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LIMA DISASTER PREPAREDNESS REPORT

VOLUME VII:

Education

by

Robert Gersony

in collaboration with

Raymond Lynch
Tony Jackson

for

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The Lima Disaster Preparedness Report has 15 sections:

Volume I:	Methodology Employed
Volume II:	Port of Callao Infrastructure Security and Emergency Evacuation Needs
Volume III:	Electricity
Volume IV:	Water and Sewerage
Volume V:	Heavy Equipment Rehabilitation and Maintenance
Volume VI:	Airport and Aircraft Resources
Volume VII:	Education
Volume VIII:	Food
Volume IX:	Housing
Volume X:	Health
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Volume XII:	Critical Abstracts from the Literature: A field perspective on major earthquakes: Peru, 5-31-70 Nicaragua, 12-23-72 Guatemala, 2-4-76
Volume XIII:	Review of Earthquake Prediction by Brian Brady
Volume XIV:	Other Issues
Volume XV:	Summary

FOREWORD

This is one section of a fifteen volume report concerning disaster preparedness in Lima, Peru. It was researched in Lima by a team of disaster specialists during the period July - November, 1981, for the Agency for International Development's Office of U. S. Foreign Disaster Assistance and USAID Mission in Peru. The report is supplemented by a considerable number of maps, charts and resource documents which are located in the USAID/ Peru Disaster Preparedness Resource Library in Lima.

June 1982

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EXECUTIVE SUMMARY

This report focuses on two disaster-related aspects of educational activities: the addition of a new, disaster preparedness feature to the regular primary and secondary school curricula of the Ministry of Education; and some modest steps which can be taken in disaster preparedness and post-disaster operations concerning school infrastructure.

Encouraged by the Brady prediction that a severe earthquake could strike Lima in the Summer of 1981, the Ministry of Education committed itself to a program of curriculum development for disaster preparedness. A four-teacher team worked for about six months using such disaster preparedness literature as it could identify. Technical assistance in this effort was sought from USAID, and supported by both the local AID Mission and OFDA/ Washington. However, a qualified expert could not be identified or was not available during the desired time-frame. Thus, the team of teachers carried on as best it could in writing teachers' guides, texts for slide presentations, and illustrated texts. Because these materials had not been approved by the Ministry, they could not be made available for review as part of this study and may not have been completed and published because of time and resource constraints.

The private sector has published a 32-page booklet. "Los Sismos: Que Hacer Antes, Durante y Después" which is quite suitable for youngsters. This clearly illustrated low-cost pamphlet was designed especially for Lima and could be used to initiate some efforts. In the meantime, materials which are

more elaborate or less elaborate, depending on the need, could continue to be developed.

A program of education in the schools is worth pursuing. USAID could add additional vigor and momentum to the Ministry's initiative by providing resources to assess the work completed by the Ministry's team and the applicability of the "Los Sismos" booklet; make funds available for procurement of the booklet, if appropriate; provide for the production, under contract, of other materials desired by the Ministry; and provide management assistance in the organization and initiation of this effort. For this purpose, specialists in the substance of earthquakes and earthquake-preparedness; and in management and organization, would be most appropriate. Specialists in curriculum development could be identified in Lima.

In addition to this major program, the Ministry of Education could assist in Tsunami evacuation education efforts in El Callao; and could consider on a trial basis the integration of Red Cross demonstration training sessions in first aid in their classes throughout Lima.

Infrastructure

A 1977 study by the National Engineering University's Ing. Julio Kuroiwa suggests that in a severe earthquake 20% of the primary schools in Lima would collapse and 30% would be irreparably damaged. The low-income tugurio areas contain the most vulnerable schools. If the earthquake were to occur during the 25% of the week when the schools are occupied, there would be considerable death and severe injury to children. Paul J. Flores, a Civil Defense consultant from California who worked in cooperation with Peruvian Civil Defense, reached similar conclusions.

This study recommends to USAID/Peru two disaster preparedness actions with respect to the schools:

(a) Conduct of a quick, "mini-research" survey of the schools, in cooperation with the Ministry of Education. This survey would provide an inventory and maps showing location of schools, student population, type of construction, and a quick assessment of their vulnerability. This study would be helpful in disaster mitigation efforts, but would also be important in relief and reconstruction efforts after a severe earthquake. According to the Ministry's disaster preparedness officer, there are no systematic maps or inventories of the schools at present.

(b) Encouragement of AID itself and other funding agencies to provide relatively modest amounts of money to reinforce the most vital evacuation and escape routes from the most vulnerable schools. The purpose of this activity would be to provide school children with a minimum amount of time to escape death or severe injury and to reach safety. It is recognized that it is not within the financial means of the Government of Peru or the donors to demolish current schools and rebuild seismic resistant ones.

Post-Disaster Operations

Re-establishment of the educational system after an earthquake would be a high priority. Parents would be anxious for their childrens' education to continue and for their children to be productively occupied while parents attend to pressing reconstruction needs. The Ministry of Education would be anxious to re-establish its services and to enable its teachers to resume their teaching duties.

For assessment, planning and implementation the availability of an inventory and map showing the location of the schools and whose development is recommended above as a preparedness measure -- would be most helpful.

USAID helped to provide for the prompt re-establishment of the schools after the Guatemala (1976) earthquake through the provision of 300 pre-fabricated BUTLER building units. After considering the advantages and disadvantages of the use of pre-fabricated buildings, the report provides the narrative recollections of the manager of the Guatemala effort, Dr. Howard D. Lusk, and such background documentation as could be located at this time.

A list of contacts in the Ministry of Education appears at the conclusion of the report.

INTRODUCTION

One approach to disaster mitigation which since the Brady prediction has begun to receive increasing attention in Lima is the use of the school system to provide training and orientation to students of different ages and educational levels. Such training and orientation assists in explaining the nature of disasters which could strike Lima; steps which can be taken to best prepare for such disasters; and first-steps to take after a major disaster.

USAID/Peru and the Office of Foreign Disaster Assistance (OFDA) in Washington considered the provision of technical assistance in the education field early in 1981, although because of difficulties beyond their control were unable to provide assistance.

After a disaster, the re-establishment of the educational system of the affected area is always a priority. Parents are anxious for their children's education to continue and for their children to be productively occupied while parents attend to pressing reconstruction needs. The Ministry of Education is anxious to re-establish its services and to enable its teachers to resume their teaching duties.

While the re-establishment of education does not share an equal priority with emergency medical attention, provision of food and water, and other life-preserving sectors, it nevertheless should be examined early in the post-disaster assessment process.

This section proposes some modest steps which could begin to establish

a basis upon which disaster planning could be conducted. In addition a USAID post-disaster experience from the 1976 Guatemala Earthquake Recovery Program which could be useful as a point of reference is documented.

This effort involved the construction of three hundred replacement schools in the Guatemala Highlands, in a short period of time, using pre-fabricated BUTLER buildings from U.S. military surplus supplies. Further documentation by OFDA of this effort has been recommended by AID/Peru officials. In the meantime, the data contained in this section of the report relies heavily on the recollections of Dr. Howard D. Lusk, currently USAID/Peru Deputy Director, who served as USAID Education Officer in Guatemala and was the principal manager of the BUTLER building program there. In addition, four volumes of documentation concerning the program are available in the USAID/Peru Disaster Preparedness Resource Library.

DISASTER-RELATED CURRICULUM DEVELOPMENT IN PERU

Encouraged by the prediction of Dr. Brian T. Brady that a severe earthquake might strike Lima in the Summer of 1981, the Ministry of Education, for the first time, committed itself to a program of curriculum development for disaster preparedness. From June through December, 1981, four Ministry teachers were assigned full-time to prepare curriculum materials. These teachers had considerable classroom experience, although none had been involved professionally in disaster preparedness activities.

During its initial organizational phase, the teachers gathered a number of documents -- not all directly applicable to their task -- concerning disaster preparedness. Working as a team, they developed draft materials for both primary and secondary levels. These materials include teachers' guides, slide presentations with texts, illustrated texts for students, and other materials. Because the materials had not yet been officially approved at the time of this study, they could not be made available by the Ministry for review.

During the month of November 1981, the team scheduled a test of the use of the materials it had developed. The test was to utilize 60 teachers at three different schools. However, the test may not have been implemented because of strikes and related problems which emerged in the second half of October.

The month of December was to have been dedicated to the revision of the materials and their preparation for publication.

From casual observation, it appeared that the teacher's manual was a collection of four scientific articles concerning earthquakes, three published in Spanish and one in English. The lengthy technical descriptions of earthquake phenomena and, in the case of one article, use of the English language, might present some problems in assisting teachers to reach the goals desired by the team. Delays in the program may have had the result that it could not be completed unless the four teachers' appointments were renewed for another six months. Thus, the work may remain uncompleted. In addition, funds for publication of the materials had not been appropriated.

USAID Participation Sought

During its visit to Lima, the International Disaster Assessment Team, which included an OFDA representative contacted the Ministry's Disaster Preparedness Director, Dra. Lia Fernandez Arriaran M., and USAID's assistance was sought. In particular, the Ministry requested a curriculum development specialist to assist and guide the Curriculum Development Team in the preparation of both teachers' manuals and didactic materials.

This proposal, which had the energetic support of the USAID/Peru Mission and OFDA, was the subject of considerable discussion between Lima and Washington. An insuperable problem, however, was that a qualified, bilingual U.S. expert in curriculum development for disaster preparedness could not be identified or, when identified, was not available when needed for the program. As a result, it was not possible to provide the requested technical assistance to the Ministry of Education.

As part of the conduct of this disaster preparedness study, the Mission Disaster Relief Officer (MDRO) requested that an assessment of the proposed project be made and that specific suggestions be provided in the final report. Based on the suggestion, meetings were conducted with Dra. Fernandez, the Curriculum Development Team, and other officials. The previous files on this subject were reviewed and, to the superficial degree permitted, the materials developed by the Minsitry were examined. Of course, the subject of disaster preparedness education was discussed in meetings with officials from various backgrounds outside the Ministry as well. The following are the principal conclusions of this assessment.

1. The commitment by the Ministry of Education of four teachers to the development of the first disaster preparedness curriculum is an important step and one which would have warranted USAID technical support, as both USAID/Peru and OFDA concurred. It demonstrates the Ministry's real interest in adding this new feature to its curriculum. Unfortunately, for reasons outside the control of either, it was not possible to identify the type of expert who was sought in that time period. In addition, when AID suggested the provision of a qualified available Chilean expert, the Ministry indicated that a U.S. expert was preferred.

2. While they have some deficiencies, some disaster preparedness materials have neen produced by the Ministry which could have been, and perhaps still could be, used for classroom teaching.

However, a privately published low-cast illustrated booklet of 32-pages, which was available at that time called "Los Sismos: Qué hacer antes, durante y después" (see Appendix) might also be quite suitable for youngsters.

The booklet, developed in the private sector with technical assistance from the National Civil Defense System, provides some basic recommendations on what to do before, during and after an earthquake. It explains the origin of earthquakes. In the absence of more elaborate materials desired by the Ministry, this clearly illustrated booklet might serve quite adequately and at low-cost to initiate a program. More or less elaborate materials can always follow.

3. At this time, a program of education in the schools about disaster preparedness is worth pursuing, and this report recommends such pursuit be encouraged by AID with the following aims:

(a) Assessment of the final products or current status of the Ministry's in-house Disaster Preparedness Team, if any.

(b) Assessment of the value of the "Los Sismos...Qué Hacer" booklet to determine its applicability: grade levels for which it is suitable; type of teacher training required for its use, etc.

