the above three veins are as follows.

	Horizontal(m)	Vertical(m)
Anomalia I de cobre	20	40
Garcia I	10	?
Garcia II	10	10

Metal contents of them are genarally low grade , while some of them are shown scarcely high grade as shown below.

· North Area(Futaleufu)

	Width(m)	Au(ppb)	Cu(%)
FM327 showing	0.3	200	4.30
KM311 showing	0.05	2.4ppm	1.26

· South Area(Alto Palena)

	Width(m)	Au(ppb)	Ag(ppm)	Cu(%)	Pb(%)	Zn(%)
KM342 showing(vein)	float	600	75	3.32		
KM350 showing(vein)	float	80	692	0.36	24.0	36.0

Alteration of host rock, occured in mineral indications, is characterized by weak chloritization, epidotization and silicification. The first two alterations are developed distinctively near the batholith. Excepting mineral indications, hydrothermal alteration zones are also observed mainly at the boundary between intrusive rocks and intruded rocks, accompanying with limonite diseminatuion and stockwork, hematite and pyrite.

Hydrothermal alteration is generally weak and main alteration minerals are quartz and selisite, accompanying a small amount of kaolinite and chlorite.

5.3. Geochemical Exploration

5.3.1. Stream sediment geochemistry

(1) Sampling and chemical analysis

Geochemical exploration of stream sediments was caried out in two phases. In first phase, it was done for the whole area and in second phase, for the Alto Palena subarea(Fig.Ⅱ-5-1). An amount of sediments taken is 100g/sample and the size of it is -30 mesh. The number of samples is total 210; 106 samples in the first phase, 104 samples in the second phase.

The samples of the first phase were analized by SERNAGEOMIN laboratory and those of the second phase were analized by Chemex Lab. Inc. of Canada. The

components analized are 7 elements in the first phase; Au, Ag, Cu, Pb, Zn, Mo. In the second phase, they are 6 elements that are excluded Mo from 7 elements of the first phase.

(2) Anomalous values and zone

1) Threshold

Threshold values for elements were fixed by M(mean) + 2σ (standard deviation) in the area. Threshold value of each element is shown as follows;-

Element	Phase I	Phase II
Au(ppb)	all<20	11
Ag(ppm)	0.15	0.16
Cu(ppm)	76.9	70.0
Pb(ppm)	30.0	47.0
Zn(ppm)	136.1	165.0
As(ppm)	9.0	13.0
Mo(ppm)	1.6	

2) Anomaulous zones

Numbers of the anomalous values in each phase are listed in following Table.

Element	Phase I	Phase II
Au	0	2
Ag	3	1
Cu	0	1
Pb	4	4
Zn	1	7
As	9	6
Mo	6	

5.3.2. Panned concentrate geochemistry

(1) Sampling and chemical analysis

Samples were collected on the same sample points as stream sediments in the first phase and on the area around Futauleufu Town situated in the northern part of this area in the second phase. The number of samples is total 236; 105 samples in the first phase and 131 samples in the second phase. Eight kg of sediments were always supplied for panning. After panning 8 kg sediments, heavy minerals of about 20g were collected and submitted to SERNAGEOMIN laboratory. Elements analized are 3 in the first phase and 7 in

the second phase; Au, Ag, Pb in the first phase and Au, Ag, Cu, Pb, Zn, Mo, As in the second phase.

(2) Geochemical anomalous values and anomalous zone

1) Threshold

The same method to fix the thresholds was used as that of stream sediments. Threshold values caluculated for each element are listed in Table below

Element	Phase I	Phase II
Au(ppb)	17.12μg	389
Ag(ppm)	18.13μg	1.7
Pb(ppm)	0.85mg	151
Cu(ppm)		191
Zn(ppm)		252
Mo(ppm)		5
As(ppm)		14

2) Geochemical anomalies

The number of anomalies estimated from the thresholds mentioned above is as follows:-

Element	Phase I	Phase II
Au	8	8
Ag	5	6
Pb	4	3
Cu	-	3
Zn	-	2
Mo	-	7
As	-	12

5.3.3 Summary

As the above mentions, stream sediment and panned consentrate geochemistries were carried out in two phases: Phase I and Phase II. The anomalies detected in two phases, are summarized in Fig.Ⅱ-5-1, though the threshold values vary by each phase and each kind of samples. The anomalous points are shown in different colors by element. The geochemical characteristics of this area, estimated from Fig.Ⅱ-5-1, are summarized as follows.

Au : Au anomalies are concentrated in the intrusive rock zone of the Futaleufu Area. Among these anomalies, single anomalies of only Au are possible to be noises not acompanied with mineralizations. Detecting the anomalous points acompanied with anomalies of Ag, Cu, Pb, Zn that have similar behavier as Au, the anomalous zone are squeezed on the area around Mt,Teta.

Cu : the anomalies of copper are very few. Copper minaralizations would be inferred to be scarce in this area.

Pb-Zn : the anomalies are densely detected in the distribution of the Cretaceous in the Alto Palena Area which is located in the southern part of this area. Especially, the areas coexisted in Pb, Zn anomalies should be paid attention on the west area of Alto Palena Town, distributed in the Coyhaique Formation, and the area of south branch of the El Salto River situated in the southern margin of the area. In the former area, geochemical anomalies are considered to show the posiblity of Pb-Zn mineralization, because the floats containing high grade Pb-Zn are observed. In the latter area, geochemical anormalies are also considered to show the same posibility, because Pb anomalies of pannde concentrate corespond to those of stream sediments.

Mo : the anomalies of Mo are concentrated in and near the Patagonia Batholith.

As : the anomalies of As trend to be single element and concentrated. These anomalies are inffered to show the posibility of pyrite mineralization.

5.4. Conclusions

The area is situated in the eastern margin of the Patagonia Batholith, and the two third of the area are occupied by the batholith. The distributions of intruded rocks are limited in the area around the Chile - Algentineborder. Therefore, the aerea of mineral deposits is narrow in this area. based on the mineralization characteristics of Aysen Area that the mineral deposts are limited in the zone of intruded roks.

Mineral indications are distributed mainly in the area around the Patagonia Batholith and seem to have been formed by hydrothermal alteration of high temperature, related to the intrusion of the batholith, on the baisis of the combination of alteration minerals(chlorite, epidote, actinolite) acompanied with mineralizations. The places of mineral deposits occur in the joints or the small faults of the host rocks. Therefore, they are of a small

scale and not well continuous.

This area regionally, coresponds to the Mo-Cu belt nearmost of the batholith, and inferred to be detached from the center of Pb-Zn or Au-Ag belt. Therefore, the mineralization of Au, Ag, Pb Zn is very weak, despite the precence of deposits in the area. Moreover, it is not expected to occur the large scale Pb-Zn deposit of Silver type or El Toqui type in the area, because no development of limestone was recognized. Copper mineralization is recognized in the area, but deposits are of vein type with poor continuity. There would be posibilities for Mo deposit to be present in the area of the batholith, but they would be inferred to be very small scale based on the areal characteristics of mineralization.

As a result of geochamical explorations, there would be expected the existence of Au-Ag mineralization around Mt,Teta, but neither indication nor mineralization zone were recognized in both this survey and existing data. They would be inferred to be of a small scale,if exist.

With respect to the deposit that coresponds to the geochemical anomalies of Au, Ag. Mo, it is considered that there are posibilities vein type deposits of a small scale there would be, also, very small the posibilities of existence of predominant copper deposit, because they are not recognized in geological survey and the geochemical anomalies were scarcely detected.

5.5. Recommendations

As mentioned above ,it is considered that mineral potential of Au, Ag and base metals is very small. Therefore, the necessity of further exploration works is small.

CHAPTER 6. ALTO CISNES-EL TOQUI AREA

6.1. Geology and Geologic Structure

This area is underlain by the Patagonia Batholith in the west and strata consisting of volcanic rocks and sedimentary rocks in the east. The strata in the east are divided into the Mesozoic and Cenozoic Systems by a marked angular uncomfomity.

The Mesozoic System is subdivided into the following three formations in ascending order(Fig.Ⅱ-6-1).

Ibañez Formation
Coyhaique Formation
Divisadero Formation

The Ibañez Formation is extensively distributed in the east, and partly on the Patagonia Batholith as roof pendants. It lithologically consists mainly of felsic pyroclastic rocks and volcanic rocks of rhyolite, andesite and dacite.

The Coyhaique Formation is observed mainly in the southern part of the area and conformably, partly unconformably with minor erosion, overlies the Ibañez formation. It is marine in origin consisting mainly of fossiliferous shale and sandstone. Around the El Toqui Deposit mentioned below, it contains intercalated calcareous beds, limestone and coquinite, which are host rocks of the deposit.

The Divisadero Formation, conformably overlying the Coyhaique Formation, rests on higher portion of mountains. It is composed of pyroclastic rocks and lavas varying andesitic to rhyolitic in rock facies. Lapilli tuff predominates in the formation and welded tuff is locally intercalated in it.

The Cenozoic System is subdivided into the following four formations in ascending order.

Frias Formation
Las Nacientes del Rio Cisnes Formation
Older fluviatile and glacial deposits
Younger fluviatile and glacial deposits

The Frias Formation is distributed mainly at the upper reaches of the Cisnes River. It consists mainly of weakly consolidated sand and gravel with intercalated tuff beds. This formation is referred to as the Neogene.

The Las Nacientes del Rio Cisnes Formation is distributed as a insular bodies at the head of the Cisnes River. It is plateau basalt lying unconformably on the older formations and is referred to as extrusive products of Pliocene age.

Older and younger fluviatile and glacial deposits, unconformably overlying mentioned late Tertiary to early Quaternary sediments, are extensively distributed in and around the Cisnes River.

Granitic intrusives are exposed in the west of the areas composing eastern edge of the Patagonia Batholith, and basaltic dikes intruded in them. Regarding the age of granitic intrusives, the following data are repoted.

Niemeyer et al.(1984)	107, 109 Ma(Rb-Sr)
SERNAGEOMIN (1983)	70, 85, 100, 125 Ma(K-Ar)
JICA-MMAJ (1990)	93, 75, 84, Ma(K-Ar)
JICA-MMAJ (1992)	124, 78 Ma(K-Ar)

All of these data indicate of Cretaceous age that they are.

6.2. Mineralization

More than ten ore deposits and/or mineral indications occur in the area, as shown in Table 1 in Appendix. They are classified into the following three groups based on main ore mineral assemblage.

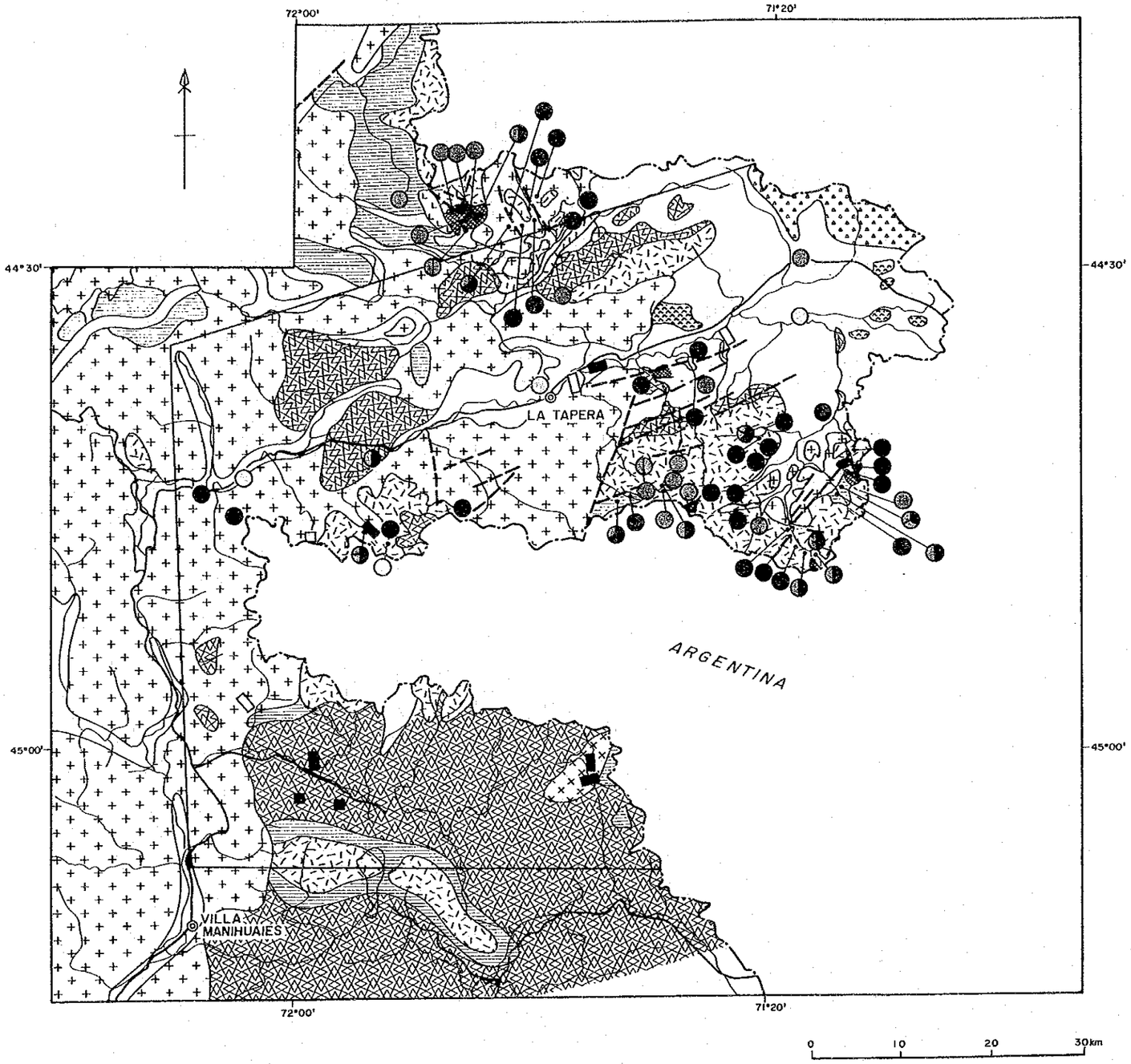
Au-(Cu) deposits
Pb-Zn deposits
Mo-(Cu) deposits

More than ten hydrothermal alteration zones are distributed mainly in the north and east of the area.

All of the Au-(Cu) ore deposits are of vein type represented by the Santa Teresa Deposit and Katterfeld Deposit. Detailed features of each deposit are shown in Table 1 of Appendix.

The Santa Teresa (El Condor) Deposit is hosted by quartz porphyry body and is composed of galena, sphalerite, chalcopyrite and quartz. Au content is rather high (max.65g/t).

In the Katterfeld Deposits, two types of mineralizations are recognised. One is sulfide minerals veins of Cu, Pb and Zn with Au, and the other is quartz-hematite(-pyrite) veins without sulfide minerals, which are concentrated as numerous parallel veins in the ore zone of 1 km in width. Au



LEGEND

Holocene		Fluvial and alluvial deposits
Pleistocene	Las Nacientes del Río Cisnes stratum	Basalts and andesite
Neogene	Frías F	Gravels semi-consolidated tuffs and tuffites
Late Cretaceous	Divisadero F.	Dacites, andesites and those pyroclastic rocks
Neocomian	Coyhaique F.	Shales and sandstones
Late Jurassic	Ibañez F.	Rhyolites dacites andesites tuff breccias and those pyroclastic rocks
	Intrusive rocks	Dacite porphyry
		Granites to gabbros
		Quartz porphyry
		Hydrothermal alteration
		Fault
		Vein type deposits confirmed
		Vein type deposits reported
		Strata-bound, manto and lenticular type deposits confirmed
		Strata-bound, manto and lenticular type deposits reported

Geochemical anomalies of 3 phases

- Au
- Ag
- Cu
- Pb
- Zn
- As
- Mo

Survey area

Fig. II-6-1 Geological and Geochemical Map of Area No.4 (Alto Cisnes-El Toqui Area)

content of these quratz veins at outcrops is less than 1 ppm and Au content at the deeper level is not published. Zonal arrangement of host rock (andesite of the Ibañez Formation) alteration, such as muscovite-kaolinite-calcite zone in the center and silica-dickite zone in the outer side, is observed.

Pb-Zn ore deposits are represnted by the El Toqui Deposit and Cerro Estatuas Deposit, which are in operation at present. Both of them are of metasomatic deposit replaced calcareous beds of the Coyhaique Formation and are accompanied by skarn minerals.

The El Toqui Deposit consists of three horizons as mentioned in Chapter 2 of Part I. The Cerro Estatuas Deposit is considered to be located in the upper horizon than the uppermost horizon of the El Toqui Deposit. Both deposits are of medium size and have with several tens of millions tons of ore reserves.

Mo-(Cu) ore deposits are hosted in the Patagonian Batholith They consist of veinlets of less than 0.2 m wide.

The largest and most intensive hydrothermal alteration zone in the area is the Cerro Aguja Alteration Zone. The rest is weakly silicified zones with quartz veinlets and pyrite dissemination, in which no mineralization of usefull metals are observed. The Cerro Aguja Alteration Zone is summarized below.

Cerro Aguja Alteration Zone

This altration zone extends 5 km east and west and 4 km north and south centering around Mt. Aguja. Although the alteration zone itself is located in pyroclastic rocks of the Divisadero Formation, granitic batholith is developed in the neighberhood (Fig.Ⅱ-6-2).

Alteration is characterized by acidic alteration consistiag of quartz, alunite, pyrophyllite and others, and is accompanied by fine pyrite impregnation and aboundant limonite-hematite impregnation and stockwork. A very small amount of chalcopyrite is discerned in limonite as relic mineral. Arsenic is detected as a microelement (Fig. Ⅱ-6-3). Samples collected at the center of the alteration zone show the following average contents.

