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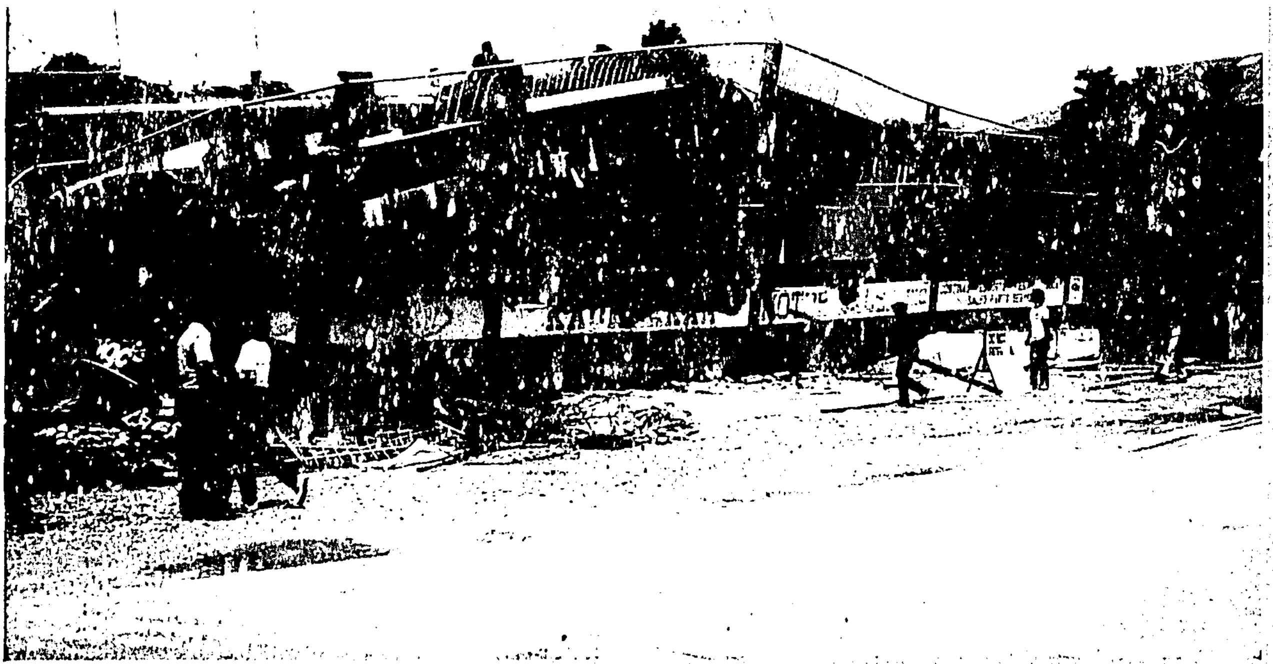

PHILIPPINES

Front Cover

The most severe earthquake experienced in northwestern Luzon in 52 years and probably the second largest earthquake event to hit Laoag and its immediate vicinity in historical times, occurred shortly after eight o'clock in the evening of the 17^{th} of August 1983. A number of reinforced concrete buildings either totally collapsed or sustained major structural damage beyond rehabilitation.

SOUTHEAST ASIA ASSOCIATION OF SEISMOLOGY

AND EARTHQUAKE ENGINEERING

Series on Seismology

Volume IV PHILIPPINES

PART A	CATALOGUE OF PHILIPPINE EARTHQUAKES 1589-1983
PART B	CATALOGUE OF PHILIPPINE EARTHQUAKES 1865-1899
PART C	CATALOGUE OF PHILIPPINE EARTHQUAKES 1901-1942
PART D	CATALOGUE OF PHILIPPINE EARTHQUAKES 1948-1983
PART E	CATALOGUE OF DESTRUCTIVE EARTHQUAKES IN THE PHILIPPINE 1589-1983
PART F	ASSESSMENT OF SEISMIC INTENSITY OF PHILIPPINE HISTORICAL EARTHQUAKES
PART G	SEISMIC SOURCE ZONES OF THE PHILIPPINES
PART H	SEISMOTECTONICS OF THE PHILIPPINES

by

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CATALOGUE OF PHILIPPINE EARTHQUAKES 1589-1864

Lolita C. Garcia, Rolando G. Valenzuela,
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CATALOGUE OF PHILIPPINE EARTHQUAKES
PART A 1589-1864

Introduction

This catalogue of Philippine earthquakes is the result of Step 3, entitled "Seismic Data Gathering, Southeast Asia" of the Earthquake Hazard Mitigation Program in Southeast Asia which was undertaken under the auspices of the Southeast Asia Association of Seismology and Earthquake Engineering (SEASEE). The project was supported by the Office of Foreign Disaster Assistance (OFDA) of the U.S. Agency for International Development. The Office of Earthquake Studies of the U.S. Geological Survey provided technical and administrative assistance during the implementation of the project in co-operation with the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), the Philippine Member Agency to SEASEE. The Project was started in September 1982.

Several Philippine earthquake catalogues have been published in the past. One of these is the "Catalogue of Philippine Earthquakes, 1589-1899" by William Repetti, S.J. This was published in July 1946. (BSSA, Vol. 36, No. 3). Most of the information contained in this catalogue was culled from Repetti's work which consists mainly of seismic activity during the Spanish regime.

Material was also obtained from reports of the Weather Bureau of the Philippines (now the PAGASA) which started in 1901 after the Manila Observatory was reorganized. A group of researchers from the National Library likewise produced a significant amount of translated material, from Spanish to English, mostly post-1900 information. Moreover, material from United States libraries was contributed by the USGS.

This catalogue is presented in four (4) volumes. The four volumes represent the divisions of the history of seismological service in the Philippines.

The first volume contains a listing of seismic events from 1589 to 1864. Data from this period were taken mostly from church chronicles, reports of the clerics, government documents, historical publications and personal diaries and letters of private individuals. During this period, there was no organized seismological service in the Archipelago. It was only in January of 1865 that the Manila Observatory, under the Jesuits, began its work.

A significant milestone in 1901 was the reorganization of the Manila Observatory as the Weather Bureau of the Philippines. This effected the addition of new and better seismological instruments, resulting in more accurate reports. These reports were then classified into either instrumental or non-instrumental bulletins. Hence, the third volume of this catalogue covers the period 1901 to the year 1942, when the Second World War spread to this area, and the end of the Manila Observatory's function as a government institution.

During the two years it took to prepare this catalogue, no reports on earthquake events during those years were found. The post-war Weather Bureau resumed earthquake observation in 1948. Volume 4, then, contains listings from 1948 to 1983.

There are other interesting reasons for so dividing the data. The Rossi-Forel intensity scale was introduced in the Philippines at the beginning of the 20th century and was used until the end of 1934. Prior to 1900 the Jesuits were using a scale where, for every level of intensity, there is a general description of events from "perceptible" to "destructive". Appendix A shows a comparative relation of the Manila Observatory Scale to that of the Rossi-Forel Scale. In 1935, Fr. Repetti modified the original Rossi-Forel scale by reducing the 10 levels to 9 (see Appendix B). It has since been adopted in the evaluation of Philippine earthquakes. Up to the present time, the same modified scale is being used.

After the Second World War, earthquake reports by Weather Bureau Observers were straightforward, field-station evaluated intensity observations. These reports rarely contain detailed information, except for large events. After large events, field surveys are conducted listing details accompanying the events. Questionnaires are also distributed among residents of a stricken area in order to provide members of the survey team with data on which to base intensity evaluation.

Acknowledgements

The PAGASA staff members who worked on this Project acknowledge with sincere gratitude the support provided by the Office of Foreign Disaster Assistance of the U.S. Agency for International Development and the Office of Earthquake Studies of the U.S. Geological Survey, without which the production of this catalogue of Philippine earthquakes could not have been realized. Particular expression of appreciation goes to Dr E.P. Arnold of the USGS for his time and effort in giving technical and administrative advise in the compilation of the data. The same token of appreciation goes to each and every member of the Project Advisory Committee who reviewed the results of the project and offered further suggestions concerning the final outputs.

The Project team likewise wishes to thank Dr Roman L. Kintanar, Director-General of PAGASA and Mr Ernesto V. Calpo, Director of the National Geophysical and Astronomical Office, PAGASA and other PAGASA staff, for their full support to the project. Gratitude also goes to the Philippine National Library for allowing the researchers access to its information files, from which a great amount of earthquake data were derived.

To all those who have helped, in one way or another, in the preparation of this catalogue much gratitude is also due.

APPENDIX A

INTENSITY SCALE

MANILA OBSERVATORY		ROSSI-FOREL
I	Perceptible	II, III
II	Light	IV
III	Regular	V
IV	Strong	VI, VII
V	Violent	VIII
VI	Destructive	IX, X

APPENDIX B

ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES ADAPTED

I. Hardly perceptible shock - felt only by an experienced observer under favourable conditions.

II. Extremely feeble shock - felt by a small number of persons at rest.

III. Very feeble shock - felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.

IV. Feeble shock - felt generally indoors, outdoors by a few. Hanging objects swing slightly. Creaking of frames of houses.

V. Shock of moderate intensity - felt generally by everyone. Hanging objects swing freely. Overturning of all tall vases and unstable objects.

VI. Fairly strong shock - general awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillation of hanging lamps. Slight damage to very old or poorly-built structures.

VII. Strong shock - overturning of movable objects. General alarm, all run outdoors. Damage slight in well-built houses, considerable in old or poorly-built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.

VIII. Very strong shock - people panicky. Trees shaken strongly. Changes in the flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides.

IX. Extremely strong shock - panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.

APPENDIX C

MODIFIED MERCALLI INTENSITY SCALE (1956 VERSION)

I. Not felt. Marginal and long-period effects of large earthquakes.

II. Felt by persons at rest, on upper floors, or favourably placed.

III. Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.

IV. Hangking objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing cars rock. Window, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frames creak.

V. Felt outdoors; direction estimated. Sleepers awakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

VI. Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knick-knacks, books, etc. fall off shelves. Pictures fall off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church and school). Trees, bushes shaken visibly, or heard to rustle.

VII. Difficult to stand. Noticed by drivers. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, also unbraced parapets and architectural ornaments. Some cracks in masonry C. Waves on ponds, water turbid with mud. Small slides and caving-in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.

VIII. Steering of cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken off trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

IX. General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas, sand and mud ejected, earthquake fountains, sand craters.

X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dykes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.

XI. Rails bent greatly. Underground pipelines completely out of service.

XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

*** To avoid ambiguity of language, the quality of masonry, brick or otherwise, is specified by the following letters:

Masonry A - Good workmanship, mortar and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.

Masonry B - Good workmanship and mortar; reinforced but not designed in detail to resist lateral forces.

Masonry C - Ordinary workmanship and mortar; no extreme weaknesses like failing to tie-in at corners, but neither reinforced nor designed against horizontal forces.

Masonry D - Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

APPENDIX D

THE ROSSI-FOREL SCALE (ORIGINAL)

I. Microseismic shock. Recorded by a single seismograph or by seismographs of the same model, but not by several seismographs of different kinds: the shock felt by an experienced observer.

II. Extremely feeble shock. Recorded by several seismographs of different kinds; felt by a small number of persons at rest.

III. Very feeble shock. Felt by several persons at rest; strong enough for the duration to be appreciable.

IV. Feeble shock. Felt by persons in motion; disturbance of movable objects, doors, windows, cracking of ceilings.

V. Shock of moderate intensity. Felt generally by everyone; disturbance of furniture, beds, etc., ringing of some bells.

VI. Fairly strong shock. General awakening of those asleep; general ringing of bells; oscillation of chandeliers; stopping of clocks; visible agitation of trees and shrubs; some startled persons leaving their dwellings.

VII. Strong shock. Overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.

VIII. Very strong shock. Fall of chimneys; cracks in the walls of buildings.

IX. Extremely strong shock. Partial or total destruction of some buildings.

X. Shock of extreme intensity. Great disaster; ruins; disturbance of the strata, fissures in the ground, rock falls from mountains.

Event	Felt Effect	Source
1589 July 13	Manila: Just before the fort was completed, it was shaken by strong earthquakes. A crack of more than a finger's breadth appeared and it was found advisable to erect cavaliers (i.e. heaps of earth) as buttresses.	97
1599 June 21 10:00 a.m.	Manila: Manila suffered one of the strongest earthquakes it had known, resulting in the destruction of the church of San Domingo, fissuring of the stone vault of the church of the Society of Jesus and damage to all the principal edifices of the city. Two entire sections of the college of the Society of Jesus were damaged in the earthquake of June 21, as a result of which the community was exposed to the view of its neighbours. Father Pedro Chirino, S.J. described the earthquake as violent, with damage to many buildings. In the church of the Dominicans (or Sto. Domingo) the handsome woodwork was mutilated and the walls so much damaged as to necessitate demolition of the building. The nave of the Jesuit church was so badly cracked that it had to be removed at once.	97
1601 Jan 16 midnight	Manila: An earthquake so furious and cruel that lasted about seven or eight minutes. It broke down a great part of the side aisle of the church (already damaged by the June 21, 1599 earthquake) and left the rest so damaged and cracked that it was necessary to take it all down. In the city, it caused much damage, destroying the buildings and injuring several persons. It threw down many stone houses in Manila and the entire church of the Society of Jesus and the Jesuit monastery suffered no slight damage. It resulted in the death of some people of little account and many were left injured. Father Chirino, S.J. was awakened by the noise of the shutters and windows. He noticed the	

Event	Felt Effect	Source
	strong rocking of the building, in danger of being overthrown. The room was swinging from end to end, just as a vessel in the sea rises and falls from bow to stern, but as rapidly as a small boat. The damage done to the church was very great. It fissured two lateral vaults spared by the preceding shock and destroyed most of that of the right side. The back wall of the main aisle was considerably cracked. The vault of the left side stood the shaking owing to the support afforded by the adjoining building.	97
1619 Nov 30 Noon	Northern Luzon: A terrifying earthquake which travelled from the east coast of Luzon to Manila and caused great damage. Bataris (Batac?) - the church, house and granaries were destroyed. The friars jumped from the windows and although they escaped with their lives they were somewhat bruised. Dingles (Dingras) - the church was partly destroyed and the Prior jumped from the window. Sinai (Sinait?) - the church suffered great damage. Large fissures opened into which some persons fell, but only one perished in this manner in the hills of Vigan. Two neighbouring hills slumped together and buried two heathen villages situated in the valley between them. All the inhabitants were buried except one man. Zagaian Province (Cagayan) - the earthquakes were stronger. The trembling of the ground was so violent as to toss the people around; they could not keep their balance even while sitting.	

Events	Felt Effect	Source
	Nueva Segovia (Lao-lo) capital of Zagaian - the church fell and the monastery, which was beautifully and substantially built of stone, was partly destroyed. The monks were bruised. In other places only two persons perished.	
	San Vicente, Tocolano - the same fate befell the church in this place in spite of its very thick walls. The same destruction overtook many stone churches and buildings.	
	There were many landslides; new springs began to flow; rivers changed their courses and many other strange things happened. Large forests were overthrown, great springs opened out. Nine friars were attached to the house in Lal-lo; one saved his life by standing under the arch of a window, and one, who was ill in bed, suffered a broken arm. One native servant was killed.	
	Malaueg, Cagayan - wall surrounding the church was so badly damaged that much of it had to be torn down and rebuilt.	
	Manila - destroyed and levelled and church of the Dominicans.	97
	This earthquake figures among the most violent ever felt in the northern province of Luzon. At noon in these islands from Manila to the farthest corner of Nueva Segovia and Ilocos Provinces, (Cagayan and Ilocos), the most violent earthquake. In Ilocos Province, it overturned and buried coconut plantations so deeply that only the leaves were left out, hills were razed and thrown down by the force and shocks. A great number of dwellings destroyed and numerous persons killed.	

Event	Felt Effect	Source
	Nueva Segovia (Cagayan) - it rent mountains, water gushing forth and the ground ejecting mud and sand. In the highlands populated by the Mandajos a mountain slid down destroying and burying a town with most of its people. In the vicinity of the river the high ground sank to the level of the water; the great undulation started high waves, as in a sea swept by hurricane. Stone buildings sustained the greatest damage; the church and convent of our city (Lalloc) fell down, even the foundations failing in some places.	69
1627 September	Northern Luzon: Fourteen earthquakes were felt in one day. A hill called "Los Caraballos" en route to Nueva Segovia, sank until level with its surroundings. Cagayan Province - some Dominican monasteries were ruined. Bangui, North end of Luzon - earthquake felt on the boats anchored in the bay. Cagayan - many buildings were wrecked; an enormous mountain opened in the centre with a tremendous gap; trees were overthrown by the terrific force of the waves of the sea which invaded the land for a distance of a league (about 3 miles). This is probably a tsunami.	97
1641 Jan 04	Northern Luzon (Ilocos Norte), Northern part of Mountain and Cagayan, Aparri, Laoag: A frightening earthquake occurred in the land, of the Igorots that was five days journey away from Ilocos. It was preceded and was announced by a typhoon. The earth opened and buried in its wake 3 mountains rendering the three towns at foot of the mountain inaccessible.	93

Event	Felt Effect	Source
	Terrible earthquake, water and mud erupted.	69
1645 Nov 30 8:00 p.m.	Manila and its vicinity. All Luzon except Ambos and Camarines, Albay: This was the most destructive and memorable earthquake in the history of Manila. There were so great an earthquake in this city that it ruined most of the buildings. As these were of stone, many persons among the natives and slaves were killed. It was said this earthquake claimed 3,000 victims. Manila - Preceded by a terrifying noise, the earth commenced to tremble with such furious violence that it seemed to desire to become a tomb for all the inhabitants. The earthquake, running from north to south, then passing from west to east with violent movement, brought to the ground in that short time the most beautiful and magnificent buildings of the city. The stone walls were shaken and bent like leaves of paper or parchment blown by the wind; the towers shook and swayed. Nothing was heard but a confused noise of the crash of buildings, voices and screams of those who pleaded for the mercy of heaven. The cries of animals added to the horror. Nothing was to be seen in the streets but piles of stones from the fallen houses, which blocked the flight of those who were leaving their homes in fright. Some tried to save their lives by sheltering in the open spaces of the doors and windows, but this careful effort was of no avail for many, because the houses, falling flat, buried them in wood and stone. In this first shock, one hundred and fifty principal houses, which would be palaces in other places, were totally destroyed. It has not been possible to verify the number of dead; those who are known to be missing exceed four hundred and	

Event	Felt Effect	Source
	fifty. The Palace and the Royal Audience Chamber, for the most part, fell. Likewise, most of the Royal Chapel fell, and what remained of it was badly damaged. The cathedral-tower, roofs, chapels were completely levelled to their foundations.	
	College of Sta. Potenciana - great ruin. A section fell and carried down eight girls who were killed and thirty injured.	
	Outside the Walled City - the parish church of Santiago and its tower fell. The structure of the church of Nuestra Senyora de Guia and of St. Anthony fell without leaving anything standing. The entire monastery and church of the Order of St. Dominic fell.	
	College of Santo Tomas - a great gate fell.	
	College of San Juan de Letran - fell completely.	
	Church of the Fathers of St. Francis - badly damaged and the walls surrounding the monastery were completely ruined. Five hundred persons died; amount of damage, P77,141.00; of mortgages loss P69,510.00.	
	The monastery of the Fathers of St. Augustine - the tower and the church fell.	
	Society of Jesus - classrooms of Arts and Theology, an old edifice, fell. At the church, although the tallest in Manila, only the tiles of the cupola were thrown off.	
	College of San Jose - one section, which was just being completed, fell; the rest was badly shaken.	

Event	Felt Effect	Source
	Town of San Miguel - church and houses completely fell. Father Francisco Roa was buried up to his shoulders by the ruins.	
	Binondo - a parish of the Fathers of St. Dominic; its very sumptuous church, of which the erection had been completed a few years previously, fell.	
	San Francisco del Monte - the monastery and the church fell. San Miguel, Binondo, San Francisco del Monte and Santa Ana churches and convents were destroyed. Santa Ana church was so badly damaged that it cannot be used. Villas on the bank of the river were ruined.	
	Manila - the wooden beams of the roofs crashed; the roar increased when cabinets, tables, chairs, and other furniture were dislodged and struck the walls and floors; roofs opened, the walls fell, the floors were buried, the edifices pulled apart.	
	Sto. Domingo - Church vault, which was made of masonry and very strong, collapsed.	97
	At about 8:00 p.m. the City of Manila was precipitated into ruins. The sea rose with a broad swell and lashed the very walls. Again this may be a small local Tsunami or seiche in Manila Bay. Frightful noises fell upon the ear, the earth trembled, and animals cowered to the ground in terror. Again and again were shocks repeated, walls cracked under the unseen power which swayed them. The people in fear sought refuge under doorways and arches, but roofs and timbers fell about them, immuring many in a common grave. The cries of the wounded and dying mingled with the crash of crumbling edifices. In less time	

Event	Felt Effect	Source
	than has been consumed in the narration of the catastrophe, the destruction was complete. The cathedral, most of the churches and public buildings, and countless private ones were ruined.	36
	In other provinces of the Island. 1. Whole villages of Indians (a common Spanish reference to Philippines) fell. 2. Hills were levelled. 3. Streams dried up which afterwards resumed their flow; others leaped from their banks and flooded the towns; great fissures appeared and even chasms in the fields. 4. In the rivers of Manila, so great was the change and commotion of the waves that it seemed that they would flood all the land, for their fury forced the river from its bed and threw its water over the top of the bridge.	
	Uplands of Gapang, province of Pampanga - very strong and lasted many days.	97
	This earthquake compares in magnitude with the greatest mentioned in the history of the world. Its mesoseismic or epicentral diameter was not less than 490 kms. from north to south; that is, from the southern coast of Batangas and Tayabas to the northern part of Cagayan. On the western coast it seems to have been of less intensity. At least, the chroniclers of the time are silent about its effects in these parts, while they deal largely with the destruction caused in Manila and neighbouring provinces of the south, east and north and the eastern part of the Cordillera Central, that is, in Mountain Province. That such an earthquake was due to tectonic	

Event	Felt Effect	Source
	movements there cannot be the slightest doubt; furthermore, it is certain that its origin was along a north and south line, and this line was within Luzon and not beyond its eastern periphery. The question arises whether the dislocations which then occurred along that line or fault were of such proportions as to be responsible for the many singular topographic features that now exist along it in Nueva Ecija, Nueva Viscaya and Isabela Provinces. Moreover, as in that memorable earthquake, Manila seems to have been very close to its origin.	102
1645 Dec 05 11:00 p.m.	Luzon: Earthquake with the same violence as the 1645 Nov. 30 tremor, but there was no injury to the people because all were on the alert; the fall of many buildings was completed, the city remaining in such a condition that it was impossible to walk through it.	97
1651 May 18	Eastern Mindanao: Linao - the earth trembled violently, followed by a second earthquake with a motion vigorous enough to wreck the strongest buildings. Butuan - felt.	97
1658 Aug 20 3:00 p.m.	Southern Luzon, Manila and neighbouring provinces: Manila - wiped out not only what had been damaged by the previous earthquake but also what appeared very solid. The beautiful church of the Barefoot Friars of St. Augustine was ruined, and three rooms fell from this very strong edifice. Some persons were killed. Santa Cruz - A great part of the church underwent almost complete destruction; the only part that remained intact was that above the altar of the statue of the Most Blessed Virgin. The monastery of	

Event	Felt Effect	Source
	Santo Domingo was rendered uninhabitable.	
	Note: Most of the houses in Manila were constructed of wood and the roofs were strengthened with immense timber. The remnants of Old Manila were completely wiped out, according to the report by Fr. Diaz.	35
	Manila - several persons perished and some were injured by falling ruins. - appreciable damage to buildings. - stone vault of the church of Santa Clara was damaged. - half of the house of the Archbishop was demolished.	
	Antipolo - Tower of Antipolo was affected. The top of the wall and the front of the principal facade were considerably cracked and loosened.	97
1675 March	Luzon & Mindoro: Pola, Mindoro - opened a fissure at the edge of one of the mountains. - the sea entered through this gap and flooded an extensive and fertile plain. - new church of the hospital destroyed.	97
	Atimonan, Tayabas - church ruined by the earthquake.	
	Manila - also felt the earthquake which did some damage.	69
1677 Dec 07 7:30 p.m.	Central & Southern Luzon: Manila - There were terrible vibrations which lasted a long time, cracked the beams of buildings, shook down tiles and loosened stone walls. The greatest damage was suffered in old buildings and those in bad condition. Only one or two persons were killed. The aftershocks continued all night; one person counted forty.	

Event	Felt Effect	Source
	Bauan, Batangas & Gapang, Nueva Ecija - wide crevice opened.	
	There were sea waves in some places, and reports of boats at sea almost submerged by waves. These effects indicate an origin in the China Sea.	97
	Manila - Chasms opened in the ground. Although the author did not mention the region principally affected by the tsunamis, it was supposed that the waves were raised in the China Sea near the West Coast of Cavite, Bataan and Zambales.	69
1683 Aug 24	Manila: Damaged some buildings.	87
1684 Aug 24 5:00 a.m.	Manila: Strong earthquake. The earth trembled strongly and a balcony projecting above the Bagumbayan Gate on the inside of the wall filled with spectators fell down; in such an accident many were injured among them 2 monks; severe, but with little damage to the city.	69
1699	Manila: Destructive earthquake. In 1699 and 1700 new earthquakes destroyed the town entirely.	69
1700 Sep 29 a.m.	Manila: It happened that within an hour there was a strong earthquake that put men on scaffolding in some danger. The church swayed strongly, to the accompaniment of an extra-ordinary noise.	97
1717 Sep	Luzon and Tables: Antipolo - opened a very large crevice in the hills of Antipolo.	
	Tablas - there was an opening one braza (about six feet) in width.	97
1721 Jan 14 7-8 p.m.	Northeastern Luzon: Great earthquake in the Cagayan Valley.	
	Abulug, Massi - strong buildings destroyed.	

Event	Felt Effect	Source
	The church of Tocolona and Lalloc fells. The churches and monastery of Pamplona were also damaged.	97
1728 Nov 28	Luzon: Manila - caused great damage.	97
	Destructive earthquake felt throughout the Archipelago, but chiefly in Luzon. It caused great loss and damage to the city of Manila. Destructive in the fourth district.	69
1730	Tayabas Province: Violent earthquake which damaged the church at Mauban; it caused similar destruction in other towns of Tayabas Province.	97
1738	Laguna: Very strong earthquake which ruined the bell tower of the church at Majayjay, Laguna Province.	97
1743 Jan 12 5-6 p.m.	Province of Tayabas, Laguna, Luzon: A very great earthquake occurred which was repeated the next day at the same hour but with less intensity. For the monks of St Francis in charge of the towns of Tayabas it ruined nine churches and convents; a tower subsided two yards into the ground. Near Tayabas there opened two chasms or vents which emitted sulphurous water; only three or four persons perished. The church of St Pablo also fell into ruins, with like effects in several other towns. Huerta writes about the ruins of the town of Sariaya which, during or immediately after the earthquakes, was buried beneath the mud and rocks of a flow or avalanche issuing from the waters of Mount Banahao, the outlet of which had been obstructed by the earthquake of 1730. The earthquakes of 1734 loosened the obstruction and the water of the lake, formed within the crater and augmented by the heavy rains of the season, rushed through the gorge flooding and materially devastating the plain below. Father Huerta does not make clear whether	

Event	Felt Effect	Source
	the flow coincided with the earthquakes or not. After reporting them; he simply adds: "The same year the large lake of Mount Banahao burst and the flood nearly razed the whole town of Sariaya".	69
	Sariaya - the church and monastery, made of stone, were left totally ruined by the earthquake; all the walls collapsed, coming to earth with all their beams and tiles, shattering the retables and statues, leaving everything buried in a confused mass. The tower totally collapsed and one bell was cracked. Of all the equipment of the church for divine service, not one thing was saved. Water jars were knocking and striking one another and smashing to bits. On the side of the mountain which faces this town one can see dark openings and deep chasms, various precipices and breaks in the mountain; some remain fixed, others are tumbled down from their old places by the force of the earthquake, together with the torrent of water which the volcano poured forth. From the summit of the mountain rocks of enormous size rolled down, mixed with trees of immense girth, water and mud, with which they tumbled in confusion. The natives acknowledged that they had never seen or heard of such destruction; it was so great that the town was rendered uninhabitable and its people were forced to move to another place and build a new town.	
	Tayabas - The church and the monastery all of stone, are ruined and destroyed to such a degree that not a thing remains which can be put to use. The tower, which was very strong, fell. The facade of the main entrance collapsed and tumbled to the ground. The walls were left very cracked. Two sacristans were buried	

Event	Felt Effect	Source
	in the ruins, one of whom was suffocated and the other got out only with great effort, alive but badly bruised. All that night, terrifying noises were heard on the mountain; copious floods of turbulent water rushed down, opened new channels, and closed and levelled old ones. For several days the earthquakes were more or less continuous and more or less strong. The monastery was totally ruined, the walls crushing and cracking everything below. The inscription was shaken from the cross; although it was made of heavy wood, it was loosened from the large and strong wedges with which it was firmly attached to the cross.	
	Lucban - the entire facade of the church collapsed; half the tower collapsed, carrying the bells to the ground. The walls of the church remained standing, but so damaged that they cannot be used. The damage to the sacristies was greater; the walls were totally demolished. The monastery also suffered much, for it was demolished down to the floor, the boards of the walls being thrown out with all the partitions of the rooms and offices. The cracks which threaten complete ruin are terrible, wherefore it is necessary to take the walls down at once.	
	Majayjay - the tower, which was very high, to correspond to the height of church, came down with the bells, leaving some open walls above and below, the cracks extending into the foundations. The walls of the church, especially on the side of the monastery were cracked from face to face at the middle, with some other cracks more or less large and deep. Some cracks ran through and some lengthwise, and many from the top down to the foundations. At the junction with the tower, all of the	

Event	Felt Effect	Source

best construction, there was severe destruction because the stones and the keys were pulled apart at various places. No casualties. Deep cracks were made in the mountain which is called Majayjay, on the side which faces directly toward the town and they extend from the summit down.

Lilio - the tower, with the bells, collapsed, and because they fell from such a height the result was a mass of ruins. Seeing such a jumbled mass of stones in the patio, some in pieces, some entire and bells mixed in with them, it did not seem that any natural cause could explain it. One of these dislodged pieces landed on one of the corners of the boys' school which was also of masonry and totally demolished it, wiped it out so that it now looks like a pile of dirt. The principal entrance of the church suffered most. The entire sacristy was destroyed. The structure of the monastery is in a dreadful state; the common-rooms and the kitchen are totally destroyed. No casualties.

Nagcarlan - the church was wholly ruined by the earthquake; the entire roof with its timbers and tiles came to earth; stones were thrown out from the walls. The sacristy was also totally destroyed. The tower was broken into three sections by terrible cracks. The uppermost section, containing the bells, came down with the entire roof towards the rear. The gaps which divide the bays from top to bottom leave lofty hanging walls and peaks, slit in various parts or else leaning. The monastery was totally wrecked and one of the servants was killed and buried in the ruins. In several places, the ground is serrated and torn with cavernous openings and landslides. According to the

Event	Felt Effect	Source
	natives, the mountain has dropped more than 50 brazas (about 300 feet).	
	Sta. Cruz - the whole facade of the church, and the sanctuary vault and side naves were totally ruined; the body of the church has several cracks in the walls, which threaten the total ruin of all. No casualties. In the pharmacy, many bottles and flasks were broken, with loss of the medicine.	
	San Pablo - ruined.	97
1743 Sep or Oct	Island of Leyte: Very great earthquakes which ruined many towns, and a mountain sank six hundred feet. Believed that these earthquakes were at the end of 1743 and the beginning of 1744.	97
1744	Northern Luzon: There were widespread earthquakes which lasted for whole months. The sea enters the river with great force.	97
1750 Mar 10 7:00 p.m.	Southeastern Luzon: Nueva Caceres - the roof of the church which had just been completed is ruined and some parts of the walls have suffered.	
1766 Aug 19 6:00 p.m.	Manila: Sta. Cruz - there was a six-foot chandelier which seemed to swing through arcs of eight or nine inches.	97
1766 Dec 06 10:45 a.m.	Manila: Forceful shock. It lasted in its full strength about two minutes. First, strong vertical shocks were felt repeatedly for half a minute; then came oscillations which were very sharp, and they continued about three quarters of a minute. They then began to decrease in intensity and became imperceptible after about one minute. The whole duration of the earthquake was more than three minutes. The framework of a house	

Event	Felt Effect	Source
	gave a frightening noise and large houses of the Indians were moving with a perceptible vibration.	97
1766 Dec 09 5:00 p.m.	Manila: A sudden vertical shock was felt which did not last. Creaking of the timbers of the house was noticed. The shock was followed by slight oscillations which lasted more than a minute. These oscillations gave the sensation of seasickness.	97
1767 Feb 08 1:05 a.m.	Manila: Strong earthquake which awakened almost all in the city; began with two vertical shocks followed by ample oscillations; one of the astronomical pendulums stopped at 1^h5^m.	69
1767 Nov 13 3.25 p.m.	Manila: A strong earthquake which lasted not quite a minute. Noise of the timbers of the house was heard. A number of people ran out of their houses. Cracked some walls and dislodged many tiles from the roofs. A number of persons suffered headaches; swaying of the house lasted about 30^s. After a second of calm a strong vertical shock was felt followed by rapid vibrations of increasing amplitude; movement of the walls and floor, begin distinctly seen, lasted about 30^s and ceased suddenly.	69
1767 Nov 15 2:44 a.m.	Manila: Strong shock occurred with some oscillations but of short duration.	69
1770 Dec 9-11 p.m.	Manila: Violent, and destroyed many houses. Within an hour, felt 3 shocks which caused the author a sudden jump of the heart. Vessels in the bay felt the shocks and thought they had struck the bottom or a reef.	69, 97
1771 Feb 01 night	Manila: Earthquake which caused damage principally in the place called Ermita. Church of N.S. de	

Event	Felt Effect	Source
	Guia was considerably ruined; the churches of Recoletos and San Miguel were also damaged.	
	Antipolo - the church sustained much damage.	97
	Violent earthquake.	69
1773 October	Luzon: Very strong shocks with rumblings felt by some vessels sailing near the Luzon coast.	69
1783 Apr 19 night	Dapitan, northwestern Mindanao: Very strong earthquake.	97
1787 July 13 6:45 a.m.	Panay Island, Provinces of Iloilo and Antique, Buenavista: Tremendous earthquake felt in the whole island of Panay on the 13th instant (July) at 6:45 in the morning.	
	Iloilo - of all the stone churches of this province only two remain standing, that of Tigbauan and this one of Guimbal; fort was damaged; those of Jaro, Dumangas, Laglag, Passi, and Alimodian lie in ruins, and in these last towns the fate of the churches also befell the parochial houses, which are also of stone. Fifteen persons were buried in the ruins of the church of Laglag. The church of Maasin, although standing, will have to be completely demolished. A number of persons have perished and some have been injured. The two side walls are so fissured that they will fall of their own accord.	
	Santa Barbara and Pototan - wooden churches were destroyed.	
	Capiz - town of Dumalag in this province, the church and bell tower have been destroyed, both of them of stone and separated from one another. In several towns many houses sank to the level of their	

Event	Felt Effect	Source
	floors. Many fissures opened in the earth and out of them came sand of different colours. Some of the mountains have lost their peaks.	97
	In all the churches and convents numerous bells fell from the belfries and were broken.	69
1796 Nov 05 2:00 p.m.	Luzon: Cagayan and Ilocos - the earthquake was felt but without damage.	
	Pangasinan - suffered fearful destruction. Nine churches were ruined; the earth opened in different places. The observation that these effects were less and were felt less, as one progressed into provinces more distant from Pangasinan, leads one to believe that the earthquake was centred there.	
	Baguio - two enormous crevasses formed. One was one hundred and eleven varas (300 feet) long and half a vara wide and its depth was so great that five brazas (some 30 feet) of rope did not reach the bottom; and the second was twenty-nine brazas (about 175 feet) long, two wide, and its depth unknown.	
	Pongot - inhabited by Pagans, a hill of considerable size was levelled and a lake took its place. In other places, sand and water were thrown up from great rifts.	
	Zambales - two churches totally destroyed.	
	Camarines and Albay - the earthquake was perceptible but light, nothing unusual occurred.	
	Manila - Some walls were shaken, some houses were split, some arches of the palace were cracked and the barracks of the Royal Regiment were	

Event	Felt Effect	Source
	damaged, but none seriously. Water overflowed from troughs and many wells. A large vessel which had been full of water lost 3 inches of water; the lamps oscillated, and the motion of a carriage at the entrance was that of one which passes over a half-paved street. Inside the house the main columns which supported the roof were split in two.	
	High seas 33 miles from Manila - on board an English ship, the main mast was jolted upwards and fell on the rail. All parts of the ship creaked.	97
1799	Manila: Strong earthquake.	97
1804 Aug 07	Tayabas: Earthquakes of moderate to strong intensity.	97
1808	Zamboanga, Mindanao: Violent earthquake damaged Port Pilar.	97
1811 Oct 05	Southern Luzon (Camarines and Albay) Nueva, Caceres, Albay: Violent earthquakes felt throughout Camarines Sur, chiefly along its central plain. The churches of Calabanga and Magarao and the tower of Baao fell in ruins. It was strongly felt eastward in Albay Province.	97
1824 Jan	Manila or Northern Luzon: Dreadful shocks, after which many dead fish were seen floating on the river which flows past the city.	97
1824 Oct 26	Manila and nearby province: Manila and suburbs - severe shocks which demolished several churches, a bridge and many private houses. Military barracks were levelled to the ground.	
	Guadalupe - the earth opened with a tremendous explosion and, shortly after, shoals of dead fish were seen floating down the river into the sea.	

Event	Felt Effect	Source
	San Francisco, Manila - bell tower of the church was ruined. The earthquake caused considerable loss of human life. Cavinti, Laguna; Lucban, Tayabas - churches destroyed. Antipolo - portion of the roof of the church was shaken down and walls damaged.	97
1828 Nov 09 6:30 p.m.	Manila: The motion seemed to come from the south and was undulatory. An earthquake which produced rocking and creaking of the house; hanging lamps swung like pendulums in an arc of four feet. People ran out into the streets. The massive gates of the great bridge, one of the entrances of the city, were moved on their hinges by the shock in such wise that a person who was passing at the time thought they were being closed behind him. It made the bells of the churches ring. It lasted two to three minutes. After the earthquakes, the river rose to the same height that it reaches in the rainy season and inundated the lowland near its banks. The arches of two or three churches were broken and the buttresses of another were shaken down. The debtors' prison was slightly damaged and many houses were cracked. No subterranean noises were heard. No one was killed. A correspondent tells that he was lighting a cigar at a lamp when it suddenly swung away from him. He thought his hat had touched the lamp, but he was quickly undeceived by the next oscillation, when the chair on which he was standing overturned. One person who was riding through the town in a buggy noticed that the water in the gutters washed up first to one side and then to the other. As the motion of the carriage prevented him from feeling the earthquake, he could not	

Event	Felt Effect	Source
	imagine the cause of the strange action until he saw all the people on their knees and he stepped out. The ships in the port felt the shocks strongly, as if something had struck their hulls. The damage was not considerable and no-one was killed.	
	Manila - violent shocks; houses destroyed and many buildings damaged. Duration two minutes.	97
1829 Dec 07	Manila: Violent earthquake. An earthquake occurred which caused some damage to the Old Jesuits' college at General Luna and Victoria Streets, Walled City, to the library and to a portion of the college known as the Mirador.	
	Majayjay, Laguna - strong shocks occurred.	69, 97
1830 Jan 18 5:15 p.m.	Manila and nearby provinces: Manila - an earthquake which was at first slight in motion continued with increasing strength. Water from the river came rushing up several feet but quickly retreated and broke upon the opposite bank with a noise resembling thunder and then gradually subsided. Horses, dogs, sheep, goats, turkeys and other animals were in terrible panic, the former rearing, plunging, neighing, howling, bleating, uttering strange sounds and committing strange actions. All these took place within a space not exceeding a minute. No serious damage was done in the city. Inside the house, the floors were covered with fallen plaster, and the walls were all rent. One life lost due to the falling of a stone from a house; but in some of the provinces, where the earthquake was felt more severely, there were several lives lost and much damage done.	

Event	Felt Effect	Source
	Mauban, Tayabas - the church walls and bell tower were badly fissured and the monastery demolished.	97
1830 Sep 16	Manila: Several strong shocks felt at Manila during a "colla", a sudden strong SW squall.	97
1836 Jan 03	Mindanao: Very violent earthquake, many volcanoes of Mindonao being then active; felt almost throughout the whole island.	97
1836 June 20	Manila: Strong earthquake, lasted about a minute.	97
1836 Aug 7:30 a.m.	Manila: Strong earthquake.	97
1839 Feb 27	Northwestern Luzon: Tagudin, Ilocos Sur - one of the church towers fell and damaged the rectory. Pagan Igorrotes reported that a hill, two leagues (about 6 miles) from Bauang, had shifted and that in some places cracks had opened and small lakes spouted sand and water.	97
1840 Mar 22 morning	Sorsogon: Sorsogon and Casiguran - the churches as well as the smallest town houses were destroyed; seventeen persons lost their lives and two hundred were injured; and the whole neighbourhood sank five feet below its former level.	
	Albay - church was destroyed by the quake; as a result of the earthquake, the bottom of the bay of Sorsogon seemed to have undergone some change; the sea has invaded a great part of the beach and the houses which were nearest the shore.	97
1842 Oct 24 9:30 a.m.	Southern Luzon: Strong earthquake with an E-W direction which lasted about two minutes. This was felt at a place 8 kms. from the town of Taal. One person awakened by the shock which he described as similar to that which one would feel if a	

Event	Felt Effect	Source
	person playfully pulled one's bed toward himself, then pushed it away, then pulled it again and so on.	
	Canaman near Naga, Camarines Sur - the church was partly ruined.	97
1843 Jan 02 1:15 a.m.	Manila: Moderate shocks; two distinct series of vibrations were noticed in a short interval; the seconds. lasted about nine seconds. The Register shows all shocks in the localities connected with the great volcanic band of the Moluccas, because the northern extremity of this band is found in our territories; the whole band thus connected with India proper. The shock in question appears to have been slight, but it was the forerunner of a series, one of which was of great violence.	97
1852 Sep 16 6:30 p.m.	Southwestern Luzon: Manila - an earthquake which began with a gentle shaking movement and changed in a few moments to a north south oscillation which attained such strength that it moved the pendulum through 31° in its swing. The violence decreased for a moment and then there followed a terrible shaking and at the same time an east-west oscillation of such force that the pendulum mounted to 43°, the duration of the terrible earthquake being precisely one minute. Public buildings, the churches, the monasteries and private houses suffered serious damage, particularly the old church of the Society of Jesus, which collapsed in spite of its strong arches. The country house of Malacanyang has been left in a ruinous condition.	
	Governor-General's palace - some of the principal walls, arches and columns cracked, several tiles knocked off. The disaster announced its presence with a subterranean	

Event	Felt Effect	Source
	humming accompanied by the creaking of buildings, the shouts of the people, the noise of walls, cornices and roofs which were dislodged and the terror pulled at all hearts. The Spanish brigantine "Romano" felt the quake when at position $17^{o}30'$N-$118^{o}30'$E. Losses to properties are incalculable. Casualties: three dead, one injured. Account of damage to buildings in Manila.	
	Military buildings - the offices present a deplorable appearance which would have been complete ruin if there had been another shock as strong as the first.	
	Barracks No. 4 in the old Society of Jesus - all the walls and columns were weakened; part of the roof has fallen. The great roof of the church contiguous to this edifice collapsed.	
	Barracks No. 1 and barracks of the artillery and No. 2 regiment - suffered but little damage.	
	Meisic - all the columns and walls of the second floor offer a sad sight. Some of the floors show signs of sinking and some have been disturbed in the strongest parts.	
	Malate - the barracks of regiment No. 3 showed appreciable effects of the earthquake in the exterior gallery of the patio. Officers' Pavilion - suffered considerably. Several large cracks in a vertical direction, and one horizontal which cut across most of the 2nd floor, are the most conspicuous effects.	
	Fort Santiago - the thick and solid curtain-wall of the front has opened in large cracks on the side which faces the sea and also on the land side. Nearly all the arches and	

Event	Felt Effect	Source
	lintels of the new barracks are cracked more or less at the joints, and in the said buildings the transverse walls have separated from those of the facade. In the Baluarte of San Domingo - there are several cracks and breaks. Of these, the most serious one is vertical in the exterior wall of one of the arches, which begins at the key and extends to the top of the wall, cutting through a gun embrasure. Herrerias - there is an enlargement of the breaks in the arches on the lintels of the communicating doors. They are in a ruinous condition. In the arches of the battery of San Francisco - there is also some slight damage. Gates of the Plaza - that of the Almacenes has a large crack and in the curtain-wall, contiguous to the said gate, all the arches are displaced. In the Gate of Santa Lucia - there is a crack in the key and the railing of the bridge is broken. In the arches of the Royal Gate - there are cracks in the entrance and exit gates. In the Parian Gate - some of the posts at the end of the bridge are weakened. Nagtajan - some cracks of dangerous size in the arcade, some stones of the roof being displaced. Ecclesiastical structures: The archiepiscopal palace - this building suffered very little; only one arch of the balcony and one wall of the patio were broken.	

Event	Felt Effect	Source
	The cathedral - the two last arches of the trancept were broken where they joined the front wall, and the latter is badly cracked and separated from the roof in some places by a space of three or four fingers. One section of the dome has been somewhat damaged and an old crack in the exterior wall of the sacristy has noticeably increased.	
	San Agustin - this structure has suffered considerably, the two walls of the stairway cracking from top to bottom. The vault also cracked. The wall of the church cracked in four places; the vaults of the church, sacristy, tower cloister and the arches of the entrance suffered similar damage.	
	San Domingo - there was only an enlargement of the cracks produced by the earthquake of 1824 and some others in the arches of the cloister of the church.	
	The Society of Jesus - the roof and the two spacious and beautiful galleries completely collapsed.	
	Recoletos - the facade of the church suffered some minor damage.	
	San Francisco - almost all the arches of the monastery have been weakened and the church is damaged.	
	San Juan de Dios - the new church suffered very little but the old one has two cracks of considerable size. The stone arches of the tribune and those of the upper part of the altar of St. Anthony are very badly cracked.	
	Pandacan - almost all the roof of the church and part of the rectory have been ruined.	

Event	Felt Effect	Source
	San Fernando de Dilao - the church and rectory of this town have been rendered useless. Sampaloc - the church was somewhat weakened; its walls and arches have cracked and the whole roof is destroyed. Paranyaque - the church of this town has cracks in many places and some of them are horizontal Tondo - the facade of the church was damaged San Miguel - the tower of this church has been rendered useless and some of the walls have cracked. Third Order of Sampaloc - damage similar to that suffered by the San Miguel Church. Third Order of Manila - the facade is cracked and the tower is destroyed. Beaterio of Santa Rosa - this building has been damaged to such a degree that it may be necessary to remove the nuns to another place while repairs are being made. Buildings of the State: Slight to considerable damage was suffered by the following: Santa Potenciana - little damage. The Great Bridge - the key of the arch of the 3rd span suffered the only noteworthy damage. Several other keystones and some other arch stones have slipped in their positions; some slight cracks can be seen which traverse one or other and in the direction of the axis. Cemetery - residence of the Chaplain presents a sight of ruin; all the side walls and partitions, some	

Event	Felt Effect	Source
	portions of the facade and roofs are totally weakened.	
	Supreme Court - plaster was dislodged and one main beam was broken in one office.	
	Cigar factory of Binondo - columns have been smashed by the motion of the main beam; one of them is cracked and very much broken and the roof is appreciably damaged.	
	Cigarette factory of Arroceros - the enclosure around the whole area of the cutting machine is completely ruined. The two machines have been jolted out of position and the whole foundation has moved about two inches towards the river; a buttress between two arches was cracked and demolished. The storehouse which covered a large area was completely detached; the tiles of the penthouse moved toward the ridges and vice versa; the channels cross above the covers. The roof of this house is in complete chaos; it cannot be described better than to say it appears to have been bombarded.	
	The Country House of Malacanyang - damaged quite a bit in its walls, entrance hall and partitions. The roof has suffered enough to render the structure uninhabitable.	
	The Princesa cigar factory - damage confined to spalling, an insignificant crack in a partition wall and the dislodgement of one stone from a parapet.	
	Consistorial Houses - suffered considerably; the railing has been displaced and almost all the 2nd floor has been cracked horizontally. The walls of the facade have been displaced out of their vertical position and consequently have been detached from the transverse walls,	

Event	Felt Effect	Source
	leaving everything in bad condition. Moreover, the ceiling has been shaken and large vertical cracks can be seen in the walls, in several arches, and near the doors and windows. Santa Isabel - little damage. Intendencia and Secretariat - slight damage to partitions in the quarters of the secretariat; the keystone of the entrance slipped down about two inches. Office of Auditor of State, Army and Treasury - little damage. Tax Office - two partitions were thrown completely out of place. Royal Customs House - badly damaged. Philippine-Spanish Bank of Isabel II - most of the arches of the lower gallery have opened at the keystones, all of the partition walls of the main floor have cracked and cracks more or less deep have appeared at all corners. Military Hospital - some deep cracks in its walls, spalling and one interior wall demolished. Provinces: Bataan - the capital has suffered considerably, the royal house has some cracks and fractures. Orion - the church, tower and parish house were ruined. Tower completely demolished. Orani - the entire roof, the choir and part of the tower of the church fell. The parish house, tobacco house and that which was formerly for wine have suffered much.	

Event	Felt Effect	Source
	Abucay, Pilar, Mariveles, balanga - churches and parish houses sustained considerable damage. In the district of the Sea, near the capital - a crevasse opened more than 7,000 varas (over 3 1/2 miles)) long, one metre wide and black sand appeared (1/2 metre long and one metre wide); no persons injured. Bulacan - in the capital, a man was seriously wounded by the fall of a portion of the wall of the tribunal. The royal house was cracked in eight or ten places. Polo - the facade of the church was damaged considerably. Obando - the parish house has several arches cracked; the main wall facing south was thrown out of plumb. Cavite - all the buildings in the town were damaged seriously, especially those of the arsenal and royal house. One of the eight sides of the telegraph building is cracked horizontally and there are two vertical cracks extending to the 2nd floor. In the infantry barracks, most of the posts have been dislodged. Some stones have been slightly moved, and three tie-beams in two rooms show cracks. The former church of the Jesuits was spared by the earthquake in spite of the fact that the bell tower, which leaned against the facade, was cracked from top to bottom. The house occupied by the supervisor was of very poor construction; through it the earthquake swept swiftly in all its walls, posts and partitions; the whole second floor is left in a very bad state, chiefly because its frame had been weakened by termites.	

Event	Felt Effect	Source
	In Old Cavite - one of the beams supporting the roof broke and this caused the last wall to break for a length of six varas (5 1/2 yards) and the west wall for ten varas. (about 9 yards).	
	Indang - the town suffered much, especially the church.	
	San Roque - part of the chapel and walls of the cemetery were demolished.	
	Imus - the parish house and church have sustained considerable damage.	
	Pampanga - scarcely felt the earthquake.	
	Balayan, Batangas - one third of the roof of the church collapsed, the tower was damaged and the two bells fell. The parish house was cracked. Many cracks opened in the ground (40-50 cm. wide) and emitted much water, odorous mud, and sand. In the church, the roof sank to the transept, and two houses sank in spite of their posts, because the ground opened.	
	Taal - the weather-vane, cupola and railing of the tower fell.	
	Casaysay - the railing of the church fell.	
	Tilic and Tacbac - the earthquake announced its coming with terrifying subterranean sounds.	
	Lubang, Mindoro - the entire church and the tower fell.	
	Santa Catalina - the walls fell, and likewise its battery.	
	Tilic and Tacbac forts - the forts fell, and all the houses of the town and suburbs were tilted in a remark-	

Event	Felt Effect	Source
	able manner. The bridges collapsed. Thé earth sank in several places, producing cracks as much as half a vara (over 16 inches) in width and of unknown depth.	
	Nueva Ecija - no damage in this province but the bells rang.	
	Zambales - sinking of the small island of Ubauba in Subig Bay.	97
	The centre of this destructive earthquake appears to have been in the Taal Volcano. Many fissures were opened in the earth around the volcano. Damage to buildings was great in the provinces of Manila, Cavite, Bulacan, Laguna, Tayabas and in the island of Mindoro.	87
	The inhabitants all ran into the streets, expecting every moment the houses to fall into ruins. In one of the strongest houses, an occupant writes that the lower storey did not move much, but the upper one swayed to and fro, to use his expression "like a blade of grass in the wind". The noise made by the breaking of walls, the falling of furniture, and the cracking and creaking of the timbers was such as to impress every-one with an exaggerated idea of the destruction of property. At each shock the great bell of the cathedral tolled, followed by all the bells of the city. The damage to property was considerable, though the loss of life was small; only three or four lives are known to have been lost. Almost every stone house suffered more or less, according to its strength; nearly all the government barracks, the customs house, colleges, palace, theatres, and many private dwellings were rendered completely uninhabitable. Two churches were destroyed. One, the oldest in Manila, founded nearly three hundred years ago by	

Event	Felt Effect	Source
	the Jesuits, very large, with walls and arches four feet thick, was thrown down into one immense mass of ruins. The movement was not slow and gradual, like a long heavy swell, but a quick succession of short sudden shocks. The effects of the shocks were different in various parts of the island. At Mariveles, just across the bay from Manila the earth opened with an eruption of black sand, which covered the country to a considerable extent; how large the opening was at the time is not known, but it is now seven hundred yards long and one yard wide.	
	Observations by Prof. H.D. Rogers - he referred to the circumstance that the undulatory movement of an earthquake is felt.	35
1852 Sept 25	Southeastern Luzon: Albay, Camarines Sur - felt strongly. Damage in the towns of Polangue, Albay and Nabua, Camarines Sur.	97
1852 Oct 12 5:30 a.m.	Manila and Western Province: Strong earthquake which seems to be one of the main aftershocks of the September earthquake.	69
1852 Dec 24	Southwestern Luzon: This earthquake had its origin near the southern Luzon coast.	
	Taal, Bauan, Batangas - several buildings were damaged. The churches and other stone buildings sustained the worst damage.	
	Cavite, Tayabas, Laguna, North Mindoro - the earthquake was also felt strongly.	97
1855 Mar 22	Southern Luzon: A very strong earthquake which lasted four minutes and overturned or damaged many buildings. It was accompanied by a violent eruption of the volcano of	

Event	Felt Effect	Source
	Albay. Felt in Manila and nearby provinces; it caused light damage to several buildings.	97
	Small eruption, accompanied by a violent earthquake, felt with force throughout Luzon.	87
1861 July 01 12:30 a.m.	Mindanao: Bislig - felt a strong earthquake, the oscillations of which caused the ringing of a bell which is in the guardroom of the Royal House. A little previously a subterranean noise was heard like that of the detonation of a cannonade.	97
1861 July 23 8:25 p.m.	Camarines Sur: Very strong earthquake which caused some fear in the Royal House and in the public market, as also in the fort of Pasaca.	97
1861 Aug 04 7:15 a.m.	Camarines Sur: Nueva Caceres - strong earthquake; the main walls of the Royal House were cracked and the plaster of two partition walls has fallen, so that the building is not habitable except at some risk. The main walls have parted in the masonry stores of the Chinese and in the prison.	97
1861 Aug 30 11:30 p.m.	Burias and Southeastern Luzon: Strong and much longer earthquake at 11:30 p.m. From that hour to the present date there have been several repetitions, more or less strong. All the main walls of the prison have been cracked. The ridge beam and building are perceptibly tilted. Milaor, San Fernando, Bula - the churches of these towns have suffered damage. San Pascual, Burias - cracked some plaster walls and windows.	97

Event	Felt Effect	Source
1861 Sept 06 8:15 p.m.	Ilocos Sur: A strong earthquake which lasted five or six seconds. It began with a strong vibratory motion and ended with an oscillation from the SW to NE.	97
1861 Sept 26 morning	Camarines Sur: There was a strong earthquake which lasted from 75 to 80 seconds.	97
1861 Sept 26 5:00 a.m.	Albay: A strong earthquake with an aftershock of less intensity on the night of the following day.	97
1861 Oct 02 2:00 a.m.	Tayabas: Two vibratory earthquake, the latter moderately strong. No damage has been caused in the province.	97
1862 Mar 04 5:30 p.m.	Southern Luzon and Mindoro: Minila - very strong and long earthquake, lasting 30 seconds. Slight damage to partitions of houses. Workmen on scaffolds on the towers of Santo Domingo Church badly frightened. San Isidro - light and long oscillations. Bulacan - a strong earthquake shock for about three minutes. Cavite - felt strongly. The new barracks, the telegraph, and the Royal House are the structures which suffered most, but there were no injuries to persons. Mindoro - this district felt a strong earthquake with an aftershock five minutes later. Several persons noticed a peculiar coloration of the sky.	97
1862 May 25	Vigan, Ilocos Sur: Moderate earthquake in the afternoon.	97
1862 May 31 9:05 p.m.	Northern Luzon: Ilocos Norte - a strong oscillatory earthquake with a movement from N to S. It lasted 20 seconds. No report of damage.	

Event	Felt Effect	Source
	Tuguegarao - a strong oscillatory earthquake. N to S direction and lasted for some 30 to 35 seconds. No damage of any kind.	97
1862 June 22 3:00 p.m.	Ilocos Norte: Laoag - a strong oscillatory earthquake. Its direction was east to west and it lasted about 20 seconds.	97
1862 July 13 4:00 p.m.	Tayabas, Baler: Tayabas - this port felt a strong earthquake. Cracked and walls of the presbytery and of the public prison. Aftershock at 4:00 a.m. July 14; 7:40 a.m. July 16 with a direction of east to west. Manila - the earthquake was felt moderately.	97
1862 Aug 06 2:10 a.m.	Northern Luzon: Ilocos Norte - strong earthquake, the motion of which was at first vibratory and then oscillatory from N to S and lasted about 30 seconds. It caused some damage in the Royal House and in the presbytery of Piddig, and also in the provincial building, in the chapel which is being erected in the cemetery and in the two schools which are also under construction in masonry. The shaking demolished the granaries in some towns.	97
1862 Aug 08 2:30 a.m.	Northern Luzon: Strong earthquake of moderate intensity felt chiefly in the Abra, Mountain and Isabela provinces.	97
1862 Aug 12 10:00 a.m.	Benguet Province: Earthquake of moderate intensity.	97
1862 Sept 09 3:00 a.m.	Northern Luzon: Manila - moderate, oscillatory, light earthquake, NNE-SSW and E-W. Isabela - violent, long, oscillatory. Strong aftershock on September 12, at 10:00 p.m. and another strong shock between 10 and 11 p.m.	

Event	Felt Effect	Source
	La Union - strong with oscillations from N to S with an aftershock two or three minutes later, barely perceptible. No damage was done.	
	Ilocos Norte - an earthquake was felt with oscillations from west to east. It lasted more than 50 seconds. During the night six more oscillatory shocks were felt, of longer duration. The church and presbytery of Piddig suffered moderately and in the town of Paoay the oscillatory movements were strong enough to set the bells ringing.	97
	The earthquake caused some damage to buildings in various towns, especially in Pidding.	
	In Isabela and Cagayan, the earthquake was violent. It caused some damage to churches and its general direction of movement was from west to east.	
	Ilocos Sur - felt strongly, lasted more than a minute. Six aftershocks were felt, shorter and weaker except the last which occurred at 9:00 a.m. and lasted some 20 seconds. No building was ruined. N-S direction.	
	Cagayan - felt strongly, alternately vibratory and oscillatory in different directions and some 40 seconds in duration. There were aftershocks at intervals of one and two hours.	
	Abra - an earthquake was felt which lasted about a minute and was very strong. There were four aftershocks of equal strength but of shorter duration. There was no damage.	85
1862 Sept 23 12:17 a.m.	Marinduque and Burias: Marinduque - five earthquake were felt in the five towns of the island of Marinduque at 12:17 a.m., 12:20	

Event	Felt Effect	Source
	a.m., 4:05 a.m., 4:30 a.m., 4:58 a.m.	
	Burias - at dawn on the 23rd an oscillatory shock of great length and force. A foreshock of moderate intensity had occurred the previous afternoon.	97
1862 Oct 30 noon to 1:00 p.m.	Southern Luzon: Manila - moderate, long, oscillatory.	
	Laguna - very strong and oscillatory, doing slight damage in the towns located south of the Laguna de Bay.	
	In towns near Maquiling - it was very strong.	97
1863 May 30 4:30 p.m.	Western Mindanao: Strong earthquake felt in Zamboanga and nearby towns.	97
1863 June 03 7:20 p.m.	Manila and nearby provinces: Destructive earthquake consisting of vibrations followed by oscillatory movements.	
	Manila: shook down strongest edifices, completely destroying the structural richness of this capital and spreading ruin and desolation everywhere.	
	Cathedral - the tower was left in a dangerous condition. The capitulars, the chanters and the chaplains were enveloped in the ruins and all perished where they stood on the Epistle side; but those on the other side found themselves in a cavity which the large beams of the roof, which fell there, made with the wall of the choir. Converted into a mass of shapeless ruins. The movement of oscillation was followed instantly by the fall of a part of the roof; the ruin was completed by the last motion in a different direction. The Palace of the Captain-General suffered the fall of parts of the	

Event	Felt Effect	Source
	roof and all the walls were shaken out of plumb. The house of Peele, Hubbel and Company, solidly constructed and with its lower part formed of arches of cut stone, which had passed through some strong earthquakes, without damage, collapsed in a second. The lower parts of the house remained standing but were no longer habitable. The ground along the river bank opened. Church of Santa Isabel - roof and walls were completely levelled to the ground. Santo Domingo - the disaster was complete. The facade was dislodged; one tower fell and the other is leaning and will have to be taken down; the church is likewise leaning; the greater part of the monastery is in a ruinous state. Military Hospital is a heap of debris and, in its fall, many of the sick were killed. The churches of San Francisco, San Juan de Dios and the Recoletos are left useless for divine service. The Colegio de San Jose and the Convent of Santa Catalina and Santa Rosa are on the point of falling. The tower and facade of the municipal building and the magnificent structure of the Chamber of Commerce threaten to fall out. The edifices which housed the Royal Audiencia, the Intendencia, the Council of Administration, the Customs and other public activities have in part collapsed or are ruined. Private buildings - the greater number will need much repair and many ought to be demolished for general safety. (Buildings abandoned) Among all the churches in Intramuros, Mass can be celebrated	

Event	Felt Effect	Source
	only in San Agustin. Binondo - The famous tower has fallen, as also part of the church and the adjacent cigar factory. The number of victoms in Binondo was 145 and there were 39 injured. Divisoria - The whole upper part of the fish section fell, burying 40 persons more or less. Sta. Cruz - The church and part of the general prison were left in a ruinous state. The dead were 35 and the injured, 32. Quiapo - suffered much in its buildings, very few of which remain habitable. Victims were 23 dead and 2 injured. Tondo - Almost all the buildings called "possesiones" were demolished, burying 23 persons. San Miquel - Suffer the least in injuries to persons; only 10 Chinese injured. Of the buildings of the Army - the only ones left standing are the barracks of Malate, the park of the Engineers and the barracks next to the Royal Gate. In the Fortin - there were many casualties. In the Meisic barracks - two men and 40 horses were killed. According to a resume, there were 298 persons killed, exclusive of those in the Cathedral, 218 injured. The ruined public buildings numbered 46; those on the verge of ruin, 25. The public buildings destroyed were 570; those on the verge of ruin 528; total number of buildings rendered useless - 1,172. The garrison of Manila suffered 15 killed, 88 injured and 41 bruised.	

Event	Felt Effect	Source
	San Gabriel - A fissure was found which gave off some gases and from which issued a sound like running water. In the vaults of the Commercial Warehouse the ground opened for a length of 20-40 varas (55-110 feet). Cracks in vaults were perpendicular to this fissure.	
	Sangley Point - A crater opened and emitted water and dirt.	
	Cavite - A barracks collapsed, the telegraph tower fell, and nearby all walls were cracked.	
	Pasig - The great stone bridge which joined the two banks of the Pasig was closed. Lighthouse was considerably damaged.	
	Pasig, Tambo and Navotas - The masonry buildings were either thrown down or rendered uninhabitable.	
	Antipolo - Part of the tower of the church was demolished.	
	Lubang, Mindoro - Strongly felt in this town.	
	Damage to church structures, cracked walls and demolished bell towers at: Taguig; Chinta; San Mateo; Bocaue; Polo, Bulacan, Santa Maria, Bulacan; Bulacan, Bulacan; Malolos, Bulacan; San Rafael, Bulacan; Angat, Bulacan; San Isidro, Bulacan; Guiginto, Bulacan; Lubao, Pampanga; Macabebe, Pampanga; Bacoor, Cavite; Maragondon, Cavite; Las Pinyas, Cavite; Cabuyao, Laguna; San Pedro, Laguna; Tanay; Pililla.	
	In the Bay of Manila - a wave coming from SE to NW. It struck with such force that it came over the deck which it covered completely. The frigate shook and shivered strongly as if it had struck bottom. The water boiled around the ship in	

Event	Felt Effect	Source
	strong convulsions and it appeared whitish. On the side of the land, a flame rose up, which danced on the water like a ball for one minute. (This could be evidence for earthquake lights.	97
	At 7:25 p.m. a severe earthquake, with tremblings, shock waves and loud subterranean rumblings took place. The cathedral roof fell in, burying a large part of the worshippers; some were killed and hundreds were wounded. In the great square, the Governor -General's palace was unroofed and his family barely escaped with their lives. Most of the churches were rendered useless; lofty towers fell, killing many persons whose fate was tolled on the bells by unseen hands. Almost all the public buildings were levelled, or left uninhabitable; nearly every private house suffered more or less damage, though, as a result of improved methods of construction, the loss of life was less than in previous catastrophes. The shock lasted only half a minute. The ground opened in many places, giving forth gases, and the water in the river became dark and noisome. Everyone fled to the light and elastic palm thatch houses of the suburbs for safety.	36
	Cavite - in the port, the earthquake caused great destruction. On the peninsula of Canyacao fissures opened; one near Sangley Point is especially reported as a crater emitting sand and water.	
	Laguna - light damage at Santa Cruz, Pila and Pagsanjan.	
	Morong - great damage in the churches, convents and municipal buildings of all towns. The fall of the upper portion of the Antipolo tower injured three persons.	

Event	Felt Effect	Source
	Bulacan - this province suffered also heavily; nearly all the towns had their stone buildings destroyed.	
	In Bulacan, the capital, all the public and private stone buildings were damaged. Two bridges greatly damaged. In the soil large fissures ejected sand and water.	
	Bocaue, Baliwag, Santa Maria, Malolos, Guiginto, San Isidro, Quingua, Bigaa, Angat and Polo sustained similar ruin of churches and other stone buildings. Fissures in the soil were also reported from Sta. Isabel and Bocaue. Near Angat a fissure opened about a metre wide and more than four kilometres long.	
	Nueva Ecija - not much damage; but in the district of San Agustin, near San Jose, in the Talavera River a fissure opened which emitted sand and water.	
	Pampanga - the provincial building of Bacolor reported much damage; nearly all the walls were cracked and the roof ruined. The municipal building of Arayat, under construction, much damaged also.	
	La Union, Nueva Vizcaya, Ilocos Sur and Lepanto - the shocks were strongly felt but did not cause any damage.	65
	South Luzon - A destructive earthquake occurred without any previous shocks; some persons distinguished vertical movements followed by three or four tremendous jerks in different directions, N-S and E-W. Many were said to have seen the air luminous over the city of Manila; on both sides of the river the ruin was appalling; no fewer than 47 public buildings were ruined and 25 much damage; 570 private houses ruined and 528 more or less damaged; total	

Event	Felt Effect	Source
	1,170 structures. The most lamentable was the ruin of the Cathedral in which 16 persons perished. The total number of deaths in the city was about 320. No fissures were reported in the Walled City, excepting in the Commercial Warehouse; a great one which emitted sand and water opened at San Gabriel in the Trading Quay. The Grand Bridge was nearly destroyed, had to be pulled down and the Bridge of Spain built in its place. It is remarked that more damage occurred near the river than far from it.	69
	The most lamentable effect of the shocks was the destruction of the three aisles of the Cathedral at an hour when the canons and other people were conducting a religious service. All the persons seated on the west side of the choir, nine priests and seven singers and service boys, perished under the falling timbers and debris of the cupola, ceilings and roofs, while those sitting on the east side rushed at the first movement towards a passage through the lateral wall of the choir where they remained safe, and afterwards were able to get away under the timbers of the transept which, leaning on the same wall of the choir, left a narrow exit. The pilars of the main aisle and the upper portions of the lateral and front walls all came down. It is stated that water in the bay receded from Manila to Cavite and returned from that direction; it is not said whether the return was with force and whether it flooded the shores. As an indication of such outward movement, little is added, except that a frigate anchored in deep water felt the impression of grounding and a boat in ten fathoms touched the bottom.	65

Event	Felt Effect	Source
	Tayabas - very strong earthquake, but no damage occurred, except at Lucban where the roof of the church sustained some dislocation. At Mauban, part of the roof of the Municipal Building, already condemned as unsafe, caved in. Principe or Baler District - strong earthquake with a repetition between three and four o'clock of the following morning. Camarines and Mindoro - the shocks had only moderate intensity. Central area - it comprised the provinces of Morong and Manila, at present Rizal Province, Cavite, at least as far as Cavite Port, Bulacan, eastern Pampanga and south Nueva Ecija.	69
1863 June 11 3:00 p.m.	Burias Island: Earthquake shock of moderate intensity.	69
1863 July 15 1:30 p.m.	Batangas Province: Strong earthquake preceded by subterranean rumbling.	69
1863 July 30 1:30 a.m.	Northern Luzon: Cagayan - an oscillatory earthquake which was not very strong, lasting about one minute. San Fernando, La Union - between one and two on the first of August a momentary moderately strong earthquake was felt. Vigan, Ilocos Sur - on the morning of the 30th and the first of August, earthquakes which were moderately slow and lasted some seconds were felt. Laoag, Ilocos Norte - strong earthquake which lasted 30 seconds and was oscillatory from N to S. No damage. District of Lepanto - light,	

Event	Felt Effect	Source
	oscillatory and vibratory motion was felt.	
	Abra - a strong earthquake with oscillations from E to W of short duration not causing any damage.	
	Cayan, Lepanto - light, oscillation motion was felt before one o'clock a.m. and a vibratory motion was felt at approximately two a.m.	97
1863 Aug 01 1:25 a.m.	Northern Luzon: Strong earthquake felt in the provinces of Ilocos Sur, Abra, Lepanto, and La Union; at about 2^h a strong aftershock was felt in Abra Province.	69
1863 Aug 11 6:45 a.m.	Central Luzon: Strong earthquake in the provinces of Nueva Vizcaya, where it was preceded by rumbling sounds, Benguet and La Union.	69
1863 Aug 29 2:00 p.m.	Batangas: Batangas - a momentary, oscillatory earthquake from N to S which did not cause any injury to houses or persons.	
	Mindoro - between the towns of Sabaan and Puerto Galera, demolished a wall which constituted a hill of stone on the shore of the sea and exposed a mine of sulphur.	97
1863 Sep 20 9:30 p.m.	Masbate and Burias Island: Earthquake of moderate intensity. Shocks repeated four times during two hours. The same earthquake seems to have been strongly felt in the island of Marinduque. As Marinduque lies at a distance of about 150 kms. to the NW, these earthquakes must have extended widely and made themselves felt in other neighbouring regions. Their epicentre probably lay W of Burias.	69
1863 Sep 27 11:05 a.m.	Samar and Leyte: An oscillatory earthquake, extraordinarily strong and prolonged was felt in this province.	

Event	Felt Effect	Source
	Jaro and Ormoc - those shocks felt in this province were not noticeably different, where 19 were counted in one day. Much damage has been done to public and private buildings in several towns.	97
1863 Sep 28 5:00 p.m.	Masbate Island: Strong earthquake.	69, 97
1863 Oct 11	Burias Island: Shock of moderate intensity in the late hours of the evening.	69, 97
1864 Jan 03 4:40 p.m.	Mindanao: Felt a strong oscillatory earthquake.	
	Cotabato and Zamboanga; E-W for 46 seconds; 34 seconds N-S. It was repeated at Cotabato twice within 20 minutes but not so strongly.	69, 97
1864 Jan 03 6:40 p.m.	Southeastern Mindanao: A strong earthquake; duration of 30 seconds. One hour later, and at intervals of 15 minutes, two more light after-shocks were felt.	97
1864 Apr 13	Marinduque Island: Five different shocks of moderate intensity and short duration during the day.	69
1864 June 11 12:00 p.m.	Abra Province: Earthquake of moderate intensity; repetition on the 12th at 10:50 a.m.	69, 97
1864 July 14 4:20 a.m.	Lepanto Province (N Western Luzon): Two strong earthquakes, interval of some seconds, repetition a few minutes later, direction N-S.	69, 97
1864 Sep 14 7:35 p.m.	Manila: Shock of moderate intensity but of long duration.	69, 97
1864 Oct 14 midnight	Leyte: Very strong oscillatory earthquake which lasted 15 seconds.	97
1864 Nov 10 9:50 p.m.	Mindanao: Felt a strong vibratory earthquake from N to S; with a duration of half a second; it was accompanied by a loud subterranean	

Event	Felt Effect	Source
	noise.	97
1864 Dec. 06 11:45 a.m.	Masbate & Ticao: A strong earthquake, oscillatory, was felt.	97

PART B

CATALOGUE OF PHILIPPINE EARTHQUAKES 1865-1899

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CATALOGUE OF PHILIPPINE EARTHQUAKES
PART B 1865-1899

Event	Felt Effect	Source
1865 Feb 03 morning	Ilocos Norte: Between four and five on the morning of the third, this capital felt a strong earthquake, the oscillations of which were E to W prolonged for some 20 seconds.	97
1865 Feb 24 morning	Mindanao: The capital felt a strong earthquake, the duration of which was 10 to 12 seconds and the oscillations E to W but no damage resulted.	97
1865 Mar 12 7:45 p.m.	Abra: An earthquake was felt with oscillations moderately strong but of short duration.	97
1865 Apr 05 4:30 p.m.	Lepanto: This district felt a strong earthquake. Its motion was W to E and its duration some 15 seconds but no damage was caused.	97
1865 Apr 15 8:30 p.m.	Northwestern Luzon: This district felt a strong earthquake which caused no damage.	97
1865 May 10 9:30 p.m.	Manila: Two strong earthquakes in quick succession.	97
1865 May 30 2:00 a.m.	Ilocos Sur: A strong oscillatory earthquake was felt in this province which lasted some seconds.	97
1865 Jun 07 morning between 9 and 10	Mindanao: The earthquake felt a strong earthquake, the oscillations of which were N to S and duration from 12 to 15 seconds. No damage resulted.	97
1865 July 5-9 nights	Ilocos Sur: This province felt strong earthquakes which lasted some seconds, the first being of shorter duration but stronger than the second.	97
1865 Aug 2-3	Benguet: Several earthquakes of moderate intensity and duration have been felt.	97

Event	Felt Effect	Source
1865 Aug 19 9:45 a.m.	Manila: Strong oscillations from N to S.	97
1865 Oct 03	Benguet: Two very strong earthquakes were felt in the midst of the strongest part of a typhoon.	97
1865 Oct 19 night	Southeastern Luzon: A strong oscillatory earthquake preceded by a terrifying noise. Its direction was NW-SE. Tiwi - a masonry pillar was broken in the fort of Cajo, and three corners of the municipal building, which is of lime and brick construction, have opened; it is cracked in many directions and an arch has fallen. Luban - the bridge of Luban, 408 feet long and more than 33 wide, has sustained cracks of considerable size and a hole has opened in the middle of an arch. Two hundred and nine houses have been rendered useless. A large hole has appeared in the bridge going to Tiwi. The old municipal building is tilted, the bell tower has come down; there are many cracks in the church, notably in the floor. The monastery is tilted and its balcony has fallen, the stone wall has fallen on two sides and several persons suffered bruises and slight wounds. Tabaco - the municipal building is cracked in various directions and several heavy beams have been dislodged. In the stone church under construction and in the old bell tower there are many fissures, and four main arches have fallen. San Vicente - greater part of the land is covered with holes, recently opened, out of which water came. A stone wall and a stone warehouse have fallen.	

Event	Felt Effect	Source
	Malilipot - the municipal building has been cracked in various places. The Great Bridge of Bulanan remained impassable. Bacacay - two sides of the school have fallen. Tabaco, Albay - a part of the stone gallery of the plaza has fallen. Fissures can be seen in the church; in the house of administration the main walls have separated and the timbers of the gallery have come apart. District of Iraya - in the churches and parochial houses of Libon, Palangui and Oas several cracks have appeared and as many as 14 houses have fallen. Ligao - in the church of Ligao new fissures have opened and the old ones have widened. Guinobatan - enormous quantities of earth have come down from the hills on to the road and have closed the principal route in that section. District of Rinconada - churches and municipal buildings have suffered considerably Iriga and Nabua - the towers have fallen. The church of Nabua was rendered unserviceable. Some houses on swampy ground have collapsed.	97
1865 Oct 20 10:00 p.m.	Samar Felt strong oscillatory earthquake from E to W which lasted 58 seconds but did not cause any damage.	97
1865 Nov 03 8:20 p.m.	Mindoro: A strong earthquake was felt in a S to N direction with oscillatory motion. Two seconds' duration and caused no damage.	97

Event	Felt Effect	Source
1865 Nov 23 4:00 a.m.	Manila and adjacent provinces: Very strong and alarming earthquake.	97
1865 Nov 27 between 3 & 4 in the morning	Luzon: Morong - an earthquake of very short duration. San Isidro - an oscillatory earthquake from E - W. Batangas - at 4:20 a.m. a vibratory earthquake which lasted approximately one minute but no damage resulted to any building. Calapan, Mindoro - at 4:21 a.m. in the 27th a strong earthquake was felt from E - W, with oscillatory motion. Its duration was approximately 50 seconds but it did no damage because the buildings are of wood and palm thatch.	97
1865 Dec 25 7:30 a.m.	Ilocos Sur: This province felt a strong earthquake which lasted some seconds.	97
1866 Jan 15 4:30 a.m.	Masbate and Ticao: A strong earthquake was felt which began with vibratory motions and ended with four strong oscillations from E to W.	97
1866 Apr 13 morning between 8 and 9	Ilocos Sur: This capital felt a strong earthquake which lasted some seconds.	97
1866 Apr 16 3:50 a.m.	Mindoro: A strong earthquake with vibratory motion from E to W, lasting about eight seconds but causing no damage.	97
1866 June 24 morning betwen 1:30 and 2:00 a.m.	Ilocos Norte: A moderately strong earthquake which lasted more than three seconds; it did not damage the masonry buildings.	97
1866 June 28 4:00 p.m.	Northwestern Luzon: Laoag, Ilocos Norte - a moderately strong earthquake which lasted more than two minutes and damaged some partitions of the royal house.	

Event	Felt Effect	Source
	Vigan, Ilocos Sur - a strong earthquake which lasted some seconds.	97
1866 July 09 2:15 a.m.	Zambales: Iba - earthquake of greater violence and vibratory motion, but did not cause any damage.	97
1866 July 27 9:00 p.m.	Ilocos Sur: Vigan - a strong earthquake of short duration.	97
1866 Oct 27 5:30 p.m.	Albay: Albay - a strong oscillatory earthquake.	97
1866 Oct 31 4:00 a.m.	Albay: Albay - a moderately strong earthquake which lasted about eight seconds.	97
1866 Nov 18 before 11:00 a.m.	Northwestern Luzon: Bangued, Abra - a strong earthquake was felt.	97
1866 Nov 21 2:25 a.m.	Mindoro: Calapan - moderately strong earthquake,duration ten seconds, with an oscillatory motion from E to W.	97
1866 Nov 24 morning	Laoag: Laoag - strong oscillations.	97
1866 Dec 29 3:00 a.m.	Ilocos Norte: Laoag - a very strong earthquake which began as vibratory and then became oscillatory from N to S and lasted some 25 seconds. It caused considerable damage in the royal house, the walls and arches of which have cracked and the ceiling loosened.	97
1867 Jan 04 11:00 a.m.	Southeastern Luzon: Nueva Caceres - a moderately strong earthquake was felt. Ten minutes later there was an after shock of the same intensity which produced cracks in the walls of the church of Magarao. The walls and buttresses of the administration building of this city were also cracked. Albay - a strong and long earthquake was felt. No damage was done.	97

Event	Felt Effect	Source
1867 Feb 04 1:08 p.m.	Mindoro: Calapan - a strong earthquake with oscillatory motion first from E to W then N to S; duration of five seconds. No damage.	97
1867 Feb 06 3:20 p.m.	Southern Luzon: Manila - a strong earthquake of long duration was felt; the phenomenon repeated itself at midnight. Duration, 12 seconds and the motion was vibratory; Bulacan - at 3:10 p.m., a momentary oscillation was felt, which was repeated six minutes later by another lasting some seconds. Another aftershock at midnight, but of less force.	97
1867 Feb 24 5:15 a.m.	Mindanao: This capital felt a strong earthquake with oscillations from E to W and duration some eight or ten seconds; People were thrown into consternation, no injury.	97
1867 Feb 26 8:45 p.m.	Northwestern Luzon: Cayan, Lepanto - a short but strong earthquake with vibratory motion, which did not cause any damage.	97
1867 Mar 16 morning between 9 and 10 a.m.	Northwestern Luzon: Laoag, Ilocos Norte - this province felt a very strong earthquake with oscillations from N to S, which lasted 25 seconds.	97
1867 Mar 26 1:00 a.m.	Ilocos Norte: Strong earthquake preceded by a loud noise, with oscillations, lasting 20 seconds.	97
1867 June 24 9:00 a.m.	Panay and Mindoro: San Jose de Buenavista, Antique - an earthquake was felt in almost all the towns of this district with a duration of some 3 seconds and oscillations SE - NW.	97
1867 June 24 7:00 p.m.	Mindoro: Capiz - a strong oscillatory earthquake from E to W. Mindoro - a strong oscillatory earthquake.	97

Event	Felt Effect	Source
1867 Aug 15 3:00 p.m.	Mindoro: Calapan, Mindoro - felt a strong earthquake, with oscillatory movement from E to W. Duration, one second.	97
1867 Aug 28 11:00 a.m.	Ilocos Sur: Vigan, Ilocos Sur - strong earthquake of very short duration.	97
1867 Nov 01 2:30 a.m.	Ilocos Sur: Vigan, Ilocos Sur - strong earthquake of short duration.	97
1867 Nov 16	Mindanao: Davao - felt a strong earthquake with oscillations from N to S, lasting about 38 seconds.	97
1867 Dec 27 2:30 a.m.	Samar: Catbalogan - a strong earthquake which lasted about 50 seconds without causing damage of any consequence.	97
1868 Feb 19 2:48 p.m.	Mindanao: A strong vibratory earthquake was felt which lasted from 20 to 25 seconds; it was said to be the strongest felt in Suriçao in many years.	97
1868 Feb 26 10:15 p.m.	Western Luzon: Porac, Pampanga - strong oscillatory earthquake was felt.	97
1868 Apr 04 9:00 a.m.	Leyte: Felt a strong oscillatory earthquake, S to N, which lasted 50 seconds. It cracked some partitions in the government house which it left in a ruinous condition.	97
1868 June 06 5:45 a.m.	Iloilo, Panay: Iloilo, Panay - an earthquake with strong oscillations from N to S and from E to W.	97
1868 June 28 1:30 p.m.	Ilocos Sur: Vigan, Ilocos Sur - felt a strong earthquake which lasted some seconds.	97
1868 June 29 6:55 a.m.	Panay: Panay - moderately strong earthquake from S to N.	97
1868 June 29 8:11 a.m.	Another rapid and very strong one in the same direction as the preceding; it caused considerable alarm. In	

Event	Felt Effect	Source
	Alimodian it was felt in the same way.	97
1868 June 30 7:30 a.m. 8:00 a.m. 11:00 a.m.	Antique: San Jose de Buenavista, Antique - felt three earthquakes. All were of a few seconds' duration and, although moderately strong, did not cause any damage.	97
1868 July 30 betweem 1:00 & 2:00 p.m.	Northern Luzon: Tumauini, Isabela - at 1:02 p.m. this capital felt a light oscillatory earthquake from N to S. Ilocos Sur - at 1:30 p.m. this province felt a strong earthquake which lasted some seconds. Ilocos Norte - between 1:00 and 2:00 in the afternoon, this province felt a very strong oscillatory earthquake from N to S which lasted some 20 seconds. Cagayan - at 1:00 p.m. a moderately strong earthquake was felt in almost the entire province. In the warehouse at Lallo it strained seven braces; in other towns there was no damage.	97
1868 Aug 23 3:55 a.m.	Mindoro: Calapan; Mindoro - felt a strong earthquake with oscillatory motion, N-S, lasting five seconds. It destroyed part of the government house.	97
1868 Sept 15 7:45 p.m.	Northwestern Luzon: Cayan, Lepanto - a strong earthquake was felt in this capital lasting 20 seconds. It began with vibratory motion and ended with N-S oscillations.	97
1868 Sept 21 2:30 a.m.	Lepanto: Cayan, Lepanto - a strong earthquake was felt in this capital. It was of short duration, but with strong shocks of vibratory motion.	97
1868 Oct 20 12:30 p.m.	Lepanto: Cayan, Lepanto - felt an earthquake of short duration, but moderately strong with N-S oscilla-	

Event	Felt Effect	Source
	tions.	97
1868 Oct 22 between 11:00 & 12:00 p.m.	Pampanga: Bacolor, Pampanga - a strong earthquake was felt with N-S oscillations lasting five seconds.	97
1868 Nov 15 5:00 a.m.	Samar: Catbalogan, Samar - a strong earthquake lasting 15 to 20 seconds was felt in this capital.	
	Tacloban, Leyte - oscillatory earthquakes with N-S motion were felt on the mornings of the 9th and 15th. They were not very violent and were of moderate duration.	97
1868 Nov 19 0:25 a.m.	Manila: Manila - moderately strong, but short duration.	97
1868 Nov 22 10:35 p.m.	Western and Southern Luzon: Manila - strong oscillations, NE-SW.	
1868 Nov 22 11:30 p.m.	Zambales: Iba, Zambales - an earthquake of moderate duration was felt.	
1868 Nov 22 night	Camarines Sur: Nueva Caceres, Camarines Sur - a moderate earthquake was felt in this capital.	97
1868 Dec 01	Antique: Antique - a strong earthquake was felt which had a N - S direction for some 25 seconds.	97
1869 Jan 25 & 29 2:00 p.m. & 9:00 a.m.	Ilocos Sur: Vigan, Ilocos Sur - at 2:00 p.m. on Monday and at 9:00 a.m. on Friday, the 25th, strong earthquakes of short duration were felt in this province.	97
1869 Feb 20 2:00 a.m.	Samar: Catbalogan, Samar - a long and strong earthquake was felt in this capital.	97
1869 Mar 24 9:15 a.m.	Zambales: Iba - a moderately strong earthquake was felt in this capital.	97
1869 Apr 20 6:00 a.m.	Ilocos Sur: Vigan, Ilocos Sur - a strong earthquake of short duration was felt in this capital.	97

Event	Felt Effect	Source
1869 Apr 29 between 9:00 & 10:00 a.m.	Mindanao: Cotabato - a strong earthquake was felt. A bay of the wall of the fort at Pollok fell and some military buildings were cracked.	97
1869 Aug 06 8:00 a.m.	Leyte: Tacloban - an earthquake was felt. Its motion was vibratory and although very short was felt with great force. Tanawan - it was felt in the same way and, as it happened during the time of Mass, some bruises were sustained by the people, all of whom tried to get out of the church at the same time.	97
1869 Aug 16 3:00 p.m.	Southeastern Luzon & Eastern Visayas: Masbate - animal s were terrified, domesticated birds flew around in an unwonted manner, and the sea was disturbed; the motion of the earth was E - W and so strong that all were frightened and threw themselves out of the houses in spite of the fact that they did not offer any danger as they are built of wood, bamboo and palm thatch. The few masonry buildings were considerably damaged and the others were tilted; the statues in the church turned on their pedestals, and in private houses nearly everything was jolted out of place. Large trees fell; cracks of great width opened in the south of the island of Masbate, and there were slides in the hills and on the steep sea-coast. A small island, among the many at the north end of Ticao, is said to have disappeared. Tacloban, Leyte - an earthquake was felt in this capital with N-S oscillations lasting about 20 seconds. San Pascual, Burias Islands - an earthquake of moderate intensity with NE-SW oscillations.	

Event	Felt Effect	Source
	Albay - strong rotary and oscillatory earthquake which lasted 25 seconds. Later there were some less important movements. These earthquakes have not caused any damage except in the beautiful church of this capital which is on the verge of ruin because of its damaged arches.	
	Nueva Caceres - a strong earthquake was felt in this province. Its duration was 15 seconds and it began as rotary and ended with NW-SE oscillations.	
	Samar - strong earthquake lasting 16 seconds.	97
1869 Aug 26 6:45 p.m.	Panay and Mindoro: Capiz, Panay - strong earthquake.	
	Calapan, Mindoro - a strong earthquake was felt with vibratory E-W motion, lasting five seconds.	97
1869 Sep 24 10:45 a.m.	Zambales: Iba, Zambales - a strong earthquake of short duration.	97
1869 Oct 01 11:15 a.m.	Southern Luzon and Mindoro: The first earthquake for which the records of the Manila Observatory give the results of an instrumental observation. Time 11:35 a.m. Duration: 60 seconds. Direction: SSE-NNW. Amplitude: NNW-15°; SSE-12°15'. There were no personal injuries except some bruises. The buildings have sustained some damage and some are left useless, but none has fallen.	
	Manila - facade of St. Augustine's church cracked. Administration of Rents, part of roof collapsed and doors and windows damaged. One wall in the house of Smith, Bell and Company fell. House of Ramirez damaged. House on Calle San Jacinto down. A shop at the side of the church of San Gabriel down. Shell	

Event	Felt Effect	Source
	balçony of No. 25 Guiotan, House of la Peninsular, roof damaged. Cuartel of Arroceros damaged. The steamer "Iloilo" was near Maricaban at 11:30 a.m. and a strong shaking was felt and then another, and others which made it seem that the steamer had gone on the rocks.	
	Porac, Pampanga - on the first between 11 and 12 a.m., a strong earthquake was felt in this capital. There were three SE-NW oscillations, each one lasting from 15 to 20 seconds with intervals of five or six seconds.	
	Balanga, Bataan - almost at noon, a strong earthquake was felt in this province. The oscillations are NW-SE and of long duration. The damage to buildings can be quickly repaired.	
	Iba, Zambales - at exactly 11:00 a.m., a strong earthquake of some duration was felt in this capital.	
	Cavite - the rooms of the old infantry barracks have fallen and the other public and private buildings of this port have sustained damage. As a result of the rush of employees to get out of the cigar factory, six suffered slight injuries. The fall of one of the shops in the arsenal injured five.	
	San Roque - the arches of the dome of the church under construction fell without causing any personal injury.	
	Bacoor - the vault of the church fell and destroyed the main altar.	
	Silang - some of the church walls fell.	
	Indang - some of the monastery walls fell and two large cracks appeared in the tower of the church.	

Event	Felt Effect	Source
	Naic - cracks in the bell tower.	
	Morong - a strong earthquake was felt which began with N-S oscillation and lasted 30 seconds.	
	Batangas, Batangas - at 11:30 a.m. a strong earthquake of 40 seconds' duration was felt in this province. Vibratory and oscillatory motions were perceived. The strongest masonry buildings have been damaged. especially the tower of the church, the public market, and the administration building.	
	San Isidro, Nueva Ecija - on the first, 3rd, and 5th, earthquakes were felt in this capital, the first being very strong and the last two moderate, none of which caused damage.	
	Vigan, Ilocos Sur - at 11:30 a.m. a strong earthquake which lasted some seconds.	
	Sta. Cruz, laguna - a strong earthquake which lasted more than a minute. It began with a vibratory motion, then followed violent oscillations in a SSE-NNW direction. There was no damage to buildings.	
	Lingayen, Pangasinan - a strong N-S oscillatory earthquake in the whole province. Its duration was one minute, 30 seconds. The towns which have reported have not sustained any damage.	
	Bacolor, Pampanga - a very strong earthquake with duration of more than a minute. Part of the roof of the public school fell; there was some damage to the tower of the church of Sta. Ana and there are several cracks in the minicipal building of Arayat.	
	Mindoro - an earthquake on the first	

Event	Felt Effect	Source
	which began in a terrifying vibratory manner and continued with oscillations for three minutes and 30 seconds. Bulacan - on the first of this month, there was a most horrible earthquake which lasted more than a minute, and it caused the following damage in this province: Malolos - the building occupied by the government has been damaged by cracks in its arches and main walls so that it is necessary to support them. The tower of the church is on the point of falling, part of it having been destroyed. The roofs of the church and rectory have been damaged. Cracks have opened in the principal bridge of Atlag. Several stone houses and warehouses of the district are in a ruinous state and some houses of bamboo and palm thatch have been destroyed. The tower of the chapel of San Jose district has fallen. The tower of the church of Sta. Ana, the facade of that of Bayom-bayan and the two inside arches of the church of Santa Inez and two private houses are in a ruinous condition. Paombong - besides the destruction of the municipal building, large fissures have opened which emitted burnt gases, water and sand. The main wall of the rectory was cracked, and the entrance of the chapel of the Capitangan district has fallen, as also the bridge of Caitocong, and those of Caiybon and Calariate have been destroyed. Sta. Isabel - one wall of the kitchen of the rectory has fallen, and the front is in a ruinous condition. The chapel of the Mabolo district is also in bad condition, and its entrance has fallen.	

Event	Felt Effect	Source
	Pulilan - the tower is in a ruinous condition, part of the rectory roof has fallen.	
	Barasoain - fissures, from which water and sand issured, opened behind the church. An arch and the tower adjoining the church have fallen. Some stone houses have been damaged and a man was injured on the head. Some stone warehouses have fallen.	
	Bigaa - the roof of the minicipal building is greatly damaged and the building is useless.	
	Quinga - large fissures have opened and teh posts of the municipal building were cracked to such an extent that the structure is next to useless.	
	Hagonoy - the stone house for the reception of corpses has been destroyed.	
	Baliwag - the municipal building is completely useless.	
	Boac, Marinduque - at 11:45 a.m., a strong vibratory earthquake was felt which lasted more than a minute. Several partitions and also the plaster in the municipal building fell.	
	Tayabas - between 11 and 12 a.m. on the first an earthquake was felt in the capital and in some towns of this province. It began moderately, but after an interval it increased its force. No damage of any consequence was sustained.	
	Baler - an earthquake which lasted 75 seconds. It caused no damage because the houses are of bamboo and palm thatch.	

Event	Felt Effect	Source
	Antique: San Jose de Buenavista; San Remigio; Patnongon; Bugasan - between 11 and 12 a.m., a light oscillatory earthquake which lasted about three seconds.	
	Batangas: Bauan - church tower fell and main walls cracked. Columns turned round.	
	Faal - church tower tilted; church cracked in spite of its location on rock.	
	Nueva Caceres - long, light oscillations WNW-ESE.	
	La Union - weak oscillations, scarcely perceptible.	97
1869 Oct 05 3:30 a.m.	Luzon: Lingayen, Pangasinan - a strong oscillatory and vibratory earthquake was noticed by all in spite of the advanced hour of the night.	
	Iba, Zambales - a strong earthquake of moderate duration was felt and there were two aftershocks at intervals of half an hour.	97
1869 Oct 22 4:00 a.m.	Ilocos Sur: Vigan, Ilocos Sur - a strong earthquake which lasted some seconds was felt in this capital.	97
1869 Oct 23 4:30 p.m.	Southern Luzon: Manila - four thirty p.m., five seconds, E - W direction.	
	Cavinti, laguna - an oscillatory earthquake was felt, its direction was E - W.	
	Batangas, Batangas - strong earthquake with E - W oscillation, lasting 20 seconds.	
	Morong - a strong oscillatory earthquake was felt.	
	Sta. Cruz, Laguna - at 4:30 p.m., a violent earthquake which lasted four	

Event	Felt Effect	Source
	seconds was felt. It began with a strong E - W oscillation, and then came a great vibratory motion until the end. All the stone buildings, except the jail, suffered more or less.	
	Bulacan - an earthquake of short duration was felt.	
	Camarines Sur - an oscillatory earthquake of moderate duration and in a N - S direction was felt.	97
1870 Jan 05 10:00 p.m.	Zambales: Iba, Zambales - a strong earthquake of moderate duration was felt in this capital.	97
1870 Jan 09 4:45 a.m.	Southern Luzon and Mindoro: Manila - at 4:45 a.m. an earthquake was felt which began with light shocks and ended with one a little stronger; its duration was 50 seconds.	
	Batangas, Batangas - an E - W oscillatory earthquake was felt in this capital. it lasted 15 seconds.	97
1870 Jan 29 between 1:00 & 2:00 a.m.	Mindanao: A strong earthquake was felt in this district. It was oscillatory in a N - S direction and 25 seconds' duration.	97
1870 Feb 04 2:30 a.m.	Samar: Strong oscillatory earthquake, lasting 12 seconds was felt in this capital.	97
1870 Feb 12 3:00 a.m.	Samar: Catarman - a strong oscillatory earthquake was felt. It lasted 15 seconds and caused the bells to ring. On the following day, about 8:00 a.m., there was another oscillation for a few seconds.	97
1870 Feb 22 6:40 p.m.	Southeastern Luzon: Daet, Camarines Norte - an intense earthquake was felt. It was more vibratory than oscillatory, strong, but the pendulum did not deviate much from the perpendicular. it lasted about 15 seconds.	97

Event	Felt Effect	Source
1870 Mar 10 5:30 a.m.	Mindanao: Oscillatory earthquake, violent, but of short duration.	97
1870 Mar 11 1:45 a.m.	Southeastern Luzon: Albay, Albay - a strong earthquake was felt in this province. It was oscillatory, E - W and its duration was ten seconds.	97
1870 Mar 14 between 9:00 & 10:00 a.m.	Ilocos Norte: Laoag, Ilocos Norte - a strong earthquake was felt in this province. Its oscillations were N - S and they lasted 20 seconds.	97
1870 Mar 23 11:30 p.m.	Northern Luzon: Ilagan, Isabela - at 11:30 p.m., an oscillatory earthquake from N to S lasting 50 seconds was felt in this capital. It turned a girder and a tie-beam in the tobacco warehouse.	
	Laoag, Ilocos Norte - a very strong earthquake was felt in this province. Its oscillations were N - S, it lasted 15 seconds and produced several cracks in the walls of the government building.	
	Cayan, Lepanto - a strong earthquake was felt in this capital and in other places of the district. There were prolonged oscillations from E to W of great amplitude, but not violent and the motion was very regular.	
	Vigan, Ilocos Sur - a strong vibratory and oscillatory earthquake was felt in this province. It was of very long duration.	
	Tuguegarao, Cagayan - a long and intense earthquake was felt in this capital. It was oscillatory from E to W and afterwards changed to N - S. It lasted almost a minute and during almost all of that time it was in the latter direction.	
	Bontoc, Mt. Province - a strong oscillatory earthquake was felt in this capital.	97

Event	Felt Effect	Source
1870 Aug 04 10:35 p.m.	Albay: Albay, Albay - a strong earthquake was felt in this province. The motion was oscillatory, N - S, lasting seven seconds.	97
1870 Oct 10 6:00 p.m.	Northwestern Luzon: Vigan, Ilocos Sur - at 6:00 p.m., a strong oscillatory earthquake of very short duration was felt in this capital.	97
1870 Oct 21 10:45 p.m.	Albay: Albay, Albay - a strong earthquake was felt in this capital and in the neighbouring towns. It was oscillatory, N - S, and lasted ten seconds.	97
1870 Nov 04 between 3:00 & 4:00 p.m.	Mindanao: Davao - three oscillatory earthquakes at intervals of a few minutes. Strong and long duration which caused great alarm. The intensity was sufficient to damage stone buildings. Cagayan, Misamis - from the 4th of November to the 15th, vibratory earthquakes of 20-25 seconds' duration were felt in this whole province. Town of Blanco - four men were buried alive by a landslide from a nearby hill.	97
1870 Dec 14 5:50 p.m.	Mindanao: Davao - a strong earthquake was felt which began as vibratory and ended as oscillatory.	97
1870 Dec 16 1:00 a.m.	Mindanao: Davao - oscillatory earthquake, moderately strong and with a duration of 35 to 40 seconds.	97
1870 Dec 19 8:00 p.m.	Cagayan: Tuguegarao, Cagayan - a strong vibratory earthquake was felt. It lasted about 30 seconds.	97
1871 Feb 08 1:58 a.m.	Albay: Albay - a strong oscillatory earthquake was felt. Its direction was N - S and it lasted eight seconds.	97

Event	Felt Effect	Source
1871 Feb 21 4:00 a.m.	Mindanao: A violent earthquake shook the island, causing considerable damage to the stone buildings. On the flank of the mountain, the sight was dreadful. The rolling masses of stone were destroying trees and plantations, while the opening of fissures caused a noise like that of a great storm. The inhabitants of the town were terrified and from this moment began to escape in their boats.	97
1871 Mar 24 2:48 a.m.	Northwestern Luzon: Cayan, Lepanto - at 2:48 a.m., a violent momentary earthquake was felt in this capital. It was vibratory and preceded by a momentary, uniform, oscillatory shock. Vigan - oscillatory, regular, short. La Union - oscillatory, strong.	97
1871 Mar 29 11:58 p.m.	North Luzon: Tuguegarao - a strong oscillatory earthquake was felt; E - W direction and it lasted more than 30 seconds.	97
1871 May 04 8:45 a.m.	Mindanao: Davao - an earthquake of moderate intensity was felt; its oscillations were E - W and it lasted about two minutes.	97
1871 May 05 12:15 p.m.	Mindanao: Davao - oscillatory and during its motion two moderately strong shocks were felt. It lasted two minutes.	97
1871 May 12 9:10 a.m.	Leyte, Tacloban: Leyte - a strong earthquake lasting six seconds was felt in this capital.	97
1871 May 28 5:30 a.m.	Mindanao: Davao - a prolonged earthquake was felt. Stone buildings would have suffered damage.	97
1871 June 14 between 1:00 & 2:00 a.m.	Southeastern Luzon: Two strong oscillatory earthquake were felt. Nueva Caceres, Camarines Sur -	

Event	Felt Effect	Source
	Strong oscillatory earthquakes were felt in this province at intervals of two or three seconds; the first was vibratory and lasted eight seconds. The second was short. Both were accompanied by subterranean noise.	97
1871 June 28 4:20 a.m.	Mindanao: Cagayan, Misamis - an earthquake was felt in this capital; its motion was vibratory and oscillatory and it lasted less than 15 seconds.	97
1871 July 05 12:30 p.m.	Samar: Catbalogan - a strong oscillatory earthquake lasting four seconds was felt in this capital.	97
1871 July 07 5:00 a.m.	Leyte: Tacloban - a strong oscillatory earthquake lasting about four seconds was felt in this capital.	97
1871 July 11 9:00 p.m.	Northern Luzon: Tuguegarao, Cagayan - at 9:00 p.m., a strong earthquake was felt which lasted 15 seconds. Bayombong, Nueva Vizcaya - an earthquake was felt in this capital. Its motion was N to S and its duration was 15 to 20 seconds. There was a weaker aftershock at 10:00 p.m. Cayan, Lepanto - a violent earthquake was felt in this capital and in the province. There were three aftershocks in half an hour. The prolonged oscillations from N to S caused the collapse of some retaining walls of the natives' rice fields but no damage was done to buildings, because they are of light materials. Bontoc, Mt. Province - two strong vibratory earthquakes were felt in this capital and in other places in the province. The shocks were separated by an interval of some seconds. At 9:00 p.m. an oscillatory shock of long duration. The first two shocks were preceded by	

Event	Felt Effect	Source
	subterranean noise.	
	Ilocos Sur - short, strong, oscillatory shock. At midnight a stronger shock was felt lasting eight seconds.	
	San Fernando, La Union - strong, oscillatory E - W shock. An aftershock a little later.	97
1871 Sept 16 2:00 a.m.	Leyte: Tacloban - a strong oscillatory earthquake was felt in this capital. It lasted three seconds.	97
1871 Oct 04 8:30 p.m.	Mindanao: Davao - strong, long, oscillatory earthquake.	97
1871 Oct 05 9:15 a.m.	Samar: Samar - vibratory and oscillatory earthquake, N - S, eight to ten seconds. Preceded by subterranean noise from the [illegible].	97
1871 Oct 09 9:30 p.m.	Northwestern Luzon: Cayan, Lepanto - a strong oscillatory earthquake was felt. There were aftershocks from N to S at intervals of 40 seconds. These shocks contributed to the ruin which was caused the next day by the force of a typhoon.	
	Laoag, Ilocos Norte - very strong earthquake was felt. Oscillations from N to S that lasted 25 seconds.	
	Bontoc, Mt. Province - small oscillatory earthquake.	
	Vigan, Ilocos Sur - strong earthquake of very short duration.	97
1871 Nov 05 8:45 a.m.	Mindanao: Surigao - oscillatory, violent, lasting five minutes. The walls of the church were damaged notwithstanding the fact that they are three varas (over 8 feet) thick; destructive.	
	Davao - violent oscillatory and rotary earthquake lasting two minutes. Motion E to W. Difficult to	

Event	Felt Effect	Source
	remain standing. Light oscillatory aftershocks at 9:20 and 10:15.	
	Cebu - oscillatory, moderate, lasting 50 seconds.	97
1871 Nov 09 between 4:00 & 5:00	Davao: Two oscillatory moderate earthquakes in half an hour. Light, rotary aftershocks at 9:15 and 10:15 p.m.	97
1871 Nov 29 4:30 p.m.	Zamboanga: Very strong oscillatory earthquake from N to S, lasting 15 seconds. Short aftershocks at 9:00 p.m. Another similar shock on the 30th at 9:00 a.m. Some damage to houses.	97
1871 Dec 08 5:30 p.m.	South Mindanao: Cotabato - violent, oscillatory, N to S and E to W, lasting 20 seconds. All buildings levelled to the ground. Half an hour later, there was a more violent shock which completed the ruin left by the former. Vibratory aftershocks all night. Continuous trembling all day on the 9th, with two shocks much stronger than the others. No habitable house left in the town. Deep subterranean noises; an earthy odour perceived by all. Some destruction in Pollok.	97
1871 Dec 11 1:55 a.m.	Davao: Strong, momentary vibratory earthquake with subterranean noise.	97
10:05 p.m.	Davao: Strong vibratory and oscillatory earthquake from N to S; preceded by subterranean noise.	97
1871 Dec 19 11:00 p.m.	Mindanao and Leyte: Davao - intense oscillatory earthquake with loud subterranean noise; bells rang.	
	Leyte - strong oscillatory earthquake lasting one minute.	97
1872 Jan 16	Isabela: Isabela - three shocks from E - W, two long and strong aftershocks.	97

Event	Felt Effect	Source
1872 Jan 22 4:46 p.m.	Masbate: Masbate - a strong vibratory earthquake was felt in this capital. It was of short duration.	97
1872 Jan 26 7:30 p.m.	Zambales: Agno, Zambales - violent, long, oscillatory earthquake, E - W, accompanied by subterranean noises. Ten or twelve aftershocks, violent, vibratory and oscillatory.	97
1872 Jan 27 afternoon	Ilocos Norte: Laoag - between 4:00 and 5:00 p.m. A very strong oscillatory earthquake was felt in this capital lasting about 25 seconds. At 9:30 p.m., an oscillatory aftershock of short duration.	97
1872 Jan 29	Northwestern Luzon: Lingayen - at 7:00 p.m., a strong earthquake of short duration.	
	Laoag, Ilocos Norte - strong, vibratory earthquake from N to S lasting 15 seconds. Aftershock at 9:00 p.m. Another at 9:00 a.m., January 30. This was followed by a series of faint shocks.	97
1872 Feb 03 4:15 p.m.	Ilocos Sur: Vigan, Ilocos - strong earthquake of short duration was felt.	97
1872 Feb 05 3:42 a.m.	Albay: Albay - strong, oscillatory earthquake, N - S.	
	Camarines Sur - strong.	85
1872 Feb 16 11:00 a.m.	Isabela: Strong oscillatory earthquake from E to W.	97
1872 Feb 26 7:30 a.m.	Samar: At 7:30 a.m., a strong oscillatory earthquake was felt. It was from E to W and lasted three seconds.	97
1872 Mar 05 8:45 a.m.	Southern Luzon and Mindoro: Strong, oscillatory, E to W lasting one second.	97
1872 Mar 15 3:00 p.m.	Mindanao, Davao: Davao - oscillatory, moderate, short earthquake.	97

Event	Felt Effect	Source
1872 Mar 25 2:05 p.m.	Mindanao: Davao - strong, short, oscillatory earthquake, E to W.	97
1872 Mar 26 7:30 a.m.	Samar: Catbalogan - strong oscillatory earthquake from W to E, lasting three seconds.	97
1872 Apr 07 10:55 a.m.	Ilocos Sur: A short, moderate earthquake.	97
1872 Apr 17	Antique: A strong earthquake was felt in the town of Patnongon. San Jose de Buenavista - oscillatory from E and W, but of short duration.	97
1872 Apr 17 5: 30 a.m.	Northeastern Luzon: Nueva Viscaya - a short, strong, vibratory earthquake. Bayombong - a short, strong vibratory earthquake.	97
1872 May 20 2:00 a.m.	Albay: A strong oscillatory earthquake.	97
1872 June 17 8:50 p.m.	Mindanao: Cagayan, Misamis - a very strong earthquake was felt. Its motion was vibratory and of very strong duration.	97
1872 July 07 7:00 - 8:00 p.m.	Masbate: Between 7:00 and 8:00 p.m., a strong vibratory earthquake lasting two seconds.	97
1872 July 22 10:50 p.m.	Camarines and Albay: Daet - strong, oscillatory earthquake N - S, 25 - 30 seconds.	97
1872 Aug 19 4:00 a.m.	Mindoro: A strong oscillatory earthquake, lasting ten seconds.	97
1872 Sept 05 11:30 a.m.	Leyte: A strong oscillatory earthquake from N to S, lasting 30 seconds. A light aftershock at 3:05 p.m.	97
1872 Sept 06 3:00 a.m.	Southeastern Luzon and Eastern Visayas: Catbalogan, Samar - a strong earthquake was felt. It lasted about one minute and its	

Event	Felt Effect	Source
	motion was rotary at first and then oscillatory.	
	Albay, Albay - strong earthquake, oscillatory from S to N and from W - E.	97
1872 Sept 10 8:20 p.m.	Luzon: Bangued, Abra - strong, vibratory shock. Four or five after-shocks at night.	97
1872 Sept 20 3:00 a.m.	Zambales: Iba - short, strong, vibratory shock. Four or five after-shocks at night.	97
1872 Oct 07 9:00 a.m.	Leyte: Tacloban - a strong earth-quake was felt. It was a vibratory shock from N to S which lasted two seconds.	97
1872 Oct 17 10:00 a.m.	Abra: A strong oscillatory shock was felt in this province.	97
1872 Nov 17 3:20 a.m.	Albay: A strong, oscillatory earth-quake.	97
1872 Nov 26 9:00 a.m.	Camarines Norte: Daet - a moderately strong earthquake. It ended as oscillatory and lasted 30 seconds.	97
1872 Dec 19 10:10 p.m.	Luzon: Manila - a moderate, oscilla-tory and vibratory earthquake.	97
1872 Dec 29 11:35 a.m.	Luzon: Pangasinan - 11:35 a.m., oscillatory, strong, N - S, 50 seconds.	
	Batangas - 11:35 a.m., vibratory - oscillatory, strong, E - W, 40 seconds. Masonry building damaged. Aftershocks at 3:00 p.m. and at night.	
	Baler - oscillatory earthquake which lasted about one minute.	
	Pulilan, Bulacan - ruined the entire dome and part of the transept of Pulilan.	
	Bulacan, Bulacan - in other public	

Event	Felt Effect	Source
	and private buildings of this province there was no damage, except to the government house, church and rectory of this town.	
	Zambales - a strong oscillatory and vibratory earthquake was felt in this province. It lasted about 50 seconds but caused no damage.	
	Ilocos Sur - between 11:00 a.m. - 12:00 noon, a light earthquake was felt in the province.	
	Balanga, Bataan - at 11:30 a.m., an oscillatory earthquake was felt in this province. It lasted from 45 to 50 seconds, but caused no damage in this town.	
	Orion - the kitchen roof of the rectory collapsed and two statues fell in the church.	
	San Isidro, Nueva Ecija - at 11:45 a.m. an earthquake lasting 20 to 25 seconds was felt in this capital. It began with vibratory motion in which several shocks were felt and then it changed to oscillatory from E to W, which continued to the end. The oscillations were of some force and rapidity.	
	Morong - a strong earthquake was felt. Its oscillations were N to S but caused no damage.	97
1873 Jan 02 morning	Cagayan: Tuguegarao - a strong oscillatory and vibratory earthquake was felt.	97
1873 Jan 16 11:45 p.m.	Luzon: Instrumental record in Manila: Time - 11:45 p.m. Duration - 12 seconds. Direction - W 1/4SW - E1/4 NE. The beginning was vibratory and, after a few moments, it became oscillatory. There was a subterranean noise.	
	Nueva Ecija - on the 16^{th} at 11:30	

Event	Felt Effect	Source
	p.m. and on the 18th at 4:20 p.m., two strong vibratory shocks were felt. The second moved a beam in the roof of the government house.	
	Cavite - on the night of the 16th, a strong vibratory earthquake was felt here. It caused no damage.	
	Morong, Morong - on the 16th, a strong vibratory earthquake was felt in the province.	
	Batangas - at 11:45 p.m. on the 16th an earthquake of short duration was felt in this province.	
	Bataan - on the 16th at 11:45 p.m., an oscillatory earthquake was felt in this province. It lasted about 20 seconds.	97
1873 Jan 18 6:00 p.m.	Camarines Norte: Daet, Camarines Norte - an earthquake was felt. It began as vibratory and became oscillatory in a N-S direction. It was moderately strong, of short duration, and there were 3 after-shocks in the same direction.	97
1873 Feb 18 about 1:00 p.m.	Samar: Mercedes Town - a strong earthquake was felt. It lasted about five seconds and was in a W to E direction; because of its violence the bells rang and part of the house, which Don Manuel Morales was erecting, collapsed.	97
1873 Feb 20 between 1:00 to 2:00 p.m.	Abra: Bangued, Abra - a vibratory motion of moderate intensity and short duration was felt.	97
1873 Mar 03 6:35 p.m.	Luzon: Bayombong, Nueva Vizcaya - a violent vibratory earthquake was felt. It was accompanied by a loud subterranean noise, and according to the people it was the strongest ever experienced.	97
1873 Mar 09 6:00 p.m.	Masbate: Masbate - there was a strong earthquake which lasted more	

Event	Felt Effect	Source
	than five seconds, and several others of shorter duration.	97
1873 Mar 14 1:00 - 2:00 a.m.	Ilocos Norte: Laoag - a strong earthquake was felt. It was oscillatory from N-S and lasted 15 seconds.	97
1873 Mar 31 1:58 a.m.	Luzon: The earthquake took place at 1:58 a.m. and its duration was about 20 seconds. It began with a moderately strong vibratory shock, and this was followed by a barely perceptible motion.	97
	Abra - a strong earthquake was felt in this province, lasting from 20 to 25 seconds.	
	Vigan, Ilocos Sur - between 1:00 and 2:00 a.m., an earthquake was felt in this province.	
	Ilocos Norte - a very strong earthquake was felt in this province. It was oscillatory from N - S and lasted 90 seconds.	97
1873 June 11 11:15 p.m.	Southern Luzon: The earthquake took place at 11:15 p.m. and lasted three seconds. Its direction was N 40°E to S 40° and its amplitude was $1^{\circ}8'$ in the first direction and $1^{\circ}14'$ in the second.	
	Sta. Cruz, Laguna - at 11:10 p.m. a slight earthquake which lasted four seconds was felt in this capital.	
	Morong, Morong - at 11:00 p.m., an earthquake was felt in this capital. It was vibratory and then oscillatory and lasted 20 to 30 seconds.	
	Tayabas, Tayabas - between 11:00 and 11:30 p.m., an oscillatory earthquake was felt in this capital. Its motion was N to S, of moderate intensity, but its duration could not be estimated. There were three successive aftershocks.	

Event	Felt Effect	Source
	Batangas, Batangas - at 11:00 p.m., an oscillatory earthquake was felt in this province. Its motion was E-W.	97
1873 July 14 3:11 p.m.	Romblon: Romblon - moderately strong, lasting about two seconds.	97
1873 Aug 27 1:15 p.m.	Morong: Morong - a very strong vibratory earthquake was felt with duration of about two seconds.	97
1873 Nov 14 5:30 p.m.	Southern Luzon: Duration of four seconds; direction E 20^{o} N - W 20^{o}S.	
	Manila - somewhat strong. Aftershock at 1:15 a.m. on the 15th. Began with a subterranean noise, but weaker than the former.	
	Morong - an oscillatory earthquake from N to S was felt in this capital. It lasted about four seconds. There was an aftershock in the morning of the 15th.	
	Batangas - a light earthquake which lasted 30 seconds was felt in this province. At 1:30 a.m. on the 15th, another of the same duration but less intensity was felt.	
	Sta. Cruz, Laguna - an oscillatory earthquake was felt in this capital. A few minutes later, there was a vibratory aftershock, moderately strong, which damaged the roof of the capital building and the public prison.	
	Tayabas - an earthquake from N to S was felt in this capital and in some towns. It lasted five seconds and opened some cracks in the walls of the municipal building in Mauban and in some houses of brick and mortar in Lucban.	
	Albay - an oscillatory earthquake was felt in this capital. It was from E to W and lasted 25 to 30	

Event	Felt Effect	Source
	seconds.	
	Daet, Camarines Norte - a strong earthquake was felt. Its motion was oscillatory from SE to NW ending with a vibratory motion. It lasted about 20 seconds. In the government house some of the walls of the single masonry section were cracked.	
	Talisay - in the municipal building of Talisay, the columns supporting the roof have turned round.	
	Sta. Cruz, Marinduque - a strong earthquake which was oscillatory from E to W and lasted three or four seconds. The higher roof of the church was loosened and some tiles were dislodged from the lower roof on the left side. There were earthquakes again at 7:00 and 11:00 p.m. and at 9:00 a.m. the following day. They were less intense and lasted one or two seconds without causing any further damage.	
	Boac, Marinduque - the earthquake was felt with the same oscillation and intensity (as in Sta. Cruz) but with a duration of 18 seconds. A partition in the municipal building fell, as also part of the roof and balcony.	
	San Pascual, Burias Island - an oscillatory earthquake was felt in this island. It was moderately strong from N to S and caused some damage in the military headquarters, in the parish house and in the church.	97
1873 Dec 17 3:45 a.m.	Southern Luzon and visayan Islanc. Capiz - a moderate oscillatory earthquake.	
	Masbate - strong earthquake was felt in this capital. It began as oscillatory and ended as vibratory.	

Event	Felt Effect	Source
	Albay - vibratory earthquake which lasted about ten seconds.	97
1873 Dec 29 1:58 a.m.	Southeastern Luzon: Camarines Norte - moderate oscillatory earthquake from N to S, lasting 30 seconds.	
	Nueva Caceres - an oscillatory earthquake from N to S was felt. It lasted about 20 seconds.	97
1874 Jan 17 4:00 a.m.	Southeastern Luzon & Masbate: Masbate & Camarines - strong earthquake with several aftershocks.	
	Manila - light oscillations, NE-SW. Duration one second.	97
1874 Feb 03 5:55 a.m.	Luzon: First earthquake - 5:55 a.m. Direction NE-SW; horizontal amplitude on both sides, 45'; vertical, six mm.; duration, 40 seconds. Second earthquake, 1:15 p.m. Direction, E - W & NE - SW. Horizontal amplitude 24 minutes of are on each side of the vertical component; duration, six seconds. Third earthquake, 1:50 p.m. Direction, NNE-SSW, horizontal amplitude, 27' on each side, vertical, 0; duration, four seconds.	
	Baler, Principe - a vibratory earthquake from N - S lasting about 15 seconds.	
	Balanga, Bataan - an oscillatory earthquake from N to S, lasting about 20 seconds was felt in this province.	
	Calapan, Mindoro - an oscillatory earthquake from N to S, lasting about 20 seconds was felt in this province.	
	Calapan, Mindoro - an oscillatory earthquake from S to N it was weak and lasted about one minute.	
	Tarlac, Tarlac - an earthquake which	

Event	Felt Effect	Source
	lasted 15 seconds. There was another of less intensity at 1:55 p.m.	
	Iba, Zambales - at 5:15 a.m., a strong earthquake was felt in this capital. It was oscillatory and vibratory from SE - NW and its duration was about 40 seconds.	
	Porac, Pampanga - a strong earthquake of moderate duration was felt. At 1:15 p.m. there was another of shorter duration and at 1:50 p.m. another of very short duration.	
	Vigan, Ilocos Sur - at 6:00 a.m., a light earthquake was felt in this capital.	
	Morong, Morong - about 6:00 a.m., a vibratory earthquake lasting about ten seconds.	
	Sta. Cruz, Laguna - about 6:00 a.m., an earthquake of short duration was felt.	
	Batangas, Batangas - at 5:45 a.m., an oscillatory earthquake from E to W lasting 20 seconds was felt.	97
1874 Feb 05 10:00 a.m.	Masbate: Masbate - a vibratory earthquake was felt in this province. It was moderately strong, lasting three seconds.	97
1874 Feb 06 4:00 a.m.	Zambales: Iba - an oscillatory, long and weak earthquake which was moderately strong at the end.	97
1874 Feb 28 8:45 p.m.	Visayas and Luzon: Masbate - strong, vibratory earthquake. It lasted 10 to 15 seconds.	
	Capiz, Panay - small earthquake felt.	
	Albay, Albay - oscillatory earthquake from N to S lasting about three seconds.	97

Event	Felt Effect	Source
1874 Mar 01	Masbate: Five earthquakes felt at intervals of an hour. They were strong shocks and all vibratory.	97
1874 Mar 05 morning 7:00 - 8:00	Masbate: Masbate - vibratory earthquakes, moderately strong, were felt on the morning of the 5^{th}.	97
1874 Mar 14 12:00 midnight	Zambales: Iba - a strong vibratory earthquake from SE to NW and short duration.	97
1874 Apr 13 6:20 a.m.	Northern Luzon: Vigan - at 6:20 a.m., a moderate earthquake with vibratory motion, lasting several seconds. Tuguegarao, Cagayan - an earthquake of short duration and very little force was felt. Laoag, Ilocos Norte - a strong earthquake. It began as vibratory and then became oscillatory from N - S lasting 15 seconds. Bangued, Abra - a vibratory motion of moderate intensity and of short duration.	97
1874 May 02 between 1:00 - 2:00 a.m.	Masbate: Masbate - a strong earthquake was felt.	97
1874 May 26 5:30 a.m.	Northern Luzon: Bangued, Abra - a vibratory motion and after a short interval and oscillatory motion, both moderately strong but of short duration. Tuguegarao, Cagayan - an earthquake of short duration.	97
1874 July 08 10:30 a.m.	Luzon: Manila Observatory record: Time - 10:30 a.m. Direction - NE 1/4N - SW 1/4S Duration - six seconds. Horizontal amplitude given by an ellipse, the major axis of which was 2^{o}: the vertical seismometer moved two mm.; moderately strong.	

Event	Felt Effect	Source
	San Isidro, Nueva Ecija - an oscillatory earthquake from E - W lasting four seconds.	
	Iba, Zambales - an oscillatory earthquake from SE - NW lasting five seconds.	
	Tumawini, Isabela - an oscillatory earthquake lasting about one minute.	
	Tarlac, Tarlac - a light earthquake was felt.	
	Baler, Principe - an earthquake which began with a strong vibratory shock and ended as oscillatory with a duration of about 20 seconds.	
	Bayombong, Nueva Vizcaya - strong, oscillatory earthquake was felt.	
	Porac, pampanga - a light earthquake was felt in this district.	97
1874 July 22 between 10:00 & 11:00 p.m.	Zambales - a moderate oscillatory earthquake.	97
1874 Aug 03	It was destructive only in Lepanto-Bontoc district.	97
1874 Aug 18 3:35 p.m.	Albay: Albay - a strong earthquake lasting five seconds with oscillatory motion from N-S.	97
1874 Aug 24 12:15 p.m.	Northwestern Luzon: Laoag - very strong oscillatory earthquake from N - S, lasting 25 seconds.	
	Vigan - an earthquake of short duration.	
	Bangued - weak earthquake of short duration.	
	Cayan, Lepanto - prolonged oscillatory earthquake from N - S.	97
1874 Aug 25 6:15 a.m.	Mindanao: Zamboanga - a strong earthquake with vibratory and E - W	

Event	Felt Effect	Source
	oscillatory motion lasting about 20 seconds was felt. Some walls in this town were cracked.	
	Isabela de Basilan - a vibratory earthquake from SW to NE lasting more than a minute. The roof collapsed and the partitions were cracked in the house of the chief of this district.	97
	The earthquake caused alarm and ruined buildings. In Zamboanga City, all houses fell. Nine posts of the cemetery were destroyed. Some buildings and a pier suffered cracks. In Isabela de Basilan, the earthquake was also felt but did not cause much damage. In the district of Cotabato, the earthquake was also felt but not too strongly.	103
1874 Aug 27 10:00 p.m.	Romblon: Romblon - an earthquake of moderate intensity was felt and in the course of an hour there were ten aftershocks.	97
1874 Aug 29 between 9:00 & 10:00 p.m.	Zambales: Iba - vibratory earthquakes which lasted six or seven seconds at intervals of 20 seconds.	97
1874 Oct 03 p.m.	Lepanto: Cayan, Lepanto - at twilight, a violent earthquake was felt. It was a momentary, vibratory shock which dislodged stones in some houses. In the tobacco warehouse, the piles of baled tobacco, which cover a great area, were shifted from their places. The same happened with objects in the houses.	97
1874 Oct 16 between 10:00 & 11:00 a.m.	Luzon: Daet, Camarines Norte - 10:05 a.m., a moderately strong earthquake. It began as vibratory and then became oscillatory. Forty seconds' duration.	
	Tarlac, Tarlac - a strong oscillatory earthquake from EW, lasting ten seconds.	

Event	Felt Effect	Source
	Baler, Principe - a strong vibratory and rotary earthquake of very short duration.	
	Bacolor, Pampanga - moderately strong, lasting, 35 seconds N - S.	
	Tayabas - an oscillatory earthquake lasting about 35 seconds.	
	Porac, Pampanga - strong earthquake of moderate duration.	
	Bulacan - an earthquake of some intensity from E to W lasting 50 seconds.	
	Sta. Cruz, Laguna - moderately strong and of some duration.	
	Cayan, Lepanto - an oscillatory earthquake from E to W, 40 seconds' duration.	
	Iba, Zambales - oscillatory earthquake from E-W, eight to ten seconds.	
	Tuguegarao, Cagayan - earthquake of light intensity and short duration.	
	Calamba - oscillatory, E-W, 50 seconds.	
	Taal - oscillatory, NW-SE.	
	Punta Santiago - oscillatory perceptible.	
	Cavite - oscillatory, light.	
	Lingayen - 26 seconds.	
	Manila - oscillatory and vibratory, direction not constant. Continuous movement between 10:09 a.m. and 12:29 p.m. Some persons say they felt 19 successive shocks. Three of these shocks were conspicuous for their intensity and duration. The first, the strongest began at 10:09	

Event	Felt Effect	Source
	a.m. Its duration was one minute and its motion vibratory to eight mm. The second earthquake occurred at 10:15 a.m. and was of less intensity and duration than the former, but it was more dangerous because the oscillation, vibration and rotation were simultaneous. The direction of oscillation was E25°N to W25°S and the rotary motion was S to N. The third was weaker than the others and was felt at 12:29 p.m. It lasted only eight seconds.	
	San Isidro, Nueva Ecija - moderate intensity, oscillations from N-S, 55 seconds.	
	Batangas, Batangas - moderately strong earthquake.	
	Sto. Tomas, Batangas - the walls of the public school were cracked.	
	Bayombong, Nueva Vizcaya - strong and oscillatory.	
	San Fernando - an earthquake from N - S.	
	Vigan, Ilocos Sur - an earthquake which lasted some seconds.	97
1874 Nov 30 4:40 a.m.	Albay: Albay, Albay - a strong earthquake of two violent vibratory shocks, duration two seconds.	97
1875 Jan 18 10:15 p.m.	Visayan Island: Catbalogan, Samar - an oscillatory earthquake with very violent shocks was felt. Its duration was 30 seconds.	
	Capiz, Panay - an earthquake was felt. First vibratory and then oscillatory from N to S and of short duration.	97
1875 Jan 27 7:30 a.m.	Southern Luzon: Daet, Camarines Norte - vibratory earthquake of moderate strength but of short duration.	

Event	Felt Effect	Source
	Sta. Cruz, Laguna - earthquake of short duration but of some intensity was felt.	
	Manila - oscillatory, light.	97
1875 Mar 08 3:00 a.m.	Northern Luzon: Tuguegarao, Cagayan - at 3:00 a.m., a strong earthquake was felt. Four hours later there was another, but in spite of the force and duration there was no damage.	
	Cayan, Lepanto - oscillatory from N - S at 3:00 a.m. Its duration was 40 seconds and it was very strong. There have been other shocks at different hours daily but no damage was done except the dislodging of the upper beams of the tobacco warehouse of this capital.	97
1875 Mar 09 1:22 a.m.	Northern Luzon: La Trinidad, Benguet - at 1:22 a.m., a very strong earthquake lasting more than 30 seconds.	
	Baler, Principe - an earthquake of moderate intensity.	
	Abra, Bangued - vibratory earthquake of moderate intensity. The following day there were three others barely perceptible. Both caused some damage to the stone buildings.	97
1875 Mar 09 3:30 a.m.	Northern Luzon: Vigan, Ilocos Sur - a strong earthquake from E to W lasting 80 seconds.	97
1875 Mar 12 9:00 p.m.	Northern Luzon: Vigan, Ilocos Sur - at 9:00 p.m., earthquake of less intensity (than that of the 9^{th} March) causing the collapse of part of the roof of the church of Cavayan.	
	Tuguegarao, Cagayan - on the 12^{th} and 17^{th}, earthquakes were felt in this province but, owing to their slight force, no damage resulted.	97

Event	Felt Effect	Source
1875 Mar 14, 16, 17 & 18 night	Bangued, Abra - vibratory earthquakes of moderate intensity and short duration.	97
1875 Apr 06 4:30 p.m.	Mindanao: Davao - an earthquake was felt of such intensity that, according to persons of longest residence in this district, it was the strongest earthquake ever experienced. It was rotary at first and afterwards took a N - S direction lasting about 30 seconds.	97
1875 Apr 17 5:00 a.m.	Northern Luzon: Cayan, Lepanto - at 5:00 a.m., a strong oscillatory earthquake from E to W was felt.	
	Bangued, Abra - a vibratory earthquake of moderate intensity but of short duration was felt.	97
1875 May 09 3:30 a.m.	Northern Luzon: Bayombong, Nueva Vizcaya - began with a strong and rapid vibratory motion and then continued as oscillatory for more than ten seconds.	97
1875 May 18 3:00 p.m.	Luzon: Manila - oscillatory, light.	
	Iba, Zambales - a strong vibratory earthquake of five seconds' duration. A few minutes later, there was another, of oscillatory motion stronger than the former and of ten seconds' duration.	
	Tarlac, Tarlac - an oscillatory earthquake from S to N lasting 15 seconds.	
	Porac Pampanga - an earthquake was felt in this district.	
	Vigan, Ilocos Sur - an oscillatory earthquake from N to S and of light intensity.	
	Bacolor, Pampanga - an earthquake of moderate intensity from E to W lasting 15 seconds.	97

Event	Felt Effect	Source
1875 May 19 11:30 a.m.	Southeastern Luzon & Samar: Manila - oscillatory, light, very long. Nueva Caceres, Camarines Sur - 11:28 a.m. lasted 50 seconds, beginning as vibratory and then becoming oscillatory from E to W. Some cracks were opened in the walls of the public prison. Daet, Camarines Norte - an earthquake which began with a vibratory motion and ended as oscillatory from E to W. It was the strongest known in this province for a long time. The masonry of the bridge of this capital sustained some damage. Albay, Albay - a strong oscillatory earthquake which lasted about one minute. After some moments there was another, but weaker. Catbalogan - a strong oscillatory earthquake. San Muguel, Burias - a strong oscillatory earthquake from N to S lasting 35 seconds. The Command Headquarters which was already in bad condition, is beginning to fall.	97
1875 May 23 3:00 a.m.	Romblon: Romblon - a strong vibratory earthquakes was felt. There was a moderate noise and the earthquake lasted 20 seconds. It cracked part of the dome of the church of this town.	97
1875 May 25 4:00 a.m.	Southeastern Luzon and Mindanao: Davao - an oscillatory earthquake from E to W lasting 30 seconds and of moderate intensity. Nueva Caceres - somewhat prolonged earthquake was felt.	97
1875 May 28 3:00 a.m.	Luzon: Bacolor, Pampanga - a moderate earthquake was felt but its direction and duration could not be estimated.	

Event	Felt Effect	Source
	Iba, Zambales - a moderately strong earthquake of moderate duration was felt.	97
1875 June 02	Southeastern Luzon: Masbate, Masbate - a strong oscillatory earthquake, ten seconds.	
	Albay, Albay - oscillatory oscillatory earthquake, 45 seconds, vibratory too.	
	Daet, Camarines Norte - light earthquake from E - W.	97
1875 June 07 1:00 & 2:00 p.m.	Abra: Bangued, Abra - a vibratory earthquake of moderate intensity but of short duration.	97
1875 July 05 6:20 p.m.	Benguet: La Trinidad, Benguet - a strong earthquake of 30 seconds' duration.	97
1875 Aug 12 7:55 a.m.	Mindanao: Zamboanga - an oscillatory earthquake from N to S of great intensity.	
	Cotabato, Cotabato - a strong earthquake of one minutes' duration. It caused some damage to the public buildings of this district and to some private houses.	97
1875 Sept 11 morning	Leyte: Tacloban - very strong earthquake was felt.	
	Dulag - it lasted a minute and a half.	97
1875 Sept 16 2:30 a.m.	Northern Luzon: La Trinidad, Benguet - strong oscillatory earthquake. It was first N to S, then SW - NE and lasted a minute and a half.	
	Vigan, Ilocos Sur - strong earthquake of short duration.	97
1875 Sept 17 3:00 a.m.	Too slight to cause any damage. The vibration was 0.5 mm. and the pendulum in its motion from N to S departed only 0.7° from the	

Event	Felt Effect	Source
	vertical, describing a total arc of 1.4° (Manila).	
	Porac, Pampanga - an earthquake of short duration.	
	Cayan, Lepanto - a violent earthquake was felt in this district. It was first vibratory and then oscillatory from E to W and visibly moved the buildings. In the tobacco warehouse, the bales were dislodged.	
	Bayombong, Nueva Vizcaya - a strong oscillatory earthquake of short duration.	
	Iba, Zambales - a strong earthquake, long and oscillatory.	
	Lingayen, Pangasinan - an earthquake of short duration was felt in this capital and in some towns of the province.	
	San Isidro, Nueva Ecija - an oscillatory earthquake of short duration and light intensity.	97
1875 Oct 15 11:00 p.m.	Benguet: La Trinidad, Benguet - a very strong earthquake of which the duration could not be estimated. Its motion was so strong and irregular that it caused considerable damage to public and private buildings.	97
1875 Nov 01 4:25 p.m.	Luzon: The earthquake which took place at 4:25 p.m. was first vibratory and then oscillatory. The duration was six seconds.	
	San Fernando, La Union - an oscillatory and vibratory earthquake of short duration. It damaged a great part of the wall on the left side of the kitchen of the prison.	
	Bangued, Abra - a light oscillatory earthquake from N to S was felt in this capital and in the neighbouring towns.	

Event	Felt Effect	Source
	Vigan, Ilocos Sur - a very strong earthquake which lasted some seconds.	
	La Trinidad, Benguet - a strong earthquake of vaired motion was felt. The oscillations were such as had not been remembered in this capital. It lasted about ten seconds.	
	Bayombong - a strong earthquake, oscillatory motion and 12 seconds' duration.	
	Lba, Zambales - an oscillatory earthqauke of moderate intensity and duration.	
	Cayan, Lepanto - a strong oscillatory earthquake from E to W which lasted 40 seconds.	
	Tuguegarao - an earthquake of light intensity and one minute's duration with N - S motion.	97
1875 Nov 05 3:00 a.m.	Samar & Leyte: Catbalogan, Samar - a strong oscillatory earthquake was felt.	
	Tacloban, Leyte - a very strong and long earthquake was felt.	97
1875 Nov 14 3:30 p.m.	Ilocos Sur: Vigan - a strong earthquake was felt.	97
1876 Feb 18 midnight	Luzon: Lingayen, pangasinan - a strong earthquake of short duration was felt. According to the Observatory, it was also felt in Ilocos Sur and Benguet.	97
1876 Mar 11 12:35 p.m.	Benguet: La Trinidad - a very strong vibratory earthquake lasting several seconds.	97
1876 Mar 19 12:15 a.m.	Northwestern Luzon: Vigan - a strong earthquake lasting some seconds.	
	Bengued - light earthquake.	97

Event	Felt Effect	Source
1876 May 26 3:45 p.m.	Ilocos Sur: Vigan - strong earthquake which lasted some seconds.	97
1876 June 12 between 11:00 & 12:00 p.m.	Southeastern Luzon: Albay - strong, oscillatory earthquake, 20 seconds' duration.	
	Nueva Caceres - strong vibratory earthquake from N - S, 30 seconds' duration.	97
1876 July 25 morning	Eastern Visayas & Mindanao: A strong earthquake lasting more than a minute was felt. It opened a crack more than a braza (about 6 feet) in length and one quarter in width in the wharf on this port.	97
1876 July 26 4:00 a.m.	Mindanao: Surigao - at 4:00 a.m., a strong vibratory earthquake from E to W lasting about 50 seconds was felt. It caused considerable damage to the government house.	97
1876 July 27 10:00 a.m.	Northeastern Luzon: Baler, Principe - an oscillatory earthquake of three seconds' duration and from N - S was felt. It was light at first, but ended in a strong and sudden shock.	97
1876 Aug 10 5:45 a.m.	Southeastern Luzon: Nueva Caceres - a strong vibratory earthquake from W - E which lasted 15 or 20 seconds was felt.	97
1876 Aug 23 12:30 a.m.	Northwestern Luzon: Vigan - a strong earthquake of short duration was felt.	97
1876 Nov 17 11:20 p.m.	Luzon: Vigan - a strong earthquake which lasted some seconds was felt.	
	Bangued, Abra - oscillatory earthquake of moderate intensity but short duration.	
	Cayan, Lepanto - a strong earthquake of short duration.	97

Event	Felt Effect	Source
1876 Nov 18 between 4:00 & 5:00 a.m.	Zambales: Iba - strong earthquake was felt.	97
1876 Nov 20 11:00 p.m.	Luzon: Tuguegarao, Cagayan - an oscillatory earthquake from E - W of moderate intensity which lasted eight seconds.	97
1876 Dec 13 11:45 p.m.	Zamboanga: Zamboanga - somewhat strong, oscillatory, 25 seconds' duration.	97
1877 Feb 26 8:27 p.m.	Luzon: The earthquake felt at 8:27 p.m. was oscillatory and vibratory; duration 12 seconds. Lingayen, Pangasinan - an earthquake from S to N which lasted 12 seconds. Iba, Zambales - a strong oscillatory earthquake was felt. Sta. Cruz, Laguna - a vibratory and oscillatory earthquake was felt. The earthquake was also reported from these places: Corregidor; Bacolor; Balanga; Tarlac; Dagupan; San Fernando;	97
1877 Mar 22 between 11:00 & 12:00 p.m.	Leyte: A strong oscillatory earthquake from S to N lasting about 40 seconds was felt. Tanawan: it was from E to W and lasted about 40 seconds; felt.	97
1877 Apr 06 2:00 a.m.	Panay: Iloilo - strong vibratory earthquake lasting 30 seconds was felt.	97
1877 Apr 17 3:00 - 4.00 p.m.	Panay: Panay - between 3:00 and 4:00 p.m., vibratory - oscillatory; violent; N - S; 45 seconds.	97
1877 June 02 11:06 a.m.	Luzon: Manila - the earthquake was perceived in Manila at 11:06 a.m. It was only oscillatory in the direction NNE-SSW. Two successive shocks were noted with a total duration of about seven seconds. In the	

Event	Felt Effect	Source
	beginning the pendulum moved in one vertical plane tracing a line in the sand but then it took on a rotary motion, describing an oval with major axis NNE-SSW measuring four degrees. The vertical seismometer did not indicate anything.	
	Sta. Cruz, Laguna - a prolonged oscillatory earthquake was felt.	
	Iba, Zambales - a strong earthquake was felt in this capital. In the beginning, it was oscillatory from N to S ending with a vibratory shock and oscillatory motion from E to W.	
	Lingayen, Pangasinan - a strong vibratory earthquake from N - S of short duration.	
	Bayombong, Nueva Vizcaya - a light vibratory earthquake which lasted some seconds; NS-EW, short duration.	
	Vigan - an oscillatory earthquake from NNE-SSW which lasted about ten seconds.	
	Cavite - a light oscillatory earthquake from E-W with duration of ten seconds.	
	Bulacan - an earthquake of moderate intensity with oscillations NNW-SSE with duration of 25 seconds.	
	San Fernando, Pampanga - an earthquake of moderate intensity, but of short duration, direction NW-SE.	
	Balanga, Bataan - a light oscillatory earthquake.	
	Bacolor, Pampanga - a strong oscillatory earthquake; direction, E-W with duration of 25 seconds.	
	Tarlac - a very strong rotary earthquake with duration of 30 seconds.	

Event	Felt Effect	Source
	Dagupan - an oscillatory earthquake from N to S with duration of 15 seconds.	
	San Isidro - a strong earthquake from N to S with duration of 22 seconds. It was vibratory and oscillatory.	
	San Fernando, La Union - strong oscillations from NW to SE of short duration.	
	Calamba - earthquake of very light intensity and duration of one second.	97
1877 June 24 between 7:00 & 8:00 a.m.	Luzon: Iba, Zambales - a strong; oscillatory and vibratory earthquake was felt.	97
1877 June 24 between 1:00 & 6:30 a.m.	Luzon: There were seven strong earthquakes in the neighbourhood of Taal Volcano and cracks were opened in the ground.	97
1877 July 05 12:07 p.m.	Luzon & Visayas: Manila - the earthquake was felt at 12:07 p.m. It was only oscillatory in the direction W 5^{o}S - E 5^{o}N. The first motion of the pendulum was to the west, departing $2^{o}15'$ from the vertical and it traced an oval of which the major axis measured $5^{o}30'$ and its minor axis 2^{o}. Only one shock was felt and the vertical seismometer did not show any vibration. This explains why it was felt as a gentle earthquake in spite of the fact that there was considerable oscillation. The duration was 17 seconds.	
	Sta. Cruz, Laguna - an earthquake of moderate duration and oscillatory from SE to NW was felt.	
	Baler, Principe - an oscillatory earthquake from N to S and of short duration was felt.	
	Tacloban, Leyte - a strong oscilla-	

Event	Felt Effect	Source
	tory and vibratory earthquake from N to S, lasting 30 seconds was felt.	
	Daet, Camarines Norte - a strong earthquake was felt in this capital. It began as vibratory and ended as oscillatory in a N-S direction lasting 30 seconds. Between 12:00 and 2:00 p.m., there were four more but they were shorter and weaker. At 11:45 p.m., there were two more, one moderately strong and prolonged.	
	Capiz, Panay - an oscillatory earthquake of some intensity and duration from E to W was felt.	
	Catbalogan, Samar - a strong earthquake was felt. It began with vibration and then oscillated from W to E and the duration was about eight seconds. Bells rang. There were slighter shocks at 7:00 p.m., at midnight and 2:00 a.m. and 6:00 p.m. the following day.	97
1877 July 06 3:55 p.m.	Southeastern Luzon: Daet, Camarines Norte - there was another moderately strong earthquake. As a result of this earthquake, (including that of July 5) the government house, condemned many years ago, has suffered considerably, especially the part which was built in the rear prison; all the walls were cracked and some stones have been thrown out of place, and it remained in a condition which threatened complete ruin. Some private buildings have been moderately damaged.	
	Milaor - moderate intensity. The walls of the church and rectory were cracked and the facade of the church has suffered, some stones having fallen from place.	
	San Jose - the wall of the church has some cracks and some glass windows were broken.	

Event	Felt Effect	Source
	Nueva Caceres, Camarines Sur - in this capital, and also in some other towns, there has been some slight damage to stone buildings. A great number of clocks stopped during the earthquake. That there was not more destruction can be attributed to the fact that the oscillations did not change their direction.	97
1877 July 23 4:20 p.m.	Leyte: Tacloban - a strong oscillatory and vibratory earthquake which lasted 30 seconds was felt. Two front walls of the courthouse and the wharf of the port have been damaged. Caporan church collapsed during the strong earthquake.	97
1877 July 24 12:30 a.m.	Cebu: Moderate, oscillatory earthquake.	97
1877 Aug 12 4:00 p.m.	Luzon: Manila and NW provinces - moderate earthquake, somewhat long. Although the earthquake was of light intensity, it was also felt in the adjoining provinces of the central seismic zone including Manila, where oscillatory movements were perceived in the NW-SE direction. It was of moderate intensity in the province of Nueva Viscaya and Isabela; strong in Ilocos Sur and Abra where it caused some damage such as the unroofing of some houses and the knocking down of other buildings being constructed. It was repeated various times but with less intensity and the movements were generally N-S; duration was 15-58 seconds.	28
1877 Sept 12 4:00 p.m.	Luzon: Manila - oscillatory, light, SE-NW, duration 15 seconds. Bayombong, Nueva Viscaya - an oscillatory earthquake from N to S which lasted some seconds. Vigan, Ilocos Sur - a strong earthquake which was vibratory for a movement and oscillatory for the	

Event	Felt Effect	Source
	space of about 20 seconds. Because of its intensity it alarmed people everywhere.	
	Tumauini, Isabela - an earthquake of short duration was felt.	
	Bangued, Abra - on the afternoon of the 12th and on the morning of the 14th three oscillatory earthquakes were felt in this capital and in the nearby towns. The one on the 12th was moderately strong and the others barely perceptible. The first damaged some tile roofs.	
	Laoag, Ilocos Norte - a strong, vibratory earthquake lasting 12 seconds.	
	Candon - oscillatory, moderate, N-S, 40 seconds.	
	Bacolor - perceptible.	97
1877 Oct 16 10:00 p.m.	Mindanao: Tamontaca - moderate earthquake was felt.	97
1877 Oct 23 between 1:00 & 2:00 p.m.	Masbate: A strong vibratory earthquake was felt in this locality. There was another at 8:00 p.m., greater force and longer duration.	97
1878 Jan 12 9:05 a.m.	Luzon: Manila - 9:05 a.m. The horizontal seismometer moved in a NNW-SSE direction with an amplitude of 1^{o} on each side; the vertical moved 2 mm. The duration was 15 seconds.	
	Iba, Zambales - at 9:00 a.m. there was a violent earthquake in this capital. Its direction was S to N and its duration was moderate but it could not be estimated exactly. The vibratory motion was not very noticeable, but the oscillatory was very marked and of great amplitude, which was shown by the fact that several bundles of papers fell from a cabinet in the courthouse. In other classes of construction there	

Event	Felt Effect	Source
	would have been great damage. Several clocks stopped and the earthquake was preceded by a subterranean noise similar to that of waves washing over the beach.	97
	Taal and Batangas - oscillatory - perceptibel.	
	Bacolor - oscillatory - SE-NW; strong; duration, 20 seconds.	
	Bulacan - oscillatory, N-S, moderate intensity.	
	Balanga (Bataan) - oscillatory; NE-SW; duration, 20 seconds.	
	Tarlac - oscillatory - light; duration; 10 seconds.	
	Lingayen (Pangasinan) - oscillatory; SW-NE; light; duration, 10 seconds.	
	Dagupan (Pangasinan) - oscillatory N-S; moderate intensity; duration, 30 seconds.	
	San Isidro (Nueva Ecija) - oscillatory; N-S; light, duration, 4 seconds.	
	San Fernando (La Union) - oscillatory; N-S; moderate intensity; duration, 4 seconds.	85
1878 Jan 17 8:00 a.m.	Leyte: Tacloban - a strong oscillatory and vibratory earthquake was felt. Several cracks appeared in the stone wharf of this port and several bridges were damaged.	97
1878 Mar 06 8:42 p.m.	Mindanao: Davao - oscillatory earthquake; moderate; E-W; 20 seconds' duration.	97
1878 Mar 12 morning	Leyte: Tacloban - on the morning of the 12th a strong vibratory earthquake which lasted 30 seconds.	97

Event	Felt Effect	Source
1878 June 25 morning	Mindanao: Moderately perceptible earthquake.	97
1878 July 29 10:00 a.m.	Romblon: Romblon - oscillatory, strong. Several shocks were felt within two minutes. The government house was cracked and the roof damaged.	97
1878 Aug 02 10:30 a.m.	Mindanao: Surigao - strong earthquake; NW-SE.	97
1878 Aug 03 12:14 p.m.	Luzon: Manila - an intense oscillatory earthquake; direction NW 9^{o}W to SE 9^{o}E; duration, one minute.	
	San Isidro - Nueva Ecija - an oscillatory earthquake from E-W and lasting 50 seconds.	
	Batangas, Batangas - a strong earthquake of moderate duration was felt.	
	Tarlac, Tarlac - an oscillatory earthquake from NE to SW lasting 25 seconds.	
	Baler, Principe - a light oscillatory earthquake, N-S, was felt.	
	Binangonan, Infanta - a strong oscillatory earthquake W to E.	
	Calapan, Mindoro - an earthquake in this capital. There were 2 others at 1:00 and 2:30 p.m.	
	Iba, Zambales - a strong earthquake was felt. It was rotary at first and then violently oscillatory. The duration could not be estimated.	
	Cavite - oscillatory earthquake lasting 50 seconds.	
	Restinga - oscillatory earthquake from E to W lasting 10 seconds.	
	Calamba - oscillatory earthquake lasting 50 seconds.	

Event	Felt Effect	Source
	Sta. Cruz - oscillatory earthquake from E to W lasting 15 seconds.	
	Taal - moderate oscillatory earthquake, E-W, lasting 15 seconds.	
	Punta Santiago - strong oscillatory earthquake, N - S, lasting 15 seconds.	
	Corregidor - strong earthquake, N - S, lasting 30 seconds.	
	Bulacan - strong oscillatory earthquake, NW-SE, lasting one minute.	
	Bacolor - strong earthquake of oscillatory motion, NE-SW, lasting 40 seconds. Strong earthquake, oscillation, SW - NE, lasting 50 seconds.	97
1878 Sept 16 12:15 p.m.	Mindanao: A strong earthquake in this locality lasted a minute and some seconds, beginning with a very pronounced circular motion and with some strong vibrations, ending with an oscillation from NE to SW; government house has been completely wrecked; the roof is dislocated by reason of the rotation of the posts, and the greater part has been taken down to avoid accidents.	97
1878 Sept 17 12:50 a.m.	Southeastern Mindanao, Davao District near Mt. Apo: Destructive effects inconsiderable.	85
1878 Nov 05 2:14 a.m.	Southeastern Luzon: Nueva Caceres - a violent oscillatory earthquake from NE - SW lasting 45 seconds. There was slight damage to buildings.	97
1878 Nov 28 2:03 a.m.	Romblon: Romblon - oscillatory, strong, two seconds' duration.	97
1879 Jan 03 9:29 a.m.	Luzon: Manila - oscillatory light.	
	Bacolor - oscillatory, light, NW - SE, ten seconds.	

Event	Felt Effect	Source
	Bolinao - oscillatory, perceptible, 6 seconds.	
	Dagupan - oscillatory, light, NE-SW, 10 seconds.	
	Taal - oscillatory, perceptible, NE-SW, 3 seconds.	
	San Fernando, Pampanga - vibratory, perceptible, momentary.	
	Iba - Zambales - A strong earthquake of moderate duration.	97
1879 Jan 06 5:50 p.m.	Mindanao: An earthquake with a duration of about 35 seconds was felt; it began with a vibration, then a tilting followed, and it ended with an oscillation from N to S.	97
1879 July 01 2:55 a.m.	Mindanao: A very violent oscillatory earthquake was felt, which lasted approximately one minute, the direction N to S. Three stone buildings with tile roofs in the town withstood the shocks, although two of them, the Governor's house which was condemned several years ago because of the poor condition of its framework and the Administration building, suffered numerous vertical cracks in the walls of the ground and upper floors; the floors were tilted and as a result some doors and windows were jammed. The damage consisted of tilting of buildings of good material and the partial sinking of old ones. The town church, which has fairly thick wall of coral limestone reinforced with timbers, has suffered considerable damage in spite of the fact that it is roofed with galvanized iron. Wide vertical cracks appeared in the east and west walls, especially from the lintels of doors and windows upward. A horizontal crack runs the whole length of the north walls a little more than a metre above the level of	

Event	Felt Effect	Source
	the floor. The rest of the buildings in town, all of wood, palm thatch and bamboo, have suffered damage of little importance.	
	Surigao - sinking of the shore of Bilan-Bilan, port of the town. The drop is said to be one foot.	
	Nine miles S of Surigao - there were signs of fissures 4 to 6 cms. wide. A few houses, all of palm thatch and bamboo, showed significant tilting which revealed the intensity of shaking as greater than in Surigao. In the mining village of Cansuran, inclinations of 25 and 50 degrees from the vertical were measured.	
	Cansuran Valley - observed some slides of stratified rock along the banks, but of small extent.	
	NW from Surigao - conspicuous and recent landslides at the steep point of the coast and some large fissures were seen.	
	Anaoaon - Felt very violent shocks; of its 40 houses of wood and palm thatch, 26 collapsed and the rest were so greatly tilted that most of them had to be reconstructed; two wooden bridges in the town were rendered useless.	
	In the streets of the town and in the adjoining fields, there are signs of fissures which opened during the earthquake and vomited white mud, marking the direction of the fissures (N 20°W-S 20°E). It is nothing but very white sand coming, no doubt, from a soft layer near the surface, which, compressed by the waves, made its escape through the fissures.	
	Lake Saponan - earthquakes were felt with great intensity. Some small points became totally submerged.	

Event	Felt Effect	Source
	Tandag/Lianga - no damage to buildings. Summarizing the report: 1. The direction of the earthquake was from SSE to NNW in places north of Saponan Lake and, in some places south of it, in the opposite direction. 2. The earthquake must have had its maximum intensity in the line of the mountain range, the northern end of which forms Point Bilaa. Surigao - movable objects were thrown down. The transept and the two lateral aisles have suffered most (church). Many stones have fallen. Statues of St. Joseph and St. Ignatius fell from their places. It is certain that the hills have been greatly disturbed and many rocks have fallen. Placer and Dinagat - the earthquake was felt but not very strongly. Point Bilaa - Landslides measured several hundred cubic metres and one fissure practically divided the promontory of the point in two. South of Anaoaon - An open plain about 1,500 metres long and 500 metres wide. This plain suffered a drop of about 50 cms. over its whole area without noteworthy damage to the houses or trees. At one place a new spring of drinkable water has appeared. According to reports, the inhabitants of the place heard a subterranean noise, apparently advancing from the south with increasing intensity. According to reports. The mountain range separating Lake Saponan from the Pacific - fissures of greater dimensions opened and landslides of greater volume occurred than at Pt. Bilaa.	

Event	Felt Effect	Source
	Mainit - In some places the earth opened more than four varas (11 feet), leaving deep gashes, and in other places, one vara (33 inches). In the lake, one point near the town disappeared completely and where before there was a beautiful beach there is now a depth like the contre of the lake, the earth quivered with vibratory motion with moderate frequency; the clothes closet fell, but no damage. The house is tilted and one end sank a few inches; the windows fell into the street and one wall was cracked. Very little that was breakable escaped damage.	97
1879 Sept 28 morning	Mindanao: Davao - earthquake moderately strong, duration of 60 seconds. Several rapid movements; subterranean noise. Another shock in the afternoon.	97
1879 Oct 05 6:30 a.m.	Mindanao: Surigao - oscillatory, strong.	97
1879 Oct 14 9:00 a.m.	Northwestern Luzon: Bacarra, Ilocos Norte - very strong, oscillatory and vibratory earthquake; slight damage to buildings.	97
1879 Oct 18 11:05 p.m.	Luzon: Baler, Principe - earthquake of greater intensity and longer duration.	
	Punta, Santiago - strong and oscillatory, 40 seconds.	
	Taal - 20 seconds' duration, N-S, oscillatory.	
	Cavite - 12 seconds' duration.	
	Corregidor - 12 seconds' duration.	
	Batangas - moderate.	
	Bacolor, Pampanga - 10 seconds' duration.	
	Bulacan - light.	

Event	Felt Effect	Source
	Balanga - 10 seconds' duration.	
	San Fernando, Pampanga - perceptible for 6 seconds' duration.	
	Calamba - oscillatory, E-W.	97
	Restinga (Cavite) - oscillatory; S-N; strong.	85
1879 Dec 02 4:30 a.m.	Mindanao: There was an oscillatory earthquake N to S of moderate force and duration of 15 seconds.	97
1879 Dec 19	Northwestern Luzon: Ilocos Norte - very strong, damage in the province.	
	Lingayen, Pangasinan - an earthquake of very short duration was felt.	
	Balanga, Bataan - an oscillatory earthquake of short duration and light force was felt.	97
1880 Mar 28 5:04 a.m.	Panay: Iloilo - strong oscillatory earthquake, NW-SE and intense vibratory shock. Duration, 100 seconds.	97
1880 Apr 19 11:45 a.m.	Negros: Island of Negros - strong vibratory earthquake, duration 15 seconds. A rare phenomenon in this island.	97
1880 July 15 12:53 a.m.	Luzon: Nueva Caceres - an earthquake of moderate intensity.	
	Casiguran - a strong oscillatory movement.	
	Baler, Principe - a strong oscillatory movement. It lasted more than half a minute without changing direction, which seemed to be S to N.	
	Morong - an oscillatory earthquake.	
	Port Lampon, Infanta - an oscillatory and vibratory earthquake of considerable duration was felt. There was a strange subterranean	

Event	Felt Effect	Source
	noise. Water was thrown from containers and buildings were damaged.	
	Tarlac - an oscillatory earthquake from N to S of moderate intensity. It lasted about 30 seconds.	
	San Fernando, Pampanga - oscillatory, strong, SE-NW, 12 seconds.	
	Bulacan - oscillatory, moderate, 8 seconds.	
	Bacolor - oscillatory, strong, NW-SE, 15 seconds.	
	Cavite - oscillatory, strong, N-S, 55 seconds.	
	Sta. Cruz, Laguna - vibratory, oscillatory, strong, 12 seconds, N-S.	
	Calamba - vibratory, oscillatory, strong, E-W, 20 seconds.	
	Lipa - oscillatory, strong, N-S, 50 seconds.	
	Taal - oscillatory, moderate, SE-NW, 30 seconds.	
	Batangas - vibratory, oscillatory, 25 seconds.	
	Tayabas - oscillatory, light, N-S, 15 seconds.	
	Mindoro - oscillatory, strong, N-S, 45 seconds.	97
	Manila - the oscillation was strong and caused some of the church bells to ring, many were alarmed and sought refuge in the mezzanine. No damage.	90
1880 July 18 12:40 p.m.	Luzon: The Observatory's Bulletin of General Observations noted: "Horrible earthquake." A rather strong	

Event	Felt Effect	Source
	earthquake which caused damage in the following places: Casiguran - experienced same incident as in Baler where altars of the church were damaged. Morong - strong earthquake causing damage. Part of the roof of the municipal building fell in; the floor of the school was damaged. Tanay - parts of the roof of the church and rectory were damaged and there were some cracks in the walls. Pililla - the tower of the church was damaged, as also part of the roof and there was serious damage in the rectory. Binangonan - there were cracks in the church and rectory. There was minor damage in the municipal building and in the house of Don Francisco Fuentes. Cainta - part of the church roof has fallen and there were cracks in the walls of the church and rectory. Nueva Caceres - very strong earthquake of more than a minute's duration. No damage. San Isidro, Nueva Ecija - strong earthquake which caused the death of 4 persons and damage to structures. Vigan, Ilocos Sur - a strong oscillatory earthquake from SW to NE and NW to SE. It lasted about 80 seconds and produced some small cracks in masonry buildings. Baler, Principe - a terrible shock with direction SE-NW followed by rotation and vibration, ending with an oscillation from S to N and from W to E, all in the space of a little more than a minute. It tilted eight	

Event	Felt Effect	Source
	houses of light material and caused the fall of standing or hanging objects. One person suffered a severe wound. The church, the rectory and the municipal building, roofed with light materials, have sustained cracks in their thick walls of masonry. Some walls in the sacristy fell. Large crevices opened in the fields, from which water and sand issued and damaged some crops; an abandoned masonry watchtower on a hill was completely wrecked; slides in the mountains can be seen. Continuous disturbance of muddy waters of the rivers.	
	Angono - fall of strongly-built partitions in the church and cracks in the facade. The government house was completely wrecked.	
	Taytay - the church and rectory have suffered, the walls of the church cracked and stones and tiles dislodged from the roof.	
	Antipolo - the church and rectory have suffered considerably.	
	Boso-Boso - part of the church tower has fallen.	
	Jala-Jala - the sugar storehouse has fallen and the sugar was ruined; the hacienda house has been rendered all but uninhabitable.	
	Laoag - strong oscillatory shock from the SW.	
	Calasiao, Pangasinan - one wall of the parish house slightly cracked.	
	Jacinto, Pangasinan - there were three large cracks in the church, one in the facade and two on the sides and one in the rectory; the partitions of the latter have fallen.	

Event	Felt Effect	Source
	Iba, Zambales - a strong oscillatory earthquake. Its exact duration cannot be given because the clock stopped, but it is estimated to have lasted more than a minute. The oscillatory movements were so strong and long that a terrible panic was caused.	
	Pultoc, Abra - oscillatory, moderate, E-W, 3 seconds, subterranean noise like thunder.	
	Talalan - vibratory, strong, SE-NW, 20 seconds, subterranean noise.	
	Candon - vibratory, strong, N-S, one minute.	
	Benguet - vibratory, oscillatory, strong, E-W, one minute.	
	San Fernando, La Union - oscillatory, strong, N-S, 70 seconds.	
	Dagupan - oscillatory, rotary, very strong, E-W, 1 minute.	
	Lingayen - vibratory, oscillatory, strong, E-W, one minute and 50 seconds.	
	Bolinao - oscillatory, strong, NE-SW, one minute.	
	Tarlac - oscillatory, strong, N-S, 30 seconds.	
	Bacolor - oscillatory, violent, NW-SE, 15 seconds, some buildings damaged, one person injured.	97
	Jaen, Pampanga - the parts of the upright timbers of a church with light palm thatch roof were thrown up vertically out of their bed-holes to the surface, the whole structure about 12 m long and 10 m wide, falling down almost without damage.	65

Event	Felt Effect	Source
	San Fernando, Pampanga - oscillatory, strong, SE-NW, 12 seconds.	
	Corregidor - oscillatory, strong, N-S, one minute.	
	Bulacan - oscillatory, violent, 90 seconds.	
	Cavite - oscillatory, strong, N-S, 55 seconds. The government house, church, rectory and telegraph office fell; in the shipyard the black sand rose around the piles.	
	Canyacao -cracks appeared, from which fine sand and dirty water issured.	97
	Manila and Japan earthquakes: In the midst of this commotion of 1880, it is said that the barometer gave no indication of atmospheric disturbance. Where my friends resided in San Miguel, the shock was especially violent. The household were at at breakfast, and of course left the table in a hurry seeking the outside air, some by the window and some by the stone staircase; one was caught by the falling roof, and sustained injuries which required amputation of an arm at the shoulder. Most of the rear part of the house, on the riverside, was so damaged that it remained for a long time untenanted. In San Antonio, near the city, for the length of more than four miles and a width of 350 feet, the ground opened in many places. Some portions were raised five or six feet and others were equally depressed. The "Diario de Manila" went to press in the middle of the street, its building being considered unsafe. The city was turned into a tented field, and the river and bay were densely peopled. Everything that had wheels or could float was loaded	

Event	Felt Effect	Source
	with persons and property seeking safety. Palace and prison, church and shop, street and bridge, house and hut, barracks and hospital, were alike prostrated and rendered useless.	36
	Manila - about 30 public buildings (government buildings, churches and convents) and 200 private residences were damaged by the shocks. Tile roofs suffered the most and their fall in many cases caused the principal damage which occurred in the upper storey of the houses and the tops of the walls of the churches. One of the San Agustin church towers was ruined. Mr. J. Centeno attributed the worst damage to faulty construction and the need of repairs, and adds that public buildings suffered less than private houses, because their construction and state of repair were better. All the bridges of the Pasig River, Espanya, Suspension Bridge and Ayala Bridge, withstood the shocks without appreciable damage. Crevasses in the ground were produced only on the bank of the river, estuaries and a few on the sea shore. The largest opened along the Malcanyang grounds parallel to the river; many were reported from the estuaries of Binondo, Sta. Cruz, and Quiapo; similarly from Pandacan, Sta. Ana and also from Canyacao, Cavite. None occurred in the Walled City. The ground in the recent alluviums along the Rio Chico, and from Bongabong to San Isidro, and the reion towards the W and SW, lying between the Chico and Grande Pampanga Rivers, was crevassed, cut and sunk in the most capricious and fearful way, the towns and suburbs of this region sustaining the greatest destruction.	65
1880 July 18 1:20, 3:25, 3:34 p.m.	Luzon: Sta. Cruz, Laguna - oscillatory, rotary, destructive, N-S, more than 60 seconds.	

