No. 34

REPORT
ON
THE COOPERATIVE MINERAL EXPLORATION
IN
THE JUNIN AREA
REPUBLIC OF ECUADOR

MARCH 1994

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

In response to request of the Government of the Republic of Ecuador, the Japanese Government decided to conduct a Mineral Exploration Project in the Junin Area and entrusted the survey to the Japan International Cooperation Agency (JICA) and the Metal Mining Agency of Japan (MMAJ).

The JICA and MMAJ sent to the Republic of Ecuador a survey team headed by Hiroshi Kusaka from June 23, 1993 to February 8, 1994.

The team exchanged views with the officials concerned of the Government of the Republic of Ecuador and conducted a field survey in the Junin area. After the team returned to Japan, Further studies were made and the present report has been prepared.

We hope that this repot will serve for the development of the Project and contribute to the promotion of friendly relations between the two countries.

We wish to express our deep appreciation to the officials concerned of the Government of the Republic of Ecuador for their kind cooperation extended to the team.

March, 1994

Kensuke Yanagiya

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Takashi Ishikawa

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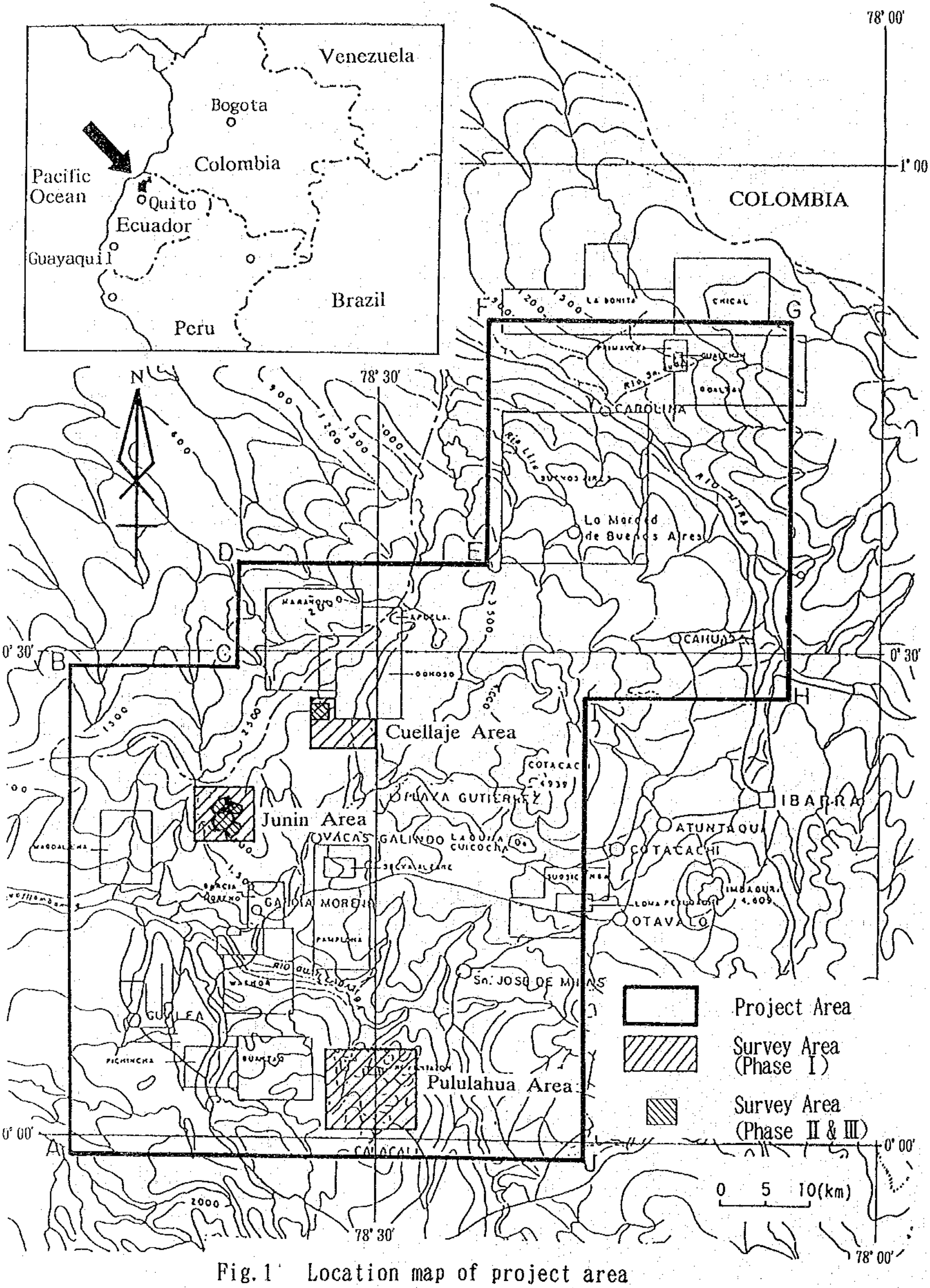

Fig.1 Location map of project area

ABSTRACT

The present survey was carried out in the Junin Project area, in conformity with the SCOPE OF WORK agreed between the governments of the Republic of Ecuador and Japan, in July 19, 1991. The project covers a period of three years. This survey corresponds to the third year's.

The purpose of the survey is to confirm the geology and mineralization to the depth with diamond core drilling in the Central Zone of the Junin area and the Rio Magdalena Zone of the Cuellaje area.

(1) Junin area

Drilling survey was carried out this year for two mineralized zones: the Q. Limonita Mineralized zone and the Rio Junin Mineralized zone. As the results of the survey, every drill holes encontered significant mineralization.

In order to investigate the Q. Limonita mineralized zone, the Holes MJJ-11 and MJJ-12 were carried out for confirming extension and intensity of mineralization toward northeastern parat, and the Hole MJJ-10 toward northwestern part.

While the Hole MJJ-13 was carried out also to investigate the Rio Junin mineralized zone.

The results of these holes are as follows:

The mineralization was confirmed that it tend to increase toward northeast (Holes MJJ-11 and 12).

Ore assay is as follows:

Average grade of MJJ-11 is;

- 0.22 % Cu and 0.012 % Mo from 10 m to 300 m in depth

Average grade of MJJ-12 is;

- 0.16 % Cu and 0.0056 % Mo from 10 m to 300 m in depth

On the other hand, in the northern part of the Q. Limonita mineralized zone, the Hole MJJ-10 penetrated a good mineralized paart under the outcrops and also a significant mineralized part below 148 m in depth.

Ore assay is as follows:

Average grade of mineralized paarts of the Hole MJJ-10;

- 0.70 % Cu and 0.0036 % Mo from 10 m to 84 m in depth
- 0.45 % Cu and 0.0025 % Mo from 148 m to 301 m in depth

For investigating the Rio Junin mineralized zone, the Hole MJJ-13 was carried out. Based on the data of the mineralization at the bottom of the hole which has not yet confirmed the eastern margin of the mineralization. The mineraization may extend more eastward.

Ore assay is as follows:

Average grade of the Hole MJJ-13 is;

- 0.55 % Cu and 0.0085 % Mo fron 10 m to 270 m in depth

In Junin area, mineralization is observed in fracture zones, and ore minerals such as chalcopyrite, bornite, (chalcocite), and molybdenite atc. exist together. Silicification and argillization (sericitization) are observed in limited intervale of cores concentrated on some parats fractured intensely (fracture zones). And those fracture zones may be formed principally in relation with faults and/or lineaments.

(2) Cuellaje area

The drilling survey was carried out to investigate the Mineralized Zone A. The hole MJC-1 was proceeded for the northern part, and the Hole MJC-2 for the southern part of the Mineralized Zone A

As the result of the investigation with MJC-1, mineralization in the northern part seemed to be more intense than that of in the southern part. Furthermore the MJC-1 penetrated fracture zone and proved that ore minerals such as Chalcopyrite, Bornite, (Chalcocite) and Molybdenite precipitated in cracks of strongly silicified Granodiorite.

Ore grade is as follows:

Average grade of the Hole MJC-1 is;

- 0.28 % Cu, 0.012 % Mo from 10 m to 200 m in depth
  (max. 1.64 % Cu, amd 0.12 % Mo)

Favorable part of the Hole averages;

- 0.64 % Cu, 0.022 % Mo from 10 m to 60 m in depth

On the other hand, in the southern part of the mineralized zone A, the rock in the shallow undergound (lower part of a ridge, topographycally) was weathered intensely, and more or less argillized and leached out primary ore minerals. Below this weahered part, pyrite dominates as a primary ore mineral.

Though the ratio of Chalcopyrite/Pyrite in this place is lower than that in the northern part, a consistent mineralization was encontered through the bottom of the hole.

Ore grade is as follows:

Average grade of the Hloe MJC-2 is;

- 0.16 % Cu, 0.0075 % Mo from 10 m to 200 m in depth

In Cuellaje area, fracture is thought to have played significant role for mineralization.

Junin and Cuellaje areas were proved to have high potential of Cu-Mo dissemination type ore deposits, therfore followings are recommended for further investigation and exploration.

(1) Junin area

1) The Q. Limonita Mineralized zone to the northeast
   (Q. verde Mineralized zone): drilling survey
2) The Rio Junin Mineralized zone to the east
   (Q. Rica Mineralized zone): drilling survey
3) The Rio Junin Mineralized zone to the south:
   drilling survey
4) The Q. Fortuna Mineralized zone:
   detailed geological survey and drilling survey

(2) The Rio Magdalena Zone of the Cuellaje area

1) The Rio Magdalena Mineralized zone (Mineralized zone A):drilling survey

2) The South Mineralized zone and its western extension: ditail geological survey and geophysical survey

(3) Intermediate area beween the Junin and Cuellaje areas: On the survey result of the Phase I and II survey, the both areas of Junin and Cuellaje are proved to have a high potential of mineralization. Therefore, in order to confirm the potential of mineral deposits in the intermediate area, geological survey (including rock geochemical survey) is recommendable.

CONTENTS

Chapter 1 Introduction

1-1 Background of the Survey

The Junin Project area lies in the western flank of Occidental Cordillera of Ecuador, where predominates a porphyry copper belt which is known to run consistently from North to South of America.(Fig.1)

The present survey was carried out in the Junin area,in conformity with the Scope of Work agreed between the governments of the Republic of Ecuador and Japan,in July 19th,1991.The project covers an area of 5,000km^2 over a period of three years.

This survey, which corresponds to the third year's, was carried out by both Ecuadorian and Japanese members.

1-2 Conclusion and Recommendation of the Phase II Survey

1-2-1 Conclusion

(1) Geology of Junin area

Geology of Junin area consists of Apuela-Nanegal batholith of granodiorite and stocks or dikes of quartz porphyry and diorite porphyry, which intrude into batholith of granodiorite. Distributional density of stocks tends to be dominate in the Central Zone of Junin area. Lineaments were also analyzed to radiate outlying section of the drainage system from the Junction of Q. Limonita and Q. Crysocola.

