it contains much pyrite, some sphalerite and galena and a small amount of chalcopyrite. In the A. Tambang Durigan upstream, there is a quartz vein (Outcrop B, N 20° W strike and 90° dip) that is distributed at the east part of the former quartz vein, in shearing within quartz diorite. The grades as analysed are vein width 20 cm, Au 3.6 g/t, Ag 2.1 g/t, Cu 0.011%, Pb less than 0.01% and Zn less than 0.01%, indicating some gold content.

(b) A. M. Botung downstream outcrop

A silicified andesite outcrop (Outcrop C) is distributed in the northern edge of the survey area on the road along A. M. Botung. It contains malachite and analysis results indicate a grade of Au 0.6 g/t, Ag 20.6 g/t, Cu 2.15%, Pb less than 0.01% and Zn 0.02%.

(c) A. Tumbalang outcrop

A silicification area (Outcrop D) of meta-andesite is located at upstream of A. Tumbalang (800 m upstream from the diverging point), which is a tributary of A. M. Botung. Analysis of ores collected from this zone resulted in low grades of Au less than 0.1 g/t, Ag 0.7 g/t, Cu 0.02%, Pb less than 0.01% and Zn tr.

4-3 CONCLUSION OF MINERALIZATION

The deposits distributed in the survey area can roughly be divided into two types; a fissure-filling ore deposit emplaced in a fissure of meta-andesite and skarn deposit emplaced in limestone.

Based on the observation of Adit C, a skarn consisting of clinopyroxene and garnet is embedded along a fissure in limestone, and the skarn deposit can be considered as a fissure-filling type skarn deposit in the broad sense. Most of these fissures are in the systems of strike and dip of N 20° to 5° W, 50 NE and N 40° W, 60 SW. It may be inferred that the place of deposit, namely the fissure, was tectonically formed by intrusion of quartz diorite stocks, considering results that the Schmidt projection analysis of joints and fissures observed on the Muara Botung meta-andesite, conducted by the first phase survey, indicate that the maximum point of fissures is concentrated into N 38° W 50 SW, N-S 70 E, and that the ore veins are also limited in distribution to the area of stocks of quartz diorite and tonalite that are arranged in the N 60° W direcition.

The ore veins emplaced in meta-andesite are gold-bearing quartz veins accompanied with pyrite, chalcopyrite and sphalerite and the gold content is 35 g/t at the maximum or in a range of 3.6 to 1.4 g/t as an average.

Based on the survey results on old tunnels that are observable, the skarn deposits have been replaced along fissures (N 5° W, 50° E), containing clinopyroxene ($Di_{85.5}$ $Hd_{13.5}$ Jo_{1}) and garnet ($Gr_{85.5 \sim 69}$, $Ad_{13.5 \sim 31}$) as found through the EPMA survey, and they are determined to be skarn deposits that are commonly accompanied by iron mineral (magnetite) deposits. Montmorillonite, kaolinite and laumontite are observed in the clay minerals accompanying ore veins in meta-andesite, and they seem to have undergone hydrothermal alteration that brought mineralization.

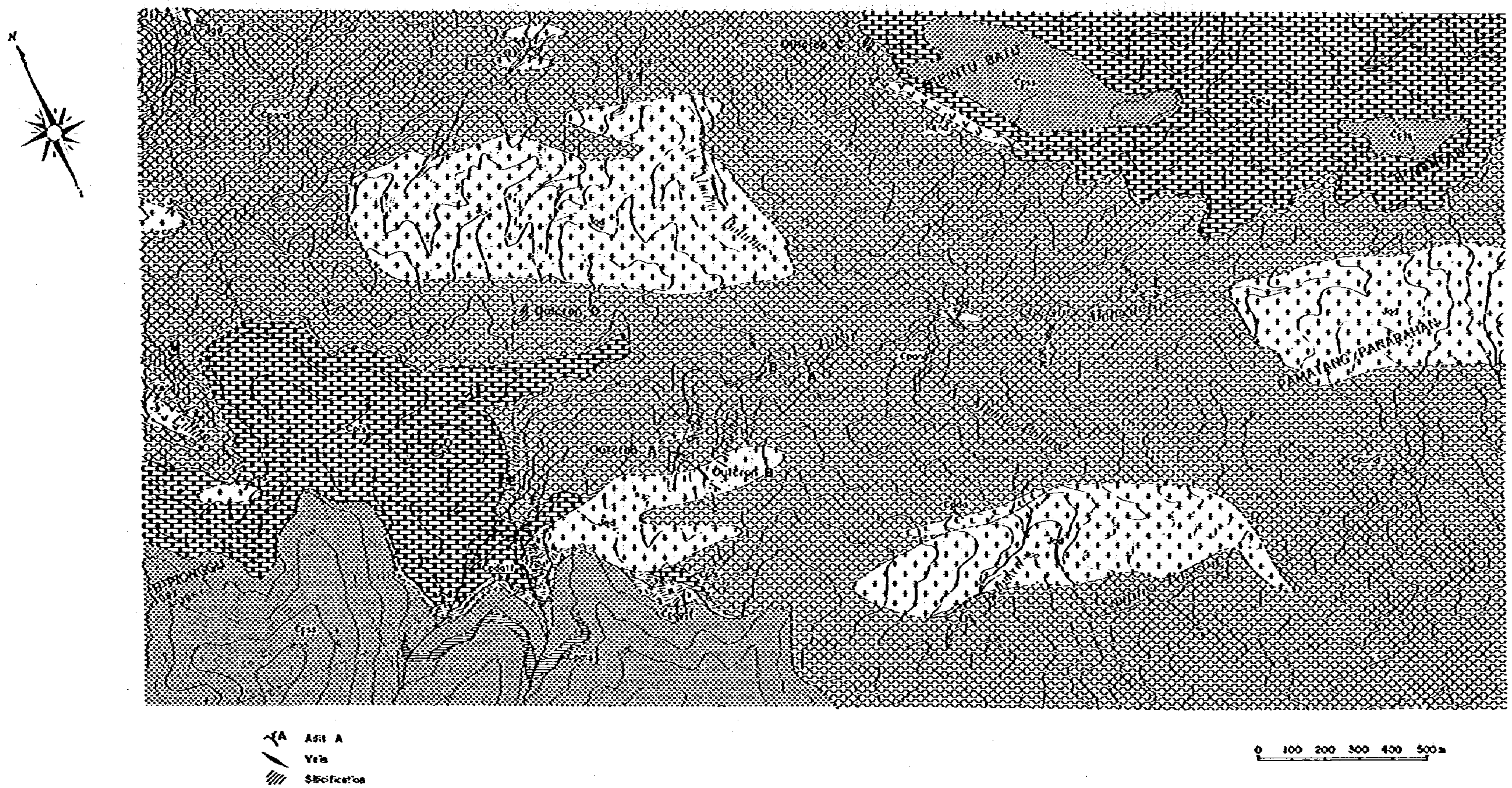


Fig. II-2-4 Map of Mineralizations in Muara Sipongi Area A

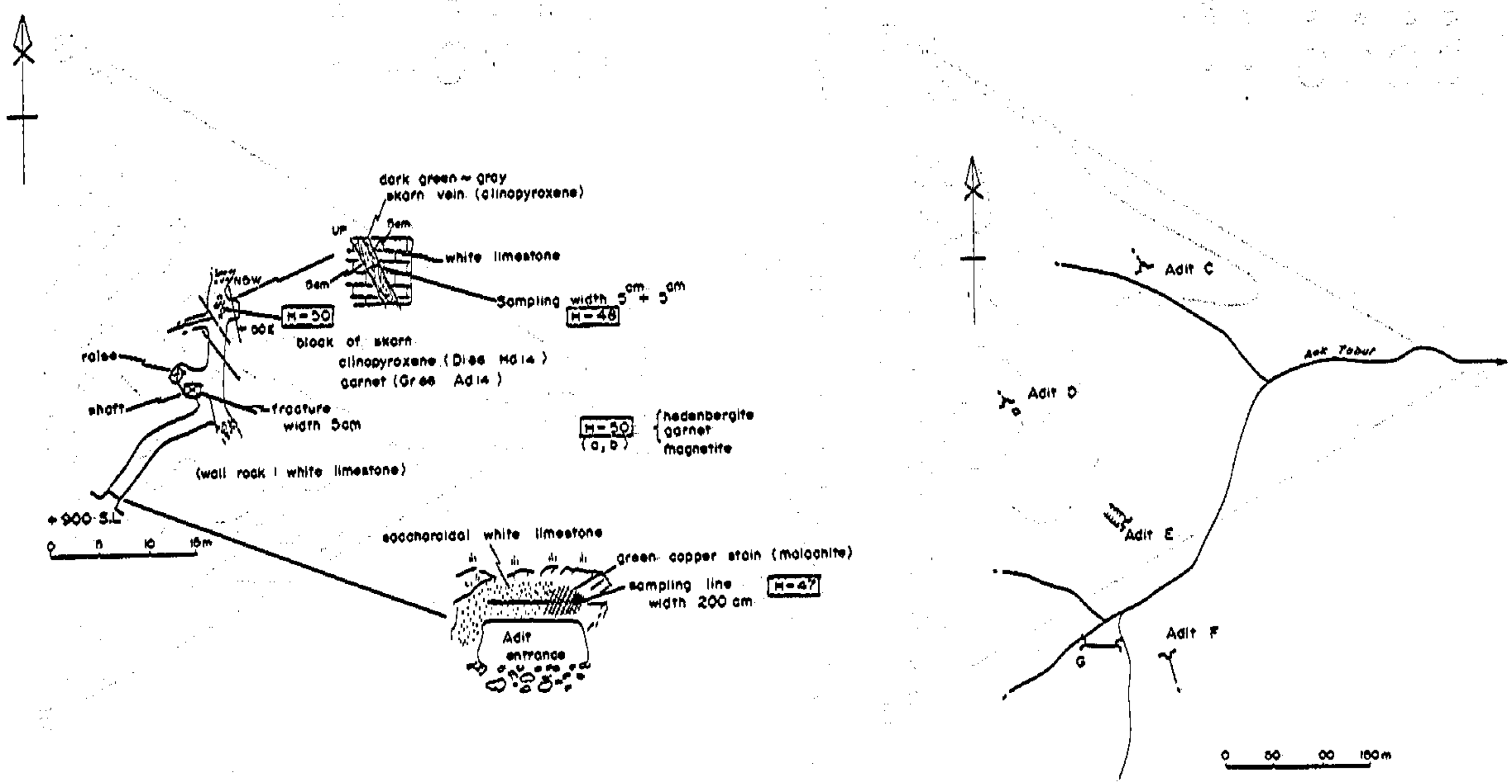


Fig. II-2-5 Sketch of Ore Deposit, Adit C, Muara Sipongi Area A

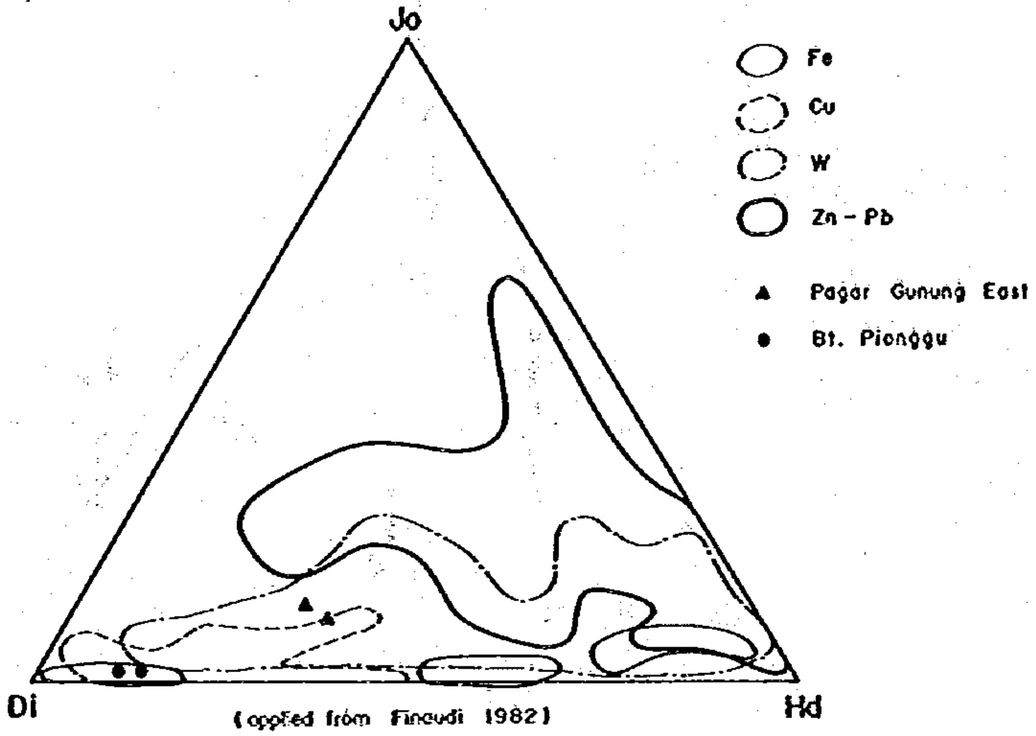


Fig. II-2-6 Jo-Di-Hd Diagram of Clinopyroxene of Skarn, Adit C, Muara Sipongi Area A

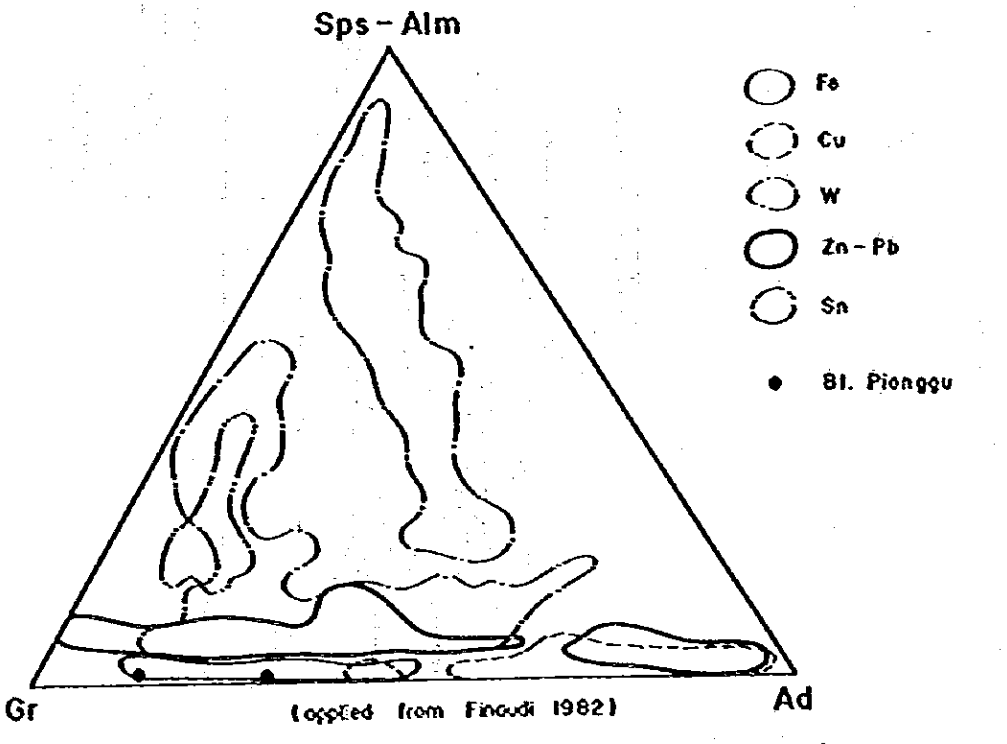


Fig. II-2-7 Sps · Alm-Gr-Ad Diagram of Garnet of Skarn, Adit C, Muara Sipongi Area A