(c) Development of alternative options for further elaboration of materials. One option which ought to be considered is the production under contract of the materials desired by the Ministry; or the completion of the tasks already undertaken in the same manner. The Peruvian authors of the privately-published booklet would be potential participants in this effort, which could probably be implemented at low cost. Ing. Raúl Ríos Jimenez of the consulting engineering firm of GALLEGOS, RIOS, CASSABONNE et al ought to be consulted for advice in the process. This activity would lend itself to the kind of "mini-research" project conducted for the food sector of this study.

(d) Management assistance to the Ministry in the organization of a program of teacher training and implementation of curriculum developed through this effort.

The need for a curriculum development specialist per se is a rather secondary priority — perhaps 20% of the problem. The curriculum specialist is really the person who packages the information which must be communicated, using the theory and practice of the most effective techniques for doing so.

What must precede the packaging is the determination of what should be communicated. Such questions as: what must the teacher know in order to provide effective instruction; what messages should be communicated to the students -- substantive ideas and instructions; what experience from previous earthquakes should be integrated in such a program, should be considered.

4. Other educational activities

In addition to the major thrust of its new curriculum in disaster preparedness, the Ministry could participate actively in two special projects:

(a) The El Callao Tsunami Evacuation education effort, recommended elsewhere, could benefit substantially from the Ministry's participation.

(b) First-aid training could be provided in the schools by the Peruvian Red Cross. Demonstrations and presentations could be undertaken by the Red Cross" training staff on a regular basis.

EDUCATIONAL INFRASTRUCTURE

Primary and secondary schools in Lima were not studied as part of the conduct of this disaster preparedness survey. However, some discussions on this subject were held with representatives of the Ministry of Education. In this section of the report, two suggestions concerning infrastructure are presented.

1. Disaster Preparedness

One study which provides an overall view of Lima's vulnerabilities to a severe disaster is Ing. Julio Kuroiwa's Protección de Lima Metropolitana Ante Sismos Destructivos, published in 1977 by the Universidad Nacional de Ingeniería. This study examined a 10% sample of 1,417 schools in Lima. Of the 144 schools examined, 122 were primary schools and 22 were secondary schools.

The review suggests that 20% of the primary schools would collapse immediately in a severe earthquake, while an additional 30% would be so severely affected that they could not be reoccupied or repaired. In summary, about 50% of the schools would be permanently out of service.

Of the secondary school, the overview suggested that 5 % would collapse immediately. But 65 % would suffer damages so severe that they would be rendered unusable.

The study reported that the low-income inner-City areas known as tugurios contain the most vulnerable schools. The loss of life in a disaster of the type foreseen by the Kuroiwa study — should the earthquake occur during the 25% of the week when the schools are occupied — is very troubling.

Paul J. Flores, a Civil Defense official from California who acted as an advisor to the National Civil Defense system, highlighted the danger to schools in his final report:

> It is estimated that 50% of the Peruvian population is of primary and secondary school age. A greater number of the buildingsthat house primary and secondary schools are in buildings hundreds of years old that have either suffered damage or have been weakened by other historic earthquakes. Of the initial studies done by the Ministry of Education, with funding from Civil Defense (PLAN ALFA CENTAURO), only 30% were analyzed. Of these 70% were considered dangerous and could suffer total collapse. An initial survey of these buildings showed that there is not sufficient space around these buildings to conduct an adequate evacuation since these are old colonial homes or convents located in the more densely populated parts of Lima. The Ministry of Education does not proceed with additional studies of the risk or adequate programs of reinforcement because they lack funds. Alternatives to this situation have not been considered.*

Thus, the precarious situation of hundreds of schools has been noted as a subject of serious concern by Peruvian and U.S. advisors as well. It was not possible to acquire copies or review the work materials upon which the conclusions are based. But it seems very likely that to a large extent these conclusions are warranted.

Two types of actions have been recommended by U.S. advisors and National Civil Defense officials:

(a) Further funds should be provided to produce additional studies of risks in the schools.

(b) Funds should be provided to reinforce critical areas of the schools — if not to avoid permanent damage, then certainly to permit adequate time

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* From Final Report - Contract PDC-0012-5-00-1052-00, Paul J. Flores, Final Draft, August, 1981. Reference for Ministry of Education building survey report indicated in excerpt not included.

for evacuation of the children.

(c) Funds should be provided to construct new schools, or to provide temporary schools while the Government of Peru constructs permanent schools in current school sites.

At a minium, there should be an inventory of schools in Lima and El Callao. According to two Ministry of Education Civil Defense and Planning officials, there is no map and up-to-date inventory of the schools in Lima. If this is true, it is a major impediment to any kind of pre- or post-disaster analysis of the educational infrastructure of the City. To improve this situation, a "mini-research" project is proposed; that is, under the "second phase" of USAID's comprehensive Disaster Preparedness Program initiated with this study, a team of Peruvian specialists should be contracted to develop an inventory of schools and a map of Lima -- by district -- indicating the location of the schools, the student population and hours of operation of each, the type of construction, and a quick assessment of its vulnerability. Significant assistance could be provided to this effort by the Ministry of Education. This would be a short-term, intensive activity carried on by a team of contractors, similar to the "mini-research project" on the Lima food supply system described in the food sector of this report. Its cost would not exceed US$5,000 - $10,000, and it could be completed in a three month period. This is certainly a <u>minimum requirement</u> which implies no further funding commitments by USAID or any particular follow-up action but which establishes a certain information base essential for any discussions.

With reference to the main problem, however, there is a self-evident dilemma:

In-depth studies of building risk will confirm that hundreds -- perhaps over 200 primary and secondary schools -- are threats to the lives of students in the event of an earthquake. Even if the actual number is 50% less, it is considerable. Yet it is doubtful that significant funds will be invested to rebuild or rehabilitate these schools. If so, then an international organization should be persuaded to commit some funds to eliminate the most dangerous risks in at least some of the schools. That would be a step in the right direction. Under some of its future programs, UNICEF, the World Bank or AID might be persuaded to provide a small percentage of its funds to this end. But the issue will require advocacy, contacts, meetings and briefings. Further surveys would not seem to be required because for the probable amounts of funds which would be available, Ministry of Education veterans could probably quickly name those which present the greatest hazards.

Thus, in a follow-on "second stage" of the kind of comprehensive activity initiated with this study, further discussions and advocacy on this issue should be included. It is a worthwhile area of concern <u>even if</u> the possibility of success in this effort is less than in some other areas.

2. <u>Post-Disaster Operations</u>

The re-establishment of the school system after a disaster would offer opportunities for international donor assistance. In complementing resettlement policies which might be implemented by the Government, assistance in accelerating the provision of educational services for children could be vital components of the Government of Peru's programs.

If the population of the most affected areas will resettle in expansion zones (such as Canto Grande, for example), one of its chief concerns will be: will vital health and education services be provided? USAID can help to reassure families forced to adjust to new homes by assisting in the emergency erection of schools and health posts.

USAID has conducted a similar program in the past, which was managed by USAID/Peru's current Deputy Director, Dr. Howard D. Lusk. The following narrative experience as provided by Dr. Lusk:

Summary of Comments

By Dr. Howard D. Lusk

The Guatemala Experience

After the 1976 earthquake in Guatemala, USAID financed the acquisition and construction of about 300 Butler buildings, the majority of which were used to replace schools which had been destroyed in the disaster. Some were also used as health posts.

1. Background

After the 1976 earthquake, there were no ideas readily available for replacing the large number of schools, health posts and other public buildings which had been destroyed. The Butler Buildings as an option were discovered almost by accident as the USAID/Education Office thought through the possibilities for assisting this sector.

Dr. Lusk was in Washington and talked with a scientist at the Bureau of Science and Technology who was working on low-income housing. He referred Dr. Lusk to a USNavy project which was also looking into low-cost housing for military personnel. This group had a computer which contained all the information on building units available to the military.

Based on an assessment of the value of the buildings, and after documentation of their cost:effectiveness, 300 such buildings (which could provide about 600 classrooms) were procured at a delivered cost of about US$4,000 each. Delivery to Guatemala was contributed (except for direct costs) by DELTA Line and Government of Guatemala vessels.

AID paid only the military's acquisition cost for the buildings. As the Vietnam conflict was winding down, the military found that it had a surplus of the buildings. The actual stocks of building parts were located in Mississippi and California, and Dr. Lusk visited the Beloxi, Mississippi installations on his return trip to Guatemala.

Of the first 300 buildings purchased, 275 were used for schools; the remaining 25 were used for health posts. This

contribution replaced roughly 50% of the units which had been lost. Construction of the first 300 buildings was completed approximately eight months after Dr. Lusk's trip to Beloxi.

2. Logistics

The most difficult part of the program was the logistical support for it. Upon seeing the unassembled boxes (19 for each building) in Mississippi, it was clear that this would be a "logistics nightmare".

Milton D. Freundel, Director for Management, ROCAP/AID Guatemala and Guatemala Mission Engineer Francis Kenefeck, developed some creative solutions to handling the complex collection of boxes. Part of the solution involved hiring some unemployed women around the Port to spray-paint number-codes on the boxes.

3. Sites

Where possible, the cement slab on which the previous school had been constructed was used as a foundation for the Butler building. Where slabs were too large or small, or where alternative sites were required, these were developed in two stages:

(a) A team which included a USAID contractor/staff, an engineer, and ministry representatives made the initial assessment;

(b) The regional education offices followed up with more detailed site planning.

Assisting in the selection of sites were: Oficina de Planificación Human Resource Development section, headed by Ing. Jorge Serrano; CONACE - the Ministry of Education school building department; and representatives of the Ministries of Health and Education.

As the site selection process was underway, the initial Butler units arrived in Guatemala. The first ones were erected as training exercises, a strategy discussed later in this report.

4. Management

At the outset, AID was almost directly operational in the construction of the units. Thereafter, the Ministry of Public Works undertook the responsibility under an especially capable Vice-Minister, who could probably still be located in Guatemala.

5. Construction

(a) The direction of construction was carried out by teams of Guatemalans expecially trained in Butler Building assembly by U.S. Navy SEABEES. Spanish-speaking SEABEES were selected to assist the Guatemalans in gaining expertise in these skills.

(b) As support material, the instruction booklets which came with the buildings were translated into Spanish. (See Books A and B supplementing this volume for Spanish and English versions of the instructions.) The Ministry of Public Works also developed a picture/training manual for the workers, Each team, which consisted of one foreman and three workers, received instruction in the assembly of the buildings and in the use of these manuals.

(c) The Ministry of Public Workds did an exceptional job in assembling the buildings. They systematized the process and brought greater efficiency to it. In the end, the Government of Guatemala with its own funds purchased an additional 100 buildings for other uses.

(d) Another booklet produced under the program showed how to landscape and maintain the buildings. (see Book C supplement to this volume).

(e) Book D supplementing this volume provides architectural drawings illustrating the adaptation of the buildings to serve as health posts.

(e) Problems Encountered

- In many cases, when slabs were not appropriate, new slabs had to be built, involving the grading and leveling of ground, etc., and this slowed up the process considerably.

- The original program strategy assumed that the trained "teams" (foreman + three workers) would be able to get voluntary contribution of manual labor by members of the local community. In practice, this did not work: people were too busy reconstructing their homes, attending to their agriculture, or in other endeavors.

- Originally, AID thought the Butler Buildings were all weatherproofed and would not deteriorate through exposure to the elements. This was not true. The buildings required painting and maintenance to prevent deterioration.

