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Taxonomy and
Management of Andisols

Proceedings of the

SIXTH INTERNATIONAL SOIL CLASSIFICATION WORKSHOP

Chile and Ecuador 9 to 20 January 1984

Part 3 : Tour-Guide for Ecuador

FIELD TRIP BACKGROUND
SITE AND PEDON DESCRIPTIONS
ANALYTICAL DATA

PREPARED BY:

SOIL MANAGEMENT SUPPORT SERVICES, USDA SOIL CONSERVATION SERVICE
WASHINGTON, DC
SOCIEDAD ECUATORIANA DE LA CIENCIA DEL SUELO

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DE LA CIENCIA DEL SUELO

SOCIEDAD ECUATORIANA
DE LA CIENCIA DEL SUELO

UNIVERSIDAD
DE PUERTO RICO

SOIL MANAGEMENT SUPPORT SERVICES

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PREFACE

6TH INTERNATIONAL SOIL CLASSIFICATION WORKSHOP

ECUADOR

Steering Committee:

F. H. Beinroth	University of Puerto Rico, U.S.A. Chairman
R. W. Fenwick	National Coordinator, SMSS, SCS, Washington, D.C.
Dr. W. Luzio L.	University of Chile, Pres., Chilean Society of Soil Science
Dr. F. Maldonado	USAID, Quito, Ecuador, Pres., Ecuadorian Society of Soil Science
Dr. M. Leamy	ICOMAND, Chairman, New Zealand

Host Organizing Committee:

Ecuador Steering Committee

Dr. F. Maldonado, Chairman	USAID/Quito Ecuador
G. del Posso M.	Soils Department of Ecuador
C. Yanchapoxi	Soils Department of Ecuador

Technical Commission

G. del Posso M., Chairman	Soil Survey Department of Ecuador (PRONAREG)
C. Luzuriaga	Soils Laboratory of Ecuador
C. Zebrowski	ORSTOM Mission in Ecuador

Organizational Commission

G. Yanchapoxi, Chairman	Soils Survey Department of Ecuador (PRONAREG)
I. Cordova	Soil Conservation Department of Ecuador (INIAP)
W. Garces	Soil Conservation Department of Ecuador (PRONACOS)
P. Toledo	Remote Sensing Department of Ecuador

Introduction

The Sixth (VI) International Soil Classification Workshop is one of a series of workshops and training activities of the Soil Management Support Services (SMSS). SMSS is a program of international technical assistance in soil survey, soil classification and correlation, and use and management of soils, primarily in tropical and subtropical areas. The program is funded by the U.S. Agency for International Development (USAID), and is carried out by the U.S. Dept. of Agriculture Soil Conservation Service (USDA/SCS). The previous workshops that have been held are:

	Country	Year	International Committee (ICOM)
I	Brazil	1977	ICOMLAC
II	Malaysia/Thailand	1978	ICOMLAC/ICOMO.
III	Syria/Lebanon	1980	ICOMMORT/ICOMID
IV	Rwanda	1981	ICOMLAC/ICOMOX/ICOMMORT
V	Sudan	1982	ICOMERT/ICOMID/ICOMMORT
VI	Chile/Ecuador	1984	ICOMAND

These workshops are an integral part of the activities of SMSS and provide a medium for soil scientists from all over the world to discuss the mandates of the International Committees. These committees are working to refine Soil Taxonomy with respect to use and application in intertropical areas and as a means for agrotechnology transfer.

The VI International Soil Classification Workshop is organized as a joint endeavor of the Sociedad Chilena de la Ciencia del Suelo and the Sociedad Ecuatoriana de la Ciencia del Suelo, both acting in behalf of various universities and national institutions, the SMSS, the University of Puerto Rico (UPR), and USAID. This cooperation and collaborative effort has been the prime reason for the success of our previous workshops. The present workshop also promises to be most successful.

This tour guide is a compilation of some basic information on the history, climate, soils, geology, vegetation, and agriculture in Ecuador. It has been prepared and written by Mr. G. del Posso, Mr. C. Luzuriaga, Mr. C. Zebrowski, and translated from Spanish to English by Dr. F. Maldonado. This contribution is under the auspices of the Ecuadorian Soil Science Society. The soils were described by T. D. Cook of SMSS, SCS and G. del Posso and others of the Soil Survey Department. The analyses of the soils were performed by the University Laboratory in Ecuador and the National Soil Survey Laboratory (NSSL) of the SCS at Lincoln, Nebraska. This workshop and tour guide could not have been accomplished without the assistance, contributions and cooperation of many people and organizations. To them we are most grateful.

The assistance of the Director General and his staff of the National Agrarian Regionalization Program (PRONAREG), and the National Institute for Agricultural Research (INIAP), and National Soil Conservation Program (PRONACOS), and the National Council of Science and Technology (CONACYC) is greatly appreciated. G. del Posso and F. Maldonado have also given of their time and energy to make this workshop a success.

We would like to thank Dr. Steve Holzhey, Head, NSSL, and his staff for performing all the analyses in a timely manner. Special analyses were run by Dr. John Kimble, Soil Chemist, SMSS, that are required for the proposed orders of Andisols. He also efficiently coordinated and compiled the data and information for the tour guides. We are grateful for his cooperation. Thin sections and micromorphological descriptions were made by Prof. Ricardo Honorato. His work and contributions are greatly appreciated. We also express our gratitude to Dr. Koji Wada, Kyushu University, for X-ray and mineralogical analysis.

We also appreciate the advice and suggestions from Dr. F. Colmet-Daage, Dr. Mike Leamy, Dr. A. Van Wambeke and Dr. K. Flach.

To make an international meeting like this successful, many Ecuadorean colleagues and organizations have contributed untold hours of extra work beyond their normal duties. We acknowledge their assistance and support. This workshop, like the previous ones, is a model of international cooperation and achievement. In this same spirit, we anticipate beneficial and productive discussion at this workshop to advance and improve Soil Taxonomy and to exchange knowledge on soil classification and agrotechnology transfer between scientists.

RICHARD W. FENWICK
National Coordinator
SMSS

SIXTH INTERNATIONAL SOIL CLASSIFICATION WORKSHOP

- Taxonomy and Management of Andisols

CHILE AND ECUADOR

9 to 20 January 1984

PROGRAM FOR ECUADOR

Saturday, 14 January 1984

1315 Participants arrive at Quito airport; transfer to and check-in at Hotel Inter-Continental Quito

1500 Registration
Free afternoon and evening in Quito; night in Quito

Sunday, 15 January 1984

Free day or optional sightseeing in Quito; night in Quito

Monday, 16 January 1984

0800 Registration of Ecuadorian participants, Hotel Inter-Continental Quito

OPENING CEREMONY
Chairman: J. Delgado
Venue: Pichincha Room, Hotel Inter-Continental Quito

0900 National anthem of Ecuador

Welcome -- F. Maldonado

Official inauguration -- H. Ortiz, Undersecretary of Agriculture

Introductory remarks by: J. Goodwin, USAID/Quito
R.W. Arnold, SCS/SMSS
M.L. Leamy, ICOMAND

Monday, 16 January 1984 (cont'd)

1000 Refreshments

Technical Session VII: RATIONALES FOR TAXONOMIC CRITERIA FOR ANDISOLS: SUBORDERS
Chairman: R. Tavernier
Rapporteur: R. W. Fenwick

1030 S. W. Buol: Use of soil temperature regimes in Soil Taxonomy

1100 A. Van Wambeke: Soil climatic regimes as criteria for establishing sub-order of Andisols.

1120 S. Shoji: The case for recognizing a sub-order of non-allophanic Andisols

1140 Discussion

1200 Lunch

Technical Session VIII: RATIONALES FOR TAXONOMIC CRITERIA FOR ANDISOLS: GREAT GROUPS AND SUBGROUPS
Chairman: S. W. Buol
Rapporteur: A. Alvarado

1330 M. Otawa; Criteria for great groups of Andisols

1400 F. Colmet-Daage: Criteria for subgroups of Andisols

1430 Discussion

1500 Refreshments

Technical Session IX: PROBLEMS OF ANDISOLS
Chairman: R. L. Parfitt
Rapporteur: V Neall

1530 J. M. Kimble and W. D. Nettleton: Analytical characterization of Andisols

1550 T. D. Cook: Field of identification and mapping of Andisols

1610 R. W. Arnold: Criteria for intergrades between Andisols and other orders

1630 Discussion

Monday, 16 January 1984 (cont'd)

Technical Session X: FIELD TRIP BACKGROUND
Chairman: C. O. Scoppa

1700 E. Maldonado and F. Maldonado: Distribution of volcanic ash soils in Ecuador

1730 G. Yanchapaxi and H. Serrano: The Machachi soil sequence

1800 G. del Posso and C. Luzuriaga: The Santo Domingo soil sequence

1830 Announcements

1845 Adjourn

Night in Quito

Tuesday, 17 January 1984

Field Trip I: QUITO-MACHACHI-SANTO DOMINGO-QUITO

0730 Dep. Hotel Inter-Continental Quito
0900 Arr. Pedon ECU 01

Discussion Leader: F. Maldonado
Rapporteur: A. Cortes
Refreshments

1030 Dep. Pedon ECU 01
1100 Arr. Pedon ECU 09

Discussion Leader: G. del Posso
Rapporteur: F. Maldonado

1215 Dep. Pedon ECU 09
1300 Arr. INIAP Experiment Station Santa Catalina for lunch
1345 Dep. Cafeteria
1400 Arr. Pedon ECU 06

Discussion Leader: W. Luzio
Rapporteur: M. Mendoza

1530 Dep. Pedon ECU 06

1545 Arr. auditorium of Santa Catalina station, refreshments

Tuesday, 17 January 1984 (cont'd)

Technical Session XI: EROSION, CONSERVATION AND MANAGEMENT OF ANDISOLS
Chairman: F. Maldonado
Rapporteur: W. Luzio

1600 G. de Noni and J. F. Nouvelot: Erosion and conservation of volcanic ash soils in the highlands of Ecuador: A. case study

1630 Discussion with INIAP staff about soil management

Review of pedons ECU 01, 09 and 06

1730 Dep. Santa Catalina station

1900 Arr. Quito

Night in Quito

Wednesday, 18 January 1984

Field trip V: QUITO-SANTO DOMINGO

0730 Dep. Hotel Inter-Continental Quito
0930 Arr. Pedon ECU 04

Discussion Leader: A. Alvarado
Rapporteur: C. O. Scoppa
Refreshments

1045 Dep. Pedon ECU 04
1330 Arr. INIAP Experiment Station Santo Domingo for lunch
1430 Dep. Cafeteria
1445 Arr. Pedon ECU 05

Disucssion Leader: F. Colmet-Daage
Rapporteur: G. del Posso

1615 Dep. PedonECU 05
1630 Arr. meeting room of Santo Domingo station
Refreshments
Discussion with INIAP staff about soil management
Review of pedons ECU 04 and 05
1730 Dep. Santo Domingo station
1900 Arr. Santo Domingo

Night in Santo Domingo, Hotel Zaracay

Thursday, 19 January 1984

Field Trip VI: SANTO DOMINGO-QUEVEDO-SANTO DOMINGO-QUITO

0730 Dep. Hotel Zaracay
0900 Arr. Pedon ECU 12

Discussion Leader: A. Cortes
Rapporteur: C. Zebrowski
Refreshments
1015 Dep. Pedon ECU 12
1115 Arr. Pedon ECU 13

Discussion Leader: A. Van Wambeke
Rapporteur: A. Alvarado

1230 Dep. Pedon ECU 13
1300 Arr. INIAP Experiment Station Pichilingue for lunch
1400 Discussion with INIAP staff about soil management
Review of pedons ECU 12 and 13 and field trips in Ecuador
1500 Dep. Pichilingue station
1630 Arr. Santo Domingo, refreshments
1700 Dep. Santo Domingo
2000 Arr. Quito

Night in Quito, Hotel Inter-Continental Quito

Friday, 20 January 1984

Technical Session XII: EVALUATION OF THE ANDISOL PROPOSAL IN DIFFERENT ENVIRONMENTS
Chairman: W. G. Sombroek
Rapporteur: J. M. Kimble

0800 H. Ikawa: A critical evaluation of the placements of the Andepts of Hawaii according to the proposed key for Andisols

0830 F. N. Muchena: A critical evaluation of the placements of the Andepts of Kenya according to the proposed key for Andisols

0900 B. Clayden: A critical evaluation of the placements of the Adnepts of New Zealand according to the proposed key for Andisols.

0930 Discussion

Friday, 20 January 1984 (cont'd)

1000 Refreshments

Technical Session XIII: ICOMAND SUMMARY DISCUSSION
Chairman: M. L. Leamy
Rapporteur: B. Clayden

1030 Discussion

1230 Lunch

Technical Session XIV: RECOMMENDATIONS OF THE WORKSHOP
Chairman: F. H. Beinroth
Rapporteur: T. D. Cook

1400 Discussion and adoption of commendations and recommendations

CLOSING SESSION
Chairman: R. Tavernier

1530 The workshop in retrospect -- W. G. Sombroek

1545 Workshop impact in Chile -- W. Luzio

1600 Workshop impact in Ecuador -- F. Maldonado

1615 Workshop impact on ICOMAND -- M. L. Leamy

1630 Vote of thanks -- A. Van Wambeke

1645 Adjourn

Refreshments

2000 Closing Dinner, Hotel Inter-Continental Quito

Saturday, 21 January 1984

Participants depart Quito

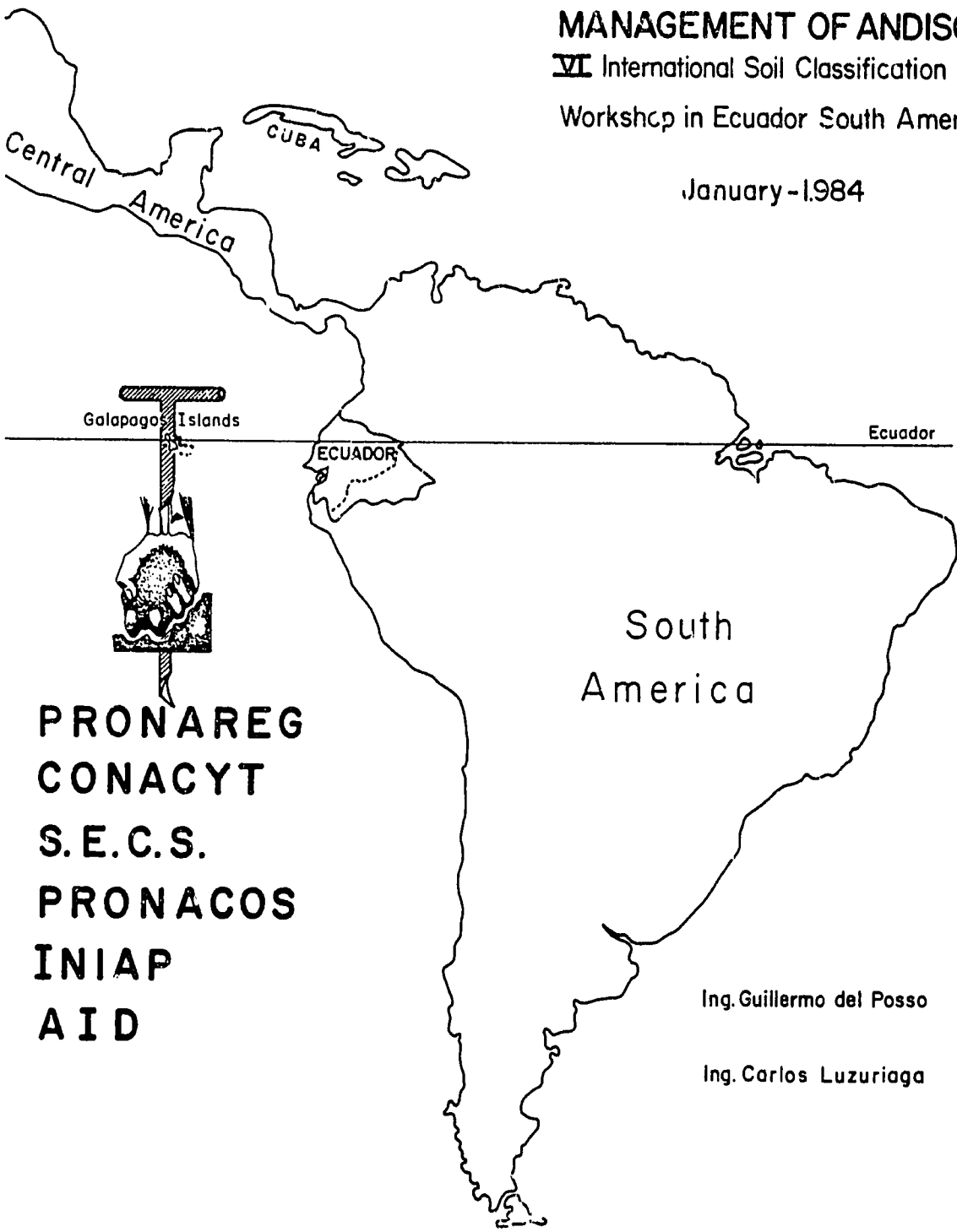
Optional pedologic or touristic programs

Guide Book for Field Trip

CLASSIFICATION AND MANAGEMENT OF ANDISOLS

VI International Soil Classification Workshop in Ecuador South America

January - 1.984



PRONAREG
CONACYT
S.E.C.S.
PRONACOS
INIAP
AID

Ing. Guillermo del Posso

Ing. Carlos Luzuriaga

Organized by:

SOIL MANAGEMENT SUPPORT SERVICES

Soil Conservation Services U.S. Department of Agriculture

co-sponsired by University of Puerto Rico

TOUR GUIDE

SIXTH INTERNATIONAL SOIL CLASSIFICATION WORKSHOP
TAXONOMY AND MANAGEMENT OF ANDISOLS
CHILE AND ECUADOR

January 9-20, 1984

International Organization: USDA, Soil Conservation Service
National Coordination: Sociedad Ecuatoriana de la Ciencia del Suelo

Sponsors:
Soil Conservation Service (SCS)
Agency for International Development (AID)
National Agrarian Regionalization Program (PRONAREG)
National Institute of Agricultural Research (INIAP)
National Council of Science and Technology (CONACYT)

Prepare by:
Guillermo del Posso, Ing. Agr. M.S.*
Carlos Luzuriaga, Ing. Agr. M.S.*

Translated by:
Fausto Maldonado, Ing. Agr. Ph. D.**

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* Members of the Soils Department, PRONAREG
** Member of the Ecuadorian Soil Science Society

INTRODUCTION

This tour guide has been prepared for the field tour in Ecuador for the Sixth International Soil Classification Workshop which will be held in Chile and Ecuador from January 9 to 20, 1984.

The tour will show the distribution and types of volcanic ash soils, starting in the highland "Sierra" and going down to the tropical lowlands. These Andisols are the result of the interaction of different tropical temperature and moisture regime and vegetation on the volcanic ash of different ages.

This guide includes general information on the country, descriptions of relevant physical aspects of the profiles and their surroundings, and the morphological descriptions and analytical data for each pedon.

The guide was prepared by the Technical Committee, Mr. Guillermo del Posso, Mr. Carlos Luzuriaga, and Mr. Claude Zebrowski and translated by Fausto Maldonado, of the Ecuadorian Soil Science Society.

The information in some chapters of this guide was taken and adapted from World Atlas of Ecuador, published by Central Bank of Ecuador and "les editions J. A."

The authors acknowledge the support and assistance received from the Director and from Departments of the Ministry of Agriculture, National Agrarian Regionalization Program (PRONAREG).

Finally, the Technical Commission received several suggestions and advice from Dr. Hari Eswaran and Terry Cook of the Soil Management Support Services, Soil Conservation Service, United States Department of Agriculture and Dr. Fred Beinroth, University of Puerto Rico.

1. GENERAL ASPECTS

1.1 History

A "Homo sapiens" of Asiatic origin lived in the country about 20,000 years ago; several stone tools found close to Quito prove his existence.

Around 1470 A.D. the Incas conquered the area; both the oral tradition and written documents testify the important role they played.

Tupac Yupanqui, his son Hupanqui, his son Huayna Capac and this latter's children, Atahualpa, and Huascar, who kept a permanent antagonism had a decisive role in the Inca empire history.

The Spanish conquest started in 1526 when, on September 21 in the second of the three expeditions that left Panama for the southern countries, Bartolome Ruiz discovered what is now Ecuadorian territory.

Sebastian de Benalcazar founded Quito, the present capital city of Ecuador, on December 6, 1534. Other cities were founded later: Portoviejo and Guayaquil, Loja and Cuenca.

On August 10, 1809, Quito declared independence from Spain although the independence process was only completed in 1822. After a short period as part of Gran Colombia, Ecuador was established as an independent republic in 1830.

1.2 Population

Ecuador has currently more than 8 million inhabitants according to the last estimate of 1983; population density is about 32 persons/km^2; 64.7 percent of them live in the coastal region, 56.6 percent in the highlands (Sierra) and only 2.1 percent in the Amazoniann region.

The Interandean Valley, a series of basins support a rural population mostly in scattered houses. Population density frequently exceeds 100 inhabitants/km^2. This high population density is the consequence of historical and geographic phenomena. On the slopes of the Andean Cordilleras, inhabited sites go up to 3,500 m above sea level, the very top level of crops, although some local variations exist due to microclimates.

In the Coastal area, the population distribution is related to the regional agricultural development while in the Amazoniann region, population is localized close to the rivers. Colonization in recent years has developed at the Cordilleras' foothills and along the roads leading to oil exploiting areas.

The Galapagos Islands have about 6,000 inhabitants or less than 1/km^2 only four of the islands are inhabited. The remaining make up part of the world known natural reserve.

Like other andean countries, Ecuador has a high percentage of native Indian's mainly in the highlands; their best known language is quichua. Native tribes also live in the Amazonian region, although since oil exploitation, a strong colonization current has developed with people from the highlands moving into this area.

The Costal Plain shows a great population diversity including indigenous, black, asiatic, and white people of Spanish origin.

1.3 Political Division and Government (Figure 1)

Ecuador is administratively divided into 20 Provinces. Five in the Coast, ten in the Sierra, four in the Amazonian Plain, and the Galapagos Islands. The Provinces are divided in "cantones" (126), these into "rural" (720) or "urban" (227) "parroquias." This division is the result of a centenary evolution in function of the different stages of space occupation. The Provinces cover areas of different dimension, depending on populated or partly populated areas, or if they have a recent or older development.

Government

According to the Constitution of January 15, 1979, Ecuador is a democratic republic with a President elected by the people on an absolute majority basis. The Vice President, elected with the President, is the Head of the National Development Council, institution in charge of preparing the development plans for the country. The National Chamber of Representatives is the legislative power. The Judicial Power is formed by the High Provincial Courts and the Supreme Court as the top judicial authority based in Quito.

Figure 1.

President

The President of Ecuador is Dr. Osvaldo Hurtado, who assumed the power on May 24, 1981. Ecuador will have new elections in January 1984.

1.4 Economic Overview

Ecuador is a small developing country whose economy has been traditionally based on agriculture. About half of its population obtain their main income from agriculture, livestock rearing, or by exploiting other renewable resources--forests and fisheries.

The Andes range, here divides into two main branches, with a high valley in the middle. This produces a wide variety of climates and the geologic configuration adds to facilitate the production of tropical crops (banana, cacao, coffee, cotton, sugar cane, rice, etc.) as well as temperate climate crops and tropical crops of the highlands like potatoes, maize, etc.

Although improved technology has reached several production areas, traditional agricultural techniques are still being used in many areas. In these areas, poor or at least lower than average yields are obtained. The introduction of improved technology has resulted in labor underemployment and, as a consequence rural to urban migration, with all the associated problems.

Economic development has been based, during the last decade, mainly on oil production from the Amazonian region. This led to continuing development when many other countries were suffering economic problems. The GNP constantly increased, there was a solid international monetary reserve, a reduced inflation rate (10 to 15 percent), and a stable money value. This led to large investments in the infrastructure, to the introduction of heavy subsidies to some imported products like wheat, and to the establishment of political prices. Agricultural production has not received the necessary support from the government and, at the beginning of the eighties, the reduction in oil production and its prices have led to the same economic situation found in most of the developing countries.

Nevertheless, Ecuador has a great potential in its natural renewable resources which are a source of new income, like the shrimp production industry which now represents the second largest export product.

1.5 COMMUNICATIONS (Figure 2)

Roads: A total of 50,000 km of roads make up the road infrastructure of which 8,000 km are paved (asphalt), 14,000 km are other permanent roads, and 18,000 are only for seasonal use.

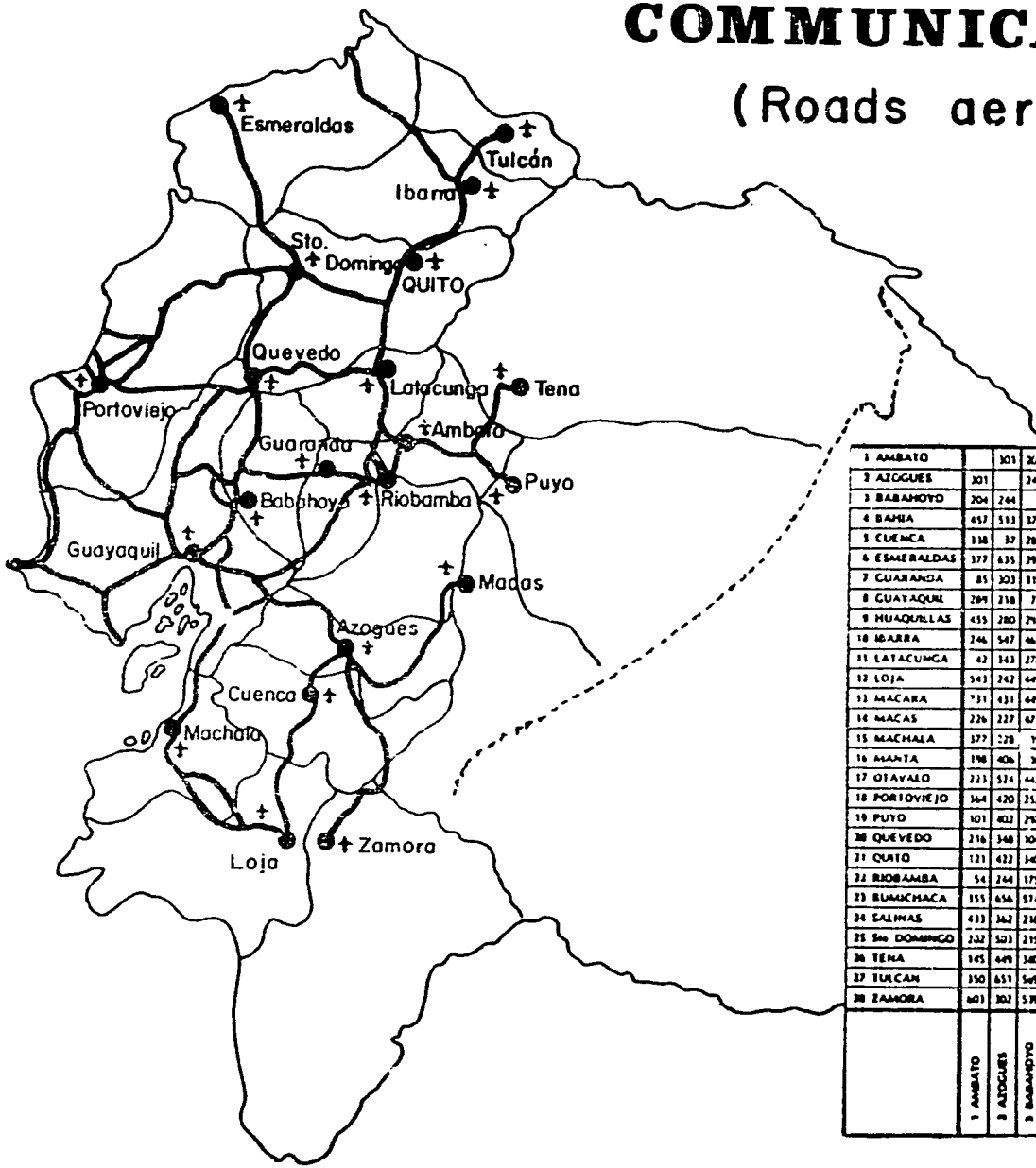
Railways: Two railways exist--one going from Guayaquil to Riobamba, Quito, Ibarra, and San Lorenzo; and the other joining Riobamba to Cuenca.

Maritime Transportation: This is very important because about 95 percent of the export and import products are carried by ship. Ecuador has a national company for common freight (TRANSNAVE) and another for oil derivatives transportation (FLOPEC).

Air Transportation: There are two international airports and 42 small airports or airstrips. Ecuador has an international airline, Ecuatoriana de Aviacion, serving the Western South American counties, Panama, and the United States of America. Other small airlines serve the internal needs of the country.

COMMUNICATIONS

(Roads aeroports)



Distances between the principal cities

	1 AMBATO	2 AZOGUES	3 BABAHOYO	4 BAHIA	5 CUENCA	6 ESMERALDAS	7 GUARANDA	8 GUAYAQUIL	9 HUAQUILLAS	10 IBARRA	11 LATACUNGA	12 LOJA	13 MACARA	14 MACAS	15 MACHALA	16 MANTA	17 OTAVALO	18 PORTOVIEJO	19 PUYO	20 QUEVEDO	21 QUITO	22 RIOBAMBA	23 RUMICHACA	24 SALINAS	25 Sto. DOMINGO	26 TENA	27 TULCAN	28 ZAMORA
1 AMBATO		301	204	457	338	377	85	289	455	246	42	543	721	226	377	198	223	364	101	216	121	54	355	433	202	148	350	603
2 AZOGUES	301		244	512	37	635	303	218	280	547	343	242	431	227	228	406	324	420	402	348	422	247	656	363	203	648	651	302
3 BABAHOYO	204	244		373	281	391	119	74	297	465	278	449	649	471	219	286	442	252	287	104	140	173	574	218	215	388	560	308
4 BAHIA	457	513	373		550	381	450	295	564	456	415	716	716	638	486	127	433	93	558	241	331	506	568	339	206	549	560	776
5 CUENCA	338	37	281	550		672	320	255	243	594	380	205	394	240	191	443	567	437	407	385	459	284	693	399	496	486	686	365
6 ESMERALDAS	377	635	391	381	672		487	464	685	471	336	838	817	603	607	446	402	416	478	237	300	431	334	608	175	470	529	898
7 GUARANDA	85	303	119	450	320	487		193	416	331	127	525	734	304	138	243	308	337	179	209	206	56	440	337	367	233	435	605
8 GUAYAQUIL	289	218	74	295	255	464	193		263	538	351	421	421	445	197	183	515	202	177	177	111	249	647	144	389	426	642	481
9 HUAQUILLAS	455	280	297	564	243	685	416	269		701	497	225	199	483	78	457	678	671	645	401	426	401	810	413	512	603	805	285
10 IBARRA	246	547	465	456	584	475	331	538	701		205	769	978	472	423	521	23	487	347	361	125	300	309	682	250	339	104	849
11 LATACUNGA	42	343	278	415	380	336	127	351	497	205		587	773	268	419	356	182	322	143	174	30	96	334	495	161	134	309	645
12 LOJA	543	242	449	716	205	838	525	421	225	769	587		189	372	230	609	766	623	417	533	664	489	898	565	664	691	893	80
13 MACARA	721	431	649	716	394	817	734	421	199	978	773	189		561	230	608	956	623	686	553	853	678	087	565	864	880	082	269
14 MACAS	226	227	471	639	240	603	304	445	483	472	268	372	567		437	633	649	647	125	442	347	248	581	589	128	308	376	312
15 MACHALA	377	228	19	486	191	607	138	191	78	423	419	230	230	633		379	680	393	646	323	498	323	732	335	434	525	737	290
16 MANTA	198	406	36	127	441	446	347	188	457	521	356	609	609	633	379		498	34	499	182	296	452	630	222	271	490	625	805
17 OTAVALO	223	324	442	433	361	403	308	515	678	23	182	766	955	649	600	498		464	324	138	302	277	132	659	227	316	127	826
18 PORTOVIEJO	364	420	252	93	457	412	337	202	671	487	322	623	621	647	393	34	464		465	148	362	418	596	236	237	456	591	683
19 PUYO	101	402	297	558	401	478	179	172	649	347	143	497	686	125	646	499	324	465		317	222	123	456	516	303	81	451	437
20 QUEVEDO	216	348	104	241	385	287	209	177	401	361	174	553	551	442	123	182	138	148	317		236	270	490	321	112	308	465	650
21 QUITO	121	422	140	337	459	303	206	411	575	125	80	664	851	347	498	396	302	362	222	236		175	234	557	125	214	279	724
22 RIOBAMBA	54	244	175	506	284	411	56	249	401	300	96	489	678	248	323	452	277	418	123	270	175		409	393	256	252	404	549
23 RUMICHACA	355	656	574	565	693	534	440	647	810	109	374	898	1087	581	732	630	133	596	456	470	234	409		791	359	448	5	958
24 SALINAS	433	362	218	327	399	608	337	144	413	682	495	565	565	589	335	222	659	236	576	321	557	393	791		433	570	786	625
25 Sto. DOMINGO	202	503	215	206	496	175	237	285	512	250	151	664	864	428	434	271	277	237	303	112	125	256	339	433		291	154	805
26 TENA	145	649	340	549	406	470	233	426	603	339	134	693	880	308	525	490	316	456	83	308	214	282	648	670	295		366	520
27 TULCAN	350	651	569	560	688	529	435	642	805	104	309	893	1087	576	727	625	127	591	451	465	229	404	5	786	350	366		953
28 ZAMORA	603	302	578	776	365	898	605	481	285	849	645	80	269	512	290	805	826	683	437	650	724	549	958	625	805	520	953	

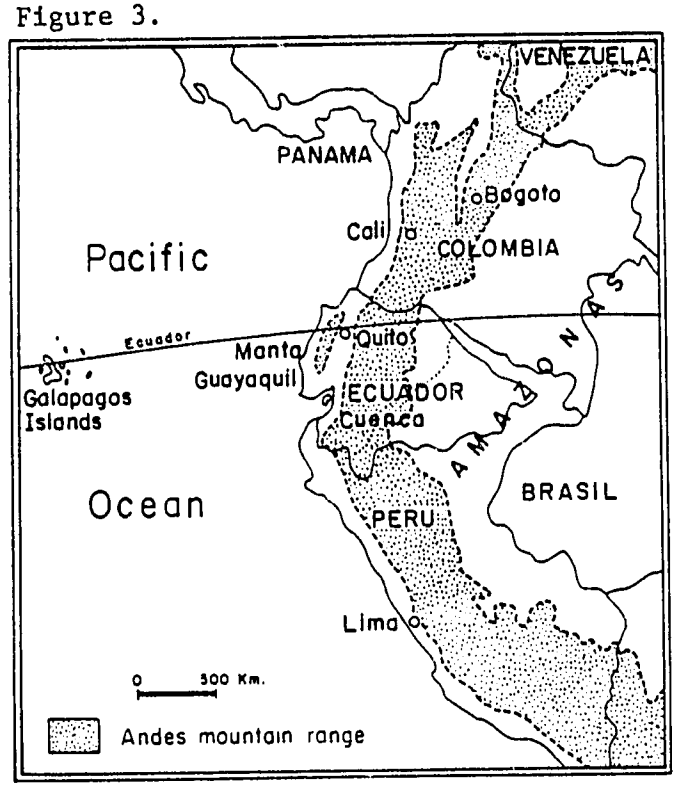
Telecommunications: Both phone and telex services permit good communication within the country and with the rest of the world.

2. PHYSICAL ASPECTS

2.1 Physiography: Geographical Setting and Relief Geographical Setting.

Ecuador covers an area of 275,032 km^2 and is located on the Western coast of South America (Figure 3). It is bounded on the north and northeast by Columbia, on the east and south by Peru, and on the west by the Pacific Ocean. Its population, geography, history, and development make up part of that great geographic Region of the Andes Range, which goes along the western side of the continent, here between the Pacific Ocean and the Amazonian Plain. Also belonging to Ecuador, the Galapagos Islands located about 1,000 km from the continental seashore. The scientific value of these islands has been known for a longtime and has led to the recognition of the islands as a Humankind Heritage.

Figure 3.

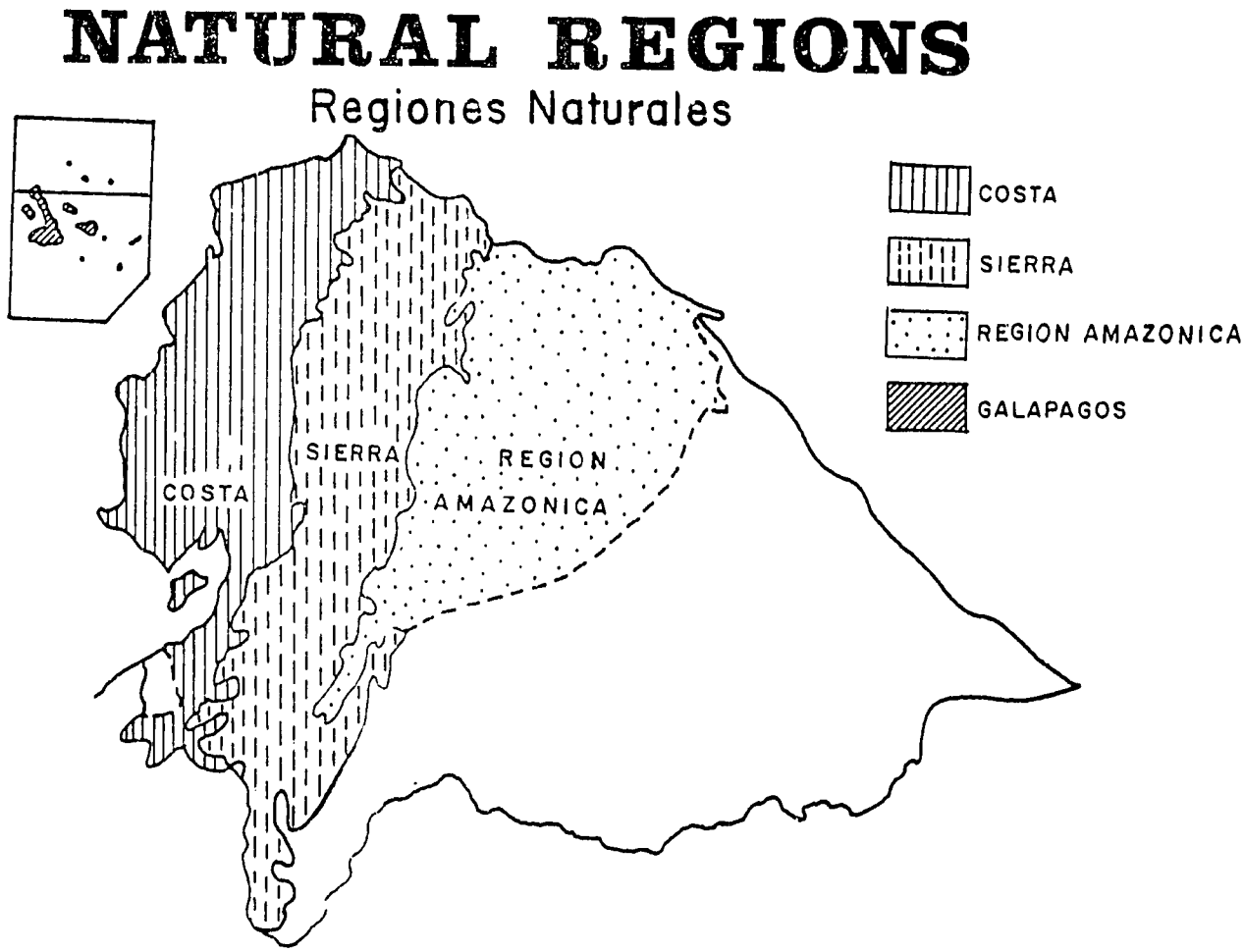


The name of Ecuador has its origin in the equator which crosses the country about 30 km north of Quito.

Relief

The major relief is the Andes Range which divides the country into three natural regions: The Coastal Plain (the Costa), the Andean mountain ranges, the Interandean Valley (the Sierra), and the Eastern plains which belong to the Amazon Basin (the Orients of Amazonian in Region). (Figures 4 and 5)

Figure 4.



The Sierra

The Andes Range form a mountainous barrier 100 to 120 km wide with external slopes of more than 4,000 m in two dominant directions: NE-SW on the north from Quito and south of Alausi and N-S in the middle. From the Colombian border in the north to the town of Alsusi in the south, there are two parallel ranges (West and East Cordillers) with altitudes between 4,000-4,500 m and cool or cold climates; several snow peaks stand out of these cordilleras, the highest being Chimborazo Mt. at about 6,300 m.

The central part of the Sierra is about 50 km wide and has a series of intermountainous valleys separated by minor transverse chains called "nudos," which with the main chains form an association similar to a ladder. The valleys are flat or rolling, and they range in altitude from 1,600 to 3,000 m. The whole area is covered by volcanic ash.

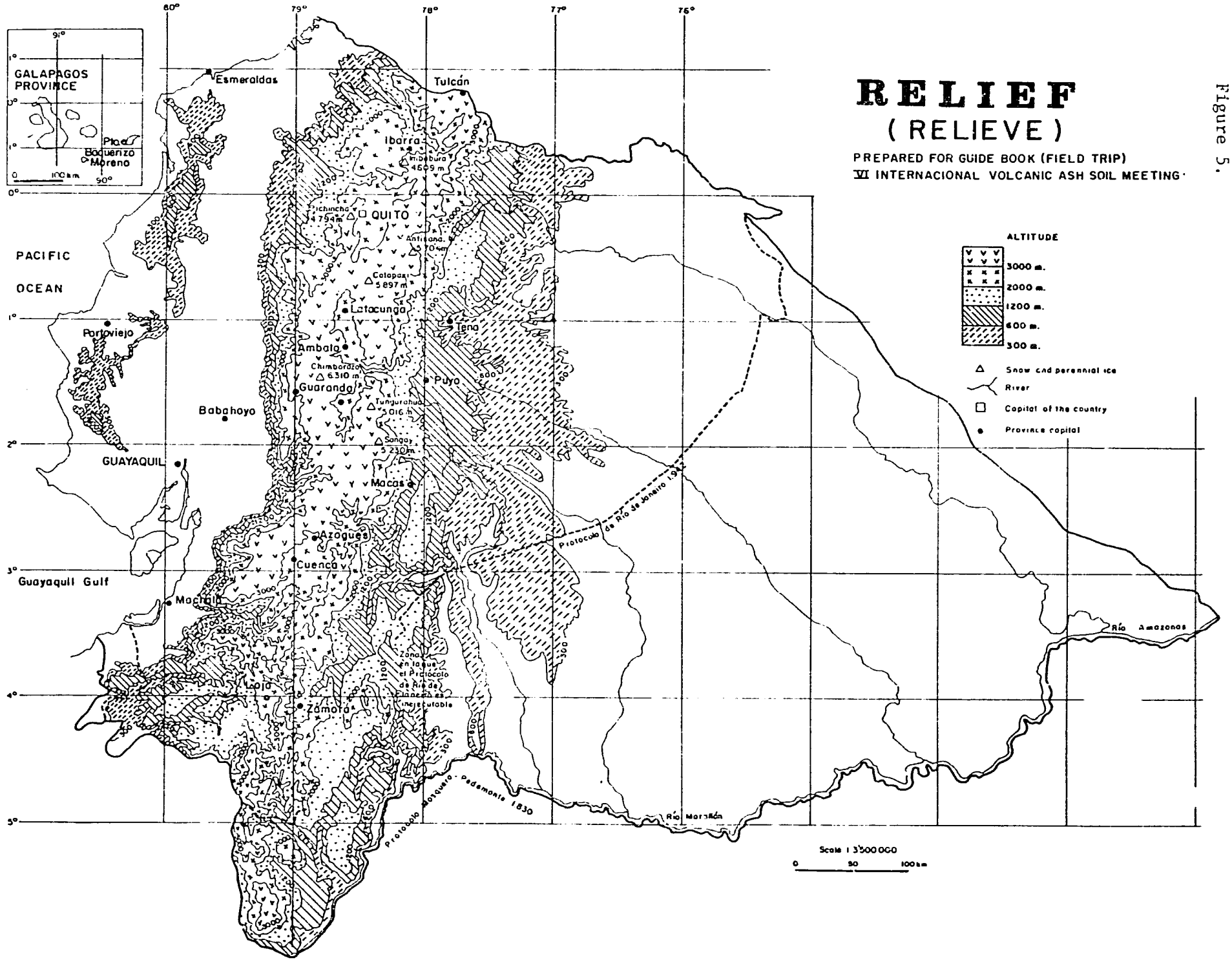

RELIEF
(RELIEVE)
PREPARED FOR GUIDE BOOK (FIELD TRIP)
VI INTERNACIONAL VOLCANIC ASH SOIL MEETING
ALTITUDE
3000 m.
2000 m.
1200 m.
600 m.
300 m.
Snow and perennial ice
River
Capital of the country
Province capital
GALAPAGOS PROVINCE
Plaza
Baquerizo Moreno
PACIFIC OCEAN
Guayaquil Gulf
Esmeraldas
Tulcán
Ibarra
Imbabura 4609 m
Ichincha 4794 m
QUITO
Antisana 5704 m
Cotopaxi 5897 m
Latacunga
Tena
Portoviejo
Ambato
Chimborazo 6310 m
Guaranda
Puyo
Tungurahua 5016 m
Sangay 5230 m
Babahoyo
GUAYAQUIL
Macas
Azogues
Cuenca
Machala
Loja
Zamora
Zona en la que el Protocolo de Río de Janeiro es inejecutable
Protocolo de Río de Janeiro 1942
Protocolo Mosquera-Pedemonte 1830
Río Amazonas
Río Marañón
Scale 1:3'500.000
0 50 100 km

Figure 5.

South from Alausi to the town of Zaruma, there are no high volcanoes and the mountains' altitude range from 3,600 to 4,700 m. Further south to the Peruvian border, the mountains are not higher than 3,500 m and no volcanic ash covers them.

The Costa

The Costa is the area west of the Western Andes Range from 600 m to sea level. It is widest in the area of Guayaquil (180 km) and is about 100 km in the south.

To the west and close to the ocean, there is a small range which goes from Esmeraldas southward to Portoviejo and Jipijapa and to the east of Guayaquil.

Between the Andes and the Coastal Range, there is a large plain about 80 km wide, slightly dissected to the north, close to Santo Domingo (600 m) and gently sloping to the south These alluvial plains and valleys are drained by large rivers. The seashore shows different landscapes; straight line beaches are found as well as cliffs and small bays and mangrove stands.

Amazonian Region or Oriente

Occupying almost 50 percent of the country, the Amazonian region is located to the east of the Cordillera Oriental and belongs to the Amazon Basin. Average altitudes are 500 m or less and the topography is formed by level plateaus which are usually dissected by rivers. The region is still mostly under forest and has a humid tropical climate.

The Galapagos Islands

This insular area of volcanic origin is formed by 13 islands at about 1,000 km west of continental Ecuador. They have different sizes and are formed by volcanoes emerging from the sea and reaching altitudes to 1,600 m.

2.2 Geology and Recent Volcanism

Geology (Figure 6)

The present geologic structure of Ecuador reflects the interaction of various orogenic and paleogeographic events among which the most important is the uprise of the Andes Cordillera. While this occurred, the Andes were under an intense erosion process, which led to the formation of continental sediments (of detrital origin; i.e., the mechanical alteration and destruction of rocks). Through the different geologic eras, these sediments were deposited either in the external slopes or in the graven between the cordilleras. Conglomerate, breccia, sandstones, clays, and shales are among these rocks.

On the other side, several oceanic transgressions and regressions, have produced the deposition of marine sediments. Among these limestones, clays, and sands are found.

Volcanism produced both acid and basic lava (rhyolitic, andesitic, and basaltic) and pyroclastic, both coarse and fine.

There are also sediments of mixed origin: volcano-sedimentary formations resulting from the volcanic activity in marine environments and sediments of the fly ash type.

GEOLOGY
(Geología)

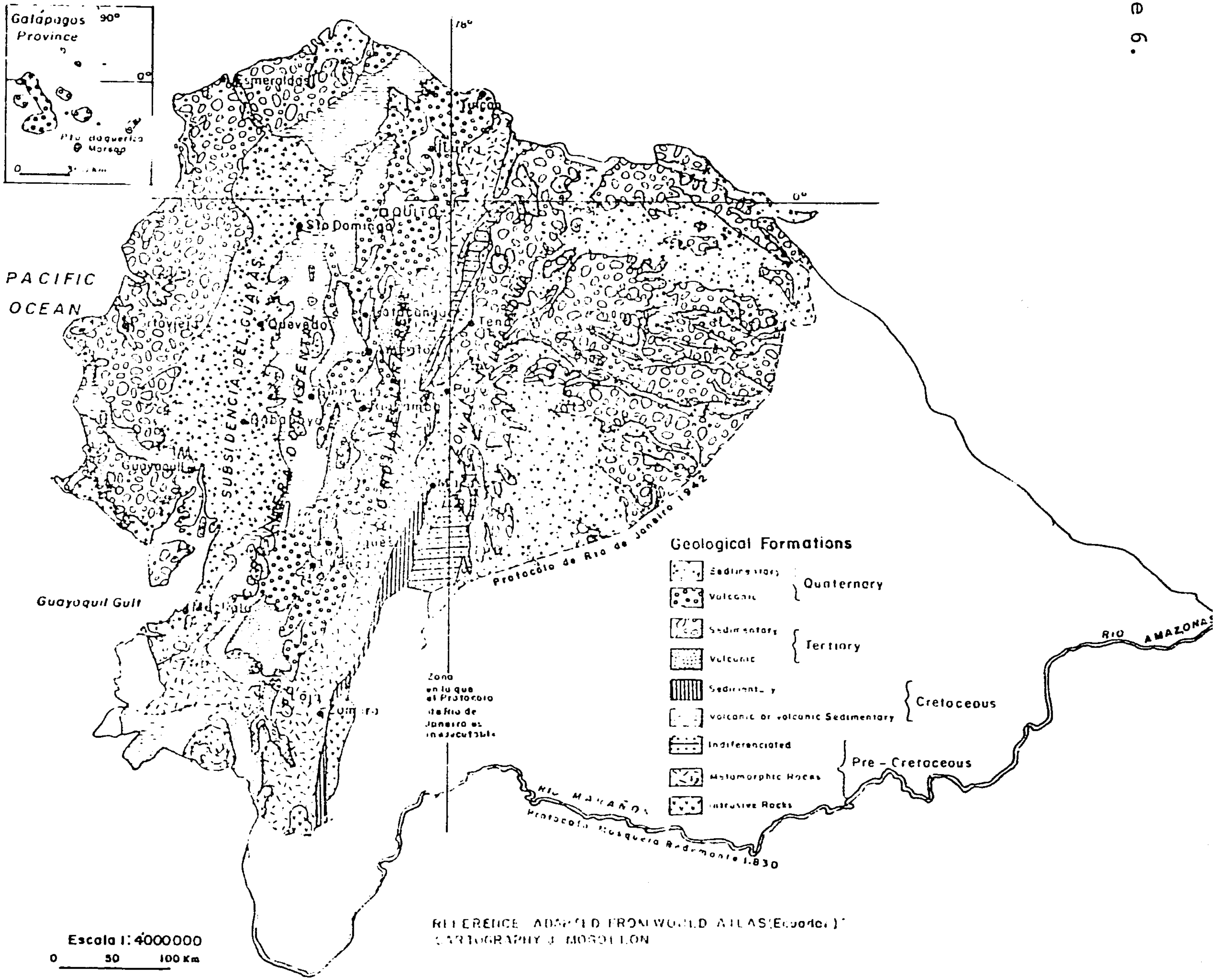


Figure 6.

Some groups of crystalline and sedimentary terrains, under strong pressures resulted in the formation of metamorphic rocks (gneiss), slates, marble, quartizes, etc.

Finally, as a consequence of breaking produced by tectonic movements, certain formations were crosscut by liquid crystalline rocks which led to the formation of intrusive massifs of granit, diorite and granodiorite.

Volcanism, tectonic movements and sedimentary deposits are the foundations of Ecuador geology, but the physiography was remodeled during the Quaternary period. In fact, late volcanic activity has covered a large area of the Andes with a thick pyroclastic layer, especially a mixture of dust and volcanic ash, frequently hardened and known as "cangahua." On the other side glaciations, mass movements, and erosion by rivers have carried a high amount of detrital materials, contributing to the formation of moraines, alluvial fans, and spreading materials to form the eastern plateaus and river valleys.

Recent Volcanism

Volcanism is important in Ecuador due to the relief formed and the thickness of and area covered by the products emitted. In fact, volcanism has met here the appropriate conditions, probably due to plate tectonics, where plate expansion has produced abundant faults and fractures through which volcanic products were ejected to the surface. Recent volcanism plio-quaternary, is formed in the following regions:

In the Andean area where two volcanic regions can be identified, the first one from the Chiles to the Sangay Volcanoes is characterized by strato-volcanoes. On the western cordillera--necks and calderas predominate. The altitude of the whole area is less than 5,000 m. Only Iliniza, Carihuairazo, and Chimborazo Mountains are higher and are permanently snowcapped. On the eastern cordillera, snowcapped mountains are more frequent. There are large volcanic cones (Cotopaxi, Tungurahua and Sangay) with slopes of about 70 percent and with hundred-meter-wide craters. These volcanoes have erupted andesitic lava of the aa type and mainly pyroclastics. An unresolved problem in the presence of the vast volcanic formation known as "cangahua" which might be an eolian deposit.

Volcanic activity has moved from the western to the eastern cordilleras and may currently be seen in the Cotopaxi, Tungurahua, and the active Reventador and Sangay volcanoes.

Going south, the second region from Sangay volcano to Zaruma, the large stratovolcanoes disappear and a large plateau is found with cliffs, locally resembling organ pipes. This large plateau is made of a mass of rhyolitic lava flows covered by a volcanic ash layer of above 50 cm.

In the subandean zone, (east from the main cordilleras) volcanism is reduced to three volcanoes, located on the Napo anticline. These are similar to the volcanoes in the eastern cordillera, but are more Stromboli type and their lava is basaltic rather than andesitic.

In the Galapagos Islands, the 14 main islands are formed from volcanoes which have emerged from a submarine mountain range. Isabela Island for instance, the largest one in the archipelagos, is formed by six volcanoes. Volcanism here is closer to the Hawaiian-type characterized by shield-like

cones with very wide calderas. Most common are the basaltic lava, very fluid of the pahoehoe type. The highest cones (1,000 to 1,700 m) and the widest calderas (5 to 9 km) are in the Fernandian and Isabela Islands.

2.3 Climate (Figure 7)

Being on the equator and with the high relief of the Andes, Ecuador has a great range of climates even over very short distances.

Main Factors Influencing Climate

Climate is influenced by two main factors: the general atmospheric circulation and the local air masses resulting from the relief. There are few other minor factors like the ocean currents which play an important role in the Coastal zone climate.

