sulfur isotopic composition is Canyon Diablo Troilite (CDT). It is known that the sulfur isotopic composition in igneous rocks is relatively close to 0‰ of the standard and shows a narrow variation. Therefore, the value of galena, -0.3‰, indicates that sulfur originated in igneous rocks.

10) Assessment

Maria deposits are located in this district. It is considered from the sulfur isotopic composition that vein deposits of lead and zinc were formed by magmatic activity. However, the veins are network type and the scale seems not to be large. Gold grades are low. In addition, host rock andesite is propylitic of green color, and contents of the As, Sb and Hg of indicator elements are low. Therefore, it is considered that there were not significant hydrothermal activities. For these reasons, this district is considered to have a low possibility that promising ore deposits will be discovered.

3-2-12 El Bolson district

1) Location

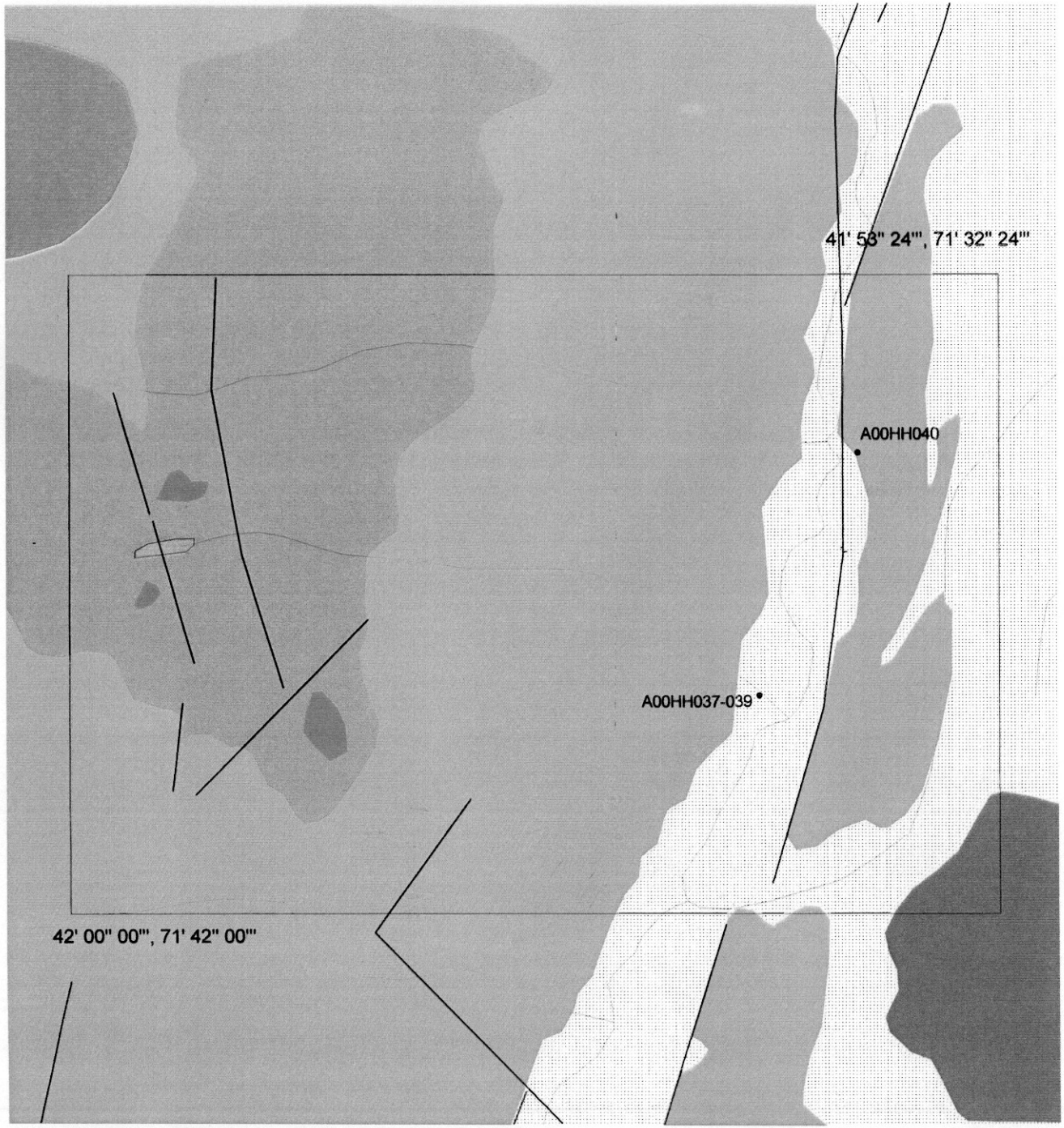
This district is located in the west of El Bolson city, in the southwest of Rio Negro province (Fig. II-3-1). The area is lat. 41° 53' 24" to 42° 00' 00" S and long. 71° 32' 24" to 71° 42' 00" W (Fig. II-3-2-12a), and about 200 km^2. The hydrothermal alteration zones, SB022 to SB024, were extracted by satellite image analysis (Fig. II-2-15). The representative coordinate is lat. 41° 58' 05.9" S and long. 71° 34' 30.0" W at the sampling point of A00HH037 at Rio Lindo riverside.

2) Topography and vegetation

Topography of this district is steep sloped mountains that form the main ranges of Cordillera de los Andes with altitude of 1,800 to 2,200 m above sea level. The slopes, which are visible from the El Bolson city, are steep precipices. This district has a cold and humid climate. Deep snow accumulates in winter. Rivers have a large quantity of water all the year round. There are also many lakes. This district has rich vegetation with woods spreading from Parque Nacional de Nahuel Huapi in the north.

3) Access

The hydrothermal alteration zones extracted by the satellite image analysis are located in the mountains with steep slopes. It takes more than one day by horse to reach the site. As we did not have enough time, we only investigated the floats at the riversides of Rio Azul and its branch Rio Lindo. The survey site is about 30 minutes by car from El Bolson city.



N

Known deposit
Sampling point
Lineament
Circular structure
River
Lake

Legend

Quaternary sediments
Pliocene to Pleistocene basalt
Tertiary sedimentary rocks
Tertiary volcanic rocks
Tertiary granitoids
Jurassic to Cretaceous sedimentary rocks
Jurassic to Cretaceous volcanic rocks
Jurassic to Cretaceous granitoids
Permian to Triassic igneous rocks
Carboniferous sedimentary rocks
Proterozoic metamorphic rocks
Alteration zone

2 0 2 4 Kilometers

Fig. II-3-2-12a Geologocal map with sampling points of the El Bolson district.

4) Previous surveys

Lizuain (1981) reported K-Ar radiometric dating results for granitic rocks in Lago Puelo in south of this district. Fourteen samples, which were diorite, granite, granodiorite or tonalite, showed a wide age range from 37±2 Ma (Paleogene) to 380±15 Ma (Devonian).

Marquez et al.(1989) reported that andesite dikes in granite rocks of Cerro Lindo located at the headwaters of Rio Lindo are accompanied by mineralization of pyrite and chalcopyrite .

