REPORT
ON
THE MINERAL EXPLORATION
IN
PERAK, MALAYSIA

(PHASE I)

MARCH 1990

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 in Perak Area Project and entrusted the survey to Japan International Cooperation Agency (JICA) and Metal Mining Agency of Japan (MMAJ).

The JICA and MMAJ sent to Malaysia a survey team headed by Mr. H. Fuchimoto from June 26th to November 2nd, 1989. The team exchanged views with the officials concerned of the Government of Malaysia and conducted a field survey in Perak Area. After the team returned to Japan, further studies were made and the present report has been prepared.

We hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

February, 1990

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

Gen-ichi Fukuhara
President
Metal Mining Agency of Japan

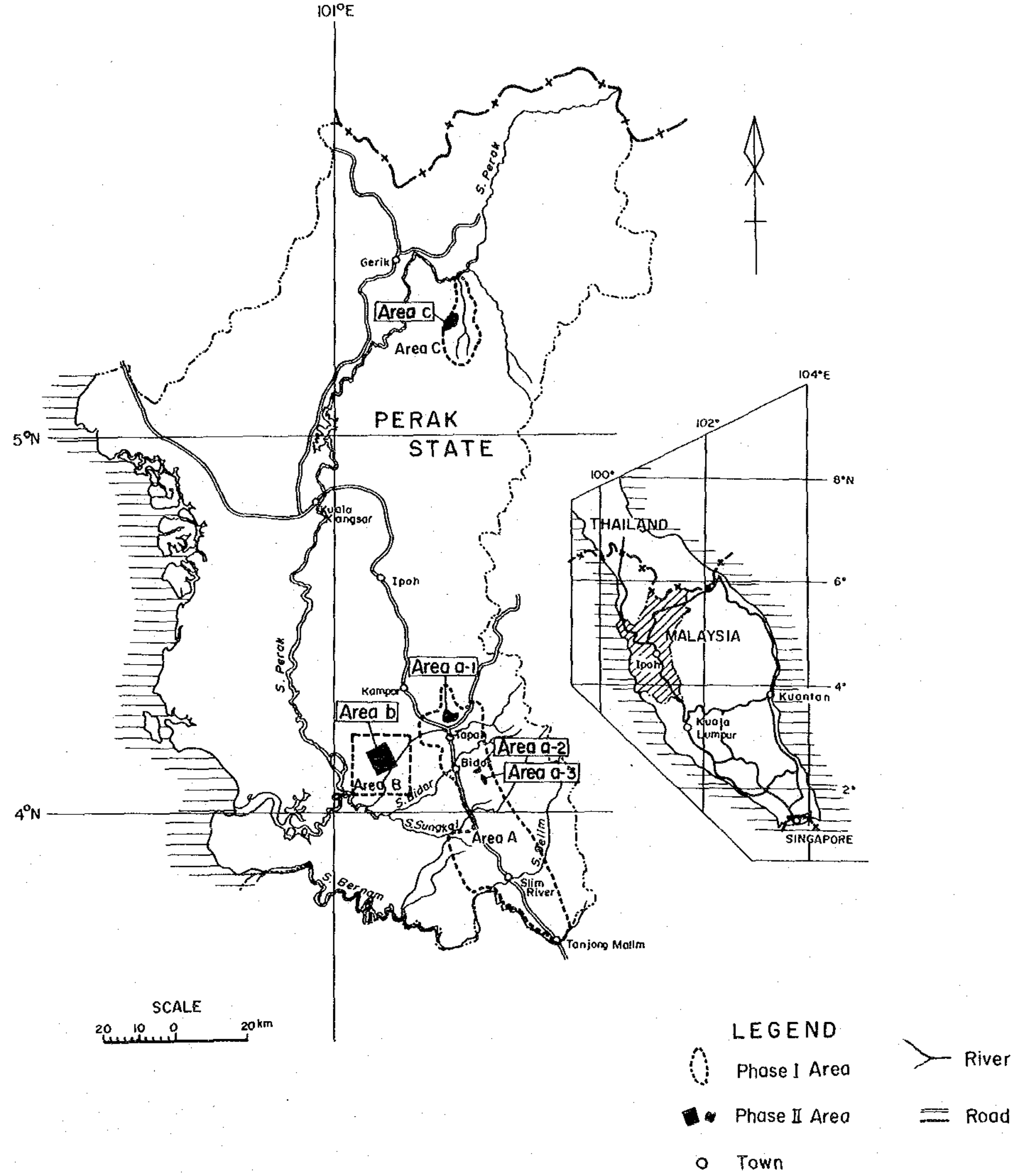


Fig. 1 Location map of the project area

Abstract

In Phase II of the mineral exploration in Perak, Malaysia, the following surveys were carried out in the promising areas, A, B, C which were selected by Phase I survey as having high potential for gold, tin and rare earths in order to determine the mineral occurrence through clarification of the geologic structures.

Geological and Geochemical Surveys

Area A	Area 9km^2, Survey Route 30km, Trench 113m, Geochemical Samples 722 pcs				
Area C	Area 18km^2, Survey Route 57.7km, Geochemical Samples 123 pcs				

Geophysical Survey

Area B	Area 4km^2, Measuring Points 860				

Drilling

Area B	Drillhole No.	MJMP-1	Length 98.0m	Inclination	-90°
		MJMP-2	76.5m		-90°
		MJMP-3	62.8m		-90°

The survey results can be summarized as follows;

(1) Area A

1 Area a-1

The area is composed of phyllite of Paleozoic and the Main Range granite of Permian - Triassic.

Geochemical soil survey disclosed an Au-As anomalous zone (area = 0.6km x 1.4km, mean value = 0.410 ppm Au and maximum value = 2.708 ppm Au) near the boundary between the Main Range granite and phyllite in the northeastern area. In the trenches, the Au content in soil tends to increase towards depth, therefore, it is considered that potential for Au deposit is high.

2 Area a-2

The area is composed of Paleozoic phyllite and Quaternary sediments. A granitic stock was newly found in the northwestern part.

Geochemical soil survey revealed an Au-As anomalous zone (area = 0.3km x 0.5km, mean Au value = 0.039 ppm, maximum Au value = 0.068 ppm) in the phyllite on the west of the granite. However, smaller scale and value of anomaly zone than those of the Area a-1 suggest lower potential for Au deposit.

3 Area a-3

The area is composed of Paleozoic phyllite and Quaternary sediments. It became clear that a tectonic line ran along S. Chebor.

The geochemical anomalies detected seem to have relation with the tectonic line. The Au anomalies are distributed on both sides of the line, showing persistence in continuation. However, the mean Au value of 0.095 ppm and maximum Au value of 0.135 ppm are much lower than those of the Area a-1.

(2) Area B (Area b)

Based on the existing drilling data, it is considered that placer tin deposits of high grade occur in the Quaternary sediments near the bedrock. As the thickness is controlled by the bedrock relief, geophysical survey and drilling were carried out to clarify the bedrock topography.

1 Geophysical Survey (Gravity Method)

Gravity survey has revealed a NW-SE system fault with a throw of more than 100 m in the northeastern part of survey area. It has also become evident that in the central part there is a U-shaped hollow extending towards north.

2 Drilling

Three (3) holes drilled at about 1.5 km intervals in the central area, encountered tin beds with 3.1 - 4.6m in thickness and 0.39 - 0.81 kg/m^3 in SnO_2 content.

A synthetic study on the data of above 3 holes and existing holes of Geological Survey of Malaysia (GSM) together with the bedrock topography obtained by gravimetric survey, made clear that almost all sites of drillholes are located over the crests or transitional slopes between crests and hollows of the bedrock and no holes have been planned over hollows. As a basin structure of bedrock is considered favorable for tin deposition, a follow up survey is necessary for the hollows.

The clays detected in the drillholes were supplementaryly tested, resulting that they are not so good in quality but they can be used for bricks and tiles.

(3) Area C (Area c)

The Area c is wholly composed of the Main Range granite with megacrysts of K-feldspar.

A Geochemical survey revealed Au and Sn anomalous zone (Au: area = $1.5km^2$, mean value = 0.06 ppm, maximum value = 0.009 ppm, Sn: area = 0.8 km^2, mean value = 50 ppm, maximum value = 70 ppm) in the upper courses of the creek where Au and Sn anomalies were found in Phase I.

Rare earth elements (REE) anomalies are sporadically distributed in the area, indicating a pointed distributions of REE minerals. The anomalous value of each element is not so high, showing 1 to 5 times the average value of the Main Range granite, which suggests low potential for Au, Sn and REE deposits.

Based on the above-mentioned results, the following activities are recommended for the Phase III survey.

Area a-1	To carry out drilling for the Au-As geochemical anomalies obtained on the west of the Main Range granite in the northeastern part in order to clarify the detailes of mineralization.
Area b	To carry out gravity survey in the adjacent area, to the Phase II survey area in order to clarify the bedrock profile. To carry out drilling and confirm the thickness and grade of placer tin deposits.

CONTENTS

PART I GENERAL REMARKS

PART II AREA A

PART III AREA B

PART IV AREA C

PART V CONCLUSIONS AND RECOMMENDATIONS

List of Figures

List of Tables

List of Appendixes

List of Plates

PART I GENERAL REMARKS

Chapter 1 Introduction

1-1 Background

The Kinta Valley, which includes Ipoh, the Capital City of Perak State, has been known as a placer tin producing center from old times. However, many mines are recently driven to suspend or stop their operation due to drain of their resources and aggravation of the market price.

To save this local strait, in 1987 the Government of Malaysia requested the Japanese Government to conduct a mineral exploration in Perak for seeking new natural resources in place of tin. Under this situation, this project started in July, 1988. This year has marked the second phase of the project and geological, geochemical and geophysical surveys and drilling were carried out in the three areas which have been selected from the phase I survey results as having highest potential for mineral resources.

1-2 Conclusions and Recommendations of Phase I Survey

1-2-1 Conclusions of Phase I Survey

Based on the results of geological, geochemical and geophysical (CSAMT method) surveys, the following conclusions were drawn.

Area A

The Area A is composed of the Paleozoic phyllite and the Permian - Triassic Main Range granite, the latter of which has intruded into the former. The mineralization in the area is of a vein type of gold and tin.

The geochemical survey desclosed a zonal arrangement of geochemical anomalies as rare earths→Sn, W→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 (2-4)km x 22km, including the Bukit Mas gold mine area. The anomalies lain on the north of Bukit Mas are better than those of Bukit Mas, suggesting higher potential for gold deposits than the Bukit Mas.

The Bukit Mas deposit is of a gold bearing 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 bed and has no direct connection with the distribution of known deposit. Therefore, it is desirable to carry out an exploration for these anomalies based on the exploration results of not only the Bukit Mas area but the large-scaled anomalous zone.

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 0.24-1.29kg/m^3) are controlled by the bedrock relief, therefore, it is necessary to investigate the bedrock structure prior to drilling.

By reasons of big specific gravity difference, easy access and low cost, a gravimetric survey is considered to be the best way for this purpose.

Area C

The Area C is composed of Paleozoic schist and the Main Range granite, the latter of which has intruded into the former.

The geochemical survey found a zonal arrangement of geochemical anomalies as rare earths·Sn→W→Au from the Main Range granite to the schist zone, which suggests high potential for gold and tin mineralization.

1-2-2 Recommendations for Phase II Survey

Based on the above-mentioned conclusions, the following works are recommended for the phase II survey.

Area A — To carry out detailed geological (and/or trenching) and geochemical soil sampling over the gold anomalous zone which extends from the north of Tapah to the south of Bidor and clarify the details of mineralization.

Area B — To carry our gravity survey in the area centering around Labu Kubung in the Teluk Intan sheet and clarify the bedrock profile.

Area C To carry out detailed geological and geochemical (soil and rock) surveys for the Au, Sn and rare earth anomalies located in the basins of S. Duabelas and S. Jopal., and for Au anomalies located in the lower reaches of S. Ringat and clarify their details.

1-3 Outline of Phase II Survey

1-3-1 Survey areas

The survey areas of Phase II are the following areas as shown in Fig. 1 and Fig. 1-1-1.

(i)	Area A: Areas a-1, a-2 and a-3	Area covered	9km^2
(ii)	Area B:	"	30km^2
(iii)	Area C:	"	18km^2
		Total	57km^2

The Area a-1 is close to Tapah, 60km south of Ipoh, Perak State and Areas a-2 and a-3 are close to Bidor located 10km south from Tapah. The accessibility is good as the National Highway No. 1 connecting Kuala Lumpur and Ipoh runs nearby.

Area B is located 30km southwest of Tapah, and it takes 30 minutes by car along the National Highway No. 5 from Tapah.

Area C is located in the upper reaches of S. Perak. It can be reached by going northward about 154km from Ipoh along the National Highway No. 76 to Gerik then crossing S. Perak by a timber company ferry, and then following a timber track about 20km to reach the survey area. Logging activities are vigorous in this area, which made accessibility easier. In a good weather, a four wheel driven car is very helpful.

1-3-2 Objectives of the survey

The survey areas are composed of three areas which were selected as promising areas based on the results of the phase I survey.

The objectives of the survey for the respective areas are as follows:

[1] Area A: In Phase I, geochemical stream sediment survey disclosed 3 strong Au anomalous zones (a-1, a-2 and a-3). In order to clarify the nature of these Au concentrations and surrounding geology and to delineate the most promising area, detailed geological (including trenching) and geochemical surveys were conducted.

