INTRODUCTION

CHAPTER 1. BACKGROUND OF PROJECT

The project forms part of a Fourth Malaysia Plan project of the department of Geological Survey of Malaysia to be implemented with bilateral aid from 1981 with the basic aim: to assess the mineral potentials of and to explore for mineral ore deposits in the Bau and Lundu-Sematan areas. The project should serve also as an impetus to revive mining activities in West Sarawak particularly in the Bau Mining District.

At the request of the Malaysian Government, the Japanese Government agreed to conduct a mineral exploration programme in the Bau area jointly with Geological Survey of Malaysia (Fig. I–1). This endeavour was inaugerated as the "Collaborative Mineral Exploration in Sarawak", Malaysia in June 1982 and is divided into 3 phases, Phase I from July 1982 to March 1983, Phase II from May 1983 to February 1984 and Phase III from June 1984 to March 1985. Though Japanese bilateral assistance became available only in July 1982, initial work by the Geological Survey of Malaysia, Sarawak including acquisition of past information, design and planning of the project, upgrading of laboratory facilities and partial geochemical sampling fieldwork was already in progress since 1981.

Phase I work which included a geochemical stream sediment and a geological survey covering 540 km^2, and a semi-detailed geological survey covering 70 km^2 in the Bau area was completed March 1983. Based on the results and recommendations of this work, 4 smaller priority areas were selected for follow-up work in Phase II. Phase II work involving detailed geological, geochemical soil, geochemical stream sediment, lithogeochemical and geophysical surveys in these areas was completed in February 1984. As a further follow-up to the findings of Phase II, detailed lithogeochemical, geochemical, geological and geophysical surveys, exploration drilling and trenching were undertaken during the Phase III work in six areas.

CHAPTER 2. RESULTS AND RECOMMENDATIONS OF PHASE II WORK

The important results of the Phase II work may be summarized as follow:

i) Geochemical soil survey and geological studies of the Gunung Ropih intrusive stock confirm the possibility of Cu-Mo mineralization of the porphyry copper type in the area.

ii) Lithogeochemical survey of the Jambusan-Tai Parit area indicates two multi-element anomalies' in the Seromah North and the Gunung Batu areas with good potentials for Au and Sb mineralizations.

iii) Investigations of some old mine workings indicate that there are good possibilities of finding ore extensions in a few of them. High grade Au mineralization was found at the Gunung Arong Bukit B, Old Working No. 2

iv) The geological and geochemical surveys in the Gunung Api-Sungai Puteh area indicate two small areas of possible primary gold mineralization.

v) The Spectral Induced Polarization survey gave strong anomalies at the Bidi ore deposit at depth and suggests that the method is suitable for locating ore bodies similar to that of this deposit.

Based on these results the following areas were recommended for further follow-up work during Phase III:

i) The Gunung Ropih Area of about 1.3 km² to be covered by an induced polarization survey and exploration drilling to confirm Cu-Mo mineralization at depth.

ii) The Seromah North and Gunung Batu areas of about 1.7 km² to be covered by a detailed geological mapping and lithogeochemical sampling programme for possible Au and Sb mineralizations as a follow-up to the multi-element 'amomalies' detected.

iii) The Gunung Arong Bakit B, Old Working No. 2 area to be mapped in detail in order to investigate the extent of the high-grade, gold mineralization found.

iv) The Sungai Sinyi and Sungai Matung Areas of about 2.0 km² to be followed up by detailed geochemical soil survey and geological mapping, and trenching to explore for primary gold mineralization.

v) The Tai Ton Area of about 70 km² to be covered by a geophysical survey to study the geology and possible Au and Sb mineralization under the cover of allumium.

vi) The Saburan and Rumoh Old Mine Working Areas to be covered by a detailed geological survey and sampling programme in order to investigate possible extensions of the known ore veins.

CHAPTER 3. OUTLINE OF PRESENT INVESTIGATION (PHASE III)

3–1 Areas Investigated

Based on the recommendations of Phase II and a subsequent meeting between officials of the Japanese and Malaysian Governments, further follow-up work during Phase III in the following areas were agreed upon (Fig. I–2):

i) The Seromah North and Gunung Batu Areas of 1.6 km²

ii) The Gunung Arong Bakit Area of 0.2 km²

iii) The Gunung Ropih Area of 1.0 km²

iv) The Sungai Sinyi and Sungai Matung Areas of 2.0 km²

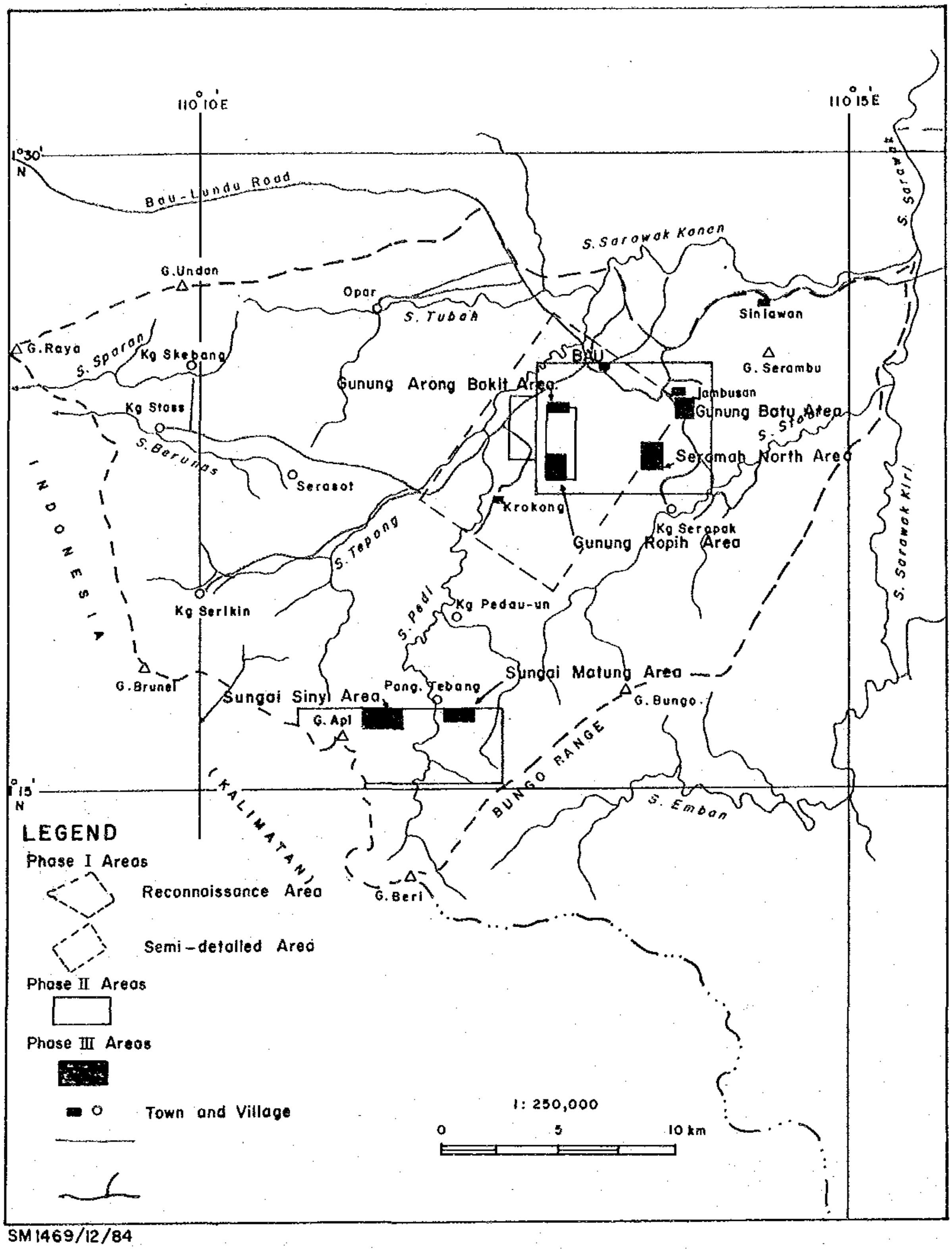


Fig. I-2 Location Map of Phase III Areas

3–2 Purpose and Method

The Seromah North and Gunung Batu Areas

The main aim in these areas is to further investigate the multi-element 'anomalies'detected for possible Au and Sb mineralizations. Detailed geological mapping and channel lithogeochemical sampling at between 50 m to 100 m intervals along preselected routes were undertaken. At each sample site, information pertaining to the colour type of limestone, structure and the number and thicknesses of calcite veins/veinlets over 1 m or more of the outcrop sampled were recorded. A total of 34.9 km were traversed and 423 rock chip channel samples collected. The samples were analysed for Au, Ag, As, Sb, Hg and Mn.

The Gunung Arong Bakit Area

The main objective in this area is to trace the extent of the ore vein of the Old Working No.2 where high grade Au mineralization was found during Phase II. By tape and compass, the exposed lateral extent and thickness of the vein were measured. 15 channel samples across the exposed part of the vein were also collected at regular intervals and analysed for their Au and Ag contents. Two other old workings in the area were also investigated in a similar fashion and 5 channel samples collected.

The Gunung Ropih Area

The main purpose in this area is to confirm that Cu-Mo mineralization of the porphyry Cu type exists in this area and to undertake a preliminary assessment of the extent of this mineralization by means of an induced polarization survey and exploratory drilling. 9.9 line km along previously prepared lines were surveyed by the induced polarization and magnetic methods and 3 holes with a total depth of 693 m were drilled in the area.

The Sungai Sinyi and Sungai Matung Areas

The main objective in these areas is to explore for primary gold mineralization. Stream sediments in the areas were systematically panned at regular intervals in order to trace the source of the alluvial gold. At certain places, the weathered soft bedrock outcrops were also panned. 10 trenches each measuring about 10 m x 1 m to bedrock were also dug in the Sungai Matung area and the soft weathered bedrock panned in an attempt to locate primary mineralization. A total of 296 panned concentrates were collected and the number of gold grains counted. Both areas were also geologically mapped and 897 geochemical soil samples collected on a grid pattern of 100 m x 25 m. The samples were analysed for Au, Ag, As, Sb, Hg and Mn.

The work carried out in Phase III may be summarized as shown in Tables I–1 and I–2.

Table I-1 Summary of Phase III Work

		Gunung Atong Bakil Area	Gunung Batu Area	Seromah North Area	Sungai Sinyi Area	Sungai Matung Area	Gunung Ropih Area
Method		Detailed Geological Survey	Detailed Geological Survey Geochemical Rock Sampling	Detailed Geological Survey Geochemical Rock Sampling	Detailed Geological Survey Panned Concentrate Sampling Geochemical Soil Sampling	Detailed Geological Survey Panned Concentrate Sampling Geochemical Soil Sampling Trenching	Detailed Geological Survey (I.P. and Magnetics)
Area Covered		0.2 km²	0.6 km²	1.0 km²	1.6 km²	0.4 km²	1.0 km²
Route Length Surveyed		1.9 km	13.9 km	20.5 km	26.4 km	7.0 km	9.9 km
Samples Collected	Rock	–	166	257	–	–	20
	Soil	–	–	–	660	237	–
	Mineralized Rock	20	–	–	–	–	–
	Panned Concentrate	–	–	–	62	234	–
Total Depth drilled/ and Number of Holes		–	–	–	–	–	693m/3 Holes
Office and Laboratory Work		Drilling Core Logging, Data Compilation and Interpretation, Geochemical Analysis and Report preparation in Office of Geological Survey of Malaysia. Geophysical Laboratory tests, report of Geophysical Surveys, Geochemical Analysis in Japan.					

Table I-2 Laboratory Study

Type of Study	Sample Type	Number	Element Analysed	Total Number of Analyses	Laboratory
Chemical Analysis	Rock	423	Au, Ag, Sb, As, Hg, Mn	2,538	GSM, Sarawak
		89	Au, Ag	178	Japan
	Ore	20	Au, Ag	40	GSM, Sarawak
		20	Au, Ag	40	Japan
	Core	80	Au, Ag, Cu, Mo	240	GSM, Sarawak
		95	Au,Ag,Cu,Mo	365	Japan
	Soil	897	Au, Ag, Sb, As, Hg, Mn		GSM, Sarawak
Polished Section	Ore	21	–	–	Japan
X-ray Diffractive Analysis	Core				GSM, Sarawak
I.P. Test	Rock/Ore	23	–	–	Japan

3–3 Project Personnel

The following personnel from the Geological Survey of Malaysia, Sarawak and the Metal Mining Agency of Japan were involved at the professional level in the implementation and report preparation for Phase III of the project:

Geological Survey of Malaysia, Sarawak

Mr. Victor Hon (Geologist, Leader, Overall Works)

Mr. Dorani bin Johari (Geologist, Geological and Geochemical Surveys)

Mr. Paul Ponar Sinjeng (Geologist, Geological and Geochemical Surveys, Report)

Mr. Wan Zawawie bin Wan Akil (Geophysicist, Geophysical Survey, Report)

Mr. Charles Chin (Geochemist, Chemical Analysis)

Miss Lucy Yap (Geochemist, Chemical Analysis)

Metal Mining Agency of Japan

Mr. Ikuhiro Hayashi (Geologist, Leader, Overall Works)

Mr. Hirofumi Taniguchi (Geologist, Geological and Geochemical Surveys, Report)

Mr. Manabu Kaku (Geophysicist, Geophysical Survey)

Mr. Kazuto Matsukubo (Geophysicist, Geophysical Survey)

Mr. Tomie Tozawa (Exploration Drilling)

Mr. Teruo Ohmori (Exploration Drilling)

Mr. Masato Hamazaki (Exploration Drilling)

3–4 Work Schedule

Phase III work commenced in June 1984 with fieldwork and ended in March 1985 with the printing of the report. Details of the work schedule is as shown in Table I–3.

Table I-3 Work Schedule, Phase III

Type of work		Area	Duration	Area Coverage km^2
Planning and preparation		All areas of Phase III	5/6/84 – 9/6/84	–
Geological Survey		Gunung Arong Bakit	10/6/84 – 16/6/84, 29/7/84 – 4/8/84	0.2
Geological and Lithogeochemical Surveys		Gunung Batu	17/6/84 – 23/6/84	0.6
		Seromah North	24/6/84 – 6/7/84	1.0
Geological, Geochemical Soil and Panned Concentrate Surveys, and Trenching		Sungai Sinyi	7/7/84 – 4/8/84	1.6
		Sungai Matung		0.4
Geophysical Surveys (I.P. and Magnetics)		G. Ropih	10/6/84 – 24/7/84	1.0
Exploration Drilling			18/7/84 – 4/11/84	
Office and Laboratory Work	Core logging, Data Compilation, Interpretation, and Geochemical analysis	All areas of Phase III	5/8/84 – 25/10/84	
	Geochemical Analysis and Report Preparation	All areas of Phase III	26/10/84 – 5/3/85	

PRESENT INVESTIGATION

CHAPTER 1. SEROMAH NORTH AND GUNUNG BATU AREAS

Results of the lithogeochemical survey of limestone in the Jambusan-tai Parit area undertaken during Phase II indicated three anomalous areas based on trend analysis. These areas showed good over-lapping of the 'high anomalies' of the anomaly surface maps for As, Sb, Hg and Mn. They are the Gunung Krian-Gunung Badud, Gunung Batu and Seromah North areas. The Gunung Krian-Gunung Badug area coincides with the area where most known old mine workings for Au and Sb are located. The other two areas were therefore considered important and merit further exploration work for possible Sb and Au mineralizations. During the present investigation (Phase III) these two areas were geologically mapped and lithogeochemically sampled in detail.

