### 3–3 Porphyry Copper-type mineralized zone

The mineralized zone is situated in the eastern slope of the Mt. Pico Duarte. Though porphyry copper-type mineralized zone did not be known in the Dominican Republic before this survey, this is the first finding in this country. It takes about six hours from La Cienaga to get to the house of national park by mule back. From there, the site can be reached within about one hour on foot.

The geology of this area is composed of the lower member of Tireo formation, granodiorite intruded into it and dykes intruded into all of them. The lower formation consists of andesite lava (Tla). The rock is augite andesite which has undergone so-called "propylitization". Granodiorite intrusive is distributed in the direction of NW-SE having an extent of 1.5 kilometers wide and 6 kilometers long. The rock is the country rock of the porphyry copper-type mineralized zone. The dyke rocks include andesite and aplite. In these rocks, hydrothermal alteration and mineralization are observed. The lower member of the Tireo formation strikes north and dips toward the east. The trend of intrusion of granodiorite is of the NW-SE system, and it dips northward. It is thought that the intrusion was related to the shearing of the second order stemmed from the faulting of the first order.

#### 3–3–1 Mineralization

The survey of this time resulted in to discover the mineralized zones at 21 places. (Fig. 18).

The mineralized zones are distributed in abundance in the southeastern part of the area, and scattered only at several places in the northwestern part. Especially in the southeastern part, they show a trend of NW-SE system and are distributed in the central part of the granodiorite stock. This trend is consistent with the direction of intrusion of the stock.

The mineralized zones are found within the stock with one exception. The exception is a copper bearing epidote quartz vein.

#### 1. P–1 Mineralized Zone

The largest mineralized zone in the area (P–1) is distributed along a ridge extending northwesterly in the southeastern part of the area with an extent of 450 m x 250 m. The top and the slope of the ridge are covered by the boulders, showing a form of "rubbly terrain" with no vegetation.

The mineralized zone is composed of disseminated ore in white-altered granodiorite. The ore minerals consist of chalcopyrite, bornite, molybdenite, and secondary minerals such as chalcocite, malachite and limonite. Silicification is the notable alteration of the country rock, which is

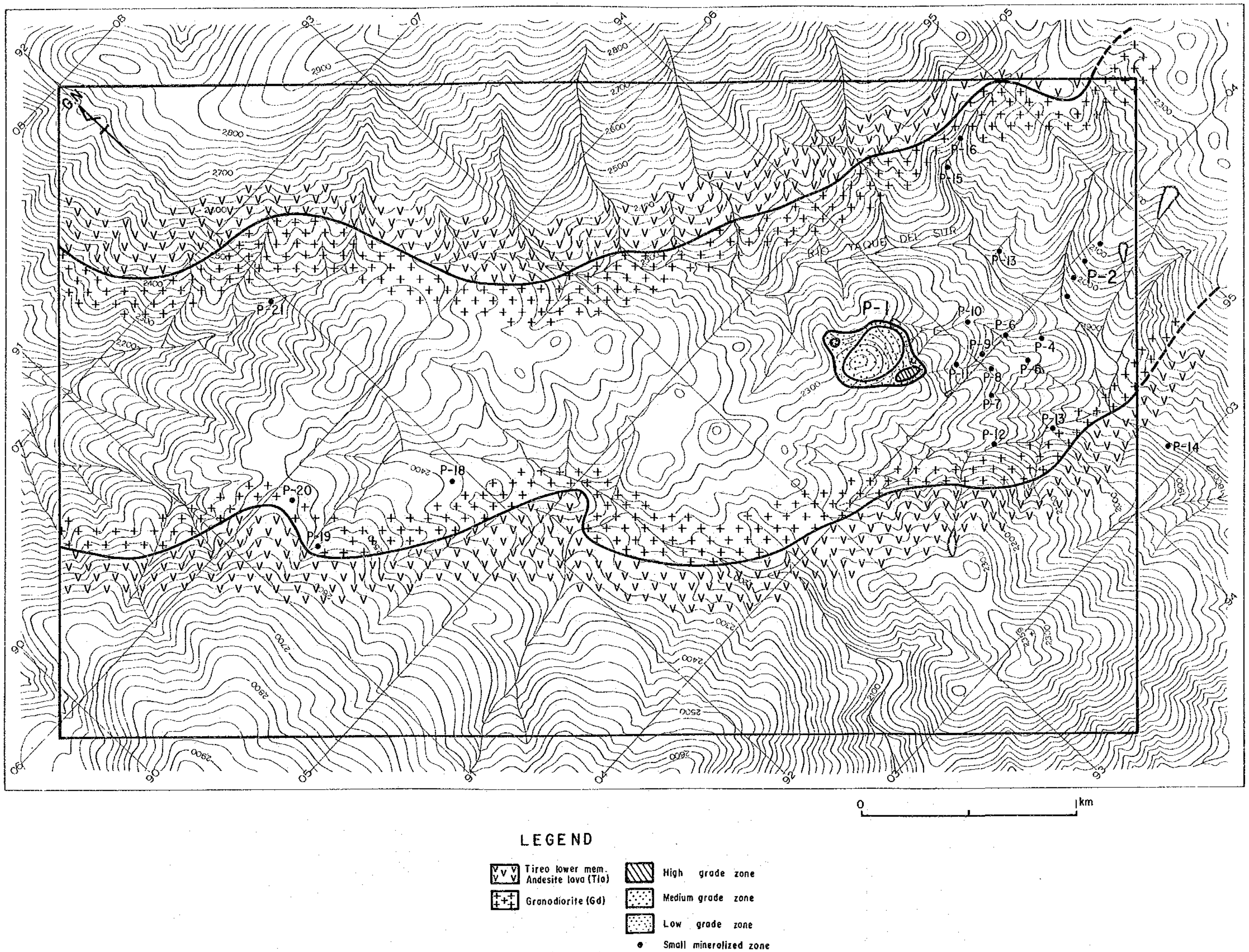



**Fig. 18 Geological Map of the Pico Duarte Area**

accompanied by sericitization and chloritization. Thus the mineralized part has generally been white-altered, and it is obviously distinguished from unaltered granodiorite in the surroundings showing the color index of 10 to 20 per cent. The distribution of alteration zone coincides with that of the mineralized zone, and its extent is narrow. Although some barren quartz veins 1 to 3 centimeters wide are partly found in the mineralized zone, brecciated structure is not so conspicuous in general.

Weathering is advanced at the outcrop, which resulted in limonitization around the copper minerals. Therefore, the outcrop of the mineralized zone displays an appearance that brown spots are scattered in white and pale green granodiorite mass. However, since chalcopyrite is present in abundance at the outcrop, it is thought that leached oxidation zone and the secondary enrichment zone are not so deep that the primary sulfide zone would be encountered in a relatively shallow part. The mineralized zone is divided into high-grade zone, middle-grade zone and low-grade zone according to the grade of copper.

**(1) High-Grade Zone**

The zone is situated along a narrow ridge put between the scars of landslides on both sides, extending N70°W with an extent of 30 m x 150 m. The northwestern extension can not be made clear because of surface soil cover, though it seems to continue further.

The zone consists of disseminated ore composed of oxidized chalcopyrite two to three millimeters in diameter scattered in highly silicified country rock. Leached copper was deposited as malachite in a form of film in cracks of the country rock. The country rock is generally pale green.

The assay result of ores of the zone is af follows.

| | Au(g/T) | Ag(g/T) | Cu(%) |
|---|---|---|---|
| PK009 | 0.67 | 11.6 | 1.52 |
| PM055 | 0.50 | 11.2 | 0.97 |
| PN056 | 0.40 | 7.1 | 0.61 |
| Average | 0.52 | 10.0 | 1.03 |

**(2) Middle-Grade Zone**

The zone occupies the most part of the P−1 mineralized zone, and the average grade is 0.3 % Cu.

Granodiorite, the country rock, is white, being subjected to silicification and sericitization. Chalcopyrite has been limonitized by weathering. Although the ore is characterized by brown spot in white groundmass, brown-spotted ore in green groundmass in locally found. Molybdenite is often observed filling the cavity. Molybdenite- chalcopyrite quartz vein which is not observed in the high-grade zone, was found in the middle-grade zone, and the copper dissemination is found in the wall rock of the vein in a width of 50 centimeters, which becomes poor in ore minerals outward grading into barren quartz vein.

Aplite dyke intruded in the zone, and copper mineralization is observed in the dyke and in the country rock in the vicinity. Thus it is likely that the quartz vein and aplite dyke are in close association with the mineralization.

The assay result of the ores of the zone is as follows.

| | Ag(g/T) | Ag(g/T) | Cu(%) |
|---|---|---|---|
| PK002 | tr. | tr. | 0.16 |
| PK003 | tr. | 2.1 | 0.30 |
| PK005 | tr. | tr. | 0.17 |
| PK006 | tr. | tr. | 0.22 |
| PK007 | tr. | tr. | 0.14 |
| PK008 | tr. | tr. | 0.22 |
| M028–1 | tr. | tr. | 0.23 |
| M029–1 | tr. | tr. | 1.29 |
| M082 | tr. | tr. | 0.17 |
| Average | tr. | tr. | 0.32 |

### (3) Low-Grade Zone

The zone is distributed in a form to surround the high-grade and middle-grade zones. The country rock has become white by sericitization, and brown spot is observed. The density of the spot is lower as compared with that of the middle-grade zone.

## 2. P–2 Mineralized Zone

The zone is situated to the southeast of the P–1 mineralized zone on the opposite bank of Rio Yaque del Sur. The zone consists of altogether four mineralized zones and showings large and small lumped together, which are found in a range of 400 meters along a ridge. The extension of 60 meters was confirmed for the largest one. Although the detail has not been made clear because of thick vegetation and steep topography, the scarps caused by hydrothermal alteration are often observed similar to those of the P–1 zone.

Hydrothermal alteration represented by silicification and sericitization is observed in the mineralized zone and in the surroundings. Although the type of ore is the dissemination similar to that of the middle-grade zone of the P–1 mineralized zone, pyrite dissemination which is hardly found in other zones is observed in this zone. In the second mineralized zone from the downstream upward, strong silicification and dissemination of chalcopyrite and pyrite are observed in the vicinity of barren quartz vein of NE system.

The assay result of the ore of the zone is as follows.

| | Au(g/T) | Ag(g/T) | Cu(%) |
|---|---|---|---|
| PM038 | tr. | tr. | 0.04 |

### 3. *Other mineralized Zone*

Many showings including P–3 to P–11 and P–15 are distributed along the trend of NW-SE system which corresponds to the direction connecting the P–1 mineralized zone and the P–2 mineralized zone, and the size of them confirmed is 10 to 20 meters in extension.

Mineralized zones are also found along the peripheral part of the granodiorite stocks at four points, among which the two points of P–12 and P–13 are distributed on the southern side (footwall side) and P–16 on the northern side (hanging wall side). In the mineralized zones such as P–3, P–5, P–6, P–8, P–9, P–11 and P–15, the country rocks have become white by sericitization, in which disseminated mineralization of limonitized chalcopyrite is observed. The P–4 mineralized zone consists of disseminated mineralization emplaced close to the wall of a quartz vein striking N10°W and dipping 80° northward. Since the sulfide minerals in the quartz vein has been limonitized, no copper mineral was confirmed. The dissemination is brown spotted ore in green groundmass, being more than 10 centimeters in width.

The mineralized zones such as P–7, P–10 and P–12 are the disseminated ones in aplite dykes and the country rocks close to them.

The mineralized zones such as P–13 and P–16 in the peripheral part of the stock are not the disseminated type, but the vein type. The veins are copper bearing epidote-quartz vein about ten centimeters wide. At P–13, the quartz vein is found at the boundary between andesite dyke of NW–SE system and the country rock. At P–16, the strike and dip of the vein are indistinct, because the rock containing the vein has been broken and moved.

The P–14 mineralized zone is the only copper bearing epidote-quartz vein in the area emplaced in the country rock of andesite which belongs to the lower Tireo member. The vein trends northwesterly having the width of about ten centimeters. The ore minerals are chalcopyrite, bornite, malachite, chalcocite and limonite. Under the microscope, exsolution structure of chalcopyrite and bornite is observed, and bornite is considered to be of primary.

Four mineralized zones such as P–18 to P–21 were discovered in the northwestern part of the area. These are inferior in number and scale to those in the southeastern part. These mineralized zones are scattered along the peripheral part on the northwestern side (footwall side) of the stock.

The mineralization of P–18, P–19 and P–20 is of the dissemination type in which brown spots are observed in the sericitized white country rock, as generally seen in the southeastern part.

The P–21 mineralized zone is located in the stock (hanging wall side), which is the alteration zone associated with andesite dyke trending northwesterly, and "gossan" can be observed in every place along the fissures of NW-SE system running in Parallel to the dyke.

The assay result of the ores from the mineralization zones such as P–4 and P–20 is as follows.

| | Au(g/T) | Ag(g/T) | Cu(%) |
|---|---|---|---|
| PM020 (P–4) | tr. | tr. | 0.23 |
| PM091 (P–20) | tr. | tr. | 0.19 |

### 3–3–2 Alteration

Alteration of the mineralized zone is characterized by silicification and sericilization. In order to make it clear, alteration zoning was classified by mineral assemblage based on the result of X-ray diffraction. The results are shown in the alteration map (Fig. 19).

The mineral assemblage of each alteration zone is as follows.

A Zone : quartz-sericite-chlorite

A' Zone : quartz-sericite-chlorite-hornblende

B Zone : chlorite-quartz-(epidote)

'A zone' is a zone generally found in the central part of the porphyry copper-type mineralized zone, in which the rock has become white, megascopically, by marked silicification. The distribution of this is consistent with the mineralized zones such as P–1 and P–2. This zone is distributed on the southwest of the P–1 mineralized zone and on the east of the P–2 mineralized zone. Although no mineralized zone has yet been discovered in these areas, these are the areas distributed by copper geochemical anomalies as mentioned later.

While 'A zone' is similar megascopically with 'A zone' in lithology and mineral assemblage, it is a characteristic of this zone that primary hornblende has survived having been released from complete replacement.

The zone is consistent with the western end of the P–2 mineralized zone and the P–7 mineralized zone. These mineralized zone and showing are small in scale as compared with the P–1

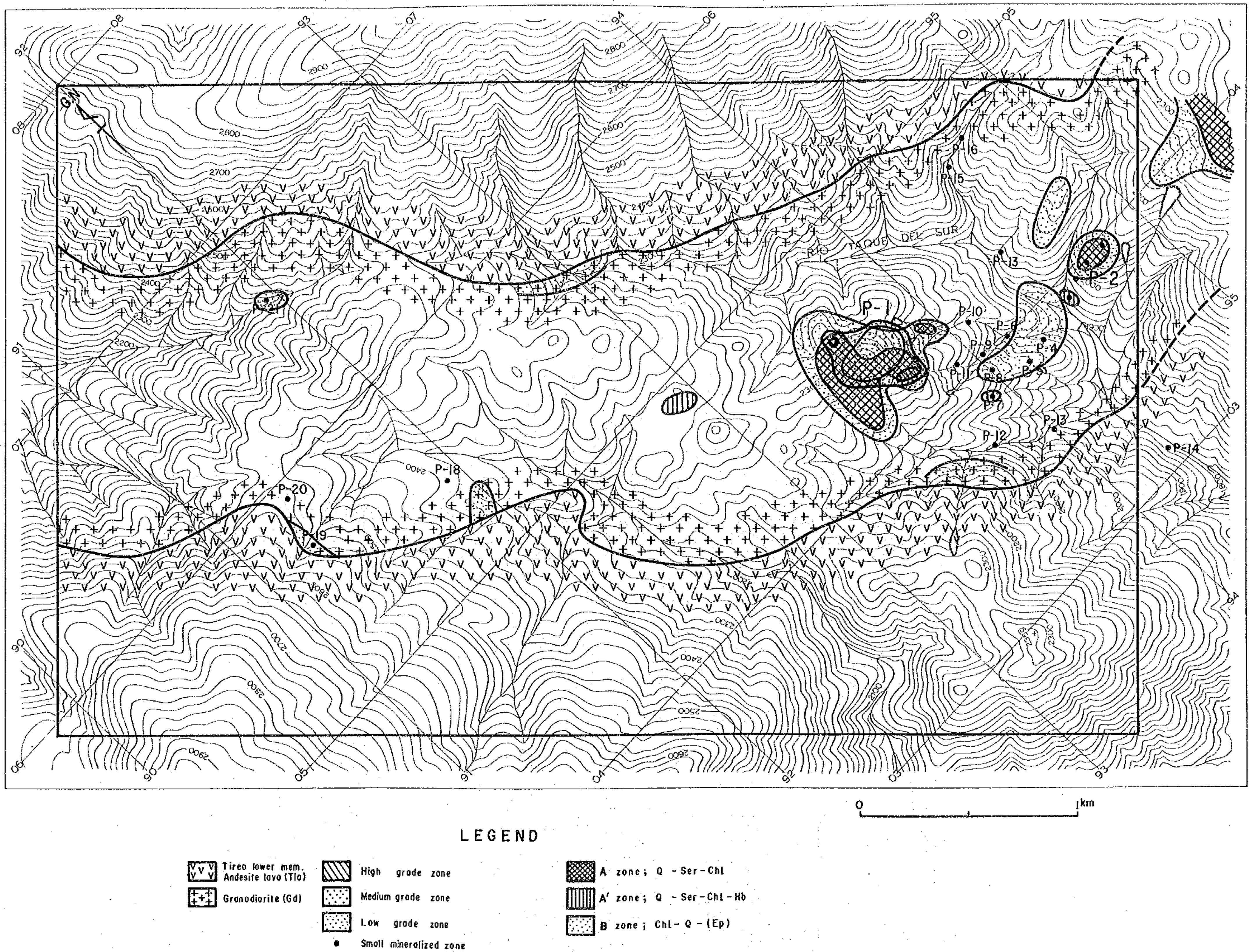



Fig. 19 Alteration Map of the Pico Duarte Area

mineralized zone. The reason of the survivition of common hornblende would be considered that it was not replaced completely by chlorite as 'A zone' because mineralization at this zone was weak.