Gelogía y Recursos Minerals del Sector Rionegrino de las "HOJA4172-IV. San Carlos de Bariloche y 4172-II, San Martin de los Andes" is published by Dirección de Minería de Río Negro y SEGEMAR in 1999. This report is one of comprehensive studies on geology and mineralization for the area including this district. However, there are only a few remarks on the western mountains of the El Bolson city where this district is located. It is said that alluvial gold mining was attempted in the Rio Azul near El Bolson.

5) Mining properties

No mining properties are established in this district.

6) Geology and geological structure

The geology of this district comprises, in ascending order, Osta Arena formation of Jurassic sedimentary rocks, Divisadero formation of Cretaceous volcanics, Cretaceous granitoids, Ventana formation of Paleogene volcanics, and Quaternary glacial sediments and alluvium. Among them, Cretaceous granitoids are distributed most widely. Granite and granodiorite are frequently recognized as floats at the riversides.

7) Mineralization and alteration

In this survey, hydrothermal alteration zones were not surveyed in-situ because of limited time and difficult access. Floats were investigated in the riversides of the Rio Azul and Rio Lindo. Floats were granite, granodiorite, syenite, andesite, basalt, sandstone, mudstone, etc. Silicified rocks were also recognized. Silicification was often found in granitic rocks and sometimes in andesitic rocks. The surface of silicified rock with pyrite dissemination was limonitized. Chloritization was also recognized in andesitic floats.

8) Characteristics of the satellite images

The geology of this district is interpreted as Kiv (upper Cretaceous volcanics), αK (Cretaceous to Tertiary plutonic and hypabyssal) and Tiv (Ecocene to Oligocene andesitic volcanics). Color tones of the false color image are brown to whitish brown. The structure due to topographic undulations is middle to rough, and water systems are dendritic, parallel or

crisscross with moderate to high densities. Ridges are quasi-clear to clear with moderate to high residence. Bedding planes develop well in Kiv. αK and Tiv are massive. Many lineaments oriented to the NNW-SSE and several lineaments in the direction of NE-SW were extracted. Small-sized hydrothermal alteration zones of SB022 to SB024 were extracted on summits. They show reddish purple color on the ratio image.

9) Laboratory work results

The chemical analysis was done for the float samples of A00HH037 and A00HH039. Granite with pyrite dissemination of A00HH037 revealed 335 ppm Cu (Appendix-6).

10) Assessment

The presence of silicified floats was confirmed, and slight copper mineralization in granite float with pyrite dissemination was also confirmed. Because the alteration zones themselves are in the steep mountains, sufficient exploration was not executed in past. Although it takes time to reach the hydrothermal alteration zones, it is desired to conduct the survey in Phase-2.

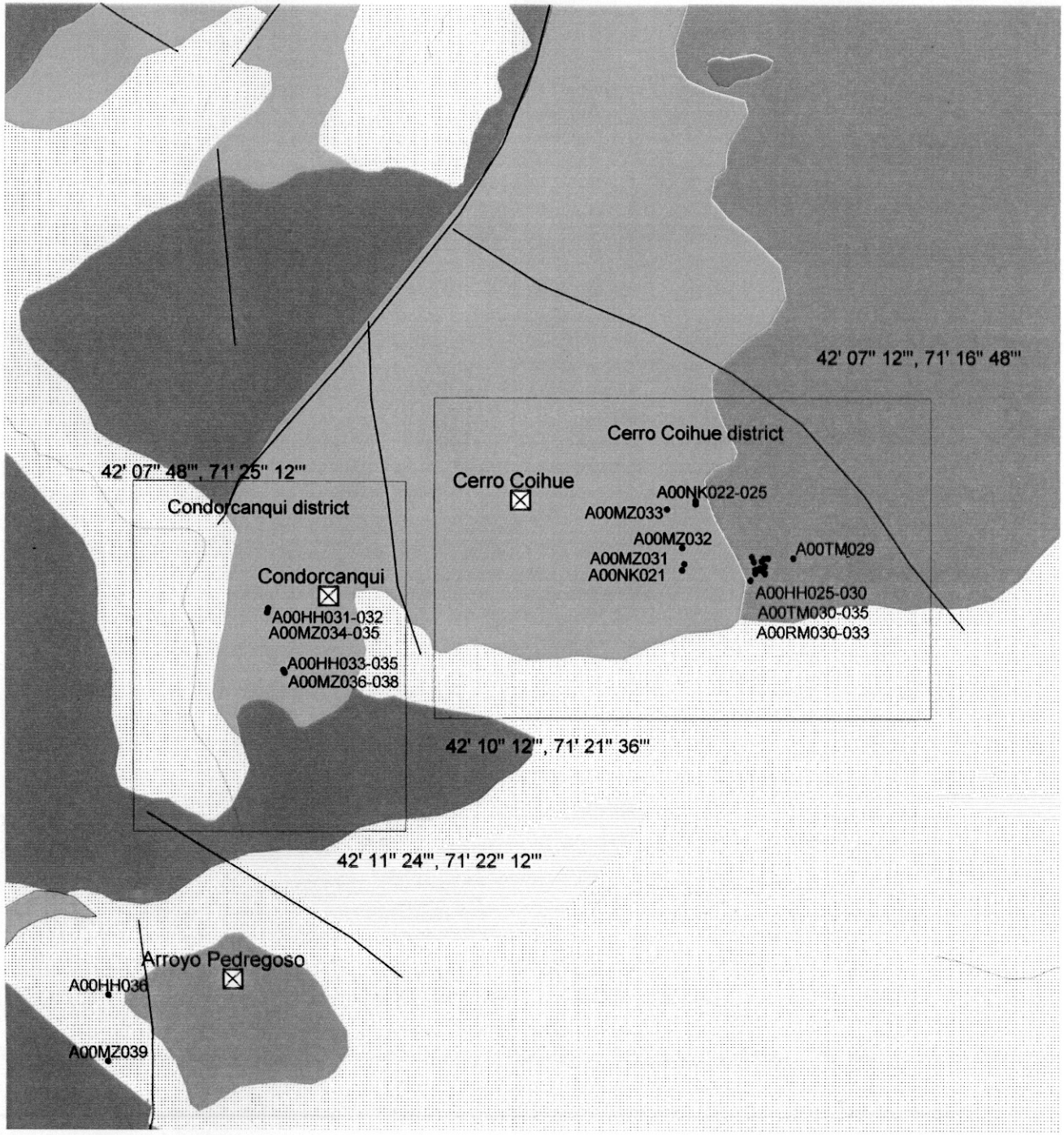
3-2-13 Cerro Coihue district

1) Location

This district is located near the border with Rio Negro province in the northwest of Chubut province (Fig. II-3-1). The area is lat. 42° 07' 12" to 42° 10' 12" S and long. 71° 16' 48" to 71° 21' 36" W (Fig. II-3-2-13a), and about 55 km^2. The representative coordinate is lat. 42° 08' 42.5" S and long. 71° 18' 30.4" W at Quebrada Baya.

