Chapter 2　Geological Survey

2-1 Survey Method

Based on the study of the existing data for the Capire and La Campana Districts, the survey rout plan has been made. The topographic maps, 1:2,500 in scale, have been prepared for the field survey modifying the existing maps. GPS has been applied for positioning in the field, and the rout maps have been made.

To clarify the geological division and structure, mineralization, and alteration has been concentrated in the survey. The location of mineralized zones and outcrops has been surveyed by a handy transit, in case of necessary, and especially important outcrops have been sketched in scale of 1:100 to 1:200, and taken in colored photographs. Specimens of typical rocks, rock facies, mineralized zones, and alteration zones have been taken to make clear their relations. The specimens have been examined by microscopic observation for thin sections or polished sections, X-ray diffraction method, and chemical analysis. The result of the examination has been investigated together with the result of the geological field survey.

The result of the integrated interpretation has been summarized in the geological map scaled 1:2,500.

2-2 Survey Result

1 Capire District

The Capire district is situated in the central Aurora area, on the ridge extending north to south, in between the Paso del Carizo River in the west and the Los Sabinas River drainage system in the east. The district is about 1,400 meters in altitude in the southwestern end, increasing the height to the east up to 1,950 meters.

The Capire Deposit is located in the central south district, and the Aurora Deposit is in the southeast corner.

(1) Geology

Figures 2-2-1 to 2-2-5 show the geological map and geological sections, columnar section, location map of specimen, and location map of mineral occurrences. Table 2-1-1 and

Table 2-1-1 show the results of the microscopic observation and ore grade assay.

The Capire district is underlain by the volcanic and sedimentary rocks of the Villa Ayala Formation, and intrusive rocks. The volcanic rocks are divided into the lower and upper by the sedimentary rocks.

(i) Lower Volcanic Rocks

The lower volcanic rocks are composed of andesitic rocks (Vaa, Vha, Vab, Vam) and dacite (Dc-1).

a) Andesitic rocks

・Massive andesite lava (Vaa) is distributed in the southwestern corner of the district. It is green to bluish-grayish green, massive porphyritic rock, containing plagioclase and pyroxene phenocrysts. It also partly shows the autobrecciated texture, grading to the hyaloclastite. Some quite weak foliation is seen. Alteration minerals such as chlorite, epidote and minor sericite, calcite are observed in a glassy matrix by the microscopic study.

・Andesitic autobrecciated lava and pyroclastic rock - hyaloclastite (Vha) is distributed in the western district in a small zone. It is green, grayish green to yellowish-grayish green, in case containing much epidotized fragments. It tends to that the autobrecciated lava grades into hyaloclastite, and is dominated by slightly finer-grained tuff and pyroclastic rocks in its upper part.

・The pyroclastic rock and hyaloclastite(Vab) normally contain clastic pebbles, several to over 10 centimeters in size. The fragments are mainly of essential to accessory andesite, showing green, yellowish green, or gray, and a small-amount of hematitic andesite and silicic rock fragments.

The NE-SW trending and NW dipping weak foliation is seen in the rock, but it is thought that the formation generally dips to the east, judging from the overall distribution.

・The alternation of slate and pyroclastic rocks (Vam) appears in a stream in the southwestern district and the depth between 48.0 and 51.1 meters of the existing drill hole C-50, therefore it is estimated that the alternation extends at least 300 meters. It is in the uppermost of the lower andesite, and the boundary zone with the dacite (Dc-1). It is about 5 meters thick in the outcrop, being an alternation of grayish mudstone, 10 to 20 centimeters in thick, containing pyrite dissemination, and lapilli-tuff, 30 to 50 centimeters in thickness, containing silicic fragments. The formation strikes N35 degrees W and dips 38 degrees to NW, but its foliation strikes N45 degrees E and dips 15 degrees to NW. The strikes and dips of the formation and cleavage obliquely cross each other.

b) Dacite (Dc-1)

The dacite is distributed in the western district, from the Tlanilpa mineral showing to the Capire deposit, in a belt zone extending north to south. Also it appears in an existing drill hole underneath the sedimentary rocks. It is 20 to 50 meters thick.

The rock is dark green to grayish green, rich in plagioclase phenocrysts, and its groundmass seems like vitric tuff. It is accompanied by lapilli of silicified rock, andesite, fine-grained pyrite mineralized rock, and in some cases graded into andesitic pyroclastic rock. In the upper part, the rock grades into the sedimentary rocks, but forms an alteration (Mts) with the sedimentary rocks in Tlanilpa in the northern district. By the microscopic observation, vitroclastic matrix contains about 10% plagioclase and small amounts of andesite, slate fragment and alteration minerals such as chlorite, sericite, and quartz.

The cleavage is accordant with the distribution of the formation, dips to NW in many cases.

In Tlanilpa, it contains mineralized fragments together with fine-grained pyrite dissemination and films, having altered.

(ii) Sedimentary Rocks

The sedimentary rocks are composed of an alternation of tuff and slate (Mts), slate (Ms, main body of the sedimentary rocks), limestone (Ml), and tuff (Mt), from the bottom.

・The alternation of tuff and slate (Mts) is distributed in the northern half of the district, and overlies the dacite (Dc-1). It consists of coarse-grained tuff and black slate, 20 to 50 meters thick, and the alternation is several meters in total thickness. Some deposition of fine-grained pyrite dissemination in the slate has been confirmed to the east of the Tlanilpa mineral occurrence. The rock formation show generally east to northeast dip, and an oblique crossing with the cleavage as well as around the Tlanilpa.

・The slate (Ms) is distributed in the central district in a belt pattern extending north to south. The rock facies is of foliated slate to phyllite, being composed of black graphite, dark grayish limestone, and grayish tuff, forming thin alternation of millimeters thick in many places. Microscopically, calcareous slate consists of abundant fine calcite and graphite occurred on the cleavage plane accompanying chlorite, pyrite.

The slate widely spreads on the surface around Tlanilpa, but it becomes very thin in the southwestern part. An existing drill hole AU-1-13, north of Capire, the slate appears more than 200 meters thick, not reached to the underlying dacite.

・The limestone (M1) appears in the sedimentary rocks from the upper to the lower horizon, however only principal distribution parts is shown in the geological map. It tends to distribute in the northern district and around Tlanilpa. The rock facies is gray to dark gray, mainly consisting of muddy to packstone, rarely thin layers of recrystallized fossil fragments.

・The tuff (Mt) is gray, mainly consisting of fine-grained volcanic ash. The mud-balls of slate are seen around the Capire and Aurora I deposits. The tuff seen near Tlanilpa to the area along the roads in the southern district is contains plagioclase phenocrysts, and forming an alternation with slate.

(iii) Upper Volcanic Rocks

The upper volcanic rocks are composed of the vitric tuff (Vat), dacitic tuff (Vdt), andesitic tuff and lava (Va-2).

・The vitric tuff (Vat) is distributed in the northeastern district extending north to south, overlying the sedimentary rocks. It is mainly composed of yellowish-grayish green foliated vitric tuff, slightly massive in the central part, and being accompanied with thin layers or lenses of mudstone, mud-ball like. The tuff consists of well foliated glassy matrix containing about 10% plagioclase and alteration minerals such as chlorite, sericite, calcite and pyrite. Pressure shadow around plagioclase was observed by microscope.

・The dacitic tuff (Vdt) is distributed from the central western district to the eastern edge through the north of the Aurora deposit, overlying the sedimentary rocks. It is also seen in the andesitic tuff (Va-2) as lenticular bodies. It is generally grayish green, and accompanied with slightly large amounts of green foliated volcanic glass, and plagioclase phenocrysts and small amounts of pebbles. It contains pyrite dissemination in the eastern edge, weathering to brownish material. Microscopically this tuff contains abundant sericite and small amounts of chlorite and pyrite.

・The andesitic tuff (Va-2) is distributed from the central to southeastern district on the steep slope of the mountain. It appears at 9.37 meters and between 50 and 87.9 meters in AU-1-13 hole. It shows greenish gray massive feature in the fresh part, but mostly weathered to undistinguishable rock. Its tuff part contains small amounts of plagioclase phenocrysts and green vitric fragments of millimeters size. Volcanic lava like parts contain about 15-40% of coarse grained plagioclase and pyroxene crystals in a hyalopilitic groundmass showing intense chloritization with sericite, calcite and pyrite.

The rock distributed along a stream in the southeastern district contains much idiomorphic pyrite along foliation plane.

The bluish green pyroxene andesite lava of the mountain body in the eastern district extending north to south is accompanied by autobrecciated lava and tuffaceous part, and its massive part varies the grain-size and amount of plagioclase crystals.

(iv) Intrusive Rock

The andesitic intrusive rock (Dio) is distributed east of the Aurora I deposit in the southeastern district. It is grayish green and massive, being accompanied by plagioclase and small amounts of pyroxene phenocrysts, but showing no foliation. Weak pyrite dissemination exists, and weathering oxidized zone of network is seen there. It is described as "diorite" in the existing geological map, but it is judged intrusive facies of "andesite" based on the microscopic observation. That is, it consists of about 20% plagioclase and small amounts of pyroxene and magnetite in a hyalopilitic groundmass.

(2) Mineralization and Alteration

The existing ore deposits, Capire and Aurora I, are situated in the southern corner of the district. Recent years, a Canadian company has performed an exploration program from 1994 to 1998, including significant drilling survey. Their target seems to be the sedimentary type stratiform sulfide ore deposit. Slate, limestone lens, and sericite tuff (taking mud-ball like slate in) are seen on the surface around the target area. The sulfide ore occurrence, 20 centimeters thick layer containing lead and zinc mineral, is seen in the prospecting adit in the Aurora I deposit. The assay result of the samples taken is as follows.

0.173 g/t Au, 95 g/t Ag, 0.68 % Cu, 6.96 % Pb, 7.56 % Zn, 115 ppm Ba, 2.38 % Fe, 7.53 % S

In the microscopic observation for the polished sections, the ore is composed of a medium amount of sphalerite, small amount of pyrite, galena and chalcopyrite, and minor amount of tetrahedrite. The sphalerite shows the chalcopyrite desseas altered texture, the pyrite shows the colloform and framboidal texture.

According to the final report of the Canadian company, 1.2 million tons of ore, average grade of 73 g/t Ag and 1.1 % Zn, was estimated in the shallow part of the Capire and Aurora I deposits.

Other than the above-mentioned occurrences, some significant mineral occurrence and alteration zone have been confirmed by the survey, in the north to northeast of the Aurora I deposit and around Tlanilpa.

In the north to northeast of the Aurora I Deposit, the dacitic tuff (Vdt) and andesitic tuff – lava (Va-2) of the upper volcanic rocks contain intense pyrite impregnation. It is a concentration of fine-grained euhedral pyrite in a form of film or band and it suggests that the mineralization is resulted by hydrothermal activity prior to the regional deformation. The assay result of the sample taken is as follows.

12 ppb Au, 1.35 ppm Ag, 7 ppm Cu, 22 ppm Pb, 176 ppm Zn, 81 ppm Ba,

14.6 % Fe, 10.11 % S

A network to film-form fine-grained pyrite occurrence is seen in the dacite (Dc-1) of the lower volcanic rocks around Tlanilpa, and fine-grained pyrite layers exist in the alternation of tuff and slate (Mts).

Weak pyrite network veins are partly hosted in the andesite of the lower volcanic rocks to the east of Tlanilpa, but its alteration is of low grade. It is thought that the mineralization center in this area is located further east to northeast of Tlanilpa. The assay result of the samples taken is as follows.

FA-03: fracture filling pyrite

3 ppb Au, 0.30 ppm Ag, 16 ppm Cu, 15 ppm Pb, 14 ppm Zn, 283 ppm Ba,

2.09 % Fe, 1.08 % S

FA-04: sericite and pyrite rock

6 ppb Au, 0.40 ppm Ag, 13 ppm Cu, 11 ppm Pb, 20 ppm Zn, 417 ppm Ba,

1.75 % Fe, 1.45 % S

FA-05: fine pyrite bed

4 ppb Au, 1.10 ppm Ag, 38 ppm Cu, 40 ppm Pb, 58 ppm Zn, 24 ppm Ba,

9.21 % Fe, 9.24 % S

JS-09: massive pyrite ore-

15 ppb Au, 3.50 ppm Ag, 31 ppm Cu, 37 ppm Pb, 22 ppm Zn, 17 ppm Ba,

28.90 % Fe, 30.90 % S

The elements other than Fe and S are of low content. Under the microscope, only pyrite is seen in all specimens, and it shows the colloform and framboidal texture.

(3) Geological Structure

The overall district has undergone the regional deformation, but especially the sedimentary rocks and fine-grained volcanic rocks show significant cleavage. The reverse folding structure, having axis of the cleavage plane axis, can be seen in some places. The bedding planes are almost flat and gently dipping to the east to northeast, seeing from their facies distribution, and only a gentle folding structure is recognized.

Figure 2-2-6 shows the stereographic project of the cleavage plane and bedding plane for each unit.

Cleavage plane of lower volcanic rocks tends to concentrate in the NNE strike and gentle NW dip. Cleavage and bedding plane of sedimentary rocks have same tendency of lower volcanic unit. Bedding plane tends to change in direction from NE strike with NW dip to MW strike with NE dip. Cleavage plane of upper volcanic rocks vary from NW strike with SW dip → NS strike with W dip → EW strike with N dip.

The main fault structures are of N-S system in the western district, WNW-ESE system continuing from Tlanilpa to the ESE direction in the northern district, and NW-SE system continuing to SE.

The N-S fault system can be seen in the outcrops along the stream west of Tlanilpa, being a normal fault showing high angle dipping to the east. The transition by the fault is large in the north, but small and thinning out in the south.

The WNW-ESE system is seen as fracture zone along the stream and roads in the northeast to east of Tlanilpa. This normal fault dips about 80 degrees to the SSW, and transits both sides of the formation about 30 to 50 meters each other.

The NW-SE system is of steep dipping, extending from nearby Tlanilpa to the SE. It is presumed that the NW side-wall is contrastively uplifted. Judging from the distribution of the formations, a fault diverts from this system in the east of Tlanilpa.

(4) X-ray Diffraction Test

The X-ray diffraction method (powder) has been applied to determine minerals of the typical rock facies and alteration zones. Table 2-2-3 shows the list of the specimens tested, and Figure 2-2-7 shows the distribution of the alteration minerals.

The minerals detected in the specimens from the Capire district are quartz, albite, kaolinite (four spots), sericite, chlorite, gypsum (one spot), dolomite (two spots), calcite, pyrite, and epidote.

The kaolinite, gypsum, and dolomite appear in the sedimentary rocks or directly above and underneath of it, but not being accompanied by strong alteration.

The sericite is widely spread, specially the 3 T -type, reflecting intensity of the alteration or metamorphism, tends to be dominant in the tuffaceous rocks in the northern district. The epidote is only seen in the andesitic part in minor amount.

2 La Campana District

The La Campana district is centered at Mount La Campana, 1,640 meters in altitude, and the drainage pattern is radial centering at the summit. The southwestern district is lowest in altitude, 1,200 meters. The most area belongs to Guerrero State, but only the northeastern corner is of Mexico State.

(1) Geology

The La Campana district is underlain by the lower volcanic rocks, sedimentary rocks, and upper volcanic rocks. Figures 2-2-8 to 2-2-12 show the geological map and cross sections, columnar section, location map of specimen, and location map of mineral occurrences.

(i) Lower Volcanic Rocks

The lower volcanic rocks are divided into foliated volcanic rocks, andesitic rocks and dacitic tuff.

a) Foliated Volcanic Rocks

The rocks are classified in the green foliated volcanic rocks (Gsh) and altered tuffaceous foliated volcanic rocks (Qsh).

・The green foliated volcanic rocks (Gsh) are distributed in the southwestern, western and northwestern district, and lies under the altered tuffaceous foliated volcanic rocks. It occasionally appears as an alternation of them. In the southwestern district, the foliation grades into weaker, and transition into the overlying andesite.

The rock facies is grayish green to dark purplish green, and shows distinct foliation. Flattened essential and accessory fragments are seen in many places, and its most part seems like andesitic tuff. In the western to northwestern district, the rocks have undergone significant alteration associated with mineralization, showing pale color, and containing pyrite dissemination and thin layers. Microscopically it contains abundant quartz, chlorite, sercite and calcite in a fine foliated matrix.

・The tuffaceous foliated volcanic rocks (Qsh) are distributed from the western edge to the northern district. It is gray to pale greenish gray and foliated, being accompanied with white fragments (essential pumice) and containing thin layers and fragments of slate. It is therefore thought that the most part of the rocks is dacitic tuff. In the northwestern district, the alteration is significant, and the rock contains fine-grained pyrite contamination and thin layers along foliated planes. The weathered part is of brownish oxidized zone. Microscopically it contains about 20% plagioclase and small amounts of opacited hornblende and alteration minerals.

In the northeastern district, the rock is accompanied with greenish vitric spots, and its alternation is weak. The rock forms an alternation with overlying sedimentary rocks in some places, but generally grades into them.

b) Andesitic Rocks (Vab)

The andesitic rocks (Vab) are distributed in the southeastern edge and southern end of the district. In the southeastern edge, it is greenish massive pyroclastic rock to hyaloclastite, and its upper part is of coarse-grained to sandy tuff showing sedimentary texture. The formation strikes E-W, dips 30 degrees to the north. It grades into the overlying dacite (Dc-1). Under the microscopic observation of aphyric andesite, about 5% of plagioclase and abundant alteration minerals such as quartz, sericite and pyrite are observed.

In the southern edge, it is grayish green to dark gray porphyritic andesite and tuff, containing weak pyrite dissemination. It shows weak foliation. The rock is in fault contact, extending E-W, with the overlying sedimentary rocks. The relation with the underlying foliated volcanic rocks is not clear, presumably grades into them.

c) Dacite (Dc-1)

The dacite is distributed in the southeastern district, being cut in lenticular shape by the E-W extending fault. The rock facies is dark green to blackish vitric lapilli-tuff and grayish green tuff-breccia, partly forming an alternation with the upper sedimentary rocks. The groundmass is rich in glass and plagioclase phenocrysts. The brecciated fragments are of tuff, mudstone, and porphyritic andesite. The cleavage crosses the bedding plane in oblique; showing NE-SW strike and NW dip 30 degrees.

