REPORT
ON
THE MINERAL EXPLORATION
IN
PERAK, MALAYSIA

CONSOLIDATED REPORT

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

This project was carried out in three years from 1988 to 1991 and completed on schedule with good collaboration of the relevant governmental agencies of Malaysia, especially the Geological Survey of Malaysia. This report is a summary of survey results of those three years.

In closing, we wish to express our sincere appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the Japanese survey teams.

February, 1991

Kensuke Yanagiya
Kensuke Yanagiya
President
Japan International Cooperation Agency

Gen-ichi Fukuhara
President
Metal Mining Agency of Japan

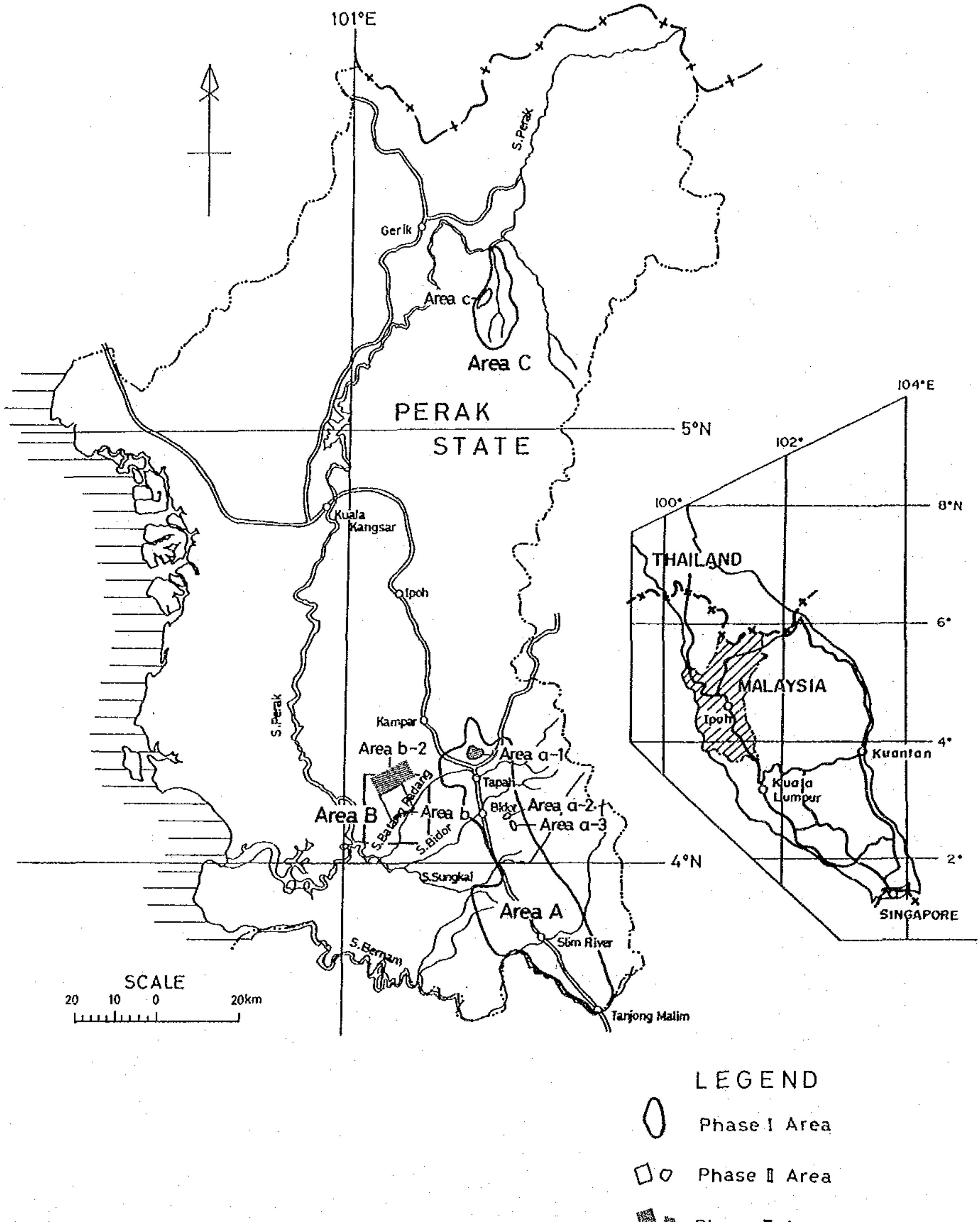

Fig. 1 Location of the project area

Abstract

This project, the Mineral Exploration in Perak, Malaysia, was started in 1988 for a duration of three years, aiming at clarifying geological setting and mineralization in the Area A, B and C, located in Perak State (Fig.1).

In Phase I (August 1988 to February 1989), geological and geochemical surveys in the entire Area A and C were conducted together with geophysical survey (CSAMT method) in a limited portion of Area A. For the Area B, a desk study of available data was carried out in the same phase. Consequently, in Area A and C, high potential areas were extracted, while in Area B, gravity survey was considered to be the best method for the determination of the bedrock topography.

During Phase II (June 1989 to February 1990), detailed geological survey and geochemical soil sampling were conducted in the high potential Area a-1, a-2 and a-3 within Area A and Area c (S. Jopal) within Area C. Consequently, in the Au anomalous zone outlined in Area a-1, high potential areas for Au mineralization were extracted by more detailed soil sampling and trenching. On the other hand, in Area b, gravity basement structure and placer tin distribution were outlined by geophysical gravity survey and Banka drilling.

In Phase III (final phase, July 1990 to February 1991), drilling was conducted in the northeastern part of Area a-1 where a highly anomalous Au zone was outlined by Phase II soil sampling while in Area B, gravity survey 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, six holes with a total length of approximately 900m were drilled and logged. A total of 296 samples from the holes were analyzed for eight elements: 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 Au 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 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 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.

Contents

PART I GENERAL REMARKS

Chapter 1 Outline of the Survey

1-1 Introduction

Tin mining has played a significant role in the social and economic development of Perak State. Since the begining of this century, Perak, in particular the Kinta Valley, has been known as one of the world's largest tin producers and for many years has supplied more than half of the total amount of tin consumed by the free world. However in recent years, tin production has sharply declined due largely to the gradual depletion of known reserves and the unfavourable tin price brought about the collapse of the tin market in 1985.

Realising the adverse effects the decline of the tin mining industry will have on the economy of the country and in particular the State of Perak, the Malaysian Government is increasing its efforts to explore for new resources of tin and other minerals so as to ensure that the mining sector will continue to contribute significantly to the country's economy and at the same time reduces the mining industry's over dependence on tin.

Consequently in 1987, the Geological Survey of Malaysia (GSM) through the Malaysian Government, forwarded a request to the Japanese Government for technical assistance to undertake a joint mineral exploration survey over selected areas in Perak. This request was granted, with the Japanese Government agreeing to provide assistance under the Japan International Cooperation Agency Development Survey Programme. The Japanese agencies entrusted to implement this survey were JICA and the Metal Mining Agency of Japan. In March 1988, the 'Scope of Work' was agreed upon and signed by representatives of GSM and JICA-MMAJ. The survey comprises three phases and was inplemented over a 3 year period from 1988 to 1990.

1-2 Survey Areas and Objectives

Based on mining records, geological and geochemical data, GSM selected 3 areas in Perak for this joint survey (Fig.1). The main objective of the survey is to explore and assess the mineral potential of the selected areas. Details of the areas are as follows:-

(1) Area A
The area extends from Tapah through Bidor to Tanjung Malim, covering some 1060 km^2. The target minerals were gold, tin tungsten and rare-earth minerals.

(2) Area B
Covering some 200km^2 of the Labu Kubung area near Teluk Intan; it was to be investigated for placer tin deposits.

(3) Area C
The drainage basin of Sungai Ringat, Gerik. The area covers some 130km^2 and was to be investigated for gold, tin, tungsten and rare-earth minerals.

1-3 Survey Methods and Coverage

The flow of the surveys from Phase I (1988) to Phase III (1990) is summarized in Fig.I-1-1. And the survey methods and coverage are summarized in Table I-1-1 and analytical items and components are in Table I-1-2.

1-4 Duration and Personnel

1-4-1 Duration

The survey was undertaken in three phases over a three year period from 1988 to 1990.

The duration for active field survey was 2 months for Phase I, 3 months for Phase II and 4 months for Phase III.

Flow of the Project

Phase I (1988)

Area A (1,060Km^2)

OBJECTIVE
To explore and assess the mineral potential.
(Main target mineral)
Au, Sn, W and REE minerals

SURVEY AMOUNTS
Geological survey
Survey route length: 374km
Geochemical survey
Stream sediments: 603pcs
Rock: 100pcs
Pan concentrates: 605pcs
Geophysical survey (CSAMT)
Area surveyed: 4Km^2
Points measured: 115pcs

CONCLUSIONS
A geochemical anomaly zone of a large scale was outlined on the east side of Route No.1 between Tapah and Sungkai.
Any resistivity structure indicating mineralized zones was not detected by CSAMT-method in the Bukit Mas area.

Area B (200Km^2)

OBJECTIVE
To investigate for placer tin deposit.

SURVEY AMOUNTS
Desk study of available data for the Changkat Jong and the Teluk Intan areas

CONCLUSIONS
The Teluk Intan area has better potential for placer tin deposit.
The best geophysical method to delineate paleo-channels having better locations for placer tin is the gravity method.

Area C (130Km^2)

OBJECTIVE
To explore and assess the mineral potential.
(Main target mineral)
Au, Sn, W and REE minerals

SURVEY AMOUNTS
Geological survey
Survey route length: 72km
Geochemical survey
Stream sediments: 155pcs
Pan concentrates: 155pcs
Rock: 50pcs

CONCLUSIONS
Geochemical anomalies of REE, Sn, W and Au are zonally arranged.
The area has good potential for rare earths and tin.

Phase II (1989)

Area a-1 (6.0Km^2)

OBJECTIVES
To clarify the nature of Au concentrations and geology.
To delineate the most promising area.

SURVEY AMOUNTS
Geological survey
Survey route length: 62km
Length trenched: 113m
Geochemical survey
Soil: 556pcs
Rock: 10pcs

CONCLUSION
A geochemical Au anomaly zone with 0.410 ppm of a mean value was outlined in an area of 0.6km width and 1.4km length, in the uppermost of the Sungai Jong.

Area a-2 (0.5Km^2)

OBJECTIVES
To clarify the nature of Au concentrations and geology.
To delineate the most promising area.

SURVEY AMOUNTS
Geological survey
Survey route length: 3km
Geochemical survey
Soil: 34pcs

CONCLUSION
Only some small geochemical Au anomalies were detected.

Area a-3 (2.5Km^2)

OBJECTIVES
To clarify the nature of Au concentrations and geology.
To delineate the most promising area.

SURVEY AMOUNTS
Geological survey
Survey route length: 15km
Geochemical survey
Soil: 132pcs

CONCLUSION
Only some small geochemical Au anomalies were detected.

Area b (30.0Km^2)

OBJECTIVES
To clarify the details of tin and clay deposits.
To study the correlation between tin concentration and bedrock.