2) Topography and vegetation

This district is located in the mountains with altitude of 1,000 to 2,000 m above sea level ranging from the border with Chile. Quebrada Baya has outcrops formed by an about 200 m wide collapse of the middle slope of a ridge ranging from Cerro Coihue. Quebrada Ferreyro is a stream running southward from the ridges of Cerro Coihue. It is located about 1.2 km west of Quebrada Baya. Ridges and drainage run in N-S direction. A vast plain, the Ñorquinco-Cushamen Basin, spreads to the east of El Maiten town located in the eastern part of this district. Woods spread from the foot to the ridges. The vegetation is distributed relative densely. However, rocks are exposed in high land without vegetation.



N

Known deposit
Sampling point
Lineament
Circular structure
River
Lake

Legend
Quaternary sediments
Pliocene to Pleistocene basalt
Tertiary sedimentary rocks
Tertiary volcanic rocks
Tertiary granitoids
Jurassic to Cretaceous sedimentary rocks
Jurassic to Cretaceous volcanic rocks
Jurassic to Cretaceous granitoids
Permian to Triassic igneous rocks
Carboniferous sedimentary rocks
Proterozoic metamorphic rocks
Alteration zone

2 0 2 4 Kilometers

Fig. II-3-2-13a Geologocal map with sampling points of the Cerro Coihue and Condorcanqui districts.

3) Access

It is drive to south on No. 258 national road from El Boloson city to the front of Epuyen town. The road is paved until this point. After this point, it is drive to east on unpaved road and drive to north on byroad to south foot of Cerro Coihue. Totally, it is about 45 km and about 1 hour drive from the El Bolson city. After getting off the car, about 1.5 hour walking is necessary to go to the outcrop of Quebrada Baya.

4) Previous surveys

The geological survey was conducted for Quebrada Baya by SEGEMAR (Genini and Grizinic, 1999). According to the report, granitic rocks of Jurassic to Cretaceous are subject to silicification, argillization, propylitization with tourmaline and limonite. The type of mineralization is dissemination, and there are descriptions of pyrite, arsenopyrite, chalcopyrite, molybdenite, tetrahedrite and copper oxides.

In 1983, JICA/MMAJ conducted a geological survey and took six samples from alteration zones with a small amount of pyrite and chalcopyrite. Chemical analysis results of 265 ppm Cu and 990 ppm Zn were reported.

5) Mining properties

Several mining properties for exploration are owned by Sunshine Argentina Inc. and others.

6) Geology and geological structure

The geology of this district comprises, in ascending order, Osta Arena formation of Jurassic sedimentary rocks, Cretaceous granitoids, Ventana formation of Paleogene volcanics and Quaternary glacial sediments, colluvium and alluvium. Dacite to basalt dykes also exist.

Cretaceous granitic rocks consist of granite, granodiorite and tonalite, and contain the xenolith of basalt. Andesite to basalt dikes intruding into granitoids show relatively horizontal structure. Volcanic rocks of the Ventana formation is andesitic.

7) Mineralization and alteration

Outcrops of Quebrada Baya are silicified and whitened-argillized with pottasium feldspar, tourmaline and pyrite. Tourmaline and pyrite occur as veins and dissemination, and maximum width of tourmaline and pyrite veins are about 20 cm and 1.5 m respectively. The area of pyrite mineralization is well limonitized. Partially, silicified and whitened-argillized alteration zones show the vein-like forms. Floats of quartz veins are also observed. Granitoids in peripheral zone show the propylitic alteration of chlorite-epidote assemblage. Pods or veinlets of calcite and laumontite were observed in tonalite and granodiorite, and overlying

andesite of Ventana formation.

In Quebrada Ferreyro, granite and granodiorite are accompanied by tourmaline-epidote veins, and locally by a small amount of copper oxides. Quartz-calcite veinlets with a small amount of pyrite in a later stage also exist in andesite to basalt dykes.

8) Characteristics of the satellite images

NW-SE lineament with about 10 km continuity was extracted in northeast part of this district. On the other hand, NE-SW lineament with 20 km continuity and another NNW-SSE lineament which cross to former are extracted in northwest part of this district. On the ratio image, color anomaly, which corresponds to alteration zone, was not extracted.

9) Laboratory work results

In the chemical analysis of the samples (A00HH028, A00TM029, A00TM031 to A00TM035, A00RM030 and A00RM033) of altered granitic rocks, andesite dikes, quartz veins and clay veins taken in Quebrada Baya, noticeable values were not obtained except that granodiorite with pyrite dissemination (A00TM035) showed 235 ppm Cu (Appendix-6).

In the powder X-ray diffraction, chlorite-sericite were identified for white clay vein of sample A00TM033. However, only chlorite was identified as alteration minerals for granitic rock samples (Appendix-5).

The results of the chemical analysis of granodiorite accompanied by a small amount of chrysocolla (A00MZ033), which was taken in Quebrada Ferreyro, showed 2,620 ppm Cu, 162 ppm Pb and 142 ppm Zn. However, noticeable results were not obtained from the other three samples (A00NK021, A00NK023, A00MZ031)(Appendix-6).

The chemical analysis for petrochemical study was carried out on granodiorite (A00MZ023) in Quebrda Ferreyro and tonalite (A00TM030) in Quebrada Baya. As shown on the AFM diagram (Fig. II-3-2-13b), these are calc-alkaline granite, and plotted in the area of granodiorite and quartz monzodiorite on the Qz-Or-P1 diagram (Fig. II-3-2-13c). On the Rb-(Y+Nb) diagram of Pearce et al. (1984), they are plotted in the area of volcanic arc granites (Fig. II-3-2-13d). Chondrite normalized patterns (Fig. II-3-2-135e) show that granodiorite in Quebrada Ferreyro has an almost similar pattern to that of granitic rocks of Andacollo district. On the other hand, tonalite in Quebrada Baya has a somewhat flat pattern where the tendency of rightward lowering is weak. Based on the knowledge that primitive granitic rock has relative flat patter with concentration of heavy rare earth elements (HREE), tonalite in Quebrada Baya is thought to be undifferentiated with poor ability of mineralization.