1–1 Method of Investigation

The two limestone areas were traversed by tape and compass starting from known points. Exposures at intervals of about 50–100 m along preselected routes were mapped and sampled. Each sample consists of channel rock chips collected over 1 m or more of the exposure. The number of calcite veins/veinlets observed over this channel distance were counted into 5 classes according to thickness of greater than 30 mm, 20–30 mm, 10–20 mm, 5–10 mm and 2–5 mm. Information pertaining to the colour type of the limestone and structure were also recorded. In the manner described, 13.9 km of traverse were made and 166 channel rock chip samples collected in the Gunung Batu area, and 20.5 km of traverse made and 257 channel rock chip samples collected in the Seromah North area (Appendices 1 and 2). Detail geological maps of the areas were prepared. The channel rock chip samples were analysed for Au, Ag, As, Sb, Hg and Mn after crushing, quartering and grinding (Appendices 3, 4 and 5).

The geochemical analytical results for Ag, As, Sb, Hg and Mn were statistically treated according to the method of Sinclair (1974) and presented as contoured maps. Au values were arbitrarily classified and also presented as contoured maps.

1–2 Geology

The Seromah North and Gunung Batu areas underlain by the Bau Limestone. In order to study the geological structure, the limestone was informally classified into 7 colour types LI, LII, LIII, LIV, LV, LVI and LVII in descending order of degree of grey colour tone which roughly corresponds to the purity of the limestone. Figures II–1 and II–3 are geological maps of the two areas constructed by using the results of this limestone classification. Generally, darker coloured limestone predominates in the lower part of the Bau Limestone, especially in the Seromah North area. As most of the limestone shows gentle bedding in comparison with slope angles of hills, the limestone observed at the lower slopes stratigraphically represents the lower part of the Formation.

1–2–1 Seromah North Area

In the Seromah North area, comparatively darker coloured limestone types LI – LIV are predominantly developed, interbedded with a smaller amount of the lighter-coloured limestone types. Black limestone (LI) containing abundant argillaceous materials is dominant in the flat area of the southern part. Comparatively lighter-coloured limestones of types LV, LVI and LVII on the other hand, are dominant around the tops of hills.

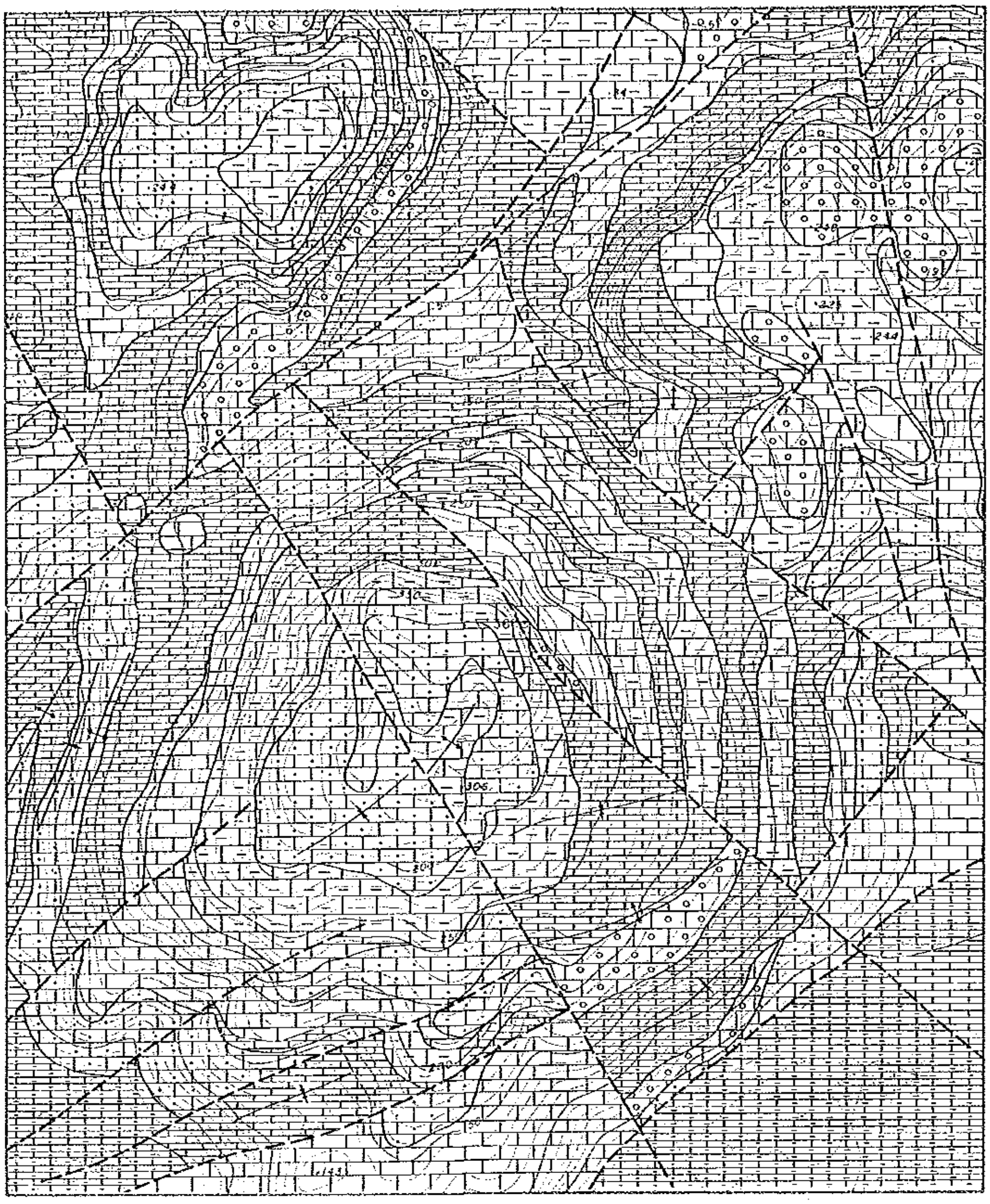
The main geological structures in the Seromah North area are faults with approximately NE-SW and NW-SE trends. The NE-SW faults which are developed in the northwestern and south-eastern parts of the area largely affect the distribution of various limestone types. The NW-SE parallel faults developed in the central and southwestern parts exert little influence over the distribution of the limestone types as they are only minor in extent. Some partially developed folds with axial trends of approximately E-W to NNE-SSW are also inferred in the area but they had little effect on the regional structure. Some of the fold axes are obviously cut by the faults.

Abundant calcite veinlets, thought to be indicative of possible underlying mineralization, are observed in the limestone. Figure II–2 shows the distribution of calcite veinlets contoured based on the number of calcite veinlets (2 mm – 30 mm thick) recorded over 1.0 m of limestone exposure at each lithogeochemical sample site. The distribution of calcite veinlets is generally seen to reflect the main NE-SW and NW-SE faults. Most barren calcite veins more than 10 cm thick appear to occur along the NE-SW fault observed in the northwestern part.

1–2–2 Gunung Batu Area

Except for the darker coloured limestone exposed in the flat area at the southwestern corner, the greater part of the Gunung Batu area is underlain by relatively lighter-coloured limestone of types LV, LVI and LVII. Around the peak of Gunung Batu, the lightest coloured limestone type LVII is developed and this gradually changes to darker coloured limestone types stratigraphically downwards.

The main geological structures are faults with approximately E-W to ENE-WSW and NW-SE to WNW-ESE trends. E-W and ENE-WSW faults influence largely the apparent distribution of the limestone types in the area but the others have little influence. Two anticlinal folds with axial



Scale
0 100 200 300m

LEGEND

BAU LIMESTONE

VII Very pale grey, pure limestone.

VI Pale grey, pure limestone.

V Light grey limestone.

IV Grey to brownish grey limestone.

III Dark grey to dark brownish grey limestone.

II Greyish black to brownish black limestone.

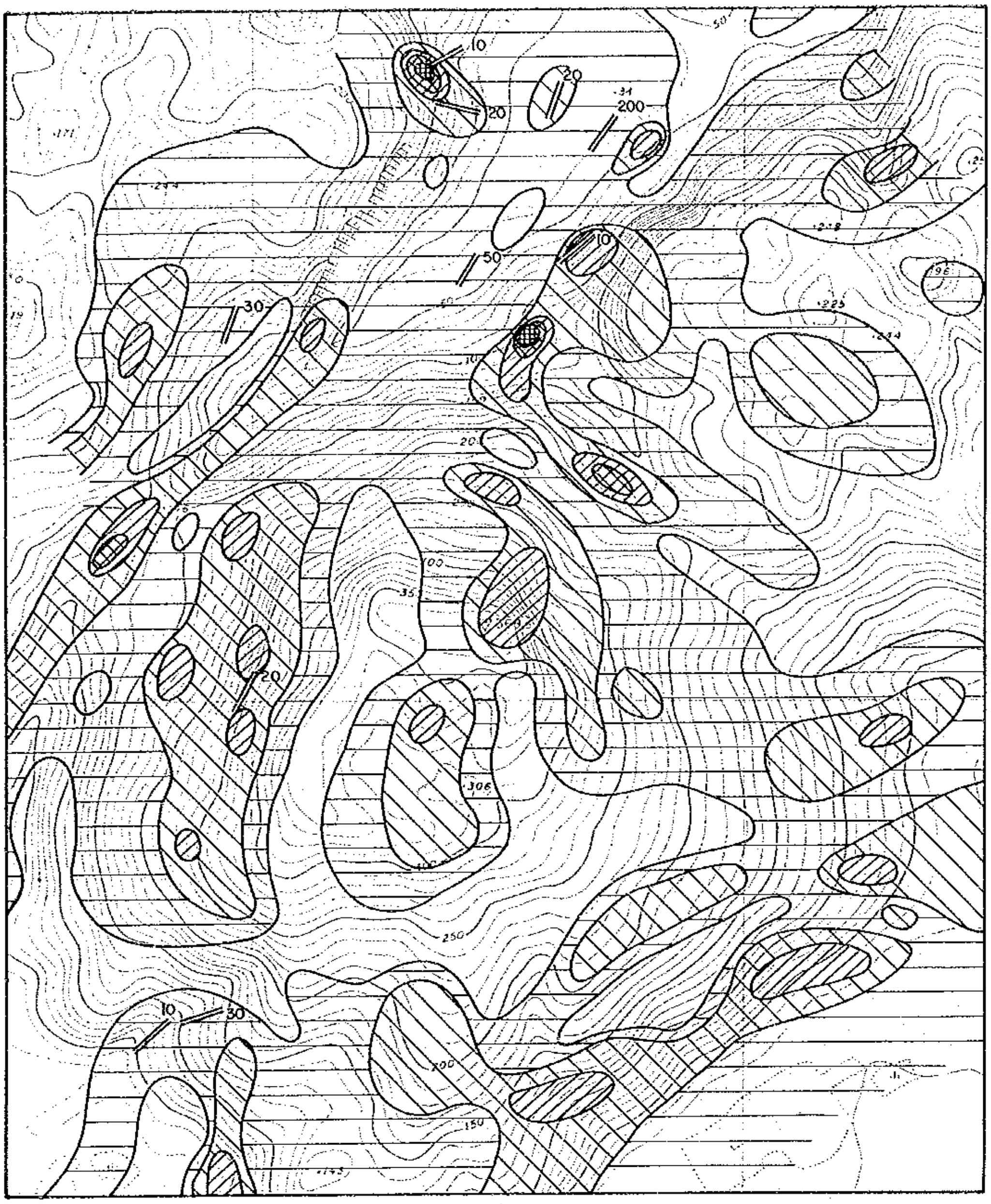
I Black argillaceous limestone.

Fault

Anticlinal and synclinal axes.

SP 3119/12/84

Fig. II-1 Geology of Seromah North Area



Scale

0 100 200 300^m

Number of calcite veinlets (2^{mm}–30^{mm} thick) over 1.0^{mm} of limestone exposure

= 0 < < 5 ≦ < 10 ≦ < 15 ≦ < 20 ≦

Calcite vein more than 10^{cm} thickness

50

Fig. II-2 Number of Calcite Veinlets in Limestone, Seromah North Area

trends of approximately NW-SE to N-S, are found north of the central part of the area. The axes of the folds are cut by faults.

Calcite veinlets are commonly observed in the Gunung Batu area together with some thick calcite veins (Fig. II–4). In either case, they are not mineralized and appear to be not related to any structure.

1–3 Results of lithogeochemical Survey

A total of 423 channel chip samples of limestone were collected over the two areas investigated, 257 in the Seromah North area and 166 in the Gunung Batu area. The samples were analysed for Au, Ag, As, Sb, Hg and Mn (Appendix 3 and 4). Except for the analytical data for Au which was arbitrarily classified because of the limitation of the analytical method used, the data for the other elements were statistically treated using Sinclair's Method (1974) and the various statistical levels read off as shown in Figures II–5 and II–6. The distributions of the various elements are presented as contoured maps.

1–3–1 Seromah North Area

The distributions of the six elements analysed are shown in Figures II–7.

Gold (Au). 20 samples gave higher class values for Au, 18 analysed 0.2 ppm and 2, 0.3 ppm. These are distributed as discontinuous patches aligned approximately along a NE trend in the northwestern part of the area.

Arsenic (As). 11 anomalous values for As ($\geqslant \overline{X} + 2S = 30$ ppm) show up as small scattered anomalies in the northwestern part 2 of these are highly anomalous ($\geqslant \overline{X} + 3S$) with values of 79.0 and 93.0 ppm. There is however, a weak NE trend of values greater than or equal to X + S in this part. Two smaller trends are distinguishable in the south and a weak NW trend just north of the central part.

Antimony (Sb). 34 samples gave anomalous values for Sb ($\geqslant \overline{X} + 2S) = 9.5$ ppm), 6 of which are highly anomalous ($\geqslant \overline{X} + 3S = 23.5$ ppm). Most of the anomalous values are also concentrated along a NE trend in the northwestern part of the area. A minor NW trend of anomalous values just north of the central part may also be distinguished.

Manganese (Mn). 10 anomalous values for Mn ($\geqslant \overline{X} + 2S = 280$ ppm) show up along a NE trend in the northwestern part of the area.

Silver (Ag). Anomalous values for Ag ($\geqslant \overline{X} + 2S = 0.22$ ppm) are detected as small scattered anomalies. Four contiguous samples in the northern part gave anomalous values.

Mercury (Hg). Anomalous values for Hg ($\geqslant \overline{X} + 2S = 400$ ppb) appear as small scattered anomalies with no distinguishable trend.

1–3–2 Gunung Batu Area

The distributions of the six elements analysed are as shown in Figure II–8.

Gold (Au). Only one sample gave a value (0.3 ppm) greater than the detection limit of 0.1 ppm.

Arsenic (As). 27 samples are anomalous for As ($\geqslant \bar{X} + 2S = 8.0$ ppm) out of which 8 are highly anomalous ($\geqslant \bar{X} + 3S = 17.0$ ppm). A NE zone of anomalous values in the northern part of the area may be distinguished. A minor concentration of anomalous values is also apparent in the southeastern corner of the area.