The General Atmospheric Circulation

Ecuador, as a whole, is located within an equatorial belt characterized by low atmospheric pressures, high moisture, and high temperatures. As a consequence of the tilting of the earth's rotation axis in relation with its orbit around the sun, this belt periodically moves towards the Southern Hemisphere. On the other side close to the 30° north and south, there are two subtropical anticyclones with a less moist, less warm air, and with high atmospheric pressures; this leads to a displacement to the lower pressure area of the equatorial belt, the Intertropical Convergence Zone. Air masses coming from the two hemispheres come in contact to generate an intertropical front, unstable zone with atmospheric disturbance, as the air masses try to overcome each other.

During the year, the intertropical front will follow the same movements as the equatorial belt:

--From February to July the front will move to the north, influencing the western area of the American continent. Ecuador is covered by temperate and rather dry air masses coming from the south and producing a stable and rather agreeable weather.

--From September to December the front enters the Southern Hemisphere influencing the eastern zone of the continent. Ecuador is under warm and moist air masses coming from the north resulting in a temperature increase, atmospheric instability, and stormy weather.

Local Air Masses

Topographic contrasts produce four types of air masses each with different properties.

--Warm air masses of oceanic origin are located over the Pacific Ocean. They are very humid and move towards the continent. Close to the Cordillera (West) the warm air rises uphill due to convention and, as it cools, it forms clouds and rain. Most of this thick cloudy layer stays onsite, but a part enters the interandean valley, although diminished of part of its moisture.

--Warm air masses of continental origin are located over the Amazonian region. Also rising by convection, they cool on the eastern cordillera and produce heavy rains on that side, sometimes entering the Interandean Valley. This type of continental air masses also exist over the coast but are not as important as over the Amazonian in area.

CLIMATE

CLIMA
(Precipitación)

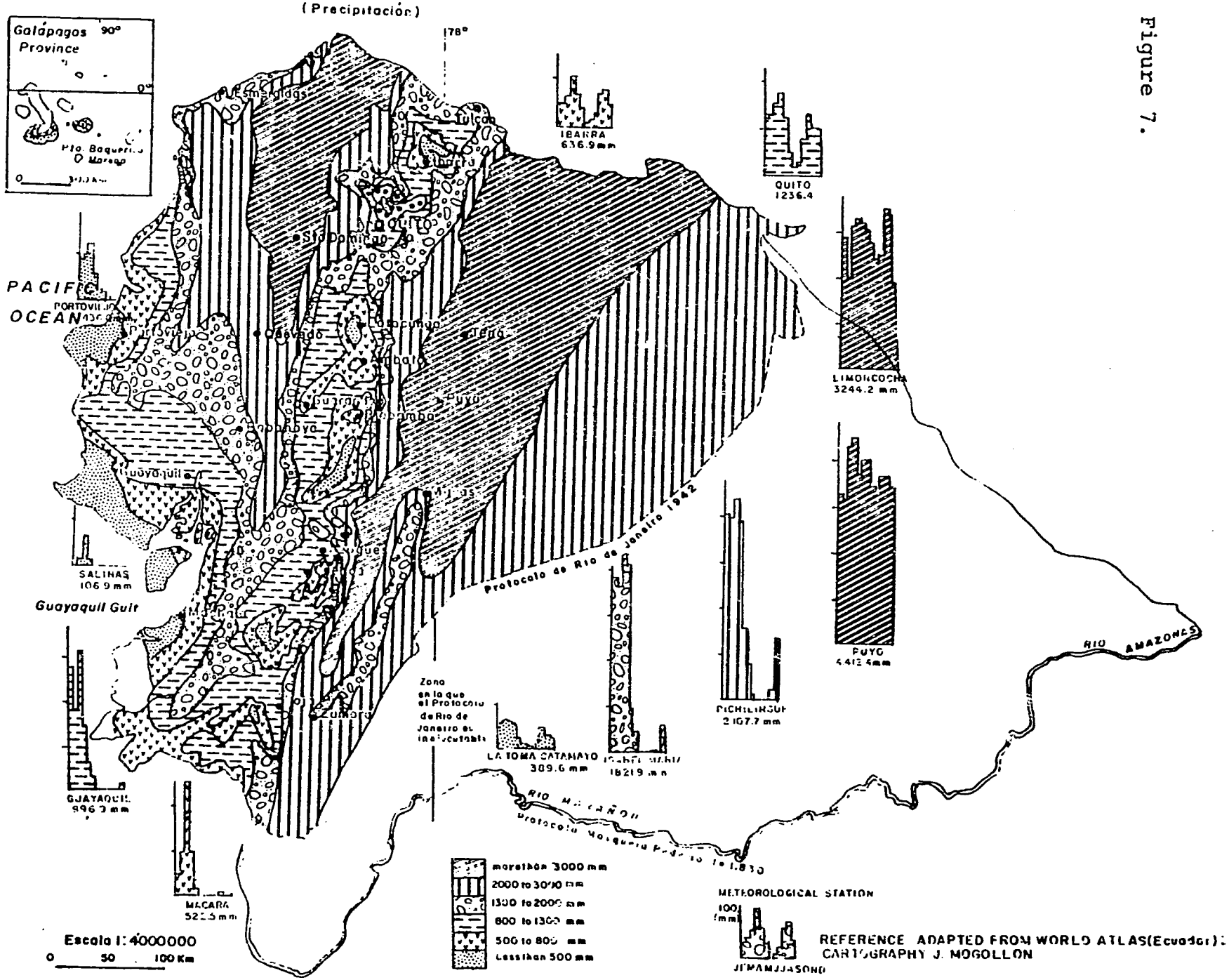


Figure 7.

--Temperate air masses are located over most of the Andes between 2,000 and 3,000 m above sea level.

--Cold air masses, rather small, are located around the tops of the highest mountains.

Oceanic Currents

The Ecuadorian Coast and particularly the Santa Elena Peninsula, are under the influence of the cold Humboldt current most of the time, whose origin is the Antartic Ocean. When it is close to the coast, usually between May and October, the cool air masses cause a lowering of the temperature. Although these masses are moisture-saturated, no heavy rains occur, only a light mist and drizzle, locally called "garua."

A counter current is formed, coming from the west, opposed to the Humboldt current. It reaches the Ecuadorian coast from December to April. This results in oceanic warm winds and storm formation with temperature increases over the coast.

A still unexplained phenomenon is the southward movement of the current, reaching even to the north of Chile, which facilitates the movement of warm weather (25-29° C) coming from Panama. This phenomenon is known as "El Nino" (Child Jesus) because it starts commonly in December. On the average, it is produced every 7 years. Its consequences are a mixed blessing: on one side comes the abundant rain to a dry area; on the other fish and aquatic birds are killed, or at least pushed to colder areas.

All the above influences are compounded to give the great variety of Ecuadorian climates.

Main Climate Classes (Figure 8)

The factors mentioned above combine to produce different kinds of climate in Ecuador. Eight classes have been identified and their names show both the amount and distribution of rainfall during the year (tropical or equatorial, having one or two rainfall peaks, respectively) and the average temperature.

--Megathermal rainy. With a mean annual temperature around 25° C., total rainfall exceeds 3,000 mm and may go up to 6,000 mm per year with a very regular distribution, slightly decreasing from December to February. Relative humidity is 90 percent or higher. This class is found in the extreme northern area (Esmeraldas) and in the Amazonian region.

--Tropical megathermal moist. This covers the outer hill-slopes of the two cordilleras. Annual rainfall exceeds 2,000 mm and may reach 5,000 mm, mostly in one rainy season. Temperature ranges from 15 to 24° C according to changes in altitude. Relative humidity is about 90 percent.

--Subhumid tropical megathermal. Rainfall ranges between 1,000 and 2,000 mm, and it is concentrated in one period (December to April), with the remaining months dry. Average temperature is 25° C and relative humidity ranges between 70 and 90 percent. This class covers an 80 km-wide belt in the coast from the northern border to Guayaquil.

DISTRIBUTION OF CLIMATES

(Tipos de climas)

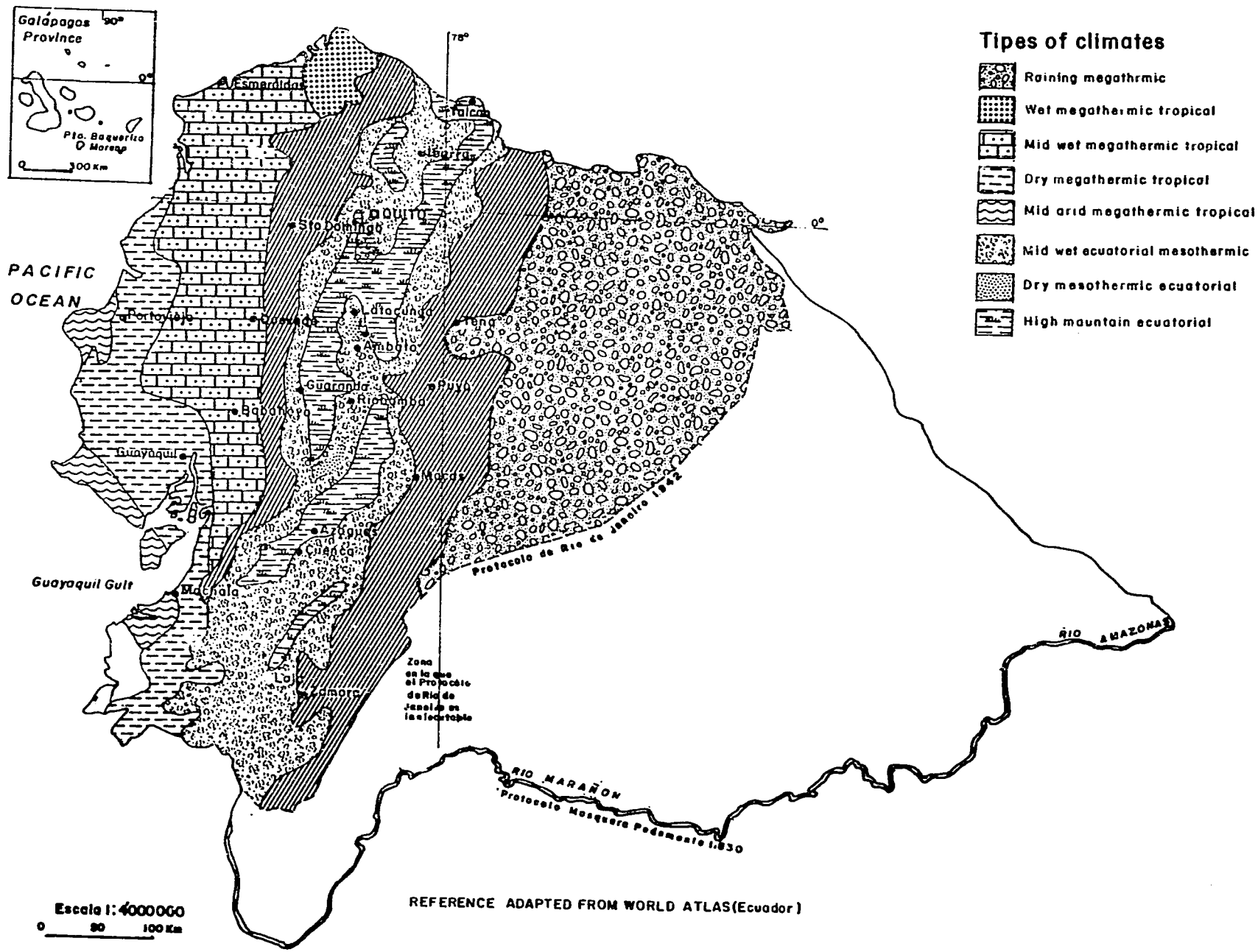


Figure 8.

--Dry tropical megathermal. Rainfall averages between 500 to 1,000 mm concentrated from January to April. The remaining months are very dry and average temperature is very high. The area influenced by this class is about 60 km wide west of the previous class and from the equator to about 4°30' S.

--Subarid tropical megathermal. Mean annual rainfall in less than 500 mm and mean temperatures range between 20 and 26° C and relative humidity is about 80 percent. The rainy season is characterized by a cloudy sky, mists and very low intensity rain. Low mountains more than 300 m high are a little moister. This class covers small areas at the coast in Manta, Santa Elena, and the coastal belt of the Galapagos Islands.

--Subhumid equatorial mesothermal. It is the most common over the Interandean area, except for areas higher than 3,000 to 3,200 m and some valleys. Total annual rainfall ranges from 500 to 2,000 mm. Mean temperatures from 10 to 20° C, following the altitude and relative humidity goes from 65 to 85 percent.

--Dry equatorial mesothermal. Temperatures range between 18 and 22° C with almost no change from one season to another. Two dry seasons separate two rainy seasons which total less than 500 mm rainfall. Relative humidity ranges from 50 to 80 percent and clear skies are common.

--High altitude equatorial climate always affects areas over 3,000 m. Mean annual temperature is about 8° although variations go from 0° to 20° in some cases. Rainfall ranges between 1,000 and 2,000 mm according to altitude and aspect of hillsides. Relative humidity is almost always higher than 80 percent.

Fauna

Ecuador is an area of exceptional interest concerning its flora and fauna. In spite of its relatively small area comparatively in South America, a high percentage of species are found in the country. For instance, 1,500 out of the 2,600 bird species in this part of the world are found in Ecuador. This is of course due to the ecological diversity going from the coastal desertic areas to the Amazonian jungle. The Andes Cordillera has contributed to create differences in flora and fauna too.

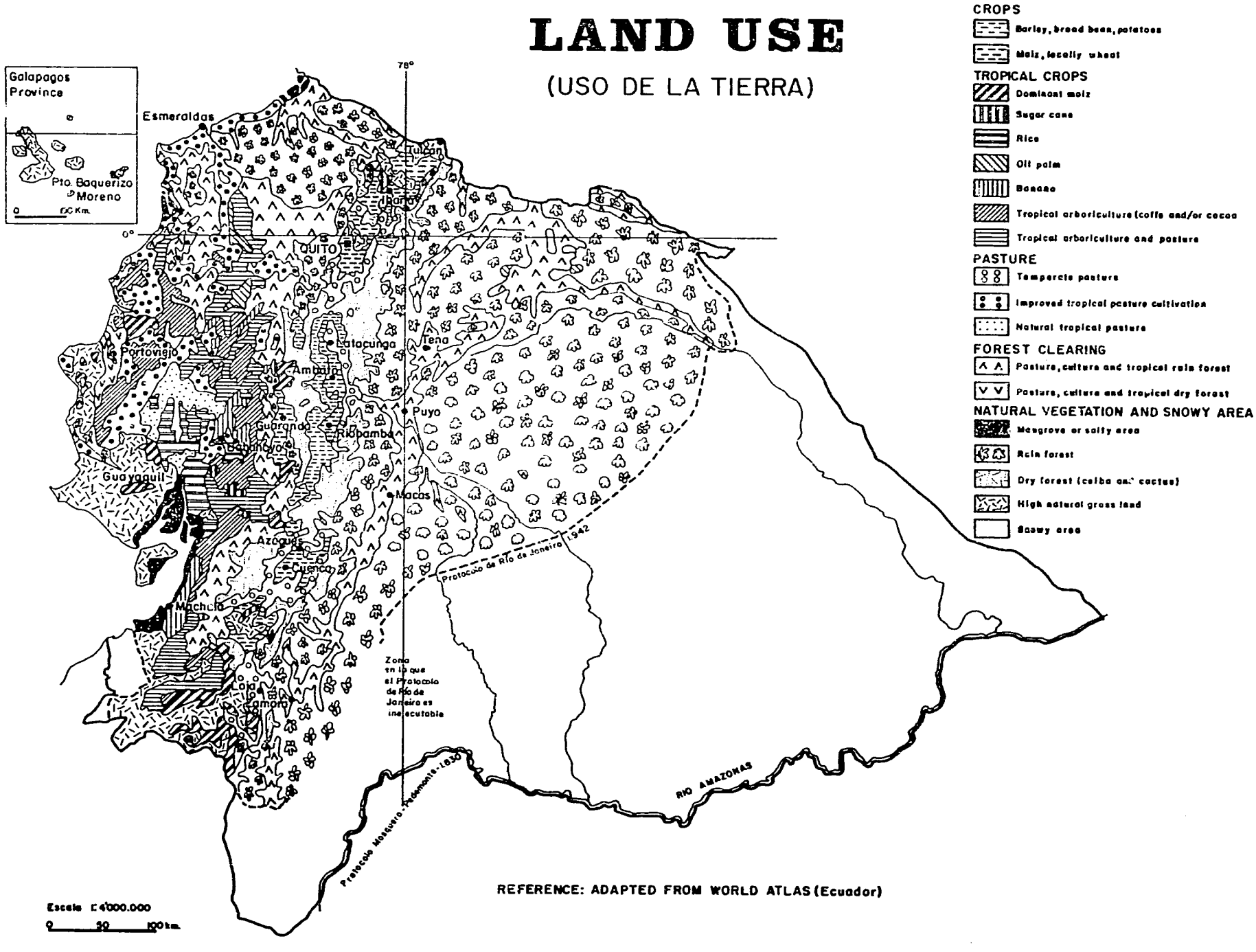
2.4 Land Use (Figure 9)

Agricultural production diversity in Ecuador is exceptional, including tropical as well as temperate climate products. In the area close to the equator, the highlands of the Andes Cordillera have crops typical of four season areas (except that day length does not change during the year). Changes in temperature are due to altitude combined with differences in moisture too.

Land use changes also according to plots size. Land distribution shows the known pattern of large areas belonging to few owners: 67 percent of the landholdings are less than five hectare, and occupies 7 percent of the agricultural land area, while 2 percent of the landholdings are of more than 100 hectares, and occupying 48 percent of the area. Crops occupy most of the minifundia (78 percent of land) while pastures (47 percent) are most common in the large haciendas (37 percent of land). Large haciendas benefit from irrigation water, more than small landholdings.

LAND USE

(USO DE LA TIERRA)



REFERENCE: ADAPTED FROM WORLD ATLAS (Ecuador)

Figure 9.

32 -

The introduction of mechanization has resulted in a decreased use of agricultural labor, which causes unemployed. This has caused many people to migrate to the cities.

All the above compounds to produce less than the country needs. Wheat, fats (oils and animal fats), and milk represent 32.5 percent of all agricultural imports; paper and wood products amount to 22 percent and the line of agricultural inputs; and machinery (33 percent) show how dependent the national agriculture is on outside inputs. Nonetheless, the balance of the sector within the external trade is rather positive. By 1980 there were $392 million imports versus $701 exports. Four tropical products make 91 percent of all agricultural exports: banana (34 percent), cacao (30 percent), coffee (20 percent), and sugar (7 percent).

The Sierra

The upper limit for agricultural use ranges from 3,200 to 3,800 m, depending on local drought, wind, or mist exposure. Few potato plots can reach the 4,000 m contour line. Above it only a natural grass (paramo) vegetation is found whose only use is for sheep (rarely cattle) or llama grazing.

Each crop is localized at a specific altitude level following the most suitable combination of temperature and moisture conditions. This results in the formation of well characterized belts of the various crops. The top level includes barley, broad beans, andean tubers like oca, (Tropaeolum sp.) and potato (Solanum tuberosum).

Above 3,800 m a very harsh climate and the frost danger prevent the growth of crops.

The middle level from 2,400 to 3,000 m is the maize area. Maize is mostly associated with beans. When irrigation water is available horticulture becomes important, as around Ambato. This level also slows pasture development, either natural in few areas or cultivated. It is at this level that wheat is being produced, although its production has decreased due to high production costs in comparison with imported wheat.

The lower level is the one of sugar cane production (below 2,200 to 2,400 m). This crop is still found in the large haciendas, while the small farmer prefers to have tomato, beans, and fruit crops like avocado. These crops grow only with irrigation.

In the southern province of Loja, the cordilleras are lower than in the north, and the area has a seasonal agriculture based on the rather irregular rainy season. Maize (hard, high protein) is there associated with another species of bean, the sarandaja (Dolichos sp.). Some tropical crops such as cassava and peanuts are also grown.

On the outer hillslopes of the cordilleras, land has been cleared by a slash and burn system of cultivation. The older the occupation of land, the more common is the presence of pastures and less of other crops.

The Sierra region shows the highest population pressure. Minifundia of less than 5 hectares make up 78 percent of all landholdings, but cover only 11 percent of the area. Only 52 percent of a small farmer income originates

in agriculture. The remaining 48 percent is obtained from other sources, especially from various jobs performed in the cities, as construction workers, etc.

The Coast

Moisture changes from southwest to northeast influence the tropical agriculture of the coast.

Desertic Southwest. The Santa Elena Peninsula and the area close to the Peru border are occupied by natural vegetation of dry areas like cacti, and show very unfavorable conditions for agricultural use.

Moist Northwest. Both accessibility, topography, and the high rainfall which have produced a tropical jungle and have prevented an early development or any kind of exploitation. Current use is reduced to pastures and few perennial or semipermanent crops (Cassava, plantain, coffee, and to a lesser degree, cacao) along the main roads and rivers. To the south of this area, colonization projects are being started.

The Center and Southeast. The tropical moist climate, with a dry season, provides favorable conditions for agricultural use. Two areas can be identified: the coastal hills and the eastern plains.

The coastal hills. The presence of clouds above 300 m has encouraged the use with tropical tree crops: coffee, cacao, and citrus are often mixed with subsistence crops and pastures in the small landholdings. In the zone of low hills and moderate relief, most of the area is under pasture. Cattle rearing is mainly for meat production.

The Plains. With the exception of the west central part whose unfavorable soil conditions allow only the development of natural pastures for extensive grazing, the plains area is formed on sedimentary materials of high fertility, where the main industrial and export crops are established.

--Cacao is more sensitive to moisture than coffee and grows in the southern part. There are about 1 million hectars of single crop and 150,000 mixed with coffee. Cacao yields are usually low due to the lack of a good plantation management and because most plantations are old. Annual production is about 90,000 tons.

--Coffee is grown all over the plains (C. robusta) where it has been cultivated more recently than in Manabi and the south of the Andes (C. arabica). It often grows mixed with cacao, bananas, citrus, and even with mango or other fruit crops in the small farms. As a single crop, it occupies about 120,000 hectares. Annual production ranges between 75,000 and 80,000 tons.

--Bananas are cultivated under two systems (1) small (family) farms where they grow associated to other fruit crops, this fills most of the country needs; (2) large farms produce export bananas. Their production started back in the fifties in Los Rios and Guayas Provinces and more recently in El Oro Province. Over production and international commercialization problems have brought about a decrease in the plantation area (about 200,000 hectares in 1972, 110,000 hectares in 1980).

--Sugar Cane. In small plantations is mostly for alcohol and brown sugar production while large enterprises work with associated sugar mills. The latter are to the east of Guayaquil. Sugar production of about 3,800,000 tons is slightly over the country's needs.

--Rice is mostly cultivated in the flood plain with a total area of 130,000 hectares. Present yields could be improved with a better water use and with improved techniques. Annual production of 145,000 tons does not meet the country's needs.

--Oil palm, of comparatively recent introduction, is cultivated in the more moist humid northern area along the main roads. Oil palm production increased from 21,000 tons in 1970 to 208,000 tons in 1980. It is one of the main raw materials to make edible oil, but its production has not met the country's needs yet. Soybeans are produced mainly in Los Rios Province and complement oil palm in the oil industry.

In spite of the importance that all these products have, the west lowland plains are under utilized as compared to their potential capability. Topography and soil conditions permit an intensification of all the crops and justify high investments to improve irrigation and drainage.

The Amazonian Region

Long before the Spanish conquest, aborigine people in this area were using the land under a shifting cultivation system based on forest clearing of the jungle. This, along with hunting and fishing, provided a balanced diet. Shifting cultivation has been, with slight variations from site-to-site, the method used all over the Amazonian region. Based on the same starting need: that being low natural fertility of the equatorial forests' soils, their rational use implies a rotational cultivation. Indigenous people to the Ecuadorian Amazonian cultivate up to 40 different species in one vegetable garden or orchard; the most common are cassava, plantain, Colocassia sp., and other tubers. The production period of a plot varies according to soil fertility from 3 to 10 years. A plot abandoned for 25 years can not be distinguished from the surrounding forest.

In the foothill areas of the cordillera where colonization fronts are moving forward, shifting cultivation is being changed to extensive cattle raising introduced by the colonizers. Instead of having small isolated plots, there is a whole area of forest clear and converted to pastureland. This results in a further impoverishment of already low fertility soils, with no compensation for the lost organic matter.

Also present in the area are a few industrial enterprises which started with tea production and more recently the introduced oil palm.

A balanced development of the Amazonian region requires a difficult compromise between the aspirations of those who chose to settle in these areas and the native people presently there who want their ways respected.

2.5 Soils* (Figure 10)

The interaction of climate and parent materials results in the formation of several soils which can be included in four groups:

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*Ecuador has adopted as official soil classification system the USDA, SCS "Soil Taxonomy."

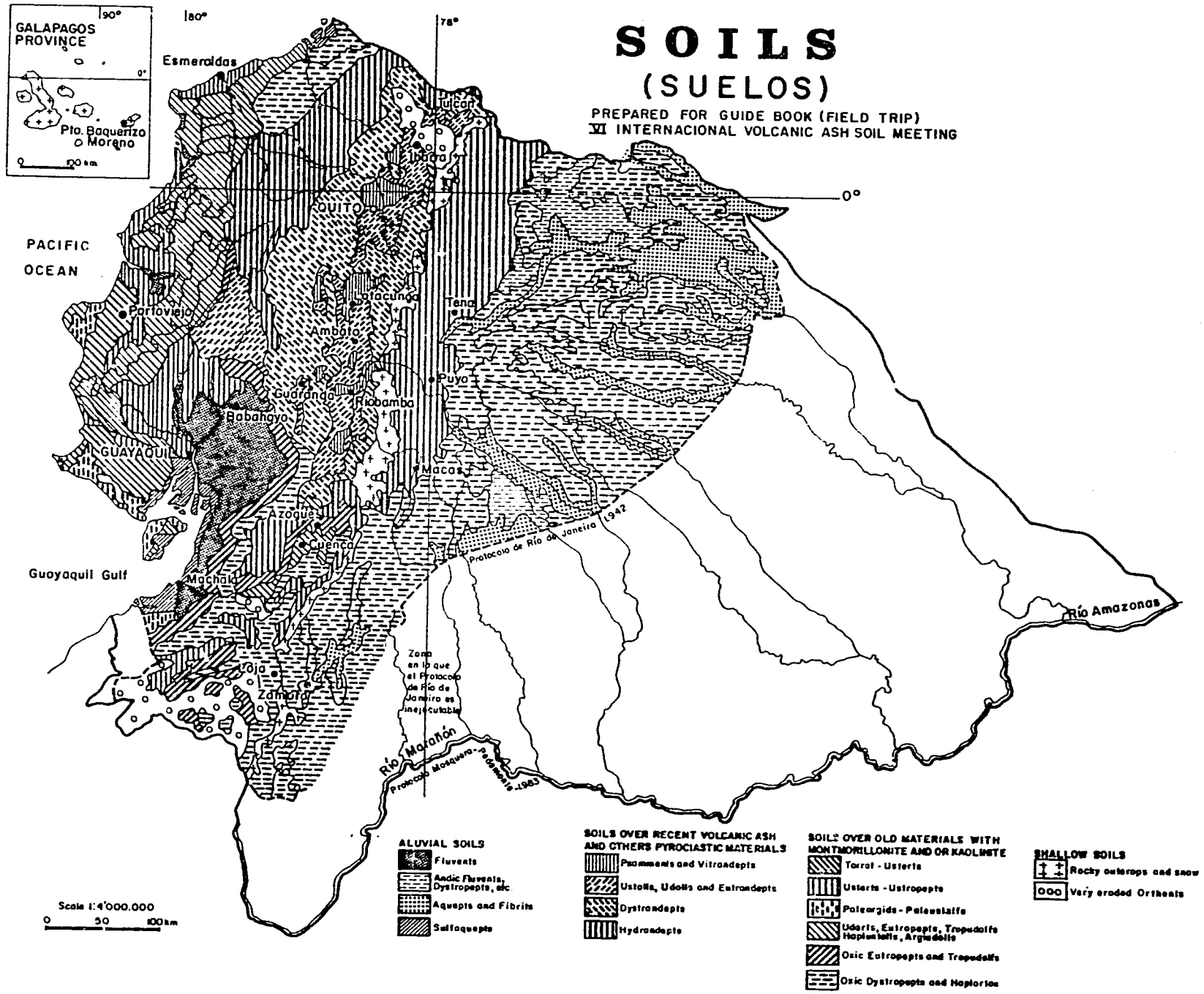
SOILS
(SUELOS)
PREPARED FOR GUIDE BOOK (FIELD TRIP)
VI INTERNACIONAL VOLCANIC ASH SOIL MEETING
GALAPAGOS PROVINCE
Pto. Baquerizo Moreno
90°
80°
78°
0°
Esmeraldas
Tulcán
Ibarra
QUITO
PACIFIC OCEAN
Portoviejo
Latacunga
Tena
Ambato
Puyo
Guaranda
Riobamba
Babahoyo
GUAYAQUIL
Macas
Azogues
Cuenca
Protocolo de Río de Janeiro 1942
Guayaquil Gulf
Machala
Río Amazonas
Zona en la que el Protocolo de Río de Janeiro es inejecutable
Loja
Zamora
Río Marañón
Protocolo Mosquera-Pedemonte 1983
Scale 1:4'000.000
0 50 100 km
ALUVIAL SOILS
Fluvents
Andic Fluvents, Dystropepts, etc.
Aquepts and Fibrists
Sulfaquepts
SOILS OVER RECENT VOLCANIC ASH AND OTHERS PYROCLASTIC MATERIALS
Psamments and Vitrandepts
Ustolls, Udolls and Eutrandepts
Dystrandepts
Hydrandepts
SOILS OVER OLD MATERIALS WITH MONTMORILLONITE AND OR KAOLINITE
Torrat - Usterts
Usterts - Ustropepts
Paleargids - Paleustalfs
Uderts, Eutropepts, Tropudalfs Hapludalfs, Argiudolls
Oxic Eutropepts and Tropudalfs
Oxic Dystropepts and Hapludox
SHALLOW SOILS
Rocky outcrops and snow
Very eroded Orthents

Figure 10.

2.5a Alluvial Soils

1. Little developed or nonhydromorphic soils which are found in the western valleys of the coastal region, mainly between Babahoyo and Machala, although they are also present in Manabi (north and northeast of Portoviejo) and northeast of Guayaquil. They are mostly Fluvents and they are either water saturated a short time in the year or not at all. Soil textures are coarse for those soils closer to the cordillera and finer in those away from the mountains. These are young soils with no diagnostic horizons, except for an Ochric epipedon. They are usually fertile soils and well suited to a wide range of crops.

2. Andic soils. These have developed on volcanic ash deposits; they are well drained and they are mostly found in the Northern Amazonian region. They belong to the Andic Dystropepts or Typic Dystropepts subgroups in "Soil Taxonomy." (Soil Survey Staff, 1975) They have volcanic or allophanic minerals; are moderately deep and clayey; they have a rather low fertility, but with a good management and fertilization could produce all kinds of crops suited to the area.

3. Hydromorphic soils. They are poorly drained soils where biologic activity is limited. Artificially drained, these soils can be used and have good fertility. They are Aquepts or Fibrists.

4. Saline water saturated soils. They are found in the mangrove areas and are mostly Sulfaquepts.

2.5b Soils on Recent Volcanic Ejects

They are formed on deposits of lapilli or ashes which have been transformed by climatic influence to crystalline or amorphous clays (allophane). They can be distinguished of each other by their age or the climate under which they have developed.

1. Sandy soils. They are found around recent volcanoes or in dry volcanic areas. They have a coarse (sand) texture, low organic matter content, and low water retention capacity. They have been classified as Psamments (?) or Vitrandepts when they have a high content of volcanic glass or pumice.

2. Loamy soils. They are the result of a more advanced weathering of the sandy soils, due to moister climate. They are rich in organic matter and nutrients, the highest fertility being shown by soils in the Interandean Valley from Tulcan to Azogues. They are mainly Ustolls or Udolls, with some Eutrandepts.

3. Allophanic soils. They are found at higher altitudes in the volcanic Sierra, moister areas where allophane is the secondary material instead of crystalline clays. Water retention capacity goes from 50 to 100 percent. They are richer in organic matter than the previous ones, but with lower fertility. Poor climatic conditions (cold) and steep slopes are the main constraints to their use. They are Dystrandepts and have the known problem of high phosphorus fixation.

4. Perhumid allophanic soils. These soils are found in areas of high rainfall along the outside slopes of the cordilleras, or in areas with older ash deposits. With the high allophane content, there is a

higher water retention capacity (more than 100 percent) in these soils and they are almost completely nutrient-depleted; their fertility is very low and their agricultural use and management represent a difficult problem. In few areas, these soils are covered by less humid allophanic layers developed from recent volcanic deposits. They are Hydrandepts, characterized by an irreversible dehydration resulting in hard coarse aggregates when the soil profile is exposed to air drying.

2.5c Soils on Ancient Materials

Whatever they have originated, the most important factor of these soils' formation is climate, which results in crystalline clay formation, sometimes rich in silica.

Montmorillonite soils. They are found where climate action is reduced, so rock weathering is not too advanced; silica and bases are little leached. These are montmorillonite-rich soils with high nutrient content. They are in general good soils for agriculture, nevertheless, there are certain differences between them:

1. Heavy clay soils, extremely plastic when wet but very hard and with deep cracks when dry. These soils have developed on clayey sedimentary rocks; carbonate deposits decrease as rainfall increases. This relationship corresponds to soil classification as follows:

a. Vertisols with high $CaCO_3$: Torrerts and Usterts
b. Vertisols with low $CaCO_3$: Usterts
c. Vertisols without $CaCO_3$: Uderts

2. Soils on flat areas: They are Planosols, characterized by a sandy or silty top soil overlying a more clayey layer. For the "Soil Taxonomy" (Soil Survey Staff, 1975) they are Paleustalfs or Paleargids. The former are Alfisols with an argillic horizon, with more than 35 percent base saturation; they have developed under an ustic regime. The latter are Aridisols with an argillic horizon.

3. Soils without vertic characteristics. They do not show cracks, even during the dry season there is no contraction or expansion. In the "Soil Taxonomy" (Soil Survey Staff, 1975) they are:

a. Clay soils of the dry area: Ustropepts
b. Clay soils of the moist area: Eutropepts

4. Well structured black soils. They have a Mollic epipedon, easily identified in the field. They have high content of organic matter and are found in the uphills of the Coastal Mountain range where high moisture allows organic matter accumulation. They are Mollisols in the "Soil Taxonomy," (Soil Survey Staff, 1975) either Ustolls or Udolls.

2.5d Kaolinite Soils

These soils are found in areas with very high rainfall and temperature factors which have led to kaolinite formation after bases and silica have been leached. These soils are grouped as follows:

1. Saturated soils: They are found in areas of high rainfall but have more than 50 percent base saturation and are nutrient-rich soils. They have been classified as Oxic Eutropepts or Oxic Tropudalfs, the former being more frequent.

2. Unsaturated soils. They are poor soils of limited agricultural potential. They have low base saturation and have been grouped as unsaturated compact soils, unsaturated eroded soils, and unsaturated clayey soils. These have been classified according to the "Soil Taxonomy" (Soil Survey Staff, 1975) as:

a. Unsaturated compact soils: Oxic Dystropepts,
b. unsaturated eroded soils: Oxic Dystropepts and Entic subgroups soils,
c. unsaturated clay soils: Oxic Dystropepts and Haplortoxs

2.5e Very Shallow Soils

They are grading to no soil (rock outcrops) and are located either over recent lava flows, on the mountain crests or in highly eroded dry areas. They are mostly Orthents.

3.2 Physical Characteristics of Excursion Route* (Figures 11 and 12)

In order to make a brief description of the different zones where the soil profiles selected for the field trip are located, the excursion route was subdivided into three parts. Each well defined according to its major differences: physiography, geology, climate, land use and soils.

3.2.1 Interandean Valley (from Quito to Machachi)

Physiography and Geology

This part starts in Quito City (2,850 m) and follows for Los Chillos Highway in direction to the Interandean Valley (2,450 m), where it is possible to experiment some decrease in altitude and after an increase in the Machachi Valley (3,000 m), with this difference we concluded that the north part is lower than the south part.

The Interandean Valley is dominated by Andean Chain which is integrated by two branches. East and west to each side of the valley. The altitude of the branches ranges between 3,200 m at the level of hillock (collado: lowest part of the chain) and 5,000 m where there are some volcanoes as Pichincha (4,749 m), El Corazon (4,788 m) and Cotopaxi (5,897 m). The typical characteristics of this zone are the presence of pyroclastic materials in all the area.

This material is from the last eruptions of the Pichincha and Cotopaxi volcanoes, which have formed some layers of great thickness (from 1 m to 10 m or more), characterized by alternative layers of Lapilli (2 to 40 mm of diameter) and alternated layers from successive emissions from volcanoes.

Climate

In this part if is possible to observe a climatic sequence in two senses:

1. North-South.--In this sense exists basic differences in humidity. In the south, it is higher than in the north, this means that Machachi valley has more precipitation than Calderon (north part of Quito).

2. East-West.--In this case the differences are higher than the last one because with the increase in the altitude from valley to the higher part of the Andean Chain in both sides of the valley, the quantity of precipitation increases significatly (Figure 13).

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*This section was prepared by G. de Passo, Chief of Soils, Department of PRONAREG.

Figure 11.

ROUTE EXCURSION

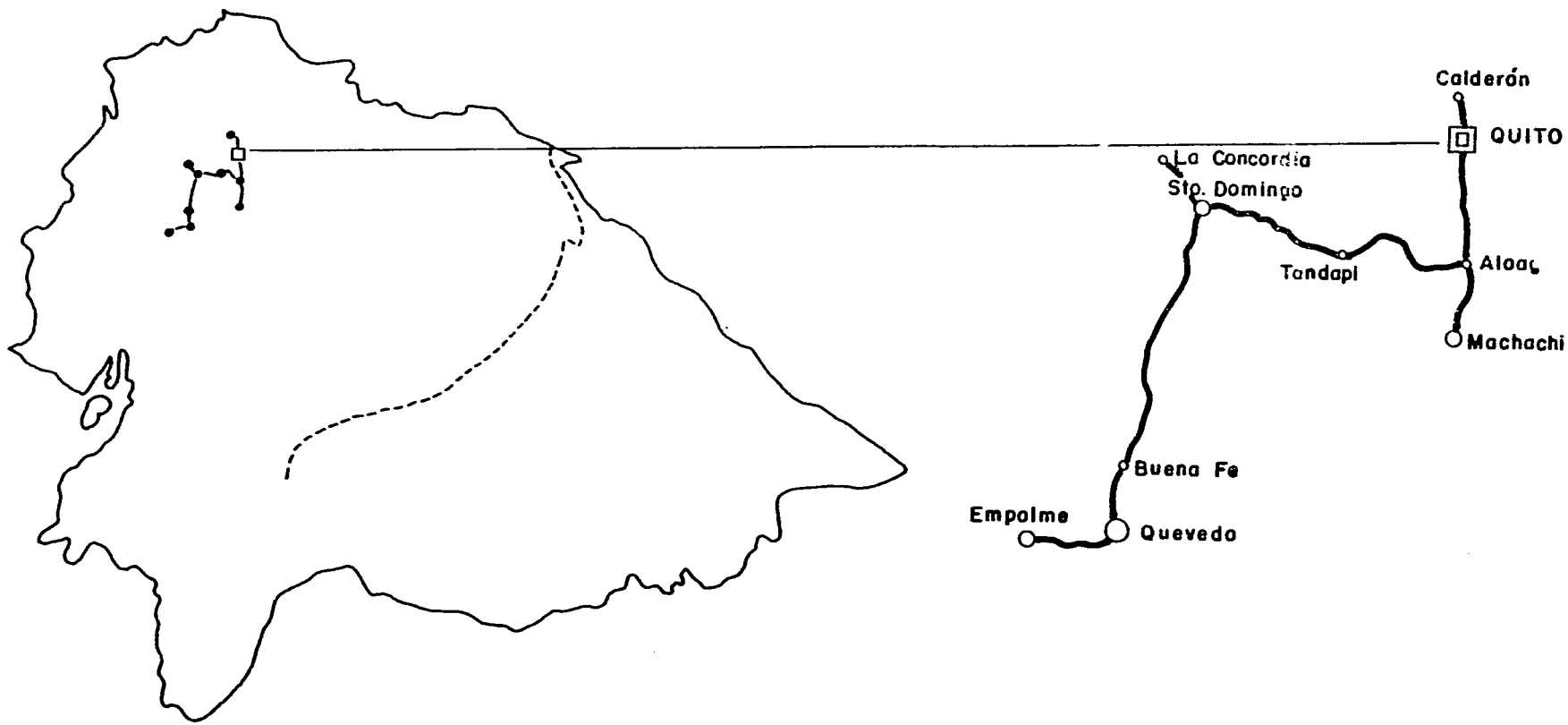
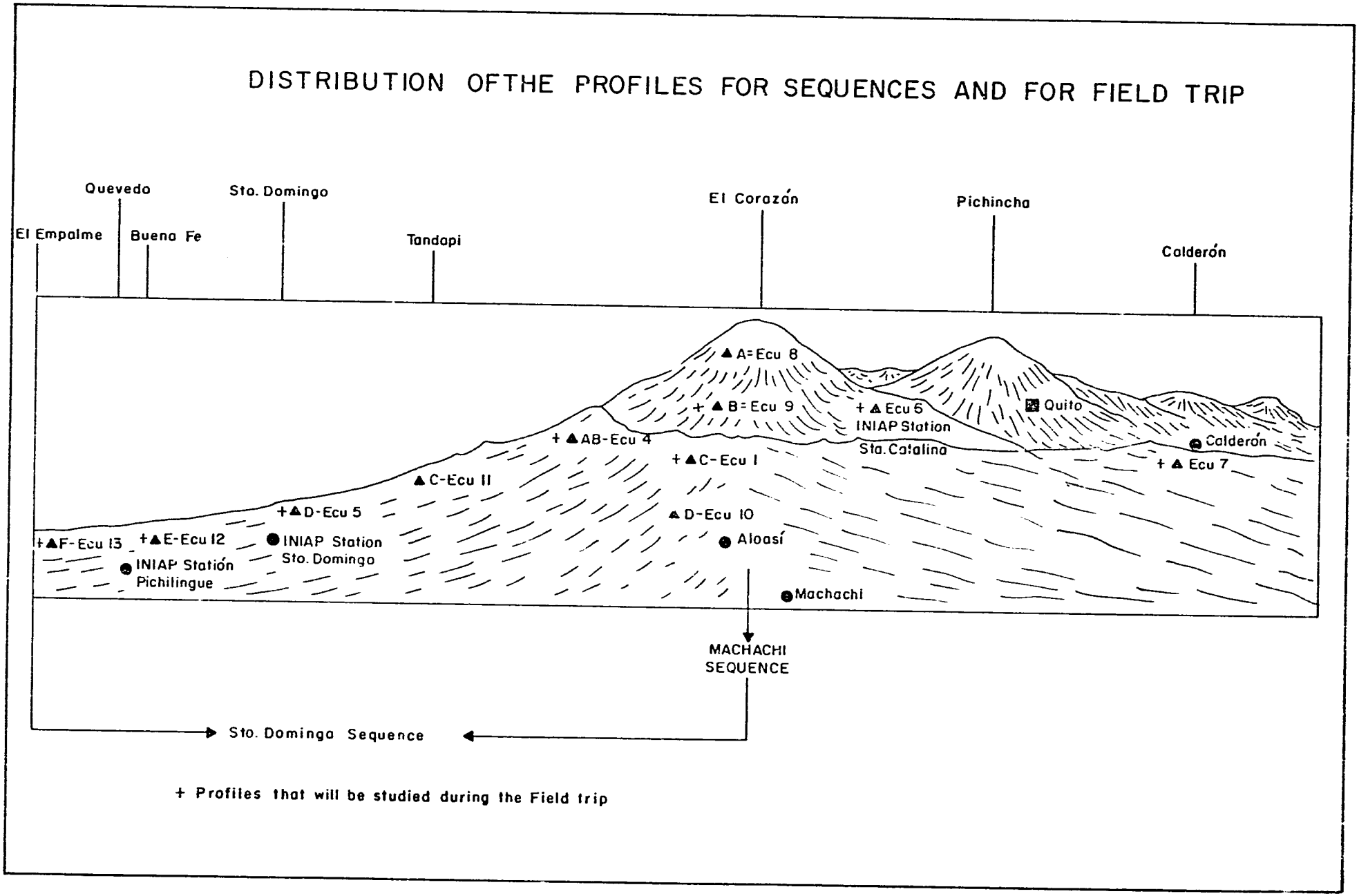


Figure 12.


DISTRIBUTION OFTHE PROFILES FOR SEQUENCES AND FOR FIELD TRIP
El Empalme
Quevedo
Buena Fe
Sto. Domingo
Tandapi
El Corazón
Pichincha
Calderón
A=Ecu 8
+ B=Ecu 9
+ Ecu 6
INIAP Station
Sta. Catalina
Quito
Calderón
+ Ecu 7
+ AB-Ecu 4
+ C-Ecu I
C-Ecu II
+ D-Ecu 5
D-Ecu 10
Aloasí
+ F-Ecu 13
+ E-Ecu 12
INIAP Station
Sto. Domingo
INIAP Station
Pichilingue
Machachi
MACHACHI
SEQUENCE
Sto. Domingo Sequence
+ Profiles that will be studied during the Field trip

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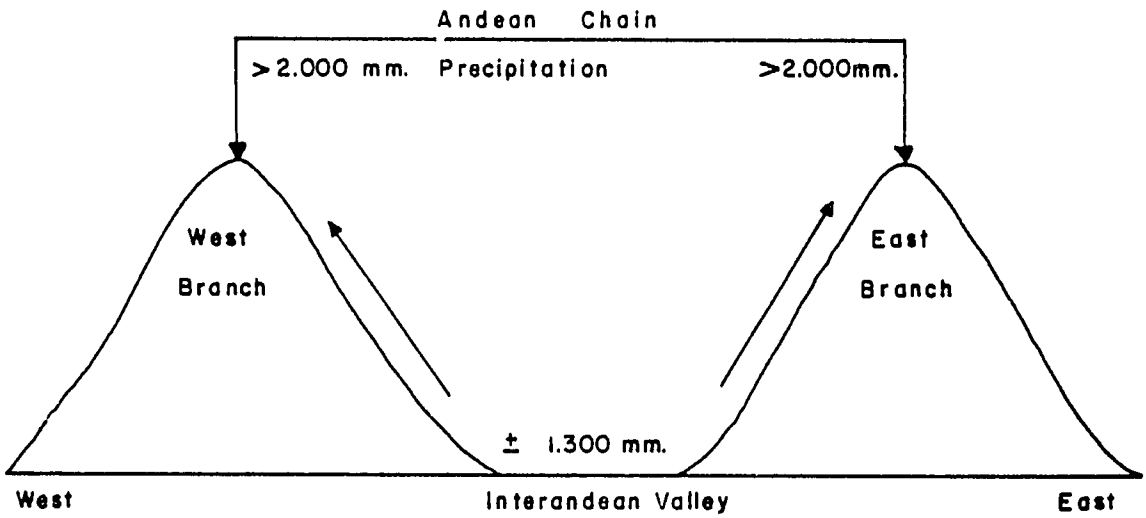
Precipitation Data

Sense	Place	Mean Annual Precipitation (mm)
North	Calderon	600.0
	Quito	1,236.4
	St. Catalina	1,400.0
South	Machachi	1,500.0

Source: PRONAREG, 1972-1982; prepared by G. de Posso.

Figure 13.



Prepared by G. del Posso.

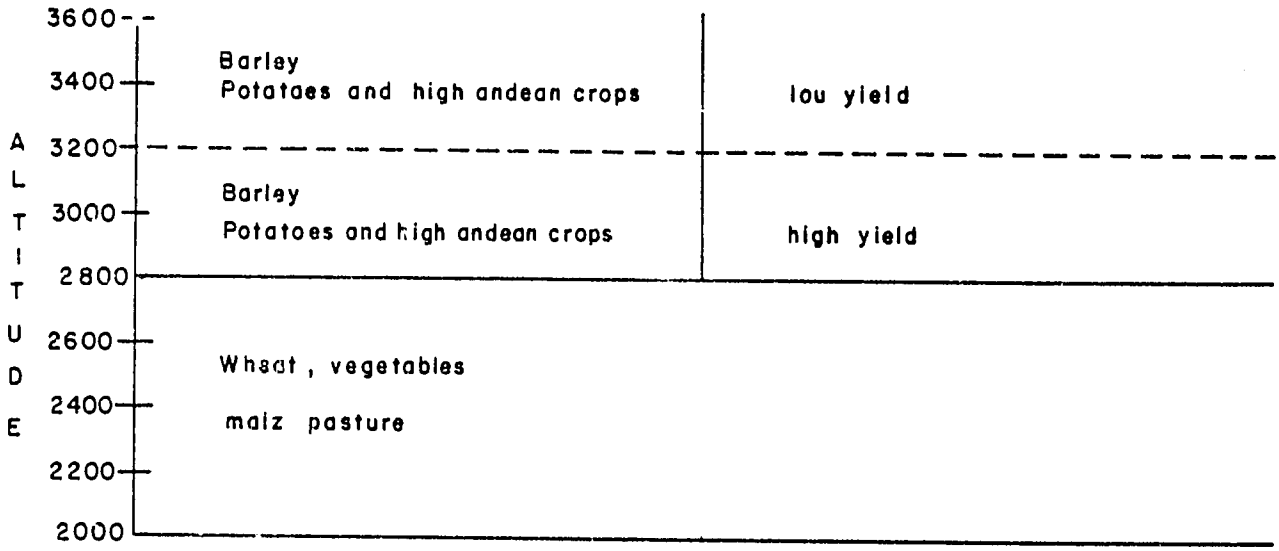
Land Use

According to the climate sequence and in relation to the altitude, the land use of this zone is the following:

The upper limit of the land use for agriculture is between 3,200 m to 3,800 m depending on local conditions. Over this limit is located the coldest natural grassland called "Paramo."

Each crop is located in a defined level of altitude according to its requirements (basically temperature and humidity). The following scheme permits to observe this distribution: (Figure 14)

Figure 14.



Source: INIAP

Prepared by G. del Posso

There is a change in land use in this zone according to the size of the farms. In general, in the valley area exists large farms (more than 100 hectare called Latifundios) and a few small farms (less than 5 hectares called Minifundios). In a few cases some large farms start in the valley and go to the boundary of the Paramo.

The majority of the small farms (Minifundios) are located generallly on high lands characterized by slopes of more than 40 percent.

The dominated land use in the big farms (Latifundios) is pasture, but in the Minifundios, the normal land use is crops (specially high andean crops) which is the typical food for the Indians:

--Melloco (Ullucus tuberosus)
--Oca (Oxalis tuberosa)
--Chocho (Lupinus mutabilis)
--Mashua (Tropaeolum tuberosum)
--Haba (Vicia Faba)
--Potatoes (Solanum tuberosum)
--Maiz (Zea maya)

The pastures in the big farms are:

--Rye grass and leguminous
--Kikuyo
--Oat and leguminous

The cattle dominant are:

--Holstein F. (imported from U.S.A.)
--Holstein F. plus criollo cattle (cattle from Ecuador)

Source: INIAP.

Soils

The distribution of the soils in this part of the route is related with climatic sequence according to the altitude. The following scheme has summarized the principal factors in this sense:

First part of excursion route from Quito to Machachi

ALTITUDE (m)	2,400	3,200	3,600
Precipitation (mm)			
Dry season (mm)			
Temperature (°C)			
Temperature Regime (°C)	Isothermic	Isomesic	Isofrigid
Principal crops	maize, pasture, wheat, vegetables	barley, potatoes, and high andean crops	natural grassland of Paramo
Soils	Mollisols Eutrandepts	Eutrandepts Dystrandepts	Cryandepts

Source: Soil Department--PRONAREG: prepared by G. del Posso.

3.2.2 Counterfort of the West Branche of Andean Chain in direction to the Coastal area (from hillock to Santo Domingo).

For this second part of the excursion route, the principal physical characteristics are summarized in the following scheme between hillock (collado) to Tandapi and Tandapi--Santo Domingo:

Second part of excursion route

Physical characteristics	Hillock (collado) to Tandapi	Tandapi to Sto. Domingo
Physiography and Geology	-Strong slopes (50%) -Area covered by pro-clastic materials exempt the eroded places, where there are outcrops of old volcanic rocks.	-Very strong slopes (70%), but near to Sto. Domingo City, the relief becomes more soft and in Sto Domingo is practically flat. -Area also covered by volcanic ash, where the aerial projection are finer and have less thickness then the last one.
Climate	-Very humid zone (Udic M.R.) -The temperature increase according to the altitude (decrease more or less 2° C by each 200 meters). -From isofrigid to isohyperthermic limit.	-Very humid zone (Perudic M.R.) -The temperature in this zone is practically uniform and there is small increase until Sto. Domingo. -Isohyperthermic (more 22° C.
Altitude	3,700 to 1,600 m	1,600 m to 500 m
Land Use	Below grassland of Paramo: barley, potatoes, habas, maiz, cold humid forest, sub-tropical forest, sub-vegetation.	-Sugar cane, banana, pasture, oil palm, coffee, rubber, pine-apple, manila, cocoa, etc.
Soils	Dystrandepts	Dystrandepts / Hydranpets

Source: Soil Depto. PRONAREG: prepared by G. del Posso.

3.2.3 Guayas River Basin (Sto. Domingo--El Empalme)

This third part is included in the Guayas River Basin and presents the following physical characteristic:

Third part of excursion route	SANTO DOMINGO	EL EMPALME
Physical Characteristics		
Altitude (m)	550	80
Physiography and Geology	-In general the relief of this area is flat. -There is a gradual decrease in altitude from Sto. Domingo to El Empalme. There are two volcanic layers in all the area which belong to two emissions separated by a genetic period.	
Climate	Sto. Domingo	Quevedo / El Empalme
Temperature	uniform:	more than 22° C
	Soil temperature:	isohyperthermic
Precipitation		
Dry season		
Land Use	-Oil palm -Rubber -Coffee and Cocoa -Banana -Tropical pasture	-Short cycle crops -Maize -Coffee and Cocoa -Banana -Tropical pasture
Soils	Dystrandepts Hydrandepts (Sto. Domingo)	Eutrandepts Tropudalfs (El Empalme)

Source: Soil Department--PRONAREG: prepared by G del Posso.

ANALYTICAL METHODS

The following is a brief description of the procedures and methodology used by the National Soil Survey Laboratory. If a more detailed description of any procedure is needed, the following report should be consulted. "Soil Survey Investigations Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples," USDA, SCS, Revision, August 1982. For equivalent procedures but ones of a less automated and instrumented nature, the 1972 revision should be consulted.

Method codes are included in the column headings on the data printouts and can be used as a key to the methods and procedures.

Some general comments on how the samples are handled:

All samples are air-dried and crushed using a wooden roller and sieved to remove fragments greater than 2 mm in diameter. All determinations are made on sieve samples and reported on an ovendry weight basis unless otherwise stated. The ovendry weight basis is determined by ovendrying a sample at 105°C.