- Supplementary funds for minor improvements which could be implemented locally would have been useful. With a small investment, the life or efficiency of the buildings could have been significantly improved. In a future situation, a special account providing for such funds should be established.

(f) Optional Features of Butler Buildings

- Each building came with its own wiring, which AID decided to include even for buildings in towns where electricity had not yet reached. Thus, at such time as electrical power reached the rural villages, the buildings would not need to be readapted.

- Insulation kits were not used. The kit materials fit between the braces and include slats of plywood.

(g) Contract Construction a Major Problem Some of the construction work for the Buildings was contracted out to private contractors in Guatemala. Based in part on lack of previous track records, some of these contractors did not perform as well as others (Note: Same occurred in Peru 1970 case). In the end, however, many contractors produced high quality results.

(h) Some project materials were developed by a contract engineer, Mr. George Hoover. He assisted the Education Office in development of drawings, specifications, procurement procedures, and other materials.

It is difficult to argue with Dr. Lusk's assertion -- supported by other USAID/Guatemala 1976 officials -- that it would be worthwhile to attempt to search the files of USAID/Guatemala, the Ministry of Communications and Public Works, the Ministry of Education and the Ministry of Health -- to complete the collection of documentation which has been begun with this report. It may not be difficult to do so, and a stop-over to do so of three to four days in Guatemala in the course of a future research or travel effort would be a good investment.

Appropriateness of Prefabricated Schools/Health Posts in Peru

The use of prefabricated structures is not a desirable one if it can be avoided, in the view of Dr. Lusk and the team conducting this study. In normal times, it would appear a better strategy to employ locally produced materials and labor to the maximum extent.

After a disaster, the employment of salvaged materials should be maximized as well.

But the demand for the limited supply of building materials and even materials salvaged from rubble exceeds the supply by such a great degree that the use of locally available materials for rebuilding schools and health posts competes with the acquisition needs of individual disaster victims. In effect, it tends to put inflationary pressure on the economy and specifically to increase the cost of available materials. One of the commodities affected in the same way is labor, whose cost is also a function of supply and demand. Finally, for vital public facilities, the long time it takes to erect buildings using normal procedures exceeds

that demanded by the community to be served; it may be more important to have a school for the children to attend in a new settlement as soon as possible rather than as locally-produced as possible.

In the end, that is a judgment which must be made by the Government of Peru and international donors after a disaster. However, based on the Guatemala experience, it is felt that prefabricated buildings such as the BUTLER type -- especially where costs are so favorable -- might be a useful option to consider. The quality of these buildings was good, and, in effect, they were permanent structures. The Government of Guatemala, which was faced with the enormous burden of post-earthquake reconstruction, purchased 300 additional BUTLER buildings with its own funds, doubling the size of the original program. An audit report (see Review of the Literature) in 1981 -- about five years after the Guatemala program was concluded -- indicated that the buildings were providing long-lasting service in Guatemala. It might only be recommended that if the BUTLER - type building is used it be painted immediately upon erection. Also, there are numerous optional features, including prefabricated insulation kits, which would help to adapt the buildings to Lima's climate.

Should such a program be undertaken, Dr. Lusk, Contract Engineer George Hoover, Mr. George A. Hill and other Guatemala (1976) AID officials might be contacted for further details.

LIST OF CONTACTS

Dra. Lia Fernandez Arriaran M.
Civil Defense Representative
and Directora, Bienestar de Personal
Ministerio de Educación
Fifth Floor - Room 502
Avenida Avancay
Parque Universitario (Sin Numero)
Lima
Phone: 275680, Anexo 206

Curriculum Development Team
Under Dra. Fernandez' Sypervision

Profesora Guadalupe Nuñez Umeres
Profesora Elsa Morayma Coronado Reys
Profesora Fanny Alvear Pickmans
Profesora Maria Victoria Limaco Alargo

APPENDIX

"LOS SISMOS: QUE HACER ANTES, DURANTE Y DESPUES"

"EARTHQUAKES: WHAT TO DO BEFORE, DURING AND AFTER"

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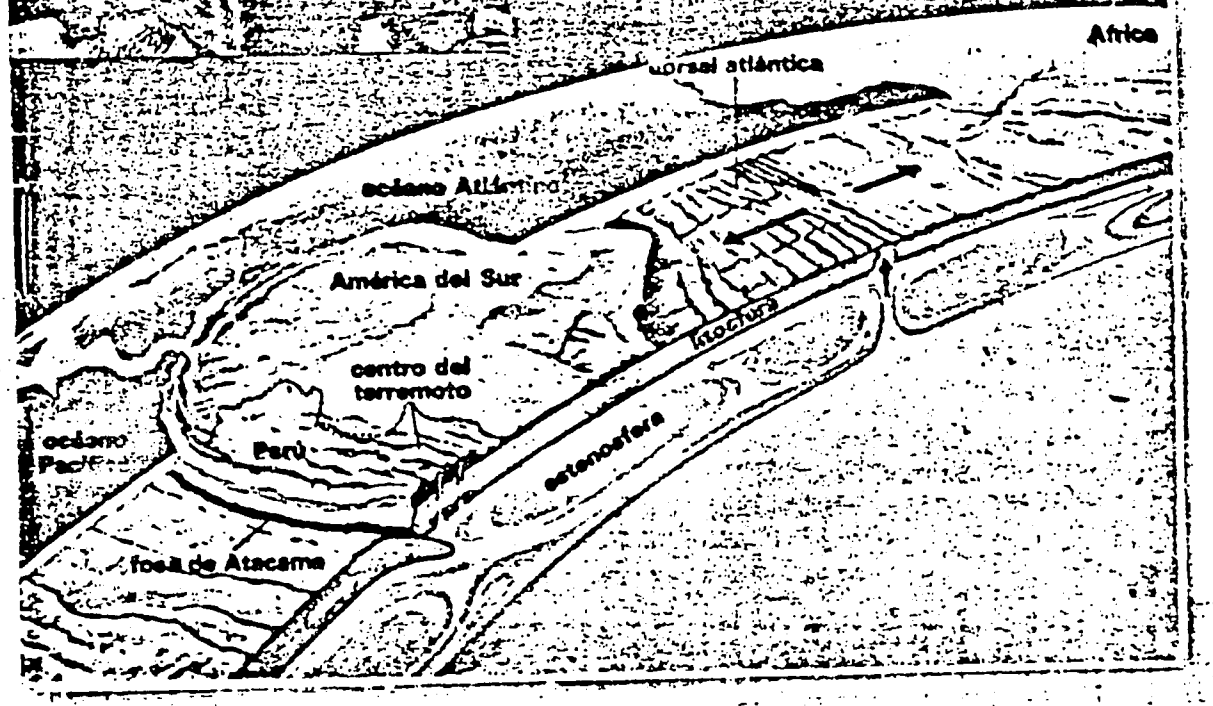
EDICIONES Y PROMOCIONES EDUCATIVAS

LOS SISMOS

QUE HACER

ANTES DURANTE Y DESPUES



NOTA DE LOS EDITORES

Con el presente folleto damos inicio a la serie "CIENCIA Y REALIDAD", la cual está destinada a divulgar, en la forma más asequible posible, temas importantes del conocimiento científico y de la realidad de nuestro país.

"LOS SISMOS" nos lleva, en forma didáctica, a comprender que vivimos en una zona eminentemente sísmica; y que debemos estar educados para afrontar estos fenómenos. Esta tarea debería ser asumida, con toda seriedad, por las instituciones públicas y privadas. En este sentido, ARTEX EDITORES, pone en sus manos este edición que pensamos será de gran utilidad no solamente para los estudiantes sino para el público en general.

INTRODUCCION

No obstante que el tema es muy amplio y complejo, hemos tratado de exponerlo de la manera más sencilla y didáctica posible.

El folleto comprende dos partes principales:

En la primera parte, tratamos de explicar, con las teorías más aceptadas en la actualidad, la configuración y evolución de la tierra y cómo ésta determina la actividad sísmica. La nueva concepción de nuestro planeta explica que existe una configuración dinámica de la estructura de la tierra (Deriva Continental y Tectónica de placas), concepción diferente a las ideas estáticas sobre la tierra dominantes hasta los años sesenta. Nuestro país se encuentra en una zona donde se produce uno de los fenómenos principales de la tectónica de placas (Subducción de la Placa de Nazca), lo que hace que nos encontremos en una zona de intensa actividad sísmica. Explicamos, también, las principales características de los sismos como la magnitud y la intensidad; y finalmente una de las consecuencias más saltantes de éstos: los maremotos o tsunamis.

En la segunda parte, tratamos de representar gráficamente los principales criterios del Sistema de Defensa Civil para afrontar los sismos. Señalamos; los efectos de los sismos y las previsiones que se deben tomar; qué hacer durante un sismo en diversos lugares como viviendas, edificios, colegios, etc.; finalmente, lo que se debe hacer despues de ocurrido uno de estos fenómenos.

Debemos agradecer las ideas y colaboración del Ing. Raúl Ríos Jimenez, la revisión del manuscrito por el Ing. Mateo Casaverde Río (Instituto Geofísico del Perú) y por el Ing. Eleodoro Bellido Bravo (Universidad Nacional Mayor de San Marcos). Además, hacemos extensivo nuestro agradecimiento a todas las personas que de alguna u otra manera han contribuido a la realización de este folleto.

Lima, Setiembre de 1981

Erland Valencia.
Niels Valencia.

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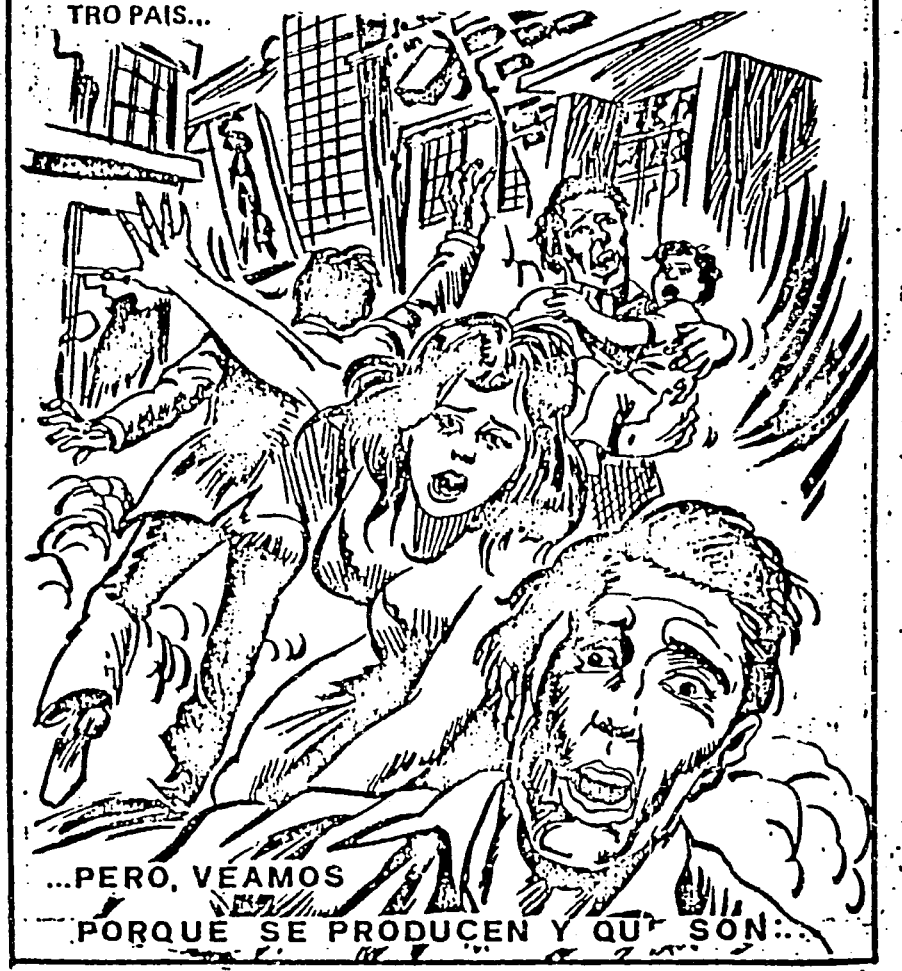
DERECHOS RESERVADOS
PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL
PRIMERA EDICION: SETIEMBRE DE 1981, Lima Perú

LOS SISMOS

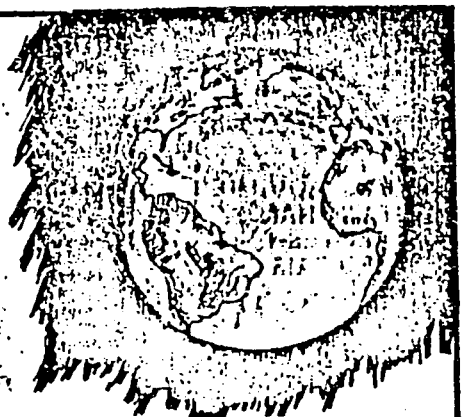
Por: Erland Valencia y Niels Valencia

LOS MOVIMIENTOS SISMICOS (TERREMOTOS Y TEMBLORES) HAN ASOLADO, DESDE TIEMPOS REMOTOS, DIFERENTES LUGARES DE LA TIERRA: ENTRE ELLOS NUESTRO PAIS...