Antimony (Sb). 55 samples are anomalous for Sb ($\geqslant \bar{X} + 2S = 3.2$ ppm). Of these, 19 are highly anomalous ($\geqslant \bar{X} + 3S = 8.0$ ppm). The distribution pattern of the anomalous values is somewhat similar to that of As.

Manganese (Mn). 43 samples are anomalous for Mn ($\geqslant \bar{X} + 2S = 18.5$ ppm) and these are distinctly concentrated in the northwestern part of the area.

Silver (Ag). 15 samples are anomalous for Ag ($\geqslant \bar{X} + 2S = 0.37$ ppm) and these show up as small scattered anomalies.

Mercury (Hg). Anomalous values for Hg ($\geqslant \bar{X} + 2S = 100$ ppb) show up as 2 discontinous, narrow NNW zones.

1–4 Discussion

1–4–1 Seromah North Area

Analytical results of the lithogeochemical samples show higher background values for As, Sb, Mn, Ag and Hg than those of the Gunung Batu area. Anomalous values for As, Sb and Mn show good correlation and are mostly concentrated along a NE zone parallel to a fault in the northwestern part of the area. Though these values do not form a contiguous anomaly, the trend of this anomalous zone is apparent from the distribution of the values higher than background. Higher class values of 0.2 ppm Au are also concentrated along this zone which is underlain chiefly by limestone of the LI, LIII and LV colour types. Another smaller zone enriched in As and Sb parallel to a NW fault just north of the central part of the area may also be distinguished. The distribution of calcite veinlets appears to be approximately correlatable with the two anomalous zones. The distribution of the calcite veins thicker than 10 cm, particularly, is confined to the NE anomalous zone.

The distribution of Ag except for minor concentrations in the northeastern extremity of the

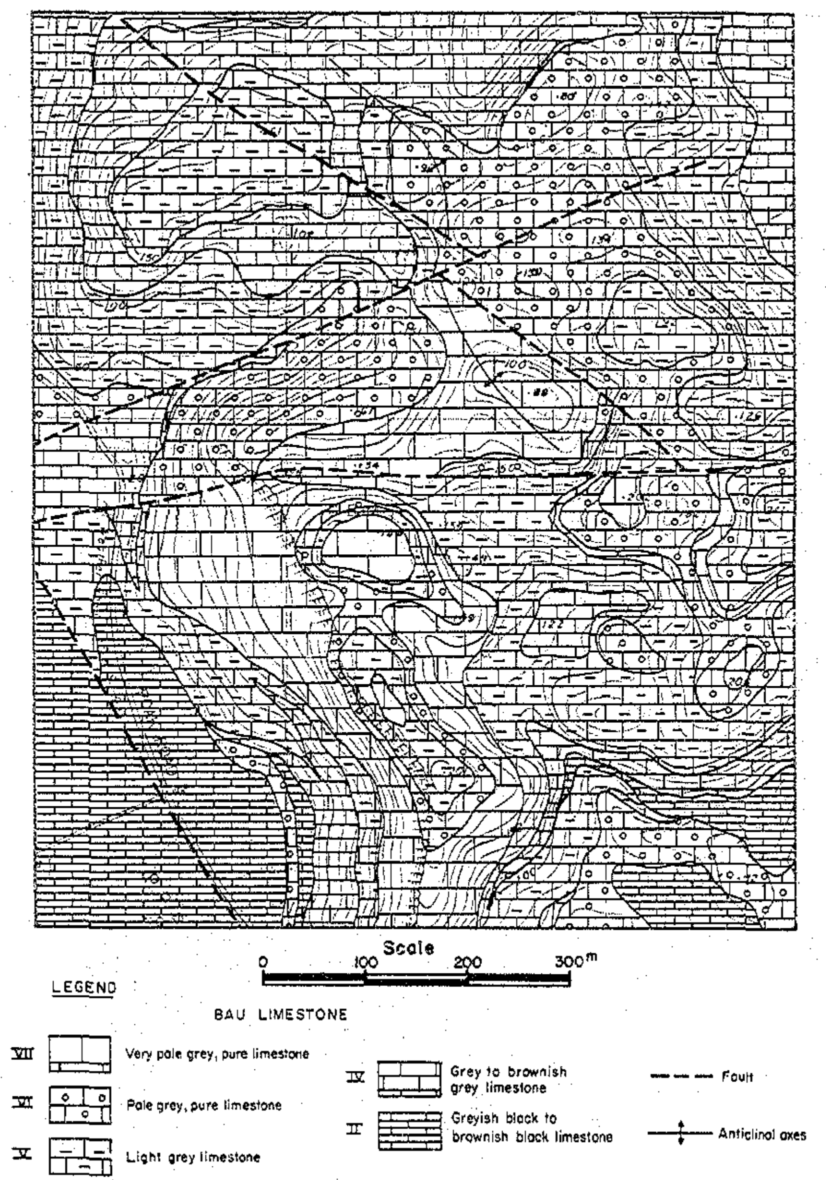


Fig. II-3 Geology of Gunung Batu Area

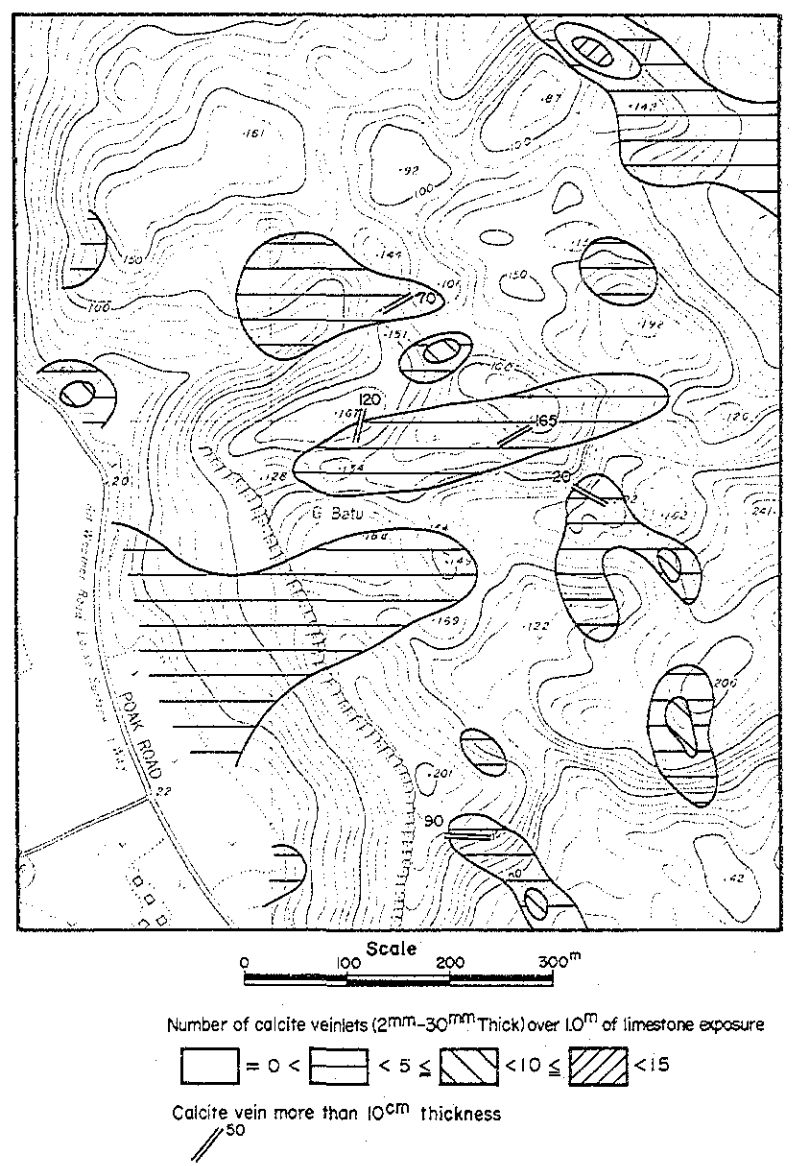


Fig. II-4 Number of Calcite Veinlets in Limestone, Gunung Batu Area

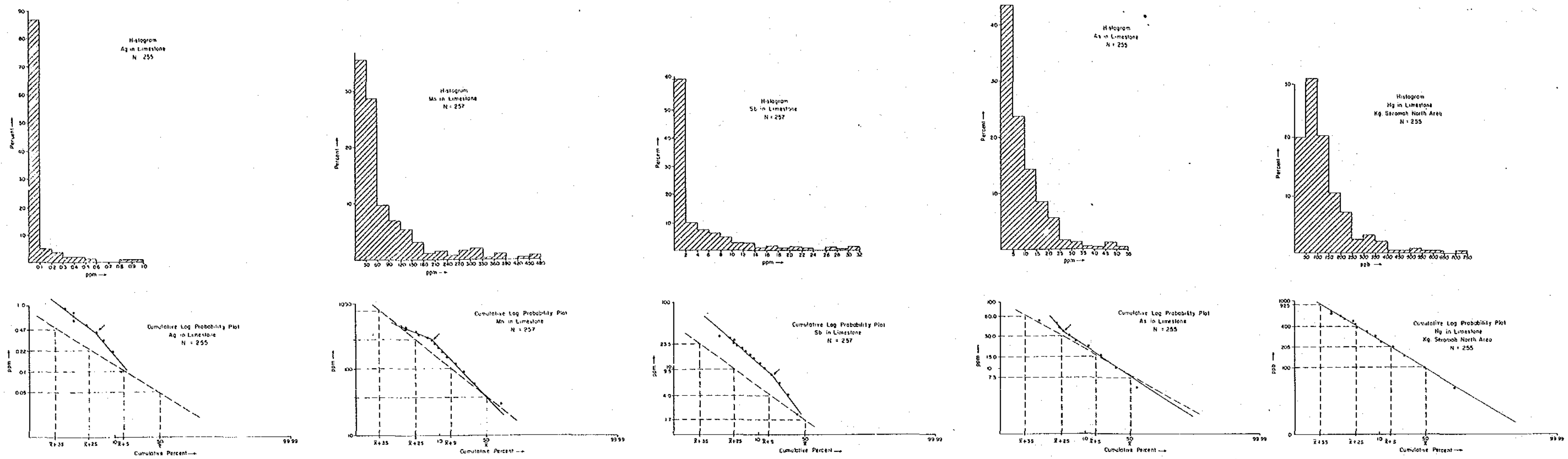


Fig. II-5 Histograms and Cumulative Log Probability Plots, Seromah North Area

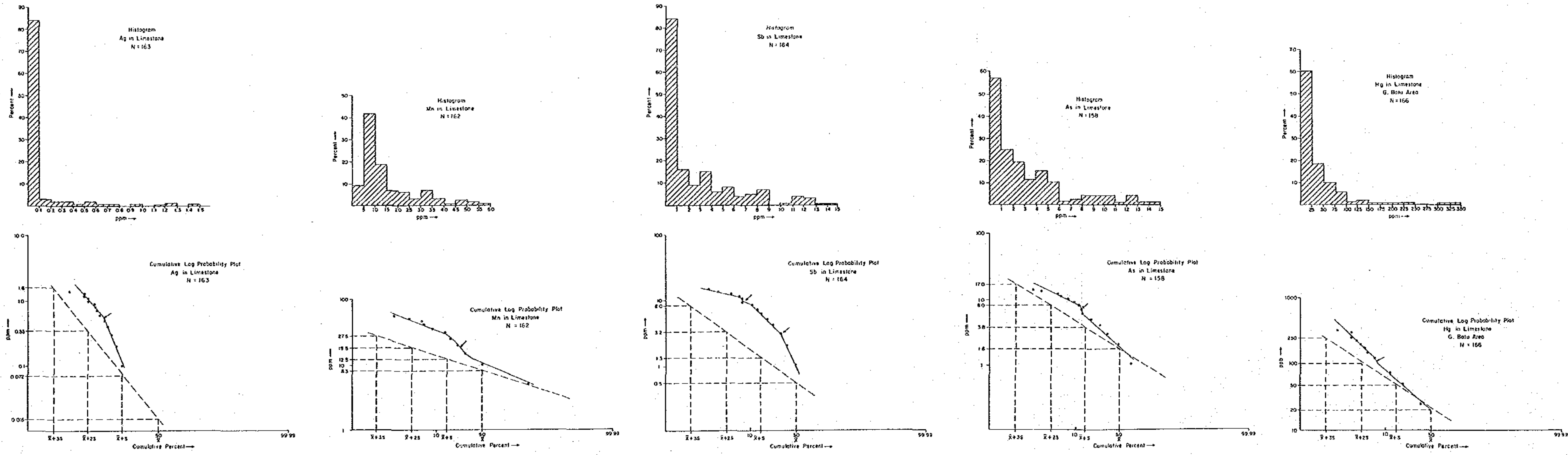


Fig. II-6 Histograms and Cumulative Log Probability Plots, Gunung Batu Area

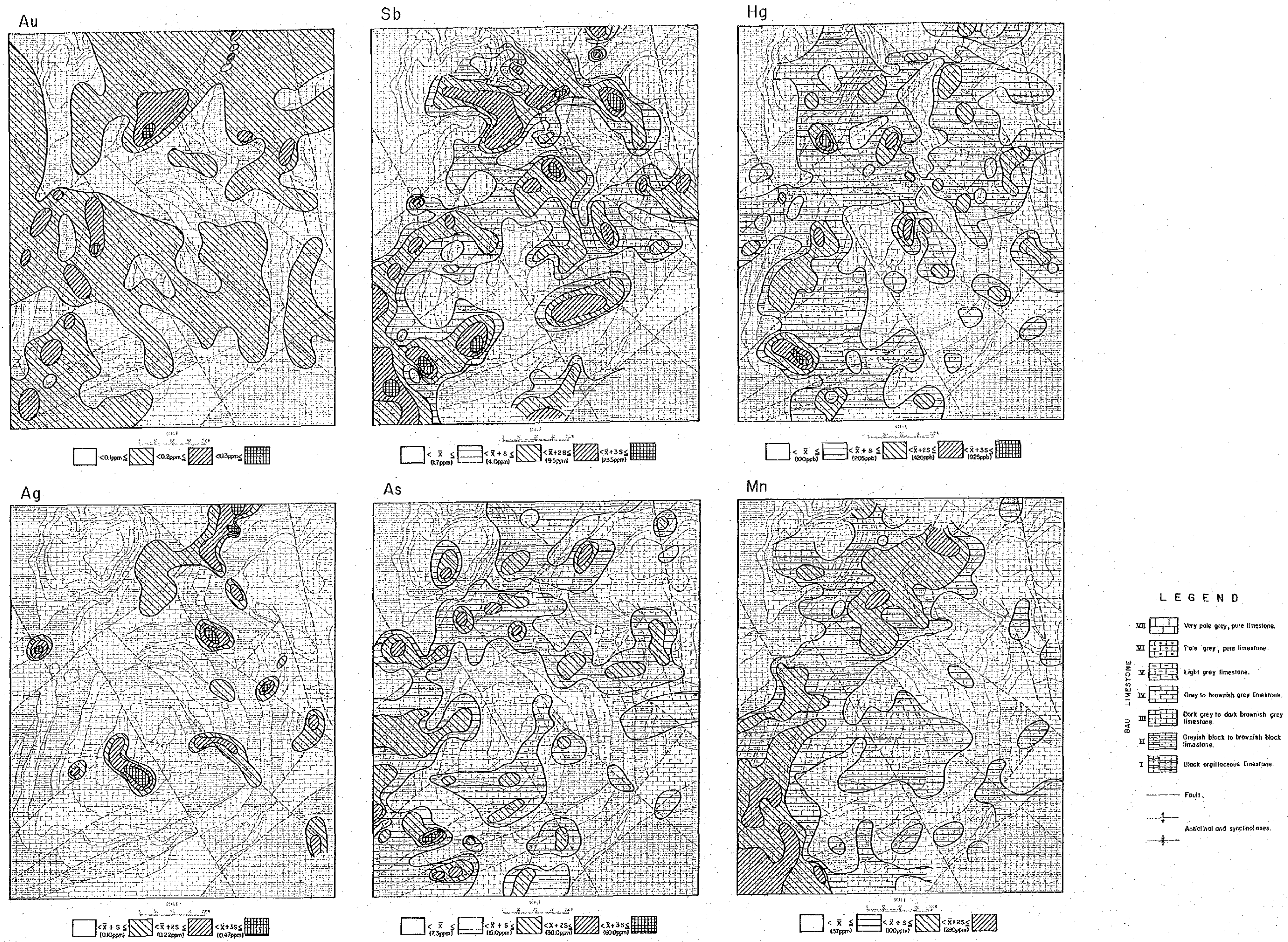


Fig. II-7 Au, Ag, Sb, As, Hg and Mn in Limestone, Seromah North Area

NE anomalous zone and along the NW fault, bears no obvious relationship to the geology. The distribution of values greater than background for Hg somewhat approximates the pattern for As, Sb, Mn and the calcite veinlets.