CONSIDERATIONS IN THE USE OF LABORATORY DATA

In consideration of the soil characterization data, be aware of the ways your concepts of specific properties compare with the same properties defined operationally. Each of us has mental pictures and conceptual definitions to aid in visualizing properties and processes. These frequently go far beyond the information supplied by any particular analysis, and we are tempted to give numbers on paper credit for connotations that are strictly our own. In this light, there are two pitfalls. One is the temptation to mix observations with concepts. Rather than first laying down observations and then building inferences, it is tempting to describe and interpret in terms of predetermined inferences. If, at some later date concepts change, there may be no way to untangle the observations from the outdated concepts to piece together new inferences.

The second pitfall is the temptation to remain unaware of the operations (analyses) involved in an observation or measurement. Results differ with different methods, but the nature of any particular operation remains the same so long as the same method is used. To compare one bit of data with another, it is important to know how both bits were gathered. This leads to operational definitions (methods). The operational definition is a device to describe a soil property in terms of the operations used to measure it. Look for operational and conceptual definitions as we discuss the following laboratory analyses. Then, as we use field and laboratory data to classify soils, we can attempt the difficult task of separating observations from concepts.

SYNOPSIS OF ANALYTICAL METHODS

PARTICLE SIZE DISTRIBUTION ANALYSIS (PSDA) AND COARSE FRAGMENTS--RECORDED AS WEIGHT PERCENT.

The fractions coarser than 20 mm are derived from screening and weighing in the field or from field volume estimates. Be sure to include volume estimates of the 20-75 mm and 75-250 mm fractions when sending samples to the laboratory. The 2-20 mm fraction is obtained by sieving in the laboratory. During sample preparation, the soil is crushed so all but the coarse fragments pass through a 2-mm sieve. In soil survey, coarse fragments are split into the 2-5 mm, 5-20 mm, and 20-75 fractions and reported as percent of the less than 75 mm, material. Fragments larger than 75 mm but smaller than 250 mm are included in the column labeled > 2 mm, percent of the whole soil (really percent of the < 250 mm material).

For PSDA, a portion of the fraction passing through the sieves is treated with H_2O_2 to remove organic matter and candle filtered to remove soluble salts. It is then dispersed in water with sodium hexametaphosphate, a dispersing agent, and with a specified physical agitation. The dispersed soil is poured through a sieve which catches the sands and allows the silt and clay to pass through. The various sand fractions are further separated by dry shaking in a nest of sieves. The silt fractions and clay are determined by pipetting known volumes from suspensions remaining after known settling times. Fine clay (< 0.0002 m) is determined by centrifugation and pipetting. The necessary settling and centrifugation times are based upon calculations which treat the particles as perfect spheres with consistent, designated specific gravity (Stokes Law). These calculations are used to determine the precise depths and times at which a pipetting will capture exactly the size fraction desired. Operationally then, the clay fraction is not the array of particles smaller than 0.002 mm. It is the array of particles that behaves in suspension in water as though it consists of perfect spheres of a designated specific gravity and a diameter of 0.002 mm. The actual dimensions may be uncertain and quite different from the conceptual perfect spheres. It is possible to calculate sedimentation rates for other shapes and specific gravities, but this is only done in special cases. The standard operation usually separates the more active fraction (clay), which is dominated by clay minerals, from the more inert fraction (silt) which is dominated by nonclay minerals. Thus, the operation would serve its purpose even if we had no concept of particle shape and specific gravity. In fact, the concept of clay as a distinct kind of soil material predates the development of modern concepts about clay-size particles and clay minerals.

Clay-sized carbonates are determined by treating the pipetted sample of clay with HCl and measuring the pressure of CO_2.

The specific chemical and physical treatments and calculations are indicated by codes in the headings. Detailed procedures are listed by these codes in Soil Survey Investigations Report No. 1.

ORGANIC CARBON--REPORTED AS WEIGHT PERCENT

Organic carbon is determined by the Walkley-Black method which is a wet combustion procedure. The sample is treated with a strong oxidizing agent (potassium dichromate) and digested in sulfuric acid. An empirical recovery factor is used in calculating percent organic carbon. The NSSL uses a recovery factor of 0.77 as proposed by Walkley. This organic carbon represents decomposed soil organic matter. It normally excludes relatively fresh plant residues, roots, charcoal, and carbon of carbonates. It can be multiplied by 1.72 for an approximation of organic matter content.

The standard procedure is not used when organic carbon content exceeds roughly 8 percent. Loss on ignition at 400°C is an acceptable substitute in such cases.

LOSS ON IGNITION--REPORTED AS WEIGHT PERCENT

This is a measure of organic matter content and generally used for samples high in organic carbon (> 8%). Ovendried samples are held overnight at 400°C, and the weight loss is measured. Some of the weight loss is sometimes caused by dehydration of clay minerals, but normally the weight loss is mostly from burning of organic matter. When there are large amounts of amorphous material or gypsum present, this weight loss by dehydration is more of a problem. Remember, this approximates organic matter not organic carbon.

NITROGEN

Nitrogen is determined by Kjeldahl digestion with ammonium being steam distilled into boric acid and titrated with HCl using an automatic titrator.

CITRATE--DITHIONITE EXTRACTABLE IRON, ALUMINUM, AND MANGANESE--REPORTED AS WEIGHT PERCENT

This procedure was originally developed for extraction of iron from soils. Some authors have designated the extracted iron as "free iron" reflecting beliefs about the nature of this component. This method extracts and measures amorphous forms and some of the crystalline forms but not total soil iron. Aluminum extracted during the rather severe chemical treatment is also recorded, and the two values together are used in the spodic horizon definition. Manganese extracted by this method is usually less than

1 percent. Some researchers use this Mn and relate it to internal soil drainage properties. Iron extracted by this procedure is often closely related to clay distribution with depth. Dithionite-citrate-extractable iron, aluminum, and manganese are determined by extracting a soil sample with an excess of sodium dithionite and sodium citrate in an 8-ounce bottle which is shaken overnight. Superfloc is added and an aliquot of the supernate is removed for the determination of iron, aluminum, and manganese by atomic absorption.

BULK DENSITY--REPORTED IN GRAMS PER CENTIMETER CUBED

Bulk densities are determined at two or more moisture contents. In coarse and moderately coarse-textured soils, they are determined at 1/10-bar moisture (moisture held against a 1/10 atmosphere pressure difference across a semipermeable membrane), and ovendry (moisture after drying at 110°C). In soils of medium and finer texture, they are determined at 1/3 bar and ovendry.

Most of the bulk densities are obtained by equilibration of Saran-coated clods at these suctions. Clods for this purpose are selected in the field and are dipped in Saran dissolved in methyl ethyl ketone. The dipped clods are dried by hanging them in air until the methyl ethyl ketone evaporates. The dry Saran then remains as a thin, tough film surrounding and supporting the clods for transport to the laboratory. This film is reinforced by added dipping in the laboratory, and supports the clods through wetting, equilibration at the desired suctions, and ovendrying. It can stretch and contract, thus allowing for changes in bulk density as moisture contents change. Bulk density is determined by weighing the clods in air, then weighing them in water. The first measurement is weight, and the difference between weight in air and weight in water is volume.

The bulk density as reported on the data sheet is calculated to represent the < 2 mm material.

COEFFICIENT--OF LINEAR EXTENSIBILITY (COLE)

COLE is a calculated value. It is based on the shrinkage of the natural soil clod between 1/3-bar moisture content (1/10 for sandier soils) and ovendryness. Therefore, bulk densities at these moisture contents are used to calculate COLE as follows:

$$\text{COLE} = \left[\left(\frac{\text{dry bulk density}}{\text{moist bulk density}}\right)^{1/3} - 1\right]$$

The cubed root of the ratio of the two bulk densities is used to correct the clod shrinking in three directions. The value obtained from the equation is corrected for coarse fragments, hence, COLE is on a whole soil base. COLE

multiplied by 100 is called Linear Extensibility (LE) and is simply COLE in percent.

1/3-BAR WATER

The 1/3-bar water is determined by equilibrating natural fabric clods at 1/3 bar and determining the weight percent moisture as a percent of the ovendry weight of the soil.

15-BAR WATER

The 15-bar water is determined by pressure membrane extraction; < 2 mm soil material is used. The water retained is expressed as a percent of the ovendry weight of the soil.

WATER RETENTION DIFFERENCE--WRD

WRD, like COLE, is also a derived value based on moisture contents at 1/3 bar (1/10 bar for sandier soils) and 15 bar. The 1/3 bar or 1/10 bar moisture contents are often referred to as field capacity while the 15-bar content is often called the wilting point. WRD is the difference between 1/3 bar (1/10 bar) and 15 bar divided by 100 then multiplied by the moist bulk density to put it on a volume base. If the soil contains coarse fragments, the aforementioned value is corrected to represent the coarse fragment content, hence, WRD is on a whole soil base.

EXTRACTABLE BASES--REPORTED AS MEQs/100 g SOIL

These are the major exchangeable bases, calcium, magnesium, sodium, and potassium. They are extracted by displacement from the cation exchange complex by another cation, ammonium (ammonium acetate buffered at pH 7 is the extraction solution). The term extractable rather than exchangeable bases is used because any additional source of soluble bases will influence the results. In soils with soluble salts or carbonates, the soluble cations must be measured separately and the results subtracted from the extractable bases for determination of exchangeable bases (Exchangeable = extractable - soluble). Exchangeable Na can be computed with acceptable accuracy unless salt contents exceed approximately 20 mmhos/cm at 25°C. Exchangeable Na = (extractable Na) - (Na in saturation extract) x (saturation percentage, percent water in the saturated paste) divided by (1,000). Exchangeable Na can be derived with greater accuracy than the other cations in the presence of gypsum or carbonates. Assuming exchangeable K negligible compared to exchangeable Ca and Mg, then exchangeable Ca + Mg = CEC (NH_4OAc) - exchangeable Na. This approximation is suitably reproducible for comparison between soils and for classification. Exchangeable Mg can be computed in the same fashion as exchangeable Na. Results

are not as satisfactory for exchangeable Ca when computed in the presence of carbonates or large amounts of gypsum. To prevent misuse of the Ca values, NH_4OAc extractable Ca is omitted from the data sheet when the carbonates are thought to significantly influence the results.

EXTRACTABLE ACIDITY--REPORTED MEQs/100 g SOIL

This is the acidity released from the soil by a barium chloride-triethanolamine solution buffered at pH 8.2. It includes all the acidity generated by replacement of the hydrogen and aluminum from permanent and pH dependent exchange sites.

EXTRACTABLE ALUMINUM--REPORTED MEQs/100 g SOIL

This measures exchangeable aluminum, which is a major constituent only in acid soils (pH < 4.5). Aluminum will precipitate if the pH rises above 4.5 to 5.0 during analysis. The Al extracted by 1N KCl approximates exchangeable Al. Because KCl is an unbuffered salt, it usually effects the soil pH only one unit or less, so the extraction is made near the pH of the soil. In acid soils, the sum of bases plus Al extracted by 1N KCl is close to the effective CEC of soil in the field.

CATION EXCHANGE CAPACITY--REPORTED AS MEQs/100 g SOIL

Several different reagents and pH levels are used to measure the CEC. It may be determined by summing all the exchangeable cations, by summing bases and extractable aluminum, or by saturating the exchange complex with one kind of cation, replacing it with another cation, and measuring the replaced cation. Ammonium in neutral ammonium acetate is the ion used for the later method.

The CEC-sum of cations is calculated by summing the extractable bases and extractable acidity. It represents the pH dependent charge. CEC-sum of cations is not calculated if soils contain soluble salts. The bases + aluminum CEC value is calculated by summing the extractable bases and KCl extractable aluminum. It is commonly called the effective CEC for acid soils since it more closely represents CEC at the soil pH. It also is not calculated for soils that have soluble salts.

The CEC-NH_4OAc is an analytically determined value. It is the value used in calculating CEC/clay ratios. The CEC-sum of cations - CEC NH_4OAc is the pH dependent charge from pH 7 to pH 8.2.

CEC measurements at other pH or by other cations may each yield somewhat different answers. It is important to know the operational definition (procedure, pH, and cation used) before evaluating the meaning of the measurement.

BASE SATURATION--REPORTED AS PERCENT OF CEC

Two values are frequently reported. One is derived from the equation:

Base saturation percentage by NH_4OAc, pH 7 is equal to sum of NH_4OAc extractable bases divided by NH_4OAc-CEC times 100.

The other is:

Base saturation percentage by sum of cations pH 8.2 is equal to the sum of NH_4OAc extractable bases divided by CEC sum of cations pH 8.2 times 100. This value is not reported if either extractable Ca or extractable acidity is omitted.

Differences between these two base saturations depend upon the size of the pH dependent CEC. Class definitions in our soil classification specify which is to be used.

The sum of bases is considered equal to exchangeable cations unless gypsum, salts, or carbonates are present. Normally, the bases extracted by this method exceed 100 percent when the more soluble constituents are present. We then assume 100 percent base saturation. The Ca from carbonates is usually much larger than Mg. Extractable Ca is omitted if more than a trace (> 0.4%) of carbonate (as $CaCO_3$) is present or if calculated base saturation exceeds 110 percent.

Other values can be obtained by using CEC derived from operationally differing methods. There are numerous differing methods utilized for numerous specific purposes. Always be sure which method you are dealing with.

EXCHANGEABLE SODIUM

Exchangeable sodium percentage (ESP). Calculated by dividing NH_4OAc extractable sodium minus water soluble sodium by NH_4OAc-CEC and multiplying by 100.

CALCIUM CARBONATE EQUIVALENT--REPORTED AS WEIGHT PERCENT

The amount of carbonate (CO_3) components in the soil are measured by treating the sample with HCl. The evolved CO_2 is measured manometerically. The amount of carbonate is then calculated on a $CaCO_3$ equivalent no matter what form (Na_2CO_3, $MgCO_3$, etc.). Calcium carbonate equivalent is most commonly reported on the < 2 mm base but, in some soils with hard carbonate concretions, carbonates are determined on both the < 2 and 2-20 mm material; and reported on a < 20 mm base.

CALCIUM SULFATE AS GYPSUM--REPORTED AS WEIGHT PERCENT

Calcium sulfate (gypsum) is determined by extracting gypsum in water and precipitation in acetone. Gypsum is reported on both the < 2 mm and < 20 mm base.

pH--WATER, SALT, NaF

The pH is measured by a glass electrode in a soil-water or soil-dilute salt solution. The extent of the dilution is shown in the heading. 1:1 means one part by weight of water was added for each part by weight of dry soil. This is important in spodic soils because, within the limits of dilutions used, the pH increases markedly with increasing dilution. Measurements in soil-water are usually 1:1 and are 2:1 for the dilute salt solution.

The use of dilute salt solutions is a popular method for masking seasonal variations in pH. Readings in the dilute salt solutions are usually lower than with distilled water. The values may be equal or even higher in highly weathered soils of the tropics. These soils would have a high anion exchange capacity. Readings in 0.01M $CaCl_2$ tend to be uniform regardless of time of year. Readings in 1N KCl tend to also be uniform. The former are more popular in regions lacking extremely acid soils. The latter are more popular in regions where many soils are quite acid and KCl is used to extract exchangeable aluminum. The pH reading then shows the pH at which the aluminum was extracted.

The pH may also be measured in 1N NaF. This measurement is done in soils where there is a large amount of amorphous material present. If there is a large amorphous component, this pH will be greater than 9.5. High values for the NaF pH will also be found if there are free carbonates. Therefore, care must be taken in interpreting this data. One gram of soil is placed in 50 ml of 1N NaF stirred and the pH read after 2 minutes.

SODIUM PYROPHOSPHATE (pH 10) EXTRACTABLE CARBON, IRON, AND ALUMINUM--REPORTED AS WEIGHT PERCENT C, WEIGHT PERCENT Fe AND WEIGHT PERCENT Al

This reagent has been used widely as an extractant of organic matter. It successfully removes much of the organo-metal accumulations in spodic horizons, but is relatively ineffective in extracting many forms of inorganically bound iron and aluminum. For this reason, it is a key to the chemical identification of spodic horizons.

MINERALOGY

The clay, silt, and sand fractions of selected horizons from each profile were analyzed to determine the mineralogical composition. The different techniques employed are briefly as follows:

1. X-ray diffraction analysis (XRD).

   A Phillips diffractometer with a copper tube is used. XRD is run on the untreated clays and also

on K and Mg saturated clays with associated heating or glycerol solvation.

2. Differential thermal analysis (DTA) was done only on the clay fractions. The instrument used was the Columbia Scientific Thermal Analyzer. Semiquantitative estimates are made using the data.

PETROGRAPHIC ANALYSIS--RECORDED AS NUMBER PERCENT

This analysis is named after the petrographic microscope which is the chief tool for mineral identification and quantitative analyses in the sand and coarser silt fractions. The data are listed on a supplemental sheet or at the bottom of the newer data sheets. Minerals are grouped under two major headings: resistant and weatherable.

SOLUBLE CATIONS AND ANIONS IN WATER EXTRACTED FROM SATURATED PASTE--REPORTED AS MEQs/LITER OF SOLUTION

Soluble cations and anions are determined in the water extracted from a saturated paste made by adding distilled water to soil until the saturation point is reached. At saturation, the soil paste glistens as it reflects light, flows slightly when the container is tipped, and slides freely and cleanly off a spatula except for soils containing large amounts of clay. In calculations of exchangeable sodium percentage, soluble sodium is subtracted from extractable sodium to obtain an estimate of exchangeable sodium.

TOTAL SALTS

Measure of percent total estimated soluble salt in the soil. Calculated from conductivity of the saturated extract.

ELECTRICAL CONDUCTIVITY

Electrical conductivity (EC) of the saturate extracted obtained the saturated paste used in the determination of water soluble anions and cations.

SAR

Sodium adsorption ratio determined by the following equation:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

The Ca, Mg, and Na are in meq/l and determined from the saturated extract of the water-soil saturated paste.

PHOSPHATE RETENTION CAPACITY

Determined by shaking 5 g of air-dry soil (< 2 mm) with 25 ml of a phosphate solution (1 ml = 1 mg P) for 24 hours in a 50 ml polypropylene centrifuge tube (Blakemore et al., 1981). Tubes are centrifuged and the P remaining in solution measured using the molybdo-vanadate method. Results are reported as percent, P-retained.

ACID OXALATE-EXTRACTABLE ALUMINUM AND SILICON

Determined by shaking 0.5 g air-dry soil (< 2 mm) with 50 ml acid oxalate reagent for 4 hours in a polyropylene centrifuge tube in the dark (Blakemore et al., 1981). Tubes are centrifuged and Al and Si determined by atomic absorption spectrophotometry.

KOH-Al

Determined by reacting 0.2 g soil with 2 ml 4N KOH for 10 minutes, filtering and determining the Al in the solution.

AVAILABLE PHOSPHOROUS (Bray-1)

Determined by shaking 1 g of air-dry soil (< 2 mm) with 10 ml of extracting solution (0.025N HCl + 0.03N NH_4F) for 5 minutes in a 50 ml Erlenmeyer flask. Extracts are filtered through Whatman No. 2 filter paper. A 2 ml aliquot is added to 8 ml solution of 50 ppm P prepared from reagent grade potassium hydrogen phosphate (KH_4PO_4). Phosphorous is measured using a colorimeter and reported in parts per million.

OTHER USEFUL INFORMATION

There are a couple ratios placed on the data sheet. These are useful in making internal checks of the data and making other useful determinations.

RELATIONSHIP OF MINERALOGY AND CATION EXCHANGE

Ratio of CEC (NH_4OAc, pH 7) to clay can be used to make an estimation of the clay mineralogy. For family placement, some CEC/clay relationships are as follows: Kaolinitic < 0.2, kaolinitic or mixed 0.2-0.3, mixed 0.3-0.5, mixed or montmorillonitic 0.5-0.7, and montmorillonitic > 0.7. When amorphous material is present, these relationships do not hold.

Ratio of CEC (at pH 8.2) to 15-bar water of greater than 1.5 and more exchange acidity than the sum of bases plus KCl extractable Al, would suggest a soil with a high pH dependent charge. This can be used along with bulk density to separate subgroups that have high levels of amorphous materials commonly derived from pyroclastics.

RELATIONSHIP OF 15 BAR TO CLAY

This value is used to give an indication of dispersion in the particle size determination. If the ratio is greater than 0.6 and soil related factors do not adequately explain the situation, incomplete dispersion in particle-size analysis may be the cause. Some soil-related factors that can cause deviation from the 0.4 reference point are: low activity clays (kaolinites, chlorites, and some micas) tend to lower the ratio to 0.35 or below. Clay-size carbonate tends to decrease the ratio. Organic matter increases the 15-bar water content. Amorphous mineral materials increase the ratio.

In "Soil Taxonomy," 1975 the inverse of this ratio is sometimes used. A ratio of < 1.25 used in conjunction with bulk density and poor dispersion qualities; i.e., ones high in amorphous materials.

pH DEPENDENT CHARGE

The pH dependent charge as inferred by "Soil Taxonomy," 1975 is the difference between the sum of bases (NH_4OAc) plus extractable acidity and sum of bases (NH_4OAc) plus 1N KCl exchangeable Al, divided by measured clay or by 15-bar water times 2.5 under conditions defined in "Soil Taxonomy," 1975.

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THE VOLCANIC ASH SOILS OF ECUADOR

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Introduction

According to Wolf (1) Ecuador is one of the most interesting countries for vulcanologic studies, and before him, Alexander von Humboldt could already understand the importance of Ecuadorean volcanoes and their effects. Reiss and Stubel, German vulcanologists, choose Ecuador for their studies on pyroclastics and volcanic rocks (1870 1874).

In the present century, volcanic ash soils have attracted the attention of researchers who have seen in them interesting characteristics; most visible of all was their very dark, almost black, low chroma, color. This led both to Miller (2) and Frei (3) to call the highland Sierra soils, Suelos Negros Andinos, a name which was locally used for several years.

Later, when elaborating the Soil Taxonomy System, other characteristics were added to these already known, to identify volcanic ash soils, which allowed their inclusion within a specific class of soils.

Several authors have contributed, since 1956, to a better knowledge of volcanic ash soils in Ecuador, with information and data to improve their use and management, and to complete their classification (4, 5, 6, 7, 8).

Since 1973, it has been PRONAREG, the Programa Nacional de Regionalización Agraria, of the Ministry of Agriculture, which has been in charge of the soil survey of the country, with the technical assistance of ORSTOM. During the development of this inventory, several problems have arisen which obliged to modify map legends. These will be discussed during the Ecuador part of the VI Soil Classification Workshop.

1. The Volcanic Terrain in Ecuador

From 1° North latitude, at the border with Colombia, to about 2° 30' South the Andes Cordillera shows a number of volcanoes, some of them reaching more than 5000 m above sea level.

The Andes Cordillera origin is known as the result of American Continent drift to the west, which caused the uplift of deep magma and the subsequent production of basaltic lavas (in Ecuador, this basic rock formation has been identified with the names of Piñón and Macuchi). These are pillow lavas, which indicate a marine environment for deposition.

On the other side, to the east, the crystalline rocks of the Guyana-Brazil Shield, started to move up too.

Two large areas had already been individualized as geological regions in the area: one with a basic volcanic basement to the west and north, and another of a metamorphic basement to the East and South (present Amazonian Region and Cordillera Oriental or Real).

But it was in the Tertiary when a generalized uplift occurred in the Andes, when both a western and an eastern range were formed. The former was made from volcanic and sedimentary terrains and the latter as an axis of metamorphic compressed rocks in overthrust foldings. At the same time, faulting was active on both sides of each range, thus creating parallel horsts going in a North-east to South west direction, with a grabben in between.

According to SAUER (9), the Andes Cordillera, after a series of vertical movements and erosion phases, at the end of the Tertiary reached only 2000 to 2500 m above sea level. Then, high magnitude movements started in the Pleistocene. These vertical movements affected different areas in the country, but their magnitude was higher to the north of parallel 2° South.

The differential uplifting caused the rupture of rock masses both with faults along the mountain ranges, and transversal to them, thus creating basins which drain either to the East or to the West. Through the lower resistance points in the Earth's crust, along the cordilleras, magma went up to the surface to reestablish volcanic activity. It is at that time that most of the volcanoes we now know were formed and continued growing, in some cases even in the present time, reaching more than 4500 m altitude.

During the Quaternary, volcanic activity shifted form the western to the eastern range where now we find the most active volcanoes (Cotopaxi, Tungurahua, Sangay, Reventador).

According to SAUER (9), the Western range is formed by the "Pacific petrologic Type" of rocks (sialic-lithogenic). These rocks are more acid (dacitic), than the ones in the eastern range, which are of the "Atlantic type" (simic-Hypogenic) and which are usually formed in the most recent phases of volcanic activity.

Volcanoes were most frequently producing andesitic or dacitic materials, and gave place to both lava flows and

pyroclasitc materials of various sizes, although they have not too different composition. Some fine, wind blown materials are probably at the origin of the "cangahua", the consolidated tuff similar to loess, which is found either below more recent deposits or outcropping where the topsoil has been eroded (10).

2. Climate

Being a tropical (equatorial) country, mean temperature is almost constant during the year, so soil temperature regimes are all "iso" regimes. Nevertheless, temperature varies with altitude producing temperature regimes from the isohyperthermic to the isofrigid. Temperature limits for the various regimes have been modified in Ecuador, being adjusted according to the temperature growing limit of crops:

- 10° limit, minimal crop temperature corresponds to "frigid";

- 13° limit between the "mesic" and the "thermic" regimes, which corresponds to the growing limit of maize;

- 20 - 22° for "hyperthermic", coincides well with the tropical crops line.

Rainfall shows important variations as it can be seen in the map (Fig. 1). In the Coastal area, rainfall increases from the Southwest, in Salinas (less than 500 mm), to North East (close to 6000 mm) in the East of Esmeraldas Province. In the Amazonian Region, rainfall is more homogeneous (usually higher than 2000 mm per year).

Abundant rainfall to the footslope of the mountain ranges, decreases with altitude, but with lower temperatures, evaporation also decreases, resulting in a compensation for rainfall reduction, and makes more humid the high altitude areas (páramos).

In the Interandean valley, rainfall decreases in the valleys, which have a comparatively dry climate.

More than the total year rainfall, their distribution determines volcanic ash soil evolution. This distribution directly influences the soil moisture regime, whose spatial variations are indicated in the rainfall map.

MAPA DE ISOYETAS
RAINFALL MAP

FIG. 1

Según P Pourrut in Atlas del Ecuador (J A)

(Este mapa representa solo una parte del territorio nacional)

REGIMENES DE TEMPERATURA Y HUMEDAD

TEMPERATURE AND MOISTURE REGIMES

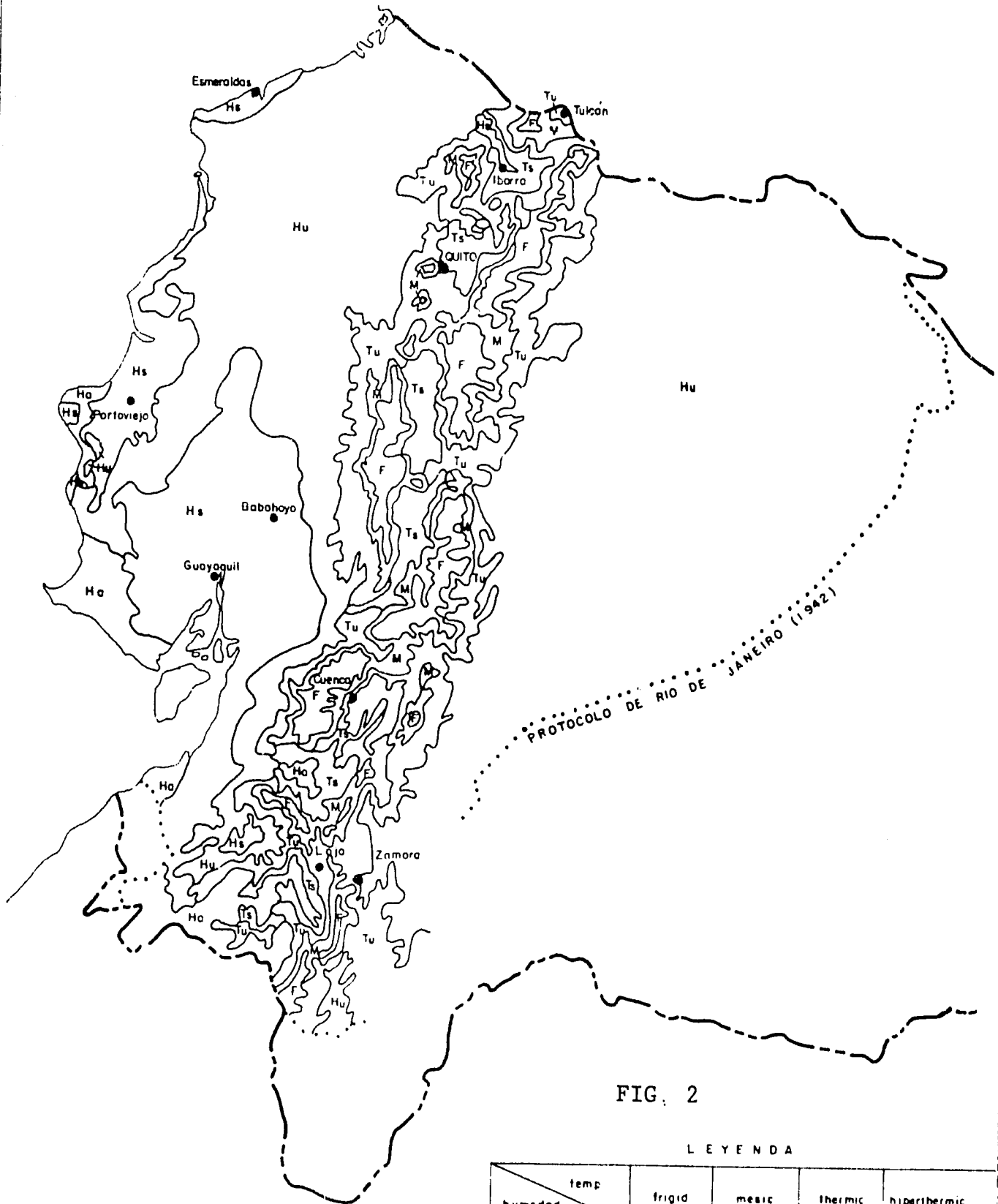

FIG. 2

LEYENDA

humedad \ temp	frigid	mesic	thermic	hiperthermic
udic	F	M	Tu	Hu
ustic	—	—	Ts	Hs
aridic	—	—	—	Ha

Fuente PRONAREG-ORSTOM

(Este mapa representa solo una parte del territorio ecuatoriano)

3. Influence of the main genetic factors on soil characteristics

The short range of variation among the various volcanic materials (lapilli, dacitic ashes) cannot explain alone the large evolution differences in soils (Colmet-Daage, 5).

On the contrary, age and particle size have a more obvious influence. Thus, the evolution difference between Amazonian soils (Hydrandepts from Puyo) and the soils of the moist area of the Guayas basin (Dystrandepts of Santo Domingo and Los Bancos) is the result of age differences in the volcanic materials ejected between those regions.

In a similar way, variations in soil characteristics of northern and central soils (close to volcanoes) and the southern soils (far from them), are due to age differences between them, although it is also possible that particle size, finer in the south than in the north will play an important role in soil genesis, explaining the differences noted.

Rainfall and mainly the duration of the humid season, as it is already known (6,17), have a primary role in volcanic ash soils' genesis: in moist areas, pedogenesis leads to individualization and preservation of amorphous materials in the soil, while in drier areas clay minerals are formed (mainly halloysite). So in the Ecuadorean Coastal Area, in a climosequence, the distribution of Dystrandepts, Eutrandepts and Mollisols is a typical example of the influence of the dry season on soils genesis.

Likewise, in the Highland Sierra, Andepts are located in the humid areas, i.e. in the high zones, while in the lower basin areas, which are drier, pedogenesis, with clay minerals formation, leads to the formation of Mollisols. In addition to the rainfall influence on the genesis of clay minerals, it is important to emphasize its role on base leaching and consequently on base saturation, pH values and carbonate accumulation in soils; all characteristics whose changes are strong and rapid, especially in the Sierra, where striking climate changes are seen on rather short distances.

Temperature, in addition to its influence on the chemical reactions and the weathering rate of volcanic materials, also has an important role in the accumulation and composition of organic matter; so humic and fulvic acids show similar contents in the cold areas, while in the warm ones, fulvic acids are more abundant.

4. Soils

The Soil map legend established for the Soil Survey of Ecuador has taken into consideration two important soil features: particle size distribution and mineralogy, which reflect the evolution degree of soils. So, Colmet-Daage *et al*. (11) have defined four great sets of soils:

- Sandy soils
- Sandy loam soils
- Clayey soils
- Soils with amorphous materials

Additionally, taking into account the subsoil, another set was established for soils developed on "cangahua" (Fig. 3).

a) Sandy soils. With the exception of alluvial soils located in the Eastern plain between Lago Agrio and Coca, sandy soils have developed from wind-blown volcanic ejecta. These are not evolved soils, either because they are young, formed on recent materials, or because they are located in areas where drought reduces weathering. They may be found close to recent volcanoes like Tungurahua, Quilotoa, Cotopaxi, Cuicocha, or in dry areas like San Antonio de Pichincha, Latacunga, Riobamba, or Palmira. In the latter area, as behind the Chimborazo Mountain, soil erosion renewes soil materials and allows the presence of sandy soils.

In addition to a sandy texture ranging from fine sand to gravel, these soils are characterized by a 1/3 bar water retention of less than 20% and their organic matter content.

- Soils with less than 1% Organic matter in the upper 20 cm have been classified as PSAMMENTS.

  In addition to the soils on medium to coarse lapilli, close to recent volcanoes (Cotopaxi, Tungurahua) over 3600 m, i.e. under a frigid regime, most of these soils are at lower altitudes under isothermic regimes.

  For these soils, pH values range from less than 6 to higher than 8, showing carbonate mycelia in very dry areas.

- Soils with more than 1% organic matter were classified as VITRANDEPTS. In these soils, there is a beginning of sand weathering, either because deposits

SUELOS SOBRE PROYECCIONES VOLCANICAS
SOILS FORMED ON VOLCANIC ASH DEPOSITS

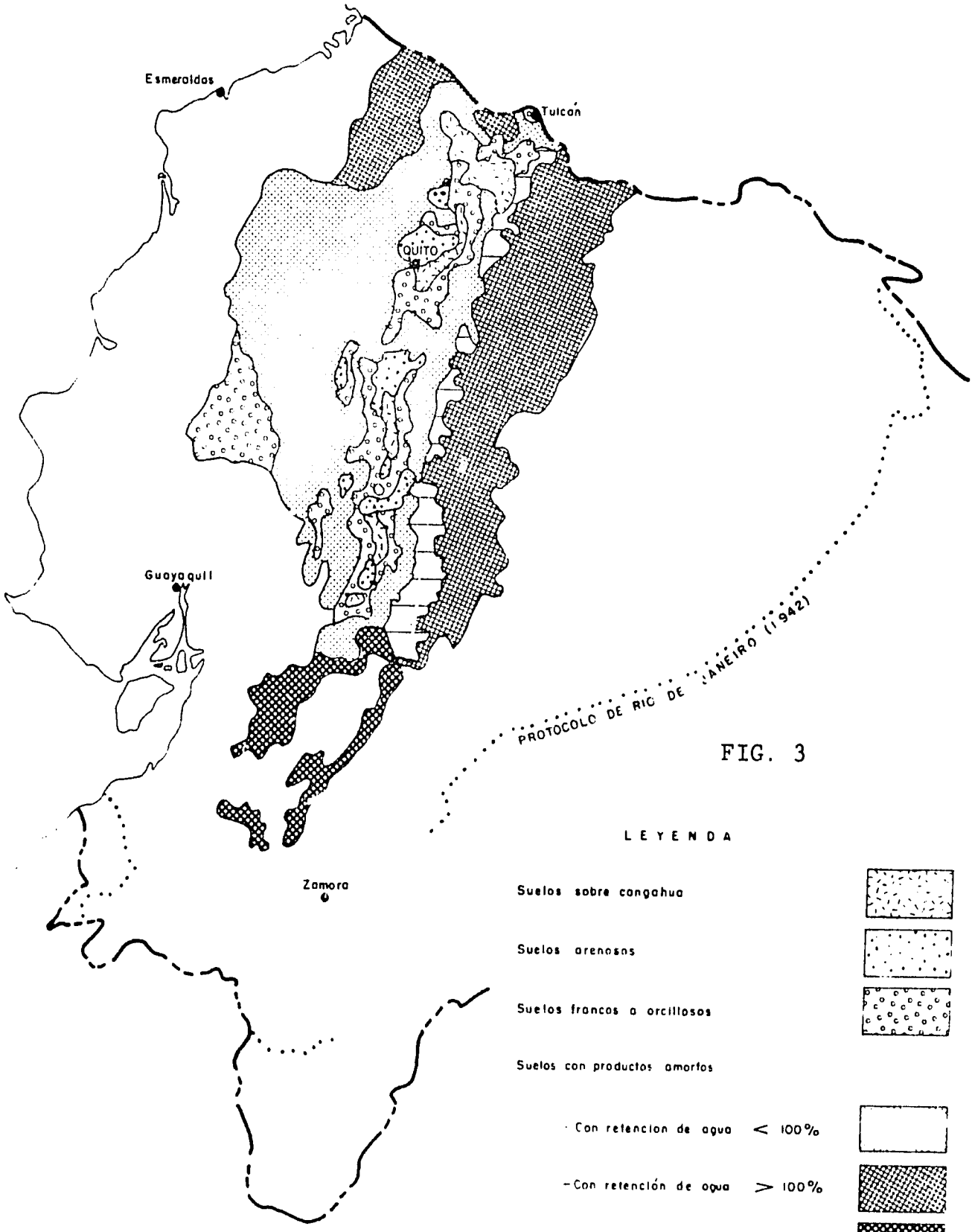

FIG. 3

Fuente: Mapas de suelos PRONAREG-ORSTOM

(Este mapa representa solo una parte del territorio nacional)

are older or because they are in moister zones, something that contributes to organic matter accumulation.

To this early weathering corresponds the formation of amorphous materials in moist areas and of clay minerals (halloysite or 14 A minerals) in dry areas. pH and base saturation values depend on the climate under which soils are evolving (Table 1).

Table 1. pH Values and Base Saturation (B. S.) According to Climatic Zones.

Temperature reg. \ Moisture regime	Ustic	Udic
Isomesic		pH < 6 B. S. < 50%
Isothermic	pH - 7 B. S. > 50%	

b) Loamy soils. These are more evolved soils either located in moister areas, or they are far away of the emission centers of ashes, or even they are developed from older pyroclastic materials.

In the Sierra, they are located in the Interandean valley at altitudes lower than 3600 m a.s.l., mostly between 2200 and 2300 m; in the Coastal area, they are found on recent deposits in the relatively dry area between Quevedo and Balzar.

These are soils whose characteristics are those of a Mollisol and locally of an Eutrandept. Thus, color is dark brown to black, texture is loam to sandy loam. Clay is essentially halloysite with occasionally montmorillonite, or amorphous products, the latter appearing in the moister areas.

Base saturation is higher than 50%; bulk density values range from .8 to 1.3 and NaF test is mostly negative, except when amorphous materials are present. Water retention at 1/3 bar shows different values, related to texture. For instance, for a first sandy loam subset, water retention is between 10 and 20%, while for a loam subset water retention is higher than 20%.

For each subset, as indicated in the following tables, main soil characteristics vary with climate: so pH, Base saturation, bulk density, NaF reaction, color and organic matter content vary according to moisture regimes, and the two latter characteristics also depend on temperature.

Table 2. Values of Certain Characteristics of Soils According to Climatic Zones

- Sandy loam soils: water retention at 1/3 bar: 10 to 20%

Temperature reg. \ Moisture regime	Ustic	Udic
Isomesic	- strong black color chroma: 0 - 1 NaF negative B.D. ≃ 1.2-1.3 - Carbonate mycelia	- strong black color chroma: 0 - 1 NaF positive B.D. ≃ 1
Isothermic	- dark brown color chroma: 1 - 2 - M.O. < 3% - pH > 7 - Carbonate accumul.	- dark brown color chroma 1 - 2 - O.M. > 3% - pH ≃ 6

- Loamy soils: water retention 1/3 bar 20%

Temperature reg. \ Moisture regime	Ustic	Udic
Isomesic	- black soil - NaF negative B.D. ≃ 1.2	- strong black soil - NaF positive - B.D. .8 - .9 - B.S. ≃ 50%
Isothermic	- O.M. < 3% - pH ≃ 7 - Carbonate mycelia local	- O.M. > 4% - pH ≃ 6 - B.D. ≃ 1 - NaF negative - B.S. ≃ 50%
Isohyperthemic	- pH ≃ 6.5 - B.D. : .8 - 1 - B.S. > 60%	- pH ≃ 6.5 - B.D. : .8 - B.S. 50-60%

c) Clayey soils. These are black soils with a mollic epipedon and base saturation higher than 50%. They are MOLLISOLS, with more than 30% clay (halloysite or montomorillonite).

In the Sierra, they occupy small areas between 2200 amd 3200 m, that is to say they have an isothermic temperature regime. They have developed on old ashes, sometimes hard, cangahua deposits, with moisture regimes

going from ustic to udic. In the Coast, they are found south of El Empalme in an area under ustic regimes; at the Dystrandept-Mollisol transition the most clayey soils of the climosequence are found.

d) Soils with amorphous materials. They are found in the eastern plain and in the moist area of the Guayas basin; in the outside hillslopes and in the high altitude areas of the mountain ranges, i.e. in moist areas under udic or perudic regimes, having as a consequence that soil moisture at any time is higher than water retention at 15 bar pressure.

They are soils with a bulk density lower than .8 in the upper 35 cm, and with base saturation lower than 50%.

Several characteristics, such as water retention and organic matter have permitted the separation of several subsets.

- Soils with water content lower than 100% (1/3 bar) - are Dystrandepts whose secondary properties, as indicated in the table below, depend on temperature. When they are under isofrigid regime, they are Cryandepts.

Table 3. Soil Properties According to Temperature Regime

Temperature Regime	Isofrigid	Isomesic	Isothermic	Isohyperthermic
Color	- black chroma: 0 - 1	- black chroma: 0 - 1	- dark over 50 cm chroma: 1 - 2	- dark over 10 to 20 cm
Base Saturation	very low	low		
Humic and fulvic acids	H. A. ≥ F. A. Especially in depth			H. A. < F. A.
pH	pH water > pH KCl			pH water > pH KCl

Among these Dystrandepts, those with a lower water retention (20 to 50%) are younger soils with sandier textures and higher bulk density (close to 1) or soils located in drier areas which have a lower content of amorphous materials.

- Soils with water retention (1/3 bar) higher than 100% have been classified as Hydrandepts or Hydric Cryandepts. They are strongly smeary, with a very low bulk density (0.3 to 0.5). They have a base saturation lower than 10%, and their reaction to NaF is very active. Organic matter content ranges from 10 to 20% in the upper 30 cm. Color, pH and fulvic & humic acids percentages change according to temperature, as in the previous soils.

  These Hydrandepts whose water retention can reach 300% have developed from lapilli and old ash deposits in very humid areas, as the eastern zone and the northeast of Esmeraldas province.

- Organic soils. These are black soils (chroma 0 - 2) which have all the properties of the previously described soils, but with a higher organic matter content: this is higher than 20% throughout the profile and sometimes it can reach 30% in the top horizon. Water retention is always high (higher than 100%) and base saturation very low (lower than 10%), with a sum of bases lower than 3 meq/100 g soil in the topsoil and 1 meq/100 g soil in depth.

  These are soils developed from fine ashes found at very long distances from volcanoes; this explains why they are frequent in the high altitude zones south of Cañar to Saraguro "páramos". They might be classified in a "histic" subgroup of Hydrandepts.

e) <u>Soils on Cangahua</u>. They are very loamy to very fine sandy soils developed on a hard layer (cangahua) which appears at less than 1 m depth.

They are found in the Interandean valley, in the lower parts of the basins and in the internal slopes to altitudes of 3200 to 3500 m. Higher than these altitudes cangahua disappear.

In the lower and drier areas, soils are not deep, because of erosion; in many cases, soil has been lost and the cangahua outcrops. Soil is sandy with very low organic

matter content, pH is higher than 7 and in the drier areas (transition regime from ustic to aridic) there is carbonate accumulation as mycelia. There is an abrupt contact with cangahua and the latter is not weathered. The soil is a DURUSTOLL and cangahua is considered as a duripan.

Little by little, and with the increase in moisture in the higher zones because of a decrease in evapotranspiration (in some cases with increase in rainfall also), soil color becomes darker due to higher organic matter content, and weathering is higher. Then we have clays such as Halloysite and Montmorillonite, an argillic horizon is formed with coatings of very dark color (black) at the contact zone of cangahua and upper deposits. The presence of this layer is caused by cangahua weathering and clay illuviation as has been shown by the coatings. pH is slightly acid, humic acids content is higher than fulvic acids, especially in the argillic horizon. These soils have been classified as DURIUDOLLS.

Conclusions

The various studies made on volcanic ash soils in Ecuador have permitted to improve the knowledge of these soils which cover about 31% of the country. They have been completely mapped by PRONAREG.

Soil map legends were established taking into consideration many characteristics (texture, mineralogy, water retention, organic matter and sorption complex), whose changes depend on the climate, especially on moisture; age of the materials and the distance to emission centers are of minor importance.

Soil classification, not yet in its final form, was developed, in some cases, using simple criteria of land use but not utilized by the Soil Taxonomy. Water retention at 1/3 bar, for instance has a limit of 100% to separate Dystrandepts from Hydrandepts, as the organic matter content of 1% is the limit between Vitrandepts and PSAMMENTS. These criteria and value, however, must still be discussed and better defined.

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Pedon Description and Analytical Data

The section contains, for each pedon, a description for the pedon sampled, analytical data in two parts: the first sheet is the standard NSSL laboratory data sheet and the second shows the results of the mineralized analysis.

Pedons that were sampled but not included in the tour part of the guide are in Appendix II.

If there are questions on the data sheet, Appendix III should be checked for an explanation.

The pedons are placed in the order that we will visit them. No classifications have been placed on any of them. If you have a chance, it would be useful to try and work through their classifications before we visit them in the field.

The location of each pedon is shown on Figure 11.

Series: Ecuador No. 1 Date: 6/83
Pedon No: S83FN-325-001
Taxonomy: Loamy over cindery, mixed, isomesic cumulic Hapludolls
Latitude: 0°31'00" Longitude: 78°37'10"
Location: Tour stop No. 1. Machachi-Aloasi area.
Physiography: Hillside in mountains.
Geomorphic Position: Hillslope
Slope and Aspect: 10% ENE convex-convex Elevation: 3200 m M.S.L
Microrelief: none
Air Temp. Summer: 11.0°C Winter: 10.9°C
Precipitation: 1200 mm Udic moisture regime.
Water Table: > 10 M
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: Small grains of wheat and barley
Erosion or Deposition: Slight sheet and rill erosion
Parent Material: moderately weathered, ash and unweathered pumice deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 25, 1983. Field Moisture, 0-4 cm dry. 4-115 cm slightly moist. 115-180 cm very slightly moist.
Vegetation: before temperate forest (chilea, fencus, eucalyptus grove).

Ap 0 - 21 cm Black (10YR 2/1, rubbed), fine sandy loam; grayish brown (10YR 5/2, dry); plowed soft clods; very friable, non-sticky and non-plastic; common very fine roots; abrupt smooth boundary.

A1 21 - 47 cm Very dark brown (10YR 2/2) fine sandy loam; weak medium and coarse angular blocky structure; very friable, non-sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and few fine tubular pores; 2% 2-5 mm pumice fragments; gradual smooth boundary. The upper part of the horizon is a dense compacted tillage pan.

A2 47 - 75 cm Black (N 2/0) gravelly sandy loam; weak coarse and very coarse subangular blocky structure parting to weak coarse and very coarse granular; very friable, non-sticky and non-plastic; few very fine, fine, and medium roots; many very fine and common fine and medium tubular pores; coarse fragments, 15% 2-50 mm pumice; abrupt wavy boundary.

2C1 75 - 84 cm Very pale brown (10YR 7/4) and dark yellowish brown (10YR 4/4) very gravelly coarse sand; single grain; loose, non-sticky and non-plastic; few very fine and coarse roots; many very fine and fine interstitial pores; coarse fragments, 45% 2-45 mm pumice; abrupt wavy boundary. Pumice strata is discontinuous in the pit and varies from 4-10 cm in thickness.

3Ab1 84 - 115 cm Black (10YR 2/1) fine sandy loam; weak medium and coarse subangular blocky structure parting to weak medium and coarse granular; friable, non-sticky and non-plastic; few very fine roots; common very fine and fine and a few medium tubular pores; 3% 2-10 mm pumice fragments; diffuse wavy boundary.

3Ab2 115 - 150 cm Very dark brown (10YR 2/2) fine sandy loam; weak medium and coarse subangular blocky structure parting to weak medium and coarse granular; friable, slightly sticky and slightly plastic; few very fine roots; common very fine and fine and few medium tubular pores; 2% 2-15 mm pumice fragments; diffuse wavy boundary.

3ACb 150 - 182 cm Very dark brown (10YR 2/2) loam; weak medium and coarse subangular blocky structure parting to weak medium and coarse granular; friable, slightly sticky and slightly plastic; few very fine roots; common very fine and fine tubular and a few medium tubular pores; 2% 2-15 mm pumic fragments; gradual wavy boundary.

3C2 182 - 205 cm Dark brown (7.5YR 3/2) and brown to dark brown (7.5YR 4/4) loam; massive; friable, slightly sticky and slightly plastic; few very fine roots; common very fine and fine and few medium tubular and many very fine interstital pores; 2% 2-15 mm pumice fragments; about 50% of the horizon is very firm moist, is weakly cemented and broken in hands with difficulty; material looks like weathered tuff.

ECUADOR 001

LAB CLASSIF: LOAMY OVER CINDERY, MIXED, ISOMESIC CUMULIC HAPLUDOLL

S 83FN-325 -001 DATE 09/25/84 SAMPLE NO. 83P2103-2110

ECUADOR-SMSS PEDON NO. 83P 459

PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	.1- 75	>2MM WT PCT O WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832103	1S	0- 21	AP	4.9	35.4	59.7			21.3	14.1	16.1	20.5	13.8	7.1	2.2	1	TR	--	44	1
832104	2S	21- 47	A1	5.0	34.3	60.7			20.4	13.9	15.2	19.3	14.1	8.6	3.5	3	TR	4V	49	7
832105	3S	47- 75	A2	2.5	26.1	71.4			14.7	11.4	15.6	16.4	15.4	14.0	10.0	9	6	27V	74	42
832106	4S	75- 84	2C1	0.8	3.7	95.5			1.7	2.0	1.3	7.2	29.8	33.7	23.5	11	10	54V	99	75
832107	5S	84-115	3AB1	6.1	42.3	51.6			26.9	15.4	16.2	16.2	10.1	6.9	2.2	1	TR	6V	40	7
832108	6S	115-150	3AB2	7.3	36.9	55.8			23.1	13.8	15.0	20.0	11.6	6.9	2.3	1	TR	4V	44	5
832109	7S	150-182	3ACB	9.2	32.2	58.6			20.3	11.9	16.0	20.3	13.7	6.8	1.8	3	1	4V	47	8
832110	8S	182-205	3C2	6.3	32.1	61.6			18.7	13.4	16.3	20.8	15.5	6.7	2.3	2	1	4V	49	7

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	COLE OVEN DRY 4A1H	WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832103	1	2.66	0.321			0.4	0.2		2.20	1.35										6.6	
832104	2	2.34	0.184			0.4	0.2		2.12	1.48				1.23	1.25	0.005			21.8	7.4	0.17
832105	3	2.28				0.5	0.2		4.56	2.72				1.11	1.11	--			27.8	6.8	0.18
832106	4	0.21				0.3	TR		3.13	3.25										2.6	
832107	5	1.13				0.5	0.1		1.44	0.92				1.29	1.29	--			25.8	5.6	0.25
832108	6	1.15				0.6	0.1		1.40	0.85				1.35	1.35	--			22.5	6.2	0.21
832109	7	0.96				0.9	0.1		1.26	1.01				1.23	1.27	0.010			25.9	9.3	0.20
832110	8	0.55				1.2	0.1		1.79	1.98				1.32	1.34	0.005			28.1	12.5	0.20

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 001 S 83FN-325 -001 DATE 09/25/84 PEDON NO. 83P 459 NATIONAL SOIL SURVEY LABORATORY

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	EXTRAL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES +AL 5A3B	AL SAT 5G1	-BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->								
832103	1	5.9	0.9	0.1	0.4	7.3	24.2	TR	31.5	10.8			23	68				9.9	5.2	5.4
832104	2	6.6	1.1	0.1	0.3	8.1	27.8	--	35.9	10.6			23	76				10.1	6.0	6.3
832105	3	6.9	1.6	0.2	0.2	8.9	21.5	TR	30.4	11.4			29	78				10.2	5.9	6.2
832106	4	1.7	0.7	0.1	0.2	2.7	8.1	--	10.8	2.5			25	100				8.2	5.7	6.3
832107	5	6.7	1.4	0.3	0.4	8.8	4.1	--	12.9	8.8			68	100				9.7	6.4	6.7
832108	6	7.5	1.5	0.3	0.4	9.7	6.4	TR	16.1	10.2			60	95				9.5	6.1	6.8
832109	7	8.1	1.7	0.3	0.6	10.7	6.3	0.1	17.0	11.6	10.8	1	63	92				9.4	6.4	6.8
832110	8	7.0	1.7	0.4	0.8	9.9	6.9	--	16.8	11.3			59	88				9.4	6.2	6.6

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI PCT FE+AL	FE+AL PCT CLAY	AL+C BY- -) PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - - <2U - - - -) 7A21	7A21	7A21	7A21	7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED BY- -)				<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->					
832103	1		0.1	0.2	0.5	0.1		610										
832104	2		0.1	0.2	0.5	0.1		868	VR 1	NX 6							2	GA39
832105	3		0.1	0.2	0.4	0.1		816										
832106	4		--	TR					NX 6									
832107	5		0.1	0.1	0.3	TR		305										
832108	6		0.1	0.1	0.3	TR		436	FD 1	NX 6								
832109	7		--	0.1	0.1	TR												
832110	8		--	0.1	0.1	TR												

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 4 PCT .1-75MM 63. SPODIC HORIZON: INDEX OF ACCUMUL 0
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL VR VERMICULITE NX AMORPHOUS GA GLASS AGG FD FELDSPAR

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

LE .	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - -	-PCT OF <2MM- - - - - - - - - - >					
03	1		6.9	36	0.4	0.2	0.4	0.3	
04	2		8.8	49	0.5	0.3	0.4	0.3	
05	3		8.5	50	0.5	0.4	0.4	0.4	
06	4		2.6	49	0.1	0.1	0.3	<0.1	
07	5		8.9	36	0.3	0.3	0.3	0.1	
08	6		8.8	34	0.2	0.2	0.3	0.1	
09	7		12.4	32	0.2	0.2	0.4	0.1	
10	8		17.5	36	0.2	0.2	0.5	0.1	

W ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY											(X-RAY					(DTA		(TOT ANAL)	
		(OPTICAL																			
		(SAND/SILT											(CLAY								
			<PCT										<RELATIVE AMOUNTS					<PCT			
83P2103	1																				
83P2104	2	VFS	2	GA39	FP24	GS17	FG 7	HN 4	PR 4	HG 2	OP 2	OG<1	VR 1	NX 6						0.5	1.6
83P2105	3																				
83P2106	4												NX 6							0.3	1.3
83P2107	5																				
83P2108	6												FD 1	NX 6						0.4	2.5
83P2109	7																				
83P2110	8																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: OP = OPAQUES FP = PLAGIOCLASE FELDSPAR GA = GLASS AGGREGATES GS = GLASS HN = HORNBLENDE PR = PYROXENE

VR = VERMICULITE NX = NON-CRYSTALLINE HG = GLASS COATED HORNBLENDE FG = GLASS COATED FELDSPAR

OG = GLASS COATED OPAQUE FD = FELDSPAR

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 9 85 Date: 8/82
Pedon No: S83FN-325-009
Taxonomy: Fine-loamy, mixed, isomesic Andic Humitropept
Latitude: 0°32'15" Longitude: 78°37'10"
Location: This pedon is located about 60 km south of Quito west of Machachi on Corazon Volcano (Aloasi zone pit two of Machu sequence).
Physiography: Mountains
Geomorphic Position: On lower foot slopes
Slope and Aspect: 25% E convex-convex Elevation: 3420 m M.S.L
Microrelief: Smooth
Air Temp. Summer: Winter:
Precipitation: 1400 mm Udic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: Cropland
Erosion or Deposition: slightly eroded with sheet and rill erosion.
Parent Material: multiple deposits of ash and pumice.
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 25, 1983. Field Moisture, 0-26 cm moist, some clods dry, 26-220 moist.
Vegetation: before temperate forest

Ap 0 - 26 cm Black (10YR 2/1, rubbed), loam; dark gray (10YR 4/1, dry); plowed, soft clods; very friable, non-sticky and non-plastic; weakly Omeary, very moist or wet; common very fine and fine roots; clear wavy boundary.