'B zone' is a propylite zone characterized by chlorite and epidote. Megascopically, the mafic minerals have become green, showing distinct green spots.

The zone includes two kinds in the following: the one surrounding 'A zone' at the mineralized zones such as P–1 and P–2 and in their vicinities, and the other distributed independently. The main zone of the former shows a good consistency with the copper geochemical anomalies in the mineralized zones and their surroundings. The independent ones are distributed at the showings and in their vicinities such as P–4, P–5, P–7 and P–19.

The outer part of 'B zone' is granodiorite which had not been affected by the mineralized alteration.

The relationship between alterations in the above and mineralized zones is generalized as the follows. In the relatively large mineralized zone, 'A zone' is situated in the central part of it and 'B zone' surrounds 'A zone'. This fact suggests that quartz, sericite and a part of chlorite of alteration minerals were related to mineralization. Concerning chlorite, it is also observed partly in the outer part of common hornblende in fresh granodiorite which had not been mineralized. Chlorite in it is considered to be the product mineral due to diagenesis. Therefore, there are two kinds of chlorite: the one related to mineralization and the other related to diagenesis, though it can not be classified clearly.

In spite of the same mineral assemblage with 'A zone', the reason of existence of common hornblende in 'B zone' is considered to originate in that all part of common hornblende had not been replaced by chlorite because mineralization was weak.

### 3–3–3 Measurement of Magnetic Susceptibility

Magnetic susceptibility was measured in order to grasp quantitatively the alteration.

The values measured showed a notable variation such as from 0.00 up to the maximum of 40.2 x 10 SI unit Report of the second phase (Report of the second phase).

Since the measured values of unweathered fresh granodiorite showed more than 10.0, the values less than 10.0 were classified as the low anomalies as in the following four ranks.

| | |
|---|---|
| 0.00 – 1.00 | (strong low anomaly) |
| 1.01 – 5.00 | (middle low anomaly) |
| 5.01 – 10.0 | (weak low anomaly) |
| 10.0 + | (background) |

An analysis map showing the distribution of anomalies was produced on the basis of these four ranks (Fig. 20).

The anomalous zones are well consistent with the alteration zones.

The low anomalous zones are widely distributed in the southeastern part of the area, and narrow in the northwestern part. They coinside in the southeastern part with the distribution of the mineralized zones such as P–1 and P–2, and they are megascopically distributed in a trend of NW-SE system.

In the P–1 mineralized zone, the strong low anomalous zones are consistent with the distribution of the high and the middle-grade zones, and the middle low anomalous zone includes the whole area of the P–1 mineralized zone. The extent of these low anomalous zones also coincide with the distribution of copper geochemically anomalous zones.

The strong and middle low anomalous zones are distributed in a considerable scale in the P–2 mineralized zone and in its vicinity.

While there are many showings in the direction of northwest connecting the two mineralized zones of P–1 and P–2, these showings correspond to the middle and low anomalous zones.

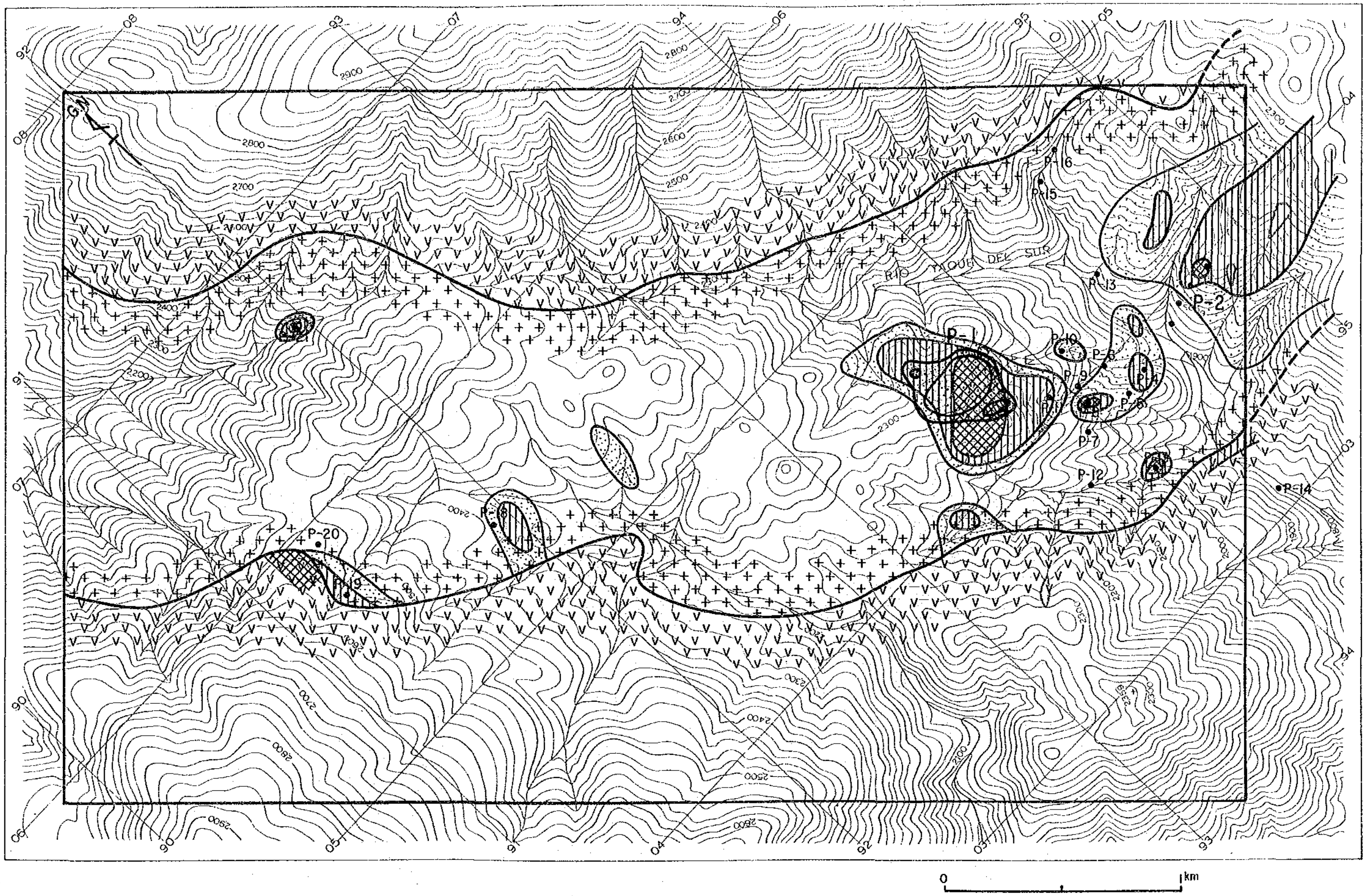
The showings also correspond to the low anomalous zones in the northeastern part, but the strong low anomalous zone is narrow in the extent of distribution or entirely absent.

As mentioned in the above, the areas of distribution of the low anomalous zones are consistent with the distribution of the mineralized zones, and are present in a form to cover them. Especially, the strong and middle low anomalous zones reflect the mineralized zone. The cause of this seems to be attributable to demagnetization of magnetite which is a magnetic mineral in granodiorite, the country rock, as the result of pyritization by hydrothermal alteration associated with mineralization. As a result, it was proved that the measurement of magnetic susceptibility is highly effective in the area to grasp the characters of mineralization and alteration and the scale of them.

While andesite of the lower Tireo member shows the value of around forty in magnetic susceptibility, demagnetization is recognized in the rock at the contact with the stock. This seems to be caused by demagnetization of magnetite in andesite by heating at the time of intrusion of the stock, which is thought to have rised nearly to the Curie point.

It is not so common that magnetic susceptibility meter is utilized as in this time for the survey of ore deposit. For preparation of the works of this time, the variation per hour and variation per day were measured to check whether the correction of the measured value would be needed or not.

The variation per hour was measured at the office in Constanza on September 27, 1984,




LEGEND

- Tireo lower mem. Andesite lava (Tla)
- Granodiorite (Gd)

- High grade zone
- Medium grade zone
- Low grade zone
- • Small mineralized zone

| | | |
|---|---|---|
| magnetic susceptibility ≦ 1.0 x10$^{-3}$ SI unit | : | High anomaly zone |
| 1.0 < m.s ≦ 5.0 | : | Medium anomaly zone |
| 5.0 < m.s ≦ 10.0 | : | Low anomaly zone |
| 10.0 < m.s | : | Background |

Fig. 20 Analysis Map of Magnatic Susceptibility of the Pico Duarte Area

and also the variation per day was measured twice every day at 7.00 a.m. and at 6.00 p.m. in the field during the period of survey. As the result, the rate of the variation per hour was two per cent (difference between maximum and the minimum mean value x 100). The rate of variation of the variation per day was six per cent at the station 1 and three per cent at the station 2. Thus it was made clear that each variation is small. Therefore, it was known that it was not necessary to correct the variation per hour as well as the variation per day in such as case of the works of this time (Report of the second phase).

### 3–3–4 Discussion

The porphyry copper mineralized zone discovered in the survey is a disseminated mineralized zone occurred in the granodiorite body which intruded into andesite of the lower member of the Tireo formation, striking northwesterly and dipping northward. The ore minerals are mainly composed of chalcopyrite, bornite, and secondary minerals of these. Pyrite is very small in amount as compared with the common porphyry copper deposit. The country rock has been highly silicified and sericitized. It is a characteristic that brecciated structure is scanty in the mineralized zone.

Only a vein is found in andesite of the lower member of the Tireo formation, while other mineralized zones are all distributed in granodiorite. The mineralized zones are megascopically distributed in a northwesterly trend. This trend is consistent with that of intrusion of granodiorite body.

These facts suggest that the mineralized zones were formed by the ascent of hydrothermal solution through the weak zone formed in association with the intrusion of granodiorite. Regarding the character of hydrothermal solution, it is suggested that it was relatively low in partial pressure of sulfur because of the presence of primary bornite in the mineralized zone as in the case of the mineralization such as Constanza and Mata Grande.

In the P–1 mineralized zone, silicification is a dominant alteration of the country rock as mentioned in the above, and the alteration zone is narrow. The brecciated structure is generally scanty, though it is partly observed. The concentrated zone of ore minerals is separated into three parts. These facts suggest that the erosion has advanced in the neighborhood of the P–1 mineralized zone.

## 3-4 Pyrite Dissemination Zone

The pyrite dissemination zones are present in green schist of the Duarte formation and dacitic and andesitic pyroclastic rocks in the middle member of the Tireo formation. The mineralized zones of this kind are distributed showing a positional relation to the intrusives. The typical zones are described in the following.

### 1. Mineralized Zone of the South of Constanza

A pyrite mineralized zone is found along Rio Grande about 7 kilometers to the south of Constanza. The mineralized zone consists of concentration of tyrite showing euhedral crystals in dacitic and andesitic tuff and lapilli tuff in the middle member of the Tireo formation. The content of pyrite is 5 to 20 percent in weight percent.

The mineralized zone is one to several meters thick, being spread over widely in the strate above mentioned. In this place, the zone is observed for an extent of about 2 kilometers along Rio Grande.

The part of pyrite dissemination is generally subjected to argillization, which was identified to be sericitization and chloritization by X-ray analysis. The mineralized zone is situated at a position to surround the tonalite intrusive mass at the south of Constanza together with the vein-type copper deposits previously mentioned, suggesting an important relation involved genetically.

The assay result of the pyrite-dissemination zone of this place is as follows:

| | Au (g/T) | Ag (g/T) | Cu (%) | Pb (%) | Zn (%) |
|---|---|---|---|---|---|
| LA042 | tr. | tr. | 0.06 | 0.03 | 0.05 |

### 2. Mineralized Zone from Mata Grande to Diferencia Area

Many pyrite-dissemination zones are found in green schists of the Duarte formation of the area. The mineralized zone is several tens centimeters thick, being spread laterally, and is generally small on a scale. The country rock in which the dissemination zone is contained is green schist of distinct schistosity derived from basic tuff. The country rock has been subjected to chloritization and sericitization. In the dissemination zone quartz veins are present partly along the schistosity. The localities of these dissemination zone is megascopically consistent with the distribution of tonalite intrusives extending northwesterly. Moreover, the distribution of the intrusives are also consistent with the localities of panning sites of placer gold. This suggestes that the instrusives occupy an important position as a forerunning igneous activity of these mineralization.

The assay results of the samples from typical localities are as follows:

| | Width dissemination zone (m) | Au (g/T) | Ag (g/T) | Cu (%) | Pb (%) | Zn (%) |
|---|---|---|---|---|---|---|
| MG013 | 1.00 | tr. | tr. | 0.05 | 0.02 | 0.01 |
| MA032 | 0.25 | tr. | tr. | 0.05 | 0.02 | 0.01 |

# III. GEOCHEMICAL SURVEY

# CHAPTER 1 GEOCHEMICAL SURVEY IN FIRST PHASE

## 1–1 General Remarks

In first phase, the geochemical survey by stream sediment was performed in the whole survery area. 1968 samples of stream sediment were taken.

The samples were analyzed for six elements such as Au, Ag, Cu, Pb, Zn and As. The result of these analysis was satistically processed by computer, and analysis of single component and multivariate analysis by factor analysis method were carried out.

The geochemical anomaly areas extracted as the result include the Sabana Cu anomaly area in the central part of the Las Canitas area, the south Constanza Cu-Zn anomaly area and the Mata Grande and Diferencia Au anomaly area in the Mata Grande area (Fig. 21). The geochemical anomalies are well consistent with the result of geological survey, which demonstrated the effecriveness of geochemical survey in this area.

## 1–2 Result of Analysis

### 1–2–1 Result of Single Component Analysis

**1. Gold (Au)**

The anomalous values of gold are dominant in the Mata Grande area and extracted as six anomaly zones. In the Las Canitas area, the anomalous values are scattered in small numbers, being insufficient to form any anomaly zones. The main anomaly zones are as follows.

**(1) Mata Grande anomaly zones**

The zone is distributed in the surroundings of the Mata Grande settlement. The area is a zone famous for panning of placer gold.

**(2) Diferencia anomaly zone**

The anomaly zone is located in the upper stream of the Diferencia area which is a famous placer gold zone similar to the adjacent area of the Mata Grande settlement. The density of concentration of anomalies is high.

**2. Silver (Ag)**

The anomalies of silver are rarely found in the Mata Grande area, and most of them are distributed in the Las Canitas area.

In the Mata Grande area, although an abundant anomalies of gold were extracted in the Mata Grande-diferencia area, those of silver were not present at all.

In the Las Canitas area, although the anomalies are present in abundance, they are dispersed, having resulted in not to extract the anomaly zone. There is a tendency that the their occurrence is harmonious with the distribution of copper-mineralized zone, which is especially conspicuous along the Ar. La Sabana creek and in the surroundings of Constanza.

### 3. Copper (Cu)

The anomalies are dominant in the Las Canitas area similar to those of silver, which are rarely found in the Mata Grande area.

Sixteen anomaly zones were extracted in the Las Canitas area.

**(1) South the Constanza anomaly zone**

The anomaly zone shows the mineralized zones such as the known ones including Pinar Bonito and Limonicito, and those discovered in this survey.

**(2) Sabana anomaly zone**

The anomaly zone contains the concentrated zone of the Sabana area which is the largest copper belt in the Las Canitas area and the copper-mineralized zones in the surroundings of the Sabana area.

### 4. Lead (Pb)

The six anomaly zones were extracted, similar to those of silver and copper, only in the Las Canitas area.

**(1) South the Constanza anomaly zone**

The anomaly zone is distributed in dacite and dacitic pyroclastic rocks disseminated by pyrite.

**(2) Tasajera anomaly zone**

The anomaly zone is located on the southern slope of Mt. Loma la Tasajera, where no mineralized zone has been known.