Event	Felt Effect	Source
	Bay, Longos, Paete, Panguil, Siniloan - churches damaged.	
	Calamba - vibratory, destructive, E-W, 12 seconds.	
	Lipa - oscillatory, strong, N-S, 50 seconds.	97
1880 July 18 3:42 p.m.	Luzon: Taal - oscillatory, moderate, SE - NW, 30 seconds.	
	Batangas - vibratory, oscillatory, strong, 85 seconds.	97
1880 July 18 3:27 p.m.	Luzon: Taal and Batangas - oscillatory, light, 15 seconds.	
	Punta Santiago - oscillatory, moderate, 50 seconds.	
	Tayabas - oscillatory, rotary, NE - SW, two minutes.	97
1880 July 18 2:25 p.m. 3:27 p.m.	Luzon: Punta Santiago and Tayabas - oscillatory, light, NE - SW.	
	Daet - strong.	
	Manila - shocks are still continuing at intervals but in general they are weak; all are in exactly the direction of the major oscillations of the first day.	97
1880 July 20 3:40 p.m.	Luzon: A very strong aftershock of the 18th July earthquake. Duration of 45 seconds.	
	Restinga - vibratory, oscillatory, strong, E - W, 40 seconds.	
	Cavite - vibratory, oscillatory, strong, one minute.	
	Binyan - oscillatory, very strong, E - W, 30 seconds. Church, municipal building and all masonry buildings ruined, some personal injuries.	
	Lipa - strong, E - W, seven seconds.	

Event	Felt Effect	Source
	Manila - tower of the cathedral fell. The Magellan monument damaged.	
	Sta. Cruz, Manila - part of the roof of the church fell; large crack in the wall.	
	Quiapo - church damaged.	
	Bagumbayan - cracks in the barracks. A mast disappeared from the "Rocdee", sunk in the bay.	
	Balicaquin, Zambales - parish house and others were cracked and some persons sustained wounds and bruises. Caused great damage in the towns of Tunasan, Binyang, Sta. Rosa, Pateros and Taguig; great destruction.	
	Guadalupe - stone vault of the church was destroyed.	97
	Sta. Mesa and San Juan - underground reservoir and the conduits of the Manila waterworks, then nearly finished, did not sustain visible damage.	65
	There came a series of very violent shocks, throwing the community into despair and terror and paralyzing the progress of the province. The shock began in Manila with tremblings and complicated movements continuing for seventy seconds. This shock was more violent than the first (18th July) and completed the destruction which the first had caused. Surprise gave way to terror, and the people fled by land and river to the country. The bed of the river Pasig was disturbed with an upheaving of a dark fluid of a sulphurous odour, but without damage to the bridges. In many places within the city, the soil cracked, with the eruption of fine sand and dirty water. Eye witness report: After hearing the first sound, which	

Event	Felt Effect	Source
	was as if hundreds of carriages were being dashed to pieces on a broken pavement, an incomprehensible faintness was experienced, causing a feeling of nausea, with inability to fly from the danger. It was as if one were on the deck of a vessel, tossed by the waves, instead of a building of stone or timber, on the ground. Mingled with this came strange rumblings, as if rocks were rolling and resounding over deep abysses and sharp clashing as of glass shattered, caused by the rolling of furniture on the bare floors and the breaking of mirrors and chandeliers. When sense returned, a rush was made to the stairs and balconies, into the courtyards, streets and squares, under arches or wherever seemed a place of safety. The disturbance extended to the suburbs of the city and in fact to most of the islands where the soil appeared like the waves of the sea. Trees were uprooted, and towns and villages, amid clouds of whitish dust, became a chaotic mass of ruins. Every animal exhibited signs of terror. Pigs, dogs, poultry, even lizards, felt the impending danger, and united in loud and unnatural noises. Horses stopped in the street, standing with ears erect, with staring eyes, and stiffly extended legs as if conscious of extraordinary peril. the natives would give no response to appeals for help but, careless of consequences, were either seeking safety themselves or were on their knees in the highway and squares, with other timorous Catholics around them. After the calamity, fallen tiles left exposed the skeleton ribs of the house roofs; hanging beams and swinging rafters threatened to fall upon the passerby. A suffocating dust filled the air; broken arches, leaning walls, blinds in fragments, piles of	

Event	Felt Effect	Source
	useless furniture and shapeless heaps of stone met the eye in every direction. Dwellings open to the sky, a general ruin was everywhere. Stone houses were abandoned for the thatched huts of the suburbs. An earthquake undoes in a minute the work of centuries, and even in a few seconds makes a city look as if sacked by a besieging enemy. The silence is interrupted only by an occasional cry for assistance, or the crack of a falling building; man is exhausted, and inanimate nature sleeps after these geological catastrophes.	36
1880 July 20 10:00 p.m.	Luzon: A third shock occurred. This was not a severe one; simply knocking furniture about, but doing no serious damage, for there was now little to destroy.	36
1880 July 26 4:02 a.m.	Luzon: Manila - a light, oscillatory earthquake, direction, W 26°S, E 26°N. Pangasinan - oscillatory, strong. San Isidro - oscillatory, strong, NE-SW, ten seconds. Tarlac - S - N, oscillatory, strong, one minute. Bacolor - oscillatory, strong, SW-NE, 15 seconds. Balanga - oscillatory, light, 18 seconds. Corregidor - oscillatory, light, 18 seconds. Cavite - vibratory, oscillatory, light, N-S, five seconds. Sta. Cruz - vibratory, strong, ten seconds.	

Event	Felt Effect	Source
	Calamba - vibratory, moderate, SW-NE, five seconds.	
	Batangas - oscillatory, light, N-S, one minute, 5 seconds.	
	Tayabas - oscillatory, light, N-S, 25 seconds.	
	Lipa - vibratory, strong, five seconds.	97
1880 July 27 6:23 a.m.	Luzon: San Isidro - oscillatory, light, NW-SE, ten seconds.	
	Tarlac - oscillatory, light, SE-NW, ten seconds.	
	San Fernando, Pampanga - oscillatory, moderate, SE-NW, eight seconds.	
	Bacolor - oscillatory, light, N-S.	
	Balanga - oscillatory, light, N-S, 30 seconds.	
	Bulacan - oscillatory, strong, E - W, six seconds.	97
1880 July 28 7:00 p.m.	Luzon: Binyan - oscillatory, moderate, W - E, four seconds.	97
1880 Aug 06 8:00 9:00 a.m.	Southeastern Luzon: Albay - a vibratory strong earthquake of short duration.	
	Malilipot - also felt.	
	Mayon Volcano - giving out black smoke.	97
1880 Aug 16 8:45 a.m.	Luzon: Manila - four light oscillatory shocks.	
	Nueva Caceres - oscillatory-vibratory, strong.	
	Daet, Camarines Norte - strong, N - S.	

Event	Felt Effect	Source
	Basud - oscillatory, vibratory, strong NW-SE.	97
1880 Aug 22 9:17 p.m.	Southeastern Luzon: Daet - momentary but strong.	97
1881 Apr 25 10:34 a.m.	Luzon: Talalan, Benguet - light, oscillatory, N - S, ten seconds with subterranean noise like thunder.	
	Pultoc, Benguet - oscillatory 20 seconds.	
	Binorongan, Benguet - oscillatory, strong, W - E, five seconds, with subterranean noise.	97
1881 May 15 7:45 a.m.	Luzon: Manila - an oscillatory earthquake of moderate intensity; duration, nine seconds.	
	Bagay - oscillatory, moderate, E - W, ten seconds.	
	Vigan - moderate, NE - SW, 15 seconds.	
	Taal - oscillatory, light.	
	Tayabas - oscillatory, light, NW - SE, 30 seconds.	
	Atimonan - rotary, light, five seconds.	97
1881 May 15 8:00 p.m.	Luzon: Strong shock.	
	Daet - oscillatory, light, NE - SW, six seconds.	
	Calamba - oscillatory light, NW - SE, four seconds.	
	Sta. Cruz - oscillatory, light, SW - NE, two seconds.	
	Cavite - oscillatory, strong, ENE - WSW, ten seconds.	
	Balanga - oscillatory, light, E - W, eight seconds.	

Event	Felt Effect	Source
	Bulacan - oscillatory, E - W, four seconds.	
	Bacolor - oscillatory, strong, N - S, 12 seconds.	
	San Fernando - oscillatory, strong, six seconds.	
	San Isidro - oscillatory, light, NE - SW, ten seconds.	
	Cabanatuan - oscillatory, light, E - W.	
	Bayombong - oscillatory, SW - NE.	
	Carig - oscillatory, strong, SW - NE, 25 seconds.	
	Libmanan - oscillatory, light, NW - SE, short.	97
1881 May 25 1:35 p.m.	Luzon: Manila - oscillatory, NE - SW, moderate, 20 seconds.	97
1881 June 01 3:00 p.m.	Mindanao: Surigao - oscillatory, moderately strong.	97
1881 June 06 5:26 p.m.	Luzon: Binorongan - strong, oscillatory, E - W, 12 seconds, with subterranean noise.	97
1881 June 13 7:00 a.m.	Mindanao: Letter from Father Quirico More, S.J.: "At 7:00 a.m., while in the middle of a sermon, I noticed that the roof of the church was in motion, like the sail of a ship, and that the greater part of the people began to run out through the openings in the bamboo, palm thatch and rattan sides. These and the roof were moving from their places and falling as if the whole were a house of paper, a real house of cards. I remained in the pulpit, barely restraining myself, and telling the people that it was unimportant. The church remained with its columns standing and beams in place, although one of these was cracked	

Event	Felt Effect	Source
	and was a danger to the lower parts joined to it, in an edifice so large without any divisions. I believe that there was but one shock, stronger than usual· the pulpit became motionless, objects were put back on the altar and, with the help of several men, the statues of the Blessed Virgin and St. Joseph were set up. One man sustained a slight head wound and two scratches on his chest; this was the only personal injury."	97
1881 June 19 8:00 p.m.	Mindanao: Surigao - strong and long. Another shock after a short time.	97
1881 July 11 12:35 p.m.	Panay & Negros: Strong, vibratory, oscillatory, N - S.	
	Southern Panay & Northwestern Negros Island: Those living at that time had never experienced one of equal intensity accompanied (preceded) by subterranean sound.	87
1881 July 16 2:13 p.m.	Luzon: Manila - weak, N - S, four seconds.	
	Candon - oscillatory, light, S - N, 20 seconds.	
	Tuguegarao - oscillatory, SSW - NNE, five seconds.	
	Ilagan - oscillatory, light, N - S, four seconds.	
	Laoag - oscillatory, strong N - S, 50 seconds.	
	Aparri - vibratory, oscillatory, light, N - S, seven seconds.	97
1881 July 27 5:00 p.m.	Nueva Vizcaya: On the 27th of the month of July at 5:00 p.m., a strong shock was felt, damaging several of the new masonry buildings.	1
11:30 p.m.	Luzon: Nueva Caceres - oscillatory, N - S, eight seconds.	97

Event	Felt Effect	Source
1881 July 28 4:50 a.m.	Luzon: Carig - oscillatory, strong, NE - SW, 30 seconds.	97
1881 July 30 2:15 p.m.	Luzon: Manila - very weak. Punta Santiago - oscillatory, strong, E - W, ten seconds. Taal - moderate, SW - NE, five seconds. Batangas - oscillatory, light, N - S, short.	97
1881 Aug 14 9:46 p.m.	Luzon: Balanga, Bataan - a strong earthquake of short duration. Cavite - vibratory, strong, five seconds. Bacolor - vibratory, oscillatory, 15 seconds. Bulacan - oscillatory, strong, eight seconds. San Isidro - vibratory, oscillatory, SW - NE, eight seconds. Taal - moderate, oscillatory, E - W, ten seconds. Tayabas - oscillatory, SE - NW, ten seconds. Lipa - oscillatory, light, N - S. Calamba - moderate, E - W, 12 seconds. Sta. Cruz - NE - SW, five seconds. Manila - vibratory and oscillatory simultaneously; duration, 15 seconds.	97
1881 Aug 16 5:02 a.m.	Luzon: Punta Santiago - oscillatory, light, E - W, six seconds. Calamba - oscillatory, moderate, N - S, six seconds.	

Event	Felt Effect	Source
	Restinga - oscillatory, light, E - W, ten seconds.	
	Sta. Cruz - oscillatory, violent, E - W, 15 seconds.	
	Corregidor - oscillatory, strong, E - W, ten seconds.	
	Cavite - oscillatory, rotary, strong, E - W, ten seconds.	
	Bulacan - oscillatory, N - S, eight seconds.	
	San Fernando - oscillatory, strong.	97
1881 Aug 17 8:15 p.m.	Manila: Manila - a strong vibratory impulse followed by a light oscillatory shock. Direction, N 10^{o}E - S $10^{o}10'$. This seismic movement was preceded and followed by an extraordinary subterranean noise, truly terrifying, which led one to expect more violent motion than that which actually occurred.	97
1881 Sept 01 12:20 p.m.	Nueva Vizcaya: A sudden, strong, quiet, trembling motion was felt, similar to all the shakes which have agitated and still continue to agitate the districts. From that moment a considerable increase of seismic activity was developed on such a scale that shocks were felt at intervals of an hour or a minute and sometimes continuously with palpitation of the ground, interrupted only by the interpolation of more serious shocks. This of course could not fail to produce upon the terrified inhabitants of that splendid province a painful and nervous moral tension.	1
	Manila - perceptible, weak, oscillatory earthquake, N - S, lasting five seconds. Preceded by light oscillations.	97

Event	Felt Effect	Source
1881 Sept 18 4:55 a.m.	Luzon: Manila - a very light earthquake.	
	Bayombong, Nueva Vizcaya - the earthquakes are continuing with greater intensity, oscillations alternating with rotations and preceded by subterranean noises.	
	Baler, Principe - strong.	97
1881 Sept 18 3:11 p.m.	Luzon: Nueva vizcaya - a very strong quake. It began with a very loud subterranean noise and its strongest part lasted two minutes.	97
1881 Sept 20 2:54 p.m.	Luzon: Manila - an oscillatory earthquake; direction, NE 4^{o}N - SW 4^{o}S.	
	Bacolor - oscillatory, NE - SW, four seconds.	
	San Fernando, La Union - oscillatory, strong, E - W, short.	
	Carig - rotary, oscillatory, strong, NE - SW, 20 seconds.	
	Lingayen - oscillatory, strong, 20 seconds.	
	Sta. Cruz, Laguna - oscillatory, moderate, ten seconds.	97
1881 Sept 28 3:34 p.m.	Luzon: Manila - felt; direction, ESE - WNW, duration, 20 seconds.	
	Nueva Vizcaya - very strong.	
	Lingayen - oscillatory, light.	
	La Union - oscillatory, strong.	97
1881 Sept 30 5:22 a.m.	Luzon: Manila - oscillatory; light; duration, four seconds.	
	Sta. Cruz - oscillatory, light, E - W, five seconds.	
	Nueva Vizcaya - moderately strong.	

Event	Felt Effect	Source
	Candon - oscillatory, light, S - N, four seconds, weak.	
	Cavite - oscillatory, light, N - S, seven seconds, weak.	
	Tarlac - oscillatory, moderate, 40 seconds, intense.	
	Bacolor - oscillatory, light, ten seconds.	97
1881 Sept 30 10:40 a.m.	Nueva Vizcaya: September 30, 1881 at 10:40 a.m. I was proceeding on horseback from Aritas towards Dupaz accompanied by an assistant officer, Don Enrique de Almonte. When passing through the village of Tambong belonging to the latter of these districts, we heard (approximately towards the north) thunder, so perfectly similar to that of atmospheric storms that I glanced up, looking at the thick clouds overhanging the summits of the surrounding mountains. But hardly five seconds afterwards, our horses stopped, spreading out their legs to assume a more stable attitude and staring about in a frightened manner. We then suddenly felt a sharp vertical movement followed by a horizontal one, which was so decided that we saw the road and the surrounding ground move about a metre on each side of our horses' heads, which served as a point of observation and comparison in as much as they tended in virtue of their inertia to keep steady. At the same time, the ground swelled and continually during the movement opened and shut in a multitude of small cracks from one to three millimetres in width, through which the waters of the puddles sank. All this was accompanied by a peculiar noise produced by the undulation, and by the movements of the bushes and the canes which formed the fences round the houses, which were	

Event	Felt Effect	Source
	swinging and shaking against one another. This phenomenon lasted from 30 to 35 seconds, after which the former calm and silence succeeded broken only by the prayers of the Indians and the tramping of our horses as they resumed their march. All shocks have not presented such distinct and noticeable oscillations as that I have just mentioned, this kind of earthquake being generally confined to the north and south parts of the provinces (Abungol and Caraballo). That we felt it so strongly on the 30th is undoubtedly to be explained by our passing along the northern slope of the great Caraballo. The peculiar and true nature of the shocks, especially in the centre of the province, is that the sensation is almost absolutely vertical, comparatively slight, and of short duration, except in cases of greatly prolonged seismic activity when the shocks follow almost without interruption. Such continuation of shocks is probably due to different and distinct vibrations, but this effect is nevertheless that of a very prolonged earthquake. The thunder, which always precedes the shock by a few seconds, is heard most distinctly towards the middle of the province in the neighbourhood of Bambang. The most important circumstance is that the interval between the sound and the movement is always shorter, the nearer the observer is to that town, and especially when on the surrounding heights clear of the deadening effects of the valley's alluvium. The sound of the shock and the movement, although perceptibly successive in these places, become very often mingled together. On the other hand, towards the frontiers of the province there are observed: first, a sound of subterranean thunder; second, an interval of rest	

Event	Felt Effect	Source
	and quiet, sometimes of five or six seconds; and third, a vertical shock accompanied by a noise which we may call the "squall" of the seismic waves, followed without interruption by a horizontal movement oscillation. When we observe the cracks produced in the masonry buildings of Bambang, we also come to an analogous but more certain conclusion. But above all, in order to give the theory of Mallet its proper place in our own deductions, we must note that the walls of the buildings exclusively employed in this province do not contain any tie-work (which so much tends to divert the direction of breaking lines) but are composed of irregular blocks of stone united with mortar generally of such excellent quality that it is difficult to break even with a mason's hammer. It is also very important to remember that, while cracks produced in the buildings of villages at a distance from Bambang show, more or less visibly, an inclination to the horizon, in this town they are perfectly horizontal; so that for instance two complete cracks in its church-tower divide the tower into three complete distinct blocks which have not yet fallen, partly doubtless an account of the excellent material, but principally from the circumstance that the shocks sustained by the tower were purely vertical movements; while it is most probable that if a horizontal shock had occurred the upper portions of the tower would have fallen. This town has also suffered much other damage in its masonry buildings. Of the few others it is possessed of, the Tribunal is very seriously damaged; one of the schools is full of cracks while the other has fallen. The monastery is entirely in pieces, and the church has suffered severely. It is to be	

Event	Felt Effect	Source
	noted that all these buildings are roofed with "cogon" (tiles). Simultaneous occurrence of sound and movement at Bambang."	1
1881 Oct 02 2:24 p.m.	Luzon: Manila - very light, oscillatory, N - S.	
	Batangas - light, loud subterranean noise.	
	Punta Santiago - light, oscillatory, E - W, 12 seconds.	
	Taal - vibratory, strong.	97
1881 Oct 04 2:00 p.m.	Luzon: Manila - perceptible, oscillatory, subterranean noise.	
	Tarlac - vibratory, oscillatory, moderate, NE - SW, long.	
	Bacolor - oscillatory, E - W, 15 seconds.	
	Taal - intense.	
	Manila - quite perceptible.	1
1881 Oct 24 6:06 a.m.	Luzon: Punta Santiago - oscillatory, moderate, N - S, 50 seconds.	
	Batangas - light.	97
1881 Dec 31 5:20 p.m.	Luzon: Manila - earthquake of oscillation and vibration; direction, NE 2^{o}N - SW 2^{o}S.	
	Bacolor - oscillatory, moderate, seven seconds.	
	Bulacan - oscillatory, light, E - W, two seconds.	
	Lingayen - oscillatory, moderate, E - W, seven seconds.	
	Balanga - oscillatory, light, W - E, four seconds.	

Event	Felt Effect	Source
	Cavite - oscillatory NNE - SSW, nine seconds.	
	Tarlac - oscillatory, 20 seconds.	
	Restinga - oscillatory, N - S, 20 seconds.	
	Corregidor - oscillatory, moderate, N - S, 15 seconds.	
	San Fernando, Pampanga - oscillatory, moderate, NE - SW, five seconds.	97
1882 Jan 11 6:25 a.m.	Luzon: Libmanan - moderately strong, oscillatory, NE - SW and vibratory, duration, two seconds.	
	Nueva Caceres - moderate, N - S, 20 seconds.	
	Ragay - rotary and oscillatory, NW - SE, short, moderately strong.	97
1882 Mar 10 7:30 p.m.	Mindanao: Cotabato - tremor of great violence composed of three shocks, also preceded by a very loud subterranean noise, duration of 20 seconds. The direction observed in almost all the shocks was from NE to SW which seems to indicate that the focus of this disturbance is in the volcano to the northeast of Pollok at a distance of some leagues (1 league = about 3 miles). Violent.	97
1882 Mar 11 2:05 p.m.	Mindanao: Zamboanga - oscillatory, strong, N - S, subterranean noise like wind or escape of steam.	97
1882 Mar 12 12:38 p.m.	Luzon: Manila - oscillatory and vibratory simultaneously, duration of seven seconds, direction SE 4°S, NW 4°N. The motion was not continuous, but was composed of three light shocks separated by intervals of one second.	
	Laguna - oscillatory, light, NE - SW.	97

Event	Felt Effect	Source
1882 Mar 12 7:45 p.m.	Luzon: Batangas - vibratory, moderate, N - S, 20 seconds. Taal - oscillatory, moderate, N - S, 20 seconds. Punta Santiago - oscillatory, strong, WNW-ESE, eight seconds. Cavite - oscillatory, light, NE-SW, six seconds. Bacolor - light, N - S, 20 seconds.	97
1882 Mar 18 night	Mindanao: Cotabato - moderately violent shock which was repeated four times at intervals of an hour. Start of the activity that alarmed the area during the last half of the month of March.	97
1882 Mar 20 8:30 p.m.	Mindanao: There was a violent earthquake of two distinct shocks, preceded by a loud subterranean noise. Duration was about 20 seconds. The direction observed in almost all the shocks was from NE to SW, which seems to indicate that the focus of disturbance is in the volcano to the northeast of Pollok.	97
1882 Apr 30 10:08 a.m.	Luzon: Manila - small, oscillatory, nine seconds, N 10^{o}E, E-S 10^{o}W. Cavite - oscillatory, moderate, N - S, four seconds. Restinga - moderate, E - W, 15 seconds. Taal - light, oscillatory, SE - NW, ten seconds. Bulacan - light, E - W, 15 seconds. Bacolor - oscillatory, strong, N - S, 45 seconds. Balanga - light, NE - SW, six seconds.	

Event	Felt Effect	Source
	Lingayen - oscillatory, NW-SE, five seconds.	
	San Isidro - light, N - S, 25 seconds.	
	Tarlac - moderate, 25 seconds, vibratory then oscillatory.	
	Iba, Zambales - strong, vibratory, oscillatory and rotary.	97
1882 June 21 10:34 p.m.	Luzon: Manila - light, N 10^{o} E-S 10^{o}W, duration of five seconds.	
	Laoag - oscillatory, moderate, E - W, ten seconds, preceded by subterranean noise.	
	Carig - oscillatory, E-W, moderate, 20 seconds.	
	Ilagan - oscillatory, intense, N - S, eight seconds.	97
1882 July 25 5:59 a.m.	Luzon: Manila - direction is NE 9^{o} E-SW 9'W; amplitude, 1^{o}55'; duration, ten seconds. Oscillatory earthquake accompanied by light vibratory movement.	
	Punta Santiago - oscillatory, strong, E-W & N-S, four seconds. It began with a light vibratory motion, which was followed by an oscillation, gentle but moderately prolonged. Duration, eight seconds.	
	Bulacan - oscillatory, N - S, four seconds.	
	Sta. Cruz - oscillatory, NW - SE, light, three seconds.	
	Cavite - oscillatory, light, N - S, ten seconds.	97
1882 July 25 10:45 a.m.	Luzon: Manila - slight vibratory movement; duration, ten seconds.	
	Taal - moderately strong, beginning	

Event	Felt Effect	Source
	with a vibration and then becoming oscillatory, SW-NE, seven seconds.	
	Lipa - light, short.	
	Bulacan - oscillatory, SE-NW, two seconds.	97
1882 July 28 3:29 p.m.	Luzon: Manila - light, oscillatory, direction, NE 10^{o} N-SW 10^{o}S amplitude $0^{o}34'$, duration two minutes and five seconds.	
	Tuguegarao - moderate, first oscillatory, then vibratory, S - N, 15 seconds.	
	Aparri - vibratory, strong, N - S, six seconds.	
	Vigan - oscillatory, N - S, ten seconds.	
	Alcala - oscillatory, W - E.	
	Binorugan - oscillatory, E - W, 20 seconds.	
	Pultoc - oscillatory, E - W, 15 seconds.	97
1882 Sept 11 11:58 p.m.	Luzon: Manila - oscillatory earthquake. It began very slowly and lightly; the oscillations increased gradually, changing alternately from one direction to the other. Amplitude, $2^{o}15'$; the duration was 17 seconds.	
	Atimonan - oscillatory, strong, SW - NE, 50 seconds.	
	Taal - oscillatory, strong, NE - SW, 45 seconds.	
	Batangas - oscillatory, strong, long.	
	Punta Santiago - oscillatory, strong, E - W, 50 seconds.	

Event	Felt Effect	Source
	Calamba - oscillatory, strong, E - W, 15 seconds.	
	Tayabas - oscillatory, moderate, N - S, 25 seconds.	
	Sta. Cruz - rotary, vibratory, moderate, SE 10^{o}S NW 10^{o}N, five seconds.	
	Lipa - oscillatory, strong, N - S, 30 seconds.	
	Cavite - oscillatory, strong SW - NE, four seconds.	
	Balanga - oscillatory, strong, S - N, ten seconds.	
	Bulacan - oscillatory, N - S, ten seconds.	
	San Isidro - oscillatory, light, S - N, 15 seconds.	
	Bayombong - oscillatory, SSE - NNW, light.	97
1882 Sept 12 8:30 p.m.	Luzon: Manila - began with slow movement of oscillation in the direction N 35^{o} E-S 35^{o}W increasing progressively and changing direction to SE - NW then back to original direction. Duration was 55 seconds.	
	Punta Santiago - oscillatory, strong, E - W, and N - S, 55 seconds.	
	Batangas - oscillatory, vibratory, strong, N - S, 20 seconds.	
	Atimonan - oscillatory, moderate, N - S, 40 seconds.	
	Restinga - oscillatory, E - W, 20 seconds.	
	Sta. Cruz - light, oscillatory, SW - NE, three seconds.	

Event	Felt Effect	Source
	Cavite - moderate, first E - W then N - S, 65 seconds.	
	Taal - NE - SW, 30 seconds.	
	Calamba - rotary, moderate, two seconds.	
	Tayabas - NE - SW, 30 seconds.	
	Balanga - oscillatory, strong, 50 seconds.	
	San Fernando - oscillatory, 35 seconds.	
	Bacolor - oscillatory, strong, SW - NE, 25 seconds.	
	Bulacan - oscillatory, strong NW - SE, 35 seconds.	
	Tarlac - oscillatory, light, E - W, 15 seconds.	
	Lipa - moderate in strength and duration.	97
1882 Sept 17 8:46 p.m.	Luzon: Manila - light, oscillatory earthquake. Direction, E 23^{o} N-W 23^{o}S. Amplitude, 0^{o}43'; duration was seven seconds. Aftershock at 11:47 p.m. These two movements were felt more strongly in the south than in Manila.	
	Albay - SW - NE, 15 seconds.	
	Nueva Caceres - oscillatory, moderately strong, SW-NE ending in a vibration, duration more than 20 seconds.	
	Daet - vibratory moderate.	
	Ragay - oscillatory, moderate SW - NE, 20 seconds.	
	Atimonan - oscillatory, moderate, SW - NE, 20 seconds.	

Event	Felt Effect	Source
	Libmanan - SW - NE, 35 seconds, moderate.	
	Bulacan - light, NE - SW, 20 seconds.	97
1882 Sept 21 12:00 midnight	Luzon: Manila - strong, oscillatory, N - S.	
	Aparri - vibratory, light, ending with oscillation, S - N, ten seconds.	
	Tuguegarao - vibratory, two seconds.	
	Alcala - oscillatory, N - S, weak.	
	Vigan - vibratory, strong, six seconds.	
	Bangued - light, ENE - WSW at first, then E - W, 15 seconds.	
	Pultoc - light, E - W, eight seconds.	97
1882 Oct 10 4:56 p.m.	Luzon: Manila - a light earthquake, oscillatory and vibratory simultaneously, direction, SE - NW; amplitude, $1^{o}14'$.	
	Camarines provinces - felt with moderate intensity chiefly with a vibratory motion.	
	Albay - moderate, NW-SE, 15 seconds.	
	Nueva Caceres - vibratory and rotary, strong, 20 seconds.	
	Daet - vibratory, strong, 45 seconds.	
	Ragay - rotary, strong, 16 seconds.	
	Libmanan - rotary, strong, 14 seconds.	
	Guinayangan - rotary, three seconds.	

Event	Felt Effect	Source
	Atimonan - oscillatory, moderate, N - S, 40 seconds.	
	Sta. Cruz - oscillatory, light, W 10^{o}S - E 10^{o}N.	
	N. Calamba - oscillatory, moderate, SE - NW, three seconds.	
	Bulacan - oscillatory, light, NE - SW, five seconds.	
	Carig - light, NNE - SSW, ten seconds.	97
1882 Nov 29 5:03 a.m.	Luzon: Manila - a light earthquake, vibratory, oscillatory simultaneously; direction, N 35^{o} E - S 35^{o}W.	
	Ilocos Sur - strong.	
	Cape Bolinao - oscillatory, weak, N - S, 20 seconds.	
	Lingayen - first vibratory, then oscillatory, E - W, 20 seconds.	
	Tarlac - oscillatory, strong, E - W, ten seconds.	
	Bacolor - strong, N - S, short.	
	Balanga - rotary and vibratory, strong, 15 seconds.	
	Bulacan - oscillatory, weak, NNW - SSE, six seconds.	
	Corregidor - oscillatory, N - S, six seconds.	97
1883 Feb 05 3:45 a.m.	Luzon: Mariquina - light, N - S, five seconds.	
	San Isidro - oscillatory, moderate; direction, N - S.	
	Manila - very light oscillatory earthquake; direction, N 25^{o} E - S 25^{o}W; amplitude of oscillation, $0^{o}12'$, vertical motion.	97

Event	Felt Effect	Source
1883 Feb 06 12:19 p.m.	Luzon: Manila - vibratory and oscillatory simultaneously; direction, N $3^{o}E$ - S $3^{o}W$; amplitude of oscillation, $1^{o}6'$, duration, five seconds.	
	Dagupan - oscillatory and vibratory, light.	
	San Fernando, La Union - oscillatory, strong, E - W, six seconds.	
	Bangued - oscillatory, light, NNW - SSE, 15 seconds.	
	Bulacan - oscillatory, ESE - WNW, ten seconds.	
	Carranglan - oscillatory, strong, E - W, subterranean noise, ten seconds duration.	
	Bacolor - rotary, NE - SW, light, short,	
	San Isidro - oscillatory, vibratory, nine seconds.	
	Lingayen - strong, E - W, ten seconds.	
	Vigan - light, N - S.	
	Laoag - light, SE - NW.	97
1883 Feb 10 3:28 a.m.	Luzon: Manila - light; oscillatory, and vibratory simultaneously; duration, N 25^{o}E S 25^{o}W; amplitude, $0^{o}47'$; duration, two seconds.	
	San Isidro - vibratory, ten seconds.	
	Bangued - oscillatory, light, N - S, five seconds.	
	Cabanatuan - oscillatory, light, W - E, short.	
	Tarlac - strong, 30 seconds.	97

Event	Felt Effect	Source
1883 Feb 11 12:38 p.m.	Luzon: Manila - very light movement, direction, E 4^{o}N; only one shock; short duration and small amplitude but it was felt more strongly to the east of Manila. Sta. Cruz - oscillatory, moderate in force and duration. Atimonan - oscillatory, moderate, direction N - S, duration, 40 seconds.	97
1883 Feb 24 3:00 p.m.	Luzon: Bangued - moderate, vibratory, rotary at first and then oscillatory, N - S, three seconds.	97
1883 Apr 26 11:26 a.m.	Luzon: Atimonan - oscillatory, moderate, direction, E - W, duration, ten seconds. Sta. Cruz - oscillatory, moderate, duration, 15 seconds.	97
1883 May 06 7:02 p.m.	Luzon: Manila - light earthquake of oscillation and vibration; direction, N34^{o} E-S 34^{o}W; amplitude, $0^{o}28'$; duration, very short. There was one momentary shock, but somewhat violent. Atimonan - oscillatory, light, N - S, short. Sta. Cruz - strong, NE - SW, moderate duration. Lipa - oscillatory, moderate, FSE - WSW. Two seconds' duration. Balanga - rotary, five seconds. San Isidro - oscillatory, light, N - S, six seconds. Cavite - oscillatory, moderate, ESE - WNW, two seconds.	97
1883 June 05 4:59 p.m.	Luzon: Manila - very light, oscillatory; direction, N 4^{o} W-S 4^{o}E; amplitude, $0^{o}8'$; vertical displace-	

Event	Felt Effect	Source
	ment.	
	Dagupan - oscillatory, moderate, E - W direction; 95 seconds' duration.	
	San Isidro - oscillatory, light, N - S direction; duration, eight seconds.	97
1883 July 14 4:25 a.m.	Luzon: Manila - oscillatory; direction, E 40^{o} S - W 40^{o}N; amplitude, 0^{o}38'.	
	South of Luzon - felt with greater force.	
	Atimonan - oscillatory, moderate, E - W, five seconds.	
	Nueva Caceres - oscillatory, strong, NE - SW, 40 seconds.	
	Ragay - vibratory, strong, E - W, 24 seconds.	
	Daet - vibratory, strong, 30 seconds.	
	Albay - vibratory, oscillatory, strong, N - S, 15 seconds.	
	Bao - the church was cracked.	97
4:35 a.m.	Luzon: Guinobatan - strong, oscillatory earthquake, N - S, which lasted a long time.	97
11:25 a.m.	Luzon: Albay - moderate, oscillatory, vibratory, E-W, eight seconds.	97
1883 July 20 4:00 p.m.	Luzon: Manila - oscillatory, amplitude, 0^{o}28'; direction, S 40^{o} E-N 4^{o}W.	
	Albay - oscillatory, vibratory, strong, N - S, 15 seconds.	
	Nueva Caceres - oscillatory, vibratory, strong, N - S, 20 seconds.	
	Daet - oscillatory, strong, preceded	

Event	Felt Effect	Source
	by subterranean noise.	
	Atimonan - oscillatory, strong, E - W, two seconds.	
	Sta. Cruz - oscillatory, light, short.	
	Guinobatan - very strong, long, subterranean noise.	
	Admon, Albay - arches of the church suffered cracks.	97
1883 July 27 2:51 p.m.	Luzon: Manila - oscillatory, vibratory simultaneously; amplitude of oscillation, $1^{\circ}5'$; direction, SE - NW.	
	Punta Santiago - strong, NE - SW, 50 seconds.	
	Taal - oscillatory, strong, WNW - ESE, 30 seconds.	
	Batangas - strong, N - S.	
	Calamba - oscillatory, NE - SW, 16 seconds.	
	Lipa - strong, SW - NE, 20 seconds.	
	Atimonan - moderate, rotary first, then oscillatory, N - S, five seconds.	
	Restinga - moderate, N - S, 15 seconds.	
	Bulacan - oscillatory, vibratory, NE - SW, subterranean noise, 20 seconds.	
	Sta. Cruz - oscillatory, moderate, 25 seconds.	
	Bacolor - oscillatory, light, N - S, short.	
	Cavite - oscillatory, light, E - W, ten seconds.	

Event	Felt Effect	Source
	San Isidro - oscillatory, moderate, N - S, 15 seconds.	
	Corregidor - oscillatory, light, direction, E - W, 15 seconds.	97
1883 Sept 28 11:00 a.m.	Mindanao: Surigao - strong earthquake.	97
1883 Oct 18 3:17 a.m.	Luzon: Aparri - strong, SSW - NNE, about 30 seconds.	97
1883 Oct 19 1:25 a.m.	Luzon: Aparri - vibratory, moderate, direction, W - E, duration, 35 to 40 seconds.	97
1883 Oct 24 8:00 a.m.	Cuyo Island: Cuyo - short, rather strong.	97
1883 Dec 13	Luzon: Vigan - earthquake of moderate intensity; motion, E - W; duration, three seconds.	97
1884 Jan 10 7:22 a.m.	Luzon: Manila - oscillatory, very light; direction, S 14^{o} E-N 14^{o}W. Horizontal amplitude, 0^{o}14'; duration, two seconds.	
	Daet - oscillatory, vibratory, SE - NW, 20 seconds.	
	Ragay - undulatory, strong, E - W, 20 seconds.	
	Libmanan - vibratory, strong, 20 seconds, subterranean noise.	
	Nueva Caceres - vibratory, strong, 15 seconds.	97
1884 Mar 22 4:49 p.m.	Luzon: Manila - oscillatory, light, direction, N 25^{o} W-S 25^{o}E; horizontal amplitude, 0^{o}25'; duration, two seconds.	
	Lingayen - moderate, N - S, eight seconds.	
	Vigan - oscillatory, moderate, seven seconds.	

Event	Felt Effect	Source
	Cape Bolinao - oscillatory, strong NW - SE, 30 seconds.	97
1884 June 05	Mindanao: Cagayan, Misamis - some terrible earthquakes were felt which were of extraordinary duration and intensity. The general movement was south to north, although it lasted so long that there was time for all kinds of seismic motion.	97
1884 Oct 29 4:09 a.m.	Luzon: Manila - oscillatory and vibratory simultaneously. It began with a slow oscillation, E - W, five seconds. Followed by three very strong oscillations.	97
1884 Oct 29 5:23 a.m.	Luzon: Nueva Caceres - oscillatory, very strong, 30 seconds.	
	Atimonan - oscillatory, light, SE - NW, 50 seconds.	
	Sta. Cruz - oscillatory, 28 seconds.	
	Morong - somewhat strong, E - W, 70 seconds.	
	Tayabas - oscillatory, moderate, E - W, 20 seconds.	
	Calamba - very weak, NE-SW, long.	
	Mariguina - oscillatory, strong, NW - SE, one minute, subterranean noise.	97
1884 Oct 29 6:03 a.m.	Luzon: Cavite - moderate, E - W, 20 seconds.	
	Montalban - oscillatory, light, N - S, 20 seconds.	
	Bulacan - oscillatory, strong, 30 seconds.	
	Bacolor - oscillatory, strong, NE - SW, 20 seconds.	
	San Isidro - oscillatory, light, E - W, four seconds.	

Event	Felt Effect	Source
	Tarlac - oscillatory, light, N - S, 40 seconds.	97
1884 Nov 11 4:26 p.m.	Luzon: Manila - oscillatory. It began with a slow movement; E 15°S - W 15°N; ten seconds; followed by oscillations somewhat stronger which forced the pendulum to oscillate in other directions.	97
1884 Nov 11 4:35 p.m.	Luzon: Burias - violent earthquake, 40 - 50 seconds' duration. Damage to military building, the only one of strong material.	97
1884 Nov 11 8:00 p.m.	Luzon: Bulacan - oscillatory, 20 seconds.	
	Cavite - oscillatory, moderate, short, E - W.	
	Mariquina - oscillatory, strong, NW - SE, 50 seconds.	
	Morong - strong, first oscillatory, W - E, then rotary 23 seconds.	
	Lipa - moderate, 30 seconds.	
	Calamba - oscillatory, light, SE - NW, 40 seconds.	
	Tayabas - oscillatory, light, N - S, ten seconds.	
	Atimonan - giratory, moderate, at first oscillatory, N - S, five seconds.	
	San Isidro - oscillatory, light, NW - SE then SW - NE, 2 seconds.	
	Nueva Caceres - oscillatory, light, 45 seconds.	
	Daet - oscillatory, strong, W - E, 30 seconds.	
	Santa Cruz - oscillatory, 20 seconds.	97

Event	Felt Effect	Source
1884 Nov 14 3:00 a.m.	Mindanao: Sapao - strong vibratory earthquake.	97
1884 Dec 17 11:56 p.m.	Luzon: Manila - oscillatory, very light, NNE - SSW; horizontal emplitude $0^{o}5'$.	
	San Fernando, Pampanga - oscillatory, light, ENE - WSW, 5 seconds.	
	Bacolor - oscillatory, moderate, ENE - WSW, 3 seconds.	
	Carranglan - moderately strong vibratory and rotary, NW - SE, 9 seconds.	
	San Isidro - oscillatory, strong, SE - NW, vibratory, 10 seconds.	
	Cabanatuan - vibratory, strong.	
	Bayombong - vibratory, moderate, preceded by subterranean noise, 15 seconds.	
	Dagupan - oscillatory, rotary, strong, NE - SW.	97
1884 Dec 24 5:00 a.m.	Samar, Leyte: Leyte - a strong vibratory and oscillatory earthquake lasting 20 seconds. There was panic in the church, with the injury of two persons.	97
1885 Feb 12	Panay: A strong oscillatory earthquake in the capital accompanied by subterranean noise.	87
1885 Feb 22 3:30 p.m.	Mindanao: Dapa, Island of Siargao - There was a long earthquake of a minute's duration.	
	Baculin, South of Lianga - was very strong, opened cracks in the floor of the church; also in the winding path by which one ascends from the beach to the town and in several other places. Great sections of the hills fell into the sea. Masonry buildings suffered severely.	

Event	Felt Effect	Source
	Gigaguit - very strong earthquake. The statues on the altars jumped as if on springs.	
	Caraga, South of Baculin - there was a strong vibratory and oscillatory earthquake with subterranean noise. It opened great cracks and caused landslides in the hills.	97
	This earthquake also affected all the coasts of Mindanao along the Pacific Mountain range from Surigao to Cape. San Agustin.	87
1885 May 15 7:05 a.m.	Luzon: Manila - light, oscillation - twice, first oscillation, amplitude $1^{o}40'$; second oscillation, $1^{o}10'$; duration, 17 seconds.	
	Mariquina - rotary, light, 15 seconds.	
	Bayombong - oscillatory, light, N - S, short.	
	Cabanatuan - oscillatory, light, SE - NW, momentary.	
	Candon - vibratory, moderate, oscillatory, N - S, light, 15-20 seconds.	
	Bacolor - short, light, NW - SE.	
	San Fernando, Pampanga - oscillatory, NW - SE, 15 seconds.	
	San Fernando, La Union - strong oscillatory, moderate, E - W, 20 seconds.	
	Lingayen - oscillatory, moderate, NW - SE, 10 seconds.	
	Carranglan - rotary, moderate, NW - SE, 12 seconds.	
	Vigan - oscillatory, strong, SE - NW, 6 seconds.	

Event	Felt Effect	Source
	Cape Bolinao - vibratory, oscillatory, SW - NE, 4 seconds.	
	San Isidro - rotary, moderate, NW - SE, 3 seconds.	
	Aparri - strong, NW - SE, 55 seconds.	97
1885 July 23 10:45 a.m.	Mindanao: Dapitan - there has been considerable material damage. Some houses have fallen and others are tilted. The government houses have suffered quite a bit. The rectory suffered but little.	
	Cavite - the church has been left in bad condition and some wall panels fell at Ilaya.	
	Dipolog - large landslides in the hills. The statues, ornaments, and steps were thrown from the altar and it was miraculous that the tabernacle did not fall, for it turned around on the table of the altar. Everything on the floor of the rectory turned. The earthquakes are still continuing but are weaker. The strong one was NW to SE, making great waves in the ground like waves in the water, opening large cracks in a NE - SW direction. Large cracks opened in many places and emitted a quantity of water.	
	Isabela, Island of Basilan - the earthquake was felt in the same way in Zamboanga and Cotabato. A strong oscillatory earthquake, E to W was felt. It stopped a clock, but no damge was done.	
	Cebu - a strong earthquake of long duration. It rang a bell in the cathedral and stopped various clocks.	97
	This quake had its epicentre near the northwestern coast of Mindanao.	

Event	Felt Effect	Source
	Great damage was done to buildings, fissures opened and displacements of the ground occurred throughout the district or quasipeninsula of Dapitan. A competent and careful observer, who was very particular about noting the direction of the seismic wave, as well as in the innumerable aftershocks, said that it is from NW - SE, i.e., land-inward from the seacoast. He likewise notes that the principal fissures had a SW - NE direction. These facts locate the focus of the disturbance in the sea, opposite the NW coast.	53
	Dapitan - a terrifying earthquake according to natives. No casualties. Some houses collapsed, some were broken. Great damage to the Comman Headquarters and at the Tribunal. Slight damage to the convent.	
	Cavite - great damage.	
	La Haya - large cracks in the earth; water coming out. In mountains there were landslides.	
	Dipolog - terrifying and very strong. All statues fell down from the altar, except for the tabernacle which just rolled over the altar. In the convent, everything fell down. The strongest tremor was felt in the NW and SE which caused "alon-alon" on land and, in the NE and SW, fissures in the ground.	103
1885 July 24 4:34 p.m.	Luzon: Manila - oscillatory, light, preceded by a light vibration; direction E 14^{o}N-W 14^{o}S. Horizontal amplitude, $0^{o}12'$.	
	Montalban - oscillatory, SW - NE, 5 seconds.	
	San Isidro - vibratory, strong, 2 seconds.	

Event	Felt Effect	Source
	Cabanatuan - vibratory, moderate, 10 seconds.	
	Carranglan - vibratory, moderate, 20 seconds.	
	Bayombong - oscillatory, moderate, E-W, short.	
	Carig - oscillatory, moderate, NW - SE, 15 seconds.	
	Lingayen - oscillatory, light, E - W, 20 seconds.	
	Mariquina - rotary, moderate, 5 seconds.	
	Morong - oscillatory, moderate, E - W, 16 seconds.	
	Dagupan - oscillatory, N - S, 20 seconds.	
	Pampanga - oscillatory, moderate, rotary, SE - NW, 45 seconds.	
	Bacolor - moderate, NW - SE, 40 seconds, rotary, then oscillatory.	
	Balanga - oscillatory, light, 3 seconds.	97
1885 Sept 09 2:04 a.m.	Luzon: Manila - a noise like the creaking of beams was heard in different parts of the house. The Bertilli pendulum increased its oscillations and a slight movement was noticed in the vertical pendulum of the Rossi microseismometer.	97
1885 Sept 09	Mindanao: There were earthquakes preceded by subterranean noises; the strongest since July 23. The little bell at the front door rang.	
	Malindang (SEE of Dapitan) - a range of hills separated into two parts.	97
1885 Sept 30 6:00 a.m.	Mindanao: Siargao - a very strong earthquake. It was vibratory and	

Event	Felt Effect	Source
	oscillatory from N to S and such that one would expect everything to fall for, in the middle of the earthquake, the earth gave a jump of such a nature that masonry buildings would have collapsed.	
1885 Oct 13 5:06 p.m.	Luzon: Manila - long and moderately strong. Duration, 25 seconds.	
	Daet - oscillatory, moderate, NE - SW, 10 seconds.	97
1885 Nov 16 11:21:35 p.m.	Luzon: Manila - strong oscillations followed by vibration and rotation. Preceded and accompanied by a very pronounced subterranean noise. This noise was also heard in other places around Manila. The pendulum began to oscillate with a slow movement in the direction N 33°E - S 33°W. After 7 seconds, there was a strong shock in the direction N 25°E - S 25°W for 10 seconds. Another shock in the direction S 43°E - N 43°W which had the greatest amplitude, 6°25'. Total duration, 21 seconds.	
	Mariquina - strong subterranean noise, oscillatory, E - W, 15 seconds. Later a rotation lasting 10 seconds.	
	Bulacan - oscillatory, strong, 30 seconds.	
	Morong - oscillatory, moderate, E - W, 12 seconds.	
	Cavite - oscillatory, strong, N - S, 45 seconds.	
	Taal - NNE - SSW, light for first minute, then moderately strong; vibratory and rotary for another minute.	
	Balanga - oscillatory, moderate, 27 seconds.	
	Bacolor - oscillatory, NW - SE, 20	

Event	Felt Effect	Source
	seconds.	
	Restinga - oscillatory, N - S, 15 seconds.	
	San Fernando, Pampanga - oscillatory, moderate, NW - SE, 25 seconds.	
	Atimonan - moderate, N - S, subterranean noise, 2 minutes.	
	Lipa - very perceptible, N - S, 10 seconds.	
	Punta Santiago - oscillatory, light, E - W, 5 seconds.	
	Calamba - oscillatory, moderate, 15 seconds.	
	Batangas - strong, NW - SE.	97
1885 Nov 18 2:37:57 a.m.	Luzon: Manila - the oscillations of the ground have repeated several times on the 17^{th} and today, but only one was of any importance and the time of this was 2.37 a.m. Direction $S4^{o}W$ - $N4^{o}E$ and the amplitude was $1^{o}15'$.	
	Mariquina - oscillatory, moderate, NNE - SSW, 8 seconds.	
	Morong - rotary, light, 5 seconds.	
	Taal - oscillatory, moderate, N - S, 10 seconds.	
	Balanga - oscillatory, moderate, 10 seconds.	
	San Fernando, Pampanga - vibratory, light, 15 seconds.	
	Punta Santiago - oscillatory, light, E - W, 6 seconds.	97
1885 Nov 19 9:31 p.m.	Luzon: Manila - light, direction N $34^{o}W$ - S $34^{o}E$, amplitude $1^{o}25'$, a subterranean noise preceded the earthquake.	

Event	Felt Effect	Source
	Lingayen - oscillatory, strong, NE - SW, 14 seconds.	
	Bayombong - rotary, very strong, 20 seconds.	
	Bacolor - vibratory, moderate, 10 seconds.	
	Carranglan - very strong, vibratory, oscillatory, NE - SW, 5 seconds.	
	San Isidro - moderate, first, vibratory, then oscillatory; E - W, 12 seconds.	
	Mariquina - oscillatory, moderate, WNW - ESE, 16 seconds, subterranean noise.	
	Morong - vibratory, moderate, oscillatory, N - S, 15 seconds.	
	Monta.ban - oscillatory, light, NNW - SSE, 20 seconds.	
	Balanga - oscillatory, light, 5 seconds.	
	Carig - vibratory, oscillatory, N - S, strong, 5 seconds.	
	San Fernando, Pampanga - oscillatory, moderate, NNW - SSE, 30 seconds.	
	Dagupan - strong, vibratory, oscillatory, NE - SW, 50 seconds.	
	Cabanatuan - strong, vibratory, oscillatory, 15 seconds.	
	Aparri - oscillatory, moderate, E - W, 35 seconds.	97
1885 Nov 25 5:35 a.m.	Luzon: Manila - moderate; directio N 25^{o}E - S 25^{o}W; amplitude, $1^{o}15'$.	
	Punta Santiago - oscillatory, N - S, five seconds.	

Event	Felt Effect	Source
	Balanga - oscillatory, moderate, 13 seconds.	
	Bulacan - oscillatory, light, 13 seconds.	
	San Isidro - somewhat strong, rotary, seven seconds, NE - SW.	
	Lipa - light, N - S, 15 seconds.	
	Mariquina - oscillatory, moderate, ENE - WSW, ten seconds.	97
1885 Dec 08 11:18 p.m.	Luzon: Vaqueros, Abra - oscillatory, strong, N - S, ten seconds, subterranean noise.	97
1885 Dec 19 5:14 p.m.	Bayombong - preceded by subterranean noise like the discharge of cannon at a great distance, then moderate movement, N - S, short.	97
1886 Jan 01 4:36 p.m.	Luzon: Cape Bolinao - strong, oscillatory, 35 seconds.	97
1886 Jan 11 4:00 a.m.	Mindanao: Surigao - strong.	97
1886 Jan 14 11:36 a.m.	Luzon: Manila - oscillatory, light, SW - NE then E - W.	
	Taal - rotary, strong, five seconds.	
	Atimonan - oscillatory, moderate, ENE - WSW, five seconds.	97
1:00 p.m.	Luzon: Manila - strong, NW - SE.	
	Aparri - oscillatory, strong, E - W, vibratory, SW - NE.	97
10:16 p.m.	Atimonan: Atimonan - vibratory, rotary, moderate, duration, six seconds.	97
1886 Mar 18 6:20 a.m.	Samar: Calbayog - vibratory, moderate.	97
1886 Apr 10 9:00 a.m.	Panay & Negros: Iloilo - strong, vibratory, short, subterranean	

Event	Felt Effect	Source
	noise.	
	Bacolod - oscillatory, strong, four seconds.	97
1886 Apr 14 11:43 p.m.	Luzon: Manila - light, oscillatory, three distinct shocks, the last being the strongest. First NE - SW then N - S.	
	Bayombong - strong, oscillatory, N - S and SW - NE, duration was 20 seconds.	
	Cabanatuan - oscillatory, moderate, NE - SW, three seconds.	
	Dagupan - rotary, strong, oscillatory, N - S 15 seconds.	
	Tarlac - strong, vibratory, three seconds.	
	Lingayen - oscillatory, moderate, N - S, 12 seconds.	97
1886 May 01 4:27 a.m.	Luzon: Aparri - oscillatory, moderate, direction, E - W, duration, seven seconds.	97
1886 May 21 12:18 p.m.	Luzon: Mariquina - rotary, then oscillatory, moderate, 30 seconds.	
	Nueva Caceres - strong, oscillatory, vibratory, E - W, 40 seconds.	
	Libmanan - strong, oscillatory, E - W, 40 seconds.	
	Albay - oscillatory, N - S, 45 seconds.	
	Ragay - strong, oscillatory, E - W, 40 seconds.	
	Daet - oscillatory, moderate, 35 seconds, subterranean noise.	97
1886 May 23 7:00 p.m.	Luzon: Taal - vibratory, then oscillatory, moderate; direction, E - W; duration, 15 seconds.	

Event	Felt Effect	Source
	Batangas - oscillatory, moderate, duration, ten seconds.	97
1886 May 29 7:34 p.m.	Luzon: Binorugan - oscillatory, vibratory, moderate, N - S direction, nine seconds' duration, subterranean noise.	97
1886 June 03 11:21 a.m.	Luzon: Taal - violent, E - W direction, two seconds' duration.	
	Corregidor - oscillatory, light, N - S direction, three seconds' duration.	97
1886 June 06 9:56 p.m.	Luzon: Manila - oscillatory; light; direction, N 20°W S 20°E; amplitude of oscillation 0°14'.	
	Iba - moderate; direction, SE - NW; eight seconds' duration.	97
1886 July 29 6:50 a.m.	Luzon: Bayombong - strong; vibratory; oscillatory; E - W direction; duration, five seconds, subterranean noise.	97
1886 Aug 02 3:58 a.m.	Luzon: Manila - moderate, long duration.	
	Bulacan - oscillatory, E - W, five seconds.	
	San Isidro - moderate, N - S and E - W, 20 seconds.	
	Alaminos - oscillatory, E - W, light, ten seconds.	
	Iba - oscillatory, moderate, N - S, 20 seconds.	
	Bacolor - vibratory, oscillatory, E - W, moderate, six seconds.	
	Balanga - strong, 35 seconds.	
	Taal - strong, vibratory, then oscillatory, NNE - SSW, 20 seconds.	
	Cavite - oscillatory, N - S, light,	

Event	Felt Effect	Source
	four seconds.	
	Punta Santiago - strong, oscillatory, E - W, nine seconds.	
	Restinga - oscillatory, NE - SW, rotary, moderate, 40 seconds.	
	Batangas - strong, oscillatory, N - S, 20 seconds.	
	Calamba; Lipa; Sta. Cruz - oscillatory, 15 - 20 seconds.	
	Montalban - light, oscillatory, SE - NW, ten seconds.	
	Mariquina - oscillatory, rotary, strong, 45 seconds.	
	Morong - strong, vibratory, then oscillatory, NE - SW, 50 seconds.	
	Cabanatuan - oscillatory, E - W, moderate, 15 seconds.	
	Tarlac - oscillatory, SE - NW, ten seconds.	
	San Fernando, Pampanga - began vibratory ended oscillatory, SE - NW, moderate, 35 seconds.	
	Bolinao - oscillatory, moderate, NE - SW, 15 seconds.	
	Sta. Cruz, Zambales - oscillatory, N - S, moderate, eight seconds.	97
1886 Sept 02 11:54 p.m.	Luzon: Manila - light; oscillatory; direction, N 22^{o}E S 22^{o}W; horizontal amplitude, $0^{o}12'$; duration of six seconds.	
	Bayombong - vibratory, oscillatory, moderate, SE - NW, five seconds.	
	San Fernando, Pampanga - light, oscillatory, direction, NNE - SSW, duration eight seconds.	

Event	Felt Effect	Source
	Bacolor - moderate, oscillatory, NNE - SSW, seven seconds duration.	
	San Fernando La Union - oscillatory, moderate, N - S, eight seconds.	
	Cabanatuan - strong, oscillatory, SE - NW, ten seconds.	
	San Isidro - oscillatory, moderate, N - S, ten seconds.	97
1886 Oct 20 5:25 a.m.	Luzon: Taal - moderate; direction, SSW - NNE; duration two seconds.	97
1886 Oct 29 11:00 - 12:00 a.m.	Panay: Iloilo - light, moderate duration, oscillatory, N - S, vibratory, Very definite subterranean noise before the earthquake.	97
1886 Nov 03 9:25 a.m.	Luzon: Bangued - oscillatory, moderate, EW, six seconds.	
	Laoag - strong, NW - SE, five seconds duration.	97
1886 Nov 04 6:00 a.m.	Luzon: Bayombong - vibratory, moderate, duration three seconds, subterranean noise.	97
1886 Nov 26 5:00 - 6:00 p.m.	Panay: Iloilo - between 5:00 and 6:00 p.m., strong, vibratory, with subterranean noise.	97
1886 Nov 26 7:00 p.m.	Luzon: Aparri - oscillatory, moderate, direction N - S, duration was 20 seconds.	97
1887 Jan 25 1:30 a.m.	Panay: Iloilo - a strong earthquake of short duration accompanied by a subterranean noise.	97
1887 Feb 01 1:20 p.m.	Luzon: Bangued - oscillatory, moderate, E - W, six seconds.	
	Vaqueros - strong, oscillatory, N - S, 20 seconds.	
	Binorugan - strong, vibratory, ten seconds, loud subterranean noise.	

Event	Felt Effect	Source
	Tuguegarao - strong, rotary, 30 seconds.	97
	The epicentre was in the Central Cordillera and affected not only the provinces of Cagayan and Isabela but also both Ilocos and Abra and the central districts where the earthquake was accompanied by innumerable subterranean noises.	28
1887 Feb 01 5:15 p.m.	Luzon: Bangued - oscillatory, E - W, shorter and weaker than the earlier quake at 1:20 p.m.	
	Laoag - oscillatory, light, E - W, four seconds.	
	Vaqueros - oscillatory, E - W, moderate, 30 seconds.	
	Binorugan - vibratory, oscillatory, strong, E - W, 15 seconds.	97
1887 Feb 02 11:00 p.m.	Panay: Iloilo - the earthquake was one of the most intense that was felt here. Panic was general and there was considerable damage, especially to glassware. A wall fell in the Customs House and several buildings were cracked. The bells rang. A subterranean noise heard; a partition fell in the church.	
	Buenavista - on the neighbouring island of Guimaras, a part of the facade of the church fell.	
	Molo - the upper part of the facade fell.	
	Sta. Barbara; Alimodian; San Miguel - there was damage in the churches, perhaps the only masonry buildings.	
	Capiz - the earthquake is said to be violent, forcibly throwing objects out of place, breaking chimneys and cracking kilns.	97

Event	Felt Effect	Source
1887 Feb 13 6:55 p.m.	Cebu: Cebu - moderately perceptible, four seconds.	97
1887 Mar 01	Cebu: Cebu - strong earthquake was felt.	97
1887 Mar 24 9:14 p.m.	Luzon: Manila - very light, oscillatory, SE - NW.	
	Sta. Cruz - light, six seconds.	
	Atimonan - oscillatory, moderate, N - S, 20 seconds.	
	Gumaca - moderate, prolonged.	
	Daet - strong, vibratory, oscillatory, SE - NW, 25 seconds.	
	Vueva Caceres - strong, vibratory, oscillatory, 50 seconds.	
	Libmanan - strong, vibratory, oscillatory, preceded by notable subterranean noise, ESE - WNW, 35 seconds.	97
1887 Mar 25 12:45 p.m.	Luzon: Manila - light, oscillatory, SE - NW, horizontal amplitude $0^{o}5'$.	
	Sta. Cruz - light, oscillatory.	
	Atimonan - vibratory, oscillatory, N - S, moderate, ten seconds.	
	Gumaca - light, short duration.	
	Ragay - strong, oscillatory, SE - NW, 30 seconds.	
	Daet - strong, vibratory, 20 seconds. Aftershock stronger at 1:05 p.m.	
	Nueva Caceres - oscillatory, moderate, N - S, 20 seconds. Very strong shock at 1:05 p.m. in the same direction, lasting 30 seconds.	
	Libmanan - oscillatory, NNE - SSW, ten seconds.	97

Event	Felt Effect	Source
1887 Mar 30 4:30 a.m.	Mindanao: Surigao - moderately strong shock; again at 5:00 a.m.	97
1887 Apr 01 7:30 p.m.	Luzon: Nueva Caceres - oscillatory, moderate, accompanied by subterranean noise, EW, 20 seconds.	
	Libmanan - oscillatory, E - W, 20 seconds.	
	Ragay - oscillatory, E - W, 20 seconds.	
	Daet - vibratory, moderate, 15 seconds.	97
1887 Apr 02 7:35 p.m.	Luzon: Albay - oscillatory, moderate.	
	Nueva Caceres - oscillatory, moderate, E - W, ten seconds.	
	Daet - oscillatory, light, eight seconds.	97
1887 Apr 13 3:00 a.m.	Mindanao: Surigao - strong.	97
1887 Apr 27 4:30 a.m.	Luzon: Nueva Caceres - oscillatory, moderate, 15 seconds.	97
1887 May 02 1:07 p.m.	Luzon: Daet - oscillatory, SE - NW, moderate, another at 1:15 p.m.	97
1887 May 21 3:15 p.m.	Luzon: Nueva Caceres - strong, oscillatory, N - S.	97
1887 June 02 10:08 p.m.	Luzon: Laoag - moderate, SE turning to W, oscillatory, ten seconds.	
	Tuguegarao - oscillatory, light, four seconds.	97
1887 June 11 10:23 a.m.	Luzon: Guinayangan - very strong, vibratory, N - S, five seconds.	
	Atimonan - oscillatory, light, SW - NE, four seconds.	
	Ragay - oscillatory, moderate, E - W, 12 seconds.	

Event	Felt Effect	Source
	Daet - oscillatory, moderate, SE - NW, 20 seconds.	
	Libmanan - oscillatory, light, three seconds.	97
1887 June 19 12:32 p.m.	Luzon: Manila - light, oscillatory, first WNW - ESE then NW to SE.	
	Mariquina - oscillatory, moderate, seven seconds.	
	Morong - strong, oscillatory, NE - SW, 20 seconds.	
	Sta. Cruz, Zambales - oscillatory, moderate, N - S, eight seconds.	
	San Fernando, Pampanga - oscillatory, 15 seconds.	
	San Isidro - moderate, NNW - SSE, ten seconds.	
	Sta. Cruz, Laguna - moderate in strength and duration.	
	Cabanatuan - strong, oscillatory, SE - NW, seven seconds.	
	Corregidor - light, oscillatory, N - W, five seconds.	
	Bayombong - oscillatory, moderate, E - W, five seconds.	
	Tarlac - moderate, oscillatory, NE - SW, five seconds.	
	Cavite - oscillatory, moderate, five seconds.	
	Atimonan - oscillatory, light, WNW - ESE, five seconds.	
	Bacolor - oscillatory, moderate, NE - SW, five seconds.	
	Balanga - moderate, N - S, six seconds.	

Event	Felt Effect	Source
	Bulacan - oscillatory, SW - NE, seven seconds.	
	Pantabangan - oscillatory, moderate, NNW - SSE, ten seconds.	
	Montalban - oscillatory, light, E - W, 20 seconds.	97
1887 Oct 01 1:45 p.m.	Mindanao: Surigao - strong.	97
10:05 p.m.	Luzon: Manila - oscillatory, light.	
	Libmanan - strong, oscillatory.	
	Albay - strong, oscillatory,	
	Daet - strong, rotary.	
	Nueva Caceres - oscillatory, moderate.	97
1887 Nov 16 3:35 a.m.	Luzon: Mariquina - rotary, light, seven seconds.	
	Iba - rotary, strong, six seconds.	
	Sta. Cruz, Zambales - oscillatory, light, N - S, five seconds.	97
1887 Dec 01 5:34 a.m.	Luzon: Manila - very light, oscillatory.	
	San Isidro - oscillatory, moderate, 25 seconds.	
	Mariquina - rotary, moderate, ten seconds.	
	Tarlac - vibratory, moderate, five seconds.	
	Cabanatuan - strong, five seconds.	97
1888 Jan 24 11:30 a.m.	Cebu: Cebu - strong.	97
1888 Jan 27 3:45 a.m.	Mindanao: Tagaloan - moderate in force and duration, E - W, vibratory.	97

Event	Felt Effect	Source
1888 July 19	Luzon: Aparri, Cagayan - detonations were heard like the discharge of artillery, coming from the towns of the south, and it was learned later that they originated in the collapse of one bank of the Rio Grande, in front of the town of Solana.	
	Alcala and Masiging - mountain called "Old" was emitting smoke. This is attributed to the five earthquakes which were felt in that locality on the 19th of which three were strong.	
	Towns near Old - force increased.	97
1888 Jul 29 3:30 p.m.	Mindanao: Hinatuan - strong earthquake.	97
1888 Aug 19 6:25 a.m.	Luzon: Bangued - oscillatory, N - S, moderate, six seconds.	
	Aparri - strong, N - S, five seconds.	
	Tuguegarao - intense, vibratory, N - S, 35 seconds.	
	Ilagan - oscillatory, moderate, NE - SW, ten seconds.	
	Lal-lo - oscillatory, strong, NW - SE, 20 seconds.	97
1888 Aug 19 2:39 p.m.	Manila: Manila - light, oscillatory, five seconds.	
	Aparri - vibratory, very strong, 30 seconds.	97
3:13 p.m.	Bayombong - strong, oscillatory, vibratory, N - S, and SE - NW, 15 seconds.	
	Ilagan - very strong, SE - NW, 15 seconds.	
	Lal-lo - great intensity, subsurface noise, oscillatory, NW - SE, 34 seconds.	97

Event	Felt Effect	Source
3:15 p.m.	Luzon: Tuguegarao - vibratory, very strong, WNW - ESE, nine seconds.	97
4:00 p.m.	Luzon: Lal-lo - great intensity, vibratory.	
	Aparri - rotary, light.	97
1888 Oct 02 10:00 p.m.	Mindanao: Cotabato - moderate earthquake.	97
1888 Oct 07 7:45 p.m.	Mindanao: Cotabato - strong, long, N - S.	97
1888 Dec 04 3:00 a.m.	Panay: Iloilo - strong, oscillatory, sea-wall in front of Customs House damaged.	97
1889 Jan 01 10:20 a.m.	Northeastern Mindanao: Surigao, Butuan - very strong. "This year god has given us many earthquakes since January 01 at 10:00 a.m. After High Mass, the people were still gathered when the earth began to move with much force in two oscillations, NW - SE and NE - SW. It was so strong that I would have rushed into the street except that I feared it would cause a panic and result in the injury of many persons by trampling."	97
1889 Jan 12 9:05 p.m.	Mindanao: Surigao - strong.	
	Hinatuan and east coast - three oscillations.	
	Butuan - moderately strong.	97
9:40 p.m.	Mindanao: Surigao - another strong earthquake, several houses fell and two statues were shaken from the altar.	97
1889 Feb 01	Mindanao (Camiguin Island): Mambajao - very violent and characterized by sharp vibrations; lasted a moderately long time, its direction was SW - NE, and it was preceded, by some seconds, by a subterranean noise. No damage resulted.	97

Event	Felt Effect	Source
1889 Feb 05 4:00 & 5:00 p.m.	Mindanao: Zamboanga - very strong shock, lasting one minute. Cotabato - there was one of terrifying character which lasted more than a minute. Two earthquakes were felt on the steamer "Churruca", one when on its outward journey and one on its return. When the first occurred, it caused alarm because in the beginning it was thought that the ship had struck a rock or shoal, but when it was noticed that the water was turbid and in whirlpools it was realized that it was due to the terrible phenomenon. No serious damage because most of the houses are of light materials. The centre of the earthquake must have been in Moro Gulf. Iloilo - between 4:00 and 5:00 p.m. Light oscillations which seemed long because there were two or three successive shocks.	97
	This earthquake showed almost the same intensity (VII RF) at Zamboanga and Cotabato, two towns separated by a distance of some 250 kms. Its focus must, consequently, be sought in this sea, about equidistant from the two towns mentioned. The disturbance was perceptible, though with small intensity, in central and eastern Mindanao and in the Visayas. At the time of this earthquake, the steamer "Churruca" was under way from Zamboanga to Cotabato, passing over the very region which, according to our opinion, contained the focus. Some sharp shocks were felt which frightened the people on board lest the boat had struck a submerged rock; the water became turbid with the mud rising from the bottom of the sea and formed whirls. No great waves could be seen from aboard the vessels, nor are such mentioned in the reports from Zamboanga and Cotabato.	53

Event	Felt Effect	Source
1889 Feb 11 11:45 a.m.	Mindanao: Zamboanga - strong earthquake.	97
1889 May 26 2:23 a.m.	Luzon and Mindoro - Calapan, Mindoro - terrible earthquake which caused general awakening. The houses jumped enough to break the posts and it was feared that the earth would swallow up houses and all. Plates, bottles, vases and lamps were turned around. The tower of the church was damaged. Followed by some aftershocks. Canyacao - earthquake of considerable intensity and duration from N - S. The "Butuan", which was on the cradle, vibrated strongly in all directions and the crew jumped as if on springs and slid hurriedly down the planks to the walls. Batangas - strong, oscillatory, vibratory earthquake which lasted 40 to 50 seconds and damaged the government house, the rectory, the jail, the royal house, as well as private houses. It also damaged the tower of the church. A subterranean noise was heard. Cavite - strong, oscillatory, N - S, 15 seconds. Corregidor - strong, oscillatory, N - S, six seconds. Mariquina - oscillatory, then rotary, strong, 45 seconds. Morong - strong, 45 seconds. Montalban - strong, N - S, 40 seconds. Balanga - strong, oscillatory, 50 seconds. Bulacan - vibratory, oscillatory, SW - NE, five seconds. Bacolor - strong, oscillatory, NW -	

Event	Felt Effect	Source
	SE, 40 seconds. San Fernando, Pampanga - strong, 20 seconds. Cabanatuan - strong, rotary, 20 seconds. Dagupan - oscillatory, three seconds. Additional reports from Batangas: In several places in the province, the ground opened in cracks. The beautiful church of Bauan has also suffered severe damage. The tile roof is badly damaged and down in part and has been replaced with iron. The people say this earthquake was stronger than those of 1863 and 1880, but of shorter duration. Punta Santiago - strong, oscillatory, E - W, 20 seconds. Taal - strong, oscillatory, N - S, three seconds. Calamba - oscillatory, subterranean noise, 30 seconds. Tayabas - moderate, oscillatory, WSW - ENE, 25 seconds. Restinga - strong, oscillatory, N - S, ten seconds, preceded by subterranean noise, second shock caused the bay of masonry on the north side of the observation tower to crack from top to bottom. Mareograph observation: The mareograph indicates waves in the apparatus of more than 10 cms. and a rise of level of a little less. Cryptophone: The instrument for detecting underground noise could not be used before the earthquake but, immediately after, it transmitted sounds like rough strokes. This momentous occurrence announced	

Event	Felt Effect	Source
	its approach with deep sounds like distant cannonading, almost producing the effect of a strong wind squall. This feature was noticed perfectly by an assistant in the observatory who was on the balcony to make the 2:00 a.m. observation. A gentle movement followed immediately and, in a few seconds, changed into a distinct oscillation, producing an indescribable sensation by the movements from the different directions. After these complex motions, two surges of intensity were noticed with a change of direction, the force decreasing until a perfect calm prevailed. The area of maximum intensity embraced the southern part of the province of Batangas and the northern part of Mindoro.	97
1889 July 20 12:30 a.m.	Panay: Iloilo - there were two or three moderately strong shocks from N - S with a subterranean noise.	97
1889 Aug 05 1:45 a.m.	Mindanao: Zamboanga - very noticeable, vibratory, oscillatory, SE - NW, 30 seconds.	97
1889 Oct 06 11:15 a.m.	Mindanao and Panay: Iloilo - at this capital was felt a slight earthquake which was not noticed by many. There were some aftershocks at night, but they were so gentle that they were not felt by more than a half dozen persons.	97
	Caraga - a strong vibratory earthquake. For a minute it seemed that everything would collapse; bottles fell; "We ran into the street, but could scarcely keep our feet because of the strong shaking, cattle ran hither and thither looking for a safe and firm place; trees, even small ones, swayed as if blown by a strong wind."	
	Davao - the earthquake was as strong here as in Caraga. It is reported as gentle in Tamontaca.	

Event	Felt Effect	Source
	Malalag - great earthquake; the altar fell over, the bell rang.	97
1890 Jan 14 5:14 a.m.	Luzon: Manila - light, oscillatory, N 20°E - S 20°W, two seconds. Greater intensity in the northwest provinces.	
	Dagupan - strong, vibratory, oscillatory, E - W, short.	
	Iba - oscillatory, strong, N - S, 30 seconds.	
	Pantabangan - vibratory, moderate, N - S, five seconds.	
	Cabanatuan - moderate, oscillatory, ten seconds.	
	Tarlac - oscillatory, SW - NE, slight rotation to the N, moderate, 25 seconds.	
	San Isidro - moderate, oscillatory, N - S, 30 seconds.	
	San Fernando, Pampanga - light, oscillatory, NW - SE, six seconds.	
	Bacolor - moderate, oscillatory, NNW - SSE, 20 seconds.	
	Bulacan - moderate, oscillatory, N - S, five seconds.	
	Mariquina - moderate, oscillatory, 35 seconds.	97
1890 Jan 18	Leyte: Tacloban - a strong earthquake which lasted about one minute. Its vibrations were such that the houses moved like a swaying railway train. The people said it was the strongest they had felt.	97
1890 Feb 07 12:30 a.m.	Samar & Leyte: Catbalogan - on the 7th, this town was shaken by a strong earthquake which alarmed the entire district. The people ran into the street lest they be buried in	

Event	Felt Effect	Source
	the ruins of the houses. The force of the first rang bell, broke glasses and lamps; tables, closets and other furniture were overturned. The house swayed from side to side. The light construction of the houses prevented casualties.	
	Barugo, Leyte - the earthquake was strong, the horrible vibration lasting a minute; as the people left their houses, they noticed cracks opening and closing in the ground. The confusion was very great, for some tried to escape into the open to avoid harm from the houses, while others were trying to get into the houses to avoid the opening abysses. Everything breakable was smashed. Stone buildings were damaged and cracked, some so much as to be rendered unserviceable. Almost all bridges from town to town have fallen; some streams changed course and others have disappeared. The church has suffered very much.	97
1890 Apr 13 2:04 p.m.	Luzon: Manila - very light, oscillatory, NW - SE. Aparri - oscillatory,	
	Aparri - oscillatory, moderate, NW - SE, 30 seconds.	
	Laoag - strong, oscillatory, SW - NE, 30 seconds.	
	Bangued - moderate, oscillatory, N - S, four seconds.	
	Tuguegarao - moderate, oscillatory, N - S, five seconds.	
	Vigan - moderate, oscillatory, SE - NW, 35 seconds.	
	Candon - moderate, oscillatory, N - S, ten seconds.	97
1890 May 05 3:24 p.m.	Luzon: Manila - light, vibratory, moderate, oscillatory.	

Event	Felt Effect	Source
	Cavite - moderate, oscillatory, E - W, 20 seconds.	
	Restinga - slight, oscillatory, N - S, 15 seconds.	
	Lipa - oscillatory, E - W, 15 seconds.	
	Punta Santiago - moderate, oscillatory, E - W, five seconds.	
	Batangas - moderate, vibratory, N - S, 45 seconds.	
	Tayabas - moderate, oscillatory, E - W, 17 seconds.	
	Atimonan - strong, oscillatory, E - W, 24 seconds.	97
1890 July 02 7:35 p.m.	Mindanao: Cotabato - moderate intensity and duration.	97
1890 July 24 5:38 a.m.	Mindanao: Cotabato - moderately strong, oscillatory, seven seconds.	97
1891 Mar 15 10:04 a.m.	Luzon: Manila - light, oscillatory, NE - SW, amplitude, $0^{o}28'$.	
	Batangas - moderate, first vibratory, then oscillatory, NW - SE, 25 seconds.	
	Taal - moderate, oscillatory, E - W, 12 seconds.	
	Punta Santiago - moderate, oscillatory, E - W, ten seconds.	
	Atimonan - moderate, oscillatory, N - S, short.	97
1891 Apr 05 5:30 a.m.	Mindanao: Cotabato - moderate, very long, oscillatory, some said it was felt for four minutes.	
	Hinatuan - strong oscillatory, bells rang several times; the small bell in the rectory also rang.	97

Event	Felt Effect	Source
1891 June 04 6:15 p.m.	Mindanao: Malalag, Province of Davao - strong.	97
1891 June 21 4:55 p.m.	Panay: Iloilo - oscillatory, quite strong, probably noticed by everyone.	97
1891 June 25 3:42 a.m.	Mindanao: Butuan - all the clocks of the rectory stopped, the pendulums of some fell and the shanks of others were broken; bells rang; some partitions were damaged; N - S; it began with strong vibratory motions of long duration and oscillations followed.	
	Hinatuan - very strong earthquake felt at night.	97
1891 June 26 8:30 p.m.	Mindanao: Southern part of the Agusan River Valley, 125°50'E, 7°40'N. A violent earthquake was the beginning of a long and fearful seismic period. It produced the most awful havoc on the houses and ground. Owing to the wildness of the country, there was little loss of life or of property. Falling banks of the river dammed it in many spots. Long and wide fissures were opened everywhere, especially on the hills separating the Agusan Valley from the Hijo and Salug rivers, which empty themselves into the Davao Gulf. The earthquake lasted several minutes. "The ground was moving as a troubled sea", according to an eyewitness.	85
	Cotabato - strong, an aftershock at midnight of less force.	97
1891 Aug 05 12:45 a.m.	Mindanao: Cotabato - moderate, oscillatory, 15 seconds.	97
1891 Aug 08 11:08 p.m.	Mindanao: Cotabato - moderate, short.	97
1891 Aug 21 2:45 a.m.	Mindanao: Cotabato - moderate, short.	97

Event	Felt Effect	Source
1891 Oct 03 5:45 a.m.	Mindanao: Butuan - eight seconds' duration; noticeable cracking of buildings.	97
1891 Oct 28 1:45 a.m.	Mindanao: Butuan - five to six seconds' duration.	97
1892 Feb 01 11:20 a.m.	Mindanao: Cotabato - strong, 15 seconds.	97
1892 Mar 14	Panay: Iloilo - in the night between Sunday and Monday, two strong earthquakes were felt in the capital. The first was moderately long and strong.	97
1892 Mar 16 9:01 p.m.	Pangasinan: At 9:00 p.m. (16th March) a very pronounced subterranean noise heralded a terrible phenomenon. Almost immediately a frightful movement of the ground began, first oscillatory, then vibratory, and finally rotary; first E - W and then N - S. The duration cannot be given accurately because it seemed like a century. According to reports, it lasted about one minute, during which there were subterranean noises and ringing of church bells due to the swinging of the tower. All were seized with panic. From that moment until the present, the earth has been trembling, sometimes at intervals of hours, at times oscillatory, at times vibratory, sometimes gently. During the first and strongest of the many shocks, the church tower and the kiosk in the Plaza twisted on their foundations.	
	Mariquina - very strong, vibratory, followed by oscillatory and rotary, 25 seconds.	
	Manila - strong, commencing with light vibratory motion followed by oscillations, sinking a part of the roof of a small house at San Pedro Street, at the corner of Bilibid Prison.	

Event	Felt Effect	Source
	Montalban - moderate, oscillatory, N - S, 20 seconds. Morong - moderate, first rotary then oscillatory, N - S, 40 seconds. Cavite - great intensity, 50 seconds. Balanga - strong, oscillatory. Capones Island - oscillatory, NE - SW. Agua Santos - rotary, 30 seconds. Sta. Cruz, Laguna - first, weak, vibratory; second, strong, oscillatory, E - W, 25 seconds. Calamba - moderate, oscillatory, SE - NW, 25 seconds. Tarlac - strong, vibratory, oscillatory, ten seconds. Iba - strong. Olangapo - very strong, long. Bolinao - strong, oscillatory, N - S, 40 seconds. Vigan - strong, oscillatory, vibratory, S - N, 50 minute. Tayabas - moderate, oscillatory, E - W, 20 seconds. Lingayen - strong, oscillatory, vibratory, W - E, one minute. The government house was damaged, the church tower was tilted, considerable damage in the court house, cracks in the jail, central part of and beams in the Melendez Bridge damaged; some damage in the school of the Dominican Sisters and in private houses. Bulacan - first vibratory, second	

Event	Felt Effect	Source
	oscillatory, WSW - ENE, great intensity.	
	Sibul - strong, N - S and E - W, 55 seconds.	
	Carig - strong, oscillatory, NE - SW, 40 seconds, light oscillatory, aftershock.	
	Bayombong - strong, first vibratory, rotary with subterranean noise, second oscillatory, NE - SW, two minutes.	
	Lal-lo - great intensity, oscillatory, N - S, 50 seconds.	
	Pantabangan - strong, oscillatory, SSW - NNE, 50 seconds.	
	San Isidro - strong, rotary, ENE - WSW and NNE - SSW, two minutes.	
	Cabanatuan - violent, 45 - 50 seconds.	
	Tuguegarao - strong, first rotary, second oscillatory, N - S, 55 seconds.	
	Batangas - moderate, oscillatory, short.	
	Taal - moderate, E - W, 16 seconds.	
	San Fernando, Pampanga - strong, oscillatory, E - W, 45 seconds.	
	Bacolor - several seismic undulations in the night, variable intensity (9:05 moderate, oscillatory, NE - SW, one minute, subterranean noise).	
	Daet - moderate, oscillatory, NE - SW, 12 seconds.	
	Sual - strong, NE - SW, 40 seconds.	
	San Fernando, La Union - very	

Event	Felt Effect	Source
	strong, vibratory, oscillatory, one minute. Laoag - moderate, 50 seconds. Bangued - very strong, vibratory, NE - SW, 15 seconds. Ilagan - moderate, oscillatory. Candon - strong, oscillatory, N - S, 35 seconds. Dagupan - part of the court sank, the rest rendered useless; girls' school and pharmacy of Sr. Saston damaged, bridge of Bagoas made useless; masonry houses damaged; cracks in the ground, giving out water and black sand. Sta. Barbara - walls and facade of the church and court cracked; doors and partitions fell; central pier of the Mora Bridge sank. San Jacinto - all stone structures, church and tower, court, girls' school, private houses damaged. Goibel and Capay bridges damaged; road leading to towns of Mangaldan and San Fabian passable only to pedestrians because of transverse and longitudinal cracks; archives, documents, etc. buried in the wreckage of the court. Mangaldan - church, tower, cemetery chapel and rice warehouses collapsed, court, bridges and culverts of Guidonyan, Bantayan and Anolid damaged; numerous cracks in the ground giving out water and sand. The earthquake was horrible, especially the first, which seemed to move the walls as if they were fragile bamboo and made the bells ring lugubriously. The rectory has not fallen, but it is rendered useless; it was all stone; it has miraculously not fallen, but it was	

Event	Felt Effect	Source
	completely riddled. The movement was very strong, E to W; N - S. Part of the tower fell and the rest was completely riddled even to the foundations; half of the church fell in huge blocks. Most of the telegraph poles and the kilometre posts were down.	
	San Fabian - floor of court sank, walls cracked, damage to Cayanga and Balangombog bridges, large cracks in the ground.	
	Malasiqui - several houses damaged.	
	Mariaoag - public school for both sexes sank; damage to facade of church, court and to bell tower in Binalonan. Court demolished completely; Justice Francisco Garcia perished in the ruins. Girls' school, rectory, chapel and cemetery walls destroyed completely. Other buildings, even those of light material, suffered damage. Wide cracks in the town, roads and fields; water and sand issuing.	
	Calasiao - bridges of Morosay, Gabon, San Pablo and Malibago rendered useless; facade of church damaged, ceiling of rectory fell, statues fell, boys' school down, large cracks in walls of church and court; ground cracks, water and sand issuing.	
	Asigan - court, church, old rectory and new rectory under construction ruined; bridge over the Agno river useless; cracks in the ground.	
	San Carlos - church and sacristy damaged, cracks in towns of Amorter, Amangloang, Mageagoin and Bayamban; Alcala bridge impassable, cracks in walls of court, church and rectory.	
	Pozorrubia - 20 houses and five granaries of light material	

Event	Felt Effect	Source
	sustained damage; damage to rectory and cemetery, cracks in the ground.	97
	Benguet; Sto. Tomas; region to the NNE - cracks and landslips.	
	Baguio; Trinidad; Itogon - destruction of houses in the populated centres.	
	Trinidad Valley - alluviums were much crevassed in all directions but chiefly in the direction of the river.	
	La Union - all the principal buildings, such as churches, convents, schools and municipal houses of nine towns, generally built of strong materials, were either destroyed or much damaged, chiefly in their principal upper floors; native structures of wood and lighter materials sustained also great damage. Landslips in steep hills and much fissuring in alluviums were likewise conspicuous. Fires started at several places.	66
1892 Mar 17 11:23 p.m.	Luzon: San Fernando, La Union - moderate, NW - SE.	
	Bayombong - oscillatory, NE - SW, moderate, five seconds' duration.	
	Manila - light, oscillatory, NNE - SSW, some movement of the Rossi seismoscope.	97
1892 Mar 22 8:35 p.m.	Luzon: San Fernando, La Union - moderate, SW - NE, 30 seconds.	
	Cabanatuan - light, oscillatory, five seconds.	
	San Isidro - light, oscillatory, E - W, 35 seconds.	
	Manila - light, oscillatory, SSW - NNE and E - W.	97

Event	Felt Effect	Source
1892 Mar 23 12:30 a.m.	Negros and Cebu: La Carlota - strong, vibratory, moderate duration accompanied by loud noise.	
	Cebu - it was of long duration and is said to have been the strongest within memory.	97
1892 Mar 26 1:45 p.m.	Luzon: Carig - moderate, oscillatory, NE - SW, 20 seconds.	
	San Fernando, Pampanga - light, oscillatory, E - W, five seconds.	
	Pantabangan - light, oscillatory, SSW - NNE, five seconds.	97
3:44 p.m.	Luzon: San Fernando, La Union - moderate, NE - SW, ten seconds.	
	San Isidro - moderate, oscillatory, NE - SW, 20 seconds.	
	Sta. Cruz - moderate, oscillatory, NE - SW, eight seconds.	
	Cabanatuan - moderate, short.	
	Bayombong - first rotary, second oscillatory, E - W, moderate, 20 seconds.	
	Candon - oscillatory, NNW - SSE, 20 seconds.	
	Tarlac - light, ten seconds.	
	Manila - light, oscillatory, vibratory; first, oscillatory, NW - SE; second, oscillatory, ENE - WSW.	97
1892 Mar 28 6:44 p.m.	Luzon: Aparri - moderate, vibratory, 20 seconds.	
	Laoag - moderate, oscillatory, NW - SE, ten seconds.	
	Lal-lo - strong, oscillatory, 40 seconds.	97

Event	Felt Effect	Source
1892 Apr 03 7:05 a.m.	Luzon: San Fernando, La Union - moderate, NE - SW, 15 seconds.	97
1892 Apr 07 4:55 p.m.	Luzon: Manila - light, vibratory, oscillatory, E - W.	
	San Isidro - light, eight seconds.	
	Cabanatuan - light, oscillatory, NE - SW, four seconds.	
	Pantabangan - rotary, oscillatory, moderate, SE - NW.	
	Bayombong - sudden, oscillatory, NE - SW, six seconds.	
	Carig - moderate, oscillatory, NNE - SSW, 15 seconds.	97
1892 Apr 17 6:54 p.m.	Luzon: Bangued - violent, vibratory, ENE - WSW, one second.	97
1892 Apr 21 11:00 a.m.	Batanes Island: The earthquake was felt in all these islands, the longest duration they have experienced. It was strong enough to spill water from containers, E - W oscillations; one minute and 15 seconds.	97
1892 Apr 22 10:06 a.m.	Luzon: Aparri - moderate, oscillatory, ENE - WSW, 15 seconds.	
	Lal-lo - oscillatory, WNW - ESE, NE - SW, eight seconds.	
	Manila - very light, oscillatory.	97
1892 May 01 10:05 p.m.	Luzon: Tabaco - moderate, oscillatory, E - W, four seconds.	
	Nueva Caceres - moderate, oscillatory, E - W, five seconds.	
	Albay - intense, oscillatory, NE - SW.	97
1892 May 06 1:35 p.m.	Luzon: Albay - moderate, oscillatory, ENE - WSW; two to three seconds.	97

Event	Felt Effect	Source
1892 May 21 6:30 a.m.	Luzon: Iba - strong, 20 seconds.	
	Manila - light, oscillatory, NNE - SSW; then vibratory, vertical displacement.	97
1892 May 31 9:34 p.m.	Luzon: Lingayen - oscillatory, moderate, E - W, eight seconds.	
	Manila - light, oscillatory, E - W, then vibratory.	97
1892 June 16 6:15 a.m.	Mindanao: Tamontaca - strong, vibratory; sudden blow, lamps did not move.	97
	It was the second violent earthquake shaking the same region and renewing the havoc of the preceding year.	85
1892 June 30 11:00 a.m.	Luzon: Lal-lo - oscillatory, strong, SW - NE, 32 seconds.	97
1892 July 07 6:56 a.m.	Luzon: Nueva Caceres - strong, vibratory, two seconds.	
	Manila - very light, N - S.	97
1892 July 28 8:07 p.m.	Luzon: Sta. Cruz, Laguna - moderate, oscillatory, ENE - WSW, five seconds.	
	San Isidro - moderate, oscillatory, N - S, 28 seconds.	
	Atimonan - moderate, oscillatory, N - S, ten seconds.	
	Morong - vibratory, then oscillatory, NW - SE, 15 seconds.	
	Manila - vibratory, oscillatory, NW - SE and N - S amplitude $0^{\circ}22'$; 30 seconds.	
	Calamba - strong, oscillatory, NE - SW, 40 seconds.	
	Pantabangan - vibratory, ten seconds.	97

Event	Felt Effect	Source
1892 July 29	Luzon: Trinidad, Benguet - two shocks, short and strong.	97
1892 Aug 15 6:50 a.m.	Luzon: Daet - strong, oscillatory, NE - SW, seven seconds.	97
1892 Aug 29 3:45 p.m.	Mindanao: Zamboanga - small oscillations at first and moderate vibrations later, accompanied by a subterranean noise like sharp detonations or successive knocks. Duration not more than five seconds; rattling of doors and knobs.	97
11:59 p.m.	Luzon: Albay - moderate, vibratory, 30 seconds.	97
1892 Sept 09 7:42 a.m.	Luzon: Benguet - very violent, vibratory, SW - NE, one second.	97
2:17 p.m.	Luzon: Benguet - same direction, duration and force as the preceding tremor.	97
1892 Sept 16 4:00 a.m.	Mindanao: Kinoguitan, Misamis Oriental - strong, moderate duration; two aftershocks in the morning somewhat gentle. Dapitan - light, oscillatory, vibratory, NNE - SSW.	97
1892 Oct 05 6:55 a.m.	Luzon: Lipa - moderate, oscillatory, WSW - ENE, four seconds.	97
1892 Oct 10 3:00 p.m.	Luzon: Lipa - first vibratory, then oscillatory, WSW - ENE, moderate, six seconds.	97
1892 Oct 21 12:45 a.m.	Mindanao: Surigao - strong, E - W, sudden, momentary.	97
1892 Nov 02 10:30 a.m.	Mindanao: Surigao - moderate earthquake.	97
1892 Dec 03 5:31 p.m.	Luzon: Manila - light, oscillatory, E - W, 20 seconds. San Fernando, La Union - oscillatory; NW - SE, seven seconds.	

Event	Felt Effect	Source
	Iba - light, N - S, 20 seconds.	
	Carig - moderate, oscillatory, WNW - ESE, eight seconds.	
	Bayombong - strong, oscillatory, N - S, 5 seconds.	
	San Isidro - moderate, oscillatory, NW - SE, 7 seconds.	
	Tarlac - light, oscillatory, N - S.	
	Pantabangan - light, oscillatory, E - W.	97
1892 Dec 06 5:50 a.m.	Luzon: Albay - strong, oscillatory, SE - NW, 4 seconds.	97
1892 Dec 18 4:29:54 a.m.	Luzon: Aparri - moderate, vibratory, 15 seconds.	
	Paoay - oscillatory, E - W, 10 seconds.	97
1893 Jan 25 8:33 p.m.	Luzon: Laoag - moderate, oscillatory, SW - NE, 25 seconds.	
	Lal-lo - very strong, vibratory, oscillatory, WNW - ESE, 35 seconds.	
	Bayombong - almost imperceptible, ENE - WSW, 3 seconds.	
	Vigan - moderate, oscillatory, N - S, 15 seconds.	97
1893 Feb 23 6:00 a.m.	Leyte: Leyte - strong, starting with sudden vibration, continuing with great oscillation, 28 seconds.	97
1893 Feb 27 2:02:08 a.m.	Luzon: Manila - oscillatory-vibratory; first N - S, then from 2nd to 4th quadrant:duration, 26 seconds.	
	Batangas - moderate, E - W, oscillatory, 15 seconds.	
	Punta Santiago - very strong, vibratory, E - W, ten seconds.	

Event	Felt Effect	Source
	Laguna - moderate, oscillatory, N - S, eight seconds.	97
1893 Mar 09 12:39 a.m.	Luzon: Manila - fairly perceptible at intervals for 60 seconds, oscillatory, vibratory.	
	Laguna - vibratory, followed by oscillation, NNE - SSW, moderate, six seconds.	
	Zambales - moderate, oscillatory, N - S, 30 seconds.	
	Lingayen - moderate, N - S, 30 seconds.	
	Bangued - moderate, oscillatory, ENE - WSW, 25 seconds.	
	San Fernando, Pampanga - light, oscillatory, 25 seconds.	
	Aguas, Santas - light, oscillatory, four seconds.	
	Bolinao - moderate, oscillatory, 17 seconds.	
	Bayombong - light, oscillatory, N - S, five seconds.	
	Vigan - light, two seconds.	97
1893 Mar 16 9:30 p.m.	Luzon: Restinga - SSW - NNE.	
	Bolinao - oscillatory, moderate, N - S, 20 seconds.	97
1893 Mar 30 7:00 a.m.	Mindanao: Tamontaca - moderate, vibratory.	97
1893 Apr 01 11:18 a.m.	Luzon: Taal - moderate, vibratory, E - W, eight seconds.	
	Calamba - light, oscillatory, WSW - ENE, five seconds.	
	Sta. Cruz - light, oscillatory, E - W, eight seconds.	

Event	Felt Effect	Source
	Bulacan - light, 11 seconds.	
	Batangas - oscillatory, E - W, four seconds.	
	Lipa - light, oscillatory, E - W, seven seconds.	
	Punta Santiago - light, oscillatory, ten seconds.	97
1893 Apr 07 7:25 p.m.	Mindanao: Surigao - moderate, oscillatory, six seconds.	97
1893 Apr 12 1:51 p.m.	Luzon & Samar: Albay - a strong, earthquake.	
	Ragay - moderate, oscillatory, N - S, eight seconds.	
	Catbalogan - two minutes' duration.	
	Guinayangan - moderate, oscillatory, NNW - SSE, 15 seconds.	
	Manila - light, oscillatory, first SSE - NNW; then S - N, ten seconds.	97
1893 Apr 24 3:24 p.m.	Luzon: Nueva Caceres - moderate; oscillatory, N - S, 20 seconds.	
	Libmanan - strong, N - S, 40 seconds.	
	Daet - moderate, oscillatory, N - S, 20 seconds.	
	Tabaco - moderate, oscillatory, E - W & N - S, 25 seconds.	
	Ligao - small, oscillatory, E - W, 20 seconds.	
	Albay - moderate, oscillatory, NNE - SSW, one minute.	
	Sorsogon - strong, oscillatory, NNE - SSW, 18 seconds.	
	Manila - very light, oscillatory NW - SE.	97

Event	Felt Effect	Source
1893 Apr 25 8:32 p.m.	Luzon: Manila - light, oscillatory, N - S, short.	
	Tayabas - moderate, oscillatory, E - W, 15 seconds.	
	Sta. Cruz - light, oscillatory, ten seconds.	
	Batangas - oscillatory, N - S, four seconds.	
	Atimonan - light, oscillatory, NW - SE, 15 seconds.	97
1893 May 09 12:27 a.m.	Luzon: Albay - intense, oscillatory, N - S, 15 seconds	97
1893 June 03 6:30 a.m.	Mindanao: Dapitan - two vibratory shocks followed by oscillations S - N, 20 seconds.	
	Misamis Oriental - strong earthquake during Mass; tabernacles had to be held with both hands to prevent their falling on the altar.	
	Pollok - very strong, vibratory then oscillatory NNE - SSW.	
	Cotabato - pendulum seismograph showed it was a moderately strong shock.	
	Zamboanga - NNE - SSW, 15 seconds. Light objects moved.	97
1893 June 21 3:30 p.m.	Mindanao & Southern Visayas: Jativa, Davao - almost completely ruined in spite of the absence of masonry houses. Large number of houses (bamboo) collapsed and some wooden houses ruined. House posts broken off at the ground. Impulses from SW were so strong that they forced the ground to the NE. Long wide cracks opened in the town and the surrounding country. Near the river, the ground dropped 1.7 metres in some places. The oscillations	

Event	Felt Effect	Source
	continued almost without a break for 30 minutes.	
	Davao - preceded by loud noise from N to S; oscillations of great force; statues and tabernacle thrown down in the church; window shades thrown from their grooves; small cracks in walls.	
	Pollok and Cotabato - strong, more than a minute.	
	Misamis - very strong, light shocks until end of month.	
	Butuan - very strong, water tank in garden half emptied by oscillations, W to E; duration one minute.	
	Linabo - very strong, subterranean noise, objects fell.	
	Clavijo - town completely ruined and the soft soil so torn up by water that it is impossible to rebuild. In front of the town, the river had been dammed by tree trunks and abandoned rafts so that only two small channels were left open; these were blocked by the caving banks and the river flooded the surrounding land.	
	Talacogon - great damage in the rectory; statues overthrown in the church; houses damaged; land sank along the river bank; waves in the river like a squally sea; many aftershocks.	
	Tagoloan - strong, subterranean noise heard.	
	Surigao - moderate, oscillatory, E - W, more than a minute.	
	Taganan - moderate oscillatory, WSW - ENE more than a minute.	

Event	Felt Effect	Source
	Cebu - moderate oscillations from the south.	97
1893 July 01 10:08 a.m.	Eastern Mindanao: Agusan - large tracts of wooded and partly cultivated land were converted into swamps though formerly the water reached them only during the highest floods.	55
1893 Aug 30 9:04 p.m.	Mindanao: Cotabato - moderate, oscillatory, amplitude $0^{o}7'$, 14 seconds.	97
1893 Sept 12 11:55 a.m.	Mindanao: Taganaan - strong, oscillatory, E - W, 30 seconds.	
	Davao - oscillatory, moderate strength and duration.	
	Surigao - moderate intensity and duration, oscillatory,	
	Agusan - light, oscillatory, SE - NW, eight seconds.	97
1893 Oct 06 11:30 a.m.	Mindanao: Talacogon - caused the fall of crosses, candle sticks and bottles.	97
1893 Oct 15 6:17 p.m.	Mindanao: Talacogon - moderate shock, clock stopped.	97
1893 Nov 16 12:31 p.m.	Luzon: Sta. Cruz - moderate, oscillatory, SE - NW, eight seconds.	
	San Isidro - strong E - W, vibratory, some rotary, 25 seconds.	
	Dagupan - moderate, oscillatory, E - W, 15 seconds.	
	Tarlac - very light at first, then strong, E - W, three seconds.	
	Manila - very perceptible, combined oscillatory and vibratory movements; principal oscillations WNW - ESE; amplitude $0^{o}30'$, vertical displacement, 1.3 mm.; 40 seconds' duration.	

Event	Felt Effect	Source
	Lingayen - light, E - W, ten seconds.	
	San Luis, Pampanga - light, oscillatory, 15 seconds.	97
1894 Jan 31 1:30 a.m.	Panay: Iloilo - strong and caused great alarm.	97
1894 Feb 10 1:05 a.m.	Mindanao: Sigaboy, Davao - horrible earthquake which was first vibratory then oscillatory, N - S, and lasted more than a minute. The houses and everything in them jumped and fell to the ground; noise terrifying, shocks so violent that one felt as if he were being jolted in a wagon running over stones.	
	Mati - strongest shock in the memory of inhabitants.	
	Davao - very strong, ESE -WNW, one minute.	
	Cotabato - moderate intensity, ESE - WNW.	
	Talacogon - moderate, SSE - NNW.	
	Taganaan - moderate, oscillatory, N - S, ten seconds.	
	Surigao - oscillatory, light, short.	97
1894 Apr 02 2:36 a.m.	Luzon: Bolinao - strong, oscillatory, SSW - NNE, 43 seconds.	
	Alaminos - moderate, oscillatory, four seconds.	
	San Isidro - moderate, oscillatory, SE - NW, ten seconds.	
	Lingayen - strong, oscillatory, N - S, 40 seconds.	
	San Fernando, La Union - moderate, oscillatory, NW - SE.	
	Manila - oscillatory, vibratory, 45	

Event	Felt Effect	Source
	seconds.	
	Sta. Cruz, Laguna - light, oscillatory, NNE - SSW, six seconds.	
	Vigan - oscillatory, N - S, 25 seconds.	97
1894 Apr 25 3:30 p.m.	Panay: Iloilo - moderately strong, but very short earthquake.	97
1894 June 29 3:15 a.m.	Mindanao: Jativa - very strong shock.	
	Veruela - extraordinarily strong oscillations, new church badly damaged.	
	Talacogon - very strong, all objects moved, houses tilted.	
	Butuan - strong, SSE - NNW, 50 seconds.	
	Balingasag - very perceptible.	97
3:40 a.m.	Mindanao: Taganaan - light, oscillatory, SSW - NNE.	
	Talacogon - very strong, short duration.	
	Butuan - very gentle.	97
4:15 a.m.	Mindanao: Talacogon - moderate, short duration.	
	Taganaan - vibratory, SSW - NNE; stronger than that of 3:40 a.m.	97
9:40 p.m.	Mindanao: Talacogon - strong,	
	Butuan - perceptible for 25 seconds.	97
1894 June 30 6:30 a.m.	Mindanao: Talacogon - strong.	
	Jativa - as strong as yesterday's shock.	
	Butuan - very perceptible.	97

Event	Felt Effect	Source
8:30 p.m.	Mindanao: Butuan - strong, similar to the morning shock.	
	Talacogon - very strong, greater than former shocks.	97
1894 July 08 9:45 p.m.	Mindanao: Taganaan - moderate, oscillatory, N - S, ten seconds.	
	Butuan - moderate, oscillatory, SSE - NNW, eight seconds.	97
1894 June 24 11:21 a.m.	Mindanao: Butuan - strong, brisk, vibratory, then light oscillations, 12 seconds.	97
1894 Aug 16 2:00 a.m.	Samar: Calbayog - oscillatory, moderate.	97
1894 Sept 04 9:25 p.m.	Mindanao: Talacogon - a strong shock.	97
1894 Sept 08 4:00 a.m.	Panay: Iloilo - short, moderate.	97
1895 Jan 22 8:15 p.m.	Panay: Iloilo - moderate, caused some alarm.	97
1895 May 14 6:45 a.m.	Luzon and Mindoro: Calapan - vibratory and oscillatory in motion, no movable objects or furniture were left in place in the houses; fragile objects were broken. The tower and facade of the church were damaged and are in danger of collapse.	
	Batangas - moderate, oscillatory, E - W, six seconds.	
	Manila - vibratory, oscillatory; amplitude $0^{\circ}24'$; vertical displacement 1.5 mm.; duration, 20 seconds.	
	Marinduque - felt but with less force.	
	Calamba - light oscillatory, NE - SW, short duration.	97
1895 May 17 12:07 a.m.	Luzon: Manila - stronger than on the 14^{th}, oscillatory, vibratory, S - N	

Event	Felt Effect	Source
	and SSE - NNW amplitude $0^{\circ}14'$; vertical displacement, 5.0 mm.; 33 seconds' duration.	
	Batangas - moderate, oscillatory, N - S, ten seconds.	
	Taal - moderate, oscillatory, E - W, seven seconds.	97
1895 June 07 10:00 p.m.	Mindoro: Calapan - terrible, vibratory, oscillatory, great amplitude with short duration, facade of church, already damaged in May, in state of imminent ruin; enclosure walls of the rectory fell.	97
1895 July 23 11:37 a.m.	Mindanao: Davao - strong, oscillatory, NW - SE, one second.	97
1895 July 30 4:35 p.m.	Luzon: Taal - moderate, oscillatory, E - W, seven seconds.	97
4:37 p.m.	Luzon: Batangas - moderate, oscillatory, N - S, seven seconds.	97
5:44 p.m.	Luzon: Batangas - stronger than former but shorter duration, vibratory-oscillatory, WNW - ESE.	
	Manila - oscillatory, WSW - ENE, total duration, 30 seconds.	
	Restinga - moderate, N - S, ten seconds.	97
1895 Aug 14 4:33 p.m.	Luzon: Manila - oscillatory, vibratory, sudden, amplitude more than one mm. On the Gray-Milne, perceptible for about 25 seconds.	
	San Fernando, Pampanga - oscillatory, N - S, two seconds.	
	Bacolor - moderate, oscillatory, S - N, five seconds.	
	Balanga - strong, long, oscillatory, E - W.	
	Mariveles & Olongapo - felt as in	

Event	Felt Effect	Source
	Balanga.	
	Tarlac - moderate, oscillatory, N - S, ten seconds.	
	San Isidro - moderate, oscillatory, NW - SE, eight seconds.	97
1895 Aug 26 10:10 p.m.	Mindanao: Taganaan - vibratory with subterranean noise.	97
1895 Sept 05 2:30 p.m.	Panay: Iloilo - moderate with long duration and also felt in western Negros.	97
1895 Sept 07 7:20 p.m.	Mindanao: Surigao - strong, oscillatory, vibratory, E - W, ten seconds.	
	Butuan - rather strong, moderate duration.	97
1895 Sept 24 9:15 a.m.	Mindanao: Taganaan - rather strong, N - S, five seconds.	97
1895 Nov 13 2:45 a.m.	Mindanao: Butuan - moderate, oscillatory, two vibratory shocks.	97
1895 Dec 11 5:15 p.m.	Mindanao: Butuan - strong, vibratory, NNW - SSE, long duration.	
	Jativa - strong.	
	Talacogon - moderate.	97
11:00 p.m.	Mindanao: Butuan - moderately long, gentle at first, followed by brusque, very strong motion, long duration; dogs barked, animals running around.	97
1896 Jan 27 8:45 a.m.	Mindanao: Butuan - somewhat strong.	97
1896 Feb 29 8:30 p.m.	Mindanao: Jativa - somewhat strong.	97
1896 Apr 17	Mindanao: Tandag - moderate earthquake.	97
1896 May 02 10:15 a.m.	Mindanao: Davao - strong earthquake.	

Event	Felt Effect	Source
	Tandag - rather strong.	97
1896 May 03 3:10 p.m.	Panay: Calibo - strong, furniture moved, some fell; felt on boats.	97
1896 June 04 3:55 p.m.	Luzon: Aparri - very strong, oscillatory, E - W, 40 seconds.	
	Laoag - oscillatory, NNW - SSE, 50 seconds.	
	Manila - very light, oscillatory, E - W and N - S.	97
	Mindanao: Tandag - moderate.	97
1896 June 17	Mindanao: Tandag - moderate.	97
1896 July 06	Mindanao: Tandag - moderate.	97
1896 Aug 01 3:22 p.m.	Mindanao: Tandag - moderate.	97
1896 Aug 12 2:00 - 3:00 a.m.	Mindanao: Tandag - moderate.	97
1896 Sept 08 4:45 a.m.	Mindanao: Veruela - strong, bells rang, people left their houses. Felt also in Butuan, Jativa and Tagoloan.	97
1896 Sept 13 1:02 p.m.	Luzon: Vigan - strong oscillatory, E - W, vibratory for 50 seconds.	
	Laoag - moderate, oscillatory, 40 seconds. some damage to buildings; one personal casualty.	
	Principe - strong, vibratory, oscillatory, 30 seconds.	
	Alcala - rotary, moderate 45 seconds.	
	Manila - light, oscillatory, three directions, first NNW - SSE; amplitude $0^{o}11'$; second WNW - ENE, amplitude $0^{o}8'$ vertical displacement, barely perceptible; duration seven seconds.	
	Ilagan - oscillatory, N - S, 30	

Event	Felt Effect	Source
	seconds.	
	Iba - oscillatory, EW, five seconds.	
	Candon - oscillatory, EW, 15 seconds.	
	Aparri - rotary, very intense; began with light vibratory motion for 50 seconds.	
	Tuguegarao - intense, oscillatory, SW - NE, 35 seconds.	97
1896 Oct 19 4:50 a.m.	Mindanao: - Taganaan - moderate, vibratory, five seconds.	
	Surigao - light, short oscillatory.	97
1896 Dec 17 1:45 p.m.	Mindanao: Taganaan - earthquake with moderate intensity	97
1896 Dec 20 5:24 p.m.	Mindanao: Taganaan - two violent shocks.	97
6:30 p.m.	Mindanao: Surigao - NE - SW.	97
1897 Jan 18 2:39 a.m.	Luzon: Laoag - moderate oscillatory, NE - SW, 40 seconds.	
	Tuguegarao - moderate, E - W, oscillatory.	
	Carig - strong, vibratory, 40 seconds.	
	Caban Viejo, Isabela - moderate, NW - SE, 45 seconds.	
	Manila - various oscillations first, ENE - WSW, amplitude $0^{o}7'$ seconds, N - S, amplitude $0^{o}3'$; total duration, two minutes and 12 seconds.	
	Vigan - moderate, oscillatory, E - W, 20 seconds.	
	Bayombong - light, vibratory, short.	97
1897 Feb 16 5:20 a.m.	Mindanao: Tandag - vibratory, strong.	

Event	Felt Effect	Source
	Veruela - strong, long duration, bells rang, rectory oscillated for a long time.	
	Taganaan - strong, vibratory, 40 seconds.	
	Davao - moderate, S - N, 12 seconds.	
	Cotabato - oscillatory earthquake with a duration of 45 seconds.	
	Dapitan - N - S, two seconds.	97
1897 Feb 27 4:00 a.m.	Mindanao: Tandag - strong, NE - SW, 15 seconds.	
	Gigaquit - vibratory, undulatory.	
	Taganaan - with 35 seconds' duration.	97
1897 Mar 16 2:40 p.m.	Mindanao: Surigao - moderate, oscillatory, SW - NE, moderate duration.	
	Gigaquit - very light, oscillatory, E - W, five seconds.	
	Tandag - oscillatory, SW - NE, eight seconds.	
	Veruela - long, weak.	
	Jativa - long, weak.	
	Davao - moderate, oscillatory, N - S, six seconds.	97
3:08 p.m.	Mindanao: Surigao - slight earthquake.	
	Gugaguit - moderate, oscillatory, E - W, 25 seconds.	
	Tandag - strong, oscillatory.	
	Davao - perceptible.	97
1897 Apr 08 9:45 p.m.	Mindanao: Mati - strong, vibratory, two seconds.	

Event	Felt Effect	Source
	Davao - light, rotary.	
	Gigaguit - moderate, oscillatory, vibratory, 12 seconds.	
	Veruela - very intense; so sudden and strong that there was no time to run out; great smashing of plates, lamps, bottles, etc.; bells rang and tower tilted to the south, statues fell from the altar although they had been well secured.	97
1897 Apr 23 11:09 a.m.	Mindanao: Tanaan - strong earthquake.	
	Gigaguit - light, two oscillations, N - S, four seconds.	97
1897 Apr 28 2:45 a.m.	Mindanao: Gigaguit - moderate, sudden, vibratory, oscillatory, E - W, four seconds.	97
1897 May 13 7:26 p.m.	Luzon: Manila - light, oscillatory, first, N - S, $0^{\circ}14'$, amplitude; then a sudden shock, E - W, $0^{\circ}12'$ amplitude; then an interval of calm; then movement from first to third quadrant (NE - SW), $0^{\circ}11'$ amplitude, total duration one minute.	
	Sta. Cruz, Laguna - moderate, oscillatory, NE - SW, ten seconds.	
	Albay - rotary, N - S, 30 seconds.	
	Nueva Caceres - moderate, oscillatory, SE - NW, 25 seconds.	97
8:00 p.m.	Masbate: Masbate - very strong earthquake which caused panic; the church and pier suffered some damage while other buildings of wood suffered little.	97
1897 June 25 10:30 p.m.	Panay: Iloilo - violent vibratory earthquake was felt. Fortunately, it was short and hence no casualties resulted.	97

Event	Felt Effect	Source
1897 Aug 15 8:21 p.m.	Luzon: Manila - principally rotary and oscillatory, vertical amplitude only one mm.; first, N - S, amplitude, $6^{o}52'$; second, NW - SE, amplitude, $4^{o}15'$; third E1/4 NE to W1/4 SW, amplitude $2^{o}20'$; first & second movement very brusque. Slightly affected two pendulum clocks of which the pendulums were in the plane of the movement. The total duration was 49 seconds.	
	Vigan - strong, oscillatory, NNW - SSE. The capital of the port reported a strong earthquake; office damaged, part of the arcade fell, furniture overturned. Damaged several houses of strong construction in the SE part of the city. The facade of the cathedral suffered; likewise the government house, the jail, and the barracks. To avoid casualties, the governor ordered the demolition of all the houses which had been seriously damaged by the shock.	
	Bolinao - very strong and long; first oscillatory, W - E, then three sudden vibratory shocks, one minute and 30 seconds.	
	Laoag - moderate, SW - NE, 50 seconds.	
	Candon - intense, oscillatory, NW - SE, vibratory 45 seconds, subsurface noise.	
	Aparri - very strong, oscillatory, N - S and E - W, 25 seconds.	
	Tuguegarao - strong, oscillatory, W - E, 1 minute and 27 seconds.	
	Bangued - strong, oscillatory, preceded by sound, SW - NE, 45 seconds.	
	Carig - strong, E - W, 40 seconds.	

Event	Felt Effect	Source
	San Isidro - strong, W - E, 40 seconds.	
	Corregidor - strong, oscillatory.	
	Alaminos, Laguna - strong, rotary, E - W, 25 seconds, light aftershocks at intervals.	
	Imus - strong, rotary, first N - S then E - W, 25 seconds.	
	Cabany Viego - moderate, oscillatory, NW - SE, 50 seconds.	
	Ilagan - moderate, first vibratory then oscillatory, N - S, one minute, 20 seconds.	
	Iba - moderate, oscillatory, N - S, 50 seconds.	
	Bayombong - moderate, rotary, one minutes' duration.	
	Lingayen - strong, oscillatory, N - S, long.	
	Sta. Cruz, Zambales - moderate, six seconds.	
	Pantabangan - rotary, N to S, moderate, 15 seconds.	
	Aliaga, Nueva Ecija - strong, oscillatory, N - S, 15 seconds.	
	San Fernando, pampanga - moderate, oscillatory, N - S, two minutes.	
	Bacolor, Pampanga - oscillatory, N - S, 35 seconds.	
	Balanga; Orani; Mariveles - intense.	
	Mariquina - strong, oscillatory, N - S, three seconds.	
	Bacolor, Cavite - moderate, oscillatory, E - W, ten seconds.	

Event	Felt Effect	Source
	Sta. Cruz, Laguna - first oscillatory, NE - SW, then rotary, moderate, 40 seconds.	
	Calamba - moderate, NNE - SSW, 20 seconds.	
	Tayabas - rotary, moderate, 30 seconds.	
	Batangas - moderate, oscillatory, NE - SW, 40 seconds.	97
1897 Sept 21 3:00 a.m.	Mindanao, Sulu Archipelago & Southern Visayan Islands: A moderately intense earthquake which lasted 70 or 80 seconds and continued throughout the morning with less intensity.	
	Jolo, Sulu Archipelago - the shock lasted 90 seconds.	
	Davao - an earthquake was felt here lasting more than a minute, N to S, not very strong but very perceptible.	
	Panay, Iloilo - moderate, oscillatory, SSE - NNW; aftershocks at intervals of about 45 minutes.	
	Capiz - strong, oscillatory, NW - SE, 40 seconds.	
	Passi - moderate, oscillatory, W - E, 20 seconds.	
	San Jose - oscillatory, NW - SE, aftershocks at intervals of 45 minutes.	
	Banate - moderate, oscillatory, one minute.	
	Pototan - moderate, E - W, 90 seconds.	
	Dumarao - oscillatory, SSE - NNW, 55 seconds.	

Event	Felt Effect	Source
	Dapitan - moderately intense, N to S, lasting one minute.	
	Cotabato - strong earthquake, lasting 52 seconds.	97
1897 Sept 21 1:15 p.m.	Mindanao, Sulu Archipelago and Southern Visayan Islands: Zamboanga - a furious earthquake with oscillatory and vibratory motions. The vibratory motion was evident because the lamp in the church threw its glass into the air, and the statue of the Sacred Heart, which is of natural size and at the feet of which is the Holy Family group, was thrown from its niche and fell without touching the other statues. The oscillations were from east to west. The posts of the old rectory have the ground separated from them in a circular space of about ten cms. on the surface. The pictures on the walls were jumping and swinging and the partitions were cracking in all directions. The earthquake caused destruction of the house. At the first shock the entire facade of the residence fell into the street. A cloud of dust was rising all around. The exterior of the church towers, nine metres high, constructed of thin brick, divided by strong crossbeams of molave, all fell, leaving one of the posts which had broken at the bottom hanging suspended in the air. The upper partitions of the towers were loosened. Almost all the walls of the church fell out and others remained half hanging. The stone walls either fell or were so badly damaged that it was necessary to destroy them. The statue of San Luis remained standing in the centre of the church. The walls of the new section of the rectory suffered some cracks and they will have to be demolished, but the framework and the masonry are perfectly good and, although only half completed, it has	

Event	Felt Effect	Source
	been our refuge in these fearful days. For eight day the earthquake, more or less strong, have not ceased. The beautiful walls surrounding the rectory and church ought to be knocked down, for the pillars of brick havebeen cracked and are out of line. The walls of the cemetery chapel are slightly cracked. In the church of Sta. Maria, the facade and part of the walls, all of stone, are cracked and there is probably no remedy except to demolish them; the rear of the church collapsed; the central arched ceiling is intact. With few exceptions, all stone buildings have been so much damaged that some are in a state of ruin. The fort of Pilar has been cracked in places, endangering some of the interior buildings. The military hospital is in a bad state. The engineers' head-quarters is uninhabitable. The house of the governor is tilted toward the street. The marine headquarters is almost destroyed. The courthouse suffered greatly. The schools are in a bad state, especially that for girls. A subterranean noise preceded the strong earthquake. An immense crack in Magay, extending from the sea to the interior of the country, and many other cracks were giving out black water with a sulphurous odour.	
	Basilan - very strong and long earthquake with aftershocks continuing for eight days. Damaged the fort and several stone houses.	
	Jolo, Sulu Archipelago - of great intensity and lasted two minutes, E to W with many aftershocks. The sea wave rose and fell every fifteen minutes. (This seems to be definite evidence for a tsunami.)	
	Siasi; Bongao - felt with many aftershocks.	

Event	Felt Effect	Source
	Jolo - shock, oscillatory, aftershocks at intervals of ten to fifteen minutes for 24 hours.	
	Maibung - the ground opened. Report from "Brutus", steaming north from Zambales: A strong earthquake felt, moderately long, with three aftershocks.	
	Dapitan - an oscillatory earthquake, NW - SE, lasting 50 seconds. No cracks in the buildings.	
	Cotabato - an intense earthquake lasting 70 seconds.	
	Iloilo - an earthquake less intense than that of the early morning but longer, lasting 70 seconds, oscillatory, E - W.	
	Capiz - various directions, especially SW - NE, longer and weaker than the preceding.	
	Passi - moderate, oscillatory, E - W, 85 seconds.	
	San Jose - oscillatory, barely perceptible, seven seconds.	
	Jan Joaquin - moderate, oscillatory, SSW - NNE, 80 seconds.	
	Negros - felt with same force as in Iloilo. A person crossing a bay in the afternoon of the 21^{st} felt the shock and the force of the waves almost capsized the boat.	97
3:15 p.m.	Mindanao: Almost as strong as the preceding earthquake. A phenomenon occurred which caused great panic. The sea was seen to rise and fall with great suddenness yet another tsunami and after a few oscillations it invaded the town with its waves, although it did not pass beyond the first buildings. The small boats on the shore were driven rapidly and	

Event	Felt Effect	Source
	left high and dry. The effects were seen in Jolo, Isabela, San Roman, Recodo and other places. The cause might have been some great movement in the bottom of the sea. A person on a boat anchored in Sibuguey Gulf said that the water rose and lifted the boat with its two anchors, endangering it several times.	
	Zamboanga - a wave rose which flowed eastward to the coast, reaching it in about ten minutes.	
	Bolong - there was a crack fifty metres long and one metre wide, from which water and black sand issued with sulphurous odour. Most of the church fell and parts which did not are out of plumb; half the rectory fell.	
	Ayala - the church has been cracked in several places, the tower is in ruins.	
	Tetuan - there was damage to the partitions in the rectory, the tower is on the point of falling, the large bell is out of its sockets; one cemetery wall fell.	
	Mercedes - the tower next to the rectory fell, also a great part of the stone facade of the church; some partitions and doors of the rectory fell, leaving the house in bad condition.	
	Isabela - the front, which was constructed thirty years ago, is left in bad condition as also are the other principal buildings. The sea destroyed twenty five houses.	
	Tetuan River - two hills alongside the river fell.	97
	Two hours later, another lighter shock and immediately afterwards came the sea tides and waves and yet	

Event	Felt Effect	Source
	another tsumani at Zamboanga; the swell occurred two full hours after the big earthquake; many times the awful waves advanced rapidly into the town and even swept some places which were 20 feet above sea level. Small craft lying near the shore were thrown out of the water and even some ships at anchor were carried to and fro. All the inhabitants began to flee to look for a safer place inland. All along the coast, west of Zamboanga, the waves invaded the shores with the same fury and, on retreating, swept away many native houses. On the Island of Basilan, was experienced the same disturbance, but sooner than at Zamboanga. The waves were higher than at Zamboanga, probably because the latter was protected by the flat island of Sta. Cruz lying in front of its harbour. The waves began ot rush against the island some 30 minutes after the earthquake, and swept away some Moro villages on the western coast, and the market and other houses situated near the wharf in the town of Isabela. The gunboat "Lezo", at anchor in the harbour, was carried by the flood waves and had a narrow escape. The waves advanced against the coast and retreated many yards beyond the tide line, with the same rapidity, at least thirty times. There were many victims.	87
	When the wave came in it had such force that it rolled great timbers and blocks of masonry. The wave came about half an hour after the earthquake; it rose about six metres above normal level. The wave rose and fell more than thirty times, and yakal timbers, six metres long, were carried along. The market was carried away by the sea. Some lives were lost in the Moro ranches; at Tagu, two injured at Panigayan, eight houses washed away; at	

Event	Felt Effect	Source
	Balawan, five dead six injured; at Tábotan, three dead, six injured; at Matiban, three dead, houses down.	97
	Jolo - the seismic tide began some 15 minutes after the earthquake shocks. The first movement was an ebb, the water retreating farther than the low limit, then it rose again with tremendous fury, repeating the process six or seven times. No damage was caused by the waves, because their velocity and height was less than at Basilan and on the west coast of Mindanao.	87
	During the sea wave, the water receded from 200 to 250 metres 'it returned ten minutes later, became normal before 9:30 p.m.'	
	Tawi-Tawi - according to the Moros, the island of Damei disappeared in the middle, leaving two islands with a channel between.	97
	Extraordinary sea movements were noticed all along the southwestern coast of Negros, the southern coast of Paragua, the eastern coast of Borneo, and one might say on all the islands and lands facing the Jolo Sea.	
	Tubigan (Island) (near Pangutaran) - a crevasse or channel was opened, dividing it into two parts.	87
1897 Oct 06 9:05 p.m.	Panay: Iloilo - moderate earthquake accompanied by a subterranean noise which greatly alarmed those in the neighbourhood, duration 25 seconds. The Captain of the Port reported it as strong, E - W, vibratory, oscillatory, lasting 80 seconds.	97
1897 Oct 08 5:15 a.m.	Mindanao: Cotabato - oscillatory, NNE - SSW, amplitude 15', duration, 16 seconds.	

Event	Felt Effect	Source
	Sta. Cruz, Davao - very strong, E - W.	
	Surigao - perceptible.	
	Tandag - oscillatory, E - W.	
	Dapitan - N - S, 30 seconds.	
	Pollok - light.	
	Mati - light, oscillatory, NW - SE, two seconds.	97
1897 Oct 19 7:52 a.m.	Luzon, Visayan Islands: Manila - perceptible, one minute, S - N, SE - NW.	
	Samar - in Oras, the facade of the church, the rectory, schoolhouse, courthouse and bridges destroyed.	
	Catubig: courthouse tilted, partition walls down, building unserviceable, most houses tilted.	
	Laoang - 17 houses destroyed; people could not keep their feet during the earthquake. This region was shaken by violent shocks that, according to old inhabitants, were the strongest in 80 years. The shocks were preceded by clear and perceptible sounds which frightened all. All the public edifices, churches, rectory, schools and court which were spared by the typhoon have been damaged by the earthquake and some have collapsed. The first shock lasted 45 seconds. Shortly afterwards, a second threw down the statues and cracked the entire church of Oras.	
	Albay - 7:52 a.m. to 11:00 p.m., earthquakes, more or less strong felt continuously.	
	Sorsogon; Tabaco; Daet; Guinayangan; Cebu; Iloilo - shock of 7:52 a.m. also reported.	

Event	Felt Effect	Source
	Nueva Caceres - moderate, oscillatory, rotary, N - S, five seconds.	
	Sulat; Borongan; Tubig; Catubig - the conditions are the same as in Laoang. It is estimated that the houses tilted 25° in the oscillations of the earthquakes, comparable to a boat in a heavy sea.	
	Biliran Island - for two days, earthquakes have been felt continuously, too strong to allow sleep and alarming everyone and preventing ordinary work. Fear is increased from the fact that the island of Biliran is a place where there are mines of sulphur, iron and pitch.	
	Calbayog, Samar - on the 19th and 20th of the month, four violent, two strong and about 38 light earthquakes, all NE - SW except one on the 20th which was NNE - SSW.	
	Catbalogan, Samar - there was a very strong earthquake which many feared would cause the houses to collapse. A half-hour later there was another shock and then they continued for 24 hours, keeping everyone in a state of tension.	97
1897 Oct 19 8:05 a.m.	Visayan Island: Tacloban, Leyte; Sorsogon; Daet; Tandag; Barugo; Cebu; Iloilo - strong shock.	97
3:05 p.m.	Luzon: Shock reported felt from Tabaco & Daet.	97
3:50 p.m.	Luzon: Nueva Caceres - light shock.	97
1897 Oct 26 10:35 p.m.	Luzon: Iloilo - moderate, oscillatory, vibratory, very long, three arches in the patio of the governors' house cracked.	
	Daet - strong, E - W, 45 seconds.	

Event	Felt Effect	Source
	Nueva Caceres - moderate, oscillatory, NW - SE, five seconds.	97
1897 Oct 27 6:15 a.m.	Mindanao: Tamontaca - strong, vibratory, oscillatory, 40 secodns.	
	Zamboanga - moderate.	
	Dapitan - vibratory, oscillatory, SW - NE, 15 seconds.	
	Pollok - felt.	97
11:45 a.m.	Mindanao: Tamontaca - oscillatory, weak, 22 seconds.	
	Pollok - oscillatory, E - W.	
	Zamboanga - perceptible.	
	Dapitan - oscillatory.	97
1897 Nov 10 10:37 a.m.	Albay: Light, oscillatory, E - W, 15 seconds.	97
12:35 p.m.	Mindanao: Dapitan, Mindanao - vibratory, oscillatory, 15 seconds.	97
1897 Nov. 14 9:03 a.m.	Luzon: Manila - oscillatory, moderate, most notable oscillations were W - E and WSW - ENE.	
	Olongapo - moderate, 35 seconds.	
	Castillejos - moderate, 35 seconds.	
	Bacolor - moderate, oscillatory, NE - SW, 20 seconds.	
	Vigan - strong, NE - SW, 35 seconds.	
	Candon - violent, vibratory, 45 seconds. Five seconds later, an aftershock followed which was oscillatory, SE - NW, two seconds; part of the church tower collapsed.	
	San Fernando, La Union - very violent, government house cracked.	

Event	Felt Effect	Source
	Aparri - moderate, oscillatory, N - S, 40 secodns.	
	Tuguegarao - moderate, oscillatory, N - S, 45 seconds.	
	Isabela - moderate, oscillatory, W - E, 30 seconds.	
	Bayombong - moderate, oscillatory, W - E, 30 seconds.	
	Bolinao - strong, N - S, 20 seconds.	
	Laoag - moderate, oscillatory, NE - SW.	
	Iba - light, oscillatory, N - S, 20 seconds.	
	Mariquina - oscillatory, NW - SE, 25 seconds.	97
1898 Jan 10 10:40 a.m.	Mindanao: Zamboanga - violent, short, SW - NE.	97
1898 Jan 19 6:00 a.m.	Mindanao: Mati - strong, S - N, one second.	97
1898 Jan 29 12:03 p.m.	Mindanao: Zamboanga - moderate, short, oscillatory shock.	97
1898 Jan 30 6:00 p.m.	Mindanao: Jolo - moderate, lasting one minute.	
	Zamboanga - oscillatory, longer but weaker than that of yesterday.	
	Basilan - shock felt.	97
1898 Jan 30 7:00 p.m.	Mindanao: Jolo - vibratory, oscillatory, N - S and stronger than the first, lasting for one minute, some damage.	
	Basilan - shock felt.	
	Zamboanga - oscillatory, longer but weaker than that of yesterday. The bells rang four times for 6:00 - 7:00 p.m.	97

Event	Felt Effect	Source
1898 Feb 21 4:25 p.m.	Mindanao: Sigaboy - strong, vibratory, eight seconds.	97
1898 Apr 10 6:30 p.m.	Mindanao: Tandag - moderate shock.	97
1898 May 20 9:25 p.m.	Mindanao: Pollok - oscillatory, strong.	
	Zamboanga - light shock.	97
1898 Nov 14 7:45 a.m.	Samar: Calbayog - strong. Vibratory, two seconds.	97
1899 June 16 3:00 p.m.	Panay: Iloilo - very strong, E - W, 30 seconds.	97
1899 Nov 26 5:25 a.m.	Mindanao: Butuan - moderate earthquake.	97
1899 Dec 25 11:15 p.m.	Mindanao: Butuan - rather strong shock.	97
1899 Dec 26 4:30 a.m.	Mindanao: Butuan - stronger than yesterday.	97

PART C

CATALOGUE OF PHILIPPINE EARTHQUAKES 1901-1942

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2208

CATALOGUE OF PHILIPPINE EARTHQUAKES
PART C 1901-1942

Event	Felt Effect	Source
1901 Dec 15 2:58 p.m.	Manila: Manila - experienced the strongest earthquake shock registered since the year 1880. Owing especially to the slowness of motion, the damage caused in Manila was of little consequence. It was felt throughout all Central Luzon from Pangasinan and Nueva Ecija to the Visayas. It was felt in Dagupan with almost the same force as in Iloilo, the oscillation at both these points measuring between 2^{o} and 3^{o}.	5
1902 Jan 31 8:10 p.m.	Western Visayan Island: Negros - stronger than in Panay. Panay - earthquake of moderate intensity, began with a vertical movement, soon followed by oscillations in the directions SSE - NNW, SE - NW, and ENE - WSW, reaching in the last plane an amplitude of $3^{o}5'$, duration not more than seven or eight seconds. A deep rumbling sound was heard from the S at the commencement of the earthquake. Calinog (Central Panay) - it was plainly felt. Capiz - it was light, duration six seconds.	98
1902 Feb 13 6:11 p.m.	Surigao, Mindanao: Rather strong earthquake.	98
1902 Feb 14 11:20 a.m.	Zamboanga, Mindanao: Moderate earthquake.	98
1902 Mar 03 9:40 p.m.	Surigao, Mindanao: Moderate earthquake.	98
1902 July 12 9:47 p.m.	Butuan, Mindanao: Cabadbaran (NE of Butuan) - violent earthquake accompanied by subterranean sounds. Owing to its short duration, no disaster	

Event	Felt Effect	Source
	resulted.	
	Butuan - a very strong oscillatory earthquake, NE - SW, duration, 20 seconds.	98
1902 Aug 06 8:30 a.m.	Samar and Leyte: Samar - this earthquake was felt more strongly than in Leyte.	
	Borongan - severe enough to throw down bottles, etc., from shelves on the walls.	98
1902 Aug 21 7:17 p.m.	Mindanao: Laguna de Lanao - a very violent earthquake. Houses was thrown down, fissures were opened in the earth.	
	Malabang - very violent, fissures were opened in the ground, which gave forth large quantities of water and disagreeable gases; one of the canals dried up or changed course, and many native houses were thrown to the ground.	
	Misamis - very violent, followed by four others, separated by short intervals; direction, SW - NE.	
	Cotabato - an oscillation in the direction WNW - ESE was very strong; some of them almost violent; the pendulum described an arc of 12^{o}; duration was 30 seconds.	
	Dapitan - an oscillatory earthquake of moderate intensity, which lasted four seconds. It was accompanied by subterranean sound lasting two seconds.	
	Davao - an earthquake with both horizontal and vertical movement, in a NW - SE direction. The pendulum described an arc of 5^{o}; movement lasted some 45 seconds. The earth movement was preceded by a dull subterranean sound, which seemed to proceed from NNW; the sound began 30	

Event	Felt Effect	Source
	seconds before there was any perceptible movement of the earth. Inside the houses objects of furniture were moved about, clocks stopped.	
	Zamboanga - fairly strong shock.	
	Jolo - strong oscillations were felt in the direction NE - SW lasting quite a long time.	
	Caraga - light oscillatory earthquake, NW - SE.	
	Dumaguete (Negros) - light oscillatory earthquake, ESE - WNW, duration about 12 seconds. After the earthquake, a strange sound was heard like the sound made by a violent hurricane or the dull noise of a distant waterfall.	
	Tagbilaran (Bohol) - oscillatory earthquake, very light, lasting three seconds.	
	Iloilo - slight oscillatory earthquake, SE - NW, lasting some six seconds.	
	Cebu - slight earthquake, SW - NE, lasting five seconds.	98
1902 Aug 26 1:09 p.m.	Island of Panay: Iloilo - violent earthquake with the dominant direction WNW - ESE; the seismometer described an arc of $10^{\circ}46'$; duration, twenty to thirty seconds. Subterranean sound like dull, heavy detonations preceded the shock for the space of two seconds and seemed to come from the south. Plaster was shaken from some of the walls and various articles were overturned in the houses.	
	Pavia - strong quake NW - SE preceded by subterranean noises.	
	Sta. Barbara - strong earthquake	

Event	Felt Effect	Source
	proceeding from the north, but finishing in a WNW direction lasting up to 25 seconds. It was preceded by subterranean sound. Calinog - very strong earthquake lasting 30 seconds' duration, S - N, sounds were heard coming from the east, one as of a heavy cart rumbling over a pavement or over a wooden door; small cracks in the wall of the church. Maasin - this was the town that suffered most from the earthquake of the 26th; the church was greatly damaged, part of the front wall was thrown down and the tower threatens to fall in ruins. At the place called Busay in the district of Sinalo, the surface of the ground on a small mound has sunk some three metres below its normal level over a space of about 15 sq. metres. In the district of Nagba, a fissure opened on the side of an eminence some 30 metres in length and about a metre in width. The epicentre was confined, then, to the neighbourhood of Maasin; we might suppose that it was at a little distance from the said town in a WNW direction. Janiuay - strong earthquake, W - E; duration, 55 seconds. San Joaquin - strong earthquake; duration, twenty seconds, accompanied by subterranean noise. Bacolod (Negros) - strong, oscillatory earthquake, SW - NE; duration, some thirty seconds. It was accompanied by a dull noise like the rush of a violent gust of wind. Cuyo Island - slight earthquake lasting some forty seconds. Capiz - oscillatory earthquake, SSW - NNE. Moderate intensity; duration,	

Event	Felt Effect	Source
	twenty-three seconds.	
	Cebu - oscillatory earthquake of moderate intensity in the direction WNW - ESE. The oscillations of the seismometer measured 2^{o} and lasted eleven seconds.	98
1902 Nov 17 8:30 a.m.	Manila: Shocks of long duration; the usual stopping of clocks; cracking of mirrors and clinking of glasses.	14
1902 Nov 17 8:37 a.m.	Batangas, Luzon: Taal Volcano (Batangas) - strong earthquake.	
	Nasugbu - subterranean noises were heard.	
	Batangas - some damage to stone buildings.	98
1902 Dec 16 1:10 p.m.	Maasin, Leyte: Moderate movement.	98
1902 Dec 30 1:08 p.m.	Aparri, Luzon: Gyratory earthquake, moderate intensity, duration approximately 12 seconds.	98
1903 May 24	Mindanao: Davao - strong earthquake; direction, WNW - ESE; amplitude of the seismometer, $8^{o}6'$; total duration, one minute and three seconds. Some five minutes before the seismic movements began to be alarming, a dull sound was heard, which seemed to proceed from the NE. The long duration of the earthquake and strength of the oscillations made the people escape in terror to the streets, for fear that houses would fall down, seeing that the movable objects within began to fall to the ground.	
	Caraga - strong earthquake, movement oscillatory; the bells were rung twice, giving two strokes each time; the amplitude of the seismometer measured 8^{o} in a WSW - ENE direction; approximate duration, one minute and five seconds. Shortly	

Event	Felt Effect	Source
	after, there was a slight repetition. On the following day, the 25th, at 800 a.m. approximately, the seismic movements were repeated, though scarcely perceptible. From the above notes we deduce that the epicentre of this earthquake, which shook such a large area, embracing the whole island of Mindanao and probably the adjacent islands to the north, must have been situated not far from Davao and Caraga, and rather nearer to the latter point. If we consider that the seismic waves were felt with almost the same intensity at Cotabato, Balingasag and Surigao, and that the sounds that preceded the earthquake at Davao seemed to come from the North East, we should place the epicentre in the neighbourhood of the headwaters of Rio Agusan, where there exists a seismic focus which was the seat of astounding activity in the year 1893 and which has since been the source of frequent seismic events. The direction of the movement at Caraga, the station nearest to this region, and the repetitions felt there serve to point out the same spot. Cotabato - earthquake of moderate intensity; direction, E - W; amplitude of the seismometer, $1^{o}5'$; duration, 15 seconds. Surigao - earthquake of moderate intensity; direction, S - N; duration, 13 seconds. Balingasag - moderate oscillatory earthquake, SE - NW. Zamboanga - perceptible oscillatory earthquake, E - W, amplitude of the oscillations of the seismometer, $0^{o}8'$; duration, 15 seconds.	47
1903 Aug 08 4:03 p.m.	Talacogon, Agusan del Sur: Earthquake of moderate intensity.	47

Event	Felt Effect	Source
1903 Aug 10 5:45 a.m.	Talacogon, Agusan del Sur: Earthquake of moderate intensity.	47
1903 Aug 11 6:25 p.m.	Talacogon, Agusan del Sur: Strong earthquake which caused a number of pendulum clocks to stop.	47
7:05 p.m.	Talacogon, Agusan del Sur: Earthquake of moderate intensity.	47
1903 Aug 15 2:40 p.m.	Talacogon, Agusan del Sur: Earthquake of moderate intensity.	47
1903 Aug 20 1:46 a.m.	Borongan, Samar: Strong earthquake that threw down objects in the houses and opened cracks in some wooden partitions. This earthquake in the Visayas was registered at Manila on the Vicentini mocroseismograph; the recorded earth movements lasted about ten minutes.	47
1903 Aug 21 7:30 p.m.	Surigao, Mindanao: Earthquake of moderate intensity; direction, SW - NE; duration, thirty-five seconds.	47
1903 Sept 14 11:35 p.m.	Zamboanga, Mindanao: Oscillatory and vertical earthquake of moderate intensity, which made the woodwork of the houses creak a great deal; duration between four and six seconds.	47
1903 Oct 26 7:16 a.m.	Mindanao: Butuan - earthquake of moderate intensity, SE - NW; duration, long. A repetition took place ten minutes later with the same force but of short duration. Davao - earthquake of moderate intensity, NW - SE, duration, 30 seconds. Caraga - light oscillatory earthquake, WNW - ESE; duration, long. At Manila, this earthquake was registered by the Vicentini microseismograph, the agitation of this instrument lasting nine minutes.	47

Event	Felt Effect	Source
1903 Dec 28 10:56 a.m.	Southeastern Mindanao: Violent earthquake, concerning which we possess the following data: Mati - the Jesuit missionary, Father Bernardino Llobera, sent the following notice: "This morning a little before 11:00 o'clock we were surprised by such a violent earthquake as I have never before experienced. The bells which are hanging at a distance of a metre above the ground were rung, swinging through an arc of more than 45°; all the statues in the church were thrown down and damaged. The walls have been cracked, especially those lying in the direction of the principal seismic waves. One house was thrown down but there were no casualties." Caraga - very strong earthquake; oscillatory in various directions. The seismometer traced arcs of 7°16' in the direction WSW - ENE, and of 7°6' in the direction ESE - WNW. The duration was more than 60 seconds. In the steep rocks separating this town from the beach, some fissures were formed between three and four cm width and about three metres long; several stone fences were thrown to the ground. About five minutes afterwards, another light shock was felt. Davao - very strong earthquake, E - W; some of the oscillations of the seismometer measured 10°; it lasted in all more than 45 seconds. Subterranean sounds were heard about ten seconds before the seismic movements became perceptible. Pendulum clocks were stopped, various objects were overthrown, and some walls were cracked. Butuan - strong earthquake; principal oscillations SSE - NNW; duration, 25 seconds.	

Event	Felt Effect	Source
	Cotabato - earthquake of moderate intensity; direction, E - W; duration, 30 seconds.	
	Surigao - light earthquake; duration, 20 seconds.	
	Maasin - light earthquake, short duration.	47
1904 Jan 24 4:30 a.m.	Butuan, Mindanao: Butuan - oscillatory earthquake of moderate intensity, duration about 40 seconds; direction, SW - NE.	
	Balingasag - perceptible earthquake; direction, N - S; duration, five seconds.	48
1904 Apr 27 2:43 a.m.	Southeast of Luzon and North of Samar: Legaspi - moderate intensity, WNW - ESE.	
	Masbate - moderate intensity, WNW - ESE.	
	Calbayog - moderate intensity, WNW - ESE.	
	Catbalogan - moderate intensity, WNW - ESE.	48
1904 July 03 4:01 a.m.	Gubat, Sorsogon Bicol Region: An oscillatory shock of moderate intensity; direction, EW; duration, two seconds.	48
1904 July 05 9:17 a.m.	Masinloc, Zambales: Masinloc - vertical and oscillatory; moderate intensity, duration, five seconds.	48
1904 July 27 5:00 a.m.	Gubat, Sorsogon Bicol Region: Gubat - oscillatory, moderate intensity, duration was two seconds; direction, S - N.	48
1904 Aug 03 1:23 p.m.	Mindanao: Butuan - strong oscillatory earthquake; direction, NW - SE; duration, one minute. It stopped pendulum clocks and rattled doors and windows, etc.	

Event	Felt Effect	Source
	Surigao - perceptible earthquake; duration, 25 seconds.	48
1904 Oct 01 6:17 p.m.	Butuan, Mindanao: Butuan - very strong earthquake; direction of principal oscillations, SW _ NE; duration, one minute and ten seconds.	
	Davao - strong oscillatory earthquake; direction, NE - SW; duration, 62 seconds.	
	Caraga - strong oscillatory and vertical earthquake; the principal movements were in the direction NW - SE; duration, more than one minute. It caused pendulum clocks to stop and small objects to fall. It began with a loud-sounding, deep rumble.	
	Cotabato - oscillatory earthquake of moderate intensity; direction, N - S; duration, 15 seconds.	48
1904 Oct 04 9:18 a.m.	Masbate Province: Masbate - strong shock.	
	Gubat - strong, oscillatory earthquake; direction, W - E; duration, five seconds approximately.	
	Catbalogan - earthquake of moderate intensity.	
	Borongan - oscillatory earthquake of moderate intensity; duration, seven seconds.	
	Calbayog - light, vertical earthquake accompanied by dull, rumbling sound; duration, ten seconds.	
	Tacloban - light, oscillatory earthquake; duration, 30 seconds.	
	Ormoc - perceptible tremor; duration, 25 seconds.	
	Legaspi - oscillatory earthquake; direction, SW - NE; duration, about	

Event	Felt Effect	Source
	four seconds.	
	Capiz - perceptible earthquake; direction, NNE - SSW; duration, 20 seconds.	48
1904 Oct 09 2:39 a.m.	Northern Luzon: Vigan - strong earthquake; direction, ENE - WSW; duration, 15 seconds. The shock was preceded by subterranean noises, and its force was sufficient to produce small cracks in the walls of earthquake; duration, more than one minute.	
	Tuguegarao - strong oscillatory earthquake; direction, SW - NE; duration, more than one minute. It stopped pendulum clocks, shook things off of shelves and overturned various objects. Subterranean rumblings, apparently from the southwest, were heard before the shock.	
	Candon - strong oscillatory earthquake from SW - NE; duration, 40 seconds.	
	Aparri - strong earthquake. The movements of greatest intensity were from west or east; duration, 45 seconds. A few minutes after, two light shocks were felt.	
	San Fernando, La Union - oscillatory earthquake of moderate intensity; direction, NNE - SSW, 40 seconds.	
	Dagupan - light oscillatory earthquake; direction, NNW - SSE; duration, five seconds.	
	Marilao - light oscillatory earthquake; direction, NNW - SSE; short duration.	
	Manila - a very light earth tremor whose epicentre was to be found in the province of northern Luzon where, to judge from the reports from the different stations which	

Event	Felt Effect	Source
	follow, the disturbance manifested considerable force.	48
1905 Jan 04 12:48 a.m.	Mindanao: Surigao - moderate intensity; duration, 15 seconds.	
	Butuan - perceptible; vertical; duration, 20 seconds.	49
1905 Jan 04 11:55 p.m.	Bicol Region: Nueva Caceres - earthquake of moderate intensity; direction, NNE - SSW; duration about 10 seconds.	49
1905 Jan 06 4:14 a.m.	Bicol Region: Nueva Caceres - earthquake of moderate intensity; direction, NE - SW; duration, 4 seconds.	49
1905 Jan 27 8:55 p.m.	Luzon: Olongapo - strong oscillatory earthquake; direction, ESE - WNW; duration, 50 seconds.	
	Manila - moderate shock, 20 seconds' duration.	
	Twin Peaks (Benguet) - light seismic movement.	
	San Fernando (La Union) - barely perceptible tremor.	
	Dagupan - light shock; maximum oscillation $0^{o}45'$ in the direction SSE - NNW; with others of less force in the direction S - N; total duration 15 seconds.	
	Bolinao - light oscillations tremor; direction of principal oscillations, SE - NW; duration about 10 seconds.	
	Tarlac - light tremor.	
	San Isidro (Nueva Ecija) - perceptible shock.	
	Arayat - light tremor.	
	Marilao - very perceptible earthquake; direction, WSW - ENE;	

Event	Felt Effect	Source
	duration, 15 seconds.	
	San Antonio (Laguna) - very light tremor; direction, W - E.	
	Corregidor - earthquake of small intensity.	
	Dolores (Porac) - oscillatory earthquake; direction, WSW - ENE; duration, about 60 seconds.	
	Masinloc - oscillatory earthquake of moderate intensity; direction, SE - NW; duration, 20 seconds.	
	Balanga - vertical and oscillatory earthquake; direction, WNW - ESE; duration, 60 seconds.	49
1905 Feb 11 4:35 a.m.	Davao, Mindanao: Davao - earthquake of moderate intensity; direction, NNE - SSW; duration, 25 seconds.	49
1905 Mar 03 2:12 a.m.	Gubat, Sorsogon Bicol Region: Gubat - moderate oscillatory earthquake; direction, SE - NW.	
	Calbayog - very light earthquake.	49
1905 Mar 18 11:07 p.m.	Ormoc: Ormoc - oscillatory earthquake of moderate intensity; direction NNW - SSE; duration, 35 seconds.	
	Tacloban - earthquake of moderate intensity; duration, 20 seconds.	
	Borongan - oscillatory earthquake of moderate intensity; duration, 29 seconds.	
	Cebu - light oscillatory tremor; direction, E - W; duration, 4 seconds.	
	Tuburan - light tremor; duration, 5 seconds, accompanied by subterranean noises which seemed to proceed from the east.	

Event	Felt Effect	Source
	Capiz - vertical and oscillatory earthquake; direction, ESE - WNW; duration 18 seconds. The foregoing notes seem to indicate that the epicentre lay to the south of Masbate.	49
1905 Apr 14	Manila: Manila - a seismic shock almost instantaneous, the movement was almost exclusively vertical with two distinct shocks, the second of which was perceptible. No preliminary microseismic movement preceded the shocks and the agitation which was considerable lasted but a few minutes. This earthquake was felt more strongly to the northwest of Manila in northern Zambales, as the two following observations show: Dagupan - light shock; the most noticeable movement was in the direction NW - SE; duration, less than 1 second. Bolinao - earthquake of moderate intensity; direction, NW - SE; duration, very short.	49
1905 Apr 21 4:59 a.m.	Ormoc: Ormoc - earthquake of moderate intensity; direction of the strongest oscillations, W - E and NW - SE; duration 58 seconds. Perceptible movements recurred at 5:08 a.m. and 5:20 a.m. Tacloban - perceptible earthquake; direction, SW - NE; duration, 13 seconds. Maasin - light oscillatory tremor; direction, W - E. Catbalogan - perceptible tremor. Cebu - perceptible, oscillatory earthquake; direction NNW - SSE; duration, 15 seconds. Borongan - perceptible oscillatory earthquake; duration 5 seconds.	49

Event	Felt Effect	Source
1905 Apr 25 12:07 a.m.	Masbate: Masbate - strong earthquake; direction; S - N, duration, 6 seconds, approximately. Legaspi - oscillatory earthquake of small intensity; direction S - N. Nueva Caceres - light earthquake; oscillations from SE to NW. Capiz - light earthquake, oscillation from E to W; subterranean noises apparently from the north. This earthquake, according to the preceding notes, must have belonged to the Masbate centre. It was registered on the Vicentini as a disturbance from a nearby centre and the record shows a vertical component of great intensity.	49
1905 May 05 8:03 a.m.	Aparri: Aparri - rotatory earthquake of moderate intensity; duration 20 seconds.	49
1905 June 01 2:24 a.m.	Aparri: Manila - a light earthquake consisting of several perceptible shocks with a large vertical component. The principal movement had a direction NW - SE. The total duration was some 40 seconds. Aparri - oscillatory earthquake of moderate intensity; direction, W - E; duration, 54 seconds, approximately. Vigan - oscillatory earthquake of moderate intensity. San Fernando (La Union) - oscillatory earthquake of moderate intensity; direction, W - E and WNW - ESE; duration, some 30 seconds; oscillations of the seismometer, $0^{o}12'$. Dagupan - oscillatory earthquake of	

Event	Felt Effect	Source
	moderate intensity; principal direction, W - E; oscillations of the seismometer, $0^{o}40'$.	
	Bolinao - oscillatory earthquake of moderate intensity.	
	Tarlac - oscillatory earthquake of moderate intensity.	
	Candon - light earthquake, WNW - ESE; duration, 30 seconds.	
	Porac - oscillatory earthquake of moderate intensity.	
	Balanga - oscillatory earthquake; direction, WSW - ENE, oscillatory of seismometer, $0^{o}30'$.	
	Marilao - oscillatory earthquake; direction, WNW - ESE; oscillations of seismometer, $0^{o}10'$. This earthquake was perceptible throughout the whole of the island of Luzon from Manila northward. Such uniformity in the direction and intensity together with the long duration of the microseismic movements cause one to suspect that the centre of perturbation was outside the island toward the China Sea.	49
1905 June 10 2:13 p.m.	Boronga: Borongan - oscillatory earthquake of moderate intensity; duration, 12 seconds.	
	Calbayog - perceptible earthquake.	
	Catbalogan - earthquake of moderate intensity.	
	Tacloban - earthquake of moderate intensity; duration, 25 seconds.	
	Ormoc - perceptible earthquake.	
	Maasin - perceptible oscillatory earthquake; direction, E - W; long duration.	

Event	Felt Effect	Source
	Gubat - earthquake of moderate intensity; direction, E - W.	
	Legaspi - light oscillatory earthquake; direction, E - W; duration about 35 seconds. This earthquake was registered as one of nearby origin, without any preliminary movements, and with a very intense vertical component. From the preceding notes it is deduced that it was perceptible throughout the area embracing the islnds of Samar, Leyte, and the southeast of Luzon. It seems to have had the same moderae intensity in all these places.	49
1905 June 25 12:38 a.m.	Sto. Domingo de Basco Batane: Sto. Domingo de Basco - moderate intensity; direction, N - S; duration, 8 seconds; much noise of doors and windows.	49
1905 June 26 7:44 p.m.	Surigao, Mindanao: Surigao - moderate intensity; direction, NE - SW; duration, 30 seconds.	49
1905 July 03 8:09 p.m.	Borongan, Samar: Borongan - oscillatory earthquake of moderate intensity; duration, 13 seconds.	49
1905 July 05 11:34 p.m.	Caraga, Mindanao: Caraga - oscillatory earthquake of moderate intensity; direction, ENE - WSW; duration about 45 seconds. Repeated at 11:39 p.m. with less intensity, the microseismic disturbance lasting 18 minutes.	49
1905 July 11 2:08 p.m.	Butuan: Butuan - strong earthquake; duration, 12 seconds.	49
1905 July 12 5:09 p.m.	Nueva Caceres: Nueva Caceres - oscillatory earthquake of moderate intensity; direction, NE - SW; duration, 6 seconds.	49
1905 July 17 3:00 a.m.	Surigao, Mindanao: Surigao - earthquake of moderate intensity and long duration.	49

Event	Felt Effect	Source
1905 July 26 1:00 p.m.	Samar and Leyte: Samar and Leyte - shortly after 1:00 p.m. on July 26 these two islands were visited by an earthquake; it was of little intensity and was followed by a number of shocks until July 30, as the following notes show: Borongan - at 1:01 p.m. vertical earthquake of moderate intensity; duration, 17 seconds. At 7:11 p.m. there were oscillatory movements of moderate intensity which lasted some 15 seconds, and in the course of the following night light movements were felt at intervals. Tacloban - 1:01:50 p.m. Perceptible oscillatory tremor; duration, 15 seconds. Maasin - 1:01 p.m. oscillatory tremor; direction, NNE - SSW.	49
1905 July 27 6:35 a.m.	Borongan: Borongan - oscillatory earthquake with strong shocks; duration, 23 seconds. Repeated at 7:15 a.m. with less intensity; duration, 17 seconds.	49
1905 July 28 6:25 a.m.	Borongan: Borongan - oscillatory and vertical earthquake of considerable intensity accompanied by subterranean noise; duration, 11 seconds; repeated at 7:04 a.m. with less intensity; a second repetition of moderate intensity took place at 8:36 a.m. and lasted 15 seconds. Tacloban - strong oscillatory earthquake; direction, NNE - SSW; duration, 1 minute 5 seconds; repeated at 6:46 a.m. with movements of moderate intensity and duration, 15 seconds. Catbalogan - earthquake of moderate intensity. Maasin - perceptible earthquake; direction, E - W; duration, 40	

Event	Felt Effect	Source
	seconds; repeated at 6:45 a.m. in the same direction, but with less intensity and duration.	
	Ormoc - perceptible earthquake.	
	Calbayog - perceptible earthquake.	49
1905 July 29 7:00 a.m.	Borongan: Borongan - oscillatory and vertical earthquake of moderate intensity; duration, 18 seconds. Repeated at 9:52 a.m. with greater intensity; duration, 7 seconds.	
	Tacloban - oscillatory and vertical earthquake of moderate intensity; duration, 40 seconds.	49
1905 July 30 5:07 p.m.	Tacloban: Tacloban - oscillatory and vertical earthquake of moderate intensity; duration, 20 seconds; at 9:47 p.m. a perceptible oscillatory tremor.	49
1905 Aug 05 12:54 p.m.	Borongan: Borongan - oscillatory earthquake of moderate intensity; duration, 22 seconds.	
	Tacloban - light oscillatory tremor; duration, 15 seconds.	49
1905 Sept 18 11:50 a.m.	Borongan: Tacloban - 11:49 a.m. earthquake of moderate intensity; direction, E - W; with vertical shocks; duration, long.	
	Borongan - strong oscillatory earthquake; duration, 15 seconds.	49
1905 Sept 30 8:20 p.m.	Butuan: Butuan - strong oscillatory earthquake; direction, SE - NW; duration, 40 seconds. Loud rattling of doors and windows and moving of objects.	
	Surigao - perceptible tremor; duration, 10 seconds.	49
1905 Oct 08 9:11 a.m.	Aparri: Aparri - rotary earthquake of moderate intensity; duration, 12 seconds, approximately.	

Event	Felt Effect	Source
	Tuguegarao - oscillatory earthquake, SE - NW; duration, 10 seconds.	49
1905 Oct 13 12:03 a.m.	Aparri: Aparri - oscillatory earthquake NE - SW; moderate intensity; duration, 20 seconds. This earthquake, as well as those felt on the 8th and 11th of this month, had its epicentre in the Pacific.	49
1905 Oct 19 10:20 p.m.	Butuan: Butuan - strong oscillatory earthquake; SSE - NNW; duration, 35 seconds.	
	Surigao - oscillatory earthquake of moderate intensity; SW - NE; duration, 38 seconds.	49
1905 Oct 20 12:25 a.m.	Surigao: Surigao - strong oscillatory earthquake with two shocks, long duration. At 4:15 a.m., light earthquake; duration, 5 seconds. At 4:30 a.m. another light earthquake of the same duration.	
	Butuan - strong oscillatory earthquake; direction, ESE - WNW; duration, 25 seconds.	49
1905 Oct 21 4:42 a.m.	Vigan: Vigan - oscillatory earthquake of moderate intensity; direction, NNW - SSE; duration, 20 seconds.	49
1905 Oct 31 3:10 p.m.	Aparri: Aparri - oscillatory and vertical earthquake; moderate intensity; duration, 20 seconds.	
	Vigan - at 3:11 p.m. oscillatory earthquake of moderate intensity; direction, SE - NW; duration, 24 seconds.	
	Candon - 3:11 p.m. perceptible oscillatory earthquake; SE - NW; duration, 10 seconds. Epicentre in the Pacific.	49
1905 Nov 17 8:26 p.m.	Borongan: Borongan - oscillatory earthquake of moderate intensity; direction, NW - SE; duration, 5	

Event	Felt Effect	Source
	seconds.	
	Tacloban - at 8:25 p.m. perceptible oscillatory earthquake.	49
1905 Nov 23 2:53 p.m.	Legaspi: Legaspi - oscillatory earthquake of moderate intensity; direction, NNW - SSE; duration, 5 seconds.	49
1905 Dec 02 2:05 a.m.	Manila: Manila - earthquake of moderate intensity, with oscillations and initial movement in the direction W - E. The perceptible movement lasted some 15 seconds and the microseismic disturbance 15 minutes and 16 seconds.	
	Marilao - perceptible oscillatory tremor, direction, W - E; duration, 5 seconds.	
	Balanga - light rotary and vertical earthquake; duration; 6 seconds.	
	Porac - perceptible oscillatory earthquake; direction, S - N; duration, about 7 seconds.	
	Corregidor - earthquake of small intensity; direction, E - W; duration, 10 seconds.	49
1905 Dec 08 4:22 p.m.	Visayan: Earthquake of great extent but of relatively small intensity.	
	Tuburan - strong oscillatory earthquake; direction, N - S; duration, 30 seconds. It was accompanied by loud subterranean noises and several fissures were opened in the ground, from one of which (in the district of Langoyon) water gushed forth; also, stone walls were thrown down here and there.	
	Capiz - light oscillatory earthquake accompanied by subterranean noises from the northeast. In Aklan and Ilaya, the earthquake was violent and lasted one minute.	