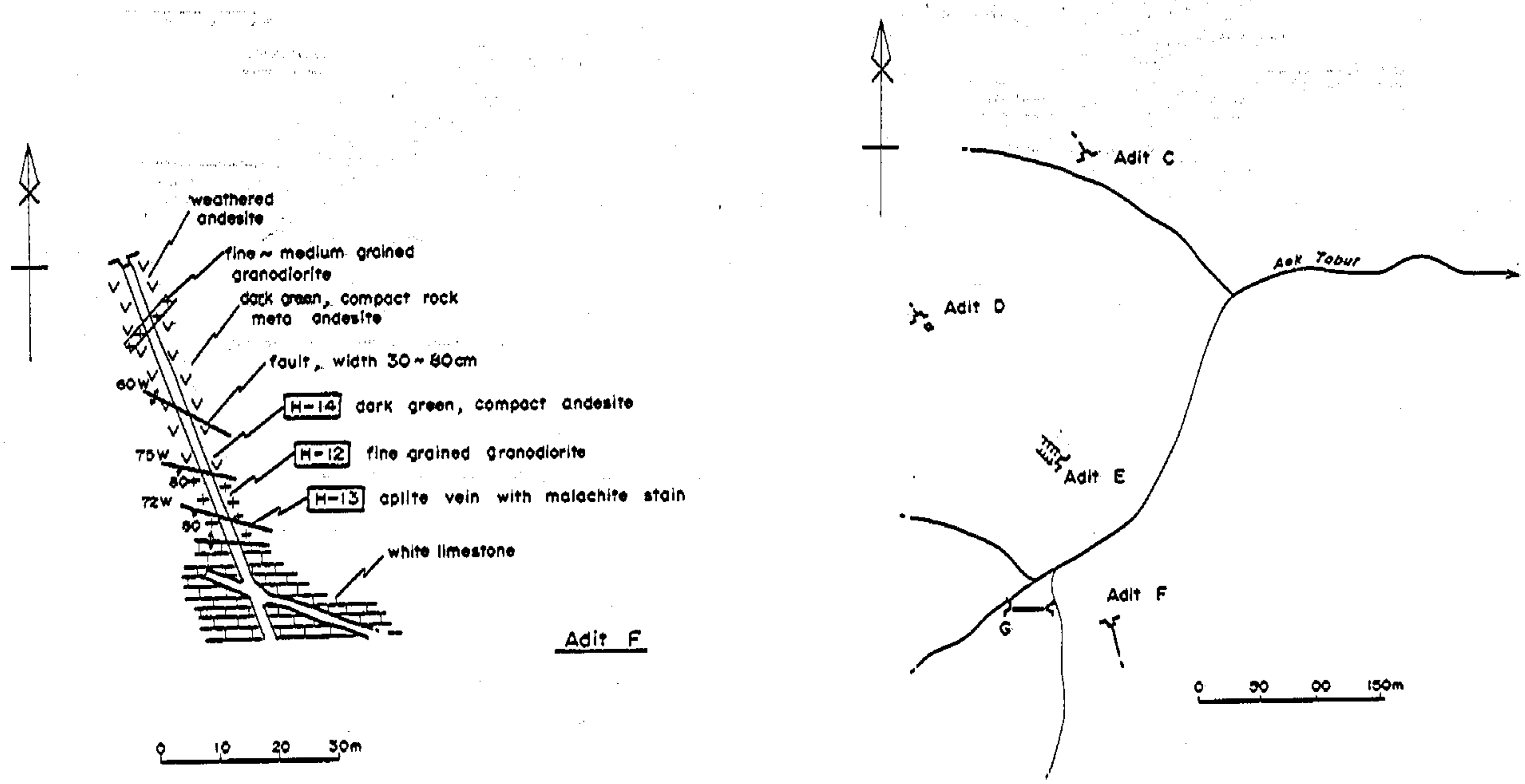
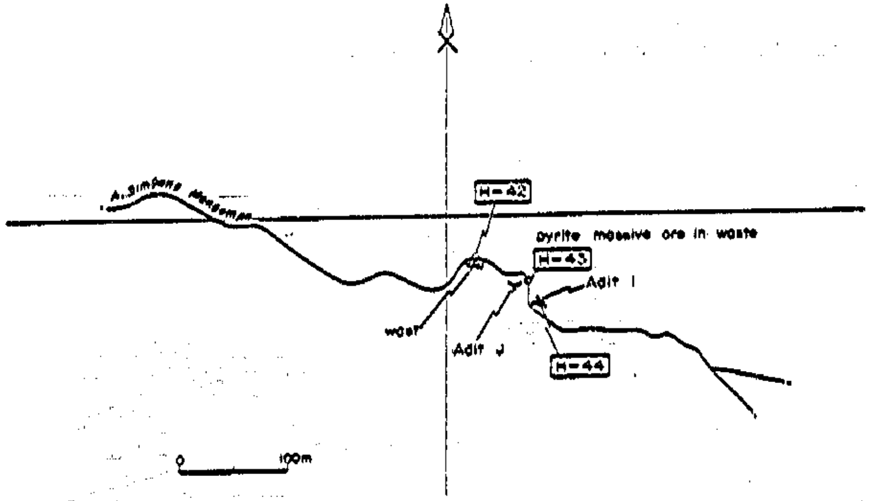
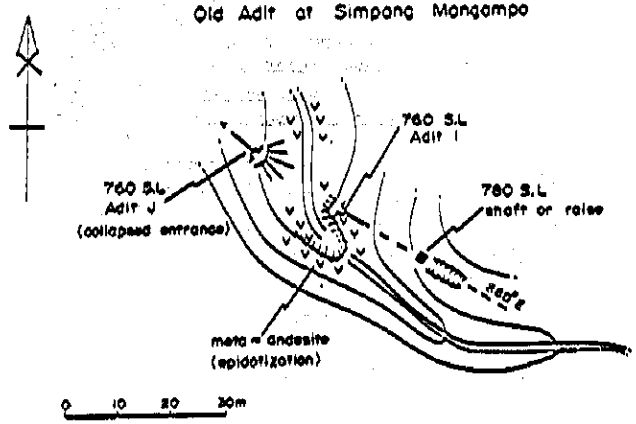


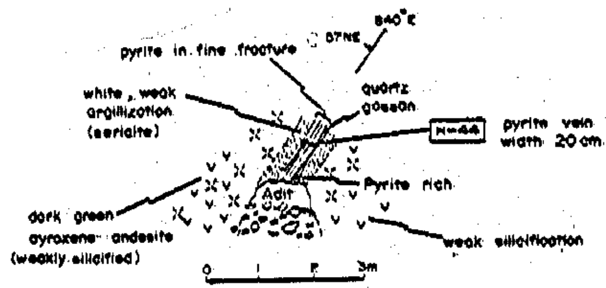
Fig. II-2-8 Sketch of Ore Deposit, Bt. Pionggu, Muara Sipongi Area A



Location map of adits at A. Simpang Mangampo

Old Adit at Simpang Mangampo





Adit I

Fig. II-2-9 Sketch of Ore Deposit, A.Simpang Manganpo, Muara Sipongi Area A

Table II-2-2 Assay Result of Ore Samples, Muara Sipongi Area A

Ore Deposit	Sample No.	Location	Mode of Ore	Width (cm)	Element					Remarks
					Au g/t	Ag g/t	Cu %	Pb %	Zn %	
Adit C	H-47	A. Tabur (Bt. Pionggu)	Green copper	200	0.5	5.5	0.17	< 0.01	0.01	
	H-48	" "	Skarn vein	10	0.1	4.8	0.01	< 0.01	0.01	
	H-50	" "	Skarn	boulder	2.7	2.7	0.11	< 0.01	0.01	
Adit G	J-11	"	Boulder		11.3	148.1	11.20	< 0.01	0.04	mal
	J-13	"	"		10.5	44.6	4.68	< 0.01	0.06	mal
Adit I	H-44	A. Simpang Manganpo	Quartz vein	10	< 0.1	1.4	0.21	< 0.01	0.02	
Adit K	G-4	A. Benkel	Silicification	10	1.4	14.4	2.48	< 0.01	0.01	mal, azu
Adit L	J-44	A. Lilian "	Boulder		2.7	16.4	2.56	< 0.01	0.05	mal
Outcrop A	H-16	A. Silelet	Quartz vein	25	0.1	2.1	0.09	0.11	0.04	py, gal, Sph (cp)
Outcrop B	J-35	A. Durigan	Quartz vein	20	3.6	2.1	0.11	< 0.01	< 0.01	
Outcrop C	G-8	A. Botung	Silicification		0.6	20.6	2.15	< 0.01	0.02	mal
Outcrop D	H-26	A. Tumbalang	Silicification		< 0.1	0.7	0.02	< 0.01	0.01	
Boulder	H-32	A. Botung	Waste ore		0.1	3.4	6.41	< 0.01	0.02	cov, mal
(Adit A)	(ER-209)	A. Tabur	Massive pyrite ore	50	35.4	19.4	0.04	0.01	0.03	
(Adit B)	(ER-175)	A. Tabur	Massive ore	12	1.2	13.9	0.38	0.13	15.30	sph, py

Abbreviation

mal: malachite
azu: azurite
py : pyrite

gal: galena
cp : chalcopyrite
cov: covelline

sph: sphalerite

	garnet 1		garnet 2	
	oxide%	formura	oxide	formura
SiO2	38.03	2.992	39.43	3.002
Al2O3	14.47	1.342	19.08	1.711
TiO2	0.59	0.035	0.00	0.000
Fe2O3	10.18	0.603	4.68	0.268
MnO	0.14	0.010	0.00	0.000
MgO	0.07	0.009	0.25	0.031
CaO	35.70	3.010	36.74	2.997
Total	99.18	8.000	100.18	8.009

	cpx 1		cpx 2	
	oxide	formura	oxide	formura
SiO2	53.64	1.983	52.44	1.943
TiO2	0.13	0.004	0.27	0.007
Al2O3	0.70	0.030	1.44	0.063
FeO	4.25	0.132	3.77	0.117
MnO	0.30	0.009	0.04	0.001
MgO	15.1	0.832	15.21	0.840
CaO	25.32	1.003	26.34	1.046
Na2O	0.10	0.007	0.00	0.000
Total	99.54	4.001	99.51	4.018

(cpx : clinopyroxene)

Sample No. H50

Table II-2-3 Chemical Composition of Skarn Mineral from Bt. Pionggu Ore Deposit Huara Sipongi Area A

Table II-2-4 Microscopic Observation of Ore Sample, Muara Sipongi Area A

Sample No.	Location	Mode of Ore	Ore Mineral						Gangue Mineral							Remarks
			py	cp	ga	sph	mag	mal	se	chl	q	pl	ep	gar	cal	
G3	Tributary of A.S. Mangampo	dissemination	o	o			◎			○	○		o			
H16	A. Silelet	"	○	o	o	o			o		◎				o	
H26	A. Tumbalang	"	o				○		o		○	o	o?			
H32	A. M. Botung	"						o		o	o		o	◎	o	boulder
H42	A. Simpang Mangampo	mossive	◎	o												boulder (Adit J)

Abbreviation

py : Pyrite
cp : Chalcopyrite
ga : Galena
sph: Sphalerite
mag: Magnetite
mal: Malachite

se : Serisite
chl: Chlorite
q : Quartz
pl : Plagioclase
ep : Epidote
gar: Garnet
cal: Calcite

◎: Abundant ○: Common o: Rare

Table II-2-5 List and Chart of X-ray Diffractive Analysis, Muara Sipongi Area A

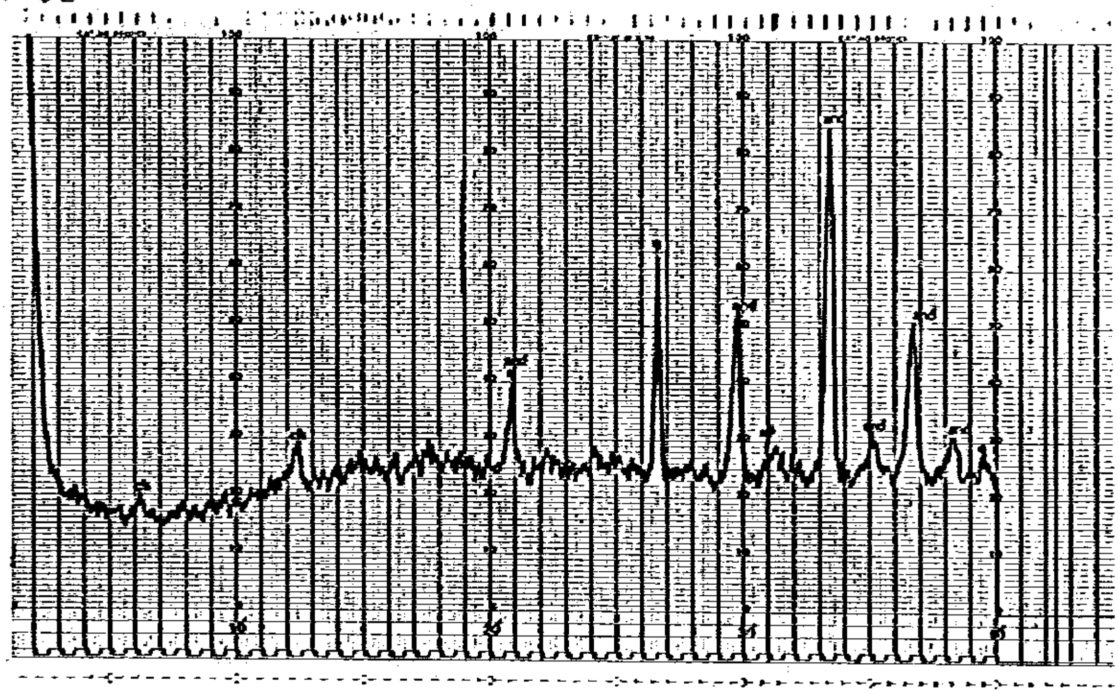
Sample No.	Sample Name	Location	m	mix	se	ch	k	la	ca	ep	and	ves	px	ho	mal	sph	py	q	kf	pl	Remark
H-13	Quartz vein	Adit F					o							o?	o?			◎	○	◎	
H-32	Oxidized ore	A. M. Botung				o				o	◎							○			Skarn
H-44	Gossan	Adit I		o?	o	○		o						o				o		○	
H-45	Oxidized ore	Adit D				o		o?					o	o?	◎			o			Skarn
H-47	Wall rock of ore vein	Adit C	o						o		o	○						○			Skarn
J-10	Skarnized limestone	Adit D									◎		o	o?	◎			o			Skarn
J-46	Clay	Adit L	○			o?	o?	o										◎		○	
J-52	Silicified andesite	Tributary of A. Botung						○										◎			

Abbreviation

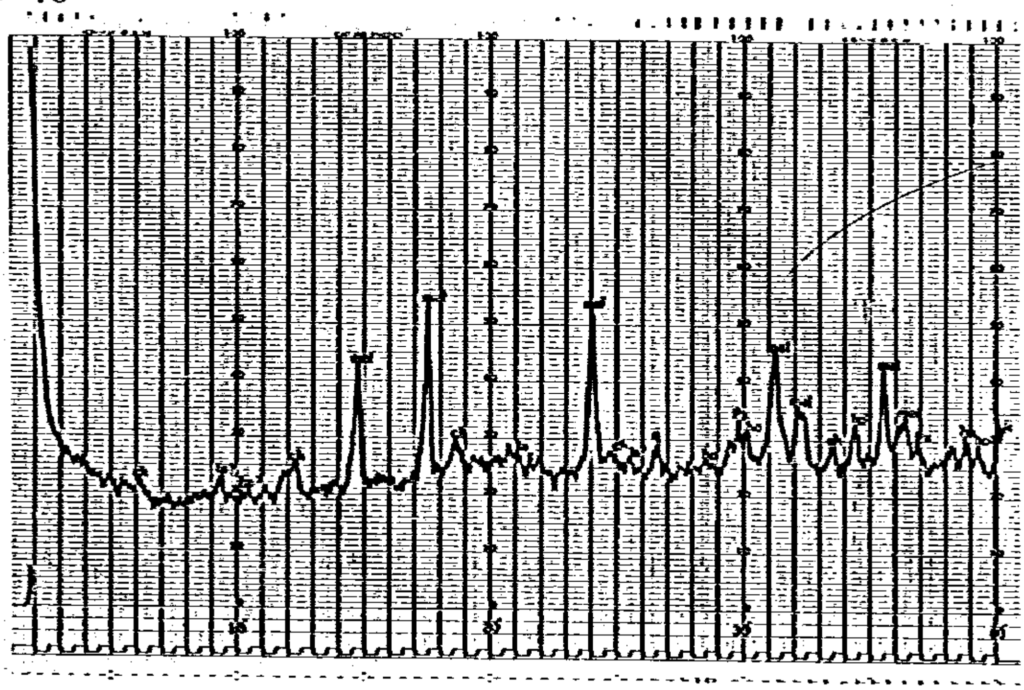
- m : Montmorillonite
- mix: Mixed-layer mineral
- se : Sericite
- ch : Chlorite
- k : Kaoline mineral
- la : Laumontite
- ca : Calcite
- ep : Epidote
- and: Andradite
- ves: Vesuvianite
- px : Pyroxene
- ho : Hornblende
- mal: Malachite
- sph: Sphalerite
- py : Pyrite
- q : Quartz
- kf : Potash feldspar
- pl : Plagioclase

◎ : Abundant ○ : Common o: Rare

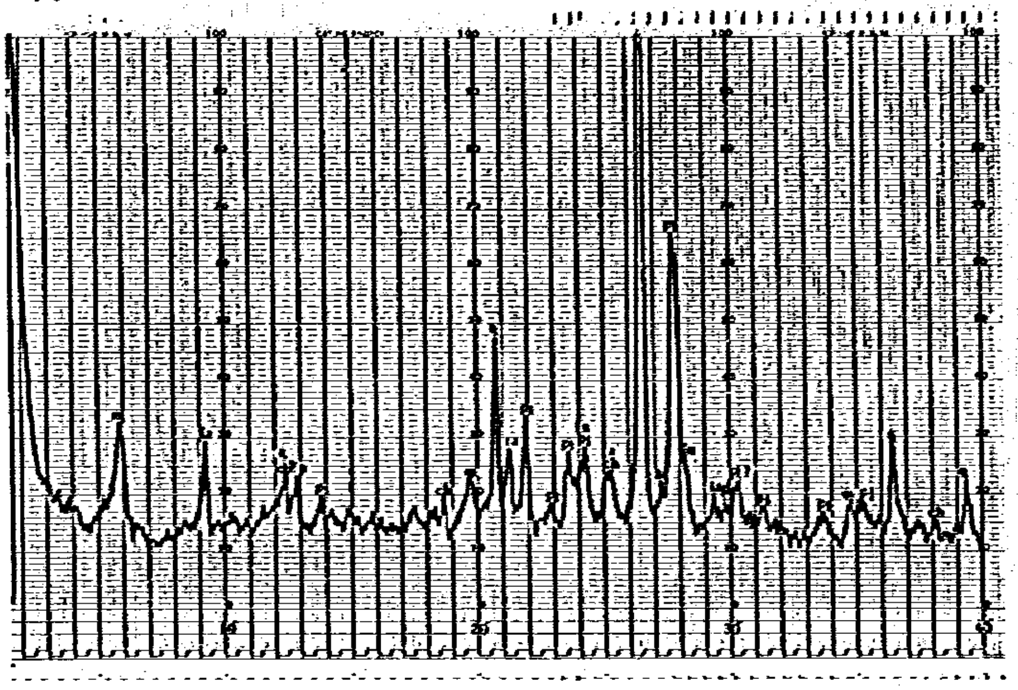
H—32



H—45



J—46



H—47

CHAPTER 5 GEOCHEMICAL SURVEY

5-1 SAMPLING

Geochemical survyes of the soil were conducted along with the geological survey. The soil samples were collected at a rate of 10 samples per km^2 so as to obtain them in as uniform a distribution as possible and the number of samples collected was 83. Efforts were made to avoid taking samples at places which would have been influenced by valleys and rivers and the samples were collected from B-Horizon at mountain slopes and summits. All collected samples were naturally dried under the sunshine and each sample was divided into two and kept by the Japanese and Indonesian sides.