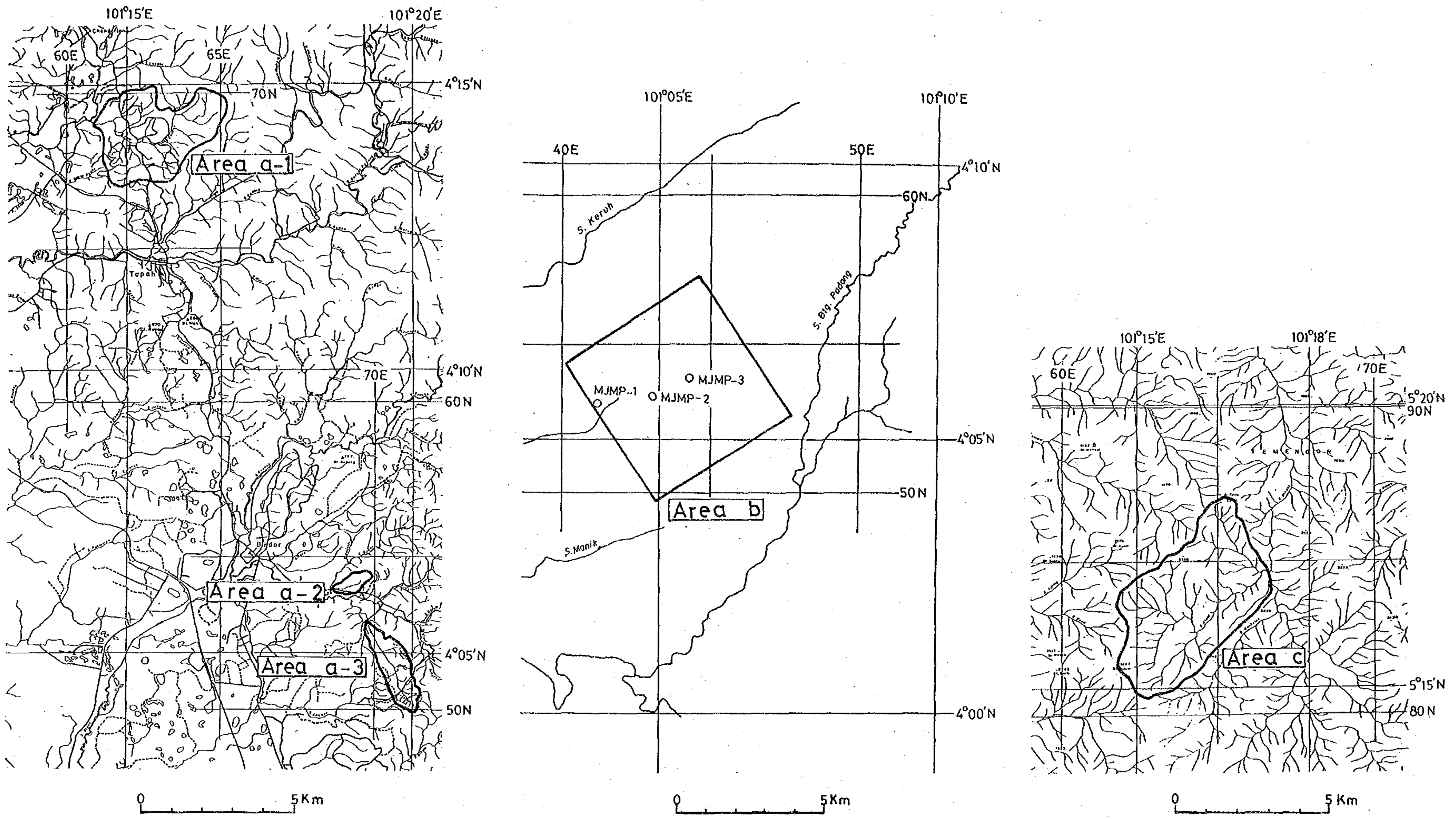


Fig. I - 1 - 1 Location map of the survey areas

[2] Area B: Based on previous studies, a distribution of Sn concentration in the Quaternary sediments in the Area B seems to be controlled by the bedrock relief. In order to investigate the bedrock profile a geophysical survey (gravity method) was carried out in the most promising area (Area b: $30km^2$) for Sn placer deposit. Three (3) holes were drilled concurrently to clarify the details of Sn deposit and clay deposit and to study the correlation between tin concentration and bedrock.

[3] Area C: During Phase I, the stream sediment survey disclosed a geochemical anomalous zone of Au, Sn and REE (rare earth element) in S. Jopal. In order to clarify the nature of mineralization and delineat the most promising area, detailed geological and geochemical rock surveys were carried out.

1-3-3 Survey Methods

(i) Geological and geochemical surveys

(1) Area A

For the three areas traverse survey was carried out along the survey route to prepare a 1/5,000 geologic map. Geochemical soil survey was carried out concurrently with a geological survey. This area was expected to have gold-bearing quartz veins in NNW-SSE direction, soil samples were taken at shorter intervals in strike direction, i.e., at 200m intervals in NNW-SSE direction and 100m intervals in ENE-WSW direction. For soil sampling, three holes were drilled at each point from a depth of 0m to 1.0m below humic soil by using an auger. About 10 liters of soil obtained from two out of the three holes was panned to check gold flakes. Gold analysis was carried out for reconfirmation. Around the points where gold flakes were observed by panning, additional samples were taken at 50m to 100m grid intervals. The soil obtained from the remaining one hole was dried and sieved with a 80-mesh sieve and analyzed for Au, Ag, Pb, Zn, Cu, As, W and Sn.

Furthermore, from the results of the geological and geochemical surveys, 13 sites with high potential for ore deposit were selected for trenching to cofirm the geology and occurrence of the deposit.

(2) Area C

For Area C, a 1/10,000 geologic map was prepared, and rock samples were taken at about 250m intervals along the traverse routes. This is to achieve almost the same sampling density in the entire area.

(ii) Geophysical survey (gravity method)

An area of $30km^2$ with highest potential for placer tin deposits was selected in Area B, judging from the past drilling data, and gravimetric survey was carried out over the area.

Traverse lines were set up in parallel to agricultural land dividing roads, and the survey was carried out in a grid of 150m survey point intervals and 250m traverse line interval in principle. The number of survey points was 860.

(iii) Drilling

In Area b, where gravity survey was carried out, three holes were drilled using a semi-mechanized Banka, owned by Geological Survey of Malaysia (GSM).

The heavy minerals in the sludge were panned at every 1.5m drilling length and analyzed for Au, Ag, Pb, Zn, Cu, As, W and Sn.

Several clay layers were also identified, and the clay tests were carried out to study their properties and suitable uses.

The contents of survey and analytical items for respective areas are listed in Table I-1-1.

Table I-1-1 Amount of Survey and Analytical Item

(1) Amount of Surveys

	Amount		
Geological & Geochemical Survey	Survey Area		9km^2
a) Area A(a-1, a-2, a-3)	Survey Route Length		80km^2
	Trenching Length		113m
	No of Samples		
	Soil		722pcs
	Rock		10pcs
b) Area c	Survey Area		18km^2
	Survey Route Length		57.7km
	No of Samples		
	Rock		123pcs
Geophysical Survey(Gravity method)			
Area b	Survey Area		30km^2
	Measuring Points		860pcs
Drilling	No.	Drilling Length	Inclination
Area b			
	MJMP-1	98.0m	-90°
	MJMP-2	76.5m	-90°
	MJMP-3	62.8m	-90°

(2) Analytical Item & Component

Analytical Item & Component		Quantity
1. Thin Section of Rocks		12pcs
2. Polished Section of Ores		6pcs
3. X-Ray Diffraction Analysis		18pcs
4. Chemical Analysis		
a) Geological Samples		
Rock	(Nb, Ta, U, Th, La, Ce, Sm, Eu, Tb, Yb, Lu, Nd)	133pcs
b) Ore Sample	(Au, Ag, Pb, Zn, Cu, As, W, Sn, Nd, Ta, U, Th, La, Ce, Sm, Eu, Tb, Yb, Lu, Nd)	17pcs
5. Density Measurement		26pcs

1-3-4 Organization of the survey team

The members participated in Phase II survey are as follows:

	Japanese Team	Malaysian Team
Leader, Geology & Geochemistry	Hiroshi Fuchimoto (BEC)*	Loh Chiok Hoong (GSM)
Geology & Geo-chemistry	Tadashi Yamakawa (do)	Mohd Anuar Mohd Yusof (do)
do	-	Mohd Suhaili Ismail (do)
Geophysics	Hiroshi Fukuda (do)	Dzazali Ayub (do)
do	Masatane kato (do)	-

*BEC: Bishimetal Exploration Company Ltd.

1-3-5 Survey Period

(i) Field Work

Geological and Geochemical Surveys : 26, Jun. 1989 - 2, Nov. 1989

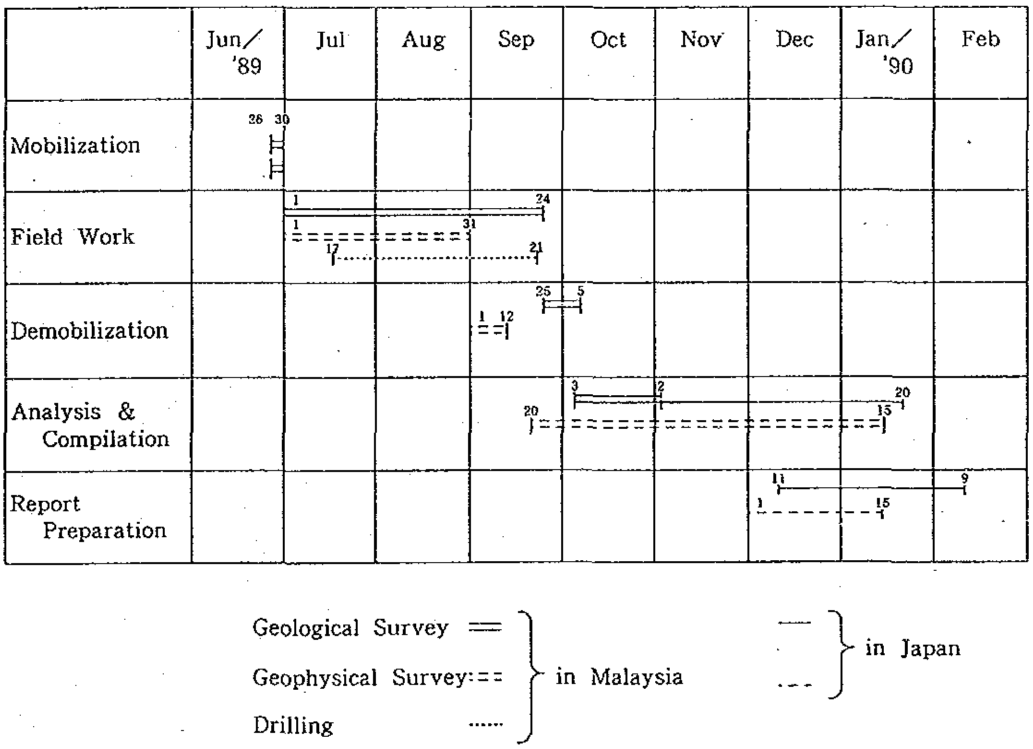
Geophysical Survey : 26, Jun. 1989 - 12, Sep. 1989

Drilling : 17, Jul. 1989 - 21, Sep. 1989

(ii) Report Preparation : 11, Dec. 1989 - 9, Feb. 1990

The time schedule of Phase II work is shown in Table I-1-2.

Table I-1-2 Time Schedule of Phase II Work



Chapter 2 Outline of the Survey area

2-1 Topography and Drainage

All the survey areas are located in the hills and plains spreading on the west of the Main Range granite belt as shown in Figs. 1 and I-2-1.

Area a-1 is located at 3km north of Tapah and covers all the drainage system of S. Jong, a tributary of S. Chenderiang. The height is 50 to 100 m above the sea level. The area is generally composed of rubber estates and oil palm estates. It is a gentle hilly area, but in the northeast of this area, the Main Range granite is distributed along a steep slope of 40 to 45°. To the west of Tapah-Chenderiang trunk road, wide spread of alluvium is encountered.

Area a-2 is located in Kg. K. Gepat 3km east of Bidor town and composed of undulating area near the confluence of S. Bidor and S. Gepat. It is about 75m above the sea level. The entire area is composed of rubber estates.

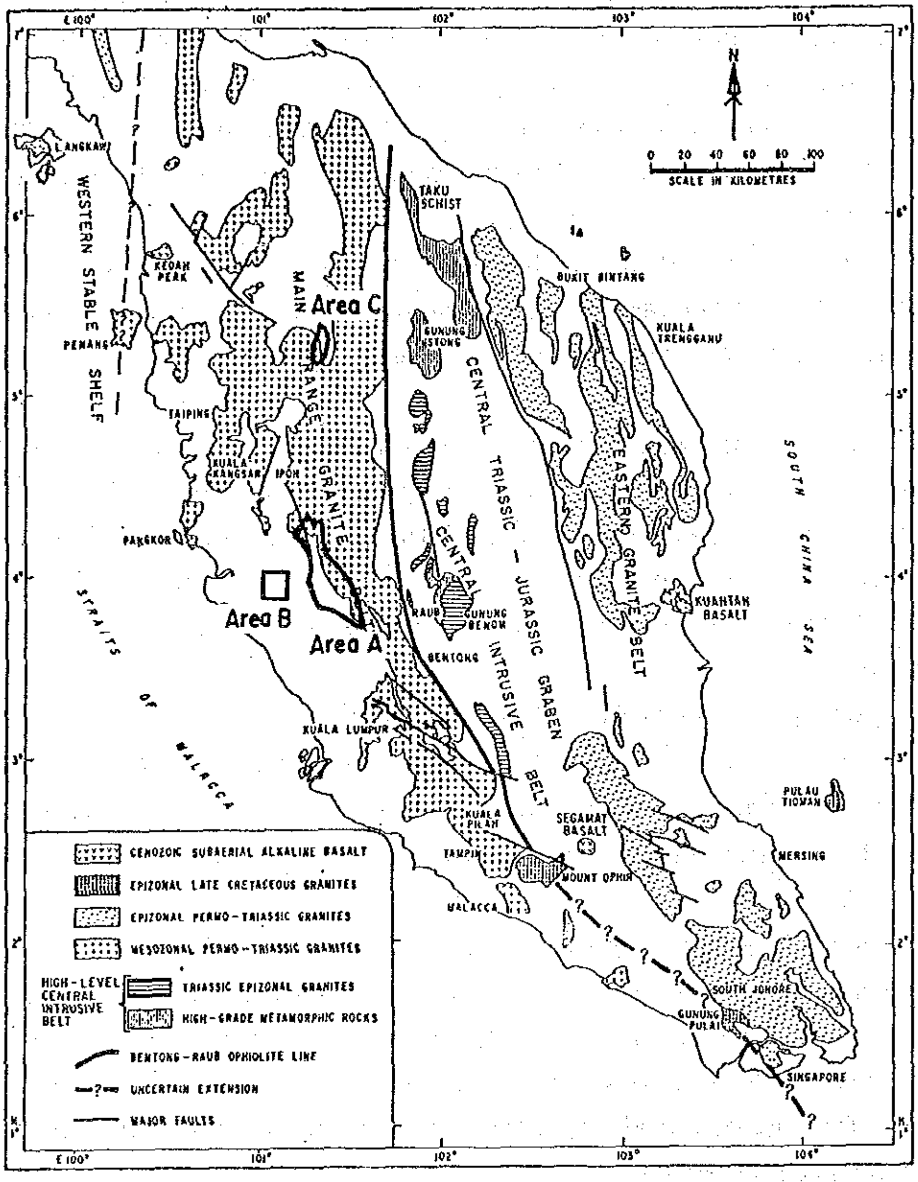
Area a-3 is located about 3km southeast of Area a-2 and covers the entire drainage system of S. Chebor, a tributary of S. Bidor. It is about 45m to 110m above the sea level. It is a gentle hilly and composed of rubber oil palm estats. Compared with Areas a-1 and a-2, the valley is somewhat deeper. S. Chebor is considered to be a tectonic valley extending in a NW-SE direction.