Event	Felt Effect	Source
	Cebu - strong oscillatory and rotary earthquake with very perceptible vertical movements; the horizontal movements, seemingly less intense, had the direction N - S; duration about 12 seconds.	
	Iloilo - oscillatory earthquake of moderate intensity; duration, 14 seconds; direction, NE - SW. Felt in all the towns of the province.	
	Bacolod - oscillatory earthquake of moderate intensity; direction, N - S; duration, 15 seconds.	
	Tagbilaran - oscillatory and rotary earthquake of moderate intensity; direction, N - S; duration, about 8 seconds. It was felt in the whole island of Bohol. Some who were out in boats saw peculiar, confused waves spring up suddenly along shore, and it was only after landing and hearing of the earthquake that they could explain the occurrence.	
	Bais - light oscillatory earthquake; direction, NNW - SSE; duration, 10 seconds.	
	Ormoc - oscillatory earthquake; WSW - ENE; light; duration, 20 seconds.	
	Tacloban - perceptible tremor; duration, 8 seconds.	
	Maasin - perceptible tremor of short duration.	
	Balingasag - light oscillatory earthquake; duration, more than 20 seconds. Judging from the notes received, the centre must have been to the south of Masbate, between northeast Panay and northern Negros and Cebu.	49
1905 Dec 11 2:12 a.m.	Visayas and Mindanao: Davao - strong and oscillatory earthquake; direction, NE - SW; duration, 1 minute 30	

Event	Felt Effect	Source
	seconds. Accompanied by subterranean noises which came from a north-easterly direction; clocks were stopped and loose objects generally thrown about.	
	Caraga - oscillatory earthquake of moderate intensity; WNW - ESE; duration, more than 40 seconds. Repeated after a short interval with less force.	
	Balingasag - strong oscillatory earthquake; direction, S - N; duration, more than 1 minute. Accompanied by subterranean noise, bells rang, and various objects were thrown down.	
	Cotabato - earthquake of moderate intensity; duration, 30 seconds.	
	Surigao - oscillatory and vertical earthquake of moderate intensity; duration, 35 seconds.	
	Tagbilaran - perceptible; oscillatory; duration, 20 seconds.	
	Cebu - perceptible oscillatory earthquake; direction, SE - NW; duration, 8 seconds.	
	Maasin - perceptible; oscillatory earthquake, WSW - ENE; duration, 30 seconds.	
	Ormoc - light; oscillatory; direction, WSW - ENE; duration, 35 seconds.	
	Tacloban - perceptible; oscillatory; long duration.	
	Borongan - oscillatory earthquake of three shocks; one moderate, the second weak, and the third strong; total duration, 40 seconds.	
	Gubat - perceptible tremor of short duration.	49

Event	Felt Effect	Source
8:28 p.m.	Northwest Luzon: Felt in all the stations north of the parallel of Manila beginning with Marilao. It was slight everywhere.	
	Pangasinan - moderate intensity.	49
1906 Jan 03 7:52 p.m.	Mindanao: Surigao - oscillatory earthquake of moderate intensity; direction, SW - NE; very long duration.	
	Caraga - oscillatory earthquake of moderate intensity; direction, NW - SE; duration, 50 seconds.	50
1906 Jan 04 10:45 p.m.	Cotabato - Cotabato - oscillatory earthquake of moderate intensity; direction, NNE - SSW; duration, 15 seconds.	50
1906 Jan 11 2:25 a.m.	Borongan: Borongan - oscillatory earthquake of moderate intensity; duration, 20 seconds.	50
7:02 a.m.	Borongan: Borongan - earthquake of moderate intensity; duration, 15 seconds. Repeated at 10:25 a.m. with less force; duration, 25 seconds.	50
2:03 p.m.	Tacloban, Leyte: Tacloban - oscillatory earthquake of moderate intensity with undulations from E to W; duration, short.	50
1906 Jan 17 12:33 p.m.	Tacloban, Leyte: Tacloban - oscillatory earthquake of moderate intensity; duration, 15 seconds.	50
1906 Jan 30 6:25 p.m.	Davao, Mindanao: Davao - oscillatory earthquake of moderate intensity; direction E - W; duration, 25 seconds.	
	Caraga - perceptible earthquake; direction, SE - NW; duration about 35 seconds.	50
1906 Mar 10 8:16 p.m.	Bicol Region and Masbate: Legaspi - strong oscillatory earthquake; direction of principal oscillations,	

Event	Felt Effect	Source
	WSW - ENE; duration some 40 seconds. Accompanied by subterranean noises.	
	Gubat - oscillatory earthquake of moderate intensity and duration.	
	Calbayog - light oscillatory earthquake; direction; WSW - ENE; duration, 15 seconds.	
	Catbalogan - light earthquake.	
	Nueva Caceres - oscillatory earthquake of moderate intensity; direction, S - N; duration, 30 seconds.	
	Masbate - very strong earthquake; duration, more than 20 seconds.	
	Capiz - oscillatory earthquake; direction, NNE - SSW; duration, 20 seconds.	50
1906 Apr 25 9:30 a.m.	Davao, Mindanao: Davao - strong, oscillatory earthquake; directions observed, S - N, and SW - NE; it lasted a little more than one minute and was accompanied by subterranean noise; clocks stopped and various objects fell.	
	Caraga - oscillatory earthquake of moderate intensity; direction, SSW - NNE; duration, 50 seconds, approximately; it caused considerable commotion and the falling of small objects such as bottles, etc.	
	Balingasag - light oscillatory earthquake; direction, SE - NW; duration, about 6 seconds.	
	Cotabato - perceptible oscillatory earthquake; duration, 10 seconds.	
	Cebu - oscillatory earthquake; direction, SE - NW; duration, 4 seconds.	50

Event	Felt Effect	Source
1906 June 05 8:38 p.m.	Eastern and Northern Samar: Eastern and Northern Samar - strong earthquake. Southeastern Luzon and the rest of Samar - easily perceptible.	50
1906 June 19 7:23 p.m.	Northern Luzon: Northern Luzon - stopped pendulum clocks; threw moderately heavy objects to the ground; duration more than one minute; accompanied by subterranean noises, as of distant explosions.	50
1906 June 23 3:15 a.m.	Naga, Bicol Region: Nueva Caceres - moderate oscillatory earthquake; direction, NNE - SSW; duration, 12 seconds. Legaspi - oscillatory earthquake, very perceptible; direction, NNE - SSW; duration, 15 seconds. Gubat - light earthquake; duration, some 3 seconds.	50
1906 July 29 6:36 p.m.	Naga, Bicol Region: Nueva Caceres - oscillatory earthquake of moderate intensity; direction, SE - NW; duration, about 10 seconds.	50
1906 July 31 2:16 p.m.	Caraga, Mindanao: Caraga - oscillatory earthquake of moderate intensity; duration, very brief; direction, NNE - SSW.	50
1906 Aug 03 5:35 a.m.	Mindanao: Butuan - trembling earthquake of moderate intensity, causing a great deal of creaking in the houses; duration, 15 seconds. Surigao - oscillatory and trembling earthquake of moderate intensity; direction, SW - NE; duration, about 7 seconds.	50
1906 Oct 09 12:25 a.m.	Surigao, Mindano: Surigao - oscillatory shock of moderate intensity; duration, 35 seconds.	50

Event	Felt Effect	Source
1906 Oct 10 8:05 p.m.	Mindanao: Surigao - earthquake of moderate intensity with distinct horizontal and vertical movements; direction of the former NE - SW; duration, 6 seconds. Butuan - perceptible oscillatory earthquake; direction, NE - SW; short duration. Caraga - light oscillatory earthquake; direction, NE - SW; duration, 20 seconds.	50
1906 Dec 03 9:35 a.m.	Naga, Bicol Region: Nueva Caceres - oscillatory earthquake of moderate intensity; direction, E - W; duration, 6 seconds.	50
1906 Dec 20 2:27 a.m.	Surigao, Mindanao: Surigao - moderate earthquake followed by a long series of aftershocks on the 20th, 21st, 22nd and 23rd. These had very light intensity; direction of the movements being always E - W. Butuan - perceptible.	50
1907 Jan 14 12:39 a.m.	NE of Mindanao and Eastern Visayas: Earthquake of Intensity V. According to information received from Borongan, Tacloban, Surigao and Butuan, the phenomenon was of greatest intensity at the two last named places, being accompanied by subterranean rumblings, noisy rattling of doors and windows, falling of objects, and ringing of bells. In both places the principal shocks came from the direction between north and northeast. Duration at Surigao, about 45 seconds.	51
1907 Apr 19 5:00 a.m. & 7:52 a.m.	Ambos Camarines, Bicol Region: The earthquakes were perceptible in the greater part of Luzon and of the Visayas, throughout an area of more than 800 kms. in greatest diameter. The mesoseismal area lay almost entirely in the province of Ambos	

Event	Felt Effect	Source
	Camarines. The general direction is SE - NW. The two violent earthquakes took place at an interval of slightly less than three hours. Both had almost the same mesoseismal area. The second shock was in reality less severe than the first. It nevertheless caused some damage to some buildings which had been badly shaken by the first quake. During that day 24 repetitions or aftershocks ranging in intensity from II to III were felt in the Camarines, 15 before noon and 9 more in the afternoon.	51
	Manila was shaken by a series of quakes for a period of three (3) hours. The seismic disturbance came in two distinct groups, beginning with a severe, undulating movement which shook every building in Manila and created alarm among the people, although little damage was done. The quakes had their epicentre near Mayon Volcano, their direction being from SSW - NNE and being of greater intensity in the vicinity of Nueva Caceres, Sorsogon, and Albay. A number of buildings have been wrecked in Nueva Caceres. It was felt in all sections of the city by persons in houses but was hardly noticed by those on the streets. The Customs House in Manila was badly damaged. Its stairway landing was pulled loose by about 8 inches from its original place, pillars cracked, and support columns leaned, one of them by about 6 inches out of plumb. Chief Manion of the Customs House said: "I am willing to swear that the dome moved six feet. The first thing I knew, my bed shot across the room and the bureau tumbled over on to me, scattering glass and other articles all over the bed". The water tank atop the Customs building was overturned. In other buildings damage was slight; windows cracked, window fastenings broken, metal safe	

Event	Felt Effect	Source
	in one room rolled into the middle of the room; bookcases wrecked, drawers of filing cabinets scattered about, and desks shifted from their original places; a typewriter was smashed. The roof tiles in two Escolta buildings fell; the adjacent Inchausti buildings were forced apart. The roof shows the undulating effect of the quake and one part of the building fronting the river appears to have about an 18-inch lean toward the street. A hanging lamp was shaken from its iron basket and dashed to pieces on the floor. Four of the arches in the main sally port leading to the old section of Fort Santiago were cracked. One person was injured in the city as he was frightened by the quake and fractured his arm. Bedridden patients, unable to walk for some days, ran during the quake. The Manila Observatory noted that seismic activity started as early as the 15th of April at 2:27 p.m. on that day. The first shock on the 19th began at 5:00:22 a.m. The initial direction was from SSW - NNE. The maximum movement was from E by S to W by N at 5:00:53. The movement was perceptible until 5:01:02 a.m. The duration of the micro-seismic movement was 1 hr. 58 m 16 seconds. The principal shock was followed by two repetitions, one at 5 h 19 m 43 seconds and the other at 6 h 59 m 56 seconds. There was another distinct shock at 7:53:16 a.m.	122
1907 May 20 3:49 p.m.	Leyte, Cebu and NE Mindanao: Leyte - Intensity VII in the southeastern extremity. Very perceptible throughout the region indicated. It was followed by several less violent repetitions. At 4:03 p.m., a second earthquake took place which was slightly less intense than the first. Scanty information furnished by the observers stationed at Ormoc	

Event	Felt Effect	Source
	and Maasin, Leyte seems to indicate that the centre of disturbance was situated some 30 kms. to the NE of Maasin. The mesoseismal region, within which the shocks were repeated with great frequency from the 17th to the end of the month, and where the two principal earthquakes of May 20 developed great violence, appears to have been limited to the peninsula formed by the southeastern part of the Island of Leyte, and measures hardly 10 kms. in diameter. In a letter dated May 20, Mr. Ramon E. Escanyo writes from Cabalian, a town situated in the extreme southeast part of Leyte, as follows: Some of the more violent quakes have caused landslides in the mountains of this neighbourhood. In a second letter, dated May 25, he adds that the shocks continue and their number exceeds sixty. Mr. Arcega, writing from the same place, says that on the 20th, earthquake were so frequent that people experienced difficult in cooking their meals. He also assures us that in a hamlet in the western part of the peninsula the oscillations were so violent as to cause the collapse of several palm thatch houses, whose upright posts gave way under the strain. Finally he states the conviction of the people that the continual commotions are due to one of the volcanoes or solfataras existing near Cabalian whose activities have increased of late. These facts and the landslides which occurred in the mountains fill the inhabitants of Cabalian and other towns of southern Leyte with fear and trembling lest a volcanic eruption be imminent.	51
1907 May 25 11:52 p.m.	Northern Luzon: Earthquake of Intensity VIII, perceptible throughout nearly the whole island. Tuguegarao - Intensity VII and Laoag	

Event	Felt Effect	Source
	- Intensity VI. The quake did considerable damage to the stone buildings in Ilocos Norte and also cracked some walls at Tuguegarao.	51
1907 July 10 2:54 a.m.	Southern Luzon: An earthquake of Intensity V, which was perceptible in the part of Luzon lying south of parallel 14^{o}N, and on the islands of Samar, Leyte, Cebu, Masbate, Negros and Panay.	51
1907 July 18 3:22 a.m.	Islands of Panay and Negros: Bacolod (NW of Negros) - Intensity V and was accompanied by subterranean noises; the principal waves appeared to come from an easterly direction. Panay (Iloilo and Capiz) - undulations of force II were felt.	51
1907 July 20 9:40 p.m.	Mindanao: Earthquake of Intensity V in the southeastern portion of the island. The origin lay to the north of Davao, probably on the eastern side of the mountain range which separates the Salug and Agusan Rivers. Davao - strong oscillations were observed, which had a NNE - SSW direction and were followed by strange subterranean rumblings. Caraga and Baganga - Intensity IV; showed two directions, WNW - ESE and W - E. They were perceptible at Surigao, a distance of about 250 kms.; and probably even at Cebu, at a distance of more than 350 kms.	51
1907 Nov 24 9:59 p.m. & 10:11 p.m.	Camarines (SE Luzon): Ambos, Camarines - earthquake of Intensity IX. The mesoseismal area of this earthquake comprised only the southeastern most part of the region. It was followed by a second shock of Intensity V or VI and by numerous small ones during the night until the next day. The towns that suffered most are those to the south	

Event	Felt Effect	Source
	of Iriga Volcano and along the Quinali River. Within this area nearly all the stone buildings which successfully withstood the earthquakes during April 14 of the current year fell to the ground; many fissures opened in the ground and huge landslides occurred on the mountain sides.	51
1908 Jan 18 11:45 p.m.	Northeastern Mindanao: Surigao - earthquake of Intensity V.	
	Butuan - earthquake of Intensity III. The directions of the seismic waves observed at the two stations seem to indicate that its origin was not far from the centre of the quake of lesser intensity which occurred on the 16th of the month.	52
1908 Jan 21 between 4:05 a.m. & 10:16 a.m.	Western Leyte: Between 4:05 a.m. and 10:16 a.m. five different shocks occurred which were perceptible along the western coast of Leyte Island for a distance of more than 60 kms. and probably also on the neighbouring Camote Islands. Of those five shocks three were of very feeble intensity, while the remaining two reached intensity VI. The times of their occurrence were the following: 4:30 a.m.; 7:21 a.m.; 7:57 a.m.; 8:29 a.m. and 10:16 a.m. The two stronger shocks registered by the microseismographs of the observatory were perceptible throughout the northern part of the island. At the Ormoc station, the SW - NE direction of the oscillations was very pronounced, which suggests that the centre of this disturbance lay beneath the waters of Ormoc Bay.	52
1908 Mar 05 10:19 a.m.	Central Mindanao: Earthquake of Intensity VIII, whose centre must have been within the island, probably in the region of the Agusan River. This earthquake was of more than Intensity VI at Butuan, in the northern part of the Agusan Valley,	

Event	Felt Effect	Source
	while at Davao, in the south, the intensity was VI, and at Cotabato, about south-southwest of the said valley, only IV; whence it is inferred that the origin must be sought between the two former stations, somewhat nearer to the first than to the second. Hence there is no doubt that the disturbance was caused by the old and well known focus which is situated near the middle of the Agusan Valley, on the west side of the river.	52
1908 May 06 7:27 p.m.	Leyte and Northeastern Mindanao: Butuan - very strong oscillations were observed, which had a N - S direction and lasted for nearly a minute. Surigao - the earthquake was less intense and lasted about 48 seconds. Leyte - the shocks were very feeble and of short duration. The origin of this disturbance was a distance of 700 kms. from Manila, probably in the Bay of Butuan.	52
1908 May 14 9:18 p.m.	Jolo and Western Mindanao: Jolo and Western Mindanao - earthquake of Intensity VI. The origin of this earthquake appears to have been in the Sulu Sea about 750 kms. south of Manila. The centre lay near the meridian 121°E and parallel 7°40'N which seems to be the region from which proceeded the violent earthquakes of 1879 and is responsible for most of the shocks which are being felt in western Mindanao and on the island of Basilan and Jolo.	52
1908 Aug 16 9:45 a.m.	Northeastern Mindanao: Butuan and Talacogon - earthquake of Intensity V; duration about 50 seconds. Its origin lay within the Agusan River Valley, where one of the most active seismic centres of the Archipelago exists.	52

Event	Felt Effect	Source
1908 Nov 07 4:57 a.m.	Northeastern Mindanao: Earthquake of Intensity V. The origin of this earthquake was in the northeastern part of the Agusan River Valley, not far from Butuan, where the intensity was V and the earthquake waves from the east, accompanied by subterranean noises, were distinctly observed.	52
1908 Nov 11 9:20 p.m.	Visayan Islands and Northern Mindanao: Iloilo and Capiz - Intensity V; Negros - perceptible. Cebu - perceptible. Bohol - perceptible. Masbate - perceptible. Leyte - perceptible. Northern Mindanao - perceptible. Jolo - perceptible. The centre was situated in the eastern part of the Sulu Sea to the SSW of Panay Island.	52
1909 Feb 07 12:01 a.m.	Butuan (N of Mindanao): Butuan - earthquake of Intensity VI, lasting 40 seconds. The direction of the waves ENE - WSW. Some objects were thrown from their places toward ENE. Some subterranean rumblings were heard which appeared, likewise, to advance in the same direction. The area shaken by this strong earthquake was very limited. The disturbance appears to have been imperceptible at the stations of Surigao and Cagayan which are both at a distance of only about 100 kms. from the epicentre. It was not recorded either on the microseismographs of Manila Observatory.	53

Event	Felt Effect	Source
1909 Mar 18 4:27 p.m.	Eastern Mindanao: Earthquake of Intensity VII. The epicentre of this quake is to be sought in the eastern mountain range of Mindanao, or very close to it on the Pacific coast. In some towns on the eastern coast, the disturbance ranged from Intensity VII-VIII. Agusan - Intensity VII, 65 kms. west of the coast. Butuan - Intensity VI, which was about 100 kms. to the northwest of the epicentral region. Hanging lamps and other suspenced objects oscillating in the direction SE - NW. The microseismographs of Manila Observatory registered the phenomenon as an earthquake of moderate violence.	53
1909 Apr 04 5:33 a.m.	Northern Luzon: Earthquake of Intensity V. The origin lay toward northeast, probably near Camiguin Island of the Babuyanes group, some 450 ksm. from Manila. The disturbance was perceptible in all the provinces north of parallel $17^{\circ}N$ latitude. Aparri - Intensity V, lasting 50 seconds.	53
1909 Apr 14 6:37 a.m.	Southeastern Luzon: Earthquake of Intensity VI. It displayed the greatest violence east and northeast of Mayon Volcano and was quite perceptible to a distance exceeding 100 kms. in the provinces of Ambos, Camarines and on Masbate Island. The centre lay probably to the southwest of Catanduanes Island. The perturbation of the microseismographs at Manila lasted about half an hour.	53
1909 Aug 12 7:24 p.m.	Agusan River Valley (E of Mindanao): Earthquake of Intensity V and long duration. The epicentre was situated in the northern part of the valley, near parallel $18^{\circ}20'$ latitude north.	

Event	Felt Effect	Source
	In Butuan at a distance of 60 kilometres the intensity was IV, and the disturbance was felt throughout almost the whole of eastern Mindanao.	53
1909 Dec 04 5:59 a.m.	Surigao, Mindanao: Earthquake of Intensity V. It shocked the whole peninsula of Surigao, and was accompanied by rumblings; it was also perceptible in the northern part of the Agusan River Valley. Most probablyits origin lay in the eastern part of Butuan Bay.	
	Butuan - it was vaguely reported as a shock of Intensity IV - V, felt at about 4:00 a.m.	53
1910 Jan 16 6:21 a.m.	Eastern Mindanao: Talacogon, Butuan and Davao - Intensity V. Of these, Talacogon, though nearest to the epicentre, was still more than 50 kilometres distant. Hence, it is very probable that within the epicentral region the disturbance was somewhat more intense.	54
1910 Feb 08 4:24 p.m.	Northern Luzon: Ilocos Norte, Mountain and Cagayan Province - Intensity V. It was perceptible throughout the other provinces of Northern Luzon down to parallel 17^{O}N latitude. Its epicentre lay probably within the northern part of the Central Cordillera. In Ilocos Norte, a noise was heard 2 seconds before the shocks, which resembled the rumblings of a somewhat distant railway train.	54
1910 Mar 26 3:18 a.m.	Baguio, Luzon: Baguio - earthquake of Intensity V. The epicentre lay probably in the province of Nueva Vizcaya.	54
1910 Apr 02 5:09 p.m.	Butuan (N of Mindanao): Butuan - oscillatory earthquake; direction, WSW - ENE; duration, 10 seconds; it was very intense; stopping of pendulum clocks, splashing of water	

Event	Felt Effect	Source
	over the rims of containers.	54
1910 May 10 10:32 p.m. & 11:07 p.m.	Agusan River Valley (E of Mindanao): Butuan - which is in the northern part of the valley registered only Intensity IV; more to the south, towards the valley, it was doubtlessly of greater intensity without, however, being violent. Surigao - Intensity III. The epicentre of this earthquake must have been in the northern part of the region of the valley which is the usual place of origin of principal earthquakes of the Agusan. A second earthquake of Intensity V and of much longer duration occurred in the same region less than an hour later.	54
1910 May 11 1:24 a.m.	Northeastern Mindanao: Surigao - Intensity V; it was accompanied by very perceptible noises.	54
1910 June 07 8:40 p.m.	Southwestern Luzon: Earthquake of Intensity V, which was perceptible in the following provinces: Bataan, Zambales, Tarlac, Laguna, Cavite, Nueva Ecija, pampanga, Bulacan, Rizal, Batangas. Its origin seems to have been in the China Sea, very near the southwestern coasts of Luzon. The mesoseismic area comprised the provinces of Cavite, Batangas and Bataan. Manila - Intensity III, SW - NE direction.	54
1910 June 15 9:28 p.m.	Leyte Island: Ormoc and other places to the south - Intensity VII. Its origin must doubtlessly be sought south or southeast or Ormoc and not far from the coast. The mesoseismic area was limited to a strip of about 20 kms. in width on the coast of Ormoc Bay. In the interior of the island the disturbance was perceptible only in the north and northeast.	54

Event	Felt Effect	Source
1910 July 02 1:38 p.m.	Valley of Agusan River (E of Mindanao): Earthquake of Intensity VI and very long duration accompanied by subterranean noises. Many aftershocks perceived.	54
1910 July 03 9:59 a.m.	Valley of the Agusan River (E of Mindanao): Oscillatory earthquake of Intensity VI; duration, 50 seconds. Many aftershocks ranging from Intensity II-III followed.	54
1910 July 22 10:01 p.m.	Northeastern Mindanao: Earthquake of Intensity V which was felt throughout the peninsula of Surigao and the northern part of the Agusan Valley.	54
1910 Sept 17 7:10 a.m.	Northern Luzon: Earthquake of Intensity V. It was felt in the entire northern part of Luzon which comprises Ilocos Norte, northern part of Cagayan and Mountain Province. The epicentre would seem to have been at a distance of some 600 kms. from Manila and at about the latitude of Babuyanes Islands.	54
1910 Oct 03 5:17 a.m.	Southeastern Luzon: Earthquake of Intensity V which was felt throughout southeastern Luzon, comprising the provinces of Sorsogon, Albay. Camarines, Tayabas and the eastern part of Laguna, and having a total length of about 350 kilometres in the direction ESE - WNW.	54
1910 Nov 26 3:14 a.m.	Southeastern Mindanao: Southeastern Mindanao - V. Sarangani Island - IV (south of Mindanao). Butuan in the north of the island - II. Davao and Agusan districts - It did not exceed V (at the intermediate stations). Its epicentre lay apparently in the eastern part of the Davao Gulf.	54

Event	Felt Effect	Source
4:18 p.m.	Southern Mindanao: Felt in the entire south of the island. Its epicentre seems to have been near the coast of Mindanao, to the northwest of Sarangani Island.	54
1910 Dec 16 10:47 p.m.	Southern Mindanao: Perceptible throughout the island. The mesoseismic area must have been of very irregular shape, from west of Sarangani Island toward the Agusan Valley.	
	Sarangani - VII to VIII.	
	Agusan Valley - VII - VIII.	
	Davao - VI.	
	Cotabato - VI; duration, 1 minute.	54
1910 Dec 17 2:55 a.m.	Southern Mindanao: Sarangani Island - VI.	
	Agusan Valley - VI.	
1910 Dec 30 8:49 a.m.	Agusan Valley (Mindanao): Earthquake of Intensity VII, whose epicentre was in the northern part of the valley.	
	Butuan - it brought down light partition walls, cracked masonry work, rang heavy bells, overturned all kinds of objects, and caused large waves in the river which capsized small craft.	
	Talacogon - VI.	
	Davao - IV.	
	North of Butuan - the intensity was not below V, based on the report received from Surigao.	
	Cebu, Samar, and Leyte - III.	
	Lake Lanao and Cotabato - Intensity III.	54

Event	Felt Effect	Source
1910 Dec 31 2:55 a.m.	Southern Mindanao: Davao - Intensity IV. Cotabato and Lanao - Intensity III. Agusan Valley - Intensity II-III.	54
1911 Jan 17 6:57 a.m.	Northeastern Mindanao and Leyte Island: Earthquake of intensity V whose epicentre appears to have been in the Pacific Ocean, close to the NE Coast of Mindanao and not far to the S or SE of Siargao Island. Isoseismal V encloses the entire NE of Mindanao, from the northern part of Agusan Valley to a distance of more than 200 kilometres south of Surigao. Isoseismal II - encloses Leyte Island and the part of eastern Mindanao comprised by the provinces of Surigao and Agusan. The longer axis of the area shaken had, consequently, an extent of about 500 kilometres in the direction SSE - NNW.	55
1911 Jan 19 1:47 p.m.	Eastern Mindanao: Its epicentre lay probably near the eastern coast of the island. Eastern Coast - Intensity IV or V. Davao - Intensity III. The direction was ENE - WSW. Butuan - Intensity III. The direction was SE - NW.	55
1911 Apr 10 4:52 p.m.	Surigao (NE of Mindanao): Earthquake of Intensity V and six seconds duration. The shocks observed were almost exclusively vertical.	55
1911 July 12 12:09 p.m.	Agusan Valley: Talacogon - there took place a very violent earthquake which wrought great havoc in the convent and church. The creaking of the beams was something awe-inspiring; doors and windows were wrenched from their hinges. Both in the church and in the house, not	

Event	Felt Effect	Source
	only light objects, but also quite heavy pieces of furniture were rolling about on the floor, statues from the altars, candlesticks, cumbersome chests, pictures, jugs and jars, etc., everything going to pieces. The houses in the town remained tilted to one side. The earthquake threw down many big trees; in the hemp plantations, placed on sloping ground, numerous and extensive landslides were produced, some of them carrying down five hundred and more plants (these plants are set in rows three metres apart, thus each hectare contains from 800 to 1,000 plants). The damage caused by the earthquake both to houses and ground was found to be equally serious in all the districts. In one of the lakes the high waves produced by the earthquake invaded the shore and penetrated far into the land. Most likely an earthquake included seiche. La Paz - suddenly there arose some waves of such dimensions and confused directions that the oarsmen needed all their skill and strength to prevent the capsizing of the boat. In the village of La Paz they found church and house unroofed and the walls fallen to the ground. Many dwellings remained permanently tilted and were in bad shape, while three had been destroyed completely. The ground showed many and large cracks. It must be borne in mind that the church and houses mentioned in the preceding lines were constructed of wood, bamboo and palm thatch. Bunauan - it is known that the banks of the river and other water-courses caved in, in many places, carrying with them trees and other obstructive materials and blocking the navigable channels which connect	

Event	Felt Effect	Source
	Bunauan with Clavijo and Veruela. Veruela - there occurred an earthquake of frightful force; the ground moved so violently that the swaying houses remained at the end permanently inclined; none, however, collapsed. (They are, without exception, constructed of bamboo and wood, held together by rattan). The ground showed waves like those of water, and the commotion of the waters of the river was imposing. The ground was fissured everywhere and in many places of the river formed quite extensive banks of mud and sand, leaving not enough depth for small boats. During three days, the river water was so muddy that it could not be used for any household purposes. Butuan - violent earthquake of oscillatory and trembling character; observed directions; S - N, SW - NE, and ESE - WNW; duration about two minutes. At first nobody took much notice of the phenomenon as, for many seconds, the movements were of little intensity, objects swaying but slightly. But thereafter the earth shook so violently that everybody rushed into the streets in terror, the violent movements lasting about 50 seconds. Within the houses everything movable went skidding about the floor. Nearly all the houses were damaged and even in the church and convent portions of partition walls came down which were of masonry with wooden trusses, the greatest damage being on the west side. Two houses of the town fell toward north and the upright posts of one were lifted about one foot out of the ground in which they were embedded. Of a variety of objects, such as pictures, chairs, lamps etc., some were thrown toward east, others toward west. Some large trees whose trunks were partly rotten came	

Event	Felt Effect	Source
	down. Several fissures opened in the direction NE - SW. Hinatuan, Boston, Baganga, Caraga - the shocks appeared to have come from several directions, as the bells and lamps of the church had a circular motion. The earthquake was even more severe in the north of Caraga. At Baganga, it opened two fissures close to the wharf; at Boston, it brought to the ground a massive stone wall which formed the facade of the church and had a thickness exceeding two varas (1.68 metres). Davao - the earthquake was very strong; it stopped clocks, caused church bells to ring, and produced general alarm, principally on account of its long duration of one minute and five seconds. The movements were mainly in the directions NNE - SSW, and ENE - WSW. The earthquake was much more violent on the northeastern side of the gulf, where it damaged buildings and opened fissures in the ground. Hence, it must have been of greater intensity in that region than at Caraga. Cagayan (Misamis) - an earthquake of long duration, though not very strong, as it did not throw down any objects. The swaying of the heads of the coconut palms seemed to be from SSE or S to NNW or N. The duration was such that there was plenty of time to leave the room, descend the stairs and go into the yard while the earth still continued to tremble. Nasipit and Cabarbaran - the earthquake was very strong and of long duration, but did not damage buildings, though it made a great noise in them and still more so in the woods which cover the nearby mountains lying to the west of those	

Event	Felt Effect	Source
	places. From Cabarbaran, which is on the east of Butuan Bay, comes practically the same information - the earthquake was strong and prolonged without doing any damage; the trees swayed violently, and the abaca plants rocked until the leaves appeared to touch the ground.	55
	This most violent earthquake in the central part of Agusan Valley, was felt throughout the whole of Mindanao, Sulu and Visayas and as far as Palawan. Its mesoseismic area extended from Central Agusan eastward to the Pacific Deep. Tectonic in origin.	102
1911 Aug 19 8:05 a.m.	Southeastern Luzon: Earthquake of Intensity V-VI, perceptible in Catanduanes, the entire province of Albay, and eastern Camarines.	
	Virac (Catanduanes) - V, in the direction W - E.	
	Legaspi (Albay) - IV, in the direction N - S.	
	Nueva Caceres (Camarines) - II-III felt during five seconds. The origin of this earthquake was approximately 330 kms. from Manila, in the northeastern part of Lagonoy Gulf, not far from 124^{o} longtitude east and 13.7^{o} latitude north.	55
1911 Aug 22 1:32 p.m.	Southeastern Luzon: Earthquake of Intensity V. Perceptible in the Catanduanes, the entire province of Albay and eastern Camarines.	55
2:26 p.m.	Southeastern Luzon: Cataduanes - V-VII.	
	Albay and Northeastern Camarines - IV-V.	55
1911 Sept 05 10:08 a.m.	Western Leyte: Earthquake of force VII on the entire western coast of the island lying betwen parallels	

Event	Felt Effect	Source
	11^{o} and $10^{o}20'$ north, and on the Camotes Islands which lie west thereof at a distance of about 35 kilometres. The epicentre appears to have been between the latter islands and the western coast of Leyte.	55
1911 Sept 06 10:14 a.m.	Agusan Valley (E of Mindanao): Earthquake of Intensity V lasting 45 seconds. It was felt throughout the entire valley.	55
1911 Sept 21 9:57 p.m.	Samar, Leyte and Northeastern Mindanao: Southern Samar, Northern and eastern Leyte - Intensity IV-V. Northeastern Mindanao - Intensity III. Its origin lay probably near the southern coast of Samar, in the neighbourhood of 125.5^{o} longitude east and 11^{o} latitude north. The stations of Tacloban and Guiuan which are the nearest to the epicentre, report an extraordinarily long duration; the undulations from east to west.	55
1911 Sept 23 2:57 a.m.	Agusan Valley: Earthquake of Intensity V-VI, felt throughout eastern and northeastern Mindanao and on Leyte Island. To judge from the intensities experienced at Butuan, which town lies near the northern end of the valley, and at Talacogon, which is some 50 kilometres south of the former place, the epicentre lay somewhat more to the north than that of the earthquakes during July. This explains why the seismic waves were perceptible toward north as far as Leyte. Agusan Valley - the shocks lasted about 50 seconds; they awoke sleepers, stopped clocks, and brought down some walls which had been left in a tottering condition by the preceding earthquakes.	55
1911 Oct 27 5:31 a.m.	Agusan Valley (E of Mindanao): Central and southern part of the	

Event	Felt Effect	Source
	Agusan Valley - Intensity IV to V. Eastern Coast of the island, the Sarangani group in the north, and Cotabato district in the west - Intensity II-III.	55
1911 Nov 06 11:26 p.m.	Central Luzon: Earthquake of Intensity V-VI, with the epicentre in the northwestern part of the province of Nueva Ecija, near 120°50' longitude east and 15°45' latitude north. It was perceptible with decreasing intensity in all the adjacent provinces of central Luzon, up to distances of 150 kilometres. Strong oscillations (V-VI) in the directions E - W and N - S were noticed; still the buildings suffered no harm, but the ground showed some cracks running in the direction north to south. The epicentre appears to include some elevations which rise in the north of the extensive plain of Luzon, between the Agno and Chico Rivers.	55
1911 Nov 22 3:23 a.m.	Northern Luzon: Earthquake of force VI, felt in all the provinces of northernmost Luzon as far as parallel 17° north. Its epicentre was at a distance of approximately 460 kilometres from Manila, probably not far from the volcanic island of Camiguin, in the neighbourhood of meridian 121°40' east and parallel 18°50' north. Aparri (Cagayan) - a very strong earthquake (VI) of trembling and gyratory character and long duration. Several persons maintain that during the disturbance they saw a reddish glow (more evidence of earthquake lights) in the north, in the direction in which lies Claro Babuyan. Laoag (Ilocos Norte) - a strong earthquake (V) of gyratory character. Direction of the principal waves NNE - SSW, duration ten	

Event	Felt Effect	Source
	seconds. The earthquake was preceded by subterranean noises which seemed to come from the direction of the Cordillera to the east and northeast. Both the earthquake and the noises were perceived throughout the province creating excitement among the people who call this kind of noise "donorodor".	
	Tuguegarao (Cagayan) - trembling and oscillatory earthquake. Direction N - S, Intensity IV, duration 12 seconds.	
	Baguio (Benguet) - oscillatory earthquake; direction, N - S, Intensity III.	
	Vigan (Ilocos Sur): oscillatory earthquake; direction NNE - SSW, Intensity III-IV, duration, ten seconds.	55
1911 Dec 09 9:20 a.m.	Davao (SE of Mindanao): Davao - Intensity V.	
	Sarangani Island - Intensity III.	
	Butuan - Intensity II. The epicentre lay probably in the southeasternmost part of Mindanao, to the east of Davao Gulf.	55
1911 Dec 16 5:04 a.m.	Northeastern Luzon: Earthquake felt throughout Cagayan Province.	
	Aparri - Intensity V and a N - S direction; was felt for about 20 seconds.	
	Tuguegarao - Intensity III, but the same kind of movement was observed during 15 seconds.	55
1911 Dec 18	Northern Luzon: Ilocos Norte, Ilocos Sur, northern part of Mt. Province and Cagayan Province - Intensity V. The epicentre appears to have been situated about 450 kilometres north of Manila, to the south of the	

Event	Felt Effect	Source
	Babuyanes group of islands (121.5°E; 18.7°N).	55
1912 Jan 27 1:57 a.m.	NE Mindanao: Earthquake of intensity V-VI. The epicentre appears to have been SE of Butuan Bay.	
	Butuan - strong oscillations from E - NE and NE were observed which lasted some 20 seconds.	
	Surigao - the movements were of only Intensity III-IV.	
	Cagayan Province - only a few people noticed oscillations of Intensity II.	56
1912 Feb 15	Northern Luzon: Earthquake of Intensity V, felt in the northern part of Luzon, above parallel 18°N. Its centre lies between the Babuyanes Islands and the northern coast of Luzon.	56
1912 Feb 25	Agusan Valley (Mindanao): Earthquake of Intensity V, felt throughout the valley, from Butuan to Davao Bay. Its epicentre lay south of Talacogon, near parallel 8°N.	56
1912 Mar 03 1:57 p.m.	Agusan Valley (E of Mindanao): Earthquake of intensity V and long duration. Its origin lay in the central part of the valley, and the shocks must have been perceptible to a distance of more than 100 kilometres in the N - S direction.	56
1912 Mar 07 12:44 p.m.	Northeastern Mindanao: Earthquake of Intensity V, whose epicentre would seem to have been situated in the northern part of the Agusan Valley.	56
1912 Mar 09 7:20 a.m.	Northeastern Mindanao: Butuan - the movements were very strong; the directions, ENE - WSW and E - W.	
	Surigao - Intensity III.	
	Talacogon - Intensity III. The	

Event	Felt Effect	Source
	epicentre lies very close to the mouth of Agusan River.	56
1912 Mar 17 11:25 p.m.	Agusan Valley (E of Mindanao): Earthquake of Intensity V-VI felt throughout the valley. Its epicentre lay probably in the northern part of the valley between Butuan and Talacogon.	56
1912 Mar 19 10:02 p.m.	Agusan Valley (E of Mindanao): Earthquake of Intensity V, felt throughout the valley. Its epicentre lay probably in the northern part of the valley between Talacogon and Butuan.	56
1912 Mar 22 12:30 p.m.	Northeastern Mindanao: Agusan Valley - Intensity V-VI. Surigao - Intensity V-VI. The epicentre seems to have been very close to the mouth of the Agusan River.	56
1912 Mar 25 10:02 p.m.	Agusan Valley (E of Mindanao): Agusan Valley - Intensity V. Butuan - Intensity V.	56
1912 Mar 30 3:39 p.m.	Samar, Leyte and Southeastern Luzon: Earthquake of Intensity V whose origin lay to the north of Samar Island, near meridian 125°E, parallel 13.5°N.	56
1912 Apr 14 8:29 p.m.	Northeastern Mindanao: Its epicentre must be sought in the southeastern part of Butuan Bay. Butuan and Surigao - Intensity IV-V.	56
1912 May 10 10:05 p.m.	Northeastern Mindanao: Butuan - Intensity VII-VIII. At Butuan, the combined trembling oscillatory movements of large amplitude and varying directions produced the impression that the movements were rotary. A few small cracks developed in walls, and many in the ground, the general direction being east to west. It	

Event	Felt Effect	Source
	must be remarked that the western bank of the Agusan, on which is located the town of Butuan, is alluvial soil and, hence, easily cracked. The mesoseismic area, within which the intensity exceeded V, seems to have formed a very narrow belt, extending in direction N - S along the mouth of the Agusan and the southeastern part of Butuan Bay. Tubay and Cabarbaran - had lesser intensity than the great earthquake of July 12, 1911. Surigao - exceeded Intensity III. Talacogon - Intensity III-IV. Nasipit - below Intensity III.	56
1912 June 27 9:05 a.m.	Northwestern Luzon: Its mesoseismic area comprised central and southern Ilocos Norte, northern Ilocos Sur and the subprovince of Abra. Laoag - Intensity VI-VII. The violent movements of the ground were preceded by noises resembling muffled detonations which seemed to come from the direction of the mountain range lying to the east and neighbouring places. Vigan - somewhat less violent; duration, 20 seconds longer than at Laoag; the same sounds were heard coming from the east. Central Cordillera - was of equal, if not greater intensity than on the coastal plains of the Ilocos. Aparri - Intensity IV. Cagayan Province - Intensity IV. Cervantes (Ilocos Sur) - Intensity V, 70 kilometres south of the	

Event	Felt Effect	Source
	parallel of Vigan. In the coast towns of the southern part of Ilocos Sur and in La Union Province, the disturbance was felt with less violence than at Cervantes. The epicentral region of this earthquake included likewise the western slopes of the Cordillera. This earthquake was perceptible in the entire part of Luzon which lies north of parallel 16.4^{o}, within an area of 250 kilometres in length and 190 kilometres in width.	56
1912 July 01 1:12 a.m.	Leyte Island: Its epicentre lay near the northwestern coast, north of parallel 11^{o}.	
	Leyte - Intensity V.	56
1912 July 04 8:06 p.m.	Central Luzon: Felt throughout that part of the island which comprises the provinces of Nueva Ecija, Tarlac, Pangasinan, La Union, Nueva Vizcaya, and the subprovinces Benguet and Lepanto. Its epicentre lay in southern Benguet and northern Pangasinan. It is assumed with a great degree of probability that it lay in the region of Mount Santo Tomas, the Bued River, and the eastern tributaries of the latter, where other earthquakes of considerable force are known to have originated.	56
1912 July 07 12:22 a.m.	Agusan Valley (E of Mindanao): Felt throughout the northern portion of the valley. Its epicentre lay a short distance southeast of Butuan.	56
6:02 p.m.	Agusan Valley: Earthquake of Intensity V. Perceptible within the same region as the preceding and apparently having the same centre of origin.	56
1912 July 09	Northern Luzon: Northernmost part Luzon Island - Intensity V. Its epicentre must have been very close to the northern coast of the island	

Event	Felt Effect	Source
	and in the neighbourhood of the prolongation of a N - S line running through the Central Cordillera of Luzon. Although the mesoseismic area comprised part of the sea and the small islands known as the Babuyanes group, it is not likely that the disturbance was of much greater intensity there than on the northern extremity of Luzon.	56
1912 July 20 4:46 p.m.	Talacogon (Agusan, E of Mindanao: Talacogon): Talacogon - Intensity IV-V. Agusan - Intensity IV-V; long duration. Its epicentre lay in the southern part of the Agusan Valley, nearer to the coast of the island.	56
1912 July 22 1:20 p.m.	Agusan Valley (E of Mindanao): Agusan Valley - Intensity V; long duration. Talacogon - Intensity V; long duration. Butuan - Intensity IV; duration, 40 seconds.	56
1912 July 23 12:42 a.m.	Agusan Valley: Agusan Valley - Same region was shaken by a second quake of smaller intensity (IV-V); duration 20 seconds at Butuan.	56
1912 Aug 18	Agusan Valley (E of Mindanao): Agusan Valley - Intensity V. Its origin appears to be in the same region as that of the great earthquake of July 12, 1911, that is to say, not far from the eighth parallel of latitude north.	56
1912 Aug 28 12:56 a.m.	Dapitan (NW of Mindanao): Dapitan - Intensity V-VI; oscillatory earthquake; direction, WNW - ESE; duration, nine seconds.	56
1912 Aug 29 9:13 p.m.	Central Luzon: Earthquake of Intensity V-VI which was felt in the provinces of Ilocos Sur, La Union,	

Event	Felt Effect	Source
	Mt. Province, Nueva Vizcaya, Nueva Ecija, Pangasinan.	
	Quiangan - the movements were very strong (Intensity VI); duration, three seconds.	
	Bayombong - less than Intensity V-VI.	
	Cervantes (Ilocos Sur) - Intensity V-VI; duration, four seconds; direction, from south to north; a warehouse of light construction collapsed.	
	Mirador Observatory (Baguio) - Intensity V; bottles and similar objects were overturned. Its origin must be sought within the Mt. Province, toward the northeast of Benquet, south of Lepanto, southwest of Ifugao, northwest of Nueva Vizcaya.	56
1912 Aug 31 2:11 a.m.	Southeastern Luzon and Northern Samar: Legaspi (Albay) - Intensity V-VI.	
	Gubat (Sorsogon) - Intensity V-VI.	
	Virac (Catanduanes) - Intensity V-VI.	
	Laoang (Samar) - Intensity V-VI.	
	Ambos, Camarines - below V.	
	Masbate, Samar - below V.	
	Leyte - below V.	
	Panay - below V. The origin of this earthquake must probably be sought in a secondary line of fracture which, starting from the great trough of Visayas and Mindanao, runs in a westerly or northwesterly direction toward San Bernardino Strait and the gulfs of Albay and Lagonoy.	56

Event	Felt Effect	Source
1912 Sept 01 9:22 p.m.	Eastern Mindanao: This earthquake was felt throughout the whole of East Mindoro, Romblon, Tablas, in the provinces of S Luzon, Tayabas, Laguna and the Islands of Marinduque. Calapan and Pandarocan - Intensity IV; duration, more than 20 seconds. Laguna and Tayabas - Intensity did not exceed III-IV. The epicentre appears to have been between Mindoro and Marinduque; the mesoseismic area was a very prolonged but narrow belt in the direction N - S which leads one to suppose that, at the epicentre, which was situated under the sea, the intensity must have reached Intensity VI or VII.	56
1912 Sept 04 8:27 a.m.	Mindoro and Southern Luzon: Calapan - Intensity V. Atimonan, Quezon - Intensity V. Marinduque - no data available but it must have had equal or greater intensity than at the above places. Extreme S of Mindoro - did not exceed Intensity IV-V. It was felt in all the other provinces of S Luzon, as far as $15^{\circ}5'$ parallel, with Intensity II-III. Its origin seemed situated between Mindoro and Marinduque.	56
1912 Sept 20 7:40 p.m.	Santo Domingo (Batanes Islands): Santo Domingo (Batanes) - Intensity IV-V; short duration. A subterranean noise preceded it.	56
1912 Oct 04 12:15 a.m.	Central Mindanao: Cotabato - Intensity V-VI. Bukidnon - Intensity V-VI. Agusan - Intensity V-VI. Judging from the observations made at Butuan and Cotabato, the place of origin	

Event	Felt Effect	Source
	was to the NE of the last-mentioned province (Cotabato).	56
8:53 p.m.	Central Luzon: Bontoc - Intensity V.	
	Baguio - Intensity V.	
	Nueva Vizcaya - Intensity V.	
	Bulacan - Intensity V. It must have originated in the N of Nueva Ecija, in the southern slopes of the Cordillera known as Caraballo Sur.	56
1912 Oct 07 7:36 p.m.	Talacogon (Agusan, E Mindanao): Talacogon - oscillatory earthquake of Intensity IV-V; direction, S - N; duration, ten seconds.	56
1912 Oct 26 5:16 p.m.	Northern Luzon: Earthquake of Intensity V felt in all the provinces situated to the north of parallel 17.5^{O}N. Its origin was probably close to the island of Camiguin.	56
1912 Nov 05 8:35 p.m.	Sorsogon: Sorsogon - Intensity V-VI.	56
1912 Nov 06 2:22 p.m.	Sorsogon: Sorsogon - Intensity IV-V; direction, SE - NW.	56
1912 Nov 08 3:54 p.m.	Sorsogon: Sorsogon - Intensity VIII-IX; direction, N - S and E - W; the high school, a building of squared, concrete blocks bound to each other with iron clamps, was cracked in many places while the portico of reinforced concrete was also fissured. In the Constabulary barracks, which is a new building of stone, the E wall fell out, while the other walls were cracked and the old stone fence which looks to the N was thrown down; six or seven private houses, built of stone up to the first storey, lost some of their walls while others were cracked; several brick terraces fell in; the facade of the church, built of brick and stone was cracked in several places and threatens to fall; all	

Event	Felt Effect	Source
	the more ancient stone buildings in the town were badly damaged; a large fissure was opened up in the road between Sorsogon and Gubat; many landslides took place among the hills that lie between Sorsogon and Bacon; the water in the bay was agitated. Gubat, Bacon, Manito, Pilar - the towns in which the earthquake was felt with the greatest violence. Bacon - the city hall, the only building constructed of stone up to the first storey, was in a rather bad state; fissures and landslides in the hills to the S and SW, so that many of the abaca plantations were damaged. Manito - there were no masonry buildings and, hence, the damage caused by the earthquake to houses was very slight; many slides took place and fissures were opened in the ground. Pilar - the earthquake was very violent, but without causing any damage.	56
4:06 p.m.	Sorsogon: Sorsogon - Intensity IV-V. The damage caused by this earthquake to the masonry structures of the capital town of Sorsogon, was very visible. Nothing is known about the soundness of the damaged buildings; the convent and the church were indeed old and not well preserved. The great masonry blocks comprising the front and side towers of the church were built of stone and bricks, this mixture being perhaps the reason for the cracks in all directions. Disturbances in the ground occurred chiefly in the alluvial and marine deposits on which the city stands and eastwards on the Gubat road from other towns, all on volcanic soil. No damage was	

Event	Felt Effect	Source
	reported.	65
1912 Nov 11 7:55 p.m.	NE Luzon: Cagayan - Intensity V. Ilocos; Nueva Vizcaya - Intensity III-IV. It was also slightly felt in the extreme SE of the island. Its origin is at some distance from the eastern coast of Luzon.	56
1912 Nov 13 1:49 p.m.	Agusan Valley (E Mindanao): Agusan Valley - Intensity IV-V; long duration. It was also felt in the whole of the N of the valley, according to data received from Butuan and Talacogon.	56
1912 Dec 23 6:39 p.m.	Butuan (N Mindanao): Butuan - Intensity V-VI; oscillatory earthquake; direction, NNE - SSW; duration, 25 seconds. The epicentre of the earthquake was in the Bay of Butuan.	56
1912 Dec 26 11:10 a.m.	SE Luzon: Earthquake of Intensity IV-V which was felt in the following provinces: Sorsogon, Albay, Catanduanes, Masbate, Eastern part of Camarines and N of Samar. Its epicentre was to the N of the San Bernardino Strait.	56
1912 Dec 28 4:01 p.m.	SE Luzon: Earthquake of Intensity V-VI which was felt in the following provinces: Island of Leyte, Sorsogon, Albay, Catancuanes, Masbate, Camarines and Samar. Its epicentre was to the N of San Bernardino Strait.	56
7:48 p.m.	NE Mindanao: Surigao - Intensity IV-V. N of Agusan Valley - Intensity IV-V. The epicentre appears to be very close to Butuan Bay.	56
1913 Jan 17 7:44 a.m.	Western Luzon: Zambales Region - earthquake of Intensity IV-V was felt. It was also felt in the provinces of Pangasinan, Tarlac, Pampanga, Nueva Ecija, Bulacan,	

Event	Felt Effect	Source
	Rizal, Cavite and La Laguna, which represents an area within the Island of Luzon of 280 by 150 kilometres. Its origin seems to have been in the China Sea at a short distance from the coast of Zambales.	57
1913 Feb 03 10:25 a.m.	NE of Mindanao: An earthquake felt throughout the peninsula of Surigao, in the north of the Agusan Valley, and in the Island of Leyte. Its origin was in the Pacific, not far from the NE coast of Mindanao. Surigao - Intensity V; and there was a repetition of Intensity III a short time after the main shock. Agusan Valley - the intensity did not pass III-IV. Leyte - the intensity was not greater than II-III.	57
1913 Feb 27 9:19 a.m.	Butuan (N Mindanao): Butuan - Intensity V; direction, WSW - ENE; duration, 15 seconds. It is probable that it was also felt in a great part of the Agusan Valley and in the subprovince of Bukidnon in the west.	57
1913 Mar 14 4:47 p.m.	Mindanao: Sarangani - heavy quake, direction N - S; duration, 25 seconds. It was a double shock. Heavy trees and posts fell. Davao - very violent earthquake from SE - NW, which lasted from four to five minutes. Before the first movement there were subterranean noises from the SE which lasted two minutes. Pendulum clocks were stopped and bottles and other objects fell from the shelves in the houses, bells rang, and fissures were opened up, from which water and fine sand came. The debris fell to the SE. Several walls in the church and convent were thrown down, while in the town, the palm thatch houses rocked a good deal and many of them	

Event	Felt Effect	Source
	remained out of plumb; crockery was broken in all of them. "This earthquake is a severe one; from the beginning I observed some of the oscillations and movements of the church and convent to be so large that it was a marvel that they were not brought to the ground. Not being able to remain upright, I knelt down but even so I could not keep still, so I lay down on the ground till the vibrations ceased, which appeared to me to be about two minutes. The earthquake seemed to be entirely oscillatory, without vertical shocks, which was the reason so little damage was done." (Rev. R. Poruga, S.J., Davao)	
	Umayan, S of Agusan Valley - the heaviest part of the shock lasted for two minutes and 35 seconds, but the slight trembling was felt for three minutes. Few fallen trees were broken off by the shocks.	
	Baganga - very strong earthquake; duration, one minute and 58 seconds.	
	Talacogon - Rev. C. Sastre, S.J. was preaching in the church at the time of the shocks and, seeing that they lasted so long, they (he and his congregation) all went out into the open. He thought that the whole place would be destroyed, for the ground seemed to go round and the beams of the houses creaked ominously. Duration was more than two minutes.	
	Tandag - "The most severe earthquake felt during my three years in the Philippines. Bells rang during the shock. It lasted about two minutes." (Rev. Walter Fanis, Tandag)	
	Cotabato - very strong earthquake, direction SSE - NNW, felt by everyone in the neighbourhood. Clocks stopped and objects fell from the	

Event	Felt Effect	Source
	shelves in the houses, especially in the shops of the Chinos; lasted for some four minutes.	
	Butuan - very violent earthquake; direction, SSE - NNW; duration, some two minutes. It was not remarkable for its intensity, but very remarkable for its long duration. The people who were in the church at the time were terror-stricken and began to weep when they noted the unusual duration of the shock and heard objects falling. No damage was done to the houses. Water in the river was agitated a good deal and moved from E - W and the boats rocked greatly. (D. Generoso Copin, Observer, Butuan)	
	Cabarbaran and Jobonga - shock was felt with the same intensity as in Butuan, duration was also about two minutes. Several boatmen, who were out at sea near Surigao, felt the shock and it caused waves to rise. (D. Generoso Copin, Observer, Butuan)	
	Zamboanga, Dapitan, Cagayan - reports indicate that the earthquake had an extraordinary duration.	
	Cebu, Bohol, Leyte - perceptible.	
	Cantilan - it was remarkable only on account of its duration, not on account of its violence or damage. There were long softly swinging movements.	57
1913 Mar 17 8:52 a.m.	NE Mindanao, Eastern Visayas: Butuan; Surigao - Intensity IV-V. Leyte; Bohol; Cebu - Intensity III. The epicentre was probably in the eastern part of Butuan Bay.	57
1913 Mar 27 8:51 p.m.	Central Mindanao: Earthquake felt in the districts of Dapitan, Misamis, Lanao, Cotabato, and the N of the	

Event	Felt Effect	Source
	Agusan Valley. Dapitan - Intensity IV-V. Two repetitions of Intensity III-IV at intervals of ten minutes. Cotabato - Intensity IV. Butuan - Intensity II-III. The epicentre was probably to the NW of Illana Bay.	57
1913 Apr 17 8:32 p.m.	Central and Eastern Mindanao: Earthquake felt in the provinces of Misamis, Lanao, Cotabato, Davao, Agusan, the southern part of Surigao and along the eastern coast. The intensity was greater than VII, included part of the coast and the interior between parallels 7.5^{o} and 8.5^{o}. Davao, the Agusan Valley, the southern part of Surigao - Intensity V. The origin of the earthquake must be placed in the Pacific Ocean close to the coast of Mindanao and on the western side of the great deep, sounded by the "Planet". (Philippine Deep)	57
1913 Apr 18 9:15 p.m.	Northern part of Mindanao: It was felt at Intensity VII-VIII in the northern part of Agusan Valley and in the centre and S of the province of Surigao; it was also perceptible with less intensity as far south as Davao and as far as Cotabato and Misamis in the SW and W. The epicentre of this earthquake was in Kantilan. The earthquake threw down heavy statues and damaged the walls of the church in Kantilan. This earthquake was the beginning of a seismic period that caused great consternation to the people of the district and made them fear some tremendous catastrophe.	57
1913 Apr 19 2:48 a.m.	NE of Luzon: Cagayan - earthquake of Intensity IV-V felt throughout the	

Event	Felt Effect	Source
	province; direction, N - S. Its epicentre appears to have been close to the extreme NE of the island of Luzon.	57
1913 Apr 23 4:52 a.m.	Ormoc: Ormoc - oscillatory earthquake of Intensity IV-V; direction, W - E; duration, ten seconds. Its epicentre was in the Bay of Ormoc toward the WSW, where there exists a hypocentre of slight depth.	57
1913 May 04 7:35 a.m.	NE of Mindanao: Earthquake of Intensity IV-V. There was a repetition of less intensity two houses afterwards.	57
1913 May 07 8:03 a.m.	NE of Mindanao: Earthquake of Intensity V-VI. There were three repetitions of less intensity in the next 50 minutes.	57
1913 May 08 4:04 a.m.	NE of Mindanao: Earthquake of Intensity V, preceded and followed by other shocks of less intensity.	57
1913 May 09 1:35 a.m.	NE of Mindanao: Earthquake of Intensity IV-V.	57
1913 May 17 6:28 p.m.	NE of Mindanao: Surigao and northern part of the Agusan Valley - earthquake of Intensity V-VI. It was repeated with less intensity at 9:05 p.m.	57
1913 May 29 9:30 p.m.	N of Luzon: Ilocos Norte and Sur and northern part of Mountain Province - Intensity VII. NW of Cagayan - Intensity VI-VII. Loud subterranean noises were very noticeable in both Ilocos Norte and Sur and they appeared to come from the E before the first perceptible shocks, duration not less than 30 seconds in any part of the area. Judging from the different intensities in Ilocos and Cagayan, it would appear that the epicentre must be placed within the Island of Luzon, near the central Cordillera,	

Event	Felt Effect	Source
	not far from parallel 18°N.	57
1913 Aug 23 10:10 a.m.	Benguet: Baguio - Intensity VII. Cervantes and San Fernando - Intensity VI. Dagupan - Intensity V. Bayombong - Intensity III-IV. Baguio - falling of objects within the houses and of all of the chimneys, and the production of small secondary cracks in walls and cracking and breaking away of coating of walls. Fissures in the ground were not observed. From the rest of the Province of Benguet to the N, there are reports that in Cabayan and other ranches some Igorot houses collapsed; no fissures in the ground or breaking of the rock-faced terraces. The origin is within the confines of Benguet. Zone of perceptibility extended as far as Vigan, the capital of Ilocos Sur, thus reaching a distance of 100 kms. to the NW.	57
1913 Aug 27 4:03 a.m.	Butuan, N Mindanao: Butuan - oscillatory earthquake; Intensity IV-V; direction, SW - NE; duration, about 15 seconds.	57
1913 Sept 04 11:00 p.m.	Samar: Samar, Leyte, SE of Luzon and NE of Mindanao - earthquake of Intensity V. E of Samar - intensity did not pass V, accompanied by subterranean noises. Leyte and NE of Luzon - earthquake felt. Surigao, NE of Mindanao - intensity must have been from IV-V for it awoke people from sleep. Agusan Valley - perceptible. Its	

Event	Felt Effect	Source
	origin was in the Pacific opposite the eastern coast of Samar. (Philippine Deep)	57
1913 Sept 29 3:05 p.m.	E Samar, NE Mindanao: NE Mindanao - Intensity IV-V; duration, long. E Samar - Intensity III. Butuan - first, very weak movements which lasted about 15 seconds, after which they increased in intensity without losing the undulatory character for about 25 seconds, when they again decreased so that the whole duration was almost one minute. Its origin was very probably in the Philippine Deep, but somewhat more to the south.	57
1913 Oct 07 10:12 a.m.	Western Visayas, NW Mindanao: Dumaguete - Intensity VI. The direction was SE - NW; duration, more than 20 seconds. Dapitan - Intensity III; duration, three seconds. Southern part of Panay and Cebu - Intensity III-IV, with a relatively long duration. Cuyo, N of Panay and Negros - Intensity III. Its origin appears to have been to the SSW of Negros and the mesoseismic area comprehended a long narrow zone in the SW - NE direction not far from the island.	57
1913 Oct 16 12:35 a.m.	NE of Mindanao: Surigao, Northern part of Agusan Valley - Intensity V. Surigao and But an - Intensity V. Its origin was probably in the Peninsula of Surigao, perhaps in the region of Lake Mainit.	57
1913 Oct 23 6:52 p.m.	Island of Panay: NW of the province of Iloilo - Intensity IV-V. Island of Panay - Intensity IV. Its	

Event	Felt Effect	Source
	origin appears to have been within the island itself towards the NW of the Province of Iloilo.	57
1913 Nov 01 7:01 a.m.	N of Luzon: Aparri - Intensity V. Laoag - Intensity IV. Benguet, W of Luzon - perceptible shock. It probably originated close to the NE part of the island as is deduced from the fact of the greater intensity and duration which it had in Aparri compared with Laoag.	57
1913 Nov 05 4:25 p.m.	Ormoc, W of Leyte: Ormoc - oscillatory earthquake of Intensity V; direction, SW - NE; duration, ten seconds.	57
1913 Nov 12 5:54 p.m.	Ormoc, W of Leyte: Ormoc - oscillatory and jerkily moving earthquake; Intensity V; direction; SSW - NNE; duration, 15 seconds.	57
1913 Nov 13 3:36 a.m.	W of Luzon: Earthquake of Intensity V principally along the coast for about 120 kms. in Ilocos Sur. Perceptible for a distance of more than 60 kms inland. It originated not far from the coast, probably in the China Sea.	57
1913 Dec 19 2:00	Butuan, N of Mindanao: Butuan - oscillatory earthquake of Intensity IV-V; direction, N - S; duration, six seconds. Epicentre of this earthquake was probably in Butuan Bay.	57
1914 Jan 14 12:39 p.m.	Jolo: Jolo - oscillatory earthquake of Intensity V; direction, WSW - ENE; duration, five seconds. It was preceded by a subterranean noise.	57
1914 Jan 20 12:43 a.m.	N of Samar, SE of Luzon: Catanduanes Island - earthquake felt, accompanied by subterranean noises. N of Samar - Intensity V.	

Event	Felt Effect	Source
	Albay - Intensity V.	
	Sorsogon - Intensity V. Origin was to the north of the San Bernardino Strait not far from Catanduanes Island.	58
1914 Jan 21 4:51 a.m.	Jolo: Jolo - Intensity IV-V; oscillatory; direction, S - N; duration, seven seconds.	
	Basilan - felt with less intensity. Its origin was probably in the NE of the Celebes Sea.	58
1914 Jan 28 9:47 p.m.	SW of Mindanao: Cotabato - Intensity IV-V. The shock was accompanied by subterranean noises.	
	Zamboanga - Intensity III. Its origin was very probably in the sea to the south of Illana Bay.	58
1914 Jan 31 10:05 a.m.	S of Luzon: Earthquake of Intensity IV-V felt in the following provinces: Batangas, Bataan, Southern part of Zambales, Cavite, Bulakan, Nueva Ecija, Rizal and N of Tayabas. Its origin was probably in the Pacific to the ENE of Manila, close to the eastern coast where there exists one of the centres which affects Manila. The area affected had a prolongation of 300 kms in the SW - NE direction and rather more than 100 kms in the NW - SE.	58
1914 Feb 20 12:27 p.m.	NE of Mindanao: Surigao and Northern part of Agusan Valley - Intensity VI-VII.	
	Butuan - Intensity VI. Direction of the first shock was E - W and a subterranean noise apparently from the E preceded the earthquake. It probably originated in the Pacific in the great deep, not far from the place of origin of the earthquake of April, 1913.	58

Event	Felt Effect	Source
1914 Feb 24 7:52 p.m.	W of Mindanao, S of Negros: Dapitan, Cotabato - Intensity V-VI. Zamboanga, Misamis, Southern part of Negros - perceptible but with less intensity. Its origin was probably in the NW of Illana Bay. The area affected by the shocks had a diameter of about 500 kilometres.	58
1914 Feb 26 8:40 p.m.	S of Negros, NW of Mindanao: Dumaguete - Intensity IV-V. Dapitan - felt but with less intensity.	58
1914 Mar 16 6:44 a.m.	Eastern Visayas: Samar - Intensity VI-VII. N of Panay - perceptible. Batag - small island to the N of Samar, subterranean noises were heard. Outside the islands of Samar and Leyte, which were closest to the place of origin, the earthquake was felt with decreasing intensity in a zone very much prolonged in the SSE - NNW direction, which extended from the NE of Mindanao to the NE of Luzon, a distance of 1,000 kms. The damage done was to old buildings only. In the description of the earthquake, sent by several observers, it is noted that the large oscillations were preceded by slow gentle movements, which they considered as moving jerkily and which lasted long enough to be recognized. its epicentre was in the northern part of tne "Philippine Deep" in the Pacific, to the E and ENE of the Island of Samar.	58
1914 Mar 18 12:56 a.m.	E of Mindanao: Butuan and Davao - Intensity IV-V. Surigao - Intensity III. It is not possible to determine whether this earthquake had its origin in the Philippine Deep which is close to	

Event	Felt Effect	Source
	the eastern coasts of the island or in the seismotectonic line of the Agusan Valley and the Gulf of Davao.	58
1914 Mar 23 2:16 a.m.	E of Mindanao: Agusan Valley and Gulf of Davao - Intensity V.	58
1914 Mar 26 9:29 p.m.	W of Ormoc: Ormoc - Intensity IV-V; direction, NE - SW; duration, ten seconds.	58
1914 Mar 28 9:59 p.m.	W of Ormoc: Ormoc - Intensity V; oscillatory; direction, WNW - ESE; duration, ten seconds. The origin of this shock apparently volcanic because of the very small extent of this earthquake.	58
1914 Apr 25 10:39 p.m.	North of Luzon: Aparri and Laoag - sudden jerky movements; Intensity VI.	
	Vigan and Tuguegarao - less intensity.	
	Cagayan Province - perceptible earth-quake.	
	Ilocos Sur and Norte - perceptible earthquake.	
	Babuyanes Island - it was also felt. Its origin must have been very close to the northern coastline at the extremity of the Central Cordillera.	58
1914 July 05 12:11 a.m.	SE of Samar: Oscillatory earthquake felt throughout the whole of the eastern and southern parts of the Island of Samar with Intensity IV-V; duration, six to seven seconds. It originated in the submarine deep which borders the eastern coast of the island.	58
1914 July 14	Butuan, N of Mindanao: Butuan - oscillatory earthquake; direction, NNW - SSE; duration, ten seconds; Intensity V.	58

Event	Felt Effect	Source
1914 July 19 12:55 p.m.	W of Mindanao: Cotabato - vertical movements followed by slow horizontal oscillations of Intensity V and apparent direction; S - N, were observed. Dapitan - oscillatory motions were noted of Intensity III-IV and direction SE - NW. It is probable that the seat of origin of the shock was in the northern part of Illana Bay.	58
1914 July 20 1:10 a.m.	Dumaguete, SW of Negros: Butuan - felt but with very little intensity. It is also certain that it was felt in the northern part of Mindanao and had its origin to the W of the volcanic islet of Camiguin. Dumaguete - Earthquake of Intensity IV-V. Northern part of Mindanao - felt.	58
1914 Aug 03 12:16 p.m.	NE of Luzon: Earthquake of Intensity V-VI, felt throughout the whole of the Province of Cagayan. Aparri - sudden jerky and rotary movements were observed which produced heavy shocks and lasted more than ten seconds. Tuguegarao - only slow oscillations, apparently in the NE - SW direction. Mirador Observatory, Baguio - felt by some few persons who were sitting still. The epicentre of this seems to be within the province of Cagayan, probably at a short distance from Aparri to the SE.	58
1914 Aug 19 7:53 p.m.	N of Luzon: Earthquake of Intensity V, felt throughout the whole of the northern part of Luzon above 16^{o} latitude N. Ilocos Sur and Ilocos Norte - Intensity V; duration, 30 seconds.	

Event	Felt Effect	Source
	N of Mt. Province - intensity slightly greater.	
	Cagayan, Benguet, Isabela, and La Union - did not exceed force II and III of the scale. The epicentre was in the Central Cordillera between 17°40' latitude N and 18° latitude N.	58
1914 Sept 12 6:03 p.m.	Butuan (N Mindanao): Butuan - oscillatory earthquake; direction, NNE - SSW; Intensity V-VI; duration, 12 seconds. The point of origin of this earthquake was probably in Butuan Bay. The seismograms place the epicentre at a distance of 670 kilometres from Manila.	58
1914 Sept 17 8:46 p.m.	Island of Masbate: Masbate - earthquake of Intensity V-VI. It seems to have originated close to the south of the western spur of Masbate Island about 400 kms from Manila.	
	NW of Samar, SE of Luzon, N of Panay, and N of Mindanao - the earthquake was also perceptible.	
	Butuan - the shock was perceptible.	
	Camarines and Albay - which are very unstable regions and all with subsoils of alluvium and tuff; the shock was very perceptible.	
	Northern Negros - Intensity IV.	
	NW Samar and W of Leyte - scarcely perceptible.	
	Nueva Caceres - felt.	58
1914 Oct 01 6:21 a.m.	Catanduanes and N Samar: Catanduanes and N Samar - earthquake of Intensity IV-V. Its origin was to the E of the San Bernardino Strait in the great Philippine Deep. It was felt principally at the stations of NE Samar and Catanduanes; its duration was about 20 seconds.	58

Event	Felt Effect	Source
1914 Oct 23 2:21 p.m.	Island of Mindanao: Earthquake of intensity IV-V which was felt throughout the whole of the island of Mindanao, except in the district of Dapitan, and also in the northern part of the province of Misamis. All the reports received from Mindanao assign to the earthquake the same purely oscillatory character, with large slow undulations. Notwithstanding the large amplitude of the undulations, as may be seen from the curves of the seismometer (0.22 metre with a pendulum one metre long), people who were outside did not notice it unless they were standing still; it certainly lasted one minute.	58
1914 Nov 01 9:36 a.m.	Ormoc (W Leyte): A jerkily moving and oscillatory earthquake; direction, SE - NW; Intensity V and duration, ten seconds. Its source of origin appears to have been in the sea to the W of Leyte.	58
1:50 p.m.	NW Luzon: Ilocos Norte and Northern part of Ilocos Sur - greatest intensity of IV-V. It probably originated in the China Sea but very close to the Ilocos coast.	58
1914 Nov 24 2:55 a.m.	Butuan (N Mindanao): Butuan - oscillatory earthquake, direction, ENE - WSW; duration, approximately six seconds.	58
1914 Dec 15 6:26 a.m.	Samar and Leyte: Felt throughout the whole of the Island of Samar and in the NE of Leyte. It originated to the E on the Great Philippine Deep of the Pacific and consequently affected principally the eastern part of Samar, where there was also a repetition of Intensity III, ten minutes later.	58
1914 Dec 16 11:58 a.m.	SE Mindanao: Davao and Cotabato - Intensity IV-V.	
	Agusan Valley - It was also felt.	58

Event	Felt Effect	Source
1915 Jan 05 6:08 a.m.	SE Luzon and Visayas: Masbate - Intensity V-VI, direction, WNW - ESE. Camarines, Albay, Northern Panay - Intensity V; direction, NNE - SSW. Its epicentre seems to be located W of Masbate Island, not far from its coast.	59
1915 Jan 21 11:05 p.m.	Central Mindanao: Agusan Valley; Cotabato; Western part of Davao; Bukidnon; Lanao; Southern part of Misamis - Intensity V-VI. At Cotabato, the shocks and the rumbling sounds awakened the people with terror. Its origin probably lay toward the NE end of the Cotabato Province. This earthquake was distinctly felt throughout an area of more than 200 kilometres long and wide.	59
1915 Jan 28 3:06 a.m.	SE Luzon and Visayas: West of Masbate; SE of Luzon; NW of Samar; Leyte; N of Panay - originated in the same region west of Masbate. Intensity IV-V.	59
1915 Feb 13 12:39 a.m.	Central Mindanao: Cotabato; Lanao; Bukidnon; Agusan; Davao - Intensity IV-V. Its origin seems to have been in the NE part of Cotabato province.	59
1915 Mar 12 10:49 p.m.	SE Luzon Eastern Visayas: Masbate - Intensity VI-VII. All SE part of Luzon; Samar; Leyte; Cebu; Panay, part of Negros - Intensity II-III. Its epicentre was close to the western part of the Island of Masbate. Butuan - lightly felt. This earthquake was recorded in Europe and America.	59
	March 12, 1915 quake with epicentre close to Masbate, of Intensity VII and a "certain amount of damage done by the tremor." The quake was also	

Event	Felt Effect	Source
	felt in Sorsogon, Albay, Camarines, Samar, Leyte, Cebu, and the northern part of Panay.	123
1915 Apr 12 9:06 p.m.	Northern Luzon: Earthquake of Intensity VI-VII, felt in the northern part of Luzon. The region affected extended from the northern coast to the parallel 15°30'N, a distance of about 300 kms. The epicentre lies between the northern coast of Luzon and the Babuyanes Island.	59
1915 Apr 18 7:27 p.m.	Western Luzon: Earthquake of Intensity V felt throughout the provinces of Ilocos Sur, La Union, Pangasinan and the southern part of Mt. Province. Its origin was some 240 kms from Manila, very probably to the west of the Benguet Subprovince along the low coast ranges which exist in that part of Luzon.	59
1915 May 08 1:13 p.m.	Mindoro and S Luzon: Mindoro - Intensity V. The epicentre lies some 140 kms from Manila, in all probability in the northern part of Mindoro where the shock had more intensity than in the neighbouring provinces of Luzon.	59
1915 May 16 9:55 p.m.	Sabtan and Batan Island: Sabtan and Batan Island - Intensity VII-VIII; duration, about six seconds; accompanied by rumbling sounds.	59
	Batan - caused damage to buildings. Public and large buildings, such as convents, churches, municipal and government halls, have some small cracks. Of private houses, many were destroyed, due chiefly to the poor quality of the mortar and the bad system of the roof construction.	65
1915 May 17 6:15 a.m.	N Luzon: Cagayan - Intensity IV-V; duration, 13 seconds.	
	Mountain Province and Ilocos Norte Province - lightly perceptible. It must have been felt also in the	

Event	Felt Effect	Source
	Babuyanes Islands. Its origin, some been in the Pacific, not far from the NE end of Luzon.	59
1915 June 08 10:39 a.m.	N Luzon: Ilocos Norte, Ilocos Sur, Mountain Province, Cagayan - the intensity reached V in the most northerly part of them. The origin lies some 450 kms from Manila, probably in the Babuyanes Islands.	59
1915 June 18 7:33 a.m.	Mindoro and S Luzon: Mindoro - Intensity IV-V. Southern Luzon - felt with less intensity. Its origin seems to have been within Mindoro.	59
1915 June 25 12:20 a.m.	Mindanao: Surigao - Intensity V. Its origin was in the great Pacific Deep, east of island.	59
1915 July 08 12:43 p.m.	Samar and Leyte: Samar Leyte - Intensity V. It was the strongest of a series of earthquakes that started at 8:54 a.m. and lasted until five o'clock in the afternoon. The origin probably lies near the SE end of the strait which separates the two islands of Samar and Leyte, somewhere to the NE of St. Pedro Bay.	59
1915 Aug 05 4:48 p.m.	Central Mindanao: Cotabato and the southern part of Agusan and Bukidnon - Intensity IV-V. It had a long duration and its origin apparently lies towards the northeastern limit of the valley and district of Cotabato.	59
1915 Sept 05 8:19 p.m.	Agusan Valley E Mindanao: Agusan Valley - Intensity VI-VII. The earthquake was also felt throughout the provinces of Davao, Cotabato and Bukidnon. Bunauan; Butuan - the earthquake was very sharp and caused great consternation among the people.	

Event	Felt Effect	Source
	Butuan - some 50 kms north of the epicentre, the movements of the ground were of great amplitude but slow and the earthquake had a total duration of about 60 seconds. One of the artesian wells of the town was obstructed by sand for many hours but it flowed again.	59
1915 Nov 13 6:54 p.m.	Central Luzon: Eastern Pangasinan; Northern Nueva Ecija - Intensity V. It was felt throughout the Central Provinces of Luzon, covering an area more than 400 kms long from Ilocos Sur to Manila in the N - S direction, and about 230 kms wide, extending from Baler Bay in the Pacific to the Zambales coast on the China Sea. The origin was in the seismotectonic line which crosses the Island of Luzon from Baler Bay to the Lingayen Gulf.	59
1915 Nov 16 8:08 a.m.	Ormoc, W Leyte: Ormoc - oscillatory earthquake of Intensity IV-V; WSW - ENE direction; duration, eight seconds. The origin was in the known centre existing near the Camotes Islands.	59
1915 Nov 19 4:20 a.m.	N Luzon: Extensive earthquake felt in the northern provinces of Luzon, Nueva Ecija, Tarlac, Zambales, Pangasinan, La Union, Montanyosa, Nueva Vizcaya, Isabela, Cagayan, Ilocos Sur, and Ilocos Norte. Laoag City - Intensity VII. The more damaged structures in Laoag were the provincial building, Constabulary quarters and offices, the provincial governor's residence, and a few houses. In the wooden houses and palm thatch shacks the loss was due to the breakage of household objects. Some fissures opened in the sandy banks near the mouth of the Laoag River on the China Sea coast. It is also added that during the earthquake, big waves were observed.	

Event	Felt Effect	Source
	Aparri - Intensity V with long duration.	
	Vigan - Intensity IV.	
	Southern part of Cagayan - Intensity III.	
	Southern Provinces - Intensity II-III.	59
1916 Jan 04 11:12 a.m.	Panay Island: Maasin, Panay - Intensity VIII. The town most affected by the earthquake was Maasin, where the bell-tower fell down, the church was cracked beyond repair, and many other old buildings sustained similar damage. In the neighbouring towns and districts some smokestacks of sugar mills were thrown down and old buildings slightly damaged. This earthquake had its origin in a region known as the most unstable of the whole island of Panay. It originated within the southeastern part of the island at a distance of some 25 kms from the coast. It had an epicentral area rather small, about 20 kms in diameter. Isoseismal V ran at a distance of 30 kms from Maasin; III-IV through the island of Panay; II-III at some 250 kms distance to Leyte; III in Cuyo.	60
1916 Mar 09 7:27 a.m.	Eastern Mindanao: Butuan - Intensity IV-V; lasted for more than ten seconds. Low noise which accompanied the quake, as well as the first impetus or propagation of the waves, seemed to come from the south.	
	Surigao - Intensity II-III; lasted for more than ten seconds. The seismographic records of Manila placed the epicentre at a distance of 850 kms and those of the Wiechert seismograph of Butuan at less than 100 kms; these values may correspond to the centre of the Agusan Valley in the vicinity of parallel 8^{o}N.	60

Event	Felt Effect	Source
1916 Apr 02 6:53 a.m.	Ormoc W Leyte: Ormoc - oscillatory earthquake of Intensity IV-V; direction, SW - NE; duration, nine seconds.	60
1916 Apr 26 7:33 a.m.	Northern Luzon: Ilocos Norte; Apayao; Cagayan - Intensity IV-V. Its epicentre lay at some 400 kms from Manila probably near the end of Central Cordillera.	60
1916 June 10 5:26 a.m.	SE Mindanao $6^{o}N - 128^{o}E$: Agusan Valley - Intensity IV-V. Davao - Intensity IV. Butuan - Intensity III.	60
1916 June 29 6:49 p.m.	SE Mindanao: Earthquake was felt over the eastern part of Mindanao. The intensity did not exceed degree IV-V. Butuan - the Observer calls attention to the great amplitude and extraordinary slowness of the waves, a fact distinctly noticed by the people of Butuan who were surprised at the unusual feeling of drowsiness and sea-sickness experienced during the long 20 seconds which the gentle rocking lasted.	60
1916 July 05 4:39 p.m.	Ambos Camarines & Albay, SE Luzon: Camarines; Albay - Intensity IV-V. The origin seems to have been in the sea, NE of these provinces, presumably near the northern part of the Philippine Deep.	60
1916 July 06 4:16 p.m.	SE Luzon: Ambos, Camarines; Albay, Sorsogon - Intensity V. The second earthquake which shook all the SE provinces of Luzon and it originated in the same Deep as the preceding one, but apparently in a place situated somewhat more toward the south.	60
1916 July 13 11:01 p.m.	Sulu Sea $9.4^{o}N - 122^{o}E$; Dumaguete (S Negros) - Intensity VI-VII.	

Event	Felt Effect	Source
	Cuyo, Panay - Intensity IV. Negros, Western part of Mindanao - Intensity IV.	
	Visayan Island, Mindanao, Palawan - perceptible.	60
1916 Aug 07 3:08 p.m.	Samar & Leyte - Southeastern Samar - Intensity V-VI.	
	West of Samar and Leyte - Intensity III. It evidently had its origin in the Pacific Ocean not far from the eastern coast of Samar where the Philippine Deep reaches depths of 8,000 metres within 50 kms from the coast.	60
1916 Aug 09 2:54 a.m.	N Luzon 19°N - 121°E: Northernmost part of Luzon; Ilocos Norte; Mountain Province; Cagayan Province - Intensity VI-VII. The earthquake decreased so rapidly that the shock was only very slightly perceptible outside of the mentioned provinces.	60
1916 Aug 15 7:38 a.m.	SE Luzon: Sorsogon; Albay - Intensity V-VI. It was distinctly felt through the whole southern and southeastern part of Luzon and the adjacent islands of Burias, Masbate, Marinduque. Its origin lay NE of Ticao Island.	60
1916 Aug 27 7:43 a.m.	N Luzon: Northeastern Cagayan - Intensity V.	
	Rest of Cagayan; Ilocos Norte - Intensity III-IV. The origin probably lay in the Pacific.	60
1916 Sept 13 1:11 a.m.	N Luzon 17.5°N - 121°E: Mountain Province - Intensity VI-VII. It was also felt through all the northern Luzon provinces lying above the 16°N parallel. The epicentre was in Mountain Province near 17.5°N and 121°E, where there exists a well-known and active centre.	60
9:50 a.m.	Agusan Valley (E Mindanao): Agusan	

Event	Felt Effect	Source
	Valley - Intensity V.	
	La Esperanza - Intensity IV.	
	Butuan - Intensity II-III.	60
1916 Nov 16 2:11 a.m.	Samar & Leyte Island 11.5°N - 126.4°E: Eastern Samar - Intensity IV-V.	60
1916 Nov 30 7:54 p.m.	NE Mindanao: Earthquake of Intensity IV-V and long duration. It originated in Butuan Bay. The greatest intensity was experienced by the towns located on the eastern shore of the said bay, but it was distinctly felt throughout the whole province of Surigao and the northern part of Agusan Valley.	60
1917 Jan 10 9:21 p.m.	Western Visayas: Cuyo; Southern Negros; Western Mindanao - Intensity V.	
	Panay - Intensity III. It originated in the northeastern part of the Sulu Sea near the meridian 121°E and the parallel 10°N. In this region exists a seismotectonic line running in a NW - SE direction. It was not registered outside of the Archipelago.	61
1917 Jan 31 12:02 p.m.	S Mindanao: Sarangani Bay - Intensity VIII-IX. In the town of Glan and its nearest suburbs, on the east and southeast shores of the bay, wooden structures of the constabulary and many native houses were destroyed; cracks and slides were also produced in the ground; one landslide killed seven persons in a suburb. The destroyed wooden structures we suppose to have been of the temporary type used in such outlying posts, while the native houses are commonly a hut of bamboo and palm leaves, raised from one to three metres above the ground on bamboo or wooden poles very little driven into the soil. Such	

Event	Felt Effect	Source
	structures are not earthquake-proof especially when the rocking lasts for nearly a minute, as happened in this instance. To these unfavourable conditions of the structures must be added the soft and loose character of the soil, consisting of volcanic tuff, sand and ashes, lightly covered in places by alluvial material from the Glan River. From the island of Sarangani, sparsely inhabited by pagans, we have not any report. Reports received from Cotabato & Kabakan, in the Moro District, & from Davao, situated respectively NW, NNW, & NNE of Glan, show that the isoseismal VI-VII must be drawn at a distance of about 140 kms from the last place. The shocks were stronger and of greater duration at the former than at the last station. Whole island of Mindanao; Eastern part of Sulu Archipelago - Intensity II-III.	61
	A severe earthquake occurred in Glan and vicinity at 11:35 a.m., January 31, 1917, which lasted about one minute. Eighteen (18) houses were wrecked in Glan and Glan Padidu and seven (7) people killed in the district of Tuyan by a great landslide caused by the earthquake. All the constabulary buildings at Glan were wrecked, except the new addition to the barracks, and one soldier, Private Paris, and one prisoner, Mamayu Gas, were slightly injured by falling timbers. The government dock at Glan was so badly damaged that it can scarcely be used for anything until extensive repairs have been made. The new store-room of the colony store that was just recently built was completely destroyed and the other colony buildings so badly damaged that they will not be worth repairing. The school-house in Glan was wrecked and has been abandoned, school being held in the public dispensary until	

Event	Felt Effect	Source
	another place can be arranged. The surface of the ground cracked open in some places to a width of from two to three feet and, in several places, water and mud were thrown several metres into the air. A tidal wave of about four feet came in a few minutes after the earthquake. The damage to all government buildings, property and supplies is estimated at $4,510.69. There have been many light earthquakes at irregular intervals during the day and night ever since the severe shock of the 31st of January.	86
1917 Feb 04 6:30 p.m.	SE Mindanao: Davao - Intensity IV-V.	
	Talacogon - Intensity V.	
	Butuan - Intensity III. The origin was about 930 kms from Manila and 150 kms from Butuan, probably in the southern part of Agusan Valley.	61
1917 Feb 14	Mindanao: There was quite a severe shock which shook down several houses that had been practically wrecked by the earthquake of January 31st	86
1917 Feb 18 6:49 a.m.	Batanes Island and Luzon $20^{\circ}N$ - $122^{\circ}E$: Basco, Batanes - Intensity IV with subterranean rumbling.	
	Northern coast of Luzon - Intensity III. The epicentre lay between the two islands but a little nearer to Taihoku (Formosa) than to Manila, presumably in the Balintang Channel.	61
	Damage: It destroyed several private houses in the town of Ibana, Batanes Islands. Many of them had been weakened by earlier earthquakes and the defects of the roofs did the rest.	65
9:24 a.m.	Eastern Visayas $10.3^{\circ}N$ - $126.5^{\circ}E$: NE end of Samar & Leyte - Intensity VI.	

Event	Felt Effect	Source
	SE of Samar & Leyte - Intensity VI.	
	Mindanao; Cebu; Bohol; Masbate; Samar; Leyte; SE part of Luzon; Catanduanes - Intensity II-III.	61
1917 Feb 25 1:21 p.m.	SE Luzon, Samar, and Leyte 14°N - 126°E: SE Luzon - Intensity IV-V.	
	Samar - Intensity IV-V.	
	Leyte - Intensity IV-V. It originated in the Pacific Ocean near 14°N and 126°E. (as determined from seismographic records of Manila, Guam, Tarhoku and other Japanese observatories)	61
1917 Mar 02 10:40 a.m.	SE Luzon: Catanduanes - Intensity V.	
	Sorsogon - slightly felt.	
	Albay - slightly felt.	
	Eastern Camarines - slightly felt.	61
1917 Mar 18 7:25 a.m.	Eastern Visayas: Catanduanes; Northern Samar - Intensity V-VI.	
	SE Luzon; Masbate; Samar; Leyte; NE Mindanao - perceptible shock.	61
1917 Mar 20 11:02 p.m.	NE Mindanao: Northern Agusan Valley - Intensity V; duration more than 20 seconds.	
	Surigao Province - Intensity V; duration more than 20 seconds. A steamer felt the shock in the sea while on its way to Butuan.	61
1917 Apr 09 7:12 p.m.	Ilocos Norte NW Luzon: Central part of Ilocos Norte - Intensity V-VI. At 7:52 p.m., a second earthquake of Intensity IV-V was felt. The meso-seismic area of these shocks comprised a zone of some 40 kms in an E - W direction from near the coast to the Cordillera Central. Their origin seems to have been of a rather shallow or local nature as	

Event	Felt Effect	Source
	only the first shock was slightly perceptible in the northern and southern parts of the province.	61
1917 Apr 12 6:02 a.m.	N Luzon: Northernmost part of Cagayan; Ilocos Norte and Apayao - Intensity V. Their origin was about 420 kms from Manila probably near the volcanic island of Camiguin. The fact that they were neither felt in the central and southern parts of the said provinces nor registered by the seismographs of Formosa tends to persuade one of their volcanic character.	61
1917 Apr 24 4:33 a.m.	Eastern Luzon: Baler - Intensity V. Nueva Ecija; Nueva Vizcaya; Isabela and Benquet - also felt. It originated at a distance of 250 kms from Manila, probably in the Pacific, E of Baler Bay.	61
1917 May 28 8:02 p.m.	SE Luzon: Laguna; Tayabas; Ambos; Albay; Romblon; Marindeque - Intensity IV-V.	61
1917 June 09 2:33 p.m.	N Luzon: Earthquake of Intensity IV-V felt throughout the provinces situated N of the 17^{o}N parallel. It probably originated near the northern end of the Cordillera Central; both in Ilocos Norte and in the northern stations of Cagayan Province. The principal movement gave the impression of E - W direction.	61
1917 July 16 1:12 p.m.	SE Luzon: Ambos Camarines - Intensity IV-V. Albay - Intensity IV-V. The epicentre lay at a distance of about 340 kms from Manila, probably in the Pacific, N of the said provinces and near to the northern end of the Philippine Deep.	61
1917 Aug 09 7:56 p.m.	SE Luzon, N Samar: Catanduanes - Intensity V.	

Event	Felt Effect	Source
	Northern Samar - Intensity III-IV.	
	Albay - Intensity III-IV. This earthquake was accompanied by subterranean rumbling in Batag Island, N of Samar. The epicentre was some 500 kms from Manila in the Philippine Deep, NE of the San Bernardino Strait.	61
1917 Sept 08 6:23 a.m.	SE Luzon: SE Luzon - Intensity VI-VII. The epicentre was in the vicinity of the old volcanic cone Isarog, through the N and NE slopes and plains consisting of soft volcanic ejecta thrown by the volcano and carried down by water. The earthquake was felt with decreasing intensity to a distance of 200 kms from the epicentre. The shock had sufficient intensity to open some cracks in the ground and in some buildings.	61
1917 Oct 04 4:14 a.m.	Ormoc W Leyte: Ormoc - oscillatory earthquake of Intensity V; direction, S - N; duration, 15 seconds. Of very local character, registered only at Butuan about 240 kms from Ormoc.	61
1917 Oct 14 7:13 p.m.	N Luzon: Northern Luzon - Intensity V. Very probably the origin was under the sea between the Babuyan Group and the coast.	61
1917 Oct 19 12:18 a.m.	NE Mindanao: Surigao - Intensity V-VI.	
	Agusan Valley - Intensity V-VI.	
	Eastern Misamis Province - Intensity V-VI. The origin lay in the Pacific, not far from the Surigao coast.	61
1917 Nov 03 11:26 a.m.	Naga (SE Luzon): Naga - Intensity V; direction, NNE - SSW; duration, 15 seconds.	
	Catanduanes Island - felt. Originated outside Camarines toward the N	

Event	Felt Effect	Source
	under the sea.	61
1917 Nov 17 6:19 a.m.	Eastern Mindanao: Earthquake of Intensity V-VI with long duration and ample but very slow undulations felt at the following places: Agusan, Davao, Cotabato, Bukidnon and Eastern Misamis. In Butuan, the slowness of the oscillations made objects move, but without jerks; persons experienced a marked feeling of sea-sickness. The direction of the movement, as observed in movable objects and in some water tanks, was S - N; it was preceded by a low noise advancing from the south. The water of an artesian well ceased to flow during the strongest movements, afterwards flowing under greater pressure but in sudden bersts or gushes, as if momentarily confined. The epicentre seems to have been in the southern portion of the Agusan Valley.	61
1917 Nov 18 10:59 a.m.	Sulu Sea between 8^{o} and 9^{o}N and 121^{o} and 122^{o}E: Zamboanga - Intensity VI-VII; causing small cracks in the buildings of that town. Mindanao; Basilan/Sulu Archipelago/ Palawan, Cuyo/Western and Central Visayas/Panay, Negros/Cebu and Bohol - fairly perceptible shocks.	61
1917 Dec 02 2:22 a.m.	S Luzon: Calapan - Intensity V. The epicentre was in the China Sea west of the Mindoro Straits. Felt through the southern part of Luzon and the adjacent islands of Mindoro and Calamianes. The shaken area had an extent of 500 kms in the N - S direction and less than half this quantity, E - W. It was registered at Butuan.	61
1918 Jan 03 9:09 p.m.	SW Luzon and Mindoro: SW Luzon; Mindoro; Cuyo; Calamianes Island - Intensity V, in a N - S extension of more than 500 kms. The origin lay at	

Event	Felt Effect	Source
	a distance of 160 kms from Manila probably between Mindoro and Busuanga Islands.	62
1918 Jan 16 2:00 p.m.	SE Luzon: Catanduanes; Albay; Sorsogon - the origin lay north of the entrance of the San Bernardino Strait.	62
1918 Jan 24 11:02 a.m.	E Visayas and Mindanao: Samar, Leyte; NE Mindanao - Intensity IV-V. Origin in the Philippine Deep near to the parallel 11°N.	62
1918 Feb 07 1:22 p.m.	E Mindanao: Eastern Mindanao; Central and Southern Surigao; Agusan, Davao - Intensity VI-VII, with long duration.	
	Dapitan - fairly perceptible. The origin seems to have been in the Pacific Deep near the parallel 8°N at a distance of about 950 kms from Manila. It was recorded throughout the world.	62
1918 Mar 09 4:17 p.m.	Samar, Leyte NE Mindanao: Southern Leyte - Intensity VI-VII; duration, over 30 seconds.	
	NE Mindanao; Samar - The origin was within the island of Leyte in its southern portion where two seismotectonic lines converge. It seems that the isoseismals had an elliptic form of the longer axis extraordinarily extended in the N - S direction approximately corresponding to the configuration of the island of Leyte and its main tectonic lines.	62
1918 Apr 14 6:42 p.m.	Cotabato SW Mindanao: Cotabato - Intensity IV-V. It originated in the eastern part of the Rio Grande Valley and was felt through the whole district.	62
1918 May 22 3:10 a.m.	Samar, Leyte E Mindanao: North-eastern Mindanao; Samar; Leyte - Intensity VI; it had its greatest	

Event	Felt Effect	Source
	intensity in northeastern Mindanao. It originated in the Philippine Deep.	62
1918 May 30 8:18 a.m.	N Luzon: Northern Luzon - Intensity V. It originated outside of the island toward the eastern part of the Babuyanes group.	62
1918 June 09 4:16 a.m.	Central Mindanao: Cotabato, Lanao, Davao - Intensity IV-V. The origin lay in the Celebes Sea, off the coast of Mindanao.	62
1918 June 12 3:47 p.m.	Ambos Camarines (SE Luzon): Eastern Region, Isarog Mountain - Intensity VI-VII, at 3:50 p.m. strong after-shocks felt only at distances of about 20 kms. Tigaon and villages on the eastern slopes - minor aftershocks were frequent in the afternoon and following night. Libod - 32 perceptible shocks were noticed. All the shocks had the same character as those felt in October 1917, great intensity, very small extension and a rumbling noise preceeding each one. Libod and Lapoc - many landslides and cracks were reported. It is certain that the origin of the shocks lies in the old volcano. The cause of so many shocks originating on the eastern side of the mountain probably lies in a readjustment which takes place in the breaks and fault existing there. Such faults could be produced by some lateral eruption or perhaps by a later abortive strain which fractured and ruined the eastern section of the volcanic cone.	62
1918 June 21 11:29 p.m.	E Mindanao: Eastern Mindanao - Intensity V-VI. The origin seems to have been in the Agusan Valley. It was perceptible within a radius of	

Event	Felt Effect	Source
	about 200 kms.	62
1918 July 01 2:10 p.m.	Eastern Visayas: Central and Eastern Mindanao; Samar, Leyte SE Luzon - Intensity VI; with great extension of about 1,000 kms.	62
1918 Aug 15 8:20 p.m.	Southern Mindanao between 5^{o} and $6^{o}N$ and 124^{o} and $125^{o}E$: Mindanao - violent and long earthquake.	
	Southern Cotabato - Intensity IX. All houses were either destroyed or badly shaken, cracks were produced in the ground and landslides on the mountains causing the death of about 50 persons in the civil settlements in the Sarangani Bay area. The origin of this great earthquake was in the sea, probably between the meridians 124^{o} and $125^{o}E$ and parallels 5^{o} and $6^{o}N$. Shortly after the earthquake, a tsunami, estimated at some places at 24 ft high, invaded the coast in an extension of about 150 kms from near Port Lebak to Glan, drowning and carrying away many persons and animals. The small islands of Sarangani and Balut, placed at the eastern end of the epicentral region, sustained similar damage from the shock and tide; 46 people killed; large rivers were completely obliterated and new ones created. It was also reported that the tsunami was between six and eight feet, killing six people and carrying a number of logs quite a distance inland.	62
	Glan - all native small boats were either destroyed or taken out to sea; houses destroyed; tsunami with height of 18 feet; drowned a number of people, cattle, horses and other domestic animals and destroyed all of the food supply of those living near the beach and all of the crops in the lowlands.	84

Event	Felt Effect	Source
1918 Sept 02 4:01 a.m.	S Mindanao: Southern Mindanao; Cotabato; Davao - Intensity V-VI. Originated in the Celebes Sea.	62
1918 Sept 05 1:20 a.m.	S Mindanao: Southern Mindanao - Intensity IV-V; originated in the Celebes Sea and felt over the greatest portion of the island.	62
1918 Sept 13 2:55 p.m.	Batanes Island: Batanes - violent earthquake of Intensity VII-VIII; causing some damage in the towns of Ivana and Sabtan. Santo Domingo de Basco - Intensity VII. Batan and Sabtan - the shock produced only some cracks in the thinner walls and the interior partitions of the buildings. Owing to the scarcity of timber, bamboo and other light materials, the houses in those islands are constructed of stone and lime; all, excepting the churches, convents and some other public buildings, are very small and low structures, consisting of four walls, some two to four metres high, roofed with a heavy and badly connected wooden frame and a thick thatch. On examining the ruins, it is found that the construction of the houses was very defective, on account of the very poor composition of the masonry work and the great weight and faulty construction of the roof. Ivana - the earthquake ruined the small houses as well as the great buildings, churches and convents, because in all prevailed defective construction. The ground was nearly undisturbed, neither cracks nor landslides of consequence being caused by the shocks; old bridges of one, and even three, arches were entirely spared. The great contrast exhibited by the complete destruction of Ivana and its suburb	

Event	Felt Effect	Source
	San Vicente in comparison with the undâmaged condition of San Carlos, seems to be due to the different location, San Carlos being built on level ground.	
	Sto. Domingo de Basco - accompanied by deep subterranean noises similar to distant detonations.	62
	Sabtan and Ivana - stand on soft and heterogenous ground formed by the talus of near cliffs and the ejection cones of torrents of ejecta. Nevertheless the effects on the ground were not so remarkable as on structures, and two small bridges escaped damaged except for a few cracks in the sides.	65
1918 Oct 08 12:17 p.m.	Batanes Islands: Batanes - earthquake of Intensity V; duration, seven seconds.	62
1918 Oct 26 3:06 a.m.	Southern Mindanao: Zamboanga; S Lanao; Cotabato; Davao - earthquake of Intensity IV-V. The origin lay in the Celebes Sea.	62
1918 Oct 27 1:01 a.m.	Central Mindanao: Extensive earthquake of Intensity V-VI; it was felt throughout the whole island. The epicentre was located some distance W of the Agusan Valley in the Bukidnon subprovince.	62
1918 Oct 30 2:03 a.m.	Basco, Batanes: Basco - earthquake of Intensity V-VI. This shock must be considered as an aftershock of the earthquake of September 13th which was felt chiefly in the destroyed towns of Ivana and Sabtan.	62
1918 Nov 01 11:00 p.m.	Batanes Island: Ivana; Sabtan - earthquake of Intensity VI, pulling down some walls damaged by the earthquake shocks that occurred in September.	62
1918 Nov 21 8:35 a.m.	Samar Island: Northern Samar - extensive earthquake of Intensity V-	

Event	Felt Effect	Source
	VI. It was also perceptible in SE Luzon, Leyte and NE Mindanao, an extension of about 700 kms in the NNW - SSE direction. Origin near Pacific Deep, E of San Bernardino Strait.	62
1918 Nov 23 9:53 a.m.	Ambos Camarines SE Luzon: Central part encircling Mount Isarog - earthquake of Intensity IV-V.	62
1918 Nov 25 8:08 p.m.	N Luzon: Northernmost provinces of Luzon and in the NW - earthquake of Intensity IV-V. It originated in the China Sea, W of Babuyanes Islands.	62
1918 Dec 02 6:34 p.m.	SE Luzon: Ambos Camarines; Albay - earthquake of Intensity IV-V. The epicentre seems to have been in the Pacific NE of the province.	62
1919 Jan 01 9:36 a.m.	E Mindanao: Mindanao - earthquake of Intensity VII. It was very extensive, shaking the whole island of Mindanao and Visayan, Samar, Leyte, Cebu and Bohol. The intensity with which it was felt at Butuan and other towns of the northern portion of the Agusan Valley indicates that the epicentre lay either within the valley or near to the Pacific Coast at about 9^{o} latitude N.	63
2:02 p.m.	E Mindanao: Second earthquake but of less extension than the $9^{h}36^{m}$ a.m. earthquake. Its origin apparently was located at a greater distance from Butuan and Manila.	63
1919 Jan 30 2:48 a.m.	Ormoc (W Leyte): Ormoc - Intensity VI; duration, 15 seconds. Origin under the sea, some distance from the west coast where there exists a local and shallow centre.	63
1919 Feb 04 9:06 p.m.	NW Luzon: Cape Bojeador - earthquake of Intensity IV-V; duration, eight seconds.	63
1919 Feb 09 12:04 a.m.	W Leyte: Ormoc - oscillatory and jerkily moving earthquake; direc-	

Event	Felt Effect	Source
	tion, E - W; Intensity V; duration, ten seconds.	63
1919 Mar 16 3:53 p.m.	E Mindanao and Visayas: Agusan - Intensity V.	
	Eastern Mindanao - Intensity III. Extensive earthquake; originated in the Pacific and felt throughout Central and Eastern Mindanao and the islands of Samar and Leyte. Its intensity was variable at different stations, depending very probably on the nature of the soil.	63
1919 Mar 21 9:03 a.m.	Southern Luzon and Visayas: Marinduque - Intensity VII.	
	Northeast Mindoro - Intensity V-VI and the whole provinces of Tayabas, Laguna and the eastern part of Batangas, Rizal, Bulacan and Nueva Ecija. This extensive earthquake was felt throughout the southern and southeastern part of Luzon and the islands of Mindoro, Marinduque, Romblon, Panay and Masbate. Its mesoseismic area extended from Marinduque northwards across the isthmus of Tayabas to Baler Bay, nearly along the meridian 111^{o}E following the direction of one of the main seismotectonic lines of the Archipelago.	63
	Movement was vertical; a big chunk of cement dropped out of the Olsen Bodega on Calle Helios and this was the only damage to a building in Manila. The hanging electric lamps in the Erlanger and Galinger building were set swinging for three-quarters of an hour. Quake lasted for a few seconds. Men inside the buildings "did the one-step down flights of stairs" and "horses that were turning corners spread their legs apart to hold firmly to mother earth."	124

Event	Felt Effect	Source
1919 Apr 17 12:42 a.m.	E Mindanao: Earthquake of Intensity V felt throughout the eastern half of the island. It originated to the E in the Pacific, not far from the coast.	63
1919 Apr 27 8:22 a.m.	SW Tablas and NW Panay - were started by violent shocks which caused considerable damage. The ground continued trembling with varying intensity the whole day, 27th th; on the 30th the number of shocks fell considerably. The towns of Tablas where greater damage was caused by the shocks are Odiongo, Look and Santa Fe, all located in the west or rather southwest, portion of the island. The shocks retained also unusual intensity through NW Panay. Carabao Island, S of Tablas - some landslides were reported. Odiongo - a thunder-like sound burst, followed by an earthquake which caused all bustling people to fall and lie on the ground in prostrate positions. Some that chanced to be near some posts and trees managed to hold on to htem. The rocking of buildings and trees, falling of the walls of some houses and the old church made a very confusing noise. Strong concrete buildings were partly damaged. The ground in different parts of the locality cracked and water in many places sprang from the cracks. Some of the ground cracks are so large and deep that a water buffalo could easily be buried in them. The extension of the mesoseismic area of the first and strongest earthquake hardly measured 100 kms in the N - S direction, comprising a little more than the southern half of Tablas Island, the group of the Carabao Islands and perhaps the NW end or peninsula of Panay. In the E - W direction, it extended itself much	

Event	Felt Effect	Source
	less, having the form of an ellipse prolonged in the direction of the meridian. In the northward direction the shock was felt as far as southern and southeastern Luzon. Southeastwards the perceptible waves reached southern Negros and southwestwards Puerto Princesa in Palawan.	63
	In the towns of Look and Santa Fe effects similar to those reported for Odiongo were reported by different correspondents.	99
1919 May 05 6:01 a.m.	N Luzon and Batanes: Aparri - Intensity V.	
	Sto. Domingo (Batan Island) - less intensity due to local condition of soil. Epicentre apparently lay in the vicinity of the Balintang Channel.	63
8:25 p.m.	SE Luzon: Irosin - earthquake of Intensity V in the region around Bulusan Volcano. The very local character of this sharp and long earthquake, felt only close to the volcano, places the shock among the actual indications of activity of the said volcano.	63
1919 May 25 7:39 p.m.	Samar and Leyte: SE Samar - Intensity V.	
	Rest of Samar - Intensity III.	
	Leyte and SE Luzon - Intensity III. Origin in the Philippine Deep.	63
1919 June 06 1:51 a.m.	W Mindanao: Zamboanga - Intensity VI.	
	Lanao, Cotabato - Intensity VI. Originated in the Celebes Sea between Zamboanga and Cotabato.	63
1919 June 15 10:37 p.m.	W Mindanao: Zamboanga, Lanao, Cotabato - earthquake of Intensity IV-V. Originated in the Celebes Sea,	

Event	Felt Effect	Source
	very probably the epicentre of the shock that occurred on the 5th	63
1919 June 25 10:35 a.m.	Vigan: An earthquake of Intensity VI-Vii startled the inhabitants of Vigan and the towns of the vicinity and of the southern part of the province. During a long 15 seconds, only a few roofs were damaged and some walls cracked. The mesoseismic area of this earthquake comprised the region of Vigan and the southern coastal region to a distance of about 50 kms; but its extension inland or eastwards was very small. The shocks were fairly perceptible throughout the whole island north of the parallel 16.5°.	99
1919 July 05 10:45 a.m.	Port Lebak SW Mindanao: Earthquake of Intensity IV-V felt in the southern portion of Cotabato Province. The origin was in the Celebes Sea.	63
1919 Aug 06 1:35 p.m.	S Mindanao: Cotabato and Davao - Intensity VI.	
	Butuan - lightly felt. Originated in the Celebes Sea.	63
1919 Aug 07 2:00 a.m.	Davao (SE Mindanao): Davao - Intensity IV-V. Originated apparently towards the southern part of the Davao Gulf.	
	Butuan - weakly felt.	63
1919 Aug 11 4:40 p.m.	Central Mindanao: Earthquake of Intensity V-VI felt only in the province of Lanao. It probably originated in the volcanic region of Makaturing and Ragang volcanoes, S of Lake Lanao.	63
1919 Aug 14 3:59 p.m.	Tablas Island: Tablas Island - Intensity VI-VII. The epicentral region comprised the southwestern portion of the island.	
	Romblon, NW Panay - it was also	

Event	Felt Effect	Source
	felt. It was preceded by four premonitory shocks of Intensity IV-V at 6^h0^m, 6^h8^m, 6^h28^m and 13^h11^m GMT.	63
1919 Aug 19 10:21 p.m.	N Luzon: Extensive earthquake felt with Intensity V-VI in the northernmost provinces of Luzon. It was felt throughout the main portion of the island north of parallel 16°N. Its origin lay near the northern end of the central mountain range of Luzon.	63
1919 Sept 26 5:07 p.m.	NW Luzon: Extensive and heavy earthquake which had its epicentre in Ilocos Sur, shaking the same region affected by the earthquake of June 25^{th}. It reached Intensity VII, causing some damage to the masonry buildings and walls; the displacement of some blocks of masonry indicates that the stronger movement had a W - E direction. The earthquake was perceptible throughout the main part of Luzon Island north of the parallel 13°N.	63
1919 Sept 27 3:42 a.m.	Central Mindanao: A series of earthquake shocks in central and western Mindanao. In Lanao Province, the most affected, not less than 17 shocks of Intensity V-VI were felt; the strongest noticeable through the whole island occurred at 3^h42^m, 3^h51^m, 5^h41^m, 6^h51^m and 8^h55^m. Their origin was probably in the Celebes Sea south of Illana Bay.	63
1919 Oct 13 1:38 p.m.	Central Mindanao: Davao - Intensity IV-V. Butuan - Intensity IV. Cagayan; Cotabato; Bukidnon - Intensity II-III. The epicentre was probably near to S Mindanao and E of Celebes Sea.	63
1919 Nov 07 12:44 a.m.	NW Luzon: Earthquake of Intensity VI-VII felt in many provinces of northern Luzon; its origin was not far from the NW end of this island,	

Event	Felt Effect	Source
	in the China Sea. From this principal shock followed a series of seven aftershocks of varying intensity, noticeable only in a small area of the NW end of Luzon. The shock felt at Cape Bojeador on the 4th may be considered as a foreshock. As none of them was recorded either at Manila or at Taihoku, they must have been very local.	63
1919 Nov 12 4:21 a.m.	NE Mindanao: Earthquake of Intensity V-VI felt in the Surigao district, and in the northern portion of the Agusan Valley. The rumblings which at Surigao preceded the shocks apparently came from the W. A seismic centre of volcanic or rockfall character has been repeatedly indicated by the writer as existing within this region of Mindanao.	63
1919 Dec 16 12:49 a.m.	SE Mindanao: Earthquake of Intensity IV-V felt in the Province of Davao. The origin seems to have been towards the eastern part of the Celebes Sea.	63
1919 Dec 30 9:55 a.m.	N Luzon: Ilocos Norte; Apayao; Cagayan - Intensity VI-VII. Babuyanes - same or greater intensity.	63
1920 Feb 26 6:39 a.m.	Mindanao	74
1920 May 07 1:40 p.m.	Mindanao: Felt throughout eastern Mindanao, the eastern Visayan Islands and the Taroena, Netherlands, East Indies.	74
1920 June 10 8:29 a.m.	Mindanao: Felt strongly throughout eastern Mindanao and Samar.	74
1920 Aug 03 11:01 a.m.	Mindanao: Felt throughout the eastern half of Mindanao.	74

Event	Felt Effect	Source
1920 Nov 03 11:35 p.m.	Mindanao: Felt strongly in the city of Zamboanga and with less intensity in other parts of southwestern Mindanao and the islands.	74
1921 Jan 26 6:40 p.m.	SE Luzon: Earthquake of Intensity IV-V in the region of the volcanic cone Isarog, Camarines Sur. It was preceded by a deep rumbling sound, and the jerks had a similar brusqueness.	64
1921 Mar 29 12:44 a.m.	S Luzon: Earthquake of Intensity V, felt chiefly through the eastern part of Batangas Province, Western Tayabas and Southern Laguna. Ambulong - the principal shock was but lightly felt.	64
1921 Apr 06 8:24 p.m.	Lais (SE Mindanao): Earthquake of Intensity IV-V. Its origin lay apparently towards the Sarangani Islands, SSW of Davao Gulf. The record at Butuan places it at a distance of 300 to 400 kilometres.	64
1921 Apr 25 6:40 a.m.	Central Mindanao: Earthquake of Intensity V; very short duration. Felt throughout Bukidnon Province, chiefly in its eastern and southern parts. It was recorded with great amplitude, but not felt at Butuan. The epicentre probably lay towards the boundary between Agusan and Bukidnon.	64
1921 May 11 evening	Mindanao: The most violent earthquake of the period; subterranean rumblings and great disturbance in the sea; the damage done in the towns located closely north and south the seventh parallel was not considerable.	100
1921 May 21 2:00 p.m.	Batag, Samar: Very violent shock put out of commission the clockwork at the lighthouse of Batag, Samar, followed by a series of aftershocks which caused considerable apprehension to the people of Samar	

Event	Felt Effect	Source
	Islands and the provinces of Sorsogon, Catanduanes, and Albay for five days.	100
1921 June 09 6:37 p.m.	E Mindanao: Earthquake of Intensity V-VI felt throughout the southern and eastern portion of Mindanao, comprising the provinces of Agusan, Davao and Cotabato. Its origin presumably lay towards the SW end of the Agusan Valley, in the mountainous region which divides it from the centre of the island. The intensity given by the ten stations which reported it, does not compare with the N - S extension of over 400 kms of the shaken area.	64
1921 July 25 3:11 a.m.	SE Luzon and N Samar: NE Samar - Intensity V-VI. It was also felt in the provinces of Sorsogon and Catanduanes. epicentre in the Philippine Deep.	64
5:22 a.m.	NE Samar: Earthquake of Intensity VI-VII in NE Samar, which had a larger extension towards Luzon and Leyte Islands.	
	Batag Island - continuous tremblings were felt.	64
1921 Sept 11 11:25 p.m.	Irosin (SE Luzon): Jerkily moving earthquake of Intensity IV-V; long duration. Most probably originated near Bulusan Volcano, active at present.	64
1921 Sept 13 6:49 p.m.	SE Luzon: Earthquake of Intensity IV-V covering the same area as the preceding one, that is, V in the provinces of Albay and Sorsogon.	64
1921 Sept 29 1:10 a.m.	Samar and Leyte Islands: Earthquake of Intensity V-VI, felt throughout these two islands; its local origin possibly lay near north of Leyte; the shock was of limited extension. Recorded at Butuan and Zikawei.	64

Event	Felt Effect	Source
1921 Nov 08 12:02 a.m.	E Mindanao and Visayas: A very extensive and violent shock was felt throughout eastern Mindanao and Visayas which marked the beginning of an exceedingly disturbed period lasting until the end of the month. The most affected portion of Mindanao extended from the eighth parallel southwards along the coast and district of Caraga, to San Agustin Point. Intensity VII - included a portion about 200 kms long on the coast and nearly a hundred westwards to the interior. Intensity III - embraced, to the north, the Visayan Islands and extreme SE Luzon to a distance of 600 kms from Caraga while, northwestwards, the shock was scarcely felt at a distance of 400 kilometres.	
	Manay - destroyed the vault of the church; however, the chapel of that town consisted rather of a wooden hall roofed with corrugated iron. Moreover it was in very bad repair. Some native houses were wrecked; wooden pillars sank in cracks opened in the soil. Numerous crevasses and landslides occurred along the coast and the near hills.	64
1921 Nov 12 12:25 a.m.	W Luzon: Earthquake of Intensity IV-V felt through the mountainous eastern portion of La Union Province and the Baguio region. It was repeated with less intensity two hours later. The epicentre apparently lay in the vicinity of the Santo Tomas mountain block.	
2:38 a.m.	Mindanao: Mati - tidal wave invaded the few bays with low lands existing there.	
	Manay - sustained greater loss in structures and crops from the tidal wave.	64
	Caraga - subterranean rumblings and	

Event	Felt Effect	Source
	great disturbance in the sea.	100
1921 Nov 22 6:22 p.m.	W Luzon: Earthquake of Intensity IV-V; felt along the western portion of Luzon between parallels 14° and 18°N. Its epicentre was located in the northern portion of Zambales.	64
1921 Nov 27 12:51 a.m.	Maasin (S Leyte): Earthquake of Intensity V-VI.	
	Cebú - felt slightly.	
	Butuan - recorded.	64
1922 Jan 15 4:29 a.m.	SW Mindanao: Lanao; Western Cotabato - earthquake of Intensity IV-V; origin in Illana Bay.	65
1922 Jan 19 11:50 p.m.	E Mindanao: Felt on eastern coast south of parallel 8°N and west-ward, southern portion of Agusan - earthquake of Intensity IV-V. The origin lay in the Pacific near the origin of the shock of the 15th.	65
1922 Jan 28 4:41 a.m.	Cebu Island: Cebu City - earthquake of Intensity VII-VIII. The area of destruction comprised the city of Cebu, a central portion of the island north of the capital and the small island of Mactan, in front to the east; the longer axis of this area measured about 40 kms in a NNE - SSW direction. Within this area, the shocks damaged old structures, generally built of coral limestone blocks. Two very old walls, remnants of ruined buildings, and consequently standing without any connection to other structures came down by the force of the shocks; one in the centre of the city and another in the suburb of St. Nicolas. Tile roofs, very numerous in Cebu, suffered more severely. Three of them partly slid down, one very steep and old of the Recoletos Church and Convent and another of a private house. The roof of the Bishop's Palace partially caved in.	

Event	Felt Effect	Source
	Cracks in the soil were noticed chiefly in limestone banks on the seashore of Mactan Island and in concrete floors built on the same. More noticeable was the damage at the junction of mortar culverts, cement and wood laid on limestone. some kilometres north of Cebu, fissures were caused in alluvial soil and on the slopes of hills composed of limestone tuff. With the principal shock was heard a very noisy rumbling, described as that which would be caused by a hundred horses galloping on a large wooden platform.	
	Bohol; Leyte; Samar; Negros; Eastern Panay - the shock was perceptible.	
	Camotes Island; Western coast of Leyte - the shock had a greater intensity.	65
1922 Feb 28 9:14 a.m.	(Origin far from Cebu): Cebu Island - Intensity IV-V. Origin of the two above shocks lay under the sea, which separates Cebu and Leyte. The region is composed of tertiary sedimentary rocks and probably the shock originated in some movement within the trough or syncline, rather than in an old structural fault.	65
	Very strong shock with damage to buildings; death of five persons.	65
1922 Mar 01 5:01 p.m.	SE Negros: Southeast of Negros - earthquake of Intensity VII-VIII, causing some damage to churches and convents, crevasses in the ground and landslides on the slopes of the hills.	
	Bacong - extremely violent. Father Rev. J.K. Boylan reported that, as he was saying his Rosary, the pulpit began to dance, then the huge church walls began to sway to and fro at least six times.	

Event	Felt Effect	Source
	Siaton - destructive earthquake; Father Brennan reported that, at the time of the earthquake, he was seated near the seashore; suddenly the sea rushed up towards him and the trees swayed to and fro. The front walls of the convent collapsed, but no casualties. Zamboangita - caused landslides and opened fissures. (A town situated midway between Siaton and Bacong). Dumaguete - Intensity VI. Siquijor - Intensity IV-V. Tuburan - fairly perceptible. The area shaken by this earthquake was exceedingly narrow in the E - W direction and very long towards NNE, precisely in the same direction as Cebu Island. Along the deep channel and narrows which separate Cebu from Leyte and Bohol, and farther SSW of the affected coast of south Negros from Siquijor, a seismotectonic line may be drawn, which would pass through both the Cebu and the Negros recent seismic epicentres.	65
1922 Apr 13 2:09 p.m.	S Samar and NE Mindanao: Southern Samar; Surigao; NE Mindanao - earthquake of Intensity V. Origin not far to the east in the Philippine Deep.	65
1922 Apr 24 5:31 a.m.	SE Luzon and Visayas: SE Luzon; Marinduque; Romblon; N Panay; N Negros; Masbate; Ticao; Burias; N Samar - earthquake of Intensity VI. Albay Province, southern coasts and Camarines, southern portion of Bondoc Peninsula; Tayabas - It showed greatest intensity with more numerous aftershocks along an E - W line.	65
1922 May 24 11:44 p.m.	Samar and NE Mindanao: Samar; Surigao - earthquake of Intensity IV-V.	

Event	Felt Effect	Source
	Bohol; Cebu; Leyte - very lightly felt. Originated in the Philippine Deep between parallels 10° and 11°N.	65
1922 June 03 4:14 a.m.	E Mindanao: E Mindanao - extensive earthquake of Intensity IV-V. It was fairly perceptible along the E and Southeast coasts of Mindanao and inland to the centre of the island. Its origin lay far off in the Pacific near the southern end of the Philippines Deep toward Talaut Island. It did not cause any alarm because of its slow undulatory movements.	65
1922 June 05 12:20 a.m.	NW Luzon: Ilocos Norte - earthquake of Intensity V-VI. The origin was located in the China Sea close to the NW end of Luzon.	65
5:26 a.m.	NW Luzon: Ilocos Norte - Intensity V.	65
1922 June 25 12:29 a.m.	W Mindanao: Zamboanga; Cotabato; Lanao - earthquake of Intensity VI-VII. Originated in the Celebes Sea, south of Illana Bay. SW coast of Cotabato - experienced greatest intensity.	65
1922 June 30 4:55 a.m.	N Luzon: Earthquake of Intensity IV-V, felt through the northern provinces of Luzon above parallel 17°N. Origin in the China Sea to the NW.	65
1922 July 13 1:00 p.m.	SE Mindanao: Cotabato; Davao - earthquake of Intensity IV-V. Bukidnon; Agusan; Zamboanga - fairly perceptible.	65
1922 July 25 9:28 p.m.	Central Mindanao: Agusan; Lanao - earthquake of Intensity IV-V. Its origin lay towards the northern limit of Cotabato.	65
1922 Aug 28 5:16 a.m.	W Mindanao: Zamboanga; Lanao; Cotabato - earthquake of Intensity	

Event	Felt Effect	Source
	IV-V. Its origin lay 829 kms from Manila in the large gulf formed by the coasts of these three provinces N of the Celebes Sea. It was preceded by rumblings.	65
1922 Aug 30 1:01 a.m.	Tablas and Semirara Island: SW and S Tablas; Semirara Island - earthquake of Intensity VI-VII. Romblon; Mindoro; S Luzon; Marinduque; Cuyo and Panay - felt with decreasing intensity and representing an extension of about 500 kms in a N - S direction and somewhat less from S - W. Carabao; Semirara - the shocks felt were much stronger. Some cracks were reported but these occurred on hill-slides where landslides take place frequently during heavy rains. Its mesoseismic area comprised nearly the southern half of Tablas Island, the northwest end of Panay, the small island of Carabao and chiefly the Semirara Group, SW of Tablas. The origin of these shocks was the same as that of those which occurred in April 1919; it is located some distance to the SW of Tablas, between Carabao and Caluya islets. Both earthquakes had also some similarity in that the shaken area extended more in a N - S direction than from E to W. That seems to indicate the existence of a fault giving rise to the shocks. The general tendency of the present movement is of upheaval rather than of subsidence.	65
1922 Oct 05 7:54 p.m.	N Luzon: Luzon - earthquake of Intensity IV-V lying N of parallel 17°N. Its origin lay near to the northern coast of parallel 17°N.	65
1922 Oct 14 8:15 a.m.	N Luzon: Luzon - earthquake of Intensity IV-V. Origin and extension nearly the same as the preceding.	65

Event	Felt Effect	Source
1922 Oct 30 4:47 a.m.	W Luzon: Benguet Province; Central part of La Union - earthquake of Intensity IV-V. Epicentre in the western portion of Benquet. Movements characteristic of shocks originating in this region.	65
1922 Nov 05 8:36 a.m.	Ormoc (W Leyte): Ormoc - earthquake of Intensity V-VI; long duration.	65
1922 Nov 08 1:05 a.m.	W Mindanao: Zamboanga; Basilan - earthquake of Intensity V. Its origin lay to the S or SSE in the Celebes Sea.	65
1922 Nov 16 6:13 p.m.	Visayan Islands: Extensive earthquake of Intensity V-VI, felt in the islands of Leyte, Masbate, Bohol, Cebu, Negros and Panay. Its greatest intensity was experienced in N Cebu and NE Negros. In N Cebu it caused some cracks in old structures and a general falling of movable objects. It was slightly noticed as far south as Butuan and Camiquin Island, N of Mindanao. The epicentre seemed to be located between N Cebu and Masbate Island.	65
1923 Feb 14 5:43 a.m.	SE Luzon: SE Luzon - extensive earthquake of Intensity IV-V. It was felt throughout the provinces of Albay, Tayabas, Camarines Sur, Camarines Norte, and Marinduque Island. Origin at about 230 kms from Manila, towards the NW of Burias.	66
1923 Feb 25 11:52 p.m.	Panay Island: Panay - earthquake of Intensity V-VI felt throughout the whole island. Its epicentre lay in the central portion of Iloilo Province, where frequently occur local shocks of shallow origin.	66
1923 Feb 26 8:51 p.m.	East Mindanao: Davao - earthquake of Intensity VI. Surigao - Intensity VI. Agusan - earthquake of Intensity VI. Originated in the Philippine Deep	

Event	Felt Effect	Source
	near parallel $8^{O}N$ not far from Mindanao coast. The area of greatest intensity extended about 200 kms along the coast and 80 kms inland to the southern portion of the Agusan Valley.	66
1923 Mar 03 12:51 a.m.	S Mindanao $4.5^{O}N$-$125^{O}E$: Mindanao - extensive earthquake of Intensity VII.	
	Cotabato - the shock was of a violent nature. Extraordinary sea waves were noticed near the coasts up the Rio Grande at Cotabato, some distance from its mouth. It was also perceptible in the southern portions of Cebu, Bohol and Negros Islands about 500 kms distant from the origin.	66
1923 Mar 15 4:46 a.m.	SE Mindanao: Davao; Surigao; Agusan; Cotabato - earthquake of Intensity V-VI. Origin in the Pacific off the SE coast of Mindanao.	66
2:03 p.m.	S Mindanao: Cotabato and Lanao - earthquake of Intensity VI, chiefly on their coasts. The origin lay in the Celebes Sea south of Illana Bay.	66
1923 Apr 09 4:22 p.m.	SE Luzon: Northern portion of Camarines Norte - Intensity IV-V. Originated to the NE in the Pacific.	66
9:51 p.m.	SW Mindanao: W and SW coast of Cotabato - Intensity IV-V. Origin near the Celebes Sea.	66
1923 May 02 1:01 p.m.	NW Luzon: Ilocos Norte; Ilocos Sur; Abra; Western part of Mountain Province - Intensity V. The epicentre was located in the China Sea near Ilocos Sur.	66
1923 July 08 3:04 p.m.	N Luzon: Ilocos Sur; Ilocos Norte; Abra; Northern Mountain Province; Cagayan - extensive earthquake of Intensity IV-V. Its origin lay probably near to the NW coast of Luzon and the hypocentre was not	

Event	Felt Effect	Source
	very deep, in spite of its intensity and great extension.	66
1923 July 19 3:41 p.m.	Panay and Cuyo: Panay; Cuyo; Northwest Negros - earthquake of Intensity V, felt in the said islands. Its origin was in the Sulu Sea south of the Cuyo group.	66
1923 Aug 24 3:26 p.m.	Pangasinan Benguet: Extensive earthquake of Intensity VII. It was repeated with the same intensity at 5:03 p.m. The total area of these earthquakes comprised the provinces of Pangasinan, Benguet, La Union, Northern Tarlac and Zambales, W Nueva Ecija and Nueva Vizcaya and southern Ilocos Sur; a land extension of 250 kms in the N - S directionand about 200 kms E - W.	
	Northern Pangasinan; Southern La Union; Benguet Province - the greatest intensity developed, which culminate in Sto. Tomas Mountain. Damage: Baguio; Benguet - NNE of Sto. Tomas, the shocks caused cracks in stone and mortar walls.	
	Pangasinan - 30 kms SSW of Sto. Tomas, some stone fences were destroyed and a portion of the sandy banks of one of the arms of the Agno River slid down. The first shock was also felt with Intensity IV - V at Baler on the Pacific coast, more than a hundred kms distant to the east from Pangasinan. That the shocks in Pangasinan could be felt particularly toward Baler seems not at all unexpected because it is nearly certain that in the northern limit of the central plain of Luzon exists a fault running from the Lingayan Gulf to the Baler coasts. Possibly the vibrations at the Pangasinan end of the fault started a movement in its eastern end. The epicentre lay in the Sto. Tomas block or very near, caused by movement in the very recent faults	

Event	Felt Effect	Source
	at the end of the Pleistocene which cross the mountain.	66
1923 Aug 30 10:40 a.m.	NE Mindanao: Agusan; Surigao - extensive earthquake of Intensity VI. Its origin apparently lay in the northern portion of the Agusan Valley possibly in the Pacific.	66
1923 Sept 27 3:03 p.m.	E Mindanao & Visayas: Eastern Mindanao; Samar; Leyte - earthquake of Intensity V-VI. The origin lay in the Pacific near the 9^{o}N parallel at a considerable distance from the affected coasts.	66
1923 Sept 30 2:03 a.m.	NW Luzon: Abra Province - earthquake of Intensity VII, where it damaged several stone walls. Vigan, Ilocos Sur - great intensity, but without causing any damage. Laoag - lightly felt. The origin of the shocks seems to have been within the Abra Valley or in the narrow Western Cordillera separating it from the coast.	66
1923 Oct 15 8:49 p.m.	E Mindanao and Visayas: N and NE Mindanao; Cebu; Bohol; Samar; Leyte - Intensity V-VI. Its origin lay in the Pacific near the Surigao Strait at about 10^{o}N.	66
1923 Oct 29 8:51 p.m.	W Luzon: Western Luzon - earthquake of Intensity V; between 13.5^{o}N and 16^{o}N. Its origin was in the China Sea not far from the Zambales coast.	66
1923 Oct 30 3:50 a.m.	NW Luzon: Ilocos Sur; Abra - Intensity VII. Amburayan; Benguet; La Union; Pangasinan; N Zambales - Intensity VI. Origin in the China Sea near Ilocos Sur.	66
1923 Oct 31 5:51 a.m.	S Luzon: Batangas; W Tayabas; N Mindoro - earthquake of Intensity VI-VII. About three hours later,	

Event	Felt Effect	Source
	October 31st at 9:30 a.m. it was repeated with the same intensity and extension. The origin lay at about 130 kms from Manila in the eastern part of the Mindoro Strait.	66
1923 Nov 02 12:45 a.m.	NW Luzon: Ilocos Norte - earthquake of Intensity V in the greatest part of the province. Its origin lay in the China Sea near to the NW end of Luzon.	66
1923 Nov 12 12:55 p.m.	Abra NW Luzon: Abra Province - Intensity IV-V. This and the shocks that occurred in September had their greatest intensity in the NW portion of the province, near the confluence of the Abra River with its main tributary running from the NE.	66
1923 Dec 12 1:48 p.m.	NW Luzon: Abra Province; Amburayan; Lepanto; N Benguet - Intensity IV-V. It had a very shallow origin. The affected area was more than 140 kms long in the N - S direction, about 100 kms corresponding to the course of the Abra River, while it was not noticed at any of the coast stations, from 25 to 30 kms distant to the west Abra River on the western side of the narrow Western Cordillera.	66
1923 Dec 21 4:35 a.m.	S Luzon: Central and Western part of Batangas - Intensity IV-V. Origin west of the strait separating Luzon from Mindoro.	66
1924 Jan 15 6:23 a.m.	NW Luzon: Ilocos Norte; Ilocos Sur; Abra - earthquake of Intensity IV-V. In the northern part of this province, where it displayed greater intensity, it was accompanied by subterranean rumbling. Its origin was located at about 400 kms from Manila in the China Sea not far from the Ilocos Norte coast.	67
1924 Feb 14 3:35 a.m.	Samar, Leyte NE Mindanao: Extensive earthquake of Intensity IV-V, origin to the east Pacific in the	

Event	Felt Effect	Source
	Philippine Deep.	67
1924 Feb 17 2:14 a.m.	Agusan Valley: Northern half of Agusan Valley - earthquake of Intensity IV-V and little extension between parallels 8° and 9°N.	67
1924 Apr 15 12:22 a.m.	Mati: This Pacific earthquake is called the Mati earthquake because this town on the Pacific Coast, SE Mindanao, was the nearest to the epicentre and suffered its most disastrous effects. It was one of the greatest submarine disturbances originating in the West Pacific. The epicentre was in parallel 6.1°N and meridian 126.8°E. The mesoseismic area had a radius of about 200 kms and included in its western sector nearly the whole province of Davao, which occupies the SE portion of Mindanao. The effects within this area were very irregular depending on the conditions of the ground. The same may be said of the boundaries of the isoseismal, including the area in which the shocks were violent but not destructive. Thus, for instance, the waves showed greater intensity along the Agusan Valley than along the coastal mountain chain or eastern Cordillera, nearer to the origin, and northwestwards to Bukidnon than westwards through Cotabato. Effects: Destruction in the towns along the Pacific to parallel 8°N and around the Davao Gulf coasts was not as excessive as feared, might have been due to the kind of constructions, most of them of wood and other lighter materials. The heaviest loss was in the interior partitions of the houses. Several bamboo houses fell down. Quantities of movable objects tumbled and were destroyed. The shocks caused more serious effects in the ground than in structures. Fissures and landslips occurred in the steep	

Event	Felt Effect	Source
	hills and the alluvial soils, and rockfalls were conspicuous chiefly in the cliffs of the coasts. A large tract of the seashore of Mati at the head of the small Pujada Bay, separated from the ocean by a narrow peninsula, sank about half a metre. It is not known whether the subsidence extended through the bay and the south end of the peninsula enclosing it. This peninsula consists of a rocky hill, formerly a separate island, united more recently to the coast by a low alluvial tract of land. Another unisolated rocky islet divides the entrance of Pujada Bay into two channels. Extension of the earthquake - the isoseismal V-VI extended to a distance of about 400 kms in the N and NW direction but less to the west, as indicated by the fact that the hypocentre was prolonged in the direction of the Philippine Deep where the shocks originated.	
	Mindanao and Visayas - isoseismal III to a distance of about 1,000 kilometres.	
	Butuan - about 300 kms distant to the NNW and comprised within the isoseismal VI-VII. On board a steamer at anchor in Caraga Bay, about 150 kilometres NNW of the epicentre, two sharp shocks followed by three not so sharp but stronger were felt, similar to the effect of the keel's striking against rock. The sea became suddenly and terribly rough, causing in the boat strong jerks that threatened to break the anchor chains; at the same time big waves were seen to break against the cliffs of the near coast.	67
	Destructive earthquake: Hit chiefly the coast of Mati where it caused damage to structures and produced cracks, fissures and subsidence in hilly and alluvial grounds. A	

Event	Felt Effect	Source
	tsunami followed which flooded low coastal shores but without considerable damage. Had more disastrous effect along the coast of Surigao and in the northern portion of the Agusan Valley. Although no loss of life was reported, the material damage was great. Cracks and landslips were conspicuous in alluvial ground and in steep surfaces chiefly along water courses. It was ascertained that only old or poorly constructed structures have sustained damage, and the disturbances in the ground could be explained by either its nature or the steepness of the angle. Mortar and stone walls, as well as modern cement buildings, generally escaped without any serious cracks. The central area of this earthquake had an extension of about 100 kms along the coasts of Surigao, south of the capital, and of some 50 kms inland to the Agusan Valley.	
1924 Apr 24 3:42 p.m.	Central Luzon: Nueva Vizcaya; S Isabela; N Nueva Ecija: N Pangasinan - Earthquake of Intensity IV-V. Its epicentre lay between Nueva Vizcaya and Benguet, apparently in the Agno Valley.	67
1924 May 07 12:10 a.m.	W Luzon $16^{o}N$ - $118^{o}E$: Agno, W Coast - earthquake of Intensity V and noticed at several other stations of Luzon. It was not generally felt because its origin lay far in the China Sea. Shortly after the earthquake, the town of Agno on the west coast of Luzon was invaded by four big sea waves which flooded its low portions and caused great consternation to the people but no material damage or harm to persons. Some persons in their excitement and fear imagined that they could see instantaneous fires northwestwards in the sea. They probably saw earthquake lights. The town of Agno is	

Event	Felt Effect	Source
	located on the north side of the Balincaguin River at a distance of about three kilometres from its mouth. The earthquake was also very distinctly felt at Bolinao, a town on the same coast but about thirty kilometres to the north, and noticed in several towns of Pangasinan, Ilocos, Benguet and in the Central Provinces as far south as Manila.	67
1924 May 16 8:52 p.m.	E Visayas and NE Mindanao: Samar; Leyte; N Cebu; NE Mindanao - earthquake of Intensity IV-V. Its origin lay in the Pacific Deep, E of Samar.	67
1924 May 24 5:03 a.m.	SE Mindanao: Surigao; Agusan; Davao; E Cotabato - extensive earthquake felt with Intensity IV-V through the E and SE part of Mindanao. Its epicentre was the same as that of the April 14 earthquake and may be considered as one strong aftershock.	67
1924 June 10 3:44 a.m.	Western Visayas: Panay Island - extensive earthquake of Intensity V-VI. It was also noticed westwards as far as Cuyo Island and eastwards in central and northern Negros and Cebu, and E - W distance of about 350 kms. The epicentre was located to the W and NW of Iloilo Province, Panay, in the region well known as the seat of shallow hypocentres where frequently strong shocks start.	67
1924 July 21 11:26 a.m.	Capiz; Iloilo; NW Occidental Negros - earthquake of Intensity IV-V. Its epicentre lay in the northern portion of Iloilo Province.	67
1924 Aug 28 4:00 p.m.	SE Mindanao: Southern portion of Davao - earthquake of Intensity V. Butuan - slightly felt. Origin near the Sarangani Islands.	67
1924 Aug 30 11:07 a.m.	Surigao and Agusan $9^{\circ}N$ - $127^{\circ}E$: Surigao - Intensity VIII-IX.	

Event	Felt Effect	Source
	Agusan Valley - Intensity VIII. Talaud Island; SE Luzon; E Coast Mindanao; Zamboanga and Panay - fairly perceptible. Its origin lay in the Philippine Deep. Damage: Butuan - none of the strong structures, either old but in good repair or modern, suffered damage, excepting a hospital of faulty construction. Generally the portions damaged by the shocks in buildings of strong and mixed materials were the interior partitions and upper walls, consisting of an inner frame of wood or bamboo covered with mortar, whenever such frame was rotten or decayed. The greatest damage in churches and other public and private buildings was sustained by similar walls but in none of them did the lower portion, constructed of stone in good mortar, present any considerable cracks caused by the earthquake. Numbers of light native houses fell down but nearly all were in bad condition. Effects on the ground: Agusan River - along the seashores and riverbanks, and inland in rough mountain soils, fissures and landslips occurred, but principally in steep slopes and soft recent banks of alluvium. It was noticed along the Agusan River that only those portions of its banks which had been deposited very recently tumbled down, whilst those composed of old clay silt and alluvium, even when very high and steep, withstood the shocks. In the extensive plain of the town of Butuan, cracks opened only close to the river the places filled up during the last 50 years, due to the recession of river towards the opposite bank, and the subsidences occurred in the very recently filled approach to the	

Event	Felt Effect	Source
	landing.	
	Pacific Coast - only recent alluviums at the mouth of rivers and very steep cliffs were crevassed. Underground currents of water, which formerly had their outlets on the beach sprang out high on the slope of the mountain after the shocks crevassed and caused the land to slide down; within the cordillera landslips felled trees and caused big rocks to tumble down, an effect which greatly awed the poor tribes people living in the fastness.	67
1924 Sept 22 10:02 a.m.	Eastern Visayas: Samar - earthquake of Intensity IV-V.	
	Leyte and NE Mindanao - Intensity III-IV.	
	Bohol and Cebu - Intensity II-III. Origin in the Philippine Deep near parallel 11°N.	67
1924 Sept 27 5:43 a.m.	Batanes Island: Batanes - earthquake of Intensity IV-V. Near origin, to the south of the islands.	67
1924 Sept 30 5:46 p.m.	NW Luzon: Ilocos Norte and Ilocos Sur - earthquake of Intensity V. Origin in the China Sea, near to the NW end of the island.	67
1924 Oct 28 3:59 a.m.	Mindanao Island 5.7°N - 123.8°E: SW part of Cotabato - earthquake of Intensity V-VI.	
	Basilan and Jolo - Intensity III-IV; it was also felt in all the provinces of Mindanao excepting N Surigao.	67
1924 Dec 25 1:02 a.m.	NW Luzon: Vigan - earthquake of Intensity V and with less intensity in several towns along the Ilocos coast in the Abra and Amburayan provinces. Near origin in the China Sea.	67

Event	Felt Effect	Source
l925 Feb 08 l:45 p.m.	E Mindanao: Davao; Agusan and S Surigao - earthquake of Intensity IV-V. Origin in the Pacific, Philippine Deep.	68
l925 Feb 13):34 p.m.	E Visayas: Samar; Leyte and NE Mindanao - earthquake of Intensity IV-V. Origin in the Philippine Deep, E of South Samar.	68
.925 Mar 26):27 p.m.	SE Mindanao: Davao - earthquake of Intensity IV-V. Origin to the E in the Philippine Deep.	68
.925 Apr 17):54 a.m.	Batan Island 21°N - 125°E: ENE of Batan Islands - earthquake of Intensity V.	68
':07 p.m.	SE Mindanao: Davao; S Surigao and Agusan - earthquake of Intensity V-VI. Origin in the northeast part of Davao Province.	68
.925 Apr 26):27 p.m.	SE Mindanao: East Mindanao - earthquake of Intensity IV-V. Origin somewhat distant in the Pacific or near the Philippine Deep.	68
.925 May 05 :07 p.m.	Visayas and N Mindanao: Southern Negros - earthquake of Intensity VIII-IX. The area of destruction was very irregular and conforming to the nature of the ground. It comprised the half of the southern part of the island formed by the peninsula - like protuberance of Dumaguete extending to the SE, and the real southern end of the island inclined to the SW. Only the south coast was invaded by the waves caused by the earthquake. The regions most violently shaken were those of Bais and Tanjay to the north of the peninsula, Tolong and Siaton, lying to the WSW of it and the mountainous unhabited track extending between Bais and Tolong. The greatest part of the Dumaguete peninsula is volcanic and seems more recent than the rest of Negros. Its NW portion comprises the said track which runs	

Event	Felt Effect	Source
	in a SSW - NNE direction from Tolong to Bais and Tanjay. The very physiography of this track seems to reveal a line of weakness. Cebu; Siquijor and NW Mindanao - the shock had less intensity. Damage: Two sugar refineries sustained damage: in the Bais refinery they were due to insufficient bracing of the tall steel columns supporting high heavy loads; in the Isabela sugar refinery, the damage sustained was due to similar conditions. A reinforced concrete pier, greatly damaged at Bais, had long supporting columns without any bracing resting on wet soft mud. The damaged old buildings, such as churches and houses, were not fit to withstand violent vibrations on account of their faulty construction. Siaton - In the public school and municipal house isolated high columns of reinforced concrete attached to wooden beams, floors and other structures were broken. Dumaguete - landslides occurred on the side of high peaks, narrow and deep valleys and along river courses; in places only cracks were produced. Roads were cracked longitudinally in portions built on mangrove inundated land. Nearly personal injuries and deaths were caused by landslides and fissures. Eighteen persons were buried by landslides. The shocks also caused some destructions to a distance of 125 kms towards the north, consisting of a general ruining of small brick burnt chimneys of old sugar mills and the falling of weaker parts of old churches and convents.	68

Event	Felt Effect	Source
1925 May 07 8:21 p.m.	SE Luzon 14.6°N - 127.0°E: Camarines Norte; Camarines Sur; Albay; Sorsogon; Catanduanes; Samar; N Leyte and Masbate - earthquake of intensity V-VI.	68
1925 May 25 11:43 a.m.	Tablas and Romblon Islands: Tablas - extensive earthquake of Intensity VI-VII. Romblon and Sibuyan - Intensity V-VI. Less intensity to a distance of 200 kms from its submarine origin near south Tablas. A small earthquake wave developed and flooded some small low villages on the SE coast of Tablas. The steamer "Compeador" distinctly felt the shock while navigating SW of Romblon Island.	68
1925 July 04 10:35 p.m.	Samar and Leyte: Samar and NE Leyte - earthquake of Intensity IV-V. Origin in the Philippine Deep, near the E coast of Samar.	68
1925 July 08 7:45 a.m.	NW Luzon: Ilocos Norte; Ilocos Sur; Abra and Mountain Province - earthquake of Intensity IV-V. Origin in the China Sea, W of Ilocos Norte.	68
4:26 p.m.	Samar and Leyte Island: Samar and Leyte - earthquake of Intensity IV-V. Origin in the Philippine Deep.	68
1925 Sept 06 12:34 p.m.	SE Mindanao: Davao; E Cotabato and S Agusan - extensive earthquake of Intensity IV-V. Origin in the Pacific, S of Davao Gulf.	68
1925 Sept 18 2:47 p.m.	Benguet: Bokod - earthquake of Intensity VI-VII. Baguio and Kapangan - Intensity IV-V. At Manila, about 211 kms distant to the south, it was recorded as a distant, very strong earthquake.	68

Event	Felt Effect	Source
1925 Sept 28 11:11 p.m.	Bokod: Bokod - a very violent earthquake felt not only throughout the subprovince of Benguet but also in the near province of Nueva Vizcaya.	68
1925 Sept 30 10:09 a.m. 10:24 a.m.	Bokod: Two violent earthquakes which originated in the Bokod centre, felt all over the subprovince and recorded at Manila.	68
10:20 a.m.	E Mindanao: Agusan Valley - earthquake of Intensity V-VI. Origin very probably within the valley.	68
1925 Oct 02 12:25 a.m.	Bokod: Bokod; Nueva Vizcaya; Subprovince of Lepanto; Amburayan and Ilocos Sur - Strong earthquake. Excessively large movements were observed at Bokod.	68
1925 Oct 31 4:21 a.m.	SE Mindanao: Northern Davao; Agusan Valley and E Cotabato - earthquake of Intensity V-VI. The origin apparently lay at a distance of 160 kms from Butuan station in the mountainous region which separates the Agusan Valley from the Pacific coast, near parallel 7.5^{o}N.	68
1925 Nov 03 10:10 a.m.	Ormoc W Leyte: Ormoc - earthquake of Intensity V. Known and near submarine shallow origin to the SW.	68
1925 Nov 05 1:30 a.m.	Basco Batan Island: Basco - earthquake of Intensity V.	68
1925 Nov 13 8:16 p.m.	Samar 13.0^{o}N - 125.5^{o}E: Samar - earthquake of Intensity VIII or IX. It was perceptible within a radius of 600 kms comprising SE and S Luzon, all the Visayas Islands and NE Mindanao. SE Luzon; Masbate; N Cebu and Leyte - Intensity V-VI, at a distance of about 300 kms from the centre. Manila - only a few persons at rest felt the earthquake, such an effect depending much on the condition of the houses and soil. The movements	

Event	Felt Effect	Source
	were gentle and slow; nevertheless, as a result of some kind of resonance of the natural oscillations of the mass of water and the vibration of the seismic waves, two large storage tanks 25 and 22 metres in diameter in the gasworks spilled the water in a SE - NW direction, the movement and spilling lasting several minutes; other smaller tanks did not spill water. Nobody in the factory felt the shock, but everyone's attention was attracted by the rhythmic noise of the water falling from the big tanks.	
	Damage: Batag Island - the lighthouse, a modern concrete construction, was fissured and the optical and mechanical parts of the lantern damaged. In the soil, cracks opened and the low shores were flooded by the waves caused by the earthquake; many fishermen lost their fishing boats and several were drowned. Numerous native houses were destroyed.	
	Laoang - numerous native houses were destroyed.	
	Coast of Samar - not only native houses but also several more substantial constructions suffered considerable damage. Many persons suffered injuries.	68
1925 Dec 27 2:25 a.m.	E Mindanao and Visayas 9.9°N - 127.0°E - NE Mindanao - earthquake of Intensity VII.	
	Eastern Mindanao; Leyte; Samar; Bohol and Cebu Island - perceptible shocks; an extension of over 800 kms in a NNW - SSE direction and about 400 kms in the E - W within the Archipelago.	68
1925 Dec 30 3:04 a.m.	E Mindanao and Visayas: NE Mindanao - earthquake with Intensity IV-V,	

Event	Felt Effect	Source
	felt at a distance of 300 kms in the SSE and NNW directions. An aftershock felt only in the northern part of Surigao and Agusan took place at 11:01 p.m.	68
1926 Jan 04 7:34 a.m.	SE Luzon N Samar 13°N - 125°E: Camarines Sur; Albay; Sorsogon and N Samar - earthquake of Intensity IV-V.	
1926 Jan 06 9:58 p.m.	Panay Island: Panay Island - earthquake of Intensity IV-V. Negros Island - with less intensity. NW Cebu - perceptible eastwards. The hypocentre lay near the SE Coast of Panay.	69
1926 Jan 23 11:13 a.m.	E Visayas and Mindanao: 10°N - 127°E: NE Mindanao and SE Samar - extensive earthquake of Intensity VI-VII. Samar; Leyte; Cebu; Bohol and Eastern Mindanao - felt with less intensity.	69
1926 Mar 04 5:33 p.m.	E and SE Mindanao 6°N - 129°E: Davao; Agusan and Surigao - earthquake felt of Intensity IV-V.	69
1926 May 09 12:10 a.m.	SE Luzon: Albay; Sorsogon; Northern end of Samar Island - earthquake felt of Intensity IV-V. Camarines Sur; Masbate Island and Central Samar - perceptible shock. Origin in the Pacific, NE of San Bernardino Strait.	69
1926 May 20 3:04 p.m.	SE Mindanao: Extensive earthquake felt in the portion of Mindanao comprising the provinces of Davao, Cotabato and southern parts of Lanao, Bukidnon, Agusan and Surigao. Its greatest intensity, V-VI, was experienced throughout the southern portion of Davao and Cotabato. The origin lay near Sunguir Island.	69

Event	Felt Effect	Source
1926 May 28 8:21 a.m.	N Luzon: Isabela Province, Central part of Mountain Province - earthquake of Intensity IV-V. Its epicentre was about 290 kms distant from Manila between the two provinces.	69
1926 June 13 2:28 a.m.	Samar and NE Mindanao: Southeast end of Samar and northern part of Surigao and Agusan - earthquake of Intensity IV-V. The epicentre was located in the Philippine Deep of the Pacific.	69
1926 July 23 1:19 p.m.	SE Mindanao 4.5°N - 127.0°E: Southeastern Coast of Mindanao - extensive earthquake felt of Intensity V. Surigao; Davao and South Agusan - felt with less intensity. Sunguir Island - it was also felt.	69
1926 July 25 7:06 p.m.	NE Luzon: Ilocos Norte and Ilocos Sur - felt of Intensity IV-V. It was felt of Intensity III throughout Abra, Mountain and northern La Union provinces.	69
1926 Aug 02 1:02 a.m.	SE Luzon: Catanduanes - extensive earthquake of Intensity VII. It caused some damage to several structures. In the neighbouring peninsula of Caramuan, Camarines Sur, it was felt of Intensity VI. Camarines Sur, Albay and southern part of Sorsogon - Intensity V. At a distance of 450 kms from the epicentre it was fairly perceptible. During the following 16 hours occurred 9 aftershocks of Intensity IV-VI; felt also through the near provinces of Albay and Camarines Sur. The epicentre of the shocks was moving northeastward, its distance from Manila increasing from 480 kms in the first shock to 570 and 580 in the last strong aftershock, the fractures occurring apparently along	

Event	Felt Effect	Source
	a line.	69
1926 Aug 24 10:52 a.m.	SE Luzon: Catanduanes - earthquake felt of Intensity IV-V.	
	Albay; Camarines Norte; Camarines Sur and Sorsogon - Intensity III.	69
1926 Oct 11 3:29 p.m.	Central Mindanao: Southern portion of Lanao - earthquake Intensity V-VI.	
	Cotabato Province - light felt. Its origin lay within the island in the volcanic region of the Macaturing volcanic group. Its limited extension and the fact that it was recorded only in Butuan and Manila seem to indicate a shallow origin, presumably volcanic. Its greatest intensity was experienced at two stations nearest to the SE and NW of the said volcanic group.	69
1926 Oct 29 5:07 a.m.	Zamboanga W Mindanao: Zamboanga - earthquake of intensity IV-V. Origin in the Sulu Sea near to the west coast of Mindanao.	69
8:08 a.m.	Central Luzon 16.3°N - 120.6°E: Extensive earthquake felt throughout all the provinces of Luzon excepting Tayabas, Camarines, Albay, and Sorsogon. It had its greatest intensity, V, in Pangasinan, Southern La Union, Benguet, NW Nueva Ecija. The epicentre lay at 240 kms from Manila, probably between the provinces of Pangasinan and Benguet.	69
1926 Nov 07 2:35 a.m.	Ormoc (W Leyte): Ormoc - earthquake of Intensity VI. Repetitions at 2:49 a.m. - Intensity IV; 2:55 a.m. - Intensity II-III. These shocks were of a very local character so much so that none of them was recorded at Butuan, only 200 kms distant.	69
	One violent earthquake which caused some slight damage; shocks were of shallow origin, not inland in the	

Event	Felt Effect	Source
	mountains but to the SW in the bay.	
1926 Nov 27 1:09 p.m.	Ormoc: Whole of Leyte, Western Samar, Bohol, Cebu Island - earthquake of Intensity VI-VII. It is noteworthy that this shock and several of the strongest aftershocks were fairly perceptible at Tacloban about 50 kms to the NE of Ormoc but not noticed at Maasin only a little farther to the south on the same western coast. Similarly it had Intensity III at Cebu and it was noticed on Negros Island at distances of 150 kms while it was not perceptible in the much nearer island of Samar and in the southern part of Bohol. The epicentre seems to have be enlocated very near the town of Ormoc in the bay towards the Camotes Islands, or possibly more close to the coast south of Ormoc in the contact between the central old volcanics of Leyte and the coastal tertiary sedimentaries. It was reported that, as an effect of the earthquake, a large landslide occurred in the mountains north of Ormoc at a distance of 17 kms. This occurrence startled people for fear that a volcano might appear. Careful investigation showed that the landslide was chiefly due to the condition of the soil and to the preceding heavy rains rather than to the shocks, as similar accidents are not a rare occurrence in the same region during the rainy season.	69
1927 Jan 09 9:28 a.m.	Ormoc W Leyte: Ormoc - earthquake of Intensity VI. The origin lies nearby in the bay close to the coast. A foreshock had been felt at 9:20 a.m. and two aftershocks took place at 5:29 p.m.	70
1927 Jan 12 8:05 a.m.	Central Luzon 15.3°N - 119.5°E: Zambales and Bataan - earthquake of Intensity IV-V. It was also felt in Central Luzon from 14° to 17°N and from coast to coast.	70

Event	Felt Effect	Source
1927 Jan 25 4:06 p.m.	NE Mindanao: Butuan - earthquake of Intensity IV-V.	
	NE Surigao and S Talacogon - lightly felt. Origin probably in the southern part of Butuan Bay.	70
1927 Feb 15 7:00 a.m.	Cateel, Davao (E Mindanao): Cateel, Davao - earthquake of Intensity IV-V. Origin in the Pacific near the coast at about 7.8^{o}N.	70
1927 Feb 19 6:59 a.m.	E Mindanao: Surigao; Agusan and Davao - earthquake of Intensity IV-V.	70
1927 Apr 11 10:49 p.m.	NW Luzon 19.0^{o}N - 120.5^{o}E: Northern Luzon and chiefly at the NW end - earthquake of Intensity IV-V.	70
1927 Apr 13 9:44 p.m.	Central Luzon 15.8^{o}N - 119.4^{o}E: Extensive earthquake felt throughout the main portion of Luzon and W Mindoro between parallels 13.5^{o}N and 18^{o}N.	
	Occidental Coast - experienced Intensity IV-V.	70
1927 Apr 20 10:30 a.m.	Central Luzon 14.5^{o}N - 119.5^{o}E: Western provinces of: Luzon; Mindoro and Calamianes - extensive earthquake of Intensity V-VI; from the parallel 12^{o} to 18^{o}N.	70
	Manila - Intensity V of 40 seconds' duration.	
	Western part of Luzon; La Union and Benguet; to Batangas; Pangasinan; Western Nueva Ecija; Tarlac; pampanga; Bulacan; Rizal; Zambales; Bataan and Cavite - Intensity IV. Epicentre was about 100 kms west of Manila not far from the Zambales coast. Its cause was some displacement in a known active line, probably a fault, extending in a SE to NW direction off the Zambales coast in the China Sea.	

Event	Felt Effect	Source
	In Manila - nearly everybody woke up during the first stage of the tremor. In many hotels the guests rushed into the streets in kimonos and other unconventional attire. Buildings creaked, and hanging objects like electric bulbs and chandeliers swayed. No damage, however, was reported. Several persons who were awake before the shock occurred said that the tremor was preceded by a rumbling sound coming from the west.	125
1927 Apr 23 9:21 p.m.	NW Luzon 18°N - 120°E: NW of Ilocos Norte - earthquake of Intensity VI-VII.	70
1927 May 13 11:13 p.m.	SW Luzon 13.7°N - 120°E: SW Luzon and NW Mindoro - earthquake of Intensity V-VI.	
	Southern Luzon and Calamianes - it was perceptible.	70
1927 June 06 1:37 p.m.	E Mindanao 8°N - 127°E: Davao, Agusan and Surigao - earthquake felt of Intensity IV-V.	70
1927 June 18 8:57 a.m.	N Luzon 18.5°N - 122°E: Northern Ilocos Norte - extensive earthquake of Intensity VI-VII; preceded by a rumbling sound.	
	Northern Ilocos Sur; Abra; Cagayan and Mountain Province - strong intensity southward to parallel 16°N - fairly perceptible.	70
2:47 p.m.	S Leyte: Earthquake felt with Intensity IV-V at Maasin on the SW Coast and around the Sogod Gulf. Origin at a distance of about 600 kms from Manila and outside of Leyte, probably to the east in the Pacific not far from Dinagat Island.	70
1927 July 03 4:17 p.m.	Catanduanes and Samar Islands and SE Luzon 14°N - 126°E: Catanduanes - earthquake of Intensity VI.	

Event	Felt Effect	Source
	Camarines Norte and Sur; Albay; Sorsogon and Samar - fairly perceptible.	70
1927 July 23 5:05 p.m.	Butuan, Agusan (N Mindanao): Butuan and Agusan - earthquake of Intensity IV-V; long duration. It seems that the origin of this earthquake was near and rather shallow. Probably it lay to the north in Butiran Bay where frequently shocks of great intensity, but very limited, occur.	70
1927 Aug 06 10:34 p.m.	Eastern Visayas NE Mindanao 10^{o}N - 126^{o}E: Northern part of Surigao and Agusan - earthquake of Intensity IV-V. Samar, Leyte, Bohol, Cebu and Eastern Mindanao - fairly perceptible.	70
1927 Oct 28 3:43 a.m.	SW Mindanao: Northern Coast of Illana Bay - earthquake of Intensity IV-V. Western Cotabato and Eastern Zamboanga - Intensity III. The origin lay in the Celebes Sea south of Illana Bay.	70
1927 Oct 29 1:38 p.m.	Panay Island: Western Coast of Panay - earthquake of Intensity IV-V. Rest of Panay and Western Coast of Negros - very perceptible. Its origin was not far from the Antique coast possibly under the mountain chain which separates the provinces of Antique and Iloilo.	70
1927 Nov 17 5:12 a.m.	SE Mindanao: SE of San Agustin Peninsula, Davao - very extensive earthquake of Intensity VI-VII. It was also felt at the following places: Cotabato, Cagayan, Lanao, Bukidnon and inthe southern parts of Agusan and Surigao - Its epicentre lay in the Pacific at a distance of more	

Event	Felt Effect	Source
	than 500 kms from Mindanao, some place E or ENE of north Moluccas Island. Also felt in SE Mindanao and in the Sanguin group.	70
1927 Nov 18 11:26 a.m.	Eastern Visayas Mindanao 10^{o}N - 127^{o}E: NE Mindanao - extensive earthquake of Intensity V-VI. Also felt at the following places: Samar, Leyte, Bohol, Cebu and in Eastern Mindonao.	70
1928 Feb 06	Mindanao Island: Mindanao - extensive earthquake of Intensity VI, excepting at its W and NE ends. SE and S Mindanao - Intensity V. Origin towards the NNE of Moluccas Island.	71
1928 Mar 13 12:57 a.m.	Cebu Islands and Leyte: Earthquake felt with Intensity VI-VII at Ormoc (W Leyte). This shock was the first of a series of shocks felt during the morning throughout northern Leyte and the Cebu Islands. They occurred at the following local times: 12:57 a.m.; 1:11 a.m.; 1:27 a.m.; 2:14 a.m.; 4:03 a.m.; and 7:05 a.m. Only the first, second and fifth which had Intensity IV-V at Ormoc were recorded at Manila. Their origin lay close to the NW coast of Leyte a little farther north of the place in Ormoc Bay. All the shocks were felt over on extended area comprising north Cebu and north Leyte, within a radius of seventy kilometres from the origin. The first was lightly recorded in the nearest observatories of the Far East.	71
1928 Mar 23 4:53 a.m.	W Luzon 16.3^{o}N - 120^{o}E: Benguet and SE La Union - extensive earthquake of Intensity IV-V. Tarlac, Pangasinan, Nueva Vizcaya, La Union, Amburayan, Ilocos Sur, Lepanto and Bontoc - lightly felt.	71

Event	Felt Effect	Source
1928 June 15 2:13 p.m.	Mindoro: Southwestern end of Mindoro - destructive earthquake of Intensity VII-VIII. A second earthquake as strong as the first took place at 1:16 a.m., June 16. The destruction occurred chiefly on the seashore in a tongue like portion of it which closes the small bay of Mangarin, forming a little port. On this ground were built a railway, running from a sugar placed inland towards the NW, to the wharf at the end, and native houses occupied by labourers. All this ground was strongly shaken and crevassed, with complete destruction of the light native structures and considerable damage to a concrete warehouse; specially in the shoreside part of the railways. It seems that the ground slipped somewhat towards the sea and port, because it was warped, with subsidence and rising in different parts. Immediately after the shocks the sea invaded the shore, flooding it permanently in sunken places and washed down the loose earth of the embankement of the railways. Inland toward NW, in the sugar refiney and N, the damage was of little account. The isoseism VI was about 160 kms from the epicentre, and the limit of perceptibility isoseism II, III, 300 kms.	71
	Manila and nearby provinces - Intensity III and IV. The shock was felt by most people and, in some central crowded places, employees rushed into the streets for safety. The tremor caused hanging articles to sway and wooden buildings to creak. No damage was reported. Origin probably lay in the China Sea but the exact location could not be determined due to absence of provincial reports. Mindoro Sugar Company's machinery was damaged by the quake to the extent of P100,000.	126

Event	Felt Effect	Source
1928 Aug 05 10:42 p.m.	W Luzon: 15.7°N - 119°E: Western Zambales; Bataan and Pangasinan - extensive earthquake of Intensity VI-VII. Also felt throughout the occidental provinces of Luzon from parallel 13°N, northwards to 19°N.	71
	Rocked all the provinces of western Luzon as far as Ilocos Norte. Epicentre at 150 kms off the Zambales coast. Iba and Olongapo - Intensity V. Manila and environs - Intensity IV. There was the usual rush for the open, especially in crowded places. No damage was reported.	127
1928 Aug 25 8:31 p.m.	W Mindanao: Southern Zamboanga and Basilan - earthquake of Intensity V. Origin SE of Sulu Sea.	71
1928 Sept 04 5:19 a.m.	Batanes Islands: Basco - Intensity V-VI. Origin in the China Sea, W of Balintang Channel.	71
1928 Nov 11 5:05 a.m.	Legaspi, Albay SE Luzon: Legaspi, Bacon, SE Coast of Albay Gulf - earthquake of Intensity III-VI.	71
1928 Nov 22 1:00 a.m.	Central Luzon 16.1°N - 120.5°E: West of Pangasinan - extensive earthquake of Intensity VI-VII. Also felt throughout southern part of Luzon from parallel 17°N down to the southern coast, and eastwards to the 122°E meridian. The epicentre was located along a fault which seems to cross the island in a NW-SE direction from the Lingayen Gulf to the Pacific Coast. It seems that the movement occurred chiefly in the southern block because it was felt southwards to distances of 280 kms while northwards it was not noticeable at a distance of only 150 kms.	71

Event	Felt Effect	Source
1928 Dec 19 7:39 p.m.	SW Cotabato: Cotabato - earthquake of Intensity VII. Surrounding area within a radius of about 80 kms - Intensity VI. W and NW at a distance of 400 kms - perceptible shocks. Numerous after-shocks were felt during the night of the 19^{th} and the following days to the 25^{th}. It caused some destruction in the town of Cotabato and surroundings, and other places on the northern coast of Illana Bay. Cotabato is on the delta of the great Pulangui River between its two arms emptying into the sea; the delta is crossed by numerous creeks running between the arms of the river. Cotabato soil was formed around a hill and a small table-land extending towards the south of the town representing an old atoll, but unfortunately the greatest part of the town was built outside this firm portion, on the bank of the river. On the other hand, the buildings consisted of materials of little resistance. Some built of stone were old, from the time of the Spanish Government, and weakened by new openings and modifications. Most of the commercial retail shops consisted of rather light wooden frames not properly and firmly tied. On the soil corresponding to the old atoll none of the structures suffered damage. Conditions were similar on the seashore of Malabang, on the north shore of Illana Bay to the NNW of the epicentre, where the Radio Station sustained damage. The town of Cotabato suffered most in its buildings; it was certainly the nearest town to the E of the epicentre but the main cause responsible for the numerous ruins was the poor condition of the buildings, most of them badly constructed and the rest old and in bad repair. These conditions were aggravated by the soft and swampy	

Event	Felt Effect	Source
	nature of the soil along the river bank. Cotabato was once upon a time a swamp. Only a few sections are solid ground and the rest filled with sand and other light materials. Most of the houses are built over this filling, that is why so many houses fell down; whilst, in nearby places where there is firmer ground, light structures withstood the shocks. Up the river, ruins occurred on its banks and in small islets in the swamps and lakes. Its epicentre was located in the NE part of the Celebes Sea.	71
	The quake hit Cotabato killing 93 persons; hundreds rendered homeless. The greatest sufferer from the quake was Cotabato where all the old buildings were razed to the ground. Those that remained standing were considered dangerous to live in and people for a time put up temporary shelters in the open.	128
1928 Dec 28 10:21 p.m.	Cotabato 7.2°N - 123°E: Small peninsula separating Sibuguey and dimaquilas from Illana Bay - earthquake of Intensity VII, destroying many native houses of Moros and miners.	
	Zamboanga and Cotabato - Intensity VI. Radius of 300 kms, perceptible shocks. The origin was a little to the NW towards the gulfs called Sibuguey and Dimaquilas.	71
	The Dec. 28, 1928 quake jolted Mindnao and Jolo. No damage reported. It originated at a distance of 930 kms from Manila, probably to the SW of Zamboanga in the Celebes Sea.	128
1929 Jan 10 3:54 a.m.	SE Luzon: Naga - earthquake of Intensity V.	
	Albay, Camarines and Legaspi - oscillations NW - SE; lasted about	

Event	Felt Effect	Source
	15 seconds. Also reported from Iriga and Guinobatan.	72
1929 Jan 15 1:30 a.m.	N Luzon: An earthquake occurred near Bokod, Benguet subprovince that ushered in a period of seismic activity which lasted, with intervals, until February. January 15: 1:30 a.m., felt as far as 100 kms. January 16: 4:08 p.m., rocks dislodged. Felt as far as Manila: 5:10 p.m., reported from 4 places at 25 kms distance. 10:04 p.m., felt as far as Manila. January 17: At intervals during the whole day. The shock at 1:29 a.m. on the 15th was felt over central and northern Luzon; the second at 4:06 p.m. and the third at 10:00 p.m. on the 16th. The first shock at 1:29 a.m. on the 15th was felt at Dagupan, Baguio, Kapangan, Camiling, Manaoag and Baler. The second and third shocks were perceptible in Manila as a very gentle rocking motion. The three predominant shocks (on the 15th and 16th) were true tectonic earthquakes of at least moderately deep origin and it is interesting to note that the initial movement in the first was a compression; in the second, a dilatation; and in the third, a compression. It is suggestive of a sudden uplift, followed by a subsidence and then another uplift.	72
1929 Feb 15 1:43 p.m.	E Mindanao: Veruela, Agusan Valley - reported as violent. Butuan to the north, Malaybalay to the west and Glan to the south - felt.	72
1929 Apr 02 2:33 a.m.	Mindanao: Butuan, Agusan - earthquake felt; pendulum clock stopped by the shock.	72
1929 Apr 05 4:28 p.m.	N Luzon: Aparri - strong earthquake lasting 15 seconds. Oscillation, E - W.	