### 5. Zinc (Zn)

The zinc anomalous zone has not been extracted in the Mata Grande area similar to those of silver, copper and lead. Three anomaly zones were extracted at the south of Constanza, where the distribution of these zones are well consistent with those of lead.

### 6. Arsenic (As)

The anomalies are distributed scatteringly. They are, however, a little collectively distributed in the El Bao tonalite batholith area in the Mata Grande area and the Guayabal area. The

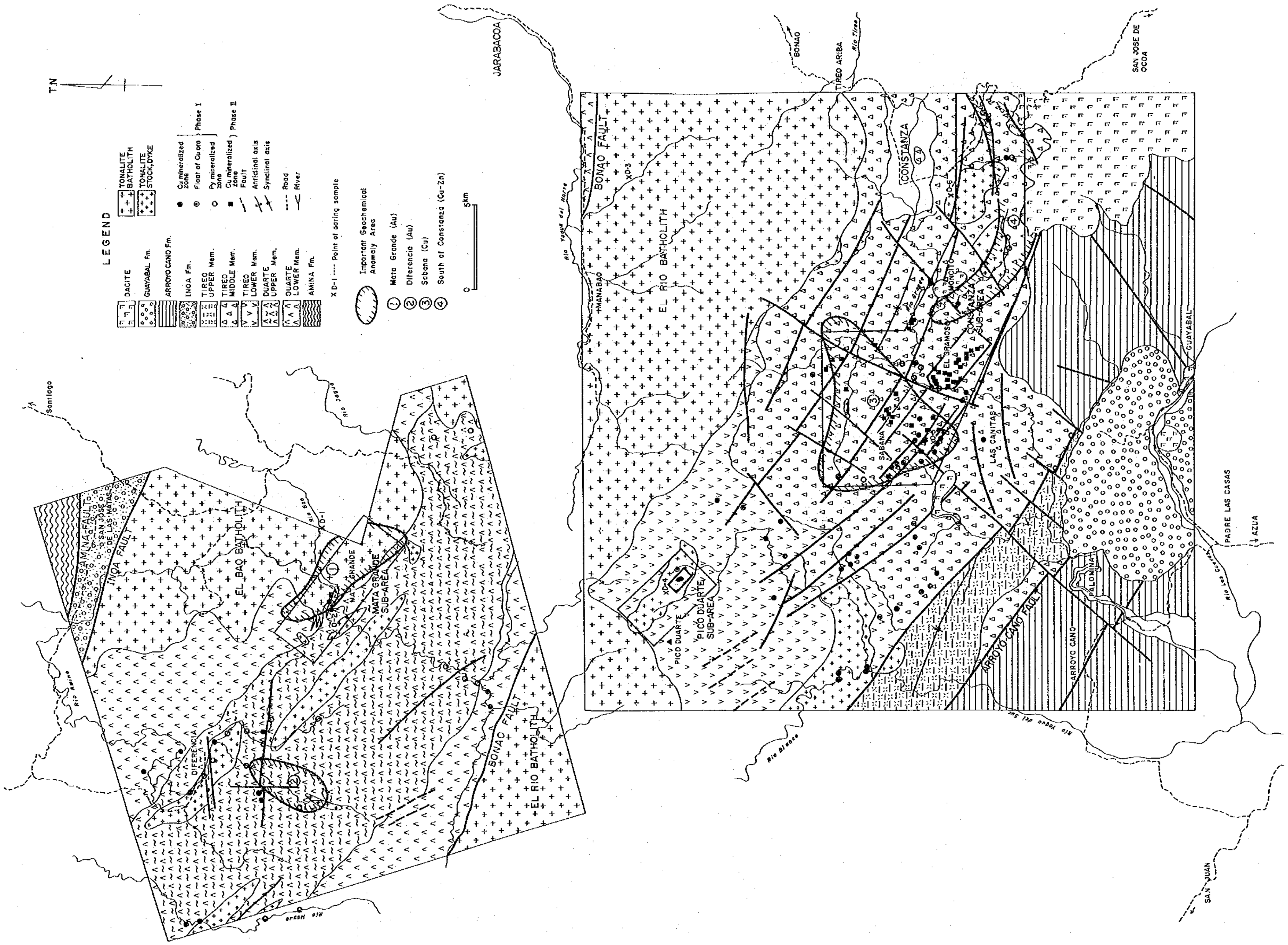



Fig. 21 Geochemical Anomaly Map of the Survey Area

showings of hot spring are observed in the vicinity of these area. Therefore, the anomalies may be derived from the hot spring water.

### 1–2–2 Result of Multivariate Analysis

While the first factor (Zn–Pb) and the second factor (Cu–Zn) show the high values in factor loadings and factor contributions, those of the third and the fourth factors are low. Therefore, the analysis was used only for the first and the second factors (Report of the first phase).

#### 1. The First Factor (Zn–Pb)

The high score zones of the factor higher than one are distributed in abundance in the Las Canitas area. They are dominant on the south of Constanza.

The distributions of the high factor score zones are well consistent with the distributions of the Zn and Pb anomaly zones. But they are hardly consistent with those of copper anomaly zone.

A characteristic point of these high factor score zones is that dacite and its tuff are distributed in these zones and/or in their surroundings, and which are disseminated by pyrite.

As mentioned in the above, the factors does not characterize the copper mineralization, but they might reflect the properties of the host rocks including dacite and the mineralization which formed the pyrite dissemination.

#### 2. The Second Factor (Cu–Zn)

A lot of the high factor score zone higher than 0.5 are distributed in the Las Canitas area.

These high score zones are well consistent with the copper anomaly zones extacted by single component analysis. This may indicate that the factor is characterized by the copper mineralization of this area.

### 1–3 Relationship between Geochemical Anomaly and Mineralization

By single component analysis, multivariate analysis and the investigation of the relationship between these anomaly and the mineralization, four important geochemical anomaly areas as follows were extracted (Fig. 21).

### 1–3 Relationship between Geochemical Anomaly and Mineralization

In the Sabana area and its surroundings, the distribution of copper-mineralized zone and copper anomaly zones extracted by single component analysis and the high score zones of the second factor (Cu–Zn) obtained by factor analysis are well consistent. A small amount of zinc is contained generally in all of mineralized zones. This supports that the second factor is the one of mineralization. From the above fact the Sabana area which is large copper anomaly zone and high score zone of the second factor, the Arroyo Sabina creek and the lower reaches of Rio Yaquesillo are thought to be the important geochemical anomaly area.

2. **South the Constanza Cu–Zn Geochemical Anomaly Area**

The copper-mineralized zones are distributed at the south of Constanza surrounding the tonalite intrusives. These mineralized zones were extracted as the copper geochemical anomaly zones and the high score zones of the second factor.

3. **Mata Grande and Diferencia Au Geochemical Anomaly Area**

Although the area is famour for the place of panning of placer gold, there are many points remained unclear as to the origin of gold.

In the Mata Grande area, the Mata Grande Au geochemical anomaly zone is important from the density of concentration of anomalies.

Another important geochemical anomaly zone is the Diferencia Au anomaly zone, because the density of concentration of anomalies is high, and the panning site of placer gold is located in the upstream of the anomalies.

# CHAPTER 2 GEOCHEMICAL SURVEY IN SECOND PHASE

## 2–1 General Remarks

Three important geochemical anonly area such as Constanza, Pico Duarte, and Mata Grande area were extracted by the survey of first phase.

In the survey of second phase, geochemical survey by soil was conducted to these areas.

The samples obtained were chemically analyzed for six components such as Au, Ag, Cu, Pb, Zn and Mo. The assay results of these were statistically processed by computer, and single component analysis and multivariate analysis by factor analysis were made.

## 2–1 Constanza Area (Fig. 22)

The sampling of soil was preponderantly carried out for the extent of about 90 square kilometers on the basis of the result of geochemical survey by stream sediment and survey of geology and ore deposit conducted in the first phase. The density of sampling was 6 to 7 samples per square kilometer, and the total number of samples obtained was 566.

### 2–1–1 Result of Single Component Analysis

1. **Gold (Au)**

Gold was detected only in four samples among those of 566, and the maximum value was 0.06 ppm. Four points showing the values more than 0.01 ppm are scattered in the vicinity of Sabana.

2. **Silver (Ag)**

The high values more than 0.5 ppm are distributed in the copper mineralized zones at Pinar Bonito in the eastern part and at Limoncito and El Gramoso in the central part, and the near of the mineralized zone at Sabana in the western part.

3. **Copper (Cu)**

The anomalous zones higher than 200 ppm coincide with the copper mineralized zones at Pinar Bonito, Limoncito, El Gramoso and Sabana. A highly anomalous zone higher than 350 ppm distributed to the west of Limoncito seems to continue through Roma Sito Grande to the highly anomalous zone at El Gramoso to the west.

In the Sabana area, the highly anomalous zones reflect the Roblito and the Fortuna mineralized zones surveyed in the first year.

The geochemically anomalous zones of copper at Ar. La Sabina detected by sediment sampling in the first phase did not show any distinct geochemical anomaly in second phase.

4. **Lead (Pb)**

The anomalous zones higher than 10 ppm coincide with the copper mineralized zones at Pinar Bonito, Limoncito and El Gramoso. In the vicinity of Sabana, the anomalies do not coincide with the copper mineralized zone, but are found in a barren zone.

5. **Zinc (Zn)**

The anomalous zones higher than 100 ppm coincide with the copper mineralized zones at Pinar Bonito, Limoncito and El Gramoso similar to the case of copper, but they do not coincide with the copper mineralized zones at Sabana and along Arroyo La Sabina in the western part, which are distributed in the surroundings of them.

6. **Molybdenum (Mo)**

About 92 per cent of the assay values of molybdenum showed the values less than 0.01 ppm which is the analytical detection limit. The point detected only coincide with the zinc mineralized zone at Pinar Bonito, and the anomalies are scattered without any relation to other elements.

### 2–1–2 Result of Multivariate Analysis

When the high factor score of each factor, the copper mineralized zone and the single component analysis graph of copper are investigated, it seems that the first factor (Cu–Zn) would be the copper mineralization factor.

The high score zone more than 1.0 in the first factor is well consistent with the distribution of the mineralized zone found at Pinar Bonito, Limoncito, El Gramoso and Sabana. Especially, the high score zone shows considerably wide distribution between El Gramoso and Limoncito. The factor is the one which characterizes the copper mineralization as shown in the above, which shows a good consistency with the result of analysis of geochemical data obtained by sediment sampling in the first phase.

While the second factor is characterized by lead and the third factor by silver, the high score zones of the second factor and the third factor become more conspicuous in agreement with the copper mineralized zone toward the east. Taking into account this fact putting together with the result of single component analysis, the zonal arrangement of elements can be assumed from the west toward the east, such as Cu–Zn at Sabana, Cu–Zn–Pb at El Gramoso and limoncito and Cu–Zn–Pb–Ag at Pinar Bonito.

### 2–1–3 Relationship between Geochemical Anomaly and Mineralization

At El Gramoso on the southwestern slope of Mt. Loma Sito Grande, 51 outcrops of gold bearing copper veins which are stable in size and grade have been discovered in an extent about 6

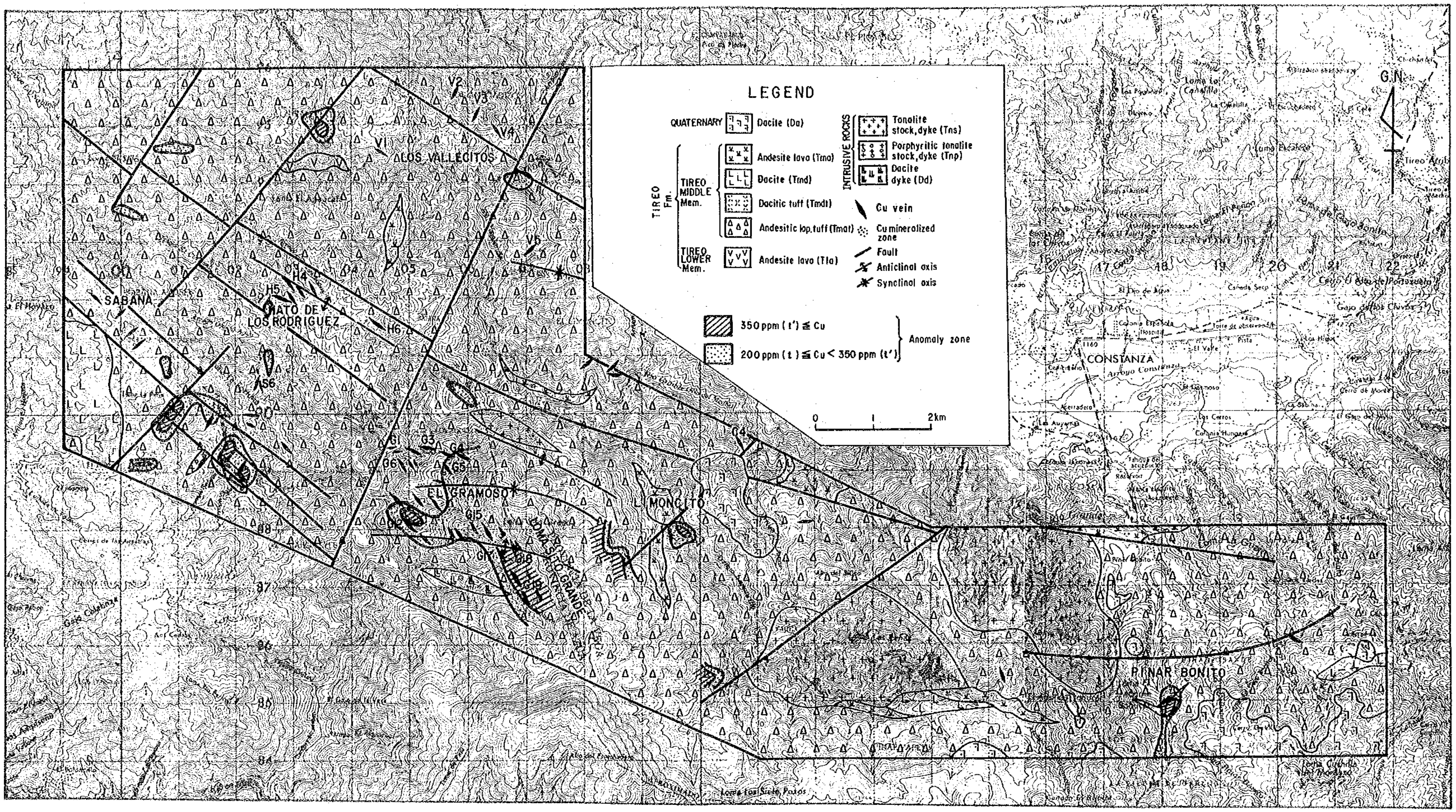



Fig. 22 Geochemical Anomaly Map of the Constanza Area

square kilometers. The largest one among them is 1.5 meters wide in average extending for 70 meters, showing the grade such as 0.3 g/T Au, 17 g/T Ag and 3.2% Cu.

Most of these veins show the structure striking northwesterly and dipping northward, and the shape of distribution extends northwesterly with a similar structure of the first and the second orders which is the direction of the main geological structure of the region. Though the whole aspect of the mineralized zone has not been made clear, it is likely that they extend toward the north, because the geochemical anomalies of copper and the high score of factor–1 (Cu–Zn) are present on the northeastern slope of Mt. Loma Sito Grande. It can be expected that the group of veins as the same system as that of the El Gramoso area might occur from the top of the mountain to the northeastern slope.

### 2–2 Pico Duarte Area (Fig. 23)

The sampling was preponderantly made in the area distributed by granodiorite, the host rock of the porphyry copper mineralized zone.

The density of sampling was raised for the mineralized zones newly discovered so as to take hold of the scale.

The samples were obtained from the B layer as in other areas, and 105 samples were obtained.

#### 2–2–1 Result of Single Component Analysis

**1. Gold (Au)**

Analysis could not be made because all the assay values of gold were below the detection limit.

**2. Silver (Ag)**

The anomalous zone higher than 0.3 ppm is distributed in the copper anomalous zone mentioned later which is consistent with the P–1 mineralized zone in the northeastern part of the area, but they are scatteringly distributed in the western part, not being consistent with the copper anomalies.

**3. Copper (Cu)**

While the anomalous zones higher than 90 ppm are consistent with many locations of mineralized zones, they especially covers the whole area of the P–1 mineralized zone, and further extend northwestward to the part covered by the soil, indicating that the mineralized zone would expand toward the west.

### 4. Lead (Pb)

Most of the lead anomalies are not consistent with the distribution of the mineralized zones, although a point showing the high value more than 5 ppm is found in the P–1 mineralized zone.

### 5. Zinc (Zn)

The points showing high values more than 50 ppm is distributed in a form to surround the P–1 mineralized zone. The zinc anomaly is recognized in the P–2 mineralized zone in which no copper anomaly was detected.

### 6. Molybdenum (Mo)

Molybdenum was detected only at 12 points out of 105. These points are mostly found on the northern side of ghe copper anomalous zone which extensively covers the P–1 mineralized zone.

