REPORT ON THE PRELIMINARY SURVEY
OF
THE PROJECT FOR INTEGRAL UTILIZATION OF PYRITES
IN
THE STATE OF GUERRERO, UNITED MEXICAN STATES

SEPTEMBER, 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

This project is to be carried out to make the feasibility study of applying pelletizing chlorination process (Kowa process), which was put into practical use in Japan, for the development of pyrite ore deposits which are in the State of Guerrero of United State of Mexico. This work was entrusted to the Japan International Cooperation Agency (JICA) by the government of Japan, at the request of the government of United States of Mexico, as one of the technical cooperation from Japan.

The objects of this preliminary study were to discuss some items including "Scope of work" with the personnel of the government of United States of Mexico, and to select suitable deposits for the feasibility study after examining the information which was obtained at the preliminary investigation of the pyrite ore deposits in the Guerrero State.

The preliminary mission, consisted of 4 engineers including Mr. Tatuso Konada as the leader, investigated the site from Jan. 25 to Feb. 21, 1980. And after returning to Japan, they analyzed and examined the materials and the result of the preliminaly investigation, and then prepared this report.

We expect that the feasibility study will be smoothly carried out based upon the result of this preliminary investigation.

In conclusion, we wish to thank the members of the preliminary study Mission who performed the investigation. And many thanks are also due to the representatives of the government of United States of Mexico for their close cooperation extended to the team.

September, 1980

Shizuo Kishida
Executive Director
Japan International Cooperation Agency

Mr. Keisuke Arita
President
Japan International Cooperation Agency

Here, we present the report of the preliminary study prior to the Feasibility Study for Integral Utilization of Pyrites in the State of Guerrero, United States of Mexico.

At first the mission for preliminary investigation held conferences several times with the representatives of Consejo de Recursos Minerales (CRM) and of the government of the State of Guerrero at Mexico city from Jan. 25 to Jan. 30, 1980.

In consequence, the mission agreed that the development of pyrite ore deposits in the State of Guerrero is very important, so they discussed the scope and contents of the feasibility study with the representatives of CRM and the government of the State of Guerrero, and then "Scope of work" was signed by each representatives on Jan. 31, 1980.

The detailed items, which were concluded in the discussion, were recorded in the minutes of the meetings.

The mission, then, carried out the field investigation for 5 pyrite deposits in the State of Guerrero Jan. 31 to Feb. 21, 1980, and not only took the samples but also collected the materials concerning these deposits.

After returning to Japan, we selected the suitable deposits for the feasibility study after due consideration of the result of the investigation and collected materials.

We are confident the feasibility study will be smoothly performed on the basis of the result of this preliminaly investigation.

In conclusion, we wish to thank the persons concerned of Ministry of Foreign Affaires, Ministry of International Trade & Industry and JICA for their valuable advices. And we also wish to thank the personnel of the embassy of Japan in Mexico and Mexico office of JICA for their cooperation in Mexico.

T. Konada

Tatsuo Konada
Leader
Preliminary Study Team
Project for Integral Utilization of
Pyrites in the State of Guerrero
United States of Mexico

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1. SUMMARY

Scope of work for the Feasibility Study of the Project for Integral Utilization of Pyrites in the State of Guerrero was agreed among CONSEJO DE RECURSOS MINERALES, EL GOBIERNO DEL ESTADO DE GUERRERO, and the JAPAN INTERNATIONAL COOPERATION AGENCY in January 31,1980. Articles agreed by three partners are written down in the Scope of Work and the Minutes (Annex 1).

Five pyritic massive sulphide deposits (page 16, Fig. I) were surveyed by the preliminary study team.

Physiography, geology, ore deposits and applicable mining methods were studied based on the survey results and analyses of the collected informations.

2. CONCLUSION

Out of the five deposits, the Copper King and the Campo Morado deposits were selected as the target mines for the Feasibility Study. The reasons why the said two mines were chosen as the target mines are mentioned below;

1) Ore Reserves

The most important item for selecting the target mines is the tonnage of ore reserves. To sustain medium scale mining operations for 10 years, ore reserves of at least 5 million tons, if possible, more than 10 million tons are required.

Ore reserves estimated by this preliminary survey are shown as follows;

(1)	the Copper King deposit	:	20 million tons
(2)	the Campo Morado deposit	:	10 million tons
(3)	the La Dicha deposit	:	2 million tons
(4)	the El Naranjo deposit	:	0.2 million tons
(5)	the Los Vises deposit	:	less 0.1 million tons.

2) Mining Cost

CIF (Cost, Insurance, and Freight) price of pyrites, which will be delivered to Lazaro Cardenas where the projected plant is to be constructed, roughly consists of mining cost and freight. Based on the survey results, each deposit is described below in order of the inferred mining cost (refer to Chapter 6).

(1)	the La Dicha deposit	:	Open pit mining method.
(2)	the Copper King deposit	:	Sublevel stoping method.
(3)	the Campo Morado deposit	:	Sublevel stoping method.
(4)	the El Naranjo deposit	:	Room and pillar method.
(5)	the Los Vises deposit	:	Shrinkage stoping method.

3) Freight

Freight is definitely subject to the transportation mileage of the ores from the mine site to Lazaro Cardenas. Estimated transportation cost may be 8$/100 Km.t.

The transportation mileage of each deposit is;

(1) the Copper King deposit : 185 Km.

(2) the La Dicha deposit : 485 Km.

(3) the Campo Morado deposit: 710 Km. - (350 Km.)

(4) the Los Vises deposit : 710 Km. - (350 Km.)

(5) the El Naranjo deposit : 710 Km. - (350 Km.)

Meanwhile, about the Campo Morando, the Los Vises, and the El Naranjo deposits, after the completion of the new route, now under construction, the transportation mileage will be reduced to almost the half of the present route distance.

4) The Application of Dressing Process

In the case that the contents of gangue minerals and/or non-ferrous heavy metals in crude ores exceeds some allowable limits, these contents must be reduced below the limits by means of a flotation method etc.

A rough feasibility of the flotation (income for selling by-produced concentrates – cost) for each deposit will be estimated as follow from the anticipated ore grade;

(1) the Los Vises deposit : Fair.

(2) the Campo Morado deposit: Fair.

(3) the El Naranjo deposit : Not so good.

(4) the La Dicha deposit : Not so good.

No dressing process is needed for the Copper King deposit.

5) Revenue from the The Recovered Metals

In the conventional process, only sulfur in pyrites is utilized for manufacturing of sulfuric acid, being abondoned iron as waste cinders, because the cinders contain such harmful elements for steel making as Cu, Pb, Zn, As, etc.

However, the proposed Process can convert the wasted cinders into pellets with good quality for steel making by removing the above mentioned elements, which are to be recovered as valuable by-products, from the cinders. Generally, Au, Ag, Cu, Pb, Zn, Se, Bi, etc. are recoverable through the Process. Expected income brought by recovered metals for each deposit surveyed is as follows;

(1) the Los Vises deposit : Much.

(2) the Campo Morado deposit: Much.

(3) the El Naranjo deposit : Medium.

(4) the La Dicha deposit : Little.

(5) the Copper King deposit : Little.

6) Conclusive Remarks

The above mentioned items can be summarized on the following table.

Name of Deposit	A	B	C	D	E
Campo Morado	○	△	×	○	○
Copper King	○	○	○	×	*
La Dicha	△	○	△	×	△
Los Vises	×	×	×	○	○
El Naranjo	×	×	×	△	△

○ : Good.

△ : Medium.

× : Poor.

A : Ore Reserves.

B : Mining Cost.

C : Freight.

D : Revenue from recovered metals.

E : Application of Dressing Process.

* : No dressing process is needed.

Both of the selected 2 deposits have the common fundamental characteristics that they have large ore reserves, but their other conditions are quite contrastive.

In the Copper King deposit, although the cost (mining cost and freight) could be low, the proceeds of the recovered metals are not expected so much.

On the contrary, in the Campo Morado deposit, we can expect much proceeds of the recovered metals, but the cost could be higher.

Consequently, if we carry out Feasibility Study on these contrastive two deposits, the results of the study could be applicable to most of other pyrite mines.

3. INTRODUCTION

3-1. PURPOSE AND BACKGROUND OF THE SURVEY

There are many pyritic massive sulphide deposits, such as the Copper King, the Campo Morado, the La Dicha, the El Naranjo, the Los Vises, the Violin, the Achotla, and the Campo Seco deposit, in the State of Guerrero, the United States of Mexico, but they are not being exploited currently.

On the other hand, industrial expansion in Mexican Pacific coast is outstanding. The Las Truchas steel complex, situated in the State of Michoacan near the border of the State of Guerrero, initiated its operation recently and the fertilizer plant (Fertlizantes Mexicanos S.A.), which plans to produce phosphate fertilizer using phosphate rock from Baja California and Frasch sulfur from Tehuantepec isthmus as raw materials, is now under construction adjacent to the said steel complx.

Pyrite ores have not been highly evaluated economically so far, because of the utilization of its sulfur (amount to about 50 percent of pyrites by weight) alone as a raw material for production of sulfuric acid. Economical value of pyrites were highly advanced through the integral utilization of sulfur, iron, and other heavy metals contained in them being used as raw materials for sulfuric acid to fertilizer, steel making, and recovery of precious and other heavy metals by the application of the Chlorinating Volatilization Process developed in Japan.

Economically, it is considered that an exploitation of the pyrite ore deposit in the State of Guerrero by an application of the said metallurgical system to process the mined pyritic ore, will be feasible, and also be useful for development of the rural communities.

The prime purpose of this preliminary study is to choose two mines which will be studied by the following feasibility study team.

3-2. SCOPE OF WORK

The Scope of Work for the Feasibility Study of the Project for the Integral Utilization of Pyrites in the State of Guerrero was agreed among CONSEJO DE RECURSOS MINERALES, EL GOBIERNO DEL ESTADO DE GUERRERO, and the JAPAN INTERNATIONAL COOPERATION AGENCY in January 31, 1980. Articles agreed by three partners are written down in the minutes (Annex 1).

3-3. MEMBERS OF THE PRELIMINARY STUDY TEAM

JICA:

Metallurgist (Chief)	:	Tatsuo Konada
Mining engineer	:	Shigekichi Iida
Geologist	:	Fumio Wada
Coordinator	:	Setsuo Takemoto

Mexican partners:

General director of CRM	:	Guillermo P. Salas
Economic consultant of EG	:	Gustavo Martinez Cabanas
Assist. director	:	Alejandro Briones y Garcia
Director of DM	:	Luis Reyes Rodriguez
Geologist of CRM	:	Cesar Gallardo Melendez
Geologist of DM	:	Sergio Cruz Ojeda
Geologist of DM	:	Everardo Gomez Serna
Metallurgist of DM	:	Humberto Valenzuela Lezain
Geologist of CRM	:	Jesus Santos Montanas

Note;

JICA	:	Japan International Cooperation Agency
CRM	:	Consejo de Recursos Minerales
EG	:	Estado de Guerrero
DM	:	Direccion de Mineria del Estado de Guerrero

3-4. ITINERARY

T: Takemoto, I: Iida, K: Konada, W: Wada, S/W: Scope of Work

1	1980 Jan. 1/25(Fri.)	T, K, W.	Left Japan, arrived in Mexico.
2	1/26(Sat.)	T, I, K, W.	Meeting in Dowa Mex. office.
3	1/27(Sun.)		Holiday.
4	1/28(Mon.)	T, I, K, W.	Greeting to Japanese Embassy and meeting in JICA Mex. office.
		T,K,W.	First meeting with CRM and EG. in CRM.
		I	Meeting with Rio Murga people.
5	1/29(Tues.)	T, K, W.	Meeting in JICA Mex. office.
		I	Meeting with Mr. Salas and discussion on the S/W.
6	1/30(Wed.)	T, I, K, W.	Meeting and discussion on the amendment of S/W.
		T, K, W.	Amendment works of S/W in JICA Mex. office.
7	1/31(Thurs.)	T, I, K, W.	Meeting in JICA Mex. office. Second meeting with Mexican partners. S/W was signed. The film of Chlorinating Volatilization Process was screened in CRM office.
8	Feb. 2/1(Fri.)	T, I, K, W.	Trip Mexico to Chilpancingo.
9	2/2(Sat.)	T, I, K, W.	Meeting with members of DM and CRM and discussion on 5 target mines for the study. Trip Chilpancingo to Mexico.
10	2/3(Sun.)		Mr. Takemoto left Mexico.
11	2/4(Mon.)	K, W.	Reporting to JICA on the results of Chilpancingo meeting.
		I, K, W.	Visit to Mr. Monjardin at laboratory of CFM. Preparation for mine survey.
12	2/5(Tues.)		Holiday.

13	2/6(Wed.)	K.	Inspection of Lazaro Cardenas steel complex.
		I, W.	Trip Mexico to Chilpancingo. Discussion with DM people on mine survey.
14	2/7(Thurs.)	K.	Trip Lazaro Cardenas to Mexico.
		I, W.	Survey of the La Dicha mine.
15	2/8(Fri.)	K.	Consultation with JICA people.
		I, W.	Trip Chilpancingo to Ixtapa.
16	2/9(Sat.)	K.	Left Mexico.
		I, W.	Survey of the Copper King deposit.
17	2/10(Sun.)	K.	Arrived in Japan.
		I, W.	Inspection of Lazaro Cardenas and its harbor facilities.
18	(2/11(Mon.)	I, W.	Trip Ixtapa to Chilpancingo
19	2/12(Tues.)	I, W.	Survey of the Campo Morado deposit.
20	2/13(Wed.)	I, W.	Survey of the Los Vises and the El Naranjo deposit. Trip Campo Morado to Chilpancingo.
21	2/14(Thurs.)	I, W.	Discussion with DM on the survey results.
22	2/15(Fri.)	I, W.	Trip Chilpancingo to Mexico.
23	2/16(Sat.)	I, W.	Analysis of the mines surveyed.
24	2/17(Sun.)	I, W.	Ditto.
25	2/18(Mon.)	I, W.	Meeting with CRM people and collection of informations.
26	2/19(Tues.)	I, W.	Collection of informations in CRM.
27	2/20(Wed.)	W.	Investigation of the legal state of the ore deposits visited in Direccion de Mina.
28	2/21(Thurs.)	W.	Left Mexico.
29	2/22(Fri.)	W.	Arrived in Japan.

3-5. FIELD WORK

The preliminary survey was carried out on the La Dicha deposit, the Copper King deposit, the Campo Morado deposit, the Los Vises deposit, and the El Naranjo deposit. Physiography, geology, ore deposit and others were investigated.

Ore and rock samples and informations related to the surveyed deposits were collected by the preliminary study team. Collected informations and data were listed in Annex 4.

3-6. WORKS IN JAPAN

Physiography, geology, ore deposits, and applicable mining methods were studied based on the survey results and analysis of the collected informations.

The Copper King and the Campo Morado deposit were chosen as the target mines for the feasibility study.

4. THE CRITERIA OF SELECTION OF THE TARGET MINES FOR THE FEASIBILITY STUDY AND THE METALLURGICAL CONSIDERATIONS

4-1. RECOVERED NON-FERROUS HEAVY METALS

The feasibility of this Integral Utilization Project of pyrite ore definitively will depend on the economic balance of the items described below.

Incomes

Sale of sulfuric acid.

Sale of iron pellets.

o Sale of recovered heavy metals.

o Sale of concentrates as by-products.

Costs:

o Mining cost (including interest and depreciation of development and infrastructural cost).

o Dressing cost.

o Freight.

Metallurgical processing cost.

Financing cost, tax, etc.

The items circled especially influence to the feasibility. Therefore, adding on the fundamental ore reserves, the mining cost, the freight, the application of a dressing process, and the revenue from recovered metals were roughly discussed in the Conclusion (See: Chapter 2) to select the two target mines.

Though the sale of the produced sulfuric acid and iron pellets will bring a lot of revenue, there will be little difference in the revenue between from a pyrite and from another one. So, at first, a revenue of recovered metals (gold, silver and copper) through the Chlorinating Volatilization Process from ores of Copper King and Campo Morado deposits is tentatively calculated basing on certain conditions, for understanding.

(a) Condition A: Metal prices used for our tentative calculation

Gold	450$/TOZ
Silver	1,400¢/TOZ
Copper	90¢/lb.

(b) Condition B: Treating(T/C) and Refining Charge (R/C)

Gold	10$/TOZ	(R/C)
Silver	50¢/TOZ	(R/C)
Copper	20¢/lb	(T/C + R/C)

Using the above condition, revenue per gram, percent and per ton in the ore was calculated as follows:

Gold	:	450$/TOZ - 10$/TOZ(R/C)	14$/g.t
Silver	:	1,400¢/TOZ - 50¢/TOZ(R/C) = 1,350¢/TOZ	0.4$/g.t
Copper	:	90¢/lb - 20¢/(T/C + R/C) = 70¢/lb	16$/%.t

(c) Calculation of the Copper King case

(1) Case A: Used assay reported by Spring (1972)

Metal		Grade		Recovery		Rev. Unit	Revenue/t.ore
Gold	:	0.27(g/t)	x	0.85	x	14$/g	= 3.2$/t.pyrite ore
Silver	:	7.3 (g/t)	x	0.85	x	0.4$/g	= 2.5$/t.pyrite ore
Copper	:	0.53 (%)	x	0.85	x	16$/%	= 7.2$/t.pyrite ore
				Total revenue			12.9$/t.pyrite ore

(2) Case B: Used assay by the writers

Gold	:	0.1(g/t)	x	0.85	x	14$/g	= 1.2$/t.pyrite ore
Silver	:	4 (g/t)	x	0.85	x	0.4$/g	= 1.4$/t.pyrite ore
Copper	:	0.06(%)	x	0.85	x	16$/%	= 0.8$/t.pyrite ore
				Total revenue			3.4$/t.pyrite ore

Consequently, revenue from the recovered metals varies from 3.4$/t. to 12.7$/t. depending on the cited ore grade.

(d) Calculation of the Campo Morado case

The ore of the Campo Morado deposit has rather similar mineral composition to that of the Matsumine deposit (the Kuroko type massive sulphide deposit in the northeast of Japan). Accordingly, the grade of pyrite concentrate was presumed based on the Matsumine case using the ore grade adopted by Lorinczi (1977).

Gold	:	2.1 (g/t) x 0.85 x 14 \$/g = 25\$ /t. pyrite conc.
Silver	:	60 (g/t) x 0.85 x 0.4\$/g = 20.4\$/t. pyrite conc.
Copper		0.11(g/t) x 0.85 x 16 \$/% = 1.5\$/t. pyrite conc.
		Total revenue 56.9%/t. pyrite conc.

On the other hand, revenue per ton of the crude ore and the pyrite concentrate using the assay results of this survey is 32.1$/t. and 26.3$/t., respectively. A difference between revenue of Copper King and Campo Morado on recovered metals from pyrite ore or pyrite concentrate is over 40$/t as shown in above calculation. The difference of 40$/t is equivalent to that of transportation distance of approx. 500 km.

As for the mining cost and the freight, there are nothing mentioned specially. Feasibility of the dressing will be discussed later on.

4-2. FLOTATION

In the conventional process, pyrite ores and pyrite concentrates were used as a raw material for sulfuric acid producing only, wasting pyrite cinders mainly consisted of hematite (Fe_2O_3), because pyrite cinders usually contained so much such harmful impurities for steel making as Cu, Pb, Zn, As, etc. that pyrite cinders could not be used for a raw material for steel making. A chlorinating roasting process, which leached out the said impurities after roasting pyrite cinders with sodium chloride, could convert wasted pyrite cinders into a valuable raw material, so called purple ores, for steel making, but it was difficult to produce high grade steel from the purple ores as a main raw material because of fairly high contents of impurities remained in the purple ores.

The idea of effectively removing the said impurities from pyrite cinders by means of Chlorinating Volatilization had been studied mainly in Europe, but the idea had not been practiced because of operational problems until a Japanese company succeeded in practical operation solving many problems. This Project is also based on the Chlorinating Volatilization Process developed by the Japanese company.

Effectively to carry out the Chlorinating Volatilization of the non-ferrous heavy metals in pyrite cinders, total content of them is needed to be lower than some limit. And also content of gangue minerals in the pyrite cinders should be lower than a certain limit, because the pellets containing more than the limited-amount of gangue minerals would tend to lose their hardness under the high temperature in blast furnaces for steel making besides decreasing iron grade in the pellets.

As the gangue minerals and the most of the non-ferrous heavy metals in pyrites are not removed by roasting, these contents must be reduced below the allowable limits by a dressing process (flotation, gravitation, etc.) before the ore is roasted prior to the Chlorinating Volatilization Process, when the contents of the said components, non-ferrous heavy metals or gangue minerals, exceed the allowable limits.

If the dressing process is applied and is able to produce marketable concentrates as by-products, soared total cost caused by the operation of the additional dressing process will be compensated to a certain extent by the revenue from the by-produced concentrates. When crude ore having higher content of the valuable metals in it is processed through dressing process, economical advantage in its operation also can be expected.

