3-2-24 Las Mentas district

1) Location

This district is located about 30 km to the south of Trevelin town, in the west of Chubut province (Fig. II-3-1). The area is lat. 43° 21' 00" to 43° 27' 36" S and long. 71° 29' 24" to 71° 36' 00" W (Fig. II-3-2-24a), and about 140 km^2. The representative coordinate is lat. 43° 24' 09.3" S and long. 71° 32' 33.1" W at the outcrop of galena vein of Las Mentas deposit.

2) Topography and vegetation

Topography of this district is gently sloped mountains and plateau although it is located at about 30 km from the border with Chile. Rio Frio runs to southwest. Small glacial lakes lie scattered. The altitude is approximately between 600 and 1,000 m above sea level. The vegetation is relatively sparse along the provincial road, but thick with woods around the Las Mentas deposit.

3) Access

It is 35km drive to south on No. 17 provincial road from Trevelin town. The provincial road is unpaved, but the road surface is well maintained. Arroyo las Mentas, a small stream, runs to the west across the provincial road to join the Rio Frio. It is about 20 minutes walk along the stream to go up to Las Mentas deposit.

4) Previous surveys

This area district was covered by the UN Revolving Fund Project executed from 1977 to 1982. Galena-chalcopyrite veins were discovered at two points by the geological survey. These veins are located at the above-mentioned point and at the point about 2 km east-southeast of the former point. Although geophysical survey and trench survey were conducted for the geochemical anomalous area detected by soil geochemical survey, it was concluded that further exploration is not necessary for the mineralized area, because poor continuation of the veins was confirmed and anomalies of chargeability and resistivity were not detected (UNDP, 1983).

5) Mining properties

No mining properties are petitioned in this district.

6) Geology and geological structure

The host rock of vein is andesitic tuff. It is considered to be Lago la Plata formation of Jurassic or Ventana formation of Paleogene. The outcrop is very small. On the periphery, Quaternary glacial sediments and colluvium are distributed in thick. According to UNDP (1983), Quaternary thickness reaches several tens of meters.

7) Mineralization and alteration

One of two veins, which is located nearer to the provincial road, was observed at the sampling point of A00MZ055 (Fig. 3-2-23a). The host rock is silicifed andesitic tuff showing pale green color. The vein comprises quartz, galena, chalcopyrite and malachite with width of 25 cm, strike of N 80° W and dip of 80° S. Beside the vein, there is a vein-like sheared zone with width of 20 cm, strike of N 60° W and dip of 70° S.

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 almost flat, and water systems are arranged in the latticelike with very low densities. Resistance is also low. Bedding planes are not recognized. NE-oriented lineaments are extracted. On the ratio image, it is impossible to extract the hydrothermal alteration zones due to thick vegetation.

9) Labortory work results

Sample from the vein of A00MZ055 revealed 0.54g/t Au, 18 g/t Ag, 0.63% Cu, 10.9% Pb and 1.29% Zn (Appendix-9).

10) Assessment

A vein deposit mainly composed of galena was confirmed, but gold mineralization is in low grade. Lack of continuation as basemetals vein was confirmed by previous survey. Therefore, this district is not considered to be promising.

3-2-25 Poncho Moro district

1) Location

This district is located about 15 km to the south of Corcovado town, in the west of Chubut province (Fig. II-3-1). The area is lat. 43° 36' 36" to 43° 43' 12" S and long. 71° 22' 48" to 71° 29' 24" W (Fig. II-3-2-25a), and about 150 km^2. The representative coordinate is lat. 43° 37' 55.1" S and long. 71° 25' 30.7" W at Pedrogoso riverside where the floats were investigated.