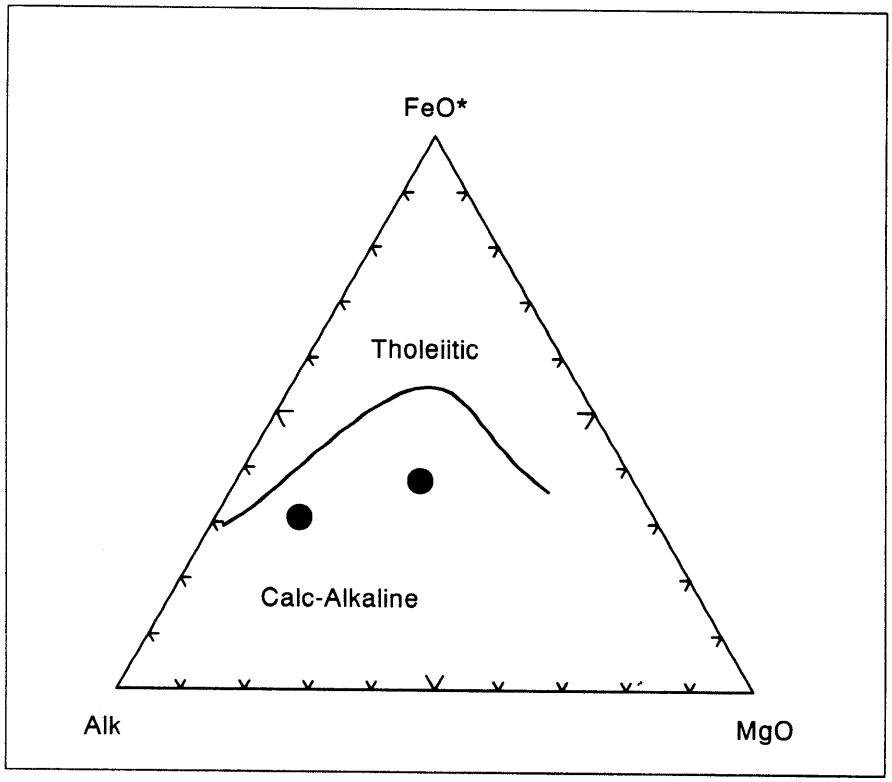


Fig. II-3-2-13b Ternary variation diagram of AFM plot for granitic rocks of the Cerro Coihue district. Alk = Na_2O+K_2O, FeO^* = Total Fe in FeO.

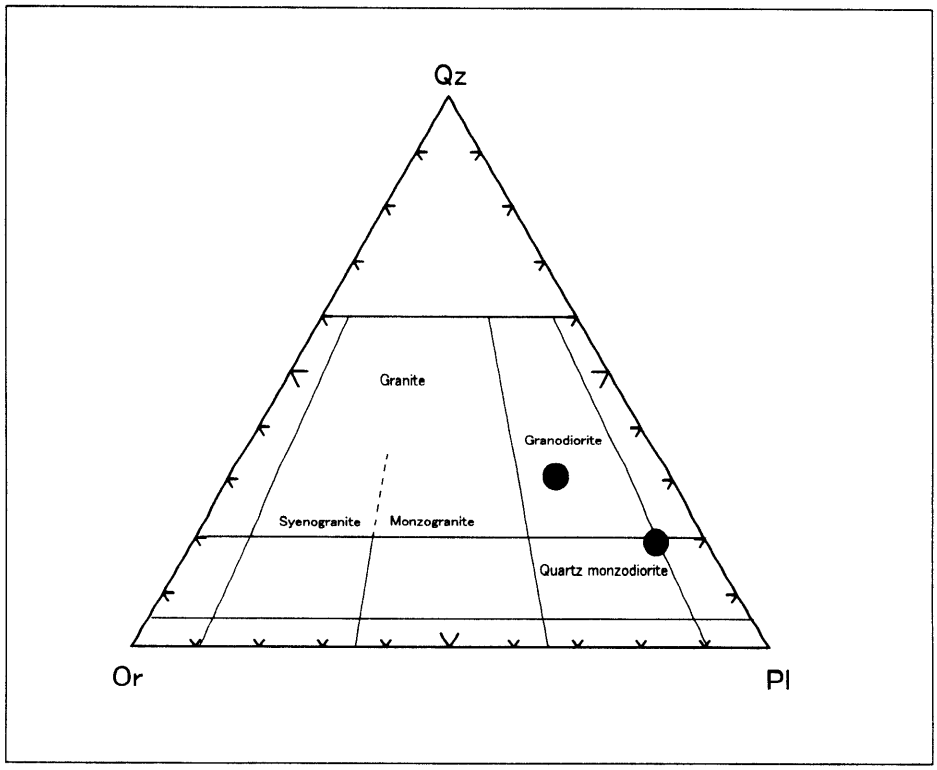


Fig. II-3-2-13c Ternary variation diagram of Qz-Or-Pl CIPW normative compositions for granitic rocks of the Cerro Coihue district.

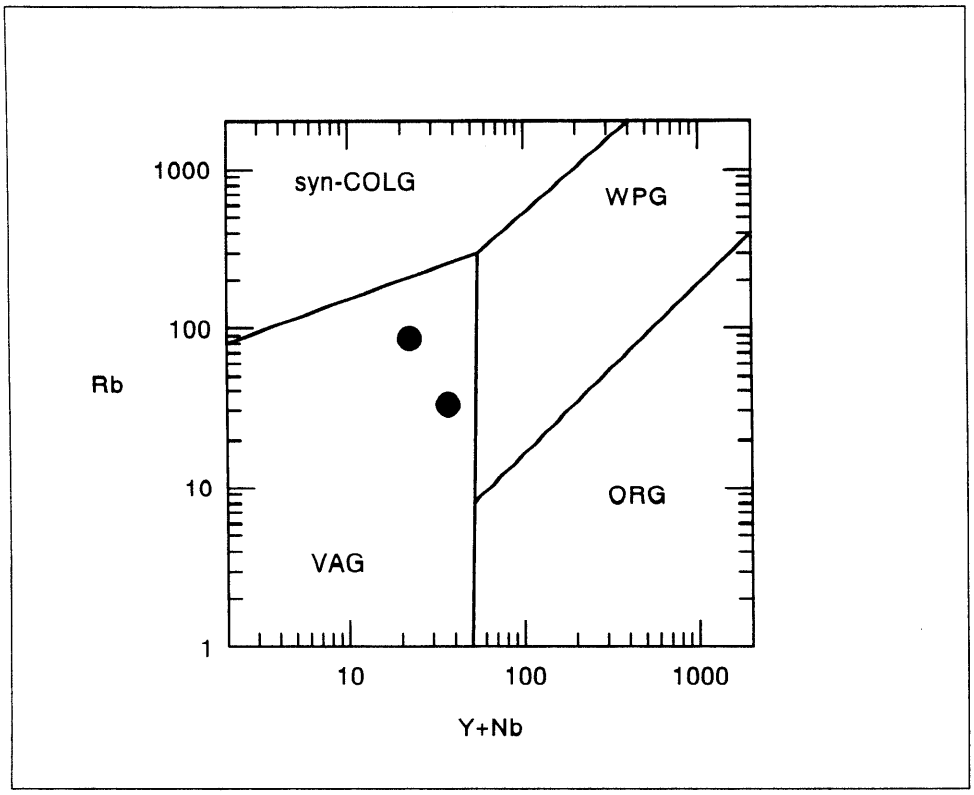


Fig. II-3-2-13d Rb - (Y+Nb) diagram for granitic rocks of the Cerro Coihue district. VAG : volcanic arc granites, syn-COLG : syn-collision granites, WPG : within-plate granites, ORG : ocean ridge granites, (Pearce et al. 1984).