Although nearly same cost are required for refining gold, silver and copper in either copper concentrates or recovered sludges by the Chlorinating Volatilization Process, much difference is expected in refining costs of lead and zinc between from lead or zinc concentrate and from the recovered sludges. As the refining costs of lead and zinc from each concentrate are much lower than that from the recovered sludges, it is advisable to recover lead and zinc from the by-produced concentrates, from the economical view point. From the said reason, the technology of the flotation which can produce salable zinc and/or lead concentrate from pyrite ores will play an important role for this Project when the pyrite deposit contains some amount of lead and/or zinc.

Detail analysis will leave to the Feasibility Study Team, as one of the main purposes of the Team is to investigate and evaluate the feasibility of this Project from various points of view.

5. DESCRIPTION OF THE ORE DEPOSITS SURVEYED

5-1. THE LA DICHA DEPOSIT

5-1-1. LOCATION AND ACCESS

The La Dicha deposit is located in the Sirra Madre del Sur region which is mountains extending from the Rio Balsas limiting the State of Michoacan and Guerrero to Guatemala through the Ithmus of Tehuantepec and a range along the Pacific coast dipping steeply to the south.

The property can be reached by a vehicle at dry season, but as for access in rainy season, especially, through dirty road of 50 km from Ocotito to Ixcuinatoyac village, it is recommendable to use a four-wheel drive vehicle. The required time by vehicle from Mexico to the mine is shown below.

Mexico —— Federal high way, route 95 (paved / 280 km 3.5 hours —— Chilpancingo —— Route 95 (federal, paved) / 50 km 0.5 hour —— Ocotito —— Dirty mountain road / 55 km 3.5 hours —— Ixcuinatoyac —— On foot / 20 minutes —— La Dicha deposit.

Unregular light aeroplane services from Chilpancingo to Ixcuinatoyac were available a few years ago but are suspended now for the sake of unfavorable landing strip condition.

5-1-2. PHYSIOGRAPHY

The local base level, at an average of 600 m, is formed by the Alcaparrosa River which comes predominantly from the north to the south. The Alcaparrosa River has a sufficient water throughout a year round. The relief around the La Dicha Deposit reaches approximately 100 m and is characterized gentle land form. Typical V-shape gorge, however, is encountered in the course of the Alcaparrosa River, although the area once had reached the stage of the maturity in the geomorphic cycle. The relief in the northern portion of the property is gradually getting steep and is estimated at about 200 m to 300 m.

Vegetations are characterized by tropical to subtropical ones (oranges, banana, mango etc.) and they grow thickly around the course of the river. But the higher portion of the hills is characterized by high trees of pine and oak and a little low grass.

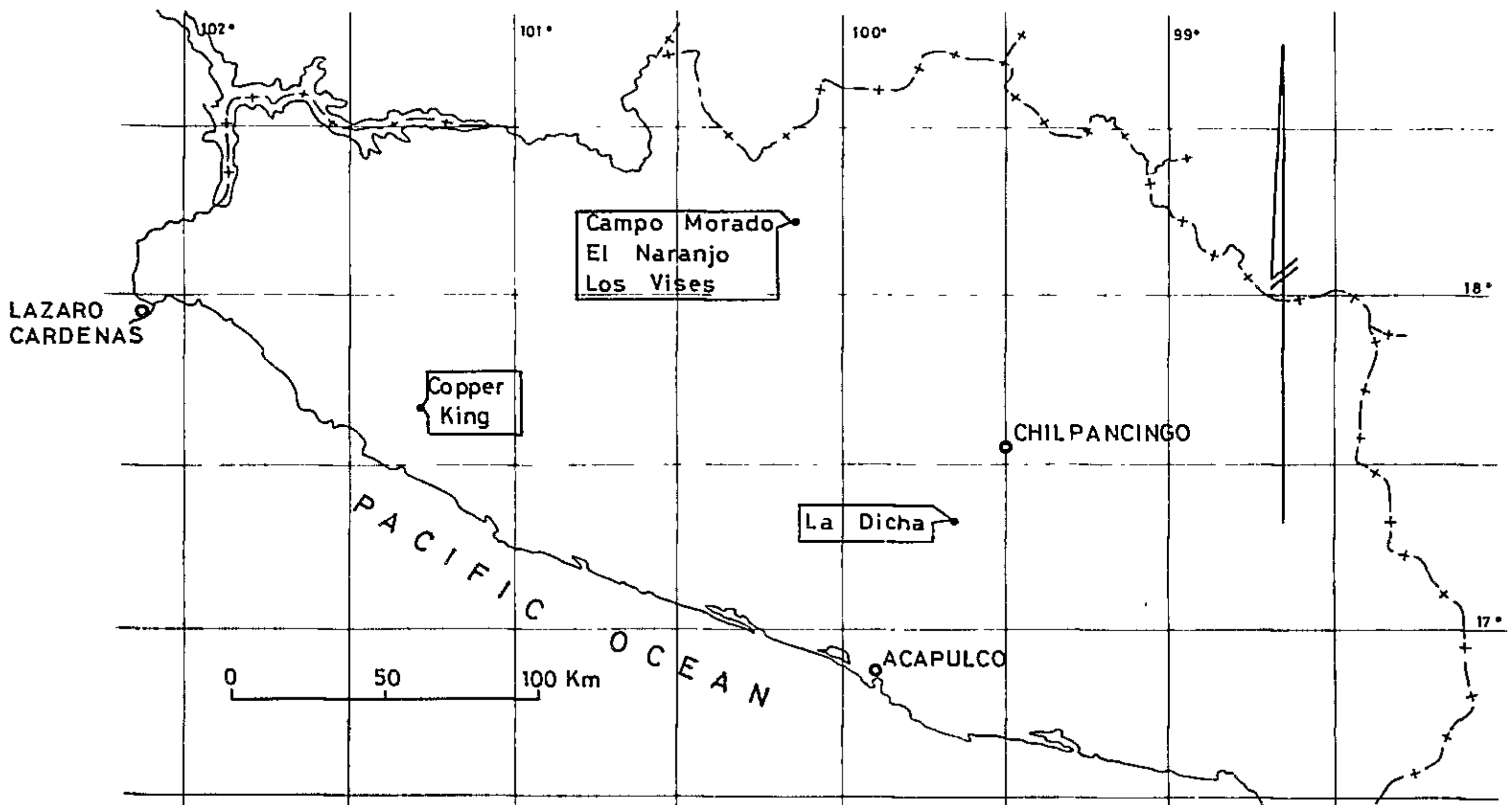
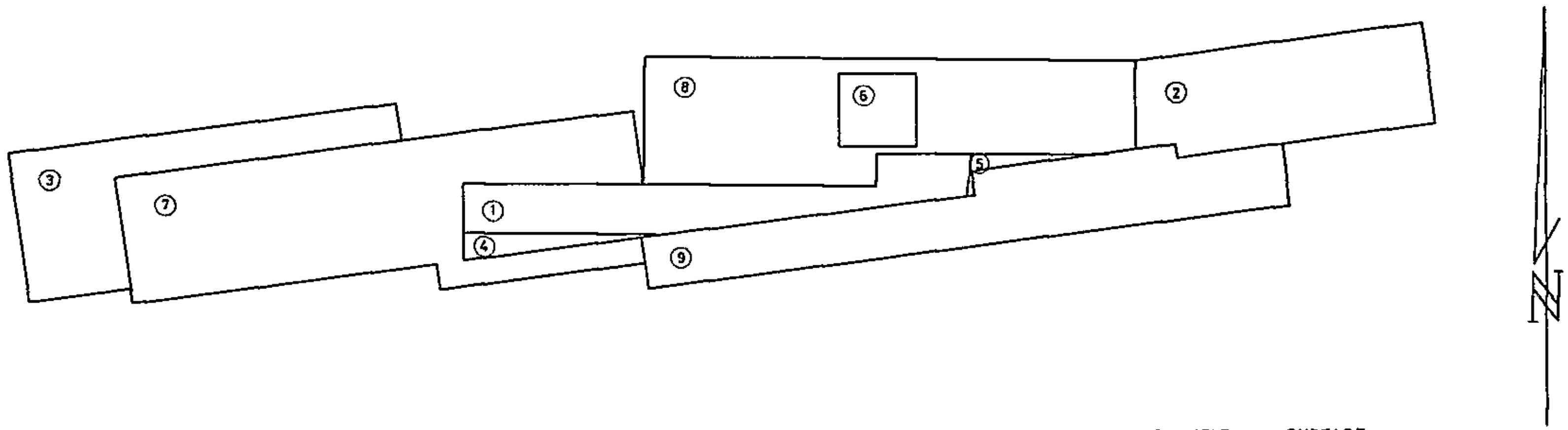
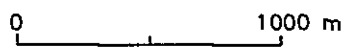


FIG. 1 LOCATION MAP OF MASSIVE SULPHIDE DEPOSITS VISITED BY PRELIMINALY STUDY MISSION (JICA)





	NAME OF CLAIM		NO. OF TITLE		SURFACE
①	La Marcela	–	T - 101557	–	34.5572 Has
②	Lourdes	–	T - 103294	–	45.4110
③	Nogales	–	T - 105334	–	40 5000
④	Amp de la Dicha	–	T - 106131	–	3.7966
⑤	La Nueva Dicha	–	T - 106339	–	1.7586
⑥	Eugenia	–	T - 106958	–	9.0000
⑦	La Conchita	–	T - 107732	–	91.8933
⑧	Amp. de la Dicha	–	T - 112633	–	92 1863
⑨	Real de la Dicha	–	T - 4676		

FIG. 2 CONFIGURATION OF LA DICHA MINING CLAIMS

According to the map of climate published by Universidad Nacional Autonoma de Mexico, the annual average temperature and amount of precipitation are 22 degrees and 1,500 mm respectively.

5-1-3. PROPERTY

The La Dicha Deposit comprises the claims shown in Fig. 2 and the right is being given based on the Mexican mining law. The property is owned by Jose C. Camou and his address is:

Shakespeare No. 6, despacho 602,
Col. Anzures, Mexico 5, D. F.

According to the investigation of the documents related to the property, the mining right was warranted as the result of fulfillment of the Mexican mining law's requirement. The property consists of nine titled claims, covering about 400 hectares and they are grouped in the sense of the mining law.

Mr. Camou is acquiring additional coverage surrounding the property on his own behalf.

Titled claims' configuration on the property is shown in Fig. 2.

5-1-4. HISTORY

The first discovery of the mineralization in the La Dicha mining area is back to 19th century in accordance with the description by Frits et al. (1973).

Historical records worth to mention specially on the prospecting and mine developments upon the La Dicha property so far are summarized as follows;

1902 - 1907: Michell Mining and Smelting Company had carried out the development of this deposit with an investment of 5 million dollars. The said company drove numerous shafts and tunnels which exist now as old workings. It is seemed that the enriched zone as for gold, silver, and copper was mined and smelted in those days.

And it also said that total copper production between 1902 and 1907 was approximately 3 million pounds (1,500 tons). Some marks of smelting yard constructed at that time are still recognizable in the property.

1923: Mining activities were again undertaken by Th. F. Cole group after suspension of mine working due to the Mexican revolution.

1942: Foshang (U.S. mining geologist) and Reyna (Mexican geologist) made an economic geological investigation on the La Dicha Deposit.

1956: Diamond drilling exploration work was conducted by Norex Syndicate in the property.

1968: The property was examined by some diamond drillings on behalf of Texas Gulf Sulfur.

1970: International Helium Limited carried out the exploration work.

1973: Brester Lake Mine Limited examined the property.

1973: Consejo de Recursos Naturales No-Renovables (antecedents of CRM) performed a mining geological survey.

5-1-4. GEOLOGY

Three geological sequences in this La Dicha mining area have been established by the previous works and they are shown in FIG. 3.

There also exists a granodiorite of intrusive. This intrusive lies roughly in the eastern portion of the La Dicha mining area as shown in FIG. 4 and partly shows gneissoid structure in its marginal part.

Only the Ixcuinatoyac formation was found around the La Dicha Deposit. This formation consists mainly of acid to intermediate volcanics, schists (sericite-biotite schist, sericite-quartz schist, etc. possibly originated from volcanics), phyllite, greywacke, and conglomerate. It is easily postulated that the submarine volcanism had been taken place in the area judging from the intimate relationships in time and space between the volcanics and sediments. The schistosity of the moderately metamorphosed rocks roughly coincides to their real strike and dip. The strike and dip of the country rocks of the La Dicha Deposit vary in place to place, however, they strike the north to the south and dip to the west in general.

The outcrop of the deposit can be followed easily due to its markable limonite gossan. The scale of the gossan is approximately 50 m in width and 2 km in

NAME OF FORMATION	ROCKS	ERAS
Capolapa	Acidic-Intermediate Lava and Pyroclastics, Graywacke, Quartzite, Phyllite, etc.	Mesozoic
— — — — —	— Discordant — —	— — — — — —
Ixcuinatoyac	Phyllite, Graywacke, Conglomerate, Sericite-Biotite-Schist, Volcanics.	Paleozoic
— — — — — —	Discordant — —	— — — — — —
Xolapa	Biotite-Schist.	Paleozoic-Precambrian

FIG. 3 STRATIGRAPHIC TABLE IN LA DICHA MINING AREA

length. The Gossan consists of dense and hard "so-called limonite" and it is thought to be derived from the massive sulphides. The La Dicha Deposit according to the observation of the mode of occurrence of the ore in the tunnel No.8 and in the Alcaparosa River occurs concordantly within sericite-biotite schist of the Ixcuinatoyac formation.

The main consituent sulphide minerals of the deposit are pyrrhotite, chalcopyrite, and sphalerite.

The form of the deposit seems to be lenticular to tabular in shape.

Moderate chloritization, silicification, and sericitization are encountered in the immediate vicinity of the deposit and there exists no extensive and intensive alteration zone as the Kuroko deposit.

The information from diamond drilling conducted by Norex Syndicate in 1956 are useful to evaluate the dimension and the mode of occurrence of the deposit. A deposit of steeply dipping to the west and lenticular to tabular in form are depicted from the drilling data and the first approximation of the dimension on the deposit between tunnel-8 to -6 (300 m in distance) is as follows;

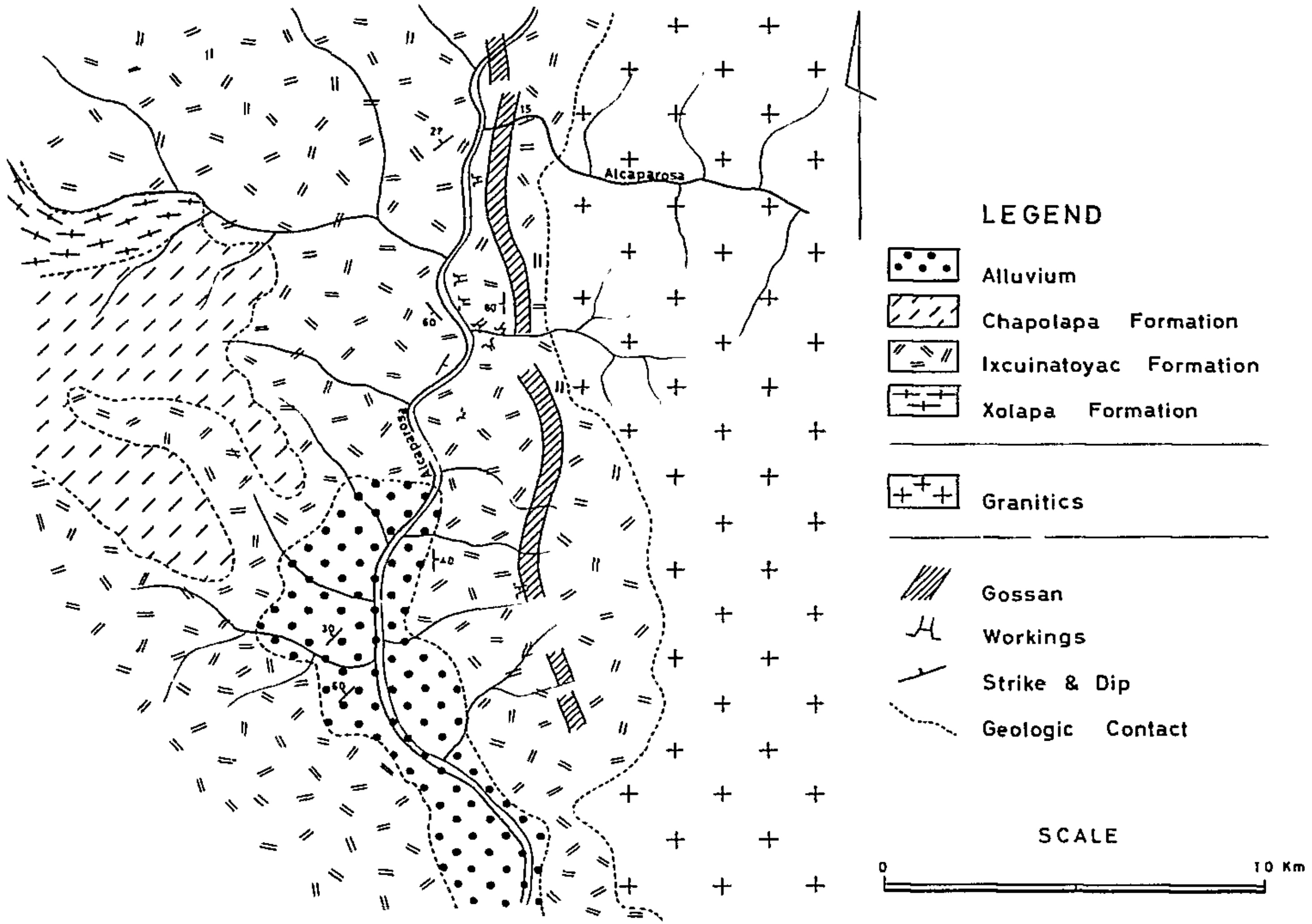


FIG. 4 GEOLOGIC MAP OF LA DICHA MINE After Frits J.W et al (1973)

