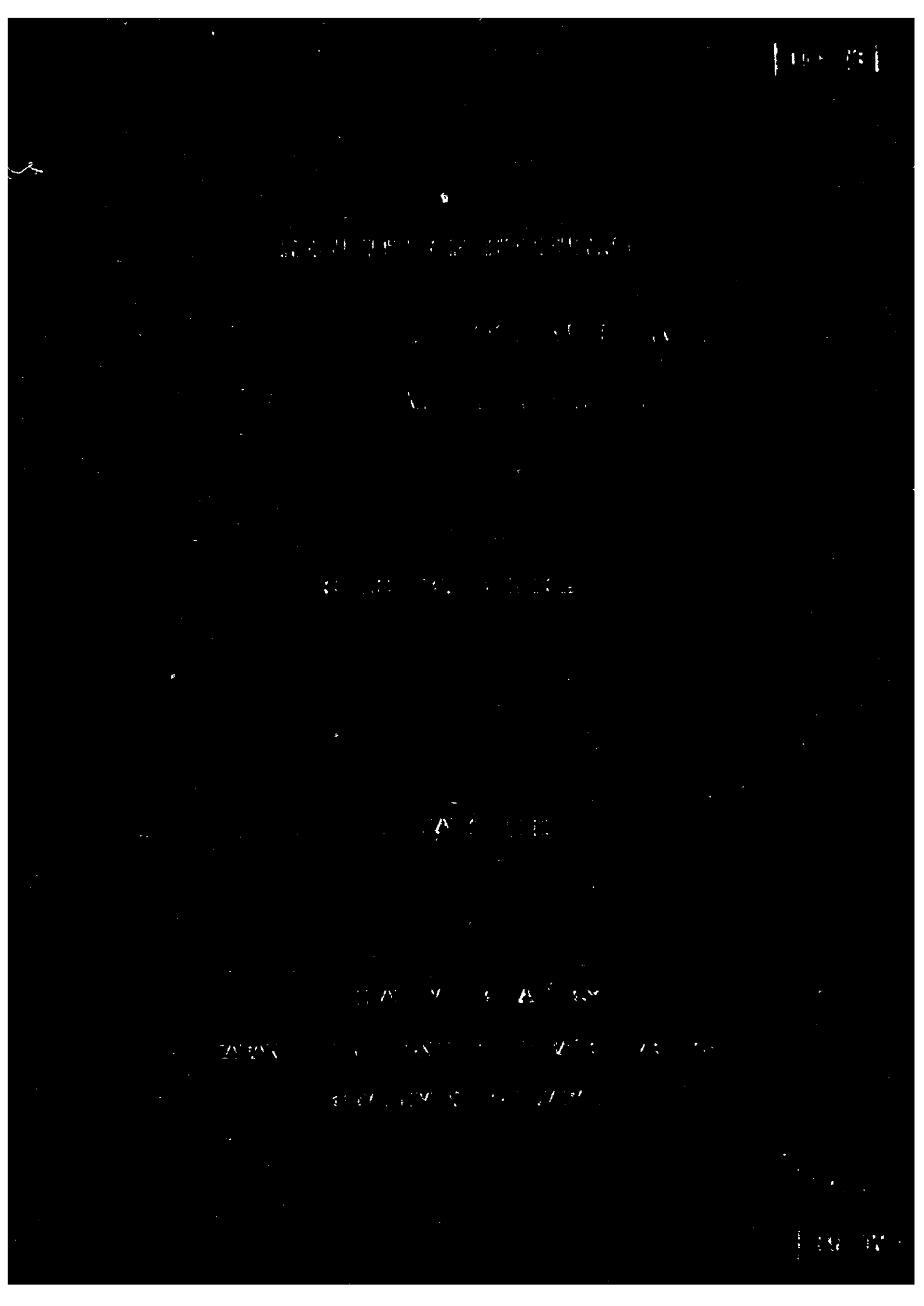

REPUBLIC OF HONDURAS

REPORT ON GEOLOGICAL SURVEY OF THE WESTERN AREA

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METAL MINING AGENCY

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF JAPAN

PREFACE

The Government of Japan, in response to a request by the Government of the Republic of Honduras, decided to investigate the potentiality of mineral resources in the western area of the Republic of Honduras and entrusted the geological and other survey works to Japan International Cooperation Agency. The Agency, considering the nature of the works to belong to special field of the investigation of geology and mineral resources, sought the cooperation of the Metal Mining Agency of Japan to accomplish the task.

These survey works carried out during three years from May 1977 to February 1980. During this period, the team, with the cooperate of the Government of the Republic of Honduras and its various agencies, was able to complete survey works on schedule.

This report summarizes the results of these surveys for three years, and forms the final survey report.