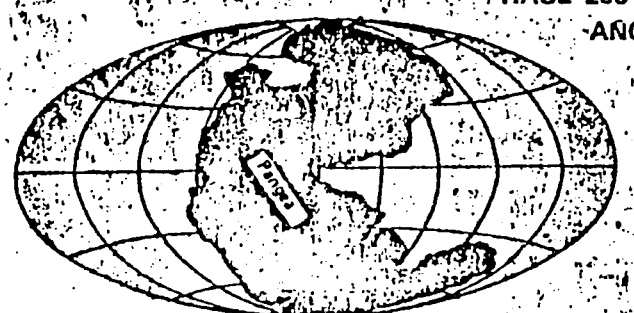
...PERO, VEAMOS PORQUE SE PRODUCEN Y QUE SON...

NUESTRO PLANETA, LA TIERRA, TIENE APROXIMADAMENTE 4,500 MILLONES DE AÑOS...



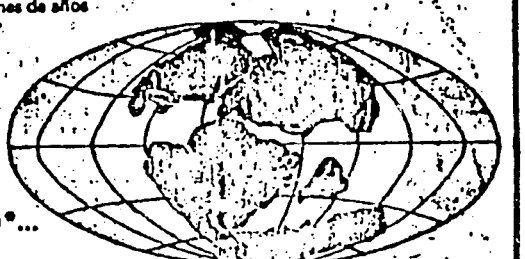
Y SU CONFIGURACION (CONTINENTES Y OCEANOS), NO HA SIDO SIEMPRE LA MISMA QUE CONOCEMOS ACTUALMENTE...

SE SABE AHORA, QUE HACE 200 MILLONES DE AÑOS LA TIERRA TENIA SOLAMENTE UN CONTINENTE MUY GRANDE LLAMADO "PANGEA"...



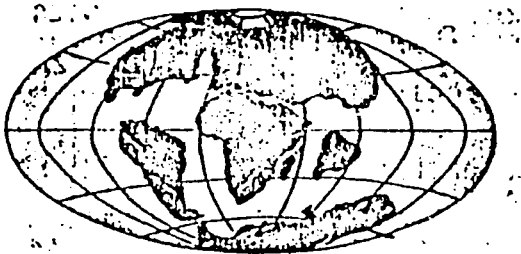
hace 200 millones de años

Y QUE POSTERIORMENTE SE DIVIDIO, EN VARIOS CONTINENTES (DERIVA CONTINENTAL)*...



hace 135 millones de años

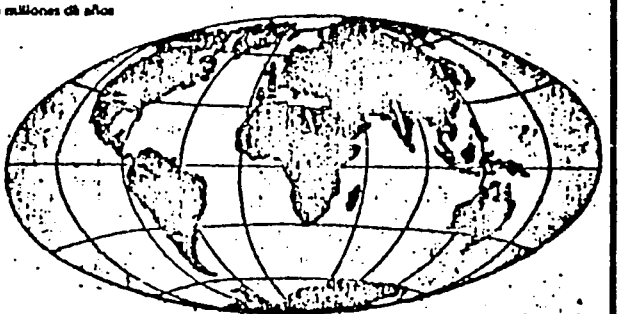
* La idea de la Deriva Continental, fue inicialmente desarrollada por el alemán Alfred Wegener (1880—1930) en los años veinte; sin embargo, estos conceptos fueron relegados hasta los inicios de la década del sesenta, cuando numerosos estudios geológicos demostraron su validez.



hace 65 millones de años

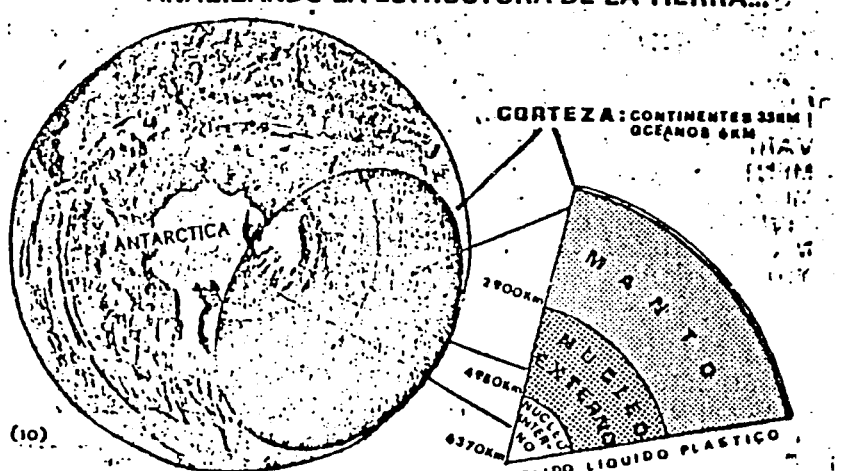
LOS CUALES SE HAN DESPLAZADO HASTA LLEGAR A LA POSICION EN LA QUE ACTUALMENTE SE ENCUENTRAN...

ESTE MOVIMIENTO NO HA CONCLUIDO, CONTINUA PERMANENTEMENTE.



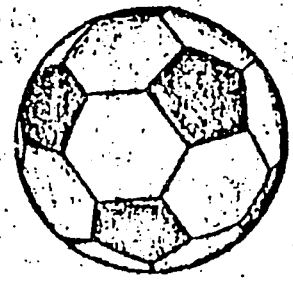
Epoca actual

ANALIZANDO LA ESTRUCTURA DE LA TIERRA...



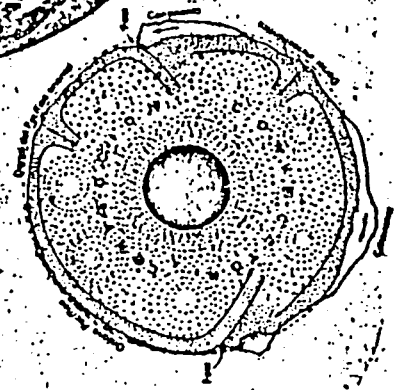
SE CONOCE QUE NO SOLO SE MUEVEN LOS CONTINENTES (SUPERFICIES QUE ESTAN FUERA DEL OCEANO), SINO QUE JUNTAMENTE CON ELLOS SE MUEVE TAMBIEN LA CORTEZA QUE ESTA DEBAJO DE LOS OCEANOS...

ES DECIR, QUE LA CORTEZA TERRESTRE ESTA CONSTITUIDA POR UNA SERIE DE PLACAS (TEORIA TECTONICA DE PLACAS)* A MANERA DE LOS PAÑOS DE UNA PELOTA DE FUTBOL.



ESTAS PLACAS, DE UN ESPESOR APROXIMADO DE 100 KMS., SE MUEVEN EN DIFERENTES DIRECCIONES Y VAN VARIANDO SU FORMA Y TAMAÑO...

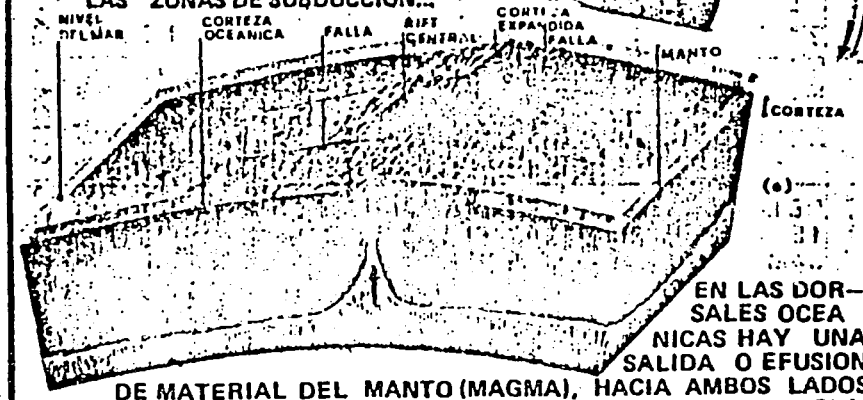
LOS DESPLAZAMIENTOS Y VARIACIONES, PROBABLEMENTE SE DEBEN A LOS MOVIMIENTOS CONVECTIVOS DEL MATERIAL DEL MANTO QUE SE ENCUENTRA EN ESTADO PLASTICO



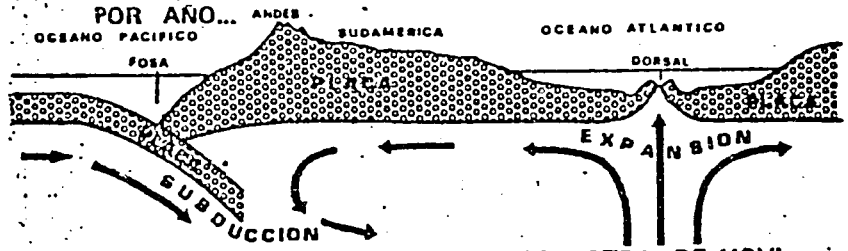
LA COLISION DE PLACAS PUEDE DAR LUGAR A LA FORMACION DE MONTAÑAS EN UN PROCESO MUY COMPLEJO (OROGENIA).

* La Teoría Tectónica de placas, es una síntesis de numerosos datos independientes probados científicamente, que explica con coherencia fenómenos geológicos no conocidos o poco comprendidos anteriormente (Deriva Continental, actividad sísmica y volcánica, orogenia, etc.); con lo que se ha ampliado los horizontes de las ciencias de la tierra.

LAS PLACAS VAN EXPANDIENDOSE Y TAMBIEN DESAPARECIENDO LA EXPANSION SE ORIGINA EN LAS ZONAS LLAMADAS DORSALES OCEANICAS, Y DESAPARECEN EN LAS ZONAS DE SUBDUCCION...