SURVEY AMOUNTS
Geophysical survey (gravity)
Points measured: 860pcs
Drilling (Banka drill)
Length drilled
MJMP-1: 98.0m
MJMP-2: 76.5m
MJMP-3: 62.8m

CONCLUSIONS
Several depressions in gravity basement interpreted as paleo-river channels were detected.
The bore holes drilled prior to gravity survey are located either on the crests or the slope of the gravity basement.

Area c (18.0Km^2)

OBJECTIVES
To clarify the nature of mineralization.
To delineate the most promising area.

SURVEY AMOUNTS
Geological survey
Survey route length: 57.7km
Geochemical survey
Rock: 123pcs

CONCLUSION
The area has low potential for Au, Sn and REE.

Phase III (1990)

Area a-1

OBJECTIVE
To investigate the origin of the superficial gold anomalous concentration detected by the Phase II geochemical survey.

SURVEY AMOUNTS
Drilling (Diamond drill)
Length drilled
MJMP-10: 150.60m
MJMP-11: 150.50m
MJMP-12: 150.50m
MJMP-13: 140.40m
MJMP-14: 150.60m
MJMP-15: 150.70m

CONCLUSIONS
Au mineralization is observed both in talus deposit and in bedrock.
The mineralizations have little economical significance at the moment.

Area b

OBJECTIVE
To study the relationship between placer tin concentration and bedrock relief projected by the Phase II gravity survey.

SURVEY AMOUNTS
Drilling (Banka drill)
Length drilled
MJMP-4: 66.0m
MJMP-5: 70.0m
MJMP-6: 71.0m

Area b-2 (22.5Km^2)

OBJECTIVES
To clarify the bedrock profile by a geophysical gravity survey and to study the relationship between placer tin concentration and bedrock relief.

SURVEY AMOUNTS
Geophysical survey (gravity)
Points measured: 860pcs
Drilling (Banka drill)
Length drilled
MJMP-7: 71.1m
MJMP-8: 79.2m
MJMP-9: 85.1m

CONCLUSIONS (Area b and Area b-2)
The preferable location for placer tin deposit is at bottom of concaved basement in a deep paleo-channel.
A large concaved basement having good potential for placer tin bed exists in the northeastern part of the area.
The placer tin encountered during the project is considered to have little economical significance at the moment.

Fig. I-1-1 Flow of the project

Table I-1-1 Amount of surveys, Phase I, II and III

Phase I (1988)

Method	Area	Items	Quantities
Geological and geochemical survey	A	Survey area	1,060 km²
		Survey route length	374 km
		Number of samples collected	
		Heavy mineral concentrate	605 pcs
		Silt	603 pcs
		Rock	100 pcs
	C	Survey area	130 km²
		Survey route length	72 km
		Number of samples collected	
		Heavy mineral concentrate	155 pcs
		Silt	155 pcs
		Rock	50 pcs
Geophysical Survey (CSAMT)	A	Survey area	4 km²
		Number of points measured	115 points

Phase II (1989)

Method	Area	Items	Quantities
Geological and geochemical survey	a-1 a-2 a-3	Survey area	9 km²
		Survey route length	80 km
		Length trenched	113 m
		Number of samples collected	
		Soil	722 pcs
		Rock	10 pcs
	c	Survey area	18 km²
		Survey route length	57.7 km
		Number of samples collected	
		Rock	123 pcs
Geophysical Survey (Gravity method)	b	Survey area	30 km²
		Number of points measured	860 points
Drilling (Banka drill)	b	Length drilled	237.3 m
		MJMP-1	98.0 m
		MJMP-2	76.5 m
		MJMP-3	62.8 m

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 Amount of laboratory studies, Phase I, II and III

Laboratory study	Phase I (1988)	Phase II (1989)	Phase I (1990)
(1) Thin section	21pcs	12pcs	40pcs
(2) Polished section	16pcs	6pcs	15pcs
(3) X-ray diffraction analysis	20pcs	18pcs	15pcs
(4) Chemical analysis			
a) Geochemical sample			
Heavy mineral concentrate Nb, Ta, U, Th, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu	852pcs	-	-
Rock Nb, Ta, U, Th, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu	150pcs	133pcs	-
b) Whole rock analysis SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MnO, MgO CaO, Na_2O_3, K_2O, P_2O_5, LOI, H_2O	20pcs	-	-
c) Ore analysis Au, Ag, Pb, Zn, Cu, As, W, Sn, Nb, Ta, U, Th, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu	10pcs	17pcs	-
(5) Physical property measurement	10pcs (Resistivity)	26pcs (Density)	-

Following the completion of field surveys, data compilation and analysis together with report preparation were immediately carried out. This stage of the survey varied from 4 to 5 months for each phase.

The work schedules for the 3 phases of the survey are shown in Table I-1-3.

Table I-1-3 Time schedule of the three phases

Phase	Survey	Period
Phase I (1988)	Geological and geochemical survey	Aug. 1, 1988 ~ Nov. 9, 1988
	Geophysical survey	Aug.26, 1988 ~ Oct. 8, 1988
Phase II (1989)	Geological and geochemical survey	Jun 26, 1989 ~ Nov. 2, 1989
	Geophysical survey	Jun 26, 1989 ~ Sep.12, 1989
	Drilling survey	Jul.17, 1989 ~ Sep.21, 1989
Phase III (1990)	Core logging and interpretation	Jul.23, 1990 ~ Nov.23, 1990
	Geophysical survey	Jul.30, 1990 ~ Sep.22, 1990
	Drilling survey (Diamond drilling)	Jul.30, 1990 ~ Oct.27, 1990
	Drilling survey (Banka drilling)	Sep.15, 1990 ~ Dec.30, 1990

1-4-2 Personnel

The survey was implemented jointly by JICA-MMAJ and GSM. Members of the survey teams for each of the 3 phases of the survey are as shown in Table I-1-4. In addition, all laboratory analysis of geochemical samples by GSM were carried out by staff of the Kuantan Laboratory headed by Mr. Chow Chong and under the supervision of Mr. Wong Yew Choong.

Table I-1-4 Members of negotiation and survey teams

Planning and negotiation (1988)

Japan side	Malaysia side
Yoshio Matsukawa (MMAJ)	Yin Ee Heng (GSM)
Nobuyoshi Takabe (MFA*)	Fateh Chand (GSM)
Tetsuo Tsujino (MITI**)	Foo Khong Yee (GSM)
Takashi Kamiki (JICA)	Aw Peck Chin (GSM)
Natumi Kamiya (MMAJ)	Wong Yew Choong (GSM)
-	Shu Yeoh Khoon (GSM)
-	Chu Ling Heng (GSM)

Field surveys during Phase I(1988)

Survey	Japanese members	Malaysian members
Leader/Geological/geochemical surveys	Hiroshi Fuchimoto (BEC***)	Chu Ling Heng (GSM)
Geological/geochemical surveys	Yoshiaki Shibata (BEC)	Mohd Anuar Mohd Yosof (GSM)
Geological/geochemical surveys	Masakatsu Onodera (BEC)	Mohd Suhaili Ismail (GSM)
Geophysical survey	Tomio Tanaka (BEC)	Ho Choon Seng (GSM)
Geophysical survey	Masatane Kato (BEC)	Dzazali Ayub (GSM)
Geophysical survey	Kazuto Matsukubo (BEC)	-
Survey	-	Liew Wee (GSM)

Planning and negotiation (1989)

Japan side	Malaysia side
Nobuyuki Masuda(MMAJ)	Yin Ee Heng (GSM)
-	Fateh Chand (GSM)
-	Shu Yeoh Khoon (GSM)
-	Chu Ling Heng (GSM)
-	Loh Chiok Hoong (GSM)

Field surveys during Phase II(1989)

Survey	Japanese members	Malaysian members
Leader/Geological/geochemical surveys	Hiroshi Fuchimoto (BEC)	Loh Chiok Hoong (GSM)
Geological/geochemical surveys	Tadashi Yamakawa (BEC)	Mohd Anuar Mohd Yosof (GSM)
Geological/geochemical surveys	-	Mohd Suhaili Ismail (GSM)
Geophysical survey	Hiroshi Fukuda (BEC)	Dzazali Ayub (GSM)
Geophysical survey	Masatane Kato (BEC)	-

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.

Chapter 2 Previous Work

Early published accounts on the geology and mineralization of the survey areas are found in Scrivenor and Jones (1919) and Ingham (1938). The report by Scrivenor and Jones contained a limited account on the mineralization in the Kalumpang-Tanjung Malim area (part of Area A) whereas detailed descriptions were given by Ingham on the lithology and mining activity known at that time in the Tapah and Teluk Anson areas (Area A and B).

More recently, GSM has undertaken several studies on various aspects of the geology and mineralization in the survey areas. Chand et al (1968) conducted a geological and geochemical reconnaissance survey in the drainage basin of S. Ringat (Area C). Their findings indicate tin and gold mineralization in the area.

In the Tanjung Malim area, Gan (1978, in manuscript) identified two metasedimentary units of Mid. Devonian to Late Paleozoic age. Potential areas for placer and primary tin mineralization were delineated in his report.

Wong (1974, in manuscript) mapped the Teluk Intan-Lumut area and gave a comprehensive account of bedrock geology and mineralization. The lithological units described by Wong appear to be similar to those in the Tanjung Malim area. Later, Loh (1978, in manuscript) studied in detail the Quaternary sediments in the same area and identified the Labu Kubung sector as having good potential for deep-seated placer tin deposits.

Chapter 3 General Geology

3-1 Geology

Hutchison (1977) subdivided Peninsular Malaysia into four major tectonic regions, these are, from west to east, the Western Stable Shelf, the Main Range Belt, the Central Graben and the Eastern Belt (Fig. I-3-1).