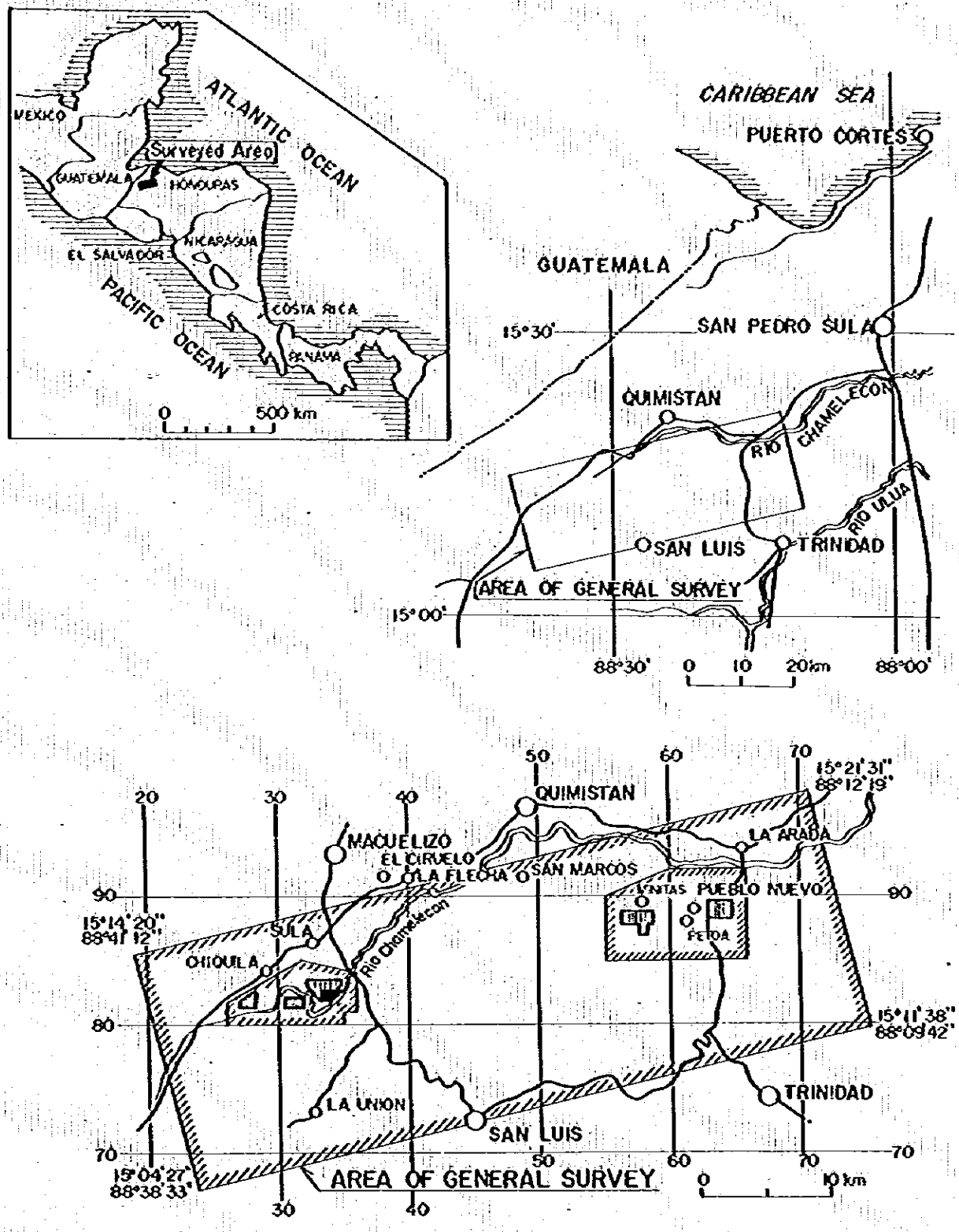
We wish to take this opportunity to express our heartful gratitude to the officials of the Government of the Republic of Honduras and its various agencies, as well as to the Ministry of International Trade and Industry, the Ministry of Foreign Affairs and cooperating companies, for the cooperation and support extended to the Japanese survey team.

February, 1980

Keisuke Arita
the president of Japan International
Cooperation Agency

Masayuki Nishiie
the president of Metal Mining
Agency of Japan

Fig. 1 LOCATION MAP OF THE SURVEYED AREA



Surveyed area in 1977 | Surveyed area in 1978 | Surveyed area in 1979

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ABSTRACT

(1) The Basic Geological Survey for the Development of Mineral Resources in the western part of the Republic of Honduras was carried out for three years in the subject area of about 1,000 km^2. By the geological survey, geophysical prospecting (IP method), the geochemical survey and the diamond drilling, favorable areas for the possibility of emplacement of mineral resources were extracted and many indications of mineralization and gold ore deposits have been found.

The present survey area is located about 75 km south of San Pedro Sula, in the northwestern part of the Republic. It is in the mountainous land of the altitude of 200 to 1500 m above sea level and occupies an area of 50 km in east-west and 20 km in north-south.

(2) Geologically, the present survey area is underlain by the old rocks in the northern part with younger formations distributed in the chronological order to the south. That is to say, in the northern part, there are Paleozoic mica schists in the direction of east and west, in the south of which Vueltas del Rio Formation and Minitas Formation of unknown age are distributed, followed, in further south, by Mesozoic Cantarranas Formation composed of limestone and shale, Atima Formation of massive limestone, Guare Formation of alternation of limestone and shale in this order. In the south of the above formation, alternation of shale and sandstone of Valle de Angeles Formation is distributed. They comprise repetition of gentle anticline and syncline with the axes in the direction of east and west. The eastern part of the area, is a little different from the western part. There are no younger formations than the Guare Formation in the east, where Tertiary Matagalpa Formation which is composed mainly of volcanic rocks as andesite, basalt, basaltic pyroclastic rocks and rhyolite, covers the older rocks.

The boundary of the Paleozoic formation to the other formations is represented by the Pueblo Nuevo overthrust fault. In the narrow zone in east and west within 5 km along this fault, intrusive rocks, correlated to the Cretaceous period, such as diabase, granodiorite, andesite and quartz diorite porphyry etc. are distributed in east and west, and the surrounding rocks are subjected to alteration and deformation.

The United Nations survey team carried out a series of investigations including geological survey, geochemical survey, geophysical prospecting, trenching and diamond drilling in five years from 1969 to 1974, and selected many favorable areas for the possibility of emplacement of ore deposits. Continuation of investigation works were then recommended.

Through the present surveys, it has been confirmed that the indications of mineralization are mainly of copper dissemination type related to the afore-stated intrusive rocks, of copper-iron-lead-zinc contact replacement type and of gold-copper-lead-zinc vein type in addition to autochthonous residual gold ore deposits, and that these indications of mineralization are distributed limitedly along the Pueblo Nuevo fault. And because they are especially concentrated in the area around the meandering part of the Chamelecon River and in Petoa area, these two areas of total about 110 km^2 were extracted for the subject areas for further detailed investigation.

(3) In the Chamelecon area, Paleozoic mica schists, Vueltas del Rio Formation, Cantarranas Formation, Atima Formation and the intrusive igneous rocks are distributed. And by the results of the geochemical survey, intense geochemical anomalies of copper, lead, zinc and gold were detected at Vueltas del Rio, at Zapotal, at Laguna Seca and in other areas, which are in good correspondence with the results of the surveys carried out by UNDP.

In the Vueltas del Rio area, detailed geological survey, geophysical prospecting (IP method) and diamond drilling in the central part of this

area were completed in the first year, and detailed geological survey accompanying trenching and diamond drilling were carried out in the second year, and indications of gold and copper mineralization were found through these investigations. In the third year, through further detailed exploration works by means of the same sorts of methods as employed in the previous year, the following results were obtained.

