rivers and the flat land to the east of the survey area.

3-2 General information of ore deposits

The distribution of major known deposits in the survey area and its surroundings is shown in Fig. I-3-4 and Table I-3-2. The area covers Mendoza, La Pampa, Neuquen, Río Negro and Chubut provinces. According to the geological terranes of Fig. I-3-1, the known deposits in Neuquen, Río Negro and Chubut provinces belong to the Patagonia terrane. Based on the Zappetini (1998), the mineralization of the Patagonia terrane is summarized below in chronological order.

1) Pampian and pre-Pampian events

These events were the diastrophism when Pampia collided with the Río de la Plata craton (Fig. I-3-1) or preceding diastrophism to the collision, and corresponds to the Proterozoic to late Cambrian.

In Patagonia terrane, during the deposition of the turbidite sequence which form the bedrock of the Somuncura massif (Fig. I-3-1), secondary basins developed with syn-sedimentary faults, which controlled the emplacement of sedimentary exhalative Pb-Zn-Ag deposits (Gonzalito mine, Río Negro). Limestone and dolomite beds are intercalated in this sequence, and they are being exploited.

2) Famatina events

These events were the diastrophism when Cuyania and Chilenia were accreted to Pampia and when Somuncura collided against Deseado (Fig. I-3-1). It corresponds to the late Cambrian to Carboniferous.

At this time, in the east of Patagonia terrane, a passive margin sequence was deposited during the Silurian and Devonian. It was accompanied by the sedimentary Fe deposits (Sierra Grande, Río Negro).

3) Gondowana events

These events were the diastrophism when Patagonia terrane collided with rest of the Gondowana continent, and corresponds with the late Carboniferous to early Jurassic.

The magmatic arc in Somuncura massif preceded the collision of Patagonia with the Gondowana continent, followed by a large lava plateau and post-collisional ignimbrites associated with Permian granitoids. This volcanism was accompanied by W vein mineralization (San Martín, Río Negro), fluorite veins (Valema; San Antonio; Carmen, Río Negro), Mn deposits (Don Antonio, Río Negro), and hydrothermal kaolin deposits.

