Chapter 3 Survey Findings by District

The findings of geological and geochemical surveys, which were executed in the sixteen promising districts selected by the result of the analysis of existing data and interpretation of satellite images, are summarized in Table II-3-1.

Except districts where the possibilities of existence of ore deposits are low, the survey findings and conclusions are as follow.

3-1 Turaquiri District (Figs. II-3-1 (1), -1(2))

Survey was carried out from Phase I to Phase III.

The Phase III survey revealed distributions of Middle to Upper Miocene sedimentary rocks, Miocene to Pliocene volcanic rocks and the presence of andesite intrusive rock.

The Turaquiri deposits are interpreted as an epithermal barite-quartz type deposit. It is associated with base metals and precious metals, which occur along the east-west fractures formed by the development of the caldera system.

The average homogenization temperatures are 200°C and the average salinities (NaCl equivalent) are 10.8 wt.%.

Many ore veins are confirmed northwest of this ore deposit. Most of them, however, are less than 10 cm in width and network and dissemination types mineralizations are not confirmed.

Variations in ore minerals are confirmed. Centering on the Turaquiri Vein, the veins change from lead and zinc veins to manganese dioxide veins in northwest and clay veins farther outside. Local gold anomalies are confirmed in Phase III.

The mineralization similar to the Turaquiri ore deposit is expected under manganese oxide veins.

However, the possibilities of ore deposits that allow large-scale mining are low.

3-2 Chullcani District

Survey was carried out from Phase I to Phase III.

(1) Geological and Geochemical Surveys (Figs. II-3-2 (1), -2 (2))

Hydrothermal alterations cover about 6.5 km^2 in andestic volcanic rocks and Diorite of Middle Miocene to Pliocene in the Chullcani District.

The igneous activity of Chullcani Volcano started around 6.5 Ma. Wide hydrothermal alteration zones were formed through the intrusion of diorite and andesite and by hydrothermal activities caused by intrusions. It is interpreted that subsequent erosion denuded the center part of the volcanic body and the dome and mesa of basalt were formed from late Pliocene to Pleistocene.

Quartz-sericite zone is detected in and around diorite. Quartz zone surrounds quartz-

Table II-3-1 Summary of Characteristics of Geology,Alteration and Mineralization at the Survey Areas

No	district	area	lithology	main direction of vein,fracture	rock age K-Ar (Ma)	rock age rock type	alteration area (km²)	alteration area arg/sil	alteration minerals (POSAM)	dome hyd br br pipe	alteration age K-Ar (Ma)	ore deposit,mineral showing: ore minerals	ore deposit,mineral showing: gangue minerals	ore deposit,mineral showing: ore reserve,ore grade	fluid inclusion: homo.temp. (℃)	fluid inclusion: salinity (Nacl wt%)	geochemical anomaly	potential: expected type	potential: estimate
1	Turaquiri		da-lava,da-tf(Turaquiri F) rhy-tf(Mauri F.)	E-W	*5.51±0.11*	da tf	2		smc>>zeo>qz	int		py,cp,sph,gn,hem	ba,qz,sid,chl,aln,ga		*ave.200*	*ave.10.8*	Ba(wide),Pb,Zn,As,Cu	III, V	○
2	Asu Asuni		an-da lava,tf,vol br,lp tf	E-W	*4.1±1.2* **3.27±0.10**	an lava an lava	5	sil>arg	qz>>smc,ser,aln,zeo	hyd br		py,hem					Ba,(Zn)	II ?	△
3	Chullcani		da-tf,tf br,lp tf an-ba lava, ba dome	radial	**5.31±0.14** **1.52±0.05** **6.14±0.12** *6.13±0.12*	bt-hb an lava ba dome hb-bt an int an lava	6.5	arg>sil	qz>aln>smc>zeo>ser,kao,pyph	ba-dome hydr br br pipe int	**5.32±0.07** **6.12±0.09**	py,Mn-oxd,grn Cu					Au,Sb,Ba,Pb,Mo,Cu,Sn:wide	II, IV	○
4	Sonia Susana		rhy-da-ba lava,dol-dyke an-rhy tf,lava(Carangas F) tf(Negrillos F)	E-W NE-SW	*17.7±0.35* *1.73±0.03* *1.52±0.03*	rhy-an tf an-da lava rhy lava	17	arg>>sil	ser,qz,smc>>kao,zeo	rhy-dome hydr br	**1.75±0.10**	py,gn,sph,grn Cu, Mn-oxd,mo			*ave.195* **ave.222**	*ave.4.7* **ave.1.5**	Au,(Ag),Cu,Pb,Zn,As,Mo,Ba,Sn:coc	IV, III	○
5	Calorno		an-da lava,an-dome? an-da tf,lp tf,tf br,vol br	N-S NW-SE	*9.01±0.18* *11.69±0.23*	an lava(north) an lava(south)	28.5		qz>>aln,smc>kao,ser,pyph	an-dome? hyd br		py,al,lim					As,Sb,Cu,Pb,Mo,Ba,Sn,Hg:sctd	IV, II	◎
6	Loma Llena		an-ba lava tf ,tf br,lp tf,vol br	N-S NE-SW	*6.24±0.12* *4.07±0.08* *3.75±0.08*	an lava(north) an lava(south) an lava(south)	8	arg>>sil	aln>smc,qz>kao>ser,zeo,pyph	hyd br		py					Cu,As,Sb,Ba,Sn:sctd	IV, II	△
7	Blanca Nieves	Blanca Nieves	an-rhy lava(west) an-rhy lava,an dome,tf br	E-W NE-SW	**0.573±0.02** **2.63±0.03**	an lava(west) an dome	5	arg>>sil	qz,aln,zeo>smc>ser	an-dome hyd br,pipe		py					Ba,Sn,Cu,As:sctd	II	△
		Titicayo	an lava,tf,tf br,lp tf,vol br	WNW-ESE	**6.94±0.07** **7.27±0.10**	hb bt an da tf	3	arg>>>sil	smc>qz>zeo,ser>aln,kao	hyd br		Mn-oxd,lim,py					Ba,Pb,As,Cu,Sb,Ag,Sn,Hg,Zn	II	○
8	Carangas	San Francisco mine	da-an tf,tf br,lp tf,ba-lava	N-S	21.7±0.7	bt an?	—	—	ser>smc			Mn-oxd>py,cp,grn Cu			**ave.256**	**ave.1.7**	Ag,Cu,Pb,Zn,Sb	III	△
		Carangas mine	an-lava,tf,lp tf,tf br,rhy-dome	WNW-ESE	15.4±0.5	rhy dome	0.5	arg>sil	smc>>zeo,ser,qz	rhy-dome,hyd br		tet,sph,pru,pyr,gn	qz,ba,dol,mgs,py		**ave.212**	**ave.3.4**	Sb,Pb,Zn,Cu,Ag,As,Ba	III	○
		others	an-tf,lp tf,tf br				2.5	arg>>sil	smc>kao,pyph								Sb	IV ?	△
9	Culebra	Todos Santos mine	an-lava,lp tf,tf br,rhy-dome	E-W	6.1±0.2	rhy tf	0.5	arg>>>sil	smc>qz	rhy-dome,hyd br		lim,gn,sph		1.0mt(Au:0.07,Ag:70)			Sb,Pb,Zn,Ag	III	○
		Culebra	an-lava,tf,lp tf,tf br, rhy-da dome,an-dyke	WNW-ESE	**5.95±0.07** **6.10±0.07** 6.3±0.2	an dyke bi rhy hb an	3.5	sil>arg	qz>smc>aln>zeo,ser,kao	rhy-dome,hyd br da-dome		py,al					Sb,Sn,Ba	II	△
10	Mendoza	Co.Kancha	an-lava,tf,lp tf,tf br,da-dome	NW-SE,E-W	**7.27±0.08** 8.0±0.2	da dome da sub vol	15+	arg>>sil	ser>smc>qz>aln,kao	da-dome,hyd br	**16.37±0.20**	Mn-oxd,lim					Cu,Pb,Zn,Sb,Ba:sctd	II	△
		La Deseada mine ~Co.Mokho	an-lava,tf,tf br,lp tf	E-W ENE-WSW	17.6±0.2	Chufusa dio	4+	arg>>sil	qz,ser>smc>aln,kao chl,ep	hyd br		gn,sph,py	qz	2.5mt(Au:0.4,Ag:280)	**ave.188**	**ave.2.5**	Deseada:Au,Ag,Cu,Pb,Zn,As,Sb,Sn:conc Mokho:Au,Pb,Sb:conc	II, IV IV	◎ ◎
		Guadalupe mine(G)~ ~Maria Luisa(M.L.)	an-lava,tf,lp tf,tf br an-rhy int.	E-W WNW-ESE			5+	sil>arg	qz>ser>smc>kao,aln	hyd br G:rhy-an int M.L:rhy-dome		gn,sph,py,en	qz	G:2.5mt(Au:0.4,Ag:280) M.L:0.175mt (Ag:471,Pb:1.11,Zn:1.83)	**ave.256**	**ave.0.3**	Au,Ag,Cu,Pb,As,Sb,Sn:conc	II, IV	○
		Co.Chorka ~Iranuta	an-lava,tf,tf br,lp tf rhy-int	NE-SW NW-SE			5	arg>>sil	Chorka:qz>smc>kao,aln>ser,pyph Iranuta:qz>>ser,smc>kao	hyd br,br pipe					**ave.258**	**ave.0.7**	Chorka:Sb,Pb:sctd Iranuta:Pb,Zn,Cu,As,Sb:conc	II, IV III	◎ △
11	Panizo	Vilasaca	rhy-an lava,lp tf,tf,tf br,ss?	NE-SW			4	arg>>sil	qz,smc>aln,kao	hyd br		py					As,Sn,Sb:sctd	II	△
		Pacoloma	an-lava,tf,lp tf,tf br	NE-SW,N-S			3	arg>>sil	qz>smc>kao>aln,pyph	hyd br		hem,al					Sb,As:sctd	IV	△
		Tulco	an-lava,tf,lp tf,tf br,ss,cgl	E-W,N-S	**11.87±0.13**		8	arg>sil	qz>>smc>aln>kao	hyd br		py,al(abund)					As,Sb,Sn,Pb:sctd	II	△
		Chinchilhuma	an-lava,an-tf,tf br,lp tf	NE-SW			5	arg>>sil	ser>qz>smc	hyd br	**9.18±0.10**	Mn-oxd			**ave.249**	**ave.2.7**	Au,Ag,Sb,Zn,Pb,Ba,Cu,As:wide	III	○
		Puquisa	an-lava,tf,tf br,lp tf,da-dome	N-S,NE-SW			1	sil>arg	qz>>aln>smc	da-dome,hyd br		Mn-oxd					(Ba)	II	△
		Panizo	an-lava,rhy-lp tf,tf,an-dome	N-S,E-W,NE-SW	**14.87±0.19**	bt rhy tf	18	arg>sil	qz>>>aln>zeo,smc,pyph,ser	br,pipe,an-dome	**13.79±0.42**	py,al(abund)					Au,(Ag),Sb,As,Sn,Mo,Cu,(Pb):wide	II, IV	◎
12	Sailica	Plasmar mine	an-lava ,tf,lp tf,tf br,an-dome	E-W,NW-SE,N-S			10.5	arg>>sil	qz>>smc>kao>ser,aln,pyph	an-dome	**8.23±0.13**						Au,(Ag),Sb,As,Pb,,Sn,Zn,Cu,Mo:wide	II, IV	◎
		Solución mine	da-an lava,tf,lp tf,tf br,ba-int	NE-SW	**1.67±0.02**		—		smc,qz>kao	hyd br		gn,sph		3,000t(Ag:24,Pb:1.4,Zn:1.4)			Sb,Zn	II	△
13	Colorado	Bayos	an-lava,tf,lp tf,tf br	E-W,NE-SW	**5.85±0.06**	bt an	0.5	arg>>sil	smc,aln>qz>ser	hyd br,br pipe?		—					As,Sb,Ba,(Ag)sctd	II	△
		Okhe	an-lava,tf,lp tf,tf br	E-W	8.6±0.5	an lava	11	arg>>>sil	qz>>aln>kao			—					Sb,As,Ba,(Sn):sctd	II	△
		Perenal	an lava,tf,lp tf,tf br	NE-SW,NW-SE	10.0±0.6 11.8±0.6	an lava an lava	5	arg>sil	qz	hyd br		py					As,Sb,(Pb,Ba,Hg,Mo,Sn):sctd	II	○
		Colorado	an-lava,tf,lp tf,tf br	E-W,NW-SE			3	arg>>sil	qz>smc>ser,kao>aln,pyph	hyd br,br pipe?		al					As,Sb,Ba,(Pb):sctd	IV	△
14	Luxsar		an-lava,lp tf,tf,vol br,an-dome	NW-SE	**5.55±0.09** 5.6±0.3	px-hb an an lava	5.5	arg>>>sil	qz>>aln>smc,kao	hyd br,an-dome		py					—	II	△
15	Cachi Unu		an-da lava,lp tf,tf br,lp tf	NW-SE	**9.67±0.13** 10.9±0.7	hb an lava an lava	1	arg>>sil	qz>>aln	hyd br		green Cu,py,hem					Ba,Sn,(Pb):sctd	I B, IV	△
16	Sedilla	Chascos	an lava ,lp tf,tf br,vol br an-dome/int?		**9.70±0.17** **10.59±0.47** **9.41±0.11** 7.2±0.5	an lava px an an dome an lava(south)	1	arg>>>sil	—	an-dome(dry)		Mn-oxd					(As,Sb)	II ?	△
		Sedilla	da-an lava,tf,lp tf,tf br	NNE-SSW NNW-SSE	6.9±0.5	an lava,vol br	1	arg>>sil	—	hyd br		hem,py?					As,Sn,(Sb)	II	△
		Eskapa	da-an lava,lp tf,tf br,vol br	N-S NW-SE	6.3±0.1	an lava	4.5	arg>>>sil	qz,smc>ser>kao	hyd br	**5.93±0.19**	py,greenCu					Sb,As,Ag,Zn,Pb,Ba,Sn,Cu,(Mo):wide	II, III	◎

an:andesite ba:basalt
da:dacite rhy:rhyolite
tf:tuff tf br:tuff breccia
lp tf:lapilly tuff vol br:volcanic breccia
ss:sandstone cgl:conglomerate
dol:dolerite
int:intrusives

【K-Ar age】 *3.75±0.08:(Phase I)*
5.55±0.09:(Phase II)
8.0±0.2:(others)

qz:quartz, aln:alunite
smc:smectite ser:sericite
kao:kaolinite pyph:pyrophylite
chl:shlorite ep:epidote
zeo:zeolite

hyd br:hydrothermal breccia
br pipe:breccia pipe
int:intrusive rock

en:enargite
al:yellow alunite
sph:spharelite
gn:galena
py:pyrite
hem:hematite
mo:molybdenite
lim:limonite
Mn-oxd:Mn oxide

mgs:magnesite ga:garnet
dol:dolomite sid:siderite

Au,Ag : g/t
Pb,Zn : %

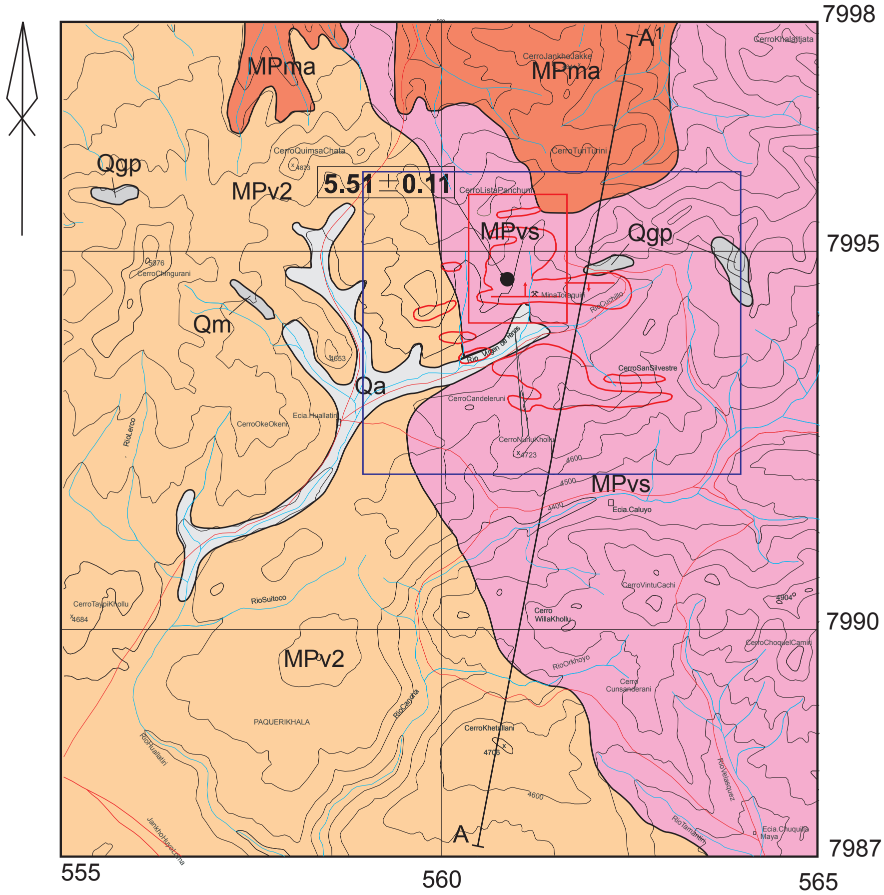
ave.195:(Phase I)
ave.222:(Phase II)