Since the deposits that are distributed in the survey area are gold-silver-copper-lead-zinc deposits, the analysis was made using gold, silver, copper and zinc as path-finder elements in reference to the geochemical survey results on the stream sediments conducted in the first phase survey. The analysis results are shown in Table II-2-8.

5-2 DATA PROCESSING

The data obtained from the analysis was firstly processed through logarithmic conversion, then histogram, mean value, standard deviation and correlation coefficient of each path-finder element were calculated, and threshold (I) (M + S.D.) and threshold (II) (M + 2 x S.D.) were obtained.

5-2-1 Correlation between Path-finder Elements

The correlation and correlation coefficients among all path-finder elements are shown in Fig. II-2-11 and Table II-2-7. The correlation between gold and silver is poor but those of others are favorable.

5-2-2 Histogram

The maximum and minimum values of each path-finder element, that is, gold (570 PPb, 1 PPb), silver (1.6 PPm, 0.1 PPm), copper (2.00 PPm, 12 PPm), lead (265 PPm, 1 PPm) and zinc (430 PPm, 23 PPm) were converted to logarithm, classified into 15 groups, and a histogram was prepared. Since the analysis values of gold and silver were extremely low and, on gold, the value of analysis limit 1 PPb, inclusive of cases where the value was less than the analysis limit, occupies 22% and on silver, the value of analysis limit 0.1 PPm, inclusive of cases where the value was less than the analysis limit, occupies

94%, the histogram of gold and silver are in an asymmetric L-shape tending toward lower grades. The histogram of copper, lead and zinc are normal frequency distribution (Fig. II-2-10).

5-2-3 Anomalous Areas

The average value (M) and standard deviation (S.D.) were calculated, from which thresholds (M + S.D. and M + 2 x S.D.) were calculated. The threshold of (M + S.D.) was set as Class 2 and the threshold of (M + 2 x S.D.) was set as Class 1, and any area where two or more anomalous values existed in the neighborhood was set as an anomalous area. As the result, Bt. Pionggu north, Bt. Pionggu east ridge, A. Muara Botung upstream, Bt. Pamatang Panarathan, and Bt. Pintu Batu east ridge were picked up to be anomalous areas (Table II-2-6, Fig. II-2-13).

(a) Bt. Pionggu anomalous area

Class 2 and Class 1 anomalous areas of gold (silver), lead and zinc overlap each other in a range of 600 m diameter and in the northern side there is anomalous area of copper. The geology of this area is limestone, and there is a mineralized zone accompanied with skarn minerals (garnet and clinopyroxene), and an old tunnel Adit D is known.

(b) Bt. Pionggu east ridge anomalous area

There is an anomalous area of Class 2 1.5 km by 0.1 km in the southern margin ridge of the survey area in the A. Tabar upstream. Anomalous areas of silver and copper are partially distributed in the range. The geology of this area is sandstone, and although there was no known mineralization, the first phase survey recognized a silicification area in the south of this area.

(c) A. Muara Botung upstream anomalous area

A Class 2 anomalous area of gold, silver and copper is distributed 1.5 km long and 0.2 km wide along the boundary of quartz diorite stocks and meta-andesite that are distributed in the A. Muara Botung upstream. No mineralized area has been discovered, but there is a weak silicification area in the meta-andesite.

(d) Pamatang Panarahan anomalous area

There is a Class 2 anomalous area of gold 600 m by 400 m in Bt. Pamatang

Panarahan in the A. Simpang Mangampo upstream. The geology of this area consists of quartz diorite stocks, however no mineralization zone or silicification zone was recognized through the geological survey.

(e) Bt. Pintu Batu anomalous area

A Class 2 anomalous area of lead and zinc 1.2 to 0.2 km is distributed in the summit of the northern margin of survey area. In this area, limestone is distributed but no skarn deposit has been discovered.

No anomalous areas were recognized in A. Tabur downstream area and old tunnel areas along A. Simpang Mangampo.

Table II-2-6 List of Mean Value, Standard Deviation and Threshold Value on Geochemical Survey in Muara Sipongi Area A

Element	Max.	Min.	Mean	S.D. (log)	M+S.D.	M+2xS.D.	M+3xS.D.
Au (ppb)	570	1	7	0.6947	34	172	
Ag (ppm)	1.6	0.1	0.11	0.1719	0.16	0.24	0.35
Cu (ppm)	2,000	12	71	0.3739	169	400	948
Pb (ppm)	265	1	5	0.4349	15	42	116
Zn (ppm)	430	23	78	0.2244	132	221	371

(population: 83)

Table II-2-7 List of Coefficients of Correlation between Path-finder Elements on Geochemical Survey in Muara Sipongi Area A

	Au	Ag	Cu	Pb	Zn
Au		- .124224	0.533602	0.348742	0.353719
Ag			-0.648518	-0.244634	-0.779508
Cu				0.292222	0.826899
Pb					0.476612
Zn					

(population: 83)

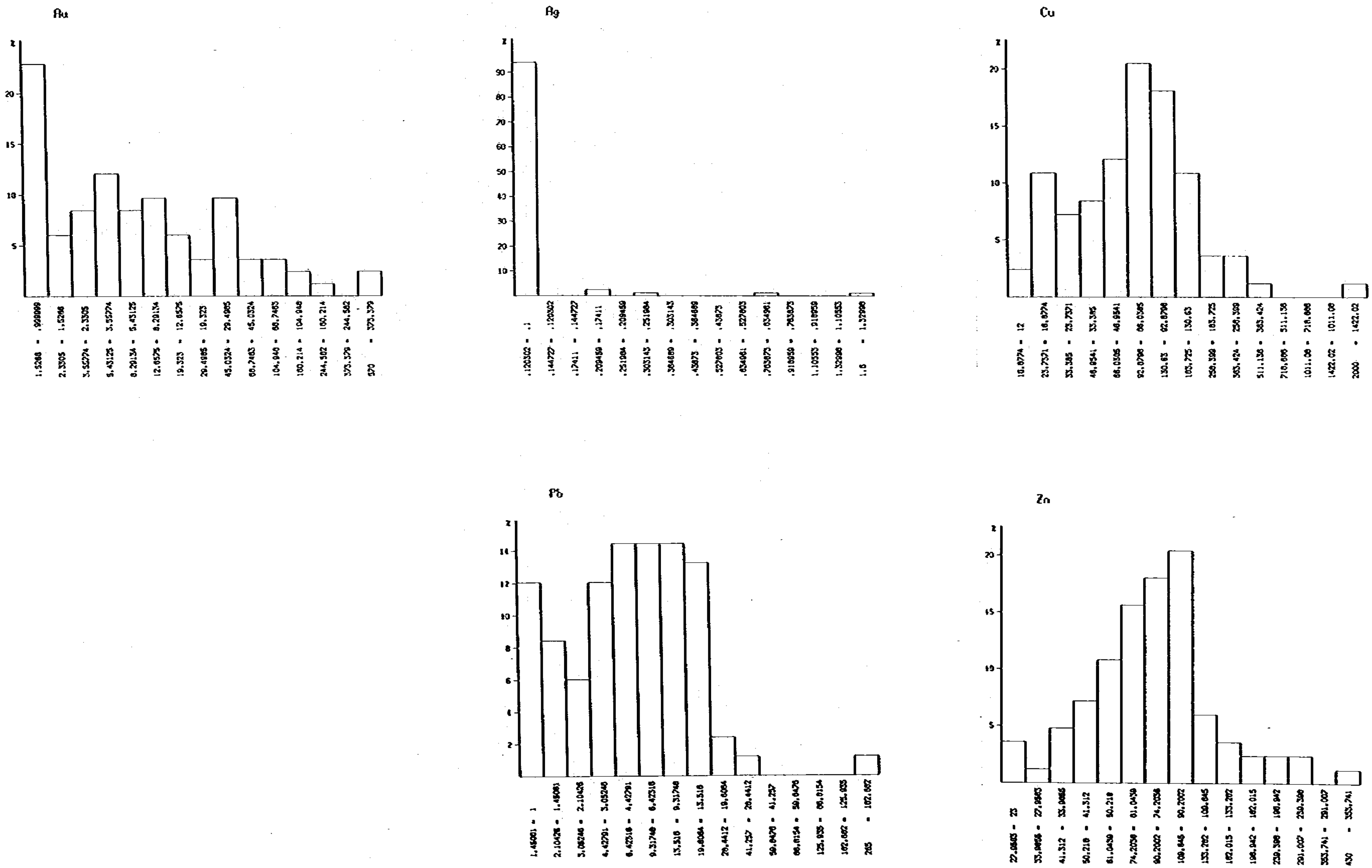


Fig. II-2-10 Histgram of Geochemical Analysis in Muara Sipongi Area A

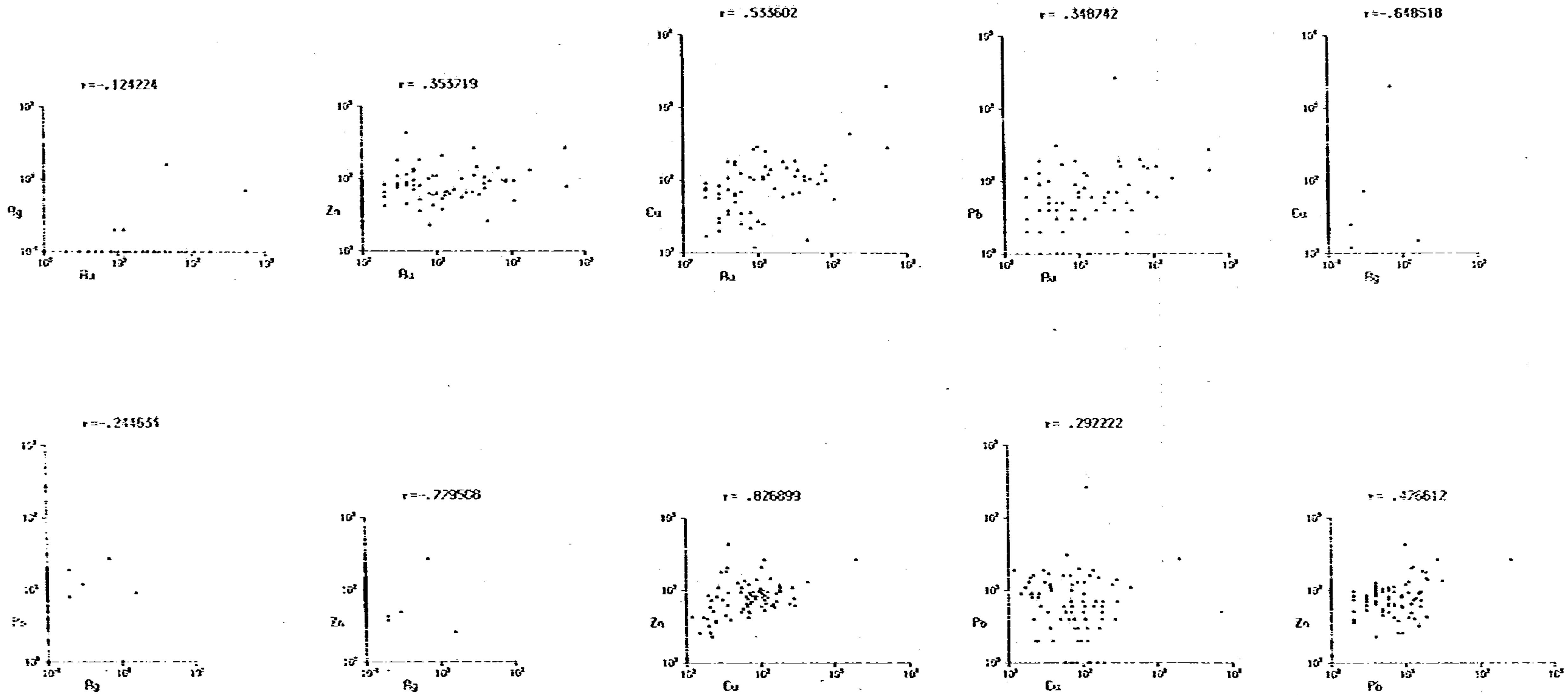


Fig. II-2-11 Coefficient of Correlation of Geochemical Path-finder Elements in Muara Sipongi Area A

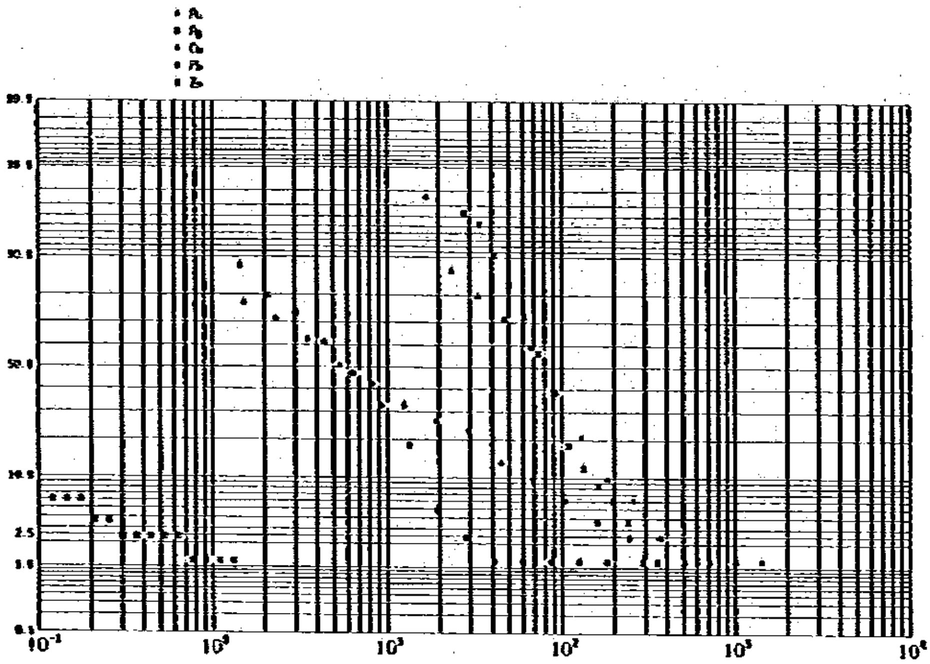


Fig. II-2-12 Cumulative Frequency Distribution of Geochemical Path-finder Elements in Muara Sipongi Area A

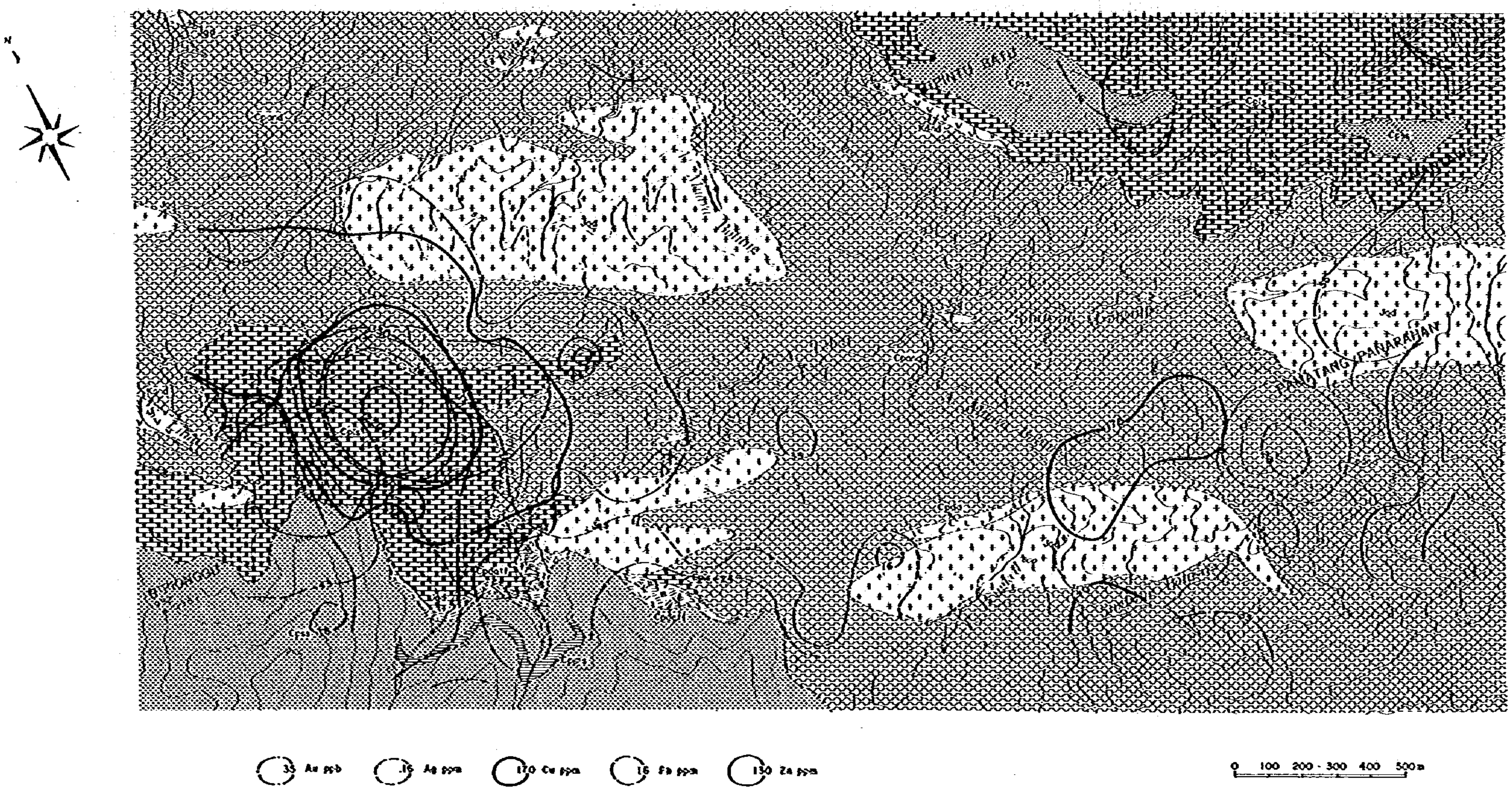


Fig. II-2-13 Map of Geochemical Anomaly in Huara Sipongi Area A
(Au, Ag, Cu, Pb, Zn)

CHAPTER 6 CONCLUSION

The results of geological survey and geochemical survey of soil in the area (8 km^2) on the skarn gold-bearing copper deposits, the gold-bearing (lead and zinc) fissure-filling ore veins deposit in the area (8 km^2) are summarized as follows:

(1) In the survey area meta-andesite is distributed in the low land along A. Tabur, A. Simpang Mangampo and A. Muara Botung, while limestone and calcareous sandstone in mountain top areas like Bt. Pionggu. Jurasic quartz diorite stocks have been intruded into meta-andesite in the alignment along a N 60° W direction.