The Vueltas del Rio area is underlain by metamorphosed tuff, tuff breccia, andesite and shale, which comprise a synclinorium with the axis of east-north-east and west-south-west, dipping gently to the east. Near the surface, silicification, sericitization and carbonatization are intensely recognized, while intense chloritization is observed at depth. Most of the fractured zones are in the direction of east and west, and of east-north-east and west-south-west. Disseminations of iron minerals containing iron, copper and electrum are found mostly in the intensely altered zones and in the remarkably fractured zones, which are the most favorable areas for the possibility of emplacement of ore deposits.

More than five indications of gold, copper and zinc ore veins are found in a shallow part of the depth of less than 200 m. Also, autochthonous residual ore deposits including gold veins are found in an area of the width of 300 m in north-south and of the extension of 1,200 m in east-west, including San Martin old workings and Nelson trenches. The survey result reveals that several hundred thousand tons of ore reserves would be expected in this gold mineralization zone. It is recommended for this gold mineralization to carry out mineralogical study, detailed trenching and geological analysis by diamond drilling as well as various tests as to mining and concentration, followed by the consideration of development.

In the Zapotal III area, Vueltas del Rio Formation, Cantarranas Formation and Atima Formation are distributed and the intrusion of quartz

dioritic porphyry is recognized. By the results of the geophysical prospecting (IP method) carried out in the area including high anomalies of the geochemical survey, indications of copper mineralization are recognized around the boundary zone between the igneous rocks and the limestone. These indications are small in scale and are associated with rather weak alteration. Also, were detected local FE anomalies, which are quite small in scale. It is concluded that the possibility of emplacement of such orebodies of sulphide minerals in considerable scale would be small in this area.

In Laguna Seca area, by the results of the geochemical survey and the detailed geological survey accompanying trenching, it has been confirmed that the Paleozoic metamorphic rocks composed of mica schists, limestone and black schists are distributed in the northern side while metamorphosed tuff, schalstein, altered dioritic porphyry and metamorphosed tuff breccia are developed in the south of the above, and that the limestones of Atima Formation are found covering the beds of Vueltas del Rio Formation, with unconformity. Dykes of liparite and andesite, trending east and west, are found intruding them. Alteration zone of silicification has been recognized along the altered dioritic porphyry, but there is no remarkable indication of mineralization and most of the alteration zones are recognized to be weak. Therefore, it is thought that this area is not so much interesting as to the possibility of emplacement of ore deposits.

In the Petoa area, are distributed Paleozoic gneissose mica schists, Minitas Formation, limestones of Atima Formation and dykes and stocks of granodiorite and andesite intruding the beds of Minitas Formation. In the southern side of this area, volcanic layers of Matagalpa Formation are found to overlie Minitas Formation and Atima Formation. By the geochemical survey and the geological survey, two areas of Minitas and Pueblo Nuevo were extracted as favorable areas, where in the second year geophysical prospecting

(IP method) and detailed geological survey accompanying trenching were carried out. Especially, the exploration by diamond drilling was added in the program in the Minitas area.

In the Minitas area, metamorphosed andesite and tuff and Paleozoic granodiorite intruding them are distributed, mainly in east and west, in the northern part, while limestones of Atima Formation are found to overlie them in the southern part. Dykes of granite prophyry, granodioritic porphyry and andesite are distributed in the direction of northwest and southeast and of east and west, intruding them.

In this Minitas area, there is a known mineralization of Macutalo ore deposits as a representative akarnization type deposits. By the diamond drilling carried out by UNDP, skarn type copper-land-zinc-iron ore deposits with skarn minerals as garnet and actinolite are confirmed.

Around the Minitas valley, indications of copper and zinc mineralization along dykes and those of copper and zinc mineralization along granite porphyry have been found. Also, in the drill hole No. 53-7, skarnized zone composed of garnet, actinolite, epidote as well as quartz, calcite, dolomite and chlorite has been found with the insertions of granite porphyry and limestone along the core length of 90 m from the depth of 6 m to 96 m. This skarnized zone includes four parts where copper and zinc ore minerals are contained, and it has been confirmed that this skarnized zone is linked to the skarnization zone on the surface, extending in northwest and southeast.

In the Pueblo Nuevo area, the geochemical survey, the geophysical prospecting (IP method) and the detailed geological survey were carried out. The area is underlain by the Minitas Formation and the limestones of Atima Formation covering the former in the southern part. The Minitas Formation is composed of metamorphosed andesite, dioritic porphyry, andesitic pyroclastic rocks and liparite which is found to intrude the above rocks in the

northern part. The area occupied by the liparite in the northern part corresponds with high IP anomaly, but no concrete relation to mineralization has been confirmed with the liparite. This liparite is thought to have intruded roughly at the same period as the granodiorite intruding the metamorphosed andesite in the Minitas area. Three indications of mineralization have been confirmed, which are Santa Inez, Santo Domingo and Esperanza. It is confirmed that all of these indications are of copper, lead and zinc mineralization, found in the limestone along the boundary between the limestone and the basement rocks, in the form of ore vein or ore beds. It would be necessary to persue the extension of these indications of mineralization.

By the basic geological survey performed in these three years, favorable areas for gold, copper, lead and zinc mineralization have been extracted as Vueltas del Rio, Minitas, Pueblo Nuevo etc., and the characters of the indications of mineralization have been comprehended. In the first place, as for the gold ore deposits in the Vueltas del Rio area, consideration for the development is necessary, and also it is necessary to carry out the detailed geological survey, diamond drilling and the study of the characters of ores for the development in addition to various tests to develop the deposits, and to proceed with feasibility study. Furthermore, as for the indications of gold and copper mineralization found in the drill holes, it is necessary to study the relation and the continuation to the indications found on the surface. Extension and ore grade should be confirmed by trenching and diamond drilling on the indications of skarn type mineralization at Maculalo and at Minitas in the Minitas area. Detailed geological survey by trenching would be required on the indications found in the Pueblo Nuevo area. As for the indications of mineralization in the other favorable areas, programs for exploration and development should be prepared referring to the results of the above-stated surveys.

