REPORT
ON
THE MINERAL EXPLORATION
IN
PERAK, MALAYSIA

(PHASE Ⅲ)

MARCH 1991

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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Preface

In response to the request of the Government of Malaysia, the Japanese Government decided to conduct a Mineral Exploration Project in Perak State and entrusted the survey to Japan International Cooperation Agency (JICA) and Metal Mining Agency of Japan (MMAJ). This report concerns the final phase (Phase III) of the project which consists of three phases commencing in 1988.

JICA and MMAJ sent to Malaysia a survey team headed by Mr. I. Hayashi from July 23rd, 1990 to November 23rd, 1990. The team exchanged views with the officials concerned of the Government of Malaysia and conducted field surveys in Perak. After the team returned to Japan, further studies were made and the present report has been prepared.

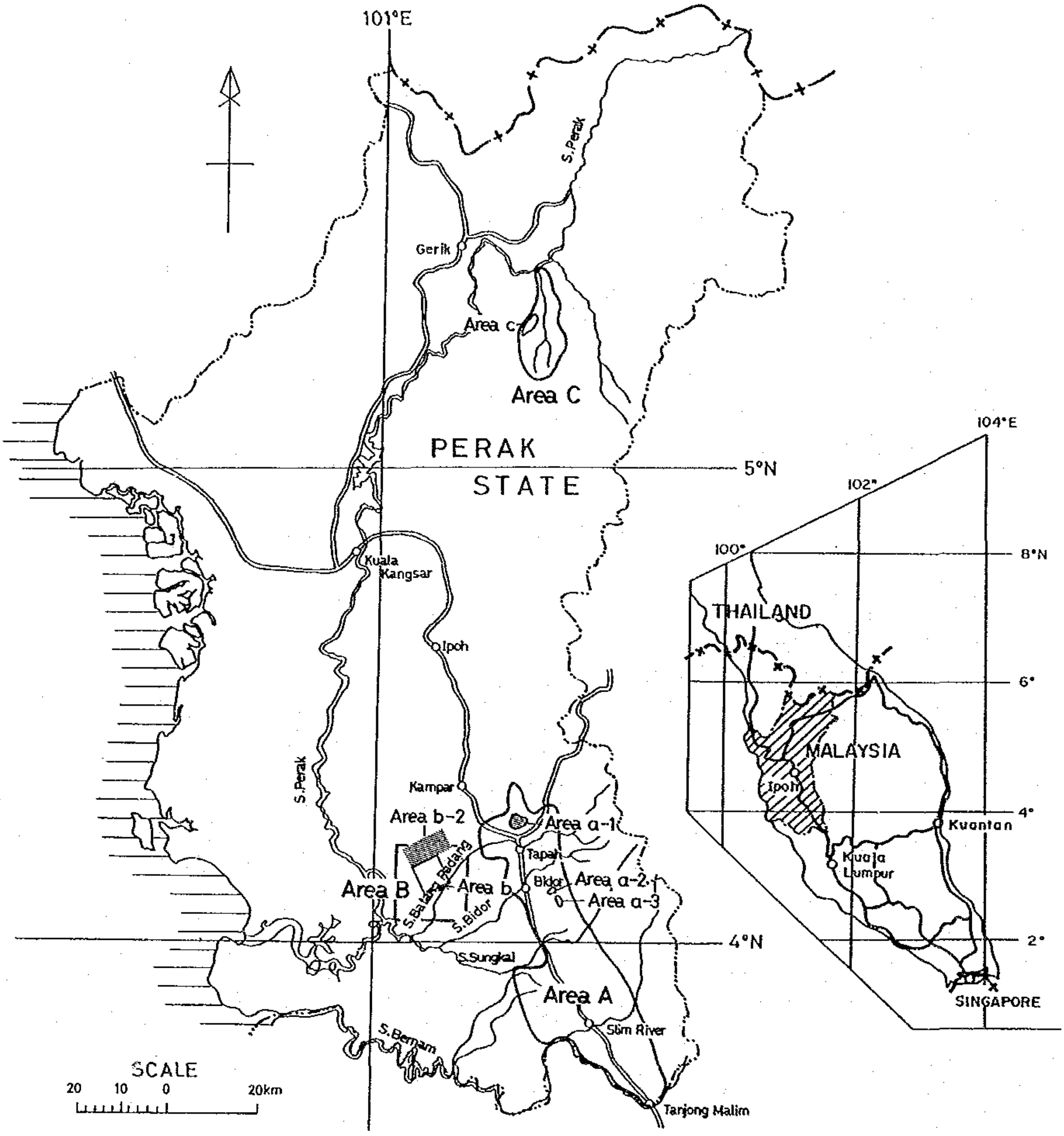
We hope that this report will serve to promote further development of the project and contributes to the promotion of friendly relations between our two countries.

We wish to express our deep appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the team.

February, 1991

Kensuke Yanagiya
President
Japan International Cooperation Agency

Gen-ichi Fukuhara
President
Metal Mining Agency of Japan



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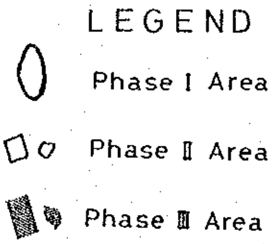

Fig.1 Location of the project area

Abstract

This project, the Mineral Exploration Project in Perak, Malaysia, was excuted over a period of three years beginning in 1988 with the aim of clarifying the geological setting and mineralization in Area A, B and C located in Perak State (Fig.1).

In Phase III (final phase, July 1990 to February 1991) drilling was conducted for the purpose of exploration for primary gold mineralization in the northeastern part of Area a-1 where a highly anomalous Au zone was outlined by soil sampling in the Phase II survey while in Area B, geophysical survey (Gravity method) and drilling were carried out to further explore the placer tin occurrences in the Quaternary sediments.

In the northeastern part of the Area a-1, drilling was conducted at three sites, each of which is approximately 50m apart along a NW-SE trending line. Two holes with inclinations of -30 degrees and -60 degrees were drilled at each site, bringing a total of six drill holes and a total length of approximately 900m. In addition to core logging, 296 samples from the holes were analyzed for eight elements such as Au, Ag, As, Cu, Pb, Zn, Sn and W. The results of the drilling suggest that the area is covered by a thick talus deposit (upto 40m thick) and beneath this talus deposit, concealed primary gold mineralization with a maximum grade of 2.1 ppm and a weak base metal (Cu, Pb and Zn) mineralization with Ag occur in silicified schist at approximately 50m and 120m below the surface respectively.

The Au concentration in the talus deposit is possibly derived from the schist roof pendants in the Main Range granite; subsequent erosion and transportation resulted in its deposition at the drill site. Such talus deposits might be present in other localities within Area A.

Although the primary Au mineralization as indicated by the present survey has little economic significance, the presence of primary Au mineralization in close association

with As in silicified schist should be a good guide for the future exploration of primary Au in the area.

In the Area B, geophysical survey (gravity method) and drilling (totals six holes and approximately 442m) were conducted in Area b-2, and Area b and b-2 respectively.

The results suggest that the most preferable locations for large scale, high grade, placer tin deposits are the bottom of concaved basements interpreted as paleo-river channels and this kind of basement topography exists in the northeastern portion of the Area B. The placer tin beds detected in the present survey, however, are located below the minable limit of depth (60m) and low overall tin grade. Therefore, the economical value is considered to be low at the moment.

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PART III CONCLUSIONS AND RECOMMENDATIONS

PART I GENERAL REMARKS

Chapter 1 Introduction

1-1 Background

The Kinta Valley in which Ipoh, the Capital City of Perak is located, has been known as a placer tin producing center for more than a hundred years, providing more than 50% of tin consumption of the free world. However, in recent years a drain of tin resources in the area and an aggravation of the world market price of tin have forced an abrupt cut down of tin production of the area.

Under these circumstances, in an attempt to seek new mineral resources that will supplement tin, the Government of Malaysia requested the Japanese Government to conduct a mineral exploration project in Perak in 1987. The JICA and MMAJ mission sent to Malaysia by the Japanese Government in response to this reached agreement with the Geological Survey of Malaysia to implement the mineral exploration project in Perak in March 1988. Subsequently, the project was started in July 1988.

The Phase I of the project (July 1988 - February 1989) was conducted in three areas, Area A, Area B and Area C, which totals 1,390km^2. The activities in each area are as follows:

Area A: geological and geochemical surveys in the whole area, geophysical survey (CSAMT method) in the Bukit Mas area

Area B: study and review of all existing reports and data

Area C: geological and geochemical surveys

Several areas of high potential were delineated by these surveys.

The Phase II of the project (July 1989 - February 1990) was conducted in the areas of high potential delineated by the Phase I survey, namely areas a-1, a-2, a-3, b and c (total of 57km^2). Various surveys conducted in Phase II consist of detailed geological survey, geochemical survey, geophysical survey (gravity method), trenching and Banka drilling. The Au geochemical anomaly outlined in the eastern part of the Area a-1 is considered the area with the highest potential for gold and borehole drilling in this area was recommended for the Phase III Survey.

1-2 Conclusions and Recommendations of Phase I Survey

1-2-1 Conclusions of Phase I Survey

(1) Area A

The Area A is composed of the Paleozoic phyllite and the Permian - Triassic Main Range granite. The mineralization in the area is of a vein type of gold and tin.

The geochemical anomalies are zonally arranged as rare earths, Sn and W, and Au from the Main Range granite to the phyllite zone. Among these anomalies, Au anomalies distributed on the east of the Tapah - Bidor highway are outstanding. They cover an area of 2 - 4km x 22km, including the Bukit Mas gold deposit area. The anomalies located on the north of Bukit Mas are better than those of Bukit Mas, suggesting higher potential for gold deposits than the Bukit Mas area.

The Bukit Mas deposit is of auriferous quartz vein type in the phyllite zone. Judging from the resistivity structure obtained by CSAMT survey, the mineralization of Bukit Mas is considered to be of a small scale. It has become clear that the gold anomalies in soil found by GSM before occur in the metasandstone beds and has no direct connection with the distribution of known deposit.

(2) Area B

In the Quaternary deposits, the Teluk Intan area has much higher potential for SnO_2 concentration than the Changkat Jong area. The SnO_2 concentrations (thickness 1.5 - 6.0m, SnO_2 content 0.24 - 1.9kg/m^3) are controlled by the bedrock relief, therefore, it is necessary to investigate the bedrock structure prior to drilling.

By reasons of large specific gravity difference, easy access and low cost, a gravity survey was considered to be the best method for this purpose.

(3) Area C

The Area C is composed of Paleozoic schist and the Main Range granite.

The geochemical anomalies show a zonal arrangement as rare earths and Sn, W and Au from the Main Range granite to the schist zone, and suggest high potential for gold and tin mineralization.

1-2-2 Recommendations for Phase I Survey

(1) Area A

To carry out detailed geological survey, geochemical soil sampling followed by trenching over the gold anomalous zone which extends from the north of Tapah to the south of Bidor and clarify the details of mineralization.

(2) Area B

To carry out gravity survey in the area centering around Labu Kubung in the Teluk Intan map sheet and clarify the bedrock profile.

(3) Area C

To carry out detailed geological and geochemical (rock) surveys for the Au, Sn and rare earth anomalies located in the basins of S. Duabelas and S. Jopal.

1-3 Conclusions and Recommendations of Phase II Survey

1-3-1 Conclusions of Phase II Survey

(1) Area A

Detailed geological survey, geochemical soil sampling and trenching in Area a-1 showed an extensive Au anomalous zone (0.6km wide x 1.4km long, average Au grade of 0.410 ppm with maximum grade of 2.708 ppm) and a possibility of primary Au mineralization beneath the Au anomaly. Detailed geological survey and geochemical survey in the Area a-2 and Area a-3 suggest low potential for Au in these areas.

(2) Area B

Geophysical survey (gravity method) conducted over the area of the Quaternary sediments for the purpose of determining relief of bedrock suggested the existence of an elongated, steep concave basement structure at a depth of more than 100m in at the northern corner of the area and U-shaped hollows reflecting ancient river channels in the central part of the area. The geophysical survey also showed that the three Phase II drill holes which intersected placer tin beds and five previous drill holes by GSM were located in the area of high basement relief.

The placer tin beds intersected by three Banka drill holes were located in the Quaternary deposits at the depth of relatively close to the bed rock with width ranging from 3.1m to 4.6m, and have average SnO_2 grade of 0.39 to 0.81kg/m^3. Each of drill holes, also, intersected relatively low quality superficial clay beds consisting mainly of kaolin and quartz.

(3) Area C

Detail geological survey and rock geochemical survey conducted in the Area c suggest a low potential for Au, Sn and REE in the area.

1-3-2 Recommendations of Phase II Survey

(1) Area a-1

Drilling was recommended in order to clarify details of mineralization in the Au-As geochemical anomalous zone which is located near the boundary between the Main Range granite and phyllite in the north eastern part of the area.

(2) Area b

Gravity survey was recommended in the area northwest of Phase II area aiming at searching for the concave structures of bedrock reflecting paleo - river channels. Drilling was recommended in the concave structures to examine possible occurrence of tin ore deposits.

1-4 Outline of Phase III Survey

1-4-1 Survey Area

The survey areas of Phase III consists of two area, Area a-1 (Area A) and Area b-2 (Area B) (Fig.1).

Area a-1 (6.0km^2), which includs the whole drainage system of S. Jong, a tributary of S. Chenderiang, is located approximately 3km north of Tapah on National Highway 1. Drilling was conducted in the Tapah Estate Sdn. Bhd. located in the eastern part of the Area a-1 (Fig.I-1-1).

Area b-2 (25km^2) is located north of the junction of S. Batang Padang and S. Bidor and is adjacent the northwestern end of the Phase II geophysical survey area (Area b) (Fig. I-1-2).

1-4-2 Objectives of Survey

(1) Area a-1

Geochemical soil sampling and trenching in Phase II suggest the highest potential for Au over the area of the Au anomalous zone on the western side of the Main Range granite located in the northeastern part of the Area a-1. Drilling was conducted to examine the area for possible occurrence of the Au quartz veins or Au dissemination beneath the anomalous zone.

(2) Area b-2

Geophysical survey (Gravity method) to clarify bedrock relief, which was conducted during the Phase II in Area b, was repeated in the area northwest of Area b. The areas showing bedrock concave structures are examined by drilling to understand the relations between distribution of the placer tin deposits and bedrock relief and to clarify potential of tin deposits in the area.