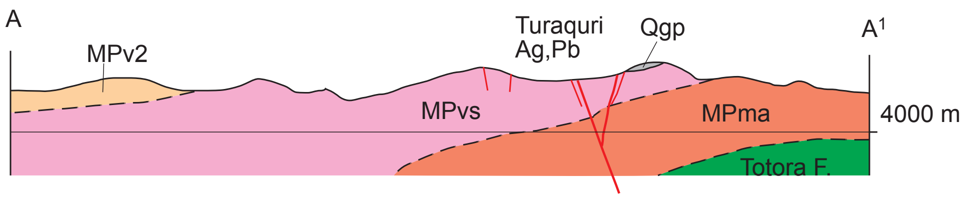
wide:widely spread sctd:scattered
conc:concentration of anomaly

【ore deposit type】 I B:bolivian-type deposit(Ag,Au,Cu)
II :volcanic rock related epithermal deposit(Au,Ag,Pb,Zn)
III:Intrusive rock related epithermal deposit(Au-Ag-Pb-Zn-Cu vein)
IV:high sulfidation type epithermal deposit(Au-Ag-Cu vein)
V:low sulfidation type epithermal deposit(quartz-adularia vein)

【estimate】 ◎:high ○:moderate △:low

TURAQUIRI DISTRICT





LEGEND

Quaternary

- Qa — alluvial deposit
- Qaa — alluvial fan deposit
- Qcf — colluvial - fluvial deposit
- Qt — terrace deposit
- Qm — moraine
- Qgp — glacial deposit

Tertiary

- PH_v — Pleistocene to Holocene volcanic rocks
- PP_v — Pliocene to Pleistocene volcanics (Perez F.)
- Mp_{v2}, MP_{br} — Upper Miocene to Pliocene volcanic rocks
- Mp_{vs}, MP_{ma} — Upper Miocene to Pliocene volcano - sedimentary rocks (MP_{vs}; Pullutuma F., MP_{ma}; Mauri F.)
- Totora F. — Upper Miocene to Pliocene sedimentary rocks
- M_{vc} — Lower to middle Miocene volcanic rocks (Carangas F.)
- OM_{vn} — Upper Oligocene to lower Miocene volcanic rocks (Negrillos F.)

Intrusive rocks

- Qi — Quaternary intrusive rocks
- MP_{vsv} — Miocene to Pliocene volcanic to sub-volcanic rocks (domes & stocks)
- M_{sv} — Miocene sub-volcanic rocks (dikes, sills, stocks)
- M_{vsv} — Lower Miocene volcanic to sub-volcanic rocks (domes, stoks & necks)

- G — Gracial
- Ore vein
- Strike and dip
- Alteration zone
- 5.51±0.11 — K-Ar Age (Ma)
- Phase II survey area
- Phase III survey area

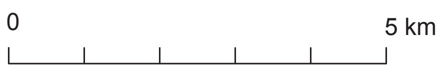


Fig. II-3-1(1) Geological Map of the Turaquiri District

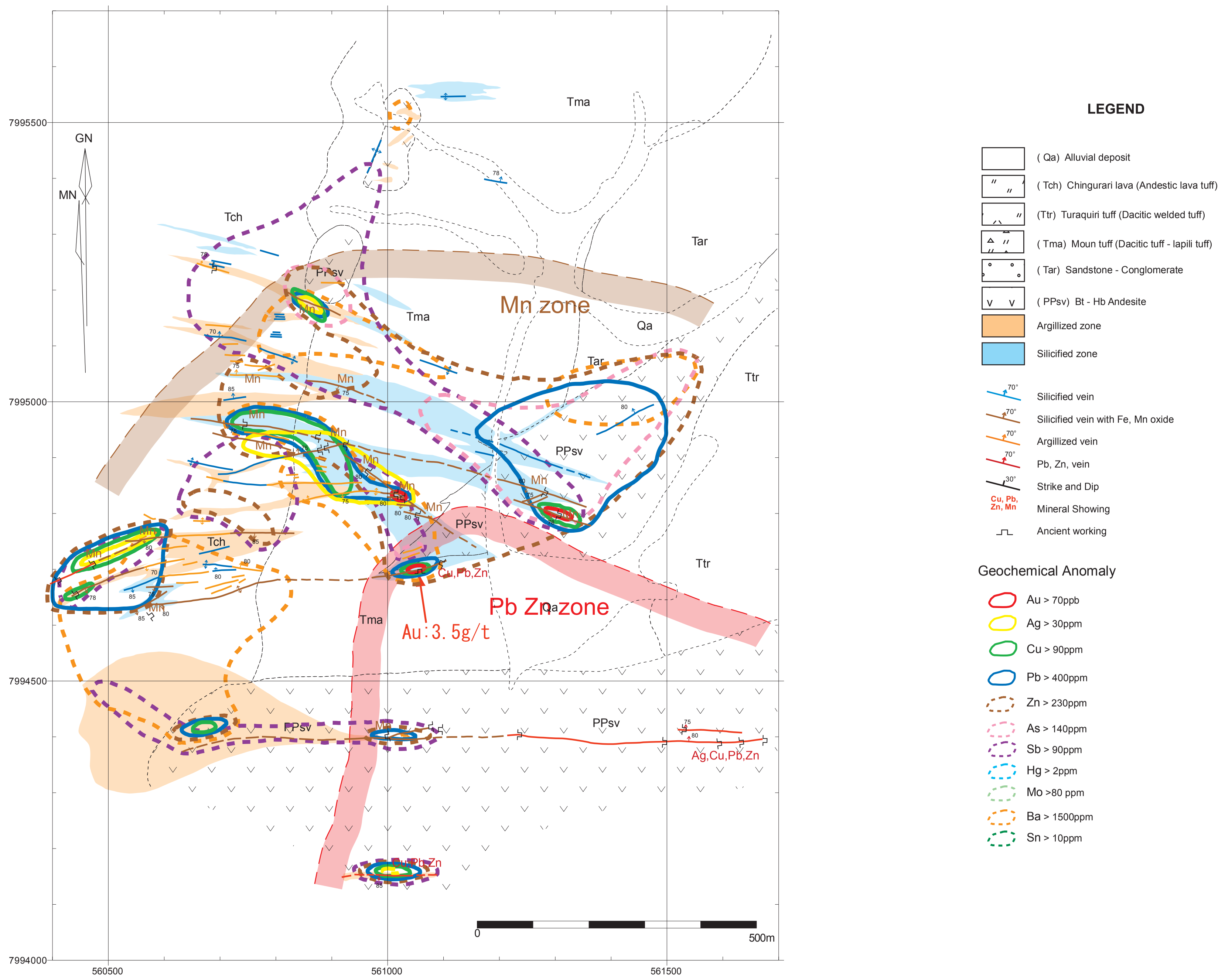


Fig.II-3-1(2) Integrated Interpretation Map of the Turaquiri District (Phase III)

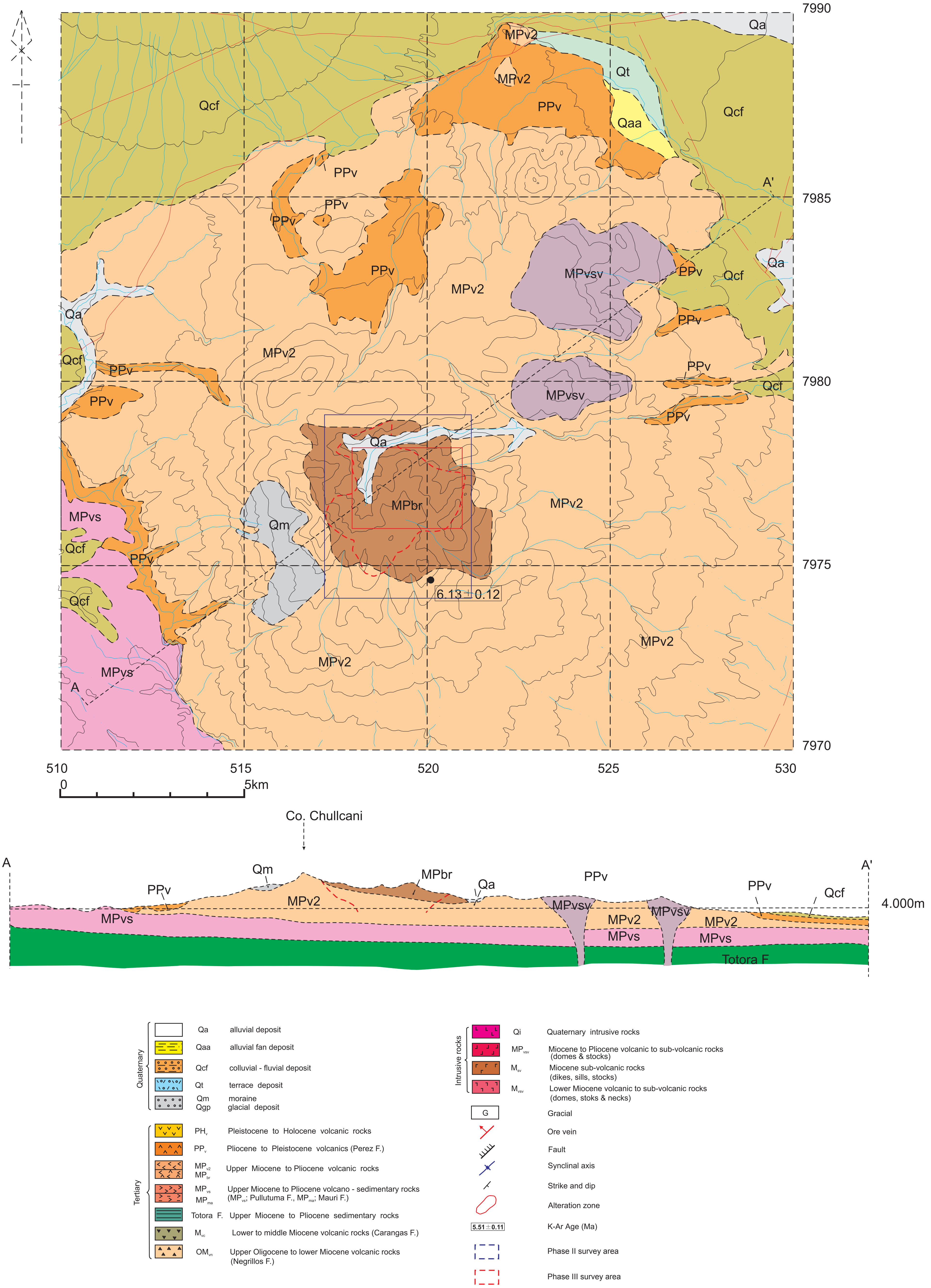


Fig. II-3-2(1) Geological map of the Chullcani District

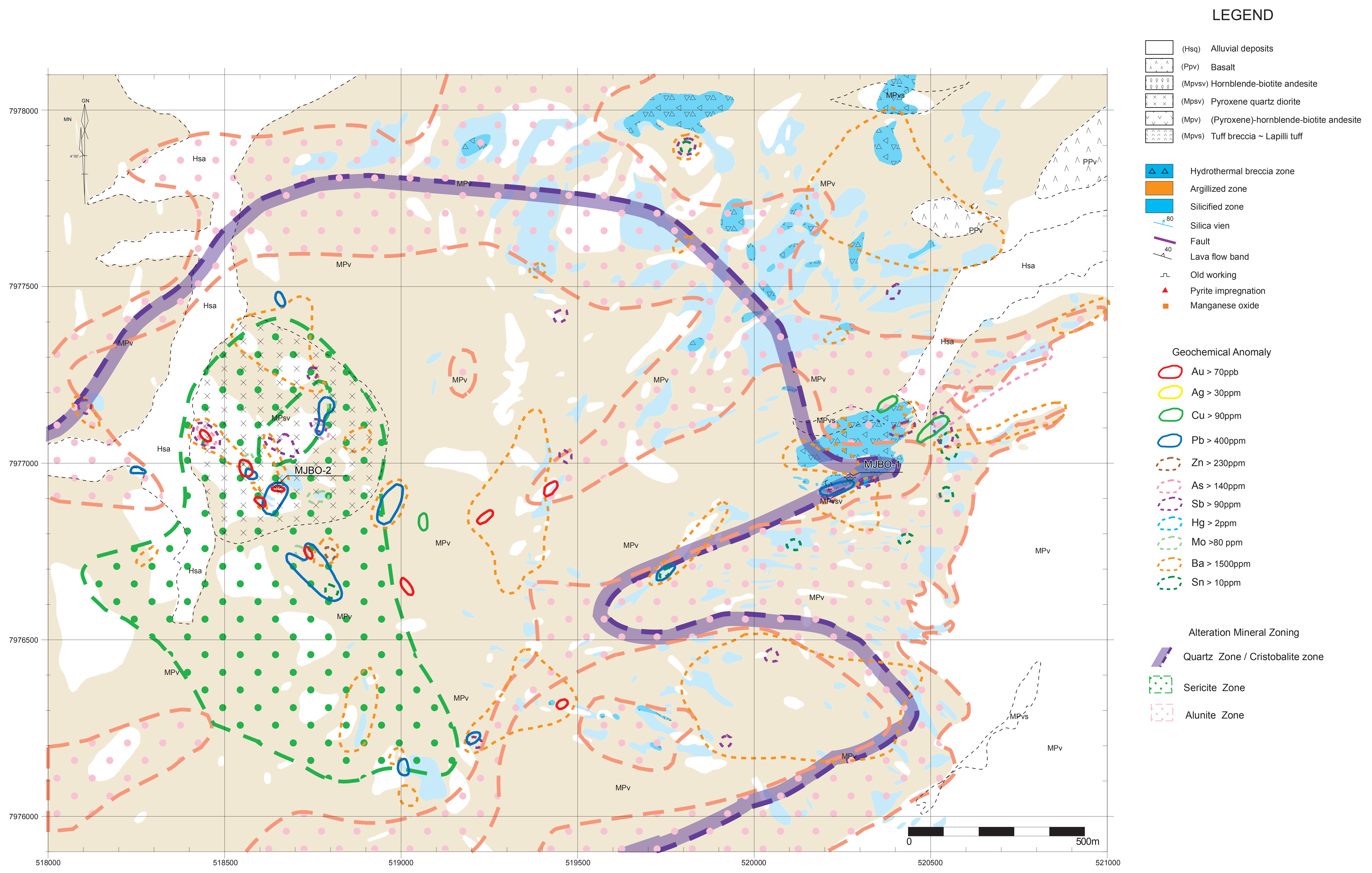


Fig. II-3-2(2) Integrated Interpretation Map of the Chullcani District (Phase III) sericite zone and cristobalite zone appears outside of the quartz zone. This suggests that intrusive rock of diorite is the center of hydrothermal activities.

The geochemical exploration shows a geochemical anomaly of gold in a diorite intrusive rock body and around it. Anomalous parts of lead, zinc and molybdenum are also distributed in the same area.

(2) Drilling Survey (Figs. II-3-2 (3-1), -2 (3-2), -2 (4-1), -2 (4-2))

The MJB0-1 drill hole shows that hydrothermal alteration is dominant all over the cores, confirming the intense hydrothermal activity. Dissemination of pyrite and native sulfur are also detected. The assembly of alteration minerals suggests a temperature rising toward the deep part. A chemical analysis shows an anomaly of lead, arsenic and zinc in some parts. However, prominent mineralization is not confirmed.

The MJB0-2 drill hole shows a continuation of diorite in some parts sandwiching andesite. Silicified and argillized zones with fault zone intersect the diorite body. The assembly of alteration minerals suggests that the condition is sufficient for gold precipitation. However, the chemical analysis shows that gold mineralization is only slightly higher than that for the MJB0-1 drill hole and prominent mineralizations are not confirmed.

In the Chullcani District, epithermal mineralization related to shallow activity of intrusive rock and high sulfidation type epithermal mineralization in some parts are estimated.

3-3 Sonia - Susana District (Figs. II-3-3 (1), -3 (2))

Survey was carried out from Phase I to Phase III.

The hydrothermal alteration zones cover about 12km^2 in the volcanic rocks of early Miocene to Pliocene ages.

Rhyolitic tuff, which lies in a circle, indicated the K-Ar age of 17.70± 0.35 Ma. Biotite rhyolite, which covers rhyolitic tuff, indicated 1.73 ± 0.03 Ma and Non-altered dacite, which lies around the national border in the west, indicated 1.52 ± 0.03 Ma.