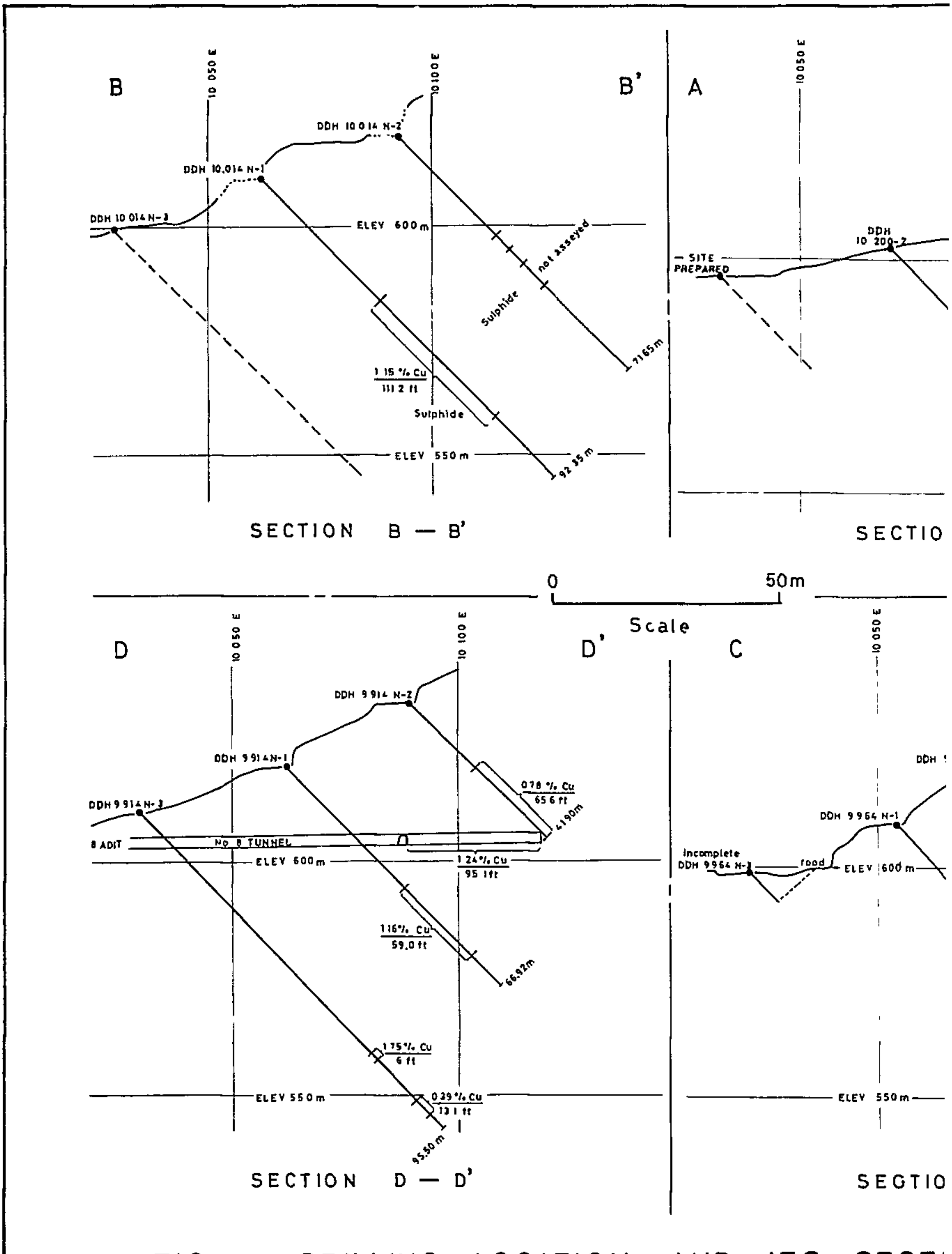


FIG. 5 DRILLING LOCATION AND ITS SECTI

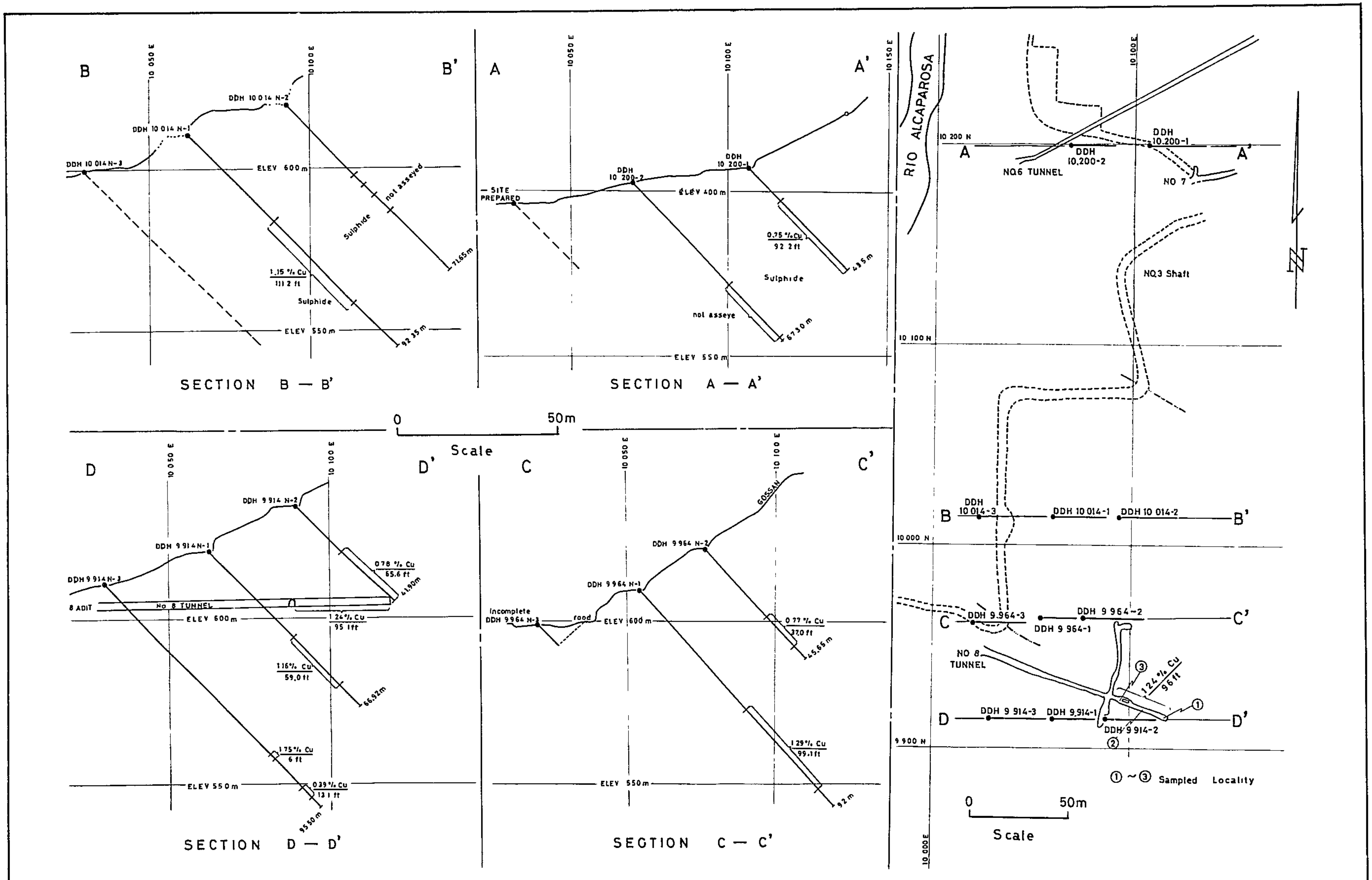


FIG. 5 DRILLING LOCATION AND ITS SECTION OF LA DICHA MASSIVE SULPHIDE DEPOSIT

Strike length*	Dip length**	Thickness***
300 m	90 m	20 m

* : It is positively suggested by no intermittent continuity of the gossan.

** : It is a conservative estimation although a few drills cut rather poor mineralization.

***: Approximate mean ore width deduced from drilling results is 20 m.

The La Dicha Deposit is characterized by the existence of pyrrhotite as a main constituent sulphide mineral. Pyrrhotite is medium in size and magnetic hexagonal variety. Chalcopyrite is contained in a minor amount but common in the La Dicha ore. Megascopically and microscopically, it occurs as a veinlet and spot in shape.

According to microscopic examination, chalcopyrite is observed filling inter-spaces in the pyrrhotite and small crucks and it suggests that the ore was affected under the certain dynamic (geological) event after its formation. It is difficult to find shalerite megascopically in the ore although it is occasionally found microscopically and includes the exsoluted minute chalcopyrite dusts.

Judging from the above mentioned facts and surrounding geology, it can be imagined that the sulphide minerals of the La Dicha Deposit have been changed probably pyrite to pyrrhotite by a certain geological event.

It is interpreted that chalcopyrite, which has physical property tending to yield to fluid more easily than other minerals under the elevated temperature and high pressure, has been removed to fill the crucks and also the exsolution of chalcopyrite in sphalerite has been caused by the same geological event.

The critical cause of these facts is supposedly attributed to the intrusion of the granodiorite exposing in the eastern part of the area.

This intrusive action is possible to explain the inclination of the La Dicha Deposit, too.

5-1-6. ORE RESERVES AND GRADE

No highly reliable ore reserves can be estimated due to insufficient exploration work. Ore reserves of only low accuracy will be tried to calculate using the data of diamond drillings performed by Norex Syndicate and an estimated dimension of the ore deposit is shown as follows;

Strike length		Dip length		Average thick.		Specific gravity		Ore reserves
300 m	x	90 m	x	20 m	x	3.7	=	2 million tons

Considering the continuity of 2 km gossan exposure, several times of ore reserves calculated above will be optimistically delineated.

Although the ore continuation is confirmed to the Alcaparosa River, its dimension considerably degrades.

Assay results from the samples taken in tunnel-8 by the writers show rather constant grade regard to the main heavy metals.

Copper grades fluctuate around 1 percent and higher iron content than sulphur is also reported due to pyrrhotite predominated ore.

The content of nickel and cobalt are not so high comparing with the ore from other mines. This is an evidence that the genesis of the deposit is ascribed to the submarine hydrothermal (exhalative) sedimentary deposit and pyrrhotite has not been formed primary but secondary.

Mean grade of the samples collected in tunnel-8 is shown below.

Au(g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	S(%)
0.1	4	0.48	0.03	0.05	53.54	34.38

5-2. THE COPPER KING DEPOSIT

5-2-1. LOCATION AND ACCESS

The Copper King Deposit is situated within the Sierra Madre del Sur mountain range, near the village of Camalotito of Petatlan municipalty. The property is at Latitude 17°40' N and Longitude 101°17' W.

Access from Mexico was as follows;

Mexico —Route 95 (Federal, paved) / 410 km 6 hours— Acapulco —Route 200 (Federal, paved) / 205 km 3 hours—

Petatlan —Dirty mountain road / 25 km 1 hour 20 minutes— Camalotite —Trail, on foot / 20 minutes—

Rio Tinto Adit.

Zihautanejo - Ixtapa, a famous Mexican resort area, is located in approximately 40 km west in a straight line from Petatlan.

Regularly scheduled jet services from Mexico to Zihuatanejo-Ixtapa are available daily.

5-2-2. PHYSIOGRAPHY

The Copper King Deposit is comprised in an area of 300 m to 900 m high mountains trending the northwest to the southeast, and reaching about 300 m in relief. The elevation of Cerro del Lloron, the highest peak of the area, is 1,200 m above sea level.

The Murga River, over 10 m in width, flows to the southwest and has an effluent water throughout the year. The area is covered by dense tropical vegetation and the main species are as follows;

High tree	:	pine, oak, mangrove, etc.
Low tree	:	banana, orange, lemon, etc.
Farm produce	:	corn, chile, onion, rice, tomato, etc.

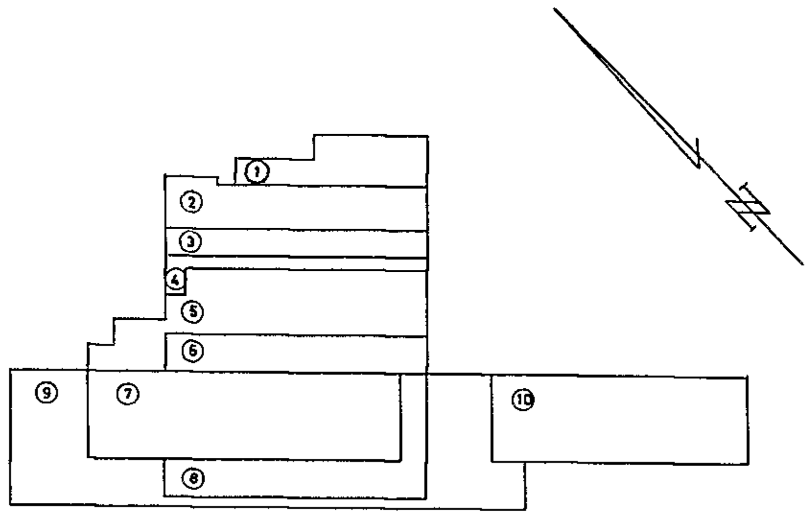
Annual temperature fluctuates between 22 degrees and 35 degrees and 24 degrees is estimated as an annual average temperature. According to the map of climate, dry (November to May) and rainy season (June to October) are clearly separated and almost all of annual precipitation (1,200 to 1,500 mm) concentrates into the rainy season.

5-2-3. PROPERTY

The claim configuration around the Copper King Deposit is shown in FIG. 6 and they consist of 10 titled concessions.

There are the documents in the Direccion de Mina which verify legal justice over the claims. Owner of the claims is Compania Minera del Rio Murga which is a mexican subsidiary of Texas Gulf Incorporation.

The titled claims cover a surface of 207 hectares.



NAME OF CLAIM		NO OF TITLE	SURFACE
① La Vainila	—	T - 139027	— 9 Has
② Don Pepe	—	T - 138134	— 26.1450
③ Lloron	—	T - 132145	— 9
④ Suriano	—	T - 141308	— 5 80
⑤ Rio Murga	—	T - 133311	— 26 50
⑥ Rey del Cobre	—	T - 115930	— 15
⑦ Rio Tinto	—	T - 102298	— 36
⑧ 2a Amp. Rio Tinto	—	T - 110178	— 18
⑨ Amp. Rio Tinto	—	T - 110019	— 42
⑩ La Trinided	—	T - 107790	— 30
			207.1450 Has

0 1000 m

SCALE

FIG. 6 CONFIGURATION OF COPPER KING MINING CLAIMS

5-2-4. HISTORY

The historical records of the exploration and development on the Copper King Deposit are summarized as follows (Spring 1972) ;

1905 - 1906: The property was discovered as a massive pyrite prospect.

1906 - 1914: The initial examination, including the development of underground workings, was made by the Pacific Copper Company. After the examination, the company concluded that the mining area has the following reserves;

Name of deposit	Reserves	
Rio Tinto	2,585,000 tons	S: 47.8%, Fe: 41.91%, Cu: 0.3%
El Cinco	8,000 tons	S: 39.4%, Fe: 36.4% , Cu: 12.2%

(The Copper King Deposit consists of the Rio Tinto and the El Cinco Deposits and their geological relationships are shown on FIG. 8 and FIG. 10).

1925: The property was acquired by Texas Gulf Sulfur Company.

1925 - 1954: An extensive examination of the property consisting of geological mapping, geochemical soil sampling, and diamond drilling was conducted by Texas Gulf Sufur Company. Nineteen holes were drilled on the Rio Tinto mineralized zone and four on the El Cinco zone.

This study concluded that the Rio Tinto zone contained a possible ore body and an estimated reserves of 4,586,000 tons of an average grade of 45.3% S, 41.2% Fe, 0.86% Cu, 8 g/t Ag, and with traces of Au were indicated.

1968: Three more diamond drill holes were drilled on the Rio Tinto zone.

1968 - 1972: Detailed geological mapping, detailed geochemical soil sampling and IP surveys were carried out.

1973 - 1975: The extensive exploration work, including 17 diamond drill holes totaling about 2,400 m, was conducted by the Compania Minera del Rio Murga on the Rio Tinto and El Cinco mineralized zone.

5-2-5. GEOLOGY

Geology of the area of the Copper King Deposit is characterized by volcano-sedimentary sequence of Upper Triassic to Lower Jurassic period.

Andestic to dacitic pyroclastics and shale and sandstone have suffered low grade metamorphism to green schist and phyllite etc. Detailed description of this sequence, Soyamichil formation, is shown on the following table (FIG. 7).

The rocks around the Adit Rio Tinto are composed of andestic to dacitic pyroclastics being suffered weakly metamorphyism to green schist.

The Copper King group of the massive sulphide deposits occurs within this green schist sequences. There exist the metamorphosed sediments surrounding this volcanics. The volcanic unit also comformable with the sediments. Therefore, no significant time gap has existed during the accumulation of the volcanics and sediments. This suggests that the ancient volcanism of the area has taken place in the submarine environment as well as the La Dicha and this is a common geological feature throughout the volcanogenic massive sulphide deposits of the entire world.

The sequence strikes the northwest to the southeast and dips steeply (70 degrees to 80 degrees) to the southwest or the northeast but locally 20 degrees to 30 degrees.

Existence of the anticline having the axis of the northwest-southeast trend can be imagined in this area. The type of fold would not be specified, but it is supposed to be highly folded one. Although just preliminary survey was carried out in the Copper King mineralized zone, no significant fault causing large dislocation between the rocks was encountered. The mode of occurrence of the deposit could not be understood fully, as no enough underground geological survey was performed due to the collapse of the tunnels in Adit Rio Tinto.

The deposit can be classified into a typical massive sulphide deposit from the examination.

No characteristic ore texture within the deposit was observed and the ore is very compact, massive, and quite homogeneous. The sulphide portion consists essentially of pyrite, with very small and variable amount of quartz, chalcopyrite, and sphalerite in decreasing order of abundance.

Therefore, this suggests that no grade, especially sulfur and iron, variation will be anticipated (this is highly evaluated in the case of the mining operation).

ROCKS	THICKNESS	REMARKS
Marble and Phyllite with intercalation of Metasandstone.	370 m	
Andestic Metapyro-clastics.	200 m	
Dacitic Metapyro-clastics.	270 m	Massive sulphide deposits are encountered in this subformation.
Metadiorite	140 m	
Phyllite	110 m	
Andestic Metapyro-clastics.	170 m	
Phyllite	130 m	

FIG. 7 GEOLOGICAL SEQUENCE OF SOYAMICHEL FORMATION

The contact between the massive sulphide body and the country rock is of clear and steeply dipping. No mixing of gangue rocks into the ore is observed.

The sulphide body is apparently concordant to the schistosity of the country rock.

According to Spring (1972), the sulphides are concentrated in the trough of this fold and pinch out upwards along the limbs of the fold. Unfortunately, the writers could not observe these occurrences.

Microscopically, the sulphides often present rearrangement and crushed structure in the polished section of the pyrite. These structures probably indicate to have been the existence of deformation history by which either the sulphides or country rock has been affected.

Yanez (1977) and Spring (1972) reported the existences of pyrrhotite-band, laminated sphalerite, veinlets of chalcopyrite in the footwall and paragenesis of chalcopyrite and pyrrhotite. But, the writers could not find these interesting textural relationships.

On a dimension of the sulphide deposit, Yanez (1977) and Spring (1972)

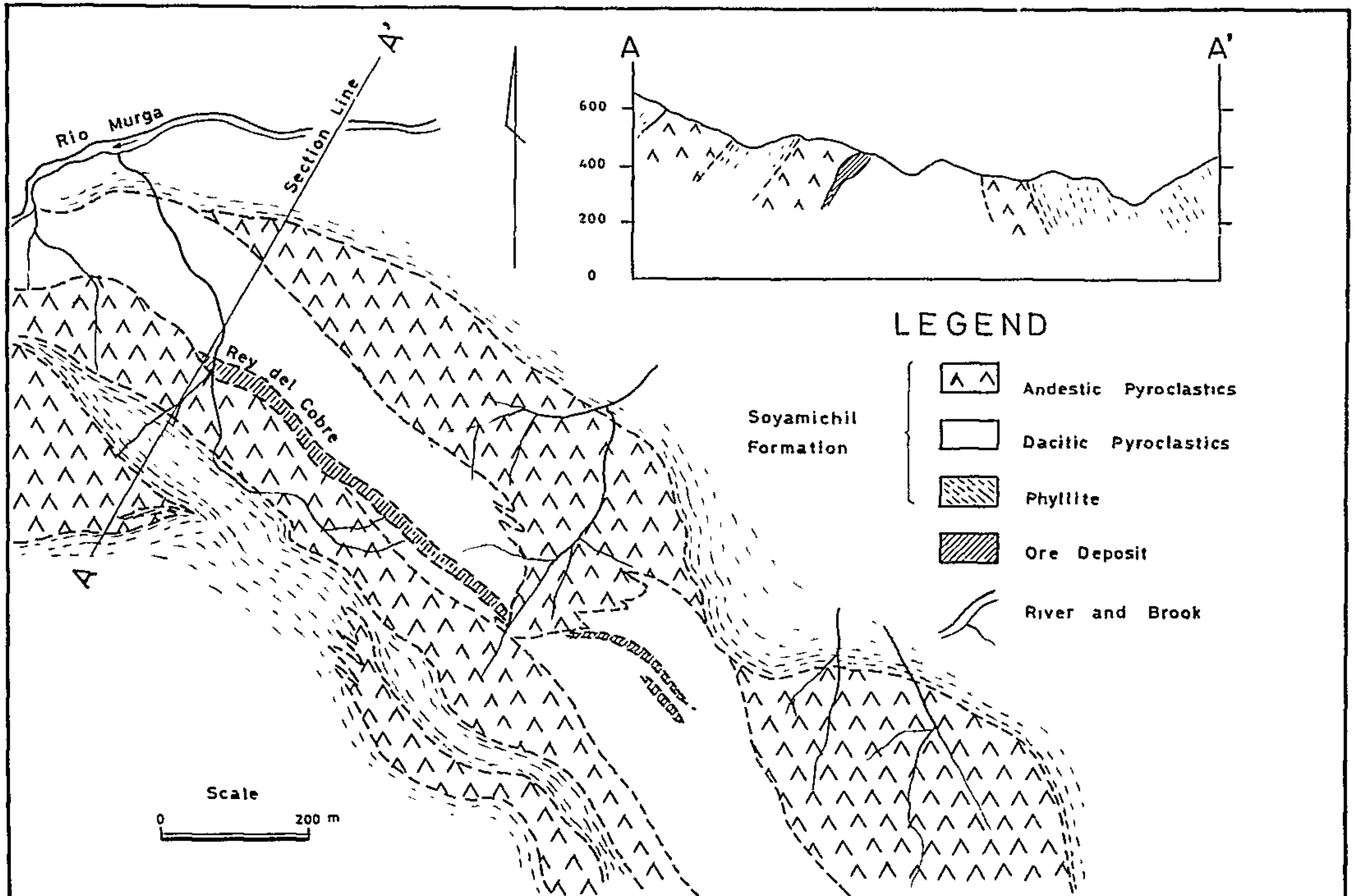


FIG. 8 GEOLOGIC MAP OF COPPER KING MINING AREA : MODIFIED AFTER YANES (1977)