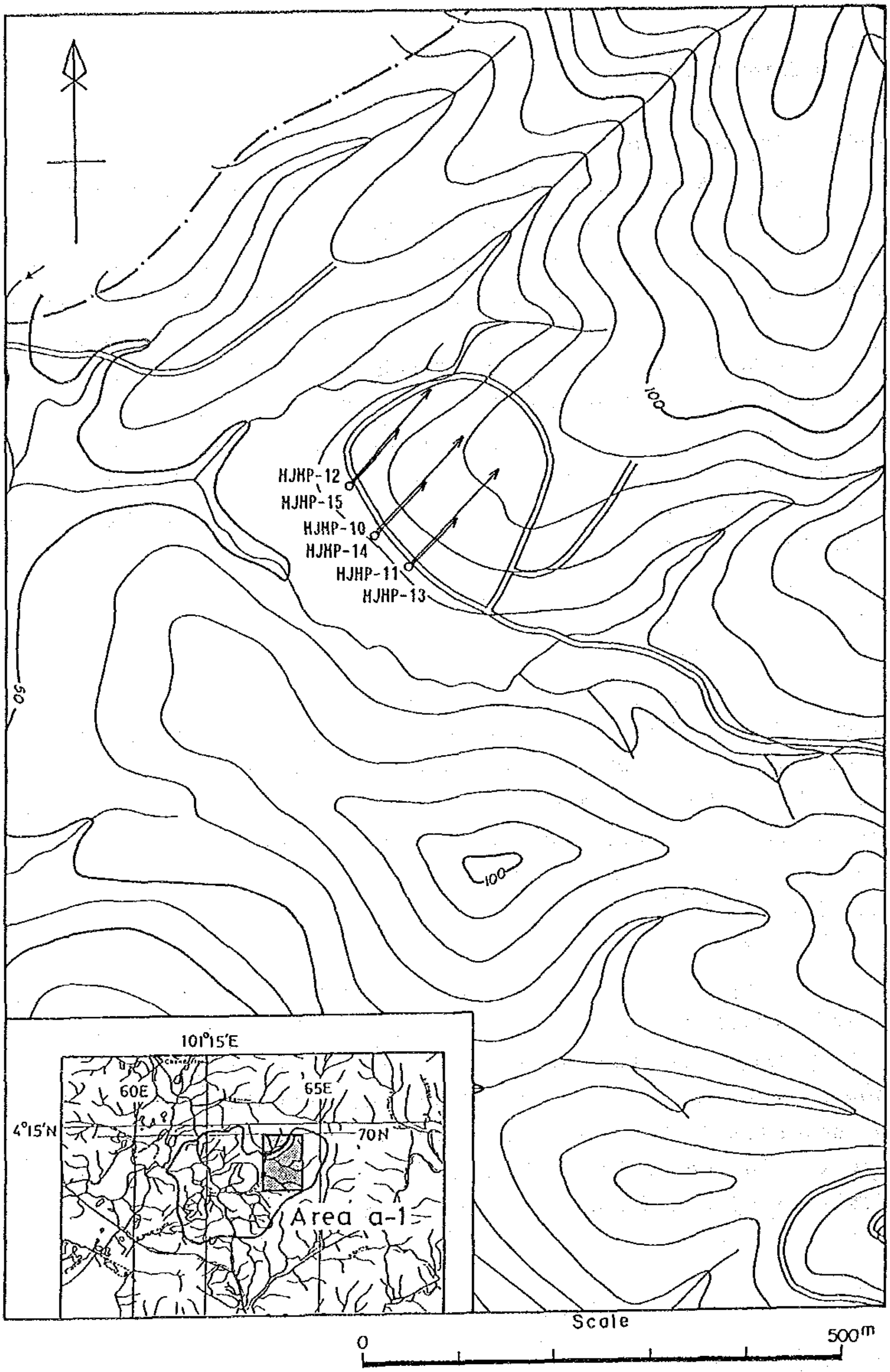

Fig. I-1-1　　Location of the drilling survey area, Area a-1

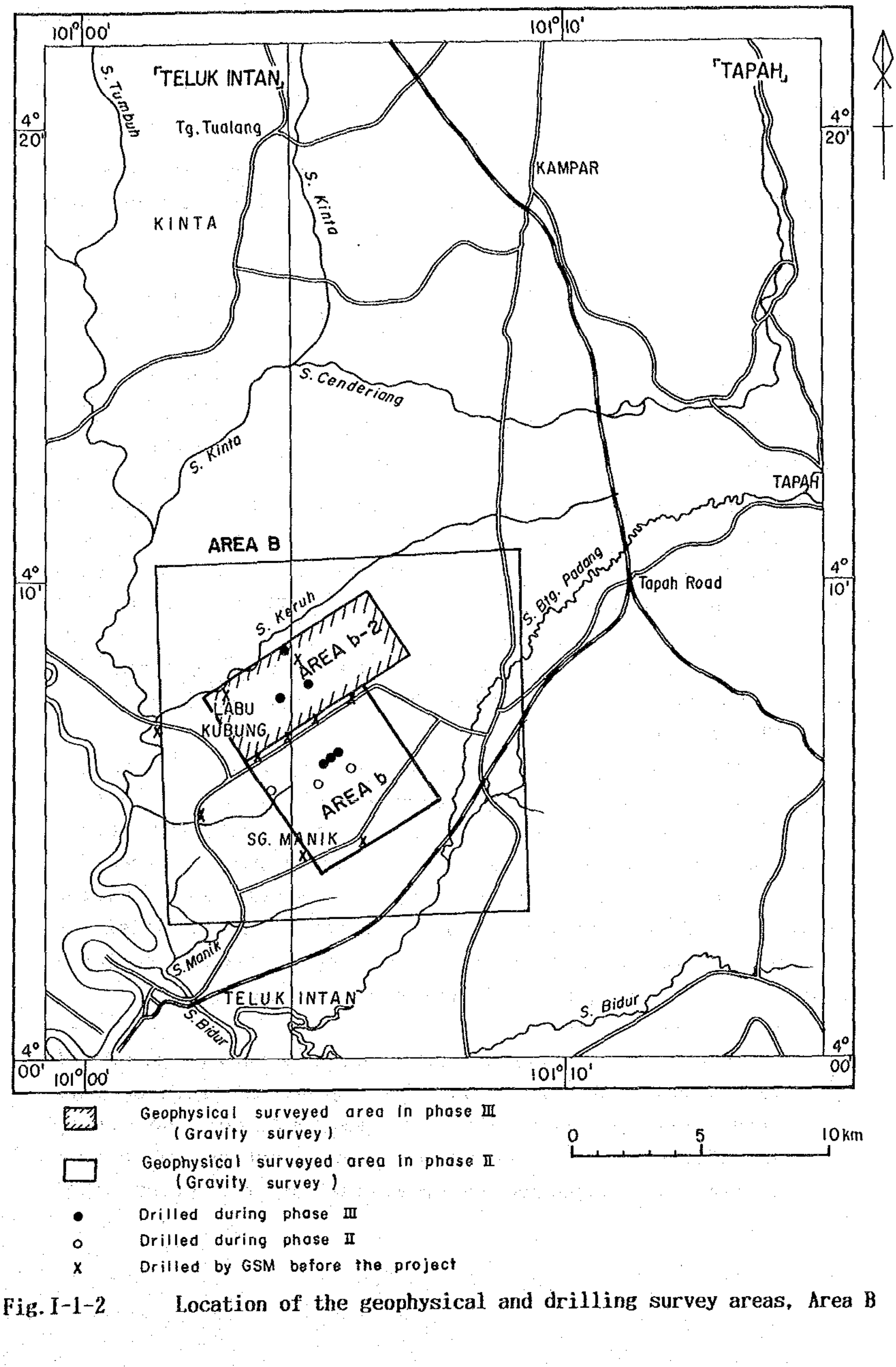

Fig. I-1-2 Location of the geophysical and drilling survey areas, Area B

1-4-3 Survey Methods

(1) Area a-1

Six bore holes shown below were drilled over the Au anomalous zone obtained by the soil geochemical survey and trenching in Phase II(*).

hole No.	bearing (degree)	inclination (degree)	length (m)
MJMP-10	45	-30	150.60
MJMP-11	45	-30	160.50
MJMP-12	45	-30	150.50
MJMP-13	45	-60	140.40
MJMP-14	45	-60	150.60
MJMP-15	45	-60	150.70

A systematic sampling of the drill cores for chemical analysis was conducted regardless of quartz veins and country rock to evaluate causes of Au anomalous zone obtained by geochemical soil sampling in Phase II, whether it is due to Au dissemination in phyllite (it later appears to be amphibolite and schist after core logging) or auriferous quartz veins beneath the anomalous zone.

(2) Area b-2

Gravity method was conducted as in Phase II for the purpose of determining a topographic profile of the bedrock covered by the Quaternary sediments, since gravity values response precisely even for small differences of specific gravity between the Quanternary sediments and bedrock (Palaeozoic formation and granite). Because of the sensitive nature of this gravity survey as different from a regional gravity survey, even small differences of gravity

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(*) Although three drilling holes with a total length of 900m (300m x 3 holes) and -30 degrees inclination were originally planned, it was amended to the above specification soon after the intersection of barren granite at unexpected shallow level by the first drill hole.

values reflecting greatly to a topographic profile, special care was taken to minimize closing errors (less than 0.2 mgal). For this reason measurement of closing error at the end of loop was done every day.

Drilling was conducted using semi-mechanized Banka, owned by Geological Survey of Malaysia (GSM) for understanding the placer tin mineralization in the Quaternary sediments and the relationship between tin concentration and topographic profile of bedrock. A total of six holes, four in the concave structures delineated by gravity survey during Phase II in Area b and two in the concave structures delineated by gravity survey during Phase III in Area b-2, were drilled during Phase III. The sludge obtained at approximately every 1.5m (5 feet) interval were instantaneously described, weighed and pan concentrates of heavy minerals were produced for chemical analysis of 8 elements (Au, Ag, Cu, Pb, Zn, W, As, Sn).

1-4-4 Survey amount

The survey methods, coverage and analytical items and components are summarized in Table.I-1-1 and I-1-2.

1-4-5 Organization of the Survey Team

The members participated in Phase III survey are listed below.

Planning and negotiation (1990)

Japan side	Malaysia side
Ryoichi Kouda (MITI)	Yin Ee Heng (GSM)
Hiroshi Shimotori(MMAJ)	Fateh Chand (GSM)
-	Shu Yeoh Khoon (GSM)
-	Foo Khong Yee (GSM)
-	Loh Chiok Hoong (GSM)

Field surveys during Phase III(1990)

Survey	Japanese members	Malaysian members
Leader/Geological survey/ Core logging	Ikuhiro Hayashi (BEC)	Loh Chiok Hoong (GSM)
Geological survey/Core logging	-	Mohd Anuar Mohd Yosof (GSM)
Geological survey/Core logging	-	Mohd Suhaili Ismail (GSM)
Geophysical survey	Hiroshi Fukuda (BEC)	-
Geophysical survey	Masatane Kato (BEC)	-
Drilling	Shigeo Sekiguchi (BEC)	Nordin bin Abdullah (GSM)
Drilling	Zenzo Kodate (BEC)	Arshad bin Musa (GSM)
Drilling	Tokuzo Kudo (BEC)	Jernail Singh (GSM)
Topographic survey	-	Abu Bakar Che Ngah (GSM)

MFA*:Ministry of Foreign Affairs MITI**:Ministry of International Trade and Industry
BEC***:Bishimetal Exploration Co., Ltd.

1-4-6 Duration

(i) Field Work (data analysis is included)

Geophysical Survey :30, Jul. 1990 - 22, Sep. 1990

Drilling :30, Jul. 1990 - 27, Oct. 1990

Preparation and logging :23, Jul. 1990 - 23, Nov. 1990

(ii) Report Preparation :24, Nov, 1990 - 27, Feb. 1991

Table I-1-1 Survey amounts

Phase III (1990)

Method	Area	Items	Quantities
Drilling (Diamond Drilling)	a-1	Length drilled	903.30 m
		MJMP-10 (45°, -30°)	150.60 m
		MJMP-11 (45°, -30°)	160.50 m
		MJMP-12 (45°, -30°)	150.50 m
		MJMP-13 (45°, -60°)	140.40 m
		MJMP-14 (45°, -60°)	150.60 m
		MJMP-15 (45°, -60°)	150.70 m
Geophysical Survey (Gravity method)	b-2	Survey area	22.5 km²
		Number of points measured	613 points
Drilling (Banka drill)		Length drilled	441.8 m
	b	MJMP-4	66.0 m
		MJMP-5	70.0 m
		MJMP-6	71.0 m
	b-2	MJMP-7	71.1 m
		MJMP-8	79.2 m
		MJMP-9	84.5 m

Table I-1-2 Laboratory tests and analyses in Japan

Laboratory studies	Amounts
(1) Thin section observation under microscope	42
(2) Polished section observation under microscope	15
(3) X-ray diffraction analysis	15

Chapter 2 Outline of Survey Area

2-1 Topography and Drainage

The eastern part of the Area A is occupied by NW-SE trending Main Range with an elevation ranges from 1,550m to 2,000m while the western part of the Area A shows a flat topography with an elevation less than 50m. Sungai Batang Padang, Sungai Bidor and Sungai Sungkai all of which are tributaries of Sungai Perak and Sungai Slim, a tributary of Sungai Bernam, are the main rivers in the Area A. All of them flow to southwestern direction. Area a-1 covers all the drainage system of Sungai Jong, a tributary of Sungai Chenderiang which flows to Sungai Batang Patang.

Area B is occupied by paddy field and shows flat topography with elevation of about 10m. Sungai Perak meanders immediately west of the area. No drainage system exists in the area, however, irrigation creeks crosscut the paddy field.

2-2 Climate and Vegetation

2-2-1 Climate

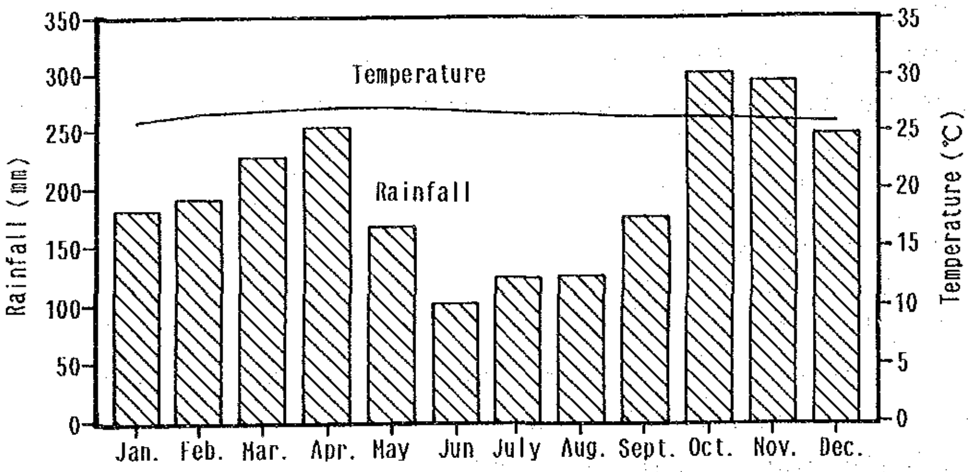
Malaysia has a tropical monsoon climate. During November to January it is a period of northeast monsoon with relatively more rainfall. While during March to April it is a period of southwest monsoon. Relatively dry weather is experienced in the intermonsoon period.

Fig.I-2-1 shows monthly averages of temperature and rainfall in Project Area. It shows a very stable temperature all year round, however, relatively less rainfall in June to August.

2-2-2 Vegetation

In Area A, most of the flat plain is developed, thus jungle is rarely seen except in the western flank of the Main Range. The flat plain in the west of the north-south running highway is occupied by a barren land because of previous activities of placer tin mining. The flat plain in the east of the highway, on the other hand, is extensively occupied by rubber and oil palm estates. The rubber and oil palm estates can be observed in almost entire area of Area a-1. Three drilling holes in the Area a-1 are located in a oil palm estate.

Area B is mainly occupied by paddy field and rubber and oil palm estates are rarely seen.



Note:Rainfall data 1951-1980, Station:Teluk Intan
Temperature data 1968-1982, Station:Sitiawan
Data from Jabatan Kajicuaca Malaysia

Fig. I-2-1 Monthly average temperature and rainfall in Project Area.

Chapter 3 Outline of Geology and Mineralization

3-1 Geology

A subdivision of Peninsular Malaysia into four major tectonic regions was proposed by Hutchison (1977). They are, from west to east, Western Stable Shelf, Main Range Belt, Central Graben*, Eastern Belt (Fig.I-3-1).

The Main Range Belt, which includes entire survey area (Areas A, B and C), consists of isoclinally folded Palaeozoic metasediments and Main Range Granite batholith. The former are intruded by the latter. The Phase III survey was conducted in Area a-1 in the Area A and Area b-2 in the Area B. The Area a-1 is located at the contact zone of the Palaeozoic metasediments and the Main Range Granite in the central part of the Main Range Belt, whereas the Area b-2 is located west of the Area a-1 in the area of the alluvial deposits (Fig.I-3-1).

According to the previous surveys of the project (Phase I and II), the metasediments in the Area a-1 are phyllite with thin layers of metasandstone and for intrusive granitic rocks, a stock of Changkat Rembian Granite with equigranular texture was identified in addition to Main Range Granite with porphylitic texture. Because of restricted exposure of fresh rock and thick soil coverage in the Area a-1, geologic boundaries were roughly estimated based on weathered rocks and occasionally by soil during the previous surveys. A few new geological evidences were added to the previous information by drilling survey of the Phase III. Occurrences of amphibolite and schist, which were not observed on the surface, were found below ground. Talus deposit, which is same age to or younger than Alluvium, was found in the previous area of phyllite.

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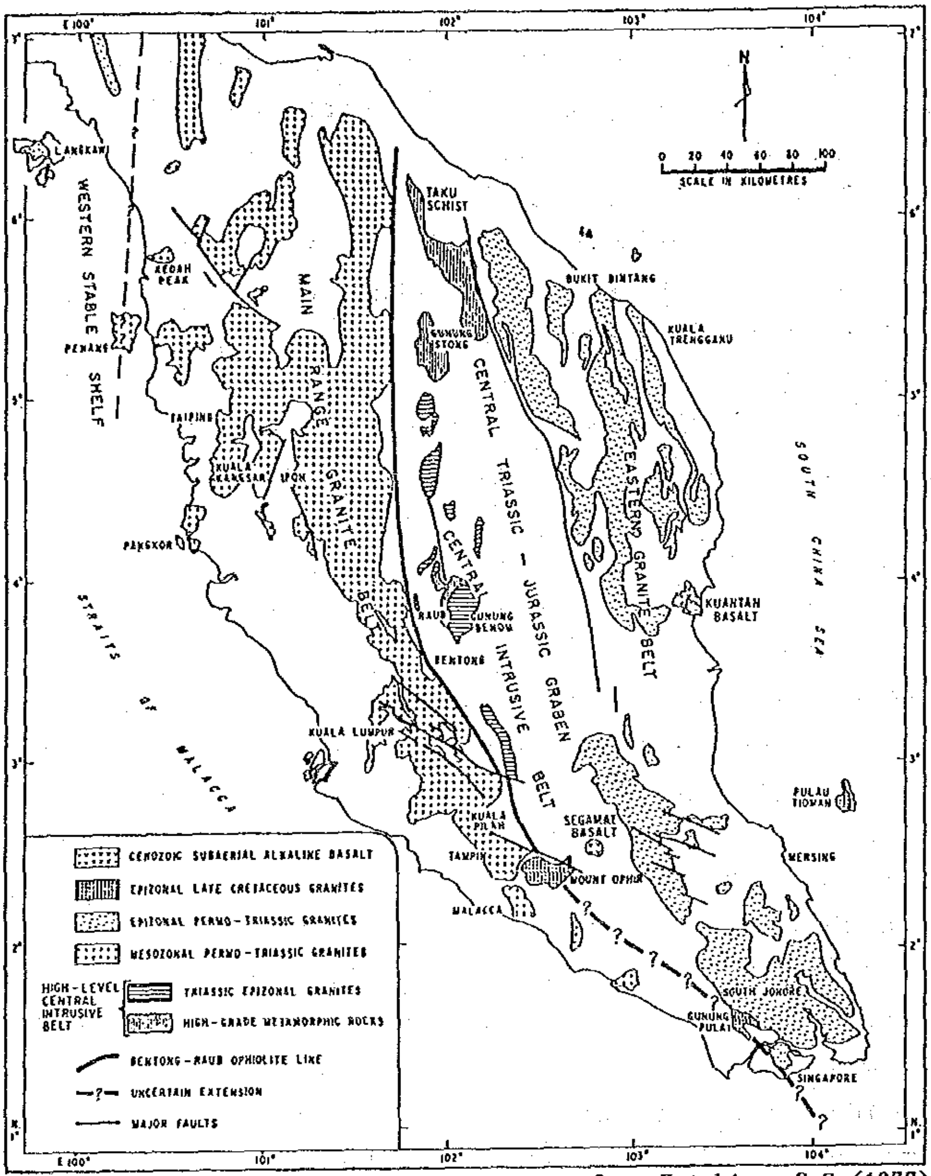
* The Central Graben corresponds to the area of Central Triassic-Jurassic Graben and Central Intusive Belt in Fig.I-3-1.



after Hutchison C. S. (1977)

Fig. I-3-1 Map showing major tectonic regions in Peninsular Malaysia

3-2 Mineralization

The Kinta Vally, which extends southwards from Ipoh, the capital city of Perak State, has been known as a placer tin producing center for more than one hundred years. In addition to tin, gold was also produced in the Kinta Vally. The placer tin deposits are located in the Quaternary sediments and they, generally, include the minerals rich in rare earth elements, such as zircon, monazite and xenotime, in addition to placer tin and gold. The primary tin deposits and its showings, being associated to the hydrothermal mineralization and skarn, are scatterd in the Main Range Granite and its vicinity. The occurrence of tin deposits produced by the hydrothermal mineralization are cassiterite-arsenopyrite-quartz veins associated by pyrite, chalcopyrite and sphalerite or cassiterite-wolframite-quartz veins associated by a few sulphides.