Area B is a paddy field area, located 30km southwest of Tapah, and is lowland of 2m to 12m above the sea level. According to land improvement programme, agricultural roads and water channels are regularly arranged like a grid. Immediately on the west side of this area, S. Perak meanders down southward.

Area C is in the upper reaches of S. Gerik, a tributary of S. Perak, and covers the drainage area of S. Jopal. It is a steep mountainous area at 400m to 1,150m above the sea level, and steep cliffs can be seen here and there. The whole area was covered by thick jungle last year. But it was released for logging activities, many timber tracks were constructed, which makes the access very easy.

2-2 Geology

The Peninsular Malaysia can be divided into four major geologic structural zones (Hutchison C.S, 1977); Western Stable Shelf, Main Range Belt, Central Graben and Eastern Belt, from west to east (see Fig. I-2-1).



after Hutchison C.S.(1977)

Fig. I - 2 - 1 Geological map of Peninsular Malaysia

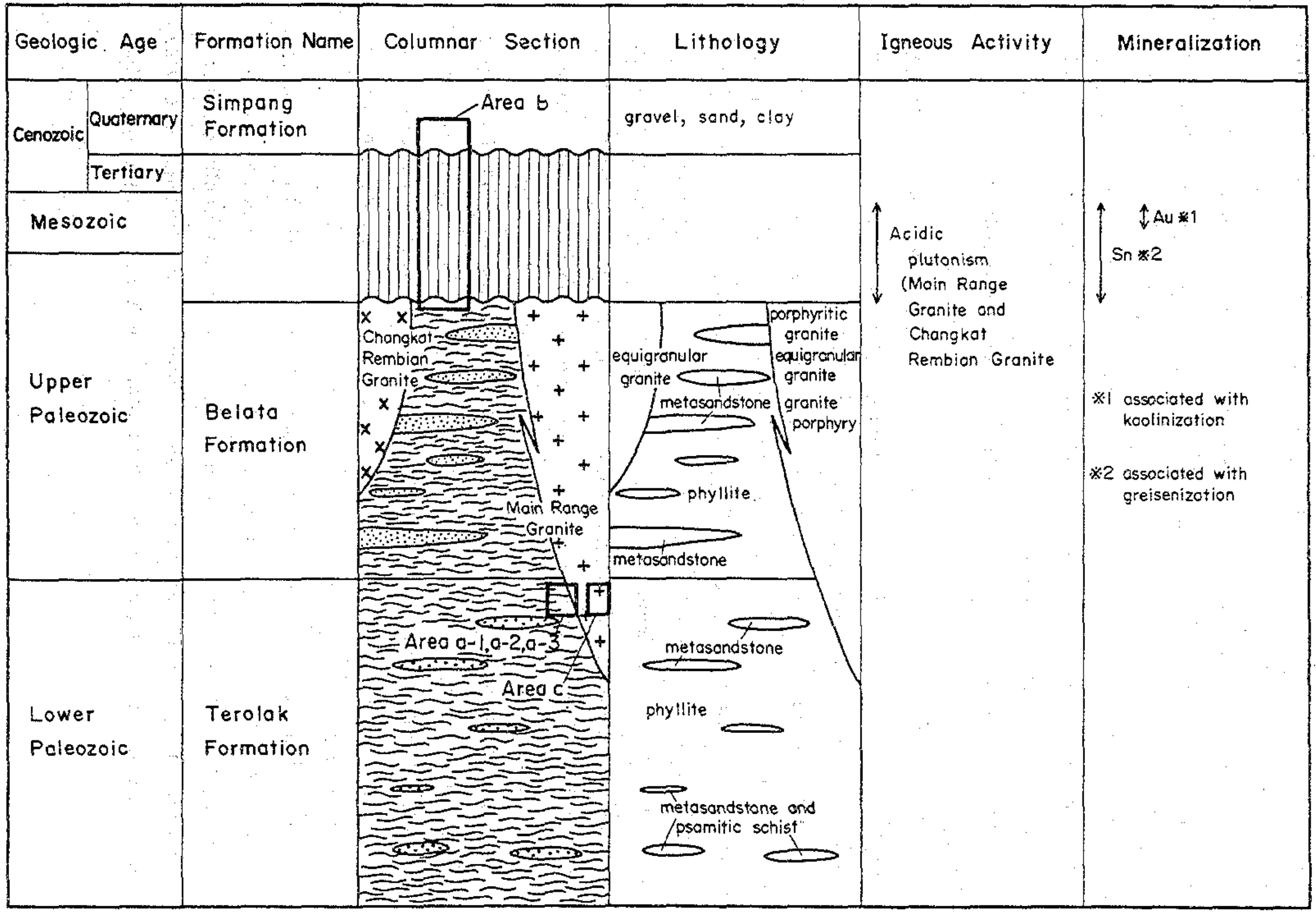


Fig. I - 2 - 2 Generalized stratigraphic section of the survey area

All the survey areas belong to the Main Range Belt, and are composed of the Terolak formation and the Belata formation mainly of Palaezoic age. The generalized geologic stratigraphy of the survey areas is shown in Fig. I-2-2.

The Terolak formation is distributed on the west side of the Main Range granite, and is mainly composed of phyllite with some metasandstone and psammitic schist.

The phyllite is black to dark grey and well-schistose. It contains graphite layers which are well persistent in the strike direction. The phyllite has many quartz segregation veins.

Some metasandstone and psammitic schist are distributed among the phyllite.

Schistosity of the Terolak formation is generally in a NNW-SSE direction and dipping 50 to 80W. It apparently shows a monoclinal structure, but is surmised to form isoclinal fold (Hutchison C.S. (1977)).

The Belata formation is distributed conformably to the west of Terolak formaion. The rock facies are similar to those of the Terolak formation. They are characterized by slight lower grade of metamorphism and higher content of metasandstone than those of the Terolak formation.

The phyllite distributed in Aeras a-1, a-2 and a-3 surveyed in this year is of the Terolak formation. However, the bedrock identified by the drilling in Area B is considered to be a member of the Belata formation in view of its location.

The Quaternary formation is alluvium deposits and is widely distributed on the west of the National Highway No. 1. It is composed of unconsolidated mud, sand and gravel. Its thickness increases westward. Since it contains cassiterite and placer gold, it has been mined long ago as placer tin deposits.

The Main Range granite is distributed in a NNW-SSE direction and forms the skeleton of the Peninsular Malaysia. The granite is considered to have intruded in Permian or Triassic age. It can be lithologically classified into porphyritic granite and equigranular granite. The former is coarse grained and characteristically contains 2 to 5cm long K-feldspar phenocrysts.

The ore deposits in this area are tin, gold and kaolin, occurring in the granite or in the phyllite near the granite.

Among them, one tin mine is located 5km east of Bidor. Many lenticular ore (1 to 2cm wide and 10cm long) of cassiterite - quartz are being mined. The ore occur along the schistosity of phyllite near the Main Range granite.

For gold, Bukit Mas deposit is located at 2km in the southeast of Tapah, and from the available records, gold-bearing quartz veins in the phyllite were prospected and mined about 100 years ago. Last year, the mineralized belt was geophysically surveyed by CSAMT method, but the results were not encouraged by the work.

In the Area a-3, there are remains of older mine where a tin-quartz vein in phyllite is surmised to have been mined, and it is said that gold was also mined as a by-product though there remains no correct record.

Chapter 3 General Discussion on the Survey Results

3-1 Area A

3-1-1 Area a-1

The Area a-1 is composed of the Terolak Formation, the Main Range granite and Changkat Rembian granite (both of which have intruded into the formation) and the Quaternary sediments.

The Terolak Formation consists of mainly phyllite, striking NNW-SSE and dipping 40° - 70°W. It is considered to show an isoclinal folding structure.

The Main Range and the Changkat Rembian granites are Permian to Triassic intrusives and accompanied with Au, Sn etc.

Based on the phase I survey results, Au bearing quartz veins were expected in the phyllite in this area. In Phase II, geochemical soil survey with a grid sampling method and geological survey including trenching were carried out in the Au anomalous area selected by the Phase I stream sediment survey.

As shown in Fig. I-3-1, geochemical survey disclosed in the northeastern area a remarkable Au-anomalous zone accompanied with As near the boundary between the Main Range granite and phyllite. The anomalous zone covers an area of 0.6 km x 1.4 km = 0.8 km^2, showing mean value = 0.41 ppm and maximum value = 2.71 ppm for Au, and mean value = 814 ppm and maximum value = 2,248 ppm for As.

Au contents in the lateral soil of 5 trenches dug in the anomalous zone range from 0.27 ppm to 3.57 ppm (mean = 1.94 ppm) and tend to increase towards depth.

The weathered soil is too thick to clarify the relationship between anomalies and geology. However, judging from the fact that Au flakes in the soil are native gold and exist together with quartz breccias, the Au anomalies seem to be related to quartz vein. In this area there are two types of quartz veins, the one is occurring along the schistosity and the other is cutting the schistosity, the former of which is of earlier stage and bears a few Au.

As the Au anomalous zone extends towards SE linearly, it is conceivable that there is a geologically weak zone at or around the contact between the Main Range granite and phyllite, along which Au-As mineralization had been taken place.

Other Au-geochemical anomalous zone is located in the southern part of central area, extending widely in a NW-SE direction.

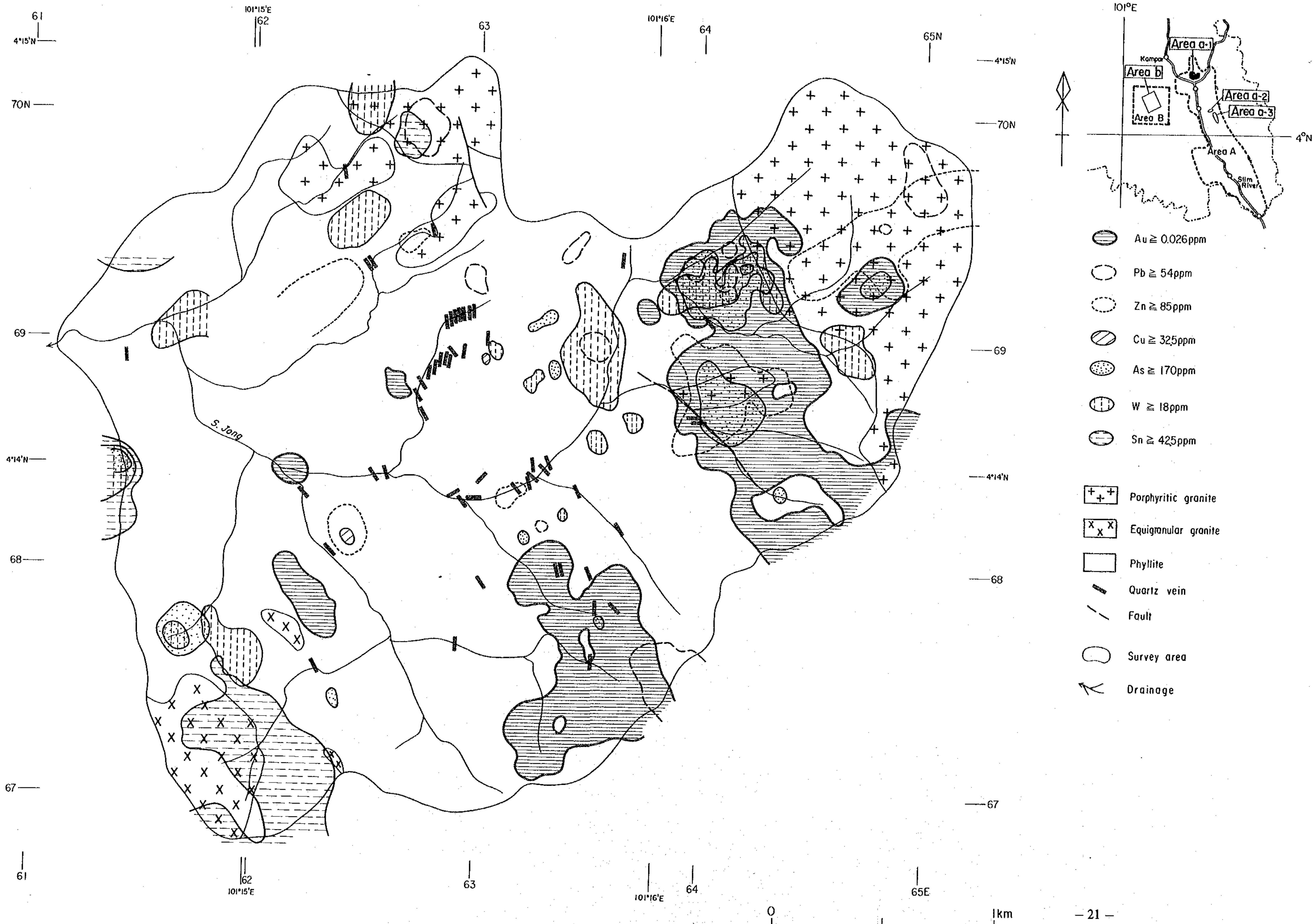


Fig. I - 3 - 1 Geochemical anomalies in the Area a-1

From the facts that Au contents are 1/3 of those of northeast anomalies, As is not accompanied and trench did not give good results, it can be inferred that potential for Au deposit seems to be low.

In the northern branch stream basin of S. Jong in the central part, many quartz veins were found but they proved barren. Geochemical soil survey and trenching also did not give good results. Many Au flakes are easily found in stream sediments at the junction between northern branch stream and S. Jong. However, their sources could not be confirmed.

A synthetic study on the results of geological and geochemical surveys shows that the basin has lower potential.

3-1-2 Area a-2

The Area a-1 is composed of the Terolak Formation, granite (which has intruded into the formation) and the Quaternary sediments.

The Terolak Formation is chiefly composed of black phyllite, striking NNW-SSE and dipping 60 W.

The granite is prophyrytic and crops out as stock. It seems to be related to the Main Range granite.

Geological survey and geochemical soil survey disclosed an Au-As geochemical anomalous zone in the phyllite on the east of the granite. Mean and maximum values for Au in the anomalous zone are 1/4 and 1/13 respectively of those of the Area a-1 anomalous zone and the same values for As are 1/4 and 1/11. According to these results and the fact that the geological circumstances of the two areas seem to be the same, the area a-2 is considered to have lower potential for Au resources than the Area a-1.

3-1-3 Area a-3

The Area a-3 is mostly composed of the Terolak Formation of Paleozoic, consisting of black phyllite and silty phyllite.

As same as in the Area a-1 and Area a-2, the schistosity of phyllite strikes NNW-SSE and dips 50 - 80 W.

Recent Quaternary sediment is mine dum, being deposited narrowly along S. Chebor running through the center of the area.

