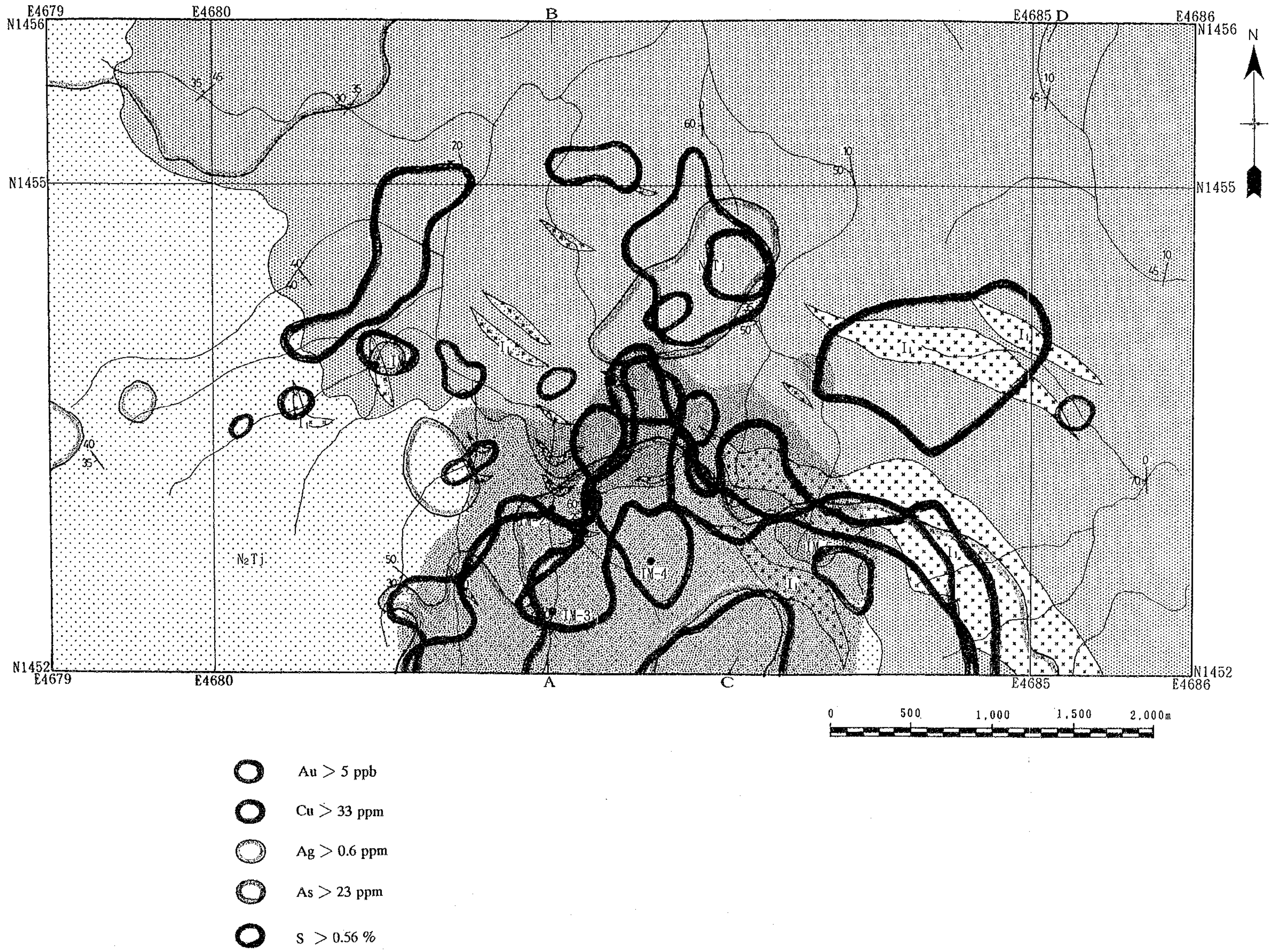
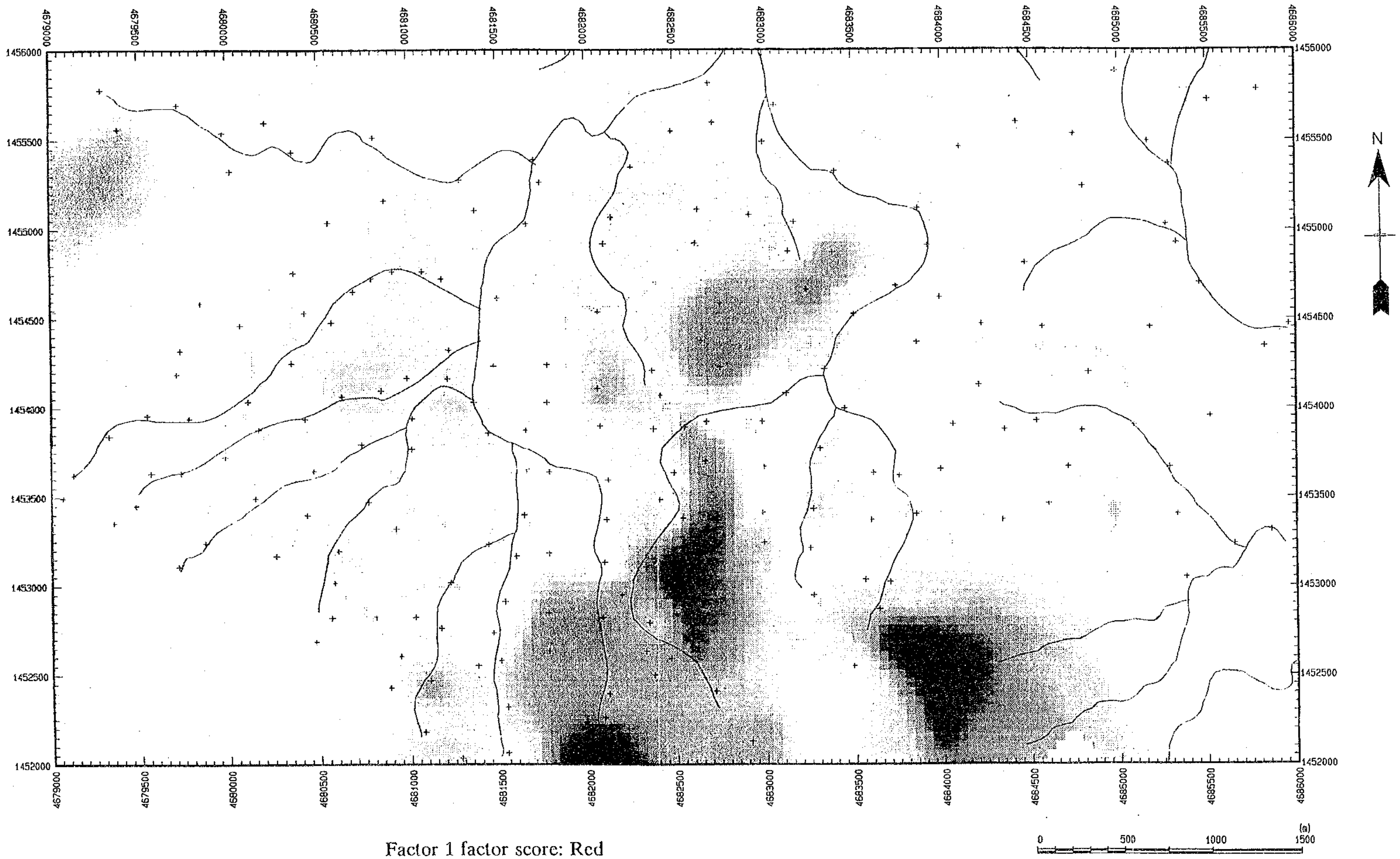


Fig. II-3-5 Distribution of geochemical anomalous zone in S. Imbak Sub-area North



Factor 1 factor score: Red

Factor 2 factor score: Blue

Factor 5 factor score: Yellow

Fig. II -3-6 Distribution of high factor scores in S. Imbak Sub-area North

silicification/pyrite dissemination, while high Factor 5 zone occurs at the eastern edge of the silicification/pyrite dissemination zone where Pb, Zn rich quartz sulfide veins occur. The high Factor 1 factor score is considered to be the area of high potential for Au-Ag mineralization. The negative relation of Ca, Mg, Na and Sr with Ag, As, Au suggest the removal of these element through the mineralization of Au and Ag. Distribution of high Factor 5 factor score in the eastern edge of silicification/pyrite dissemination zone support the theory that Pb-Zn mineralization exists in the area in addition to Ag and Au mineralization.

(2) Alteration

To understand the characteristic feature of the alteration related to the mineralization of the area, X-ray diffraction analysis was conducted for 18 samples collected from mineral showing and alteration zone and, together with these, 51 randomly selected samples from the rock geochemical survey were examined by X-ray.