(ii) Sedimentary Rocks

The sedimentary rocks are composed of the alternations of slate and limestone (Ms), and tuff and slate (Mst).

a) Alternation of slate and limestone (Ms)

The alternation is distributed in the southeastern to southern district, being an alternation of black slate and dark gray muddy limestone. The limestone layers decrease to the upper, and the dominated slate intercalates thin layers of tuff. The alternation layers are one to several tens centimeters thick. Cleavage is seen in the slate.

b) Alternation of tuff and slate (Mst)

The alternation is distributed in the eastern to southern, southwestern, and northern district, surrounding La Campana Mountain, and its area is wider in the southwestern part. The alternation is of dacitic or rhyolitic tuff to lapilli-tuff, sandy tuff, and slate, being dominated by the tuff. Limestone lenses are intercalated in the uppermost horizon in the northwestern district.

The tuff is gray, and contains much plagioclase fragments, occasionally pumice fragments. Around the Manto Rico deposit, mud-ball like slate is taken in the hanging wall side, being accompanied by chart lenses, 20 to 30 centimeters in diameter. In the southwestern district, the tuff contains slate fragments. In the northern district, the tuff grades into sandy tuff, and forms a very thin alternation layers, millimeters to centimeters thick, of fine-grained tuff and tuffaceous slate in the upper part. Microscopically, the tuff contains about 30% plagioclase and small amounts of andesitic tuff fragment in a foliated glassy matrix.

(iii) Upper volcanic rocks

The upper volcanic rocks consist of the dacitic tuff (Dc-2) and green tuff (Vat).

a) Dacitic tuff (Dc-2)

Dacitic tuff is distributed in the north of the Manto Rico deposit in the eastern edge of the district to southern, western and northern district, half surrounding La Campana Mountain. The tuff decreases its thickness toward their edge in the north of the Manto Rico deposit and northern district, and is separated into two layers.

The rock facies is grayish green, and generally shows schistosity. The principal body is of glassy, containing medium amounts of plagioclase. The most part of the tuff shows homogeneous facies, but partly contains small amounts of siliceous rock fragments showing flatten lenticular structure, 20 to 30 centimeters in size. In the north of the Manto Rico deposit, the tuff grades into overlying green tuff. Microscopically it consists of 10% plagioclase in a glassy matrix. A week pressure shadow texture was observed around the plagioclase crystals.

b) Green tuff (Vat)

The green tuff is distributed centering La Campana Mountain. The rock is grayish-green to green fine-grained tuff mainly consisting of vitric material. It is andesitic to dacitic. In the south of La Campana Mountain, the tuff is accompanied with slate layers. It shows breccia-like rock facies containing some mud-balls along roads and streams in the northern district. Microscopically it consists of fine plagioclase, andesitic fragments and foliated glassy matrix accompanying chlorite, calcite, sericite and pyrite.

(2) Mineralization and Alteration

The Manto Rico deposit and La Campana mineral occurrence are situated in the district. It is thought that the Manto Rico deposit is stratigraphically hosted in the middle part of the alternation of tuff and slate (Mst), but no significant alteration zone is seen around there. As described in the second year report, the deposit is of sulfide ore relatively rich in barite. It is possible that the ore is allochthonous, due to existence of mud-balls around there. The La Campana occurrence is hosted in the upper part of the alternation of tuff and slate (Mst), seemingly being prospected in small-scale for sulfide ore. No significant alteration zone exists there.

Other than above-mentioned occurrences, some intense alteration zones are in the foliated volcanic rocks in the western to northern district. Significant sericite and pyrite alteration zones exist there, and weathered part shows brown color due to oxidation. The pyrite bands have been deformed by folding having cleavage axis, therefore it can be said that the mineralization took place prior to the deformation.

The assay result of the samples taken is as follows.

FA-06: pyrite disseminated tuff

7 ppb Au, 0.40 ppm Ag, 35 ppm Cu, 36 ppm Pb, 35 ppm Zn, 221 ppm Ba, 4.85 % Fe, 3.73 % S

FA-07: pyrite band

60 ppb Au, 10.80 ppm Ag, 25 ppm Cu, 19 ppm Pb, 46 ppm Zn, 85 ppm Ba, 11.50 % Fe, 12.60 % S

FA-08: pyrite band

7 ppb Au, 0.70 ppm Ag, 19 ppm Cu, 5 ppm Pb, 3 ppm Zn, 89 ppm Ba, 11.30 % Fe, 15.08 % S

JC-35: pyrite disseminated tuff

1 ppb Au, 0.90 ppm Ag, 39 ppm Cu, 10 ppm Pb, 102 ppm Zn, 257 ppm Ba, 4.32 % Fe, 27.60 % S

The all elements other than Fe and S show low values, and only pyrite is seen in the all specimens under the microscope. The colloform texture is seen in pyrite in some cases.

Weak silicification zone and pyrite dissemination is seen in the andesite of the lower volcanic rocks in the southwestern district.

Some vein-type occurrence and alteration zone associated with mineralization are seen along a stream in the northern district and the upper stream area of the Manto Rico River. The former is of pyrite dissemination, and silicification and argillization zone in an intermittently extending fault zone along the stream, extending NE-SW. A vein-type ore containing lead and zinc mineral crops out in the upper stream area of the Manto Rico River, as described in the second year report. The vein is accompanied by calcite as a gangue mineral.

(3) Geological Structure

Cleavage plane is dominantly seen in the rocks, but the formations are generally flat, and no significant folding structure exists in this district as well as in the Capire District. Small folding structure and flexure for schistosity are locally seen.

Figure 2-2-13 shows the stereographic projection of the cleavage plane, and bedding plane.

Cleavage plane of lower volcanic rocks tends to concentrate on the central part of stereograph reflecting low inclination. Cleavage plane of sedimentary rocks shows mostly NE strike and NW dip. Bedding plane tends to show EW strike and gentle N dip.

Cleavage plane of upper volcanic rocks show NE strike and NW gentle dipping. Distribution pattern of cleavage and bedding plane in La Campana district is as same as that of Capire district. It may be affected by gentle open folding.

Other than the folding structure, there exist following fault structures; WNW-ESE and NW-SE systems in the northeastern district, E-W system in the southern district.

The WNW-ESE fault system extends along a same trend stream intermittently, and some fault clay containing pyrite is in the shear zone. It is steep dip fault, and the northeastern side appears uplifted judging from the distribution of the formations. This fault can be clearly and intermittently detected from the airborne electromagnetic survey map.

In the northwest of Manto Rico, the NW-SE fault system is seen along roads or streams, and contrastingly its northeast side appears uplifted.

In the southern district, the E-W fault system makes a boundary between the sedimentary rocks and lower volcanic rocks, and its north side is apparently depressed for the south side. The fault dips 60 to 70 degrees to the north at an outcrop in a stream, seemingly normal fault. It disappears in the western district, but it well continues to the east.

(4) X-ray Diffraction Test

The X-ray diffraction method has been applied to identify minerals of the typical rock facies and altered rocks in the district as well as in the Capire District. Table 2-2-3 and Figure 2-2-14 show the test result.

The detected minerals are quartz, albite, potassium feldspar, kaolinite (1 spot), halloysite (2 spots), sericite, palagonite, chlorite, gypsum (3 spots), jarosite (1 spot), goethite (2 spots), gibsite (2 spots), calcite, pyrite, and epidote.

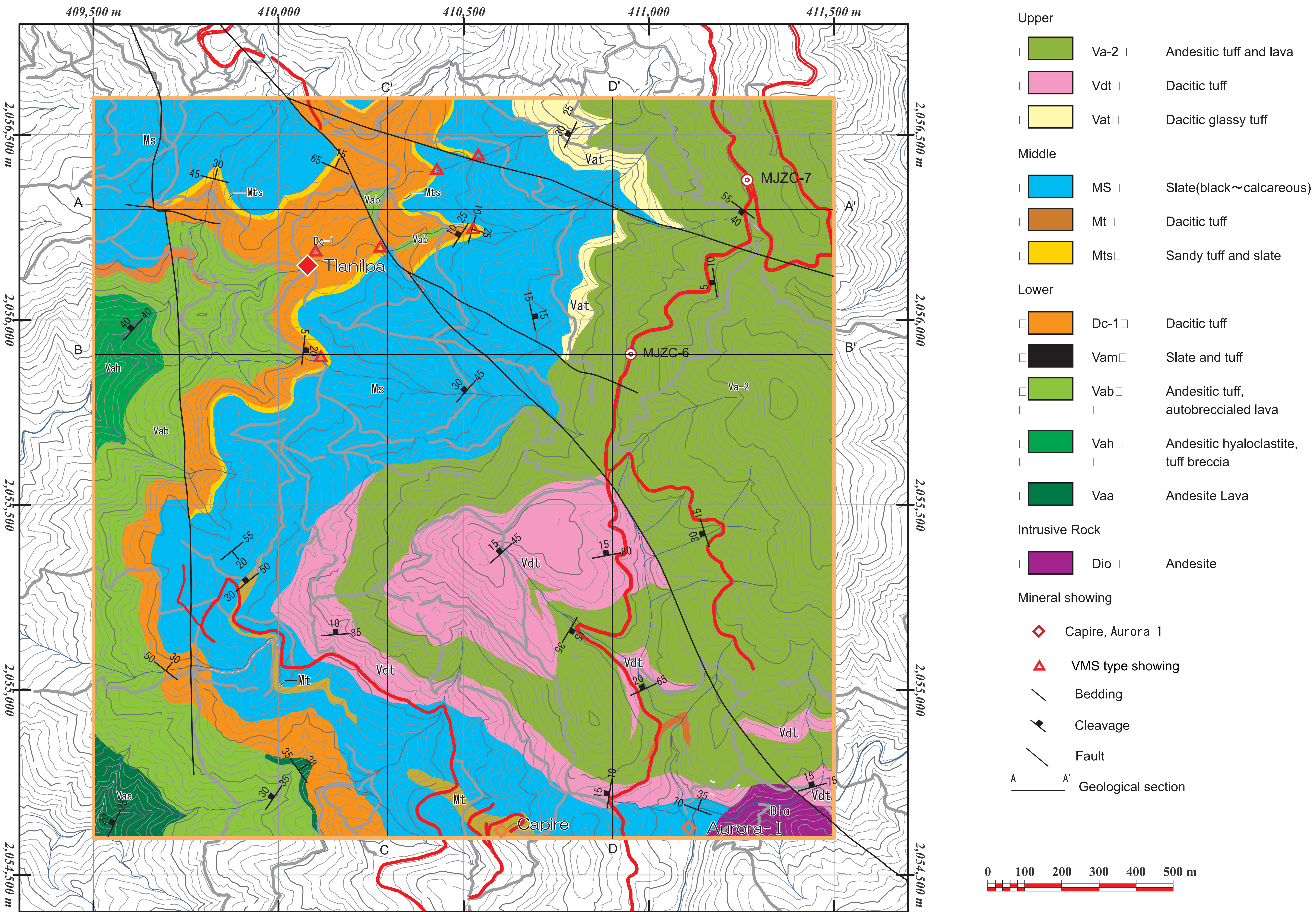


Fig.2-2-1 Geological Map of Capire District

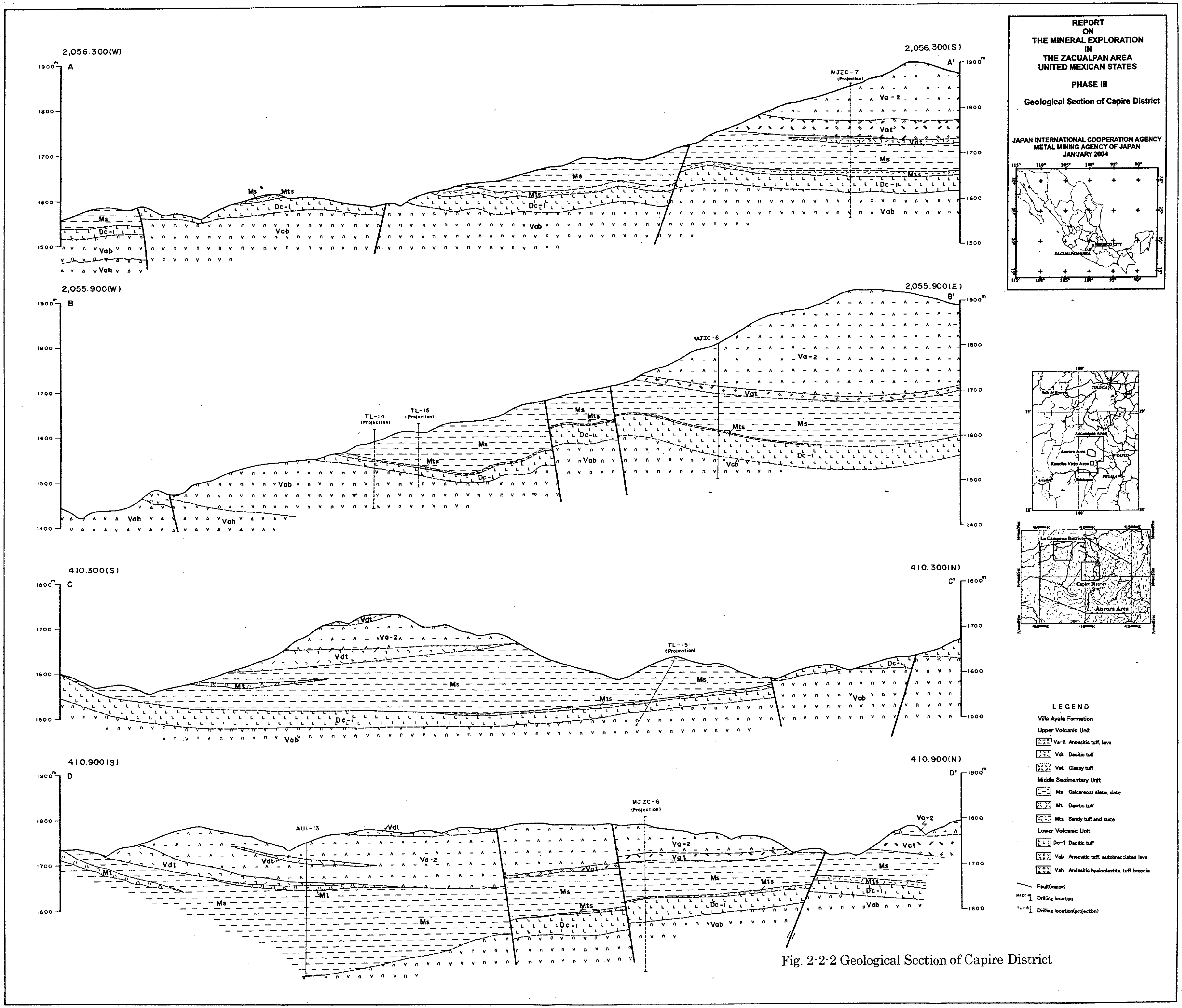
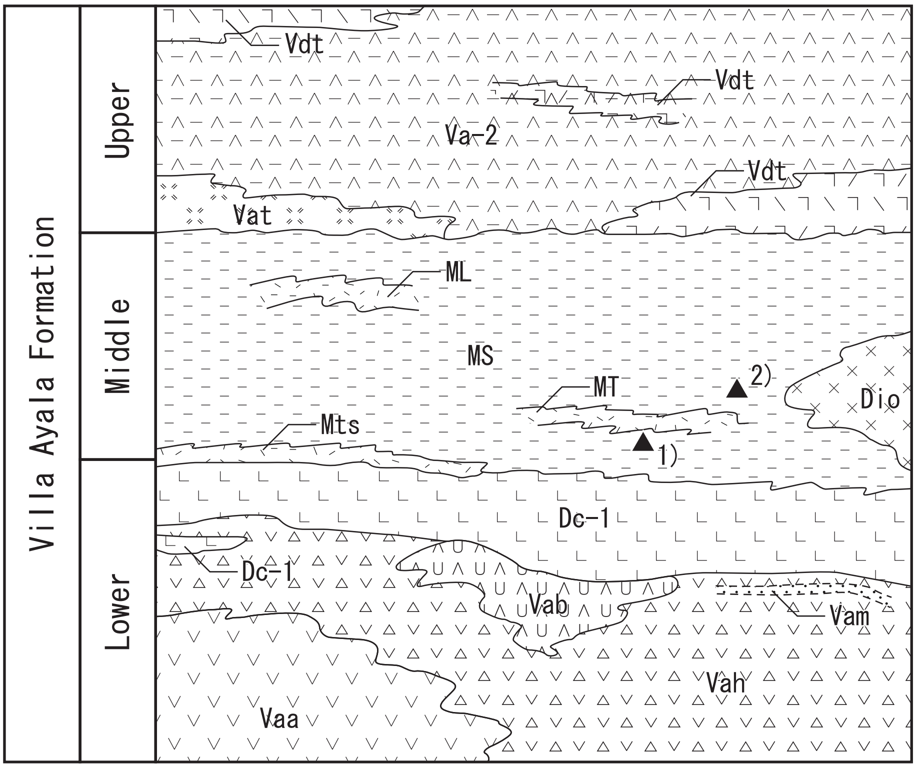


Fig. 2-2-2 Geological Section of Capire District



Villa Ayala Formation

Upper

Va-2	Andesitic tuff and lava
Vdt	Dacitic tuff
Vat	Glassy tuff

Middle

ML	Limestone foliated
MS	Slate(black～calcareous)
Mt	Dacitic tuff
Mts	Sandy tuff and slate

Lower

Dc-1	Dacitic tuff
Vam	Slate and tuff
Vab	Andesitic tuff, autobrecciated lava
Vah	Andesitic hyaloclastite, tuff breccia
Vaa	Andesite Lava