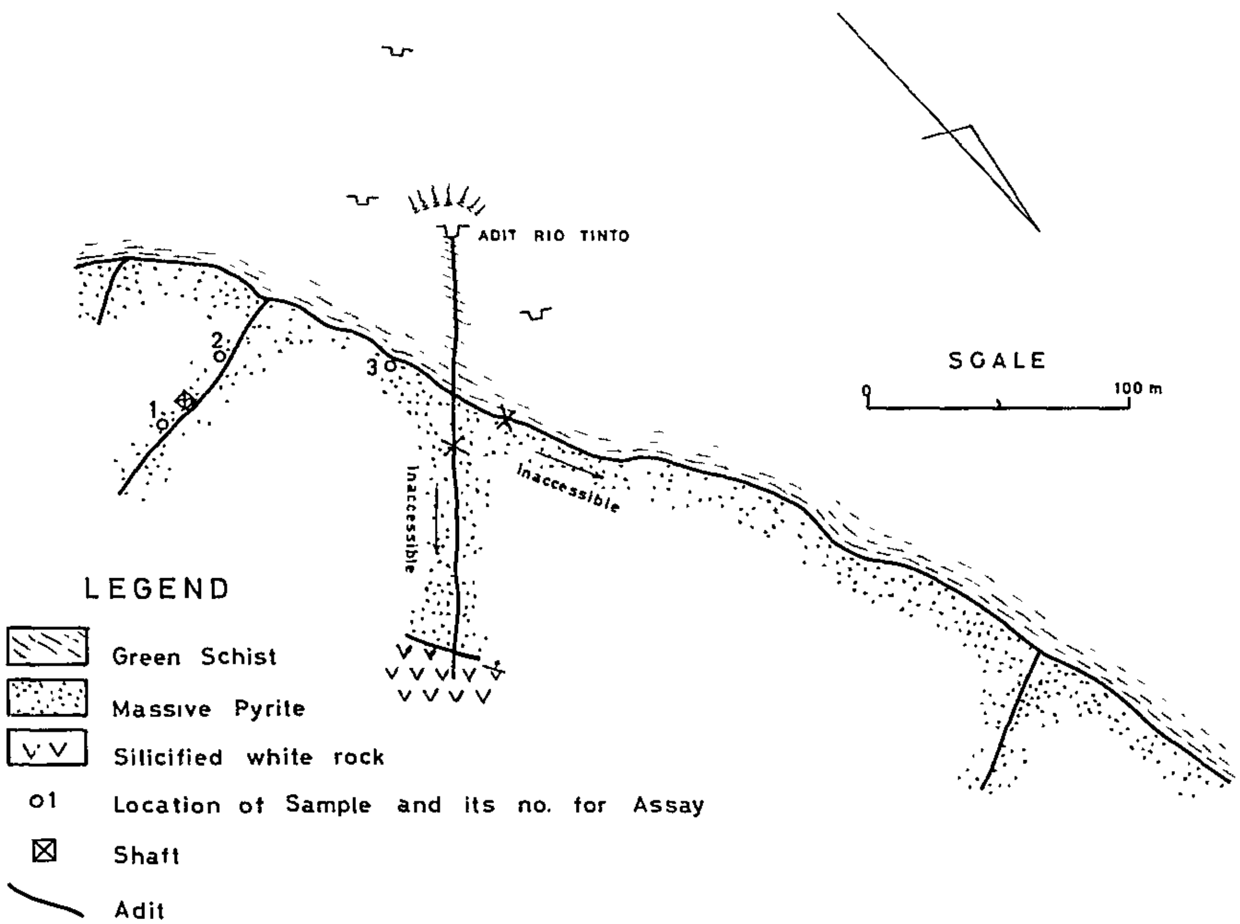


FIG. 9 UNSURVEYED SKETCH OF UNDERGROUND WORKINGS OF COPPER KING

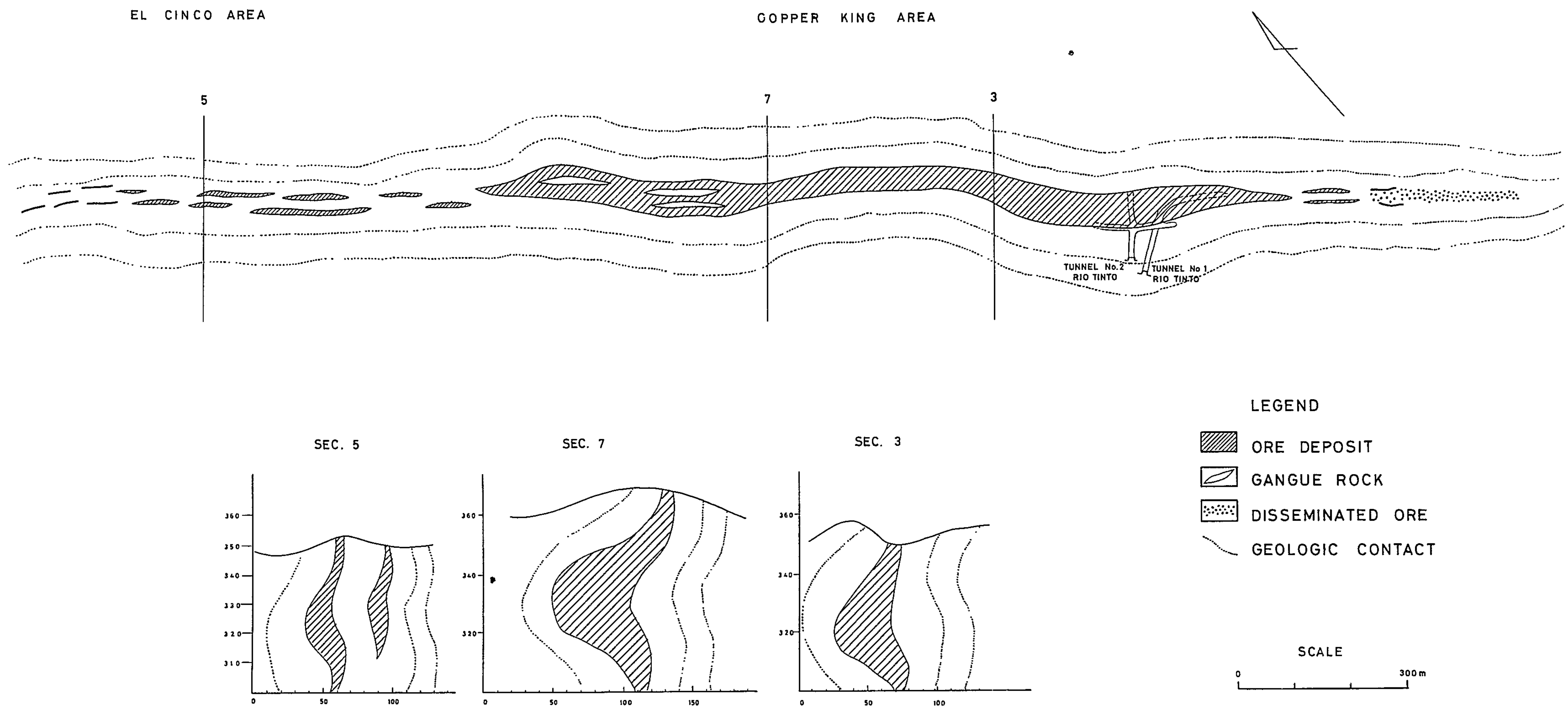


FIG.10 CORRELATION OF COPPER KING AND EL CINCO ORE DEPOSIT

evaluated the deposit differently. Estimated dimensions by two investigators were as follows;

Yanez (1977)	Several hundred m (strike length)	30 - 50 m (thickness)
Spring (1972)	400 m (strike length)	70 m (thickness)

On the other hand, the information of Cia. Minera del Rio Murga showed the dimension of the sulphide deposit to be as great as 2 km in strike length and 50 m in width. The writers were impressed after the survey that the Copper King Deposit was of large scale and characterized by constant grade as to sulfur and iron.

The most prominent alterations are of silicification, and chloritization in the immediate vicinity of the sulphide body. Locally, sericitization and carbonitization also are recognized. Degree of the alteration is generally rather weak.

5-2-6. ORE RESERVES AND GRADE

No data are available to carry out proper calculation of ore reserves.

For reference, ore reserves cited from Spring (1972) and Cia. Minera del Rio Murga are presented below.

Spring (1972):	Rio Murga area	4,753,000 tons
	El Cinco area	2,300,000 tons
Cia. Rio Murga:	Rio Murga area, El Cinco area	21,500,000 tons*

* This corresponds to the ore reserves inferred by exploration of diamond drillings in the said area. (See FIG. 10)

There are two assay results, samples from tunnel and from drilling cores, and they are listed below.

	Cu (%)	Au (g/t)	Ag (g/t)
Assay from tunnel	0.52	0.27	7.31
Assay from d. cores	0.86	tr	8

Assay results from the samples taken by the writers are shown as follows;

Cu (%)	Au (g/t)	Ag (g/t)
0.06	0.1	4

They show very low grade with respect to copper, silver, and gold.

5-3. THE CAMPO MORADO DEPOSIT

5-3-1. LOCATION AND ACCESS

The Campo Morado Deposit lies at a village of same name in Municipalty of Arcelia. The main ore deposit, Reforma, is at Latitude 18°10'30' N and Longitude 100°07'40" W. Access and required time by a vehicle from Mexico are shown as follows;

Mexico $\frac{\text{Route 95 (Federal, paved)}}{\text{180 km 2 hours}}$ Iguala $\frac{\text{Route 140 (Federal, paved)}}{\text{90 km 1 hour 30 minutes}}$

Aguacate $\frac{\text{Dirty mountain road}}{\text{35 km 2 hours}}$ Campo Morado Deposit

5-3-2. PHYSIOGRAPHY

The Campo Morado Deposit also comprised within the Sierra Madre del Sur mountain range. The terrene is rugged and deeply dissected. A difference in elevation of approximately 500 m exists between the tributary and the mountains. The small affluents trending the east - west flow into La Canita River which is a tributary of well known the Balsas River situated in 15 km south of the Campo Morado Deposit. The Canita River has a current only in the rainy season. The property covers mountainous terrene of 1,000 to 1,500 m above sea level and is situated in the eastern margin of the Balsas Basin. The elevation is gradually getting decrease to the west and attains to 300 m in the Balsas Basin. Vegetation is scarce. Tall trees are roughly limited near the community and along the tributary. The main tree species are pine, oak, mango, etc.

Annual average temperature is 24 degrees to 26 degrees and precipitation is 1,200 mm. Rainy and dry season correspond to June to October and November to May respectively.

5-3-3. PROPERTY

The claim configuration around the Camp Morado Deposit is shown in FIG. 11. The property consists of 13 claims and its coverage is 384.7 hectares. All the claims are titled and grouped in the sense of the Mexican mining law. Owner can invest effectively on this property under favor of the grouped claims. Cia. El Fenix de Campo Morado is the owner of the property and its shareholders are as follows;

Canute Corporation*	62%
Mexicans	38%

* A subsidiary of Chase Manhattan Bank.

The documents in the Direccion de Minas reported that legally obligated exploration work on the property had been carried out through Cia. Minera Rio Morado on contract basis with the owner.

5-3-4. HISTORY

The history of the Campo Morado Mine is summed up below;

1903 - 1910: Oxide ore, high grade lead and silver, was extracted before the Mexican revolution.

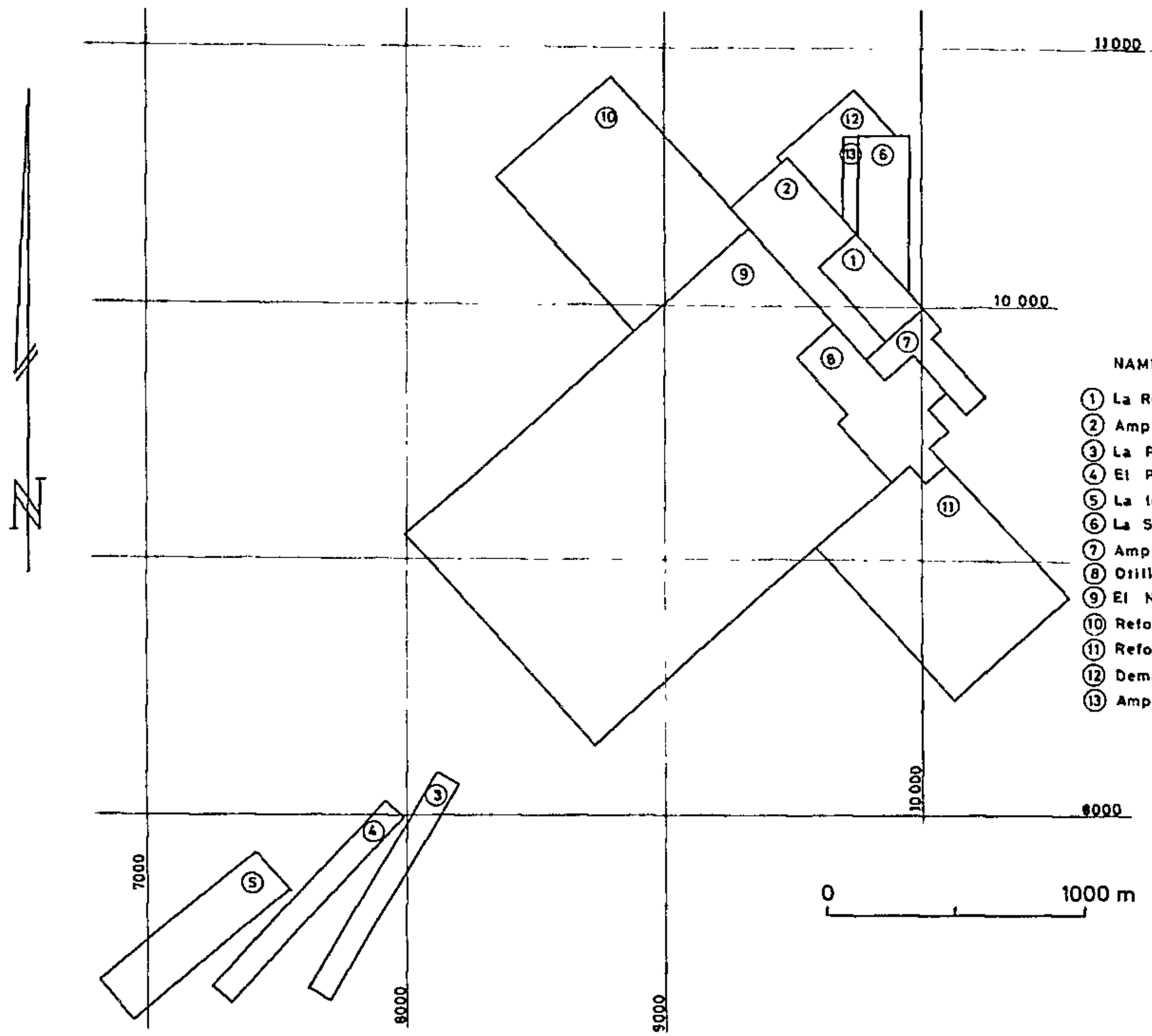
1920 - 1927: High grade pyrites and other high grade oxide ores were mined.

1937 - 1939: Mine operation at small scale was performed to maintain the concessions.

Since then, the mine was abandoned till 1971 due mainly to the unfavorable results of flotation for the ore.

1971: To fulfill the legal requirement of verification of regular working required by the Mexican mining law, Chase Manhattan Bank asked Mineral Industries Engineers Inc. to plan the exploration work of 500,000 pesos (equivalent to about 40,000 US $). Minerals Industries Engineers Inc. contracted McPher Geophysics of Toronto, Canada which conducted IP method and resistivity method on the property.

1973: Union Oil Co. of Los Angeles, California was interested in this



NAME OF CLAIM	NO OF TITLE	SURFACE
(1) La Refoma	— T- 10619	— 10 00 Has
(2) Amp de La Reforma	— T- 10620	— 14 00
(3) La Purisima	— T- 10621	— 10.00
(4) El Porvenir	— T- 10622	— 10 00
(5) La Independenia	— T- 10623	— 16 00
(6) La Sonorense	— T- 19821	— 10 15
(7) Amp de La Reforma	— T- 19993	— 6.00
(8) Otilia	— T- 24133	— 18 00
(9) El Naranjo	— T- 24134	— 184 00
(10) Reforma Norte	— T- 32306	— 48.00
(11) Reforma Sur	— T- 34648	— 47.00
(12) Demasias de La Sonorense	— T- 52190	— 9 50
(13) Amp de La Sonorense	— T- 52545	— 1.50
		384.65 Has

FIG. 11 CONFIGURATION OF CAMPO MORADO MINING CLAIMS

project. Union Oil looked for Mexican investors, through its subsidiary Minerals Exploration Co. Ingenieros Civiles Asociados S.A. (ICA) accepted to become associated Mexican partner of this exploration project.

1974 - 1976: Cia. Minera Rio Morado S.A. (51% ICA, 49% Minerals Exploration Co.) was founded at minimum fixed capital of 500,000 pesos. Simultaneously to the constitution of the company a contract was granted with the El Fenix de Campo Morado, for exploring with option to purchase. Also a contract was signed with Geocon covering the undertaking of studies and field works.

These programs were established with three objectives.

1) Verification of ore reserves.
2) Localization of new mineral deposit.
3) Hydrometallurgical survey to establish a smelting process.

The investment for the exploration works and metallurgical studies amount to 1.25 million dollars.

5-3-5. GEOLOGY

The Campo Morado Deposit occurs in the volcano-sedimentary sequence of Lower Cretaceous period.

The constituent rocks in this area are shale (phyllite), wacke, and sandstone (orthoquartzite), and breccias (there are two types of breccias; one is sediments and other volcanics), as sediment and acid pyroclastics, acidic lava, andesite, and breccias as volcanics. No basic or ultrabasic rocks has been found in the vicinity of the Campo Morado Deposit, therefore, this area is not a complete eugeosynclinal ultramafic-acid volcano-sedimentary sequence.

The sedimentary sequence has several fine pyroclastics and intraformational folding and slumping occasionally are encountered.

Two types of wackes are common in the area: graywackes and tuffwackes. The former generally has lithic fragments as well as fragments of feldspar and quartz and the latter has tuff and other fine pyroclastics in a matrix of clay mineral. The volcanics are predominantly acidic with the most common being acidic pyroclastics and these are also conformable with the sediments.

Several types of breccias have been identified in this area; laharic breccias, lithic-quartz breccias, lithic breccias, etc. The Campo Morado Area has been undergone strong deformation, resulting in some folds. The general structure of the area is the east to the west strike and the south dip.

The rocks of the area has been suffered from low grade regional burial metamorphism.

From the geological view point, the sediments are predominant over the volcanics and the area is different from other area in this point.

The deposit, a typical massive sulphide deposit, occurs in the volcano-sedimentary sequence and is peneconcordant within the country rocks. It is thought that the deposit does not keep its primary sequence but may be overturned. The evidence for overturning are summed up as follows;

1) Reversed compositional zoning within the massive sulphides.
2) Stratigraphical position of alteration zone.
3) The pattern of drag folding in phyllite.

Lorinczi (1977) also showed reversedly graded bedding as the other evidence.

The extension of the deposit in the tunnel level-6 surveyed is a dimension of strike length of 500 m and width of 50 m as shown in FIG. 12. As shown in FIG. 13, the continuation of the ore is confirmed in the portion between 1,260 m and 1,330 m above sea level by the tunnels and diamond drillings. And it is said that the sulphides continue to the lower and upper part of these levels.

Mineral association, as a common feature of this type of massive sulphide deposit, varies in stratigraphycal position within the deposit. This feature will reflect to the grade fluctuation in the deposit.

The Campo Morado Deposit is a typical massive sulphide deposit and consists essentially of pyrite, with variable amount of sphalerite, chalcopyrite, galena, and tetrahedrite in decreasing order of abundance.

In the lower most part (with reference to physical position) of the deposit, a thin bedded Kurko-type ore is encountered with the approximate thickness of one meter (?).