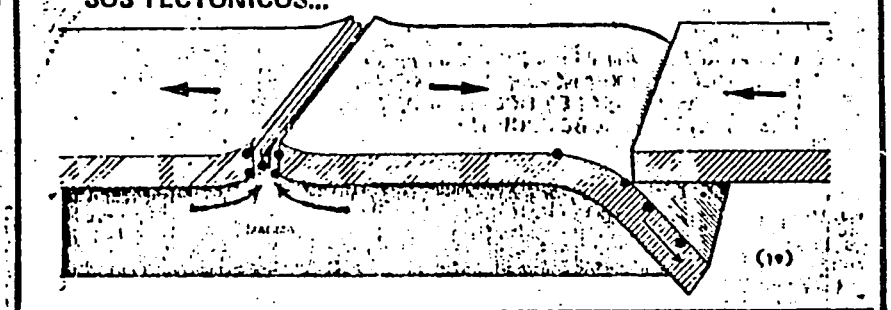
EN LAS DORSALES OCEANICAS HAY UNA SALIDA O EFUSION DE MATERIAL DEL MANTO (MAGMA), HACIA AMBOS LADOS DE LA DORSAL. ESTE MATERIAL, ADICIONADO A LAS PLACAS. HACE QUE EL FONDO OCEANICO SE EXPANDA. LA VELOCIDAD DE EXPANSION VARIA ENTRE 1 Y 10 Cms. POR AÑO...



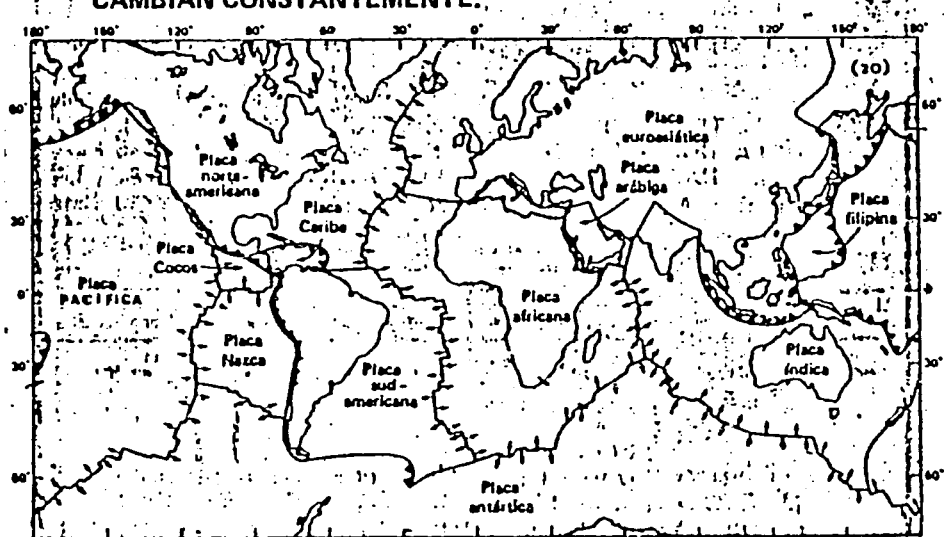
AL ENCONTRARSE UNA PLACA CON OTRA DE MOVIMIENTO CONTRARIO, UNA DE ELLAS (GENERALMENTE LA DE MAYOR MOVIMIENTO) SE INTRODUCE DEBAJO DE LA OTRA HASTA REABSORBERSE EN EL MANTO. ESTE PROCESO SE LLAMA SUBDUCCION.

* La evidencia de la expansión del fondo de los oceanos ha sido probada por estudios Paleomagnéticos y otros análisis geológicos del piso oceánico.

EN LA DORSAL, EL MAGMA ES EMPUJADO HACIA ARRIBA DESDE EL MANTO PRODUCIENDO UN LEVANTAMIENTO O CORDILLERA SUBMARINA, QUE EN ALGUNOS CASOS PUEDE ALCANZAR ALTURAS DE 3,000 METROS.
UNA FOSA SE FORMA POR LA SUBDUCCION DE LA PLACA OCEANICA BAJO LA PLACA CONTINENTAL. LAS FOSAS LLEGAN HASTA PROFUNDIDADES DE 10,000 METROS. LOS PUNTOS EN LA FIGURA INDICAN MOVIMIENTOS SISMICOS, FENOMENOS QUE ACOMPAÑAN A ESTOS PROCESOS TECTONICOS...



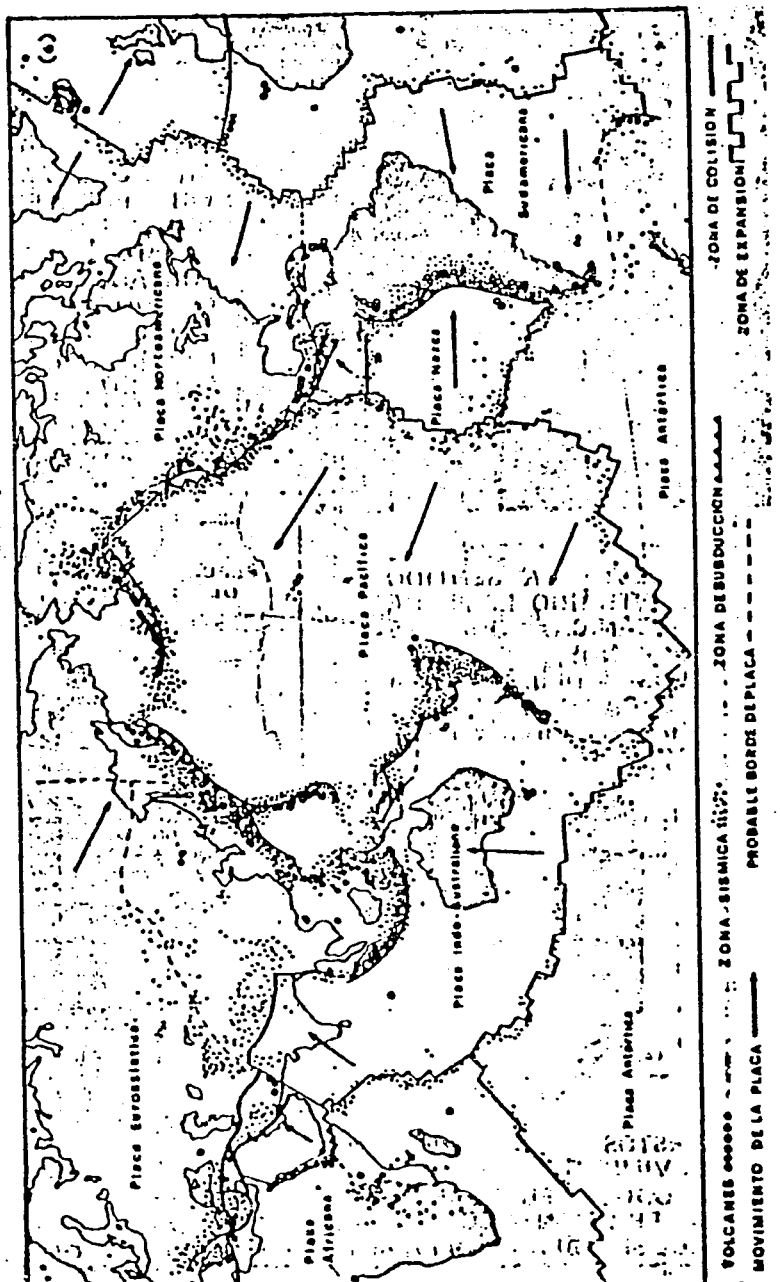
DE MANERA QUE, LA TIERRA APARECE COMO UN GIGANTESCO ROMPECABEZAS CUYAS PIEZAS SE MUEVEN Y CAMBIAN CONSTANTEMENTE.



Las placas y sus movimientos. Los triángulos de los bordes indican el sentido de inmersión allí donde la placa se hunde se puede identificar por la existencia de terremotos de foco intermedio o profundo. Las flechas pequeñas marcadas en los bordes que son dorsales indican el sentido aproximado del movimiento relativo. (D. Forsyth y S. Uyeda. Geophys. J., 43, pág. 163, 1975.)

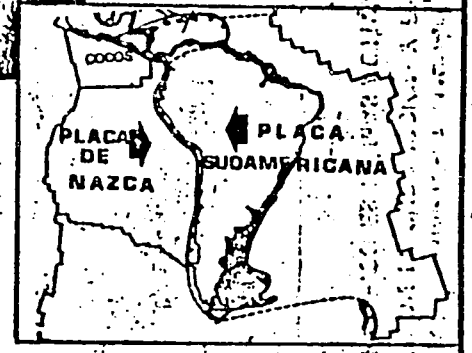
EN LA FIGURA PODEMOS APRECIAR QUE LOS BORDES DE LAS PLACAS COINCIDEN CON LAS ZONAS ACTIVAS DE LA TIERRA (ACTIVIDAD SISMICA Y VOLCANICA). ES DECIR, QUE ESTOS FENOMENOS ESTAN RELACIONADOS CON LA SUBDUCCION Y EXPANSION DE LAS PLACAS.

LA ZONA QUE RODEA EL OCEANO PACIFICO ES LA MAS ACTIVA Y SE LLAMA CINTURON DE FUEGO DEL PACIFICO.

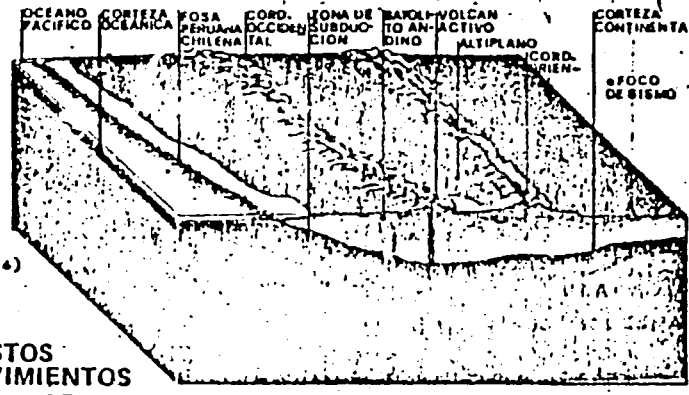


EN NUESTRO TERRITORIO, LA PLACA DE NAZCA (QUE ESTA FRENTE AL PERU) SE MUEVE APROXIMADAMENTE 9 Cms. POR AÑO Y LA PLACA CONTINENTAL SUDAMERICANA APROXIMADAMENTE 4 Cms. POR AÑO...

(11)



AMBAS PLACAS SE MUEVEN EN SENTIDO CONTRARIO. LA PLACA OCEANICA, QUE SE EXPANDE, SE PROLONGA DEBAJO DE LA PLACA CONTINENTAL HASTA CONSUMIRSE...



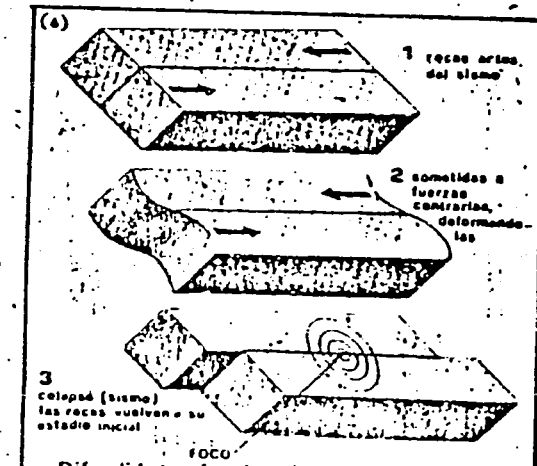
(4)

ESTOS MOVIMIENTOS PRODUCEN FUERZAS DE FRICCION Y COMPRESION, ACUMULANDOSE ENERGIA QUE SE LIBERA CON LA ACTIVIDAD SISMICA Y VOLCANICA.