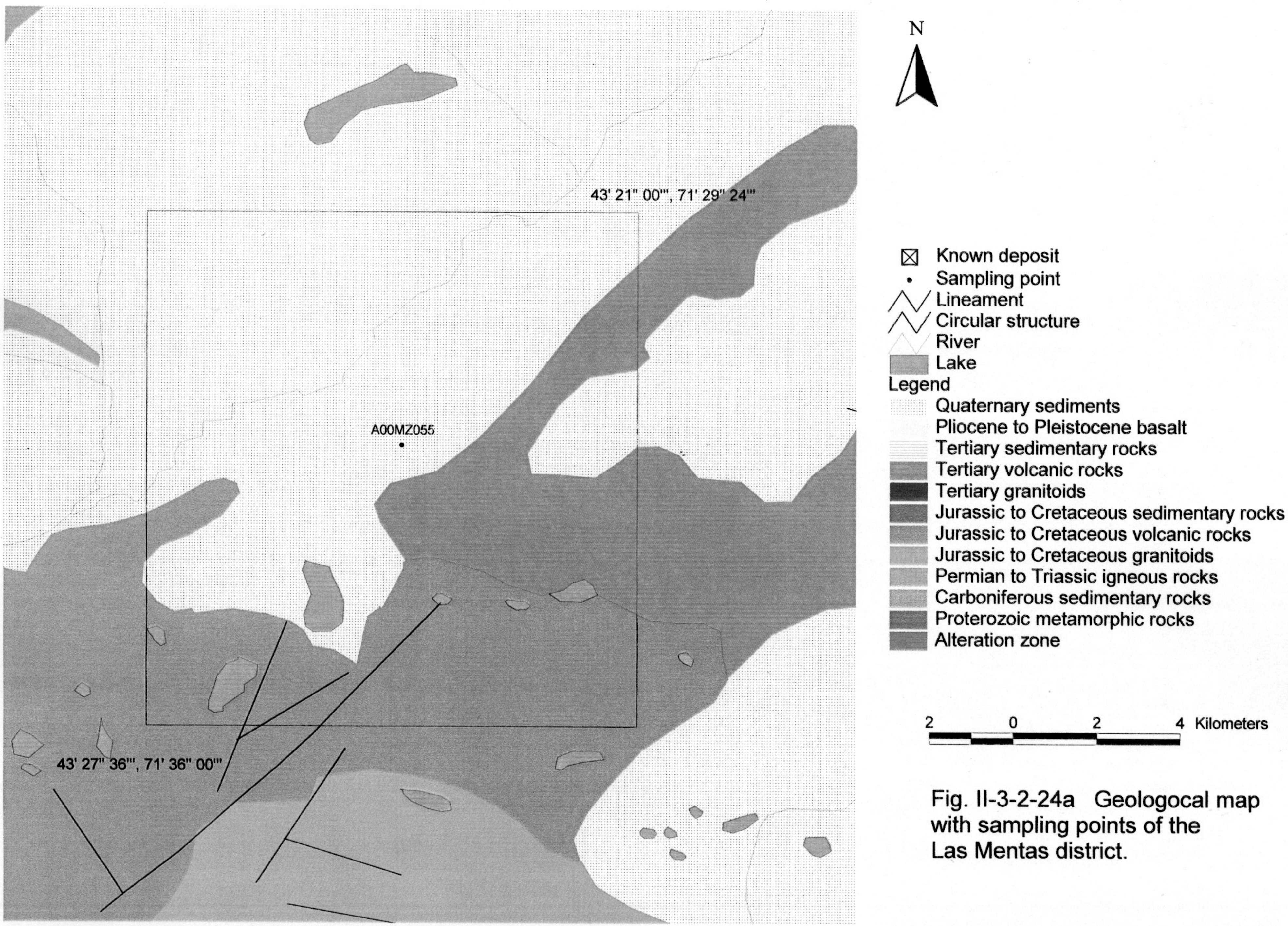
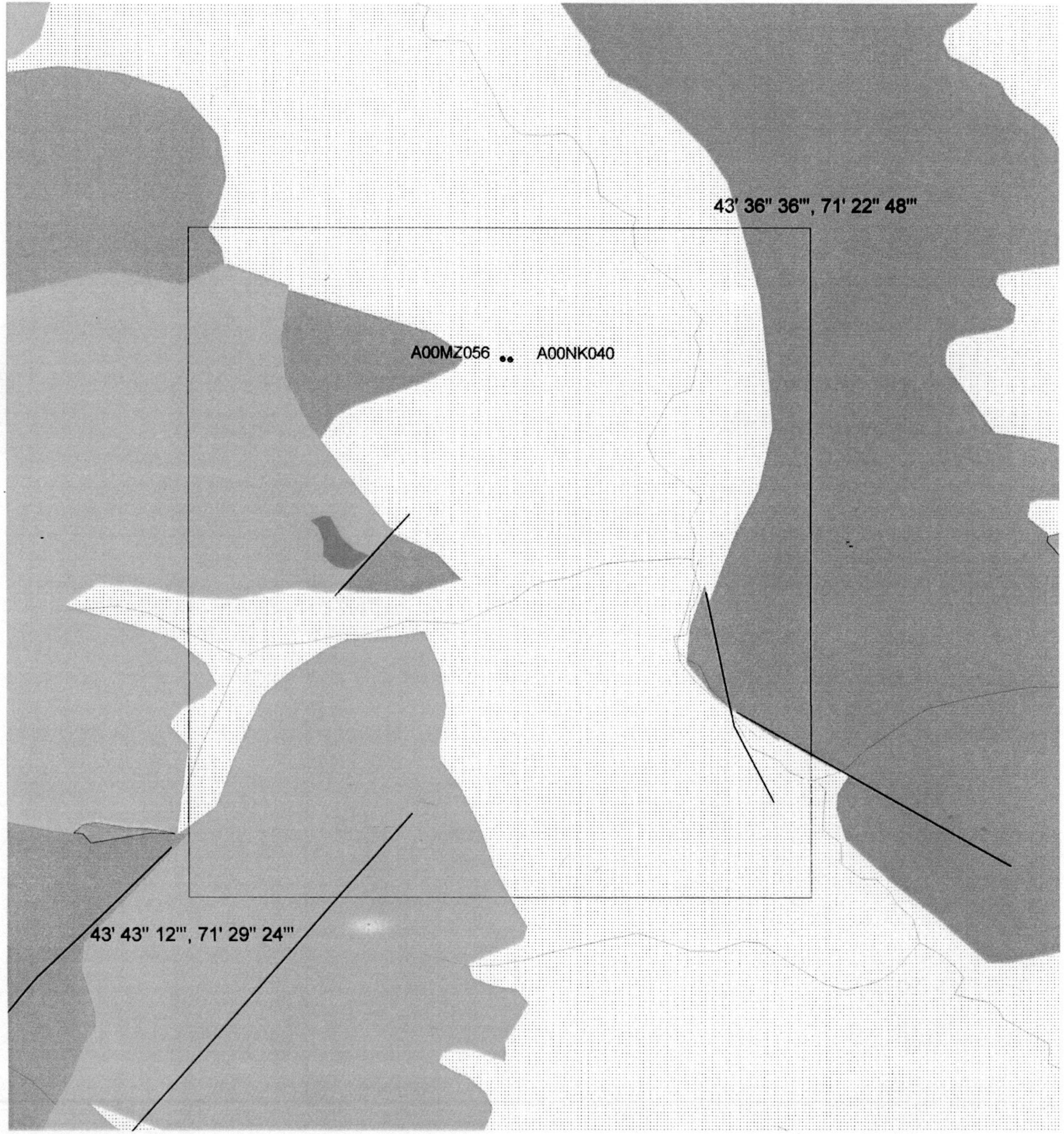