Faults, veins and fractures trending E-W are predominant in the eastern part of the district. In the central part, the NE-SW trend is dominant. In the west, the main trend is E-W but the N-S and NW-SE trends are also observable.

Pyrite dissemination is observed at various locations, as well as green copper mineralization accompanied by molybdenite in the Santa Catalina prospect..

The average homogenization temperatures are 195°C and the average salinities (NaCl equivalent) are 4.7 wt.% in Pase I and those of the Santa Catalina prospect are 222°C and 1.5 wt. %.

Geochemical anomalies of Au, Cu, Pb and Zn overlap at Santa Catalina Loma and on the

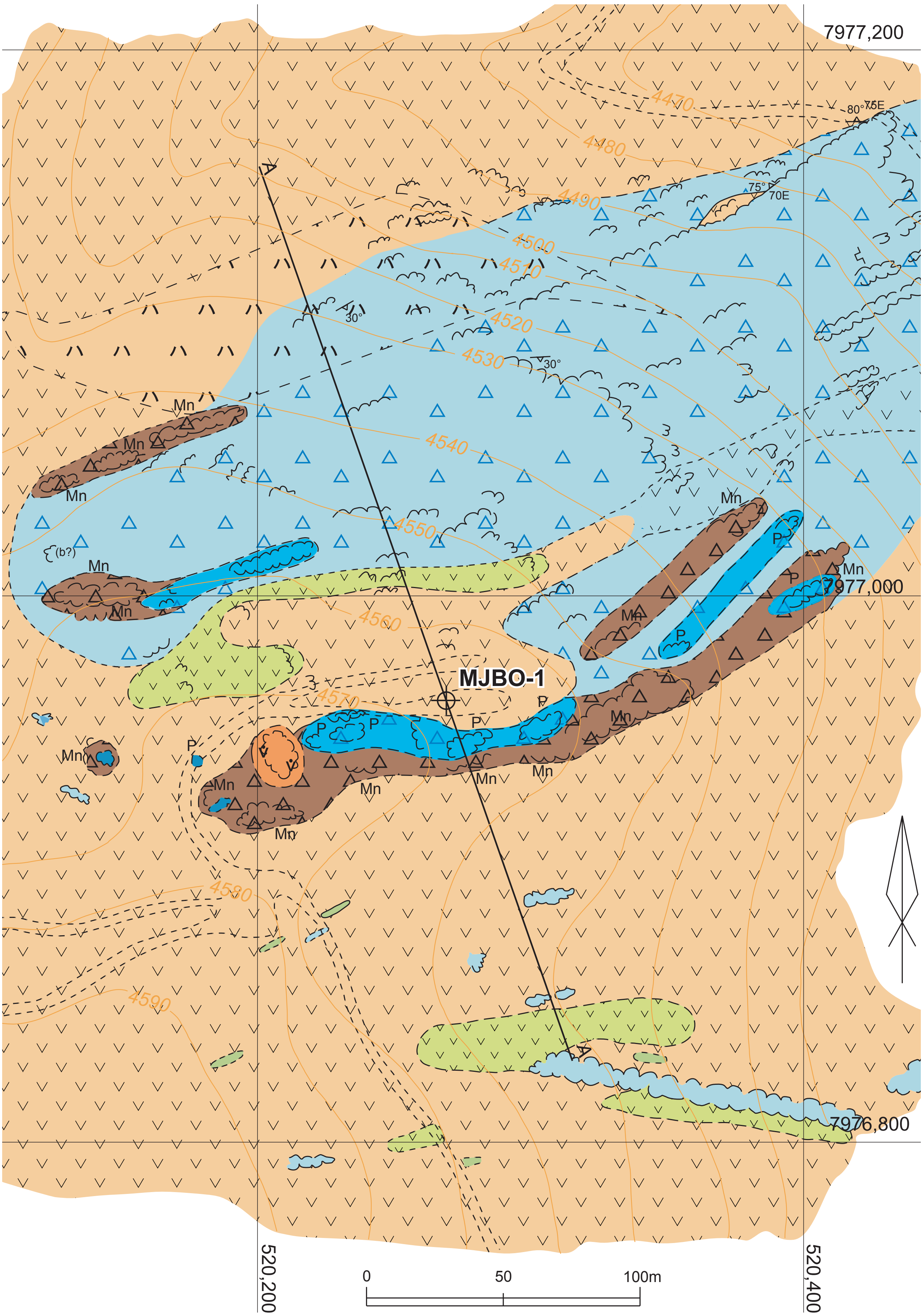


Fig. Ⅱ-3-2(3-1).Geologic Map of the Drill Hole MJBO-1 Site Area

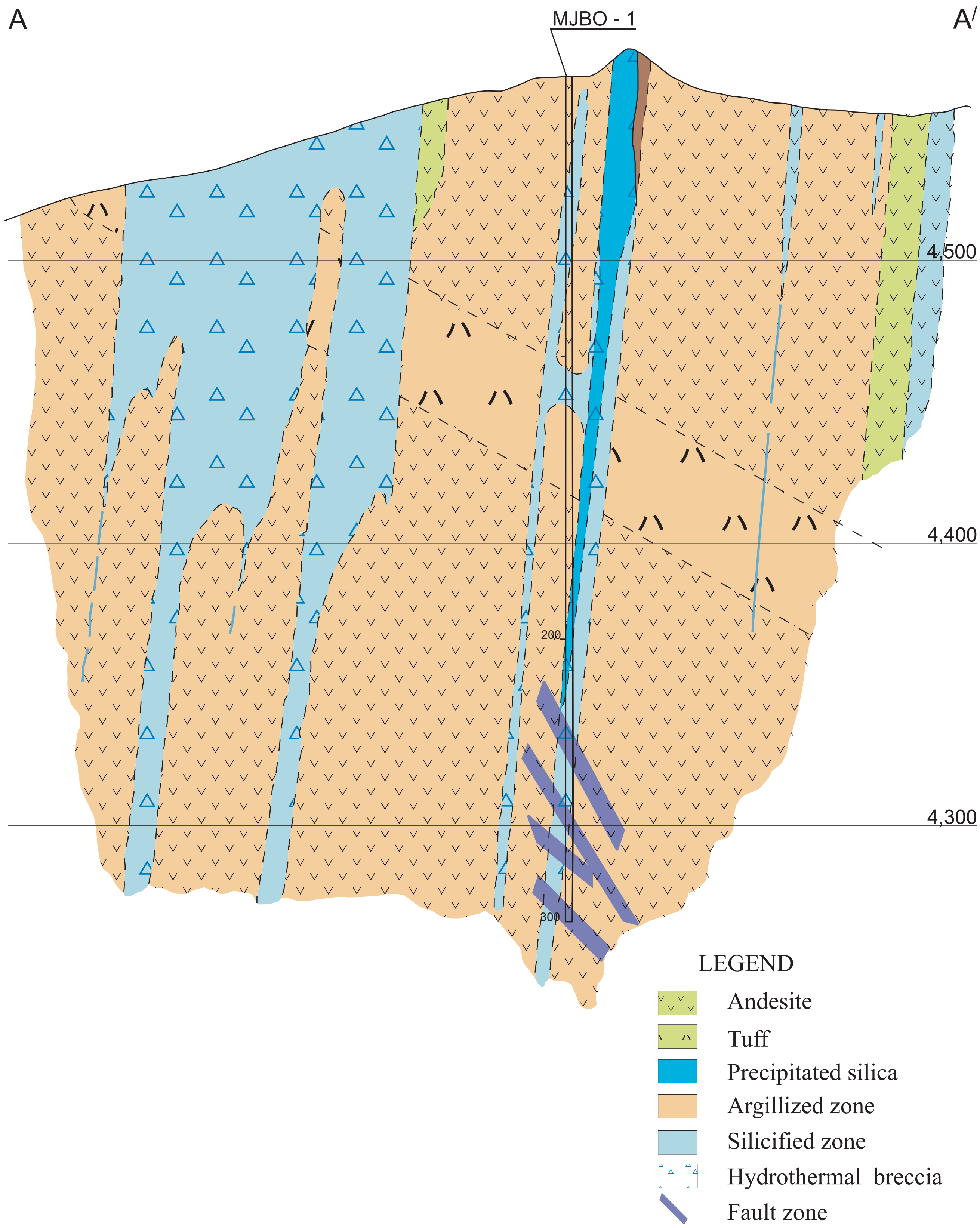


Fig. Ⅱ-3-2(3-2).Geologic Section of the Drill Hole MJBO-1

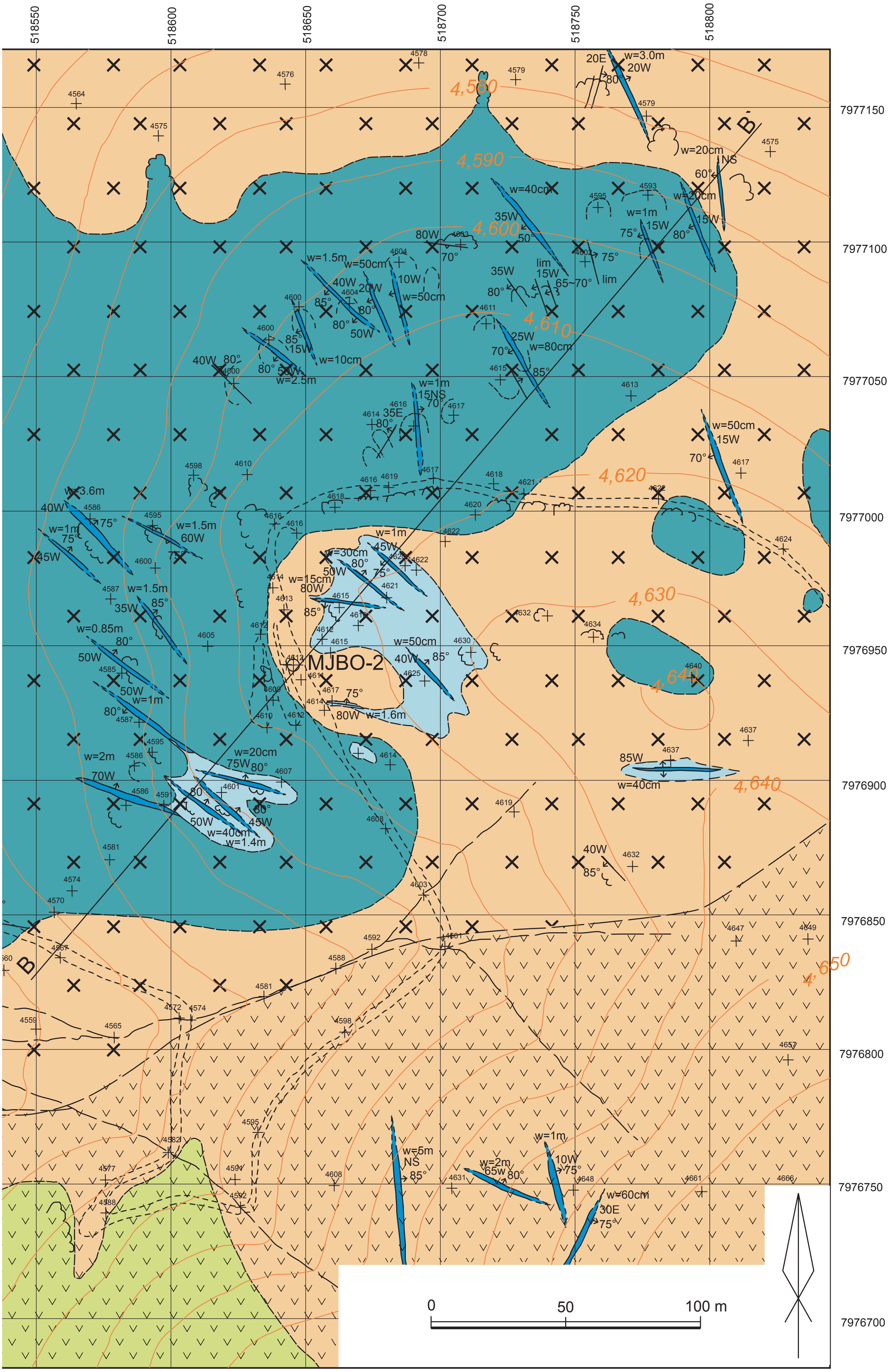


Fig. Ⅱ-3-2(4-1) Geologic Map of the Drill Hole MJBO-2 Site Area

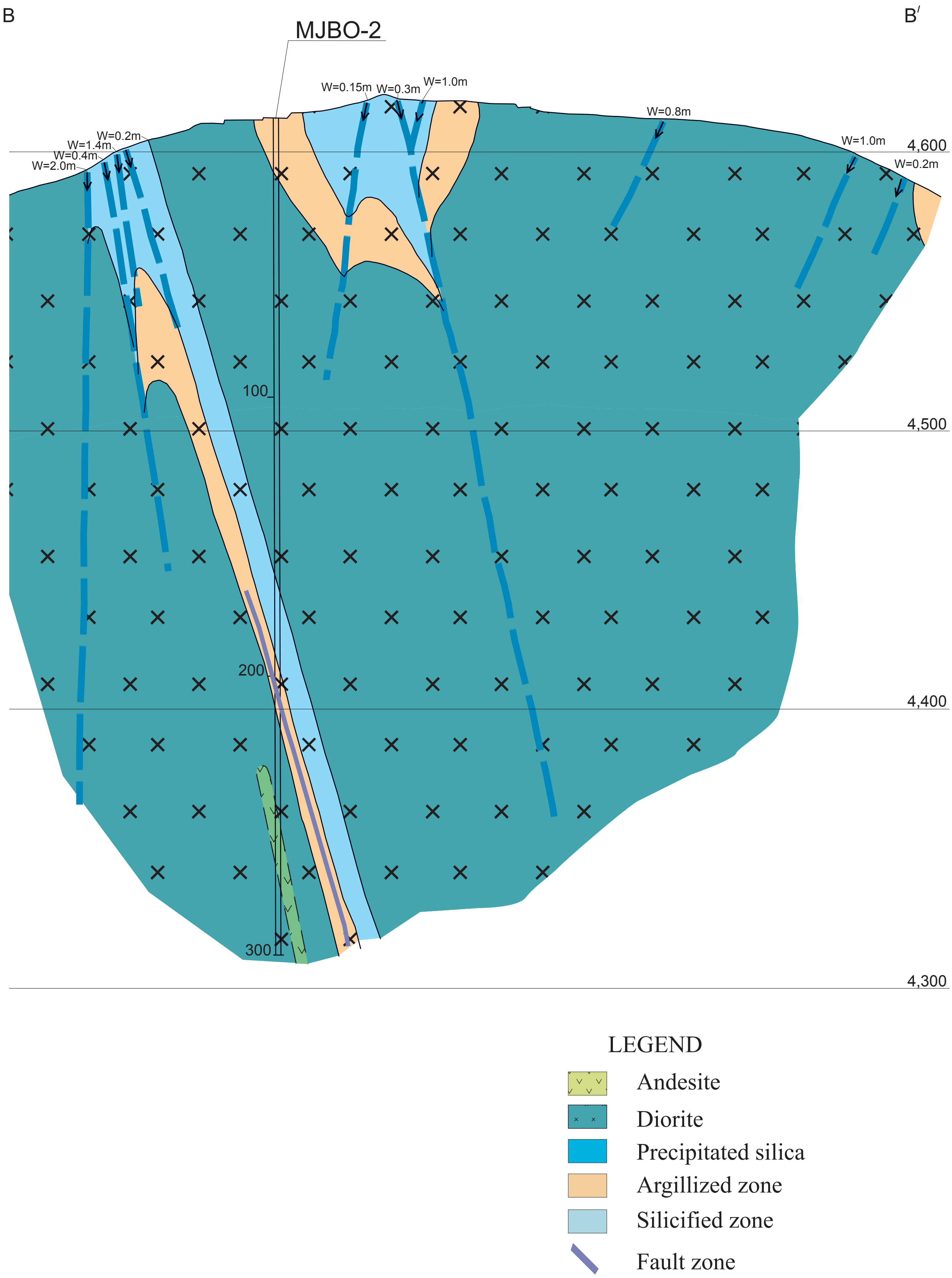
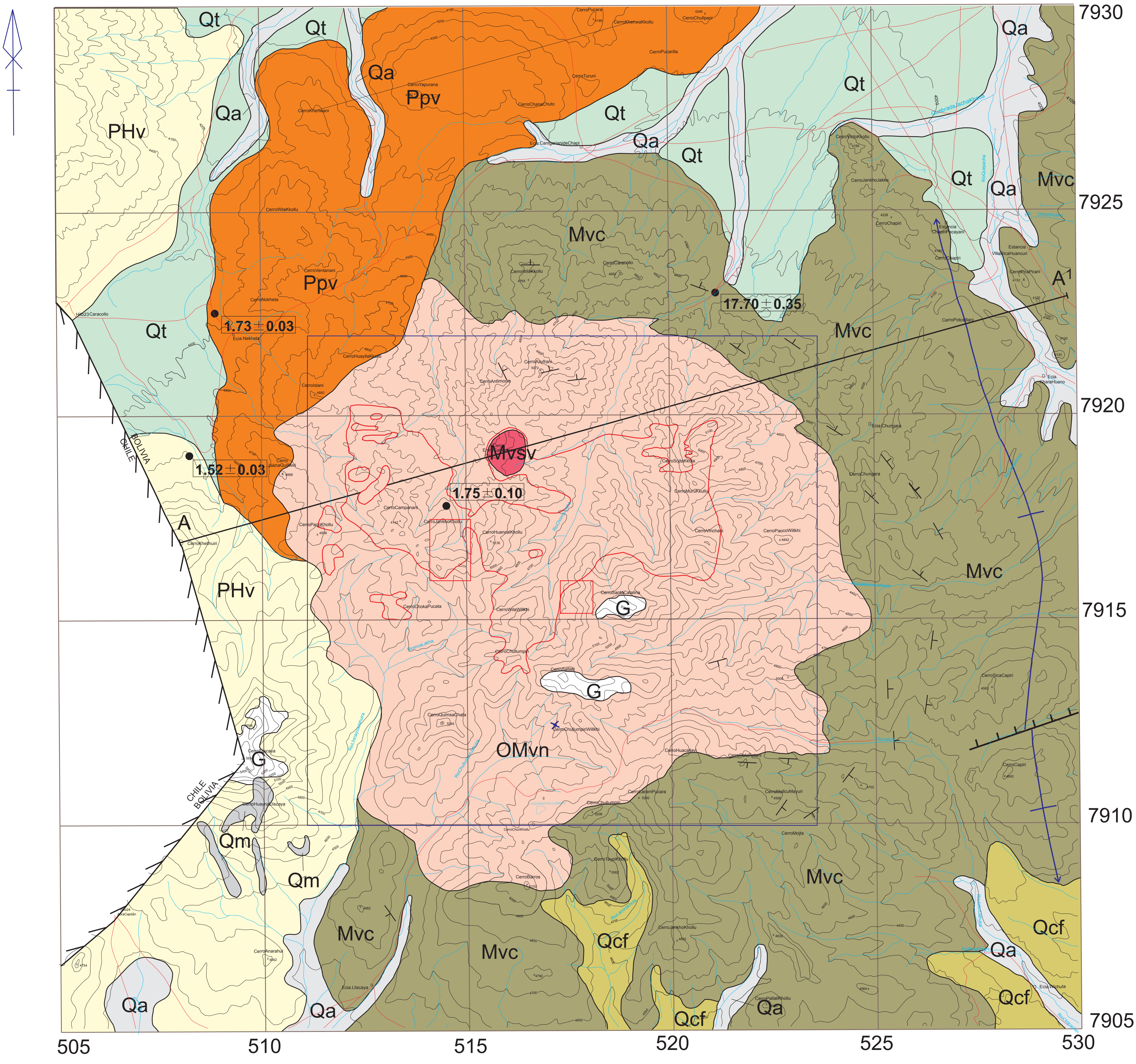