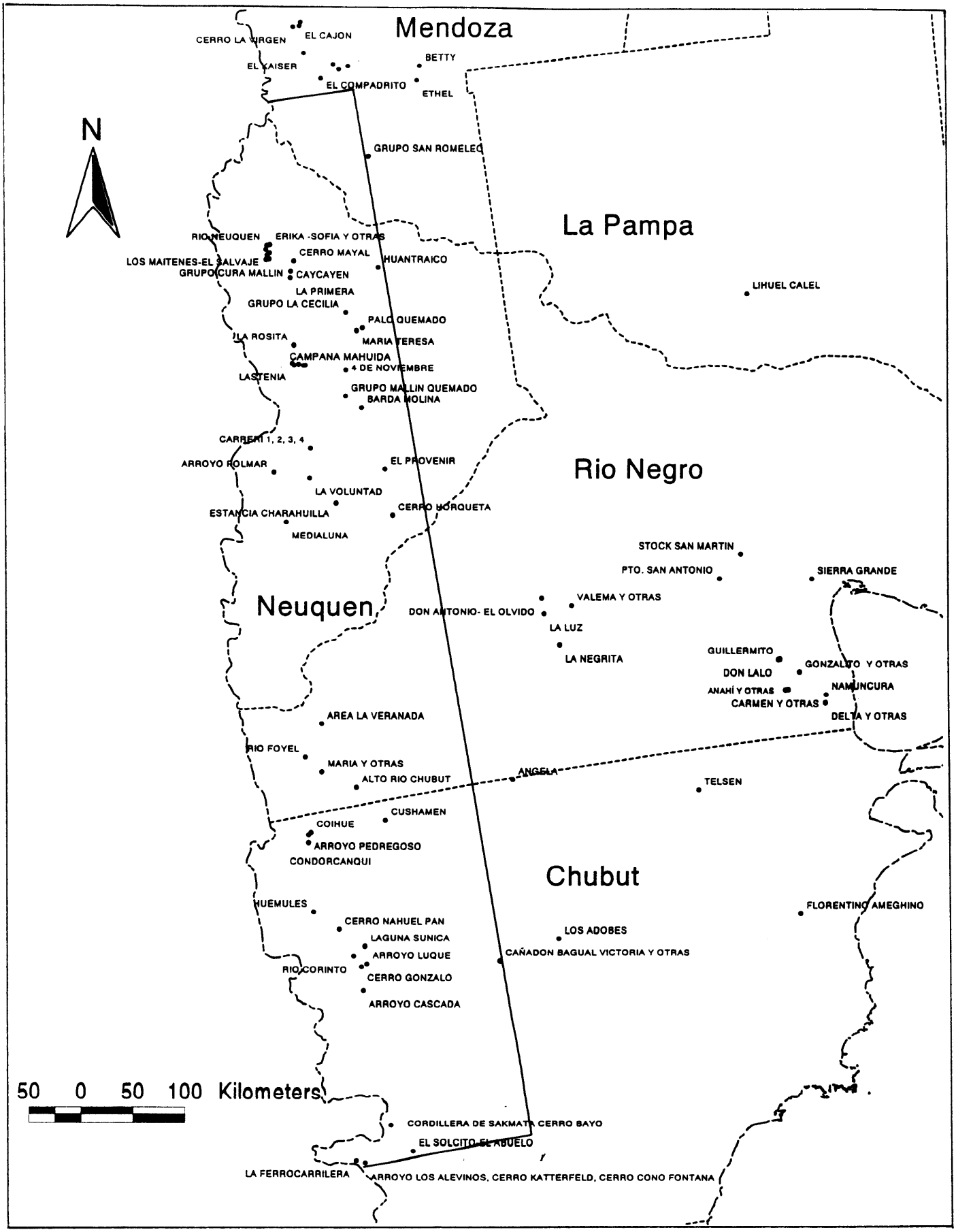

Fig. I-3-4 Distribution of major known mineral occurrences in the Provinces of Mendoza, Neuquen, La Pampa, Rio Negro and Chubut where almost of them belong to the Patagonia tarrane of Fig. I-3-1, after Zappettini (1998).

Table I-3-2 Major known mineral occurrences shown in Fig. I-3-4.