Au:12ppm, Au:0.1ppm, Cu:13ppm, Pb:66ppm, Zn:9ppm, As:123ppm, S:3.35%

6.3. Geochemical Exploration

6.3.1. Geochemical exploration by stream sediments

(1) Sampling and assay

Geochemical exploration by stream sediments has been carried out in three years in the area, along the Sisnes River in the first phase survey, on the southern Tapera in the second and on east of Tapera in the third. Number of samples and elements for assay are as follows:

Phase Ⅰ 46 samples(Au,Ag,Cu,Pb,Zn,Mo,As)
Phase Ⅱ 107 samples(Au,Ag,Cu,Pb,Zn,As)
Phase Ⅲ 150 samples(Au,Ag,Cu,Pb,Zn,As)

(2) Geochemical anomalies and anomalous zones

1) Threshold values

Threshold values

	Phase Ⅰ	Phase Ⅱ	Phase Ⅲ
Au(ppb)	15.44	7.6	1.9
Ag(ppm)	0.15	0.15	0.1
Cu(ppm)	19.69	36	15
Pb(ppm)	13.95	23	29
Zn(ppm)	68.48	105	136
Mo(ppm)	0.91	-	-
As(ppm)	5.50	16	15

2) Anomalous zone

Number of anomalies by elements detected using above threshold is as follows:

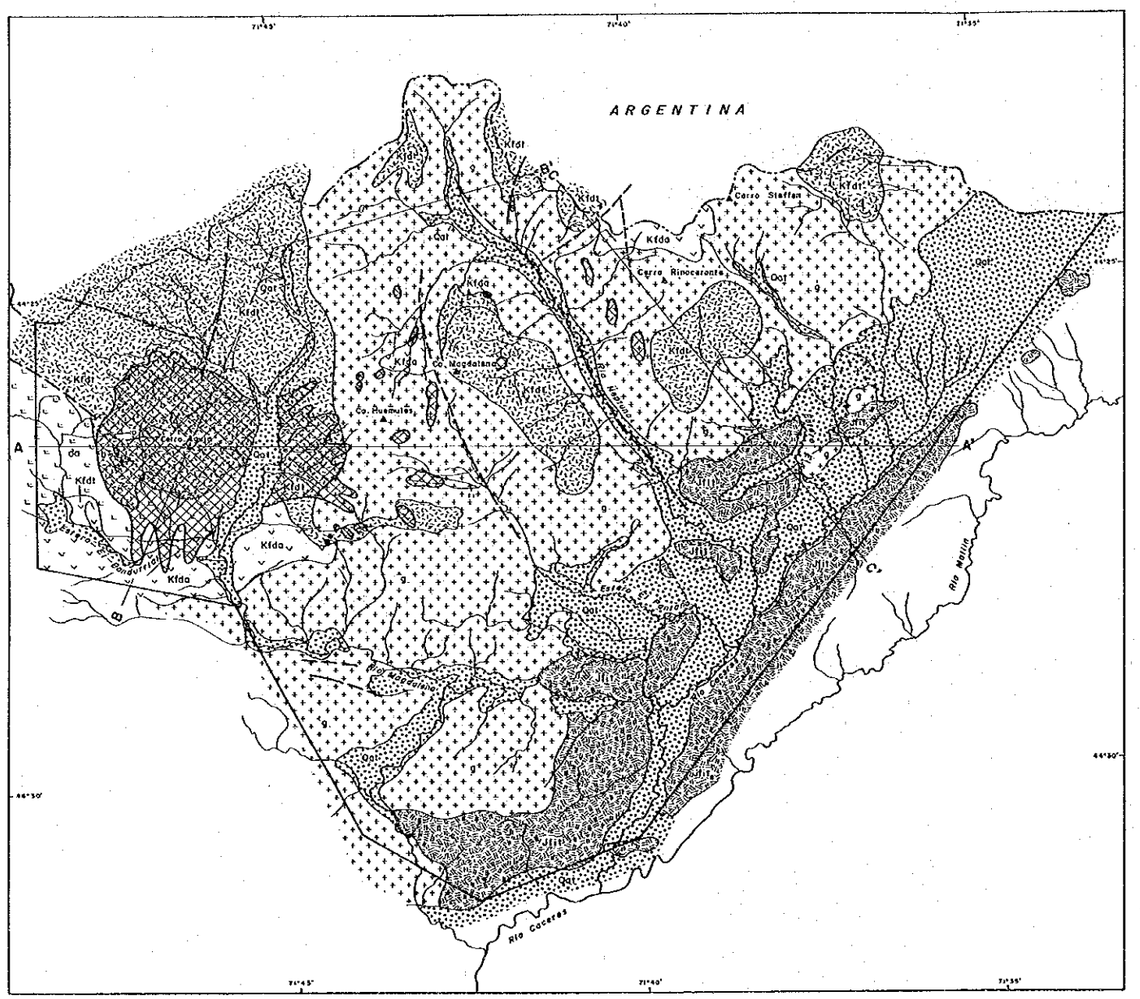
	Phase Ⅰ	Phase Ⅱ	Phase Ⅲ
Au	1	4	9
Ag	0	2	8
Cu	1	3	9
Pb	2	3	3
Zn	1	5	3
Mo	4	-	-
As	1	3	6

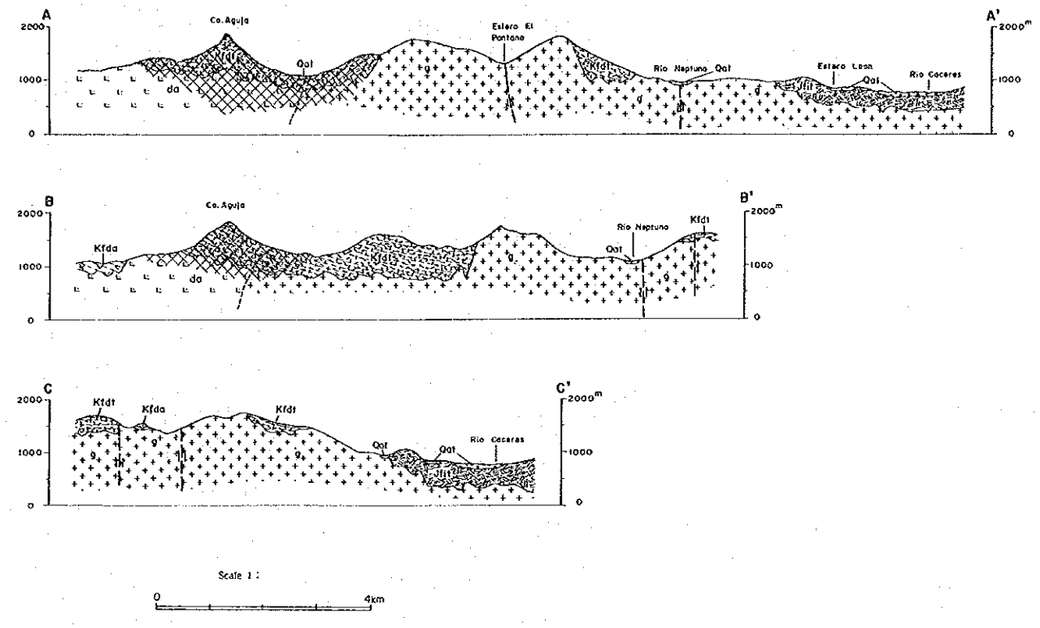
Anomalous zone detected in the first phase survey

Anomalies of Au, Cu, Pb, Zn and others are detected in the Moro River basin. Mo anomolies are scattered on granit exposure in the west.

Anomalous zone detected in the second phase survey

Anomalies of Pb, Zn As and others are detected collectively at the upstream basin of the La Buitrera River.

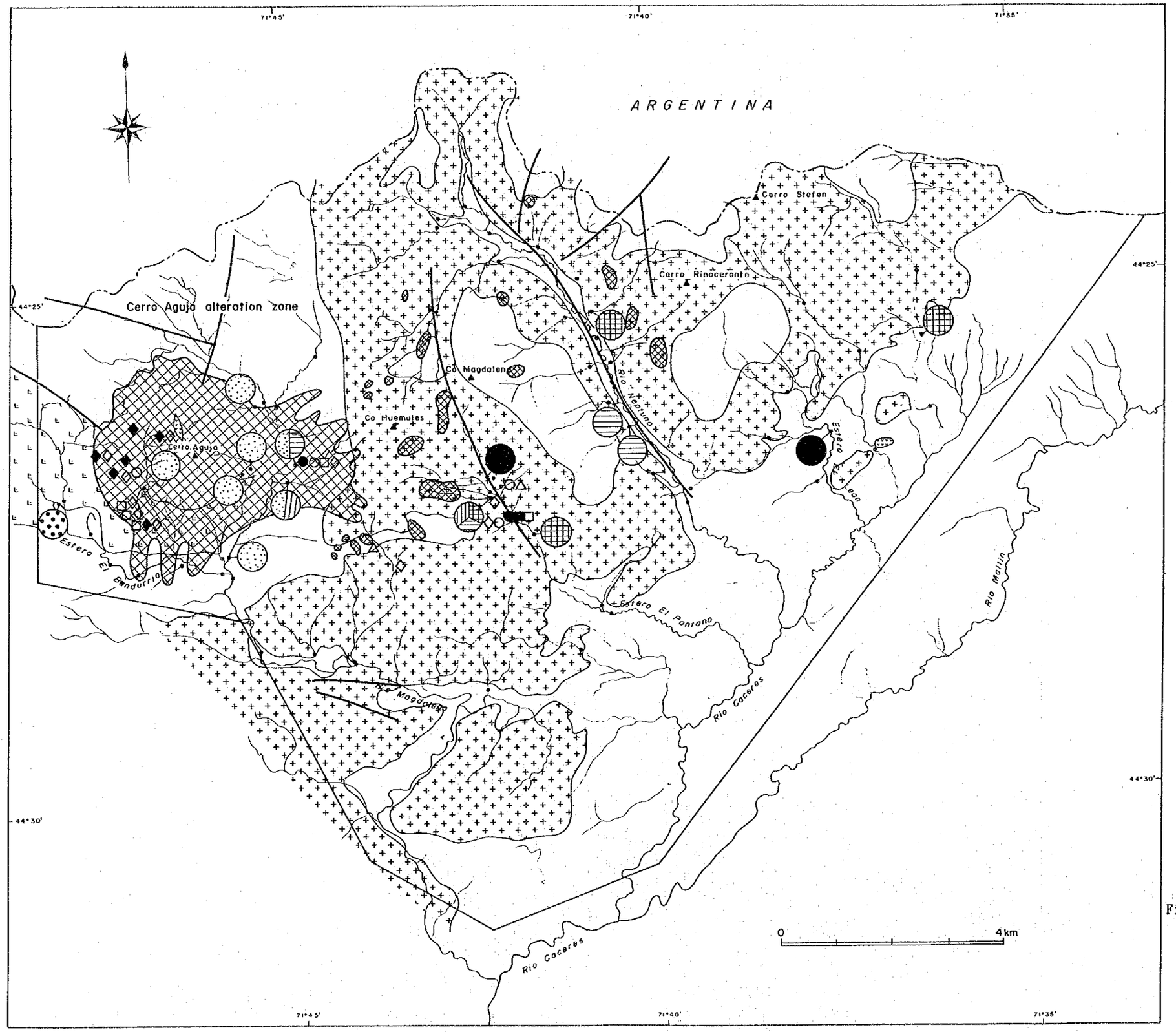




L E G E N D

Quaternary	Holocene Pleistocene	Qal	Alluvial, fluvial, colluvial, terrace, talus and glacial deposits	
Cretaceous	Late Cretaceous	Kfdt	Divisadero Formation :	Dacitic lapilli tuffs, fine tuffs, sandy tuffs
		Kfda		Mainly dark green andesite lavas
Jurassic	Late to Middle Jurassic	Jfit	Ibañez Formation :	Mainly dacitic lapilli tuffs
Intrusive rocks		b	Basalt dikes	
		da	de Dacite porphyry	
		g	Granite , granodiorite , tonalite	
			Hydrothermal alteration zones	
			Faults (broken line Inferred or fotent)	
			Bedding trace visible on aerial photographs	
		10	Strike and dip of bedding plane	

Fig. II-6-2 Geological Map of the Alto Cisnes-El Toqui Area (Cerro Aguja Alteration Zone)



LEGED

Intrusive rocks
- Basalt
- Dacite porphyry
- Granite, granodiorite, tonalite

- Hydrothermal alteration zones
- Faults
- Panned concentrate samples

Geochemical anomalies
- Au ≥ 106 ...
- Ag ≥ 2 ...
- Cu ≥ 73 ...
- Pb ≥ 65 ...
- Zu ≥ 293 ...
- As ≥ 11 ...

Ore assay
- Au ≥ 40 ...
- Ag ≥ 0.2 ...
- Cu ≥ 50 ...
- Pb ≥ 100 ...
- Zn ≥ 100 ...
- As ≥ 20 ...
- S ≥ 1 %

Fig. II-6-3 Collective Interpretation Map of the Alto Cisnes-El Toqui Area (Cerro Aguja Alteration Zone)

Anomalous zone detected in the third phase survey

Au anomalies are detected on the eastern slope of Mt. Los Matreros, and Cu and As anomalies are searched collectively at the upstream basin of the Tranquera de Vera River.

6.3.2. Geochemical exploration by panned concentrate

(1) Sampling and assay

Forty-six samples are collected at the same locality with stream sediments in the first phase survey and 67 samples are gathered at the Cerro Aguja Alteration Zone in the third phase survey. Three elements, Au, Ag, and Pb, are assayed in the first phase survey and six elements, Au, Ag, Cu, Pb, Zn and As in the third phase survey by the SERNAGEOMIN assay laboratory.

(2) Geochemical anomalies and anomalous zones

1) Threshold values

The following threshold values calculated by a formula of $m+2\sigma$ are adopted for each elements.

Threshold values

	Phase I	Phase II
Au(ppb)	6.57(μg)	106
Ag(ppm)	15.22(μg)	2
Cu(ppm)	-	73
Pb(ppm)	0.997(ng)	65
Zn(ppm)		293
As(ppm)		11

2) Anomalous zone

Number of anomalies by elements detected using above threshold is as follows:

Number of anomaly

	Phase I	Phase II
Au	3	2
Ag	2	4
Cu	-	4
Pb	2	2
Zn	-	1
As	-	7

Anomalous zone detected in the first phase survey

Anomalies of Au and Ag are detected in the Moro River basin and La Tubiana River basin (Fig.Ⅱ-6-3).

Anomalous zone detected in the second phase survey

Seven As anomalies are detected collectively in the Cerro Aguja Alteration Zone, which indicate presence of As as a microelement in the alteration zone . Most of other elements are detected outside of the said alteration zone, and they have probably no relation with mineralization (Fig.Ⅱ-6-3).

6.3.3. Summary

Since gold grains are also discerned at Au anomalous points in the Moro River basin and La Tubiana River basin detected by geochemical exploration by panned concentrate in the first phase survey, these basins are noticeable from the geochemical point of view (Fig. Ⅱ-6-1).

Arsenic anomalies detected by the third phase survey indicate precence of As mineralization in the Cerro Aguja Alteration Zone.

6.4. Conclusions

Mineral potential in the area between southern part of the Cisnes River basin to Chile-Argentina boder and around the Cerro Aguja Alteration Zone is concluded as follws:

1) Cu-Pb-Zn vein type mineralization is observed at the upstream basin of the Moro River, but the possibility of discovery of large scale ore deposits is small.

2) Judging from very limited distribution of calcareous rocks, El Toqui type deposit is hardly expected.

3) Economic concentration of Au, Ag and base metals in the downword extention of the Cerro Aguja Altration Zone is hardly expected.

4) In the alteration zones scattered on the north-east of the area, possibility of mineralization other than pyritization is very small.

5) No veins in and around the Patagonia batholith are judged to be very small.

6) There is no notable geochemical anomalies except one detected in the Horo River basin.

6.5. Recommendations

It is concluded that the necessity for further detaild exploration in the northern part of the area is small.

CHAPTER 7. IBAÑEZ-MURTA AREA(No.5)

7.1. Geology and Geologic Structure

Geology of the area consists of basement of Later Paleozoic metamorphic rocks, Mesozoic unit and Cenozoic unit. As to intrusive rocks, stocks and dikes related to the Patagonia Batholith are distributed in the area.

Metamorphic rocks are distributed in the western part of the area extending from north to south and are limited on their western edge by the Patagonia Batholith. Eastern parts of them are covered uncomformablly by the Ibañez Formation. Most of them (80 to 90%) consists of crystalline schists; mica schist and quartz schist grade into blackschist and/or greenschist. Those crystalline schists intercalate limestone, slate, phyllite and quartzite.

Mesozoic unit is divided into three formations; the Ibañez Formation, the Coyhaique Formation and the Divisadero Formation in ascending order.

The Ibañez Formation lies on most of the area except for distribution area of Paleozoic unit on the western part of the area. This formation consists of felsic pyroclastics and lavas. The former is predominant in easter part, and the latter is predominant in the middle to upper portion of the western part. Lithofacies of pyroclastic rocks are predominated by altenating beds of tuff and lapilli tuff(Fig.Ⅱ-7-1).

The Coyhaique Formation consists of altenating beds of sandstone and shale of marine origin, and overlies the Ibañez Formation with conformity. Distribution is limited on northeastern part of the area. Abundant marine fossils occur in the shale of this formation. This formation intercalates calcareous rock and conglomerate. Fig.Ⅱ-7-2 shows geological correlation column of Area No.5,No.6 and No.7.