Event	Felt Effect	Source
	Laoag - Intensity III; duration five seconds, oscillation, NE - SW and rumbling sounds in a NE direction before the earthquake.	72
1929 Apr 08 6:18 p.m.	Mindanao: Butuan - strong earthquake.	
	Lais, Davao - slight earthquake.	72
1929 May 04 4:58 p.m.	Mindanao: Butuan - strong earthquake; vertical vibrations were perceptible and the oscillatory movement seemed to be first in an ESE - WNW direction and then NNE - SSW. Clocks stopped.	
	Surigao; Talacogon; Agusan - Intensity II. Shallow origin near Butuan, probably in the bay.	72
1929 June 02 7:10 a.m.	Mindanao: Butuan - strong earthquake; duration, 45 seconds.	
	Surigao - Intensity II. The first shocks seemed to come from the NE and the succeeding oscillations seemed to be in SSE - NNW and SW - NE directions.	72
1929 June 13 5:26 p.m.	Mindanao $8^{\circ}20'$N - $126^{\circ}53'$E: Davao - Intensity V.	
	Legaspi; Sorsogon - Intensity III.	
	Cotabato; Ganassi - Intensity II. The epicentre seemed to be located on the eastern side of the Agusan Valley in the southeastern part of the province of Agusan.	72
	The following accounts are from places where it was most severe:	
	Hinatuan - numerous gashes were visible in the mountains as a result of the slides. Thousands of dead fish of all kinds and all sizes, up to 30 inches, were seen floating in the ocean and cast up on the shore. They had evidently been killed by	

Event	Felt Effect	Source
	the concussion of the shocks. The first movements were vertical vibrations of such violence that people could remain standing only with great difficulty. Most of them were obliged to kneel or sit on the ground. These vibrations were followed by horizontal oscillations. Many old houses were destroyed and nearly all others were thrown out of plumb. The front wall of the church was cracked and the roof badly damaged but concrete towers escaped injury. A small seawave came in. The agitation of the ground continued almost incessantly for a month, as many as seventy shocks being counted in one day. It was not until this period had elapsed that any attempt was made to restore the houses to their upright position. Ebro - landslides and subsidence occurred in this vicinity. Waves appeared in the soil and houses were tilted. The earthquake was described as frightful. Rivers were agitated and overflowed the subsiding areas. Talacogon - the principal shock was very strong, lasting about 50 seconds and portions of the river bank were dislodged. Sixty-five aftershocks were reported to the Central Observatory. Cateel - Father Rodes, pastor of this town, reported that, at the time of the earthquake, he was seated and that his chair was moved as if he were riding in a tartanilla (native vehicle). Esperanza - reported as a violent earthquake. Butuan - the earthquake was preceded by a rumbling sound. The motion was characterized as violent, the people throwing themselves on the ground. The water of the river appeared to	

Event	Felt Effect	Source
	heap up; on the eastern side and one man in a conoe reported a reversal of flow at San Vicente about two kilometres upstream from Butuan; bells rang, clocks stopped and some old walls and stairs were thrown down. The apparently abnormal intensity in an easterly direction from Talacogon to the Pacific has given rise to the opinion that it is indicative of a fault at right angles to the Agusan rift valley and the Mindanao Deep. Some of the effects must be ascribed, doubtless, to the nature and condition of the soil. The Agusan Valley floor is a soft, unconsolidated river deposit, in one area quite swampy. Hinatuan, is built on compact sand. Rock is on the surface a short distance from the shore up the Hinatuan River. Bislig, a few kilometres south of Hinatuan, and Lianga to the north, do not, it is said, experience such intensities as are felt in Hinatuan. Cantilan in a large area of rice fields, is another "sensitive" locality. At Hinatuan, Ebro and along the Gibong River, the earthquake was exceedingly violent. Aftershocks persisted at Hinatuan and Talacogon to an extraordinary degree, compared with other localities.	73
1929 July 08 6:50 p.m.	SE Luzon: Virac - earthquake of Intensity V.	
	Legaspi - Intensity IV. The origin was in the Philippine Deep.	72
1929 July 16 8:05 p.m.	Luzon: Baler, Tayabas - strong local shock of Intensity VI.	72
1929 July 21 9:16 p.m.	Luzon: Virac, Catanduanes - earthquake of Intensity V. It was preceded by a roaring sound. Some concrete walls were cracked and some fences overthrown.	
	Camarines; Albay - strong earth-	

Event	Felt Effect	Source
	quake.	72
9:36 p.m.	Mindanao: Zamboanga - local earthquake of Intensity V.	72
1929 Sept 02 7:14 p.m.	Mindanao: Butuan - Intensity V. Agusan; Surigao - earthquake felt. Epicentre was in the mountains east of Butuan.	72
1929 Sept 19 7:06 p.m.	Mindanao $8^{o}N$ - $129^{o}E$: Butuan - Intensity V. Earthquake felt throughout northeast section of Mindanao.	72
1929 Oct 01 7:44 p.m.	Mindanao: Zamboanga; Basilan - earthquake of Intensity IV-V; noises were perceived.	72
1929 Nov 03 6:33 a.m.	Luzon: Aparri - earthquake of Intensity V. Epicentre in the Babuyan Channel.	72
1929 Nov 17 11:45 a.m.	Mindanao $8^{o}10'N$ - $125^{o}30'E$: Butuan - Intensity VII. Tacloban, Leyte - felt. Felt over the entire island of Mindanao except the province of Zamboanga in the extreme west. The E - W extension was about 300 kms.	72
1929 Dec 22 10:28 p.m.	Mindanao: Davao - earthquake of Intensity VI. Probably a shallow focus in Davao Gulf.	72
1930 Jan 21 12:47 p.m.	Luzon: Laoag - Intensity VI. This earthquake felt along the west coast of northern Luzon from Pasuquin to Baguio. Epicentre in the China Sea at about $18^{o}10'N$, $120^{o}E$.	73
1930 May 19 11:05 p.m.	Luzon $20^{o}25'N$ - $120^{o}30'E$: Basco, Batanes - Intensity V. Northern end of Luzon - felt with less intensity.	73
1930 July 22 5:01 p.m.	Mindanao: Cateel, Davao - strongly felt. Agusan Valley - slightly felt.	

Event	Felt Effect	Source
	Epicentre probably off the east coast.	73
1930 Aug 07 2:33 p.m.	Luzon: Los Banyos, Laguna - earthquake of Intensity IV-V.	73
1930 Aug 18 7:23 p.m.	Mindanao $4^{\circ}30'$N - $120^{\circ}50'$E: Earthquake felt extensively throughout eastern Mindanao.	
	Malita, Davao - strong earthquake.	
	Northward to Butuan - less intensity.	73
1930 Oct 01 10:54 a.m.	Luzon: Aparri - felt very strongly. Shocks reported from different places in Luzon.	73
1930 Dec 21 10:52 p.m.	Batanes: Basco, Batanes - Intensity VI. Felt as far south in Luzon as Baguio. The epicentre was about 30 kms east of Basco.	73
1931 Jan 24 5:30 a.m.	Luzon: Lubuagan, Kalinga subprovince - strong earthquake of short duration.	74
1931 Feb 13 5:07 a.m.	Luzon and Northern Visayas: Legaspi - earthquake of Intensity V.	
	Catanduanes; Masbate; Panay - felt with less intensity. Epicentre was probably in the region of Burias Passage.	74
1931 Mar 17 11:21 p.m.	Luzon and Mindoro: Halcon, Mindoro - strong earthquake.	
	Batangas, Luzon - slightly felt. Epicentre was probably on the island of Mindoro.	74
1931 Mar 19 4:16 a.m.	Mindanao 4°N - 128°E: Davao - greatest intensity. It was felt throughout the whole island of Mindanao.	
	Recorded all over the world.	74
	Several tremors of considerable	

Event	Felt Effect	Source
	intensity were felt early yesterday morning (March 19) in the southern parts of Mindanao and in northern Luzon. No report of damage in Mindanao.	147
1931 Mar 19 2:26 p.m.	Luzon 18°20'N - 120°10'E: Laoag, Ilocos Norte - earthquake of Intensity VIII-IX. It was felt as far south as Ambulong. Laoag - the most extensive damage was done to old ecclesiastical structures, dating back to Spanish times. Leaks started in the water mains. Bacarra - the six-storey masonry bell tower had its two lowest stories shaken out and the upper four stories settled down upright in the ruins. The municipal building, the central school, the convent and the church also sustained damage. Vintar - the church, convent and bell tower were damaged. Pidding - the entire church edifice was slightly inclined to one side. The bell tower suffered in a manner just the opposite of that at Bacarra. In this case, the upper section of the tower was thrown off, leaving the lower portion intact. Batac - the old municipal building, the convent, church and bell tower were demolished. Sarrat - the roof of the church was damaged. Badoc - masonry structures suffered damage. Vigan - some masonry and brick structures were cracked. It is noted that the towns which suffered most are located near the river of that section and a field party of	

Event	Felt Effect	Source
	geologists from the University of the Philippines found that the ground in all of these places is of sedimentary origin.	74
	Lallo, Cagayan - the tremors badly damaged the municipal building.	
	Cabugao, Ilocos Sur - the tremors damaged the Presidency, the Catholic Church building and two brick houses. Two persons were injured by falling bricks from damaged buildings.	
	Damortis, La Union - slight damage to some buildings was reported and its telegraph and telephone lines were temporarily disrupted.	147
1931 Mar 24 4:45 a.m.	Mindanao: A strong local shock felt at Glan in Cotabato Province.	74
1931 Mar 30 9:39 p.m.	Luzon: A moderately strong earthquake felt throughout northern Luzon. It was felt at Intensity VI at Laoag on the northwest Coast.	74
1931 Apr 21 11:00 p.m.	Leyte: Biliran, Leyte - strong shock felt between 11:00 p.m. and midnight.	74
1931 May 29 4:26 p.m.	Luzon & Visayas $13^{o}5'N$ - $121^{o}6'E$: Boac - felt strongly; about P5,000 damage was suffered. The earthquake was felt throughout southern and southeastern Luzon and in northern Visayas Island.	74
1931 June 13 10:40 p.m.	Mindoro: Halcon, Baco - earthquake felt rather strongly. Epicentre in the Verde Island Passage.	74
1931 July 10 2:18 a.m.	Leyte: Ormoc, Leyte - Intensity V; 48 seconds' duration.	74
1931 July 12 5:03 p.m.	Samar: Guiuan, Samar - earthquake of Intensity V.	74
6:14 p.m.	Masbate: Masbate - another shock of Intensity V felt.	74

Event	Felt Effect	Source
1931 July 13 12:46 a.m.	Masbate 12°25'N - 123°50'E: Masbate - earthquake of Intensity VIII; with lessening intensity over a radius of 250 kilometres. Two wharves were slightly damaged, two street surfaces were cracked and the public market suffered some damage. Stores carrying breakable stocks also suffered. The total damage was estimated at about P11,000. Some of the people left their houses to seek safer places. Ticao - some artesian wells ceased their flow and some old ones, which had gone dry, again began to flow, indicating underground movements. A boat about 2 1/2 miles east of Ticao at the time of the earthquake was strongly jolted and the Captain's first thought was that he had run on a reef or shoal. His experience in these waters quickly made him realize that he had felt an earthquake shock. The inhabitants of the districts along the east side of Ticao were thrown into a state of panic. They left their houses and fled to the highlands at the back of their towns, no doubt instinctively fearing a subsidence of the low ground and a subsequent inrush of the sea. Uson, Masbate - the shock was very severely felt, being strong enough to overturn furniture. The people left their houses and remained in the streets until daylight. The epicentre was in Ticao Passage about 20 kms east of the town of Masbate. The earthquake was perceptible over an area of 250 kms radius. The area covered the northern parts of panay, Cebu, Negros, Leyte, Samar, the islands of Romblon and Marinduque, and the entire south-eastern portion of Luzon, embracing the provinces of Sorsogon, Albay, the two Camarines, and the Bondoc peninsula of Tayabas.	74

Event	Felt Effect	Source
1931 July 15 2:33 a.m.	Mindanao: Butuan - strong earthquake, 20 seconds' duration.	74
1931 July 21 5:53 a.m.	Luzon: Batangas - Intensity V, one minutes' duration.	
	Calatagan - felt slightly.	74
1931 Aug 20 4:40 a.m.	Mindanao: Lanao - strong local earthquake of five seconds' duration.	74
1931 Aug 29 10:15 a.m.	Luzon: Southwest Luzon - moderately strong earthquake. Reported from Batangas, Ambulong, Mendez and Calatagan. The epicentre probably in Verde Island Passage.	74
1931 Sept 18 5:58 a.m.	Mindanao: Strong shock felt at Hinatuan on the Pacific coast. Felt slightly at Talacogon in Agusan Valley. Centre in the Philippine Deep.	74
1931 Sept 21 1:00 a.m.	Luzon: Calatagan, Batangas - moderately strong earthquake.	74
1931 Oct 28 1:36 p.m.	Luzon: Cape Bojeador; Pasuquin - earthquake of Intensity VI-VII. It was felt over all of northern Luzon. The epicentre probably in the China Sea, 30 or 40 kms from the coast.	74
1931 Oct 31 4:27 a.m.	Mindanao: Butuan - very strong earthquake; 17 seconds' duration. The pendulum clocks stopped, the church bells rang, people left their houses in alarm. The shocks were preceded by noise from the east. It was felt all over northeastern Mindanao; reported from Surigao, Hinatuan; Compostaela, Talacogon and Mambajao.	74
1931 Nov 12 9:55 a.m.	Mindanao $8^{O}N$ - $127^{O}E$: Cateel - earthquake of Intensity V. It was reported felt at the following: East coast of Mindanao; Talacogon. Veruela; Agusan Valley.	74

Event	Felt Effect	Source
1931 Dec 31 7:38 p.m.	Mindanao: Hinatuan, Butuan - strong earthquake. It was felt throughout eastern Mindanao and as far as west Mambajao. The epicentre probably in the eastern mountain range separating Agusan Valley from the Pacific.	74
1932 Jan 04 1:30 p.m.	E Mindanao: Butuan - earthquake of Intensity IV-V; duration, 15 seconds; direction apparently from the east.	
	Cantilan; Hinatuan; Veruela; Talacogon - slightly felt.	75
1932 Jan 18 1:17 a.m.	Guiuan, Samar 10°30'N - 125°26'E: Guiuan, Samar - earthquake of Intensity V.	75
1932 Jan 19 4:27 a.m.	N Luzon 19°45'N - 124°30'E: Basco, Aparri; Cape Bojeador - strong earthquake; 34 seconds' duration at Aparri.	75
1932 Feb 06 5:10 a.m.	Mindoro: Halcon, Baco - strong earthquake.	75
1932 Feb 21 3:33 p.m.	N Luzon: Aparri - moderate earthquake; duration, ten seconds.	
	Cape Bojeador; Pasuquin - slightly felt.	75
1932 Apr 17 9:03 a.m.	SE Mindanao: Davao - moderate earthquake. Reported from Malita, Lais, Cateel and Compostela.	75
1932 Apr 26 5:02 a.m.	NW Luzon: Laoag - earthquake of Intensity V; duration, 45 seconds.	
	Sinait; Cape Bojeador - also felt.	75
1932 Apr 30 1:32 a.m.	E Mindanao 8°20'N - 126°53'E: Hinatuan; Veruela - very strong earthquake.	
	Mambajao - felt. It was felt throughout eastern Mindanao.	75
5:09 a.m.	N Luzon: Aparri; Cape Bojeador;	

Event	Felt Effect	Source
	Pasuquin - felt earthquake. At Cape Bqjeador, some walls, which had been cracked in previous earthquakes were shaken down. The epicentre probably north of the northwest end of Luzon.	75
1932 May 27 8:46 p.m.	NE Mindanao: Surigao; Agusan; Northern Davao - moderately strong earthquake. The epicentre seems to have been in the Pacific near Cantilan.	75
1932 June 08 10:52 p.m.	N Mindanao: Cagayan, Oriental Misamis - earthquake of Intensity V.	
	Bukidnon; Agusan; Surigao - strong earthquake. The epicentre seems to have been in the mountains of eastern Bukidnon.	75
1932 June 14 4:58 a.m.	NW Luzon: Vigan - earthquake of moderate intensity.	
	Ilocos Norte; La Union; Mountain Province - slightly felt. Epicentre in the China Sea. Earthquake felt throughout Northern Luzon.	75
2:00 p.m.	NW Luzon: Cape Bojeador - earthquake of Intensity VII; some walls were cracked and one lens in the lighthouse was broken. Some buildings slightly damaged in Laoag. The epicentre was in the China Sea about 30 miles from the coast.	75
1932 June 23 5:35 a.m.	Marinduque: Marinduque - earthquake of moderate intensity. Felt throughout the island. Considerable damage done to coconut trees bearing ripe fruit.	75
1932 July 18 1:02 p.m.	W Luzon: Manila - earthquake of Intensity V. Considerable fright was aroused in Manila by the shock.	
	Boac, Marinduque to the SE; Northern shore of Mindoro; Tarlac Province - also felt. Two persons were injured in Balanga, Bataan. The epicentre was in the China Sea 130 kms west of	

Event	Felt Effect	Source
	Manila.	75
	For ten seconds, all the buildings in the city were shaken by the tremor and fear seized the hearts of everybody, people actually jumping out of the tall office buildings for fear that the edifice would crumble. The greatest consternation was seen in the city's restaurants as tumblers and plates rattled and diners felt as though a holocaust had come. Several clocks in the city stopped during the quake.	148
1932 Aug 17 11:44 a.m.	N Central Luzon: Baguio - earthquake of Intensity V.	
	Surrounding district of Benguet; Neighbouring portion of La Union - felt with less intensity.	75
1932 Aug 24 8:11 p.m.	Central Luzon: Earthquake felt in Luzon from Aparri in the extreme north to Calatagan, batangas. The epicentre was in the mountains about 10 kms west of Baguio.	
	Baguio - earthquake of Intensity VII. Over an area of about 50 kms radius around Baguio, the intensity was V-VI. The limit of the macroseismic area was about 250 kms from Baguio, from Aparri in the north to about Ambulong to the south. The centre of the disturbance was in the vicinity of Baguio and northwest of Baguio. Many objects in Baguio fell to the east or southwest and the observer in San Fernando noted that the first motion was in a north-northwest, south-southeast direction. The dilatation at Baguio was in a northwest direction. Moreover at Bayombong, Infanta, Dagupan and Bangued, where the shock was oscillatory, the directions noted were at right angles to lines drawn to the locations mentioned above.	
	Damage: Manila - the pens of the	

Event	Felt Effect	Source
	Wiechert and Omori seismographs were dislocated by transverse waves. The Galitzin trace became too faint to follow after the first few vibrations.	
	Baguio - the Wiechert seismograph had both pens dislocated, one thrust arm hinge broken, one damper connecting wire broken and the component parts of the mass jolted out of position. The horizontal component pendulum of the Vicentini had its support bent by the vertical component of the earth-movement to such an extent that the pendulum came down on the arresting platform and broke the rod at the bottom of the pendulum.	
	Mirador Observatory - a retaining wall corner, about seven feet in height, slumped down. A few slight cracks in plaster. Two small patches of plaster dislodged. Some movable objects overturned.	
	Zig-zag Hotel - retaining wall bulged. Some very small cracks in wall of building just above ground level. Some very small cracks in concrete pavement.	
	Stewart Building - a new structure of concrete. Small crack appeared in column.	
	Camp John Hay - about P1,000.00 worth of medicines were destroyed in the hospital. The Post Exchange and Commissary suffered losses amounting to a few hundred pesos. Dishes and bric-a-brac in the offices' quarter broken. Stores in the city suffered several thousand pesos' loss in broken stock.	
	Camp one (Klondyke's) - a corner of the swimming pool cracked. This wall is of concrete about three feet thick and six to seven feet deep.	

Event	Felt Effect	Source
	The belt of the dynamo was thrown off. Baguio Hydro-electric Plant - eight kms west of Baguio. Flume section broken by falling boulders. Damage not serious. Bauang - the storage batteries in the railway station, used for telegraphy and yard lighting were overturned. The facade of the church was cracked from the top of the door to the peak of the roof. Some plaster was dislodged from a side wall. The rectory was very badly damaged but this cannot be taken as a criterion of the severity of the earthquake. The roof and porch beams had been honey-combed by "termites" and the wonder is that they had not fallen long ago. The walls were of rubble masonry and many buttresses were of thin brick laid in thick layers of mortar. The second floor of the building was rendered uninhabitable and dangerous by the falling of the walls in several places and the sagging of the roof. San Fernando - a lumber shed filled with timber was overturned. it is said to have been in poor condition and the loose timber probably fell against the sides. La Union Province - the municipalities of the province reported a combined loss of P3,500 (up to August 29th), exclusive of the rectory and church in Bauang. Kennon Road - was blocked for a few hours by a dislodged boulder which landed squarely between two large boulders remaining from the big slide of 1911. Naguilian Road - was blocked for a few hours by a rock slide at the kilometre 20 point from Baguio. The	

Event	Felt Effect	Source
	material came down out of a V-shaped space between two fissures where weathering had taken place. Several slides and cracks on the Naguilian Road between Ribsuan and the Benguet boundary.	75
	Baguio - was shaken by a strong earthquake and several thousand pesos' damage was done to movable articles in stores, hospitals and dwellings; seismographs at Mirador were damaged.	
	Naguilian and Kennon Road - were blocked by slides for a few hours.	
	Bauang - convent was severely damaged.	3
	Quakes badly hit all north Luzon. The centre of the quake was in the mountains near Baguio at Tokod, Mountain Province, northeast of Baguio.	
	La Union - strongest quake felt, causing ruin and desolation over a scattered area. The damage to church and to convents was believed tremendous. The Bauang convent was completely demolished whilst hundreds of stone and frame buildings in the province fell.	
	Baguio - many of its buildings were in ruins. A mass of ruins greeted the eye of Baguio officials who surveyed the damage. The famed Steward Apartments and several houses of wealthy lowlanders were destroyed. In the case of the houses, the walls cracked and caved in, scattering furnitures and glassware. The Public Market was among the edifices badly damaged. Naguilian and Kennon Roads were blocked by tremor - included land-slides. One hundred metres of the Naguilian Road caved in. Kennon Road was impassable due to huge boulders	

Event	Felt Effect	Source
	that blocked it, thereby isolating Baguio. Telegraph and telephone lines were down and these forms of communication are also disrupted. Glassware and fragile articles broken.	
	Tokod, Mt. Province (northeast of Baguio) - the tremor was of Intensity VII, seriously damaging the seismograph at Mirador Hills.	
	Bayombong - Intensity IV.	
	Vigan; Baler - Intensity III.	
	Echaque - Intensity III.	
	Aparri - Intensity V.	
	Manila and its suburbs - Intensity III. No damage.	149
1932 Aug 31 12:46 a.m.	NW Luzon: Vigan - earthquake of Intensity V.	
	Laoag; Pasuguin; Lubuagan - felt with less intensity. Epicentre probably in the China Sea.	75
1932 Sept 15 7:15 p.m.	SW Mindanao and Sulu: Jolo - earthquake of Intensity V-VI.	
	Zamboanga; Basilan - also felt. In Jolo, people were thrown off their feet, movable objects were thrown down and the glass of the lighthouse was broken.	75
	Severe quakes rocked Zamboanga and Jolo last night.	
	Zamboanga - Intensity VII.	
	Jolo - Intensity V. Probably caused serious damage.	150
1932 Sept 26 1:20 p.m.	E Mindanao: Earthquake felt throughout the whole of eastern Mindanao.	
	Upper Agusan Valley - Intensity V or	

Event	Felt Effect	Source
	VI. It caused some alarm in Butuan.	75
1932 Oct 12 3:04 p.m.	Virac: Virac, Catanduanes - moderate shock.	75
1932 Nov 14 9:12 a.m.	Leyte and Samar: Tacloban - earthquake of Intensity VI; duration about 50 seconds. Accompanied by loud noise. Palo - intensity was greater than at Tacloban. Epicentre in the Philippine Deep.	75
1932 Dec 16 3:16 p.m.	Mindanao: Butuan; Agusan; Malita, Davao - moderate earthquake. Epicentre in the southern part of the Philippine Deep.	75
1932 Dec 31 4:31 a.m.	Tacloban, Leyte: Tacloban, Leyte - earthquake of Intensity VI; duration, 38 seconds. sleepers awakened.	75
1933 Feb 19 12:36 p.m.	SE Luzon 14°10'N - 120°40'E: Earthquake felt over all of SE Luzon, Marinduque, Catanduanes and Romblon. Centre in Camarines Norte. Daet - Intensity VIII with a duration of 25 seconds, accompanied by subterranean noises. The church of San Vicente suffered about P1,000' damage and the walls of the municipal building at Indan were cracked. Aftershocks of varying degrees of Intensity IV-VI occurred at the following times during the afternoon and evening of the 19th: 12:34, 12:51, 2:16, 2:21, 6:00, 6:28, 6:40, 9:27 and 10:39.	76
1933 Feb 26 6:20 p.m.	SE Luzon: Felt with Intensity VII at Daet and Intensity III at Naga.	76
1933 Mar 03 10:20 a.m.	Western Luzon: Earthquake felt throughout western Luzon from Vigan in the north to Ambulong in the south. Centre in the Zambales Mountaines, western Luzon. Intensity IV at Dagupan was the greatest	

Event	Felt Effect	Source
	reported intensity.	76
	All Luzon rocked by strong quakes. Manilans alarmed. From Baguio down to Batangas was rocked for five seconds at 10:20 this morning by an Intensity IV quake that made buildings tremble and in many crowded places scared people into rushing out of their houses and offices. The quake originated 130 kms northwest of Manila in the China Sea off the Zambales coast. No damage was reported in Manila. In Manila, panic was produced among employees in the city hall who rushed pell-mell out of the rickety old building to the street, fearing that the aged edifice would fall on them. In the legislative building also several of the more nervous employees rushed out. Pangasinan registered an Intensity III quake at 10:25 with a 30 seconds' duration.	151
1933 Mar 29 6:11 a.m.	Mountain Province: Labuagan - strong earthquake.	76
1933 Apr 19 12:55 p.m.	Camiguin Island: Mambajao - Intensity V.	76
1933 May 27 12:43 p.m.	Samar & Leyte: Earthquake in the Philippine Deep.	
	Borongan - Intensity VI. Bell tower of the church of Borongan was damaged.	
	Tacloban - Intensity V.	76
1933 June 06 10:28 a.m.	Luzon: Strong earthquake having its centre in the eastern Cordillera near the southeast end of Laguna de Bay. The towns along the south shore, Ambulong on Lake Taal and Nasugbu on the China Sea coast were strongly shaken. Considerable damage to brick work was suffered at the generating platn in Nasugbu. In Manila and the towns of southern Batangas, Tayabas and Bulacan, the	

Event	Felt Effect	Source
	earthquake was felt with much less intensity. It was also felt in Mindoro, Culion, Cuyo and Romblon. The E - W fault through the Taal region and the south shore of Laguna de Bay was probably responsible for the strong effects perceived in that section.	76
	Quake rocked Manila, Laguna, Cavite, Batangas. Tremor was Intensity IV. In Manila, people rushed out in panic. It originated 50 kms SE of Manila and was of 15 seconds' duration. Entire province of Laguna was rocked, although the quake was felt slightly in Atimonan and Tayabas. Manila's Great Eastern Hotel, shook alarmingly. Several books on the shelves of the City Hall fell off; thre typerwriters slid onto the floor. Residents in the city's old buildings rushed out in panic feeling the buildings would collapse on them.	152
1933 July 03 12:31 p.m.	Cotabato, Mindanao: Earthquake felt in the province of Cotabato. Two strong shocks at Upi Agricultural School, Awang.	76
1933 Sept 20 6:05 a.m.	Baco, Mindoro: Moderately strong shock felt at the Halcon Rubber Station.	76
1933 Dec 02 4:44 p.m.	Basco, Batan Island: Basco - Intensity VII and duration of 15 seconds. Objects overthrown; people badly frightened. The epicentre was 15 kms from Basco, near Sabtang Island.	76
1934 Jan 26 2:21 a.m.	W Luzon: W Luzon - moderate intensity. Dagupan; San Fernando - Intensity III. Baguio; Vigan - felt, with no intensity given. Centre in the Lingayen Gulf.	77

Event	Felt Effect	Source
1934 Jan 29 1:29 p.m.	Daet, Camarines Norte: Daet, Camarines Norte - earthquake of Intensity VI; three seconds' duration.	77
1934 Feb 14 11:59 a.m.	Luzon 17°20'N - 119°20'E: It was perceptible over all of Luzon. The shaken area was approximately 1,885,900 sq kms or 723,400 sq miles. In the coast towns nearest the centre of the earthquake, the motion was perceptible for 90 to 120 seconds, while in Manila, some 350 kms from the epicentre, the motion lasted about 60 seconds. Although the earthquake caused considerable alarm, the damage done on land was negligible. The wall of a public school in Manila was cracked and a portion of a pier settled a few inches, but these effects were due to defective or weakened material, and should not be taken as a criterion of intensity. A feature of much greater importance and interest was the rupture of the Manila-Shanghai cable of the Commercial Pacific Cable Company. This epicentre is about 115 kms due west of San Esteban where a sea disturbance was observed. The first movement of the sea was reported to have been a recession and to such a noticeable extent that the people hurried out onto the exposed shore to gather fish which had been left stranded. Some persons narrowly escaped drowning when the water returned.	77
	Manila - Intensity IV; duration, 30 seconds; caused considerable panic among occupants of old and tall buildings. employees punching time clocks on their way out to lunch "dropped everything" and rushed pellmell to the streets. Only one building was slightly damaged; it leaned a little to the left. In many houses all clocks operated by pendulums stopped. At the Meisic Police Station, all clocks stopped	

Event	Felt Effect	Source
	at a few seconds after 12 noon. Electricity was stopped for a few seconds during the quake.	
	Baguio - slightly felt.	153
1934 Mar 21 4:54 a.m.	NE Mindanao and Leyte 9°20'N - 126°30'E: Butuan - earthquake of Intensity V.	
	Talisayan, Oriental Misamis, 200 kms southwest; Palo, Leyte 250 kms north - felt with decreasing intensity.	77
1934 May 14 1:03 a.m.	N Luzon: Northern Luzon - earthquake of moderate intensity.	
	Tuguegarao; Aparri - Intensity IV.	
	Laoag; Echaque; Baguio; Vigan - Intensity III. Centre in mountains of Northern Luzon.	77
1934 June 06 5:43 p.m.	Borongan, Samar: Borongan, Samar - earthquake of Intensity VII; eight seconds' duration.	77
1934 June 17 2:48 a.m.	Panay: Iloilo; SE Panay - moderate intensity.	77
1934 July 21 12:38 p.m.	N Luzon: Earthquake felt over all of northern Luzon and as far south as Manila. The centre was in the immediate vicinity of Mount Pulog.	
	Haights Place - violent intensity preceded by rapid violent sounds. Trees threshed about, dead branches were shaken off and it was impossible to keep one's feet. The oscillations seemed to be east and west and lasted for a long time.	
	Bayombong - 30 kms to the southeast, the motion was horizontal and roofs rattled. The missionary reported that it was the strongest shock in that section in 12 years.	
	Baguio - perceptible shocks; about	

Event	Felt Effect	Source
	40 seconds. Some landslides were caused near Bokod.	77
1934 July 31 1:59 p.m.	Central Luzon: Iba, Zambales - earthquake of Intensity VI; a strong sound was heard shortly before the shock was perceived. Some damage in stores. It was perceptible over a radius of about 200 kms throughout central and southern Luzon. The centre was in the China Sea, off the west coast of Luzon.	77
	Manila - duration, 60 seconds; rocked Manila and surrounding provinces; of Intensity V spoiling the lunch, siesta, or peace of mind of many residents. There was no office or business activity as it was siesta time. No panic took place and no damage was reported.	154
1934 Aug 13 7:15 a.m.	Mindanao 8°20'N - 126°50'E: Earthquake felt over all of Mindanao, except the southwest section, and in the central and eastern Visayas.	
	Surigao; Butuan; Eastern Mindanao - Intensity was VI - VII. The water of the Agusan River was strongly agitated.	
	The shock was recorded all over the world.	77
1934 Aug 14 2:54 a.m.	Borongan, Samar: Borongan, Samar - earthquake of Intensity VI.	77
1934 Sept 24 11:27 p.m.	Samar and Leyte 11°30'N - 127°E: Borongan - earthquake of Intensity VI.	
	Tacloban - Intensity IV.	77
1934 Nov 26 8:09 p.m.	China Sea 14°10'N - 120°10'E: Lubang Island - earthquake of Intensity VII.	
	Manila - Intensity VI. The earthquake was felt as far as Culion and Cuyo to the south and Baguio to the	

Event	Felt Effect	Source
	north.	
	The epicentre was in the China Sea, 50 kms off the entrance to Manila Bay.	
	Lubang - movable objects were overturned, water was splashed out of tanks and considerable fright was experienced among the people. The perceptible motion lasted for one half minute, but this is probably underestimated. The shock was felt strongly on board the "Empress of Asia" which was 40 miles north of the epicentre.	
	Manila - tall buildings oscillated alarmingly, some electric lines were broken by the swaying of poles, and some windows were cracked. Pieces of cement covering the join between the Insular Life and Filipinas buildings were loosened and fell to pavement. The perceptible motion lasted about one minute, and a vertical component could be detected. The intensity along the coast of Luzon, opposite the epicentre, was VI-VII.	77
	The shocks were so strong that the needles of the seismograph apparatus were jerked off, the plates and all the clocks there, and in many other places, were thrown out of order or stopped at exactly nine minutes and 35 seconds after eight o'clock last night. Epicentre about 90 kms WSW of Manila, somewhere in the China Sea off the coast of Nasugbu, Batangas.	
	Manila - crowded places were immediately emptied as people panicked. Parts of the city were thrown into darkness as electric wires snapped; shrieks of terror-stricken women and children rent the air; tall buildings swayed and sustained cracks. "Cascos" and craft in the Pasig River collided; glassware in many stores was broken;	

Event	Felt Effect	Source
	the din of traffic in busy streets was stopped as motorists and drivers of vehicles and horse-drawn carriages abruptly stopped and did not know where to go; there was general commotion for many seconds. Intramuros was badly shaken. Residents dashed out. Manila's cinemas were emptied when the quake occurred; the city's bridges were scenes of confusion as pedestrians and commuters did not know what to do. The massive buildings on the Escolta swayed dangerously and caused cold shivers to run down the spines of passers-by who saw the swaying. Despite the alarm and panic, no loss of life or serious damage was reported. The Filipinas Building on Plaza Moraga cracked loose from the Insular Life Building. Lights went out in the studio of Radio Manila on the 7th floor of the Insular Life Building. The quake shook the water out of the gutters on the roof of the Cu Unjieng Building on the Escolta and broke the glass in the bookcases in the law office of Laurel and del Rosario on the 6th floor. The lift in the Heacock Building dropped one floor and gave the passengers a bad scare. The top of one of the lifts of the Bay View Hotel caved in. Fires treatened to break out in the city, due to fallen and severed live electric wires. Tremors of Intensity VI were felt within a radius of 65 kms from the epicentre. Pampanga - was rocked by a quake of Intensity IV of two minutes' duration, spreading terror among its inhabitants and sending them out of their houses. No damage reported. Bulacan - people panicked; duration, 16 seconds; no damage reported. Baguio - slight and feeble.	

Event	Felt Effect	Source
	Cavite - quake of great intensity; sent people rushing out of their houses; no damage.	
	Pasig - duration, 20 seconds.	155
1934 Nov 27 3:49 p.m.	Leyte and Samar 11°06'N - 125°05'E: Tacloban - earthquake of Intensity VII; duration of 30 seconds. A wall of the High School Building was cracked. It was also reported from Guiuan and Catbalogan. Its centre was in Leyte Gulf near Tacloban.	77
1935 May 24 1:37 p.m.	E Visayas and Mindanao: Very strong earthquake having its epicentre in the Philippine Deep.	
	Guiuan; Borongan; Tacloban - Intensity VI-VII. It caused general panic in the last-named towns where it was perceptible for about two minutes and damaged some houses. The earthquake was felt over an area of about 450 kms radius.	78
1935 Aug 01 10:07 p.m.	Samar and Leyte: Tacloban - earthquake of Intensity VII-VIII. Some cracks were produced in the High School Building.	
	Calbayog; Catbalogan; Guiuan; Borongan - also reported felt. The centre seems to have been in the Philippine Deep.	78
1935 Sept 01 1:17 a.m.	Samar and Leyte: Tacloban; Guiuan - earthquake of Intensity V. A second shock of Intensity III was felt in the same place about five minutes after the first. Centre in the Philippine Deep.	78
8:30 a.m.	Guiuan, Samar: Guiuan, Samar - moderate earthquake; duration, 17 seconds.	78
1935 Sept 08	Rosario, La Union: Rosario, La Union - moderate earthquake was felt during the night. The time was not noted.	78

Event	Felt Effect	Source
1935 Sept 10 12:20 a.m.	Tacloban, Leyte: Tacloban - earthquake of Intensity VI; duration, 50 seconds. The centre was probably in San Pedro Bay.	78
10:49 p.m.	Samar and Leyte: Guiuan; Dulag - moderate earthquake. Centre probably in tne Gulf of Leyte.	78
1935 Sept 13 1:10 p.m.	Sallapadan, Abra: Sallapadan, Abra - moderate earthquake felt.	78
1935 Sept 18 12:24 a.m.	Dulag, Leyte: Dulag, Leyte - moderate earthquake felt.	78
1935 Sept 19 11:00 a.m.	Oriental Negros: Dumaguete; Zamboanguita - moderately strong earthquake.	
	Lazi - slightly felt.	78
1935 Sept 27 9:32 p.m.	Davao, Mindanao: Lupon - moderately strong earthquake.	
	Mati, Davao - slightly felt.	78
1935 Sept 28 1:06 a.m.	Catanduanes: Virac; Viga - strongly felt.	
	Virac - strong vertical motion.	78
1935 Sept 29 11:43 p.m.	Kabangklan Occidental Negros: Kabankalan, Occidental Negros - moderate earthquake.	78
1935 Oct 04 1:17 p.m.	Mindanao $6^{o}20'N - 125^{o}E$: Sta. Cruz; Glan - moderately felt.	
	Probably a deep focus earthquake in southern Mindanao.	78
1935 Oct 06 2:56 a.m.	Mindanao: Sta. Cruz, Davao; Glan, Cotabato - moderately strong earthquake.	78
1935 Oct 07 6:24 p.m.	Sorsogon: Juban - strongly felt earthquake.	
	Barcelona; Bulan; Sorsogon; Donsol - moderately felt earthquake.	78

Event	Felt Effect	Source
1935 Oct 09 4:05 a.m.	W Luzon: Botolan, Zambales - strongly felt.	
	Iba, Zambales; San Antonio; Manila - slightly felt. Centre in the China Sea.	78
4:32 a.m.	Mindanao: Bunawan, Agusan - felt strongly.	
	Butuan; Agusan; Baler; Cantilan, Surigao - slightly felt.	78
3:30 p.m.	Masinloc, Zambales: Masinloc, Zambales - moderate earthquake.	78
7:20 p.m.	Luzon and Masbate: Donsol, Sorsogon; Aroroy, Masbate - earthquake of moderate intensity.	78
1935 Oct 10 2:18 a.m.	Sorsogon: Bulan, Sorsogon; Donsol - earthquake of moderate intensity.	78
5:15 a.m.	Jaban, Sorsogon: Juban, Sorsogon - strong earthquake felt.	78
1935 Oct 12 11:40 a.m.	Guiuan, Samar: Guiuan, Samar - moderate strong earthquake; duration, 12 seconds.	78
1935 Oct 15 3:47 a.m.	Luzon: San Fernando, La Union - earthquake of Intensity VI. Felt over all of western Luzon from Bangued and Sagada in the north, to Manila in the south and Nueva Vizcaya to the east.	
	Dagupan - some concrete pavements were cracked.	
	La Union; Pangasinan - strong aftershock felt at 3:53 a.m.	
	San Fernando; Aringay - very slight shock was felt at 4:03 a.m. Centre of earthquake in Lingayen Gulf.	78
1935 Oct 20 4:31 a.m.	Samar and Leyte: Guiuan, Samar, Balangiga, Samar - strongly felt.	
	Jaro, Leyte - moderately felt.	

Event	Felt Effect	Source
	Gandara, Samar - slightly felt.	78
1935 Oct 24 10:10 p.m.	Badajoz, Romblon: Badajoz, Romblon - moderate intensity.	78
1935 Oct 26 1:12 a.m.	Dapa, Surigao: Dapa, Surigao - moderately strong earthquake.	78
4:15 a.m.	Samar and Leyte: Gandara; Dulag; Hinundayan - moderately strong earthquake.	
	Borongan; Tanauan - slightly felt.	78
1935 Oct 27 2:35 a.m.	Dumaguete Oriental Negros: Dumaguete - earthquake of Intensity V; duration, three seconds.	78
1935 Nov 04 5:00 a.m.	Hinundayan Leyte: Hinundayan, Leyte - moderate earthquake.	78
1935 Nov 06 4:59 a.m.	Mindanao: Kingking; Mati; Glan; Sta. Cruz - strongly felt.	
	Davao; Manay - Intensity IV.	
	Butuan; Cantilan - slightly felt. Centre in the Philippine Deep.	78
1935 Nov 07 5:48 a.m.	Davao and Cotabato: Davao; Mati; Glan - moderately strong earthquake.	78
12:30 p.m.	San Luis, Batangas: Moderately strong earthquake.	78
1935 Nov 13 3:30 a.m.	Lumbatan, Lanao: Moderately strong earthquake.	78
1935 Nov 16 1:51 p.m.	Samar and Leyte: Oras - strong earthquake.	
	Tacloban; Dulag; Babatngon; Tinambacan; Gandara; Tanauan; Borongan; Calbayog - moderately strong earthquake. Centre probably in the Philippine Deep.	78
1935 Nov 26 2:00 p.m.	Hinundayan, Leyte: Moderately strong earthquake.	78

Event	Felt Effect	Source
1935 Nov 27 5:13 p.m.	Samar and Leyte: Tacloban - Intensity VII-VIII; duration, 50 seconds. Baybay, Leyte; Borongan, Samar - moderately strong. Gandara; Oras; Tanauan; Hinundayan - slight intensity. Centre in San Pedro Bay.	78
1935 Dec 01 6:12 a.m.	SE Luzon: Naga - strongly felt. Daet - Intensity IV. Calauag, Tayabas, Donsol, Sorsogon - moderately felt.	78
1935 Dec 08 1:16 p.m.	S Luzon: Tanauan and Lipa Batangas - strongly felt, short duration. Ibaan; Rosario; Bauan - moderately felt. Tayabas; Laguna; Marinduque; Mindoro; Cavite; Rizal - slightly felt. Centre near Tanauan, Batangas.	78
1935 Dec 14 1:00 a.m.	Cantillan, Surigao: Moderately strong earthquake.	78
1935 Dec 15 9:44 a.m.	N Luzon: Aparri - strongly felt; duration, 18 seconds. Lallo; Bangui - moderately felt. Laoag; San Vicente; San Pablo, Isabela; Lubuangan; Infanta - slightly felt. Centre in the mountains of Northern Luzon.	78
1935 Dec 16 7:24 p.m.	San Vicente, Ilocos Sur: Moderately strong earthquake.	78
1935 Dec 22 8:26 p.m.	Mindanao and Leyte: Butuan, Cantilan - strongly felt. Placer; Dulag - moderately felt. Surigao; Tanauan; Bunawan - slightly felt. Centre probably in the Gulf of Leyte.	78

Event	Felt Effect	Source
1936 July 05 10:29 p.m.	Bulan, Sorsogon: Moderate earthquake.	79
1936 July 06 2:57 a.m.	Mindanao 3°20'N - 126°20'E: Davao; Cotabato - strongly felt.	
	Surigao; Agusan; Zamboanga; Jolo - moderately felt.	79
1936 July 11 3:24 a.m.	Glan, Cotabato: Moderate earthquake.	79
1936 July 17 3:29 a.m.	Moncada, Tarlac: Moderate earthquake.	79
1936 July 23 3:19 p.m.	Glan, Cotabato: Strong earthquake, with vertical motion followed by horizontal.	79
9:28 p.m.	SE Luzon: Legaspi; Bulan - moderate earthquake.	79
1936 July 30 4:45 p.m.	Tigaon, Camarines Sur: Strong earthquake.	79
1936 July 31 8:45 a.m.	Albay, Luzon: Malinao; Tabaco - strongly felt.	
	Polangue - moderate felt.	79
1936 Aug 04 10:10 p.m.	N Luzon 19°10'N - 120°30'E: Northern Luzon; Batan Island - strong earthquake.	79
1936 Agu 05 10:15 p.m.	Cantilan, Surigao: Moderate earthquake.	79
1936 Aug 10 12:08 a.m.	Bangui, Ilocos Norte: Strong earthquake.	79
1936 Aug 14 4:04 a.m.	Leyte and Mindanao: Surigao; Butuan - strong felt.	
	Hinundayan, Leyte - strongly felt.	
	Davao; Oriental Misamis - moderately felt.	79
1936 Aug 22 4:05 a.m.	Malinao, Albay: Moderate earthquake.	79

Event	Felt Effect	Source
1936 Sept 15 9:13 p.m.	Bangar, Ilocos Norte: Moderate earthquake.	79
1936 Sept 19 5:49 p.m.	Cantilan, Surigao: Strong earthquake.	79
1936 Sept 22 6:20 a.m.	Lallo, Cagayan: Moderate earthquake.	79
1936 Oct 05 2:10 p.m.	W Visayas 9°20'N - 120°E: Tolong Negros - strongly felt. Felt over all of Panay and Negros.	79
1936 Oct 08 11:49 p.m.	San Mariano Isabela: Moderate earthquake.	79
1936 Oct 10 3:13 p.m.	Luzon, Mindoro and Marinduque: Naujan - strongly felt. Boac; Atimonan - slightly felt.	79
1936 Oct 18 3:40 p.m.	Bangui, Ilocos Norte: Moderate earthquake.	79
1936 Nov 04 4:16 a.m.	N Luzon: Lallo, Cagayan; Bangui, Ilocos Norte - moderate earthquake.	79
1936 Nov 16 2:30 p.m.	Badajoz, Romblon: Moderate earthquake.	79
1936 Nov 18 10:24 p.m.	Ormoc, Leyte: Ormoc, Leyte - Intensity VI; duration, 30 seconds; oscillatory earthquake.	79
1936 Nov 20 6:00 a.m.	Samar: Hinambacan - strongly felt. Calbayog - moderately felt.	79
1936 Dec 03 3:18 a.m.	N Luzon: Lallo, Cagayan - strongly felt. Ilocos Norte; Isabela - moderately felt.	79
2:08 p.m.	N Luzon: Bontoc; Sagada; Mount Data, in Mountain Province - moderate earthquake.	79
1936 Dec 04 2:03 a.m.	Baler, Tayabas: Earthquake of Intensity V felt in Beler, Tayabas; duration of nine seconds; preceded	

Event	Felt Effect	Source
	by a rumbling sound.	79
1936 Dec 05 11:29 a.m.	Cabalian, Leyte: Strong earthquake.	79
1936 Dec 08 12:28 a.m.	N Luzon: Lallo - strongly felt.	
	Aparri, Cagayan - slightly felt.	79
6:25 p.m.	Leyte, Cebu N Mindanao: Ormoc, Leyte - very strong earthquake; causing panic among the people. Felt as far as Cantilan and Surigao to the east, Cebu to the west. Centre was probably in Ormoc Bay.	79
1936 Dec 14 12:04 p.m.	Luzon: Felt throughout the provinces of southern and western Luzon; centre was in the China Sea off the mouth of Manila Bay. Several shocks felt on Corregidor Island.	79
1936 Dec 15 9:41 p.m.	Aroray, Masbate: Moderate earthquake.	79
1936 Dec 18 11:25 a.m.	Luzon: Manila; Cavite Province - moderate intensity.	79
1936 Dec 21 11:41 a.m.	N Luzon: Moderate earthquake felt in Ilocos Sur and Lubuagan and Mt. Data in Mountain Province. Epicentre in the China Sea.	79
1936 Dec 23 1:00 a.m.	Barcelona, Sorsogon: Moderate earthquake.	79
1936 Dec 26 12:00 p.m.	Tabaco, Albay: Strong earthquake.	79
11:26 p.m.	SE Luzon: Virac; Legaspi - earthquake of Intensity V. Twelve seconds later, there was an aftershock at Virac. Twelve minutes later, there was an aftershock at Legaspi.	79
1937 July 03 12:32 a.m.	Cotabato, Mindanao: Cotabato, Mindanao - strong earthquake; duration, five seconds; followed by a shock of slight intensity, lasting two seconds at Kiamba.	

Event	Felt Effect	Source
	Glan, Cotabato - strongly felt.	80
1937 July 18 2:26 a.m.	Central and Eastern Luzon: Baler - Intensity V; duration, 18 seconds. Sta. Cruz, Laguna - Intensity IV. Alabat, Infanta and Dagupan - Intensity III. Manila, Mt. Arayat and Lucban - Intensity II. Centre in the Cordillera, northeast of Manila; oscillatory motion in every place.	80
1937 Aug 10 8:18 p.m.	NE Mindanao: Dapa - Intensity V; duration, one minute. Butuan - Intensity IV. Surigao - Intensity II. Centre probably in the Philippine Deep.	80
1937 Aug 13 12:39 a.m.	E Luzon: Sta. Cruz, Laguna - Intensity V.	80
1937 Aug 20 7:59 p.m.	S and SE Luzon: Quezon - the waters have risen in the town of Quezon at the south end of Alabat. This town is practically on Calauag Bay at the head of which there was a rise in the sea level. The people of the town of Calauag, at the head of the bay, reported that the water rose from low- to high-tide level in the space of about 10 minutes. Some persons who were ascending the Calauag River in canoes were surprised at the rapid progress they made, not knowing that they were being pushed upstream by a wave. Tayabas - the town of Polillo reported that damage had been sustained there to the amount of P5,000. The sea wall of Mauban was damaged. The water system of Tayabas and Atimonan suffered some damage. Some houses were damaged in the towns of Sariaya, Lucban and Lucena. In the island of Alabat nearly all	

Event	Felt Effect	Source
	of the houses were tilted or slightly damaged.	
	Atimonan - tower and college of Atimonan were damaged partially.	
	Gumaca - tower of Gumaca destroyed completely.	
	Laoag and Iloilo - perceptible.	80
	Tayabas - damage in this province consisted of destroyed church towers, cracked cement or concrete pillars, twisted telephone/telegraph posts, disjointed steel rails and cracks in roads. The quakes were intense in Lucena, Lucban, Gumaca, Atimonan, Quezon and Candelaria. One house completely destroyed in Lucban. Belfries of churches in Gumaca totally destroyed, also that in Atimonan; traffic in the famous Atimonan zigzag totally stopped, due to dangerous cracks in it making the road impassable; telephone lines between Candelaria and Lucban interrupted; water tanks at Lucena railway station collapsed and fell onto the rails; water system supplying water to Tayabas, Pagbilao and Lucena sustained serious damage; Lucena provincial capitol suffered cracks.	156
	Manila - a 36" water main broke in the Santa Ana section of the city. A 16" main on Ayala Bridge broke, also an 8" main at Pier No. 3 and No. 5 and flooded a warehouse, damaging several hundred sacks of flour.	
	Heacock Building - so badly damaged that the City Engineer ordered its demolition. The upper floors overhung the first floor giving a cantilever effect and there was a lack of bracing in the first floor. This floor had been designed to give a large open space with no obstruction except the column. The	

Event	Felt Effect	Source
	column capitals crushed when the building rocked. Cracks were produced in the Insular Life Building, in the Philippine National Bank, in the Grand Theatre, in the church of San Francisco, in the Great Eastern Hotel, in two concrete arches in the Army and Navy Club, and in the cupola of the stairway in the monastery of San Augustine. No doubt there were many others which were not reported.	
	Great Eastern Hotel - seems to have settled a few inches and the lifts jamed during the earthquake.	
	Bayview and Luneta Hotels - minor cracks and dislodged plaster.	
	Army and Navy Club - some of the tiled floor was loosened in the kitchen and a water pipe was broken.	
	American YMCA - the kitchen floor dropped several inches. A crack 12 feet long appeared in the lobby of the University Club.	
	Law Building of Sto. Tomas University - some cracks appeared on the second floor. The vault of the City Treasurer was cracked. some stones fell from the tower of the Recoleto Church. The tower of Pandacan church collapsed. The Ermita Elementary School was condemned. Two factories were closed by order of the city authorities and damage of various degrees was reported from 33 private houses. Ten city schools were slightly damaged. A crack appeared in Dewey Boulevard. (Now, Roxas Boulevard) Cracks in the concrete railings of the Arlegui Bridge. Shop windows were broken in the Heacock Building, Estrella del Norte, the Philippine National Bank, the People's Shoes, and some on Rizal Avenue. Bookstacks in the National Library overturned. A crane	

Event	Felt Effect	Source
	was derailed on Pier 7.	80
	Both Manila and nearby provinces suffered considerable damage and reported many injuries as a result of last night's (Aug 20) series of violent earthquakes, the first two of which were of Intensity VI and VII, respectively. In Manila, several modern office buildings were so badly damaged that they were temporarily condemned by the city hall authorities. Two Manila bridges, the Sta. Cruz and Ayala bridges were also considered so shaken that prohibition of heavy traffic was decided upon. Churches, bell towers, and old Spanish buildings constitute the damage in the provinces which was considerable. One person died in Cavite due to fright when the quake struck. A number of schools in Manila sustained heavy damage. Arellano High School's main stairways were torn loose, doors were totally destroyed and bookcases upturned, water pipes in the building broken, and the electric fans in the ceiling torn down. Stairway of the Mapa High School also shifted out of place. Cement bases of several posts of the Ermita Elementary School were also stripped off and the left wing is in such shape that the City Engineer's office was requested to inspect the building to ensure the safety of the pupils and teachers. The Quiapo Primary School showed cracked walls and many glass windows broken. The Tondo Primary School Annexe showed cracked walls, too. All police telephones in Manila were put out of order. Cement wall in the City Treasury's vault was also cracked. Innumerable electric and telephone lines were cut or burned; water mains broken at Ayala, corner Suter St., Sta. Ana. Most of the destruction to power lines was	

Event	Felt Effect	Source
	caused by short circuits or grounded wires snapped by the tremor. The Manila Hotel swayed from side to side during the tremor. Heacock Building at Escolta sank six inches.	156
	Bulacan - the ceiling of the convents of San Miguel church and the front wall of the municipal building cracked.	
	Cavite - several old buildings in the town of Cavite were cracked; a building on Calle Colon collapsed; some piers in the Navy yard cracked; one wall of a house in the Navy yard collapsed. Some cracks appeared in the walls of the churches at Mendez Nunyez and Silang. The latter church is about 300 years old.	
	Rizal - at Caloocan, the municipal building and church suffered some cracks. The municipal building at Morong sustained some cracks. One exterior edge from roof to ground of one transept of the church at Antipolo collapsed. Some damage was sustained by the churches in the following towns: Teresa, Pililla, Taytay, Tanay, Baras, Morong, Pasig and Mariquina. The churches at Antipolo, Taytay and Morong are some 300 years old.	
	Camarines Sur - some walls of the Abella Building in Naga collapsed. The Manila Railway water tank, having a capacity of 65,000 gallons, crushed its tower. Some smaller tanks at other places which were filled at the time were overturned. Tanks which were empty or nearly so were not damaged.	
	Laguna - the constabulary building in Sta. Cruz was damaged and the vault of the church was cracked. The provincial telephone lines were broken. The Manila Railway water tank at Panaan collapsed. The bridge	

Event	Felt Effect	Source
	at Siniloan was damaged. The walls were cracked in the market and in the municipal building of Pagsanjan. Considerable loss in coconuts will result from unripe nuts being shaken from the trees. It is said that there is an injurious effect on the trees from which they do not recover for several years. Church of Sta. Maria, Laguna, destroyed completely. Church and convent of Paete, destroyed completely.	
	Pangil, Laguna - church and convent were damaged partially.	
	Famy, Laguna - church was destroyed completely.	
	Pakil, Laguna - convent was destroyed completely.	
	Sta. Cruz, Laguna - tower was damaged partially.	
	Cavinti, Laguna - church was damaged partially.	
	Lumbang, Laguna - church was damaged partially.	80
	Experts at the Weather Bureau compared this quake with that which destroyed San Francisco, California, but the duration was too short to result in much destruction. The quake's direction covered a long distance from north to south and indicated a varying distance from Manila of 20 to 100 kms. The source of the quake was not at a point but along a line. The strongest to hit the Philippines since 1882, the quake was also felt in the following places: Baquio, Intensity III; Masbate, Intensity III-IV; Dagupan, Intensity IV; Infanta, Naga and Daet, Intensity VI; Legaspi, Intensity VI to VII.	156

Event	Felt Effect	Source
1937 Sept 03 2:53 a.m.	Sta. Cruz, Davao: Strong earthquake.	80
1937 Sept 04 5:10 a.m.	Central and N Luzon: Baguio - Intensity V; duration, three seconds. Dagupan, Casiguran, and Laoag - Intensity III. San Fernando, La Union; San Pablo, Isabela; Echaque; Manila - slight shock. Centre in the Caraballo Mountains.	80
1937 Sept 06 5:07 a.m.	N Luzon: Sto. Domingo, Ilocos Sur - moderately strong earthquake. Aparri and Laoag - Intensity II. Centre probably in mountains of northern Luzon.	80
1937 Sept 16 5:10 p.m.	Boac, Marinduque: Earthquake of Intensity V.	80
1937 Sept 17 2:11 a.m.	S Luzon: Sta. Cruz, Boac and Atimonan - moderately strong. Marinduque Island, batangas, Laguna and Tayabas Province - felt. Centre in Tayabas Bay.	80
1937 Sept 22 11:12 a.m.	E Visayas and SE Luzon: Southern Masbate - very strong earthquake. Northern part of the island - Intensity V. Legaspi and Calbayog - Intensity IV. Felt as far north as Atimonan; in northeast Panay and at Catbalogan to the southeast. Centre in Samar Sea near Masbate.	80
1937 Sept 25 9:46 p.m.	San Pablo, Isabela: Moderate earthquake.	80
1937 Dec 17 2:26 a.m.	Virac, Catanduanes: Oscillatory earthquake of Intensity V; duration, 12 seconds. Aftershocks of Intensity III.	80

Event	Felt Effect	Source
1938 Jan 12 9:39 p.m.	Virac, Catanduanes: Virac, Catanduanes - oscillatory earthquake of Intensity V. Duration, 22 seconds. Aftershock of Intensity V; duration, seven seconds.	81
1938 Feb 05 5:55 p.m.	S Luzon: The centre was in the region of Catanduanes Island.	
	Virac - Intensity VII; duration, 17 seconds. A strong vertical motion was felt, an underground noise was heard; windows were broken and movable objects were displaced to the NW. Old brick structures were slightly damaged.	
	Mayon Rest House; Tabaco; Polangui - the shock was strong.	
	Legaspi - Intensity V; duration, 40 seconds.	
	Daet; Sorsogon; Atimonan - Intensity IV.	
	Capalonga; Naga - Intenstity III.	
	Ambulong - Intensity II.	81
1938 Feb 06 2:45 p.m.	Kiamba, Cotabato: Moderate earthquake.	81
1938 Feb 11 10:40 p.m.	N Luzon: Moderately strong in Sto. Domingo, Ilocos Sur, and slight in Aparri and Laoag. Epicentre probably in mountains of northern Luzon.	81
1938 Feb 17 4:47 a.m.	SE Luzon: Malinao, Tabaco, Legaspi, Sorsogon - felt moderately for 20 seconds.	81
1938 Mar 02 4:27 a.m.	Tacloban, Leyte: Tacloban, Leyte - Intensity V; duration, 15 seconds.	81
1938 Mar 11 12:23 a.m.	E Mindanao: Sta. Cruz, Davao - felt strongly. Port Lamon and Lingig in Surigao - felt slightly.	
	Butuan and Agusan - felt slightly. Epicentre in southern part of	

Event	Felt Effect	Source
	Philippine Deep.	81
1938 Mar 12 4:02 p.m.	Cagayan, Misamis Oriental: Cagayan, Misamis Oriental - Intensity V.	81
1938 Mar 13 4:02 p.m.	Alabay, Tayabas: Moderate earthquake.	81
1938 Mar 23 4:22 p.m.	Luzon: Batac, Ilocos Norte - felt very strongly; duration, 56 seconds. Laoag, Ilocos Norte - Intensity V; duration, 40 seconds. Vigan - Intensity VI; duration, 55 seconds; slight damage to old buildings.	81
1938 June 27 4:35 a.m.	Samar: Calbayog - Intensity V; duration, 15 seconds; direction, SE - NNW.	81
1938 July 03 7:15 p.m.	Luzon and Samar: Legaspi - Intensity V; duration, ten seconds. Calbayog - Intensity I; duration, five seconds.	81
1938 July 04 5:31 a.m.	NE Mindanao: Earthquake of Intensity IV and 17 seconds' duration at Dapa. Creaking of houses and lamps swing. Very slight at Butuan but the motion was of such a character as stop a pendulum clock. At Surigao, it was extremely slight and was felt for only five seconds.	81
1938 July 25 5:42 p.m.	Luzon and Samar: Calbayog - Intensity VI. Ten seconds' duration. Bulan, Legaspi, Sorsogon, Tabaco - Intensity IV. Daet - Intensity III and slight at Mayon Rest House.	81
1938 Aug 29 11:23 p.m.	SE Luzon and Visayan Island: Cataingan, Masbate - Intensity VIII. The municipal building shifted five inches on its foundations and tilted several degrees to the west; strong	

Event	Felt Effect	Source
	posts were broken; the post office was almost demolished and the safe, weighing 400 kgs, moved several metres and doors and windows twisted out of shape. Ten houses collapsed. Hanging objects swung from west to east; dishes were broken; furniture was overturned, and the populace became panicky. In a nearby bridge, a crack appeared with a length of several metres anv varying in width from ten to 45 cms; stones were dislodged from neighbouring hills.	
	Calbayog, Samar - Intensity VII; duration; 50 seconds.	
	Legaspi - Intensity V-VI; duration, 25 seconds. It was felt throughout SE Luzon, northern and western Samar, northern Leyte, Bohol, Cebu and Panay. The epicentre is in the Samar Sea near the south end of the island of Masbate.	81
1938 Sept 04 6:00 a.m.	Carmen, Bohol: Carmen, Bohol - violent earthquake; probably the collapse of a limestone cavity beneath the town.	81
1938 Nov 13 12:54 p.m.	Mindanao, Samar and Leyte: Dapa - Intensity VI; duration, 20 seconds. Epicentre in the Philippine Deep.	
	Butuan - Intensity VI; the church bell rang once, clocks were stopped, hanging objects swung from N to S and people ran into the streets; the shock lasted for one minute.	
	Hinatuan; Guiuan - felt strongly.	
	Surigao; Port Lamon; Maasin; Ormoc - it was also felt.	81
1938 Nov 17 1:35 p.m.	Badajoz, Romblon: Moderate earthquake.	81
1938 Dec 03 9:15 p.m.	NE Mindanao: Butuan - strong earthquake; 30 seconds' duration. Windows and doors were strongly shaken;	

Event	Felt Effect	Source
	pendulum clock stopped.	
	Tagaloan and Balingasag (Oriental Misamis) - felt moderately.	
	Surigao; Agusan - felt slightly.	81
1938 Dec 26 11:00 p.m.	Cataingan, Masbate: Cataingan, Masbate - strong shock.	81
1938 Dec 27 4:00 a.m.	Cataingan, Masbate: Cataingan, Masbate - moderate intensity; some slight damages in stores.	81
1939 Feb 15 7:42 p.m.	Calbayog, Samar: Calbayog, Samar - Intensity VI; duration, 15 seconds; vertical motion.	82
1939 Mar 01 3:01 a.m.	Cataingan, Masbate: Strong earthquake of three seconds' duration. Slight damage in stores.	82
1939 Mar 29 10:30 a.m.	NE Mindanao: Cantilan - felt strongly.	
	Hinatuan; Dapa - felt moderately.	
	Port Lamon; Butuan; Mainit; Cabadbaran - felt slightly. Centre in the Philippine Deep.	82
1939 Apr 05 12:47 a.m.	Mindanao and Samar: Dapa - Intensity V; duration, five seconds.	
	Guiuan - Intensity IV.	
	Port Lamon; Mainit; Butuan - slight.	82
1939 Apr 14 11:55 p.m.	SE Negros: Dumaguete - Intensity V; duration, five second.	
	Cauayan, Occidental Negros - it was also felt.	82
1939 May 04 6:59 a.m.	NE Mindanao: Hinatuan - moderately strong.	
	Butuan - vertical motion predominated; duration, 30 seconds; pendulum stopped.	

Event	Felt Effect	Source
	Port Lamon; Cabadbaran - slight.	82
1939 May 07 1:00 a.m.	Mindoro and S Luzon: North coast of Mindoro; South coast of Luzon - very strong. Batangas - Intensity V; accompanied by loud noise. Ambulong; Atimonan; Lucena; Boac; Daet; Sta. Cruz; Manila - Intensity IV. Centre in the Verde Island Passage.	82
1939 May 25 2:16 p.m.	SE Luzon: Capalonga - Intensity VII; duration, five seconds; vertical motion predominating; wall of the church slightly cracked and some slight damage in stores and houses. Daet - Intensity VI; duration, 30 seconds; stores suffered about one thousand pesos' damage to stocks. Naga - Intensity V. Libmanan; Legaspi; Virac - Intensity IV. Ambulong; Catarman, Samar - Intensity slight. Centre in the Pacific Ocean.	82
1939 June 02 2:11 p.m.	SE Luzon: Naga - Intensity V; oscillatory; short duration; preceded by a noise. Daet - Intensity IV; oscillatory; duration, 30 seconds. Nabua - slight.	82
1939 June 28 7:06 a.m.	Mindanao & Eastern Visayan Island: Butuan - Intensity V; oscillatory; duration, two minutes; pendulum clock stopped; church bell rang once; sensation of sea-sickness felt. Port Lamon; Dapa; Cagayan; Baganga; Davao - Intensity IV.	

Event	Felt Effect	Source
	Southern Leyte; Southern Samar; Cebu; Other parts of Mindanao - felt slightly. Centre in the Philippine Deep.	82
1939 Aug 05 8:12 a.m.	NE Mindanao: Surigao - Intensity V; duration, eight seconds; slight damage in Chinese stores.	
	Dapa - Intensity IV-V; duration, four seconds; strongest motion at the beginning.	
	Butuan - feeble; pendulum clock stopped.	
	Cantilan - slight. Centre in the Philippine Deep.	82
1939 Aug 24 5:23 a.m.	E Mindanao: Baganga - Intensity V; duration, 26 seconds; oscillatory.	
	Butuan; Davao; Port Lamon - Intensity III.	
	Cantilan; Cabadbaran - it was also felt. Centre in the Philippine Deep.	82
1939 Dec 08 1:27 a.m.	Tablas Strait: Felt strongly in Romblon. Clock stopped and bell rang at Bongabong, Mindoro. Intensity III at Odiongan, Tablas. Intensity II at Boac, Marinduque.	82
1939 Dec 21 4:25 a.m.	Negros: Dumaguete - Intensity V; duration, ten seconds.	
	Tayasan; Carabalan; Jimalalud - felt slightly.	82
1939 Dec 22 5:04 a.m.	Mindanao and Sulu: Earthquake in Celebes, Netherlands East Indies.	
	Jolo - Intensity IV-V.	
	Zamboanga and Davao - felt slightly.	82
1939 Dec 23 9:00 a.m.	Negros: Two strong shocks felt at Carabalan. One felt at Tayasan.	82

Event	Felt Effect	Source
1940 Feb 22 9:32 p.m.	N Luzon: Calayan, Babuyan Islands - Intensity V; oscillatory motion; duration, 20 seconds; creaking of houses.	
	Aparri - Intensity IV; duration, eight seconds.	
	Laoag and Basco - Intensity III.	
	Ilocos Norte; Mountain Province; Cagayan; Isabela - felt slightly. Epicentre in Babuyan Islands.	83
1940 Feb 26 3:40 a.m.	Romblon: Romblon - strong earthquake.	83
1940 Mar 28 11:49 p.m.	Luzon and Mindoro: Manila - Intensity IV-V; duration, 50 seconds; oscillatory.	
	Capas, Tarlac; Iba, Zambales - Intensity V; preceded by a roaring noise.	
	Northwest, central & southern Luzon Province; Mindoro; Marinduque; Catanduanes - felt in these places, which indicates a macroseismic area of about 400 kms; no damage was reported. Epicentre in the China Sea.	83
	Culion, Palawan - Intensity V.	
	Batangas and Manila - Intensity IV; stopped a few clocks in Manila; moved base of instruments at the Weather Bureau.	
	Baguio; Naga; Boac - Intensity III.	157
1940 Apr 08 10:50 a.m.	SE Luzon and Eastern Visayas: Laoang - Intensity V.	
	Legaspi - Intensity IV; duration, 40 seconds; oscillatory.	
	Southeast Luzon; Samar; Abuyog in Leyte - felt slightly. Epicentre in the Philippine Deep.	83

Event	Felt Effect	Source
1941 Feb 04 8:03 p.m.	Mindanao: Felt at Butuan, Hinatuan, Jagna, Borongan, Atimonan, and Baguio.	
1941 Feb 18 2:05 a.m.	Luzon: Felt in western Luzon and Manila.	
1942 Apr 09 between 12:41 a.m. & 1:44 p.m.	Manila: Five violent tremors occurred between 12:41 a.m. and 1:44 p.m. Fifteen other tremors followed and were felt in Manila. Ten buildings slightly damaged in Manila; several electric wires snapped, fire broke out at 2:40 p.m. due to grounded wire connections snapped by the quake. The first tremor was so violent that the needle of the Weather Bureau's seismograph jumped off the sheet. Of Intensity VI or VII and fully perceptible for two minutes. Tectonic in origin and epicentre some 170 kms. SSE of Manila near the Bondoc Peninsula, Tayabas. The four following tremors occurred at 2:05 a.m.; 4:33 a.m.; 8:45 a.m.; and 1:44 p.m. ranging between Intensities III and VI. The corridor of the Philippine General Hospital's second floor cracked; window panes of the Heacock Building, Paris Building, and Filipinas Building sustained cracks. Fragments of concrete came off the wall of the Philippine National Bank; a glass globe light shade hanging from the Meisic police station fell and shattered on the floor. Wall and pendulum clocks stopped and electric lights dimmed. Residents jumped out of bed and rushed to open spaces.	166

PART D

CATALOGUE OF PHILIPPINE EARTHQUAKES 1948-1983

Lolita C. Garcia, Rolando G. Valenzuela,
Teodoro G. Macalincag

Event	Felt Effect	Source
1948 Jan 25 1:46 a.m.	Panay: Panay - most severe earthquake ever to strike the Philippines. It rocked the island of Panay with an Intensity VII. For 47 days, its repeated shocks left 55 churches in ruins. Of the remaining churches in the diocese, 17 totally collapsed, 20 were cracked and shaken beyond repair and practically all churches and rectories were damaged.	
	Iloilo City - was the most damaged area in this Panay quake, as some of its historic structures were destroyed. The five-storey belfry of Jaro Cathedral toppled. A 100-yard fissure in the earth sprayed black sand and water high into the air.	23
	Antique - 15 churches destroyed or damaged; in some towns in Antique, about 50% of the houses were damaged. The Coronet tower of Arevalo was also ruined.	163
1949 Jan 23 8:35 a.m.	Off SW Coast of Panay Island: Iloilo City - Intensity V. Shocks were felt all over the southern portion of Panay but not in the nearby island-provinces. Near panic resulted during the first shocks. A two-storey market building in Iloilo City suffered three cracks and some of its cornices fell. An auto-train en route to Capiz was almost derailed. Unconfirmed information on a landslide on Mt. Madias and on a 20-metre long fissure in Bocari District, Leon were reported.	88
1949 Feb 15 2:50 a.m.	$13^{\circ}28'N$; $120^{\circ}45'E$ N Mindoro: Manila - Intensity V.	
	Tanauan - Intensity IV.	
	Cabanatuan - Intensity III.	

Event	Felt Effect	Source
	Culion - Intensity II.	88
1949 Mar 31 4:35 a.m.	Butuan Bay: Surigao - Intensity V.	
	Butuan - Intensity IV.	88
1949 Apr 11 2:41 a.m.	Masbate: Masbate - Intensity V.	
	Legaspi - Intensity III.	88
1949 Apr 30 9:28 a.m.	Bukidnon: Lagao - Intensity VI.	
	Malaybalay - Intensity V.	
	Davao City - Intensity IV.	
	Cagayan de Oro - Intensity IV.	
	Jolo - Intensity II.	88
1949 July 09 6:42 a.m.	Cotabato: Cotabato - Intensity VI.	88
1949 Dec 29 11:05 a.m.	17°00'N; 121°38'E Isabela: Major earthquake. A total of 70 aftershocks were recorded from December 29-31 and a total of 107 more were recorded from January 1-31, 1950.	
	Tuguegarao - Intensity VII, two minutes' duration.	
	Cabanatuan - Intensity VI; one minute.	
	Manila - Intensity VI, two minutes and 30 seconds.	
	Aparri - Intensity VI; 65 seconds.	
	Baguio - Intensity V; one minute and 30 seconds.	
	Laoag - Intensity V, one minute, 30 seconds.	
	Lucena, Vigan, Malasiqui - Intensity V.	
	Quezon City - Intensity V, one	

Event	Felt Effect	Source
	minute. Daet - Intensity IV, 55 seconds. Ambulong - Intensity IV, 25 seconds. Iba - Intensity III, 40 seconds. The Isabela earthquake of December 29, 1949, though certainly not among the severest ever experienced in the Philippines as far as intensity or damage and casualties are concerned, had one of the greatest extents of any earthquake in the past decade. The major shock was felt throughout the island of Luzon, from the Batanes down to the Bicol region. The epicentre of this earthquake was located instrumentally in the vicinity of $17^{o}00'$N latitude and $121^{o}38'$E longitude, which is in Isabela, west of the Cagayan River. The first and major shock occurred at 11:05 a.m., 120^{th} Meridian Time or 0305 Greenwich Mean Time. Over 50 aftershocks were felt in the vicinity of the epicentre within the following week, though not all of these could be verified instrumentally. The earthquake was decidedly of tectonic origin due to readjustments of the rock strata within the earth's crust. No volcanic action was reported in connection with this earthquake although, immediately following it, people in the epicentral area believed that a volcano caused the tremors. This was because water and sand came out of fissures in the ground and gave off a sulphurous odour. However, the odour of rotting vegetation in the lower deposits may easily have been mistaken for sulphur fumes. Apart from the fact that Northern Luzon has no active volcanoes, the macroseismic extent of the earthquake was too great to be of volcanic origin. Most of the structures damaged by the earth-quakes were large churches	

Event	Felt Effect	Source
	constructed in the late seventeenth or early eighteenth century, many of them previously bombed-out or burned during the last war. Residential buildings in the towns are one- or two-storey wooden constructions with regular concrete footings. Since many of the towns in the Cagayan Valley were devastated by the war, practically all of these have been erected within the past five years. It is, therefore, not to be wondered at that these structures survived the violent tremors which the formidably constructed churches could not withstand. Fifteen persons were officially reported to have been killed or missing as a result of the earthquakes. Most of these were drowned in the Cagayan River, caused by the capsizing of the canoes they were travelling in. Others were buried under river banks which collapsed while they fished under them. No casualties, however, were caused by the collapse of walls or towers of churches.	88
	The area of highest intensity covered the junction of the Magat and Pinacanauan de Ilagan rivers with the Cagayan River. Damage was limited to old structures (churches) in Isabela and southern Cagayan. The tremor was also felt at Kiangan, Mt. Province of Intensity VIII. Fissuring and sand boils were observed. The earthquake was also registered in the following places: Baler - Intensity VI; one minute and eight seconds' duration. Casiguran - Intensity V; 55 seconds' duration. Quezon City - Intensity V; one minutes' duration. Manila International Airport (Pasay) - Intensity V; one minute and 30	

Event	Felt Effect	Source
	seconds' duration.	
	Basco - Intensity II-III; 45 seconds' duration.	171
	A series of four tremors occurring at intervals of a few minutes, the strongest of which was Intensity V, rocked Manila and Quezon City, sending Manilans, particularly those in tall buildings, scampering for safety. Cracks in buildings appeared. In Manila, panic was evident in most tall buildings with inhabitants rushing down to street level. Traffic was stopped in some areas as crowds swarmed the streets. Plaster fell from the Great Eastern Hotel Building. Adjacent buildings, such as the Insular Life Building and Filipinas Building on Plaza Moraga were almost separated by a big crack between their walls. An electric post leaned and two others fell.	
	San Fernando, Pampanga - employees of the municipal buildings rushed outside in panic.	106
1950 Jan 03 10:51 a.m.	Isabela 17°00'N; 121°18'E; Tuguegarao - Intensity VI-VII.	
	Aparri - Intensity V.	
	Vigan - Intensity IV.	
	Laoag - Intensity IV.	
	Baguio - Intensity IV.	
	Manila - Intensity IV.	
	Cabanatuan - Intensity II.	88
1950 May 07 6:01 p.m.	Babuyan Channel: Calayan - Intensity V.	88
1950 July 19 12:27 a.m.	Mindanao Deep: Surigao - Intensity VI.	

Event	Felt Effect	Source
	Hinatuan - Intensity V.	
	Mambajao - Intensity II.	
	Malaybalay - Intensity II.	88
1950 Aug 07 10:47 a.m.	Davao: Davao City - Intensity VI.	
	Dadiangas; Malaybalay - Intensity V.	
	Hinatuan - Intensity IV.	
	Cagayan de Oro - Intensity III.	88
1950 Sept 12 11:54 a.m.	Off W Coast of Ilocos Norte: Laoag - Intensity V.	88
1950 Oct 29 9:00 a.m.	Off NE Coast of Camarines Norte: Aurora - Intensity V.	
	Daet - Intensity IV.	
	Manila - Intensity I.	88
1951 May 31 1:34 a.m.	NE of Calayan: Calayan - Intensity V.	
	Aparri - Intensity IV.	88
1951 June 01 4:56 a.m.	$18^{o}00'N$; $119^{o}00'E$ W of Ilocos Norte: Laoag - Intensity VI.	
	Vigan - Intensity V.	
	Aparri - Intensity V.	
	Calayan - Intensity IV.	
	Tuguegarao - Intensity IV.	
	Baguio - Intensity III.	
	Manila - Intensity III.	
	Casiguran - Intensity II.	88
	Covered entire Northern Luzon. Belfry of Laoag Church, destroyed; other buildings, damaged, one person injured.	107

Event	Felt Effect	Source
1951 July 08 1:45 p.m.	Panay Gulf: Iloilo City - Intensity VI.	
	Dumaguete - Intensity V>	
	Roxas City - Intensity III.	
	Cuyo - Intensity III.	
	Dipolog - Intensity III. Its magnitude was given as 6.5 by the observation centre at Pasadena, California. The earthquake was felt in the whole of western Visayas and northwestern Mindanao.	88
1951 Nov 04 7:11 p.m.	Off NE Coast of Samar: Catbalogan - Intensity VI.	
	Borongan - Intensity V.	88
1951 Dec 24 6:11 a.m.	Southern Oriental Negros - Dumaguete - Intensity VI.	
	Iloilo City - Intensity III. Very little damage was reported.	88
5:58 p.m.	Southern Oriental Negros: Dumaguete - Intensity V.	
	Iloilo City - Intensity II.	88
1952 Feb 06 12:52 a.m.	Eastern Davao: Hinatuan, Butuan - Intensity V.	
	Davao - Intensity IV.	
	Mambajao - Intensity III.	88
1952 Mar 19 6:59 p.m.	Butuan Bay: Butuan - Intensity VI.	
	Surigao - Intensity V.	
	Tacloban; Cebu; Cagayan de Oro; Dipolog; Davao City - Intensity IV.	
	Catbalogan; Dadiangas; Virac; Hinatuan; Borongan - Intensity III.	
	Iloilo City; Malaybalay - Intensity II. At Butuan City, where the	

Event	Felt Effect	Source
	intensity was highest, the only known structural damage was cracks produced in one of the walls of the town church. A two- by three-metre section of the wall fell and broke some of the church pews.	88
1952 Apr 08 6:02 p.m.	Off N Coast of Zamboanga 8°30'N; 122°40'E: Dipolog - Intensity VI. Dumaguete - Intensity IV. Iloilo, Cagayan de Oro, Mambajao - Intensity III. Zamboanga, Butuan - Intensity II. The macroseismic area of the tremor covered western Mindanao, Bohol, Cebu, Negros and the southern part of Panay Island.	88
1952 June 03 2:09 a.m.	Mindanao: Davao City - Intensity V. Hinatuan - Intensity II.	88
1952 Aug 14 2:29 p.m.	Off NE Coast of Camiguin Island 9°20'N; 124°50'E: Mambajao - Intensity V. Butuan - Intensity IV. Cagayan de Oro, Hinatuan - Intensity III. Malaybalay - Intensity I. The macroseismic area covered the provinces of Misamis Oriental, Bohol, Surigao, Agusan and Southern Leyte.	88
1952 Sept 11 2:48 a.m.	Cebu 10.5°N; 122.3°E: Cebu - Intensity V. Iloilo City - Intensity IV. Roxas City, Romblon - Intensity II. Cuyo, Dumaguete, Tacloban - Intensity II.	88

Event	Felt Effect	Source
1952 Sept 20 1:31 a.m.	North of Leyte: Catbalogan - Intensity V.	
	Masbate - Intensity III.	
	Catarman - Intensity II.	
	Roxas City - Intensity I.	88
1952 Dec 28 2:16 a.m.	Mindanao Sea: Mambajao - Intensity V.	
	Surigao - Intensity IV.	88
11:03 p.m.	Davao: Davao City - Intensity.V.	
	Dadiangas - Intensity IV.	88
1953 Mar 07 8:45 p.m.	Butuan Bay: Butuan - Intensity V.	
	Surigao - Intensity IV.	
	Mambajao - Intensity II.	88
1953 Mar 15 1:02 a.m.	Cotabato Davao border 6.2^{o}N; 125.6^{o}E: Dadiangas - Intensity VI.	
	Davao City - Intensity V.	
	Cotabato - Intensity IV.	
	Malaybalay, Cagayan de Oro, Mambajao - Intensity III.	
	Evidence indicated that this tremor had a maximum intensity of VII RF in the immediate vicinity of the centre.	88
1953 Aug 04 5:33 a.m.	Ragay Gulf: Aurora - Intensity V.	
	Daet - Intensity IV.	88
1954 Apr 09 3:26 p.m.	Babuyan Island: Calayan - Intensity V.	
	Aparri - Intensity IV.	88
1954 Apr 28 12:51 a.m.	East of Davao: Davao City - Intensity V.	

Event	Felt Effect	Source
	Hinatuan - Intensity III.	88
1954 July 02 10:46 a.m.	Sorsogon: Sorsogon - Intensity VII.	
	Daet - Intensity V; duration, 80 seconds.	
	Virac - Intensity IV.	
	Legaspi - Intensity IV; duration, 15-28 seconds.	
	Roxas City - Intensity IV.	
	Catarman - Intensity IV.	
	Masbate - Intensity IV.	
	Aurora - Intensity IV.	
	Catbalogan - Intensity III.	
	Tacloban - Intensity III, 22 seconds.	
	Mambajao - Intensity III, 4 seconds.	
	Iloilo - Intensity II.	
	Due to the magnitude of this earthquake; a number of casualties and some damage to structures resulted. The centre of this earthquake was determined by the instrumental data from its aftershocks, as the recordings of the main quake were lost due to its great intensity; it was found to be 380 kms SE of Manila in the immediate vicinity of the towns of Bacon and Sorsogon. The official report of casualties showed a total of 13 people killed. Of the 13 deaths, eight were in Sorsogon, four in Bacon, and one in Legaspi. A total of 101 persons were injured, seven of them seriously. Damage to buildings was limited to old and poorly built structures of bricks and cobbles cemented only by lime mortar. Water mains were broken and several electric wires were cut.	

Event	Felt Effect	Source
	Damage to roads was negligible. Some fissures occurred in the roads but this did not affect their use.	88
	Sorsogon - Intensity VII. The old church, which had survived all previous earthquakes and typhoons, was totally demolished. Several people in the church were said to have been trapped when the concrete walls and tile roofings collapsed. Radio and telegraph facilities of the Philippine Constabulary at Sorsogon were badly damaged. Water pipes were destroyed. Large landslides and fissures occurred in Balibag District. There were landslides at several points on the Inang Maharang Mountain which is visible from the town. Forty (40) houses including the old cathedral in Sorsogon were destroyed; thirty in Sorsogon; ten in Bacon. Most of the buildings destroyed were built during the early Spanish times with adobe stone foundations. Property loss was estimated at P1,500,000. Initial reports counted 20 persons dead, 17 injured, and scores missing. Concrete buildings, including the capitol building, suffered cracks. Pharmacies and grocery stores surfered damage as bottles and glass containers crashed onto the floors. Most pendulum clocks stopped; concrete electric posts in Guinobatan buckled.	37
	The Sorsogon cathedral tower crumbled. The former Bacon shoreline no longer appeared during low tides; injured 109 (15 seriously) and killed 13 persons.	143
1954 Aug 21 2:40 p.m.	Southern Davao: Davao City - Intensity V.	
	Dadiangas - Intensity III.	
	Hinatuan - Intensity III.	

Event	Felt Effect	Source
	Butuan - Intensity II.	88
1955 Mar 06 9:34 p.m.	Sulu Sea: Dipolog - Intensity V. Cuyo - Intensity IV. Dumaguete - Intensity III. Iloilo City - Intensity III.	88
1955 Mar 12 7:34 a.m.	Zamboanga - Misamis Occidental border: Dipolog - Intensity V. Mambajao - Intensity II.	88
1955 Apr 01 2:17 a.m.	Lanao 8°N; 124°E: Dansalan - Intensity VIII. Ozamis City; Dipolog - Intensity VIII. Malaybalay; Cagayan de Oro; Dumaguete - Intensity VI. Iloilo; Mambajao; Cebu; Cotabato; Davao City - Intensity V. Jolo; Zamboanga; Hinatuan - Intensity IV. Dadiangas - Intensity III. Several persons around Lake Lanao heard a low-pitched sound like a muffled explosion of a cannon a few seconds before they felt the first vibrations. Those close to the epicentral area first experienced a strong vertical movement which was followed immediately by violent sideways jerks. People found it difficult to stay on their feet during the height of the tremor. The air became filled with the noises of falling objects and crashing structures, the shrieks of women and children and the cries of those injured. An odour like that of rotten eggs became noticeable in low areas. Fissures were seen to form and people found it difficult to	

Event	Felt Effect	Source
	stay on their feet because of violent vibrations. The main shock was followed closely by aftershocks of varying intensity which created further panic among the already distraught populace. The water of Lake Lanao swished back and forth during the earthquake, causing the lake-end of the Agus river alternately to dry up and swell. The most catastrophic earthquake to have hit the Philippines since World War II occurred at 2:18 in the early morning of April 01, 1955. This earthquake was centred between Lake Lanao and Panguil Bay in the province of Lanao. A maximum intensity of between VII and VIII was felt in the western half of Lanao and the eastern third of Misamis Occidental. The area affected by Intensity VI and higher included the rest of Lanao, Misamis Occidental, Zamboanga del Norte, Zamboanga del Sur, Misamis Oriental, Bukidnon and even the southern tip of Negros Oriental. Included within the intensity isoseismals are all the rest of the provinces in Mindanao and the Visayas, thus giving the earthquake a macroseismic area of approximately 1,400 square kilometres. Lanao was the most affected and so the earthquake was named after it. Contrary to local fears, the tremor was not volcanic but decidedly of tectonic origin, caused by the sudden movement along a plane of weakness in the earth's crust in the epicentral area. As in the case of most destructive tectonic earthquakes, the salient geological feature of the Lanao earthquake was the variance in damage due to the differences in ground conditions. The greatest destruction was wrought on structures built on alluvial deposits along unstable slopes. Structures relatively closer to the epicentre but built on firm ground	

Event	Felt Effect	Source
	were only slightly damaged whilst those farther away on poorly consolidated deposits were severely damaged. The total casualties listed by the authorities and relief agencies were about 400. Compared to earthquakes of like magnitude in other countries, the number of casualties was small. This, in large measure, was due to the resiliency of wooden constructions which characterize the preponderance of Filipino houses. In the municipal district of Tugaya, beside Lake Lanao, there was a high loss of life (174 persons out of about 2,000 living in the village) and this was brought about only because of the rather unfortunate geological situation of the settlement. The deaths were due to drowning when the portion of the town bordering the lake slipped (as much as 40 feet) into the water. No true surface expression of the movement that caused the tremor was observed, but evidence obtained from the apparent change of level of the lake water and from the distribution of slides and sand boils, complemented by observed fissures, strongly suggests the possibility of a major fracture oriented approximately N 75°W, starting a little east of Masiu on the eastern side of Lake Lanao and extending towards and beyond Molave in Misamis Occidental. Perhaps the absence of any surface trace of faulting is not altogether unusual considering the depth (40-60 kms) at which major displacement must have occurred. The vertical development could very well have been taken up by the overlying formations. However, around Lake Lanao, there are indications that changes in elevations of land surface points may have occurred.	34, 88
	Lanao: Slight damage to the hydro-electric plant at Ma. Cristina.	

Event	Felt Effect	Source
	Small water pipes feeding the plant cracked wide open. Roads leading to the plant were blocked by landslides or were gaping wide open. Augus and Danasan Bridges were partially damaged. Masiu alluvial plain (eastern shores of Lake Lanao) - sustained very severe damage; large tracts of land on the lake-side became submerged under several feet of water due to differential compaction; cracks and fissures were most abundant in this area in spite of its greater distance from the epicentre; sand boils were formed, a seiche occurred. In the Masiu lowland area, water lilies from the lakes were swept by the seiche into the rice paddies as far as 300 metres from the water's edge. Tugaya, Bacolod and Ganassi (west shore of the lake) - severe damage was confined mostly to the lake terraces. In the municipal district of Uato, a little north of Tugaya, the same type of damage as in Masiu was observed. The region bordering the southern shore of the lake sustained damage, only due to landslides along an old fault scarp. The concrete mosques at Bacolod, Tugaya and Uato were completely ruined. A noticeable feature common to these damaged structures was the serious lack of adequate steel reinforcements and insufficient corner ties in the concrete. The concrete walls were found to have been poured without though t of securing monolithic qualities. Balutmasla Island (southern part of Lake Lanao) - large slides occurred on the whole periphery of this island with the coastline showing settlement of about three feet as a	

Event	Felt Effect	Source
	result of this earthquake. In the neighbourhood of Makagiling, fronting the southern edge of Lake Lanao, field observation showed large incipient slides. Some of these incipient slides had subsequently given way, triggered most probably by strong aftershocks and/or heavy rains. From Tugaya to Ganassi around the Lake Lanao area alone, 148 people were killed as the lake sank two metres during the quake, toppling houses into the swirling waters. Landslides also occurred. In Lanao town, 85% of the town's buildings were demolished. Big cracks appeared in roads.	39, 110, 160
	Ozamis City - thousands of the residents were rendered homeless. The Catholic Cathedral was destroyed. The water system and electric service were seriously imparied.	
	Fort Santiago sank five feet deeper, making entrance impossible. The wharf was also badly damaged. Deep and wide cracks littered the national highway. Hundred of houses collapsed and many people were believed injured. The wharf area, which is on reclaimed ground, suffered severe fissuring and differential compaction. The earthquake movements caused several electric posts to be thrown out of position. Another cause of breaks along power lines was the collapse of houses and the consequent snapping of house-to-main connections. At several points in the city, especially in the waterfront area which is largely unconsolidated ground, breaks occurred in water mains. This was evidenced by water flows on the ground immediately above buried pipes. Several bridges and bridge approaches between Ozamis City and Pagadian, Zamboanga del Sur became	

Event	Felt Effect	Source
	unusable. Wharfage facilities were damaged by failure of their foundations. Roads in the wharf area of Ozamis City were badly cracked due to slumping of fills.	147
	Iligan City: Damage was also extensive. The Agus River-bed, the only outlet of Lake Lanao near Dansalan City, ran completely dry for about half an hour at the height of the quake. Glass panes in the local telecom office were broken and the flooring cracked. The hydro-electric and fertilizer plants were damaged. The quake caused landslides and earth fissures measuring as wide as one foot in some places. Worst hit was the waterfront area where the office of Compania Maritima collapsed into the sea. The road to the powerhouse near Ditukalan was covered by landslides. City streets including pavements and the national highways cracked.	109, 159
	Cotabato: Heavy damage to public and private buildings. The quake caused aroused sleepers to rush into the streets. Electric power and telephone service failed four minutes after the main quake, and even the wall clocks stopped.	160
	Dansalan City: Panicky people scampered to safety and slept in the open. One mosque and two houses were destroyed. In Marantao district, several houses destroyed and fissures appeared.	
	Zamboanga City: Several houses collapsed and a part of the local wharf was damaged. Landslides occurred, causing half a million pesos' worth of property damage, 910 persons were rendered homeless and 18 kms of road were blocked.	109, 111
	Dumaguete City: An earthquake of Intensity VI rocked this city for 35	

Event	Felt Effect	Source
	seconds. No casualties were reported. The quake caused wild panic among local residents who rushed into the streets after they were jolted from their sleep. Several residents prayed loudly, whilst dogs barked.	
	Cagayan de Oro: Residents fled from their homes. Slight damage to buildings. Short-circuited electricity in the city and caused a minor fire in a local hotel.	
	Misamis Occidental: Hundreds were reported homeless, Philippine Coustubulary barracks was destroyed. Landslides made roads in some places impassable.	
	Mambajao: The quake cracked concrete walls and made houses sway.	
	Davao City: The quake caused panic among the people.	
	Basilan City: Intensity II and lasted for 10 seconds. No casualties or damage have been reported.	160
	Pagadian: Several houses collapsed and a part of the local wharf was damaged.	159
4:54 a.m.	Lanao: Cagayan de Oro - Intensity V.	
	Malaybalay, Cebu, Davao City and Mambajao - Intensity IV.	
	Cotabato and Hinatuan - Intensity II.	
	Dumaguete - Intensity I.	88
7:41 a.m.	Lanao: Cagayan de Oro - Intensity VI.	
	Cotabato and Malaybalay - Intensity III.	88
	The second tremor at 2:31 a.m. was	

Event	Felt Effect	Source
	felt at Intensity V in Cagayan de Oro of five seconds' duration; 26 seconds' duration in Davao.	88
1955 Apr 11 1:40 a.m.	Lanao: Cagayan de Oro, Dipolog and Cotabato - Intensity VI.	
	Malaybalay - Intensity V.	
	Cebu - Intensity IV.	
	Zamboanga - Intensity III.	
	Surigao; Davao City; Dadiangas and Iloilo - Intensity IV.	88
	Dumaguete - Intensity I.	
	No casualties, few losses in houses, with Dansalan City bearing the brunt; new fissures seen.	
	Cagayan de Oro - a small fire due to the quake occurred. Residents in this quake disaster area fled their houses and slept in the open.	
	Dansalan City - Intensity VI (1:50 a.m.). Panicky people scampered to safety and slept in the open.	
	Cagayan de Oro - Intensity VI at 1:45 a.m., ten seconds' duration.	
	Lanao - three quakes, the time 1:40 a.m., caused panic among the city residents, big cracks in roads.	111
1955 May 12 4:54 a.m.	Off Central Coast of Cebu: Cebu - Intensity V.	88
1955 Dec 06 2:13 a.m.	Southern Cagayan: Tuguegarao - Intensity V.	
	Bangued, Abra - Intensity III.	88
1956 Jan 27 11:35 p.m.	Camiguin Island: Mambajao - Intensity V. Epicentre between 30 and 50 kilometres SE of Mambajao.	112

Event	Felt Effect	Source
1956 July 20 4:41 p.m.	Off W Coast of Zambales: Iba - Intensity VI.	
	Manila; Dagupan and Baguio - Intensity IV.	88
1956 Oct 23 4:42 p.m.	Off W Coast of Batangas: Manila and Cavite - Intensity V.	
	Calapan and Romblon - Intensity IV.	
	Lucena; Ambulong and Cabanatuan - Intensity III.	88
	Caused a lot of apprehension to people of Manila and the neighbouring provinces.	
	Quezon City, Pasay City and Paranyaque - Intensity V.	159
1956 Oct 28 6:45 p.m.	Near East Coast of Camarines Norte: Daet - Intensity VI; slight damage was caused by the tremor; a few soft drinks bottles fell from stands which were tall and not well anchored; there were reports of small fissures along the seashore in Daet. These fissures were local in nature and may have been due to the loose formation of the soil in that area.	
	Aurora - Intensity V.	
	Infanta - Intensity IV.	
	Lucena, Virac, Lepaspi and Ambulong - Intensity III.	
	Manila, Baler, Cabanatuan, Romblon and Catbalogan - Intensity II.	
	Baguio - Intensity I.	88
1956 Nov 10 10:40 a.m.	Zambales, Pangasinan border: Dagupan - Intensity VI.	
	Baguio and Baler - Intensity IV.	
	Cabanatuan - Intensity III.	

Event	Felt Effect	Source
	Manila - Intensity II. Some damages were caused to old structures made of bricks and cobbles which were cemented by lime mortar without reinforcing iron rods. The Catholic Church is of that particular type and was the only edifice noticeably damaged. Viewing the perspective from the front of the church, the left wall was fractured from the top down to the base. The steeple located near the rear end of the building, situated almost above the altar, was tipped in a precarious position towards the west because the old brick base gave way. Three old Spanish-built pillars along the street collapsed as a result of the earthquake. Small fissures were observed a few kilometres almost due south of the town. The main quake was accompanied by roaring sounds similar to that caused by bombs and the sounds came from a southerly direction.	88
1956 Dec 27 5:33 a.m.	Off E Coast of Surigao: Hinatuan - Intensity V.	
	Surigao; Davao and Mambajao - Intensity II.	
	Malaybalay - Intensity I.	88
1957 Jan 27 7:06 p.m.	Philippine Deep: Surigao - Intensity V.	
	Hinatuan - Intensity II.	88
1957 Feb 11 6:34 a.m.	Near Philippine Deep: Surigao - Intensity VI.	
	Mambajao; Hinatuan; Catbalogan; Borongan and Catarman - Intensity III.	
	Iloilo City - Intensity I.	
	Cagayan de Oro - Intensity I.	88
	Caused alarm to the people. Epicen-	

Event	Felt Effect	Source
	tre 730 kms SE of Manila or in the vicinity of Dinagat, Surigao.	113
9:16 a.m.	Near Philippine Deep: Surigao - Intensity V.	
	Mambajao - Intensity III.	
	Hinatuan and Borongan - Intensity II.	88
1957 Feb 12 11:57 a.m.	Philippine Deep: Surigao - Intensity V.	88
1957 June 12 2:50 a.m.	Off W Coast of Ilocos Sur: Vigan - Intensity VII, 52 seconds' duration.	
	Laoag - Intensity VI, 15 seconds duration.	
	Aparri - Intensity V; 37 seconds duration.	
	Tuguegarao - Intensity V; 40 seconds duration.	
	Dagupan - Intensity IV; 60 seconds' duration.	114
	Calayan; Baguio - Intensity III.	88
	Manila - Intensity II; 20 seconds' duration.	
	Basco - Intensity II; 15 seconds' duration.	
	Pangasinan - rocked at 2:30 a.m., Intensity V, of several seconds' duration; injured a woman who fell from her house when the tremor struck.	
	La Union - rocked at 2:45 a.m., Intensity IV, of 55 seconds' duration; jarred residents out of their beds and was considered the strongest tremor felt in this province since 1950.	114

Event	Felt Effect	Source
1957 Aug 18 4:37 p.m.	Masbate Island: Masbate; Catarman - Intensity V.	
	Roxas City - Intensity IV.	
	Legaspi; Catbalogan; Tacloban; Iloilo City; Canlaon - Intensity III.	88
1957 Nov 15 3:54 p.m.	North Coast of Zamboanga: Dipolog - Intensity VI.	
	Dumaguete - Intensity V.	
	Mambajao; Cotabato - Intensity III.	
	Zamboanga - Intensity II.	
	Cavao; Iloilo - Intensity I.	88
1957 Dec 24 3:29 a.m.	Mindoro: Calapan - Intensity V.	
	Romblon - Intensity II.	88
1958 Jan 20 3:13 p.m.	$14^{o}5'$N; $120^{o}12'$E Near W Coast of Batangas: Manila - Intensity V.	
	Quezon City - Intensity IV.	
	Ambulong - Intensity III.	
	Calapan - Intensity II. A large number of people felt the quake and its intensity was high enough to cause some panic in public places, such as theatres and schools. Depth of focus: 100 kilometres.	88
1958 Mar 14 7:50 a.m.	Masbate Island: Aurora - Intensity V.	
	Masbate - Intensity IV.	
	Legaspi; Daet - Intensity III.	
	Manila - Intensity II.	
	Roxas City; Iloilo City - Intensity I.	88
	Centred at Burias Island, Masbate;	

Event	Felt Effect	Source
	no report of damage.	115
1958 May 16 2:46 a.m.	Southeast of Cuyo Island: Cuyo - Intensity V. Iloilo City - Intensity III. Canlaon - Intensity I.	88
1958 Nov 18 12:18 a.m.	San Bernardino Strait: Catarman - Intensity VI. Catbalogan - Intensity III.	88
1958 Dec 09 1:58 p.m.	Masbate Island: Masbate - Intensity VI. Legaspi - Intensity I.	88
1959 May 28 6:00 a.m. 11:20 p.m. May 29 2:45 a.m.	Sorsogon: A series of three strong earthquakes, intensities undetermined. The 11:20 p.m. tremor caused a stampede inside a cinema "Loida", resulting in an injury to a small child. The same quake awakened sleeping residents and toppled goods in the stores.	160
1959 July 19 3:55 a.m.	$15^{\circ}30'N$; $120^{\circ}20'E$ Zambales, Pangasinan border: Iba - Intensity VI. Dagupan - Intensity V. Manila; Quezon City; Baguio; Baler; Laoag - Intensity IV. Cabanatuan; Vigan - Intensity III. Bulacan; Aparri; Bataan - Intensity II. A number of people were awakened from sleep.	88
	Capitol building in Iba, Zambales was slightly damaged. Some electrical wires disconnected in Balanga, Bataan. In Pampanga, damage to household goods, kiosks, restaurants and other amusement places. Manila residents said buildings creaked; lamps, chairs and	

Event	Felt Effect	Source
	furniture moved during the quake.	118
1960 Jan 18 5:07 p.m.	$05^{o}10'N$; $126^{o}35'E$: Dadiangas - Intensity V.	
	Davao City - Intensity II.	89
1960 Mar 30 12:00 a.m.	$13^{o}45'N$; $120^{o}25'E$ Off NW Coast of Mindoro: Calapan - Intensity VI.	
	Batangas - Intensity III.	
	Cavite - Intensity II.	
	Manila - Intensity I. Inhabitants of northern Mindoro were awakened from sleep.	89
1960 June 26 5:32 a.m.	$10^{o}50'N$; $123^{o}36'E$ NW Coast of Cebu: Cebu City - Intensity V.	89
1960 Oct 07 morning	District Cale, 45 kms from Iloilo City: Cracks and openings in the earth covering an area of 100 hectares. Three killed and damage to crops and property estimated at about 1/2 a million pesos.	144
1960 Dec 07 2:21 a.m.	$11^{o}30'N$; $125^{o}30'E$ Off Eastern Coast of Samar: Borongan - Intensity V.	
	Tacloban - Intensity IV.	
	Catbalogan - Intensity III.	89
	Epicentre: 600 kms SE of Manila, or off the eastern coast of Samar. No report of damage or injury.	116
1961 Feb 27 5:07 a.m.	$16^{o}00'N$; $121^{o}36'E$ Northern Quezon: Baler - Intensity V.	
	Dagupan - Intensity III.	
	Infanta; Casiguran; Cabanatuan; Iba - Intensity II. Inhabitants of Baler awakened from sleep.	89
1961 June 19 9:46 a.m.	$12^{o}36'N$; $121^{o}54'E$ Off Western Coast of N Tablas: Tablas - Intensity VI.	

Event	Felt Effect	Source
	Romblon - Intensity V.	
	Roxas City; Aurora - Intensity III.	
	Alabat - Intensity II.	
	San Agustin - the earthquake was felt most strongly in this town which was very close to the epicentre. Slight damage to old and weak structures; several cracks appeared in concrete floors and walls in several structures. Northern wall of an unfinished school building cracked diagonally. Several parts of an old church suffered minor damage. A six-inch wide ground fissure about several hundred feet long was observed in the epicentral region.	89
1961 Dec 19 10:19 a.m.	19°36'N; 120°48'E Balintang Channel: Calayan - Intensity VI.	89
1962 Mar 12 3:21 a.m.	09°00'N; 126°42'E Off Eastern Coast of Surigao: Surigao - Intensity V.	
	Catbalogan; Tacloban - Intensity IV.	
	Mambajao; Malaybalay - Intensity III.	
	Dumaguete - Intensity II. Awakened some residents of the town of Surigao.	89
1962 May 28 10;49 a.m.	16°10'N; 120°10'E Lingayen Gulf: Dagupan; Lingayen - Intensity V.	
	Binmaley - Intensity IV.	89
	Dagupan City - a cement sphere representing a globe, which was perched on the Catholic Church's steeple, toppled and fell. Big loss to a pharmacy due to broken medicine containers. Oxygen tank toppled and its contents wasted at the provincial hospital. Ballot boxes piled on top of each other inside the city hall fell like a house of cards.	39

Event	Felt Effect	Source
1962 June 30 3:30 a.m.	16°20'N; 121°45'E W of Casiguran: Casiguran - Intensity VI. Baler; Cabanatuan - Intensity IV. Baguio; Manila - Intensity III.	89
1962 Aug 17 1:05 p.m.	10°36'N; 121°36'E Off the Western Coast of Antique: Cuyo - Intensity V. Iloilo City; Roxas City - Intensity IV.	89
1962 Oct 28 8:06 p.m.	14°48'N; 119°42'E Near W Coast of Zambales: Iba - Intensity VI. Manila - Intensity IV. Baguio City - Intensity II.	89
1963 Feb 26 7:45 a.m.	15°30'N; 121°18'E Central Luzon: Baler - Intensity V. Manila; Cabanatuan; Intensity IV. Infanta; Dagupan - Intensity II.	89
1963 May 17 2:09 p.m.	15°50'N; 120°10'E S Western Pangasinan: Dagupan; Iba - Intensity V. Manila - Intensity I.	89
1964 July 09 1:47 p.m.	15°45'N; 119°30'E NW of Iba, Zambales: Iba - Intensity V. Dagupan - Intensity III. Baguio - Intensity II. Manila - Intensity I.	89
1964 Nov 05 5:05 a.m.	06°48'N; 125°24'E Off SW of Davao City: Davao - Intensity V. General Santos - Intensity IV. Mambajao; Hinatuan - Intensity III.	89

Event	Felt Effect	Source
1964 Nov 24 8:41 p.m.	13°05'N; 124°35'E East of Lepaspi: Virac - Intensity VI. Legaspi; Catarman - Intensity V. Daet; Masbate; Catbalogan; Roxas City - Intensity IV. Borongan - Intensity III. Catbalogan - Intensity II.	89
1965 May 25 7:22 a.m.	13°35'N; 125°00'E East of Virac, Catanduanes: Virac - Intensity V. Catarman - Intensity IV. Borongan - Intensity III. Daet - Intensity II.	89
1965 June 23 7:50 a.m.	06°40'N; 124°35'E SE of Cotabato: Intensity V. Zamboanga - Intensity III. Dipolog; Cagayan de Oro - Intensity II.	89
1965 July 20 9:20 p.m.	07°10'N; 124°37'E East of Cotabato: Cotabato - Intensity VI. Caused a lot of apprehension to the residents of Cotabato City and neighbouring places; caused some landslides from steep hills along the mountain ranges and from steep banks along the Polangui River. Malaybalay - Intensity II. Dumaguete - Intensity I.	89
1966 Jan 07 10:32 p.m.	15.3°N; 119.2°E West Coast of Zambales: Iba - Intensity V. Glassware fell off shelves; unstable objects overturned.	17
1966 Jan 10 9:19 a.m.	13.9°N; 120.7°E N Coast of Lubang Island: Ambulong - Intensity V. Calapan; Manila - Intensity IV.	17

Event	Felt Effect	Source
1966 Mar 17 4:39 a.m.	08.8°N; 121.9°E Sulu Sea: Mambajao - Intensity V.	
	Dipolog; Dumaguete - Intensity III.	
	Cebu City - Intensity II.	17
1966 Aug 15 10:45 a.m.	13.4°N; 121.5°E NE of Mindoro: Calapan - Intensity V.	
	Romblon - Intensity V.	
	Manila - Intensity IV.	
	Ambulong - Intensity III.	
	Infanta; Alabat; Lucena - Intensity II.	17
	Calapan - rocked the town for 20 seconds; threw the whole town into panic.	
	Manila and environs - traffic stopped; people rushed out into the streets.	
	Batangas - people, especially in the lakeshore towns, panicked.	129
1966 Aug 21 1:02 p.m.	08.7°N; 126.7°E Off the Coast, East of Surigao del Sur: Hinatuan - Intensity V.	
	Davao City - Intensity IV.	
	Cagayan de Oro - Intensity II. Glassware fell off shelves.	17
1966 Dec 21 2:39 a.m.	14.3°N; 122.1°E North of Alabat: Alabat - Intensity VI; slight damage to very old structures near the epicentral area; slight unusual tidal change.	
	Manila - Intensity V.	
	Lucena; Daet; Batangas - Intensity IV.	
	Aurora; Baler; Casiguran; Baguio -	

Event	Felt Effect	Source
	Intensity II.	17
1967 Jan 17 6:35 a.m.	07.0°N; 122.0°E Near Zamboanga City: Zamboanga - Intensity V.	17
1967 June 21 11:46 p.m.	12.7°N; 123.1°E NW of Masbate: Legaspi - Intensity V.	
	Masbate; Aurora - Intensity-IV.	17
1967 Sept 11 1:49 a.m.	Norzagaray Bulacan: Manila; Quezon City - Intensity VI; tremor awakened people from sleep and frightened a few.	17
1967 Oct 18 5:06 a.m.	17.0°N; 121.9°E South of Ilagan: Tuguegarao; Ilagan - Intensity V.	
	Casiguran - Intensity III.	17
1968 Feb 13 4:48 a.m.	11.4°N; 125.2°E Southern Samar: Tacloban - Intensity V.	
	Borongan - Intensity IV.	
	Catbalogan - Intensity III. M = 5.1	17
1968 Mar 27 1:42 a.m.	08.1°N; 126.3°E Southern Surigao del Norte: Hinatuan - Intensity V.	
	Cagayan de Oro - Intensity III. Originated in the Philippine Deep area and was felt over northeastern Mindanao.	17
1968 July 14 3:30 p.m.	17.4°N; 121.4°E Kalinga Apayao: Tuguegarao - Intensity V.	17
1968 Aug 02 4:19 a.m.	16.5°N; 122.3°E East of Casiguran: The earthquake was felt throughout Luzon and part of Northern Visayas. It was considered the most severe and destructive experienced in the Philippines during the last 20 years. The following were the observations made by the Weather Bureau Survey Team in the epicentral region:	
	Nueva Vizcaya, Isabela area - landslides were observed in the north-	

Event	Felt Effect	Source
	western Nueva Vizcaya and southwestern Isabela prominences towards the Sierra Madre area. An upheaval of the Manglad River, a tributary of the Cagayan River which is on the outskirts of Madella, Nueva Vizcaya was observed. The upheaval reached a height of about 15 metres, 85 metres long and 25 metres wide and blocked the river, causing its normal flow to divert to the adjacent corn fields. On the eastern bank of the river where a series of rolling mountains exist, a big block was seen adjacent to the upheaved mass. Some artesian wells were drained and subsidence of some rivulets occurred. Casiguran, Aurora Sub-province - massive and large-scale landslides. Fissures of some kilometres or so in length with a general north-south direction. River in the Baler-Casiguran area ran dry. In the City of Manila - a six-storey concrete reinforced apartment building, with a height of 19.8 metres, completely collapsed like a flattened accordion, causing the loss of many lives. Rescue work was undertaken by the authorities with the help of numerous private sectors immediately after the earthquake. Several other large buildings in the city suffered serious damage in their main columns and beams. Cracks in numerous buildings were reported and observed. There were more than 232 persons injured as a result of this earthquake. The greatest destruction was wrought on structures built on alluvial deposits, as in the city of Manila, where most of the damage was confined and reached several millions of pesos. Those built on firm ground, which are relatively closer to the epicentre suffered only slight damage. Intensities	

Event	Felt Effect	Source
	reported at various places:	
	Casiguran - Intensity VIII.	
	Manila - Intensity VII.	
	Baler, Quezon City, Tuguegarao, Aparri, Baguio, Dagupan, Iba, Cabanatuan, Alabat - Intensity VI.	
	Tarlac, Ambulong, Infanta, Jomalig - Intensity V.	
	Legaspi, Lucena, Calapan, Aurora, Laoag, Catarman, Virac - Intensity IV.	
	Romblon, Vigan - Intensity III.	17
	A tsunami generated by this earthquake was observed at several mareographic stations along the Pacific Coast, Japan.	
	Description of damage: Two hundred people were killed and 261 injured by the earthquake. The cost of property damage was several million dollars. One six-storey building collapsed completely. A few major buildings were close to collapse. Several major buildings suffered severe structural damage and many suffered moderate structural damage or considerable non-structural damage. Damage to particular buildings in Manila:	
	Ruby Tower - The Ruby Tower was a large six-storey building containing nineteen shops on the first storey, nineteen offices on the second storey and seventy-six residential flats on storeys three to six. It collapsed totally, except for a few rooms at the northern end, killing or injuring 528 of the occupants. The building had a six-storey reinforced concrete frame of 11 by 7 bays. (Fig. 1) The floors were reinforced concrete slabs, and the	

Event	Felt Effect	Source
	roof was a light-weight wood frame sheathed in iron. The beam-and-slab foundation was two metres deep. The shops, offices and flats were separated by six-inch concrete hollow block panels, lightly reinforced. The building, therefore, contained a large number of complete panels, each framed by beams and columns. The building stiffness was balanced for N - S forces but very unbalanced for E - W forces. Three factors combined to concentrate the stiffness towards the northern end: the reinforced concrete fire wall, four inches thick, across the northern end; the orientation of the long dimension of the rectangular columns; and the position of the concrete block walls. The building suffered total collapse except for a part of the northern end of storeys one and two. The upper storeys fell southward while the southern end also moved eastward. The southern end of the roof moved about 30 feet south and 10 feet east. The lower floors appeared to fall close to their plan position.	
	Philippine Bar Association Building - The Philippine Bar Association (PBA) Building was a six-storey building of medium size with accommodation for club rooms and offices. (Fig. 2) Many first-storey columns were severely crushed and the building came close to collapse. The reserve strength of spirally reinforced columns prevented the collapse which would certainly have occurred if they had been reinforced by rectangular ties. The building had a six-storey reinforced-concrete frame of 6 by 3 bays with very deep exterior beams. Across the end, grid 1, was a substantial bearing wall. A longitudinal wall A1 to A2 resisted longitudinal deformation. The floors and roof were four- to six-inch reinforced-concrete slabs. All	

Event	Felt Effect	Source
	partitions were lightweight, flexible, wooden panels except for the two with CHB (ceramic hollow blocks). Between the exterior beams of storeys two to six were sets of cast-in-place concrete shades about three feet deep. These added considerably to the stiffness and somewhat to the strength of the building above the first storey. The foundation consisted of substantial slabs and beams which extended eight feet below the ground surface while the first-storey floor was two feet above the ground. Many of the first-storey columns suffered total collapse or very severe damage and shortening. The severity of damage increased towards the southeast end of the building. Exterior columns suffered greater damage and shortening than nearby interior columns. This resulted in very severe deformation of some interior beams and part of the floor at each storey level. The exterior beams on the long sides were deformed with a single curve in beams on grid D and a double curve for those on grid A. Most of the exterior beam damage was close to A3 to A6. Seven first-storey columns were damaged to such an extent that they were supporting little or no vertical load after the earthquake; these were A5, A6, A7, D5, D6 and D7. Although columns B6, B7 and C7 were severely shortened, their spiral reinforcing enabled them to support substantial loads. The building was rotated about its north-west end so that the southeast end of the second floor was displaced eight inches towards the northeast. The southeast end of the building was also tilted towards the northeast and the whole building was tilted a little towards the southeast. Aloha Theatre Building - The Aloha Theatre is a large eight-storey	

Event	Felt Effect	Source
	building which suffered severe damage near its southern end. The damage was initiated by the collapse of a few very short columns towards the southern end of storey four, and spread out and up to affect the southern end of the building very severely. The Aloha Theatre had an eight-storey reinforced-cencrete frame of 14 bays by about five bays, with the long axis running N - S. The southern third of the building was tapered until there were only two bays across the southern end. An open theatre area on the eastern side of the southern part of the building extends south to within three bays of the southern end. Along the southern end of the theatre, a deep beam above the floor of storey four reduced the height of four columns to 40 inches. Across the northern end of the building was a complete fire wall, probably of reinforced concrete, concentrating the attack of E - W forces at the southern end. Wall panels were of ceramic hollow block. The building was probably slightly less than 30 metres in height, above which earthquake-resistant design is required. The four short columns at the southern end of the theatre collapsed completely, allowing the ceiling beam to drop one to two feet on to the mid-height beam. Along the exterior wall on the eastern side of the theatre, the fourth storey lost three feet of height, leaving the southern third of the building tilted towards the east above storey four. Fourth-storey columns to the south and east of the theatre area were crushed and shortened by an amount which diminished at increasing distance from the theatre. The severest damage was concentrated at storeys four and five but some damage occurred throughout the southern part.	

Event	Felt Effect	Source
	Tuason Building - The Tuason Building is a medium-sized, six-storey building which came very close to complete collapse, with the columns along the southern side wrecked or severely damaged. The building had a six-storey, reinforced-concrete frame of five bays N - S by four bays E - W. There was a fire wall along the eastern side. The remaining three sides were street frontages, with the building above storey one cantilevered four feet beyond the column line. The facings were of reinforced concrete and ceramic hollow blocks. Ceramic hollow block partitions are more numerous near the eastern side. The western part is particularly open at the first-storey level, where some beams have been omitted to allow a clear two-storey height. Considerable lateral stiffness is added near the northeast corner by the shaft and a stairway, with an additional stairway from ground level to the second storey. Spandrel beams reduced the clear height of the columns to about 1.8 metres on the south and east sides of storey one. The first-storey column against the fire wall on the southeast corner, was severely damaged and the next two were completely shattered with a height loss of three to four inches. These columns contained 1/4 inch ties at 12-inch centres. Just north of one shattered column, a column suffered severe damage at a structural joint which contained a layer of sawdust and wood chips. The whole of the southern facing dropped about three inches and suffered extensive damage, as did the northern facing. The most severely damaged interior panels were those running E - W, from storeys one to four. Trinity Building - Trinity is a seven-storey office building of	

Event	Felt Effect	Source
	medium size. It suffered considerable structural and non-structural damage at storeys three, four and five. The Trinity building has a seven-storey reinforced concrete frame of six by four bays. (Fig 3) Along most of the west, north and east sides are box beams, four feet deep, which reduce the clear height of the exterior columns to six feet. The interior columns are cylindrical with a clear height of about 8 1/2 feet. A substantial 5-inch reinforced concrete wall runs across half the southern end and included two short N - S sections. Another reinforced-concrete wall runs from E1 to E2 and a short section runs from D1 a third of the way towards E1. There are some concrete hollow block panels near the southeast and northeast corners but nearly all the interior walls are of flexible wood-frame panels. The wall at the southern end presented considerable resistance to E - W deflections, while the two walls at the northeast corner had the effect of a tower, permitting increased inter-storey displacements at increased height. The severest structural damage occurred to the northwest corner columns of storeys two, three, four and five, with somewhat lesser damage to nearby exterior columns. The reinforced concrete shades between the damaged columns were also damaged. The severity of the column and shade damage decreased along grid 1 with increasing distance from A1. However, there was complete failure of the short concrete wall in bay D1 - E1 at several levels. The above damage was consistent with torsional movement about some point southeast of the central axis under E - W inertia forces. There was also considerable damage to secondary columns, shades, and N - S hollow concrete block walls on the eastern	

Event	Felt Effect	Source
	side of the building. This damage was consistent with deformation under N - S inertia forces, with the wall between E 1 and E2 deforming as a vertical cantilever. Diamond Tower - The Diamond Tower is a large eleven-storey apartment building. It suffered moderate structural damage and considerable non-structural damage particularly at the cantilevered ends. The eleven-storey reinforced concrete frame building is of 11 by 2 bays. (Fig. 4) Above the second storey, the floors were cantilevered 2.15 metres beyond the column lines along the north side and at each end. The overall length was 51.3 metres and the mean width 11.7 metres. Along the southern sides, with three small breaks for patios, was a substantial reinforced concrete wall. Associated with the centrally placed stairways and lift shaft were two short reinforced concrete walls running N - S. There were many complete hollow concrete block panels between columns in both the N - S and E - W directions. The building was balanced for transverse forces and only moderately unbalanced for longitudinal forces. Typical lower columns were 28 x 28 inches, with 20 bars of 1-inch and three sets of 3/8-inch ties at 12-inch intervals. Since this building exceeded 30 metres in height, and had a large height-to-width ratio, an anti-seismic design was required with a uniform horizontal loading of 0.1 g. The moderate frame damage was severest at the lower storeys. The severest cracking was in transverse beams with 1 mm cracks in some beams of the first storey. Moderate cracks also occurred in many columns, particularly in association with the construction joints which were near the tops of the columns. In a few instances, the upper parts of the	

Event	Felt Effect	Source
	columns suffered shear cracks due to failure at an upper corner of an adjoining concrete block wall panel. Liwayway Hotel - The Liwayway Hotel is a nine-storey building of 7 by 7 bays which suffered severe beam damage up to the fifth storey. The tall columns which formed the arcade along the front were severely split. This 33-year old building contained a reinforced concrete frame with wide exterior columns. Above the beams were six-inch reinforced concrete walls to sill level. Across the east side was a substantial reinforced concrete fire wall broken by a patio which ran most of the way across the fourth bay from the front. Frame beams were continued across the patio. The west and the north walls suffered severe shear damage to beams and spandrel walls up to the fifth storey. The column behind the fire escape has severe shear cracks indicating a lurch to the right, westward. The wide columns at the front suffered severe shear damage and splitting. Further column damage is seen in the patio. National Library - The National Library is a large building in which the stiffness is very unbalanced for transverse forces but is approximately balanced for longitudinal forces. Some very stiff reinforced concrete walls along the central section suffered shear damage but no damage associated with transverse forces was observed. The building is 128 metres long and about 23 metres wide. Its height varies from 26 metres to 34 metres. The western section, 49 metres long, is supported on relatively slender columns about 6 metres high. The longitudinal wall in the central section suffered severe shear cracking. However, transverse walls, in particular those at the first-	

Event	Felt Effect	Source
	storey level, showed no damage despite the severe unbalance for transverse forces. This suggests that the main inertia attack was along the long axis, which was orientated N 63^{o}E. Nearby, two small monuments fell parallel to the long axis, and in opposite directions. The damaged longitudinal walls were much stiffer than other longitudinal components. They did not have sufficient strength to withstand the resultant loads of this large building. Old Philippine National Bank - The Old Philippine National Banik is a large H-shaped building with the sides of the H fronting on Escolta and Muelle D.B. Nacional streets. This seven-storey building was very severely damaged and is to be demolished. The building had fire walls on each side which provided considerable stiffness and strength against motion at right angles to the streets. However, the deep spandrel beams and wide columns suffered severe damage from motion parallel to the street. Some components showed evidence of a particularly severe lurch along the street in the direction N 48^{o}E. Boie Building - The Boie Building is of seven storeys with 9 bays by 6 bays. It suffered moderate column damage along the northwest face. There was widespread but moderate damage to hollow concrete block panels. The building had deep box beams along the northwest and northeast sides, fronting Escolta and Pinpin streets. On the southwest side, adjoining the Old Philippine National Bank, was a reinforced concrete fire wall. On the southeast side are some short reinforced concrete walls associated with the stairways and lift shaft. The shear damage to the short exterior columns	

Event	Felt Effect	Source
	on the northwest side, and to small sections of reinforced concrete wall, indicated a lurch towards the northeast. There was evidence of very little deformation in the northwest direction. The exterior columns suffered shear damage because they were stiffened by the box beams and hence received most of the shear loads. The southeast area of the building would have caused torsional movements and hence additional loading on the northwest columns.	
	Araneta and Tuason Building - This eight-storey office building has a reinforced concrete frame of 8 bays by 3 bays. It is symmetrical, with a fire wall along each long side. There was considerable non-structural damage to concrete hollow block panels due to transverse swaying. There was also damage to the transverse walls of a central patio. The damage resulted from associating rigid low-strength components with flexible structural components.	
	Development Bank of the Philippines - This eight-storey building of 6 bays by 5 bays suffered moderate non-structural damage in a few places. The building contains substantial reinforced concrete walls on two sides. On the two remaining sides, reinforced concrete walls extended 1 metre above the beams. Near one corner, short wall sections extend from adjoining columns to reduce the clear length of the beam and low wall from about 6 metres to 2 metres. These short lintel walls were severely damaged by shear forces at storeys five to eight.	
	Phoenix Building - The Phoenix is an eight-storey building of 12 bays by 4 bays with a reinforced concrete	

Event	Felt Effect	Source
	frame. It suffered slight structural damage and moderate non-structural damage. The building is almsot symmetrical about both axes, the longitudinal axis being N 41^{o}W. There were a considerable number of transverse panels of concrete hollow blocks which suffered slight diagonal cracking both ways. Despite the four longitudinal walls at the ends of the building, there was sufficient longitudinal swaying to cause light beam and column cracking and to break a number of windows. The most pronounced cracking was at storeys three, four, five and six. La Tondenya Building - The La Tondenya is an eight-storey office building of moderate size. (Fig. 5) The substantial beams at the southeast end suffered severe shear failure due to interaction with reinforced concrete end walls. The building has eight storeys of 3.8 metres storey-height. It has 5 bays 6.5 metres long and a single bay 18 metres wide. Lateral stability is provided by reinforced concrete walls across each end. The wall at the southeast end is in two sections, exposing a 4.5 metres length of the beams at that end. Longitudinal stability is provided by spandrel beams 2.5 metres deep. These terminate in walls about 2.5 metres wide at each end of the building. Typical lower columns are 40 x 20 inches with 94 bars of 1 3/8 inch diameter. Typical transverse beams are 32 x 24 inches with the following steel in the central section: at the bottom were 27 bars of 1 1/8 inch, at the top 4 bars of 1/2 inch. Ties are two rectangles of 3/8 inch bar at 12-inch intervals. The columns are supported on clusters of about 15 concrete piles 12 x 12 inches driven to a depth of about 120 feet.	

Event	Felt Effect	Source
	When the building lurched towards the northeast, the sections of end wall tilted and applied large shear forces to the beams, causing failures. Rotation of the bases of these wall sections also damaged a first-storey concrete panel. There was moderate cracking of some first-storey columns and some cracking of reinforced concrete walls at the end of the deep longitudinal beams and at construction joints. Ground slumping of a few inches occurred at the eastern end of the building damaging the ground floor surface but not evidently attacking the structure. Although it suffered severe structural damage, the building was not close to collapse. Had the southeast wall been complete, it would have suffered only moderate damage. New Philippine National Bank - This large steelframe building suffered only slight damage to non-structural components. These were pre-cast with protruding bars which were welded in place before plastering. Overseas Terminal - The Overseas Terminal building consisted of two three-storey blocks parallel to the axis of pier 9 and running from the fill on to the pier. They were joined by a framed structure at the third-storey level which formed a rectangular arch at the entrance to the pier. The side columns at the entrance were given monumental dimensions of about 6 feet by 4 1/2 feet. They had a very low percentage of steel with 7/8 inch vertical bars and 3/8 inch ties. The fill close to the pier slumped about 25 cm. There were severe shear failures of the two large columns. Damage to the ground floor of the northwest block. The slumping has carried the lower parts of the large columns toward the pier. It appears that the tops	

Event	Felt Effect	Source
	of the foundation system are not connected by adequate beams in the direction of the pier axis. Metropolitan Cathedral of Manila - The massive cathedral, situated a few hundred metres east of the Philippine Bar Association Building, suffered no damage although three earlier stone cathedrals on this site had been destroyed by earthquakes. However, the cupola over the main altar was displaced and deformed 15 cm towards the east. The western column was displaced to the east. Damage to the base of the eastern column was tilting towards the east. F.E.U. Arts and Science Blocks - At the Far Eastern University are two large seven-storey reinforced concrete frame buildings. The Science Block is 77 metres long and 17 metres wide over most of its length, while the Arts Block is of comparable size. Each building has transverse reinforced concrete walls associated with its stairways and lifts. The long axis of each building is about N 60°W. Moderate damage to shear walls was associated with transverse inertia forces. These forces acted both ways along an axis N 30°E. There was damage at the first-storey level to an internal shear wall in the Science Block to the wall at the southeast end of the Arts Block and damage to pavement due to tilting of the base of this wall. Dinadiawan area - landslides: Large-scale landslides occurred in several places on the steep slopes of surrounding mountains. Large amounts of surface mud and rocks had been gouged out in several places and new bare surfaces were observed on the mountain sides. In the afternoon, after a very big aftershock had	

Event	Felt Effect	Source
	shaken the area at about noon, new landslides had occurred in at least six places. The largest landslide took place on the cliff at Dinajawan Point facing Casiguran Bay. Landslides which accompanied the main shock were mostly on the slopes of mountains north of Casiguran, while those which accompanied the big aftershocks were observed on mountains both to the north and to the west. Fissures: Fissures in the ground were observed in the river bed of the Jagdauan River. The width of the main fissure was about one metre and it appeared very deep. The length was about 150 metres in a direction roughly NE - SW. About 3 metres to the east, another shorter fissure, about 70 metres long, ran almost in the same direction. Parallel to these fissures there was another smaller fissure, 60 metres in length. Upper Manglad River - water was diverted from one part of the Upper Mangald river after the big earthquake of 2 August. The width of the river in this part was about 2.4 metres with the water about 2 feet deep. Casiguran area - in the area around the town of Casiguran, many cracks were observed. Most of these cracks had alignments nearly parallel to the nearest rivers. Surface soil in this area is mostly deltaic sand and is rather loose. The length of the cracks varies mainly from 10 to 200 metres, though some reached a length of about 400 to 500 metres. Spacing between cracks was 5 to 20 metres. Fissures were formed on the road from Casiguran to District Tabas, about 1 km north of the town of Casiguran. This place is about 8 metres from the Casiguran River at the top of a steep bank approximately 2.5 metres high.	

Event	Felt Effect	Source
	Fissures were sometimes as wide as 0.5 metres, and the surface subsidence amounted to as much as about 2 metres. These fissures were observed extending to the north, as far as two or three kms, in echelon formation. Other fissures were observed on a logging road, 30 metres from and parallel to the river bank, also in the Casiguran area. Soon after the formation of these fissures, it was observed that water and sand had been expelled. In the town of Casiguran, notable subsidence of about 1 metre was observed at the abutment of the Casiguran Bridge. Only 10 metres away from the bridge, fissures were seen running through the foundations of a house without serious damage to the house. Besides these fissures, some other damage was also seen in the town of Casiguran: a) the arch portion of the gate of the Municipal Building was broken along construction joints and moved towards S 60^{o}W, showing a displacement of about 3 cm; b) an elementary school of two units of prefabricated construction suffered damage by the collapse of hollow block walls; c) a two-storey house under construction had reinforced beams and columns damaged at the beam level in a northwest direction. Minor cracks also formed in lower beams; d) minor damage, such as cracks in concrete flooring and differential settlement, was seen in houses built of concrete and wood materials.	92
	Casiguran - it raised tall waves which drowned one fisherman, caused extensive fissures and landslides of 5,000 sq metres.	133
	The damage in Baler was not extensive. In the outskirts of the town, the bridge leading to Barrio Loongan was moved sideways and is no	

Event	Felt Effect	Source
	longer aligned with the road.	
	Manglad and Maddela, Nueva Vizcaya - in the Manglad (Barrio) and Maddela area of Nueva Vizcaya very large landslides were observed. In these areas, many landslides took place along the steep slope of the river terrace. A mud layer several metres thick covers hard bed rock along the cliff facing the river. The largest landslide took place on the slope of a river terrace on the right bank of the Manglad River, a branch of the Cagayan River. A large volume of this surface mud ran down the slopes of a hill and after reaching the river bed formed a small hill more than 20 metres high and 100 metres long. The Manglad River runs behind the corn field and just this side of the white patch in the middle, which is the newly-formed small hill. The slope down which the mud and detritus had flowed to the river bed is been just to the left of the white patch.	92
	Maddela, Nueva Vizcaya (District Manglad) - S 30^{o}E of town proper about 5 kms away. At Manglad River near junction with Cagayan River (20 metres away) - upheaval at its basin with an area of about 80 metres athwart the basin, 25 metres longitudinal and 15 metres high approximately. Average normal depth of Manglad River is about 4 feet at this site. East of the upheaved basin massive block landslides of slightly folded beddings, occurred and these landslides were observed also north of the upheaved area along the Cagayan River banks. Predominant vibration in this locality was vertical; rumblings heard from a north to south direction before every felt tremor, as observed by some people. Upper Manglad River observed to have become dry after August 2. Portion	

Event	Felt Effect	Source
	of river reached a direction flowing formerly N 40^{o}E with average depth of 2 feet and 24 metres wide.	
	Santiago, Isabela - auditorium wall of the North Eastern College, 10 metres high, hollow blocks with 3/4" steel ties every other block and without plastering, collapsed and the reinforced concrete columns 16" x 16" cracked diagonally.	
	Alicia, Isabela - Alicia Parish Church of red brick masonry, about 1800; centre cross spire toppled down southwards; masonry side walls (both) rear and front facades cracked diagonally.	
	Ilagan, Isabela - school building, three-reinforced concrete, about 1914, was strafed (machine-gunned by planes) during war; concrete chimney toppled down 20^{o} to the south of building near roof abutment to wall.	
	Tumauini, Isabela - Aroon Bridge - steel framed; very slight crack on concrete surface at north end of bridge. (bridge has 3 spans and is about 60 metres long)	
	San Pablo, Isabela - old brick masonry structures, remains of 1846. Municipal Hall - bricks collapsed, NE - SW direction.	
	San Agustin and Jones, Isabela - several artesian wells did not yield water, some produced adulterated non-drinkable water; two rivulets of San Agustin temporarily stopped flowing and on their banks some evidence of settlement was observed and recorded.	30
	San Juan - no extensive damage occurred except for some Meralco posts that fell and high-tension wires that snapped.	

Event	Felt Effect	Source
	Navotas - powerlines to this fishing town snapped during the earthquake, causing a black-out. No casualties or damage of consequence were reported.	
	Malaban - the belfry of San Roque Church cracked.	130
1968 Aug 28 10:42 a.m.	15.2°N; 122.6°E ENE of Polilio: Manila, Alabat and Baler - Intensity V.	
	Quezon City - Intensity IV.	16
1968 Aug 29 4:42 a.m.	Baler: Manila, Baler and Alabat - Intensity V.	
	Infanta, Quezon City and Dagupan - Intensity IV.	
	Baguio, Lucena, Ambulong and Tarlac - Intensity III.	
	Daet - Intensity II.	134
1968 Aug 30 5:08 a.m.	NNE of Baler: Manila and Baler - Intensity V.	
	Infanta, Alabat and Cabanatuan - Intensity II.	134
1968 Sept 15 7:20 a.m.	Masbate: Masbate - Intensity V	
	Legaspi - Intensity I.	134
1968 Nov 22 4:59 p.m.	E of Casiguran: Manila - Intensity V.	
	Casiguran and Baler - Intensity IV.	
	Baguio and Infanta - Intensity III.	
	Quezon City, Aparri, Tuguegarao and Alabat - Intensity II.	16
1969 Jan 30 6:32 p.m.	04.8°N; 127.4°E Talaud Island: Davao City - Intensity VI; damage limited to broken glassware; very slight damage to very old structures in the epicentral area.	

Event	Felt Effect	Source
	General Santos; Hinatuan - Intensity IV.	
	Dipolog; Cagayan de Oro; Malaybalay - Intensity III.	17
1969 June 11 1:15 a.m.	13.2°N; 121.4°E Northern Lake Naujan, Mindoro Oriental: Victoria, Mindoro Oriental - Intensity VI. Rumbling sounds were heard during the occurrence of the earthquake.	
	There was a report of slight movement of the water by people living around the lake. Slight structural damage such as small cracks along concrete walls and floors were observed. Glassware and unstable objects fell during the tremor.	
	Marinduque - Intensity V.	
	Talisay, Batangas; Calapan - Intensity III.	
	Romblon; Manila - Intensity II.	17
1969 Sept 19 9:31 a.m.	06.1°N; 125.4°E Mindanao: Davao City; General Santos - Intensity V.	
	Cotabato - slight damage.	
	Cagayan de Oro; Hinatuan - Intensity II.	17
1969 Oct 06 8:48 p.m.	Off SW Coast of Zambales: Iba - Intensity VI.	
	Manila; Pasay; Dagupan Gulod - Intensity IV.	
	Baguio; Quezon City; Tarlac - Intensity III. The epicentral distance was about 140 kms west of Quezon City, 15.1°N; 119.8°E. Very slight damage near the epicentral area but no casualties were reported.	17

Event	Felt Effect	Source
1969 Dec 08 5:47 a.m.	9.67°N; 125.63°E Surigao del Norte: Surigao - Intensity V.	
	Hinatuan - Intensity I. M = 5.2	17
1970 Jan 10 8:07 p.m.	06.8°N; 126.7°E Off Coast of South Mindanao: Davao - Intensity VI.	
	Cagayan de Oro and Hinatuan - Intensity V.	
	Catbalogan, Catarman, and Surigao - Intensity IV.	
	Tacloban and Borongan, E Samar - Intensity III.	
	Cebu and Virac - Intensity II.	
	Dipolog City - Intensity I.	17
	Small cracks in old and poorly built buildings. This area lies off the eastern coast of Davao. The tremor originated along the Philippine Trench where there is a major fault-line. A number of aftershocks were recorded by the seismic stations and those felt were as follows: Jan 10, 10:19 p.m., Davao City, III; Jan 11, 1:04 p.m., Hinatuan, I; Jan 24, 10:34 a.m., Hinatuan, I; Feb 12, 10:19 p.m., Hinatuan, II; Mar 04, 10:10 p.m., Davao City, II; Hinatuan, II; Surigao, I; Mar 10, 10:13 p.m., Hinatuan, I; Mar 17, 2:37 p.m., Hinatuan, I.	41
1970 Jan 23 6:00 p.m.	17.4°N; 122.1°E Northern Luzon: Tuguegarao - Intensity V.	
	Aparri and Calayan - Intensity II.	17
1970 Feb 06 6:05 a.m.	12.6°N; 122.2°E Tablas Island: Romblon - Intensity VI. Small fissures were found in the municipalities of San Agustin and Odiongan, where they were most prominent and with several inches of displacement. Also slight cracks in some structures were observed in	

Event	Felt Effect	Source
	both municipalities on the steep side of Mt. Payaopao, situated on the northern tip of the island. A landslide killed three persons when their houses were crushed and several persons were injured.	
	Alabat, Calapan, Legaspi, San Francisco and Lucena - Intensity IV.	
	Roxas and Gulod - Intensity II.	
	Masbate, Daet, Iloilo, Quezon City and Manila - Intensity II. M = 6.0	17
	The shock had a magnitude of 6.0 (USCGS) on the Richter scale and was perceptile over an area of 120,000 km^2 which included Quezon City in the north and Iloilo City in the south. Following the main shock there have been a large number of aftershocks, some of them strong enough to be recorded by seismic network. A total of eight persons were reported killed and damage to property was estimated to be at least P830,000. The casualties were caused by large limestone boulders, triggered and dislodged by the earthquake, rolling down the steep slopes of Mt. Payaopao.	135, 136
	Alcaraz (COMCOL Earthquake Worksheet, Feb 6, 1970) computed the epicentre of the earthquake to be at 12.30°N and 121.90°E off the western shorelines of Tablas Island, using the seismic data of volcano observatories at Mayon Resthouse, Taal, Canlaon, and the Central Office in Quezon City. Macroseismic effects and analysis of the initial cracks in concrete buildings and man-made structures in Odiongan and San Agustin seem to support the shock's epicentre as plotted by Alcaraz. The most considerable damage was noted in Odiongan, western Tablas and was concentrated in man-made structures situated over	

Event	Felt Effect	Source
	the narrow zone to the coastline and/or river course. A ground fissure along this area measured a maximum length of 600 metres and maximum of 14 inches vertical displacement, according to Moreno (oral communication, 1970). The slumping of the upper layers and the evidence of slight liquefaction along the western coast of Tablas Island can fully explain the pattern of damage, out of plumb houses, fissures, and faults. The main shock, in addition to the ground changes and damage to structures, was attended by generation of sandboils in Odiongan and San Agustin, as cited by Moreno (oral communication, 1970). Field studies on the damage to man-made structures and deformation of superficial layers caused by the Feb 5 earthquake indicated that the effect was more intense and extensive in Odiongan than in San Agustin, although the two places are almost equidistant from the source of shock. For this reason alone, Odiongan should merit a higher rating than San Agustin in any intensity scale.	105
	Epicentre - 280 kms SSE of Quezon City in the vicinity of the Sibuyan Sea between Romblon and Burias islands.	
	San Agustin, Romblon - Intensity V, most affected. Its water-main was cracked by the tremor and trees were uprooted.	42
	Army radio station on top of Mt. Payaopao was completely destroyed by the strongest earthquake felt in Romblon. Lighthouse at Punta Gorda was put out of commission by the quake. Road to District Cauayan was blocked by big boulders from Mt. Payaopao. It caused a "rock slide" in District Sugod, San Agustin,	

Event	Felt Effect	Source
	Romblon, Burying three houses.	119
10:17 a.m.	W of Tablas Island: Romblon - Intensity VI.	
	Roxas - Intensity III.	
	Manila - Intensity II.	17
1970 Feb 16 11:56 p.m.	Romblon Province: Romblon - Intensity V.	17
1970 Mar 10 2:15 p.m.	Romblon Island: Romblon - Intensity VI.	
	Mt. Payaopao, District Sugod - quake sent a giant boulder, the size of a truck, crashing down onto a house on the slopes of Mt. Payaopao. Killed four persons and injured two.	137
1970 Mar 31 12:46 a.m.	06.8°N; 126.7°E Philippine Deep: Surigao and Cagayan de Oro - Intensity V.	
	Davao and Malaybalay - Intensity IV.	
	Catbalogan, General Santos and Cebu - Intensity II>	17
1970 Apr 07 1:34 p.m.	15.8°N; 121.7°E Eastern Luzon: A strong earthquake of major magnitude which shook the whole of Luzon and Northern Visayas. Intensities reported at various places:	
	Baler and Metropolitan Manila - Intensity VII.	
	Dagupan, Cabanatuan, Baguio, Infanta, Tuguegarao, Talisay and Tayabas - Intensity VI.	
	Casiguran, Alabat, Vigan, Bayombong, Tanay, Laoag and Legaspi - Intensity V.	
	Iba, Tarlac, Aparri, Daet and Calapan - Intensity IV.	

Event	Felt Effect	Source
	Jomalig and Catarman - Intensity III.	17
	Main shock hit Manila at 1:34 p.m., 45 seconds' duration. Epicentre was placed at 197 kms NNE of Quezon City, somewhere inland in the vicinity of Maddela, Nueva Vizcaya. Damage: P. Guevarra Elementary School on San Fernando St., Binondo, collapsed at the height of the main shock. Buildings in central Manila, particularly those already weakened by the 1968 earthquake, suffered cracks, structural damage and broken windows. Manila International Airport suffered cracked walls and broken windows. High buildings along Rizal Avenue, Escolta and Roxas Boulevard suffered broken windows and structural damage. Communication lines were temporarily disrupted. Telephone calls from one area to another become garbled for at least one hour.	43
	Casualties and Damage: Total casualties were 14 killed and some hundreds injured. The deaths all resulted from the main shock. Some dozens of injuries occurred during the most severe aftershock at 12:02 p.m. on 12 April, and a few injuries occurred during other aftershocks. Considerable damage to buildings occurred throughout the alluvial ground area of Manila City. There were reports of heavy damage to public and private buildings in Baler, Dipaculao, Casiguran and Maria Aurora. These towns are all close to the epicentre, the first three being on the coast and the fourth a little inland on a coastal plain. In the Baler area there was also severe damage to bridges and roads, including a fissure over 1 km in length, about three feet in depth and a foot wide, which ran along the main road between Baler and San Luis. Other losses included severe	

Event	Felt Effect	Source
	damage to control tower equipment at Manila International Airport and damage to coconut trees in Quezon Province, estimated at P2,000,000 by the Philippine Coconut Administration. Most of the buildings damaged in 1968 suffered some further damage in 1970, often as a result of forces in a direction quite different from the direction of attack during the earlier earthquake. While the recent damage was more severe in some buildings, it was less severe in many others, either because strengthening shear walls had been added or because the building had greater resistance to forces in the direction of attack of the 1970 earthquake. Damage of particular buildings in Manila: Philippine Bar Association Building - this six-storey reinforced concrete frame building of 6 x 4 bays suffered severe crushing of the first-storey columns towards one end and was very close to collapse after 1968 earthquake. The building included a "T" shape of RC walls at one end, the top of the "T" forming a fire wall. The short longitudinal wall forming the stem of the "T" suffered severe shearing and crushing at the first-storey level. This damage resulted from earthquake forces along the axis of the building which were evidently more severe than the axial forces of the previous earthquake, since the longitudinal stem of the "T" was the main resisting element for the first storey during both earthquakes. Aloha Theatre Building - the southern ends of storeys five to eight were removed (after the 1968 earthquake) and the remainder of the building was repaired. It is understood that a shear wall was introduced near the southern end to	

Event	Felt Effect	Source
	balance the fire wall across the northern end. No damage was reported from the 1970 earthquake. Trinity Building - this seven-storey building of 6 x 4 bays suffered considerable damage to short exterior columns and near the eastern and western corners, and some panel damage near the eastern and northern corners, during the August 1968 earthquake. It suffered less damage this time. The most severe damage was to a few short columns near the southern end of the NE side. Glass bricks to the left of these short columns had been damaged in 1968. The broken bricks were replaced by reinforced concrete which extends to half the height of the short columns. The new reinforced concrete panels damaged the columns when the building swayed towards the SE. The swaying and consequent damage would have been more severe, particularly on the first few storeys, if it had not been limited by a short shear wall at the far end of the NE wall. Diamond Tower - this long, narrow, eleven-storey building of 11 x 2 bays suffered considerable structural and non-structural damage due to transverse swaying during the 1968 earthquake. The beams and columns were repaired by chipping off damage concrete and replacing it with dry-pack concrete. Where damage was severe, an additional cage of half-inch steel bars was provided. Cracks were filled with a pressure grout of epoxy resin. The sagging cantilevered parts were repaired without removing the sag. Two short transverse shear walls were added at about a fifth of the building length from each end, to provide increased resistance to transverse forces. Each shear wall was formed by casting heavily reinforced concrete	

Event	Felt Effect	Source
	panels at all storey levels of a single bay. Some of the panel reinforcing bars were welded to the steel of the columns and beams, this steel having been exposed by chipping away the faces of these columns and beams. The transverse shear walls suffered only slight local damage, and general non-structural damage resulting from transverse movements was very small. However, it is probable that the most severe attack during the April 1970 earthquake was along the axis of the building, and hence its transverse resistance was not severely tested. The longitudinal fire wall provides effective resistance against longitudinal forces. However, the wall is broken up into lengths of about 25 feet by light recesses, and there was sufficient flexibility for moderate panel damage to occur along the first storey. Relative vertical movements between the near ends of shear walls caused severe damage to low panels and small cracks in the stairway. Along the northern face of the building, in the plane of the wall, was a set of shade panels running vertically between the balcony balustrades. These shades suffered considerable cracking at construction joints, probably due to longitudinal swaying of the building. Towards the ends of the building, the cast-in-situ shade panels suffered no such damage.	
	Liwayway Hotel - in April 1970 this nine-storey building suffered somewhat less severe damage than in August 1968. In particular, the repaired columns along the outside of the arcade suffered no further damage. Around three sides of the building, spandrel beams, up to storey six, suffered damage which was less severe than in 1968. The fourth side includes a fire wall.	

Event	Felt Effect	Source
	Although the damage was distributed over a large number of building components it was of a type which absorbs relatively little energy: namely, diagonal shear cracks and compression crushing. National Library, storeys six and nine - the damage to the axial shear wall in April 1970 was similar to that in August 1968. However, other damage associated with longitudinal movements indicated less swaying in this direction. The recent earthquake caused some damage to concrete hollow block panels which was not observed in the earlier earthquake. The cracks were a result of swaying towards NNW. Philippine National Bank - the demolition of this old seven-storey building was well advanced by April 1970. Of particular interest was the unexpected discovery of a riveted steel frame contained within the reinforced concrete beams and columns. It is therefore probable that the building was much further from collapse than it appeared to be during visual inspection after the 1968 earthquake. Despite this reserve of earthquake resistance, the damage was so extensive that demolition was the only practicable course. Botica Boie Building, Escolta Street - this six-storey reinforced concrete frame building of 9 x 6 bays suffered damage in 1970 comparable to that in 1968. The damaged panels of glass bricks were replaced after August 1968 by reinforced concrete panels, and these were damaged in April 1970. The spandrel beams and columns on the NE side suffered considerably more severe damage in 1970. The pattern of damage again supports the hypothesis that the attack of this	

Event	Felt Effect	Source
	earthquake was relatively more severe in the NW - SE direction. Development Bank of the Philippines, Escolta Street - this eight-storey reinforced concrete building of 6 x 5 bays suffered moderate but extensive panel damage in August 1968. As part of a comprehensive repair programme, the building had been stripped of its exterior panels on the NE and SE sides by April 1970. Thus reduced in weight, it suffered no significant damage during the recent earthquake. Phoenix Building, Recoletos Street - this eight-storey reinforced concrete building of 12 x 4 bays, with its long axis in an ENE direction, suffered moderate structural and non-structural damage during the August 1968 earthquake. In general, damage was less severe in April 1970. This may be consistent with the assumption that in 1970 the longitudinal forces were less but the transverse forces were the same as in 1968. In particular, all transverse sections have reduced stiffness in the second bay, from the south, since the beams are cut to half length, leaving the floors to provide continuity. End panels and low walls on the corresponding end bay suffered damage up to storey six. Overseas Terminal Building, Pier 9 - a six-inch steel water main, parallel to the pier axis, ran from the fill on to the pier. It was reported to have been broken by tensile forces and the ends drawn several inches apart. Manila Cathedral Cupola - in April 1970 the cupola of the Manila Cathedral moved towards the east with a pattern of damage almost identical to that suffered in August	

Event	Felt Effect	Source
	1968. Most of the broken marble components had been repaired, and it is probable that a residual weakness remained, permitting movement towards the east. The cupola was deformed in 1970 without the sliding of the blocks immediately above the pedestal, which occurred in 1968.	
	Far Eastern University, Arts Block - this seven-storey building, of 7 x 2 bays suffered considerable structural and non-structural damage at most levels in August 1968. There has been further deformation, since a number of the timber props installed after the 1968 earthquake now have some clearance, while some light steel props have been buckled. Some beam damage occurred adjacent to the shear tower formed at the eastern end by the lift shaft. A shear failure occurred in a column associated with the eastern stairway and considerable damage occurred at the construction joints of columns and reinforced concrete walls. There was a shear tower, around a lift shaft, across each end of the building. It was no doubt these which caused the earthquake damage to be distributed throughout the full height of the building. If the walls had been absent, the attack would probably have occurred mostly at the first and second storeys and would have been more severe. However, in the longitudinal direction the shear walls were shorter, the frame more flexible, and the damage was slight.	
	P. Guevarra Elementary School Building (PGES) - this L-shaped three-storey school building collapsed completely during the 1970 earthquake. The northern side of the "L" was completed in August 1968, when it suffered some structural damage. This damage was repaired and	

Event	Felt Effect	Source
	the whole building completed in January 1970. If it is assumed that the collapsing building swayed towards the area in which total collapse first occurred, then collapse must have occurred first about midway along the western side of the wing which runs towards the north. Agoncillo Elementary School - this three-storey concrete frame building of 3 x 3 bays suffered severe shear damage in two first-storey columns, each of which had a concrete hollow block panel extending to about 2/3 of its height. Beside the stairway, on the first and second storeys, the concrete hollow block panels had been severely damaged and would have collapsed across the stairway if the earthquake had been somewhat more severe. This column damage provides the clearest possible warning against neglecting panels as "non-structural" during the design of a building containing a reinforced-concrete frame. Manila High School - this building was in the form of a hollow triangle, with two recently-built wings of four storeys and a third older wing of three storeys. The newer wings suffered moderate frame damage and considerable panel damage at the first and second storeys. There were five concrete folded-plate sun shades on the roof of the newer wings, of which three collapsed while the remaining two suffered severe damage. While the concrete strength is unceratin, it should be noted that a considerable number of building appendages suffered damage during the April 1970 earthquake. Hope Christian High School - this long three-storey school building had an axis running approximately NW	

Event	Felt Effect	Source
	- SE. Concrete hollow block panels, one-third of the column height, extended along the NE wall at storey one. Under the effect of longitudinal swaying, the shortened columns suffered moderate "X" cracks.	
	Consolidated Apartment House - this was a large seven-storey building of 13 bays by 5 bays. It had a reinforced concrete frame and hollow ceramic-brick panels. The panels in several bays of the long exterior walls had no openings, while other exterior panels on the long and short sides had only small window openings. Throughout the length of the building there was a light wall on one side of the central (third) bay.	
	This effectively separated the building into two halves, without interconnecting floor diaphragms or vertical panels, but the two parts were closely linked by the beams of the frame. This building suffered moderate cracking of some beams and columns, including working of construction joints. The panels without openings suffered damage around the edges, in some cases rather severe. Incomplete panels suffered more severe damage. Considerable debris fell from panels, which ruptured where they had cast-iron pipes embedded. Strong reinforced-concrete canopies over the exits of this building would have provided considerable protection to fleeing occupants. Those bays which contained complete, or almost complete, panels swayed somewhat as short shear walls, so that considerable inter-storey deflections were carried to the upper levels of the building.	
	Pearl Towers - this consists of a long five-storey building of 19 x 2	

Event	Felt Effect	Source
	bays and a rectangular seven-storey building of 7 x 5 bays, connected by beams at the first- and second-storey levels. Fire walls along the SW side of the five-storey building, and on both sides of the seven-storey building, give them considerable resistance to longitudinal forces. These buildings suffered moderate damage in August 1968 from transverse swaying. Strengthening was provided by a pair of short shear walls in each building. Very little damage occurred in the recent earthquake. While the transverse shear walls must have provided added resistance, the general pattern of damage in Manila City suggests that the transverse attack in the NE - SW direction was less servere than the attack in the NW - SE direction.	
	Gocheco - this six-storey building is in the form of a hollow square in which the sides are either 3 or 4 bays wide. It suffered some frame and panel damage during the August 1968 earthquake. The more severe structural damage was repaired with hardpack concrete, and the cracks with injected epoxy resin. In April 1970 there was less frame damage than during the 1968 earthquake. At least some of this damage appeared to be associated with NW - SE motions. Some beams which had been damaged by NE - SW motions during the 1968 earthquake, and repaired with epoxy, suffered no further damage in 1970.	
	United Building - the United Building extends 8 bays along a NE - SW axis and is 4 to 5 bays wide. It has a reinforced concrete frame and a reinforced concrete fire wall along the NW side. There were a considerable number of panels of concrete blocks. This building suffered little damage in August	

Event	Felt Effect	Source
	1968 but in April 1970 it suffered such severe column damage that it was very close to total collapse. Most of this column damage was caused by the attack of transverse panels during swaying of the building in a NW - SE direction.	101
	Scores of buildings in central Manila, particularly those already weakened by the 1968 quake suffered cracks, structural damage and broken windows. The Manila International Airport suffered cracked walls and broken windows. Its control tower was heavily damaged. Most high buildings along Rizal Avenue, Escolta and Roxas Boulevard suffered broken windows and structural damage. Communication lines were temporarily disrupted. Telephone calls from one area to another became garbled for at least one hour. A few buildings in Caloocan, Quezon City and Makati suffered structural damage. In Caloocan City, the city hall annexe suffered cracks. Structural damage also occurred to Vinzon's Hall in U.P. Diliman and to four tall buildings on Ayala Avenue. Telltale signs of the earthquake were all over Manila, reflected in broken bits of glass and pieces of plaster and concrete which littered most streets.	43
	In Intramuros, heavily damaged were the National Press Club Building and Manila High School Building whose roof top shades collapsed. On Kalaw St., the tall Antonio building as well as Volkswagen House displayed shattered window panes. At Plaza Miranda, numerous glass panels of the Pecache building "shattered like gunfire". Cinerama cinema was a checkerboard of shattered panels. A crane on top of the Manila International Hotel on Roxas Boulevard snapped, but fortunately became entangled with the steel	

Event	Felt Effect	Source
	girders of the building, thus preventing it from falling. Roof of Guzman Technology building on Mendoza St., Quiapo caved in. Otis Department Store's roof also caved in. Binondo church tower fell to the ground. Philippine Long Distance Telephone Company reported that main cables connecting Caloocan and Riverside exchanges were damaged. A MERALCO transformer on F. Manalo St. exploded at the height of the tremor.	161
	Reports from the provinces: Road to Baler, Quezon from Bongabon, Nueva Ecija has been rendered impassable due to fissures. The main road from San Luis to Baler was reported cracked in many places, the cracks about one-half metre wide and one-half metre deep. In Barrio District Calabuan, Baler, water rose from the fissures about 3 metres high. In Naga, Philippine National Railway's water tank collapsed. The tank was capable of containing 40,000 gallons of water.	
	Quezon Province: Ysmael Lumban Concession Field Office Site, near Dinajawan Bay (Debutunan) - several cracks near shoreline. General direction N-S. Distance from one crack to another was about three metres; others wider.	
	Aleman, Antatabong area - Sierra Madre Range, Quezon - very few cracks longitudinal to ridge contours, one about 80 metres long; opening about eight to 12 inches wide and average depth of two feet, in the general direction of E-W. The ridges observed are planted with trees and are very narrow, not being more than 20 metres on the top portion in most cases. Condition of top soil is rather loose. It is believed to be tending towards a landslide but, because of the	

Event	Felt Effect	Source
	adherence of the numerous roots of trees, the slide was prevented. Within this area several landslides from steep contours were observed.	
	Casiguran Quezon: Bailey Bridge (steel and wood construction) approaching town proper and crossing Casiguran River - settlement of both approaches of the bridge approximately three to four feet. Some materials of the approaches are earth-filled and held by rift-rafting.	
	House with concrete backwall - the portion near the concrete structure, settlement was about one inch. House has concrete flooring (with reinforcement) and several cracks were observed on the first floor of the house. Fresh exuded sand deposits were also observed along construction joint of pavement and wall.	
	Municipal Building Gate - orientation N 60°E, arch portion of the gate separated at the construction joints, moved to direction of S 60°W with a displacement of one inch. Cross-section area of arch is 24" x 24". Hollow block fencing of the Town Hall also collapsed. Concrete hollow blocks are without reinforcement.	
	Unfinished concrete house - a two-storey structure with reinforced concrete frame and lower-portion walls half finished, and one side having four columns visible. Beam (topmost) in the centre snapped, oriented in the NW - SE direction. Tower beams incurred some minor cracks, too. Cross-section of beam is about 12" x 8" and column is about 12" x 12".	
	School fence - concrete hollow-block walls with bamboo reinforcement	

Event	Felt Effect	Source
	collapsed.	31
	The April 7, 1970 quake was characterized by "short rapid jerks, zigzags rather than arcs" and rattled buildings as though they were convulsed by inner jitters. This quake radiated from the point of the fault-line that runs along the Philippine Pacific coast. The epicentral zone covered the area of Casiguran, Baler, Sta. Lucia, Quezon and the coastal ranges of the Cordilleras. People of the shore towns "saw the sea pushed back saw the water stripped off like a carpet from the shoreline and folded up into the horizon. But the next moment the folded sea unrolled and came rushing back as a wall of water, a sort of tide, a mile-wide torrent that flooded and crashed past the shoreline, engulfing trees, boats, huts and beach". Roads split as wide as two feet, water fountained from the deep chasms created, bridges collapsed.	145
1970 Apr 12 12:01 p.m.	N of Polilio Island: Baler, Infanta, Manila and Pasay - Intensity V. Quezon City - Intensity IV.	17
1970 Apr 15 9:14 p.m.	ENE of Polilio Island: Felt widely in Luzon with maximum Intensity of V in Manila.	17
1970 May 01 11:22 a.m.	SE of Baler, Quezon: Baler and Cabanatuan - Intensity V. Manila and Quezon City - Intensity IV. Batangas, Iba, Baguio City and Infanta - Intensity III. Tarlac and Alabat Island - Intensity II.	17
1970 May 30 9:16 p.m.	Northern Samar: Catarman - Intensity VI.	

Event	Felt Effect	Source
	Virac - Intensity IV.	
	Catbalogan and Borongan - Intensity III.	
	Legaspi - Intensity II.	
	Tacloban - Intensity I.	
	Epicentre - 50 kms N of Catarman and 70 kms E of Sorsogon.	17
1970 July 16 12:44 p.m.	Baler, Quezon: Baler - Intensity V.	
	Manila and Quezon City - Intensity I.	17
1970 Aug 26 11:11 p.m.	Near Laoag, Ilocos Norte: Aparri and Laoag - Intensity V.	
	Vigan - Intensity VI.	
	Dagupan, Baguio and Tuguegarao - Intensity II.	17
1970 Sept 30 5:52 p.m.	Basco, Batanes: Basco - Intensity VII.	
	The municipalities of Uyugan suffered slight damage to property. Same as in Sabtang. Among the 65% of houses affected in Basco that were damaged with cracks on walls, three of these totally collapsed. In a southern municipality on the mainland, 30% of the houses suffered only slight damage, mostly cracks; damage to public property was mostly to waterworks; a landslide on Mt. Iraya greatly damaged the water system where it is located. Smaller slides were also observed south of Basco; slight fissures were observed in some areas affected by the earthquake; small local tidal disturbance was reported along the coastal areas.	17
	Epicentre - 50 kms S of Basco or 632 kms NNE of Quezon City.	

Event	Felt Effect	Source
	Basco - several structures in Bascoi collapsed, others suffered extensive cracks, rendering them unsafe for use or habitation. The quake left 60% of Basco in ruins and knocked out its water system. The capital's water supply comes from Mt. Siraya. The main supply pipes at the water basins were reportedly snapped or twisted by the earthquake roads in Basco had been torn up. Only bicycles could be used by residents in going from one distant place to another; devastation was more terrifying in towns and places in the SW part of Batanes. Communications were completely disrupted.	44
1970 Nov 03 11:15 p.m.	NE of Laoag, Ilocos Norte: Laoag - Intensity V; 30 seconds' duration.	
	Aparri, Cagayabn - Intensity III; 15 seconds' duration.	
	Vigan - Intensity II; six seconds' duration.	
	Epicentre - 150 kms ESE of Aparri, near the mouth of Cagayan River.	45
1970 Nov 08 7:18 a.m.	NE of Laoag, Ilocos Norte: Laoag - Intensity V.	
	Aparri, Vigan and Tuguegarao - Intensity III.	17
	Laoag - church belfry showed signs of sinking as concrete around it cracked.	
	Bacarra, Ilocos Norte - topmost portion of Bacarra church belfry collapsed. The belfry was four storeys high. It was originally constructed in the early 16th century of Moorish-Corinthian architecture, about 12 feet in height.	139
1970 Nov 13 10:16 p.m.	Sorsogon, Bicol Province: Sorsogon - Intensity VI.	