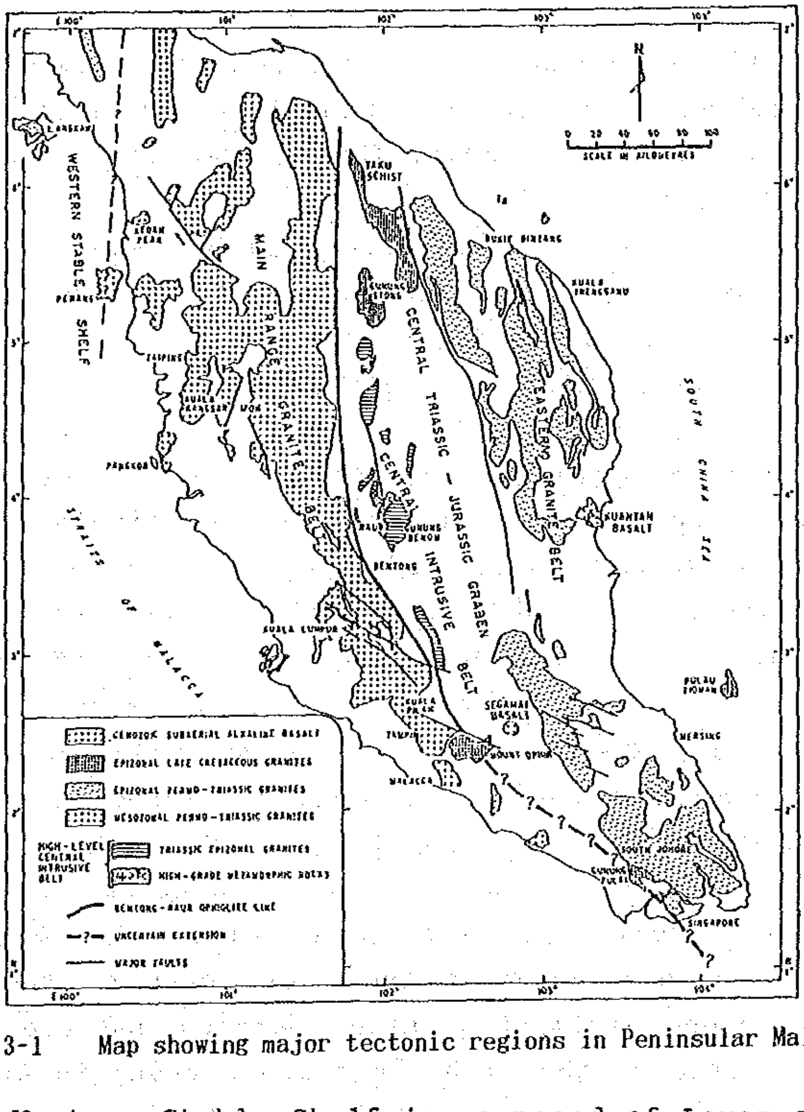

Fig. I-3-1 Map showing major tectonic regions in Peninsular Malaysia

The Western Stable Shelf is composed of Lower and Upper Paleozoic, gently folded miogeosynclinal sediments. These sediments represent the oldest rocks found in Peninsular Malaysia.

The Main Range Belt is characterized by the huge Main

Range Granite batholith which intruded into isoclinally folded metasediments of Early and Late Paleozoic age. The Main Range granites are of a mesozonal type emplaced throughout the Permian and Triassic as a result of continental collison.

The Central Graben is occupied by gently folded Mesozoic sediments which are underlain by more strongly folded Permian and Triassic as a result of continental collison.

The Central Graben is occupied by gently folded Mesozoic sediments which are underlain by more strongly folded Permian basement rocks. This graben is largely devoid of granitic rocks.

The Eastern Belt is characterized by numerous elongate granitic plutons intruded into Upper Paleozoic sediments. The granites are of an epizonal type.

The mineralization is different in each tectonic region. The Main Range Belt is characterized by tin, the Central Graben by gold and base metals and the Eastern Belt by tin, tungsten and iron. However, recent findings indicate that the Eastern Belt is also mineralized with gold.

The survey areas fall under the Main Range Belt. The local geology is represented by a series of Paleozoic metasediments intruded by the Main Range Granite. Unconsolidated Quaternary sediments cover the inland valleys and other low-lying areas. The rocks are largely isoclinally folded with fold axes trending NNW-SSE. Mineralization consists of mainly quartz veins and stockworks which carry cassiterite $\pm$ wolframite and some gold. Such mineralized veins are commonly found at the roof zones of the granite bodies and along sediment-granite contacts and are believed to be the source of the rich tin placers found in Area A and B.

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 deposits and they, generally, include minerals rich in rare earth elements, such as zircon, monazite and xenotime in addition to placer tin and gold. The primary tin deposits and prospects, being associated with 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 with pyrite, chalcopyrite and sphalerite or cassiterite-wolframite-quartz veins associated with some sulphides.

The auriferous quartz veins in phyllite, located 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.

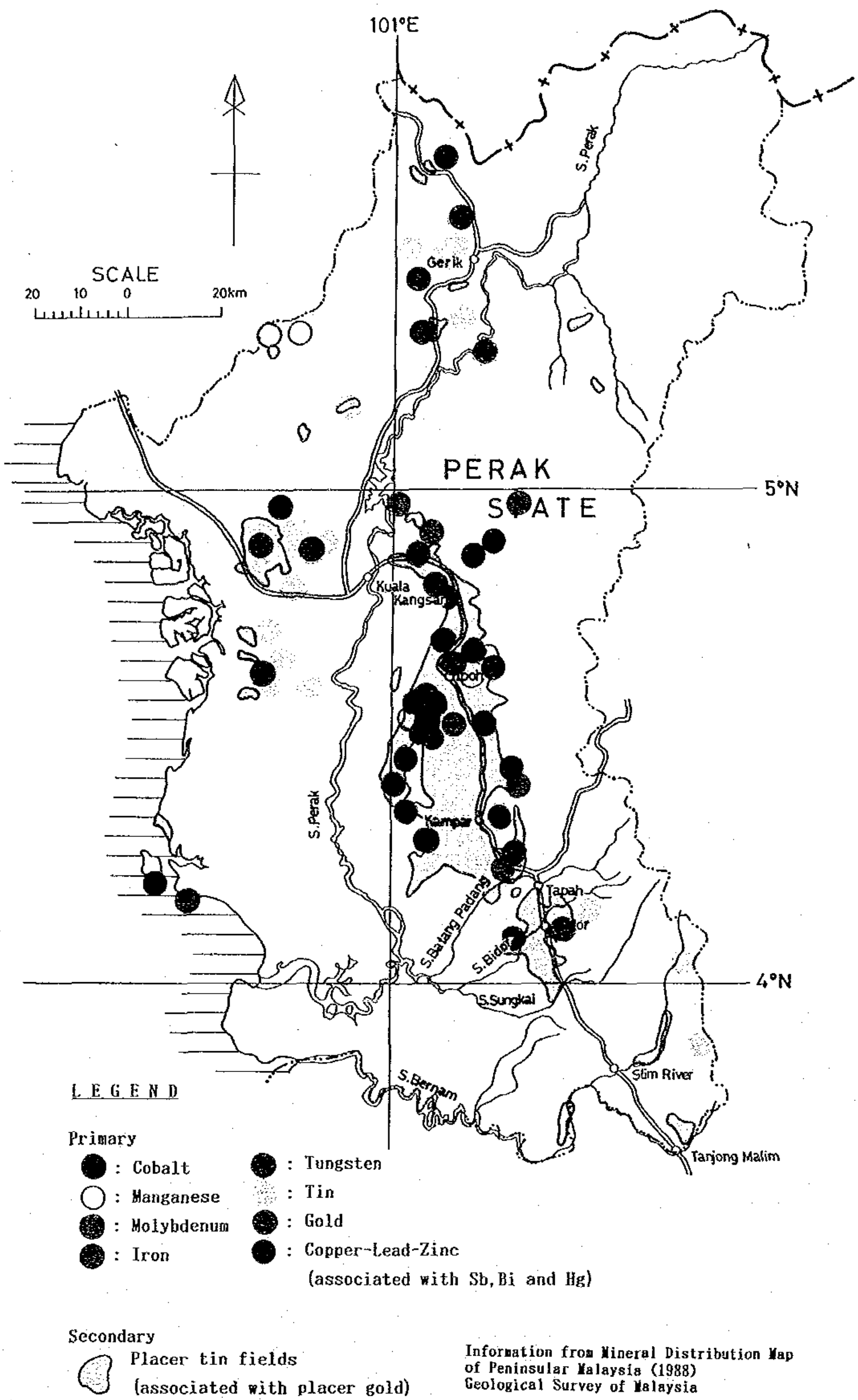

Fig. I-3-2 Mineral resources distribution in the State of Perak

Chapter 4 Physiography

4-1 Location and Access

The survey areas are located in the state of Perak, Malaysia (Fig.1).

Area A extends from Tapah, about 60km south of Ipoh (the capital city of Perak) through Bidor to the township of Tanjung Malim which is located near the state boundary between Perak and Selangor. Access into the area is extremely good as both the north-south highway and railway line linking Kuala Lumpur and Ipoh run through the area. In addition, numerous metalled roads, estate roads and tracks are found on both sides of the main highway.

Area B is approximately 20km southwest of Tapah. It is accessible via the main road connecting Tapah to Teluk Intan. Apart from this, paddy fields occupy a large portion of the area and numerous tracks built on top of the bunds in the paddy fields provide direct access into the survey area.

Area C is located about 30km southeast of Gerik, a small township 154km north of Ipoh. Access into the area from Gerik involves the crossing of the Perak river by ferry at Pasir Renak near Gerik and proceeding eastwards for about 25km along timber tracks. Alternatively, the area can be reached by boat from a village near Bersia, 10km east of Gerik. From this point, it is necessary to travel upstream along Perak river for an hour before reaching the mouth of Sg. Ringat, a stream draining the entire survey area.

4-2 Topography and Drainage

The western part of Peninsular Malaysia is dominated by an elongated mountain range (Main Range) trending in a NNW-SSE direction and rising to heights of 1500-2000m above MSL. West of this mountain range is an extensive, flat coastal plain.

Area A is situated in the transtional region between the Main Range in the east and the coastal plain in the west. Consequently, two main topographic features are prominent in the area: the hilly foothills of the Main Range in the northeastern sector and the relatively flat lowlands less than 50m in height in the southwestern sector.

The main rivers draining Area A are - from north to south - S. Chenderiang, S. Batang Padang, S. Bidor, S. Sungkai and S. Selim. These rivers flow generally in a southwesterly direction towards the coastal plain.

Area B, being part of the coastal plain is flat and lowlying, rarely exceeding 20m above MSL. S. Keruh and S. Manik, two minor tributaries of S. Perak, flow through Area B in a southwesterly direction.

Area C is a rugged, mountainous region with elevations of 100-1700m. above MSL. Steep cliffs and waterfalls are common. The area constitutes the entire drainage basin of S. Ringat, a tributary of S. Perak. The general direction of flow is from south to north.

4-3 Climate and Vegetation

The climate in the survey areas is of the equatorial type characterized by high, uniform temperature and humidity. Rain falls throughout the year with no pronounced wet or dry seasons. Fig. I-4-1 shows the temperature and rainfall data at Teluk Intan and Sitiawan near Area B.

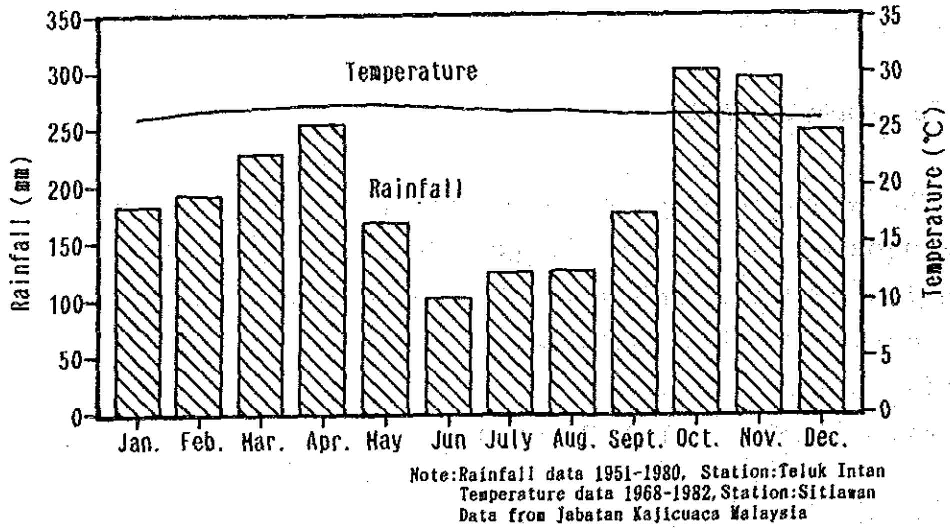

Fig. I-4-1 Monthly average temperature and rainfall in project area

In Area A, the sector west of the Kuala Lumpur - Ipoh highway is largely barren of vegetation as a result of tin mining activities. East of the highway, the area is mainly under rubber and oil palm cultivation.