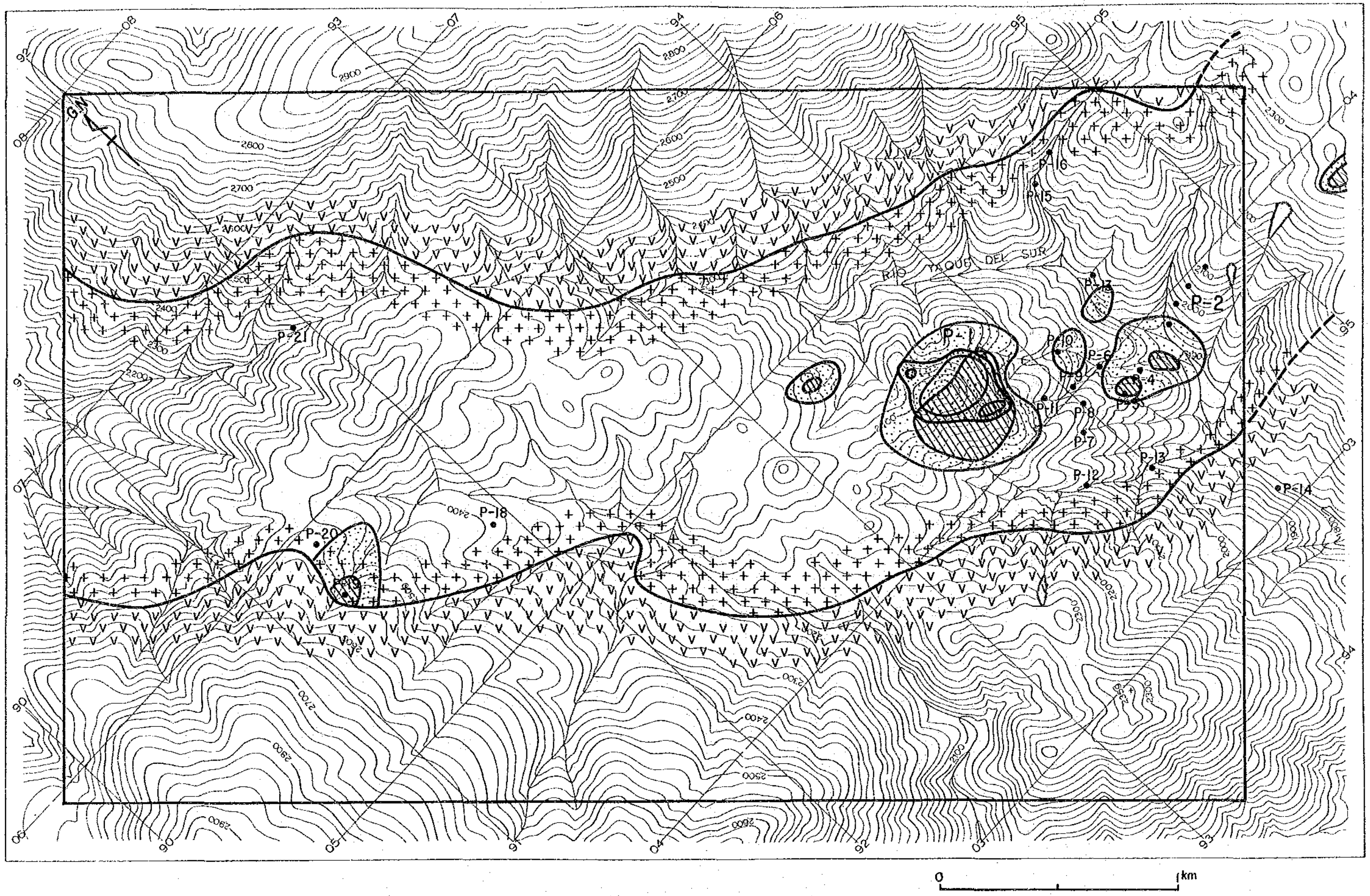
## 2–2–2 Results of Multivariate Analysis

Factor analysis of geochemical data by varimax method was conducted in the area as was in the Constanza area. The elements used for the factor analysis are the four elements such as Ag, Cu, Pb and Zn. As to Au and Mo, they were excluded because most of the assay values showed below the detection limit. As the result, three factors including Cu–Zn as the first factor and Pb as the second factor were obtained (Report of the second phase).

Investigation of the high factor marks score of each factor, the copper mineralized zone and the single component analysis graph of copper, leads to the assumption that the third factor (Cu) would be the mineralization factor.

The high factor score zones of the third factor are well consistent with the mineralized zones including the P–1 zone.

Other factors which characterize the zones are Cu–Zn–Ag of the first factor and Pb of the second factor. At the P–1 mineralized zone and in its surroundings, the third factor is found at the center surrounded by the first factor, which is further surrounded by the second factor. These facts suggest a zonal arrangement of elements, such as Cu at the center, Cu–Zn and Pb toward outside.




LEGEND

Tireo lower mem. Andesite lava (Tla)
Granodiorite (Gd)
High grade zone
Medium grade zone
Low grade zone
• Small mineralized zone
120 ppm (t') ≦ Cu
90 ppm (t) ≦ Cu < 120 ppm (t')
} Anomoly zone

**Fig. 23 Geochemical Anomaly Map of the Pico Duarte Area**

### 2–2–3 Relationship between Geochemical Anomaly and Mineralization

Although the extent of P–1 mineralized zone exposed on the surface is 450 m x 250 m, the geochemical anomaly of copper, the low magnetic susceptibility zone and the alteration zone extend further to the southern part covered by surface soil. (Fig. 18, 19, 20, 23). If the latent mineralized zone is included, the whole extent would be 500 m x 500 m.

The high grade zone exposed on the surface (0.5 g/t Au, 10 g/t Ag, 15 Cu in average) is 30 meters in width and 150 meters in length. This part is expected to expand to the southern part covered by the soil.

## 2–3 Mata Grande Area (Fig. 24)

Sampling of soil was conducted by the grid sampling method in order to grasp the lateral extension of the Mata Grande deposit and to find out the origin of placer gold being mined in the area. The survey lines for sampling were set up almost at right angles to the strike of the Mata Grande deposit. The length of survey line was determined to be 1.5 to 2.0 kilometers putting the deposit at the center. The line-spacing was 200 meters in the vicinity of the ore deposit, which was windened to 500 meters, and then to 700 meters as going away from the center. Samples were taken at an interval of 100 meters in the vicinity of the ore deposit, and 200 meters along the lines far apart from the deposit. 291 samples were obtained. Their location are shown in Fig. 24.

### 2–3–1 Result Single Component Analysis

**1. Gold (Au)**

Since assay values of gold were all below the analytical detection limit, the analysis could not be made.

**2. Silver (Ag)**

The anomalies higher than 0.4 ppm are found in the areas distributed by tonalite batholith and tonalite intrusive rocks.

**3. Copper (Cu)**

The anomalous zones higher than 120 ppm caught the northwesterly trending vein of the Mata Grande deposit as a trend 100 meters to 200 meters wide.

As the result, it was known that the deposit extends for about one kilometers northwestward from the mine and about two kilometers southeastward. It was also made clear that another trend of anomalous zone was distributed to the south, suggesting the existence of potential parallel veins which would correspond to the Mata Grande copper vein.

4. **Lead (Pb)**

The anomalies higher than 6 ppm are dominant in the northwestern part of the area, being almost consistent with the distribution of tonalite intrusives.

5. **Zinc (Zn)**

Although the zinc anomalous zone higher than 90 ppm caught the Mata Grande deposit similarly to the copper anomalous zone, and it shows a marked southeastward extension as compared with the copper anomalous zone, no notable northwestward extension can not be observed.

6. **Molybdenum (Mo)**

About 93 percent of the assay values of molybdenum showed the values below the analytical detection limit of 0.1 ppm. All the points detected are present in the area distributed by tonalite intrusive rocks.

### 2–3–2 Result of Multivariate Analysis

Factor analysis of geochemical data by varimax method was conducted in the area as that in the Constanza area. The elements used for the factor analysis are the four elements such as Ag, Cu, Pb and Zn. As to Au and Mo, they were excluded because most of the assay values showed below the analytical detection limit. As the result, the factors such as Cu–Zn as the first factor and Ag as the second factor were obtained.

The investigation of the high factor marks, the copper mineralized zone and the single component analysis graph of copper, leads to the assumption that the first factor (Cu–Zn) would be the mineralization factor.

The high marks zones of the first factor (Cu–Zn) include a northwesterly trending zone which caught the Mata Grande deposit, and another one to the south of it.

The other factor, the second factor is the one characterized by silver. Although the high marks are present in the area distributed by tonalite batholith, it has not been made clear whether it reflects the character of the country rock or it is related to gold of which the analysis was of the country rock or it is related to gold of which the analysis was impossible.

### 2–3–3 Relationship between Geochemical Anomaly and Mineralization

The Mata Grande deposit consists of copper veins occurred in the country rocks such as

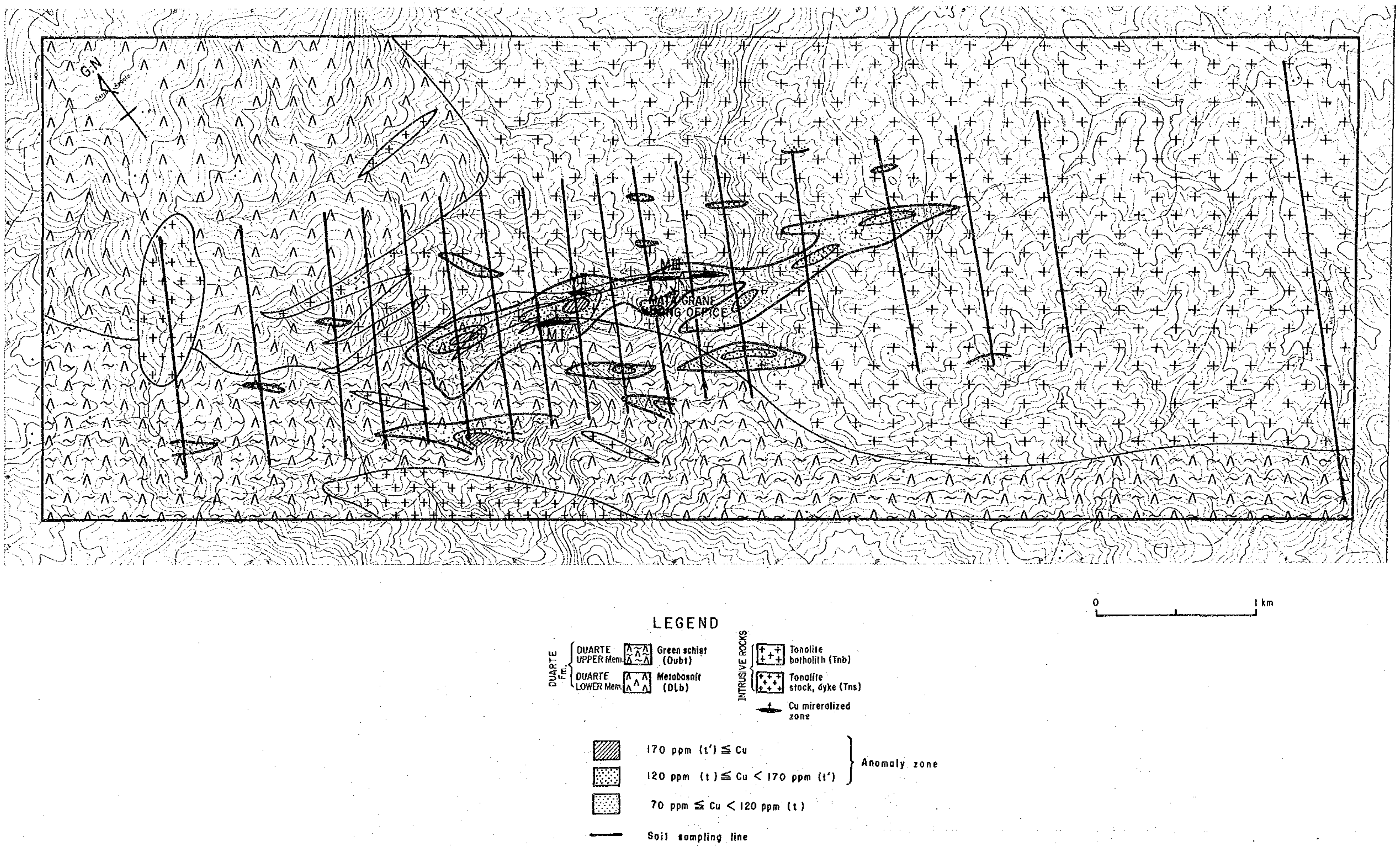



Fig. 24 Geochemical Anomaly Map of the Mata Grande Area

green schistose rocks of the Duarte formation and tonalite. The deposit is composed of three veins arranged in echelon trending northwesterly.

The outcrops of the veins are approximately 150 meters, 200 meters and 500 meters in extension respectively from northwest to southwest, being distributed in an extent of 1.2 kilometers.

The result of geochemical survey shows that the copper anomalies continue to both sides of northwest and southeast, reaching 3 kilometers in total extension. Some copper anomalies extending northwesterly were detected to the south of the above, which suggests the potential existence of the parallel veins.

Among the veins of the Mata Grande deposit, those in the zone in the vicinity of the outcrop which is extending for 500 meters in the southwestern part are steady in scale and grade. Since, in this place, the scale and the grade of the vein at the outcrop is relatively stable, the extent from the creek on the east of the mine to the southern slope of the top of mountain seems to be most promising.

# IV. GEOPHYSICAL SURVEY

# CHAPTER 1 SPECTRAL INDUCED POLARIZATION SURVEY

## 1–1 General Remarks

### 1–1–1 Objectives of the Survey

In the first and the second phase of this project, it was revealed that more than 20 mineralized zones, including porphyry copper type ore, are found in the granodioritic body seen around the Rio Yaque del Sur river southeast of Mt. Pico Duarte.

The third phase of this project, in this year, had the purpose of investigating the biggest, among 20 mineralized zones of P-1. For this reason it was adopted the geophysical method called SIP (Spectral Induced Polarization), which would permit to know the continuity of the mineralized zone at depths, by studying the spectral type of data observed over the investigated area.

### 1–1–2 Surveyed Area

The surveyed area is located on the south-eastern slopes of the Mt. Pico Duarte, which is the highest peak in the Dominican Republic, with an elevation of 3,078m.a.s.l.

The topography of the surveyed area is very rugged, with a debris at P-1 zone and with a cliff of 70 m high and 400 m wide in the southern side of the P-1 zone. Figs. 1.25 shows the area under study.

### 1–1–3 Specifications

The details of the surveyed lines for the mentioned geophysical technique is as follows.

| Item | Specifications |
|---|---|
| Method | Spectral IP |
| Survey Line | 5 lines (1.3 km x 5 = 6.5 km) |
| Observation Points | 39 points x 5 lines = 195 points |
| Line Direction | N50°W |
| Line Spacing | 150 m |
| Station Interval | 100 m |
| Electrode Separation Factor | n=1 to 5 |

## 1–2 Result of the Survey

The results obtained by using the SIP Method, in combination with the geological and geochemical surveys are given as follows. The interpretation of the data was done using the block diagram indicated in the Fig. 26.

1) A resistive zone with an apparent resistivity of more than 400 ohm-meter extending in the NE-SW direction is seen around the stations Nos. 4 to 7 on the lines PA and PB. These results are supported by the geochemical survey interpretation and suggest that the resistive zone is due to the silification.

The model simulations done for each of the lines indicate that this resistive body extends to the depth of 150 m on line PB. The information obtained from the model, may also help to delineate the distribution of the silicified granodiorite, which has a close relation with the mineralization. In this area, an Spectral type "A" was mainly detected.

2) A conductive zone with a resistivity less than 400 ohm-m, was detected surrounding the above mentioned resistive zone. The low resistivity of either side of the resistive zone is thought to be due to the fracturing developed in the west of the resistive zone and to the weathering seen in the east of the zone.

On the other hand, the low resistivity detected in the other area is due to the shallow overburden, with an assumed thickness between 150 and 200 m on the lines PD and PE.

3) From the investigations, two spectral types were identified: a type "A", seen in the whole area and a type "B" observed at depths and at the end of the lines. The boundaries of the two types are not so clear.

In spite of the fact that both spectral types observed are caused by the sulfide mineralization, the IP effects detected were very weak. The phase difference was less than −15 mrad. at 0.125 Hz and the PFE, less than 1.3% in the 0.125 to 1.0 range. The reasons of the mentioned weak response are attributed to the following facts:

a) The pyrite, which is the strongest IP anomalous source among the sulfide mineralization, was not observed from the little chalcopyrite seen around the P-1 mineralized zone.

b) Oxidization is only seen at a considerable depth.

c) The granodiorite which is generally compact and with a poor development of cracks, makes low the mobility of the ionic solution.