Event	Felt Effect	Source
	Catarman - Intensity V.	
	Legaspi, Roxas, Catbalogan and Masbate - Intensity IV.	17
1970 Nov 21 8:19 p.m.	Zambales Province: Iba - Intensity VI.	17
1971 Apr 18 2:58 a.m.	Butuan City, Northeastern Mindanao: A quake rocked Butuan City on April 18 at 2:58 a.m., ranging from Intensity I to VI. It was preceded by a "rumbling noise" and was reported to be part of a series of shocks which started in late March, occurring in clusters of two to four almost twice a week. Roads in Butuan City were cracked at least three to four inches wide.	46
1971 Apr 30 3:56 a.m.	Romblon Province: Romblon - Intensity VI.	
	Roxas City; Alabat - Intensity III.	
	Tayabas; Calapan - Intensity II.	16
1971 July 02 1:34 p.m.	Off East Coast of Masbate Island: Masbate - Intensity V.	
	Legaspi - Intensity IV.	
	Catarman - Intensity III.	
	Catbalogan; Borongan - Intensity I.	16
1971 July 04 7:31 p.m.	Off East Coast of Baler, Quezon: Baler, Cabanatuan; Manila - Intensity V.	
	Quezon City; Dagupan City; Iba; Infanta - Intensity IV.	
	Pasay City; Casiguran; Alabat - Intensity III.	
	Daet - Intensity I.	16
	Manila - caused buildings and offices in the central area to sway for 16 seconds. Other places that	

Event	Felt Effect	Source
	also felt the tremor were Baguio City, Intensity IV and Tuguegarao, Intensity II. The Weather Bureau tentatively placed the epicentre of the quake at 138 kms NNE of Quezon City or 15 kms SE of Baler, Quezon on the sea bottom. Seismologists said the crustal disturbance is part of the offshore seismic activity currently going on in the vicinity of Baler, Quezon. The earthquake's direction was east to west.	140
1971 July 20 6:34 p.m.	Iba, Zambales: Iba - Intensity VI.	
	Manila - Intensity II.	16
	An earthquake of Intensity VI was felt in Iba, Zambales at 6:34 p.m. The Weather Bureau placed the epicentre at 157 kms NW of Quezon City or 20 kms west of Iba, Zambales. The predominance of vertical movements at Iba indicates that the epicentre of the tremor was relatively close to the area. This earthquake is believed to be of tectonic origin but shallower than normal. No report of damage or casualties had been received.	141
1971 July 25 8:52 p.m.	East Coast of Masbate Island: Masbate; Legaspi - Intensity V.	
	Roxas City; Catarman - Intensity IV.	
	Iloilo City - Intensity III.	
	Tacloban; Catbalogan; Quezon City; Manila - Intensity II.	16
1972 Jan 25 10:09 a.m.	22.5^{o}N; 122.3^{o}E Taiwan Region: Basco - Intensity V.	
	Tuguegarao; Aparri; Itbayat; Virac - Intensity III.	16
1972 Mar 16 1:09 p.m.	15.7^{o}N; 121.8^{o}E Off Coast of Baler, Quezon: Baler - Intensity VI.	
	Baguio City; Dagupan City;	

Event	Felt Effect	Source
	Cabanatuan City - Intensity IV.	
	Manila; Quezon City; Infanta - Intensity III.	
	Virac - Intensity II.	16
1972 Apr 26 3:30 a.m.	13.4°N; 120.3°E NW Coast of Occidental Mindoro: Lubang Island - Intensity VI.	
	Greater Manila area; Cavite; Ambulong; Tayabas - Intensity V.	
	Cabanatuan; Cuyo; Coron; Iba - Intensity IV.	
	Infanta; San Francisco - Intensity III.	
	Roxas City; Alabat - Intensity II.	16
	Earthquake rocked Manila and other areas at 3:30 a.m. on April 26. Manila was hardest hit. Geophysical Centre at Diliman, Quezon City recorded the quake as Intensity V. Epicentre traced to about 174 kms southwest of Quezon City in the vicinity of Lubang Island, Mindoro. Main shock was also felt in southern Tagalog provinces, part of Central Luzon, and the Visayas.	
	Damage: City Library of Manila on Arroceros St. "heavily damaged" and declared off limits. Manila City Hall's fourth floor also damaged, in addition to previous earthquake damage. In Ermita, buildings damaged were the Bayview Hotel, Hilton Hotel, VIP building, Torres Hotel. Also damaged were the Manufactures's Bank in Plaza Santa Cruz, Corrimar building at Escolta, Amparo building at Espanya, Don Mariano building at Sampaloc. In Laguna, lights in most parts of the province where out as a result of the earthquake. The tremor "knocked out" the local power source in Sta. Rosa affecting Binyan, San	

Event	Felt Effect	Source
	Pedro, Sta. Rosa, Cabuyao, Calamba. In Bulacan, the electrical service in Plaridel town was temporarily cut off, as several electric wires were damaged. In Olongapo, the quake shook houses, toppling glassware and tinned goods from their shelves, especially in stores and supermarkets.	120
1972 May 22 2:04 p.m.	16.1°N; 122.3°E Off E coast of Casiguran, Quezon Province: Manila; Cabanatuan - Intensity VI. Baguio City; Quezon City; Dagupan City; Tuguegarao - Intensity V. Aparri - Intensity IV. Ambulong; Iba; Laoag - Intensity III.	16
	Duration was 20 seconds. Epicentre estimated at about 273 kms NE of Diliman or somewhere in the vicinity of Isabela. Damage: It damaged at least six buildings in Manila. The Marsman building, port area, housing the Department of Public Works and the Weather Bureau suffered cracked walls on the second and fourth floors. Delgado Brothers' building on Bonifacio Drive, Intramuros, suffered cracked walls. Marco Bazaar, on Hidalgo St., second floor walls collapsed on to a parked truck. The L & S building on Roxas Boulevard, Philippine Savings Bank in Plaza Miranda, Quiapo, and the Manila Banking Corporation building in Escolta suffered cracked walls.	121
1972 June 13 12:43 a.m.	3.9°N; 124.3°E Celebes Sea: Davao City; General Santos - Intensity VI. Dipolog - Intensity IV. Cagayan de Oro; Surigao - Intensity II. Mb = 5.8	16

Event	Felt Effect	Source
1972 Dec 02 8:22 a.m.	6.5^{o}N; 126.6^{o}E Off SE Coast of Davao, Mindanao: Davao City - Intensity VI.	
	Cagayan de Oro; Malaybalay; General Santos - Intensity V.	
	Hinatuan - Intensity IV.	
	Catarman; Catbalogan; Borongan - Intensity III.	
	Dipolog; Cebu - Intensity II.	16
	Preliminary seismic readings placed the epicentre at about 830 kms SE of Quezon City.	6
1973 Mar 17 4:31 p.m.	Ragay Gulf: Macroseismic observations: The macroseismic area of the Ragay Gulf earthquake covered about 157,000 sq km using a cut-off intensity of III in the Rossi-Forel Scale of IX. At the height of the earthquake, people panicked. They had to hold on to stable objects to maintain their balance otherwise they would have fallen to the ground. There were reports of changes in the flow of springs and wells. Sand and mud were ejected from fissures in soft ground. A reinforced concrete highway bridge collapsed. Within the epicentral area, the inhabitants heard rumbling sounds coming from different directions during the occurrence of the main shock and ensuing larger aftershocks. Those living close to the fault-line either fell down or were thrown up for a few feet due to the initial vertical jolt of the earthquake. Four-legged animals such as buffalo and cows were likewise knocked down. Piles of coconut trunks lying five metres away from the fault-line in district Sintones, Guinayangan were thrown southwestward, pinning down and killing a man who was lying down nearby during the time of the main shock. An employee	

Event	Felt Effect	Source
	of the Philippine National Railways in Hondagua, Lopez, who was sitting with a clear view of the rails at the time of the main shock, reported the dislodgement in a wavy form of the rails from the ground. Some people in Calauag, Lopez, and Guinayangan reportedly saw the ground heave up and down in a dizzying, wave-like manner. The sea at the western end of the sea-wall in Calauag was observed to go beyond the shore by 20 metres. This was due to a rise in sea level of 1.3 metres. Rise in sea level was similarly noticed in the town of Quezon at the southern tip of Alabat Island.	
	Manila, where the earthquake was felt at Intensity VI, is underlain largely by alluvial and deltaic deposits. High-rise buildings suffered shattering of window panes and minor cracks in walls and ceilings. Earthquake effects on buildings, roads, bridges, railway tracks, communication lines, electric systems, waterworks and sewerage systems, sea-walls and piers were extensive in the Tayabas isthmus and understandably moderate in the sparsely populated area of northern Bicol. The relative distances of the centres of population to the epicentre of the main shock range from 70 kms to 150 kms. But some of the aftershocks, which were probably related to the successive rupturing along the fault, were situated underneath or in the vicinity of the affected towns in the isthmus. Consequently, these conditions contributed much to the earthquake's destructive effects. Evaluation of these effects on civil structures obviously showed the apparent lack of earthquake-related safety factors in their design and construction especially in the seismically active areas,	

Event	Felt Effect	Source
	that is, in the Tayabas isthmus. The town worst hit by the earthquake is Calauag, Quezon where 98 houses were totally destroyed and 270 others were partially destroyed. In Barrio Sumulong of the same town, 70% of the school building was damaged. Most of the partially to completely destroyed houses and buildings were situated along the seashore in the northern section of the town proper. The damaged houses were largely wooden and some were poorly built concrete buildings. Effects on strongly built ones were limited to the toppling of concrete hollow-block walls and decorative tiles. The town of Lopez ranks next to Calauag with respect to the extent of the destruction. The place is relatively farther from the causative fault and the epicentre of the main shock, but soft underlying sediments present in Calauag are similarly found in Lopez. The concrete hollow block (CHB) retaining walls of a five-room Parent Teacher Association (PTA) building of the Lopez Provincial School collapsed on both sides of the building along the N - S direction. Similarly, the CHB walls of the Library building were badly cracked. A residential three-storey concrete building was severely tilted to the north. The facade of the Sto. Rosario Catholic Church of Lopez suffered cracks and some parts of the CHB walls on both sides toppled down. Its northern section tilted to the east and a part of its southern portion, which is a remnant of an old convent constructed of masonry walls, gave way. The hollow block facade of a nearby chapel on the eastern side of the church collapsed towards the north. The one-kilometre-long concrete sea-wall along the ESE coast of Calauag suffered minor cracks mostly along construction joints. Near a mid-	

Event	Felt Effect	Source
	section in one of its stairways there was a ten cms crack. One section was displaced five cms to the north from the other section. In district Hondagua, Lopez, five kms east of Calauag, some buildings were totally or partially damaged. The CHB wall of one of the classrooms of the Hondagua Elementary School toppled down. Estimated losses to the Philippine Flour Mills in Hondagua were reported to be about one million pesos. The losses were due to the temporary stoppage of operation to repair the destroyed conveyor system and damage to piers, displaced machinery and buildings. The concrete columns of the housings of the conveyor machines buckled. There was differential settlement of the ground along fills in the pier such that the floorings of some of the buildings became uneven and were cracked. The Hondagua Theatre, which had been converted into a restaurant, completely collapsed at the height of the earthquake. The Catholic chapel of the district was partially destroyed. Its facade toppled down and its CHB walls were cracked. The earthquake wrought damage on roads, railways and bridges. This hampered travel to and from the Bicol region. At least four highway bridges on the Manila South Road were reported to have suffered damage ranging from partial to total collapse. The bridge which totally collapsed was the Sumulong highway bridge in Sumulong, Calauag. It is newly constructed with three-span reinforced concrete double girders on opposite beams. It was severed into two sections across the first span on the Sumulong side approach. The Calauag pier sagged down below the water level causing its second and third sections to fall into the river. The Sumulong pier was tilted to the NW and its abutment was badly cracked. Measured horizontal	

Event	Felt Effect	Source
	displacement was 76 cm to the NW at the Calauag approach. A Philippine National Railway (PNR) trestle bridge crossing the Calauag River and situated about 600 metres north of the highway bridge was badly damaged, although it did not collapse. Measurement on both sides of the abutment showed that the span was displaced 50 cms northwesterly from its original position. The rails along the bridge were badly twisted. A slight movement was detected at the PNR bridge in Morato, Tagkawayan. Its ties were observed to have moved eight cms to the east, and the base plate of its western abutment was moved five cms to the south. Damage to national and municipal roads was limited to cracking of the concrete slabs along the Manila South Road. Subsidence occurred along the Sumulong Guinayangan road. Between the towns of Lopez and Calauag, the rails of the PNR were reported to have been badly twisted. The major twisting of the lines however occurred some 300 metres from the southwestern approach of the PNR trestle bridge in Sumulong. The measured horizontal displacement of the Sumulong PNR bridge was only 0.5 metre across the line; it was 1.85 metre along the fault trace. A goods wagon loaded with charcoal in Hondagua at the pier of the Philippine Flour Mill at the time of the earthquake fell on its side to the northwest. Electric systems, waterworks systems and telegraph systems in the towns of Lopez, Calauag and Guinayangan were severely disrupted. In Calauag, water-main pipes were either fractured or severed. Electric and telegraph lines snapped due to the appreciable horizontal movements of the ground. Fires which broke out during the earthquake were immediately controlled. In the town of Lopez, a concrete electric post	

Event	Felt Effect	Source
	broke on its base and toppled, pinning down five youngsters who were hanging on to it to prevent themselves from being thrown off their feet, due to the strong shaking of the ground. The electric post had a dimension of 0.16 x 7.70 m. Disruption to water system was minimal. In district Hondagua, Lopez a 3/4 inch water pipe was subjected to tensional forces which resulted in the breaking and separation of the pipes. Agricultural Effects: The agricultural industry in the epicentral area is based mainly on coconut. The coconut production was low because of the shaking down of young nuts during the earthquake. Furthermore, the roots of some trees situated within a distance of about one km on both sides of the fault traces were cut off as a consequence of the horizontal ground movement, thus affecting their fruit-bearing capability. Concrete fishpond dykes in the epicentral region were cracked, although to a minor extent. Mud dykes which were loosely made toppled down while others were fissured. Geological Features and Effects: The most interesting feature in this earthquake was the remarkable extent of the faulting. The farthest observable fault-trace from the epicentre is 90 kms away in the coastal district of Sumulong, Calauag. Ground breakages were seen along the segment of the Philippine Fault, from the western coast of Ragay Gulf to Calauag Bay, a stretch of about 30 kms. The fault traces exhibited "mole-track" features with ground fissures arranged in echelon to one another in an E - W trend. From District Cabong towards Barrio Sintones in the town of Guinayangan, some 6 kms northwestward, the traces	

Event	Felt Effect	Source
	were observed to have followed a moderate depression. In three places along this segment, trunks of fallen coconut trees were split and displaced left laterally. Going uphill from Barrio Sintones to Barrio San Pedro, seven kms east of Guinayangan, the traces were encountered along the trail. About three kms west of the barrio schoolhouse of San Pedro, two sets of ruptures were observed. One set trended N 30^{o}E with vertical slip of 0.21 metre and is believed to be a complementary shear. The other set is half a kilometre uphill with maximum width of 0.50 metre and a ground subsidence of the same amount. The extension of the fault-trace from the mountain side was seen in Barrio Yaganak, Calauag. Along the fault-line stands a palm thatch hut. One of the wooden posts of the house was displaced in the left-lateral direction by 1.10 metres. Furthermore, the south-western part of the house sagged due to the ground movement. About 200 metres from the same house stood a coconut tree, the main root of which was severed and displaced also by 1.10 metres. Some 100 metres away from the Calauag approach to the collapsed Sumulong Bridge, the fault transects the main road almost perpendicularly. From there, the faulting crossed the railway lines and sheared them by 1.85 m. On its extension towards the sea, the fault-trace was still discernible in the soft sediments of complementary fissures located on the eastern side of the fault-line. The strong shaking of the ground during the Ragay Gulf earthquake caused two areas along the Calauag-Guinayangan municipal road between kms 236 and 238 to subside. One of the resulting depressions was 225 metres long while the other was 95 metres long. The longer depression was two kms NW	

Event	Felt Effect	Source
	from the first. It crossed the road obliquely. These depressions may be due to "quicksand" effects triggered by the main shock as indicated by the charcoal black mud extruded along the sides of the depressions. A fissure, 15 cms wide and of unknown length, lies along the foothills some 200 metres NW of the Philippine National Railway terminal in Calauag. It is believed to be one of the complementary shears of the major fault. In the town of Lopez, two fissures were observed along Lopez-Jaena Street. The western side was depressed by 12 cms with maximum width of 44 cms. These fissures may be due to settlement of the bank of the Talolong River. Close to the eastern bank of the Calauag River in districts Sumulong and Mabini, several mudboils were found. Mudboils are formed when water-laden sediments are subjected to compressional forces, thereby causing the water and fine sand and mud to be ejected into the air through the fissures or just to well up towards the surface. In three places, along steep road cuts and unstable rocks, landslides occurred due to the severe shaking of the ground at the time of the earthquake, but only to a minor extent. Tension-cracks of small to moderate widths were observed along the Guinayangan-Sumulong road. Felt intensities of the Ragay Gulf earthquake: Calauag, Quezon - Intensity VIII. E - W. Lopez, Quezon - Intensity VIII. N - S. Guinayangan, Quezon - Intensity VIII, N - S. Alabat, Quezon - Intensity VII, 20	

Event	Felt Effect	Source
	seconds; E - W.	
	San Francisco, Quezon - Intensity VI; 10 seconds; N - S.	
	Manila - Intensity VI; 45 seconds; NE - SW.	
	Quezon City - Intensity V; 12 seconds; NNE - SSW.	
	Romblon, Romblon - Intensity V; 12 seconds; NNE - SSW.	
	Daet, Camarines Norte - Intensity V; 45 seconds; NE - SW.	
	Tayabas, Quezon - Intensity IV; 23 seconds; E - W.	
	Manila International Airport (MIA) (Pasay City) - Intensity IV; 10 seconds; N - S.	
	Ambulong, Tanauan, Batangas - Intensity IV; 30 seconds; N - S.	
	Legaspi, Albay - Intensity IV; 10 seconds; E - W.	
	Infanta, Quezon - Intensity IV; 27 seconds; N - S.	
	Dagupan - Intensity IV; 18 seconds; E - W.	
	Virac, Catanduanes - Intensity III; 10 seconds; SE - NW.	
	Catbalogan, Samar - Intensity III.	91
1973 Apr 05 12:33 p.m.	Off northeast coast of Panay Island: Roxas City - Intensity V.	
	Romblon - Intensity III.	16
1973 July 03 3:04 p.m.	Off NE coast of Samar: Borongan and Catbalogan - Intensity V.	
	Catarman and Virac - Intensity IV.	

Event	Felt Effect	Source
	Tacloban City and Legaspi City - Intensity III.	
	Iloilo and Surigao - Intensity II.	
	Roxas City - Intensity I.	16
1973 July 06 6:47 a.m.	San Bernardino Strait: Catbalogan - Intensity VI.	
	Virac - Intensity VI.	
	Catarman - Intensity V.	
	Masbate, Legaspi and Borongan - Intensity IV.	
	Daet and Roxas - Intensity II.	16
1973 Aug 18 4:26 p.m.	Off W coast of Panay Island: Iloilo City - Intensity V.	16
1974 Feb 19 11:30 a.m.	Southern Quezon Province: Calauag - Intensity VIII.	
	Alabat - Intensity VII.	
	Manila - Intensity VI.	16
	Epicentre reported at Alabat Island, some 150 kms ESE of Quezon City.	
	Quezon City - Intensity V; duration, 20 seconds. Surrounding provinces and towns stretching from an area 150 miles north of Baguio to 320 miles south of Catarman, Samar, felt the quake with varying intensity.	
	Manila - tall buildings swayed, some walls cracked.	
	Calauag, Quezon - twice as strong as the one which hit the town on March 17, 1973. The quake cut off the electric power and water service in the area.	
	Malolos, Bulacan - Intensity III-IV; duration, 35 seconds.	

Event	Felt Effect	Source
	Baler, Quezon - Intensity IV.	
	Tayabas, Quezon - Intensity IV.	
	Infanta - Intensity IV.	
	Daet, Camarines Sur - Intensity IV.	
	Marinduque - Intensity IV.	
	Baguio - Intensity III.	
	Dagupan - Intensity III.	
	Legaspi City - Intensity III.	
	Sangley Pt., Cavite - Intensity III.	
	Ambulong, Batangas - Intensity III.	
	Cabanatuan - Intensity III.	
	Catarman, Samar - Intensity II.	8
1974 May 27 6:38 p.m.	West of Dipolog, Mindanao: Dipolog - Intensity VI; very slight damage; broke window panes.	
	Zamboanga - Intensity IV.	
	Dumaguete - Intensity III.	
	Cagayan de Oro - Intensity II.	16
1975 Apr 09 11:04 p.m.	11.7°N; 122.5°E Off East Coast of Samar: Borongan - Intensity V.	
	Guiuan - Intensity IV.	
	Catarman - Intensity II.	16
1975 Apr 17 2:46 a.m.	Leyte Gulf: Borongan - Intensity V.	
	Guiuan and Tacloban City - Intensity III.	16
1975 Apr 29 4:42 p.m.	Northern Mindoro Island: Puerto Galera - Intensity VI.	
	Ambulong, Tayabas, Alabat, Daet and Calapan - Intensity III.	

Event	Felt Effect	Source
	Manila - Intensity II.	16
1975 Oct 31 4:28 p.m.	Samar and Leyte: Borongan, Catbalogan and Tacloban - Intensity VI.	
	Legaspi City - Intensity V.	
	Catarman, Iloilo and Roxas City - Intensity IV.	
	Masbate - Intensity III.	
	Manila - Intensity II. Tsunami with a maximum height of four metres was generated.	18
1975 Nov 10 4:45 a.m.	Bicol and Samar: Virac, Catanduanes - Intensity V; duration, five seconds.	
	Legaspi; Catarman, Samar - Intensity III. Epicentre was 442 kms ESE of Quezon City or 80 kms SE of Catanduanes. There were warnings of possible tidal waves.	4
1975 Nov 17 4:40 a.m.	Bicol Region: Virac, Catanduanes - Intensity IV.	
	Legaspi - Intensity III.	167
1976 Feb 13 4:07 p.m.	15.67°N; 121.7°E Luzon: Baler, Quezon City, Manila - Intensity V.	
	Infanta, Alabat, Cabanatuan - Intensity IV.	
	Tuguegarao, Daet, Ambulong, Baguio City - Intensity II.	18
	An earthquake of moderate intensity shook Metropolitan Manila sending scores of panicky and safety-conscious residents spilling out into the streets. The main shock, registered at Intensity V on the RF scale of nine, swayed buildings at 4:08 p.m. yesterday for about ten seconds. It was followed by a four-second aftershock of lesser	

Event	Felt Effect	Source
	magnitude at 6:35 last night. The quake was felt as far north as Tuguegarao, Cagayan and as far south as Talisay, Batangas. Preliminary determination at the Geophysical Observatory in Diliman, Quezon City placed the epicentre at 155 kms NE of Quezon City or somewhere in Baler, Quezon area. There was still no indication of possible tidal action in eastern Luzon, particularly in the seas near Quezon Province, Cabanatuan City and Infanta. Quezon registered Intensity IV while Tuguegarao, Baguio City, Dagupan City and Ambulong in Talisay registered Intensity II.	7
1976 Feb 20 9:30 a.m.	Iloilo Province: Iloilo City - Intensity VI.	
	Roxas City - Intensity III.	18
1976 June 07 3:36 p.m.	14.20°N; 124.8°E Catanduanes: Virac - Intensity V.	
	Catbalogan and Legaspi City - Intensity III.	
	Manila - Quezon City, Daet and Baguio City - Intensity II.	18
1976 Aug 17 12:11 a.m.	Moro Gulf: A strong earthquake which was felt as far north as the Visayas and the southeastern tip of Luzon and as far south as Borneo. It inflicted heavy losses in lives and considerable damage to property in the areas near the epicentre. Most of the lives lost were due to the tsunamis which inundated the coastal areas of southern Mindanao within minutes of the earthquake. The magnitude was 7.8 on the Richter Scale, from preliminary determinations made by the National Oceanographic and Atmospheric Administration (NOAA), U.S.A. The number of people confirmed killed reached a total of 3,564. Missing were 1,502; injured were 8,256 and	

Event	Felt Effect	Source
	12,183 families were rendered homeless. A report from Bongo Island, located at the mouth of the Rio Grande de Mindanao and another from Tabina, Zamboanga del Sur, indicated the formation of wells immediatedly after the earthquake. In Sebu Lake area in Sultan Kudarat, lake water movements resulted in damage to several houses built along the lake shore and loss of lives in the area. Tsunamis generated by the earthquake reached a maximum height of 14 feet in several places. Inundations by the tsunamis cover almost the entire coastal regions bordering Moro Gulf. Tsunami damage was evident along the coast from Kalamansique, Sultan Kudarat province in the eastern section of the Gulf to the western section in Bololobong, Basilan Province.	142
	Dipolog and Malaybalay - Intensity VI. Cagayan de Oro; Davao City; General Santos - Intensity V. Dumaguete; Hinatuan; Tagbilaran; Cebu; Surigao - Intensity IV. Roxas City; Iloilo City; Tacloban City; Legaspi City; Palo, Leyte; Catbalogan - Intensity II. Mb = 6.4 Ms = 7.8	18
	The quake was followed by tsunamis which swept the coastal areas of the provinces of Zamboanga del Sur, Lanao del Norte, Cotabato, Sultan Kudarat and Maguindanao. Mindanao, Sulu, Tawi-Tawi and Basilan declared disaster areas. "About a hundred people were killed in Malabang, Lanao del Sur, due to a 15-foot tsunami that followed the earthquake and overwhelmed the houses at the shoreline". An earthquake of major intensity struck five Mindanao provinces. Early reports said 1,200	

Event	Felt Effect	Source
	persons were killed, thousands more were homeless or missing, and dozens of business establishments, government buildings, bridges, and residential houses collapsed or suffered extensive damage. Hardest hit province was Lanao del Sur where 175 persons were reported killed and 47 more missing in Balabagan town. In the neighbouring town of Malabang, two squads of at least 16 members of the Armed Forces of the Philippines (AFP) belonging to the 33rd Infantry Brigade. were swept out to sea by the tsunamis with all their equipment. In Pagadian City, 30 persons were killed and 100 families rendered homeless by the earthquake. In Margosatubig, Zamboanga del Sur, there were six persons dead and eight more injured. Some 200 families were rendered homeless. The municipal wharf in Margosatubig collapsed, the water system was damaged, 40 houses were damaged, four persons were trapped inside a collapsed building. The Philippine National Red Cross reported that 60 guests of the collapsed Sultan Hotel in Cotabato City were trapped inside the building. Some 15 more were reportedly trapped in the Sagittarius Hotel including, the entire family of the hotel owner. Another Philippine National Red Cross (PNRC) report said that a helicopter survey showed that the entire Maguindanao province, coastal area had been submerged by the tsunamis, with the initial report of 300 killed in the coastal districts of Linek and Kusiong, Dianig town. In Pagadian City, the earthquake followed by the tsunami killed 360 persons, mostly children, injured 2,000 and rendered homeless over 10,000 families here in several coastal towns of Zamboanga del Sur. A landslide covered the main road in Sigbalabat on the east coast,	

Event	Felt Effect	Source
	rendering the road impassable from Zamboanga City to other towns in Zamboanga del Sur. In Davao City some 961 persons were reported dead and several buildings and residential houses collapsed in several places. In Lebak, Sultan Kudarat, initial reports placed the homeless at 2,000. The Don Mariano Marcos Elementary School and town church were damaged while the public market sank three to five inches. Sultan Kudarat was one of the most badly hit areas. It was nearest the epicentre of the quake, which was somewhere in the Celebes Sea, about 160 miles from the shore of Sultan Kudarat.	9
	The earthquake which registered 7.8 on the Richter Scale, struck south-western Mindanao shortly after midnight, crumbling multi-storey buildings in urban areas, trapping people under the falling debris and generating huge tsunamis which flattened and swept away the flimsy houses of the rural people huddled along the Moro Gulf coastal towns. First-hand observers heard squeaking sounds and glass-bursts and experienced jolting, shaking and swaying movements within buildings. Minor shocks recorded total 179. Major cause of the casualties was the tsunami which broke outwards from the epicentre into three waves ten minutes after the earthquake, at a very high velocity of 720 kms/hour, and rushed as far as 500 metre inland, drowning, injuring and washing away persons. Malabang, Lanao del Sur was hit by 20-foot waves coming from one direction, and District Linek in South Cotabato was hit by 28-foot waves from two directions. Cotabato City was spared by tsunamis because of the presence of Bongo Island which blocked or dispersed the huge sea waves. Most of the damaged buildings were near	

Event	Felt Effect	Source
	the shoreline, river banks and between rivers. The properties damaged by the earthquake include wharves, public and private school buildings, government buildings, bridges, business establishments, houses, roads, pumpboats, fishtraps, fishponds. The Philippine National Red Cross (PNRC) reported that all units of the 35th Infantry Battalion stationed in coastal areas in Cotabato were wiped out by gigantic waves and all communication lines in the city were out of commission after the earthquake. Effects of the earthquake in other cities: Pagadian City - the coastal districts of Sta. Luciá, Santiago, San Pablo, San Roque and White Beach Barangay were hardest hit by the tsunamis. Almost all of the houses along the coast within 500 metres inland were destroyed. Some houses made of reinforced concrete hollow blocks were able to withstand the force of the waves and also served as protection to other houses made of light materials. The approach to the Pagadian City wharf settled down, causing cracks in the slab of the approach area and in the concrete deck itself. This is due probably to the subsidence in the concrete footings and slabs caused by the scouring action of the ensuing waves. The five-storey reinforced concrete building of the Saint Columban College had noticeable cracks in the concrete hollow block walls. Shear cracks in two columns were observed at the junction. Davao City - minor cracks between columns and concrete hollow block walls were noted in the five-storey reinforced concrete building of the Philippine Harvardian College. Zamboanga - fourteen buildings	

Event	Felt Effect	Source
	partially damaged and 26 buildings suffered minor damage. The City Hall suffered noticeable cracks along the front facade. Ateneo de Zamboanga suffered failures at the bottom of columns on the 4^{th} floor probably due to poor concreting and weakening due to the seepage of water coming from the galvanized iron down-pipes embedded in the columns which caused a diminution of the column area. Anchorage for the roof trusses was not adequately provided. Zamboanga Agricultural and Engineering College suffered damage to columns in the floors due to failures at end moments, followed by shear failures which were evident in the exposed portions of the columns. Zamboanga City was spared from the waves due to the strategic geographical position of Basilan and Santa Cruz Islands, which served as a buffer and deflected the waves which otherwise could have inflicted heavy damage along its coastline. Damaged buildings mostly suffered from cracks in the plastered walls. Insufficient ties in some columns were also noticed.	169
	August 17, 1976, at dawn on this day, residents of the cities of Cotabato and Pagadian and other areas located along the coastal line of the Moro Gulf were jolted out of bed by a strong earthquake. Glasses and plates fell from wooden cabinets, then the cabinets smashed on the floors, beds moved as if they had wheels, while all around there were loud sounds like cannons being fired. The tremor was so strong that people recalled one couldn't stand without staggering or crumpling on the floor. After a little over 20 seconds, the movement of the earth, which registered Intensity VII on the RF scale, stopped. But the destruction and terror that it caused scared people for a life-	

Event	Felt Effect	Source
	time. Just as soon as the earthquake stopped, the sea, stirred by the powerful quake, swelled and moved some three kilometres away from the coastline. Some ten minutes later, it moved back to the shore and beyond, roaring and soaring as high as the treetops, then unloaded its fury on everything near the shore. Thousands of houses were destroyed in Pagadian City. A grim picture was seen in the bits of houses floating in the sea and the bodies which littered the shores. Three days after the quake and the tsunamis, search and rescue teams were still retrieving bodies from small creeks and rivers of Cotabato City and in the wide seas of the Moro Gulf. When the hysteria died down, authorities counted up to 8,000 people killed and at least 100,000 families left homeless. Alicia, a fishing village in Zamboanga del Sur, was almost devoid of life after the tsunami struck. Not a house stood.	104
	The death toll from the killer quake and tsunamis that hit Mindanao early Tuesday morning (12:13 a.m.) rose to 3,103. Some 2,282 more persons were listed as missing even as massive rescue and relief operations in western Mindanao went into high gear. Preliminary damage estimate in the stricken areas, particularly the Cotabato, Lanao and the Zamboanga provinces, was placed at P750 million. Centres of relief operations are Cotabato City where 80% of the commercial buildings collapsed either totally or partially, and the coastal areas of the Cotabato provinces, Lanao provinces and Zamboanga del Sur. Bridges and other infrastructure projects also were reported damaged, including the newly constructed Cotabato City section of the 200 kms. Cotabato City-General Santos road project. On property damage,	

Event	Felt Effect	Source
	some 650 structures were totally damaged, including the town hall of Buig, Zamboanga del Sur and a multi-purpose building in Sibuco, Zamboanga del Sur. Houses destroyed were placed at 1,076. The Civil Aeronautics Administration (CAA) tower in Zamboanga City cracked, two market buildings in Maguindanao and another school building in south Cotabato collapsed. All houses along the coastal beaches of Lanao del Sur and Pagadian were completely washed away by tsunamis. Six hundred residential houses and six commercial buildings in Lanao del Norte were devastated.	10
	Cotabato City - damage to structures consisted of crushing of first-storey columns leading to the total collapse of the buildings, collapse of first storeys and leaning of buildings. Non-structural damage included toppling of concrete hollow blocks, collapse of internal and external walls and cracks in walls and plastering. Extensive damage to concrete panels with free edges was observed. In one location, sand boils were observed. These sand boils which were found on the site of a collapsed building, measured, on average, one foot in diameter; other evidence of the effects of the earthquake included settlement of back-filled approaches to bridges and slight buckling and cracking of the pavements in some sections of the road from Cotabato City proper to the Awang Airport near the Tamontaka River. The direction of the ground motion was parallel to the affected road sections.	142
	Cotabato City - cables of the external telephone system fell, over approximately two kilometres of its length, and they broke at many of the damaged buildings. Damage to poles and lines was experienced	

Event	Felt Effect	Source
	mainly in three areas of poor foundation soil: the northern part of the central section, the vicinity of Notre Dame University, and the Malagapas and Esteros villages, south of Cotabato City. The water system's bell and spigot joints broke at many places where the line crossd the Tamontaka River on the bridge near the airport and for a few kilometres to the north. The 26 cm pipe sheared off where it went from the bridge deck into the north abutment. Six of the eight wells of an auxiliary water supply source 2 kms south of the city collapsed during the earthquake. Approximately 30% of the commercial buildings in Cotabato City were damaged. The undamaged buildings were used to shelter the victims whose properties had suffered from the earthquake. Ground shaking was more severe in certain regions of the city than in others. Significant building damage occurred exclusively on the deltaic plain to the north and east of Colina Hill. This area has approximately one metre of recent fill and is swampy as a result of its deltaic location, heavy rains, and runoff.	
	Notre Dame University - is located on Notre Dame Avenue approximately 1.5 km southeast of the central area. The site has wet and soft marshy ground. Ground water appeared to be very near the surface, as ponds were evident throughout the site. Four buildings on this site suffered some degree of damage from the earthquake. Fronting on Notre Dame Avenue are the Auditorium/Science Building which collapsed and the Administration (Burke) Building which suffered only slight damage.	
	In the southwest portion of the site, a complex of buildings is	

Event	Felt Effect	Source
	located which includes the Technical School which suffered moderate damage. Toward the northwest end of the site a new residence hall nearing completion suffered only slight damage. The New Residence Hall - is a rectangular, three-storey structure. Its construction consists of concrete exterior columns and thin concrete exterior walls. Mid-height windows run the full width of each bay throughout most of the building. There are some solid panels, especially at the south end. Interior columns and floor systems are wood, and the roof employs galvanized iron sheeting. For the most part, the interior partitions are constructed of plywood. Architectural vertical fins are located opposite all exterior columns, with a thin exterior accenting horizontal line. Damage to the building was slight. The architectural fins were cracked at the floor line, and some columns were damaged at the sill line. Interior partitions were torn apart, and some of the ceiling panels fell. There was considerable cracking of the ground floor slab. At one location where two slabs were constructed with a vertical offset (46 cm), the slabs pulled apart more than 1.3 cm. The Technical School - is a two-storey building approximately 10 x 30 m. Built in 1965, it has a concrete frame consisting of column line girders and columns, with a concrete two-way slab floor. The columns are approximately 36 cm square reinforced with nine bars with plain ties at 23 cm spacing. The exterior had windows running from column to column, with a 1.07 m sill height constructed of hollow block infill panels. Architectural	

Event	Felt Effect	Source
	concrete fins were poured adjacent to each column along one longitudinal side. This building is linked to an adjacent building by a common wood canopy. Damage to the structure was moderate. The first-storey columns were damaged at the head and sill levels, failing in shear. The fins were also damaged at similar locations. This canopy, supported on round steel columns, collapsed at its end bay. The Administration Building - is a rectangular three-storey structure constructed in the early 1960s. It has an aspect ratio of 8:1. The building has a reinforced concrete frame of columns and girders with concrete floors. One longitudinal side has mid-height windows the full width of each bay with sills about 76 cm high, made up of hollow block panels. There is a 3 m concrete panel at the entrance, which was severely cracked. The other longitudinal wall is set in from the edge, allowing for an exterior corridor. This wall has a 38 cm and 76 cm high louvre running continuously between columns at the top and bottom, respectively. The balance of the wall is hollow block. This side has a one-bay projection at mid-length equal to approximately one-third the building's length. There are two longitudinal interior walls along a corridor constructed similarly to the louvred rear wall. The end walls are solid. Damage to the building was slight. The hollow block walls were damaged along with the louvre mullions. As stated above, the front concrete panel was also damaged. Damage to the concrete frame was minor. Notre Dame University Auditorium and Science Building - is a 48 x 30 m auditorium crossed at its entrance by a three-storey 51 x 12 m science	

Event	Felt Effect	Source
	wing. The longitudinal axis of the wing lies N 60W. For the present discussion it is assumed that the axis runs east and west. Constructed in 1969, masonry was used as the infill for the reinforced concrete frames. Smooth bars were used throughout the building. The first-, second-, and third-storey heights in the science wing were 3.5, 3.2, and 3.0 m, respectively. The auditorium roof had the same elevation as the roof of the science wing. The science wing was a moment-resistant frame with reinforced concrete floors and roof. Typical bays in the frame were 12 m in the transverse direction of the wing and 4.25 m in the longitudinal direction. The auditorium roof was corrugated sheet metal supported by purlins on steel trusses spanning the width. Lateral resistance in the longitudinal and lateral direction was provided by the moment frame, end walls, and a pair of stair towers at each end of the wing. The infilled walls at the ends of the wing and outside ends of the tower resisted transverse north-south motion. Diagonal cracking of slip around infills and stairway joint damage due to transverse north-south motion. Solid reinforced wall configurations resisted longitudinal east-west motion with slippage and bending at the second floor construction joint. The tied column cross sections were of two principal types: a truncated widge-like shape or a rectangular shape. Haunched rectangular beams were used in the 12 m span transverse direction, while prismatic rectangular beams were used longitudinally. In general, the beams were larger than the columns, indicating a "strong beam/weak column" type of construction. Masonry finfills were used below windows. The first- and second-storey columns show heavy	

Event	Felt Effect	Source
	damage at the top of window infills and the soffit of beams due to longitudinal east-west motion. The columns supporting the entrance canopy show especially heavy damage. The transverse long span beams also had heavy shear cracks due to north-south motion. The science wing collapsed after the fire had burned for several hours. The moment frame dropped three storey, starting from the stair tower at the west end to a point just beyond the entrance canopy. At the east stair tower, the frame did not collapse. There is a transition of floor elevations going from the entrance canopy to a location next to the east stair tower. The west stair tower dropped three storeys, but the east stair tower remained standing. The uncollapsed stair tower is badly out of plumb on the second and third storeys. Heavy slippage and bending at a second floor construction joint due to collapse and longitudinal east-west motion. Motion in the north-south direction caused diagonal cracking and slippage at the joints between the frame and masonry infills on the first storey of the east tower. The auditorium suffered heavy fire damage. The infilled frame walls of the auditorium did not suffer structural damage, but the entrance of the auditorium was destroyed when the science wing collapsed. Harvardian College Campus - the building had a plan dimension of 11 x 90 m. It was divided longitudinally into 19 equally spaced bays, and transversely into two bays of 3 and 8 metres. The short bay was for an exterior passage. Constructed in 1962, it had a reinforced concrete frame and reinforced concrete slabs at the second level and at the exterior passages at the third, fourth, and	

Event	Felt Effect	Source
	fifth levels. The balance of the floors were wood joist with square laid planking. The top storey was constructed completely of wood, and the roof had galvanized iron sheeting. Reportedly, the structure was originally designed for three storeys, with the fourth and wood-framed fifth storey being added later with no strengthening of the lower storeys. The building experienced heavy sway, predominantly in the north-south direction, i.e., in the building's transverse direction. The fifth storey, which was constructed of wood, collapsed but remained flat on top of the fifth floor. A rapid sequence of popping sounds occurred, followed by a large tilting of the complete building toward the south. The collapsed wood structure slid off the sloping fifth floor and fell into the pond on the south side of the building. The first-storey columns collapsed totally on the south side. This was the extent of the collapse at the west end, but at the east end the south second-storey columns also collapsed. Starting from the east, there was a five- to six-bay transition zone to where there was no complete failure of the second-storey columns. The structure also came to rest with a tilt to the east. Except for the fifth storey, which slid off the structure, the rest of the structure was relatively damage-free, including the reinforced concrete girders. The Amicus Building, Sagittarius Hotel and d'Max Restaurant - form a complex of three adjacent buildings that collapsed. All of these buildings "pancaked". The Amicus Building, a four-storey reinforced concrete frame commercial building constructed in 1969, was approximately 12 x 15 m in plan. The Sagittarius Hotel was a four-storey	

Event	Felt Effect	Source
	reinforced concrete frame building constructed in 1965. It was approximately 12 x 15 m in plan. The d'Max Restaurant was a two-storey reinforced concrete plus wood building constructed in 1968. It was approximately 10 x 15 m in plan. First Gift and Book Store - (also known as the Yap Building, named after the building's owner) was a four-storey building which collapsed. Built in 1968/69, the building was 15 x 20 m, had a reinforced concrete frame, and was on a timber pile foundation. The first floor collapsed during the initial earthquake tremor and fire broke out within the structure. It was not until 5 to 6 hours later that complete collapse of the structure took place. This building leaned north into the adjacent three-storey structure, knocking it into a third building, the City Evangelical Church. Damage to the church was slight. Sultan Hotel - the collapse of the structure with the second floor resting on the ground must have been rather slow, since the portion above the second floor remained relatively intact. The portion above the second floor cantilevered out about 2.4 m past the front first-storey columns. Except for the front wall, which had windows, the other three exterior walls were solid. The front wall above the second floor was relatively stiff due to short columns (by comparison with the other interior concrete frames designed for vertical loads only) and probably carried about half of the lateral load in the east-west direction. However, the wall on the first storey was made up of tall columns only and high torsional forces were imposed on the first-floor structural elements. This type	

Event	Felt Effect	Source
	of failure, with sudden change in rigidities compounding the torsional problem, has been noted in other earthquakes. New Society Hotel - was a four-storey reinforced concrete frame and shear wall building constructed in 1968. The 4 x 4 bay building is a square in plan; dimensions are 21 x 21 m. The first-storey height is 6 m, while the upper-storey heights are 3.5 m. A mezzanine storey 3 m high extends three bays in each direction from the south and east sides of the building. The south side of the building is covered by a wall with pilasters aligned with the frame. The east side of the building is covered by a wall with window openings and pilasters spaced to match with the frame. The remainder of the building is constructed with an approximately square grid of moment-resistant frames. The side dimension of a typical bay in the grid is 4.5 m. Floors and walls are reinforced concrete slabs. The dimensions of beams and columns are comparable; but, when the effect of slab action both in bending and twisting is considered, the beams appear to be considerably stronger than the columns. This is borne out by the damage that occurred in the building. The New Society Hotel is within 30 m of the Rio Grande, whose elevation is 2 m below street level. The columns are founded on wood piles with reinforced concrete pile caps; 20 cm diameter wood piles 7.6 m long were used. The pile cap and water elevation are nearly coincidental. Flaws in the structure were the principal causes of failure. The circular first-storey columns on the north and west sides of the building hinged at the top and bottom as the building experienced a heavy twisting motion. Collapse ensued as follows: 1) the	

Event	Felt Effect	Source
	building twisted in a counterclockwise direction; 2) the northwest corner second-floor level dropped, on a helicoidal path 6.7 m long, to the street; and 3) the opposite southeast corner, where walls intersect, suffered a torsional failure in the corner pilaster and out-of-plane shearing of adjacent walls. The frame and walls above the first storey were practically undamaged. The floors of the second storey did not suffer from diaphragm response but, during the collapse, th second floor "mounded up" in a few locations over rubble from the first storey. Damage to second-floor beam is slight and in most cases the columns became disconnected from the second-floor beam as the building collapsed. This occurred because the splice pulled apart. The walls suffered out-of-plane shearing damage as the building rotated.	
	LCT Hardware and Auto Supply - is a two-storey reinforced concrete structure with wood trusses and galvanized sheet iron roof. During the earthquake, the first storey collapsed toward the west.	
	Cotabato Auto Supply - was on a main street running east-west. It had a three-storey reinforced concrete frame, concrete floor, and hollow block infill exterior walls. Interior partitions were timber and plywood. The 15 x 60 m building was built in 1968. The first and second storeys were used for car parts sales and storage, the third floor for the proprietor's living quarters. The first storey of this building collapsed, with the upper storeys coming to rest approximately 3 m west of their original location. The front and rear faces of the building were open with doors and windows, but the extent of the openings is not known. In any event,	

Event	Felt Effect	Source
	the openings left the structure with a weaker first storey. It should also be noted that the structure was not designed for seismic forces and, therefore, the first storey experienced lateral stresses beyond normal overstress levels. The balance of the building was free of damage, except for minor cracking. The collapse was gradual. The proprietor claimed that he was upstairs during the earthquake and was let down in gentle motion. Storage shelves on the second floor were still standing after the quake. A one-storey lean-to concrete structure behind this building also collapsed, falling transversely to the west.	
	South Seas Trading - was a three-storey structure which pancaked. Built in 1967, it was 20 x 30 m and had a concrete frame and concrete floor slab. It is important to note that the columns of this structure also contained downpipes. This architectural detail was found in many of the collapsed structures in the area.	
	Tilson Building - was the only building in Cotabato City reputed to have been designed with seismic considerations. It was designed by Manila engineers using the "California Code" (exact year not known). It survived the quake with no structural damage and only a slight crack in a concrete block partition. Some water tanks on the roof in concrete saddles moved to the west about 0.6 cm. Some flower pots on the roof moved about 8 cm to the west. The Tison Building was placed on 20 cm precast concrete piles about 12 m long. It was located close to Colina Hill (good soil), but the piles were still friction piles (no piles reached firm ground).	

Event	Felt Effect	Source
	Melbourne Hotel - is a three-storey reinforced concrete frame with masonry infills, constructed in 1970, and has a plan dimension of 20 x 30 m. The four by four bay frame has a first-storey height of 6 m, while upper-storey heights are 3.5 m. A mezzanine storey 3 m tall covers the full width in the north-south direction and three bays going from east to west. The front of the building is open, the back has masonry infills with openings, and the north and south exterior walls are completely infilled. The first-storey columns suffered heavy damage as a result of north-south motion. A first-storey permanent offset of 15 cm to the south remained after the quake. On the west side of the building, the tall first-storey columns hinged at the base and directly below the shade beam. Going one bay to the east, where the mezzanine begins, there were heavy shear failures in the columns. The shear failures occurred in the mezzanine columns and not in the taller west side columns for the following reasons: 1) the shorter storey height caused higher column shears; 2) the failure over short distance of decorative masonry piers which surrounded the columns caused high shears; and 3) the window infills on the mezzanine storey caused high column shears. On the east side of the building, masonry panels were pushed out, and window infills on the mezzanine storey buckled outward because of heavy frame action. North and south walls were undamaged.	
	Imperial Hotel #2, Rita Theatre, and Imperial Hotel #1 - are situated together and face toward the south. The fronts of these buildings interacted strongly during the earthquake. Imperial #1 and Rita drifted to the west and pushed	

Event	Felt Effect	Source
	against Imperial #2. Imperial #1 is a four-storey reinforced concrete frame with masonry infills constructed in 1963. The approximate plan dimensions are 20 x 30 m. The building has a 6 m first storey and 3.5 m upper storeys. There is a mezzanine on the first storey. The building experienced a 38 cm permanent offset on the first storey. The rear portion of the building collapsed. The Rita Theatre is a two-storey, 12 m tall reinforced concrete frame in front, with a reinforced concrete, plus masonry plus wood, auditorium section in the rear. The auditorium roof has two elevations. Plan dimensions are 20 x 35 m. The frame section in front drifted [illegible] cm west, along with Imperial #1. The auditorium frame, plus infilled wall on the east side, was knocked over by Imperial #1. The "rod and block" truss roof in this part of the roof collapsed. Further to the rear of the theatre, collapse did not occur because the roof elevation was lower and Imperial #1 did not hammer the wall. Imperial #2 is a six-storey reinforced concrete frame structure constructed in 1967. Approximate plan dimensions are 35 x 30 m. The building suffered minor damage consisting of the following: 1) a column in the architectural frame in front was damaged when the Rita Theatre impacted against the hotel, 2) infill panels suffered diagonal cracking on the first storey adjacent to the Rita Theatre, and 3) the slap on grade in the northwest corner of the building showed heavy cracking. Imperial #2 came through the earthquake with superficial damage. Its front was capable of carrying its own lateral forces plus the impact forces from the front of the Rita Theatre and Imperial #1. A portion of this impact force caused a shear failure of the second-storey	

column in the architectural frame.

Immaculate Conception Church: The only noticeable damage to this church across the stress from the Tison Building was a settlement of about 15 cm of its tower. A loose ornament on the tower was thrown to the west a distance of about 3 m from the top. The church grounds were very soft, and the tower was apparently not on piles.

Melineen Building - was a two-storey reinforced concrete structure that pancaked. Very little is known about this structure, since demolition was well under way when reviewed by the team. The concrete was being knocked off the reinforcing steel by hand, thus leaving the reinforcing steel intact. The slabs had one layer of reinforcing consisting of light bars at 15 cm on centre each way. It is suspected that continuity over the supporting girders was minimal. Columns were light (26 cm square).

Tamontaka Catholic Church - was reputed to have been built by the Spaniards 104 years ago. It was the only structure noted to be constructed of reinforced brick walls with interior timber columns and wood roof. The severely damaged church was located near the Tamontaka River and Bridge and founded on soft marshy soil.

Waterfront Warehouse - in large numbers were located at the edge of the Rio Grande west of the Manday River. This area is called Lugay Lugay and is in a Moslem zone. Practically all of the warehouses collapsed. They appeared to be constructed of masonry walls, timber trusses, and corrugated metal roof (no diaphragms). They were poorly-built, apparently non-engineered structures, except perhaps for wood

Event	Felt Effect	Source
	trusses, and most certainly had no seismic resistance. Cotabato Chinese School Gymnasium - is a reinforced concrete plus wood structure constructed in 1962. The four outer walls have reinforced concrete columns, reinforced concrete beam, and wood beams. Masonry infills were used in the outside walls. The roof is "rod and block" wood truss with galvanized sheet iron covering. The stands inside are wood. During the earthquake, the walls fell outward and the roof fell in. Cotabato Chinese School Administration Building - is a two-storey reinforced concrete frame. The building suffered minor damage on some of the masonry frame infills. It was reported that the building was designed for three-storeys. A pile foundation had been used. The building was less than 3 years old. Cotabato Cinema - is a large structure to the rear of the Sultan Hotel. The hotel and the theatre were somehow connected. The hotel portion collapsed, which caused severe structural damage to the theatre complex. It could not be determined whether collapse of the hotel caused failure of the theatre or merely contributed to an already damaged structure. The side walls of the theatre are leaning dangerously. Boston Bakery - is a two-storey reinforced concrete building constructed in 1965. The plan dimensions are 15 x 20 m. The building experienced 60 cm drift to the west on the first storey. Cotabato Fire Station (combined with the police station) - settled toward the river during the earthquake.	

Event	Felt Effect	Source
	Francel Theatre - was a reinforced concrete plus wood building constructed in 1966. The reinforced concrete frame portion of the building collapsed, causing a failure of the "rod and block" wood truss roof.	
	Tan Bo Building - is a four-storey building constructed in 1971-72. The structure is a reinforced concrete frame with hollow block infilled walls and was built on timber piles 7.6 to 9.1 m long. The only damage noted was the cracked infilled panels at the stair core.	
	Dawns Hotel - is a six-storey reinforced concrete frame and wall building. The only damage of note was a working of the floor joints of the wall on the south side of the building.	
	Bridge Damage: Quirino Bridge - is a four-span structural steel bridge. Each span of this bridge over the Rio Grande de Mindanao River is 40 m long. The second span from the south end collapsed into the river during the earthquake. Each span was supported on rollers at one end and pinned at the other. The collapse was caused by the second span's sliding off its bearing plates in the easterly direction. Lack of consideration of seismic forces was obviously the reason for this failure. The failure occurred by the span's sliding to the east off the dumbbell-shaped supports. The supports as constructed would not allow for much east-west movement before the spans would collapse. Other notable damage is the near collapse of the third span from the south. Shear cracks appear several centimetres below the base of the south abutment.	
	Tamontaka Bridge - is located appro-	

Event	Felt Effect	Source
	ximately 6 kms south-southwest of central Cotabato City. Spanning some 230 m across the Tamontaka River, the bridge is made up of six spans resting on pile-supported piers. The 180 cm deep box girder sections, as well as the piers and piles, are of reinforced concrete. The bridge was constructed in three sections. Two expansion joints are located approximately 56 and 30 m from the north and south ends, respectively. After the earthquake, the bridge's longitudinal axis had a permanent displacement, with the ends closing to the west. The bridge experienced a great deal of movement predominantly in the east-west direction. The centre section moved east and west in excess of 38 cm each way, as evidenced by the broken concrete keepers on each end of the supporting piers. It came to rest approximately 30 cm east of its original position. The northern section moved even greater distances. The north end of this portion again moved both east and west, coming to rest 46 cm west of its original location on the abutment. The south portion moved but with less amplitude. At the south, only the keepers on the east side of the piers were damaged. Damage to the abutments as a result of longitudinal movement was not evident below the bridge surface, although the bearing plates at the north abutment did reveal an 8 cm permanent offset to the north. There was damage to the railings at both abutments and at the expansion joints. This damage was most extensive at the north end. It appeared that the damage to the railings at expansion joints was due more to the opening and closing of the joints from the heavy east-west movement (bowing of the bridge) than to longitudinal movements.	

Event	Felt Effect	Source
	Zamboanga City Argicultural and Engineering College - is a four-storey structure of reinforced concrete construction located in the town centre. The parapets were damaged, with some beam-to-column connections being distressed on the upper floors. Diamond Bazaar - is of three-storey concrete frame with masonry infill panels. Damage was to the second-storey exterior columns and to the adjoining architectural block screen. Chien Tian Un Building - is a three-storey plus mezzanine structure, with plan dimensions of 15 x 20 m, constructed in 1962. The framework is reinforced concrete with infill masonry panels. The first-storey plaster cover spalled, and the infill panels and adjoining columns had shear cracks. It was reported that the mezzanine was very heavily loaded, which contributed to the damage on the first storey. Mendoza Building (Shopping Centre) - was constructed in 1970. It has three storeys with a reinforced concrete frame and slabs. It houses retail shops at the street level with office space above. Damage occurred at the wall panels, especially adjacent to the open stair, and at the windowed interior panels (materials unknown). Asiatic Commercial Building - is a two-storey structure erected in 1950. The structural system is unknown except that the exterior had solid panels. Damage consisted of shear cracking of the piers in the windowed exterior walls. To Tek So Building - is a four-storey reinforced concrete structure, located on a corner site.	

Event	Felt Effect	Source
	The first-storey corner piers and columns experienced shear cracking. Other buildings reported partially damaged include: Southern City College (one-unit building), Kang Ha Wee Family Building, V. Fargas Residential Building, Zen Hong Trading Building, Zamboanga General Hospital of Nursing, Ever Building, Carlos Wee Building, Esperanza Seng Building, and Pilar College Building and Chapel.	96
	It is now clear why Cotabato City and its vicinity received the brunt of that killer earthquake that rocked the Moro Gulf of Mindonao last Aug 17. They were close to the epicentre. The epicentre was located by the US Geological Survey at 6.3°N, 124.0°E, only 11 kms from the shore districts of Kisek and Balinwang of the new provinces of Sultan Kudarat (formerly part of Cotabato) on the eastern side of the mouth of the Moro Gulf where the sea is 2.65 kms deep. Previous local reports gave the epicentre at 5.4°N or 5.8°N latitude and 122.3°E or 122.4°E longitude or some 120 kms south of Basilan in the Celebes Sea and far from Cotabato. The U.S. Geophysicist also stated that the magnitude eight earthquake originated 33 kms below the bottom of the sea. This depth placed the focus of the quake in the subduction zone or contact of the China and Philippine tectonic plates where Philippine tectonic earthquakes originate. As the vibration rose from the focus and rocked the bottom of the sea at the epicentre, the quake created seismic sea waves or tsunamis that spread around the confines of the Moro Gulf. The velocity of the seismic sea waves created was 580 kms per hour and was obtained from the square root of the product of the acceleration due to gravity times the depth of the sea at the	

Event	Felt Effect	Source
	epicentre (8,712 feet). Rushing to the shore, the giant waves reached Pagadian, 178 kms away in just 18.4 minutes; struck Sacol Island near Zamboanga City, 225 kms away, in 23.3 minutes; and washed the Basilan coast, 200 kms away in 20.7 minutes. There was therefore very little time to warn the coast dwellers of the Moro Gulf of the approach of the tsunamis.	11
1976 Aug 25 8:29 p.m.	13.1°N; 124.48°E Bicol and Northern Samar: Legaspi and Catbalogan - Intensity VI.	
	Virac and Catarman - Intensity IV.	
	Masbate - Intensity III.	
	Daet and Tacloban - Intensity II.	18
1976 Oct 09 5:05 a.m.	Northern Luzon: Calayan - Intensity V.	
	Aparri - Intensity IV.	
	Laoag and Basco - Intensity III.	
	Vigan - Intensity II.	18
1976 Nov 08 4:50 a.m.	Cotabato, Mindanao 7.20°N; 124.20°E: Cotabato - Intensity V.	
	Cagayan de Oro - Intensity III. M = 4.8; Depth = 50 kilometres.	18
1976 Nov 11 1:28 a.m.	Hinatuan, Mindanao 8.36°N; 126.58°E: Hinatuan - Intensity VII.	
	Butuan - Intensity VI.	
	Surigao - Intensity V.	
	Davao, Malaybalay and Cagayan de Oro - Intensity IV.	
	Catbalogan, Tacloban, Borongan and Guiuan - Intensity III.	
	General Santos, Cotabato - Intensity	

Event	Felt Effect	Source
	II. M = 5.3; Depth = 10.1 kms.	18
1977 Mar 02 5:53 p.m.	05.77°N; 123.22°E Mindanao: Cagayan de Oro - Intensity V.	
	Zamboanga City - Intensity IV.	
	Dipolog - Intensity III.	
	General Santos City - Intensity II. M = 5.8	18
1977 Mar 12 4:09 p.m.	SW of Marinduque 13.03°N; 121.81°E: Marinduque - Intensity VI.	
	Manila and Calapan - Intensity III.	
	Tayabas - Intensity II.	
	Daet, Ambulong and Quezon City - Intensity I.	18
10:00 p.m.	Luzon 15.94°N; 120.95°E: Baguio City - Intensity V.	
	Dagupan and Cabanatuan City - Intensity IV.	
	Infanta, Tuguegarao and Metropolitan Manila - Intensity III.	18
1977 Mar 19 5:43 a.m.	16.70°N; 122.31°E Luzon: Tuguegarao - Intensity VII.	
	Cabanatuan, Manila, Cavite and Dagupan - Intensity V.	
	Alabat, Baguio and Calapan - Intensity IV.	
	Tayabas, Infanta and Laoag City - Intensity III.	
	Bataan, Virac and Vigen - Intensity II.	18
	Metropolitan Manila - one person died by electrocution; 22 buildings suffered cracked walls and broken windows. Among the buildings were the Bank of the Philippine Islands,	

Event	Felt Effect	Source
	in Plaz Cervantes; the former Insular Life Building, also in Plaza Cervantes; Pacific Banking Corporation in Quintin Paredes St.; First Hotel and International Hotel in Ongpin St., Puyat; Bank of the Philippine Islands and the Bureau of Internal Revenue building in the Escolta area; Cathay House and Elizalde Building in Dasmarinyas St., in Binondo. The other damaged buildings were the Araullo High School in Taft Avenue; First United Bank, Magsaysay Plywood Industries and National Library on T.M. Kalaw St. near Luneta Park; and the new Manila Hotel. The Veterans Bank on Arroceros St.; Bureau of Posts; Recto Theatre; National Book STore; General C. Geronimo Elementary School; and Timberland Hotel.	
	Palanan, Isabela - eight persons were injured. The injured persons are from the towns of Mapnican, Dibalan and Dinago. All government buildings, including the Palanan Elementary School, the town Health Centre, and a dozon other buildings were destroyed. Also destroyed was the Constabulary's communication system between Kalinga-Apayao and Cagayan. In Isabela and Nueva Vizcaya and the quake was of Intensity V and IV, respectively. The quake in Palanan was followed by two aftershocks of equal intensity to the first. The first aftershock was at 7:00 a.m. and the second at 9:45 a.m.	
	Lucena City - an earthquake hit this city this morning and lasted for about five seconds. There were no reported casualties. Damage to coconut plantations was reported extensive. Many coconut roots were cut off. This will effect their fruit-bearing capacity.	12

Event	Felt Effect	Source
1977 June 13 7:47 p.m.	Virac, Catanduanes: Virac - Intensity VI.	
	Legaspi - Intensity IV.	
	Catbalogan City, Daet and Manila - Intensity III.	
	Masbate - Intensity II.	
	Tacloban and Quezon City - Intensity II.	18
1977 July 21 9:45 p.m.	Luzon 17.05°N; 122.50°E: Felt widely in Eastern Luzon.	
	Tuguegarao - Intensity VII.	
	Baguio City - Intensity V.	
	Aparri, Metropolitan Manila, Dagupan and Baler - Intensity IV.	
	Cabanatuan City - Intensity III. ML = 5.6	18
1977 July 30 6:23 a.m.	Luzon 18.3°N; 120.6°E: Laoag - Intensity V.	
	Aparri - Intensity III.	
	Tuguegarao and Vigan - Intensity II. ML = 5.0	18
1977 Nov 14 5:12 a.m.	Northern Luzon 19.44°N; 121.33°E: Calayan - Intensity V.	
	Tuguegarao - Intensity III.	
	Vigan and Aparri - Intensity II. ML = 5.0	18
1978 Aug 21 5:39 a.m.	Luzon: Dagupan and Baguio - Intensity V.	
	Santo Tomas - Intensity IV.	
	Iba and Cabanatuan - Intensity I.	18
1978 Sept 06 10:46 p.m.	Panay.Gulf: Dumaguete - Intensity VI.	

Event	Felt Effect	Source
	La Carlota and Iloilo - Intensity V.	
	Pandan and Roxas City - Intensity III.	
	Romblon - Intensity II.	
	Marinduque - Intensity I.	18
1978 Nov 16 6:45 p.m.	Eastern Mindanao: Mt. Pasian - Intensity V.	
	Hinatuan and Bislig - Intensity IV.	18
1979 Mar 29 3:56 a.m.	Carigara Bay, Leyte: Ormoc City - Intensity V.	
	Palo and Catbalogan - Intensity III.	
	Tacloban and Cebu City - Intensity II.	18
1979 Apr 12 11:37 p.m.	Guimaras Strait: Iloilo City - Intensity VI.	
	La Carlota - Intensity III.	
	Cebu and Dumaguete - Intensity III.	18
	Epicentre = 40 kms SW of Iloilo.	
	Damage: Several buildings sustained minor damage at Iloilo. The door of an old Catholic church collapsed at Iloilo. The quake knocked down telephone lines at Bacolod City. At least three buildings were reportedly damaged in Bacolod, including a hospital and the brand-new P1.8 million Integrated National Police Headquarters in District Taculing. Several tall concrete buildings in Bacolod City suffered cracks.	25
	Epicentre is most probably in the Panay Gulf, along the Visayan fault line.	13
1979 Aut 26 10:31 p.m.	Luzon: Aparri - Intensity V.	

Event	Felt Effect	Source
	Tuguegarao - Intensity IV.	
	Laoag - Intensity III.	
	Vigan - Intensity II.	
	Baguio City - Intensity I.	18
1979 Sept 11 7:52 p.m.	08.09°N; 125.29°E Mindanao: Cagayan de Oro - Intensity V.	
	Malaybalay - Intensity IV.	
	Cotabato - Intensity III. ML = 5.4	18
1979 Dec 14 4:49 p.m.	Mindoro Island: Puerto Galera, Occidental Mindoro - Intensity IV.	
	Ambulong - Intensity IV.	
	Manila and Sangley Pt. - Intensity III.	
	Quezon City - Intensity II.	18
1979 Dec 28 2:23 a.m.	Virac, Catanduanes: Virac - Intensity V.	
	Legaspi and Masbate - Intensity III.	
	Daet - Intensity II.	18
1980 Jan 03 4:58 a.m.	5.90°N; 126.88°E Mindanao: General Santos - Intensity V.	
	Cagayan de Oro and Davao - Intensity III.	
	Palo and Malaybalay - Intensity II. M = 5.7; H = 129.2 kms.	18
1980 Mar 31 8:41 p.m.	16.04°N; 121.88°E Luzon: Casiguran - Intensity VI.	
	Manila, Cabanatuan, Baguio City, Baler and Cavite City - Intensity V.	
	Quezon City, Daet, Ambulong, Tayabas, Dagupan City and Tarlac - Intensity IV.	

Event	Felt Effect	Source
	Infanta, Iba and Tuguegarao - Intensity III.	
	Pasuguin - Intensity I.	18
1980 June 19 1:14 a.m.	09.66°N; 127.0°E Northeastern Mindanao: Tandag, Hinatuan and Surigao - Intensity III.	
	Guiuan - Intensity II. ML = 5.4	18
	There were no reports of damage or casualties but strong surface waves of the tremor which originated in the Philippine Trench (also known as the Philippine Deep) were picked up by the National Oceanographic Administration Office in Honolulu. The United States earthquake monitoring office rated the earthquake magnitude (amount of energy released) at 6.7 on the open-ended Richter Scale. The epicentre was estimated to be 898 kms southeast of Quezon City or directly east of Tandag, Surigao del Sur.	168
1980 July 08 12:39 p.m.	Mindanao 6.61°N; 125.91°E: Davao City - Intensity V.	
	Mt. Pasian, Hinatuan and General Santos - Intensity III. ML = 5.6; Depth = 241.1 kms.	
	Davao City - as residents were having lunch, table plates rattled. Preliminary instrument readings placed the epicentre of the tremor somewhere on the southeastern coast of Mindanao about 950 kms southeast of Manila; the PAGASA (Geophysical Observatory) said the quake was of tectonic origin. The area lies southeast of the epicentre of an earthquake of similar intensity which affected Mindanao last June 19, 1980. No damage to property or casualties were reported.	26
1980 Oct 03 3:06 a.m.	19.99°N; 122.39°E Batanes: Basco - Intensity V.	

Event	Felt Effect	Source
	Pasuguin and Santa - Intensity II. ML = 5.4	18
1980 Oct 26 1:14 p.m.	(MAN) 12.04°N; 126.33°E, (NEIS) 11.75°N; 125.50°E Off East Coast of Samar: Borongan - Intensity VI.	
	Guiuan; Leyte Province: San Miguel, Tolosa and Dulag - Intensity V.	
	Tacloban, Maasin, Dagami, Barugo, Palo and Catbalogan - Intensity IV.	
	Catarman and Legaspi - intensity III.	
	Virac; Cebu and Surigao - Intensity II. ML = 5.2; Mb = 6.0; Ms = 6.1. Slight damage to property near epicentre.	18
1980 Dec 09 3:00 a.m.	Siquijor Island 9.22°N; 123.62°E: Lazi, Siquijor - Intensity VI. Slight damage to structures.	18
1980 Dec 17 7:41 p.m.	Eastern Mindanao 7.99°N; 126.71°E: Surigao - Intensity V.	
	Hinatuan - Intensity IV.	
	Cagayan de Oro and Davao - Intensity III.	
	Butuan - Intensity II. ML = 5.4. Depth = 50 kms.	18
1981 Jan 08 5:36 a.m.	Northern Luzon 19.27°N; 121.0°E: Calayan - Intensity V.	
	Pasuguin - Intensity IV.	
	Aparri Tuguegarao - Intensity II. ML = 5.4	19
1981 Nov 22 11:06 p.m.	Northwestern Luzon 18.71°N; 120.65°E: Pagudpud - Intensity VII.	
	Laoag - Intensity VI.	
	Pasuquin - Intensity VI.	

Event	Felt Effect	Source
	Santa - Intensity V.	
	Baguio and Calayan - Intensity IV.	
	Vigan, Aparri and Tuguegarao - Intensity III.	
	Manila - Intensity I. ML = 5.2	
	Laoag - splashing and spilling out of water from fountain reservoir; jet plane-like sound was heard from the NW direction; stationary jeep moved back and forth; it was the strongest earthquake experienced; people at the Philippine Constabulary-Integrated National Police Headquarters could not move out and had to hold on to tables and walls while the shock was going on; the city's church tower sank by one foot in below the ground; DBP building across from the tower developed cracks in the windows; the third-floor windows of an 8-storey PVA building which housed the clearing office of the Central Bank were broken.	
	Bacarra, Ilocos Norte - people in the area had felt the shock strongly. the municipal building, which is strongly built, suffered minor cracks. A large portion of the church belfry fell down.	
	Pasuquin, Ilocos Norte - two intensity-indicating instruments installed at Pasuquin Seismic Station toppled down. Both are rated corresponding to Intensity VI and VII (RF).	
	Burgos Lighthouse - a small landslip is noticeable at the foot of the tower. At the main building, the roof has been damaged and almost toppled down. The kitchen developed cracks through and through. The lighthouse glass prisms were almost all broken. Five persons on duty ran	

Event	Felt Effect	Source
	out from their quarters. A hissing sound was heard and two smaller shocks were felt minutes later. Pagudpud, Ilocos Norte - people in the area were shaken by a shock from a N - S direction. A wave-like sound was heard while another roaring sound dominated the air. Some felt as though the ground were grinding while the earthquake was in progress. People felt the earthquake much more strongly than the Luzon August 2, 1968 event. A concrete 40-foot Barangay Buravoc bridge developed cracks at both ends. One side of the foot the bridge had 3-inch wide cracks and was raised by 10-12 inches. The other side had 6-inch wide cracks. At Barangay Sulvec, a concrete 30-foot bridge was slightly damaged. Cemented stone blocks serving as retaining walls at both sides of the bridge's approach were shattered and thrown down. Santa, Ilocos Sur - the earthquake was felt by many, most of whom were awakened from sleep; objects inside the houses swung and old frames fell down; the intensity measuring instrument installed at the Santa Seismic Station, and rated corresponding to Intensity VI (RF), toppled down. Vigan, Ilocos Sur - the earthquake was felt by many; minor cracks were observed at Vigan Synoptic Weather Station. The building which is made of hollow blocks suffered cracks in its wall facing south. Magsingal, Ilocos Sur - the earthquake made a few minor cracks in walls of houses made of hollow blocks. It was felt greatly indoors. Bangued, Abra - the earthquake was felt by many who were awakened by creaking of houses and roofs;	

Event	Felt Effect	Source
	several persons witnessed the swinging of electric wires on the posts.	94
1982 Jan 11 2:11 p.m.	14.0°N; 124.5°E Virac, Catanduanes: Virac - Intensity VII. The tremor was oscillatory. Manila, Legaspi, Catarman, Baler and Catbalogan - Intensity V. Quezon City, Tacloban and Infanta - Intensity IV. Dagupan and Baguio - Intensity III. Calapan and Roxas - Intensity II. Rumbling noise was heard north of Virac before the earthquake. Several people panicked. Animals ran in all directions. Drinking water from wells became murky. Cracks in walls made of hollow blocks were observed in some houses. Cabugao - rumbling noise was heard north of Cabugao. People also panicked. Animals ran in all directions. Crack of 20 metres long with maximum width of 20 inches and seven feet deep in a rough road was formed along the N - S direction. Bato - damage to concrete post and CHB walls of the Central Lyceum College of Catanduanes. A booming sound was heard before the earthquake. Radar Station - the radar building (under construction) was heavily damaged. Concrete walls on the ground floor collapsed. Other concrete walls suffered cracks. A booming sound was heard north of teh station. Two construction workers on the building suffered minor injuries. Everyone panicked. The swaying was in the N - S direction. Viga - the Viga Emergency Hospital	

Event	Felt Effect	Source
	was the most affected by the earthquake. Cabinets fell. Record files and medicines were scattered around the place. Many people panicked.	
	Payo - both side walls of the church suffered cracks, separating them from the back wall. Crack of one metre long on the floor in an E - W direction. The floor moved upward by two inches. Swaying was in the N - S direction. People panicked.	
	Bagomoc - crack of 2 1/2 metres long, 1 1/2 inches wide and eight inches deep in a N - S direction was observed on the cement road. Crack of 50 feet long, E - W direction, was also observed on the seashore, with water reportedly spurting out to a height of 20 feet. The municipal building had also cracks in the walls and floors. Duration of the tremor was 42 seconds; direction generally N - S. People panicked. Landslides were observed in the following places:	
	Katipunan, San Miquel; Mabato, San Miguel and Summit, Vige. From the information gathered, the earthquake was strongly felt at Bagamoc and Payo.	95
1982 Apr 19 10:42 p.m.	19.86°N; 120.43°E: Calayan - Intensity V.	
	Aparri and Basco - Intensity IV.	
	Pasuquin - Intensity II.	20
1982 May 23 9:41 p.m.	17.82°N; 119.85°E: Magsingal and Sto. Domingo, Ilocos Sur - Intensity V.	
	Santa - Intensity IV.	
	Pasuquin - Intensity II.	20
1982 Aug 17 5:41 p.m.	18.0°N; 120.54°E: Pasuquin, Ilocos Norte - Intensity V.	

Event	Felt Effect	Source
	Santa, Ilocos Sur - Intensity IV.	
	Vigan - Intensity II.	20
1982 Aug 20 2:47 a.m.	17.24°N; 119.75°E: Santa, Ilocos Sur - Intensity V.	
	Pasuquin and Laoag - Intensity IV.	20
1982 Dec 28 9:50 p.m.	20.11°N; 121.45°E: Calayan - Intensity V.	
	Santa - Intensity IV.	
	Basco - Intensity II.	20
1982 Dec 29 10:05 p.m.	14.66°N; 119.81°E: Manila, Bagac and Subic - Intensity V.	
	Quezon City - Intensity IV.	
	Baguio City - Intensity III.	
	Ambulong - Intensity II.	
	Alabat - Intensity II.	20
1983 May 07 2:24 a.m.	Luzon: Baguio City and Baler - Intensity V.	
	Manila, Sangley, Cavite and Munyoz, Nueva Ecija - Intensity IV.	
	Dagupan - Intensity IV.	
	Alabat, Tuguegarao, Quezon City and Calapan - Intensity III. One hundred and sixty kms from Quezon City.	21
1983 Aug 17 8:18 p.m.	18.33°N; 120.87°E Northern Luzon: Vintar - the central school was heavily damaged; a single-storey concrete building was divided by a crack of three inches; water tank suffered major crack; statues in the church broken, all fell to the ground; 70 houses partially damaged, 79 totally damaged; some parts of the road along the river leading to the suburbs collapsed; landslide debris rendered the roads	

Event	Felt Effect	Source
	impassable; 41 houses in Barangay Barangobong collapsed. The houses are usually two-storey houses made of (hollow block) concrete and wood; three school buildings in Barangay Barangobong collapsed; the main altar completely collapsed. The church is an old building of poor construction. The walls are made of brick and mortar. The facade of the church collapsed completely. The bell tower collapsed totally; the quay wall sustained cracks and showed evidence of subsidence. The convent which was originally built in 1804 and restored in 1977 was heavily damaged. Only the restored portion remained undamaged. The old portion of the convent collapsed completely; rectory partitions (panel, concrete) collapsed; majority of debris fell to the west; one teacher staying on the first floor of the rectory fainted. All told, 4 adjacent places suffered major destruction; these are: Barangobong, Dipilat, Tandayan and Alseon. Bacarra - bell tower, convent, bridge partially damaged. Several schools partially collapsed. Differential settlement on the north approach to Bacarra Bridge. Most portable appliances toppled, contents of open shelves spilled out, no water in the taps and toilet, no electricity. Loud deep rumbling sound; 20 houses partially damaged; two houses totally damaged. Carassi - 59 houses partially damaged. Ira Beach - 102 houses partially collapsed; ten school buildings damaged. Burgos - Municipal hall cracked; Cape Bojeador lighthouse partially damaged.	

Event	Felt Effect	Source
	Pasuquin - several houses collapsed; some window panes broken; one cooking pan toppled; a refrigerator opened, spilling its contents. Several room partitions torn from the walls; slight swellings of the sea-water observed; cracks appeared on the shore (varying width) but generally two feet wide and one km long; portable appliances fell, legs of appliances broke; people were afraid to enter dwellings; opted to sleep outdoors; west side of the road leading to the north cracked; eastern approach to Niquet Bridge sank. Paldi bridge northern approach cracked. Barangay Caruan - two persons collapsed from fright. Three houses were slightly damaged. Barangay Nalvo - one person collapsed from fright. Barangay Zamboanga, Laoag - sand-boils of various depths and sizes found in this barangay, biggest of which is more than a metre in width and about a metre in depth. These are located near the east side of the Zamboanga Creek within a sugar plantation. Extruded material is greyish sand. A 20-foot abandoned artesian well tube spurted water; concrete floor of one house cracked; fissures formed in the ground. In Bangkag, two wells dried up as a result of the earthquake; in Bacsil, a total of 56 houses made of concrete hollow block, wood and galvanized iron sheets suffered partial collapse. At NBI office, a steel safe (weighing about a ton) moved one foot. Laoag City - abrupt shaking of the ground as if it were a ball being dribbled, then a circular movement and, finally, a reversed swaying motion. Stores display items and	

Event	Felt Effect	Source
	goods fell; bottles fell and smashed. A portion of a tower fell on one victim's head. Contents of cabinets spilled out. Earthquake movement was east-west. Stampede in cinemas; low rumbling sound like a big approaching truck was heard; Airport (Gabo) partially damaged. Several houses collapsed. Philippine Constabulary Office - abrupt shaking; sound like that of horses' hooves (stampeding) heard. Philippine Veterans Bank ground, 2nd, 3rd and penthouse, airconditioning fell from its housing, all furniture destroyed; 4th to 7th floors not much visible damage. Moving vehicle jerked. Pictures swayed wildly. Municipal hall tilting of the floor. Sandboils appeard; black mud with frothing water ejected. Two persons perished. Far East Building, damaged after the earthquake was small but, after 24 hours, it became so much worse that temporary supports had to be added. Shirley Building, vertical motion felt by occupants, sounds of heavy "thuds" preceded the shaking, table moved two feet wall partitions fell. San Nicolas: Kaunlaran Building, which housed a shop and bodega on the ground floor and apartments on the 2nd and 3rd storeys and the penthouse, collapsed. Damage, totally. The filling station along the side of Kaunlaran Building was not damaged at all; the contents of the shelves, mostly cans of oil, grease and other petroleum products, fell to the floor. It was a general observation that objects in cabinets and on shelves were thrown down. The two-storey concrete house across the road from Kaunlaran was not damaged; teh wall mirror which was leaning against the concrete wall was shaken strongly and shifted about three feet from its forms position; E.M.	

Event	Felt Effect	Source
	Laeno's Building consisting of three floors first floor totally collapsed giving the appearance of only two storeys; Teresa, mezzanine floor suffered the most damage; PVB Building, the west portion of the 2nd floor was ruined, exposing the inside of the establishment, constructed of bricks (walls); Sunrise Building walls, cracked and plaster peeled glass panes broken, building tilted to NW direction; Five Sisters' Twin Cinema Building, CHB walls and plaster on at least one column at mid-section ground floor appeared to be sheared; total of damaged commercial buildings, 5; partially damaged buildings, 16; Kanlaon Building collapsed looking like a stack of pancakes; residential houses damaged not less than 100; Laoag International Airport, slight cracks on some portions of the terminal building, non-operational VOR/DME Monitor toppled down from equipment machine, old tower cracked. Dangui - church damaged (estimate P150,000) ten houses partially damaged. Paoay - old Spanish church collapsed, damaging adjacent structures. According to some fishermen, the water looked as though it were boiling beneath, but the surface of the water was calm; the water on the shoreline receded; people felt dizzy, houses swayed with a N - S direction; tremor preceded by a low rumbling noise; the church was slightly damaged; the bell tower which was built in 1593 sustained minor cracks. Batac - Municipal building, minor cracks; one residential house collapse. Pinili - Don Mariano Marcos Memorial	

Event	Felt Effect	Source
	Hospital partially collapsed (estimated P500,000); Tugaoan Elementary School partially collapsed. Dingras - one residential house collapsed, causing damage to a parked vehicle; church partially collapsed; some parts of St. Joseph Institute cracked and twisted. Pagudpud - Pagudpud Central School, portion of 2nd floor collapsed; St. Jude High School building slightly leaned to the south and fences collapsed; Lusuyo Primary School, all walls nearly collapsed; Subec Elementary School, pre-fabricated building division cracked and nearly collapsed; Balaoi Primary School, north portion collapsed and south portion wall cracked. Burayoc Bridge, both ends of the bridge sank about six inches; Philippine Independent Church, the tower was cracked; house near the beach built with CHB walls reinforced with bamboo slats, palm thatch roofings collapsed. Badoc - church damaged. Sarrat - cracks on front of the church and on the altar. Municipal hall, heavily damaged; one residential house collapsed; Marcos Museum, slightly damaged; Edralin Bridge, cracks on both sides of bridge; Rural Health Unit Centre, heavily damaged; Binatuan School, heavily damaged. Burgos - Municipal hall sustained cracks. Cape Bojeador Lighthouse partially damaged, light projection prism of several light glass panes (half-inch thick), enclosure broken; apparatus to rotate light damaged; kitchen unit (separate building of about 8 m x 6 m; brick masonry structure, single-level one-room	

Event	Felt Effect	Source
	unit) upper corner south-east section of masonry detached; some cracks in several walls of dormitory and office sections cracked; water level of well not disturbed. No observed slides along spiral road leading to tower.	32
	The most severe earthquake experienced in northwestern Luzon in 52 years and probably the second largest earthquake event to hit Laoag and its immediate vicinity in historical times, occurred shortly after eight o'clock in the evening of the 17th of August 1983. The tremor was perceptible over a distance of 400 kms from its origin. In the aftermath, when the last quivering of the ground was felt, several lives and millions of pesos in property were found to have been lost.	
	In Laoag City, a number of reinforced concrete buildings either totally collapsed or sustained major structural damage beyond rehabilitation. Not a few public and residential structures suffered minor damage that, nevertheless will require a huge sum for repair work.	
	In the neighbouring town of San Nicolas, a three-storey, reinforced concrete, commercial-apartment building collapsed, all its upper floors piled up like a stack of pancakes. In other municipalities, churches and bell towers that had withstood the shaking of the March 1931 earthquake sustained major damage. Public and residential buildings, bridges and other structures sustained damages of varying degrees. Nearly all the damaged buildings in the area were of reinforced concrete frame. Most of the external walls and internal partitions were of concrete hollow blocks. There are, however, some	

Event	Felt Effect	Source
	buildings with wood partitions. Several sandboils were observed in barangay Zamboanga, Laoag City. The diameters of these craters vary from a few centimeters to 300 centimeters. The largest observed sandboil, as manifested by the size of the area covered by extruded subsurface sand, had a diameter of 8.5 metres. In Barangay Zamboanga, three wells were reported to have gone dry after the main shock. In another well, the water was reported to have changed in colour and smell. An abandoned artesian well of galvanized iron pipes with a diameter of 5 centimetres and a length of 6.6 metres shot up water as high as ten metres at the time of the shaking. Landslides were observed in several places at or near the intensity centre. Most of these however, occurred where the slopes were steep, as along road cuts. The condition for sliding of materials was also aggravated by several days of rain in the region and lack of vegetation. Nearly all bridge approaches had differential settlement of overlay materials. These were also observed in most building sites. Observed magnitude of settlement measured from a few centimetres to about 26 centimetres. Irregular cracks and small fissures were found along sea-shores, roads, river-banks and alluvial fans. These were probably due to compression. Cases of fright and nausea were reported in the epicentral area. Reports indicated several dogs and fowls acting agitated before and during the time of the main shock. Most people in or near the epicentral area reported low, rumbling sounds immediately preceding or accompanying part of the shock. Most of the aftershocks were reported to have been preceded by rumbling sounds.	170

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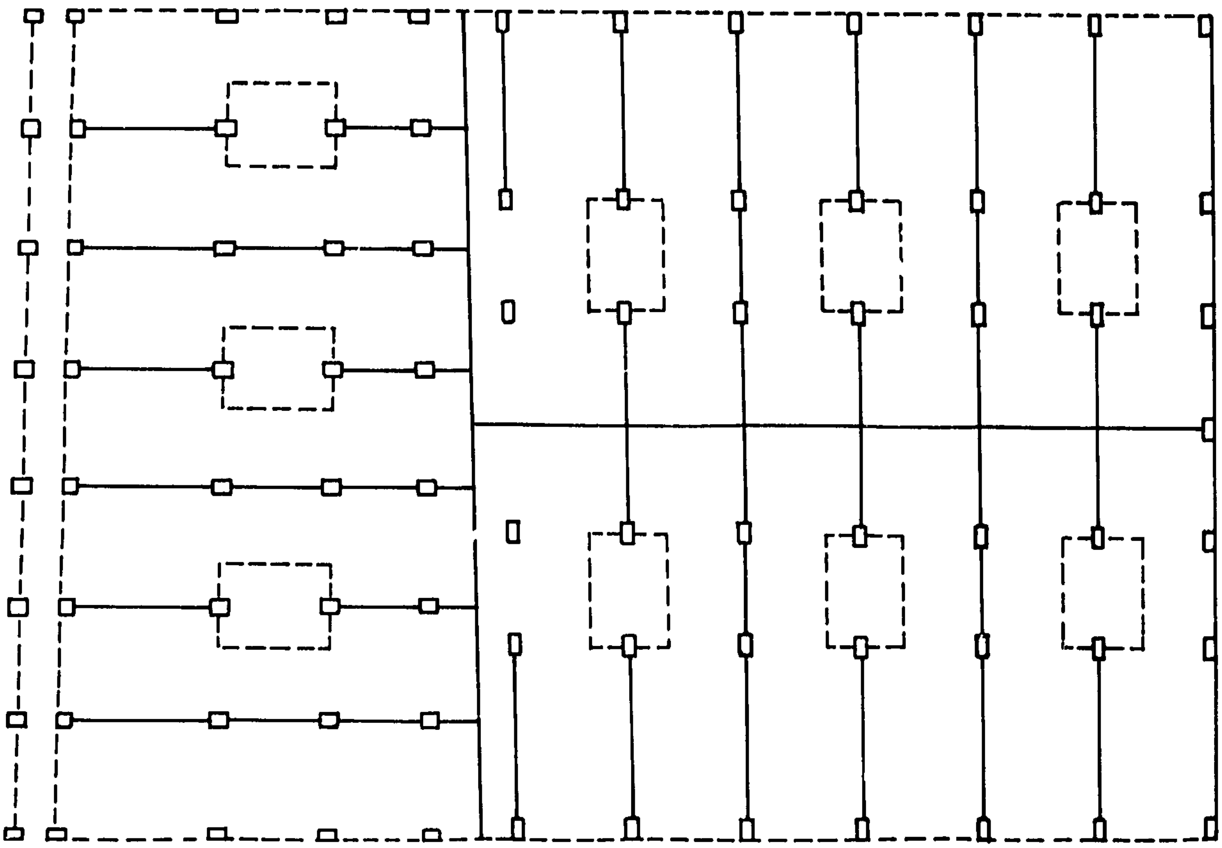

RUBY TOWER
6 Storey

Typical Column 12" x 24"
Typical Beam 10" x 16"
Typical Floor Slabs 4 1/2" RC

0 3 6 9 metres

Fig. 1 Ruby Tower

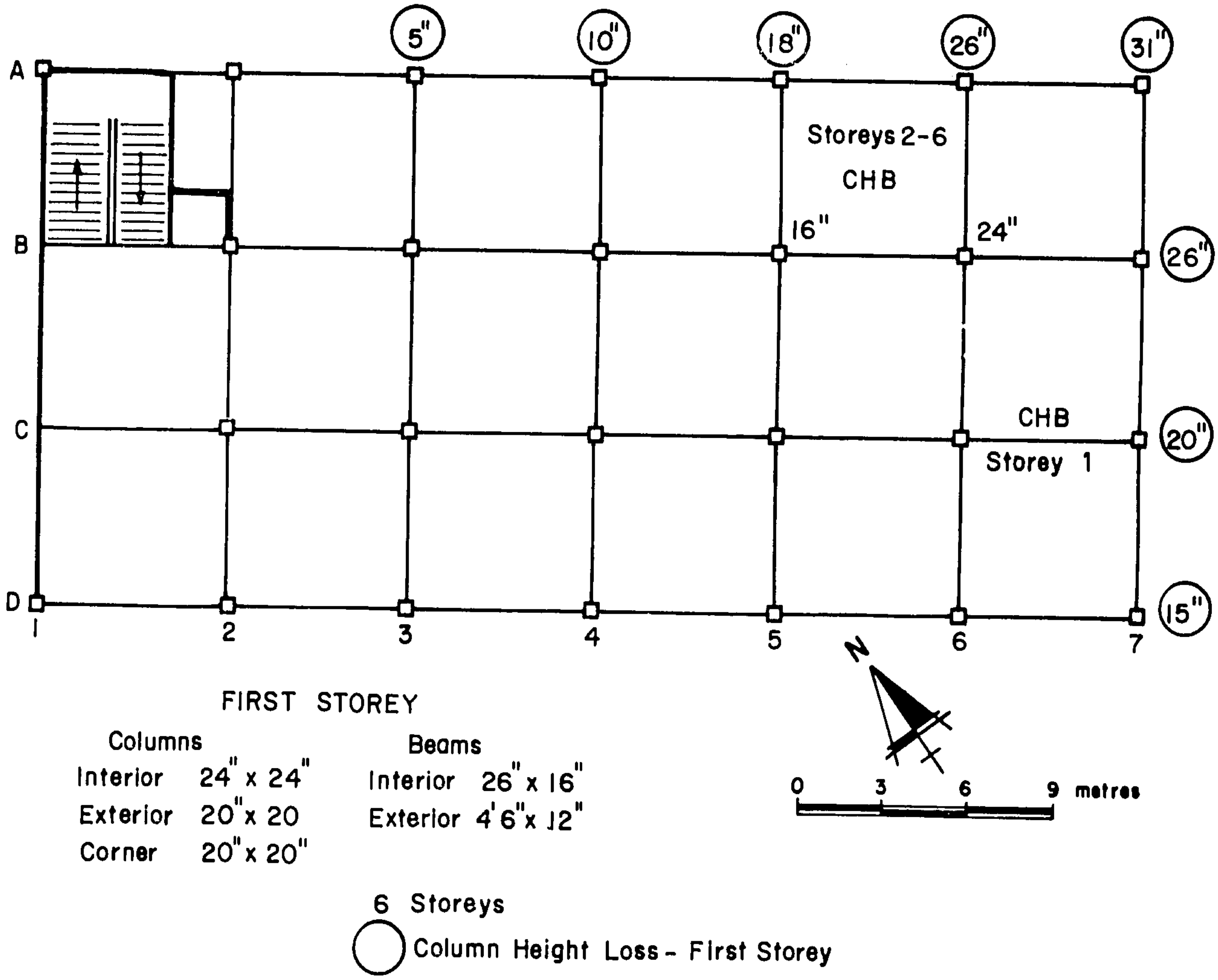

Fig. 2 Philippine Bar Association Building

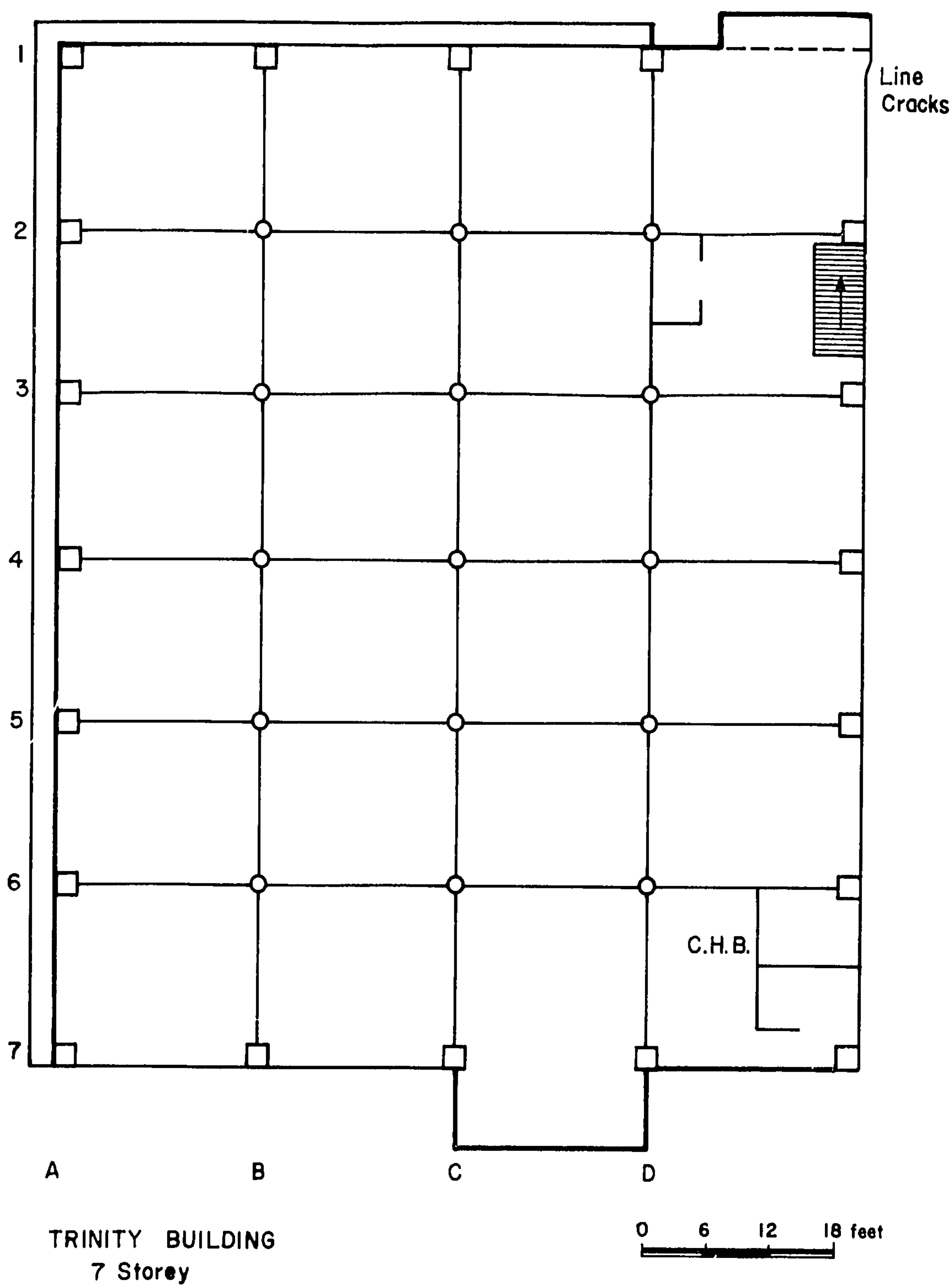

Fig. 3 Trinity Building

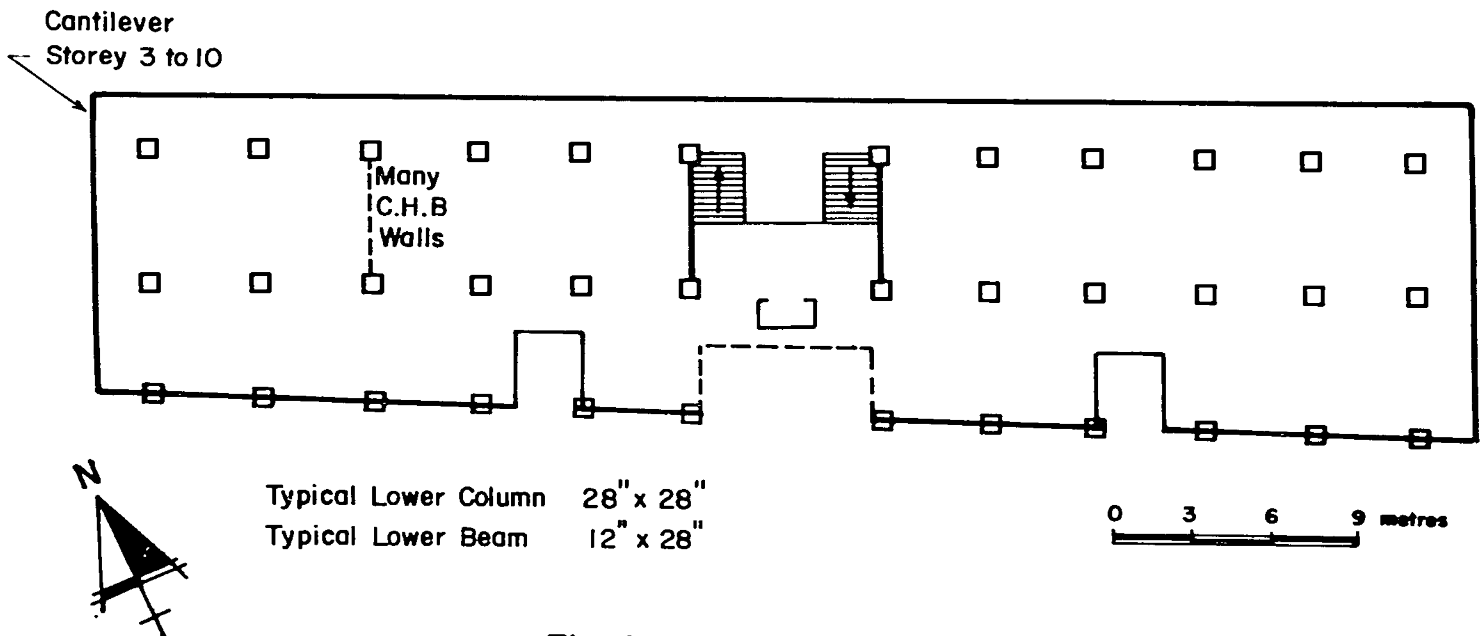

Fig.4 Diamond Tower Apartments

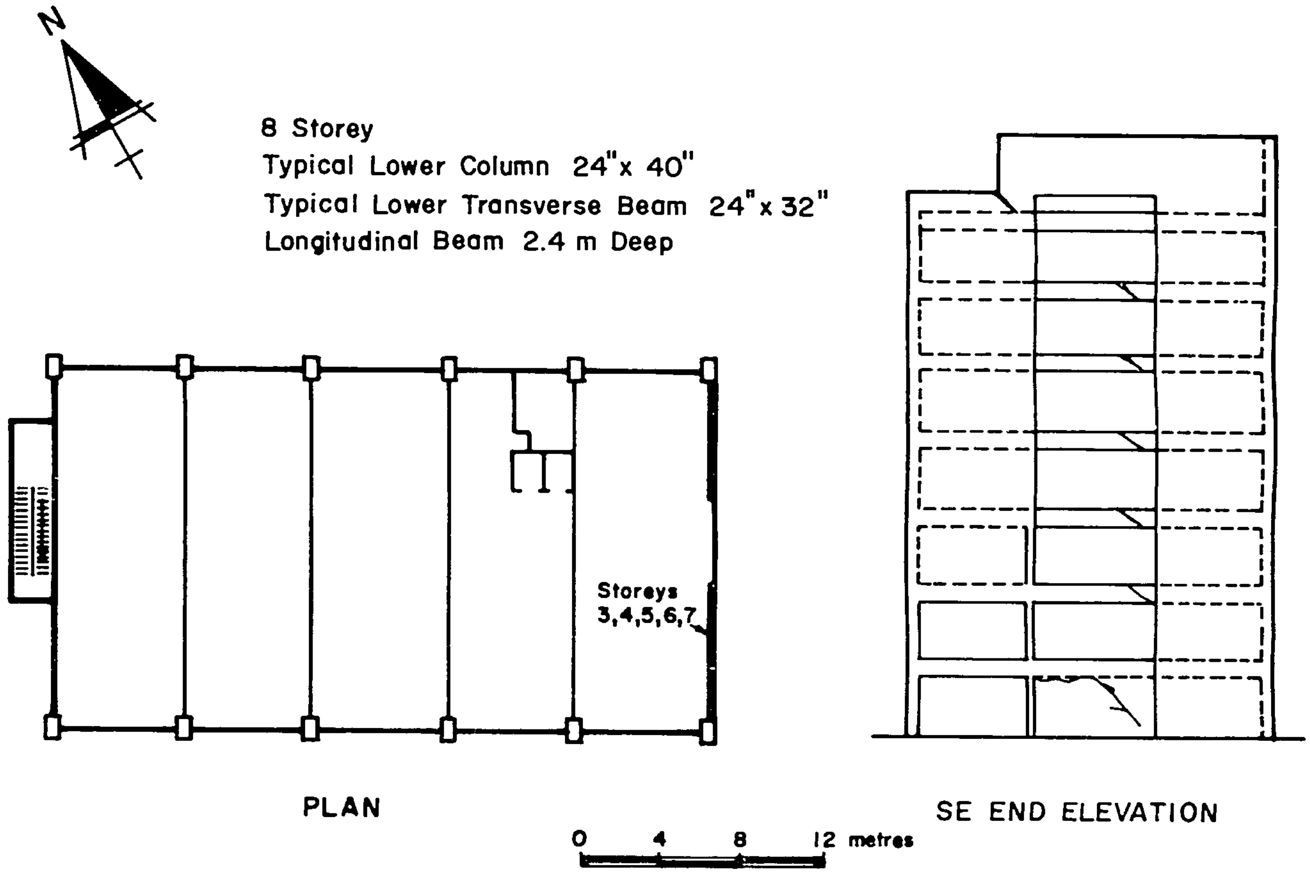

Fig. 5 La Tondena Building

PART E

CATALOGUE OF DESTRUCTIVE EARTHQUAKES IN THE PHILIPPINE 1589-1983

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Nancy T. Lance

PART E CATALOGUE OF DESTRUCTIVE EARTHQUAKES IN THE PHILIPPINE 1589 - 1983

Introduction

Nearly 400 years of written seismic history were reviewed in the preparation of this catalogue. Only destructive earthquakes were considered. 'Destructive', in this case, denotes, 'that which rendered the buildings unfit for use'. There are reports which give very long narratives of earthquake effects. On the other hand, there are those which were described simply as 'destructive'. Both cases are included in this catalogue inasmuch as we have no real way of discriminating genuine destructive events from seemingly destructive events.

A total of 63 events are included in this catalogue. Each earthquake is assigned a maximum observed intensity, I_0, in Modified Mercalli. All intensities appearing in the text are taken to be from the Rossi-Forel Scale. There are 3 significant periods wherein intensity scales differ. Prior to 1900, earthquakes were described using a 6-step scale ranging from 'perceptible' to 'destructive'. Annex A shows this 6-step scale with its corresponding Rossi-Forel (RF) intensity. From 1900 to 1934, the original Rossi-Forel intensity scale was used after which Fr. Repetti, then with the Manila Observatory, modified the original scale. Rossi-Forel (adapted), as it is popularly known in the Philippines, has been in use since 1935. Annexes B, C and D give the original R-F, the R-F (adapted) and the Modified Mercalli Intensity scales respectively.

All data included in this catalogue were taken from Catalogues of Significant Philippine Earthquakes for different time periods, newspaper reports, various earthquake bulletins and special reports on destructive earthquakes, for example, UNESCO Reports and EERI Reconnaissance Reports, to name a few.

Figure 1 shows the epicentres of 40 out of the 63 earthquakes reported here. From 1907 to 1983, instrumental determination of epicentres was used, with the exception of the 1902, 1907 and 1917 epicentres. These three earthquakes were located using the respective isoseismal maps. The same method was used to locate the epicentres of the pre-1900 earthquakes. Table 1 shows the epicentral parameters of these 40 events.

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ANNEX A

INTENSITY SCALE COMPARISON

Manila Observatory		Rossi-Forel
I	Perceptible	II, III
II	Light	IV
III	Regular	V
IV	Strong	VI, VII
V	Violent	VIII
VI	Destructive	IX, X

ANNEX B

THE ROSSI-FOREL SCALE

I. Microseismic shock. Recorded by a single seismograph or by seismographs of the same model, but not by several seismographs of different kinds: the shock felt by an experienced observer.

II. Extremely feeble shock. Recorded by several seismographs of different kinds; felt by a small number of persons at rest.

III. Very feeble shock. Felt by several persons at rest; strong enough for the duration to be appreciable.

IV. Feeble shock. Felt by persons in motion; disturbance of movable objects, doors, windows, cracking of ceilings.

V. Shock of moderate intensity. Felt generally by everyone; disturbance of furniture, beds, etc., ringing of some bells.

VI. Fairly strong shock. General awakening of those asleep; general ringing of bells; oscillation of chandeliers; stopping of clocks; visible agitation of trees and shrubs; some startled persons leaving their dwellings.

VII. Strong shock. Overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.

VIII. Very strong shock. Fall of chimneys; cracks in the walls of buildings.

IX. Extremely strong shock. Partial or total destruction of some buildings.

X. Shock of extreme intensity. Great disaster; ruins; disturbance of the strata, fissures in the ground, rock falls from mountains.

ANNEX C

ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES (ADAPTED)

I. Hardly perceptible shock - felt only by an experienced observer under favourable conditions.

II. Extremely feeble shock - felt by a small number of persons at rest.

III. Very feeble shock - felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.

IV. Feeble shock - felt generally indoors, outdoors by a few. Hanging objects swing slightly. Creaking of frames of houses.

V. Shock of moderate intensity - felt generally by everyone. Hanging objects swing slightly. Creaking of frames of houses.

V. Shock of moderate intensity - felt generally by everyone. Hanging objects swing freely. Overturning of all tall vases and unstable objects.

VI. Fairly strong shock - general awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillations of hanging lamps. Slight damage to very old or poorly-built structures.

VII. Strong shock - overturning of movable objects. General alarm, all run outdoors. Damage slight in well-built houses, considerable in old or poorly-built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.

VIII. Very strong shock - people panicky. Trees shaken strongly. Changes in the flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides.

IX. Extremely strong shock - panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.

ANNEX D

MODIFIED MERCALLI INTENSITY SCALE (1956 VERSION)

I. Not felt. Marginal and long-period effects of large earthquakes.

II. Felt by persons at rest, on upper floors, or favourably placed.

III. Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.

IV. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frames creak.

V. Felt outdoors; direction estimated. Sleepers awakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

VI. Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knick-knacks, books, etc. fall off shelves. Pictures fall off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church and school). Trees, bushes shaken visibly, or heard to rustle.

VII. Difficult to stand. Noticed by drivers. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, also unbraced parapets and architectural ornaments. Some cracks in masonry C. Waves on ponds, water turbid with mud. Small slides and caving- in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.

VIII. Steering of cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken off trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

IX. General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated area, sand and mud ejected, earthquake fountains, sand craters.

X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dykes, embankments. Large landslides. Water thrown on banks of canals, rivers lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.

XI. Rails bent greatly. Underground pipelines completely out of service.

XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

***** To avoid ambiguity of language, the quality of masonry, brick or otherwise, is specified by the following letters:

Masonry A - Good workmanship, mortar and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.

Masonry B - Good workmanship and mortar; reinforced but not designed in detail to resist lateral forces.

Masonry C - Ordinary workmanship and mortar; no extreme weaknesses like failing to tie-in at corners, but neither reinforced nor designed against horizontal forces.

Masonry D - Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

Table 1 Epicentral Parameters of Destructive Earthquakes 1589 - 1983

	Date	Time (LST)	Location Lat °N	Location Long °E	Magnitude Ms		I_o (MMI)
1.	1599 June 21	10:00 a.m.	14.60	121.00			VIII
2.	1619 Nov 30	noon	18.17	121.60			X
3.	1743 Jan 12	5-6:00 p.m.	14.00	121.60			X
4.	1787 July 13	6:45 a.m.	10.70	122.55			X
5.	1796 Nov 05	2:00 p.m.	16.05	120.30			X
6.	1852 Sept 16	6:30 p.m.	13.95	120.40			IX
7.	1863 June 03	7:20 p.m.	14.63	121.40			X
8.	1869 Aug 16	3:00 p.m.	12.17	123.69			IX
9.	1869 Oct 01	11:15 a.m.	14.82	120.82			IX
10.	1873 Nov 14	5:30 p.m.	13.11	122.98			VIII
11.	1880 July 18	12:40 p.m.	16.00	121.85			X
12.	1885 July 23	10:45 a.m.	8:43	123.60			X
13.	1889 May 26	2:23 a.m.	13.59	121.19			VIII
14.	1892 Mar 16	9:01 p.m.	16.06	120.42			IX
15.	1893 June 21	3:30 p.m.	6:88	125.83			X
16.	1897 Sept 21	1:15 p.m.	7.11	122.11	8.7	*	IX
17.	1897 Oct 19	7:52 p.m.	12.40	125.00	8.1	*	IX
18.	1902 Aug 21	7:17 p.m.	8.10	124.25			X
19.	1907 Nov 24	9:59 p.m.	13:30	123.40			X
20.	1911 July 12	12:09 p.m.	9.00	126.00	7.7	*	X
21	1913 Mar 14	4:47 p.m.	4.50	126.50	7.9	(PAS)	IX
22.	1917 Jan 31	12.02 p.m.	5.60	124.80			IX
23.	1918 Aug 15	8:20 p.m.	5.50	123.00	8.3	*	X
24.	1924 Apr 15	12:22 a.m.	6.50	126.50	8.3	*	IX
25.	1924 Aug 30	11:07 a.m.	8 1/2	126 1/2	7.3	(PAS)	IX
26.	1925 Nov 13	8:16 p.m.	13.00	125.00	7.3	(PAS)	VIII
27.	1929 June 13	5:26 p.m.	8 1/2	127.00	7.2	(PAS)	X
28.	1931 Mar 19	2:26 p.m.	18.30	120.20	6.9	(PAS)	VIII
29.	1937 Aug 20	7:59 p.m.	14.20	122.10	7.5	*	VIII
30.	1948 Jan 25	1:46 a.m.	10.90	122.10	8.3	*	IX
31.	1954 July 02	10:46 a.m.	13.00	124.00	6 3/4	(PAS)	IX
32.	1955 Apr 01	2:17 a.m.	8.00	124.00	7.5	(PAS)	X
33.	1968 Aug 02	4:19 a.m.	16.50	122.30	7.3	*	IX
34.	1970 Apr 07	1:34 p.m.	15.80	121.70	7.3	(NEIS)	IX
35.	1973 Mar 17	4:31 p.m.	13.41	122.87	7.0	(NEIS)	XI
36.	1976 Aug 17	12:11 a.m.	7.30	123.60	7.9	(NEIS)	X
37.	1977 Mar 19	5:43 a.m.	16.70	122.31	7.0	(NEIS)	VIII
38.	1981 Nov 22	11:06 p.m.	18.71	120.65	6.7	(NEIS)	VIII
39.	1982 Jan 11	2:11 p.m.	14.00	124.50	7.1	(NEIS)	VIII
40.	1983 Aug 17	8:18 p.m.	18.33	120.87	6.5	(NEIS)	VIII

* Lomnitz, C. (1974), Global Tectonics and Earthquake Risk, p. 231.

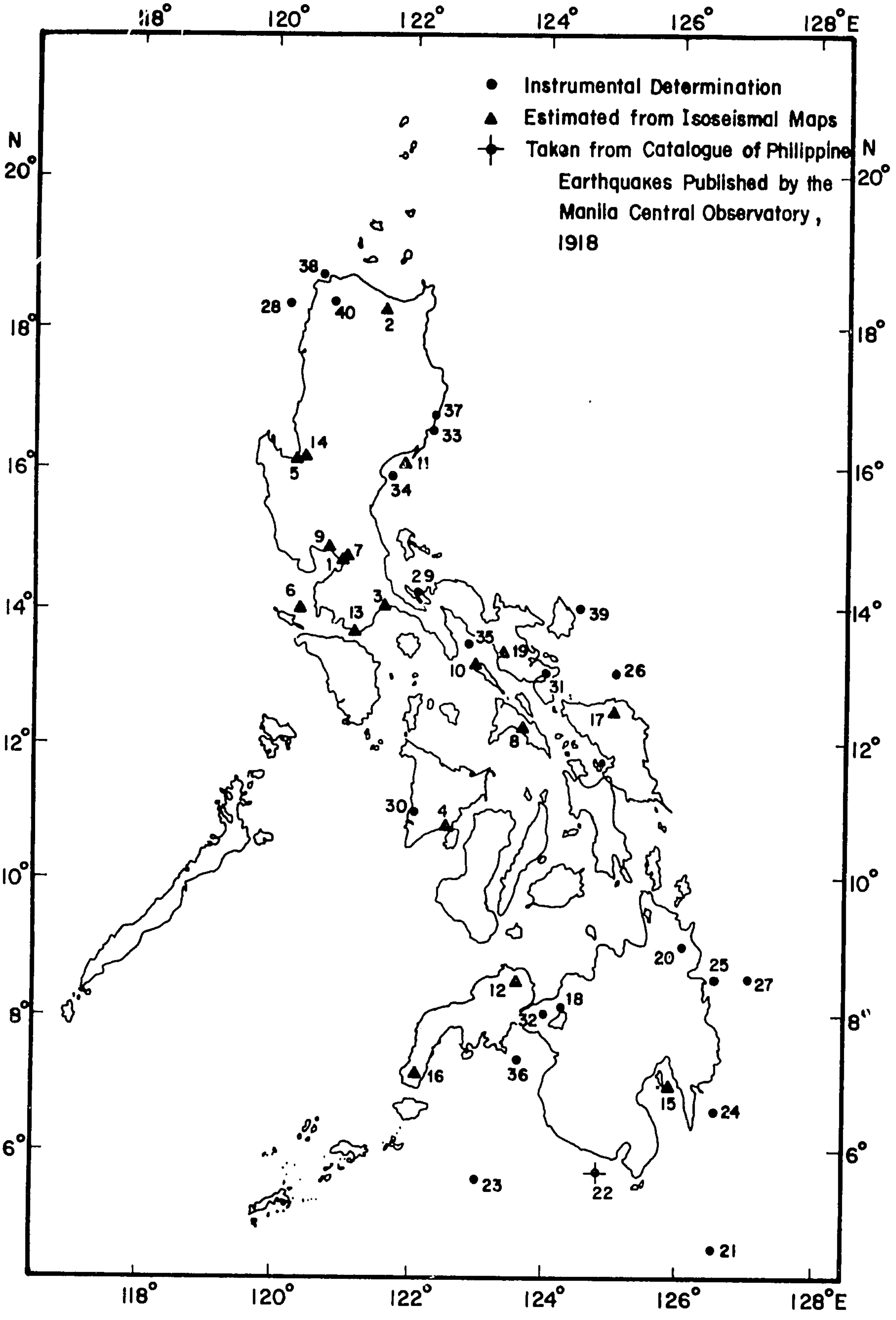

Fig. 1 Location of Destructive Earthquakes (1589-1983)

Event	Felt Effect	Source
1599 June 21 10:00 a.m.	Manila: Manila suffered one of the strongest earthquakes it had known, resulting in the destruction of the church of San Domingo, fissuring of the stone vault of the church of the Society of Jesus and damage to all the principal edifices of the city. Two entire sections of the college of the Society of Jesus were damaged in the earthquake of June 21, as a result of which the community was exposed to the view of its neighbours. Father Pedro Chirino, S.J. described the earthquake as violent, with damage to many buildings. In the church of the Dominicans or Sto. Domingo, the handsome woodwork was multilated and the walls so much damaged as to necessitate demolition of the building. The nave of the Jesuit church was so badly cracked that it had to be removed at once. Intensity - VIII.	45
1601 Jan 16 midnight	Manila: An earthquake so furious and cruel that lasted about seven or eight minutes. It broke down a great part of the side aisle of the church (already damaged by the June 21, 1599 earthquake) and left the rest so damaged and cracked that it was necessary to take it all down. In the city, it caused much damage, destroying the buildings and injuring several persons. It threw down many stone houses in Manila and the entire church of the Society of Jesus and the Jesuit monastery suffered no slight damage. It resulted in the death of some people of little account and many were left injured. Father Chirino, S.J. was awakened by the noise of the shutters and windows. He noticed the strong rocking of the building, in danger of being overthrown. The room was swinging from end to end, just as a vessel in the sea rises and falls from bow to stern, but as	

Event	Felt Effect	Source
	rapidly as a small boat. The damage done to the church was very great. It fissured two lateral vaults spared by the preceding shock and destroyed most of that of the right side. The back wall of the main aisle was considerably cracked. The vault of the left side stood the shaking owing to the support afforded by the adjoining building.	
	Intensity - IX.	45
1619 Nov 30 noon	Northern Luzon: A terrifying earthquake which travelled from the east coast of Luzon to Manila and caused great damage.	
	Bataris (Batac) - the church, house and granaries were destroyed. The friars jumped from the windows and although they escaped with their lives they were somewhat bruised.	
	Dingles (Dingras) - the church was partly destroyed and the Prior jumped from the window.	
	Sinai (Sinait) - the church suffered great damage. Large fissures opened into which some persons fell, but only one perished in this manner in the hills of Vigan. Two neighbouring hills slumped together and buried two heathen villages situated in the valley between them. All the inhabitants were buried except one man.	
	Zagaian Province (Cagayan) - the earthquakes were stronger. The trembling of the ground was so violent as to toss the people around; they could not keep their balance even while sitting.	
	Nueva Segovia (Lal-lo) capital of Zagaian - the church fell and the monastery, which was beautifully and substantially built of stone, was partly destroyed. The monks were	

Event	Felt Effect	Source
	bruised. In other places, only two persons perished. San Vicente, Tocolano - the same fate befell the church in this place in spite of its very thick walls. The same destruction overtook many stone churches and buildings. There were many landslides; new springs began to flow; rivers changed their courses and many other strange things happened. Large forests were overthrown, great springs opened out. Nine friars were attached to the house in Lal-lo; one saved his life by standing under tha arch of a window and one, who was ill in bed, suffered a broken arm. One native servant was killed. Malaueg, Cagayan - wall surrounding the church was so badly damaged that much of it had to be torn down and rebuilt. Manila - destroyed and levelled the church of the Dominicans. This earthquake figures among the most violent ever felt in the northern province of Luzon. At noon in these islands from Manila to the farthest corner of Nueva Segovia and Ilocos Provinces, (Cagayan and Ilocos), the most violent earthquake. In Ilocos Province, it overturned the buried coconut plantations so deeply that only the leaves were left out, hills were razed and thrown down by the force and shocks. A great number of dwellings destroyed and numerous persons killed. Nueva Segovia (Cagayan) - it rent mountains, water gushing forth and the ground ejecting mud and sand. In the highlands populated by the Mandajos, a mountain slid down	

Event	Felt Effect	Source
	destroying and burying a town with most of its people. In the vicinity of the river, the high ground sank to the level of the water; the great undulation started high waves, as in a sea swept by hurricane. Stone buildings sustained the greatest damage; the church and convent of our city (Lalloc) fell down, even the foundations failing in some places.	
	Intensity - X.	31
1627 Sept	Northern Luzon: Fourteen earthquakes were felt in one day. A hill called "Los Caraballos" en route to Nueva Segovia, sank until level with its surroundings.	
	Cagayan Province - some Dominican monasteries were ruined.	
	Bangui, North end of Luzon - earthquake felt on the boats anchored in the bay.	
	Cagayan - many buildings were wrecked; an enormous mountain opened in the centre with a tremendous gap; trees were overthrown by the terrific force of the waves of the sea which invaded the land for a distance of a league (about 3 miles).	
	Intensity - X.	45
1645 Nov 30 8:00 p.m.	Manila: This was the most destructive and memorable earthquake in the history of Manila. There was so great an earthquake in this city that it ruined most of the buildings. As these were of stone, many persons among the natives and slaves were killed. It was said this earthquake claimed 3,000 victims.	
	Manila - preceded by a terrifying noise, the earth commenced to tremble with such furious violence	

Event	Felt Effect	Source
	that it seemed to desire to become a tomb for all the inhabitants. The earthquake, running from north to south, then passing from west to east with violent movement, brought to the ground in that short time the most beautiful and magnificent buildings of the city. The stone walls were shaken and bent like leaves of paper or parchment blown by the wind; the towers shook and swayed. Nothing was heard but a confused noise of the crash of buildings, voices and screams of those who pleaded for the mercy of heaven. The cries of animals added to the horror. Nothing was to be seen in the streets but piles of stones from the fallen houses, which blocked the flight of those who were leaving their homes in fright. Some tried to save their lives by sheltering in the open spaces of the doors and windows, but this careful effort was of no avail for many, because the houses, falling flat, buried them in wood and stone. In this first shock, one hundred and fifty principal houses, which would be palaces in other places, were totally destroyed. It has not been possible to verify the number of dead; those who are known to be missing exceed four hundred and fifty. The Palace and the Royal Audience Chamber, for the most part, fell. Likewise, most of the Royal Chapel fell, and what remained of it was badly damaged. The cathedral-tower, roofs, chapels were completely levelled to their foundations. The wooden beams of the roofs crashed; the roar increased when cabinets, tables, chairs, and other furniture were dislodged and struck the walls and floors; roofs opened, the walls fell, the floors were buried, the edifices pulled apart. College of Sta. Potenciana - great	

Event	Felt Effect	Source
	ruin. A section fell and carried down eight girls who were killed and thirty injured.	
	Outside the Walled City - the parish church of Santiago and its towers fell. The structure of the church of Nuestra Sonyora de Guia and of St. Anthony fell without leaving anything standing. The entire monastery and church of the Order of St. Dominic fell.	
	College of Santo Tomas - a great gate fell.	
	College of San Juan de Letran - fell completely.	
	Church of the Fathers of St. Francis - badly damaged and the walls surrounding the monsastery were completely ruined. Five hundred persons died; amount of damage, P77,141.00; loss mortgages P69,510.00.	
	The monastery of the Fathers of St. Augustine - the tower and the church fell.	
	Recoleto Fathers - the monastery and church fell.	
	Society of Jesus - classrooms of Arts and Theology, an old edifice, fell. At the church, although the tallest in Manila, only the tiles of the cupola were thrown off.	
	College of San Jose - one section, which was just being completed, fell; the rest was badly shaken.	
	Town of San Miguel - church and houses completely fell. Father Francisco Roa was buried up to his shoulders by the ruins.	
	Binondo - a parish of the Fathers of St. Dominic; its very sumptuous	

Event	Felt Effect	Source
	church, of which the erection had been completed a few years previously, fell.	
	San Francisco del Monte - the monastery and the church, fell. San Miguel, Binondo, San Francisco del Monte and Santa Ana churches and convents were destroyed. Santa Ana church was so badly damaged that it cannot be used. Villas on the bank of the river were ruined.	
	Sto. Domingo - church vault, which was made of masonry and very strong, collapsed.	45
	At about 8:00 p.m. the city of Manila was precipitated into ruins. The sea rose with a broad swell and lashed the very walls. Frightfull noises fell upon the ear, the earth trembled, and animals cowered to the ground in terror. Again and again were shocks repeated, walls cracked under the unseen power which swayed them. The people in fear sought refuge under doorways and arches, but roofs and timbers fell about them, immuring many in a common grave. The cries of the wounded and dying mingled with the crash of crumbling edifices. In less time than has been consumed in the narration of the catastrophe, the destruction was complete. The cathedral, most of the churches and public buildings, and countless private ones were ruined.	14
	In other provinces of the Island. 1. Whole villages of Indians fell. 2. Hills were levelled. 3. Streams dried up which afterwards resumed their flow; others leaped from their banks and flooded the towns; great fissures appeared and even chasms in the fields. 4. In the rivers of Manila, so great was the change and	

Event	Felt Effect	Source
	commotion of the waves that it seemed that they would flood all the land, for their fury forced the river from its bed and threw its waters over the top of the bridge.	
	Uplands fo Gapang, Province of Pampanga - very strong and lasted many days.	45
	This earthquake compares in magnitude with the greatest mentioned in the history of the world. Its mesoseismic or epicentral area was not less than 490 kms from north to south; that is, from the southern coast of Batangas and Tayabas to the northern part of Cagayan. On the western coast it seems to have been of less intensity. At least, the chroniclers of the time are silent about its effects in these parts, while they deal largely with the destruction caused in Manila and neighbouring provinces of the south, east and north and the eastern part of the Cordillera Central, that is, in Mountain Province. That such an earthquake was due to tectonic movements there cannot be the slightest doubt; furthermore, it is certain that its origin was along a north and south line, and this line was within Luaon and not beyond its eastern periphery. The question arises whether the dislocations which then occurred along that line or fault were of such proportions as to be responsible for the many singular topographic features that now exist along it in Nueva Ecija, Nueva Vizcaya and Isabela Provinces. Moreover, as in that memorable earthquake, Manila seems to have been very close to its origin.	
	Intensity - X.	48

Event	Felt Effect	Source
1645 Dec 05 11:00 p.m.	Luzon: Earthquake with the same violence as the 1645 November 30 tremor, but there was no injury to the people because all were on the alert; the fall of many buildings was completed, the city remaining in such a condition that it was impossible to walk through it.	
	Intensity - VIII.	45
1658 Aug 20 3:00 p.m.	Southern Luzon: Manila - wiped out not only what had been damaged by the previous earthquake but also what appeared very solid. The beautiful church of the Barefoot Friars of St. Augustine was ruined, and three rooms fell from this very strong edifice. Some persons were killed.	
	Santa Cruz - a great part of the church underwent almost complete destruction; the only part that remained intact was that above the altar of the statue of the Most Blessed Virgin. The monastery of Santo Domingo was rendered uninhabitable.	
	Note: Most of the houses in Manila were constructed of wood and the roofs were strengthened with imense timber. The remnants of Old Manila were completely wiped out, according to the report by Fr. Diaz.	13
	Manila - several persons perished and some were injured by falling ruins. - appreciable damage to buildings. - stone vault of the church of Santa Clara was damaged. - half of the house of the Archbishop was demolished.	
	Antipolo - tower of Antipolo was affected. The top of the wall and the front of the principal facade were considerably cracked and loosened.	

Event	Felt Effect	Source
	Intensity - X.	45
1699	Manila: Destructive earthquake. In 1699 and 1700, new earthquakes destroyed the town entirely.	
	Intensity - X.	31
1728 Nov 28	Luzon: Manila - caused great damage. Destructive earthquake felt throughout the Archipelago, but chiefly in Luzon. It caused great loss and damage to the city of Manila. Destructive in the fourth district.	
	Intensity - X.	31
1730	Tayabas Province: Violent earthquake which damaged the church at Mauban; it caused similar destruction in other towns of Tayabas Province.	
	Intensity - X.	45
1743 Jan 12 5:00-6:00 p.m.	Province of Tayabas, Luzon: A very great earthquake occurred which was repeated the next day at the same hour but with less intensity. For the monks of St. Francisco in charge of the towns of Tayabas, it ruined nine churches and convents; a tower subsided two yards into the ground. Near Tayabas there opened two chasms or vents which emitted sulphurous water; only three or four persons perished. The church of St. Pablo also fell into ruins, with like effects in several other towns. Huerta writes about the ruins of the town of Sariaya which, during or immediately after the earthquakes, was buried beneath the mud and rocks of a flow or avalanche issuing from the waters of Mount Banahao, the outlet of which had been obstructed by the earthquake of 1730. The earthquakes of 1734 loosened the obstruction and the water of the lake, formed within the crater and augmented by the heavy rains of the	

Event	Felt Effect	Source
	season, rushed through the gorge flooding and materially devastating the plain below. Father Huerta does not make clear whether the flow coincided with the earthquakes or not. After reporting them, he simply adds: "The same year the large lake of Mount Banahao burst and the flood nearly razed the whole town of Sariaya."	
	Intensity - X.	31
	Sariaya - the church and monastery, made of stone, were left totally ruined by the earthquake; all the walls collapsed, coming to earth with all their beams and tiles, shattering the retables and statues, leaving everything buried in a confused mass. The tower totally collapsed and one bell was cracked. Of all the equipment of the church for divine service, not one thing was saved. Water jars were knocking and striking one another and smashing to bits. On the side of the mountain which faces this town, one can see dark openings and deep chasms, various precipices and breaks in the mountain; some remain fixed, others are tumbled down from their old places by the force of the earthquake, together with the torrent of water which the volcano poured forth. From the summit of the mountain rocks of such enormous size rolled down, mixed with trees of immense girth, water and mud, with which they tumbled in confusion. The natives acknowledged that they had never seen or heard of such destruction; it was so great that the town was rendered uninhabitable and its people forced to move to another place and build a new town.	
	Tayabas - the church and the monastery, all of stone, are ruined and destroyed to such a degree that not a thing remains which can be put	

Event	Felt Effect	Source
	to use. The tower, which was very strong, fell. The facade of the main entrance collapsed and tumbled to the ground. The walls were left very cracked. Two sacristans were buried in the ruins, one of whom was suffocated and the other got out only with great effort, alive but badly bruised. All that night, terrifying noises were heard on the mountain; copious floods of turbulent water rushed down, opened new channels, and closed and levelled old ones. For several days, the earthquakes were more or less continuous and more or less strong. The monastery was totally ruined, the walls crushing and cracking everything below. The inscription was shaken from the cross; although it was made of heavy wood, it was loosened from the large and strong wedges with which it was firmly attached to the cross. Lucban - the entire facade of the church collapsed; half the tower collapsed, carrying the bells to the ground. The walls of the church remained standing, but so damaged that they cannot be used. The damage to the sacristies was greater; the walls were totally demolished. The monastery also suffered much, for it was demolished down to the floor, the boards of the walls being thrown out with all the partitions of the rooms and offices. The cracks which threaten complete ruin are terrible, wherefore it is necessary to take the walls down at once. Majayjay - the tower, which was very high to correspond to the height of church, came down with the bells, leaving some open walls above and below, the cracks extending into the foundations. The walls of the church, especially on the side of the monastery were cracked from face to face at the middle with some	

Event	Felt Effect	Source
	other cracks more or less large and deep. Some ran through and some lengthwise, and many from the top down to the foundations. At the junction with the tower, all of the best construction, there was severe destruction because the stones and the keys were pulled apart at various places. No casualties. Deep cracks were made in the mountain which is called Majayjay, on the side which faces directly toward the town, and they extend from the summit down. Lilio - the tower, with the bells, collapsed, and because they fell from such a height, the result was a mass of ruins. Seeing such a jumbled mass of stones in the patio, some in pieces, some entire, and bells mixed in with them, it did not seem that any natural cause could explain it. One of these dislodged pieces landed on one of the corners of the boys' school which was also of masonry and totally demolished it; wiped it out so that it now looks like a pile of dirt. The principal entrance of the church suffered most. The entire sacristy was destroyed. The structure of the monastery is in a dreadful state; the common-rooms and the kitchen are totally destroyed. No casualties. Nagcarlan - the church was wholly ruined by the earthquake; the entire roof with its timbers and tiles came to earth; stones were thrown out from the walls. The sacristy was also totally destroyed. The tower was broken into three sections by terrible cracks. The uppermost section, containing the bells, came down with the entire roof towards the rear. The gaps which divide the bays from top to bottom leave lofty hanging walls and peaks, slit in various parts or else leaning. The monastery was totally wrecked and	

Event	Felt Effect	Source
	one of the servants were killed and buried in the ruins. In several places, the ground is serrated and torn with cavernous openings and landslides. According to the natives, the mountain has dropped more than 50 brazas (about 300 feet). Sta. Cruz - the whole facade of the church and the sanctuary vault and side naves were totally ruined; the body of the church has several cracks in the walls, which threaten the total ruin of all. No casualties. In the pharmacy, many bottles and flasks were broken, with loss of the medicine. San Pablo - ruined. Intensity - X.	45
1770 Dec 9:00-11:00 p.m.	Manila: Violent and destroyed many houses. Within an hour, felt three shocks which caused the author a sudden jump of the heart. Vessels in the bay felt the shocks and thought they had struck the bottom or a reef. Intensity - IX.	31, 45
1771 Feb 01 night	Manila: Violent earthquake which caused damage principally in the place called Ermita. Church of Nuestra Senyora de Guia was considerably ruined; the churches of Recoletos and San Miguel were also damaged. Antipolo - the church sustained much damage. Intensity - IX.	45
1787 July 13 6:45 a.m.	Panay Island: Tremendous earthquake felt in the whole island of Panay on the 13th instant (July) at 6:45 in the morning.	

Event	Felt Effect	Source
	Iloilo - of all the stone churches of this province, only two remain standing, that of Tigbauan and this one of Guimbal; fort was damaged; those of Jaro, Dumangas, Laglag, Passi and Alimodian lie in ruins, and in these last towns, the fate of the churches also befell the parochial houses, which are also of stone. Fifteen persons were buried in the ruins of the church of Laglag. The church of Maasin, although standing, will have to be completely demolished. A number of persons have perished and some have been injured. The two side walls are so fissured that they will fall of their own accord.	
	Santa Barbara and Pototan - wooden churches were destroyed.	
	Capiz - town of Dumalag in this province, the church and bell tower have been destroyed, both of them of stone and separated from one another. In several towns, many houses sank to the level of their floors. Many fissures opened in the earth and out of them came sand of different colours. Some of the mountains have lost their peaks.	45
	In all the churches and convents, numerous bells fell from the belfries and were broken.	
	Intensity - X.	31
1796 Nov 05 2:00 p.m.	Luzon: Cagayan and Ilocos - the earthquake was felt but without damage.	
	Pangasinan - suffered fearful destruction. Nine churches were ruined; the earth opened in different places. The observation that these effects were less and were felt less, as one progressed into provinces more distant from Pangasinan, leads one to believe	

Event	Felt Effect	Source
	that the earthquake was centred there. Baguio - two enormous crevasses formed. One was one hundred and eleven varas (300 feet) long and half a vara wide and its depth was so great that five brazas (some 30 feet) of rope did not reach the bottom; and the second was twenty-nine brazas (about 175 feet) long, two wide, and its depth unknown. Pongot - inhabited by Pagans, a hill of considerable size was levelled and a lake took its place. In other places, sand and water were thrown up from great rifts. Zambales - two churches totally destroyed. Camarines and Albay - the earthquake was perceptible but light, nothing unusual occurred. Manila - some walls were shaken, some houses were split, some arches of the palace were cracked and the barracks of the Royal Regiment were damaged, but none seriously. Water overflowed from troughs and many wells. A large vessel which had been full of water lost three inches of water; the lamps oscillated, and the motion of a carriage at the entrance was that of one which passes over a half-paved street. Inside the house, the main columns which supported the roof were split in two. High seas 33 miles from Manila - on board an English ship, the main mast was jolted upwards and fell on the rail. All parts of the ship creaked. Intensity - X.	45
1824 Oct 26	Manila: Manila and suburbs - severe shocks which demolished several churches, a bridge and many private	

Event	Felt Effect	Source
	houses. Military barracks were levelled to the ground.	
	Guadalupe - the earth opened with a tremendous explosion and, shortly after, shoals of dead fish were seen floating down the river into the sea.	
	San Francisco, Manila - bell tower of the church was ruined. The earthquake caused considerable loss of human life.	
	Cavinti, Laguna; Lucban, Tayabas - churches destroyed.	
	Antipolo - portion of the roof of the church was shaken down and walls damaged.	
	Intensity - IX.	45
1828 Nov 09 6:30 p.m.	Manila: The motion seemed to come from the south and was undulatory. An earthquake which produced rocking and creaking of the house; hanging lamps swung like pendulums in an arc of four feet. People ran out into the streets. The massive gates of the great bridge, one of the entrances of the city, were moved on their hinges by the shock in such wise that a person who was passing at the time thought they were being closed behind him. It made the bells of the churches ring. It lasted two to three minutes. After the earthquake, the river rose to the same height that it reaches in the rainy season and inundated the lowland near its banks. The arches of two or three churches were broken and the buttresses of another were shaken down. The debtors' prison was slightly damaged and many houses were cracked. No subterranean noises were heard. No-one was killed. A correspondent tells that he was lighting a cigar at a lamp when it suddenly swung away from him. He	

Event	Felt Effect	Source
	thought his hat had touched the lamp, but he was quickly undeceived by the next oscillation, when the chair on which he was standing overturned. One person who was riding through the town in a buggy noticed that the water in the gutters washed up first to one side and then to the other. As the motion of the carriage prevented him from feeling the earthquake, he could not imagine the cause of the strange action until he saw all the people on their knees and he stepped out. The ships in the port felt the shocks strongly, as if something had struck their hulls. The damage was not considerable and no-one was killed.	
	Manila - violent shocks; houses destroyed and many buildings damaged. Duration, two minutes.	
	Intensity - IX.	45
1830 Jan 18 5:15 p.m.	Manila: Manila - an earthquake which was at first slight in motion continued with increasing strength. Water from the river came rushing up several feet but quickly retreated and broke upon the opposite bank with a noise resembling thunder and then gradually subsided. Horses, dogs, sheep, goats, turkeys and other animals were in terrible panic, the former rearing, plunging, neighing, howling, bleating, uttering strange sounds and committing strange actions. All these took place within a space not exceeding a minute. No serious damage was done in the city. Inside the house, the floors were covered with fallen plaster, and the walls were all rent. One life lost due to the falling of a stone from a house; but in some of the provinces, where the earthquake was felt more severely, there were several lives lost and much damage done.	

Event	Felt Effect	Source
	Mauban, Tayabas - the church walls and bell tower were badly fissured and the monastery demolished.	
	Intensity - IX.	45
1840 Mar 22 morning	Sorsogon: Sorsogon and Casiguran - the churches as well as the smallest town houses were destroyed; seventeen persons lost their lives and two hundred were injured; and the whole neighbourhood sank five feet below its former level.	
	Albay - church was destroyed by the quake; as a result of the earthquakes, the bottom of the bay of Sorsogon seemed to have undergone some change; the sea has invaded a great part of the beach and the houses which were nearest the shore.	
	Intensity - X.	45
1852 Sept 16 6:30 p.m.	Southwestern Luzon: Manila - an earthquake which began with a gentle shaking movement and changed in a few moments to a north-south oscillation which attained such strength that it moved the pendulum through 31° in its swing. The violence decreased for a moment and then there followed a terrible shaking and at the same time an east-west oscillation of such force that the pendulum mounted to 43°, the duration of the terrible earthquake being precisely one minute. Public buildings, the churches, the monasteries and private houses suffered serious damage, particularly the old church of the Society of Jesus, which collapsed in spite of its strong arches. The country house of Malacanyang has been left in a ruinous condition.	
	Governor-General's Palace - some of the principal walls, arches and columns cracked, several tiles	

Event	Felt Effect	Source
	knocked off. The disaster announced its presence with a subterranean humming accompanied by the creaking of buildings, the shouts of the people, the noise of walls, cornices and roofs which were dislodged and the terror pulled at all hearts. The Spanish brigantine "Romano" felt the quake when at position $17^{o}30'$N, $118^{o}30'$E. Losses to properties are incalculable. Casualties; three dead, one injured. Account of damage to buildings in Manila: Military buildings - the offices present a deplorable appearance which would have been complete ruin if there had been another shock as strong as the first. Barracks No. 4 in the old Society of Jesus - all the walls and columns were weakened; part of the roof has fallen. The great roof of the church contiguous to this edifice collapsed. Barracks No. 1 and barracks of the artillery and No. 2 regiment - suffered but little damage. Meisic - all the columns and walls of the second floor offer a sad sight. Some of the floors show signs of sinking and some have been disturbed in the strongest parts. Malate - the barracks of regiment No. 3 showed appreciable effects of the earthquake in the exterior gallery of the patio. Officers' Pavilion - suffered considerably. Several large cracks in a vertical direction, and one horizontal which cut across most of the 2^{nd} floor, are the most conspicuous effects. Fort Santiago - the thick and solid curtain-wall of the front has opened	

Event	Felt Effect	Source
	in large cracks on the side which faces the sea and also on the land side. Nearly all the arches and lintels of the new barracks are cracked more or less at the joints, and in the said buildings the transverse walls have separated from those of the facade. In the Baluarte of San Domingo - there are several cracks and breaks. Of these, the most serious one is vertical in the exterior wall of one of the arches, which begins at the key and extends to the top of the wall, cutting through a gun embrasure. There was an enlargement of the cracks produced by the earthquake of 1824 and some others in the arches of the cloister of the church. Herrerias - there is an enlargement of the breaks in the arches on the lintels of the communicating doors. They are in a ruinous condition. In the arches of the battery of San Francisco - there is also some slight damage. Almost all the arches of the monastery have been weakened and the church was damaged. Gates of the Plaza - that of the Almacenas has a large crack and in the curtain-wall, contiguous to the said gate, all the arches are displaced. In the Gate of Santa Lucia - there is a crack in the key and the railing of the bridge was broken. In the arches of the Royal Gate - there are cracks in the entrance and exit gates. In the Parian Gate - some of the posts at the end of the bridge were weakened.	

Event	Felt Effect	Source
	Nagtajan - some cracks of dangerous size in the arcade, some stones of the roof being displaced. Ecclesiastical structures;	
	The archiepiscopal palace - this building suffered very little; only one arch of the balcony and one wall of the patio were broken.	
	The cathedral - the two last arches of the lateral nave were broken where they joined the front wall, and the latter was badly cracked and separated from the roof in some places by a space of three or four fingers. One section of the dome has been somewhat damage and an old crack in the exterior wall of the sacristy has noticeably increased.	
	San Agustin - this structure has suffered considerably, the two walls of the stairway cracking from top to bottom. The vault also cracked. The wall of the church cracked in four places; the vaults of the church, sacristy, tower cloister and the arches of the entrance suffered similar damage.	
	The Society of Jesus - the roof and the two spacious and beautiful galleries completely collapsed.	
	Recoletos - the facade of the church suffered some minor damage.	
	San Juan de Dios - the new church suffered very little but the old one has two cracks of considerable size. The stone arches of the tribune and those of the upper part of the altar of St. Anthony were very badly cracked.	
	Pandacan - almost all the roof the church and part of the rectory have been ruined.	
	San Fernando de Dilao - the church	

Event	Felt Effect	Source
	and rectory of this town have been rendered useless. Sampaloc - the church was somewhat weakened; its walls and arches have cracked and the whole roof was destroyed. Paranyaque - the church of this town had cracks in many places and some of them are horizontal. Tondo - the facade of the church was damaged. San Miguel - the tower of this church has been rendered useless and some of the walls have cracked. Third Order of Sampaloc - damage similar to that suffered by the San Miguel Church. Third Order in Manila - the facade was cracked and the tower was destroyed. Beaterio of Santa Rosa - this building has been damaged to such degree that it may be necessary to remove the nuns to another place while repairs are being made. Buildings of the State: Slight to considerable damage was suffered by the following: Santa Potenciana - little damage. The Great Bridge - the key of the arch of the 3rd span suffered the only noteworthy damage. Several other keystones and some other arch stones have slipped in their positions; some slight cracks can be seen which traverse one or other and in the direction of the axis. Cemetery - residence of the Chaplain presents a sight of ruin; all the side walls and partitions, some portions of the facade and roofs	

Event	Felt Effect	Source
	were totally weakened. Supreme Court - plaster was dislodged and one main beam was broken in one office. Cigar factory of Binondo - columns have been smashed by the motion of the main beam; one of them was cracked and very much broken and the roof was appreciably damaged. Cigarette factory of Arroceros - the enclosure around the whole area of the cutting machine was completely ruined. The two machines have been jolted out of position and the whole foundation has moved about two inches towards the river; a buttress between two arches was cracked and demolished. The storehouse which covered a large area was completely detached; the tiles of the penthouse moved toward the ridges and vice versa; the channels cross above the covers. The roof of this house is in complete chaos; it cannot be described better than to say it appears to have been bombarded. The Country House of Malacanyang - damaged quite a bit in its walls, entrance hall and partitions. The roof had suffered enough to render the structure uninhabitable. The Princesa cigar factory - damage confined to spalling, an insignificant crack in a partition wall and the dislodgement of one stone from a parapet. Consistorial Houses - suffered considerably; the railing has been displaced and almost all the 2nd floor has been cracked horizontally. The walls of the facade have been displaced out of their vertical position and consequently have been detached from the transverse walls, leaving everything in bad condition.	

Event	Felt Effect	Source
	Moreover, the ceiling has been shaken and large vertical cracks can be seen in the walls, in several arches, and near the doors and windows.	
	Tax Office - two partitions were thrown completely out of place.	
	Royal Customs House - badly damaged.	
	Military Hospital - some deep cracks in its walls, spalling and one interior wall demolished.	
	Provinces: Orion - the church, tower and parish house were ruined. Tower completely demolished.	
	Orani - the entire roof, the choir and part of the tower of the church fell. The parish house, tobacco house and that which was formerly for wine, have suffered much.	
	In the district of the Sea, near the capital - a crevasse opened more than 7,000 varas (over 3 1/2 miles) long, one metre wide and black sand appeared (1/2 metre long and one metre wide); no persons injured.	
	Obando - the parish house has several arches cracked; the main wall facing south was thrown out of the plumb.	
	Cavite - all the buildings in the town were damaged seriously, especially those of the arsenal and the royal house. One of the eight sides of the telegraph building was cracked horizontally and there are two vertical cracks extending to the 2nd floor. In the infantry barracks, most of the posts have been dislodged. Some stones have been slightly moved, and three tie-beams in two rooms show cracks. The former church of the Jesuits was spared by the earthquake in spite of the fact	

Event	Felt Effect	Source
	that the bell tower, which leaned against the facade, was cracked from top to bottom. The house occupied by the supervisor was of very poor construction; through it the earthquake swept swiftly in all its walls, posts and partitions; the whole second floor was left in a very bad state, chiefly because its frame had been weakened by termites. Old Cavite - one of the beams supporting the roof broke and this caused the last wall to break for a length of six varas (5 1/2 yards) and the west wall for ten varas (about 9 yards). San Roque - part of the chapel and walls of the cemetery were demolished. Balayan, Batangas - one third of the roof of the church collapsed, the tower was damaged and the two bells fell. The parish house was cracked. Many cracks opened in the ground (40-50 cm wide) and emitted much water, odorous mud, and sand. In the church, the roof sank to the transept, and two houses sank in spite of their posts, because the ground opened. Taal - the weather vane, cupola and railing of the tower fell. Casaysay - the railing of the church fell. Lubang, Mindoro - the entire church and the tower fell. Santa Catalina - the walls fell and likewise its battery. Tilic and Tacbac forts - the forts fell and all the houses of the town and suburbs were tilted in a remarkable manner. The bridges collapsed. The earth sank in several	

Event	Felt Effect	Source
	places, producing cracks as much as half a vara (over 16 inches) in width and of unknown depth.	45
	The centre of this destructive earthquake appears to have been in the Taal Volcano. Many fissures were opened in the earth around the volcano. Damage to buildings was great in the provinces of Manila, Cavite, Bulacan, Laguna, Tayabas and in the island of Mindoro.	39
	The inhabitants all ran into the streets, expecting every moment the houses to fall into ruins. In one of the strongest houses, an occupant writes that the lower storey did not move much, but the upper one swayed to and fro, to use his expression "like a blade of grass in the wind". The noise made by the breaking of walls, the falling of furniture, and the cracking and creaking of the timbers was such as to impress every-one with an exaggerated idea of the destruction of property. At each shock, the great bell of the cathedral tolled, followed by all the bells of the city. The damage to property was considerable, though the loss of life was small; only three or four lives are known to have been lost. Almost every stone house suffered more or less, according to its strength; nearly all the government barracks, the customs house, colleges, palace, theatres, and many private dwellings were rendered completely uninhabitable. Two churches were destroyed. One, the oldest in Manila, founded nearly three hundred years ago by the Jesuits, very large, with walls and arches four feet thick, was thrown down into one immense mass of ruins. The movement was not slow and gradual, like a long heavy swell, but a quick succession of short sudden shocks. The effects of the shocks were	

Event	Felt Effect	Source
	different in various parts of the island. At Mariveles just across the bay from Manila, the earth opened with an eruption of black sand, which covered the country to a considerable extent; how large the opening was at the time is not known, but it is now seven hundred yards long and one yard wide.	
	Intensity - IX.	13
1863 June 03 7:20 p.m.	Manila: Destructive earthquake consisting of vibrations followed by oscillatory movements.	
	Manila - shook down strongest edifices, completely destroying the structural richness of this capital and spreading ruin and desolation everywhere.	
	Cathedral - the tower was left in a dangerous condition. The capitulars, the chanters and the chaplains were enveloped in the ruins and all perished where they stood on the Epistle side; but those on the other side found themselves in a cavity which the large beams of the roof, which fell there, made with the wall of the choir. Converted into a mass of shapeless ruins. The movement of oscillation was followed instantly by the fall of a part of the roof; the ruin was completed by the last motion in a different direction. The Palace of the Captain General suffered the fall of parts of the roof and all the walls were shaken out of plumb. The house of Peele, Hubbel and Company, solidly constructed and with its lower part formed of arches of cut stone, which had passed through some strong earthquakes, without damage, collapsed in a second. The lower parts of the house remained standing but were no longer habitable. The ground along the river bank opened.	

Event	Felt Effect	Source
	In the Bay of Manila - a wave coming from SE to NW. It struck with such force that it came over the deck which it covered completely. The frigate shook and shivered strongly as if it had struck bottom. The water boiled around the ship in strong convulsions and it appeared whitish. On the side of the land, a flame rose up, which danced on the water like a ball for one minute.	
	Church of Santa Isabel - roof and walls were completely levelled to the ground.	
	Santo Domingo - the disaster was complete. The facade was dislodged; one tower fell and the other is leaning and will have to be taken down; the church is likewise leaning; the greater part of the monastery is in a ruinous state.	
	Military Hospital - heap of debris and, in its fall, many of the sick were killed.	
	The churches of San Francisco, San Juan de Dios and the Recolets are left useless for divine service.	
	The Colegio de San Jose and the Convent of Santa Catalina and Santa Rosa are on the point of falling. The tower and facade of the minicipal building and the magnificent structure of the Chamber of Commerce threaten to fall out. The edifices which housed the Royal Audiencia, the Intendencia, the Council of Administration, the Customs and other public activities have in part collapsed or are ruined.	
	Private buildings - the greater number will need much repair and many ought to be demolished for the general safety. (Buildings abandoned) Among all the churches in	

Event	Felt Effect	Source
	Intramuros, Mass can be celebrated only in San Agustin. Binondo - the famous tower has fallen, as also part of the church and the adjacent cigar factory. The number of victims in Binondo was 145 and there were 39 injured. Divisoria - the whole upper part of the fish section fell, burying 40 persons more or less. Sta. Cruz - the church and part of the general prison were left in a ruinous state. The dead were 35 and the injured, 32. Quiapo - suffered much in its buildings, very few of which remain habitable. Victims were 23 dead and 2 injured. Tondo - almost all the buildings called "possesiones" were demolished, burying 23 persons. San Miguel - suffered the least in injuries to persons; only 10 Chinese injured. Of the buildings of the Army - the only ones left standing are the barracks of Malate, the park of the Engineers and the barracks next to the Royal Gate. In the Fortin - there were many casualties. In the Meisic barracks - two men and 40 horses were killed. According to a resume, there were 298 persons killed, exclusive of those in the Cathedral, 218 injured. The ruined public buildings numbered 46; those on the verge of ruin, 25. The public buildings destroyed were 570; those on the verge of ruin 528; total number of buildings rendered useless, 1,172. The garrison of Manila suffered 15 killed, 88 injured and 41 bruised.	

Event	Felt Effect	Source
	San Gabriel - a fissure was found which gave off some gases and from which issued a sound like running water. In the vaults of the Commercial Warehouse the ground opened for a length of 20-40 varas (55-110 feet). Cracks of vaults were perpendicular to this fissure.	
	Sangley Point - a crater opened and emitted water and dirt.	
	Cavite - a barracks collapsed, the telegraph tower fell, and nearly all walls were cracked.	
	Pasig - the great stone bridge which joined the two banks of the Pasig was closed. Lighthouse was considerably damaged.	
	Pasig, Tambo and Navotas - the masonry buildings were either thrown down or rendered uninbahitable.	
	Antipolo - part of the tower of the church was demolished.	
	Lubang, Mindoro - strongly felt in this town.	
	Damage to church structures, cracked walls and demolished bell towers at: Taguig; Cainta; San Mateo; Bocaue; Polo, Bulacan; Santa Maria, Bulacan; Bulacan, Bulacan; Malolos, Bulacan; San Rafael, Bulacan; Angat, Bulacan; San Isidro, Bulacan; Guiginto, Bulacan; Lubao, Pampanga; Macabebe, Pampanga; Bacoor, Cavite; Maragondon, Cavite; Las Pinyas, Cavite; Cabuyao, Laguna; San Pedro, Laguna; Tanay; Pililla.	45
	At 7:25 p.m., a severe earthquake with tremblings shock waves and loud subterranean rumblings took place. The cathedral roof fell in, burying a large part of the worshippers; some were killed and hundreds were wounded. In the great square, the	

Event	Felt Effect	Source
	Governor-General's palace was unroofed and his family barely escaped with their lives. Most of the churches were rendered useless; lofty towers fell, killing many persons whose fate was tolled on the bells by unseen hands. Almost all the public buildings were levelled, or left uninhabitable; nearly every private house suffered more or less damage, though, as a result of improved methods of construction, the loss of life was less than in previous catastrophes. The shock lasted only half a minute. The ground opened in many places, giving forth gases, and the water in the river became dark and noisome. Everyone fled to the light and elastic palm thatch houses of the suburbs for safety.	14
	Cavite - in the port, the earthquake caused great destruction. On the peninsula of Canyacao fissures opened; one near Sangley Point is especially reported as a crater emitting sand and water.	
	Laguna - light damage at Sta. Cruz, Pila and Pagsanjan.	
	Morong - great damage in the churches, convents and municipal buildings of all towns. The fall of the upper portion of the Antipolo tower injured. three persons.	
	Bulacan - this province suffered also heavily; nearly all the towns had their stone buildings destroyed. All the public and private stone buildings were damaged. Two bridges greatly damaged. In the soil, large fissures ejected sand and water.	
	Bocaue, Baliwag, Santa Maria, Malolos, Guiginto, San Isidro, Quingua, Bigaa, Angat and Polo - sustained similar ruin of churches and other stone buildings. Fissures	

Event	Felt Effect	Source
	in the soil were also reported from Sta. Isabel and Bocaue. Near Angat a fissure opened about a meter wide and more than four kilometres long.	
	Nueva Ecija - not much damage; but in the district of San Agustin, near San Jose, in the Talavera River, a fissure opened which emitted sand and water.	
	Pampanga - the provincial building of Bacolor reported much damage; nearly all the walls were cracked and the roof ruined. The municipal building of Arayat, under construction, much damage also.	
	La Union, Nueva Vizcaya, Ilocos Sur and Lepanto - the shocks were strongly felt but did not cause any damage.	29
	South Luzon - destructive earthquake occurred without any previous shocks; some persons distinguished vertical movements followed by three or four tremendous jerks in different directions, N-S and E-W. Many were said to have seen the air luminous over the city of Manila; on both sides of the river the ruin was appalling; no fewer than 47 public buildings were ruined and 25 much damaged; 570 private houses ruined and 528 more or less damaged; total 1,170 structures. The most lamentable was the ruin of the Cathedral in which 16 persons perished. The total number of deaths in the city was about 320. No fissures were reported in the Walled City, excepting in the Commercial Warehouse; a great one which emitted sand and water opened at San Gabriel in the Trading Quay. The Grand Bridge was nearly destroyed, had to be pulled down and the bridge of Spain built in its place. It is remarked that more damage occurred near the river than far from it.	31

Event	Felt Effect	Source
	The most lamentable effect of the shocks was the destruction of the three aisles of the Cathedral at an hour when the canons and other people were conducting a religious service. All the persons seated on the west side of the choir, nine priests and seven singers and service boys, perished under the falling timbers and debris of the cupola, ceilings and roofs, while those sitting on the east side rushed at the first movement towards a passage through the lateral wall of the choir where they remained safe, and afterwards were able to get away under the timbers of the lateral aisle, which, leaning on the same wall of the choir, left a narrow exit. The pillars of the main aisle and the upper portions of the lateral and front walls all came down. It is stated that the water in the bay receded from Manila to Cavite and returned from that direction; it is not said whether the return was with force and whether it flooded the shores. As an indication of such outward movement; little is added, except that a frigate anchored in deep water felt the impression of grounding and a boat in ten fathoms touched the bottom.	27
	Tayabas - very strong earthquake, but no damage occurred, except at Lucban where the roof of the church sustained some dislocation.	
	At Mauban, part of the roof of the Municipal Building, already condemned as unsafe, caved in.	
	Principe or Baler District - strong earthquake with a repetition between three and four o'clock of the following morning.	
	Camarines and Mindoro - the shocks had only moderate intensity.	

Event	Felt Effect	Source
	Central area - it comprised the provinces of Morong and Manila, at present Rizal Province, Cavite, at least as far as Cavite Port, Bulacan, eastern Pampanga and south Nueva Ecija.	
	Intensity - X.	31
1865 Oct 19 night	Southeastern Luzon: A strong oscillatory earthquake preceded by a terrifying noise. Its direction was NW-SE.	
	Tiwi - a masonry pillar was broken in the fort of Cajo, and three corners of the municipal building, which is of lime and brick construction, have opened; it was cracked in many directions and an arch has fallen.	
	Luban - the bridge of Luban, 408 feet long and more than 33 wide, had sustained cracks of considerable size and a hole had opened in the middle of an arch. Two hundred and nine houses have been rendered useless. A large hole had appeared in the bridge going to Tiwi. The old municipal building was tilted, the bell tower has come down; there are many cracks in the church, notably in the floor. The monastery was tilted and its balcony has fallen, the stone wall has fallen on two sides and several persons suffered bruises and slight wounds.	
	Tabaco, Albay - the municipal building was cracked in various directions and several heavy beams have been dislodged. In the stone church under construction and in the old bell tower there are many fissures, and four main arches have fallen. A part of the stone gallery of the plaza has fallen. Fissures can be seen in the church; in the house of administration, the main walls have separated and the timbers	

Event	Felt Effect	Source
	of the gallery were disjoined.	
	San Vicente - greater part of the land was covered with holes, recently opened, out of which water came. A stone wall and a stone warehouse have fallen.	
	Malilipot - the municipal building has been cracked in various places. The Great Bridge of Bulanan remained impassable.	
	Bacacay - two sides of the school have fallen.	
	District of Iraya - in the churches and parochial houses of Libon, Palangui and Oas, several cracks had appeared and as many as 14 houses have fallen.	
	Ligao - in the church of Ligao, new fissures had opened and the old ones had widened.	
	Guinobatan - enormous quantities of earth have come down from the hills on to the road and had closed the principal route in that section.	
	District of Rinconada - churches and municipal buildings had suffered considerably.	
	Iriga and Nabua - the towers have fallen. The church of Nabua was rendered unserviceable. Some houses on swampy ground have collapsed.	
	Intensity - IX.	45
1869 Aug 16 3:00 p.m.	Southeastern Luzon and Eastern Visayas: Masbate - animals were terrified, domesticated birds flew around in an unwonted manner, and the sea was disturbed; the motion of the earth was E - W and so strong that all were frightened and threw themselves out of the houses in spite of the fact that they did not	

Event	Felt Effect	Source
	offer any danger as they are built of wood, bamboo and palm thatch. The few masonry buildings were considerably damaged and the others were tilted; the statues in the church turned on their pedestals, and in private houses nearly every thing was jolted out of place. Large trees fell; cracks of great width opened in the south of the island of Masbate, and there were slides in the hills and on the steep sea-coast. A small island, among the many at the north end of Ticao, is said to have disappeared.	
	Tacloban, Leyte - an earthquake was felt in this capital with N-S oscillations lasting about 20 seconds.	
	San Pascual, Burias Islands - an earthquake of moderate intensity with NE-SW oscillations.	
	Albay - strong rotary and oscillatory earthquake which lasted 25 seconds. Later, there were some less important movements. These earthquakes have not caused any damage except in the beautiful church of this capital which is on the verge of ruin because of its damaged arches.	
	Nueva Caceres - a strong earthquake was felt in this province. Its duration was 15 seconds and it began as rotary and ended with NW-SE oscillations.	
	Samar - strong earthquake lasting 16 seconds.	
	Intensity - IX.	45
1869 Oct 01 11:15 a.m.	Southern Luzon and Mindoro: The first earthquake for which the records of the Manila Observatory give the results of an instrumental observation. Time: 11:35 a.m.	

Event	Felt Effect	Source
	Duration: 60 seconds. Direction: SSE-NNW. Amplitude: NNW, 15^{o}; SSE, $12^{o}15'$. There were no personal injuries except some bruises. The buildings have sustained some damage and some are left useless, but none has fallen. Manila - facade of St. Augustine's church cracked. Administration of Rents, part of roof collapsed and doors and windows damaged. One wall in the house of Smith, Bell and Company fell. House of Ramirez damaged. House on Calle San Jacinto down. A shop at the side of the church of San Gabriel down. Shall balcony of No. 25 Guiotan, House of La Peninsular, roof damaged. Cuartel of Arroceros damaged. The steamer "Iloilo" was near Maricaban at 11:30 a.m. and a strong shaking was felt and then another, and others which made it seem that the steamer had gone on the rocks. Porac, Pampanga - on the first between 11 and 12 a.m., a strong earthquake was felt in this capital. There were three SE-NW oscillations, each one lasting from 15 to 20 seconds with intervals of five or six seconds. Bacolor, Pampanga - a very strong earthquake with duration of more than a minute. Part of the roof of the public school fell; there was some damage to the tower of the church of Sta. Ana and there are several cracks in the municipal building of Arayat. Balanga, Bataan - almost at noon, a strong earthquake was felt in this province. The oscillations were NW-SE and of long duration. The damage to buildings can be quickly repaired. Iba, Zambales - at exactly 11:00	

Event	Felt Effect	Source
	a.m., a strong earthquake of some duration was felt in this capital. Cavite - the rooms of the old infantry barracks have fallen and the other public and private buildings of this port have sustained damage. As a result of the rush of employees to get out of the cigar factory, six suffered slight injuries. The fall of one of the shops in the arsenal injured five. San Roque - the arches of the dome of the church under construction fell without causing any personal injury. Bacoor - the vault of the church fell and destroyed the main altar. Silang - some of the church walls fell. Indang - some of the monastery walls fell and two large cracks appreared in the tower of the church. Naic - cracks in the bell tower. Morong - a strong earthquake was felt which began with N - S oscillation and lasted 30 seconds. Batangas, Batangas - at 11:30 a.m., a strong earthquake of 40 seconds' duration was felt in this province. Vibratory and oscillatory motions were perceived. The strongest masonry buildings have been damaged, especially the tower of the church, the public market, and the administration building. Batangas: Bauan - church tower fell and main walls cracked. Columns turned round. Taal - church tower tilted; church cracked in spite of its location on rock.	

Event	Felt Effect	Source
	Nueva Caceres - long, light oscillastions, WNW-ESE.	
	La Union - weak oscillation, scarcely perceptible.	
	San Isidro, Nueva Ecija - or the first, 3rd, and 5th, earthquakes were felt in this capital, the first being very strong and the last two moderate, none of which caused damage.	
	Vigan, Ilocos Sur - at 11:30 a.m., a strong earthquake which lasted some seconds.	
	Sta. Cruz, Laguna - a strong earthquake which lasted more than a minute. It began with a vibratory motion, then followed violent oscillations in a SSE-NNW direction. There was no damage to buildings.	
	Lingayen, Pangasinan - a strong N - S oscillatory earthquake in the whole province. Its duration was one minute, 30 seconds. The towns which have reported have not sustained any damage.	
	Mindoro - an earthquake on the first which began in a terrifying vibratory manner and continued with oscillations for three minutes and 30 seconds.	
	Bulacan - on the first of this month, there was a most horrible earthquake which lasted more than a minute, and it caused the following damage in this province.	
	Malolos - the building occupied by the government has been damaged by cracks in its arches and main walls so that it is necessary to support them. The tower of the church is on the point of falling, part of it having been destroyed. The roofs of the church and rectory have been	

Event	Felt Effect	Source
	damaged. Cracks have opened in the principal bridge of Atlag. Several stone houses and warehouses of the district are in a ruinous state and some houses of bamboo and palm thatch have been destroyed. The tower of the chapel of San Jose district has fallen. The tower of the church of Sta. Ana, the facade of Bayombayan and the two inside arches of the church of Sta. Inez and two private houses are in a ruinous condition. Paombong - besides the destruction of the minucipal building, large fissures have opened which emitted burnt gases, water and sand. The main wall of the rectory was cracked, and the entrance of the chapel of the Capitangan district has fallen, as also the bridge of Caitocong, and those of Caiybon and Calariate have been destroyed. Sta. Isabel - one wall of the kitchen of the rectory has fallen, and the front is in a ruinous condition. The chapel of the Mabolo district is also in bad condition, and its entrance has fallen. Pulilan - the tower is in a ruinous condition, part of the rectory roof has fallen. Barasoain - fissures, from which water and sand issued, opened behind the church. An arch and the tower adjoining the church have fallen. Some stone houses have been damaged and a man was injured on the head. Some stone warehouses have fallen. Bigaa - the roof of the municipal building was greatly damaged and the building was rendered useless. Quinga - large fissures have opened and the posts of the municipal	

Event	Felt Effect	Source
	building were cracked to such an extent that the structure is next to useless.	
	Hagonoy - the stone house for the reception of corpses has been destroyed.	
	Baliwag - the municipal building was rendered completely useless.	
	Boac, Marinduque - at 11:45 a.m., a strong vibratory earthquake was felt which lasted more than a minute. Several partitions and also the plaster in the municipal building fell.	
	Tayabas - between 11 and 12 a.m. on the first, an earthquake was felt in the capital and in some towns of this province. It began moderately, but after an interval it increased its force. No damage of any consequence was sustained.	
	Baler - an earthquake which lasted 75 seconds. It caused no damage because the houses are of bamboo and palm thatch.	
	Antique: San Jose de Buenavista, San Remigio, Patnongon, Bugasan - between 11 and 12 a.m., a light oscillatory earthquake which lasted about three seconds.	
	Intensity - IX.	45
1871 Nov 05 8:45 a.m.	Mindanao: Surigao - oscillatory, violent, lasting five minutes. The walls of the church were damaged notwithstanding the fact that they are three varas (over 8 feet) thick; destructive.	
	Davao - violent oscillatory and rotary earthquake lasting two minutes. Motion E to W. Difficult to remain standing. Light oscillatory aftershocks at 9:20 and 10:15.	