PROVINCE	NAME	MAJOR ELEMENT	MINOR ELEMENT	MODEL	LON (D)	LON (M)	LAT (D)	LAT (M)
MENDOZA	LA FLOR	Pb,Ag,Zn	Cu	Epithermal	69	56	35	22
	CERRO LA VIRGEN	Cu	Ag,Zn	Metasomatism	70	1	35	24
	EL CAJON	Pb,Zn,Ag	Au	Epithermal	69	57	35	24
	EL KAISER	Fe		Metasomatism	69	57	35	38
	HUEMUL, ARROYO SECO, AGUA BOTADA.	U	Cu	Sedimentary	69	40	35	46
	CERRO MIRANO, ROSA	U	Cu	Sedimentary	69	31	35	48
	CASA DE PIEDRA	U,Cu		Sedimentary	69	37	35	49
	EL COMPADRITO	Ba		Sedimentary	69	49	35	52
	BETTY	Mn		Epithermal	68	47	35	53
	ETHEL	Mn	F	Epithermal	68	50	36	0
	GRUPO SAN ROMELEO	Cu		Sedimentary	69	27	36	35
LA PAMPA	LIHUEL CALEL	Co,Mo,Cu		Porphyry	65	40	38	10
NEUQUEN	ERIKA -SOFIA Y OTRAS, ANDACOLLO	Au	Pb,Zn	Epithermal	70	37	37	11
	RIO NEUQUEN	Au		Placer	70	39	37	11
	LOS MAITENES-EL SALVAJE	Au		Porphyry	70	40	37	13
	EL PORVENIR	Pb,Zn,Au,Cu,Ag		Epithermal	70	38	37	15
	MILLA MICHICO	Au	Pb,Zn,Ag	Epithermal	70	40	37	16
	GRUPO CURA MALLIN	Cu	Pb,Zn	Epithermal	70	41	37	18
	CURA MALLIN	Ba		Exhaletive sulfides	70	39	37	18
	CERRO MAYAL	Au		Epithermal	70	24	37	21
	CAYCAYEN	Cu	Fe	Porphyry, Metasomatism	70	27	37	26
	LA PRIMERA	U	Cu	Sedimentary	70	28	37	29
	HUANTRAICO	Fe		Association of subaerial volcanism	69	32	37	31
	GRUPO LA CECILIA	Sr	Ba	Sedimentary	69	57	37	51
	PALO QUEMADO	U,V	Cu	Sedimentary	69	48	38	0
	MARIA TERESA	U,V	Cu	Sedimentary	69	52	38	1
	LA ROSITA	Ba		Sedimentary	70	33	38	3
	LASTENIA	Pb,Ag,Zn		Epithermal	70	36	38	12
	CAMPANA MAHUIDA	Cu	Au	Porphyry	70	32	38	13
	AMELIA, BELEN , TERESA	Pb,Ag,Zn	Ba	Epithermal	70	35	38	13
	AGUSTINA Y OTRAS	Pb,Ag,Zn		Epithermal	70	29	38	14
	CERRO HUAYELON	Pb,Ag,Zn	Cu	Epithermal	70	28	38	14
	4 DE NOVIEMBRE	Ba		Sedimentary	70	3	38	20
	GRUPO MALLIN QUEMADO	Ba		Sedimentary	70	6	38	33
	BARDA MOLINA	Cu		Sedimentary	69	57	38	40
	CARRERI 1, 2, 3, 4	Pb,Ag,Zn	Cu	Vein and Breccia (Various genesis)	70	34	38	56
	ARROYO POLMAR	Au		Placer	71	0	39	5
	LA VOLUNTAD	Cu	Mo	Porphyry	70	38	39	11
	EL PROVENIR	Cu		Sedimentary	69	49	39	13
	ESTANCIA CHARAHUILLA	Cu,Ag	U	Sedimentary	70	24	39	26
	MEDIALUNA	Au		Placer	70	58	39	31
	CERRO HORQUETA	Cu		Sedimentary	69	49	39	37
RIO NEGRO	STOCK SAN MARTIN	W		Vein associated with granitoid	66	5	40	23
	DON ANTONIO- EL OLVIDO	Mn		Epithermal	68	21	40	31
	PTO. SAN ANTONIO	F		Vein and Breccia (Various genesis)	66	21	40	34
	VALEMA Y OTRAS	F		Vein and Breccia (Various genesis)	68	2	40	37
	LA LUZ	Pb,Ag,Zn		Epithermal	68	21	40	39
	SIERRA GRANDE	Fe		Sedimentary	65	20	40	40
	LA NEGRITA	Mn		Epithermal	68	14	40	56
	AREA LA VERANADA	Au	Cu,Pb,Zn	Epithermal	71	0	41	15
	GUILLERMITO	W	Mn	Vein associated with granitoid	65	48	41	19
	DON LALO	Mn		Epithermal	65	49	41	19
	GONZALITO Y OTRAS	Pb,V,Ag,Zn	Cu,Fe,As	Exhaletive sulfides	65	36	41	27
	RIO FOYEL	Au		Placer	71	15	41	30
	ANAHI Y OTRAS	F		Vein and Breccia (Various genesis)	65	45	41	35
	CARMEN Y OTRAS	F		Vein and Breccia (Various genesis)	65	47	41	35
	NAMUNCURA	Fe		Sedimentary	65	20	41	40
	DELTA Y OTRAS	F		Vein and Breccia (Various genesis)	65	21	41	44
	ALTO RIO CHUBUT	Au		Placer	70	45	41	50
CHUBUT	MARIA Y OTRAS	Pb,Ag,Zn,Cu		Epithermal	71	6	41	39
	ANGELA	Pb,Zn	Ag,Au	Epithermal	69	0	42	0
	COIHUE	Cu,Au	Pb,Zn	Porphyry	71	21	42	8
	CUSHAMEN	Mo		Vein associated with granitoid	70	30	42	9
	CONDORCANQUI	Cu	Au	Association of subaerial volcanism	71	23	42	9
	ARROYO PEDREGOSO	Au		Placer	71	24	42	13
	TELSEN	Au		Epithermal	66	55	42	20
	HUEMULES	Au		Epithermal	71	30	42	48
	CERRO NAHUEL PAN	Au		Epithermal	71	15	42	59
	LAGUNA SUNICA	Au	Cu	Epithermal	71	0	43	10
	RIO CORINTO	Au		Placer	71	9	43	14
	ARROYO LUQUE	Cu	Mo	Porphyry	71	1	43	19
	CERRO GONZALO	Mo,Cu,Ag,Au		Vein and Breccia (Various genesis)	71	5	43	20
	LOS ADOBES	U	Cu	Sedimentary	68	47	43	24
	FLORENTINO AMEGHINO	Mn		Epithermal	65	57	43	30
	CAÑADON BAGUAL VICTORIA Y OTRAS	Pb,Ag,Zn	Au,Bi	Epithermal	69	30	43	30
	ARROYO CASCADA	Au,Ag		Epithermal	71	7	43	32
	CORDILLERA DE SAKMATA CERRO BAYO	Au	Pb,Zn	Epithermal	71	7	44	42
	LA FERROCARRILERA	Pb,Zn	Cu,Au,Ag	Epithermal	71	36	44	56
	EL SOLCITO-EL ABUELO	Fe	Mn	Metasomatism	70	55	44	57
	ARROYO LOS ALEVINOS, CERRO KATTERFELD, CERRO CONO FONTANA	Au	Cu,Pb,Zn,Ag	Epithermal	71	30	44	58