The Divisadero Formation lies on the Coyhaique Formation conformably in northeastern part of the area. Top of this formation has not been identified due to erosion. Lithofacies, mainly tufaceous sandstone and rhyolitic or dacitic tuff, grade into andesitic facies toward west.

Cenozoic unit is consists of the Meseta Buenos Aires Formation of the Tertiary System and unconsolidated sediments of Quaternary. The Meseta Buenos Aires Formation overlies the Divisadero Formation unconformably. This formation is distributed sporadically in southern part and eastern edge of the area. Lithology is basaltic. This rock forms lava plateau and intrusive

facies of pipe-shaped are recognized in the lower portion. Absolute ages of this rock, according to dating study by K-Ar method, are Oligocene and Palaeocene to Middle Eocene Series. The Quarternary System consists of alluvium, terrace deposit and glacier deposit.

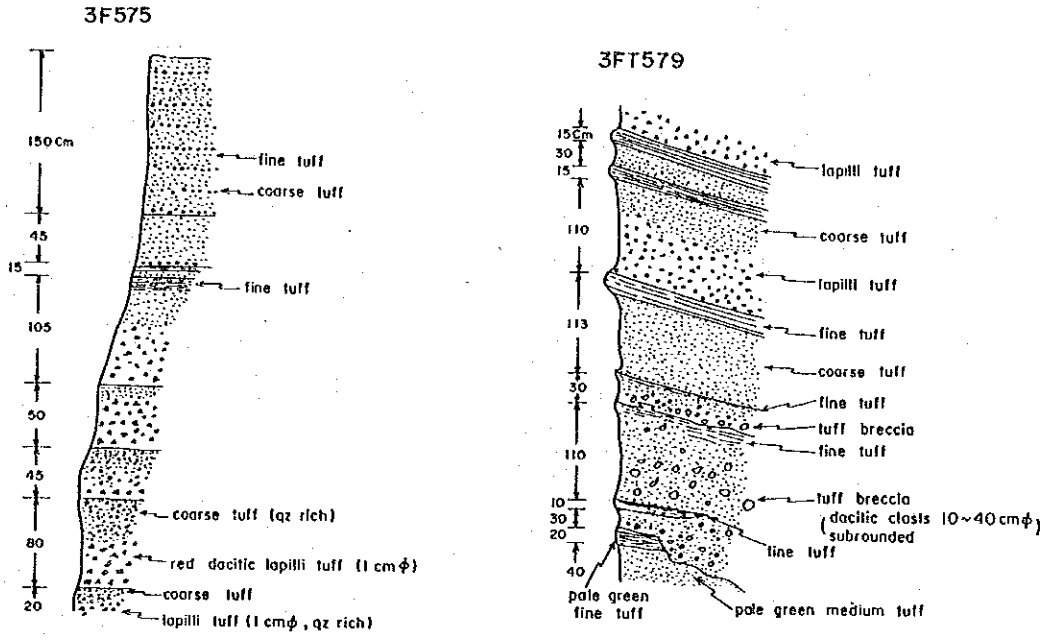


Fig. II-7-1 Sketch of Stratigraphic Column of the Ibañez Formation at Localities of 3F575 and 3F579

Intrusive rocks are consisted of plutonic rocks and dike rocks. As to plutonic rocks, eastern side of the Patagonia Batholith lies on the western part of the area, otherwise stocks occur in central and eastern part of the area. Plutonic rocks are granite, tonalite, granodiorite and quartz monzonite. Times of the intrusion are grouped into two periods of 110 to 125 Ma(Early Cretaceous) and 70 to 80 Ma(Later Cretaceous) by K-Ar radioactive age determination. Dike rocks are syenite porphyry, monzonite porphyry, rhyolite and dacite.

Complicated geologic structures are observed on only Paleozoic unit. Mesozoic unit shows gentle structure and Cenozoic unit is of nearly horizontal structure. Four styles of deformation are recognized in Paleozoic

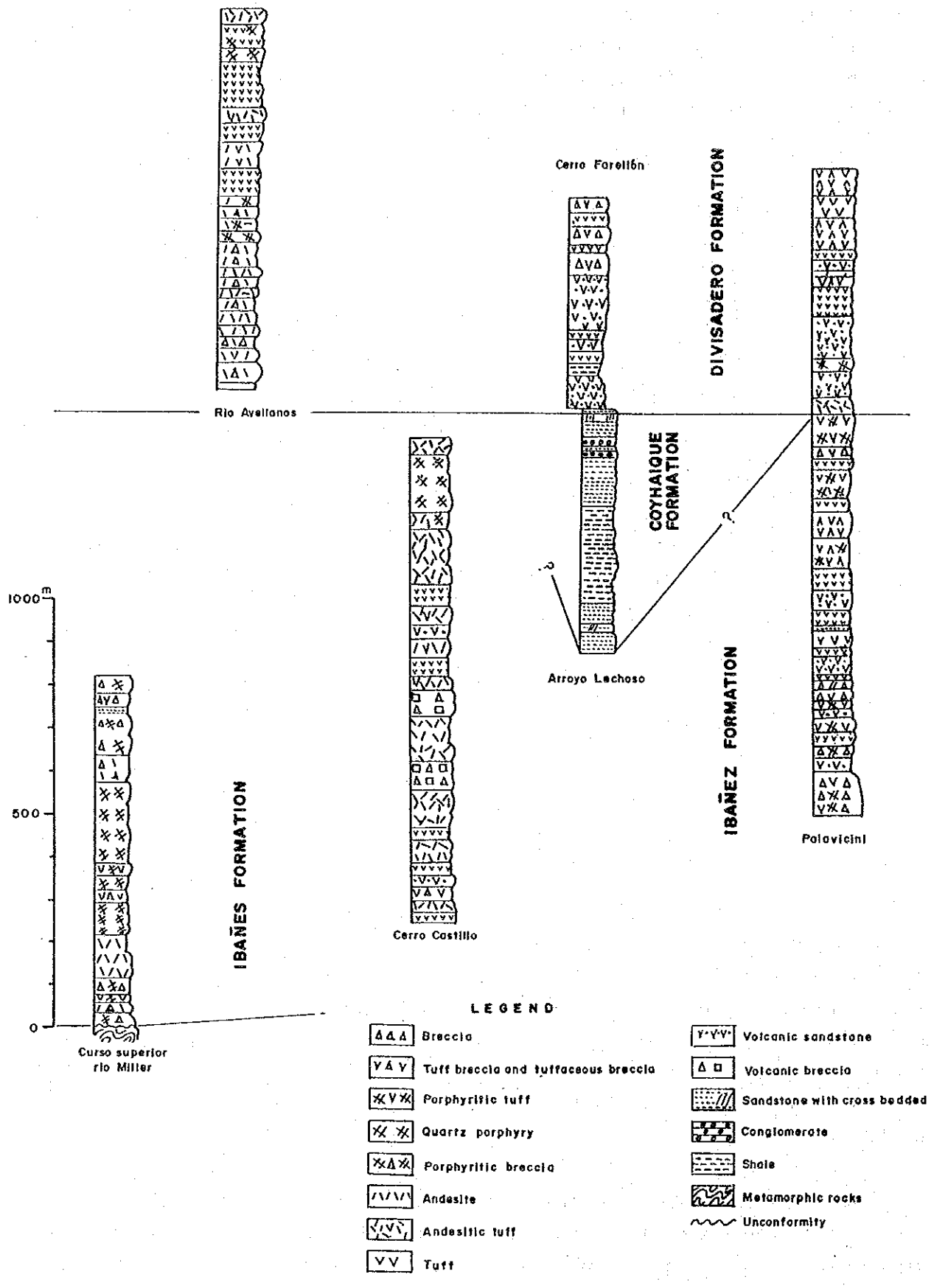


Fig. II-7-2 Schematic Geological Correlation Column of the Areas No.5,No.6 and No.7

metamorphic rocks; that is, schistosity, isoclinal fold inclining northeast, fold plunging northwest, and folds repeating anticline and syncline with northeast trend.

Geologic structures of the Ibañez Formation are the fold structures of NE-SW axis, waving gently. The Coyhaique Formation shows monoclinic structure inclined gently to east. Structures of the Divisadero Formation and the Meseta Buenos Aires Formation are almostly horizontal.

All faults are normal faults dipping nearly vertical. In the western part of the area, N-S and NNW-SSE systems predominate occuring along the contact of granitc rocks and metamorphic rocks. In the eastern part, N-S and NNE-SSW systems occur mainly in the Ibañez Formation.

7.2. Mineralization

In this section, the area of phase I and II is called Ibañez-Murta Area (South),since Ibañez-Murta Area (North) was added in phase II.

Mineralization is described in the following to be devided into two areas.

7.2.1. Ibañez-Murta Area (South)

Seventy and a few more mines and/or prospects are known in the area. Data for them are compiled in Table 1 of Appendix. Among them, 22 mines have been in oeration, 18 mines were explored in underground or by trenching on a small scale and 30 are still unexplored other than by very small exploraton pits. Moreover, many hydrothermal alteration zones are developed in the area.

From standpoint of principal ore metals associations, 33 are of copper, 32 are of lead-zinc, three are of gold-copper, three are of molybdenium and three are of alteration of surface only. Categorizing deposits on the basis of types of deposits, 49 are vein deposit, 20 are replacement deposit, two are disseminated ore deposit and three are categorized into others. Type of deposits of operated mines are as follows; seven are vein deposit, 16 are replacement deposit. Those operated mines are also grouped based on principal ore metal species; that is, 18 are of lead-zinc, three are of copper and one is of molybdenium.

Characteristics of the mineralization in the area are summarized as follows:-

• Copper-lead-zinc mineralization predominates. Vein type deposit is the first prevailling style of the mineralization. Replacement deposit is ranked the second.

• Relatively large and rich deposits which were mined are mostly of replacement deposit of lead-zinc.

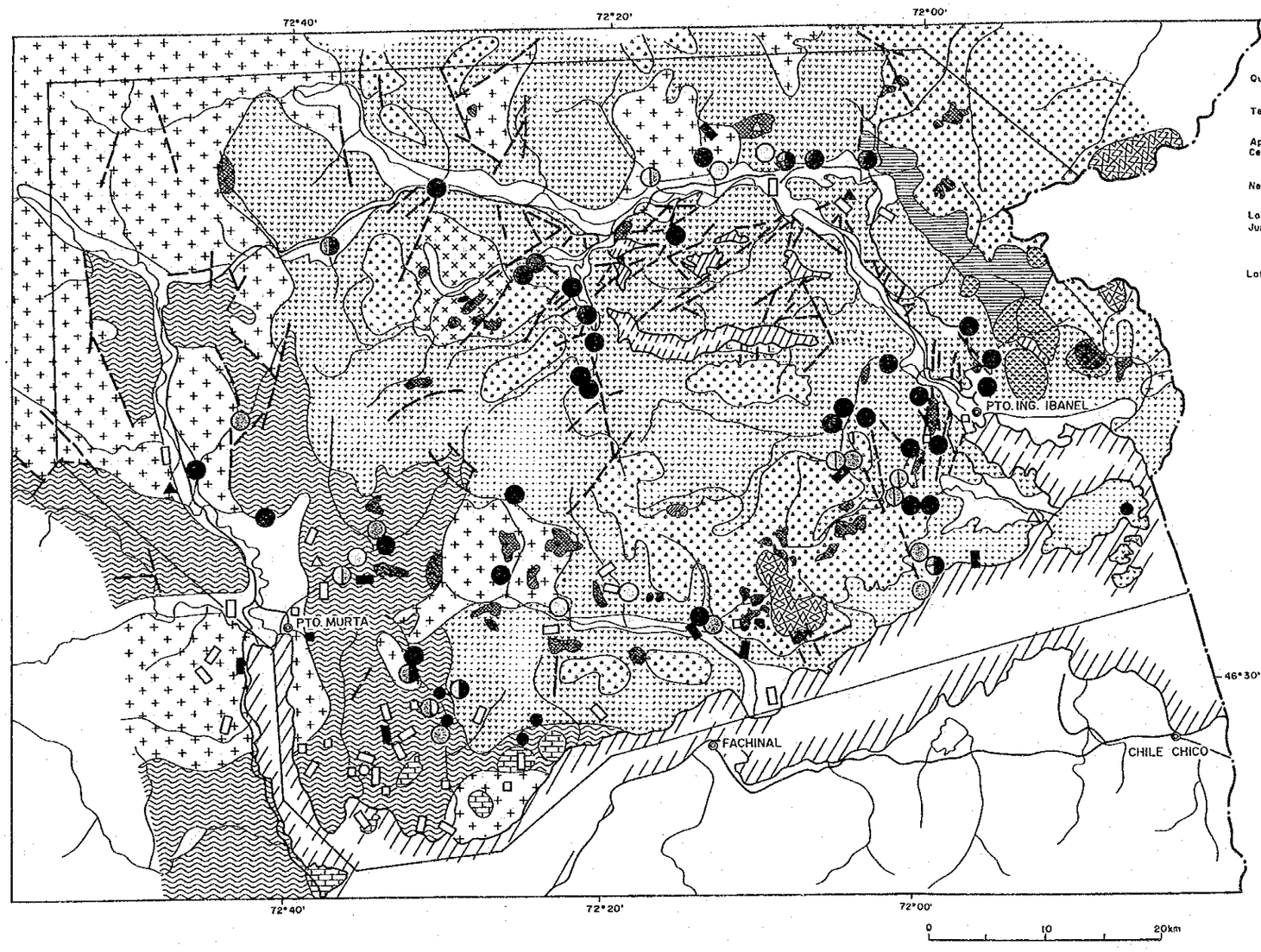
• Copper-molybdenum deposits are known as well. They are, howerver, very small in general. Numbers of gold deposit are very few.

Deposits are unevenly distributed in the distribution area of Paleozoic unit on the western side of the area as shown in Fig. Ⅱ-7-3. Looking over the distribution of deposits, it is recognized that deposits are distributed with a zonal arrangement; molybdenum belt, copper belt, lead-zinc belt and gold belt toward east from west. As mentioned in Part 1., this zoning feature is a part of the regional metal zonig recognized throughout the Aysen Region. This zonation is inferred to be related to the distance from the Patagonia Batholith.

Molybdenum deposits, all is vein type deposit, occur in the batholith and stock of granitic rocks, or in the vicinities of them. The deposits are accompanied mostly with copper minerals and quartz, or rarely with tungsten minerals(for instance, the Cerro Castillo Mine). Generally veins are very narrow, 5 to 15 cm wide, and poorly continuous.

Copper deposits are concentrated on the distribution area of Paleozoic unit. Most of them are vein deposits, though some parts of them are skarn deposits. Principal ore mineral is chalcopyrite accompanying a small amount of pyrrohotite, pyrite and chlorite in many cases. Short extention along strike is noted for the most deposits except for the Las Chivas Deposit which extends 1,700 m along strike with average width of 1.5 m.

The lead-zinc deposits are representative deposits in the area so that the Aysen Region including this area is known as lead-zinc production area. Typical lead-zinc deposits such as the Silva the Rosillo and the El Pelado are replacement deposits with massive, lense-shaped and bedded features which replaced limestone intercalated in Paleozoic metamorphic rocks. Each deposit consists of several to some ten orebodies in general. Ore minerals are sphalerite and galena with small amount of chalcopyrite and pyrite. Gangue



LEGEND

Quaternary		Alluvial, fluvial, colluvial and talus deposits
Tertiary	Meseta Buenos Aires F.	Alcalic basaltic lavas
Aptian Cenomanian	Divisadero F.	Rhyolitic pyroclastic rocks, rhyolite, andesites, and sandstone
Neocomian	Coyhaique F.	Fossiliferous black shales, sandstones Partialy calcareous conglomerates
Late to Middle Jurassic	Ibañez F.	Rhyolite, dacite and andesite, and those pyroclastic rocks
Late Paleozoic	Metamorphic basement	Amphibolite, schist, phyllite and quartzite
		Marl and calcareous schist
	Intrusive rocks	Rhyolite
		Basalt
		Quartz monzonite
		Granites, tonalites and diorite
		Hydrothermal alteration
		Fault
		Unclassified deposits
		Vein type deposits confirmed
		Vein type deposits reported
		Strata - bound, manto and lenticular type deposits, confirmed
		Strata - bound, manto and lenticular type deposits, reported
		Dissemination and / or stockworks deposits, confirmed
		Dissemination and / or stockworks deposits, reported

Geochemical anomalies of 3 phases

- Au
- Ag
- Cu
- Pb
- Zn
- As
- Mo

Survey area

Fig. II-7-3 Geological and Geochemical Map of the Ibanez-Murta Area

minerals are generally not much.

Ore reserves of deposits of this type are about five hundred thousand to seven hundred thousand tonnes for the Silva and the Rosillo Deposits which are regarded as the largest deposits in the area. Only the Rosillo Mine is in operation in the area; now producing 30t of zinc crude ore a day.

Gold deposit lies outermost belt of the above zonation and is inferred to form independent mineral province as describing in Part I, although it seems to consist of outermost of zonation. Small scale veins and indications are developed, but predominant ore deposit has not yet found in the area. The deposits are narrow vein deposit with width of less than one meter. In many cases, quartz veins are accompanied with chalcopyrite. General scales of deposits have not been revealed well. The deposits of this type are represented by Río Avellanos II Deposit situated in the down reaches of the Avellanos River. Assay on outcrop of this deposit is reported to be 20g/t Au and 4 to 5 % Cu.