Event	Felt Effect	Source
	Cebu - oscillatory, moderate, lasting 50 seconds.	
	Intensity - IX.	45
1871 Dec 08 5:30 p.m.	Cotabato - violent, oscillatory, N to S and E to W, lasting 20 seconds. All buildings levelled to the ground. Half an hour later, there was a more violent shock which completed the ruin left by the former. Vibratory aftershocks all night. Continuous trembling all day on the 9th, with two shocks much stronger than the others. No habitable house left in the town. Deep subterranean noises; an earthy odour perceived by all. Some destruction in Pollok.	
	Intensity - X.	45
1873 Nov 14 5:30 p.m.	Southern Luzon: Duration of four seconds; direction, E 20^{o}N - W 20^{o} S.	
	Manila - somewhat strong. Began with a subterranean noise, but weaker than the former.	
	Morong - an oscillatory earthquake from N to S was felt in this capital. It lasted about four seconds. There was an aftershock in the morning of the 15th.	
	Batangas - a light earthquake which lasted 30 seconds was felt in this province. At 1:30 a.m. on the 15th, another of the same duration but less intensity was felt.	
	Sta. Cruz, Laguna - an oscillatory earthquake was felt in this capital. A few minutes later, there was a vibratory aftershock, moderately strong, which damaged the roof of the capital building and the public prison.	
	Tayabas - an earthquake from N to S	

Event	Felt Effect	Source
	was felt in this capital and in some towns. It lasted five seconds and opened some cracks in the walls of the municipal building in Mauban and in some houses of brick and mortar in Lucban. Albay - an oscillatory earthquake was felt in this capital. It was from E to W and lasted 25 to 30 seconds. Daet, Camarines Norte - a strong earthquake was felt. Its motion was oscillatory from SE to NW ending with a vibratory motion. It lasted about 20 seconds. In the government house, some of the walls of the single masonry section were cracked. Talisay - in the municipal building of Talisay, the columns supporting the roof have turned round. Sta. Cruz, marinduque - a strong earthquake which was oscillatory from E to W and lasted three or four seconds. The higher roof of the church was loosened and some tiles were dislodged from the lower roof on the left side. There were earthquakes again at 7:00 and 11:00 p.m. and at 9:00 a.m. on the following day. They were less intense and lasted one or two seconds without causing any further damage. Boac, Marinduque - the earthquake was felt with the same oscillation and intensity (as in Sta. Cruz) but with a duration of 18 seconds. A partition in the municipal building fell, as also part of the roof and balcony. San Pascual, Burias Island, - an oscillatory earthquake was felt in this island. It was moderately strong from N to S and caused some damage in the military headquarters, in the parish house and in the	

Event	Felt Effect	Source
	church.	
	Intensity - VIII.	45
1877 July 06 3:55 p.m.	Southeastern Luzon: Daet, Camarines Norte - there was another moderately strong earthquake. As a result of this earthquake, (including that of July 5) the government house, condemned many years ago, has suffered considerably, especially the part which was built in the rear prison; all the walls were cracked and some stones have been thrown out of place, and it remained in a condition which threatened complete ruin. Some private buildings have been moderately damaged. Milaor - moderate intensity. The walls of the church and rectory were cracked and the facade of the church has suffered, some stones having fallen from place. San Jose - the wall of the church has some cracks and some glass windows were broken. Nueva Caceres, Camarines Sur - in this capital, and also in some other towns, there has been some slight damage to stone buildings. A great number of clocks stopped during the earthquake. A great number of clocks stopped during the earthquake. That there was not more destruction can be attributed to the fact that the oscillations did not change their direction.	
	Intensity - VIII.	45
1879 July 01 2:55 a.m.	Mindanao: A very violent oscillatory earthquake was felt, which lasted approximately one minute, the direction N to S. Three stone buildings with tile roofs in the town withstood the shocks, although two of them, the Governor's house which was condemned several years	

Event	Felt Effect	Source
	ago because of the poor condition of its framework and the Administration building suffered numerous vertical cracks in the walls of the ground and upper floors; the floors were tilted and as a result some doors and windows were jammed. The damage consisted of tilting of buildings of good material and the partial sinking of old ones. The town church, which has fairly thick walls of coral limestone reinforced with timbers, suffered considerable damage in spite of the fact that it is roofed with galvanizd iron. Wide vertical cracks appeared in the east and west walls, especially from the lintels of doors and windows upward. A horizontal crack runs thé whole length of the north walls a little more than a metre above the level of the floor. The rest of the buildings in town, all of wood, palm thatch and bamboo, suffered damage of little importance. Surigao - sinking of the shore of Bilan-Bilan, port of the town. The drop is said to be one foot. Movable objects were thrown down. The transept and the two lateral aisles have suffered most (church). Many stones have fallen. Statues of St. Joseph and St. Ignatius fell from their places. It is certain that the hills have been greatly disturbed and many rocks have fallen. Nine miles S of Surigao - there were signs of fissures 4 to 6 cms wide. A few houses, all of palm thatch and bamboo, showed significant tilting which revealed the intensity of shaking as greater than in Surigao. In the mining village of Cansuran, inclinations of 25 and 50 degrees from the vertical were measured. Cansuran Valley - observed some slides of stratified rock along the banks, but of small extent.	

Event	Felt Effect	Source
	NW from Surigao - conspicuous and recent landslides at the steep point of the coast and some large fissures were seen	
	Anaoaon - felt very violent shocks; of its 40 houses of wood and palm thatch, 26 collapsed and the rest were so greatly tilted that most of them had to be reconstructed; two wooden bridges in the town were rendered useless.	
	South of Anaoaon - an open plain about 1,500 metres long and 500 metres wide. This plain suffered a drop of about 50 cms over its whole area without noteworthy damage to the houses or trees. At one place, a new spring of drinkable water appeared. According to reports, the inhabitants of the place heard a subterranean noise, apparently advancing from the south with increasing intensity. According to reports, the mountain range separating Lake Saponan from Pacific - fissures of greater dimensions had opened and landslides of greater volume had occurred than at Pt. Bilaa.	
	Mainit - in some places, the earth opened more than four varas (11 feet), leaving deep gashes, and in other places, one vara (33 inches). In the lake, one point near the town disappeared completely and where before there was a beautiful beach there is now a depth like the centre of the lake, the earth quivered with vibratory motion with moderate frequency, the clothes closet fell but no damage. The house was tilted and one end sank a few inches; the windows fell into the street and one wall was cracked. Very little that was breakable escaped damage.	
	Intensity - X.	45

Event	Felt Effect	Source
1880 July 18 12:40 p.m.	Luzon: The Observatory's Bulletin of General Observations noted: "Horrible earthquake". A rather strong earthquake which caused damage in the following places: Casiguran - experienced same incident as in Baler where altars of the church were damaged. Morong - strong earthquake causing damage. Part of the roof of the municipal building fell in; the floor of the school was damaged. Tanay - parts of the roof of the church and retory were damaged and there were some cracks in the walls. Pililla - the tower of the church was damaged, as also part of the roof and there was serious damage in the rectory. Binangonan - there were cracks in the church and rectory. There was minor damage in the municipal building and in the house of Don Francisco Fuentes. Cainta - part of the church roof has fallen and there were cracks in the walls of the church and rectory. Nueva Caceres - very strong earthquake of more than a minute's duration. No damage. San Isidro, Nueva Ecija - strong earthquake which caused the death of 4 persons and damage to structures. Vigan, Ilocos Sur - a strong oscillatory earthquake from SW to NE. It lasted about 80 seconds and produced some small cracks in masonry buildings. Baler, Principe - a terrible shock with direction SE-NW followed by rotation and vibration, ending with	

Event	Felt Effect	Source
	an oscillation from S to N and from W to E, all in the space of a little more than a minute. It tilted eight houses of light material and caused the fall of standing or hanging objects. One person suffered a severe wound. The church, the rectory and the municipal building, roofed with light materials, have sustained cracks in their thick walls of masonry. Some walls in the sacristy fell. Large crevices opened in the fields, from which water and sand issued and damaged some crops; an abandoned masonry watchtower on a hill was completely wrecked; slides in the mountains can be seen. Continuous disturbance of muddy waters of the rivers.	
	Angono - fall of strongly-built partitions in the church and cracks in the facade. The government house was completely wrecked.	
	Taytay - the church and rectory had suffered, the walls of the church cracked and stones and tiles dislodged from the roof.	
	Antipolo - the church and rectory have suffered considerably.	
	Boso-Boso - part of the church tower has fallen.	
	Jala-Jala - the sugar storehouse has fallen and the sugar was ruined; the hacienda house has been rendered all but uninhabitable.	
	Laoag - strong oscillatory shock from the SW.	
	Calasiao, Pangasinan - one wall of the parish house slightly cracked.	
	Jacinto, Pangasinan - there were three large cracks in the church, one in the facade and two on the sides and one in the rectory; the	

Event	Felt Effect	Source
	partitions of the latter have fallen.	
	Iba, Zambales - a strong oscillatory earthquake. Its exact duration cannot be given because the clock stopped, but it is estimated to have lasted more than a minute. The oscillatory movements were so strong and long that a terrible panic was caused.	
	Pultoc, Abra - oscillatory, moderate, E - W, 3 seconds, subterranean noise like thunder.	
	Talalan - vibratory, strong, SE - NW, 20 seconds, subterranean noise.	
	Candon - vibratory, strong, N - S, one minute.	
	Benguet - vibratory, oscillatory, strong, E - W, one minute.	
	San Fernando, La Union - oscillatory, rotary, strong, N - S, 70 seconds.	
	Dagupan - oscillatory, rotary, very strong, E - W, one minute.	
	Lingayen - vibratory, oscillatory, strong, E - W, one minute and 50 seconds.	
	Bolinao - oscillatory, strong, NE - SW, one minute.	
	Tarlac - oscillatory, strong, N - S, 30 seconds.	
	Bacolor - oscillatory, violent, NW - SE, 15 seconds, some buildings damaged, one person injured.	
	Jaen, Pampanga - the parts of the upright timbers of a church with light palm thatch roof were thrown up vertically out of their bed-holes to the surface, the whole structure	

Event	Felt Effect	Source
	about 12 metres long and 10 metres wide, falling down almost without damage.	
	San Fernando, Pampanga - oscillatory, strong, SE - NW, 12 seconds.	
	Corregidor - oscillatory, strong, N - S, one minute.	
	Bulacan - oscillatory, violent, 90 seconds.	
	Cavite - oscillatory, strong, N - S, 55 seconds. The government house, church, rectory and telegraph office fell; in the shipyard, the black sand rose around the piles.	
	Canyacao - cracks appeared, from which fine sand and dirty water issued.	29, 45
	In the midst of this commotion of 1880, it is said that the barometer gave no indication of atmospheric disturbance. Where my friends resided in San Miguel, the shock was especially violent. The households were at breakfast, and of course left the table in a hurry seeking the outside air, some by the window and some by the stone staircase; one was caught by the falling roof, and sustained injuries which required amputation of an arm at the shoulder. Most of the rear part of the house, on the riverside was so damaged that it remained for a long time untenanted.	
	In San Antonio, near the city, for the length of more than four miles and a width of 350 feet, the ground opened in many places. Some portions were raised five or six feet and others were equally depressed. The "Diario de Manila" went to press in the middle of the street, its building being considered unsafe.	

Event	Felt Effect	Source
	The city was turned into a tented field, and the river and bay were densely peopled. Everything that had wheels or could float was loaded with persons and property seeking safety. Palace and prison, church and shop, street and bridge, house and hut, barracks and hospital, were alike prostrated and rendered useless. Manila - about 30 public buildings (government buildings, churches and convents) and 200 private residences were damaged by the shocks. Tile roofs suffered the most, and their fall in many cases caused the principal damage which occurred in the upper storey of the houses and the tops of the walls of the churches. One of the San Agustin church towers was ruined. Mr. J. Centeno attributed the worst damage to faulty construction and the need of repairs, and adds that public buildings suffered less than private houses, because their construction and state of repair were better. All the bridges of the Pasig River; Espanya, Suspension Bridge and Ayala Bridge withstood the shocks without appreciable damage. Crevasses in the ground were produced only on the banks of the river, estuaries and a few on the sea shore. The largest opened along the Malacanyang grounds parallel to the river; many were reported from the estuaries of Binondo, Sta. Cruz, and Quiapo; similarly from Pandacan, Sta. Ana and also from Canyacao, Cavite. None occurred in the Walled City. The ground in the recent alluviums along the Rio Chico, and from Bongabong to San Isidro, and the region towards the W and SW, lying betwen the Chico and Grande Pampanga Rivers, was crevassed, cut and sunk in the most capricious and fearful way, the towns and suburbs of this region sustaining the greatest destruction.	

Event	Felt Effect	Source
	Intensity - X.	14, 29
1880 July 20 3:40 p.m.	Luzon: A very strong aftershock of the 18th July earthquake. Duration of 45 seconds. Restinga - vibratory, oscillatory strong, E - W, 40 seconds. Cavite - vibratory, oscillatory strong, one minute. Binyan - oscillatory, very strong, E - W, 30 seconds. Church, municipal building and all masonry buildings ruined, some personal injuries. Lipa - strong, E - W, seven seconds. Manila - tower of the cathedral fell. The Magellan monument damaged. Sta. Cruz, Manila - part of the roof of the church fell; large crack in the wall. Quiapo - church damaged. Bagumbayan - cracks in the barracks. A mast disappeared from the "Rocdee", sunk in the bay. Balicaquin, Zambales - parish house and others were cracked and some persons sustained wounds and bruises. Caused great damage in the towns of Tunasan, Binyang, Sta. Rosa, Pateros and Taguig; great destruction. Guadalupe - stone vault of the church was destroyed. Sta. Mesa and San Juan - underground reservoir and the conduits of the Manila waterworks, then nearly finished, did not sustain visible damage.	29, 45
	There came a series of very violent shocks, throwing the community into	

Event	Felt Effect	Source
	despair and terror and paralyzing the progress of the province. The shock began in Manila with tremblings and complicated movements continuing for seventy seconds. This shock was more violent than the first (18th July) and completed the destruction which the first had caused. Surprise gave way to terror, and the people fled by land and river to the country. The bed of the river Pasig was disturbed with an upheaving of a dark fluid of a sulphurous odour, but without damage to the bridges. In many places within the city, the soil cracked, with the eruption of fine sand and dirty water. Eye witness report: After hearing the first sound, which was if hundreds of carriages were being dashed to pieces on a broken pavement, an incomprehensible faintness was experienced, causing a feeling of nausea, with inability to fly from the danger. It was as if one were on the deck of a vessel, tossed by the waves, instead of a building of stone or timber, on the ground. Mingled with this came strange rumblings, as if rocks were rolling and resounding over deep abysses and sharp clashing as of glass shattered, caused by the rolling of furniture on the bare floors and the breaking of mirrors and chandeliers. When sense returned a rush was made to the stairs and balconies, into the courtyards, streets and squares, under arches or wherever seemed a place of safety. The disturbance extended to the suburbs of the city and in fact to most of the islands where the soil appeared like the waves of the sea. Trees were uprooted, and towns and villages, amid clouds of whitish dust, became a chaotic mass of ruins. Every animal exhibited signs of terror. Pigs, dogs, poultry, even lizards, felt the impending danger, and	

Event	Felt Effect	Source
	united in loud and unnatural noises. Horses stopped in the street, standing with ears erect, with staring eyes, and stiffly extended legs as if conscious of extraordinary peril. The natives would give no response to appeals for help but, careless of consequences, were either seeking safety themselves or were on their knees in the highway and squares, with other timorous Catholics around them. After the calamity, fallen tiles left exposed the skeleton ribs of the house roofs; hanging beams and swinging rafters threatened to fall upon the passerby. A suffocating dust filled the air; broken arches, leaning walls, blinds in fragments, piles of useless furniture and shapeless heaps of stone met the eye in every direction. Dwellings open to the sky, a general ruin was everywhere. Stone houses were abandoned for the thatched huts of the suburbs. An earthquake undoes in a minute the work of centuries, and even in a few seconds makes a city look as if sacked by a besieging enemy. The silence was interrupted only by an occasional cry for assistance, or the crack of a falling building; man is exhausted, and inanimate nature sleeps after these geological catastrophes.	
	Intensity - IX.	14
1881 Sept 30 10:40 a.m.	Nueva Vizcaya: September 30, 1881 at 10:40 a.m., "I was proceeding on horseback from Aritas towards Dupaz accompanied by an assistant officer, Don Enrique de Almonte. When passing through the village of Tambong belonging to the latter of these districts, we heard (approximately towards the north) thunder, so perfectly similar to that of atmospheric storms that I glanced up, looking at the thick clouds	

Event	Felt Effect	Source
	overhanging the summits of the surrounding mountains. But hardly five seconds afterwards, our horses stopped, spreading out their legs to assume a more stable attitude, and staring about in a frightened manner. We then suddenly felt a sharp vertical movement followed by a horizontal one, which was so decided that we saw the road and the surrounding ground move about a metre on each side of our horses' heads, which served as a point of observation and comparison in as much as they tended in virtue of their inertia to keep steady. At the same time, the ground swelled and continually during the movement, opened and shut in a multitude of small cracks from one to three millimetres in width, through which the waters of the puddles sank. All this was accompanied by a peculiar noise produced by the undulation and by the movements of the bushes and the canes which formed the fences round the houses, which were swinging and shaking against one another. This phenomenon lasted from 30 to 35 seconds after which the former calm and silence succeeded, broken only by the prayers of the Indians and the tramping of our horses as they resumed their march. All shocks have not presented such distinct and noticeable oscillations as that I have just mentioned, this kind of earthquake being generally confined to the north and south parts of the provinces (Abungol and Caraballo). That we felt it so strongly on the 30th was undoubtedly to be explained by our passing along the northern slope of the great Caraballo. The peculiar and true nature of the shocks, especially in the centre of the province, is that the sensation is almost absolutely vertical, comparatively slight, and of short duration, except in cases of greatly prolonged seismic	

Event	Felt Effect	Sourc
	activity when the shocks follow almost without interruption. Such continuation of shocks is probably due to different and distinct vibrations, but this effect is nevertheless that of a very prolonged earthquake. The thunder, which always precedes the shock by a few seconds, is heard most distinctly towards the middle of the province in the neighbourhood of Bambang. The most important circumstance is that the interval between the sound and the movement is always shorter, the nearer the observer is to that town, and especially when on the surrounding heights clear of the deadening effects of the valley's alluvium. The sound of the shock and the movement, although perceptibly successive in these places, become very often mingled together. On the other hand, towards the frontiers of the province, there are observed: first, a sound of subterranean thunder; second, an interval of rest and quiet, sometimes of five or six seconds; and third, a vertical shock accompanied by a noise which we may call the "squall" of the seismic waves, followed without interruption by a horizontal movement oscillation. When we observe the cracks produced in the masonry buildings of Bambang, we also come to an analogous but more certain conclusion. But above all, in order to give the theory of Mallet its proper place in our own deductions, we must note that the walls of the buildings exclusively employed in this province do not contain any tie-work (which so much tends to divert the direction of breaking lines) but are composed of irregular blocks of stone united with mortar generally of such excellent quality that it is difficult to break even wih a mason's hammer. It is also very important to remember that	

Event	Felt Effect	Source
	while cracks produced in the buildings of villages at a distance from Bambang show, more or less visibly, an inclination to the horizon, in this town they are perfectly horizontal; so that for instance, two complete cracks in its church-tower divide the tower into three complete distinct blocks which have not yet fallen, partly doubtless on account of the excellent material, but principally from the circumstance that the shocks sustained by the tower were purely vertical movements; while it is most probable that if a horizontal shock had occurred the upper portions of the tower would have fallen. This town has also suffered much other damage in its masonry buildings. Of the few others it is possessed of, the Tribunal was very seriously damaged; one of the schools is full of cracks while the other has fallen. The monastery was entirely in pieces, and the church had suffered severely. It is to be noted that all these buildings were roofed with "cogon" (tiles) Simultaneous occurrence of sound and movement at Bambang."	
	Intensity - VIII.	1
1885 July 23 10:45 a.m.	Mindanao: Dapitan - there has been considerable material damage. Some houses have fallen and others were tilted. The government houses have suffered quite a bit. The rectory suffered but little. A terrifying earthquake according to natives. No casualties. Some houses collapsed, some were broken. Great damage to the Command Headquarters and at the Tribunal. Slight damage to the convent.	
	Cavite - the church has been left in bad condition and some wall panels fell at Ilaya. Great damage.	

Event	Felt Effect	Source
	Dipolog - large landslides in the hills. The statues, ornaments, and steps were thrown from the altar and it was miraculous that the tabernacle did not fall, for it turned around on the table of the altar. Everything on the floor of the rectory turned. The earthquakes are still making great waves in the ground like waves in the water, opening large cracks in a NE - SW direction. Large cracks opened in many places and emitted a quantity of water. Terrifying and very strong. All statues fell down from the altar, except for the takenacle which just rolled over the altar. In the convent, everyghing fell down. The strongest tremor was felt in the NW and SE which caused "alon-alon" on land and, in the NE and SW, fissures in the ground. Isabela, Island of Basilan - the earthquake was felt in the same way in Zamboanga and Cotabato. A strong oscillatory earthquake, E to W was felt. It stopped a clock, but no damage was done. Cebu - strong earthquake of long duration. It rang a bell in the cathedral and stopped various clocks. Haya - large cracks in the earth; water coming out. In mountains there were landslides.	45, 49
	This quake had its epicentre near the northwestern coast of Mindanao. Great damage was done to buildings, fissures opened and displacements of the ground occurred throughout the district or quasipeninsula of Dapitan. A competent and careful observer, who was very particular about noting the direction of the seismic wave, as well as in the innumerable aftershocks, said that it is from NW - SE, i.e., land-	

Event	Felt Effect	Source
	inward from the seacoast. He likewise notes that the principal fissures had a SW - NE direction. These facts locate the focus of the disturbance in the sea, opposite the NW coast.	
	Intensity - X.	21
1889 May 26 2:23 a.m.	Luzon and Mindoro: Calapan, Mindoro - terrible earthquake which caused general awakening. The houses jumped enough to break the posts and it was feared that the earth would swallow up houses and all. Plates, bottles, vases and lamps were turned around. The tower of the church was damaged. Followed by some aftershocks.	
	Canyacao - earthquake of considerable intensity and duration from N - S. The "Butuan", which was on the cradle, vibrated strongly in all directions and the crew jumped as if on springs and slid hurriedly down the planks to the walls.	
	Batangas - strong, oscillatory, vibratory earthquake which lasted 40 to 50 seconds and damaged the government house, the rectory, the jail, the royal house, as well as private houses. It also damaged the tower of the church. A subterranean noise was heard.	
	Cavite - strong, oscillatory, N - S, 15 seconds.	
	Corregidor - strong, oscillatory, N - S, 6 seconds.	
	Mariquina - oscillatory, then rotary, strong, 45 seconds.	
	Morong - strong, 45 seconds.	
	Montalban - strong, N - S, 40 seconds.	
	Balanga - strong, oscillatory, 50	

Event	Felt Effect	Source
	seconds. Bulacan - vibratory, oscillatory, SW - NE, five seconds. Bacolor - strong, oscillatory, NW - SE, 40 seconds. San Fernando, Pampanga - strong, 20 seconds. Cabanatuan - strong, rotary, 20 seconds. Dagupan - oscillatory, three seconds. Additional reports from Batangas: In several places in the province, the ground opened in cracks. The beautiful church of Bauan has also suffered severe damage. The tile roof was badly damaged and down in part and has been replaced with iron. The people say this earthquake was stronger than those of 1863 and 1880, but of shorter duration. Punta Santiago - strong, oscillatory, E - W, 20 seconds. Taal - strong, oscillatory, N - S, three seconds. Calamba - oscillatory, subterranean noise, 30 seconds. Tayabas - moderate, oscillatory WSW - ENE, 25 seconds. Restinga - strong, oscillatory, N - S, ten seconds, preceded by subterranean noise, second shock caused the bay of masonry on the north side of the observation tower to crack from top to bottom. Mareograph observation: the mareograph indicates waves in the apparatus of more than 10 cms and a rise of level of a little less.	

Event	Felt Effect	Source
	Cryptophone: the instrument for detecting underground noise could not be used before the earthquake but, immediately after, it transmitted sounds like rough strokes. This momentous occurrence announced its approach with deep sounds like distant cannonading, almost producing the effect of a strong wind squall. This feature was noticed perfectly by an assistant in the observatory who was on the balcony to make the 2:00 a.m. observation. A gentle movement followed immediately and, in a few seconds, changed into a distinct oscillation, producing indescribable sensation by the movements from the different directions. After these complex motions, two surges of intensity were noticed with a change of direction, the force decreasing until a perfect calm prevailed. The area of maximum intensity embraced the southern part of the province of Batangas and the northern part of Mindoro.	
	Intensity - VIII.	45
1890 Feb 07 12:30 a.m.	Samar and Leyte: Catbalogan - on the 7th, this town was shaken by a strong earthquake which alarmed the entire district. The people ran into the street lest they be buried in the ruins of the houses. The force of the first rang bells, broke glasses and lamps; tables, closets and other furniture were overturned. The houses swayed from side to side. The light construction of the houses prevented casualties.	
	Barugo, Leyte - the earthquake was strong, the horrible vibration lasting a minute; as the people left their houses, they noticed cracks opening and closing in the ground. The confusion was very great, for some tried to escape into the open to avoid harm from the houses, while	

Event	Felt Effect	Source
	others were trying to get into the houses to avoid the opening abysses. Everything breakable was smashed. Stone buildings were damaged and cracked, some so much as to be rendered unserviceable. Almost all bridges from town to town have fallen; some streams changed course and others have disappeared. The church has suffered very much.	
	Intensity - VIII.	45
1892 Mar 16 9:01 p.m.	Pangasinan: At 9:00 p.m. (16th March), a very pronounced subterranean noise heralded a terrible phenomenon. Almost immediately a frightful movement of the ground began, first oscillatory, then vibratory, and finally rotary; first E - W and then N - S. The duration cannot be given accurately because it seemed like a century. According to reports, it lasted about one minute, during which there were subterranean noises and ringing of church bells due to the swinging of the tower. All were seized with panic. From that moment until the present, the earth has been trembling, sometimes at intervals of hours, at times oscillatory, at times vibratory, sometimes gently. During the first and strongest of the many shocks, the church tower and the kiosk in the plaza twisted on their foundations.	
	Mariquina - very strong, vibratory, followed by oscillatory and rotary, 25 seconds.	
	Manila - strong, commencing with light vibratory motion followed by oscillations, sinking a part of the roof of a small house at San Pedro Street, at the corner of Bilibid Prison.	
	Montalban - moderate, oscillatory, N - S, 20 seconds.	

Event	Felt Effect	Source
	Morong - moderate, first rotary then oscillatory, N - S, 40 seconds.	
	Cavite - great intensity, 50 seconds.	
	Balanga - strong, oscillatory.	
	Capones Island - oscillatory, NE - SW.	
	Agua Santos - rotary, 30 seconds.	
	Sta. Cruz, Laguna - first, weak, vibratory; second, strong, oscillatory, E - W, 25 seconds.	
	Calamba - moderate, oscillatory, SE - NW, 25 seconds.	
	Tarlac - strong, vibratory, oscillatory, ten seconds.	
	Iba - strong.	
	Olongapo - very strong, long.	
	Bolinao - strong, oscillatory, N - S, 40 seconds.	
	Vigan - strong, oscillatory, vibratory, S - N, 50 seconds.	
	Tayabas - moderate, oscillatory, E - W, 20 seconds.	
	Lingayen - strong, oscillatory, vibratory, W - E, one minute. The government house was damaged, the church tower was tilted, considerable damage in the court house, cracks in the jail, central part of, and beams in, the Melendez Bridge damaged, some damage in the school of the Dominican Sisters and in private houses.	
	Bulacan - first vibratory, second oscillatory, WSW - ENE, great intensity.	

Event	Felt Effect	Source
	Sibul - strong, N - S and E - W, 55 seconds.	
	Carig - strong, oscillatory, NE - SW, 40 seconds, light oscillatory, aftershock.	
	Bayombong - strong, first vibratory, rotary with subterranean noise, second oscillatory, NE - SW, two minutes.	
	Lal-lo - great intensity, oscillatory, N - S, 50 seconds.	
	Pantabangan - strong, oscillatory, SSW - NNE, 50 seconds.	
	San Isidro - strong, rotary, ENE - WSW and NNE - SSW, two minutes.	
	Cabanatuan - violent, 40-50 seconds.	
	Tuguegarao - strong, first rotary, second oscillatory, N - S, 55 seconds.	
	Batangas - moderate, oscillatory, short.	
	Taal - moderate, E - W, 16 seconds.	
	San Fernando, Pampanga - strong, oscillatory, E - W, 45 seconds.	
	Bacolor - several seismic undulations in the night, variable intensity (9:05 moderate, oscillatory, NE - SW, one minute, subterranean noise).	
	Daet - moderate, oscillatory, NE - SW, 12 seconds.	
	Sual - strong, NE - SW, 40 seconds.	
	San Fernando, La Union - very strong, vibratory, oscillatory, one minute.	
	Laoag - moderate, 50 second.	

Event	Felt Effect	Source
	Bangued - very strong, vibratory, NE - SW, 15 seconds.	
	Bangued - very strong, vibratory, NE - SW, 15 seconds.	
	Ilagan - moderate, oscillatory.	
	Candon - strong, oscillatory, N - S, 35 seconds.	
	Dagupan - part of the court sank, the rest rendered useless; girls' school and pharmacy of Sr. Saston damaged; bridge of Bagoas made useless; masonry houses damaged; cracks in the ground, giving out water and black sand.	
	Sta. Barbara - walls and facade of the church and court cracked; doors and partitions fell; central pier of the Mora Bridge sank;	
	San Jacinto - all stone structures, church and tower, court, girls' school, private houses damaged. Goibel and Capay bridges damaged; road leading to towns of Mangaldan and San Fabian passable only to pendestrians because of transverse and longitudinal cracks; archives, documents, etc. buried in the wreckage of the court.	
	Mangaldan - church, tower, cemetery, chapel and rice warehouses collapsed, court, bridges and culverts of Guidonyan, Bantayan and Anolid damaged; numerous cracks in the ground giving out water and sand. The earthquake was horrible, especially the first, which seemed to move the walls as if they were fragile bamboo and made the bells ring lugubriously. The rectory has not fallen, but it is rendered useless; it was all stone; it has miraculously not fallen, but it was completely riddled. The movement was very strong, E - W; N - S. Part of	

Event	Felt Effect	Source
	the tower fell and the rest was completely riddled even to the foundations; half of the church fell in huge blocks. Most of the telegraph poles and the kilometre posts were down.	
	San Fabian - floor of court sank, walls cracked, damage to Cayanga and Balangombong bridges, large cracks in the ground.	
	Malasiqui - several houses damaged.	
	Mariaoag - public school for both sexes sank; damage to facade of church, court and to bell tower in Binalonan. Court demolished completely; Justice Francisco Garcia perished in the ruins. Girls' school, rectory, chapel and cemetery walls destroyed completely. Other buildings, even those of light material, suffered damage. Wide cracks in the town, roads and fields; water and sand issuing.	
	Calasiao - bridges of Morosay, Gabon, San Pablo and Malibago rendered useless; facade of church damaged, ceiling of rectory fell, statues fell, boys' school down, large cracks in walls of church and court; ground cracks, water and sand issuing.	
	Asigan - court, church, old rectory and new rectory under construction ruined; bridge over the Agno river useless; cracks in the ground.	
	San Carlos - church and sacristy damaged, cracks in towns of Amorter, Amangloang, Mageagoin and Bayamban; Alcala bridge impassable, cracks in walls of court, church and rectory.	
	Pozorrubio - 20 houses and five granaries of light material sustained damage; damage to rectory and cemetery, cracks in the ground.	

Event	Felt Effect	Source
	Benguet; Sto. Tomas; region to the NNE - cracks and landslips. Baguio; Trinidad; Itogon - destruction of houses in the populated centres. Trinidad Valley - alluviums were much crevassed in all directions but chiefly in the direction of the river. La Union - all the principal buildings such as churches, convents, schools and municipal houses of nine towns, generally built of strong materials, were either destroyed or much damaged, chiefly in their principal upper floors; native structures of wood and lighter materials sustained also great damage. Landslips in steep hills and much fissuring in alluviums were likewise conspicuous. Fires started at several places. Intensity - IX.	45, 28
1893 June 21 3:30 p.m.	Mindanao and Southern Visayas: Jativa, Davao - almost completely ruined in spite of the absence of masonry houses. Large number of houses (bamboo) collapsed and some wooden houses ruined. House posts off at the ground. Impulses from SW were so strong that they forced the ground to the NE. Long wide cracks opened in the town and the surrounding country. Near the river, the ground dropped 1.7 metres in some places. The oscillations continued almost without a break for 30 minutes. Davao - preceded by loud noise from N to S; oscillations of great force; statues and tabernacle thrown down in the church; window shades thrown from their grooves; small cracks in walls.	

Event	Felt Effect	Source
	Pollok and Catabato - strong, more than a minute.	
	Misamis - very strong, light shocks until end of month.	
	Butuan - very strong, water tank in garden half emptied by oscillations, W to E; duration one minute.	
	Linabo - very strong, subterranean noise, objects fell.	
	Clavijo - town completely ruined and the soft soil so torn up by water that it is impossible to rebuild. In front of the town, the river had been dammed by tree-trunks and abandoned rafts so that only two small channels were left open; these were blocked by the caving banks and the river flooded the surrounding land.	
	Talacogon - great damage in the rectory; statues overthrown in the church; houses damaged; land sank along the river bank; waves in the river like a squally sea; many aftershocks.	
	Surigao - moderate, oscillatory, E - W, more than a minute.	
	Taganan - moderate, oscillatory, WSW - ENE more than a minute.	
	Cebu - moderate oscillations from the south.	
	Intensity - X.	45
1897 Sept 21 1:15 p.m.	Mindanao: Zamboanga - a furious earthquake with oscillatory and vibratory motions. The vibratory motion was evident because the lamp in the church threw its glass into the air, and the statue of the Sacred Heart, which is of natural size and at the feet of which is the Holy Family group, was thrown from	

Event	Felt Effect	Source
	its niche and fell without touching the other statues. The oscillations were from east to west. The posts of the old rectory have the ground separated from them in a circular space of about ten cms on the surface. The pictures on the walls were jumping and swinging and the partitions were cracking in all directions. The earthquake caused destruction of the house. At the first shock, the entire facade of the residence fell into the street. A cloud of dust was rising around. The exterior of the church towers, nine metres high, constructed of thin brick, divided by strong crossbeams of molave, all fell, leaving one of the posts which had broken at the bottom hanging suspended in the air. The upper partitions of the towers were loosened. Almost all the walls of the church fell out and others remained hanging. The stone walls either fell or were so badly damaged that it was necessary to destroy them. The statue of San Luis remained standing in the centre of the church. The walls of the new section of the rectory suffered some cracks and they will have to be demolished, but the framework and the masonry are perfectly good and, although only half completed, it has been our refuge in these fearful days. For eight days the earthquake, more or less strong, have not ceased. The beautiful walls surrounding the rectory and church ought to be knocked down, for the pillars of brick have been cracked and are out of line. The walls of the cemetery chapel are slightly cracked. In the church of Sta. Maria, the facade and part of the walls, all of stone, are cracked and there is probably no remedy except to demolish them; the central arched ceiling is intact. With few	

Event	Felt Effect	Source
	exceptions, all stone buildings have been so much damaged that some are in a state of ruin. The fort of Pilar has been cracked in places, endangering some of the interior buildings. The military hospital is in a bad state. The engineers' headquarters is uninhabitable. The house of the governor was tilted toward the street. The marine headquarters was almost destroyed. The courthouse suffered greatly. The schools are in a bad state, especially that for girls. A subterranean noise preceded the strong earthquake. An immense crack in Magay, extending from the sea to the interior of the country, and many other cracks were giving out black water with a sulphurous odour.	
	Basilan - very strong and long earthquake with aftershocks continuing for eight days. Damaged the fort and several stone houses.	
	Jolo, Sulu Archipelago - of great intensity and lasted two minutes, E - W with many aftershocks. The sea wave rose and fell every fifteen minutes.	
	Siasi; Bongao - felt with many aftershocks.	
	Jolo - shock, oscillatory, aftershocks at intervals of ten to fifteen minutes for 24 hours.	
	Maibung - the ground opened. Report from "Brutus", steaming north from Zambales: A strong earthquake felt, moderately long, with three aftershocks.	
	Dapitan - an oscillatory earthquake, NW - SE, lasting 50 seconds. No cracks in the buildings.	
	Cotabato - an intense earthquake lasting 70 seconds.	

Event	Felt Effect	Source
	Iloilo - an earthquake less intens than that of the early morning bu longer, lasting 70 seconds, oscillatory, E - W.	
	Capiz - various directions, especially SW - NE, longer and weaker than preceding.	
	Passi - moderate, oscillatory, E - W, 85 seconds.	
	San Jose - oscillatory, barely perceptible, seven seconds.	
	San Joaquin - moderate, oscillatory, SSw - NNE, 80 seconds.	
	Negros - felt with same force as in Iloilo. A person crossing a bay in the afternoon of the 21st felt the shock and the force of the waves almost capsized the boat.	
	Intensity - IX.	45
3:15	Mindanao: Almost as strong the preceding earthquake. A phenomenon occurred which caused great panic. The sea was seen to rise and fall with great suddenness and after a few oscillations it invaded the town with its waves, although it did not pass beyond the first buildings. The small boats on the shore were driven rapidly and left high and dry. The effects were seen in Jolo, Isabela, San Roman, Recodo and other places. The cause might have been some great movement in the bottom of the sea. A person on a boat anchored in Sibuguey Gulf said that the water rose and lifted the boat with its two anchors, endangering it several times.	
	Zamboanga - a wave rose which flowed eastward to the coast, reaching it in about ten minutes.	
	Bolong - there was a crack fifty	

Event	Felt Effect	Source
	meters long and one metre wide, from which water and black sand issued with sulphurous odour. Most of the church fell and parts which did not are out of plumb; half the rectory fell. Ayala - the church has been cracked in several places, the tower is in ruins. Tetuan - there was damage to the partitions in the rectory, the tower is on the point of falling, the large bell is out of its sockets; one cemetery wall fell. Mercedes - the tower next to the rectory fell, also a great part of the stone facade of the church; some partitions and doors of the rectory fell, leaving the house in bad condition. Isabela - the front, which was constructed thirty years ago, was left in bad condition as also are the other principal buildings. The sea destroyed twenty-five houses. Tetuan River - two hills alongside the river fell. When the wave came in, it had such force that it rolled great timbers and blocks of masonry. The wave came about half an hour after the earthquake; it rose about six metres above normal level. The wave rose and fell more than thirty times, and yakal timbers, six meters long, were carried along. The market was carried away by the sea. Some lives were lost in the Moro ranches; at Tagu, two injured; at Panigayan, eight houses washed away; at Balawan, five dead, six injured; at Tabotan, three dead, six injured; at Matiban, three dead, houses down. During the sea wave, the water receded from 200 to 250 metres; 'it returned ten minutes later, became normal before 9:30 p.m.'	

Event	Felt Effect	Source
	Tawi-Tawi - according to the Moros, the island of Damei disappeared in the middle, leaving two islands with a channel between.	45
	Two hours later, another lighter shock and immediately afterwards came the sea tides and waves at Zamboanga; the swell occurred two full hours after the big earthquake; many times the awful waves advanced rapidly into the town and even swept some places which were 20 feet above sea level. Small craft lying near the shore were thrown out of the water and even some ships at anchor were carried to and fro. All the inhabitants began to flee to look for a safer place inland. All along the coast, west of Zamboanga, the waves invaded the shores with the same fury and on retreating swept away many native houses. On the Island of Basilan was experienced the same disturbance, but sooner than at Zamboanga. The waves were higher than at Zamboanga, probably because the latter was protected by the flat island of Sta. Cruz lying in front of its harbour. The waves began to rush against the island some 30 minutes after the earthquake, and swept away some Moro villages on the western coast, and the market and other houses situated near the wharf in the town of Isabela. The gunboat "Lezo", at anchor in the harbour, was carried by the flood waves and had a narrow escape. The waves advanced against the coast and retreated many yards beyond the tide line, with the same rapidity, at least thirty times. There were many victims.	
	Jolo - the seismic tide began some 15 minutes after the earthquake shocks. The first movement was an ebb, the water retreating farther than the low limit, then it rose again with tremendous fury,	

Event	Felt Effect	Source
	repeating the process six or seven times. No damage was caused by the waves, because their velocity and height was less than at Basilan and on the west coast of Mindanao. Extraordinary sea movements were noticed all along the southwestern coast of Negros, the southern coast of Paragua, the eastern coast of Borneo, and one might say on all the islands and lands facing the Jolo Sea.	
	Tubigan (Island) near Pangutaran - a crevasse or channel was opened, dividing it into two parts.	
	Intensity - IX.	39
1897 Oct 19 7:52 a.m.	Luzon and Visayan Islands: Laoang - 17 houses destroyed; people could not keep their feet during the earthquake. This region was shaken by violent shocks that, according to old inhabitants, were the strongest in 80 years. The shocks were preceded by clear and perceptible sounds which frightened all. All the public edifices, churches, rectory, schools and court which were spared by the typhoon have been damaged by the earthquake and some have collapsed. The first shock lasted 45 seconds. Shortly afterwards, a second shock threw down the statues and cracked the entire church of Oras.	
	Catubig - courthouse tilted, partition walls down, building unserviceable, most houses tilted.	
	Biliran Island - for two days, earthquakes have been felt continuously, too strong to allow sleep and alarming everyone and preventing ordinary work. Fear was increased from the fact that the island of Biliran is a place where there are mines of sulphur, iron and pitch.	

Event	Felt Effect	Source
	Oras, Samar - the facade of the church, the rectory, schoolhouse, courthouse and bridges destroyed.	
	Calbayog, Samar - on the 19th and 20th of the month, four violent, two strong and about 38 light earthquakes, all NE - SW except one on the 20th which was NNE - SSW.	
	Catbalogan, Samar - there was a very strong earthquake which many feared would cause the houses to collapse. A half-hour later, there was another shock and then they continued for 24 hours, keeping everyone in a state of tension.	
	Albay - 7:52 a.m. to 11:00 p.m., earthquake, more or less strong felt continuously.	
	Sorsogon; Tabaco; Daet; Guinayanga; Cebu; Iloilo - shock of 7:52 a.m. also reported.	
	Nueva Caceres - moderate, oscillatory, rotary, N - S, five seconds.	
	Sulat; Borongan; Tubig; Catubig - the conditions are the same as in Laoang. It is estimated that the houses tilted 25^{o} in the oscillations of the earthquakes, comparable to a boat in a heavy sea.	
	Manila - perceptible, one minute, S - N, SE - NW.	
	Intensity - IX.	45
1902 Aug 21 7:17 p.m.	Mindanao: Laguna de Lanao - a very violent earthquake. Houses were thrown down, fissures were opened in the earth.	
	Malabang - very violent, fissures were opened in the ground, which gave forth large quantities of water and disagreeable gases; one of the	

Event	Felt Effect	Source
	canals dried up or changed course, and many native houses were thrown to the ground.	
	Misamis - very violent, followed by four others, separated by short intervals; direction, SW - NE.	
	Cotabato - an oscillation in the direction WNW - ESE was very strong, some of them almost violent; the pendulum described an arc of 12°; duration was 30 seconds.	
	Dapitan - an oscillatory earthquake of moderate intensity, which lasted four seconds. It was accompanied by subterranean sound lasting two seconds.	
	Davao - an earthquake with both horizontal and vertical movement in a NW - SE direction. The pendulum described an arc of 5°; movement lasted some 45 seconds. The earth movement was preceded by a dull subterranean sound, which seemed to proceed from NNW; the sound began 30 seconds before there was any perceptible movement of the earth. Inside the houses, objects of furniture were moved about, clocks stopped.	
	Zamboanga - fairly strong shock.	
	Jolo - strong oscillations were felt in the direction NE - SW lasting quite a long time.	
	Caraga - light oscillatory earthquake, NW - SE.	
	Dumaguete (Negros) - light oscillatory earthquake, ESE - WNW, duration about 12 seconds. After the earthquake, a strange sound was heard like the sound made by a violent hurricane or the dull noise of a distant waterfall.	

Event	Felt Effect	Source
	Tagbilaran (Bohol) - oscillatory earthquake, very light, lasting three seconds.	
	Iloilo - slight oscillatory earthquake, SE - NW, lasting some six seconds.	
	Cebu - slight earthquake, SW - NE, lasting five seconds.	
	Intensity - X.	46
1907 Nov 24 9:59 p.m. & 10:11 p.m.	Camarines: Ambos, Camarines - earthquake of Intensity IX. The mesoseismal area of this earthquake comprised only the southeasternmost part of the region. It was followed by a second shock of Intensity V or VI and by numerous small ones during the night until the next day. The towns that suffered most are those to the south of Iriga Volcano and along the Quinali River. Within this area, nearly all the stone buildings which successfully withstood the earthquakes during April 14 of the current year fell to the ground; many fissures opened in the ground and huge landslides occurred on the mountain sides.	
	Intensity - X.	19
1911 July 12 12:09 p.m.	Agusan Valley: Talacogon - there took place a very violent earthquake which wrought great havoc in the convent and church. The creaking of the beams was something awe-inspiring; doors and windows were wrenched from their hinges. Both in the church and in the house, not only light objects, but also quite heavy pieces of furniture were rolling about on the floor, statues from the altars, candlesticks, cumbersome chests, pictures, jugs and jars, etc., everything going to pieces. The houses in the town remained tilted to one side. The earthquake threw down many big	

Event	Felt Effect	Source
	trees; in the hemp plantations, placed on sloping ground, numerous and extensive landslides were produced, some of them carrying down five hundred and more plants (these plants are set in rows three metres apart, thus each hectare contains from 800 to 1,000 plants). The damage caused by the earthquake both to houses and ground was found to be equally serious in all the districts. In one of the lakes, the high waves produced by the earthquake invaded the shore and penetrated far into the land.	
	La Paz - suddenly, there arose some waves of such dimensions and confused directions that the oarsmen needed all their skill and strength to prevent the capsizing of the boat. In the village of La Paz, they found church and houses unroofed and the walls fallen to the ground. Many dwellings remained permanently tilted and were in bad shape, while three had been destroyed completely. The ground showed many and large cracks. It must be borne in mind that the church and houses mentioned in the preceding lines were constructed of wood, bamboo and palm thatch.	
	Bunauan - it is known that the banks of the river and other water-courses caved in, in many places, carrying with them trees and other obstructive materials and blocking the navigable channels which connect Bunauan with Clavijo and Veruela.	
	Veruela - there occurred an earthquake of frightful force; the ground moved so violently that the swaying houses remained at the end permanently inclined; none, however collapsed. (They are, without exception, constructed of bamboo and wood, held together by rattan). The ground showed waves like those of	

Event	Felt Effect	Source
	water, and the commotion of the waters of the river was imposing. The ground was fissured everywhere and in many places of the river formed quite extensive banks of mud and sand, leaving not enough depth for small boats. During three days, the river water was so muddy that it could not be used for any household purposes.	
	Butuan - violent earthquake of oscillatory and trembling character; observed directions: S - N; SW - NE, and ESE - WNW; duration about two minutes. At first, nobody took much notice of the phenomenon as, for many seconds, the movements were of little intensity, objects swaying but slightly. But thereafter, the earth shook so violently that everybody rushed into the streets in terror, the violent movements lasting about 50 seconds. Within the houses, everything movable went skidding about the floor. Nearly all the houses were damaged and even in the church and convent portions of partition walls came down which were of masonry with wooden trusses, the greatest damage being on the west side. Two houses of the town fell toward north and the upright posts of one were lifted about one foot out of the ground in which they were embedded. Of a variety of objects such as pictures, chairs, lamps, etc., some were thrown toward east, others toward west. Some large trees whose trunks were partly rotten came down. Several fissures opened in the direction NE - SW.	
	Hinatuan, Boston, Baganga, Caraga - the shocks appeared to have come from several directions, as the bells and lamps of the church had a circular motion. The earthquake was even more severe in the north of Caraga.	

Event	Felt Effect	Source
	At Baganga, it opened two fissures close to the wharf; at Boston, it brought to the ground a massive stone wall which formed the facade of the church and had a thickness exceeding two varas (1.68 metres).	
	Davao - the earthquake was very strong; it stopped clocks, caused church bells to ring, and produced general alarm, principally on account of its long duration of one minute and five seconds. The movements were mainly in the directions NNE - SSW, and ENE - WSW. The earthquake was much more violent on the northeastern side of the gulf, where it damaged buildings and opened fissures in the ground. Hence, it must have been of greater intensity in that region than at Caraga.	
	Cagayan (Misamis) - an earthquake of long duration, though not very strong, as it did not throw down any objects. The swaying of the heads of the coconut palms seemed to be from SSE or S to NNW or N. The duration was such that there was plenty of time to leave the room, descend the stairs and go into the yard while the earth still continued to tremble.	
	Nasipit and Cabarbaran - the earthquake was very strong and of long duration, but did not damage buildings, though it made a great noise in them and still more so in the woods which cover the nearby mountains lying to the west of those places. From Cabarbaran, which is on the east of Buruan Bay, comes practically the same information - the earthquake was strong and prolonged without doing any damage; the trees swayed violently, and the abaca plants rocked until the leaves appeared to touch the ground. This most violent earthquake in the	

Event	Felt Effect	Source
	central part of Agusan Valley, was felt throughout the whole of Mindanao, Sulu and Visayas and as far as Palawan. Its mesoseismic area extended from Central Agusan eastward to the Pacific Deep. Tectonic in origin.	
	Intensity - X.	22, 48
1913 Mar 14 4:47 p.m.	Mindanao: Sarangani - heavy quake, direction N - S; duration, 25 seconds. It was a double shock. Heavy trees and posts fell.	
	Davao - very violent earthquake from SE - NW, which lasted from four to five minutes. Before the first movement, there were subterranean noises from the SE which lasted two minutes. Pendulum clocks were stopped and bottles and other objects fell from the shelves in the houses, bells rang, and fissures were opened up, from which water and fine sand came. The debris fell to the SE. Several walls in the church and convent were thrown down, while in the town, the palm thatch houses rocked a good deal and many of them remained out of plumb; crockery was broken in all of them. "This earthquake is a severe one; from the beginning, I observed some of the oscillations and movements of the church and convent to be so large that it was a marvel that they were not brought to the ground. Not being able to remain upright, I knelt down but even so I could not keep still, so I lay down on the ground till the vibrations ceased, which appeared to me to be about two minutes. The earthquake seemed to be entirely oscillatory, without vertical shocks, which was the reason so little damage was done." (Rev. R. Poruga, S.J., Davao)	
	Umayan, S of Agusan Valley - the heaviest part of the shock lasted	

Event	Felt Effect	Source
	for two minutes and 35 seconds, but the slight trembling was felt for three minutes. Few fallen trees were broken off by the shocks. Baganga - very strong earthquake; duration, one minute and 58 seconds. Talacogon - Rev. C. Saster, S.J. was preaching in the church at the time of the shocks and, seeing that they lasted so long, they (he and his congregation) all went out into the open. He thought that the whole place would be destroyed, for the ground seemed to go round and the beams of the houses creaked ominously. Duration was more than two minutes. Tandag - "The most severe earthquake felt during my three years in the Philippines. Bells rang during the shock. It lasted about two minutes." (Rev. Walter Panis, Tandag) Cotabato - very strong earthquake; direction, SSE - NNW, felt by everyone in the neighbourhood. Clocks stopped and objects fell from the shelves in the houses, especially in the shops of the Chinos; lasted for some four minutes. Butuan - very violent earthquake; direction, SSE - NNW; duration, some two minutes. It was not remarkable for its intensity, but very remarkable for its long duration. The people who were in the church at the time were terror-stricken and began to weep when they noted the unusual duration of the shock and heard objects falling. No damage was done to the houses. Water in the river was agitated a good deal and moved from E - W and the boats rocked greatly. (D. Generoso Copin, Observer, Butuan)	

Event	Felt Effect	Source
	Cabarbaran and Jobonga - shock was felt with the same intensity as in Butuan, duration was also about two minutes. Several boatmen, who were out at sea near Surigao, felt the shock and it caused waves to rise. (D. Generoso Copin, Observer, Butuan)	
	Zamboanga, Dapitan, Cagayan - reports indicate that the earthquake had an extraordinary duration.	
	Cebu, Bohol, Leyte - perceptible.	
	Cantilan - it was remarkable only on account of its duration, not on account of its violence or damage. There were long softly swinging movements.	
	Intensity - IX.	24
1917 Jan 31 12:02 p.m.	S Mindanao: Sarangani Bay - Intensity VIII-IX. In the town of Glan and its nearest suburbs on the east and southeast shores of the bay, wooden structures of the constabulary and many native houses were destroyed; cracks and slides were also produced in the ground; one landslide killed seven persons in a suburb. The destroyed wooden structures suppose to have been of the temporary type used in such outlying posts, while the native houses are commonly a hut of bamboo and palm leaves, raised from one to three metres above the ground on bamboo or wooden poles very little driven into the soil. Such structures are not earthquake-proof especially when the rocking lasts for nearly a minute, as happened in this instance. To these unfavourable conditions of the structures must be added the soft and loose character of the soil, consisting of volcanic tuff, sand and ashes, lightly covered in places by alluvial material from the Glan River. From	

Event	Felt Effect	Source
	the island of Sarangani, sparsely inhabited by pagans, we have not any report. Reports received from Cotabato & Kabakan, in the Moro District, & from Davao, situated respectively NW, NNW, & NNE of Glan, show that the isoseismal VI - VII must be drawn at a distance of about 140 kms from the last place. The shocks were stronger and of greater duration at the former than at the last station. Whole island of Mindanao; Eastern part of Sulu Archipelago, Intensity II-III.	25
	A severe earthquake occurred in Glan and vicinity at 11:35 a.m., January 31, 1917, which lasted about one minute. Eighteen (18) houses were wrecked in Glan and Glan Padidu and seven people killed in the district of Tuyan by a great landslide caused by the earthquake. All the constabulary buildings at Glan were wrecked, except the new addition to the barracks, and one soldier, Private Paris, and one prisoner, Mamayu Gas, were slightly injured by falling timbers. The government dock at Glan was so badly damaged that it can scarcely be used for anything until extensive repairs have been made. the new store-room of the colony store that was just recently built was completely destroyed and the other colony buildings so badly damaged that they will not be worth repairing. The school house in Glan was wrecked and has been abandoned, school being held in the public dispensary until another place can be arranged. The surface of the ground cracked open in some places to a width of from two to three feet and, in several places, water and mud were thrown several metres into the air. A tidal wave of about four feet came in a few minutes after the earthquake. The damage to all government buildings, property and supplies was estimated at $4,510.69.	

Event	Felt Effect	Source
	There have been many light earthquakes at irregular intervals during the day and night even since the severe shock of the 31^{st} of January. Intensity - IX.	38
1918 Aug 15 8:20 p.m.	S Mindanao: Mindanao - violent and long earthquake. Southern Cotabato - Intensity IX. All houses were either destroyed or badly shaken, cracks were produced in the ground and landslides on the mountains causing the death of about 50 persons in the civil settlemtnts in the Sarangani Bay area. The origin of this great earthquake was in the sea, probably between the meridians 124^{o} and 125^{o}E and the parallels 5^{o} and 6^{o}N. Shortly after the earthquake, a tsunami estimated at some places at 24 ft. high invaded the coast in an extension of about 150 kms from near Port Lebak to Glan, drowning and carrying away many persons and animals. The small islands of Sarangani and Balut, placed at the eastern end of the epicentral region, sustained similar damage from the shock and tide; 46 people killed; large rivers were completely obliterated and new ones created. It was also reported that the tsunami was between six and eight feet, killing six people and carrying a number of logs quite a distance inland. Glan - all native small boats were either destroyed or taken out to sea; houses destroyed; tsunami with height of 18 ft.; drowned a number of people, cattle, horses and other domestic animals and destroyed all of the food supply of those living near the beach and all of the crops in the lowlands. Intensity - X.	26, 37

Event	Felt Effect	Source
1924 Apr 15 12:22 a.m.	Mati: This Pacific earthquake is called the Mati earthquake because this town on the Pacific coast, SE Mindanao, was the nearest to the epicentre and suffered its most disastrous effects. It was one of the greatest submarine disturbances originating in the West Pacific. The epicentre was in parallel 6.1^{o}N and meridian 126.8^{o}E. The mesoseismic area had a radius of about 200 kms and included in its western sector nearly the whole province of Davao, which occupies the SE portion of Mindanao. The effects within this area were very irregular depending on the conditions of the ground. The same may be said of the boundaries of the isoseismal, including the area in which the shocks were violent but not destructive. Thus, for instance, the waves showed greater intensity along the Agusan Valley than along the coastal mountain chain or eastern Cordillera, nearer to the origin, and northwestwards to Bukidnon than westwards through Cotabato. Effects: Destruction in the towns along the Pacific to parallel 8^{o}N and around the Davao Gulf coasts was not as excessive as might have been feared, due to the kind of constructions, most of them of wood and other slighter materials. The heaviest loss was in the interior partitions of the houses. Several bamboo houses fell down. Quantities of movable objects tumbled and were destroyed. The shocks caused more serious effects in the ground than in structures. Fissures and landslips occurred in the steep hills and the alluvial soils, and rockfalls were conspicuous chiefly in the cliffs of the coasts. A large tract of the seashore of Mati at the head of the small Pujada Bay, separated from the ocean by a narrow peninsula, sank about half a metre. It is not known whether the subsidence extended	

Event	Felt Effect	Source
	through the bay and the south end of the peninsula enclosing it. This peninsula consists of a rocky hill, formerly a separate island, united more recently to the coast by a low alluvial tract of land. Another unisolated rocky islet divides the entrance of Pujada Bay into two channels. Extension of the earthquake - the isoseismal V-VI extended to a distance of about 400 kms in the N and NW direction but less to the west, as indicated by the fact that the hypocentre was prolonged in the direction of the Philippine Deep where the shocks originated.	
	Mindanao and Visayas - isoseismal III to a distance of about 1,000 kms.	
	Butuan - about 300 kms distant to the NNW and comprised within the isoseismal VI - VII. On board a steamer at anchor in Caraga Bay, about 150 kms NNW of the epicentre, two sharp shocks followed by three not so sharp but stronger were felt, similar to the effect of the keel's striking against rock. The sea became suddenly and terribly rough, causing in the boat strong jerks that threatened to break the anchor chains; at the same time, big waves were seen to break against the cliffs of the near coast. Destructive earthquake hit chiefly the coast of Mati where it caused damage to structures and produced cracks, fissures and subsidences in hilly and alluvial grounds. Tsunami followed which flooded low coastal shore but without considerable damages. Had more disastrous effect along the coast of Surigao and in the northern portion of the Agusan Valley. Although no loss of life was reported, the material damage was great. Cracks and landslips were conspicuous in alluvial ground and	

Event	Felt Effect	Source
	in steep surfaces chiefly along water courses. It was ascertained that only old or poorly constructed structures have sustained damage, and the disturbances in the ground could be explained by either its soft nature or the steepness of the angle. Mortar and stone walls as well as modern cement buildings generally escaped without any important cracks. The central area of this earthquake had an extension of about 100 kms along the coasts of Surigao, south of the capital, and some 50 kms inland to the Agusan Valley.	
	Intensity - IX.	29
1924 Aug 30 11:07 a.m.	Surigao and Agusan: Surigao - Intensity VIII-IX. Agusan Valley - Intensity VIII. Talaud Island; SE Luzon; E Coast Mindanao; Zamboanga and Panay - fairly perceptible. Its origin lay in the Philippine Deep, close to the meridian 127°E and the parallel 9°N. Damage: Butuan - none of the strong structures, either old but in good repair or modern, suffered damage, excepting a hospital of faulty construction. Generally the portions damaged by the shocks in buildings of strong and mixed materials were the interior partitions and upper walls, consisting of an inner frame of wood or bamboo covered with mortar, whenever such frame was rotten or decayed. The greatest damage in churches and other public and private buildings was sustained by similar walls but in none of them did the lower portion, constructed of stone in good mortar, present any considerable cracks caused by the earthquake. Numbers of light native houses fell	

Event	Felt Effect	Source
	down but nearly all were in bad condition. Effects on the ground:	
	Agusan River - along the seashores and riverbanks, and inland in rough mountain soils, fissures and landslips occurred, but principally in steep slopes and soft recent banks of alluvium. It was noticed along the Agusan River that only those portions of its banks which had been deposited very recently tumbled down, whilst those composed of old clay silt and alluvium, even when very high and steep, withstood the shocks. In the extensive plain of the town of Butuan, cracks opened only close to the river in places filled up during the last 50 years, due to the recession of the river towards the opposite bank, and the subsidences occurred in the very recently filled approach to the landing.	
	Pacific Coast - only recent alluviums at the mouth of rivers and very steep cliffs were crevassed. Underground currents of water, which formerly had their outlets on the beach sprang out high on the slope of the mountain after the shocks crevassed and caused the land to slide down; within the cordillera, landslips felled trees and caused big rocks to tumble down, an effect which greatly awed the poor tribes-people living in the fastness.	
	Intensity - IX.	29
1925 Nov 13 8:16 p.m.	Samar: Samar - earthquake of Intensity VIII or IX. It was perceptible within a radius of 600 kms comprising SE and S Luzon, all the Visayas Islands and NE Mindanao.	
	SE Luzon; Masbate; N Cebu and Leyte - Intensity V-VI, at a distance of about 300 kms from the centre.	

Event	Felt Effect	Source
	Manila - only a few persons at rest felt the earthquake, such an effect depending much on the condition of the houses and soil. The movements were gentle and slow; nevertheless, as a result of some kind of resonance of the natural oscillations of the mass of water and the vibration of the seismic waves, two large storage tanks 25 and 22 metres in diameter in the gasworks spilled the water in a SE - NW direction, the movement and spilling lasting several minutes; other smaller tanks did not spill water. Nobody in the factory felt the shock, but everyone's attention was attracted by the rhythmic noise of the water falling from the big tanks. This earthquake originated in the Philippine Deep, NE of Samar near 125.5°E and 13.0°N.	
	Damage: Batag Island - the lighthouse, a modern concrete construction, was fissured and the optical and mechanical parts of the lantern damaged. In the soil, cracks opened and the low shores were flooded by the waves caused by the earthquake; many fishermen lost their fishing boats and several were drowned. Numerous native houses were destroyed.	
	Laoang - numerous native houses were destroyed.	
	Coast of Samar - not only native houses but also several more substantial constructions suffered considerable damage. Many persons suffered injuries.	
	Intensity - VIII.	30
1929 June 13 5:26 p.m.	Mindanao: Davao - Intensity V.	
	Legaspi; Sorsogon - Intensity III.	
	Cotabato; Ganassi - Intensity II.	

Event	Felt Effect	Source
	The epicentre seemed to be located on the eastern side of the Agusan Valley in the southeastern part of the province of Agusan. The following accounts are from places where it was most severe: Hinatuan - numerous gashes were visible in the mountains as a result of the slides. Thousands of dead fish of all kinds and all sizes, up to 30 inches, were seen floating in the ocean and cast up on the shore. They had evidently been killed by the concussion of the shocks. The first movements were vertical vibrations of such violence that people could remain standing only with great difficulty. Most of them were obliged to kneel or sit on the ground. These vibrations were followed by horizontal oscillations. Many old houses were destroyed and nearly all others were thrown out of plumb. The front wall of the church was cracked and the roof badly damaged but concrete towers escaped injury. A small seawave came in. The agitation of the ground continued almost incessantly for a month, as many as seventy shocks being counted in one day. It was not until this period had elapsed that any attempt was made to restore the houses to their upright position. Ebro - landslides and subsidence occurred in this vicinity. Waves appeared in the soil and houses were tilted. The earthquake was described as frightful. Rivers were agitated and overflowed the subsiding areas. Talacogon - the principal shock was very strong, lasting about 50 seconds and portions of the river bank were dislodged. Sixty-five (65) aftershocks were reported to the Central Observatory. Cateel - Father Rodes, pastor of	

Event	Felt Effect	Source
	this town, reported that, at the time of the earthquake, he was seated and that his chair was moved as if he were riding in a tartanilla (native vehicle). Esperanza - reported as a violent earthquake. Butuan - the earthquake was preceded by a rumbling sound. The motion was characterized as violent, the people throwing themselves on the ground. The water of the river appeared to heap up on the eastern side and one man in a canoe reported a reversal of flow at San Vicente about two kilometres upstream from Butuan; bells rang, clocks stopped and some old walls and stairs were thrown down. The apparently abnormal intensity in an easterly direction from Talacogon to the Pacific has given rise to the opinion that it is indicative of a fault at right angles to the Agusan rift valley and the Mindanao Deep. Some of the effects must be ascribed, doubtless, to the nature and condition of the soil. The Agusan Valley floor is a soft, unconsolidated river deposit, in one area quite swampy. Hinatuan is built on compact sand. Rock is on the surface a short distance from the shore up the Hinatuan River. Bislig, a few kilometres south of Hinatuan and Lianga to the north, do not, it is said, experience such intensities as are felt in Hinatuan. Cantilan in a large area of rice fields, is another "sensitive" locality. At Hinatuan, Ebro and along the Gibong River, the earthquake was exceedingly violent. Aftershocks peristed at Hinatuan and Talacogon to an extraordinary degree compared with other localities. The epicentre is over the western slope of the Mindanao Deep $8^{o}20'N$, $126^{o}53'E$.	

Event	Felt Effect	Source
	Intensity - X.	32, 33
1931 Mar 19 2:26 p.m.	Luzon: Laoag, Ilocos Norte - earthquake of Intensity VIII-IX. It was felt as far south as Ambulong. The most extensive damage was done to old ecclesiastical structures, dating back to Spanish times. Leaks started in the water mains.	
	Bacarra - the six-storey masonry bell tower had its two lowest stories shaken out and the upper four stories settled down upright in the ruins. The municipal building, the central school, the convent and the church also sustained damage.	
	Vintar - the church, convent and bell tower were damaged.	
	Pidding - the entire church edifice was slightly inclined to one side. The bell tower suffered in a manner just the opposite of that at Bacarra. In this case, the upper section of the tower was thrown off, leaving the tower portion intact.	
	Batac - the old municipal building, the convent, church and bell tower were demolished.	
	Sarrat - the roof of the church was damaged.	
	Badoc - masonry structures suffered damage.	
	Vigan - some masonry and brick structures were cracked. It is noted that the towns which suffered most are located near the river of that section and a field party of geologists from the University of the Philippines found that the ground in all of these places is of sedimentary origin.	
	Lallo, Cagayan - the tremors badly damaged the municipal building.	

Event	Felt Effect	Source
	Cabugao, Ilocos Sur - the tremors damaged the Presidency, the Catholic Church building and two brick houses. Two persons were injured by falling bricks from damaged buildings.	
	Damortis, La Union - slight damage to some buildings was reported and its telegraph and telephone lines were temporarily disrupted. The epicentre of the severe earthquake was in the China Sea, at 18°20'N, 120°10'E, about 50 kms from the coast.	
	Intensity - VIII	34, 63
1937 Aug 20 7:59 p.m.	S and SE Luzon: Quezon - the waters have risen in the town of Quezon at the south end of Alabat. This town is practically on Calauag Bay at the head of which there was a rise in the sea level. The people of the town of Calauag, at the head of the bay, reported that the water rose from low- to high-tide level in the space of about 10 minutes. Some persons who were ascending the Calauag River in canoes were suprised at the rapid progress they made, not knowing that they were being pushed upstream by a wave.	
	Tayabas - the town of Polillo reported that damage had been sustained there to the amount of P5,000. The sea wall of Mauban was damaged. The water system of Tayabas and Atimonan suffered some damage. Some houses were damaged in the towns of Sariaya, Lucban and Lucena. In the island of Alabat, nearly all of the houses were tilted or slightly damaged.	
	Atimonan - tower and college of Atimonan were damaged partially.	
	Gumace - tower of Gumaca destroyed completely.	

Event	Felt Effect	Source
	Caoag and Iloilo - perceptible. Manila - a 36" water main broke in the Sta. Ana section of the city. A 16" main on Ayala Bridge broke, also an 8" main at Pier No. 3 and No. 5 and flooded a warehouse, damaging several hundred sacks of flour. Heacock Building - so badly damaged that the City Engineer ordered its demolition. The upper floors overhung the first floor giving a cantilever effect and there was a lack of bracing in the first floor. This floor had been designed to give a large open space with no obstruction except the column. The column capitals were crushed when the building rocked. Cracks were produced in the Insular Life Building, in the Philippine National Bank, in the Grand Theatre, in the church of San Francisco, in the Great Eastern Hotel, in two concrete arches in the Army and Navy Club, and in the cupola of the stairway in the monastery of San Augustine. No doubt there were many others which were not reported. Great Eastern Hotel - seems to have settled a few inches and the lifts jammed during the earthquake. Bayview and Luneta Hotels - minor cracks and dislodged plaster. Army and Navy Club - some of the tiled floor was loosened in the kitchen and a water pipe was broken. American YMCA - the kitchen floor dropped several inches. A crack 12 feet long appeared in the lobby of the University Club. Law Building of Sto. Tomas University - some cracks appeared on the second floor. The vault of the City Treasurer was cracked. Some	

Event	Felt Effect	Source
	stones fell from the tower of the Recoleto Church. The tower of Pandacan church collapsed. The Ermita Elementary School was condemned. Two factories were closed by order of the city authorities and damage of various degrees was reported from 33 private houses. Ten city schools were slightly damaged. A crack appeared in Dewey Boulevard (now, Roxas Boulevard). Cracks in the concrete railings of the Arlegui Bridge. Shop windows were broken in the Heacock Building, Estrella del Norte, the Philippine National Bank, the People's Shoes, and some on Rizal Avenue. Book stacks in the National Library overturned. A crane was derailed on Pier 7.	
	Bulacan - the ceiling of the convents of San Miguel church and the front wall of the municipal building cracked.	
	Cavite - several old buildings in the town of Cavite were cracked; a building on Calle Colon collapsed; some piers in the Navy yard cracked; one wall of a house in the Navy yard collapsed. Some cracks appeared in the walls of the churches at Mendez Nunyez and Silang. The latter church is about 300 years old.	
	Rizal - at Caloocan, the municipal building and church suffered some cracks. The municipal building at Morong sustained some cracks. One exterior edge from roof to ground of one transept of the church at Antipolo collapsed. Some damage was sustained by the churches in the following towns: Teresa, Pililla, Taytay, Tanay, Baras, Morong, Pasig and Mariquina. The churches at Antipolo, Taytay and Morong are some 300 years old.	
	Camarines Sur - some walls of the Abella Building in Naga collapsed.	

Event	Felt Effect	Source
	The Manila Railway water tank, having a capacity of 65,000 gallons, crushed its tower. Some smaller tanks at other places which were filled at the time were overturned. Tanks which were empty or nearly so were not damaged.	
	Laguna - the constabulary building in Sta. Cruz was damaged and the vault of the church was cracked. The provincial telephone lines were broken. The Manila Railway water tank at Panaan collapsed. The bridge at Siniloan was damaged. The walls were cracked in the market and in the municipal building of Pagsanjan. Considerable loss in coconuts will result from unripe nuts being shaken from the trees. It is said that there is an injurious effect on the trees from which they do not recover for several years.	
	Church of Sta. Maria, Laguna, destroyed completely. Church and convent of Paete, destroyed completely.	
	Pangil, Laguna - church and convent were damaged partially.	
	Famy, Laguna - church was destroyed completely.	
	Pakil, Laguna - convent was destroyed completely.	
	Sta. Cruz, Laguna - tower was damaged partially.	
	Cavinti, Laguna - church was damaged partially.	
	Lumbang, Laguna - church was damaged partially.	
	Intensity - VIII.	36
	Tayabas - damage in this province consisted of destroyed church	

Event	Felt Effect	Source
	towers, cracked cement or concrete pillars, twisted telephone/telegraph posts, disjointed steel rails and cracks in roads. The quakes were intense in Lucena, Lucban, Gumaca, Atimonan, Quezon and Candelaria. One house completely destroyed in Lucban. Belfries of churches in Gumaca totally destroyed, also that in Atimonan; traffic in the famous Atimonan zigzag totally stopped, due to dangerous cracks in it making the road impassable; telephone lines between Candelaria and Lucban interrupted; water tanks at Lucena railway station collapsed and fell on the rails; water system supplying water to Tayabas, Pagbilao and Lucena sustained serious damage; Lucena provincial capitol suffered cracks. Both Manila and nearby provinces suffered considerable damage and reported many injuries as a result of last night's (Aug 20) series of violent earthquakes, the first two of which were of Intensity VI and VII, respectively. In Manila, several modern office buildings were so badly damaged that they were temporarily condemned by the city hall authorities. Two Manila bridges, the Sta. Cruz and Ayala bridges were also considered so shaken that prohibition of heavy traffic was decided upon. Churches, bell towers, and old Spanish buildings constitute the damage in the provinces which was considerable. One person died in Cavite due to fright when the quake struck. A number of schools in Manila sustained heavy damage. Arellano High School's main stairways were torn loose, doors were totally destroyed and bookcases upturned, water pipes in the building broken, and the electric fans in the ceiling torn down. Stairway of the Mapa High School also shifted out of place. Cement bases of several posts of the Ermita	

Event	Felt Effect	Source
	Elementary School were also stripped off and the left wing is in such shape that the City Engineer's office was requested to inspect the building to ensure the safety of the pupils and teachers. The Quiapo Primary School showed cracked walls and many glass windows broken. The Tondo Primary School Annexe showed cracked walls, too. All police telephones in Manila were put out of order. Cement wall in the City Treasury's vault was also cracked. Innumerable electric and telephone lines were cut or burned; water mains broken at Ayala, corner Suter St., Sta. Ana. Most of the destruction to power lines was caused by short circuits or grounded wires snapped by the tremor. The Manila Hotel swayed from side to side during the tremor. Heacock Building at Escolta sank six inches. Experts at the Weather Bureau compared this quake with that which destroyed San Francisco, California, but the duration was too short to result in much destruction. The quake's direction covered a long distance from north to south and indicated a varying distance from Manila of 20 to 100 kms. The source of the quake was not at a point but along a line. The strongest to hit the Philippines since 1882, the quake was also felt in the following places: Baguio - Intensity III. Masbate - Intensity III-IV. Dagupan - Intensity IV. Infanta, Naga and Daet - Intensity VI. Legaspi - Intensity VI-VII.	65

Event	Felt Effect	Source
1948 Jan 25 1:46 a.m.	Panay: Panay - most severe earthquake ever to strike the Philippines. It rocked the island of Panay with an Intensity of VII. For 47 days, its repeated shocks left 55 churches in ruins. Of the remaining churches in the diocese, 17 totally collapsed, 20 were cracked and shaken beyond repair and practically all churches and rectories were damaged.	
	Iloilo City - was the most damaged area in this Panay quake, as some of its historic structures were destroyed. The five-storey belfry of Jaro Cathedral toppled. A 100-yard fissure in the earth sprayed black sand and water high into the air.	
	Antique - 15 old churches destroyed or damaged; in some towns in Antique, about 50% of the houses were damaged. The Coronet tower of Arevalo was also ruined.	
	Intensity - IX.	8, 69
1954 July 02 10:46 a.m.	Sorsogon: Sorsogon - Intensity VII. The old church which had survived all previous earthquakes and typhoons was totally demolished. Several people in the church were said to have been trapped when the concrete walls and tile roofings collapsed. Radio and telegraph facilities of the Philippine Constabulary at Sorsogon were badly damaged. Water pipes were destroyed. Large landslides and fissures occurred in Balibag District. There were landslides at several points on the Inang Maharang Mountain which is visible from the town. Forty (40) houses including the old cathedral in Sorsogon were destroyed; thirty in Sorsogon; ten in Bacon. Most of the buildings destroyed were built during the early Spanish times with adobe stone foundations. Property loss was estimated at P1,500,000.	

Event	Felt Effect	Source
	Initial reports counted 20 persons dead, 17 injured, and scores missing. Concrete buildings, including the capitol building, suffered cracks. Phamacies and grocery stores suffered damage as bottles and glass containers crashed on to the floors. Most pendulum clocks stopped; concrete electric posts in Guinobatan buckled. The Sorsogon cathedral tower crumbled. The former Bacon shoreline no longer appeared during low tides; injured 109 (15 seriously) and killed 13 persons. Daet - Intensity V; duration, 80 seconds. Virac - Intensity - IV. Legaspi - Intensity IV; duration, 15-28 seconds. Roxas City - Intensity IV. Catarman - Intensity IV. Masbate - Intensity IV. Aurora - Intensity IV. Catbalogan - Intensity III. Tacloban - Intensity III, 22 seconds. Mambajao - Intensity III, 4 seconds. Iloilo - Intensity II. Due to the magnitude of this earthquake, a number of casualties and some damage to structures resulted. The centre of this earthquake was determined by the instrumental data from its aftershocks, as the recordings of the main quake were lost due to its great intensity; it was found to be 380 kms SE of Manila in the	

Event	Felt Effect	Source
	immediate vicinity of the towns of Bacon and Sorsogon. The official report of casualties showed a total of 13 people killed. Of the 13 deaths, eight were in Sorsogon, four in Bacon, and one in Legaspi. A total of 101 persons were injured, seven of them seriously. Damage to buildings was limited to old and poorly built structures of bricks and cobbles cemented only by lime mortar. Water mains were broken and several electric wires were cut. Damage to roads was negligible. Some fissures occurred in the roads but this did not affect their use.	
	Intensity - IX.	40, 15, 61
1955 Apr 01 2:17 a.m.	Lanao: Dansalan - Intensity VIII. Panicky people scampered to safety and slept in the open. One mosque and two houses were destroyed. In Marantao district, several houses destroyed and fissures appeared.	
	Ozamis City - thousands of the residents were rendered homeless. The Catholic Cathedral was destroyed. The water system and electric service were seriously impaired. Fort Santiago sank five feet deeper, making entrance impossible. The wharf was also badly damaged. Deep and wide cracks littered the national highway. Hundreds of houses collapsed and many people were believed injured. The wharf area, which is on reclaimed ground, suffered severe fissuring and differential compaction. The earthquake movements caused several electric posts to be thrown out of position. Another cause of breaks along power lines was the collapse of houses and the consequent snapping of house-to-main connections. At several points in the city, especially in the water-front area which is largely unconsolidated ground, breaks	

Event	Felt Effect	Source
	occurred in water mains. This was evidenced by water flows on the ground immediately above buried pipes. Several bridges and bridge approaches between Ozamis and Pagadian, Zamboanga del Sur became unusable. Wharfage facilities were damaged by failure of their foundations. Roads in the wharf area of Ozamis City were badly cracked due to slumping of fills.	
	Dipolog - Intensity VII.	
	Malaybalay - Intensity VI.	
	Cagayan de Oro - residents fled from their homes. Slight damage to buildings. Short-circuited electricity in the city and caused a minor fire in a local hotel. Intensity - VI.	
	Dumaguete - an earthquake of Intensity VI rocked this city for 35 seconds. No casualties were reported. The quake caused wild panic among local residents who rushed in to the streets after they were jolted from their sleep. Several residents prayed loudly, whilst dogs barked.	
	Iloilo and Cebu - Intensity V.	
	Mambajao - Intensity V. The quake cracked concrete walls and made houses sway.	
	Cotabato - Intensity V. Heavy damage to public and private buildings. The quake caused aroused sleepers to rush into the streets. Electric power and telephone service failed four minutes after the main quake, and even the wall clocks stopped.	
	Davao - Intensity V. The quake caused panic among the people.	
	Zamboanga - several houses collapsed	

Event	Felt Effect	Source
	and a part of the local wharf was damaged. Landslides occurred, causing half a million pesos' worth of property damage, 910 persons were rendered homeless and 18 kms of road were blocked.	
	Jolo and Hinatuan - Intensity IV.	
	Dadiangas - Intensity III.	
	Misamis Occidental - hundreds were reported homeless, Philippine Constabulary barracks was destroyed. Landslides made roads in some places impassable.	
	Basilan City - Intensity II and lasted for 10 seconds. No casualties or damage have been reported.	40, 52, 54, 63, 67
	Several persons around Lake Lanao heard a low-pitched sound like a muffled explosion of a cannon a few seconds before they felt the first vibrations. Those close to the epicentral area first experienced a strong vertical movement which was followed immediately by violent sideways jerks. People found it difficult to stay on their feet during the height of the tremor. The air became filled with the noises of falling objects and crashing structures, the shrieks of women and children, and the cries of those injured. An odour like that of rotten eggs became noticeable in low areas. Fissures were seen to form and people found it difficult to stay on their feet because of violent vibrations. The main shock was followed closely by aftershocks of varying intensity which created further panic among the already distraught populace. The water of Lake Lanao swished back and forth during the earthquake, causing the lake-end of the Agus River alternately to dry up and swell. The most catastrophic earthquake to have	

Event	Felt Effect	Source
	hit the Philippines since World War II occurred at 2:18 in the early morning of April 01, 1955. This earthquake was centred between Lake Lanao and Panguil Bay in the province of Lanao at latitude 07°55' north and at longitude 124°05 east. A maximum intensity of between VII and VIII was felt in the western half of Lanao and the eastern third of Misamis Occidental. The area affected by Intensity VI and higher included the rest of Lanao, Misamis Occidental, Zamboanga del Norte, Zamboanga del Sur, Misamis Oriental, Bukidnon and even the southern tip of Negros Oriental. Included within the intensity isoseismals are all the rest of the provinces in Mindanao and the Visayas, thus giving the earthquake a macroseismic area of approximately 1,400 square kilometres. Lanao was the most affected and so the earthquake was named after it. Contrary to local fears, the tremor was not volcanic but decidedly of tectonic origin, caused by the sudden movement along a plane of weakness in the earth's crust in the epicentral area. As in the case of most destructive tectonic earthquakes. The salient geological feature of the Lanao earthquake was the variance in damage due to the differences in ground conditions. The greatest destruction was wrought on structures built on alluvial deposits along unstable slopes. Structures relatively closer to the epicentre but built on firm ground were only slightly damaged whilst those farther away on poorly consolidated deposits were severely damaged. The total casualties listed by the authorities and relief agencies were about 400. Compared to earthquakes of like magnitude in other countries, the number of casualties was small. This, in large measure, was due to the resiliency	

Event	Felt Effect	Source
	of wooden constructions which characterize the preponderance of Filipino houses. In the municipal district of Tugaya, beside Lake Lanao, there was a high loss of life (174 persons out of about 2,000 living in the village) and this was brought about only because of the rather unfortunate geological situation of the settlement. The deaths were due to drowning when the portion of the town bordering the lake slipped (as much as 40 feet) into the water. No true surface expression of the movement that caused the tremor was observed but evidence obtained from the apparent change of level of the lake water and from the distribution of slides and sand boils, complemented by observed fissures, strongly suggests the possibility of a major fracture oriented approximately N 75^{o}W, starting a little east of Masiu on the eastern side of Lake Lanao and extending toward and beyond Molave in Misamis Occidental. Perhaps the absence of any surface trace of faulting is not altogether unusual considering the depth (40-60 kms) at which major displacement must have occurred. The vertical development could very well have been taken up by the overlying formations. However, around Lake Lanao, there are indications that changes in elevations of land surface points may have occurred.	12, 40
	Lanao - slight damage to the hydro-electric plant at Ma. Cristina. Small water pipes feeding the plant cracked wide open. Roads leading to the plant were blocked by landslides or were gaping wide open. Augus and Danasan Bridges were partially damaged.	
	Masiu alluvial plain (eastern shores of Lake Lanao) - sustained very severe damage; large tracts of land	

Event	Felt Effect	Source
	on the lake-side became submerged under several feet of water due to differential compaction; cracks and fissures were most abundant in this area in spite of its greater distance from the epicentre; sand boils were formed; a seiche occurred. In the Masiu lowland area, water lilies from the lake were swept by the seiche into the rice paddies as far as 300 metres from the water's edge. Tugaya, Bacolod and Ganassi (west shore of the lake) - severe damage was confined mostly to the lake terraces. In the municipal district of Uato, a little north of Tugaya, the same type of damage as in Masiu was observed. The region bordering the southern shore of the lake sustained damage, only due to landslides along an old fault scarp. The concrete mosques at Bacolod, Tugaya and Uato were completely ruined. A noticeable feature common to these damaged structures was the serious lack of adequate steel reinforcements and insufficient corner ties in the concrete. The concrete walls were found to have been poured without thought of securing monolithic qualities. Balutmasla Island (southern part of Lake Lanao) - large slides occurred on the whole periphery of this island with the coastline showing settlement of about three feet as a result of this earthquake. In the neighbourhood of Makagiling, fronting the southern edge of Lake Lanao, field observation showed large incipient slides. Some of these incipient slides had subsequently given way, triggered most probably by strong aftershocks and/or heavy rains. From Tugaya to Ganassi around the Lake Lanao area	

Event	Felt Effect	Source
	alone, 148 people were killed as the lake sank two metres during the quake, toppling houses into the swirling waters. Landslides also occurred. In Lanao town, 85% of the town's buildings were demolished. Big cracks appeared in roads.	16 ,53, 67
	Iligan City - damage was also extensive. The Agus River-bed, the only outlet of Lake Lanao near Dansalan City, ran completely dry for about half an hour at the height of the quake. Glass panes in the local telecom office were broken and the flooring cracked. The hydro-electric and fertilizer plants were damaged. The quake caused landslides and earth fissures measuring as wide as one foot in some places. Worst hit was the waterfront area where the office of Compania Maritima collapsed into the sea. The road to the powerhouse near Ditukalan was covered by landslides. City streets including pavements and the national highways cracked.	
	Pagadian - several houses collapsed and a part of the local wharf was damaged.	
	Intensity - X.	52, 66
1968 Aug 02 4:19 a.m.	East of Casiguran: The earthquake was felt throughout Luzon and part of Northern Visayas. It was considered the most severe and destructive experienced in the Philippines during the last 20 years. The following were the observations made by the Weather Bureau Survey Team in the epicentral region:	
	Nueva Vizcaya, Isabela area - landslides were observed in the northwestern Nueva Vizcaya and southwestern Isabela prominences towards the Sierra Madre area. An upheaval of the Manglad River, a	

Event	Felt Effect	Source
	tributary of the Cagayan River which is on the outskirts of Madella, Nueva Vizcaya was observed. The upheaval reached a height of about 15 metres, 85 metres long and 25 metres wide and blocked the river, causing its normal flow to divert to the adjacent corn fields. On the eastern bank of the river where a series of rolling mountains exist, a big block was seen adjacent to the upheaved mass. Some artesian wells were drained and subsidence of some rivulets occurred.	
	Maddela, Nueva Vizcaya (District Manglad) - S 30^{o}E of town proper about 5 kms away. At Manglad River near junction with Cagayan River (20 metres away) upheaval at its basin with an area of about 80 metres athwart the basin, 25 metres longitudinal and 15 metres high approximately. Average normal depth of Manglad River is about 4 feet at this site. East of upheaved basin massive block landslides of slightly folded beddings, and these landslides were observed also north of the upheaved area along the Cagayan River banks. Predominant vibration in this locality was vertical; rumblings heard from a north to south direction before every felt tremor, as observed by some people. Upper Manglad River observed to have become dry after August 2. Portion of river reached a direction flowing formerly N 40^{o}E with average depth of 2 feet and 24 metres wide.	
	Santiago, Isabela - auditorium wall, of the North Eastern College, 10 metres high, hollow blocks with 3/4" steel ties every other block and without plastering, collapsed and the reinforced concrete columns 16" x 16" cracked diagonally.	
	Alicia, Isabela - Alicia Parish	

Event	Felt Effect	Source
	Church of red brick masonry, about 1800; centre cross spire toppled down southwards; masonry side walls (both) rear and front facades cracked diagonally.	
	Ilagan, Isabela - school building, three-storey reinforced concrete, about 1914, was strafed (machine-gunned by planes) during war; concrete chimney toppled down 20^{o} to the south of building near roof abutment to wall.	
	Tumauini, Isabela - Arcon Bridge, steel framed; very slight crack on concrete surface at north end of bridge (bridge has 3 spans and is about 60 metres long).	
	San Pablo, Isabela - old brick masonry structures, remains of 1846. Municipal Hall - bricks collapsed, NE - SW direction.	
	San Agustin and Jones, Isabela - several artesian wells did not yield water, some produced adulterated non-drinkable water; two rivulets of San Agustin temporarily stopped flowing and on their banks some evidence of settlement was observed and recorded.	
	Casiguran area - in the area around the town of Casiguran, many cracks were observed. Most of these cracks had alignments nearly parallel to the nearest rivers. Surface soil in this area is mostly deltaic sand and is rather loose. The length of the cracks varies mainly from 10 to 200 metres, though some reached a length of about 400 to 500 metres. Spacing between cracks was 5 to 20 metres. Fissures were formed on the road from Casiguran to District Tabas, about one kilometre north of the town of Casiguran. This place is about 8 metres from the Casiguran River at the top of a steep bank	

Event	Felt Effect	Source
	approximately 2.5 metres high. Fissures were sometimes as wide as 0.5 metres, and the surface subsidence amounted to as much as about 2 metres. These fissures were observed extending to the north, as far as two or three kilometres, in echelon formation. Other fissures were observed on a logging road, 30 metres from and parallel to the river bank, also in the Casiguran area. Soon after the formation of these fissures, it was observed that water and sand had been expelled. In the town of Casiguran, notable subsidence of about 1 metre was observed at the abutment of the Casiguran Bridge. Only 10 metres away from the bridge, fissures were seen running through the foundations of a house without serious damage to the house. Besides these fissures, some other damage was also seen in the town of Casiguran: a) the arch portion of the gate of the Municipal Building was broken along construction joints and moved towards S 60°W, showing a displacement of about 3 cms; b) an elementary school of two units of prefabricated construction suffered damage by the collapse of hollow block walls; c) a two-storey house under construction had reinforced beams and columns damaged at the beam level in a northwest direction. Minor cracks also formed in lower beams; d) minor damage, such as cracks in concrete flooring and differential settlement, was seen in houses built of concrete and wood materials. The earthquake raised tall waves which drowned one fisherman. Dinadiawan area - landslides: Large-scale landslides had occurred in several places on the steep slopes of surrounding mountains. Large amounts of surface mud and rocks had been gouged out in several places	

Event	Felt Effect	Source
	and new bare surfaces were observed on the mountain sides. In the afternoon, after a very big aftershock had shaken the area about noon, new landslides had occured in at least six places. The largest landslide took place on the cliff at Dinajawan Point facing Casiguran Bay. Landslides which accompanied the main shock were mostly on the slopes of mountains north of Casiguran, while those which accompanied the big aftershocks were observed on mountains both to the north and to the west. Fissures: Fissures in the ground were observed in the river bed of the Jagdauan River. The width of the main fissures was about one metre and it appeared very deep. The length was about 150 metres in a direction roughly NE - SW. About 3 metres to the east, another shorter fissure, about 70 metres long, ran almost in the same direction. Parallel to these fissures, there was another smaller fissure, 60 metres in length. In the City of Manila - a six-storey concrete reinforced apartment building, with a height of 19.8 metres, completely collapsed like a flattened accordion, causing the loss of many lives. Rescue work was undertaken by the authorities with the help of numerous private sectors immediately after the earthquake. Several other large buildings in the city suffered serious damage in their main columns and beams. Cracks in numerous buildings were reported and observed. There were more than 232 persons injured as a result of this earthquake. The greatest destruction was wrought on structures built on alluvial deposits, as in the city of Marila, where most of the damage was confined and reached several millions of pesos. Those built on firm ground, which are	

Event	Felt Effect	Source
	relatively closer to the epicentre, suffered only slight damage. Intensities reported at various places:	
	Casiguran - Intensity VIII.	
	Manila - Intensity VII.	
	Baler, Quezon City; Tuguegarao, Aparri, Baguio, Dagupan, Iba, Cabanatuan, Alabat - Intensity VI.	
	Tarlac Ambulong, Infanta, Jomalig - Intensity V.	
	Legaspi, Lucena, Calapan, Aurora, Laoag, Catarman, Virac - Intensity IV.	
	Romblon, Vigan - Intensity II.	6, 9, 42, 57
	A tsunami generated by this earthquake was observed at several mareographic stations along the Pacific Coast, Japan.	
	Description of damage: Two hundred people were killed and 261 injured by the earthquake. The cost of property damage was several million dollars. One six-storey building collapsed completely. A few major buildings were close to collapse. Several major buildings suffered severe structural damage and many suffered moderate structural damage or considerable non-structural damage. Damage to particular buildings in Manila:	
	Ruby Tower: the Ruby Tower was a large six-storey building containing nineteen shops on the first-storey, nineteen offices on the second storey and seventy-six residential flats on storeys three to six. It collapsed totally, except for a few rooms at the northern end, killing or injuring 528 of the occupants. The building had a six-storey reinforced concrete frame of 11 by 7	

Event	Felt Effect	Source
	bays. The floors were reinforced concrete slabs, and the roof was a light-weight wood frame sheathed in iron. The beam-and-slab foundation was two metres deep. The shops, offices and flats were separated by six-inch concrete hollow block panels, lightly reinforced. The building, therefore, contained a large number of complete panels, each framed by beams and columns. The building stiffness was balanced for N - S forces but very unbalanced for E - W forces. Three factors combined to concentrate the stiffness towards the northern end: the reinforced concrete fire wall, four inches thick, across the northern end; the orientation of the long dimension of the rectangular columns; and the position of the concrete block walls. The building suffered total collapse except for a part of the northern end of storeys one and two. The upper storeys fell southward while the southern end also moved eastward. The southern end of the roof moved about 30 feet south and 10 feet east. The lower floors appeared to fall close to their plan position. Philippine Bar Association Building - the Philippine Bar Association Building (PBA) was a six-storey building of medium size with accommodation for club rooms and offices. Many first-storey columns were severely crushed and the building came close to collapse. The reserve strength of spirally reinforced columns prevented the collapse which would certainly have occurred if they had been reinforced by rectangular ties. The building had a six-storey reinforced-concrete frame of 6 by 3 bays with very deep exterior beams. Across the end, grid 1, was a substantial bearing wall. A longitudinal wall A1 to A2 resisted longitudinal deformation. The floors	

Event	Felt Effect	Source
	and roof were four- to six-inch reinforced-concrete slabs. All partitions were lightweight, flexible wooden panels except for the two with CHB (ceramic hollow blocks). Between the exterior beams of storeys two to six were sets of cast-in-place concrete shades about three feet deep. These added considerably to the stiffness and somewhat to the strength of the building above the first storey. The foundation consisted of substantial slabs and beams which extended eight feet below the ground surface while the first-storey floor was two feet above the ground. Many of the first-storey floor was two feet above the ground. Many of the first-storey columns suffered total collapse or very severe damage and shortening. The severity of damage increased towards the southeast end of the building. Exterior columns suffered greater damage and shortening than nearby interior columns. This resulted in very severe deformation of some interior beams and part of the floor at each storey level. The exterior beams on the long sides were deformed with a single curve in beams on grid D and a double curve for those on grid A. Most of the exterior beam damage was close to A3 to A6. Seven first-storey columns were damaged to such an extent that they were supporting little or no vertical load after the earthquake; these were A5, A6, A7, D5, D6 and D7. Although columns B6, B7 and C7 were severely shortened, their spiral reinforcing enabled them to support substantial loads. The building was rotated about its northwest end so that the southeast end of the second floor was displaced eight inches towards the northeast. The southeast end of the building was also tilted towards the northeast and the whole building was tilted a little towards the	

Event	Felt Effect	Source
	southeast. Aloha Theatre Building - the Aloha Theatre is a large eight-storey building which suffered severe damage near its southern end. The damage was initiated by the collapse of a few very short columns towards the southern end of storey four, and spread out and up to affect the southern end of the building very severely. The Aloha Theatre had an eight-storey reinforced concrete frame of 14 bays by about five bays, with the long axis running N - S. The southern third of the building was tapered until there were only two bays across the southern end. An open theatre area on the eastern side of the southern part of the building extends south to within three bays of the southern end. Along the southern end of the theatre, a deep beam above the floor of storey four reduced the height of four columns to 40 inches. Across the northern end of the building was a complete fire wall, probably of reinforced concrete, concentrating the attack of E - W forces at the southern end. Wall panels were of ceramic hollow block. The building was probably slightly less than 30 metres in height, above which earthquake-resistant design is required. The four short columns at the southern end of the theatre collapsed completely, allowing the ceiling beam to drop one to two feet on to the mid-height beam. Along the exterior wall on the eastern side of the theatre, the fourth storey lost three feet of height, leaving the southern third of the building tilted towards the east above storey four. Fourth-storey columns to the south and east of the theatre area were crushed and shortened by an amount which diminished at increasing distance from the theatre. The severest damage was	

Event	Felt Effect	Source
	concentrated at storeys four and five but some damage occurred throughout the southern part. Tuason Building - the Tuason Building is a medium-sized, six-storey building which came very close to complete collapse, with the columns along the southern side wrecked or severely damaged. The building had a six-storey, reinforced-concrete frame of five bays N - S by four bays E - W. There was a fire wall along the eastern side. The remaining three sides were street frontages, with the building above storey one cantilevered four feet beyond the column line. The facings were of reinforced concrete and ceramic hollow blocks. Ceramic hollow block partitions are more numerous near the eastern side. The western part is particularly open at the first-storey level, where some beams have been omitted to allow a clear two-storey height. Considerable lateral stiffness is added near the northeast corner by the shaft and a stairway, with an additional stairway from ground level to the second storey. Spadrel beams reduced the clear height of the columns to about 1.8 metres on the south and east sides of storey one. The first-storey column against the fire wall, on the southeast corner, was severely damaged and the next two were completely shattered with a height loss of three to four inches. These columns contained 1/4 inch ties at 12-inch centres. Just north of one shattered column, a column suffered severe damage at a structural joint which contained a layer of sawdust and wood chips. The whole of the southern facing dropped about three inches and suffered extensive damage, as did the northern facing. The most severely damaged interior panels were those running E - W, from storeys one to	

Event	Felt Effect	Source
	four. Trinity Building - Trinity is a seven-storey office building of medium size. It suffered considerable structural and non-structural damage at storeys three, four and five. The Trinity building has a seven-storey reinforced concrete frame of six by four bays. Along most of the west, north and east sides are box beams, four feet deep, which reduce the clear height of the exterior columns to six feet. The interior columns are cylindrical with a clear height of about 8 1/2 feet. A substantial 5-inch reinforced concrete wall runs across half the southern end and included two short N - S sections. Another reinforced-concrete wall runs from E1 to E2 and a short section runs from D1 a third of the way towards E1. There are some concrete hollow block panels near the southeast and northeast corners but nearly all the interior walls are of flexible wood-frame panels. The wall at the southern end presented considerable resistance to E - W deflections, while the two walls at the northeast corner had the effect of a tower, permitting increased inter-storey displacements at increased height. The severest structural damage occurred to the northwest corner columns of storeys two, three, four and five, with somewhat lesser damage to nearby exterior columns. The reinforced concrete shades between the damaged columns were also damaged. The severity of the column and shade damage decreased along grid 1 with increasing distance from A1. However, there was complete failure of the short concrete wall in bay D1 - E1 at several levels. The above damage was consistent with torsional movement about some point southeast of the central axis under E - W inertia	

Event	Felt Effect	Source
	forces. There was also considerable damage to secondary columns, shades, and N - S hollow concrete block walls on the eastern side of the building. This damage was consistent with deformation under N - S inertia forces, with the wall between E1 and E2 deforming as a vertical cantilever. Diamond Tower - the Dimond Tower is a large eleven-storey apartment building. It suffered moderate structural damage and considerable non-structural damage particularly at the cantilevered ends. The eleven-storey reinforced concrete frame building is of 11 by 2 bays. Above the second storey, the floors were cantilevered 2.15 metres beyond the column lines along the north side and at each end. The overall length was 51.3 metres and the mean width 11.7 metres. Along the southern sides, with three small breaks for patios, was a substantial reinforced concrete wall. Associated with the centrally placed stairways and lift shaft were two short reinforced concrete walls running N - S. There were many complete hollow concrete block panels between columns in both the N - S and E - W directions. The building was balanced for transverse forces and only moderately unbalanced for longitudinal forces. Typical lower columns were 28 x 28 inches, with 20 bars of 1-inch and three sets of 3/8-inch ties at 12-inch intervals. Since this building exceeded 30 metres in height, and had a large height-to-width ratio, an anti-seismic design was required with a uniform horizontal loading of 0.1 g. The moderate frame damage was severest at the lower storeys. The severest cracking was in transverse beams with 1 mm cracks in some beams of the first storey. Moderate cracks also occurred in many columns,	

Event	Felt Effect	Source
	particularly in association with the construction joints which were near the tops of the columns. In a few instances, the upper parts of the columns suffered shear cracks due to failure at an upper corner of an adjoining concrete block wall panel. Liwayway Hotel - the Liwayway Hotel is a nine-storey building of 7 by 7 bays which suffered severe beam damage up to the fifth storey. The tall columns which formed the arcade along the front were severely split. This 33-year old building contained a reinforced concrete frame with wide exterior columns. Above the beams were six-inch reinforced concrete walls to sill level. Across the east side was a substantial reinforced concrete fire wall broken by a patio which ran most of the way across the fourth bay from the front. Frame beams were continued across the patio. The west and the north walls suffered severe shear damage to beams and sprandel walls up to the fifth storey. The column behind the fire escape has severe shear cracks indicating a lurch to the right, westward. The wide columns at the front suffered severe shear damage and splitting. Further column damage is seen in the patio. National Library - the National Library is a large building in which the stiffness is very unbalanced for transverse forces but is approximately balanced for longitudinal forces. Some very stiff reinforced concrete walls along the central section suffered shear damage but no damage associated with trensverse forces was observed. The building is 128 metres long and about 23 metres wide. Its height varies from 26 metres to 34 metres. The western section, 49 metres long, is supported on relatively slender columns about 6 metres high. The	

Event	Felt Effect	Source
	longitudinal wall in the central section suffered severe shear cracking. However, transverse walls, in particular those at the first-storey level, showed no damage despite the severe unbalance for transverse forces. This suggests that the main inertia attack was along the long axis, which was orientated N 63°E. Nearby, two small monuments fell parallel to the long axis, and in opposite directions. The damaged longitudinal walls were much stiffer than other longitudinal components. They did not have sufficient strength to withstand the resultant loads of this large building. Old Philippine National Bank - the Old Philippine National Bank is a large H-shaped building with the sides of the H fronting on Escolta and Muelle D.B. Nacional streets. This seven-storey building was very severely damaged and is to be demolished. The building had fire walls on each side which provided considerable stiffness and strength against motion at right angles to the streets. However, the deep spandrel beams and wide columns suffered severe damage from motion parallel to the street. Some components showed evidence of a particularly severe lurch along the street in the direction N 48°E. Boie Building - the Boie Building is of seven storeys with 9 bays by 6 bays. It suffered moderate column damage along the northwest face. There was widespread but moderate damage to hollow concrete block panels. The building had deep box beams along the northwest and northeast sides, fronting Escolta and Pinpin streets. On the southwest side, adjoining the Old Philippine National Bank, was a reinforced concrete fire wall. On the southeast	

Event	Felt Effect	Source
	side are some short reinforced concrete walls associated with the stairways and lift shaft. The shear damage to the short exterior columns on the northwest side, and to small sections of reinforced concrete wall, indicated a lurch towards the northeast. There was evidence of very little deformation in the northwest direction. The exterior columns suffered shear damage because they were stiffened by the box beams and hence received most of the shear loads. The southeast area of the building would have caused torsional movements and hence additional loading on the northwest columns. Araneta and Tuason Building - this eight-storey office building has a reinforced concrete frame of 8 bays by 3 bays. It is symmetrical, with a fire wall along each long side. There was considerable non-structural damage to concrete hollow block panels due to transverse swaying. There was also damage to transverse walls of a central patio. The damage resulted from associating rigid low-strength components with flexible structural components. Development Bank of the Philippines - this eight-storey building of 6 bays by 5 bays suffered moderate non-structural damage in a few places. The building contains substantial reinforced concrete walls on two sides. On the two remaining sides, reinforced concrete walls extended 1 metre above the beams. Near one corner, short wall sections extend from adjoining columns to reduce the clear length of the beam and low wall from about 6 metres to 2 metres. These short lintel walls were severely damaged by shear forces at storeys five to eight.	

Event	Felt Effect	Source
	Phoenix Building - the Phoenix is an eight-storey building of 12 bays by 4 bays with a reinforced concrete frame. It suffered slight structural damage and moderate non-structural damage. The building is almost symmetrical about both axes, the longitudinal axis being N 41^{o}W. There were a considerable number of transverse panels of concrete hollow blocks which suffered slight diagonal cracking both ways. Despite the four longitudinal walls at the ends of the building, there was sufficient longitudinal swaying to cause light beam and column cracking and to break a number of windows. The most pronounced cracking was at storeys three, four, five and six. La Tondenya Building - the La Tondenya is an eight-storey office building of moderate size. The substantial beams at the southeast end suffered severe shear failure due to interaction with reinforced concrete end walls. The building has eight storeys of 3.8 metres storey height. It has 5 bays 6.5 metres long and a single bay 18 metres wide. Lateral stability is provided by reinforced concrete walls across each end. The wall at the southeast end is in two sections, exposing a 4.5 metres length of the beams at that end. Longitudinal stability is provided by spandrel beams 2.5 metres deep. These terminate in walls about 2.5 metres wide at each end of the building. Typical lower columns are 40 x 20 inches with 94 bars of 1 3/8 inch diameter. Typical transverse beams are 32 x 24 inches with the following steel in the central section: at the bottom were 27 bars of 1 1/8 inch, at the top bars of 1 1/8 inch, at the sides 4 bars of 1/2 inch. Ties are two rectangles of 3/8 inch bar at 12-inch intervals. The columns are supported on clusters of about 15	

Event	Felt Effect	Source
	concrete piles 12 x 12 inches driven to a depth of about 120 feet. When the building lurched towards the northeast, the sections of end wall tilted and applied large shear forces to the beams, causing failures. Rotation of the bases of these wall sections also damaged a first-storey concrete panel. There was moderate cracking of some first-storey columns and some cracking of reinforced concrete walls at the end of the deep longitudinal beams and at construction joints. Ground slumping of a few inches occurred at the eastern end of the building damaging the ground floor surface but not evidently attacking the structure. Although it suffered severe structural damage, the building was not close to collapse. Had the southeast wall been complete, it would have suffered only moderate damage. New Philippine National Bank - this large steel-frame building suffered only slight damage to non-structural components. These were pre-cast with protruding bars which were welded in place before plastering. Overseas Terminal - the Overseas Terminal building consisted of two three-storey blocks parallel to the axis of pier 9 and running from the fill on to the pier. They were joined by a framed structure at the third-storey level which formed a rectangular arch at the entrance to the pier. The side columns at the entrance were given monumental dimensions of about 6 feet by 4 1/2 feet. They had a very low percentage of steel with 7/8 inch vertical bars and 3/8 inch ties. The fill close to the pier slumped about 25 cm. There were severe shear failures of the two large columns. Damage to the ground floor of the northwest block. The slumping has carried the lower	

Event	Felt Effect	Source
	parts of the large columns toward the pier. It appears that the top of the foundation system are not connected by adequate beams in the direction of the pier axis. Metropolitan Cathedral of Manila - the massive cathedral, situated a few hundred metres east of the Philippine Bar Association Building, suffered no damage although three earlier stone cathedrals on this site had been destroyed by earthquakes. However, the cupola over the main altar was displaced and deformed 15 cms towards the east. The western column was displaced to the east. Damage to the base of the eastern column was tilting towards the east. F.E.U. Arts and Science Blocks - at the Far Eastern University are two large seven-storey reinforced concrete frame buildings. The Science Block is 77 metres long and 17 metres wide over most of its length, while the Arts Block is of comparable size. Each building had transverse reinforced concrete walls associated with its stairways and lifts. The long axis of each building is about N 60°W. Moderate damage to shear walls was associated with transverse inertia forces. These forces acted both ways along an axis N 30°E. There was damage at the first-storey level to an internal shear wall in the Science Block, to the wall at the southeast end of the Arts Block and damage to pavement due to tilting of the base of this wall. San Juan - no extensive damage occurred except for some Meralco posts that fell and high-tension wires that snapped. Navotas - powerlines to this fishing town snapped during the earthquake,	

Event	Felt Effect	Source
	causing a black-out. No casualties or damage of consequence were reported. Malabon - the belfry of San Roque Church cracked. Intensity - IX.	42, 56
1970 Apr 07 1:34 p.m.	Eastern Luzon: A strong earthquake of major magnitude which shook the whole of Luzon and Northern Visayas. Intensities reported at various places: Baler and Metropolitan Manila - Intensity VII. Dagupan, Cabanatuan, Baguio, Infanta, Tuguegarao, Talisay and Tayabas - Intensity VI. Casiguran, Alabat, Vigan, Bayombong, Tanay, Laoag and Legaspi - Intensity V. Iba, Tarlac, Aparri, Daet and Calapan - Intensity IV. Jomalig and Catarman - Intensity III. Main shock hit Manila at 1:34 p.m., 45 seconds' duration. Epicentre was placed at 197 kms N northeast of Quezon City, somewhere inland in the vicinity of Maddela, Nueva Vizcaya. Damage: P. Guevarra Elementary School on San Fernando St., Binondo collapsed at the height of the main shock. Buildings in central Manila, particularly those already weakened by the 1968 earthquake, suffered cracks, structural damage and broken windows. Manila International Airport suffered cracked walls and broken windows. High buildings along Rizal Avenue, Escolta and Roxas Boulevard suffered broken windows and structural damage. Communication	

Event	Felt Effect	Source
	lines were temporarily disrupted. Telephone calls from one area to another became garbled for at least one hour.	6, 17
	Casualties and Damage: Total casualties were 14 killed and some hundreds injured. The deaths all resulted from the main shock. Some dozens of injuries occurred during the most severe aftershock at 12:02 p.m. on 12 April, and a few injuries occurred during other aftershocks. Considerable damage to buildings occurred throughout the alluvial ground area of Manila City. There were reports of heavy damage to public and private buildings in Baler, Dipaculao, Casiguran and Maria Aurora. These towns are close to the epicentre, the first three being on the coast and the fourth a little inland on a coastal plain. In the Baler area, there was also severe damage to bridges and roads, including a fissure over 1 km in length, about three feet in depth and a foot wide, which ran along the main road between Baler and San Luis. Other losses included severe damage to control tower equipment at Manila International Airport and damage to coconut trees in Quezon Province, estimated at P2,000,000 by the Philippine Coconut Administration. Most of the buildings damaged in 1968 suffered some further damage in 1970, often as a result of forces in a direction quite different from the direction of attack during the earlier earthquake. While the recent damage was more severe in some buildings, it was less severe in many others, either because strengthening shear walls had been added or because the building had greater resistance to forces in the direction of attack of the 1970 earthquake. Damage to particular buildings in Manila:	

Event	Felt Effect	Source
	Philippine Bar Association Building - this six-storey reinforced concrete frame building of 6 x 4 bays suffered severe crushing of the first-storey columns towards one end and was very close to collapse after the 1968 earthquake. The building included a "T" suffered severe shearing and crushing at the first-storey level. This damage resulted from earthquake forces along the axis of the building which were evidently more severe than the axial forces of the previous earthquake, since the longitudinal stem of the "T" was the main resisting element for the first storey during both earthquakes. Aloha Theatre Building - the southern ends of storeys five to eight were removed (after the 1968 earthquake) and the remainder of the building was repaired. It is understood that a shear wall was introduced near the southern end to balance the fire wall across the northern end. No damage was reported from the 1970 earthquake. Trinity Building - this seven-storey building of 6 x 4 bays suffered considerable damage to short exterior columns and near the eastern and western corners, and some panel damage near the eastern and northern corners, during the August 1968 earthquake. It suffered less damage this time. The most severe damage was to a few short columns near the southern end of the NE side. Glass bricks to the left of these short columns had been damaged in 1968. The broken bricks were replaced by reinforced concrete which extends to half the height of the short columns. The new reinforced concrete panels damaged the columns when the building swayed towards the SE. The swaying and consequent damage would have been	

Event	Felt Effect	Source
	more severe, particularly on the first few storeys, if it had not been limited by a short shear wall at the far end of the NE wall. Diamond Tower - this long, narrow, eleven-storey building of 11 x 2 bays suffered considerable structural and non-structural damage due to transverse swaying during the 1968 earthquake. The beams and columns were repaired by chipping off damaged concrete and replacing it with dry-pack concrete. Where damage was severe, an additional cage of half-inch steel bars was provided. Cracks were filled with a pressure grout of epoxy resin. The sagging cantilevered parts were repaired without removing the sag. Two short transverse shear walls were added at about a fifth of the building length from each end, to provide increased resistance to transverse forces. Each shear wall was formed by casting heavily reinforced concrete panels at all storey levels of a single bay. Some of the panel reinforcing bars were welded to the steel of the columns and beams, this steel having been exposed by chipping away the faces of these columns and beams. The transverse shear walls suffered only slight local damage, and general non-structural damage resulting from transverse movements was very small. However, it is probable that the most severe attack during the April 1970 earthquake was along the axis of the building, and hence its transverse resistance was not severely tested. The longitudinal fire wall provides effective against longitudinal forces. However, the wall is broken up into lengths of about 25 feet by light recesses, and there was sufficient flexibility for moderate panel damage to occur along the first storey. Relative vertical movements between the near ends of	

Event	Felt Effect	Source
	shear walls caused severe damage to low panels and small cracks in the stairway. Along the northern face of the building, in the plane of the wall, was a set of shade panels running vertically between the balcony balustrades. These shades suffered considerable cracking at construction joints, probably due to longitudinal swaying of the building. Towards the ends of the building, the cast-in-situ shade panels suffered no such damage.	
	Liwayway Hotel - in April 1970, this nine-storey building suffered somewhat less severe damage than in August 1968. In particular, the repaired columns along the outside of the arcade suffered no further damage. Around three sides of the building, spandrel beams, up to storey six, suffered damage which was less severe than in 1968. The fourth side includes a fire wall. Although the damage was distributed over a large number of building components, it was of a type which absorbs relatively little energy; namely, diagonal shear cracks and compression crushing.	
	National Library, storeys six and nine - the damage to the axial shear wall in April 1970 was similar to that in August 1968. However, other damage associated with longitudinal movements indicated less swaying in this direction. The recent earthquake caused some damage to concrete hollow block panels which was not observed in the earlier earthquake. The cracks were a result of swaying towards NNW.	
	Philippine National Bank - the demolition of this old seven-storey building was well advanced by April 1970. Of particular interest was the unexpected discovery of a riveted steel frame contained within the	

Event	Felt Effect	Source
	reinforced concrete beams and columns. It is therefore probable that the building was much further from collapse than it appeared to be during visual inspection after the 1968 earthquake. Despite this reserve of earthquake resistance, the damage was so extensive that demolition was the only practicable course. Botica Boie Building, Escolta Street - this six-storey reinforced-concrete frame building of 9 x 6 bays suffered damage in 1970 comparable to that in 1968. The damaged panels of glass bricks were replaced after August 1968 by reinforced concrete panels, and these were damaged in April 1970. The spandrel beams and columns on the NE side suffered considerably more severe damage in 1970. The pattern of damage again supports the hypothesis that the attack of this earthquake was relatively more severe in the NW - SE direction. Development Bank of the Philippines, Escolta Street - this eight-storey reinforced concrete building of 6 x 5 bays suffered moderate but extensive panel damage in August 1968. As part of a comprehensive repair programme, the building had been stripped of its exterior panels on the NE and SE sides by April 1970. Thus reduced in weight, it suffered no significant damage during the recent earthquake. Phoenix Building, Recoletos Street - this eight-storey reinforced concrete building of 12 x 4 bays, with its long axis in an ENE direction, suffered moderate structural and non-structural damage during the August 1968 earthquake. In general, damage was less severe in April 1970. This may be consistent with the assumption that	

Event	Felt Effect	Source
	in 1970, the longitudinal forces were less but the transverse sections have reduced stiffness in the second bay, from the south, since the beams are cut to half length, leaving the floors to provide continuity. End panels and low walls on the corresponding end bay suffered damage up to storey six.	
	Overseas Terminal Building, Pier 9 - a six-inch steel water main, parallel to the pier axis, ran from the fill on to the pier. It was reported to have been broken by tensile forces and the ends drawn several inches apart.	
	Manila Cathedral cupola - in April 1970 the cupola of the Manila Cathedral moved towards the east with a pattern of damage almost identical to that suffered in August 1968. Most of the broken marble components had been repaired, and it is probable that a residual weakness remained, permitting movement towards the east. The cupola was deformed in 1970 without the sliding of the blocks immediately above the pedestal, which occurred in 1968.	
	Far Eastern University, Arts Block - this seven-storey building of 7 x 2 bays suffered considerable structural and non-structural damage at most levels in August 1968. There has been further deformation, since a number of the timber posts installed after the 1968 earthquake now have some clearance, while some light steel props have been buckled. Some beam damage occurred adjacent to the shear tower formed at the eastern end by the lift shaft. A shear failure occurred in a column associated with the eastern stairway and considerable damage occurred at the construction joints of columns and reinforced concrete walls. There	

Event	Felt Effect	Source
	was a shear tower, around lift shaft, across each end of the building. It was no doubt these which caused the earthquake damage to be distributed throughout the full height of the building. If the walls had been absent, the attack would probably have occurred mostly at the first and second storeys and would have been more severe. However, in the longitudinal direction, the shear walls were shorter, the frame more flexible, and the damage was slight. P. Guevarra Elementary School Building (PGES) - this L-shaped three-storey school building collapsed completely during the 1970 earthquake. The northern side of the "L" was completed in August 1968, when it suffered some structural damage. This damage was repaired and the whole building completed in January 1970. If it is assumed that the collapsing building swayed towards the area in which total collapse first occurred, then collapse must have occurred first about midway along the western side of the wing which runs towards the north. Agoncillo Elementary School - this three-storey concrete frame building of 3 x 3 bays suffered severe shear damage in two first-storey columns, each of which had a concrete hollow block panel extending to about 2/3 of its height. Beside the stairway on the first and second storeys, the concrete hollow block panels had been severely damaged and would have collapsed across the stairway if the earthquake had been somewhat more severe. This column damage provides the clearest possible warning against neglecting panels as "non-structural" during the design of a building containing a reinforced-concrete frame.	

Event	Felt Effect	Source
	Manila High School - this building was in the form of a hollow triangle, with two recently-built wings of four storeys and a third older wing of three storeys. The newer wings suffered moderate frame damage and considerable panel damage at the first and second storeys. There were five concrete folded-plate sun shades on the roof of the newer wings of which three collapsed while the remaining two suffered severe damage. While the concrete strength is uncertain, it should be noted that a considerable number of building appendages suffered damage during the April 1970 earthquake.	
	Hope Christian High School - this long three-storey school building had an axis running approximately NW - SE. Concrete hollow block panels, one-third of the column height, extended along the NE wall at storey one. Under the effect of longitudinal swaying, the shortened columns suffered moderate "X" cracks.	
	Consolidated Apartment House - this was a large seven-storey building of 13 bays x 5 bays. It had a reinforced concrete frame and hollow ceramic-brick panels. The panels in several bays of the long exterior walls had no openings, while other exterior panels on the long and short sides had only small window openings. Throughout the length of the building there was a light wall on one side of the central (third) bay. This effectively separated the building into two halves, without interconnecting floor diaphragms or vertical panels, but the two parts were closely linked by the beams of the frame. This building suffered moderate cracking of some beams and columns, including working of construction joints. The panels without opening suffered damage	

Event	Felt Effect	Source
	around the edges, in some cases rather severe. Incomplete panels suffered more severe damage. Considerable debris fell from panels, which ruptured where they had cast-iron pipes embedded. Strong reinforced-concrete canopies over the exits of this building would have provided considerable protection to fleeing occupants. Those bays which contained complete, or almost complete, panels swayed somewhat as short shear walls, so that considerable inter-storey deflections were carried to the upper levels of the building. Pearl Towers - this consists of a long five-storey building of 19 x 2 bays and a rectangular seven-storey building of 7 x 5 bays connected by beams at the first- and second-storey levels. Fire walls along the SW side of the five-storey building, and on both sides of the seven-storey building, give them considerable resistance to longitudinal forces. These buildings suffered moderate damage in August 1968 from transverse swaying. Strengthening was provided by a pair of short shear walls in each building. Very little damage occurred in the recent earthquake. While the transverse shear walls must have provided added resistance, the general pattern of damage in Manila City suggests that the transverse attack in the NE - SW direction was less severe than the attack in the NW - SE direction. Gocheco - this six-storey building is in the form of a hollow square in which the sides are either 3 or 4 bays wide. It suffered some frame and panel damage during the August 1968 earthquake. The more severe structural damage was repaired with hardpack concrete, and the cracks with injected epoxy resin. In April	

Event	Felt Effect	Source
	1970, there was less frame damage than during the 1968 earthquake. At least some of this damage appeared to be associated with NW - SE motions. Some beams which had been damaged by NE - SW motions during the 1968 earthquake, and repaired with epoxy, suffered no further damage in 1970.	
	United Building - the United Building extends 8 bays along a NE - SW axis and is 4 to 5 bays wide. It had a reinforced concrete frame and a reinforced concrete fire wall along the NW side. There was a considerable number of panels of concrete blocks. This building suffered little damage in August 1968 but in April 1970 it suffered such severe column damage that it was very close to total collapse. Most of this column damage was caused by the attack of transverse panels during the swaying of the building in a NW - SE direction.	47
	Scores of buildings in central Manila, particularly those already weakened by the 1968 quake suffered cracks, structural damage and broken windows. The Manila International Airport suffered cracked walls and broken windows. Its control tower was heavily damaged. Most high buildings along Rizal Avenue, Escolta and Roxas Boulevard suffered broken windows and structural damage. Communication lines were temporarily disrupted. Telephone calls from one area to another became garbled for at least one hour. A few buildings in Caloocan, Quezon City and Makati suffered structural damage. In Caloocan City, the city hall annexe suffered cracks. Structural damage also occurred to Vinzon's Hall in U.P. Diliman and to four tall buildings on Ayala Avenue. Telltale signs of the earthquake were all over Manila,	

Event	Felt Effect	Source
	reflected in broken bits of glass and pieces of plaster and concrete which littered most streets. In Intramuros, heavily damaged were the National Press Club Building and Manila High School Building whose rooftop shades collapsed. On Kalaw St., the tall Antonio building as well as Volkswagen House displayed shattered window panes. At Plaza Miranda, numerous glass panels of the Pecache building "shattered like gunfire". The Cinerama cinema was a checkerboard of shattered panels. A crane on top of the Manila International Hotel on Roxas Boulevard snapped, but fortunately became entangled with the steel girders of the building, thus preventing it from falling. Roof of Guzman Technology building on Mendoza St., Quiapo caved in. Otis Department Store's roof also caved in. Binondo church tower fell to the ground. Philippine Long Distance Telephone Company reported that main cables connecting Caloocan and Riverside exchanges were damaged. A MERALCO transformer on F. Manalo St. exploded at the height of the tremor. Reports from the provinces: Road to Baler, Quezon from Bongabon, Nueva Ecija has been rendered impassable due to fissures. The main road from San Luis to Baler was reported cracked in many places, the cracks about one-half metre wide and one-half metre deep. In District Calabuan, Baler, water rose from the fissures about 3 metres high. In Naga, Philippine National Railway's water tank collapsed. The tank was capable of containing 40,000 gallons of water. Quezon Province: Ysmael Lumban Concession Field Office Site, near Dinajawan Bay (Dekutunan) - several cracks near shoreline. General	

Event	Felt Effect	Source
	direction N - S. Distance from one crack to another was about three metres; others wider. Aleman, Antatabong area; Sierra Madre Range, Quezon - very few cracks longtudinal to ridge contours, one about 80 metres long; opening about 8 to 12 inches wide and average depth of two feet, in the general direction of E - W. The ridges observed are planted with trees and are very narrow, not being more than 20 metres on the top portion in most cases. Condition of top soil is rather loose. It is believed to be tending towards a landslide but, because of the adherence of the numerous roots of trees, the slide was prevented. Within this area, several landslides from steep contours were observed. Casiguran Quezon - Bailey Bridge (of steel and wood construction) approaching town proper and crossing Casiguran River, settlement of both approaches of the bridge approximately three to four feet. Some materials of the approaches are earth-filled and held by rift-rafting. House with concrete backwall - the portion near the concrete structure, settlement was about one inch. House has concrete flooring (with reinforcement) and several cracks were observed on the first floor of the house. Fresh exuded sand deposits were also observed along construction joint of pavement and wall. Municipal Building Gate - orientation N 60°E, arch portion of the gate separated at the construction joints, moved to direction of S 60°W with a displacement of one inch. Cross-section area of arch is 24" x 24". Hollow block fencing of the Town Hall also collapsed. Concrete hollow blocks are without reinforce-	

Event	Felt Effect	Source
	ment. Unfinished concrete house, a two-storey structure with reinforced concrete frame and lower-portion walls half finished and one side having four columns visible. Beam (topmost) in the centre snapped, oriented in the NW - SE direction. Tower beams incurred some minor cracks, too. Cross-section of beam is about 12" x 8" and column is about 12" x 12". School fence, concrete hollow-block walls with bamboo reinforcement collapsed.	10
	The April 7, 1970 quake was characterized by "short rapid jerks, zigzags rather than arcs" and rattled building as though they were convulsed by inner jitters. This quake radiated from the point of the fault-line that runs along the Philippine Pacific coast. The epicentral zone covered the area of Casiguran, Baler, Sta. Lucia, Quezon and the coastal ranges of the Cordilleras. People of the shore towns "saw the sea pushed back, saw the water stripped off like a carpet from the shoreline and folded up into the horizon. But the next moment the folded sea unrolled and came rushing back as a wall of water, sort of tide, a mile-wide torrent that flooded and crashed past the shoreline, engulfing trees, boats, huts and beach". Roads split was wide as two feet, water fountained from the deep chasms created, bridges collapsed.	
	Intensity - IX.	62
1973 Mar 17 4:31 p.m.	Ragay Gulf: Macroseismic Observations - the macroseismic are of the Ragay Gulf earthquake covered about 157,000 sq kms using a cut-off Intensity of III in the Rossi-Forel Scale of IX. At the height of the earthquake, people panicked. They had to hold on to stable objects to maintain their balance otherwise	

Event	Felt Effect	Source
	they would have fallen to the ground. There were reports of changes in the flow of springs and wells. Sand and mud were ejected from fissures in soft ground. A reinforced concrete highway bridge collapsed. Within the epicentral area, the inhabitants heard rumbling sounds coming from different directions during the occurrence of the main shock and ensuing larger aftershocks. Intensity - XI.	
	Those living close to the fault-line either fell down or were thrown up for a few feet due to the initial vertical jolt of the earthquake. Four-legged animals such as buffalo and cows were likewise knocked down. Piles of coconut trunks lying five metres away from the fault-line in district Sintones, Guinayangan were thrown southwestward, pinning down and killing a man who was lying down nearby during the time of the main shock. An employee of the Philippine National Railways in Hondagua, Lopez, who was sitting with a clear view of the rails at the time of the main shock reported the dislodgement in a wavy form of the rails from the ground. Some people in Calauag, Lopez and Guinayangan reportedly saw the ground heave up and down in a dizzying, wave-like manner. The sea at the western end of the sea-wall in Calauag was observed to go beyond the shore by 20 metres. This was due to a rise in sea level of 1.3 metres. Rise in sea level was similarly noticed in the town of Quezon at the southern tip of Alabat Island.	
	Manila, where the earthquake was felt at Intensity VI, is underlain largely by alluvial and deltaic deposits. High-rise buildings suffered shattering of window panes and minor cracks in walls and ceilings. Earthquake effects on	

Event	Felt Effect	Source
	buildings, roads, bridges, railway tracks, communication lines, electric systems, waterworks and sewerage systems, sea-walls and piers were extensive in the Tayabas isthmus and understandably moderate in the sparsely populated area of northern Bicol. The relative distances of the centres of population to the epicentre of the main shock ranges from 70 kms to 150 kms. But some of the aftershocks, which were probably related to the successive rupturing along the fault, were situated underneath or in the vicinity of the affected towns in the isthmus. Consequently, these conditions contributed much to the earthquake's destructive effects. Evaluation of these effects on civil structures obviously showed the apparent lack of earthquake-related safety factors in their design and construction especially in the seismically active areas, that is, in the Tayabas isthmus. The town worst hit by the earthquake is Calauag, Quezon where 98 houses were totally destroyed and 270 others were partially destroyed. In district Sumulong of the same town, 70% of the school building was damaged. Most of the partially to completely destroyed houses and buildings were situated along the seashore in the northern section of the town proper. The damaged houses were largely wooden and some were poorly built concrete buildings. Effects on strongly built ones were limited to the toppling of concrete hollow block walls and decorative tiles. The town of Lopez ranks next to Calauag with respect to the extent of the destruction. The place is relatively farther from the causative fault and the epicentre of the main shock, but soft underlying sediments present in Calauag are similarly found in Lopez. The concrete hollow block (CHB)	

Event	Felt Effect	Source
	retaining walls of a five-room Parent Teacher Association building of the Lopez Provincial School collapsed on both sides of the building along the N - S direction. Similarly, the CHB walls of the Library building were badly cracked. A residential three-storey concrete building was severely tilted to the north. The facade of the Sto. Rosario Catholic Church of Lopez suffered cracks and some parts of the CHB walls on both sides toppled down. Its northern section tilted to the east and a part of its southern portion, which is a remnant of an old convent constructed of masonry walls, gave way. The hollow block facade of a nearby chapel on the eastern side of the church collapsed towards the north. The one-kilometre-long concrete sea-wall along the ESE coast of Calauag suffered minor cracks mostly along construction joints. Near a mid-section in one of its stairways, there was a ten cms crack. One section was displaced five cms to the north from the other section. In district Hondagua, Lopez, five kms east of Calauag, some buildings were totally or partially damaged. The CHB wall of one of the classrooms of the Hondagua Elementary School toppled down. Estimated losses to the Philippine Flour Mills in Hondagua were reported to be about one million pesos. The losses were due to the temporary stoppage of operation to repari the destroyed conveyor systems and damage to piers, displaced machinery and buildings. The concrete columns of the housings of the conveyor machines buckled. There was differential settlement of the ground along fills in the pier such that floorings of some of the buildings became uneven and were cracked. The Hondagua Theatre, which had been converted into a	

Event	Felt Effect	Source
	restaurant, completely collapsed at the height of the earthquake. The Catholic chapel of the district was partially destroyed. Its facade toppled down and its CHB walls were cracked. The earthquake wrought damage on roads, railways and bridges. This hampered travel to and from the Bicol region. At least four highway bridges on the Manila South Road were reported to have suffered damage ranging from partial to total collapse. The bridge which totally collapsed was the Sumulong highway bridge in Sumulong, Calauag. It is newly constructed with three-span RCDG on opposite one beam. It was severed into two sections across the first span on the Sumulong side approach. The Calauag pier sagged down below the water level causing its second and third sections to fall into the river. The Sumulong pier was tilted to the NW and its abutment was badly cracked. Measured horizontal displacement was 76 cms to the NW at the Calauag approach. A Philippine National Railway (PNR) trestle bridge crossing the Calauag River and situated about 600 metres north of the highway bridge was badly damaged although it did not collapse. Measurement on both sides of the abutment showed that the span was displaced 50 cms northwesterly from its original position. The rails along the bridge were badly twisted. A slight movement was detected at the PNR bridge in Morato, Tagkawayan. Its ties were observed to have moved eight cms to the east, and the base plate of its western abutment was moved five cms to the south. Damage to national and municipal roads was limited to cracking of the concrete slabs along the Manila South Road. Subsidence occurred along the Sumulong Guinayangan road. Between the towns of Lopez and Calauag, the rails of the PNR were reported to have been	

Event	Felt Effect	Source
	badly twisted. The major twisting of the lines however occurred some 300 metres from the southwestern approach of the PNR trestle bridge in Sumulong. The measured horizontal displacement of the Sumulong PNR bridge was only 0.5 metre across the lines; it was 1.85 metre along the fault trace. A goods wagon loaded with charcoal in Hondagua at the pier of the Philippine Flour Mill at the time of the earthquake fell on its side to the northwest. Electric systems, waterworks systems and telegraph systems in the towns of Lopez, Calauag and Guinayangan were severely disrupted. In Calauag, water-main pipes were either fractured or severed. Electric and telegraph lines snapped due to the appreciable horizontal movements of the ground. Fires which broke out during the earthquake were immediately controlled. In the town of Lopez, a concrete electric post broke on its base and toppled, pinning down five youngsters who were hanging on to it to prevent themselves from being thrown off their feet due to the strong shaking of the ground. The electric post had a dimension of 0.16 x 7.70 metres. Disruption to water system was minimal. In district Hondagua, Lopez, a 3/4 inch water pipe was subjected to tensional forces which resulted in the breaking and separation of the pipes. Agricultural Effects: The agricultural industry in the epicentral area is based mainly on coconut. The coconut production was low because of the shaking down of young nuts during the earthquake. Furthermore, the roots of some trees situated within a distance of about one km on both sides of the fault traces were cut off as a consequence of the horizontal ground movement, thus affecting their fruit-bearing	

Event	Felt Effect	Source
	capability. Concrete fishpond dykes in the epicentral region were cracked although to a minor extent. Mud dykes which were loosely made toppled down while others were fissured. Geological Features and Effects: The most interesting feature in this earthquake was the remarkable extent of the faulting. The farthest observable fault-trace from the epicentre is 90 kms away in the coastal district of Sumulong, Calauag. Ground breakages were seen along the segment of the Philippine Fault, from the western coast of Ragay Gulf to Calauag Bay, a stretch of about 30 kms. The fault traces exhibited "moletrack" features with ground fissures arranged in echelon to one another in an E - W trend. From District Cabong towards barrio Sintones in the town of Guinayangan, some 6 kms northwestward, the traces were observed to have followed a moderate depression. In three places along this segment, trunks of fallen coconut trees were split and displaced left laterally. Going uphill from barrio Sintones to barrio San Pedro, seven kms east of Guinayangan, the traces were encountered along the trail. About three kms west of the barrio schoolhouse of San Pedro, two sets of ruptures were observed. One set trended N 30^{o}E with vertical slip of 0.21 metres and is believed to be a complementary shear. The other set is 1/2 km uphill with maximum width of 0.5 metre and a ground subsidence of the same amount. The extension of the fault-trace from the mountain side was seen in barrio Yaganak, Calauag. Along the fault-line stands a palm thatch hut. One of the wooden posts of the house was displaced in the left-lateral direction by 1.10 metres. Furthermore, the south-western part of the house sagged due	

Event	Felt Effect	Source
	to the ground movement. About 200 metres from the same house stood a coconut tree, the main root of which was severed and displaced also by 1.10 metres. Some 100 meters away from the Calauag approach to the collapsed Sumulong bridge, the fault transects the main road almost perpendicularly. From there, the faulting crossed the railway lines and sheared them by 1.85 metres. On its extension towards the sea, the fault-trace was still discernible in the soft sediments of complementary fissures located on the eastern side of the fault-line. The strong shaking of the ground during the Ragay Gulf earthquake caused two areas along the Calauag-Guinayangan municipal road between kms 236 and 238 to subside. One of the resulting depressions was 225 metres long while the other was 95 metres long. The longer depression was two kms NW from the first. It crossed the road obliquely. These depressions may be due to "quicksand" effects triggered by the main shock as indicated by the charcoal black mud extruded along the sides of the depressions. A fissure, 15 cms wide and of unknown length, lies along the foothills some 200 metres NW of the Philippine National Railway terminal in Calauag. It is believed to be one of the complementary shears of the major fault. In the town of Lopez, two fissures were observed along Lopez-Jaena Street. The western side was depressed by 12 cms with a maximum width of 44 cms. These fissures may be due to settlement of the bank of the Talolong River. Close to the eastern bank of the Calauag River in districts Sumulong and Mabini, several mudboils were found. Mudboils are formed when water-laden sediments are subjected to compressional forces, thereby causing the water and fine sand and mud to be ejected into the air	

Event	Felt Effect	Source
	through the fissures or just to well up towards the surface. In three places, along steep road cuts and unstable rocks, landslides occurred due to the severe shaking of the ground at the time of the earthquake, but only to a minor extent. Tension-cracks of small to moderate widths are observed along the Guinayangan-Sumulong road.	
	Felt intensities of the Ragay Gulf earthquake: Calauag, Quezon - Intensity VIII; E - W.	
	Lopez, Quezon - Intensity VIII; N - S.	
	Guinayangan, Quezon - Intensity VIII; N - S.	
	Alabat, Quezon - Intensity VII; 20 seconds; E - W.	
	San Francisco, Quezon - Intensity VI; 10 seconds; N - S.	
	Manila - Intensity VI; 45 seconds; NE - SW.	
	Quezon City - Intensity V; 12 seconds; NNE - SSW.	
	Romblon, Romblon - Intensity V; 12 seconds; NNE - SSW.	
	Daet, Camarines Norte - Intensity V; 45 seconds; NE - SW.	
	Tayabas, Quezon - Intensity IV; 23 seconds; E - W.	
	Manila International Airport (Pasay City) - Intensity IV; 10 seconds; N - S.	
	ambulong, Tanauan, Batangas - Intensity IV; 30 seconds; N - S.	
	Legaspi, Albay - Intensity IV; 10 seconds; E - W.	

Event	Felt Effect	Source
	Infanta, Quezon - Intensity IV; 27 seconds; N - S.	
	Dagupan - Intensity IV; 18 seconds; E - W.	
	Virac, Catanduanes - Intensity III; 10 seconds; SE - NW.	
	Catbalogan, Samar - Intensity III.	41
1976 Aug 17 12:11 a.m.	Moro Gulf: Dipolog and Malaybalay - Intensity VI.	
	Cagayan de Oro; Davao City; General Santos - Intensity V.	
	Dumaguete; Hinatuan; Tagbilaran; Cebu; Surigao - Intensity IV.	
	Roxas City; Iloilo City; Tacloban City; Legaspi City; Palo, Leyte; Catbalogan - Intensity II; Mb = 6.4; Ms = 7.8.	7
	The quake was followed by tsunamis which swept the coastal areas of the provinces of Zamboanga del Sur, Lanao del Norte, Cotabato; Sultan Kudarat, and Maguindanao. Mindanao, Sulu, Tawi-Tawi and Basilan declared disaster areas. "About a hundred people were killed in Malabang, Lanao del Sur, due to a 15-foot tsunami that followed the earthquake and overwhelmed the houses at the shoreline." An earthquake of major intensity struck five Mindanao provinces. Early reports said 1,200 persons were killed, thousands more were homeless or missing, and dozens of business establishments, government buildings, bridges and residential houses collapsed or suffered extensive damage. Hardest hit province was Lanao del Sur where 175 persons were reported killed and 47 more mission in Balabagan town. In the neightbouring town of Malabang, two squads of at least 16 members of the Armed Forces of the	

Event	Felt Effect	Source
	Philippines (AFP) belonging to the 33^{rd} Infantry Brigade were swept out to sea by the tsunamis with all their equipment. In Pagadian City, 30 persons were killed and 100 families rendered homeless by the earthquake. In Margosatubig, Zamboanga del Sur, there were six persons dead and eight more injured. Some 200 families were rendered homeless. The municipal wharf in Margosatubig collapsed, the water system was damaged, 40 houses were damaged, four persons were trapped inside a collapsed building. The Philippine National Red Cross reported that 60 guests of the collapsed Sultan Hotel in Cotabato City were trapped inside the building. Some 15 more were reportedly trapped in the Sagittarius Hotel, including the entire family of the hotel owner. Another Philippine National Red Cross (PNRC) report said that a helicopter survey of showed that the entire Maguindanao province coastal area had been submerged by the tsunamis, with the initial report of 300 killed in the coastal districts of Linek and Kusiong, Dianig town. In Pagadian City, the earthquake followed by the tsunami killed 360 persons, mostly children, injured 2,000 and rendered homeless over 10,000 families here in several coastal towns of Zamboanga del Sur. A landslide covered the main road in Sigbalabat on the east coast, rendering the road impassable from Zamboanga City to other towns in Zamboanga del Sur. In Davao City, some 961 persons were reported dead and several buildings and residential houses collapsed in several places. In Lebak, Sultan Kudarat, initial reports placed the homeless at 2,000. The Don Mariano Marcos Elementary School and town church were damaged while the public market sank three to five inches.	

Event	Felt Effect	Source
	Sultan Kudarat was one of the most badly hit areas. It was nearest the epicentre of the quake, which was somewhere in the Celebes Sea, about 160 miles from the shore of Sultan Kudarat. Intensity - X.	2
	Cotabato City - damage to structures consisted of crushing of first-storey columns leading to the total collapse of the buildings, collapse of first storeys and leaning of buildings. Non-structural damage included toppling of concrete hollow blocks, collapse of internal and external walls and cracks in walls and plastering. Extensive damage to concrete panels with free edges was observed. In one location, sand boils were observed. These sand boils which were found on the site of a collapsed building, measured, on average, one foot in diameter; other evidence of the effects of the earthquake included settlement of back-filled approaches to bridges and slight buckling and cracking of the pavements in some sections of the road from Cotabato City proper to the Awang Airport near the Tamontaka River. The direction of the ground motion was parallel to the effected road sections. Cables of the external telephone system fell, over approximately two kilometres of its length, and they broke at many of the damaged buildings. Damage to poles and lines was experienced mainly in three areas of poor foundation soil: the northern part of the central section, the vicinity of Notre Dame University, and the Malagapas and Esteros villages, south of Cotabato City. The water system's bell and spigot joints broke at many places where the line crossed the Tamontaka River on the bridge near the airport and for a few kilometres to the north. The 26 cms pipe sheared off where it went from the bridge deck	

Event	Felt Effect	Source
	into the north abutment. Six of the eight wells of an auxiliary water supply source 2 kms south of the city collapsed during the earthquake. Approximately 30% of the commercial buildings in Cotabato City were damaged. The undamaged buildings were used to shelter the victims whose properties had suffered from the earthquake. Ground shaking was more severe in certain regions of the city than in others. Significant building damage occurred exclusively on the deltaic plain to the north and east of Colina Hill. This area has approximately one metre of recent fill and is swampy as a result of its deltaic location, heavy rains, and runoff. Notre Dame University - is located on Notre Dame Avenue approximately 1.5 km southeast of the central area. The site has wet and soft marshy ground. Ground water appeared to be very near the surface, as ponds were evident throughout the site. Four buildings on this site suffered some degree of damage from the earthquake. Fronting on Notre Dame Avenue are the Auditorium/Science Building which collapsed and the Administration (Burke) Building which suffered only slight damage. In the southwest portion of the site, a complex of buildings is located which includes the Technical School which suffered moderate damage. Toward the northwest end of the site, a new residence hall nearing completion suffered only slight damage. Notre Dame University Auditorium and Science Building - is a 48 x 30 metres auditorium crossed at its entrance by a three-storey 51 x 12 metres science wing. The longitudinal axis of the wing lies N 60°W. For the present discussion it is assumed that the axis runs east	

Event	Felt Effect	Source
	and west. Constructed in 1969, masonry was used as the infill for the reinforced concrete frames. Smooth bars were used throughout the building. The first-, second-, and third-storey heights in the science wing were 3.5, 3.2 and 3.0 metres, respectively. The auditorium roof had the same elevation as the roof of the science wing. The science wing was a moment-resistant frame with reinforced concrete floors and roof. Typical bays in the frame were 12 metres in the transverse direction of the wing and 4.25 metres in the longitudinal direction. The auditorium roof was corrugated sheet metal supported by purlins on steel trusses spanning the width. Lateral resistance in the longitudinal and lateral direction was provided by the moment frame, end walls, and a pair of stair towers at each end of the wing. The infilled walls at the ends of the wing and outside ends of the tower resisted transverse north-south motion. Diagonal cracking of slip around infills and stairway joint damage due to transverse north-south motion. Solid reinforced wall configurations resisted longitudinal east-west motion with slippage and bending at the second floor construction joint. The tied column cross sections were of two principal types: A truncated wedge-like shape or a rectangular shape. Haunched rectangular beams were used in the 12 metres span transverse direction, while prismatic rectangular beams were used longitudinally. In general, the beams were larger than the columns, indicating a "strong beam/weak column" type of construction. Masonry infills were used below windows. The first- and second-storey columns show heavy damage at the top of window infills and the soffit of beams due to longitudinal east-west motion. The	

Event	Felt Effect	Source
	columns supporting the entrance canopy show especially heavy damage. The transverse long span beams also had heavy shear cracks due to north-south motion. The science wing collapsed after the fire had burned for several hours. The moment frame dropped three storeys, starting from the stair tower at the west end to a point just beyond the entrance canopy. At the east stair tower, the frame did not collapse. There is a transition of floor elevations going from the entrance canopy to a location next to the east stair tower. The west stair tower dropped three storeys, but the east stair tower remained standing. The uncollapsed stair tower is badly out of plumb on the second and third storey. Heavy slippage and bending at a second floor construction joint due to collapse and longitudinal east-west motion. Motion in the north-south direction caused diagonal cracking and slippage at the joints between the frame and masonry infills on the first-storey of the east tower. The auditorium suffered heavy fire damage. The infilled frame walls of the auditorium did not suffer structural damage, but the entrance of the auditorium was destroyed when the science wing collapsed. The New Residence Hall - is a rectangular, three-storey structure. Its construction consists of concrete exterior columns and thin concrete exterior walls. Mid-height windows run the full width of each bay throughout most of the building. There are some solid panels, especially at the south end. Interior columns and floor systems are wood, and the roof employs galvanized iron sheeting. For the most part, the interior partitions are constructed of plywood. Architectural vertical fins are	

Event	Felt Effect	Source
	located opposite all exterior columns, with a thin exterior accenting horizontal line. Damage to the building was slight. The architectural fins were cracked at the floor line, and some columns were damaged at the sill line. Interior partitions were torn apart, and some of the ceiling panels fell. There was considerable cracking of the ground floor slab. At one location where two slabs were constructed with a vertical offset (46 cms), the slabs pulled apart more than 1.3 cms.	

The Technical School - is a two-storey building approximately 10 x 30 metres. Built in 1965, it has a concrete frame consisting of column line girders and columns, with a concrete two-way slab floor. The columns are approximately 36 cms square reinforced with nine bars with plain ties at 23 cms spacing. The exterior had windows running from column to column, with a 1.07 metre sill height constructed of hollow block infill panels. Architectural concrete fins were poured adjacent to each column along one longitudinal side. This building is linked to an adjacent building by a common wood canopy. Damage to the structure was moderate. The first-storey columns were damaged at the head and sill levels, failing in shear. The fins were also damaged at similar locations. This canopy, supported on round steel columns, collapsed at its end bay.

The Administration Building - is a rectangular three-storey structure constructed in the early 1960s. It has an aspect ratio of 8:1. The building has a reinforced concrete frame of columns and girders with concrete floors. One longitudinal side has mid-height windows the full width of each bay with sills about

Event	Felt Effect	Source
	76 cms high, made up of hollow block panels. There is a 3-metre concrete panel at the entrance, which was severely cracked. The other longitudinal wall is set in from the edge, allowing for an exterior corridor. This wall has a 38 cms and a 76 cms high louvre running continuously between columns at the top and bottom, respectively. The balance of the wall is hollow block. This side has a one-bay projection at mid-length equal to approximately one-third the building's length. There are two longitudinal interior walls along a corridor constructed similarly to the louvred rear wall. The end walls are solid. Damage to the building was slight. The hollow block walls were damaged along with the louvre mullions. As stated above, the front concrete panel was also damaged. Damage to the concrete frame was minor. Harvardian College Campus - the building had a plan dimension of 11 x 90 metres. It was divided longitudinally into 19 equally spaced bays, and transversely into two bays of 3 and 8 metres. The short bay was for an exterior passage. Constructed in 1962, it had a reinforced concrete frame and reinforced concrete slabs at the second level and at the exterior passages at the third, fourth, and fifth levels. The balance of the floors were wood joist with square laid planking. The top storey was constructed completely of wood, and the roof had galvanized sheeting. Reportedly, the structure was originally designed for three storeys, with the fourth and wood-framed fifth storey being added later with no strengthening of the lower storeys. The building experienced heavy sway, predominantly in the north-south direction, i.e., in the building's	

Event	Felt Effect	Source
	transverse direction. The fifth storey, which was constructed of wood, collapsed but remained flat on top of the fifth floor. A rapid sequence of popping sounds occurred, followed by a large tilting of the complete building toward the south. The collapsed wood structure slid off the sloping fifth floor and fell into the pond on the south side of the building. The first-storey columns collapsed totally on the south side. This was the extent of the collapse at the west end, but at the east end the south second-storey columns also collapsed. Starting from the east, there was a five- to six-bay transition zone to where there was no complete failure of the second-storey columns. The structure also came to rest with a tilt to the east. Except for the fifth storey, which slid off the structure, the rest of the structure was relatively damage-free including the reinforced concrete girders. The Amicus Building, Sagittarius Hotel and D'Max Restaurant - from a complex of three adjacent buildings that collapsed. All of these buildings "pancaked". The Amicus Building, a four-storey reinforced concrete frame commercial building constructed in 1969, was approximately 12 x 15 metres in plan. The Sagittarius Hotel was a four-storey reinforced concrete frame building constructed in 1965. It was approximately 12 x 15 metres in plan. The D'Max Restaurant was a two-storey reinforced concrete plus wood building constructed in 1968. It was approximately 10 x 15 metres in plan. First Gift and Book Store - (also known as the Yap Building, named after the building's owner) was a four-storey building which	

Event	Felt Effect	Source
	collapsed. Built in 1968/69, the building was 15 x 20 metres, had a reinforced concrete frame, and was on a timber pile foundation. The first floor collapsed during the initial earthquake tremor and fire broke out within the structure. It was not until 5 to 6 hours later that complete collapse of the structure took place. This building leaned north into the adjacent three-storey structure, knocking it into a third building, the City Evangelical Church. Damage to the church was slight.	
	Sultan Hotel - the collapse of the structure with the second floor resting on the ground must have been rather slow, since the portion above the second floor remained relatively intact. The portion above the second floor cantilevered out about 2.4 metres past the front first-storey columns. Except for the front wall, which had windows, the other three exterior walls were solid. The front wall above the second floor was relatively stiff due to short columns (by comparison with the other interior concrete frame designed for vertical loads only) and probably carried about half of the lateral load in the east-west direction. However, the wall on the first storey was made up of tall columns only and high torsional forces were imposed on the first-floor structural elements. This type of failure, with sudden change in rigidities compounding the torsional problem, has been noted in other earthquakes.	
	New Society Hotel - was a four-storey reinforced concrete frame and shear wall building constructed in 1968. The 4 x 4 bays building is a square in plan; dimensions are 21 x 21 metres. The first-storey height is 6 metres, while the upper-storey	

Event	Felt Effect	Source
	heights are 3.5 metres. A mezzanine storey 3 metres high extends three bays in each direction from the south and east sides of the building. The south side of the building is covered by a wall with pilasters aligned with the frame. The east side of the building is covered by a wall with window openings and pilasters spaced to match with the frame. The remainder of the building is constructed with an approximately square grid of moment-resistant frames. The side dimension of a typical bay in the grid is 4.5 metres. Floors and wood are on reinforced concrete slabs. The dimensions of beams and columns are comparable; but, when the effect of slab action both in bending and twisting is considered, the beams appear to be considerably stronger than the columns. This is borne out by the damage that occurred in the building. The New Society Hotel is within 30 metres of the Rio Grande, whose elevation is 2 metres below street level. The columns are founded on wood piles with reinforced concrete pile caps; 20 cm diameter wood piles 7.6 metres long were used. The pile cap and water elevation are nearly coincidental. Flaws in the structure were the principal causes of failure. The circular first-storey columns on the north and west sides of the building hinged at the top and bottom as the building experienced a heavy twisting motion. Collapse ensued as follows: 1) the building twisted in a counterclockwise direction; 2) the northwest corner second-floor level dropped, on a helicoidal path 6.7 metres long, to the street; and 3) the opposite southeast corner, where walls intersect, suffered a torsional failure in the corner pilaster and out-of-plane shearing of adjacent walls. The frame and walls above the first storey were	

Event	Felt Effect	Source
	practically undamaged. The floors of the second storey did not suffer from diaphragm response but, during the collapse, the second floor "mounded up" in a few locations over rubble from the first storey. Damage to second-floor beam is slight and in most cases the columns became disconnected from the second-floor beam as the building collapsed. This occurred because the splice pulled apart. The walls suffered out-of-plane shearing damage as the building rotated. LCT Hardware and Auto Supply - is a two-storey reinforced concrete structure with wood trusses and galvanized sheet iron roof. During the earthquake, the first storey collapsed toward the west. Cotabato Auto Supply - was on a main street running east-west. It had a three-storey reinforced concrete frame, concrete floor, and hollow block infill exterior walls. Interior partitions were timber and plywood. The 15 x 60 metres building was built in 1968. The first and second storeys were used for car parts sales and storage, the third floor for the proprietor's living quarters. The first storey of this building collapsed, with the upper storeys coming to rest approximately 3 metres west of original location. The front and rear faces of the building were open with doors and windows, but the extent of the openings is not known. In any event, the openings left the structure with a weaker first storey. it should also be noted that the structure was not designed for seismic forces and, therefore, the first storey experienced lateral stresses beyond normal overstress levels. The balance of the building was free of damage, except for minor cracking. The collapse was gradual. The	

Event	Felt Effect	Source
	proprietor claimed that he was upstairs during the earthquake and was let down in gentle motion. Storage shelves on the second floor were still standing after the quake. A one-storey lean-to concrete structure behind this building also collapsed, falling transversely to the west.	
	South Seas Trading - was a three-storey structure which pancaked. Built in 1967, it was 20 x 30 metres and had a concrete frame and concrete floor slab. It is important to note that the columns of this structure also contained downpipes. This architectural detail was found in many of the collapsed structures in the area.	
	Tison Building - was the only building in Cotabato City reputed to have been designed with seismic considerations. It was designed by Manila engineers using the "California Code" (exact year not known). It survived the quake with no structural damage and only a slight crack in a concrete block partition. Some water tanks on the roof in concrete saddles moved to the west about 0.6 cm. Some flower pots on the roof moved about 8 cms to the west. The Tison building was placed on 20 cms precast concrete piles about 12 metres long. It was located close to Colina Hill (good soil), but the piles were still friction piles (no piles reached firm ground).	
	Melbourne Hotel - is a three-storey reinforced concrete frame with masonry infills, constructed in 1970, and has a plan dimension of 20 x 30 metres. The four by four bay frame has a first-storey height of 6 metres, while upper-storey heights are 3.5 metres. A mezzanine storey 3 metres tall covers the full width in	

the north-south direction and three bays going from east to west. The front of the building is open, the back has masonry infills with openings, and the north and south exterior walls are completely infilled. The first-storey columns suffered heavy damage as a result of north-south motion. A first-storey permanent offset of 15 cms to the south remained after the quake. On the west side of the building, the tall first-storey columns hinged at the base and directly below the shade beam. Going one bay to the east, where the mezzanine begins, there were heavy shear failures in the columns. The shear failures occurred in the mezzanine columns and not in the taller west side columns for the following reasons: 1) the shorter storey height caused higher column shears; 2) the failure over short distance of decorative masonry piers which surrounded the columns caused high shears; and 3) the window infills on the mezzanine storey caused high column shears. On the east side of the building, masonry panels were pushed out, and window infills on the mezzanine storey buckled outward because of heavy frame action. North and south walls were undamaged.

Imperial Hotel #2, Rita Theatre, and Imperial Hotel #1 - are situated together and face toward the south. The fronts of these buildings interacted strongly during the earthquake. Imperial #1 and Rita drifted to the west and pushed against Imperial #2. Imperial #1 is a four-storey reinforced concrete frame with masonry infills constructed in 1963. The approximately plan dimensions are 20 x 30 metres. The building has a 6 metres first storey and 3.5 metres upper stories. There is a mezzanine on the first storey. The building

Event	Felt Effect	Source
	experienced a 38 cms permanent offset on the first storey. The rear portion of the building collapsed. The Rita Theatre is a two-storey, 12 metres tall reinforced concrete frame in front, with a reinforced concrete, plus masonry plus wood, auditorium section in the rear. The auditorium roof has two elevations. Plan dimensions are 20 x 35 metres. The frame section in front drifted 38 cms west, along with Imperial #1. The auditorium frame, plus infilled wall on the east side, was knocked over by Imperial #1. The "rod and block" truss roof in this part of the roof collapsed. Further to the rear of the theatre, collapse did not occur because the roof elevation was lower and Imperial #1 did not hammer the wall. Imperial #2 is a six-storey reinforced concrete frame structure constructed in 1967. Approximately plan dimensions are 35 x 30 metres. The building suffered minor damage consisting of the following: 1) a column in the architectural frame in front was damaged when the Rita Theatre impacted against the hotel; 2) infill panels suffered diagonal cracking on the first storey adjacent to the Rita Theatre; and 3) the slab on grade in the northwest corner of the building showed heavy cracking. Imperial Hotel #2 came through the earthquake with superficial damage. Its front was capable of carrying its own lateral forces plus the impact forces from the front of the Rita Theatre and Imperial #1. A portion of this impact force caused a shear failure of the second-storey column in the architectural frame. Immaculate Conception Church: The only noticeable damage to this church across the street from the Tison Building was a settlement of about 15 cms of its tower. A loose	

Event	Felt Effect	Source
	ornament on the tower was thrown to the west a distance of about 3 metres from the top. The church grounds were very soft, and the tower was apparently not on piles. Melineen Building - was a two-storey reinforced concrete structure that pancaked. Very little is known about this structure, since demolition was well under way when reviewed by the team. The concrete was being knocked off the reinforcing steel by hand, thus leaving the reinforcing steel intact. The slabs had one layer of reinforcing consisting of light bars at 15 cms on centre each way. It is suspected that continuity over the supporting girders was minimal. Columns were light (26 cms square). Tamontaka Catholic Church - was reputed to have been built by the Spaniards 104 years ago. It was the only structure noted to be constructed of reinforced brick walls with interior timber columns and wood roof. The severely damaged church was located near the Tamontaka River and Bridge and founded on soft marshy soil. Waterfront Warehouses - in large numbers were located at the edge of the Rio Grande west of the Manday River. This area is called Lugay Lugay and is in a Moslem zone. Practically all of the warehouses collapsed. They appeared to be constructed of masonry walls, timber trusses, and corrugated metal roof (no diaphragms). They were poorly-built, apparently non-engineered structures, except perhaps for wood trusses, and most certainly had no seismic resistance. Cotabato Chinese Gymnasium - is a reinforced concrete plus wood structure constructed in 1962. The four outer walls have reinforced	

Event	Felt Effect	Source
	concrete columns, reinforced concrete beams, and wood beams. Masonry infills were used in the outside walls. The roof is "rod and block" wood truss with galvanized sheet iron covering. The stands inside are wood. During the earthquake, the walls fell outward and the roof fell in. Cotabato Chinese School Administration Building - is a two-storey reinforced concrete frame. The building suffered minor damage on some of the masonry frame infills. It was reported that the building was designed for three storeys. A pile foundation had been used. The building was less than 3 years old. Cotabato Cenema Theatre - is a large structure to the rear of the Sultan Hotel. The hotel and the theatre were somehow connected. The hotel portion collapsed, which caused severe structural damage to the theatre complex. It could not be determined whether collapse of the hotel caused failure of the theatre or merely contributed to an already damaged structure. The side walls of the theatre are leaning dangerously. Boston Bakery - is a two-storey reinforced concrete building constructed in 1965. The plan dimensions are 15 x 20 metres. The building experienced 60 cms drift to the west on the first storey. Cotabato Fire Station (combined with the police station) - settled toward the river during the earthquake. Francel Theatre was a reinforced concrete plus wood building constructed in 1966. The reinforced concrete frame portion of the building collapsed, causing a failure of the "rod and block" wood truss roof.	

Event	Felt Effect	Source
	Tan Bo Building - is a four-storey building constructed in 1971-72. The structure is a reinforced concrete frame with hollow block infilled walls and was built on timber piles 7.6 to 9.1 metres long. The only damage noted was the cracked infilled panels at the stair core. Dawns Hotel - is a six-storey reinforced concrete frame and wall building. The only damage of note was a working of the floor joints of the wall on the south side of the building. Bridge Damage: Quirino Bridge - is a four-span structural steel bridge. Each span of this bridge over the Rio Grande de Mindanao River is 40 metres long. The second span from the south end collapsed into the river during the earthquake. Each span was supported on rollers at one end and pinned at the other. The collapse was caused by the second span's sliding off its bearing plates in the easterly direction. Lack of consideration of seismic forces was obviously the reason for this failure. The failure occurred by the span's sliding to the east off the dumb-bell-shaped supports. The supports as constructed would not allow for much east-west movement before the spans would collapse. Other notable damage is the near collapse of the third span from the south. Shear cracks appear several centimetres below the base of the south abutment. Tamontaka Bridge - is located approximately 6 kms south-southwest of central Cotabato City. Spanning some 230 metres across the Tamontaka River, the bridge is made up of six spans resting on pile-supported piers. The 180 cms deep box girder sections, as well as the piers and piles, are of reinforced concrete.	

Event	Felt Effect	Source
	The bridge was constructed in three sections. Two expansion joints are located approximately 56 and 30 metres from the north and south ends, respectively. After the earthquake, the bridge's longitudinal axis had a permanent displacement, with the ends closing to the west. The bridge experienced a great deal of movement predominantly in the east-west direction. The centre section moved east and west in excess of 38 cms each way, as evidenced by the broken concrete keepers on each end of the supporting piers. It came to rest approximately 30 cms east of its original position. The northern section moved even greater distances. The north end of this portion again moved both east and west, coming to rest 46 cms west of its original location on the abutment. The south portion moved but with less amplitude. At the south, only the keepers on the east side of the piers were damaged. Damage to the abutments as a result of longitudinal movement was not evident below the bridge surface, although the bearing plates at the north abutment did reveal an 8 cms permanent offset to the north. There was damage to the railings at both abutments and at the expansion joints. This damage was most extensive at the north end. It appeared that the damage to the railways at the expansion joints was due more to the opening and closing of the joints from the heavy east-west movement (bowing of the bridge) than to longitudinal movements. Zamboanga City Argicultural and Engineering College - is a four-storey structure of reinforced concrete construction located in the town contre. The parapets were damaged, with some beam-to-column connections being distressed on the	

Event	Felt Effect	Source
	upper floors. Diamond Bazaar is a three-storey concrete frame with masonry infill panels. Damage was to the second-storey exterior columns and to the adjoining architectural block screen. Chien Tian Un Building - is a three-storey plus mezzanine structure, with plan dimensions of 15 x 20 metres, constructed in 1962. The framework is reinforced concrete with infill masonry panels. The first-storey plaster cover spalled, and the infill panels and adjoining columns had shear cracks. It was reported that the mezzanine was very heavily loaded, which contributed to the damage on the first storey. Mendoza building (Shopping Centre) - was constructed in 1970. It has three storeys with a reinforced concrete frame and slabs. It houses retail shops at the street level with office space above. Damage occurred at the wall panels, especially adjacent to the open stair, and at the windowed interior panels (materials unknown). Asiatic Commercial Building - is a two-storey structure erected in 1950. The structural system is unknown except that the exterior had solid panels. Damage consisted of shear cracking of the piers in the windowed exterior walls. To Tek So Building - is a four-storey reinforced concrete structure, located on a corner site. The first-storey corner piers and columns experienced shear cracking. Other buildings reported partially damaged include: Southern City College (one-unit building), Kang Ha Wee Family Building, V. Fargas Residential Building, Zen Hong	

Event	Felt Effect	Source
	Trading Building, Zamboanga General Hospital of Nursing, Ever Building, Carlos Wee Building, Esperanza Seng Building, and Pilar College Building and Chapel.	
	Intensity - X.	60, 44
1977 Mar 19 5:43 a.m.	Luzon: Tuguegarao - Intensity VII.	
	Cabanatuan, Manila, Cavite and Dagupan - Intensity V.	
	Alabat, Baguio and Calapan - Intensity IV.	
	Tayabas, Infanta and Laoag City - Intensity III.	
	Bataan, Virac and Vigan - Intensity II.	
	Metropolitan Manila - one person died by electrocution; 22 buildings suffered cracked walls and broken windows. Among the buildings were the Bank of the Philippine Islands, in Plaza Cervantes; the former Insular Life Building, also in Plaza Cervantes; Pacific Banking Corporation in Quintin Paredes St.; First Hotel and International Hotel in Ongpin St., Puyat; Bank of the Philippine Islands; and the Bureau of Internal Revenue building in Escolta area; Cathay House and Elizalde Building in Dasmarinyas St., in Binondo. The other damaged buildings were the Araullo High School in Taft Avenue; First United Bank, Magsaysay Plywood Industries and National Library on T.M. Kalaw St. near Luneta Park; and the new Manila Hotel. The Veterans Bank on Arroceros St.; Bureau of Posts; Recto Theatre; National Book Store; General C. Geronimo Elementary School; and Timberland Hotel.	
	Palanan, Isabela - eight persons were injured. The injured persons	

Event	Felt Effect	Source
	are from the towns of Mapnican, Dibalan and Dinago. All government buildings, including the Palanan Elementary School, the town Health Centre, and a dozen other buildings were destroyed. Also destroyed was the Constabulary's communication system between Kalinga-Apayao and Cagayan. In Isabela and Nueva Vizcaya, the quake was of Intensity V and IV, respectively. The quake in Palanan was followed by two aftershocks of equal intensity to the first. The first aftershock was at 7:00 a.m. and the second at 9:45 a.m.	
	Lucena City - an earthquake hit this city this morning and lasted for about five seconds. There were no reported casualties. Damage to coconut plantations was reported extensive. Many coconut roots were cut off. This will affect their fruit-bearing capacity.	
	Intensity - VIII.	5
1981 Nov 22 11:06 p.m.	Northwestern Luzon: Pagudpud - Intensity VIII.	
	Laoag - Intensity VI.	
	Pasuquin - Intensity VI.	
	Santa - Intensity V.	
	Baguio and Calayan - Intensity IV.	
	Vigan, Aparri and Tuguegarao - Intensity III.	
	Manila - Intensity I. Ml = 5.2; Epicentre = 18.68^{o}N; 120.63^{o}E.	
	Laoag - splashing and spilling out of water from fountain reservoir; jet plane-like sound was heard from the NW direction; a stationary jeep moved back and forth; it was the strongest earthquake experienced;	

Event	Felt Effect	Source
	people at the Philippine Constabulary-Integratd National Police Headquarters could not move out and had to hold on to tables and walls while the shock was going on; the city's church tower sank by one foot below the ground; DBP building across from the tower developed cracks in the windows; the third-floor windows of an eight-storey PVA building which housed the clearing office of the Central Bank were broken.	
	Bacarra, Ilocos Norte - people in the area had felt the shock strongly. The municipal building, which is strongly built, suffered minor cracks. A large portion of the church belfry fell down.	
	Pasuquin, Ilocos Norte - two intensity-indicating instruments installed at Pasuquin Seismic Station toppled down. Both are rated corresponding to Intensity VI and VII (RF).	
	Burgos Lighthouse - a small landslip is noticeable at the foot of the tower. At the main building, the roof has been damaged and almost toppled down. The kitchen developed cracks through and through. The lighthouse glass prisms were almost all broken. Five persons on duty ran out from their quarters. A hissing sound was heard and two smaller shocks were felt minutes later.	
	Pagudpud, Ilocos Norte - people in the area were shaken by a shock from a N - S direction. A wave-like sound was heard while another roaring sound dominated the air. During the earthquake, a grating sound was heard coming from the ground. People said this earthquake is much stronger than that of August 2, 1968. A concrete 40-foot Barangay Buravoc bridge developed cracks at	

Event	Felt Effect	Source
	both ends. One side of the bridge had 3-inch wide cracks and was raised 10-12 inches. The other side had 6-inch wide cracks. At Barangay Sulvec, a concrete 30-foot bridge was slightly damaged. Cemented stone blocks serving as retaining walls at both sides of the bridge's approach were shattered and thrown down.	
	Santa, Ilocos Sur - the earthquake was felt by many, most of whom were awakened by the quake from sleep; objects inside the houses swung and old frames fell down; the intensity measuring instrument installed at the Santa Seismic Station toppled down. It registered an Intensity VI (RF).	
	Vigan, Ilocos Sur - the earthquake was felt by many; minor cracks were observed at Vigan Synoptic Weather Station. The building which is made of hollow blocks suffered cracks in its wall facing south.	
	Magsingal, Ilocos Sur - the earthquake made a few minor cracks in walls of houses made of hollow blocks. It was felt greatly indoors.	
	Bangued, Abra - the earthquake was felt by many who were awakened by the creaking of houses and roofs; several persons witnessed the swinging of electric wires on the posts.	
	Intensity - VIII.	43
1982 Jan 11 2:11 p.m.	Virac, Catanduanes: Virac - Intensity VII. The tremor was oscillatory.	
	Manila, Legaspi, Catarman, Baler and Catbalogan - Intensity V.	
	Quezon City, Tacloban and Infanta - Intensity IV.	