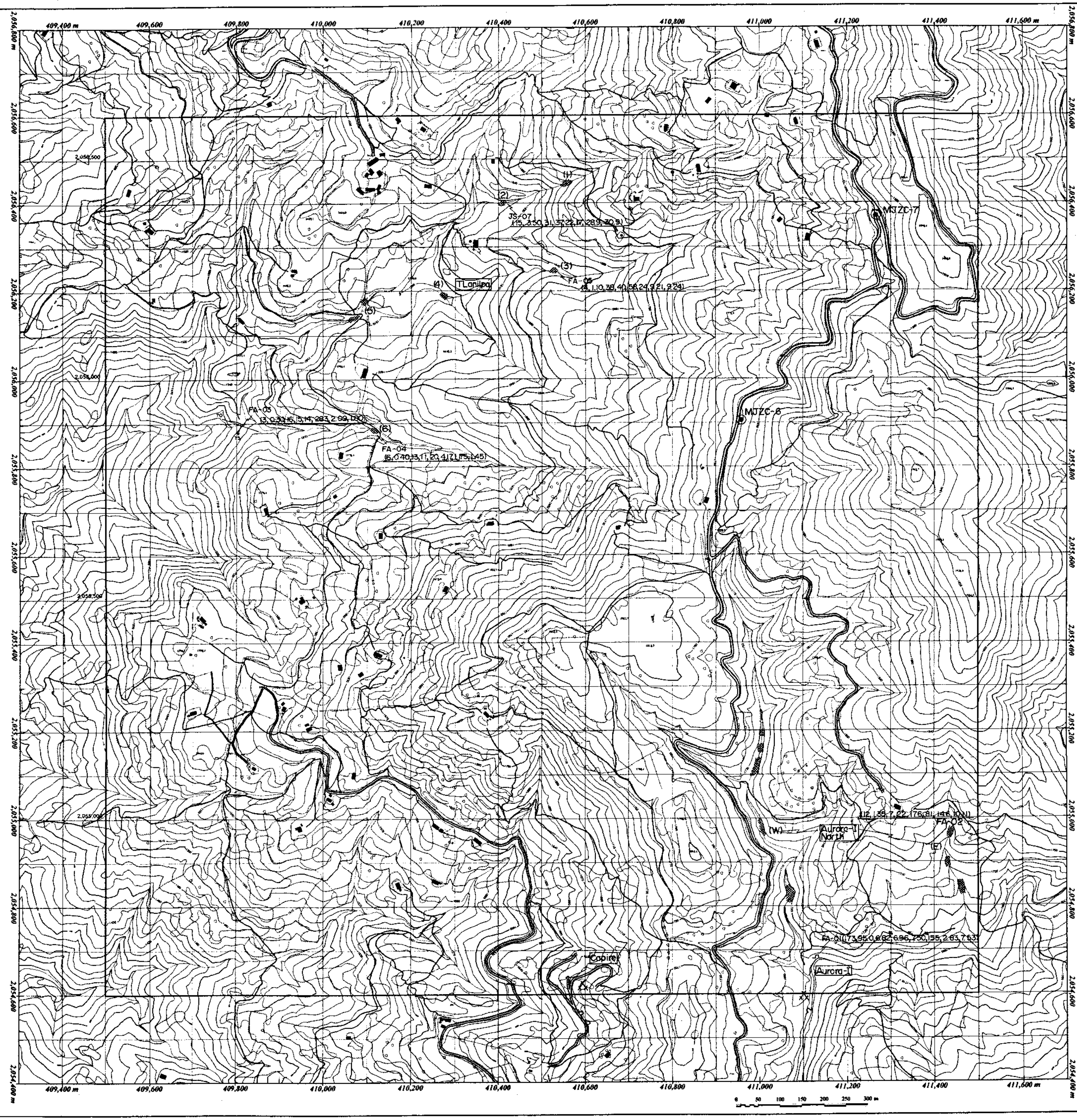
Intrusive Rock

Dio	Andesite

Ore showing

▲1)	Capire
▲2)	Aurora- I

Fig.2－2－3 Schematic Stratigraphic Column of Capire District



LEGEND

Outcrop of mineralization

FA-08 Sample No and assay result

Au(ppb), Ag(ppm), Cu(ppm), Pb(ppm), Zn(ppm), Ba(ppm), Fe(%), S(%)

◉ Drilling location

⎍ Adit

第Ⅱ-２－4図　カピレ区域鉱徴地位置図

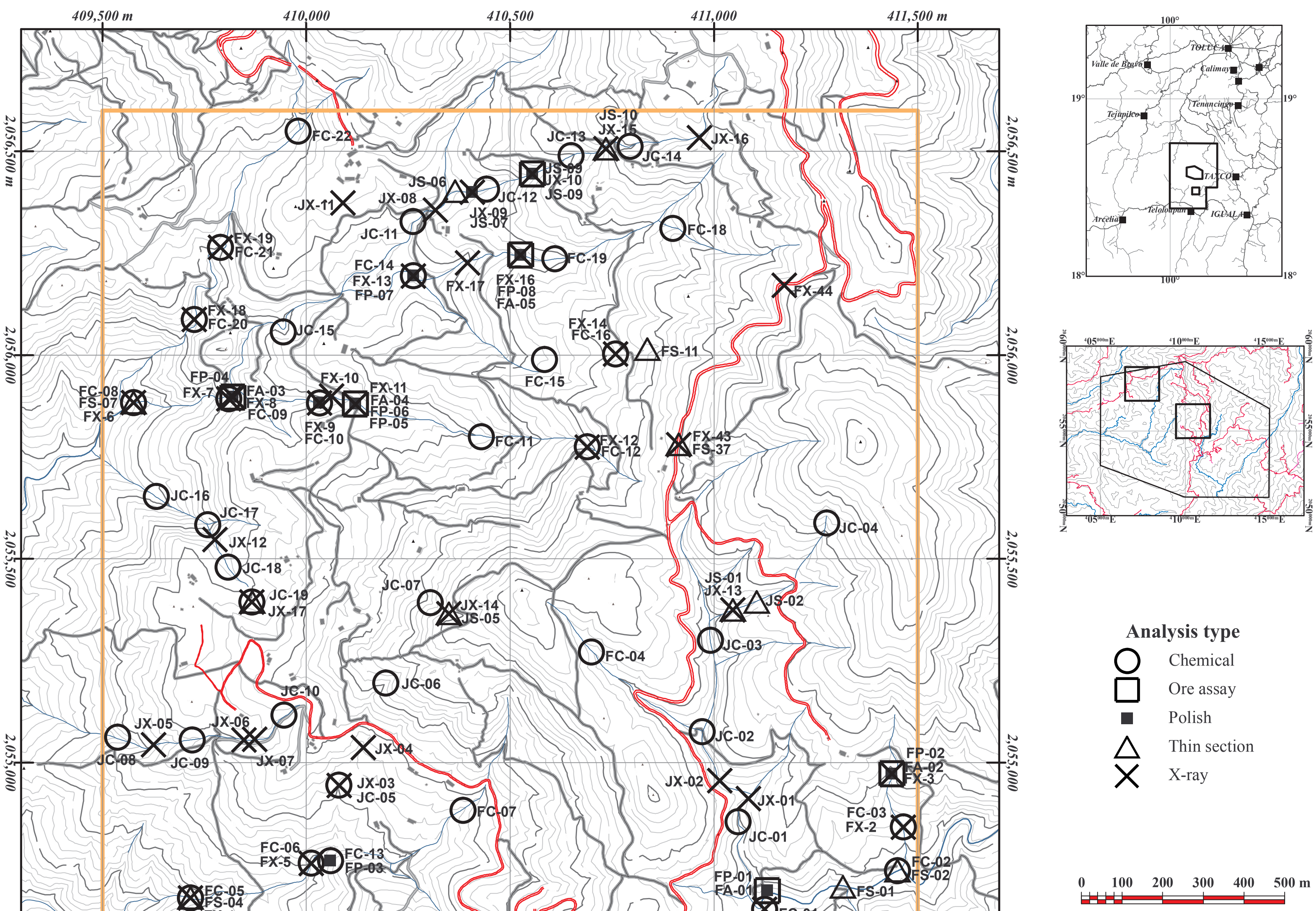
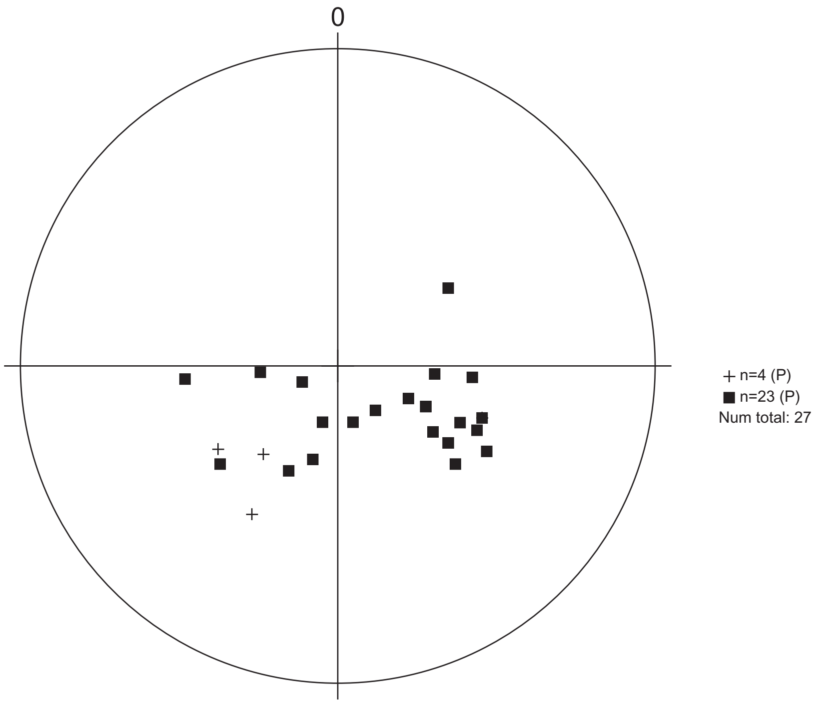
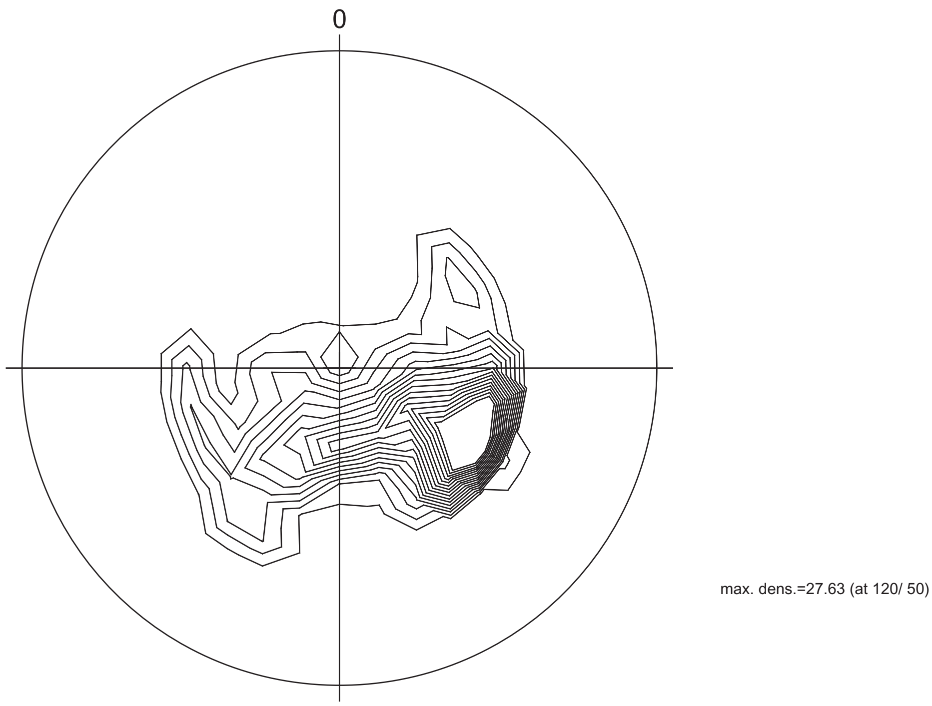


Fig.2-2-5 Sample Location Map(Capire District)

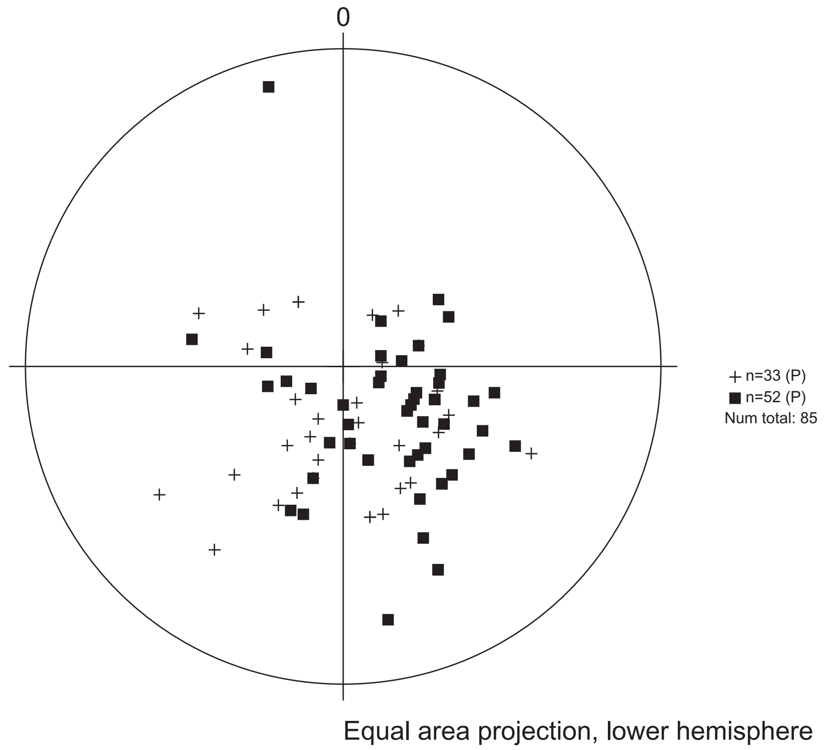


Equal area projection, lower hemisphere



Equal area projection, lower hemisphere
＋bedding plane
■cleavage plane

Fig.2－2－6(1) Stereographic Projection
（Capire district:Lower volcanic rocks）



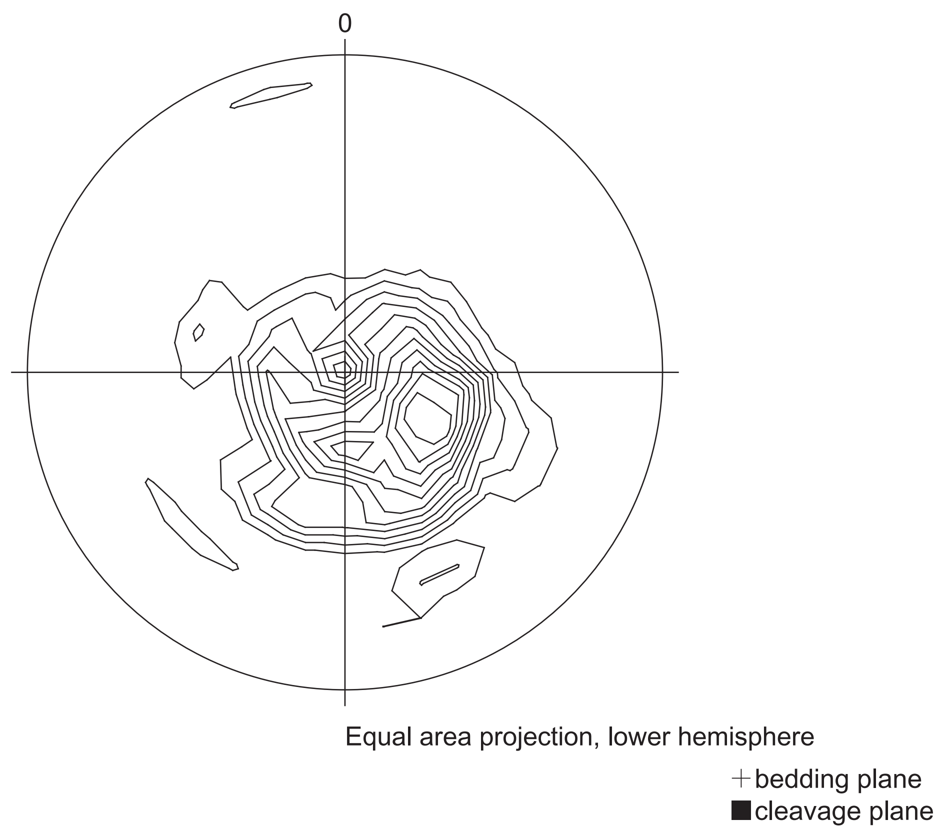
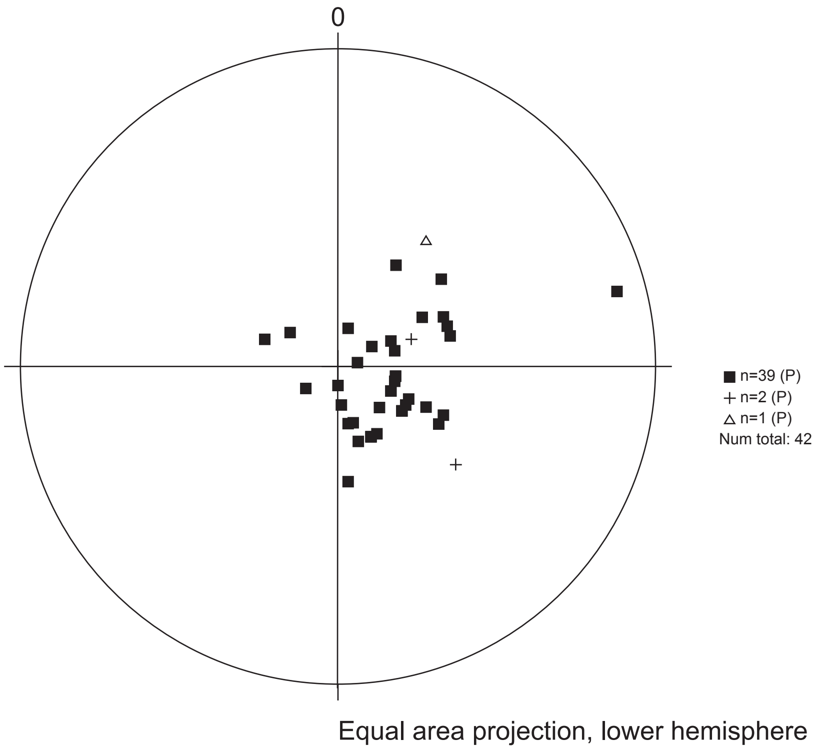
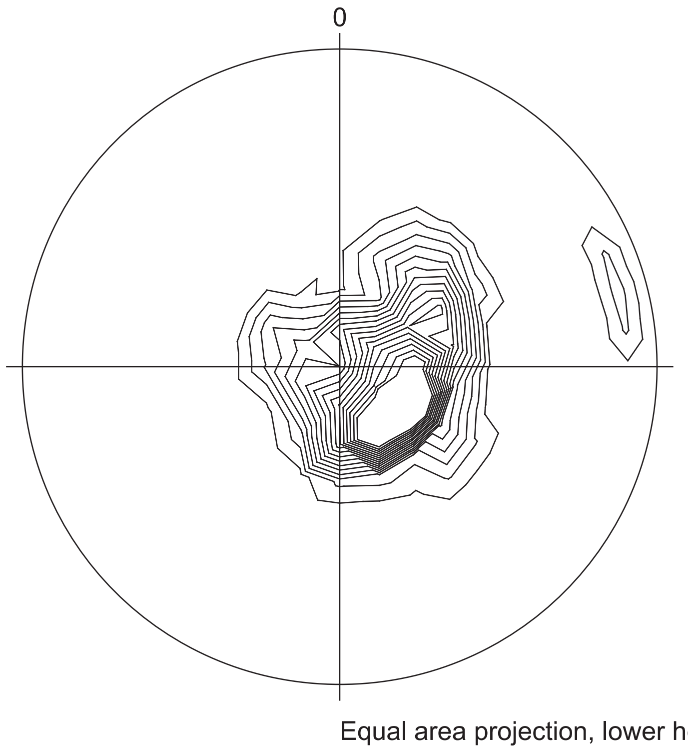