It many be said in conclusion that two anomalous zones of metal enrichment, a NE zone in the northwestern part of the area and a minor NW zone just north of the central part exist in the area. These zones are fault related and particularly the NE zone holds possibility for Au and Sb mineralizations. Very detailed mapping and rock sampling are recommended as further follow-up work in former area.

1–4–2 Gunung Batu Area

The analytical results of the lithogeochemical samples show good correlation of As, Sb and Mn. Anomalous values for these elements appear to form a ENE trending zone in the northwestern part of the area. In particular, anomalous values for Mn equal or greater than $\overline{X} + 2S$ (12.5 ppm) show up as an extensive anomaly while those for As and Sb form narrow zones chiefly on the northwestern side of a major ENE fault. The ENE anomalous zone is underlain chiefly by limestone of the LIV and LV colour types. The southeastern corner of the area underlain mainly by limestone of the LII and LV colour types is also somewhat enriched in As, Sb and Mn. Background values for these three elements appear to be mainly confined to the LVII colour type which occur chiefly on the southern side of the ENE fault. There is no apparent correlation among Au, Ag, Hg, limestone colour types and the geological structure. The distribution of calcite veinlets also appears to bear no relationship to the elemental distribution, the limestone colour types and the structure.

It may be summarized that an As-Sb-Mn enriched zone trending ENE exists in the northwestern part of the area. The zone appears to be confined largely to the northwestern side of a major ENE fault and is underlain mainly by limestone of the LIV and LV colour types. Since Au as shown in Phase II is associated with As, Sb and Mn, it is inferred that the ENE anomalous zone may have some potential for Au and Sb mineralization.

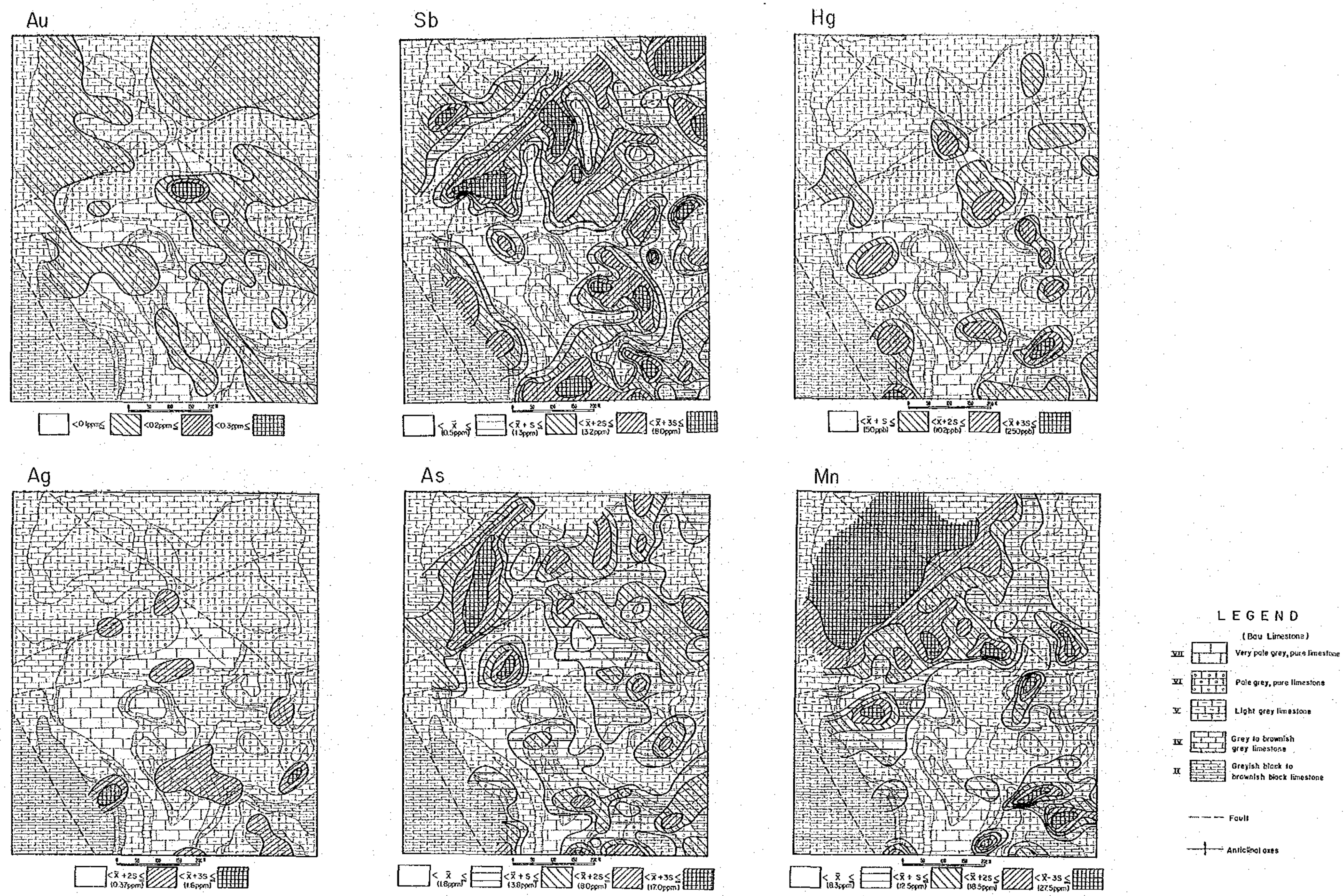


Fig. II-8 Au, Ag, Sb, As, Hg and Mn in Limestone, Gunung Batu Area

CHAPTER 2. GUNUNG ARONG BAKIT AREA

Detailed geological investigation of old mine workings during Phase II shows that a high grade gold ore vein exists in the Gunung Arong Bakit B area, at a small old mine working site. Channel samples were analysed to contain an average of 57.4 g/t Au and 30.8 g/t Ag. The area of about 0.2 km^2 was further investigated in detail during the present investigation in order to trace the lateral extension of this vein and to determine its ore grade. Two other veins in the area were also similarly investigated.

2–1 Method of Investigation

Detailed geological mapping of the area particulary in the vicinity of three small old mine working sites denoted as Gunung Arong Bakit B, Old Working No. 1, 2 and 3 was undertaken. The high grade Au ore vein found during the Phase II work is located at Old Working No.2. Using tape and compass, the locations of the workings were fixed on a prepared contoured map of the area relative to the road just south of the workings. The lateral extensions of the veins at the old workings were then traced and mapped by tape and compass. Channel chip samples across the vein at regular intervals of about 10 m were collected wherever possible and analysed for Au and Ag. In the manner described, a total of 1.9 km route length was traversed and 20 channel chip samples taken.

2–2 Geology

The Gunung Arong Bakit area lies just adjacent to the contact with the Gunung Juala quartz porphyry intrusive of granodioritic composition. A few discontinuous lensoidal-shaped quartz veins are known to occur in marble in the area. Three of these veins which were worked previously for Au were investigated in detail (Fig. II–2). They are located within the same marble horizon on the steep southern slope of Gunung Arong Bakit between the 150 and 180 m contour levels. The vein at the Old Working No. 2 dips at about 10° towards the NNE. At the Old Working No. 3, the vein dips about 15° towards the NW. The vein consist of chiefly very hard, quartz with some wollastonite and calcite. In places, chalcopyrite, malachite and pyrite are observable as blebs confined within discontinuous streaks. Fine gold is observable in polished slabs of a sample from one spot at the site of the Old Working No. 2 associated with chalcopyrite and tetrahedrite. The vein of Old Working No. 2 is traceable along a strike length of about 71 m with an average thickness of 4.3 m (Fig. II–10). It is faulted off at its western extremity. Its eastern end thins out. The vein at Old Working No. 1 has a maximum thickness of at least 2 m but pinches out rapidly within a strike distance of 8 m. Similarily, the vein at Old Working No. 3 with a maximum thickness of 1 m, pinches out laterally within a distance of about 34 m along strike.

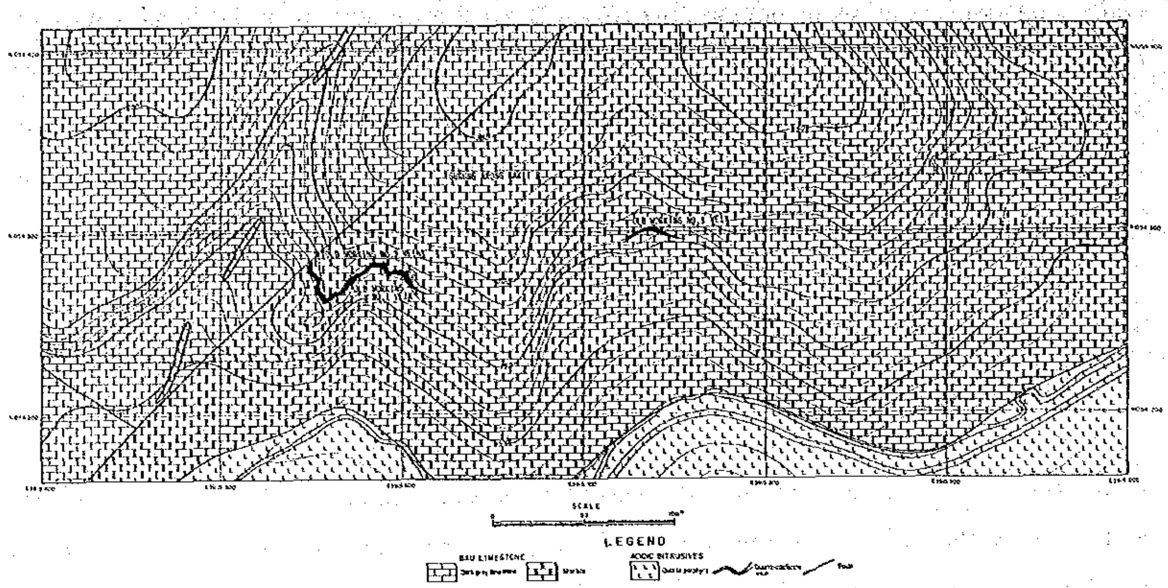


Fig. II-9 Geology of Gunung Arong Bakit Area

2–3 Chemical Analytical Results and Discussion

20 channel rock chip samples from the veing of Old Working No. 2 and 3 were analysed for Au and Ag and their results are as shown in Table II–1.

The analyses show that the gold and silver contents of the veins are highly variable within short distances both laterally and vertically. This also suggest that sampling may not be truly representative as the vein exposure is generally very hard and smooth and sampling tended to be mostly along fracture edges. Probable discrepancies may also result from the relatively small amounts of sample analysed. However, the results show that the weighted average grades calculated over the whole strike length of about 71 m of the Old Working No. 2 vein with an average thickness of 4.3 m are 6.3 g/t Au and 10.2 g/t Ag. Using a measured specified gravity of 2.61 and assuming a down dip extension equal to and half the strike length, the reserves may be calculated to be approximately 55,800 and 27,000 tonnes respectively. The grades are considered to be slightly below the economical grade because of mining and ore processing difficulties on account of the terrain and hardness of the ore. Assuming a cut-off mineable grade of 10 g/t Au, the average grade of the section of the vein with a strike length of 26.4 m and an average thickness of 5.1 m, represented by the samples between JR0503 and JR0530 inclusive, may be calculated to be 14.7 g/t Au and 21.4 g/t Ag. Based on the same assumptions of the down-dip extension, the corresponding reserves may be calculated to be 9,200 and 4,600 tonnes (Table II–2).

From the work undertaken in the area, it is speculated that other similar gold-bearing quartz veins probably exist in the areas underlain by marble immediately west and north of the Gunung Juala intrusive. Locating such veins would require very detailed mapping and geochemical rock sampling.