The auriferous quartz veins in phyllite, located at 2km southeast of Tapah, is the only primary gold deposit in the area. It has a history of operation and production, known as Bukit Mas gold deposit (*).

Basemetal (Cu, Pb and Zn) deposits with operation and production histories are not known in the area and scattered locations of only minor deposits/prospects of this type are known at the marginal part of the Main Range Granite in the Kinta Vally.

The kaolin deposits found in the area between Tapah and Bidor are important non-metallic deposits in the area. They occur in the restricted area of 1.5km x 4km in the southeastern margin of the Changkat Rembian Granite.

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* Detail geological survey, soil geological survey and drilling were conducted in the area by GSM. The Phase I of this project includes geophysical survey (CSAMT) in the area.

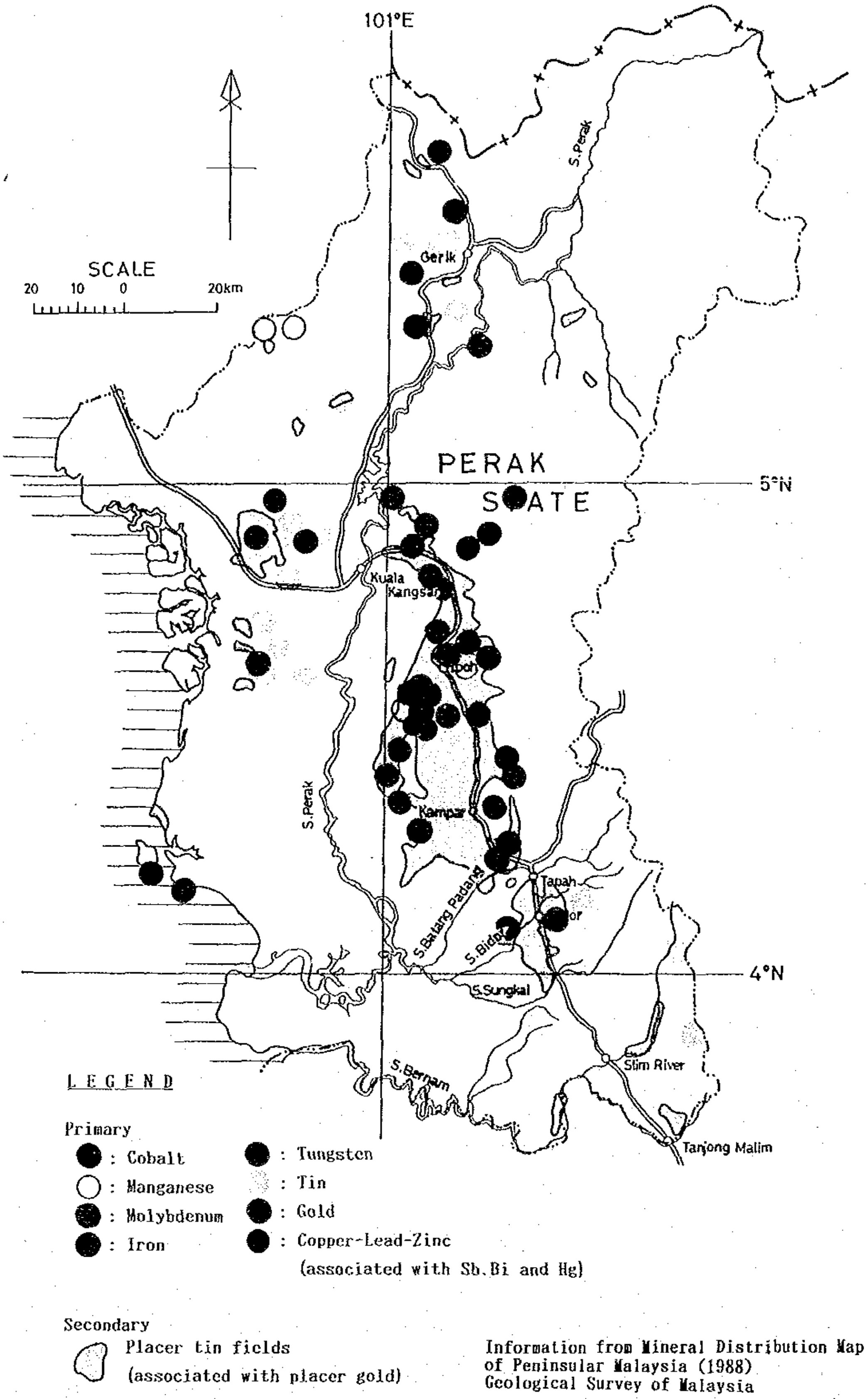


Fig. I-3-2 Mineral resources distribution in the State of Perak

Chapter 4 General Discussion on the Survey Results

4-1 Area A

In the Area a-1, the drilling were conducted to investigate the origin of the gold concentration in the superficial soil, which was detected by Phase II soil sampling. It resulted in finding of concealed mineralization of Au and base metal in the bedrock.

Au grade (max?2.1g/t) intersected by the drill holes have little economic significance at the moment due to the low grade. However the fact that primary Au is associated with As in silicified rock is a good guide for primary Au exploration in the future.

The Au concentration in the superficial soil is not considered to be directly derived from the primary Au mineralization in the underlying bedrock because of the thick talus deposit between the superficial soil and the bedrock. The Au concentration in the superficial soil and the talus deposit are considered to be originated from the granitic mountains located immediately east and north of this area which were once covered by mineralized schists.

On the other hand, the Au concentration in the talus deposit itself is also a significant resource. In view of this, additional sampling with 50m grid was conducted by GSM. The summary of the result and the experimental evaluation is attached as Appendix-5.

The total gold content in area of 350m x 2,400m with maximum depth of 3m covering the drilling area is approximately 150kg with an average grade of 0.16g/m^3. When a cut-off grade is assumed to be 0.3 ppm, the total gold is approximately 108kg with an average grade 0.90g/m^3 and a total volume of 120,000m^3.

The whole neighborhood of the sampling area is possibly covered by a thick talus deposit. If so, the volume is expected to increase sharply. Therefore, Au grade in the thick talus deposit should be a significant factor for the evaluation of the mineralization.

4-2 Area B

Concaved structures in the gravity basement occur as discontinuous curvilinear features. These concaved structures are considered to be meandering channels of paleo river. Assuming that the gravity basement map well shows such general basement topography, locations of drill sites can be considered in relation to the bedrock topography.

As shown in the gravity basement map superimposed on drill sites, MJMP-4, 5, 8 and 9 are located in the area of concaved bedrock topography, showing the altitude of bedrock appearance less than -80m. Although all of the four drill sites are located less than 500m apart from the bottom of the concaved places, only MJMP-4 shows relatively low grade of tin compared with the other three holes. The reason for this can be atributed to the location of MJMP-4 on the local and steep slope. MJMP-6 and 7, on the other hand, are located on the local uplifts of paleo river channels. This is not preferable site for the placer tin deposits.

Based on the relationship between locations of drill sites on the gravity basement map and tin grades, the most recommendable location for exploration drilling is concluded to be point A located in the northeastern part of the area, composed of Area b and b-2, on Fig.II-2-13. The concaved structure at point A may be the largest in the area, although it is not revealed entirely because of lack of gravity data. Therefore, point A shows all the favourable aspects of placer tin deposits.

Other zones of concaved bedrock topography are also potential sites for placer tin deposits.

Chapter 5 Conclusions and Recommendations

5-1 Conclusions

5-1-1 Area A

The following conclusions are drawn from the results of drilling survey in the Area a-1:-

(1) The five trenches (Nos.8, 9, 11, 12 and 13) that gave high Au concentrations in the Phase II survey are located on the talus deposit (up to 40m thick) which shows a interfinger relation with alluvial deposits. The talus deposit, consisting of mainly angular schist fragments has high Au concentration. Consequently, the high Au concentrations in the talus deposit are believed to be derived from a possible occurrence of schist roof pendants on the Main Range granite in the northeastern part of the area. Subsequent erosion and transportation resulted in the deposition of the talus deposit at the present site.

(2) Concealed Au mineralization with a maximum grade of 2.1 ppm (sampling width: 1.00m) at approximately 50m from ground surface and base metal (Cu, Pb and Zn) mineralization with Ag at approximately 120m from ground surface are confirmed in the silicified rock.

(3) Geochemically, the primary Au mineralization is closely related to As. Therefore As is an available pathfinder for the future exploration of primary gold mineralization.

5-1-2 Area B

The following are drawn from the results of geophysical survey (gravity method) in the Area b-2 and drilling survey in the Area b and b-2:-

(1) The preferable sites for large scale and high grade

placer tin deposits are at the bottom of a large concaved basement structures (paleo river channels).

(2) Among the concaved basement structures (paleo river channels) delineated, the largest, located at the northeastern part of the survey area (basement altitude less than -100m) is considered to have the best potential for high grade placer tin deposit.

(3) The placer tin beds intersected by the six drill holes all lie at the depth of more than 60m corresponding to the mining limit at the moment. In addition, the overall tin grade is low due to the thick overburden. Therefore, they have probably little economical significance at the moment.

5-2 Recommendations

The gold and tin deposits discovered by the project have little economical significance at the moment. When the metal deposits are re-evaluated in the future, however, the following are recommended:-

5-2-1 Area A

(1) Grid Banka drilling is recommended to clarify the three dimensional distribution of gold in the talus deposit, Area a-1.

(2) Some of the geochemical Au anomalous areas located near the contact with Main Range granite, extracted by Phase I and II surveys, probably have talus deposits. Therefore, detailed mapping should be carried out to delineate such talus deposits followed by detailed soil sampling and Banka drilling.

(3) Follow-up drilling is recommended to clarify shape, size and Au grade of the primary Au mineralization confirmed by the Phase III drilling in Area a-1.

5-2-2 Area B

(1) Drilling a limited number of Banka holes arranged across the paleo river channels is recommended to obtained a better understanding of the occurrence and distribution of the placer tin.

(2) Additional gravity survey and Banka drilling are recommended to reveal entirely the concaved structure, suggested by the gravity survey, in the northeastern part of the area and to obtain a better understanding of the occurrence and distribution of placer tin there.

PART II DETAILED DESCRIPTION

Chapter 1 Area a-1 (Area A)

1-1 Drilling

1-1-1 Objectives

The purpose of the drilling is to confirm possible occurrences of auriferous quartz veins or Au disseminated bedrock beneath the Au anomalous zone suggested by geochemical soil sampling and trenching on the west side of the Main Range Granite in the northeastern part of the Area a-1.

1-1-2 Survey Method

(1) Location of Drilling Site

The target of the drilling was set to the areas beneath the trenches No.8, No.9 and N0.13 which showed high Au grades. Considering general trend and dip of the quartz veins on the surface, the bearing, inclination and length of the drill holes were determined as follows so as to hit quartz veins perpendicularly.

Hole No.	Bearing (degree)	Inclination (degree)	Length (m)
MJMP-10	45	-30	300
MJMP-11	45	-30	300
MJMP-13	45	-30	300

The drilling plan was modified as below soon after the first drill hole unexpectedly hit barren granite at shallow level.

Hole No.	Bearing (degree)	Inclination (degree)	Planned Length(m)	Actual Length(m)
MJMP-10	45	-30	150	150.60
MJMP-11	45	-30	160	160.50
MJMP-12	45	-30	150	150.50
MJMP-13	45	-60	140	140.40
MJMP-14	45	-60	150	150.60
MJMP-15	45	-60	150	150.70

(2) Core Logging

Drill cores, both of quartz veins and bedrock were systematically sampled for chemical analysis to evaluate the cause of high Au concentrations in the surface soil, whether they derived from Au disseminated phyllite (it was, later, confirmed to be mainly amphibolite and schist by core logging) or auriferous quartz veins expected in the underground.

Furthermore, to construct a vertical profile of Au concentration of the soil, samples were also collected from soil for a few holes by dry drilling.

The topographic map of Phase II produced by a conventional method using pocket compass and tape is not accurate enough to determine precise location of drilling and trench sites. For this purpose in the Phase III survey, an accurate surveying was conducted using transit to produce the topographic map by GSM.

1-1-3 Description Of Drilling Site And Operation

(1) Drill Site

All of the drill sites are located within Tapah Estate, in the eastern part of the Area a-1. The access to the drill sites is easy. The entrance of the Tapah Estate can be reached by a ten-minute drive from Tapah along the paved road conecting Tapah and Cameron Highland. Then, ten minutes drive to the drill sites taking a steep winding road only accessible by a four wheel drive vehicle. A total of six drill sites in three locations were in the oil palm estate (Fig.II-1-1). Location No.1 (MJMP-11 and 13) and Location No.2 (MJMP-10 and 14) are on the flat alluvium, a right bank of the upper stream of Sungai Jong and Location No.3 (MJMP-12 and 15) is on the south slope of a gentle hill.

(2) Operation of Drilling

Heavy equipments such as a drill machine (Longyear '34') and a pump were made available by GSM, whereas drill

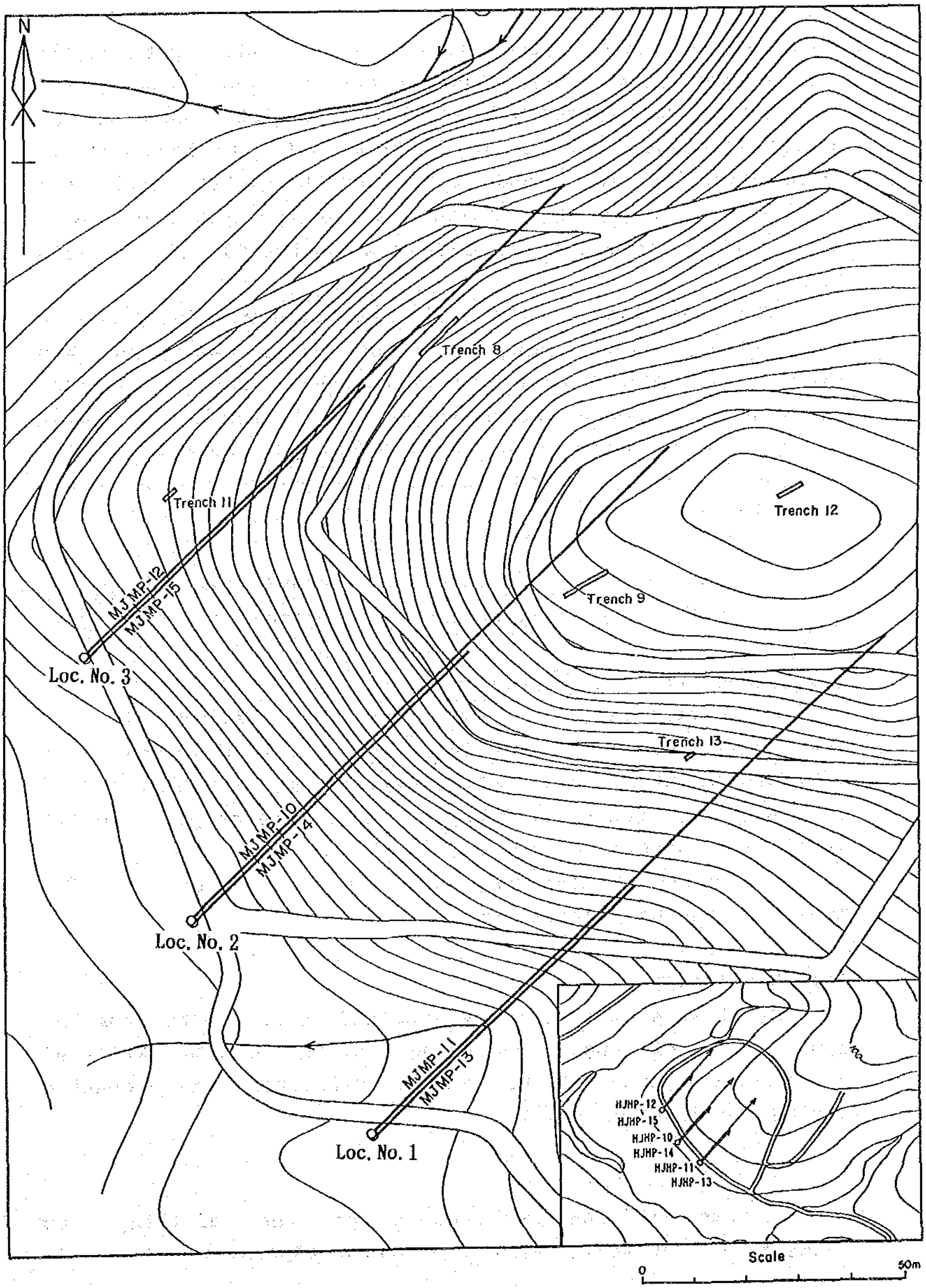


Fig. II-1-1 Location map of the drill holes and its related trenches, Area a-1 tools and consumable items such as bits, rods and bentonite were shipped from Japan. Logs for derrick mast, wood plates and cement were purchased locally. The drill machine was operated 24 hours/day deploying three shifts (8 hours each). Preparation, removing and moving of the drill sites were conducted by a day shift (8:00 a.m. to 4:00 p.m.) or two 6 hour shifts (7:00 a.m. to 1:00 p.m. and 1:00 p.m. to 7:00 p.m.).

The completion of the drill operation was delayed by a few reasons. The commencement of drill operation was hampered by problems in custom clearance for the various shipment from Japan. Breakdown of drill machine and slow drill progress because of thick silicified rock were also reasons for delay of completion. The period of the drill operation was as follows:

Date of the commencement	August 14, 1990
Date of the completion	October 17, 1990

(3) Transportation and moving

After repairing the estate road, the drill machine and pump were despatched directly to the drill site from Ipoh GSM. The tools and materials shipped from Japan were stored in a warehouse rented in Tapah and they were supplied to the drill site whenever they were needed.

The drill machine was towed by a truck or jeep for moving to the next drill site.

(4) Water supply

Drill water was directly supplied through pipe from the upper stream of Sungai Jong using a discharge pump. Shortage of water was expected, however, no difficulty was encounted during the drill operation.

(5) Drill operation

A summary and a process of the drilling are respectively shown on each hole basis (Appendix-1 and -2).