A1 26 - 68 cm Black (10YR 2/1) loam; weak medium and coarse subangular blocky structure parting to moderate medium and coarse granular; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few very fine roots; many very fine interstitial few fine and medium tubular, pores; 2% 2 to 5 mm pumice fragments; diffuse wavy boundary.
30 to 50% worm casts in horizon.

A2 68 - 120 cm Black (N 2/0) loam; weak very coarse subangular blocky structure parting to moderate medium and coarse subangular blocky; friable, slightly sticky and slightly plastic; a few thin patchy organic coatings on peds; few very fine roots; many very fine, few fine and medium tubular pores; coarse pumice fragments, 10% 2 to 40 mm; abrupt wavy boundary.
30 to 50% worm casts in horizon. Fragments increase in amount in the lower part of the horizon.

2C 120 - 138 cm Very pale brown (10YR 7/4) and dark yellowish brown(10YR 4/4) very gravelly coarse sand; single grain; loose, non-sticky and non-plastic; few very fine roots; many very fine and fine interstital pores; coarse pumice fragments, 40% 2 to 40 mm; abrupt wavy boundary.

3Ab1 138 - 183 cm Black (10YR 2/1) loam; weak very coarse subangular blocky structure parting to weak coarse subangular blocky; friable, slightly sticky and slightly plastic; few thin patchy dark reddish brown (5YR 3/3) organic coatings on peds; many very fine, few fine tubular pores; 1% 2 to 10 mm pumice fragments; diffuse wavy boundary. 30 to 50% worm casts in horizon.

3Ab2 183 - 220 cm Black (10YR 2/1) loam; weak very coarse subangular blocky structure parting to weak medium and coarse subangular blocky; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few thin patchy dark reddish brown (5YR 3/3) organic coatings on peds; many very fine and few fine tubular, pores. 30 to 50% worm casts in horizon.

ECUADOR 009

LAB CLASSIF: FINE-LOAMY, MIXED, ISOMESIC ANDIC HUMITROPEPT

S 83FN-325 -009 DATE 09/25/84 SAMPLE NO. 83P2091-2096
PEDON NO. 83P 457
PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) 2 -5	COARSE FRACTIONS(MM) 5 -20	COARSE FRACTIONS(MM) 20 -75	COARSE FRACTIONS(MM) .1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832091	1S	0- 26	AP	7.1	36.7	56.2			22.6	14.1	14.1	17.8	14.3	7.8	2.2	1	TR	--	43	1
832092	2S	26- 68	A1	3.4	40.8	55.8			26.6	14.2	14.2	18.1	12.5	8.0	3.0	1	TR	5V	45	6
832093	3S	68-120	A2	2.0	28.6	69.4			17.0	11.6	13.4	16.5	15.9	14.1	9.5	7	6	20V	71	33
832094	4S	120-138	2C	0.1	3.3	96.6			1.8	1.5	0.7	7.1	31.9	35.0	21.9	9	9	50V	99	68
832095	5S	138-183	3AB1	4.1	46.5	49.4			30.7	15.8	15.4	17.0	9.8	5.8	1.4	1	TR	2V	36	3
832096	6S	183-220	3AB2	5.4	37.4	57.2			24.7	12.7	13.0	20.3	13.6	7.3	3.0	3	1	2V	48	6

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	DITH-CIT EXTRACTABLE AL 6G7A	DITH-CIT EXTRACTABLE MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A3A	BULK DENSITY 1/3 BAR 4A1D	BULK DENSITY OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	WATER CONTENT 1/3 BAR 4B1C	WATER CONTENT 15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832091	1	6.17	0.420			0.4	0.3		3.00	2.30				0.84	0.99	0.056			50.7	16.3	0.29
832092	2	4.32	0.253			0.6	0.4		4.68	3.68				0.98	1.07	0.029			46.2	12.5	0.32
832093	3	3.70	0.229			0.6	0.3		7.40	5.35				1.05	1.21	0.040			39.1	10.7	0.25
832094	4	0.23				0.3	TR		20.00	65.00										6.5	
832095	5	2.02				0.6	0.2		3.22	1.98				1.20	1.26	0.016			34.3	8.1	0.31
832096	6	1.69				0.8	0.1		2.54	1.57				1.22	1.28	0.016			31.5	8.5	0.27

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 009 S 83FN-325 -009 DATE 09/25/84 PEDON NO. 83P 457 NATIONAL SOIL SURVEY LABORATORY

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G					- - - - - - - - - - - ->					<- - - - -PCT - - - ->								
832091	1	10.0	2.3	0.1	0.8	13.2	19.3	TR	32.5	21.3			41	62				10.0	5.5	5.6
832092	2	5.1	1.7	0.2	0.4	7.4	20.4	0.2	27.8	15.9	7.6	3	27	47				10.6	5.3	5.9
832093	3	6.0	0.9	0.2	0.2	7.3	18.3	0.1	25.6	14.8	7.4	1	29	49				10.5	5.3	6.0
832094	4	1.3	0.3	0.1	0.1	1.8	1.4	0.1	3.2	2.0	1.9	5	56	90				9.0	5.5	6.2
832095	5	8.2	1.2	0.3	0.4	10.1	10.0	--	20.1	13.2			50	77				9.6	5.9	6.4
832096	6	8.8	1.3	0.4	0.4	10.9	8.7	--	19.6	13.7			56	80				9.3	6.1	6.5

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI PCT FE+AL	FE+AL AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED BY- -)				<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->		
832091	1		0.3	0.3	0.9	0.1	753								
832092	2		0.3	0.4	0.7	0.2	1096		VR 2	NX 6				1	GA42
832093	3		0.2	0.3	0.6	0.3	1279		NX 6						
832094	4		0.1	TR	0.3	1.0			FD 1	NX 6				4	GA35
832095	5		0.2	0.2	0.5	0.1	812								
832096	6		0.1	0.1	0.2	TR	625		FD 1	NX 6					

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 3 PCT .1-75MM 56. SPODIC HORIZON: INDEX OF ACCUMUL 2375
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL VR VERMICULITE NX AMORPHOUS GA GLASS AGG FD FELDSPAR

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832091	1		16.2	54	0.5	0.2	0.4	0.4	
832092	2		16.9	67	0.7	0.4	0.5	0.7	
832093	3		14.7	69	0.8	0.4	0.5	0.7	
832094	4			30	0.1	0.1	0.2	0.1	
832095	5		14.8	36	0.5	0.3	0.4	0.3	
832096	6		14.7	47	0.4	0.3	0.5	0.2	

* NEW ZEALAND PROCEDURE

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		MINERALOGY																			
		OPTICAL											X-RAY					DTA		TOT ANAL	
		SAND/SILT											CLAY								
		<-----PCT----->											<----RELATIVE AMOUNTS------>					<-------PCT---------->			
83P2091	1																				
83P2092	2	VFS	1	GA42	FP22	GS18	FG 8	HN 4	PR 3	HG 1	FE 1	OG 1	VR 2	NX 6						0.3	1.8
83P2093	3												NX 6							0.2	1.8
83P2094	4	VFS	4	GA35	FP18	FG14	GS11	HG 7	HN 5	FE 4	BT 3	OG 2	FD 1	NX 6						0.2	0.9
83P2095	5																				
83P2096	6												FD 1	NX 6						0.3	2.6

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: FE = IRON OXIDES FP = PLAGIOCLASE FELDSPAR GA = GLASS AGGREGATES GS = GLASS HN = HORNBLENDE

PR = PYROXENE VR = VERMICULITE NX = NON-CRYSTALLINE HG = GLASS COATED HORNBLENDE

FG = GLASS COATED FELDSPAR OG = GLASS COATED OPAQUE BT = BIOTITE FD = FELDSPAR

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 6 91 Date: 6/83
Pedon No: S83EN-325-006
Taxonomy: Fine-loamy, mixed, isomesic Andic Humitropept
Latitude: 0°20'15" Longitude: 78°33'45"
Location: In a pasture on the Santa Catalina INIAP Experiment Station
Physiography: Terrace
Geomorphic Position: On a hillslope
Slope and Aspect: 12% E planar-planar Elevation: 3140 m M.S.L.
Microrelief: smooth
Air Temp. Summer: 10.6°C Winter: 11.1°C
Precipiation: 1450 mm Udic moisture regime
Water Table: > 10 meters
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: pasture in an experimentation station
Erosion or Deposition: none
Parent Material: ash and pumice deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff
Remarks: . Date described: January 21, 1983. Field Moisture, 0-185 cm moist. Worm casts occupy 20 to 50 percent of the pedon. All coarse fragments are pumice.
Vegetation: Before clearing a native temperate forest, now mostly kikuyu grass

A1 0 - 10 cm Black (10YR 2/1) loam; moderate medium coarse and very coarse granular structure; friable, non-sticky and non-plastic; many very fine, common medium and coarse roots; common very fine interstitial and few very fine pores; 1% 2 to 5 mm fragments; clear wavy boundary.

A2 10 - 55 cm Black (N 2/0) loam; weak coarse subangular block structure parting to weak coarse and very coarse granular; friable, slightly sticky and slightly plastic; very weakly smeary, very moist or wet; common very fine and fine roots; many very fine and few fine tubular pores; 1% 2 to 5 mm fragments; clear wavy boundary.

A3 55 - 79 cm Black (N 2/0) gravelly loam; weak coarse subangular blocky structre parting to weak coarse and very coarse granular; friable, slightly sticky and slightly plastic; very weakly smeary, very moist or wet; few thin discontinuous organic coatings on peds; few very fine and fine roots; many very fine tubular and few fine tubular pores; coarse fragments, 20% 2 to 60 mm; clear wavy boundary.

2Ab1 79 - 117 cm Black (10YR 2/1) loam; weak coarse subangular blocky structure parting to weak coarse and very coarse granular; friable, slightly sticky and slightly plastic; very weakly smeary, very moist or wet; common thin continuous organic coatings on peds; few very fine and fine roots; many very fine tubular and few fine tubular pores; 1% 2 to 5 mm fragments; diffuse wavy boundary.

2Ab2 117 - 151 cm Black (10YR 2/1) silt loam; weak coarse subangular blocky structure parting to weak coarse and very coarse granular; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; many thin continuous organic coatings on peds; few very fine and fine roots; many very fine and few fine tubular pores; 1% 2-5 mm fragments; diffuse wavy boundary.

2Ab3 151 - 185 cm Black (N 2/0) silt loam; weak coarse subangular blocky structure parting to weak coarse and very coarse granular; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; many thin continuous organic coatings on peds; few very fine and fine roots; many very fine and few fine tubular pores; coarse fragments, 15%; most fragments in layer about 10-15 cm thick, average for whole horizon less than 5%.

ECUADOR 006

LAB CLASSIF: FINE-LOAMY, MIXED, ISOMESIC ANDIC HUMITROPEPT

S 83FN-325 -006 DATE 09/25/84 SAMPLE NO. 83P2065-2070
PEDON NO. 83P 453
PROJECT NO. 83P 83

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	(- - -TOTAL - - -) CLAY LT .002	SILT .002 -.05	SAND .05 -2	(- -CLAY- -) FINE LT .0002	CO3 LT .002	(- -SILT- -) FINE .002 -.02	COARSE .02 -.05	(- - - - - -SAND- - - - - -) VF .05 -.10	F .10 -.25	M .25 -.50	C .5 -1	VC 1 -2	(-COARSE FRACTIONS(MM)-) 2 -5	5 -20	WEIGHT 20 -75	.1- 75	(>2MM WT PCT O WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832065	1S	0- 10	A1	4.7	50.7	44.6			33.2	17.5	15.5	16.1	8.3	3.4	1.3	TR	TR	3V	31	3
832066	2S	10- 55	A2	3.8	50.7	45.5	--		34.0	16.7	15.7	16.4	8.6	3.6	1.2	TR	--	3V	32	3
832067	3S	55- 79	A3	2.4	44.6	53.0	0.1		29.4	15.2	13.6	16.4	10.0	5.9	7.1	7	3	40V	70	50
832068	4S	79-117	2AB1	3.2	54.2	42.6	0.1		35.8	18.4	15.5	16.1	6.7	2.9	1.4	TR	--	3V	29	3
832069	5S	117-151	2AB2	2.6	55.2	42.2			35.1	20.1	19.5	13.7	4.8	2.9	1.3	1	TR	3V	26	4
832070	6S	151-185	2AB3	2.6	50.5	46.9			29.9	20.6	21.2	13.0	6.0	4.6	2.1	1	1	13V	37	15

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	(- - DITH-CIT - -) EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832065	1	6.22	0.424			0.8	0.6		4.55	3.30				0.79	0.92	0.051			56.7	15.5	0.32
832066	2	5.68	0.368			0.8	0.6		5.55	4.18				0.98	1.07	0.029			47.0	15.9	0.30
832067	3	5.38				0.8	0.5		9.08	6.42				0.87	0.96	0.025			54.6	15.4	0.26
832068	4	4.21				0.9	0.5		6.56	4.34				1.06	1.15	0.027			45.5	13.9	0.33
832069	5	3.91				1.1	0.4		9.46	6.00				1.01	1.13	0.038			50.9	15.6	0.35
832070	6	4.13				1.1	0.3		10.50	6.46				0.92	1.09	0.054			57.2	16.8	0.35

* PSDA IN THIS PEDON SHOULD NOT BE USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 006 S 83FN-325 -006 DATE 09/25/84 PEDON NO. 83P 453 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6Q2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G							- - - - - - - - - - ->			<- - - - -PCT			- - - ->					
832065	1	3.9	0.6	0.1	0.4	5.0	28.8	1.2	33.8	21.4	6.2	19	15	23				10.9	4.7	5.1
832066	2	4.6	0.4	0.1	0.2	5.3	28.8	0.6	34.1	21.1	5.9	10	16	25				11.0	4.9	5.6
832067	3	5.1	0.7	0.1	0.2	6.1	27.1	0.3	33.2	21.8	6.4	5	18	28				11.0	5.1	5.9
832068	4	5.4	0.9	0.1	0.3	6.7	27.7	0.3	34.4	21.0	7.0	4	19	32				10.9	5.4	6.0
832069	5	9.3	1.5	0.2	0.7	11.7	25.6	TR	37.3	24.6			31	48				10.2	5.6	6.3
832070	6	12.4	2.1	0.2	1.0	15.7	23.0	TR	38.7	27.3			41	58				9.8	5.2	6.2

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI PCT FE+AL	FE+AL AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED BY- -)			<- RELATIVE AMOUNTS ->				<- - - - -PCT			- - - ->
832065	1		0.4	0.5	0.6	0.2	314								
832066	2		0.4	0.5	0.6	0.2	1449	NX 6							
832067	3		0.3	0.4	0.5	0.3	768								
832068	4		0.3	0.4	0.5	0.2	1246	NX 6							
832069	5		0.4	0.3	0.5	0.3	1224								
832070	6		0.5	0.3	0.6	0.3	1272								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 3 PCT .1-75MM 43. SPODIC HORIZON: INDEX OF ACCUMUL 5878
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL NX AMORPHOUS

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832065	1		17.4	80	0.9	0.4	0.6	1.0	
832066	2		25.0	83	1.0	0.5	0.7	1.1	
832067	3		25.5	86	1.2	0.6	0.6	1.3	
832068	4		26.5	86	1.2	0.7	0.6	1.4	
832069	5		29.6	76	1.0	0.7	0.9	0.9	
832070	6		31.7	70	0.8	0.6	1.0	0.6	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY																			
		(OPTICAL											(X-RAY					(DTA		(TOT ANAL	
		(SAND/SILT											(CLAY								
			<PCT										<RELATIVE AMOUNTS					<PCT			
83P2065	1																				
83P2066	2	VFS		GA34	OT32	GC22	GS11						NX 6							0.3	2.0
83P2067	3																				
83P2068	4	VFS		GA37	OT27	GC21	GS15						NX 6							0.2	1.9
83P2069	5																				
83P2070	6																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 4 Date: 6/83
Pedon No: S83FN-325-004
Taxonomy: Coarse-loamy over cindery, mixed, isomesi. Typic Humitropept
Latitude: 0°28'00" Longitude: 78°42'40"
Location: Aurora Farm
Physiography: Mountains
Geomorphic Position: Hillslope
Slope and Aspect: 25% N convex-convex Elevation: 2780 m M.S.L
Microrelief:
Air Temp. Summer: Winter:
Precipitation: 1700 mm approximately. Udic moisture regime.
Water Table: > 10 meters
Drainage: Well drained Permeability: Moderately slow
Stoniness: nonstony
Land Use: Pasture
Erosion or Deposition: None to slight
Parent Material: ash and pumice deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 26, 1983. Field Moisture, 0-45 cm wet, 45-150 cm moist, 150-190 cm wet.
Vegetation: Native vegetation was a temperate forest. Now cleared and planted to kikuyu pasture grass.

A1 0 - 24 cm Very dark brown (10YR 2/2) loam; weak coarse subangular blocky structure parting to moderate medium, coarse, very coarse granular; friable, slightly sticky and slightly plastic; common very fine and few fine and medium roots; many very fine and few fine tubular pores; 1% 2-5 mm pumice fragments; gradual wavy boundary.

A2 24 - 45 cm Very dark brown (10YR 2/2) sandy loam; weak medium and coarse subangular blocky structure; very friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine, fine, and medium roots; many very fine interstitial and tubular and common fine tubular pores; 5% 2-20 mm pumice fragments; clear wavy boundary.

2Bw 45 - 63 cm Brown to dark brown (10YR 4/3) gravelly coarse sand; single grain; loose; few very fine, fine, and medium roots; many very fine and fine interstitial pores; 30% 2-20 mm pumice fragments; clear wavy boundary. This and next two horizons composed of many strata of pumice from about 100% 10-60 mm pumice to strata composed of pumice all less than 2 mm in size.

2C1 63 - 83 cm Pale yellow (2.5Y 7/4) gravelly coarse sand; single grain; loose; few fine and medium roots; many very fine and fine inter-stitial pores; 30% 2-40 mm pumice fragments; clear wavy boundary.

2C2 83 - 150 cm Light gray (10YR 7/2) very gravelly coarse sand; single grain loose; very few very fine roots; many very fine and fine interstitial pores; 50% 2-60 mm pumice fragments; abrupt wavy boundary.

3Abg 150 - 168 cm Very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) silt loam; common fine prominent dark reddish brown (5YR 3/3) and few fine prominent dark reddish brown (2.5YR 3/4) mottles; weak very coarse angular blocky structure; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet, very few very fine roots; common very fine tubular pores; gradual wavy boundary. Some brown (7.5YR 4/4) material in pores that looks like gel deposits (imogolite). The upper 5 cm of this horizon contains a few pumice fragments 5-10 cm in size.

3Bw1b 168 - [illegible] cm Dark grayish brown (10YR 4/2) and brown to dark brown (10YR 4/3) silt loam; common fine distinct brown to dark brown (7.5YR 4/4) mottles; weak coarse angular blocky structure; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet, very few very fine roots; common very fine tubular pores; gradual wavy boundary.

3Bw2b 190 - 207 cm Brown to dark brown (10YR 4/3) and dark brown (7.5YR 4/4) silty clay loam; massive; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet, very few very fine roots; common very fine and few fine tubular pores; 7% 2-30 mm pumice fragments.

ECUADOR 004

LAB CLASSIF: FINE-LOAMY OVER CINDERY, MIXED, ISOMESIC TYPIC HUMITROPEPT

S 83FN-325 -004 DATE 09/25/84 SAMPLE NO. 83P2119-2126
PEDON NO. 83P 461
PROJECT NO. 83P 83

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .002 -.05	-3-- TOTAL SAND .05 -2	-4-- CLAY FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7-- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS(MM) 2 -5	-14- COARSE FRACTIONS(MM) 5 -20	-15- COARSE FRACTIONS(MM) 20 -75	-16- COARSE FRACTIONS(MM) .1- 75	-17- >2MM WT PCT O WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832119	1S	0- 24	A1	2.1	39.1	58.8			24.3	14.8	16.5	20.1	13.5	6.7	2.0	2	1	3V	46	6
832120	2S	24- 45	A2	1.8	27.1	71.1			17.0	10.1	13.5	20.7	18.5	11.8	6.6	6	3	11V	66	20
832121	3S	45- 63	2BW	0.6	3.0	96.4			2.4	0.6	3.9	15.5	26.0	29.5	21.5	9	10	40V	97	59
832122	4S	63- 83	2C1	0.9	1.7	97.4			1.7	TR	1.1	8.6	31.2	36.9	19.6	11	16	39V	99	66
832123	5S	83-150	2C2	0.9	1.3	97.8			1.3	--	1.0	7.1	33.0	35.9	20.8	9	15	58V	99	82
832124	6S	150-168	3ABG	3.1	53.4	43.5			35.0	18.4	17.4	16.4	7.1	2.2	0.4	--	--	--	26	--
832125	7S	168-190	3BW1B	3.6	51.4	45.0			34.3	17.1	14.8	17.6	8.1	3.1	1.4	1	1	--	32	2
832126	8S	190-207	3BW2B	13.0	36.7	50.3			25.7	11.0	13.2	15.3	11.1	6.8	3.9	3	1	15V	49	19

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	(- - DITH-CIT - -) EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	(ATTERBERG) LIMITS LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832119	1	4.26	0.358			1.0	0.7		7.24	5.95				1.02	1.08	0.019			41.4	12.5	0.29
832120	2	2.51	0.190			0.8	0.5		5.28	4.83				1.02	1.07	0.015			37.5	8.7	0.27
832121	3	0.29	0.020			0.3	0.1		2.67	5.83										3.5	
832122	4	0.17				0.3	0.1		2.11	4.00										3.6	
832123	5	0.14				0.3	TR		1.56	4.44										4.0	
832124	6	1.09				0.8	0.2		2.68	2.84				1.09	1.16	0.021			43.6	8.8	0.38
832125	7	1.07				0.9	0.2		2.50	2.69				1.09	1.17	0.024			43.5	9.7	0.37
832126	8	0.49				1.9	0.2		0.90	1.33				1.09	1.17	0.022			42.6	17.3	0.25

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 004 S 83FN-325 -004 DATE 09/25/84 PEDON NO. 83P 461 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G					- - - - - - - - - - - ->					<- - - - -PCT			- - - ->					
832119	1	3.3	0.5	0.1	0.1	4.0	27.3	0.2	31.3	15.2	4.2	5	13	26				11.3	5.4	6.0
832120	2	1.8	0.3	0.1	TR	2.2	18.5	0.3	20.7	9.5	2.5	12	11	23				11.2	5.6	5.9
832121	3	0.4	0.1	0.1	--	0.6	3.0	0.1	3.6	1.6	0.7	14	17	38				10.4	5.6	6.1
832122	4	0.6	0.1	0.1	TR	0.8	1.7	TR	2.5	1.9			32	42				10.2	5.3	6.1
832123	5	0.5	0.1	0.1	TR	0.7	1.3	0.1	2.0	1.4	0.8	12	35	50				9.7	5.3	6.1
832124	6	2.9	0.6	0.2	0.4	4.1	10.6	0.1	14.7	8.3	4.2	2	28	49				10.1	5.7	6.2
832125	7	3.5	0.9	0.3	0.4	5.1	9.8	TR	14.9	9.0			34	57				10.0	5.7	6.2
832126	8	4.1	1.3	0.5	0.6	6.5	10.2	--	16.7	11.7			39	56				9.6	5.8	6.5

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	(- -DIVIDED BY- -) FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->							<- RELATIVE AMOUNTS ->				<- - - - -PCT		- - - ->	
832119	1		0.4	0.6	0.6	0.5		726								
832120	2		0.3	0.5	0.6	0.4		416	NX 6							
832121	3		--	0.1	0.3	0.2										
832122	4		--	0.1	0.3	0.1										
832123	5		--	0.1	0.3	0.1			NX 6							
832124	6		0.2	0.2	0.4	0.1		237	NX 6							
832125	7		0.2	0.2	0.4	0.1		288	KH 1	NX 6						
832126	8		0.1	0.1	0.1	TR		173								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 1 PCT .1-75MM 90. SPODIC HORIZON: INDEX OF ACCUMUL 764
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL NX AMORPHOUS KH HALLOYSITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -	-PCT OF	<2MM- - - - - - - - - -			>	
832119	1		23.8	86	1.2	0.5	0.7		
832120	2		16.0	75	1.1	0.5	0.6		
832121	3		4.5	34	0.3	0.2	0.2		
832122	4		4.4	27	0.2	0.2	0.3		
832123	5		4.5	25	0.1	0.2	0.3		
832124	6		17.5	56	0.5	0.4	0.5		
832125	7		19.1	52	0.4	0.4	0.6		
832126	8		26.1	54	0.3	0.3	0.7		

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY)											(X-RAY)					(DTA)		(TOT ANAL)	
		(OPTICAL)																			
		(SAND/SILT)											(CLAY)								
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
83P2119	1																				
83P2120	2	VFS		GA32	OT27	GS24	GC17						NX 6							0.0	1.9
83P2121	3																				
83P2122	4																				
83P2123	5												NX 6							0.3	0.5
83P2124	6												NX 6							0.2	2.4
83P2125	7												KH 1	NX 6						0.3	3.0
83P2126	8																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

KH = HALLOYSITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 5 Date: 6/83
Pedon No: S83FN-325-005
Taxonomy: Medial, isohyperthermic Entic Dystrandept
Latitude: Longitude:
Location: In an Oil Palm Grove at INIAP Experiment Station at La Concordia.
Physiography: Terrace
Geomorphic Position: stable summit
Slope and Aspect: 1% planar-planar Elevation: 280 m M.S.L
Microrelief: smooth
Air Temp. Summer: 22.9°C Winter: 24°C
Precipitation: 3200 mm Udic moisture regime.
Water Table: 2 meters
Drainage: Somewhat poorly drained Permeability: Moderately rapid
Stoniness: nonstony
Land Use: Oil palm plantation and pasture for grazing
Erosion or Deposition: none
Parent Material: several ash deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 27, 1983. Field Moisture, 0-110 cm wet, 110-190 cm free water. Medium and coarse decayed roots and pores to 142 cm, mostly above 110 cm.
Vegetation: before native tropical humid forest.

A 0 - 7 cm Dark brown (10YR 3/3) and black (10YR 2/1) loam; weak coarse subangular blocky structure; friable, non-sticky and non-plastic; common very fine and few fine roots; common very fine to fine tubular pores; clear irregular boundary. About 1% fragments of brick and artifacts.

Bw1 7 - 27 cm Brown to dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; very friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few very fine and fine roots; many very fine and fine tubular very fine interstitial pores; gradual wavy boundary. About 1% fragments of brick and artifacts.

Bw2 27 - 54 cm Brown to dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; weak coarse angular blocky structure parting to weak medium subangular blocky; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine and fine roots; common very fine and fine tubular pores; gradual wavy boundary. About 1% fragments of brick and artifacts.

2Ab 54 - 79 cm Very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) loam; weak coarse angular blocky structure parting to weak medium subangular blocky; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine roots; common very fine and fine tubular and many very fine interstitial pores; gradual wavy boundary.

2Bwb 79 - 100 cm Brown to dark brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loam; weak coarse angular blocky structure parting to weak medium subangular blocky; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few very fine roots; common very fine and fine tubular and many very fine interstitial pores; clear wavy boundary.

2Cg 100 - 110 cm Variegated gray (5Y 5/1) and olive gray (5Y 5/2) fine sandy loam; common fine and medium distinct and priminent dark yellowish brown and dark brown (10YR 4/4, 5/4, 4/3) and dark grayish brown (2.5Y 4/2) mottles; structureless; friable, non-sticky and non-plastic; moderately smeary, very moist or wet; few very fine roots; many very fine interstitial and common very fine tubular pores; abrupt irregular boundary.

3Ab 110 - 142 cm Very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 3/4) silt loam; structureless; friable, slightly sticky and slightly plastic; strongly smeary, very moist or wet; few very fine roots; many very fine interstitial and tubular pores; clear wavy boundary. Very thixotropic free water can be squeezed by hand.

3Bwb 142 - 190 cm Dark grayish brown (10YR 4/2) silt loam; many fine distinct and prominent dark yellowish brown (10YR 4/4) and brown to dark brown (7.5YR 4/4) mottles; structureless; very friable, slightly sticky and slightly plastic; strongly smeary, very moist or wet; few very fine roots; many very fine interstitial and tubular pores. Very thixotropic free water can be squeezed by hand.

ECUADOR 005

LAB CLASSIF: MEDIAL, ISOHYPERTHERMIC ENTIC DYSTRANDEPT

S 83FN-325 -005 DATE 09/25/84 SAMPLE NO. 83P2151-2158

ECUADOR-CMSS PEDON NO. 83P 465

PROJECT NO. 83P 83

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	>2MM .1-75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832151	1S	0- 7	A	4.0	56.6	39.4			38.4	18.2	20.3	18.2	0.7	0.2	--	TR	--	3V	22	3
832152	2S	7- 27	BW1	2.0	53.0	45.0			33.6	19.4	23.5	20.7	0.8	--	--	--	--	--V	21	--
832153	3S	27- 54	BW2	1.7	42.5	55.8			25.6	16.9	26.0	25.6	3.9	0.3	--	TR	--	3V	32	3
832154	4S	54- 79	2AB	1.2	35.6	63.2			17.9	17.7	25.6	33.5	4.1	--	--	--	--	--	38	--
832155	5S	79-100	2BWB	1.1	41.7	57.2			23.4	18.3	23.8	29.3	4.0	0.1	--	TR	--	--	33	--
832156	6S	100-110	2CG	1.9	44.3	53.8			25.1	19.2	22.6	28.6	2.6	--	--	--	--	--	31	--
832157	7S	110-142	3AB	2.2	35.5	62.3			19.4	16.1	24.9	33.6	3.6	0.2	--	--	--	--	37	--
832158	8S	142-190	3BWB	--	16.2	83.8			7.5	8.7	21.3	43.8	14.8	3.6	0.3	TR	--	--	62	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P 6R3A	TOTAL S 6C2B	DITH-CIT EXTRACTABLE FE 6G7A	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832151	1	5.71	0.466			0.7	0.4		5.90	5.28				0.80	0.94	0.055			61.7	21.1	0.32
832152	2	2.68	0.239			0.7	0.5		6.00	6.50				0.73	0.84	0.048			55.7	13.0	0.31
832153	3	2.23	0.200			0.9	0.5		7.47	8.24				0.84	0.95	0.041			58.8	14.0	0.37
832154	4	1.78				0.9	0.5		8.25	10.17				0.85	0.95	0.038			53.1	12.2	0.35
832155	5	1.00				0.8	0.4		6.82	10.00				0.88	0.97	0.033			49.9	11.0	0.34
832156	6	0.57				0.7	0.3		3.53	5.42				1.05	1.09	0.013			32.6	10.3	0.23
832157	7	2.12				1.9	0.8		9.45	9.50				0.77	0.89	0.049			58.5	20.9	0.29
832158	8	1.45				2.5	0.9							0.60	0.85	0.123			77.9	19.4	0.35

* PSDA IN ANDEPTS SHOULD NOT BE USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 005 S 83FN-325 -005 DATE 09/25/84 PEDON NO. 83P 465 NATIONAL SOIL SURVEY LABORATORY

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F	H2O 8C1F
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - ->							1:2	1:1
832151	1	15.5	1.9	0.2	0.2	17.8	43.4	--	61.2	23.6			29	75				10.4	5.7	6.0
832152	2	3.8	1.0	0.2	0.1	5.1	21.6	TR	26.7	12.0			19	42				10.9	5.6	6.1
832153	3	1.3	0.4	0.2	0.1	2.0	26.1	0.2	28.1	12.7	2.2	9	7	16				11.1	5.4	5.8
832154	4	0.5	0.2	0.2	TR	0.9	23.8	0.1	24.7	9.9	1.0	10	4	9				11.1	5.3	5.6
832155	5	0.3	0.1	0.2	TR	0.6	17.7	TR	18.3	7.5			3	8				11.0	5.4	5.6
832156	6	0.5	0.1	0.1	0.1	0.8	17.7	0.1	18.5	6.7	0.9	11	4	12				10.8	5.8	5.8
832157	7	1.7	0.3	0.1	1.8	3.9	33.0	0.1	36.9	20.8	4.0	2	11	19				11.0	5.5	6.1
832158	8	3.0	0.7	0.1	2.5	6.3	32.6	TR	38.9	22.8			16	28				10.8	5.2	6.0

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	(- -DIVIDED BY- -) FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->							<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832151	1		0.3	0.4	0.6	0.2		414								
832152	2		0.2	0.5	0.6	0.4		514	VC 1	NX 6						
832153	3		0.1	0.4	0.4	0.3		736								
832154	4		--	0.4	0.3	0.3		602	NX 6							
832155	5		--	0.3	0.3	0.3		373	NX 6							
832156	6		0.1	0.2	0.3	0.2		175								
832157	7		0.1	0.4	0.2	0.2		1146	MI 1	NX 6						
832158	8		0.1	0.3	0.1											

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 1 PCT .1-75MM 34. SPODIC HORIZON: INDEX OF ACCUMUL 373
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL VC VERM-CHLOR NX AMORPHOUS MI MICA

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - -	-PCT OF <2MM- - - - - - - - - - >					
832151	1		28.3	68	0.7	0.3	0.4	0.8	
832152	2		24.7	61	1.0	0.5	0.4	1.3	
832153	3		32.1	90	1.4	0.8	0.4	2.2	
832154	4		28.5	94	1.9	1.2	0.4	2.2	
832155	5		24.3	89	1.6	1.2	0.4	1.8	
832156	6		18.6	77	1.2	0.8	0.3	1.4	
832157	7		38.7	97	2.7	1.7	1.0	2.2	
832158	8		58.9	97	2.1	1.5	0.8	2.0	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
83P2151	1																				
83P2152	2	VFS		GA59	GC17	OT14	GS10						VC 1	NX 6						0.1	1.2
83P2153	3																				
83P2154	4	VFS		GA65	OT16	GC14	GS 5						NX 6							0.0	1.1
83P2155	5	VFS		GA58	OT24	GC15	GS 3						NX 6							0.0	1.3
83P2156	6																				
83P2157	7	VFS		GA78	OT14	GC 6	GS 2						MI 1	NX 6						0.4	2.2
83P2158	8																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS VC = VERMICULITE-CHLORITE OT = OTHER NX = NON-CRYSTALLINE

GC = GLASS COATED GRAIN MI = MICA

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 12 Date: 8/82
Pedon No: S83EW-325-012
Taxonomy: Fine-loamy, mixed, isohyperthermic Typic Argiudoll
Latitude: 0°50'00" Longitude: 79°28'50"
Location: This pedon is located about 90 km south of Santo Domingo near Buena Fe (1 km before this town).
Physiography: Fan Terrace.
Geomorphic Position: Summit.
Slope and Aspect: 1% plonar-planar Elevation: 120 m M.S.L
Microrelief: smooth.
Air Temp. Summer: 23.4°C Winter: 24.9°C
Precipitation: 2200 mm Udic moisture regime.
Water Table: > 10 meters
Drainage: Well drained Permeability: Moderately slow
Stoniness: nonstony
Land Use: Forest, ungrazed
Erosion or Deposition: none
Parent Material: multiple recent ash deposits over a very old ash deposit with a strongly developed argillic horizon.
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date Described: January 28, 1983. Field Moisture, 0-170 cm wet. To a depth of 130 cm there are a few (1%) artifact fragments of broken, brick and stone, tools.
Vegetation: Tropical forest in closely with cocoa trees.

A1 0 - 10 cm Very dark brown (10YR 2/2) loam; moderate coarse subangular blocky structure parting to strong medium and coarse granular; friable, slightly sticky and slightly plastic; few very fine, fine, medium and coase roots; many very fine, fine and medium tubular and many very fine and fine interstital pores; clear wavy boundary.

Bw 10 - 52 cm Dark brown (7.5YR 3/2) loam; moderate medium and coarse subangular blocky structure parting to weak coarse granular; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few very fine, medium, and fine, coarse roots; many very fine, fine, and medium tubular pores; clear wavy boundary.

2Ab 52 - 83 cm Very dark brown (10YR 2/2) loam; weak coarse angular blocky structure; very friable, slightly sticky and slightly plastic; moderately smeary, very moist or wet; few very fine, medium, and fine coarse roots; many very fine, fine, and medium tubular; gradual wavy boundary.

3Btb1 83 - 102 cm Very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam; moderate medium and coarse subangular blocky structure; very friable, sticky and slightly plastic; strongly smeary, very moist or wet; few very fine, fine, and medium, and coarse roots; many very fine, fine, and medium tubular pores; few thin patchy stress oriented coats on peds; gradual wavy boundary.

3Btb2 102 - 130 cm Dark brown (7.5YR 3/2) clay loam; weak coarse subangular blocky structure parting to weak coarse granular; friable, sticky and plastic; moderately smeary, very moist or wet; few fine, medium, and coarse roots; many very fine, fine, and medium tubular pores; many thin continuous clay films on peds and in pores; few pressure faces; diffuse wavy boundary.

4Btb3 130 - 150 cm Dark reddish brown (5YR 3/2) clay; moderate medium and coarse prismatic structure parting to moderate medium and coarse angular blocky; firm, sticky and plastic; weakly smeary, very moist or wet; many very fine, fine, and medium tubular pores; many thin continuous stress oriented coats on faces and many thin clay films on peds and in pores; gradual wavy boundary.

4Btb4 150 - 170 cm Dark reddish brown (5YR 3/4 exterior ped faces) and dark brown (7.5YR 3/4 interior) clay; moderate medium prismatic structure parting to moderate medium and coarse angular blocky; firm, sticky and very plastic; weakly smeary, very moist or wet; common very fine, fine, and medium tubular pores; many thin continuous stress oriented coats on faces of peds and many thin clay fims in pores and on peds, few moderately thick clay films in pores.

ECUADOR 012

LAB CLASSIF: FINE-LOAMY, MIXED, ISOHYPERTHERMIC TYPIC ARGIUDOLL

S 83FN-325 -012 DATE 09/25/84 SAMPLE NO. 83P2167-2173
PEDON NO. 83P 467
PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	>2MM .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832167	1S	0- 10	A1	7.0	53.5	39.5			30.6	22.9	21.0	15.5	2.3	0.7	--	--	--	--V	18	--
832168	2S	10- 52	BW	3.3	40.1	56.6			23.0	17.1	23.0	30.0	3.3	0.3	--	--	--	--V	34	--
832169	3S	52- 83	2AB	3.4	48.0	48.6			29.1	18.9	23.0	23.9	1.5	0.2	--	TR	--	3V	28	3
832170	4S	83-102	3BTB1	13.0	51.8	35.2			33.5	18.3	19.3	15.0	0.7	0.1	0.1	--	--	3V	18	3
832171	5S	102-130	3BTB2	27.1	40.2	32.7			25.8	14.4	14.3	17.7	0.7	--	--	TR	--	2V	20	2
832172	6S	130-150	4BTB3	52.3	27.7	20.0			17.9	9.8	9.1	10.1	0.7	0.1	--	TR	--	--	11	--
832173	7S	150-170	4BTB4	65.3	21.5	13.2			14.3	7.2	5.4	6.3	1.0	0.3	0.2	TR	--	--	8	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P 6R3A	TOTAL S 6C2B	DITH-CIT EXTRACTABLE FE 6G7A	AL 6D2A	MN	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4G1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832167	1	4.33	0.464						3.91	2.89				0.91	1.02	0.039			47.1	20.2	0.24
832168	2	1.65	0.170						5.88	5.52				0.78	0.83	0.021			50.4	18.2	0.25
832169	3	1.65	0.156		1.5	0.4			5.35	5.09				0.82	0.87	0.020			52.4	17.3	0.29
832170	4	0.58			1.8	0.2			0.92	1.18				0.88	0.94	0.022			52.4	15.3	0.32
832171	5	0.24			1.9	0.2			0.34	0.59				1.40	1.51	0.025			26.8	16.0	0.15
832172	6	0.15			2.7	0.3			0.25	0.51				1.21	1.49	0.072			38.8	26.6	0.15
832173	7	0.19			3.7	0.4			0.24	0.52				1.13	1.44	0.084			44.2	34.2	0.11

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 012 S 83FN-325 -012 DATE 09/25/84 PEDON NO. 83P 467 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
832167	1	18.2	3.9	0.1	0.9	23.1	16.3	--	39.4	27.4			59	84				10.2	6.1	6.5
832168	2	8.9	0.9	0.1	1.1	11.0	18.9	--	29.9	19.4			37	57				10.6	5.8	6.6
832169	3	7.7	0.4	0.2	0.9	9.2	22.0	--	31.2	18.2			29	51				10.6	6.1	6.4
832170	4	5.8	0.6	0.2	1.6	8.2	9.8	--	18.0	11.9			46	69				9.8	5.8	6.7
832171	5	4.6	1.1	0.3	0.5	6.5	5.9	--	12.4	9.2			52	71				9.5	6.3	6.8
832172	6	5.8	1.7	0.4	0.7	8.6	7.3	--	15.9	12.9			54	67				9.5	6.2	6.6
832173	7	6.3	2.2	0.4	1.0	9.9	8.1	--	18.0	15.9			55	62				9.4	6.0	6.5

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	(- -DIVIDED BY- -) FE+AL DI-CI	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -) (- - - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -)(- -<2U - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->			FE+AL	CLAY	CLAY		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832167	1															
832168	2								MI 1	NX 6						
832169	3		0.1	0.3	0.2	0.1		914								
832170	4		0.1	0.2	0.2	TR		218	KH 1	FD 1	NX 6		KH16			
832171	5		--	TR												
832172	6		--	TR					KH 3	MI 1	CL 1	FD 1	KH59			
832173	7		--	TR												

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 6 PCT .1-75MM 28. SPODIC HORIZON: INDEX OF ACCUMUL 0
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL MI MICA NX AMORPHOUS KH HALLOYSITE FD FELDSPAR CL CHLORITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832167	1		27.2	70	0.8	0.4	0.6	0.6	
832168	2		31.6	85	0.9	0.6	0.7	1.2	
832169	3		25.0	85	1.5	1.1	0.9	1.5	
832170	4		21.5	43	0.3	0.2	0.5	0.3	
832171	5		20.4	46	0.1	0.1	0.6	0.1	
832172	6		35.6	53	0.1	0.1	0.5	0.2	
832173	7		43.8	55	0.1	0.1	0.4	0.2	

* NEW ZEALAND PROCEDURE

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY)											(X-RAY)					(DTA)		(TOT ANAL)	
			(OPTICAL)										(CLAY)								
			(SAND/SILT)																		
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
83P2167	1																				
83P2168	2	VFS		OT62	GA25	GC 7	GS 6						MI 1	NX 6						0.3	2.6
83P2169	3																				
83P2170	4												KH 1	FD 1	NX 6			KH16		0.5	3.9
83P2171	5																				
83P2172	6												KH 3	MI 1	CL 1	FD 1	NX 6	KH59		0.3	4.4
83P2173	7																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS MI = MICA OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

FD = FELDSPAR KH = HALLOYSITE CL = CHLORITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 13 115 Date: 8/82
Pedon No: S83FN-325-013
Taxonomy: Fine, mixed, isohyperthermic Pachic Paleustoll
Latitude: Longitude:
Location: This pedon is located 20 km west of Quevedo about 6 km from El Empalme.
Physiography: Fan Terrace
Geomorphic Position: Summit
Slope and Aspect: 1% planar-planar Elevation: 100 m M.S.L
Microrelief: summit
Air Temp. Summer: 23C Winter: 25C (Est from nearby stations.)
Precipitation: 2000 mm Ustic moisture regime.
Water Table: > 10 m
Drainage: Moderately well drained Permeability: Moderately slow
Stoniness: nonstony
Land Use: Forest, ungrazed
Erosion or Deposition: none
Parent Material: multiple recent ash deposits over a very old ash deposit with a strongly developed argillic horizon.
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 28, 1983. Field Moisture, 0-165 cm moist. About 1% broken brick and stone artifacts from 0 to 77 cm.
Vegetation: native tropical forest of guaua, cocoa, coffee, and other broad leaf trees.

A1 0 - 30 cm Black (10YR 2/1, moist) loam; moderate medium and coarse subangular blocky structure; very friable, non-sticky and non-plastic; weakly smeary, very moist or wet; common medium and coarse roots; very fine, common fine, and medium tubular pores; gradual wavy boundary.

Bw 30 - 55 cm Dark brown (7.5YR 3/2, moist) and very dark brown (10YR 2/2, moist) silt loam: moderate fine and medium subangular blocky structure; very friable. slightly sticky and slightly plastic; weakly smeary, very moist or wet; few medium and coarse roots; many very fine, fine, and medium, and few coarse tubular pores; diffuse wavy boundary.

2Btb1 55 - 77 cm Very dark brown (10YR 2/2, moist) silty clay: loam, strong medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine tubular pores; few thin patchy stress oriented coats on peds; few thin clay films on peds and in pores; diffuse wavy boundary.

2Btb2 77 - 107 cm Dark brown (7.5YR 3/4, moist) clay; moderate coarse prismatic structure parting to moderate coarse angular blocky; firm, sticky and plastic few fine and medium roots; common very fine and fine, and few medium tubular pores; many thin continuous stress oriented coats on peds; many thin clay films on peds; gradual wavy boundary.

2Btb3 107 - 165 cm Variegated dark yellowish brown (10YR 4/4, moist), red (2.5YR 4/8, moist) and light olive gray (5Y 6/2, moist) clay: moderate coarse and very coarse prismatic structure parting to moderate medium and coarse angular blocky; firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; many thin continuous stress oriented coats on peds; many thin clay films on peds.

ECUADOR 013

LAB CLASSIF: FINE, MIXED, ISOHYPERTHERMIC PACHIC PALEUSTOLL

S 83FN-325 -013 DATE 09/25/84 SAMPLE NO. 83P2181-2185

ECUADOR-SMSS PEDON NO. 83P 469

PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	.1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832181	1S	0- 30	A1	10.0	59.5	30.5			37.1	22.4	20.8	8.5	0.6	0.6	--	TR	--	3V	12	3
832182	2S	30- 55	BW	13.1	56.2	30.7			36.0	20.2	19.1	10.9	0.5	0.2	--	--	--	2V	13	2
832183	3S	55- 77	2BTB1	36.5	43.5	20.0			28.4	15.1	11.5	7.6	0.5	0.3	0.1	TR	--	2V	10	2
832184	4S	77-107	2BTB2	70.0	19.7	10.3			13.0	6.7	4.2	3.7	1.4	0.7	0.3	TR	--	--	6	--
832185	5S	107-165	2BTB3	84.8	11.8	3.4			6.8	5.0	2.0	1.2	0.2	--	--	TR	--	--	1	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR TOTAL P	S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832181	1	3.36	0.344			2.0	0.4		3.01	2.06				0.82	0.94	0.046			50.5	20.6	0.24
832182	2	1.20	0.113			2.2	0.3		1.33	1.38				1.21	1.27	0.016			33.0	18.1	0.18
832183	3	0.33				2.9	0.3		0.30	0.59				1.35	1.46	0.026			28.0	21.7	0.08
832184	4	0.30				5.2	0.5		0.21	0.51				1.14	1.42	0.076			46.0	35.6	0.12
832185	5	0.27				5.1	0.5		0.17	0.49				1.04	1.37	0.096			52.9	41.2	0.12

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FILED TEXTURE.

ECUADOR 013 S 83FN-325 -013 DATE 09/25/84 PEDON NO. 83P 469 NATIONAL SOIL SURVEY LABORATORY

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6Q2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F	H2O 8C1F
		<- - - - - - - - - - -MEQ /					100 G - - - - - - - - - - ->					<- - - - -PCT - - - ->							1:2	1:1
832181	1	19.3	2.1	0.2	1.6	23.2	18.8	--	42.0	30.1			55	77				9.5	5.9	6.3
832182	2	10.4	1.2	0.3	0.7	12.6	14.3	--	26.9	17.4			47	72				9.9	6.2	6.6
832183	3	6.3	1.6	0.2	0.5	8.6	7.7	--	16.3	10.9			53	79				9.4	6.2	6.7
832184	4	6.4	2.4	0.4	0.3	9.5	10.2	--	19.7	14.4			48	66				9.3	5.6	6.1
832185	5	7.6	2.6	0.4	0.4	11.0	7.3	--	18.3	14.8			60	74				9.6	6.3	6.7

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C BY- -) PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -) (- - - - - X-RAY - - - -)				(- -DTA - -)	(- -<2U - -)	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED				(- - - - - <2U - - - -)							
									7A2I	7A2I	7A2I	7A2I	7A3	7A3		
									<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832181	1		0.2	0.2	0.2	TR		1110								
832182	2		--	0.1	TR	--			KH 1	FD 1	NX 6		KH17			
832183	3		0.1	0.1	0.1	--			KH 2	FD 1	CR 1	NX 6	KH44			
832184	4		--	TR					KH 3	CR 2	NX 6		KH67			
832185	5		--	TR												

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 37 PCT .1-75MM 10. SPODIC HORIZON: INDEX OF ACCUMUL 0

ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES

MINERALOGY: KIND OF MINERAL KH HALLOYSITE FD FELDSPAR NX AMORPHOUS CR CRISTOBALITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - -	-PCT OF <2MM- - - - - - - - - - >					
832181	1		28.4	74	0.6	0.5	1.1	0.5	
832182	2		23.6	64	0.4	0.4	0.8	0.4	
832183	3		34.1	50	0.1	0.1	0.5	0.1	
832184	4		44.4	69	0.2	0.1	0.2	0.2	
832185	5		53.0	60	0.2	0.1	0.1	0.2	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY RELATIVE AMOUNTS 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			PCT															PCT			
83P2181	1																				
83P2182	2	VFS		OT65	GA26	GC 5	GS 4						KH 1	FD 1	NX 6			KH17		0.2	4.2
83P2183	3												KH 2	FD 1	CR 1	NX 6		KH44		0.3	4.9
83P2184	4												KH 3	CR 2	NX 6			KH67		0.2	5.0
83P2185	5																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: FD = FELDSPAR GA = GLASS AGGREGATES GS = GLASS OT = OTHER KH = HALLOYSITE NX = NON-CRYSTALLINE

GC = GLASS COATED GRAIN CR = CRISTOBALITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Appendix I

Extra Data and Descriptions

This appendix contains analytical data and pedon descriptions for pedons that were sampled but not used on the tours because of constrains of time.

Series: Ecuador No. 2 Date: 6/83
Pedon No: S83EN-325-002
Taxonomy: Ashy, isomesic Mollic Vitrandept
Latitude: 2°07'20" Longitude: 78°43'50"
Location: About 5-6 km south of Palmira.
Physiography: In uplands in eolian dunes
Geomorphic Position: On a slope
Slope and Aspect: 13% W planar-convex Elevation: 3200 m M.S.L
Microrelief: undulating
Air Temp. Summer: Winter:
Precipitation: 500 mm Ustic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: Moderately rapid
Stoniness: nonstony
Land Use: Grassland or grazing land
Erosion or Deposition: severe wind erosion
Parent Material: ash over unrelated tuff breccia
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 29, 1983. Field Moisture, 0-126 moist.
Vegetation: clumps of stipa sp. separated by bare soil.

A1 0 - 53 cm Dark yellowish brown (10YR 4/4, rubbed dry), loamy fine sand; black (10YR 2/1, moist); structureless; very friable, non-sticky and non-plastic; few very fine and fine roots; few very fine tubular and many very fine interstital pores; diffuse smooth boundary.

A2 53 - 90 cm Very dark brown (10YR 2/2, moist); loamy fine sand, structureless; very friable, non-sticky and non-plastic; few very fine roots; few very fine tubular and many very fine interstital pores; gradual smooth boundary.

A3 90 - 110 cm Very dark gray (10YR 3/1, moist); loamy fine sand, structureless; friable, non-sticky and non-plastic; very weakly cemented; few very fine roots; few very fine tubular and many very fine interstitial pores; 1% 2-5 mm rock fragments; clear wavy boundary.

2C 110 - 120 cm White (10YR 8/1, moist); gravelly loamy fine sand, structureless; firm, non-sticky and non-plastic; weakly to moderately cemented; few very fine tubular and few very fine interstitial pores; coarse fragments, 30% 2-30 mm; common fine white (N8/0, moist) filaments; abrupt wavy boundary.

3R 120 - 126 cm unweathered bedrock, tuff breccia. There is a thin (0-3 cm) discontinuous dark gray (10YR 4/1, moist) layer just above the hard rock.