Chapter 1 Introduction

1-1 Particulars and Purpose of the Survey

The government of the Republic of Honduras, with the cooperation of UNDP, conducted, for five years from 1969 to 1974, regional geological survey and geochemical exploration in the total area of 10,800 km^2 of the northwestern part of the Republic, and also performed systematic exploration works, in the selected areas, through the combination of the methods such as geological survey, detailed geochemical exploration, geophysical exploration, pitting, trenching and diamond drilling. Based on the results of the works, several favorable areas bearing indications of mineralization of dissemination-type and skarn-type associated with metal minerals of copper, gold, lead and zinc were recommended, and the government of the Republic of Honduras requested the government of Japan for Basic Geological Survey for the Development of Mineral Resources in October of 1975.

The government of Japan despatched the mission for the Project Finding in the South America Area, headed by Minoru Takagi in October 1976, and are selected the area including Chamelecon area and Petoa area.

And in February 1977, Japan has sent the Project Negotiating Mission headed by Masanori Takagi, the operation of the survey works was decided.

This survey is conducted with the cooperation of the Direccion General de Minas e Hidrocarburos of the Republic of Honduras (hereunder abbreviate this organization to DGMH) a period of three years during from May 1977 to February 1980, had conducted many survey process as the geological survey, geochemical survey, geophysical survey (IP Method) and diamond drilling, as well as are analyzing with some explorated data in the past.

We are recognized the geology and geological structure in the area, and are extructed the favorable areas for mineral resources on each annual

phases and the purpose is to gain the important guides for the programming for further investigation and exploitation.

1-2 Outline of the Survey Works

The programmed survey area is shown in Fig. 1, the total area of which is approximately 1,000 km^2 of about 50 km in east-west by about 20 km in north-south.

Concerning the surveyed area in each phases are shown in Table 6-1, 6-2 for surveyed area, methods, quality, number of engineers and period.

1-2-1 Geological Survey

The geological survey in the whole programmed area during primary phase was carried out for the comprehension of geology and geo-structure by drawing route maps of the scale of 1 to 25,000 with the survey density of the route interval of about 1 km and situated the data of geology and geological structure in the whole area. Due to deep weathering and thick vegetation, outcropping of the rocks on the surface is so poor in the area, rendering the confirmation of relation of respective rocks very hard. With the help of the reports and literatures, analysis of airphotographs was reflected to the survey work of geology, making full use of survey data, drill-data obtained by UNDP and interpretation of airphoto.

In the Chamelecon area and the Petoa area selected by the above survey works, detailed geological survey with the density of route interval of approximate 300 m was carried out by mapping with compass and tapes in the scale of 1 to 5,000 in the total area of 110 km^2, and the result was compiled in the geological map of the scale of 1 to 10,000. The topographical map of 1 to 10,000 for the compilation of geology was prepared after air photographs.

As for the indications of mineralization in Chamelecon area, trenching

Table 6—1 Summary of the Surveys (1977—1979)

	Area Surveyed	Surveys Applied	Amount of Work	Number of Members			Period of Survey (Interpretation, Reporting)
1977	Department Santa Barbara Chamelecon Area Petoa Area	Geological Survey	Reconnaissance geological Survey 1,000 km^2 Detailed Geological Survey 110 km^2 Trenching	Administration Geologist Counterpart	Japanese " Honduranian	6 6 7	25th/May - 6th/Aug. 1977 (6 months)
	Vueltas del Rio Minitas, Zapotal III Pueblo Nuevo	Geophysical Survey	Geophysical IP Survey 39 line, 74.4 km	Administration Geophysicist	Japanese "	6 6	1st/June - 21st/Aug. 1977 (7 months)
	Vueltas del Rio Minitas	Diamond Drilling	6 hole, length 1825.9 m	Drilling Engineer Geologist Counterpart	" " Honduranian	5 1 9	19th/Aug. - 25th/Dec. 1977 (3 months)
1978	Vueltas del Rio Minitas Pueblo Nuevo Laguna Seca	Geological Survey	Detailed Geological Survey 15 km^2 Trenching 11 km	Administration Geologist	Japanese "	5 3	5th/June - 6th/Oct. 1978
	Vueltas del Rio Minitas	Diamond Drilling	Diamond Drilling 8 holes, length 2,905.9 m	Drilling Engineer Counterpart	Japanese Honduranian	7 5	5th/June - 6th/Oct. 1978 (5 months)
1979	Vueltas del Rio	Geological Survey	Detailed Geological Survey 2.5 km^2 Trenching 6.6 km	Administration Geologist	Japanese "	5 1	25th/June - 7th/Sep. 1979 (6 months)
	Vueltas del Rio	Diamond Drilling	8 holes, length 2,102.7 m	Drilling Engineer	"	7	6th/June - 7th/Sep. 1979 (3 months)
	Department Olancho	Preliminary Geological Survey	Area 3,000 km^2	Geologist Counterpart	Japanese Honduranian	1 4	25th/June - 7th/Sep. 1979 (6 months)

Table 6—2 Members List of the Survey Teams (1977—1979)

Years	1977	1977	1978	1979
Japan Chief of Mission	Tadashi Sakuma	Tadashi Sakuma	Tadashi Sakuma	Tadashi Sakuma
Coordinator & Administrator	Shigeru Takagi Shinsei Terashima Hisamitsu Moriwaki Yukio Harada Junnosuke Oikawa	Shigeru Takagi Kazuhiko Tsuda Shinsei Terashima Hisamitsu Moriwaki Yukio Harada	Sadayuki Nagahata Takeo Kuroko Hisamitsu Moriwaki Yukio Harada	Masaru Tateishi Makoto Ishida Nobuhisa Nakajima Yukio Harada
Member Geology	Kiyohisa Shibata Yoshihiro Nagumo Haruo Watanabe Akira Takigawa Yoshio Akiyama Nobuyuki Goto	Kiyohisa Shibata	Junnosuke Oikawa Jinichi Nakamura Kiyohisa Shibata	Kiyohisa Shibata Ikuhiro Hayashi
Geophysics		Junnosuke Oikawa Takashi Aoyama Akira Egawa Hiroshi Fukuda Masatane Kato Mutsuo Kondo		
Drilling		Harukichi Shimode Munenori Onuki Kazuo Takahashi Hitoshi Abe Yoshinori Seki	Harukichi Shimode Kaneo Shitagaki Hisaji Shimizu Yoshio Obara Tsugio Kita Munenori Onuki Shigeo Sekiguchi	Harukichi Shimode Kiyomi Miura Tsutomu Aoyama Munenori Onuki Shigeo Sekiguchi Shigemitsu Watanabe Kazutoshi Uchimura
Honduras	Sergio I. Vicencio Wilmer S. Flores Jose M. Gutierrez Francisco Galeano Jorge Mayorga Roberto Irias Marco Rodriguez	Sergio I. Vicencio Wilmer S. Flores Jose M. Gutierrez Francisco Galeano Jorge Mayorga Roberto Irias Marco Rodriguez Danilo Vasquez Jose R. Paredes	Sergio I. Vicencio Jose M. Gutierrez Danilo Vasquez Francisco Galeano Porfirio Zuniga F.	Guillermo Houghton Jose M. Gutierrez Francisco Galeano Napoleon Ramos