(2) Mineralization and alteration in the Central Zone of Junin area

Mineralized and alteration zones in this area were classified in three types based on their occurrences: Type I, Type II and Type III. Type I and II are thought to be of the porphyry copper type mineralization.

Type I was characterized by dissemination and film of Cu-Mo minerals accompanied with phyllic alteration zone, which occurred mainly in the granodiorite around quartz porphyry stocks or dikes.

Type II occurred as Cu-Mo-Ag veins in granodiorite, and was subdivided into Type IIA and Type IIB on their occurrences.

1) Type IIA : abundant in sulfide ore minerals which was scattered in clay as principal gangue mineral.

2) Type IIB : quartz veins with sulfide ore minerals.

Both phyllic and potassic alteration zones were identified along the vein contacts mentioned above.

This type mineralized zones were sketched geologically and mineralogically in this Phase.

Type III was observed to be as a acidic alteration zone being accompanied with networky quartz veins in granodiorite and diorite porphyry. Geochemical Au-Ag anomalies were delineated in a part of this alteration zone.

The Q.Limonita-Upper reach mineralized zone, which belongs to Type IIA, has a vein of 2 m wide and 140 m long. Ore assay result averages 10 % Cu and 15 g/t Ag.

The Q.Crisocola mineralized zone belongs to Type IIA mainly, and has 1.1 m in vein width and 50 m in length. Average ore assay result is 30 % of Cu.

The Rio Junin mineralized zone is observed in an area of 200 m in width and 500 m in length, where Type I, IIA and IIB coexists as mineralization in sequence. Ore assay result is 1 % Cu.

The Q.Controversia mineralized zone is overlapped by Type I, Type IIA and Type IIB on an area of 150 m in width and 200 m in length. The mineralization, however, is not intense.

The Q.Rica mineralized zone is also overlapped by Type I and Type IIB, but the area is limited.

(3) Drilling survey in the Central Zone of Junin area

Drilling survey was carried out in the Q.Limonita and Rio Junin mineralized zones, which predominated dissemination and film of bornite-chalcopyrite-pyrite-molybdenite.

The drilling results are as follows:

In the Q.Limonita mineralized zone, intense mineralization is recognized to increase and predominate to the northeasternward and to the depth over 150 m. As the assay result of 37 samples obtained from drill cores (between 8.00 m and 148.80 m of drill hole MJJ-4; direction to the northeast), the content was 3.84 % Cu in maximum and 1.30 % Cu in average.

In the Rio Junin mineralized zone, strong mineralization is also observed. According to the assay result of 112 samples obtained from drill cores (between 6.00 m and 233.45 m of drill hole MJJ-8; direction to the east), the content was 2.10 % Cu in maximum and 0.46 % Cu in average.

Since a large amount of bornite was observed in fractures of drill cores, predominant mineralized part was thought to exist in the lower parts of the northeastern ridge of and the eastern ridge of the Q.Limonita and the Rio Junin mineralized zone, respectively.

(4) Mineralization and geochemical exploration in the Surrounding Zone of Junin area

The Surrounding Zone of Junin area comprises three mineralized zones; Q.Cristal-Branch, Q.Esperanza and Q.Fortuna.

The Q.Cristal-Branch is divided into east mineralized zone and west. The former consists of Type I generally, and the latter Type II mainly.

Q.Esperanza mineralizes zone, which contains vein deposit of 1 m wide, 1 km long and 120 m high, is classified in Type II. Ore assay result averages 10 % Cu and 20 g/t Ag.

Q.Fortuna mineralized zone, which consists of Type I mainly and Type II additionally, is distributed on an area of 600 m in length, 200 m in width and 200 m in vertical difference. Ore assay result was 1 % Cu on average.

The distributional pattern of geochemical anomalous zones indicates a good coincidence with those of mineralization and/or alteration. For instance, Cu-Mo geochemical anomalous zones includes the mineralized zones observed, while Pb-Zn anomalous zone are scattered around the mineralized zone. Stream sediment anomalies (Phase I) and rock geochemical anomalies (Phase II) are both interpreted to be from mineralized outcrops.

(5) Rio Magdalena Zone of Cuellaje area

Geology of Cuellaje area consists mainly of the Apuela-Nanegal batholith of granodiorite, and stocks or dikes of andesitic porphyry, dioritic porphyry and/or quartz porphyry, which intrude into the batholith.

In the Rio Magdalena Zone, the following mineralized zones are developed: mineralized zones A,B,C and E, all of which belong to Type I; two other mineralized zones in south belongs Type II; and mineralized zone D belongs to Type III. A part of the mineralized zone C is overlapped by the mineralized zone D.

The mineralized zone A is the biggest one observed in an area of 500 m x 400 m. Stockwork and dissemination deposits distribute in the center, film deposits around them. The mineral assemblage of alteration minerals shows zonal distribution which is in harmony with the mineralization types: quartz-sericite-chlorite-pyrite zone and chlorite-calcite zone in outward order. These zonal assemblages coincident with phyllic alteration zone and propylitic alteration zone of general porphyry copper deposit. The zoning of mineralization is also coincide markedly with that of general porphyry copper deposit. Average ore assay result is 0.6 % of Cu. The scale of the mineralization and Cu grade in this area ranks next to those of the Q.Limonita-Q.Verde mineralized zone of Central Zone of Junin area and the Q.Fortuna mineralized zone of Surrounding Zone of Junin area.

On the basis of correlation between geochemical anomaly and mineralization, high factor score distribution zones of Cu-Mo-Au-Ag were delineated on the mineralization A and E, south mineralized zone and northeastern part, high factor score distribution zones of Au-Ag on the mineralized zone D.

Owing to correlation between geophysical anomaly and mineralization, middle to low apparent resistivities and high to middle percent frequency effects were detected inside and/or beside the mineralized zones A and E, middle apparent resistivity and middle to low percent frequency effect inside and/or beside the mineralized zone D, and high apparent resistivity and high to middle percent frequency effect inside and/or beside south mineralized zone. IP anomaly zones detected inside and/or beside the mineralization A and the south mineralized zone continue toward western and lower parts from both mineralized zones.

As to evaluation of IP anomaly by contents of normative chalcopyrite-pyrite, IP anomaly is proportional to total amounts of sulfide minerals. It seems that IP anomalies on the mineralized zone A and E are caused by same amount of chalcopyrite and pyrite, IP anomaly on the south mineralized zone pyrite>chalcopyrite, and IP anomaly on the northeastern part pyrite.

1-2-2 Recommendations for Phase III Survey

Junin and Cuellaje areas were proved to have high potential of Cu-Mo-Ag dissemination and vein deposits. Followings are, therefore, recommended for Phase III survey including ore forming model.

(1) Central Zone of Junin area

According to the steep topography, it is difficult to adopt the geophysical exploration. Drilling survey is, consequently, recommended to be continued although a transportation problem needs to be solved.

Taking the mobilization of diamond drilling machine into consideration, the recommended order of drilling survey is as follows:

1) The Q.Limonita mineralized zone, and an area between the Q.Limonita and the Q.Verde mineralized zones (Type I)
2) The Q.Verde mineralized zone (Type I)
3) The Rio Junin mineralized zone (Types I and II)
4) The Q.Limonita-Upper reach mineralized zone (Type II)
5) The Q.Crisocola mineralized zone (Type II)

(2) Surrounding Zone of Junin area

1) The Q.Fortuna mineralized zone (Type I):
Detailed geological sketch on mineralized zone, detailed geological survey, and drilling survey in the southeastern and eastern parts of quartz porphyry stock.
2) The Q.Esperanza mineralized zone (Type II):
Drilling survey, underground exploration including Q.Limonita-Upper reach and Q.Verde mineralized zones.

(3) Rio Magdalena Zone of Cuellaje area

1) The Rio Magdalena-Branch mineralized zone (the mineralized zone A) and its western extension:
Drilling survey, and geophysical survey.
2) The south mineralized zone and its western extension:
Detailed geological survey and geophysical survey.

1-3 Outline of the Phaase III Survey

1-3-1 Survey Area

According to the "Recommendation for Phase III survey" mentioned above, the survey areas of the Phase III were selected to be as followings: the Central Zone of Junin area; the Rio Magdalena Zone of Cuellaje area (Fig.1).

1-3-2 Purpose of the Survey

The purpose of the Phase III survey is to confirm the existence of deposits by clarifying the geological setting of mineralization in the Junin Project area, and to transfer technology to counterparts of Ecuadorian organization through survey.

1-3-3 Survey Method

In the Central Zone of Junin area and the Rio Magdalena Zone of Cuellaje area, drilling survey was carried out.

The items and amounts of survey activities are shown on Tab.1-1.

Tab.1-1 Amounts of field works and laboratory tests

Area	Survey contents	Hole	Direction	Inclination	Depth
Junin	Drilling survey	MJJ-10	325 °	-45 °	301.30 m
		MJJ-11	30 °	-45 °	302.50 m
		MJJ-12	30 °	-45 °	302.00 m
		MJJ-13	90 °	-45 °	270.00 m
		Total			1174.80 m
Cuellaje	Drilling survey	MJC- 1	--	-90 °	202.00 m
		MJC- 2	--	-90 °	201.50 m
		Total			403.50 m

Items and contents of laboratory work	Amount
Drilling survey	
① Rock thin section	12
② Ore polished section	12
③ Chemical analyses	315
—Ore (4 elements: Cu, Pb, Zn & Mo)	253
—Ore (6 elements: Cu, Pb, Zn, Au, Ag & Mo)	62

1-3-4 Organization of the Survey

Personnel who were involved in the Project are listed up on Tab.1-2.

Fig.1-2 Members of project administration and field survey

(Japanese counterparts)		
Jiro Osako	Director	MMAJ
Kosuke Takamoto	Overseas Act.Dept.	MMAJ
Seiichi Mizusawa	Rima Office	MMAJ
Hiroshi Kusaka	Leader of project	BEC
(Ecuadrian counterparts)		
Ramon Vera	President	CODIGEM
Wilson Santamaria	Geological surv.	CODIGEM
Edgar Lopez	Geophysical survey	CODIGEM
Luis Quevedo	Geological survey	CODIGEM
Gabriel Valenzuela	Geological survey	CODIGEM
Wilson Bonilla	Geological survey	CODIGEM
Luis de La Torre	Drilling	CODIGEM
Alfonso Vaca	Drilling	CODIGEM

MMAJ:Metal Mining Agency of Japan
BEC:Bishimetal Exploration Co.,Ltd.
CODIGEM:Corporacion de Desarrollo e Investigacion Geologico-Minero y Metalurgica

1-3-5 Period of the survey

Field survey
Drilling
From 23rd of June, 1993 to 8th of February, 1994

Analysis and documentaion
From 1st of August, 1993 to 24th of February, 1994

1-4 Geographic Features of the Survey Area

1-4-1 Location and Access

The Project area of Junin locates about 20 to 80 km north of Quito, the capital city of Ecuador. The area extends through two Provinces, the Provincia de Imbabura and the Provincia de Pichincha. The Phase III survey includes two survey areas, which are Junin and Cuellaje (Fig.1).