Area B is mainly covered by paddy fields while Area C, designated as a wildlife reserve, is still under thick jungle.

Chapter 5 Results

5-1 Phase I Results

5-1-1 Area A

Geological mapping, geochemical silt and heavy mineral concentrate sampling and geophysical survey (CSAMT method) were undertaken. The followings are the main findings of the survey:

(1) The area is underlain by Paleozoic meta-sediments of the Terolak and Belata formations which are intruded by the Main Range Granite and the Changkat Rembian Granite. The meta-sediments are essentially phyllites and meta-sandstone isoclinally folded with NNW trending fold axes and westerly dips.

(2) The Main Range Granite and the Changkat Rembian Granite appear to be contemporaneous based on their similarities in mineralogical and chemical compositions.

(3) Primary mineralization is related to granite intrusions which have resulted in fracture fillings; giving rise to veins and stockworkds carrying gold, tin and tungsten. Mineralization is accompanied by greisenization and intense kaolinization within the granites and along the contact zones.

(4) The geochemical survey for stream silts and heavy mineral concentrates disclosed a zonal arrangement of rare earths, Sn-W and Au anomalies. Rare earths anomalies are mainly concentrated within the granites, Sn-W near or along the contat zones and Au in the phyllitic country rocks away from the granite-sediment contacts.

(5) A gold anomalous zone covering an area of about $60km^2$ is delineated east of the Tapah-Bidor-Sungkai highway. This zone can be subdivided in three Au anomalous areas - Northern Area, Bukit Mas Area and Southern Area. Based on size and gold content, the Northern Area appears to be most promising for primary gold mineralization. This is

supported by analytical results for silt samples.

(6) The geophysical survey detected two high resistivity zones located in the east and west of the study area (Bukit Mas). These zones correspond to meta-sandstone beds. The geophysical survey did not detect any structure related to mineralization. Gold mineralization in the study area is therefore believed to be small scale quartz vein swarms of limited extent.

5-1-2 Area B

A desk study of available data for the Changkat Jong area and the Teluk Intan area revealed the following:

(1) The Teluk Intan area has better potential for placer tin deposits.

(2) Placer tin deposits occur near the bedrock at depths of 50-80m below ground surface in the vicinity of Labu Kubung in the Teluk Intan area.

(3) The placer tin deposits are concentrated in paleo-channels in the bedrock and the best geophysical method to delineate these channels is the gravity method.

5-1-3 Area C

Geological mapping and geochemical silt and heavy mineral concentrate sampling were undertaken. The following are the main findings:

(1) The area is underlain by Paleozoic schists intruded by the Main Range Granite.

(2) Primary tin mineralization is in the form of cassiterite - tourmaline - quartz veins occurring near granite - schist contacts.

(3) Geochemical anomalies occur in a zonal arrangement: Au in the schist country rock, W near the contacts while Sn and rare earths are within the granites.

(4) The area has good potential for rare earths and tin as the analytical values of these elements in the heavy

mineral concentrates are much higher compared to Area A.

5-2 Phase II Results

5-2-1 Area A

Detailed geological mapping, grid soil sampling and limited trenching were undertaken in 3 sub-areas designated as a-1, a-2 and a-3. The following are the main findings:

Area a-1

(1) The area is underlain by meta-sediments of the Terolak formation which is intruded by the Main Range and Changkat Rembian granites.

(2) The geochemical soil survey revealed the presence of two prominent Au anomalous zones; one in the northeast near the granite contact and the other in the south - central sector. These two gold anomalous zones have elevated Au values exceeding 0.026 ppm Au.

(3) The Au anomalous zone in the northeast covers an area of 0.4km x 1.4km, shows a mean value of 0.41 ppm Au and a maximum value of 2.71 ppm Au. There is a distinct Au-As association with a mean value of 814 ppm As and a maximum vlue of 2,248 ppm As within the zone.

(4) Five trenches dug in the northern part of the northeastern Au anomalous zone showed elevated Au values of 0.27 ppm - 3.57 ppm in the soil. The Au values tend to inclease with depth. This area was recommended as a target for follow-up exploratory drilling.

(5) The south-central anomalous zone is relatively less anomalous in Au than the northeast zone (Au contents only 1/3 of northeast zone). There is no Au-As asociation and this zone is considered to have low potential for primary gold mineralization.

Area a-2

(1) The geology of the area consists of black phyllites (Terolak formation) intruded by granite. Quaternary

sediments cover the lowlying areas.

(2) A Au-As soil anomaly occurs in the phyllites east of the granite body. However, the mean and maximum Au values are only 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 respectively. Therefore, Area a-2 is considered to have a lower potential for primary gold mineralization than Area a-1.

Area a-3

(1) The area is composed entirely of phyllites of the Terolak formation. Recent sediments are found along S. Chebor which drains through the centre of the are.

(2) Several Au anomalies which are somewhat elongated in a NNW-SSE derection were detected on both sides of S. Chebor. The distribution of the anomalies suggested that mineralization is controlled by a fault zone located along S. Chebor.

(3) The mean and maximum values for Au in the anomalies are 0.095 ppm and 0.135 ppm respectively, corresponding to 1/4 and 1/20 of those in Area a-1. Similarly, the values of As are 1/7 and 1/15 respectively. Based on these values Area a-3 is considered to have a lower potential than Area a-1 for gold mineralization.

5-2-2 Area B

Under Phase II, a grvity survey was carried out over a $30km^2$ area (Area b) near Labu Kubung. In addition, three holes were drilled in the area using a semi-mechanized banka. The following are the main findings:

(1) The gravity survey detected the presence of several depressions in the gravity basement at depths of more than 80m below ground surface. These depressions are interpreted as paleo-river channels.

(2) The survey also revealed the presence of a NW-SE trending trench-like depression more than 100m deep in the

northeast portion of the study area.

(3) Data obtained from the three boreholes indicate the presence of rich tin placers up to several metres thick near the bedrock.

(4) Inspection of the basement interpretation map and all available borehole data (all the boreholes were drilled prior to gravity survey) suggests that the boreholes are located either on the crests or the slopes of gravity basement highs. It can also be seen that the interpreted gravity basement depths differ from the bedrock depths determined by drilling by an average of 12m.

5-2-3 Area C

Detailed geological mapping and geochemical rock sampling were conducted in the drainage basin of S. Ringat (Area C). The following are the main findings:

(1) The area is underlain by the Main range granite.

(2) Partially overlapped Au anomalous zones (area: 1.5km^2, mean: 0.006 ppm Au, maximum: 0.009km^2 Au) and Sn anomalous zone (area: 0.8km^2, mean: 50 ppm Sn, maximum: 70 ppm Sn) occur in the central part of the area.

(3) REE anomalies lack areal extent and are sporadically distributed. This is probably due to a point distribution of REE minerals such as monazite.

(4) The area has low potential for Au, Sn and REE as the anomalous values for these elements are rather low.

5-3 Phase III Results

5-3-1 Area a-1 (Area A)

Six holes with an aggregate length of approximately 900m were drilled using a diamond core drill over the gold target located in the northeastern part of the Area a-1. The following are the main findings:

(1) The five trenches (Nos.8, 9, 11, 12 and 13) that

gave high Au concentrations in the Phase II survey are located on a talus deposit (up to 40m thick) which shows a interfinger relation with alluvium. The talus deposit, consisting of mainly angular rock fragments of schist, have high Au concentration. Consequently, the high Au concentrations in the talus deposit are thought 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 have resulted in the deposition of the talus deposit at the survey area.

(2) Concealed primary Au mineralization with a maximum value of 2.1 ppm Au and base metal (Cu, Pb and Zn) mineralization with Ag were confirmed in silicified rock at approximately 50m and 120m below the surface respectively.

(3) The primary Au mineralization is associated with As in silicified rock. Therefore, As should be a good pathfinder element for the future exploration of the primary gold.

5-3-2 Area B

The geophysical survey (gravity method) and drilling survey conducted in Area b-2, and Area b and b-2 respectively. The following are the main findings:

(1) Banka drilling revealed the presence of high grade tin beds several metres thick at the bottom of concave basement structures (paleo river channels) at depths of more than 60m below ground surface.

(2) The gravity survey detected several concave basement structures. The largest basement structure (basement altitude less than -100m) is located in the northeastern part of the area surveyed.

Chapter 6 Conclusions and Recommendations

6-1 Conclusions

The following are conclusions obtained from the geological, geochemical, geophysical and drilling surveys for three phases of the project:

Area A

(1) The five trenches (Nos.8, 9, 11, 12 and 13) that gave high Au concentrations in the Phase II survey are located on a talus deposit (up to 40m thick) which shows an interfinger relation with alluvium. The talus deposit, consisting of mainly angular rock fragments of schist, have high Au concentrations. Consequently, the high Au concentrations in the talus deposit are thought 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 have led to the deposition of the talus deposit in the survey area.

(2) Concealed primary Au mineralization with a maximum value of 2.1 ppm Au and base metal (Cu, Pb and Zn) mineralization with Ag were confirmed in silicified rock at approximately 50m and 120m below the surface respectively.

(3) The primary Au mineralization is associated with As in silicified rock. Therefore, As should be a good pathfinder element for the future exploration of the primary gold in Area a-1.

Area B

(1) The preferable locations for large scale, high grade, placer tin deposits are at bottom of concaved basement structures (bottom of paleo river channels).

(2) Among the concave basement structures detected, the largest, located at the northeast (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 6 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 (high grade tin beds only occur near the bedrock). Therefore they probably have little economic significance at the moment.

Area C

(1) The geochemical rock survey undertaken in Area C indicated weak and sporadic anomalies for Au, Sn and REE.

(2) Area C is therefore considered to have very low potential for the elements investigated.

6-2 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:-

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.

Area B

(1) Drilling a limited number of Banka holes arranged across the paleo river channels is recommended to obtain 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.

Area C

(1) No further work is recommended for Area C as it is considered to have very low potential for the elements investigated.

PART II DETAILED DESCRIPTION

Chapter 1 Area A

1-1 Geology

Area A is underlain by two sequences of Paleozoic meta-sediments reffered to as the Terolak formation and the Belata formation, and Triassic granitoids of the Main Range granite and Changkat Rembian granite. In addition, unconsolidated Quaternary sediments cover the inland valleys and the fringe of the coastal plain. The stratigraphy and geology are shown in Fig.II-1-1 and II-1-2 respectively.