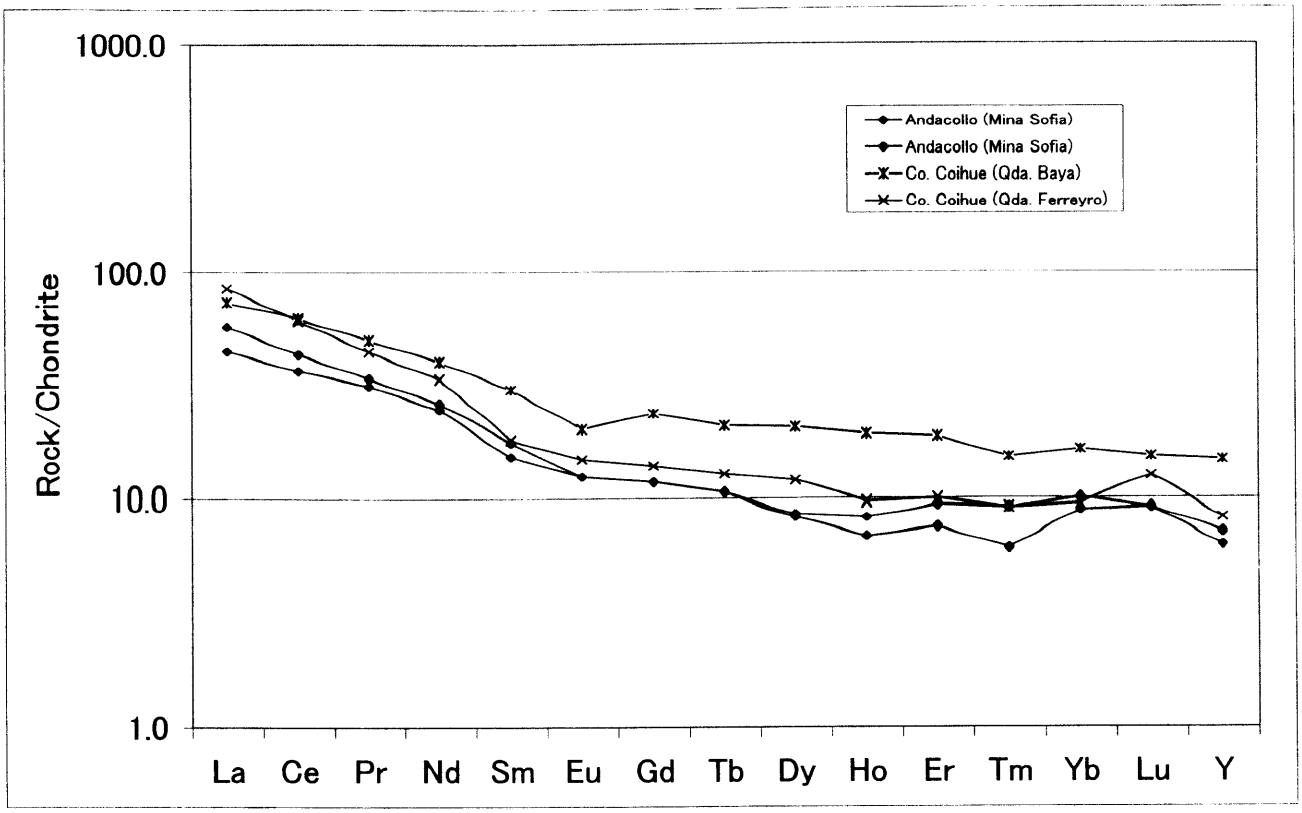


Fig. II-3-2-13e Chondrite normalized REE patterns for granitic rocks of the Cerro Coihue district campared with Andacollo district.

10) Assessment

Although alteration of potassium feldspar, tourmaline, and vein and dissemination of pyrite were observed in Quebrada Baya, the presence of copper mineralization was not confirmed. Hydrothermal alteration is in chlorite or sericite-chlorite assemblage and intensive sericite alteration and potassic alteration were not observed. Characteristics of porphyry Cu deposit reported by the previous surveys were not confirmed for the alteration zone of Quebrada Baya. Meanwhile, copper mineralization with tourmaline-epidote veinlets in Quebrada Ferreyro is very slight. Therefore, it is considered that this district has low potentiality of mineralization and does not deserve to be surveyed in Phase-2.

3-2-14 Condocanqui district

1) Location

This district is located about 5 km to the north of Epuyen town, in the northwest of Chubut province (Fig. II-3-1). The area is lat. 42° 07' 48" to 42° 11' 24" S and long. 71° 22' 12" to 71° 25' 12" W (Fig. II-3-2-13a), and about 40 km^2. The representative coordinate is lat. 42° 09' 46.1" S and long. 71° 24' 03.8" W at Condorcanqui deposits.

2) Topography and vegetation

This district is located in Cordillera de los Andes at approximately 30 km from the border with Chile. There are glacial lakes including Lago Epuyen in the east. The altitude is about 300 to 2,000 m above sea level. Although each mountain is prefixed with Cerro, meaning "hill," the mountains are significantly different in relative height in topography. The vegetation is thick with woods. Partially, there are some places with sparse shrubbery.

3) Access

It is about 5 km drive to north on 258 national road from the Epuyen town. After getting off the car, about 20 minutes walk on slope beside the road is necessary to reach the outcrops of Condorcanqui deposits.

4) Previous surveys

Condorcanqui copper deposits were discovered in 1945. From 1951 to 1953, DGFM conducted geological surveys (Tabachi, 1953). DGFM also conducted the drilling survey of 22 holes of total 626 m, and the trench survey of 12 lines of total 485 m. As a result of these surveys, ore deposits were calculated to be 431,350 t and the average grade of copper was calculated to 1.02%. Genini (1976) mentioned that mineralization was related to andesite of 30 m thickness and a small amount of granitic rocks intruding the andesite. Ametrno et al.

(1979) reported the results of mapping in the scale of 1/1,000 and geochemical survey for copper, lead and zinc. However, promising mineralization that it needs further exploration was not discovered.

5) Mining properties

Private companie owns the mining properties for Condorcanqui deposits.

6) Geology and geological structure

The geology of this district comprises, in ascending order, Jurassic sedimentary rocks, Cretaceous granitic rocks, Paleogene volcanic rocks, and Quaternary glacial sediments, colluvium and alluvium (Fig. II-3-2-13a).

Osta Arena formation of Jurassic consists of mudstone, sandstone and limestone. Cretaceous granitic rocks are granodiorite, tonalite and granite. Ventana formation of Paleogene is andesitic rocks and host rocks of Condorcanqui deposits. Though Condorcanqui deposits and sampling points are shown in the distribution area of Cretaceous granite in Fig. II-3-2-13a, in fact, andesite and its tuff of Ventana formation are distributed there. Andesite is massive and compact, looking gray to green. Tuff has no bedding planes, and small faults of N-S, 60° E and E-W, 60° S are observed. According to Ametrano et al. (1979), andesite porphyry dykes intruded in Ventana formation in the NW directions.

7) Mineralization and alteration

According to Ametrano et al. (1979), 15 places of copper mineralization are scattered in the area of about 1.4 km in N-S direction and of 0.3 km in E-W direction. Among them, one mineralized place, where the samples A00MZ036, etc. were taken, was observed in this survey. Copper mineralization consists of chalcopyrite dissemination, quartz-chalcopyrite veinlets and secondary malachite in the host rock of gray to green andesite. Locally, andesite is brecciated and malachite filled up the matrix part. Quartz veinlet with chalcopyrite dissemination strikes N 65 ° W and dips 70° N with the width of 5 cm, accompanied by vleinlets network of the same quality.