ECUADOR 002

LAB CLASSIF: ASHY, ISOMESIC MOLLIC VITRANDEPT

S 83FN-325 -002 DATE 09/25/84

SAMPLE NO. 83P2191-2195
PEDON NO. 83P 471
PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .05 -.05	-3-- TOTAL SAND -2	-4-- TOTAL FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7-- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS(MM) 2 -5	-14- COARSE FRACTIONS(MM) 5 -20	-15- COARSE FRACTIONS(MM) 20 -75	-16- COARSE FRACTIONS(MM) .1- 75	-17- >2MM WT PCT O WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832191	1S	0- 53	A1	0.9	30.1	69.0			8.3	21.8	44.7	22.6	1.6	0.1	--	--	--	--	24	--
832192	2S	53- 90	A2	1.0	27.7	71.3			5.9	21.8	51.3	17.7	1.9	0.4	--	TR	--	--	20	--
832193	3S	90-110	A3	0.9	29.4	69.7			8.6	20.8	44.7	19.2	3.1	1.5	1.2	1	TR	2V	27	3
832194	4S	110-120	2C	1.2	31.4	67.4			9.7	21.7	42.1	16.7	3.0	2.9	2.7	3	5	43V	63	51
832195	5S	120-126	3R													--	--	--		--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 5C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832191	1	0.60	0.050			0.5	0.1		6.33	4.56				1.40	1.40	--			18.8	4.1	0.21
832192	2	0.37	0.026			0.6	0.1		6.70	4.70				1.46	1.47	0.002			16.9	4.7	0.18
832193	3	0.26				0.6	0.1		9.22	5.89				1.41	1.43	0.005			23.8	5.3	0.26
832194	4	0.27				0.6	0.1		7.75	4.75				1.40	1.43	0.005			24.3	5.7	0.17
832195	5																				

* PSDA IN ANDEPTS SHOULD NOT BE USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 002 S 83FN-325 -002 DATE 09/25/84 PEDON NO. 83P 471 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 602D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTRAL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - -				-MEQ /	100 G	- - -	- - - - - - - - -		->	<- - - -	-PCT	- - -	->					
832191	1	4.6	1.9	0.2	0.3	7.0	1.0	--	8.0	5.7			87	100	--			9.8	7.0	7.4
832192	2	4.9	2.5	0.3	0.8	8.5	--	--	8.5	6.7			100	100	--			9.8	7.4	7.8
832193	3	6.1	3.3	0.4	1.0	10.8	--	--	10.8	8.3			100	100	--			10.0	7.6	8.2
832194	4	23.4	3.8	0.4	1.2	28.8	--	TR	28.8	9.3			100	100	1			10.3	8.5	8.7
832195	5																			

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A21	7A21	7A21	7A21	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- - - -	-PCT	- - -	->
832191	1								
832192	2								
832193	3	NX 6							
832194	4	NX 6							
832195	5	NX 6							

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 1 PCT .1-75MM 23
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL NX AMORPHOUS

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832191	1		4.2	34	0.3	0.2	0.3	0.1	
832192	2		5.1	17	0.2	0.1	0.7	<0.1	
832193	3		5.9	22	0.2	0.2	0.7	<0.1	
832194	4		6.6	14	0.2	0.2	0.8	<0.1	
832195	5								

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
			MINERALOGY																		
			OPTICAL										X-RAY					DTA		TOT ANAL	
			SAND/SILT										CLAY								
			<-----PCT----->										<----RELATIVE AMOUNTS------>					<-------PCT---------->			
83P2191	1																				
83P2192	2	VFS		GA68	OT17	GC14	GS 1						NX 6							0.5	1.2
83P2193	3	VFS		GA64	GC18	OT17	GS 1						NX 6							0.5	0.5
83P2194	4	VFS		GA63	OT18	GC17	GS 2						NX 6							0.4	0.7
83P2195	5																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 3 127 Date: 6/83
Pedon No: S83FN-325-003
Taxonomy: Coarse-loamy, mixed, isomesic Typic Humitropept
Latitude: 1°25'00" Longitude: 78°37'15"
Location: About 7 km south of Mocha. Urbina-Paramo area
Physiography: in uplands
Geomorphic Position: On a slope
Slope and Aspect: 10% W convex-convex Elevation: 3400 m M.S.L
Microrelief: hummucky
Air Temp. Summer: Winter:
Precipitation: 1000 mm Udic moisture regime.
Water Table: 5 to 10 meters
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: Grassland or grazing land
Erosion or Deposition: none
Parent Material: ash
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 29, 1983. Field Moisture, 0 to 175 cm wet. Worm casts occupy 30-40% of the soil mass; 15-20 mm holes made by insects and grubs occupy 1% of the pedon.
Vegetation: cushion plant.

O 10 - 0 cm - decomposed material; weak medium to coarse subangular blocky structure; loose; clear smooth boundary. This layer varies in thickness from 5 to 35 cm within a horizontal distance of 10 to 100 cm.

A1 0 - 15 cm Very dark brown (10YR 2/2) loam; weak medium and coarse subangular block structure; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; common very fine, fine, and medium roots; common very fine and fine tubular pores; gradual smooth boundary.

A2 15 - 54 cm Black (10YR 2/1) loam; common fine faint dark brown (10YR 3/3) mottles; weak very coarse subangular blocky structure parting to weak medium subangular blocky; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; common very fine, fine, and medium roots; common very fine and fine tubular pores; gradual smooth boundary.

A3 54 - 98 cm Black (10YR 2/1) sandy loam; common fine faint very dark grayish brown (10YR 3/2) mottles; weak coarse prismatic structure parting to weak coarse angular blocky; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine, fine, and medium roots; common very fine and fine tubular and common very fine interstitial pores; diffuse smooth boundary.

A4 98 - 137 cm Black (10YR 2/1) sandy loam; common fine faint very dark gray (10YR 3/1) mottles; weak coarse prismatic structure parting to weak coarse angular blocky; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine, fine, and medium roots; common very fine and fine tubular and common very fine interstitial pores; gradual smooth boundary.

2Ab 137 - 175 cm Black (N 2/0) loam; massive; friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; many thin continuous organic coats in pores; few very fine, fine, and medium roots; common very fine, fine, and medium tubular and few very fine interstitial pores.

ECUADOR 003

LAB CLASSIF: COARSE-LOAMY, MIXED, ISOMESIC TYPIC HUMITROPEPT

S 83FN-325 -003

DATE 09/25/84

SAMPLE NO. 83P2200-2204
PEDON NO. 83P 473
PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	.1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832200	1S	0- 15	A1	1.3	36.5	62.2			15.1	21.4	22.7	24.6	8.1	3.0	3.8	TR	TR	--	39	TR
832201	2S	15- 54	A2	1.5	37.7	60.8			15.6	22.1	26.8	25.3	6.0	2.1	0.6	TR	--	--	34	--
832202	3S	54- 98	A3	1.3	33.3	65.4			17.1	16.2	24.1	28.1	9.3	3.1	0.8	TR	TR	--	41	TR
832203	4S	98-137	A4	0.8	30.0	69.2			16.2	13.8	21.5	26.8	14.7	5.5	0.7	TR	TR	--	48	TR
832204	5S	137-175	2AB	1.8	47.9	50.3			27.0	20.9	26.8	1[illegible].3	5.8	1.4	--	TR	--	--	23	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P 6R3A	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832200	1	7.83	0.478			0.5	0.3		13.23	15.69				0.79	0.98	0.074			66.9	20.4	0.37
832201	2	2.99	0.219			0.8	0.3		5.93	5.87				1.13	1.22	0.026			38.2	8.8	0.33
832202	3	1.64				0.6	0.2		4.62	4.08				1.25	1.31	0.016			27.8	5.3	0.28
832203	4	1.23				0.5	0.2		7.00	5.88				1.27	1.32	0.013			25.2	4.7	0.26
832204	5	3.54				1.1	0.3		9.78	6.72				1.03	1.13	0.031			44.8	12.1	0.34

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 003 S 83FN-325 -003 DATE 09/25/84 PEDON NO. 83P 473 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6Q2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F	H2O 8C1F
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->							1:2	1:1
832200	1	4.2	2.3	0.3	0.2	7.0	23.4	0.7	30.4	17.2	7.7	9	23	41				9.8	4.8	5.4
832201	2	2.1	1.6	0.3	0.1	4.1	12.8	0.3	16.9	8.9	4.4	7	24	46				10.2	5.3	6.0
832202	3	1.6	1.6	0.2	TR	3.4	9.3	0.2	12.7	6.0	3.6	6	27	57				10.3	5.6	6.1
832203	4	1.6	1.7	0.2	TR	3.5	7.2	0.1	10.7	5.6	3.6	3	33	62				10.1	5.7	6.2
832204	5	6.9	5.5	0.3	0.2	12.9	16.0	--	28.9	17.6			45	73				9.8	5.8	6.3

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	(- -DIVIDED BY- -) FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - -MINERALOGY - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->							<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832200	1		0.4	0.3	0.9	0.5		446								
832201	2		0.3	0.2	0.5	0.3		630	NX 6							
832202	3		0.2	0.2	0.5	0.3		530	NX 6							
832203	4		0.1	0.1	0.3	0.3		402								
832204	5		0.3	0.3	0.4	0.3		1064	VR 1	NX 6						

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 1 PCT .1-75MM 39. SPODIC HORIZON: INDEX OF ACCUMUL 1234
ANALYSES: S= ALL ON SIEVED <2MM BASIS
MINERALOGY: KIND OF MINERAL NX AMORPHOUS VR VERMICULITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

ECUADOR 003 S83FN-325-003

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - -	-PCT OF <2MM- - - - - - - - - - >					
832200	1		32.7	52	0.3	0.1	0.5	0.4	
832201	2		13.8	52	0.5	0.3	0.6	0.4	
832202	3		9.6	41	0.4	0.3	0.5	0.4	
832203	4		8.5	32	0.4	0.3	0.4	0.4	
832204	5		21.4	56	0.7	0.5	0.7	0.5	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
			<-PCT->										<-RELATIVE AMOUNTS->					<-PCT->			
		(MINERALOGY)																		(TOT ANAL)	
				(OPTICAL)									(X-RAY)					(DTA)			
				(SAND/SILT)									(CLAY)								
83P2200	1																				
83P2201	2	VFS		GA59	GC19	OT14	GS 8						NX 6							0.4	2.5
83P2202	3												NX 6							0.2	1.7
83P2203	4																				
83P2204	5												VR 1	NX 6						0.2	1.7

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

VR = VERMICULITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 7 Date: 6/83
Pedon No: S83FN-325-007
Taxonomy: Ashy over loamy, mixed, isothermic Typic Ustifluvent
Latitude: 0°05'25" Longitude: 78°25'00"
Location: about 15 km NE of Quito, in the Calderon area
Physiography: Terrace
Geomorphic Position: On a slope
Slope and Aspect: 1% planar-planar Elevation: 2620 m M.S.L
Microrelief: smooth
Air Temp. Summer: Winter:
Precipitation: 600mm Ustic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: Idle land, adjacent land is cropped to corn
Erosion or Deposition: none
Parent Material: multiple ash deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date Described: January 24, 1983. Field Moisture, 0-10 cm dry, 10-67 cm slightly moist, 67-205 moist. All rock fragments are pumice. From 0 to 35 cm appears to be distrubed by artificial digging or scraping, therefore did not seperate a thin surface horizon.
Vegetation: Planted eucalyptus grove, chilca, herbs and kikuyu grass.

A 0 - 35 cm Very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2, dry); massive; very friable, non-sticky and non-plastic; few very fine and common medium and coarse roots; many very fine interstitial and few very fine tubular pores; 10% 2 to 70 mm fragments; gradual wavy boundary. Included are fragments of charcoal, brick, rags and other artifact pieces.

AC 35 - 67 cm Dark grayish brown (2.5Y 4/2) loamy sand, light grayish brown (10YR 6/2, dry) and grayish brown (10YR 5/2, dry); common fine distinct dark grayish brown (10YR 6/2, moist) mottles; massive; very friable, non-sticky and non-plastic; few very fine and common medium and coarse roots; many very fine interstitial and few very fine tubular pores; 10% 2 to 70 mm fragments; clear wavy boundary. Included are fragments of charcoal, brick, rags, and other artifact pieces.

2C1 67 - 90 cm Grayish brown (2.5Y 5/2) loamy coarse sand, light gray (5Y 7/1, dry); structureless; very friable, non-sticky and non-plastic; few very fine, fine, and medium roots; many very fine interstitial, common very fine and fine tubular pores, 15% fragments; abrupt wavy boundary. At bottom of this horizon there is a layer 5 to 20 mm thick with 40% pumice fragments 2 to 30 mm in size.

3C2 90 - 107 cm Black (10YR 2/1) and very dark grayish brown (10YR3/2) fine sandy loam; structureless; very friable, non-sticky and non-plastic; few, medium and coarse roots; many very fine interstitial and a few very fine tubular pores; clear wavy boundary.

3Ab 107 - 143 cm Very dark grayish brown (10YR 3/2) and black (10YR 2/1) loam; structureless; friable, slightly sticky and slightly plastic; a few thin patchy organic coats on peds few fine, medium and coarse roots; many very fine interstitial and common very fine and fine tubular pores; gradual wavy boundary.

3ACb 143 - 185 cm Very dark grayish brown (10YR 3/2) and black (10YR 2/1) loamy sand; structureless; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; few very fine and fine roots; many very fine interstitial, few very fine tubular pores; abrupt smooth boundary.

4C3 185 - 205 cm Dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) loamy sand; structureless; firm, non-sticky and non-plastic; weakly cemented; few very fine and fine roots; common very fine interstitial pores. A black and very dark grayish brown (10YR 2/1, 3/2) layer 5 to 10 mm thick occures at top of horizon.

ECUADOR 007

LAB CLASSIF: ASHY OVER LOAMY, MIXED, ISOTHERMIC TYPIC USTIFLUVENT

S 83FN-325 -007 DATE 09/25/84 SAMPLE NO. 83P2077-2083
PEDON NO. 83P 455
PROJECT NO. 83P 83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	>75MM .1-75	WT PCT OF WHOLE SOIL
	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832077	1S	0- 35	A	2.4	25.2	72.4			13.4	11.8	11.9	20.3	24.1	12.8	3.3	2	1	19V	69	22
832078	2S	35- 67	AC	2.4	24.7	72.9			13.7	11.0	10.5	19.5	23.9	14.3	4.7	3	1	19V	71	23
832079	3S	67- 90	2C1	2.7	25.8	71.5			18.9	6.9	5.4	20.2	23.5	15.6	6.8	3	1	29V	77	33
832080	4S	90-107	3C2	7.6	36.7	55.7			20.4	16.3	16.1	21.1	12.0	4.9	1.6	1	TR	--	40	1
832081	5S	107-143	3AB	11.3	35.7	53.0			20.2	15.5	15.3	21.5	12.6	2.9	0.7	TR	TR	--	38	TR
832082	6S	143-185	3ACB	5.0	25.9	69.1			13.6	12.3	12.7	24.3	22.0	7.9	2.2	1	--	--	57	1
832083	7S	185-205	4C	3.1	23.5	73.4			9.8	13.7	16.2	21.3	15.4	12.3	8.2	5	TR	--	59	5

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	COLE OVEN DRY 4A1H	WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832077	1	0.61	0.044			0.3	TR		2.00	1.67				1.24	1.25	0.002			19.5	4.0	0.17
832078	2	0.49	0.044			0.3	TR		1.83	1.46				1.23	1.26	0.007			18.4	3.5	0.16
832079	3	0.15	0.004			0.2	TR		1.19	1.00				1.14	1.27	0.030			28.5	2.7	0.24
832080	4	0.45				0.5	TR		0.97	0.82				1.28	1.38	0.025			27.5	6.2	0.27
832081	5	0.66				0.5	0.1		0.88	0.68				1.38	1.43	0.012			19.3	7.7	0.16
832082	6	0.20				0.4	TR		1.00	0.94				1.57	1.66	0.019			17.4	4.7	0.20
832083	7	0.20				0.4	TR		1.87	2.10				1.42	1.51	0.020			20.1	6.5	0.19

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 007 S 83FN-325 -007 DATE 09/25/84 PEDON NO. 83P 455 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	BASE SUM 5C3	SAT-NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH NAF 8C1D	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- NH4OAC EXTRACTABLE BASES ->				-MEQ / 100 G						<- PCT ->								
832077	1	7.6	0.3	0.1	0.3	8.3	1.6	TR	9.9	4.8			84	100	--			9.6	7.6	7.7
832078	2	3.9	0.6	TR	0.3	4.8	2.2	--	7.0	4.4			69	100	--			9.4	7.0	7.3
832079	3	2.4	0.7	0.1	0.2	3.4	1.2	--	4.6	3.2			74	100	--			8.4	6.8	7.8
832080	4	5.8	1.3	0.2	0.2	7.5	1.7	--	9.2	7.4			82	100	--			8.8	6.9	7.6
832081	5	7.8	1.7	0.9	0.2	10.6	2.0	TR	12.6	9.9			84	100	--			9.1	7.3	8.1
832082	6	3.4	0.9	0.8	0.2	5.3	0.5	--	5.8	5.0			91	100	--			8.6	7.4	8.5
832083	7	3.8	1.2	0.8	0.2	6.0	1.3	--	7.3	5.8			82	100	--			8.1	7.8	8.4

SAMPLE NO.	HZN NO.	SPODIC HORIZON CRITERIA: NA PYROPHOSPHATE EXTRACTABLE C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	MINERALOGY: CLAY X-RAY <2U 7A2I	CLAY X-RAY <2U 7A2I	CLAY X-RAY <2U 7A2I	CLAY X-RAY <2U 7A2I	DTA 7A3	DTA 7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			DIVIDED BY				<- RELATIVE AMOUNTS ->				<- PCT ->			
832077	1		--	TR												
832078	2		0.1	TR	0.3	TR										
832079	3		--	TR					FD 1	NX 6						
832080	4		--	TR												
832081	5		--	TR					FD 1	NX 6						
832082	6		0.1	0.1	0.5	TR		139								
832083	7		--	TR					NX 6							

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 3 PCT .1-75MM 69. SPODIC HORIZON: INDEX OF ACCUMUL 0

ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES

MINERALOGY: KIND OF MINERAL FD FELDSPAR NX AMORPHOUS

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832077	1		3.3	25	0.2	0.1	0.2	<0.1	
832078	2		4.0	7	0.2	0.1	0.2	<0.1	
832079	3		1.7	17	0.1	<0.1	0.1	<0.1	
832080	4		6.8	10	0.1	<0.1	0.1	<0.1	
832081	5		9.3	30	0.2	0.1	0.1	<0.1	
832082	6		4.8	17	0.1	<0.1	0.1	<0.1	
832083	7		4.6	3	0.1	0.1	0.2	<0.1	

* NEW ZEALAND PROCEDURE

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY																		(TOT ANAL)	
		(OPTICAL											(X-RAY					(DTA			
		(SAND/SILT											(CLAY								
			<PCT										<RELATIVE AMOUNTS					<PCT			
83P2077	1																				
83P2078	2																				
83P2079	3												FD 1	NX 6						0.5	1.4
83P2080	4	VFS		GA45	OT33	GS14	GC 8						FD 1	NX 6						0.6	2.8
83P2081	5																				
83P2082	6																				
83P2083	7												NX 6							0.3	1.7

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: FD = FELDSPAR NX = NON-CRYSTALLINE GA = GLASS AGGREGATES GS = GLASS OT = OTHER

GC = GLASS COATED GRAIN

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 8 137 Date: 6/83
Pedon No: S83EN-325-008
Taxonomy: Coarse-loamy over cindery, mixed, isomesic Andic Humitropept
Latitude: 0°32'10" Longitude: 78°38'40"
Location: This pedon is located on the NE side of Corazon Volcano about 10 km W of Machachi.
Physiography: Mountains
Geomorphic Position: Hillslope
Slope and Aspect: 45% NE planar-convex Elevation: 3840 m M.S.L
Microrelief: smooth
Air Temp. Summer: Winter:
Precipitation: 1200 mm (there is not data) Udic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: moderate
Stoniness: nonstony
Land Use: Grassland or grazing land
Erosion or Deposition: none
Parent Material: multiple ash and pumice deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date described: January 31, 1983. Field Moisture, 0-184 cm wet. All rock fragments are pumice.
Vegetation: stypa ichu (paramo pasture)

A1 0 - 26 cm Black (10YR 2/1) loam; weak medium and coarse subangular blocky structure; very friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; many very fine and fine, few medium roots; many very fine and fine few medium tubular pores; 1% 2 to 5 mm fragments; diffuse wavy boundary. Worm casts make up about 35% of the horizon.

A2 26 - 63 cm Black (10YR 2/1) loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; moderately smeary, very moist or wet; common very fine and fine roots; many very fine and fine tubular, pores; 1% 2 to 5 mm fragments; diffuse wavy boundary. Worm casts make up about 35% of the horizon.

A3 63 - 92 cm Black (N 2/0) gravelly loam; weak medium and coarse subangular blocky structure parting to weak coarse and very coarse granular; very friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet, common very fine and fine roots; many very fine and fine tubular, pores; coarse fragments, 20% 2 to 40 mm; abrupt wavy boundary. Worm casts make up about 35% of the horizon. Pumcie fragments and roots increase in amount in the lower part of the horizon.

2C 92 - 134 cm Yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) very gravelly coarse sand; single grain; loose, non-sticky and non-plastic; few very fine and fine roots; many very fine, fine and medium interstital pores; coarse fragments, 45% 2 to 50 mm; abrupt wavy boundary. Dominate colors of pumice fragments, many other colors present.

3Ab 134 - 184 cm Black (10YR 2/1) loam; many fine and medium dark brown (7.5YR 3/2) mottles; weak coarse and very coarse angular blocky structure; very friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few thin patchy clay skins or organic coatings on peds and common thin clay skins or organic coats in pores many very fine and fine common medium tubular pores. Worm casts make up about 35% of the horizon.

ECUADOR 008

LAB CLASSIF: COARSE-LOAMY OVER CINDERY, MIXED, ISOMESIC ANDIC HUMITROPEPT

S 83FN-325 -008 DATE 09/25/84 SAMPLE NO. 83P2210-2214
PEDON NO. 83P 475
PROJECT NO. 83P 83

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .002 -.05	-3-- TOTAL SAND .05 -2	-4-- CLAY FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7-- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS(MM) WEIGHT 2 -5	-14- COARSE FRACTIONS(MM) WEIGHT 5 -20	-15- COARSE FRACTIONS(MM) WEIGHT 20 -75	-16- COARSE FRACTIONS(MM) WEIGHT .1- 75	-17- >2MM WT PCT O WHOLE SOIL
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832210	1S	0- 26	A1	2.3	31.7	66.0			18.0	13.7	14.5	21.6	18.6	8.8	2.5	TR	TR	3V	53	3
832211	2S	26- 63	A2	1.7	35.5	62.8			20.8	14.7	13.5	19.0	15.9	10.4	4.0	2	TR	3V	52	5
832212	3S	63- 92	A3	1.1	28.6	70.3			16.5	12.1	14.4	15.6	16.7	15.2	8.4	5	8	40V	79	53
832213	4S	92-134	2C	0.2	4.4	95.4			2.7	1.7	1.4	12.1	37.8	28.2	15.9	9	14	54V	99	77
832214	5S	134-184	3AB	2.0	49.5	48.5			32.2	17.3	16.0	17.4	9.1	4.9	1.1	TR	--	--	32	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P 6R3A	TOTAL S	DITH-CIT EXTRACTABLE FE 6C2B	DITH-CIT EXTRACTABLE AL 6G7A	DITH-CIT EXTRACTABLE MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A3A	BULK DENSITY 1/3 BAR 4A1D	BULK DENSITY OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	WATER CONTENT 1/3 BAR 4B1C	WATER CONTENT 15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832210	1	7.15	0.425			0.8	0.6		8.30	8.87				0.88	1.03	0.053			49.2	20.4	0.25
832211	2	6.29	0.380			1.0	0.7		10.71	11.41				0.97	1.11	0.045			40.7	19.4	0.29
832212	3	5.58				0.9	0.7		16.55	15.55				0.84	0.93	0.025			53.7	17.1	0.23
832213	4	0.47				0.3	0.1		14.00	19.00										3.8	
832214	5	1.53				1.0	0.5		7.30	5.55				1.05	1.15	0.031			42.1	11.1	0.33

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CALSSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 008 S 83FN-325 -008 DATE 09/25/84 PEDON NO. 83P 475 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	CA 5B5A 6N2E	MG 5B5A 6Q2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH NAF 8C1D	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- -MEQ / 100 G ->										<- -PCT ->								
832210	1	2.4	0.8	0.2	0.4	3.8	31.5	1.5	35.3	19.1	5.3	28	11	20				10.9	4.7	5.6
832211	2	2.1	0.7	0.2	0.3	3.3	32.0	0.6	35.3	18.2	3.9	15	9	18				11.2	5.1	5.9
832212	3	3.0	0.8	0.2	0.2	4.2	30.8	0.4	35.0	18.2	4.6	9	12	23				11.2	5.0	6.0
832213	4	0.6	0.1	0.1	--	0.8	3.9	0.1	4.7	2.8	0.9	11	17	29				10.7	5.3	6.1
832214	5	3.0	0.8	0.2	0.1	4.1	21.5	0.3	25.6	14.6	4.4	7	16	28				11.0	5.2	6.1

SAMPLE NO.	HZN NO.	SPODIC HORIZON CRITERIA: NA PYROPHOSPHATE EXTRACTABLE C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	MINERALOGY: CLAY X-RAY <2U 7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED BY- -)				<- RELATIVE AMOUNTS ->				<- -PCT ->			
832210	1		0.4	0.6	0.7	0.4		888								
832211	2		0.4	0.6	0.6	0.6		1275	NX 6						1	GA42
832212	3		0.4	0.6	0.6	0.9		999	NX 6							
832213	4		0.1	0.1	0.5	1.0		193								
832214	5		0.2	0.4	0.4	0.3		1230	NX 6							

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 1 PCT .1-75MM 67. SPODIC HORIZON: INDEX OF ACCUMUL 2928
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL NX AMORPHOUS GA GLASS AGG

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832210	1		26.6	80	0.8	0.3	0.5	0.9	
832211	2		28.7	90	1.2	0.6	0.7	1.4	
832212	3		24.1	87	1.2	0.6	0.6	1.3	
832213	4		4.5	32	0.3	0.2	0.3	0.3	
832214	5		21.6	81	1.1	0.7	0.6	1.2	

* NEW ZEALAND PROCEDURE

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY)																			
		(OPTICAL)											(X-RAY)					(DTA)		(TOT ANAL)	
		(SAND/SILT)											(CLAY)								
		<PCT>											<RELATIVE AMOUNTS>					<PCT>			
83P2210	1																				
83P2211	2	VFS	1	GA42	GS20	FP19	FG 7	PR 4	AR 4	FE 1	OG 1	HG 1	NX 6							0.3	2.1
83P2212	3												NX 6							0.2	2.1
83P2213	4																				
83P2214	5												NX 6							0.2	1.9

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: FE = IRON OXIDES AR = WEATHERED AGGREGATES FP = PLAGIOCLASE FELDSPAR GA = GLASS AGGREGATES GS = GLASS

PR = PYROXENE NX = NON-CRYSTALLINE HG = GLASS COATED HORNBLENDE FG = GLASS COATED FELDSPAR

OG = GLASS COATED OPAQUE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 10 Date: 8/82
Pedon No: S83FN-325-010
Taxonomy: Sandy, mixed, isomesic Fluventic Hapludolls
Latitude: 0°33'00" Longitude: 78°37'00"
Location: This pedon is located about 2 km N of Aloasi or 5 km W of Machachi.
Physiography: Terrace
Geomorphic Position: Summit
Slope and Aspect: 3% E planar-planar Elevation: 3000 m M.S.L
Microrelief: Smooth
Air Temp. Summer: Winter:
Precipitation: 1100 mm Udic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: moderate
Stoniness: none
Land Use: pasture mostly kikuyo
Erosion or Deposition: none
Parent Material: mixed ash deposits
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date Described: January 25, 1983. Field Moisture, 0-180 cm slightly moist. The upper 117 cm seems to be mixed by many animals or uprooted trees. Fifty meters from pit in another pasture the surface horizon was very dark brown (10YR 2/2) to a depth of 25 cm. Field estimates of the weighted average particle size control section places it in the sandy family.
Vegetation: Pasture grasses and planted Ecucalyptus grove.

A 0 - 10 cm Very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) sandy loam; weak fine subangular blocky structure; very friable, non-sticky and non-plastic; common very fine and fine and few medium and coarse roots; many very fine and fine interstital few very fine tubular, pores; 2% 2 to 5 mm fragments clear wavy boundary.

C1 10 - 28 cm Dark grayish brown (10YR 4/2) and dark brown (10YR 3/3) sandy loam; massive; very friable, non-sticky and non-plastic; very weakly smeary, very moist or wet; few very fine, fine medium, and coarse roots; many very fine interstital, common very fine and fine tubular pores; 2% 2 to 5 mm fragments gradual wavy boundary.

C2 28 - 40 cm Dark grayish brown (10YR 4/2) sandy loam; massive; very friable, non-sticky and non-plastic; very weakly smeary, very moist or wet; few very fine, medium, fine,and coarse roots; many very fine interstital common very fine and fine tubular pores; 2% 2 to 5 mm fragments; clear irregular boundary.

C3 40 - 53 cm Very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) coarse sand; single grain; loose, non-sticky and non-plastic; few very fine, medium, fine and coarse roots, many very fine interstital, few very fine tubular pores; 2% 2 to 5 mm fragments; clear irregular boundary.

2Ab1 53 - 85 cm Black (10YR 2/1, rubbed) and very dark gray (10YR 3/1, rubbed); loamy sand; weak fine and medium subangular blocky structure; very friable, non-sticky and non-plastic; few very fine, fine, medium, and coarse roots; many very fine interstital, few very fine tubular pores; 7% 2 to 10 mm fragments; diffuse wavy boundary. 15 to 20% of horizon is very dark gray (10YR 3/1, moist) pockets 10 to 15 cm in size.

2Ab2 85 - 117 cm Black (10YR 2/1, rubbed) and very dark gray (10YR 3/1 rubbed) sandy loam; weak fine and medium subangular blocky structure; friable, non-sticky and non-plastic; few very fine, fine, medium, and coarse roots; many very fine interstital, few very fine tubular pores; coarse fragments, 10% 2 to 20 nmm; gradual wavy boundary. 15 to 20% of horizon is very dark gray (10YR 3/1, moist) pockets 10 to 15 cm in size.

2Ab3 117 - 180 cm Dark reddish brown (5YR 2/2) loam; weak fine and medium subangular blocky structure; very friable, slightly sticky and slightly plastic; weakly smeary, very moist or wet; few very fine, fine and coarse roots; few very fine interstital, common very fine and fine tubular pores.

ECUADOR 010

LAB CLASSIF: SANDY, MIXED, ISOMESIC FLUVENTIC HAPLUDOLL

S 83FN-325 -010 DATE 09/25/84 SAMPLE NO. 83P2220-2226

ECUADOR-SMSS PEDON NO. 83P 477

PROJECT NO. 83P 83

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	TOTAL CO3 LT .002	CLAY FINE .002 -.02	CLAY COARSE .02 -.05	SILT VF .05 -.10	SILT F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	COARSE FRACTIONS(MM) WEIGHT 5 -20	COARSE FRACTIONS(MM) WEIGHT 20 -75	COARSE FRACTIONS(MM) WEIGHT .1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																				
832220	1S	0- 10	A	2.7	25.5	71.8			14.1	11.5	15.2	22.6	16.6	11.9	5.5	4	[illegible]	4V	61	9
832221	2S	10- 28	C1	2.3	24.7	73.0			14.0	10.7	16.8	24.3	17.4	10.3	4.2	3	[illegible]	4V	60	8
832222	3S	28- 40	C2	2.5	27.1	70.4			17.1	10.1	15.1	21.7	17.2	11.3	5.1	4	1	4V	59	9
832223	4S	40- 53	C3	1.0	15.1	83.9			8.2	6.9	11.6	22.4	25.5	16.3	8.1	5	1	4V	75	10
832224	5S	53- 85	2AB1	1.3	20.5	78.2			10.7	9.8	15.9	22.5	18.7	14.9	6.2	6	3	14V	71	23
832225	6S	85-117	2AB2	2.1	27.0	70.9			14.5	12.5	17.5	18.3	13.5	13.4	8.2	7	4	20V	68	31
832226	7S	117-180	3AB3	3.5	42.5	54.0			26.5	16.0	16.0	19.0	10.0	6.1	2.9	3	1	7V	45	11

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	DITH-CIT EXTRACTABLE AL 6G7A	DITH-CIT EXTRACTABLE MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A3A	BULK DENSITY 1/3 BAR 4A1D	BULK DENSITY OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	WATER CONTENT 1/3 BAR 4B1C	WATER CONTENT 15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832220	1	2.87	0.225			0.3	0.1		4.22	3.26											
832221	2	0.85	0.072			0.3	0.1		2.13	1.91										8.8	
832222	3	0.47	0.044			0.3	0.1		1.68	1.52				1.18	1.18	--			28.7	4.4	0.28
832223	4	0.42				0.3	0.1		3.70	3.50										3.8	
832224	5	0.77				0.3	0.1		4.31	3.08				1.21	1.24	0.007			25.9	3.5	
832225	6	1.04				0.4	0.1		3.62	2.19				1.10	1.12	0.005			32.6	4.0	0.23
832226	7	0.93				0.4	0.1		2.43	1.49				1.11	1.14	0.009			28.8	4.6	0.26
																				5.2	0.25

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 010 S 83FN-325 -010 DATE 09/25/84 PEDON NO. 83P 477 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SUM 5C3	SAT-NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH NAF 8C1D	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- - - - - - - - - - - -				-MEQ / 100 G	- - - - - - - - - - - -					<- - - - -		-PCT - - - ->						
832220	1	8.0	1.8	0.1	0.5	10.4	6.0	TR	16.4	11.4			63	91				9.6	5.9	6.0
832221	2	2.8	0.8	0.1	0.3	4.0	2.4	TR	6.4	4.9			62	82				9.9	6.0	6.2
832222	3	2.4	0.9	0.1	0.3	3.7	1.7	0.1	5.4	4.2	3.8	3	69	88				9.7	6.1	6.6
832223	4	1.7	1.0	0.2	0.2	3.1	1.9	0.1	5.0	3.7	3.2	3	62	84				9.8	5.9	6.6
832224	5	3.3	1.3	0.2	0.3	5.1	2.0	TR	7.1	5.6			72	91				9.9	6.0	6.6
832225	6	5.4	1.0	0.2	0.2	6.8	3.9	0.1	10.7	7.6	6.9	1	64	89				10.0	6.1	6.6
832226	7	6.5	1.4	0.2	0.4	8.5	3.4	0.1	11.9	8.5	8.6	1	71	100				9.7	6.5	6.9

SAMPLE NO.	HZN NO.	NA PYROPHOSPHATE EXTRACTABLE C 6A4A	FE 6C8A	AL 6G10	FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	MINERALOGY CLAY X-RAY <2U 7A21	7A21	7A21	7A21	DTA 7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- PCT OF <2MM->			(- -DIVIDED BY- -)				<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832220	1		0.1	0.1	0.5	0.1		150								
832221	2		--	0.1	0.3	TR										
832222	3		--	0.1	0.3	TR			NX 6							
832223	4		--	0.1	0.3	0.1										
832224	5		--	0.1	0.3	0.1			NX 6							
832225	6		--	0.1	0.2	TR										
832226	7		--	0.1	0.2	TR			NX 6							

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 2 PCT .1-75MM 68. SPODIC HORIZON: INDEX OF ACCUMUL 0
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL NX AMORPHOUS

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8Clg
			<- - - - - - - - - -PCT OF <2MM- - - - - - - - - - >						
832220	1		7.5	20	0.2	0.1	0.2	0.1	
832221	2		3.8	14	0.2	0.1	0.2	0.1	
832222	3		3.8	14	0.1	0.1	0.2	0.1	
832223	4		3.3	14	0.1	0.2	0.2	0.1	
832224	5		4.5	17	0.3	0.2	0.2	0.2	
832225	6		5.9	20	0.3	0.3	0.2	0.2	
832226	7		7.0	17	0.4	0.3	0.2	0.1	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	PE 6C7A
			<PCT>										<RELATIVE AMOUNTS>						<PCT>		
83P2220	1																				
83P2221	2	VFS		GA40	OT29	GS17	GC15														
83P2222	3												NX 6							0.7	1.6
83P2223	4																				
83P2224	5												NX 6							0.4	0.8
83P2225	6																				
83P2226	7												NX 6							0.3	1.6

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GA = GLASS AGGREGATES GS = GLASS OT = OTHER NX = NON-CRYSTALLINE GC = GLASS COATED GRAIN

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Series: Ecuador No. 11 Date: 8/82
Pedon No: S83FN-325-011
Taxonomy: Coarse-loamy over ashy (pumice), mixed, isohyperthermic Andic Humitropept
Latitude: 0°25'00" Longitude: 79°02'20"
Location: This pedon is located 20 km east of Alluriquin near Tandapi.
Physiography: mountains
Geomorphic Position: Hillslope
Slope and Aspect: 45% NE planar-convex Elevation: 1500 m M.S.L.
M.S.L.
Microrelief: Complex.
Air Temp. Summer: Winter:
Precipitation: 2100 mm perudic moisture regime.
Water Table: > 10 m
Drainage: Well drained Permeability: moderate rapid in upper part, moderate in lower part.
Stoniness: nonstony
Land Use: pasture.
Erosion or Deposition: none apparent.
Parent Material: multiple coarse and fine ash and pumice deposits.
Described by: T. Cook, G. Del Posso, and Soil Survey Staff.
Remarks: Date Described: January 27, 1983. Field Moisture, 0-202 cm wet.
Vegetation: Native vegetation was subtropical mixed forest, now cleared and planted to pasture grasses.

A1 0 - 25 cm Black (10YR 2/1) loam; moderate medium and coarse subangular blocky structure parting to moderate medium and coarse granular; friable, non-sticky and non-plastic; many very fine, common fine, few coarse roots; many very fine and few fine tublar, common very fine interstitial pores; 1% 2 to 5 mm pumice fragments; gradual wavy boundary. About 1% fragments of brick, stones, artifacts, and charcoal.

A2 25 - 57 cm Black (10YR 2/1) loam; weak medium and coarse subangular blocky structure parting to weak coarse granular; friable, non-sticky and non-plastic; weakly smeary, very moist or wet; common very fine and fine roots; many very fine and common fine tubular pores; 1% 2 to 5 cm pumice fragments; diffuse wavy boundary. About 1% fragments of brick, stone, artifacts, and charcoal.

A3 57 - 84 cm Black (N 2/0) sandy loam; weak coarse subangular blocky structure; friable, non-sticky and non-plastic; a few thin patchy organic coatings on peds; few very fine and fine roots; many very fine, and few fine tubular pores; 7% 2 to 15 mm pumice fragments; clear wavy boundary.

2C1 84 - 120 cm Brown to dark brown (10YR 4/3) gravelly coarse sand; single grain; loose, non-sticky and non-plastic; few very fine roots; many very fine interstital pores; 25% 2 to 10 mm pumice fragments; clear wavy boundary. The upper few centimeters of the horizon has been stained black (10YR 2/1).

3Ab1 120 - 133 cm Very dark grayish brown (10YR 3/2) loam; weak coarse angular block structure; friable, non-sticky and non-plastic; moderately smeary, very moist or wet; few very fine roots; many very fine, few fine tubular, and common very fine interstital pores; 1% 2 to 10 mm pumice fragments; diffuse wavy boundary.

3Ab2 133 - 156 cm Very dark grayish brown (2.5Y 3/2) loam; weak coarse angular blocky structure; very friable, non-sticky and non-plastic; moderately smeary, very moist or wet; a few very fine roots; many very fine, few fine tubular and many very fine interstital pores; 1% 2 to 5 mm pumice fragments; clear wavy boundary.

3Ab3 156 - 178 cm Very dark brown (10YR 2/2) sandy loam; weak medium subangular blocky structure; very friable, non-sticky and non-plastic; few very fine roots; many very fine, fine tubular and many very fine interstital pores; 7% 2 to 15 mm pumice fragments; clear wavy boundary.

4C2 178 - 202 cm Yellowish brown (10YR 5/6) gravelly coarse sand; single grain; loose, non-sticky and non-plastic; few very fine roots; many very fine and fine interstitial pores; 35% 2 to 30 mm pumice fragments.

ECUADOR 011

LAB CLASSIF: COARSE-LOAMY OVER ASHY (PUMICE), MIXED, ISOHYPERTHERMIC ANDIC HUMITROPEPT

S 83FN-325 -011 DATE 09/25/84 SAMPLE NO. 83P2135-2142
PEDON NO. 83P 463
PROJECT NO. 83P 83

ECUADOR-SMSS

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	COARSE FRACTIONS(MM) WEIGHT 5 -20	COARSE FRACTIONS(MM) WEIGHT 20 -75	>2MM WT .1-75 PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->		
***** SEE FOOTNOTE REGARDING PSDA BELOW *****																			
832135	1S	0- 25	A1	3.9	46.5	49.6			30.5	16.0	15.3	19.9	11.8	2.4	0.2	TR	TR	3V	36	3
832136	2S	25- 57	A2	4.6	47.5	47.9			31.5	16.0	16.4	19.2	9.3	2.5	0.5	TR	TR	3V	34	3
832137	3S	57- 84	A3	3.0	34.4	62.6			21.2	13.2	13.1	20.2	18.1	8.3	2.9	2	1	16V	59	19
832138	4S	84-120	2C1	1.5	3.0	95.5			2.4	0.6	1.1	15.7	37.9	27.3	13.5	6	2	36V	97	44
832139	5S	120-133	3AB1	2.7	33.6	63.7			21.7	11.9	14.4	27.8	17.6	3.2	0.7	TR	TR	2V	50	2
832140	6S	133-156	3AB2	2.7	36.9	60.4			24.3	12.6	16.0	20.4	16.6	5.0	2.4	1	TR	2V	46	3
832141	7S	156-178	3AB3	2.5	16.1	81.4			10.7	5.4	6.2	15.0	31.6	21.1	7.5	3	2	15V	80	20
832142	8S	178-202	4C2	1.2	4.1	94.7			3.1	1.0	2.9	11.2	32.7	33.6	14.3	5	6	47V	97	58

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	COLE OVEN DRY 4A1H	WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
832135	1	7.24	0.585			0.7	0.6		6.97	5.95				0.76	0.94	0.073			72.8	23.2	0.37
832136	2	3.53	0.259			0.8	0.5		3.30	2.52				1.02	1.07	0.016			42.5	11.6	0.31
832137	3	3.38	0.229			1.0	0.6		4.90	4.07				0.99	1.06	0.021			45.8	12.2	0.30
832138	4	0.20				0.3	0.1		1.40	2.33										3.5	
832139	5	1.08				0.5	0.2		2.37	2.56				1.12	1.16	0.012			31.1	6.9	0.27
832140	6	0.95				0.5	0.2		2.33	2.33				1.19	1.21	0.006			29.0	6.3	0.27
832141	7	0.92				0.6	0.2		2.56	2.16				1.13	1.17	0.011			26.4	5.4	0.22
832142	8	0.15				0.4	0.1		1.67	2.17										2.6	

* CAUTION SHOULD BE USED WITH PSDA DATA WHEN USED FOR MAKING ENGINEERING INTERPERTATIONS BECAUSE OF INCOMPLETE DISPERSION OF AMORPHOUS MATERIAL. THEY ARE PRESENTED TO AID IN CLASSIFICATION AND ASSESSMENT OF MINERALOGY. REFER TO PEDON DESCRIPTION FOR FIELD TEXTURE.

ECUADOR 011 S 83FN-325 -011 DATE 09/25/84 PEDON NO. 83P 463 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2U	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) NAF 8C1D	CACL2 .01M 8C1F	H2O 8C1F
		<- - - - - - - - - - - -MEQ / 100 G					- - - - - - - - - - - ->					<- - - - -PCT - - - ->							1:2	1:1
832135	1	13.2	1.9	0.3	0.6	16.0	27.7	0.1	43.7	27.2	16.1	1	37	59				10.8	5.5	5.8
832136	2	2.8	0.3	0.2	0.2	3.5	24.5	0.4	28.0	15.2	3.9	10	12	23				11.1	5.4	5.8
832137	3	3.2	0.2	0.3	0.1	3.8	25.7	0.1	29.5	14.7	3.9	3	13	26				11.0	5.6	6.1
832138	4	0.6	0.1	0.3	--	1.0	2.6	--	3.6	2.1			28	48				10.1	5.5	6.2
832139	5	1.7	0.1	0.3	--	2.1	11.5	0.1	13.6	6.4	2.2	5	15	33				10.8	5.8	6.2
832140	6	1.6	0.2	0.3	--	2.1	10.5	0.1	12.6	6.3	2.2	5	17	33				10.7	5.9	6.1
832141	7	2.0	0.2	0.3	--	2.5	9.9	0.1	12.4	6.4	2.6	4	20	39				10.7	6.0	6.3
832142	8	0.6	0.2	0.2	--	1.0	2.6	TR	3.6	2.0			28	50				10.3	5.8	6.2

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	(- -DIVIDED BY- -) FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->							<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
832135	1		0.4	0.6	0.8	0.3		1044								
832136	2		0.2	0.6	0.6	0.2		822	VR 1	NX 6						
832137	3		0.2	0.5	0.4	0.2		756	NX 6							
832138	4		--	0.1	0.3	0.1										
832139	5		--	0.2	0.3	0.1		159	NX 6							
832140	6		--	0.2	0.3	0.1		259								
832141	7		--	0.2	0.3	0.1		245								
832142	8		--	0.1	0.2	0.1			CL 1	NX 6						

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 3 PCT .1-75MM 56. SPODIC HORIZON: INDEX OF ACCUMUL 1344
ANALYSES: S= ALL ON SIEVED <2MM BASIS V= 75-20MM FROM VOLUME ESTIMATES
MINERALOGY: KIND OF MINERAL VR VERMICULITE NX AMORPHOUS CL CHLORITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

N S S L

S U P P L E M E N T A L D A T A S H E E T

SAMPLE NO.	HZN NO.	EXT P BRAY1 6S3 PPM	15 BAR MOIST 4B2b	P RETENT *	(- -ACID OXALATE- -) AL *	SI *	FE *	EXTR AL (KOH)	pH KCl 8C1g
			<- - - - - - - - -	-PCT OF <2MM- - - - - - - - - - >					
832135	1		31.0	78	0.8	0.3	0.5	0.8	
832136	2		21.5	83	1.1	0.5	0.4	1.2	
832137	3		22.9	89	1.7	0.8	0.6	1.5	
832138	4		5.0	27	0.4	0.3	0.4	0.3	
832139	5		13.3	70	1.0	0.6	0.2	1.0	
832140	6		12.1	66	1.1	0.6	0.3	1.0	
832141	7		9.8	52	0.8	0.5	0.2	1.0	
832142	8		5.3	40	0.3	0.2	0.2	0.4	

* NEW ZEALAND PROCEDURE

CP83FN128

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
		(MINERALOGY)																			
		(OPTICAL)											(X-RAY)					(DTA)		(TOT ANAL)	
		(SAND/SILT)											(CLAY)								
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
83P2135	1																				
83P2136	2												VR 1	NX 6						0.2	1.7
83P2137	3	VFS		GA49	GC21	OT20	GS10						NX 6							0.2	2.0
83P2138	4																				
83P2139	5	VFS		GA48	OT31	GC17	GS 5						NX 6							0.0	1.0
83P2140	6																				
83P2141	7																				
83P2142	8	VFS		GS55	GC28	OT10	GA 7						CL 1	NX 6						0.1	0.7

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: VR = VERMICULITE NX = NON-CRYSTALLINE GA = GLASS AGGREGATES GS = GLASS OT = OTHER

GC = GLASS COATED GRAIN CL = CHLORITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Appendix II

Summary of micromorphological descriptions of soils for the Sixth International Soil Classification Workshop

R. Honorato

Facultad de Agronomía
Pontificia Universidad Católica de Chile

PEDON	SAMPLE	RELATED DISTRIBUTION PATTERN		SOIL FABRIC	PEDOLOGICAL FEATURES				ORGANIC COMPOUNDS		SKELETAN GRAINS	
		Normal	Specific		Cutans	Sesq.Glab.	Pedotubules	Org.skeleton	Coloidal humus	Coloidal mull	Mineralogy	Degree of weathering
007	2081	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	-	xx	-	-	xx	-	plagioclases(A) volcanic rock frag.(S) amph.-pyroxenes(S)	nearly fresh/complex alteration some pyroxenes moderately altered pellicular
009	2093	Porphyric	Aggl.-congelic(E) Porphyroskelic(B)	Isotic	amorphous coatings	xx	xx	x	x	xx	pumice vitric frag.(C-A) (coated and uncoated) plagioclases(A) volcanic rock frag.(S) pyroxenes(S) quartz (T)	nearly fresh some plagioclases slighthly altered
009	2095	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	-	xx	x	-	xxx	-	plagioclases(A) volcanic rock frag.(S) pyroxenes(S) pumice vitric frag.(S-C) quartz (T)	nearly fresh
009	2096	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	-	xx	-	-	x	-	plagioclases(A) volcanic rock frag.(S) pumice vitric frag.(S-C) amph.-pyroxenes(S) micas (T)	nearly fresh
001	2104	Porphyri-granic	Aggl.-congelic Porphyroskelic(B)	Isotic	amorphous coatings	xx	xx	-	xxx	xx	pumice vitric frag.(A) (coated) amph.-pyroxenes(C) plagioclases(C) volcanic rock frag.(S) micas (S)	nearly fresh
001	2108	Porphyric	Aggl.-congelic Porphyroskelic(B)	Isotic	amorphous coatings	xx	x	-	xx	x	plagioclases(A) pumice vitric frag.(C) amph.-pyroxenes(S) volcanic rock frag.(S) micas (T)	nearly fresh to slighthly alteration complex of plagioclases
004	2120	Porphyri-granic	very loose congelic to dermatic	Isotic	amorphous coatings	xx	-	-	x	xx	pumice vitric frag.(A) (coated and uncoated) plagioclases(A) volcanic rock frag.(S) amph.-pyroxenes(S) micas (T)	nearly fresh some amph.-pyroxenes strongly altered
004	2124	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	-	xx	-	-	x	-	plagioclases(C) pumice vitric frag.(S) amph.-pyroxenes(S)	nearly fresh
011	2117	Phyri-granic	Aggl.-congelic Porphyroskelic(B)	Isotic	some amorphous coatings	-	-	-	x	xx	plagioclases(A) pumice vitric frag.(C) amph.-pyroxenes(S) micas (T)	nearly fresh
005	2152	Porphyric	Aggl.-congelic Porphyroskelic(B)	Isotic	few amorphous coatings	xx	xx	xx	xx	xx	plagioclases(C-A) amph.-pyroxenes(S)	nearly fresh some amph.-pyroxenes strongly altered
005	2154	Porphyric	Int. congelic-aggl. Porphyroskelic(B)	Isotic	xx amorphous	xx	xx	x	xx	xx	plagioclases(C-A) amph.-pyroxenes(S) pumice vitric frag.(S) (coated) micas (T)	nearly fresh to slighthly fresh some amph.-pyroxenes strongly altered
005	2155	Porphyric	Int. aggl.-congelic Porphyroskelic(B)	Isotic	xx	xx	x	x	xx	x	plagioclases(C) amph.-pyroxenes(T) pumice vitric frag.(S) (coated)	nearly fresh

PEDON	SAMPLE	RELATED DISTRIBUTION PATTERN Normal	Specific	SOIL FABRIC	PEDOLOGICAL FEATURES Cutans	Sesq.Glob.	Pedotubules	ORGANIC COMPOUNDS Org.skeleton	Coloidal humus	Coloidal mull	SKELETAN GRAINS Mineralogy	Degree of weathering
005	2157	Porphyric	Int. congelic-aggl. Porphyroskelic(B)	Isotic	x	xx	x	-	xx	xx	plagioclases(S-C) micas (T)	sligthly altered (complex alteration)
012	2168	Porphyric	Int. aggl.-cong.(E) Porphyroskelic(B)	Isotic	x (amorphous)	xx	xx	-	xx	-	plagioclases(C) pumice vitric frag.(S) amph.-pyroxenes(S)	sligthly altered (complex alteration)
012	2170	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	x	xx	-	-	xx	-	plagioclases(C) volcanic rock frag.(S)	sligthly altered plagioclases fracrented
012	2172	Plasmi-porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	xx	xx	-	-	x	-	plagioclases(A)	sligthly altered plagioclases fragmented
013	2183	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	x	xx	x	-	x	-	pumice vitric frag.(S) plagioclases (A) quartz (T)	sligthly altered coins of plagioclases
013	2184	Plasmic	Agglutinic(E) Porphyroskelic(B)	Isotic	xx (ferrans)	xx	-	-	x	-	scarce skeleton quartz (T)	--
013	2185	Plasmic	Agglutinic(E) Porphyroskelic(B)	Isotic	xx (ferrans)	xxx	-	-	-	-	no grains	--
002	2192	Phyri-granic	Dermatic	Isotic	-	-	-	-	x	-	to thick in some coarse grains plagioclases are coated (A)	nearly fresh
002	2193	Phyri-granic	Dermatic	Isotic	?	-	-	-	x	-	volcanic rock frag.(S) (glassy) plagioclases(C)	nearly fresh
002	2194	Mainly volcanic material with a fine volcanic paste as matrix including phenocryste of feldesphate and pyroxenes principaly.										
003	2201	Porphyric	Int.cong.-aggl.(E) Porphyroskelic(B)	Isotic	-	xx	x	x	xx	x	plagioclases(C) pumice vitric frag.(C)	plagioclases and pumice sligthly fresh to strongly altered
003	2202	Porphyric	Int.aggl.-cong.(E) Porphyroskelic(B)	Isotic	-	xx	x	-	xx	x	plagioclases(C) pumice vitric frag.(C)	plagioclases and pumice sligthly fresh to strongly altered
003	2204	Porphyric	Agglutinic(E) Porphyroskelic(B)	Isotic	-	?	-	-	x	-	plagioclases(C) pumice vitric frag.(C) amph.-pyroxenes(S)	plagioclases and pumice sligthly fresh to strongly altered
008	2211	Porphyric	Int.aggl.-cong. Porphyroskelic(B)	Isotic	amorphous coatings	xx	-	xx	xx	x	plagioclases(C-A) pumice vitric frag.(C-A) (coated and uncoated)	plagioclases and pumice sligthly fresh to strongly altered
008	2212	Porphyric	Int.aggl.-cong. Porphyroskelic(B)	Isotic	amorphous coatings new pumice	xx	x	x	xx	x	plagioclases(C-A) pumice vitric frag.(A) (coated and uncoated)	plagioclases and pumice sligthly fresh to strongly altered (something less)
008	2214	Porphyric	Int.aggl.-cong. Porphyroskelic(B)	Isotic	amorphous coatings new pumice	xx	x	-	x	-	plagioclases(C-A) pumice vitric frag.(A) (coated and uncoated)	plagioclases and pumice sligthly fresh to strongly altered (something less)
010	2221	Granic	Dermatic(E)	Isotic	some amorphous coatings	x	x	x	xx	-	plagioclases(A) pumice vitric frag.(A) some coated	slightly altered

Key:

- Abondant xxx A
- Common xx C
- Scarce x S
- Truces T

Soil Fabric

E = Eswaran

B = Brewer

Nomenclature and criteria:

Weathering Degree

G. Stoops, E. Bisdom, J.Delvigne, E. Fitzpatrick and G. Paneque. 1978. Sub-group on weathering phenomena and neofromations a progress report.