(2) The ore deposits are fissure-filling type deposits emplaced in fissures of two systems of N 20° - 5° W 50° NE and N 40° W 60° SW. From the observation results of Adit C, the skarn ore deposits have been skarnized limestone along the fissures, and the location of mineralization is thought to be controlled by the fissures, the same as in the ore veins in meta-andesite. These skarn minerals are diopside (Di $_{85-88}$) of clynopyroxene and grossularite (Gr $_{87-70}$) of garnet, and these skarn minerals commonly accompany iron or copper ore deposits.

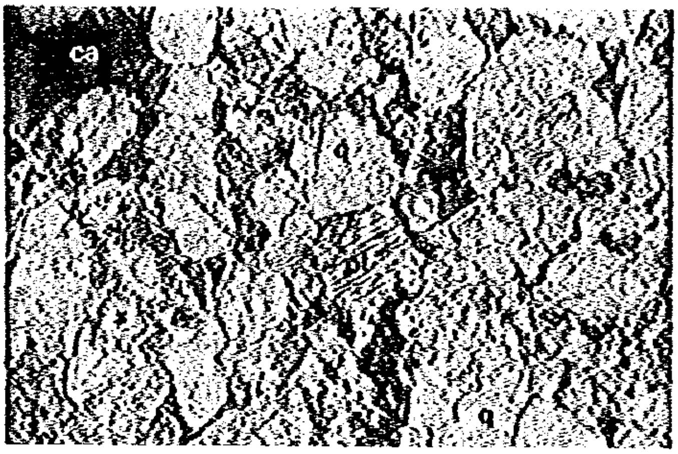
(3) The ore minerals contained in the ore veins are mostly pyrite and chalcopyrite, and some sphalerite and galena are also contained. Green copper ores like malachite can be recognized as oxide ore. Some ore veins contain gold of 1 to 3 g/t, and seldomly as much as 35 g/t.

(4) Through the geochemical survey of soil, anomalous areas overlapped elements such as gold, silver, copper, lead and zinc and are recog in the mineralized area (centering on Adits C, D, E and L) within limestone that is distributed in the north of Bt. Pionggu. In other areas, there are anomalous areas of gold, silver and copper in the A. Muara Botun upstream, an anomalous area of gold in Pamatang Panaharan (upstream of A. Sinpang Mangampo), and an anomalous area of lead and zinc in Bt. Pintu Batu, but no anomalous areas exist in the already known mineralized areas along A. Muara Botung, A. Tabur and A. Simpang Mangampo.

Fig. II-2-14 Microscopic Photograph of Thin Section and Ore Sample Muara Sipongi Area A

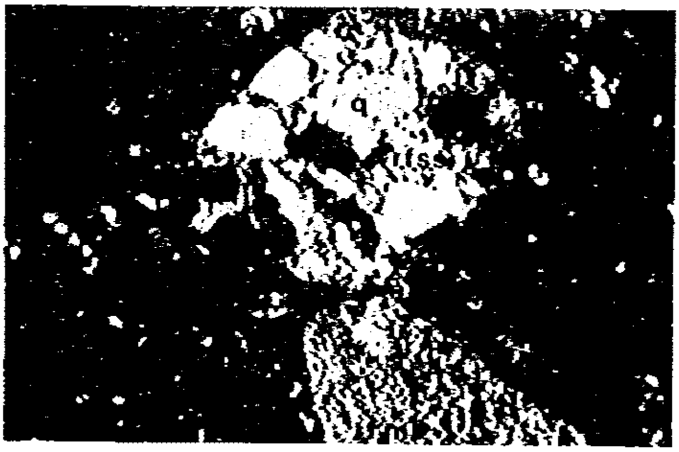
Abbreviation

q	:	Quartz
pl	:	Plagioclase
ho	:	Hornblende
fe	:	Ferric mineral
ca	:	Calcite
hd	:	Clinopyroxene
gar	:	Garnet
ep	:	Epidote
mt	:	Magnetite
mal	:	Malachite
r.f.ss	:	Rock fragment (sandstone)



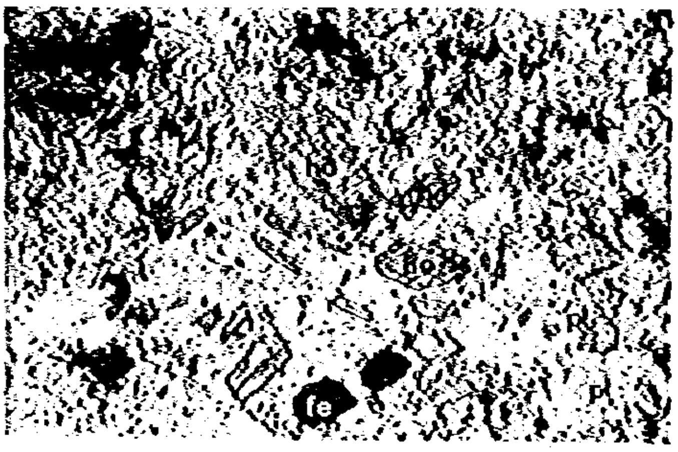
Sample No.: J-21
Location : Upper stream of A. Tabur
Rock name : Calcareous sandstone
Formation : Patahajang Formation

only lower polar
0 0.5mm



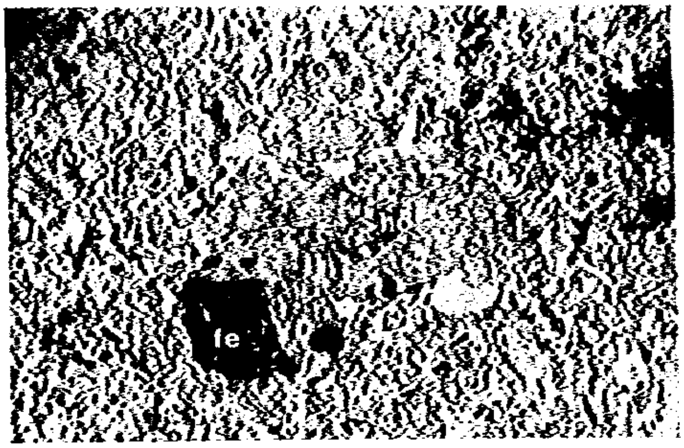
Sample No.: J-26
Location : A. M. Botung
Rock name : Dacitic tuff
Formation : Patahajang Formation

cross polars
0 0.5mm



Sample No.: H-7
Location : A. M. Botung
Rock name : Hornblende andesite
Formation : Muara Botung Formation

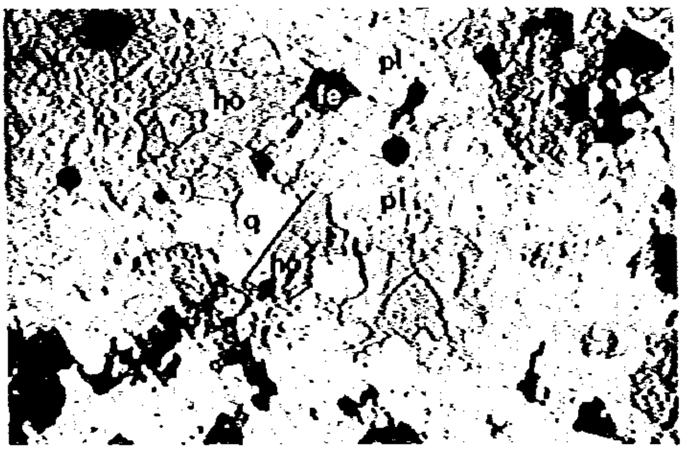
only lower polar
0 0.5mm



Sample No.: H-15
Location : A. Silelet
Rock name : Hornblende andesite
Formation : Muara Botung Formation

only lower polar

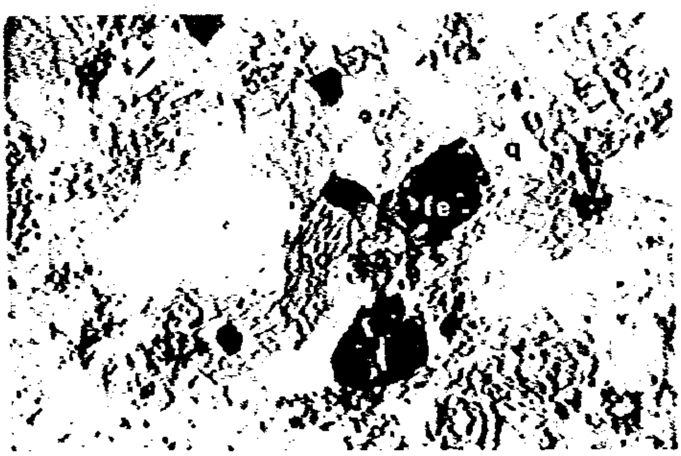
0 0.5mm



Sample No.: H-22
Location : A. Tumbalang
Rock name : Diorite porphyry

only lower polar

0 0.5mm



Sample No.: J-47
Location : A. Tabur
Rock name : Quartz diorite

only lower polar

0 0.5mm

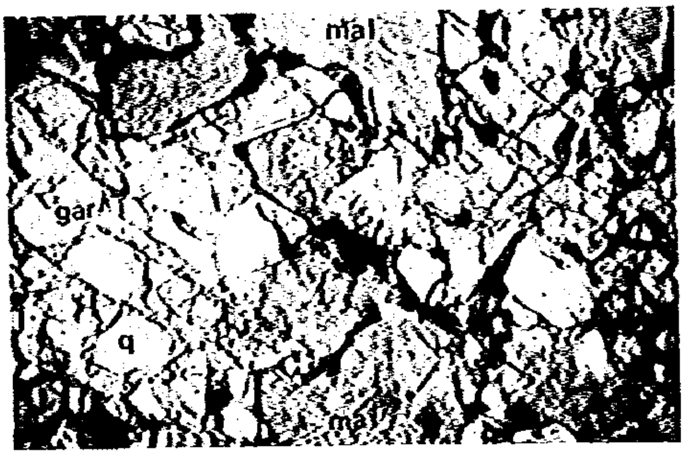
Sample No.: J-47
Location : A. Tabur
Rock name : Quartz diorite

cross polars

0 0.5mm

Sample No.: G-3
Location : Tributary of A. Simpang Manganpo
Ore name : Magnetite dissemiation

0 0.2mm



Sample No.: H-32
Location : A. M. Botung (K. Muara Botung)
Ore name : Oxidized ore

0 0.2mm

Sample No.: H-50
Location : A. Tabur, Adit C
Rock name : Skarn

only lower polar

0 0.5mm

Table II-2-8 Assay Result of Geochemical Survey, Muara Sipongi Area A

Sample No.	Coordinates X	Y	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm
JS1	2035	-745	10	0.1	290	7	62
JS2	2225	-1040	110	0.1	55	6	50
JS3	2480	-1125	4	0.1	74	4	58
JS4	2850	-1075	13	0.1	155	1	59
JS5	3085	-950	4	0.1	38	10	430
JS6	3055	-695	1	0.1	70	10	120
JS7	2680	-450	1	0.3	72	12	49
JS8	2620	-645	44	0.1	101	5	105
JS9	3065	150	17	0.1	77	4	70
JS10	3330	270	3	0.1	26	9	32
JS11	2930	365	6	0.1	25	2	36
JS12	190	390	30	0.1	65	4	65
JS13	65	-135	110	0.1	55	16	94
JS14	415	-140	1	0.1	31	13	74
JS15	430	100	12	0.2	25	8	38
JS16	1310	-130	8	0.1	22	4	23
JS17	1410	130	44	0.1	114	2	74
JS18	975	-70	22	0.1	59	5	55
JS19	-340	475	4	0.1	34	5	45
JS20	-430	130	1	0.1	21	8	26
JS21	-120	230	1	0.1	20	15	32
JS22	-240	955	12	0.1	113	3	53
JS23	1320	1105	4	0.1	107	6	81
JS24	1360	885	25	0.1	148	7	64
JS25	1830	1250	1	0.1	69	6	76
JS26	1785	1040	3	0.1	56	1	108
JS27	755	1400	1	0.1	81	1	95
GS1	2495	-240	13	0.1	250	12	65
GS2	2245	-615	1	0.1	39	2	39
GS3	2100	-320	9	0.1	270	4	109
GS4	2050	25	14	0.1	120	1	66
GS5	3030	680	1	0.1	37	11	93
JS6	2685	650	6	0.1	35	17	182
GS7	2555	390	8	0.1	110	4	100
GS8	20	750	35	0.1	138	19	146
GS9	305	670	555	0.7	2000	27	265
GS10	590	630	570	0.1	285	14	73
GS11	915	585	67	0.1	90	20	111
GS12	1230	515	3	0.1	65	4	84
GS13	1590	380	6	0.1	69	5	51
GS14	1780	100	9	0.1	103	9	60
GS15	1900	255	4	0.1	180	4	114
GS16	2080	325	2	0.1	77	3	84
GS17	2225	590	1	0.1	19	13	41
GS18	1700	645	3	0.1	84	2	84
GS19	2175	880	5	0.1	62	31	135
JS20	2450	885	1	0.1	69	7	42
GS21	2265	1075	3	0.1	20	9	85
GS22	2060	860	2	0.1	17	11	42
GS23	1740	845	2	0.1	58	1	56

Sample No.	Coordinates X	Coordinates Y	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm
GS24	200	965	32	0.1	135	7	111
GS25	90	1310	5	0.1	180	5	95
GS26	325	1480	1	0.1	85	3	77
GS27	550	1630	5	0.1	65	1	81
GS28	895	1615	1	0.1	72	1	93
GS29	1165	1405	1	0.1	190	1	98
GS30	1450	1380	12	0.1	104	13	210
GS31	-35	1200	130	0.1	440	11	131
GS32	-70	1480	6	0.1	125	1	80
GS33	45	1865	43	0.1	114	1	86
GS34	310	1885	1	0.1	96	2	97
HS1	1820	-500	5	0.1	50	4	126
HS2	1595	-690	1	0.1	23	2	51
HS3	1315	-590	10	0.1	27	6	199
HS4	1160	-400	8	0.1	36	3	62
HS5	1490	-295	9	0.2	12	19	43
HS6	1909	-190	37	0.1	68	16	60
HS7	3050	-160	51	0.1	105	4	92
HS8	3225	-450	1	0.1	36	12	205
HS9	3345	-225	85	0.1	99	7	96
HS10	3385	65	75	0.1	124	16	96
HS11	2610	20	2	0.1	92	2	83
HS12	-30	540	32	0.1	114	265	265
HS13	630	245	22	0.1	180	6	100
HS14	785	-465	47	1.6	15	9	26
HS15	3560	250	1	0.1	21	3	59
HS16	3610	550	3	0.1	30	19	179
HS17	3315	595	1	0.1	22	16	73
HS18	845	1175	2	0.1	73	6	65
HS19	835	930	3	0.1	85	13	76
HS20	635	805	5	0.1	165	3	70
HS21	1040	810	15	0.1	140	6	62
HS22	460	1205	85	0.1	163	15	92