Fig. II-3-2-24a Geologocal map with sampling points of the Las Mentas district.



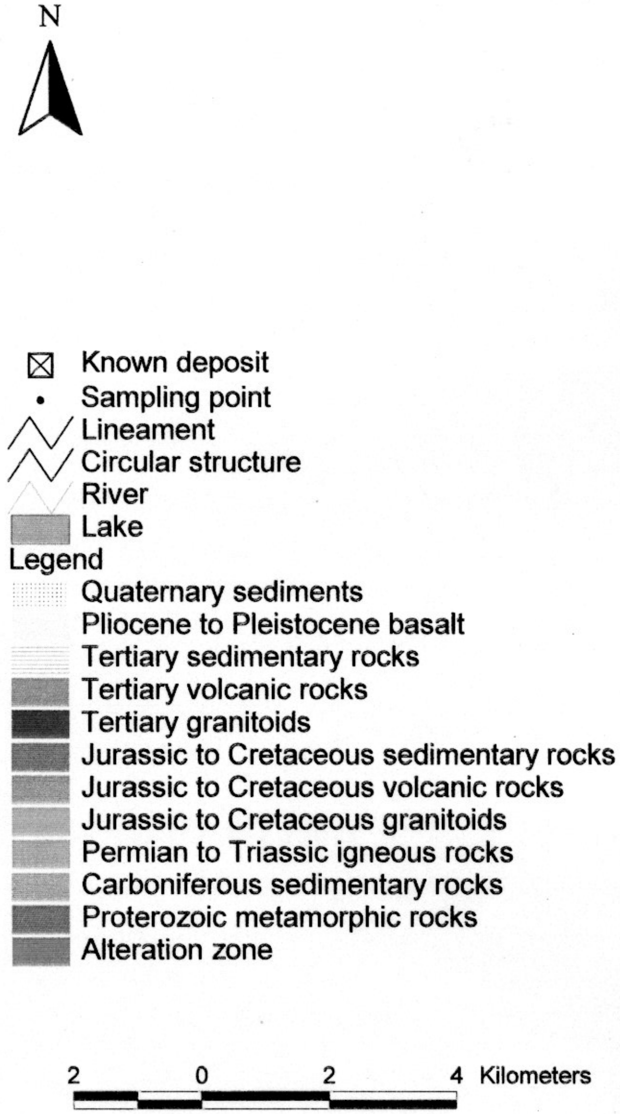


Fig. II-3-2-25a Geologocal map with sampling points of the Poncho Moro district.