Table II-1 Chemical Analysis, Channel Chip Samples, Gunung Arong Bakit Area

	Sample No.	Thickness of vein at sampling site (m)	Channel sample width (m)	Au g/t	Ag g/t
Old Working No. 2 Vein	JR 0532	0.2	0.2	1.00	2.30
	JR 0531	1.8	1.8	0.86	3.00
	JR 0530	2.4	2.4	1.04	2.4
	JR 0502	2.0	2.0	6.25	15.5
	JR 0501	4.2	1.8	14.67	107.1
	JR 0512		1.3	1.50	165.6
	JR 0513		1.1	2.27	16.2
	JR 0515	5.4	2.2	1.09	2.1
	JR 0516		3.2	38.64	10.5
	JR 0503	6.0	6.0	11.88	23.8
	JR 0505	4.6	4.6	0.33	2.4
	JR 0508	5.5	5.5	tr	tr
	JR 0509	5.0	5.0	1.00	8.4
	JR 0510	5.6	5.6	0.67	3.2
	JR 0514	2.0	2.0	0.83	3.3
Old Working No. 3 Vein	AR 502	0.4	0.2	14.09	83.0
	AR 503		0.2	1.76	129.1
	AR 501	0.3	0.2	0.94	35.1
	AR 505	1.0	1.0	0.16	0.8
	AR 504	0.2	0.2	6.03	7.3
(Au) tr – trace (< 0.01 g/t), (Ag) tr – trace (< 0.1 g/t)					

Table II-2 Average Grades, Old Working No. 2 Vein, Gunung Arong Bakit Area

Vein	Strike length (m)	Weighted average thickness	Weighted average Au g/t	Weighted average Au g/t	Reserve assuming down-dip extent equal to strike length (s.g. = 2.61)	Reserve assuming down-dip extent half of strike length (s.g. = 2.61)
Old Working No. 2 Vein	70.6	4.29	6.31	10.24	55,800 t	27,900 t
	26.4	5.08	14.68	21.44	9,200 t	4,600 t

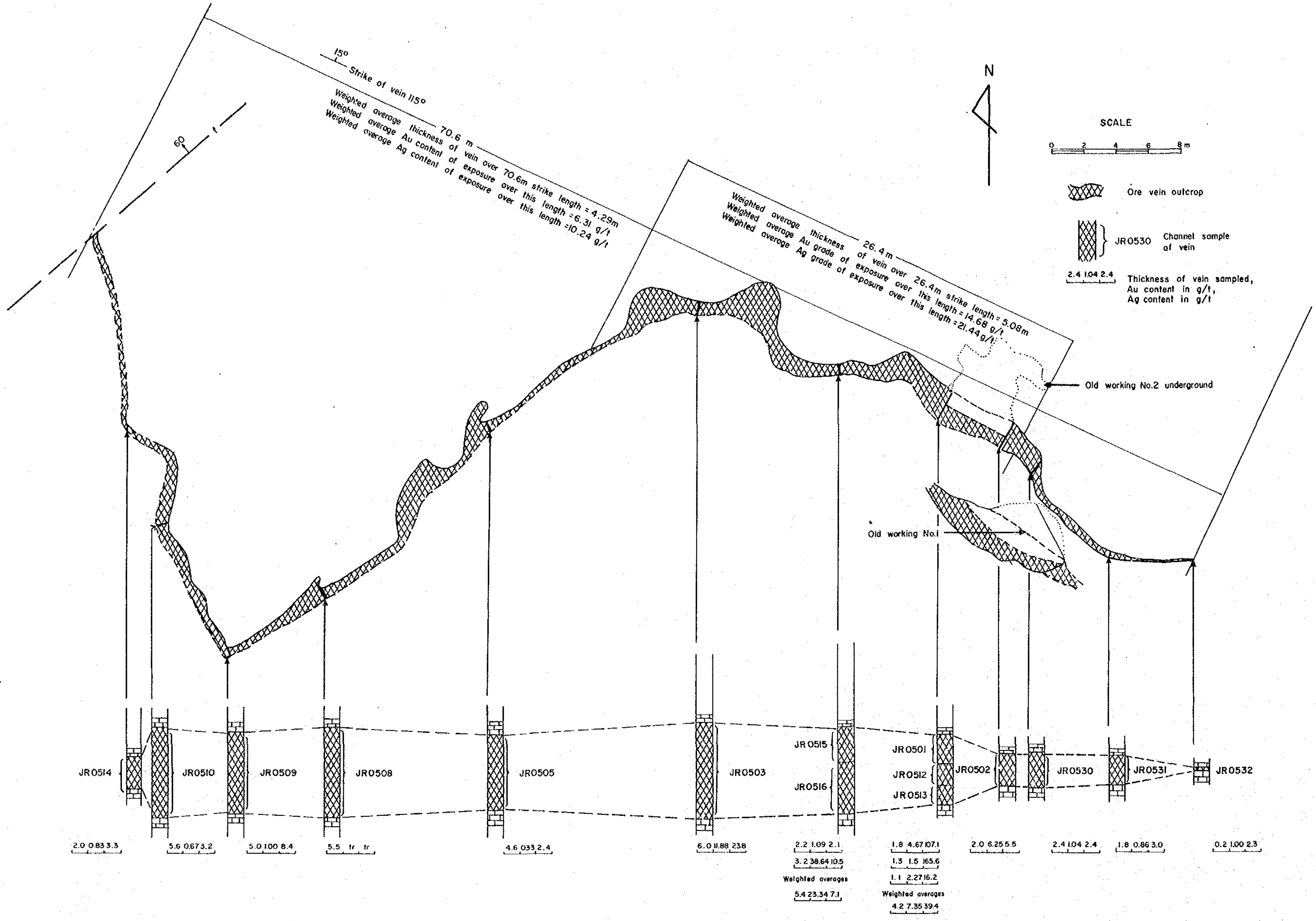


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Fig. II-10 Extention of Old Working No. 2 Vein, Gunung Arong Bakit Area

CHAPTER 3. SUNGAI SINYI AND SUNGAI MATUNG AREAS

3–1 Method of Investigation

In the Sungai Sinyi and Sungai Matung areas, detailed geological mapping, geochemical soil sampling, panned concentrate sampling and trenching were carried out as a follow-up to the anomalous amounts of placer gold found by panning and the favourable field observations made in these areas during Phase II. The geological mapping work was conducted at the same time as the geochemical soil, stream sediment and panned concentrate sampling. Soil was also found useful in identifying the parent rock type because outcrops are limited by deep weathering in the areas.

The geochemical soil sampling was conducted on a grid pattern of 100 m by 25 m (appendices 6 and 7). A total of 897 samples of the B horizon were collected using steel gouge augers. 659 are from the Sungai Sinyi area and 238 from the Sungai Matung area. After drying, grinding, quartering and rolling, the samples were analyzed for Au, Ag, Sb, As, Hg and Mn. Analytical results are shown in Appendix 7 and 8. Contoured maps showing the metal distributions were constructed for the Ag, Sb, As, Hg and Mn after the same statistical treatment of the analytical data as adopted for the Seromah North and Gunung Batu Areas. Au values as in the case of these areas were arbitrarily classified and also presented as contoured maps.

Panning of the stream sediments was initially undertaken around the anomalous zones roughly delineated by the panned concentrate survey carried out during Phase II. Panning of the alluvium and highly weathered rock from the river banks was undertaken after the anomalous zones were narrowed down by the stream sediment panning.

Trenching was done along the middle reaches of the Sungai Matung where gold grains are anomalously concentrated in the stream sediments. Locations, directions and lengths of 13 trenches were decided, taking into consideration the geology, especially the trends of the sheared zones in which gold mineralization was expected, and the results of the panning. Though a total length of 120 m of trenches were dug, only a total of 100.7 m in length of the 11 trenches were geologically mapped and sampled, as 2 trenches were flooded and destroyed by heavy rain. Panning of the weathered rock, clay and alluvium in the trenches was also carried out simultaneously.

3–2 Geology

3–2–1 Sungai Sinyi Area

As shown in Figure II–11, the Sungai Sinyi area is underlain by 3 major units, the Cretaceous Pedawan Formation, Tertiary acidic intrusives and recent alluvium.

The Pedawan Formation consists of bedded alternations of shale, mudstone, siltstone and sandstone, with moderate to steep bedding and a ENE strike. The Formation in the area is characterized by folds with ENE axial trends.

The Tertiary acidic intrusives occurring as dikes are found mainly on both sides of Sungai Sinyi elongated along the same strike as that of the Pedawan Formation. A dike with a width of 200 to 300 m forms the hill in the southern side of Sungai Sinyi whereas the narrower dike in the northern side is not topographically distinguishable. The intrusive rock is described as a dacite or quartz porphyry. It is highly altered to a white to pale yellow, soft clayey rock containing abundant quartz phenocrysts.

Alluvium is widely distributed along the Sungai Sebuloh and the Sungai Sinyi valleys. Along the foot path to Pangkalan Tebang in the eastern part of the area, some gravels thought to have been derived from a high level river terrace, are encountered.

The main geological structures in the Sungai Sinyi area are folds and faults in the Pedawan Formation and the elongation trend of the dikes. The axes of the folds trend ENE. The faults consist of strike faults and oblique faults. The former and the folds are cut by oblique faults which trend NNE. The ENE elongation of the dikes were most probably controlled by the folds and strike faults and the regional strike trend of the Pedawan Formation.

3–2–2 Sungai Matung Area

The Sungai Matung area is underlain by the Cretaceous Pedawan Formation, acidic intrusives and tuff breccia of Tertiary age and recent alluvium (Fig. II–12).

In addition to the same sequence observed in the Sungai Sinyi area, the Pedawan Formation in this area includes also a tuffaceous member of sandy tuff and tuffaceous mudstone which is encountered along a tributary in the upper reaches of Sungai Matung. The tuffaceous rocks are observed to overlie concordantly the normal sequence of alternating thin beds of shale, mudstone, silstone and sandstone of the Formation. The latter is widely exposed in the middle reaches of Sungai Matung and is steeply dipping with a ENE strike. Tight folds and shearing along steeply dipping strike faults with slight silicification in the form of quartz veinlets and thin discontinuous quartz lenses, are commonly observed in outcrops. Generally, rocks of the Formation are soft and may be easily crushed with the hammer.

Tertiary acidic intrusives similar to those found in the Sungai Sinyi area, occur as a dike on the northern side of Sungai Matung and as part of stock in the eastern part of the area. They form hilly terrain, the dike as a ENE elongated hill of about 100 m to 150 m wide parallel to the regional strike. Dacitic tuff breccia with pebble size fragments is found near the top of a hill in the

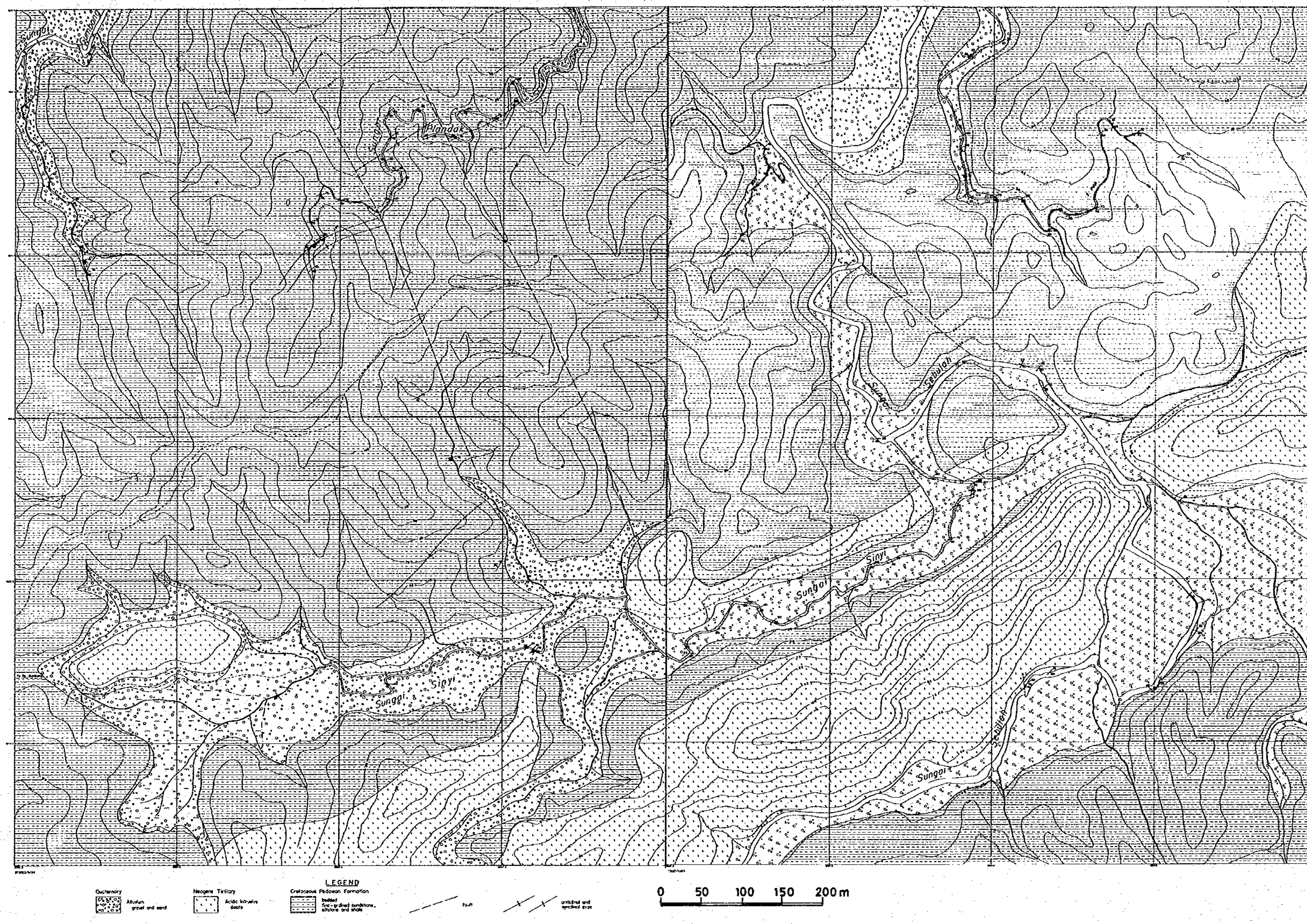


Fig. Ⅱ-11 Geology of Sungai Sinyi Area

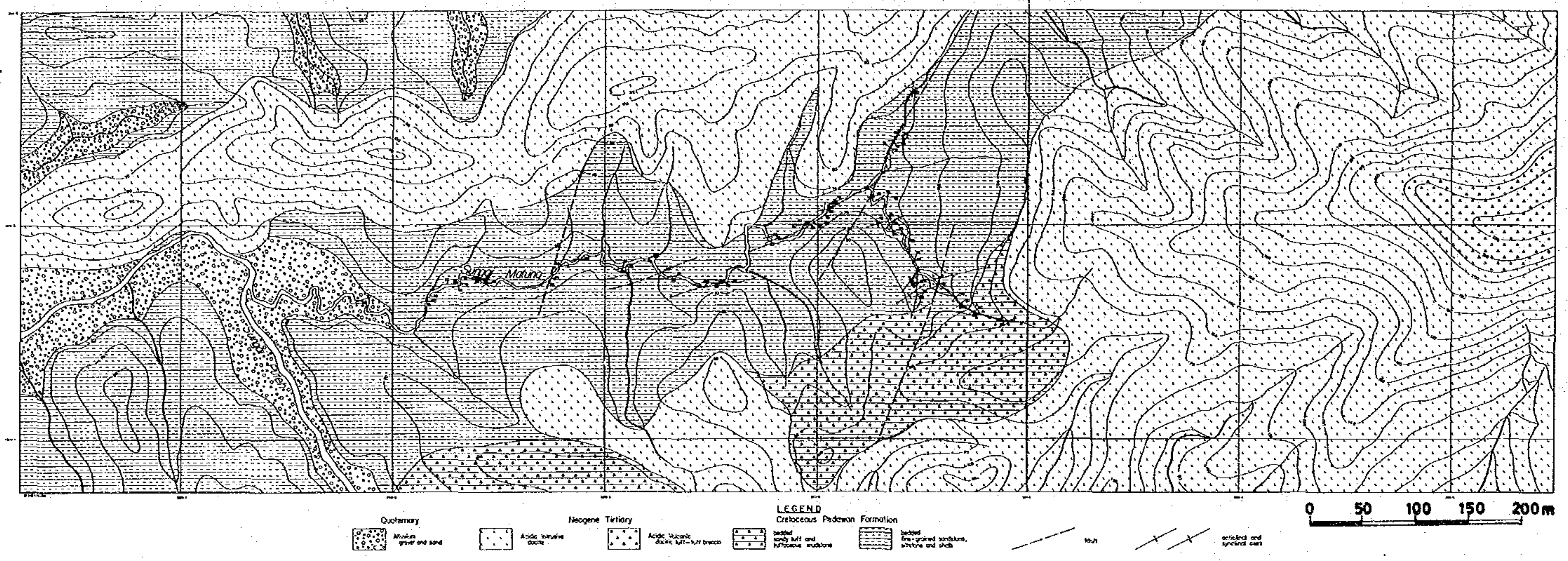


Fig. II-12 Geology of Sungai Matung Area

eastern part and probably represents the extrusive equivalent of the intrusive stock.