4) The results of the physical property of the rock samples, show that most of the spectral type detected on the granidiorite is of "A" type. The mineralized rocks show also the same behaviour.

Among the spectral "A" type, no significant differences are seen in the spectral shape detected in the samples.

5) In conclusion, it can be said that the detected IP effect were unexpectedly low, not only

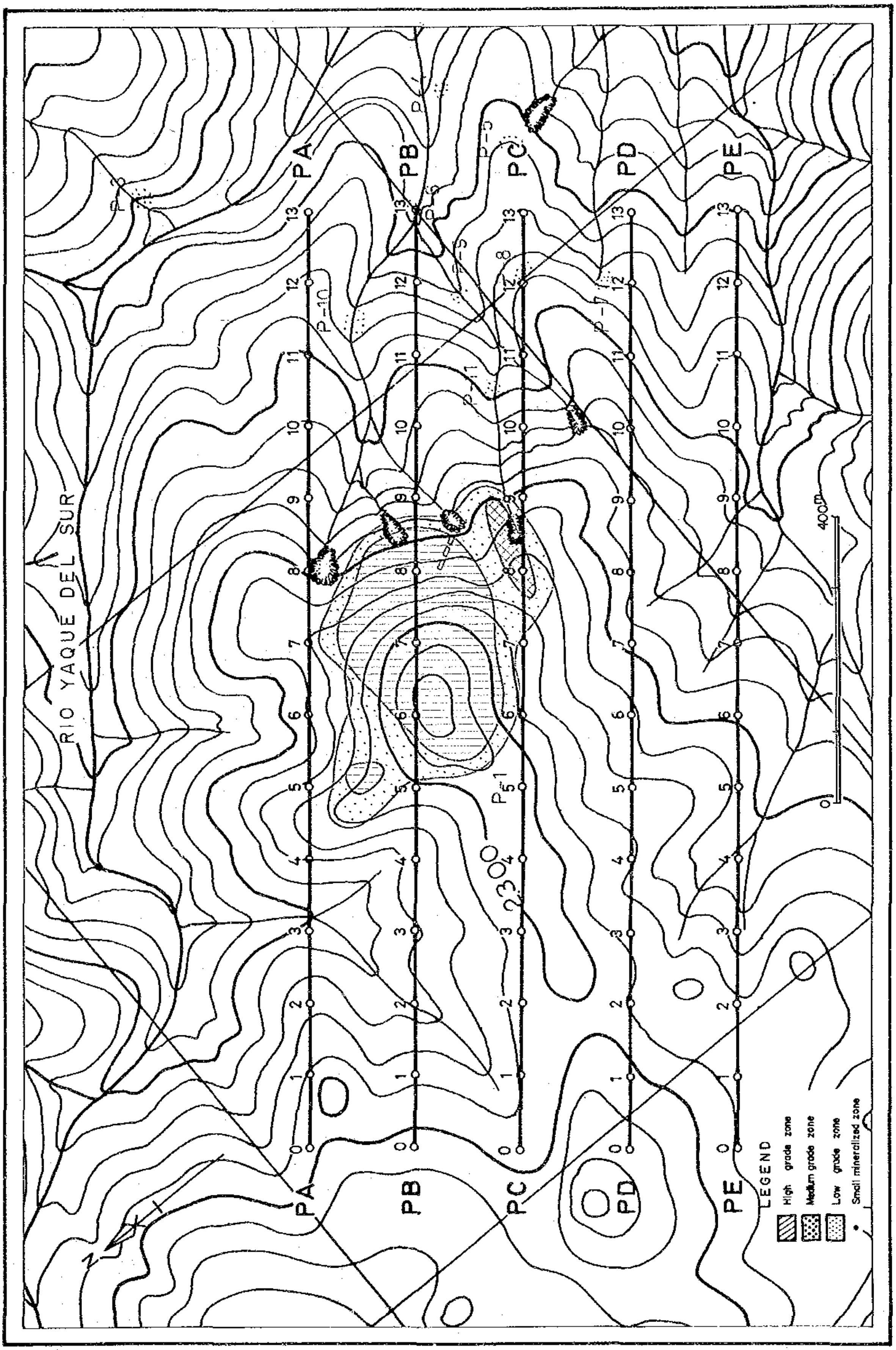



Fig. 25 Location Map of SIP Survey Lines

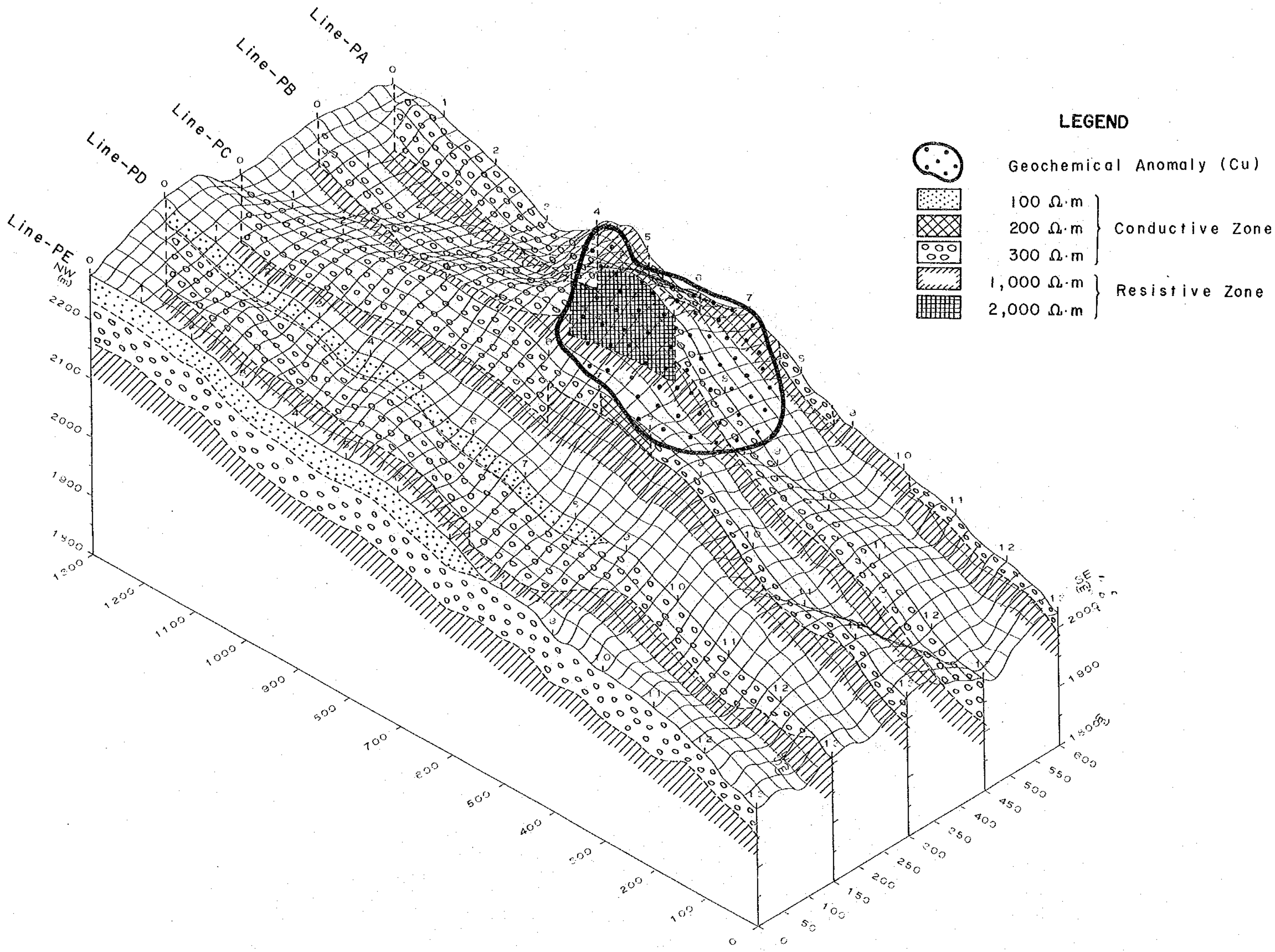



Fig. 26 Block Diagram for Interpretation

because of the wide and deep oxidization zone, but also because of the scattered constituent minerals. The silicified zone, very close related to the mineralization, seems to correlate well with the assumed resistive model of dimensions 300 m long, 150 m deep and 300 m wide on the line PB.

As referred in the second phase report, this body must have been eroded out of the considerable depths, suggesting that the resistive body could correspond to the root of the porphyry copper type mineralization.

# V. DRILLING SURVEY

## Chapter 1 General Remarks

Geology of the area is mainly composed of andesite lava and pyroclastic rocks of the same source belonging to the middle member of the Cretaceous Tireo formation. The intrusive rocks including tonalite and dacite are distributed in the northern part and the southern part of the survey area, extending northwesterly. Mineralization is the copper bearing quartz veins with the trend of NW system, and many outcrops are distributed in the vicinity of the El Gramoso settlement.

The drilling survey was conducted for the five holes the following to test the main outcrops.

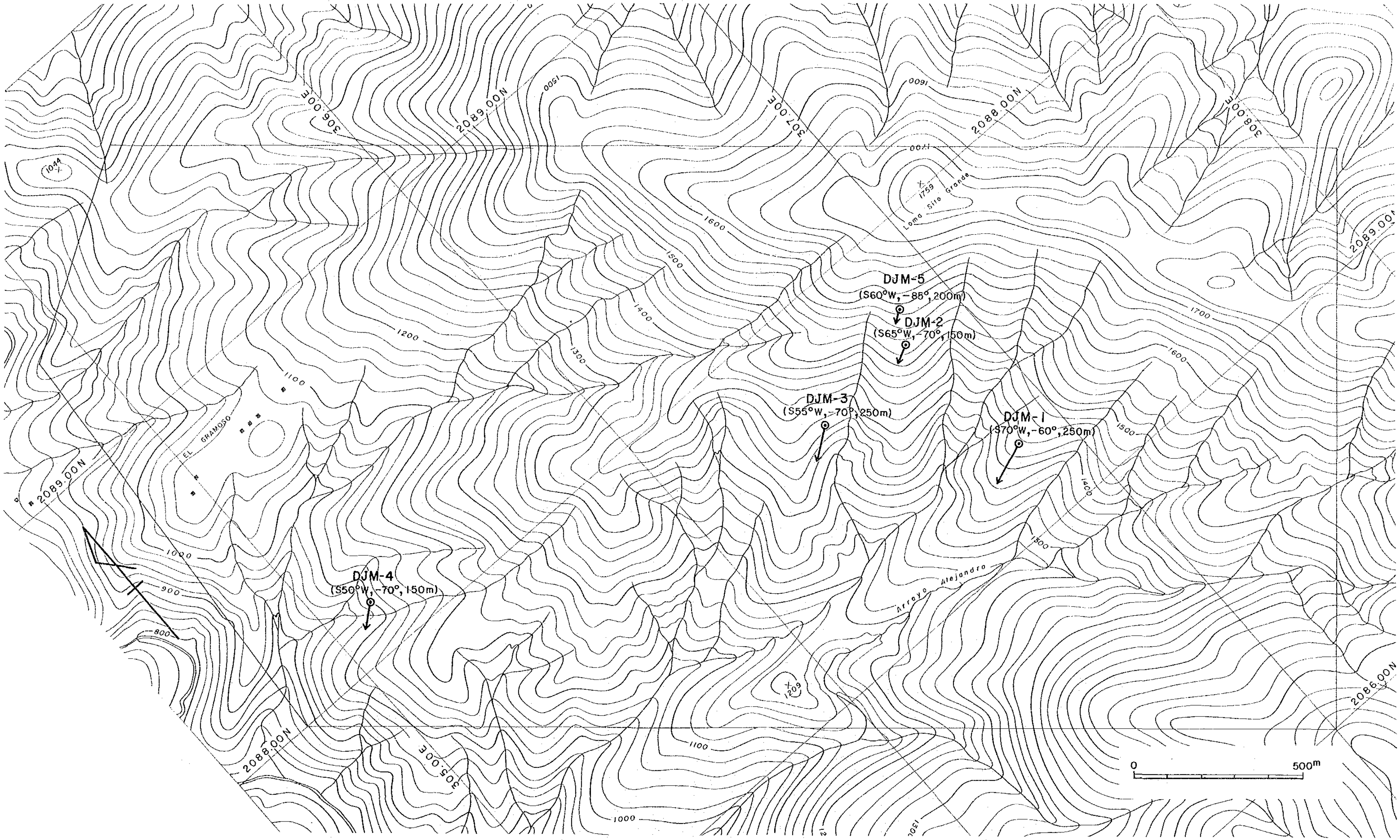



Fig. 27 Location Map of Dill Holes

## Chapter 2 Results of the Survey

### 2–1 Hole DJM-1

**1. Situation, Direction and Inclination of the Hole**

Situation: Longitude N2,087.25, Latitude E306.85, Altitude 1,435 m a.s.l.

Direction: S70°W

Inclination: –60°

Depth: 250.20 m

**2. Purpose**

The drilling was made to evaluate the lower part of the outcrop G-19.

The total lateral length of the outcrop G-19 is 35 meters, and the average of the assay results of the samples from the high grade part for six meters long and one meter wide are as in the following. 0.4 g/T Au, 31 g/T Ag, 4.2 % Cu, 0.7 % Pb and 0.3 % Zn.

The vein strikes N20°W and dips 60° northward.

**3. Result of the Intersections**

The results of the main parts of the intersections are as follows.

| Depth(m) | Core Length(m) | Au(g/T) | Ag(g/T) | Cu(%) | Pb(%) | Zn(%) |
|---|---|---|---|---|---|---|
| 132.45~132.65 | 0.20 | 0.1 | 2.0 | 0.35 | 0.02 | 0.05 |
| 132.75~132.80 | 0.05 | tr | 1.9 | 0.35 | 0.02 | 0.03 |
| 159.30~159.40 | 0.10 | tr | 1.5 | 0.31 | 0.02 | 0.83 |
| 192.90~193.00 | 0.10 | tr | tr | 0.20 | 0.02 | 0.01 |
| 230.75~231.05 | 0.30 | tr | 0.3 | 0.24 | 0.02 | 0.01 |
| 242.30~242.60 | 0.30 | tr | tr | 0.06 | 0.02 | 0.01 |

The downward extension of the outcrop G-19 corresponds to the veins at 132.45 meter and 132.75 meter in the hole, which were located at the vertical depth of about ninety meters below the surface.

These are malachite-chalcopyrite-limonite-quartz-epidote network veins. Those intersected at 159.30 meter, 192.90 meter, 230.75 meter and 242.30 meter are chalcopyrite-pyrite-quartz-epidote veins and the one at 242 meter is pyrite-hematite-quartz vein. Any outcrop corresponds to these veins has not been confirmed. A number of quartz veins, quartz-epidote veins and quartz-calcite veins are found in the surrounding of ore veins. The veins more than one centimeter wide are 42 in number. Rock control for formation of the veins has not been recognized.

The country rocks include andesitic tuff breccia, lapilli tuff and course-grained to fine-grained tuff. Although the fine-grained tuff is essential tuff, the others contain a small amount of accidental fragments of dacite. Pisolite is contained in the fine-grained tuff.

Hematitization is observed in the sections such as from 54 meter to 61 meter and deeper than

233 meters.

Fig. 21 shows the location and Fig. 22 shows the geological section.

4. **Considerations**

It was made clear from the data of the hole DJM-1 that the size and grade of the outcrop are becoming poor at the depth though the veins continue to the lower part, that the lower extension of the outcrop changes to a zone in which many fractures filled with gangue minerals and that ore minerals are a small quantity. These facts indicate that the fracture zone underneath the outcrop had not been the zone of crystallization of ore minerals, but played a role for the passage of hydrothermal solution. These suggest that the lower limit of the veins was formed in this part.

As a result of geochemical prospecting conducted in the second phase, the center of the El Gramoso mineralization is assumed to be in the vicinity of the top of Loma Sito Grande. The area of this outcrop, therefore, might be the outer peripheral part of the above, and it is disappointing that it has resulted in to be endorsed by the data of this drilling hole.

Because malachite is observed at the intersection of 132.75 meter and no oxide minerals could be recognized in the lower part deeper than 159.30 meters, the extent of oxidation seems to be approximately within 150 meters.

2. **Hole DJM-2**

1. **Situation, Direction and Inclination of the Hole**

| | |
|---|---|
| Situation: | Longitude N2,087.68, Latitude E306.78, Altitude 1,530 m a.s.l. |
| Direction: | S65°W |
| Inclination: | −70° |
| Depth: | 150.50 m |

2. **Purpose**

The drilling was made to evaluate the lower part of the outcrop G-18. The outcrop G-18 is composed of four series of copper bearing quartz vein 0.1 to 1.2 meters wide and 20 to 35 meters long along strike. The grade at the outcrop was shown to be 0.04 to 2.37 % Cu.