Fig. II-3-2(4-2) Geologic Section of the Drill Hole MJBO-2

SONIA SUSANA DISTRICT



LEGEND

Quaternary

Qa	alluvial deposit
Qaa	alluvial fan deposit
Qcf	colluvial - fluvial deposit
Qt	terrace deposit
Qm Qgp	moraine glacial deposit

Tertiary

PH_v	Pleistocene to Holocene volcanic rocks
PP_v	Pliocene to Pleistocene volcanics (Perez F.)
Mp_{v2} MP_{br}	Upper Miocene to Pliocene volcanic rocks
Mp_{vs} MP_{ma}	Upper Miocene to Pliocene volcano - sedimentary rocks (MP_{vs}: Pullutuma F., MP_{ma}: Mauri F.)
Totora F.	Upper Miocene to Pliocene sedimentary rocks
M_{vc}	Lower to middle Miocene volcanic rocks (Carangas F.)
OM_{vn}	Upper Oligocene to lower Miocene volcanic rocks (Negrillos F.)

Intrusive rocks

Qi	Quaternary intrusive rocks
MP_{vsv}	Miocene to Pliocene volcanic to sub-volcanic rocks (domes & stocks)
M_{sv}	Miocene sub-volcanic rocks (dikes, sills, stocks)
M_{vsv}	Lower Miocene volcanic to sub-volcanic rocks (domes, stoks & necks)

G	Gracial
	Ore vein
	Fault
	Synclinal axis
	Strike and dip
	Alteration zone
5.51 ± 0.11	K-Ar Age (Ma)
	Phase II survey area
	Phase III survey area

Fig.II-3-3(1) Geological Map of the Sonia - Susana District

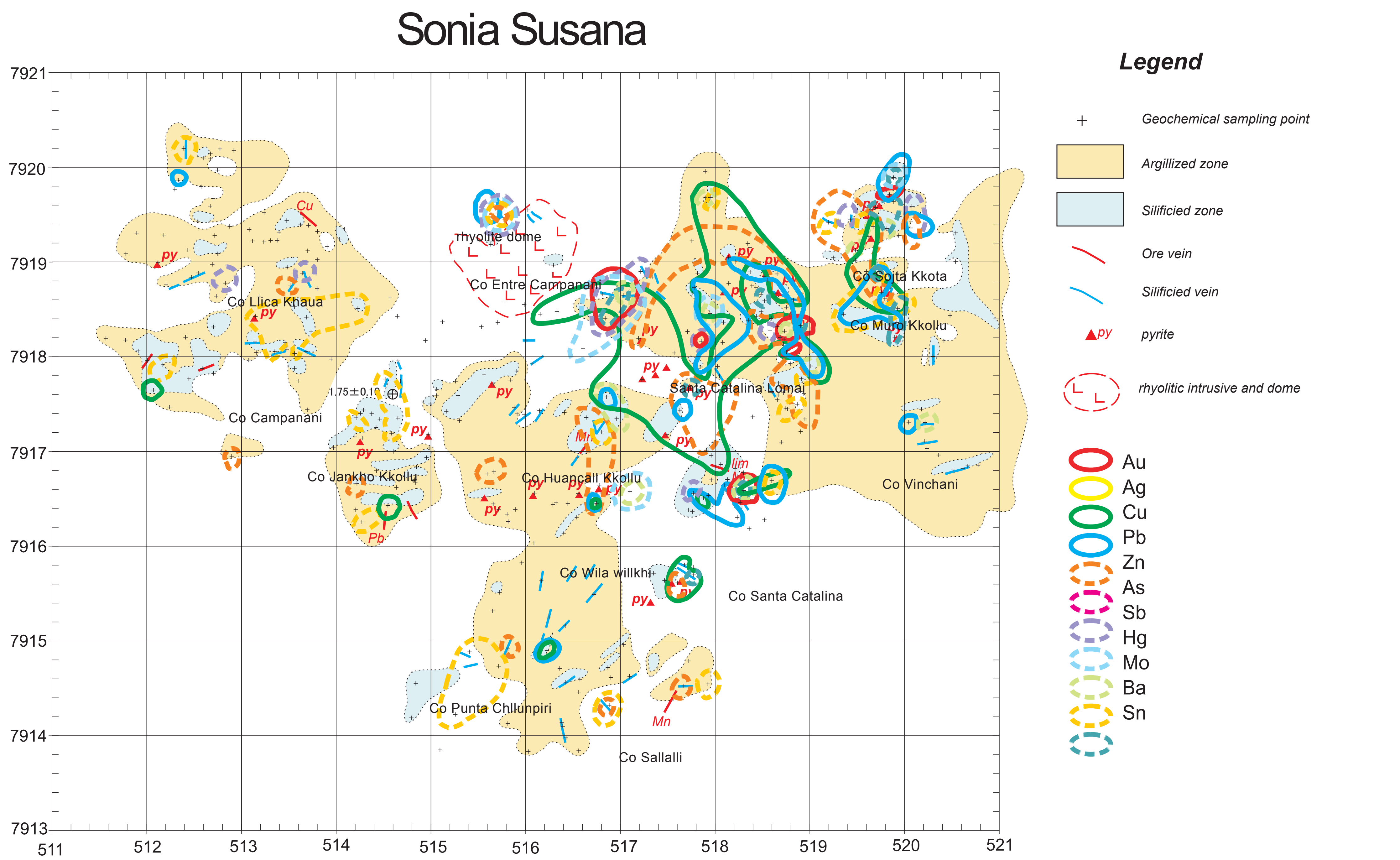


Fig.II-3-3(2)　Integrated Interpretation Map of the Sonia-Susana District (Phse II) western slope of Co. Sojta Kkota, and these of Au, Sn, Sb and As overlap at southeastern part of Co. Entre Campanani.

This implies different types of mineralizations have place at least in two stages. The former is the epithermal mineralization related to shallow hypabyssal intrusion, and the later is the epithermal gold- silver-lead- zinc mineralization related to shallow volcanic activity.

Volcanic rocks in the Jankho Kkollu prospect were correlated to the Negrillos Formation (Upper Oligocene to Lower Miocene). The Phase III survey revealed that dacite intruded into a stratovolcano and the center part of the volcano is exposed due to erosion. It is possible that the volcano was formed later than the time when the Carangas Formation was formed in the Middle Miocene, instead of the Upper Oligocene to Lower Miocen ages.

Many lead-zinc bearing barite-quartz veins are confirmed in areas south of the intrusive rock body. A limonite vein is confirmed north of the intrusive rock body. It is not clear whether or not their mineralization periods are the same, although there are mineral differences in the vein type.

Judging from the existence of neutral hydrothermal alteration and intrusive rock, the mineralization of this area is estimated to be epithermal silver, lead, zinc and copper deposits related to a hypabyssal rock intrusion activity in a shallow place. However, ore veins in the south part are discontinuous and small in size. The veins in the north part are also very small.

Geochemical anomaly of molybdenum shows that the porphyry type mineralization is expected for the Santa Catalina prospect. However, positive signs suggesting its existence are not confirmed in this Phase survey.

3-4 Calorno District (Figs. II-3-4 (1), -4 (2))

Survey was carried out in Phase I and Phase II.

The hydrothermal alteration zones, biggest in the whole area, cover about 28.5km^2 in the volcanic rocks of Middle Miocene to Pliocene ages.

The K-Ar dating of andesite sample collected from the northern part in the area indicates 9.01 ±0.18 Ma and of sample from the southern part indicates 11.69±0.23 Ma and both show Middle to Late Miocene ages.

In the northeastern part of the district, faults, veins and fractures with the N-S trend are predominant, followed by those with the NW-SE trend. In the northwestern part, the N-S trend are predominant, followed by those with the ENE- SWS. In the central part of the district, the NW-SE trend is conspicuous while the NE-SW and E-W trends are also observable.

The hydrothermal alteration zones widespread in the district are considered to be situated at the topmost (outermost) parts of the alteration zones, because non-altered rocks are left on top of many mountains while no presence of propylite is known.

Gossans, mainly of geothite, that occur along the Rio Agua Milagro show arsenic and

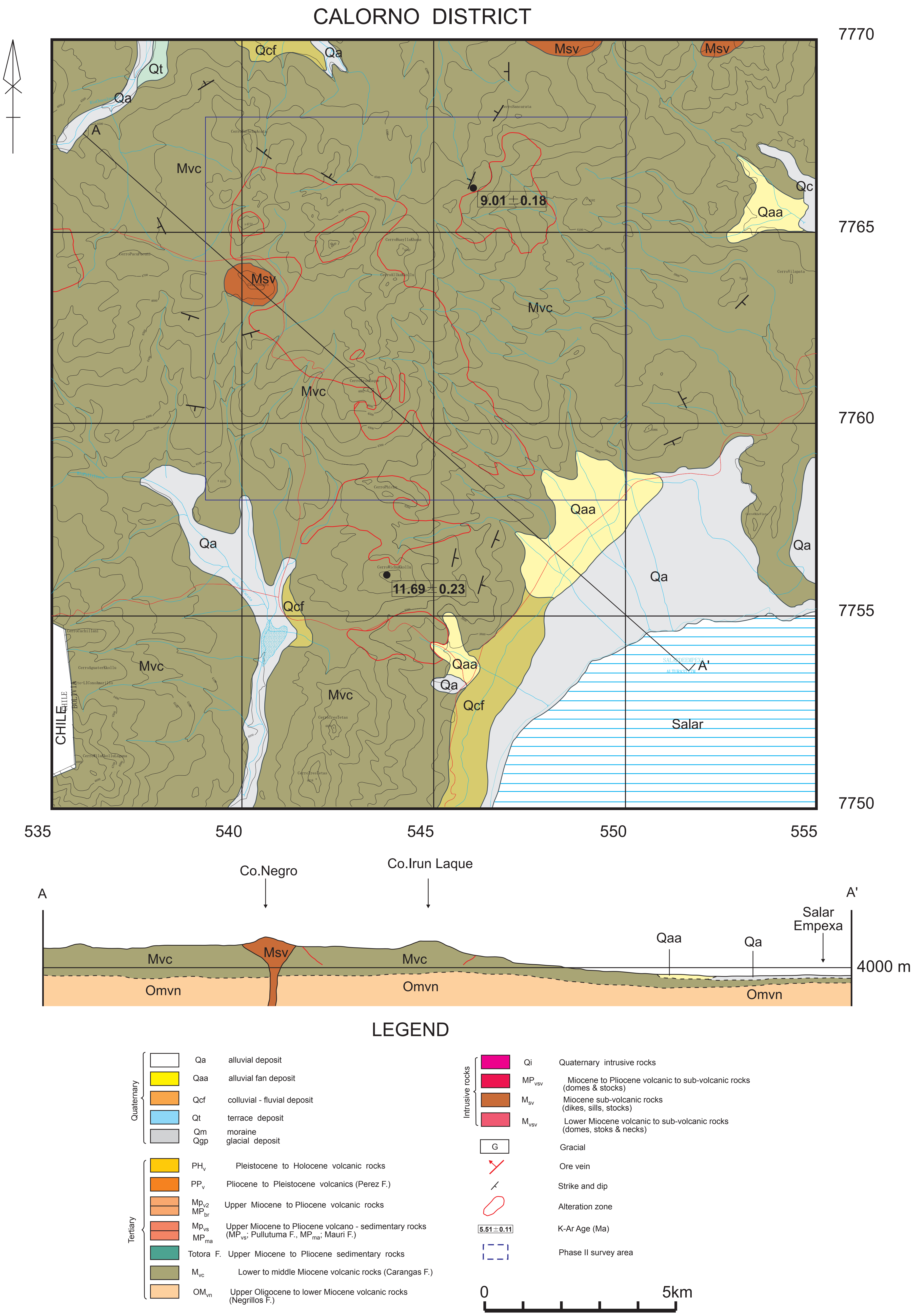


Fig. II-3-4(1) Geological Map of the Calorno District

Calorno

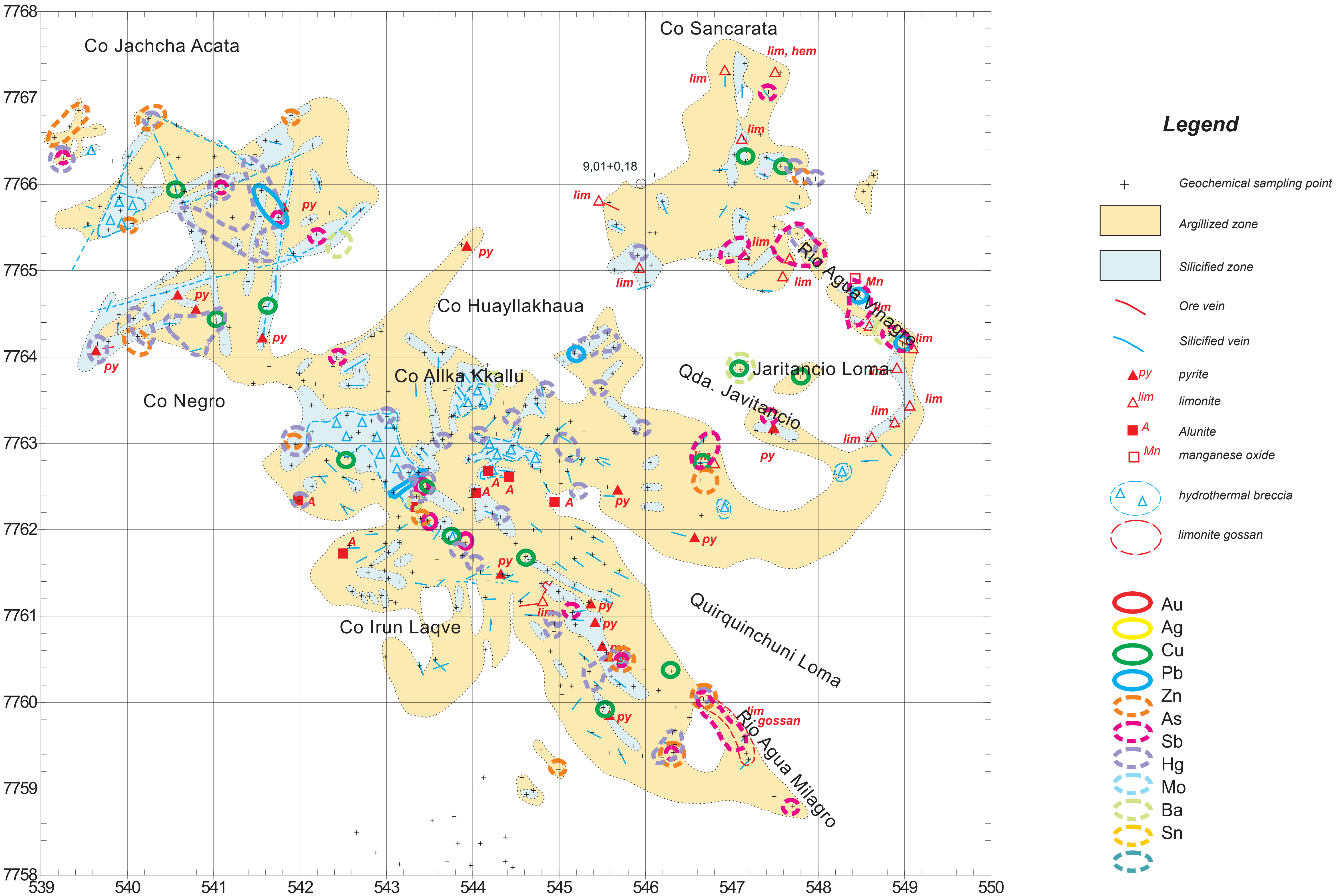


Fig.II-3-4(2) Integrated Interpretation Map of the Calorno District (Phase II) antimony anomalies at the uppermost part of gossan body; it is conceivable that thermal water effused from around the uppermost part and flowed down. As the district appears to be a little away from the center of a volcanic body, low sulfidation type epithermal mineralization is possible.