The hydrothermal alteration zones objected in this survey are twenty and several zones in whole area, but most of them are distributed limitingly in the east part. They are developed mainly in the Ibañez and the Divisadero the Formations and most of them are weak silicified and argillized alteration zone mostly accompaied with disseminated and/or stockwork limonite and hematite. And there is observed a small amount of lead and zinc in a part of them. Most of them are not including useful metal and are pyrite dissemirations and/or stockworks, small barren quartz veins.

7.2.2. Ibañez-Murta Area (North)

Through the interpretation of Landsat TM image in the Phase II, 12 localities of alteration zones were extracted in the area. As a result of field survey in the Phase III, thirty-odd mineralization zones of various sizes were recognized over the whole area. for the convenience of explanation, these confirmed mineralization zones have been grouped into eleven divisions(A to K hereafter). The divisions are called Mineralization Group A,etc.

The host rocks of the mineralization groups are pyroclastic rocks and rhyolite lavas of Divisadero Formation. These alteration zones are devided to the following two types(Fig.II-7-4).

(a) The mineralization groups that show stockworks or veins of white quartz-pyrite with druses(Mineralization Group E, F, C, I and J)

(b) The mineralization groups composed mainly of pyrite disseminations and veinlets of limonite, accompanied with few veinlets of quartz(A, B, C, D, I and J).

Mineralization groups of (a) type are located densely around Las Horquetas Grandes in the central part of the area. The shape of mineralization zone is circular or elliptical and its average horizontal size is 1kmx1km. The sphere where stockworks of quartz veins is remarkably condenced, is around 500mx500m in the mineralzation zone.

The analytical results of about eighty samples of quartz veins grade and shown in the followings. The values of Au rarely detected were only 0.1 to 0.2ppm.

Au : <20 to 220ppb, Ag : <0.1 to 8.3ppm, Cu : <10 to 40ppm,
Pb : <10 to 68ppm, Zn : <5 to 263ppm, S : 0.01 to 2.10%

However, the analytical values of panned concentrate show 2 to 4ppm of Au, 2000 to 3000ppm of Zn and several hundreds ppm of As in the rivers of these mineralization group. Moreover, a few gold grains were also found in these samples. Main alteration minaral is quartz, gold accompanied with a small amount of selicite.

Mineralization groups of (b) type are developed in the area around mineralization groups (a) and its shape is similar to those of type (a). Metal contents are lower than those of the type (a). Alteration is only silisification.

The mineralization groups of (a) type, show the above characteristic, are supposed to belong to hot-spring-type of gold deposit. It is considered that the present superficial part of these type mineralization zone would be corresponded to the level of "Stockwork in the model (Fig.Ⅱ-7-5) established by Berger and Bimon(1982).

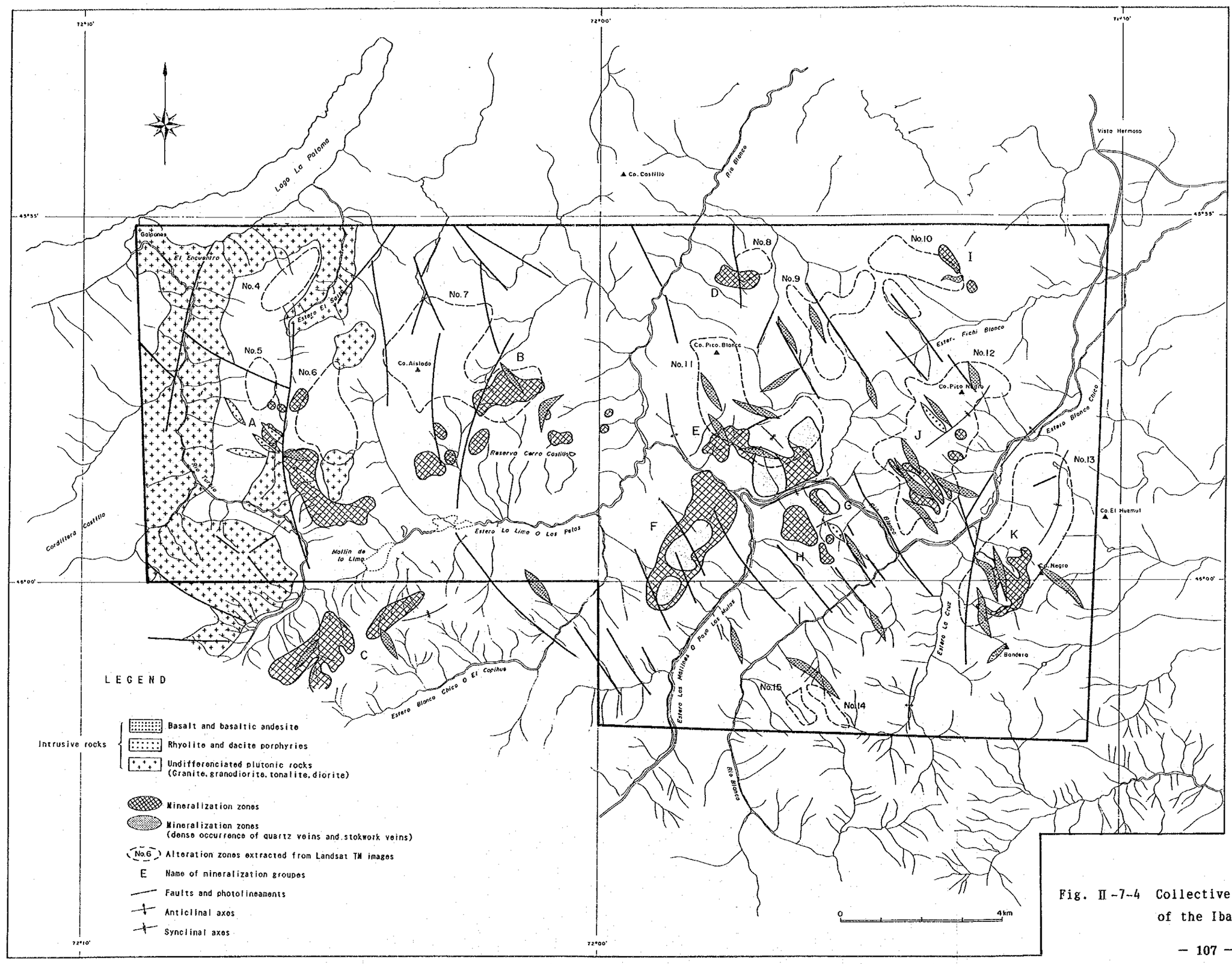


Fig. Ⅱ-7-4 Collective Interpretation Map of the Ibanez-Murta Area (North)

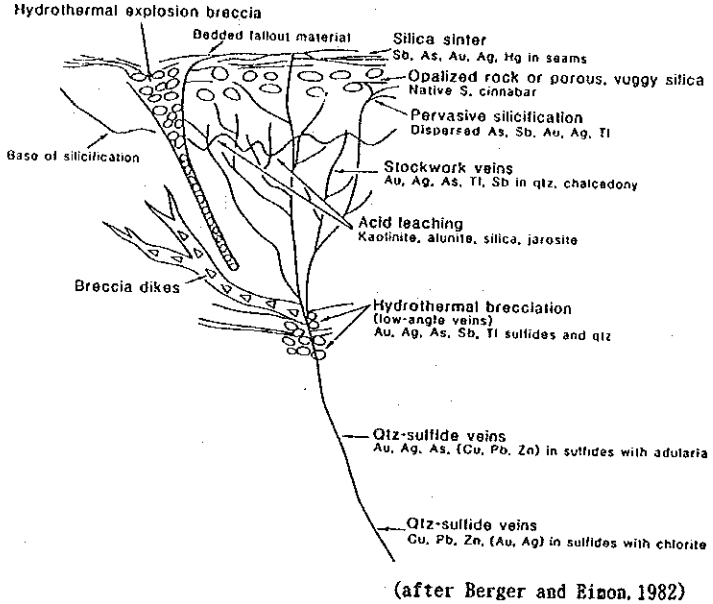


Fig. Ⅱ-7-5 Schematic Cross Section Illustrating Geologic Features in a Hot Spring-Type Gold Deposit

7.3. Geochemical Exploration

7.3.1. Stream sediment geochemistry

(1) Sampling and chemical analysis

Stream sediment geochemical exploration, in the first phase, was carried out in the south western part of the area(between the Avellano River and the Hurta River). Number of samples taken is 62. Elements analized are 7; Au, Ag, Cu, Pb, Zn, Mo, As.

(2) Anomalous values and zone

1) Threshold

Threshold values are fixed at the point of 2.5% on the cumulative frequency curve for 2 elements; Cu, As. M+2σ was used as threshold for 5 elements; Au, Ag, Pb, Zn, Mo.

Threshold for each element

Element	Threshold
Au	all < 20ppb
Ag	0.4ppm
Cu	48.5ppm
Pb	54.5ppm
Zn	155.8ppm
Mo	0.9ppm
As	18.2ppm

2) Geochemical anomaulous zones

Numbers of the anomalous values are as follow, detected on the above thresholds.

Au : 0, Ag : 1, Cu : 2, Pb : 0, Zn : 2, Mo : 7, As : 8

Anomalies of Mo are obtained gathering in the area of Resbalon river, and north branches in the middle reaches of the Ibañez River. As anomalies are also found compalatively gathering in the area of the Avellanos River, Ibañez and Resbalon Rivers.

7.3.2. Panned concentrate geochemistry

(1) Sampling and chemical analysis

Number of samples collected is 220 in total; 62 in the phase I and 158 in the phase Ⅲ. Samples were taken on the identical sample points to those stream sediments in the phase I and collected on the central to northern part of the area in the phase Ⅲ. Elements analyzed are 3 elements of Au, Ag, Pb in the phase I and 6 elements of Au, Ag, Cu, Pb, Zn, As in the phase Ⅲ.

(2) Geochemical anomalous values and anomalous zone

1) Threshold

The threshold of Au is fixed at the break point of cumulative frequency curve and those of Ag and Pb are calculated by $M + 2\sigma$ in the phase I. In the phase Ⅲ, those of Ag, Cu, Pb and Zn are determined by $M + 2\sigma$, that of Au is fixed at the lower limit of higher group on the histgram of samples and That of As is fixed at the point of detection limit in chemical assay

Threshold for each element and each phase

Element	Phase I	Phase III
Au	1.033 μ g	316 ppb
Ag	43.96 μ g	1.8ppm
Cu	-	40 ppm
Pb	9.013 mg	126 ppm
Zn	-	578 ppm
Mo	-	-
As	-	5 ppm

2) Geochemical anomalies

The number of anomalous values detected are as follows:-

Number of Anomalous Values in Each Phase

Element	Phase I	Phase III
Au	7	18
Ag	1	9
Cu		7
Pb	1	5
Zn		6
Mo		
As		3

Au : Anomalies are obtained comparatively gathering in the northeastern part of Cerro Castillo Village, to the north and west of Puerto Ibañez and in the area of the Avellanos River.

Ag : Anomalies are detected acompanying with Au anomalies in the same area. In addition to these, 3 anormalies are obtained gatheringly to the west of Lake Lapparent.

Cu : Anomalies are distributed gatheringly in the north part of Cerro Castillo Village and western part of the area.

Pb and Zn : Anomalies are distributed to the west of Puerto Ibañez, accompanied with each other.

As : No noticeable anomaly is obtained.

7.3.3. Summary

Anomalies obtained in Phase I and Phase Ⅲ are summarized in Fig.Ⅱ-7-3. Anomalies located to the north of Puerto Ibañez are accompanied with native gold grains. The upper reaches of those anormalies are worth to be noticefied.

In the anomalous zones of Pb and Zn distributed gatheringly to the west of Puerto Ibañez, Pb-Zn vein type deposits are relatively concentrated and the second component scores in principal component analysis are high and gathered. Therefore, it would be considered for these factors to show the existences of lead and zinc mineralization.

It is not considered always for the other anomalies to show the existence of minaralization.

7.4. Conclusions

1) Molibdenum deposits are rarely laid in and/or around the area of plutonic rocks belong to the Patagonia Batholith, occurring in a small scale and not worth to be noticeable as deposit.

2) Copper deposits are considered to be of a small scale, while mesothermal type of them are expected to occur existent near and around the Patagonia Batholith. Copper mineralization is generally weak.

3) There is left the possibility of existence of Pb-Zn replaced deposits developed in metamorphic rocks. Especially, there are promissing area for the further works in the area near and around the Silva and Rosillo Mines. The possibility of existence of Pb-Zn vein type deposits is left only in the eastern part of the area. Furthermore there is the possibility of the existence of Pb-Zn deposits which replaced calcarious beds of the Coyhaique Formation(outside the surveyed area) distributed to the east of the area. That is, however, considered not to be high, because the intrusive rocks are scarcely distributed in that area.

4) There is left the possibility of existence of Au-Ag deposits in the eastern part from Puerto Ibañez and in the area from upper reaches of Long to Avellanos Rivers. However, large scale deposits similar to the Laguna Verde Deposit is considered not to occur high. The deposits would be small scale vein type.

5) Au mineralization is not recognized in the (a) type Mineralization Groups that are distributed in the northern part of the area, and those are situated

under the depositional conditions of gold. It is assumed that gold was not consequently concentrated in those Mineralization Groups. Additionally, it would be hard for the gold concentrations grading up into the depth of those zones to be expected. It would be dificult for Pb-Zn contents to be concentrated to economically minable level, while Pb-Zn concentrations would be expected to a certain extent in the depth of those groups. The (b) type mineralization groups developed in that same area are not worth to be noticeable.

7.5. Recommendations

1) It is considered that special emphasis for the future exploration should be placed on the area in the vicinity of the Silva and Rosillo Mines. Especially, it is thought that it is urgent necessity to pursue the calcaleous beds in metamorphic rocks.

2) It is recommended that the geological survey should be carried out on the area between Chile-Argentine border and the road connecting Puerto Ibañez with Coyhaique.

CHAPTER 8. LOS LEONES RIVER AREA

8.1. Geology and Geologic Structure

The area is underlain by the metamorphic complex that is believed to be the basement unit of the Aysen Region and it is covered unconformably by the Ibañez Formation. The above units are intruded by several intrusive rock bodies ranging from intermediate to felsic in composition(Fig.Ⅱ-8-1).

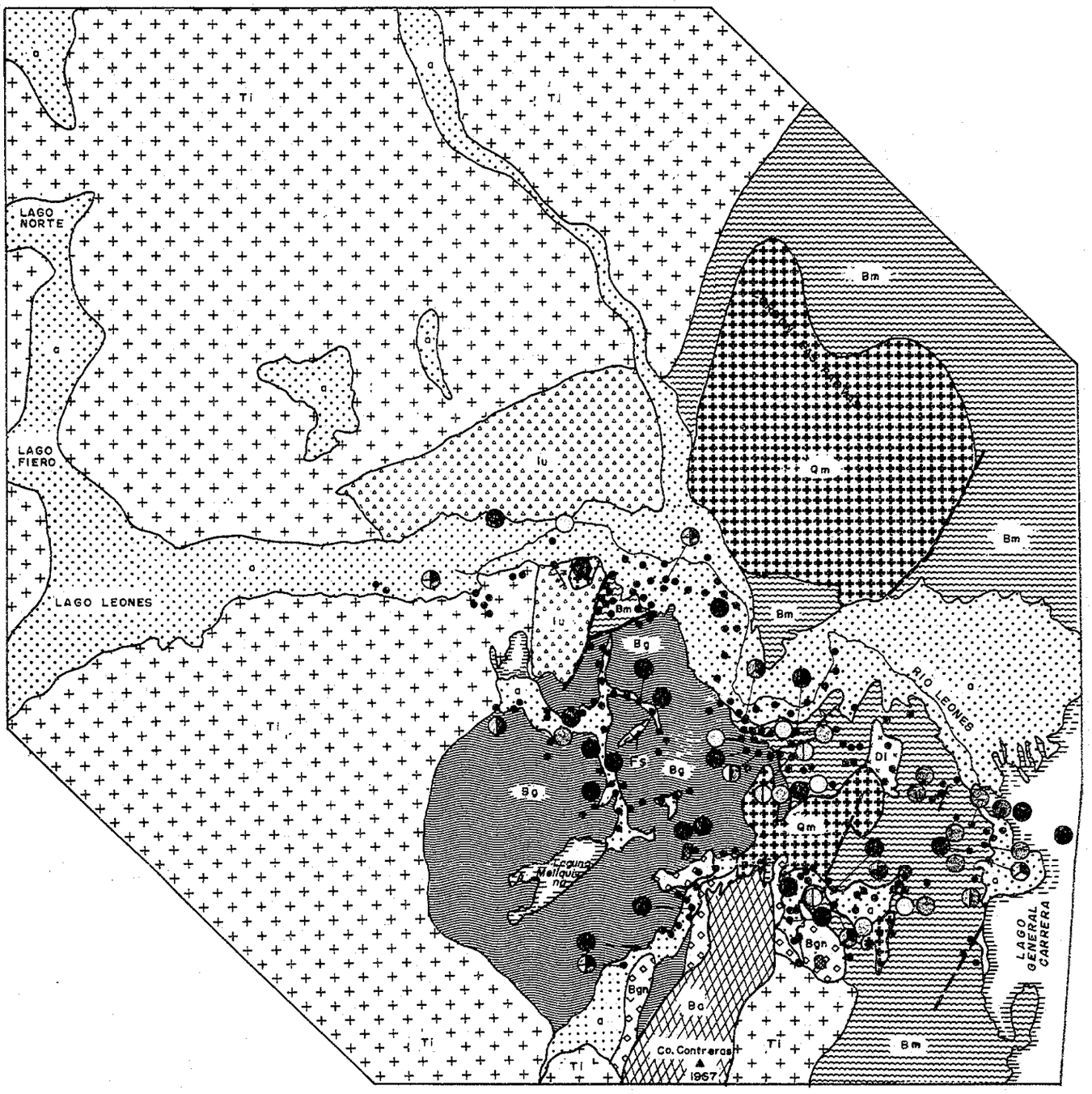
The metamorphic complex is broadly distributed in this area. It is largely classified into two rock types, namely the metasediments and metabasites. The metamorphism is generally not of high-grade. However, rather high-grade metamorphic rocks such as amphibolite and gneisses are also developed near the intrusive bodies.