No gold and silver minerals have been found by the microscopic observation,

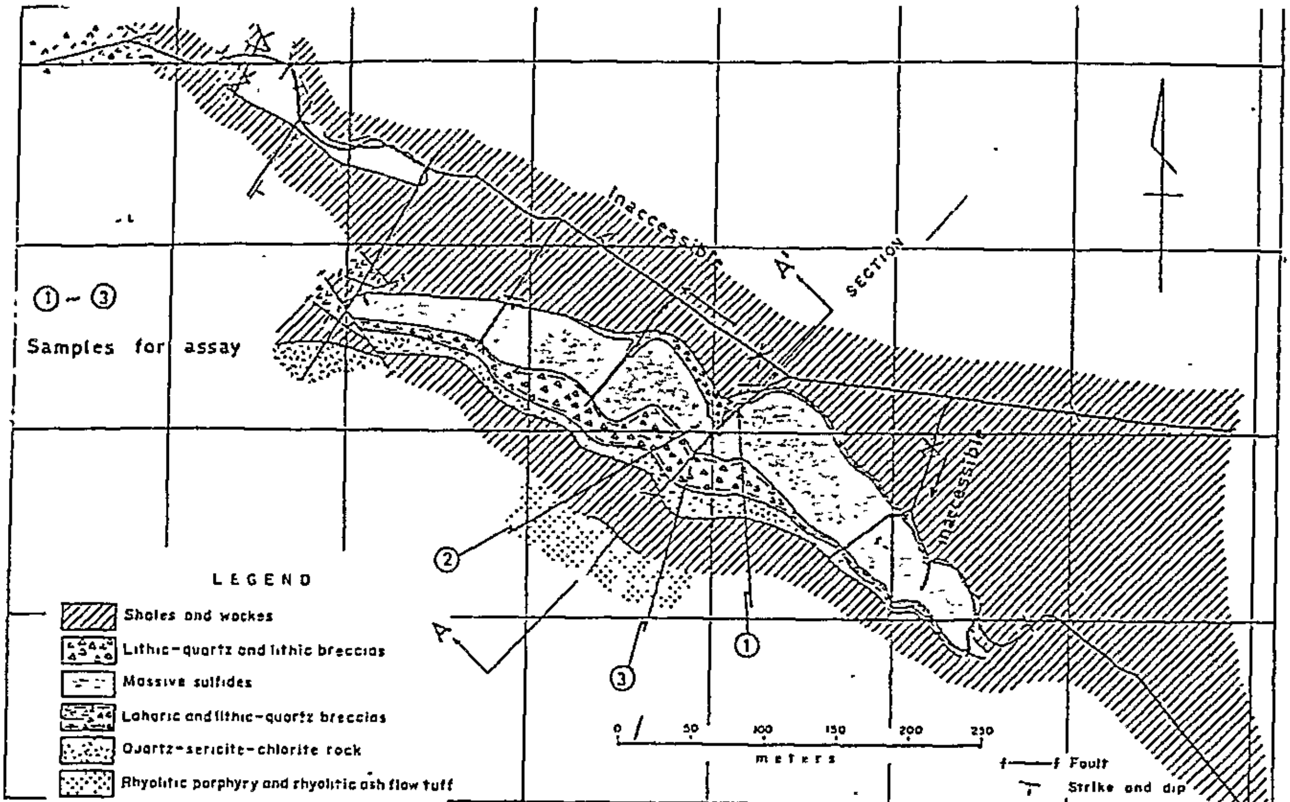


FIG. 12 UNDERGROUND GEOLOGICAL MAP OF CAMPO MORADO (REFORMA) DEPOSIT: LEVEL 6

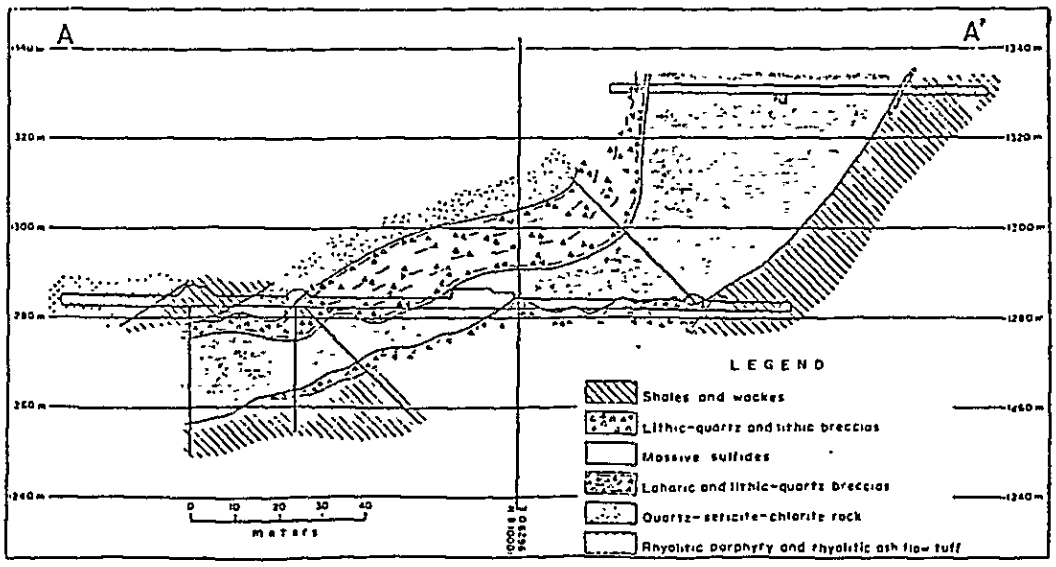


FIG. 13 CROSS SECTION ALONG LINE A - A' OF FIG. 12

although Lorinczi (1977) reported some occurrences of the precious metals (typical ore textures are shown in Annex 2).

Alteration is not so remarkable both in underground and surface, but an altered rock of quartz-sericite-chlorite can be found in the footwall (in stratigraphical sense).

5-3-6. ORE RESERVES AND GRADE

No sufficient data are available to calculate the ore reserves. Geocon has delineated the following ore reserves after the realization of 20 diamond drillings in tunnel level-6 and tunnel exploration;

Proved ore reserves	:	2,248,000 tons
Grade	:	Au; 1.2 g/t, Ag; 111.8 g/t, Cu; 0.68% Pb; 1.07%, Zn; 3.12%
Probable ore reserve	:	7,200,000 tons (corresponding to the reserves the portion between level-6 and -4)
Grade	:	Nearly same to the grade of proved ore reserves.
Possible ore reserves	:	No calculated.
Grade	:	No calculated.

Assay results from samples taken by the writers this time give in general low grade comparing with the previous ones.

	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	S (%)
Level-6	0.7	63	0.18	0.38	0.64	42.93	48.8

5-4. THE LOS VISES DEPOSIT

5-4-1. LOCATION AND ACCESS

The Los Vises Deposit lies on the western flank of Cerro Reforma and about one kilometer west of the Campo Morado Deposit. There is no pass way of the vehicle and it takes nearly one hour on foot along the trail.

5-4-2. PHYSIOGRAPHY

Same to the Campo Morado Deposit.

5-4-3. PROPERTY

The deposit is included in the claim Reforma Norte as shown in FIG. 11.

5-4-4. HISTORY

The greater part of the historical work on the deposit is unknown. It is said that whenever the Campo Morado Deposit was carried out the development or exploration work, the deposit also was targeted for the survey and a small scale exploitation in the past.

5-4-5. GEOLOGY

The recent examination by the writers could not confirm real mode of occurrence of this massive sulphide deposit. The surface geology around the deposit is analogous to that of the Campo Morado Deposit.

Geology consists mainly of breccias, phyllite, acidic volcanics and andesite as shown in FIG. 14.

The sulphides which lie scattered around the workings have many varieties such as pyritic ore to Kuroko type ore. Being of various kinds of ore is an evidence of the high fluctuation of the grade within the deposit. Strike and dip of the phyllite are considered to be the hangingwall of the deposit changing greatly in place to place.

From the field survey and the examination of the dump rocks, no special alteration was recognized. The quartz veinlets in phyllite concentrates partly in parallel with their bedding plane. Judging from the configuration of workings, geologic structure, and the explanation of the guides, existence of lenticular deposit developed to more dip direction than strike and steeply inclined can be imagined here.

It is thought that this is a satellite deposit of the Campo Morado Deposit.

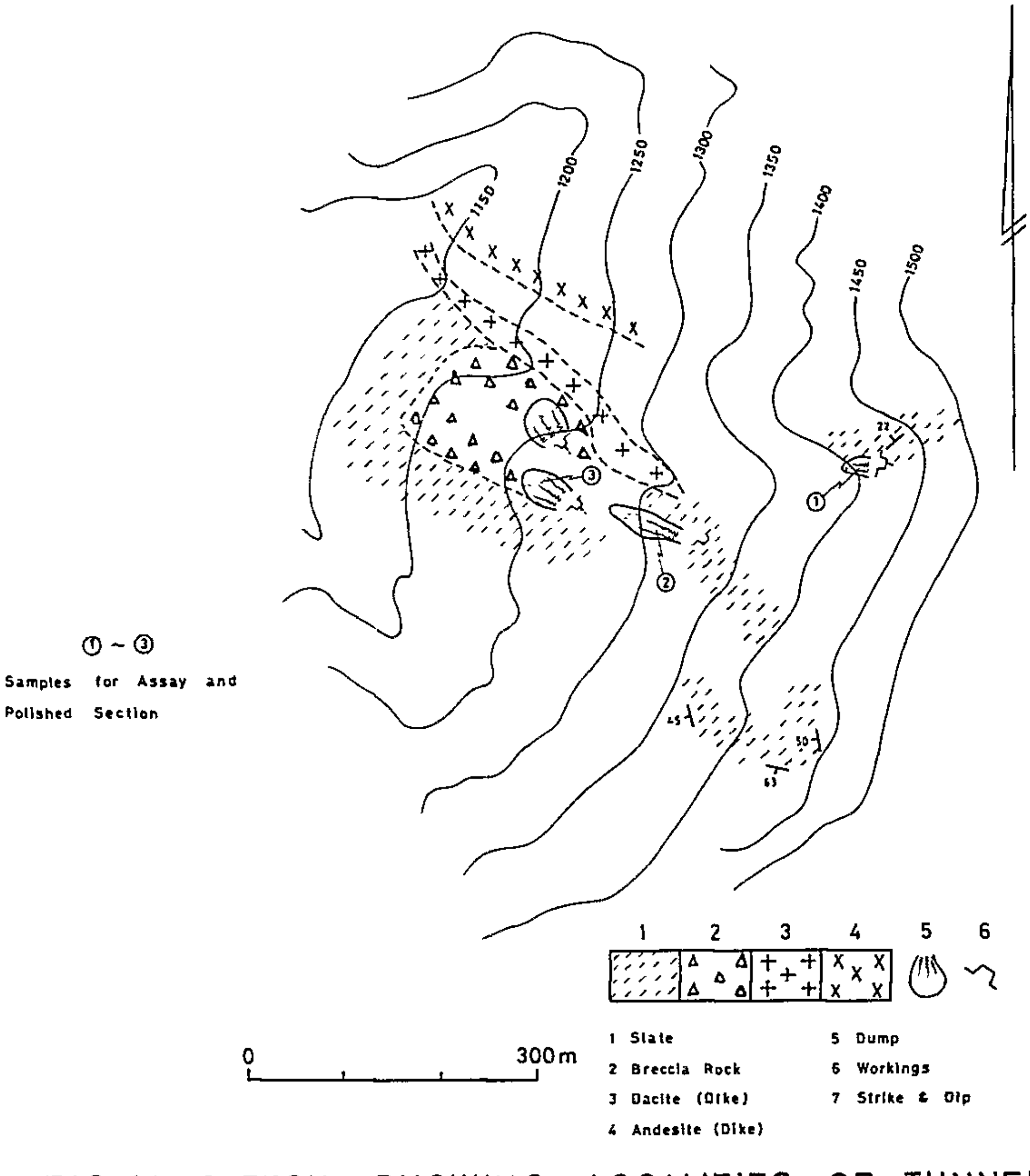


FIG.14 SKETCH SHOWING LOCALITIES OF TUNNELS AND ROCK RELATIONSHIPS IN LOS VISES

5-4-6. ORE RESERVES AND GRADE

According to the field survey and oral communication from the guides, a dimension and ore reserves are postulated as follows;

Strike length		Dip length		Thickness		Specific gravity		Ore reserves
30 m	x	150 m	x	4 m	x	4	=	72,000 tons

Assay results show that there are at least two types of ore, one is analogous to the Copper King's and other to the Campo Morado's ore.

5-5. THE EL NARANJO DEPOSIT

5-5-1. LOCATION AND ACCESS

The deposit is located in 1.5 km southwest of the Campo Morado Deposit. No vehicles are available and it takes about one hour on foot through the trail.

5-5-2. PHYSIOGRAPHY

Same to the description of the Campo Morado Deposit.

5-5-3. PROPERTY

The deposit is comprised in the claim El Naranjo as shown in FIG. 11.

5-5-4. HISTORY

It is said that a small scale operation was conducted for the purpose of the mining of gold and silver before the Mexican revolution, but the detailed history on the deposit is still unknown.

The preliminary prospecting works were carried out by Geocon geologists during 1974 to 1976 when the course of the exploration program was performed on the Campo Morado property.

5-5-5. GEOLOGY

Geology around the El Naranjo Deposit is shown in FIG. 15. Strike and dip vary considerably in the vicinity of the deposit. But, in general, bedding planes may gently undulate and keep strike the east to the west and dip to the south.

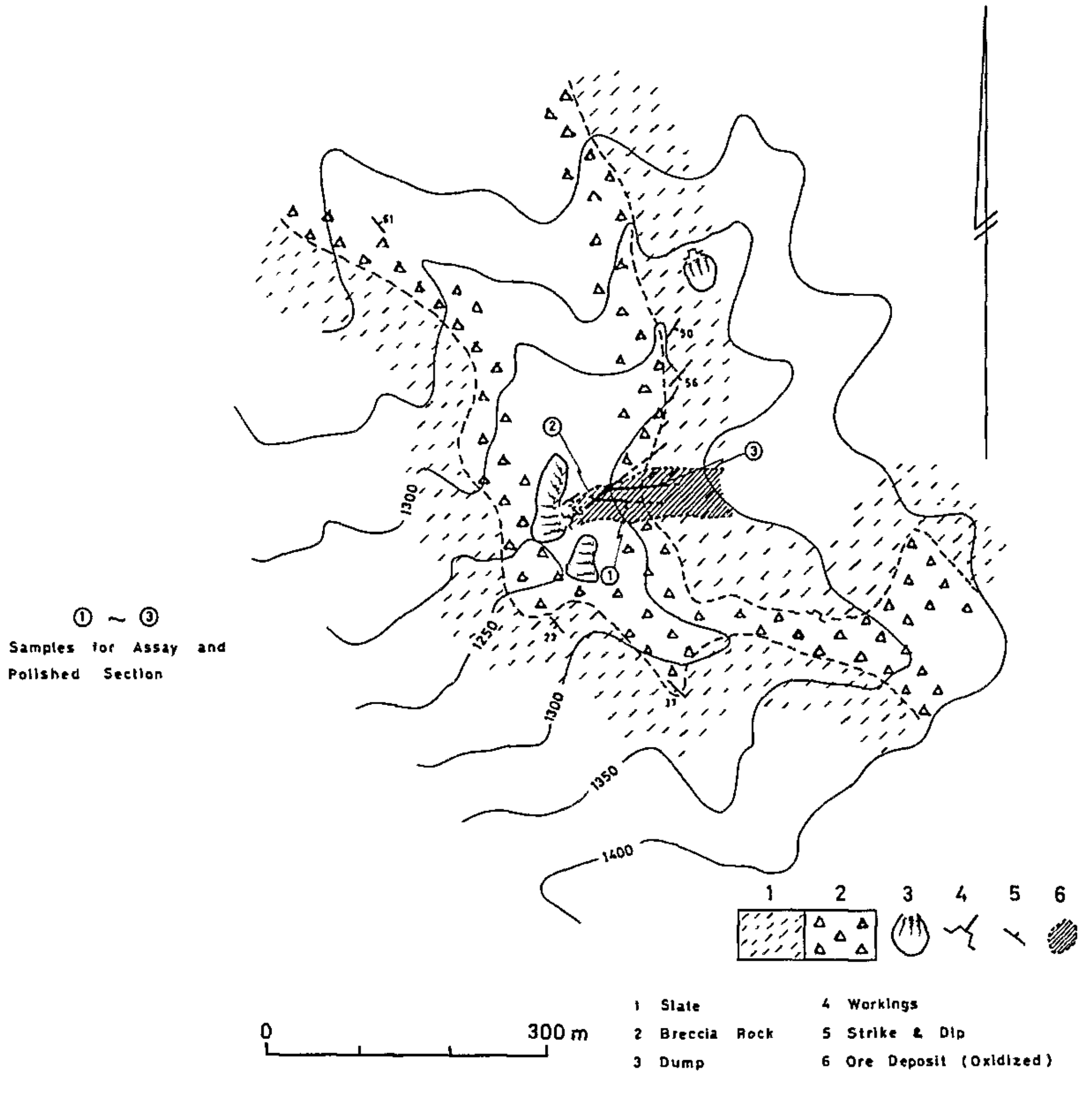


FIG. 15 GEOLOGIC SKETCH OF EL NARANJO MINERALIZED ZONE

Only phyllite and breccias (mostly volcanic origin) are encountered here.

The deposit consists of almost all of the brown limonite possibly derived from the massive sulphides.

The oxide ore deposit is included completely within the said breccia (pyroclastics). Silicified rocks and very little amount of siliceous lead-zinc sulphide are found in the footwall. This may suggest the ore deposit is not overturned. Ore dimension inferred from this survey and other information is nearly as follows;

Strike length	Dip length	Thickness
200 m	50 m	5 m

Limonite, main constituent of the deposit, is structurally massive and has no special microscopic texture and includes an aggregated needle-like unknown mineral.

Microscopically, the textural relationships of the siliceous sulphides suggest that the ore has been formed by the coprecipitation of sulphides and silica (quartz) (see Annex 2)

5-5-6. ORE RESERVES AND GRADE

An order of 200,000 tons of reserves is estimated from the inferred ore dimension said above.

Average grade of the primary sulphide deposit does not enable to deduce from the assay results of samples taken this time. The sulphide deposit, rather high grade in lead and zinc, can be expected from the existence of lead-zinc rich siliceous ore. This sort of ore is always accompanied with the Kuroko Deposit.

The massive limonite, megascopically and microscopically, has 30 percent to 60 percent of silica in it, it may show that the oxide is probably a product of derivation from siliceous sulphide.

6. APPLICABLE MINING METHOD

Applicable mining method should be discussed throughly after the fundamentals, such as a shape of deposit, physical property of the country rocks, grade distribution within the deposit etc., are known clearly.

This time, the mining methods which were figured out taking into consideration on the results of the preliminary study were tentatively proposed.

6-1. THE LA DICHA DEPOSIT

The concrete mode of occurrence of this deposit is still unknown. But it is considered to be similar to the Copper King Deposit and having slightly smaller dimension than that. From the mining view point, several ore bodies having a dimension of 200 m to 300 m in length and about 20 m in width are considered as a mining unit. Ore bodies are lenticular to tabular in shape, striking the north to the south and dipping to the west.

If a dimension of 300 m in strike length, 70 m in dip length, and 20 m in thickness are assumed as a mining target, ore reserves of the unit ore body amount to approximately 1.5 million tons. The ore body may occur as a manner shown in FIG. 16. In this case, open pit mining method will be applicable because of the thin overlying burden.

Five dollars per ton ore or waste as mining cost is estimated and ore to waste ratio will be 1 to 1.5 in generally speaking.

Ore below the open pit bottom will be extracted by using of underground mining system. In this case, no profitable mining operation is expected due to higher mining cost etc. Although the pit slope will finally reach to as much as 60 degrees, but little problem is envisaged owing to the strong country rock's character.

It was said in a report that at Mt. Lyell, Tasmana, the open pit has the same final pit slope of 60 degrees.