Soil Fabric and Pedological Features

H. Eswaran and C. Baños. 1976. Related distribution patterns in soils and their significance. An.Edaf. y Agrb.

R. Brewer.1964. Fabric and mineral analysis of soils. John Wiley Inc.

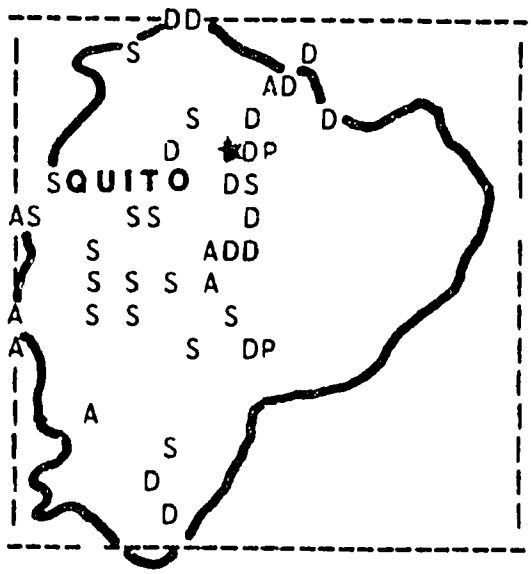
Appendix III

Soil Moisture and Temperature Regimes

The following five pages show the determination of soil moisture and temperature regimes according to Franklin Newhall system of computation for selected stations in the Ecuador (Newhall, 1972). This information was taken from SMSS Technical Monograph No. 2, 1981 (Van Wambeke, 1981).

ECUADOR

MOISTURE REGIMES



SYMBOL TABLE:

USTIC - - - S
UDIC - - - D
ARIDIC - - - A
XERIC - - - X
PERUDIC - - P

DETERMINATION OF SOIL MOISTURE REGIME ACCORDING TO FRANKLIN NEWHALL SYSTEM OF COMPUTATION

FOR ECUA

NAME OF STATION	MEAN SOIL TEMPERATURE ANN	SUMM	WINT	TEMPERATURE REGIME	CUMULATIVE DAYS MSC IN ONE YEAR IS DRY	M/D	MOI	WHEN SOIL TEMP >5 DRY	M/D	MOI	MAX.CONSECUTIVE DAYS THAT MCS IS MOIST IN SOME PARTS IN ONE YEAR	WHEN SOIL TEMP > 8	DRY AFTER SUMMER SOLST.	MOIST AFTER WINTER SOLST.	MOISTURE REGIME
AMBATO	16.4	16.7	15.6	ISOTHERMIC	245	115	0	245	115	0	86	86	75	0	ARIDIC
ANCON	26.1	27.0	24.8	ISOHYPERTH.	328	32	0	328	32	0	18	18	45	0	ARIDIC
ANGEL (EL)	14.2	13.5	14.3	ISOMESIC	0	0	360	0	0	360	360	360	0	120	UDIC
ARGELIA (LA)	17.5	17.6	17.0	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
ASCAZUBI	17.9	17.6	18.1	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
BABAHOYO	27.6	27.9	26.6	ISOHYPERTH.	127	55	178	127	55	176	219	219	13	13	USTIC
BAHIA DE CAR	27.2	27.7	26.5	ISOHYPERTH.	239	40	81	239	40	81	98	98	15	0	USTIC
BALZAR	27.8	28.1	27.1	ISOHYPERTH.	119	44	197	119	44	197	229	229	14	32	USTIC
BANOS	19.4	19.6	18.7	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
CALDERON	17.9	17.6	18.1	ISOTHERMIC	141	219	0	141	219	0	167	167	38	0	USTIC
CANAR	13.4	13.4	13.0	ISOMESIC	192	168	0	192	168	0	168	168	45	0	USTIC
CARIAMANGA	18.4	18.5	17.9	ISOTHERMIC	0	45	315	0	45	315	360	360	0	96	UDIC
COLIMES	27.4	27.7	26.8	ISOHYPERTH.	65	38	257	65	38	257	295	295	0	62	USTIC
COTOCOLLAO	15.3	15.7	14.7	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
COTOPAXI	10.1	10.3	9.8	ISOMESIC	0	0	360	0	0	360	360	33	0	120	UDIC
CUENCA	16.6	16.9	16.0	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
DAULE	28.3	28.6	27.6	ISOHYPERTH.	155	44	161	155	44	161	197	197	15	0	USTIC
ESMERALDAS	27.9	28.1	28.0	ISOHYPERTH.	204	53	103	204	53	103	146	146	120	75	USTIC
GUARANDA	15.6	15.7	15.4	ISOTHERMIC	0	91	269	0	91	269	360	360	0	74	USTIC
GUAYAQUIL EC	27.4	27.8	26.5	ISOHYPERTH.	163	36	161	163	36	161	197	197	15	0	USTIC
GUAYAQUIL	27.9	28.4	27.2	ISOHYPERTH.	181	35	144	181	35	144	179	179	15	0	USTIC
GUAYLLABAMBA	18.5	18.5	18.4	ISOTHERMIC	137	223	0	137	223	0	137	137	73	0	USTIC
IBARRA	18.5	18.5	18.4	ISOTHERMIC	32	210	118	32	210	118	328	328	32	15	USTIC
ISABEL MARIA	27.5	28.0	26.5	ISOHYPERTH.	144	48	168	144	48	168	206	206	14	3	USTIC
LATACUNGA	15.3	15.7	14.7	ISOTHERMIC	223	137	0	223	137	0	110	110	75	0	USTIC
LIBERTAD (LA	27.8	28.5	27.0	ISOHYPERTH.	326	34	0	326	34	0	19	19	45	0	ARIDIC
LIMONES	28.4	28.2	28.4	ISOHYPERTH.	0	31	329	0	31	329	360	360	0	120	UDIC
LOJA	18.4	18.5	17.9	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
MACARA	27.4	28.0	26.5	ISOHYPERTH.	243	48	69	243	48	69	117	117	45	0	USTIC
MACHALA	27.2	27.9	26.4	ISOHYPERTH.	201	53	106	201	53	106	159	159	15	0	USTIC
MANTA	27.2	27.7	26.5	ISOHYPERTH.	333	27	0	333	27	0	15	15	45	0	ARIDIC
MENDEZ	26.1	26.3	25.4	ISOHYPERTH.	0	0	360	0	0	360	360	360	0	120	PERUDIC
MILAGRO	27.1	27.5	26.3	ISOHYPERTH.	145	40	175	145	40	175	215	215	15	10	USTIC
OTAVALO	16.6	16.1	16.8	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
PALMIRA	13.4	13.4	13.0	ISOMESIC	245	115	0	245	115	0	115	115	75	0	USTIC
PAPALLACTA	11.9	12.1	11.3	ISOMESIC	0	0	360	0	0	360	360	360	0	120	PERUDIC
PATATE	19.1	19.3	18.3	ISOTHERMIC	70	290	0	70	290	0	290	290	70	0	USTIC
PICHILINGUE	27.0	27.3	26.0	ISOHYPERTH.	97	66	197	97	66	197	263	263	0	28	USTIC
PILLARO	14.2	14.2	13.5	ISOMESIC	0	0	360	0	0	360	360	360	0	120	UDIC
PORTOVELO	25.7	25.6	25.4	ISOHYPERTH.	103	66	191	103	66	191	257	257	0	26	USTIC
PORTOVIEJO	27.4	27.7	26.6	ISOHYPERTH.	221	51	88	221	51	88	139	139	15	0	USTIC
PUERTO BOLIV	27.2	27.9	26.2	ISOHYPERTH.	261	54	45	261	54	45	86	86	17	0	ARIDIC
QUITO ECUADO	15.5	15.5	15.5	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
QUITO	15.5	15.5	15.5	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
RIOBAMBA	15.7	16.0	15.1	ISOTHERMIC	314	46	0	314	46	0	46	46	105	0	ARIDIC

COMPUTED BY FORTRAN PROGRAM V608, APR 1981

DATE 04/08/81

FOR ECUA DETERMINATION OF SOIL MOISTURE REGIME ACCORDING TO FRANKLIN NEWHALL SYSTEM OF COMPUTATION

NAME OF STATION	MEAN SOIL TEMPERATURE ANN	SUMM	WINT	TEMPERATURE REGIME	CUMULATIVE DAYS MSC IN ONE YEAR IS DRY	M/D	MOI	WHEN SOIL TEMP >5 DRY	M/D	MOI	MAX.CONSECUTIVE DAYS THAT MCS IS MOIST IN SOME PARTS IN ONE YEAR	WHEN SOIL TEMP > 8	DRY AFTER SUMMER SOLST.	MOIST AFTER WINTER SOLST.	MOISTURE REGIME
SALINAS	25.5	26.6	24.4	ISOHYPERTH.	351	9	0	351	9	0	9	9	75	0	ARIDIC
SAN GABRIEL	14.2	13.2	14.6	ISOMESIC	0	0	360	0	0	360	360	360	0	120	UDIC
SAN LORENZO	28.4	28.2	28.4	ISOHYPERTH.	0	0	360	0	0	360	360	360	0	120	UDIC
SANTA ISABEL	22.1	21.4	23.0	ISOHYPERTH.	266	94	0	266	94	0	94	94	75	0	USTIC
SANTO DOMING	24.5	24.4	24.3	ISOHYPERTH.	0	0	360	0	0	360	360	360	0	120	UDIC
TABACUNDO	15.5	15.5	15.5	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC
TIPUTINI	27.9	28.3	27.4	ISOHYPERTH.	0	0	360	0	0	360	360	360	0	120	UDIC
TISALEO	13.9	14.2	13.1	ISOMESIC	0	0	360	0	0	360	360	360	0	120	UDIC
TULCAN	13.5	12.7	13.8	ISOMESIC	0	0	360	0	0	360	360	360	0	120	UDIC
UYUMBICHO	15.5	15.5	15.5	ISOTHERMIC	0	0	360	0	0	360	360	360	0	120	UDIC

COMPUTED BY FORTRAN PROGRAM VW08, APR 1981

DATE 04/09/81

DETERMINATION OF SOIL MOISTURE REGIME ACCORDING TO FRANKLIN NEWHALL SYSTEM OF COMPUTATION

FOR ECUA

NAME OF STATION	MOISTURE REGIME	CON.D. M/D T>8	TEMPERATURE REGIME	TENTATIVE SUBDIVISION OF MOISTURE REGIME		CONS DAYS MOIST(2+3) SUM.	CONS DAYS MOIST(2+3) WINT	CUM.DAYS MOIST(2+3) SUM.	CUM.DAYS MOIST(2+3) WINT	CONS.DAYS COMP.MOIST SUM.	CONS.DAYS COMP.MOIST WINT	CUM.DAYS COMP.MOI. SUM.	CUM.DAYS COMP.MOI. WINT
AMBATO	ARIDIC	86	ISOTHERMIC	WEAK	ARIDIC	75	11	104	11				
ANCON	ARIDIC	18	ISOHYPERTH.	TYPIC	ARIDIC	18	0	32	0				
ANGEL (EL)	UDIC	360	ISOMESIC	TYPIC	UDIC					180	180	180	180
ARGELIA (LA)	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
ASCAZUBI	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
BABAHOYO	USTIC	219	ISOHYPERTH.	TYPIC	TROPUST.	167	52	167	66				
BAHIA DE CAR	USTIC	98	ISOHYPERTH.	ARIDIC	TROPUST.	98	0	121	0				
BALZAR	USTIC	229	ISOHYPERTH.	TYPIC	TROPUST.	166	63	166	75				
BANOS	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
CALDERON	USTIC	167	ISOTHERMIC	ARIDIC	TROPUST.	135	45	142	77				
CANAR	USTIC	168	ISOMESIC	ARIDIC	TROPUST.	135	33	135	33				
CARIAMANGA	UDIC	360	ISOTHERMIC	DRY	TROPUDIC					180	96	180	135
COLIMES	USTIC	295	ISOHYPERTH.	UDIC	TROPUST.	180	100	180	115				
COTOCOLLAO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
COTOPAXI	UDIC	33	ISOMESIC	TYPIC	UDIC					180	180	180	180
CUENCA	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
DAULE	USTIC	197	ISOHYPERTH.	TYPIC	TROPUST.	165	32	165	40				
ESMERALDAS	USTIC	146	ISOHYPERTH.	ARIDIC	TROPUST.	0	146	0	156				
GUARANDA	USTIC	360	ISOTHERMIC	UDIC	TROPUST.					180	74	180	89
GUAYAQUIL EC	USTIC	197	ISOHYPERTH.	TYPIC	TROPUST.	165	32	165	32				
GUAYAQUIL	USTIC	179	ISOHYPERTH.	ARIDIC	TROPUST.	165	14	165	14				
GUAYLLABAMBA	USTIC	137	ISOTHERMIC	ARIDIC	TROPUST.	75	105	107	116				
IBARRA	USTIC	328	ISOTHERMIC	UDIC	TROPUST.	75	180	148	180				
ISABEL MARIA	USTIC	206	ISOHYPERTH.	TYPIC	TROPUST.	166	40	166	50				
LATACUNGA	USTIC	110	ISOTHERMIC	ARIDIC	TROPUST.	105	27	105	32				
LIBERTAD (LA	ARIDIC	19	ISOHYPERTH.	TYPIC	ARIDIC	19	0	34	0				
LIMONES	UDIC	360	ISOHYPERTH.	DRY	TROPUDIC					134	180	149	180
LOJA	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
MACARA	USTIC	117	ISOHYPERTH.	ARIDIC	TROPUST.	117	0	117	0				
MACHALA	USTIC	159	ISOHYPERTH.	ARIDIC	TROPUST.	159	0	159	0				
MANTA	ARIDIC	15	ISOHYPERTH.	TYPIC	ARIDIC	15	0	27	0				
MENDEZ	PERUDIC	360	ISOHYPERTH.		PERUDIC					180	180	180	180
MILAGRO	USTIC	215	ISOHYPERTH.	TYPIC	TROPUST.	165	50	165	50				
OTAVALO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
PALMIRA	USTIC	115	ISOMESIC	ARIDIC	TROPUST.	105	10	105	10				
PAPALLACTA	PERUDIC	360	ISOMESIC		PERUDIC					180	180	180	180
PATATE	USTIC	290	ISOTHERMIC	UDIC	TROPUST.	75	180	110	180				
PICHILINGUE	USTIC	263	ISOHYPERTH.	TYPIC	TROPUST.	180	68	180	83				
PILLARO	UDIC	360	ISOMESIC	TYPIC	UDIC					180	180	180	180
PORTOVELO	USTIC	257	ISOHYPERTH.	TYPIC	TROPUST.	180	62	180	77				
PORTOVIEJO	USTIC	139	ISOHYPERTH.	ARIDIC	TROPUST.	139	0	139	0				
PUERTO BOLIV	ARIDIC	86	ISOHYPERTH.	WEAK	ARIDIC	86	0	99	0				
QUITO ECUADO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
QUITO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
RIOBAMBA	ARIDIC	46	ISOTHERMIC	WEAK	ARIDIC	46	0	46	0				

COMPUTED BY FORTRAN PROGRAM VW08, APR 1981

DATE 04/29/81

DETERMINATION OF SOIL MOISTURE REGIME ACCORDING TO FRANKLIN NEWHALL SYSTEM OF COMPUTATION

FOR ECUA

NAME OF STATION	MOISTURE REGIME	CON.D. M/D T>8	TEMPERATURE REGIME	TENTATIVE SUBDIVISION OF MOISTURE REGIME		CONS DAYS MOIST(2+3) SUM.	CONS DAYS MOIST(2+3) WINT	CUM.DAYS MOIST(2+3) SUM.	CUM.DAYS MOIST(2+3) WINT	CONS.DAYS COMP.MOIST SUM.	CONS.DAYS COMP.MOIST WINT	CUM.DAYS COMP.MOI. SUM.	CUM.DAYS COMP.MOI. WINT
SALINAS	ARIDIC	9	ISOHYPERTH.	TYPIC	ARIDIC	9	0	9	0				
SAN GABRIEL	UDIC	360	ISOMESIC	TYPIC	UDIC					180	180	180	180
SAN LORENZO	UDIC	360	ISOHYPERTH.	TYPIC	UDIC					180	180	180	180
SANTA ISABEL	USTIC	94	ISOHYPERTH.	ARIDIC	TROPUST.	94	0	94	0				
SANTO DOMING	UDIC	360	ISOHYPERTH.	TYPIC	UDIC					180	180	180	180
TABACUNDO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180
TIPUTINI	UDIC	360	ISOHYPERTH.	TYPIC	UDIC					180	180	180	180
TISALEO	UDIC	360	ISOMESIC	TYPIC	UDIC					180	180	180	180
TULCAN	UDIC	360	ISOMESIC	TYPIC	UDIC					180	180	180	180
UYUMBICHO	UDIC	360	ISOTHERMIC	TYPIC	UDIC					180	180	180	180

COMPUTED BY FORTRAN PROGRAM VW08, APR 1981

DATE 04/29/81

Appendix IV

In this appendix, eleven pages called a data sheet packet--an explanation is included. If you have any questions concerning the data sheet, these pages should be reviewed.

DATA SHEET PACKET - AN EXPLANATION

WARWICK

SAMPLED AS: LOAMY-SKELETAL, MIXED, MESIC TYPIC DYSTROCHREPT

S 78WT-025 -002 SAMPLE NOS. 78P1791 - 1796 DATE 6/ 5/79

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SPODOSOL STUDY WINDHAM COUNTY

GENERAL METHODS 1B1A, 2A1, 2B

-1— -2— -3— -4— -5— -6— -7— -8— -9— -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS (MM) WEIGHT 2 -5	5 -20	20 -75	.1-75	(>2MM) WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM (3B1) ->				
781791	1S	0- 5	A1	11.9	38.5	49.6			22.4	16.1	12.8	11.7	5.4	8.1	11.6	7	13	5	53	25
781792	2S	5- 23	B21IR	10.4	39.0	50.6			21.2	17.8	12.1	10.4	5.5	7.8	14.8	5	27	48	88	83
781793	3S	23- 35	B22	11.3	42.6	46.1			23.4	19.2	12.4	11.4	4.6	6.9	10.8	6	11	19	50	56
781794	4S	35- 50	B23	10.4	38.9	50.7			20.3	18.6	11.4	9.8	5.5	9.0	15.0	7	20	37	78	74
781795	5S	50- 61	B3	7.4	23.8	68.8			12.7	11.1	6.4	8.7	7.3	15.9	30.5	10	29	35	90	79
781796	6S	61-117	2C	5.7	7.8	86.5			4.5	3.3	3.4	10.0	12.4	27.4	33.3	10	30	37	96	85

SAMPLE NO.	HZN NO.	ORGN TOTAL C 6A1C	TOTAL N 6B1B	EXTR TOTAL P 6S1A	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1B	WHOLE SOIL 4D1	COLE	FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->				CM/CM	<- - -PCT OF <2MM - ->				CM/CM
781791	1	5.59	0.208			1.8	0.3		2.81	1.32				0.90							15.7	
781792	2	2.41	0.113			1.9	0.7		1.26	0.92				0.98	1.01	0.010				34.7	9.6	0.25
781793	3	1.33	0.064			1.8	0.5		0.61	0.60	31	1		1.17	1.20	0.008				30.0	6.8	0.27
781794	4	0.91	0.053			1.7	0.4		0.55	0.53				1.20							5.5	
781795	5	0.58				1.1	0.3		0.62	0.54				1.50							4.0	
781796	6	0.41				0.7	0.2		0.63	0.93				1.60							5.3	

SAMPLE NO.	HZN NO.	NH4OAC EXTRACTABLE BASES CA 5B4A 6N2B	MG 5B4A 6Q2D	NA 5B4A 6P2B	K 5B4A 6Q2B	SUM BASES 6H2B	ACIDITY 6G1E	EXTR AL 6G1E	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8A	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SAT SUM 5C3	BASE SAT NH4 OAC 5C1	CO3 AS RES. CACO3 <2MM 6H1B	OHMS /CM 8H1	PH CACL2 .01M 8C1B 1:2	PH H2O 8C1A 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->						
781791	1	0.3	0.2	--	--	0.5	31.9	7.5	39.4	33.4	8.0	94	1	1			3.2	3.5
781792	2	0.1	--	--	--	0.1	22.0	3.5	22.1	13.1	3.6	97	TR	1			4.0	4.1
781793	3	TR	--	--	--	TR	11.7	2.2	11.7	6.9	2.2	100	TR	TR		23000	4.2	4.3
781794	4	TR	--	--	--	TR	10.2	2.0	10.2	5.7	2.0	100	TR	TR			4.2	4.3
781795	5	--	--	--	--	--	7.6	1.1	7.6	4.6	1.1	100	TR	TR			4.4	4.4
781796	6	TR	--	--	--	TR	5.2	0.6	5.2	3.6	0.6	100	TR	1			4.4	4.5

SAMPLE NO.	HZN NO.	SPODIC HORIZON CRITERIA C 6A4A	PYROPHOSPHATE EXTRACTABLE FE 6C5A	AL 6G5A	FE+AL 6G5A	FE+AL DI-CI PCT FE+AL	AL+C DIVIDED BY CLAY PCT CLAY	INDEX OF ACCUM	MINERALOGY CLAY X-RAY 7A2B	7A2B	7A2B	7A2B	DTA 7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->							<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
781791	1		1.1	0.2	0.6	0.1		167								
781792	2	1.8	0.6	0.5	0.4	0.1	0.2	304								
781793	3		0.2	0.3	0.2	TR		73								
781794	4		0.2	0.2	0.2	TR		75								
781795	5		0.2	0.2	0.3	0.1		43								
781796	6		0.1	0.2	0.3	0.1		132								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 7.6 PCT .1-75MM 86.4. SPODIC HORIZON: INDEX OF ACCUMUL 0

ESTIMATED BULK DENSITY FOR LAYER 1, 4, 5, 6,

ANALYSES: S= ALL ON SIEVED <2MM BASIS

DATA SHEET HEADING

WARWICK

SAMPLED AS: LOAMY-SKELETAL, MIXED, MESIC TYPIC DYSTROCHREPT

S 78VT-025 -002 SAMPLE NOS. 78P1791 - 1796 DATE NOVEMBER. 1979

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SPODOSOL STUDY WINDHAM COUNTY

GENERAL METHODS 1B1A, 2A1, 2B

Warwick
Name of the soil series, pedon sampled to represent.

Sampled As
Classification (field) of pedon at time of sampling.

Pedon number S78 VT-025-002
S = special sample
78 = calendar year sampled
VT = state where sampled - 2-letter FIPS code for state where sampled
025 = FIPS county code
002 = consecutive pedon number for calendar year for county

Sample numbers--NSSL assigned numbers.
78 = year (CY)
P = permanent storage of data on NSSL computer disk (T = temporary storage)
1791 = last four digits is consecutive sample number (NSSL)
Date-date of printout

Project name and/or county sampled.

General methods for soil preparation--see SSIR No. 1.

General conventions. Unless otherwise specified analyses are calculated to an oven dry weight base. Therefore, if analyses are reported on a < 2 mm base, it means that analyses are on all particles < 2 mm in size and results are calculated using an oven dry sample weight. Conversely, if the analyses are reported on a whole soil base, it means that the analyses are for all particles with coarse fragments included, and are calculated using an oven dry sample weight.

Footnotes

FAMILY CONTROL SECTION: DEPTH 25- 71 PCT CLAY 51 PCT .1-75MM 2

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL MI MICA MT MONTMORILL KK KAOLINITE CL CHLORITE QZ QUARTZ

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

Family control section: Depth limits of control section; calculated weighted average % clay of control section; and calculated weighted average % 0.1-75 mm fraction for use in determining loamy vs. silty particle size class.

Estimated bulk densities for layer: . . . self explanatory.

Analyses: Tier 1, column 1 provides explanation of soil preparation code.

Mineralogy: identifies clay mineralogy codes and relative amount codes.

Tier 1

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
							(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND-	- - - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
							CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC					WT
							LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
							.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
							<- - - - - - - - - - - - -				PCT OF <2MM			(3A1)	- - - - - - - - - - - - -			->	<- PCT OF <75MM(3B1)->			SOIL
781791	15	0- 5	A1				11.9	38.5	49.6			22.4	16.1	12.8	11.7	5.4	8.1	11.6	7	13	5	53	25

General: First two columns (unnumbered columns) are the same for each tier. The first column on the left is the NSSL sample number, the second number is the horizon number. Except for columns 1-3, tier 1 is entirely particle size and coarse fragment data. Particle size distribution (columns 4-15) is reported on the < 2 mm fraction and is determined after destruction of organic matter, washing free of soluble salts, drying the sample, and obtaining a base weight, and dispersion with sodium hexametaphosphate.

Column 1. Space after horizon number for two letter preparation code.
- S = standard preparation. Coarse fragments > 2 mm weighed and discarded from sample shipped to lab.
- SP = same as "S" but clod parameters (tier 2, columns 12-14 and 16-18) reported on a whole soil base. Often used in soils with soft shale, tuff, or other water holding coarse fragments.
- SK = same as "S" except 2-20 mm fractions are ground to < 2 mm and kept. Analysis of 2-20 mm fraction is combined with analysis of < 2 mm and reported as < 20 mm base. Often used for calcium carbonate and for gypsum; i.e. calcic horizon with hard concretions, see Soil Taxonomy, p. 387.
- SR = same as "SK" except 2-20 mm fractions recombined with < 2 mm fraction. Results reported on < 20 mm base
- GP = entire sample ground. Results reported on whole soil base.
- WP = same as "GP" except > 2 mm fractions sieved and weighed before grinding to < 2 mm and recombining with < 2 mm material. Results reported on whole soil base.

Column 2. Depth in cm.

Column 3. Horizon notation. Arabic numbers are used instead of Roman Numerals. Printed horizon designation may be truncated since only six spaces available for notation. The entire notation is stored in computer

Column 4. % total clay. Particles < 0.002 mm. Sedimentation and pipette analysis.

Column 5. % total silt. Particles 0.002 mm to 0.05 mm. Sedimentation and pipette analysis.

Column 6. % total sand. Particles 0.05 mm to 2.0 mm. Sieve analysis.

Column 7. % fine clay. Particles < 0.0002 mm. Centrifugation and pipette analysis.

Column 8. % carbonate clay. Carbonate < 0.002 mm. Sedimentation and pipette analysis, HCl treatment, and CO_2 evolution Subtracted from col. 4 to obtain % noncarbonate clay when determining taxonomic particle size class.[2] See Soil Taxonomy, p. 384, footnote 1.

Column 9. % fine silt. Particles 0.002 mm to 0.02 mm. Sedimentation and pipette analysis.

Column 10. % coarse silt. Particles 0.02 mm to 0.05 mm. By difference--coarse silt = [100-(% clay + % fine silt + % sand)]

Column 11. % very fine sand (VFS). Particles 0.05 mm to 0.1 mm. Sieve analysis. Treated as silt to distinguish loamy and silty particle size classes. See Soil Taxonomy, p. 383.

Column 12. % fine sand (FS). Particles 0.1 mm to 0.25 mm. Sieve analysis.

Column 13. % medium sand (MS). Particles 0.25 mm to 0.5 mm. Sieve analysis.

Column 14. % coarse sand (CS). Particles 0.5 to 1.0 mm. Sieve analysis.

Column 15. % very coarse sand (VCS). Particles 1 mm to 2 mm. Sieve analysis.

Column 16. Weight % coarse fragments 2 mm to 5 mm. Reported on < 75 mm base. Sieve analysis.

Column 17. Weight % coarse fragments 5 mm to 20 mm. Reported on < 75 mm base. Sieve analysis.

Column 18. Weight % coarse fragments 20 mm to 75 mm. Reported on < 75 mm base. Sieve analysis in field (at least 20 kg sampled needed) or calculated from volume estimates.

Column 19. Weight % particles and fragments 0.1 mm to 75 mm. Reported on < 75 mm base. Sieve analysis and/or estimates of > 20 mm fraction. Used to distinguish loamy and silty particle size classes (see p. 384, Soil Taxonomy).

Column 20. Weight % fragments > 2 mm. Reported on whole soil base. Includes fragments from 2 mm to 250 mm in size. Calculated from sieve analysis and volume estimates. Used to convert analysis on < 2 mm base to whole soil base by formula:

datum whole soil = datum < 2 mm x [1-(col. 20/100)].

Coarse fragments assumed diluents in this equation.

Tier 2

SAMPLE NO.	HZN NO.	-1- ORGN C 6A1C	-2- TOTAL N 6B1B	-3- EXTR P 6S1A	-4- TOTAL S 6H3A	-5- DITH-CIT EXTRACTABLE FE 6C2B	-6- AL 6G7A	-7- MN 6D2A	-8- (RATIO/CLAY) CEC 8D1	-9- 15 BAR 8D1	-10- (ATTERBERG) LIMITS LL 4F1	-11- PI 4F	-12- (BULK DENSITY) FIELD MOIST 4A3A	-13- 1/3 BAR 4A1D	-14- OVEN DRY 4A1H	-15- COLE WHOLE SOIL 4D1	-16- (WATER CONTENT) FIELD MOIST 4B4	-17- 1/10 BAR 4B1C	-18- 1/3 BAR 4B1C	-19- 15 BAR 4B2	-20- WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT	<0.4MM	<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
78 781	1	1.57	0.143						0.71	0.33	49	25		1.29	1.55	0.063			25.8	16.2	0.12

General. Unless otherwise noted, analyses are reported on < 2 mm base.

Column 1. % organic carbon. Wet combustion analysis (Walkley-Black). Multiply % organic carbon by 1.7 to estimate organic matter.

Column 2. % total nitrogen. Kjeldahl digestion analysis. Carbon/nitrogen ratios ≅ 10-12 in mollic epipedons. Higher ratios may indicate a nitrogen immobilization problem.

Column 3. % total extractable phosphorous. Perchloric acid digestion. Presently not determined at NSSL.

Column 4. % total sulfur. Leco ignition, KIO_3 titration. Used to assess potential acidity in sulfidic soils or mine spoils.

Column 5. % iron. Dithionite-citrate extractable (Fe DI-CI). Commonly called "free iron." Used in spodic horizon criteria.

Column 6. % aluminum. Dithionite-citrate extractable (Al DI-CI). Used in spodic horizon criteria.

Column 7. % manganese. Dithionite-citrate extractable.

Column 8. CEC-7/clay ratio. Ratio of CEC-7 (Tier 3, col. 9) to total clay (Tier 1, col. 4). Related to activity of clay fraction.

Column 9. 15-bar/clay ratio. Ratio of 15-bar water (Tier 2, col. 19) to total clay (Tier 1, col. 4). If clay > 10% and if organic carbon/clay (Tier 2, col. 1/Tier 1, col. 4) is < 0.1, ratio should be between 0.3 and 0.5. Ratios > 0.6 may indicate a dispersion problem. See p. 384, footnote 1, Soil Taxonomy.

Column 10. Liquid limit reported on < 0.4 mm base. Used in Unified and AASHO engineering classifications.

Column 11. Plasticity index reported on < 0.4 mm base. Calculated by liquid limit (col. 10) minus plastic limit. Used in Unified and AASHO engineering classifications.

Column 12. Bulk density at field moisture content g/cc (dry wt./moist vol.). Measured on natural fabric clod.

Column 13. Bulk density at 1/3-bar or 1/10-bar moisture content g/cc (dry wt./moist vol.). Measured on natural fabric clod. Used on SCS-SOILS-5. 1/10 bar run on sandy soils that have 15-bar moisture (tier 2, col. 19) < 5% throughout.

Column 14. Ovendry bulk density g/cc (dry wt/dry vol.). Measured on natural fabric clod.

Column 15. COLE. Coefficient Of Linear Extensibility whole soil base. Calculated from increase in bulk density between moist (tier 2, col. 13) and ovendry conditions (tier 2, col. 14). Used in determining shrink-swell potential for SCS-SOILS-5 or total potential linear extensibility for vertic subgroups. Total potential extensibility equals horizon thickness in cm x COLE: summed for each horizon to the depth in question (assumes no large cracks between air-dryness and 1/3-bar moisture and that coarse fragments are diluents).

Column 16. Weight % field moisture content (wt. H_2O/dry wt. soil x 100).

Column 17. Weight % moisture content at 1/10-bar tension. Calculated from water retained in natural fabric clods for loamy and clayey soils and from water in < 2 mm sample for sandy soils. Used to represent field capacity for sandy soils.

Column 18. Weight % moisture content at 1/3-bar tension. Calculated from water retained in natural fabric clods. Used to represent field capacity for loamy and clayey soils.

Column 19. Weight % moisture content at 15-bar tension. Calculated from water retained in < 2 mm soil sample. Represents the wilting point.

Column 20. Water Retention Difference (WRD) Reported as cm of water per cm depth of soil. Volume fraction for whole soil of water between 15 bar and an upper limit, usually 1/3 bar but 1/10 bar for sandy soils. After adjustment for salts (tier 4, col. 11 salt sheet) and root exfoliation, WRD provides estimate of Available Water Capacity (AWC).

Tier 3

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
										ACID											
		(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - -	-CEC	- - -)	AL	-BASE	SAT-	CO3 AS	RES.			(- - -	-PH	- - -)
		CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS				CACL2	H2O
SAMPLE	HZN	5B4A	5B4A	5B4A	5B4A	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM				.01M	
NO.	NO.	6N2B	6Q2D	6P2B	6Q2B		6H2B	6G1K	5A3A	5A8A	5A3B	5G1	5C3	5C1	6H1B	8E1				8C1E	8C1A
		<- - -	- - -	- - -	- - -	-MEQ /	100 G	- - -	- - -	- - -	- - ->	<- - -	- - -PCT	- - -	->					1:2	1:1
781793	3	TR	—	—	—	TR	11.7	2.2	11.7	6.9	2.2	100	TR	TR		23000				8.2	8.3
										SALT											
		(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC-	-)	EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - -	-PH	- - -)
		CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	
SAMPLE	HZN	5B4A	5B4A	5B4A	5B4A	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
NO.	NO.	6N2B	6Q2D	6P2B	6Q2B		6H2B		5A3A	5A6A	5D2	5E	5C3	5C1	6H1B		6F1C	6F1C	8C1B	8C1E	
		<- - -	- - -	- - -	- - -	-MEQ /	100 G	- - -	- - -	- - -	->		<- -PCT-	>	<-	-PCT	->	<- -PCT	->	1:2	
78 781	1		5.3	0.1	1.1					35.3		TR	TR			1			7.7		

General: The NSSL has acid and salt data sheet formats. The first two tiers are the same for each format, but tiers 3 and 4 differ. All analysis on tier 3 are reported on the < 2 mm base. Columns 1 through 4 are bases extractable in normal ammonium acetate (N NH_4OAc) at pH 7 (CEC-7).

Column 1. NH_4OAc extractable calcium (Ca) meq/100 g. Note that Ca is not reported for horizon 1 salt sheet because the sample is calcareous. NH_4OAc dissolves and extracts Ca from carbonates, gypsum, and other soluble salts. Commonly used as soil test for Ca. Convert to kg/Ha = Ca meq/100/g x 20 x thickness in cm x bulk density (tier 2, col. 13) x [1-(Vol. > 2 mm/100)].

Column 2. NH_4OAc extractable magnesium (Mg) meq/100 g. Commonly used as soil test for Mg. Convert to kg/ha = Mg meq/100g x 12 x thickness (cm) x bulk density (tier 2, col. 13) x [1-(Vol. > 2 mm/100)]

Column 3. NH_4OAc extractable sodium (Na) meq/100 g.

Column 4. NH_4OAc extractable potassium (K) meq/100 g. Common soil test for K. Convert to kg/ha = K meq/100 g x 39 x thickness (cm) x bulk density (tier 2, col. 13) x [1-(Vol. > 2 mm/100)]

Column 5. Sum of bases (Ca + Mg + Na + K) extractable by N NH_4OAc (Cols. 1+2+3+4)

Column 6. Extractable acidity measured at pH 8.2 meq/100 g.

Column 7. Normal potassium chloride (KCl) extractable aluminum (Al) meq/100 g (acid sheet only; blank on salt sheet). Normally little present if pH > 5 (col. 20).

Column 8. Cation Exchange Capacity at pH 8.2 (CEC-8.2). Calculated by summing NH_4OAc extractable bases (col. 5) and extractable acidity (col. 6). Not reported on salt sheet for horizons with carbonates or soluble salts.

Column 9. CEC at pH 7 (CEC-7). Measured by retention of ammonium by soil at pH 7.

Column 10. Acid sheet. Bases plus Al (CEC-unbuffered). Calculated by summing NH_4OAc extractable bases (col. 5) and KCl extractable Al (col. 7). Commonly called effective CEC of acid soils.

Column 10. Salt sheet. Exchangeable Sodium Percentage (ESP). Calculated by dividing extractable Na (col. 3) by CEC-7 (col. 9) and multiplying by 100. Extractable Na is adjusted for soluble Na (Tier 4, col. 3) if present. NH_4OAc will extract both exchangeable and soluble Na. Calculated, Exchangeable Na = Extractable Na meq/100g - [(soluble Na meq/l)(SP-Tier 4, col. 10 salt sheet)÷1000]. Used as natric horizon criteria.

Column 11. Acid sheet. % aluminum saturation. Calculated by dividing KCl extractable Al (col. 7) by bases plus Al (col. 10) and multiplying by 100. Considered root limiting if ≥ 60%.

Column 11. Salt sheet. Sodium Absorption Ratio (SAR). SAR = Na (Tier 4, col. 3)/$\sqrt{Ca + Mg/2}$ (tier 4, cols. 1+2). Criteria for natric horizon and used in assessing salinity problems. Set up to assess quality of irrigation water.

Column 12. % base saturation, sum of cations. Calculated by dividing sum of bases (col. 5) by CEC-8.2 (col. 8) and multiplying by 100. Used in most alfic-ultic separations in Soil Taxonomy.

Column 13. % base saturation, NH_4OAc. Calculated by dividing sum of bases (col. 5) by CEC-7 (col. 9) and multiplying by 100. Used in mollic, umbric, and eutro-dystro breaks in Soil Taxonomy.

Column 14. % calcium carbonate equivalent. Carbonates of Ca + Mg analyzed. Expressed as $CaCO_3$ equivalent. Used to assess calcic horizons and mineralogy class.

Column 15. Resistivity ohms/cm. Determined on saturated paste. Used to determine potential hazard for corrosion of uncoated steel.

Column 16. Salt sheet. % $CaSO_4$ as gypsum < 2 mm base. Used to determine potential hazard for corrosion of concrete, also to assess gypsic horizons and mineralogy class.

Column 17. Salt sheet. % $CaSO_4$ as gypsum < 20 mm base. Used in mineralogy class--see Taxonomy p. 387.

Column 18. Acid sheet. pH 1:1 N KCl or NaF pH. KCl pH used as indicator of net negative charge. Commonly 1 unit less than pH in 1:1 soil-water suspension. NaF pH > 10 indicates presence of structually weak Al associated with allophane, organic matter, or halloysite.

Column 18. Salt sheet. pH of saturated paste.

Column 19. pH in 1:2 soil-0.01 M calcium chloride ($CaCl_2$) suspension. Used to eliminate possible seasonable variations in pH. Normally about 0.5 units below the 1:1 soil-water pH (col. 20) but may be greater for acid soils. Relates somewhat with base saturation when BS > 60%; ie, if $CaCl_2$ pH is 6.0, NH_4OAc base saturation is commonly > 75%; if pH is > 7.5, the soil is normally saturated with bases. Used in reaction classes--see Soil Taxonomy pp. 388, 390.

Column 20. pH in 1:1 soil-water suspension. Normally varies according to season of the year.

Tier 4

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

ACID

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -BA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A <- PCT OF <2MM->	FE 6C5A	AL 6G5A	FE+AL FE+AL (- -DIVIDED BY- -) DI-CI PCT FE+AL CLAY	AL+C PCT CLAY	INDEX OF ACCUM		(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -) (- -DTA - -) 7A2B 7A2B 7A2B 7A2B 7A3 7A3 <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->	TOTAL RES 7B1A	DOM WEATH 7B1A
781791	1		1.1	0.2	0.6	0.1		167			
781792	2	1.8	0.6	0.5	0.4	0.1	0.2	304			

SALT

SAMPLE NO.	HZN NO.	(- - - - - - - -WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - -) CA 6N1B <- - - - - - - - - -MEQ / LITER - - - - - - - - ->	MG 6O1B	NA 6P1B	K 6Q1B	CO3 6I1B	HCO3 6J1B	CL 6K1C	SO4 6L1C	NO3 6M1C	H2O 8A <- -PCT ->	TOTAL SALTS EST. 8A1A 8D5	ELEC. COND. 8N8OS /CM	(- - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -) (- - - - X-RAY - - - -) (- -DTA - -) (- - - - - <2U - - - -) (- -<2U - -) 7A2B 7A2B 7A2B 7A2B 7A3 7A3 <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->	TOTAL RES 7B1A	DOM WEATH 7B1A
78 784	4	24.0	14.5	0.7	0.3		1.2	TR	41.4		58.0	0.1	2.80	BY 3 BY 3 KK 3 CL 1 KK1B		

General. The first 12 columns of the acid and salt data sheets differ and are discussed separately. All analyses in tier 4 except mineralogy are reported on the < 2 mm base. Clay mineralogy is reported on total clay base unless otherwise noted. Grain counts are on base of fraction(s) specified in heading.

ACID

Column 1. % sodium pyrophosphate (0.1 M $Na_4P_2O_7$) extractable carbon (C-pyro). Used in spodic horizon criteria with < 0.1% Fe-Pyro (col. 2).

Column 2. % sodium pyrophosphate extractable iron (Fe-pyro). Used in spodic horizon criteria. Usually considered to be iron associated with organic matter.

Column 3. Sodium pyrophosphate extractable aluminum (Al-pyro). Used in spodic horizon criteria.

Column 4. Pyrophosphate Fe+Al/dithionite citrate Fe+Al ratio. Calculated by dividing Fe-Pyro + Al-pyro (cols. 2+3) by Fe DI-CI + Al DI-CI (tier 2, cols. 5+6). Used in spodic horizon criteria.

Column 5. Pyrophosphate Fe+Al/clay ratio. Calculated by dividing Fe-pyro + Al-pyro (cols. 2+3) by % clay (tier 1, col. 4). Used in spodic horizon criteria.

Column 6. Pyrophosphate Al plus carbon/clay ratio. Calculated by dividing C-pyro + Al-pyro (cols. 1+3) by % clay (tier 1, col. 4). Used when column 2 < 0.1.

Column 7. Index of accumulation of spodic horizon. Calculated by subtracting 1/2 clay % (tier 1, col. 4) from CEC-8.2 (tier 3, col. 8) and multiplying by thickness (cm) of subhorizon. Total index is sum of all subhorizons of spodic horizon. See Soil Taxonomy p. 32 for limits of spodic horizon.

SALT

Column 1-9 are soluble cations and anions (salts) in a water extract from a saturated soil paste.

Column 1. Water soluble Ca meq/l.

Column 2. Water soluble Mg meq/l.

Column 3. Water soluble Na meq/l.

Column 4. Water soluble K meq/l.

Column 5. Water soluble carbonate (CO_3) meq/l. pH (Tier 3, col. 20) must be $\geq$ 9 in order to have carbonate anion.

Column 6. Water soluble bicarbonate (HCO_3) meq/l.

Column 7. Water soluble chloride (Cl) meq/l.

Column 8. Water soluble sulfate (SO_4) meq/l. Used along with gypsum (Tier 3, cols. 16 & 17 salt sheet) in estimating potential corrosivity of concrete.

Column 9. Water soluble nitrate (NO_3) meq/l.

Column 10. Weight % water content of saturated paste (Saturation Percentage--SP). Used to convert from meq/l (cols. 1-9 salt sheet) to meq/100g. Datum meq/100g = (Datum meq/l)(SP)/1000.

Column 11. % total estimated soluble salts in soil. Calculated from conductivity (EC, col. 12 salt sheet) of saturation extract. Total salt meq/l = -4.2333 + 12.2347 (EC, col. 12 salt sheet) + 0.0580 $(EC)^2$ - 0.0003 $(EC)^3$. Total salt % = total salt meq/l x 0.00064 SP (col. 10 salt sheet).

Column 12. Electrical conductivity (EC) of saturation extract mmho/cm. Used as a measure of salinity.

BOTH ACID AND SALT DATA SHEETS

Columns 13-16. Relative amounts of clay minerals. 1--trace, 2--small, 3--moderate, 4--abundant, 5--dominant, 6--indeterminate.

Columns 17-18. Quantitative amounts of clay minerals in percent (Differential Thermal Analysis--DTA).

Column 19. % total resistant minerals. Optical count of minerals in dominant fraction (silt or sand). Is used to assess family mineralogy class.

Column 20. % dominant weatherable mineral in fraction(s) indicated.

(1)

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL INTERPRETATIONS RECORD

A	B	C	D	F	E	G	H	I	J	K
FOOTNOTE			ESTIMATED SOIL PROPERTIES							
DEPTH (IN)	USDA TEXTURE	UNIFIED	AASHO	FRACT. > 3 IN. (PCT)	PERCENT OF MATERIAL LESS THAN 3 IN. PASSING SIEVE 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX

L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
DEPTH (IN)	CLAY (PCT OF <2MM)	MOIST BULK DENSITY (G/CM³)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (pH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
SAME DEPTH AS ABOVE													

*Column A. Thickness in in--layer or zone. See tier 1, col. 1. Convert cm to in-in = cm/2.54
Example--pedon 2, Ap, 0-10 cm = 0-4 in.

Column B. USDA texture. See tier 1, cols. 4-6 and 11-15 and vol. estimates of coarse fragments in description.
Example--pedon 2, 0-10 cm, silty clay.

Column C. Unified engineering classification. See "Guide for Interpreting Engineering Uses of Soils" (GIEUS).
See cols. F, G, H, I, J, K.
Example--pedon 2, 0-10 cm = CH

Column D. AASHO engineering classification. See GIEUS and Cols. F, G, H, I, J, K
Example--pedon 2, 0-10 cm = A-7-6.

Column E. Fraction > 3 inches (75 mm) calculated from data in tier 1
% > 3 inches = col. 20 - [(cols. 16 + 17 + 18)(100 - col. 20)/100 - (cols. 16 + 17 + 18)]
Example--pedon 1, 10-23 cm.
% > 3 inches = 61 - [(6 + 16 + 31)(100 - 61)/100 - (6 + 16 + 31)] = 61 - [(53)(39)/(100-53)] =
61 - [2067.47] = 61 - 44 = 17%

Column F. Percent passing #4 sieve (material < - 5 mm) calculate from data in tier 1
% passing #4 = [100 - (col. 17 + 18)]
Example--pedon 1, 0-10 cm.
% passing #4 = [100 - (2 + 35)] = [100 - 37] = 63%

Column G. % passing #10 sieve (material < 2 mm). Calculate from data in tier 1.
% passing #10 = [100 - (cols. 16 + 17 + 18)]
Example--pedon 1, 0-10 cm.
% passing #10 = [100 - (1 + 2 + 35)] = [100 - 38] = 62%.

Column H. % passing #40 sieve (material < 0.42 mm) estimate using data in tier 1.
% passing #40 = col. G - [(cols. 14 + 15)(col. G/100)]
Example--pedon 1, 0-10 cm.
% passing #40 = 52 - [(4.7 + 4.0)(62/100)] = [(8.7)(0.62)] = 62-5 = 57%

Column I. % passing #200 sieve (material < 0.074 mm) calculate using data in tier 1.
% passing #200 sieve = (col. G/100) [(col. 4 + 5) + (col. 11/2)]
Example--pedon 1, 0-10 cm
% passing #200 sieve = (62/100) [(13.2 + 54.2) + (9.6/2)] = (0.62) [(67.4)
+ (4.8)] = 0.62 (72.2) = 45%

Column J. Liquid limit (LL). See tier 2, col. 10
Example--pedon 2, 0-10 cm, LL = 52.

Column K. Plasticity index (PI). See tier 2, col. 11.
Example--pedon 2, 0-10 cm, PI = 27

Column L. Same as col. A.

Column M. Percent clay. See tier 1, col. 4
Example--pedon 2, 0-10 cm % clay = 45.8%

Column N. Moist bulk density. See tier 2, col. 13.
Example--pedon 2, 0-10 cm, bulk density = 1.15 g/cc

Column O. Permeability in inches/hour of layer.

Column P. Available water capacity (AWC). Estimate from WRD (tier 2, col. 20). WRD must be adjusted to rooting depth and restrictions and for salts. If no root restrictions or salts WRD minimum estimater of AWC.
Example--pedon 2, 0-10 cm layer minimum AWC = 0.15.

Column Q. Soil reaction (pH). See tier 3, col. 20
Example--pedon 1, 0-10 cm reaction = 5.1.

Column R. Salinity. Based on EC (tier 4, col. 12, salt sheet). See GIEUS for classes.
Example--pedon 2, 23-46 cm EC = 2.8 rating = low.

Column S. Shrink-swell potential. Based on COLE (tier 2, col. 15). See GIEUS for classes.
Example--pedon 2, 0-10 cm COLE = 0.077 rating = high.

Column T. K factor--values assigned by series. Can estimate from Wischmeier nomograph.

Column U. T factor--values assigned by series.

Column V. Wind erodibility group. See Technical Guide

Column W. Organic matter. Calculate by multiplying % organic carbon (tier 2, col. 1) x 1.7.
Example--pedon 1, 0-10 cm % organic matter = 4.35 x 1.7 = 7.4%.

Column X. Corrosivity uncoated steel. Based on Resistivity (tier 3, col. 15) or acidity (tier 3, col. 6). See GIEUS for classes.
Example--pedon 1, 63-122 cm zone acidity = 7.6 meq/100 g. Resistivity = 29,000. Rating = low.

Column Y. Corrosivity concrete. Based on soluble sulfate (tier 4, col. 8, salt sheet) or % gypsum (tier 3, col. 16 + 17, salt sheet), and pH (tier 3, col. 20). See GIEUS for classes.
SO_4 ppm = SO_4 meq/l x sp (tier 4, col. 10, salt sheet) x 0.48.
Example--pedon 2, 81-140 cm. SO_4 ppm = 90 x 7.9 x 0.48 = 3412 ppm or moderate rating.
Gypsum is partially soluble in water and contributes 30 meq/l SO_4. If the soil contains > 1% gypsum, it has a potential source of > 7,000 ppm SO_4. Therefore, rating may have to be adjusted for presence of gypsum.

* Form 5 will most likely be converted to metric system within 1980. For purpose of comparison to data sheet, depths are listed in cm.