4) Mesozoic events

These events were the diastrophism that an important extensional regime developed a significant basin in the periphery of the cratonic nucleus and the Gondowana continent was dismantled by the opening of the Atlantic Ocean. It corresponds to the Jurassic and the Cretaceous.

The volcanic activity related to the rifting which originated with opening of the Atlantic Ocean generated epithermal gold deposits which is controlled by shear zones. Outside the area of Fig. I-3-4, the Cerro Vanguardia Au deposit was formed in Santa Cruz province. In the Cretaceous, on the other hand, a magmatic arc was formed by the Pacific subduction which generated the porphyry Cu deposits (Campana Mahuida, Neuquén; Cerro Coihue, Chubut).

In the Jurassic, intracratonic basins were formed around the periphery of cratonic nucleus from the south of San Juan province to the south of Neuquen province, accompanied by sedimentary deposits. There are sedimentary Cu deposits (El Provenir, Neuquén), barite deposits (Mallín Quemdo, Neuquén), celestite and gypsum.

The retro-arc basins formed during the Jurassic to Cretaceous have marine and continental stratabound deposits of celestite-barite (Noviembre; Grupo La Cecilia, Neuquén), halite, limestone and phosphorite.

The sequences filling the thermal subsidence basins, which emerge after magmatism contain deposits of stratabound U deposits (Los Adobes, Chubut).

5) Andean events

These events were the diastrophism of the Andean orogeny over the Paleogene, Neogene, and Quaternary.

a) Paleogene

The Paleogene is represented by volcanic arc activities, which reached their climax in Chile to generate numerous porphyry Cu deposits. The volcanic arc extends southward to Chubut province via Mendoza and Neuquen provinces. The volcanic activities generated porphyry Cu deposits also in Patagonia terrane (Cerro Caicayan, Neuquén). And gold-rich polymetallic deposit (Huemlas, Chubut) and manto-type Cu deposit (Condorcanqui, Chubut) relative to andesitic lava were generated. At the latitudes of these deposits, it is suggested that paleo-Benioff zone was flattened during the Oligocene to Miocene.

b) Neogene

The Neogene epoch includes the evolution and migration of a magmatic arc emplaced in the axis of the Andean cordillera. The range of the magmatism extended eastward up to 700

km from the oceanic trench. Major ore deposits, including the Bajo de la Alumbrera porphyry Cu deposit of Catamarca provnce in the northwest region of Argentine, were generated by the magmatic activities.

Between lat. 36° and 41°S, the volcanic arc migrated to the west in the beginning of the Miocene, and developed toward east retro arc magmatism represented by the Auca Mhuida volcano of Neuquén province. Related to the eastern magmatism are veins of magmatic Fe (Huantraico, Neuquén), epithermal Mn deposits (Ethel, Mendoza) and fumarolic sulfur deposits. In the west region, related to the magmatism are gold-rich polymetallic deposits (Andacollo, Neuquén) and prophyry Au deposits (Los Maitenes-El Salvaje, Neuquén).

The sediments related to retro-arc basins are accompanied by clay, sedimentary bentonite and lagoon diatomite.

To the south of lat. 41°S, magmatism was restructured. The volcanism characterized by a high angle inclination of the Benioff zone and low velocity of convergence, and isoleted volcanos like Tronador. This is a intraplate alkaline volcanism related to extension regime and has no known ore deposits.