1-1-4 Results of core logging

(1) MJMP-11

(1-1) Specifications

Coordinates: 364.102E, 469.568N
Bearing : 45 degree
Inclination: -30 degree
Length : 160.50 m

(1-2) Descriptions (Fig.II-1-2)

0.00m - 50.80m (none core)

Sand derived from granite and schist in 0.00m to approximately 40.00m (estimated from sludge), yellowish brown weathered soil in approximately 40.00m to 50.80m.

50.80m - 52.10m

Clear quartz vein with pale brown dusts consisting of iron oxides. Fine pyrite grains rarely appear.

52.10m - 56.00m

Pale green schist with marked schistosity, consisting of quartz, plagioclase and biotite. Irregular shape, garnet-chlorite-quartz veins occur parallel to the schistosity.

56.00m - 99.00m

Amphibolite consisting of plagioclase and hornblende with a rare occurrence of biotite. It shows a weak banded structure by a segregation of certain minerals in layers. Thin calcite-chlorite veins of 1mm to a few mm wide are widespread all through the core and quartz-calcite-chlorite patches of a few cm wide start to appear at approximately 80m. Relatively coarse garnet grains occasionaly appear in patches. A dissemination of pyrrhotite commonly occur parallel to the banded structure. Pyrite, also, commonly appears scattered in amphibolite regardless of banded structure, however, its amount is less than that of pyrrhotite. A trace amount of chalcopyrite restrictedly occur only in the pyrrhotite grains. Sphalerite is rarely observed in thin veins of calcite at approximately 86m.

99.00m - 112.00m

Generally pale gray schist composed of mainly quartz, plagioclase and biotite. An occurrence of biotite thin layers gives schistose appearance to this rock. Pyrrhotite and pyrite commonly occur in a same manner as in the depth shallower than 99.00m and a trace amount of chalcopyrite occur in the pyrrhotite grains.

112.00m - 144.55m

Grayish green amphibolite with mineral assemblage of hornblende, plagioclase and biotite. Thin biotite layers are conspicuous at 120m to 125m. Thin quartz-calcite-chlorite veins are fairly common at the depth shallower than approximately 130m, while round garnet grains are distinguished in thin quartz-calcite veins parallel to schistosity at deeper than 135m. Very thin veins and patches of epidote, on the other hand, appear at approximately 120m and they become more frequent as increases of depth. Pyrite occurs both in veins and in amphibolite, however, dissemination in amphibolite is more frequent. Pyrrhotite is not observed neither in veins nor in amphibolite.

145.55m - 160.50m (bottom of the hole)

Porphyritic granite (biotite tonalite) composed of quartz, plagioclase and biotite, with a scattered occurrence of large euhedral phenocryst, 2cm long. It intrudes into the schist. Biotite grains are partly altered to chlorite, and a intensity of the alteration decreases as increases of depth. Very thin epidote veins rarely occur all through the core, while very thin chlorite veins are restricted at the depth shallower than 153m. A trace amount of minute grains of pyrite only occur at the contact between porpyritic granite and the schist.

(2) MJMP-13

(2-1) Specifications

Coordinates: 364.102E, 469.568N
Bearing : 45 degree
Inclination: -60 degree
Length : 140.40m

(2-2) Descriptions (Fig.II-1-2)

0.00m to 17.90m (none core)

Sand derived from granite and schist (estimated from sludge).

17.90m to 18.20m

Abundant breccia of quartz vein

18.20m to 24.00m

Yellowish brown to reddish gray soil with breccia of strongly weathered schist.

24.00m to 32.20m

Yellowish brown to reddish gray weathered (argillized) schist.

32.20m to 39.00m

Intensely chloritized, pale greenish gray amphibolite. It is weathered up to 36.00m. A dissemination of minute pyrite grains covers all through the core. Minute pyrrhotite(?) grains are rarely observed only in restricted part of the core.

39.00m - 44.00m

Amphibolite same as above with intense shearing and abundant thin veins of chlorite. Minute pyrite grains occur as a dissemination all through the core and they, also, occur along fractures.

44.00m - 56.00m

Intensely sheared, greenish gray amphibolite composed of hornblende and plagioclase. Thin calcite veins associated by quartz and chlorite fill fractures. Minute pyrite grains occur as a dissemination all through the core and they, also occur in thin veins.

56.00m - 99.00m

Green schist with a pronounced schistosity, composed of mainly chlorite and plagioclase with a minor association of biotite. Biotite thin layers are conspicuous at the depth deeper than 66m. A shearing occur all through the core and most intensive approximately at 66m to 71m. Thin veins of clacite, quartz with a minor chlorite are observed all through the core and they increase their amount to more than 10% of the core with a local appearance of very thin epidote veins at the depth deeper that 75m. Minute pyrite grains occur all through the core and they are most abundante in 80m to 87m. Although a quartz vein was intersected at 77.35m to 78.10m, ore mineral was observed in it even through a hand lens.

99.00m - 107.50m

Strongly sheared, grayish green amphibolite, mainly composed of hornblende and plagioclase. Thin layers of biotite commonly occur. Thin veins of calcite, quartz and minor chlorite, a rare occurrence of very thin epidote veins and minute grains of pyrite are observed all through the core. A shearing is the most intensive from 106m to the contact of porphyritic granite at 107.50m. The shearing plane cut the core with a low angle.

107.50m - 140.40m (bottom of the hole)

Porphyritic granite composed of quartz, plagioclase, biotite and potash-feldspar. Silicification, in addition to alteration of biotite to chlorite, is observed from the top of porphyritic granite at 107.50m to approximately 110m and approximately from 115m toi 128m. Very thin veins of quartz and epidote rarely appear and are relatively abundant approximately from 111m to 118m. A dissemination of minute pyrite grains is observed all through the core, however, it is weaker than in the schist.

(3) MJMP-10

(3-1) Specifications

Coordinates: 364.144E, 469.534N
Bearing : 45 degree
Inclination: -30 degree
Length : 150.60m

(3-2) Descriptions (Fig.II-1-2)

0.00m - 24.00m (none core)
Sand derived from granite and schist (estimated from sludge).

24.00m - 24.50m
Quartz sand with medium grain.

24.50m - 25.00m
Mainly consists of subangular quartz breccia.

25.00m - 29.20m
Yellowish brown clay with strongly weathered pebble of schist.

29.20m - 56.10m
Yellowish brown-reddish brown-greenish gray clay (strongly weatherd rock).

56.10m - 61.20m
Greenish gray schist with occasional appearance of biotite-rich thin layers. Silicification is observed from 56.85m to 57.85m. Very thin veins of epidote, chlorite and quartz with

a small amount of pyrite were rarely observed. A weak dissemination of pyrite and pyrrhotite are locally seen.

61.20m - 64.00m

Strongly silicified schist. Schistose structure is obscured because of strong silicification. Very thin veins of chlorite and epidote are rarely seen. Pyrite occurs both in the veins and in the schist as a weak dissemination.

64.00m - 66.00m

Greenish gray brittle schist. Relatively coarse (a few mm across) garnet grains commonly appear along the schistosity. No visible ore minerals are observed.

66.00m - 72.00m

Schist with a faint color, composed of quartz, plagioclase and biotite. Very thin veins composed of epidote, chlorite and quartz are very rarely occur with association of trace amount of pyrite and chalcopyrite.

72.00m - 125.65m

Greenish gray amphibolite mainly composed of hornblende and plagioclase with occasional appearance of biotite-rich thin layers. Rare occurrences of quartz-chlorite thin veins are observed all through the core. Calcite appears within the veins at deeper level. Garnet commonly occur and it forms coarse grains (a few mm across) in the thin quartz veins cross cutting the schistosity at 74m to 76m. Pyrite occur in very thin veins, while pyrrhotite is more common as a dissemination in the amphibolite. Brecciated, barren quartz with no visible sulphide occurs at 74.50m to 75.50m.

125.65m - 150.60m (bottom of the hole)

Weakly epidotized and chloritized porphyritic granite composed of quartz, plagioclase and biotite, Silicification and intense epidotization are observed from the contact to amphibolite (125.65m) to approximately 126m. While, chloritization is relatively prominent from 144m to the bottom of the hole. The epidote and chlorite occur in very thin veins (less than 1mm wide). The very thin veins of epidote are found from contact to amphibolite (125.65m) to approximately 134m and from 134m to approximately 141m, whereas very thin chlorite veins are found from 129m to approximately 134m. Pyrite is only sulphide found in the core and it occurs in the very thin epidote veins or in the porphyritic granite as a dissemination from the contact to the amphibolite to approximately 130m. They pyrite in not visible at the depth deeper than approximately 130m.

(4) MJMP-14

(4-1) Specifications

Coordinates: 364.144E, 469.534N
Bearing : 45 degree
Inclination: -60 degree
Length : 150.60m

(4-2) Descriptions (Fig.II-1-2)

0.00m - 40.00m (none core)
Unknown.

40.00m - 52.00m
White to pale greenish gray schist with silicification and chloritization. Rare occurrence of thin quartz veins is only observed at 40m to 41m, whereas a relatively strong pyrite dissemination occur all through the core.

52.00m - 60.00m
Greenish gray schist with cloritization. Epidotization is associated with chloritization at 52m to 57m. A relatively strong dissemination of pyrite is observed all through the core continuously from the above lithological unit.

60.00m - 66.40m

White to pale greenish gray schist. Thin quartz vein is abundant at 63m to 64m. Reratively intence disseminations of pyrite all through th core and magnetite around 63m are observed. Pyrrohtite occur as a dissemination in schist and in thin quartz vein at 62m to 65m.

66.40m - 74.00m

Greenish gray amphibolite with thin biotite layers. Very thin, calcite-quartz veins with epidote and chlorite rarely occur. A relatively strong pyrite dissemination is observed all through the core.

74.00m - 77.00m

White to pale greenish gray, silicified amphibolite. Chlorite and epidote occur all through the core, while garnet is seen only restricted part. Very thin, calcite-quartz veins with epidote and chlorite and a relatively intence pyrite dissemination spread all through the core.

77.00m - 102.00m

Greenish gray amphibolite with thin biotite layers. Very thin layers composed of mainly calcite with minor association of quartz and epidote rarely occur all through the core. Pyrite dissemination commonly observed.

102.00m - 106.30m

Greenish gray amphibolite with dispersed occurrence of thin biotite layers. Very thin layers of quartz-calcite and epidote-quartz rarely occur all through the core. Pyrite dissemination with local variation in its intensity commonly occur all through the core.

106.30m - 108.00m

Silicified and chloritized, fine grained granite. Very thin, calcite-quartz veins very rarely occur. Pyrite dissemination is commonly observed.

108.00m - 115.00m

Greenish gray amphibolite with dispersed occurrence of thin biotite layers, same lithology as at 102.00m to 106.30m. Very thin, epidote-calcite veins rarely occur. Inhomogineous occurrence of pyrite appear all through the core.

115.00m - 118.80m

Greenish gray schist with a intence chloritization and weak silicification. Rare occurrence of very thin, quartz-calcite veins and pyrite dissemination are observed all through the core.

118.80m - 131.90m

Strongly silicified rock of probably amphibolite origin. Chloritization is observed at the top and at the bottom of the lithological unit. Dissemination of pyrite occur all through the core. It is most intensive at 119m to 122m where pyrite occur as thin veins.

131.90m 150.60m (bottom of hole)

Silicified and chloritized granite. Biotite is totally altered to chlorite and it is only identifiable at deeper than 148m. Pyrite dissemination is relatively strong.

(5) MJMP-12

(5-1) Specifications

Coordinates: 364.195E, 469.515N
Bearing : 45 degree
Inclination: -30 degree
Length : 150.50m

(5-2) Descriptions (Fig.II-1-2)

0.00m - 3.00m

Clay (estimated from sludge).

3.00m - 5.00m
Yellow to brownish gray clay.

5.00m - 5.50m
Purplish gray, strongly weathered rock with yellow clay.

5.50m - 6.10m
Reddish brown sand with breccia of yellowish gray schist.

6.10m - 7.90m
Pale gray to dark gray clay with breccia of weathered schist.

7.90m - 8.80m
Dark gray fine sand with breccia of weathered schist.

8.80m - 23.20m
Pale gray to dark gray and reddish gray to yellow clay.

23.20m - 24.40m
White, coarse sand with breccia of quartz vein.

24.40m - 43.00m (none core)
Unknown.

43.00m - 43.80m
Strongly weathered granite (boulder)

43.80m - 44.00m
Grey to reddish grey clay with breccia of weathered schist.

44.00m - 47.80m (none core)
Unknown.

47.80m - 51.30m
Subangular pebble of quartz vein and weathered schist.

51.30m - 63.00m

Yellowish brown weathred schist.

63.00m - 74.10m

Schist composed of quartz, plagioclase, biotite and a minor amount of biotite. Cordierite altered to pinite (aggregation of minute chrolite and sericite) and pyralspite garnet are occationaly observed. Chlorite ans sericite occur as the secondary minerals. Thin layers of graphite appear at certain level. Very thin quartz vein occurs locally and weak pyrite dissemination appears at deeper than 64m.

74.10m - 84.00m

Porphyritic granite with chloritization/silicification. A relatively fine grained phase is observed over 1.5m long from the contact to the schist. Because of an alteration of biotite to chlorite schist, biotite is, only, rarely observed. Pyrite dissemination occurs all through the core and it is intensitive at 78m to 80m.

84.00m - 90.00m

Weakly altered porphyritic granite. Biotite is usually observed without alteration and pyrite dissemination is very rare.

90.00m - 99.00m

Porphyritic granite with chloritization/silicification. Biotite is observed without alteration at approximately 90m to 95m. Pyrite dissemination occur all through the core and it is intensive at 97m to 99m.

99.00m - 108.00m

Porphyritic granite with weak chloritization/silicification. Approximately a half of the biotite remains without alteration. Very thin veins of epidote rarely occur all through the core and rare pyrite dissemination is observed locally.

108.00m - 133.00m

Porphyritic granite (biotite granodiorite after the classification of granitic rock) with chloritization/silicification. Biotite is mostly altered to chlorite and partly epidote. Pyrite dissemination is relatively intensive at 119m to 127m.

133.00m - 149.00m

Porphyritic granite with relatively weak chloritization/ silicification. Approximately a half of the biotite grains are preserved without alteration. A weak pyrite dissemination is locally observed.

149.00m - 150.50m (bottom of the hole)

Porphyritic granite (adamellite after the classification of granitic rock). Weak pyrite dissemination is rarely observed.

(6) MJMP-15

(6-1) Specifications

Coordinates : 364.195E, 469.515N
Bearing : 45 degree
Inclination: -60 degree
Length : 150.70m

(6-2) Descriptions (Fig.II-1-2)

0.00m - 9.00m (none core)

Yellow to brown clay (estimated from sludge).

9.00m - 11.00m

Yellow clay.

11.00m - 13.00m

Coarse to fine quartz sand with a intercalation of yellowish gray silty clay at 11.70m to 12.00m.

13.00m - 14.00m

Brownish gray to dark gray, sandy clay.

14.00m - 15.90m

Gray clay with aboundante fragments of schist (schistose texture is preserved).

15.90m - 17.20m

Gray, medium to coarse, quartz sand with a mixture of clay material at lower horizon.

17.20m - 20.30m

Gray to dark gray clay with a occational occurrence of argillized schist fragments. Limonite causes a yellowish brown color at deeper 19m and a hard crust of limonite occurs at approximately 19.30m.

20.30m - 21.40m

Gray medium to coarse sand with clay material. An amount of the clay increase as depth.

21.40m - 22.40m

Dark gray to blueish black, argillized quartz-graphite schist.

22.40m - 22.90m

Gray, medium-grained sand.

22.90m - 23.80m

Dark gray to blueish black, argillized quartz-graphite schist.

23.80m - 24.80m

Pale yellow to grayish yellow clay with angular, around 1cm across, pebbles of quartz-graphite schist.

24.80m - 25.00m

Reddish brown, angular fragments of schist, oxidized to limonite.

25.00m - 25.50m

Brownish gray sand with clay material.

25.50m - 25.70m

White clay with kaolin.

25.70m - 33.00m (none core)

Unknown.

33.00m - 36.20m

Weathered schist.

36.20m - 40.40m

Pale gray to pale green, chloritized biotite schist composed of quartz, plagioclase, biotite and minor potash-feldspar. Very thin veins of epidote-quartz rarely occur and a weak pyrite dissemination is observed all through the core.

40.40m - 41.60m

Calcite-quartz vein with rock fragments. Fragments of chloritized biotite schist in upper half and fragments of porphyritic granite in lower half. Trace of minute pyrite grains associated with it.

41.60m - 45.00m

Chloritized biotite schist as same lithology as at 36.20m to 40.40m. Rare occurrence of very thin, quartz-epidote veins and weak dissemination of minute pyrite grains are observed.

45.00m - 69.80m

Pale green, chloritized, biotite schist with prominet biotite-rich, thin layers. Thin layers of graphite occur at approximately 57m to 69m. Secondary sericite is partly observed. Very thin veins mainly composed of epidote, very rarely, occur and weak dissemination of pyrite occur all through the core.

69.80m - 150.70m (bottom of the hole)
Porphyritic granite with weak to moderate silicification/ chloritization. Biotite is mostly altered to chlorite and rare occurrence of epidote is observed at 100m to 115m. Dissemination of minute pyrite grains occur fall through the core. It is relatively intensive at approximately 108m to 134m.

1-1-5 Results Of Chemical Analysis

A total of 296 samples collected from drill cores were chemically analyzed for eight elements (Au, Ag, As, Cu, Pb, Zn, Sn and W). A detail of samples is shown on drill hole basis on the table below.

The result of chemical analysis and geometric means on lithological basis for each drill hole are, respectively, shown on Appendix-6 and Table II-1-1. Geochemical profiles of each element as a function of depth and lithology are shown in Fig.II-1-3 (1 to 3).

Geochemical characteristics of each drill hole are summarized as follows:

<u>MJMP-11</u>

The result of chemical analyses shows no significantly high concentration for all elements (Au, Ag, As, Cu, Pb, Zn, Sn and W).

<u>MJMP-13</u>

The concentrations of Au, Ag, As, Pb, Zn and Sn show a clear contrast between the soil samples and the rock samples. They are generally higher in the former than in the latter except for Cu and W.