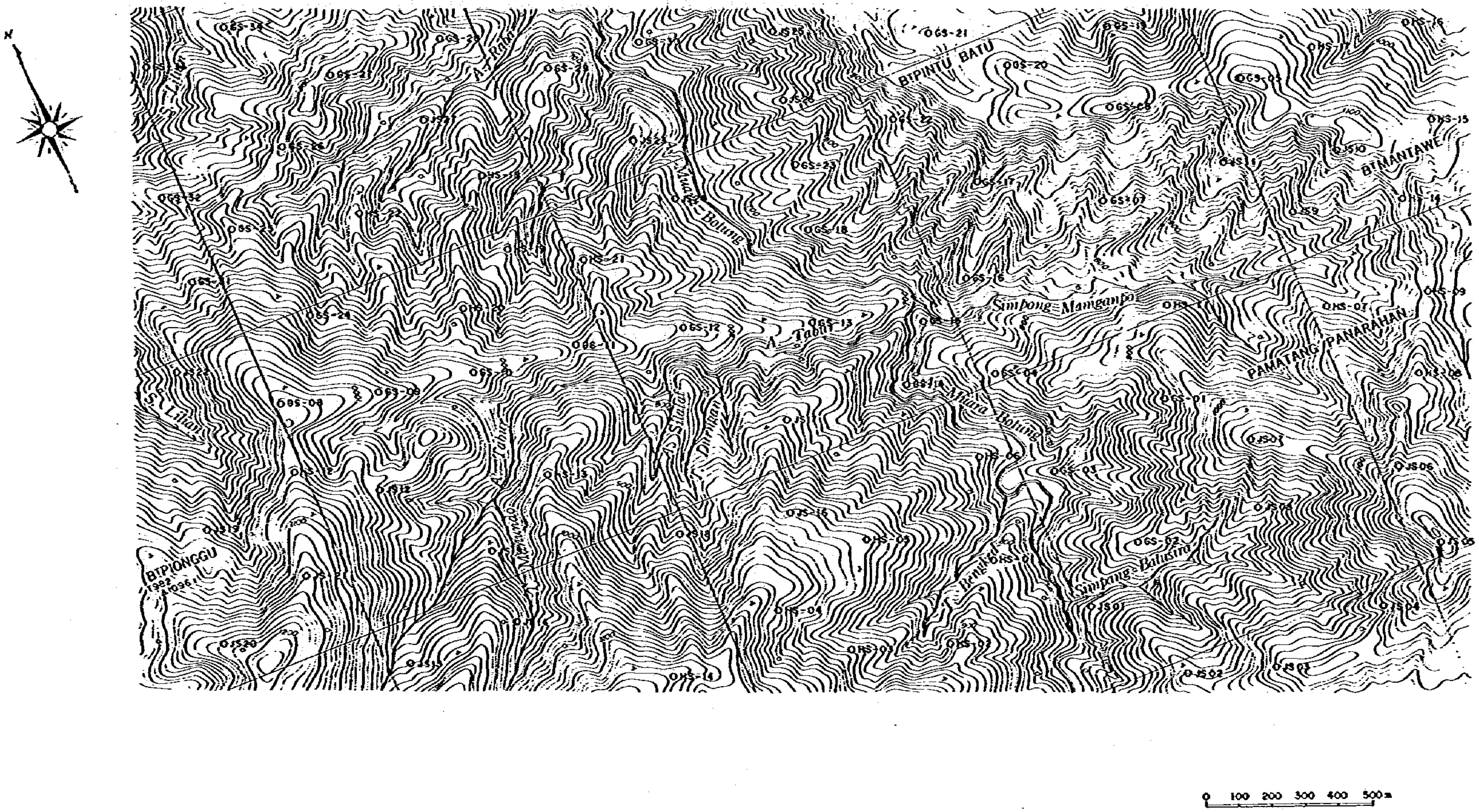
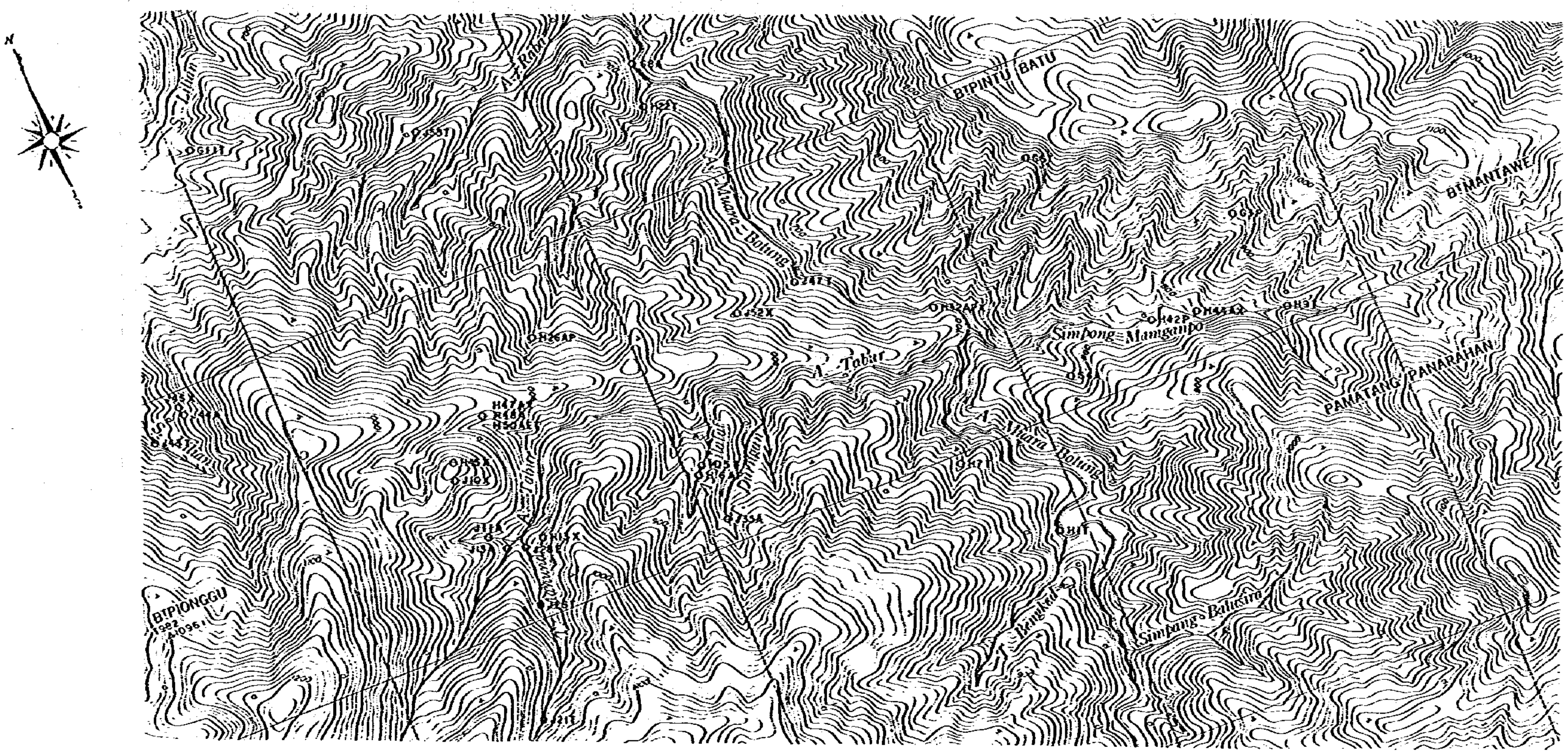


Fig. II-2-15 Location Map of Geochemical Samples in Kuara Sipongi Area A



abbreviation

T : Thin Section
P : Polished Section of Ore
X : X-ray Diffractive Analysis
E : Electron Probe Micro Analysis
A : Chemical Assay of Ore

0 100 200 300 400 500m

Fig. II-2-16 Location Map of Rock and Ore Samples Tested in Muara Sipongi Area A

PART II-3

MUARA SIPONGI AREA B

CHAPTER 1 OUTLINE

1-1 SUMMARY OF THE FIRST PHASE SURVEY

The geology of this survey area comprises a Patahajang Formation consisting of sandstone, mudstone (slate and phyllite) and limestone. And the Formation is correlative with the Silungkang Formation of the Permian-Carboniferous Peusangan Group. Jurassic granitoid rocks have been intruded therein. Pagar Gunung silver bearing copper-lead-zinc skarn deposits ore embedded in intertrappean limestone of Patahajang Formation, emplacing the limestone. The Pagar Gunung deposit has been confirmed its extension of 200 m long following outcrops. Between the Pagar Gunung deposit and the Patahajang mineralized area (6 km across), a geochemical survey of stream sediment indicated continuous anomalous regions comprising copper, lead, zinc and arsenic.

1-2 PURPOSE OF THE SECOND PHASE SURVEY

The second phase survey pursued, first of all, the continuity of the silver bearing lead-zinc mineralized areas (Pagar Gunung deposit and Patahajang mineralized area). At the same time, the geology, geological structure and igneous activity of the area between the Pagar Gunung deposit and the Patahajang mineralized zone were investigated and a geochemical survey of soil was also conducted to evaluate the deposit continuity.

1-3 SURVEY METHODS AND QUANTITIES

(1) Topographic map preparation

Aerial photographs of 1/120,000 scale were used to prepare a topographic map of 1/10,000 scale. The map was then used as the original topographic map for editing geological maps and other data. For geological survey and geochemical survey in the field, the topographical map of 1/10,000 scale was enlarged into a topographical map of 1/5,000 scale.

(2) Geological survey

By use of the 1/5,000-scale topographical map, a geological survey was conducted along main rivers and sampling lines of geophysical survey to compile a 1/10,000 geological map. In the main mineralized zones, a survey using compass and measure tape was conducted to sketch 1/100 ore deposit maps. The survey route was 78 km long in total.

(3) Geochemical survey

Soil was sampled from B-horizon, at 50 m interval along each sampling line in the area (9 sampling lines of 1.2 km each, 150 m apart) under the geophysical survey and at 7 locations per sq. kilometer in the area outside of the geophysical survey. To avoid contamination from rivers, sampling was made at hillsides and hilltops. The soil samples totalled 427 pieces, 229 from along sampling lines under geophysical survey, and 198 from the other area. The samples were dried in the sun at the Kotanopan base camp, and divided into two portions: one kept by the Japanese team and the other by the Indonesian team. Analysis of the samples was performed by having gold, silver, copper, lead and zinc selected as path-finder elements.

CHAPTER 2 GEOLOGY

2-1 GEOLOGICAL OUTLINE

Through the First Phase Survey in the Muara Sipongi area, the strata comprising limestone, sandstone, mudstone and tuff and distributed in the Pagar Gunung and Patahajang area were divided into Patahajang Formation together with the Muara Botung Formation that is overlain lower and consists of meta-andesite. The survey correlated the Patahajang and Muara Botung Formations with the Silungkang Formation of the Permian-Carboniferous Peusangan Group according to the stratigraphic classification for Northern Sumatra (by Cameron et al, 1980).

The Second Phase Survey involved more detailed geological surveys that divided the Patahajang Formation into seven Members including volcanic rock (basic rock, andesite, dacite), limestone, sandstone and mudstone. Listed from upper to lower geologically, the members are:

Upper Limestone Member	Patahajang Formation
Basic Volcanic Rock Member	Patahajang Formation
Lower Limestone Member	Patahajang Formation
Upper Andesite Member	Patahajang Formation
Alternated Member of Clastic Rock and Volcanic Rock	Patahajang Formation
Dacite Member	Patahajang Formation
Lower Andesite Member	Muara Botung Formation

The Lower Andesite Member was of green massive andesite and was correlative with the Muara Botung Formation for its similar rock facies with the Muara Botung andesite. On hilltops, Tertiary pyroxene andesite was distributed, overlying uncomformably the Patahajang Formation.

Muscovite granodiorite was extensively distributed in the north margin of the survey area, with numerous stocks of tonalite and quartz diorite intruded into the granodiorite.

Schistosity was produced in sedimentary rock, and the rock was metamorphosed slightly to slate and phyllite and muscovite granodiorite was cataclasted and has been altered into mylonite, under geological tectonics. Through regional metamorphism of the chloritization and sericitization, the andesite and basic volcanic rock in the Muara Botung and Patahajang Formations have mostly been altered into meta andesite (Fig. II-3-1 - 4).

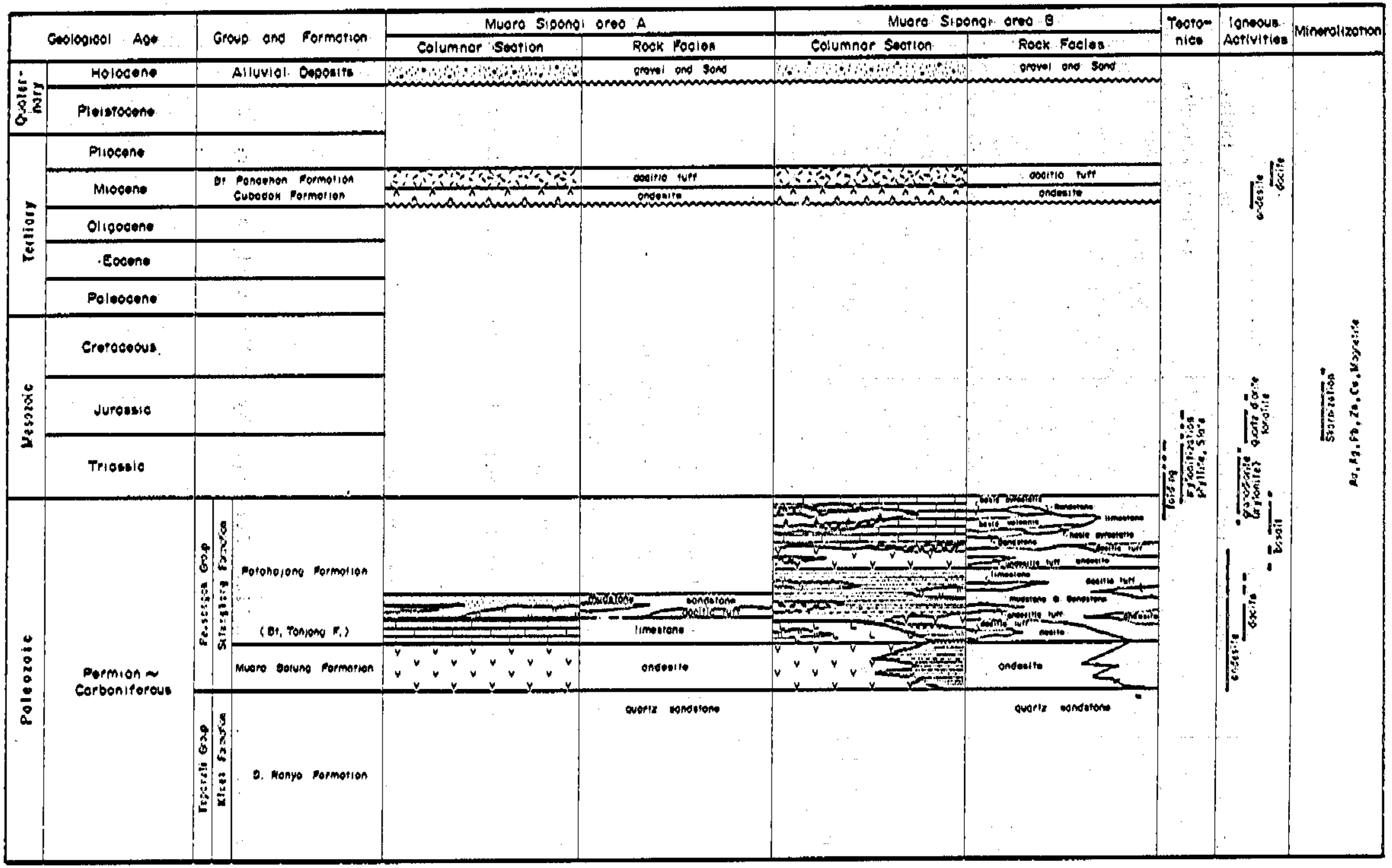
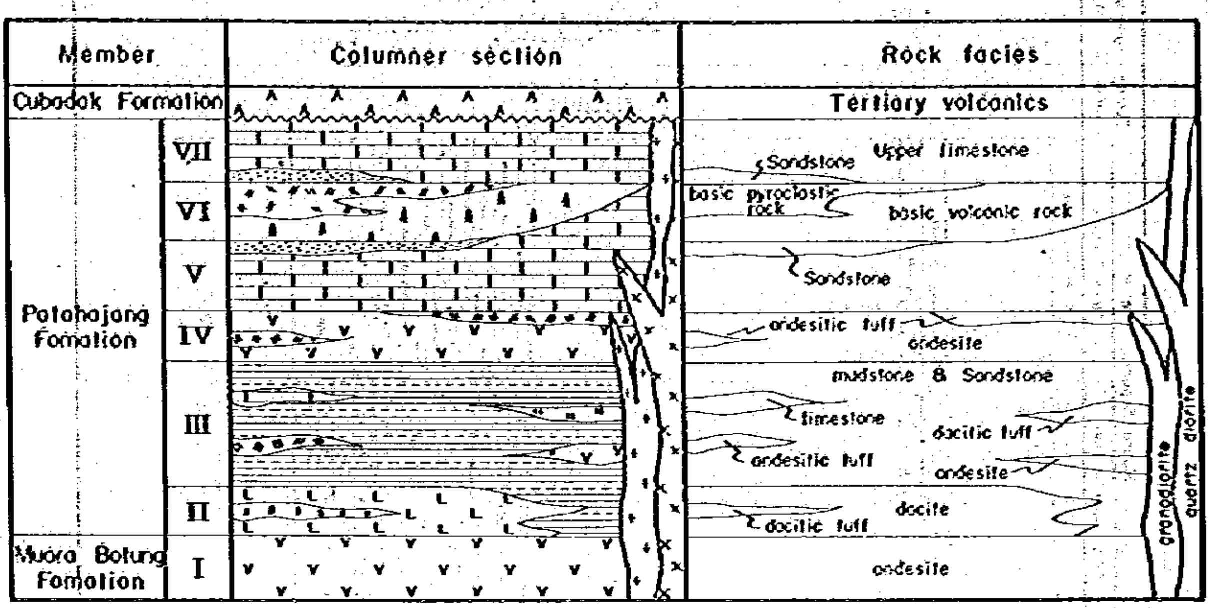


Fig. II-3-1 Generalized Stratigraphy in Muara Sipongi Area



Patahajang Formation	VII	Upper Limestone Member
	VI	Basic Volconic Rock Member
	V	Lower Limestone Member
	IV	Andesite Member
	III	Alternated Member of Clastic Rock and Volcanic Rock
	II	Dacite Member
M. Botung Formation	I	Andesite Member

Fig. II-3-2 Generalized Stratigraphy in Muara Sipongi Area B

2-2 GEOLOGY

2-2-1 Muara Botung Formation

Distribution:

The Muara Botung Formation consists of the andesite distributed lowest in this survey area, downstream of the A. Mandagang and near K. Simpan Pining to the south.