3. **Results of the Intersections**

Although the assay results at the ore intersections are shown in Table 4, the results of the

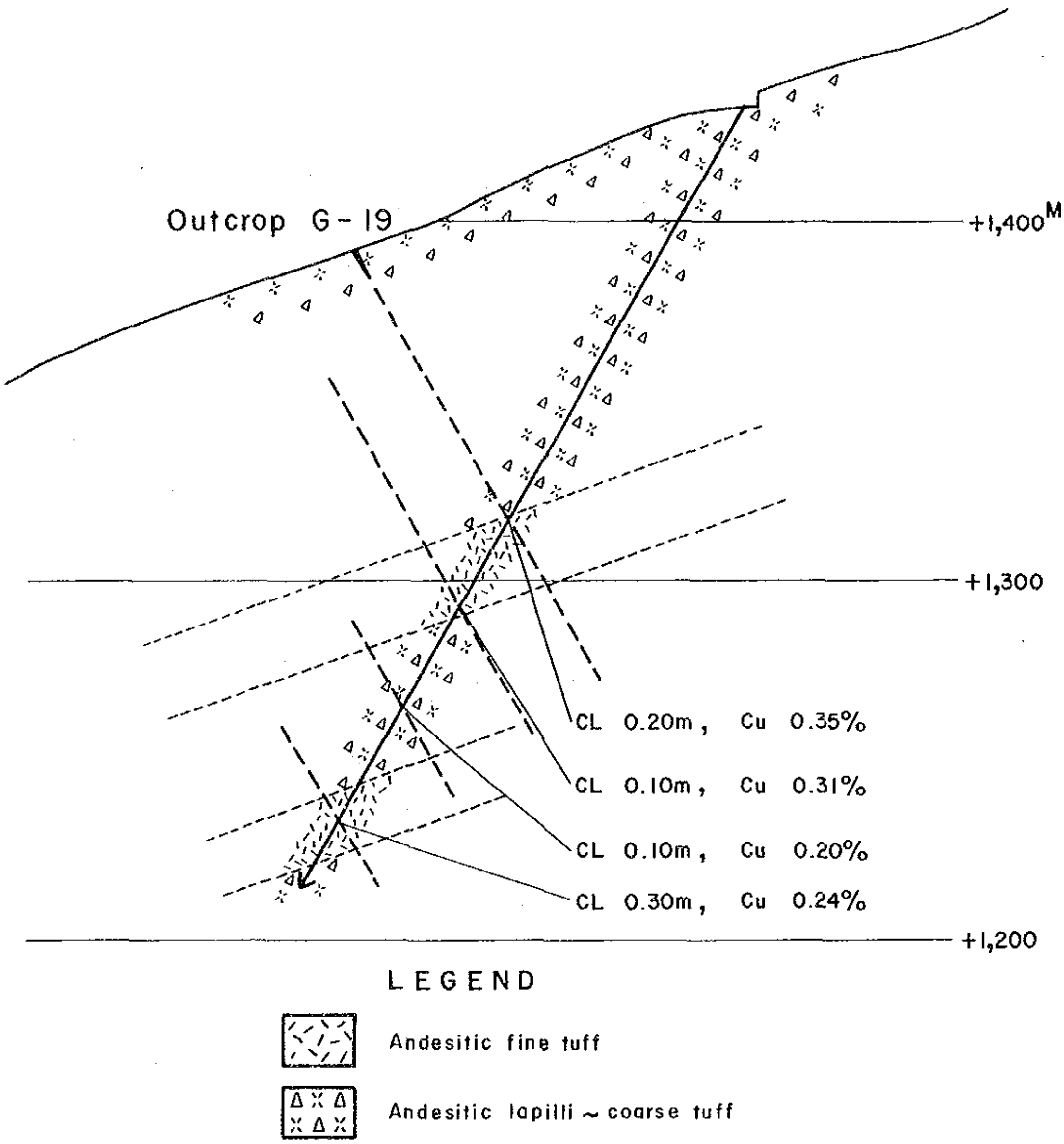



Fig. 28 Geological Section of Hole DJM-1

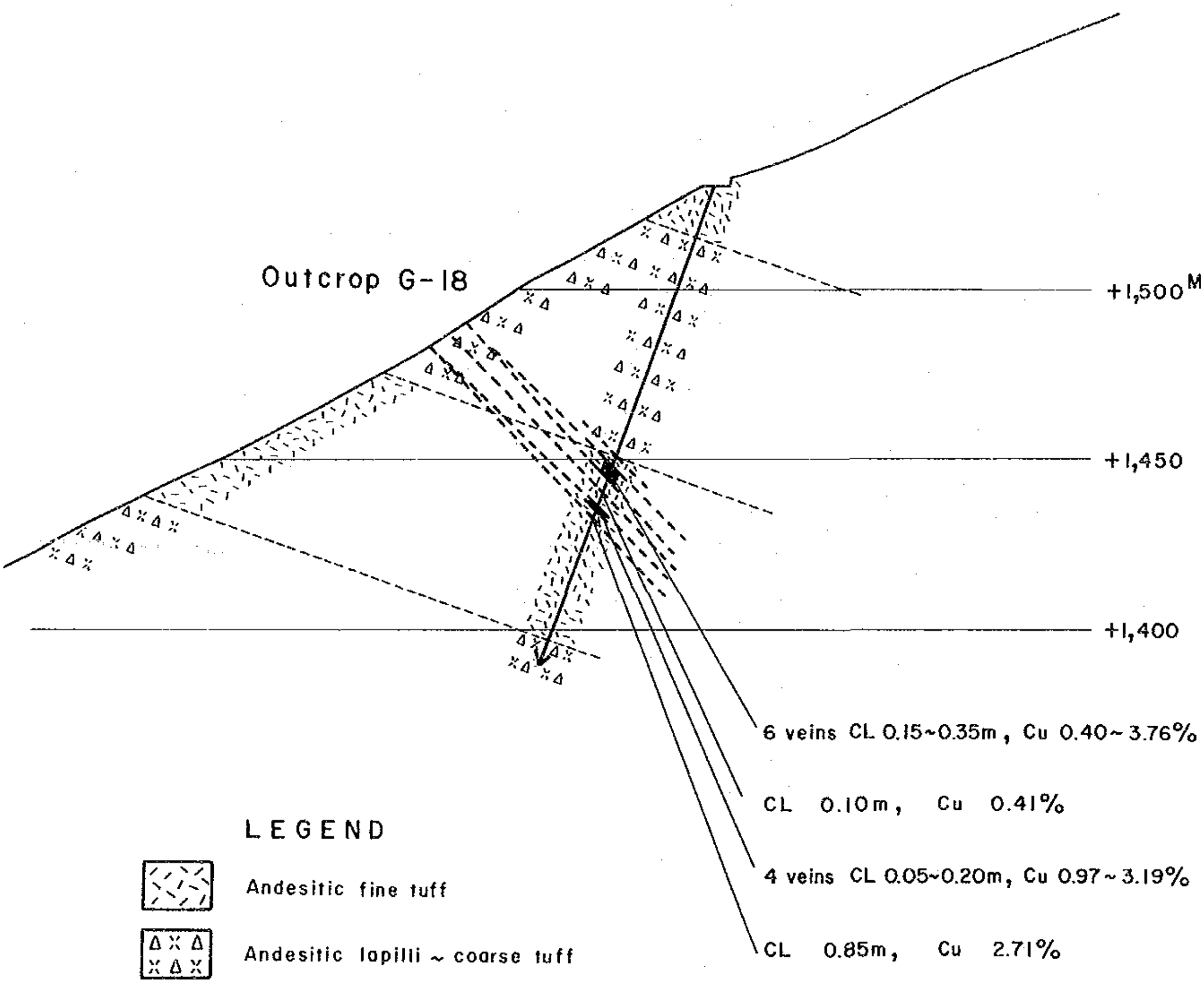



Fig. 29 Geological Section of Hole DJM-2

main parts of the intersections are as follows.

| Depth(m) | Core Length(m) | Au(g/T) | Ag(g/T) | Cu(%) | Pb(%) | Zn(%) |
|---|---|---|---|---|---|---|
| 87.50~ 87.65 | 0.15 | 0.2 | 30.3 | 3.76 | 0.02 | 0.02 |
| 88.65~ 88.80 | 0.15 | 0.1 | 20.1 | 2.65 | 0.02 | 0.01 |
| 89.45~ 89.60 | 0.15 | tr | 1.9 | 0.40 | 0.02 | 0.03 |
| 89.90~ 90.05 | 0.15 | 0.1 | 11.7 | 2.94 | 0.02 | 0.03 |
| 90.40~ 90.75 | 0.35 | 0.2 | 16.4 | 2.37 | 0.02 | 0.05 |
| 91.35~ 91.70 | 0.35 | 0.1 | 9.1 | 1.78 | 0.02 | 0.01 |
| 95.30~ 95.40 | 0.10 | tr | 1.7 | 0.41 | 0.03 | 0.01 |
| 99.60~ 99.80 | 0.20 | 0.2 | 12.0 | 1.97 | 0.02 | 0.02 |
| 100.80~100.85 | 0.05 | 0.3 | 23.2 | 3.19 | 0.01 | 0.02 |
| 101.20~101.30 | 0.10 | 0.1 | 7.9 | 1.38 | 0.02 | 0.05 |
| 101.50~101.70 | 0.20 | tr | 8.4 | 0.97 | 0.02 | 0.02 |
| 103.20~104.05 | 0.85 | 0.2 | 22.3 | 2.71 | 0.02 | 0.73 |

All the veins including the six veins within the range of 4.20 meters from the depth of 87.0 meters to 91.70 meters and those intersected up to 103.20 meters correspond to the downward extension of the outcrop G-18.

The distance between the outcrop and the intersections is about 60 meters. The size and grade of the ore in the drill hole are the same or more superior on the whole as compared with those of the outcrop. These veins are chalcopyrite-pyrite-quartz veins, and most of them are the single solid veins although network veins are found partly.

A number of epidote veins, epidote-quartz veins and quartz-calcite veins are present on the hanging wall side of the ore veins. The total number of the intersections of vein more than one centimeter wide was 18. No notable vein was found in the footwall side of the ore veins (in the part deeper than 104.05 m). The country rocks are andesitic lapilli tuff, course-grained to fine-grained tuff and tonalite. The fine-grained tuff is the essential one and the others contain accidental fragments of dacite. The sections such as 36 to 77 meter and 107 to 117 meter are epidotized.

Fig. 23 shows the location of the hole and Fig. 24 shows the geologic section.

## 4. Considerations

It was known from the data obtained from the drill hole DJM-2 that the outcrop G-18 continued to the lower part and that the parts of intersections were much the same in size and grade as the outcrop. Although these facts indicate that the veins would be swollen further in the depth, it is to be turned for the further exploration. The location of this hole is closer to the ridge of Mt. Loma Sito Grande than the holes such as DJM-1 and DJM-3. The superior grade and size of the ore veins as compared with the others suggest that these intersections are getting near the center of the mineralization. It is thought that the extent of oxidation is not deeper than 80 meters below the surface because no oxidation minerals could not be observed in the cores of the intersection.

### 2–3 Hole DJM-3

**1. Situation, Direction and Inclination of the Hole**

Situation: Longitude N2,087.66, Latitude 306.46, Altitude 1,370 m a.s.l.

Direction: S55°W

Inclination: –70°

Depth: 250.40 m

**2. Purpose**

The drilling was made to evaluate the lower extension of the outcrop G-17.

The outcrop G-17 is composed of a copper bearing quartz vein 0.2 to one meter wide and 15 meters long along the strike.

**3. Results of the Intersections**

The results of the main parts of the intersections are as follows.

| Depth(m) | Core length(m) | Au(g/T) | Ag(g/T) | Cu(%) | Pb(%) | Zn(%) |
|---|---|---|---|---|---|---|
| 65.80~ 66.85 | 0.05 | tr | 2.5 | 0.40 | 0.02 | 0.06 |
| 113.30~113.40 | 0.10 | tr | 1.1 | 0.29 | 0.01 | 0.01 |
| 139.15~139.20 | 0.05 | 0.1 | 4.3 | 0.93 | 0.02 | 0.01 |
| 156.85~156.88 | 0.03 | tr | 0.8 | 0.29 | 0.02 | 0.01 |
| 165.60~166.00 | 0.40 | tr | tr | 0.07 | 0.02 | 0.02 |
| 183.15~183.40 | 0.25 | 0.1 | 3.7 | 0.75 | 0.02 | 0.01 |
| 192.30~192.80 | 0.50 | tr | 1.4 | 0.17 | 0.04 | 0.05 |
| 193.70~194.50 | 0.80 | tr | 2.2 | 0.41 | 0.02 | 0.03 |
| 197.70~197.75 | 0.05 | tr | tr | 0.23 | 0.02 | 0.01 |
| 228.45~228.50 | 0.05 | tr | tr | 0.16 | 0.04 | 2.09 |

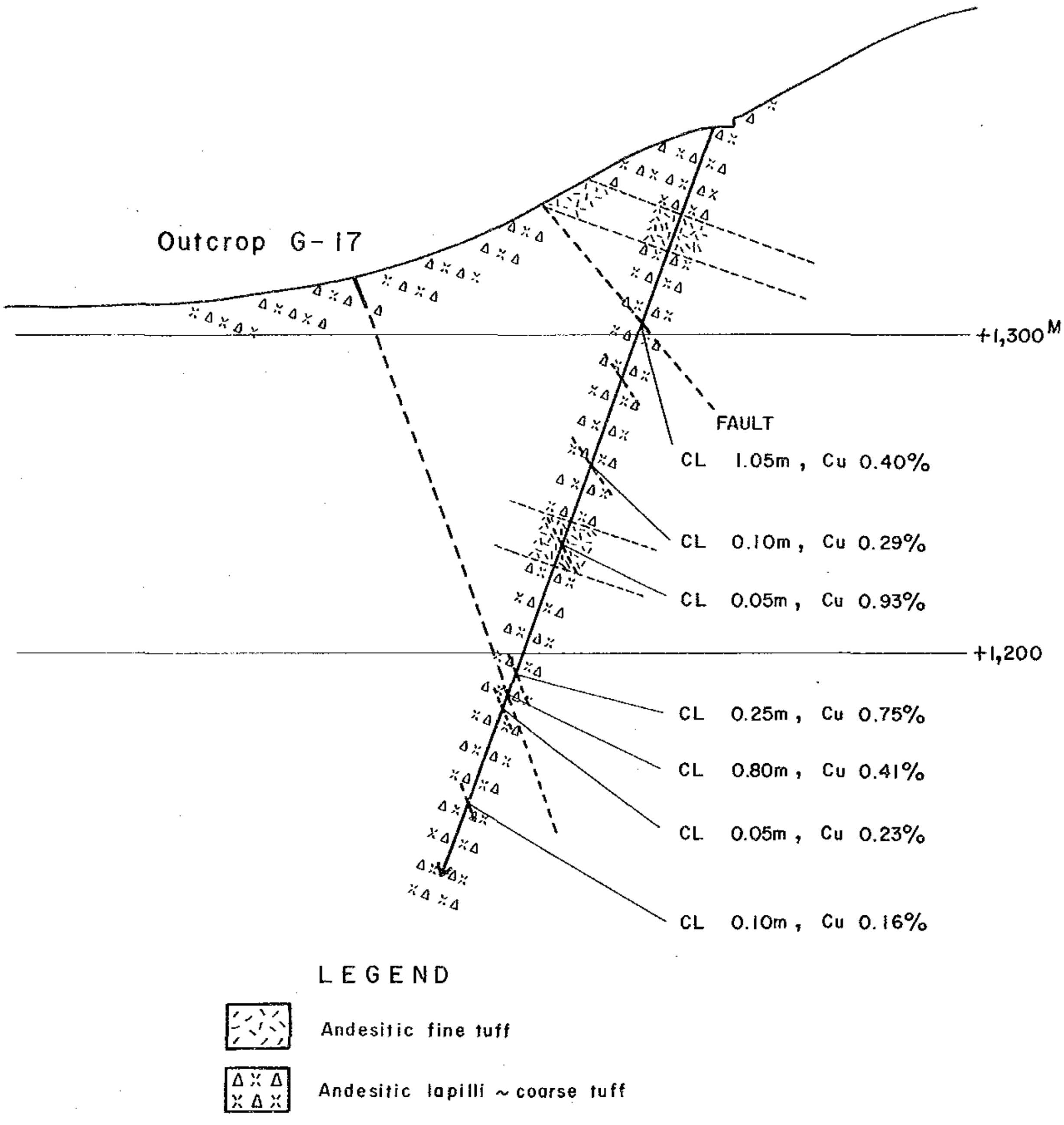



Fig. 30 Geological Section of Hole DJM-3

These are the single solid veins or network veins with mineral assemblage of chalcopyrite-pyrite-hematite-quartz-(epidote)-(calcite). The vein at the depth of 228.45 meters contains sphalerite, and is a little peculiar. Pyrite is commonly found in the veins at this area, although it is rarely found in the veins in the El Gramoso area.