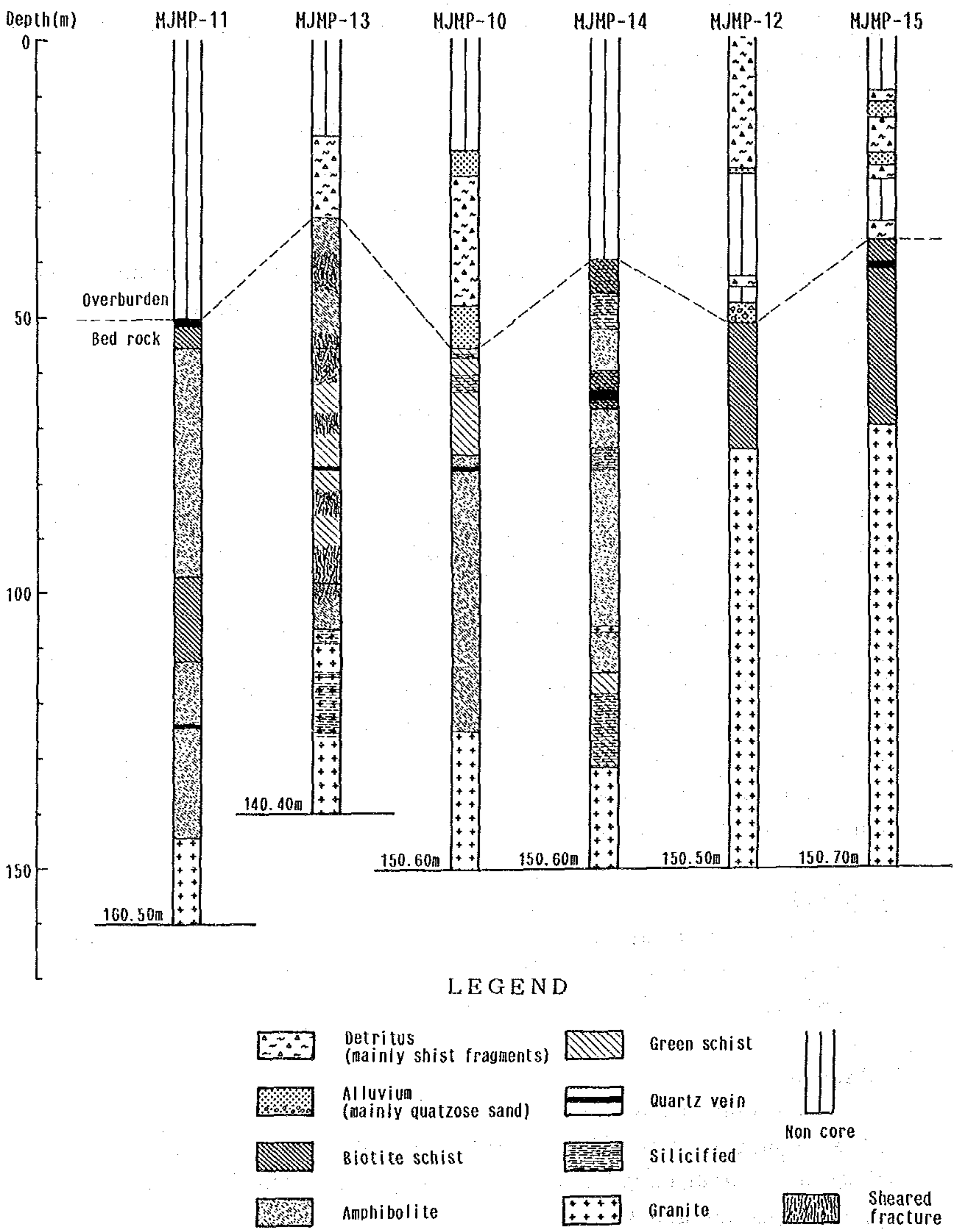


Fig.II-1-2 Summarized geological logs, Area a-1

MJMP-10

All the analyzed elements, except Au and As, give relatively low values and they show similar chemical profiles to the MJMP-11.

Au high zone of more than 0.100 ppm including the maximum value (0.811 ppm) is located at 56m to 65m, corresponding to a location of strongly silicified schist.

The maximum value of As (4,589 ppm) was obtained from a soil sample. The geochemical behavior of As in schist is similar to that of Au with As high concentration zone (more than 1,000 ppm) in schist at 56m to 65m overlapping the Au high concentration zone.

MJMP-14

Six elements (Au, Ag, As, Cu, Pb and Zn) obviously show high concentrations at silicified schist.

Samples with more than 0.100 ppm Au, including one with the maximum value (2.141 ppm), were collected from strongly silicified schist at 60m to 63m.

Ag gives an average value of 0.42 ppm which is the highest among holes MJMP-10 to -15. Almost all the samples of silicified schist show Ag values more than 1.00 ppm. The average Ag at 118m to 127m (core length 9.00m) is 7.03 ppm and the maximum value of 18.00 ppm was obtained within this portion.

A high concentration zone of As, more than 1,000 ppm with the maximum value of 6,181 ppm, overlaps the zone of Au high (more than 0.100 ppm Au) located at 61m - 63m.

The maximum value of 710 ppm Cu was obtained from the sample at 118m to 119m, just above the silicified rock of 119m to 132m. The second largest value of 400 ppm was obtained from the samples at 41m to 42m just above the silicified rock of 40m to 52m.

The maximum value of Pb (1,800 ppm) and Pb values of more than 100 ppm were obtained from the silicified schist which also gives Ag values of more than 1.00 ppm.

Zn values more than 200 ppm with maximum value of 900 ppm were obtained from the weakly weathered, brittle skarn with epidote and garnet close to the silicified zone.

MJMP-12

All the elements (Au, Ag, As, Cu, Pb, Zn, Sn and W) show relatively low concentration and no significantly high value was obtained from any of the samples.

MJMP-15

Same as MJMP-12, no significantly high concentra- tion was obtained for all the elements.

Table II-1-1 Geometric means of metal contents in samples from drill holes MJMP-10~15, Area a-1

Hole No.	Geol. unit	Au ppm	Ag ppm	As ppm	Cu ppm	Pb ppm	Zn ppm	Sn ppm	W ppm
MJMP-10	Soil	0.007	0.11	1,159	78	61	148	7	24
MJMP-10	Metam.	0.024	0.06	200	43	12	57	8	7
MJMP-10	Granite	0.003	0.05	9	9	16	59	8	4
MJMP-10	Whole	0.013	0.07	172	37	18	70	8	9
MJMP-11	Soil	-	-	-	-	-	-	-	-
MJMP-11	Metam.	0.006	0.06	60	64	14	65	13	6
MJMP-11	Granite	0.001	0.05	9	14	11	50	13	3
MJMP-11	Whole	0.004	0.05	53	58	14	70	14	6
MJMP-12	Soil	0.003	0.06	315	60	29	56	7	42
MJMP-12	Metam.	0.006	0.06	8	81	21	90	5	8
MJMP-12	Granite	0.003	0.07	6	13	16	46	7	5
MJMP-12	Whole	0.004	0.06	7	28	19	64	6	6
MJMP-13	Soil	0.015	0.54	204	98	224	323	17	85
MJMP-13	Metam.	0.003	0.17	6	69	39	128	19	34
MJMP-13	Granite	0.005	0.07	5	21	15	53	8	4
MJMP-13	Whole	0.005	0.20	15	59	51	136	15	27
MJMP-14	Soil	-	-	-	-	-	-	-	-
MJMP-14	Metam.	0.005	0.43	21	32	69	115	10	10
MJMP-14	Granite	0.002	0.42	10	12	30	49	6	4
MJMP-14	Whole	0.004	0.42	19	29	63	105	10	9
MJMP-15	Soil	0.006	0.11	346	54	45	84	5	85
MJMP-15	Metam.	0.004	0.10	11	38	13	78	7	5
MJMP-15	Granite	0.001	0.06	5	11	17	44	7	5
MJMP-15	Whole	0.002	0.08	11	19	18	56	7	7
Whole	Soil	0.007	0.14	401	71	65	123	8	52
Whole	Metam.	0.006	0.11	22	51	22	85	9	9
Whole	Granite	0.002	0.08	7	13	17	50	8	4

1-1-6 Results Of Thin Section Study

Microscopic observation of 42 thin sections suggest a division of these samples into following five groups:-

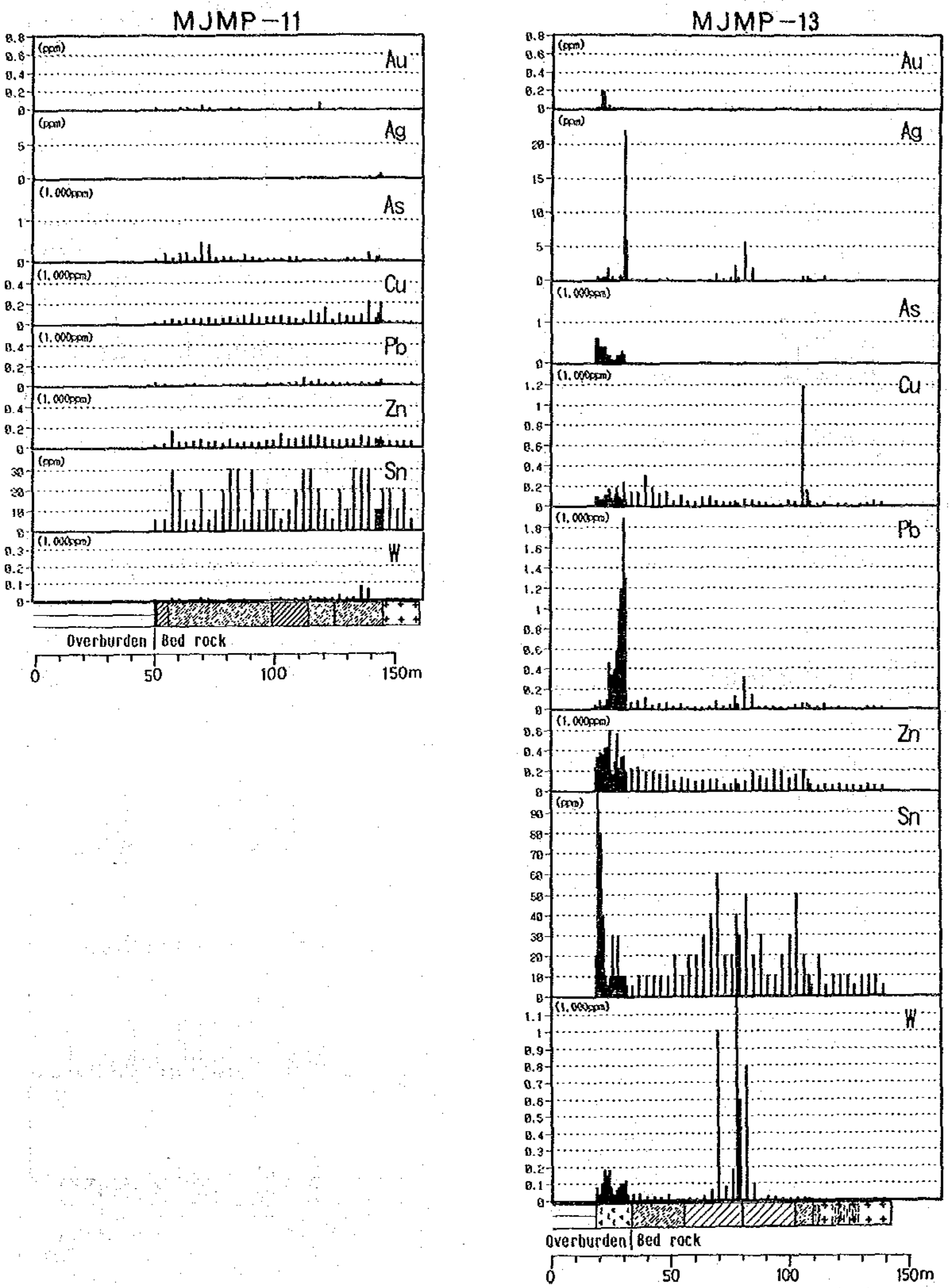


Fig. II-1-3 (1) Metal contents in drill holes, MJMP-11 and MJMP-13, Area a-1

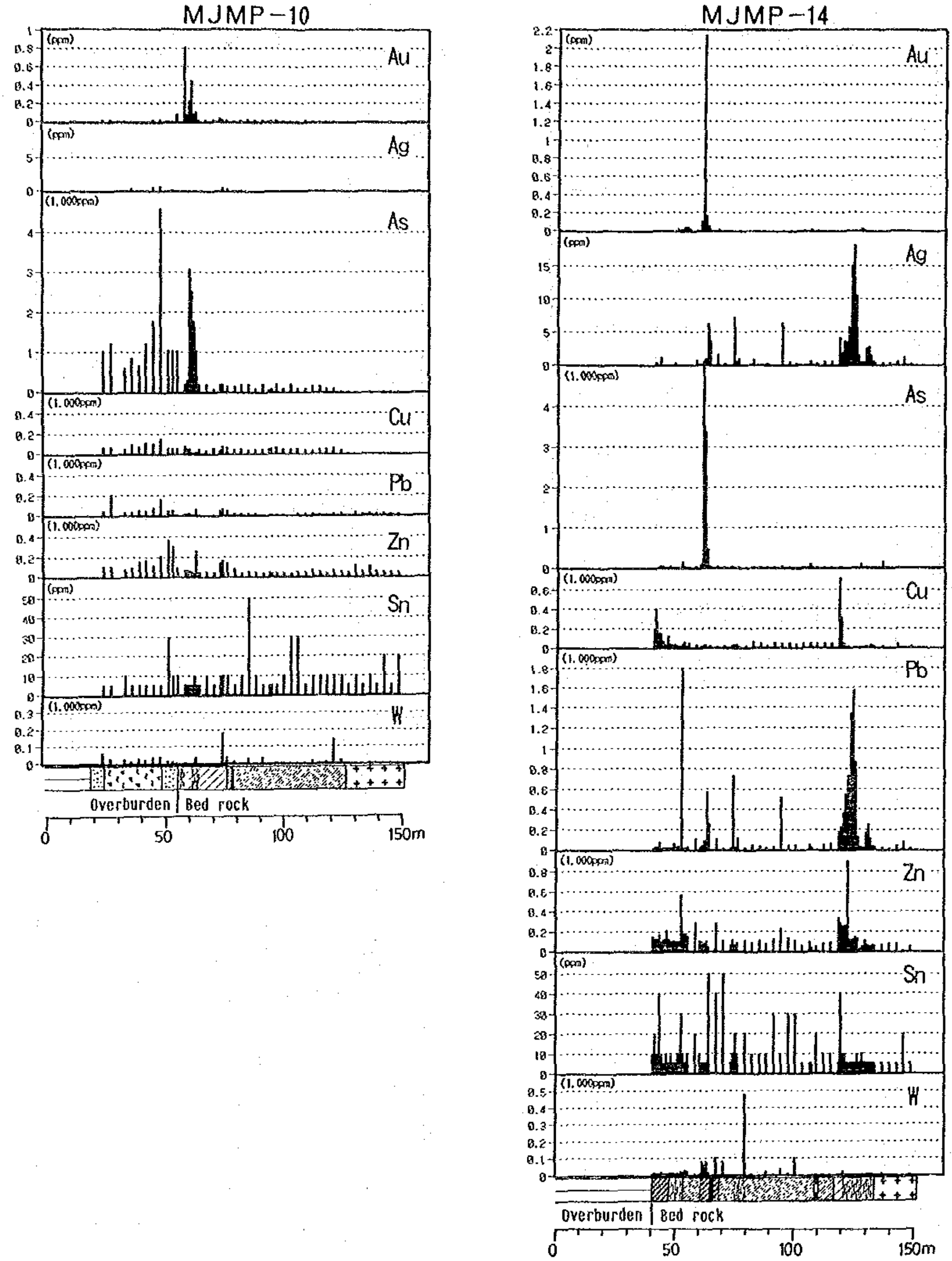


Fig.II-1-3(2) Metal contents in drill holes, MJMP-10 and MJMP-14, Area a-1

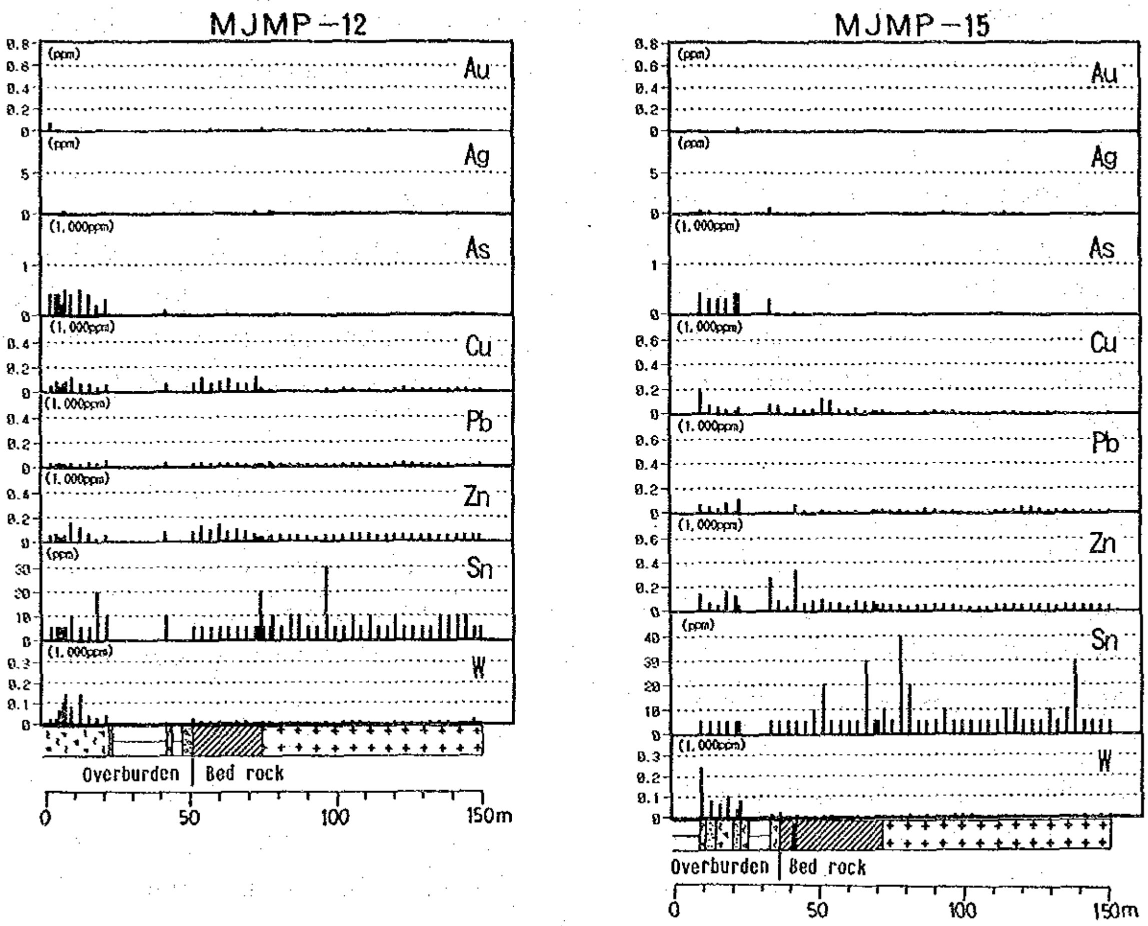


Fig.II-1-3(3) Metal contents in drill holes, MJMP-12 and MJMP-15, Area a-1

(1) Biotite Schist (includes graphite schist and meta-sandstone)

Samples of this group are mainly composed of quartz, plagioclase, biotite and potash-feldspar, and they show lepidoblastic to granoblastic texture. Shale and sandstone are presumed to be the original rock for this group.