Fig.2－2－6(2) Stereographic Projection
(Capire district:Sedimentary rocks)





+bedding plane
■cleavage plane

Fig.2－2－6 (3) Stereographic Projection
(Capire district : Upper volcanc rocks)

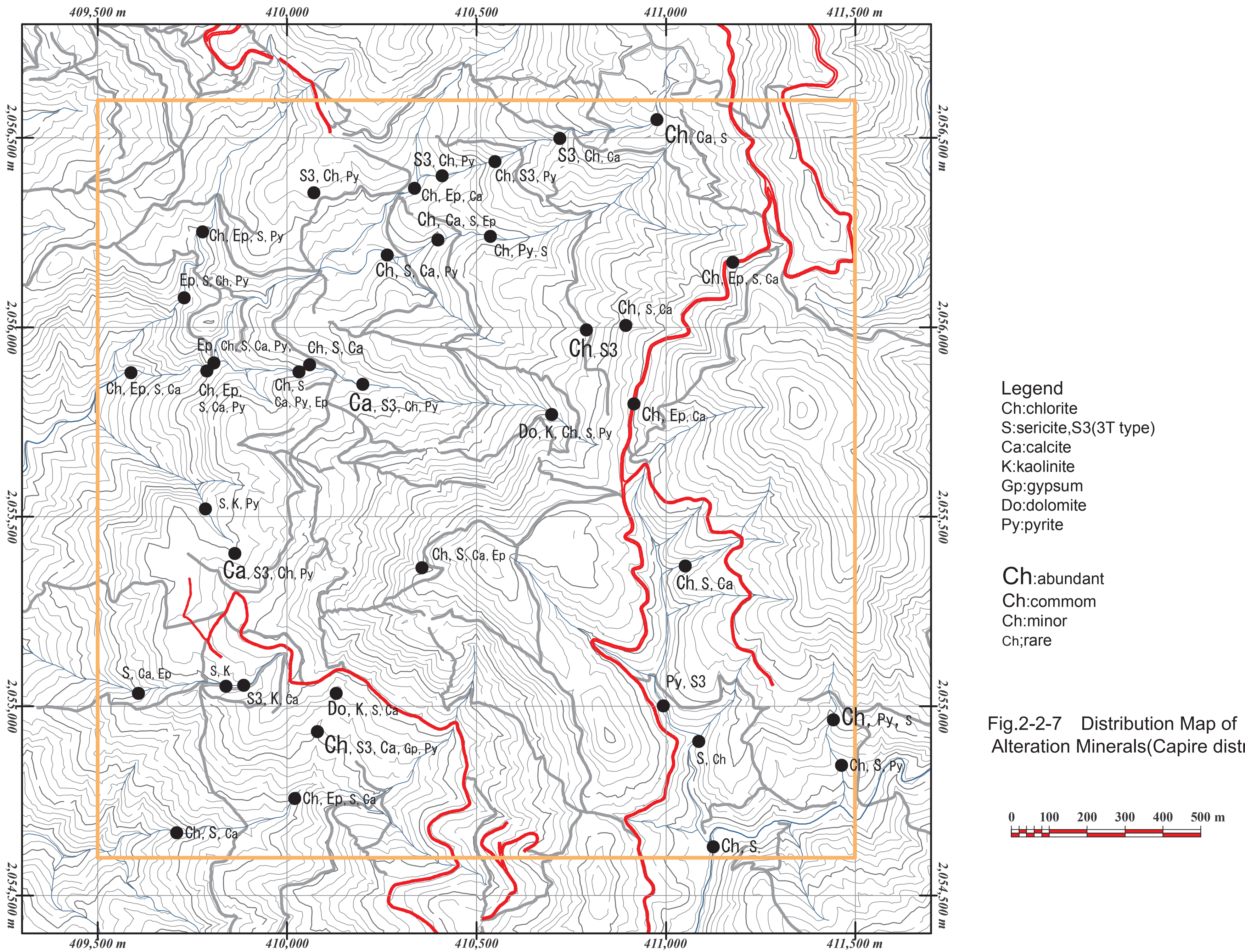


Fig.2-2-7 Distribution Map of Alteration Minerals(Capire district)

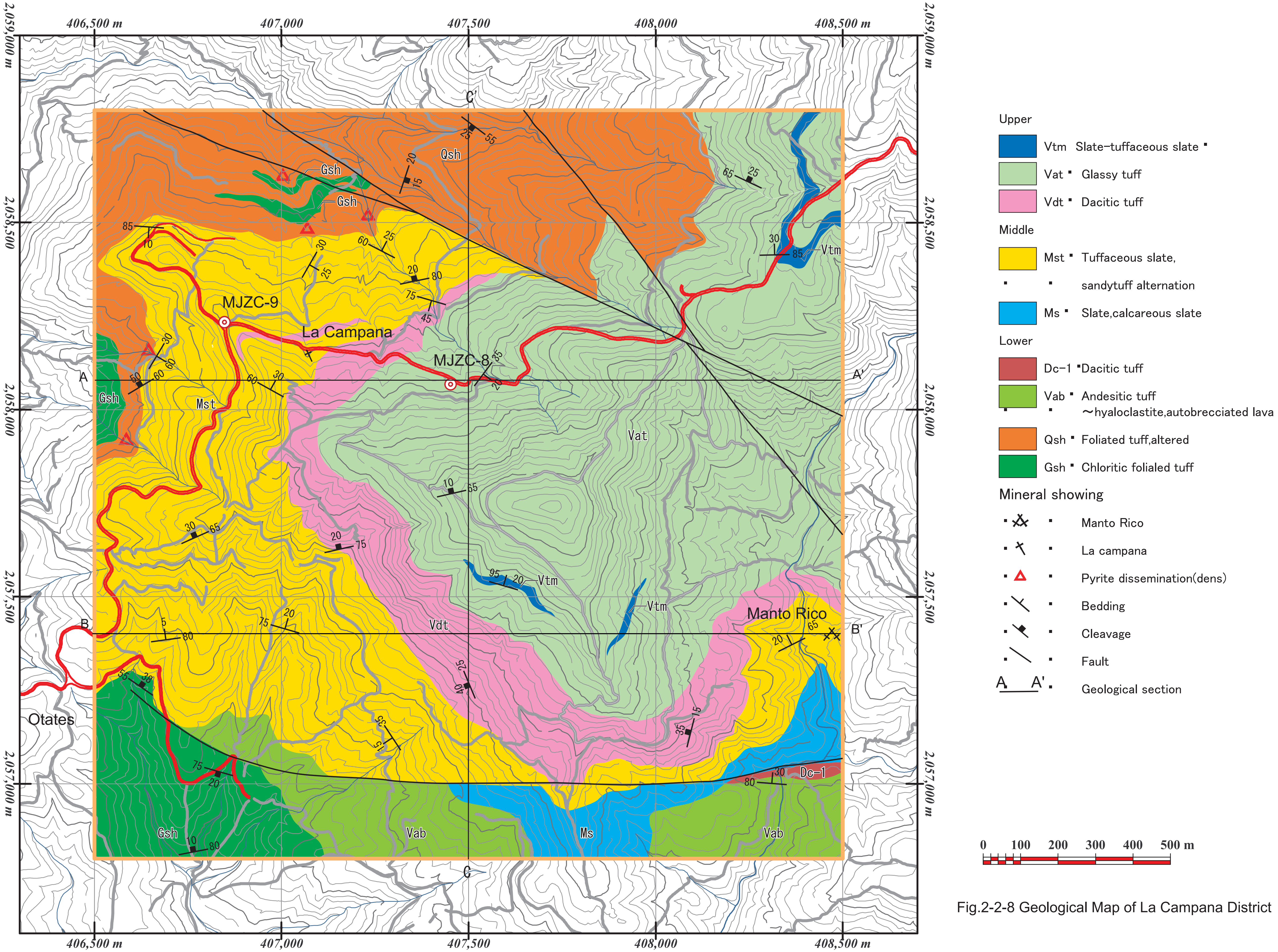


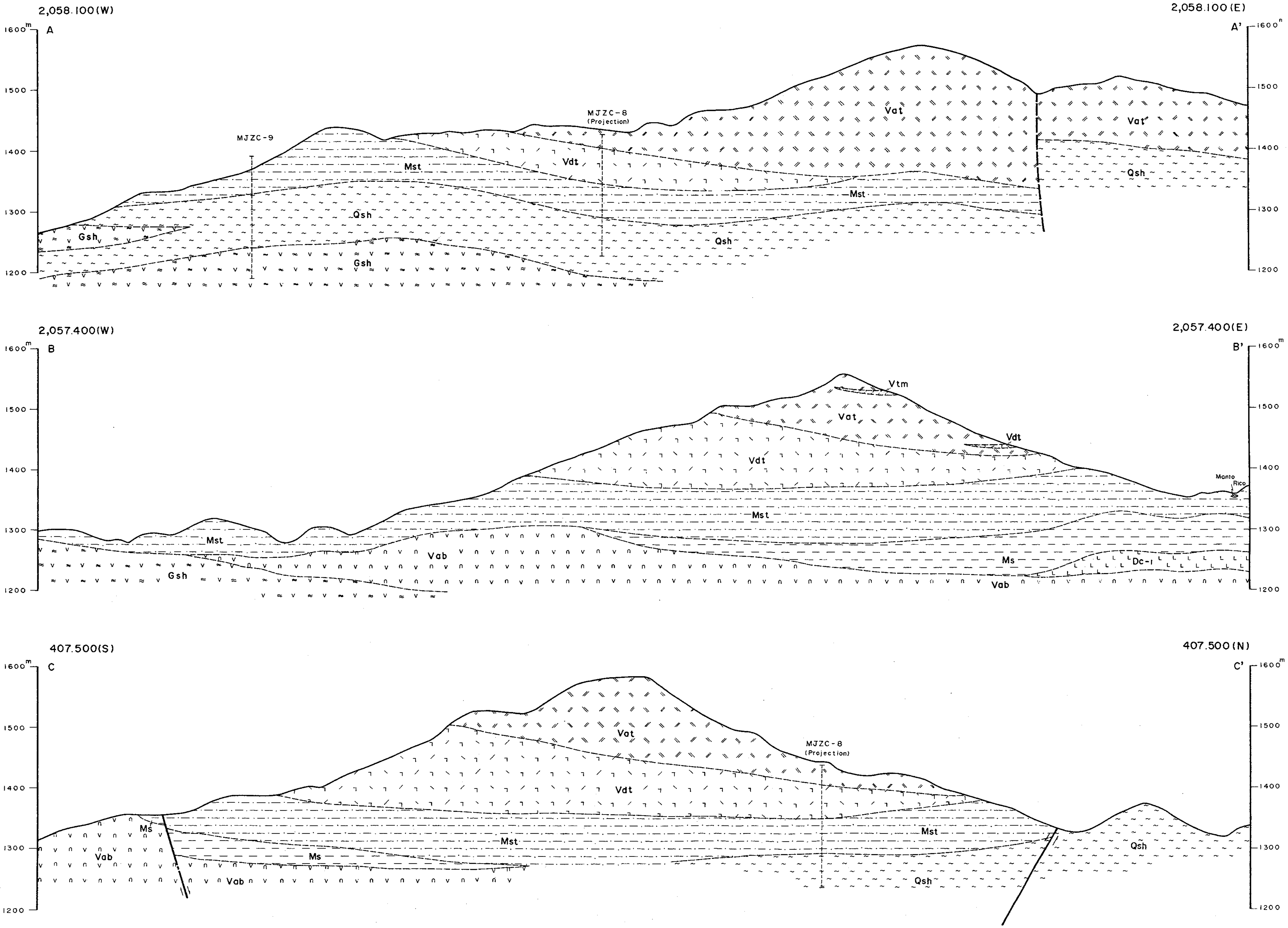
Fig.2-2-8 Geological Map of La Campana District

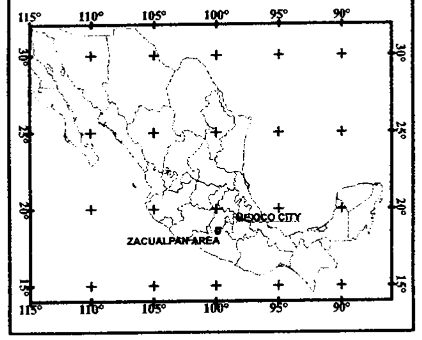
REPORT ON THE MINERAL EXPLORATION IN THE ZACUALPAN AREA UNITED MEXICAN STATES

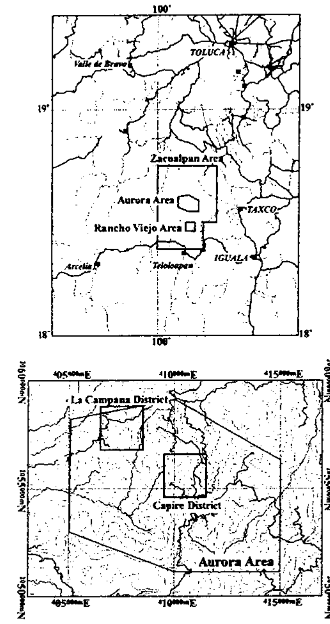
PHASE III

Geological Section of La Campana District

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
JANUARY 2004







LEGEND

Villa Ayala Formation

Upper Volcanic Unit
- Vtm Slate, tuffaceous slate
- Vdt Dacitic tuff
- Vat Glassy tuff

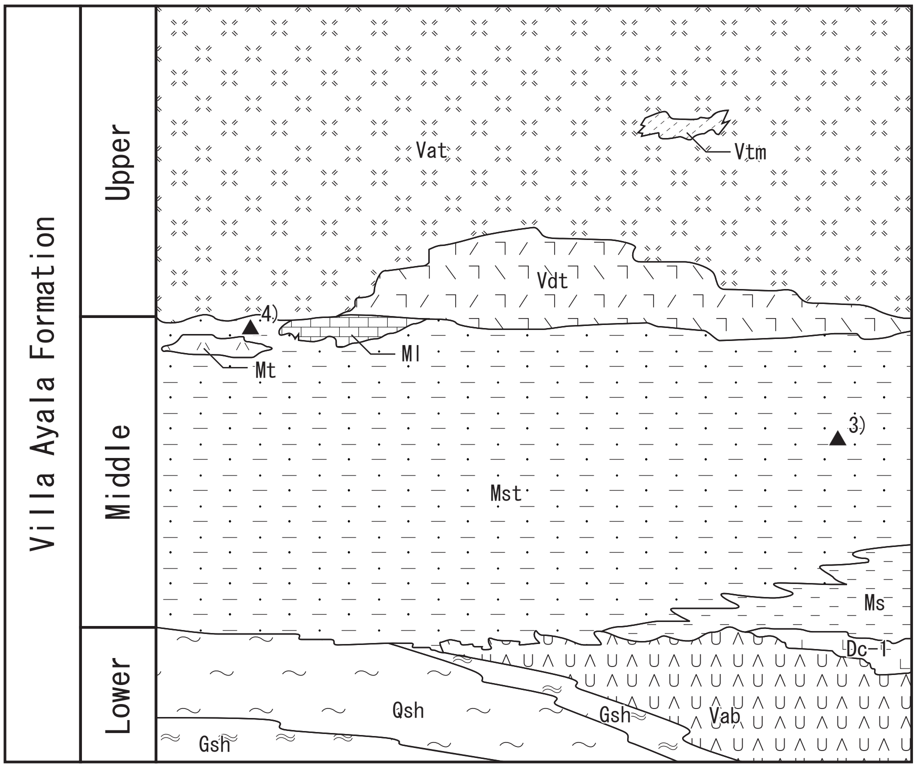
Middle Sedimentary Unit
- Mst Alternation of sandy tuff and tuffaceous slate
- Ms Calcareous slate, slate

Lower Volcanic Unit
- Dc-1 Dacitic tuff
- Vab Andesitic tuff, autobrecciated lava
- Qsh Foliated tuff
- Gsh Foliated andesite, tuff

Fault(major)

Drilling location(projection)