The passive margin basins have economically interesting deposits of limestone, gypsum, bentonite, sedimentary kaolin and alunite.

c) Quaternary

The Quaternary sedimentary basins in dry climate have concentrations of sodium chloride and local concentrations of sulfate. In mountain regions, a variety of heavy minerals are found in high concentration due to erosion. Alluvial Au deposits are distributed extensively in linkage with the type of a variety of primary gold ore deposits (e.g., Río Neuquén, Neuquén).

3-3 Recent mining activities

1) Exploration activities

The exploration activities in Neuquen province were started in 1941 by the Dirección General de Fabricaciones Militares (DGFM) with organized activity extensively carried out as Plan Cordillerano between 1963 and 1969. From 1968 to 1969 during this period, as Plan Cordillerano Centro, drilling campaign was executed in promising sites then selected by these exploration activities (Mendéz et al., 1995).

Also in Rio Negro and Chubut States, the first exploration was done by DGFM (e.g., Pages, 1951). Later, an extensive investigation by Plan Patagonia Comahue of the Servicio Minero Nacional (current; Subsecretaria de Mineria) was executed from 1972. Following the

results, an exploration activity based on a UN revolving fund was carried out between 1977 and 1982, and the final report was submitted in 1983.

These fundamental investigations have so far identified numerous mineral occurrences. The distribution of all the known deposits in the survey area is shown in Fig. I-3-5. Table I-3-3 summarizes the major deposits of these.

Exploitation is now in progress in the Andacollo gold mine in Neuquen province. Its mine property is owned by the Corporación Minera del Neuquén Sociedad del Estado Provincial (CORMINE S.E.P.), and the operation has been run under the contract of CORMINE S.E.P. by a Canadian and Chilean joint venture, Mineral Andacollo Gold S. A., since January, 1999. The quartz veins containing gold and base metals are exploited underground to produce gold by the cyanide process on site. The minimum capacity of the plant is 200 t/d. The announced minable ore reserves are 199,916 tons of 7.77 g/t Au for the Erica vein and 79,836 tons of 14.72 g/t Au for the Sofia vein. According to a company source, the production of gold now stands at 50,000 oz/y and is planned to be increased up to 80,000 oz/y.

Drilling exploration is now active in the are of Joya del Sol gold deposits in Chubut province. The mine property is owned by Minera el Desquite S. A., whose capital is 60% held by a British company, Brancote Holdings Plc., and 40% by an Argentine company, MBP. The former is actually engaged in the exploratory operation. The exploration target is low-sulfidation epithermal auriferous quartz veins. According to Sunshine Mining, which gave up the exploration, the reserves are estimated at 209,000 oz for gold and 1,410,000 oz for silver with an average grade of 5.8 g/t Au and 39.5 g/t Ag, respectively. Minera el Desquite S.A. acquired the option right from Sunshine Mining in October 1998 and has been conducting systematic drilling exploration since 1999. According to Internet information of February 2000, the 1999 drilling program has taken the resources up to 1,000,000 oz Au of which 75% is in the measured and inferred categories.

The Huemules in Chubut province is auriferous polymetallic vein deposits. The drilling survey conducted under the above-mentioned UN-revolving fund project estimates that the reserve of 2,975,000 tons. Of this reserve, the ore with grade averaging higher than 9g/t Au is re-estimated to be 750,000 tons (Viera and Hughes, 1999). Minera el Desquite S.A now owns the Huemules mine property because it is located about 20 km to the west of the earlier-mentioned Joya del Sol deposits. Even if the single reserve of Huemules deposits may not be economically feasible for development, it is certain that the combined development with the Joya del Sol deposits will make it economically feasible.

The Cerro Colorado in Chubut province is high-sulfidation Au deposit with hydrothermal breccias where value of 7.95 g/t Au is obtained in the surface alteration zone. Billiton Argentina B.V. participated in the joint venture with Newcrest Minera Argentina S.A. and started a drilling survey in 1998. Billiton, however, stopped the survey because Newcrest