2) Topography and vegetation

This district is located in Cordillera de los Andes at about 10 km from the border with Chile. Arroyo Pedregoso and Arroyo Poncho Moro run down from the western mountains to east to join to Rio Corcovado that runs to north-north east. The altitude is approximately between 500 and 2,100 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.

3) Access

There is a road from Corcovado town to Lago General Vintter in south. The road is not unpaved, but the road surface is well maintained. It is about 15km drive from Corcovado town to south on the road along the western bank of Rio Corcovado to the survey sites. An alteration zone was extracted by satellite image analysis in the western mountains. Horse will be needed to reach the alteration zone because there is no byroad accessible by 4-wheel vehicle.

4) Previous surveys

Previous surveys in this district are unknown, although northern area from lat. 43° 30' S and southern area around south bank of Lago General Vintter were surveyed as part of the Plan Patagonia Comahue. The UN Revolving Fund Project was conducted for northern area from lat. 43° 36' S and it is also outside of this district.

5) Mining properties

No mining properties are petitioned in this district.

6) Geology and geological structure

The geology of this district comprises andesitic rocks of Lago la Plata formation of Jurassic or Divisadero formation of Cretaceous, and Cretaceous granitoids. Andesitic rocks are propylitic showing green color. Granitoids are made up of granite and granodiorite.

7) Mineralization and alteration

Hydrothermal alteration zone was extracted by satellite image analysis. In this survey, however, only floats were investigated in the riverside of Arroyo Pedregoso and Arroyo Poncho Moro running down from the alteration zone, because of restriction of time and accessibility. As the results, silicified andesite with pyrite dissemination and quartz veins were frequently observed. Meanwhile, alteration floats of granitic rocks were not recognized.

8) Characteristics of the satellite images

The color tone of the false color image is green, which means thick vegetation. Highlands are blue on the whole, which means the presence of snow, while looking reddish gray locally, which means that some exposed rock zones exist on highlands. The structure due to topographical undulations is rough on lowlands and fine in the mountains. Water systems are dendritic with moderate densities. Ridges in the mountain are unclear due to snow. Bedding planes are not recognized. Lineaments oriented to the NE and NNW are extracted. On the ratio image, a hydrothermal alteration zone looking bright reddish purple is extracted on highlands.

9) Laboratory work results

As the results of chemical analysis for float samples, altered andesite sample of A00NK040 revealed 149 ppm Cu, quartz vein sample of A00MZ056 revealed 0.02g/t Au, 1.6g/t Ag and 84 ppm As.

10) Assessment

A hydrothermal alteration zone was extracted by satellite image analysis. Although the alteration zones could not be reached due to poor access, silicified andesite and quartz veins were recognized by float investigation in riversides where the rivers running down from the alteration zone. Arsenic content obtained for quartz vein float shows the influence of hydrothermal alteration. It is desired to survey the alteration zone in-situ in Phase-2. However, the priority is judged to be low.

3-2-26 Cerro Colorado district

1) Location

This district is located near the border with Chile, in the west of Chubut province (Fig. II-3-1). The area is lat. 43° 55' 48" to 44° 05' 24" S and long. 71° 31' 48" to 71° 40' 12" W (Fig. II-3-2-26a), and about 260 km^2. Cerro Colorado deposit and Cerro Riñon deposit are located in the south of Lago General Vintter. The representative coordinate is lat. 43° 57' 47.7" S and long. 71° 34' 9.4" W at the point where floats were investigated.

2) Topography and vegetation

This district is located in the mountains with altitude of 1,500 to 2,000 m above sea level running along the border with Chile. Lago General Vintter spreads in E-W direction. The altitudes of Cerro Riñon and Cerro Colorado are 1,814 m and 2,015 m above sea level respectively. Sparse woods widely spread from the shore of Lago General Vintter to the middle