Fig. 2-2-9 Geological section of La Campana District



Villa Ayala Formation

Upper

Vtm Slate-tuffaceous slate

Vat Glassy tuff

Vdt Dacitic tuff

Middle

Ml Limestone

Mt Dacitic tuff

Mst Tuffaceous slate, sandytuff alternation

Ms Slate,calcareous slate

Lower

Dc-1 Dacitic tuff

Vab Andesitic tuff ～hyaloclastite,autobrecciated lava

Qsh Foliated tuff,altered

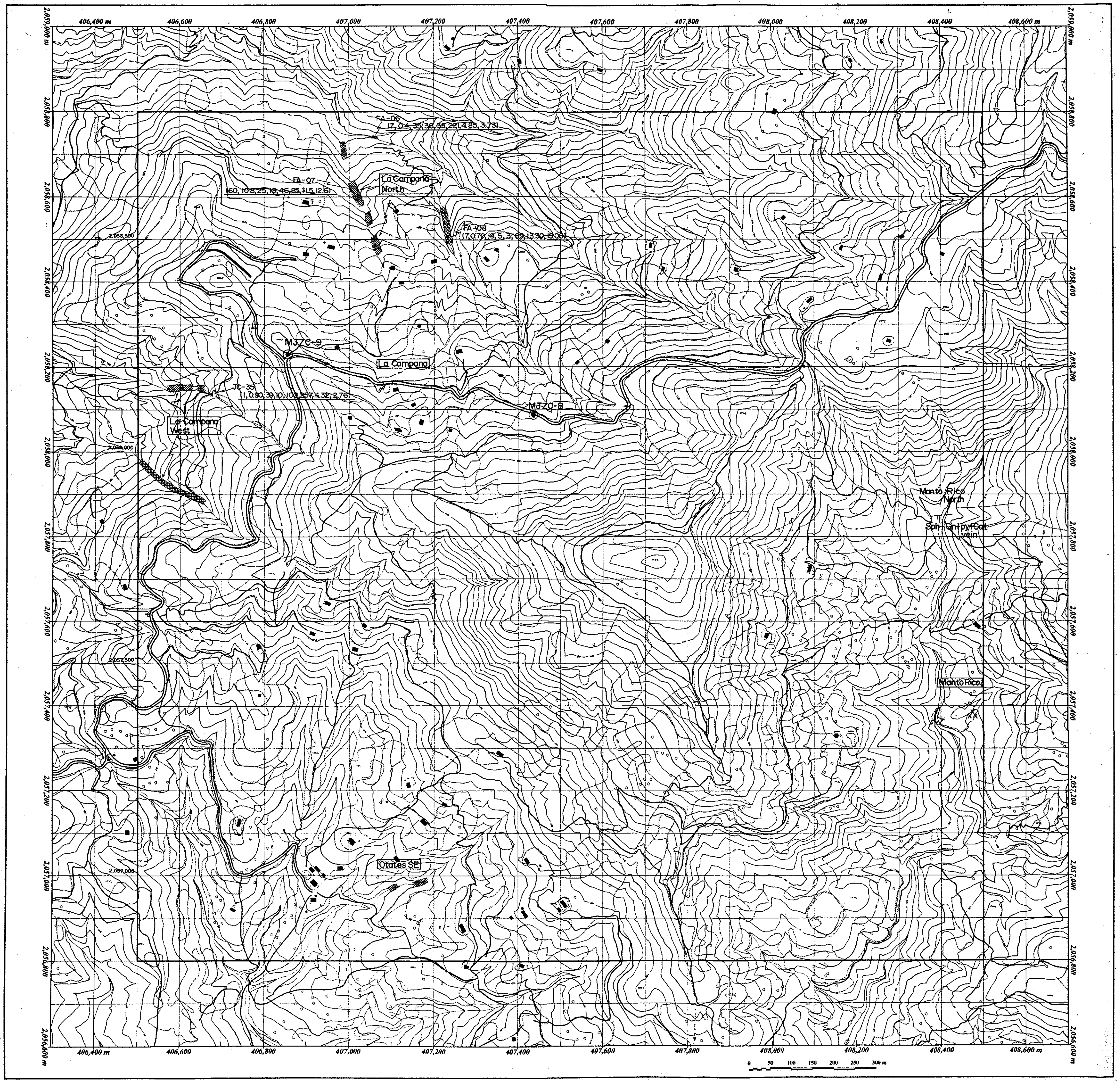
Gsh Foliated andesite,tuff

Ore showings

▲3) Manto Rico

▲4) La Campana

Fig.2－2－10 Schematic Stratigraphic Column of La Campana District



LEGEND

Outcrop of mineralization

FA-08 Sample No and assay result

Au(ppb), Ag(ppm), Cu(ppm), Pb(ppm), Zn(ppm), Ba(ppm), Fe(%), S(%)

Drilling location

Adit

Fig. 2-2-11 Location Map of Ore Showings

(La Campana District)

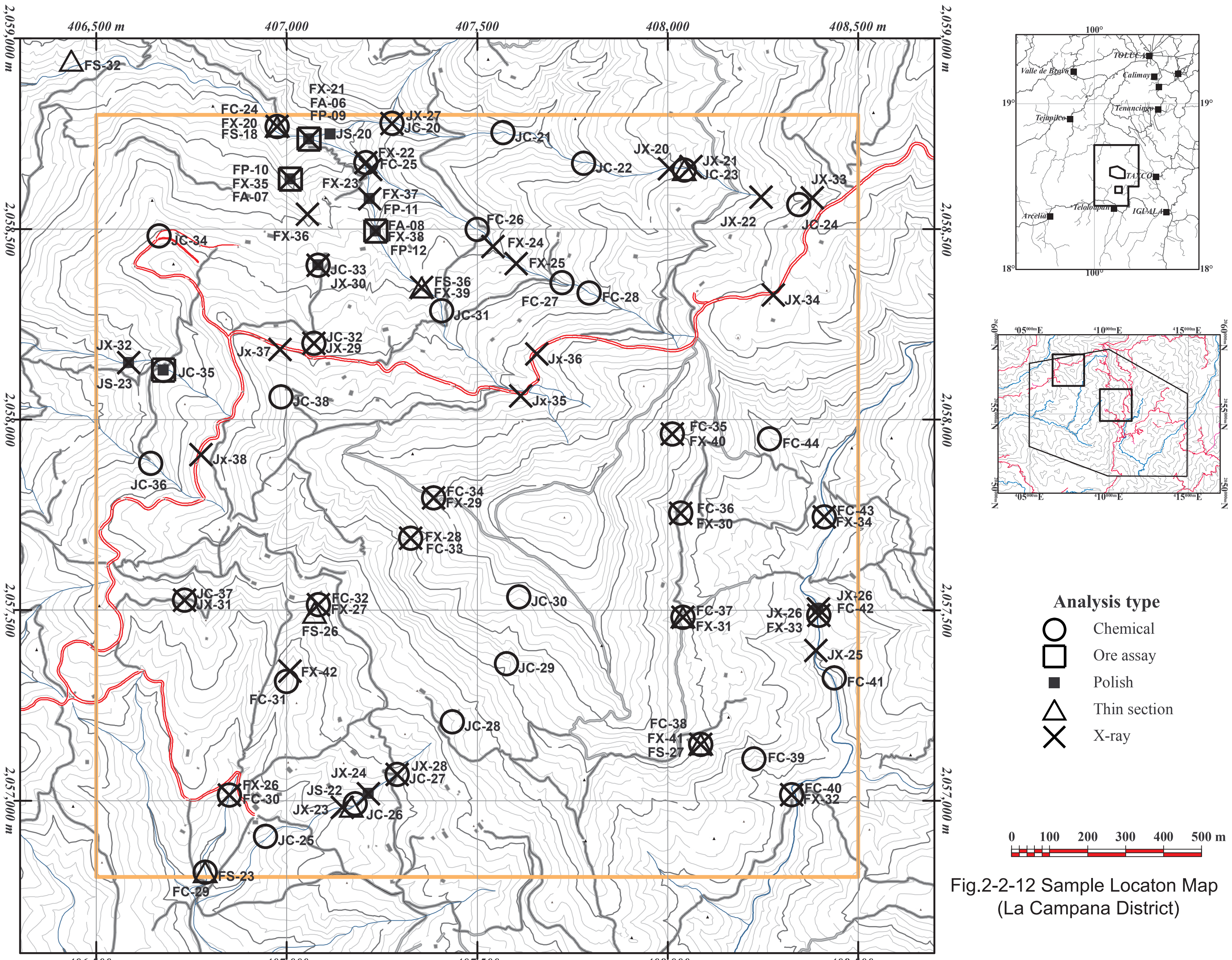
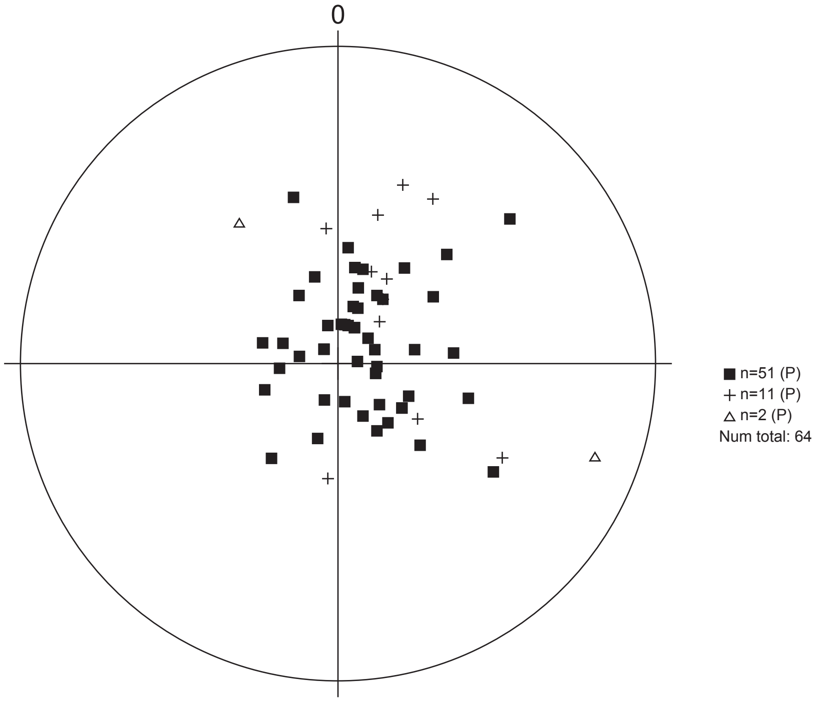
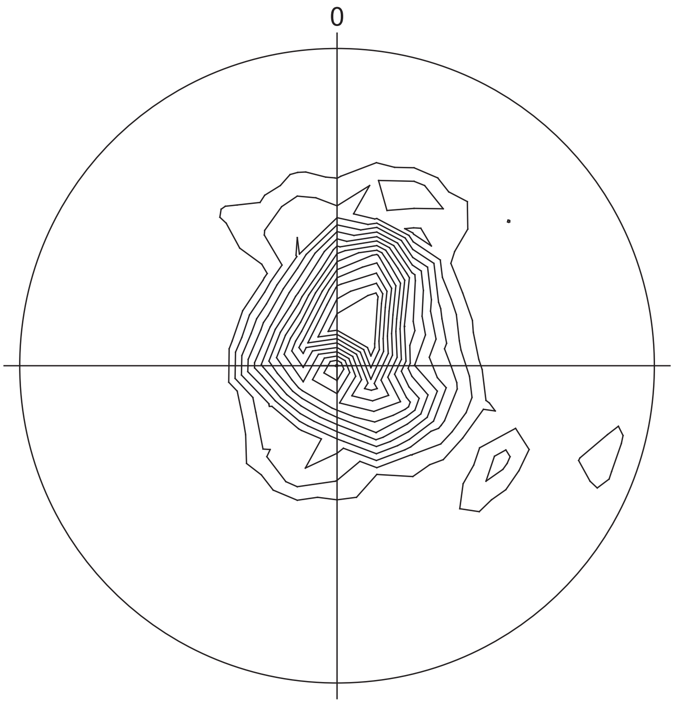


Fig.2-2-12 Sample Locaton Map
(La Campana District)



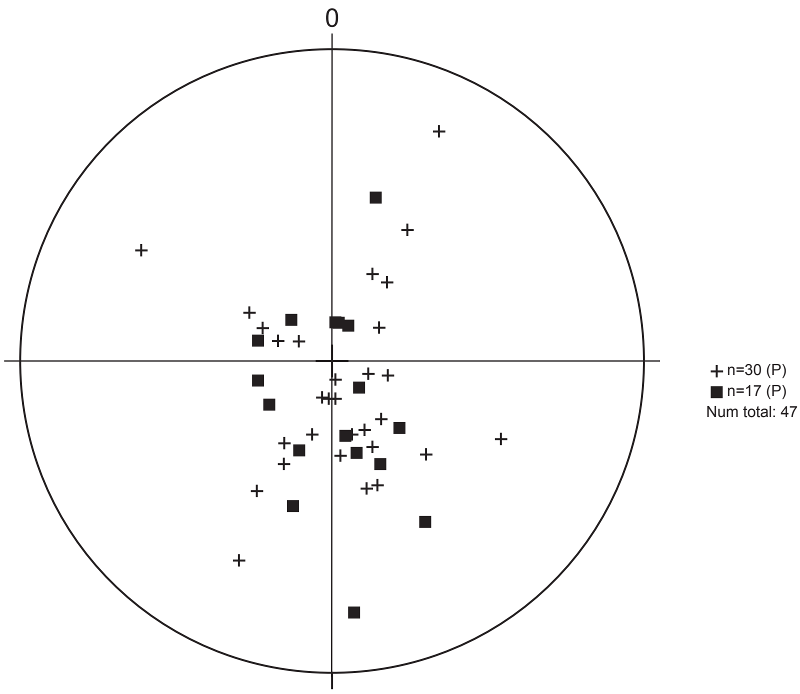
Equal area projection, lower hemisphere



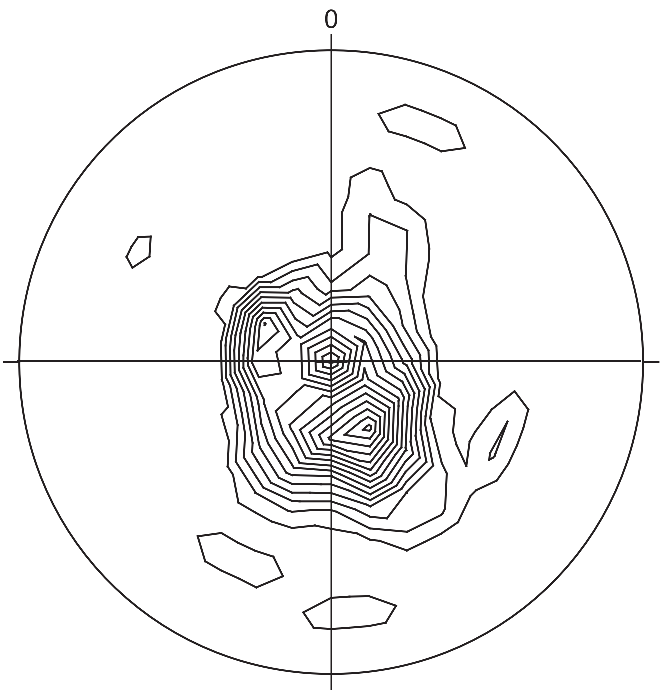
Equal area projection, lower hemisphere

+bedding plane
■cleavage plane

Fig.2－2－13(1) Stereographic Projection
（La Campana district:Lower volcanic rocks）



Equal area projection, lower hemisphere



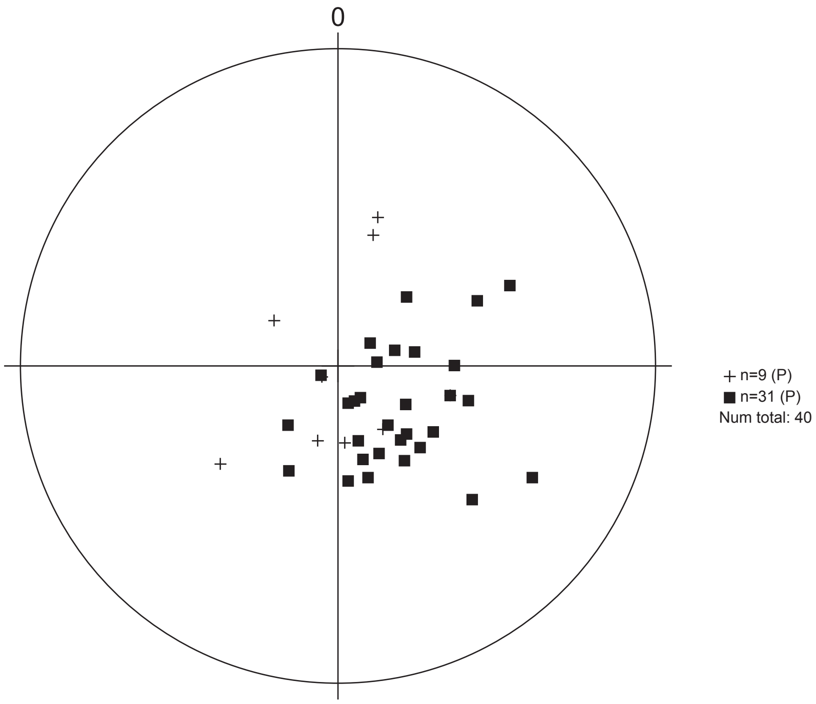
Equal area projection, lower hemisphere

+ bedding

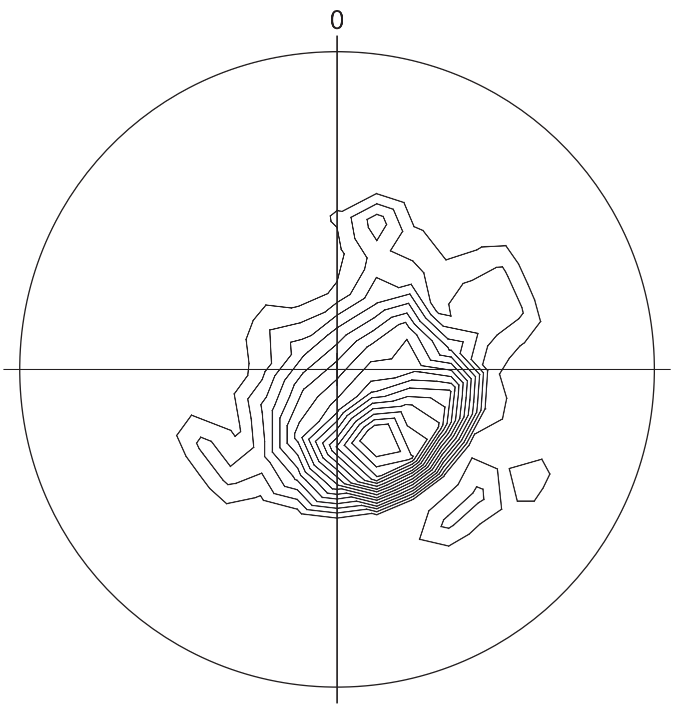
■cleavage

Fig.2－2－13(2) Stereographic Projection

（La Campana district:Sedimentary rocks）



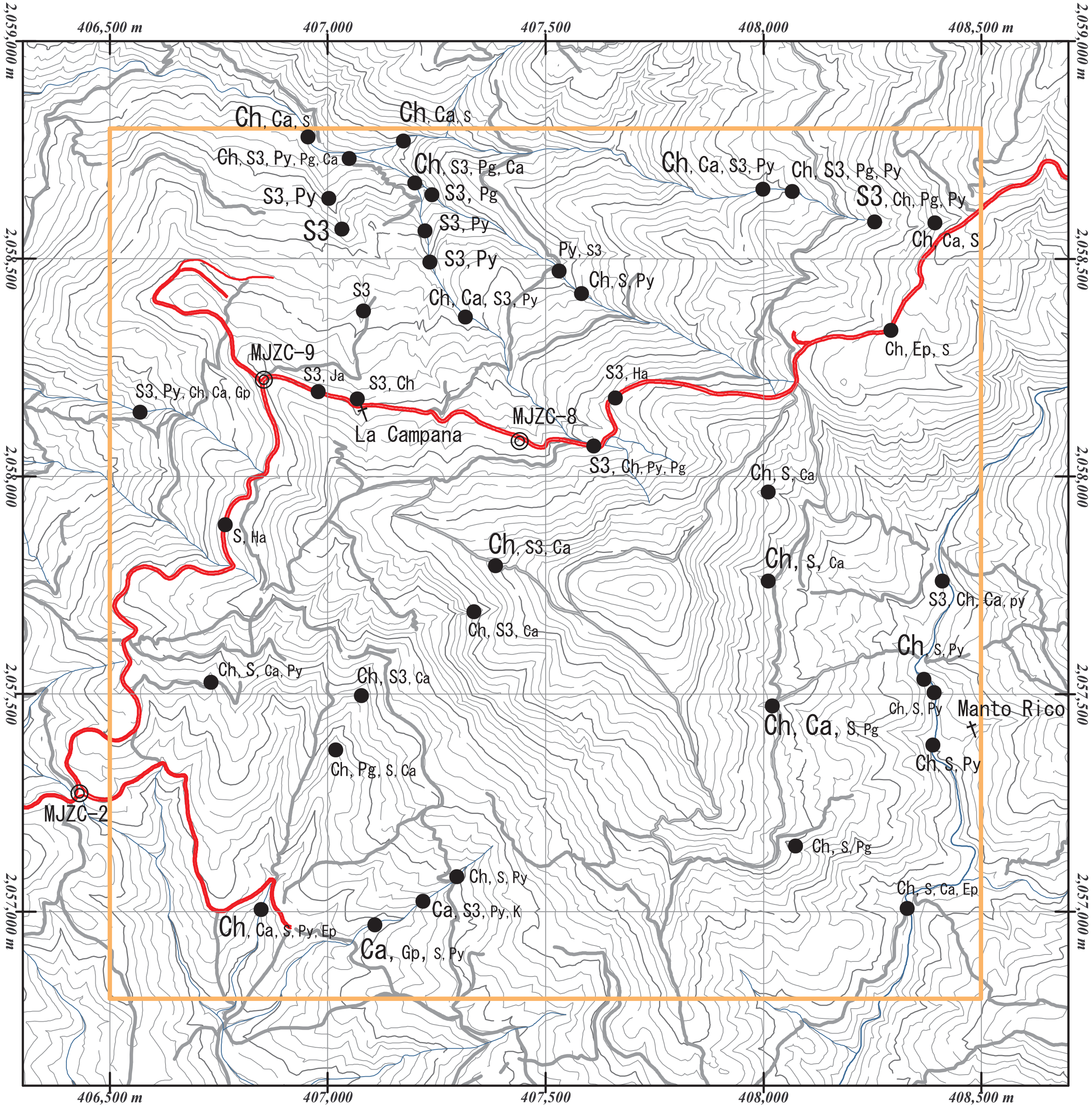
Equal area projection, lower hemisphere



Equal area projection, lower hemisphere

+ bedding plane
■cleavage plane

Fig.2－2－13(3) Stereographic Projection
（La Campana district:Upper volcanic rocks）