Support-camp was located at Nangulvi, which is about 180 km of road distance and four hours drive from Quito via Otavalo (110 km of paved road between Quito and Otavalo, and 70 km of unpaved road between Otavalo and Nangulvi). From Nangulvi to Chalguayacu Alto, the entrance of Junin, two hours drive approximately for 40 km of unpaved road via Garcia Moreno.

From Chalguayacu Alto to "Junin Heliport" in the Central Zone of Junin area, 10 km requires half an hour by jeep in dry season. And for about 20 minutes on foot from Junin Heliport to the Base (Junin Camp), which is utilized for investigating Quebradas which are mineralized, and for the activities of drilling survey.

From Nangulbi to the Cuellaje area, it takes an hour drive by jeep through 22 km of unpaved road.

1-4-2 Topography and Hydrography

The project area lies in the western flank of West-Andian mountain range. The topography of the project area is very steep, altitudinal difference is between 1,500 m and 3,000 m above sea level in Junin area, and between 1,800 m and 2,600 m above see level in Cuellaje area,

The prominent summit distributed inside of the Project area is Mt Cotacachi (4,937 m ASL) which occupies about 20 km east of the Cuellaje area, and the other prominent summit outside is Mt Cayambe (5,790 m ASL) which rises high at about 50 km east of the Pululahua area.

Junin and Cuellaje areas situate on the southern flank and southeastern flank of Cordillera de Toisan.

In the Project area, the principal drainage system originates from the Andian mountain rage and consists macroscopically of the E-W direction represented by Rio Guayllabamba running to the west in southern area and the NW-SE direction represented by Rio Mira streaming toward the northwest direction.

Adding to these directions, second degree drainage systems are developed, which are characterized with NE-SW system and N-S system. Two survey areas, Junin and Cuellaje, are distributed in an area along a Branch of upper stream of Rio Guayllabamba.

1-4-3 Climate and Vegetation

Climate in the survey area is tropical, high humidity in lower altitude area and temperate, dry in higher altitude area.

The records show that annual humidity be from 50% to 75%. Precipitation sums up 2,000 mm to 3,000 mm annually.

The rain season runs from December to April. In Junin area,it is very common to start raining in the afternoon and decreasing temperature from October. It rains through day and night from December.

Dry climate shows Pululahua area, which situates in the eastern part of the Project area and which was selected as an area to be surveyed for the Phase I. The altitude of which is the highest among the survey areas and the climate much more temperate. In an area higher than Pululahua, perpetual snow gets covering summits and peaks (for instance, Mt Cotacachi etc).

Vegetation mainly consists of jungles. Plantations of sugar cane and banana exist along valleys, and fields of corn and beans or ranchos are developed partly in highland.

1-5 Geological Features of the Survey Area

Ecuador situates in the northwestern part of South American Continent and occupies an area between Columbia and Peru geographically. Geotectonically, Ecuador belongs to so-called mobile belt of the Andian geosyncline, which is formed in a narrow stripe along the western margin of the Guiana-Brazil shield, and which is characterized such geotectonic structure with faults, folds and violent volcanic activities as eugeosyncline.

The geology of Ecuador consists of rocks from Pre-Cambrians up to Quaternaries. Principal geologic structure shows NNW-SSE trend which reflects upon the distribution of the three geotectonic ranges: Coast; Mountains; and Orient.

Geology of coastal range is composed of Mesozoic marine formation (the Pinon formation), Tertiary formation and Quaternary formations.

Geology of Mountain ranges is composed of three geologic zones: the West-Cordillera; the Andian inner valley; and the East-Cordillera.

In the West-cordillera volcanic rocks, which are dated to be from Cretaceous to Paleogene (the Macuchi formation), are piled up enormously. In the southern part of this geologic range, Paleozoic and Pre-Cambrian basements are recognized to distribute. In the Andian inner valley, scattered are many depositional basins which are filled with sediments and volcanic detritus.

Geology of Orient is composed of sedimental layers from Carboniferous to Quaternary.

Ecuador has two major Metallogenic Provinces: Oriental and Occidental, each of which is subdivided into three and five Metallogenic Zones respectively as shown in Fig.1-1 (INEMIN, 1988). Classification of these zones is interpreted on Tab.1-3.

The Junin area is situated in the Metallogenic Zone VII, a anticlinorium-synclinorium of Occidental Metallogenic Province. The Zone VII extends north-south: northern most limit may be around the Piedrancha deposits in Columbia (50Ma, JICA-

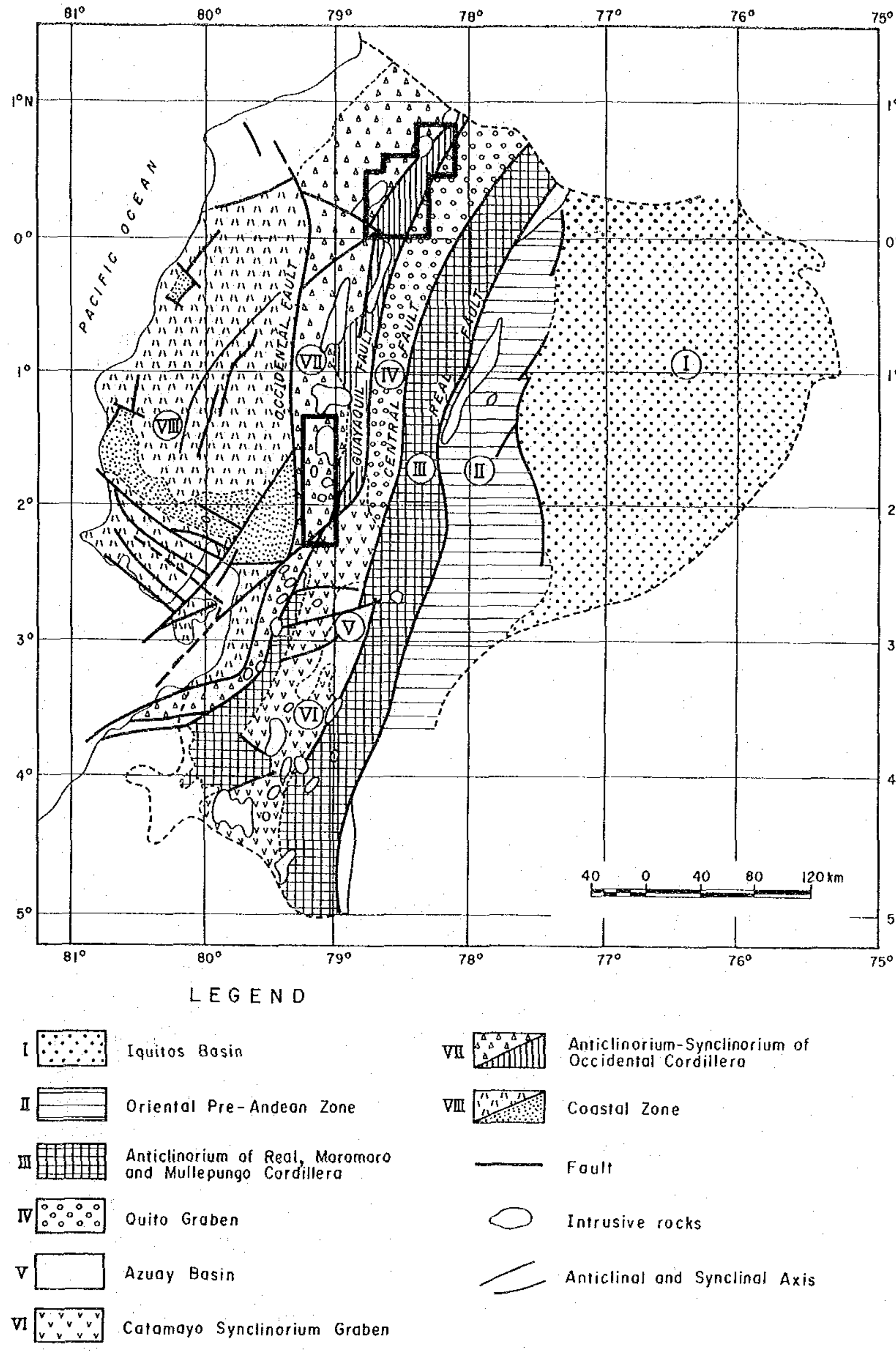

Fig. 1-1 Geotectonic and metallogemic zones of Ecuador

MMAJ,1983); down to the south around El Torneado mineralized zones (30/24Ma, JICA-MMAJ, 1989) and/or Chaucha deposits (Eocene, OMRD, 1972); and the Michiquillay deposits (46/21 Ma, Stewart et al, 1974) can be concluded to be as the southern mostlit.

In the vicinity of Piedrancha, Later stage auriferous mineralization is also recognized. Massive sulfide deposits have been mined at the La Plata mine and the Macuchi mine which are just south of Quito, and polymetallic deposits are being mined at the Portovelo mine in the southern part of Ecuador. Therefore the Zone VII may have a high potential of ore deposits, especially of porphyry copper type deposits.

Geology of Junin area consists of Cretaceous Macuchi formation, Silante formation and Yunguilla formation, which are intruded by acidic to intermediate granitic rocks (MRNE/DGGM, 1982). In the eastern part of the area, Quaternary volcanic detritus and lavas distribute extensively.

Limiting to the Phase III survey area, two areas consist entirely of granitic rocks.

Henderson (1979) described that within the Macuchi formation just outside of the Project area identified were marine fossil fauna (Inoceramus peruanas) and fossil foraminifera (Globotruncana sp.) corresponding to upper Cretaceous, and fossil foraminifera (Nummulites nummulitiformis Rutten, Amphistegina spp.) corresponding to Eocene; and that the Macuchi was dated to be 51.5+2.5 Ma with K-Ar method, which corresponded to Lower Eocene. Furthermore batholith of granodiorite in the Project area was determined to be 13 to 15 Ma; Stocks of porphyritic rocks were to be 6 to 11 Ma with K-Ar method (JICA/MMAJ, 1992).

Principal geologic structure show N-S and NNE-SSW directions which are represented by distributional characteristics of Apuela-Nanegal batholith.

Four types of mineralization and alteration were recognized in the Project area (JICA/MMAJ,1992).

- -Type 1 : Cu-Mo mineralization observed as dissemination of copper and molybdenum minerals in granitic rocks (Porphyry copper type).....(In Junin and Cuellaje areas)
- -Type 2 : Cu-Mo mineralization observed as vein in granitic rocks (Porphyry copper type).....(In Junin and Cuellaje areas)
- -Type 3 : Acidic hydrothermal alteration observed in granitic rocks (In Junin area).
- -Type 4 : Cu-Pb-Zn mineralization observed in Quaternary volcanic detritus (In Pululahua area).