was carried out to remove surface soil with two bulldozers for the mapping of further details, to compensate poor exposure due to thick vegetation and deep weathering.

Also, in both of the areas, soil smaples were collected to confirm the UNDP data and to correlate the distribution of assay results with the geological structure, in such density as 5 samples/km^2 in whole of the areas and 10 samples/km^2 in the area around the indications of mineralization. Chemical analysis of copper, lead, zinc and gold (hereinafter referred to Cu, Pb, Zn and Au) contained in the soil samples were performed, followed by the analysis of the assay results.

1-2-2 Geophysical Survey (IP method)

By the results of the above-mentioned various surveys, geophysical survey (IP method) and diamond drilling were carried out as parts of the second phase survey in the extracted four areas of total about 16 km^2, which are Vueltas del Rio area and Zapotal III area in the Vueltas del Rio area, and Minitas area and Pueblo Nuevo area included in the Petoa area.

As to the geophysical survey of IP method, frequency domain method was employed, and electrode-separation was by dipole-dipole configuration, with the distance of 100 m, and the measurement was completed to the electrode separation factor of n=4. In part of the Minitas area, the measurement with the distance of 50 m was additionally conducted. Line spacing of 200 to 250 m was employed generally. The results of the survey were correlated with the geology etc. by the computer analysis and were effective for the extraction of the favorable areas.

1-2-3 Diamond Drilling

At the points selected through the geological survey and the geophysical survey, diamond drilling of 6 holes with total length of 1,825.9 m

was carried out ----- 4 holes with total length of 1,202.6 m in Vueltas del Rio area, and 2 holes with total length of 623.3 m in the Minitas area. Two drill machines of TCM-5A were used. (The capacity of drilling is 510 m in final NQ size and 660 m in final BQ size.) The machines were operated by two shifts per day, with first shift of 8 hours and second shift of 7 hours. Core logging and sampling were conducted, and analytical research was performed on the basis of chemical analysis.

1-2-4 Surveys in the Second Year

By the results of the surveys completed in the first year, 4 favorable areas of Vueltas del Rio, Laguna Seca, Minitas and Pueblo Nuevo were extracted as the areas where further investigations would be warranted, and as the second year's program detailed geological survey and diamond drilling were carried out. As the detailed geological survey, trenching of total length of 11 km was carried out by bulldozers and geological mapping and laboratory works were conducted. And 8 holes of total length of 2,905.9 m of diamond drilling were performed, which comprises 5 holes of total length of 2,004.1 m in the Vueltas del Rio area and 3 holes of total length of 901.8 m in the Minitas area.

1-2-5 Surveys in the Third Year

In the central part of the Vueltas del Rio area extracted as favorable area warranting further concrete investigation, by the previous years' surveys, as well as in the area where many indications of gold and copper mineralization have been found on the surface, detailed geological survey accompanying trenching and diamond drilling were carried out. Detailed geological survey was conducted with bulldozer trenching of the total length of 6.6 km in an area of 1,200 m in east-west by 300 m in north-south, including San Martin old workings and Nelson trenches. Diamond drilling

was performed in the surrounding areas of the indications of copper and gold mineralization caught in the drill hole in the previous year, and in the plain in the eastern extension of the Vueltas del Rio Formation for the confirmation of features of the mineralization. And 8 holes of total length of 2,102.7 m were completed. Through these investigations, many indications of gold, copper and zinc mineralization were confirmed. Especially, considerable ore reserves of gold ore deposits were confirmed on the surface, which would warrant further consideration for the development.

1-3 Former Study

The Republic of Honduras, though being one of the main member of Central America with Republic of Guatemala and Nicaragua, has little been investigated geologically, hence geological data inabundant.

Apart from pioneers' partial studies of geology as Karl Sapper (1898), Newberry (1888), Knowlton (1918), Redfield (1923), Bengston (1926), Olson and McGrew (1941), Mullerried (1942), Weaver (1942) and Carpenter (1954), the general regional geology was first shown with three reports respectively by the studies of Roberts & Irving (1957), Williams & Mcbirney (1969) and Mills, Hugh, Feray & Swolfs (1967). Mills et al. (1967) reported the stratigraphy of the broad area including this survey area based on many previous reports and their own accumulation of data collected in the fields. Especially their report on the stratigraphy of Mesozoic formations is excellent. Williams studied igneous rocks around this survey area and defined the characters of the volcanic rocks well. As for ore deposits, there is a volume "Mineral Deposits of Central America" by Roberts & Irving. In this volume are described more than 50 mines and indications in the Republic of Honduras, including some in this survey area. In addition, it is said "Mineral Potential of Honduras" has been pressed by Direccion General de Minas e Hidrocarburos (DGMH). A map in a scale of 1 to 2 million of the

distribution of metallic ore deposits in Central America has been published in which mineral's indications of Petoa and San Martin are described.