Beside these, 26 veins including the single veins and network veins of pyrite-quartz veins, quartz-epidote veins and quartz-calcite veins were encountered in the hole. No control of the emplacement of the veins by the rocks is recognized.

The country rocks include andesitic lapilli tuff and course to fine-grained tuff. Although fine-grained tuff is essential tuff, the others contain a small amount of accidental fragments of dacite. Epidotization and silicification are the common alteration of the country rocks.

Fig. 27 shows the location and Fig. 30 shows the geological section.

**4. Considerations**

It was known from the data of the hole DJM-3 that the lower part of the outcrop G-17 forms the zone occurred by a number of small veins including the veins consisting of only gangue minerals, that pyrite is commonly present, that sphalerite is found in a part of the veins and that these veins are difficult to be operated economically because of low grade of ore.

These facts indicate that the fractures to have been the passage of hydrothermal solution were present at the initial stage of mineralization, and that the main minerals crystallized in the fracture were gangue minerals, and the ore minerals were small in amount. The fact that sphalerite is found in a part of the veins suggests that this part is located in the outer zone of the El Gramoso mineralized zone.

## 2–4 Hole DJM-4

**1. Situation, Direction and Inclination of the Hole**

Situation: Longitude N2,088.29, Latitude E305.14, Altitude 990 m a.s.l.

Direction: S50°W, Inclination: −70°, Depth: 150.40 m

**2. Purpose**

The drilling was made to evaluate the lower part of the outcrop G-12.

The outcrop G-12, the largest one found in the El Gramoso area, has lateral length of 180 meters. The shoot is 70 meters long and 1.50 meters wide and shows the average values such as 0.3 g/T Au, 17 g/T Ag and 3.2 % Cu.

### 3. Results of the Intersections

Although the assay results are shown in Table 4, the main intersections are as follows.

| Depth(m) | Core length(m) | Au(g/T) | Ag(g/T) | Cu(%) | Pb(%) | Zn(%) |
|---|---|---|---|---|---|---|
| 52.45~52.60 | 0.15 | 0.1 | 1.4 | 0.74 | 0.02 | 0.02 |
| 60.20~60.45 | 0.25 | 0.4 | 22.5 | 5.71 | 0.04 | 0.26 |

The vein which was the main target could not be intersected because the hole passed through the fault zone encountered at the depth from 90.70 meters to 92.00 meters, which displaced the vein. The vein intersected is chalcopyrite-pyrite-(sphalerite)-quartz-epidote vein.

Quartz–epidote veins, quartz-calcite veins and hematite-quartz-(calcite)-(epidote) veins are present in abundant at the depth between 40 meters and 120 meters. The number of veins more than one centimeter wide are 18. The country rocks include andesitic lapilli tuff and fine to course-grained tuff. The dominant alteration of the country rocks is chloritization. Strong hematitization is observed at the depth between 112 meters and 118 meters. Fig. 27 shows the situation and Fig. 31 the geological section.

### 4. Considerations

The position on the surface of the fault encountered in the hole DJM-4 corresponds to that found on the halfway between the outcrop G-12 and the drill site, and it is likely that the northern extension of the G-12 vein was displaced toward the west to continue to the small outcrops scattered on the slope of the northern ridge.

Because the ore minerals observed at the intersections mentioned in the above consist of chalcopyrite and pyrite and no oxide minerals are found, the extent of oxidation below the surface seems to be shallower than 50 meters.

## 2–5 Hole DJM-5

### 1. Situation, Direction and Inclination of the Hole

Situation: Longitude N2,087.78, Latitude E306.85, Altitude 1,585 m a.s.l.

Direction: S60°W, Inclination: –85°, Depth: 201 m

### 2. Purpose

The drilling was made to evaluate the downward extension of the outcrop G-21 discovered in the survey of this phase.

The vein of the outcrop G-21 is 1.70 meters wide in average and 35 meters long along the strike. The average assay values are 0.2 g/T Au, 28 g/T Ag and 4.7 % Cu.

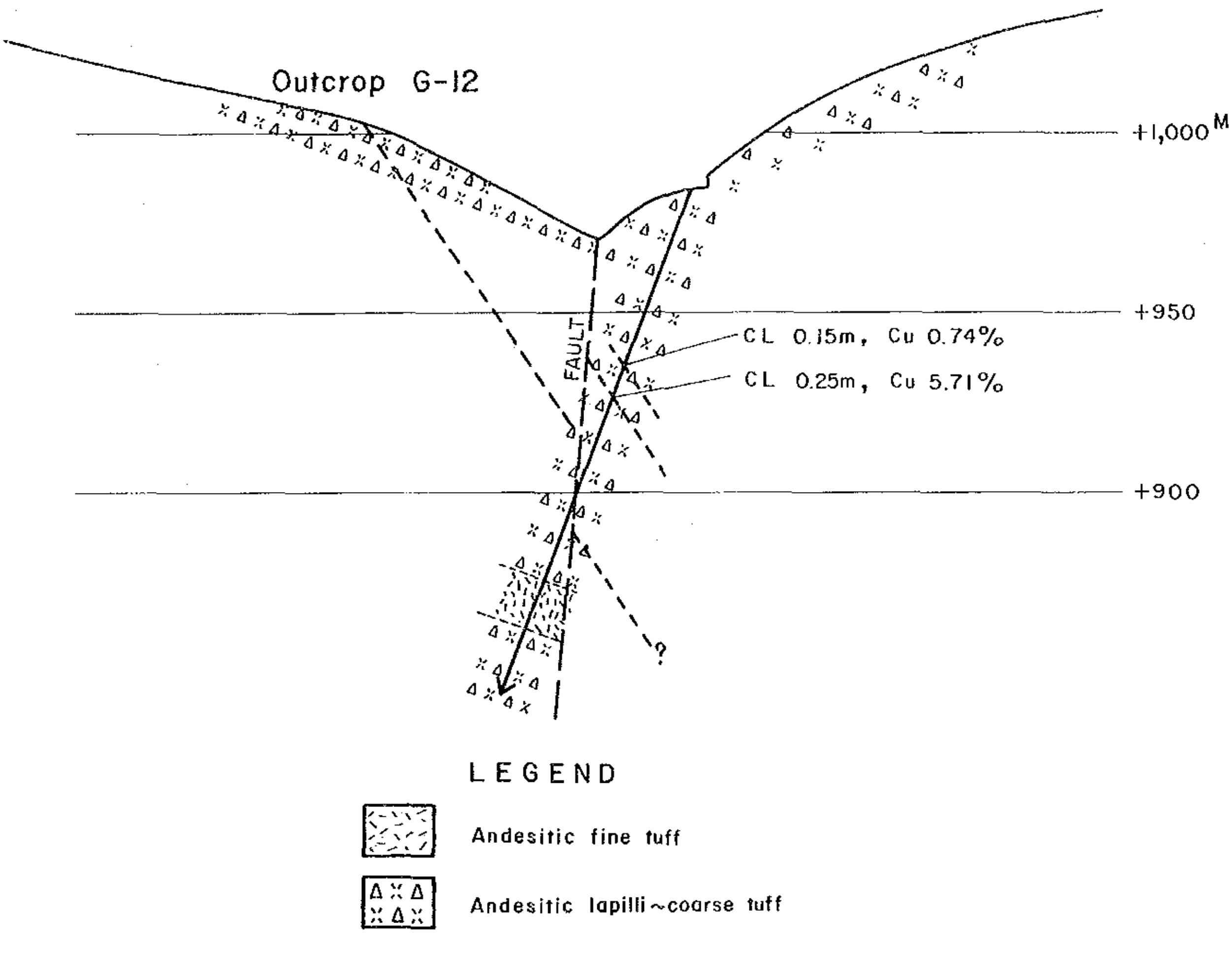



Fig. 31 Geological Section of Hole DJM-4

### 3. Results of Intersections

The assay result of the main intersections are as follows.

| Depth(m) | Core length(m) | Au(g/T) | Ag(g/T) | Cu(%) | Pb(%) | Zn(%) |
|---|---|---|---|---|---|---|
| 40.50~45.70 | 5.20 | 0.3 | 13.1 | 3.43 | 0.02 | 0.03 |
| 47.80~48.20 | 0.40 | 0.2 | 7.8 | 1.03 | 0.02 | 0.02 |
| 58.60~61.00 | 2.40 | tr | 1.3 | 0.43 | 0.02 | 0.03 |
| 61.50~61.90 | 0.40 | 0.6 | 25.8 | 5.41 | 0.10 | 0.05 |
| 71.40~71.60 | 0.20 | 0.1 | 2.0 | 0.92 | 0.02 | 0.01 |
| 72.20~73.00 | 0.80 | tr | 1.1 | 0.36 | 0.02 | 0.02 |

The veins found up to the depth of 61.50 meters are malachite-chalcopyrite-chalcocite-pyrite-limonite-quartz network veins and those further in the deeper part are chalcopyrite-pyrite-quartz-epidote veins.

The surrounding part of the former veins is strongly silicified (metasomatic type) for a wide extent. Epidote is conspicuous in the latter veins. The vein intersected at the depth of 40.50 meters corresponds to the lower extension of the outcrop G-21. This vein was positioned in this part as the result of displacement by the normal fault encountered at the depth of 37.35 meters to 38.80 meters (Fig. 30). The ore veins are present in the range of the depth from 40 to 150 meters, and a few small veins consisting of quartz and calcite are found in the deeper part beyond the aboves. The country rocks include andesitic lapilli tuff, course to fine-grained tuff and decite.

Fig. 27 shows the situation and Fig. 32 the geological section.

### 4. Considerations

On the basis of the data obtained from the hole DJM-5, it was shown that the size and grade of the veins about 50 meters below the outcrop G-21 were much the same as those of the outcrop and that the rocks were extensively silicified.

The ore veins are stable in size and grade as compared with the results of other holes and the silicified zone of metasomatic type has been extensively formed.

These facts suggest that this part is relatively close to the center of mineralized zone.

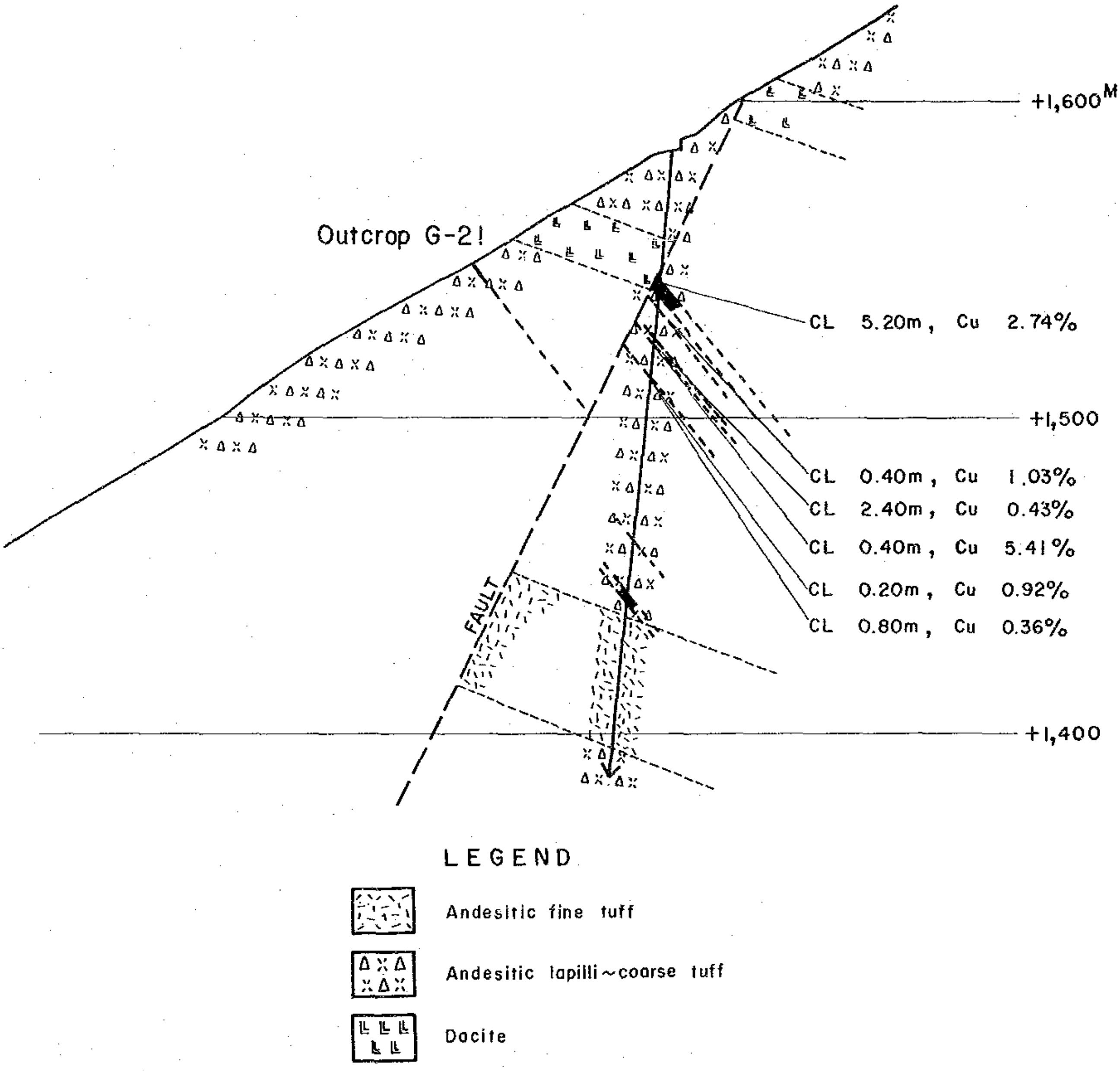



Fig. 32 Geological Section of Hole DJM-5

# VI. CONCLUSION AND RECOMMENDATION

# CHAPTER 1 CONCLUSION

The project, "Collaborative Mineral Exploration in the Las Canitas area" in the Dominican Republic was conducted for the purpose of making clear the actual state of the geology and ore deposit, selecting the promising areas for occurrence of ore deposit and evaluating the possibility of development of the ore deposit, and geological, geochemical geophysical and drilling surveys were carried out. The conclusions obtained as the result of these surveys is as follows.

1. The pre-Cretaceous Duarte formation and the Cretaceous Tireo formation, the ore bearing horizons, were further subdivided into members, such as the former into two members and the latter into three members on the basis of the characteristics of igneous activity, and it was clarified that the mineralized zones most predominate in the Tireo formation.

2. The tonalite masses are divided into batholiths and stocks (or dykes), and the absolute time measured led to an assumption of the time of intrusion to be in middle Cretaceous for the former and early Palaeocene for the latter. The mineralized zones are distributed in and around the stocks (or dykes), and the igneous activity and mineralization seem to be in close association.

3. The mineralization of the area took place between Palaeocene and Oligocene associated with tectonic movement and igneous activity in the later stage of the Laramide Orogeny, and includes the three types such as vein-type, porphyry copper-type and pyrite dissemination-type.

These mineralized zones are distributed in association with the tonalite intrusive masses and/or the tectonic lines of NW-SE system.

4. The vein-type mineralized zones include two types of ore mineral assemblages such as copper dominant type found at El Gramoso, Sabana and Mata Grande, and copper, lead and zinc type in the south of the Constanza.

(1) The 51 copper bearing vein-type mineralized zones confirmed at El Gramoso are included in the mineralized zone centering on the top of Mt. Loma Sito Grande, which are distributed in a form to extend northwesterly showing the relation with the tonalite intrusive masses.

Two holes out of five drilled in the area encountered the veins which were much the same quantity as the outcrops.

(2) The copper vein-type mineralized zone at Sabana extends northwesterly, which is the one related to the NW-SE tectonic line.

(3) The Mata Grande copper vein deposit is composed of three veins arranged in echelon in the direction of northwest, and the mineralized zone are scattered northwesterly for about 1.2 kilometers. The result of geochemical survey shows that copper anomalies extend for about 3 kilometers northwestward.

(4) The mineralized zones of copper, lead and zinc vein and the copper vein are distributed surrounding the tonalite intrusive masses, and it seems that the mineralization has the relation with the igneous activity.

(5) The porphyry copper mineralized zone in the Pico Duarte area is emplaced in granodiorite. The stretch of the mineralized zone near the surface is estimated to be as wide as 500 m x 500 m taking the result of geochemical survey into account, and the dimension in subsurface is presumed based on the result of geoelectrical survey by SIP method that the mineralized zone having an extent of 300 m x 300 m continues downward to the depth of 150 meters.

(6) The mineralized zones of pyrite dissemination are emplaced in the Duarte and Tireo formations, and many of them are distributed with relationship with tonalite intrusive masses.

# CHAPTER 2 RECOMMENDATION

The following surveys are recommended based on the result of survey conducted for three years.

**1. The Northern Slope Area of Mt. Loma Sito Grande:**

The area corresponds to the northern half of the copper vein-type mineralized zone centering on the top of Mt. Loma Sito Grande. The southern half, the zone centering on the El Gramoso settlement, was investigated, and the actual condition of the mineralized zone has been illuminated. However, the whole aspect of the northern half of the mineralized zone has not yet been made clear.