In the place where the samples A00MZ034, etc. were taken, small faults of N-S, 60° E and E-W, 60° S were observed in andesitic tuff, these fault zones are accompanied by zeolite and pyrite dissemination.

8) Characteristics of the satellite images

The color tone of the false color image is green, which means vegetation is thick. The structure due to topographical undulations is rough, and water systems are arborescent with low densities. Ridges are unclear with low resistance. This makes a contrast to Cerro Coihue

in the northeast, which shows clear ridges. Bedding planes are not recognized. Lineaments oriented to the NE and the NW are extracted. Hydrothermal alteration zones are not extracted on the ratio image.

9) Laboratory work results

The sample A00MZ036 of mineralized andesite with chalcopyrite and sample A00MZ037 of brecciated andesite with malachite from Condorcanqui deposits revealed 3.69 to 4.72%, Cu, less than 0.03 g/t Au, 13 to 22 g/t Ag, 210 to 590 ppm Pb and 120 to 640 ppm Zn (Appendix-9). The elements except copper are in low grade.

According to microscopic observation of sample A00MZ38, which is andesitic host rock of Condorcanqui deposits, the composition of alteration minerals is chlorite, epidote and calcite, and alteration is propylitic (Appendix-4). The sample A00HH034 in a same condition of A00HH034 revealed 10ppm As, less than detection limit of Sb and Hg and 1,175 ppm Cu (Appendix-6). Based on the propylitic alteration and low contents of indicator elements of hydrothermal alteration, it is considered that host rock of andesite is not intensively altered and copper might not be derived from hydrothermal water. Therefore, copper might originated the magma that formed the andesitic host rock of the Condorcanqui deposits.

The sulfur isotopic composition of chalcopyrite in Condorcanqui deposits is -26.7‰ (Appendix-11). The standard of sulfur isotopic composition is Canyon Diablo Troilite (CDT). The sulfur isotopic composition in igneous rocks is relatively close to 0‰ of the standard and shows a narrow variation range. On the other hand, the sulfur isotopic composition in sedimentary rocks shows a wide variation range due to the isotopic fractionation by bacteria effect. Therefore, -26.7‰ of chalcopyrite implies that sulfur originated in sedimentary rocks. However, the assumption is discordant with field observation that the chalcopyrite is disseminated in andesitic rocks. It is necessary to consider the isotopic fractionation between H_2S of chalcopyrite and fictitious SO_4^{2-}. If the total sulfur isotopic composition was 0 ‰ which means magmatic origin, mineralization temperature was 250 ℃, and ratio of H_2S to SO_4^{2-} was 1 to 9. There is a isotopic fractionation of 25‰ between H_2S and SO_4^{2-} at 250℃ (Rye and Ohmoto, 1974). Then, X as the sulfur isotopic composition of H_2S and Y as that of SO_4^{2-}, the relations of "Y - X = 25‰" and "0.1 X + 0.9 Y = 0‰" are established. For H_2S, -22.5‰ is calculated, which is relatively close to the actually measured value. Like this, there is a possibility that, even though sulfur originated the magma, the sulfur isotopic composition of chalcopyrite shows a small value due to fractionation between different sulfur kinds. If this is true, it is assumed that there were activities of acid hydrothermal water including SO_4^{2-} besides the sulfides mineralization by activities of H_2S. Then, it can be expected the possibility that highl-sulfidation gold mineralization is accompanied, related to the activities of acid hydrothermal water.

10) Assessment

Only one mineralized outcrop was investigated in this survey. However, according to Ametrano et al. (1979), 15 places of copper mineralization are scattered in the area of about 1.4 km in N-S direction and of 0.3 km in E-W direction. Although the sulfur isotopic measurement of chalcopyrite was made for only one sample, besides the chalcopyrite mineralization, high-sulfidation gold mineralization related to acid hydrothermal water activities is expected. Ametrano et al. (1979) reported the presence of strongly silicified alteration in addition to propylite alteration. The past geochemical survey was made for copper, lead and zinc only. Therefore, in order to verify the potentiality of high-sulfidation gold mineralization in this district, more wide area should be surveyed in Phase-2.

3-2-15 Cushamen district

1) Location

This district is located near the border with Rio Negro province, in the northwest of Chubut province (Fig. II-3-1). Cushamen deposit is also called Cura Limay deposit. The area is lat. 42° 06' 00" to 42° 13' 48" S and long. 70° 26' 24" to 70° 34' 12" W (Fig. II-3-2-15a), and about 200 km^2. The representative coordinate is lat. 42° 09' 40.7" S and long. 70° 30' 33.2" W.

2) Topography and vegetation

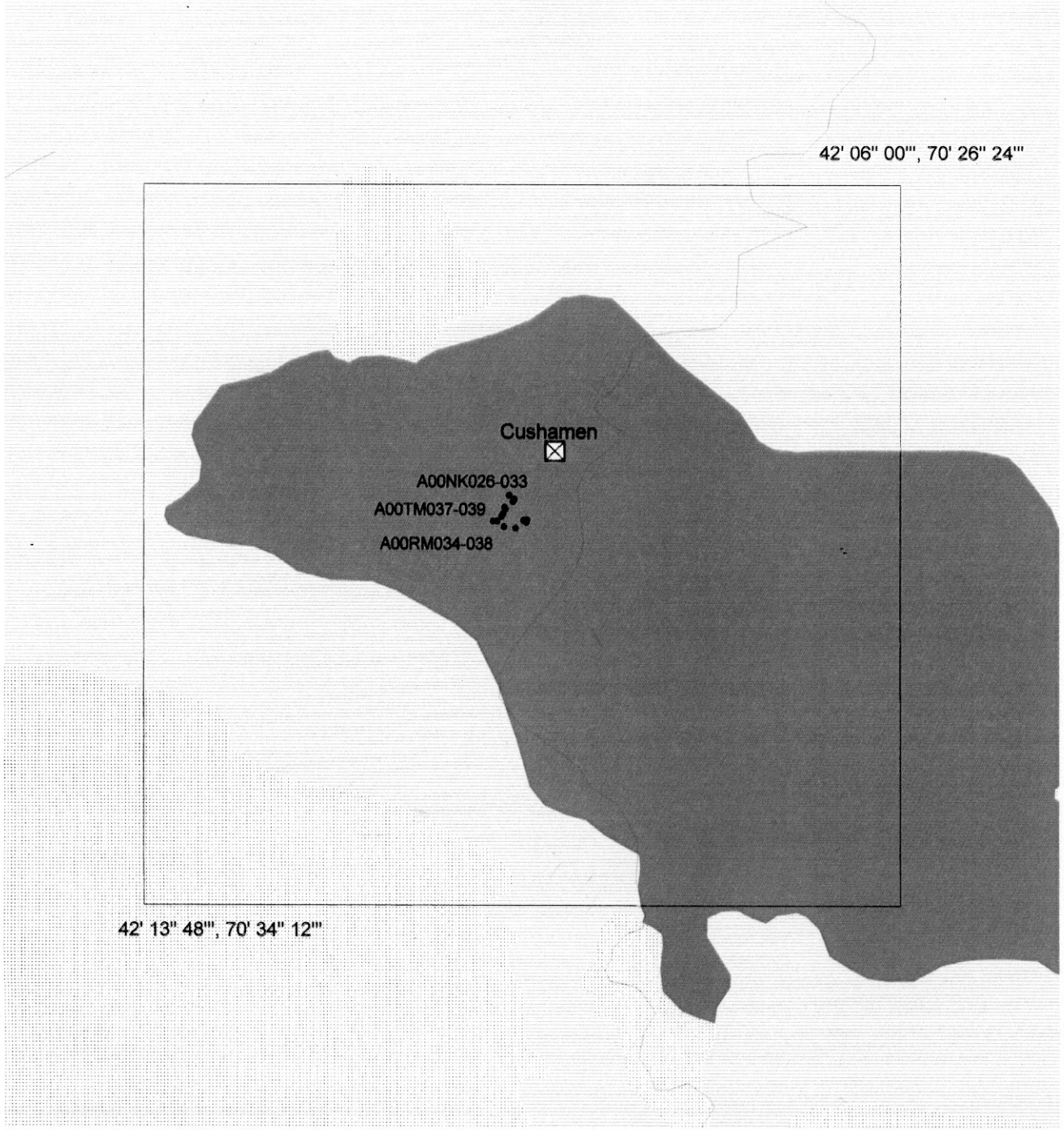
This district is gently sloped hills with altitude of 1,000 to 1,500 m above sea level. Drainage has not been developed. Short grasses sparsely grow on the hills, and shrubs between the hills.