The geochemical stream sediment survey in Phase 1 detected Au-anomalies in the lower reaches of S. Chebor. Geological survey and geochemical soil survey were carried out to find out the source, resulting in discovery of old mine workings in the middle courses of S. Chebor. It is said that the mine was operated for primary Sn with Au around the year 940.

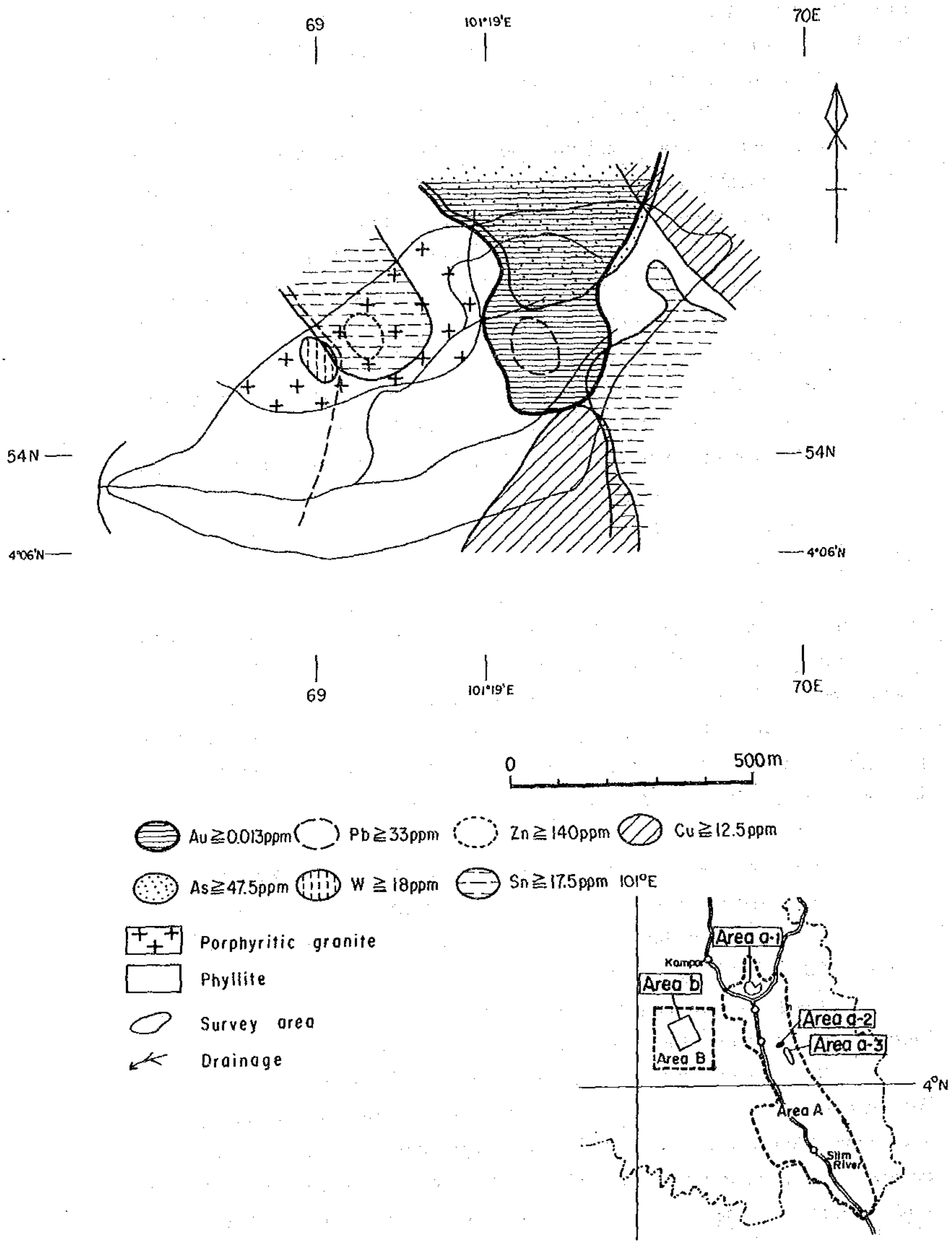


Fig. I - 3 - 2 Geochemical anomalies in the Area a-2

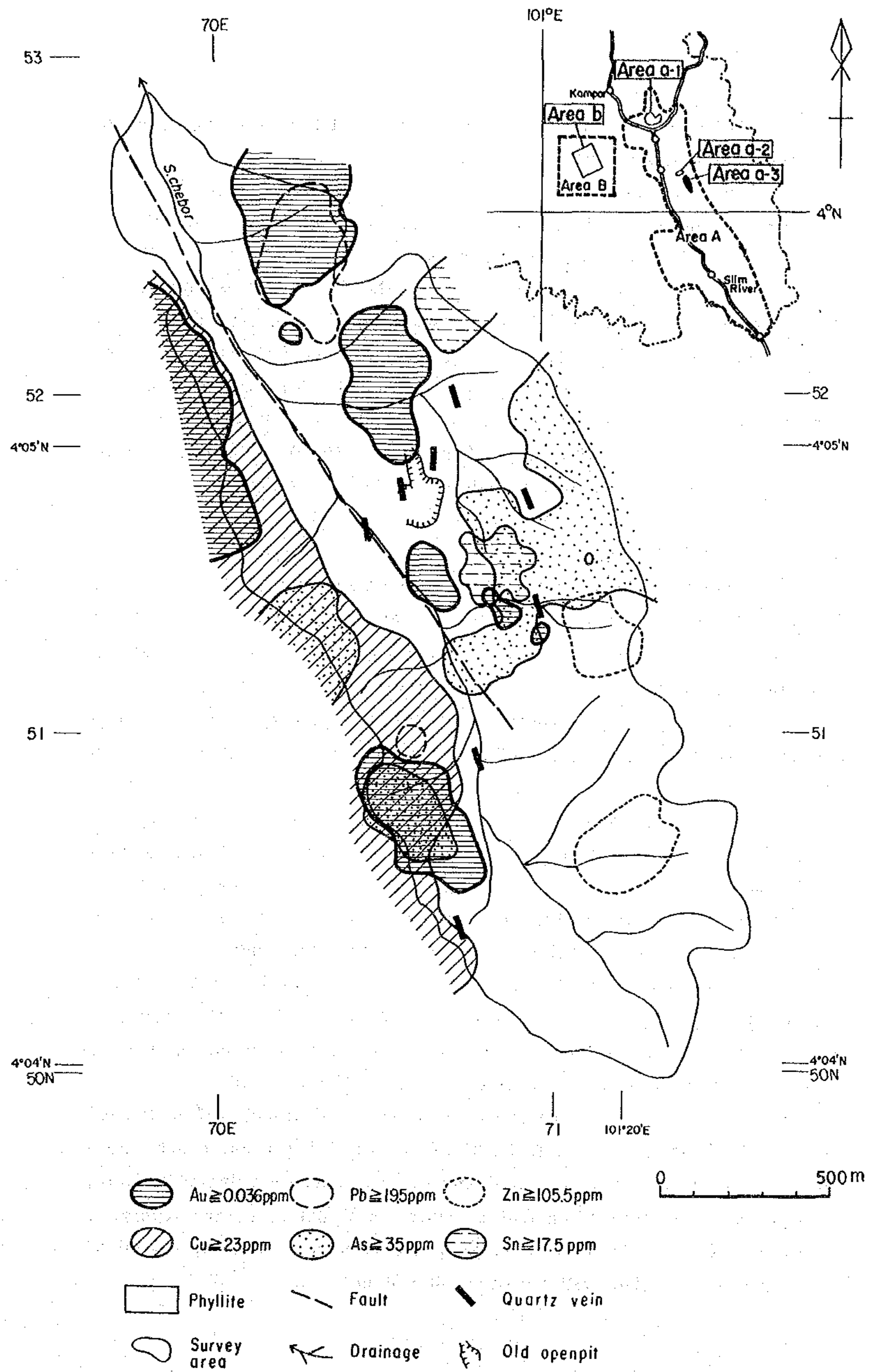


Fig. I - 3 - 3 Geochemical anomalies in the Area a-3

The geochemical anomalies of Au are distributed on both sides of S. Chebor, extending in a NNW-SSE direction.

The old mine is located at the edge of anomalies on the east side. As the dum contains 0.135 ppm Au, Au anomaly in the lower reaches of S. Chebor is probably originated from the mine.

The mean and maximum values of the Au anomalies obtained in this phase are 0.095 ppm and 0.135 ppm respectively, corresponding to 1/4 and 1/20 of those in the Area a-1. Regarding As, the figures are 1/7 and 1/15. The distribution of anomalies of Cu, Zn, Sn etc. suggests that the mineralization is controlled by the fault zone which runs along S. Chebor.

However, from the values of Au and As, the Area is considered to have lower potential for Au deposit like the Area a-2.

3-2 Area B (Area b)

The area is composed of the Simpang Formation of the Quaternary Pleistacene. Judging from the surrounding area, the bedrock is composed of the Terolak Formation and/or the Belata Formation of Paleozoic and the Main Range granite which has intruded into these formations.

The simpang Formation is made up of clay, silt, sand, gravel and peat which are alluvial fan and braided stream deposits with a thickness of 40 - 90 m.

The boreholes drilled by Geological Survey of Malaysia (GSM) in the Labu Kubung area hit deep-seated placer tin deposits with high grades (thickness = 1.5 - 6.0 m, SnO_2 content = 0.24 - 1.29 Kg/m^3). This tin bearing formation is a member of the Simpang Formation on or near the bedrock and its thickness is affected by the bedrock topography.

In this phase, a gravity survey was conducted in the most promising area (30 km^2) to clarify the bedrock relief. In parallel with this survey, 3 boreholes were drilled to check the applicability of gravimetric method by comparing differences between drilled depth and estimated depth.

Gravity survey revealed a structure line (trench) of a NW-SE system in the northeastern part. Depth of the trench is estimated to be more than 100 m. As the trough is located on a southern extension line of S. Kinta, it is probably the trail of ancient S. Kinta. A U-shaped hollow structure, open northwestwards in the central part, is also considered to be a trail of meander of ancient river with a depth of 30 - 50 m.

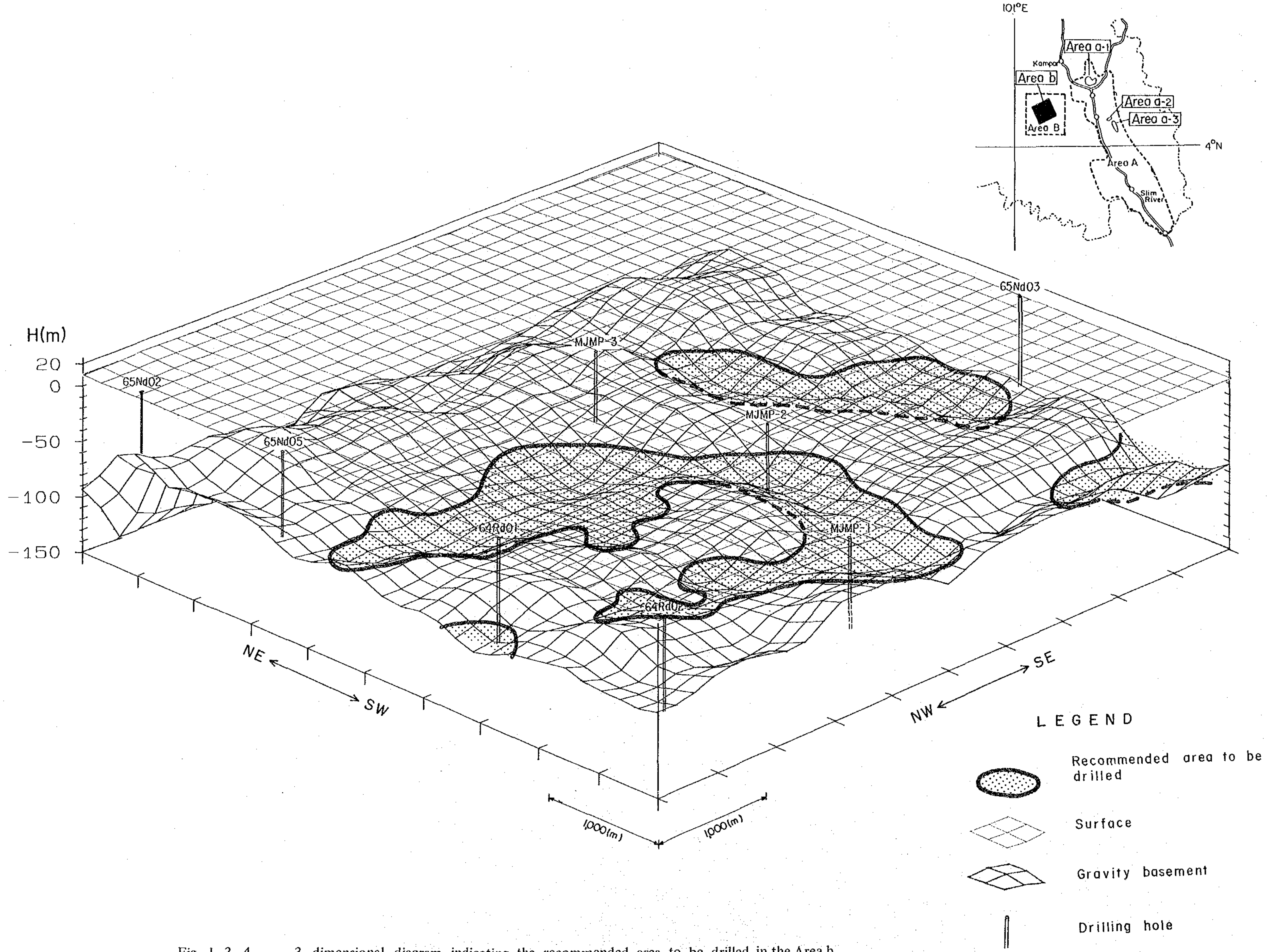


Fig. 1-3-4 3-dimensional diagram indicating the recommended area to be drilled in the Area b.

As local bedrock relief can not be well detected by gravity survey, drilled depths of the bedrock differ 12 m on average from the estimated depth.

The SnO_2 content (Kg/m^3) is generally rich in sand or gravel bed near the bedrock. The sections with more than 0.2 Kg/m^3 of SnO_2 are as follows:

	Section (m)	SnO_2 (Kg/m^3)
MJMP-1	83.8 - 88.4 m (4.6 m gravel, sand)	0.81
MJMP-2	62.5 - 65.6 m (3.1 m gravel)	0.39
	68.6 - 73.2 m (4.6 m gravel, peat)	0.41
MJMP-3	57.9 - 61.0 m (3.1 m gravel)	0.81

Synthetical study on these drilling data together with past GSM drilling data, indicates that all drillholes are located over crests of the bedrock or over transitional slopes between crest and hollow of the bedrock and no information on these hollows has been yet obtained. As the basin structure of bedrock is considered favorable for tin deposition, a follow up survey is necessary for the hollows (Fig. I-3-4).