(2) Amphibolite

Hornblende and plagioclase are the main constituents of this group with minor association of biotite. A nematoblastic texture is commonly observed in this group and cataclastic texture and chloritization occur in some of the samples. The original rock of this group is, probably, pyroclastic rock.

(3) Green Schist

This group, mainly composed of chlorite and plagioclase with minor association of biotite, shows lepidoblastic to granoblastic texture. The original rock of this group is, probably, pyroclastic rock.

(4) Skarn (irregular veins)

Calcite, clinopyroxene, tremolite, hornblende, grandite garnet, epidote and wollastonite are constituent minerals of this group with saccharoidal texture.

(5) Biotite Granodiorite (includes Tonalite and Adamellite)

Samples of this group are composed of quartz, biotite, potash feldspar and plagioclase and show a equigranular texture. Generally, they are granodiorite with few exceptions of tonalite and adamellite and are partly silicified and chloritized.

Group (1), (2) and (3) were thermally metamorphosed by the intrusion of granodiorite (5) and subsequent episodes of retrogressive metamorphism and hydrothermal alteration were superimposed to them.

Table II-1-2　Rocks and mineral assemblages of core samples from drill holes MJMP-10～15, Area a-1

Ser. NO.	Sample NO.	Depth (m)	Rock Name	Texture	Main constituent															Accessary					Secondary									Veinlet								
					Qz	Pl	Kf	Bt	Cl	Hb	Tr	At	Cx	Wo	Gd	Py	Ep	Cd	Cc	Ap	Zr	Tm	Sp	Oq	Qz	Ms	Se	Pi	Cl	Sp	Ep	Ac	Cc	Qz	Cc	Ep	Ac	Cl	Pr	Ad	Ze	Fl
1	T10-01	75.70m	Skarn	Saccharoidal		○				○	○		○		○		•		◎	•			•	•											•				•	•	•	
2	T10-02	86.90m	Amphibolite	Nematoblastic		○				◎										•				•					•	•										•		
3	T10-03	113.30m	Amphibolite	Nematoblastic		○		•		◎		•								•				•					○	•										•		
4	T10-04	116.00m	Amphibolite	Nematoblastic		○		•		◎										•				•			•		•	•		•										
5	T10-05	122.80m	Amphibolite	Nematoblastic		◎		•		◎										•				•					•	•		•			•	•	•			•		
6	T11-01	55.10m	Biotite schist	Grano-lepidoblastic	◎	○	•	•												•	•	•		•					•	•	•	•	•							•		
7	T11-02	61.30m	Skarn	Saccharoidal		•				○	•		○		○		•		◎				•	•		•			•	•	•				•							
8	T11-03	70.90m	Amphibolite	Nematoblastic		◎		○		◎										•				•					•	•	•	•										
9	T11-04	90.20m	Skarn	Saccharoidal		○	•			○	○		○	•	○				◎				•						•	•												
10	T11-05	99.20m	Biotite schist	Grano-lepidoblastic	◎	○	•	○		•			•							•	•	•							•	•		•	•		•					•		
11	T11-06	103.15m	Skarn	Polygonal arcs		○	•	○			○		○				○			•	•		•	•			•		○											•		
12	T11-07	114.10m	Chloritized amphibolite	Lepidoblastic																•	•						○		◎	•		•										
13	T11-08	118.10m	Amphibolite	Nematoblastic		◎				◎														•			•		○	•		◎			•			•		•		
14	T11-09	128.00m	Amphibolite	Nematoblastic		◎				◎										•	•		•	•					•	•		•			•	•	•			•		
15	T11-10	143.80m	Amphibolite	Nematoblastic		◎		○		◎										•				•					•	•	•	•			•	•	•	•		•		
16	T11-11	159.20m	Biotite tonalite	Equigranular	◎	○	•	○												•	•			•		•	•		•		•									•		
17	T12-01	70.10m	Biotite schist	Granoblastic	◎	○	•	○								◎		○			•	•		•		•		◎	○													
18	T12-02	73.00m	Biotite schist	Granoblastic	◎	○	•	○								○		○		•	•	•	•	•		•		○	○													
19	P12-02	138.50m	Biotite granodiorite	Equigranular	◎	○	○	○												•	•	•		•			•		○		○					•						
20	T12-08	150.30m	Biotite adamellite	Equigranular	○	○	○	○												•	•			•					○							•						
21	T13-01	46.10m	Amphibolite	Nematoblastic		○				◎										•	•			•					○		•									•		
22	T13-02	56.20m	Chloritized amphibolite	Grano-lepidoblastic		○				◎										•	•			•			◎		◎			•			•					•		
23	T13-03	68.40m	Green schist	Grano-lepidoblastic		◎		•	◎											•	•			•		•	•		•	•			○		•							
24	T13-04	90.80m	Green schist	Lepidoblastic		◎		•	◎											•	•		•	•			◎		•	•	•				•							
25	T13-05	101.20m	Mylonitized amphibolite	Nematoblastic		◎				◎										•			•				•		•						•							
26	T13-06	105.10m	Meta-sandstone		○	○		•												•	•			•			○		○	•			•		•			•				
27	T13-07	109.00m	Silicified granodiorite	Mortar	•	•	•													•	•		•	•	◎		•		•	•	•		•		•	•						
28	T13-08	129.00m	Biotite adamellite	Equigranular	•	•	•													•	•			•	•		•		•	•					•					•		
29	T14-01	44.05m	Biotite schist	Granoblastic	◎	○	•	○												•				•		•	•		•					?								
30	T14-02	50.10m	Green schist	Granoblastic		◎		•	◎											•		•		•		•	•		◎					•						•		
31	T14-04	67.75m	Amphibolite	Nematoblastic		○		•		○										•	•			•			•		○			•			•	•	•	•		•		
32	T14-05	80.40m	Amphibolite	Nematoblastic		○		•		○														•			•		◎			•						•		•		
33	T14-06	91.60m	Chloritized amphibolite	Lepidoblastic		•		•												•				•			•		○			○			•					•		
34	T14-07	102.45m	Amphibolite	Nematoblastic		○				○										•				•			◎		•			◎						•		•		
35	T14-08	118.15m	Green schist ?	Lepidoblastic					◎															•			○		•						•					•		•
36	T14-09	132.65m	Biotite granodiorite	Equigranular	◎	◎	○													•	•		•	•	•	•			○		•									?		
37	T15-01	38.00m	Biotite schist	Granoblastic	◎	○	•	○								◎		○			•	•		•		•		◎	○							•						
38	T15-02	48.80m	Biotite schist	Granoblastic	◎	○	•	○										?		•	•			•		•	○?		○		•		•									
39	T15-03	54.80m	Skarn ?	Granoblastic	•	○?							○								•			•			•		•		○		○			•				•		
40	T15-04	60.35m	Graphite schist	Granoblastic	◎	○?		•												•	•			•					○		•		•		•					?		
41	T15-05	66.30m	Biotite schist	Granoblastic	◎	○	○	○												•	•	•		•			•		○		•		•		•	•						
42	T15-06	96.00m	Biotite adamellite	Equigranular	○	○	○	○												•	•	•	•	•		•	○		○		•									?		

ABBREVIATIONS

Ac:actinolite	Bt:biotite	Cx:clinopyroxene	Hb:hornblende	Pi:pinite	Qz:quartz	Tm:tourmarine
Ad:adularia	Cc:calcite	Ep:epidote	Kf:K-feldspar	Pl:plagioclase	Se:sericite	Wo:wollastonite
Ap:apatite	Cd:cordierite	Fl:fluorite	Ms:muscovite	Pr:prehnite	Sp:shane	Ze:zeolite
At:anthophyllite	Cl:chlorite	Gd:grandite	Oq:opaque	Py:pyralspite	Tr:tremolite	Zr:zircon

LEGEND

◎:abundant　○:common　•:rare

A sequence of episodes are summarized as follows in term of mineral assemblages.

1. Metamorphism
   Amphibolite (hornblende-plagioclase)
   Green schist (chlorite-plagioclase)
   Biotite schist (biotite-cordierite-garnet-plagioclase)
2. Skarn
   calcite-epidote-garnet-clinopyroxene-hornblende-wollastonite
3. Retrogressive metamorphism
   actinolite-chlorite-epidote-pinite (sericite and chlorite)-muscovite
   adularia-calcite-epidote-prehnite-actinolite veins
4. Hydrothermal alteration
   chlorite-sericite-calcite
   quartz-chlorite-calcite-zeolite-fluorite veins

1-1-7 Results Of Polished Section Study

The result of ore microscopic observation is given in Table II-1-3. Minute grains of eight ore minerals, chalcopyrite, sphalerite, galena, arsenopyrite, enargite, pyrrohtite, pyrite and magnetite were found from fifteen polished sections.

Chalcopyrite appears as minute grains of 10 to 100 micron across in fourteen polished sections except sample P10-01. Chalcopyrite occurs both in vein and host rock as either dissemination of only this mineral or coexisting grains with other minerals (pyrrohtite, sphalerite, pyrite, magnetite and arsenopyrite).

Sphalerite occurs in eight polished sections. It appears in very thin veins coexisting with pyrrohtite in sample P11-02 and in cracks of crushed pyrite grains in sample P13-01.

Table II-1-3 Ores and mineral assemblages of core samples from drill holes MJMP-10～14, Area a-1

Ser. NO.	Sample NO.	Depth (m)	Analysis No.	Metal Minerals Cp	Sp	Gn	As	En	Po	Py	Mt	Occurrence
1	P10-01	63.60m	MJMP-10 R- 6				•	•				Dissemination
2	P10-02	77.90m	MJMP-10 R-13	•			•	•	◎			Veinlet & dissem.
3	P11-01	73.20m	MJMP-11 R- 7	•			◎		○	•	•	Veinlet & dissem.
4	P11-02	86.60m	—	•	◎	•			◎	•		Veinlet
5	P11-04	118.30m	MJMP-11 R-22	•	•					◎		Dissemination
6	P12-01	124.95m	MJMP-12 R-28		•					◎		Dissemination
7	P12-02	130.50m	MJMP-12 R-30	•						•		Dissemination
8	P13-01	47.50m	—	•	•					○		Dissemination
9	P13-02	65.20m	—	•						•	•	Dissemination
10	P13-03	103.60m	—	•	•	◎				•		Dissemination
11	P13-04	120.10m	MJMP-13 R-32	•						•		Dissemination
12	P14-01	73.90m	MJMP-14 R-25	•						•		Dissemination
13	P14-02	119.10m	MJMP-14 R-44	•	•					◎		Dissemination
14	P14-03	62.55m	MJMP-14 R-20	•	•		◎			◎		Dissemination
15	P14-04	132.65m	MJMP-14 R-57	•	•	•				◎		Dissemination

ABBREVIATIONS
Cp:chalcopyrite
Sp:sphalerite
Gn:galena
As:arsenopyrite
En:enargite
Po:pyrrhotite
Py:pyrite
Mt:magnetite

LEGEND
◎:abundant
○:common
•:rare

Galena was found in three polished sections, P11-02, P13-03 and P14-04. Relatively large grains of it, more than 1mm across, were found in sample P13-03.

Arsenopyrite occurs in four samples, P10-01, P10-02, P11-01 and P14-03. Two samples, P11-01 and P14-03, have relatively large grains of arsenopyrite, 0.2 to 1mm across. It coexist with pyrrohtite in sample P11-01 and it includes minute pyrite grains in sample P14-03.

A dissemination of enargite occurs coexisting with arsenopyrite grains, 10 to 20 micron across, in host rock.

1-1-8 Results of XRD Analysis

Table II-1-4 shows a result of X-ray diffraction analysis. Although there is some variation in abundance, all of four samples, C10-01, C10-02, C14-19 and C14-20, with high concentration of Au and As, have plagioclase, quartz, chlorite and hornblende except for C14-19 which lacks hornblende. A small amount of calcite is, also, observed in C14-19 and C14-20.

For the samples other than above four, X-ray difraction analysis was done as an aid for microscopic observation of thin sections.

Table II-1-4 Mineral assemblages determined by X-ray diffraction analysis
Area a-1

Ser. NO.	Sample NO.	Depth(m) from	Depth(m) upto	Description	Qz	Pl	Hb	Cl	Se	Sp	Cx	Gd	Wo	Cc
1	C10-01	56.00m	57.00m	0.081ppm Au and 1,030ppm As	•	○	○	○						
2	C10-02	59.00m	60.00m	0.811ppm Au and 200ppm As	○	◎	○	○						
3	C14-19	61.00m	62.00m	2.141ppm Au and 6,181ppm As	◎	◎		•						•
4	C14-20	62.00m	63.00m	0.171ppm Au and 3,371ppm As	◎	◎	•	•						•
5	T10-01	75.70m		Skarn			○	•		•	•	•		◎
6	T10-02	86.90m		Amphibolite		•	•	◎	?					
7	T11-04	90.20m		Skarn			•				•	•	•	◎
8	T11-07	114.10m		Chloritized amphibolite		•		○	◎					
9	T11-08	118.10m		Amphibolite		•	◎	○	○					
10	T12-02	73.00m		Biotite schist	◎	○		○	•					
11	T13-04	90.80m		Green schist	•	○		◎	○					○
12	T13-06	105.10m		Meta-sandstone		◎		•	○					○
13	T14-01	44.05m		Biotite schist	○	○		○	•					
14	T14-08	118.15m		Green schist	○	•		◎	•					○
15	T15-04	60.35m		Graphite schist	◎	○		•						•

ABBREVIATIONS
Qz: quartz
Pl: plagioclase
Hb: hornblende
Cl: chlorite
Se: sericite
Sp: sphane
Cx: clinopyroxene
Gd: grandite
Wo: wollastonite
Cc: calcite

LEGEND
◎: abundant
○: common
•: rare

1-1-9 Discussion

(1) Geology

Three geological sections, which, respectively, cut through drill sites MJMP-11 to -13, MJMP-10 to -14 and MJMP-12 to -15, were constructed based on the results of core logging and microscopic observation Fig.II-1-4 (1) to (3).

As shown in geological sections, thick overburden prevents exposure of bedrock in the area surrounding trenches, No.8, 9, 11, 13. An existence of well sorted, quartz sand layers, intercalated with poorly sorted, angular fragments of schist (strongly weathered and argillized) was confirmed beneath the trenches by core logging of MJMP-15 and other holes. The quartzose sand layers correspond to the alluvial deposits found along the river in the southwestern part of the area, while argillized angular fragments of schist are considered to be talus breccia transported from topographic highs (probably slope of the mountains in the northeastern part of the area). The overburden in this area, therefore, consists of alluvial deposits of quartz sand and thick (the maximum thickness reaches at 35m in drill hole MJMP-12 and -15) talus breccia of schist fragments. They show an interfinger relation.