Pyrophyllite, a somewhat high-temperature and acidic mineral, has been observed at several points. It is interpreted that a hydrothermal alteration zone was formed from strong acidic solution of magma origin. And tin geochemical anomaly suggests that the mineralization is high sulfidation type or epithermal Au-Ag-Pb-Zn mineralization related to volcanic activity.

Although the geochemical anomaly is not extensive, as the vast amount of hot water is spouting out and wide area is covered by the hydrothermal breccia, large scale deposits are expected, if exists.

3-5 Carangas District (Figs. II-3-5 (1), -5 (2))

Survey was carried out in Phase II.

In the San Francisco mine area the mineralization is probably weak, as the alteration zone is not extensive and development of the fracture is poor.

Carangas mine area

The hydrothermal alteration zones cover about 3km^2 in the volcanic rocks of late Oligocene to early Miocene ages.

In Carangas mine area an alteration zone is recognized at Co. Espiritu, and it is weak at Co. San Antonio. Both of them are neutral and tin anomaly is not yet found. The mineralization in this district is thought to be epithermal precious metal deposit related to shallow hypabyssal intrusion which are recognized at Co. Espiritu.

Homogenization temperature of quartz and sphalerite samples indicates 212°C in average, the salinity (NaCl equivalent) is 3.4 wt.% in average and it is considered to appear rather lower part of mineralized zone by erosion.

Geochemical anomaly zones of silver, copper, lead, zinc and antimony overlap widely.

Silver- bearing manganese oxide mineralization is observed along the fractures at Co. San Antonio. The mineralization seems to be weak.

3-6 Culebra district (Figs. II-3-6 (1), -6 (2))

Survey was carried out in Phase II.

In the Culebra prospect the mineralization will be weak or deep-seated, if exists,as

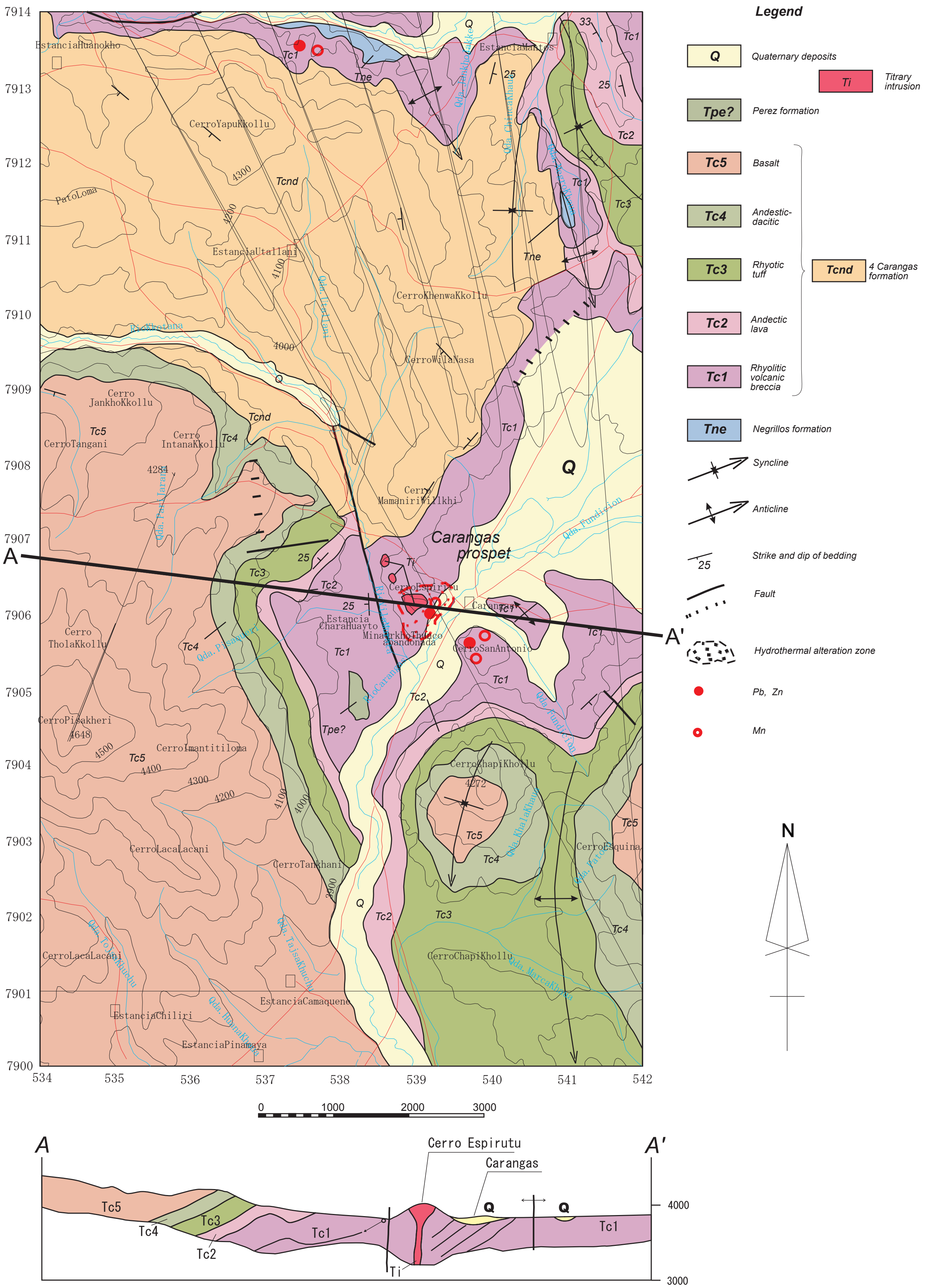


Fig. II-3-5(1) Geological Map of the Carangas District

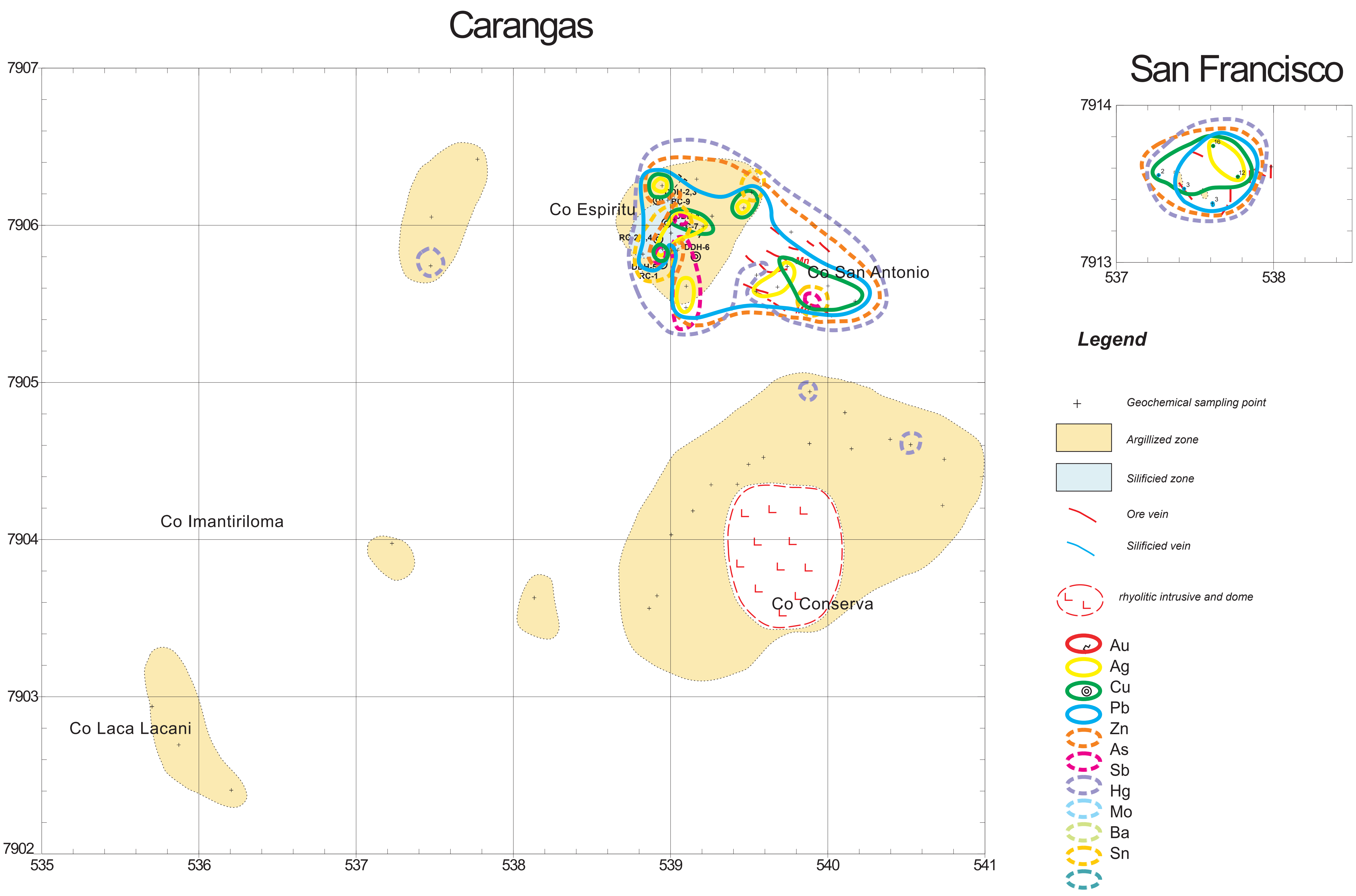
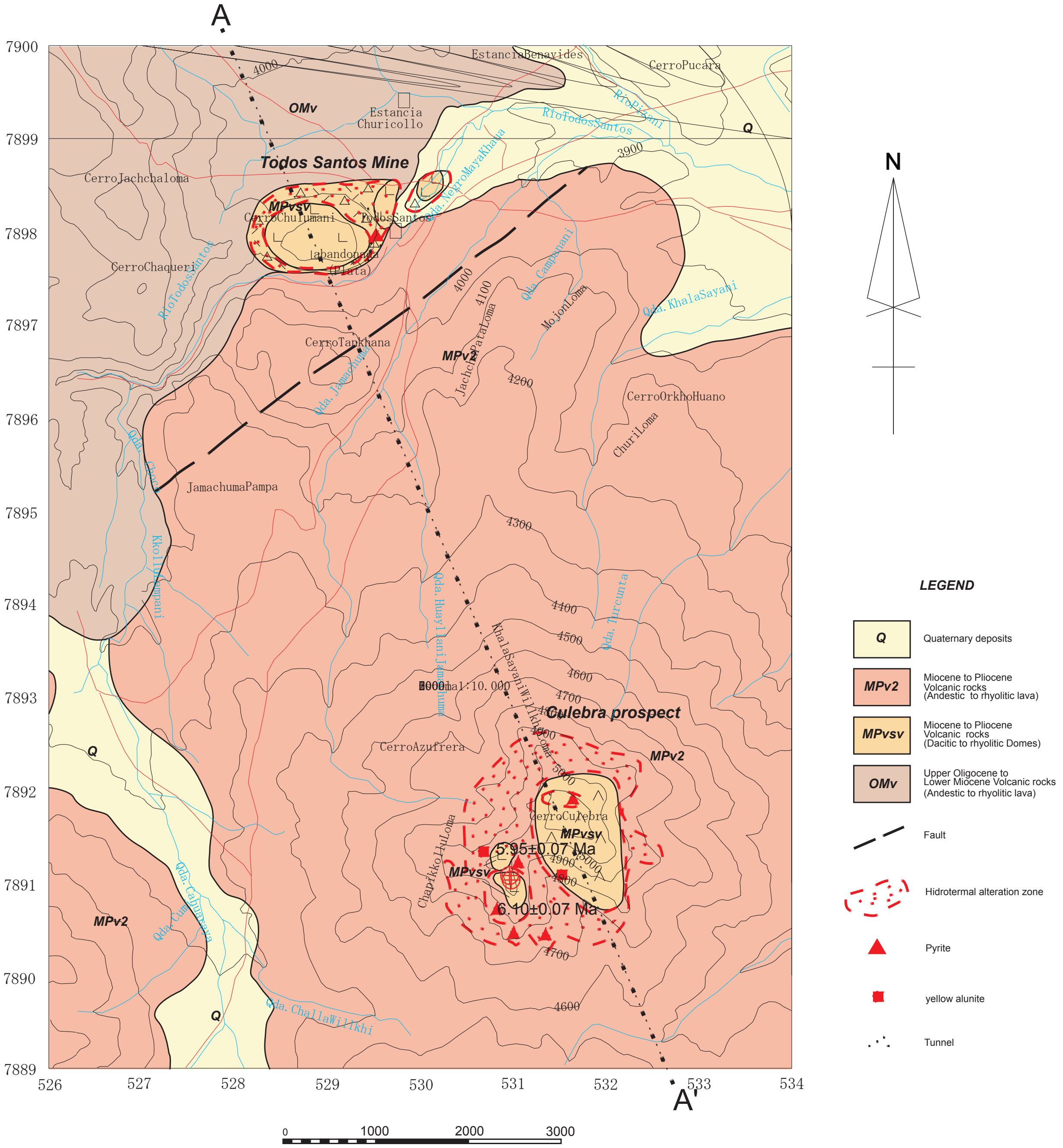


Fig.II-3-5(2)　Integrated Interpretation Map of the Carangas District (Phase II)