The metamorphic rocks developed in the survey area consist mainly of low-grade crystalline schists. They are divided into two members, namely mica-schist and phyllite distributed in the eastern part, and greenschist in the western part of the area. It is believed that the former is the metasediments derived from the pelitic rocks and the latter is derived from mafic rocks.

The original stratigraphic relationship of the both members could not be established because of strong deformation. Judging from the regional geology, however, a monoclinal regional geologic structure striking NNW-SSE and dipping E is recognized because the Ibañez Formation which overlies the basement unconformably crops out adjacent to the east of the basement. Therefore, the metasediments member is assumed to overlie the greenschist member.

The age determination revealed that metamorphic events took place 228±7 Ma (Middle to Late Triassic) for muscovite-quartz schist lied in the eastern half of the survey area and 389±28 Ma (Middle Devonian) for amphibolite in the southwestern part of the area.

The Ibañez Formation is distributed along the Los Leones River in the north-western part of the area. This formation is found first in the area and in this survey. The stratigraphy of the Ibañez Formation is generally simplified as follows: The lower portion consists mainly of acidic pyroclastic rocks and the upper portion is the sequence of andesite lava and andesitic pyroclastic rocks. The formation recognized in this area is composed of andesite lava and interbedded andesitic lapilli tuff. Both rock units are silicified extensively.



LEGEND

Quaternary		a	Alluvial, fluvial, terrace and glacial deposits
Late Jurassic	Ibañez F.	Iu	
Paleozoic	Metamorphic Complex	Bm	Mica schist
		Bg	Green schist
		Ba	Amphibolite
		Bgn	Gneiss
Intrusive Rocks		Qm	Quartz Monzonite
		Ti	Tonalite
		Di	Diorite
		Fs	Felsite

Faults

Ore veins

Mineralization zone

Geochemical anomalies

- Au, Ag
- Zn
- Cu
- As
- Pb
- Mo

Fig. II-8-1 Geological and Geochemical Map of the Rio Los Leones Area (No. 6)

This sequence unconformably overlies the basement metamorphic rock complex, but the contact seems to be partly fault.

Quaternary sequences consist of river terrace deposits, alluvium and drift. Composition of intrusive rocks in the survey area ranges between intermediate and felsic composition. Their rock types are tonalite, quartz monzonite and diorite.

The schistosity of the metasediment member principally strikes N-S, but its dip azimuth is not very consistent. The elongation of the intrusive bodies are generally oblique to the direction of the their schistosity with low angles. The schistosity direction of greenschist facies sub-unit vary widely from N-S to E-W.

Anticline and syncline are inferred in the northwestern part of the area on the basis of the pattern of strike-dip direction of schistosity, and the strike of the inferred faults, namely NNE-SSW to NE-SW.

It is noted that three structural features; the principal directions of the elongation of intrusive bodies and folds and faults are approximately in the same direction.

This suggests the presence of the rupture-deformation structure with the NNE-SSW to NE-SW direction which existed prior to the intrusion event of the granitic rocks.

The Ibañez Formation shows different structural features from that of the basement rocks. The attitudes of units layers of the andesite lava flow are believed to be nearly parallel to one of the dominant two joints which are parallel to the lapilli tuff beds. The structure of the formation is a monocline structure striking N65 to 80°E and dipping 50°N.

8.2. Mineralization

Mining activity is hitherto unknown in this area and neither of mining nor exploration concession was marked out as of October, 1989. Several small indications of mineralization are recognized in the area and notable ore outcrop among them are at VM-606, VM-607 and VM-610(Table 1 of Appendix).

These mineralization occurs at the edge of diorite stock, near the

contact with muscovite-quartz schist featuring stockwork of quartz-pyrite(-chalcopyrite-hematite). This stockwork zone is 3 to 5m wide and strike NNE-SSW to NE-SW.

The host rock alteration is merely weak silicification and confined within the stockwork zone. Assay on these outcrops show very low grade, though ore grades at the point YM 607 are a little remarked for Au, Ag and Cu. Assay results are listed up on the following table.

Sample	Au(ppb)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)
YM606	20	0.1	9	20	25
YM607	0.5ppm	3.1	0.12%	450	14
YM610	60	0.5	9	26	12

Other than that, single veins and disseminated stockwork of quartz-pyrite associated with felsite and andesite dikes are recognized. Mineral assemblage is mainly quartz-pyrite-hematite and sometimes is accompanied by galena-sphalerite or chalcopyrite. Stockwork mineralization associated with dikes (usually some 10cm wide) are 2m wide at maximum and country rocks, usually greenschist, are affected by silicification and pyrite dissemination within the stockwork zones.

Stockwork consists of very simple assemblage, quartz and pyrite. Ag-Cu mineral is not recognized under the microscope, while those elements are detected in a part of assay samples.

Notable assay results on some outcrops are shown on the following table. As a matter of fact, it is concluded from the surface geological survey that no promising mineralized zone with economic possibility has yet been defined in the area.

Assays on Some Disseminated or Stockwork Associating Dikes

Sample	Au(ppb)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)
KM685(stockwork[1])	60	6.7	97	250	730
KM686(disseminated[2])	20	6.3	451	270	960
YM616(disseminated[3])	20	1.6	0.16%	14	139
YM633(stockwork[4])	<20	0.3	0.28%	5	32

8.3. Geochemical Exploration

8.3.1. Stream sediment geochemistry

(1) Sampling and chemical analysis

Geochemical exploration of stream sediments was carried out in the phase I. Number of samples taken is 15. Elements analized are 7; Au, Ag, Cu, Pb, Zn, Mo, As.

(2) Anomalous value and zone

1) Threshold

Threshold values are fixed by $M + 2\sigma$ for 5 elements of Au, Ag, Pb, Zn, Mo. Those of Cu and As are fixed at the point of 2.5% in cumulative frequency curve.

Threshold for Each Element

Element	Threshold
Au	all<20ppb
Ag	0.4ppm
Cu	48.5ppm
Pb	54.5ppm
Zn	155.8ppm
Mo	0.9ppm
As	18.2ppm

2) Anomalous zone

Number of anormalies detected by the above methods is as followings;-

Au : 0, Ag : 0, Cu : 0, Pb : 3, Zn : 0, Mo : 2, As : 3

Anormalies of Mo, As and Pb are detected gathering in the area of the south branches of Los Leones River.

8.3.2. Panned concentrate geochemistry

(1) Sampling and assays

Panned concentrate geochemical exploration was conducted throughout this area. Number of samples taken is total 231; 15 in the Phase I and 216 in the Phase II. The samples of the Phase I were taken on the identical same points to those of stream sediments. Elements analized are 3 in the Phase I and 7 in the Phase II; Au, Ag, Pb in the Phase I and Au, Ag, Cu, Pb, Zn, Mo, As in the Phase II.

(2) Geochemical anomalies and anomalous zone

1) Threshold

Threshold of Au was fixed at the break point on the cumulative frequency curve and those of Ag, Pb were fixed by $M + 2\sigma$ in the Phase I. In the Phase II, thresholds were determined by $M + 2\sigma$ for all elements.

Threshold for Each Element

Element	Phase I	Phase II
Au	1.033 μ g	170 ppb
Ag	43.96 μ g	0.5ppm
Cu	-	93 ppm
Pb	9.013 mg	27 ppm
Zn	-	230 ppm
Mo	-	2 ppm
As	-	58 ppm

2) Geochemical anomalous zones

Number of anormalies detected are as follow;-

Element	Phase I	Phase II
Au	6	15
Ag	0	12
Cu	-	4
Pb	0	9
Zn	-	7
Mo	-	7
As	-	12

Au : Small numbers of anomalies are situated in the mouth of the El Cañal River and scattered in the area from the central to the western part of this area.

Ag : A few anomalies are sporadically distributed in the upper reaches of the Meliquina River in the western part, middle and lower reaches of the El Cañal River in the southern part, in the Mirasal area of the north-eastern part in the area.

Cu : Anomalies are very sporadically distributed along El Cañal River and the upper reaches of the Meliquina River.

Pb : Anomalies are distributed in the middle and lower reaches of the El Cañal River, and the eastern rim of the area. They are especially concentrated on the rim area.

Zn : The distribution patterns are similar to those of Pb.

Mo : Many anomalies occur in the Mirasal area located in the north eastern part of the area.

As : Many anomalies distributed densely in the Mirasal area and in the middle reaches the El Cañal River.

8.3.3. Summary

The results of geochemical exploration are summarized in Fig.Ⅱ-8-1 and the followings are features of the anomalies obtained in the Phase I and Phase Ⅱ.

Au : Anomalies are sporadically distributed.

Ag : The number of anomalies is very small.

Cu : The number of anomalies is very small.

Pb + Zn : Anomalies are gatheringly distributed in the middle to lower reaches of the El Cañal River

Mo : Many anomalies occur in the Mirasal area.

As : Many anomalies are distributed densely in the Mirasal area and in the middle reaches of the El Cañal River.

8.4. Conclusions

The geology of this area consists of the Paleozoic metamorphic rocks, the Ibañez Formation that covers these metamorphic rocks and the intermediate to felsic intrusive rocks. Only faint copper-silver mineralization is developed in relation to the igneous activity of these intrusive rocks.

Although gold, lead and zinc geochemical anomalies were detected in the periphery of the intrusive bodies, these anomalies are extremely low level and do not suggest the existence of significant mineralization.

Therefore, it is concluded that the possibility of existence of large scale ore deposit is small, while there would be small and weak mineralization zone including mainly gold and copper in this area.

8.5. Recommendations

As mentioned above, it is concluded that there is small potentiality of existence of middle to large scale ore deposit which is composed of gold, silver and base metals in the area. Therefore, the necessity for further exploration activities is low.

CHAPTER 9. CHILE CHICO-CHACABUCO AREA(No.7)

9.1. Geology and Geologic Structures

Mesozoic and Cenozoic units overlie the basement of Later Paleozoic metamorphic rocks. Intrusions are mainly stocks and dikes of granitic rocks derived from the Patagonia Batholith, while the Patagonia Batholith is not distributed in the area(Fig. II-9-1).

Metamorphic rocks lie on the western part of the area extending with elongation of the N-S direction. The western edge of the rocks are cut by the Patagonia Batholith and the eastern part is overlain by the Ibañez the Divisadero and the Guadal Formations unconformably. Those rocks are composed of mica schist, quartz scaist, blackschist, greenschist, slate, phyllite and quartzite. Segregated quartz veins are developed also in this area. No intercalation of limestone occurs in the area.

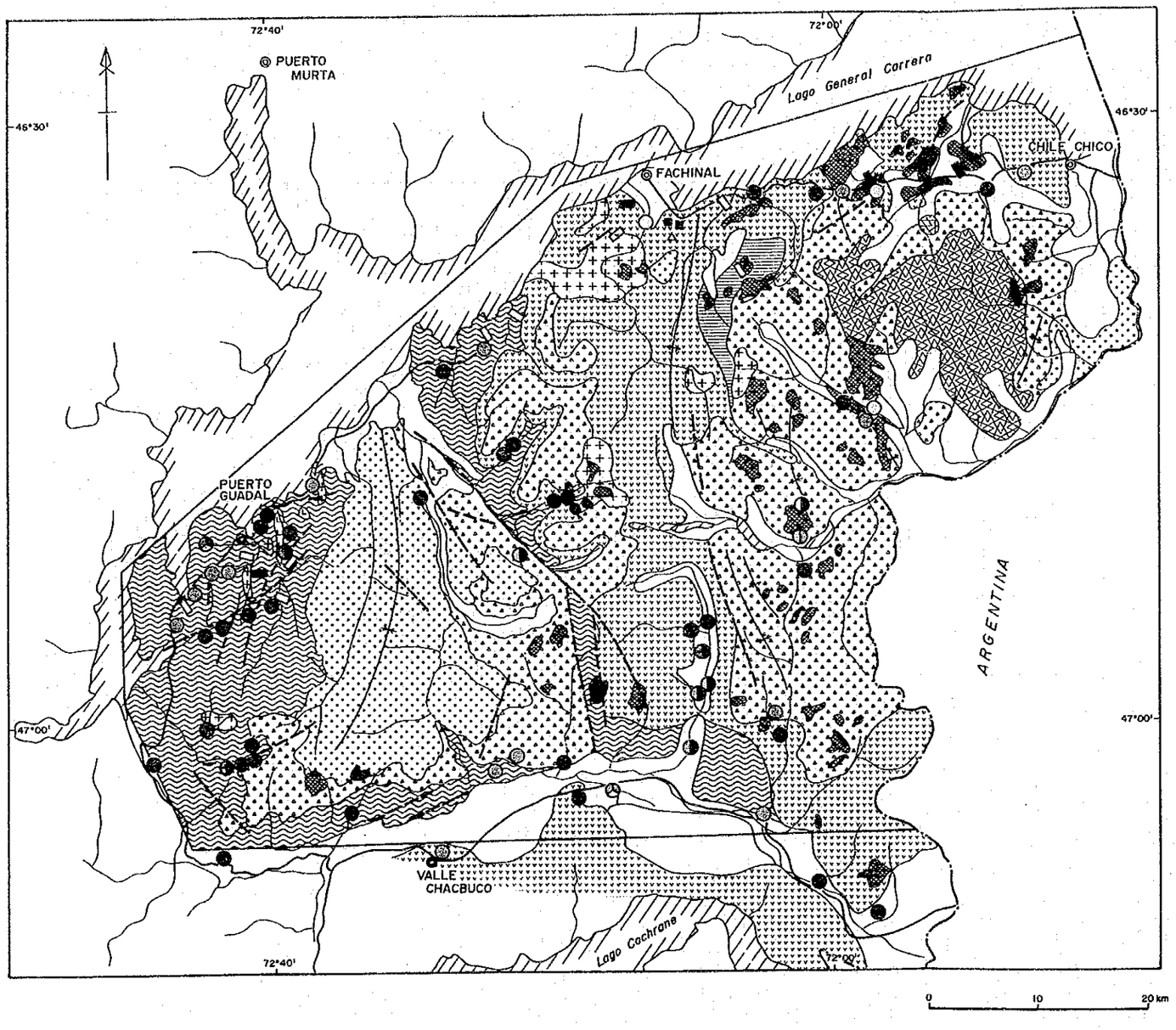
Mesozoic unit consists of the Ibañez the Coyhaique and the Divisadero Formations in ascending order.

The Ibañez Formation overlies Paleozoic unit unconformably in the eastern part of the area. This formation is composed of felsic and intermediate volcanic rocks. Lower portion is predominated by rhyolite and dacitic pyroclastic rocks. Upper portion consists chiefly of andesitic pyroclastic rocks. Age of this formation is reported to be Middle to Late Jurassic time(Skarmeta,1978).

The Coyhaique Formation consists of altenating beds of sandstone and shale of marine origin, and overlies the Ibañez Formation unconformably. Distribution is limited on the central to eastern part of the area. Abundant marine fossils occur in the shale of this formation. This formation intercalates calcareous rocks and conglomerate. This formation is reported to be of Neocomian stage(Skarmeta,1978).

The Divisadero Formation lies on Paleozoic unit and the Ibañez Formation with unconformity, but on the Coyhaique Formation with conformity. This formation occupies two third of this area. Lithofacies, mainly tuffaceous sandstone and rhyolitic or dacitic tuff, grades into andesitic facies toward west. Age of the formation is Aptian to Cenomanian stage(Skarmeta,1978).

The Cenozoic is composed of Tertiary unit and Quaternary unit. Tertiary unit is divided into three formations; the Guadal , the Galera and the Meseta Buenos Aires Formations.



LEGEND

Quaternary		Alluvial, fluvial, colluvial and talus
Tertiary	Meseta Buenos Aires F	Alcalic basaltic lavas
Early Miocene ~ Early Oligocene	Galera F. and Guadal F.	Conglomerates, sandstones, shales and tuffites
Aptian ~ Cenomanian	Divisadero F.	Rhyolitic pyroclastic rocks, rhyolite, andesites and sandstone
Neocomian	Coyhaique F.	Fossiliferous black shales, sandstones Partialy calcareous conglomerates
Late to Middle Jurassic	Ibañez F.	Rhyolite, docite and andesite, and those pyroclastic rocks
Late Paleozoic	Metamorphic basement	Amphibolite, schist, phyllite and quartzite
	Intrusive rocks	Rhyolite and docite
		Granites, tonalites and diorite

Hydrothermal alteration

Fault

Synclinal axes

Anticlinal axes

Vein type deposits, confirmed

Vein type deposits reported

Strata-bound, manto and lenticular type deposits confirmed

Strata-bound, manto and lenticular type deposits, reported

Dissemination and / or stockworks deposits, confirmed

Dissemination and / or stockworks deposits, reported

Geochemical anomalies of 3 phases

Au

Ag

Cu

Pb

Zn

As

Mo

Survey area

Fig. II-9-1 Geological and Geochemical Map of the Chile Chico-Chacabuco Area

The Guadal Formation overlies the Paleozoic unit with angular unconformity and the Divisadero Formation with unconformity of erosion distributed in the east of the Puerto Guadal. This formation overlies the Divisadero Formation unconformably around the Chile - Argentine border,namely the eastern edge of the area. This formation consists mainly of sandstone of marine origin occasionaly intercalated with conglomerate, limestone(micrite and sparite facies), calcareous mudstone and carboneous matter. Niemeyer et al.(1984) led the age of this formation to Later Oligocene to Early Miocene. They thought the sedimentatation took place under a calcareous condition of shallow marine.