Legend
Ch:chlorite
S:sericite,S3(3T type)
Pg:paragonite
Ca:calcite
K:kaolinite
Ha:halloysite
Gp:gypsum
Ja:jarosite
Ep:epidote
Py:pyrite

Ch:abundant
Ch:common
Ch:minor
Ch:rare

Fig.2-2-14 Distribution Map of
Alteration Minerals (La Campana district)

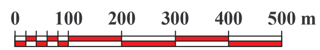


Table 2－2－1 Result of Microscopic Observation(thin section)

No.	Sample No.	Rock Name	Coordinates		Minerals																											texture
			UTM-E	UTM-N	Phenocryst							Grandmass/matrix/fragment													Alteration minerals							
					Qz	Pl	Ho	Opx	Cpx	Ap	Fe	Si	Qz	Pl	K-f	Bio	Opx	Cpx	Fe	Gl	Op	Mud	And	Pum	se	chl	ca	ep			op	
1	FS-01	plagioclase-phyric andesite (strongly altered)	411,317	2,054,695		◎			△		△			△					△	◎					◎	○					△	porphyritic, hyalopilitic
2	FS-02	glassy rhyolite (strongly altered)	411,451	2,054,735		△					・									◎					◎	・					△	porphyritic, fluidal, glassy
3	FS-04	andesite (nearly aphyric)	409,716	2,054,668		△			△?					△					△	◎					△	○	△	○			△	hyalopilitic, prhenite
4	FS-07	andesitic lapilli tuff～coarse tuff	409,576	2,055,884									△	△					△	◎			◎		△	◎	△				△	
5	FS-11	tuff-mudstone-muddy tuff	410,837	2,056,015									◎	○		△			△	◎		◎			△	△	△				△	lepidoblastic
6	FS-37	andesitic tuff	410,914	2,055,781									△	◎					△	◎				△	△	○	△				△	vitroclastic
7	FS-23	meta dacite (andesite)	406,786	2,056,813		○	◎				△			△					△	◎					△	○	△				△	porphyritic, hyalopilitic, fluidal, schistosity
8	FS-18	meta hornblende bearing dacite (andesite)	406,975	2,058,770	・	◎	・				△				△				△	◎					△	○	△				△	porphyritic, hyalopilitic, schistosity
9	FS-26	andesitic coarse tuff	407,073	2,057,494										◎			?		△	◎					△	○	△				△	schistosity
10	FS-27	plagioclase rhyolite	408,087	2,057,148		○														◎					△	○	△				△	porphyritic, fluidal, glassy
11	FS-32	fine tuff (weakly metamorphozed)	406,435	2,058,943										・					△	◎					△	○	△				△	vitroclastic, schistosity
12	FS-36	mudstone-calcareous mudstone-fine limestone	407,355	2,058,347									△						△		○	◎			△	△	◎				△	lepidoblastic
13	FC-37	altered tuff	408,041	2,057,482										○						◎			△		△	○	△				△	
14	JS-01	pyroxene andesite	411047	2055375		◎		○		・	△			・					△	◎					△	○	△	△			△	porphyritic, hyalopilitic glomeroporphyritic,
15	JS-02	pyroxene andesite	411105	2055394		◎		○			△			△					△	◎					△	○	△	△			△	porphyritic, hyalopilitic glomeroporphyritic,
16	JS-05	pyroxene andesite (dacite)	410350	2055366		○		△		・	△	◎		◎					△	◎					△	○	△	△			△	porphyritic, glomeroporphyritic, cryptocrystalline-felsitic
17	JS-06	rhyolitic welded tuff	410365	2056403										・						◎		△	△	・	◎	△	△				△	vitroclastic, eutaxitic
18	JS-10	plagioclase glassy rhyolite	410735	2056507		△														◎					◎	○	△				△	porphyritic, fluidal, glassy
19	JC-19	calcareous phyllite (calcareous slate、calcareous pelitic schist)	409867	2055394									△								◎				△	△	◎				△	
20	JS-22	aphyric dacite (andesite)	407170	2056985		△								△					△	◎					◎	△	△				△	cryptocrystalline-felsitic
21	JC-23	aphyric dacite/rhyorite	408044	2058656		△								△						◎					△	○	△				△	fluidal

Legend: ◎, abundant; ○, common; △, minor; ・, rare
Qz:Quartz, Pl:Plagioclase, Ho:Hornblende, Opx:Orthopyroxene, Cpx:Clinopyroxene, Ap:Apatite, Fe:Fe minerals,
Si:Silica minerals, K-f:K-feldspar, Bio:Biotite, Gl:Glass, Coa:Coal, Se:Sericite, Chl:Chlorite, Ca:Calcite, Py:Pyrite,
And:Andesite, Mud:Mudstone, Mud, Pum:Pumice

Table2—2—1 Result of Microscopic Observation (polished section)

No.	Sample No.	Location	Sample Type	Coordinates		Ore Minerals												Note (others)
				UTM-E	UTM-N	Py	As	Mc	Sph	Gn	Cp	Th	Bo	Ilm	Ba	Cv	Rt	
1	FP-01	aurora I	Massive ore	411,317	2,054,695	△			○	△	△	・						colloform, framboidal, cp disease
2	FP-02	Capire	Disseminated pyrite	411,437	2,054,973	◎												
3	FP-03	Capire	Pyrite net	410,060	2,054,759	△												colloform, framboidal
4	FP-04	Capire	Disseminated pyrite	409,820	2,055,897	△												
5	FP-05	Capire	Pyrite net～disseminated	410,033	2,055,883	△												
6	FP-06	Capire	Pyrite net	410,121	2,055,880	△												
7	FP-07	Capire	Massive pyrite	410,263	2,056,195	◎												colloform
8	FP-08	Capire	Pyrite net	410,526	2,056,246	○												
9	FP-09	La Campana	Pyrite net	407,059	2,058,737	○												bedded
10	FP-10	La Campana	Pyrite net	407,010	2,058,632	◎								・?				bedded
11	FP-11	La Campana	Disseminated pyrite	407,218	2,058,580	◎												bedded～massive
12	FP-12	La Campana	Pyrite net	407,234	2,058,495	◎												bedded, colloform
13	JS-07	Capire	Disseminated pyrite	410408	2056400	◎												colloform
14	JS-09	Capire	Disseminated pyrite	410555	2056445	◎												colloform
15	JS-20	La Campana	Massive, disseminated pyrite	407115	2058750	◎												
16	JS-23	La Campana	Disseminated pyrite	406586	2058150	○												
17	JC-33	La Campana	Disseminated pyrite	407083	2058406	・												banding
18	JC-35	La Campana	Disseminated pyrite	406677	2058130	○												bedded～banding, lens
19	JX-24	La Campana	Disseminated pyrite	407215	2057019	○												
20	JX-26	La Campana	Pyrite net	408396	2057504	○												bedded～banding

Legend: ◎, abundant; ○, common; △, minor; ・,rare
Py:Pyrite, As:Arsenopyrite, Mc:Marcasite, Sph:Sphalerite, Gn,Galena, Cp:Chalcopyrite, Th:Tetrahedrite,
Bo:Bornite, Ilm:Ilmenite, Ba:Barite, Cv:Covelline, Rt:Rutile

Table2—2—2 Result of Ore Grade Assay

No.	Sample No.	Sample Type	Area	Coordinates		Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Ba (ppm)	Fe (%)	S (%)
				UTM-E	UTM-N								
1	FA-01	gn-sph-py ore	Capire	411,132	2,054,686	173	95.0	6820	69600	75000	155	2.83	7.53
2	FA-02	pyrite dissemination	Capire	411,437	2,054,973	12	1.35	7	22	176	81	14.60	10.11
3	FA-03	fracture filling	Capire	409,820	2,055,897	3	0.30	16	15	14	283	2.09	1.80
4	FA-04	altered rocck pyrite,serici	Capire	410,121	2,055,880	6	0.40	13	11	20	417	1.75	1.45
5	FA-05	fine pyrite bed in slate	Capire	410,526	2,056,246	4	1.10	38	40	58	24	9.21	9.24
6	FA-06	tuff pyrite dissemination	La Campana	407,059	2,058,737	7	0.40	35	36	35	221	4.85	3.73
7	FA-07	pyrite band,tuff	La Campana	407,010	2,058,632	60	10.8	25	19	46	85	11.50	12.60
8	FA-08	pyrite band,tuff	La Campana	407,234	2,058,495	7	0.70	19	5	3	89	13.30	15.08
9	JS-09	massive pyrite ore	Capire	410555	2056445	15	3.50	31	37	22	17	28.90	30.90
10	JC-35	dissemination pyrite	La Campana	406677	2058130	1	0.90	39	10	102	257	4.32	27.6

Table2−2−3 Result of X-ray Diffraction(1)

No.	Sample No.	Rock name type	Coordinate		Detected Minerals																								
			UTM-E	UTM-N	Silica	Feldspar M			Clay Minerals								Sulphate M				Other Minerals								
					Qz	Ab	Kf		Sm	Ha	K	Ch	S	S3	Pg	S/Sm	Gp	Ba	Ja		Ca	Do	Mg	Go	Py	Gn	Sph	Ep	Hb
1	JX-01	Dacitic tuff, weath.	411,085	2,054,912	◎							·	△																
2	JX-02	Pyritized tuff,andesitic	411,015	2,054,956	◎									△											△				
3	JX-03	Dacite plagiorich tuff	410,081	2,054,944	△	◎						◎		△			·				△				·				
4	JX-04	Glassy tuff	410,140	2,055,037	○	◎					△		·								·	○			·				
5	JX-05	Glassy andesite	409,625	2,055,044	○	○						·?	△								·				·			·	
6	JX-06	Sandy tuff	409,847	2,055,056	◎	◎					·		·																
7	JX-07	Altered rock	409,873	2,055,057	○	◎					△		△								·								
8	JX-08	Glassy andesite	410,317	2,056,356	△	○						△									·							△	
9	JX-09	Altered dacite	410,408	2,056,400	○	·						△		○											·				
10	JX-10	Altered dacite	410,555	2,056,445	○	·						△		△											·				
11	JX-11	Altered dacite	410,090	2,056,374	○	△						△		△											·				
12	JX-12	Dacite	409,776	2,055,548	◎	◎					·		·												·				
13	JX-13	Andesite	411,047	2,055,375	○	△						○	△								△								
14	JX-14	Andesite, glass patch	410,350	2,055,366	○	○						○	△								·				·			·	
15	JX-15	Dacite	410,735	2,056,507	◎	○						△		○							·								
16	JX-16	Dacite	410,965	2,056,534	○	○						◎	·								△								
17	JX-17	Slate	409,867	2,055,394	○	·						△		△							◎				·				
18	JX-20	Dacitic tuff	408,005	2,058,659	○	△	·?					◎		△							○				△				
19	JX-21	Sandy tuff	408,062	2,058,665	○	○	·?					○		○	△										△				
20	JX-22	Fine tuff dacite	408,246	2,058,585								△		◎	△										△				
21	JX-23	Tuffaceous sandstone	407,146	2,056,983	○	◎							·				△				◎				·				
22	JX-24	Andesite-dacite	407,215	2,057,019	△	◎	△				·		△				·				○				·				
23	JX-25	Foliated andesite	408,390	2,057,395	○							○	△												△				
24	JX-26	Glass dacite	408,396	2,057,504	◎							◎	·												·				
25	JX-27	Foliated tuff	407,277	2,058,778	△	○						◎	·								○								
26	JX-28	Slate	407,290	2,057,069	◎	△						△	·												·				
27	JX-29	Dacite	407,072	2,058,201	◎	○						△	△																
28	JX-30	Slate	407,083	2,058,406	◎	·								△															
29	JX-31	Tuff	406,732	2,057,527	△	◎						△	△								·				·				
30	JX-32	Tuff	406,586	2,058,150	○	○	·					·	△				·				·				△				
31	JX-33	Chlorite schist	408,380	2,058,583	△	◎						○	△								△				·				
32	JX-34	Andesite	408,278	2,058,328	△	◎						△	·								·							△	
33	JX-35	Sandy tuff	407,615	2,058,063	○	○						△		○	·										·				
34	JX-36	Tuff	407,657	2,058,173	○	○				·			△															·	
35	JX-37	Dacitic tuff	406,983	2,058,185	◎	△	△							△					·									·	
36	JX-38	Dacitic tuff	406,775	2,057,909	◎	◎				·			△																
37	FX-01	Dacitic tuff	411,125	2,054,640	○							△	△																
38	FX-02	Glassy tuff	411,465	2,054,842	◎							△	△												·				
39	FX-03	Glassy tuff	411,437	2,054,973	○							◎	·												△				
40	FX-04	Andesite	409,716	2,054,668	△	○						△	△								·							·	·
41	FX-05	Andesitic tuff	410,012	2,054,753	○	○						△	·								·							△	
42	FX-06	Andesitic tuff	409,576	2,055,884	△	○						△	·								·							△	
43	FX-07	Andesite	409,810	2,055,893	△	○						△	·								·				·			△	

Legend ; ◎, abundant ; ○, common ; △, minor ; ·, rare
Qz:quartz, Ab:albite, Kf:K-feldspar, Sm:smectite, Ha:halloysite, K:kaolinite, Ch:chlorite, S:sericite, S3:sericite(3T), Pg:palagonite, S/Sm:ser
Gp:gypsum, Ja:jarosite, Ca:calcite, Do:dolomite, Mg:magnesite, Ba:barite, Go:goethite, Py:pyrite, Gn:galena, Sph:sphalerite, Px:pyroxene, Hb:ho

Table2－2－3　Result of X-ray Diffraction(2)

No.	Sample No.	Rock name type	Coordinate		Detected Minerals																									
			UTM-E	UTM-N	Silica	Feldspar M			Clay Minerals								Sulphate M				Other Minerals									
					Qz	Ab	Kf		Sm	Ha	K	Ch	S	S3	Pg	S/Sm	Gp	Ba	Ja		Ca	Do	Mg	Go	Py	Gn	Sph	Ep	Hb	
43	FX-08	Andesite	409,820	2,055,897	○	◎						・	・								・				・			△		
44	FX-09	Andesite	410,033	2,055,883	・	◎						△	・								・				・			・		
45	FX-10	Altered tuff	410,062	2,055,900	○	△						△	△								△									
46	FX-11	Altered tuff	410,121	2,055,880	◎	◎						・		△							○				・					
47	FX-12	Andesite-dacite	410,690	2,055,775	○	○					△	△	・									○			・					
48	FX-13	Dacitic tuff	410,263	2,056,195	○	・						○	△								△				・					
49	FX-14	Sandy tuff	410,759	2,056,003	○							◎		○																
50	FX-15	Andesite-dacite	410,900	1,056,010	△	○						△	・								・				・			・		
51	FX-16	Slate/tuff	410,526	2,056,246	○	◎						△	・												△					
52	FX-17	Andesitic tuff	410,396	2,056,227	△	◎						○	・								△							・		
53	FX-18	Andesite	409,725	2,056,088	△	◎						・	・								・				・			△		
54	FX-19	Andesite	409,790	2,056,265	・	○						△	・								・				・			△		
55	FX-20	Foliated tff dc?	406,975	2,058,770	○	○						◎	・								○									
56	FX-21	Foliated tff dc?	407,059	2,058,737	○	○						○		△	・						・				△					
57	FX-22	Tuff	407,208	2,058,675	○	△						◎		△	△						・									
58	FX-23	Altered tuff	407,221	2,058,657	◎	△								○	△															
59	FX-24	Altered tuff	407,542	2,058,455	◎	・	△						・												△					
60	FX-25	Altered tuff	407,603	2,058,410	○	△	△					○	△												△					
61	FX-26	Altered tuff	406,850	2,057,015	○	○						◎	・								△				・			・		
62	FX-27	Sandy tuff	407,084	2,057,515	○	○						○		△							・							・		
63	FX-28	Dacite	407,326	2,057,689	◎	○						△		△							・			・						
64	FX-29	Tuff	407,386	2,057,795	△	○						◎		△							△				・					
65	FX-30	Dacitec-andeiste tuff	408,035	2,057,755	△	○						◎	△								・							・		
66	FX-31	Dacitec-andeiste tuff	408,041	2,057,482	○	○						◎	△		・						◎									
67	FX-32	Andesite	408,326	2,057,016	○	○						△	・								・							・		
68	FX-33	Dacitic sandy tuff	408,397	2,057,487	○	○						・	・												・					
69	FX-34	Andesitic tuff	408,412	2,057,745	○	△						△		△							△				・			・		
70	FX-35	Pyrite band	407,010	2,058,632	○									○											○					
71	FX-36	Altered tuff	407,055	2,058,540	○	△								◎																
72	FX-37	Pyrite band	407,218	2,058,580	○	・						・?		○											△					
73	FX-38	Pyrite band	407,234	2,058,495	○	△								○											○					
74	FX-39	Slate>tuff alternation	407,355	2,058,347	○	○						○		△							○				・					
75	FX-40	Tuff	408,013	2,057,963	△	◎						○	△								・							・		
76	FX-41	Dacite	408,087	2,057,148	◎	△						△	・		・													・		
77	FX-42	Sandy tuff	407,009	2,057,340	◎	△						△	・		△						・									
78	FX-43	Andesite	410,914	2,055,781	○	○						○									・							△		
79	FX-44	Andesite	411,173	2,056,172	△	○						△	・								・							△		

Legend；　◎, abundant；　○, common；　△, minor；　・, rare

Qz:quartz, Ab:albite, Kf:K-feldspar, Sm:smectite, Ha:halloysite, K:kaolinite, Ch:chlorite, S:sericite, S3:sericite(3T), Pg:palagonite, S/Sm:ser

Gp:gypsum, Ja:jarosite, Ca:calcite, Do:dolomite, Mg:magnesite, Ba:barite, Go:goethite, Py:pyrite, Gn:galena, Sph:sphalerite, Px:pyroxene, Hb:ho

It is characteristic that palagonite (sodium sericite) appears in this district, but not in the Capire District. Palagonite are detected in the tuff of the foliated volcanic rocks, sedimentary rocks, and upper volcanic rocks.