Tab. 1-3 Classification of metallogenic zones

Topography		Geology	Metallo-genic Province	Metallogenic Zone	Metallogenic Sub-Province
Galapagos Islands		Pliocene ~ Quaternary			Cu-Ni-Co Sub-Province of Ocean Floor (Quaternary)
Coast		Pre-Cretaceous ~ Pleistocene (Pinion Formation)	Occidental (Ocean Crust, Eugeosyncline)	VIII. Coastal Zone	Fe-Ti-Pt Sub-Province of Coast (Jura ~ Early Cretaceous)
Mountain Range	Occidental Cordillera	Cretaceous ~ Paleocene (flysh) (Macuchi Formation)		VII. Anticlinorium-Synclinorium of Occidental Cordillera	Cu Sub-Province of Occidental Cordillera (Cretaceous ~ Miocene)
	Interandean Depression	Neogene ~ Holocene		VI. Catamayo Synclinorium Graben	Polymetalic Sub-Province of High Plateau (Paleocene ~ Quaternary)
				V. Azuay Basin	
				IV. Quito Graben	
	Real Cordillera	Metamorphic Rocks of Paleozoic and Mesozoic	Oriental (Continental Crust, Miogeosyncline)	III. Anticlinorium of Real, Moromoro and Mullepungo Cordillera	Sn-W-U Sub-Province of Real Cordillela (Later Paleozoic)
Orient		Carboniferous ~ Cretaceous		II. Oriental Pre-Andean Zone	Au Sub-Province of Orient Basin (Mesozoic ~ Cenozoic)
		Tertiary ~ Quaternary		I. Iquitos Basin	

Chapter 2 Details

2-1 Junin area

Drilling survey was carried out this year for some promising mineralized zones which were delineated as the results of the Phase II survey.

2-1-1 Purpose and Method of the Survey

(1) Purpose of the survey

The purpose of the drilling survey is to clarify the extension and intensity of mineralization of the depth in the promising area which is selected and recommended as the result of the Phase II survey.

(2) Method of the survey

In order to confirm the condition of geology and mineralization in the depth, diamond core drilling method was adopted. the ditails are as follows:

1) Location of the drill holes

The location of the drill holes are shown in Fig.2-1.

2) Outline of drilling works

The drilling works were carried out from July 25, 1993 to February 8, 1994. Drilling work was proceeded, as a rule, for 24 hours a day. Drilling method adopted was wireline which would maximize recovery of drill cores and efficiency of its activities.

The drilling machines utilized were L-38 which had sufficient capacity of drilling in order to meet the condition to drill down deeper. Drilling performance of the hole are shown on Appendix 5, 6 and 7.

As the mineralized rock body has tremendous fractures and contains underground water which cause some difficulties of drilling, cementation (injection of cement-milk) was needed to be done repeatedly. Main drilling machines and equipments adopted were listed up on Appendix 8.

3) Transportation and preparation

All the machines, equipments and materials were transported to Magnolia, where new heliport was constructed. Another heliport was also constructed at the hill top near Junin, which was named "Junin heliport". Helicopter service was taken place between Magnolia and Junin heliport. From Junin heliport to drilling sites, however, horseback and man's shoulder were utilized for mobilization.

Every existing narrow and snaky road was amplified and adjusted completely in order to supply foods and materials which were required for camp and/or drilling activities.

Drilling water was introduced directly from Junin River.

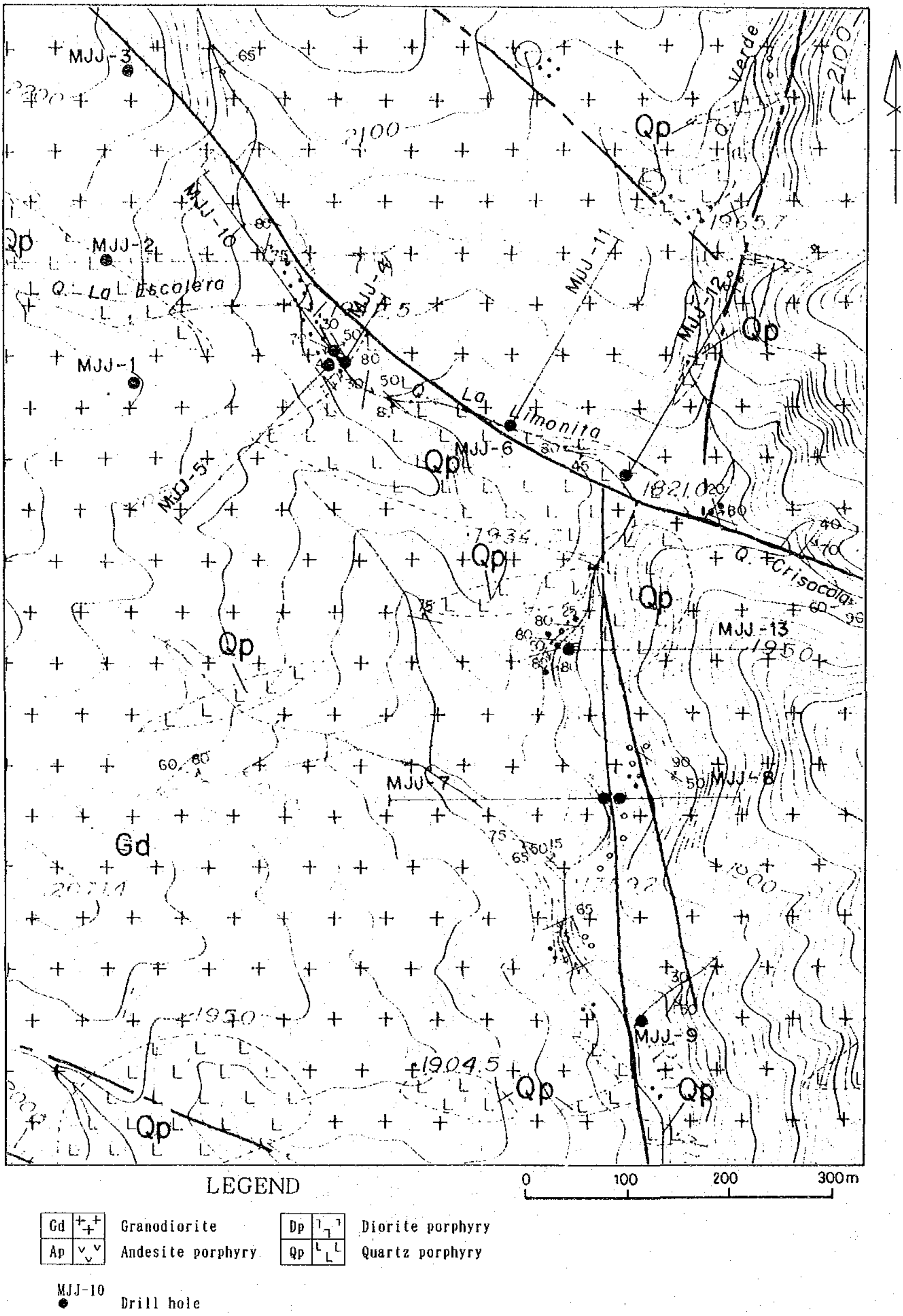

Fig.2-1 Location map of the drilling survey in Junin area

4) Drilling work

Actual drilling progress is shown on Appendix 6, actual drilling work on Appendix 7, and drilling machines, equipments and materials consumed on Appendix 8.

5) Examination of drill cores

The drill cores were examined simultaneously with drilling operation at the sites and then at base camp in Garcia Moreno.

The results of this examination were compiled in columnar section (Appendix 3) and geologic section on a scale of 1 to 200. Drill cores were split with a diamond cutter after completing the examination of each hole. One half of split cores was taken as samples for laboratory tests and the others were reserved for the future reference.

All of the samples assayed were collected every 1 m carefully. Assay results are listed up on Appendices 3 and 4.

6) Specification of the drill holes

Drilling survey of Phase III aimed to investigate two mineralized zones, the Q.Limonita Mineralized Zone and the Rio Junin Mineralized Zone.

The coordination, altitude, inclination, depth and Aim of each hole were shown on the following table:

Fig.2-1 Specification of holes in Junin

Hole No.	Coordination N	Coordination S	ASL (m)	*	Depth (m)	Aim of drill holes
MJJ-10	35.890	760.485	1,912	-45	301.30	To confirm north-western extension of the Q. Limonita mineralization
MJJ-11	35.840	760.650	1,857	-45	302.50	To confirm north-eastern extension of the Q. Limonita mineralization
MJJ-12	35.790	760.765	1,832	-45	302.00	To confirm north-eastern extension of the Q. Limonita mineralization
MJJ-13	35.615	760.705	1,795	-45	270.00	To confirm eastern extension of the Rio Junin mineralization

ASL: Above Sea Level
* : Inclination of the hole (in degree)

2-1-2 Geology and Geological Structure

(1) Geology

Geology of the Central Zone of this area consists of granodiorite(Gd), quartz porphyry (Qp) and diorite porphyry(Dp). The granodiorite belongs to Apuela- Nanegal batholith. The quartz porphyry and diorite porphyry, which forms dykes or stocks, intruded into the granodiorite batholith.

1) Granodiorite(Gd)

The Granodiorite shows greyish color and is medium grained, and includes biotite and hornblende as a mafic minerals. The rock shows massive, however, veinlets and films are distinct beside the contact to quartz porphyry.

2) Quartz porphyry(Qp)

The scale of the distribution of quartz porphyry is 400 m of maximum extention,and 150m in width as dyke, and 250m in the maximum diameter as stock. The distribution is concentrated in Q.Limonita to Q.Escalera, Q.Verde, Q.Controversia and Rio Junin. The rock includes quartz phenocrysts of 2 to 5 mm in fine groundmass. Joint system develops more distinctively in the body of quartz porphyry in comparison with that of granodiorite, but the distribution density of the joint is rough.

3) Diorite porphyry(Dp)

Stocks of diorite porphyry distribute on the scale of 500m in diameter in the southeastern part. The rock includes abundant hornblende phenocrysts and less quartz phenocrysts in comparison with those of quartz porphyry.

These three type of rocks were classified in magnetite series. According to the result of isotope age determination with K-Ar method, the age of granodiorite showed middle Miocene of Tertiary Period, while those of porphyries showed later Miocene of Tertiary (JICA/MMAJ).

(2) Geological structure

As the conspicuous structure, the lineaments are mainly developed the NE-SW and the NW-SE directions, and lineaments with the N-S and the E-W directions overlapping the former structures. Almost all the lineaments converge around the juncture of Q.La Limonita, Q.La Verde and Q.La Crisocola.

2-1-3 Result of the survey

The geological colum of the drill hole cores are shown in Appendix 3 in detail. The assay result of the mineralized part are also shown in Appendix 4. The correlation of geology between the cores and surface is shown in Fig.2-2(1) through (4).