It is desired that geological and geochemical surveys be conducted in order to make clear the occurrence of the mineralized zone of the area.

**2. Mata Grande Area :**

As the result of the survey, it became clear that the Mata Grande deposit is composed of three veins arranged in echelon in the northwestern direction and that the mineralized zones are scattered trending northwesterly for about 1.2 kilometers.

Although the occurrence of the veins on the surface was grasped, the subsurface conditions have not yet been clarified.

Therefore, it is desired that drill survey be conducted in the area centering on the mine to make clear the downward extension of the veins and to evaluate those veins.

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# APPENDICES

# Table A-1 List of Main Mineralized Zones in the Survey Area

(1)

| Ser. No. | | Name and/or Number of Mineralized Zone | Kind of Ore | Type | Location | Host Rock | Structure and Scale of Mineralized Zone | | | Grade | | | | | Description of Samples | Ore Minerals | Sample No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Strike and Dip | Lateral Extension | Average Width | Au (g/T) | Ag (g/T) | Cu (%) | Pb (%) | Zn (%) | | | |
| 1 | Constanza Area | El Gramoso (G–1) | Cu | Vein | El Gramoso | Andesitic lap. tuff (Tmat) | N50°~70°W | 0.5 m | 0.5 m | 0.90 | 17.7 | 4.18 | 0.15 | 0.02 | Sampling width: 0.50 m | Bo, Mal, Spc | SK076 |
| 2 | | do. (G–2) | do. | do. | do. | do. | N70°E 55°N | 4 | 0.1~0.3 | 0.20 | 5.9 | 1.89 | 0.91 | 0.02 | Sampling width: 0.20 m | Mal, Cp, Cv, Py, Lm | SK079 |
| | | | | | | | N70°W 50°N | 1 | 0.1 | 0.20 | 6.5 | 2.65 | 0.12 | 0.04 | Sampling width: 0.10 m | Mal, Cp, Bo, Lm | SK080 |
| 3 | | do. (G–3) | do. | do. | do. | Andesite(Tma) | N70°E 65°N | 1.5 | 0.3 | 0.10 | 2.8 | 0.99 | 0.05 | 0.10 | Sampling width: 0.30 m | Mal, Cp, Lm | SK081 |
| | | | | | | Andesitic lap. tuff (Tmat) | N80°E | 3.5 | 0.3~0.4 | 0.33 | 16.5 | 6.15 | 0.14 | 0.10 | Sampling width: 0.40 m | Mal, Cp, Cc, Cv, Lm | SK082 |
| 4 | | do. (G–4) | do. | do. | do. | Andesitic tuff (Tmat) | N70°W 70°N | | 0.5 | 0.22 | 9.7 | 1.90 | 0.07 | 0.02 | Sampling width: 0.50 m | do. | SY005 |
| 5 | | do. (G–5) | do. | do. | do. | Andesitic lap. tuff | NW | 1.3 | 0.5 | 1.00 | 43.1 | 29.83 | 0.12 | 0.06 | Sampling width: 0.50 m | Mal, Cc, Lm | SK084 |
| | | | | | | Shale (Tms) | N10°W 50°N | 3.5 | 1.5 | 0.10 | 3.9 | 1.97 | 0.07 | 0.02 | Sampling width: 0.10 m | Mal, Cp, Bo, Cc, Lm | SK086 |
| 6 | | do. (G–6) | do. | do. | do. | Andesitic lap. tuff (Tmat) | N20°W | 20 | 3 | tr. | 1.7 | 0.68 | 0.08 | 0.02 | Sampling width: 3.00 m | Mal, Cp, Bo, Spc, Lm | SK072 |
| 7 | | do. (G–9) | do. | do. | do. | do. | N50°W | 0.3 | 0.1 | 0.33 | 8.1 | 7.56 | 0.27 | 0.10 | Sampling width: 0.10 m | Mal, Cp, Bo, Cc, Lm | SK057 |
| 8 | | do. (G–12) | do. | do. | do. | do. | N50°W 50°N | 70 | 1.5 | tr. | 2.5 | 0.97 | 0.07 | 0.04 | Sampling width: 0.90 m | Mal, Cp, Bo, Cc, Lm | SK060 |
| | | | | | | | | | | 0.50 | 16.3 | 2.01 | 0.08 | 0.04 | Sampling width: 0.40 m | do. | SK061 |
| | | | | | | | | | | 0.50 | 9.8 | 1.38 | 0.04 | 0.02 | Sampling width: 0.30 m | do. | SK063 |
| | | | | | | | | | | 0.33 | 24.5 | 5.43 | 0.12 | 0.10 | Sampling width: 1.00 m | do. | SK064 |
| | | | | | | | | | | 0.30 | 24.3 | 3.97 | 0.09 | 0.02 | Sampling width: 0.80 m | do. | SK065 |
| | | | | | | | | | | 0.40 | 28.6 | 4.33 | 0.16 | 0.06 | Sampling width: 1.20 m | do. | SK066 |
| | | | | | | | | | | 0.40 | 15.3 | 4.43 | 0.09 | 0.05 | Sampling width: 0.70 m | do. | SK067 |
| 9 | | do. (G–17) | do. | do. | do. | do. | N30°W,50°N | 3 | 0.1~0.3 | 0.10 | 2.8 | 1.73 | 0.08 | 0.04 | Sampling width: 0.30 m | Mal, Cp, Bo, Cc, Spc, Lm | ST001 |
| | | | | | | | N25°W,60°N | 10 | 2 | 0.20 | 25.4 | 2.63 | 0.08 | 0.02 | Sampling width: 1.00 m | do. | ST008 |
| | | | | | | | N30°W | 5 | 1.5 | 0.20 | 4.8 | 0.44 | 0.17 | 0.40 | Sampling width: 1.50 m | do. | ST007 |
| 10 | | do. (G–18) | do. | do. | do. | do. | N50°W,30°N | 3 | 2 | tr. | 2.1 | 0.17 | 0.07 | 0.02 | Sampling width: 0.50 m | Mal, Cp, Lm | ST010 |
| | | | | | | | N30°W,60°N | 2 | 1.5 | tr. | 2.5 | 2.39 | 0.07 | 0.02 | Sampling width: 0.50 m | do. | ST011 |
| | | | | | | | N30°W,60°N | 5 | 0.5 | 0.20 | 14.9 | 2.83 | 0.02 | 0.04 | Sampling width: 0.70 m | do. | ST012 |
| 11 | | do. (G–19) | do. | do. | do. | | | 3 | 1 | 1.50 | 123.4 | 11.72 | 0.12 | 0.02 | Sampling width: 1.00 m | Mal, Cp, Cc, Lm | SK104 |
| | | | | | | | N25°W,40°N | 8 | 1~1.5 | 0.30 | 82.6 | 7.04 | 0.12 | 0.02 | Sampling width: 0.70 m | do. | SK106 |
| 12 | | do. (G–21) | do. | do. | do. | do. | N70°W,60°N | 35 | 1~2.5 | tr. | tr. | 14.41 | 0.16 | 0.01 | Sampling width: 1.50 m | Mal, Cp, Cc, Lm | GK085 |
| | | | | | | | | | | 0.10 | 2.8 | 2.16 | 0.17 | 0.01 | Sampling width: 1.00 m | do. | GK086 |
| | | | | | | | | | | 0.10 | 4.3 | 1.73 | 0.15 | 0.02 | Sampling width: 2.00 m | do. | GK087 |
| | | | | | | | | | | 0.10 | 4.9 | 0.36 | 0.09 | 0.01 | Sampling width: 1.40 m | do. | GK088 |
| | | | | | | | | | | 0.30 | 117.9 | 6.03 | 0.20 | 0.21 | Sampling width: 2.50 m | do. | GK089 |
| | | | | | | | | | | 0.50 | 40.6 | 40.3 | 0.22 | 0.05 | Sampling width: 2.00 m | do. | GK090 |
| 13 | | Hato de Los Rodriguez (H–1) | do. | do. | Hato de Los Rodriguez | do. | N25°W,35°N | 32 | 0.7 | 0.20 | 11.8 | 2.10 | 0.14 | 0.04 | Sampling width: 0.70 m | Mal, Cp, Bo, Cc, Lm | SK034 |
| 14 | | do. (H–4) | do. | do. | do. | do. | N30°W,40°N | 2.5 | 0.25 | 0.20 | 13.0 | 2.61 | 0.02 | 0.04 | Sampling width: 0.25 m | Mal, Cp, Bo, Cc, Lm | SK039 |
| 15 | | do. (H–5) | do. | do. | do. | do. | N20°W | 12 | 1.10 | tr. | 1.3 | 1.53 | 0.03 | 0.10 | Sampling width: 1.10 m | Mal, Cp, Bo, Cc, Lm | SK046 |
| | | | | | | | | | 2.70 | 0.10 | 1.4 | 1.23 | 0.15 | 0.15 | Sampling width: 2.70 m | do. | SK047 |

| Ser. No. | | Name and/or Number of Mineralized Zone | Kind of Ore | Type | Location | Host Rock | Structure and Scale of Mineralized Zone | | | Grade | | | | | Description of Samples | Ore Minerals | Sample No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Strike and Dip | Lateral Extension | Average Width | Au (g/T) | Ag (g/T) | Cu (%) | Pb (%) | Zn (%) | | | |
| 16 | Constanza Area | Hato de Los Rodriguez (H-6) | Cu | Vein | Hato de Los Rodriguez | Andesitic lap. tuff (Tmat) | N45°W | 3 | 0.5 | 1.10 | 11.7 | 2.64 | 0.09 | 0.05 | Sampling width: 0.50 m | Mal, Bo, Cc, Lm | SK027 |
| 17 | | Limoncito (C-4) | do. | do. | Limoncito | do. | N20°W | 100 | 3 | tr. | 7.1 | 1.85 | 0.02 | 1.10 | Sampling width: 2.00 m | Mal, Cp, Py, Lm | CT002 |
| 18 | | Los Vallecitos(V-2) | do. | do. | Los Vallecitos | do. | N5°E,65°N | 5 | 1.5 | 0.33 | 21.0 | 4.77 | 0.16 | 0.10 | Sampling width: 0.04 m | Mal, Cp, Bo, Cc, Lm | SY023-1 |
| 19 | | do. (V-4) | do. | do. | do. | do. | N25°W,60°S | 15 | 0.5 | 1.50 | 193.7 | 18.31 | 0.16 | 0.20 | Sampling width: 0.25 m | Mal, Cp, Bo, Py, Spc, Lm | SY024-3 |
| 20 | | Cana de Gallo(S-6) | do. | do. | North of Sabana | do. | | 1.2 | 0.8 | tr. | tr. | 9.36 | 0.22 | 0.04 | Sampling width: 0.40 m | Mal, Spc, Lm | SK04 |
| 21 | | Sabana (S-1) | do. | do. | Sabana | do. | N40°E, 20°N | 8m | 1.50m | 0.1 | 0.7 | 2.15 | 0.03 | 0.02 | High grade ore from Pit No.1 | Mal, Cc, Bo, Spc, Lm | LK046 |
| | | | | | | | | 10m | 7~8m | tr. | tr. | 3.02 | 0.03 | 0.02 | High grade ore from Pit No.7 | do. | LK050 |
| | | | | | | | | | | tr. | tr. | 0.93 | 0.04 | 0.05 | Ore from Pit No.7 | do. | LK052 |
| 22 | | Sabana North New Orebody (S-2) | do. | do. | do. | do. | N50°E, 20°N | 16m | 2.5m | 0.5 | 8.9 | 2.35 | 0.06 | 0.02 | Sampling width: 4.0m | Mal, Cc, Bo, Cv, Cp, Py, Spc, Lm | LH064-2 |
| | | | | | | | | | | 0.5 | 15.2 | 2.86 | 0.04 | 0.02 | Sampling width: 2.8m | do. | LH064-2 |
| | | | | | | | | | | 4.3 | 12.1 | 4.00 | 0.02 | 0.02 | Ore | do. | LK043 |
| 23 | | Roblito (S-3) | do. | do. | Ary. Fortuna | do. | N30°E, 40°S<br>N50°W, 40°N<br>N80°E, 75°N | +3m | 0.35m | 0.3 | 2.8 | 2.84 | 0.04 | 0.02 | Mineralized zone from Pit No.3 Sampling width: 0.35m | Mal, Py, Spc, Lm | LH057 |
| 24 | | Fortuna (S-4) | do. | do. | do. | do. | N60°E, 65°N | +3m | 1.10 m | tr. | tr. | 1.41 | 0.05 | 0.05 | Mineralized zone from Pit No.1 Sampling width: 1.10 m | Mal, Spc, Lm | LH039 |
| | | | | | | | | +5m | 0.50m | 0.2 | 2.3 | 3.96 | 0.08 | 0.05 | Mineralized zone from Pit No.3 Sampling width: 0.50m | do. | LH042 |
| 25 | | Pinar Bonito (C-1) | Cu-Pb-Zn | do. | South of Constanza | Andesitic lap. tuff | N60°E, 60°N | 10m | 1.50m | 0.3 | 7,9 | 0.97 | 5.62 | 0.05 | A vein in the mineralized zone, Vein width: 0.10m | Cp, Gl, Sph, Mal, Cv, Py, Spc | LH027 |
| | | | | | | | N20°W, 60°N | +2m | 0.10m | 0.2 | 2.1 | 0.96 | 0.90 | 2.26 | Vein width: 0.10m | do. | LH023 |
| 26 | | C-2 | do. | do. | do. | do. | N65°E, 20°N | several m | 0.60m | 0.1 | 0.7 | 0.18 | 0.07 | 1.14 | Vein width: 0.60m | Mal, Cp, Sph, Py, Spc | LT012 |
| | | | | | | | N65°E, 50°N | do. | 0.10m | 0.3 | 3.9 | 1.57 | 0.06 | 0.05 | Vein width: 0.10m | do. | LT014 |
| 27 | | Limoncito (C-3) | Cu | do. | S.W. of Constanza | do. | | 200m | 80m | 0.2 | 3.4 | 0.96 | 0.05 | 0.02 | Ore | Mal, Cv, Spc, Lm | LH012 |
| | | | | | | | | | | 0.2 | 2.3 | 2.98 | 0.08 | 0.02 | Ore | do. | LH016 |
| 28 | | C-4 | do. | do. | do. | Andesite | N50°E, 50°N | several m | 5m | 0.4 | 5.3 | 2.63 | 0.02 | 5.70 | Ore | Mal, Cp, Sph, Py, Lm | LH025 |
| 29 | | C-5 | Py | Disse-mination | do. | Dacitic lap. tuff | | 2km | (Thickness) (1~several m) | tr | tr. | 0.06 | 0.03 | 0.05 | Ore | Py | LA042 |
| 30 | Pio Duarte Area | Pico Duarte (P-1) | Cu | Por-phyry Copper | Pico Duarte | Granodiorite(Gd) | | 150m | 30m | 0.67 | 11.6 | 1.52 | | tr. | Ore | Cp, Bo, Cc, Mal, Lm | PK009 |
| | | | | | | | | | | 0.50 | 11.2 | 0.97 | | tr. | do. | do. | PM055 |
| | | | | | | | | | | 0.40 | 7.1 | 0.61 | | tr. | do. | do. | PM056 |
| 31 | Mata Grande Area | Mata Grande(M-3) | do. | Vein | Mata Grande | Green schist(Dubt) | N40°W | 0.5 | 0.5 | 0.30 | 8.9 | 1.37 | | | Sampling width: 0.50m | Mal, Cp, Bo, Cc, Az, Lm | MK015 |
| | | | | | | | N10°W, 80°S | 6 | 1.50 | 0.50 | 4.7 | 4.47 | | | Sampling width: 1.50m | do. | MK016 |
| | | | | | | | N50°W, 90° | 1.5 | 0.4 | 0.25 | 0.8 | 0.88 | | | Sampling width: 0.40m | do. | MK017 |
| | | | | | | | N50°W, 90° | 0.5 | 0.5 | 0.20 | 2.5 | 1.71 | | | Sampling width: 0.50m | do. | MK018 |
| 32 | Others | Tasajera (T-1) | do. | do. | Ary, Limon | And., andesitic lap. tuff | | +1m | | 0.2 | 2.3 | 4.36 | 0.05 | 0.02 | High grade ore from trench No.1 | Mal, Cc, Cv, Spc, Lm | LH060 |
| 33 | | T-2 | do. | do. | do. | do. | N50°W, 20°N | +1m | 0.15m | tr. | tr. | 4.21 | 0.23 | 0.20 | Ore | Mal, Cc, Cv, Cp, Bo, Spc, Lm | LK040 |

Abbreviation Py : Pyrite, Spc : Specularite, Cp : Chalcopyrite, Lm : Limonite, Bo : Bornite, Q : Quartz, Cc : Chalcocite, Ep : Epidote, Cv : Covelline, v : Vein, Mal : Malachite

Pico Duarte Area