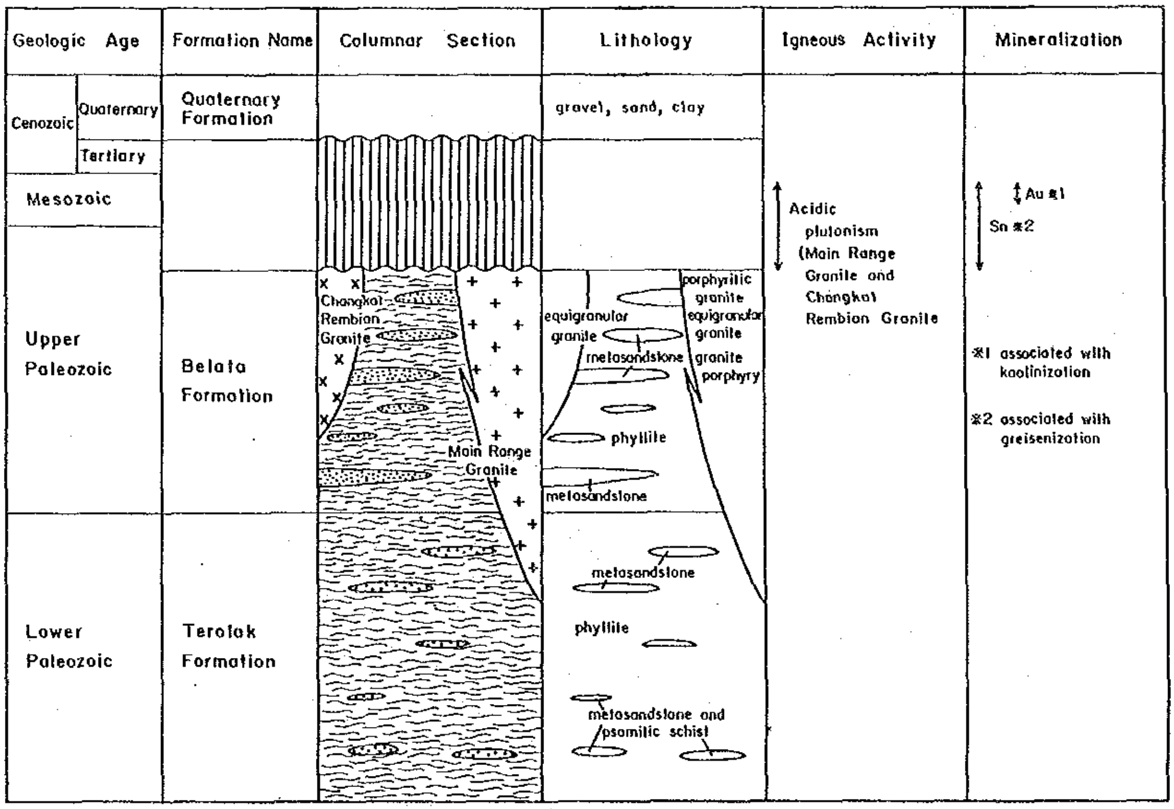

Fig. II-1-1 Stratigraphic section of the Area A

(1) Terolak Formation

The term 'Terolak formation' refers to a sequence of regionally metamorphosed, Lower paleozoic sediments that occur fairly extensively in the Tanjung Malim area (Gan, 1978). In Area A, the formation occurs as a NW-SE trending belt that extends from Tapah in the NW to Tanjung Malim in the SE. It is bordered by the Main Range granite in the east

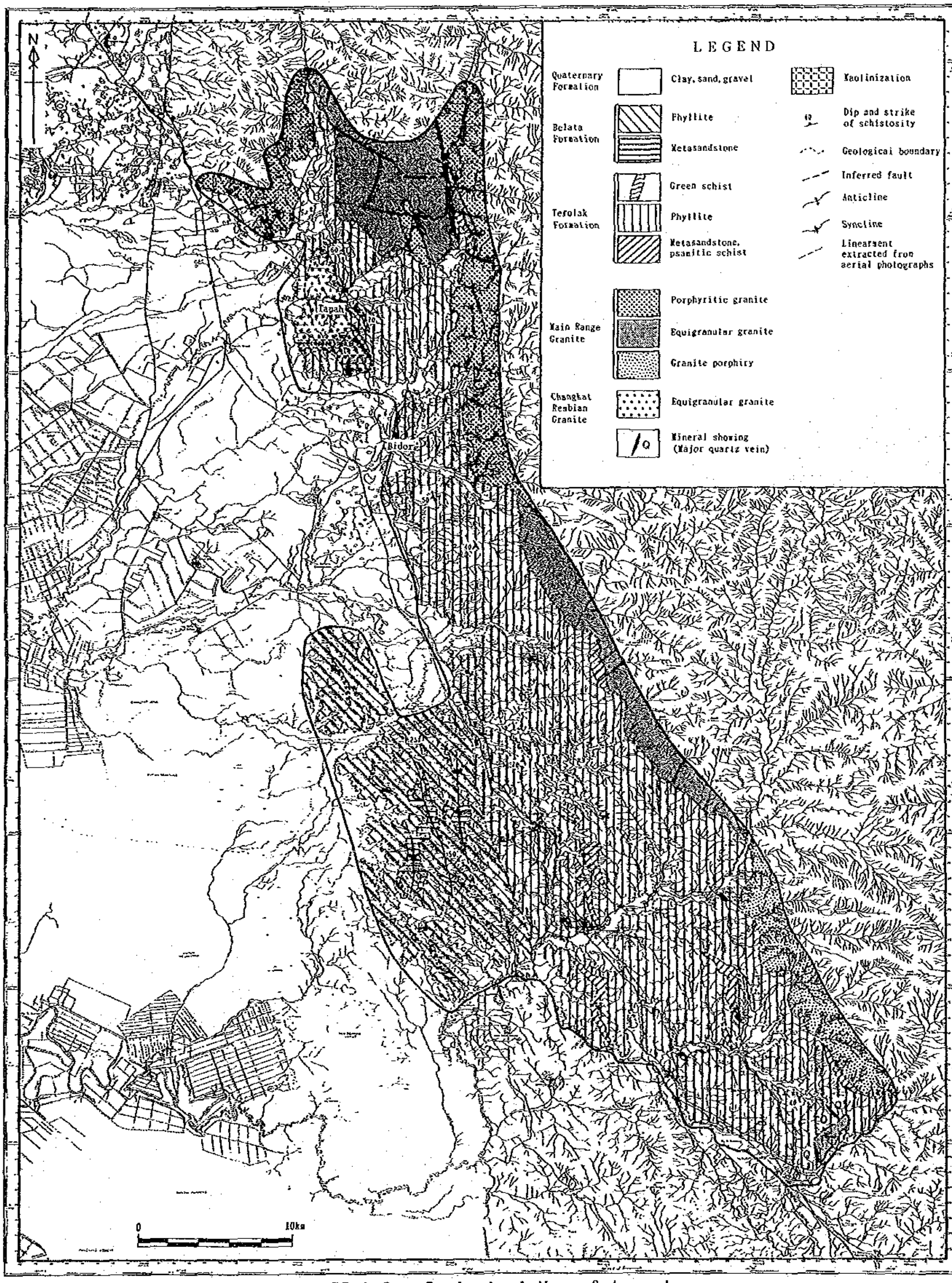

Fig.II-1-2 Geological Map of Area A

and by rocks of the Belata formation in the west.

The formation is predominantly argillaceous, comprising mainly phyllite, graphitic schist and quartz-mica schist with minor interbeds of meta-quartzite and quartz schist. A lens-shaped body of crystalline limestone occurs within the formation and is exposed in the Tanjung Malim - Kalumpang area in the south.

The result of core legging in Area a-1 during Phase III showed that the granite contact area are underlain by amphibolite and green schist considered to be meta-volcanics.

(2) Belata Formation

The term 'Belata formation' is an informal name given by Gan (1978) to a sequence of Upper Paleozoic meta-sediments exposed in the southwestern sector of Area A. Rocks of the Belata formation are somewhat similar to those of the Terolak formation except that they are more arenaceous and exhibit a lower grade of metamorphism.

(3) Unconsolidated Quaternary Sediments

Unconsolidated Quaternary sediments are composed of colluvial and alluvial deposits which infilled the inland river valleys and cover the fringes of the coastal plain in the southwestern sector of Area A.

(4) Granitoids

The granitoids are represented by rocks of the Main Range granite and the Changkat Rembian granite. The Main Range granite occupies the eastern side of Area A while the Changkat Rembian granite is a small pluton exposed just west of Tapah.

The most common rock type of the Main Range granite is a porphyritic to non-porphyritic, coarse-grained biotite granite. Minor amounts of muscovite is normally present. Small bodies of granite porphyry are present near the granite - sediment contacts in the Tanjung Malim area. These are likely to be marginal phases of the Main Range Granite

(Gan, 1978). Other late phase minor intrusives include aplite and dolerite dykes.

The Changkat Rembian granite is essentially an equigranular, fine to medium-grained biotite granite. Granite porphyry and greisen represent the marginal phases of the granite body which is also intensely kaolinised.

Radiometric age determinations of the Main Range granite suggest that the main phase of intrusion took place during Triassic times.

1-2 Structure

The major geological structures in the area are oriented in a NNW-SSE direction which is consistent with the regional structural trend in Peninsular Malaysia. This can be seen from the direction of elongation of the Main Range batholith which is NNW-SSE and the general strike directions of the rocks of Terolak and Belata formations which vary in the range N20° - 40°W.

Rocks of the Terolak formation appear to be largely isoclinally folded. The belata formation in the southwestern sector exhibits open folds with fold axes oriented in N-S and NNW-SSE directions and a wave length of about 3km. Small scaled fold structures with 2-5m wave lengths have also been observed.

Lineaments are well developed in the Main Range granite, particularly in the area north of Tapah. Northeast of Tapah, a N-S fault system has been inferred from air-photo interpretation.

1-3 Mineralization

Primary tin and gold mineralization known in the Area A are located in or near the granite and consists mainly of quartz veins and stockworks which carry casiterite +/- wolframite or gold.

(1) Changkat Rembian Deposit

Location: East of Chankat Rembian, elevation at 201m above sea level.

Type of Ore: Parallel veins of cassiterite-tourmaline-quartz vein in greisenized granite.

Country Rock: Granite

Present Condition: Pit and dump still remain on the slope of the mountain. A few parallel veins of tourmaline-quartz (5 to 20cm wide) are found in the pit.

Mining History: Because of poor information, details are unknown. Cassiterite and wolframite were extracted from weathered granite, and alluvial deposits by hydraulic mining.

(2) Batu Lombong Deposit

Location: 5km east of Bidor

Type of Ore: Primary and placer deposits exist in the area. The primary deposits consists of a stockwork of lenticular shaped cassiterite-quartz veins (1 to 2cm wide, 10cm long) parallel to the foliation of the phyllite and intersected at right angle by veins of cassiterite-tourmaline-quartz (2 to 5cm wide). These are, generally, strongly weathered. The placer deposits is hosted in the alluvial sediments and the extracted minerals, in order of abundance, are cassiterite, pyrite, (quartz), goethite, covellite and magnetite.