The Galera Formation covers Guadal Formation with conformity, but the Divisadero Formation with unconformity. Distribution area covers the western part of this area and the eastern edge of this area. This formation consists of tuff, shale, sandstone and conglomerate. Skarmeta(1976b) led to a conclusion that the age of this formation ranges from Miocene to Early Pliocene.

The Meseta Buenos Aires Formation overlies the Guadal and the Divisadero Formations unconformably in the eastern part of this area. The rock is alkaline basalt forming lava plateau. Absolute ages of this rock, based on dating study by K-Ar method, range from Oligocene to Middle Eocene.

The Quarternary System consists of alluvium, terrace deposit and glacier deposit.

Intermediate to felsic dike rocks and plutonic rocks are distributed in the central and western part of this area. Dike rocks are andesite, rhyolite and dacite. Plutonic rocks are granit, tonalite,quartz diorite and diorite. Intrusion of these rocks took place from late Cretaceous to early Tertiary.

Although some papers reported that geologic structure of the Paleozoic unit is complicated, detailed structure is not revealed yet. Mesozoic formations show gentle folds trending the N-S direction. The Guadal and Galera Formations are distributed in the west showing syncline structure with the N-S direction. The Meseta Buenos Aires Formation is almostly horizontal.

Fault system is predominated by N-S and NW-SSE systems. A part of faults extends upward to the Guadal Formation of Middle to Late Tertiary in age.

9.2. Mineralization

9.2.1. Whole area

Total of 20 mines and prospects are reported in the area. Other than them, some hydrothermal alteration zones are developed with large

gossaneous zone (Fig.Ⅱ-9-1). Geological and mineralogical features of those deposits are compiled in Table 1 of Appendix. No mine is in operation at present and three of them were mined in the past. Two of them are lead-zinc deposit and one is copper deposit.

Those 20 deposits are categorized into four groups on the basis of principal ore metal associations; ten are of lead-zinc, five are of copper, three are of molybdenium and two are of gold. Whereas, fourteen deposits are vein type deposit, four are disseminated deposit and one is not known.

Molybdenium deposits are vein or network vein occuring in stock-shape granitic rocks. They are generally narrow and uncontionuous. Width of vein ranges from 1 to 30cm.

Copper deposits are vein type deposits, and occur in the Paleozoic unit and the Ibañez Formation. Mineralization of this type is represented by the Escondida Mine. This mine is located in about four km south of the Puerto Guadal and was in operation until 1981. The vein is 0.3m wide in average and extends 350m along strike. Other deposits of this type are very small.

Lead-zinc deposits occur as either vein deposit or disseminated deposit developed in the Paleozoic unit and the Ibañez Formation. Vein deposits are represented by the San Sebastian Deposit. A vein extends 325m along strike and 25m toward depth with 0.9m in width occuring in the Paleozoic unit. Ore minerals consist mainly of sphalerite and galena accompanied with chalcopyrite. Gangue mineral is quartz only. Ore grade is relatively high showing 250g/t Ag, 2.19% Cu, 28% Pb and 7.9% Zn.

As to disseminated ore deposits, La Poza deposit is most notable deposit(Fig.Ⅱ-9-2). This deposit consists of disseminated ore in tuffaceous shale occuring concordantly with bedding planes(Fig.Ⅱ-9-3). Principle ore mineral is galena and spharerite is very few. Assay on outcrop of rich ore shows 16% Pb and 182g/t Ag and averagely 4 to 5% Pb.

Many hydrothermal alteration zones accompanied with small amount of gold are developed in the area, while gold deposits are few. The representative gold deposit is called the Laguna Verde Deposit. In the area of this deposit, broard silicification zone is developed. The alteration zone similar to this silicification zones are distributed densely in the eastern part of this area. Twenty-one zones among these zones were investigated in the Phase Ⅱ. The outlines of those results are descrived below. These alteration zones are grouped into nine zones; A to I as shown in Fig.Ⅱ-9-4.

Among these alteration zones, 2 float of quartz vein showing 6.7ppm Au and 1.1%Pb was found in C zone. Geochemical anomalies of Au, Ag, Pb, Zn and As, believed to be derived from C zone, were also detected. Furthrmore geochemical anomalies of Au, Ag, Pb and As were detected in D alteration zone. According to these facts detailed geological survey were carried out for

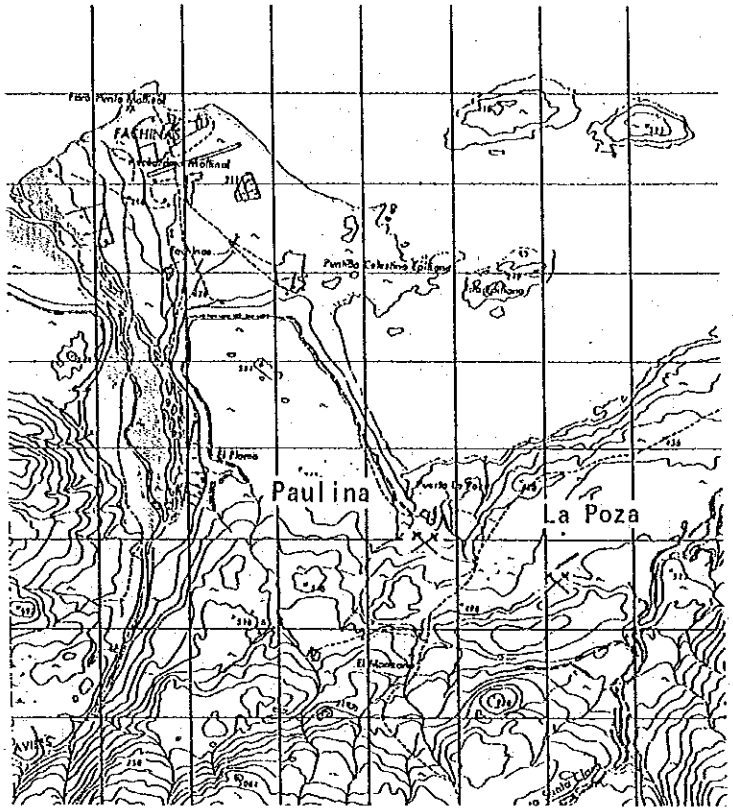
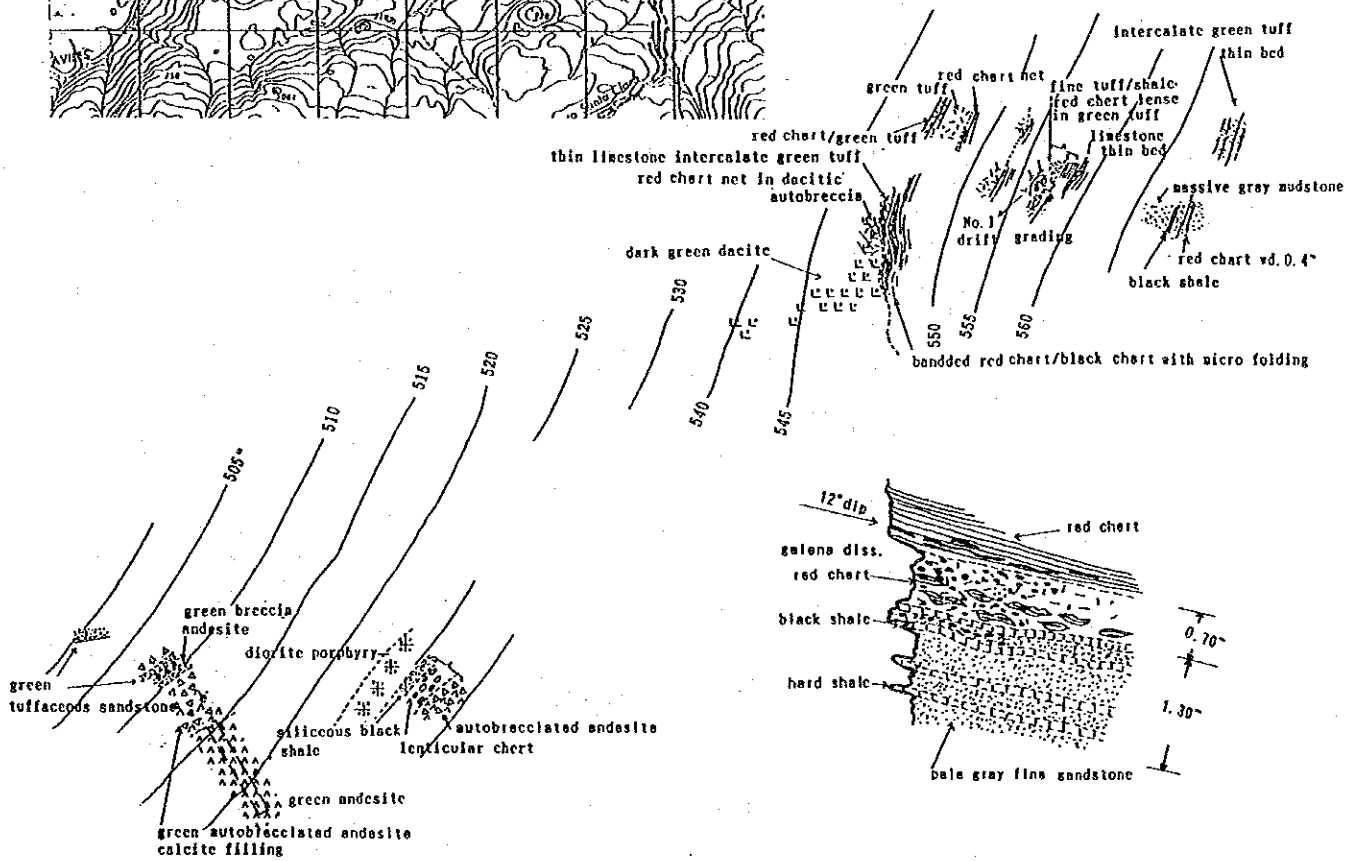


Fig. II-9-2 Location Map of the Paulina and the La Poza Deposits



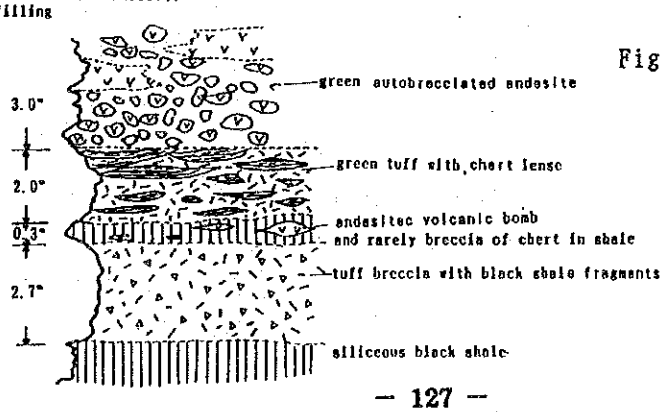


Fig. II-9-3 Geological Sketch of the La Poza Mine Area

these alteration zone in the Phase Ⅲ. The outlines of this results will be mentioned in the next section.

9.2.2. Lake Jeinimeni alteraion zone

Geology around this area is composed of pyroclastic rocks of the Divisadero Formation intruded by dacite, basalt and granite.

(1) Alteration Group C

Alteration Group C is devided into four alteration zoes bordered by unaltered zones. These alteration zones are named Alteration Zones No.1 to No.4(Fig.Ⅱ-9-5). Among them, No.4 Alteration Zone is the most intensive in terms of mineralization and alteration.

This alteration zone is located on the northern shore of Lake Jeinimeni, and extends from east to west. it is separated into two blocks, namely the eastern block and the western block, by unaltered part. The both blocks are developed around the contact with dacite stock and lapilli tuff. The eastern block is estimated to be ca. 700m x 250m and the western one ca. 350m x 100m.

In the both blocks, quartz veilets are developed around the contact of dacite stock, with distribution density of 5 to 6 veins per 1m. Each veinlets is narrower than 1 cm. Veinlets point to various directions without any regurality. A trace of galena disseminations is found rarely in quartz veinlets.

The float of quartz vein that contains 6.7 g/t Au (collected in the Phase Ⅱ) might have been derived from this alteration zone. Analysis results of the samples with quartz vein are shown in the following table.

Analysis Results of Quartz Veinlets

Sample description		Au(ppb)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	S(%)
The West Block							
3TM723	outcrop	0.1ppm	1.0	20	666	385	0.21
3TM715	float	0.2ppm	13.5	30	1.60%	213	0.45
3TM716	float	1.9ppm	17.1	30	0.38%	0.24%	1.84
3TM718	outcrop	<20	0.1	10	38	18	0.01
3Tm731	outcrop	0.8ppm	4.5	40	0.62%	530	0.41
The East Block							
3YM756	float	<20	6.8	<10	183	22	3.70
3YM758	float	<20	0.1	<10	104	83	0.12
3YM765	outcrop	<20	0.8	10	207	414	0.12
3YM766	outcrop	20	0.7	20	0.10%	302	0.11

The host rocks of both blocks are dacite and lapilli tuff. Both rocks underwent weak silicification and argillization, and are accompanied by dissemination of fine-grained pyrite. And also there are observed

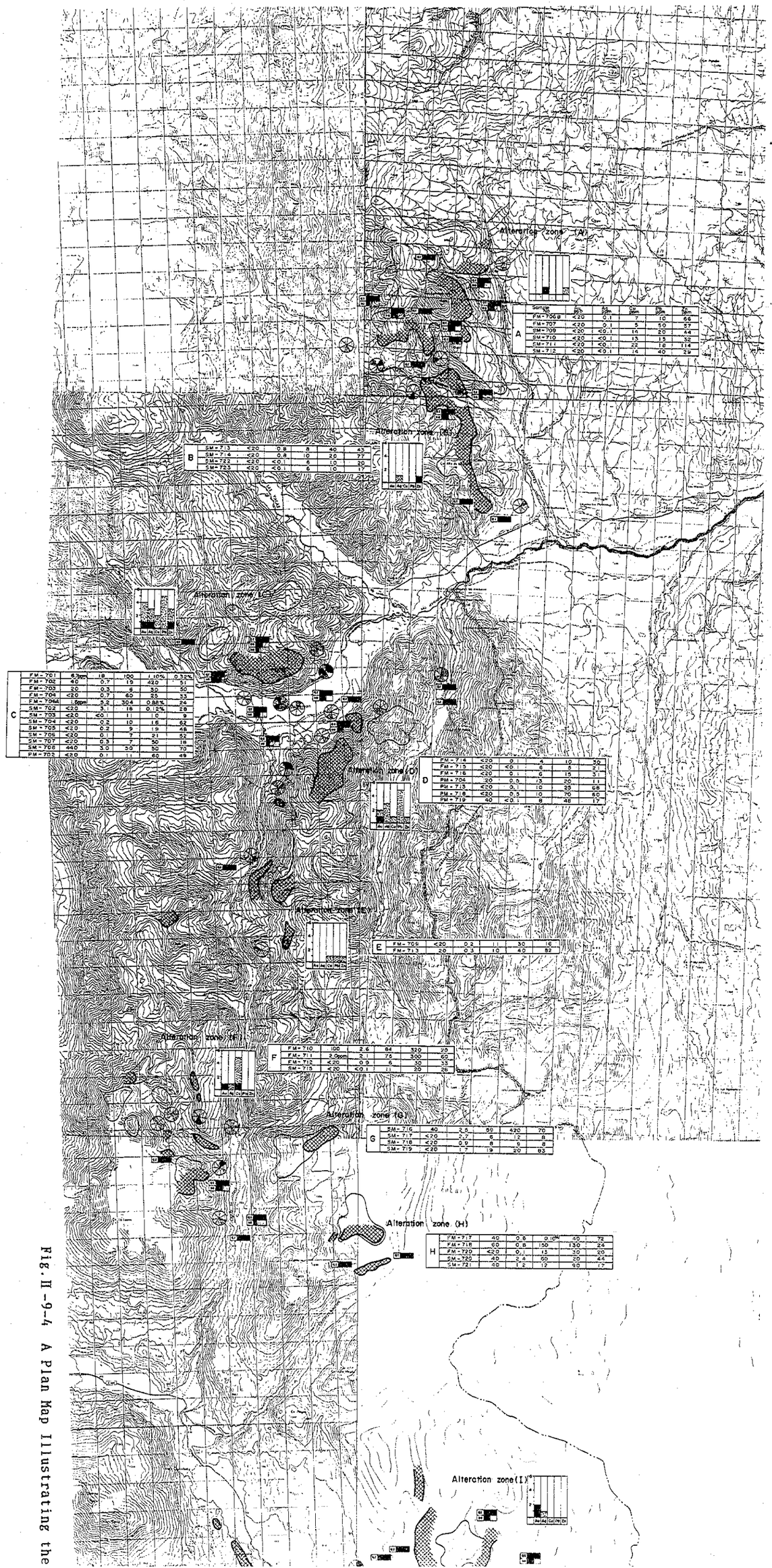
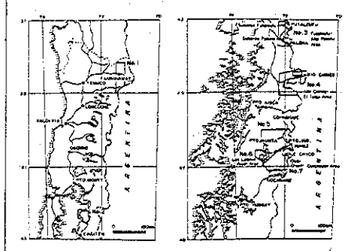