Recent alluvium consisting of gravel, sand and clay up to a few m thick overlies the Pedawan Formation in the Sungai Matung valley.

The main geological structures observed are folds and faults within the Pedawan Formation and the elongation trend of the Tertiary dike. Except for a few minor oblique NE and NS faults, all structures have the same ENE trend.

3–3 Results of Geochemical Soil Survey

A total of 897 soil samples were collected over the two areas investigated, 659 from the Sungai Sinyi area and 238 from the Sungai Matung area. The samples were analysed for Au, Ag, As, Sb, Hg and Mn (Appendices 8 and 9). Except for the results of Au which were arbitrarily classified because of the limitation of the analytical method used, the data for the other elements were statistically treated and the various statistical levels read off as shown in Figure II–13 and II–14.

3–3–1 Sungai Sinyi Area

The distributions of the six elements analysed are as shown in Figure II–15.

Gold (Au). Generally the higher class values for Au of equal or more than 0.3 ppm accounting for about 2% of the data set show up mainly in the southwestern part of the area. 5 Au values of more than 0.5 ppm with a maximum of 1.6 ppm are concentrated in a small area in the upper reaches of Sungai Sinyi.

Arsenic (As). Anomalous values for As ($\geqslant \bar{X} + 2S = 22$ ppm) generally reflect the underlying intrusive hilly areas south of Sungai Sinyi. A small anomaly represented by 5 As values of $\geqslant \bar{X} + 3S$ also show up in the tributaries of the upper reaches of Sungai Sinyi coincident with higher class values for Au.

Antimony (Sb). Anomalous values for Sb ($\geqslant \bar{X} + 2S = 10.5$ ppm) form small scattered anomalies and appear not correlatable with the geology or the other elements.

Manganese (Mn). Anomalous values for Mn ($\geqslant \bar{X} + 2S = 27.0$ ppm) are mostly found in the southeastern half of the area as distinct ENE elongated anomalies on the lower slopes and valleys of the hills formed by acid intrusive dikes.

Silver (Ag). Anomalous Ag values of $\geqslant \bar{X} + 2S$ (1.0 ppm) form extensive scattered anomalies. As the lower background population was used in the calculation of the statistical levels, the anomalies are interpreted to express only background values of the higher background population. Higher anomalous values $\geqslant \bar{X} + 3S$ (1.7 ppm) form only small scattered anomalies not correlatable with the geology or the other elements.

Mercury (Hg). Anomalous Hg values of $\geqslant\bar{X} + 2S$ (140 ppb) form a large distinct ENE trending anomaly in the southeastern part of the area just south of Sungai Sinyi and NE of Sungai Sebuloh. The anomaly overlaps the anomalies for Mn and As in this part of the area except that As is comparatively more confined.

The geochemical soil survey illustrates that high values for Au is distinctly correlatable with an As anomaly and to a lesser extent with Mn and Hg. The As anomaly which overlaps the higher class values for Au in the upper reaches of Sungai Sinyi is interpreted to represent possible bedrock mineralization and merit priority follow-up work. Geochemical soil sampling should be extended further to the south initially in the follow-up work in order to delineate the limits of this open ended anomaly. Trenching and exploration drilling should follow to confirm bedrock Au mineralization. Other anomalies for As and the extensive anomalies for Mn and Hg are thought to reflect merely the underlying acidic intrusives and in the case of the Mn also secondary concentration in the soil in the lower slopes and valleys adjacent to the intrusives.

3–3–2 Sungai Matung Area

The distributions of the six elements analysed are shown in Figure II–16.

Gold (Au). Higher class values for Au ($\geqslant$0.3 ppm) show up as several narrow tracts in the upper reaches of Sungai Matung near the contact with the intrusive stock.

Arsenic (As). Anomalous As values $\geqslant\bar{X} + 2S$ (55 ppm) show up as three small anomalies, in the upper reaches of Sungai Matung near the contact with the intrusive stock in the southern part of the stock and north of Sungai Matung over a part of the intrusive dike. The first anomaly may be correlated with the concentration of the higher class Au values.

Antimony (Sb). Anomalous Sb values $\geqslant\bar{X} + 2S$ (15 ppm) occur mainly as single values. The three anomalous values in the upper reaches of Sungai Matung partly overlap the anomaly for As

Manganese (Mn). Anomalous Mn values $\geqslant\bar{X} + 2S$ (60 ppm) form relatively larger anomalies along the Sungai Puteh valley and in the lower slopes of the hilly terrain underlain by the acidic intrusive stock. As in the case of the Sungai Sinyi area, Mn reflects its enrichment on the lower slopes or valleys near intrusives.

Silver (Ag). Anomalous Ag values $\geqslant\bar{X} + 2S$ (1.12 ppm) show up as only 3 small single sample anomalies in the western part of the area.

Mercury (Hg). Anomalous Hg values $\geqslant\bar{X} + 2S$ (380 ppb) forms a relatively larger anomaly elongated in the EW direction coincident with the acid intrusive dike.

The geochemical soil survey suggest that the area in the upper reaches of Sungai Matung where higher class values for Au, an As anomaly and partly Sb anomalous values overlap may be the only significant area for exploring for possible Au mineralization. If present, Au mineraliza-

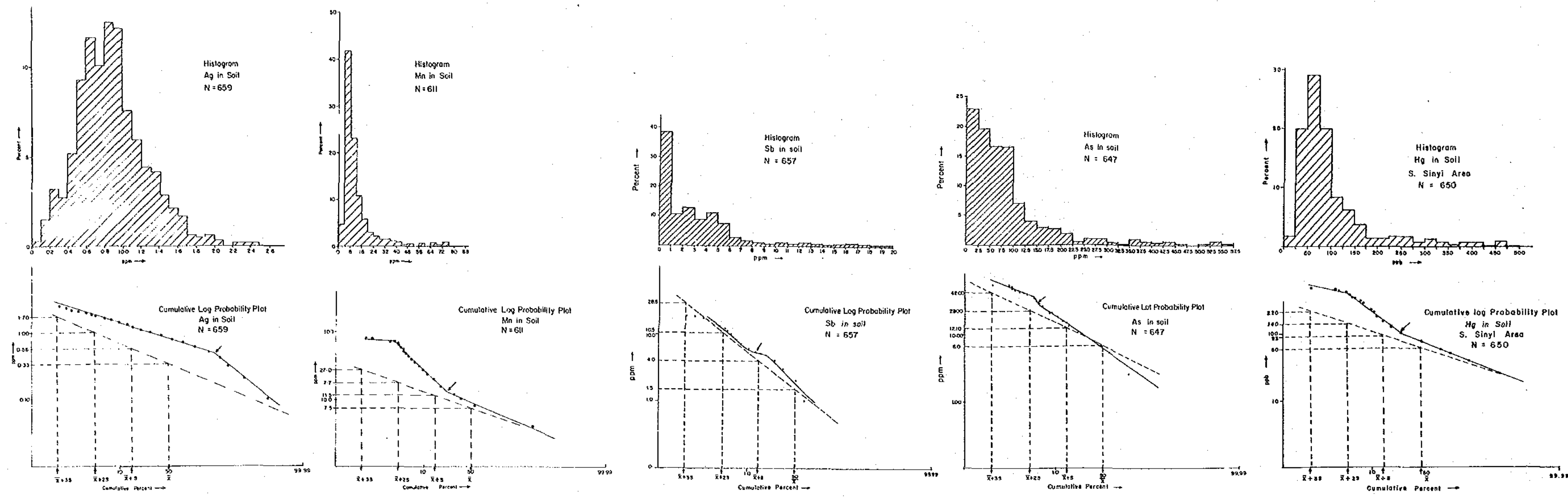


Fig. II-13 Histograms and Cumulative Log Probability Plots, Sungai Sinyi Area

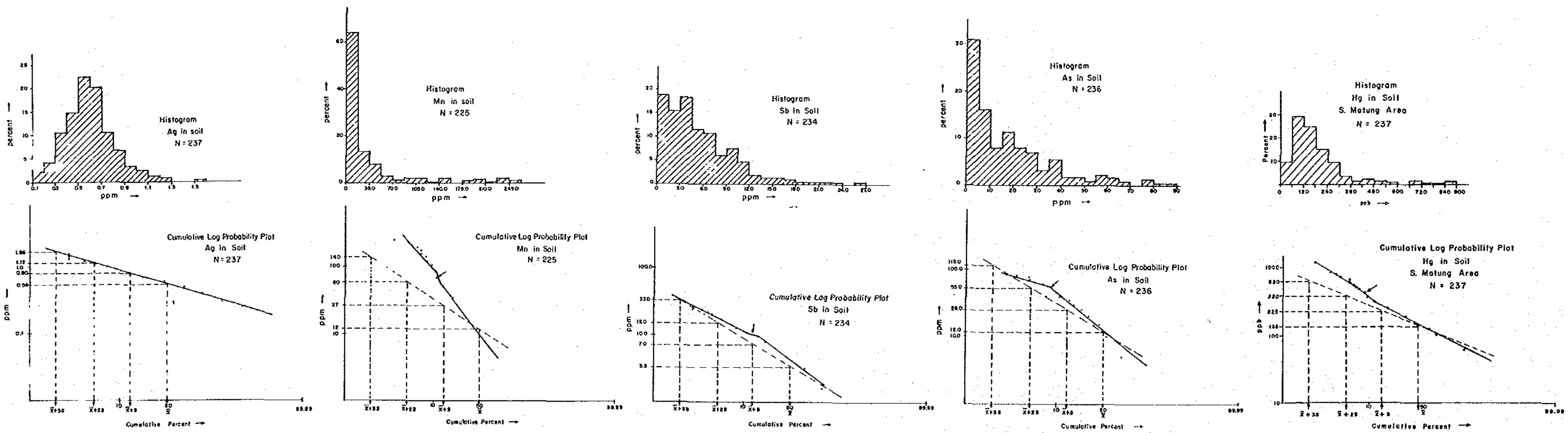


Fig. II-14 Histograms and Cumulative Log Probability Plots, Sungai Matung Area

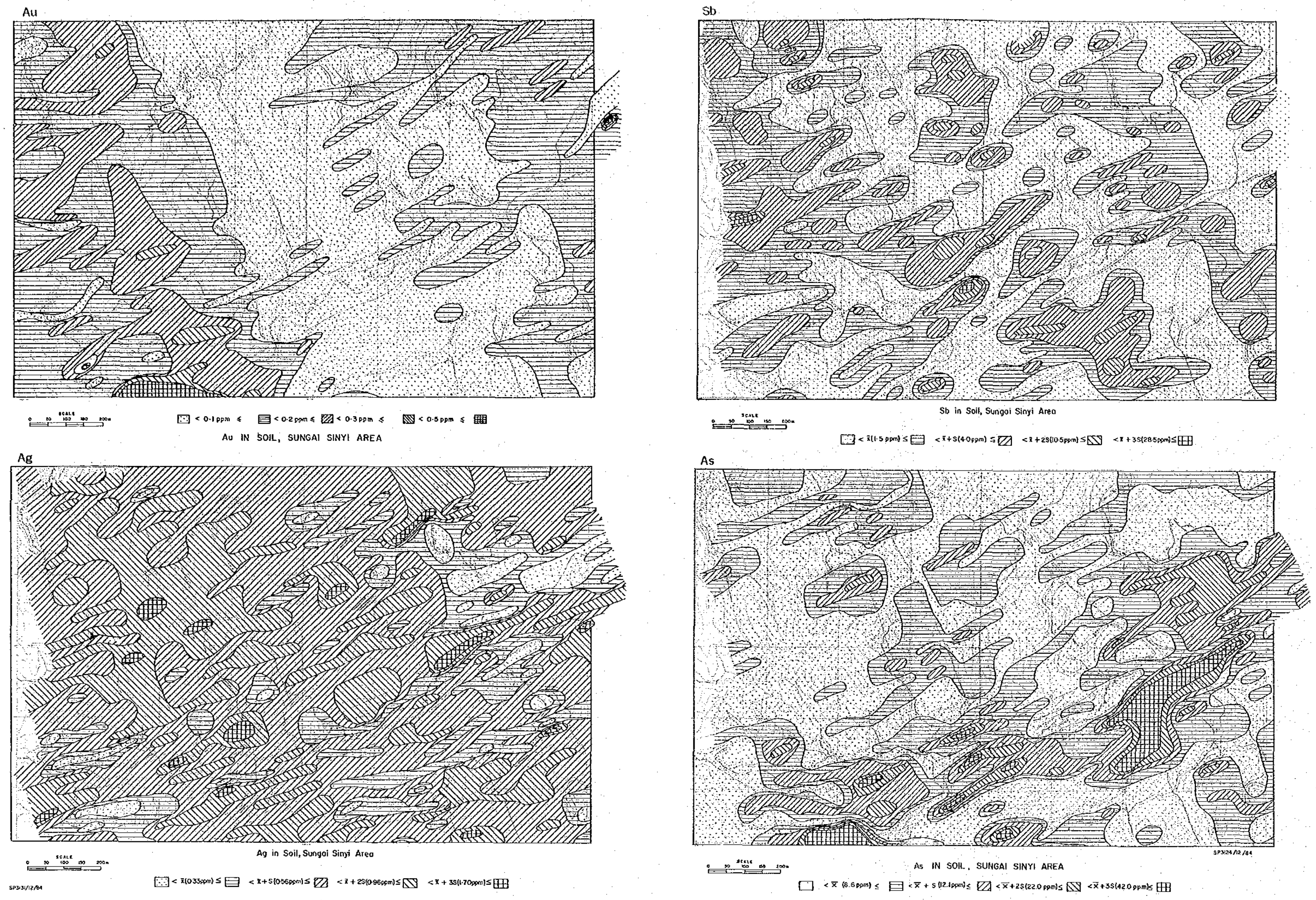
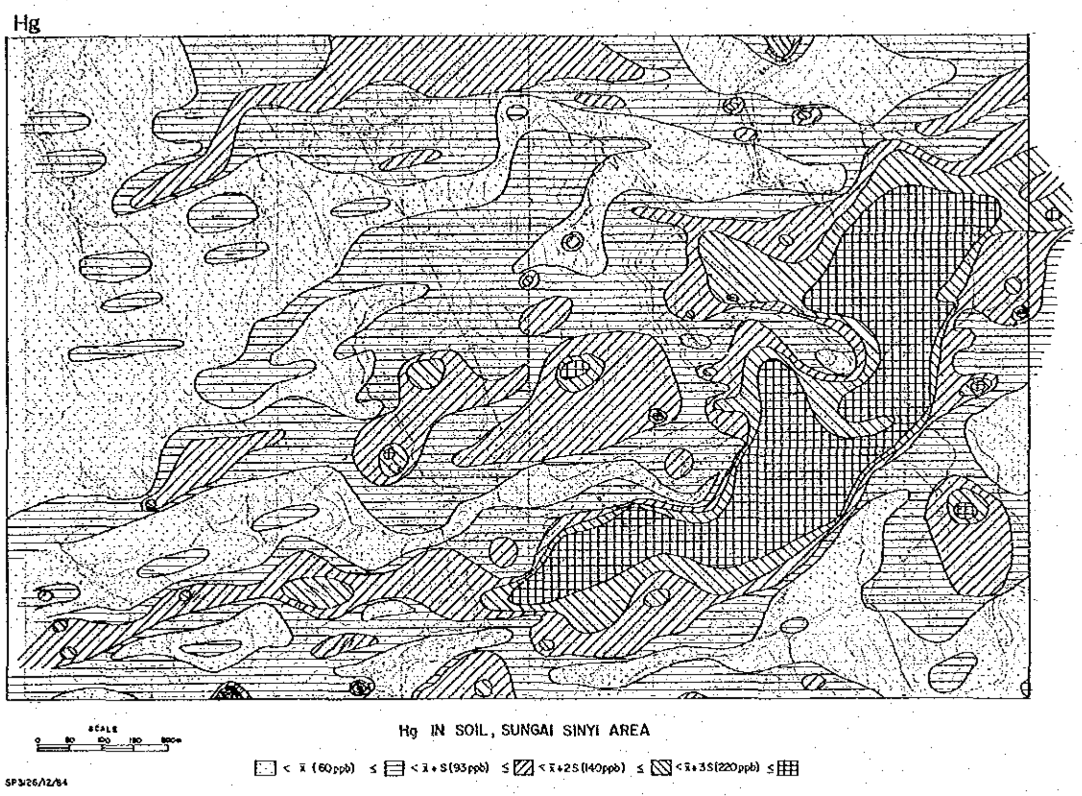