ADEMAS, LA CONSTANTE FRICCION ENTRE LAS PLACAS PRODUCE FRACTURAS (FALLAS) EN OTROS LUGARES DE LA CORTEZA, GENERALMENTE EN FORMACIONES GEOLOGICAS FRAGILES.

UN SISMO (SEISMO), ES UN MOVIMIENTO VIBRATORIO VIOLENTO DE AMPLIOS SECTORES DE LA SUPERFICIE DE LA TIERRA, PRODUCIDO POR EL DESPLAZAMIENTO SUBITO (COLAPSO) DE BLOQUES DE LA CORTEZA Y MANTO SUPERIOR COMO CONSECUENCIA DE LA ACCION DE FUERZAS INTERNAS...

LOS SISMOS MAYORES SON DE ORIGEN TECTONICO *



Difundida teoría sobre el colapso de las rocas.

EL COLAPSO DE LAS ROCAS LIBERA ENERGIA EN FORMA DE ONDAS, DENOMINADAS SISMICAS. ESTA PERTURBACION SE PROPAGA EN TODAS LAS DIRECCIONES A SEMEJANZA DE LAS ONDAS PRODUCIDAS POR UNA PIEDRA QUE CAE AL AGUA.

LAS ONDAS SISMICAS** LAS SENTIMOS, EN LA SUPERFICIE, COMO REMESONES O MOVIMIENTOS VIBRATORIOS DEL SUELO. ESTAS, SON REGISTRADAS POR APARATOS LLAMADOS SISMOGRAFOS.

* Otras causas de sismos más locales son la formación o activación de fallas (Como por ejemplo en Ayacucho y Arequipa). También producen sismos menores la caída de rocas en cuevernas y minas, las erupciones volcánicas o, artificialmente, las explosiones.

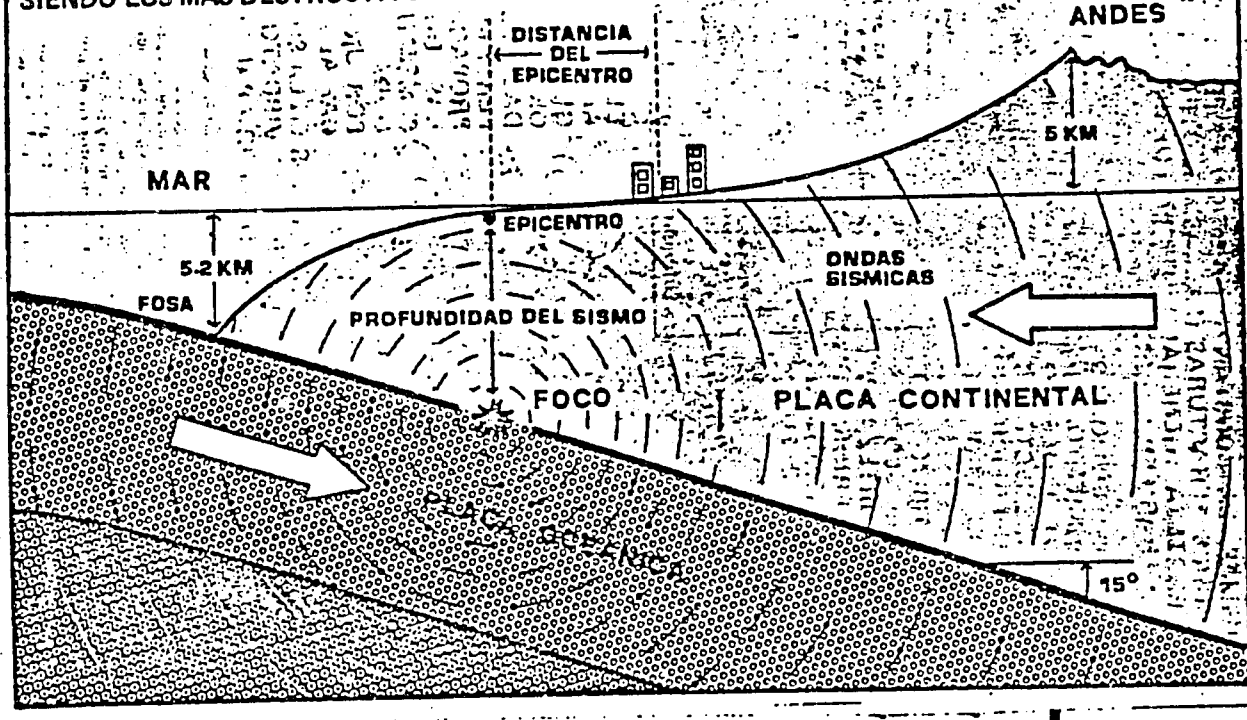
** Existen varios tipos de ondas sísmicas, las principales son:

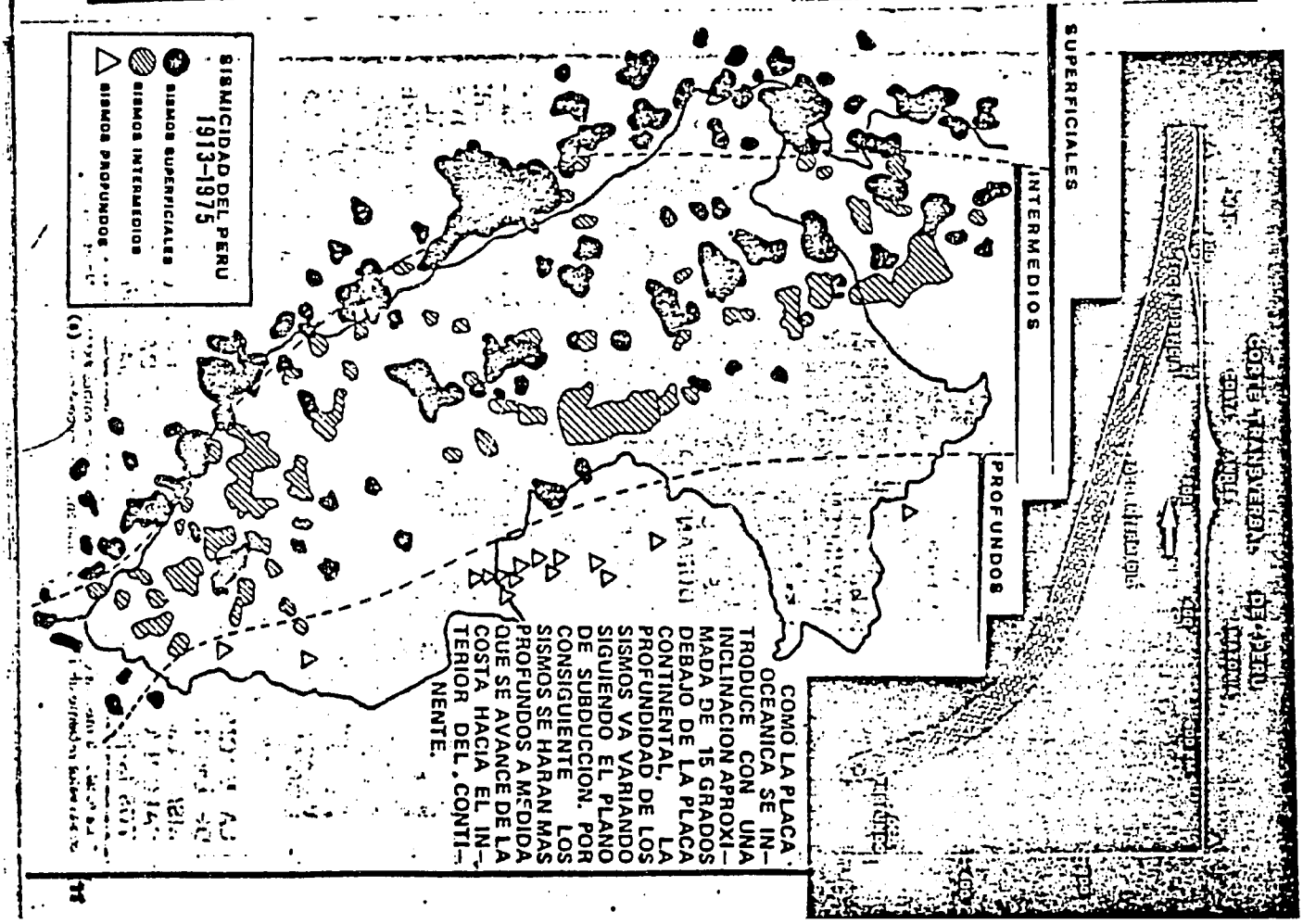
1) PRELIMINARES.-Ondas rápidas que se registran primero y son de dos tipos:
   a) Longitudinales o Primeras (P): Provocan movimientos en el mismo sentido de propagación y se regirtran primero.
   b) Transversales o Segundas (S): Provocan movimientos perpendiculares al sentido de propagación; son de mayor amplitud y de menor velocidad que las longitudinales.

2) SUPERFICIALES.- Ondas que se propagan por la superficie, son producto de las ondas P y S y son las más destructivas. Estas se dividen en Ondas R, Ondas B y Ondas L.

SE LLAMA FOCO O HIPOCENTRO AL PUNTO DEL INTERIOR DE LA TIERRA DONDE SE ORIGINA EL SISMO, Y EPICENTRO AL PUNTO, EN LA SUPERFICIE ENCIMA DEL FOCO, DONDE MAS SE SIENTEN LAS SACUDIDAS.

DE ACUERDO A LA PROFUNDIDAD LOS SISMOS PUEDEN SER:
SUPERFICIALES: DE 0 A 60 Km. INTERMEDIOS: DE 60 A 300 Km. PROFUNDOS: DE 300 A 600 Km.
SIENDO LOS MAS DESTRUCTIVOS LOS SUPERFICIALES.





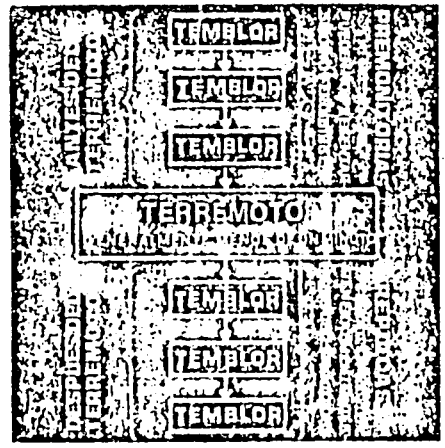
LOS MOVIMIENTOS SISMICOS, SUELEN LLAMARSE TEMBLORES CUANDO SON DEBILES Y TERREMOTOS CUANDO SON MUY FUERTES. LA MAYORIA DE MOVIMIENTOS SISMICOS DURAN MENOS DE UN MINUTO; Y FRECUENTEMENTE, VAN ACOMPAÑADOS DE GRANDES RUIDOS PARECIDOS A LOS TRUENOS.

EN UN TERREMOTO, POR LO GENERAL, SE PUEDEN DISTINGUIR TRES FASES:

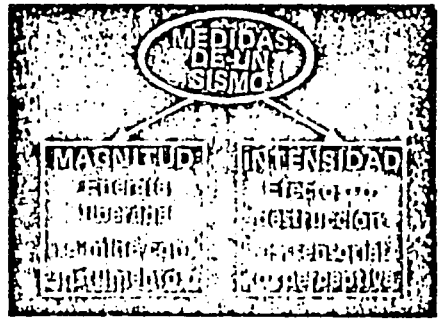
1.– SACUDIDAS MENOS IMPORTANTES ANTES DEL TERREMOTO, LLAMADAS PREMONITORIAS; ESTAS, ALGUNAS VECES, NO PUEDEN PRESENTARSE O SON TAN PEQUEÑAS QUE NO SON PERCEPTIBLES.