The 3 T -type sericite, which seemingly reflects high-grade alteration or metamorphism, is extensively seen in the foliated volcanic rocks, sedimentary rocks, and upper volcanic rocks, especially dominated in the foliated volcanic rocks.

The gypsum has been confirmed in the green foliated volcanic rocks of the lower volcanic rocks and the andesite of the lower volcanic rocks, being spotted and in small amounts.

The jarosite and halloysite have been detected in the specimens taken along the road, probably as weathered product.

3 Rock Geochemical Survey

(1) Survey Method

The rock geochemical survey has been performed in the Capire and La Campana districts. The fresh 40 specimens have been taken for every survey route. The four standard samples have been assayed for every 20 specimens to verify the accuracy of the assay.

The analysis has been entrusted to ALS Chemex Company. The assay method and the detection limits for each element are as follows.

Analytical method and detection limit

Element	Method	Detection Limit	Element	Method	Detection Limit
Au	FA-ICP	1ppb	Ag	ICP	0.2ppm
Al	ICP	0.01%	As	ICP-AES	2ppm
Ba	ICP-AES	10ppm	Be	ICP-AES	0.5ppm
Bi	ICP-AES	2ppm	Ca	ICP-AES	0.01%
Cd	ICP-AES	0.5ppm	Co	ICP-AES	1ppm
Cr	ICP-AES	1ppm	Cu	ICP-AES	1ppm
Fe	ICP-AES	0.01%	K	ICP-AES	0.01%
La	ICP-AES	10ppm	Mg	ICP-AES	0.01%
Mn	ICP-AES	5ppm	Mo	ICP-AES	1ppm
Na	ICP-AES	0.01%	Ni	ICP-AES	1ppm
P	ICP-AES	10ppm	Pb	ICP-AES	2ppm
S	ICP-AES	0.01%	Sb	ICP-AES	2ppm
Sr	ICP-AES	1ppm	Ti	ICP-AES	0.01%
V	ICP-AES	1ppm	W	ICP-AES	10pm
Zn	ICP-AES	2ppm			

(2) Survey Result

The figures of the assay result have been converted by logarithmic index for each element, and analyzed. The values lower than the detection limit, have been treated as the half of the limit figure. The alteration index has been obtained by the recalculation of the principal element content to the oxide percentage. Tables 2-2-4 to 2-2-6 show the assay result, and Figures II-2-15 t0 II-2-35 show the analyzed result. The maps show the assay result in this survey together with the last year's result.

(i) Principal element

The alteration index, $(MgO+K2O)/(Na2O+CaO+MgO+K2O)$ X 100 %, has been figured out to extract the alteration regarding mineralization.

Figure 2-2-16 shows the histogram for each rock facies and the ranks classified by the standard deviation together with the last year's result.

In the Capire district, the high point parts of the alteration index are corresponded with the alteration zone of the north of the Aurora deposit and the intermittently continuing zone from the Capire deposit to the northwest. It is possible that anomaly zones appeared along the roads or on the ridges might reflect weathered zones.

In the La Campana district, the high point parts of the alteration index have been detected in an intermittently extending zone from the west of the La Campana occurrence to the east. Around the Manto Rico deposit, the index figures are lower than $+1\sigma$ in average, indicating no high anomaly. It is also possible that the anomalies along the roads might reflect weathered zones.

(ii) Trace element

As shown in the basic statistics, scatter diagram, and histogram, the most of the values for Bi and W show lower than the detection limit, therefore thy have eliminated from the analysis, and not shown in the figures

The more than 75 percent of the values for Ag, Cd, and Sb are lower than their detection limit figures.

Based on the result, the elements are divided into several groups. The description for each group is as follows.

1) Au, Ag, Be, Cd, Mo, Sb

These elements except Be show mostly lower values of the detection limit, therefore the higher values than the detection limit have been treated as apparently anomalous values.

・Au and Ag are weakly correlated, and their anomalous spots are commonly coincident. In the Capire district, anomalies are in the west of the Capire deposit, around the Aurora I deposit, western district, and east of Tlanilpa. In the La Campana district, anomalies are in the southwest of the Manto Rico deposit, east of Otates, and around the La Campana occurrence. The most of the anomalies are in the sedimentary rocks.

・Be does not show any distinguish anomaly, as presumed by the result that the highest value is 1.8 ppm where as the detection limit is 0.5 ppm.

・Cd shows concentrated anomalies in the sedimentary rocks. In the Capire district, anomalies are in the area from the Aurora I deposit to the west of Capire, and the area from the north to east of Tlanilpa. In the La Campana district, anomalies are in the southeast of Otates.

・Mo also shows concentrated anomalies in the sedimentary rocks as well as Cd, and the areas are larger. In the Campana district, anomalies are in the south of Manto Rico and around the La Campana occurrence, other than the southeast of Otates.

・Sb also tends to show same anomalies distribution as Cd and Mo. In the Capire district, the anomalous zones decrease their area, and are in the west of the Capire deposit, northwestern district, and around Tlanilpa. The anomalous zone extends to the lower volcanic rocks area. In the La Campana district, anomalies expand in the south of the Manto Rico deposit.

2) Co, Cr, Ni, V

These elements are generally high content in the basic volcanic rocks, and low content in the sedimentary rocks. Followings are the description of the characteristic anomaly zones.

・Co tends to concentrate in the volcanic rocks in the west of Tlanilpa, in the Capire district. Cr is high in the northern La Campana district together with Ni.

・Ni and V show high anomaly zones in the sedimentary rocks in the east of Tlanilpa, in the Campana district.

3) As, Ba, Cu, Pb, Zn, S

These elements are contained in the ore minerals, and are useful as pathfinder elements.

・As does not show any concentrated anomaly zone, but it tends to high near the boundary between the upper volcanic rocks and sedimentary rocks in the Capire district. In the La Campana district, it shows higher in a zone from the southwest to south of the Manto Rico deposit. Small-scale anomalies are scattered in the sedimentary rocks.

・ Ba shows the same tendency with As, and anomalies are scattered in the sedimentary rocks. Anomalies extend partly to the lower volcanic rocks.

・Cu anomaly tends to scatter around mineral occurrences in the Capire district, but it tends to concentrate in the sedimentary rocks in the east of Tlanilpa. In the La Campana district, anomalies are scattered, and no significant anomaly appears around the Manto Rico and La Campana occurrences.

・Pb strong anomalies are scattered in the northern and southern ends of the Capire district, around the Aurora I and Capire deposits. It tends to that weak anomalies continuously appear along the boundary between the lower volcanic rocks and the sedimentary rocks. In the Campana district, anomalies are in the sedimentary rocks. Weak anomalies are concentrated in the south of Manto Rico, and some slightly strong anomalies are in the east of Otates and around La Campana.

・Zn anomalies, slightly strong, are concentrated in the east of Tlanilpa, in the northern Capire district. Anomalies spread around the Aurora I deposit and Capire Deposits, in the northern Capire district. In the La Campana district, it tends to that weak anomalous zones are scattered.

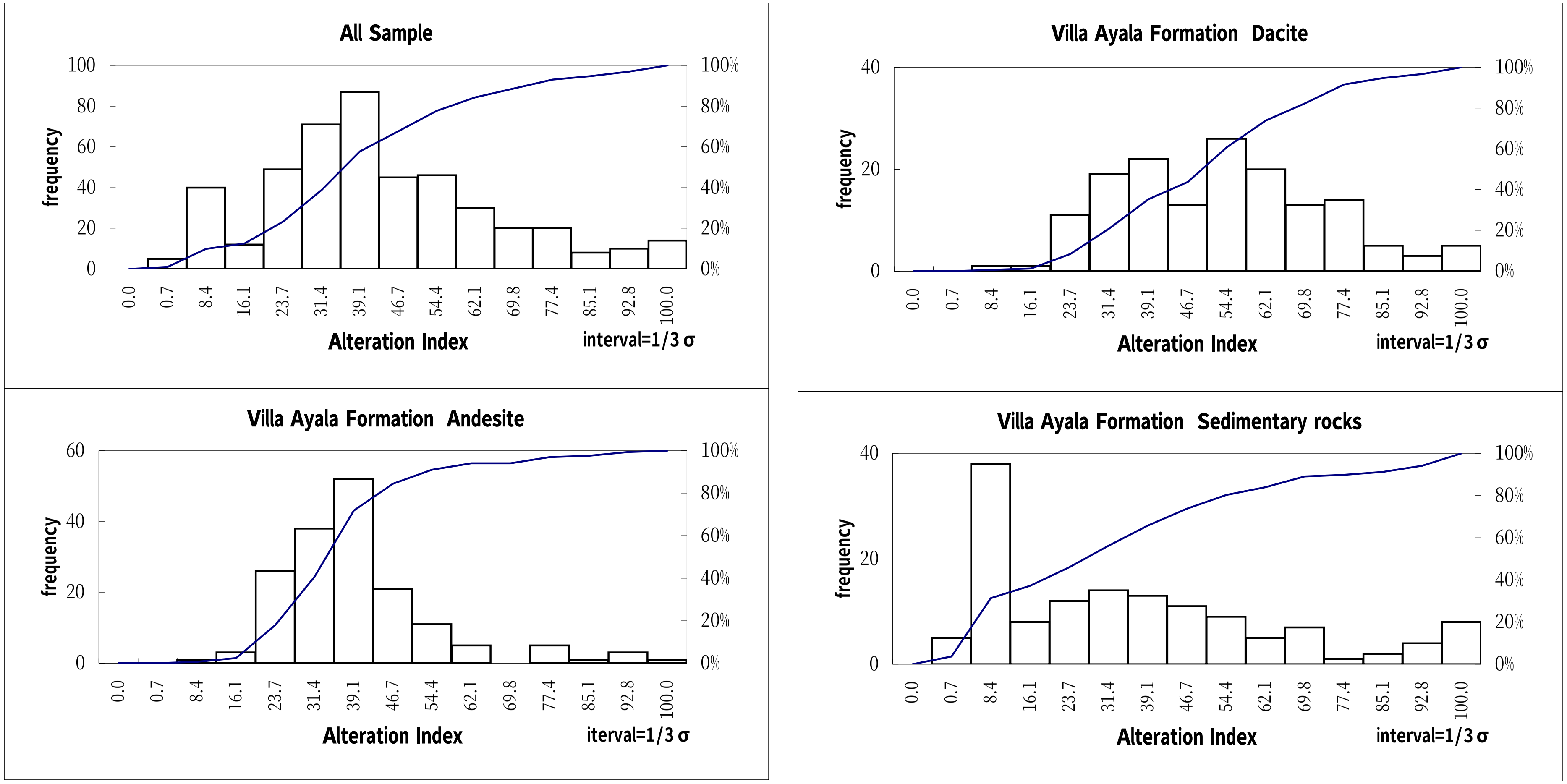
・S possibly reflects intensity of the pyritization. In the Capire district, It shows high anomaly in the northern alteration zone of the Aurora I deposit and the distribution zone of the andesitic intrusive rocks. It also tends to high in the boundary zone between the lower volcanic rocks and sedimentary rocks in the west of the Capire deposit to the western district. It is high in the lower volcanic rocks in the west of Tlanilpa, reflecting pyritization there. Anomaly zones are in the west of the La Campana occurrence.

(iii) Principal Component Analysis

The principal component analysis has been performed for the minor elements. It is thought that the first principal component is the factor relating to the mineralization, because the load values of Au, Ag, As, Cd, Cu, Mo, Pb, Sb, and Zn are high. The contribution rate is 23.93 percent. The second principal component is characteristic in the negative anomaly of Co, Ni, V etc. It is thought that this component is of the factor of the rock facies. The contribution rate is 19.67 percent. Due to the low contribution rate of the other principal components, only the first principal component has been adopted for the analysis. The point of the principal component for each sample has been classified into four categories based on the standard deviation, and shown in the map. The last year's result of the analysis also is shown in the map.

In the Capire district, the high-point spots are concentrated in the northern and southern districts. In the southern district, the high-point spots are distributed around the Aurora I deposit and the west to northwest of the Capire deposit, being mainly in the sedimentary rocks. In the northern district, the high- point spots spread over the sedimentary rocks in the east of the Tlanilpa occurrence. It tends to show high points in the andesite of the lower volcanic rocks and upper volcanic rocks.

In the La Campana district, the high-point spots are in the south of the Manto Rico deposit, east of Otates, and west and east of the La Campana occurrence, being in the sedimentary rocks.



	Number	Average	Exponential ave.	Standard deviation
All Sample	457	39.1	-	23.0
Villa Ayala Formation Andesite	167	35.8	-	15.6
Villa Ayala Formation Dacite	153	49.8	-	20.1
Villa Ayala Formation Sedimentary rocks	137	31.1	-	28.6

Fig.2—2—16 Histogram of Alteration Index

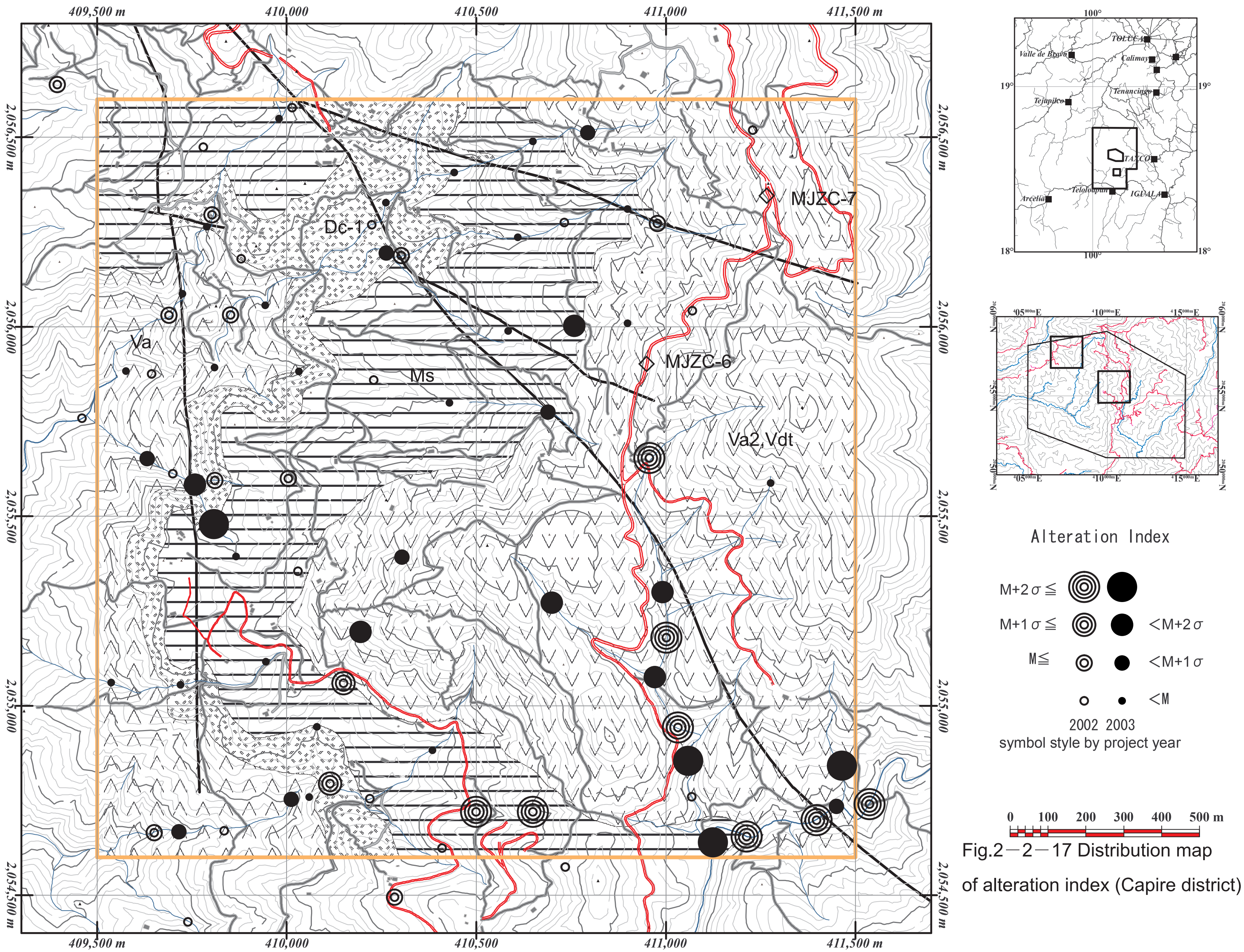


Fig.2—2—17 Distribution map of alteration index (Capire district)