Country rock: Phyllite (primary deposits)

Present Condition: Mining operations working on weathered phyllite and placer tin deposits are currently ongoing by four companies, Lee Sen Pin & Sons Sdn. Bhd., PPL Galian Sdn. Bhd. and two other companies. A total production of four companies is estimated to be approximately 25 to 30 t/month at average grade of 20% Sn2O.

(3) Bukit Mas Deposit

Location: 2km southeast of Tapah

Type of Ore: Auriferous quartz veins

Country Rock: Phyllite

Present Condition: Only land collapse of old working and a

few troughs stretching in a SSE direction can be seen in rubber estate at present. Traces of quartz veins formally mined cannot be found.
Mining History: Mining operation was started at 1894 for auriferous veins in phyllite and ceased at the end of 1898. The annual production of gold at 1897 is assumed to be 41.8kg.

(4) Tapah Kaolin Deposit
Location: Located south of Changkat Rembian, occupying 1.5km x 4km bordered by the highway on the east.
Type of Ore: Produced by hydrothermal alteration of the Changkat Rembian Granites. Mainly consists of kaolinite with a small amount of illite, quartz and feldspar and others.
Present Conditon: A few companies including Associated Kaolin Industry are now under operation.
Mining History: Mining operation was started in 1932 for production of kaolin filler in rubber factory.

(5) S. Chebor Old Workings
Location: At the middle stream of the S. Chebor.
Type of Ore: Unknown
Present Conditon: A trough 50 to 150m wide, 400m long and 20m high is a remnant of the old workings. A sample taken from the quartz veins (3 to 10cm wide) found on the side wall of old workings gives Au grade of less than detection limit (0.003 ppm).
Mining History: Operated for tin and gold as by-products in 1940s.

1-4 Geochemical Survey

1-4-1 Geochemical Rock Survey (Preliminary)
Phase: I
Purpose: To understand the geochemical nature of each lithological unit for future geochemical work.
Sampling Area: The whole survey area.

Sampling Method: Samples were collected (avoiding altered rocks) simultaneously with the geological survey.

Chemical Analysis: 29 elements.

Data Processing: Geometric means and standard deviations were calculated for each element on each lithological unit basis.

Results: The results are given on Table II-1-1.

Table II-1-1 Statistical parameters of elements analyzed (rock) in Area A

(ppm)

	Area A			
	Granite		Phyllite	
	Mean	S.D.	Mean	S.D.
Pb	11.7	2.080	10.7	2.588
Ni	3.1	2.449	6.8	3.141
Co	3.0	2.104	4.0	2.460
Ag	0.144	2.512	0.148	2.535
Mo	1.67	1.923	2.06	2.213
Cu	6.6	2.825	13.1	3.926
Zn	15.1	2.748	17.1	3.597
Fe	1.55	2.748	0.87	3.954
Mn	155.6	4.074	129.6	2.858
Au	0.009	1.306	0.009	1.227
As	9.4	2.897	12.7	2.793
Sn	13.5	2.296	10.4	2.168
W	4.6	1.552	4.0	–
U	1.45	7.709	0.33	3.784
Hg	0.086	1.355	0.082	1.455
Sb	1.5	1.790	2.1	3.365
Bi	1.9	2.270	2.0	2.032
Ba	157.2	3.342	237.0	2.825
Ce	40.7	2.716	44.2	2.259
Eu	0.48	2.449	0.51	2.838
La	23.9	2.773	20.4	2.350
Lu	0.35	2.193	0.28	1.995
Nd	14.9	2.158	13.0	2.228
Sm	2.63	3.148	3.07	2.323
Tb	0.53	2.500	0.36	2.528
Th	13.9	2.606	7.8	2.296
Yb	1.72	2.773	1.15	2.547
Ta	2.6	1.675	2.1	1.189
Nb	15.1	1.479	13.7	1.710

S.D.=Standard Deviation

(Rock)

1-4-2 Geochemical Pan-Concentrate Survey

Phase: I

Purpose: To understand variety and distribution of heavy minerals in the area.

Sampling Area: Whole survey area.

Sampling Method: Samples were collected at the sampling locations of stream sediment geochemical survey. Panning was conducted, instantaneously, at the site to obtain heavy mineral concentrates more than 35g. Number of dulang to obtain concentrates more than 35g was recorded for each sample.

Chemical Analyses: Samples wee treated following the flow chart shown in Fig.II-1-3. Semiquantitative mineral examination and chemical analyses of 18 elements (Au, Ag, As, Hg, Sn, Hg and 12 REEs) were conducted.

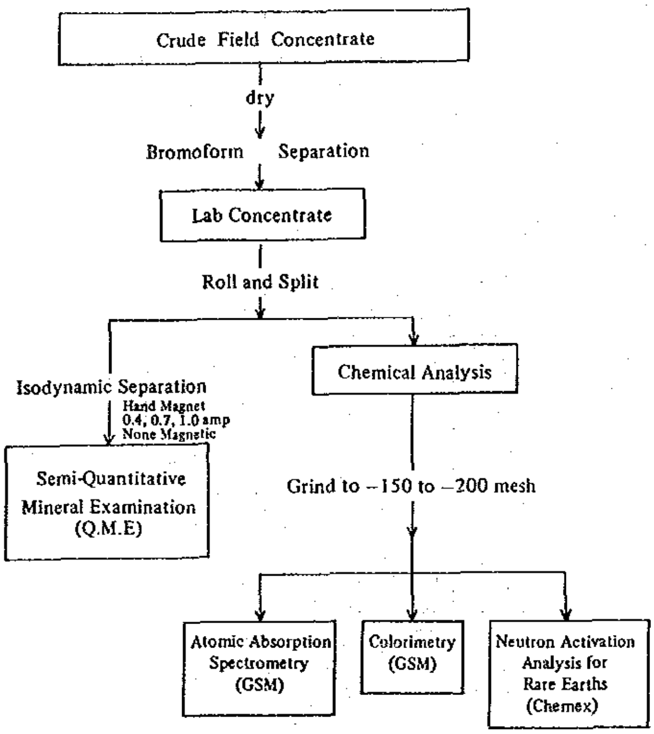

Fig. II-1-3 Flow chart for heavy mineral concentrate analysis

Data Processing: The semiquantitative mineral examination was done using the binocular microscope. Single component analysis and factor analysis were conducted for the results of chemical analyses.

Results: The results of semiquantitative mineral examination shows that heavy mineral concentrates consist mainly of gold, ilmenite, tourmaline, monazite, xenotime, cassiterite, rutile, zircon, topaz with a minor association of magnetite, garnet, allanite, epidote, pyrite. Some charsteristic features of heavy mineral concentrates on the basis of mineral assembladges and their distributions are shown on Table II-1-2.

The results of single component analysis are shown in Fig.II-1-4, each respectively showing distribution of Au, Sn and W anomalies. Au anomalies (more than 0.0028 mg/d*) are

Table II-1-2 Dominant heavy minerals and their distributions in Area A

Location	Area	Dominant minerals
East of Tapah-Chenderiang road	14km²	Gold·Cassiterite
Around Bukit Mas	2km²	Cassiterite·Rutile·Zircon
East of Bidor-Sungkai Highway	14km²	Cassiterite·Rutile·Zircon·Topaz
Between S.Batang Padang and S.Sungkai	-	Tourmaline·Topaz
South of S.Selim	-	Ilmenite

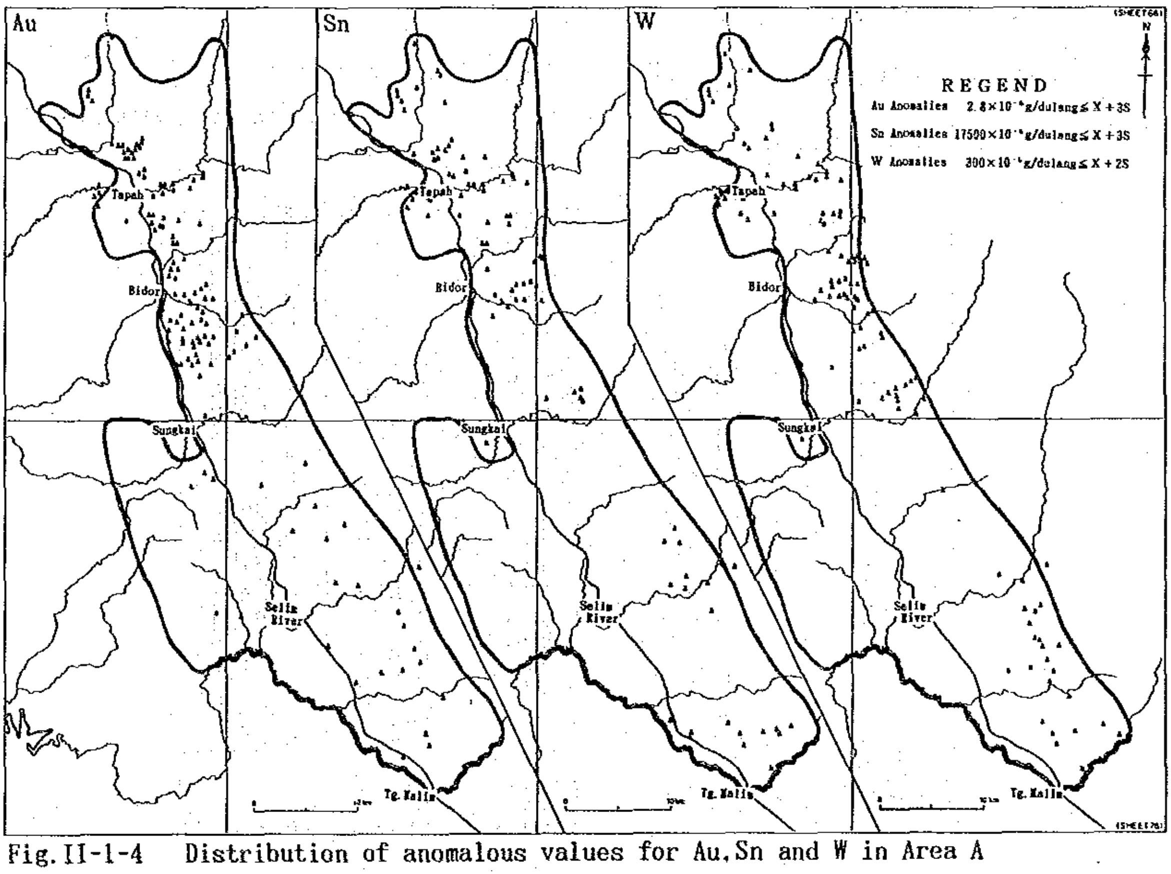

Fig.II-1-4 Distribution of anomalous values for Au,Sn and W in Area A (heavy mineral concentrate)

concentrated east of the highway from the S. Chenderiang to the S. Bikam. A large anomalous zone, 3 to 5km wide and 22km long, was obtained over the area north of Tapah to south of Bidor. (d*: dulang, a standard pan with volume of 4.7 l). Sn anomalies (more than 17.5 mg/d*) are relatively concentrated over the area between S. Chendering and S. Bidor. Other anomalies in the south of this area are scattered. W anomalies (more than 0.3 mg/d*) are mainly observed over the area between S. Chendering to S. Bikam and densely distributed at the vicinity of the Main Range Granite.