Based on three key minerals characterizing the alteration of the area, Se/Mo, chlorite and appearance of sericite of more than trace amount, results of X-ray diffraction analysis are shown on Fig. II-3-7. As shown in the figure, three zones of alteration minerals are identified in a concentric distribution surrounding the silicification/pyrite dissemination zone at the center. Se/Mo occurs in the outer margin, mainly in the northwestern part of the area and chlorite occur in the middle, near the outer margin of the silicification/pyrite dissemination zone. The samples with sericite greater than trace amount occur only in side the silicification/pyrite dissemination zone. These three zones are considered to be indicators of the intensity of alteration. The alteration increases toward the silicification/pyrite dissemination zone.

3-3 Geophysical survey

The purpose of the survey is to clarify the relation of the IP results with the existing mineralization and geochemical anomalies for investigating the possible occurrences of mineralization underground. An investigation of the electrical structure of the survey area was carried out by clarifying the distribution of IP anomalies in the survey area obtained by time domain IP method.

The IP survey in the S. Imbak Sub-area North was conducted in Phase I and Phase II. The Phase I survey resulted in the finding of clear IP anomaly near the south end of the lines led to the further IP survey in the area immediately south of the Phase I survey to trace the IP anomaly further south.

The results of the Phase I and II surveys were combined together and given below.

3-3-1 Survey method

The measurements were done by using the time domain IP method adopting a dipole-dipole electrode configuration with a separation factor "n" from 1 to 4. Based upon the geological structure,

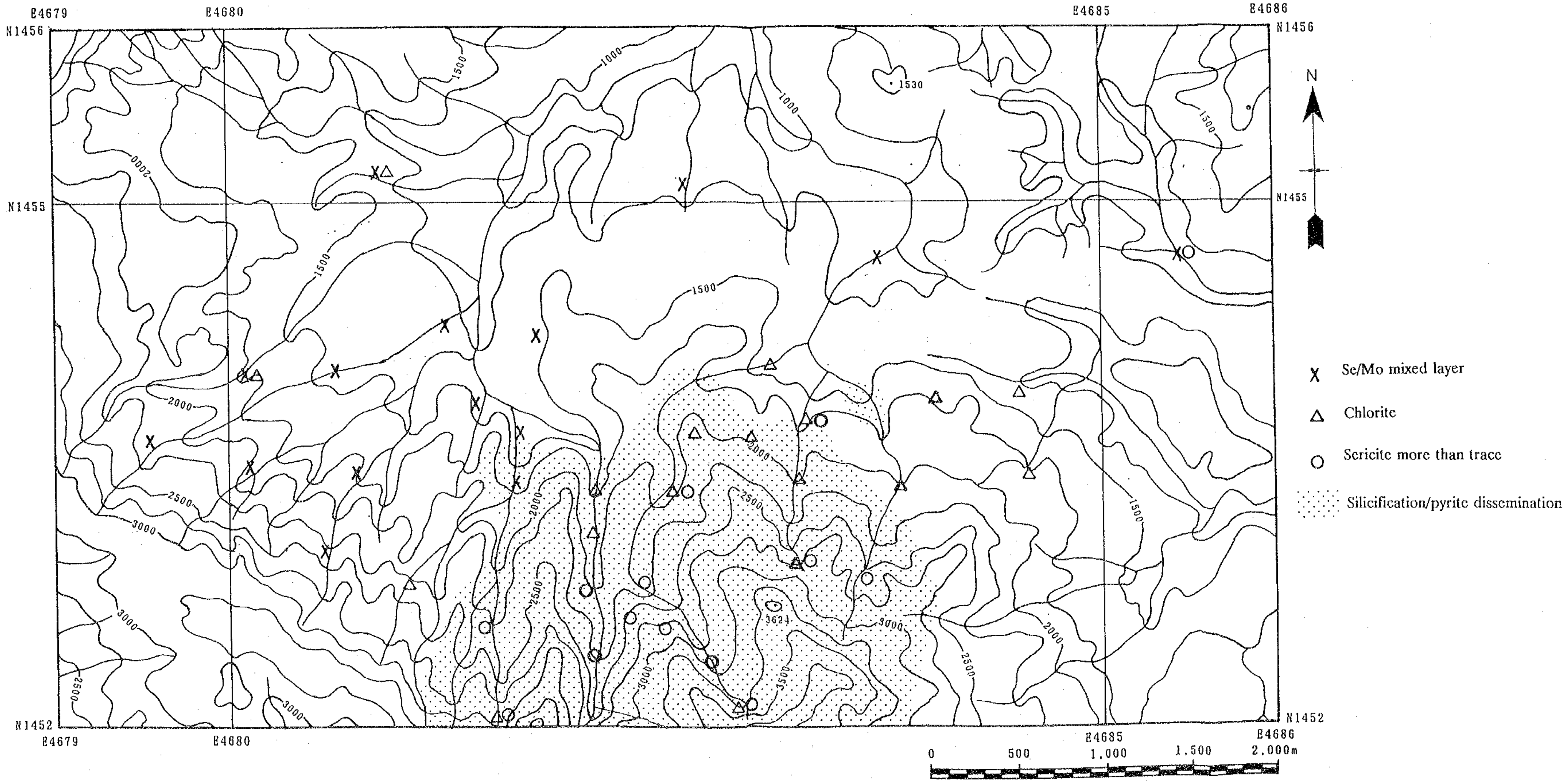


Fig. II-3-7 Results of X-ray diffraction analysis in S. Imbak Sub-area

12 survey lines were set along a N–S direction with a 300m line spacings. The numbering of IP survey stations were set from the north end of each line with 100m spacing from the north to the south. Survey specifications are shown in Table II–3–2.

The survey was conducted using battery–driven potable equipments (transmitter: TSQ–3, receiver: IPR–12) manufactured by Scintrex Ltd.Electrical measurement of rock samples collected from outcrop and drill holes were carried out in order to determine the actual electrical properties of rocks distributed in the survey area.

The procedure used for IP data analysis and interpretation work are shown in FigII –2–2.

3–3–2 Survey results

The IP survey results of the Phase I and Phase II were combined together and shown in FigII –3–8 and Fig.II –3–9. The apparent resistivity values were detected in the range from 1 to 2000Ω–m and chargeability values in range from 40 to 77 mV/V in the S. Imbak Sub–area North. Based on this, apparent resistivity (AR) and chargeability (M) values were classified in three groups as follow.

Classification of AR and M

Class	Apparent resistivity(AR) (Ω–m)	Chargeability(M) (mV/V)
High	65≤ AR	30 ≤ M
Medium	15≤ AR < 65	10 ≤ M < 30
Low	AR < 15	M < 10

The apparent resistivities from medium to low values are distributed in the northern part of the area consisting of mudstone with especially low values less than 5Ω–m are distributed at depth in the area. High resistivity zone is distributed in the southern half of the survey area with a steep topography, consisting of silicified sandstone; especially high values in the central to eastern part of the survey area. This high resistivity zone coincides with the occurrence of intrusive rocks (diorite porphyry). A medium to low resistivity zone is located in two areas, one is an area which extends southeastwards from station No.16 on line–E and the other is the area which extends southwards from the station No.17 on line–D.

Distribution of chargeability presents low values of less than 10 mV/V in the northern part of the area, and medium to high values of over 20 mV/V in the southern half of the area. High chargeability zones of more than 20 mV/V extend south–east and south in the central part of the survey area. The highest chargeability values of more than 30 mV/V are detected at shallow depth in the southern half of the Line–D to line–G. These high chargeability values suggest a strong mineralization, mainly of

Table II-3-2 Specification of IP survey in S. Imbak North

Item	Specifications	
Method	Time domain	
Configuration	Dipole-dipole	
n-spread	n = 1 to 4	
Phase	Phase I (1994)	Phase II (1995)
Survey lines	10 lines	11 lines
Total amount	21.0 line-km	19.7 line-km
Line spacing	300 m	300 m
Samples for IP measurement	14 samples	21 samples