The SnO_2 rich zone indicated by width % (thickness (m) x SnO_2 content (Kg/m^3)) trends to extend northwards. Therefore, a follow up survey is needed to clarify the bedrock relief for the surrounding area, especially for the northwesterly adjacent area.

3-3 Area C

The Area C is composed of the Main Range granite with megacrysts of K-feldspar.

Geochemical rock survey conducted in the drainage basin of Phase I anomalies of Au, Sn and REE revealed Au anomalous zones (area: 1.5 km^2, mean value = 0.006 ppm maximum value = 0.009 ppm) and Sn anomalous zones (area = 0.8 km^2, mean value = 50 ppm, maximum value = 70 ppm) in the central part of the area (Fig. I-3-5). Both anomalous zones are partly overlapped. The source of geochemical anomalies of Au and Sn was thus confirmed. The mean values of anomalies are 1 - 5 times as high as those of the Main Range granite.

It became clear that REE anomalies did not show an areal extension but sporadical distribution. This fact is probably due to point distribution of REE minerals such as monazite.

The anomalous values themselves are not so high, showing low potential for Au, Sn and REE resources.

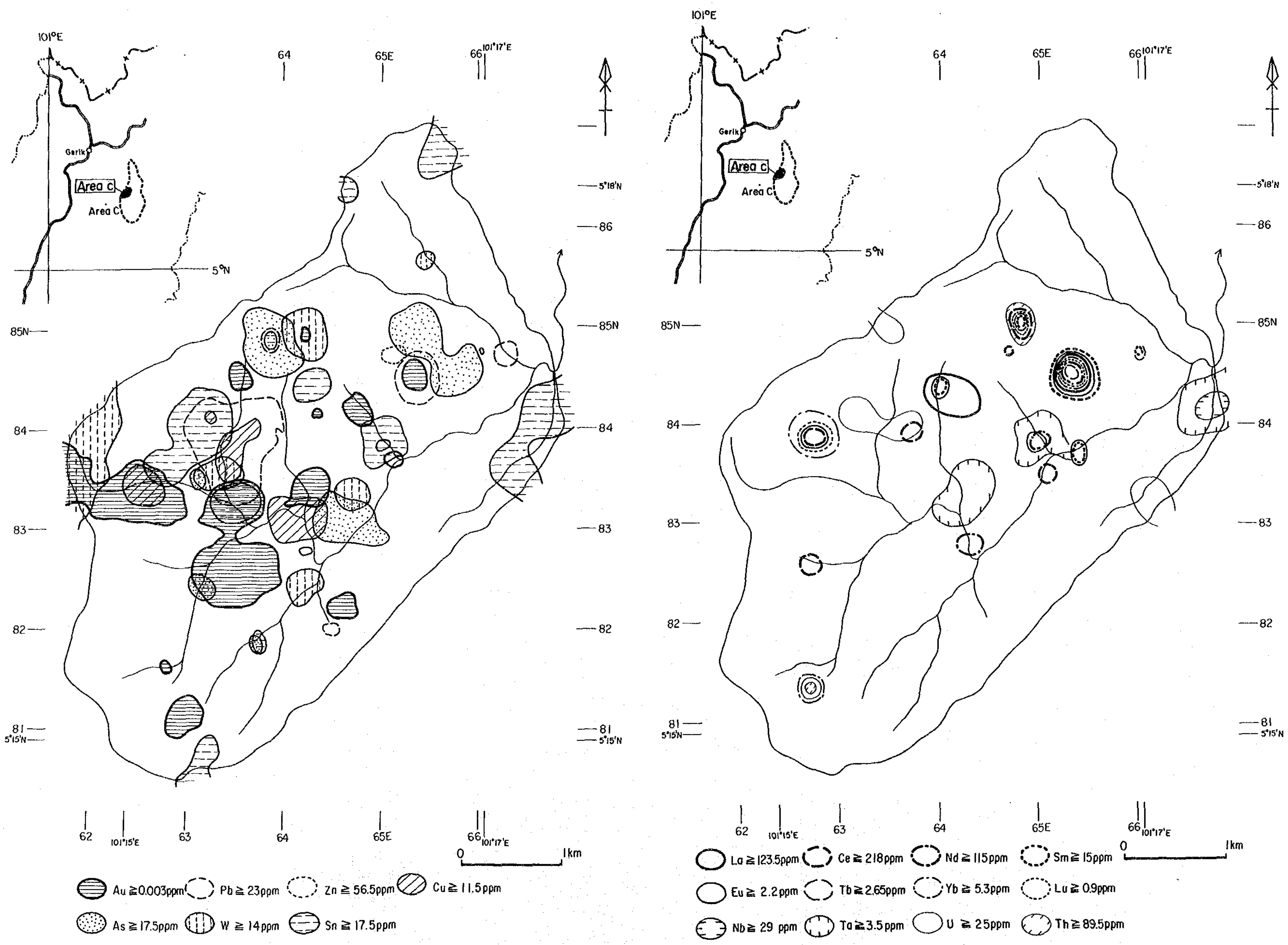


Fig. I - 3 - 5 Geochemical anomalies in the Area c

Chapter 4 Conclusions and Recommendations

4-1 Conclusions

Based on the results of geological, geochemical, geophysical (gravity method) surveys and drilling carried out in Perak in Phase II, the following conclusions were drawn:

Area a

1 The Areas a-1, a-2 and a-3, selected by the Phase I survey as having high potential for Au resources, are composed of Paleogoic phyllite and the Main Range granite which intruded into the phyllite in the Permian - Triassic age.

2 In the Area a-1, a wide Au anomalous zone (width = 0.6 km, length = 1.4 km, mean Au value = 0.410 ppm maximum Au value = 2.708 ppm) was found near the boundary between the Main Range granite and phyllite in the northeastern part. As Au contents tend to increase towards depth, Au is possibly concentrated on the bedrock. A follow up survey is needed to clarify the mineralization in the upper part of bedrock.

As other anomalies of Zn, Sn and W are also overlapped here, it is considered that this anomalous zone has high potential for Au deposits.

3 In the Areas a-2 and a-3, geochemical Au anomalies were obtained near granite stock or along a tectonic line. Their mean and maximum values are as low as 1/4 to 1/40 of those of the Area a-1, therefore, these areas have low potential for Au resources.

Area b

1 Gravity survey disclosed the bedrock relief under the Quaternary sediments. In the northeastern part bedrock is considered to sink more than 100 m (fault zone?). A U-shaped hollow structure open northwards was inferred in the central part.

2 Three (3) boreholes hit tin ore layers (width = 3.1 - 4.6 m SnO_2 = 0.39 - 0.81 Kg/m^3) near the bedrock. The whole boreholes including past GSM's holes are located over the crest of the bedrock topography estimated from gravity survey results.

3 The clays obtained by drilling are of not so high quality but can be used for bricks or tiles.

Area c

1 The whole area is composed by the Main Range granite.

2 Geochemical rock survey disclosed Au and Sn anomalous zones. Anomalies of REE are sporadically distributed and do not show any areal extension.

4-2 Recommendations for Phase III Survey

Based on the above-mentioned conclusions, the following activities are recommended.

Area a-1: To carry out drilling in order to clarify the details of mineralization in the Au-As geochemical anomalous zone which is located on the west of Main Range granite in the northeastern part.

Area b: To carry out gravity survey in order to clarify the bedrock relief, and

To carry out drilling for the hollows estimated by gravity survey.

PART II AREA A

Chapter 1 Outline of the Area A Survey

1-1 Outline of the Survey

The Area A surveyed in Phase I is a slender area covering 80 km from south to north and 10 to 20 km from east to west between the Main Range granite and the National Highway No. 1 connecting Tapah and Tanjong Malim. Last year, for the purpose of clarifying occurrence of ore deposits, geological and geochemical stream sediment surveys were carried out over the whole area. As a result, it was found that a large-scale gold geochemical anomalous zone of 2 to 4 km in width and 22 km in length is located on the east of the National Highway No. 1 from Tapah to Bidor.

The anomalous zone can be divided into three areas of Bukit Mas gold mine area said to be mined 100 years ago, the northern and southern areas on both sides of Bukit Mas area. The gold contents of the respective areas are listed in Table II-1-1.

Table II-1-1 Gold Anomalous Zones (Heavy Mineral Concentrate)

	Northern Area	Bukit Mas Area	Southern Area
Anomalous Area	2 km x 8 km	3 km x 4 km	3 km x 10 km
Average Content	0.192 g/m^3	0.026 g/m^3	0.046 g/m^3
Maximum Value	1.833 g/m^3	0.099 g/m^3	4.001 g/m^3

Based on the survey results of the Phase I program, the drainage basin of S. Joing in the northern area (Area a-1), the area around Kg. K. Gepat in the southern area (Area a-2) and the drainage basin of S. Chebor (Area a-3) were selected as the areas of highly potential for gold deposit. The detailed geochemical soil survey (grid sampling) and detailed geological survey including trenching were carried out in the Phase II program of the project.

1-2 Objectives and Methods of the Survey

For the three gold anomalous zones (Areas a-1, a-2 and a-3) selected by the Phase I survey, a detailed geological (including trenching) and geochemical soil survey were carried out in order to clarify the details of mineralization to delineate the most promising area.

In each area, a base line survey was carried out along a road using pocket compass and a tape. Traverse lines were set at an equal intervals from the base line. Thus, a 1/5,000 topographic map was prepared.

Since gold-bearing quartz veins with a NNW-SSE direction were expected in all the three areas from the results of the Phase I survey, traverse lines were set at 200 m intervals in a N60E direction, and soil samples were taken at 100 m intervals along each traverse line. At the same time, the geology at and around each point was surveyed.

Soil samples were taken as much as possible, to avoid the nugget effect (uneven distribution) of gold. In general, three holes were drilled at each sampling point by an auger to a depth of 1.0 from humic soil. Two dulangs (about 10 liters) of soil obtained from two holes were panned at site, to check gold flakes, and were analyzed for gold. When gold flakes were confirmed in the panning, additional samples were taken in a 50 to 100 m grid, to confirm their extention.

Since fine gold grains might flow out during panning, the soil obtained from the remaining one hole was dried and prepared with a 80-mesh sieve, being analyzed for 8 elements of Au, Ag, Pb, Zn, Cu, As, W and Sn.

Based on the results of the geological and geochemical surveys, trenching was carried out at 13 sites, to confirm geology and mineralization. Two (2) dulangs of samples were taken at 2 m intervals from one side of wall, and panned and analyzed for gold. One dulang of soil sample was also collected from another side of wall at 2 m intervals, and analyzed for 8 elements; Au, Ag, Pb, Zn, Cu, As, W and Sn.

1-3 Contents of the Survey

The contents of the survey carried out in the second year are as listed in Table II-1-2.

Table II-1-2 Amount of Surveys in the Areas a-1, a-2 and a-3

Area	Quantity	
Geological & Geochemical Surveys		
(1) Area a-1	Survey Area	6 km^2
	Survey Route Length	62 km
	Trenching Length	113 m
	Number of Collected Samples	
	Soil	556 pcs
	Rock	10 pcs
(2) Area a-2	Survey Area	0.5 m^2
	Survey Route Length	3 km
	Number of Collected Samples	
	Soil	34 pcs
(3) Area a-3	Survey Area	2.5 km^2
	Survey Route Length	15 km
	Number of Collected Samples	
	Soil	132 pcs
Total	Survey Area	9 km^2
	Survey Route Length	80 km
	Trenching Length	113 m
	Number of Collected Samples	
	Soil	722 pcs
	Rock	10 pcs

1-4 Method of Data Analysis

This year, 722 soil samples were taken from three areas of a-1, a-2 and a-3, and analyzed for Au, Ag, Cu, Pb, Zn, W, Sn and As, and also Au in the heavy mineral concentrate, totaling 9 elements. These analytical data were statistically processed for each area using a computer. The values below the detection limit were taken as 1/2 of the detection limit for the conventional sake.

Since some samples were collected from Quaternary alluvium. These samples were divided into 2 groups, whole samples and alluvium-excluded samples for single component analysis and multivariate analysis.

(1) Single component analysis

Geochemical data has been conventionally processed based on the classical statistical methods and hypothesis testing, assuming normal distributions. However, geochemical data often include data inconsistencies, polymodal behaviour and upper and lower outliers and often show different distributions far from ideal models. The classical statistics are clearly not designed such situations, leading to doubtful interpretations.

The analysis of this year adopted the Exploration Data Analysis method (EDA method) which was applied by Kurzl H. (1988) for data processing of geochemical survey and is very useful for describing and analyzing single component data.

According to Kurzl H., the EDA method is composed of the following:

(a) 5 number summary
(b) box plot
(c) density traces
(d) one-dimensional scatter plots
(e) quantile plot

Among these, 5-number summary and the boxplot, a graphical display, are briefly described below.

(a) 5-number summary

The five numbers show the most important character of a data set, and can be arranged as follows in the descending order of value

maximum
upper hinge
median
lower hinge
minimum

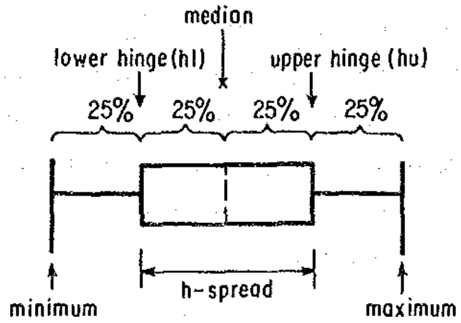


Fig. II - 1 - 1 Definition of the boxplot as a graphical display of the 5 number summary

The spread between the upper hinge and the lower hinge is called h-spread.

(b) Boxplot

A box is drawn between the upper hinge and the lower hinge. The peripheral data behaviour is symbolized by whiskers, step and fences. The whiskers represent 25% of data between hinges and extremes. The step and fences are calculated from the following equations.

step = 1.5 h-spread
lower fence = lower hinge - step
upper fence = upper hinge + step

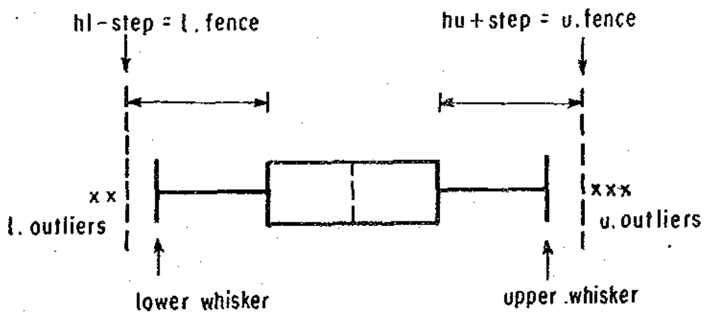


Fig. II - 1 - 2 Introduction of the outlier cutoffs by fences and their graphical presentation in the boxplot

This time, the 5-number summary was obtained from a frequency distribution histogram, and the values of lower hinge, upper hinge, upper whisker and upper fence were read.