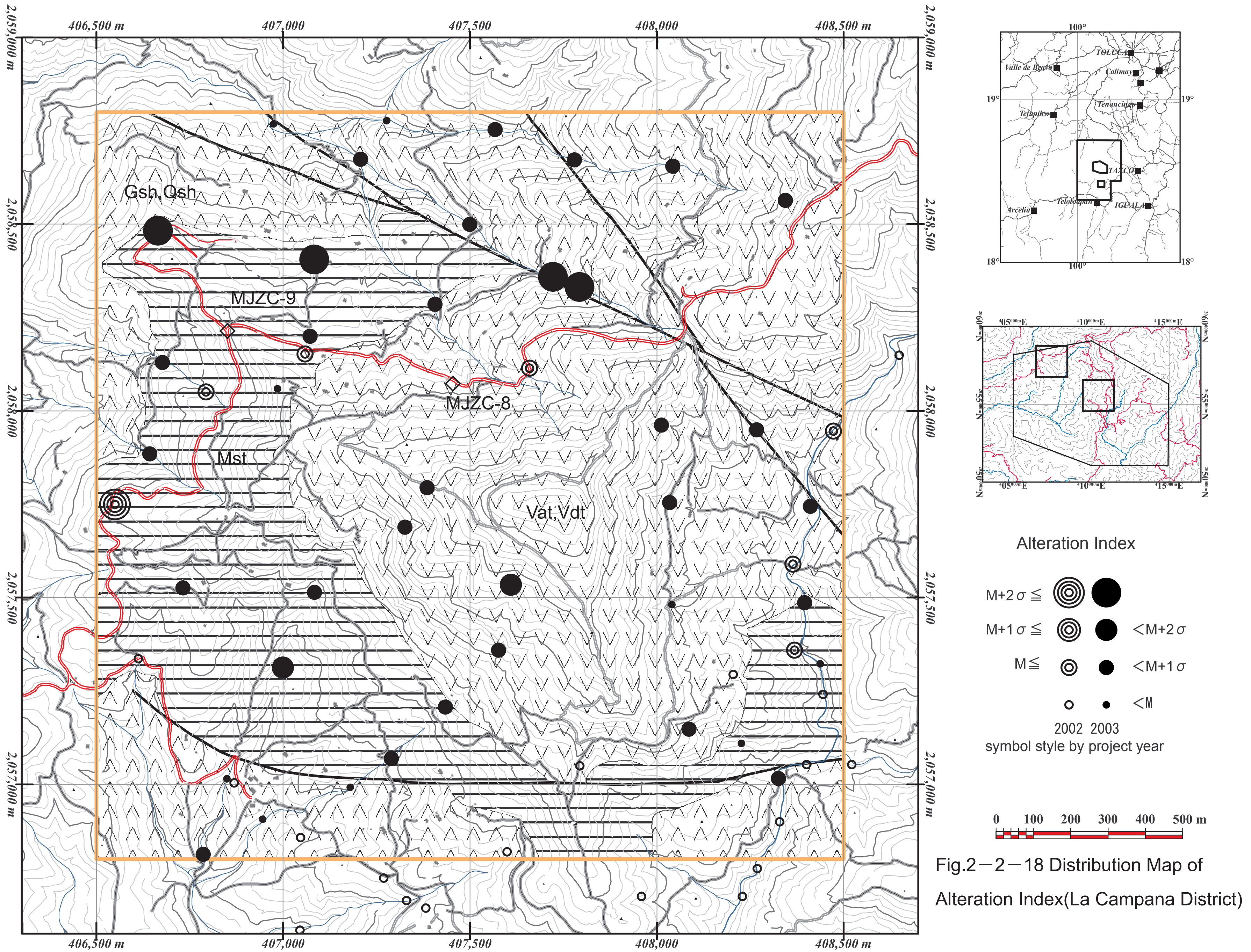


Fig.2—2—18 Distribution Map of Alteration Index(La Campana District)

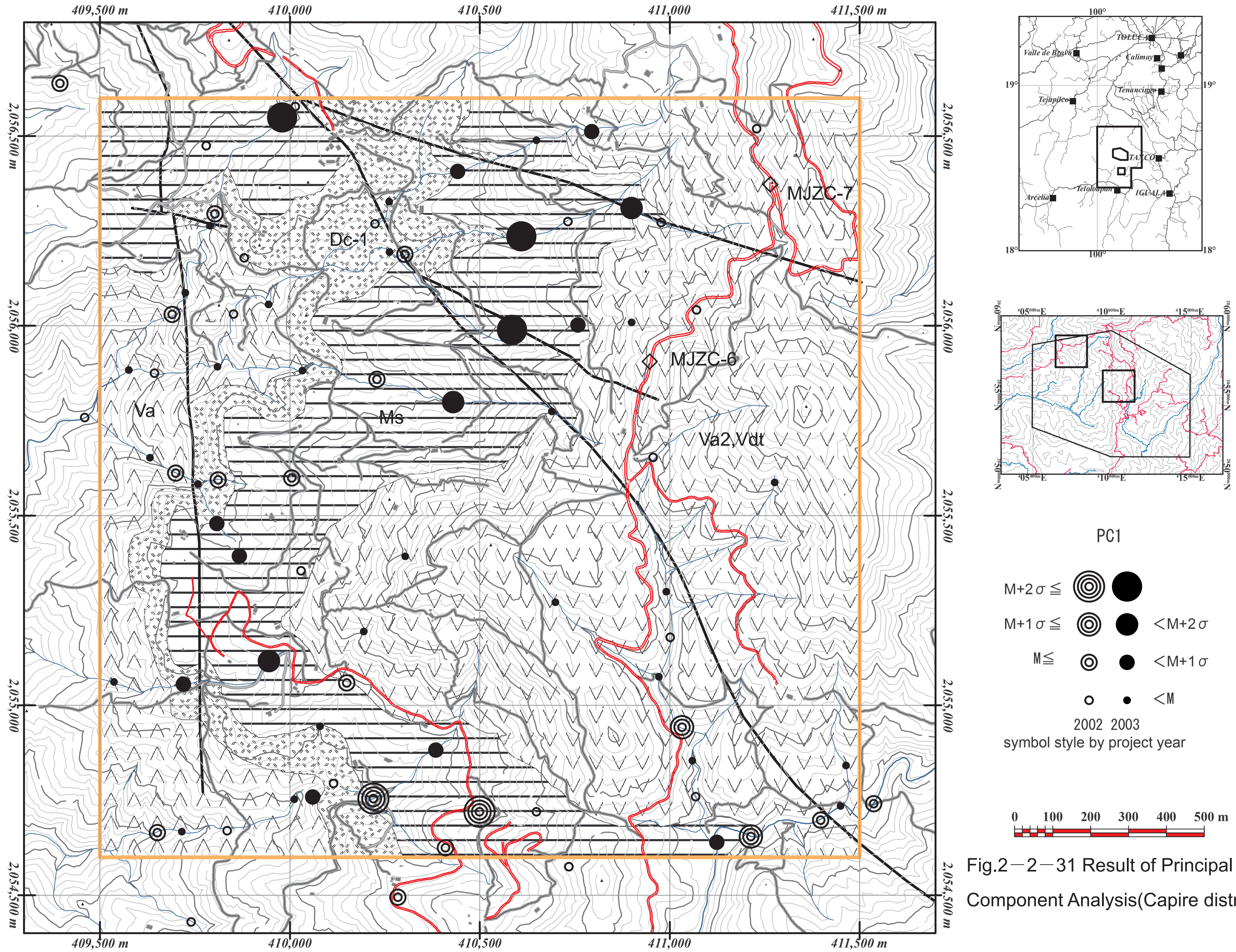


Fig.2－2－31 Result of Principal Component Analysis(Capire district)

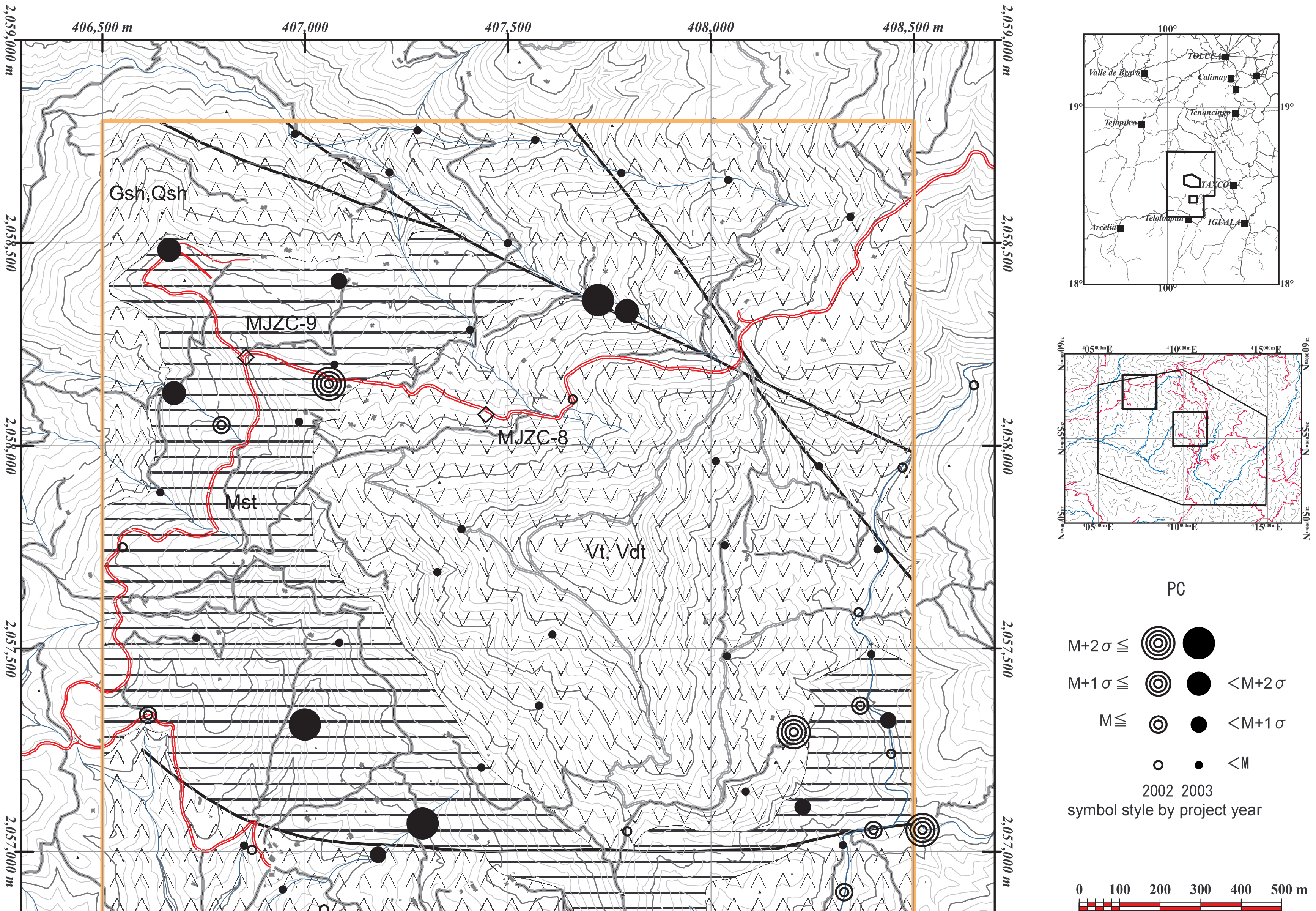


Fig.2－2－32 Result of principal component analysis (La Campana district)

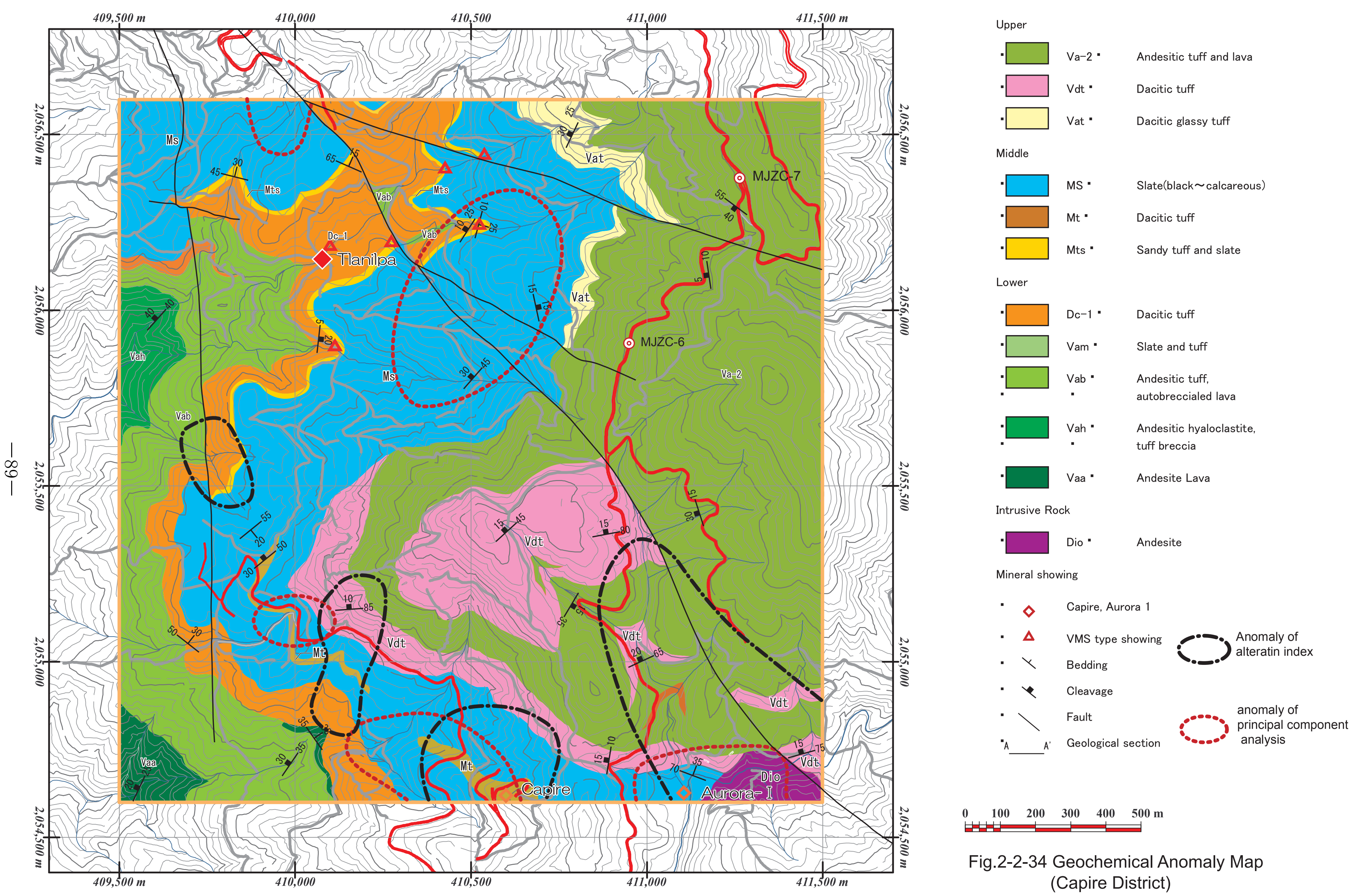


Fig.2-2-34 Geochemical Anomaly Map (Capire District)

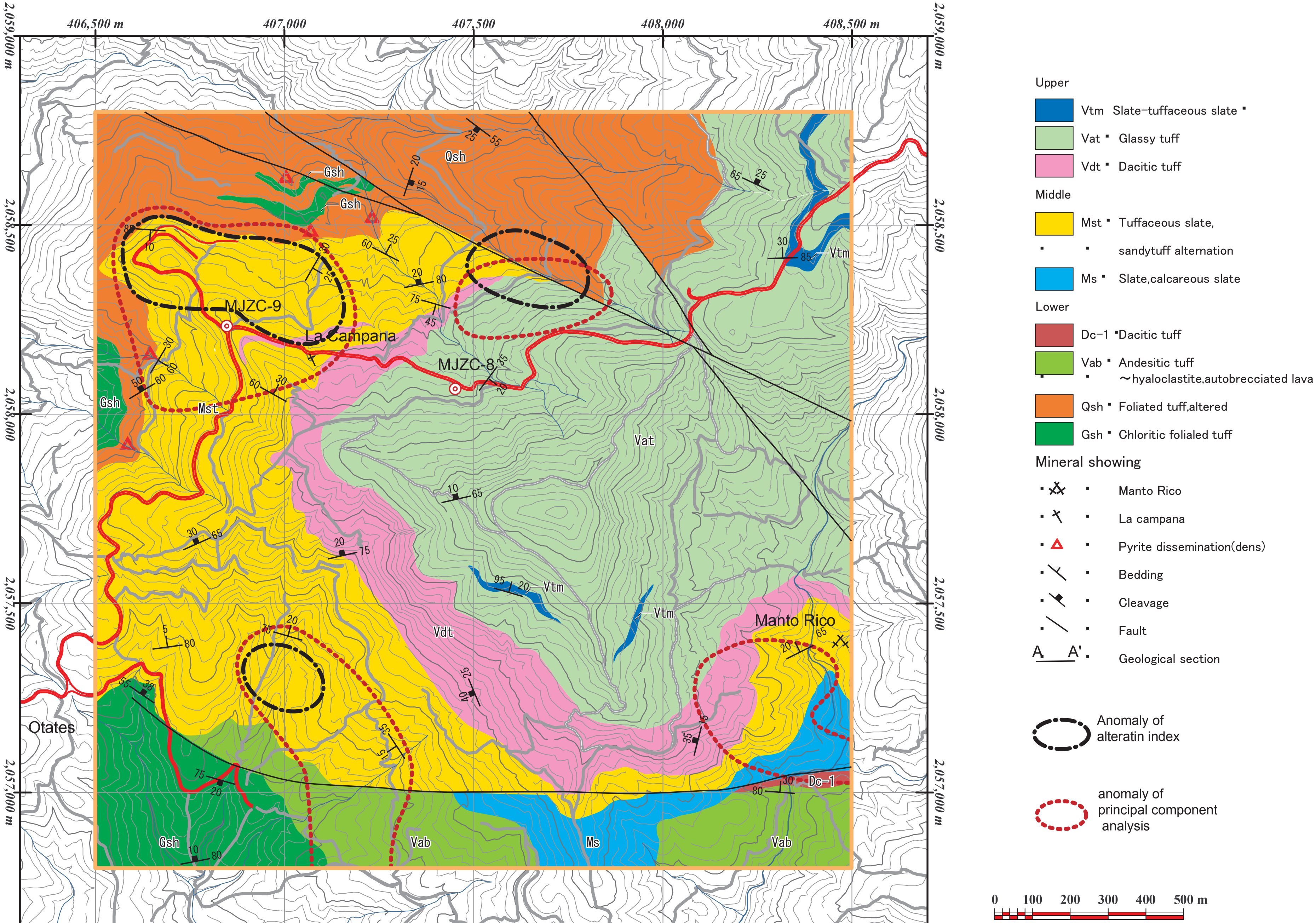


Fig.2-2-35 Geochemical Anomaly Map (La Campana District)