3) Access

From El Bolson city, it is drive to south on No. 258 national road to the front of Epuyen town, then drive to east via El Maiten town on No. 4 provincial road to near Cushamen deposit. Totally, it takes 3 hours and 40 minutes to drive 154 km from El Bolson city.

4) Previous surveys

Regional geological mapping was conducted in past. Silicification and argillization were reported around the boundary between metamorphic basement and rhyolite intrision. Molybdenum, lead and zinc mineralization is known with quartz veins in the silicification zone. In the area surveyed, there is a old pit of about 20 m in diameter excavated for kaolinite exploitation.



Known deposit
Sampling point
Lineament
Circular structure
River
Lake

Legend

Quaternary sediments
Pliocene to Pleistocene basalt
Tertiary sedimentary rocks
Tertiary volcanic rocks
Tertiary granitoids
Jurassic to Cretaceous sedimentary rocks
Jurassic to Cretaceous volcanic rocks
Jurassic to Cretaceous granitoids
Permian to Triassic igneous rocks
Carboniferous sedimentary rocks
Proterozoic metamorphic rocks
Alteration zone

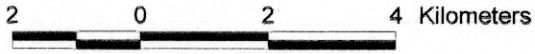


Fig. II-3-2-15a Geologocal map with sampling points of the Cushamen district.

5) Mining properties

A mining property near the survey sites was abandoned now. No mining properties are petitioned.

6) Geology and geological structure

In this district, Precambrian granitoids and metaedimentary rocks of gneiss and schist are distributed as window. The gneiss is accompanied by small dykes of pegmatite. Rhyolite dykes of Huitrera formation of early Tertiary intruded into Precambrian rocks. Overlying them unconformably, Neogene Tertiary sedimentary rocks are distributed.

Near the survey sites, shistosity of psammitic to pelitic schist of metamorphic basement is steep. Small dikes of pegmatite are in parallel or slightly oblique to the schistosity. Rhyolite dykes have structure of about 10 m or more in width, with the strike of E-W and dip of 75° S.

7) Mineralization and alteration

In the rhyolite intrusion, alterations of potassium feldspar and tourmaline zone, acid argillized zone are zonally arranged from center to outer. The potassium feldspar and tourmaline zone is defined in central part of rhyolite intrusion, accompanied by quartz veinlets and hydrothermal breccia. The acid argillized zone is distributed in peripheral of rhyolite intrusion, without accompaniments of silicified alteration and quartz veins. Sericite and kaolinite were identified by the POSAM measurement. Quartz veins are distributed in schist of basement over 50 m from the boundary with rhyolite intrusion. Major quartz veins have the width of 1 to 2 m and structure of NW strike and vertical dip. Quartz veins zone extends about more than 100m in direction of NW with significant limonitization.

8) Characteristics of the satellite images

No lineaments or alteration zones have been extracted in this district. Also, no lineaments have been extracted on the periphery of this district. On the false color image, the flat and smooth surface is shown, from which low resistance can be recognized. No color anomalies indicating the hydrothermal alteration are recognized on the ratio image.

9) Laboratory work results

Chemical analysis was carried out on the samples of silicified rhyolite and quartz veins (A00NK027 to A00NK029, A00NK032, A00NK033, A00TM038, A00TM039, A00RM036, A00RM037). Silicified rhyolite of A00NK029 showed 364 ppm Cu, and the quartz vein of A00NK027 showed 709 ppm Mo. No noticeable values of gold and others could be obtained (Appendix-6).

In the powdery X-ray diffraction of silicified schist (A00NK030) and argillized rhyolite

(A00NK031, A00TM037, A00RM034, A00RM035), sericite and kaolin were identified (Appendix-5).

The sample of A00TM039, white quartz vein of 1 m width which is accompanied by medium-grained limonite, fluid inclusion study revealed homogenization temperatures of 215 to 283℃, averaging 259℃; salinities of 28.3 to 30.9 wt%, averaging 29.6 wt% (Appendix-10). The oxygen isotopic composition of same quartz sample was +9.7‰. Then + 1.2‰ is calculated for hydrothemal water, which generated quartz, by oxygen isotopic fractionation factor between water and quartz (Matsuhisa et al., 1979) at average homogenization temperature (Appendix-12). The oxygen isotopic composition of magmatic water shows heavy values from +6‰ to +9‰ (Taylor, 1974), while the oxygen isotopic composition of meteoric water generally shows light values from -4‰ to -14‰, although with regional differences (Craig, 1963). Therefore, the above-mentioned oxygen isotopic composition of hydrothermal water which formed the quartz vein indicates that magmatic water was mixed with meteoric water. It is assumed that magmatic water was relatively dominant in hydrothermal water of this district.

10) Assessment

Rhyolite intrusion is thought to be concerned with formation of alteration zones in this district because it is concordant with the distribution of potassium feldspar and tourmaline zone and argillized alteration zone. Homogenization temperature of fluid inclusions shows that these are epithermal type. Although it is assumed from the oxygen isotopic composition that magmatic water was concerned, no remarkable mineralization of gold, copper and molybdenum was confirmed. This district is judged to have low potentiality of mineralization. It is not necessary to conduct the survey in Phase-2.