The mountains in the northeastern part of the area are occupied only by the Main Range Granite and a occurrence of the schist is not found at present. This suggests an

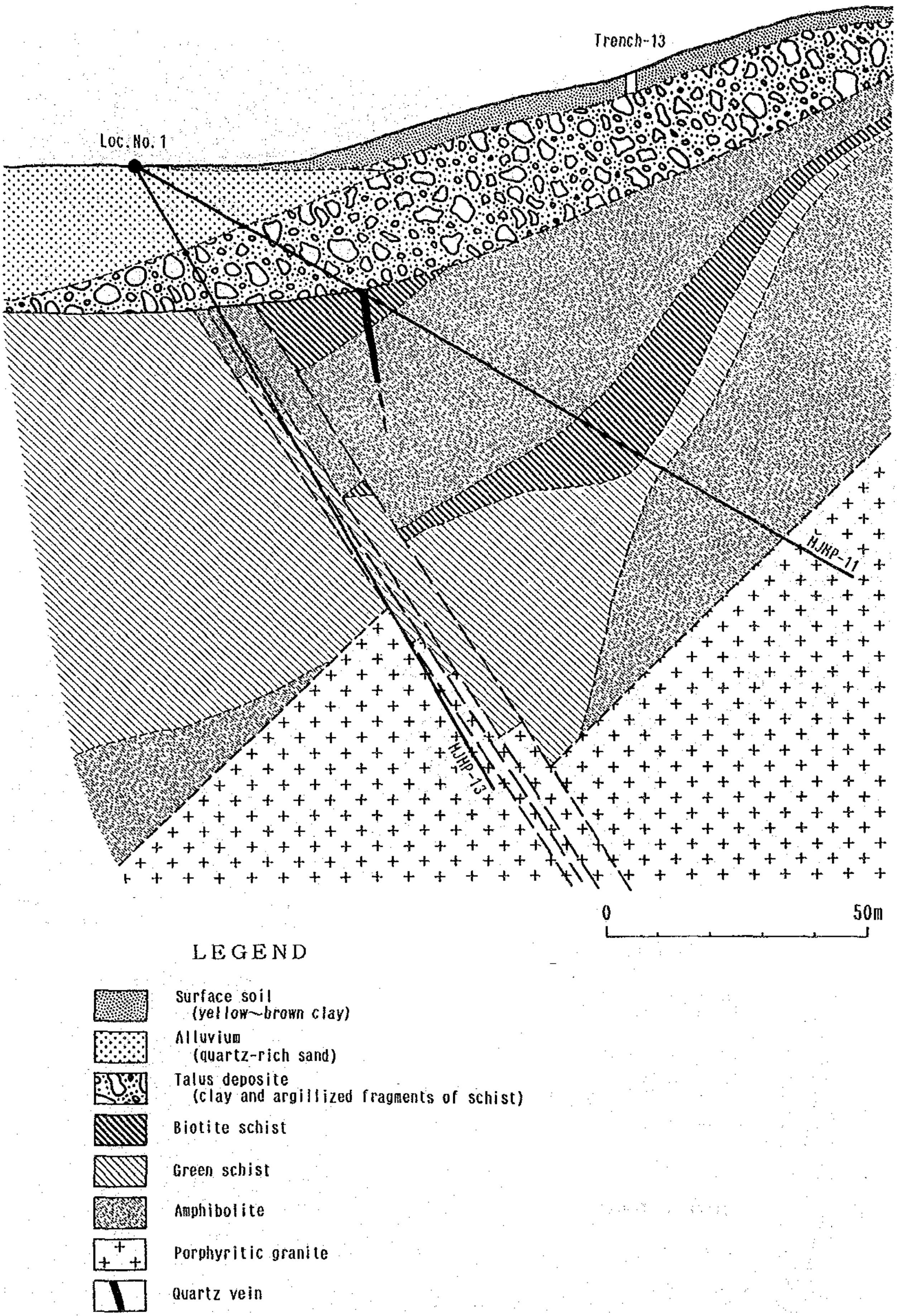


Fig. II-1-4(1) Cross section through drill holes, MJMP-11 and MJMP-13, Area a-1

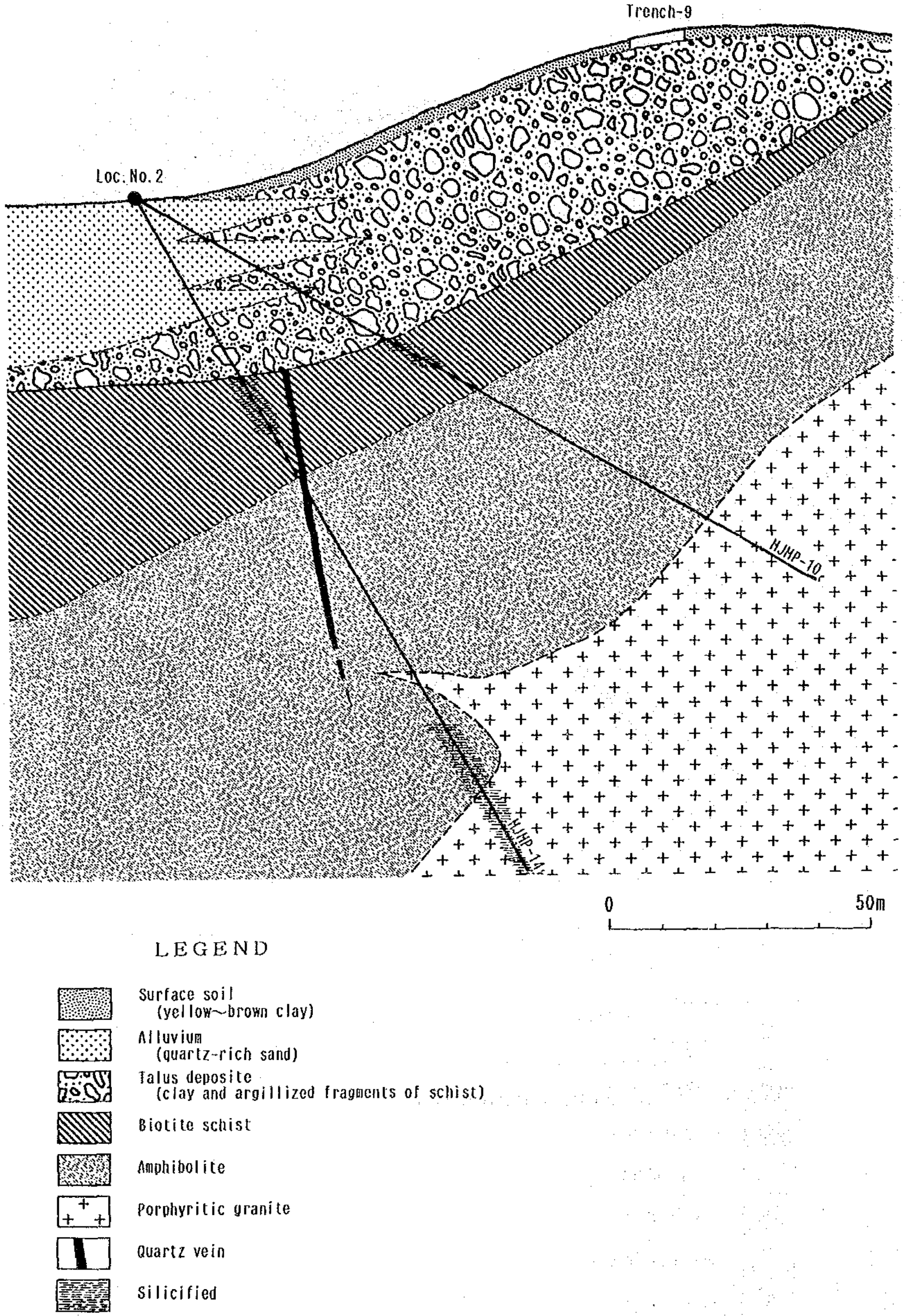


Fig. II-1-4(2) Cross section through drill holes, MJMP-10 and MJMP-14, Area a-1

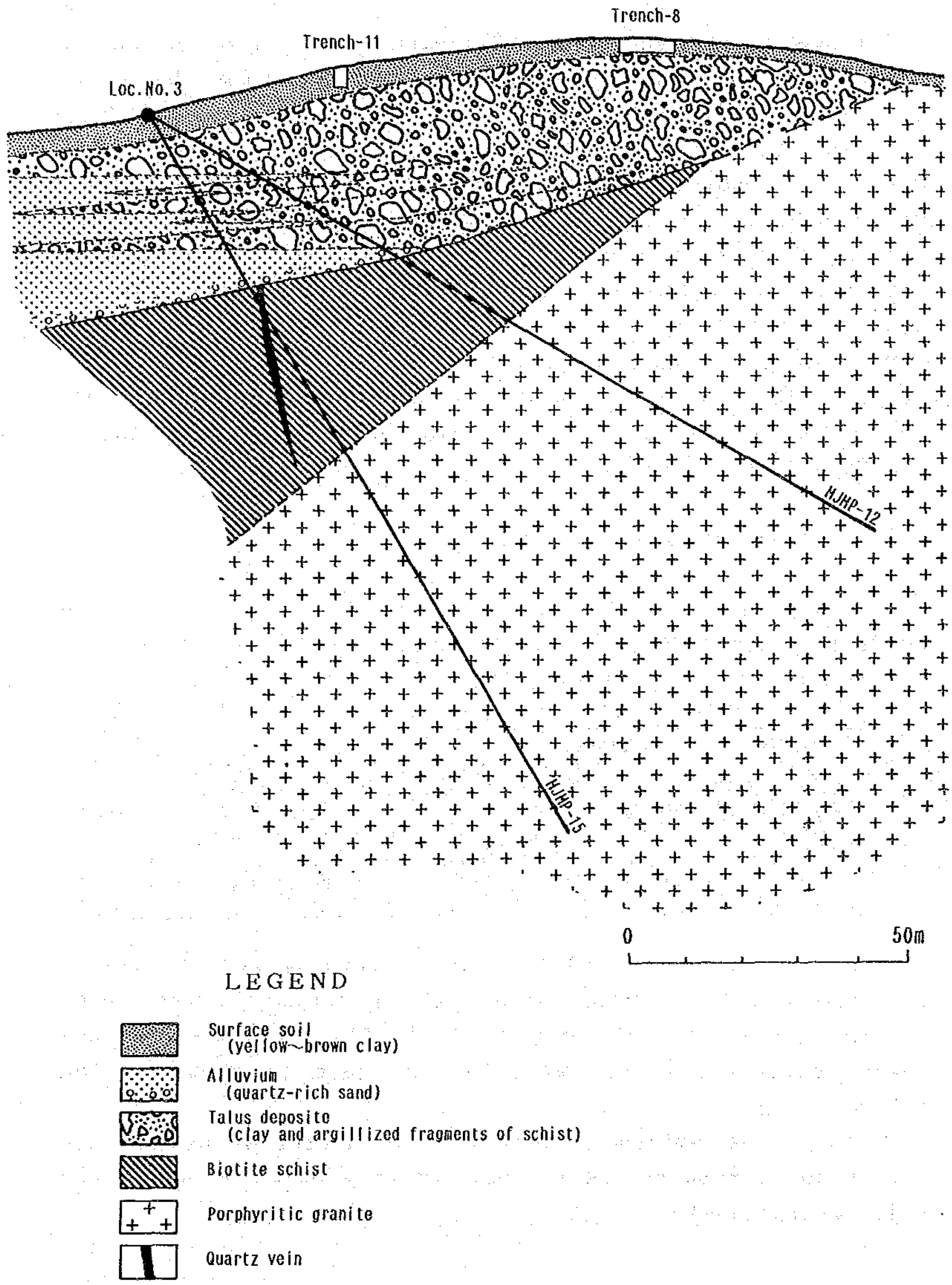


Fig.II-1-4(3) Cross section through drill holes, MJMP-12 and MJMP-15, Area a-1

existence of the schist as something like a roofpendant on slopes of the mountains before erosion to form the talus breccia of schist fragments.

The bedrock in this area, overlain by thick talus deposits, consists of metamorphic rocks (amphibolite and green schist) of pyroclastic origin and it, in terms of lithology and metamorphic grade, is different from Terolak Formation (phyllite with thin intercalations of meta-sandstone) exposed in the Area a-1. This is most probably explained by a uplifting of the older metamorphic rocks (amphibolite and green schist) to the present location close to the occurrence of Terolak Formation by the intrusion of the Main Range Granite.

(2) Au-grade of Quartz Veins.

Assay result of Au and Ag in quartz veins intersected by drill holes MJMP-10 to -14 is shown on Table II-1-5.

Table II-1-5 Au and Ag contents in the main quartz veins intersected by drill holes MJMP-10～14, Area a-1

Ser. No.	Sample No.	Depth (m) from	upto	Au ppm	Ag ppm	Description
1	MJMP-10 R-11	74.50m	75.50m	0.035	0.05	Breccia vein
2	MJMP-11 R-00	50.80m	52.10m	0.023	0.05	Associated with pyrite
3	MJMP-11 R-24	124.10m	124.90m	0.011	0.05	No sulphide found
4	MJMP-12 R-13	78.75m	78.95m	0.006	0.20	No sulphide found
5	MJMP-13 R-16	77.35m	78.10m	<0.003	2.20	No sulphide found
6	MJMP-14 R-22	63.60m	65.00m	<0.003	3.50	No sulphide found

Similar to the results in the Phase II, represented by the quartz veins cutting across the phyllite in the lower stream area at the vicinity of Phase III area, most of the quartz veins are barren with low Au grade as shown on the Table.

The above evidences suggest that quartz veins are not likely to be responsible for high concentration of Au in the soil (overburden).

(3) Occurrence of Au

Assay result of core samples gives four rock samples with high Au-grade of more than 0.2 ppm, maximum at 2.141 ppm. All these four samples were collected at silicified rock or at vicinity of it in drill holes MJMP-10 and MJMP-14, both of which are located in the middle of three drill sites. In addition to Au, the four samples show high assay values of As and a dissemination of minute arsenopyrite grains, suggesting a similar geochemical behavior between As and Au.

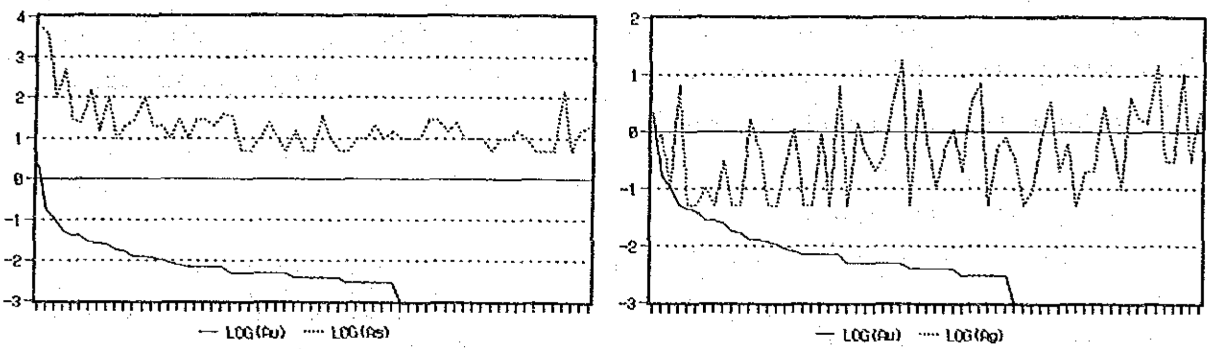


Fig. II-1-5 Relationship between Au and As (Ag) in drill hole MJMP-14, Area a-1

A relationship between concentrations of Au and As in MJMP-14 is shown in Fig.II-1-5, arranging samples in order of higher Au concentration on horizontal axis. In addition to this, Au-Ag relation is, also, shown in the figure. Generally, a good relation exists between concentration of Au and Ag however in this case as shown in Fig.II-1-5, a much closer relation is observed in Au-As rather than in Au-Ag. No gold grains, so far, have been obtained by microscopic observation, though, there still remains some possibility of an existence of minute gold grains enclosed in arsenopyrite.

(4) Au in Talus Deposits and Its Origin

Although soil geochemical survey in Phase II show a high Au concentration zone (more than 0.2 ppm) over the area of Phase III drill sites, chemical analysis of soil samples (talus deposits of argillized fragments of schist) recovered by drilling gives only one sample of high Au concentration, more than 0.2 ppm, at MJMP-13.

A source of Au in soil was attributed to Au mineralization of underlaying bedrock by the results of soil geochemical survey in Phase II. Drilling survey of Phase III, however, suggests that recovered soil (overburden) samples are weathered soil produced from talus deposits of schist fragments (probably transported from the slope of mountains in northwestern part of the area) rather than in-situ soil produced from weathering of underlaying bedrock. The Au concentration in the soil (overburden) of the area, therefore, possibly derived from the schist roof pendant in the Main Range Granite after a transportation of its angular fragment to the site.

(5) Other Ore Minerals

Most of the samples with anomalous Ag, Cu, Pb and Zn values, in addition to Au and As, were obtained from MJMP-14, either in silicified schist at 119m - 132m or at the vicinity of it. The polished sections of the silicified schist and associating silicified granite show minute grains of galena, arsenopyrite and calcopyrite in pyrite dissemination.

Apart from the result of chemical analysis, core logging and microscopic observation suggest some indications of base metal mineralization, in addition to Au, in the area of the drilling by the rare occurrences of calcopyrite, sphalerite, galena, arsenopyrite, enargite, pyrrohtite, pyrite and magnetite.

1-2 Discussion on Area a-1

The drilling conducted in the Area a-1, aiming at clarifying the possibility of Au mineralization in underlaying bedrock suggested by the soil geochemical survey in Phase II, resulted in finding of concealed mineralization of Au and base metal in the bedrock. Although

Au grade of 2.1g/t having little economical significance was obtained from the mineralized zone, precise shape and size of the mineralized zone are still unknown. Therefore, the mineralized zone has a high potential and further exploration to clarify shape and size of the mineralized zone is recommended for the future.

As mentioned previously, a source of Au in the Au anomalous zones obtained from geochemical sampling of superficial soil is atributed to Au mineralization of the schist roof pendant, once existed in the Main Range Granite. The talus deposits, as thick as 40m, prevented the above Au mineralization of the bedrock to reflect Au concentration of the superficial soil.

Considering a potentiality of Au in the soil (overburden) as a source of Au, a sampling of the soil at 50m grid was conducted by GSM. A summary of the work and a brief evaluation are attached on Appendix-5. In conclusion, the soil sampling indicates that in the top 3m of the soil overburden, the total Au content is approximately 150kg (average grade 0.16 g/m^3) over the sampling area of 350m x 2400m. If a cutoff grade of 0.3 ppm Au is assumed, the Au content is 108kg (average grade 0.90 g/m^3 in 120,000m^3 of soil overburden) over an area of 80,000m^2. The thick overburden of the area suggested by the drilling survey can further increase the above calculated ore reserve. For more acurate evaluation of this Au placer deposit, Au grade of the talus deposit below 3m must be obtained.

Chapter 2 Area B

2-1 Geophysical Survey (Gravity Method, Area b-2)

2-1-1 Objectives of Survey

The distribution of placer tin deposits is controlled by basement topography of paleozoic metasediments, and the existence of high grade placer deposits is especially expected at the bottom of concaved topographic feature of the basement. There is a clear difference in density between the unconsolidated Quaternary sediments composed of clay, sand as well as gravel and the bedrock.

The purpose of gravity survey is to clarify the feature of basement relief by using the nature of above mentioned density difference and to obtain information for the selection of drilling locations.