The most important and the most detailed investigation of the ore deposits is that carried out by UNDP. The UNDP and the government of the Republic of Honduras did systematic investigation works for ore deposits, for five years from 1969 to 1974, in total area of 10,800 km^2 in the north-western part of the country, employing the methods of regional geological survey, geochemical exploration, local detailed geological survey, detailed geochemical exploration, geophysical exploration, pitting, trenching and diamond drilling, and selecting high potential areas for mineralization, recommended further detailed exploration in several areas as Chamelecon and Petoa, leaving the minuteful reports of geology and mineral deposits and the geological map of 1 to 50,000.

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Chapter 2 Outline of the Survey Area

2-1 Outline of the Republic of Honduras

The Republic of Honduras is the second largest country in the Central America, with the total area of 112,088 km^2 and the population of 2,830,000, which lead to the density of population to be 25/km^2. It is said to be by Columbus who named the country Honduras by the meaning of "depth", when he spent hard time with hurricane and deep tidal current in his fourth voyage to the vicinity of this land in 1502.

Although by the constitution enforced in 1965, respective independence of the legislature, the executive and the judicature was established, the constitution has been suspended and the Diet has been dissolved since General Lopez Arellano's inauguration as the President at the time of the coup d'etat in December 1972. Colonel Juan Alberto Melgar since April 1975, and Policarpo Paz Garcia has been the President since August 1978.

Official language is Spanish, and the most prevailing religion is Catholic. Most of the inhabitants are mixed-blood called Mestizo.

The characteristic feature of the economic conditions of the Republic is "mono-culture economy", based on the export of the agricultural products as banana, coffee, cotton and tabacco etc. Modern industries are being developed in the fields of cement, textile, chemical industry and so on. Gross National Production is $328/man (1975) and the amount of exports in foreign trading is 283.3 million dollars, while that of imports is 400 million dollars. The Republic has seeded from Central American Common Market since the boundary problem with El Salvador in 1969, which has not been solved yet. There is no special control on foreign capital, and any foreign individual person or any foreign corporation can claim same rights as given to Honduras.

History of mining goes far back to the Spanish Colonial age. Mining products are mostly from the two main mines, El Mochito and Las Animas, the amount of which reached 52.40 million Lempira in 1973 against 30.95 million Lempira in 1969. Main metal product is zinc with silver, lead, cadmium, antimony and gold.

In 1941, El Quetzal Mine, situated near the border to Guatemala, started operation with the production of 700 s. tons of antimony. After that, Rosario Resources Corp. of the United States carried out positively the exploration works in limestone area in 1940's to result in the operation of El Mochito lead-zinc mine in Santa Barbara State in 1950's which is now producing 28,000 tons of crude ore per month with the combined grade of 16%, in 1975. Las Animas mine, about 30 km east of Tegucigalpa, the capital of the Republic, was operated by Compania Minera los Angeles to produce 2,000 tons of crude ore per month with the grade of about 15% lead and zinc combined. The mine stopped working in 1976.

In recent years, exploration for mineral resources have been active as those represented by the investigation works in Vueltosa area in Santa Barbara State by Rosario-ASARCO (1968-1972), the works for lead and zinc minerals in the western part of Santa Barbara State by Nicaragua capital, the works in Cerro La Mina area by Rosario-Mitsubishi Metal Corp. and the surveys in Chamelecon area by UNDP (1969-1974). Also, the regional geological survey is being carried out in Olancho State by the Direccion General de Minas e Hidrocarburos promoted by the government of the Republic of Honduras.

The production of main metal minerals in 1976 is shown in the Table 6-13.

2-2 Topography

The survey area is situated near the border to the Republic of Guatemala,

Table 6—13 Production of Main Mineral Products

(June 1, 1977)

	Unit	Amount	Grade *
Antimony ore	cubic ton	299.66	43.03 %
Cadomium in zinc concentrate	cubic ton	301.44	0.61
Au: in nugget	troy ounce	199.97	
Au: in concentrate	troy ounce	2,080.25	0.028 T. oz/t
Pb: in lead concentrate	cubic ton	18,532.77	63.21%
Pb: in zinc concentrate	cubic ton	1,959.15	4.14%
Ag: in ingot	troy ounce	157,690.06	-
Ag: in concentrate for export	troy ounce	2,806,289.14	36.65 oz/t
An: in zinc concentrate	cubic ton	23,883.68	49.73%
Zn: in lead concentrate	cubic ton	3,507.85	11.93%
Cu: in zinc concentrate	cubic ton	286.32	0.60%
Cu: in lead concentrate	cubic ton	115.29	0.40%

* Grade: Average grade of crude ore or concentrate

(After Direccion General de Minas e Hidrocarburos)

in the northwestern part of the Republic of Honduras, as shown in Fig. 1. The survey area is in the catchment area of Chamelecon River, which flows toward ENE followed by east, from the southwestern part of the area, joining branches of Blanco River, Colmillo River and Cacaulupa River, which are flowing south to north. Then the Chamelecon River flows out Caribbean Sea, after confluence of Ulua River in the northeast beyond the survey area.

The survey area is along the northwestern side of the range roughly trending east and west. The area along the Chamelecon River, like the survey area, forms mostly plain-land or hillyland, while in the south of such area it is steep highland of the altitude of about 1,000 meters above sea level. High mountains, represented by the highest of Mt. Cantiles, 1731 m above sea level, are forming ranges, stretching dominantly E-W and NNE-SSW in west part and N-S or SSW-NNE in east part. In the north, ranges extending east-west are seen partly.

The northern part of the survey area composed of crystalline schists comprises round feature of hills with dendritic drainage system, while in the southern part composed of limestones are formed mountains of shape of hanging-bell, gentle on the top and steep along the sides. In the south-eastern part composed of volcanic rocks, generally young features of topography like steep cliffs or plateau are formed according to the particularity of the geology.

Along the Chamelecon River, several stages of river-terraces are observed, and also two plains are formed, one is over 13 km long in north-south from Sula to El Ciruelo with the width of 5 km, and the other is irregular one approximately 4 km wide and 15 km in length extending ENE-WSW from Chumbagua. The plains are called Valle de Quimistan, cultivated as sugar-cane field and utilized as pasture.

2-3 Climate and Vegetation

Although the Republic of Honduras is situated in tropical climate zone in latitude 13° to 16°, the climate is somewhat different between the northern low-land part around San Pedro Sula near Caribbean Sea and the southern high-land area including Tegucigalpa, the capital city. The climate in the northern part shows typical tropical character with rather high temperature and rather long rainy season, while in the southern area dry season keeps itself long with slightly lower temperature. Generally dry season is from December to April and rainy season is between May and October. In rainy season rain is usually torrential with thunderstorm and rivers are often in flood.