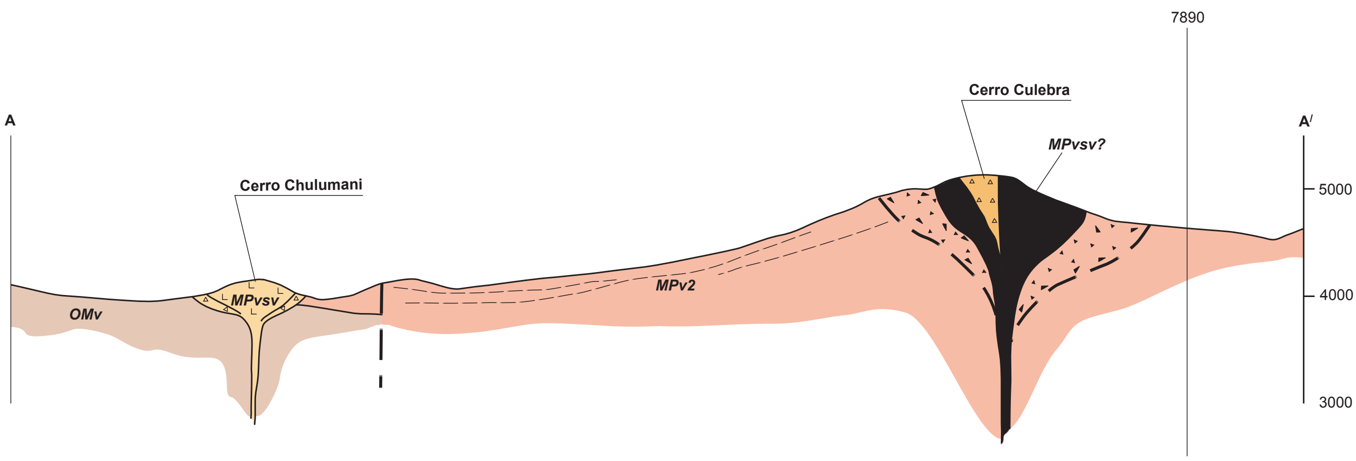


Fig. II-3-6(1) Geological Map of the Culebra District

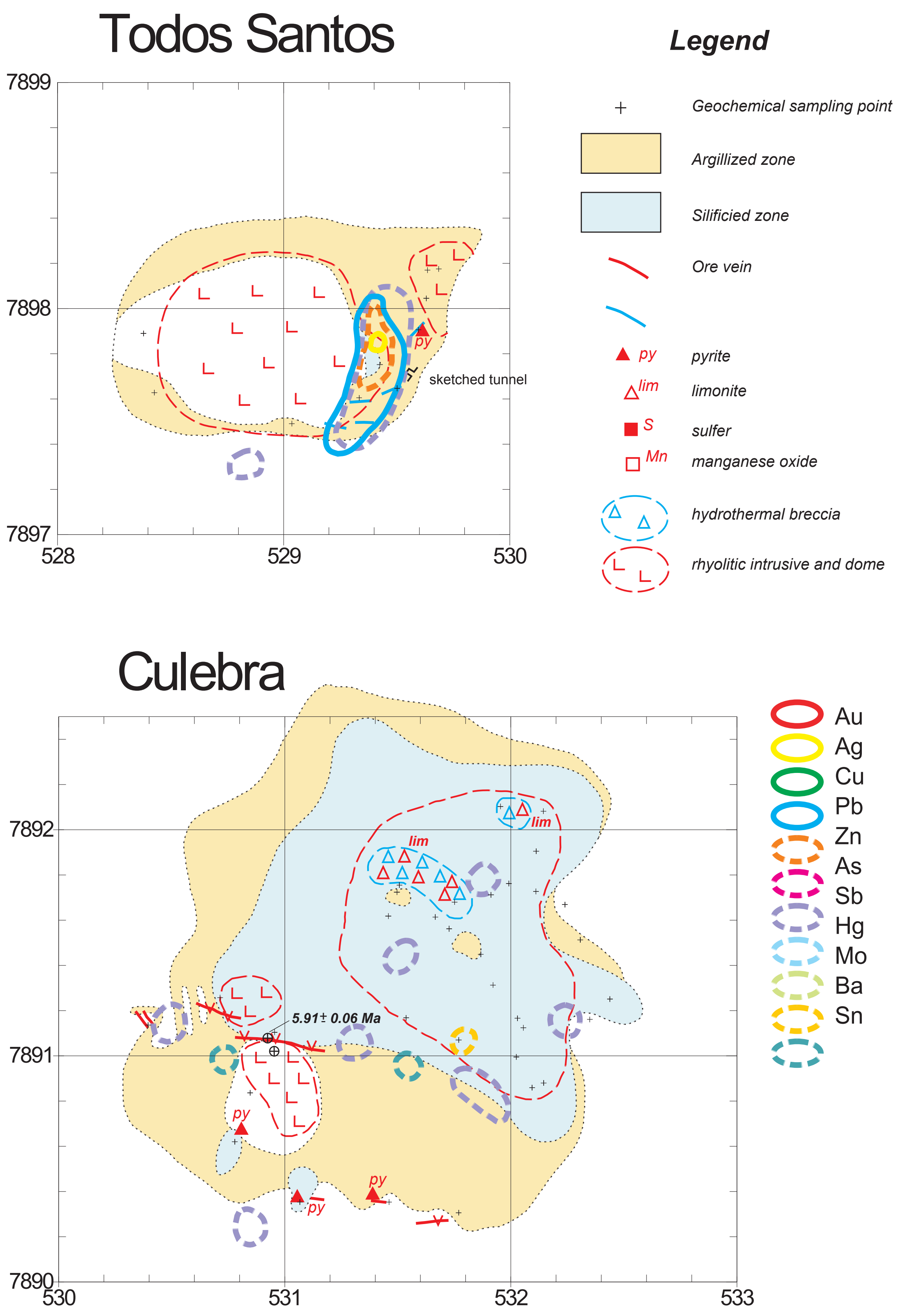


Fig.II-3-6(2) Integrated Interpretation Map of the Culebra District (Phase II) geochemical anomaly is weak.

Todos Santos mine area

The hydrothermal alteration zones cover about 0.5 km^2 in the volcanic rocks of late Oligocene to early Miocene ages.

Numerous tunnels and E-W trend workings are left since the colonial periods. A dome is observed at Todos Santos mine.

As the alteration of Todos Santos mine area is neutral and tin anomaly is not recognized, the mineralization in this district appears to be epithermal precious metal deposit related to shallow hypabyssal avtivity.

3-7 Mendoza district (Fig. II-3-7 (1))

Survey was carried out in Phase II (whole area) and Phase III (Co.Chorka-Iranuta prospect).

The mineralization in Co. Kancha prospect is probably weak or deep-seated, as the geochemical anomalies are weak and are scattered.

La Deseada mine (Fig. II-3-7 (2))

The hydrothermal alteration zones cover about 4km^2 in the volcanic rocks of late Oligocene to early Miocene ages.

In the area, faults, veins and fractures with the E-W and ENE-WSW trends are dominant.

The ore deposit of La Deseada mine is an epithermal Au- Ag- Pb- Zn deposit related to shallow volcanic activity.

The characteristics of mineralization changes (vein materials and geochemical anomaly) from the upper margin to the lower of the deposit are well observed (Fig.II-2-10 (7)).

These findings are applicable to another prospects and can consider position of mineralized zone.

Homogenization temperature of two samples indicates 188°C in average, the salinity (NaCl equivalent) is 2.5 wt.% in average and it is considered that this vein continues more lower part.

The existence of the similar ore deposit to La Deseada ore deposit is expected beneath the geochemical anomaly of Co. Mokho. Besides, as the alteration zone of Co. Mokho is continuously extended to La Deseada mine, the mineralizations of two areas are probably connected.

Guadalupe mine, Maria Lúisa mine (Figs. II-3-7 (2))

The hydrothermal alteration zones cover about 5km^2 in the volcanic rocks of late Oligocene to early Miocene ages.

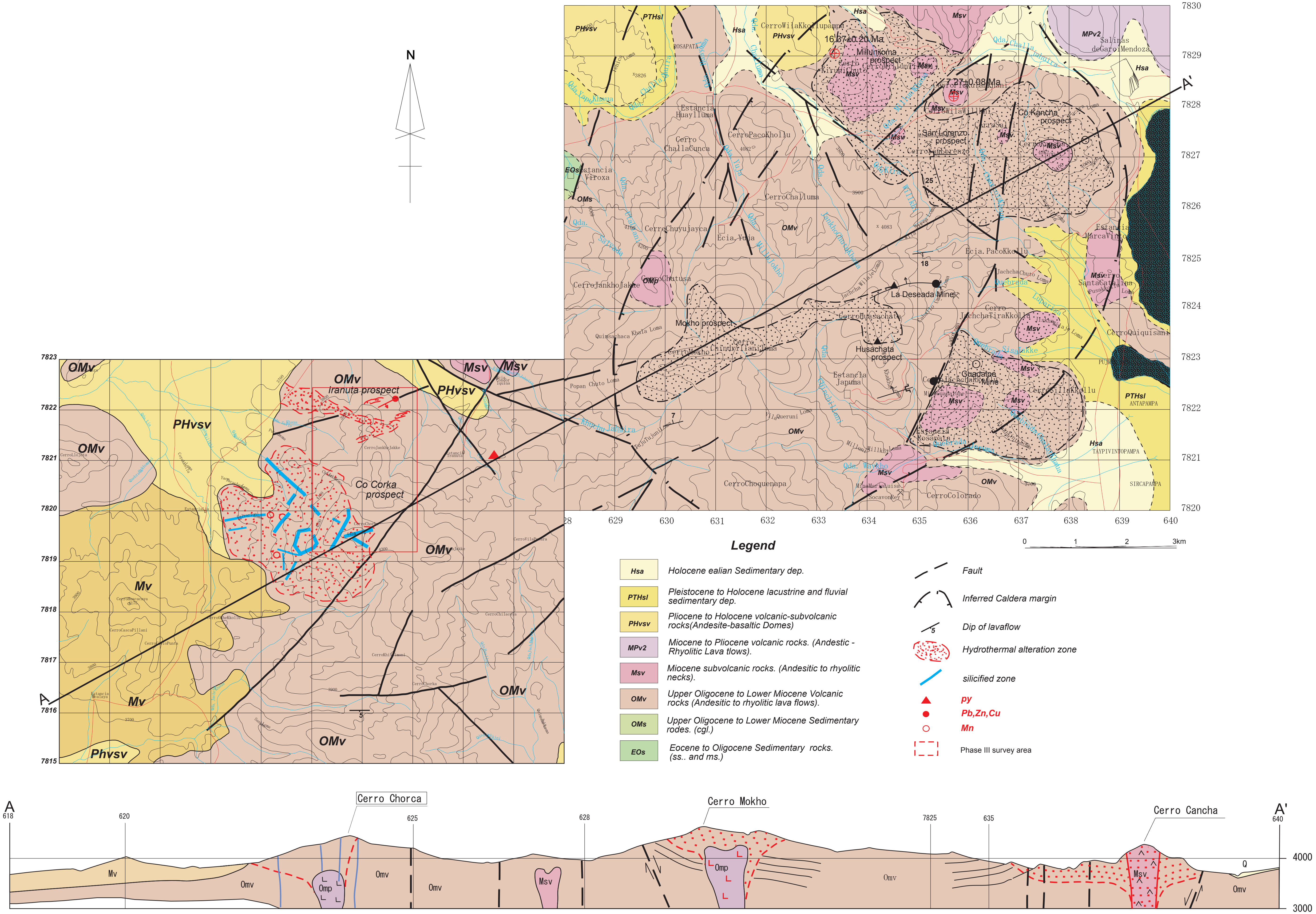


Fig. II-3-7(1) Geological Map of the Mendoza District

Mendoza
Mina La Deseada, Mokho, Husachata, Mina Guadalupe

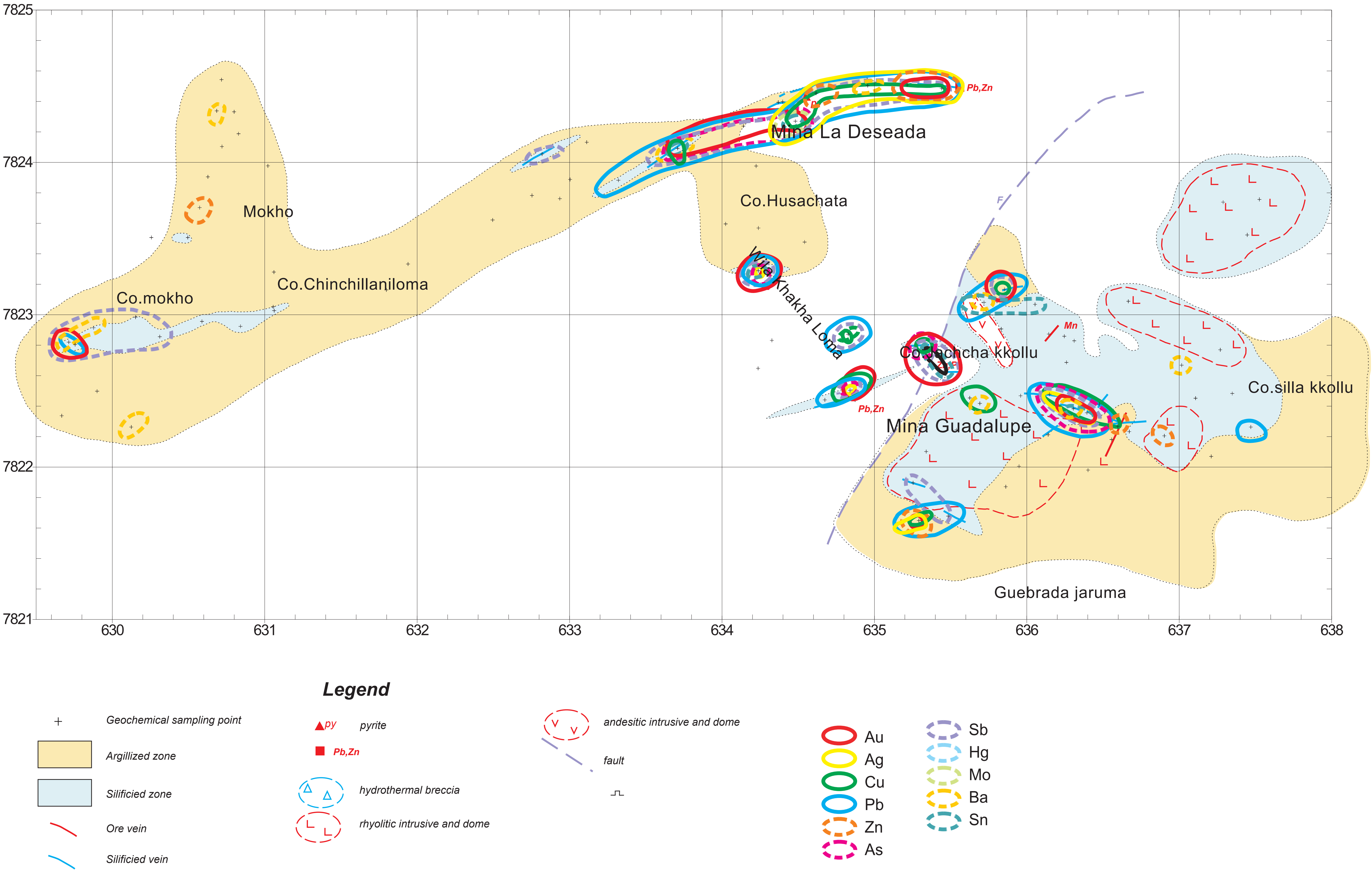


Fig.II-3-7(2) Integrated Interpretation Map of the Mendoza District (La Deseada: Phase II)

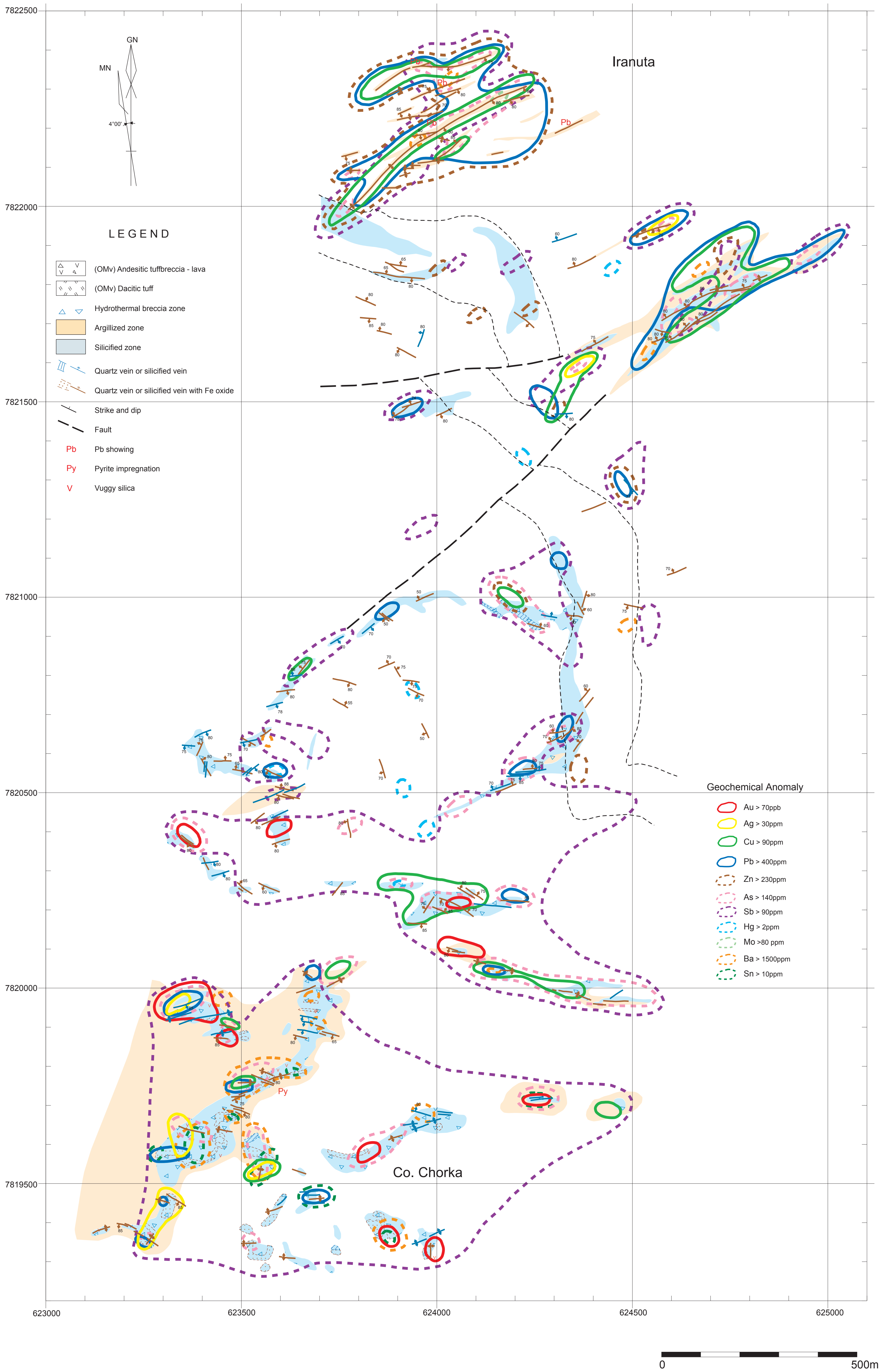


Fig. II-3-7(3) Integrated Interpretation Map of the Mendoza District (Chorka, Iranuta: Phase III)

In the area, faults, veins and fractures with the E-W and WNW-ESE trends are dominant.