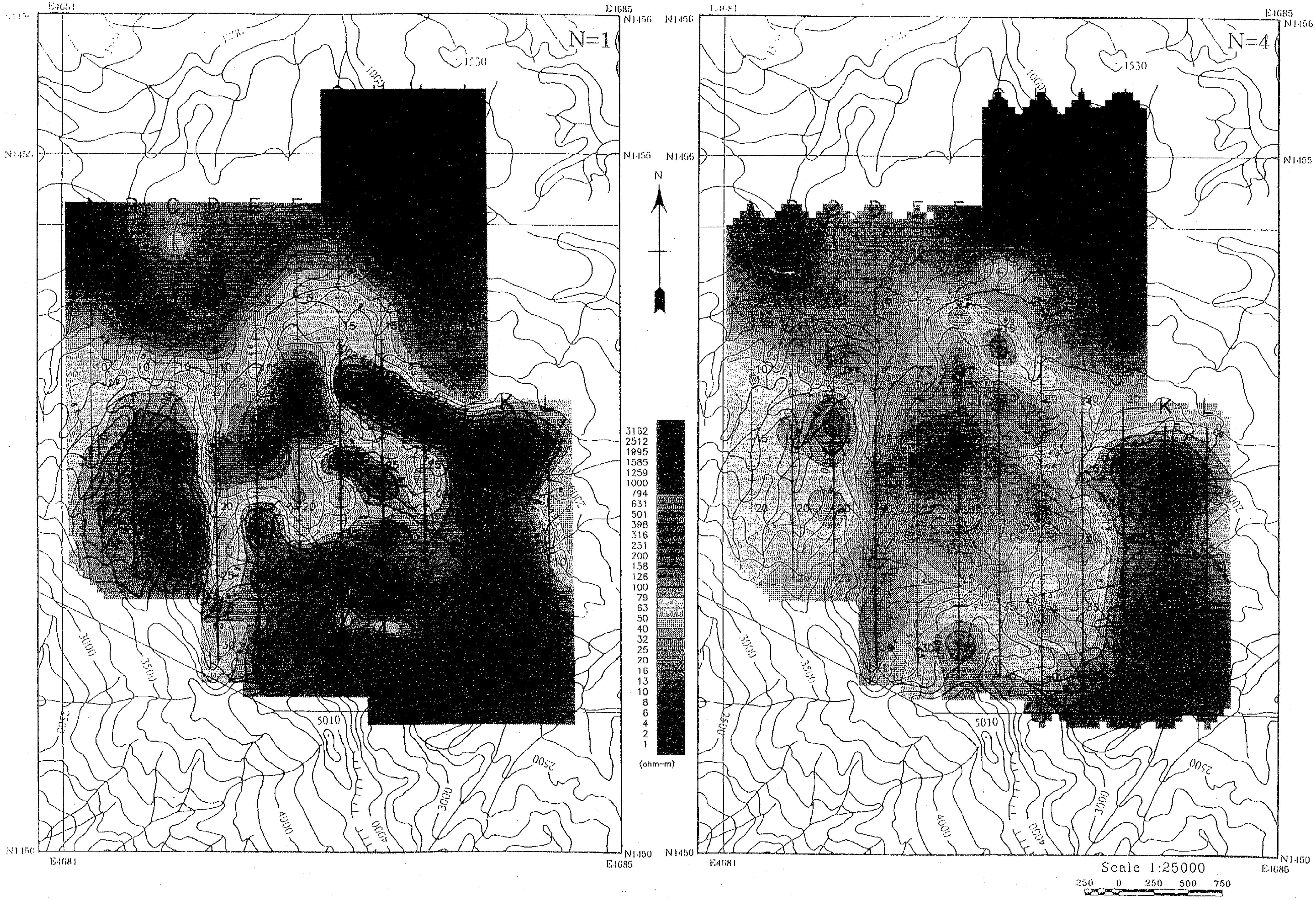


Fig. II-3-8 Plan map of apparent resistivity in S. Imbak Sub-area North

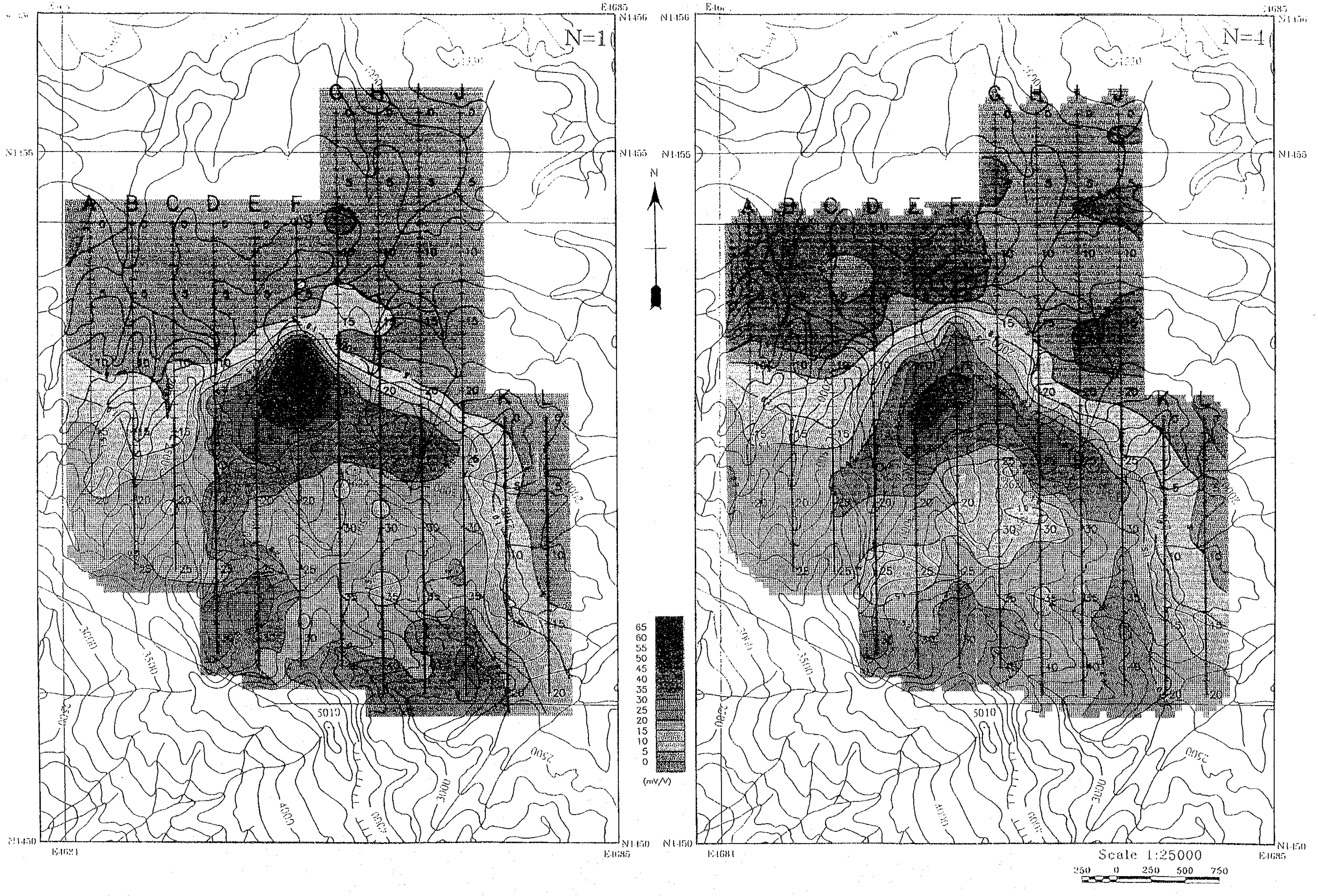


Fig. II-3-9 Plan map of chargeability in S. Imbak Sub-area North

sulfide type. In the survey area, the following types of IP anomalies are seen.

<u>Classification of IP anomalies</u>

Type	Item	Alteration/Mineralization
Type 1	Resistivity Low	Strong alteration and strong sulfide mineralization
	Chargeability High	Dissemination type
Type 2	Resistivity Medium	Medium alteration and strong sulfide mineralization
	Chargeability High	Dissemination and/or vein combination
Type 3	Resistivity High	Weak alteration and considerable sulfide mineralization
	Chargeability High	Veins

The Type 1 IP anomaly is mainly distributed in the mountainous area of the central part of the survey area. The distribution of Type 2 IP anomaly is mainly found in two areas, one is the area which extends southeast from the central part of the area, another is the area which extends southeast from the central part of Line-H. The distribution of Type3 IP anomaly is restricted only in the higher mountainous area of the southern end of the survey area.

The strong IP anomaly, mentioned above, which probably indicates a strong sulfide mineralization, is considered important for the simulation analysis. The results of the two dimensional model simulation of the IP anomalies are shown in Fig. II-3-10.

IP anomaly of Type 1, with low resistivity and high chargeability, is seen in the mountainous area of the central part of the survey area extending from No.15 on Line-E to No.25 on Line-H. IP anomaly of Type 2, with medium resistivity and high chargeability is distributed in two areas, namely, an area which extends southeastward from the central part of the area (around No.13 and No.20 on Line-D to the south end on Line-G), and another area which extends southeast from the central part of Line-H (around No.22 on Line-H to No.31 on Line-J). IP anomaly of Type 3 is seen in the higher mountainous area of the southern end of the survey area (the south end of lines D, E, H and J).