As shown on Table II-1-3, factor analysis gives factor loadings of each element for three factors. The table suggests following groups of elements controlling three factors.

Factor 1: Eu, Ce, Sm, La, Nd, Tb, Th

Factor 2: Au, Ag, Sn, (As)

Factor 3: Nd, U, Yb, Nb, Ta, Th, Tb

Table II-1-3 Factor loadings of elements analyzed in Area A

(heavy mineral concentrate)

Factor Loading

	Area A			
	Factor 1	Factor 2	Factor 3	Comunality
Au	0.256	-0.766	0.134	0.7099
Ag	0.227	-0.618	0.345	0.7615
As	0.264	-0.474	0.290	0.7846
Sn	0.273	-0.533	0.331	0.7459
W	0.158	-0.337	0.439	0.7489
Hg	0.298	-0.268	0.238	0.7325
Ce	0.829	-0.226	0.417	0.9853
Eu	0.838	-0.238	0.109	0.8070
La	0.803	-0.235	0.458	0.9767
Lu	0.413	-0.236	0.840	0.9833
Nd	0.768	-0.180	0.452	0.9009
Sm	0.813	-0.171	0.350	0.9154
Tb	0.685	-0.207	0.615	0.9517
Th	0.491	-0.220	0.675	0.9693
U	0.369	-0.162	0.834	0.9489
Yb	0.435	-0.244	0.829	0.9785
Ta	0.295	-0.289	0.675	0.9845
Nb	0.288	-0.241	0.705	0.9850
Factor Contribution	% 79.810	% 8.972	% 6.462	

(Heavy Mineral Concentrate)

Locations of samples with high factor scores (more than 1.0) were plotted on the geological map for each factor (Fig.II-1-5). Factor 1 and Factor 3 high scores are mainly seen, respectively, in the areas of the metasediments and the Main Range Granite. Distribution of Factor 2 high scores is concentrated over the area between S. Chendering and S. Bikam, in the east of the Highway, overlapping Au anomalous zone.

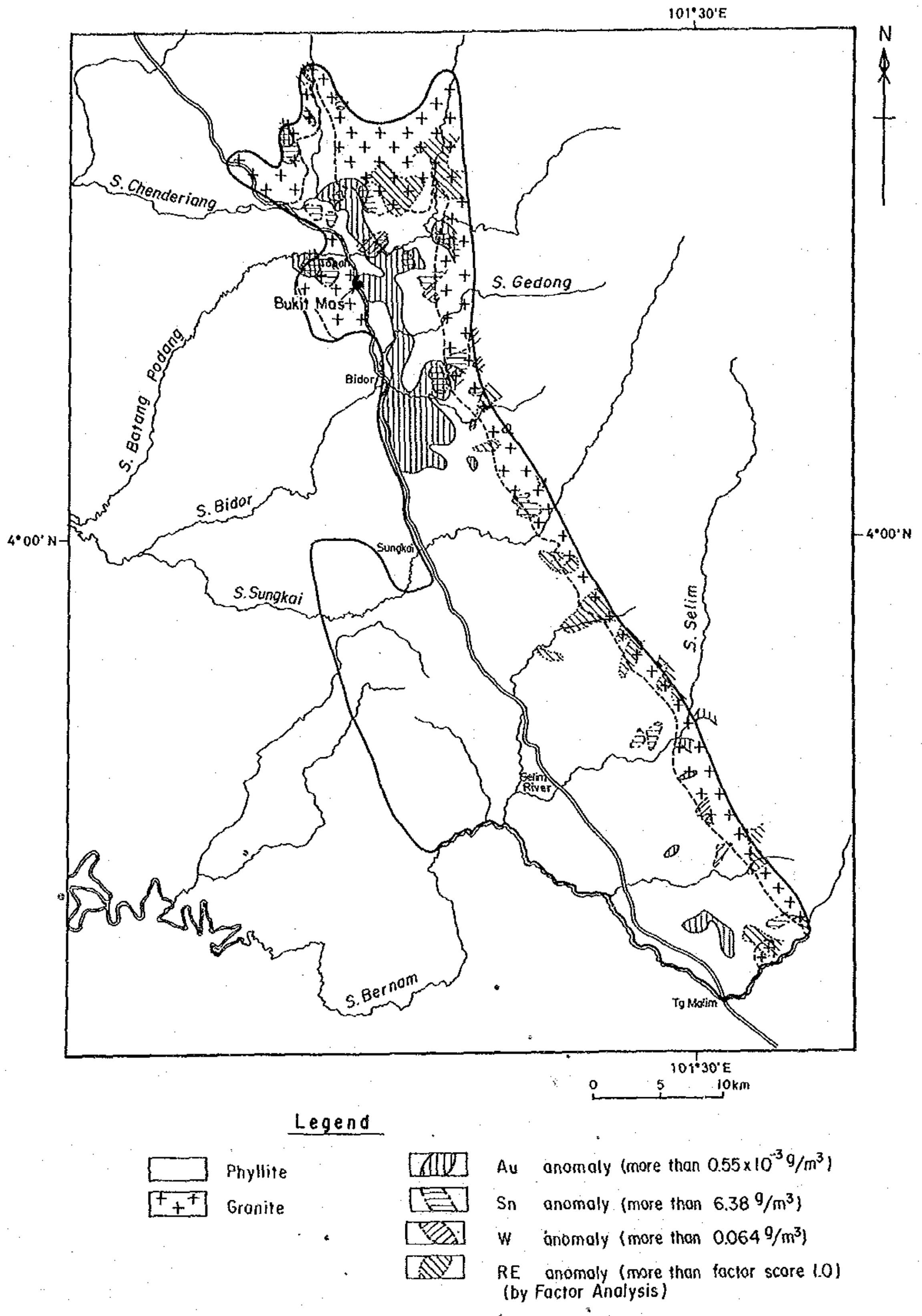

Fig. II-1-5 Geochemical anomalous zones for Au, Sn, W and REE in Area A
(heavy mineral concentrate)

1-4-3 Geochemical Stream Silt Survey

Phase: I

Purpose: To understand geochemical nature, concentration and distribution of elements, of the survey area.

Sampling Area: Whole survey area.

Sampling Method: Stream sediments (silt) were collected, simultaneously, during geological survey, at approximately 1km intervals along the main drainage system over the survey area.

Chemical Analyses: Six metallic elements, Au, Ag, As, Hg, Sn and W.

Data Processing: Single component analysis and factor analysis.

Results: Since many samples show analytical values less than detection limits for Ag, As, W and Hg, distribution map of anomalous samples were drawn only for Au and Sn (Fig.II-1-6). A relatively concentrated distribution of Au anormalous samples (more than 0.047 ppm) is in the areas approximately 3km north of Tapah and east of Bidor. Sn anomalous samples (more than 25 ppm) are found in Changkat Rembian area, along S. Batang Padang, at tributaries of S. Gedong and in the upper stream area of S. Paku.

Table II-1-4 Factor loadings of elements analyzed in Area A (silt)

Factor Loading

	Area A			
	Factor 1	Factor 2	Factor 3	Comunality
Au	0.158	-0.332	-0.053	0.1380
Ag	0.047	0.262	-0.059	0.0745
As	0.293	-0.052	-0.307	0.1824
Sn	0.632	-0.106	0.033	0.4113
W	0.629	0.025	-0.017	0.3965
Hg	-0.036	0.037	-0.282	0.0824
Factor Contribution	% 73.018	% 14.465	% 13.082	

(Silt)

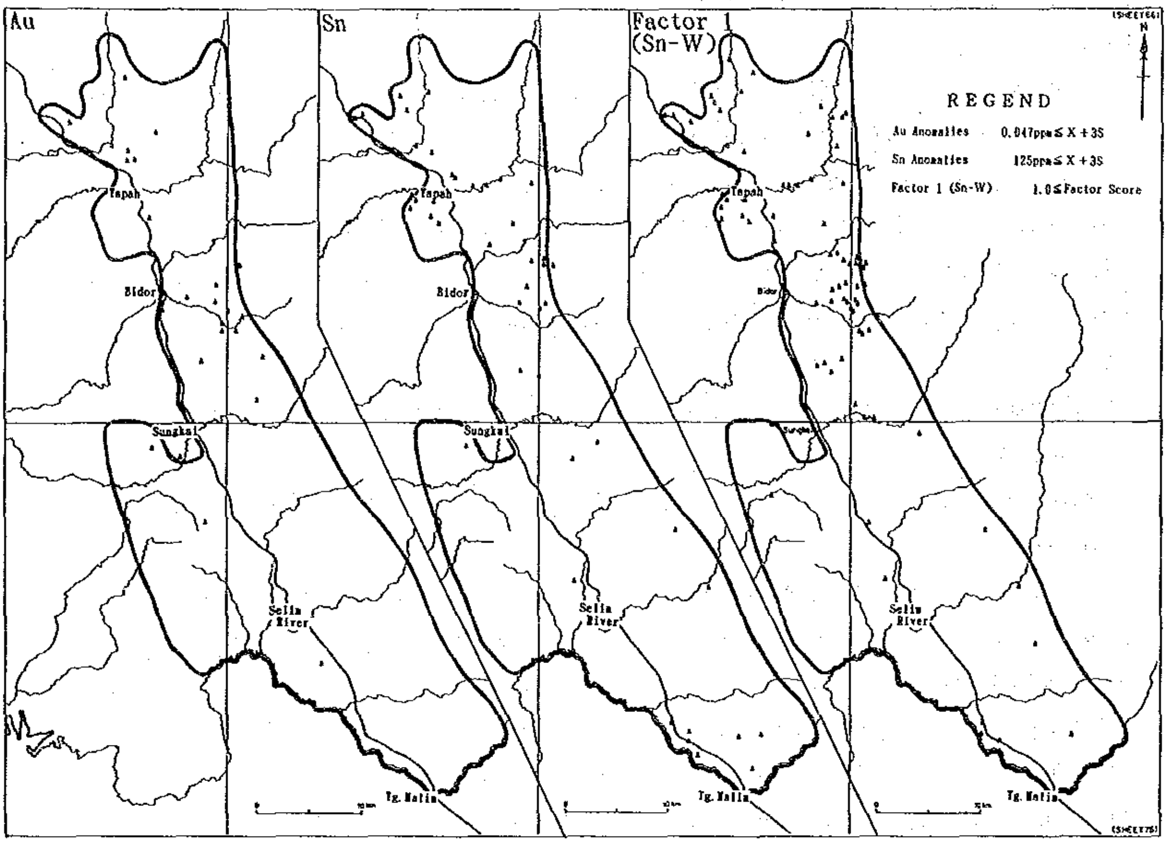

Fig. II-1-6 Distribution of anomalous values for Au, Sn and Factor 1 in Area A (Silt)

Factor analysis gives factor loadings of each element for three factors (Table II-1-4). Factor 1 is obviously controlled by Sn and W, whereas there is no clear indication of controlling elements for Factor 2 and 3 with low values of factor loading. Samples with high Factor 1 scores (more than 1.0) are distributed in the areas of the Changkat Rembian Granite, eastern part of Bidor, S. Gemuroh and over an extensive area between S. Gepat and S. Bikam (Fig.II-1-6).