Rainfall and Temperature at Tegucigalpa
(Location 14°4'N; 87°13'W 1,007 m G.H.)

	Jan.	Feb.	Mar.	Apr.	May	June
Temperature (°C)	19.2	20.3	21.8	23.2	23.7	23.1
Rainfall (m/m)	14	5	11	28	156	166

	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Temperature (°C)	22.6	22.8	22.9	21.9	20.8	19.7	21.8
Rainfall (m/m)	92	111	176	141	40	15	954

In the survey area, belonging to the tropical climate zone, the temperature goes up over 30°C in daytime of May to August. The average temperature in lowland area, is approximately 24°C in November to March and about 27°C in April to October. The rainy season is from June to October and the average monthly rainfall in the season is estimated to be about 200 m/m. It becomes impossible to ford Chamelecon River and Blanco River in the rainy season. But, in the southern part of the survey area, the climate is of highland type; less hot, and in morning and evening it sometimes becomes cool. The survey area is covered with thick vegetation due to high temperature and high humidity, and cultivated for corn field and pasture

in many places. In Chumbagua area at the central-part of the survey area, sugarcane field spreads and sweetcorn, pineapple, banana etc. are in cultivation. In the southern hilly part or highland area, coniferous trees are widely distributed and the land is cultivated with sweetcorn and coffee. There are dangerous creatures like venomous serpent, scorpion, tick in the survey area, but no malaria has been found.

2-4 Inhabitant and Industries

The total area of the Republic of Honduras is 112,088 km^2, about one-third of that of Japan. The population is 2,832 thousand; urban population is 1,030 thousand and rural 1,800 thousand. The density of population is 25.3 men per square kilometer (1975 estimated). Working population in each production group is as follows:

(thousand)

	1973	1975
Agriculture, Forestry, Hunting, Fishery	508.0	522.7
Mining, Quarrying	2.4	2.4
Manufacturing	68.1	70.0
Construction	18.5	19.3
Electricity, Gas, Water, Health	4.7	4.8
Transport, Communication, Storing	14.0	14.5
Finance, Insurance, Realty, Commerce	42.9	44.2
Others (Officials, Defense etc.)	27.4	28.2
Total	781.4	804.2
Total Population	2,675.9	2,837.0

The population of the capital, Tegucigalpa, is about 320 thousand. Racial composition is as follows; Mixed blood of White and Indio 91%, Indio 6%, Black 2% and White 1%. There is no racial discrimination. The most

prevailing religion is Catholic. Official language is Spanish and no native language is used officially.

Chief industries in this country is represented by agricultural production as banana, coffee, cotton, tabacco, wood and meat. Gross National Production is 996 million dollars (1975 estimated) and Production per man is 328 dollars. Currency is Lempira. (1 US$ = 2.00 Lempira)
Reserve in foreign currency is 52.2 million dollars.
Foreign trade; Export 283.3 million US$.
Import 400.0 million US$.

For reference, there are shown hereunder Production of Main Agricultural Products (Table 6-3), Production of Main Products (Table 6-4), Main Civilization Factors (Table 6-5), Export of Main Mineral Products (TAble 6-13), Export of Main Products (Table 6-6A) and Import of Main Products (Table 6-6B).

2-5 Access

It is four hours drive, along the main highway running north-south, from Tegucigalpa, the capital, to San Pedro Sula in the northeast of the survey area. The highway is with two lanes, completely sealed all the way of this 242 km. To reach the survey area from San Pedro Sula, a ride of an hour and a half on the 2-lane highway toward the border of Guatemala through La Entrada along Chamelecon River is required to La Flecha village in the central part of the survey area. The distance is 75 km. Although the highway has many bending, it is paved and with 2-lanes, which gives good access to the survey area.

There are airfield at Tegucigalpa and San Pedro Sula for middle to small class airplane including jet-liner, connecting neighbouring countries. Also, buses are serviced respectively on the way Tegucigalpa-San Pedro Sula-La Flecha. There is an unpaved road, which branches at La Arada in the

survey area, from the way from San Pedro Sula to La Flecha, running to south toward Santa Barbara, the State capital, through Trinidad. As all the other roads in the survey area branching from the highway of San Pedro Sula-La Flecha-La Entrada are unpaved and become soft on the surface in rainy season, and also there are only a few bridges to pass over Chamelecon River, it is very difficult for vehicles to get through the survey area in rainy season. Horses are used for inter-mountains traffic and communication by the inhabitants.

For foreign trade, Cortes port is available along the coast of Caribbean Sea, which is said to be the best port in the Central America. The port is located 58 km north of San Pedro Sula. They are connected by a modern road for 45 minutes drive. Although there is a port called San Lorenzo port, along the Pacific Ocean side coast, it has not sufficient depth and cargoes are re-loaded at Las Palmas Island.

Table 6—3 Production of Main Agricultural Products

(unit: 1,000 quintal=46 ton)

	1973	1974	1975	1976	1977	1978
Sweetcorn	7,918	7,902	7,583	8,331	7,327	7,632
Rice	496	483	834	502	385	501
Beans	923	1,042	751	948	950	980
Millet	1,340	1,401	1,333	1,519	1,346	1,351
Cotton	268	328	321	193	437	699
African palm	1,123	1,005	1,086	1,036	1,180	1,304
Tabacco	79	102	121	129	149	143
Coffee	1,124	1,083	1,199	1,176	1,127	1,483
Banana tree	30,076	26,042	17,031	23,867	26,902	27,533
Sugarcane	26,860	31,574	33,026	33,517	41,107	47,054
Banana	2,254	2,108	1,971	2,094	1,650	1,895