The values above the upper fence were regarded as anomalous values. When the upper fence exceeded the maximum, the values above the upper whisker were regarded as anomalous values. In this way, the geochemical anomalies map for each element was prepared.

Statistical values obtained were the classic statistics, correlation coefficient, etc.

(2) Multivariate analysis

In order to establishing a small number of provisional variables called factors from a large number of variables, a varimax method was applied. In this method, each sample is given by factor which represents the degree of association. Relationship between mineralization and lithology was studied.

Chapter 2 Area a-1

2-1 Geological Survey

2-1-1 Geology

This area is composed of Palaezoic Terolak Formation, the Main Range granite and Changkat Rembian granite (which have intruded into the Terolak Formation) and Quaternary formation.

The Terolak formation is widely distributed in the area except for parts of eastern, northern and western edges of the surveyed area. It is mainly composed of phyllite and intercalated with thin layers of metasandstone. Iron layers are locally observed.

The phyllite is black to dark gray in colour and is well schistose. The schistosity strikes NNW-SSE and dips 50 to 70°W. In the center of the surveyed area, 50 m of thick graphitic phyllite is distributed. The phyllite around the stocks which seem to be a part of the Main Range granite is altered into hornfels.

The Quaternary formation composed of alluvium, is widely distributed in the northwest of the surveyed area. It is also distributed locally in the drainage areas of respective streams. The formation is composed of sand and gravel, and basal conglomerate at the bottom. A thickness is several meters at maximum.

The Main Range granite is distributed from the eastern edge to the northern edge with its some stocks. The granite is mostly distributed on steep slopes, in contrast to the gentle topography where the Terolak formation is distributed.

The granite is prophyrytic and contains 2 to 5 cm long K-feldspar crystals. Main component minerals are quartz > feldspar > plagioclase > biotite > muscovite with small amounts of apatite, tourmaline, sphene and opaque minerals.

The Changkat Rembian granite is distributed in the west edge of the surveyed area and has some stocks. The granite is generally heavily weathered and an original texture becomes unclear. In general, it is fine to medium grained and equigranular.

Contact metamorphism is very weak and only a small area of hornfels is observed around the stocks close to the Main Range granite on the east side.

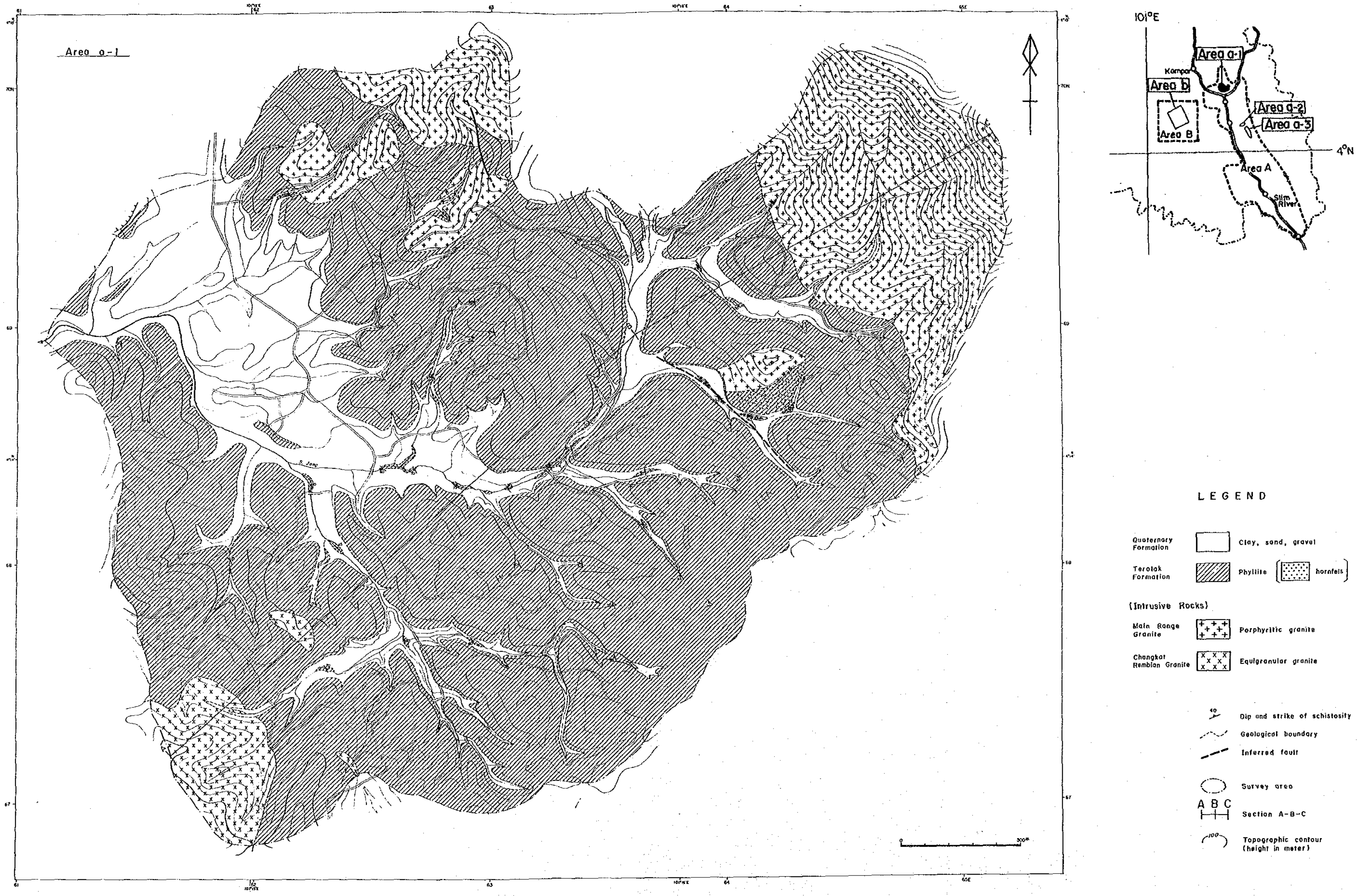


Fig. II - 2 - 1 Geological map of the Area a-1

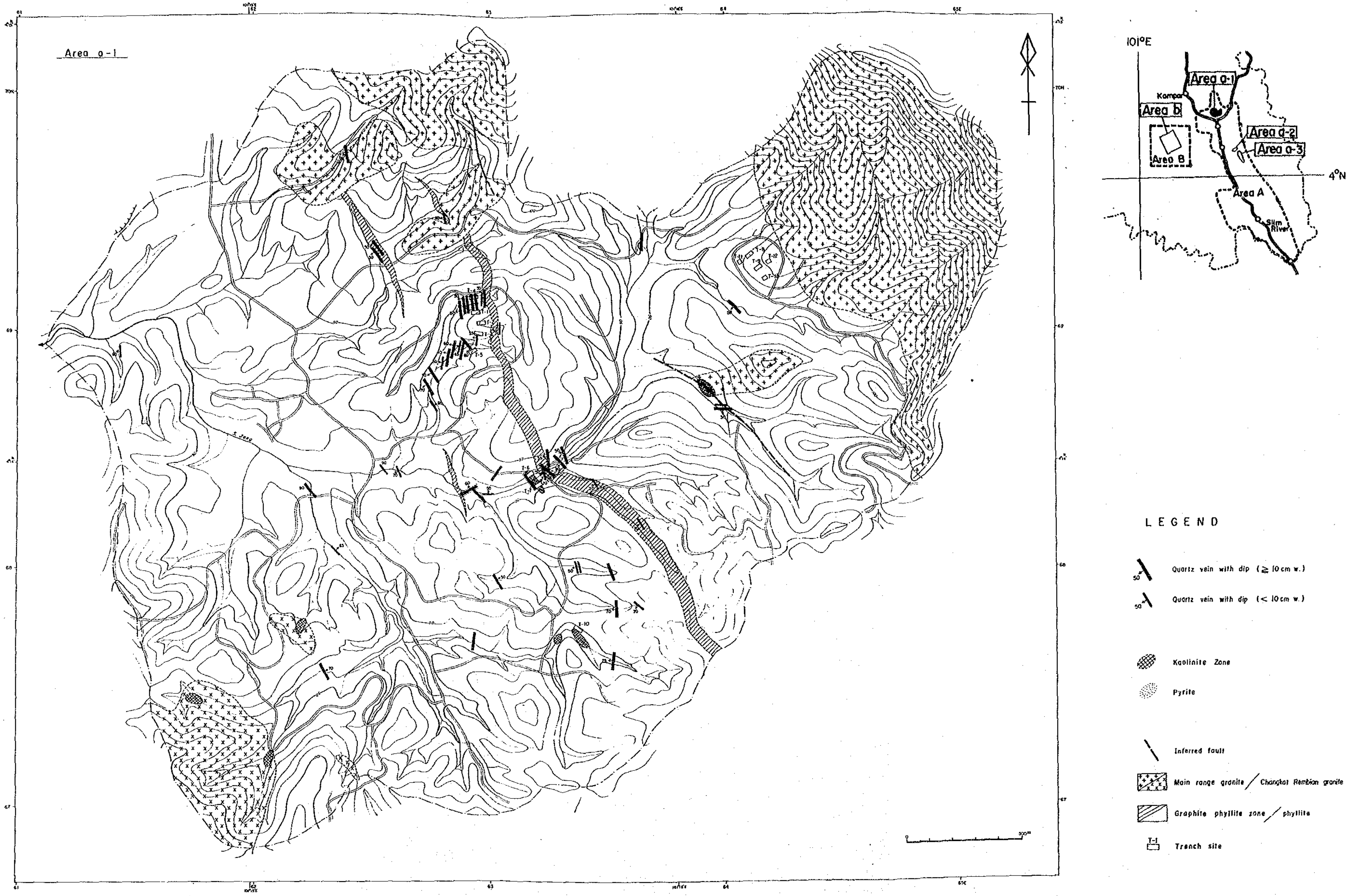


Fig. II - 2 - 2 Distribution map of the quartz veins and alteration zones in the Area a-1