Fig. II-9-4 A Plan Map Illustrating the

PL. 12

THE INVESTIGATION OF MINERAL POTENTIAL
IN THE LOQUIMAY AREA AND REGIONS LOS LAGOS AND AYSEN
PHASE II

DISTRIBUTION MAP OF MINERALIZATION AND ALTERATION ZONE
OF CHILE CHICO-CHACABUCO AREA



FEBRUARY 1994

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

0 4km

LEGEND

: Hydrothermal alteration zone interpreted by Landsat TM image

: Hydrothermal alteration zone confirmed by field survey

Class A geochemical anomaly of Pan Concentrate (dark shading) : M ≥ 23

Au : 223.3ppb≦ Cu : 289ppm≦ Zn : 882ppm≦ As : 281ppm≦
Ag : 4.1ppm≦ Pb : 3,947ppm≦ Mo : 5.8ppm≦

Class B geochemical anomaly of Pan Concentrate (dot)
M = 19≦ , M < 23

Au : 64.1ppb ≦ , < 223.3 ppb Mo : 2.3ppm ≦ , < 5.8ppm
Ag : 1.63 ppm ≦ , < 4.1 ppm As : 75 ppm ≦ , < 281 ppm
Cu : 77 ppm ≦ , < 289 ppm
Pb : 782 ppm ≦ , < 3,947 ppm

: Number of class A geochemical anomaly on each alteration zone

: Number of class B geochemical anomaly on each alteration zone

qz : Principal alteration mineral assemblage determined by X-ray diffraction analysis and these peak intensities
strong
medium
weak
qz : quartz
Se : sericite
Ka : kaoline minerals

FM-701 : Ore assays

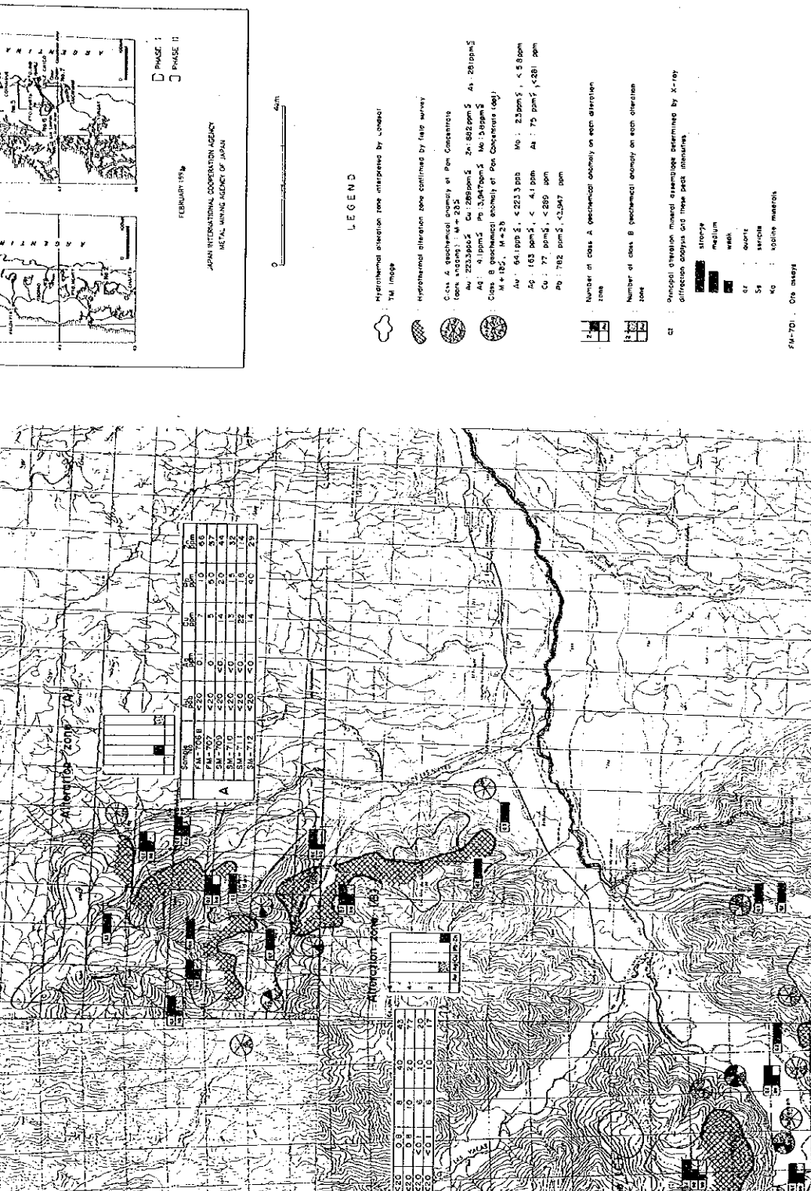
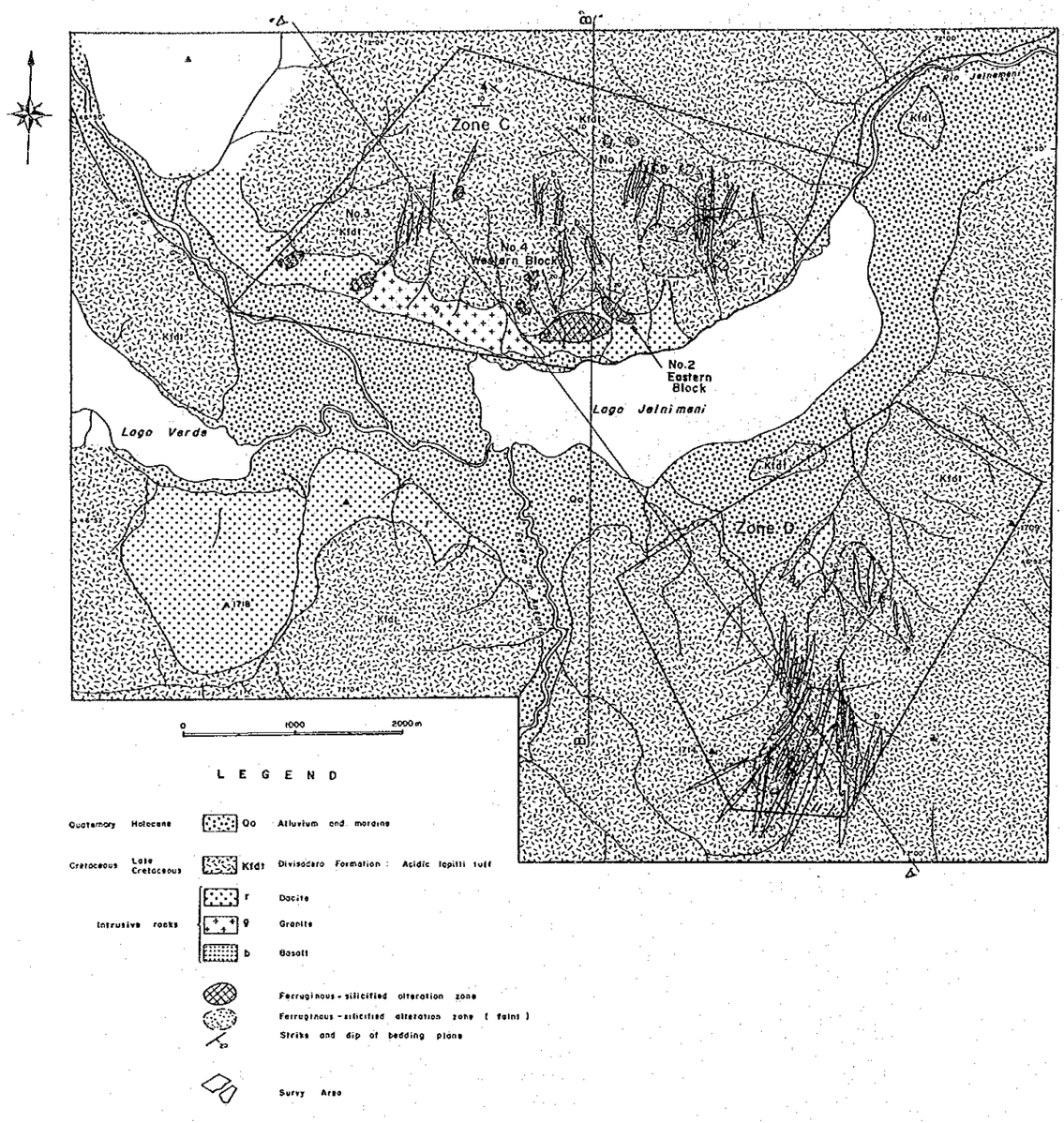


Fig.II-9-4 A Plan Map Illustrating the Results of the Surface Survey



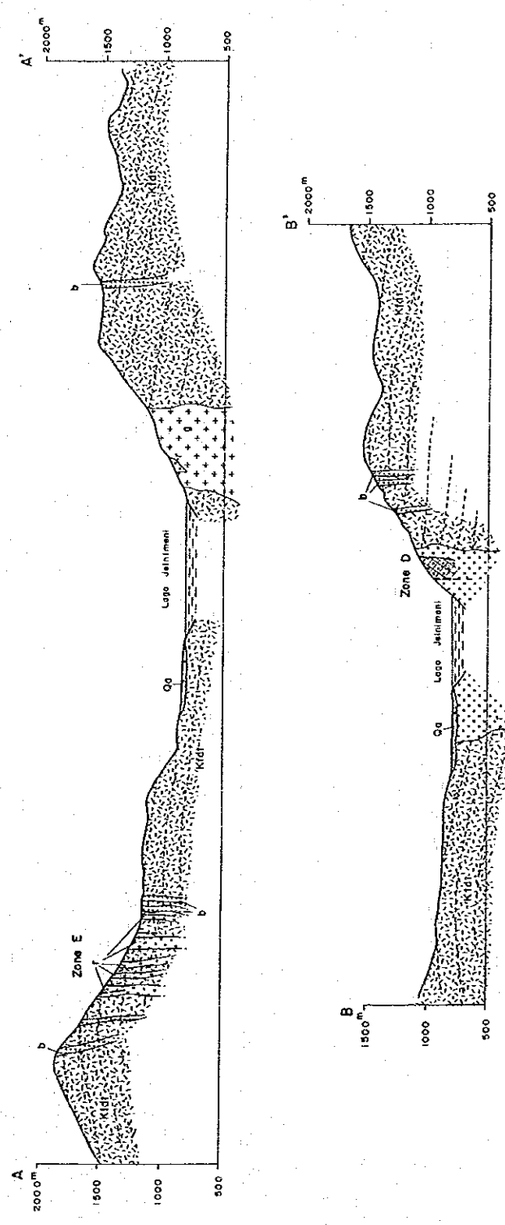


Fig. II -9-5 Geological Map of the Chile Chico-Chacabco Area
(Lake Jeinimeni Alteration Zone)

dissemination or stockwork of limonite and hematite, generally tinged with brown. The contents of each element is very low in the altered rocks. Alteration products are mainly quartz and often accompanied with a small amount of sericite.

(2) Alteration Group D

This alteration group is developed in the area around dacite dikes and lies on the oval area (2.5km x 1km) with the same direction of elongation as dikes. Minute pyrite disseminations are always found and no quartz vein is observed in this alteration group.

The outcrops of this alteration group look brown due to dissemination or stockwork of secondary oxide minerals such as limonite and hematite. The analysis results of representative altered rocks are as shown in below.

Analysis Results of Altered Rocks

Sample description		Auppb)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	S(%)
3TH740	outcrop	<20	0.2	<10	39	206	0.01
3TH746	outcrop	<20	0.1	<10	12	91	0.01
3YH775	outcrop	20	0.5	30	8	26	0.37
3YH780	outcrop	<20	0.1	10	13	25	0.02

As shown the above, usefull metal elements are not almostly contained in the samples. The minerals identified by X-ray diffraction are composed of many amount of quartz and plagioclase, and a small amount of sericite. Abundant existence of primary plagioclase constituting the host rocks means that alteration was weak.

9.3. Geochemical Exploration

9.3.1. Stream sediment geochemistry

(1) Sampling and chemical analysis

Geochemical exploration of stream sediments was carried out for two Phases; the Phase I and the Phase II. In the Phase I, that was done chiefly in the southern part of the area and 60 samples were taken. In the Phase III, 162 samples were collected on the western part of the area. Samples of each phase were analized by Chemex Lab. Inc. of Canada.

(2) Anomalous values and zone

1) Threshold

Threshold values are varied by each phase as shown in the following table. The threshold valeues of Cu and As are fixed at the break point on

cumulative frequency curve. The others are calculated by $M + 2\sigma$.

Threshold Value for each Element

Element	Phase I	Phase III
Au(ppb)	all<20	3
Ag(ppm)	0.38	0.1
Cu(ppm)	48.53	35
Pb(ppm)	54.52	36
Zn(ppm)	155.80	242
Mo(ppm)	0.98	-
As(ppm)	18.20	59

2) Anomaulous zones

Numbers of the anomalous value of each element, detected by the above methods, are listed in following Table

Number of the Anomalous Value

Element	Phase I	Phase III
Au	0	11
Ag	4	11
Cu	1	4
Pb	2	4
Zn	2	8
Mo	2	-
As	9	4

The Anomalous zones of the Phase I

The anomalies of Ag were detected gatheringly in the areas of the Chacabuco River and the Arellanos River. The anomalies of the other elements are distributed sporadically(Fig. II-9-1).

The Anomalous zones of the Phase III

Au anomalies were detected gatheringly in the areas to the south of puerto Guadal and of upper reaches of the Bertrand River(Fig. II-9-1).

Zn anomalies were also detected in the area to the south west of puerto Gadal.

Anomalies of As are detected gatheringly, accompanied with Au anomalies.

Anomalies of the other elements are distributed sporadically.

9.3.2. Pan concentrate geochemistry

(1) Sampling and chemical analysis

Samples were collected on the identical sample points to those of stream sediments in the Phase I and in the alteration zones of the eastern part of the area in the Phase II.

Number of samples is total 117; 60 in the Phase I and 57 in the Phase II. The elements analized are 3 in the Phase I; Au, Ag, Pb and 7 in the Phase II; Au, Ag, Cu, Pb, Zn, Mo, As. These samples were analized by SERNAGEOMIN laboratory.

(2) Geochemical anomalous values and anomalous zone

1) Threshold

The threshold of Au was fixed at the break point on cumulative frequency curve and those of the other elements are calculated by $M + 2\sigma$. Thresholds calculated are listed below.

Threshold

Element	Phase I	Phase II
Au	1.033μg	223.3ppb
Ag	43.963μg	4.1ppm
Pb	9.013 mg	3947 ppm
Cu	-	289 ppm
Zn	-	882 ppm
Mo	-	5.8ppm
As	-	281 ppm

2) Geochemical anomalies

Anomalous values detected by the above methods are as follows:-

Number of Anomalous Values

Element	Phase I	Phase II
Au	6	5
Ag	1	2
Pb	2	0
Cu	-	1
Zn	-	2
Mo	-	2
As	-	1

Au anomalies were detected densely in the areas of upper reaches of the

Aviles River, around Lake Jeinimeni and between Chile Chico and Fachinal(Ⅱ-9-1).

9.3.3. Summary

The geochemical anomalies obtained in three phases were shown in Fig.Ⅱ-9-1. As shown in Fig.Ⅱ-9-1, Au anomalies are distributed densely in the areas from the Laguna Verde Deposit situated in the eastern part of the area where the aletration zones are developed, accompanied with the anomalies of Pb and As. The anomalies of Au and As are also sporadically distributed in the area of the Chacabuco River.

9.4. Conclusions

Only at one locality the calcareous schists were confirmed despite the wide distribution of the basement metamorphics in this area resulted in almost no Pb-Zn mineral potential of the Silva type. The Cu-Pb-Zn vein type deposits hosted by either the basement metamorphics or the Ibañez and Divisadero Formations may occur in this area, but they must have small potentiality in view of the features of known mines and mineral indications.

There is no mineral potential in the middle of this area where the post-mineralization Tertiary marine sediments are widely distributed.

Lake Jeinimei Alteration Zones(C and D alteration zone) are of epithermal type based on alteration mineral assemblage and are accompanied by local weak gold lead mineralizations. The density of quartz vein is low and the area of these quartz veins is narrow(200x200m).

D zone is silicification zone with pyrite dissemination. In this zone, no quartz vein is recognized and useful metal contents are very low. It is inferred that contents of gold were a small amount in mineralizing solution of this zone. Therefore, it is concluded that the mineralization takes unlikely a turn for the better downward.

The other alteration zones are more inferior in mineralization and alteration than C and D zones, and it is concluded that the potentiality of the existence of ore deposit is low. However, there is unknown the potentiality of alteration zones in the private claims that were not objected in this survey.

9.5. Recommendations

The Lake Jeinimeni Alteration Zone and A to I alteration zones themselves do not warrant further exploration because the mineralization is faint and is not believed to be improved underground.

The eastern part of the area, however, is situated at the southern extension of the "Au-Ag" belt mentioned before. Therefore, emphasis of future exploration is placed on the Au-Ag belt in the area of Devisadero Formation between Lake General Carrera and the Chacabuco River.