1-4-4 Geochemical Soil Survey

Phase: II

Purpose: To understand geochemical nature, concentration and distribution of the certain elements, for extracting the most promissing area.

Sampling Area: Three areas (a-1, a-2 and a-3) of high potential selected by stream sediment geochemical survey of Phase I.

Sampling Method: Soil samples were collected in the three areas at 100m interval along traverse lines spaced at 200m apart. At sampling site, three holes were drilled by hand auger to a depth of 1m below humic soil. Approximately 10 liters of soil sample collected from two holes was panned at the site to produce concentrates. After checking for gold flakes the concentrates were sent for chemical analysis. The soil samples collected from remaining one hole were dried and sieved through minus 80 mesh.

Chemical Analyses: Both of concentrates and sieved samples were analyzed for eight elements (Au, Ag, Pb, Zn, Cu, As, W and Sn).

Data Processing: Since some of the samples were collected over areas covered by alluvium, the geochemical data were separated into two groups - one group containing all samples and the other excluding alluvial samples. Single component analysis was done for both of the groups by EDA method and multivariate analysis (factor analysis) was done only for alluvium excluded samples.

Results: Distributions of geochemical anomalous zones for three areas are shown in Fig.II-1-7 and they are summarized as follows:

Area a-1 (alluvium excluded samples): Au anomalous zones (more than 0.023 ppm) are distributed in the eastern, south central and western part of the area, elongated in NNW-SSE direction. Small anomalous zones of As (more than 170 ppm) are scattered north to south in the eastern part of the area. The one in the northeastern part overlaps Au anomaly.

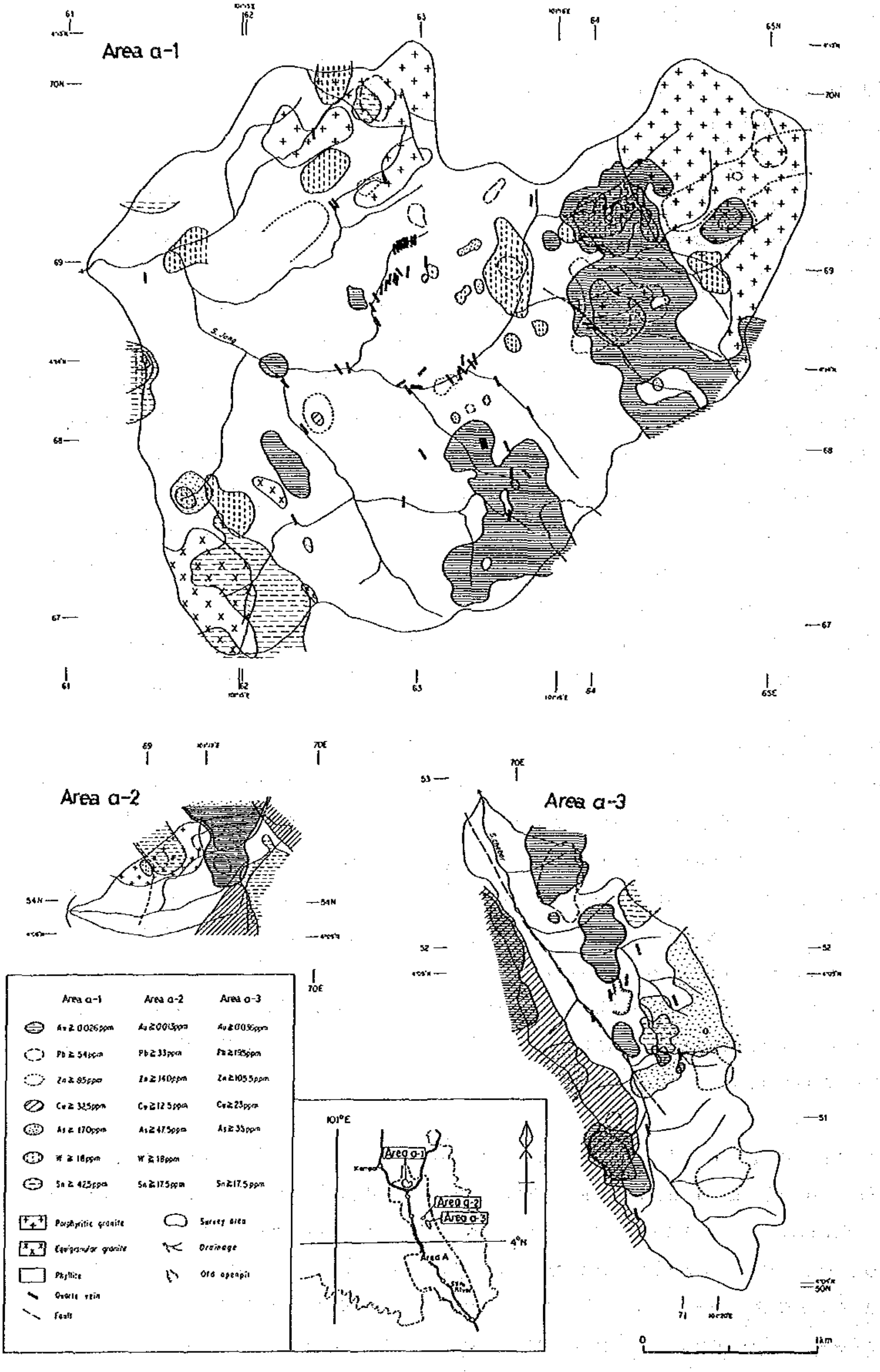

Fig. II-1-7 Geochemical anomalous zones in Area a-1, a-2 and a-3 (soil)

Each of As anomalous zone extends NW-SE or NE-SW direction.

Area a-2 (alluvium excluded samples): An extensive anomalous zone of Au (more than 0.013 ppm) is found in the central part of the area, overlapping As anomalous zone (more than 47.5 ppm).

Area a-3 (alluvium excluded samples): Extensive Au anomalous zones (more than 0.036 ppm) are found both sides of S. Chebor, extending NW-SE direction. An As anomalous zone (more than 35 ppm) is extensively distributed in the central part of the area, extending NW-SE direction.
No significant result was obtained by the factor analysis.

1-5 Trenching

Phase: II
Purpose: To confirm extension of the quartz veins found by detailed geological survey and to clarify Au anomalies obtained by the soil geochemical survey.
Location: A total of thirteen trenches were dug in the Area a-1 where many gold flakes were found in concentrates of soil samples (Fig.II-1-8). Five trenches (Nos 1 to 5) are located in the central part of the Area a-1 where numerous quartz veins were exposed and two trenches (Nos 6 and 7) are located in the alteration/mineralization zone of the middle reaches of the S. Jong. Further, six trenches were dug over the areas giving anomalous Au values in soil samples.
Sampling Method: Channel sampling of soil samples was done at 2m interval on the both sides of trench wall. Samples collected from the one side of the trench wall were panned to produce concentrates and counting of gold flakes was done at the site. They were sent for chemical analysis together with samples collected from the other side of trench wall.
Chemical Analysis: The concentrates were analyzed for Au and soil samples were analyzed for eight elements (Au, Ag, Pb, Zn, Cu, As, W and Sn).
Data Processing: Analytical values of Au were plotted on

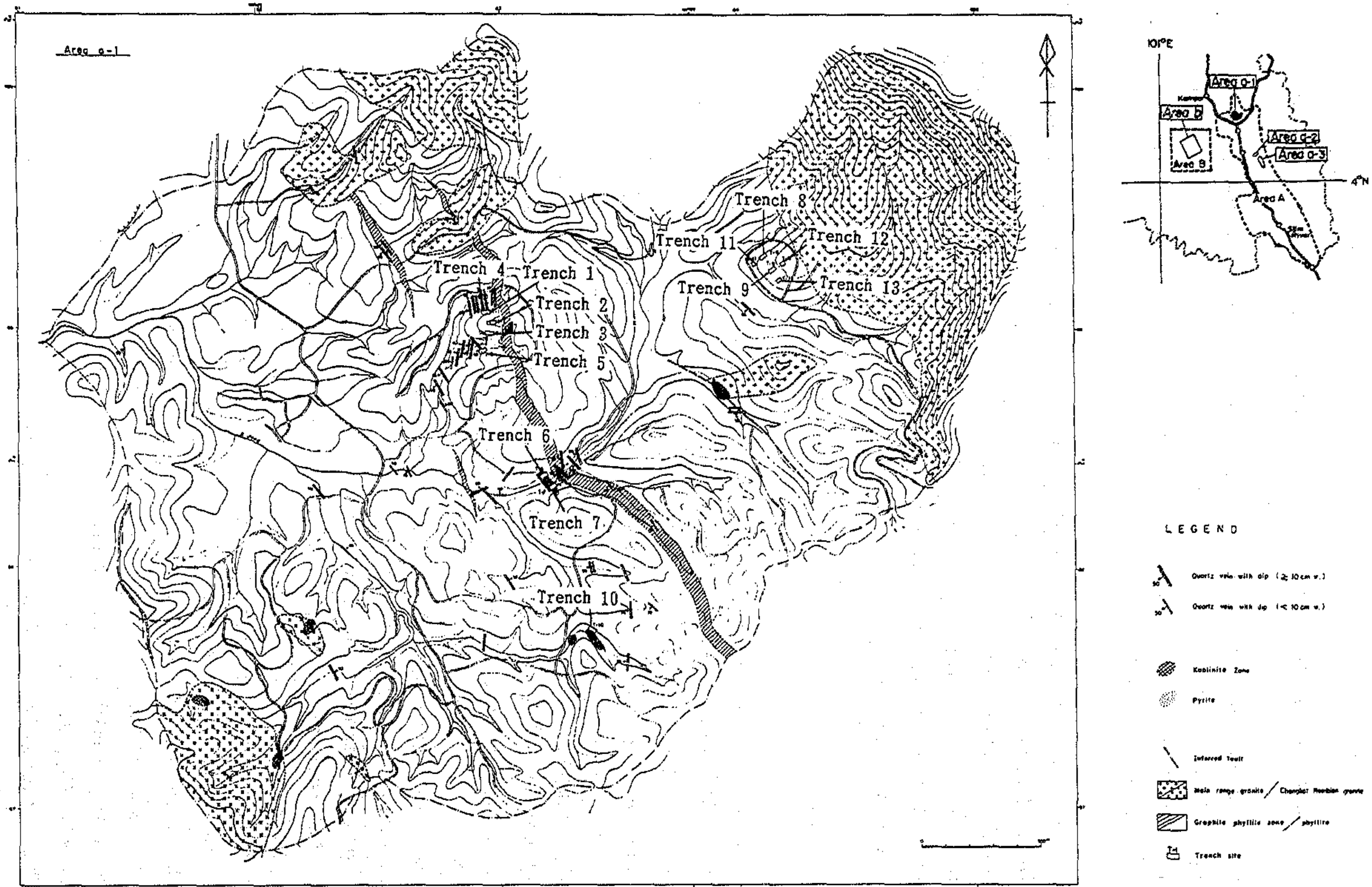

Fig.II-1-8 Location map of the trenches No.1 ～ No.13 in Area a-1