The prominent characteristics of geology and mineralization obserbed on drill hole cores are listed up as follows:

MJJ-10

0.00- 2.00m Surface soil (none core)

2.00- 8.20m Granodiorite; pyrite and chalcopyrite dissemination; strong sericitization; remarkable fractures; -Chalcopyrite/Pyrite/Bornite in fractures

5.20- 33.00m Quartz porphyry; pyrite and chalcopyrite dissemination; sericitization; remarkable fractures

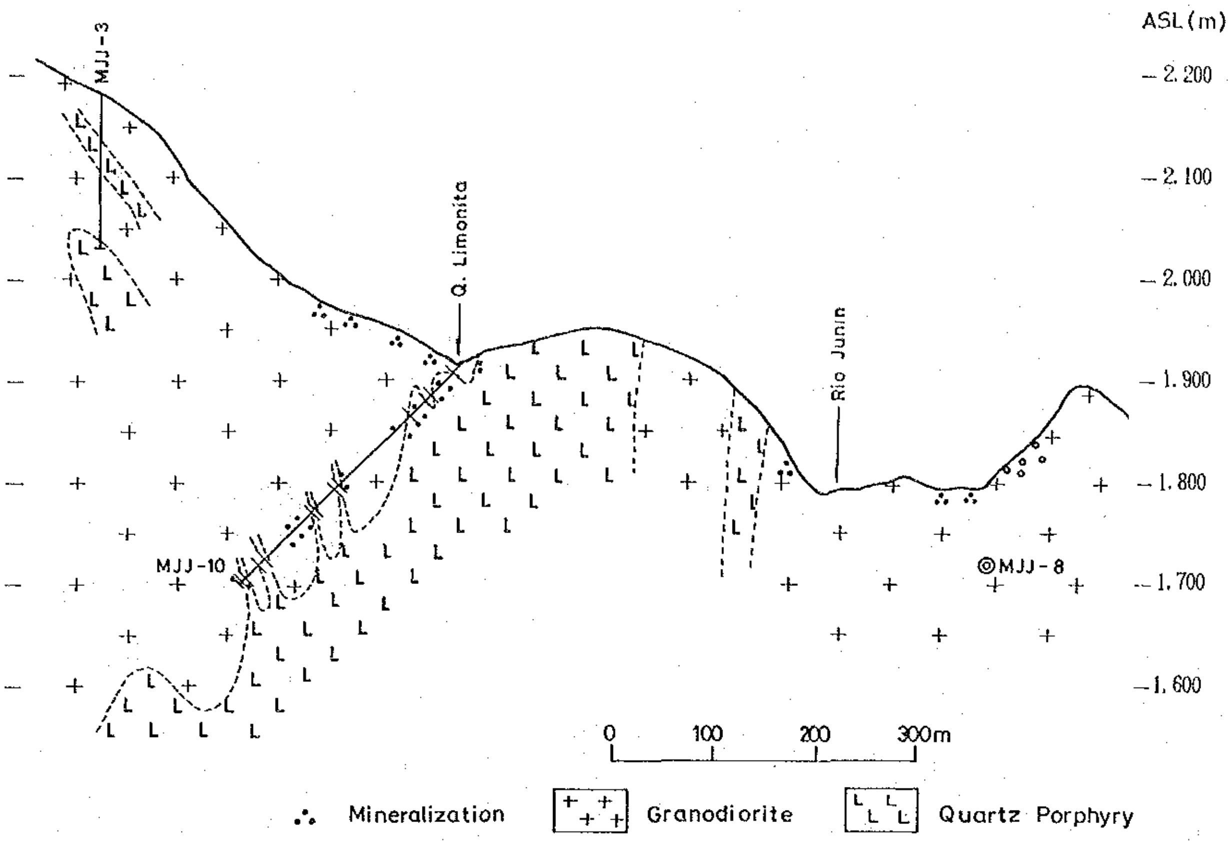

Fig. 2-2(1) Geologic profile of the MJJ-10 in Junin area

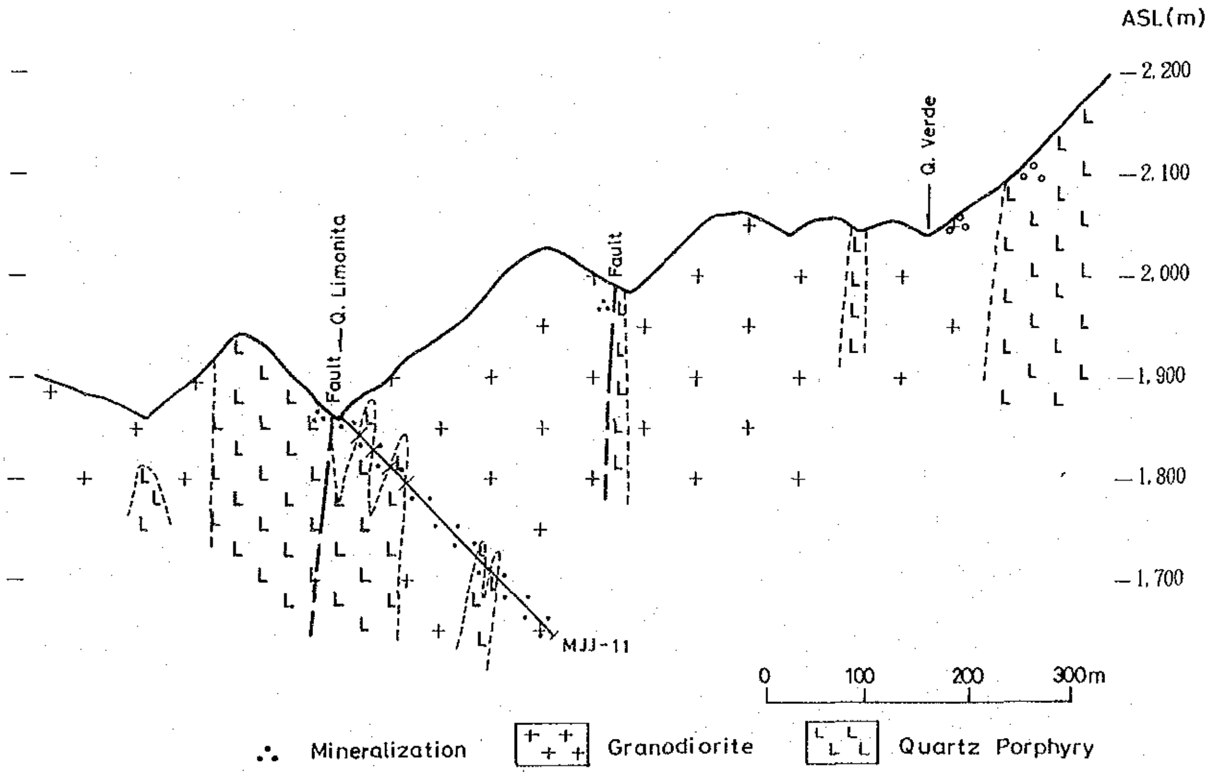

Fig. 2-2(2) Geologic profile of the MJJ-11 in Junin area

33.00- 46.80m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

46.80- 66.20m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

66.20- 90.00m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

90.00-166.40m Granodiorite; remarkable fractures;

166.40-167.90m Quartz porphyry; pyrite dissemination;

167.90-199.50m Granodiorite; pyrite dissemination; chloritization and epidotization; -Chalcopyrite/Pyrite/Bornite in fractures

199.50-202.00m Quartz porphyry; weak pyrite dissemination;

202.00-219.50m Granodiorite; pyrite mineralization; chloritization and epidotization; -Chalcopyrite/Pyrite in fractures

219.50-228.80m Quartz porphyry; pyrite dissemination; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

228.80-231.50m Granodiorite; pyrite dissemination; sericitization;

231.50-232.80m Quartz porphyry; pyrite dissemination;

232.60-236.60m Granodiorite; pyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

236.80-238.20m Quartz porphyry; chalcopyrite pyrite and bornite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

238.20-267.30m Granodiorite; pyrite and chalcopyrite dissemination;

267.30-271.50m Quartz porphyry; pyrite dissemination; sericitization; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

271.50-279.30m Granodiorite; pyrite and chalcopyrite dissemination; sericitization; remarkable fractures

279.30-280.00m Quartz porhyry; pyrite mineralization; sericitization;

280.00-282.50m Granodiorite; pyrite dissemination;

282.50-283.60m Quartz porphyry; pyrite and chalcopyrite dissemination;

283.60-291.20m Granodiorite; pyrite and chalcopyrite dissemination;

291.20-292.90m Quaratz porphyry; weak pyrite dissemination; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

292.90-296.60m Granodiorite; pyrite and chalcopyrite dissemination;

296.60-297.70m Quartz porphyry; weak pyrite dissemination;

297.70-301.30m Granodiorite; pyrite dissemination; chloritization and epidotization;

MJJ-11

0.00- 2.00m Surface soil (none core)

2.00- 14.00m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/ Molybdenite in fractures

14.00- 25.70m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

25.70- 46.40m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/ Molybdenite in fractures

46.40- 88.50m Granodiorite; pyrite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

88.50-218.60m Granodiorite; pyrite dissemination; chloritization and epidotization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

218.60-222.50m Quartz porphyry; pyrite dissemination; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

222.50-302.50m Granodiorite; pyrite and chalcopyrite dissemination; sericitization; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

MJJ-12

0.00- 2.00m Surface soil (none core)

2.00- 36.40m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/ Molybdenite in fractures

36.40- 38.80m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization;
-Chalcopyrite/Pyrite/Bornite in fractures

38.80- 40.00m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

40.00-105.00m Granodiorite; pyrite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

105.00-108.00m Quartz porphyry; pyrite dissemination;

108.00-109.20m Granodiorite; pyrite dissemintion; chloritization and epidotization;

109.20-111.00m Quartz porphyry; weak pyrite dissemination;

111.00-112.60m Granodiorite; pyrite dissemination; chlolitization and epidotization;

112.60-134.50m Quartz porphyry; pyrite dissemination; remarkable fractures;

134.50-136.50m Granodiorite; pyrite dissemination; remarkable fractures;

136.50-148.40m Quaartz porphyry; pyrite dissemination; remarkable fractures

148.40-161.30m Granodiorite; pyritedissemination; sericitization; -Pyrite/Chalcopyrite in fractures

161.30-184.50m Quartz porphyry; pyrite dissemination; remarkable fracures; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

184.50-187.00m Granodiorite; pyrite and chalcopyrite dissemination;

187.00-188.30m Quartz porphyry; pyrite dissemination; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

188.30-189.30m Granodiorite; pyrite dissemination; remarkable fracutures;

189.30-192.10m Quartz porphyty;

192.10-248.50m Granodiorite; -Chalcopyrite/Pyrite/Bornite in fractures

248.50-254.30m Quaartz porphyry; pyrite dissemination;