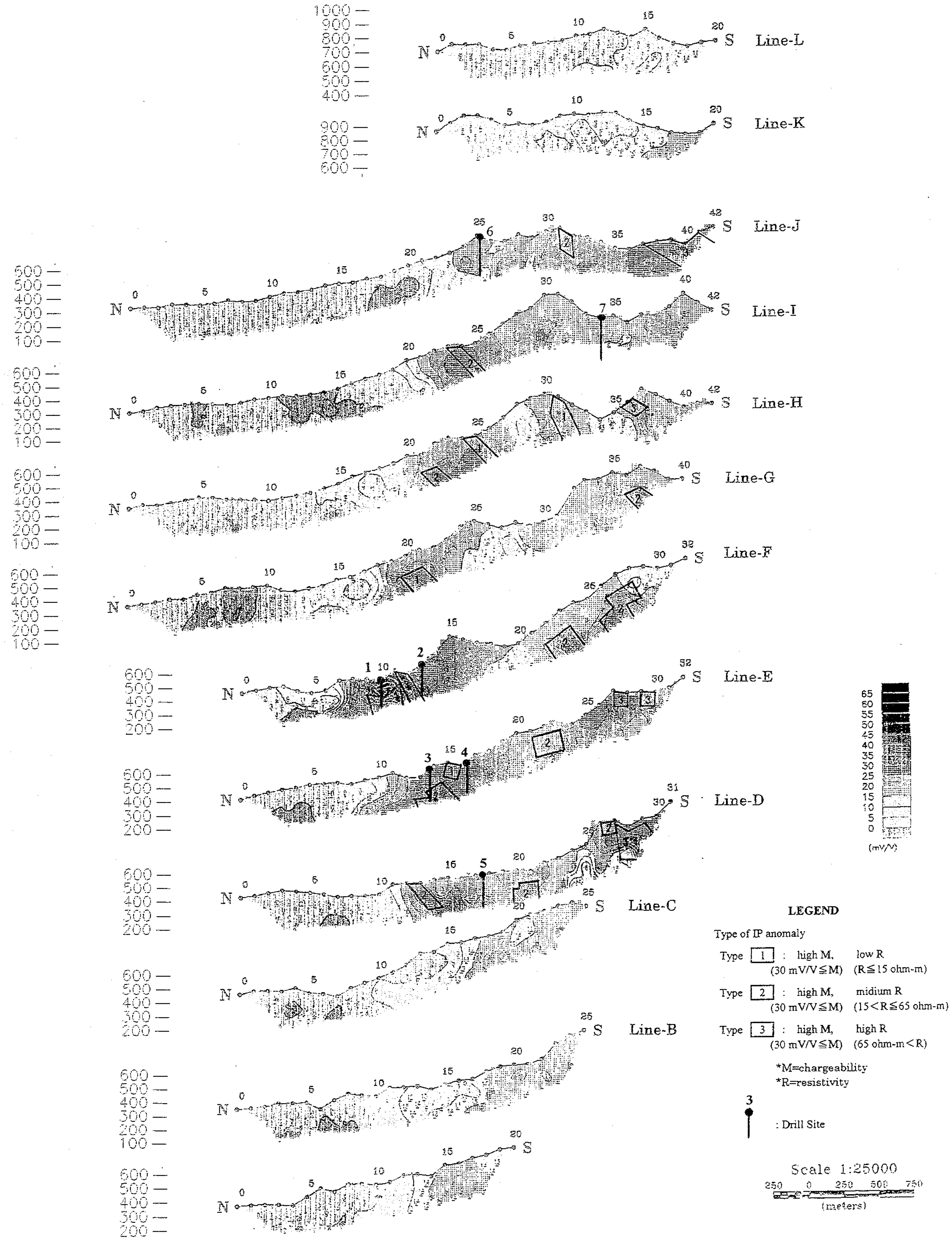


Fig. II-3-10 Results of model simulation in S. Imbak Sub-area North

3-4 Drilling Survey

The drilling survey was conducted in the S. Imbak Sub-area North to evaluate the of the mineralization under the surface. The locations of the five drill holes in PhaseII and two drill holes in Phase III were decided based on the geological information, IP anomalies and geochemical anomalies.

3-4-1 Survey method

Seven holes were drilled over the silicification/pyrite dissemination zone in the S. Imbak Sub-area North. As given in Table II-3-3, the drill holes of PhaseII (MJSI-1 to MJSI-5) are 200m deep and vertical. Phase III drill holes(MJSI-6 to MJSI-7) are 300 m deep and vertical. The drill sites are shown in Fig. II-3-11.

The equipment and the materials for drilling operation were transported by vehicles from Kota Kinabalu to the base camp located beside a logging road at the closest point to the S. Imbak Sub-area North. A long distance winching work was considered to be impossible because of the rugged topography of the area. For minimizing the winching work, a helipad was constructed within a radius of few tens of meters from each drill site. Mobilization and demobilization of the equipments and the materials for drilling operation were conducted using a helicopter for all holes.

3-4-2 Survey results

The summary of geology and mineralization are given below:

1. MJSI-1

[Geology]: It mainly consists of dark gray mudstone, intercalated by alternating sandstone and mudstone layers. The alteration is found occasionally through the core. The lamination and bedding dip 20°.

[Mineralization]: Very weak dissemination of pyrite, pyrrhotite, arsenopyrite is observed throughout the core associated by fracture filling by pyrite and pyrrhotite-chalcopyrite of± 1mm thick. Patches and nodules of pyrite-chalcopyrite-sphalerite-marcasiteof few cm across occur sporadically.

Other than above, quartz-sulfides (pyrite, pyrrhotite, chalcopyrite) veins of few mm to few cm thick occur with steep dips of more 60°.

2. MJSI-2

[Geology]: It mainly consists of dark gray mudstone, intercalated by alternating sandstone and mudstone layers. These sedimentary rocks are intruded by fine diorite porphyry with hornblende phenocrysts from the surface up to 47.55 m. The diorite porphyry has appearance similar to andesite and is partly chloritized and silicified. The lamination and bedding of the sedimentary rocks dip 20°.

Table II-3-3 Specification of drill holes

Phase II

Hole No.	Coordinates		Elevation	Bearing	Inclination	Depth
	N	E				
MJSI-1	1453.37	4682.75	697 m	-	-90°	201.25 m
MJSI-2	1453.16	4682.77	758 m	-	-90°	200.30 m
MJSI-3	1453.04	4682.46	708 m	-	-90°	200.84 m
MJSI-4	1452.80	4682.45	763 m	-	-90°	202.20 m
MJSI-5	1452.68	4682.20	727 m	-	-90°	200.20 m

Phase III

Hole No.	Coordinates		Elevation	Bearing	Inclination	Depth
	N	E				
MJSI-6	1452.66	4683.89	982 m	-	-90°	300.50 m
MJSI-7	1451.77	4683.59	1,118 m	-	-90°	302.71 m

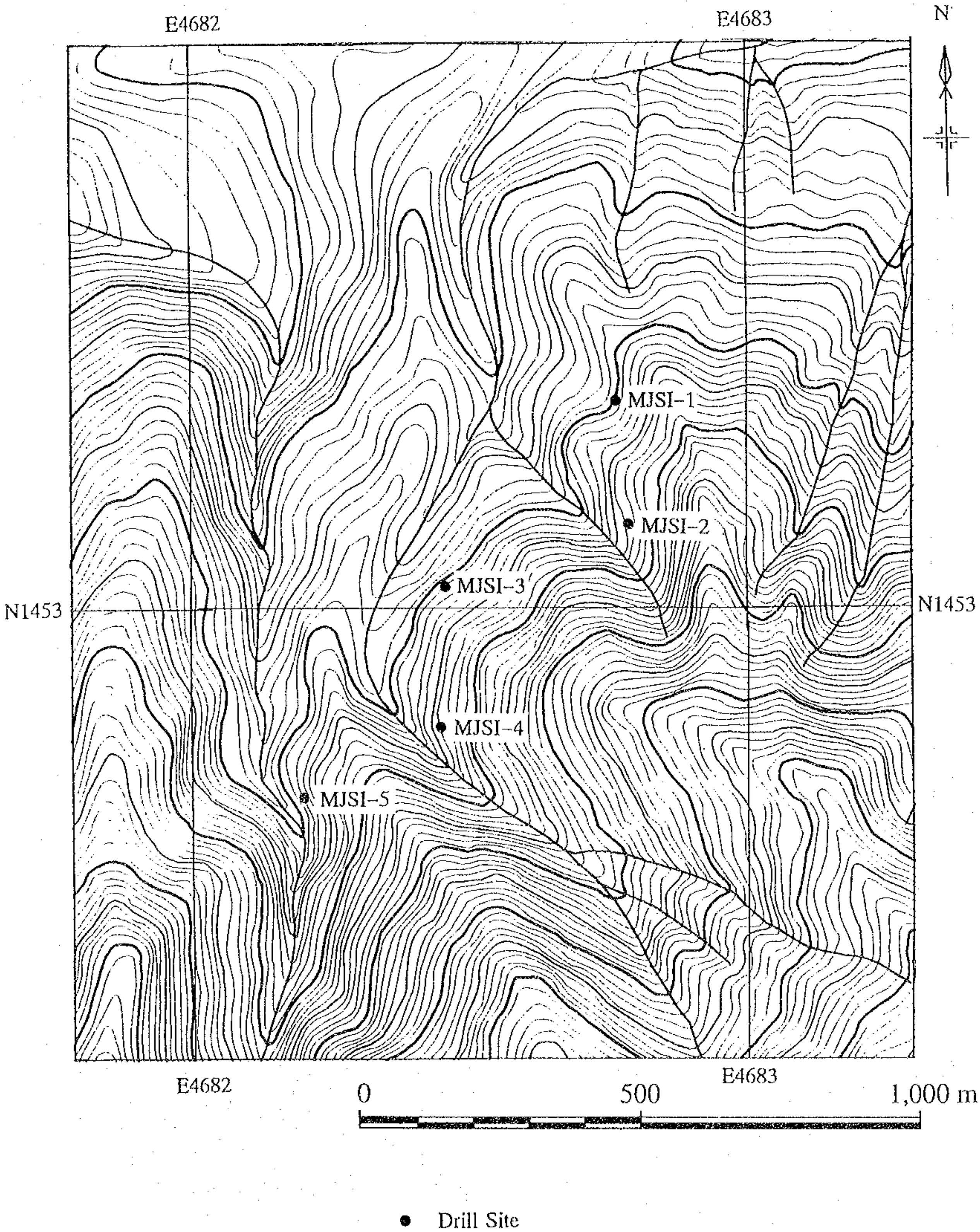


Fig. II -3-11 Location of drilling site (1)