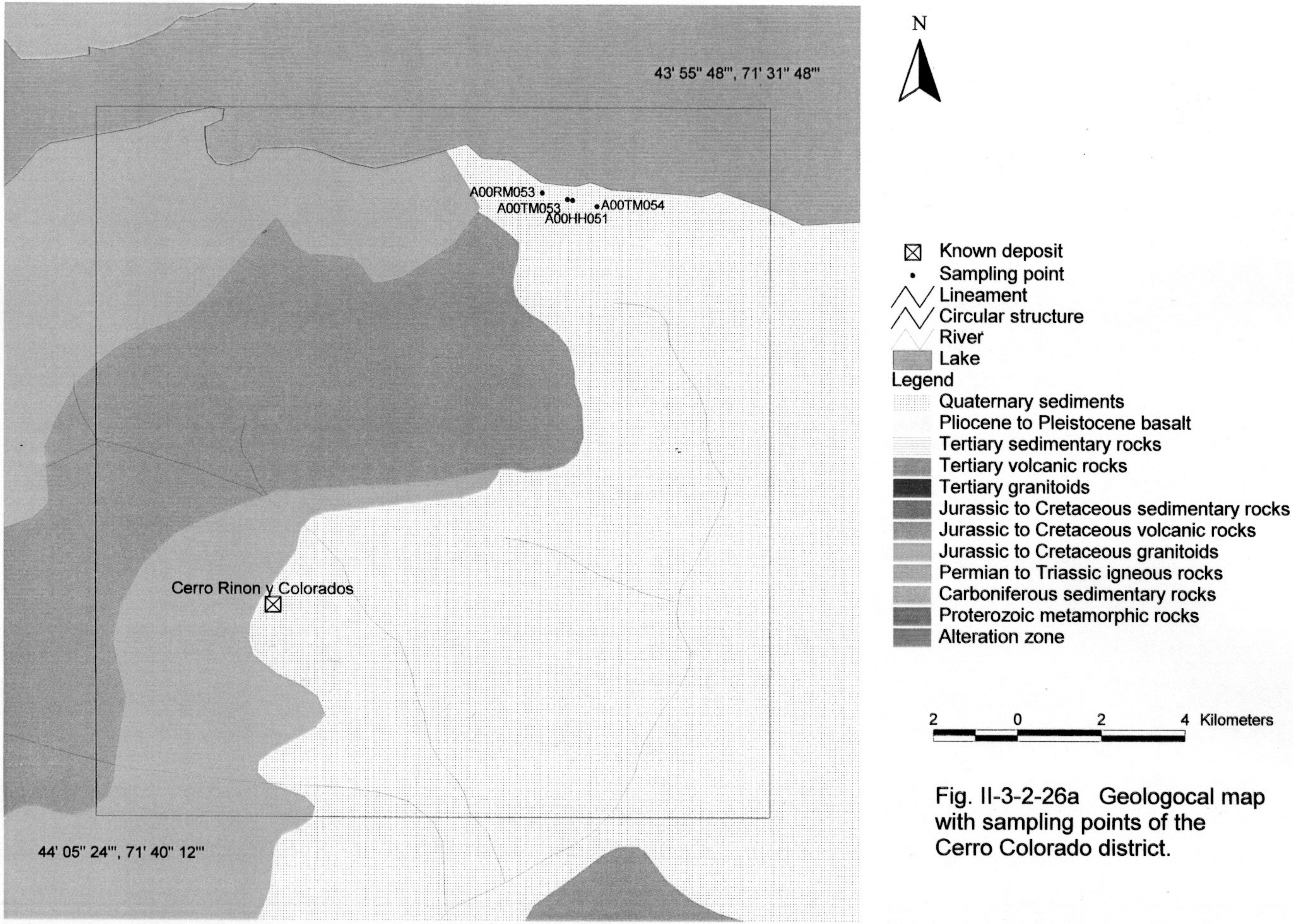


Fig. II-3-2-26a Geologocal map with sampling points of the Cerro Colorado district.

slopes of the ridges. Around the summits are rock-exposed zone without vegetation.

3) Access

The route from Esquel city to near Cerro Colorado deposit is No. 40 national road to south, unpaved road to southwest from Tecka town and No.19 provincial road to west. The last access road to Cerro Colorado is in bad condition that 4-wheel vehicle is only available. However a collapse of slope across the road prevented to reach Cerro Colorado deposit. Horse is necessary to reach there.

4) Previous surveys

High-sulfidation epithermal gold deposit at around the summit of Cerro Colorado is known by exploration activities of Billiton Argentina. It is reported as hydrothermal breccia and silicified zone in Jurassic andesite of Lago la Plata formation. Rock chips were taken from the bulldozer trenches, and average 4.7g/t Au was obtained in 10m intervals sampling, and average 5.9g/t Au was obtained in 14m intervals sampling. In addition, 66 rock chip samples taken from 2,200 m^2 revealed average 7.95g/t Au (Peréz and Sureda, 1999).

At Cerro Riñon, JICA/MMAJ conducted geological survey in 1983. As the results of chemical analysis, 108 ppm Cu and 120 ppm Pb were obtained among five samples of silicified rocks with pyrite.