Event	Felt Effect	Source
	Dagupan and Baguio - Intensity III.	
	Calapan and Roxas - Intensity II. Rumbling noise was heard north of Virac before the earthquake. Several people panicked. Animals ran in all directions. Drinking water from wells became murky. Cracks in walls made of hollow blocks were observed in some houses.	
	Cabugao - rumbling noise was heard north of Cabugao. People also panicked. Animals ran in all directions. Crack of 20 metres long with maximum width of 20 inches and seven feet deep in a rough road was formed along the N - S direction.	
	Bato - damage to concrete post and CHB walls of the Central Lyceum College of Catanduanes. A booming sound was heard before the earthquake.	
	Radar Station - the radar building (under construction) was heavily damaged. Concrete walls on the ground floor collapsed. Other concrete walls suffered cracks. A booming sound was heard north of the station. Two construction workers on the building suffered minor injuries. Everyone panicked. The swaying was in the N - S direction.	
	Viga - the Viga Emergency Hospital was the most affected by the earthquake. Cabinets fell. Record files and medicines were scattered around the place. Many people panicked.	
	Payo - both side walls of the church cracks, separating them from the back wall. Crack of one metre long in the floor in an E - W direction. The floor moved upward by two inches. Swaying was in the N - S direction. People panicked.	

Event	Felt Effect	Source
	Bagomoc - crack of 2 1/2 metres long, 1 1/2 inches wide and eight inches deep in a N - S direction was observed on the cement road. Crack of 50 feet long, E - W direction, was also observed on the seashore, with water reportedly spurting out to a height of 20 feet. The municipal building also had cracks in the walls and floors. Duration of the tremor was 42 seconds. People panicked. Landslides were observed in the following places: Katipunan, San Miguel; Mabato, San Miguel and Summit, Viga. From the information gathered, the earthquake was strongly felt at Bagamoc and Payo. Intensity - X.	43 A
1983 Aug 17	Northern Luzon: Vintar - the central school was heavily damaged; a single-storey concrete building was divided by a crack of three inches; water tank suffered major crack; statues in the church broken, all fell to the ground; 70 houses partially damaged, 79 totally damaged; some parts of the road along the river leading to the suburbs collapsed; landslide debris rendered the roads impassable; 41 houses in Barangay Barangobong collapsed. The houses are usually two-storey houses made of (hollow block) concrete and wood; three school buildings in Barangay Barangobong collapsed; the main altar completely collapsed. The church is an old building of poor construction. The walls are made of brick and mortar. The facade of the church collapsed completely. The bell tower collapsed totally; the quay wall sustained cracks and showed evidence of subsidence. The convent which was originally built in 1804 and restored in 1977 was heavily damaged. Only the restored portion remained undamaged. The old portion of the convent collapsed	

Event	Felt Effect	Source
	completely; rectory partitions (panel, concrete) collapsed; majority of debris fell to the west; one teacher staying on the first floor of the rectory fainted. All told, 4 adjacent places suffered major destruction; these are: Barangobong, Dipilat, Tandayan and Alseon.	
	Bacarra - bell tower, convent, bridge partially damaged. Several schools partially collapsed. Differential settlement on the north approach to Bacarra Bridge. Most portable appliances toppled, contents of open shelves spilled out, no water in the taps and toilet, no electricity. Loud deep rumbling sound; 20 houses partially damaged; two houses totally damaged.	
	Carassi - 59 houses partially damaged.	
	Ira Beach - 102 houses partially collapsed; ten school buildings damaged.	
	Burgos - Municipal hall cracked; Cape Bojeador lighthouse partially damaged.	
	Pasuquin - several houses collapsed; some window panes broken; one cooking pan toppled; a refrigerator opened, spilling its contents. Several room partitions torn from the walls; slight swellings of the sea-water observed; cracks appeared on the shore (varying width) but generally two feet wide and one km long; portable appliances fell, legs of appliances broke; people were afraid to enter dwellings; opted to sleep outdoors; west side of the road leading to the north cracked; eastern approach to Niguet Bridge sank. Paldi bridge northern approach cracked.	

Event	Felt Effect	Source
	Barangay Caruan - two persons collapsed from fright. Three houses were slightly damaged. Barangay Nalvo - one person collapsed from fright. Barangay, Zamboanga, Laoag - sandboils of various depths and sizes found in this barangay, the biggest of which is more than a metre in width and about a metre in depth. These are located near the east side of the Zamboanga Creek within a sugar plantation. Extruded material is greyish sand. A 20-foot abandoned artesian well spurted water; concrete floor of one house cracked; fissures formed in the ground. In Bangkag, two wells dried up as a result of the earthquake: in Bacsil, a total of 56 houses made of concrete hollow block, wood and galvanized iron sheets suffered partial collapsed. At NBI office, a steel safe (weighting about a ton) moved one foot; Laoag City - abrupt shaking of the ground, as if it were a ball being dribbled, then a circular motion and, finally, a reversed, swaying motion. Stores display items and goods fell; bottles fell and smashed. A portion of a tower fell on one victim's head. Contents of cabinets spilled out. Earthquake movement was eastwest. Stampede in cinemas; low rumbling sound like a big approaching truck was heard; Airport (Gabo) partially damaged. Several houses collapsed. Philippine Constabulary Office - abrupt shaking; sound like that of stampending horses' hooves heard. Philippine Veterans Bank ground, 2nd, 3rd and penthouse, airconditioning fell from its housing, all furniture destroyed; 4th to 7th	

Event	Felt Effect	Source
	floors not much visible damage. Moving vehicle jerked. Pictures swayed wildly.	
	Municipal Hall - the floor tilted. Sandboils appeared; black mud with fronthing water ejected. Two persons perished. Far East Building, damage after the earthquake was small but, after 24 hours, it became so much worse that temporary supports had to be added. Shirley building, vertical motion felt by occupants, sounds of heavy "thuds" preceded the shaking, table moved two feet, wall partitions fell.	
	San Nicolas: Kaunlaran Building, which housed a shop and bodega on the ground floor and apartments on the 2nd and 3rd storeys and the penthouse, collapsed. Damage, total. The filling station along the side of the Kaunlaran building was not damage at all; the contents of the shelves, mostly cans of oil, grease and other petroleum products, fell to the floor. It was a general observation that objects in cabinets and on shelves were thrown down. The two-storey concrete house across the road from Kaunlaran was not damaged; the wall mirror which was leaning against the concrete wall was strongly shaken and shifted about three feet from its former position; E.M. Laeno's building consisting of three floors-first floor totally collapsed giving the appearance of only two storeys; Teresa, mezzanine floor suffered the most damage; PVB Building, the west portion of the 2nd floor was ruined exposing the inside of the establishment, which was of bricks; Sunrise Building, walls cracked and plaster peeled, glass panes broken, building tilted to NW direction; Five Sisters' Twin Cinema Building, CHB walls and plaster on at least one column at midsection ground floor appeared to	

Event	Felt Effect	Source
	be sheared. Total of damaged commercial buildings, 5; partially damaged buildings, 16. Kanlaon Building collapsed, looking like a stack of pancake. Residential houses damaged, not less than 100; Laoag International Airport, slight cracks on some portions of the terminal building, non-operational VOR/DME Monitor fell, old tower cracked in different places.	
	Dangui - church damaged (estimate P150,000); ten houses partially damaged.	
	Paoay - old Spanish church collapsed, damaging adjacent structures. According to some fishermen, the water looked as though it were boiling beneath, but the surface of the water was calm; the water on the shoreline receded; people felt dizzy, houses swayed with a N - S direction; tremor preceded by a low rumbling noise; the church was slightly damaged; the bell tower which was built in 1953 sustained minor cracks.	
	Batac - Municipal building, minor cracks; one residential house collapsed.	
	Panili - Don Mariano Marcos Memorial Hospital partially collapsed (estimated P500,000). Tugaoan Elementary School partially collapsed.	
	Dingras - one residential house collapsed, causing damage to a parked vehicle; church partially collapsed; some parts of St. Joseph Institute cracked and twisted.	
	Pagudpud - Pagudpud Central School, portion of 2nd floor collapsed; St. Jude High School building slightly leaned to the south and fences collapsed; Lusuyo Primary School,	

Event	Felt Effect	Source
	all walls nearly collapsed; Subec Elementary School, pre-fabricated building division cracked and nearly collapsed; Balaoi Primary School, north portion collapsed and south portion wall cracked. Burayoc Bridge, both ends of the bridge sank about six inches; Philippine Independent Church, the tower was cracked; house near the beach built with CHB walls reinforced with bamboo slats, palm thatch foofings collapsed.	
	Badoc - church damaged.	
	Sarrat - cracks on front of the church and on the altar. Municipal hall, heavily damaged; one residential house collapsed; Marcos Museum, slightly damaged; one residential house collapsed; Marcos Museum, slightly damaged; Edralin bridge, cracks on both sides of bridge; Rural Health Unit Centre, heavily damaged; Binatuan School, heavily damaged.	
	Burgos - Municipal hall sustained cracks. Cape Bojeador Lighthouse partially damaged, light projection prism of several light glass panes (half-inch thick), enclosure broken; apparatus to rotate light damaged; kitchen unit (separate building of about 8 metres x 6 metres; brick masonry structure, single-level one-room unit) upper corner south-east section of masonry detached; some cracks in several walls of dormitory and office section cracked; water level of well not disturbed. No observed slides along spiral road leading to tower.	11
	The most severe earthquake experienced in northwestern Luzon in 52 years and probably the second largest earthquake event to hit Laoag and its immediate vicinity in historical times, occurred shortly	

Event	Felt Effect	Source
	after eight o'clock in the evening of the 17th of August 1983. The tremor was perceptible over a distance of 400 kms from its origin. In the aftermath, when the last quivering of the ground was felt, several lives and millions of pesos in property were found to have been lost. In Laoag City, a number of reinforced concrete buildings either totally collapsed or sustained major structural damage beyond rehabilitation. Not a few public and residential structures suffered minor damage that, nevertheless, will require a huge sum for repair work. In the neighbouring town of San Nicolas, a three-storey reinforced concrete commercial-apartment building collapsed, all its upper floors piled up like a stack of pancakes. In other municipalities, churches and bell towers that had withstood the shaking of the March 1931 earthquake sustained major damage. Public and residential buildings, bridges and other structures sustained damage of varying degrees. Nearly all the damaged buildings in the area were of reinforced concrete frame. Most the external walls and internal partitions were of concrete hollow blocks. There are, however, some buildings with wood partitions. Several sandboils were observed in Barangay Zamboanga, Laoag City. The diameters of these craters vary from a few centimetres to 300 centimetres. In largest observed sandboil, as manifested by the size of the area covered by extruded subsurface sand, had a diameter of 8.5 metres. In Barangay Zamboanga, three wells were reported to have gone dry after the mainshock. In another well, the water was reported to have changed in colour and smell. An abandoned artesian well of	

Event	Felt Effect	Source
	galvanized iron pipes with a diameter of 5 cms and a length of 6.6 metres shot up water as high as ten metres at the time of the shaking. Landslides were observed in several places at or near the intensity centre. Most of these, however, occurred where the slopes were steep, as along road cuts. The condition for sliding of materials was also aggravated by several days of rain in the region and lack of vegetation. Nearly all bridge approaches had differential settlement of overlay materials. These were also observed in most building sites. Observed magnitude of settlement measured from a few centimetres to about 26 cms. Irregular cracks and small fissures were found along sea-shores, roads, river-banks and alluvial fans. These were probably due to compression. Cases of fright and nausea were reported in the epicentral area. Reports indicated several dogs and fowls acting agitated before and during the time of the mainshock. Most people in or near the epicentral area reported low, rumbling sounds immediately preceding or accompanying part of the shock. Most of the aftershocks were reported to have been preceded by rumbling sounds.	71

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PART F

ASSESSMENT OF SEISMIC INTENSITY OF PHILIPPINE HISTORICAL EARTHQUAKES

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PART F ASSESSMENT OF SEISMIC INTENSITY OF PHILIPPINE HISTORICAL EARTHQUAKES

Introduction

Historical records from 1589 to 1983 reveal that the Philippines have been very frequently shaken by earthquakes of various intensities - from mild to severely violent and destructive tremors. This historical fact is not surprising. The Philippine Archipelago is situated in a region characterized by a composition of major and minor tectonic plates, and marked by active major and minor faults.

Continuing urbanization and rapid growth of population contribute much to the increase in seismic risk. More and more man-made structures and human lives are being exposed to earthquake threat. This situation has brought about a more urgent need for assessment of seismic risk as an approach to earthquake hazard mitigation.

The implementation of the "Earthquake Hazards Mitigation Programme in Southeast Asia" under the auspices of the Southeast Asia Association of Seismology and Earthquake Engineering (SEASEE), in co-operation with the Office of Foreign Disaster Assistance of the U.S. Agency for International Development and the U.S. Geological Survey, resulted in the collection of data for a seismological data base and the assessment of seismic intensity in each of the SEASEE member countries (Indonesia, Malaysia, the Philippines and Thailand).

This presentation discusses the preparation of isoseismal maps and the determination of the attenuation functions in the Philippine Archipelago.

The Data File

The file consists of four parts. These represent the divisions of the history of the seismological service in the Philippines in such a way as to emphasize the variance in formats of reporting during the different periods. This variance, by and large, caused the data to be non-homogenous.

Part A contains a listing of seismic events from 1589, the earliest year when earthquake events were chronicled, to 1864. During this period, there was as yet no organized seismological service in the Archipelago.

Part B contains data from 1865 to 1900. January 1865 saw the beginning of the Manila Observatory of the Society of Jesus of the Philippines. This year marked the start of formal seismological observation and study.

A significant milestone in 1901 was the re-organization of the Manila Observatory as the Weather Bureau of the Philippines. From this year onward, more accurate observations were derived as a result of the addition of better instruments. Reports were classified into instrumental and non-instrumental bulletins. In 1942, the Manila Observatory ceased its function as a government institution. This coincided with the Second World War. Hence, the coverage of Part C is from 1901 to 1942.

Part D covers earthquake events from 1948 to 1983. Except in cases of large earthquakes which were covered by post-earthquake field surveys, field station reports were expressed in straightforward intensity ratings using the Rossi-Forel Intensity Scale of 9, an adapted version of the original 1934 scale.

The search for data for part 1942 to 1947 did not yield any record of earthquake events. Instrumental data of foreign seismological observatories, however, show earthquakes did occur during this period.

On the completeness of historical seismic data, it cannot be claimed that all the factual information has been gathered. The search for data was not as exhaustive as it should have been because of the limitations of time and funds. There are strong possibilities of finding more data in Spain, a former colonizer of the Philippines, and in other countries which have had relations, in one way or another, with the Philippines. The data gathered, nevertheless, are found to be suitable for the assessment of seismic intensity.

Sources of Macroseismic Data

The richest source of historical earthquake information was the "Catalogue of Philippine Earthquakes, 1589-1899" by William Repetti, S.J., which was published in the BSSA in 1946. Repetti's work, which was based principally on several Philippine earthquake catalogues published in earlier periods, consists mainly of a record of seismic activity during the Spanish regime. Data extracted from the collection of official reports of the Weather Bureau of the Philippines, which started in 1901, comprise the main bulk of earthquake information after the Spanish period.

A group of researchers of the Philippine National Library produced a very significant volume of information, most of which was translated from Spanish in to English. The same group spent time searching for information on earthquakes that might occurred prior to the Spanish invasion. No data, however, were retrieved. Materials from American libraries were contributed by the U.S. Geological Survey. Information from newspapers, journals, official and private communications, and papers by individuals also form part of the catalogue.

Preparation of Isoseismal Maps

In the process of evaluating intensity, based on the description of the gross effects of an earthquake in a given locality, a certain amount of confidence in data reduction may have been lost, due to the incompatibility of the intensity scale used with the structures affected by the ground motions. Intensity scales used were developed in foreign countries where the engineering aspects are dissimilar to local conditions in the Philippines. When the suitability of fitting a characteristic group of effects to one of any two levels of the scale became a matter of a choice, the higher level was chosen.

There are large destructive events with limited spatial distribution of observation points for a more reasonable definition of isoseismal lines. In most cases, reports are confined to a region of single-level intensity. For cases like these, isoseismals were not drawn.

A large number of earthquake events are described purely in terms of intensity ratings. Prior to 1934, the original scale of ten of the Rossi-Forel Intensity Scale was in use. From that year, a revised Rossi-Forel Intensity Scale of 9 was adopted. The suggestion of Fr. Sergio S. Su, S.J. of the Manila Observatory for the equivalence between the Rossi-Forel Scale (adapted) and the Modified Mercalli Scale which, as a Project requirement, was used in the present work, was taken in evaluating earthquake effects. The following table shows the suggested equivalence of the two scales:

Table 1

R-F (adapted)	MM (1956)
1	2
2	3
3	4
4	5
5	6
6	7 - 8 (lower)
7	8 (upper) - 9 (lower)
8	9 (upper) - 10
9	11 - 12

Attenuation of Intensity

Attenuation rates for 36 earthquakes have been calculated using an equation derived by Su (1980) for the Philippine region in the form:

$$I(R) - Io = a - bR - c \log R \qquad (1)$$

where $I(R)$ = Intensity as a function of distance
Io = Intensity at the epicentre

R = Epicentral distance in kilometres

The coefficient b is related to the absorption factor while the coefficient c is associated with the geometric spreading factor (Howell and Schultz, 1975).

Intensity Attunuation Data

Isoseismal maps for 37 earthquakes (Figs. -37) in the Philippine region from 1589-1983 were drawn, but only 35 have been found suitable to provide good data. All the 35 events were analyzed to obtain the intensity-distance relation. In most cases, 3 sample ray paths were taken for each earthquake. a, b and c were calculated for each event by employing a regression analysis that fits through data points I_i (R_i) a least-squares curve of equation (1). Table 2 gives the listing of events and their respective a, b and c values derived from this method.

To simplify comparison of values, events were grouped according to seismotectonic provinces. These provinces were taken to be the same seismic source zones as delineated by Su (1985). These zones are:

- Zone 1 - East Luzon subduction zone
- Zone 2 - Philippine trench
- Zone 3 - Philippine fault
- Zone 4 - Double forearc associated with Manila trench
- Zone 5 - Manila trench
- Zone 6 - Negros and Sulu trenches
- Zone 7 - Cotabato trench and the northern extension of the Molucca Sea plate

Events were grouped according to zones as follows:

Zone	1	2	3	4	5	6	7
No. of earthquakes per zone	8	8	1	12	0	0	6

There were no sample earthquakes for zones 5 and 6. It is hoped that earthquakes may occur in these zones, if only for the purpose of studying the attenuation function in these areas.

The a, b and c values for zones 1, 2, 3, 4 and 7 are shown in Table 3, while attenuation curves are represented in Figures 39-43 respectively.

However, 3 earthquakes were subjected to further examination after computations of individual a, b and c values because either their very large or very small attenuation rates departed greatly from the average values for their respective groups. These earthquakes are January 10, 1970 - Zone 2; August 16, 1976 - Zone 7 and March 31, 1980 - Zone 1 Further analysis of these earthquakes is recommended. Inasmuch as earthquakes in the

Table 2 List of Events Used for Intensity-Distance Attenuation Computation

	Date	Epicentre Lat °N	Epicentre Long °E	Io (MMI)	a	b	c
1.	1852 Sept 16	13.95;	120.40	IX	5.531552	-0.013249	-3.192130
2.	1880 July 18	16.00;	121.85	IX	4.574782	-0.008053	-2.187242
3.	1892 Mar 16	16.06;	120.42	IX	1.566311	-0.010209	-0.795276
4.	1911 July 16	9.00;	126.00	X	3.377046	-0.008302	-2.622990
5.	1931 Mar 14	4.50;	126.00	IX	3.935529	-0.004738	-2.030975
6.	1931 Mar 19	18.30;	120.20	VIII	2.528296	-0.003874	-1.429308
7.	1932 Aug 24	16.50;	120.50	VII	3.643132	-0.006104	-2.417826
8.	1937 Aug 20	14.20;	122.10	VIII	4.476718	-0.039064	-2.945239
9.	1949 Dec 29	17.00;	121.63	IX	4.651885	-0.006746	-3.765001
10.	1950 Jan 03	17.60;	121.10	VII	2.786550	-0.503386	-1.278303
11.	1951 June 01	18.00;	119.00	VII	2.333964	-0.011687	-1.050067
12.	1952 Mar 19	9.40;	126.10	VII	7.412699	-0.000100	-3.671602
13.	1954 July 02	13.00;	124.00	IX	1.721129	-0.003003	-2.306835
14.	1955 Mar 31	8.00;	124.00	X	6.625746	-0.018409	-1.385440
15.	1955 Apr 10	7.80;	124.10	VIII	5.549073	-0.000355	-3.156348
16.	1956 Oct 28	13.94;	122.98	VII	3.454500	-0.036860	-2.446632
17.	1957 June 12	17.88;	120.24	VIII	2.508133	-0.010871	-1.297766
18.	1959 July 19	15.50;	120.33	VII	1.068560	-0.006645	-0.898640
19.	1968 Aug 01	16.50;	122.33	IX	6.530390	-0.008943	-3.000000
20.	1970 Jan 10	6.80;	126.70	VII	9.273395	-0.000254	-4.051376
21.	1970 Apr 07	15.80;	122.70	IX	3.033319	-0.018431	-1.277658
22.	1971 July 04	15.60;	121.85	VI	7.754283	-0.004342	-2.677510
23.	1972 Apr 26	13.40;	120.30	VII	5.073628	-0.012358	-2.005167
24.	1972 May 22	16.10;	122.30	VII	6.639731	-0.008229	-2.488747
25.	1973 Mar 17	13.41;	122.87	XI	3.448681	-0.054780	-3.332591
26.	1974 Feb 19	13.98;	122.17	VII	3.534985	-0.002128	-2.184250
27.	1975 Oct 31	12.47;	126.01	VII	6.122996	-0.000319	-3.179876
28.	1976 Aug 16	7.30;	123.60	X	10.902350	-0.000050	-5.725272
29.	1976 Nov 11	8.36;	126.58	VIII	5.757759	-0.009318	-1.907273
30.	1977 Mar 19	16.70;	122.31	VIII	6.120612	-0.012222	-2.754127
31.	1980 Mar 31	16.04;	121.88	VII	1.837912	-0.012474	-0.500000
32.	1980 Oct 26	12.04;	126.33	VII	2.049114	-0.014935	-0.910102
33.	1981 Nov 22	18.71;	120.65	VIII	1.524204	-0.214798	-0.613689
34.	1982 Jan 11	14.00;	124.50	VII	3.119324	-0.009309	-1.100000
35.	1983 Aug 17	18.33;	120.87	VIII	1.951468	-0.006583	-1.232840

Table 3 Values for a, b and c for the Various Seismotectonic Provinces

Zone	a	b	c
1	6.391013	-0.008066	-3.045896
2	3.036227	-0.009080	-1.714270
3	3.448681	-0.054480	-3.332591
4	3.686528	-0.016540	-1.893100
7	4.958582	-0.085856	-2.590441

Philippines fall into two categories; a) offshore earthquakes and b) inland earthquakes, two methods of determining Io are employed. For the first category, maximum intensities, Io, are extrapolated values from the individual intensity decay curve whereas, for the 2nd category, Io is taken to be the maximum observed intensity. This is particularly true for the post-1900 earthquakes where the instrumental determination of epicentres is available. Intensity attenuation curves were drawn using the maximum observed intensity assessed for each zone.

Analysis of Intensity Attenuation Data

When attenuation rates, c, for different provinces were compared, it was found that zone 3 has the highest attenuation rate of -3.33, which could be attributed to the presence of the Philippine Fault. Zones 2 and 4 are purely associated with trench-arc systems and therefore give very close values of c. While zones 1 and 7 are both associated with trench-arc systems, these zones have fault systems in their respective areas. It is, therefore, not sheer coincidence that they have similar values for c.

Acknowledgements

This study was made possible with the assistance and cooperation of the Office of Foreign Disaster Assistance of the U.S. Agency for International Development and the U.S. Geological Survey under USGS Agreement No. 14-08-001-G-713. Gratitude is, therefore, expressed by the PAGASA Project Staff to these agencies and their staff who were involved in the implementation of the Project. In particular, sincere thanks are due to Dr. E.P. Arnold of the U.S. Geological Survey, Fr. Sergio S. Su, S.J. of the Manila Observatory, Dr. Roman L. Kintanar, Administrator of PAGASA and Mr. Ernesto V. Calpo, Director of the National Geophysical and Astronomical Office, PAGASA.

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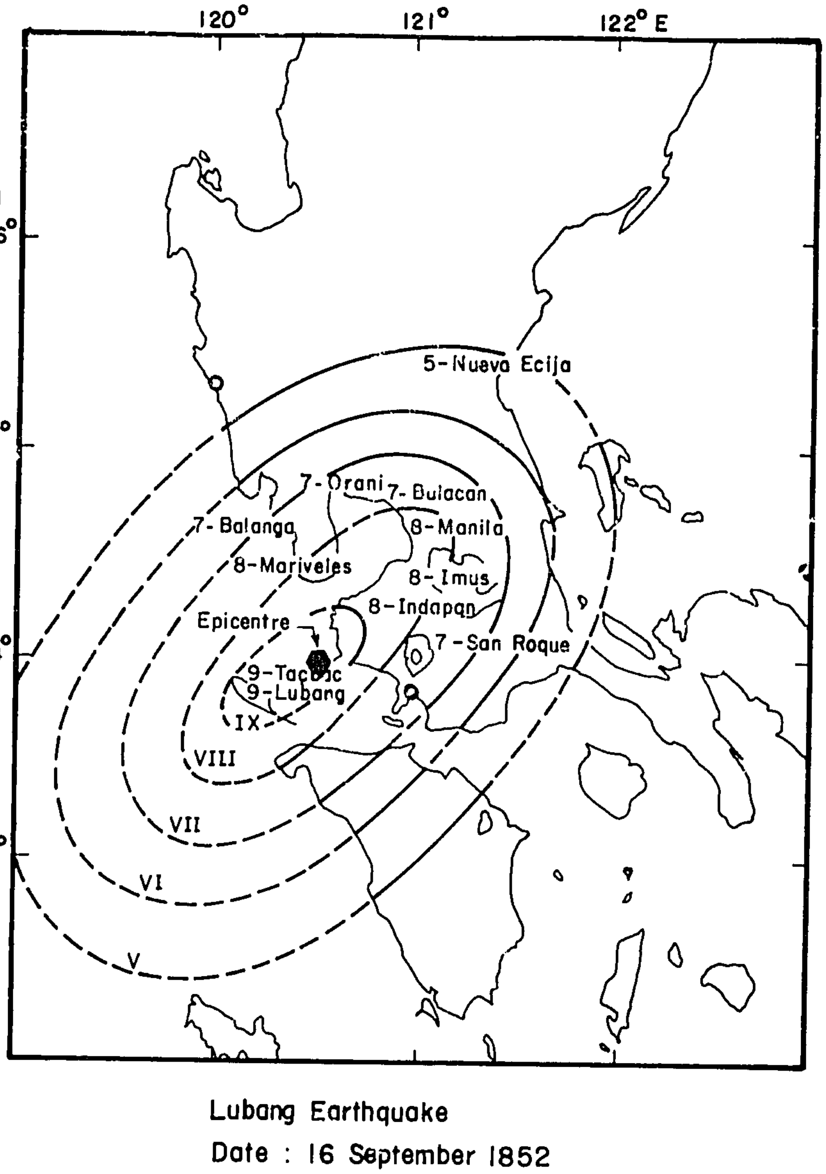
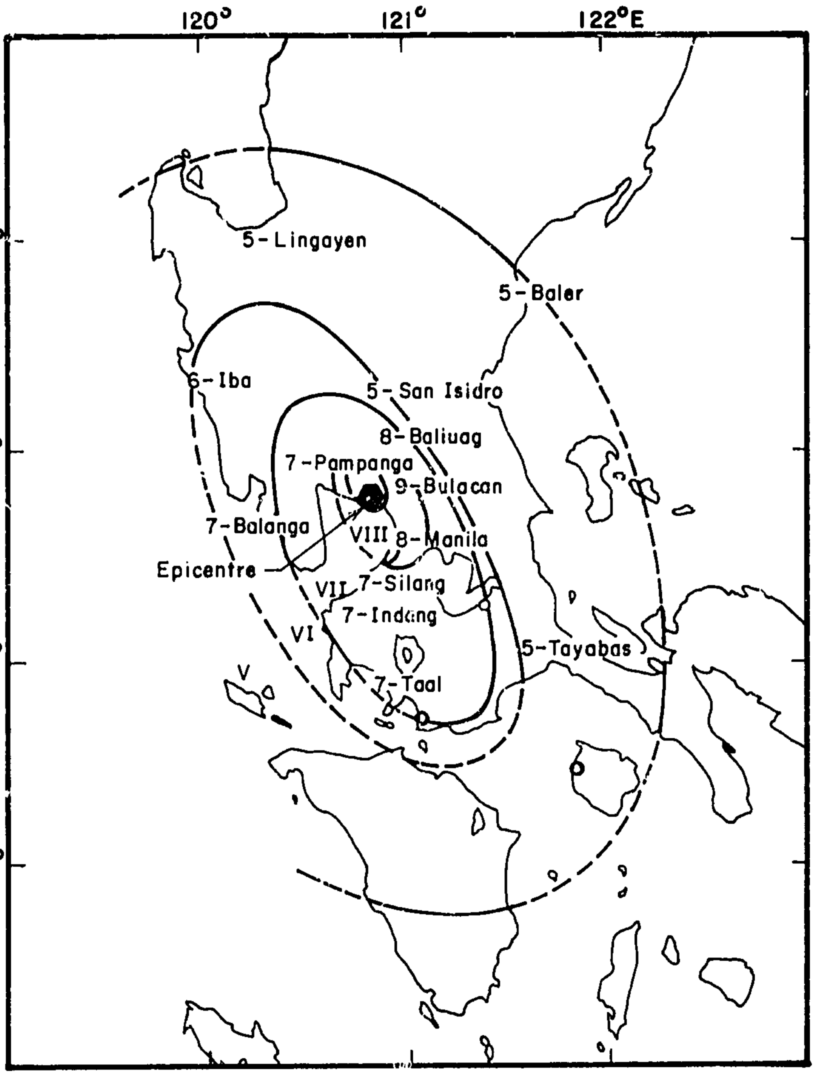


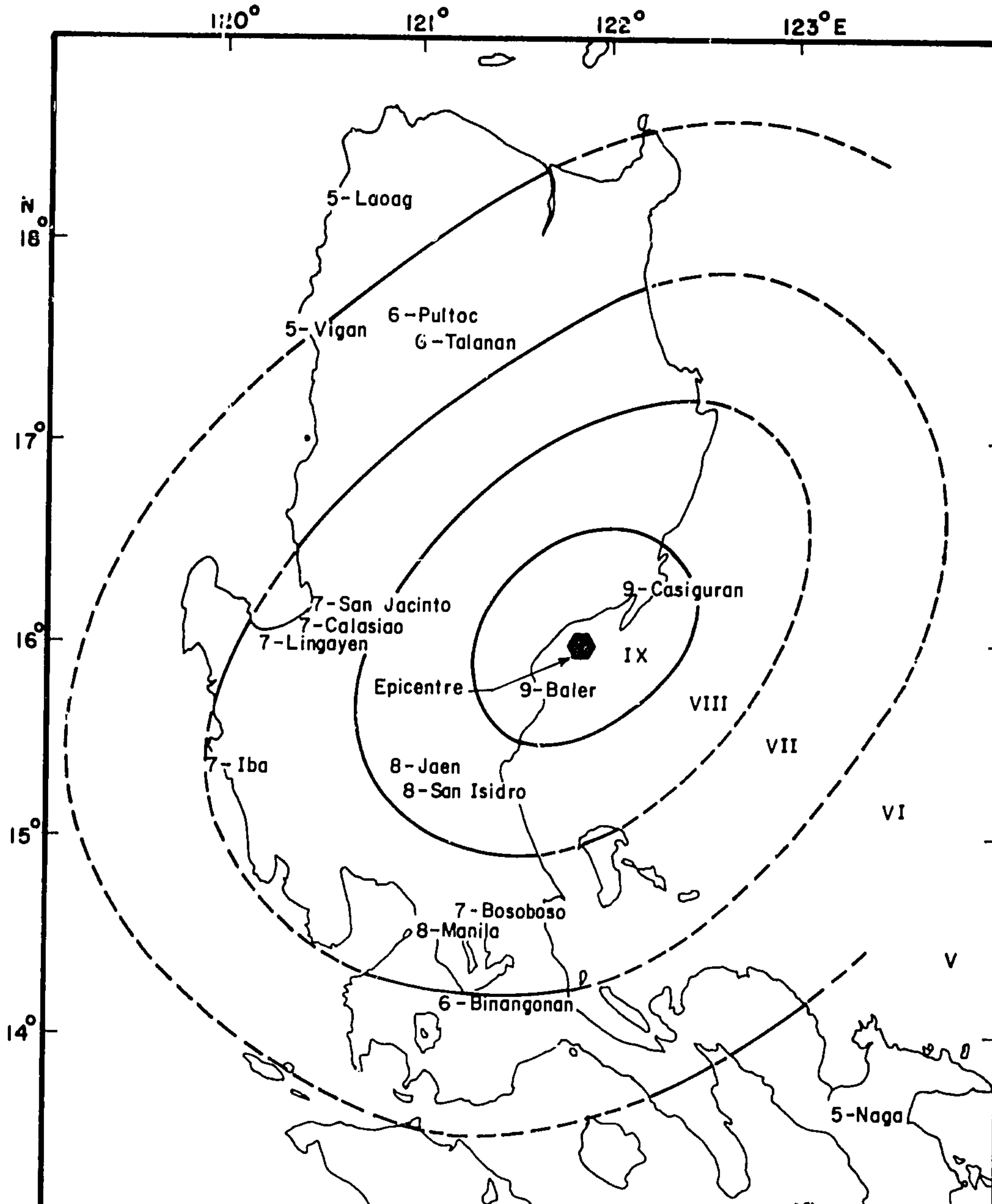
Lubang Earthquake
Date : 16 September 1852
Time : 10 h 30 m
Epicentre : 13.95° N 120.4° E

Fig. 1 Isoseismal Map of the 16 September 1852 Earthquake of Lubang



Central Luzon Earthquake
Date : 01 October 1869
Time : 03h 15m
Epicentre : 14.82°N , 120.82°E ⬢

Fig. 2 Isoseismal Map of the 01 October 1869 Earthquake of Central Luzon



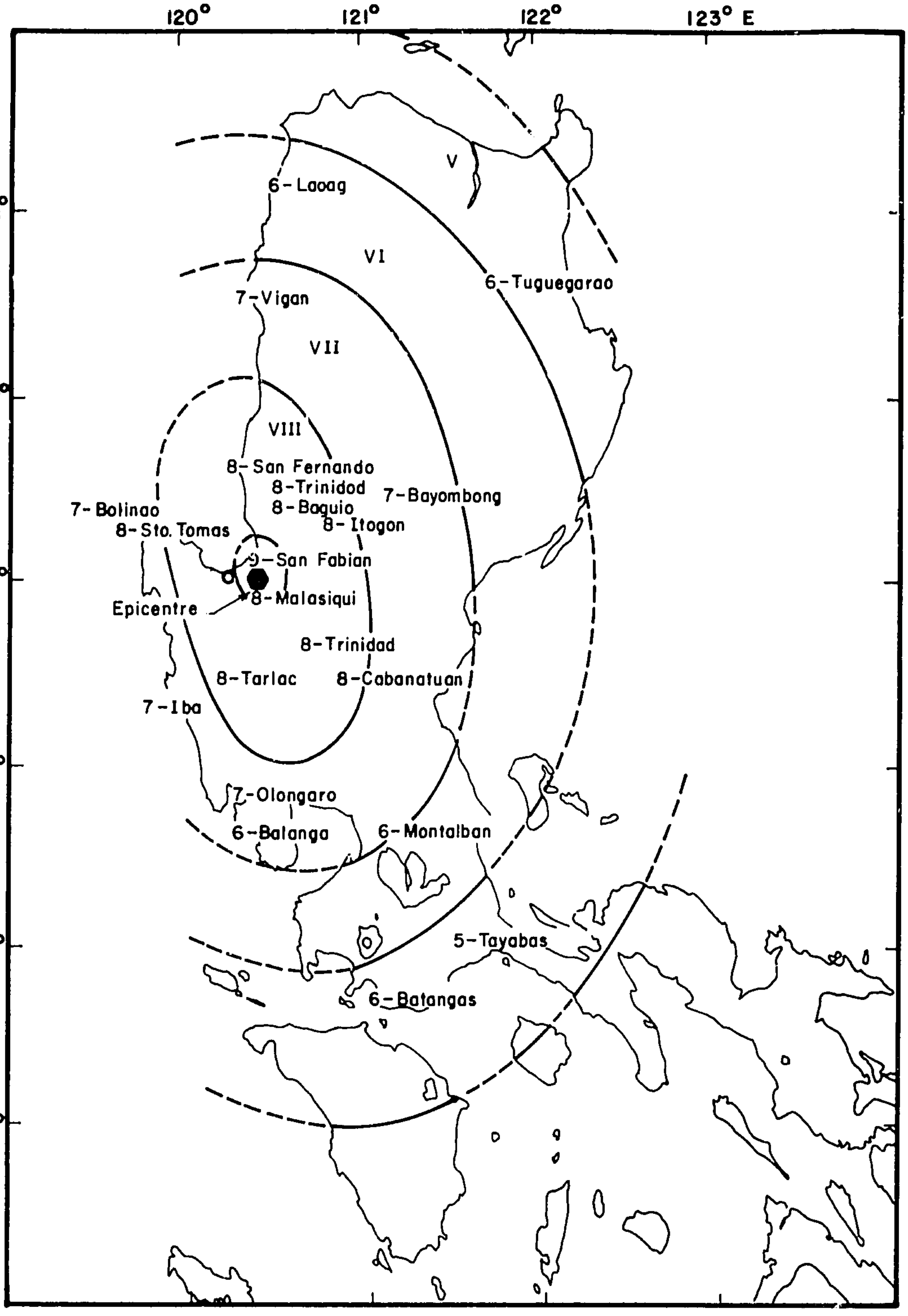
Eastern Luzon Earthquake

Date : 18 July 1880

Time : 04 h 40 m

Epicentre : 16.00° N , 121.85° E ⬢

Fig. 3 Isoseismal Map of the 18 July 1880 Earthquake of Eastern Luzon



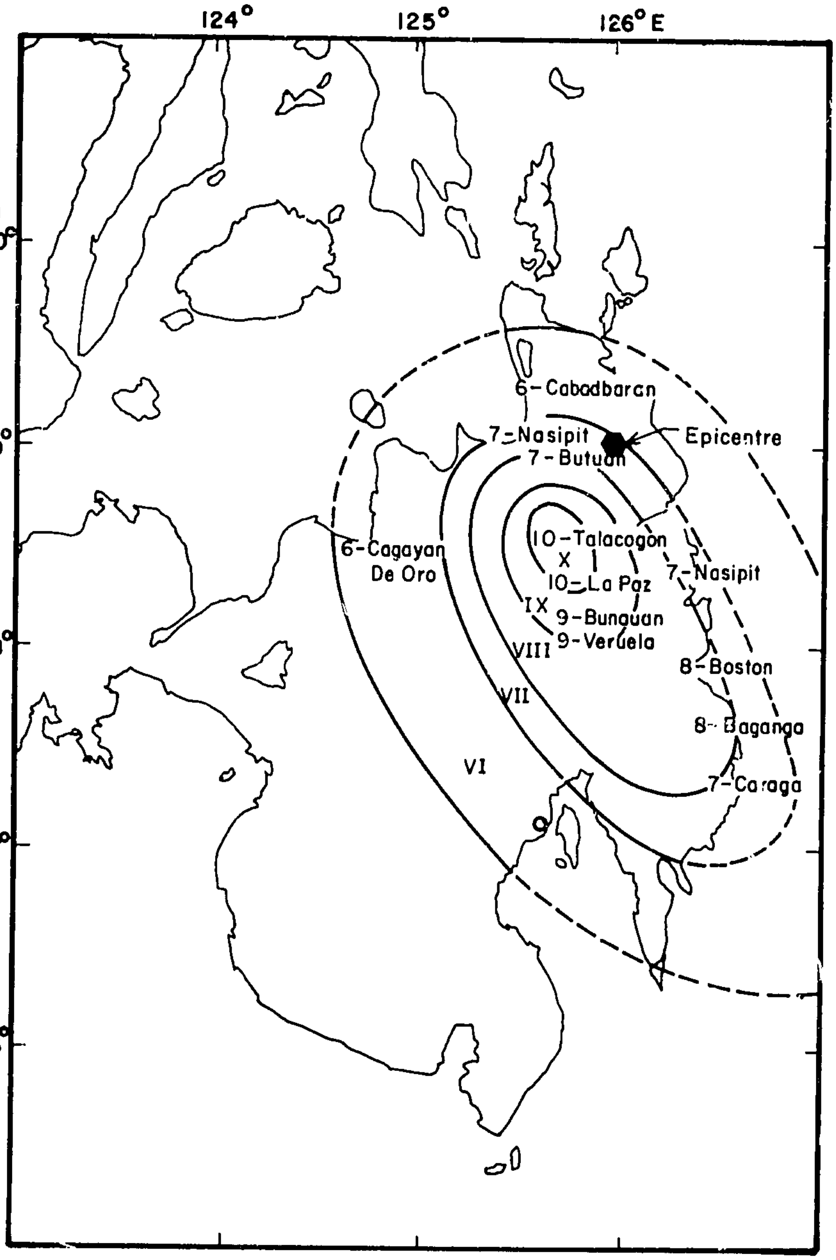
Pangasinan Earthquake

Date : 16 March 1892

Time : 13 h 01 m

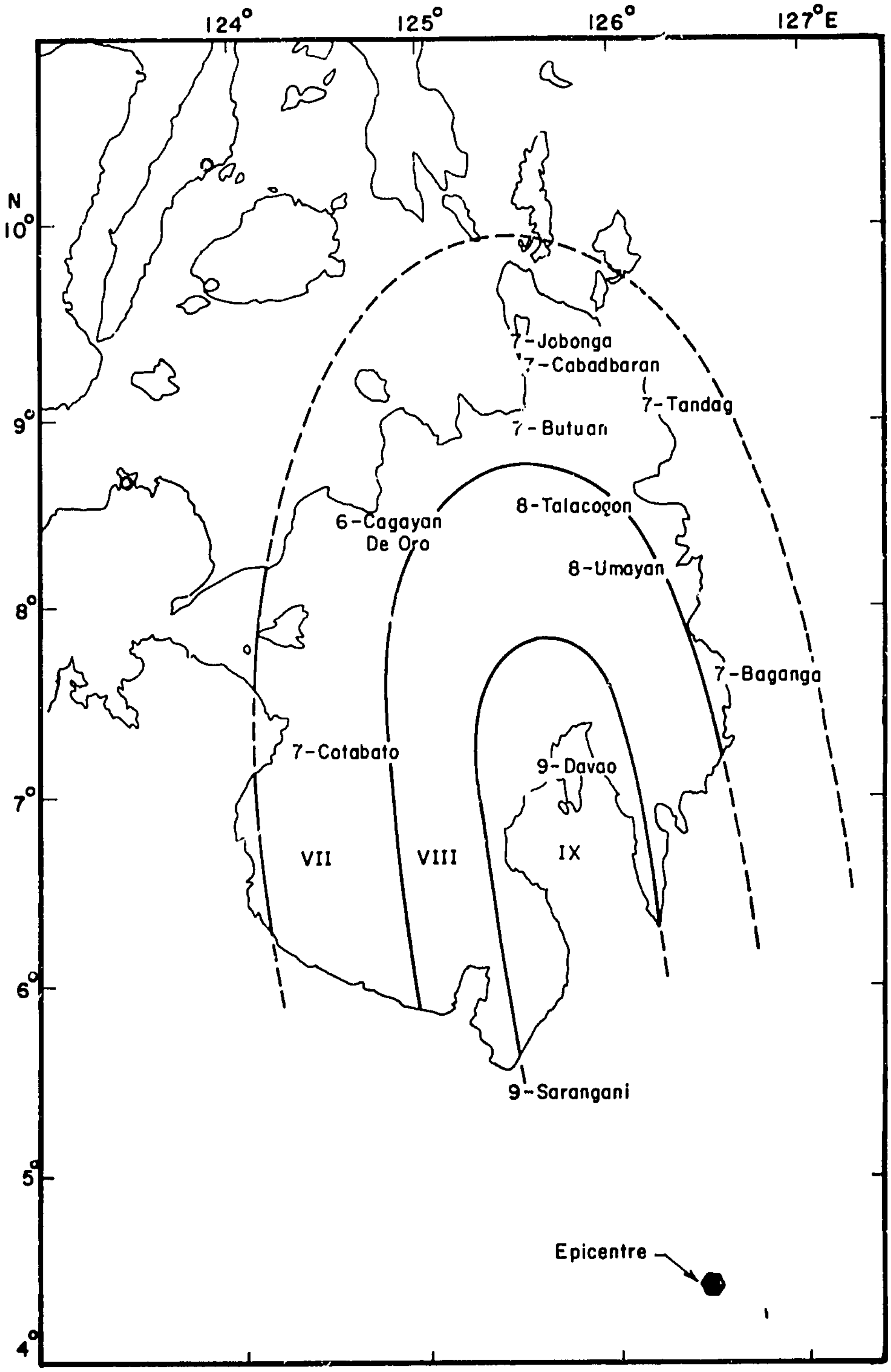
Epicentre : 16.06° N , 120.42°E

Fig. 4 Isoseismal Map of the 16 March 1892 Earthquake of Pangasinan



Agusan Valley Earthquake
Date : 12 July 1911
Time : 04h 07m 36s
Epicentre : 9° N 126° E
Magnitude : MS = 7.75 (PAS)

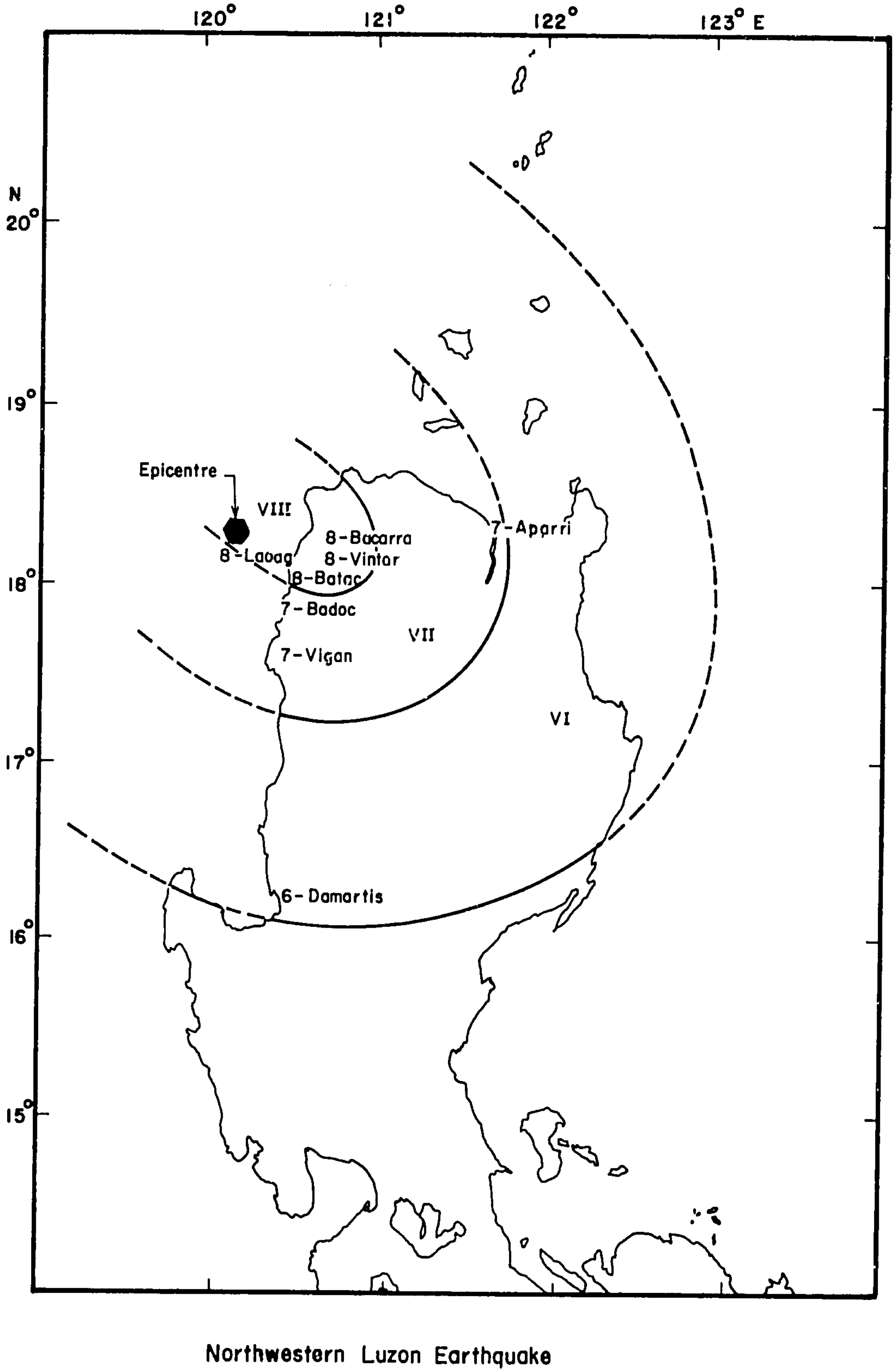
Fig. 5 Isoseismal Map of the 12 July 1911 Earthquake of Agusan Valley



Davao Earthquake
Date : 14 March 1913
Time : 08 h 45 m 00.0 s

Epicentre : 4.5° N 126.5° E
Magnitude : MS = 7.9 (PAS)

Fig. 6 Isoseismal Map of the 14 March 1913 Earthquake of Davao



Northwestern Luzon Earthquake

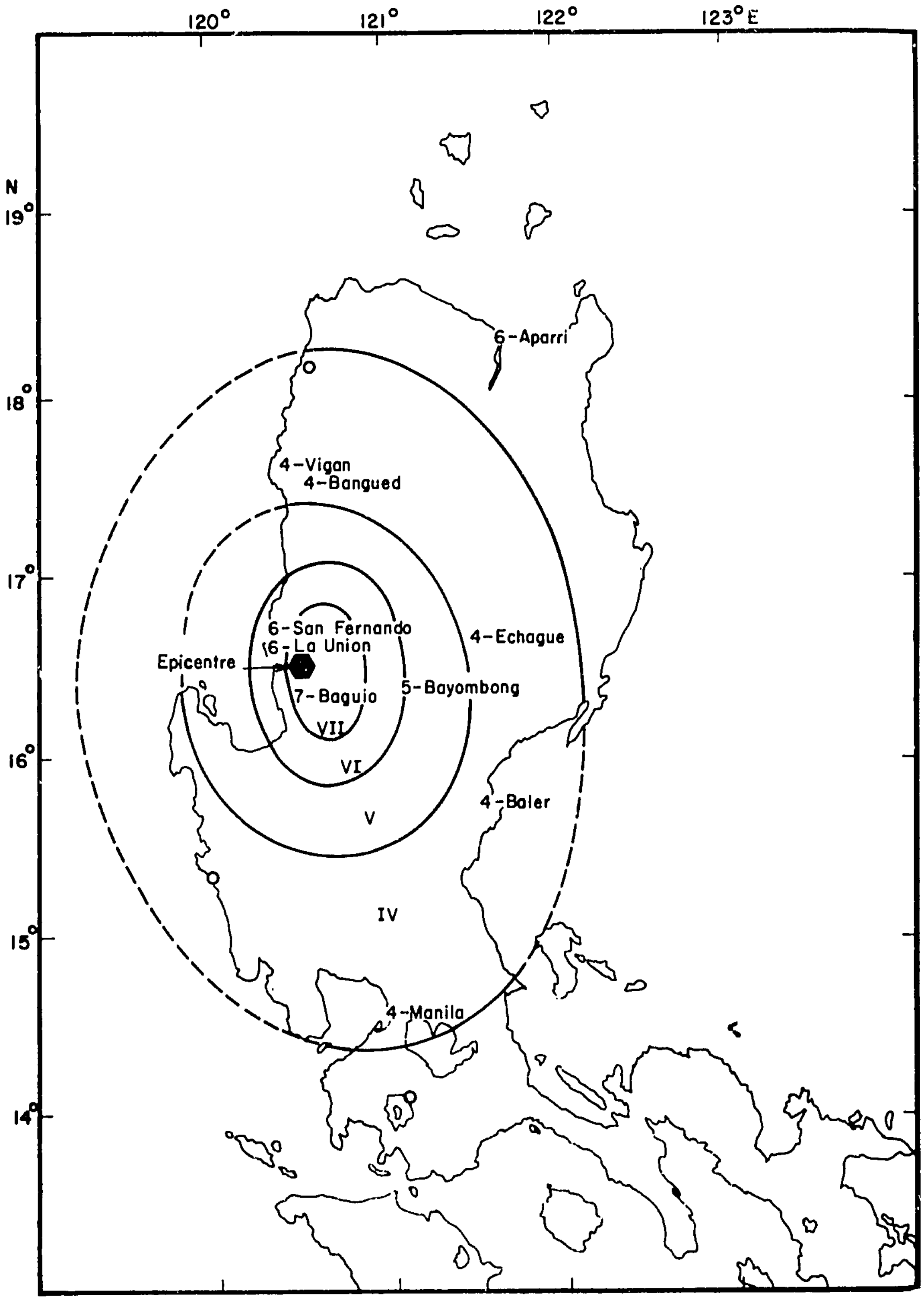
Date : 19 March 1931

Time : 06 h 25 m 00 s

Epicentre : 18.0°N 120.5°E

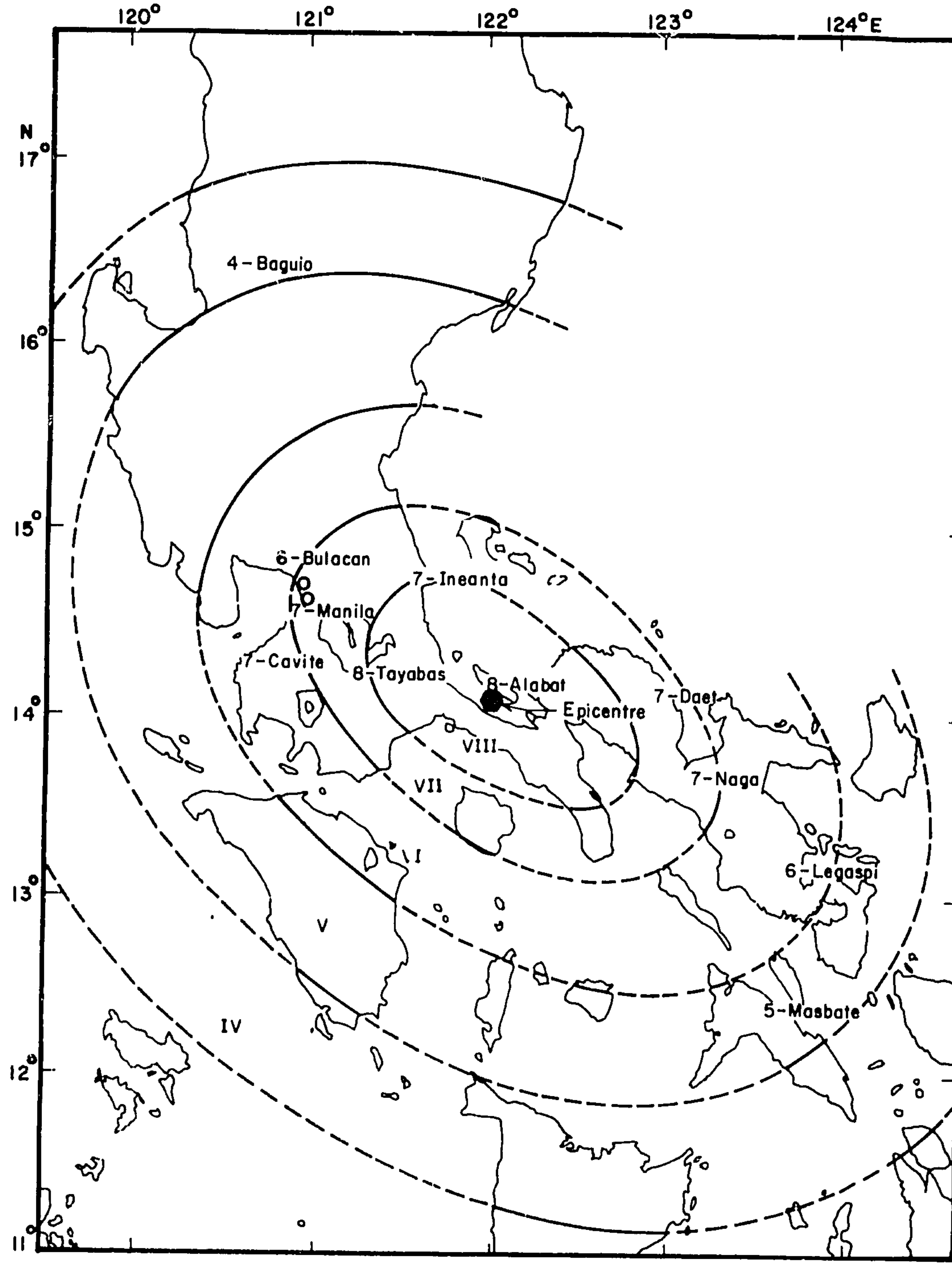
Magnitude : MS = 6.9 (PAS)

Fig. 7 Isoseismal Map of the 19 March 1931 Earthquake of Northwestern Luzon



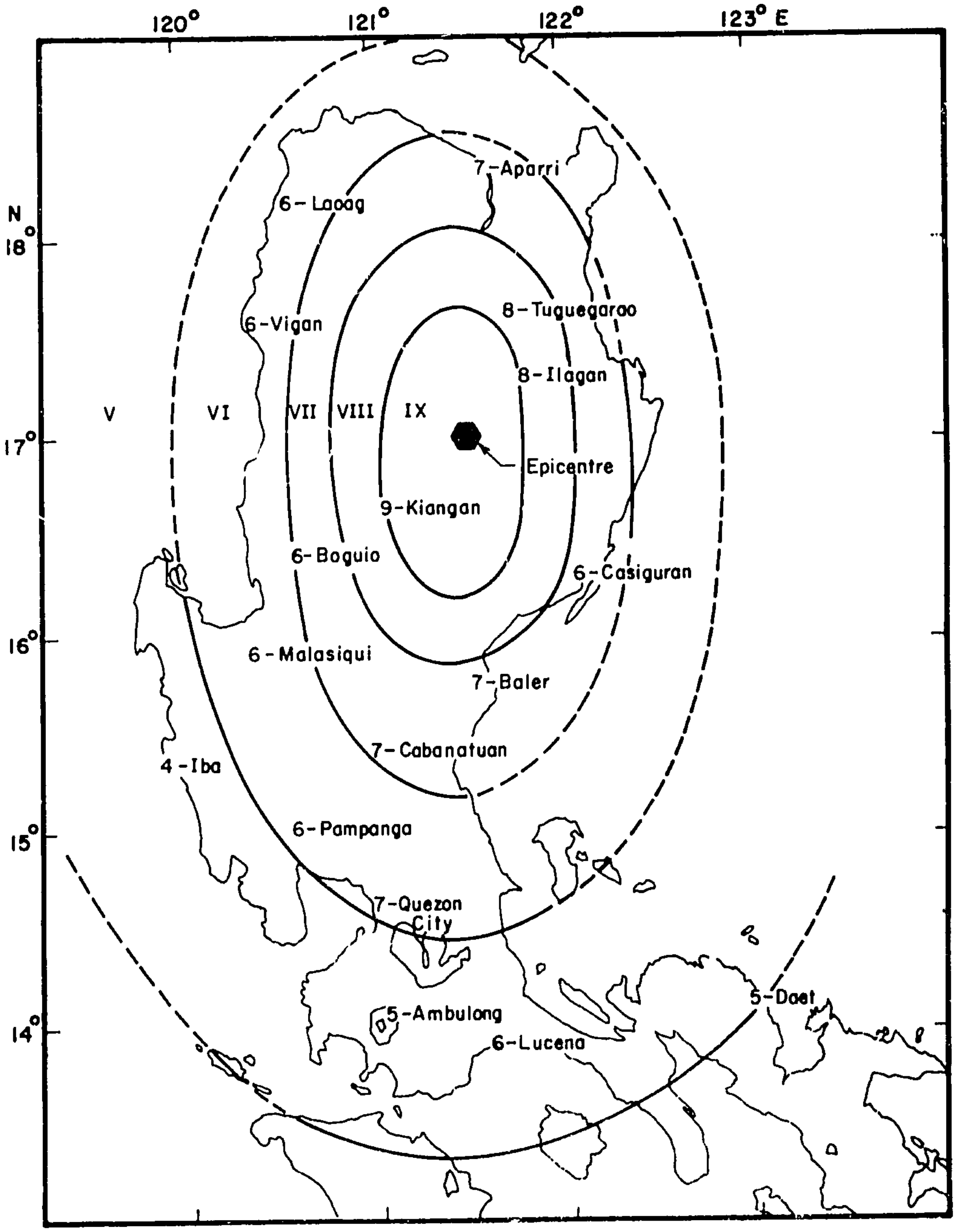
Western Luzon Earthquake
Date : 24 August 1932
Time : 12 h 10 m 32.0 s
Epicentre : 16.5°N 120.5°E
Magnitude : MS 6.25 (PAS)

Fig. 8 Isoseismal Map of the 24 August 1932 Earthquake of Western Luzon



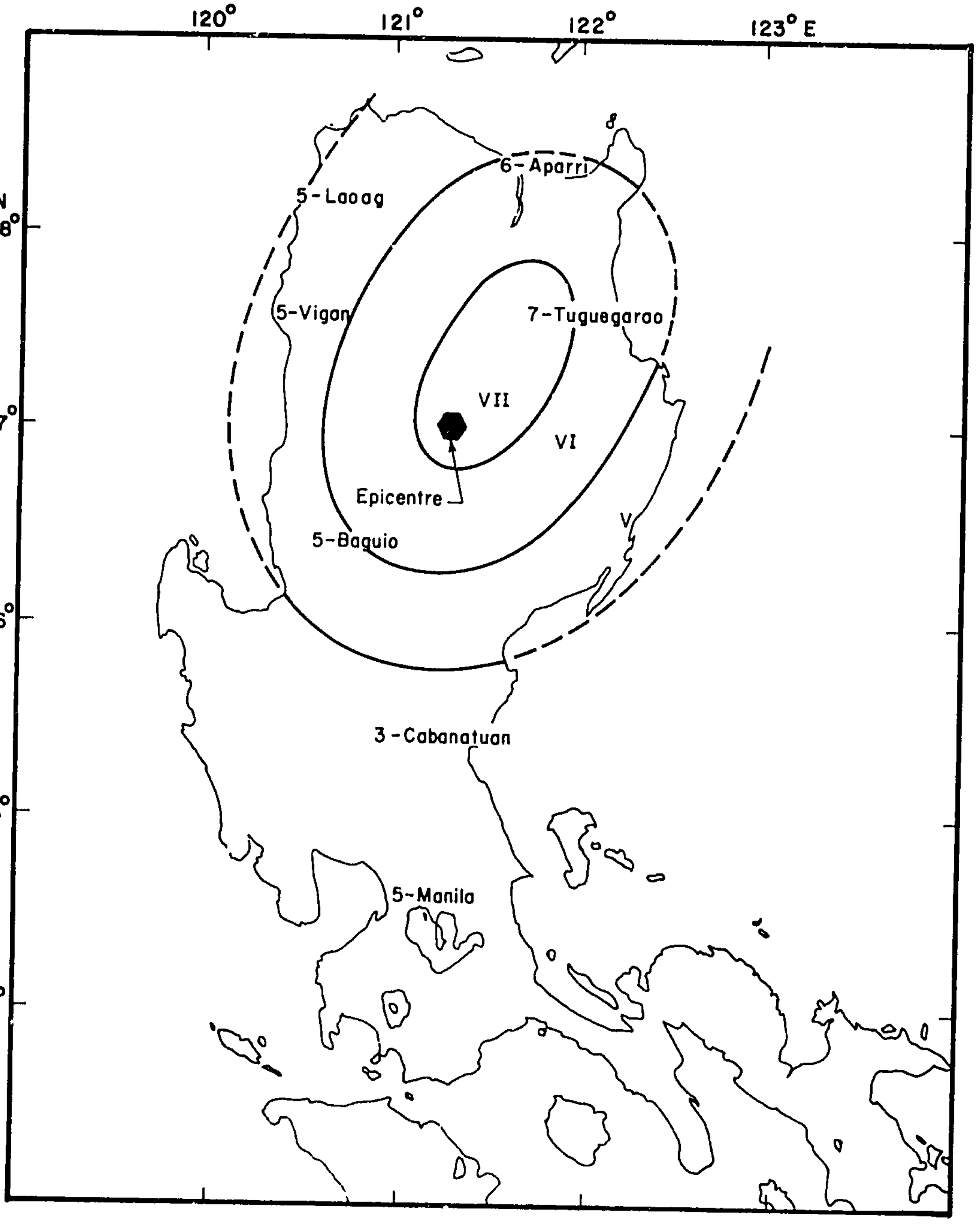
Alabat Earthquake
Date : 20 August 1937
Time : 11h 59 m 15s
Epicentre : 14.2°N 122.1°E ⬢
Magnitude : MS = 7.5 (PAS)

Fig. 9 Isoseismal Map of the 20 August 1937 Earthquake of Alabat, Quezon



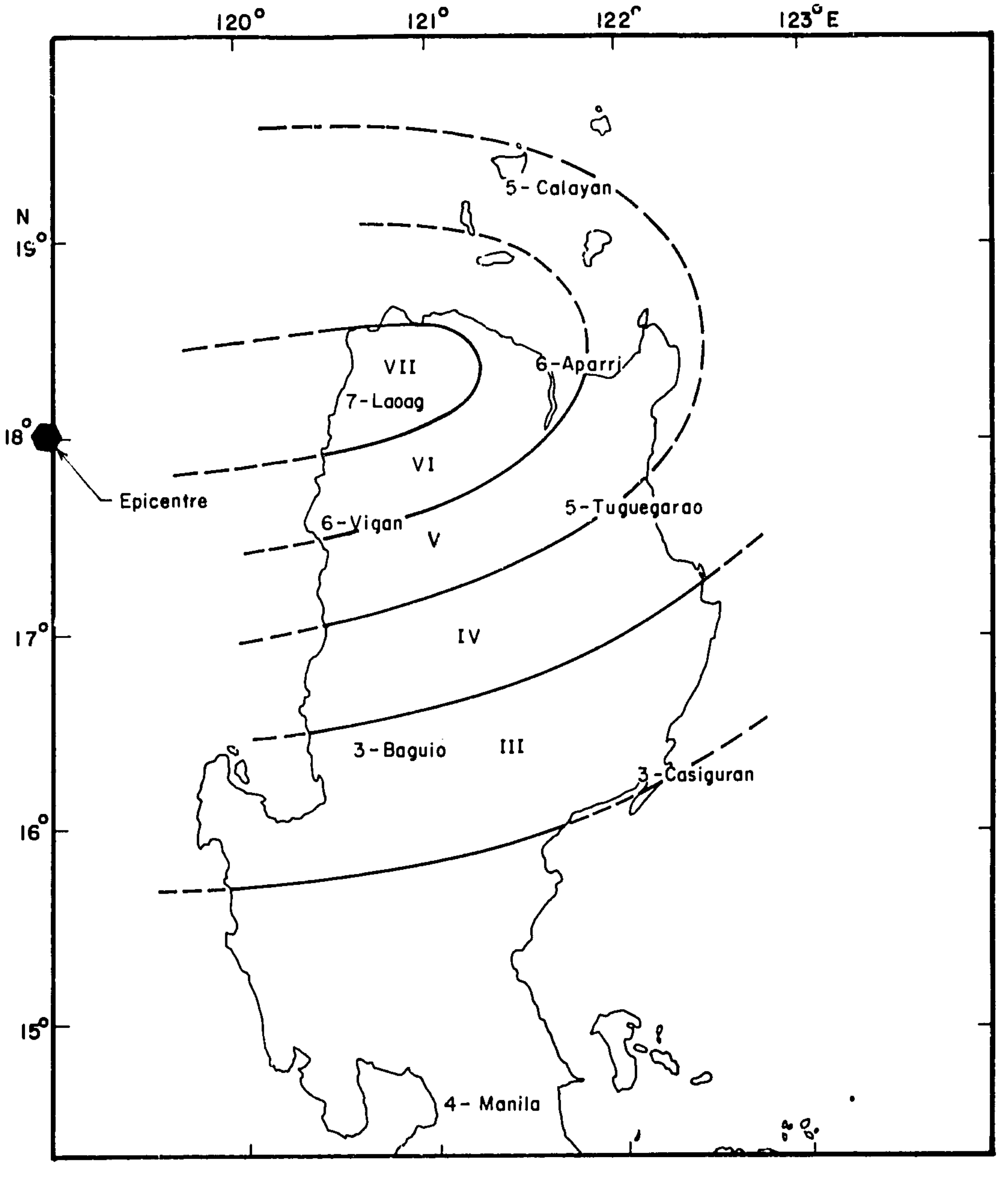
Isabela Earthquake
Date : 29 December 1949
Time : 03 h 05 m 50.0 s
Epicentre : 17.5°N 121.5°E
Magnitude : MS = 7.2 (PAS)

Fig. 10 Isoseismal Map of the 29 December 1949 Earthquake of Isabela



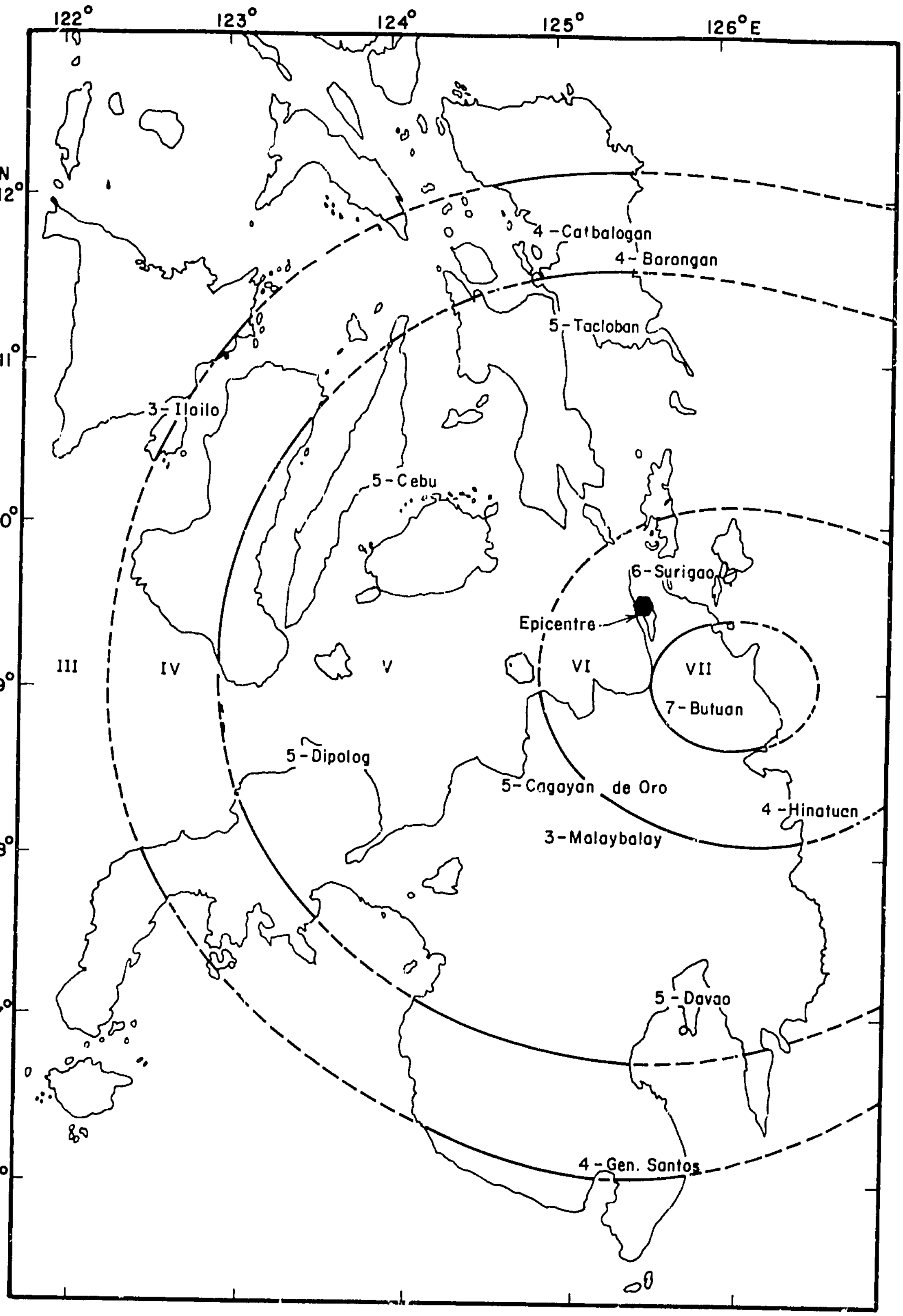
Mountain Province Earthquake
Date : 03 January 1950
Time : 02h 51 m 50 s
Epicentre : 18°N 121.5°E ⬣
Magnitude : MS = 6.5 (PAS)

Fig. 11 Isoseismal Map of the 03 January 1950 Earthquake of the Mountain Province



Northwestern Luzon Earthquake
Date : 31 May 1951
Time : 20h 56m 01s
Epicentre : 18.6°N 121.2°E ⬢
Magnitude :
Depth : 96 kms

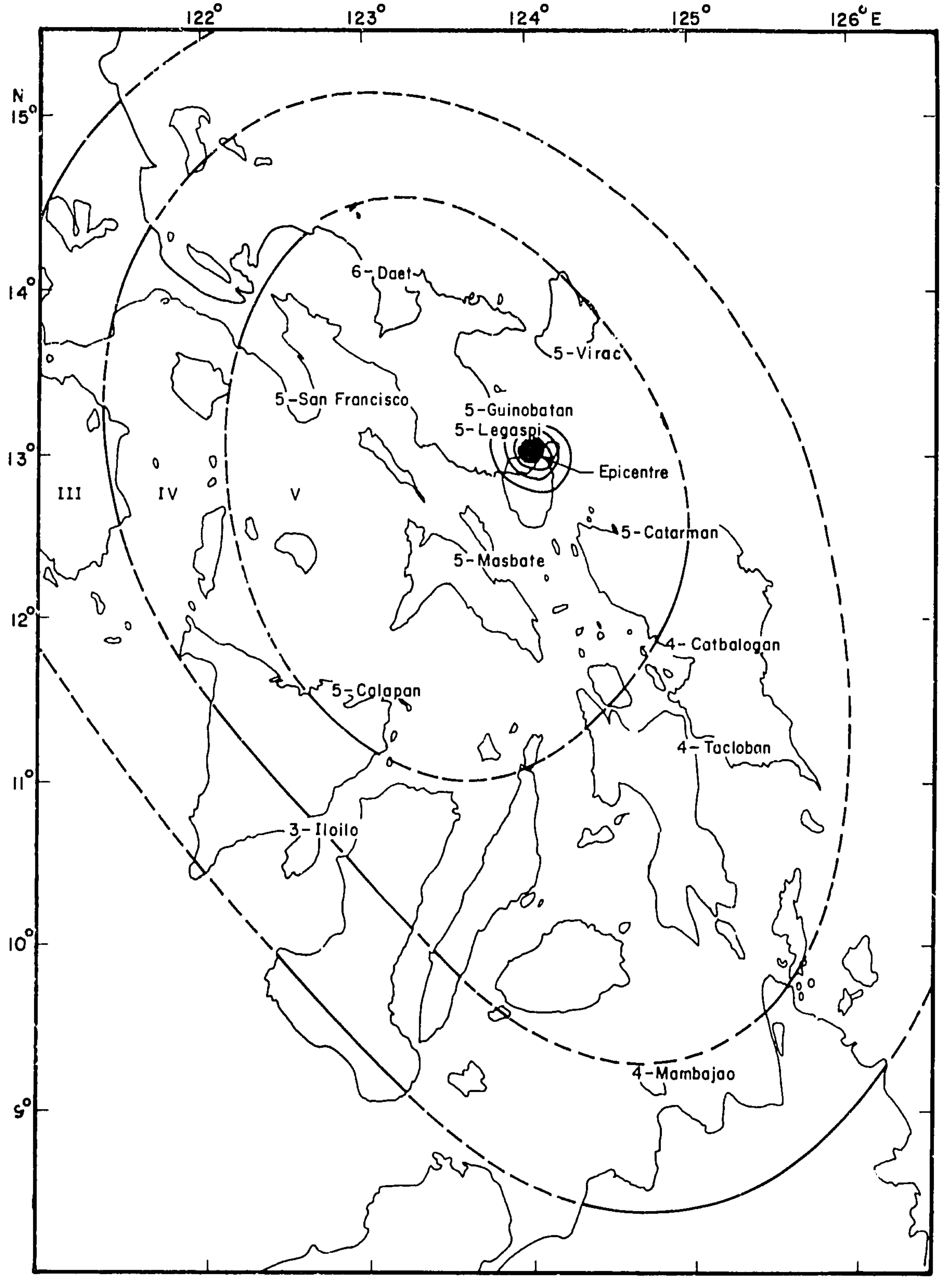
Fig. 12 Isoseismal Map of the 31 May 1951 Earthquake of Northwestern Luzon



Butuan (Northeastern) Mindanao
Date : 19 March 1952
Time : 10 h 57 m 07 s

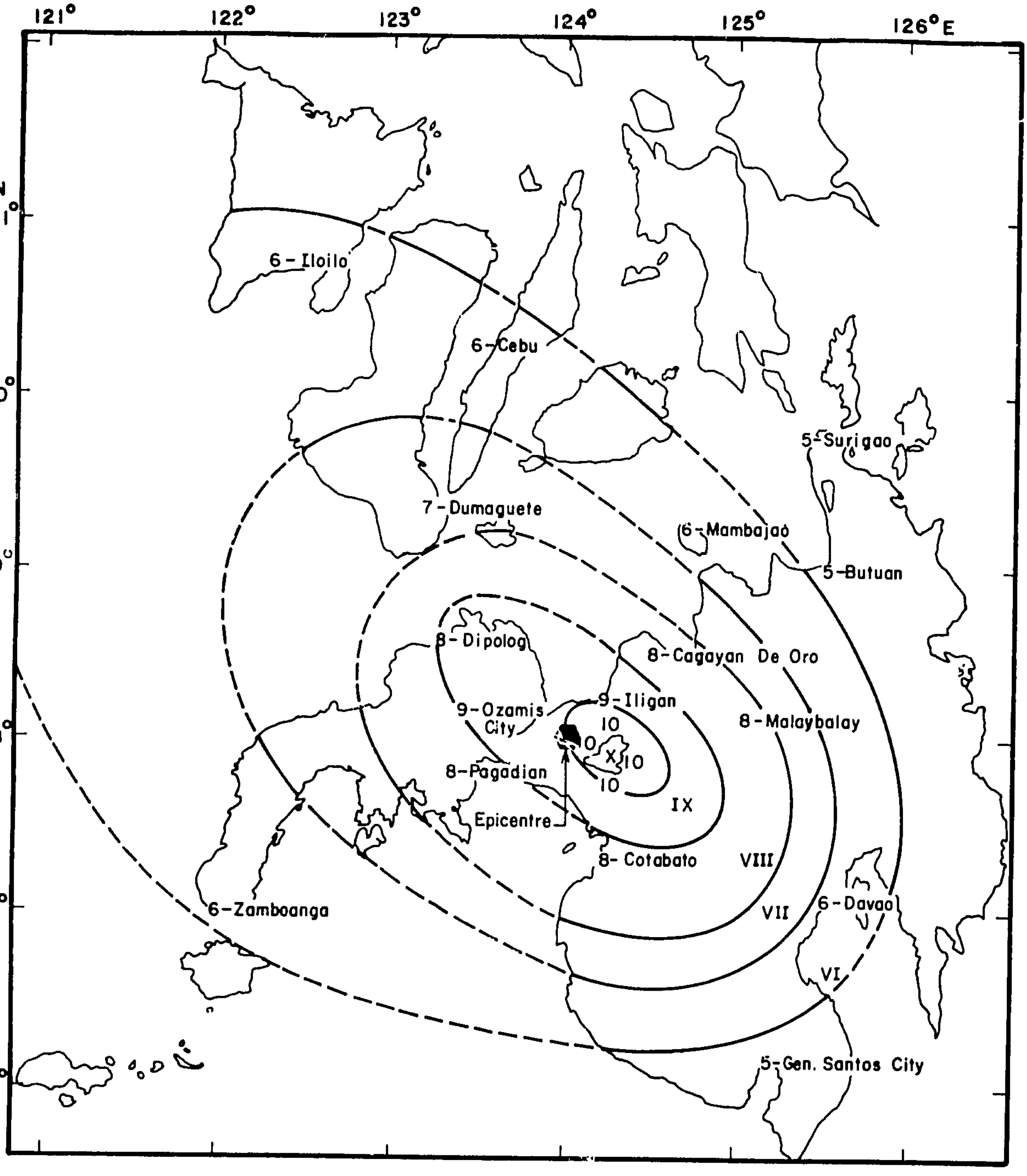
Epicentre : 9.5°N 126.5°E ●
Magnitude : MB - 7.75 (PAS)
Depth :

Fig. 13 Isoseismal Map of the 19 March 1952 Earthquake of Butuan (Northeastern) Mindanao



Albay Earthquake
Date : 02 July 1954
Time : 02 h 45 m 09 s
Epicentre : 13°N 124°E
Magnitude : MB = 6.75 (PAS)
Depth : 60 kms

Fig. 14 Isoseismal Map of the 02 July 1954 Earthquake of Albay



Lanao Earthquake

Date : 31 March 1955

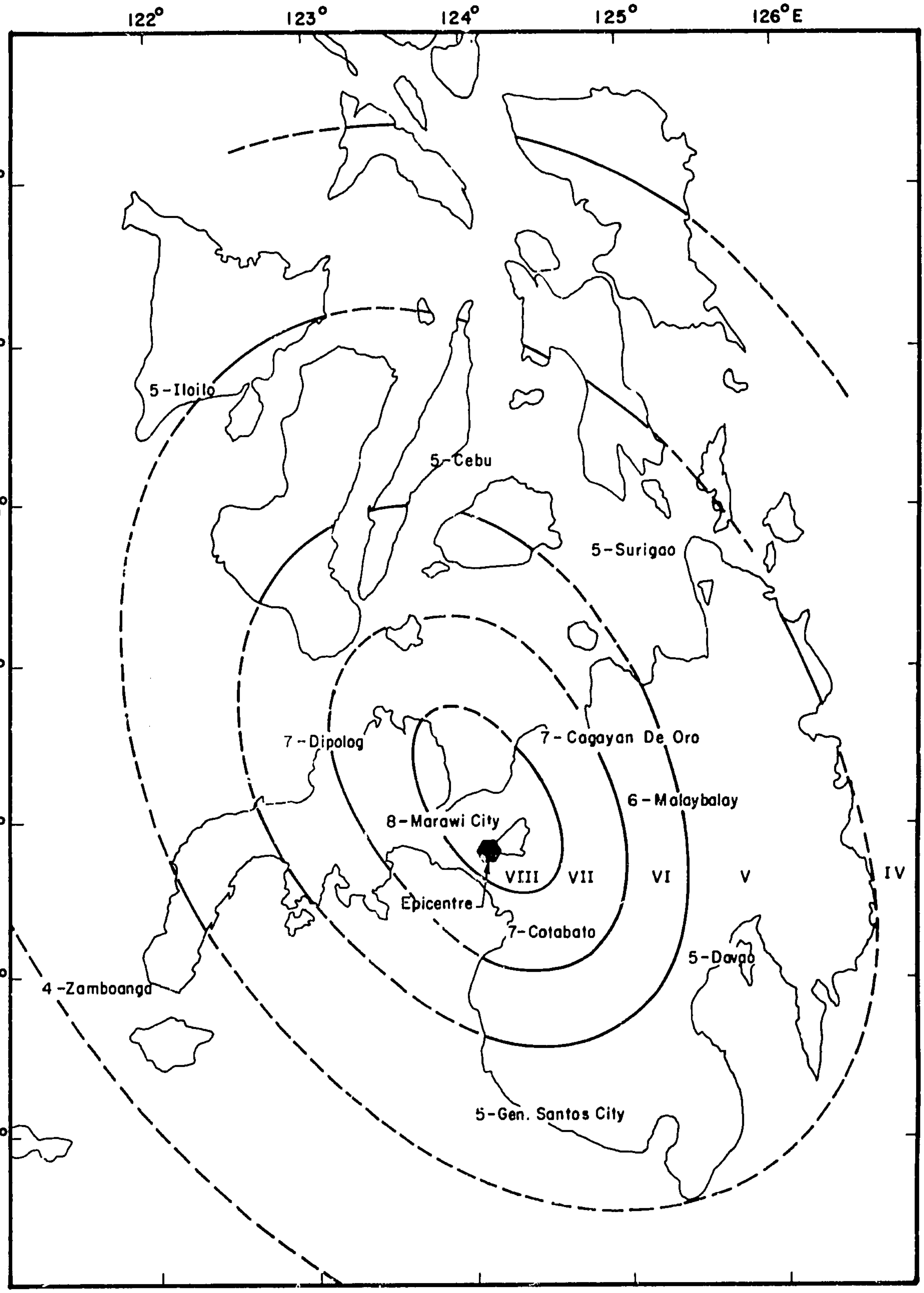
Time : 8 h 17 m 00 s

Epicentre : 8°N 124°E ⬢

Magnitude : MS = 7.5 (PAS)

Depth : 96 kms

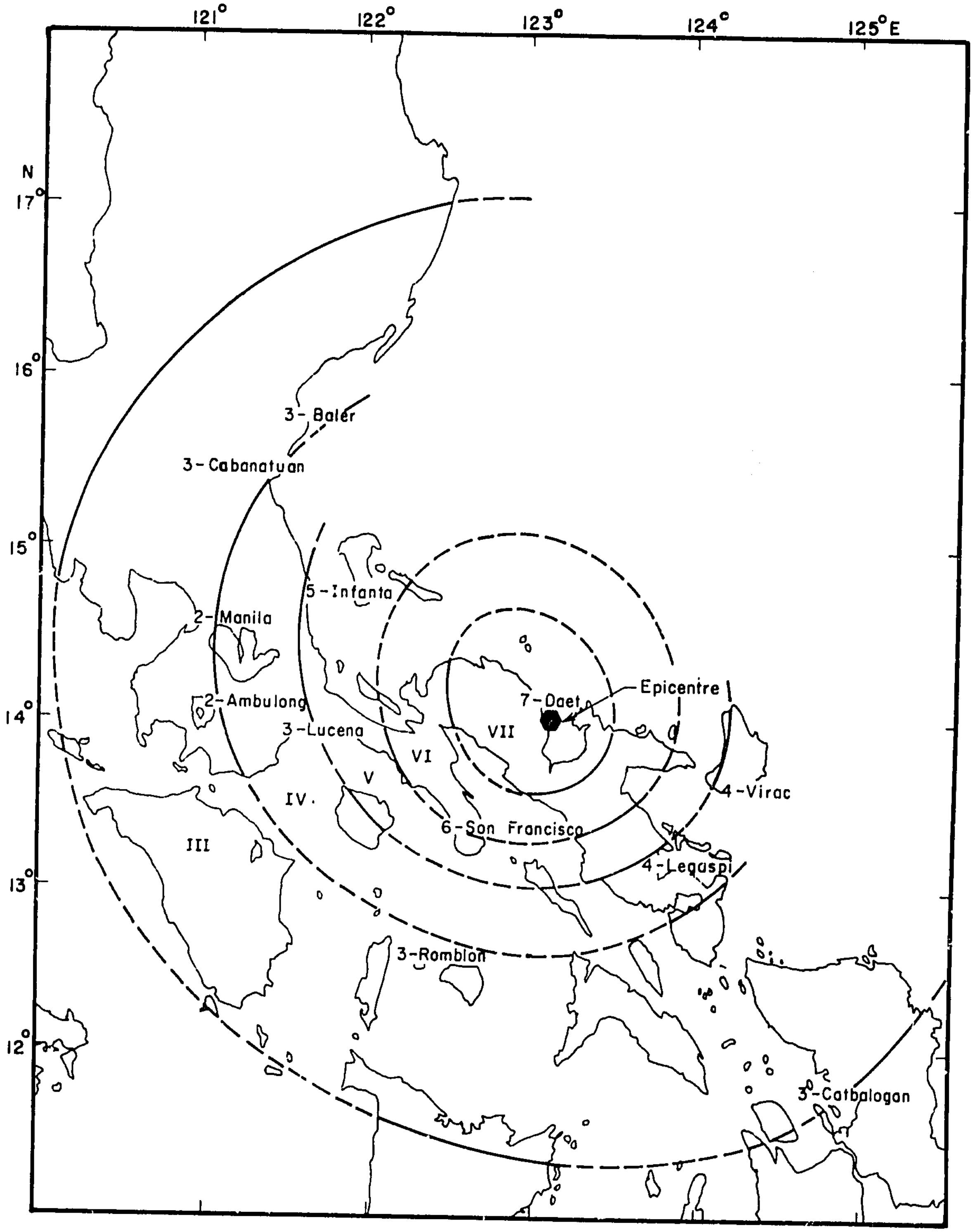
Fig. 15 Isoseismal Map of the 31 March 1955 Earthquake of Lanao



Lanao Earthquake
Date : 10 April 1955
Time : 17 h 38 m 12 s

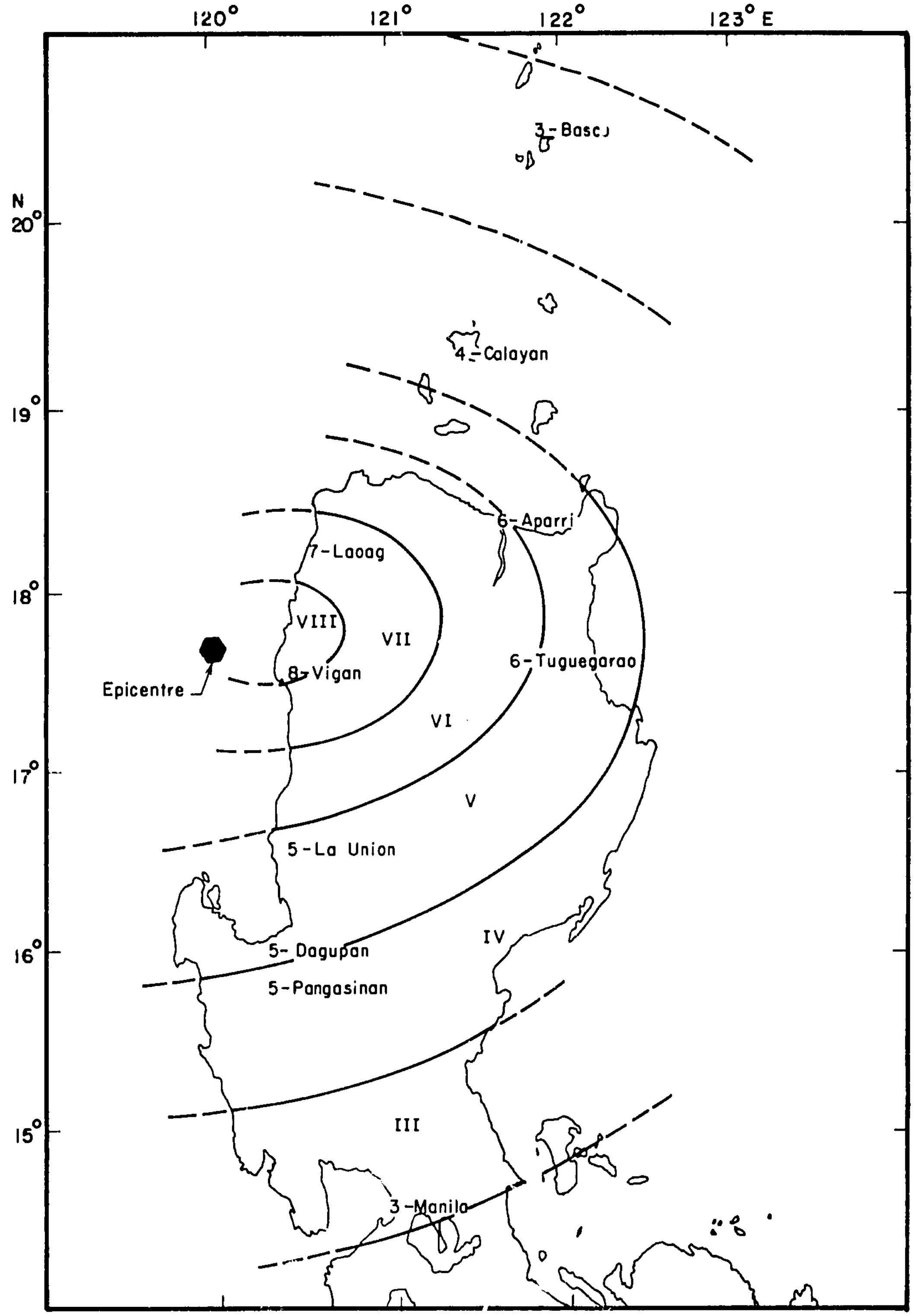
Epicentre : 7.8°N 124.1°E ⬢
Magnitude : MB = 6.5 (PAS)
Depth :

Fig. 16 Isoseismal Map of the 10 April 1955 Earthquake of Lanao



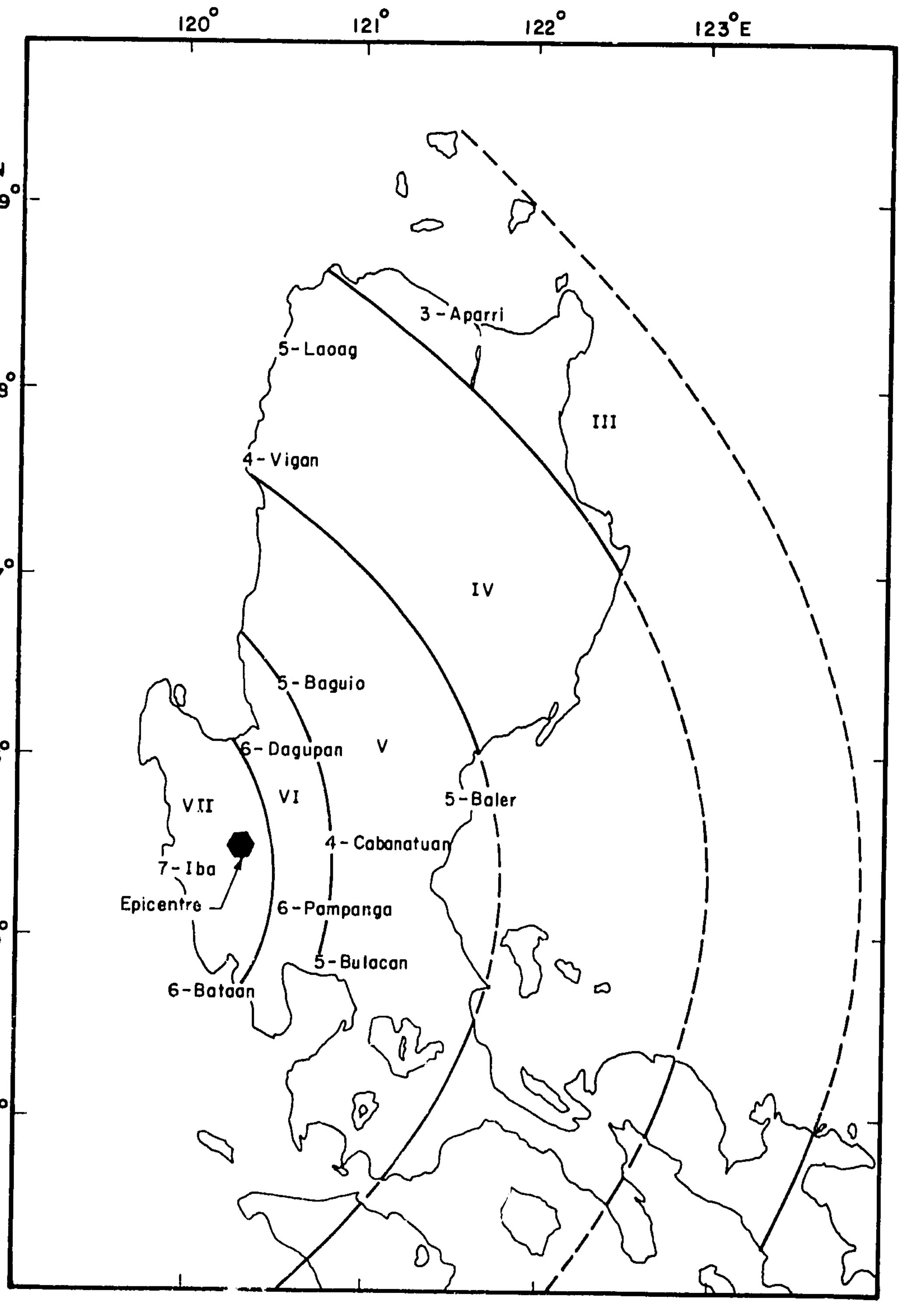
Camarines (Southern Luzon) Earthquake
Date : 28 October 1956
Time : 10 h 45 m 06 s
Epicentre : 14.0°N 123.25°E ⬣
Magnitude : MB = 6.75 (BCIS)
Depth :

Fig. 17 Isoseismal Map of the 28 October 1956 Earthquake of Camarines (Southern Luzon)



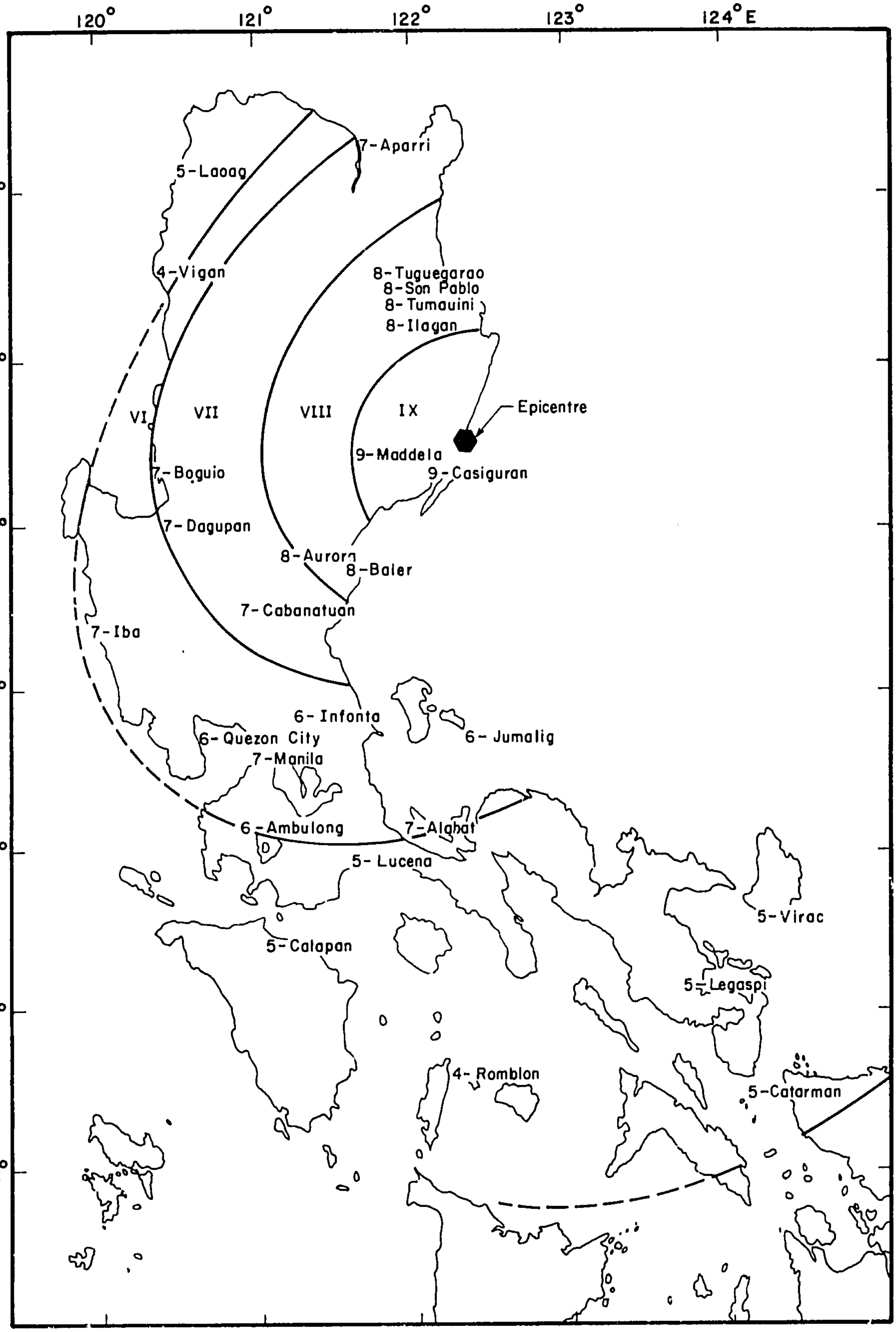
Northwestern Luzon Earthquake
Date : 11 June 1957
Time : 18 h 49 m 32 s
Epicentre : 17.88°N 120.24°E
Magnitude : MB = 6.7 (ROM)
Depth : 44 kms

Fig. 18 Isoseismal Map of the 11 June 1957 Earthquake of Northwestern Luzon



Zambales Earthquake
Date : 18 July 1959
Time : 19h 54m 57s
Epicentre : 15.5°N 120.5°E ⬢
Magnitude : MB = 6.6 (PAS)
Depth : 150 kms

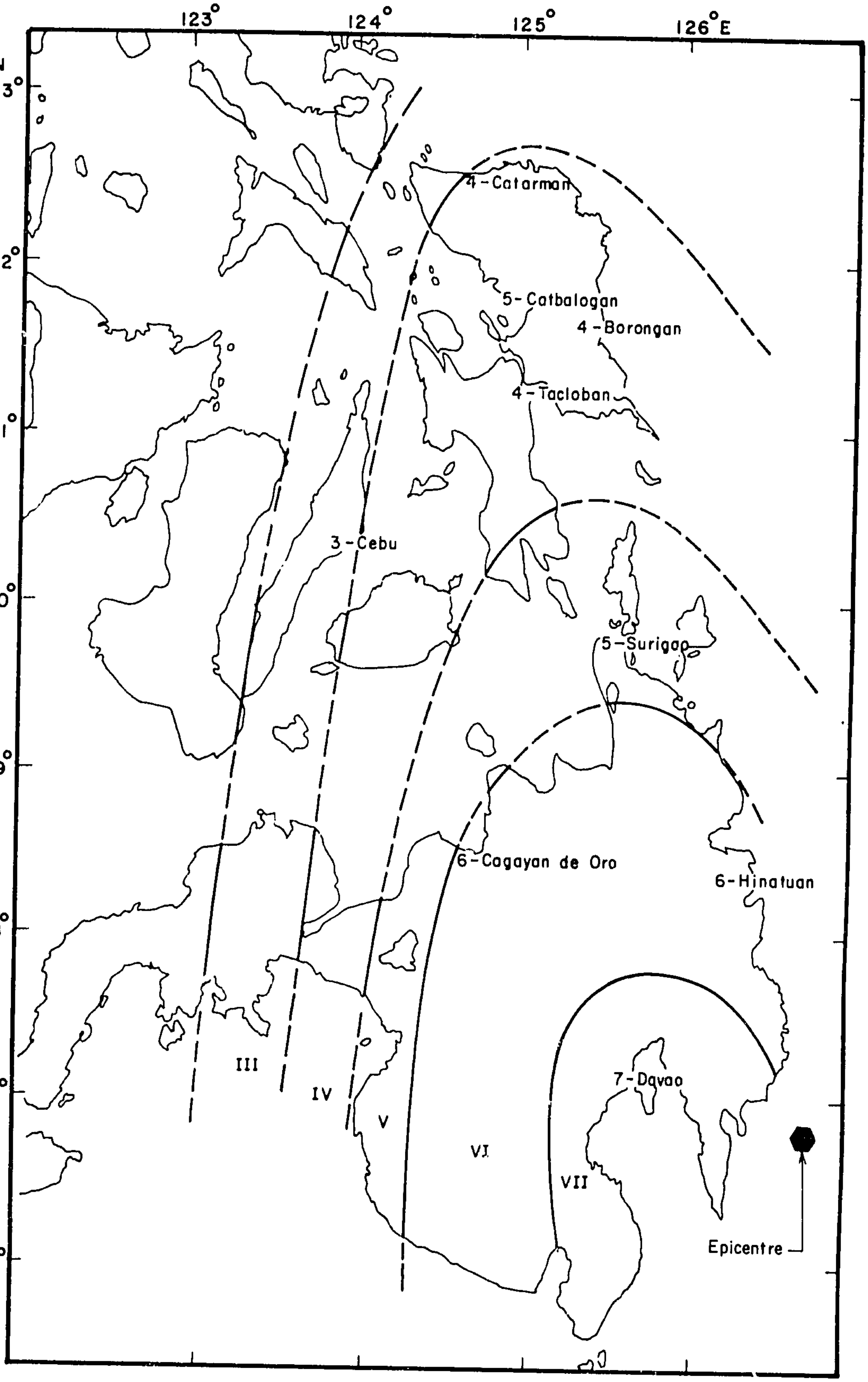
Fig. 19 Isoseismal Map of the 18 July 1959 Earthquake of Zambales



Casiguran Earthquake
Date : 01 August 1968
Time : 20 h 19 m 21.5 s

Epicentre : 16.3° N 122.1° E
Magnitude : MB = 5.9 (ISC)
Depth : 31 kms

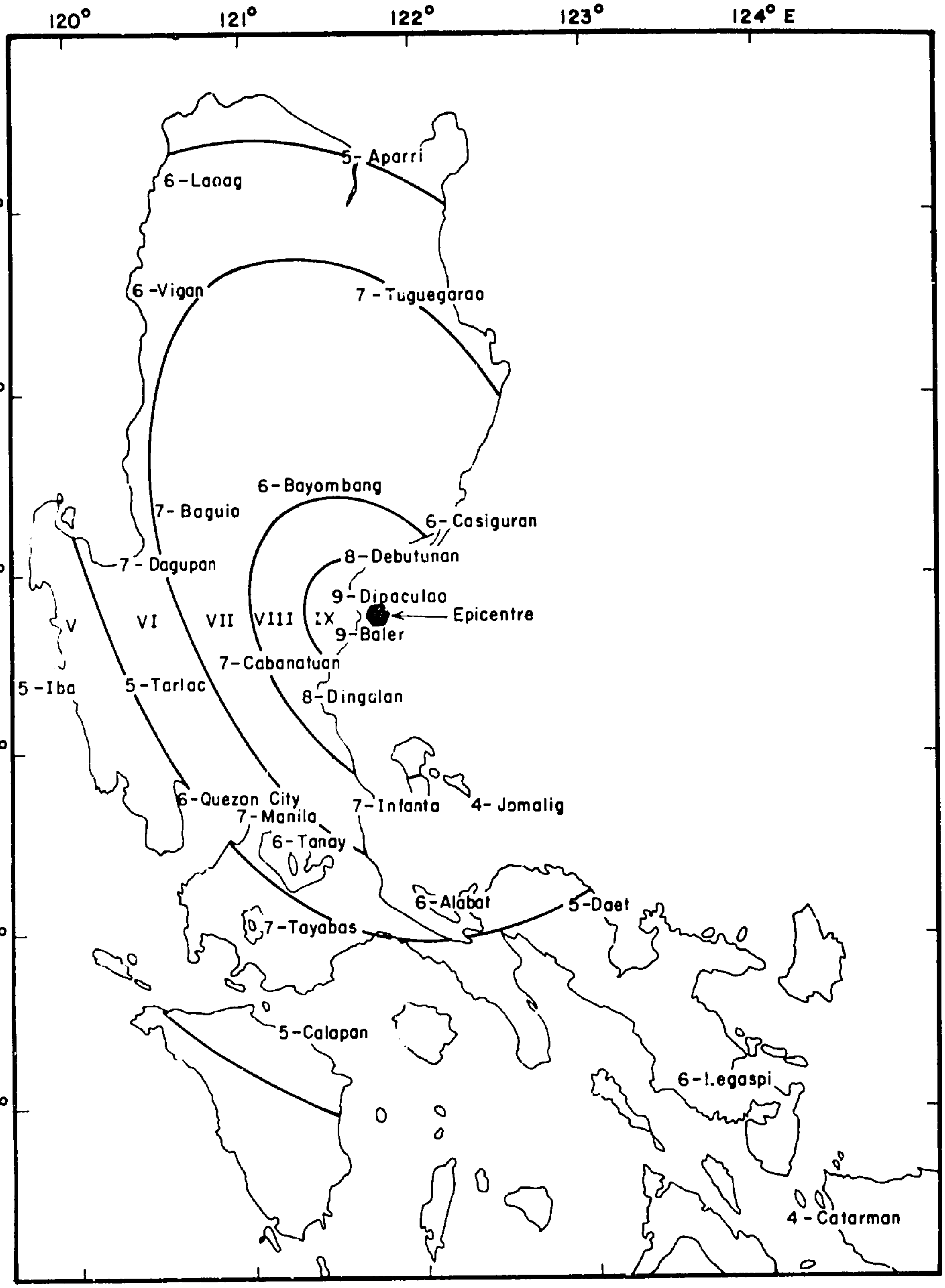
Fig. 20 Isoseismal Map of the 01 August 1968 Earthquake of Casiguran, Quezon



Davao Earthquake
Date : 10 January 1970
Time : 12h 07m 08.6s

Epicentre : 6.8°N 126.75°E ⬣
Magnitude : MB-5.9 (ISC)
Depth : 68 kms

Fig. 21 Isoseismal Map of the 10 January 1970 Earthquake of Davao



Baler Earthquake

Date : 07 April 1970

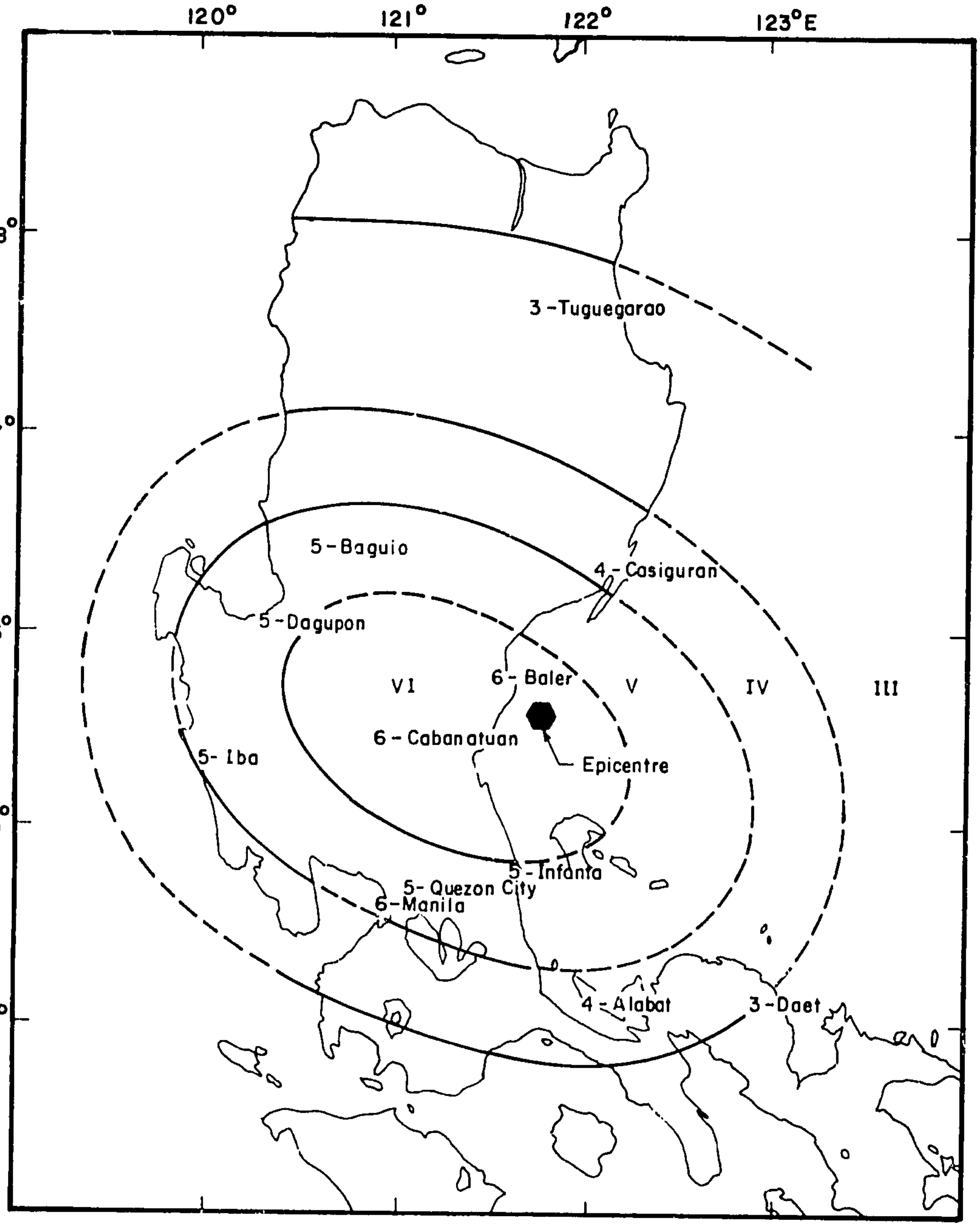
Time : 05h 34 m 06.2 s

Epicentre : 15.78° N 121.71°E

Magnitude : MB = 6.5 (ISC)

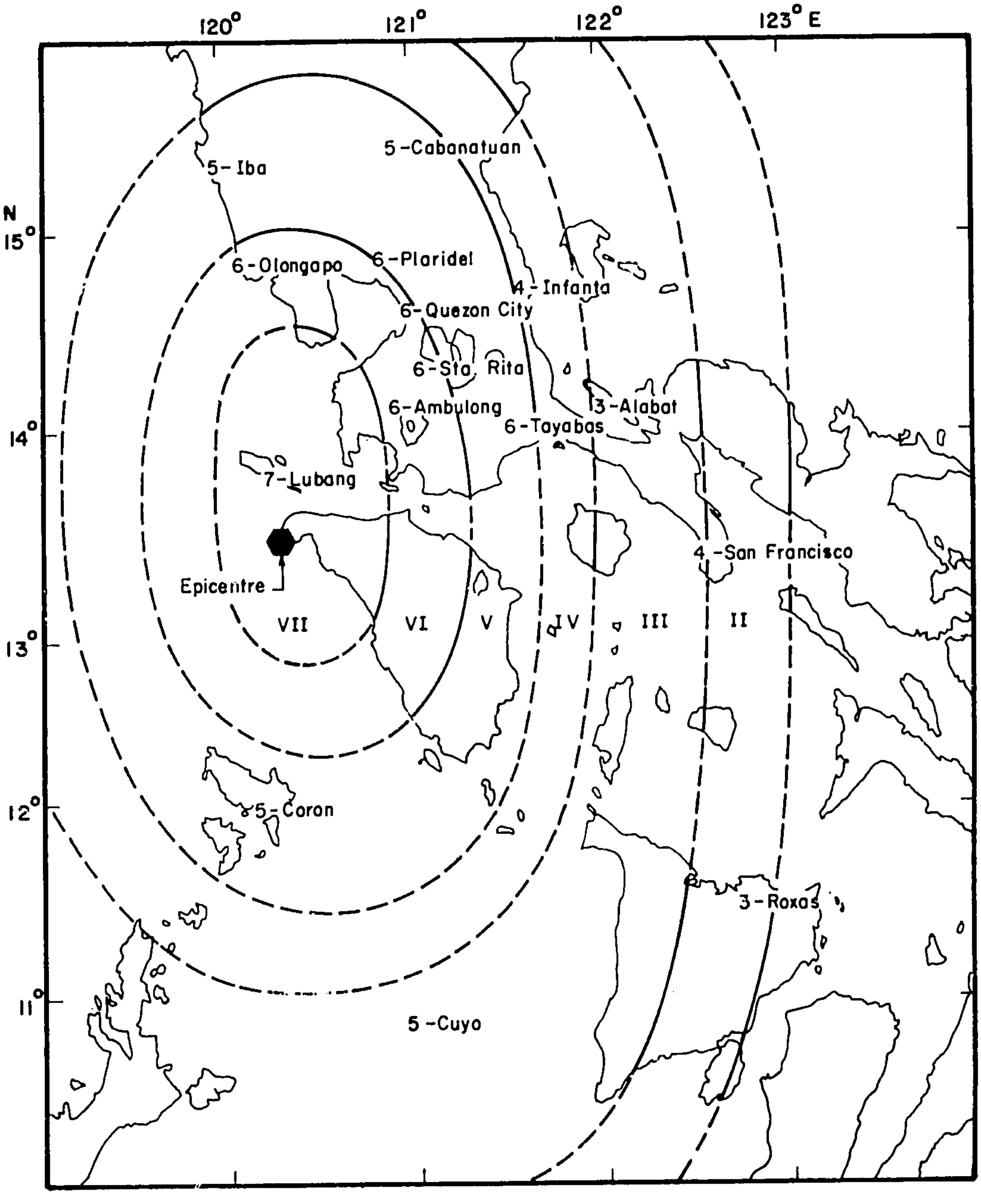
Depth : 40 kms

Fig.22 Isoseismal Map of the 07 April 1970 Earthquake of Baler, Quezon



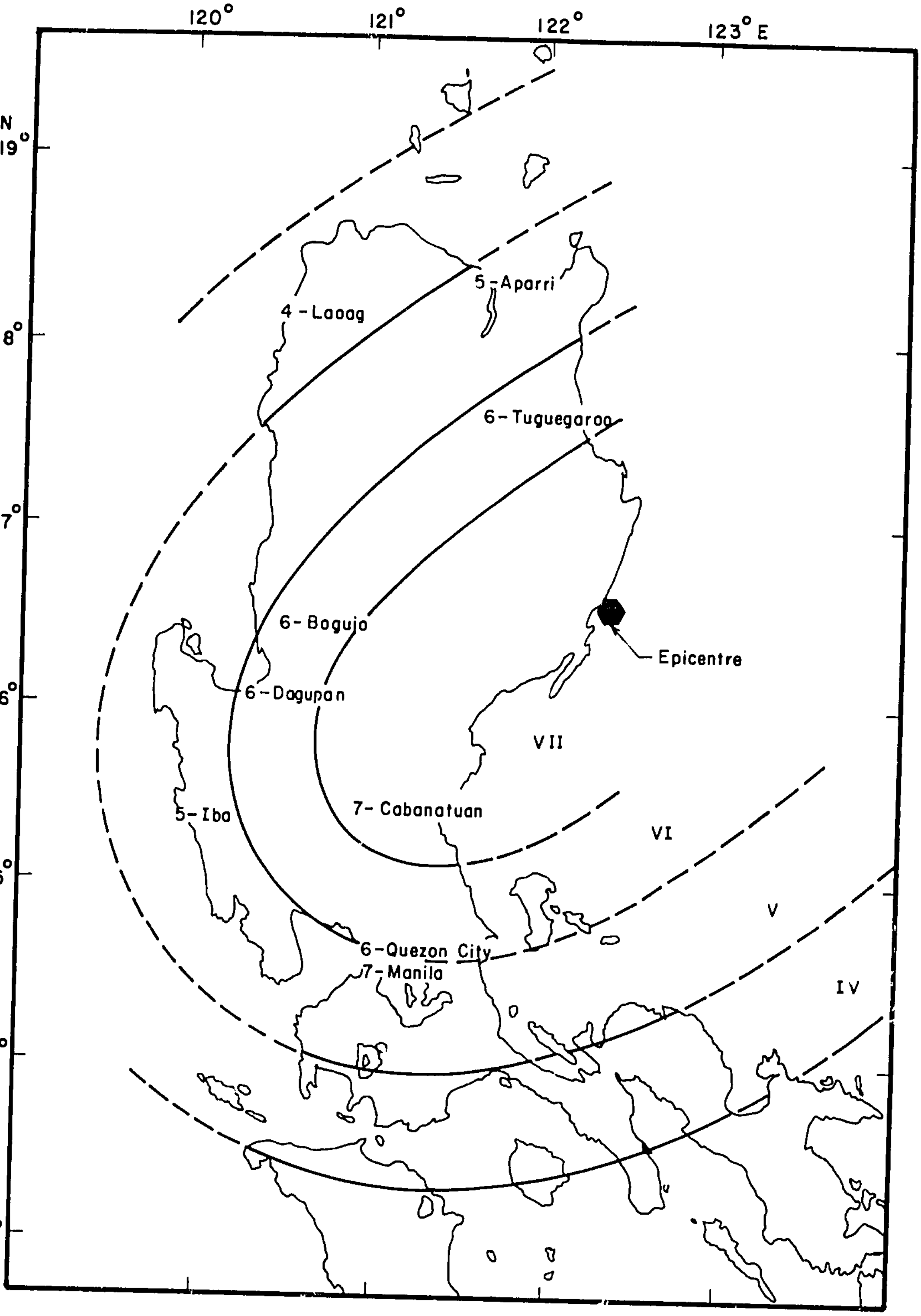
Eastern Luzon Earthquake
Date : 04 July 1971
Time : 11 h 30 m 53.8 s
Epicentre : 13.41°N 122.87°E ⬢
Magnitude : MB 5.5 (ISC)
Depth : 50 kms

Fig. 23 Isoseismal Map of the 04 July 1971 Earthquake of Eastern Luzon



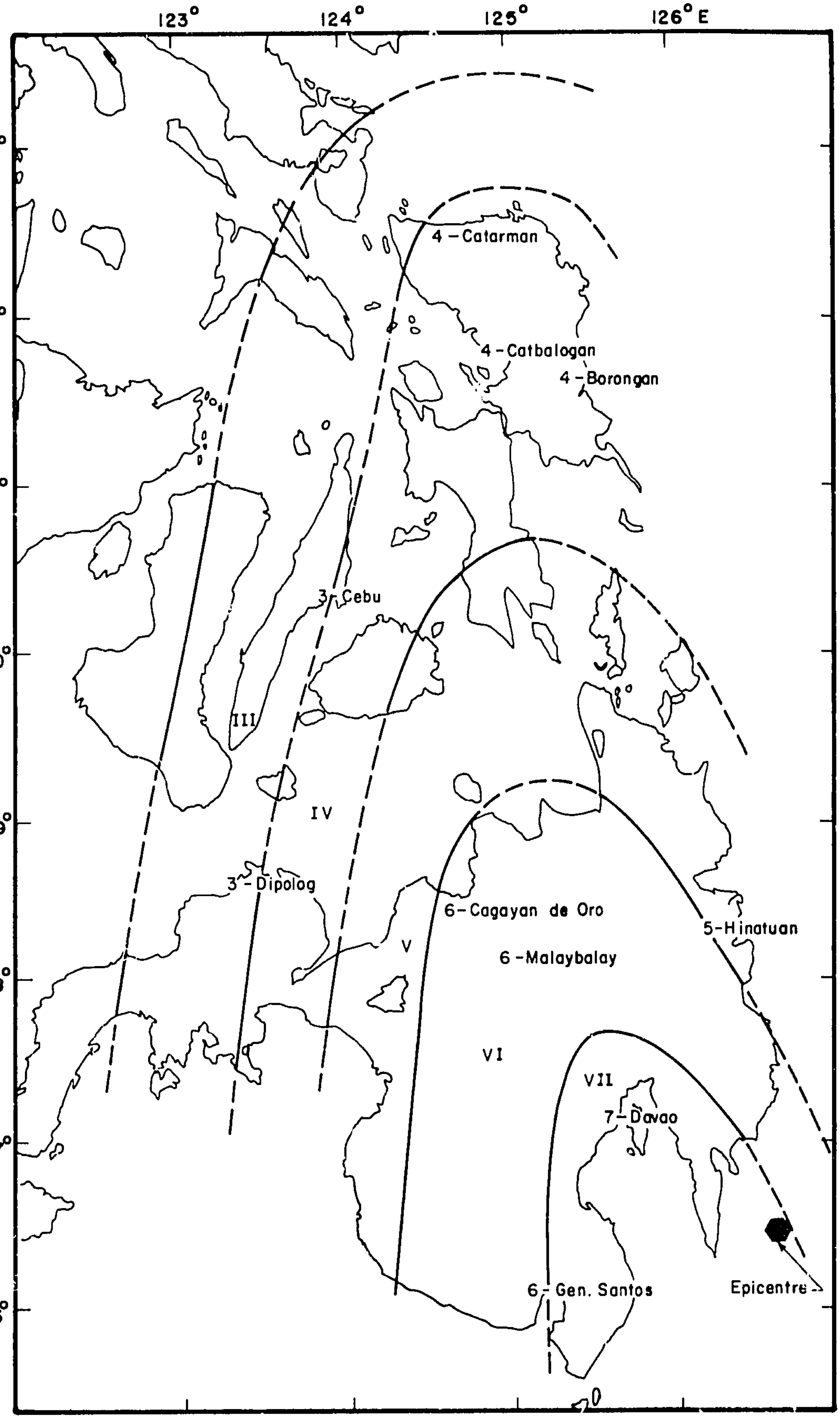
Lubang Island Earthquake
Date : 25 April 1972
Time : 19 h 30 m 08.0 s
Epicentre : 13.38°N 120.34°E ⬣
Magnitude : MB = 6.4 (ISC)
Depth : 38 kms

Fig. 24 Isoseismal Map of the 25 April 1972 Earthquake of Lubang Island



Tuguegarao Earthquake
Date : 22 May 1972
Time : 06 h 04 m 01.1 s
Epicentre : 16.6° N 122.19° E ⬢
Magnitude : MB = 5.9 (ISC)
Depth : 36 kms

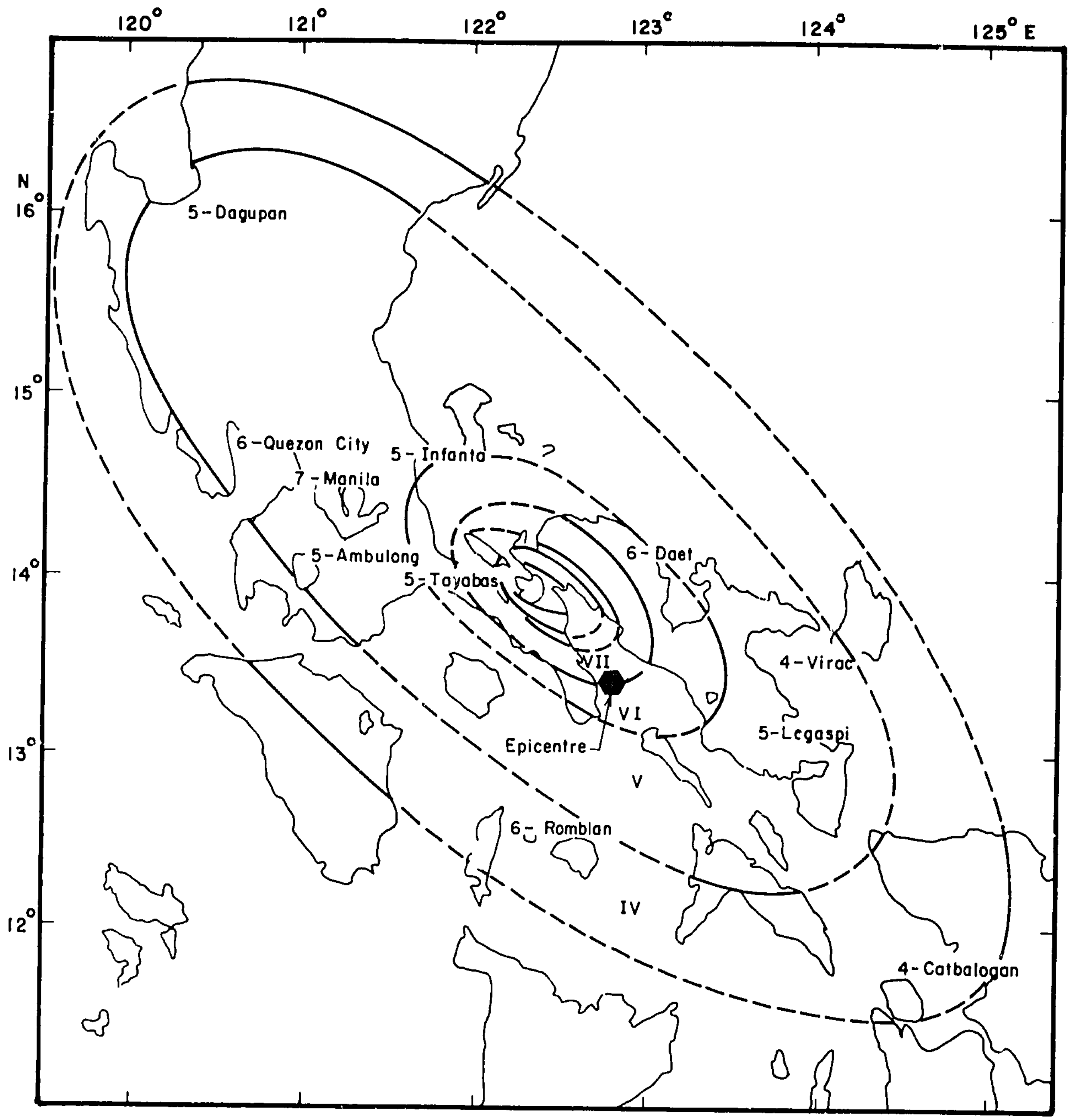
Fig. 25 Isoseismal Map of the 22 May 1972 Earthquake of Tuguegarao



Davao Earthquake
Date : 02 December 1972
Time : 00 h 19 m 52 s

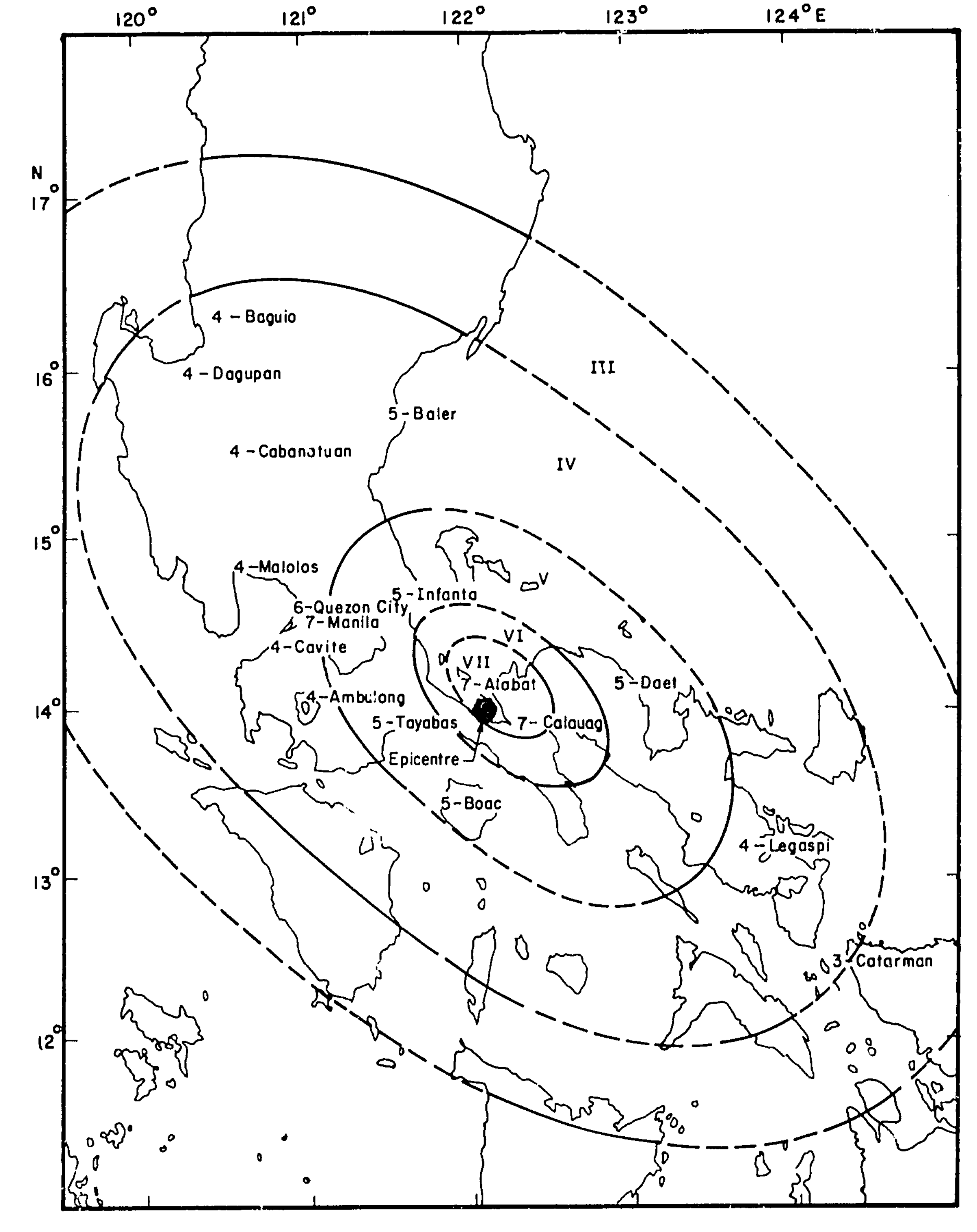
Epicentre : 6.41°N 126.62°E
Magnitude : MB = 6.0 (ISC)
Depth : 73 kms

Fig. 26 Isoseismal Map of the 02 December 1972 Earthquake of Davao



Ragay Gulf Earthquake
Date : 17 March 1973
Time : 08h 30m 53.4 s
Epicentre : 13.41°N 122.87°E
Magnitude : MB = 5.9 (ISC)
Depth : 33 kms

Fig. 27 Isoseismal Map of the 17 March 1973 Earthquake of Regay Gulf



Alabat Earthquake

Date : 19 February 1974

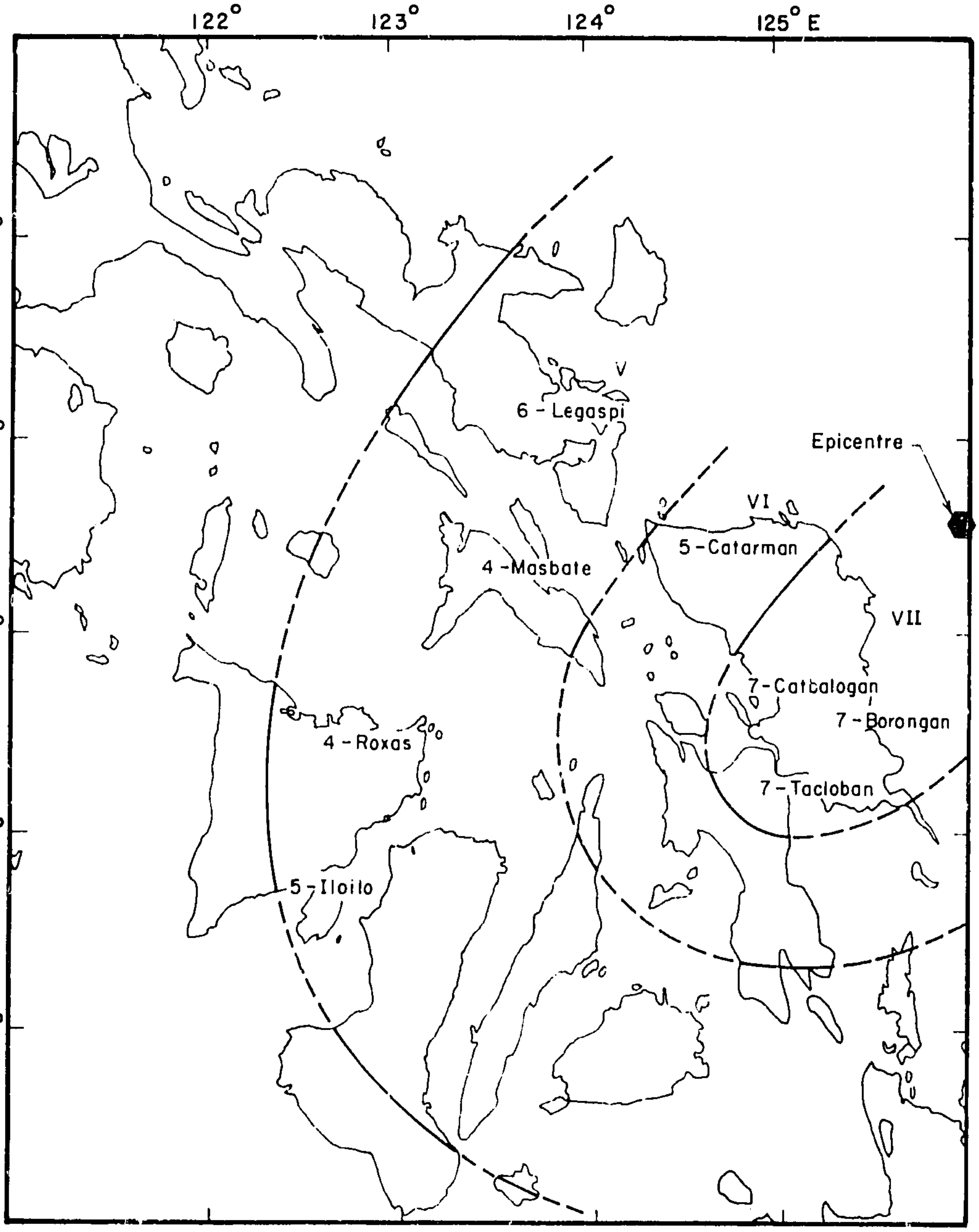
Time : 03h 30m 22s

Epicentre : 13.98°N 122.17°E ⬢

Magnitude : MB = 5.7 (ISC)

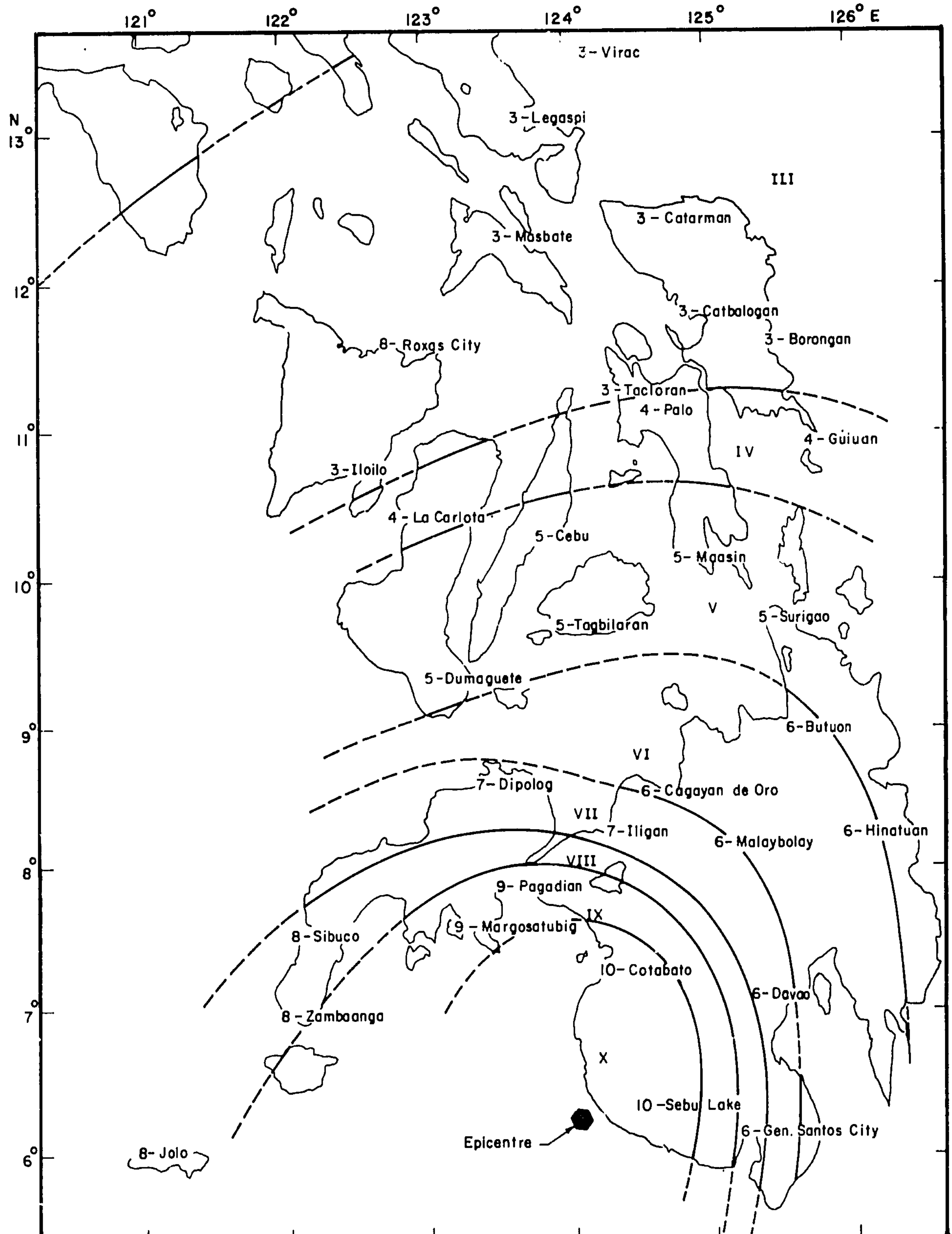
Depth : 19 kms

Fig. 28 Isoseismal Map of the 19 February 1974 Earthquake of Alabat



Samar Earthquake
Date : 31 October 1975
Time : 08 h 27 m 57.78 s
Epicentre : 12.56° N 125.95° E
Magnitude : ML = 6.0 (PAGASA)
Depth : 0 kms

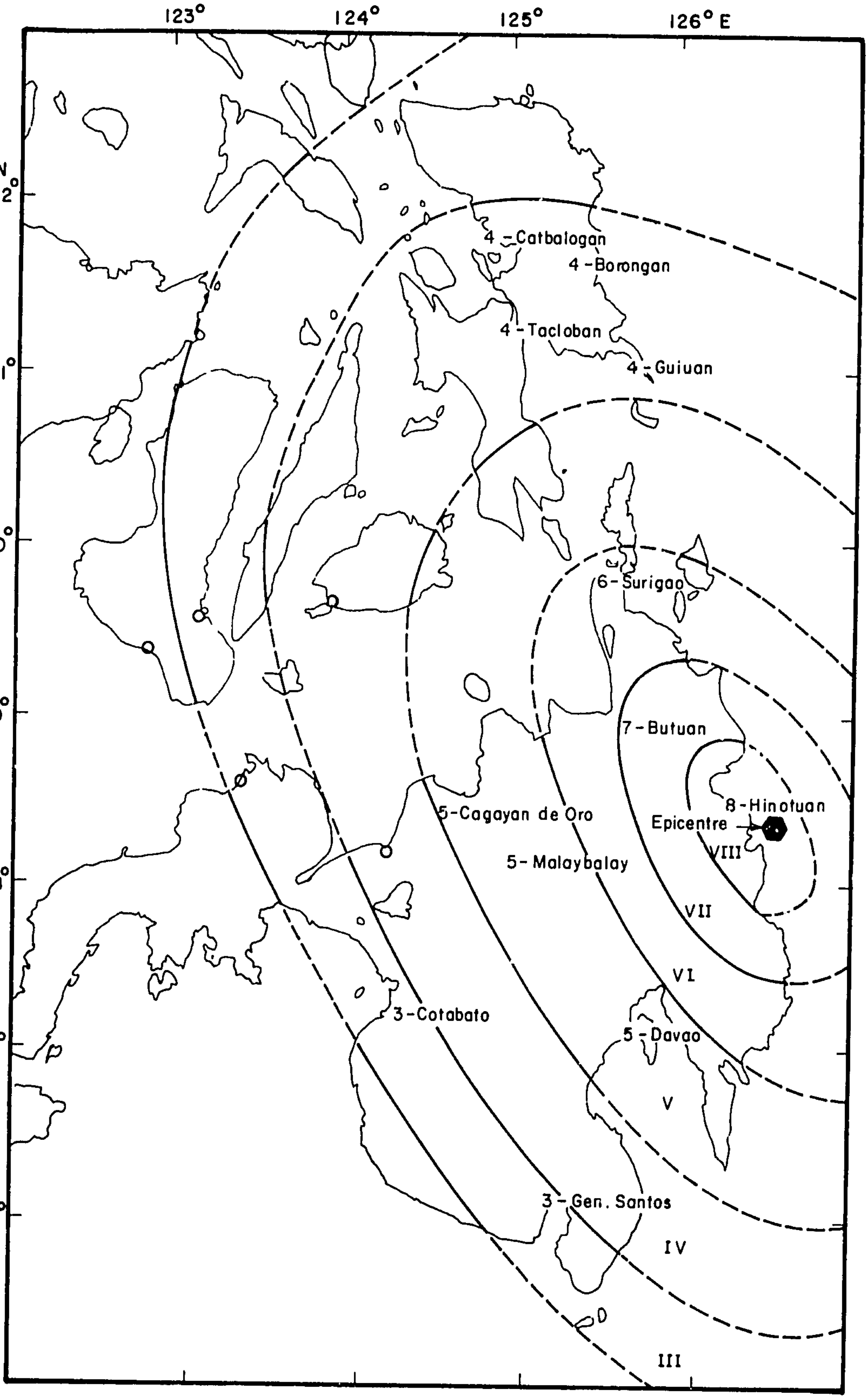
Fig. 29 Isoseismal Map of the 31 October 1975 Earthquake of Samar



Moro Gulf (Mindanao) Earthquake
Date : 16 August 1976
Time : 16 h 11 m 05.72 s

Epicentre : 6.11° N 123.87° E
Magnitude : ML = 6.4 (PAGASA)
Depth : 50 kms

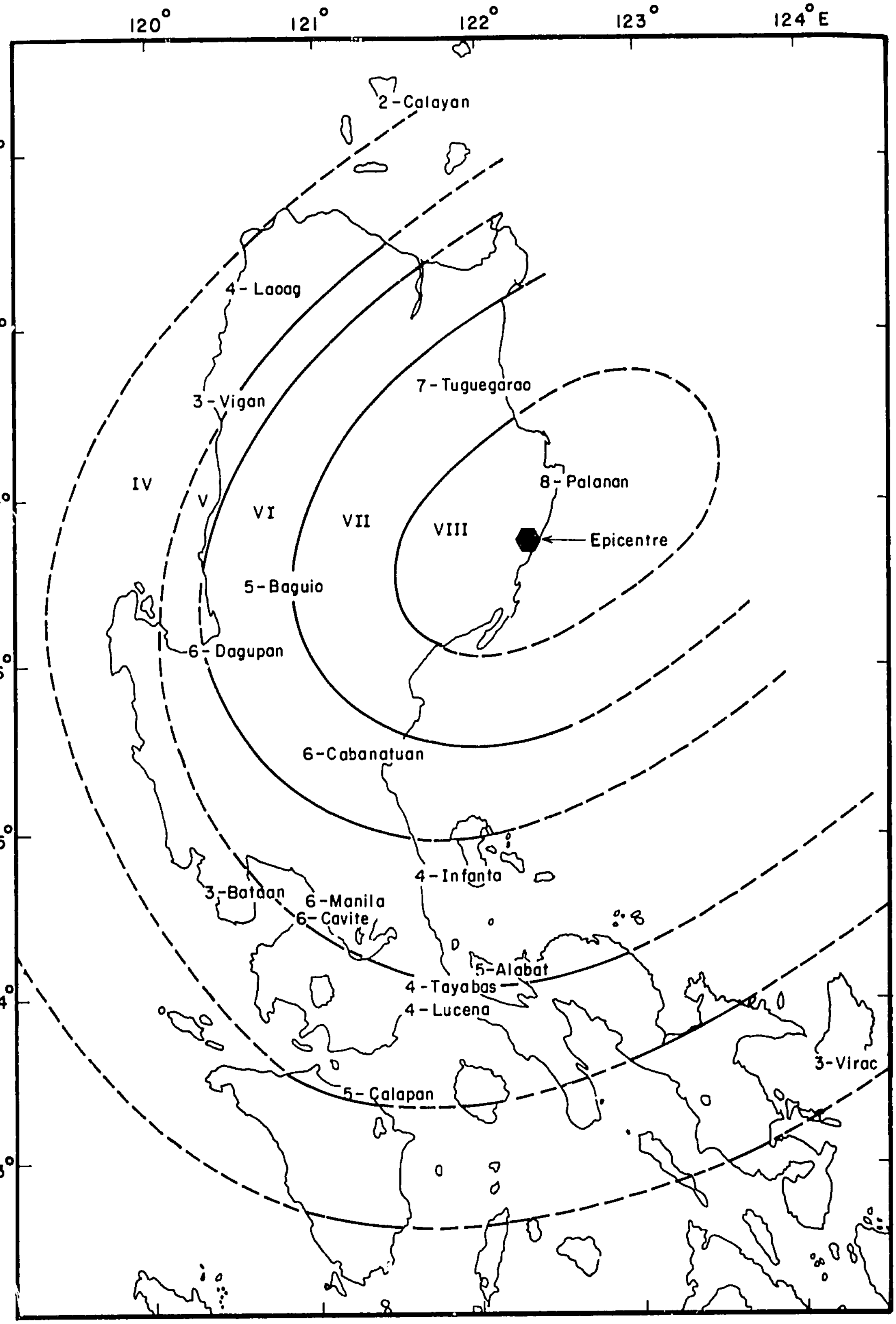
Fig. 30 Isoseismal Map of the 16 August 1976 Earthquake of Moro Gulf (Mindanao)



Surigao Earthquake
Date : 10 November 1976
Time : 17h 28 m 21.09 s

Epicentre : 8.27°N 126.78°E
Magnitude : ML = 5.3 (PAGASA)
Depth : 60 kms

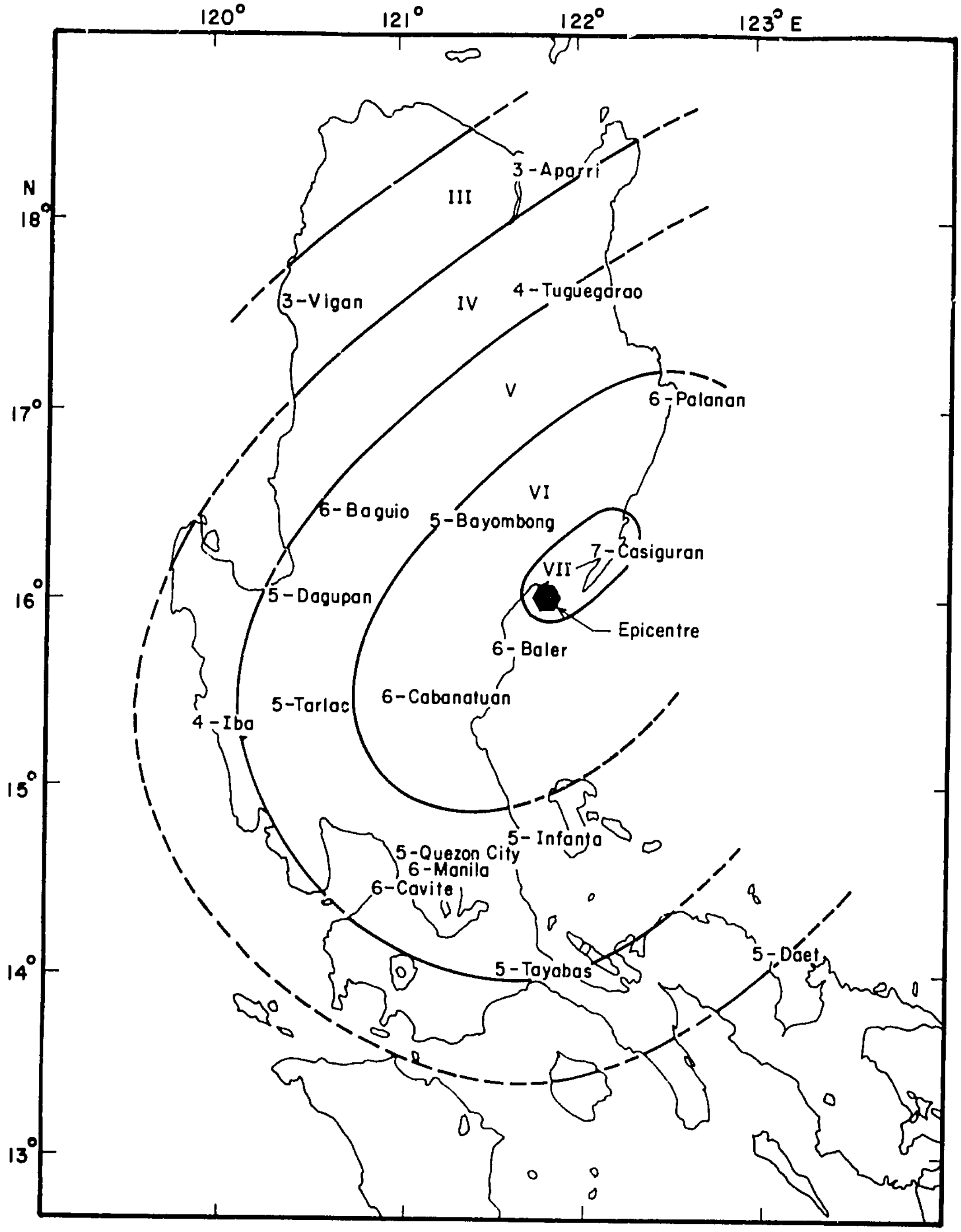
Fig. 31 Isoseismal Map of the 10 November 1976 Earthquake of Surigao



Easthern Luzon Earthquake
Date : 18 March 1977
Time : 21 h 43 m 43.72 s

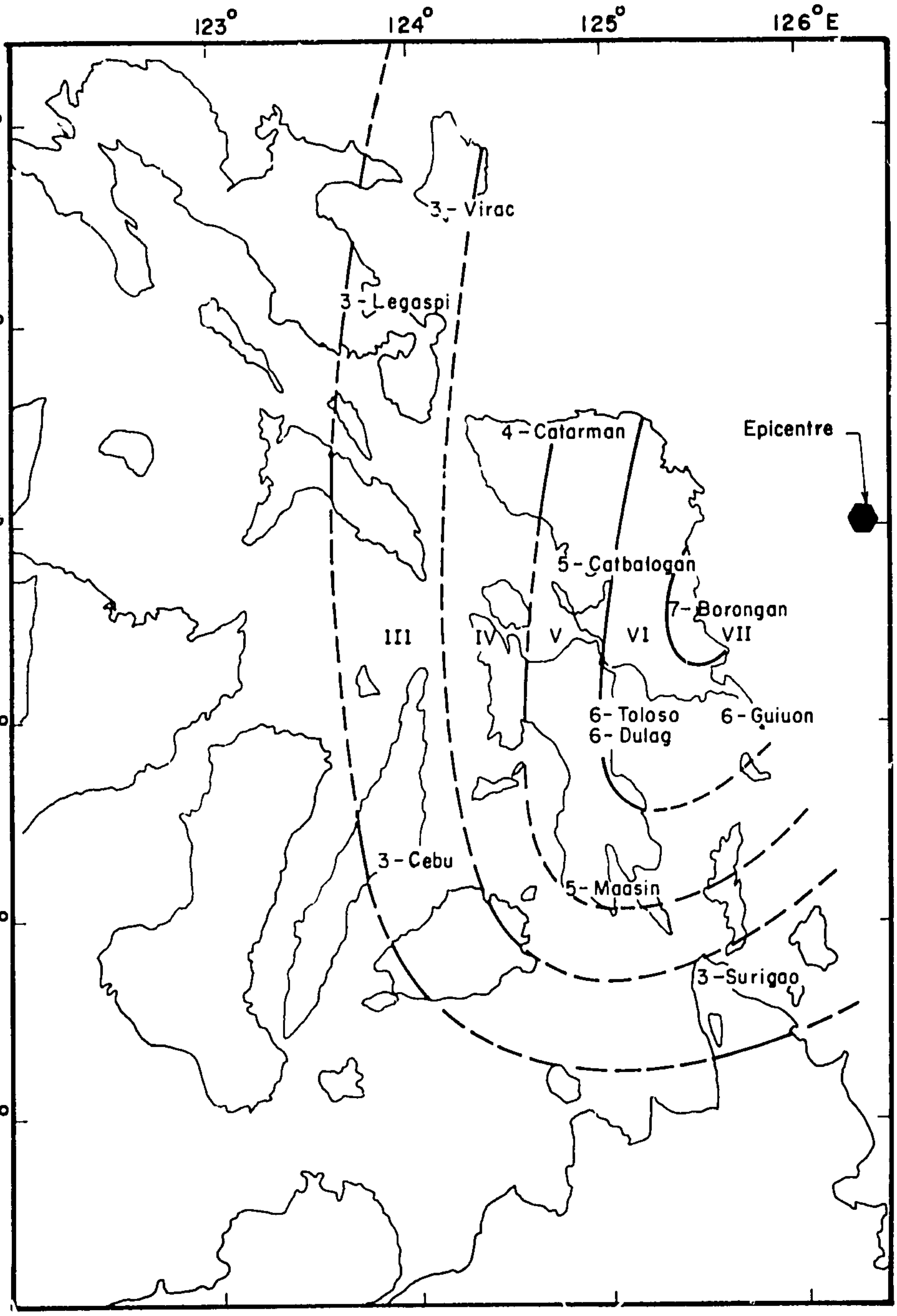
Epicentre : 17.3° N 122.63° E ⬢
Magnitude : ML=6.0 MB=5.8 (PAGASA)
Depth : 50 kms

Fig. 32 Isoseismal Map of the 18 March 1977 Earthquake of Eastern Luzon



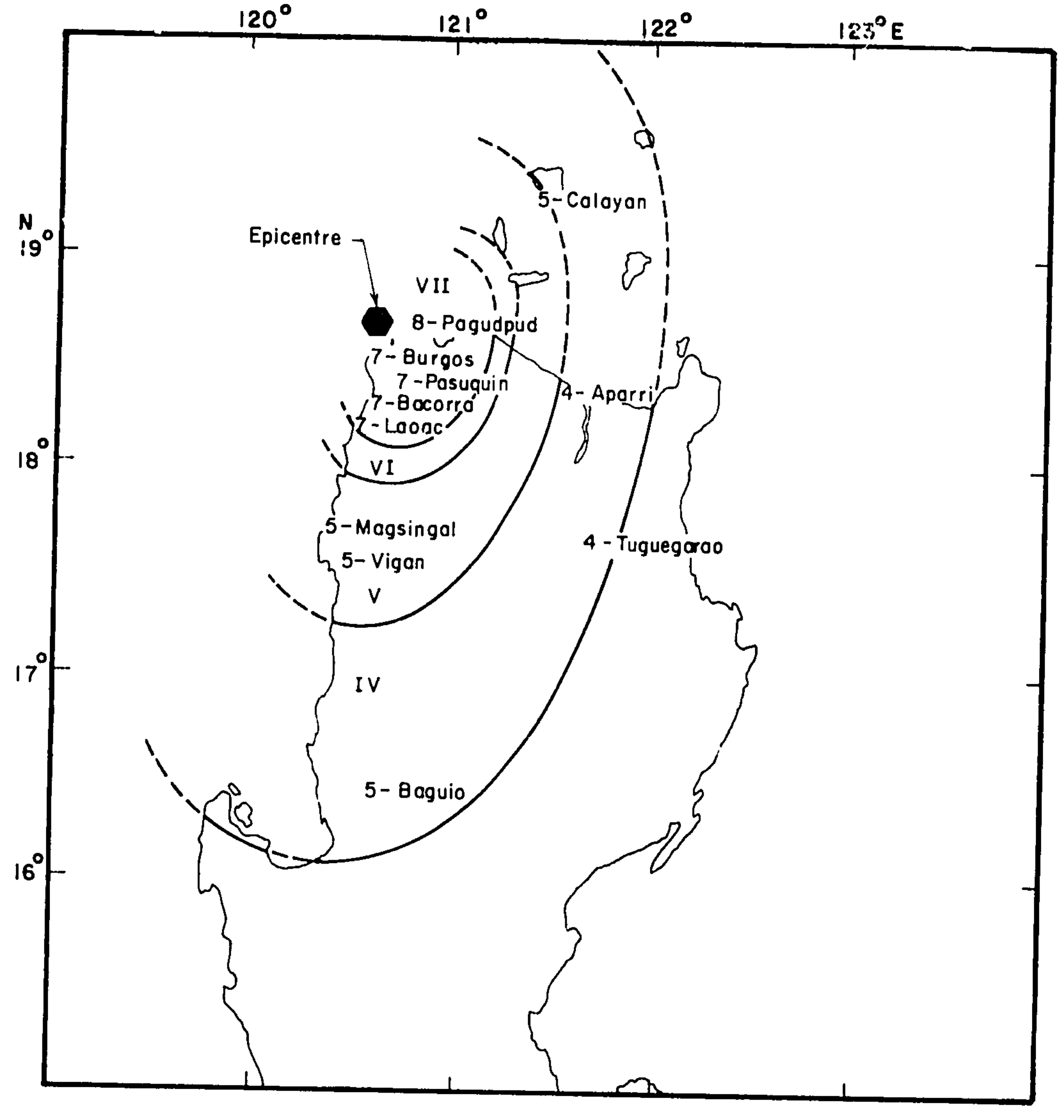
Eastern Luzon Earthquake
Date : 31 March 1980
Time : 12 h 41 m 44.93 s
Epicentre : 16.29° N 122.24°E ⬢
Magnitude : ML = 4.2 (PAGASA)
Depth : 116.6 kms

Fig. 33 Isoseismal Map of the 31 March 1980 Earthquake of Eastern Luzon



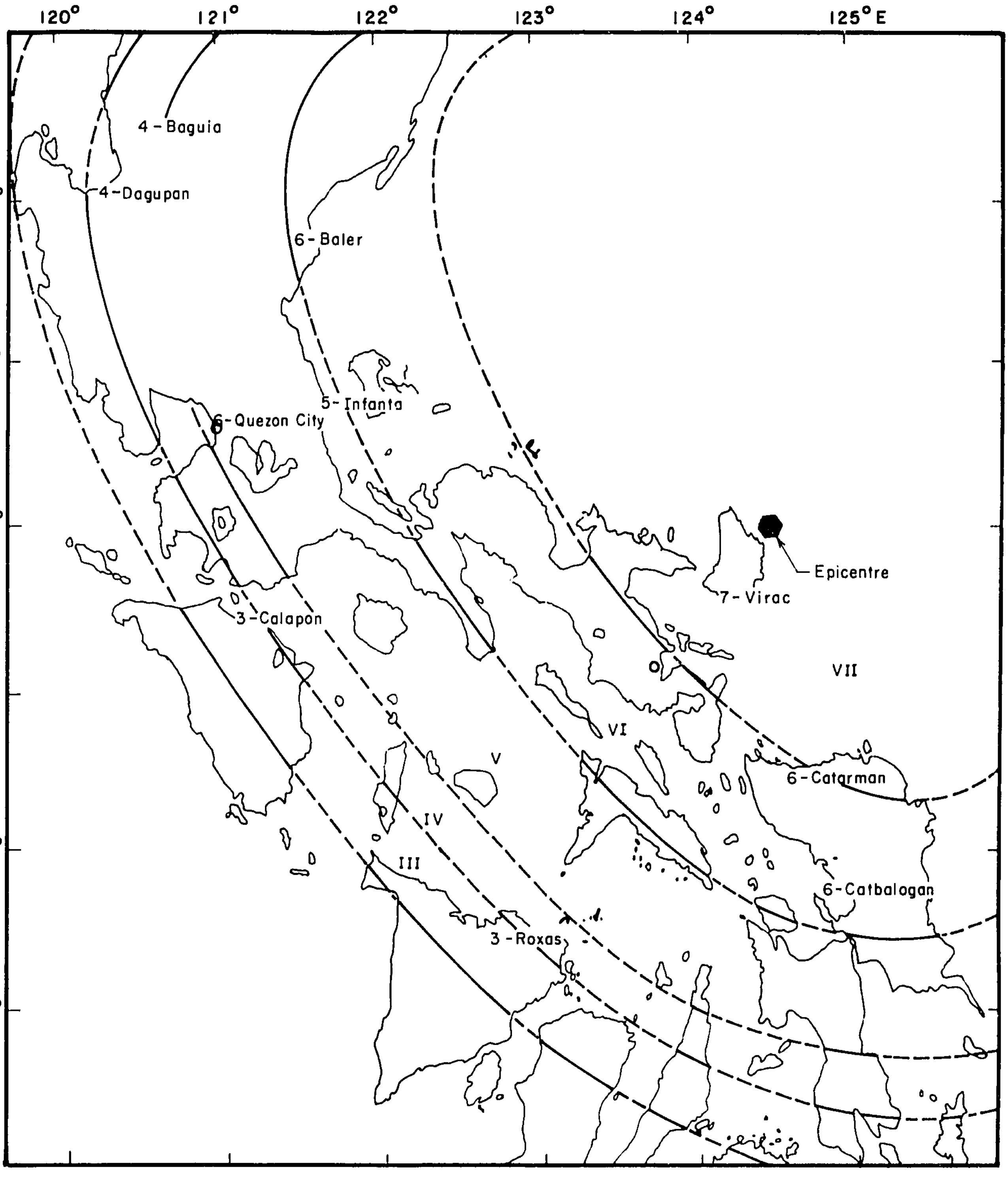
Eastern Samar Earthquake
Date : 26 October 1980
Time : 05 h 14 m 11.08 s
Epicentre : 11.75°N 125.5°E
Magnitude : MB = 6.0 MS = 6.1
Depth :