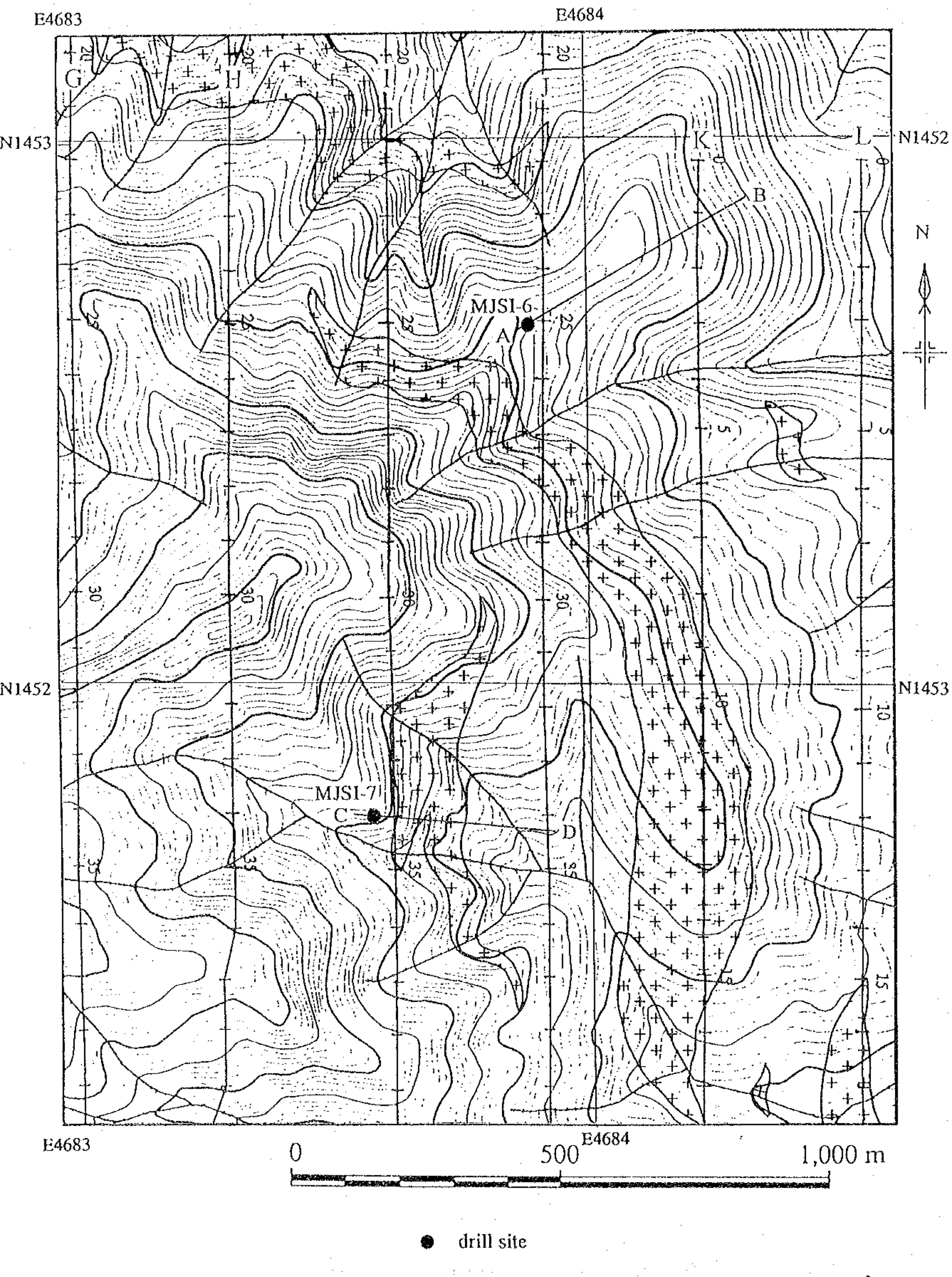


Fig. II -3-11 Location of drilling site (2)

[Mineralization]: Alteration is more intense in the diorite porphyry than in sedimentary rocks. Weak dissemination of pyrrhotite, pyrite and chalcopyrite occur throughout the diorite porphyry. Generally, the more altered part shows stronger dissemination of pyrrhotite and chalcopyrite, while the less altered part shows weaker dissemination of pyrite. In addition to the dissemination, fracture fillings of ±1mm wide by mineral assemblages of pyrite, pyrrhotite–chalcopyrite, pyrite–sphalerite and steep dipping (70° to 80°) quartz–sulfides (pyrite, pyrrhotite, arsenopyrite) veins of few cm wide occur. A quartz–sulfide vein of 3.5 cm wide at 26.10 m consisting of arsenopyrite, chalcopyrite, sphalerite, galena, pyrrhotite and marcasite shows assay results of Ag 25.2 g/t, Pb 0.13% and Zn 0.51 % for sampling length of 65 cm.

In the sedimentary rocks, very weak dissemination of pyrrhotite and pyrite and fracture fillings of ±1mm wide consisting of pyrrhotite–chalcopyrite and pyrite occur. Poor assay results were obtained from the sedimentary rocks.

3. MJSI–3

[Geology]: Upper part consists mainly of alternate mudstone and sandstone laminae and lower part is dominated by dark gray mudstone. The laminae and bed dip approximately 20° .

[Mineralization]: The ore mineral assemblages change at approximately 100 m. Weak pyrite dissemination and fracture filling with a thickness of±1 mm prevail in the core shallower than 100 m. While in the core deeper than 100 m, amount of pyrrhotite with association of chalcopyrite increases and exceed the amount of pyrite. The mineral assemblages of fracture filling consist of the same minerals as dissemination. The dissemination is slightly intensive in mudstone than in sandstone. Quartz–sulfides (pyrrhotite, pyrite, chalcopyrite) veins of a few cm wide are scattered between 60 m to 70 m and pyrite–chalcopyrite–sphalerite veins of 0.5 cm to 1.0 cm wide occur between 167 m to 172 m. Sulfide (pyrrhotite, pyrite, chalcopyrite) patches and nodules of a few cm across occur rarely at depths of 50 m to 60 m and 95 m to 99 m. The sandstone and mudstone with sulfide veinlets, respectively, at 18 m and 50 m show low assay grades of Ag 4.6 g/t and Ag 0.6 g/t. Ag grade is slightly high (Ag 15.8 g/t) in the mudstone with irregular patches of quartz–pyrrhotite–chalcopyrite. The mudstone with ± 1cm wide sulfides (pyrite, sphalerite, chalcopyrite) veins give slightly high Ag (11.8 g/t, 8.4 g/t) and low grade of Pb (0.14 %, 0.15 %) and Zn (0.43 %, 0.14 %).

4. MJSI–4

[Geology]: Sedimentary rocks of mudstone, sandstone and alternate laminae of sandstone and mudstone are predominant in the MJSI–4 and diorite porphyry with plagioclase, hornblende and biotite phenocrysts intrudes into the sedimentary rocks between the depth from 62.00 m to 107.00 m. The diorite porphyry is altered and distinct mineralization associate with it. The laminae and bedding of the sedimentary rocks dip approximately 20° .

[Mineralization]: The main mineralization occur in the diorite porphyry. The weak dissemination of pyrite, chalcopyrite, (arsenopyrite) and (sphalerite) occur throughout the diorite porphyry. The intensity of dissemination increases with the degree of alteration. In addition to this, fracture filling,± 1mm wide films of sulfides (pyrite, sphalerite, chalcopyrite and arsenopyrite) occur. The most prominent mineralization occurs between the depth of 84.10 m to 101.90 m where few mm to 10 cm size network veins and patches of sphalerite–chalcopyrite–pyrite occur all over the diorite porphyry and grade of Zn ranges from 0.5 % to 1.0 % throughout this zone. Within this zone, at the depth between 86.70 m to 93.40 m, few cm to few tens cm size, irregular veins and patches of quartz–sulfides (sphalerite, pyrite, arsenopyrite, chalcopyrite, marcasite) occur overlapping to the sphalerite mineralization. The assay result of 1 m span samples of mineralized diorite porphyry between the depth of 84.10 m to 101.90 m show high Ag (9.0 g/t to 90.5 g/t) and Zn (0.42 % to 2.20 %). Cu (0.08 % to 0.13 %)and Pb (0.02% to 0.79 %) are slightly low. Au ranges from 0.1 g/t to 0.5 g/t.