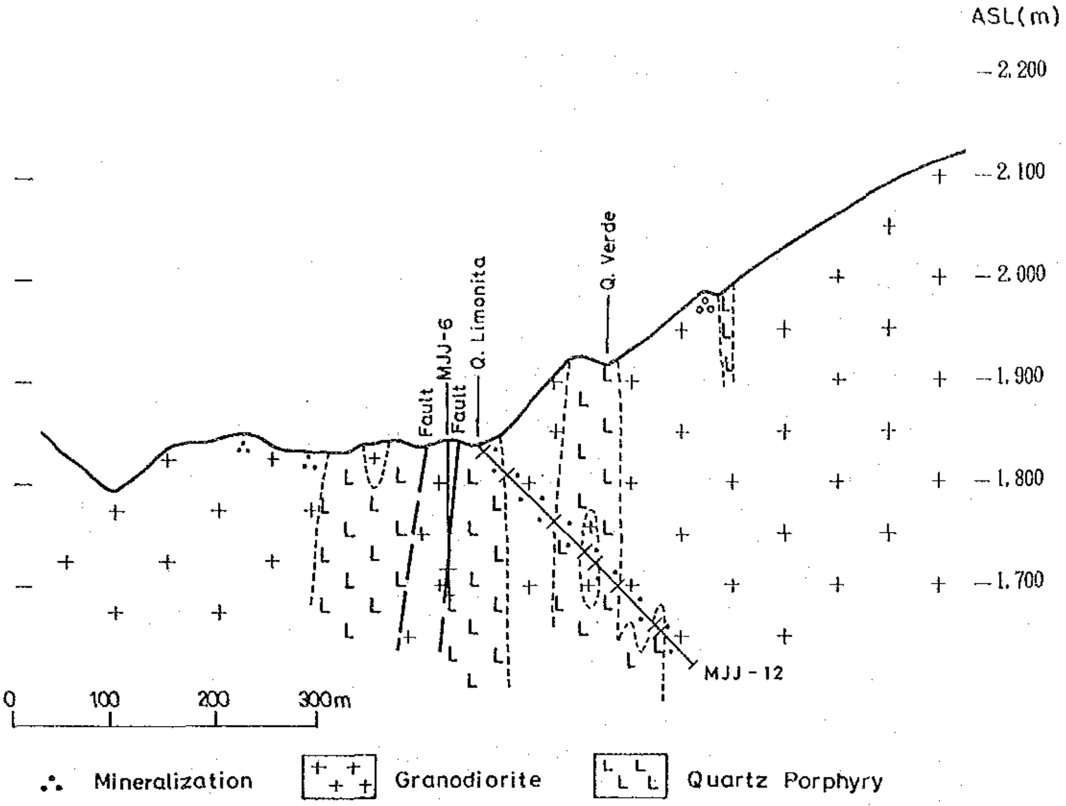

Fig.2-2(3) Geologic profile of the MJJ-12 in Junin area

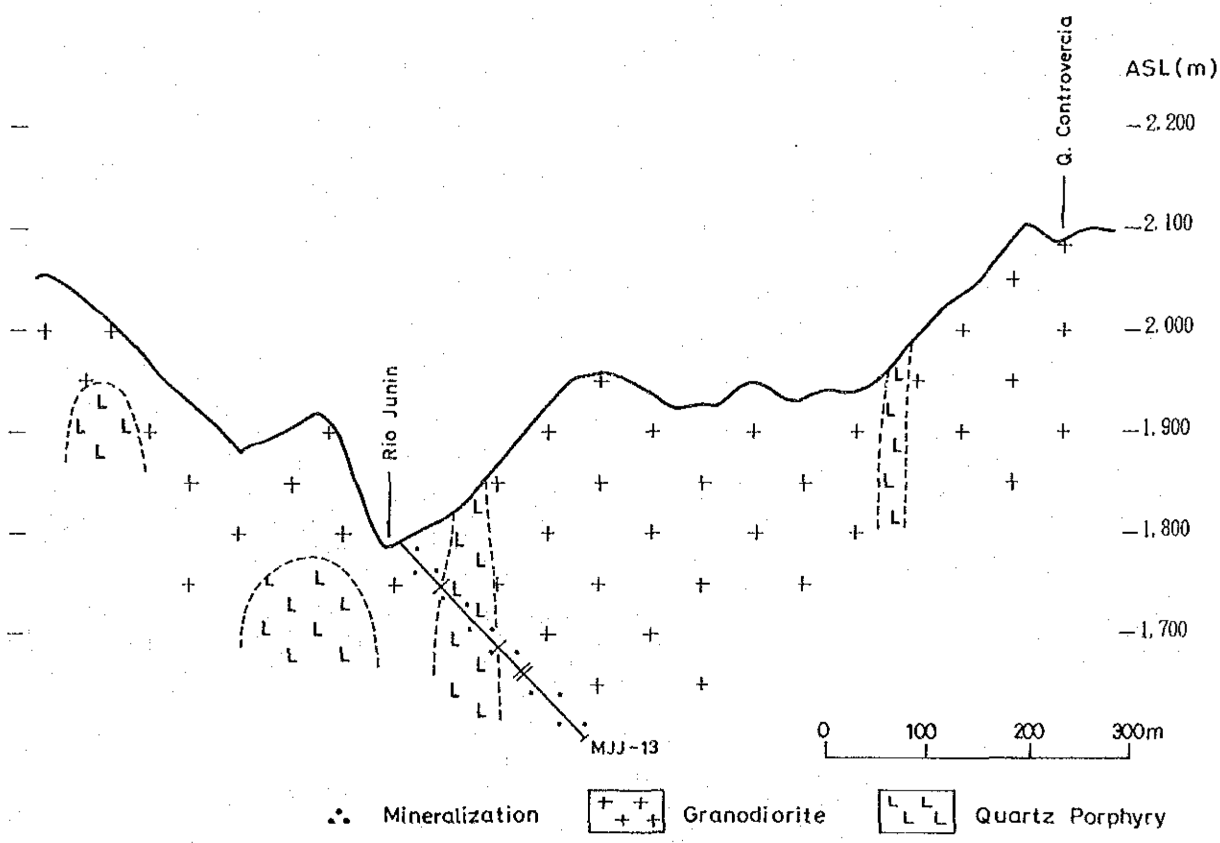

Fig.2-2(4) Geologic profile of the MJJ-13 in Junin area

-Chalcopyrite/Pyrite/Bornite in fractures

254.30-302.00m Granodiorite; pyrite dissemination; -Chalcopyrite/Pyrite/Bornite in fractures

MJJ-13

0.00- 2.00m Surface soil (none core)

2.00- 59.00m Granodiorite; pyrite and chalcopyrite dissemination; sericitization; remarkable fractures; -Chalcopyrite/Pyrite/Bornite in fractures

59.00- 76.00m Diorite porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

76.00-119.00m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

119.00-120.00m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

120.00-126.40m Quartz porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

126.40-128.20m Granodiorite; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

128.20-144.00m Quartz porphyry; pyrite dissemination;-Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

144.00-147.00m Granodiorite; remarkable fractures; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

147.00-149.00m Diorite porphyry; pyrite bornite and chalcopyrite dissemination; sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

149.00-175.20m Granodiorite; pyrite dissemination; chloritization and epidotization; -Chalcopyrite/Pyrite/Bornite in fractures

175.20-180.60m Quartz porphyry; pyrite dissemination; chloritization and epidotization; -Chalcopyrite/Pyrite/Bornite/Molybdenite in fractures

180.60-270.00m Granodiorite; pyrite bornite and chalcopyrite dissemination; silicification and sericitization; -Chalcopyrite/Pyrite/Bornite in fractures

2-1-4 Consideration

In order to investigate the Q. Limonita mineralized zone, the Holes MJJ-11 and MJJ-12 were carried out for confirming extension and intensity of mineralization toward northeastern parat, and the Hole MJJ-10 toward northwestern part.

While the Hole MJJ-13 was carried out also to investigate the Rio Junin mineralized zone.

The results of these holes are as follows:

The mineralization was confirmed that it tend to increase toward northeast (Holes MJJ-11 and 12). These holes passed fracture zones and proved that ore minerals such as chalcopyrite, pornite, (chalcocite), and Molybdenite precipitated in cracks. Ore assay is as follows: Average grade of MJJ-11 is 0.22 % Cu and 0.012 % Mo from 10 m to 300 m, and average grade of MJJ-12 is 0.16 % Cu and 0.0056 % Mo from 10 m to 300 m in depth.

On the other hand, in the northern part of the Q. Limonita mineralized zone, lower part of the Hole MJJ-3 which was carried out in the Phase I survey, was selected as an area to be investigated suprementally. the result of the Hole MJJ-10 shows average grade 0..70 % Cu and 0.0036 % Mo from 10 m to 84 m in depth, and 0.45 % Cu and 0.0025 % Mo from 148 m to 301 m in depth. Granodiorite in this hole were observed less fractures than those of holes which were carried out in southeastern Q.Limonita mineralized zone. Quartz porphyry intrusions were encountered on the drill cores, which were 1 to 10 m of core length (width).

Quartz porphyry was generally disseminated with ore mineral.

For investigating the Rio Junin mineralized zone, the Hole MJJ-13 was carried out and confirmed mineralization extensively. Ore assay shows average grade 0.55 % Cu and 0.0085 % Mo fron 10 m to 270 m in depth. Based on the data of the mineralization at the bottom of the hole which has not yet confirmed the eastern margin of the mineralization. The mineraization may exted more eastward.

IN Junin area, mineralization, argillization (sericitization) are all observed in limited intervale of cores concentrated on some parats fractured intensely (fracture zones), and those fracture zones may be formed principally in relation with fault and/or lineament.

2-2 Cuellaje area

Drilling survey was carried out this year for a promissing area which was selected as one of the results of the Phase II survey

2-2-1 Purpose and Method of the Survey

(1) Purpose of the survey

The purpose of the drilling survey is to clarify the extension and intensity of mineralization of the depth in the promising area which is selected and recommended as the result of the Phase II survey.

(2) Method of the survey

In order to confirm the condition of geology and mineralization in the depth, diamond core drilling method was adopted. the ditails are as follows:

1) Location of the drill holes

The location of the drill holes are shown in Fig.2-3.

2) Outline of drilling works

The drilling works were carried out from July 10, 1993 to January 10, 1994. Drilling work was proceeded, as a rule, for 24 hours a day. Drilling method adopted was wireline which would maximize recovery of drill cores and efficiency of its activities.

Drilling performance of the hole are shown on Appendix 5.

As the rock body has tremendous fractures and contains underground water which cause some difficulties of drilling, cementation (injection of cement-milk) was needed to be done repeatedly.

3) Transportation and preparation

All the machines, equipments and materials were transported to Magdalena, where new advanced camp was constructed, which was named "Cuellaje Camp". For mobilization of machines and equipments from Cuellaje Camp to drilling sites, however, horseback and man's shoulder were utilized.

Every existing narrow and snaky road was amplified and adjusted completely in order to supply foods and materials which were required for camp and/or drilling activities.

Drilling water was introduced directly from Magdalena River.