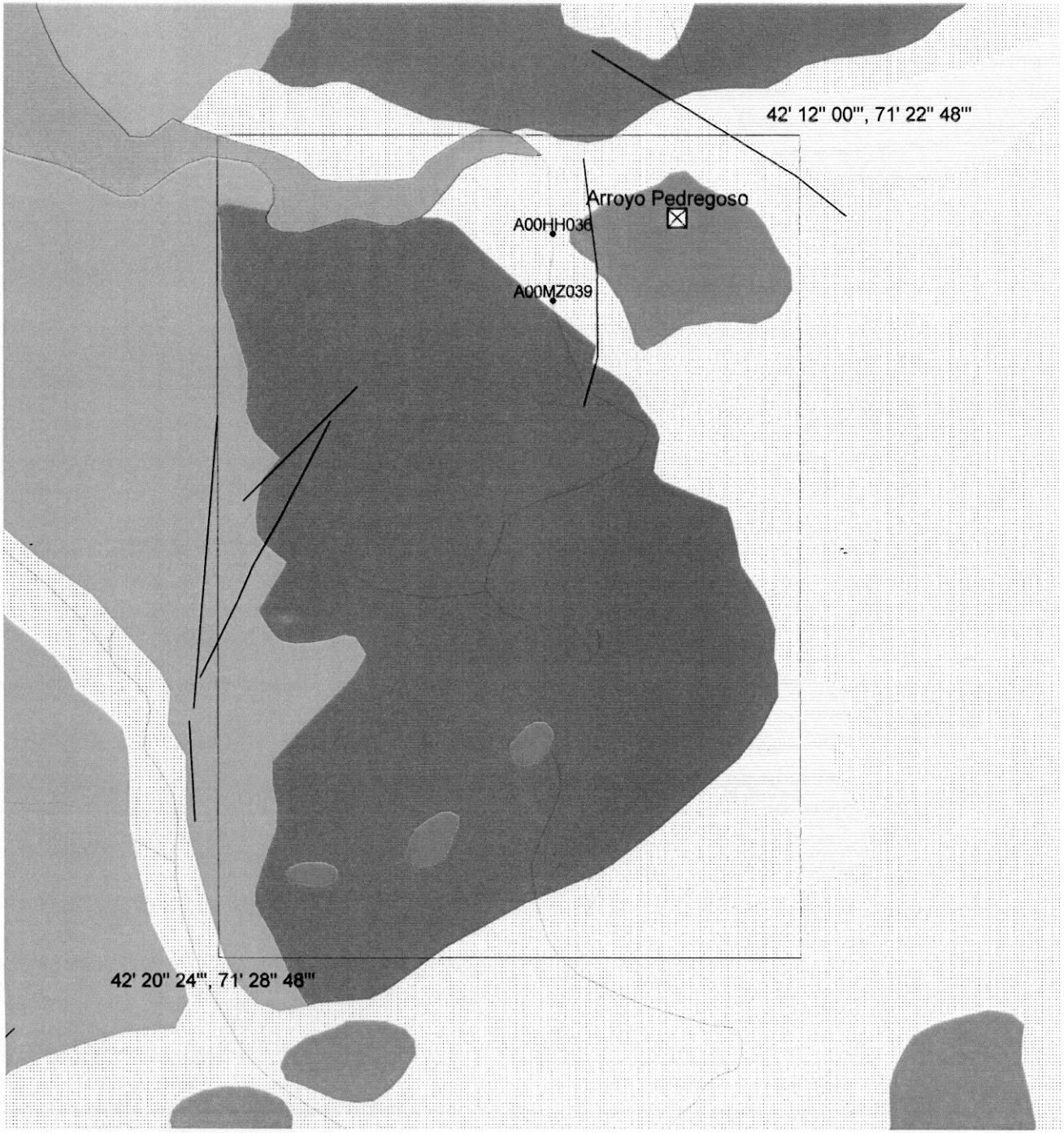
3-2-16 Epuyen district

1) Location

This district is located in the southwest of Epuyén town in the northwest of Chubut province (Fig. II-3-1). The area is lat. 42° 12' 00" to 42° 20' 24" S and long. 71° 22' 48" to 71° 28' 48" W (Fig. II-3-2-16a), and about 170 km^2. The hydrothermal alteration zones, SB081 to SB083, were extracted by satellite image analysis (Fig. II-2-15). The representative coordinate is lat. 42° 13' 51.9" S and long. 71° 25' 17.7" W at the sampling point of A00MZ039 in Pedrgoso riverside.

2) Topography and vegetation

The proximity of Epuyén town is low lands at around 300 m above sea level. Cordón de Cholila is steep mountains with altitude of 1,000 to 1,500 m above sea level, and the highest



Known deposit
Sampling point
Lineament
Circular structure
River
Lake

Legend

Quaternary sediments
Pliocene to Pleistocene basalt
Tertiary sedimentary rocks
Tertiary volcanic rocks
Tertiary granitoids
Jurassic to Cretaceous sedimentary rocks
Jurassic to Cretaceous volcanic rocks
Jurassic to Cretaceous granitoids
Permian to Triassic igneous rocks
Carboniferous sedimentary rocks
Proterozoic metamorphic rocks
Alteration zone

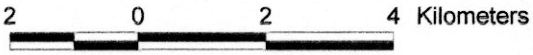


Fig. II-3-2-16a Geologocal map with sampling points of the Epuyen district.

peak at 2,082 m above sea level. Major ridges and streams run N-S to NNW. Woods spread in the low lands while the vegetation on the highlands is sparse. The Lago Epuyén is located in the northwestern part of this district.

3) Access

Alteration zones extracted by the satellite image analysis are located in the highlands of Cordón de Cholila. Although distant view of them were seen in the fielsd, it was not accessible by restrictions of time and accessibility. Therefore, floats were investigated at Pedregoso riversides running down to the north from the alteration zones. There is a farm road accessible to the survey site by car, but the gate on the road is locked.

4) Previous surveys

There is old Pedregoso mine of placer gold. Petersen and Bonorino (1974) described the geology of the western part of Chubut province. Beltramone (1978) reported the results of geological survey and geochemical survey of Lago Epuyen area as a part of the Plan Patagonia Comahue. The survey area was 1,400 km^2 from lat. 42° to 42°30' S and from long. 71° W to the border with Chile. Six hydrothermal alteration zones were reported. In addition, geochemical survey was conducted for copper, lead and zinc by stream sediments and rocks chips samples. As the result, a geochemical anomaly of 320 ppm Cu of rock sample was detected.

5) Mining properties

Private companies own several mining properties for gold and placer gold.

6) Geology and geological structure

The geology of this district, inascending order, Osta Arena formation of Jurassic sedimentary rocks, Cretaceous granitoids, Ventana formation Paleogene volcanic rocks, and Quaternary glacial sediments, colluvium and alluvium. The Cretaceous granitoids are distributed in the western side of Cordón de Cholila, Jurassic sedimentary rocks are distributed in that eastern side.

7) Mineralization and alteration

Spots and veinlets of zeolite were observed in andesite along the Arroyo Pedregoso where the floats were surveyed. The surface is partially limonitized. Floats were basalt to dacite and granitoids. Silicification, dissemination of pyrite and limonitization were observed for those floats.