Table 6—4 Production of Main Products

	Unit	1973	1974	1975	1976	1977	1978
Sugar	quintal (46 ton)	1,321	1,640	1.745	1,877	2,302	2,490
Cement	42.5 kg bag	5,542	5,059	6,377	5,501	5,805	6,455
Tabacco	box containing 20	83,574	90,535	90,211	98,235	107,568	108,508
Wheat flour	quintal	791	728	700	836	1,053	1,143
Match	box containing 40	52,060	50,632	51,021	51,592	59,234	72,005
Cloth	yard	17,801	16,933	16,596	15,010	15,194	15,556
Cooling drink	6 once bottle	414,991	492,476	589,438	638,881	878,078	962,238
Beer	12 once bottle	96,850	89,276	90,709	69,890	92,598	105,568
Spirits	littre	1,148	1,134	1,070	1,301	1,561	1,613
Liquar compound	littre	3,560	4,334	4,513	5,006	5,636	5,861
Electric power	1,000 kwh	332,381	395,658	463,043			
Service water	1,000 m^3	10,899	12,538	13,048			

(After Empresa Nacional de Energia Electrica (ENEE))

Table 6—5 Main Civilization Factors

	Unit	1973	1974	1975	1976	1977	1978
Road	km	5,943	6,136	6,595	8,704	9,199	10,613
Asphalt-sealed	km	1,228	1,240	1,327	1,405	1,442	1,480
Passable all-season	km	3,225	3,406	3,570	4,162	4,435	5,426
Passable only in summer	km	1,490	1,490	1,698	3,137	3,322	3,707
Vehicles	number	45,547	49,126	52,114	58,980	63,831	71,062
National railway	km	205	205	205	205	205	205
Railway for banana company	km	791	784	772	772	772	772
Auto-phone	number	13,697	17,555	18,261	17,681	18,683	19,104
Postmovement length	miles	36,958	40,292	44,279	51,069	54,264	60,690
Bed in hospital	number	4,406	4,714	4,616	4,567	4,545	4,629
Primary school children	number	484,268	507,202	530,571	643,937	658,236	673,613
School	number	4,245	4,422	4,602			

Table 6—6A Export of Main Products

(thousand unit and million lempiras)

		1973		1974		1975		1976		1977		1978	
		Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value
Banana	40 lbs. box	45,413	188.0	35,343	169.4	20,084	90.6	33,080	213.4	39,030	255.7	39,224	270.2
Coffee	60 kg bag	664	96.9	514	87.9	812	114.2	721	200.6	599	336.4	958	422.0
Wood	m^3	591	78.2	479	81.4	393	78.2	430	81.5	446	94.4	358	84.6
Zinc, Lead	pound	84,436	26.0	81,762	37.8	101,864	46.5	85,122	36.5	83,577	40.2	85,068	40.7
Silver	troyounce	3,067	14.0	3,427	26.2	3,654	27.5	3,359	27.1	2,709	23.6	2,796	28.2
Oil-byproducts	kilo	222,120	8.3	213,982	29.0	180,944	24.5	16,267	2.3	8,001	1.2	-	-
Chilled meat	kilo	19,828	43.9	13,103	33.6	16,970	36.7	20,694	51.2	17,644	43.3	22,637	77.6
Lobster etc.	kilo	2,306	4.5	1,805	8.1	2,511	20.6	2,538	24.5	3,269	30.4	2,505	31.2
Sugar	kilo	100	-	7,545	9.0	10,111	13.9	6,696	4.4	19,746	7.5	22,588	11.0
Tabacco	kilo	1,374	5.7	2,368	8.5	2,748	11.1	3,242	11.8	4,470	18.1	4,360	17.9
Cotton	kilo	3,121	3.1	4,466	6.4	5,334	9.0	3,726	8.7	5,129	13.6	13,040	31.1
Washing Soap	kilo	3,851	2.6	6,349	5.4	8,207	7.9	12,400	13.2	21,306	23.0	23,863	27.2
Colohonia (resin)	kilo	4,103	2.3	4,683	4.9	6,778	6.7	6,396	4.6	6,930	5.1	5,185	4.6
Cement	kilo	70,863	3.4	29,539	1.6	101,242	5.8	38,648	2.6	2,279	0.2	5,060	0.5
Canned Fruits	kilo	11,394	3.8	9,778	3.8	11,696	4.4	13,329	6.2	14,603	7.5	9,674	5.6
Others	kilo	-	41.5	-	76.5	-	69.0		100.5		111.3		141.2

Main countries to export

U.S.A.	266.2	262.0	293.6	446.1	502.1	686.0
West Germany	58.2	58.8	64.2	92.5	186.2	149.8
Holland	19.2	19.6	25.6	21.5	48.0	64.3
Japan	20.8	22.4	18.4	24.5	53.7	29.2

(After Direccion General de Estadistica y Censos)

Table 6—6B Import

(million kgs and million lempiras)

	1973	1974	1975	1976		1977		1978	
	Value	Value	Value	Amount	Value	Amount	Value	Amount	Value
Food	44.5	62.3	90.4	88.3	74.5	124.0	83.0	160.9	102.1
Tabacco, drinks	1.9	2.9	2.8	1.2	4.5	2.0	8.5	2.5	9.5
Raw materials	5.4	11.2	12.5	17.3	17.1	19.6	16.6	29.4	21.0
Fuel, oil	52.1	126.9	137.0	507.4	107.7	569.8	142.0	585.2	152.7
Oil and fats of animal and plant	4.3	9.3	8.9	1.6	11.2	13.2	14.2	13.8	14.6
Chemical products	79.4	111.9	116.5	109.9	148.0	156.9	189.1	126.9	223.5
Manufactural products	150.9	209.3	172.8	189.7	236.1	208.5	274.3	242.3	312.6
Transport machinery	151.9	204.6	213.5	40.5	261.7	53.5	357.5	57.9	459.9
Other manufactural products	32.6	38.1	43.2	6.2	54.2	8.4	76.0	9.7	98.0
Products for Trade	1.9	6.3	2.4	0.9	2.5	0.4	1.1	4.2	6.8

Main countries for import

U. S. A.	214.0	307.8	333.0		396.4		497.4		581.5
Japan	44.2	48.0	33.2		79.8		127.2		123.7
Guatemala	32.4	42.0	27.4		53.2		65.9		87.8
Costa Rica	13.8	20.8	28.4		30.2		38.8		61.9
Nicaragua	18.4	20.4	27.6		33.5		37.7		43.9
West Germany	22.0	37.4	27.4		42.4		41.2		48.6