2-1-2 Method of Survey

(1) Survey Planning

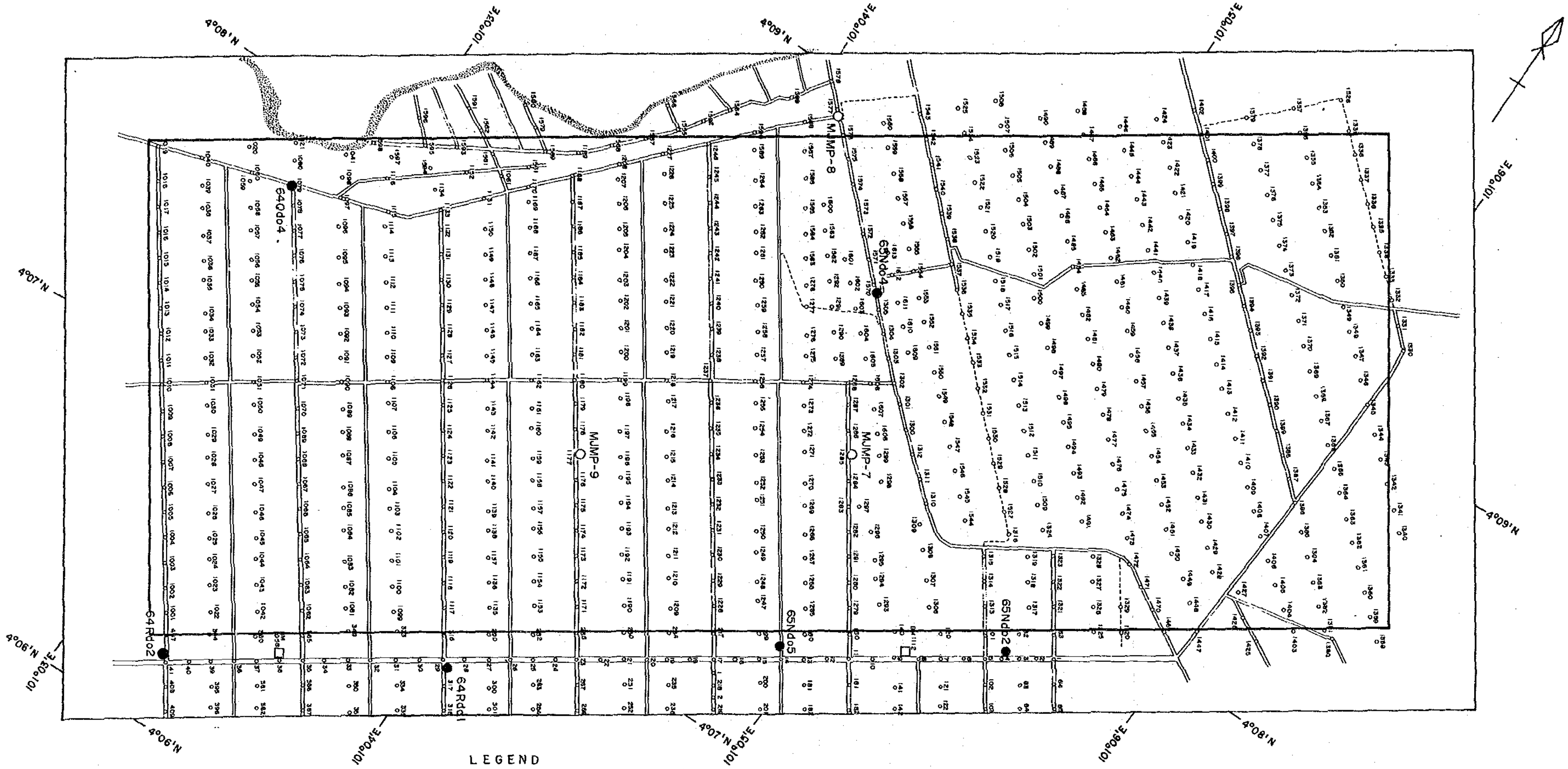
Observation points (No.1001-1613) were set at 613 stations mainly on the road as well as footpaths which pass at 250m intervals in the NW-SE direction. A standard distance between observation points is 150m, as shown in Fig.II-2-1.

(2) Gravity Meter

La Coste G type gravity meter manufactured by La Coste & Romberg Limited, which was used in the Phase II, was also utilized in this survey.

(3) Standard Gravity Value

A gravity base station (978,078.334 mgal), which had



LEGEND

- Geophysical survey area (gravity method)
- ∘ Gravity point measured in this phase
- ○ Drilling site conducted by MMAJ in this phase
- ● Previous drilling site conducted by G.S. Malaysia
- ◘ Base station of leveling

Fig.II-2-1 Location map of gravity stations, Area b-2

been set in the phase II survey, was also adopted in this survey. The base station is located at a site in the rest house in Teluk Intan 20km southward of the survey area.

(4) Leveling

Instruments

A direct leveling method was adopted for determining elevations of all observation stations. The instrument used is a Level B-2 of Sokkisha made in Japan. Two locations on Route 70, which passes through the survey area, were adopted as bench marks for leveling. These locations and their altitudes are listed below.

	Altitude of bench mark		
No. of bench mark	altitude	latitude	longitude
A-1058	4.054m	04°06'24"	101°03'34"
A-1112	9.613m	04°07'25"	101°05'03"

Leveling Accuracy

Leveling was carried out as accurate as possible. A consequent leveling error was within D, which was accurate enough as compared with a standard error, 50D. The errors realized are listed on Table II-2-1.

Table II-2-1 Leveling errors in gravity survey. Area b-2

Order	Route	Observed elevation difference (m)	Closed error (mm)	Distance of closed loop (km)	Precision realized (mm)
1	BM1058-35-29-11-BM1112	+5.562	+6	3.8	$3\sqrt{D}$
1	BM1058-41-1019-1151-1576-5-BM1112	-5.572	+13	11.6	$4\sqrt{D}$

(5) Calculation of Bouguer anomaly value

Bouguer anomaly values were calculated by processing (Fig.II-2-2) the observed data (Appendix-7) read by a gravity meter. An optimum assumed density of 1.8 g/cm^3, which had been determined in the Phase II survey, was also adopted for this data processing. Remeasurement at 17 stations where gravity had been measured in the Phase II survey was done to compile the existing data in the b area that is adjacent to this survey area, and the previous data (b area) were converted to new data (b-2 area) using the following formula.

$$G\ (new) = G\ (old) + 0.222\ (mgal)$$

2-1-3 Method of Data Analysis

Underground structure was clarified by analyzing Bouguer anomalies using the following mathematical techniques (Fig.II-2-3).

(1) Filtering

The Bouguer anomaly is produced by the difference in composition of various kind of materials existing underground, namely the variation of underground structure.

To clarify underground structure, Bouguer anomalies are separated into noise, residual and regional anomalies by a power spectral analysis and subsequently, a gravity residual map which reflects basement structure was drawn for further interpretation.

	Wavelength	
Noise	0-690m	Reflecting small structure near surface
Residual	690m-2,160m	Reflecting basement structure
Regional	over 2,160m	Reflecting regional structure

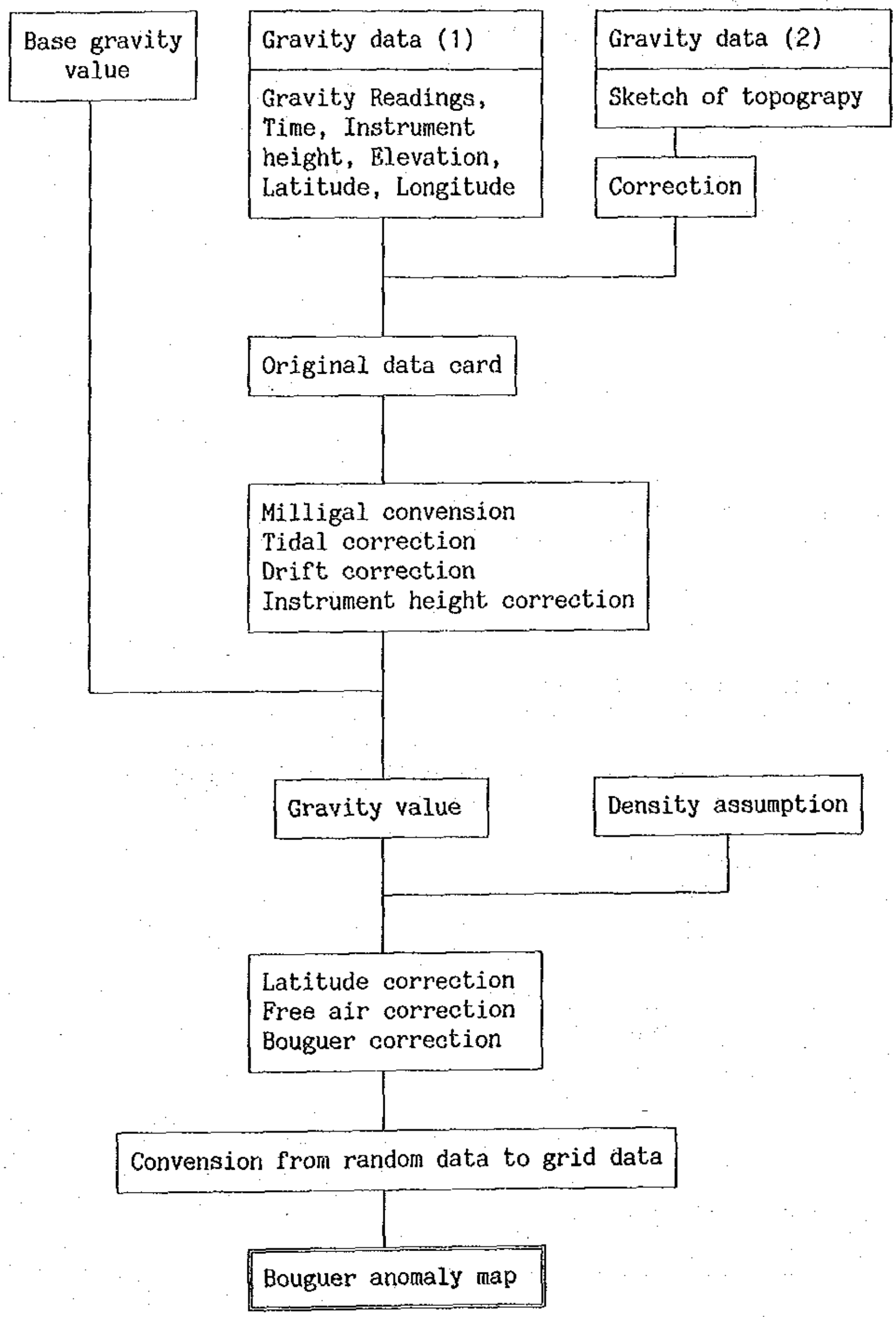


Fig. II-2-2　Flow chart of data processing, gravity survey

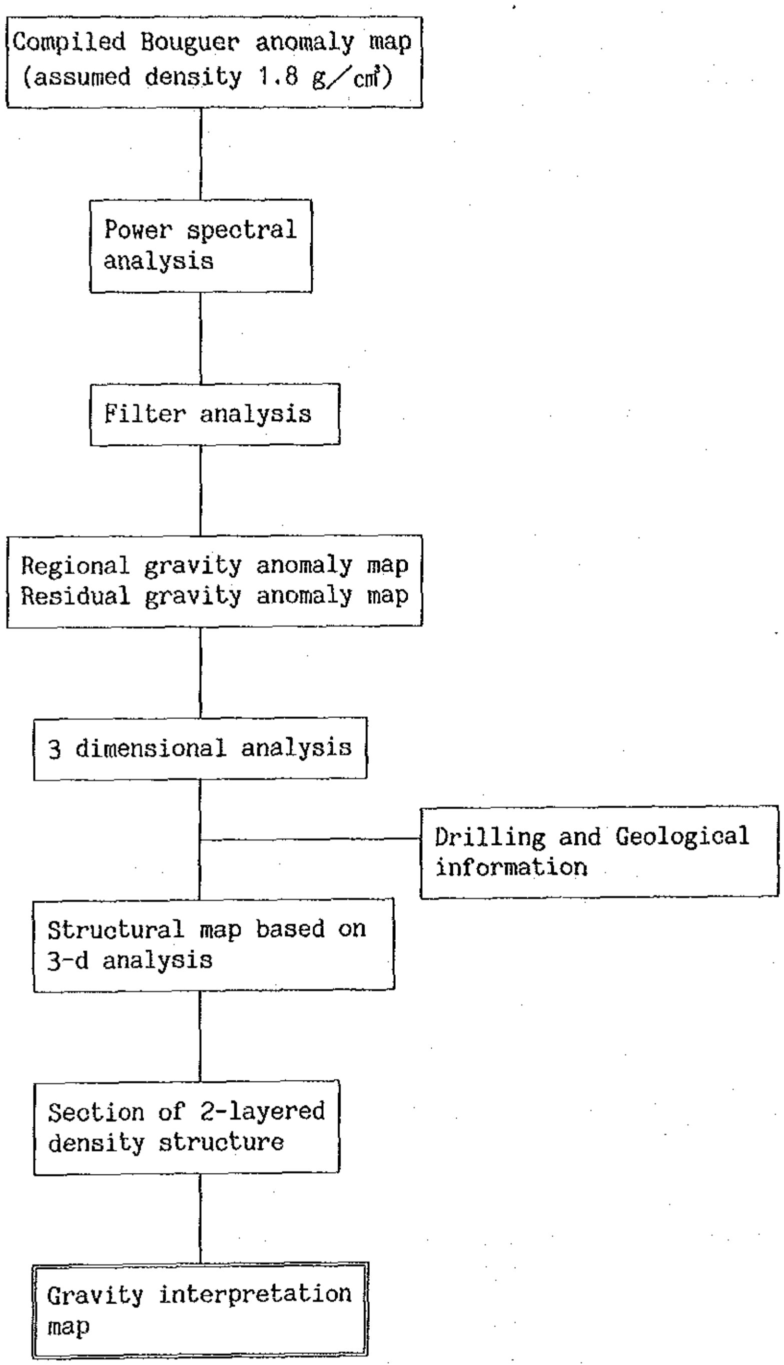


Fig. II-2-3 Flow chart of the gravity analysis

This residual map was produced by subtracting the noise anomalies and regional anomalies from the Bouguer anomalies. The calculation was done by Fast Fourier Transform method using a 135m grid interval.

(2) 3-dimensional two layered analysis

The geologic structure in the area can be assumed as a two layered structure, consisting of the unconsolidated layered sediments and paleozoic sediments. Based on this assumption, the depths to a basement rock were calculated by analyzing the above residual gravity by means of a Fast Fourier Transform. The computation was done for four types of density differences and mean depths of basement rock.

Table II-2-2 Comparison of basement depths confirmed by drilling and those estimated by gravity results

SNo.	Hole		Depth of gravity basement							
			a		b		c		d	
	Name	Depth (m)	Depth (m)	ΔD (m)	Depth (m)	ΔD (m)	Depth (m)	ΔD (m)	Depth (m)	ΔD (m)
1	65Nd02	-63	-55	-8	-64	1*	-66	3	-74	11
2	65Nd05	-63	-63	0*	-70	7	-73	10	-78	15
3	64Rd01	-84	-72	-12	-73	-11	-81	-3	-82	-2*
4	64Rd02	-67	-63	-4	-68	1*	-70	3	-75	8
5	65Nd04	-72	-58	-14	-65	-7	-71	-1*	-74	2
6	64Qd04	-45	-63	18	-70	25	-73	28	-80	35
7	MJMP-7	-77	-60	-17	-68	-9	-71	-6	-77	0*
8	MJMP-8	-80	-72	-8	-78	-2*	-82	2*	-88	8
9	MJMP-9									

a: Density difference 0.65 g/cm³, mean depth 65 m
b: Density difference 0.70 g/cm³, mean depth 70 m
c: Density difference 0.75 g/cm³, mean depth 75 m
d: Density difference 0.80 g/cm³, mean depth 80 m

A most suitable gravity basement depth map was selected by the comparison of the results of the estimated depths and the known depths at drill holes (Table II-2-2). Consequently, it was found that the result of depths to gravity basement rock calculated under the assumption of $0.75 g/cm^3$ and a mean depth of 75m is nearly consistent with the known depths at drill holes.

(3) Two layered structural section

Fig.II-2-7 (1) to (4) show structural sections passing through each drilled hole. The sections were drawn using the results of the gravity basement depths. Filtering results are also shown in these sections.

2-1-4 Results of Interpretation

(1) Bouguer anomaly map (Fig.II-2-4)

The Bouguer anomaly values ranging between 5 to 14 mgal have a tendency to increase from NE to SW.
The flow of equi-gravity contour changes from the direction of N-S to NW-SE. A steep gravity gradient, reflecting a fault, is clearly seen at the northeastern edge of the area.

The distortion of equi-gravity contour of long wave (wave length about 1km), which is seen in the central and southwestern part of the area, seems to indicate a basement relief.

(2) Gravity residual map (Fig.II-2-5)

Residual gravity values change in a narrow band ranging from -0.4 mgal to 0.5 mgal. Several distinct gravity anomalies appear at the locations of equi-gravity contour distortion in the Bouguer anomaly map. High gravity anomalies reflect uplift of basement and low gravity anomalies reflect concave of basement. Hereafter the zone more than 0.2 mgal is conveniently named "high gravity anomaly zone" and the zone less than -0.2 mgal named "low gravity anomaly zone".

High gravity anomaly zones are distributed in the northeast (H1), the central (H2, H3) and southwest of the area. Among these anomaly zones the H1 anomaly zone located at 1km north of 65Nd02 drilling hole gives the highest anomaly value, 0.5 mgal and continues to a high anomaly zone detected in the Phase II survey, and extends to the north.

Low gravity anomaly zones are distributed in the eastern edge (L1), the central (Lw, L4 and Lt), the northwestern edge (L3) and the southwest (L6). Among these anomalies the L1 anomaly zone gives the lowest anomaly value and tends to decrease its value to the eastward. This anomaly zone continue to a low anomaly zone detected in the Phase II survey.

(3) Gravity basement depth map (Fig.II-2-6)

Gravity basement is located at the depth of 55m to 100m from the surface and the feature of equi-depth contour is dominant in the direction of NE-SW.

Gravity basement in the high anomaly zones (H1 to H4) gives the shallowest depth of 55m in the H1 anomaly zone, but is mostly located at the depth of 60m to 70m. The gravity basement in the low anomaly zones (L1 to L6) gives the deepest depth of 100m in the L1 anomaly zone and the depth to gravity basement in the L2 to L6 is nearly 80m to 90m.

(4) Two layered structural section

D-D' section (Fig.II-2-7 (1))

This section passes drilling holes 64Rd02, 64Rd01, 65Nd05 and 65Nd02 in the direction of NE-SW.

Gravity basement undulates at the depth of 70m to 90m and is concaved in the vicinity of drilling hole 64Rd01. A drilling hole 65Nd02 is situated in the crest of gravity basement, and the depth to gravity basement here is about 65m and steeply deepens to the east.

F-F' section (Fig.II-2-7 (2))

This section passes drilling holes 64Qd04, MJMP-9 and 65Nd05 in the direction of E-W. Gravity basement undulates at the depth of 70m to 90m and its uplift of about 70m in depth is located at No.6-No.9, are located under No.21 to No.25.