4) Drilling work

Actual drilling progress is shown on Appendix 6, actual drilling work on Appendix 7, and drilling machines, equipments and materials consumed on Appendix 8.

5) Examination of drill cores

The drill cores were examined simultaneously with drilling operation at the sites and then at base camp in Garcia Moreno.

The results of this examination were compiled in columnar section (Appendix 3) and geologic section on a scale of 1 to 200. Drill cores were split with a diamond cutter after completing the examination of each hole. One half of split cores was taken as samples for laboratory tests and the rests were reserved for the reference in the future.

All of the samples to be assayed were collected every 1 m carefully. Assay results are listed up on Appendices 3 and 4.

6) Specification of the drill holes

Drilling survey of Phase III aimed to investigate the Mineralized Zone A.

The coordination, altitude, inclination, depth and Aim of each hole were shown on the following table(Tab.2-2):

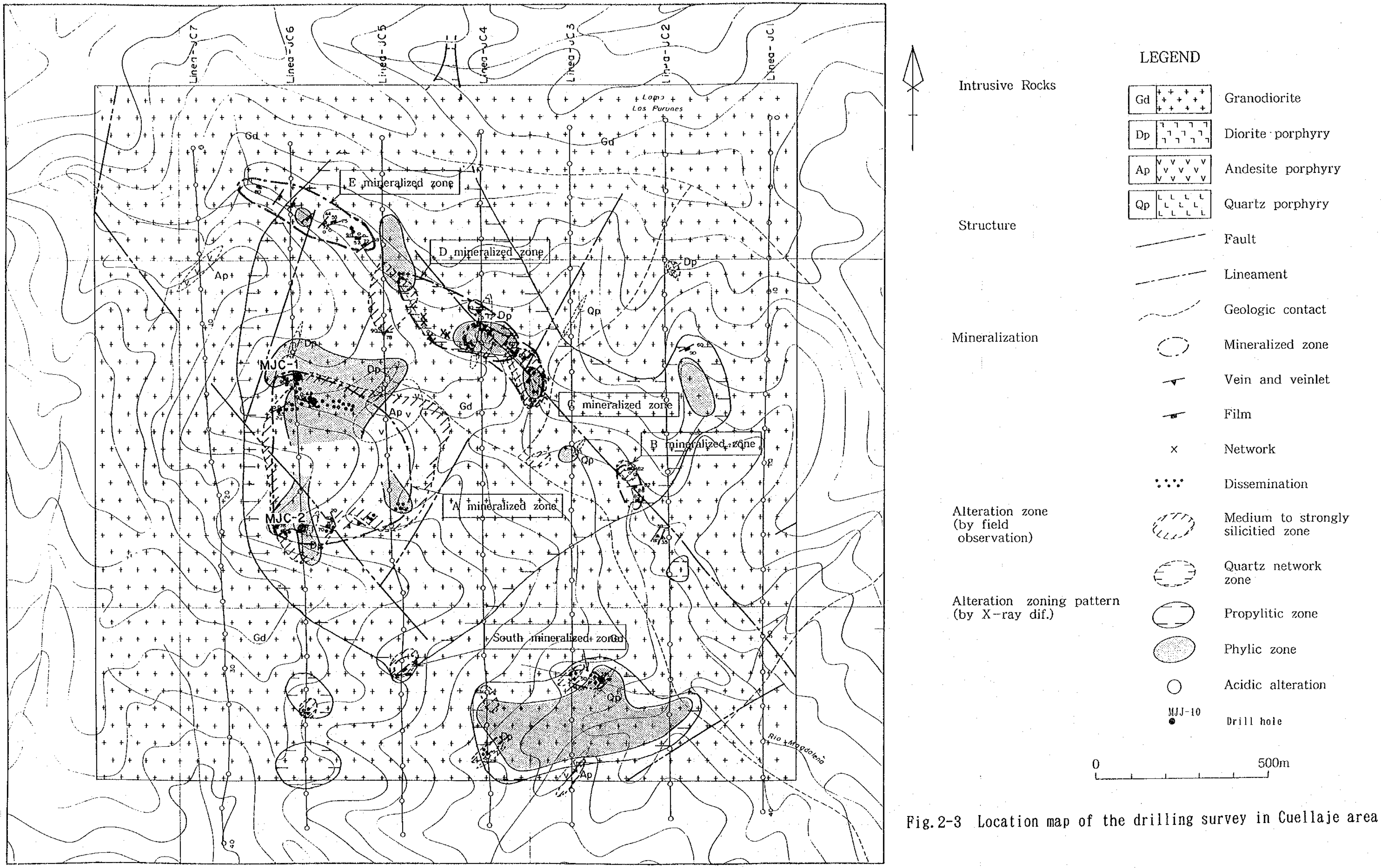

Fig.2-3 Location map of the drilling survey in Cuellaje area

Tab.2-2 Specification of holes in Cuellaje

Hole No.	Coordination N	S	ASL (m)	*	Depth (m)	Aim of drill holes
MJC-1	48.620	771.330	2,230	-90	202.00	To confirm northern extension of the Mineral-ized Zone A
MJC-2	48.230	771.350	2,240	-90	201.50	To confirm southern extension of the Minerl-ized Zone A

ASL: Above Sea Level
* : Inclination of the hole (in degree)

2-2-2 Geology and Geological Structure

(1) Geology

The geology of this area consists of granodiorite mainly which forms batholith as the same one distributed in Junin area, moreover, andesite porphyry(Ap), quartz porphyry(Qp) and diorite porphyry(Dp) which intrude into granodiorite in forms of stock and/or dike.

1) Granodiorite(Gd)

The Granodiorite shows grayish in color and is medium grained, and it includes biotite> hornblende as mafic minerals. The rock is generally the same as that of Junin area, though some rock body is observed to contain few hornblende partly.

2) Andesite porphyry(Ap)

Andesite porphyry distributes in the north-western part of the branch of Rio Magdalena, and in the western part of the Rio San Joaquin.

The former, which shows an elliptical distribution in an limited area of 120 x 60m, distributes in the center of the Rio Magdalena-Branch mineralized zone. The lithology is felsic with plagioclase phenocrysts. The latter includes big plagioclase phenocrysts of several milimeters in greenish glassy groundmass.

3) Diorite porphyry(Dp)

Diorite porphyry is observed extensively in stock form along the Rio Cristopamba which occupies central part of the survey area. Occurence is in dike-form of ENE to NNE direction in such several limited areas as the western and north-western parts of the Q.San Joaquin and the southeastern part of Cuellaje village.

The lithology of the diorite porphyry resembles that of an-desite porphyry, its groundmass, however, shows its groundmass more holocrystalline and coarser. Outside of the area to the north, diorite porphyry was observed to have contact with gra-nodiorite gradually. Outcrops along the Rio Cristopamba show weathered intensely.

4) Quartz porphyry(Qp)

Quartz porphyry occurs as several small dikes with direction of NE-SW in the vicinity of the union of Rio Cristopamba and Rio Magdalena, approximately central part of the survey area.
The rock, which is grayish white in color and compact, includes quartz phenocrysts of 1 to 2 mm in diameter in glassy groundmass.

(2) Geological structure

The lineaments with the directions of NNE-SSW and NW-SE are conspicuous, and are also developed ones with N-S and E-W directions as the second order.

Ore veins are dominat in E-W direction.

2-2-3 Result of the survey

The geological colum of the drill hole cores are shown in Appendix 3 in detail. The assay result of the mineralized part are also shown in Appendix 4. The correlation of geology between the cores and surface is shown in Fig.2-4.

The prominent characteristics of geology and mineralization obserbed on drill hole cores are listed up as follows:

MJC-1

0.00- 0.24m Surface soil (none core)

0.24- 66.35m Granodiorite; strong silicification and sericitization; remarkable fractures; -Chalcopyrite/Bormite/Chalcopyrite/Molybdenite/ Pyrite in fractures

66.35- 74.39m Quartz porphyry; pyrite bornite and chalcopyrite dissemination, strong silicification and sericitization; -Chalcopyrite/Bornite/Chalcocite and Molybdenite in fractures

74.39-150.40m Granodiorite; pyrite chalcopyrite dissemination; silicification and sericitization;

150.40-182.67m Quartz porphyry; pyrite bornite chalcopyrite-dissemination; Silicification and sericitization; -Chalopyrite/Pyrite/Bornite and Molybdenite in fractures

182.67-202.00m Granodiorite; pyrite dissemination; silicification; -Chalcopyrite/Pyrite/Bornite in fractures

MJC-2

0.00- 2.00m Surface soil (none core)

2.00- 35.00m Granodiorite; light bluish green in color; sericitization; remarkable fractures; pyrite and chalcopyrite dissemination; -Chalcopyrite/Pyrite/Bornite in fractures

35.00- 50.00m Granodiorite; dark gray in color; pyrite dissemination; sericitization; -Chalcopyrite/Pyrite in fractures

50.00- 90.00m Granodiorite; gray in color; pyrite dissemination; sericitization; -Chalcopyrite/Pyrite in fractures

90.00-112.00m Granodiorite; remarkable chloritization and epidotization;

112.00-145.00m Granodiorite; pyrite dissemination; remakable chloritization and epidotization; -Pyrite in fractures

145.00-160.00m Granodiorite; remarkable chloritization and epidotization

160.00-170.00m Granodiorite; pyrite dissemination; sericitization; remarkable fractures; -Pyrite/Chalcopyrite/Bornite in fractures

170.00-201.50m Granodiorite; pyrite dissemination; sericitization; -Pyrite/Chalcopyrite in fractures

2-2-4 Consideration

The drilling survey was carried out to investigate the Mineralized Zone A. The hole MJC-1 was proceeded for the northern part, and the Hole MJC-2 for the southern part of the Mineralized Zone A

As the result of the investigation with MJC-1, mineralization in the northern part seemed to be more intense than that of in the southern part.

Furthermore the MJC-1 penetrated fracture zone and proved that ore minerals such as Chalcopyrite, Bornite, (Chalcocite) and Molybdenite precipitated in cracks of strongly silicified Granodiorite. Silicification and argillization, (and/or sericitization) are reacognized mainly within some parts centered in fractures. Those fracture zones are considered to have close relationship with faults as well as liniaments.

Ore grade is as follows: 0.28 % Cu, 0.012 % Mo average of the hole from 10 m to 200 m in depth (max. 1.64 % Cu, amd 0.12 % Mo). Favorable part of this part averages 0.64 % Cu, and 0.022 % Mo from 10 m to 60 m.

On the other hand, in the southern part of the mineralized zone A, the rock in the shallow undergound (lower part of a ridge, topographycally) was weathered intensely, and more or less argillized and leached out primary ore minerals. Below this weahered part, pyrite dominates as a primary ore mineral and a ratio of Chalcopyrite/Pyrite in this place is smaller than that in northern part.

Though MJC-2 disclosed extensive mineralization from surface to the bottom of the hole, ore assay shows only low grade as mentioned below: 0.16 % Cu and 0.0075 % Mo (max 0.54 % Cu and 0.14 % Mo) from 10m to 200 m in depth.