Example Pedon 1 ACID SHEET

SAMPLED AS: LOAMY-SKELETAL, MIXED, FRIGID FRAGIOCHEPT

S 77HN-031 -001 SAMPLE NOS. 78P 552 - 556 DATE JULY 1979

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

COOK AND ST. LOUIS COUNTIES

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002 (1)	TOTAL SILT .002 -.05 (2)	TOTAL SAND .05 -2 (3)	TOTAL FINE CLAY LT .0002 (4)	CLAY CO3 LT .002 (5)	SILT FINE .002 -.02 (6)	SILT COARSE .02 -.05 (7)	SAND VF .05 -.10 (8)	SAND F .10 -.25 (9)	SAND M .25 -.50 (10)	SAND C .5 -1 (11)	SAND VC 1 -2 (12)	COARSE FRACTIONS (MM) 2 -5 (13)	5 -20 (14)	20 -75 (15)	.1- 75 (16)	(>2MM) WT PCT OF WHOLE SOIL (17)
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM (3B1) ->				
78 552	1S	0- 10	A1	13.2	54.2	32.6			36.4	17.8	9.6	9.5	4.8	4.7	4.0	1	2	35	52	50
78 553	2S	10- 23	B21HI	19.5	42.6	37.9			28.2	14.4	7.1	8.8	4.9	7.3	9.8	6	16	31	67	61
78 554	3S	23- 38	B22HI	12.2	23.2	64.6			15.5	7.7	6.0	7.2	5.3	11.3	34.8	8	8	29	77	54
78 555	4S	38- 63	B3	8.8	40.5	50.7			35.9	14.6	12.0	11.9	6.3	8.9	11.6	5	9	30	66	52
78 556	5S	63-122	CX	12.7	41.4	45.9			31.1	10.3	10.3	10.0	5.8	8.6	11.2	8	12	27	66	61

SAMPLE NO.	HZN NO.	ORGN C (6A1C)	TOTAL N (6B1B)	EXTR P (6S1A)	TOTAL S (6B3A)	DITH-CIT EXTRACTABLE FE (6C2B)	AL (6G7A)	MN (6D2A)	CEC (8D1)	RATIO/CLAY 15 BAR (8D1)	ATTERBERG LIMITS LL (4F1)	PI (4F)	BULK DENSITY FIELD MOIST (4A3A)	1/3 BAR (4A1D)	OVEN DRY (4A1H)	COLE WHOLE SOIL (4D1)	WATER CONTENT FIELD MOIST (4B4)	1/10 BAR (4B1C)	1/3 BAR (4B1C)	15 BAR (4B2)	WRD WHOLE SOIL (4C1)
		<- - - - - - -PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
78 552	1	4.35	0.260			1.3	0.2		1.76	1.26				0.90						16.6	
78 553	2	2.27	0.150			0.9	0.7		1.05	0.72				1.04	1.18	0.026			35.3	14.1	0.14
78 554	3	1.21	0.077			2.0	0.7		0.98	0.74				1.20						9.0	
78 555	4	1.24	0.069			2.0	0.7		1.16	0.95				1.47	1.50	0.004			22.1	8.4	0.13
78 556	5	0.26	0.017			1.6	0.2		0.86	0.51				1.55	1.61	0.007			22.3	6.5	0.13

SAMPLE NO.	HZN NO.	NH4OAC EXTRACTABLE BASES CA (5B4A) (6H2E)	MG (5B4A) (6O2D)	NA (5B4A) (6P2B)	K (5B4A) (6Q2E)	SUM BASES (-MEQ / 100 G-)	ACID-ITY (6H2B)	EXTR AL (6G1E)	CEC SUM CATS (5A3A)	CEC NH4-OAC (5A8A)	BASES + AL (5A3B)	AL SAT (5G1)	BASE SUM (5C3)	SAT- NH4 OAC (5C1)	CO3 AS CACO3 <2MM (6E1B)	RES. OHMS /CM (8E1)	PH CACL2 .01M (8C1E) 1:2	PH H2O (8C1A) 1:1
		<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - ->						
78 552	1	8.3	2.2	—	0.5	11.0	19.7	1.3	30.7	23.2	12.3	11	36	47			4.3	5.1
78 553	2	2.9	0.8	--	0.2	3.9	25.5	3.2	29.4	20.4	7.1	45	13	19			4.4	5.1
78 554	3	0.6	0.1	--	TR	0.7	16.4	1.2	17.1	12.0	1.9	63	4	6			4.7	5.3
78 555	4	0.6	0.1	—	TR	0.7	17.4	1.4	18.1	10.2	2.1	67	4	7			4.8	5.3
78 556	5	4.7	1.3	TR	TR	6.0	7.6		13.6	10.9			44	55		29000	4.9	5.9

SAMPLE NO.	HZN NO.	SPODIC HORIZON CRITERIA NA PYROPHOSPHATE EXTRACTABLE C (6A4A)	FE (6C5A)	AL (6G5A)	FE+AL DI-CI FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	INDEX OF ACCUM	MINERALOGY CLAY X-RAY <2U (7A2B)	(7A2B)	(7A2B)	(7A2B)	DTA <2U (7A3)	(7A3)	TOTAL RES (7B1A)	DOM REACT (7B1A)
		<- PCT OF <2MM ->			(-DIVIDED BY-)				<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
78 552	1		0.2	0.1	0.2	TR		241								
78 553	2		0.9	0.4	0.8	0.1		255	VR 2	KK 1			KK15			
78 554	3		0.3	0.4	0.3	0.1		166								
78 555	4		0.2	0.4	0.2	0.1		342								
78 556	5		0.1	0.1	0.1	TR		440	VR 2	HI 1						

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 11.3 PCT .1-75MM 67.6. SPODIC HORIZON: INDEX OF ACCUMUL 0

ESTIMATED BULK DENSITY FOR LAYER 1, 3,

ANALYSES: S= ALL OD SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL VR VERMICULITE KK KAOLINITE HI MICA

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

Example Pedon 2 SALT SHEET

WAYDEN

SAMPLED AS: CLAYEY, MONTMORILLONITIC, (CALCAREOUS), FRIGID, SHALLOW TYPIC USTORTHENT

S 77ND-001 -008 SAMPLE NOS. 78P 775 - 780 DATE 6/29/79 379

UNSATURATED HYDRAULIC CONDUCTIVITY STUDY

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA, AND
NORTH DAKOTA AGRI. EXP. STA., FARGO, ND

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	SILT CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS (MM) WEIGHT 2 -5	5 -20	20 -75	.1-75	>2MM WT PCT OF WHOLE SOIL
				<- PCT OF <2MM (3A1)												<- PCT OF <75MM (3B1) ->				
78 775	1S	0- 10	AP	45.8	46.6	5.6			33.9	14.7	2.8	1.4	0.5	0.7	0.9	TR	--	--	3	TR
78 776	2S	10- 23	AC	52.4	45.9	1.7			35.2	10.7	0.7	0.3	0.3	0.3	--	TR	--	--	1	TR
78 777	3S	23- 46	C1	48.1	51.0	0.9			37.8	13.2	0.2	0.2	--	0.2	--	TR	--	--	TR	TR
78 778	4S	46- 56	CR1	49.9	50.0	0.1			41.8	8.2	--	0.1	--	--	--	TR	--	--	TR	TR
78 779	5S	56- 81	CR2	45.2	54.7	0.1			42.1	42.6	0.1	0.1	--	--	--	TR	--	--	TR	TR
78 780	6S	81-140	CR3	56.3	43.5	0.2			12.6	0.9	0.1	0.1	--	--	--	--	--	--	TR	--

SAMPLE NO.	HZN NO.	ORGN TOTAL C 6A1C	ORGN TOTAL N 6B1B	EXTR TOTAL P 6S1A	EXTR TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	15 BAR 8D1	ATTERBERG LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	WHOLE SOIL 4D1	COLE	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2	WRD WHOLE SOIL 4C1
		<- PCT OF <2MM									PCT <0.4MM		<- G/CC		->		CM/CM	<- PCT OF <2MM			->	GM/CM
78 775	1	1.42	0.144						0.82	0.37	52	27		1.17	1.46	0.077				27.9	17.1	0.13
78 776	2	0.58	0.068						0.73	0.34				1.48	1.83	0.073				26.9	17.7	0.14
78 777	3	0.22	0.038						0.76	0.36	60	36		1.47	1.76	0.062				24.9	17.4	0.11
78 778	4	0.16	0.034						0.73	0.37				1.53	1.85	0.065				24.3	18.6	0.09
78 779	5	0.13	0.025						0.74	0.37				1.59	1.86	0.054				23.4	16.9	0.10
78 780	6	0.12	0.030						0.49	0.35	58	34		1.55	1.73	0.037				25.6	19.8	0.09

SAMPLE NO.	HZN NO.	NH4OAC EXTRACTABLE BASES CA 5B4A 6N2B	MG 5B4A 6Q2D	NA 5B4A 6P2B	K 5B4A 6Q2B	SUM BASES	ACIDITY 6H2B	CEC SUM CATS 5A3A	CEC NH4-OAC 5A6A	EXCH NA 5D2 PCT	SAR 5E	BASE SATURATION SUM 5C3	BASE SATURATION NAOAC 5C1	CARBONATE AS CACO3 <2MM 6H1B	CARBONATE AS CACO3 <20MM	CASO4 AS GYPSUM <2MM 6F1C	CASO4 AS GYPSUM <20MM 6F1C	PH SAT PASTE 8C1B	PH CACL2 .01M 8C1E 1:2
		<- MEQ / 100 G										<- PCT- >		<- PCT ->		<- PCT ->			
78 775	1		6.5	0.1	1.3				37.5	TR	TR			2				7.7	
78 776	2		6.6	0.1	0.7				38.4	TR	TR			2				7.5	
78 777	3	28.0	7.6	0.1	0.6	36.3			36.6	TR	TR		99					7.5	
78 778	4	19.0	12.0	0.3	0.6	31.9			36.5	1	TR		87					7.7	
78 779	5	10.3	17.0	0.4	0.6	28.3			33.5		2		84					7.8	
78 780	6	5.0	15.3	0.5	0.5	21.3			27.5		5		77					7.5	

SAMPLE NO.	HZN NO.	WATER EXTRACTED FROM SATURATED PASTE CA 6N1B	MG 6Q1B	NA 6P1B	K 6Q1B	CO3 6I1B	HCO3 6J1B	CL 6K1C	SO4 6L1C	NO3 6M1C	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A1A	MINERALOGY X-RAY CLAY				DTA <20		DTA <20		TOTL. ANALYSIS K2O 6Q3A	FE 6C7A
		<- MEQ / LITER									<- PCT ->		MMHOS /CM	<- RELATIVE AMOUNTS ->				<- PCT					
78 775	1	4.4	1.5	0.4	0.4		3.1	TR	3.1		60.0	TR	0.60	MT 4	MI 3	KK 3	CL 2					2.0	4.6
78 776	2	25.9	7.3	0.5	0.3		1.6	TR	30.0		61.0	0.1	2.60										
78 777	3	34.4	9.3	0.7	0.4		1.4	0.1	34.2		57.0	0.1	2.80	MT 5	MI 3	KK 2	QZ 2					1.5	4.1
78 778	4	21.0	15.0	1.5	0.5		1.2	TR	47.6		68.0	0.1	3.00										
78 779	5	21.0	30.0	9.7	0.4		1.0	TR	61.2		71.0	0.2	4.20										
78 780	6	18.0	35.5	23.6	0.4		0.7	TR	90.0		79.0	0.3	5.50	MT 4	MI 3	KK 2	CL 2	KK13				2.7	4.6

FAMILY CONTROL SECTION: DEPTH 25- 46 PCT CLAY 48.1 PCT .1-75MM 0.7

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL MT MONTMORILL MI MICA KK KAOLINITE CL CHLORITE QZ QUARTZ

RELATIVE AMOUNT 6 INDEFERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

Example Pedon 1

Pedon Classification: Fragiochrept; loamy-skeletal, mixed, frigid
Series Classification: Same
Soil: Series not designated
Soil No.: S77MN-031-001
Location: Cook County, Minnesota SW¼, NE¼, NW¼, Sec. 7, T. 62 N., R. 2 E. about 50 feet north of curve in road, 1,190 feet south and 2,100 feet east of northwest section corner, about 9 miles north of Grand Marais.
Climate: Some characteristics of temperatures are: annual normal 36° F (2° C), winter normal 11° F (- 12° C), summer normal 63° F (16° C); some characteristics of precipitation are: mean annual 29 inches (74 cm.), June to September 12 inches (30 cm.), mean snowfall 65 inches (165 cm.)
Parent Material: Grayish brown loamy-skeletal till of the Rainy Lobe of the Late Wisconsin glaciation.
Physiography: Moraine.
Landscape Setting: Sampling site is on the upper part of a 3 percent southwest facing convex slope that is on the side of a ridge about 1,000 feet long and 150 feet wide. The elevation is about 1,600 feet. The local relief in this section is about 300 feet.
Vegetation: Mainly white spruce 3 to 14 inches d.b.h. with few aspen 2 to 3 inches d.b.h. Understory is mainly hazel
Drainage: Well drained.
Erosion: None
Permeability: Slow to moderately slow.
Ground water: Water table is probably perched above the fragipan for short periods.
Described by: R. Lewis October 13, 1977.
Sampled by: S. Holzhey, M. Hausbach, R. Turner, H. Finney, D. Grigal and J. Engen.

A1 78P552 0 to 10 cm. (0 to 4 inches). Black (10YR 2/1) cobbly loam; strong fine granular structure; very friable, slightly sticky, and nonplastic; few worm casts; many fine and very fine continuous pores; many very fine to coarse roots; about 15 percent coarse fragments; about 5-10 percent larger than 5 cm.; clear smooth boundary. (8 to 13 cm. thick)

A2 10 to 13 cm. (not sampled) (4 to 5 inches). Discontinuous horizon occupies about 10 percent of pedon; reddish gray (5YR 4/2) loam; moderate very fine and fine granular structure; friable, slightly sticky, and nonplastic; abrupt broken boundary. (2 to 5 cm. thick)

B21hir 78P553 10 to 23 cm. (4 to 9 inches). Dark reddish brown (5YR 3/3) cobbly loam; brown (7.5YR 5/4) dry; moderate very fine and fine granular structure; very friable, slightly sticky, nonplastic, and smeary; many fine and very fine discontinuous pores; many very fine to coarse roots; about 15 percent coarse fragments; about 5 to 10 percent are larger than 8 cm.; gradual wavy boundary. (10 to 20 cm. thick)

B22hir 78P554 23 to 38 cm. (9 to 15 inches). Dark reddish brown (5YR 3/4) cobbly loam; moderate fine granular; very friable, slightly sticky, nonplastic, and smeary; many fine and very fine discontinuous pores; many very fine to coarse roots; about 10 percent coarse fragments; about 5 to 10 percent are larger than 8 cm.; gradual wavy boundary. (10 to 20 cm. thick)

B3 78P555 38 to 63 cm. (15 to 25 inches). Discontinuous horizon occupying about 15 percent of pedon; brown (7.5YR 4/4) cobbly loam; moderate fine subangular blocky structure parting to moderate fine granular structure; friable, slightly sticky, nonplastic, and slightly smeary; common fine and very discontinuous pores; common fine and very fine vertical roots; about 15 percent coarse fragments; about 5 to 10 percent are larger than 8 cm.; clear wavy boundary. (0 to 25 cm. thick)

Cx 78P556 63 to 122 cm. (25 to 48 inches). Dark grayish brown (10YR 4/2) cobbly loam; weak medium and coarse platy structure; firm, and brittle; few very fine horizontal pores; few very fine and fine roots in upper part, dominantly between plates; about 45 percent coarse fragments; about 35 percent greater than 8 cm.

Remarks: Colors are for moist soil. Backhoe was used for the sampling pit. Lithology of rock fragments is mainly gabbro and basalt. Few "red rock" fragments.

Example Pedon 2

Soil Type: Wayden silty clay.
Sample No.: S77ND001-4 (FIPS)
Date: September 12, 1977.
Sampled by: M. Mausbach, F. Schroer, M. Meyer.
Described by: F. Wilhelm, G. Muckel, S. Ekart, E. Gamble.
Area: About 2 miles east and 2½ miles north of Reeder, Adams County.
Location: 300 feet east and 330 feet north of the southwest corner of the NW¼, Sec. 30, T131N, R98W.
Classification: Clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthent.
Vegetation: Summerfallow (spring wheat in 76).
Parent Material: Clayey shales of the Ft. Union (Tongue River) formation.
Physiography: Hilltop.
Relief: Convex, simple.
Slope: 2 percent.
Permeability: Slow (0.06 - 0.2 in./hr.).
Moisture: Moist throughout.
Drainage: Well drained.
Ground Water: >5 feet.
Erosion: Slight.
Aspect: Northeast.
Elevation: Approximately 2,900 feet.
Pedon Description: Wayden silty clay.

(Colors are for dry soil unless otherwise stated.)

Ap 0 to 10 cm. Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist: strong very fine granular structure; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; slight effervescence; abrupt smooth boundary.

AC 10 to 23 cm. Light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist: moderate very fine subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; tongues of Ap less than 5 mm thick; common irregularly shaped soft lime masses; slight effervescence; clear wavy boundary.

C1 23 to 46 cm. Pale yellow (5Y 7/3) silty clay with 30 percent shale fragments, olive (5Y 5/3) moist; moderate very fine subangular blocky and rock structure; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; common medium yellowish brown (10YR 5/6 moist) iron stains; common gypsum crystals; common pressure faces; tongues of Ap less than 5 mm thick; clear wavy boundary.

Cr1 46 to 56 cm. Pale yellow (5Y 7/3) clay shales, olive (5Y 5/3) moist; rock (fissile) structure; extremely hard, very firm, very sticky and very plastic; common very fine roots with most following fissures and cleavage planes; few very fine pores; common medium yellowish brown (10YR 5/8 moist) iron stains; few tongues less than 5 mm wide; common pressure faces; common gypsum crystals; clear wavy boundary.

Cr2 56 to 81 cm. Pale yellow (5Y 7/3) clay shales, olive (5Y 5/3) moist: rock (fissile) structure; extremely hard, very firm, very sticky and very plastic; few very fine roots following fissures and cleavage planes; few very fine pores; common medium dark brown (7.5Y 4/4 moist) iron stains; common gypsum crystals; common fine paleoroots;common pressure faces; gradual wavy boundary.

Cr3 81 to 140 cm. Light gray (5Y 7/1) clay shales, gray (5Y 5/1) moist; rock (fissile) structure; extremely hard, very firm, very sticky and very plastic; few very fine roots following fissures and cleavage planes; very few fine pores; common gypsum crystals; common fine paleoroots; few pressure faces.

Additional Notes

Large horizontal and vertical cleavage planes extend through the shales. Some are as large as 19 inches by 24 inches. These are coated with brown (10YR 4/3 moist) and some have up to 2 inches of weathered material along these planes. The rock structure size increases with depth. Lignite was encountered at a depth of 55 inches. Also, an Unsatruated Hydraulic conductivity study is being conducted at this site.

Appendix V

This appendix contains a supplemental data sheet for all of the pedons sampled.

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 001

SAMPLED AS:

S 83PN-325 -001 SAMPLE NOS. N3P2103 - 2110 DATE 11/30/83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

ECUADOR-SNSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT PASSING 3	2	3/2	1	3/4	3/8	4	10	40	200	PASSING 20	5	2	CUMULATIVE CURVE USDA 1.	.5	LESS THAN .25	.10	.05	FRACTIONS (<76MM) DIAMETERS (MM) AT 60	50	10	ATTERBERG LL	PI	GRADATION UNIFORMITY CU	CURVATURE CC
				<-----INCHES---->						<-MESH->				<-MICRONS->			<--------MM-------->					<--PERCENTILE-->			<-PCT>			
	1			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832103	1S	0- 8	AP	100	100	100	100	100	100	100	99	86	49	26	13	5	97	90	76	56	40	0.12	0.078	0.004			34.4	1.6
832104	2S	8- 18	A1	100	99	98	97	96	96	96	93	78	45	24	12	5	90	82	69	51	37	0.16	0.097	0.004			42.0	1.6
832105	3S	18- 29	A2	100	92	87	79	73	70	67	58	42	22	10	5	1	52	44	35	26	17	2.42	0.829	0.020			>100	0.5
832106	4S	29- 33	AC1	100	99	73	57	46	41	36	25	9	1	1	TR	TR	19	11	3	1		127.12	21.034	0.468			57.9	0.7
832107	5S	33- 45	BA11	100	99	97	95	94	94	94	93	82	54	31	16	6	91	85	75	60	45	0.10	0.063	0.003			33.5	1.2
832108	6S	45- 59	BA12	100	99	98	97	96	96	96	95	83	50	29	16	7	93	86	75	56	42	0.12	0.074	0.003			43.5	1.4
832109	7S	59- 72	BAC3	100	99	98	97	96	96	95	92	81	46	27	16	8	90	84	71	53	38	0.14	0.088	0.002			58.9	1.9
832110	8S	72- 81	BC2	100	99	98	97	96	96	95	93	81	44	23	13	6	91	85	70	51	36	0.15	0.096	0.003			44.5	2.0

SAMPLE NO.	HZN NO	(WHOLE SOIL) >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	2 <2	(MM) -75	75 -5	5 -2	2 <2	WHOLE SOIL 1/3 BAR	OVEN -DRY	MOIST	SATUR -ATED	UNIT WT SOIL 1/3 BAR	15 BAR	OVEN -DRY	MOIST	SATUR -ATED	G/CC WHOLE SOIL 1/3 BAR	15 BAR	OVEN -DRY	MOIST	SATUR -ATED	VOID RATIOS WHOLE SOIL	AT 1/3 BAR <2 MM
		<------PCT OF WHOLE SOIL------>								<--PCT OF <2MM-->																		
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50			
832103	1	1	--	--	1	--	TR	1	99	1	--	TR	1	99	1.40													
832104	2	7	--	--	7	4	TR	3	93	7	4	2	3	93	1.28	1.30	1.64	1.80	1.23	1.24	1.25	1.50	1.77	1.07	1.13			
832105	3	42	--	--	42	27	6	7	58	42	27	6	9	58	1.47	1.47	1.71	1.92	1.11	1.11	1.11	1.42	1.69	0.80	1.39			
832106	4	75	--	--	75	59	10	11	25	75	59	10	11	25	1.25													
832107	5	7	--	--	7	6	--	1	93	7	6	--	1	93	1.34	1.34	1.66	1.83	1.29	1.29	1.29	1.62	1.80	0.98	1.05			
832108	6	5	--	--	5	4	TR	1	95	5	4	TR	1	95	1.38	1.38	1.67	1.86	1.35	1.35	1.35	1.65	1.84	0.92	0.96			
832109	7	3	--	--	3	4	1	1	92	3	4	1	1	92	1.29	1.33	1.60	1.80	1.23	1.26	1.27	1.55	1.77	1.05	1.15			
832110	8	7	--	--	7	4	1	2	93	7	4	1	2	93	1.36	1.36	1.71	1.85	1.32	1.33	1.34	1.69	1.82	0.95	1.01			

SAMPLE NO.	HZN NO	(WHOLE SOIL) >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	(MM) 2- .05	.05- .002	.002 LT	POINTS	(G/CC)	(ATTERBERG) CLAY	(ATTERBERG) SUM SALTS	TO <2 MM FRACTION SAND OAC	SILT H2O	CLAY BAR	CLAY 15 BAR 1/3 BAR	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR TO 15 BAR OVEN -DRY	(IN/IN) -> 15 BAR OVEN -DRY	(WHOLE SOIL) <--IN/IN->	<2 MM
		<----------PCT OF WHOLE SOIL---------->																						
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832103	1	1	--	--	1	--	TR	1	99	15	11	3	45		4	6.43	2.20								
832104	2	8	--	--	8	2	23	1	97	27	15	2	25	26	13	7.13	2.12	1.48	0.100	0.3	0.5	0.3	0.5	0.17	0.18
832105	3	23	--	--	23	15	3	5	77	25	6	1	31	29		12.16	4.56	2.72						0.18	0.23
832106	4	63	--	--	63	45	3	9	37	20	1		17			13.50	3.13								
832107	5	4	--	--	4	3	--	1	96	24	20	9	17	12		2.11	1.44	0.92						0.25	0.26
832108	6	3	--	--	3	2	TR	1	97	28	11	4	19	23		2.21	1.40	0.85						0.21	0.2[illegible]
832109	7	4	--	--	4	2	1	1	96	26	14	4	20	31		1.55	1.26	1.01	0.120	0.3	1.0	0.4	1.1	0.20	0.21
832110	8	4	--	--	4	2	1	1	96	30	16	1	14	15		2.67	1.79	1.98	0.079	0.2	0.5	0.3	0.5	0.20	0.21

SAMPLE NO	HZN NO	(WHOLE SOIL) >2	75 -2	20 -2	2- .05	.05- .002	LT .002	VC	C	M	F	VF	C	F	VF	(FRACTIONS) CLAY	(PH) IN WATER	(PH) IN CACL2	(ELECTRICAL) SAND .05- 2	SILT .002- .05	CLAY LT .002	CEC CL2	(CUMULT. AMOUNTS) EXT. BASES	OUCT. OHMS	SALT MG/KG	IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY (WHL SOIL)
		<----PCT OF >2MM+SAND+SILT>						(------PCT OF SAND+SILT------)								(--PCT OF <2MM--)			(--PCT OF <2MM--)				(- - - - <2 MM- - - -)			(WHL SOIL)	
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100		
832103	1	1	1	1	62	37	5	2	7	15	22	17	15	22	5		FSL	54.2	35.4	8.9	5.2						
832104	2	7	7	3	59	33	5	4	9	15	20	16	15	21	5		FSL	60.7	34.3	5.0	6.0						
832105	3	43	43	15	42	15	1	10	18	16	17	16	12	15	3		SL	71.4	26.1	2.5	5.3						
832106	4	75	75	21	24	1	TR	24	34	30	7	1	2	2	1		COS	95.5	3.7	0.8	5.7						
832107	5	7	7	1	51	42	6	2	7	11	17	17	16	23	6		FSL	51.6	42.3	6.1	6.4						
832108	6	5	5	1	57	38	7	2	7	13	22	16	15	25	4		FSL	55.3	36.4	7.3	6.1						
832109	7	3	3	4	59	32	9	2	7	15	22	13	13	22	10		FSL	50.1	37.2	9.2	6.4						
832110	8	7	7	3	61	32	6	2	7	17	22	17	14	20	7		FSL	64.[illegible]	32.1	6.3	6.2						

SAMPLE	OP LOW	LOW DIP	CLAY	SAND	OC	S/C	W S/C	W OC	OP LOW	LOW DIP	S/C	W S/C	W OC
832103	0- 21	21 21	4.9	59.7	2.657	12.2	12.2	2.7	0- 21	11 13	12.2	12.2	2.7
832104	21- 47	40 19	5.0	60.7	2.339	12.1	12.2	2.5					

S U P P L E M E N T A R Y C H A R A C T E R I Z A T I O N D A T A

ECUADOR 002

SAMPLED AS:

S 93PN-325 -002 SAMPLE NOS. 83P2191 - 2195 DATE 11/30/83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

ECUADOR-SMSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/8 (6)	4 (7)	10 (8)	40 (9)	200 (10)	PASSING 20 (11)	5 (12)	2 (13)	USDA 1. (14)	.5 (15)	LESS THAN .25 (16)	.10 (17)	.05 (18)	DIAMETERS (MM) AT 60 (19)	50 (20)	10 (21)	ATTEN-BERG LL (22)	PI (23)	GRADATION OMI-PNTY CU (24)	CUR-VTUR CC (25)
				<-----INCHES---->						<-NUMBER->				<-MICRONS->			<--------MM------->							<-PCT>			
832191	1S	0- 21	A1	100	100	100	100	100	100	100	100	99	69	9	4	1	100	100	98	76	31	0.08	0.067	0.021			3.8	1.4
832192	2S	21- 35	A2	100	100	100	100	100	100	100	100	99	62	7	3	1	100	100	98	80	29	0.08	0.067	0.023			3.4	1.5
832193	3S	35- 43	A3	100	99	99	98	98	98	98	97	94	57	9	4	1	96	94	91	73	29	0.08	0.070	0.021			3.9	1.5
832194	4S	43- 47	2C	100	88	79	66	57	55	52	49	46	29	5	2	1	48	46	45	37	16	20.91	2.659	0.030			>100	--
832195	5S	47- 50	3R	FRACTIONS NOT DETERMINED																								

SAMPLE NO.	HZN NO	(WEIGHT WHOLE SOIL) >2 -UP (26)	250 -75 (27)	250 -2 (28)	75 -20 (29)	75 -5 (30)	20 -2 (31)	PRA (MM) -2 (32)	<2 (33)	CT <75 MM FRACTION 75 -2 (34)	75 -20 (35)	20 -5 (36)	5 -2 (37)	<2 (38)	(39)	WEIGHT WHOLE SOIL SOIL SURVEY 1/3 BAR (40)	ENGINEERING OVEN -DRY (41)	MOIST (42)	SATUR -ATED (43)	UNIT WEIGHT <2 MM FRACTION SOIL SURVEY 1/3 BAR (44)	ENGINEERING 15 BAR (45)	OVEN -DRY (46)	MOIST (47)	SATUR -ATED (48)	VOLUME G/CC WHOLE SOIL 1/3 BAR (49)	VOID RATIOS <2 MM (50)
832191	1	--	--	--	--	--	--	--	100	--	--	--	--	100		1.40	1.40	1.67	1.87	1.40	1.40	1.40	1.66	1.87	0.89	0.89
832192	2	TR	--	--	--	--	--	TR	100	--	--	--	TR	100		1.46	1.47	1.71	1.91	1.46	1.47	1.47	1.71	1.91	0.82	0.82
832193	3	3	--	--	3	2	TR	1	97	3	2	TR	1	97		1.44	1.46	1.77	1.90	1.41	1.43	1.43	1.75	1.88	0.84	0.88
832194	4	51	--	--	51	43	5	3	49	51	43	5	3	49		1.34	1.97	2.06	2.15	1.40	1.42	1.43	1.74	1.87	0.44	0.89

SAMPLE NO.	HZN NO	(VOLUME WHOLE SOIL) >2 -UP (51)	250 -75 (52)	250 -2 (53)	75 -20 (54)	75 -5 (55)	20 -2 (56)	PRA (MM) -2 (57)	<2 (58)	ACT 1/3 .05 (59)	BAR .002 (60)	1/3 .002 (61)	PORES 0 (62)	RAT P (63)	-IO (64)	(C/N) (65)	(WATER TO CLAY) <2 MM FRACTION PINE CLAY (66)	CATS SUM (67)	CATS NHA-OAC (67)	15 BAR H2O (68)	LE 1/3 BAR (69)	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR TO (IN/IN)-> 15 BAR (70)	OVEN -DRY (71)	<2 MM 15 BAR (72)	OVEN -DRY (73)	WHOLE SOIL <--IN/IN-> (74)	<2 MM (75)
832191	1	--	--	--	--	--	--	--	100	37	16		20	27	12			5.89	6.33	4.56						0.21	0.21
832192	2	TR	--	--	--	--	--	TR	100	39	15	1	20	25	14			3.56	6.70	4.70	0.200	0.2	0.2	0.2	0.2	0.18	0.18
832193	3	2	--	--	2	1	TR	1	98	36	15		13	33				12.00	9.22	5.89	0.556	0.5	0.5	0.5	0.5	0.26	0.26
832194	4	36	--	--	36	30	4	2	64	23	11		9	22				24.00	7.75	4.75	0.583	0.4	0.5	0.5	0.7	0.17	0.26

SAMPLE NO	HZN NO	(WEIGHT WHOLE SOIL) >2 (76)	75 -2 (77)	20 -2 (78)	2- .05 (79)	.05- .002 (80)	LT .002 (81)	(FRACTIONS-CLAY FRESS) VC (82)	C (83)	M (84)	F (85)	VF (86)	C (87)	F (88)	VF (89)	(TEXTURE) (DETERMINED IN FIELD) (90)	BY PSDA (91)	(PSD) SAND 2- .05 (92)	SILT .05- .002 (93)	CLAY LT .002 (94)	(PH) CA-CL2 .01M (95)	(ELECTRICAL) RES-IST. OHMS (96)	CON-DUCT. MMHOS (97)	(CUMULT. AMOUNTS) SALT MG/KG (98)	IN. OF H2O 1/3 BAR TO 15BAR AIRDRY (WHL SOIL) (99)	(100)
		PCT OF >2MM+SAND+SILT> (PCT OF SAND+SILT)														(<2 MM)		(PCT OF <2MM)			(<2 MM)					
832191	1			70	30	1		TR	2	23	45	22	8	1		VFSL		69.0	30.1	0.9	7.0					
832192	2			72	28	1		TR	2	18	52	22	6	1		LVFS		71.3	27.7	1.0	7.4					
832193	3	3	3	1	68	29	1	1	2	3	19	45	21	9	1	VFSL		69.7	29.4	0.9	7.6					
832194	4	51	51	4	33	15	1	3	3	3	17	43	22	10	1	VFSL		67.4	31.4	1.2	8.5					
832195	5																									

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832191	0-	53	40	40	0.9	69.0	0.602	76.7	76.7	0.6	0-	53	19	19	76.7	76.7	0.6

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 003

SAMPLED AS:

S 83FN-325 -003 SAMPLE # . 83P2200 - 2204 DATE 11/30/83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

ECUADOR-SMSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENTAGE PASSING 2 (1)	3/2 (2)	1 (3)	3/4 (4)	3/8 (5)	4 (6)	10 (7)	40 (8)	200 (9)	SIEVE 20 (10)	5 (11)	2 (12)	USDA 1. (13)	.5 (14)	LESS THAN .25 (15)	.10 (16)	.05 (17)	DIAMETERS(MM) AT 60 (18)	50 (19)	10 (20)	ATTERBERG LL (21)	PI (22)	GRADATION UNIFMTY CU (23)	CURVTURE CC (24)
				<-----INCHES---->					<-MICRONS->							<--------MM-------->					<--PERCENTILE-->			<-PCT>			
832200	1S	0- 6	A1	100	100	100	100	100	100	100	100	41	51	16	7	1	96	93	85	61	38	0.10	0.073	0.008			13.1	1.7
832201	2S	6- 21	A2	100	100	100	100	100	100	100	100	96	55	17	8	2	99	97	91	66	39	0.09	0.066	0.007			12.2	1.9
832202	3S	21- 39	A3	100	100	100	100	100	100	100	100	44	49	18	8	1	99	96	87	59	35	0.10	0.078	0.006			16.2	2.2
832203	4S	39- 54	B4	100	100	100	100	100	100	100	100	90	43	17	7	1	99	94	79	52	31	0.13	0.093	0.007			17.6	2.3
832204	5S	54- 69	2AB	100	100	100	100	100	100	100	100	97	66	29	13	2	100	99	93	77	50	0.07	0.050	0.004			16.2	1.7

SAMPLE NO	HZN NO	(WEIGHT PER WHOLE SOIL) >2 -UP	250 -75	250 -2	75 -20	75 -5	20 -2	5 <2	<75 MM FRACTION 75 -2	75 -20	20 -5	5 <2	(WEIGHT PER UNIT VOLUME G/CC) WHOLE SOIL 1/3 BAR	OVEN -DRY	ENGINEERING MOIST -ATED	<2 MM FRACTION SOIL 1/3 BAR	SURVEY OVEN -DRY	ENGINEERING MOIST -ATED	(VOID RATIOS) AT 1/3 BAR WHOLE SOIL	BAR <2 MM
		<------PCT OF WHOLE SOIL----->							<--PCT OF <75 MM->											
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
832200	1	TR	--	--	--	--	--	TR	100	--	--	--	TR	100		0.79	0.98	1.32	1.49	0.79	0.93	0.98	1.32	1.49	2.35	2.35
832201	2	--	--	--	--	--	--	--	100	--	--	--	--	100		1.13	1.22	1.56	1.70	1.13	1.20	1.22	1.56	1.70	1.35	1.35
832202	3	TR	--	--	--	--	--	TR	100	--	--	--	TR	100		1.25	1.31	1.60	1.78	1.25	1.30	1.31	1.60	1.78	1.12	1.12
832203	4	TR	--	--	--	--	--	TR	100	--	--	--	TR	100		1.27	1.32	1.59	1.79	1.27	1.31	1.32	1.59	1.79	1.09	1.09
832204	5	--	--	--	--	--	--	--	100	--	--	--	--	100		1.03	1.13	1.49	1.64	1.03	1.11	1.13	1.49	1.64	1.57	1.57

SAMPLE NO	HZN NO	(VOLUME WHOLE SOIL) >2 -UP	250 -75	250 -2	75 -20	75 -5	20 -2	5 <2	<75 MM FRACTION 2- .05	.05- .002	LT .002	POROS	RAT -IO	(C/N) RATIOS TO CLAY FINE CLAY	CLAY <2 MM FRACTION ---CEC--- SUM CATS	MH4- OAC	15 BAR H2O	LE 1/3 BAR	LINEAR EXTENSIBILITY <-1/5 BAR TO 15 BAR	WHOLE SOIL (IN/IN) OVEN -DRY	15 BAR	<2 MM OVEN -DRY	WHOLE SOIL <--IN/IN->	<2 MM
		<----------PCT OF WHOLE SOIL---------->																						
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832200	1	TR	--	--	--	--	--	TR	100	19	11		17	53	16		23.38	13.23	15.69	5.692	5.6	7.4	5.6	7.4	0.37	0.37
832201	2	--	--	--	--	--	--	--	100	26	16	1	14	43	14		11.27	5.43	5.87	1.733	2.0	2.6	2.0	2.6	0.33	0.33
832202	3	TR	--	--	--	--	--	TR	100	31	16	1	18	35			9.77	4.62	4.08	1.231	1.3	1.6	1.3	1.6	0.28	0.28
832203	4	TR	--	--	--	--	--	TR	100	33	14		20	32			13.38	7.00	5.08	1.625	1.0	1.3	1.0	1.3	0.26	0.26
832204	5	--	--	--	--	--	--	--	100	20	19	1	15	46			16.06	9.73	6.72	1.722	2.5	3.1	2.5	3.1	0.34	0.34

SAMPLE NO	HZN NO	(WEIGHT FRACTIONS-WHOLE SOIL) >2 -2	75 -2	20 -.05	2- .002	-CLAY FREE) LT .002	SANDS VC	C	M	F	VF	SILTS C	F	CL	AY	(-TEXTURE-) (DETERMINED BY FIELD)	(--PSA (MM)---) SAND 2- PSDA	.05-	SILT .002-	CLAY LT .002	(PH) CA- CL2	(-ELECTRICAL) RES- IST. OHMS	CON- DUCT. MMHOS	(CUMULT. AMOUNTS) SALT MG/ KG	IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY (WHL SOIL)
		PCT OF >2MM+SAND+SILT>					(------PCT OF SAND+SILT------)										(--<2 MM-)		(--PCT OF .2MM-)			(- - - - <2 MM- - - -)				
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
832200	1				63	37	1	4	3	8	25	23	22	15	1		VFSL	62.2	36.5	1.3	4.3					
832201	2				62	38	2	1	2	6	26	27	22	16	2		VFSL	60.9	37.7	1.5	5.3					
832202	3				66	34	1	1	3	9	29	24	16	17	1		VFSL	65.9	33.3	1.3	5.6					
832203	4				70	30	1	1	6	15	27	22	14	16	1		FSL	69.2	30.0	0.8	5.7					
832204	5				51	49	2		1	6	17	27	21	27	2		VFSL	50.3	47.4	1.8	5.8					

SAMPLE	UP LOW	LOW DIF	CLAY	SAND	OC	S/C	4 S/C	W OC	UP LOW	LOW DIF	S/C	4 S/C	W OC
832200	0- 15	15 15	1.3	62.2	7.826	47.8	47.8	7.8	0- 15	15 15	47.8	47.8	7.8
832201	15- 54	40 25	1.5	60.8	2.998	40.5	43.3	4.3	15- 54	11 3	40.5	46.6	7.0

S U P P L E M E N T A R Y C H A R A C T E R I Z A T I O N D A T A

ECUADOR 004

SAMPLED AS:

S 93PM-325 -004 SAMPLE NOS. 83P2119 - 2126 DATE 11/30/83

ECUADOR-SMSS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HOR-IZON	PERCENT 3	2	3/4	1	3/4	3/8	4	10	40	200	PASSING 20	5	2	USDA 1.	.5	.25	.10	.05	60	50	10	LL	PI	ONI-TY CU	CUR-VTUR CC
				<-----INCHES---->						<-MM->				<-MICRONS->			<-----MM----->					<--PERCENTILE-->			<-PCT>			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832119	1S	0- 9	A1	100	99	99	98	97	97	96	94	83	48	25	11	2	92	36	73	54	39	0.13	0.083	0.005			29.4	1.3
832120	2S	9- 18	A2	100	97	95	91	89	88	86	80	62	29	15	7	1	75	65	50	34	23	0.39	0.243	0.009			45.0	1.8
832121	3S	18- 25	2C1	100	80	80	68	60	55	50	41	17	2	1	1	TR	32	20	9	3		119.00	4.700	0.259			73.2	0.2
832122	4S	25- 33	2C2	100	89	81	69	61	53	45	34	12	1	1	1	TR	27	15	4	1		117.41	7.272	0.366			47.6	0.3
832123	5S	33- 59	2C3	100	83	72	55	43	36	23	19	7	1	TR	TR	TR	15	8	2	1	TR	28.62	22.490	0.599			47.8	1.9
832124	6S	59- 66	3A6	100	100	100	100	100	100	100	100	96	67	33	17	3	100	97	90	74	56	0.06	0.036	0.003			18.3	0.8
832125	7S	66- 75	3C4	100	100	100	100	100	100	99	94	82	62	37	17	4	97	94	86	68	54	0.07	0.040	0.003			21.5	0.7
832126	8S	75- 81	3C5	100	96	93	86	85	85	84	81	76	46	31	19	11	78	72	63	51	40	0.20	0.094	0.002			>100	0.9

SAMPLE NO	HZ NO	WEIGHT >2	250-UP	250-75	75-2	75-20	20-5	5-2	<2	<75 MM 75-2	75-20	20-5	5-2	<2	WHOLE SOIL 1/3 BAR OVEN-DRY	15 BAR	OVEN-DRY	MOIST	SATURATED	SOIL 1/3 BAR OVEN-DRY	15 BAR	OVEN-DRY	MOIST	SATURATED	AT 1/3 WHOLE SOIL	BAR <2 MM
		<------PCT OF WHOLE SOIL------>								<--PCT OF <75 MM-->																
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
832119	1	6	--	--	6	3	1	2	94	6	3	1	2	94		1.06	1.12	1.47	1.66	1.02	1.07	1.08	1.44	1.64	1.50	1.60
832120	2	20	--	--	20	11	3	6	80	20	11	3	6	80		1.16	1.21	1.51	1.72	1.02	1.06	1.07	1.40	1.64	1.28	1.60
832121	3	59	--	--	59	40	10	9	41	59	40	10	9	41		1.98										
832122	4	66	--	--	66	39	16	11	34	66	39	16	11	34		2.07										
832123	5	81	--	--	81	57	15	9	19	81	57	15	9	19		2.31										
832124	6	--	--	--	--	--	--	--	100	--	--	--	--	100		1.09	1.16	1.57	1.68	1.09	1.15	1.16	1.57	1.68	1.43	1.43
832125	7	2	--	--	2	--	1	1	96	2	--	1	1	98		1.10	1.18	1.57	1.69	1.09	1.16	1.17	1.56	1.68	1.41	1.43
832126	8	19	--	--	19	15	1	3	81	19	15	1	3	81		1.23	1.31	1.66	1.77	1.09	1.14	1.17	1.55	1.68	1.15	1.43

SAMPLE NO	HZ NO	VOL >2	250-UP	250-75	75-2	75-20	20-5	5-2	<2	2-.05	.05-.002	LT .002	BARS	POREs	RAT -15	(C/N)	FINE CLAY	RATIOS TO <2 MM FRACTION SUM CATS	MM4-DAC	CLAY 15 BAR H2O	LE 1/3 BAR	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR TO 15 BAR	OVEN-DRY	15 BAR	OVEN-DRY	WHOLE SOIL <--IN/IN-->	<2 MM
		<----------PCT OF WHOLE SOIL---------->																									
		51	52	53	54	55	56	57	58	59	60	61	62	63	64		65	66	67	68	69	70	71	72	73	74	75
832119	1	2	--	--	2	1	1	1	98	22	15	1	13	41	1.			14.90	7.24	5.95	0.305	1.5	1.9	1.6	1.9	0.29	0.29
832120	2	9	--	--	9	5	1	1	91	25	9	1	21	35	13			11.50	5.28	4.43	0.869	1.1	1.4	1.3	1.6	0.27	0.29
832121	3	45	--	--	45	38	3	7	55	23	1		25		15			6.00	2.67								
832122	4	52	--	--	52	31	13	3	49	26			22					2.78	2.11								
832123	5	71	--	--	71	50	13	3	29	16			13					2.22	1.56								
832124	6	--	--	--	--	--	--	--	100	19	22	1	11	43				4.74	2.63	2.84	0.677	1.9	2.1	1.9	2.1	0.38	0.39
832125	7	1	--	--	1	--	1	1	99	18	21	1	11	47				4.14	2.50	2.69	0.667	1.9	2.4	2.1	2.4	0.36	0.37
832126	8	9	--	--	9	7	1	1	91	19	19	1	11	43				1.23	0.48	1.33	0.185	1.3	2.1	1.5	2.4	0.25	0.27

SAMPLE NO	HZ NO	WEIGHT >2	75-2	20-2	.05-.002	LT .002	VC	C	M	F	VF	C	F	AT	(-TEXTURE--) DETERMINED BY FIELD	USDA	(--SOIL SIZE (MM)---) 1-.05	.05-.002	SILT LT .002	CLAY	(PH) CA-CL2	(-ELECTRICAL) RES-IST. OHMS	CON-DUCT. MMHOS	(COMPLT. AMOUNTS) SALT MG/KG	IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY (WHL SOIL)
		PCT OF >2MM+SAND+SILT>					(------PCT OF SAND+SILT------)								(--<2 MM-)		(--PCT OF <2MM-)				(- - - - <2 MM- - - -)					
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
832119	1	6	6	1	56	38	2	2	7	14	21	17	15	25	2		FSL	51.8	39.1	2.1	5.9					
832120	2	20	20	9	58	22	1	7	12	12	21	14	19	17	2		SL	71.1	27.1	1.8	5.6					
832121	3	59	59	19	40	1	TR	22	30	25	16	4	1	2	1		COS	96.4	3.0	0.6	5.6					
832122	4	66	66	27	33	1	TR	20	37	31	9	1		2	1		COS	97.9	1.7	0.9	5.3					
832123	5	81	81	24	19	TR	TR	21	36	33	7	1		1	1		COS	97.8	1.3	0.9	5.3					
832124	6				45	55	3	TR	2	7	17	19	14	36	3		SIL	93.5	5.4	3.1	5.7					
832125	7	2	2	2	46	52	4	1	3	8	18	15	19	36	4		SIL	95.0	5.4	3.6	5.7					
832126	8	21	21	4	46	33	12	8	8	13	18	15	13	30	15		L	59.3	36.7	13.0	5.8					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832119	0-	24	24	24	2.1	58.8	4.263	28.3	29.0	4.3	0-	24	16	08	28.0	29.0	4.3
832120	24-	45	40	16	1.8	71.1	2.513	39.5	32.6	3.6							

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 005

SAMPLED AS:

S 83EN-325 -005 SAMPLE NOS. 83P2151 - 2158 DATE 11/30/83

ECUADOR-SMSS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT PASSING 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/8 (6)	4 (7)	10 (8)	40 (9)	200 (10)	20 MICRONS (11)	5 (12)	2 (13)	CUMULATIVE USDA LESS THAN .5 (14)	.25 (15)	.10 (16)	.05 (17)	60 MM (18)	DIAMETERS (MM) AT 50 (19)	10 (20)	ATTERBERG LIMITS PI (21)	(22)	(23)	GRADATION UNIFORMITY CU (24)	CONVATURE CC (25)
832151	1S	0- 3	A	100	99	99	98	97	97	97	97	97	71	41	19	4	97	97	96	78	59	0.05	0.032	0.003			17.9	0.7
832152	2S	3- 11	BW1	100	100	100	100	100	100	100	100	100	69	36	15	2	100	100	99	79	55	0.06	0.039	0.003			16.7	0.9
832153	3S	11- 21	BW2	100	99	99	98	97	97	97	97	96	58	26	12	2	97	97	93	68	43	0.08	0.061	0.004			18.5	1.7
832154	4S	21- 31	2AB	100	100	100	100	100	100	100	100	99	51	19	8	1	100	100	96	62	37	0.09	0.071	0.006			15.1	2.1
832155	5S	31- 39	2C1	100	100	100	100	100	100	100	100	99	56	24	10	1	100	100	96	67	43	0.08	0.062	0.005			17.2	1.8
832156	6S	39- 43	2C6	100	100	100	100	100	100	100	100	99	59	27	12	2	100	100	97	69	46	0.08	0.056	0.004			18.2	1.7
832157	7S	43- 56	3AB	100	100	100	100	100	100	100	100	99	52	22	10	2	100	100	96	63	38	0.09	0.070	0.005			18.4	2.2
832158	8S	56- 75	3C2	PRACTIONS								NOT		DETERMINED														

SAMPLE NO	HZN NO	(WHOLE SOIL) >2 250 -UP (26)	250 -75 (27)	75 -2 (28)	75 -20 (29)	20 -5 (30)	5 -2 (31)	2 (32)	(33)	<75 MM PRACTION 75 -2 (34)	75 -20 (35)	20 -5 (36)	5 -2 (37)	2 (38)	(39)	(WEIGHT PER UNIT VOLUME G/CC) WHOLE SOIL SOIL SURVEY 1/3 BAR (40)	OVEN -DRY (41)	ENGINEERING MOIST (42)	SATURATED (43)	<2 MM PRACTION SOIL SURVEY 1/3 BAR (44)	15 BAR (45)	ENGINEERING OVEN -DRY (46)	MOIST (47)	SATURATED (48)	(VOID RATIOS) WHOLE SOIL (49)	AT 1/3 BAR <2 MM (50)
832151	1	3	--	--	3	3	--	--	97	3	3	--	--	97		0.92	0.96	1.31	1.51	0.90	0.90	0.94	1.29	1.50	2.23	2.31
832152	2	--	--	--	--	--	--	--	100	--	--	--	--	100		0.73	0.84	1.14	1.45	0.73	0.82	0.84	1.14	1.45	2.63	2.63
832153	3	3	--	--	3	3	--	TR	97	3	3	--	TR	97		0.86	0.97	1.35	1.54	0.34	0.93	0.95	1.33	1.52	2.08	2.15
832154	4	--	--	--	--	--	--	--	100	--	--	--	--	100		0.85	0.95	1.30	1.53	0.85	0.93	0.95	1.30	1.53	2.12	2.12
832155	5	--	--	--	--	--	--	--	100	--	--	--	--	100		0.88	0.97	1.32	1.55	0.88	0.96	0.97	1.32	1.55	2.01	2.01
832156	6	--	--	--	--	--	--	--	100	--	--	--	--	100		1.05	1.09	1.40	1.65	1.05	1.08	1.09	1.39	1.65	1.52	1.52
832157	7	--	--	--	--	--	--	--	100	--	--	--	--	100		0.77	0.89	1.22	1.48	0.77	0.86	0.89	1.22	1.48	2.44	2.44
832158	8	--	--	--	--	--	--	--	100	--	--	--	--	100		0.60	0.85	1.07	1.37	0.60	0.81	0.85	1.07	1.37	3.42	3.42

SAMPLE NO	HZN NO	(WHOLE SOIL) >2 250 -UP (51)	250 -75 (52)	75 -2 (53)	75 -20 (54)	20 -5 (55)	5 -2 (56)	2 (57)	(58)	<2 MM PRACTION .05- .002 (59)	.05- .002 (60)	LT .002 (61)	POREs (62)	BAR (63)	(C/N) (64)	(RATIOS TO <2 MM PRACTION) PLANT CLAY (65)	CEC SUM CATS (66)	CEC 15 BAR NH4-OAC (67)	CEC 15 BAR H2O (68)	LE 1/3 BAR (69)	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR TO (IN/IN)-> (70)	OVEN -DRY (71)	<2 MM 15 BAR (72)	<2 MM OVEN -DRY (73)	(WRD) WHOLE SOIL <--IN/IN-> (74)	<2 MM (75)
832151	1	1	--	--	1	1	--	--	99	12	17	1	20	49	12		15.30	5.90	5.28	1.375	3.9	5.4	4.0	5.5	0.32	0.32
832152	2	--	--	--	--	--	--	--	100	12	15	1	31	41	11		13.35	6.00	6.50	2.400	4.0	4.8	4.0	4.8	0.31	0.31
832153	3	1	--	--	1	1	--	TR	99	18	13	1	19	49	11		16.53	7.4[illegible]	3.24	2.471	3.4	4.1	3.5	4.2	0.37	0.38
832154	4	--	--	--	--	--	--	--	100	20	11		23	45			20.58	8.25	10.17	3.167	3.0	3.8	3.0	3.8	0.35	0.35
832155	5	--	--	--	--	--	--	--	100	19	14		23	44			16.64	6.[illegible]2	10.00	3.000	2.9	3.3	2.9	3.3	0.34	0.34
832156	6	--	--	--	--	--	--	--	100	21	18	1	25	35			9.74	3.53	5.12	3.634	0.9	1.3	0.9	1.3	0.23	0.23
832157	7	--	--	--	--	--	--	--	100	19	10	1	25	45			16.77	4.45	9.50	2.227	3.3	4.9	3.8	4.9	0.29	0.29
832158	8	--	--	--	--	--	--	--	100	19	4		30	47							10.5	12.3	10.5	12.3	0.35	0.35

SAMPLE NO	HZN NO	(WHOLE SOIL) >2 75 -2 (76)	20 -2 (77)	2- .05 (78)	.05- .002 (79)	LT .002 (80)	(<2 MM PRACTION) VC (81)	C (82)	M (83)	F (84)	VF (85)	C (86)	F (87)	VF (88)	(89)	(TEXTURE) (DETERMINED IN FIELD) (90)	(PSDA) (91)	(PSD A(MM)) 2- .05 (92)	.05- .002 (93)	CLAY LT .002 (94)	(PH) CA-CL2 (95)	(ELECTRICAL) RESIST. OHMS (96)	CONDUCT. MMHOS (97)	(CUMULT. AMOUNTS) SALT MG/KG (98)	IN. OF H2O 1/3 BAR TO (WHL SOIL) (99)	AIRDRY (100)
832151	1	3	3		40	57	4		TR	1	19	21	19	40	9		SIL	39.4	56.6	4.0	5.7					
832152	2				46	54	2			1	21	24	20	34	2		SIL	45.0	53.0	2.0	5.6					
832153	3	3	3		55	42	2		TR	4	26	26	17	26	2		VFSL	55.8	42.5	1.7	5.4					
832154	4				64	36	1			4	34	26	13	18	1		FSL	63.2	35.6	1.2	5.3					
832155	5				58	42	1		TR	4	30	24	19	24	1		VFSL	57.2	41.7	1.1	5.4					
832156	6				55	45	2			3	29	23	20	26	2		VFSL	53.3	44.3	1.9	5.3					
832157	7				64	36	2		TR	4	34	25	16	20	2		FSL	62.3	35.5	2.2	5.5					
832158	8				84	16		TR	4	15	44	21	3	7			LFS	83.3	16.2	—	5.2					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	N S/C	N OC
832151	0- 7	7	7	7	4.0	39.4	5.713	9.8	9.8	5.7
832152	7- 27	27	20	20	2.0	45.0	2.682	22.5	19.2	3.5
832153	27- 54	40	13	13	1.7	55.8	2.227	32.8	23.6	3.1

	UP	LOW	LOW	DIF	S/C	N S/C	N OC
	0- 7	7	7	7	9.8	9.8	5.7
	7- 27	19	11	11	22.5	17.6	3.9

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 006

SAMPLED AS:

S 83PN-325 -006 SAMPLE NOS. 832065 - 2070 DATE 11/30/83

ECUADOR-SMSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT PASSING 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/8 (6)	4 (7)	10 (8)	40 (9)	200 (10)	SIEVE 20 (11)	5 (12)	2 (13)	CUMULATIVE USDA (14)	LESS THAN 1. (15)	.5 (16)	.25 (17)	.10 (18)	.05 (19)	DIAMETERS (MM) AT 60 (20)	50 (21)	10 (22)	ATTERBERG LIMITS LL (23)	PI (24)	GRADATION UNIFORMITY CU (25)	CURVATURE CC (26)
				<-----INCHES----->						<-MESH->				<-MICRONS->			<-------MM------->						<--PERCENTILE-->			<-PCT->			
832065	1S	0- 4	A1	100	99	99	98	97	97	97	97	90	63	37	17	5	96	92	84	69	54	0.07	0.041	0.003			22.6	0.8
832066	2S	4- 22	A2	100	99	99	98	97	97	97	97	90	62	37	17	4	96	92	84	68	53	0.07	0.043	0.003			22.3	0.7
832067	3S	22- 31	A3	100	88	80	68	60	59	57	50	42	27	16	7	1	46	43	38	30	23	19.00	2.000	0.008			>100	0.1
832068	4S	31- 46	2A91	100	99	99	98	99	98	98	98	92	65	38	17	3	97	94	87	71	56	0.06	0.036	0.003			18.9	0.7
832069	5S	46- 59	2A92	100	99	99	98	97	97	97	96	91	67	36	16	2	95	92	87	74	55	0.06	0.039	0.003			17.7	0.9
832070	6S	59- 73	2AB3	100	96	94	90	87	87	86	85	70	56	28	12	2	83	79	74	63	45	0.09	0.060	0.004			21.9	1.4

SAMPLE NO	HZ NO	(WEIGHT PERCENT OF WHOLE SOIL) >2 (26)	250-2 (27)	250-75 (28)	75-2 (29)	75-20 (30)	20-5 (31)	5-2 (32)	<2 (33)	<75 MM FRACTION 75-2 (34)	75-20 (35)	20-5 (36)	5-2 (37)	<2 (38)	(39)	(WEIGHT PER UNIT VOLUME G/CC) WHOLE SOIL 1/3 BAR (40)	OVEN-DRY (41)	MOIST (42)	SATURATED (43)	<2 MM FRACTION 1/3 BAR (44)	15 BAR (45)	OVEN-DRY (46)	MOIST (47)	SATURATED (48)	(VOID RATIOS) WHOLE SOIL AT 1/3 BAR (49)	<2 MM (50)
832065	1	3	--	--	3	3	--	TR	97	3	3	--	TR	97		0.81	0.94	1.26	1.50	0.79	0.89	0.92	1.24	1.49	2.27	2.35
832066	2	3	--	--	3	3	--	TR	97	3	3	--	TR	97		1.00	1.09	1.46	1.62	0.98	1.04	1.07	1.44	1.61	1.65	1.70
832067	3	50	--	--	50	40	3	7	50	50	40	3	7	50		1.31	1.41	1.66	1.82	0.87	0.94	0.96	1.35	1.54	1.02	2.05
832068	4	2	--	--	2	2	--	--	98	2	2	--	--	98		1.08	1.17	1.57	1.67	1.06	1.13	1.15	1.54	1.66	1.45	1.50
832069	5	4	--	--	4	3	--	1	96	4	3	--	1	96		1.03	1.15	1.53	1.64	1.01	1.10	1.13	1.52	1.63	1.57	1.62
832070	6	15	--	--	15	13	1	1	85	15	13	1	1	85		1.02	1.20	1.52	1.64	0.92	1.05	1.09	1.45	1.57	1.60	1.88