5) Mining properties

Billiton Argentina B.V. SUC. ARG. owns several mining properties for exploration.

6) Geology and geological structure

In this district, batholith of granite and granidiorite of late Cretaceous, and Jurassic andesite of Lago la Plata formation as roof pendant in the batholith are distributed. And Quaternary glacial sediments are distributed in the eastern part.

Cerro Riñon deposit is distributed in andesite and its tuff of Lago la Plata formation with intrusion of andesite porphyrite (JICA/MMAJ, 1983).

7) Mineralization and alteration

According to Peréz and Sureda (1999), alteration and mineralization in Cerro Colorado is related to high-sulfidation epithermal activity, and hydrothermal breccia pipe is distributed near the border between granitc rocks and ignimbrite of Lago la Plata formation. Advanced argillic alteration of quartz-pyrophyllite assemblage is centered to breccia pipe, and propylitic alteration is distributed in the periphery. Hydrothermal breccia and silicification are distributed over about 50 m, and quartz-pyrophyllite alteration is distributed over about 300

m. Surface is intensively oxidized to secondary limonite. Mineralization of gold is recognized in breccia pipes and silicified rocks. The grade is lower toward the periphery. Geochemical anomalies of copper, arsenic and antimony are recognized overlapping with the zone of silicification and argillization. It is considered that enargite exists in the lower part of sulfide zone on the surface.

According to JICA/MMAJ (1983), Cerro Riñon deposit consists of quartz-pyrite veinlets centered to andesite porphyrite that intruded into andesitic rocks of Lago la Plata formation. Propylitic alteration is distributed in the periphery. Total scale of the alteration is 6km in E-W direction and 2km in N-S direction. Significant mineralization was not recognized.

On the shores of Lago General Vintter, Many floats of granitic rocks were observed, some of that are strongly silicified with disseminated pyrite. Pyrophyllite was identified by POSAM measurement for these samples.

8) Characteristics of the satellite images

No lineaments were extracted in this district. Although, no hydrothermal alteration zones were extracted, color anomalies of reddish purple are recognized around the summits of Cerro Riñon and Cerro Colorado. In the field, reddish brown zones on the summits were observed in a distant view.

9) Laboratory work results

Floats of granitic rocks were taken on the shore of Lago General Vintter as samples of A00TM053 and A00TM054. Sample A00TM053 revealed 110 ppm Zn. However, no other anomalous values were obtained.

10) Assessment

Cerro Colorado deposit was not surveyed in-situ because of the problem of accessibility. It is considered that high potentiality of this district has been already proven, because the high-sulfidation gold mineralization was reported by exploration activities of a major company, and mining properties are retained by the company. With consideration given to the purpose of this project, that new promising areas should be extracted, it is judged unnecessary to include this district in Phase-2 survey.

3-2-27 Estrella Gaucha district

1) Location

This district is located about 7 km from the border with Chile and about 35 km to the northeast of the Lago Fontana, in the west of Chubut province (Fig. II-3-1). The area is lat. 44° 37' 48" to 44° 46' 48" S and long. 71° 03' 00" to 71° 10' 12" W (Fig. II-3-2-27a), and about 230 km^2. The representative coordinate is lat. 44° 41' 24.0" S and long. 71° 06' 49.3" W at the sampling point of A00RM060.

2) Topography and vegetation

Cordillera de Sakmata is gently sloped mountains and hills that are in N-S direction and in altitude of 1,500 to 1,700 m above sea level. And Cordillera de Sakmata is located between Rio Apeleg Chico and Rio Apeleg Grande that are upper streams of Rio Apeleg. Estrella Gaucha, an old kaolin exploitation pit, is located on Cerro Bayo of 1,618 m above sea level, in the northern end of Cordillera de Sakmata. The vegetation is sparse. It is dry in summer, and windy and snowy in winter.

3) Access

It is about 30 minutes drive to north on No. 40 national road from Alto Rio Senguerr town, then about 2 hours drive to west on unpaved road. It is necessary to walk about 30 minutes for last approach of 1 to 2 km to Estrella Gaucha kaolin deposit.

4) Previous surveys

Hayase (1970) described several mineral deposits in Chubut province including Estrella Gaucha kaolin deposit. According to the report, alteration zones of sificification, alunite and kaolin are distributed in Estrella Gaucha deposit. Minerals of kaolin, dickite, alunite, barite and quartz were described. At that time, exploitation of kaolin had been ceased and road to the mine had been abandoned.