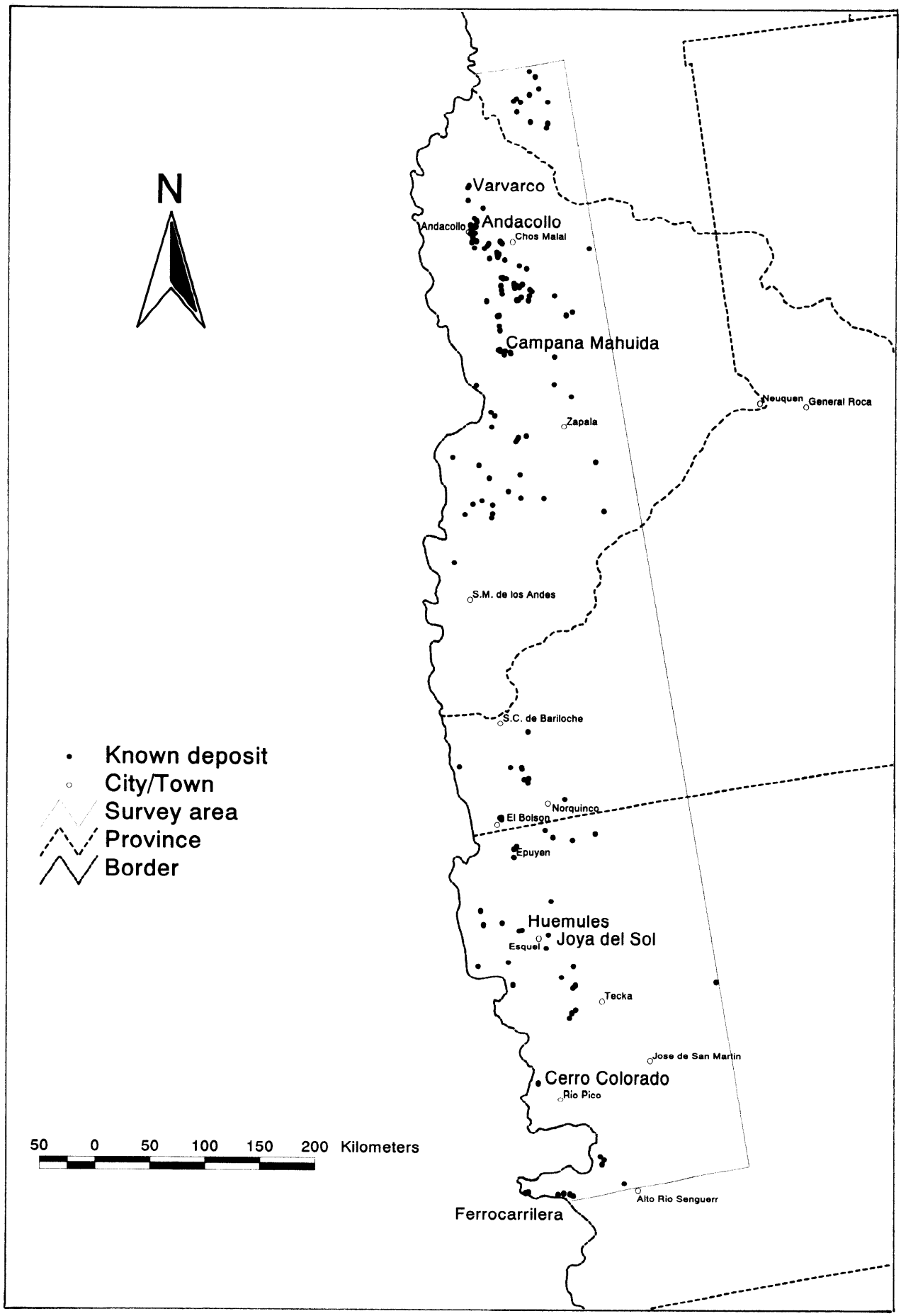

Fig. I-3-5 Distribution of all known mineral occurrences in the survey area.

Table I-3-3 Data of major deposits of the survey area.