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APPENDIX

An attachment to the Table 1 and 2

ABBREVIATIONS USED IN THE TABLE

Mineralogy

Ag-tet:silver bearing tetrahedrite
apy:arsenopyrite
bn:bornite
cc:chalcocite
cov:coveline
cp:chalcopyrite
Cu-oxi:copper oxide minerals
gn:galena
ht:hematite
mol:molybdenite
mt:magnetite
po:pyrrohotite
py:pyrite
sche:scheelite
sp:sphalerite
wol:wolframite

bar:barite
cal:calcite
chl:chlorite or chloritization
qz:quartz
ser:sericite or sericitization
arg:argilization
limo:limonite

Petrology

and:andesite
apl:aplite
gr:granite
ker:keratophyre
ls:limestone
peg:pegmatite
phy:phyllite
sch:schist
int:intrusion
volc:volcanic

General

na:not available
Mt:milliontonnes
Kt:kilotonnes
EMA:Empresa Minera de Aysen
aprox:approximately

Table 1 List of the Mineral Prospects and Mines in the Survey Area(1)

Area No.1 Lonquimay area

No.	Prospect and Mine	lat ˢ / lon ᵂ	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Alteration	Exploration & Production	Title holder※
1-1	Galletué mineralized zone	38°42′36″ / 71°19′19″	Cu,Mo	cp,py,mol, (mt,po,sp)	Disseminated + Stockwork + veinlet (Porphry Cu-Mo deposit)		1kmx0.5km	Stockwork-disseminated ore(average value)		0.12			23	Tonalite	qz-ser (inner zone) and chl-epi (outer zone)	Geological, geochemical survey and IP(28.2km)+ drilling(8 holes,1334m) by MMAJ	no
								at max:		0.43			1700				
								Veinlet sample (average value)		0.14			54				
								at max.		0.82			730				
1-2	Rio Qinquen	38°34′05″ / 71°22′10″	Fe,Cu	mt,cp,po,ht / qz	Stockwork-Disseminated		250x300m ;extention of alteration zone	40 ppb	0.9	0.07	-	-	8	Quartz diorite	sil+ arg	Geological, geochemical survey(MMAJ)	no
								"-"express "<0.01%"									
1-3	Estero El Saltilo	38°35′26″ / 71°21′23″	Fe	po	Disseminated		500x300m							Shale and sandstone	ditto	ditto	no
1-4	Estero Cajin Chico	38°35′29″	Fe	py(po+cp)	Veinlet and disseminated along beds		400x300m	<40 ppb	0.4	0.02	-	0.01		Sandstone and shale	ditto	ditto	no
1-5	Mallín del Torro	38°40′16″ / 71°25′29″	Fe	py,po(cp)	Disseminated		800x1000m							Shale and sandstone	sil+ chl	ditto	no
1-6	La Fusta	38°35′32″ / 71°26′41″	Fe	py	ditto		100mx300m; extention of alteration zone	<40 ppb	<0.2	-	-	-	8	Gneiss	sil+ ser	ditto	no
1-7	Rio Pacunto	38°32′ / 71°19′		po,py,cp, free Au? / qz	Veinlets	N30E	Each veins are 1 to 5cm wide extending 5-10m along strike Width of mineralized zone is 2km	38 g/t	9.1	0.07	-	-	12	Quartz-diorite	sil+ chl	No work,but trenching and shallow shaft were tried to skarn deposit in vicinity. Preliminary geochemical work as well	

*: expressed as g/t for Au and Ag ,and as % for others

※: not defined as the exploration title or the mining title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(2)

Area No.1 Lonquimay area(continued)

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Altera-tion	Exploration & Production	Title holder※
1-8	Cordillera Lonquimay	38°32'04" / 71°21'41"	Fe	cp,mt / qz	Vein single vein	N50W 75N	Very small	<40 ppb	0.3	-	-	-	9	Shale and sandstone	no	Geological, Geochemical work(preli-minary)	no
1-9	Estero Huemules	38°32'32" / 71°21'14"	Fe	py / qz	Vein	N20E 80W	4 veins are recognized	<40 ppb	<0.2	-	-	-	5	Tonalite	sil+ ser	ditto	no

"-" express <0.01%

Area No 3 Futaleufu-Alto Palena area

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade *	Country rock	Altera-tion	Exploration & Production	Title holder※
3-1	Anomalia 1 de Cobre	43°11' / 71°53'	Cu	cp,ht	Vein		3m wide, 20m along strike Extention of 40m to depth is expected Ore reserve of 6,000t @ 2.97% Cu is expected	No assay data on outcrop	na	na	no	no

*: expressed as g/t for Au and Ag ,and as % for others

※: not defined as the exploration title or the mining title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(3)

Area No.4 Alto Cisnes-El Toqui area

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Altera-tion	Exploration & Production	Title holder※
4-1	Cerro Estatuas	45° 02′ 00″ / 71° 58′ 05″	Cu-Pb-Zn -(Ag)	sp,cp,gn,py / gangue:na	Manto	E-W dip:na	Composed of 5 ore bodys:- 1:2x35m 2:Upper;2x40m Lower;3.7x50m 3:Upper;3x70m Lower;7.4x70m 4:Upper;4x18m Middle;7.8x40m Lower;4x38m 5:Upper;1.5x?m Middle;7x200m Lower;2x250m Ore reserves:- Proven:1.5Mt Probable+possible:3.6Mt Grade:na Further 5 Mt as potential	average ore grade 0.5	183	0.7	4.5	12	-	Lava,trachytic tuff and metasediment (Ibañez Fm.)	na	・Room and Pillar ・Exploration :na	Sociedad Contractual Minera Toqui
4-2	Rio Correntoso	45° 28′ / 72° 16′	Mo-Cu +(U-Pb)	mol,cp / gangue:na	Vein	N60-70E/ 90-70NW	0.3m^{wd} (max.) 20m in strike	not available 0.12 to 4% as U_3O_8						Granitic rock partly with apl. +peg.	na	na	na
4-13	Lago Atravesado	45° 41′ 51″ / 72° 15′ 41″	Pb-Cu-Zn	py,gn,cp, Cu-oxi / gangue:na	Vein	N-S/80E and E-W/75E	2 veins recognized;30cm and 5cm wide. Strike length: na	-	2.9	0.16	700-525>ppm	-	-	Andesite lava+dacitic intrusion in gr. (Ibañez Fm.)	Ser+Arg	na	na
								rock chip samples of altered rock									

*: expressed as g/t for Au and Ag ,and as % for others

※: not defined as the exploration title or the mining title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(4)

Area No.4 Alto Cisnes-El Toqui

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Alteration	Exploration & Production	Title holder※
4-3	Santa Teresa (El Condor or Katterfeld I)	44°45′48″ 71°55′52″	Cu-Pb-Zn Au-Ag	cp,sp,gn,py / qz	vein	N35-45E 40S	1-3m in wd. 120m in strike	64 65	465 na	0.25 1.1	21.4 40.4	0.05 5.3	- -	Dioritic rock	na	na	Carmen Reyes
								(2 samples)									
4-4	Mina el Toqui	45°01′ 71°54′	Cu-Pb Zn-(Ag)	Mantos:sp, cp,gn,py Veins:gn,sp, cp / gangue:na	Manto and vein characteristic features of the each type are not known.	N-S dip:na	Extention of deposit:na Ore reserves: proven;1.5 Mt probable+possible:3.6 Mt potential; 5Mt (The El Toqui composes of several ore-bodies,such as San Antonio, Zuñiga,Estatuas ,Antolín and Concordia) The above figures show the sum of ore reserves of some deposits.	-	183	0.7	4.5	12	-	Altered tuff +volc.rocks of Ibanez Fm	na	Exploration: na The mine started production with the Mina Ketterfeld in early1983. On the June, 1984,production achieved to: 38,000t of Zn conc.@54%Zn 5,000t of Pb conc.@60%Pb 2,500t of Cu conc.@25%Cu	Sociedad Contructural Minera Toqui
								Averaged grade with ore grade of Cerro Estatuas combined									
4-5	Mina Katter Feld (Nirehuao)	45°05′00″ 71°35′00″	Cu-Pb-Zn -(Au-Ag)	cp,sp,gn / qz	vein with some parallel veins	N20-35E 80W	1-4m in wd. 29m in strike Ore reserves: proven;30,000t probable+possible:60,000t potential; 12Mt ore grades:na	4	150	1.89	2	4	-	Andesite of Ibañez Fm. and Int.of diorite.	ser.	exploration: na production: start:1959 In the summer of 1983,under the control of the Mina Toqui.	ditto
								(Mean value)									

*: expressed as g/t for Au and Ag, and as % for others

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Table 1 List of the Mineral Prospects and Mines in the Survey Area(5)

Area No.4 Alto Cisnes-El Toqui area(continued)

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Altera-tion	Exploration & Production	Title holder※
4-6	Veta Campamento or Estancia Cisnes	44°34′ 71°25′	Cu,Mo	cp,mol / qz,ht	Vein	N10W 35E	0.15-0.25m wide 25cm in strike	na	na	0.0 to 1.1 (3 samples)	na	na	0.0 to 0.4	Granite-granodiorite	na	na	na
4-7	Estancia Cisnes	44°25′ 71°23′	Cu	Cu-oxi / ht	Disseminated	na	na	na						Andesite	na	na	na
4-8	Campo Grande	44°56′ 72°04′	Pb	gn / gangue:na	Vein	N50W 90	na	na						Sedimentary rock(upper Jurassic or lower Cretaceous)	sil py	na	na
4-9	Rio Cisnes entre Rio Pedregoso y Estero Solis	44°37′30″ 71°37′30″	Mo	na	Vein?	na	na	na						Granite	na	na	na
4-10	Rio Cisnes entre Rio Pedregoso y Estero Buitre	44°36′04″ 71°35′03″	Mo	mol,py,cp, apy / qz	Vein	N55-70E 60-70SE and N70W 45S	1-15cm wide 30m in strike	20↑	0.1	35↑	137↑	40↑	0.2	Diorite	na	na	na
4-11	Puerto Cisnes	44°45′ 71°37′	Fe	ht,cp	Disseminated	na	na	20↑	0.9	338↑	34↑	324↑	26↑	Traignén Fm. (Petrology: na)	na	na	na
								Fe;20.6% Max.grades from 18 samples									
4-12	Arroyo de los Canelos (Cisnes Medio)	44°47′ 71°58′	Cu	py,cp,ht	Lense-shaped	na	Max. 2m²	<20↑	0.1 to 0.5	79 to 700↑	29 to 38↑	<140↑	<2	Lava(Divisadero Fm)	sil	na	na

*: expressed as g/t for Au and Ag, and % for the others

↑: expressed as ppm

※: not defined as the exploration title or the mining title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(6)

Area No.5 Ibanes-Murta area

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Alteration	Exploration & Production	Tenement holder¥
5-1	Rio Huina	46°19'22" / 72°47'52"	Cu	cp / qz	qz vein	na	wd.0.4m	na						na	na	na	na
5-2	Cerro El Coco	46°22'00" / 72°47'51"	Cu(-Pb)	cp,gn,py,po / fine-qz	vein(lense-shaped)	N25-50°W 60°E	wd.2m(max.) 1m(av.)	-	-	2.74	-	-	-	In contact of gr+and.	na	Trenching	na
5-3	Veta Perez	46°31'51" / 72°45'37"	Pb-Zn	gn,sp / gangue:na	ditto	N20W-NS/ 25W	wd.0.4m(max) 10m(visible), 500m(possible) in strike	na						In contact of ls.+granitic apl.	na	na	na
5-4	Veta Dionisio Villarreta	46°23'45" / 72°38'57"	Cu	po,cp,py / qz	vein	N25E/ 85N	0.2-1.5m in wd. 7-10m in strike	-	-	3.67 and 21.7	-	-	-	qz porphry and greenschist	ka	na	na
5-5	Rio Resbalon	46°24'56" / 72°36'07"	Cu	py,cp / qz,chl	vein (2veins recognized)	N10W/85W N70E/90	0.4m in wd. (each) 5m and 1m in strike	-	-	15.1 (selected sampele from the rich part)	-	-	-	Phyllite	na	na	na
5-6	Felix Barria	46°28'56" / 72°38'31"	Cu	py / qz,chl	vein	N45E/ subvertical to E	0.1-1m in wd. 15m in strike	-	-	4.26	-	-	-	Metamorphic rock	na	na	na
5-7	Mina Cerro Castillo	46°05'11" / 72°12'55"	Mo-Cu-Pb (-W-U)	ht,mt,py, mol,cp,gn +trace of wol,radioactive min. / gangue:na	veinlet	na	5-15cm in wd. 20m(max.)in strike and 15m in depth veinlets with 3-5m spacing	na						Intrusion of granodiorite into volcanic sequence (Ibañez Fm.)	na	na	na
5-8	Mina Las Chivas	46°33'40" / 72°32'48"	Cu	cp,py / qz,cal	veins	N10-30 70-90W	1.5m in av.wd. (0.2-6.0m) 1,700m in strike 100m in depth	na						mica sch. +phyllite There are pre and/or post mineralization faults.	na	2,200m adits in 8 levels	EMA

*: expressed as g/t for Au and Ag, and as % for the others.

¥: not defined as mining title or exploration title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(7)

Area No.5 Ibanes-Murta area(continued)

No.	Prospect and Mine	lat S / lon W	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Alteration	Exploration & Production	Title holder※
5-8	Mina Las Chivas (continued)						Ore reservbes proven:8,000t @2%Cu low grade ore; 3,000t@1.5-2% possible; 20,000t@1.5-2%									Roechmann spent US$0.6M for explo-ration(IP) to have obtained ore reserve 0.1Mt@ more than 4% Cu	
5-9	Mina El Pelado	46°31′37″ 72°29′55″	Pb-Zn (Ag-Cu)	gn,sp+minor py,cp / gangue:na	Manto	N40W/ 20-30NW	na for thick-ness.200m in strike. Ore reserves probable:4.5Kt possible:20Kt	-	120	0.5	4	12-13	-	Marble. Contact with grey phy. is dislocated by faults.	na	adit and 10 drills (360m in total) production apx.8,000t annual@4%Pb. 8%Zn and 150 g/tAg.	ditto
5-10 to 5-19	Mina Silva	46°32′50″ 72°24′55″	Pb-Zn	sp,gn+minor Ag-tet,cp,py apy / cal,qz	irregular massive Vertical zoning is recognized: upper;Pb>Zn lower;Zn>Pb	N30E/ 15N	wd.and length :variable apx.500-3000m³ in volume of each ore body	na	na	na	4.5	12	na	Ls(Pz) with 1,000m thickness	na	development: 6,000m adits in total were devel-ped in nine levels. production: -1968: 233,000tPb ore -1980: 105,000t in 1980 9,432t@4.8%Pb 10.4%Zn	EMA

crude ore grade ?

Outcrop(after MMAJ. 1979)†;expressed as ppm

wdM	Ag†	Cu	Pb	Zn
4.0	8.3	157†	272†	4.60
5.0	81	535†	1.65	26.40
1.5	<0.5	8†	<20†	220†
3.0	1.1	10†	20†	480†
na	na	6†	<15†	60†
3.2	7	76†	102†	2.0
0.5	175	910†	4.42	230†
1.3	198	0.13	305†	12.9
1.5	198	910†	615†	48.6
4.0	81	0.12	2.05	25.30

*: expressed as g/t for Au and Ag, and as % for the others.

※: not defined as the exploration title or the mining title

Table 1 List of the Mineral Prospects and Mines in the Survey Area(8)

Area No.5 Ibanes-Murta area(continued)

No.	Prospect and Mine	lat ˢ / lon ᵂ	Ore metals	Ore mineral / Gangue min.	Features of deposit	strike / dip	Size of deposit	Ore grade * Au	Ag	Cu	Pb	Zn	Mo	Country rock	Alteration	Exploration & Production	Title holder※
5-20 (a)	Veta Anita (Rio Avellanos I)	46°27′53″ / 72°12′47″	Cu-(Pb)	py,apy,cp po,gn / gangue:na	vein	N20W 50SW	0.6m in wd.	-	-	13	-	-	-	Sodium Trachyete (ibáñez Fm.)	na	Exploration adit(duration + amount:na)	ditto
5-20 (b)	Rio Avellanos II	46°29′32″ / 72°10′23″	Au-Cu	free gold / qz	vein	na	1m in wd.	20	-	4-5	-	-	-	Qz keratophyer (Ibáñez Fm.)	na	na	ditto
5-21	Mina Casca O Cascara	46°21′20″ / 72°01′14″	Cu-Pb-Zn	cp,gn,sp,py / qz	vein	N40E dip:na	wd.:na 200m in strike	na						Lava (Ibáñez Fm.)	sil	adit of apx. 70m	ditto
5-22	San Jose de Ibañez	46°18′04″ / 71°58′11″	Cu-Pb-Zn	vein1:cp,py cal; vein2:gn,cp, py,sp qz,cal; vein3:cp,py gn / gangue:na	vein	na	3 veins recognized: vein1;0.3m wd. vein2;0.1-0.6m in wd, 2m in strike vein3;vesicular shaped	na						Tuffs of Ibañez Fm.	na	na	Jose Domingo Parra (Puerto Ibañez)
5-23	Mina Long	46°20′48″ / 71°59′16″	Pb-Zn	sp,gn / cal	Manto	N30W 15SW	0.1-0.7m thick 25-30m in strike, 10m in depth Ore reserves: proven:1,000t	na						Andesite lava(Ibañez Fm.)	na	Workings on 2 horizons of 30m in total. Otherwise, various short adits.	EMA
5-24	Prospecto Cerro Castillo	46°05′18″ / 72°10′18″	Cu	py,cp,po, mt,ht	Disseminated		Extention: Sector north: 1,100x250m Sector south: 800x150m	na						Int.of granodiorite in volcanic sequence of Ibañez Fm.	qz-ser	na	na
5-25	Mina Fenix	46°08′03″ / 72°08′08″	Pb-Zn -(Cu)	sp,gn,cov, py / qz,cal	vein 2 lense-shaped ore pockets recognized	N-S to N15W/90	0.2-1.85m in wd. 300m in strike proven(minable) :2,952t@5.5%Zn probable:6,600t @ 3%Pb+5%Zn	-	-	-	1.21	6.2	-	Tufaceous sedimentary rock+andesitic lava. Qz veins in sediments.	limo	na	na

*: expressed as g/t for Au and Ag, and as % for the others.

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