Pedro (1981) surveyed three kaolin deposits in the western part of Chubut province including Estrella Gaucha. According to the report, alteration zones of Estrella Gaucha are classified to silicified zone, alunite zone, kaolin zone and chlorite-sericite zone, in order outward from the center. Minerals of kaolin, dickite, alunite, quartz, barite, pyrophyllite, diaspore, etc. were described.

This district was included in the areas of UN Revolving Fund Project from 1977 to 1982, as the Apeleg area (UNDP, 1983). Maximum 112 ppm Ag of rock geochemistry, and 6,900 ppm Pb, 876 ppm Zn, 530 ppm Cu and 82 ppm Ag of soil geochemistry were detected by geochemical survey. It was considered that these are original nature of sedimentary rocks containing heavy metals or secondary enrichment by underground water from low-grade basemetals deposits.

Cayetano et al. (1993) reported the results of chemical analysis for 134 rock samples taken in Cerro Baya. However, any noticeable contents of gold, silver, copper and zinc were not obtained.

5) Mining properties

Individual mining property for gold exploration was petitioned in this district.

6) Geology and geological structure

The geology of this district comprises sedimentary rocks of Apeleg formation and volcanic rocks of Divisadero formation of lower Cretaceous. Apeleg formation consists of tuffaceous sandstone, conglomerate and mudstone. Parallel and oblique bedding are developed in the sandstone and conglomerate. Divisadero formation consists of andesitic welded tuff and ignimbrite. Surface of unconformity to Apeleg formation is clearly observed.

Intrusions of rhyolite and basalt, related with hydrothermal alteration, intruded into Apeleg formation. A dyke at 2 km east from the kaolin pit is aphanitic and in width of 3 to 4 m. It strikes E-W and dips vertical. In the place slightly south of the dyke, there are two brecciated quartz veins in parallel with width of about 50 cm, strike of N 35° W and vertical dip.

7) Mineralizaion and alteration

Hydrothermal alterations develop mainly in Apeleg formation, and reach even welded tuff in the upper Divisadero formation. Silicified zone forms a small topographical rise of Cerro Baya where alunite zone, kaolin zone, and chlorite-sericite zone are distributed in downward order. Limonite zones were scatteringly observed, but bedding planes and texture of conglomerate were also observed. Welded tuff unconformably overlying them is also strongly silicifed. Alunite was identified by powdery X-ray diffraction for a sample of silicification.

Kaolin zone is distributed in taffaceous sandstone and mudstone of Apeleg formation. Kaolin, exactly dickite is white soil-like to light bluish gray wax-like with high purity and crystallization. Limonite is observed on surface and along cracks of kaolinized rocks.

Peripheral chlorite-sericite zone with dissemination of pyrite and limonite is not so developed. Sericite and montmorillonite were identified by POSAM measurement.

Chlorite was observed microscopically for sample of basalt dyke at 2 km east from the kaolin exploitation pit. Quartz veins in south of basalt dyke consists of white to clear quartz, and brecciation is more intensive at the edge part. Central part of the quartz veins are