Rock facies:

The Formation is of dark green massive andesite, similar in quality to the altered andesite (hornblende andesite) widely distributed in the Muara Botung area.

Thickness: 300 m ±

2-2-2 Patahajang Formation

(1) Dacite Member

Distribution:

The Dacite Member is distributed upstream of the A. Nabobar and the A. Tolang, tributaries of the A. Mandagang to the northeast of the survey area.

Rock facies:

This Member consists mainly of massive dacite lava, with lapilli tuff containing green lopilli (of pumice). The rock has been decolored by alteration and appears white. A microscopic observation (M18) reveals that Phenocrysts of sericitized plagiclase and chloritized and epidotized mafic mineral (may be hornblende or pyroxene originally) are embedded in groundmass consisting of silicate mineral, plagioclase, iron mineral and epidete. The tuffaceous dacite (M21) has a pyroclastic texture, accompanied by lithic fragments of andesite and siliceous rock. These components have all been altered into sericite, chlorite, calcite, kaoline and epidote of secondary minerals, and dissemination of pyrite occurs extensively. This is slightly andesitic in quality.

Stratigraphy:

The contact point with the lower andesite (Muara Botung Formation) is not observable because of poor exposure. Because there is no conglomerate or fault identified to indicate unconformity between the two Formations, they could be in conformity. As will be described later, the phyllitic siliceous rock is distributed in the upper part of the

Dacite Member and along the A. Saladi south of the Patahajang syncline structure. Some part of the siliceous rock is of acidic tuffaceous and seems to be related with dacite.

Thickness: Up to 150 m

(2) Alternated Member of Clastic Rock and Volcanic Rock

Distribution:
This Member is distributed in the Pagar Gunung mineralized area to the northwest of this survey area, along the A. Saladi and the A. Sabul to the southeast, upstream of the A. Karbar and along the A. Nabobar to the east.

Stratigraphy:
Mudstone is predominant in the Pagar Gunung mineralized area, containing intercalated sandstone, dacite, tuffaceous sandstone, andesitic tuffaceous sandstone and calcareous mudstone beds. By contrast, the areas along the A. Saladi and the A. Sabul south of the Patahajang geosyncline are dominated by mudstone, sandstone and quartzite, intercalating with andesite layers.

Rock facies:
The mudstone in this Member is of grey to dark grey phyllite or slate. Microscopic observation reveals that the sandstone intercalated in the Formation consits of the andesitic tuffaceous sandstone having andesitic sub-breccia (up to 4 mm diameter) (KR21), dacitic tuffaceous sandstone (L138) containing chloritized or sericitized pumiceous lapilli, and andesitic tuffaceous sandstone (L147) having the pyroclastics of quartz and plagioclase in groundmass consisting of plagioclase, calcite, quartz and iron minerals. This tuffaceous sandstone has been altered more or less into sericitization, chloritization or kaolinization.

Thin calcareous mudstone are found as intercalated layers near the Pagar Gunung deposits, and replacement was undergone to form a lead and zinc ore deposit.

Pale gray fine phyllitic siliceous rock is distributed along the A. Saladi and the A. Patahajang. Microscopic observation (K13) reveals it is lithic dacitic tuff containing fragments of mudstone, andesite and pumice. This type of rock may be correlated as part of the Dacite Member mentioned above.

Geological structure:

The mudstone in the Pagar Gunung mineralized area folded complexly. In the survey area, the stratum strikes approximately N 70° - 90° W and dips 40° - 70° S in the northern part, while strikes N 70° - 90° W and dips 40° - 70° N in the southern part, thus there is a synclinal structure with a synclinal axis of approximately E-W, N 70° W. At the area of the A. Baruran and the A. Tambang Buluh in K. Simpan Pining, the Member, together with the andesite beds, is disturbed in their strike and dip. Locally, there is a small anticlinal axis of approximately N 20° W in direction.

Thickness: 400 m ±

(3) Upper Andesite Member

Distribution:

This Member overlies Alternated Member of Clastic Rock and Volcanic Rock northwest of K. Simpang Pining and upstream of the A. Karlan, overlain by the Lower Limestone Member distributed on the top of T. Mandagang.

Rock facies:

The member is of green, massive andesite, intercalating green coarse-grained andesitic tuff. The andesitic tuff (L19) contains sub-brecciated fragments of andesite and dacite, and fragments of plagioclase and colored minerals. These minerals have been altered in chloritization, epidotization, sericitization, calcitization, or kaolinization.

Thickness of bed: Up to 100 m

(4) Lower Limestone Member

Distribution:

This Member is extensively distributed from the south side of T. Pagar Gunung to the top of T. Mandagang.

Rock facies:

The member is of white, massive limestone, recrystallized to become marble limestone (L1) consisting of coarse grained calcite. There is a sandstone stratum on the boundary with the Basic Volcanic Rock Member.

Thickness: 300 m ±

(5) Basic Volcanic Rock Member

Distribution:
This Member is distributed near T. Pagar Gunung and on to around the hilltop south of the Pagar Gunung mineralized area.

Rock facies:
The Member is of black to dark green basic volcanic rock, and interbedded tuffaceous rock. Microscopic observation reveals basalt, basaltic tuff, and ultrabasic rocks that may be called ultramafic pyroxenite. The basalt (L113) is composed of phenocrysts of plagioclase, augite and orthopyroxene and amigdalidal chlorite in groundmass, of plagioclase, common augite and orthopyroxene. The basaltic tuff (L125) consists of heavily chloritized pumice and pyroxene embedded in a matrix of common augite and iron minerals, and shows pyroclastic texture. Plagoclase is very scarce in the rock and the character is substantially basic.

Ultrabasic rock (L2, L3) that may be called pyroxenite, composing augite and a bit of hypersthene phenocryst in groundmass of clinopyroxene as its major component mineral is also distributed in the Member. This rock shows a clastic texture, but it is not clear whether it was crushed by tectonics of later periods or was crushed while the rock came up and sedimented. Because it occurs along with basic volcanic rocks such as basalt and basaltic tuff, it is supposed as a bed of the Basic Volcanic Rock Member.

Clastic rock consisting of basaltic tuff, sandstone and mudstone is distributed along the boundary between this Member and the Upper Limestone Member.

Thickness: 100 m ±

(6) Upper Limestone Member

Distribution:
This Member is distributed on the hilltop T. Pagar Gunung, overlying the Basic Volcanic Rock Member.

Rock facies:
As with the Lower Limestone Member, this Member is also of white massive recrystallized marble limestone.

Thickness: Up to 100 m

2-2-3 Tertiary Andesite

Distribution:

This bed is distributed from T. Simpang Opat to T. Mandagang, overlying unconformably the Patahajang Formation on the mountain ridge.

Rock facies:

A bit basic in quality, this rock is of slightly basic and fresh andesite. Microscopic observation (L29, L100) reveals the two pyroxene andesite composing phenocryst of plagioclase and augite (hypersthese) in intersertal groundmass of plagioclase, pyroxene and iron minerals.

Correlation:

This rock is correlative with a part of the Neogene volcanic rock (dacite, andesite) widely distributed in Northern Sumatra (Rock et al, 1983).

2-2-4 Quaternary System

An alluvial bed composed of gravel, sand and silt not yet consolidated is distributed along the A. Pungkat and the A. Sabal.

2-2-5 Igneous Rocks

At the north margin of the survey area, leucocratic muscovite granodiorite is widely distributed, intruded by numerous stocks of tonalite and quartz diorite.

(1) Muscovite granodiorite

Distribution:

This rock is widely distributed from upstream of the A. Sambak to upstream of the A. Karlan, to the north in the survey area.

Rock facies:

The granodiorite is leucocratic medium grained holocrystalline rock and has a partly banded structure. Microscopic observation (KR27, L131, L135, M40, M51, M64) revealed that quartz, plagioclase and muscovite as the major rock-forming minerals, accompanied by sericite, epidote, chlorite and calcite as secondary minerals. The mosaic quartz show undulatory extinction and are arranged partly in banded structure. The quartzs are catacrastic, and the granodiorite has been altered into mylonite. Silicification has occurred into the granodiorite north of the Pagar Gunung deposits and upstream of the A. Karlan, accompanying quartz veinlets and dissemination of pyrite.

(2) Tonalite and Quartz Dionite

Distribution:

Stocks of tonalite or quartz dionite and their porphyry have been intruded in muscovite granodiorite and in the Patahajang Formation.

Rock facies:

The tonalite (K15) distributed along the A. Tolang is around 20 in color index, and of porphyrytic texture. Plagioclase, and common hornblende and small amount quartz constitute the main minerals of the rock in phenocryst and groundmass. The tonalite has undergone alteration of chloritization, sericitization and kaolinization, as well as pyrite dissemination.

The tonalite (L121) distributed at T. Simpang Opat south of the survey area is the same in mineral constitution, namely containing a small amount of quartz and most of the mafic minerals have been altered hardly into chlorite, and contains scarcely fresh minerals, but biotite could be contained. The plagioclases have been substantially sericitized.

Between the above mentioned two stocks, several stocks of similar rock are distributed near the confluence (K38) of the A. Sambak and the A. Palelo, upstream of the A. Karlan (M40), and upstream of the A. Mandagang. The rock (K38) at the A. Palelo was subjected to heavy silicification, sericitization and epidotization, and it is hard to identify the original rock. But the rock is inferred to be diorite porphyry which is a little porphyrytic. At the south margin of the survey area along the A. Sabal, several small outcrops of this kind of rock are distributed. The dike (L49) of one of the outcrops is quartz diorite porphyry having the phenocryst of plagioclase and augite in groundmass consisting of plagioclase, quartz, hornblende and augite.

Mode analysis on these rocks (K15, K28, L121), plotting in a triangle diagram for quartz-plagioclase-potash feldspar, shows that these rocks are tonalite (Fig. II-2-5).

Time of inclusion:

Muscovite granodiorite has been catanastized and altered into mylonite. On the contrary, the tonalite and quartz diorite have not been crushed. The quartz diorite which belong Muara Sipongi Granitoid rocks has been dated as 166 ± 20 Ma, by K-Ar method in the First Phase Survey and has

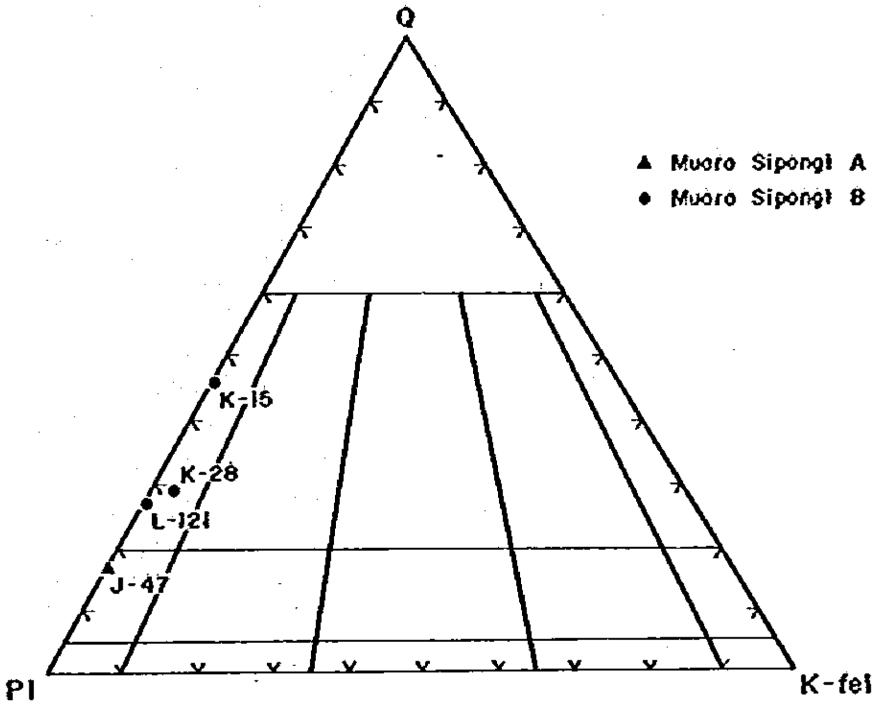


Fig. II-3-5 Modal Qz-Pl-Kfel Diagram of Granitoid Rocks in Muara Sipongi Area B been determined intrusion of Jurassic Period. Accordingly, the muscovite granodiorite is thought to be intruded before the Jurasic period, that is, around the Permian-Carboniferous to Triassic Period, because Jurassic tonalite has intruded into the muscovite granodiorite.

Intrusion structure:

Stocks of tonalite and quartz diorite are arranged in the two zones of direction of N 60° W, namely ore is along Pagar Gunung to Patahajang at north and another ore along the B. Sabul at the south. As pointed out in the First Phase Survey, this direction of the stocks is the same as that of the major geological structures such as the anticline, syncline and plutonic rock intrusion in the Muara Sipongi area. It appears that these stocks were included under the influence of general geological structures in the N 60° W direction in this area.

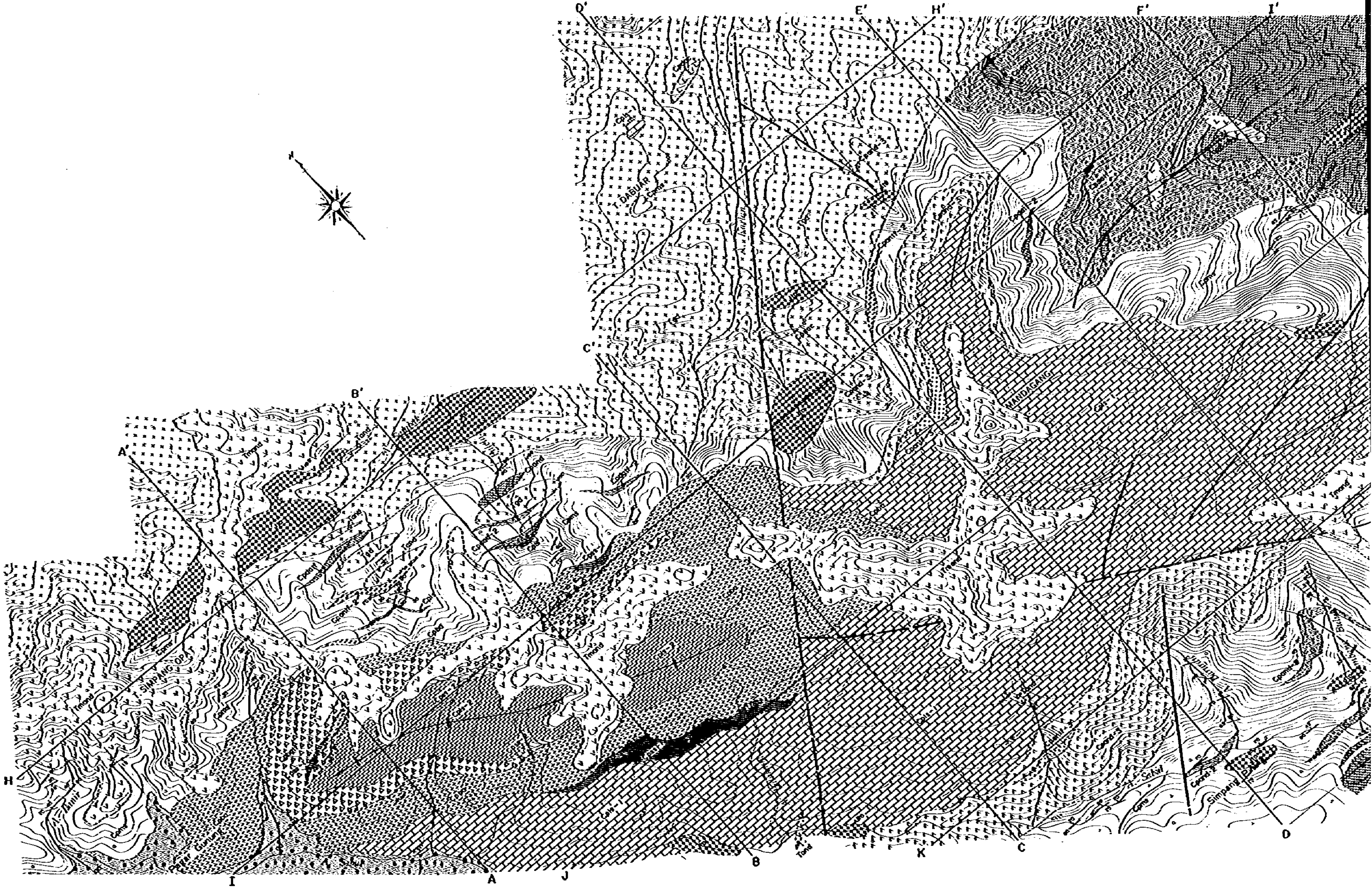
Table-II-3-1 Microscopic Observation of Thin Section, Muara Sipongi Area B