In the vicinity of the Hole MJC-2, Granodiorite body distributes with less fractured.

In Cuellaje area, fracture is thought to have played significant role for mineralization.

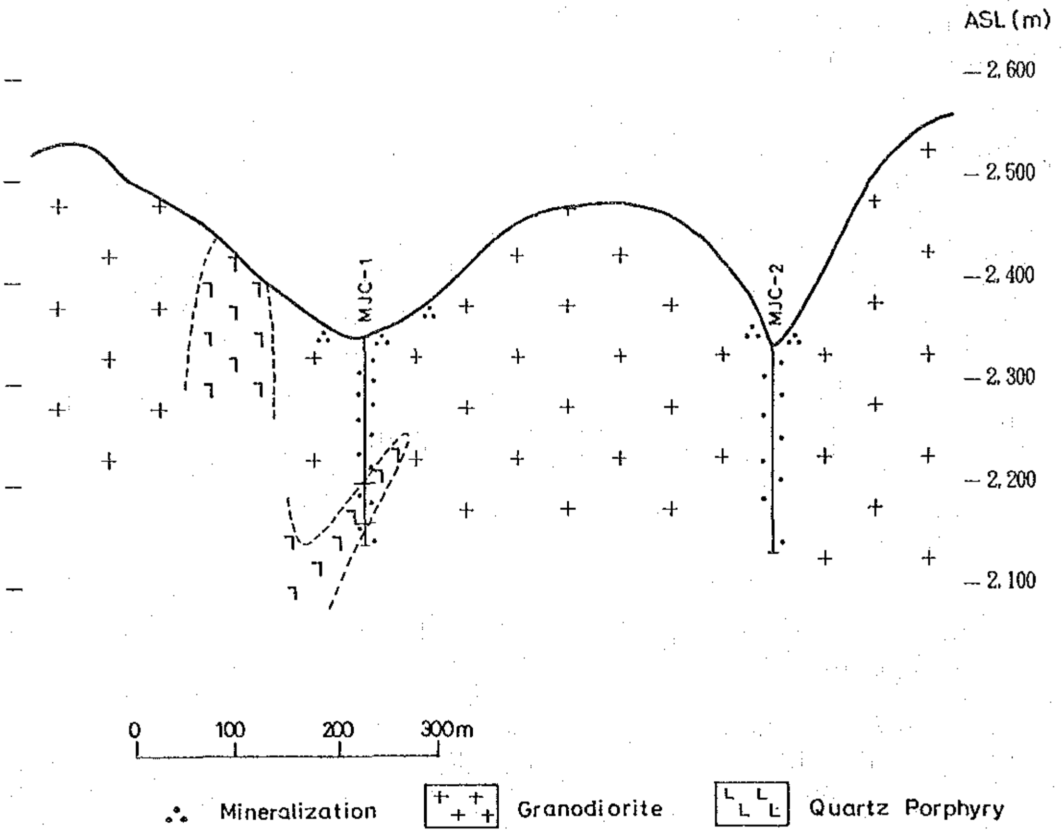

Fig.2-4 Geologic profile of the MJC-1 & 2 in Cuellaje area

2-3 Discussion

The mineralization in the Junin area is controled by the geostructural movement and the system of lineaments. Each geological structures and lineaments are considered:

(1) Intrusion trend of granodiorite batholith, which is called "APUELA-NANEGAL batholith", consists of a part of gran andian geostructure directing N-S TO NNE-SSW.

(2) Predominant lineament systems, which direct generally NE-SW and NW-SE and which are considered to be a cojugate set, can be classified to a medium scale geostructure.

(3) These three structures are presumed to have existed as a basement structure for Quartz Diorite magma intrusion to form stocks

(4) The radial lineaments (fractures) develop in the vicinity of the juncture of Q. Limonita and Q. Crisocolla. These fractures can be considered to have been a path of Porphyry and also of ore solusion.

(5) The mineraization was finalized with acidic hydrothermal alteration.

(6) Secondary copper minerals are precipitated by some local circulation of groundwater. (For instance, a secondary enrichment zone was formed in the Q. Crisocollamineralized zone.)

The Central Zone of the Junin area is considered to be a place where these structural and igneous activity centralized.
On the structural analysis with data of radial lineaments, a thrusting force is estimated to have been upward from the deeper underground around the juncture of Q. limonita and Q. Crisocolla.

In the Rio Magdalena Zone of the Cuellaje area, the geological seting of mineralization may be basically the same as that of Junin area.

On the base of drilling survey data, IP anomalies in the Cuellaje area have some good corelationship with mineralization. The IP anomaly ditected on JC-6 survey line, which consists of low resistivity and high frequency efect, seems to coincide with Cu-MO mineralization and intense argillization (sericite, kaoline, epidote, etc.). The IP method will be one of effective exploration measures in this area.
Therefore other anomalies detected on JC-4, 5 and 7, which have the same anomalous characteristics as JC-6 mentioned above, are expected and needed to be investigated with diamond drilling survey in the future.

The recommendable areas, which have high potential of ore deposits, are as followings:

(1) The Central Zone of the Junin area
  1) The Q. Limonita Mineralized zone to Q. verde Mineralized zone: drilling survey
  2) The Q. Verde Mineralized zone: drilling survey
  3) The Rio Junin Mineralized zone: drilling survey
  4) The Q. Limonita Upper Reach Mineralized zone: ditailed geological survey and drilling survey, including a survey in an areas of the southeast and the east of quartz porphyry stock.
  5) The Q. Crisocolla Mineralized zone: drilling survey

(2) The Sorounding Zone of the Junin area
  1) The Q. Fortuna Mineralized zone: drilling survey
  2) The Q.EsperanzaMineralized zone: drilling survey

(3) The Rio Magdalena Zone of the Cuellaje area
  1) The Rio Magdalena Mineralized zone (Mineralized zone A):drilling survey
  2) The South Mineralized zone and its western extension: ditail geological survey and geophysical survey

(4) Intermediate area beween the Junin and Cuellaje areas: On the survey result of the Phase I and II survey, the both areas of Junin and Cuellaje are proved to have a high potential of mineralization. Therefore, in order to confirm the potential of mineral deposits in the intermediate area, geological survey (including rock geochemical survey) is recommendable.

Chapter 3 Conclusions and Recommendations

3-1 Conclusions

(1) Junin area

Drilling survey was carried out this year for two mineralized zones: the Q. Limonita Mineralized zone and the Rio Junin Mineralized zone. As the results of the survey, every drill holes encontered significant mineralization.

In order to investigate the Q. Limonita mineralized zone, the Holes MJJ-11 and MJJ-12 were carried out for confirming extension and intensity of mineralization toward northeastern parat, and the Hole MJJ-10 toward northwestern part.
While the Hole MJJ-13 was carried out also to investigate the Rio Junin mineralized zone.

The results of these holes are as follows:
The mineralization was confirmed that it tend to increase toward northeast (Holes MJJ-11 and 12).
Ore assay is as follows:
Average grade of MJJ-11 is;
- 0.22 % Cu and 0.012 % Mo from 10 m to 300 m in depth

Average grade of MJJ-12 is;
- 0.16 % Cu and 0.0056 % Mo from 10 m to 300 m in depth

On the other hand, in the northern part of the Q. Limonita mineralized zone, the Hole MJJ-10 penetrated a good mineralized paart under the outcrops and also a significant mineralized part below 148 m in depth.
Ore assay is as follows:
Average grade of mineralized paarts of the Hole MJJ-10;
- 0.70 % Cu and 0.0036 % Mo from 10 m to 84 m in depth
- 0.45 % Cu and 0.0025 % Mo from 148 m to 301 m in depth

For investigating the Rio Junin mineralized zone, the Hole MJJ-13 was carried out. Based on the data of the mineralization at the bottom of the hole which has not yet confirmed the eastern margin of the mineralization. The mineraization may exted more eastward.
Ore assay is as follows:
Average grade of the Hole MJJ-13 is;
- 0.55 % Cu and 0.0085 % Mo fron 10 m to 270 m in depth

IN Junin area, mineralization is observed in fracture zones, and ore minerals such as chalcopyrite, bornite, (chalcocite), and molybdenite atc. exist together. Silicification and argillization (sericitization) are observed in limited intervale of cores concentrated on some parats fractured intensely (fracture zones). And those fracture zones may be formed principally in relation with faults and/or lineaments.

(2) Cuellaje area

The drilling survey was carried out to investigate the Mineralized Zone A. The hole MJC-1 was proceeded for the northern part, and the Hole MJC-2 for the southern part of the Mineralized Zone A

As the result of the investigation with MJC-1, mineralization in the northern part seemed to be more intense than that of in the southern part. Furthermore the MJC-1 penetrated fracture zone and proved that ore minerals such as Chalcopyrite, Bornite, (Chalcocite) and Molybdenite precipitated in cracks of strongly silicified Granodiorite.

Ore grade is as follows:

Average grade of the Hole MJC-1 is;

- 0.28 % Cu, 0.012 % Mo from 10 m to 200 m in depth (max. 1.64 % Cu, amd 0.12 % Mo).

Favorable part of the Hole averages;

- 0.64 % Cu, 0.022 % Mo from 10 m to 60 m in depth

On the other hand, in the southern part of the mineralized zone A, the rock in the shallow undergound (lower part of a ridge, topographycally) was weathered intensely, and more or less argillized and leached out primary ore minerals. Below this weahered part, pyrite dominates as a primary ore mineral.

Though the ratio of Chalcopyrite/Pyrite in this place is lower than that in the northern part, a consistent mineralization was encontered through the bottom of the hole.

Ore grade is as follows:

Average grade of the Hloe MJC-2 is;

- 0.16 % Cu, 0.0075 % Mo from 10 m to 200 m in depth

In Cuellaje area, fracture is thought to have played significant role for mineralization.

3-2 Recommendations

Junin and Cuellaje areas were proved to have high potential of Cu-Mo dissemination type ore deposits, therfore followings are recommended for further investigation and exploration.

(1) Junin area

1) The Q. Limonita Mineralized zone to the northeast (Q. verde Mineralized zone): drilling survey
2) The Rio Junin Mineralized zone to the east (Q. Rica Mineralized zone): drilling survey
3) The Rio Junin Mineralized zone to the south: drilling survey
4) The Q. Fortuna Mineralized zone: detailed geological survey and drilling survey

(2) The Rio Magdalena Zone of the Cuellaje area

1) The Rio Magdalena Mineralized zone (Mineralized zone A):drilling survey

2) The South Mineralized zone
and its western extension:
ditail geological survey and geophysical survey

(3) Intermediate area beween the Junin and Cuellaje areas:
On the survey result of the Phase I and II survey, the both areas of Junin and Cuellaje are proved to have a high potential of mineralization. Therefore, in order to confirm the potential of mineral deposits in the intermediate area, geological survey (including rock geochemical survey) is recommendable.

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FIGURES

TABLES

APPENDIX