6-2. THE COPPER KING DEPOSIT

If a dimension of 300 m (strike length), 50 m (width) and dip of 70 degrees to 80 degrees of the deposit is postulated as a mining unit, proposed mining methods are described below;

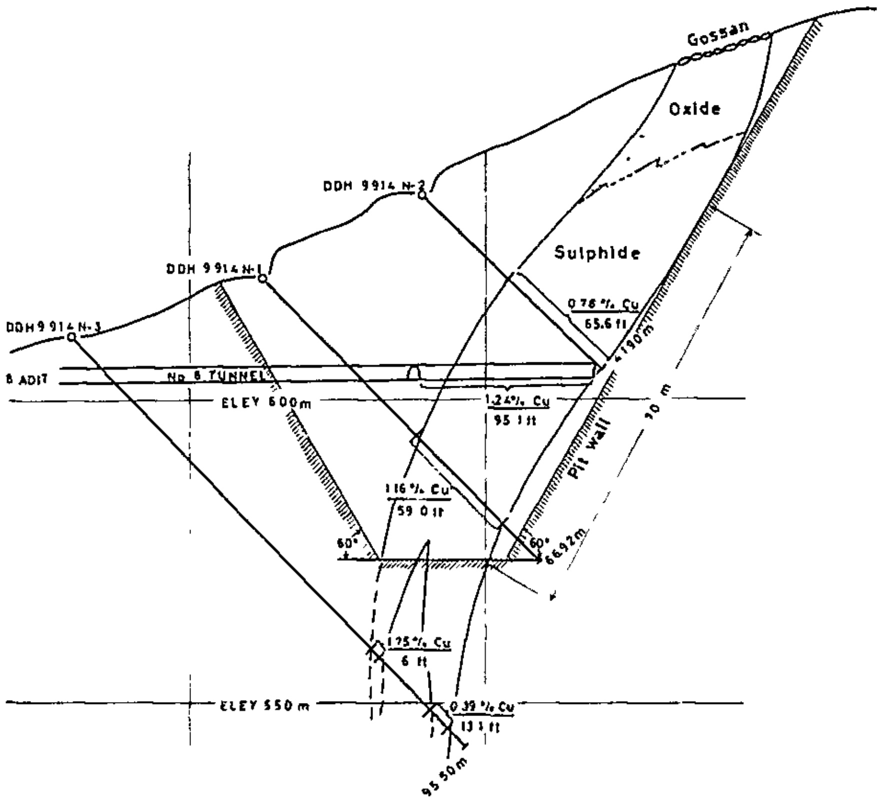
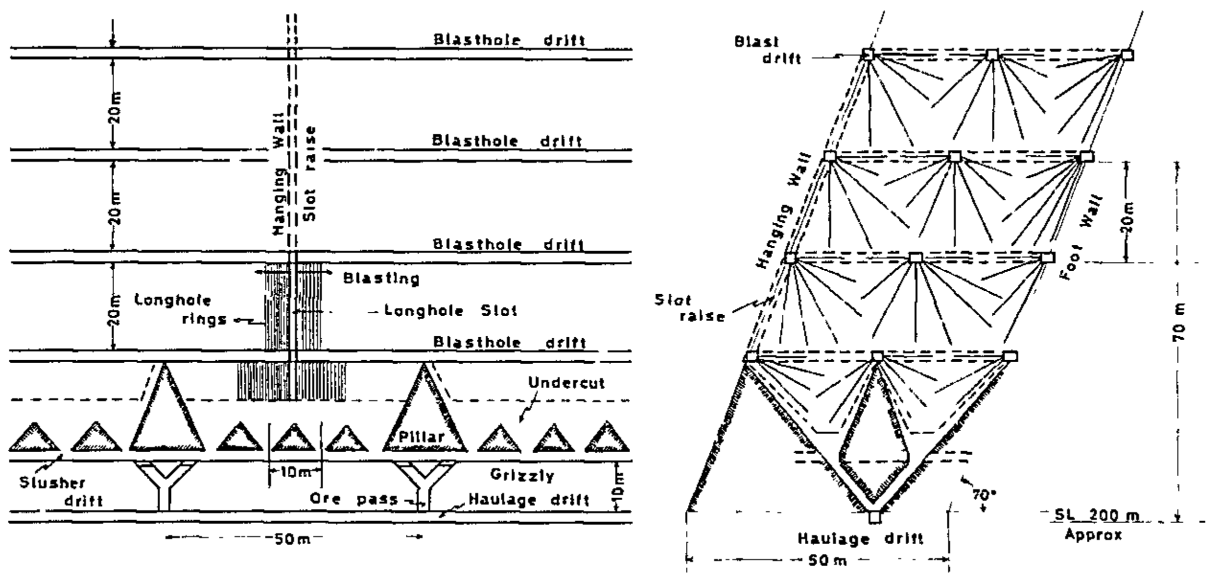


FIG. 16 PROPOSED OPEN PIT DESIGN FOR LA DICHA DEPOSIT



A SECTION

B SECTION

FIG. 17 PROPOSED SUBLEVEL STOPING LAYOUT AT COPPER KING AND CAMPO MORADO DEPOSIT

a) Sublevel caving method

Cross cut of 200 m to 300 m will be driven at level of 200 m above sea level in the Rio Tinto mineralized zone. Haulage drift also is driven from cross cut and 6 to 7 ore passes at horizontal interval of 50 m are cut. After draw drift of 300 m and about 30 chutes are prepared, sublevel caving method is available.

b) Mats-laid sublevel caving method

To prevent the dilution from mixing the waste from hangingwall, mats are laid on the upper most part of the ore body. After the completion of this preparation, caving is initiated by the sublevel blasting. Optimum operations of this method will attain to 95 percent ore recovery.

Surface subsidence caused by the mining will not provoke any serious problem, as the surface is covered with a coppice and there are no habitations and cultivate land.

c) Sublevel stoping method

The most fitting mining method considering the ore characteristics (inherently harder and stronger ore) is sublevel stoping method. The tunnel layout resemble a sublevel caving method. After sublevels at vertical interval of 20 m are prepared, ore passes at horizontal interval of 50 m and other main and auxiliary tunnels are driven, and exploitation of the ore deposit 50 m in width will be initiated.

Diagrammatic sublevel stoping layout of the Copper King Deposit is shown in FIG. 17. Hangingwall failure may be ruled out by our investigation in this deposit. But if a possibility of failure is envisaged, leaving of the supporting pillars are recommended for the measure. In the case of leaving the pillars, about 80 percent of available ore may be mined.

6-3. THE CAMPO MORADO DEPOSIT

The mode of occurrence of the deposit is analogous to that of the Copper King Deposit. Therefore, sublevel stoping method is the best one for the deposit. To leave suitable supporting pillars and no stope filling are recommended from technical and economical point of view. Eighty percent of ore recovery will be reached by this type of mining method. Because of more gentle dipping and broader width of the body than that of the Copper King Deposit, more drifts and chutes are needed. Therefore, it is unevitable that mining operation may be more expensive than the Copper King's case.

Mining cost will be as low as 10$/ton.

6-4. THE LOS VISES DEPOSIT

If a dimension of 30 m (strike length), 150 m (dip length), 4 m (width), and 40 degrees to 50 degrees of dip are postulated as one mining unit, overhand shrinkage stoping method is considered to be an optimum one.

The main haulage drift is set in the footwall and drifts for ventilation are driven at the vertical interval of 20 m.

Each drift is connected by vertical raise, which is driven along the ore, cribbed by timber and divided into two compartments, one containing service line and a ladderway, and the other for ore pass. Three sets of the working faces which are enough to output of 1,000 tons per month is an optimum mining scale for this type of small deposit.

6-5. THE EL NARANJO DEPOSIT

This deposit has more gentle dip than the above mentioned deposit. Consequently, room and pillar by inclined drifting method using slusher and bucket are applicable to the deposit. Gentle dipping of ore deposit prevents from the application of shrinkage stoping method.

For the purpose of effective mining performance, the length of working place should be within 30 m and also for safety, it is recommended to leave of 10 m-width pillars.

Seven-set of working face can afford to produce 10,000 tons of ore per month, if 200 m in strike length, 50 m in dip length, and 5 m in thickness are postulated as a size of this deposit and a mining unit.

7. REFERENCES

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Instituto Politecnico Nacional, Ciencias de la Tierra.

ANNEX 1

SCOPE OF WORK FOR THE FEASIBILITY STUDY OF

PROJECT FOR INTEGRAL UTILIZATION OF PYRITES IN THE STATE OF GUERRERO

AGREED BETWEEN

CONSEJO DE RECURSOS MINERALES, SECRETARIA DE PATRIMONIO Y FOMENTO INDUSTRIAL,

EL GOBIERNO DEL ESTADO DE GUERRERO, ESTADOS UNIDOS MEXICANOS

AND JAPAN INTERNATIONAL COOPERATION AGENCY

JANUARY 31, 1980

MR. GUILLERMO P. SALAS DIRECTOR GENERAL DEL CONSEJO DE RECURSOS MINERALES	MR. GUSTAVO MARTINEZ CABAÑAS ASESOR ECONOMICO DEL ESTADO DE GUERRERO	MR. SETSUO TAKEMOTO COORDINATER OF JICA MISSION

Scope of Work for the Feasibility Study

on

Project for Integral Utilization of Pyrites in the State of Guerrero

1. Introduction

As for conducting the feasibility study of the Project for Integral Utilization of Pyrites in the State of Guerrero, it is agreed between

CONSEJO DE RECURSOS MINERALES,

SECRETARIA DE PATRIMONIO Y FOMENTO INDUSTRIAL

AND EL GOBIERNO DEL ESTADO DE GUERRERO,

ESTADOS UNIDOS MEXICANOS

and the Mission from Japan International Cooperation Agency (hereinafter referred to as JICA) to work jointly in conducting the said study in accordance with the minutes of meetings hereinafter stated.

2. Objectives

The objectives of the said study are to assess the metallurgical feasibility of pyrite utilization and preliminary economic feasibility of the Project. (Refer to Fig. 3 "Position of this feasibility study".)

This project aims to utilize pyrite deposited in Guerrero State, Mexico by applying pyrite integral utilization system developed in Japan and incidentally to develop the neighbouring community.

This system:

(i) The pyrite is roasted to produce sulfuric acid and cinder.

(ii) The cinder is processed into iron pellets for steel making while removing impurities.

(iii) The removed impurities which consist of many kinds of non-ferrous metals are treated to recover gold, silver, copper, zinc, lead, etc.

3. Scope of Work

The required work for the feasibility study will include the following items:

3-1 Preliminary Study

3-1-1 The term and the purposes

The Preliminary Study will be carried out from Jan. 25 to May 15, 1980.

The purposes of this study are as follows:

- To make site revision into each of the five pyrite mines.
- To collect and analyze data on these mines
- To select two of them as the objects of the Feasibility Study.

3-1-2 Field Survey

As for each area or mine:

- Revision of geology, topographic features, and conditions of location and climate
- Collection of data for right of mining claims, mining histories, geology, ore deposits, ore reserves, and working environment
- Sampling of representative ores for works in Japan.

A visit to Lazaro Cardenas and its port facilities

Collection of data and informations required for works in Japan.

3-1-3 Works in Japan

Chemical analyses, microscopic observations, estimation of ore reserves, and report making.

3-2 Feasibility Study

3-2-1 The term and the purpose

The Feasibility Study will be carried out from the end of September, 1980 to May 15, 1981.

The purpose of this study is to elaborate "The Metallurgical and Preliminary Economic Feasibility Report", based on detailed investigation into the two mines selected in the Preliminary Study, and metallurgical tests with ore samples.

3-2-2 Field Survey

Geological Survey:

- Site investigation of geology and ore deposits for confirmation of ore reserves and grade by ground survey and core check
- Collection of geological data
- Investigation at mines in operation.

Mining Survey:

- Site investigation of topographic and geological conditions of planning mining method and equipment layout
- Sampling for works in Japan
- Collection of data for purchase channels and prices of mining materials, regulations and laws, scale and technical skill of constructors, and working environment

Mineral Dressing Survey:

- Site investigation of topographic and ground conditions for planning mill layout and dam location
- Collection of data for purchase channels and prices of milling materials, regulations and laws, and working environment
- Investigation of relevant items at mines in operation.

Metallurgical Survey:

- Site investigation of ground and surrounding conditions for planning plant location and equipment layout

Economic Survey:

- Collection of data for purchase channels and prices of materials and chemicals, and working environment.
- Visit of mines in operation for economic survey.

Infrastructural Survey:

- Investigation of infrastructure such as water supply, electric supply, company house facilities, and transportation and its facilities for the mines, the mill plants, and the metallurgical plant

- Collection of data for infrastructural costs.

3-2-3 Works in Japan

Geological works:

- Chemical analyses, microscopic observations and EPMA (Electron Probe Micro Analyser) analyses of samples
- Calculation of ore reserves.

Metallurgical works:

- Milling tests and metallurgical tests (roasting, chloridizing volatilization test and crushing strength test)
- Judging for suitability of the pyrite samples to the chloridizing volatilization process.

Infrastructural Survey:

- Selection of plant location and transportation method for raw materials and products.

Conclusion:

- Estimation for capital cost and running cost
- Feasibility study.

4. Undertakings of JICA

4-1 JICA will dispatch the following experts required for conducting the study. (See Fig. 2 "Schedule of the Works".)

(A) Preliminary Study Mission

1 Team Leader (Metallurgical Engineer)
1 Mining Engineer
1 Geologist
1 Official of JICA

(B) Feasibility Study Mission

1 Team Leader (Metallurgical Engineer)

1 Geologist

1 Mining Engineer

1 Mineral Dressing Engineer

1 Infrastructural Engineer

1 Official of JICA

(C) F/R Draft Explanation Mission

1 Team Leader

4-2 JICA will submit the following reports written in English to the Mexican counterpart.

- Preliminary Report: (10 copies)	Within 6 months after the commencement of the Preliminary Study.
- Feasibility Report: (20 copies)	Within 9 months after the commencement of the Feasibility Study.

4-3 JICA Study Teams will transfer knowledge to the Mexican counterparts staff in the field related to the work concerned.

5. Undertakings of Mexican counterpart authorities

Mexican counterpart authorities will provide the following counterpart contributions for the execution of the studies:

5-1 To provide the Study Teams with all available data, records, reports, maps, aerial photographs and drawings shown in the Annex and any other information relevant to the Project if available.

5-2 To arrange for the Study Teams in getting necessary approvals, permits, authorizations and security for JICA's personnel by the Mexican Government for the execution of the studies.

5-3 To arrange for the Study Teams in getting necessary laboratories, accommodations and office near each area or mine subject to study.

5-4 To arrange for the Study Teams to be entitled with privileges and immunities such as tax and duty exemption on temporary importation of goods necessary for the execution of the study in accordance with the regulations of the Mexican Government.

5-5 To provide the Study Teams with counterpart experts and supporting personnel as follows:

Preliminary Study Team

1 Counterpart Project Manager	1 Mining Engineer
1 Geologist	1 Metallurgical Engineer
	Laborers

Feasibility Study Team

1 Counterpart Project Manager	1 Metallurgical Engineer
1 Geologist	1 Civil and Architectural Engineer
1 Mining Engineer	1 Typist
	Laborers

5-6 To provide the Study Teams with vehicles with drivers for carrying out the field survey.

5-7 To carry out surface topographic survey, mapping works, surface trenching works and reopening of old adits, if necessary for the JICA's studies.

5-8 To carry out necessary works which are to be mutually agreed.

Fig. 1

LOCATIONS OF THE PROPOSED MINES

KEY TO MAPS

- △ PROPOSED MINES
- ⊙ PRINCIPAL CITIES
- —— ROADS
- -·- STATE BOUNDARY

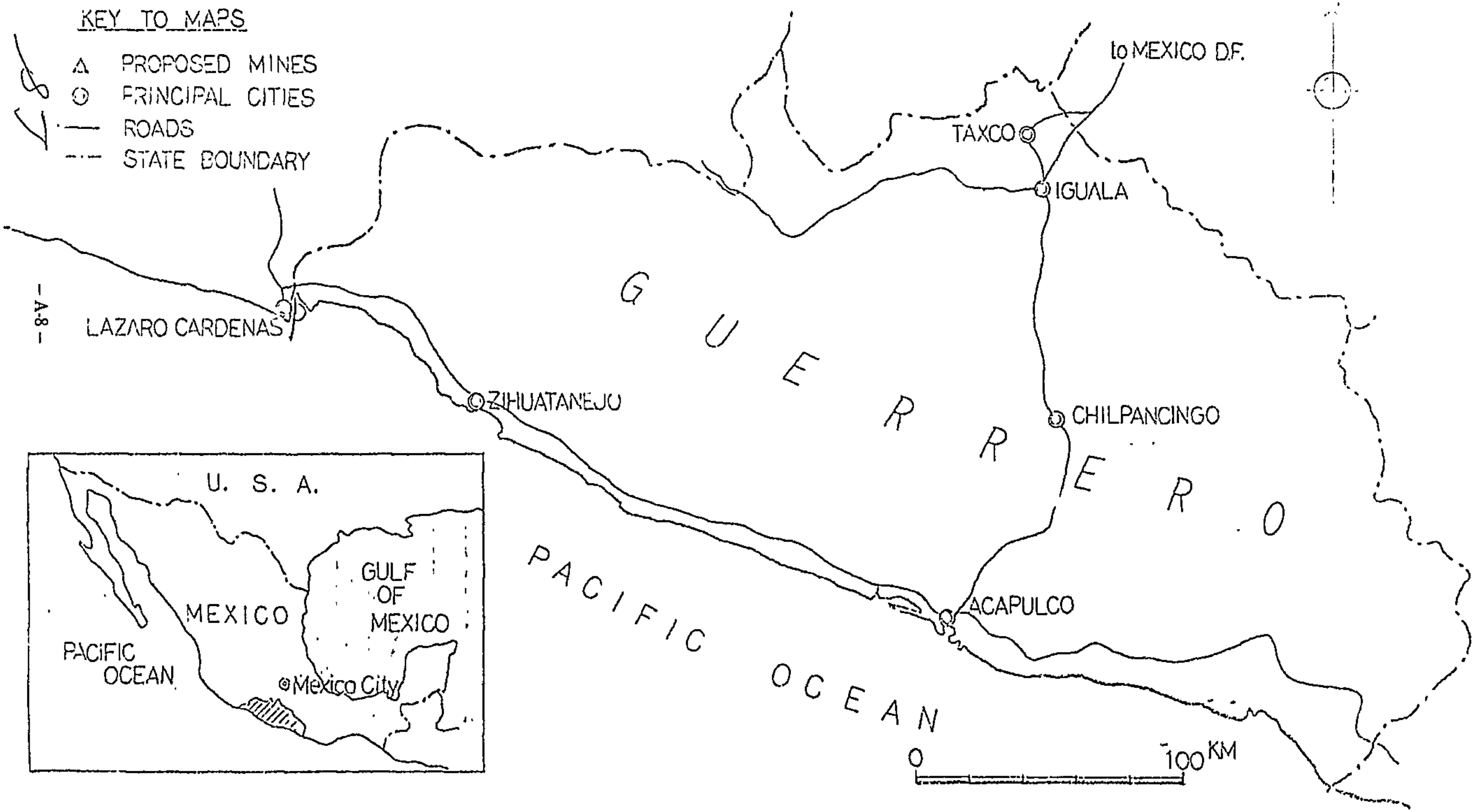


Fig. 2 SCHEDULE OF THE WORKS (TENTATIVE)