Sample No.	Rock Unit	Rock Name	Texture	Phenocryst/Fragment q	kf	pl	bi	ho	hy	au	Fe	ca	he	Others
Tertiary Volcanics														
L-29	T.vol	Andesite				◎			∘	○	∘			
L-100	T.Vol	Andesite				◎			○	∘	∘			
Patchajang Formation														
L-2	VI	Pyroxenite							∘	◎				
L-3	VI	"							∘	◎	∘			
L-95	VI	Andesitic tuff				○			∘	○				an ◎
L-113	VI	Basalt				∘			∘	○				
L-125	VI	Basaltic tuff							○	○				pu ○
L-1	V	Limestone										○		
L-9	IV	Andesitic tuff				◎					∘			an ∘ da ∘ maf ∘
L-19	IV	Andesite				∘								maf ∘
KR-13	III	Andesite				○					∘			maf ○
L-49	III	Lamprophyre					◎		○					
L-132	III	Andesite	hol.cla			∘								maf ∘
L-133	III	"	" "			∘								maf ∘
L-138	III	Dacitic Sandy tuff		○		∘					∘			pu(?) ○ si-r ∘
L-147	III	Andesitic tuff		∘		○					∘			
L-156	III	Dacitic tuff		○			? (bi–au)				∘			
M-2	III	Phyllitic mudstone		∘										
KR-21	III	Sandstone	c-g	○	∘						∘			an ∘
K-10	III	Dacitic tuff		∘		○					∘			an ∘ si-r ∘ maf ∘
M-18	III	Dacite				◎								maf ○
M-21	III	Dacitic tuff		∘		○								an ∘ si-r ∘
Muara Sipongi Granitoid Rocks														
K-15		Tonalite porphyry	Por			◎		∘						
K-28		Tonalite				◎	∘				∘			ap ∘
K-38		Altered rock	Por			◎		? (ho–au)						
L-41		Diorite porphyry	Por			∘				∘				
L-121		Tonalite		∘		◎					∘			maf ○ sp ∘
Granodiorite (Mylonite)														
L-131		Granodioritic mylonite	band. cla	◎		○					∘			mu ∘ sp ∘
L-135		" "	"	◎		○					∘			mu ∘ sp ∘
M-40		Mylonite	cla	◎		◎					∘			mu ∘
M-51		Granodioritic mylonite	band. cla	◎		◎					∘			mu ∘ ap ∘
M64		" "	"	◎		◎					∘			mu ∘
Dacite														
M-22		Dacite				○					∘			maf ∘

Sample No.	Groundmass/Matrix q	kf	pl	bi	ho	hy	au	Fe	sp	ca	Others	Secondary Mineral q	se	ch	ca	ep	bi	ka	py	m	Remarks
Tertiary Volcanics																					
L-29			◎				∘	○							∘						fresh, slightly basic
L-100			◎	∘		∘		∘													fresh
Patchajang Formation																					
L-2							◎							○	∘						m alt
L-3							◎				ch ∘			∘	○						m alt, chl
L-95			○					∘	∘				∘		∘	∘					w alt
L-113			○			∘	○	∘						○							w ~ m alt
L-125							○	○						○							w ~ m alt (mylonite)
L-1	∘									○											
L-9	○		∘					○					○	∘	○	∘					m ~ s alt
L-19	∘		∘					∘	∘		maf ∘	∘	∘	∘	∘			? ○			s alt
KR-13	∘		○					∘			maf ○			○	○	○					m ~ s alt
L-49			◎	∘	○	?	?	∘	∘					∘	○	∘					m alt
L-132	∘		◎					∘			maf ∘		∘	∘		∘					w alt
L-133			◎					∘	∘		maf ∘		∘	∘	∘	∘					w ~ m alt
L-138								∘	∘		se ○ chl ○		○	○		∘					s alt
L-147	∘		∘					∘		◎			∘		◎						m ~ s alt slightly sandy
L-156	◎							∘			ch ○ ep ○	○		○		○					s alt, basic
M-2	∘									∘	se ◎ clay ○										
KR-21	◎		∘					∘		∘	clay ∘										tuffaceous
K-10	◎		○					∘			maf ∘	○	∘	∘		∘				∘	w alt
M-18	◎		○					∘			ap ∘ ep ∘	○				○					m alt
M-21	○		∘		? (ho–au)			∘					○	(?)	○						s alt
Muara Sipongi Granitoid Rocks																					
K-15	◎		○		∘			∘					∘	∘				∘	∘		w alt
K-28													∘			∘		∘			fresh
K-38	◎		∘					∘				◎	∘			∘					Tonalite porphyry?
L-41	∘		◎		∘		∘	○					∘	∘	∘	∘					m alt
L-121													∘	○		○					m ~ s alt
Granodiorite (Mylonite)																					
L-131													∘			∘					w alt
L-135													○		∘						w alt
M-40													∘		∘	∘					w ~ m alt original rock
M-51													∘			∘					w ~ m alt w band
M64													∘			∘					" "
Dacite																					
M-22	○							∘			maf		○	∘	○	∘					m ~ s alt

Abbreviation:

q : quartz	Fe : Ferric mineral	ap : apatite	ap : apatite	da : dacite	◎ Abundant
kf : potash feldspar	ca : calcite	ch : chlorite	py : pyroxene	pu : pumice	○ Common
bi : biotite	he : hedenbergite	ep : epidote	hol : holocrystalline	maf : mafic mineral	∘ Rare
ho : hornblende	sp : sphane	ka : kaoline	cla : clastic	si-r : siliceous rock	
hy : hypersthene	se : sericite	mu : muscovite	poik: poikilitic	alt-w,m,s: alteration weak, medium strong	
au : augite	zi : zircon	m : montmorillonite	an : andesite		



D'
E'
H'
F'
I'
C'
B'
A'
H
I
A
J
B
K
C
D
T. DABUAR
MANDAGANG
SIMPANG OPA

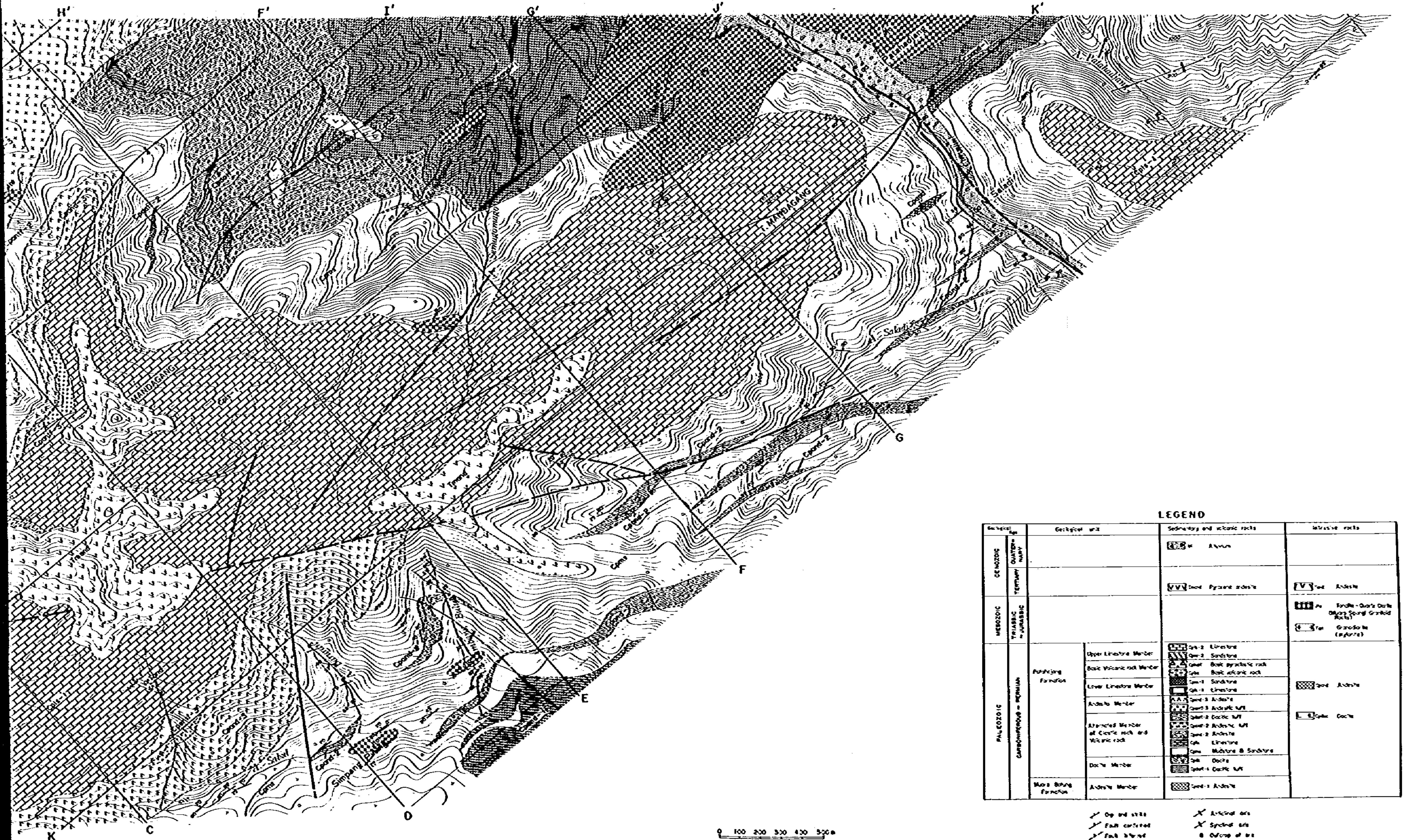
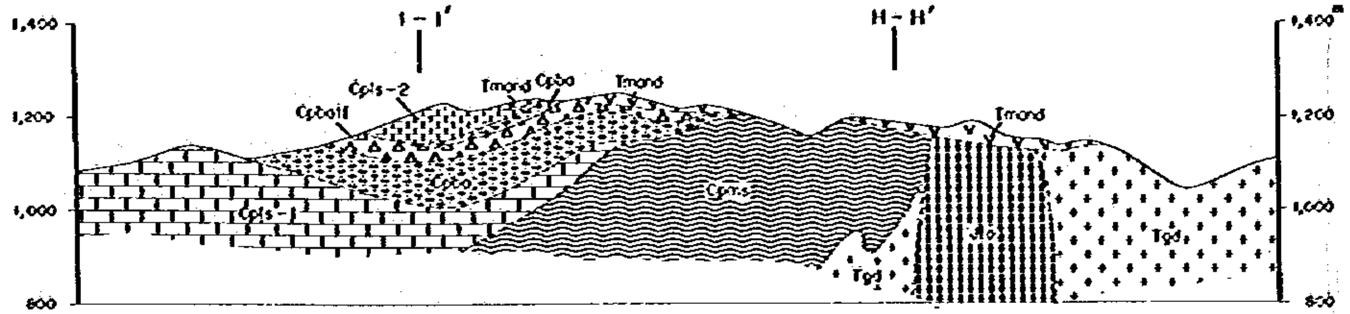
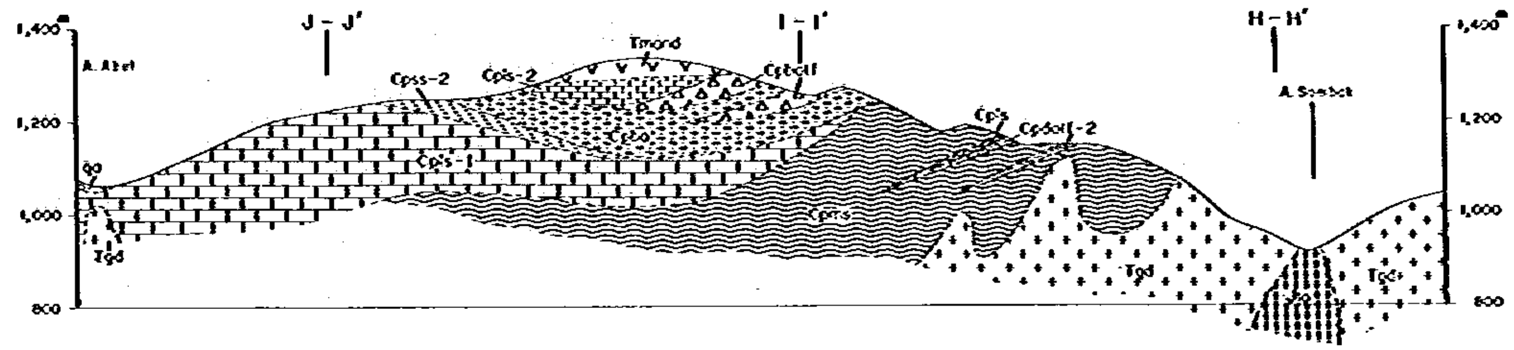


Fig. II-3-3 Geological Map of Muara Sipongi Area B

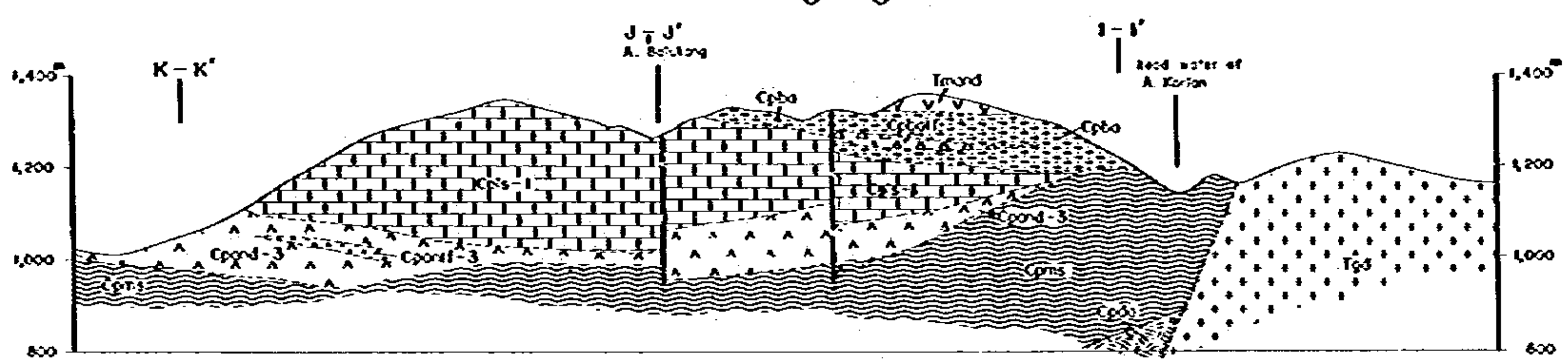
A – A′


I – I′
H – H′
Cpls-2
Cpbalf
Tmand
Cpba
Cpls-1
Cpms
Tgd
1,400
1,200
1,000
800

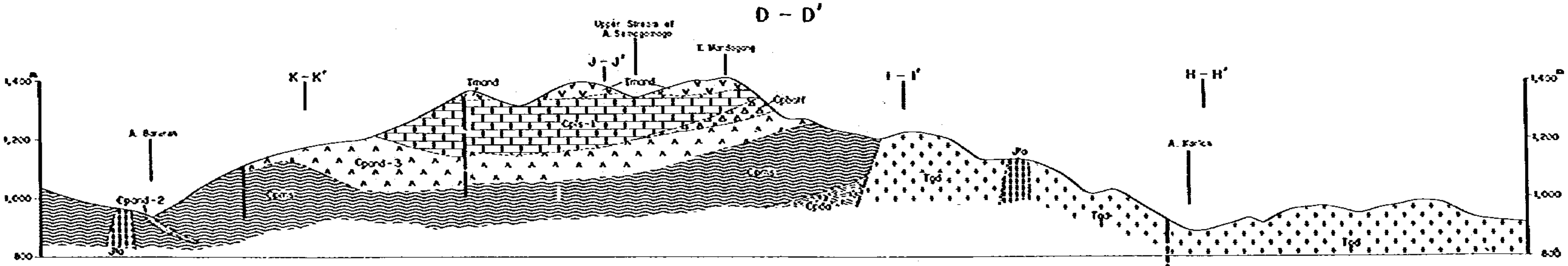
B – B′


J – J′
I – I′
H – H′
A. Abel
A. Sombot
Tmand
Cpss-2
Cpls-2
Cpbalf
Cpls-1
Cpms
Tgd
1,400
1,200
1,000
800

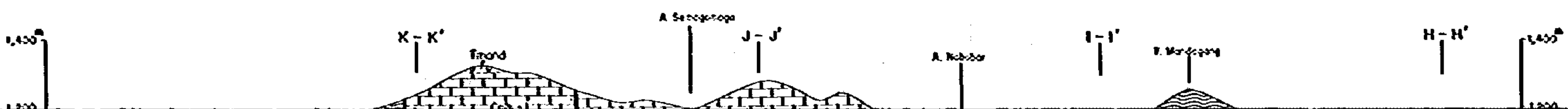
C – C′


K – K′
J – J′
A. Bolulang
I – I′
Head water of A. Karlan
Cpba
Tmand
Cpand-3
Cpms
Tgd
1,400
1,200
1,000
800

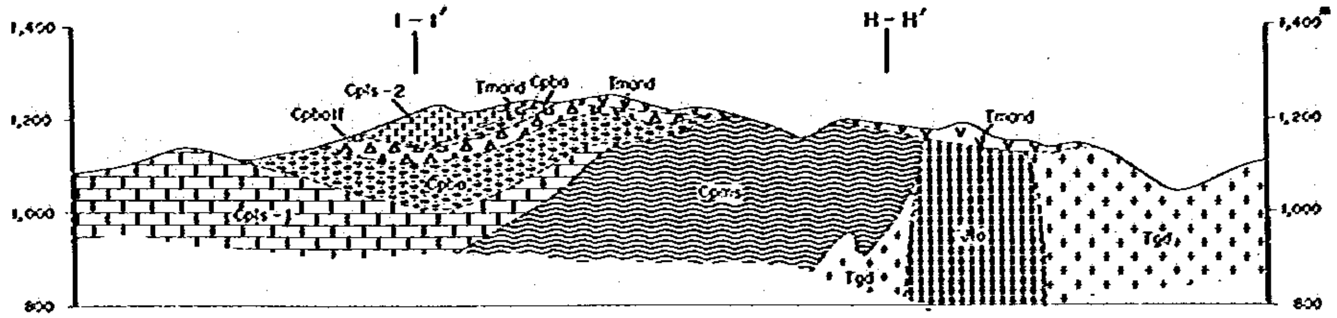
D – D′


Upper Stream of A. Sanggomogo
E. Mandagang
K – K′
J – J′
I – I′
H – H′
A. Barunan
A. Karlan
Tmand
Cpbalf
Cpand-3
Cpand-2
Cpms
Tgd
1,400
1,200
1,000
800