2.– TERREMOTO O MOVIMIENTO PRINCIPAL.

3.– MOVIMIENTOS MENOS IMPORTANTES, POSTERIORES AL TERREMOTO, LLAMADOS REPLICAS. ALGUNAS VECES ESTOS SE REPITEN DURANTE UN LARGO PERIODO.



LOS SISMOS SE MIDEN POR SU MAGNITUD O POR SU INTENSIDAD.



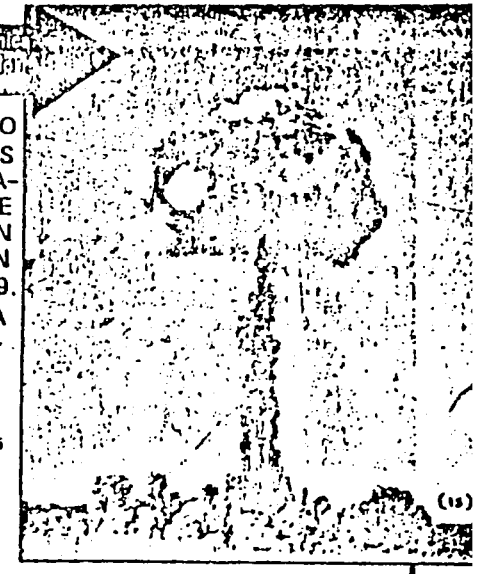
MAGNITUD

LA MAGNITUD ES LA CANTIDAD DE ENERGIA LIBERADA POR UN SISMO EN SU FOCO. SE MIDE Y CALCULA MEDIANTE INSTRUMENTOS (SISMOGRAFO NORMALIZADO).

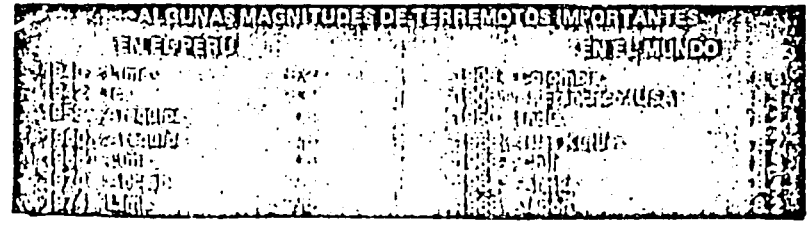
UN SISMO TIENE SOLAMENTE UNA MAGNITUD LA ESCALA DE MAGNITUD MAS USADA ES LA DE RICHTER.* LOS MOVIMIENTOS SISMICOS GENERALMENTE ESTAN ENTRE 0 Y 9 GRADOS. CUANDO LA MAGNITUD AUMENTA UNA UNIDAD DE LA ESCALA LA CANTIDAD DE ENERGIA SISMICA AUMENTA 30 VECES Y CUANDO LA MAGNITUD SE ELEVA DOS UNIDADES LA ENERGIA LIBERADA ES 1,000 VECES MAYOR. ESTO QUIERE

*La escala de magnitud es logarítmica y es abierta en ambos extremos. No es una escala con el valor máximo de 10, como comunmente se conoce.

DECIR, POR EJEMPLO: UN SISMO DE GRADO 8 LIBERA 30 VECES MAS ENERGIA QUE UNO DE GRADO 7 Y 1,000 VECES MAS QUE OTRO DE GRADO 6. NO SE HAN REGISTRADO TERREMOTOS CON MAGNITUDES MAYORES QUE 8. 9. PARA TENER UNA IDEA DE LA CANTIDAD DE ENERGIA LIBERADA POR UN SISMO, VEAMOS UN EJEMPLO: EL TERREMOTO DE 1940 EN LIMA, DE MAGNITUD 8.2, LIBERO APROXIMADAMENTE 10^{25} ERGIOS, IGUAL A LA ENERGIA DE 10,000 BOMBAS ATOMICAS COMO LAS DETONADAS EN HIROSHIMA!.



SE LLAMAN GRANDES TERREMOTOS A AQUELLOS CUYA MAGNITUD ES MAYOR DE 7.5 LA MAYORIA SON SUPERFICIALES Y, CASI TODOS, TIENEN LUGAR EN EL CINTURON DE FUEGO DEL PACIFICO.



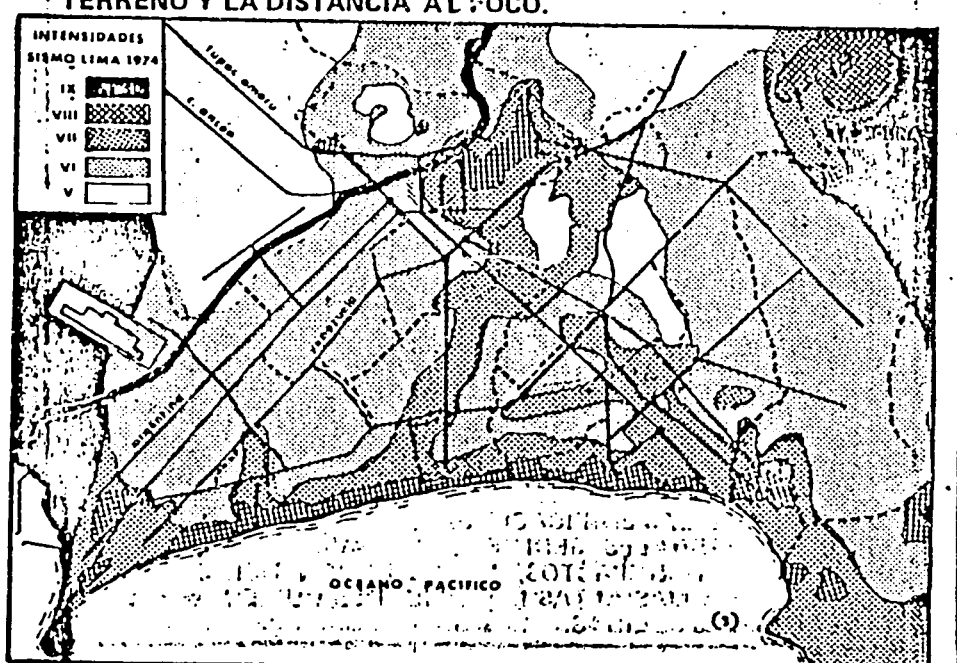
INTENSIDAD

EL CONCEPTO DE INTENSIDAD DE UN SISMO, SE BASA EN LA APRECIACION DE LOS EFECTOS QUE ESTE PRODUCE, EN LA SUPERFICIE, SOBRE EL HOMBRE, LAS EDIFICACIONES, LA NATURALEZA, ETC.

LA INTENSIDAD SE MIDE SIN INSTRUMENTOS; Y LA ESCALA QUE MAS SE USA ES LA DE MERCALLI MODIFICADA (MM) QUE TIENE DOCE GRADOS EXPRESADOS EN NUMEROS ROMANOS.

LOS EFECTOS, DEPENDEN DEL TERRENO Y DE LAS CONDICIONES DE LAS EDIFICACIONES. ASI, EN AREAS DE TERRENOS ALUVIALES, SEDIMENTOS SUAVES O AREAS DE TERRENOS INCOMPACTOS, LA AGITACION DEL SUELO REGISTRARA MAS ALTAS INTENSIDADES QUE EN AREAS SOBRE ROCAS SOLIDAS.

UN SISMO DE UNA MAGNITUD DADA TIENE DIFERENTES INTENSIDADES, DEPENDIENDO PRINCIPALMENTE DEL TERRENO Y LA DISTANCIA AL FOCO.

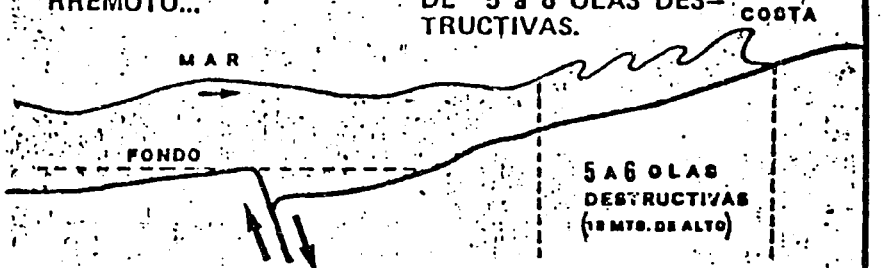


LOS SISMOS, ADEMAS DE PRODUCIR EFECTOS DESASTROSOS EN LAS CONSTRUCCIONES, SON LA CAUSA DE MAREMOTOS Y DE AVALANCHAS (ALUVIONES).

TSUNAMI O MAREMOTO

SON GRANDES OLAS MARINAS CAUSADAS POR LA DEFORMACION O HUNDIMIENTO DEL FONDO MARINO PRODUCIDO POR UN TERREMOTO...

CUANDO LLEGAN A LA COSTA, LAS OLAS ALCANZAN ALTURAS DE MAS DE 12 mts., CAUSANDO GRAVES DAÑOS. SE PRESENTAN DE 5 a 6 OLAS DESTRUCTIVAS.



ESTAS OLAS VIAJAN A 750 Km POR HORA, PERO EN ALTAMAR NO SE NOTAN PORQUE TIENEN UNA GRAN LONGITUD DE ONDA (800 Km.) Y SOLAMENTE DE 1 A 2 mts. DE ALTURA, ADEMAS CADA OLA DEMORA EN PASAR UNA HORA.

FRECUENTEMENTE, EN LAS COSTAS, LA LLEGADA DE LAS OLAS VA PRECEDIDA DE UNA AMPLIA RETIRADA DEL MAR QUE PUEDE DURAR VARIOS MINUTOS..

EXISTE UN SISTEMA DE ALERTA DE TSUNAMIS POR RADIO; PUDIENDO ANTICIPARSE CON TIEMPO LA LLEGADA DE LAS OLAS. ESTE CENTRO SE ENCUENTRA EN HONOLULU, HAWAI.

EL MAYOR TSUNAMI REGISTRADO EN EL MUNDO FUE ORIGINADO POR LA ERUPCION DE UN VOLCAN EN KRAKATOA, SU MAYOR OLA LLEGO HASTA 30 mts...

OBSERVACIONES Y CONCLUSIONES

[illegible]

NO ES CIERTO

[illegible]

EFECTOS COLATERALES

[illegible]

PREDICCIONES

[illegible]

DE LAS PAGINAS ANTERIORES, CONCLUIMOS QUE VIVIMOS EN UNA ZONA EMINENTEMENTE SISMICA, POR LO QUE, LOS MOVIMIENTOS SISMICOS SE PUEDEN PRESENTAR EN CUALQUIER MOMENTO:

NECESITAMOS ESTAR PREPARADOS Y EDUCADOS PARA PODER AFRONTARLOS.

EFECTOS DE LOS SISMOS

DURANTE UN SISMO, RARA VEZ ES EL MOVIMIENTO MISMO DE LA TIERRA LA CAUSA DE MUERTE O LESIONES.

LA MAYOR PARTE DE LAS DESGRACIAS SE DEBEN A:...

..DERRUMBES PARCIALES DE CASAS O EDIFICIOS.
PAREDES QUE SE VIENEN ABAJO...