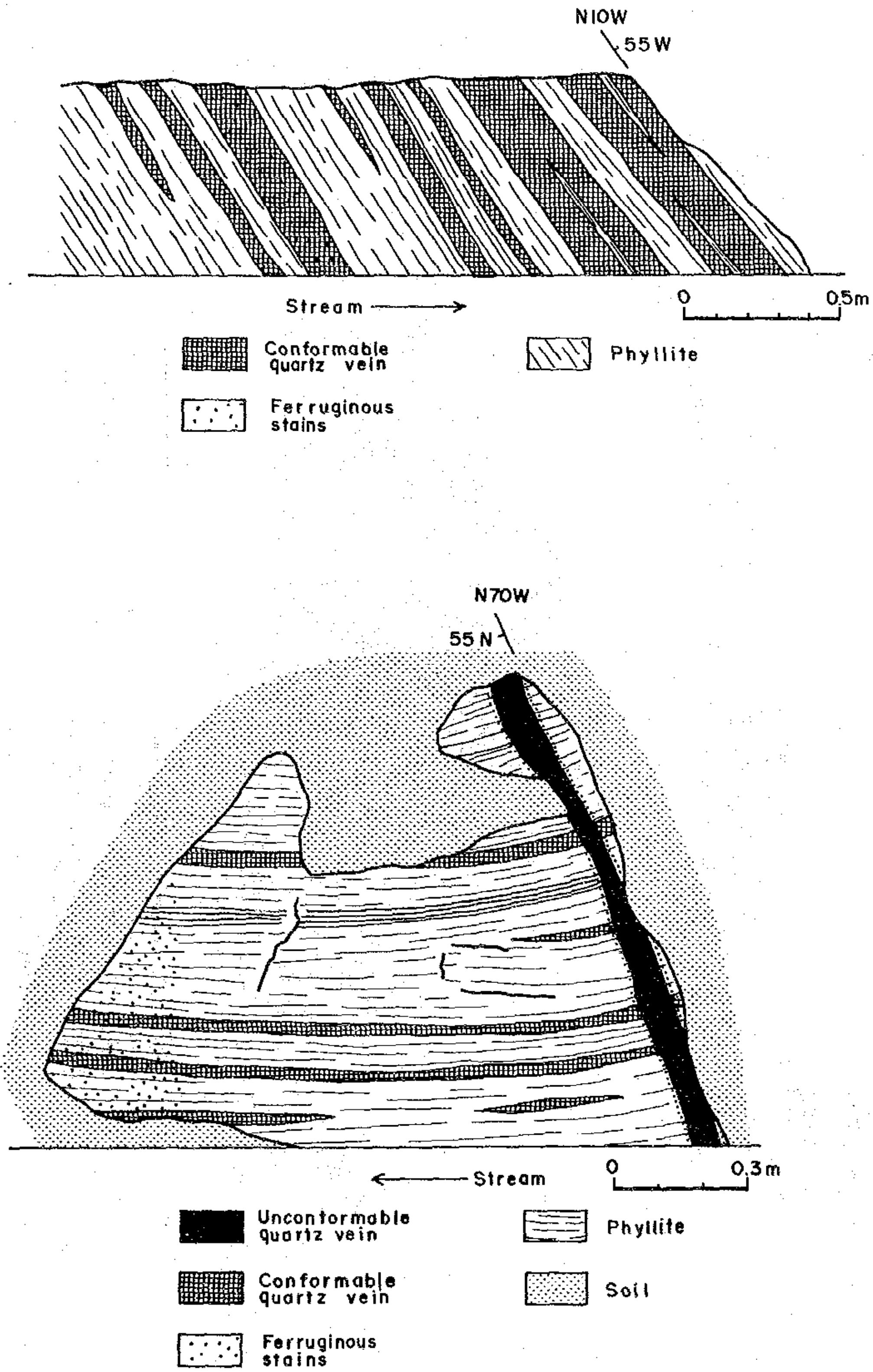


Fig. II - 2 - 3 Sketch map of quartz vein

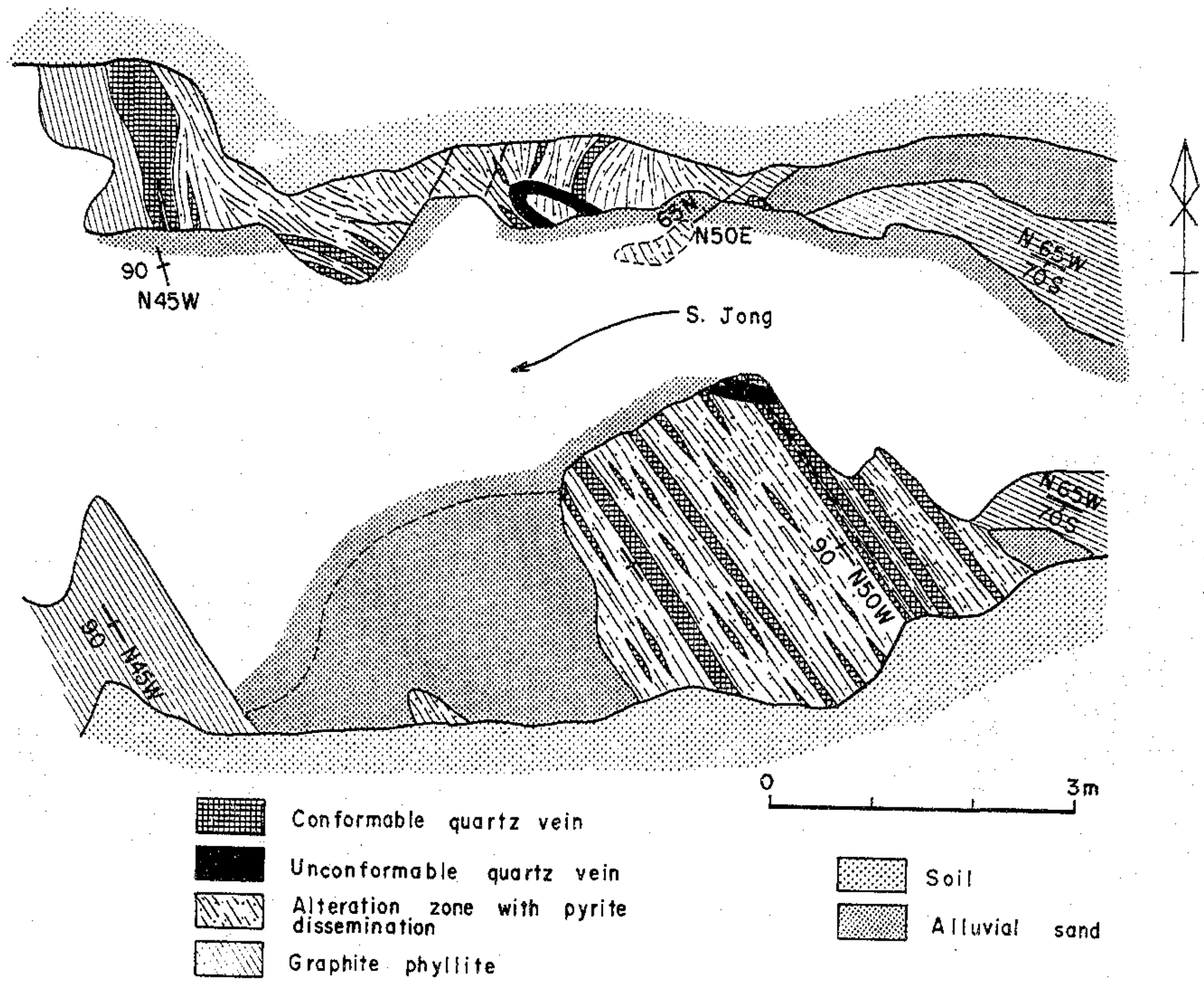


Fig. II - 2 - 4 Sketch map of alteration zone

2-1-2 Mineralization and Alteration

In this area, many quartz veins are distributed (Fig. II-2-2). Most of them are narrow veins (5 to 10 cm in thickness) along the schistosity of phyllite. They are milky white, and contain few sulfide minerals. The another type of quartz vein cuts the phyllite (NNW-SSE, 50-60E or NNE-SSW, 60N) and is transparent or crystalline. This type contains few gold.

A sketch of quartz veins in the middle reaches of S. Jong is shown in Fig. II-2-3.

The alternation such as kaolinization and pyritization are observed. The former occurs mainly in granite and also includes some kaolinization of phyllite. The latter was observed at 2 places in S. Jong where both kaolinization and pyritization occur. Kaolinized outcrop samples show gold grains by planning. This suggests that the kaolinization and pyritization are related to the Au mineralization.

2-2 Geochemical Survey

2-2-1 Results of Interpretation

The classical statistical values of each element and the correlation coefficients between respective elements and the values obtained by EDA method are shown in Table II-2-1.

(2) Classical statistical values and correlation coefficients

Whole sample is little different from alluvium-excluded samples in content of 8 elements of Au, Ag, Pb, Zn, Cu, As, W and Sn and the gold content in heavy mineral concentrate, judging from the classical statistical values.

As for the correlation coefficients between the whole sample and the alluvium-excluded samples showed somewhat high from 0.363 to 0.399 for Au-As, 0.336 to 0.392 for Sn-Pb and 0.340 to 0.389 for W-As. The high correlativity between Au and As was estimated from the behavior of elements as in general gold deposits. The correlation coefficient between the gold content in soil and the gold content in heavy mineral concentrate showed very lower values of 0.393 and 0.403 than expected. This is attributable to the nugget effect of gold. There may be a problem in the sampling method.

Table II-2-1 Statistical values of each element in the Area a-1 (2)

(5) Granite area

	Pgt, Egt			
element	Maximum	Minimum	Mean	S.D.(LOG)
Au	2.628	.001	.002	.696
Ag	.300	.050	.067	.227
Pb	470.000	5.000	29.734	.258
Zn	189.000	10.000	37.319	.307
Cu	32.000	2.000	6.696	.330
As	1400.001	5.000	32.720	.454
W	180.000	2.000	9.375	.224
Sn	70.000	5.000	15.148	.312

Pgt; Porphyritic granite
Egt; Equigranular granite

	Correlation matrix							
	Au	Ag	Pb	Zn	Cu	As	W	Sn
Au	1.000							
Ag	-.065	1.000						
Pb	.083	.061	1.000					
Zn	.357	.220	.283	1.000				
Cu	.344	-.061	-.259	-.013	1.000			
As	.519	.036	-.069	-.116	.329	1.000		
W	.524	-.069	.209	-.083	.287	.520	1.000	
Sn	-.109	-.010	.327	-.211	-.387	.095	.097	1.000

(6) Phyllite area

	Phy, Hor			
element	Maximum	Minimum	Mean	S.D.(LOG)
Au	2.708	.001	.005	.789
Ag	2.100	.050	.060	.199
Pb	192.000	3.000	18.990	.239
Zn	175.000	10.000	29.562	.248
Cu	43.000	2.000	9.406	.282
As	2529.000	5.000	36.106	.447
W	160.000	2.000	9.343	.193
Sn	80.000	5.000	8.337	.311

Phy; Phyllite
Hor; Hornfels

	Correlation matrix							
	Au	Ag	Pb	Zn	Cu	As	W	Sn
Au	1.000							
Ag	.010	1.000						
Pb	.159	.056	1.000					
Zn	.179	.008	.080	1.000				
Cu	.179	-.059	.064	.276	1.000			
As	.371	-.068	.142	.116	.279	1.000		
W	.220	-.006	.230	.116	.019	.350	1.000	
Sn	.154	.090	.324	-.040	-.208	.322	.319	1.000

(7) Alluvium

	All samples (556)			
element	Maximum	Minimum	Mean	S.D.(LOG)
Au	.902	.001	.005	.735
Ag	.400	.050	.064	.232
Pb	92.000	6.000	21.583	.206
Zn	183.000	12.000	36.299	.242
Cu	32.000	1.000	6.368	.280
As	1200.001	5.000	25.370	.371
W	36.000	2.000	9.395	.183
Sn	90.000	5.000	10.041	.333

	Correlation matrix							
	Au	Ag	Pb	Zn	Cu	As	W	Sn
Au	1.000							
Ag	-.088	1.000						
Pb	.173	.237	1.000					
Zn	.291	.070	.171	1.000				
Cu	.356	.023	.169	.002	1.000			
As	.202	.045	.076	.137	.342	1.000		
W	.035	-.041	.161	-.052	.013	.068	1.000	
Sn	.034	.088	.029	.187	-.180	.242	.281	1.000

(1) Maximum, minimum and mean values (ppm)

element	All samples (556)				Phy, Hor, Pgt, Egt (456)			
	Maximum	Minimum	Mean	S.D.	Maximum	Minimum	Mean	S.D.
Au	2.708	<0.003	0.004	0.771	2.708	<0.003	0.004	0.779
Ag	2.10	0.05	0.062	0.211	2.10	0.05	0.061	0.206
Pb	470	3	21.0	0.247	470	3	20.8	0.256
Zn	189	10	31.9	0.262	189	10	31.0	0.265
Cu	43	1	8.3	0.300	43	2	8.8	0.298
As	2529	5	33.3	0.439	2529	5	35.4	0.448
W	180	2	9.4	0.197	180	2	9.4	0.200
Sn	90	5	9.5	0.329	80	5	9.4	0.328
conc-Au	39.344	<0.003	0.012	1.272	39.344	<0.003	0.011	1.232

Phy; Phyllite Hor; Hornfels Pgt; Porphyritic granite Egt; Equigranular granite

(2) Correlation matrix

Soil samples except for alluvium samples

	Au	Ag	Pb	Zn	Cu	As	W	Sn	conc-Au
Au	1.000								
Ag	-.031	1.000							
Pb	.100	.108	1.000						
Zn	.206	.079	.173	1.000					
Cu	.246	-.062	-.046	.114	1.000				
As	.363	-.034	.074	.051	.314	1.000			
W	.240	-.025	.207	.044	.073	.340	1.000		
Sn	.036	-.093	.336	.012	-.277	.240	.258	1.000	
conc-Au	.393	-.077	.053	.056	.040	.201	.225	.125	1.000

All soil samples

	Au	Ag	Pb	Zn	Cu	As	W	Sn	conc-Au
Au	1.000								
Ag	-.019	1.000							
Pb	.087	.083	1.000						
Zn	.187	.078	.172	1.000					
Cu	.236	-.077	-.077	.159	1.000				
As	.399	-.047	.078	.052	.292	1.000			
W	.279	-.022	.215	.061	.087	.389	1.000		
Sn	.049	.094	.392	-.026	-.296	.247	.254	1.000	
conc-Au	.403	-.067	.076	.053	.059	.244	.229	.115	1.000

(3) Result of EDA

Soil samples except for alluvium samples (ppm)

	Au	Ag	Pb	Zn	Cu	As	W	Sn	conc-Au
MAXIMUM	2.708	2.10	470	189	43	2529	180	80	39.344
U.FENCE	0.026	0.05	54	85	32.5	170	18	42.5	0.294
U.WHISKER	0.020	0.10	34	58	17	100	12	20	0.256
U.HINGE	0.011	0.05	30	46	16	80	12	20	0.118
MEDIAN	0.003	0.05	20	27	8.5	25	8	10	0.004
L.HINGE	0.001	0.05	14	20	5	20	8	5	0.001
L.WHISKER	0.001	0.05	13	18	4	15	8	5	0.001
L.FENCE	-0.014	0.05	-10	-19	-11.5	-70	2	-17.5	-0.175
MINIMUM	<0.003	0.05	3	10	2	5	2	5	<0.003

All soil samples (ppm)

	Au	As	conc-Au
MAXIMUM	2.708	2529	39.344
U.FENCE	0.0238	120	0.343
U.WHISKER	0.017	100	0.282
U.HINGE	0.01	60	0.138
MEDIAN	0.003	25	0.004
L.HINGE	0.001	20	0.001
L.WHISKER	0.001	15	0.001
L.FENCE	-0.012	-40	-0.204
MINIMUM	<0.003	5	<0.003

(4) Result of factor analysis

Factor loading and communality

	Factor 1	Factor 2	Factor 3	Communality
Au	0.565	0.080	0.226	0.3760
Ag	-0.089	-0.159	0.156	0.0573
Pb	0.137	-0.531	0.320	0.4032
Zn	0.111	0.016	0.460	0.2241
Cu	0.343	0.433	0.214	0.3517
As	0.682	-0.135	-0.013	0.4671
W	0.558	-0.237	0.002	0.3673
Sn	0.214	-0.651	-0.068	0.4746

Factor contribution (%)

Factor 1	Factor 2	Factor 3
56.086	36.319	14.399

Tabel II - 2 - 1 Statistical values of each element in the Area a-1 (1)

Table II-2-1 shows the correlation coefficients between respective elements for each rock type. In granite area, relatively high correlation coefficients such as 0.519 for Au-As, 0.524 for Au-W and 0.520 for As-W are obtained.

(2) Results of analysis by EDA method

For Au, As and Au in heavy mineral concentrate, the whole samples and the alluvium-excluded samples were respectively processed, and for the other elements, only the alluvium-excluded samples were processed.

Au

1-1 Whole soil samples

The minimum content is less than 0.003 ppm and the maximum content is 2.708 ppm. More than 90% of the contents are 0.181 ppm or less. Therefore, the boxplot is truncated toward the lower content side. A geochemical anomalies map is illustrated by the three divisions of upper fence (0.023 ppm), upper whisker (0.071 ppm) and upper hinge (0.01 ppm).

When the values above the upper fence (0.023 ppm) are considered to be anomalous, the anomalous values are distributed in the east, central south and west of the area and tends to extend in a NNW-SSE direction.

1-2 Alluvium-excluded soil samples

The minimum and maximum values are the same as those of the whole sample. The boxplot is also truncated toward the lower content side. A geochemical anomalies map is illustrated by three divisions of upper fence (0.026 ppm), upper whisker (0.02 ppm) and upper hinge (0.011 ppm).

The zone where anomalous values above the upper fence are distributed is found in the east, central south and west of the area and tends to extent in a NNW-SSE direction as in the case of the whole samples.

2-1 Whole heavy mineral concentrate sample

The minimum content is less than 0.003 ppm and the maximum content, 39.344 ppm. A geochemical anomalies map is showed by 3 ranks of upper fence (0.343 ppm), upper whisker (0.282 ppm) and upper hinge (0.138 ppm).

The zone where anomalous values above the upper fence are distributed tends to extend in a NNW-SSE direction as in the case of soil samples. However, it is also found to extend in a NE-SW direction.

2-2 Alluvium-excluded heavy mineral concentrate samples

The minimum content is 0.003 ppm, the maximum content is 39.344 ppm and 94% of the contents were 2 ppm or less. The boxplot is truncated toward the lower content side.

Upper fence (0.294 ppm), upper whisker (0.256 ppm), upper hinge (0.118 ppm) are taken.

The distribution of anomalous values above the upper fence is observed to tend to be in a NE-SW direction as in the case of whole heavy mineral concentrate samples of 2-1.