Type	Name	Province	Metal	Type	Host rock	Data	Property	Note
1	Erica	Neuquen	Au,Pb,Zn	Polymetal vein	Tuff (C)	199,916t, 7.77g/t Au	Minera Andacollo Gold S.A./CORMINE S.E.P.	These veins are exploited as the Andcollo gold mine from January 1999. Current production is 50,000 oz/y Au and increase to 80,000 oz/y Au is planned.
1	Sofia	Neuquen	Au,Pb,Zn	Polymetal vein	Tuff (C)	79,836t, 14.72g/t Au		
2	Joya del Sol	Chubut	Au,Ag	Low sulfidation quartz vein	Andesitic and dacitic volcanics (J β a)	209,000 oz Au, 1,410,000 oz Ag with 5.8g/t Au, 39.5g/t Ag	Minera el Desquite S.A.	1,000,000 oz Au, of which 75% is in the measured and inferred categories, had already gained by systematic drilling survey.
3	Campana Mahuida	Neuquen	Cu,Au,Mo	Porphyry Cu (Chacocite blanket)	Sandstone (Jk), Andesite (Kg)	4,637,782.3t, 0.73% Cu oxide and 22,890,977t, 0.6% Cu, (Cut off 0.3% Cu)	CORMINE S.E.P.	Outline of orebody was unveiled by drilling survey. Secondary enrichment zone is not thick.
3	Huemules	Chubut	Au,Ag,Pb	Polymetal vein	Andesitic volcanics (J β a)	Total 2,975,000t; 750,000t, 9g/t Au	Minera el Desquite S.A.	Ore reserves were calculated by drilling survey of UNRF. Currently Minera el Desquite owns the property because it is adjacent to their Joya del Sol property.
3	La Ferrocarrilera	Chubut	Pb,Zn,Ag	Polymetal vein	Andesitic volcanics (J β a)	708,630t, 1.63% Pb, 4.49% Zn, 0.61% Cu, 0.1g/t Au, 14g/t Ag	Gropo Minero Aconcagua S.A.	Previously it was explored by drilling and underground survey in 1940's. Lower extension of the veins is not expected.
4	Cerro Colorado	Chubut	Au	High sulfidation epithermal breccia	Andesite (J β a), Granitoids (Kg)	7.95g/t Au, 66 samples of 2,200km2	Billiton Argentina B.V.	Billiton Argentina B.V. retains the property. Drilling survey was ceased in 1998 after the withdrawal of Newcrest Argentina S.A. who was the partner of J/V.

Type1= mine in operation, Type2=drilling survey is being conducted, Type3= exploration was ceased, but reserve calculation was done,
Type4= exploration was ceased, but noticeable ore grades were reported.

decided to withdraw from the operation. The mine property is still owned by Billiton.

The Campana Mahuida in Neuquen province is porphyry Cu deposit and was drilled by the DGFM and Falconbridge with 45 holes totaling 4,043 m. As the result, 4,637,782.3 tons of 0.73% Cu for oxides and 22,890,977 tons of 0.6% Cu for sulfides were calculated by cut-off 0.3% Cu. At present, there are no exploration activities going on. The mine property is owned by the CORMINE S.E.P.

The Ferrocarrilera in Chubut province is polymetallic vein deposits of Pb, Zn and Ag. Drilling exploration and a underground survey were conducted in the 1940s. The place was also taken up as one of the UN-revolving fund projects. Based on the result of these exploration surveys, the ore reserve was calculated by SEGEMAR in 1985 and determined to be 708,630 tons of 1.63% Pb, 4.49% Zn, 0.61% Cu, 0.1g/t Au and 14g/t Ag, respectively (Zubia, 1985). The exploration is now stopped as the ore condition in the lower extension is not encouraging. The mine property is owned by the association of small-mine owners.

2) Public mining corporation

The Neuquen province government established a public mining corporation, CORMINE S.E.P.(Corporación Minera del Neuquén, Sociedad del Estado Provincia) in 1975. The CORMINE S.E.P. owns mining properties and promotes exploration activities within the province through the option contracts with private companies. As of January 2000, it has 11 mining properties within the province. The property of Andacollo gold mine operated by the above-mentioned Minera Andacollo Gold S.A is also owned by the CORMINE S.E.P.. Neither Rio Negro nor Chubut province governments have a public mining corporation.

3) PASMA Project

In order to create a comprehensive investment environment by the Argentine government, the PASMA project (Proyecto de Apoyo Minero Argentino) is now in progress with the support of the World Bank. The objectives of this project is to format as a database, open and share through the Internet various kinds of information possessed by the central government, and respective province governments, including mining property information and fundamental geological information.

As a part of the PASMA project, the program of geophysical and mineral resources mapping has been implemented, and the metallogenic map published by SEGEMAR in 1997 was digitized in 1998 (Zappettini ed., 1998). In addition, airborne geophysical survey is being carried out over the range including the survey area.