The mineralization of both Guadalupe mine and Maria Lúisa mine is presumed to be an epithermal Au- Ag- Pb- Zn deposit related to shallow hypabyssal activity. On the other hand, enargite collected from the waste dump of the portal suggests that there was a high sulfidation epithermal mineralization. As the ore of enargite and pyrite is brecciated, two stages of mineralization have probably taken place.

Co.Chorka , Iranuta prospects (Figs. II-3-7 (3))

The hydrothermal alteration zones cover about 5km^2 in the volcanic rocks of late Oligocene to early Miocene ages.

In the area, faults, veins and fractures with the ENE-WSW, NE-SW and NW-SE trends are dominant.

Homogenization temperature of quartz and calcite samples indicates 258°C in average, and is considered to appear rather lower part of mineralized zone by erosion.

Volcanic rocks consisting mainly of dark gray andesite lava and pyroclastic rocks dominate this area. All rocks have undergone hydrothermal alteration (argillization and silicification).

A large number of lead-zinc bearing veins are confirmed in propylitic rock in the Iranuta section.

Based on the results of the geochemical analysis, the distribution of geochemical anomalies and hydrothermal alteration minerals, the mineralization in the Iranuta section is believed to have been caused by rhyolite intrusive rocks in the north and that the mineralization is different from Mt. Chorka.

The acidic alteration, confirmed on the upper north slope of Mt. Chorka and is inferred to be caused by magma, overlaps with geochemical anomalies of gold, copper, arsenic, antimony and mercury. A high sulfidation type mineralization is expected there.

An existence of intrusive rock is estimated below places near the top of Mt. Chorka because of dominant hydrothermal activity in the area. Possibilities for epithermal gold and silver ore deposits related to hypabyssal intrusive activity in shallow places are high.

3-8 Panizo district (Figs. II-3-8 (1))

Survey was carried out in Phase II.

The mineralization in Vilasaca, Pacoloma, Tulco and Puquisa prospects is probably weak or deep-seated, as the geochemical anomalies are weak or no.

Chinchilhuma prospect (Figs. II-3-8 (2))

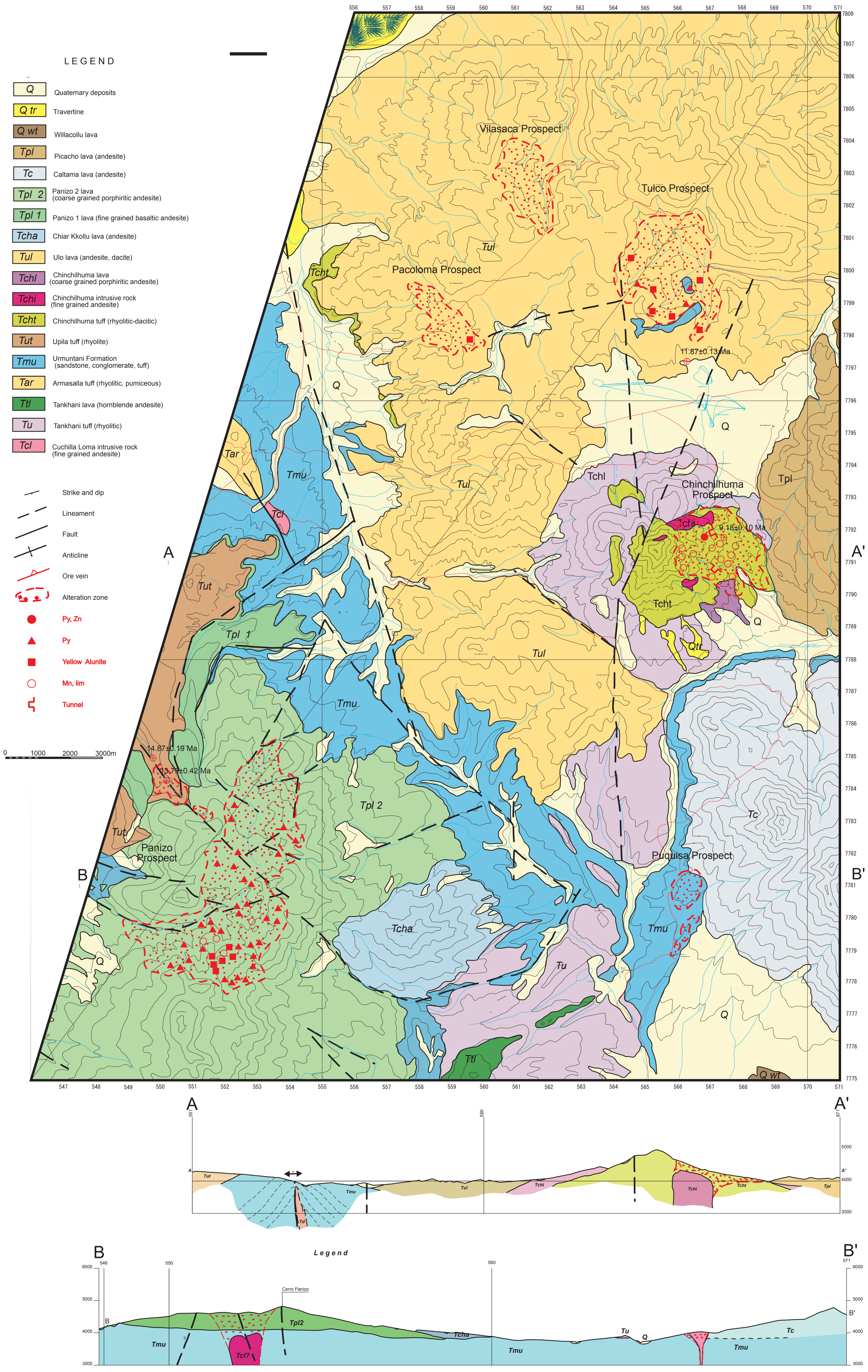


Fig. II-3-8(1)　Geological Map of the Panizo District

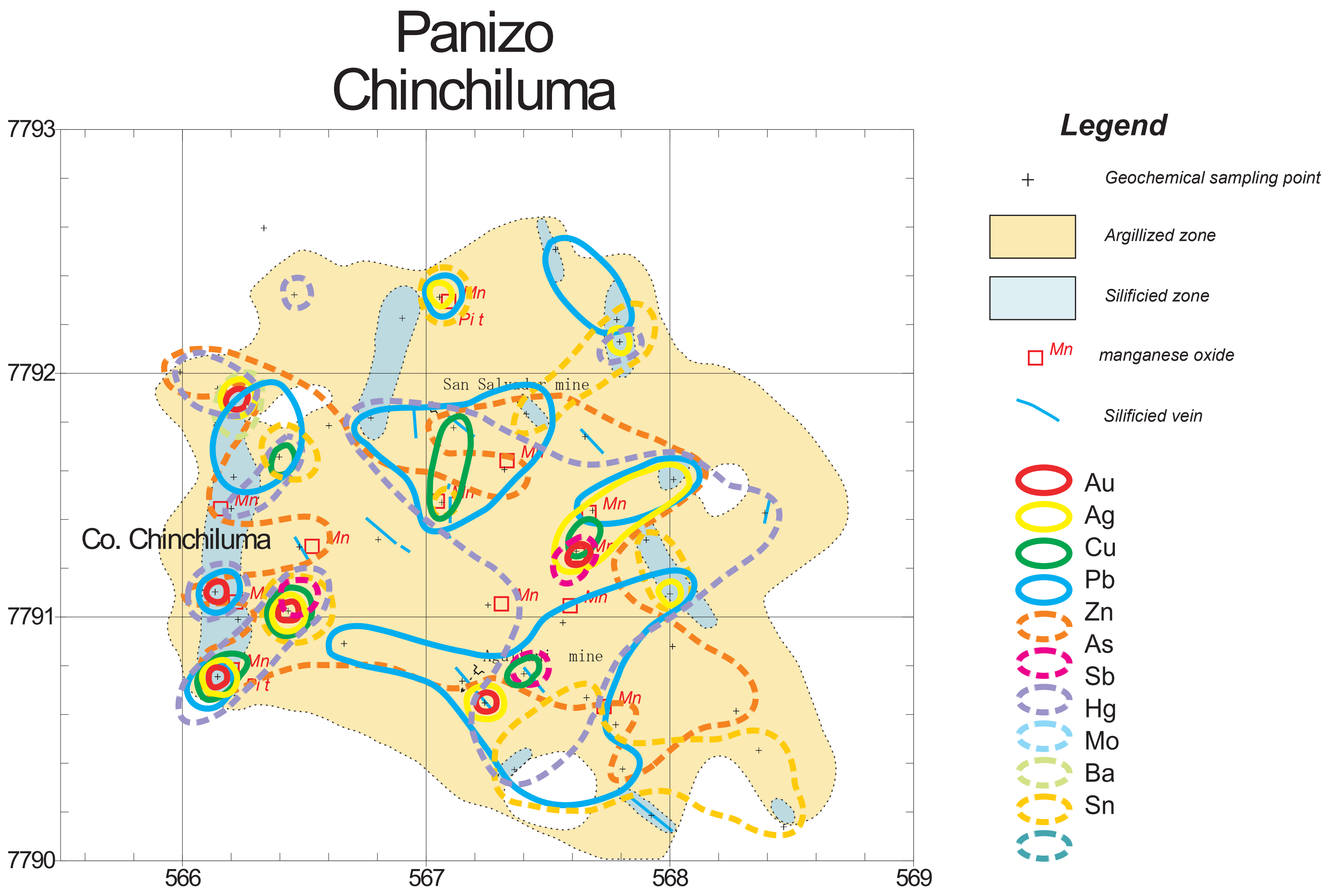


Fig.II-3-8(2) Integrated Interpretation Map of the Panizo District (Chinchilhuma: Phase II)

Panizo - Panizo

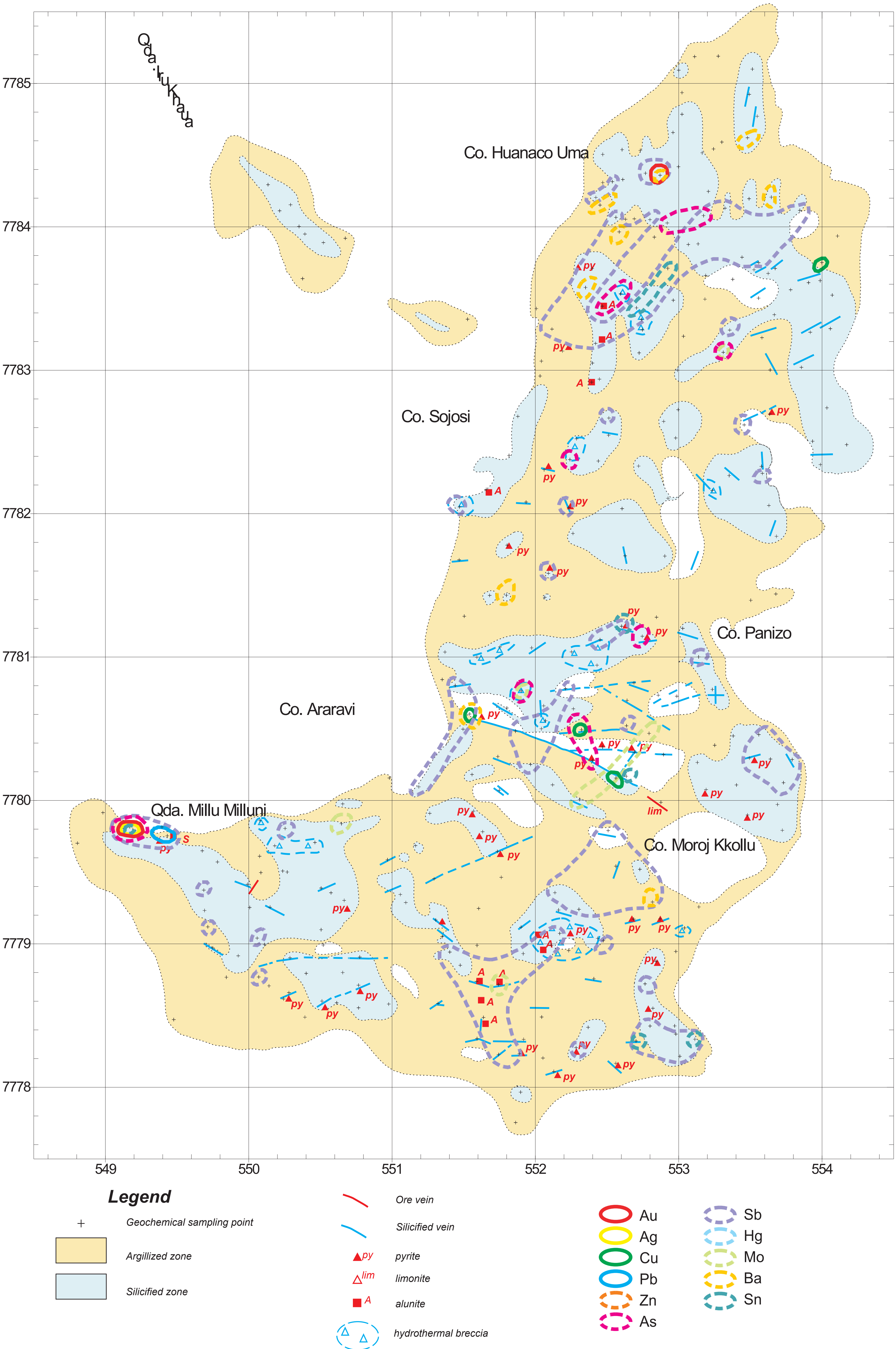


Fig.II-3-8(3) Integrated Interpretation Map of the Panizo District (Panizo: Phase II)

The hydrothermal alteration zones cover about 5km^2 in the volcanic rocks of middle to late Miocene ages.

In the area, faults, veins and fractures with the NE-SW trend prevail and N-S trend is also obserbable.

Old drifts are left at San Salvador mine and Aguilani mine.

The ore deposits in Chinchilhuma prospect are appear to be epithermal precious metal deposit related to shallow hypabyssal intrusion as the alteration zone is neutral and tin is not recognized.

Geochemical anomalies are somewhat intense.

The mineralization is similar to that of Sonia-Susana, except no presence of acidic alteration.

Panizo prospect (Figs. II-3-8 (3))

The hydrothermal alteration zones cover about 18 km^2 in the volcanic rocks of middle to late Miocene age.

Though faults, veins and fissures in the prospect trend mainly N-S, the NE-SW trend is increasingly dominant southward and, in the central and the southern parts, the E-W trend is predominant.

In Panizo prospect, there are anomalies of Au, As, Sb in the northern part, anomalies of Cu, As, Sb, Mo and Sn in the central part, and anomalies of Au, Ag, Pb, As, Sb and Sn in southwestern part. Considering the presence of tin and pyrophyllite, the mineralization in the northern and southwestern parts of the area will be epithermal Au- Ag- Pb- Zn mineralization, and in the central part, high sulfidation epithermal Au- Ag- Cu mineralization are expected. In the southwestern part, as there are abundant kaolinite, mineralization of high sulfidation epithermal deposit could be overlapped.

As the K-Ar dating of the alteration showed late of Middle Miocene, erosion has been considerably advanced. Beside the geochemical anomalies are rather intense, suggesting that there is a possibility of existing ore deposits in the place not very deep from the surface.

3-9 Sailica district (Figs. II-3-9 (1))

Survey was carried out in Phase II.

Judging from the mode of occurrence and size of ore deposit in underground working, and extent of geochemical anomaly and alteration, the possibility of existing a large-scale ore deposit seems to be low in the Solución mine area.