.CAIDA DE CORNIZAS, CHIMENEAS, ESTUQUE DEL TECHO, MACETEROS ...

..VIDRIOS ROTOS QUE SALTAN DE LAS VENTANAS.
OBJETOS PESADOS QUE CAEN DE LAS REPISAS O LAMPARAS, O CUADROS....

..CABLES O POSTES ELECTRICOS DERRIBADOS ...

O INCENDIOS QUE SE PRODUCEN POR CORTOS CIRCUITOS, O EL DERRAMIENTO DE COMBUSTIBLE O LIQUIDOS INFLAMABLES.

Y PRODUCIR TSUNAMIS O MAREMOTOS

COMO EL OCURRIDO EN EL CALLAO EL 28 DE OCTUBRE DE 1746. PROBABLEMENTE EL MAS FUERTE EN EL PERU, SU MAYOR OLA LLEGO A 20 M. DE ALTURA. PROVOCO NUMEROSAS MUERTES. 19 BARCOS INCLUIDOS LOS DE GUERRA FUERON DESTRUIDOS O ENCALLADOS. UNO DE ELLOS FUE VARADO APROXIMADAMENTE 1.5 KM. TIERRA ADENTRO

PREVISIONES

SEÑALE EL LUGAR MAS SEGURO Y REFUERCELO SI ES NECESARIO

LOS LUGARES MAS SEGUROS DURANTE UN SISMO SON:

LUGARES ABIERTOS, COMO PATIOS AMPLIOS O LA CALLE EN SITIOS ALEJADOS DE LAS FACHADAS O ALAMBRES DE LUZ.

CERCA DEL ASCENSOR LA ESTRUCTURA ES MUY SÓLIDA.

CERCA DE LAS COLUMNAS

ALEJADOS DE VIDRIOS O VENTANAS

DEBAJO DE LAS VIGAS O DINTELES

DETERMINE LA RUTA DE ESCAPE A SU AREA DE SEGURIDAD ELIMINE TODOS LOS OBSTACULOS DE ESTA

PROCURE QUE LAS PUERTAS Y CERROJOS ESTEN ENGRASADOS. TENGA A MANO LA LLAVE DE LA PUERTA PRINCIPAL

MIENTRAS YO ABRO LA PUERTA TU, JUAN, AYUDAS A TU ABUELITA

YO SACO LA LINTERNA EL RADIO PORTÁTIL Y LA FRAZADA

YO SACO A JORGE

DISTRIBUYA LAS TAREAS ENTRE SUS FAMILIARES.

ENSEÑE A LOS MIEMBROS RESPONSABLES COMO CERRAR LAS LLAVES CENTRALES DE CORRIENTE, AGUA Y GAS.

ENSAYE LA EVACUACION

REUNA A SU FAMILIA, CADA CIERTO TIEMPO; E INSTRUYA QUE HACER EN UN SISMO.

LO PRINCIPAL ES LA SERENIDAD

SOSTENGA CONVERSACIONES CALMADAS Y HAGA QUE NO SE NARRE CUENTOS SOBRE DESASTRES QUE PUEDAN ASUSTAR.
PROCURE QUE SE INSTRUYA EN PRIMEROS AUXILIOS.

TOME SIMILARES MEDIDAS EN SU CENTRO DE TRABAJO

EN LOS COLEGIOS:

RECUERDEN LAS ZONAS DE SEGURIDAD Y RUTAS DE EVACUACION.

CONSULTA, CONSTANTEMENTE, A TUS PROFESORES QUE HACER DURANTE UN SISMO.

QUE HACER Y NO HACER DURANTE UN TERREMOTO

GUARDE LA CALMA Y LA SERENIDAD

TRANQUILO HIJITO

UNA PERSONA SERENA PIENSA MEJOR

NO GRITE NI SE DESESPERE

REFLEXIONE SOBRE CUALQUIER MEDIDA A TOMAR DE SU ACTITUD DEPENDE LA INTEGRIDAD Y SEGURIDAD DE LOS DEMAS.

CONDUZCA A SU FAMILIA EN FORMA ORDENADA, PISANDO FIRME, HACIA LA ZONA DE SEGURIDAD.

NO CORRA

ACTUE CON FIRMEZA E IMPONGA TRANQUILIDAD

¡TRANQUILO!
¡DESPACIO!
¡EN ORDEN!

NO SE PONGA NERVIOSO

SU CARA EN ACTITUD ANGUSTIOSA ASUSTA A QUIENES ESTAN A SU LADO

PERMANEZCA TRANQUILO EN LA ZONA DE SEGURIDAD

NO SALGA CORRIENDO A LA CALLE Y SIN CUIDADO:

SI SE TIENE QUE EVACUAR LA CASA, PORQUE ES ANTIGUA O NO OFRECE NINGUNA SEGURIDAD

ADELANTESE A ABRIR LA PUERTA Y SALGA EN ORDEN. ALEJESE DE LA FACHADA

SI ES DE NOCHE PROCURE SACAR FRAZADAS Y ZAPATOS.

NO SE APROXIME A LOS POSTES O ALAMBRES ELECTRICOS.

SI SE ENCUENTRA EN EDIFICIOS:

SERENESE Y ACTUE PENSANDO

¡CALMESE POR FAVOR!

AYUDE A SERENAR A PERSONAS MAS NERVIOSAS

NO CORRA HACIA AFUERA

COLOQUESE EN UN LUGAR SEGURO

SI NO DEBE SALIR. COLOQUESE DEBAJO DE UN ESCRITORIO O MUEBLE SOLIDO

NO TRATE DE BAJAR POR LAS ESCALERAS

BAJO DE UNA VIGA, ALEJADO DE LOS VIDRIOS.

UN LUGAR SÓLIDO ES CERCA AL ASCENSOR

NO ABORDE EL ASCENSOR

SI SE ENCUENTRA ABORDO, TRATE DE BAJAR EN EL PISO INMEDIATO.

SI SE ENCUENTRA EN LUGARES MUY CONCURRIDOS:

SERENESE Y UBIQUE UN LUGAR SEGURO ALEJADO DE VIDRIOS Y OBJETOS QUE PUEDAN CAER.

¡TRANQUILA HIJITA, EN AQUELLAS COLUMNAS ESTAREMOS A SALVO!

NO CORRAS HACIA LA PUERTA

MUCHOS HAN PENSADO CORRER HACIA ELLA

SI DECIDE EVACUAR, BUSQUE CON CALMA UNA SALIDA NO CONGESTIONADA

POR ESTA SALIDA SALDRE SIN PELIGRO

ESCAPE

EN ESTOS LUGARES LAS PRINCIPALES DESGRACIAS SON DEBIDAS AL PANICO

SI SE ENCUENTRA EN LA CALLE:

BUSCUE UN LUGAR ABIERTO

ALEJESE DE LAS FACHADAS Y POSTES CON CABLES

NO CORRA NI GRITE.

TENGA CUIDADO CON LOS VEHICULOS, YA QUE EN MUCHOS CASOS SE DESCONTROLAN

SI SE ENCUENTRA EN UN VEHICULO:

UN LUGAR SEGURO ES COLOCARSE DEBAJO DEL AUTO

ESTACIONAR EN UN LUGAR SEGURO ALEJADO DE FACHADAS Y CABLES.

EN EL COLEGIO

PERMANECE TRANQUILO

ESTA ATENTO A TU PROFESORA

NO LLORES NI GRITES

SI EL PROFESOR NO INDICA SALIR

PERMANECE DEBAJO DE TU PUPITRE, ESCRITORIO o MESA

NO CORRAS A LA PUERTA

EN CASO CONTRARIO DEBERAS COLOCARTE:

1º CON LA ESPALDA DIRIGIDA HACIA LA VENTANA, PONTE DE RODILLAS Y JUNTALAS.

2º AMBAS MANOS DEBEN ESTAR FUERTEMENTE DETRAS DE LA CABEZA CON LA FINALIDAD DE CUBRIRSE EL CUELLO.

3º ESCONDE EL ROSTRO ENTRE LOS BRAZOS PARA PROTEGERTE LA CABEZA, CIERRA FUERTEMENTE LOS OJOS.

MANTENTE EN ESTA POSICION HASTA QUE TE AVISEN

SI EL PROFESOR O ENCARGADO ORDENA LA EVACUACION:

¡SALGAN EN ORDEN NO RECOJAN NADA!

DEJA TUS COSAS TAL COMO ESTAN Y SAL EN ORDEN.

NO EMPUJARSE NI DESESPERARSE

SI ALGUIEN CAE:

AYUDALO A LEVANTARSE RAPIDAMENTE

DE NO HACERLO SE CORRE GRAVE PELIGRO:

SI SE TE CAE ALGO.

DEJALO. NO LO RECOJAS

SI LO HACES

LOS QUE VIENEN CAERAN SOBRE TI.

DESPLAZATE POR LA RUTA DE EVACUACION

AYUDA A LOS MAS DEBILES

SI NO ESTAS CON TU CLASE SIGUE EL DESPLAZAMIENTO DEL GRUPO

LAS DISTANCIAS SEGURAS DE UN EDIFICIO PELIGROSO APROXIMADAMENTE SON

DE UN PISO	15 MTS.	(20 PASOS)
DE DOS PISOS	25 MTS.	(40 PASOS)
DE TRES PISOS	35 MTS.	(60 PASOS)

Y ASÍ SUCESIVAMENTE

PERMANECE EN TU ZONA DE SEGURIDAD Y SIGUE LAS INDICACIONES

DESPUES DEL SISMO

PASADO DOS MINUTOS, SE DEBE RESCATAR A LAS PERSONAS ATRAPADAS O IMPEDIDAS

O PUEDE ENTRAR A RECOGER LAS FRAZADAS E IMPLEMENTOS

DE PRIMEROS AUXILIOS, DEBE HACERLO ANTES DE LOS 25 MINUTOS. NO MUEVA A LOS HERIDOS GRAVES;

SI EL SISMO HA SIDO FUERTE, SALGA Y PERMANEZCA EN LUGAR ABIERTO. GENERALMENTE LA PRIMERA REPLICA SUCEDE UNOS 25 MINUTOS DESPUES

SI VIVE EN ZONAS COSTERAS BAJAS, PUEDE PRODUCIRSE UN TSUNAMI, ESTE LISTO A TRASLADARSE A LUGARES SEGUROS.

SI EL SISMO HA SIDO DE NOCHE, PONGASE LOS ZAPATOS Y ABRIGUESE

USE LA LINTERNA. NO PRENDA FOSFORO, PUEDE PRODUCIRSE UN INCENDIO

GASOLI

DESCONECTE LA ELECTRI. CIDAD Y GAS.

ABRA LAS PUERTAS DE LOS ARMARIOS CON PRECAUCION.

¡UF! SINO CORTABA LA CORRIENTE HABIA CORTO CIRCUITO

REVISE LAS INSTALACICHES CON CUIDADO

NO HAGA FUNCIONAR EL INODORO HASTA COMPROBAR QUE EL DESAGUE ESTA BIEN

NO COMA NI BEBA NADA QUE HAYA ESTADO CERCA DE VIDRIOS ROTOS.

HIERVA EL AGUA UTILICE LAS PARRILLAS AL AIRE LIBRE COMO COCINA DE EMERGENCIA

SI NO TIENE AGUA PUEDE USAR LA DEL TANQUE DE LOS SERVICIOS HIGIENICOS O DERRETIR LOS CUBOS DE HIELO. CONSUMA PRIMERO LOS ALIMENTOS QUE SE PUEDAN DESCOMPONER. RACIONANDO LOS VÍVERES QUE PUEDA DISPONER

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