Ag

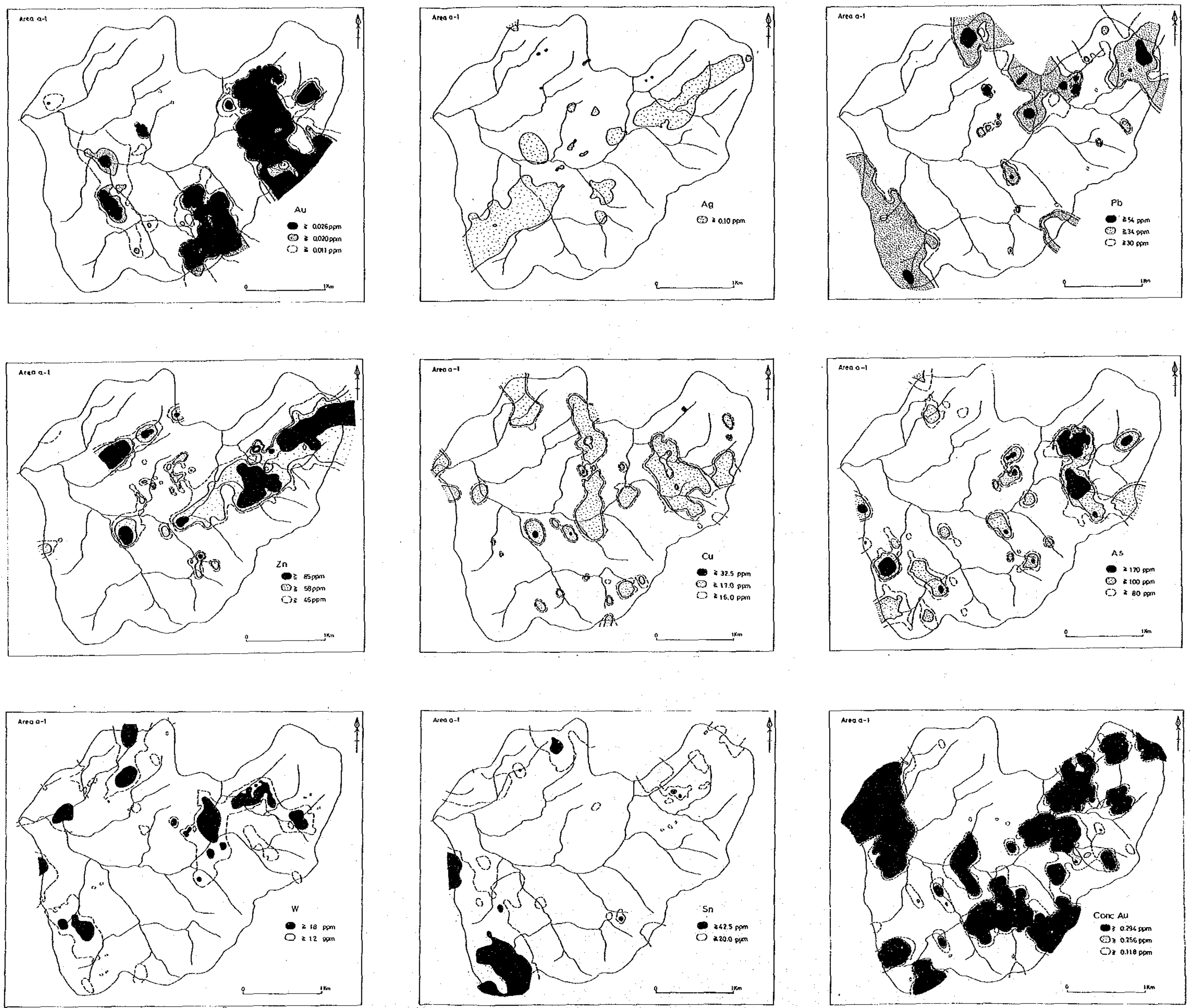
Ag values vary from a minimum content of 0.05 pm to a maximum content of 2.1 ppm, and more than 90% of the contents are 0.187 ppm or less. Therefore, the boxplot is truncated toward the lower content side. Since the upper whisker (0.1 ppm) is higher than the upper fence (0.05 ppm), a geochemical anomalies map is expressed by two divisions in reference to the upper whisker.

The high content zone above the upper whisker is observed to tend to extend from the northeast to southwest of the area.

Pb

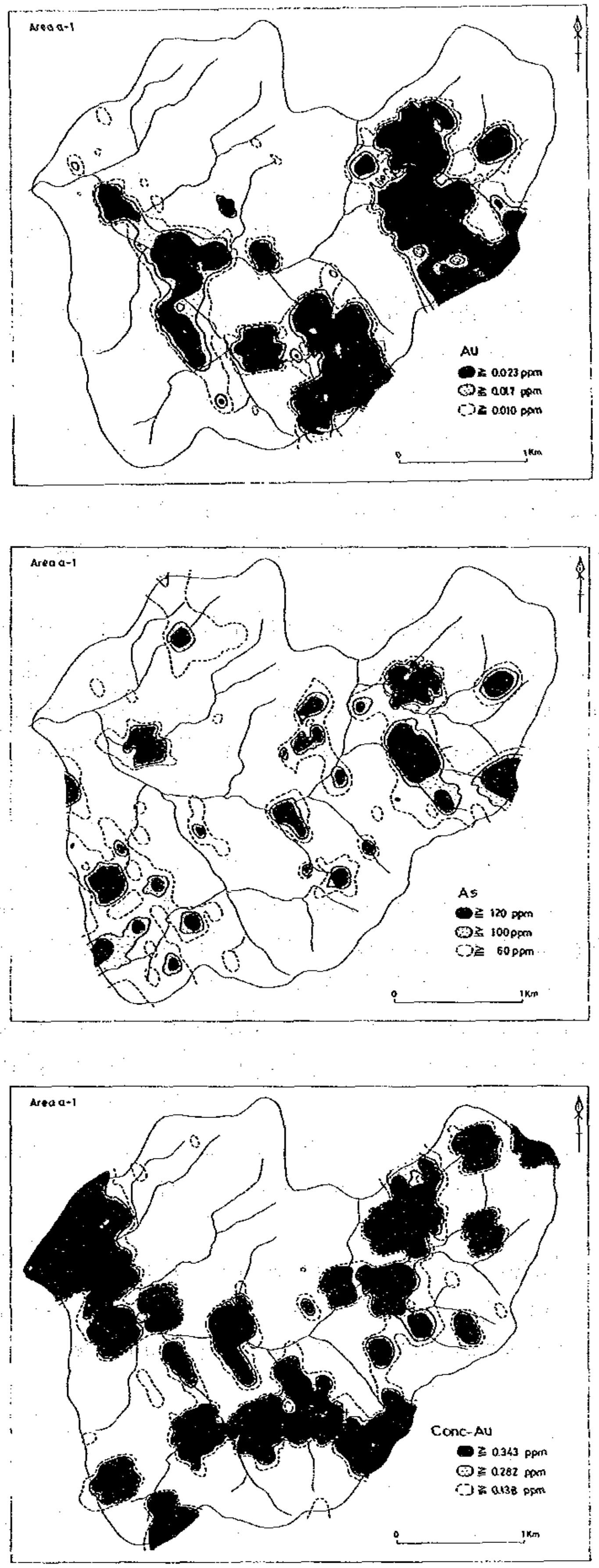
Pb values vary from a minimum content of 3 ppm to a maximum content of 470 ppm, and more than 80% of the contents are 34 ppm or less. Thus, the boxplot is located toward the lower content side. A geochemical anomalies map is illustrated by the divisions of upper fence (54 ppm), upper whisker (34 ppm), upper hinge (30 ppm) and lower hinge (14 ppm).

The anomalous values above the upper fence are scattered in the area and show no clear trend. The values above the upper whisker are mostly observed in the northeast, central north and south, and southwest, and extend in NNW-SSE direction as a general trend.



(Soil samples except for alluvium samples)

Fig. II - 2 - 5 Distribution map of elements in soil samples (Area a-1) (1)



(All samples)

Fig. II–2–5 Distribution map of elements in soil samples (Area a-1) (2)

Zn

Zn values range from a minimum content of 10 ppm to a maximum content of 189 ppm. The boxplot is located widely on the relatively higher content side compared with other elements.

Upper fence (85 ppm), upper whisker (58 ppm), upper hinge (46 ppm) and lower hinge (20 pm) are decided. The anomalous values above the upper fence are distributed from the center to the northeast. A geochemical anomalies map shows a NE-SW direction as general trend, and partial overlap of the Ag anomalous zone.

Cu

Cu values range from a minimum content of 2 ppm to a maximum content of 43 ppm. The boxplot is located widely on the relatively high content side, as in the case of Zn.

Upper fence (32.5 ppm), upper whisker (17 ppm), upper hinge (16 ppm) and lower hinge (5 ppm) are taken. The anomalous values above the upper fence are scattered near the center. If the values above the upper whisker are anomalous, they are uniformly distributed in the area and tend to extend rather in NW-SE direction.

As

1 Whole soil sample

As values range from a minimum content of 5 ppm to a maximum content of 2,549 ppm. More than 90% of the contents are 173 ppm or less, and the boxplot is truncated toward the lower content side.

The geochemical anomalies map is illustrated by divisions of upper fence (120 ppm), upper whisker (100 ppm), upper hinge (60 ppm) and lower hinge (20 ppm).

The anomalous values above the upper fence are scattered like small islands, and the trend of distribution is not clear.

2 Alluvium-excluded samples

As values range from a minimum content of 5 ppm to a maximum content of 2,529 ppm. More than 90% of the contents are 173 ppm or less. The boxplot is compressed toward the lower content side.

Upper fence (170 ppm), upper whisker (100 ppm), upper hinge (80 ppm) and lower hinge (20 ppm) are taken.

The anomalous values above the upper fence are scattered from the northeast to southwest of the area. The anomalous zone in the northeast coincides with the anomalous zone of Au.

The trend of the content distribution is not clear since even the values above the upper whisker are fairly scattered. Individual anomalous zones extend in a NW-SE or a NE-SW direction.

W

W ranges from a minimum content of 2 ppm to a maximum content of 180 ppm, and 86% of the contents show 13 ppm or less. The boxplot is truncated on the lower content side.

The anomalous values above the upper fence are scattered in the northeast, north and west, showing no clear trend.

Sn

Sn ranges from a minimum content of 5 ppm to a maximum content of 80 ppm. The boxplot is located widely on the lower content side.

The geochemical anomalies map is illustrated by the divisions of upper (42.5 ppm) and upper whisker (20 ppm).

The anomalous values above the upper fence are distributed in the southwest and also scattered in the north or northeast. A general distribution trend is not clear, but the anomalous zones are located close to granite.

(3) Results of multivariate analysis

For 456 alluvium-excluded samples, factor analysis was carried out. As a result, three factors as shown in Table II-2-1 were selected.

The contribution rates of factors 1 and 2 are respectively 56.1% and 36.3%, and the cumulative contribution rate of these two factors accounts for 92%. This means that most of potential factors behind variates can be explained by these two factors. Therefore, only factors 1 and 2 are discussed here.

Factor 1 (Au-As-W)

Factor 1 is mainly composed of Au, As and W, and is considered to be a factor reflecting the mineralization of Au or W.

The distribution of factor scores of respective samples are shown in 2 ranks of 1,000 and 0.500 in Fig. II-2-6. Main high-score zones are located near the boundary of Main Range granite in the northeast and tend to extend in a NNW-SSE direction.

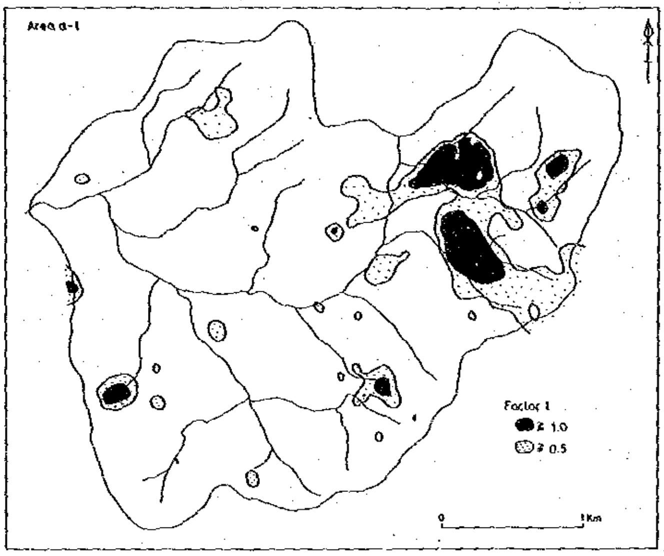
Factor 2 (Pb-Sn)

Factor 2 is considered to reflect the mineralization of Pb and Sn. The factor score distribution map is illustrated in two ranks of -1,000 and -0.500. Main high factor score zones are located in the northeast, north and southwest, and seem to have relation with the distribution of granite.

2-2-2 Discussion

From the results of single component analysis and factor analysis, the high score zones of factor 1 selected as a result of the factor analysis seem to be anomalous zones reflecting the mineralization of Au. The high score zones of factor 1 are widely distributed near the boundary between the Main Range granite and phyllite in the northeast. In these zones, high anomalous values of W, Zn, Pb and As elements are also obtained as described in the paragraph of single component analysis. They extend generally in a NW-SE direction. Because of poor exposure, it is difficult to estimate underground geology. However, it is likely that there exists a tectonic line parallel to the boundary of the Main Range granite, and that the mineralization of mainly Au has occurred along the line.

The high score zones of factor 1 are distributed also in the central south, though they are small in scale. With this point as the center, the high anomalous values of Au spread in a NNW-SSE direction. In this area, since factor 1 tends to be distributed around the granite, the high scores in the central south suggest the existence of granite at deep underground.



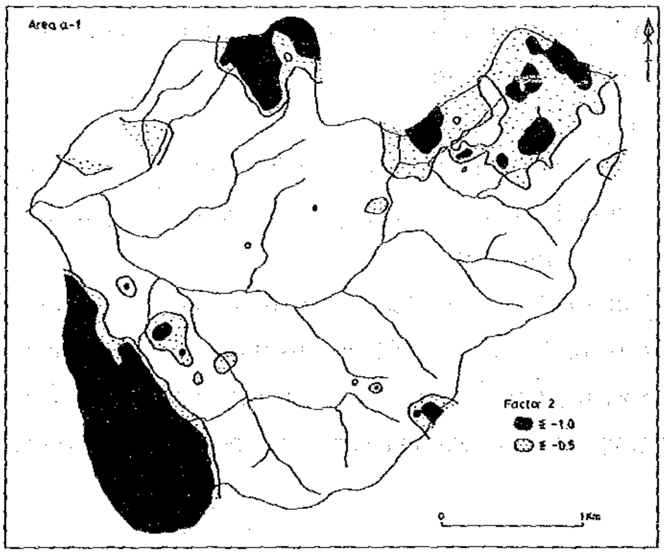


Fig. II - 2 - 6 Factor analysis map in the Area a-1