SAMPLE NO	HZ NO	(VOLUME PERCENT OF WHOLE SOIL) >2 (51)	250-2 (52)	250-75 (53)	75-2 (54)	75-20 (55)	20-5 (56)	5-2 (57)	<2 (58)	(PERCENT OF WHOLE SOIL) 2-.05 (59)	.05-.002 (60)	LE .002 (61)	PORES D (62)	F (63)	(C/N) RAT -IO (64)	(RATIOS TO <2 MM FRACTION) FINE CLAY (65)	CEC-SUM CATS (66)	CEC-NH4-OAC (67)	15 BAR H2O (68)	LE 1/3 BAR (69)	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR (70)	15 BAR OVEN-DRY (71)	<2 MM (IN/IN) 15 BAR (72)	OVEN-DRY (73)	(WRD) WHOLE SOIL <--IN/IN-> (74)	<2 MM (75)
832065	1	1	--	--	1	1	--	TR	99	13	15	1	24	45	15		7.19	4.55	3.30	1.106	4.0	5.1	4.1	5.2	0.32	0.33
832066	2	1	--	--	1	1	--	TR	99	17	19	1	16	46	15		4.97	5.55	4.18	0.789	2.0	2.9	2.0	3.0	0.30	0.30
832067	3	25	--	--	25	20	1	3	75	13	11	1	16	55		0.04	13.83	9.03	6.42	1.375	2.0	2.5	2.6	3.3	0.26	0.34
832068	4	1	--	--	1	1	--	--	99	17	21	1	10	49		0.03	10.75	6.56	4.34	0.875	2.1	2.7	2.2	2.8	0.33	0.34
832069	5	2	--	--	2	1	--	1	98	16	21	1	11	50			14.35	9.46	6.00	1.462	2.8	3.7	2.9	3.8	0.35	0.36
832070	6	6	--	--	6	5	1	1	94	15	16	1	11	50			14.33	10.50	6.46	2.231	4.4	5.6	4.5	5.8	0.35	0.37

SAMPLE NO	HZ NO	(WHOLE SOIL PERCENT OF WHOLE SOIL) >2 (76)	75-2 (77)	20-2 (78)	.05-.05 (79)	LT .002 (80)	.002 (81)	<2 MM FRACTION SANDS VC (82)	C (83)	M (84)	F (85)	VF (86)	SILTS C (87)	F (88)	CL (89)	(SATURATED PASTE) PH (90)	(<2 MM) (91)	(SAND .05-2 MM) (92)	(SILT .002-.05 MM) (93)	(CLAY LT .002 MM) (94)	(OM) CA-CO2 (95)	(ELECTRICAL RESIST. OHMS (96)	CONDUCT. MMHOS (97)	(CUMULT. AMOUNTS) SALT MG/KG (98)	IN. OF H2O 1/3 BAR TO WHOLE SOIL (99)	<2 MM (100)
832065	1	3	3		45	52	5	1	4	9	17	16	18	35	5		SIL	44.6	50.7	4.7	4.7					
832066	2	3	3		46	51	4	1	4	9	17	16	17	35	4		SIL	45.5	50.7	3.8	4.9					
832067	3	51	51	10	27	23	1	7	6	10	17	14	16	30	2		FSL	53.0	44.6	2.4	5.1					
832068	4	2	2		43	55	3	1	3	7	17	16	19	37	3		SIL	42.5	54.2	3.2	5.4					
832069	5	4	4	1	42	54	3	1	3	5	14	20	21	36	3		SIL	42.2	54.2	2.6	5.3					
832070	6	15	15	2	41	44	2	2	5	6	13	22	21	31	3		SIL	46.9	50.5	2.6	5.2					

SAMPLE	UP LOW	LOW DEP	DEP DEP	CLAY	SAND	OC	S/C	W S/C	W OC	UP LOW	LOW DEP	DEP DEP	S/C	W S/C	W OC
832065	0- 10	10	10	4.7	44.6	6.217	9.5	9.5	6.2	0- 10	10	10	9.5	9.5	6.2
832066	10- 55	40	30	3.8	45.5	5.681	12.0	11.4	5.8	10- 55	40	8	12.0	10.6	6.0

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 007

SAMPLED AS:

S 83PN-325 -007 SAMPLE NOS. 83P2077 - 2083 DATE 11/30/83

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

ECUADOR-SMSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/8 (6)	4 (7)	10 (8)	40 (9)	200 (10)	SIEVE 20 (11)	5 (12)	2 (13)	USDA (14)	LESS THAN .5 (15)	.25 (16)	.10 (17)	.05 (18)	CUMULATIVE CURVE FRACTIONS (<76MM) DIAMETERS (MM) AT 60 (19)	50 (20)	10 (21)	ATTERBERG LIMIT PT (22)	(23)	GRADATION UNIFORMITY CU (24)	CURVATURE CC (25)
832077	1S	0- 14	A	100	94	91	85	81	81	80	78	61	27	12	6	2	75	65	47	31	22	0.41	0.283	0.012			34.1	1.8
832078	2S	14- 26	AC	100	94	91	85	81	81	80	77	58	25	12	6	2	73	62	44	29	21	0.46	0.314	0.012			38.6	2.1
832079	3S	26- 35	2C1	100	92	86	78	72	72	71	68	49	21	15	7	2	63	53	37	23	19	0.80	0.443	0.009			92.9	3.6
832080	4S	35- 42	3C2	100	100	100	100	100	100	100	99	90	53	28	16	8	97	93	81	60	44	0.10	0.065	0.003			38.0	1.9
832081	5S	42- 56	3AB	100	100	100	100	100	100	100	100	93	56	31	19	11	99	96	84	62	47	0.09	0.057	0.002			58.7	2.1
832082	6S	56- 73	3ACJ	100	100	100	100	100	100	100	99	84	38	16	10	5	97	89	67	43	31	0.19	0.130	0.005			40.0	2.5
832083	7S	73- 81	4C	100	100	100	100	100	100	100	95	72	34	12	7	3	87	76	61	41	25	0.24	0.153	0.011			21.0	1.4

SAMPLE NO	HZ NO	WEIGHT >2 (26)	250-UP (27)	250-75 (28)	75-2 (29)	75-20 (30)	20-5 (31)	5-2 (32)	<2 (33)	<75 MM FRACTION 75-2 (34)	75-20 (35)	20-5 (36)	5-2 (37)	<2 (38)	(39)	WEIGHT PER WHOLE SOIL SOIL 1/3 BAR (40)	SURVEY OVEN-DRY (41)	ENGINEERING MOIST (42)	SATURATED (43)	UNIT WT <2 MM FRACTION SOIL 1/3 BAR (44)	SURVEY 15 BAR (45)	VOLUME OVEN-DRY (46)	ENGINEERING MOIST (47)	SATURATED (48)	G/CC	VOID RATIOS WHOLE SOIL (49)	AT 1/3 BAR <2 MM (50)
832077	1	22	--	--	22	19	1	2	78	22	19	1	2	78		1.40	1.41	1.61	1.87	1.24	1.25	1.25	1.48	1.77	0.89	1.14
832078	2	23	--	--	23	19	1	3	77	23	19	1	3	77		1.40	1.43	1.60	1.87	1.23	1.26	1.26	1.46	1.77	0.89	1.15
832079	3	32	--	--	32	23	1	3	68	32	23	1	3	68		1.39	1.52	1.65	1.87	1.14	1.26	1.27	1.46	1.71	0.91	1.32
832080	4	1	--	--	1	--	TR	1	99	1	--	TR	1	99		1.29	1.39	1.64	1.80	1.28	1.36	1.38	1.63	1.80	1.05	1.07
832081	5	TR	--	--	--	--	--	TR	100	--	--	--	TR	100		1.38	1.43	1.64	1.86	1.38	1.41	1.43	1.65	1.86	0.92	0.92
832082	6	1	--	--	1	--	--	1	99	1	--	--	1	99		1.56	1.67	1.85	1.98	1.57	1.64	1.66	1.84	1.98	0.68	0.69
832083	7	5	--	--	5	--	TR	5	95	5	--	TR	5	95		1.45	1.54	1.73	1.90	1.42	1.48	1.51	1.71	1.88	0.83	0.87

SAMPLE NO	HZ NO	VOLUME >2 (51)	250-UP (52)	250-75 (53)	75-2 (54)	75-20 (55)	20-5 (56)	5-2 (57)	<2 (58)	<2 MM FRACTION 2-.05 (59)	.05-.002 (60)	LT .002 (61)	BORES (62)	P (63)	C/N (64)	RATIO FINE CLAY (65)	CLAY SUM CATS (66)	15 BAR H2O (67)	LE 1/3 BAR (68)	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR TO (IN/IN)-> 15 BAR (69)	OVEN-DRY (70)	15 BAR (71)	OVEN-DRY (72)	WHOLE SOIL <2 MM (IN/IN) (73)	(74)	(75)
832077	1	12	--	--	12	10	1	1	88	30	10	1	26	21	10		4.13	2.00	1.67	0.125	0.2	0.2	0.3	0.3	0.17	0.19
832078	2	12	--	--	12	10	1	2	88	30	10	1	27	20	11		2.92	1.83	1.46	0.333	0.7	0.7	0.8	0.8	0.16	0.18
832079	3	17	--	--	17	15	1	2	83	25	9	1	22	26	37		1.70	1.19	1.00	1.370	2.8	3.0	3.4	3.7	0.24	0.29
832080	4	1	--	--	1	--	TR	1	99	27	13	4	16	35			1.21	0.97	0.82	0.329	2.0	2.5	2.0	2.5	0.27	0.27
832081	5	TR	--	--	--	--	--	TR	100	23	19	6	22	26			1.12	0.88	0.68	0.106	0.7	1.2	0.7	1.2	0.16	0.16
832082	6	1	--	--	1	--	--	1	99	41	15	3	13	27			1.16	1.03	0.94	0.399	1.5	1.9	1.5	1.9	0.20	0.20
832083	7	3	--	--	3	--	TR	3	97	38	12	2	17	28			2.15	1.87	1.10	0.677	1.9	2.0	1.9	2.1	0.19	0.19

SAMPLE NO	HZ NO	WEIGHT >2 (76)	75-2 (77)	20-.05 (78)	.05-.002 (79)	LT .002 (80)	VC (81)	C (82)	M (83)	F (84)	VF (85)	C (86)	F (87)	VF (88)	(89)	(TEXTURE) DETERMINED IN FIELD (90)	USDA (91)	SAND .05-2 (92)	SILT .002-.05 (93)	CLAY .002 (94)	CA-CL2 .01M (95)	RES-IST. OHMS (96)	CON-DUCT. MMHOS (97)	SALT MG/KG (98)	(CUMULT. AMOUNTS) IN. OF H2O 1/3 BAR TO 15BAR (99)	AIRDRY (WHL SOIL) (100)
832077	1	22	22	3	58	20	2	3	13	25	21	12	12	14	2		SL	72.4	25.2	2.4	7.6					
832078	2	23	23	4	57	19	2	5	15	24	20	11	11	14	2		LS	72.9	24.7	2.4	7.0					
832079	3	33	33	4	50	18	2	7	16	24	21	6	7	19	3		SL	71.5	25.8	2.7	6.8					
832080	4	1	1	1	60	39	8	2	5	13	23	17	11	22	3		FSL	55.7	36.7	7.6	6.9					
832081	5				60	40	13	1	3	14	24	17	17	23	13		FSL	53.0	35.7	11.3	7.3					
832082	6	1	1	1	72	27	5	2	0	23	26	13	13	14	5		SL	69.1	25.9	5.0	7.4					
832083	7	5	5	5	72	23	3	8	13	16	22	17	14	10	3		LS	73.4	23.5	3.1	7.9					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832077	0-	35	35	35	2.4	72.4	0.611	30.2	30.2	0.6	0-	35	14	18	30.2	30.2	0.6
832078	35-	67	40	5	2.4	72.9	0.491	30.4	30.2	0.6							

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 008

SAMPLED AS:

S 83PN-325 -008 SAMPLE NOS. 83P2210 - 2214 DATE 11/30/83

ECUADOR-SHSS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HOR-IZON	PERCENT 1	PERCENT 2	PERCENT 3/2	PERCENT 1	PERCENT 3/4	PERCENT 3/8	PERCENT 4	PERCENT 10	PERCENT 40	PERCENT 200	SIEVE 20	SIEVE 5	SIEVE 2	USDA .1	USDA .5	LESS .25	THAN .10	THAN .05	DIAMETERS(MM) 60	50	10	ATTERBERG LL	ATTERBERG PI	UNIFORMITY CU	CURVATURE CC
				<-----IN CHES----->						<-MICRONS->				<-------MM------->								<--PERCENTILE-->			<-PCT>			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832210	1S	0- 10	A1	100	99	99	98	97	97	97	97	82	41	20	9	2	95	86	68	47	33	0.18	0.114	0.006			31.6	1.7
832211	2S	10- 25	A2	100	99	99	98	97	97	97	95	78	43	21	9	2	91	81	66	48	35	0.18	0.110	0.005			34.3	1.3
832212	3S	25- 36	A3	100	83	80	63	60	56	52	47	34	18	8	4	1	43	36	28	21	14	19.00	3.339	0.026			>100	0.2
832213	4S	36- 53	2C	100	84	73	57	46	39	32	23	11	1	1	TR	TR	19	13	4	1		127.12	21.034	0.398			66.1	1.4
832214	5S	53- 72	3A3	100	100	100	100	100	100	100	100	92	51	34	15	2	99	94	85	67	51	0.07	0.046	0.004			20.4	0.9

SAMPLE NO	HZN NO	>2 -UP	250 -75	250 -2	75 -20	75 -5	20 -2	5 -2	<2	<75 -20	<75 -5	20 -2	5 -2	<2	WEIGHT SOIL 1/3 BAR	WEIGHT OVEN-DRY	WEIGHT ENGINEERING MOIST	WEIGHT ENGINEERING SATUR-ATED	UNIT WEIGHT SOIL 1/3 BAR	UNIT WEIGHT 15 BAR	VOLUME <2 MM SOIL SURVEY 1/3 BAR	VOLUME <2 MM SOIL SURVEY OVEN-DRY	VOLUME <2 MM ENGINEERING MOIST	VOLUME <2 MM ENGINEERING SATUR-ATED	G/CC WHOLE SOIL	VOID RATIOS AT 1/3 BAR WHOLE SOIL	VOID RATIOS BAR <2 MM
		<------PCT OF WHOLE SOIL----->								<--PCT OF <75 MM->																	
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
832210	1	3	--	--	3	3	--	TR	97	3	3	--	TR	97		0.90	1.05	1.33	1.56	0.88	0.97	1.03	1.31	1.55	1.94	2.01	
832211	2	5	--	--	5	3	TR	2	95	5	3	TR	2	95		1.00	1.14	1.39	1.62	0.97	1.05	1.11	1.36	1.60	1.65	1.73	
832212	3	53	--	--	53	40	8	5	47	53	40	8	5	47		1.32	1.42	1.65	1.82	0.84	0.91	0.93	1.29	1.52	1.01	2.15	
832213	4	77	--	--	77	54	14	9	23	77	54	14	9	23		2.23											
832214	5	--	--	--	--	--	--	--	100	--	--	--	--	100		1.05	1.15	1.49	1.65	1.05	1.13	1.15	1.49	1.65	1.52	1.52	

SAMPLE NO	HZN NO	>2 -UP	250 -75	250 -2	75 -20	75 -5	20 -2	5	2- .05	.05- .002	LT .002	BAR	POWER	MAT -15	(C/N)	(C/N) CLAY	RATIOS SUM CATS	TO <2 MM FRACTION CEC-NH4-OAC	15 BAR H2O	LE 1/3 BAR	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR 15 BAR	TO (IN/IN) OVEN-DRY 1/3 BAR	15 BAR	OVEN-DRY	<2 MM WHOLE SOIL <--IN/IN->	<2 MM
		<----------PCT OF WHOLE SOIL---------->																								
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832210	1	1	--	--	1	1	--	TR	99	22	13	1	23	43	17		15.35	8.30	8.87	2.348	3.2	5.3	3.3	5.4	0.25	0.25
832211	2	2	--	--	2	1	TR	1	99	22	13	1	23	19	7		20.76	10.71	11.41	2.706	2.6	4.5	2.7	4.6	0.20	0.21
832212	3	26	--	--	26	20	4	2	74	16	7		17	33			31.32	16.55	15.55	3.182	1.7	2.5	2.7	3.5	0.23	0.31
832213	4	65	--	--	65	45	12	3	35	19	1		16				23.50	14.00								
832214	5	--	--	--	--	--	--	--	100	14	49	1	16	44			12.40	7.30	5.55	1.550	2.5	3.1	2.5	3.1	0.33	0.33

SAMPLE NO	HZN NO	>2 -2	75 -2	20 -2	2- .05	.05- .002	LT .002	VC	C	M	F	VF	C	F	VF	CL	(-TEXTURE--) DETERMINED IN FIELD	BY PSDA	(--PSDA(MM)---) SAND 2- .05	SILT .05- .002	CLAY LT .002	(PH) CACL2 .01M	(-ELECTRICAL) RES-ISTI. OHMS	CONDUCT. MMHOS	(CUMULT. AMOUNTS) SALT MG/KG	IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY (WHL SOIL)
		PCT OF >2MM+SAND+SILT>						(------PCT OF SAND+SILT------)									(--<2 MM-)		(--PCT OF <2MM-)			(- - - - <2 MM- - - -)					
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91		92	93	94	95	96	97	98	99	100
832210	1	3	3		65	31	2	3	9	19	22	15	14	18	2		FSL		66.0	31.7	2.3	4.7					
832211	2	5	5	2	61	34	2	4	11	16	19	14	15	21	2		SL		62.3	35.5	1.7	5.1					
832212	3	53	53	13	33	14	1	9	15	17	16	15	12	17	1		SL		70.3	28.6	1.1	5.0					
832213	4	77	77	23	22	1	TR	16	20	39	12	1	2	3	TR		COS		95.4	4.4	0.2	5.3					
832214	5				49	51	2	1	5	9	18	16	18	33	2		FSL		48.5	44.5	2.0	5.2					

SAMPLE	UP LOW	LOW DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP LOW	LOW DIF	S/C	W S/C	W OC
832210	0- 26	26 26	2.3	66.0	7.146	28.7	29.7	7.1	0- 26	13 18	28.7	29.7	7.1
832211	26- 63	40 14	1.7	62.8	6.294	36.9	31.6	6.3					

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 009

SAMPLED AS:

S 83PN-325 -009 SAMPLE NOS. 832091 - 2096 DATE 11/30/83

ECUADOR-SHSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT 3	PERCENT 2	INCHES 3/2	INCHES 1	INCHES 3/4	INCHES 3/8	PASSING 4	PASSING 10	PASSING 40	PASSING 200	SIEVE 20	SIEVE 5	SIEVE 2	USDA 1.	LESS THAN .5	.25	.10	.05	DIAMETERS (MM) AT 60	50	10	ATTERBERG LL	PI	UNIFORMITY CU	GRADATION CURVATURE CC
				<-----INCHES----->						<-MICRONS->							<-------MM------->					<--PERCENTILE-->			<-PCT>			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832091	1S	0- 10	AP	100	100	100	100	100	100	100	99	36	51	29	16	7	97	89	75	57	43	0.12	0.070	0.003			42.3	1.4
832092	2S	10- 27	A1	100	99	98	96	96	95	95	94	81	49	28	13	3	91	84	72	55	42	0.13	0.078	0.004			35.2	1.0
832093	3S	27- 47	A2	100	94	90	84	80	77	74	67	49	26	13	6	1	61	51	41	29	21	0.95	0.463	0.012			82.9	1.0
832094	4S	47- 54	2C	PRACTIONS NOT DETERMINED																								
832095	5S	54- 72	3AB1	100	99	99	98	96	98	98	97	88	50	34	16	4	96	90	81	64	49	0.08	0.052	0.003			26.0	0.8
832096	6S	72- 86	3AB2	100	99	99	98	98	98	97	94	81	47	23	14	5	91	84	72	52	40	0.14	0.087	0.003			44.1	1.1

SAMPLE NO	HZ NO	WHOLE SOIL >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	<75 MM FRACTION 75	75 -2	20 -.20	5 -.5	-2	<2	WEIGHT OF WHOLE SOIL 1/3 BAR	WHOLE SOIL SURVEY OVEN-DRY	WHOLE SOIL ENGINEERING MOIST	WHOLE SOIL ENGINEERING SATURATED	<2 MM FRACTION SOIL 1/3 BAR	<2 MM FRACTION SURVEY 15 BAR	<2 MM FRACTION SURVEY OVEN-DRY	<2 MM FRACTION ENGINEERING MOIST	<2 MM FRACTION ENGINEERING SATURATED	G/CC WHOLE SOIL	VOID RATIOS AT 1/3 BAR	VOID RATIOS <2 MM
		<------PCT OF WHOLE SOIL----->								<--PCT OF <75 MM->																		
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50		
832091	1	1	--	--	1	--	TR	1	99	1	--	TR	1	99		0.85	1.00	1.28	1.53	0.84	0.95	0.99	1.27	1.52	2.12	2.15		
832092	2	6	--	--	6	5	--	1	94	6	5	--	1	94		1.02	1.11	1.46	1.64	0.98	1.05	1.07	1.43	1.61	1.60	1.70		
832093	3	33	--	--	33	20	6	7	67	33	20	6	7	67		1.32	1.48	1.66	1.82	1.05	1.17	1.21	1.46	1.65	1.01	1.52		
832094	4	68	--	--	68	50	4	9	32	68	50	9	9	32		2.11												
832095	5	3	--	--	3	2	--	1	97	3	2	--	1	97		1.22	1.20	1.62	1.76	1.20	1.25	1.26	1.61	1.75	1.17	1.21		
832096	6	6	--	--	6	2	1	3	94	6	2	1	3	94		1.25	1.31	1.63	1.78	1.22	1.27	1.28	1.60	1.76	1.12	1.17		

SAMPLE NO	HZ NO	VOLUME WHOLE SOIL >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	<2 MM FRACTION .05	.05- .002	LT .002	PORES D	PORES P	(C/N) RATIO	(R/N) RATIO FINE CLAY	<2 MM FRACTION CRC SHM CATS	<2 MM FRACTION CRC MM4-OAC	<2 MM FRACTION 15 BAR H2O	<2 MM FRACTION LE 1/3 BAR	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR TO 15 BAR	LINEAR EXTENSIBILITY WHOLE SOIL OVEN-DRY	LINEAR EXTENSIBILITY <2 MM (IN/IN) 15 BAR	LINEAR EXTENSIBILITY <2 MM (IN/IN) OVEN-DRY	WRD WHOLE SOIL <--IN/IN->	WRD <2 MM <--IN/IN->
		<----------PCT OF WHOLE SOIL---------->																								
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832091	1	1	--	--	1	--	TR	1	100	13	12	2	26	42	15		4.50	3.00	2.30	0.789	4.1	5.6	4.2	5.6	0.29	0.29
832092	2	2	--	--	2	2	--	1	98	20	15	1	17	44	17		8.18	4.68	3.68	0.882	2.2	2.9	2.3	3.0	0.32	0.33
832093	3	16	--	--	16	10	3	3	84	23	9	1	16	34	16		12.80	7.40	5.35	2.400	2.9	3.9	3.7	4.8	0.25	0.30
832094	4	55	--	--	55	40	7	7	45	24	1		20				32.00	20.00								
832095	5	1	--	--	1	1	--	1	99	22	21	2	14	40			4.90	3.22	1.98	0.390	1.3	1.6	1.4	1.6	0.31	0.31
832096	6	3	--	--	3	1	1	1	97	26	17	2	16	37			3.63	2.54	1.57	0.296	1.3	1.6	1.3	1.6	0.27	0.28

SAMPLE NO	HZ NO	WHOLE SOIL >2	75 -2	20 -2	2- .05	.05- .002	LT .002	SANDS VC	SANDS C	SANDS M	SANDS F	SANDS VF	SILTS C	SILTS F	CL	TEXTURE DETERMINED IN FIELD	TEXTURE DETERMINED BY PSDA	PSDA SAND 2-.05	PSDA SILT .05-.002	PSDA CLAY LT .002	PH CA-CL2 .01M	ELECTRICAL RES-IST. OHMS	CONDUCT. MMHOS	CUMULT. AMOUNTS SALT MG/KG	IN. OF H2O 1/3 BAR TO 15BAR (WHL SOIL)	IN. OF H2O AIRDRY (WHL SOIL)
		PCT OF >2MM+SAND+SILT>						<------PCT OF SAND+SILT------>								<--<2 MM->		<--PCT OF <2MM->			<- - - - <2 MM- - - ->					
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
832091	1	1	1	1	60	39	3	2	8	15	19	15	15	24	8		FSL	56.2	35.7	7.1	5.5					
832092	2	6	6	1	54	40	3	3	9	13	19	15	15	29	4		FSL	55.1	40.3	3.4	5.3					
832093	3	33	33	13	47	19	1	10	14	16	17	14	12	17	2		SL	51.4	26.6	2.0	5.3					
832094	4	68	68	18	31	1	TR	22	35	32	7	1	2	2	TR		COS	96.6	3.3	0.1	5.5					
832095	5	3	3	1	50	47	4	1	6	10	18	16	16	32	4		FSL	49.4	46.5	4.1	5.9					
832096	6	6	6	4	57	37	5	3	8	14	21	14	13	26	6		FSL	57.2	37.4	5.4	6.1					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832091	0-	26	26	26	7.1	56.2	6.168	7.9	7.9	6.2	0-	26	26	26	7.9	7.9	6.2
832092	26-	68	40	14	3.4	55.8	4.320	16.4	10.9	5.5							

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 010

SAMPLED AS:

S 83PN-325 -010 SAMPLE NOS. 83P2220 - 2225 DATE 11/30/83

ECUADOR-SMSS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

SAMPLE NO.	HZN NO.	(IN) DEPTH	HOR-IZON	PERCENT 3	2	3/2	1	3/4	3/8	4	10	40	200	PASSING 20	5	2	CUMULATIVE USDA 1.	.5	LESS .25	THAN .10	.05	DIAMETERS(MM) AT 60	50	10	ATTER-BERG LL	PI	GRADATION UNI-FMTY CU	CUR-VTUR CC
				<-----INCHES----->						<-MICRONS->							<--------MM------->					<--PERCENTILE-->			<-PCT>			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832220	1S	0- 4	A	100	99	98	97	96	96	95	91	71	33	15	8	2	86	75	60	39	26	0.25	0.160	0.008			31.7	2.0
832221	2S	4- 11	C1	100	99	98	97	96	96	95	92	75	33	15	7	2	88	79	63	40	25	0.22	0.149	0.006			27.4	2.2
832222	3S	11- 16	C2	100	99	98	97	96	96	95	91	72	35	10	3	2	86	76	60	41	27	0.25	0.154	0.006			38.6	2.2
832223	4S	16- 21	C3	100	99	98	97	96	96	95	90	62	20	8	4	1	83	68	45	25	14	0.39	0.290	0.026			15.2	1.6
832224	5S	21- 33	2AB1	100	96	94	90	87	86	84	78	58	24	9	4	1	73	62	47	29	17	0.46	0.289	0.022			21.5	1.1
832225	6S	33- 46	2AB2	100	94	90	84	80	78	76	69	52	27	11	5	1	63	54	45	32	20	0.78	0.369	0.014			54.4	0.7
832226	7S	46- 71	3AB3	100	98	97	94	93	93	92	89	79	49	27	13	3	86	81	72	55	41	0.13	0.078	0.004			33.2	1.2

SAMPLE NO.	HZN NO	(WEIGHT PERCENTS) WHOLE SOIL >2	250-UP	250-75	75-2	75-20	20-5	5-2	<2	<75 MM FRACTION 75-2	75-20	20-5	5-2	<2	(WEIGHT PER WHOLE SOIL) SOIL 1/3 BAR	SURVEY OVEN-DRY	ENGINEERING MOIST	SATURATED	UNIT VOLUME G/CC SOIL SURVEY 1/3 BAR	15 BAR	OVEN-DRY	ENGINEERING MOIST	SATURATED	(VOID RATIOS) AT 1/3 BAR WHOLE SOIL	<2 MM
		<-------PCT OF WHOLE SOIL----->								<--PCT OF <75 MM->															
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
832220	1	9	--	--	9	4	1	4	91	9	4	1	4	91		1.50										
832221	2	8	--	--	8	4	1	3	92	8	4	1	3	92		1.23	1.23	1.55	1.77	1.18	1.18	1.18	1.52	1.73	1.15	1.25
832222	3	9	--	--	9	4	1	4	91	9	4	1	4	91		1.50										
832223	4	10	--	--	10	4	1	5	90	10	4	1	5	90		1.52										
832224	5	22	--	--	22	13	3	6	78	22	13	3	6	78		1.37	1.40	1.64	1.85	1.21	1.24	1.24	1.52	1.75	0.93	1.19
832225	6	31	--	--	31	20	4	7	69	31	20	4	7	69		1.33	1.35	1.64	1.83	1.10	1.12	1.12	1.46	1.69	0.99	1.41
832226	7	11	--	--	11	7	1	3	89	11	7	1	3	89		1.13	1.21	1.49	1.73	1.11	1.14	1.14	1.43	1.69	1.25	1.39

SAMPLE NO.	HZN NO	(VOLUME PERCENTS) WHOLE SOIL >2	250-UP	250-75	75-2	75-20	20-5	5-2	<2	<75 MM FRACTION .05-.002	.002-.001	.001-.0	1/3 BAR	(C/N)	(WATIONS TO <2 MM FRACTION) CLAY	FINE CLAY	COARSE CLAY	15 BAR H2O	LE 1/3 BAR	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR TO (IN/IN)-> 15 BAR	OVEN-DRY	<2 MM 15 BAR	OVEN-DRY	(W M D) WHOLE SOIL	<2 MM
		<----------PCT OF WHOLE SOIL---------->																						<--IN/IN->	
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832220	1	5	--	--	5	2	1	2	95	13	13	1	13		11		6.07	4.22							
832221	2	4	--	--	4	2	1	1	96	11	11	1	12	12	12		2.71	2.13	1.91					0.28	0.29
832222	3	5	--	--	5	2	1	2	95	17	14	1	13		11		2.16	1.63							
832223	4	6	--	--	6	2	1	3	94	43	1	1	13				5.00	3.70							
832224	5	12	--	--	12	7	2	3	88	32	1	1	21	27			2.46	4.31	3.08	0.615	0.7	0.7	0.8	0.8	0.23	0.27
832225	6	16	--	--	16	10	2	4	84	25	9	1	19	31			5.10	3.62	2.19	0.286	0.5	0.5	0.6	0.6	0.26	0.31
832226	7	5	--	--	5	3	1	1	95	22	17	1	24	31			3.40	2.43	1.49	0.257	0.8	0.8	0.9	0.9	0.25	0.26

SAMPLE NO	HZN NO	(WEIGHT FRACTIONS-CLAY FREE) WHOLE SOIL >2 MM	75-2	20-2	2-.05	.05-.002	LT .002	<2 MM FRACTION SAND VC	C	M	F	VF	SILTS C	F	CL	(TEXTURE) (DETERMINED IN FIELD (<2 MM)	BY PSDA	(SAND 2-.05	SILT .05-.002	CLAY LT .002	(PH) CACL2 .01M	(ELECTRICAL) NEUT. OHMS	CONDUCT. MMHOS	(CUMULT. AMOUNTS) SALT MG/KG	IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY
		PCT OF >2MM+SAND+SILT>						(-----PCT OF SAND+SILT-----)								(--<2 MM-)		(--PCT OF <2MM-)			(- - - - <2 MM- - - -)				(WHL SOIL)	
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
832220	1	9	9	5	67	24	3	6	12	17	23	16	12	14	3		SL	71.8	25.5	2.7	5.9					
832221	2	8	8	4	69	23	2	4	11	18	25	17	11	14	2		LS	73.0	24.7	2.3	6.0					
832222	3	9	9	5	66	25	2	5	12	19	22	15	10	19	3		SL	70.4	27.1	2.5	6.1					
832223	4	10	10	6	76	14	1	9	16	26	23	12	7	8	1		LS	83.9	15.1	1.0	5.9					
832224	5	22	22	9	62	16	1	6	15	19	23	16	10	11	1		LS	78.2	20.5	1.3	6.0					
832225	6	31	31	11	50	19	1	8	14	14	19	18	13	15	2		SL	70.9	27.0	2.1	6.1					
832226	7	11	11	4	50	39	3	3	6	10	20	17	17	27	4		FSL	54.0	42.5	3.5	6.5					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832220	0-	10	10	10	2.7	71.8	2.871	26.6	26.6	2.9	0-	10	10	10	26.6	26.6	2.9
832221	10-	28	28	18	2.3	73.0	0.853	31.7	29.9	1.6	10-	28	18	8	31.7	28.9	2.0
832222	28-	40	40	12	2.5	70.4	0.472	28.2	29.4	1.2							

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 011

SAMPLED AS:

S 83PN-325 -011 SAMPLE NOS. 83P2135 - 2142 DATE 11/30/83

ECUADOR-SMSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENTAGE PASSING 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/8 (6)	4 (7)	10 (8)	40 (9)	200 (10)	SIEVE 20 (11)	5 (12)	2 (13)	USDA 1. (14)	.5 (15)	LESS .25 (16)	THAN .10 (17)	.05 (18)	DIAMETERS (MM) 60 (19)	50 (20)	10 (21)	ATTERBERG LL (22)	PI (23)	UNIFORMITY CU (24)	CURVATURE CC (25)
				<-----IN CHES----->						<-MICRONS->				<-------MM------->								<--PERCENTILE-->			<-PCT>			
832135	1S	0- 10	A1	100	99	99	98	97	97	97	97	92	57	33	16	4	97	94	83	64	49	0.08	0.053	0.003			25.9	0.9
832136	2S	10- 22	A2	100	99	99	98	97	97	97	97	92	60	35	17	4	97	94	85	66	51	0.08	0.048	0.003			24.9	0.8
832137	3S	22- 33	A3	100	95	92	87	84	84	83	81	63	36	20	9	2	79	72	57	41	30	0.28	0.166	0.006			51.5	1.5
832138	4S	33- 47	2C1	100	90	82	72	64	63	62	56	28	3	2	1	1	48	33	12	3	3	3.54	1.154	0.205			17.3	0.3
832139	5S	47- 52	3A11	100	99	99	98	98	98	98	98	90	44	24	11	3	97	94	77	50	36	0.14	0.101	0.004			31.9	1.7
832140	6S	52- 61	3A12	100	99	99	98	98	98	98	97	86	47	26	12	3	95	90	74	54	38	0.13	0.084	0.004			32.2	1.3
832141	7S	61- 70	3A33	100	96	93	88	85	85	84	11	51	18	11	5	2	75	58	32	20	15	0.55	0.404	0.017			32.8	4.9
832142	8S	70- 79	4C2	100	86	77	63	53	50	47	42	18	3	2	1	1	36	22	8	3		223.31	9.450	0.275			84.9	0.1

SAMPLE NO.	HZN NO.	(WEIGHT) WHOLE SOIL >2 (26)	250 -UP (27)	250 -75 (28)	75 -2 (29)	75 -20 (30)	20 -5 (31)	5 -2 (32)	<2 (33)	<75 MM FRACTION -2 (34)	-20 (35)	-5 (36)	-2 (37)	<2 (38)	(39)	(WEIGHT PER UNIT VOLUME G/CC) SOIL 1/3 BAR (40)	SURVEY OVEN -DRY (41)	ENGINEERING MOIST (42)	SATURATED (43)	SOIL 1/3 BAR (44)	SURVEY 15 BAR (45)	ENGINEERING OVEN -DRY (46)	MOIST (47)	SATURATED (48)	(VOID) AT 1/3 BAR WHOLE SOIL (49)	<2 MM (50)
		<-----PCT OF WHOLE SOIL----->								<--PCT OF <75 MM->																
832135	1	3	--	--	3	3	--	TR	97	3	3	--	TR	97		0.78	0.97	1.33	1.49	0.76	0.89	0.94	1.31	1.47	2.40	2.49
832136	2	3	--	--	3	3	TR	TR	97	3	3	TR	TR	97		1.04	1.09	1.47	1.65	1.02	1.06	1.07	1.45	1.64	1.55	1.60
832137	3	19	--	--	19	16	1	2	81	19	16	1	2	81		1.13	1.20	1.55	1.70	0.99	1.05	1.06	1.44	1.62	1.35	1.68
832138	4	44	--	--	44	36	2	6	56	44	36	2	6	56		1.02										
832139	5	2	--	--	2	2	--	TR	98	2	2	--	TR	98		1.14	1.18	1.48	1.71	1.12	1.15	1.16	1.47	1.70	1.32	1.37
832140	6	3	--	--	3	2	TR	1	97	3	2	TR	1	97		1.21	1.23	1.55	1.75	1.19	1.21	1.21	1.54	1.74	1.19	1.23
832141	7	19	--	--	19	15	1	3	81	19	15	1	3	81		1.27	1.31	1.54	1.79	1.13	1.16	1.17	1.43	1.70	1.09	1.35
832142	8	58	--	--	58	47	6	5	42	58	47	6	5	42		1.47										

SAMPLE NO.	HZN NO.	(VOLUME) WHOLE SOIL >2 (51)	250 -UP (52)	250 -75 (53)	75 -2 (54)	75 -20 (55)	20 -5 (56)	5 -2 (57)	<2 (58)	<75 MM FRACTION -2 (59)	-.05 (60)	-.002 (61)	-.002 (62)	PORES (63)	RAT -IO (64)	(C/N) CLAY (65)	(RATIOS TO CLAY) ---C/N--- CARB (66)	NITR-OGEN (67)	15 BAR H2O (68)	LE 1/3 BAR (69)	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/5 BAR TO 15 BAR (70)	OVEN -DRY (71)	(IN/IN) -> 15 BAR (72)	OVEN -DRY (73)	(WHOLE SOIL) <--IN/IN-> (74)	<2 MM (75)
		<-----PCT OF WHOLE SOIL----->																								
832135	1	1	--	--	1	1	--	TR	99	14	13	1	16	55	12		11.21	6.47	5.95	1.872	5.7	7.5	5.4	7.3	0.38	0.38
832136	2	1	--	--	1	1	TR	TR	99	13	11	2	15	43	14		6.07	3.30	2.52	0.343	1.3	1.6	1.3	1.6	0.31	0.32
832137	3	8	--	--	8	7	1	1	92	21	18	1	15	42	15		4.33	4.30	4.07	0.767	1.7	2.0	2.0	2.3	0.31	0.33
832138	4	30	--	--	30	25	1	4	70	36	1	1	11				2.40	1.40								
832139	5	1	--	--	1	1	--	TR	99	27	14	1	23	34			5.04	2.37	2.56	0.444	0.7	1.2	0.9	1.2	0.27	0.27
832140	6	1	--	--	1	1	TR	1	99	27	16	1	20	34			4.67	2.33	2.33	0.222	0.5	0.5	0.6	0.6	0.27	0.27
832141	7	9	--	--	9	7	1	1	91	31	6	1	25	27			4.36	2.56	2.16	0.480	0.8	1.0	0.9	1.2	0.22	0.24
832142	8	43	--	--	43	35	4	4	57	29	1		26				3.00	1.67								

SAMPLE NO	HZN NO	(WEIGHT FRACTIONS-CLAY FREE) WHOLE SOIL >2 (76)	75 -2 (77)	20 -.05 (78)	2- .05 (79)	-LT .002 (80)	<2 MM FRACTION VC (81)	C (82)	M (83)	F (84)	VF (85)	C (86)	F (87)	VF (88)	CL (89)	(TEXTURE) IN (90)	BY PSDA (91)	(PSDA(MM)) SAND 2- .05 (92)	SILT .05- .002 (93)	CLAY LT .002 (94)	(PH) CA-CL2 .01M (95)	(ELECTRICAL) RES-IST. OHMS (96)	CON-DUCT. MMHOS (97)	(COMPOSITE AMOUNTS) SALT MG/KG (98)	IN. OF H2O 1/3 BAR TO 15BAR (99)	AIRDRY (100)
		PCT OF >2MM+SAND+SILT> (76)	(77)	(78)	(79)	(80)	(-----PCT OF SAND+SILT-----) (81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(--<2 MM-) (90)	(91)	(--PCT OF .2MM-) (92)	(93)	(94)	(- - - - <2 MM- - - -) (95)	(96)	(97)	(98)	(WHL SOIL) (99)	(100)
832135	1	3	3		50	47	4	TR	2	12	21	16	17	32	4		VFSL	47.6	46.5	3.9	5.5					
832136	2	3	3		49	48	5	1	3	10	20	17	17	33	5		VFSL	47.9	47.5	4.6	5.4					
832137	3	19	19	3	52	29	2	3	9	19	21	14	14	22	3		FSL	62.6	34.4	3.0	5.6					
832138	4	44	44	8	54	2	1	14	20	30	16	1	1	2	2		COS	95.3	3.0	1.5	5.5					
832139	5	2	2		64	34	3	1	3	18	29	15	12	22	3		FSL	63.7	33.6	2.7	5.8					
832140	6	3	3	1	60	37	3	2	5	17	21	16	13	25	3		FSL	60.4	36.9	2.7	5.9					
832141	7	19	19	4	67	13	2	8	22	32	15	6	6	11	3		LCOS	81.8	16.1	2.5	6.0					
832142	8	58	58	11	40	2	1	14	34	33	11	3	1	3	1		COS	94.7	4.1	1.2	5.8					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832135	0-	25	25	25	3.9	49.6	7.244	12.7	12.7	7.2	0-	25	18	19	12.7	12.7	7.2
832136	25-	57	40	15	4.6	47.9	3.526	10.4	11.9	5.8							

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 012

SAMPLED AS:

S 83PN-325 -012 SAMPLE NOS. 83P2167 - 2173 DATE 11/30/83

ECUADOR-SHSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SAMPLE NO.	HZN NO.	DEPTH (IN)	HORIZON	PERCENT PASSING 3	2	3/2	1	3/4	3/8	4	10	40	200	SIEVE 20	5	2	USDA 1.	.5	LESS .25	THAN .10	.05	DIAMETERS (MM) 60	50	10	ATTERBERG LL	PI	UNIFORMITY CU	CORRUGATION CC
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832167	1S	0- 4	A1	100	100	100	100	100	100	100	100	99	73	38	19	7	100	99	97	81	60	0.05	0.033	0.003			19.6	1.0
832168	2S	4- 20	B3	100	100	100	100	100	100	100	100	99	56	26	12	3	100	100	96	66	43	0.08	0.061	0.004			21.1	1.8
832169	3S	20- 33	2B6	100	99	99	98	97	97	97	97	96	63	32	15	3	97	97	95	72	50	0.07	0.050	0.003			19.8	1.3
832170	4S	33- 40	3BT81	100	99	99	98	97	97	97	97	97	74	45	26	13	97	97	96	82	63	0.04	0.026	0.001			34.7	0.9
832171	5S	40- 51	3BT82	100	99	99	98	98	98	98	98	98	74	52	37	27	98	98	97	80	66	0.03	0.017	--			71.4	0.5
832172	6S	51- 59	4BT83	100	100	100	100	100	100	100	100	100	85	70	59	52	100	100	99	89	80	0.01	0.002	--			17.3	0.3
832173	7S	59- 67	4BT84	100	100	100	100	100	100	100	100	99	90	80	71	65	100	99	98	92	87	--	0.001	--			5.8	0.7

SAMPLE NO	HZ NO	WHOLE SOIL >2	250 -UP	250 -75	75 -2	FINE SOIL (MM) 75 -20	20 -5	5 -2	<2	<75 MM FRACTION 75 -2	75 -20	20 -5	5 -2	<2	WEIGHT PER WHOLE SOIL SURVEY 1/3 BAR	OVEN -DRY	ENGINEERING MOIST	SATURATED	UNIT VOLUME <2 MM FRACTION SOIL SURVEY 1/3 BAR	15 BAR	OVEN -DRY	ENGINEERING MOIST	SATURATED	G/CC WHOLE SOIL AT 1/3 BAR	VOID RATIOS WHOLE SOIL	<2 MM
		PCT OF WHOLE SOIL								PCT OF <75 MM																	
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
832167	1	--	--	--	--	--	--	--	100	--	--	--	--	100		0.91	1.02	1.34	1.57	0.91	0.98	1.02	1.34	1.57	1.91	1.91	
832168	2	--	--	--	--	--	--	--	100	--	--	--	--	100		0.78	0.83	1.17	1.49	0.78	0.81	0.83	1.17	1.49	2.40	2.40	
832169	3	3	--	--	3	3	--	--	97	3	3	--	--	97		0.84	0.89	1.27	1.52	0.82	0.86	0.87	1.25	1.51	2.15	2.23	
832170	4	3	--	--	3	3	--	--	97	3	3	--	--	97		0.90	0.96	1.36	1.56	0.88	0.92	0.94	1.34	1.55	1.94	2.01	
832171	5	2	--	--	2	2	--	--	98	2	2	--	--	98		1.41	1.52	1.76	1.88	1.40	1.45	1.51	1.76	1.87	0.88	0.89	
832172	6	--	--	--	--	--	--	--	100	--	--	--	--	100		1.21	1.49	1.65	1.75	1.21	1.31	1.49	1.68	1.75	1.19	1.19	
832173	7	--	--	--	--	--	--	--	100	--	--	--	--	100		1.13	1.44	1.63	1.70	1.13	1.21	1.44	1.63	1.70	1.35	1.35	

SAMPLE NO	HZ NO	WHOLE SOIL >2	250 -UP	250 -75	75 -2	FINE SOIL (MM) 75 -20	20 -5	5 -2	<2	<2 MM FRACTION .05- .002- .005- .002	LT .005	PORES RAT -10	(C/N)	CLAY	---C E C--- MEQ/ 100 GRS	MEQ/ 100 CC	15 BAR H2O	LZ 1/3 BAR	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR TO 15 BAR	OVEN -DRY	<2 MM 15 BAR	OVEN -DRY	WRD WHOLE SOIL	<2 MM	
		PCT OF WHOLE SOIL																								
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832167	1	--	--	--	--	--	--	--	100	14	14	1	21	43	9		5.63	3.91	2.89	0.557	2.5	3.9	2.5	3.9	0.24	0.24
832168	2	--	--	--	--	--	--	--	100	17	13	1	32	39	10		3.06	3.13	3.52	0.636	1.7	2.1	1.3	2.1	0.25	0.25
832169	3	1	--	--	1	1	--	--	99	15	15	1	25	43	11		4.18	5.35	5.09	0.588	1.6	1.9	1.6	2.0	0.29	0.29
832170	4	1	--	--	1	1	--	--	99	12	17	4	20	46			1.38	0.92	1.18	0.169	1.5	2.2	1.5	2.2	0.32	0.33
832171	5	1	--	--	1	1	--	--	99	17	21	1	10	37			0.46	0.34	0.59	0.096	1.2	2.5	1.2	2.6	0.15	0.15
832172	6	--	--	--	--	--	--	--	100	9	13	24	7	47			0.30	0.25	0.51	0.139	2.7	7.2	2.7	7.2	0.15	0.15
832173	7	--	--	--	--	--	--	--	100	6	9	28	7	50			0.23	0.24	0.52	0.129	2.3	8.4	2.3	8.4	0.11	0.11

SAMPLE NO	HZ NO	WHOLE SOIL >2	75 -2	20 -.05	2- .05	.002	LT .002	VC	C	M	F	VF	C	F	VF	SILT	CL	AY	(RETENTIVE IN FIELD)	HYD CONDUCT PSDA 2- .05	.05- .002	CLAY LT .002	(PH) CA-CL2	(ELECTRICAL) RES-IST. .01M OHMS	CON-DUCT. MMHOS	SALT MG/KG	(CUMULT. AMOUNTS) IN. OF H2O 1/3 BAR TO 15BAR	AIRDRY
		PCT OF >2MM+SAND+SILT						(PCT OF SAND+SILT											(<2 MM)	(PCT OF <2MM)				(<2 MM			(WHL SOIL)	
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100		
832167	1				42	58	8		1	2	17	23	25	33	8		SIL	39.5	53.5	7.0	6.1							
832168	2				59	41	3		TR	3	31	24	18	24	3		VFSL	56.6	40.1	3.3	5.8							
832169	3	3	3		49	48	3		TR	2	25	24	20	30	4		VFSL	48.6	41.0	3.4	6.1							
832170	4	3	3		39	57	14	TR	TR	1	17	22	21	39	15		SIL	35.2	51.8	13.0	5.5							
832171	5	3	3		44	54	36			1	24	20	20	35	37		CL	32.7	40.2	27.1	6.3							
832172	6				42	50	110		TR	1	21	19	21	38	110		C	20.0	27.7	52.3	6.2							
832173	7				38	62	188	1	1	3	18	16	21	41	188		C	13.2	21.5	65.3	6.0							

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832167	0-	10	10	10	7.0	39.5	4.332	5.6	5.6	4.3	0-	10	10	10	5.6	5.6	4.3
832168	10-	52	40	30	3.3	56.6	1.652	17.2	14.3	2.3	10-	52	40	8	17.2	10.8	3.1

SUPPLEMENTARY CHARACTERIZATION DATA

ECUADOR 013

SAMPLED AS:

S 83PM-325 -013 SAMPLE NOS. 832181 - 2185 DATE 11/30/83

ECUADOR-SRSS

GENERAL METHODS: ENGINEERING FRACTIONS WERE CALCULATED FROM USDA FRACTION SIZES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SAMPLE NO.	HZN NO.	(IN) DEPTH	HORIZON	PERCENT 3	2	1/2	1	3/4	3/8	4	10	40	200	SIZE 20	5	2	CUMULATIVE CURVE USDA 1.	.5	LESS THAN .25	.10	.05	FRACTIONS(<76MM) DIAMETERS(MM) AT 60	50	10	ATTERBERG LL	PI	GRADATION UNIFORMITY CU	CURVATURE CC
				<-----INCHES---->						<-UNIFORM->				<-MICRONS->			<--------MM------->					<--PERCENTILE-->			<-PCT>			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
832181	1S	0- 12	A1	100	99	99	98	97	97	97	97	96	30	46	24	16	97	96	96	88	67	0.04	0.024	0.002			17.9	0.7
832182	2S	12- 22	A2	100	99	99	98	95	93	93	98	98	40	49	27	13	98	98	97	87	68	0.03	0.022	0.001			28.8	0.9
832183	3S	22- 30	2BC01	100	99	99	98	93	98	93	93	97	35	64	47	36	98	99	97	90	78	0.01	0.007	--			39.0	0.3
832184	4S	30- 42	2BC02	100	100	100	100	100	100	100	100	99	42	33	75	70	100	99	98	94	90	--	0.001	--			5.2	0.7
832185	5S	42- 65	2BC3	100	100	100	100	100	100	100	100	100	98	92	38	85	100	100	100	99	97	--	0.001	--			3.9	0.8

SAMPLE NO	HZ NO	>2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	75 -2	75 -.05	20 -.05	5 -.002	<2	WEIGHT PER UNIT VOLUME G/CC WHOLE SOIL 1/3 BAR	SOIL SURVEY OVEN -DRY	ENGINEERING MOIST	ENGINEERING SATURATED	SOIL SURVEY 1/3 BAR	<2 MM FRACTION 15 BAR	SOIL SURVEY OVEN -DRY	ENGINEERING MOIST	ENGINEERING SATURATED	VOID RATIOS AT 1/3 BAR WHOLE SOIL	<2 MM
		<------PCT OF WHOLE SOIL---->								<--PCT OF <75 MM-->															
		26	27	28	29	30	31	32	33	34	35	36	37	38	40	41	42	43	44	45	46	47	48	49	50
832181	1	3	--	--	3	3	--	--	97	3	3	--	--	97	0.84	0.96	1.25	1.52	0.82	0.90	0.94	1.23	1.51	2.15	2.23
832182	2	2	--	--	2	2	--	--	98	2	2	--	--	98	1.22	1.28	1.61	1.76	1.21	1.24	1.27	1.61	1.75	1.17	1.19
832183	3	2	--	--	2	2	--	--	98	2	2	--	--	98	1.36	1.47	1.73	1.85	1.35	1.38	1.46	1.73	1.84	0.95	0.96
832184	4	--	--	--	--	--	--	--	100	--	--	--	--	100	1.14	1.42	1.66	1.71	1.14	1.21	1.42	1.66	1.71	1.32	1.32
832185	5	--	--	--	--	--	--	--	100	--	--	--	--	100	1.04	1.37	1.59	1.65	1.04	1.12	1.37	1.59	1.65	1.55	1.55

SAMPLE NO	HZ NO	>2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	2-.05	.05-.002	LT .002	POREs	PERM RATE	(C/N) RATIOS CLAY	<2 MM FRACTION SUM CATS	TO 15 BAR AMM-OAC	15 BAR H2O	LE 1/3 BAR	LINEAR EXTENSIBILITY WHOLE SOIL <-1/5 BAR TO (IN/IN)-> 15 BAR OVEN -DRY	<2 MM 15 BAR	OVEN -DRY	WHOLE SOIL <2 MM <--IN/IN->	
		<----------PCT OF WHOLE SOIL---------->																							
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
832181	1	1	--	--	1	1	--	--	99	9	18	3	27	41	10		4.20	3.01	2.06	0.470	3.1	4.6	3.2	4.7	0.24	0.25
832182	2	1	--	--	1	1	--	--	99	14	25	6	15	39	11		2.05	1.33	1.38	0.122	0.8	1.6	0.8	1.6	0.18	0.18
832183	3	1	--	--	1	1	--	--	99	10	22	18	12	37			0.45	0.30	0.59	0.071	0.7	2.6	0.7	2.6	0.08	0.09
832184	4	--	--	--	--	--	--	--	100	4	8	30	5	52			0.20	0.21	0.51	0.109	2.0	7.6	2.0	7.6	0.12	0.12
832185	5	--	--	--	--	--	--	--	100	1	5	33	6	55			0.22	0.17	0.49	0.113	2.5	9.6	2.5	9.6	0.12	0.12

SAMPLE NO	HZ NO	>2	75 -2	20 -2	2-.05	.05-.002	LT .002	VC	C	M	F	VF	C	F	AY	(-TEXTURE--) IN FIELD	BY PSDA	(--PSDA(MM)---) 2-.05	.05-.002	LT .002	(PH) CL2	(-ELECTRICAL) EST. OHMS	CONDUCT. MMHOS	(CONSULT. AMOUNTS) ALT MG/KG	IN. OF H2O 15BAR	1/3 BAR TO AIRDRY
		PCT OF >2MM+SAND+SILT>						<------PCT OF SAND+SILT------>								<--<2 MM->		<--PCT OF <2MM->				<- - - - <2 MM- - - ->				(WHL SOIL)
		76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
832181	1	3	3		33	64	11		1	1	9	23	25	41	11		SIL	30.5	59.5	10.0	5.9					
832182	2	2	2		35	63	15		TR	1	13	22	23	41	15		SIL	30.7	56.2	13.1	6.2					
832183	3	3	3		31	66	56	TR	TR	1	12	18	23	45	57		SICL	20.0	43.5	36.5	6.2					
832184	4				34	66	233	1	2	5	12	14	22	43	233		C	10.3	19.7	70.0	5.6					
832185	5				22	78	558			1	8	13	33	45	558		C	3.4	11.5	84.8	6.3					

SAMPLE	UP	LOW	LOW	DIF	CLAY	SAND	OC	S/C	W S/C	W OC	UP	LOW	LOW	DIF	S/C	W S/C	W OC
832181	0-	30	30	30	10.0	30.5	3.358	3.0	3.0	3.4	0-	30	18	18	3.0	3.0	3.4
832192	30-	55	40	10	13.1	30.7	1.201	2.3	2.3	2.8							