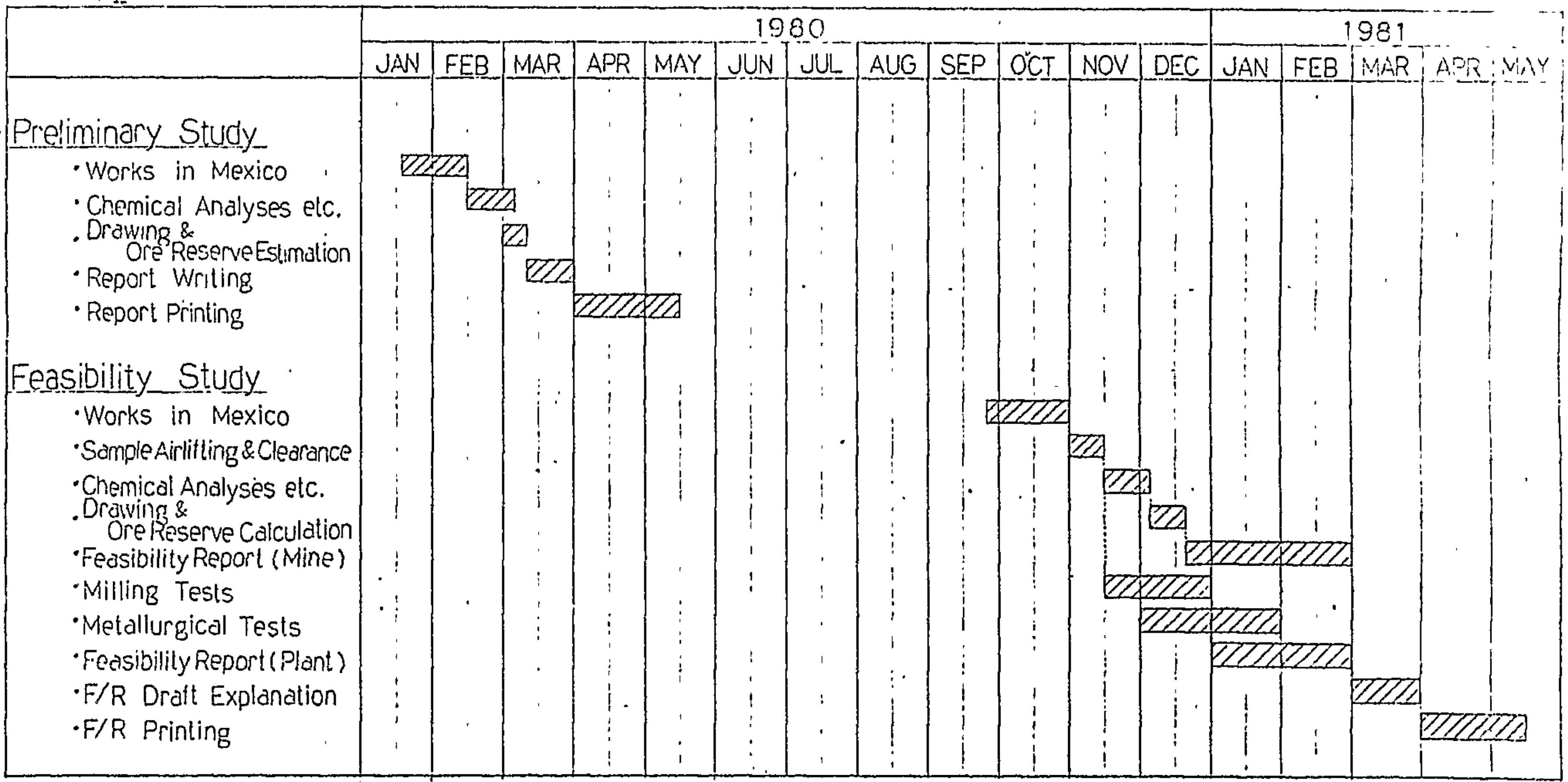
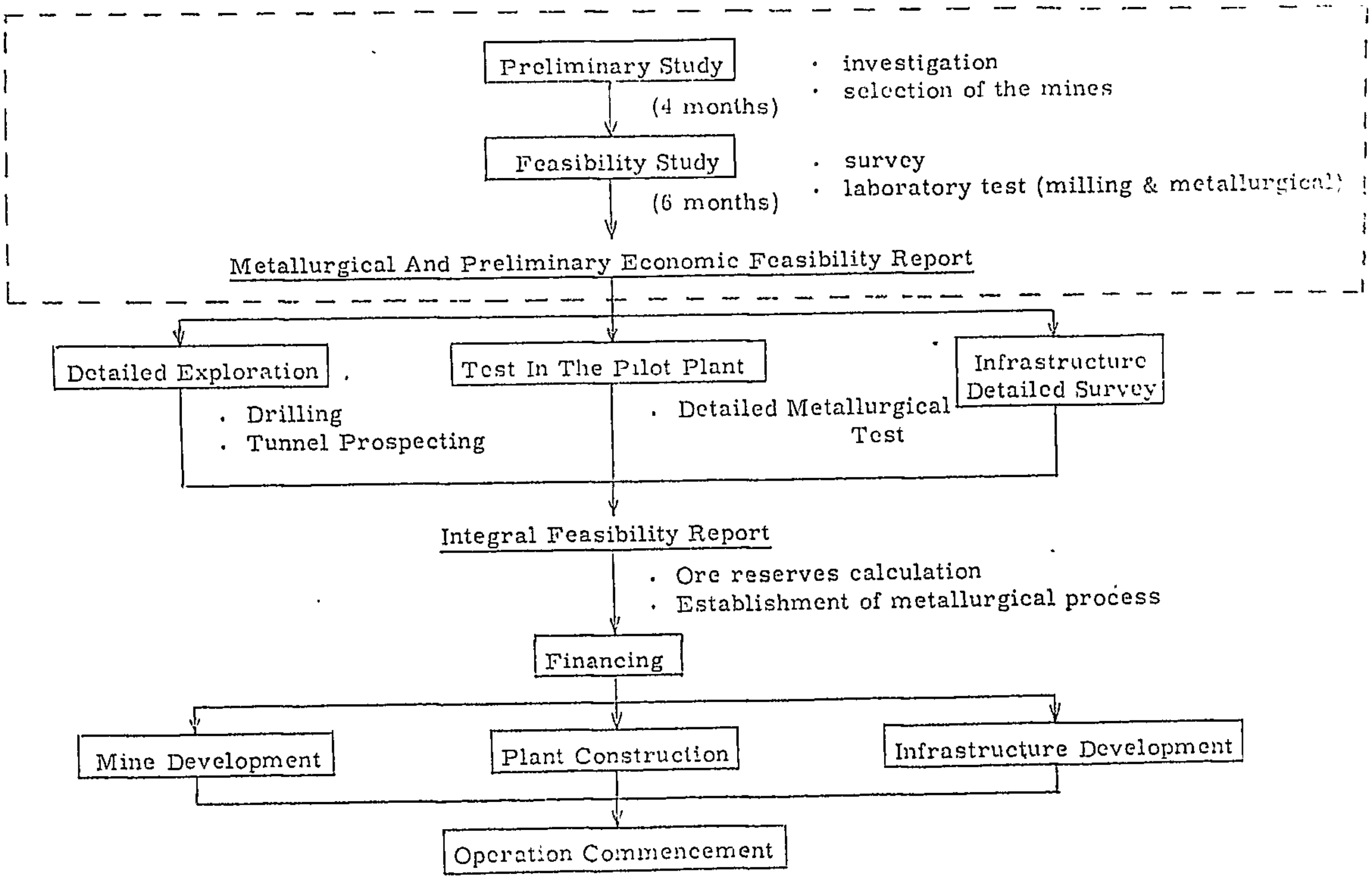


Fig. 3 Position of This Feasibility Study (Circled by dotted line)



List of data and informations necessary for JICA's Study (ANNEX)

1. For the Preliminary Study

1-1 Following documents and records are to be submitted to JICA's Preliminary Study Team:

a. Theses and reports regarding the geology, ore deposits and mines in the State of Guerrero
b. Data on calculation of ore reserve of the mines subject to study
c. Data on exploration and operation practised in these mines
d. Cost of exploration (classified in items like drilling, tunneling and labor costs etc.)
e. Mining Law
f. Labor Law
g. Commercial Law
h. Corporation Law
i. Law of taxation
j. General information on economic situation (General tendency, rate of inflation and unemployment, etc.)

1-2 Following drawings and charts are to be submitted to JICA's Preliminary Study Team:

a. Map of Mexican United States
b. Topographic maps of the States of Guerrero and Michoacan
c. Road maps of the States of Guerrero and Michoacan
d. Topographic maps of the proposed mine areas (scale: 1/50,000)
e. A set of aerial photographs of the proposed mine areas
f. Geological map of Mexican United States
g. Metallogenic map of Mexican United States
h. Geological map of the State of Guerrero
i. Metallogenic map of the State of Guerrero
j. Surface geological maps of the proposed mines (plan and section)
k. Underground geological maps of the proposed mines (plan and section)
l. Underground and surface facilities location maps of the proposed mines

2. For the Feasibility Study Team

2-1 Following documents and records are to be submitted to JICA's Feasibility Study Team:

a. Required specification of pellet for Las Truchas Work

b. Transportation facilities between mines and Lazaro Cardenas

c. Documents and records requested by JICA.

ANNEX 1-1

MINUTES OF MEETINGS (1) FOR THE FEASIBILITY STUDY OF

PROJECT FOR INTEGRAL UTILIZATION OF PYRITES IN THE STATE OF GUERRERO

AGREED BETWEEN

CONSEJO DE RECURSOS MINERALES, SECRETARIA DE PATRIMONIO Y FOMENTO INDUSTRIAL AND

EL GOBIERNO DEL ESTADO DE GUERRERO, ESTADOS UNIDOS MEXICANOS

AND JAPAN INTERNATIONAL COOPERATION AGENCY

JANUARY ~~FEBRUARY~~ 31, 1980

MR. GUILLERMO P. SALAS DIRECTOR GENERAL DEL CONSEJO DE RECURSOS MINERALES	MR. GUSTAVO MARTINEZ CABAÑAS ASESOR ECONOMICO DEL ESTADO DE GUERRERO	MT. TATSUO KONADA LEADER OF JICA MISSION

MINUTES OF MEETINGS (1)

1. To implement the feasibility study of integral utilization of pyrites in the State of Guerrero, Mexico, CONSEJO DE RECURSOS MINERALES (CRM), ESTADO DE GUERRERO, and JICA Mission discussed the content of the "Scope of Work" of this project.

Some of the important matters to be recorded are as follows;

(1) Mexican counterparts' contribution or duty for this work is divided in the following table (refer to "Scope of Work")

Item No. of Scope of Work		C. R. M.	GUERRERO
5		5-4	5-1, 5-2, 5-3, 5-5 5-6, 5-7, 5-8
Annex	1 - 1	a, d, e, f, g, h, i	a, b, c, j
	1 - 2	a, e, f, g, h, j	b, c, d, j, k, l
	2 - 1		a, b, c

2. About the mines to be surveyed:

The following are the candidate mines for this study (The number is at the most five).

a) Cooper King, b) La Dicha, c) Tizapa,

d) Violin, e) Campo Morado, f) Achotla,

g) Trinidad.

Mexican Counterparts will be in charge of the arrangement for the entry permissions of the mines visited from the concession owners. (State of Guerrero)

Selection of 5 mines to be surveyed will be discussed later on and the names will be recorded in another minutes of meeting.

ANNEX 1-2

MINUTES OF MEETINGS (2) FOR THE FEASIBILITY STUDY OF PROJECT FOR INTEGRAL UTILIZATION OF PYRITES IN THE STATE OF GUERRERO

AGREED BETWEEN

CONSEJO DE RECURSOS MINERALES, SECRETARIA DE PATRIMONIO Y FOMENTO INDUSTRIAL AND

EL GOBIERNO DEL ESTADO DE GUERRERO, ESTADOS UNIDOS MEXICANOS

AND JAPAN INTERNATIONAL COOPERATION AGENCY

FEBRUARY 2, 1980

MR. LUIS REYES RODRIGUES	MR. CESAR GALLARDO MELENDEZ	MR. A. SHIGUEKICHI IIDA
DIRECTOR DE DIRECCION DE MINERIA DEL ESTADO DE GUERRERO	REPRESENTANTE DE LA RESIDENCIA DE CHILPANCINGO DE CRM	MIEMBRO DE JICA MISSION

C/Cop. MR. GUILLERMO P. SALAS
C/Cop. MR. GUSTAVO MARTINEZ CABAÑAS
C/Cop. MR. AKIO SUZUKI

MINUTES OF MEETINGS (2)

1. To carry out successfully a preliminary study, JICA Mission and Mexican Counterparts, both representatives of Direccion de Mineria and CRM's residence of the State of Guerrero, discussed on the "Scope of Work" of this Project.

The essential agreements are summarized as follows:

1) Mexican Counterparts will submit all available data *over the mines scheduled to visit to JICA Mission by February 15, 1980.

   * The data are specified in "Scope of Work" and "Minutes of Meeting (1)".

2) Mexican Counterparts suggested that the field work by Feasibility Study Team should be carried out in the dry season (corresponding to November - June) and JICA possitively take into account this suggestion to program the itinerary of the followed JICA Mission.

3) The itinerary for the target mines agreed by JICA Mission and Mexican Counterparts is shown in the following table.

Month/Date	Name of Mines Visited
Feb./ 5	
6	
7	La Dicha
8	La Dicha
9	
10	Copper King
11	Copper King
12	
13	Campo Morado Mining Area*
14	Campo Morado Mining Area
15	Campo Morado Mining Area
16	
17	
18	
19	
20	
21	

* This mining area includes some 5 mines. Three mines at least are visited by the preliminary study team.

PHOTOMICROGRAPHS OF ORES FROM MASSIVE SULPHIDE DEPOSITS IN STATE OF GUERRERO, MEXICO.

ABBREVIATION

Py.	Pyrite
Sph.	Sphalerite
Cp.	Chalcopyrite
Gal.	Galena
Po.	Pyrrhotite
Lim.	Limonite
Qtz.	Quartz
X.	Unknown Mineral

ANNEX 2

A LIST OF POLISHED SECTIONS

No.	Name of P. Section	Locality
1	LD 1	La Dicha, Tunnel 8
2	LD 2	La Dicha, Tunnel 8
3	LD 3	La Dicha, Tunnel 8
4	CK 1	Copper King, Adit Rio Tinto
5	CK 2	Copper King, Adit Rio Tinto
6	CK 3	Copper King, Adit Rio Tinto
7	CM 1	Campo Morado, Level 6
8	CM 2	Campo Morado, Level 6
9	CM 3	Campo Morado, Level 6
10	LV 1	Los Vises, Collection from Mined Ore
11	LV 2	Los Vises Collection from Mined Ore
12	LV 3	Los Vises, Collection from Mined Ore
13	EN 1	El Naranjo, Adit El Naranjo
14	EN 2	El Naranjo Adit El Naranjo
15	EN 3	El Naranjo, Adit El Naranjo

ANNEX 3

ASSAY RESULTS.

No.	Au-g/t	Ag-g/t	Cu-%	Pb-%	Zn-%	Fe-%	S-%	Cd-%	SiO2-%	Co-%	Ni-%	Bi-%	As-%	Sb-%	Hg-ppm
1	0.1	2	0.04	0.03	0.02	45.07	51.54	0.001	4.31	0.124	0.006	0.006	0.006	0.003	0.3
2	0.1	4	0.04	0.03	0.03	44.97	51.54	Tr	2.80	0.039	0.007	0.004	0.007	0.006	0.8
3	0.1	6	0.10	0.03	0.08	43.79	50.98	0.001	2.84	0.010	0.003	0.003	0.008	0.006	4.8
4	0.8	73	0.10	0.65	0.15	43.00	48.69	0.004	3.10	Tr	Tr	0.008	0.123	0.049	17.4
5	0.6	61	0.32	0.29	1.61	41.61	46.68	0.009	5.56	0.003	0.004	0.005	0.105	0.020	12.3
6	0.6	56	0.12	0.19	0.15	44.18	51.11	0.002	3.94	0.007	0.004	0.003	0.103	0.023	18.8
7	Tr	3	0.91	0.03	0.06	51.69	33.21	Tr	5.75	0.034	0.002	0.003	0.002	0.007	0.2
8	Tr	4	0.87	0.04	0.08	54.26	34.05	0.002	4.63	0.018	0.001	0.004	0.004	0.004	0.2
9	0.3	4	0.82	0.03	0.02	54.66	35.89	0.002	3.75	0.030	0.002	0.005	0.001	0.005	0.8
10	1.0	11	0.13	0.48	0.06	40.23	0.41	0.001	31.07	Tr	0.001	0.005	0.161	0.019	21.8
11	1.0	11	0.09	0.22	0.07	23.92	0.11	0.001	58.61	Tr	0.002	0.005	0.081	0.014	11.3
12	Tr	22	0.09	0.20	0.03	22.83	0.17	0.001	59.64	0.002	0.003	0.004	0.036	0.005	12.1
13	4.4	79	0.20	0.90	2.46	39.63	44.84	0.001	8.50	0.002	0.003	0.008	1.385	0.044	47.4
14	1.3	381	0.06	2.26	1.28	42.20	49.06	0.007	1.92	0.018	0.003	0.007	0.308	0.056	18.5
15	0.1	18	0.06	0.10	0.05	44.28	50.55	0.001	4.86	0.034	0.004	0.005	0.16	0.008	3.6

No. 1-3 : Copper King Deposit.
No. 7-9 : La Dicha Deposit.
No. 13-15: Los Vises Deposit.

No. 4-6 : Campo Morado Deposit.
No. 10-12: El Naranjo Deposit.

PHOTOMICROGRAPHS OF ORES FROM MASSIVE SULPHIDE DEPOSITS IN STATE OF GUERRERO , MEXICO.

A B B R E V I A T I O N

Py.	Pyrite
Sph.	Sphalerite
Cp.	Chalcopyrite
Gal.	Galena
Po.	Pyrrhotite
Lim.	Limonite
Qtz.	Quartz
X.	Unknown Mineral

ANNEX 2

A LIST OF POLISHED SECTIONS

No.	Name of P. Section	Locality
1	LD 1	La Dicha, Tunnel 8
2	LD 2	La Dicha, Tunnel 8
3	LD 3	La Dicha, Tunnel 8
4	CK 1	Copper King Adit Rio Tinto
5	CK 2	Copper King,Adit Rio Tinto
6	CK 3	Copper King,Adit Rio Tinto
7	CM 1	Campo Morado, Level 6
8	CM 2	Campo Morado, Level 6
9	CM 3	Campo Morado, Level 6
10	LV 1	Los Vises, Collection from Mined Ore
11	LV 2	Los Vises, Collection from Mined Ore
12	LV 3	Los Vises, Collection from Mined Ore
13	EN 1	El Naranjo, Adit El Naranjo
14	EN 2	El Naranjo, Adit El Naranjo
15	EN 3	El Naranjo, Adit El Naranjo

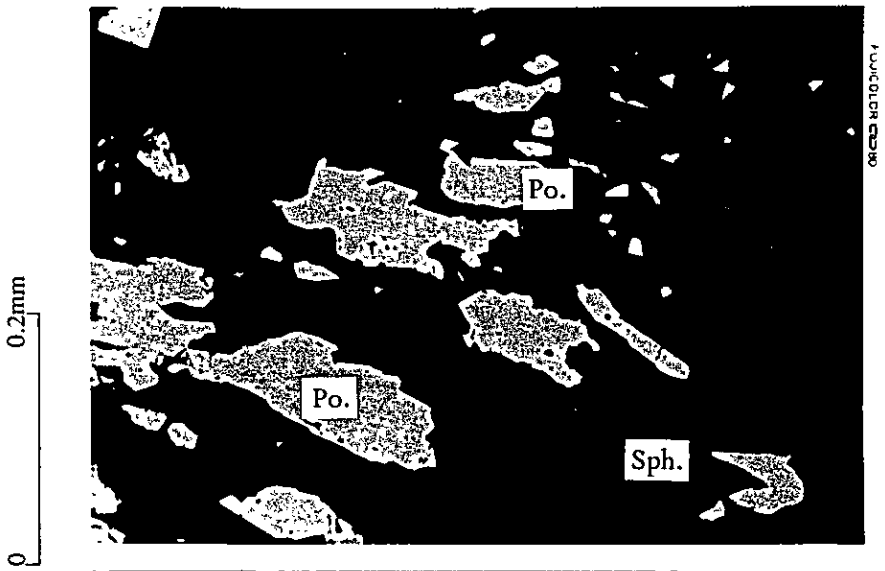


Photo 1
La Dicha

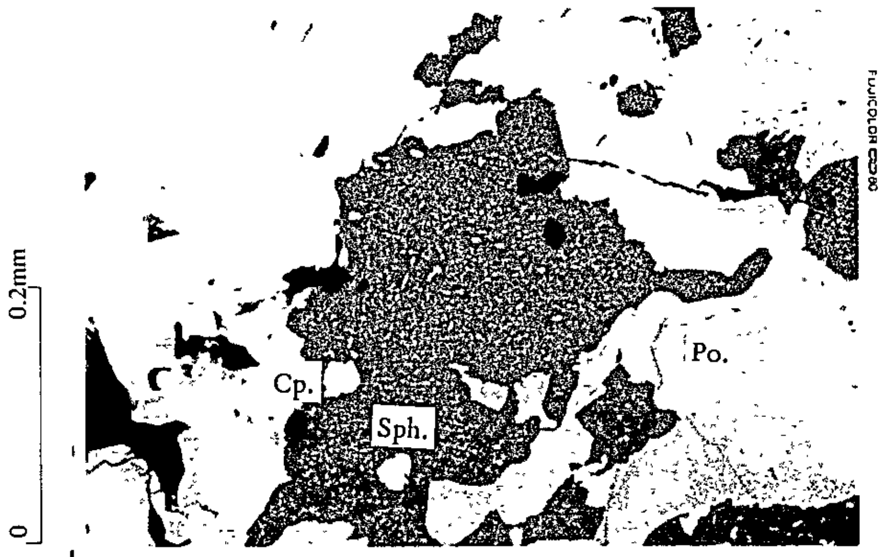


Photo 2
La Dicha

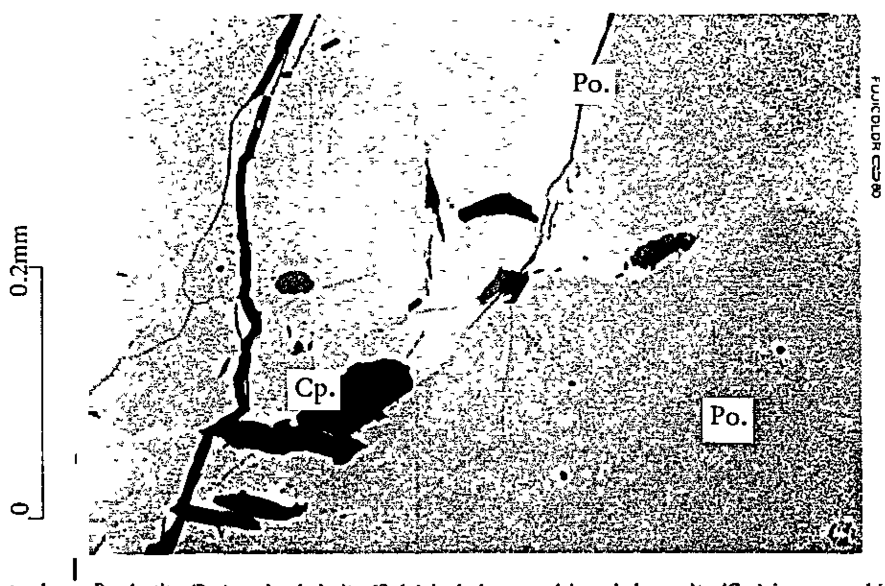


Photo 3
La Dicha

Photo 1 Pyrrhotite (Po.) and sphalerite (Sph) including emulsion chalcopyrite (Cp.) in green schist Large part of sulphide occurs subparallel to schistosity of the country rock.