Plasmar mine area (Figs. II-3-9 (2))

The hydrothermal alteration zones cover about 10.5 km^2 in the volcanic rocks of late Miocene to Pliocene ages.

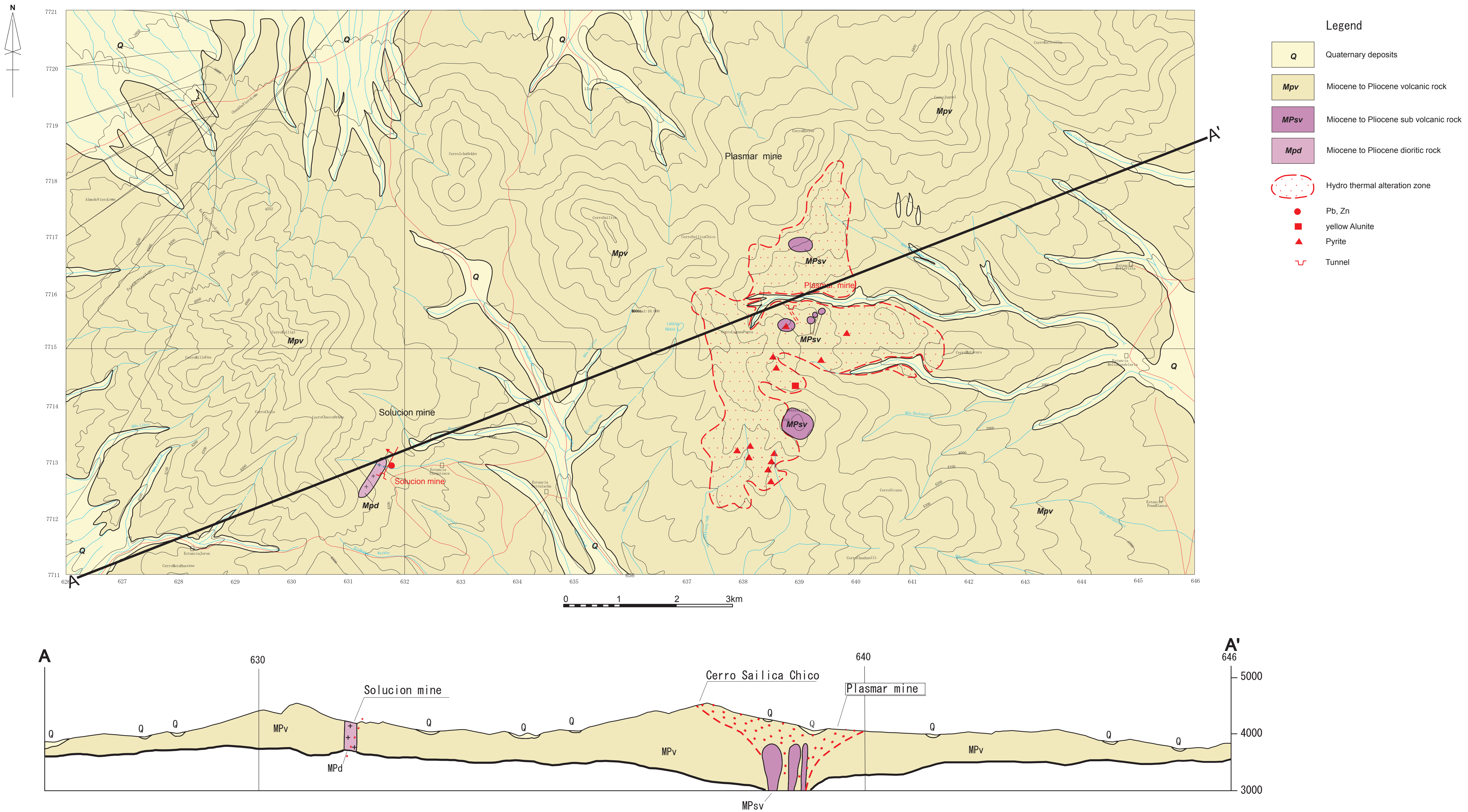


Fig. II-3-9(1) Geological Map of the Sailica District

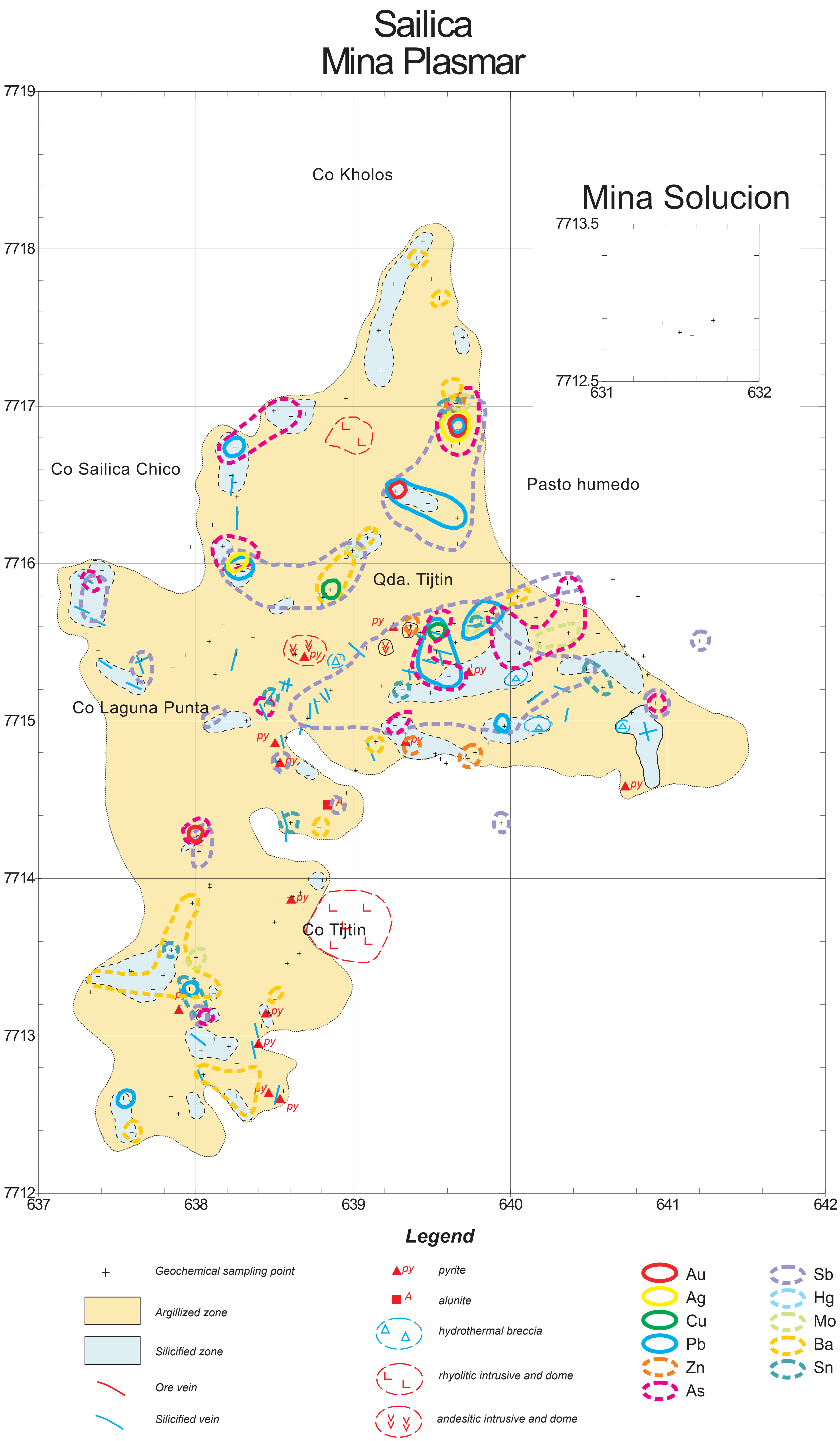


Fig.II-3-9(2) Integrated Interpretation Map of the Sailica District (Plasmar,Solucion: Phase II)

Faults, veins and fissures in the area trend E-W, NW-SE and NNE-SSW (N-S).

The mineralization of Plasmar mine correspond to epithermalAu- Ag- Pb- Zn mineralization related to shallow volcanic activity that is estimated from the previous data and result of geochemical survey. And there is a possibility of overlapping of high sulfidation Au- Ag- Cu mineraliztion from the presence of pyrophyllite and copper anomalies. As there is an extensive alteration zone and remarkable geochemical anomaly, the possibility of existence of ore deposits in deep underground seems to be high.

3-10 Sedilla district (Figs. II-3-10 (1))

Survey was carried out in Phase II.

The mineralization in Chascos and asedilla prospects in the Sedilla district is probably weak or deep-seated.

Eskapa mine area (Figs. II-3-10 (2))

The hydrothermal alteration zones cover about 4.5 km^2 in the volcanic rocks of late Miocene.

A neutral alteration zone is widely distributed in Eskapa prospect, and ore deposit is expected in shallow portion.

The mineralization appears to correspond to an epithermal Au- Ag- Pb- Zn deposit from the presence of tin and silver- lead anomalies. It is also possible the mineralization of the area correspond to upper part of porphyry type mineralization from the presence of neutral alteration.

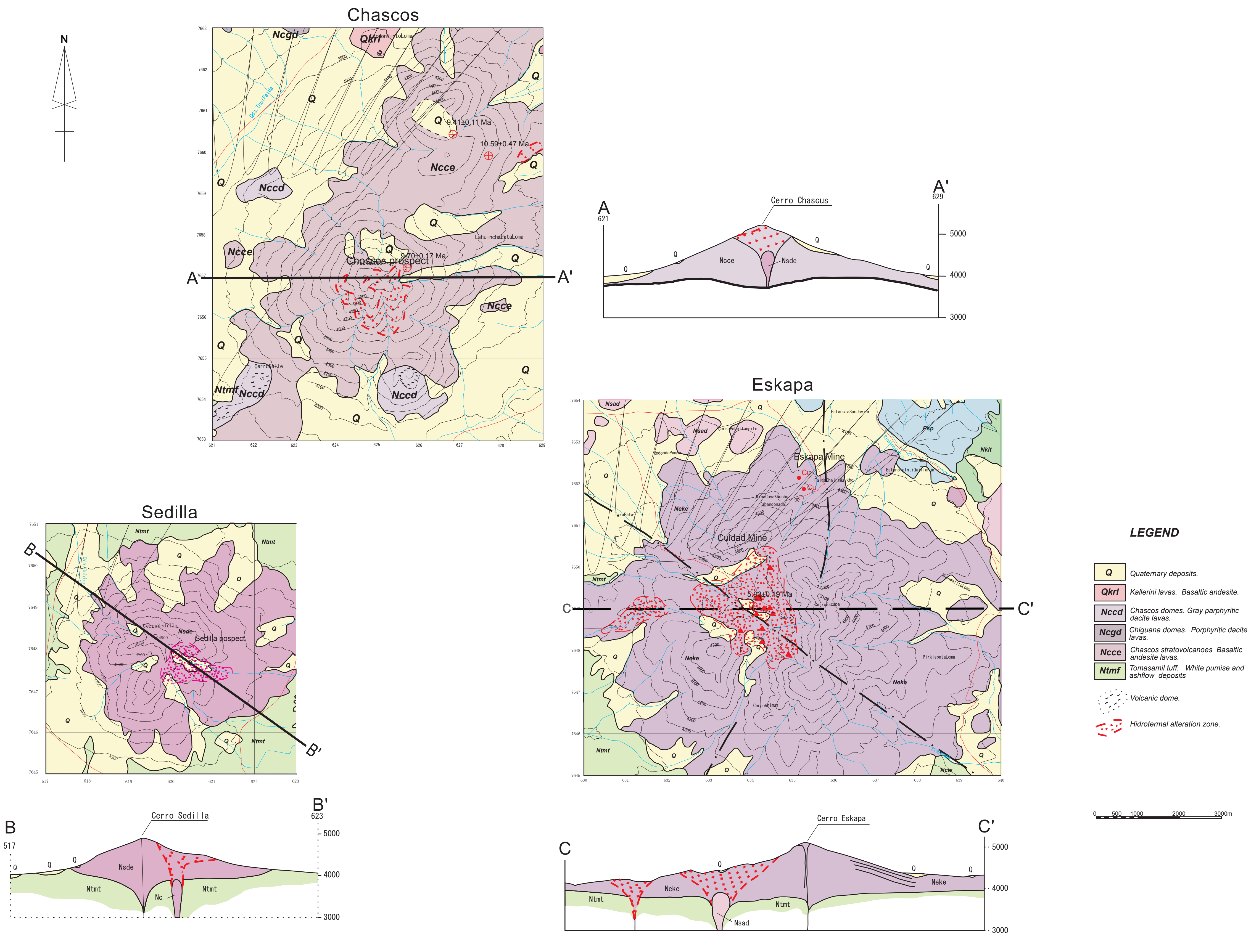


Fig.II-3-10(1) Geological Map of the Sedilla District

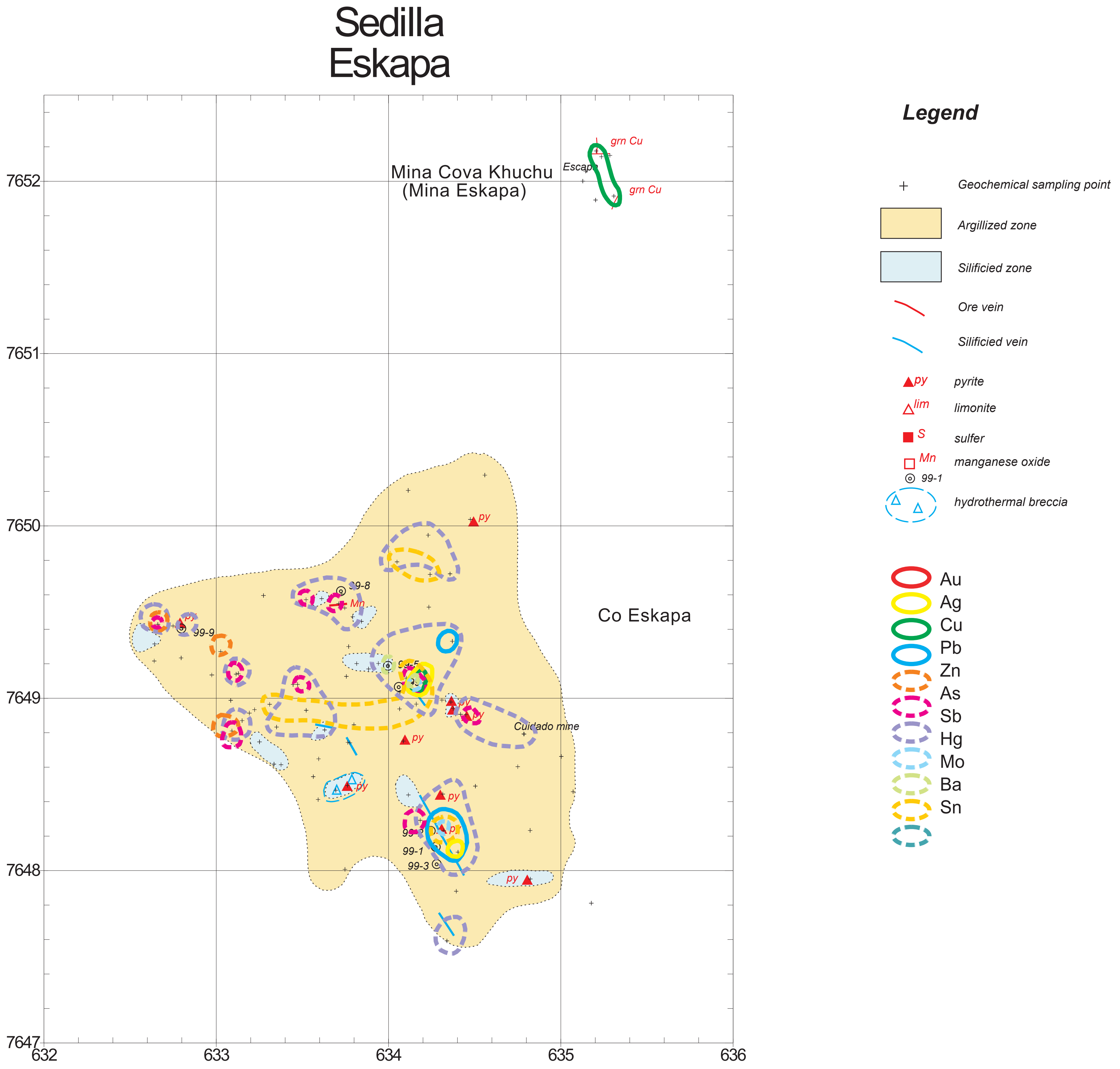


Fig.II-3-10(2)　Integrated Interpretation Map of the Sedilla District (Eskapa: Phase II)