A weak dissemination of pyrite and pyrite–pyrrhotite occur all through the sedimentary rocks and ± 1 mm wide fracture filling film by the same minerals are occasionally associated. The sulfide (pyrrhotite, pyrite, chalcopyrite) patches and nodules of few cm across only occur rarely in MJSI–4. In addition, ± 1 cm wide quartz–sulfides (pyrite, arsenopyrite, pyrrhotite, sphalerite, chalcopyrite) veins also occur in the sedimentary rocks. These quartz–sulfide veins show relatively high Ag (1.3 g/t to 26.2 g/t) and low Au (1.3 g/t at the maximum).

5. MJSI–5

[Geology]: It mainly consists of sandstone with subordinate mudstone layers. The diorite porphyry intrudes at the 169.80 m depth and it continues to the bottom. The sedimentary rocks are slightly silicified and chloritized. The diorite porphyry however commonly exhibits silicification and chloritization. The lamina and bed dip approximately 20° .

[Mineralization]: Dissemination of pyrite and pyrrhotite and fracture filling film by the same minerals occur all through the MJSI–5. In addition, quartz–sulfide (pyrite, pyrrhotite, sphalerite, chalcopyrite, arsenopyrite) veins of few cm wide occur sporadically. Mineralization is more intense in the diorite porphyry than in the sedimentary rocks.

Pyrite is the main dissemination mineral in the sedimentary rocks at depth shallower than 80 m. Beyond 80 m, the amount of pyrite decreases and pyrrhotite associated with chalcopyrite increases. The same mineral assemblages are observed in the fracture filling sulfide films. The sulfides of the steep dipping (60° to 80°) quartz–sulfides veins, also, appear to change at the depth of approximately 80 m. At shallower than 80 m, they mainly consist of pyrite–chalcopyrite–(sphalerite), then, while beyond this, pyrrhotite and arsenopyrite increase and barite appears in the quartz–sulfides veins. The quartz sulfide vein at 123.90 m includes abundant arsenopyrite and three grains of native gold with the maximum grain size of 110μ ×90μ were found within arsenopyrite.

The assay results of sedimentary rocks with quartz–sulfides veins show that the samples collected at shallower than 100 m have relatively lower Au (0.1 g/t to 0.3 g/t)and Ag (0.5 g/t to 8.1 g/t) compared to the ones collected at deeper than 100 m which have Au ranging from 0.2 g/t to 12.3 g/t and Ag ranging from 4.1 g/t to 13.8 g/t. The maximum grade of Au (12.3 g/t) was obtained from the samples with native gold grains, collected at depths of 123.40 m to 124.00 m.

Dissemination of pyrrhotite, chalcopyrite and pyrite is slightly more widespread in the diorite porphyry compared to the sedimentary rocks. In the altered part of the diorite porphyry amount of sulfides may reache up to 1 %. Fracture fillings and deeply dipping veins(±80°) of few cm wide quartz–(barite)–sulfides (pyrrhotite, chalcopyrite) also occur in the diorite porphyry.

The diorite porphyry with quartz–sulfides vein has assay results of Au 0.4 g/t, Ag 4.7 g/t and Cu 0.14 %.

6. MJSI–6

[Geology]: Dark gray diorite porphyry occur from the surface up to 227.50m and below than this dark gray mudstone occurs up to the bottom(300.50m) of the drill core. The mudstone is intruded by strongly argillized, white diorite porphyry from 260.55 m to 280.40 m.

[Mineralization]: Very weak pyrite dissemination occurs all through the core. In the diorite porphyry, alteration zones of few 10cm to few m occurs. The most distinct part is from 75.35 m to 83.10 m where dissemination of pyrite is more clear with pyrite films of few mm wide. The strongly silicified and argillized diorite porphyry of 260.55m to 280.40 m shows weak pyrite dissemination associated by pyrite films of few mm wide. Encouraging assay results were not obtained from MJSI–6.

7. MJSI–7

[Geology]: Mudstone occurs from the surface up to 84.20 m and it is intruded by fine diorite porphyry with an appearance similar to andesite from 52.40m to 68.65 m. Sandstone occur from 84.20 m to 178.60m, then followed by mudstone with sandstone layers until it is intruded by diorite porphyry. Diorite porphyry with phenocrysts of plagioclase and hornblende occur from 195.40m to 302.71 m.

[Mineralization] Weak pyrite dissemination occur all through core. Diorite pyrrhotite shows a weak pyrrhotite dissemination in addition to pyrite and occasional minute grains of chalcopyrite occurs associated with pyrrhotite. Silicification and chloritization zones of few 10 cm to few m sporadically occur in the diorite porphyry and pyrite dissemination is clearly seen in these zones. The most intense silicification and chloritization occur for 15m from 272.80m to 288.35m where pyrite films occur in addition to pyrrhotite and pyrite dissemination. The most distinct mineralization in MJSI-7 occur within this zone from 274.85 m to 278.15 m. Patches or veins of sulfides (pyrite, arsenopyrite, chalcopyrite) occur from 274.85m to 275.15m and assay results of Au 3.5 g/t and Ag 26.5 g/t were obtained . Network veins of sulfides (pyrite, arsenopyrite, chalcopyrite), 1 cm to 1 mm wide, occur from 276.15 m to 278.15 m in the diorite porphyry, however, Cu % does not 0.1% .

8. Summary of drilling survey

The lithological facies encountered by the seven holes are mudstone, sandstone, alternate laminae of mudstone and sandstone and diorite porphyry. The general dip of the sedimentary rocks is approximately 20° and the intrusion of the diorite porphyry is parallel to the sedimentary structure at MJSI-2 and MJSI-3 and oblique to the sedimentary structure at MJSI-5, MJSI-6 and MJSI-7.

The alteration of the sedimentary rocks by sericite and chlorite is not intensive. The sedimentary rocks of MJSI-5 seem to show the highest alteration with an abundant sericite with an absence of chlorite.

There is two types of diorite porphyry. The one is fine grained with distinguished hornblende phenocrysts and has an appearance similar to andesite. The other is more felsic with phenocrysts dominated by plagioclse with subordinate hornblende and biotite. Clear indications of thermal metamorphism in the sedimentary rocks occur at the vicinity of the intrusion and chilled margins in the diorite porphyry were not observed. In the diorite porphyry, mineralization associated with chloritization and silicification occur.

Weak dissemination of pyrite, pyrrhotite-chalcopyrite occur in all the cores associated with fracture filling films of the same minerals. Quartz-sulfides veins of few cm wide occur sporadically in both sedimentary rocks and diorite porphyry. The most prominent mineralization is found in MJSI-4 where sphalerite-(chalcopyrite) network veins and patches occur in the diorite porphyry and Zn grade ranges from 0.4 % to 1.0 % for 15 m. This Zn mineralization zone includes 3 m long, Ag enriched (Ag 37.2 g/t to 90.5 g/t) zone of irregular quartz-sulfides veins and patches. The quartz-sulfide veins in the sedimentary rocks within 60 m from diorite porphyry intrusion at MJSI-5 show Au grade of 5.7 g/t and 12.3 g/t and one of samples contain native gold in arsenopyrite.

There is a general tendency of the sulfide assemblage to form dissemination, fracture filling films and quartz sulfides veins. MJSI-1 is dominated by pyrite, while at MJSI-4 both assemblages of pyrite and pyrite-pyrrhotite are common. At MJSI-3 and MJSI-5 pyrite is predominant at shallower depths, while and pyrrhotite-(chalcopyrite) associated by arsenopyrite occur at the deeper depths. At MJSI-2 pyrite is rare and pyrrhotite and pyrrhotite-(chalcopyrite) assemblages are dominant.

3-5 Discussion

The mineralization and alteration of the area occur in the silicification/pyrite dissemination zone located in the central to southeastern part of the area where many small intrusions of diorite porphyry occur. Within this zone quartz-sulfide veins varying from a of few cm to 25 cm wide occur sporadically. The distribution of Au-Ag type quartz-sulfides veins seem to be restricted in the southwest part of the silicification/pyrite dissemination zone, while, Pb and Zn veins tend to occur in the northeast part of the silicification/pyrite dissemination zone.