Photo 2 Paragenesis of pyrrhotite, chalcopyrite, and sphalerite with exsolution chalcopyrite.

Photo. 3 Pyrrhotite- chalcopyrite-sphalerite intergrowth. Pleochroism of pyrrhotite is discernible. Chalcopyrite occurs as a veinlet

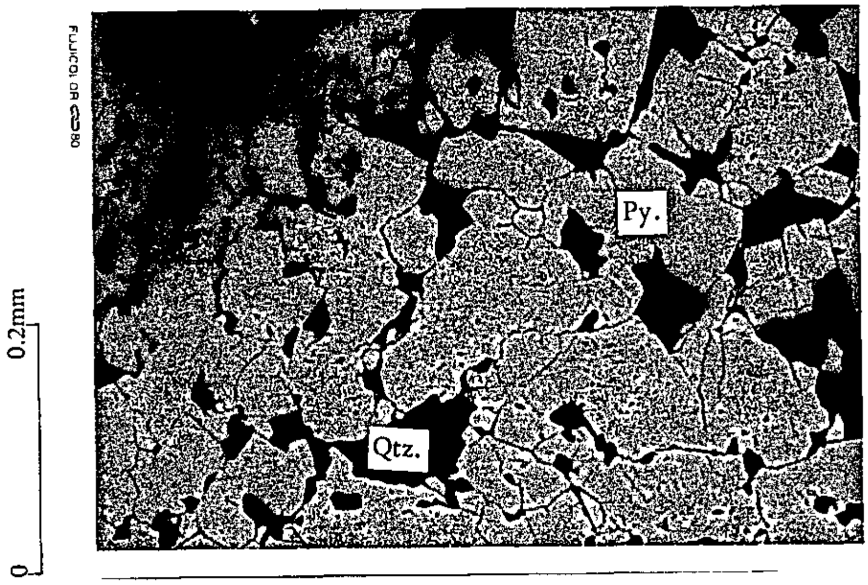


Photo 4
Copper King

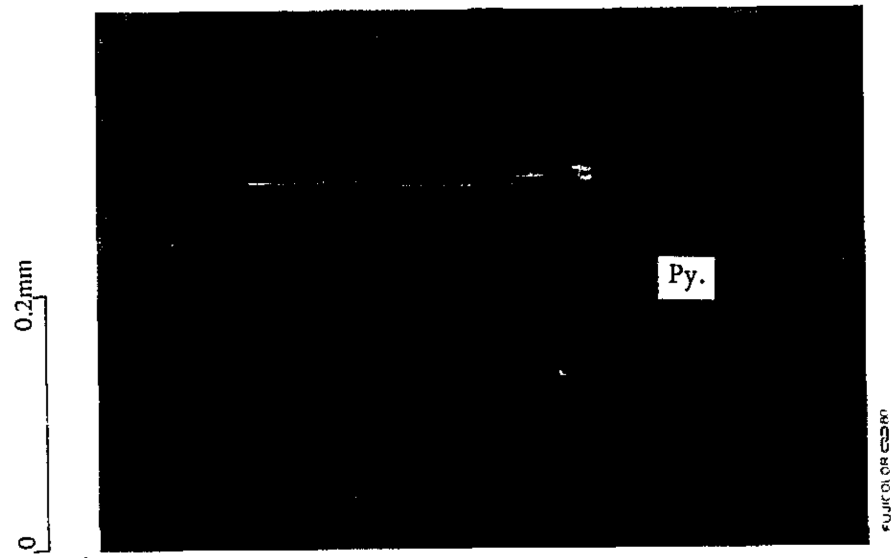


Photo. 5
Copper King

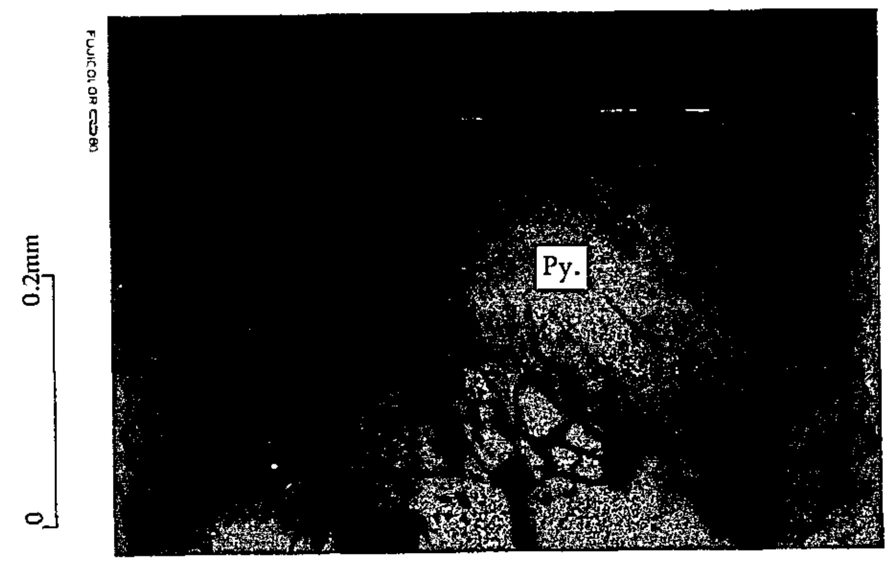


Photo. 6
Copper King

Photo 4	Intergrowth of fine-medium grain pyrite (Py.) and quartz (Qtz.) assemblage Weakly crushed texture is observable.
Photo. 5	Well-crystallized pyrite grain aggregate.
Photo 6	Faintly oriented pyrite grains. Possible rearrangement of pyrite can be envisaged.

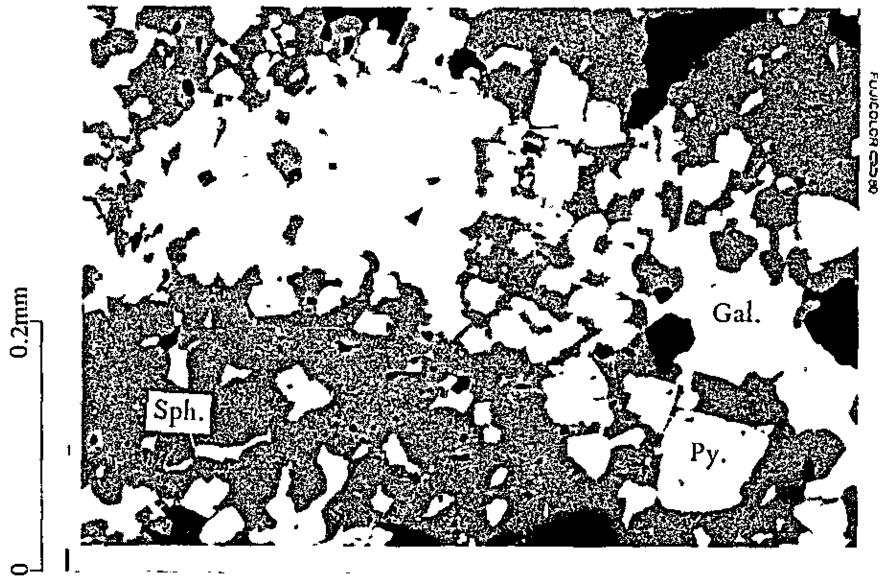


Photo 7
Campo Morado

Photo. 8
Campo Morado

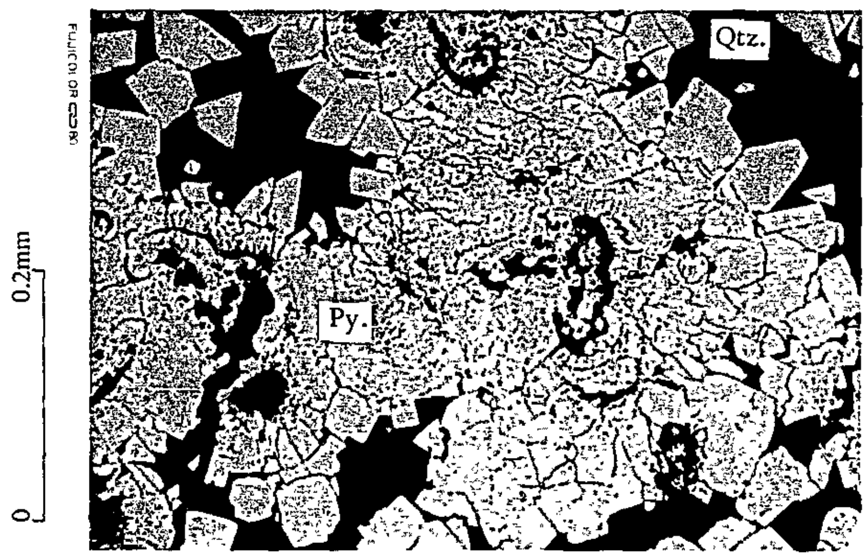


Photo 9
Campo Morado

Photo 7 Sphalerite, galena (Gal.), and pyrite intergrowth. A typical polymetallic massive sulphide texture

Photo. 8 Pyrite-sphalerite-galena-chalcopyrite assemblage. Sphalerite filling interspaces in pyrite

Photo 9 Colloform and euhedral pyrite. This texture suggests a recrystallization effect was imposed on colloform pyrite after its formation.

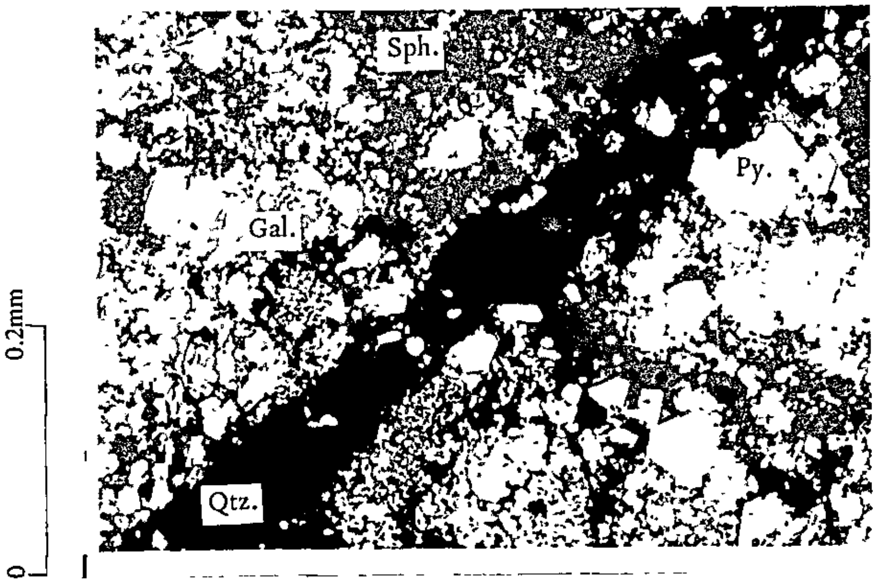


Photo 10
Los Vises

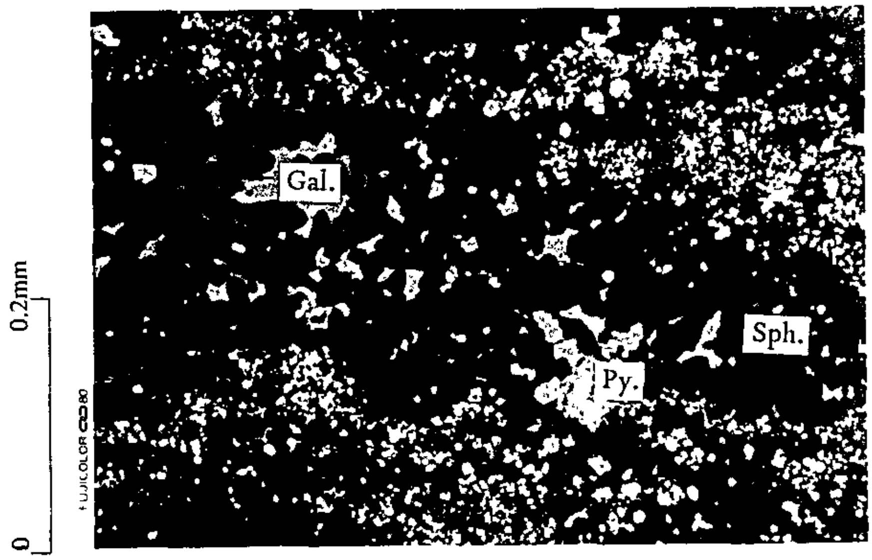


Photo. 11
Los Vises

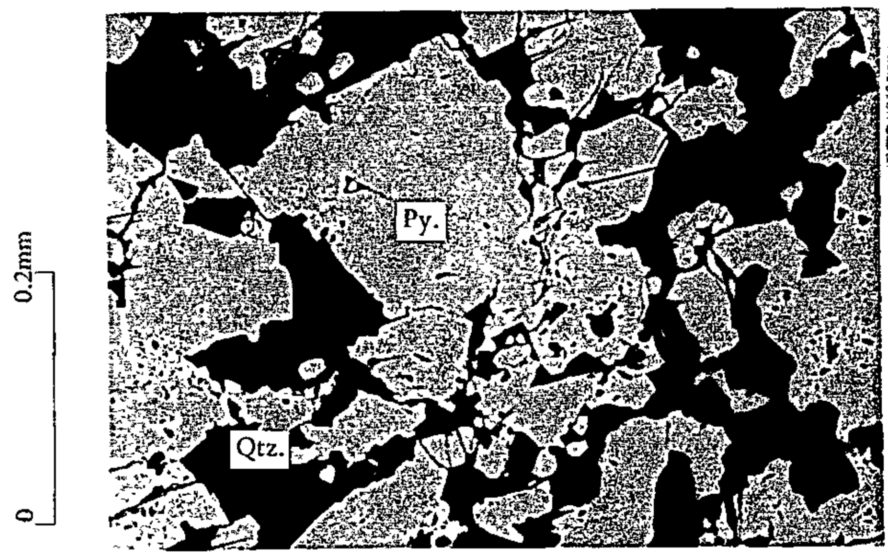


Photo. 12
Los Vises

Photo 10 Fine pyrite and galena in sphalerite Quartz veinlet cutting sulphide mineral assemblage.

Photo. 11 Very fine pyrite and galena assemblage in sphalerite. Compositional banding consisting pyrite and galena is noticeable

Photo. 12 Medium euhedral-subhedral pyrite and quartz intergrowth.

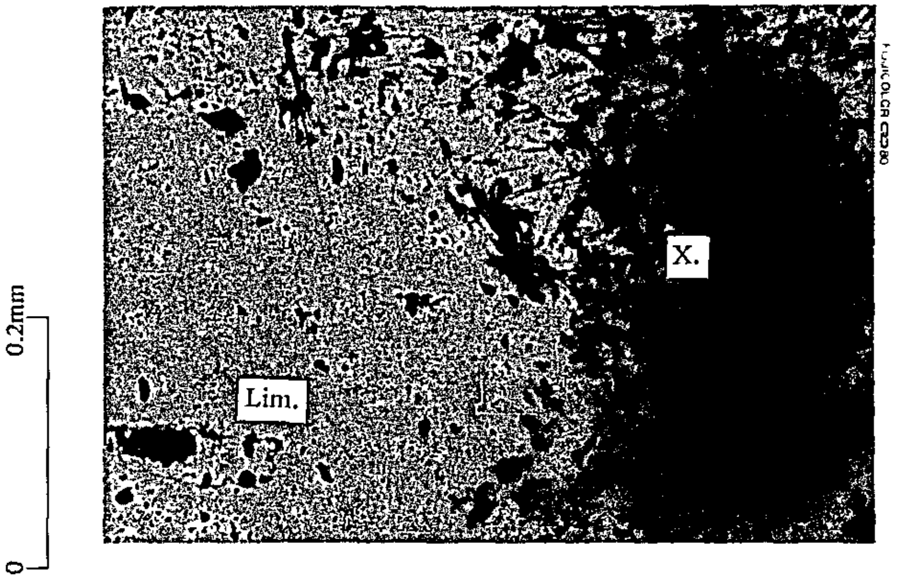


Photo 13
El Naranjo

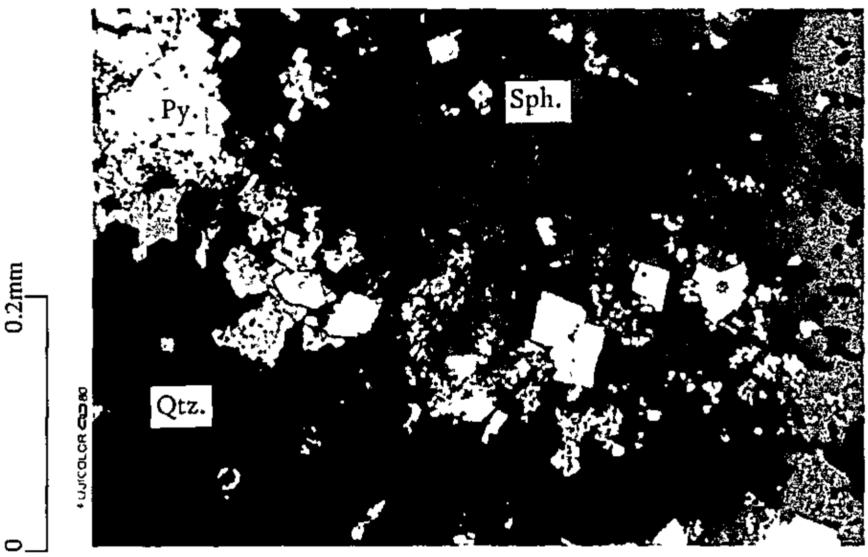


Photo. 14
El Naranjo

Photo. 15
El Naranjo

Photo. 13 Intergrowth of massive limonite (Lim.) and brown acicular – shape unknown mineral (X.)
Photo. 14 Intricate intergrowth sulphide minerals and quartz. Two types of pyrite, euhedral and corroded pyrite, coexist
Photo. 15 Paragenesis of sphalerite, galena, pyrite, and quartz. A typical massive sulphide texture.

ANNEX 4-1

A LIST OF DATA SUBMITTED BY DIRCCION DE MINERIA DEL ESTADO DE GUERRERO TO JICA'S PRELIMINARY STUDY TEAM.

FEB. 15, 1980

1) Cannon D. M., (1968)
Report of Examination of La Dicha Property, Municipality of Chilpancingo, State of Guerrero, Mexico.

2) Cannon D. M., (1970)
Interim Report for International Helium Ltd. on the Dicha Project, State of Guerrero, Republic of Mexico.

3) Cannon D M., (1971)
Report on the La Dicha Property, Chilpancingo, State of Guerrero, Mexico.

4) Gonzalez R. J., and Foshag W F., (1947)
El Criadero de Cobre de "La Dicha" Municipio de Chilpancingo, Estado de Guerrero.

5) Klesse E., (1968)
Geology of the El Ocotito - Ixcuinatoyac Region and of La Dicha Stratiform Sulphide Deposit State of Gerrero.
Bol. Soc. Geol. Mexicana, V.31 N.2 P. 107-104

6) Phendler R. W., (1972)
Report on Recent Geological Mapping on the La Dicha Copper Property, Chilpancingo, Guerrero, Mexico.

7) Whitaker O. R., (1912)
Report on the property of the Reforma Mining and Milling Company, Campo Morado, Guerrero, Mexico.

8) Gobierno de Estado de Guerrero
Plano Geologico Estado de Guerrero.

ANNEX 4-2

A LIST OF REFERENCES AND MAPS ACQUIRED BY JICA's PRELIMINARY STUDY TEAM IN MEXICO.

A) REFERENCES

(1) Lopez R. E., (1979)
Geologia de Mexico, Tomo III

(2) Legislacion Minera (Decimosegunda Edicion) 1979.

(3) Nueva Ley Federal del Trabajo, 1980.

(4) Sociedades Mercantiles y Cooperativas (Trigesimoprinera Edicion), 1979.

(5) Ley de Impuesto al Valor Agregado, 1980.

(6) Ley del Impuesto sobre la Renta (Tercera Edicion), 1980.

(7) Codıgo de Comercio y Leres Complementarios (Trigesimosexta Edicion), 1979.

B) MAP

(1)	Geological Map, Scale 1 50,000,		Iguala.
(2)	"	"	Teloloapan.
(3)	Topographic Map, Scale 1:50,000,		Teloloapan.
(4)	"	"	, Santa Teresa.
(5)	"	"	, Apaxtla de Castrejon.
(6)	"	"	, Ciudad Altamırano.
(7)	"	"	, Iguala.
(8)	"	"	, Atcelia.
(9)	"	"	, Villa Hidalgo.
(10)	Map of Climate, Scale 1:500,000,		Acapulco.
(11)	"	"	, Colima, Zacatula.
(12)	Road Map, Scale 1:800,000,		State of Guerrero.