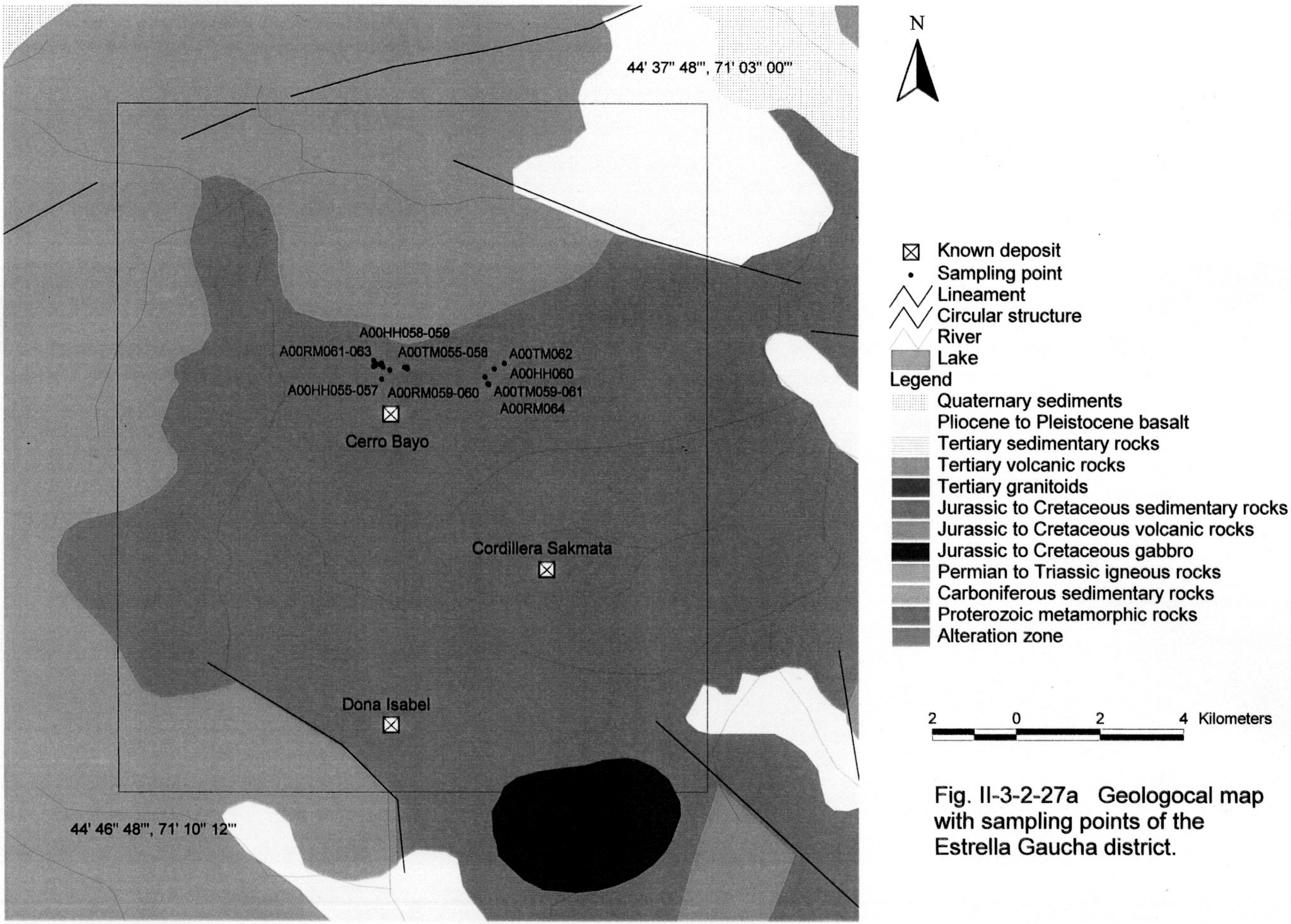


Fig. II-3-2-27a Geologocal map with sampling points of the Estrella Gaucha district.

accompanied by crystalline quartz.

8) Characteristics of the satellite images

The geology of this district is interpreted as Kis2 of lower Cretaceous sedimentary rocks for Apeleg formation, and Kiv of upper Cretaceous volcanic rocks for Divisadero formation. Color tones of the false color image range from brown to whitish brown. The structure due to topographical undulations is fine to rough, and water systems are parallel or dendritic with moderate to high densities. Ridges are quasi-clear to clear with moderate to high resistance. Bedding planes develop in Kis2 and are uncommonly recognized in Kiv. Lineaments in the directions from the NNW-SSE to WNW-ESE are somewhat dominant on the periphery. Small color anomaly showing bright reddish purple is recognized on the ratio image.

9) Laboratory work results

Microscopically, Sample A00HH060 was observed as aphanitic basalt, and sample A00RM060 was observed as lapilli tuff (Appendix-3).

As the results of powdery X-ray diffraction, a large amount of kaolin was identified for samples of A00RM059 taken near kaolin deposits. A very little amount of anatase and alunite were identified only for sample of A00TM057. Potassium feldspar and chlorite were identified for sample of A00TM060 in the peripheral alteration zone, and sericite was identified for samples of A00TM062 and A00RM065 (Appendix-5).

As the results of chemical analysis, no noticeable values were not obtained although 9 samples of altered rock, quartz vein, hydrothermal breccia and brecciated quartz vein were analyzed (Appendix-6).

Fluid inclusion study for quartz of sample A00TM059 showed average homogenization temperature of 136℃, and average salinity of 1.2 wt% (Appendix-10). Oxygen isotopic composition of same quartz sample was +7.3‰ (Appendix-12). Then, -9.4‰ is calculated for oxygen isotopic composition of hydrothermal water, which generated quartz, by oxygen isotopic fractionation factor between quartz and water (Matsuhisa et al., 1979) at the average homogenization temperature. Oxygen isotopic composition of magmatic water shows heavy values ranging from +6‰ to +9‰ (Taylor, 1974), while oxygen isotopic composition of meteoric water shows generally light values from -4‰ to -14‰, although with regional differences (Craig, 1963). Therefore, calculated -9.4‰ indicates that hydrothermal water originated in meteoric water.