The drilling survey shows that the mineralization is more intense in the diorite porphyry than in the sedimentary rocks. The most prominent mineralization is 15 m wide Zn mineralization with an Ag rich zone of 3 m wide at MJSI-4. The occurrence of Au rich quartz-sulfides veins were confirmed close to the intrusion of the diorite porphyry at MJSI-5 and native gold is found associated with arsenopyrite. The mineralization characterized by Au-Ag, Cu, Pb, Zn is closely related to an igneous activity of the diorite porphyry. The geological environment of the area, mineral assemblage of ore minerals, alteration, filling temperature of fluid inclusion (300 C to 400° C) suggest that the mineralization of the area is not of an epithermal type. However, the temperature of the mineralization is not so much high as a mineralization occurs at the center of magmatism. The most probable geological model for the mineralization of S. Imbak Sub-area is an outer margin of the mineralization similar to a porphyry copper type environment. The center of the alteration in the S. Imbak Sub-area characterized by an abundant sericite is located in the central to western part of the silicification/pyrite dissemination zone and it is regarded as a phyllic alteration zone of the typical porphyry copper type mineralization. A chlorite rich zone corresponding to the propylitic zone of typical porphyry copper type, also, occur in the S. Imbak Sub-area North surrounding the sericite rich zone. The Au rich quartz-sulfides vein with arsenopyrite occur within the sericite rich zone close to the diorite porphyry. The mineral assemblage (pyrite-pyrrhotite-arsenopyrite) suggests that the hydrothermal solution related to the mineralization of the S. Imbak Sub-area North is of an intermediate sulfidation state.

The results of geophysical survey (IP method) in Phase I and Phase II clarified the strong IP anomalous zones which show a medium to high chargeability values of more than 20 mV/V. The Au, Ag and Cu anomalies of the rock geochemical survey in the center to south part of the area correspond to the medium to high chargeability anomalies of more than 20 mV/V. Some core samples (diorite porphyry with pyrite dissemination and silicification/argillization, sandstone with fracture filling pyrite) from the drill hole MJSI-4 show high chargeability values of over 60 mV/V.

The strong IP anomalous zone occur in the silicification/pyrite dissemination zone showing a letter "C" shape opening to east. The highest center is located in the center of Line F and it extends toward both to the east and to the south. The strong IP anomalous zone also occur in the south of the area, along a E-W direction.

The drilling survey of Phase II was conducted in the area of strong IP anomalies and failed to intersect distinguished mineralization. The strong IP anomalies in the area probably reflect pyrite veins and dissemination near the surface.

Letter "C" shape IP anomaly is commonly observed in the are of porphyry copper mineralization elsewhere in the world and it is known that the main mineralization occurs in the center of letter "C" shape anomaly. If a mineralization similar to porphyry copper type exits in the S. Imbak Sub-area, the area at center of letter "C" anomaly with relatively lower IP anomaly seem to be better target for drilling. The drilling sites for Phase III was decided in the area of relatively lower IP anomaly at the center of letter "C" shape anomaly, then, it was, later, found that the area of the proposed drilling sites was covered by the area of Reserved Virgin Jungle in where cutting tree is strictly prohibited. Therefore, the drilling survey of PhaseIII was conducted shifting the drilling sites further east and it failed to intersect distinguished mineralization.

The area at the center of letter "C" shape anomaly should be examined in future.

Chapter 4 S. Imbak Sub-area South

4-1 Introduction

4-1-1 Background

Detail geological information was not available for the S. Imbak Sub-area before starting of the Central Sabah project and the area had been considered to be overlain by undulating Tertiary sediments. The soil geochemical survey conducted in the Area T during the Supra-regional survey resulted in the finding of a Au-Ag mineralization at the south end of the area, and it was concluded that the mineralization continued further south. Based on the results of this soil geochemical survey, a soil geochemical survey of the S. Imbak Sub-area South (NS 10 km× EW 7 km, 70 km^2), located immediate south of S. Imbak Sub-area North, was conducted in the PhaseI of the Central Sabah Project to pursue the extension of the mineralization further south.

The encouraging results of the soil geochemical survey of the S. Imbak Sub-area South in Phase I led to a semi-detail geological survey in smaller areas of more potential in the following year of Phase II.

4-1-2 Survey area

The S. Imbak Sub-area South is located immediately south of the S. Imbak Sub-area North separated by a steep ridge of more than 1,000 m high and no previous detailed geological work has been done in the area. The area is drained by the Sungai Kuli, which is a tributary of Sungai Kuamut. The drainage system of the area is separated by the ridge running in NNW-SSE direction in the center of the area. In the area west of the ridge, streams flow to the southwest, while in the area east of the ridge the streams flow to the east. Because of a steep topography, these streams form many water falls in the area close to the ridge.

The topography of the area, consisting of the ridge running in the middle of the area trending in NNW-SSE direction and slopes of both sides of the ridge, is very steep and rugged. The altitude of the ridge is more or less 1,000 m and the maximum elevation reaches to approximately 1,500 m in the northern part of the area. The Gunong Kuli is located on this ridge in southeastern part of the area.

The entire area is covered by primary jungle. The access to the area is very poor, only a few trails being found in the area. The geochemical survey and subsequent geological survey were conducted by fly camp and it takes three day to reach the northwest corner of the area.

The soil geochemical survey of soil samples in the Phase I was conducted covering the area of 70 km^2 (NS 10 km × EW 7 km). Based on the results of the soil geochemical survey, the area of semi-detail geological survey of the PhaseII was established excluding south part of the Phse I area for 3 km. It has an irregular square shape covering 45.5 km^2(NS 7 km × EW 7 km).

4-1-3 Amount of work

In the phase Ⅰ, a soil geochemical survey covering an area of 70 km^2 was conducted. In the following year of the Phase II, based on the results of soil geochemical survey, a semi-detail geological survey was conducted covering the area of 45.5 k㎡. During the geological survey, 283 rock samples were collected for rock geochemical survey.

4-2 Soil geochemical Survey

A soil geochemical survey was conducted in the S. Imbak Sub-area South to trace the extension of the soil geochemical anomalies of the area T (S. Imbak Sub-area North) toward south.

4-2-1 Survey method

A soil geochemical survey was conducted following the method of the Super-regional survey in the S. Imbak Sub-area South. A total of 283 soil samples were collected over the area of 70km^2 (NS10km × EW7km) at sampling density of approximately 4 samples/km^2.

The collected soil samples of B horizon were dried, and -80 mesh fraction was prepared for chemical analyses of 21 elements (As, Au, Ba, Co, Cr, Cu, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, S, Sb, Sr, Ti. U. W, Zn). The analytical results were computerized and statistical data treatment, EDA (Exploratory Data Analysis) and factor analysis conducted.

4-2-2 Survey results

The results of the soil geochemical survey were shown in Fig.II-4-1 and Fig II-4-2.

Numerous intrusive bodies of diorite porphyry were found along both slopes of the ridge that runs in the center of the area. K-Ar dating of three samples of diorite porphyry show their age of intrusion to be late Miocene to early Pliocene (7.27±0.18 Ma to 10.5±0.27Ma). The silicification/pyrite dissemination zones occur in the sedimentary rock along the slopes of the ridge, closely associated with intrusion of diorite porphyry. The intensive silicification/pyrite dissemination zones occur in the northwest part of the area and the central part of the area. The central part of the area shows a chalcopyrite dissemination in the diorite porphyry, in addition to pyrite dissemination of the sedimentary rocks. The polished section shows a small grain of native gold surrounded by chalcopyrite. The soil geochemical survey shows distributions of overlapping Au, Cu, Hg, S anomalies over the areas of silicification /pyrite dissemination zones in northwest and center parts of the area. These areas are, also, covered by high factor score zone of Factor 2 (Au, Cu, Sb, W) and Factor 6 (As, Au, Hg, S). These two zones of the above were considered to a have high potentiality for the mineralization. The mineralization that occurs in the S. Imbak Sub-area North seem to be continued over the ridge of Gunong Kuli to S. Imbak Sub-area South.