Fig. 34 Isoseismal Map of the 26 October 1980 Earthquake of Eastern Samar



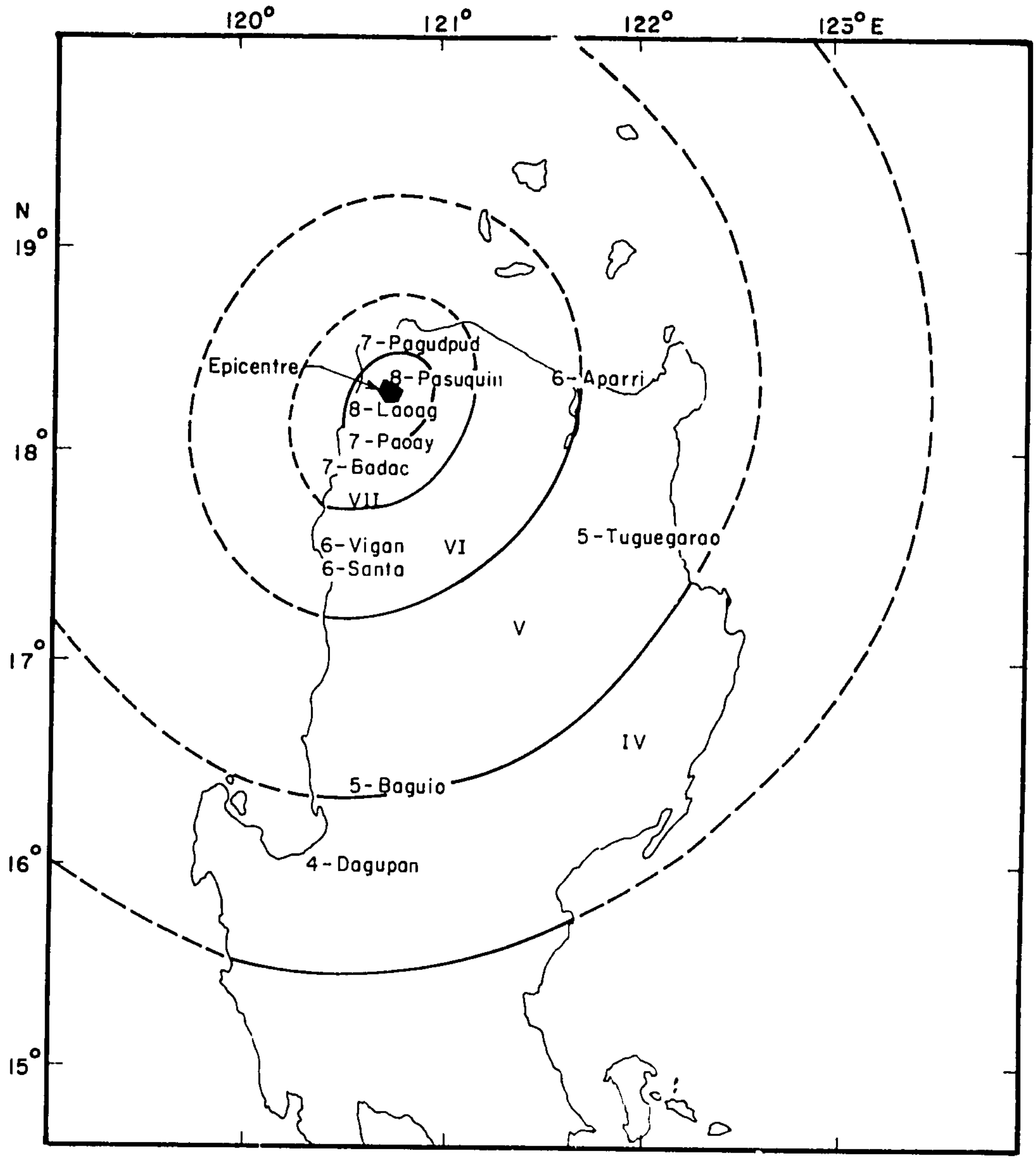
Northeastern Luzon Earthquake
Date : 22 November 1981
Time : 15h 05 m 23.22 s
Epicentre : 18.71° N 120.65°E ⬢
Magnitude : ML = 5.2 MB = 6.3 (PAGASA)
Depth : 33 kms

Fig. 35 Isoseismal Map of the 22 November 1981 Earthquake of Northeastern Luzon



Eastern Bicol Earthquake
Date : 11 January 1982
Time : 06 h 10 m 2.35 s
Epicentre : 14.04° N 124.53° E
Magnitude : ML = 5.3 (PAGASA)
Depth : 62.6 kms

g. 36 Isoseismal Map of the 11 January 1982 Earthquake of Eastern Bicol



Northeastern Luzon
Date : 17 August 1983
Time : 12h 18 m 03.5 s
Epicentre : 18.33° N 120.87° E
Magnitude : ML = 5.3 (PAGASA)
Depth : 42 kms

Fig. 37 Isoseismal Map of the 17 August 1983 Earthquake of Northeastern Luzon

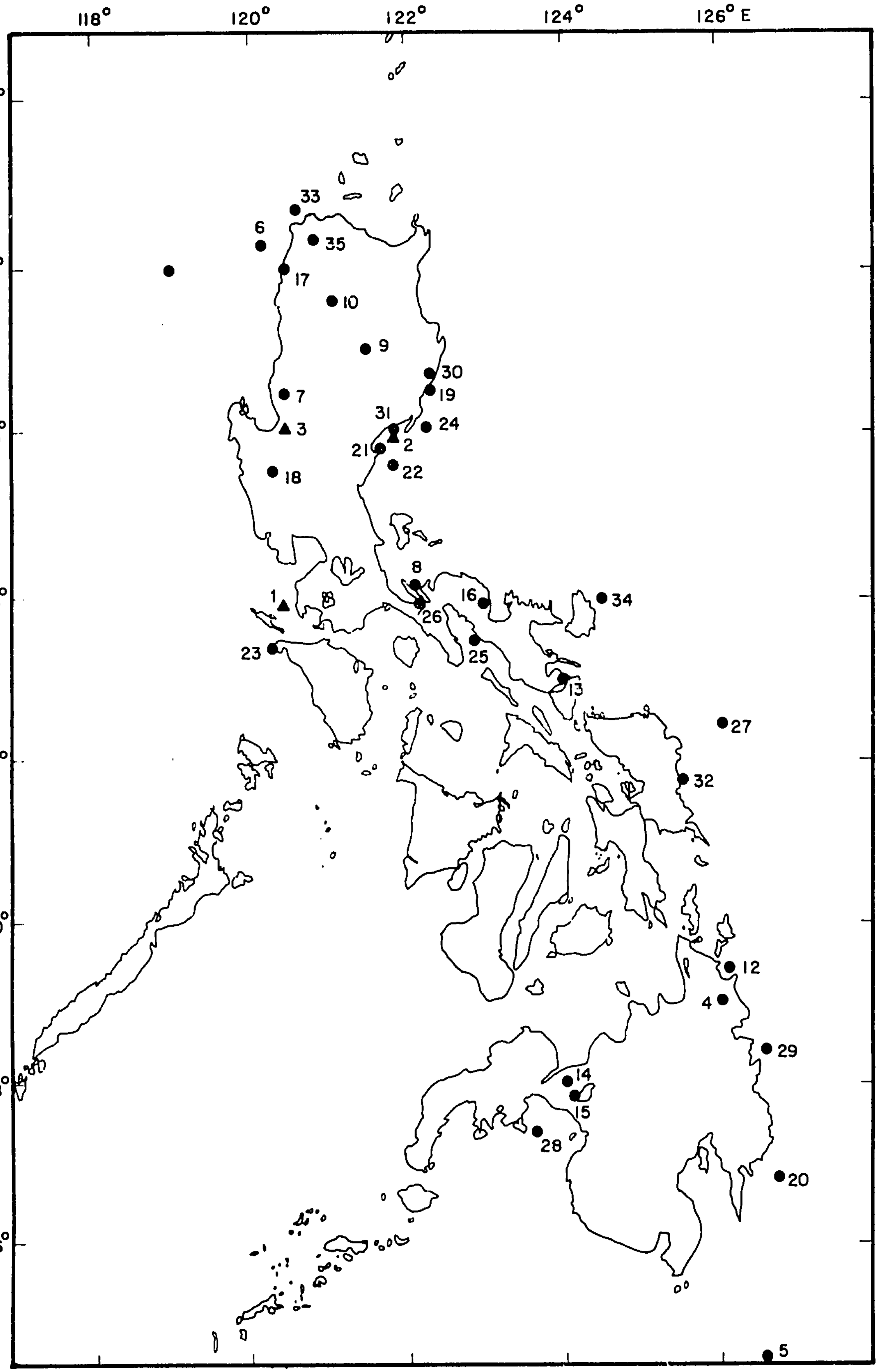


Fig. 38 Location of Earthquakes in the Intensity Attenuation Computation

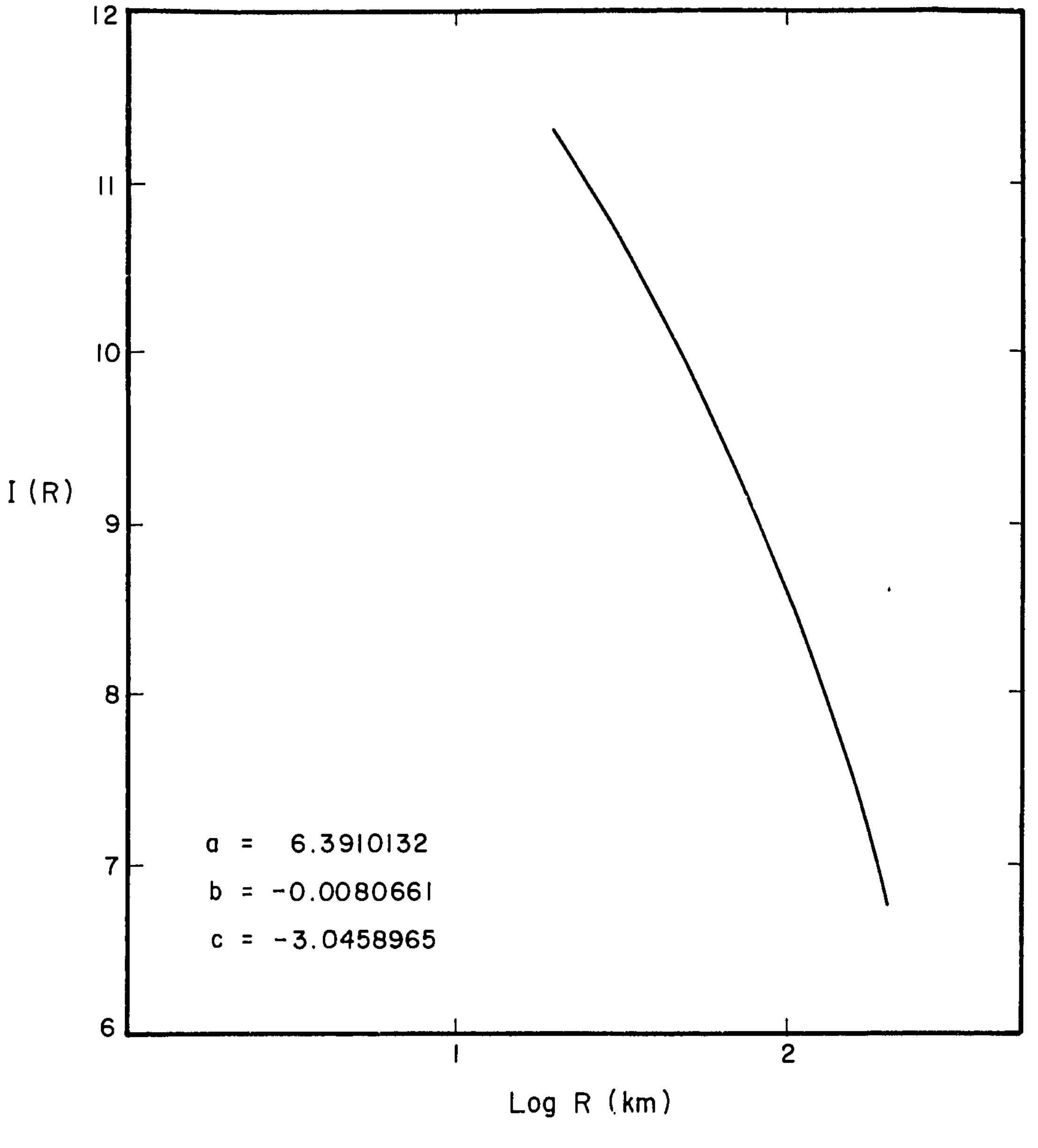


Fig. 39 Intensity Attenuation Curve for Zone 1

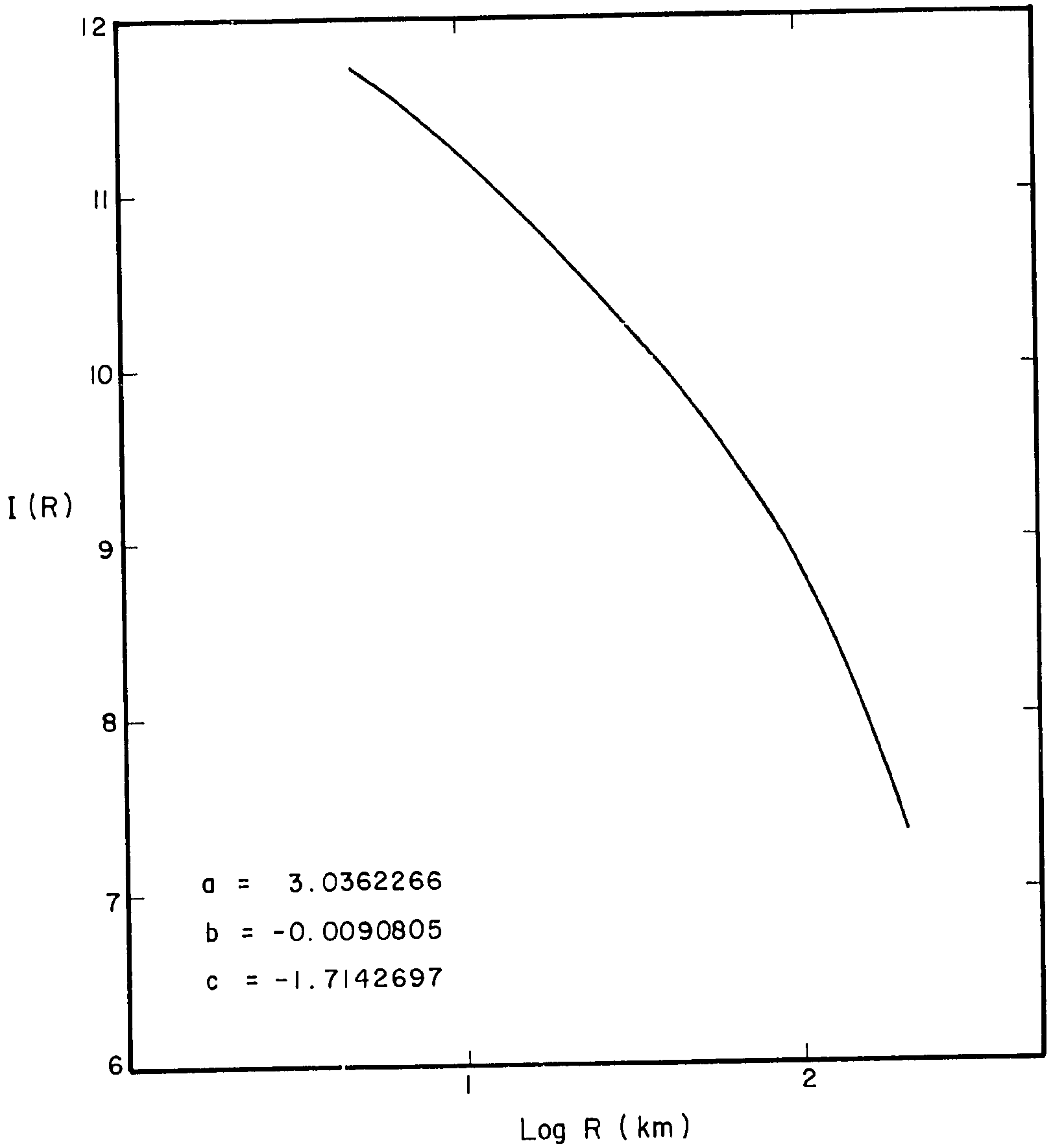


Fig. 40 Intensity Attenuation Curve for Zone 2

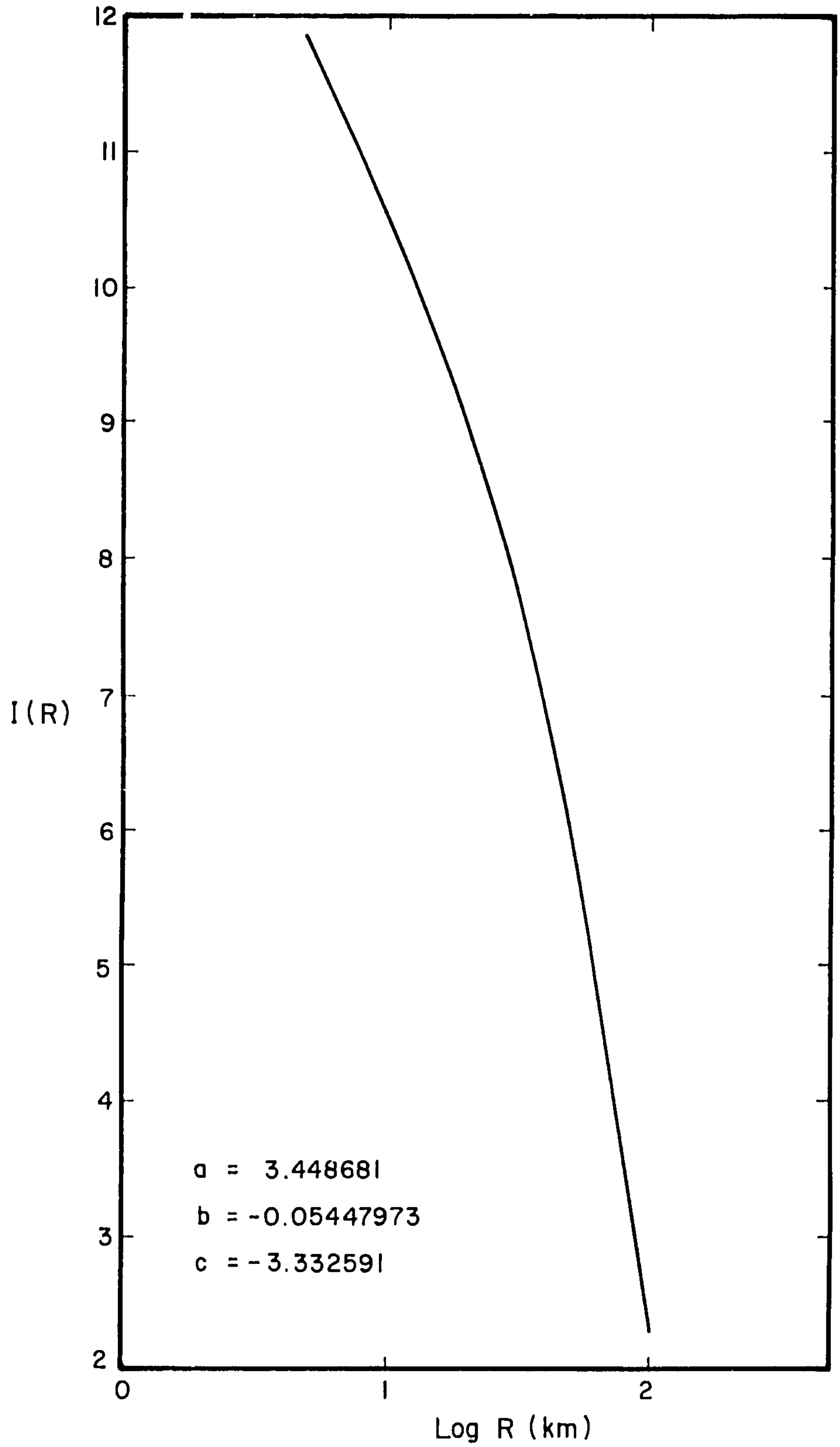


Fig. 41 Intensity Attenuation Curve for Zone 3

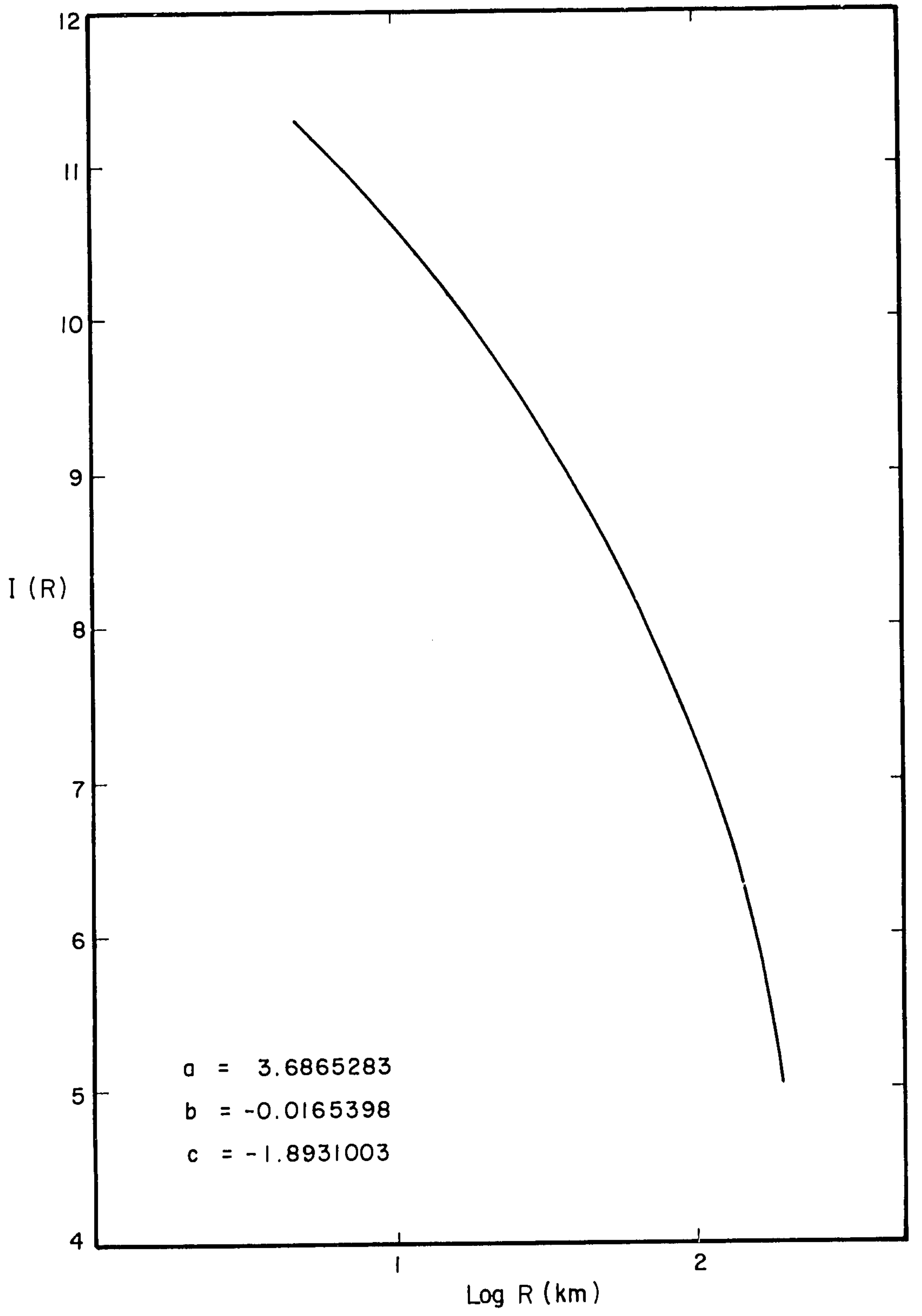


Fig. 42 Intensity Attenuation Curve for Zone 4

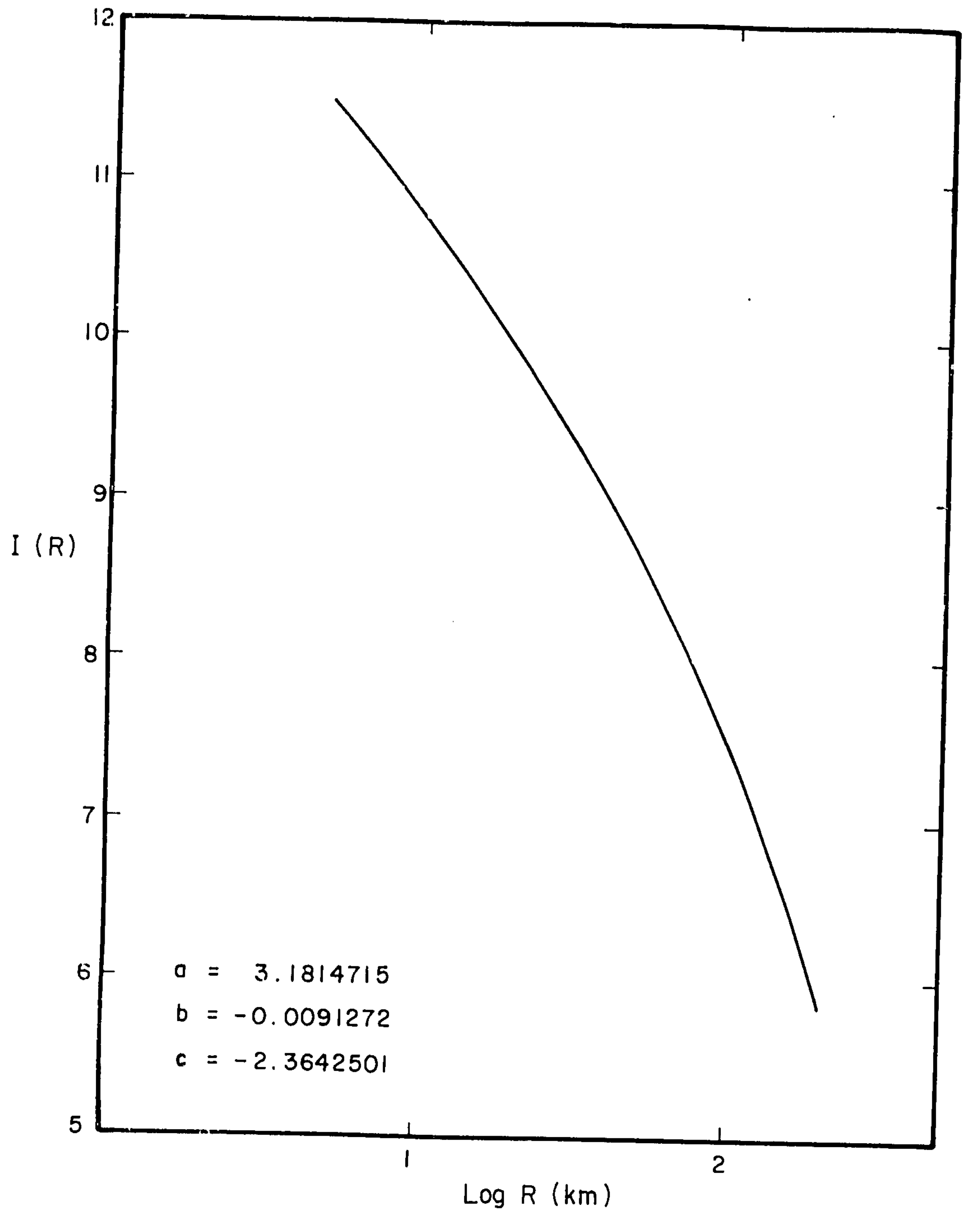


Fig. 43 Intensity Attenuation Curve for Zone 7

PART G

SEISMIC SOURCE ZONES OF THE PHILIPPINES

Fr. Sergio S. SU, S.J.

1993 II

PART G
SEISMIC SOURCE ZONES OF THE PHILIPPINES

Introduction

The preparation of seismic source-zone maps is the first major step towards the zoning of the Philippines according to seismic hazards. Together with intensity-attenuation curves for the region, the seismogenic maps form the basis for the preparation of seismic hazard maps.

Methodology

The method consists of two parts: the first part is a rough definition or delineation of the zone boundaries by three preliminary seismic analyses: seismicity contours, energy-flux contours, and b-Value contours. The second part is a finer delineation of the zone boundaries and subdivision within each zone by recourse to geotectonic knowledge.

Part I: three contour maps were prepared: seismicity or earthquake-frequency map, energy-flux map, and the b-Value contour map (Figures 1a, 1b, 2, 3). From the overlay of these three maps, a general or rough map of the seismogenic zones was prepared (Figure 4). This corresponds fairly accurately to the division of various tectonic structures known from geology.

Part II: Use of geotectonic knowledge to refine the zone boundaries and zone subdivisions. The description of each zone is summarized below. The final map of the seismogenic zones, with the subdivisions, is shown in Figure 5.

Description of Zones

Zone 1

Zone 1 comprises the East Luzon subduction zone and the submarine ridges and troughs off the northeast coast of Luzon. The subdivision of Zone 1 into 1-A, 1-B, 1-C, and 1-D is based on seismicity, bathymetry, seismic reflection profiles, focal mechanism solutions of earthquakes, and gravity anomaly surveys. 1-C differs sharply from 1-A and 1-B in seismicity; likewise, 1-A from 1-B (Lewis and Hayes, 1983). Focal mechanisms for Zone 1 are predominantly thrust type while those for Zone 4 (contiguous to 1-A) are generally strike-slip type (Lewis and Hayes, 1983, citing Cardwell et al., 1980, Seno and Kurita, 1978, Fitch, 1972, Katsumata and Sykes, 1969). Negative free-air gravity anomaly extends from 15.5N to 20.0N, that is, from 1-C to 1-A (but not 1-B), while the zone of sedimentary strata deformation shown by reflection profiles extends north only to 18.0N. Negative gravity anomaly is interpreted as an indicator of crustal downwarping and a precursor to rupture (Lewis and Hayes, 1983).

Seismicity, focal mechanisms, and seismic profiles show recent (Pleistocene) to present underthrusting in 1-C (Cardwell et al., 1980). However, absence of active volcanism, lack of a well-defined Benioff zone and of earthquakes deeper than 200 km show that current subduction is young. The existence of at least one previous subduction episode (Eocene, Oligocene) is strongly indicated, first, by the geology of the Sierra Madre Mountains (Christian, 1964, Karig, 1973); secondly, by radiometric dating of granitic plutons in the Sierra Madre Range (Wolfe, 1981); and thirdly, by seismic profiles showing the existence of a regional inconformity (Karig, 1973). This Tertiary subduction episode was believed to have ended in late Oligocene or Pliocene and to have coincided with the beginning of the subduction in the Manila Trench and western Luzon (Hamburger et al., 1983, citing Murphy, 1973, Karig, 1973, Bowin et al., 1978, De Boer et al., 1980, Balce et al., 1980).

Focal mechanism solutions of two earthquakes (Seno & Kurita, 1978, Cardwell et al., 1980), existence of a sharp bathymetric low at 15.5N, the shape of the aftershock zone of the earthquake' of April, 1970, and concentrated seismicity in 1-D support the interpretation of this sub-zone as a transform fault linking the East Luzon Trench and the Philippine Trench to the south (Lewis and Hayes, 1983, Hamburger et al., 1983).

Zone 2

Zone 2 comprises the Philippine Trench (2-B) and the Quaternary volcanic forearc (2-A) (Divis, 1980). The trench has a poorly developed Benioff zone that extends landward (dipping west) to less than 150 km in length or about 100 km deep in Southeast Luzon (Cardwell et al., 1980). However, extending southward to Samar, Leyte, and Mindanao, the lithosphere apparently reaches deeper (less than 200 km) as shown by earthquake of intermediate depth. Nevertheless, this relatively shallow Benioff zone beneath Mindanao and Talaud Island, together with the lack of significant Quaternary volcanism in Eastern Mindanao and Samar (Lewis and Hayes, 1983) and also with the evidence from seismic reflection profiles showing no well-developed accretionary prism in the forearc region (Hamilton, 1979, Karig, 1975, Karig & Sharman, 1975) strongly indicate that the present subduction pulse may have begun only recently (Quaternary time). It is believed to be propagating southward to the east of Talaud and Halmahera islands (Cardwell et al., 1980, Murphy, 1973). Cardwell et al., (1980) suggest a transform fault connecting the Talaud-East Mindanao Ridge (2-A) with the Halmahera Arc (2-B). Halmahera Arc is volcanic and active since Quaternary (Sukamto et al., 1979). Volcanism of the Talaud-East Mindanao Ridge (2-A) is believed to have begun in Early- to Mid-Tertiary (Moore, 1981, Karig, 1973) and to have ceased since late Miocene (Cardwell et al., 1980).

In Eastern Mindanao there appear to be only a few small volcanic cones of possible Quaternary age (Cardwell et al., 1980, citing Wolfe, personal communication); there is clearly no major Quaternary cone along the East Mindanao-Talaud Ridge.

Zone 3: Philippine Fault and Other Major Faults

The Philippine Fault extends over 1200 km from Luzon to Mindanao (Allen, 1962). Krause (1966) suggests that it extends even beyond Mindanao to the Talaud Ridge. Fault movement is left-lateral strike-slip (Ranneft et al., 1960, Allen, 1962, Rutland, 1968). Morante and Allen (1974) studied the geomorphic effects of the 1973 Ragay Gulf earthquake and found a left-lateral displacement of 3.2 metres near the Tayabas Isthmus of Southern Luzon. This was confirmed by a later focal-mechanism solution of the earthquake (Lewis and Hayes, 1983). Other earthquakes (1937, 1973, 1975) studied by Acharya and Aggarwal (1980) have focal-mechanism solutions that can be correlated with left-lateral movements of the fault. Geomorphic features in other parts of Luzon, Masbate, Leyte likewise corroborate left-lateral movements (Allen, 1962).

Eight other large earthquake, namely of 1893, 1901, 1911, 1924, 1937, 1941, 1947, 1948, had their epicentres along or very near the fault zone (Rowlett and Kelleher, 1976). Thus, seismicity indicates that the Philippine Fault is presently active. Additional evidence from geology, such as the sharpness of fault scarps, disrupted soil horizons, stream offsets, confirm that the fault has been active since Quaternary times (Lewis and Hayes, 1983). Certain surface deformations near or along the fault have been associated with historical earthquakes, such as the ones of 1869, 1879, 1893 (Allen, 1962).

In Central Luzon, the fault divides the mountainous Cordillera Central in the north from the lowlands of the Central Valley Basin in the south.

Past episodes of intense activity along the fault have been placed in late Miocene and post Pliocene (Rutland, 1968).

Zone 4

Zone 4 is the double forearc associated with the Manila Trench, which lies west of Luzon (Lewis and Hayes, 1983, Cardwell et al., 1980, Karig, 1973). 4-B and 4-D are the "inner" volcanic forearc, extending from North Luzon Ridge to Marinduque Island, while 4-A and 4-C make up the "outer" non-volcanic arc.

There is a sharp difference in seismicity between 4-C and 4-D; also between the North Luzon Ridge (upper part of 4-B) and North Luzon Trough (upper part of 4-A). The volcanic inner arc (4-B and 4-D) is marked by presently active volcanoes and Quaternary cones (Cardwell et al., 1980). Karig (1973) and Murphy (1973) believe that the Luzon arc has been active at least since late Miocene. Volcanic rocks of the North Luzon Ridge are calcium-alkaline and pyroclastics of Miocene and Pliocene age (Hamburger et al., 1983). Volcanism was active through Quaternary (Bowin et al., 1978, Divis, 1980). In 4-D Taal Volcano is the only presently active volcano. Several other major eruptions of Taal are believed to have occurred within Pleistocene age (Wolfe and Self, 1983).

Focal-mechanism solutions of earthquakes in the North Luzon Ridge are predominantly strike-slip type, although some are left-lateral and some are right-lateral, which leads to a variety of interpretations of the tectonic process in this region by different studies (Lewis and Hayes, 1983, Seno and Kurita, 1978). Seismicity is shallow, indicating that faulting is still active.

Zone 5

Zone 5 is the Manila Trench. Beginning of subduction along here and Western Luzon is variously placed at Pliocene (Murphy, 1973, Ben Avraham, 1978), or late Miocene (Karig, 1973). It is believed to be more or less contemporaneous with the cessation of subduction along Eastern Luzon: between late Oligocene and early Miocene (Schweller et al., 1983, Lewis and Hayes, 1983).

The Manila Trench has a Benioff zone that dips 40^{o} in the north and becomes almost vertical south of Manila Bay, extending to a depth of about 220 km (Hayes and Lewis, 1984). South of 13^{o}, the Manila Trench changes its trend from N-S to NW-SE, and projects towards the Mindoro Strait. This is believd to be due to the collision of the subducting lithosphere with the North Palawan (Calamian) micro-continental block (Lewis and Hayes, 1984). The collision is placed between late Oligocene and mid-Miocene (Karig, 1983).

Seismic activity in the trench and in the forearc, as well as volcanic activity in the latter, are evidence of present-day convergence between the South China Sea plate and Luzon (Hamburger et al., 1983). Convergence rate is estimated to be about 10 to 20 mm per year (Hayes and Lewis, 1984).

Zone 6

Zone 6 comprises the Negros Trench and Sulu Trench and their volcanic forearcs. Seismicity is relatively low in both subduction zones. There are relatively few shallow earthquakes of the thrust type in the Negros Trench. However, seismic reflection profiles show sediments being underthrusted to the east along the Negros Trench (Cardwell et al., 1980, Hamilton, 1979). There is no clearly defined Benioff zone; but there are intermediate earthquakes, showing that the lithosphere is being subducted (Cardwell et al., 1980).

The Sulu Ridge (6-B) parallels the Palawan Ridge which has no seismicity at all. The latter was associated with a subduction episode that occurred in early Tertiary to Miocene. The Sulu Ridge, on the other hand, was associated with a subduction that occurred in late Cenozoic to Pleistocene or Quaternary (Cardwell et al., 1980).

The Sulu Basin has very little of its original oceanic crust preserved today. Oligocene age is assigned to the oceanic crust of the Sulu Basin (Weissel, 1980). Late Oligocene appeared to be the beginning of subduction at the Sulu Trough or Trench.

The island of Panay, together with the Tablas Lineament, presents an interesting study as the area of collision or break between the Manila Trench and the Negros Trench (Uyeda and McCabe, 1983, Hamilton, 1979, McCabe et al., 1982, Cardwell et al., 1980).

The Negros Trench and the Sulu Trough are considered to be one tectonic unit (Divis, 1980). Kanlaon is an active volcano on Negros Island.

Zone 7

Zone 7 is a superposition of two structural or tectonic elements: a shallower or upper zone (7-A) which is the Cotabato Trench and forearc, and a deeper or lower zone (7-B) which is the northern extension of the Molucca Sea Plate. The Cotabato Trench (Moro Gulf) is characterized by high seismicity and thrust-type earthquakes (Hamilton, 1979, Cardwell et al., 1980, Moore and Silver, 1983) and appears to be propagating southward towards the West Sangihe Trench. The lower zone (7-B) is characterized by intermediate and deep earthquakes and dips westward to a depth of 680 km (Cardwell et al., 1980) and is identified with the Molucca Sea Plate that dips both to the west and to the east and has its surface expression along the Sangihe Ridge. This ridge, which is volcanic, extends north to Central Mindanao where there is a chain of volcanoes. On the western flank of southern Mindanao, or Moro Gulf, there is another cluster of volcanoes which is believed to make up the forearc of the Cotabato Trench.

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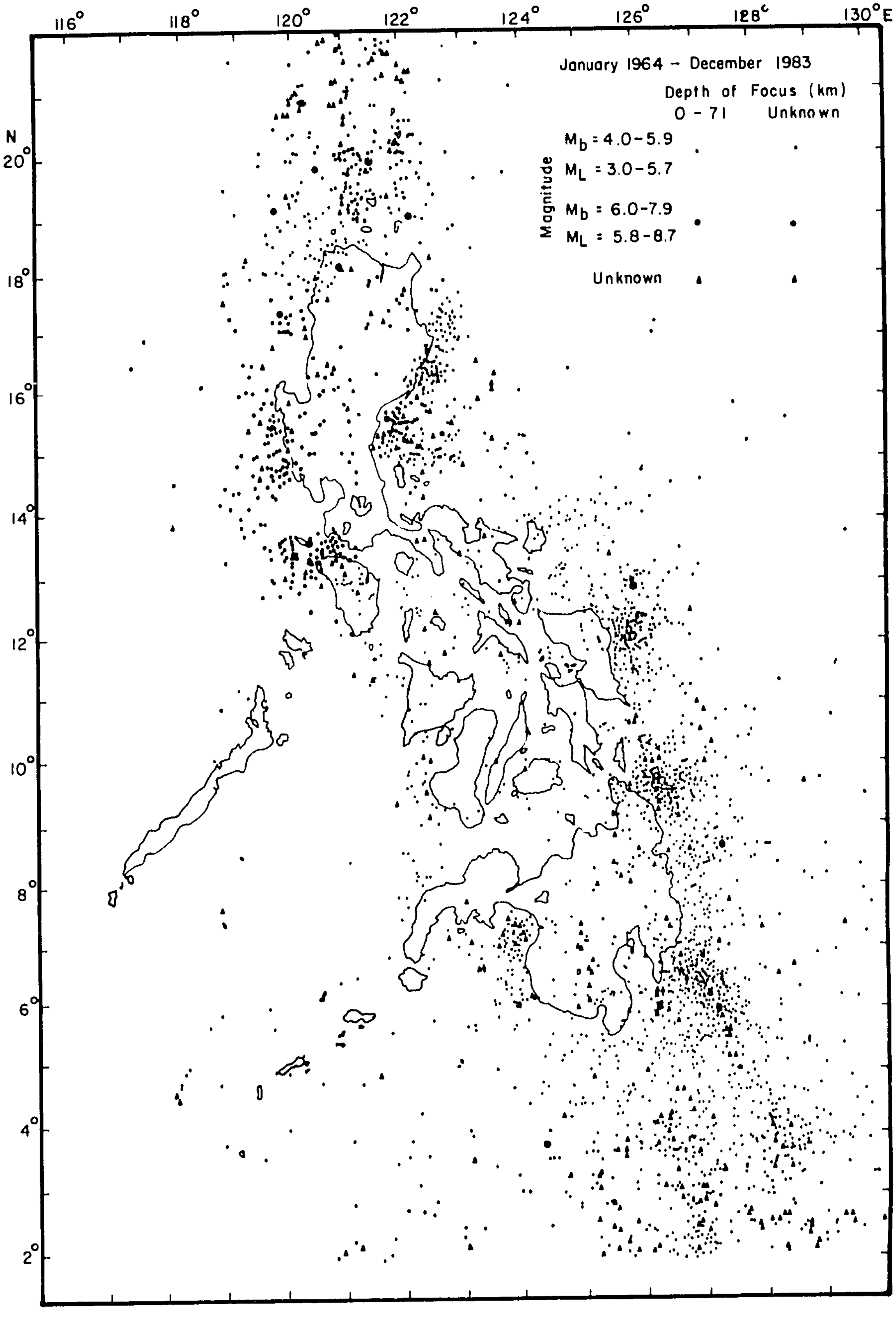

Fig. 1a Seismicity Map (Depth = 0-70 km., 1964-1983)

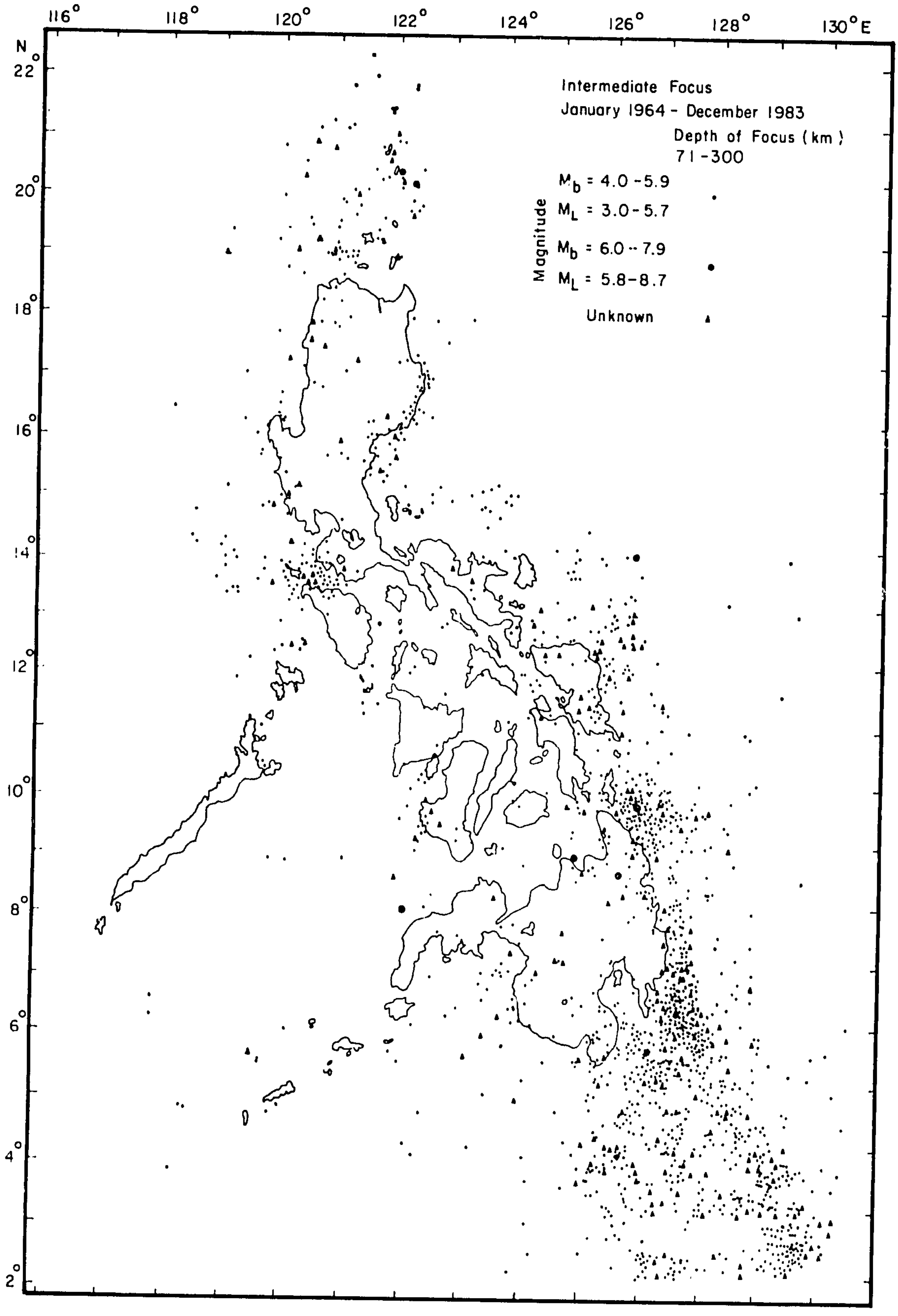

Fig. 1 b Seismicity Map (Depth = 71-300 km., 1964-1983)

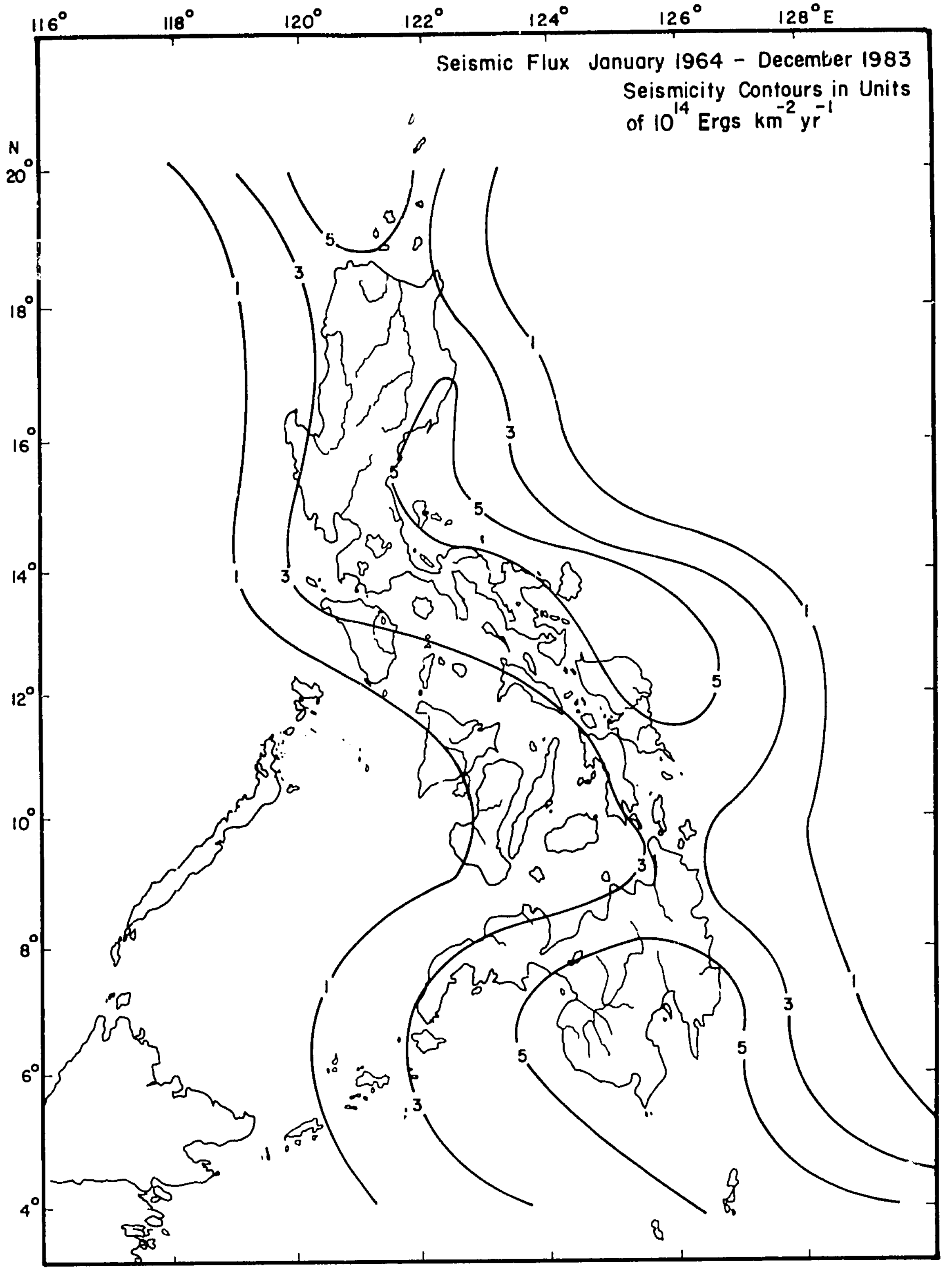

Fig. 2 Energy Flux Map (Contours Numbered in 10^{14} Ergs km^{-2} $year^{-1}$)

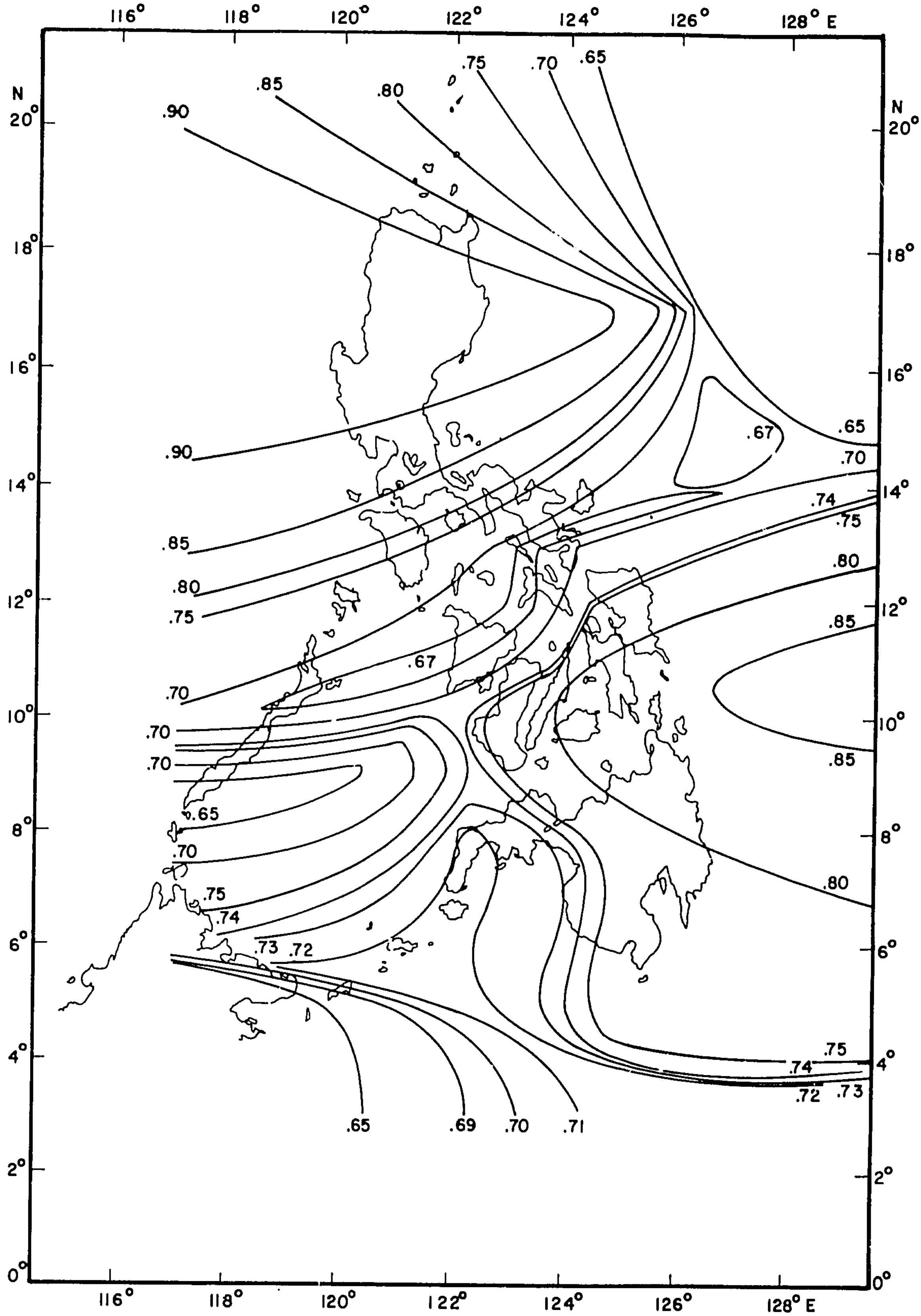

Fig.3 b- Values, 1964-1983

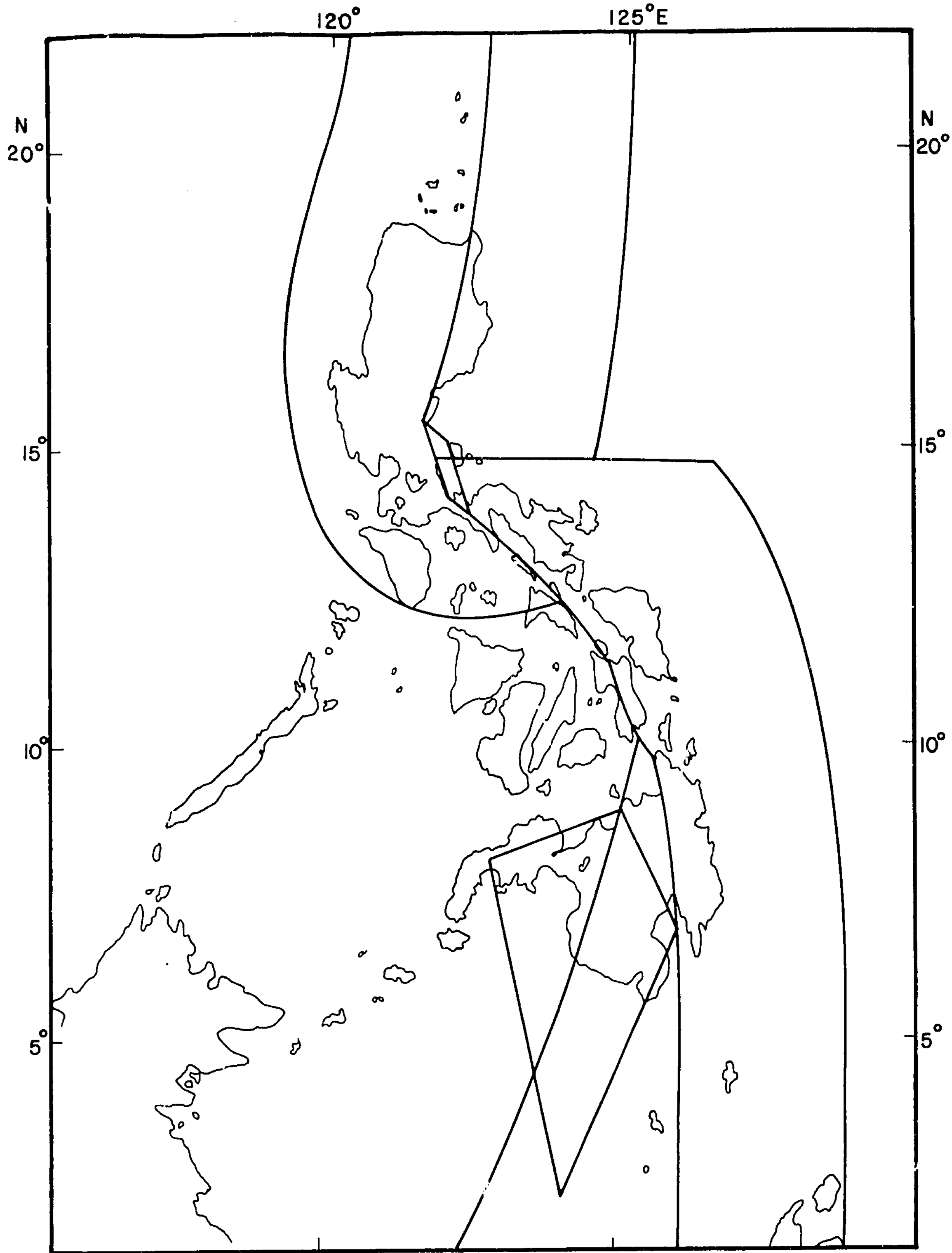

Fig. 4 Preliminary Seismogenic Zones

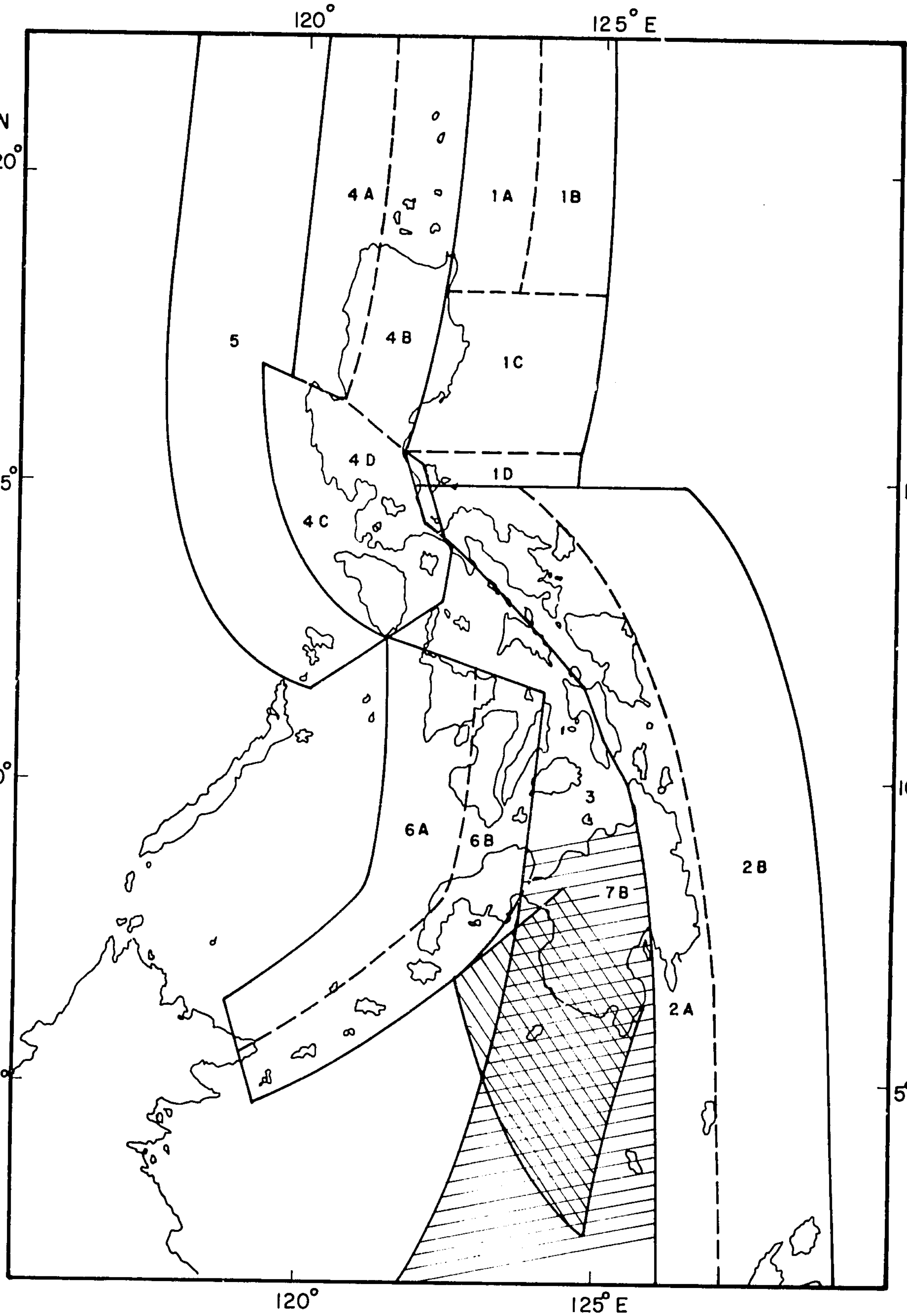

Fig. 5 Final Map of Seismogenic Zones

PART H

SEISMOTECTONICS OF THE PHILIPPINES

Guillermo R. Balce, Lolita C. Garcia

PART H
SEISMOTECTONICS OF THE PHILIPPINES

Introduction

The relation between earthquake and earth structure in the Philippines has been studied since the latter part of the nineteenth century. Early works, such as those of von Drasche (1878), Maso (1895, 1910, and 1924), Repetti, (1935), Willis (1937 and 1944), Alcaraz (1947), Irving et al., (1948) and Allen (1962) correlated seismicity with linear structures that are evident on the surface. Later works, heralded by that of Van Bemmelen (1949), treated seismicity and tectonics on a three-dimensional basis. Fault-plane mechanism solutions and contouring of earthquake hypocentres have become common tools for seismotectonic interpretation just as plate tectonics became widely accepted as the driving mechanism for earth movements. Estimates of plate convergence rates and slip rates became an added dimension in the 1980s.

The seismotectonic map of the Philippines, as presented herewith, is therefore mainly a compilation of data and inferences from previous works. The geological map base is largely from the 1:1,000,000 (1963) and 1:2,500,000. (1982) geological maps published by the Philippine Bureau of Mines and Geo-Sciences. Only minor revisions have been introduced to accommodate recent findings, such as new locations of faults indicated by Landsat and aerial photo-interpretation checked by field surveys.

Offshore geological and structural features shown in the maps are from recently published results of geological-geophysical investigations. Data sources are Taylor and Hayes (1980, 1983) for the structures and magnetic lineations in the South China Sea; Hayes and Lewis (1984) and Lewis and Hayes (1984) for the structures of the Manila Trench and the West Trough; Shih (1980) and Lewis and Hayea (1980) for the structures and magnetic lineations of the West Philippine Sea; Lewis and Hayes (1983) for the East Luzon Trough and the area north of Luzon; Hinz and Schloter (1983) for the Sulu Sea and west Palawan offshore areas; Weissel (1980) for the Celebes Sea; and Moore and Silver (1983) and McCaffrey et al., (1980) for the area south of Mindanao. Sediment isopach contours for the central and northern Philippines are taken from unpublished reports on file in the Philippine Bureau of Energy Development and from Hamilton (1979) for other areas in the southern Philippines.

Focal mechanism solutions of adequately located earthquakes are from Katsumata and Sykes (1969), Fitch and Molnar (1970), Fitch (1970 and 1972), Seno and Kurita (1978), Stewart and Cohn (1977), Acharya and Aggarwal (1980), Cardwell et al., (1980), and Hamburger et al., (1983). L. Garcia and Sudarmo, who are members of the preparation team for the seismotectonic map of the Philippines and Indonesia, have augmented the focal mechanism data by their new solutions. They used M = 5.5 as cut-off.

The seismotectonic map also includes contours on Benioff zones, from Hamilton (1979), Cardwell et al. (1980) and Hamburger (1983); plate convergence rates along the Philippine and East Luzon trenches from Ranken et al., (1984), and seismic-slip rates for the Philippine Fault and Manila Trench from Acharya (1980).

Earthquake epicentres, too numerous to be mixed with the geological and tectonic information in a single map, are plotted on the overlay. The period covered is January, 1964 to December, 1983, the period when the location of Philippine earthquakes is considered of sufficient reliability, owing to the availability of an adequate number of seismic monitoring facilities. Seismic flux and maximum·intensity contours are also plotted on the overlay. These parameters have been determined by L. Garcia and her co-workers at the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) specifically for the purpose of this seismotectonic map. PAGASA's CATALOGUE OF PHILIPPINE EARTHQUAKES (1589-1983) served as the data base for the determination of maximum-intensity values.

This map is part of the Seismotectonic Map of Southeast Asia, compiled under the leadership of Prinya Nutalaya of Thailand and E.P. Arnold of the U.S. Geological Survey. The map is intended to provide a basis for the earthquake Hazard Mitigation Programme in Southeast Asia which is undertaken jointly by the Southeast Asian countries under the auspices of the Southeast Asia Association of Seismology and Earthquake Engineering (SEASEE). The compilation work was financially supported by the Office of Foreign Disaster Assistance (OFDA) of the U.S. Agency for International Development (USAID). Technical assistance was provided by the U.S. Geological Survey.

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Tectonic Setting

The Philippine Archipelago is a north-south strip of lithosphere between the Eurasian and Pacific plates within $4^{o}N$ to $22^{o}N$ latitudes and $115^{o}E$ and $130^{o}E$ longitudes. It is a collage of stacked-over and opposing trench-arc systems built partly on rifted portions of continental Palaeozoic-Mesozoic crust from southern China and partly on obducted Late Mesozoic to Palaeogene oceanic basement. This arrangement is punctuated by small ocean basins formed by normal sea floor spreading or marginal basin spreading up to Miocene time and trapped by the collision of bordering arc systems.

Carboniferous-Jurassic

Geological history starts from the formation and consolidation during the Indosinian orogeny of a Late Palaeozoic-Middle Mesozoic continental curst in southern China (Holloway, 1981). Portions of this continental crust are now present in the Reed Banks, northern Palawan, Calamian Island Group, Cuyo Island Group, Romblon Island Group, Mindoro, Northwestern Panay and under the allochthonous ophiolite sheet in southern Palawan (Hashimoto and Sato, 1968 and 1973; Taylor and Hayes, 1980; Fontaine, 1979; Holloway, 1981; Hinz and Schloter, 1983). Specifically, the continental basement sequence represented in this region, which we shall call the "Palawan Block" for purposes of this paper, consists of metamorphosed arkose of probable Carboniferous age, Permian clastics and limestones, Triassic clastics, radiolarites and limestone, and Early Jurassic limestones, shales and sandstones (Hashimoto and Sato, 1973; Fontaine et al. 1979). The sequence is represented as the Carboniferous-Jurassic time rock-unit in the seismotectonic map.

Jurassic-Cretaceous

The second oldest time rock-unit, Jurassic to Cretaceous, encompasses lithologies of diverse tectonic settings. The Middle to Late Jurassic Mansalay formations, lying unconformably over the metamorphosed continental basement in Mindoro, have been deposited in the shallow marine continental shelf of Mesozoic southern China (Hashimoto and Sato, 1968; Holloway, 1981). The late Jurassic to Cretaceous clastics and carbonates penetrated by offshore oil exploration wells in Mindoro Strait, offshore northeast Palawan, offshore west and northwest Palawan and Reed Banks have been deposited in the same continental margin, varying from shallow neritic to fully marine eastwards (Holloway, 1981). Outer arc and forearc basin environments during the Cretaceous have been recognized by Holloway (1981) in the sequences of offshore Palawan. This is consistent with the idea of an Andean arc-type margin bounded by a northwest dipping subduction zone that gave rise to the mid-Jurassic to mid-Cretaceous calc-alkaline extrusives and intermediate to acid intrusives of southeastern Vietnam and eastern China (Holloway, 1981; Taylor and Hayes, 1983).

In the Late Cretaceous, the subduction zone bounding the Andean arc-type margin became inactive but another northwest dipping subduction zone appeared to the southeast, passing east of present-day Borneo, southeast of Zamboanga Peninsula and eastern Bohol (Balce et al., 1979; Mitchell et al., 1985). This subduction zone relates to the Cretaceous diorites of central Cebu and possibly Zamboanga Peninsula. The Early Cretaceous-Palaeocene Mananga Group in central Cebu, composed of pelagic mudstones, spilites, andesitic to basaltic volcanics, molluscan limestone and some carbonaceous shales, are evidently formed in a marine environment of extremely high relief corresponding to an oceanic island-arc environment similar to the present-day Marianas. Similar Cretaceous-Palaeocene sequences in the Luzon Sierra Madre, Bicol Peninsula and Catanduanes could have been formed in analogous island-arc systems.

The Late Cretaceous spilites and manganese-bearing pelagic sediments generally associated with mafic and ultramafic rocks in northern Luzon Sierra Madre, Samar, and central and eastern Mindanao were probably formed in extensional oceanic environments.

Palaeogene

The Palaeogene time rock-unit represented in the map is adequately controlled only for Late Eocene to Early Oligocene sequences. Palaeocene and Early Eocene exposures are usually of limited extent, and conformable with associated Cretaceous units from which they are lithologically indistinguishable. Definite examples are in central Cebu and southern Sierra Madre where it is likely that many exposures of this age have been mapped as Late Cretaceous. The only definitely mappable Palaeocene-Lower Eocene exposure is the coal-bearing Sula formation in Catanduanes which could have been deposited in the shallow-water portion of a Cretaceous-Eocene volcanic arc. Late Oligocene rocks are usually mapped together with Early Miocene, since there is no distinct physical boundary between these two ages in the Philippines. The unconformity is usually at the base of the Late Oligocene (Hashimoto and Balce, 1976; BMG, 1982).

Tectonic environments indicated by Palaeogene sequences are of three types: 1) shallow marine clastics and carbonates over the Palawan Block; 2) deep marine and ophiolic sequences in southern Palawan, Western Panay, and Zambales; and 3) volcanic-dominated, deep to shallow marine island-arc sequences in other parts of the Archipelago. Dioritic to granitic intrusives of this age occur in belts thought to represent Palaeogene magmatic arcs. Among the adequately dated belts are northern Palawan (UNDP, 1985), northern Luzon Sierra Madre (RP-Japan, 1977), and SW-Negros - Eastern Panay.

Events that led to the complex structural framework of the

Archipelago occurred during this period. The Celebes Sea, which had been initially part of an extensional oceanic basin, during the Late Cretaceous or at least during the Palaeocene and Early Eocene (42-59 M yr bp or Magmatic Anomalies 18-25) was separated from the West Philippine Sea when a probable N-S transform fault separating the Proto-Celebes and West Philippine Seas was converted into a subduction zone during about 40 M yr bp. This subduction zone must have had a west-dipping polarity to account for an active Eocene-Oligocene magmatic arc in northeastern Luzon. It could have extended south through the present Ragay Gulf, eastern Leyte and Davao-Agusan Trough. Bicol Peninsula, Samar and eastern Mindanao could be an arc bounded by an east-dipping subduction far away to the east.

A proto-Sulu Sea opened, probably by back-arc spreading, during the Eocene. It occupied central Borneo and Sabah, the present Sulu Sea, the Antique Range of Panay Island and extended farther north to the Zambales Range. Northwestward subduction along the proto-Sulu-Zamboanga-Cebu/Bohol arc gave way to eastward subduction along a line connecting the present Sulu and Negros trenches, passing beneath Antique, Sibuyan and probably extending as far north as Luzon central valley and the Ilocos basins. This gave rise to a metal-rich Eocene-Oligocene magmatic arc connecting Zamboanga, SW Negros, eastern Panay and Masbate. The rise of the Luzon Central Cordillera and southern Sierra Madre is attributable to this eastward subduction.

By the end of this period, Middle Oligocene (32 M yr bp), sea-floor spreading commenced in the South China Sea (Taylor and Hayes, 1983; Schweller et al., 1983). Back-arc spreading in the Zambales-Antique and Sabah portions of the proto-Sulu Sea ceased, but eastward subduction of the Sulu plate remained active, as manifested by the Luzon Central Cordillera, southeran Sierra Madre and southwards to Negros. Westward subduction east of Luzon ceased but its continuation to the south appears to be active.

Neogene

The Neogene time rock-unit in the seismotectonic map actually includes Late Oligocene, but usually excludes Pliocene, since Pliocene and Pleistocene are generally inseparable in the Philippines. Rock sequences consist of deep marine to sub-terrestrial clastics, carbonates and volcanics, with probable terrestrial volcanics in the Luzon Central Cordillera and other Neogene volcanic arcs. Clastic and carbonate sequences in the Palawan Block remained free of volcanic products. In other areas volcanics are normal components of Neogene rocks. Practically all are deposited in island-arc settings, in deep forearc or back-arc basins, in shallow-water reef drapes of arcs, in deep marginal basins and in trenches.

Convergence of practically all tectonic terranes in the Archipelago happened during this period. The southward push of the South China Sea opening resulted in the collision of the

Palawan Block with the island-arc system on the eastern and southeastern sides of the proto-Sulu Sea. The segments of the proto-Sulu Sea in Borneo and in Antique-Western Luzon were closed during the Late Oligocene and the east-dipping subductior zone was partly inactivated (UNDP, 1985). In southern Palawa.. and Sabah, a large part of the Eocene ophiolite crust of the proto-sea was overthrust on the continental Palawan block apparently from the middle Miocene (Hinz and Schloter, 1983).

From a transform fault separating the northern part of the proto-Sulu Sea and the South China Sea, the Manila Trench was initiated in the early Miocene (?) as an east-dipping subduction zone replacing and older one passing through the eastern border of the Luzon Central Valley and the Ilocos Basins. This resulted in the emergence of the Zambales Range and the formation of the West Luzon fore-arc basin (Schweller et al. 1983; Hayes and Lewis, 1984). Late Miocene-Pliocene volcanism in the Luzon Central Cordiliera, eastern Zambales Range, Cavite, Batangas, northeast Mindoro and Marinduque are attributed to this subduction zone. The east-dipping subduction along the Negros and Sulu Trenches remained active during this period but the volcanic arc shifted eastward by 30-50 km.

The west-dipping subduction zone passing through eastern Leyte and the Agusan-Davao Trough was probably active during this period, as shown by Miocene dioritic intrusives in Masbate, Eastern Cebu, Leyte and Central Mindanao. Suturing of the Bicol-Samar-E. Mindanao arc with the rest of the Philippines resulted in the initiation of the Philippine Fault over the line of suture in the Miocene (Barcelona, 1981). The subduction slab of oceanic lithosphere from the east, however, remained active. Initiation of westward subduction along the present Philippien Trench must have come into existence towards the end of the Neogene, as the related volcanic belt in Bicol and eastern Mindanao appears to have started in the Pliocene or Late Miocene.

In the Celebes Sea, the east-dipping Cotabato subduction zone was developed probably during the Miocene, as a result of continuing subduction underneath the Agusan-Davao Trough after collision of eastern Mindanao with central Mindanao (Cardwell et al., 1980; Moore and Silver, 1983).

Quaternary

After the cessation of spreading in the south China Sea during the Middle Miocene and the initiation of the subduction zones along the Manila Trench and Philippine Trench in the Neogene, the general tectonic frame work of the Philippine Archipelago changed very little. Subduction along the Manila, Negros, Sulu, Philippine and Cotabato trenches continued through the Quaternary up to the present. Along the Davao-Agusan Trough the subducting oceanic slab continued sinking to the present level of about 700 km. All these subduction zones are accompanied by Quaternary volcanic belts that are active in certain portions at present.

A Quaternary volcanic belt apparently stretches from Southern Mindoro, through the Cuyo Island group and then to the Cagayan de Sulu Islands, northeast of Sabah. This belt could be related to the zone of eastward underthrusting of continental crust beneath mixed continental and oceanic crusted material along the Northwest Borneo-Palawan Trough. Underthrusting is apparently inactive at present, since no seismic activity can be related to it so far.

East of Luzon, incipient westward subduction activity is obvious from active seismicity. Volcanism along a belt connecting Sta. Ana and the Didicas volcanoes, from the northeastern tip of Luzon, is close to this subduction zone. However, most previous workers have postulated that volcanism in this area is, rather, related to subduction along the east-dipping Manila Trench (Bowin et al., 1978; Hamburger et al., 1983).

Consistent with the extremely active volcanism in most of the archipelago during the Quaternary, the lithologies represented in the Quaternary time rock-unit are mainly volcanic rocks and sediments derived from volcanic ejecta. Reef limestone is almost always present in coastal areas fringing the islands. In central Visayas, especailly in Cebu, Bohol and Leyte, Quaternary reef limestone deposits extensively blanket the islands and occur up to elevations as high as 200 metres. Unconsolidated Quaternary deposits are present only along shorelines, river deltas, flood-plains and piedmonts at the foothills of mountain ranges.

Earthquake Distribution, Energy and Intensity

Earthquake Distribution

Earthquakes in the Philippines account for over 3.2% of the world's seismic activity. Their spatial distribution has been studied by Damasco (1970), Sevilla et al., (1964), Hsu (1971) and many others. The Bureau of Mines and Geo-Sciences (1982) published a frequency distribution map of the country as well as a seismic zone map.

The frequency distribution map showed clustering of earthquakes within zones bounded by the trenches except for the Palawan Trench. A belt of earthquake coincided with the Philippine Fault. Based on the frequency distribution, the seismic zone map presented seven zones as follows:

"Zone I — Related to the Manila Trench subduction zone, dipping east

Zone II — Related to subduction along the East Luzon Trench, dipping west

Zone III — Related to subduction along the Sulu Sea Trench and Antique Trough (Negros Trench)

Zone IV — Related to the Philippine Trench subduction zone, dipping west

Zone V — Related to the Cotabato Trench subduction zone, dipping east

Zone VI — Related to activity along the Philippine Fault

Zone VII — Possibly related to a west-dipping subduction zone surfacing at the Agusan-Davao Trough and traceable southwards into the Mollucas Sea."

The distribution of Philippine earthquakes divides the Archipelago into an aseismic region and a seismically active region called by Gervacio (1966, 1967, 1973) the "Mobile Region". The aseismic region covers the Palawan Islands and westward. The eastern boundary is defined by the Manila Trench and the Negros-Sulu Trench. The seismically active region occupies the rest of the Philippines which are covered by seismic zones I to VII. Within this region, however, there are areas with no earthquake epicentres of more than magnitude 5. These are the Central Visayas and the Cagayan Valley.

At the same time as this seismotectonic map is being prepared, Fr. Su of the Manila Observatory is also preparing for SEASEE a seismic zone map which is based not only on frequency distribution and tectonics but also on energy flux and b-Values. The distribution of earthquakes with respect to Fr. Su's zones is given in Table 1. This tables show that 60.50% of Philippine earthquakes occur in relation to the Philippine Trench.

Table 1 Earthquake Distribution

Division	Percentage of Philippine Seismicity
Zone 1	6.61
Zone 2	60.50
Zone 3	0.86
Zone 4	12.08
Zone 5	1.57
Zone 6	4.31
Zone 7	14.07

Seismic Energy

The seismic energy released, or seismic flux per unit area, has been computed using earthquakes from January 1964 to December 1983. The resulting contour map is represented in the overlay. Energy for each earthquake was computed from the following formula:

$$\text{Log } E = 6.3 + 2.4 \text{ Mb}$$

Where Mb = body-wave magnitude
and E = energy in ergs

The values contoured are the sum of the energies of earthquakes occurring per square degree latitude-longitude. Smoothing of the data prior to contouring is made over a 4^o x 4^o window. Each earthquake within the window is divided by the square root of distance. This gives the attenuated energies. The contour values are in units of 10^{14} ergs per square kilometre per year.

Intensity

Earthquakes are studied by observation and then by analysis of their effects on the ground, on buildings and on man. The effects considered here are directly observable without the use of any special instruments.

For historical earthquakes (pre-1900 earthquakes), the description of their effects is the only evidence we have for defining the seismicity of different regions.

The limits of the area of perception of an earthquake are often very difficult to define exactly. They depend on the individual acuity of the sense of different observers. Sometimes it is necessary to take averages. It is knowledge of the average intensity of earthquakes in each region that will be used to measure the danger to which this phenomenon exposes man and his works. The intensity scale used in this study is the Modified Mercalli (1956 version).

Once the maximum intensities observed at different points have been marked on a map, it is possible to draw isoseismal lines which delineate areas in which the same intensity has been observed. From this method, maximum observed intensity contour maps are prepared. These maps are essential materials for the study of seismicity, which is dependent on a couple of factors: period over which observations are made and population density of each area in the region. In thinly populated areas, the data are often incomplete.

The maximum earthquake intensity contours are plotted in the seismotectonic map overlay. At least eight (8) urban centres are within areas of X, and above, maximum intensity. These are Manila, Dagupan, Batangas, Legaspi, Iloilo, Bacolod, Surigao, and Cotabato.

Seismicity and Trench-Arc Systems

The relation between seismicity and trench-arc systems in the Philippines has been well documented since the late 1960s when earthquake zones began to be studied in three dimensions (Hatherton and Dickinson, 1969; Fitch, 1970; Hsu, 1971). Focal mechanism solutions and contours on Benioff zones have been employed to elucidate this relation. Boundaries of the trench-arc systems are clear-cut in so far as the trench sides are concerned. Landward, the boundaries are less well defined especially as the present-day arc elements overlap those of former trench-arc systems. The location of volcanic belts generally parallel to the trenchs is, however, usually diagnostic of the extent of present trench-arc systems.

Manila Trench-Arc System

This is the same system called by Cardwell et al., (1980) the "Luzon Island Arc". We prefer the term "Manila Trench-Arc System".

The trench-arc system includes the Manila Trench, West Luzon Trough, North Luzon Trough, and the belt of Quaternary volcanic centres from the Babuyan Islands, through the Luzon Central Cordillera, Luzon Central Valley Basin and eastern Zambales Range, northeastern Mindoro and terminates abruptly in the small volcanic islands southwest of Marinduque. The trench starts as a bathymetric feature at about latitude 21^{o}N, southwest of Taiwan. It continues southward as the boundary between the abyssal South China Sea and Luzon, and ends between the Calamian Islands and Mindoro. The trench front is marked by a ridge interpreted as being an accretionary prism built up by scraped-off and accreted turbidite sediments (Hayes and Lewis, 1984). Eastward subduction started somewhere between the Late Oligocene and Middle Miocene, but fore-arc mass budget calculation agrees more closely with inception of underthrusting in the Middle Miocene (Lewis and Hayes, 1984; Schweller et al., 1983; Balce, et al., 1979).

East of the accretionary prism is a well-developed fore-arc basin filled with up to 4.5 km of Cenozoic sediments. The basin is disrupted by a basement high beneath the Stewart Bank which marks the separation between the West Luzon Trough and North Luzon Trough portions of the basin. The basement high represents underthrusting of a major seamount formed near the relict South China Sea spreading centre. NNW trending splays of the Philippine Fault also disrupt portions of the fore-arc basin. (Hayes and Lewis, 1984).

East of the fore-arc basin is the partly emergent Zambales Ridge which is composed of ophiolite formed in a large marginal basin or at an oceanic spreading ridge during the Late Eocene to Late Oligocene (Schweller, et al., 1983). Offshore, the ophiolite is draped with 1 to 4 km of sediments which thicken eastward to the Luzon Central Valley Basin (Lewis and Hayes, 1983).

Luzon Central Valley Basin starts north at Pasuquin, Ilocos Norte where the Zambales Ridge is exposed and joins with the

Luzon Central Cordillera. The basin extends almost 400 km southward to Batangas and Cavite in southeastern Luzon. Eocene to recent sediment fills vary from less than 1 km at the eastern foothills of the Zambales Range to more than six (6) km thick, 20 km to the east (Schweller, et al., 1983). Basin width is about 100 km south of the Philippine Fault and only about 40-50 km north of the fault. Also south of the Philippine Fault, the basin is occupied by a wide belt of Pliocene (?) - Quaternary volcanic centres almost parallel to the southern part of the Manila Trench. North of the fault, the western front of the volcanic belt is shifted by about 20 km eastward to occupy the N-S summits of the Luzon Central Cordillera. The volcanic belt widens and curves east towards northern Luzon and the Babuyan Channel. It continues farther north to east of Taiwan.

Active seismicity in this trench-arc system is largely associated with eastward subduction from the Manila Trench. The Benioff zone is normally inclined (up to 45^{o}) until it reaches about 100 km depth, where it steepens to almost vertical, especially at the northern and southern ends of the seismic zone. The 100 km and 150 km depth contours on the tops of the Benioff zone are traceable throughout the extent of the Manila Trench, but the 200 km depth is present only from northern Mindoro to central Luzon (Hamburger et al., 1983). Volcanic centres generally lie above the portion of the Benioff zone with depths of 100 to 150 km. However, those in Taal, Makiling, Banahaw and the Mindoro-Marinduque area are over a very much deeper portion of the Benioff zone, or the seismic zone may not be present at all beneath these volcanic centres (Cardwell et al., 1980; Hamburger et al., 1983).

Very few large shallow-focus earthquakes are available for study from this trench-arc system. Rowlett and Kelleher (1976) and Seno and Kurita (1978) interpreted this as an indication of a slowing down or cessation of convergence between Luzon and the South China Sea. However, the absence of undeformed sediment blanketing the Manila Trench and its accretionary prism led Hamburger et al., (1983) to doubt this interpretation. They pointed out that one thrust mechanism obtained by Acharya and Aggarwal (1980) represents east-northeast underthrusting along a fault plane dipping eastward from the Manila Trench at 38^{o}. Several other thrust mechanisms are now available for earthquakes related to the Manila Trench subduction. Hayes and Lewis (1984) nevertheless pointed out that a low convergence rate could explain the low level of seismicity related to the Manila Trench.

Negros-Sulu Trench-Arc System

This trench-arc system had its beginnings in the Eocene to Oligocene time when an east-dipping subduction zone was active at the eastern border of the proto-Sulu Sea. Since that time, the related volcano-plutonic arc has shifted increasingly eastward, probably due to periodic eastward shift of the trench or changes in the dip of the subduction zone.

The trench-arc system is divisible into two parts: the Negros segment and the Sulu segment. The boundary is at the re-entrant to the Bohol Strait between Negros Island and Zamboanga. Mascle and Biscarat (1979) showed in this re-entrant the meeting of the Negros and Sulu trenches which are both actively subducting eastward, although they appear to be acting divergently.

The Negros Trench is a short bathymetric feature sharply convex westward. It shoals northward to the southern portion of the Iloilo Basin. The Antique Range appears to be a highly uplifted accretionary prism of the east dipping subduction zone of this trench. The accretionary prism is composed of ophiolite melange scraped off from an Eocene spreading ridge in the proto-Sulu Sea. (UNDP, 1985). West of the Antique Range is a narrow trough marking the zone of collision between the continental Palawan Block and the accretionary prism. During the Eocene to Oligocene, the trench-arc system must have consisted of a well developed fore-arc basin in the present location of the Iloilo Basin, extending up north to the Sibuyan Basin. The related volcanic arc must have occupied the belt of well truncated dioritic plutons from Masbate to southwestern Negros. In the Neogene, the fore-arc basin became constricted as the Antique accretionary prism was uplifted due to collision with the Palawan Block. The southern part, west of Negros, remained undersea. The volcanic arc transferred eastward to a belt occupying central Negros and offshore eastern Panay. Volcanism was most active in this belt during the Middle Miocene, as represented by the thick green tuff sequence in the whole of Central Negros. During the Quaternary, the volcanic arc became highly active once more up to the present. The present belt of Quaternary volcanoes is somewhat east of the Neogene belt.

Seismicity in this segment of the trench-arc system relates to an east-dipping Benioff zone originating in the Negros Trench. At least two fault-plane mechanism solutions of shallow-focus earthquakes show eastward underthrusting beneath Negros (Acharya and Aggarwal, 1980). This underthrusting mechanism is consistent with marine seismic reflection data showing an eastward infolding of sediments in the Negros Trench (Hamilton, 1979; Mascle and Biscarat, 1979).

The Sulu trench-arc segment consists of the Sulu Trench, a highly upraised accretionary prism including the line of non-volcanic islands in the northwestern part of the Sulu Archipelago, a well developed fore-arc basin and a Quaternary volcanic arc from the northeastern Zamboanga Peninsula through Subuguey, Basilan Island, Jolo and Tawi-Tawi. This arc system continues farther southwest to eastern Sabah. Shifting of the volcano-plutonic belt eastward is manifested in the Zamboanga Peninsula where a belt of probable Eocene-Oligocene dioritic plutons exists in the western part of the Peninsula. Neogene dioritic bodies are aligned east of this belt. The Quaternary volcanic centres are slightly shifted eastward, similarly to the situation in Negros.

Very little seismic activity is attributable to tectonic crustal movements in this portion of the Negros-Sulu trench-arc system. However, historically active volcanism in the Budajo Volcano in Jolo indicates some activity, perhaps related to southeastward subduction from the Sulu Trench. This corroborates the seismic reflection data showing infolding of thick sediments along the Sulu Trench (Krause, 1966; Hamilton, 1979).

East Luzon Trench-Arc System

Marine multichannel seismic reflection and other geophysical data show that in the eastern coastal and offshore arc of northern Luzon is a trench-arc system that we shall call the East Luzon trench-arc system. From east to west, the system consists of a trench called the East Luzon Trough, a fore-arc called the Isabella Ridge, a fore-arc basin called the Sierra Madre Basin and a magmatic arc constituting the Northern Sierra Madre Range and its offshore extensions, named the Palani and Gagna Ridges (Lewis and Hayes, 1980, 1983). The southern limit is an east-west transform fault which connects to the Philippine Trench at about 15°N latitude. To the north it extends beyond the limit of the seismotectonic map at latitude 20°N.

The East Luzon Trough is a flat-floored depression, about 5000 m deep or more, and almost symmetrically bounded by topographic highs to the east and west. To the east is the Benham Rise which emerges to a broad topographic high at 2000-3000 m water depth and reaches to within 38 m of the sea surface at Benham Bank (Karig et al., 1975). This rise is composed of a series of basement ridges roughly parallel to the East Luzon Trough and appears to be a distinct tectonic feature from the East Luzon trench-arc system.

To the west, the East Luzon Trough rises to the Northern Sierra Madre Range, from latitude 17°N southward, and to the Isabella Ridge northward of this latitude. West of the Isabella Ridge is the Sierra Madre Basin which contains about 4.5 km of sediments (Lewis and Hayes, 1983). The basin rises eastward to the northern Sierra Madre-Palani-Gagna Ridges.

Recent deformation, related to active westward subduction, is observed at the southern Sierra Madre side of the East Luzon Trough from 15.5°N to 17.5°N latitude, and also at the Southern Sierra Madre side of the Sierra Madre Basin between 17.5°N and 18°N. North of 18°N no recent deformation of sedimentary strata is recognizable (Lewis and Hayes, 1983).

The zone of observable recent deformation coincides with a concentration of earthquake epicentres between 15°N and 17°N latitudes. Focal mechanism solutions in this zone are characteristically of the thrust-fault type indicating that westward underthrusting is presently active (Lewis and Hayes, 1983). There is, however, no well-defined Benioff zone. The hypocentral depths are mostly deeper than 70 km and always shallower than 200 km. That subduction does not occur, or has only recently begun, north of $17^{o}N$ is indicated by the low seismicity and lack of thrust-fault type mechanisms of earthquakes, which is consistent with the absence of structures indicating recent deformations (Lewis and Hayes, 1983).

The recent subduction activity in this trench-arc system is thought to be just a renewal of the westward subduction east of Luzon which terminated in the Late Oligocene. The ancient subduction zone is traced on the western side of the East Luzon Trough with the Isabella Ridge representing the subduction complex formed over the subducting Philippine Sea plate (Lewis and Hayes, 1983).

Philippine Trench-Arc System

This trench-arc system is by far the most seismically active one in the Archipelago. It consists of the Philippine Trench and the belt of Quaternary volcanic centres from the Bicol Peninsula through Leyte and eastern Mindanao.

The Philippine Trench is more than 5 km deep, extending from the transform fault east of Luzon to Halmahera. It marks the boundary between the abyssal west Philippine Sea and the eastern portion of the Archipelago. The bathymetric profiles, absence of accretionary prisms and the relatively thick lobe of sediments east of the trench indicate a young age (Cardwell et al., 1980; Karig and Sharman, 1975; Hamilton, 1975; Karig, 1975). That subduction has started just recently in the southern portion is indicated by the lack of significant Quaternary volcanism along East Mindanao and the Talad Ridge (Cardwell et al., 1980).

From the Philippine Trench a seismic zone dips west to depths of less than 200 km (Cardwell et al., 1980). Normal fault-type mechanism solutions occur mostly seaward of the trench, indicating extensional bending stresses at the upper surface of the Philippine Sea Plate (Cardwell et al., 1980). Underthrusting-type mechanism solutions, on the other hand, occur landward of the trench. North of Mindanao the underthrusting-type mechanism solutions dip gently west (24^{o+}-10^{o}). To the south the dips are much steeper (45^{o+}-10^{o}). The steeply dipping seismic zone in the southern Philippine Trench occurs at a depth of 100 km at an unusually short distance of 50 km west of the trench, indicating once more the young age of the trench, even compared with the Kermadec and New Hebrides trenches (Cardwell et al., 1980; Karig, 1975).

While present-day subduction along the Philippine Trench is admittedly of relatively recent initiation, it is on the other hand necessary to relate the Palaeogene to Neogene volcano-plutonic complexes along a continuous belt from Polillo, through the eastern Bicol Peninsula, Catanduanes, Samar and eastern

Mindanao. If it is related to a westward subduction from the eastern margin of the Archipelago, probably almost coinciding with the present Philippine Trench, the Quaternary-to-present subduction activity along the trench must be just a renewal of activity, perhaps similar to that in the East Luzon trench-arc system. Alternatively, this volcano-plutonic belt could be related to an east-dipping subduction zone from east of the Bicol Peninsula through eastern Leyte and then to the Davao-Agusan trough. Evidently, much has yet to be done to find a reasonably constrained explanation for the superimposition of arc elements of different ages in this trench-arc system.

Sangihe Trench-Arc System

This system is a complete trench and arc system in the Indonesian portion of the seismotectonic map. It extends northward to Mindanao where the Agusan-Davao Basin, a geomorphic feature on land, takes the place of the Sangihe Trench. The northern limit is in the Bohol Strait at about latitude 10^{o}N.

The Sangihe Trench is a narrow bathymetric depression with more than 2 km depth of sea-floor extending south where it connects with the Gorontalo Basin between the northern and southern arms of Sulawesi. To the north, it connects with the Davao Gulf which, in turn, connects with the Agusan-Davao Basin. The trench is mantled by highly deformed sediments obscuring the surface expression of the subduction zone trench that Cardwell et al., (1980) believe existed on the east side of the Sangihe Ridge. Intense deformation in the south is in contrast with the merely slight folding of sediments in the Davao Gulf. In the Agusan-Davao Basin, the thick Neogene to Quaternary section is also only slightly to moderately folded. Folds along the western side of this basin show a definite eastward vergence, indicating that the Central Mindanao Cordillera is being displaced eastward over the basin floor (Ranneft et al., 1960; Cardwell et al., 1980).

The arc related to the trench-basin element appears to be situated rather close. It is defined by a belt of active volcanoes extending from Camiguin Island, in the Bohol Sea, through the Mindanao Central Cordillera, Sangihe Islands and the northern arm of Sulawesi. Mt. Apo, the highest peak in the Philippines, is part of this belt. This volcanic arc slopes straight down to the trench depression.

Seismicity related to this trench-arc system defines a Benioff zone dipping westward down to about 700 km (Hamilton, 1979; Silver and Moore, 1978; McCaffrey et al., 1980; Cardwell et al., 1980). The Benioff zone starts from beneath the Talaud Ridge and Eastern Mindanao and extends as far down beneath the central part of Celebes Sea (Cardwell et al., 1980). The active volcanoes south of the Sangihe Islands occur where the top of the Benioff zone is about 100 km deep. To the north, the volcanoes are at positions of greater depth from the top of the seismic zone

(Cardwell et al., 1980). The dip of the seismic zone is about 55° under the Sangihe Islands and about 65° under Mindanao. Cardwell et al., (1980) noted that there are no deep-focus or intermediate-depth earthquakes beneath central Mindanao except for an event at 71 km. They showed that the lateral continuity of deep-focus earthquakes from under the Celebes Basin to central Mindanao is connected with the lithosphere that is subducted beneath the Sangihe trench-arc system, and distinct from the lithosphere being subducted beneath the Philippine Trench. Focal mechanism solutions of earthquakes occurring at the subduction lithosphere beneath this arc system suggest that the subduction lithosphere is under extension at intermediate depths and compression at greater depths.

Cotabato Trench-Arc System

On a collision course with the Sangihe trench-arc system, the Cotabato trench-arc system is composed of the Cotabato Trench and the Daguma Range, as a volcanic arc of Quaternary age superimposed on a volcano-plutonic arc of earlier age.

The Cotabato Trench is a depression more than 4 km deep at the northeastern edge of the Celebes Sea Basin. It starts as a bathymetric feature between the Zamboanga Peninsula and Central Mindanao and extends southeastward to the western side of the Sangihe Islands where it loses its identity. Deformed sediments in this trench are infolded northeast-eastward.

The corresponding volcanic arc is about 100 km away from the trench, extending from the vicinity of Cotabato City to Dadiangas Bay. It includes the Parke Volcano.

That eastward directed underthrusting of the Celebes Basin occurs along the trench has been demonstrated by Stewart and Cohn (1977) and Acharya (1978), based on the M = 7.8 earthquake of 1976. The presence of an underthrusting plane dipping east was demonstrated by aftershocks. An ill-defined seismic zone is manifested by a cluster of shallow earthquakes dipping eastward up to less than 100 km depth. Seismic activity decreased southward. Cardwell et al., (1980) suggested that subduction in this system started relatively recently, since there is no active volcanic arc. However, if the Parker volcanic belt truly relates to the subduction, the underthrusting activity must have begun well within the Quaternary.

Seismicity and Major Faults

Major faults in the Archipelago are not necessarily proven to be seismically active although most of them have signs of very recent deformation, such as the cutting of recent alluvial deposit and offsetting streams. We shall discuss in this section the nature and seismicity of faults or fault zones, excluding the major overthrust zones related to subduction that are presented above in the discussion of trench-arc systems.

Philippine Fault

Well documented in literature since the late 19th century, this fault is among the same class of spectacular zones of crustal displacement as the San Andreas and Semangko faults. It has been traced by Allen (1962) for about 1,200 km as a physiographically recognizable feature from Luzon to Mindanao. Recent offshore information shows extensions of the fault zone across the Lingayen Gulf in Western Luzon (Lewis and Hayes, 1984) and through the offshore Pujada Peninsula in southeastern Mindanao (Moore and Silver, 1983). This zone actually consists of a number of faults, en echelon in part and branching and scissoring in part. Physiographic features revealing the location of these faults are fault-line scarps, fault troughs and valleys, side hill ridges, fault sags, sag ponds and stream offsets.

Allen (1962) observed that vertical displacements are evident along sections of the fault but concluded that the horizontal component in the sinistral sense has far exceeded the vertical. Gervacio (1973) reported a 28 km sinistral offset in Mindanao and 30 km in the same sense in Leyte. On March 17, 1973, the Ragay Gulf earthquake of magnitude 7.3 caused left-lateral ground displacement up to 3.2 m (Morante and Allen, 1974). Acharya and Aggarwal (1980) estimated the seismic slip rate along the fault to be 6.86 cm/yr.

Strong seismicity along the fault has been demonstrated by Rowlett and Kelleher (1976) who found that the large earthquakes in 1901, 1911, 1924, 1937, 1941, 1947 and 1948 lie near the fault. Allen (1962) associated with the fault the Masbate earthquakes of 1869 and 1895, and the Surigao, Mindanao earthquake of 1879. The largest magnitude earthquake was the Mati, Mindanao, earthquake of April 14, 1924 with magnitude 8.3 (Allen, 1962).

Focal mechanism solutions of some earthquakes along the fault zone show left-lateral strike-slip motion, affirming the observed recent displacements. The Ragay Gulf earthquake of 1973, however, shows a NW-SE fault direction coinciding with a splay projecting to the Bicol Peninsula, through the vicinity of the Mayon Volcano.

Between Polillo Island and eastern Luzon, the continuity of the fault zone is obscured by a change in trend of faults from northwesterly, in the Tayabas Isthmus, to more northerly along the eastern coast of Luzon and the western coast of Polillo. Farther north, in the Dingalan-Lingayen segment, the zone is more northwesterly. The Polillo segment could be just a case of scissoring along the fault zone or it could mark a rhombohedral split betwen en echelon segments - the Ragay Gulf and Dingalan-Lingayen segments.

The situation of faulting in the Luzon Central Cordillera appears analogous to the Polillo segment. The Dingalan-Lingayen segment of the Philippine Fault is connected with the similarly trending Bangui Fault to the north by a rhombohedral system of fault splays, one of which is the Digdig Fault (Allen, 1962). More studies are evidently necessary to characterize adequately the Philippien Fault zone.

Bangui Fault

The Bangui fault slices in a NW-SE direction the northern part of the Luzon Central Cordillera from Bangui Bay and extends southward to mark the boundary between the Cordillera and the Cagayan Basin. Stretching for more than 300 km, the fault offsets the Neogene-Palaeogene lithologic boundaries, indicating sinistral movement at least in its NW-SE trending northern segment. The southern segment is generally N-S and curved, with the convex side to the east. Northeasterly faults apparently cross the Bangui fault, offsetting it in a right-lateral sense. No seismic activity can be directly related to this fault but stream offsets indicate fairly recent movements along its course.

East Luzon Transform Fault

This fault is defined by a line of intense seismicity trending E-W offshore north of Polillo Island, about 50-70 km south of the bathymetric trough connecting the Philippine Trench and the East Luzon Trough. Focal mechanism solutions clearly show left-lateral strike-slip motion directed E-W (Lewis and Hayes, 1983). Multi-channel seismic reflection profiles across the transform zone show a series of northward dipping faults spaced roughly 2 to 5 km, with a cumulative vertical offset of at least 100 m (Lewis and Hayes, 1983). That this zone is an active trench-trench transform is indicated by the fact that seismicity and deformation ends at the trenches. The magnitude of earthquakes along this fault zone is generally low to moderate.

San Antonio Fracture Zone

This zone is a WNW graben, about 5 km wide, north of Subic Bay (De Boer et al., 1980). It displaces the NS trending Zambales ultramafic complex and hides beneath the northern apron of Natib Volcano. Wolfe and Self (1983) project a thin fault zone through Manila Bay and Laguna de Bay, although they admit that the true nature of this fault zone, which they call the "Manila Fault", is still debatable. According to De Boer et al., the largest historical earthquake in this zone is M = 5.75.

Taal Fracture Zone

This NE-SW trending fracture zone (De Boer et al., 1980) used to be known as the Taal Line, after Alcaraz (1947). It is considered to pass through a physiographic depression in northeastern Mindoro connecting Mamburao and Abra de Ilog, and to extend across the Verde Island Passage, through Taal Volcano and the eastern lobe of Laguna de Bay. Some geometrical constraint is involved as this lineament crosses the Verde Island Passage, an E-W trough considered by many as a locus of faulting related to the Manila Trench (De Boer et al., 1980; Gervacio, 1973; Wolfe and Self, 1983). A line of dense seismicity coinciding with this lineament, however, makes it obligatory to attach importance to this tectonic feature. At least two fault plane mechanism solutions show right-lateral motion, suggesting a conjugate relation with the NW-SE trending Philippine fault in eastern Luzon.

Antique-Tablas Lineament

This N-S lineament is a pronounced structure marking the boundary between the Manila and Negros-Sulu trench-arc systems. The name was established by Gervacio (1966) who considered it as the boundary of two major crustal blocks, the "South Luzon Block" and the "Visayan Block". The lineament is apparently composed of vertical faults arranged en echelon. One segment appears on land along the eastern coast of Tablas Island. Another segment is a very pronounced fault line separating the Busuanga Peninsula and the Antique Range in western Panay. The Busuanga Peninsula is composed of Palaeozoic metamorphic rocks and is considered part of the continental Palawan Block. In contrast, the Antique Range is composed mainly of ophiolite melange. The fault zone can be traced as a bathymetric feature as far north as east of Marinduque Island. To the south, it coincides with the Antique Trough along the west side of Panay Island. Apparently, it connects with the Negros Trench between the southwestern tip of Panay and the Cagayan de Sulu Ridge.

Several large but shallow-focus earthquakes occur along this lineament. Focal mechanism solutions of three earthquakes show strike-slip motion parallel to the lineament but they vary from right-lateral to left-lateral (Cardwell et al., 1980). A large earthquake that occurred on Jan 24, 1948 near the west coast of Panay has a dextral solution (Allen, 1962). On the basis of this dextral solution, Allen (1962) considered this major northeast-trending fault as conjugate to the Philippine Fault.

Mindanao Fault

The zone of NW-SE faulting from the northern Zamboanga Peninsula to eastern Cotabato, was considered by Gervacio (1964) as one of the major lineaments in the Archipelago. It is traceable on land for about 400 km. It is physiographically expressed as a linear depression, in the Sindangan Valley, northern Zamboanga, characterized by an intensely crushed zone, rows of volcanic plugs and small cones and numerous small lenses of sheared peridotites (Gervacio, 1966). Gervacio (1964) noted that the fault is concealed under Quaternary volcanic debris in Lanao and is split into two branches in the Cotabato area; one branch passes through the Makaturing and Apo volcanoes and another passes along the northern foot of the Cotabato Highlands and Mt. Parker Volcano. No seismic activity can be attributed to this fault, but a closer look at the record of Philippine earthquakes may reveal recent movements, such as those related to the many Mindanao earthquakes apparently situated along the lineament.

Conclusion and Recommendations

The Philippine Archipelago is a strip of lithosphere along the zone of convergence between the Eurasian and Pacific plates. Opposite-dipping subduction zones subtend the main portion of the Archipelago from Luzon to Mindanao. These subduction zones have formed well-defined trench-arc systems manifested by trenches and parallel belts of Quaternary volcanoes. Seismicity is brought about mainly by underthrusting of the oceanic lithosphere beneath the trench-arc systems. Seismically active transcurrent faults are generated by stresses attributable to oblique-slip convergence of small and large lithospheric plates (Fitch, 1972).

The seismotectonic map shows the general relation between seismicity and earth structures. However, further studies have to be undertaken to relate accurately earthquakes, especially the large and shallow ones, to specific structures. Field survey of the ground effects of historical and recent earthquakes could contribute a great deal towards this end. Much has yet to be done to enhance the usefulness of this seismotectonic map for hazard assessment and foundation engineering.

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FOCAL MECHANISM SOLUTIONS
1974 - 1983

NO. OF EQ.	DATE			TIME			EPICENTRE		DEPTH	MAGNITUDE			POLE OF 1st NODAL PLANE	POLE OF 2nd NODAL PLANE	AXIS OF COMPRESSION P	AXIS OF TENSION T	NULL AXIS B
	DY	MO	YR	HR	MIN	SEC	LAT(N)	LONG(E)	KM	MB	ML	MS	TREND/ PLUNGE	TREND/ PLUNGE	TREND/ PLUNGE	TREND/ PLUNGE	TREND/ PLUNGE
1	20	10	71	08	40	19.9	21.94	121.40	43	5.6			217.0/16.5	37.50/73.50	37.11/28.50	216.79/51.50	307.04/00.14
2	04	03	67	05	09	24.6	21.40	121.90	134	5.4			75.0/29.5	327.00/28.64	111.17/00.53	20.67/43.40	201.73/46.59
3	01	03	65	13	20	58.7	21.19	121.16	57	5.3			160.0/25.0	340.50/65.00	340.50/20.00	160.50/70.00	70.50/00.00
4	08	06	72	09	14	05.0	21.08	120.17	7	5.6			312.0/22.5	129.00/67.47	314.12/67.48	131.12/22.49	221.56/01.06
5	26	04	65	22	15	42.0	21.00	121.00	29	5.8			274.5/30.5	65.00/55.91	310.94/70.82	82.94/13.10	176.21/13.76
6	28	01	72	16	18	26.7	20.96	120.07	33	5.5			146.5/44.5	0.50/40.51	67.05/72.10	164.11/02.27	254.83/17.75
7	08	01	72	14	32	14.2	20.94	120.36	25	5.1			343.0/34.0	152.0/55.51	158.54/10.80	4.59/78.01	249.52/05.14
8	10	01	72	05	23	52.0	20.94	120.36	25	5.1			171.0/34.5	266.5/07.94	224.51/29.88	123.99/17.63	7[illegible]71/54.34
9	08	01	72	0[illegible]	27	53.7	20.94	120.26	36	6.1			267.0/33.0	101.0/66.37	255.0/65.0	92.0/20.0	359.0/04.5
10	08	01	72	0[illegible]	35	34.0	20.89	120.28	12	5.3			12.5/00.0	192.5/90.0	192.50/45.0	12.5/45.0	104.0/00.0
11	04	01	67	0[illegible]	41	33.0	20.36	120.06	7	5.4			253.0/13.5	73.0/76.5	253.0/58.5	73.0/31.50	343.0/00.0
12	27	11	72	02	45	43.02	20.11	121.50	45	5.3			93.0/16.0	198.0/42.07	241.13/16.19	135.99/41.97	347.17/43.57
13	06	03	65	20	23	57.3	20.09	121.33	61	5.4			76.5/30.5	336.5/26.43	119.07/09.15	22.85/33.97	222.11/55.48
14	13	12	64	13	15	49.0	20.06	121.98	17	5.4			107.0/18.0	294.0/71.87	103.62/72.94	288.72/27.97	197.67/02.07
15	10	11	68	17	02	00.0	19.94	121.39	46	5.3			259.5/19.5	161.0/22.60	119.73/02.08	210.96/30.56	26.21/59.36
16	26	03	66	14	09	08.0	19.84	120.74	17	5.1			14.0/13.0	276.0/30.0	328.42/30.47	231.92/10.89	124.53/57.24
17	02	11	72	17	06	39.4	19.49	121.49	60	5.2			308.5/22.0	211.5/16.78	350.81/03.48	258.96/27.98	87.32/61.77
18	20	05	66	18	02	35.9	19.38	122.09	53	5.4			334.5/14.0	164.5/76/97	163.7/30.99	345.83/58.99	254.27/00.94
19	09	11	64	18	43	36.1	19.36	121.22	11	5.5			215.0/79.0	34.5/79.0	215.12/56.0	34.92/34.0	124.98/00.09
20	08	02	72	03	37	52.0	19.36	122.06	45	5.8			115.0/79.5	115.0/79.5	115.42/34.5	295.61/55.5	205.48/00.09
21	15	10	71	02	33	14.6	19.20	121.13	41	5.3			354.0/35.7	354.0/35.7	35.81/10.06	297.18/38.39	138.53/49.63
22	05	01	70	00	20	13.7	19.16	121.21	41	5.4			314.0/29.92	314.0/29.92	278.41/00.26	8.67/44.5	188.15/45.50
23	24	04	65	08	02	27.0	19.14	121.08	49	5.2			269.0/79.0	90.5/11.0	270.26/34.0	90.86/56.0	0.45/00.28
24	25	06	73	07	19	45.9	19.11	121.19	45	5.8			89.0/31.50	291.0/57.93	273.6/13.28	70.68/75.28	182.32/05.4
25	28	08	70	18	22	06.0	18.7	121.0	44	5.1			199.5/24.5	302.0/25.4	250.49/36.63	340.92/00.58	71.7/53.37
26	21	09	73	13	48	37.0	18.65	120.77	66	5.0			260.0/10.0	79.5/[illegible].5	260.1/54.5	79.93/35.5	169.99/00.08
27	03	11	70	15	12	14.3	18.45	120.88	62	5.4			62.5/15.5	327.[illegible]/17.45	284.74/01.32	15.31/23.64	191.72/66.32
28	07	11	70	23	18	26.1	18.45	120.88	73	5.3			305.0/10.5	123.0/34.48	303.71/10.51	118.62/79.45	213.64/00.93
29	08	05	65	03	05	36.9	18.42	120.33	39	5.2			265.5/10.5	85.0/79.5	85.42/34.5	265.61/55.5	175.48/00.09
30	06	03	73	03	58	38.7	18.22	120.69	80	5.0			209.5/31.5	29.5/58.5	209.5/76.5	29.5/13.5	299.5/00.00
31	24	04	71	00	46	47.8	18.21	120.85	56	5.3			331.5/24.0	145.0/65.88	336.31/68.91	149.65/20.96	240.5/02.24
32	26	08	70	15	11	54.9	18.02	120.48	58	5.5			258.0/12.0	58.0/78.0	57.06/34.01	238.17/56.99	147.39/00.51
33	29	02	72	13	00	48.0	18.02	120.37	63	5.1			39.0/89.0	219.5/01.0	219.51/46.0	39.49/44.0	129.5/00.01
34	17	10	67	21	05	23.9	17.27	121.83	41	5.5			37.0/11.0	135.0/33.88	180.44/15.03	80.81/31.95	292.04/53.9
35	27	10	71	09	27	19.5	17.48	120.41	57	5.3			282.0/04.5	101.5/85.5	101.96/40.5	282.04/49.5	192.0/00.04
36	28	03	67	19	32	28.3	17.02	122.43	76	5.1			174.0/18.0	64.5/45.77	131.53/46.49	23.05/16.75	279.09/38.71
37	03	02	66	11	58	36.0	16.66	119.93	71	5.3			197.0/70.0	20.0/19.97	21.71/64.96	199.25/25.02	289.65/00.96
38	12	06	72	11	19	45.6	16.61	122.45	41	5.1			296.0/00.5	116.0/90.5	116.0/45.5	296.0/44.5	206.00/00.00
39	22	05	72	06	04	01.4	16.60	122.19	36	5.9			274.0/44.0	98.5/45.91	96.21/00.96	209.23/87.55	6.17/02.25
40	03	08	68	06	25	07.4	16.45	122.31	52	6.1			113.5/48.0	341.5/29.07	140.0/14.0	32.50/64.0	235.0/26.5
41	03	08	68	19	19	04.8	16.35	122.41	40	5.2			169.0/20.5	272.0/32.0	216.0/38.0	311.5/11.0	52.0/50.0
42	01	08	68	20	19	21.5	16.30	122.11	31	5.9			137.5/64.18	261.5/15.14	98.13/26.86	234.92/55.2	357.27/20.4

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
43	28	09	68	09	54	49.6	16.18	122.39	42	5.2			135.0/22.0	230.0/14.0	184.37/26.23	91.89/05.04	351.83/63.22
44	22	11	68	08	59	27.7	16.17	122.17	60	5.3			388.0/34.0	174.0/54.94	164.54/10.57	308.24/76.97	73.12/07.54
45	29	08	68	21	08	09.3	15.90	121.75	50	5.3			345.0/04.0	254.0/02.0	31.0/01.00	300.0/04.0	122.00/86.0
46	07	04	70	05	34	06.2	15.78	121.71	40	6.5			277.0/25.5	72.5/62.34	90.0/20.0	303.0/68.0	183.0/11.0
47	22	09	68	09	20	30.2	15.72	121.88	47	5.3			63.0/20.0	319.0/33.61	278.3/08.6	15.41/39.29	178.13/49.41
48	16	03	72	05	09	07.8	15.71	121.68	61	5.1			242/35.5	15.0/43.72	39.98/04.48	300.72/64.06	132.12/25.49
49	23	08	68	06	42	59.5	15.7	121.90	57	5.1			19.5/17.0	112.0/08.12	66.79/17.86	334.8/06.13	226.56/71.05
50	06	08	68	04	53	04.4	15.7	122.00	48	5.3			17.0/15.5	194.5/74.49	192.54/29.5	11.04/60.49	102.18/00.64
51	07	04	70	06	11	52.8	15.68	121.85	22	5.5			344.5/37.0	154.0/52.7	160.83/07.87	8.71/81.11	251.4/04.10
52	04	07	71	11	30	53.8	15.6	121.85	50	5.5			291.0/27.0	32.0/20.53	250.32/04.19	343.23/34.68	154.32/55.99
53	29	08	68	08	05	36.2	15.57	122.01	68	5.1			161.0/32.0	347.0/57.86	151.11/76.77	343.31/12.95	252.69/02.70
54	08	04	70	23	33	45	15.55	121.85	26	5.3			154.0/47.5	349.0/41.51	161.89/03.02	50.17/81.89	252.29/07.52
55	07	04	70	06	34	19.2	15.53	121.86	33	5.5			108.5/14.0	210.0/38.65	254.3/15.70	151.71/37.78	2.45/47.95
56	29	08	68	01	36	22.5	15.51	121.98	39	5.3			135.0/21.5	27.5/37.36	87.37/43.49	347.95/09.78	248.07/44.86
57	07	04	70	05	53	48.6	15.50	122.40	47	5.6			295.0/27.15	35.0/18.71	253.5/05.50	347.13/33.33	155.26/56.10
58	07	04	70	07	59	57.3	15.49	121.78	33	5.2			213.5/44.0	340.5/31.93	286.39/59.9	184.64/06.73	90.87/29.18
59	10	08	68	16	41	31.5	15.41	121.59	86	5.1			28.5/05.5	213.5/84.48	27.97/50.5	208.94/39.5	118.55/00.48
60	08	04	70	21	23	54.0	15.43	121.75	7	5.7			212.5/28.0	60.0/61.99	26.11/16.57	232.3/71.65	118.4/07.65
61	08	04	70	17	54	31.0	15.39	121.63	4	5.3			165.0/17.5	263.0/23.82	212.63/29.88	305.04/04.18	42.24/59.77
62	08	04	70	08	17	54.31	15.38	121.63	4	5.2			238.0/36.0	158.0/54.0	158.00/08.0	338.0/92.0	68.0/00.0
63	22	04	70	13	48	56.0	15.37	121.83	46	5.1			279.5/17.09	15.5/18.78	57.75/01.14	327.2/25.83	150.09/64.16
64	13	04	70	08	28	22.6	15.26	122.24	5	5.2			99.0/24.5	282.5/65.46	96.07/69.47	290.1/20.49	189.6/01.32
65	12	04	70	05	18	09.1	15.17	122.51	32	5.4			105.0/17.0	20.0/20.0	54.92/29.41	321.5/06.3	220.12/60.77
66	12	04	70	10	48	45.1	15.12	122.05	39	5.1			10.0/32.0	264.0/23.8	314.12/41.31	48.64/05.12	144.4/48.23
67	15	04	70	13	14	26.7	15.11	122.71	50	5.6			224.5/06.0	44.0/84.0	44.45/39.00	224.56/51.0	134.49/00.05
68	16	06	70	08	09	14.0	15.10	122.00	19	5.1			337.0/32.0	157.0/58.0	328.87/76.0	157.04/12.98	66.62/01.80
69	01	04	70	04	01	44.6	15.08	122.01	25	5.8			229.5/28.5	39.0/61.09	45.78/16.36	241.82/73.02	137.08/04.45
70	14	08	68	07	56	37.0	15.08	122.51	15	5.5			314.0/27.0	135.0/63.0	134.34/18.0	312.96/72.0	44.21/00.40
71	12	04	70	14	22	38.2	15.08	122.51	26	5.4			324.0/27.77	65.0/19.92	283.07/05.08	16.61/34.78	185.84/54.75
72	21	11	70	12	19	40.1	15.01	120.13	53	5.5			345.5/33.0	116.5/45.29	143.29/06.74	40.11/62.58	236.66/26.44
73	06	10	69	12	48	05.8	14.99	120.11	66	5.6			230.0/28.0	108.5/44.5	75.84/09.42	180.0/55.85	339.78/32.48
74	06	06	68	19	44	04.7	14.90	119.90	53	5.3			232.0/02.0	141.0/26.55	189.73/19.93	93.38/16.94	325.99/63.36
75	20	12	66	18	39	43.7	14.57	122.17	32	5.3			281.5/29.0	87.0/60.21	96.26/15.71	299.04/73.03	188.02/06.25
76	06	04	70	00	54	32.8	13.97	120.57	88	5.2			40.5/22.5	305.0/13.03	84.13/06.38	351.08/25.47	187.18/63.63
77	10	01	66	01	19	11.9	13.81	120.72	133	5.3			286.5/14.0	98.5/75.87	104.89/30.97	289.17/58.96	196.03/01.89
78	12	06	68	23	26	30.1	13.80	120.75	135	5.1			320.5/37.5	158.5/51.1	148.44/06.88	275.81/78.75	57.37/08.86
79	05	01	67	06	13	31.8	13.78	120.71	170	5.4			332.0/45.0	160.0/44.72	336.01/00.14	244.01/85.99	66.02/04.01
80	22	06	64	21	23	35.5	13.67	120.55	72	5.1			164.0/57.5	338.5/32.38	160.64/12.57	319.06/77.17	70.08/02.49
81	27	04	72	01	29	38.1	13.55	120.63	63	5.3			217.5/32.0	102.0/34.57	69.22/01.52	161.08/50.89	337.99/39.07
82	26	04	72	04	03	19.0	13.47	120.53	70	5.0			350.0/24.5	173.0/65.47	170.94/20.49	347.49/69.48	80.52/01.13
83	19	06	72	01	32	22.1	13.45	120.51	75	5.2			337.0/38.5	148.0/51.15	153.0/06.35	8.03/82.27	243.49/04.4
84	26	04	72	17	35	07.9	13.45	120.60	45	5.2			20.5/37.0	275.0/19.53	321.55/41.44	61.34/10.91	163.06/46.5
85	17	03	73	08	30	53.2	13.41	122.87	44	5.9			22.0/00.0	112.0/00.0	68.0/00.0	158.0/00.0	00.0/90.0
86	30	08	66	12	40	28.2	13.40	120.80	86	5.3			40.0/18.0	145.0/40.0	210.84/28.5	29.87/61.50	120.62/00.41
87	25	04	72	19	30	08.0	13.38	120.34	38	6.4			328.0/03.73	59.0/14.99	104.41/07.87	12.55/13.23	224.37/74.53

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
88	21	06	69	07	47	24.4	13.38	123.04	17	5.2			32.0/06.0	124.0/18.37	76.61/17.26	169.29/8.56	284.63/70.61
89	17	05	72	05	27	49.0	13.36	120.05	12	5.3			120.5/22.0	28.0/22.22	347.71/00.14	77.8/32.16	257.48/57.84
90	30	04	72	00	13	31.0	13.35	120.64	66	5.2			222.0/05.0	132.0/00.0	268.00/05.00	178.0/4.0	45.0/84.0
91	30	04	72	15	15	35.0	13.35	120.55	66	5.2			4.0/06.5	96.0/17.03	48.86/16.69	141.06/7.3	253.85/71.7
92	26	05	72	08	38	18.1	13.33	120.40	95	5.3			31.5/16.5	212.0/73.5	211.61/28.5	31.29/61.50	121.54/00.14
93	26	04	72	06	18	46.1	13.32	120.59	41	5.2			77.5/10.5	256.5/79.5	77.73/55.5	257.34/34.5	347.47/00.18
94	10	06	68	17	15	28.0	13.20	121.50	17	5.1			28.0/02.5	207.5/87.5	28.0/47.5	208.0/42.5	298.0/00.0
95	05	07	73	22	46	15.0	13.18	124.65	18	5.5			74.0/00.0	342.0/00.0	30.0/00.0	120.0/00.0	0.0/90.0
96	24	11	64	12	40	56.3	13.12	124.58	25	5.6			245.5/16.5	344.5/27.84	26.98/07.43	292.29/33.08	128.51/56.87
97	24	05	65	23	21	13.6	13.10	124.50	54	5.7			288.5/29.5	44.0/37.27	77.87/04.59	342.19/50.93	171.55/38.69
98	21	06	67	15	45	24.0	12.75	123.00	16	5.3			69.0/13.0	251.0/76.99	68.4/58.0	249.38/32.0	159.1/00.44
99	29	04	71	19	56	14.0	12.63	122.27	19	5.6			32.5/15.0	123.5/03.73	347.08/7.88	78.95/13.22	227.1/74.52
100	05	02	70	22	05	58.5	12.58	122.09	8	5.9			310.0/19.5	213.5/29.5	261.42/26.83	352.02/01.19	84.36/63.14
101	25	07	71	12	51	43.5	12.44	123.71	33	5.7			217.0/0.0	307.0/00.0	82.00/00.0	352.0/0.0	00.0/90.0
102	02	07	71	05	34	28.9	12.42	123.84	35	5.4			92.0/01.0	272.0/89.0	972.0/46.0	92.0/44.0	182.0/00.0
103	03	07	73	06	37	35.4	12.27	125.32	47	5.5			40.5/38.5	220.5/51.5	218.17/4.1	321.02/72.15	126.89/17.35
104	18	08	73	08	25	47.0	11.45	121.38	30	5.7			305.0/32.0	135.29/57.58	274.0/76.0	127.0/14.0	37.0/05.5
105	29	06	72	03	44	10.6	11.34	125.68	71	5.0			90.0/48.0	273.5/41.95	91.84/3.03	301.79/86.51	181.93/01.74
106	21	06	69	06	31	43.3	11.31	125.44	78	5.2			270.5/17.5	12.5/33.4	54.58/10.17	316.81/37.01	157.45/51.05
107	23	12	67	17	14	33.7	11.03	125.37	122	5.2			274.5/29.0	93.5/61.0	94.14/16.0	275.74/74.0	184.26/00.42
108	19	08	67	15	28	08.5	10.36	125.87	60	6.0			283.0/26.46	72.0/49.24	90.0/05.0	343.0/73.0	181.0/16.0
109	16	03	66	20	38	25.0	9.48	122.18	38	5.2			104.0/83.5	283.0/6.50	282.87/51.5	103.1/38.5	13.01/00.11
110	04	07	72	10	16	13.1	9.42	122.54	64	5.7			224.0/39.0	345.0/42.46	193.17/3.76	288.66/55.54	100.61/34.20
111	14	07	71	00	01	50.3	9.34	126.16	82	5.2			62.0/71.0	253.0/18.61	260.14/63.42	70.94/26.29	162.76/03.68
112	20	09	73	20	43	39.8	9.23	123.92	542	5.9			311.0/05.5	113.0/84.0	313.0/53.0	128.0/39.0	221.0/02.0
113	13	09	73	06	19	45.4	9.20	126.19	64	5.3			23.5/34.5	270.5/19.62	58.01/02.93	324.69/48.59	150.58/41.26
114	31	03	71	09	41	05.0	8.98	125.72	34	5.5			21.5/09.0	289.0/15.4	244.59/4.42	345.97/17.36	140.77/70.05
115	31	03	71	10	53	24.8	8.97	125.66	0	5.4			41.5/58.5	181.5/25.15	15.93/17.6	147.87/64.61	280.12/17.70
116	20	03	69*	16	19	57.5	8.69	127.35	33	6.1			109.0/22.0	229.0/51.0	150.0/55.0	264.0/16.0	5.00/31.0
117	20	12	72	22	42	53.8	8.52	125.96	74	5.2			359.0/32.5	260.5/13.06	304.98/32.67	43.3/12.72	151.63/54.35
118	21	08	66*	05	00	24.0	8.48	126.62	67	5.8			248.0/24.0	68.0/64.0	63.0/19.0	248.0/71.0	349.0/00.0
119	18	09	65*	22	03	15.1	8.31	126.96	85	5.4			282.0/10.0	102.0/80.0	102.0/35.0	282.0/55.0	13.0/00.0
120	10	05	71	11	53	53.8	7.99	126.95	42	5.9			114.0/87.5	291.0/02.5	290.86/47.5	111.13/42.5	21.01/00.13
121	19	10	69	12	25	44.9	7.70	126.00	58	5.3			1.50/38.0	99.5/13.72	314.09/15.52	56.21/37.09	205.65/48.72
122	01	10	72	23	49	37.5	7.46	123.77	632	6.0			307.0/35.0	124.0/54.96	317.0/78.5	124.0/11.0	216.0/04.0
123	23	01	65*	23	24	30.1	7.43	123.86	628	5.2			276.0/10.0	16.0/44.0	316.0/38.0	64.0/22.0	177.0/44.0
124	16	09	65	13	50	12.2	7.13	126.58	178	5.9			270.0/25.0	12.0/24.03	230.82/0.62	321.27/35.93	139.96/54.06
125	06	10	69	21	46	36.8	7.17	123.78	68	5.3			143.0/26.0	37.5/28.72	91.18/40.52	359.71/01.71	267.72/49.43
126	24	03	72	17	17	42.3	7.14	123.68	47	5.6			140.0/34.5	23.0/33.45	171.72/0.62	80.92/52.21	262.2/37.78
127	05	10	69	16	34	15.8	7.10	123.70	33	5.4			30.5/32.16	296.5/6.33	77.77/17.36	338.59/27.02	196.64/57.7
128	24	06	65	07	45	13.9	7.00	126.25	51	5.7			129.5/31.5	8.5/40.04	337.26/04.[illegible]	74.44/55.53	243.93/34.02
129	05	06	71	09	20	56.3	6.82	126.11	87	5.3			85.5/26.0	195.5/35.04	232.37/5.51	136.69/45.72	327.67/43.75
130	10	01	70	12	07	08.6	6.80	126.75	68	5.9			333.0/36.5	115.0/46.99	135.0/06.0	35.0/69.0	228.0/20.0
131	30	03	70*	16	46	46.2	6.78	126.66	82	5.8			62.0/30.0	280.0/54.0	256.0/13.0	19.0/66.0	162.0/10.0
132	04	08	68	11	41	23.8	6.60	126.80	96	5.9			284.5/26.0	80.69/63.21	91.0/20.0	288.0/70.0	182.0/06.0

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
133	28	04	73	20	39	48.3	6.44	117.84	71	5.1			84.0/14.0	277.0/75.14	266.0/30.5	59.0/69.0	174.0/02.5
134	02	12	72	00	19	52.0	6.41	126.62	73	6.0			264.0/58.5	78.5/31.38	261.0/15.0	69.5/76.0	170.5/02.0
135	09	03	73	10	06	37.7	6.32	127.38	55	6.0			271.0/70.0	97.5/19.88	112.44/63.64	269.54/24.53	3.7/9.04
136	08	06	67	07	01	55.0	6.16	125.83	161	5.1			149.0/17.5	49.0/28.84	6.96/07.38	101.9/33.62	266.15/55.36
137	24	10	68*	15	51	16.0	6.06	126.97	70	5.5			73.0/50.0	309.0/29.0	107.0/11.0	356.0/61.0	204.0/26.0
138	18	05	66	17	25	53.0	5.96	116.64	52	5.3			156.5/24.0	332.0/65.93	334.0/21.0	162.0/68.0	66.0/02.0
139	11	07	64*	15	35	55.5	5.93	126.31	183	5.0			124.0/22.0	17.0/35.0	338.0/08.0	75.0/42.0	239.0/47.0
140	03	07	72	05	31	28.7	5.82	125.93	108	5.5			127.0/33.0	224.0/10.63	180.61/31.03	81.49/14.76	329.49/54.0
141	02	04	64*	15	56	52.5	5.77	125.73	168	5.6			99.0/10.0	8.0/08.0	54.0/13.0	144.0/01.0	240.0/77.0
142	02	04	64*	15	56	52.5	5.77	125.73	78	5.7			78.0/84.0	258.0/06.0	78.0/39.0	253.0/51.0	168.0/00.0
143	16	05	65*	11	35	52.1	5.26	125.57	53	5.6			38.0/31.0	268.0/48.0	240.0/00.0	349.0/69.0	145.0/26.0
144	25	11	68*	18	36	52.3	5.05	126.77	30	5.3			68.0/85.0	249.0/06.0	68.0/40.0	249.0/50.0	158.0/00.0
145	10	06	64*	22	16	39.0	5.02	127.43	23	5.1			340.0/02.0	242.0/02.0	21.0/00.0	291.0/29.0	111.0/61.0
146	03	02	69	21	41	43.4	4.81	127.54	46	6.1			61.5/23.0	315.5/37.0	277.0/06.0	12.0/42.0	179.0/48.0
147	30	01	69	10	29	40.3	4.80	127.50	72	5.9			251.0/78.0	67.0/11.97	247.0/33.0	68.0/57.0	158.0/00.5
148	30	01	69*	10	29	40.3	4.77	127.50	70	5.9			64.0/20.0	270.0/63.0	251.0/25.0	43.0/63.0	156.0/04.0
149	03	03	64*	21	39	44.0	4.72	125.67	204	5.0			278.0/20.0	9.0/04.0	232.0/11.0	323.0/17.0	110.0/60.0
150	24	10	65*	14	32	13.9	4.17	125.81	151	5.4			64.0/74.0	244.0/16.0	64.0/29.0	244.0/61.0	154.0/00.0
151	31	01	69*	00	44	15.1	4.13	128.14	30	5.5			38.0/50.0	232.0/20.0	76.0/17.0	323.0/52.0	173.0/32.0
152	05	03	69*	13	52	08.0	4.04	128.11	30	5.5			39.0/60.0	270.0/20.0	74.0/22.0	302.0/60.0	171.0/22.0
153	11	06	72	16	41	02.7	3.86	124.26	336	6.2			276.0/11.5	147.5/71.9	259.0/55.0	109.0/33.0	9.0/14.0
154	17	02	69*	00	43	33.0	3.69	128.40	14	5.6			125.0/60.0	242.0/14.0	82.0/26.0	212.0/53.0	339.0/26.0
155	08	07	64*	07	45	50.8	3.19	128.31	70	5.2			240.0/10.0	141.0/40.0	95.0/19.0	199.0/35.0	341.0/48.0
156	01	11	64*	12	26	07.5	3.11	128.06	89	5.8			128.0/39.0	241.0/02.0	94.0/07.0	192.0/07.0	356.0/40.0
157	12	10	64*	15	42	55.1	3.02	126.50	53	5.5			270.0/18.0	32.0/06.0	70.0/22.0	301.0/56.0	172.0/24.0
158	12	10	64*	15	42	55.1	3.02	126.50	62	5.5			100.0/08.0	3.0/40.0	315.0/21.0	60.0/34.0	199.0/49.0
159	18	11	74	18	03	03.5	20.54	121.22	38	5.5			3.5/35.5	181.5/54.48	182.67/9.49	8.46/80.46	272.83/0.95
160	27	10	82	10	30	13.2	20.483	121.530	40	5.5			70.5/11.5	249.5/78.5	250.33/33.5	70.76/56.5	340.46/0.2
161	02	08	83	02	17	41.0	20.43	122.101	158	6.1		6.3	303.5/41	51/19.08	3/45	264/18	160/42
162	03	07	83	02	49	27.9	20.16	122.38	220	6.1			223/60	48/29.91	54.74/74.78	226.17/15.06	316.75/2.16
163	28	12	82	13	49	29.0	19.95	121.40	34	6.0		5.9	102/34.88	339.5/37.62	310.5/1.5	46.56	220/56.5
164	17	04	82	09	20	57.8	19.871	120.526	10	6.2		6.0	290/7.5	20.5/33.51	332/22	70/22	188/56
165	09	01	81	09	46	05.5	19.512	121.964	37	5.3			98/67	257/31.23	85.15/13.09	227.62/73.66	352.89/9.61
166	15	10	81	20	46	25.5	19.186	121.185	23	5.1			57/43	152/5.34	113.98/33.23	6.52/24.61	247.65/46.5
167	07	01	81	21	36	22.8	19.173	121.151	39	5.7			104.5/23.5	6.5/18.77	146.04/3.12	54.19/30.63	241.27/59.17
168	02	12	74	06	34	07.6	19.15	121.22	50	5.6			308/4	41/2	86/2	355/4	181/88
169	11	03	77	06	58	02.3	19.138	121.243	42	5.4			98/30	336.5/42.14	304.76/6.95	45.13/55.9	210.19/33.2
170	07	01	74	03	55	41.7	19.13	121.13	58	5.0			178/19.5	347/70.43	350.69/25.48	174.74/64.46	81.44/1.58
171	26	08	79	14	31	25.8	19.04	122.12	43	6.0			240.5/44.5	105.5/35.74	264/5	165/66	358/24
172	19	11	74	03	55	21.0	19.0	121.39	60	5.7			124.5/30.5	8/37.14	334.87/3.9	69.85/51.8	241.82/37.93
173	08	10	76	21	05	31.4	18.93	121.27	58	5.6			190/37.5	99/1.3	240.95/24.48	137.82/26.52	7.3/52.47
174	03	02	74	10	08	47.4	18.93	120.13	21	5.8			161/36	331/53.58	185.68/79.94	336.77/8.82	67.51/4.78
175	22	01	76	16	05	18.5	18.89	120.01	45	5.2			176/17	84/6.51	221.06/7.27	128.87/16.67	333.78/71.72
176	15	04	74	03	43	54.0	18.88	120.89	49	5.2			102/33	202.5/15.68	58.97/11.19	156.99/35.18	314/52.56
177	22	11	81	15	05	20.0	18.75	120.80	24	6.2			89.5/29	191.54/59.12	318/68	179/16	84.5/12

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
178	03	09	74	05	55	09.1	18.26	119.20	34	5.9			334.5/19	79.5/36.93	120.68/11.22	20.77/41.93	222.92/41.89
179	17	08	83	12	17	55.9	18.231	120.86	39	6.2		6.5	261/67	81/23	261.24	80/67	170/0
180	16	09	83	23	10	47.8	17.974	120.766	33	5.6		5.2	276/24	30/42.41	323.72/49.87	66.94/10.91	165.62/38.04
181	29	08	77	14	23	40.5	17.44	119.87	12	6.0			67.5/31.5	252.5/58.4	248.0/16	70/64	160/1
182	05	12	76	23	28	40.5	17.37	120.08	43	5.2			153.5/31	245.0/2.49	104.99/19.48	203.74/23.26	339.14/58.88
183	03	04	75	06	26	44.7	17.13	120.35	83	5.1			349/36.5	244.5/18.69	30.38/11.18	290.71/40.33	132.84/47.49
184	21	03	78	13	42	26	17.106	122.410	43	5.3			66/62.5	245.5/27.5	65.67/17.50	244.96/72.5	335.61/0.2
185	21	07	77	13	45	54.4	16.86	122.39	29	6.0			254.5/27.5	52.5/60.69	67/17	278/71	160/9
186	17	01	74	02	44	09.0	16.79	119.96	73	5.1			43/41.5	290/23.83	337.94/48.96	80.27/10.54	178.97/39.1
187	18	03	77	21	43	54.0	16.73	122.29	40	6.2			320/24	103/39.82	124/8	10/70	216.5/19
188	20	08	78	21	39	26.7	16.457	120.486	29	5.2			130/17.5	28/33.4	345.92/10.17	83.69/37.01	243.05/51.15
189	31	03	80	12	41	47.7	16.13	121.96	43	5.9			326/36	207.5/33.3	207.5/33.3	357.3/1.57	88.47/36.46
190	09	02	74	08	28	18.3	16.05	119.92	87	5.0			356/23	262/9.33	262/9.33	306.87/23.01	151.39/64.97
191	21	05	77	05	35	22.5	15.69	120.82	189	5.7			279/35	41.5/37.5	41.5/37.5	338.58/56.72	161.69/33.24
192	13	02	76	08	07	32.8	15.67	122.70	44	5.4			243/39.5	356/25.36	356/25.36	206.51/8.45	109.37/39.93
193	08	01	77	06	41	04.1	15.324	121.906	36	5.3			281/40.5	281/40.5	105.5/49.41	103.07/4.46	12.90/2.22
194	07	06	76	07	36	55.4	14.08	124.80	33	6.1			291/9.5	185/58.74	135/30	250/38	25/28
195	24	01	82	06	08	56.6	14.08	124.34	37	5.6		6.4	225.5/24	66/64.58	45/19.5	208/68.5	319/8
196	10	12	76	23	05	27.2	14.00	124.89	33	5.5			254.5/39.5	92/49.16	82.52/4.89	201.46/79.98	351.77/8.73
197	19	02	74	03	30	22	13.98	122.17	19	5.7			136.5/37	235/11.1	192.54/34.17	90.7/16.82	338.92/50.81
198	18	06	75	04	11	02.9	13.96	120.65	139	5.3			293.5/27.5	201.5/3.84	244.02/21.95	340.75/16.21	104.2/62.19
199	08	10	75	10	27	38	13.95	120.18	74	5.2			229.5/11	320.5/5.13	275.42/11.43	75.11/77.84	75.11/77.84
200	11	01	82	06	49	18.9	13.945	124.407	33	5.9			124.5/17.5	34/1.59	77.89/13.43	298.99/72.42	298.99/72.42
201	28	06	78	04	51	41.9	13.93	120.72	168	5.4			261/42	102/45.94	91.39/2	1/10.92	1/10.92
202	19	03	80	08	45	46.5	13.892	120.725	43	5.9			298.5/34	57.5/36.22	88.56/1.58	179.71/36.04	179.71/36.04
203	22	09	76	09	08	34.5	13.84	120.70	133	5.2			265/21.5	89.5/68.44	86.27/23.48	355.61/1.54	355.61/1.54
204	01	06	83	01	36	58.1	13.833	120.749	55	5.3			168.5/19	344.5/70.96	347.47/25.99	170.6/63.98	78.08/1.23
205	16	04	74	11	22	52.9	13.80	120.71	125	5.3			276.5/41	48/37.32	251.57/2.02	345.58/63.2	160.56/26.71
206	11	01	82	06	10	04.01	13.74	124.30	26	5.9			166/53.5	33.5/26.25	188/15	72/65	284/19
207	14	12	79	08	48	53.3	13.64	120.698	96	5.0			108/6	10/52.94	74.76/39.66	316.96/29.36	202.45/36.41
208	29	04	75	08	41	54.1	13.60	120.84	55	5.2			37/37.5	143/19.2	356.47/11.41	96.77/41.53	254.31/46.22
209	12	02	74	09	47	46.7	13.60	120.48	88	5.4			322.5/33	67.5/21.73	282.76/7.08	18.81/40.31	184.59/48.81
210	02	05	76	07	17	16.3	13.58	122.34	57	5.2			275/3	96/87	95.05/42	274.94/48	5/0.05
211	22	10	74	22	45	44.0	13.48	120.48	51	5.4			43/5	347/50.07	293.98/28.73	48.51/37.15	177.13/39.49
212	25	08	76	12	29	56.6	13.10	124.48	39	5.7			355/76	176/14	356.2/31	177/58.99	86.41/0.35
213	15	02	76	01	54	19.0	12.98	125.74	33	6.2			263.5/13	39.5/72.21	278/56	74/31	170/12
214	15	11	75	20	39	29.8	12.91	125.88	35	6.1		6.0	275.5/11	10/21.98	320.99/23.55	54.26/7.45	160.67/65.15
215	23	02	79	22	36	30.6	12.829	124.599	26	5.6			79.5/84.5	259.5/5.5	259.5/50.5	79.5/39.5	349.5/0
216	06	11	75	12	36	17.3	12.50	126.06	30	6.1			73/36.5	243.5/53.12	98.05/80.48	248.94/8.34	339.61/4.56
217	31	10	75	08	28	02.4	12.47	126.01	48	6.5			3/72.62	104/0.31	290.55/42.14	77.29/42.74	184.1/17.38
218	27	11	77	02	19	52.3	11.80	125.472	33	5.5			56/29	299.5/38.83	265.7/5.77	3.09/51.83	171.24/37.57
219	28	03	79	19	56	33.7	11.346	124.611	44	5.1			127/25.5	219/7.17	82.19/5.78	173.87/16.1	333.06/72.84
220	01	08	78	18	27	50.5	11.31	125.79	58	5.2			249.5/20	154/14.75	200.85/24.96	292.5/3.54	30.04/64.76
221	14	05	78	04	43	10.1	11.297	125.718	57	5.1			240.5/21	59/68.99	60.08/24	241.43/66	150.31/0.5
222	17	08	76	01	11	10.3	10.09	125.09	33	6.0			310/42.5	72/30.04	18/56	278/6	184/33

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
223	23	08	75	15	06	42.4	10.04	125.86	66	5.8			285.5/43.5	45.5/28.62	252/9.5	354/55	157/34
224	14	01	82	11	36	03.9	9.994	124.25	606	5.6			84/18	303.5/67.16	63.25/60.48	275.17/25.67	178.5/13.58
225	04	09	81	11	15	13.6	9.96	124.04	645	6.0			63/29	333/0	13/21	112/20	240/62
226	02	12	78*	18	07	16.2	9.937	126.322	57.7	5.3			220/36	350/26	277/47	145/05	96/44
227	05	10	79*	01	02	56.9	9.789	126.290	52.8	5.3			318/40	210/20	358/13	257/42	100/43
228	14	12	75	20	49	14.7	9.70	122.56	49	5.5			5/39	246.5/30.51	37.51/4.93	300.8/53.51	131.11/36.04
229	10	03	75	21	00	02.4	9.57	124.03	46	5.3			272/27	5/5.86	225.51/14.4	321.82/23.16	106.27/62.27
230	19	12	78	02	54	37.0	9.567	122.053	67	5.1			359/42	121.5/30.83	327.98/6.36	67.74/56.67	233.9/32.56
231	13	06	80*	02	17	45.5	9.456	126.554	31	5.3			234/20	350/50	029/16	271/50	130/33
232	01	05	79*	10	47	01.9	9.446	125.641	42.2	5.3			307/18	038/01	262/10	354/13	134/71
233	23	06	80*	13	46	14.4	9.357	126.558	53.3	5.1			194/34	90/20	138/38	236/10	137/47
234	19	06	80*	14	14	52.1	9.353	126.55	36	5.5			192/27	96/10	236/11	140/27	350/57
235	18	06	80*	23	50	43.8	9.335	126.789	52.9	5.2			322/20	225/20	274/30	184/0	092/61
236	13	04	80	05	41	44.4	9.00	126.27	49	5.9			226/40.5	78/44.8	61/4	160/74	330/16
237	24	12	80*	23	55	06.4	8.955	112.041	63	5.6			139/20	44/13	91/25	183/04	282/65
238	21	06	80*	02	21	59.2	8.904	126.828	50.7	5.1			64/50	244/40	64/05	244/85	344/00
239	08	11	76	10	48	44.6	8.87	125.94	140	5.4			290.5/30.5	150/52.64	246.05/67.06	126.68/11.72	32.49/19.42
240	19	02	83	20	14	22.8	8.735	124.039	568	5.8		5.8	254/15.5	76/74.49	267/60	74/30	344/2
241	01	12	78*	17	10	29.5	8.665	122.206	40	5.8			195/22	96/20	236/02	145/31	328/26
242	22	11	78	09	32	19.9	8.586	126.038	33	5.5			348/25	94/30.59	39.04/41.2	132.11/3.5	226.08/48.59
243	22	06	78*	06	37	51.5	8.514	126.63	59.3	5.5			162/26	342/54	342/08	162/82	252/00
244	07	11	76	17	09	07.1	8.46	126.38	60	6.1			350.5/18	225.5/47.17	195.5/12	302/58	98/30
245	14	06	78*	13	34	09.6	8.238	122.381	79	5.9			17/10	109/10	63/16	153/0	247/76
246	31	05	75	07	43	03.4	8.20	122.91	67	5.2			117.5/25.5	4/39.9	67.8/49.28	327.71/8.58	230.59/39.42
247	26	10	78	09	14	51.0	8.182	125.841	42	5.3			92.5/21	1/3.9	138.6/11.85	44.8/17.55	260.98/68.61
248	30	10	78*	13	43	14.6	8.051	122.286	33	5.7			212/10	116/39	168/26	072/13	318/60
249	16	11	78*	10	45	08.8	8.028	126.596	55.7	5.4			290/40	110/50	110/15	290/85	20/00
250	22	12	79*	02	29	02.2	7.752	122.14	44.3	5.2			308/20	128/70	128/24	308/66	038/00
251	22	11	80*	01	00	49.4	7.672	126.934	67.1	5.2			060/09	158/40	101/34	206/20	318/42
252	06	09	76	01	42	24.0	7.60	123.60	67	5.1			163/23	260.5/17.09	212.98/28.95	120.8/3.93	23.77/60.73
253	23	10	81*	08	19	01.24	7.58	126.547	159.3	5.2			37/28	217/62	217/17	37.73	127/0
254	20	03	79*	08	53	47.2	7.559	126.596	147	5.3			237/26	332/13	287/27	192/10	89/58
255	19	08	76	17	07	32.5	7.54	123.76	33	5.2			274/74.5	93/15.5	92.62/60.5	273.22/29.5	183.07/0.26
256	08	07	79*	02	24	11.5	7.362	123.232	43.9	5.1			255/18	160/08	299/04	206/20	47/67
257	16	08	76	23	49	39.8	7.35	123.42	20	5.5			35.0/51.50	199.50/37.47	158.86/79.60	26.31/7.08	295.36/7.59
258	17	08	76	07	53	31.8	7.26	123.32	16	5.6			123.5/22.5	300/67.46	302.47/22.49	125.98/67.47	32.99/1.24
259	18	08	76	07	53	31.0	7.24	123.22	72	5.1			215.5/15.5	123.50/7.17	260.31/5.78	168.63/16.10	9.44/72.84
260	17	08	76	15	07	02.6	7.22	122.99	17	6.2			203.5/24.0	101/25.93	62.0/2.0	154.0/37.0	330.0/54.0
261	02	05	77	21	53	56.5	7.186	123.258	24	5.7			152.0/76.5	332.0/13.5	332.0/58.50	152.0/31.50	62.0/00.0
262	10	08	77	09	33	29.2	7.081	123.565	54	5.3			16.0/23.0	117.0/24.2	66.18/34.49	156.72/0.78	247.85/55.50
263	16	08	76	18	16	20.2	7.05	123.71	44	5.8			212/18.29	111.0/30.0	69.33/7.56	164.69/35.13	328.87/53.82
264	23	11	81*	04	46	13.3	7.0	125.6	53.2	5.0			207/24	300/08	162.09	256/23	47/64
265	07	11	76	20	49	14.0	6.98	123.83	32	5.9			109.5/10.0	8.0/8.44	53.62/13.10	143.87/1.09	238.53/76.85
266	20	08	76	15	05	03.3	6.90	123.90	60	5.3			119.5/21.0	19.5/24.24	70.33/33.01	339.91/2.18	245.57/56.9
267	18	08	76	20	22	33.4	6.89	123.68	45	5.6			329.0/41.5	229.5/10.57	15.78/19.81	270.18/36.74	128.14/46.57

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
268	01	03	77	00	35	00.8	6.857	123.976	45	5.5			100/67.5	280.0/22.5	280.0/67.5	100.0/22.5	10.0/00.0
269	21	08	76	09	46	17.8	6.85	123.77	56	5.0			187.5/18.5	83.5/35.87	141.23/39.69	41.99/10.95	299.49/48.22
270	03	05	79*	16	42	15.2	6.849	125.244	529.3	5.0			154/64	270/17	247/54	112/27	8/34
271	25	09	76	03	30	03.9	6.83	123.80	47	5.7			100.5/35.0	352.0/24.38	138.44/6.53	42.04/44.22	235.02/45.04
272	21	11	77*	11	39	40.1	6.83	123.58	601	5.5			90/66	292/23	106/21	303/67	199/8
273	31	10	78*	11	21	01.1	6.807	123.863	554	5.4			308/50	66/21	25/52	272/15	171/32
274	02	03	77	09	53	07.5	6.80	123.70	51	6.3			2.0/51.0	184.5/38.97	4.0/7.0	199.0/80.0	95.0/1.5
275	30	01	78*	13	14	54.1	6.794	126.882	69.1	5.3			120/56	270/30	100/13	231/69	009/14
276	04	04	78	06	56	00.0	6.783	123.783	43	5.6			216.0/43.5	57.0/11.37	269.47/20.33	16.78/38.77	158.30/44.27
277	21	08	76	07	34	13.2	6.78	123.83	55	5.4			111.0/20.5	20.5/1.34	63.87/15.32	157.60/13.36	286.93/69.45
278	08	09	76	09	15	01.7	6.75	124.00	59	5.5			46.0/22.0	148.5/28.18	95.45/36.78	188.41/3.96	283.67/52.93
279	18	01	78	09	55	45.9	6.729	123.624	38	5.1			307.0/18.42	38.0/18.42	83.94/10.74	351.01/15.09	208.08/71.32
280	27	03	78*	18	33	38.9	6.709	123.558	602.4	5.2			296/39	196/10	238/37	343/19	96/39
281	18	10	76	02	50	53.5	6.70	123.96	70	5.3			185.5/16.0	293.0/46.36	336.12/18.47	336.12/18.47	81.95/39.25
282	18	08	76	05	58	32.3	6.69	123.82	41	5.2			333.0/16.0	72.5/30.0	115.26/9.08	115.26/9.08	218.58/55.25
283	05	10	78	20	07	26.6	6.686	123.549	65	5.1			253.0/8.0	351.0/44.72	291.29/36.58	291.29/36.58	155.15/44.17
284	01	10	78	13	23	50.5	6.682	123.982	46	5.6			298.0/00.0	20.0/00.0	73/0	163/0	0/90
285	30	08	76	02	00	11.6	6.67	123.95	40	5.3			281.0/0	101/90	281/45	101/45	10/0
286	08	11	75	14	53	32.6	6.66	126.79	96	5.6			286.0/29.5	108.0/60.49	108.0/16.0	290.0/73.5	17.0/0.0
287	08	07	80	04	39	29.4	6.63	125.77	178	5.9			261.5/10.0	46.28/77.82	76.0/35.0	268.0/54.0	170.0/4.0
288	14	08	78*	08	26	59.7	6.608	126.949	78.5	5.0			258/14	357/37	42/12	302/35	148.52
289	06	04	79*	20	27	19.9	6.548	126.76	121.8	5.4			170/50	90/40	270/05	90/85	00/00
290	26	10	75	10	41	33.2	6.54	126.81	61	5.9			294/35.0	80.0/48.82	97.0/8.0	352.0/71.0	186/17
291	10	07	75	18	29	15.8	6.51	126.65	81	5.9			280.0/29.0	41.0/42.90	73.0/11.0	331.0/53.0	169.0/33.0
292	28	04	79*	09	53	39.4	6.50	126.27	138.0	5.1			90/20	356/10	042/21	134/06	242/67
293	11	10	80*	22	10	20.7	6.493	126.692	76.6	5.3			248/10	153/28	204/27	108/12	355/58
294	17	08	76	05	18	49.3	6.47	123.90	32	5.5			98.0/22.0	3.0/12.17	48.85/24.46	141.89/6.65	246.06/64.54
295	25	08	79	00	55	06.4	6.444	125.723	33	5.1			212/80.50	32.0/9.50	31.0/52.0	212.0/36.0	121.0/2.5
296	02	02	79*	11	54	57.0	6.433	124.268	49.4	5.1			207/30	117/00	158/19	256/19	027/59
297	25	04	78*	00	34	15.1	6.414	123.98	33	5.4			287/30	101/69	101/25	281/65	10/0
298	25	04	78	00	34	12.0	6.414	123.995	33	5.4		5.3	224.5/39.50	110.5/26.26	260.29/7.87	160.91/49.70	256.76/39.21
299	13	03	81*	23	19	44.23	6.389	125.736	145.6	5.0			108/00	18/00	63/00	153/00	99/90
300	29	02	80	11	13	00.0	6.33	126.90	102	6.0			224.5/47.0	62.0/41.65	233.0/4	115/81.0	324.0/8.0
301	05	12	79*	23	04	56.0	6.289	126.254	509.2	5.2			106/06	286/84	106/51	286/39	016/00
302	26	10	76	12	51	29.8	6.28	126.31	84	5.6			101.5/39.0	316.5/45.33	298.1/3.32	36.02/71.42	207.0/18.26
303	16	08	76	16	11	07.3	6.22	124.10	33	5.4			274.0/66.5	96.0/23.49	276.0/22.0	96.0/69.0	5.0/5
304	21	05	78*	07	24	06.6	6.176	123.61	572.2	5.3			356/24	176/66	176/22	256/68	268/00
305	14	03	78*	01	57	03.7	6.138	126.885	81.6	5.5			306/22	198/138	258/44	159/10	62/42
306	09	12	79*	02	20	33.7	6.117	125.916	134.7	5.3			306/40	98/47	6/76	113/05	204/14
307	02	12	80*	02	33	59.9	6.083	126.83	87.8	5.1			208/32	320/30	264/44	174/00	83/44
308	02	01	80	20	58	45.5	6.00	126.13	75	6.0			313.0/83.5	135.0/6.5	135.0/52.0	316.0/40.0	44.5/00.0
309	16	07	80*	06	31	21.1	5.938	127.191	116.5	5.2			32/20	288/34	247/09	344/39	147/49
310	28	03	79*	16	54	24.5	5.917	126.15	110.6	5.1			202/40	322/30	171/04	257/55	76/34
311	21	09	80*	01	00	51.6	5.907	126.195	119.5	5.4			110/40	350/30	143/05	047/53	237/34
312	19	11	79*	22	17	20.2	5.86	125.295	85.0	6.1			120/37	300/53	300/08	120/82	30/00

NO. OF EQ.	DATE DY MO YR	TIME HR MIN SEC	EPICENTRE LAT(N)	EPICENTRE LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
313	13 05 81*	01 39 54.82	5.83	127.008	145	6.0							
314	19 02 79*	00 35 46.3	5.683	124.696	61.3	5.5			101/46	215/22	61/12	171/50	324/37
315	12 02 83	08 47 42.7	5.669	126.297	51	5.7			344/33	228/38	196/02	290/54	101/35
316	15 04 79	22 14 52.3	5.66	123.59	555	5.9		6.0	246.0/30.0	358.5/33.54	33.0/3.0	302.0/48.0	126.0/42.5
317	19 05 81*	17 11 32.82	5.61	126.59	107.1	5.3			284.0/23.0	144.5/60.83	254/64	119/19	23/18
318	14 07 83	19 47 46.5	5.56	126.45	43	5.8			136/11	229/20	274/06	181/24	019/69
319	20 02 83	10 49 54.1	5.55	126.25	61	5.9			42/18.5	298/35.87	258/35.87	357/41.0	157/48
320	02 07 80*	09 06 32.6	5.457	126.177	76.4	5.2			102/20	1/38.77	60/44	319/11.0	219/44.0
321	19 09 79*	08 24 30.7	5.411	124.00	497.3	4.9			242/20	340/20	019/00	290/29	111/61
322	13 01 78*	01 29 08.3	5.391	123.311	576.6	5.0			246/39	147/10	189/36	291/17	046/48
323	03 04 80*	16 34 24.6	5.345	125.365	212.3	5.6			150/66	330/24	150/20	330/70	60/0
324	15 03 83	19 58 30.4	5.33	126.57	41	5.7			225/10	075/80	255/55	75/35	345/0
325	07 10 81*	17 48 45.07	5.21	123.128	595.2	5.3		6.6	202/48	340.5/37.79	180/8.0	286.5/66.5	87/22.5
326	07 02 79*	21 02 06.8	5.21	127.295	129.0	6.2			123/60	303/30	123/15	303/75	33/0
327	12 08 80*	10 18 24.2	5.043	122.74	631.4	5.1			288/22	174/39	137/05	236/48	036/34
328	06 01 82*	12 38 37.99	5.0	126.86	473.3	5.1			114/10	19/30	72/29	333/12	222/58
329	13 03 77*	15 20 02.5	4.93	127.45	87.2	5.3			217/14	312/20	356/4	264/25	92/65
330	26 07 76	02 56 39.4	4.93	118.34	29	5.6			184/42	292/22	247/47	145/11	45/51
331	26 07 76	08 49 37.4	4.89	118.36	57	5.2			148.5/18	273.19/60.28	150/57	340/23	51.0/23.5
332	25 12 81*	00 28 15.79	4.76	118.477	39.1	5.4			162.5/21.0	30/60	130.0/60.0	358.5/21	262/20.5
333	26 03 78*	07 21 17.8	4.751	125.421	28.4	5.0			255/60	355/6	326/44	200/32	89/29
334	26 03 78*	06 50 28.6	4.745	125.422	50.3	5.2			112/28	010/21	59/35	153/06	247/52
335	25 04 78*	04 24 53.7	4.718	124.593	42.9	5.9			15/20	118/30	66/34	159/06	261/50
336	11 06 78*	10 22 05.1	4.693	126.613	77.6	5.6			345/20	230.50	302/51	191/17	88/34
337	17 10 81*	20 04 15.42	4.6	122.662	624.6	5.8			264/20	160/35	120/10	217/39	19/53
338	13 08 78*	10 12 50.3	4.55	126.630	112.8	5.5			198/56	291/02	139/33	261/37	22/34
339	10 04 81*	15 10 05.68	4.446	122.830	592.8	5.1			00/15	093/20	047/26	139/14	232/67
340	13 09 80*	17 13 46.2	4.319	128.328	67.1	5.1			133/66	313/24	133/20	312/70	43/00
341	29 08 81*	22 06 05.22	4.28	127.759	149.9	5.1			242/28	344/20	201/06	295/33	102/53
342	16 10 81*	14 40 56.72	4.27	128.33	56	5.3			207/36	305/16	258/30	164/06	063/59
343	08 09 78*	12 28 39.7	3.951	126.448	46.4	5.4			263/50	39/30	238/10	350/66	143/22
344	28 01 80*	10 23 56.4	3.749	128.48	53.5	5.0			164/33	270/26	126/05	220/42	29/48
345	30 01 80*	00 38 06.9	3.734	122.543	605.6	5.1			51/19	231/71	231/26	51/64	141/00
346	11 01 80*	12 39 42.6	3.644	128.264	56.4	5.0			106/04	203/52	138/39	258/30	12/38
347	09 04 79*	06 31 52.3	3.629	122.07	614	5.1			277/34	152/40	123/04	220/59	031/30
348	03 05 78*	02 29 54.8	3.573	127.246	42.6	5.7			150/40	330/50	150/86	[illegible]0/04	60/00
349	20 05 81*	05 42 44.93	3.53	122.669	554.3	5.1			317/20	52/14	274/06	[illegible]/22	183/63
350	23 12 79*	08 33 59.1	3.502	126.846	33.0	5.8			114/20	295/70	114/65	294/25	24/0
351	01 01 80*	19 19 05.9	3.491	126.716	54.2	5.0			250/70	056/19	240/24	050/65	147/04
352	26 03 81*	21 30 04.7	3.412	127.998	60.5	6.1			260/20	354/10	216/08	308/20	105/68
353	18 02 78*	03 59 05.6	3.383	122.9	522.1	5.1			350/20	170/70	170/25	350/65	80/0
354	14 02 81*	07 31 33.69	3.333	128.128	154.9	5.6			231/30	338/26	195/03	286/43	100/48
355	24 10 81*	10 51 52.35	3.30	127.291	75.7	5.1			280/20	24/34	65/08	327/39	168/47
356	19 08 79*	16 00 12.60	3.213	128.099	115.0	5.4			147/27	247/20	105/05	198/27	8/55
357	31 08 79*	20 35 12.6	3.211	126.995	72.9	5.2			84/21	186/29	226/02	132/38	323/51
									250/23	349/20	209/01	300/31	115/57

NO. OF EQ.	DATE DY	MO	YR	TIME HR	MIN	SEC	EPICENTRE LAT(N)	LONG(E)	DEPTH KM	MAGNITUDE MB	ML	MS	POLE OF 1st NODAL PLANE TREND/PLUNGE	POLE OF 2nd NODAL PLANE TREND/PLUNGE	AXIS OF COMPRESSION P TREND/PLUNGE	AXIS OF TENSION T TREND/PLUNGE	NULL AXIS B TREND/PLUNGE
358	12	08	80*	14	19	44.8	3.191	128.471	133.7	5.1			58/15	298/61	258/23	28/54	155/24
359	20	12	79*	14	23	22.3	3.0661	122.641	551.5	5.0			100/20	358/30	052/37	317/05	219/52
360	01	02	80*	10	50	35.6	3.065	125.465	143.9	5.1			120/60	120/60	120/15	300/75	30/00
361	16	03	80*	10	33	09.4	3.0594	126.94	45	5.6			230/50	230/50	300/48	185/20	082/36
362	30	08	81*	10	00	02.36	3.05	124.635	308.1	5.0			202/40	202/40	202/85	022/05	122/00
363	24	05	80*	08	23	45.6	3.035	126.466	68.5	5.2			130/29	130/29	091/06	185/37	354/51
364	10	04	79	01	42	22.1	3.02	127.01	40.0	6.5			279/24	34/43.51	71/13	326/41	170/37
365	14	12	79*	11	08	26.2	3.089	127.088	56.0	5.3			280/46	138/38	300/05	197/69	032/20
366	29	01	82*	11	20	11.46	6.77	127.07	70	5.0			160/50	253/02	104/31	220/34	345/40
367	22	03	82*	07	12	51.41	6.15	125.93	111	5.0			222/40	90/30	232/6	133/54	326/34
368	27	11	82*	11	13	51.62	5.3	125.758	147.4	5.1			25/64	205/26	25/19	205/71	115/00
369	08	11	82*	18	31	34.71	4.83	127.286	159.7	5.4			20/30	130/30	75/45	345/00	255/45
370	04	06	82*	15	21	33.1	4.09	124.523	328	5.7			340/12	243/30	199/11	296/32	88/57
371	01	02	82*	17	51	09.41	5.28	126.333	134.8	5.1			20/30	113/4	70/21	332/17	211/60