Fig. II-15 Au, Ag, Sb, As, Hg and Mn in Limestone, Sungai Sinyi Area (1)



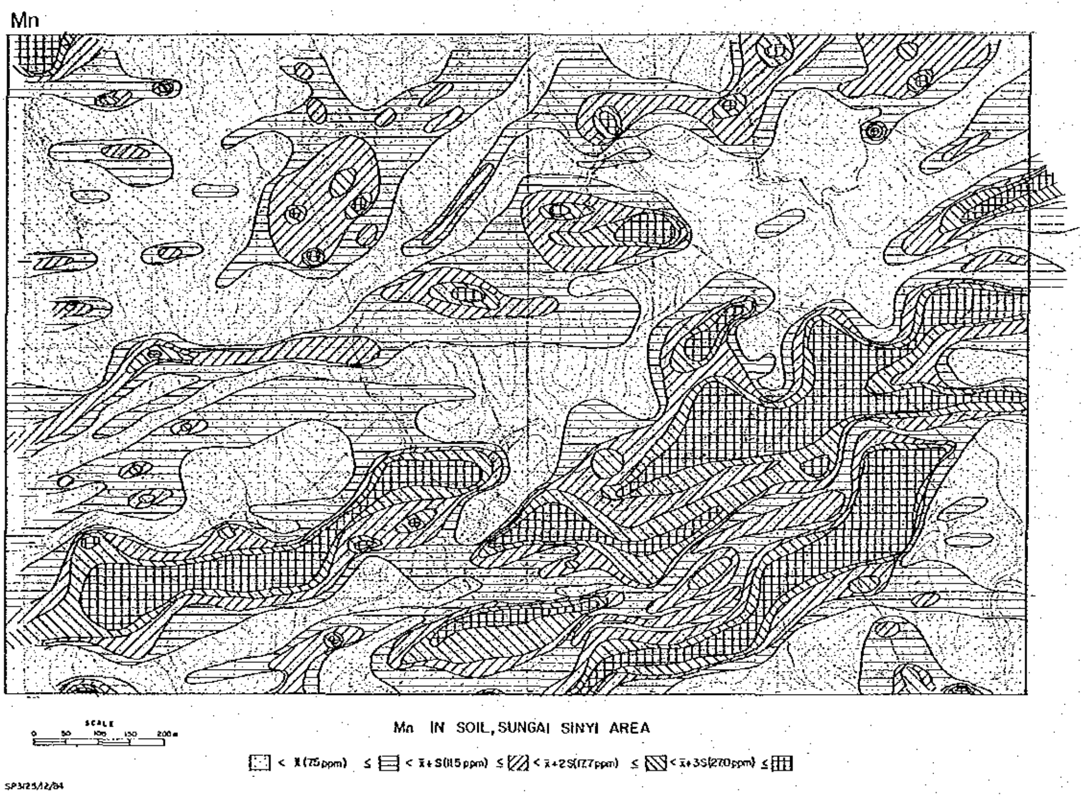


Fig. II-15 Au, Ag, Sb, As, Hg and Mn in Limestone, Sungai Sinyi Area (2)

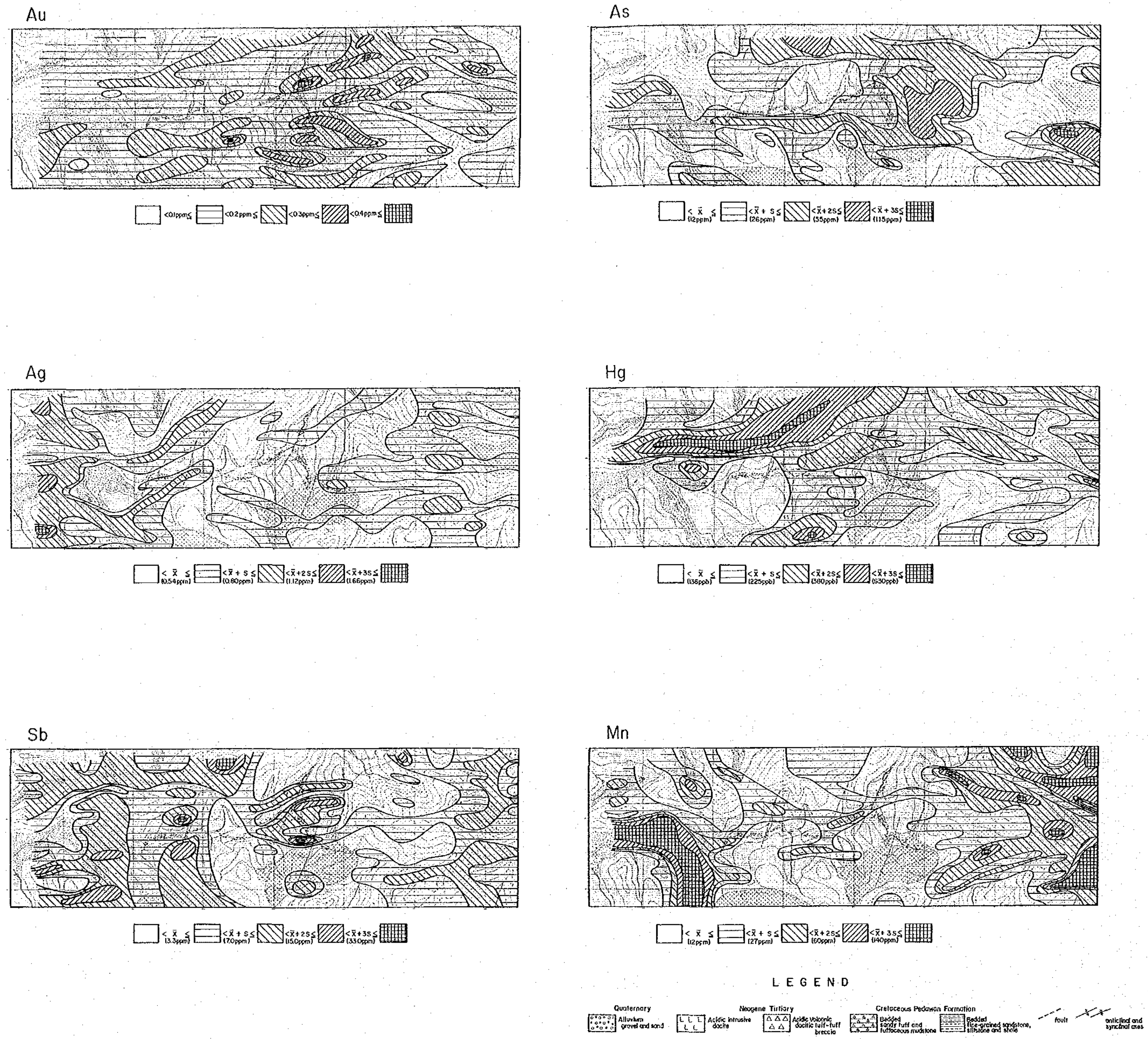


Fig. II-16 Au, Ag, Sb, As, Hg and Mn in Limestone, Sungai Matung Area

tion would most likely be very local in extent. Anomalous values for Hg reflect the underlying intrusive dike whereas those for Mn reflect concentration in soil in the lower slopes and valleys near the intrusive stock.

3–4 Results of Panned Concentrate Survey

3–4–1 Sungai Sinyi Area

Figure II–17 shows the distribution of gold grains in panned stream sediment samples of Sungai Mud and Sungai Sinyi in the Sungai Sinyi area. Of the total of 51 samples, 21 were collected from Sungai Mud and its tributaries and 30 from Sungai Sinyi and its tributaries. Gold grains were observed in 34 samples. Out of the 34 samples, one sample containing 184 gold grains from 15 l of stream sediments was collected from just downstream of a wide swamp in the upper reaches of Sungai Sinyi. 5 samples with more than 50 gold grains are located along Sungai Sinyi. Other samples with fewer gold grains are located in the tributraries of the Sungai Sinyi. Generally, only a few gold grains are observed in samples from Sungai Mud and its tributaries. Other samples collected in the upper reaches of the Sungai Mud contain no observable gold grains.

In order to determine the source of the gold, river bank materials were also panned at several places. Generally, the banks of Sungai Sinyi are composed of weathered bedrock, clay of probably highly weathered bedrock, gravel, sand and soil in ascending order of abundance. Results obtained in the upper reaches of the Sungai Sinyi where considerable number of gold grains were detected are shown in Figure II–18. It is clear that most of gold grains are contained in the gravel and sand. The clay, probably altered from bedrock by deep weathering also contains a considerable amount of gold grains. However, it is thought that the gold grains originated from the overlying gravel and sand as the underlying bedrock gave only very few gold grains.

Sungai Matung Area

Figure II–19 shows the distribution of gold grains in stream sediment samples panned from the Sungai Matung area. Out of the total 33 samples, gold grains are observed in 20 samples. The sample with the most gold grains (235) detected was collected from 15 l of stream sediments in the middle reaches of the river. Generally, samples with considerable gold grains are found along a stretch of about 200 m in the middle reaches whereas very little or none were obtained further upstream.

For the same purpose as that in the Sungai Sinyi area, samples of bedrock were collected from the banks, crushed and panned. Care was taken to ensure that there was contamination of these samples. From the results as shown in Figure II–20, considerable amounts of gold grains were seen to occur also in the bedrock, some of which are sheared with small amounts of drusy quartz lenses and veinlets.

3–5 Trenching

The locations and the geology of 11 trenches studied around the middle reaches of Sungai Matung are shown in Appendix 10. The trenches are all located in an area which is underlain by the Pedawan Formation consisting mainly of shale, siltstone and sandstone. 9 trenches were dug across sheared zones trending N65E to E-W and 2, No. 6 and No. 7, parallel to the zones. The geology and panning results of the trenches are described below.

Trench No. 1

Trench No. 1 is 10.7 m. Shale and siltstone interbedded with fine sandstone are exposed at the bottom of the trench with a general N60°E strike. Slight shearing is observed in places and patchy streaks of quartz are abundant in the northern part of the trench.

10 samples were collected from the bedrock and panned but no gold grains were observed in the samples.

Trench No. 2

Trench No. 2 is 10 m long trending N15°W and is located 25 m west of trench No. 1. The bedrock, composed mainly of shale and minor fine grained sandstone, is exposed only in the northern half of the trench. The beds are intensely sheared and the strike is uncertain. A small amount of quartz as veinlets, patches and streaks are observed in places. The southern half of the trench is still covered by a grey overburden clay.

9 samples were collected from the bottom of the trench and panned. All 5 samples of the bedrock and 4 samples of the clay gave no gold showings.

Trench No. 3

Trench No. 3 was not studied because of wall collapse.

Trench No. 4

Trench No. 4, dug on the southern side of the river is 10 m long. The bedrock exposed is composed mainly of shale and siltstone and some intercalated beds of sandstone. In the northern part irregular wavy shearing and a fault trending N80°W are observed. The shale is highly weathered and limonitized and the sandstone is partly accompanied by lenticular veinlets of quartz.

10 samples were collected from the bedrock and panned. 4 fine gold grains, less than 0.5 mm across, were observed in 1 sample of the sandstone with lenticular veinlets of quartz but no gold was found in the other 9 samples.

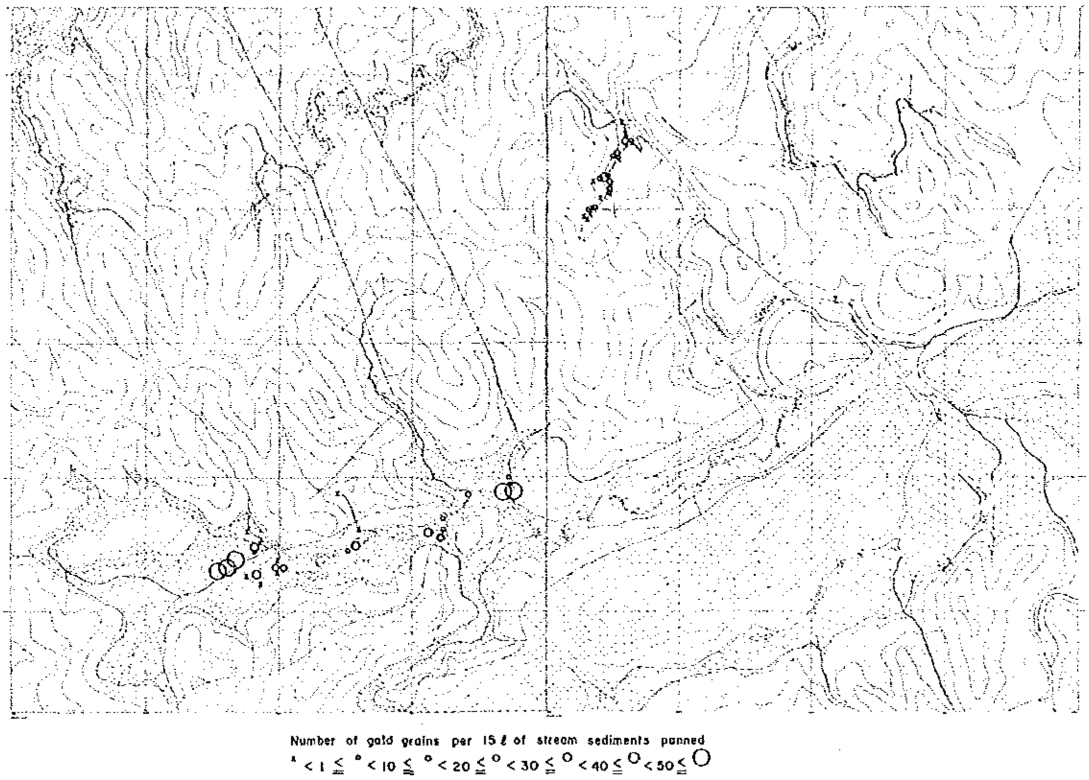
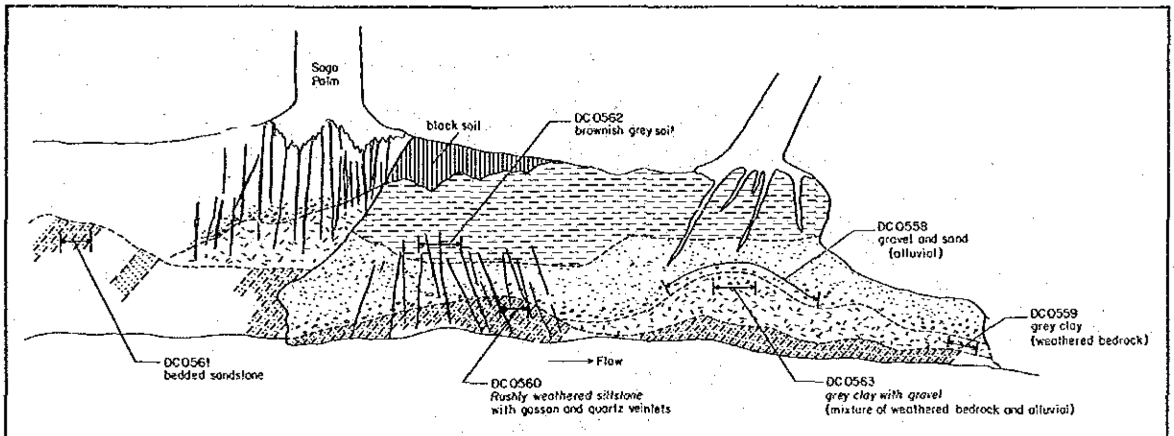