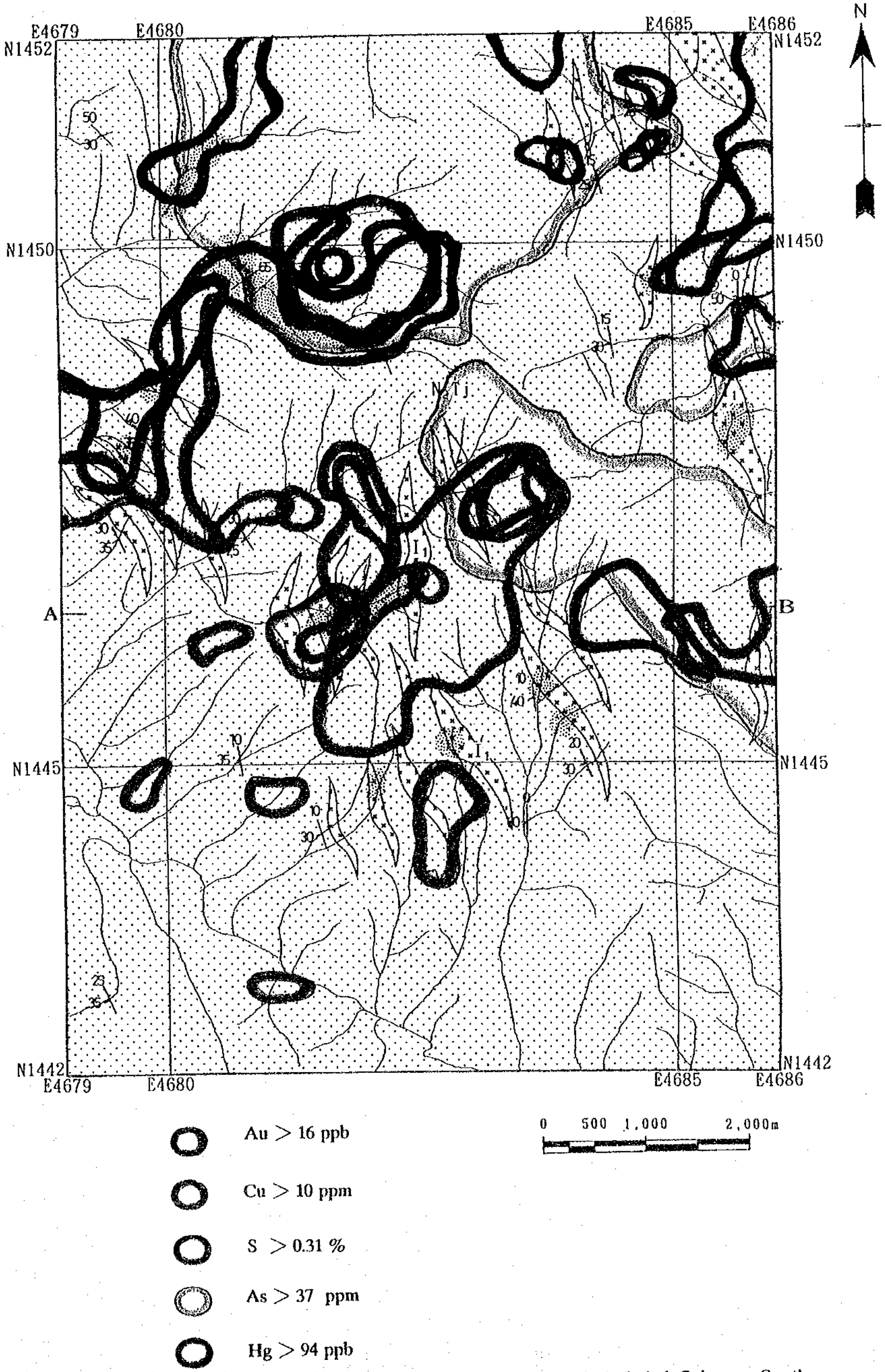
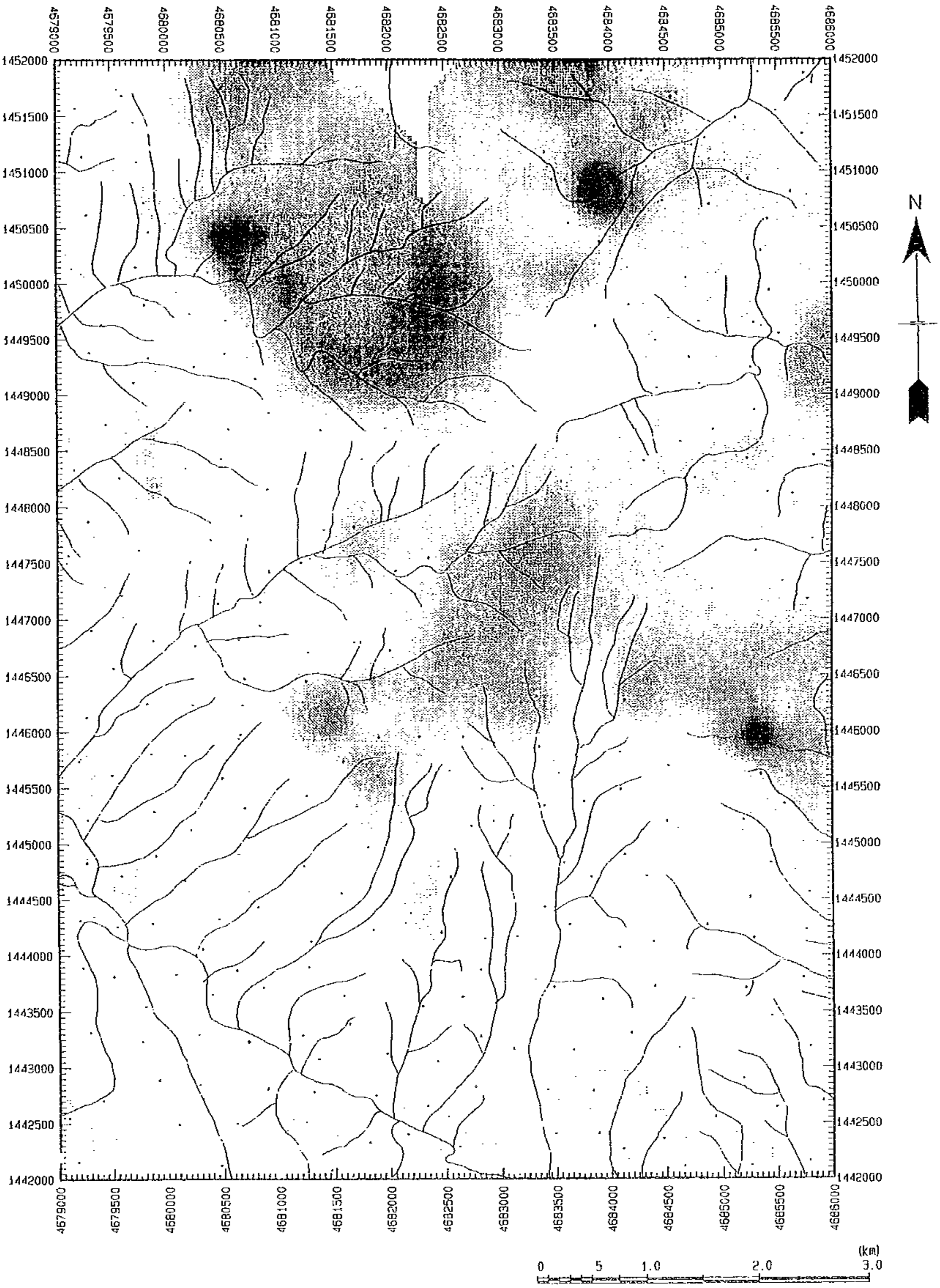


Fig. II-4-1 Distribution of geochemical anomalous zone in S. Imbak Sub-area South



Factor 2 factor score: Blue

Factor 3 factor score: Yellow

Factor 6 factor score: Red

Fig. II-4-2 Distribution of factor scores in S. Imbak Sub-area South

4-3 Geological survey

Based on the results of the soil geochemical survey, a semi–detail geological survey was conducted in the area of more potential, covering the geochemical anomalies and silicification/pyrite dissemination zone in the Phase II.

4-3-1 Survey method

The semi-detail geological survey was conducted for the area 45.5 km^2 by using 1 : 5,000 scale map produced from enlargement of the 1 : 50,000 topographic sheet. Typical rock and ore samples were collected for thin section and polished section. Ore assaying of 7 elements (Au, Ag, Cu, Mo, Pb, Zn and S) and X-ray diffraction analysis were done, respectively, for mineralized and alteration samples. To estimate the temperature of the mineralization, measurement of the filling temperature of fluid inclusion was conducted for the quartz of quartz–sulfide veins.

A total of 300 rock samples were collected during the semi-detail geological survey for geochemical investigation. The analytical results of 15 elements (Ag, As, Au, Ca, Cu, Hg, K, Na, Mg, Pb, Rb, S, Sb, Sr, Zn) were input in computer and statistical data treatment, EDA (Exploratory Data analysis) and factor analysis were conducted. Among the 300 rock samples of geochemical survey, 55 samples were selected for X-ray diffraction analysis.

4-3-2 Geology

The S. Imbak Sub–area South is overlain by the Tanjong Formation of early to middle Miocene. In addition to this, many small bodies of diorite porphyry occur intruding to the sedimentary rocks of the Tanjong Formation. The geological map together with cross sections are given in FigII –4–3.

The area is entirely overlain by the Tanjong Formation and it is divided into three formations. They are, from bottom to top, lower mudstone formation, sandstone formation and upper mudstone formation. All the sedimentary rocks, consistently, dip SW. The mudstone formations occur on the both sides of the ridge, in the areas of relatively lower altitude, while the sandstone formation occurs in the area of higher altitude, being distributed along the ridge. The small intrusive bodies of the diorite porphyry are distributed on both sides of the slope close to the ridge.

The lower mudstone formation is distributed on the east facing slope of the ridge at the elevation lower than 900 m in the east part of the area. Dark gray to black, slightly soft mudstone occupies the area from north to south along the east edge of the area. Sandstone layers of few cm to few tens cm thick are intercalated in the area near the sandstone formation. The amount of the sandstone increases toward boundary, then mudstone formation gradually change to the sandstone formation. The mudstone close to the diorite porphyry is, generally, silicified and disseminated by pyrite. Pyrite