Fig. Ⅱ-17 Results of Panned Concentrate Survey, Sungai Sinyi Area



	Volume (ℓ) of Sample	Total grains	0.5^{mm} 1.0^{mm}		
DC0 558	15ℓ	42	38	4	–
DC0 559	15ℓ	18	17	1	–
DC0 550	20ℓ	14	14	–	–
DC0 561	10ℓ	9	8	–	1
DC0 562	10ℓ	4	4	–	–
DC0 563	15ℓ	2	2	–	–

SKETCH OF A BANK OF SUNGAI SINYI WITH SAMPLE LOCATIONS

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Fig. Ⅱ-18 Sketch of a Bank of Sungai Sinyi, with Sample Locations

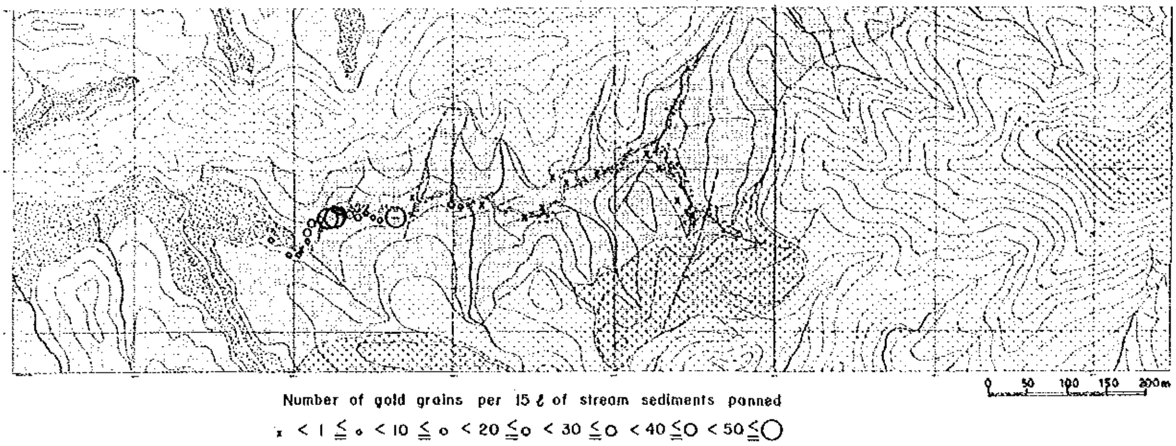


Fig. Ⅱ-19 Results of Panned Concentrate Survey, Sungai Matung Area(1)

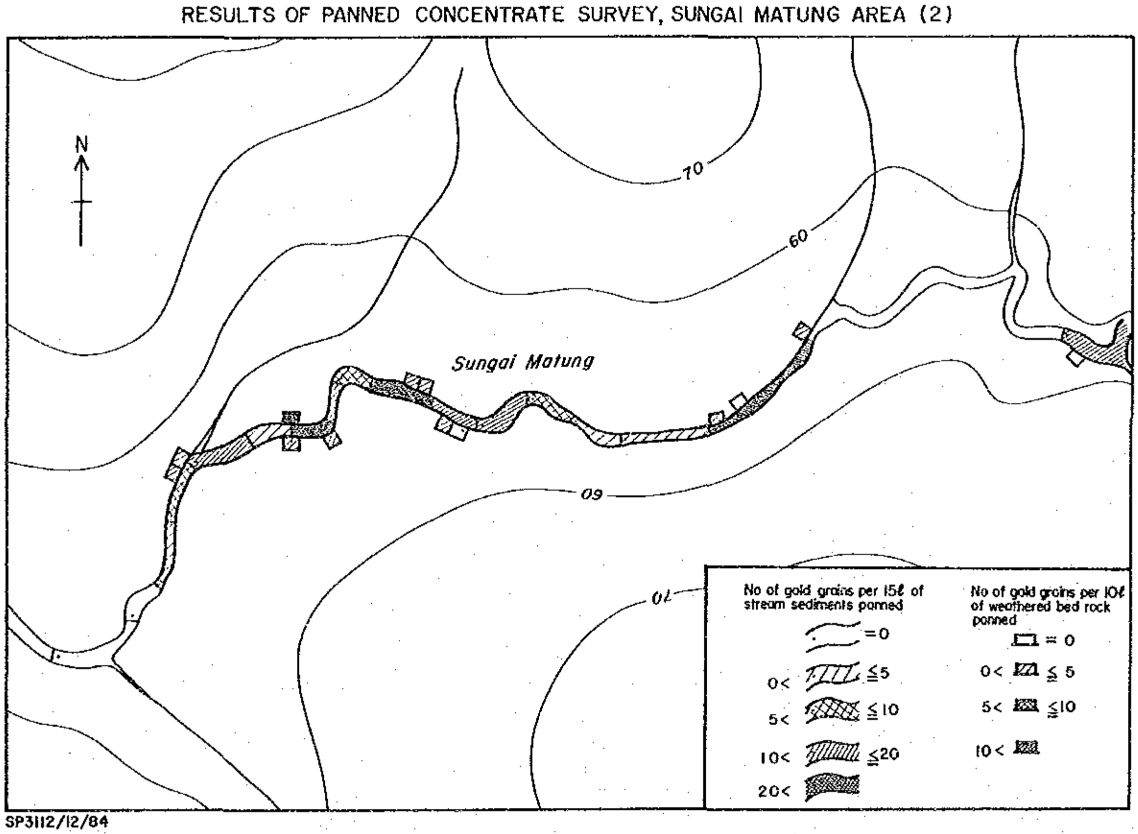
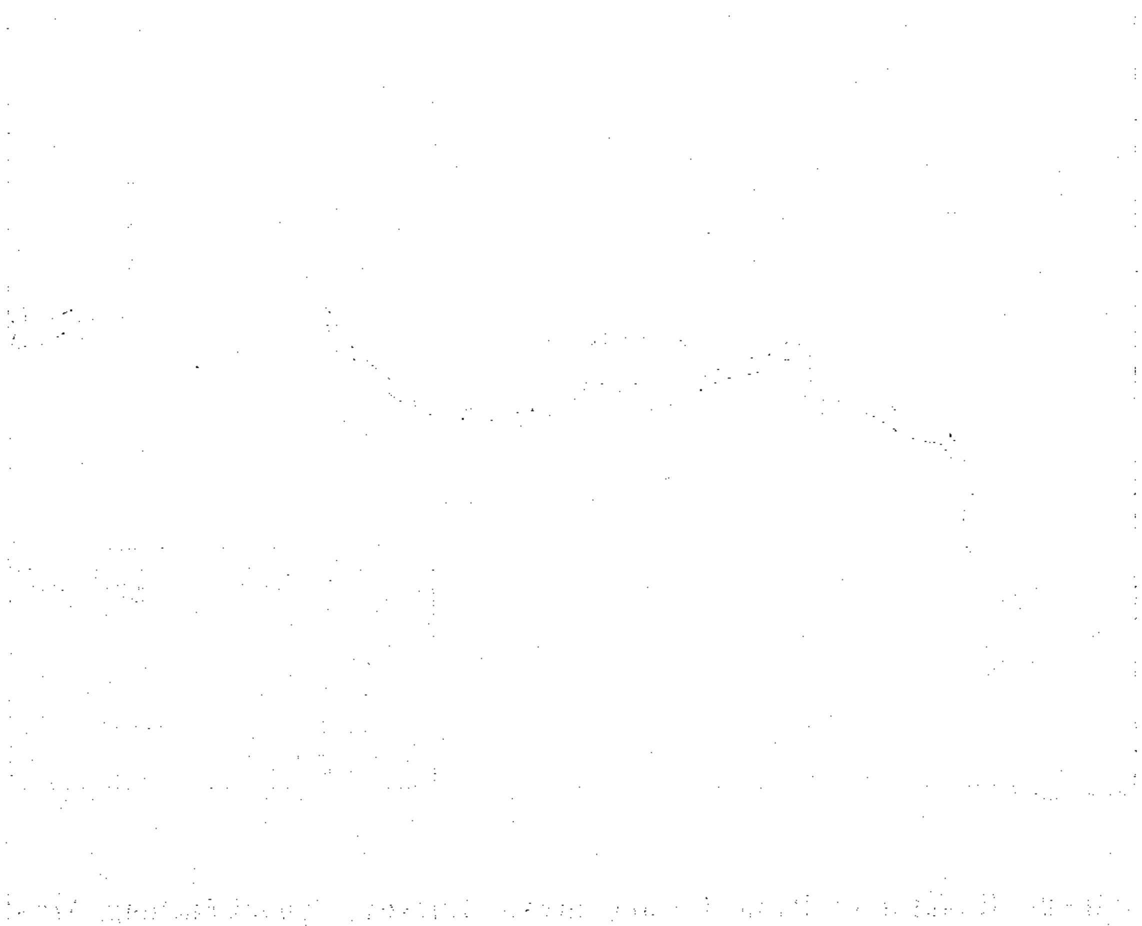


Fig. Ⅱ-20 Results of Panned Concentrate Survey, Sungai Matung Area(2)



Trench No. 5

Trench No. 5 was not studied because of wall collapse.

Trench No. 6

Trench No. 6, dug on the eastern side of the river, is located about 25 m west of trench No. 4. Bedrock is exposed at the bottom of the major part of the trench. It consists of alternations of shale and siltstone and is highly weathered, so that details are uncertain.

10 samples were collected from the bedrock and panned. Some gold grains were observed in 3 of the samples.

Trench No. 7

Trench No. 7 (No. 7N and No. 7S) was dug across the river. In No. 7N, the bedrock is composed of mostly alternations of shale and siltstone with a strike of N75°W and a dip of 63°N. Some parts are still covered by the overlying sandy alluvium. Faults trending nearly N–S are observed in the bedrock consisting of alternations of shale and sitlstone in No. 7S. The alternation east of the fault are folded but the folding axis is not clear.

34 samples were collected from the trench and panned. The samples included 6 samples collected from the bedrock, 22 samples from the light grey clay overlying the bedrock in No. 7S and 6 samples from the alluvium covering the bedrock in No. 7N. The results show that the alluvium contains the most gold grains corresponding to a mean number of 6.3 grains per 10 l of sample panned whereas the clay contains only 0.3 grains per 10 l and the bedrock contains no gold grains.

Trench No. 8

Trench No. 8, located only 3 m west of trench No. 7, was dug on the northern side of the river. The bedrock is exposed in the southern half of the trench floor but on the northern half it is covered by clay. It consists of siltstone intercalated with medium-grained sandstone beds striking nearly E-W.

11 samples were panned including 4 samples collected from the bedrock and 7 samples from the overlying clay. However, no gold was found in all the panned concentrates.

Trench No. 9

Trench No. 9, on the southern side of the river, is located just opposite trench No. 8. Its bedrock of shale and siltstone is sheared and accompanied by abundant limonite streaks. A fault trending N60E in an intensely sheared zone is observed in the central part of the trench. Some quartz streaks occur together with the sheared black shale which shows a wavy pattern.

10 samples were collected from the bedrock and panned but no gold was found.

Trench No. 10

Trench No. 10 is located on the slope of a hill in the westernmost end of the trenched area. The bedrock consists of bedded shale with limonite streaks. The beds strike N80W and dip 60°S.

20 samples collected from the bedrock were panned but no gold was observed.

Trench No. 11

Trench No. 11, on the northern side of the river, is located about 16 m east of trench No. 10. Alternations of grey to dark grey shale and siltstone are exposed, interbedded with a light grey siltstone bed. Rare quartz and limonite streaks were found at one place. Some pebbles of dacite and vein quartz were observed in the overlying alluvial clay.

No gold is found in 10 panned samples of the bedrock.

Trench No. 12

Trench No. 12 is situated on the opposite side of trench No. 4. The bedrock is composed mainly of siltstone, shale and sandstone. Quartz streaks and drusy quartz crystals are commonly found, mainly in siltstone beds.

10 samples collected of the bedrock were panned but no gold grains were observed.

3–6 Discussion

The results of the panned concentrate survey and trenching indicate that the placer gold detected in stream sediments originated from the alluvial bank deposits of gravel, sand and clay in the Sungai Sinyi and Sungai Matung areas. From the geochemical soil suvey however, possible primary sources of the alluvial gold may be delineated particularly in the Sungai Sinyi area.

In the Sungai Sinyi area, the source of gold in stream sediments found chiefly in Sungai Sinyi was traced by means of panning, to a wide swampy area of gravel, sand and clay in the upper reaches of the river. A distinct anomaly for As and high Au values occur just SE of the swamp into which, streams which drain this anomalous area flow. It is clear that the anomalous area is the most likely primary source of the alluvial gold found in Sungai Sinyi. Gold grains which were also found in panned concentrate samples in the lower reaches of Sungai Mud most probably originated from this primary source, the gold being carried there by the Sungai Sebuloh which drains the SE part of the anomalous area.

In the Sungai Matung area, it was initially thought that the placer gold originated from the sheared shale and quartz veinlets along a fault parallel to the river. Panning of crushed bedrock samples also indicate this possibility. However, the trenches dugged in the area and panning of the bedrock exposed suggest that the alluvial gold may have been derived mainly from the alluvial sand and clay. Gold grains found in panned bedrock samples might have been the result of contamination by gold grains sinking into cracks in the bedrock from the overlying aluvium. A possible primary source is detected by the geochemical soil survey to be in the upper reaches of Sungai Matung. However, this possible source even if present is suggested to be of a very small extent.