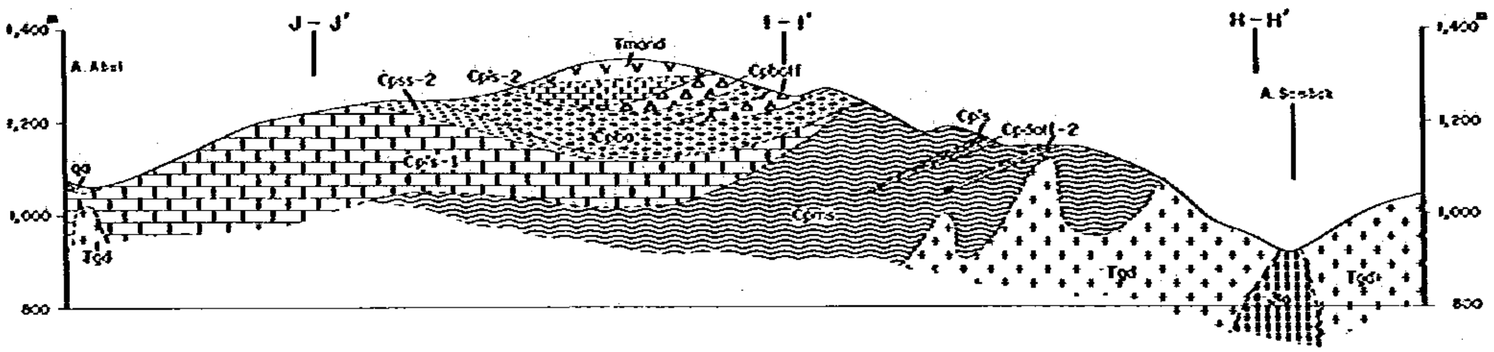
E – E′


A. Sanggomogo
K – K′
J – J′
A. Nabubar
I – I′
E. Mandagang
H – H′
Tmand
1,400

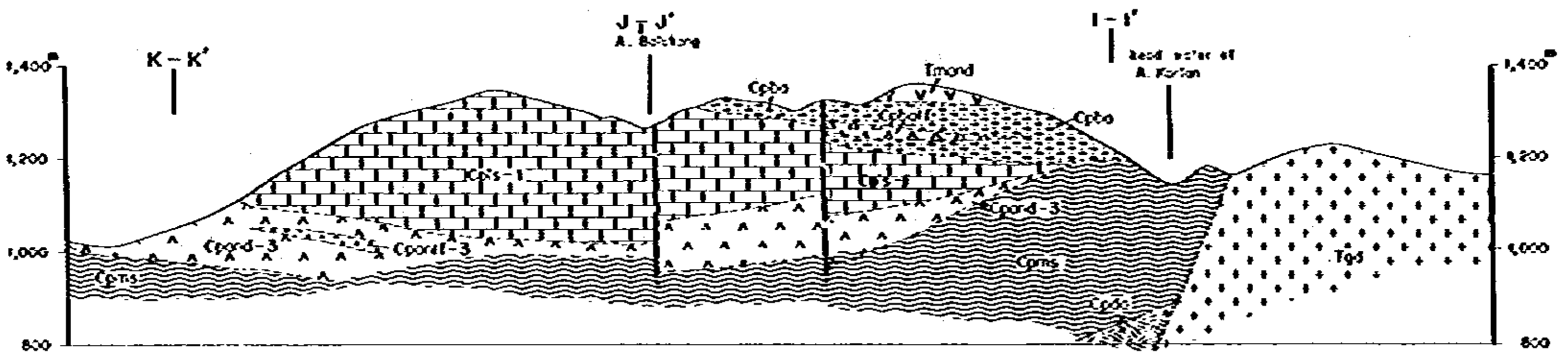
A – A′


I – I′
H – H′
1,400
1,200
1,000
800
Tmand
Cpbo
Cpms
Tgd

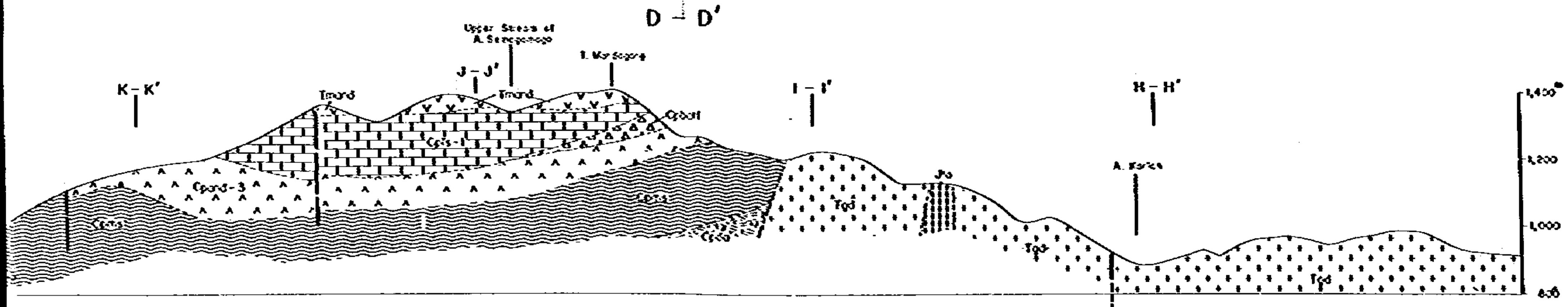
B – B′


J – J′
I – I′
H – H′
1,400
1,200
1,000
800
Tmand
Cpms
Tgd

C – C′


K – K′
J – J′
I – I′
1,400
1,200
1,000
800
Tmand
Cpbo
Cpms
Tgd

D – D′


K – K′
J – J′
I – I′
H – H′
1,400
1,200
1,000
800
Tmand
Tgd

E – E′


K – K′
J – J′
I – I′
H – H′
1,400
1,200
Tmand

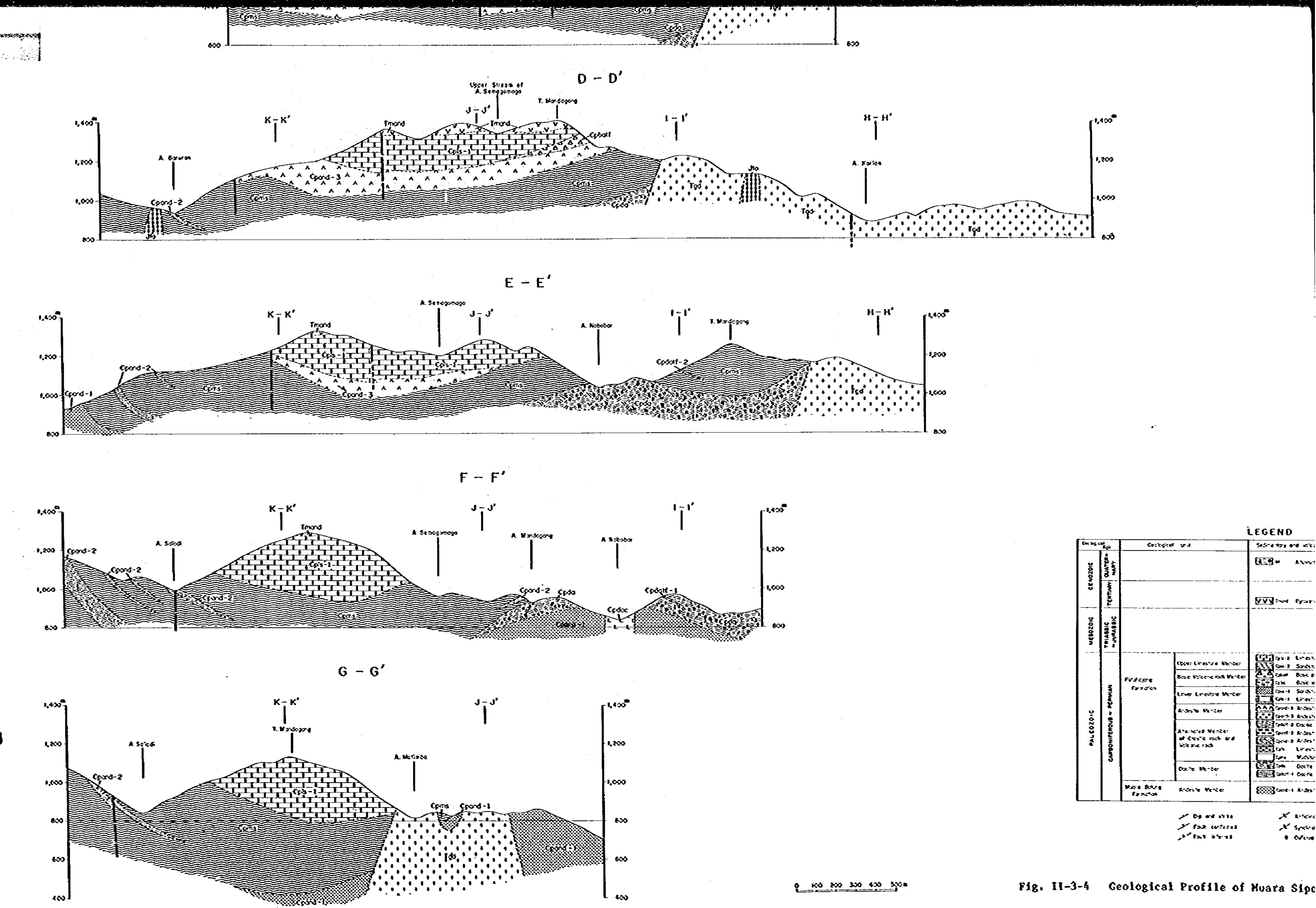
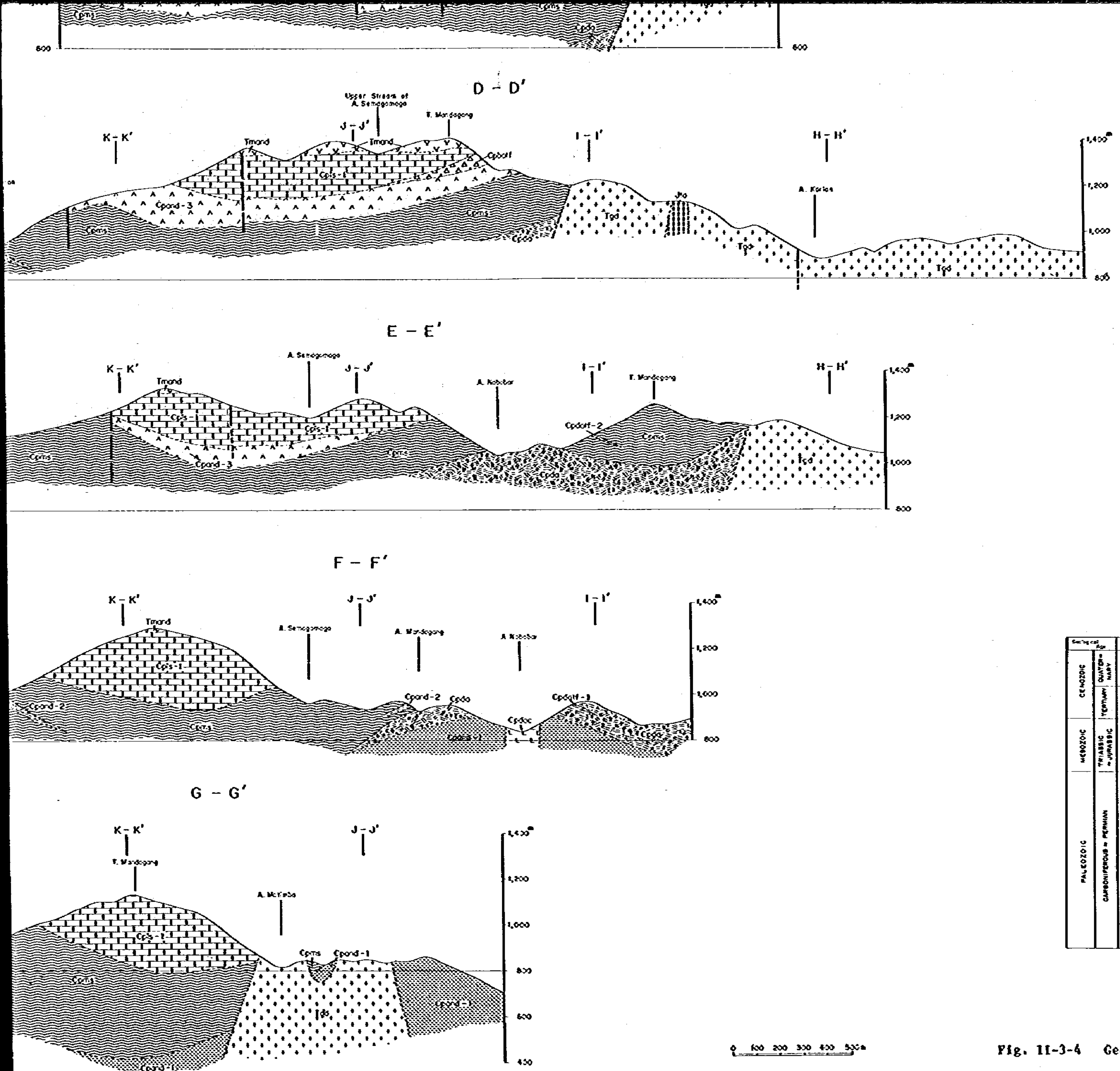


Fig. II-3-4 Geological Profile of Muara Sipo



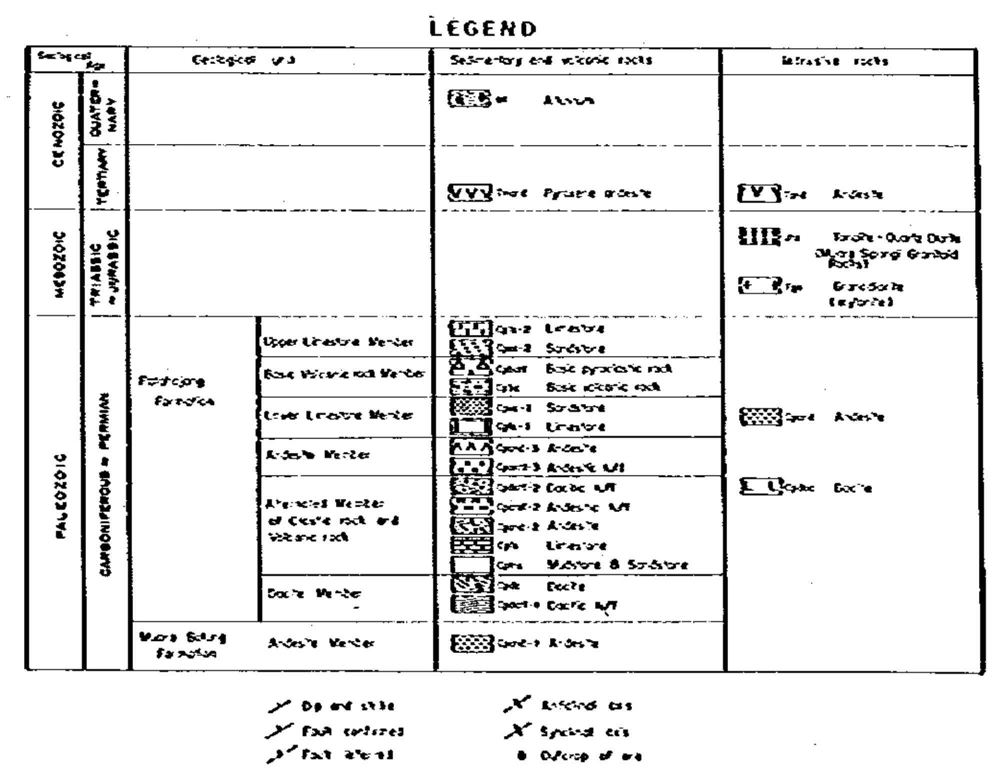
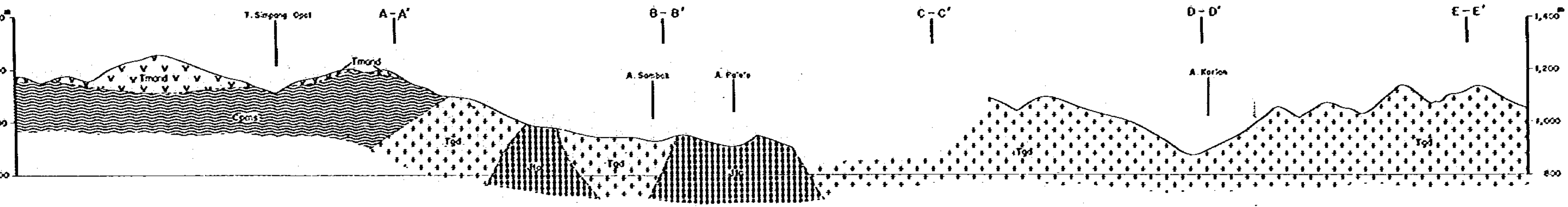
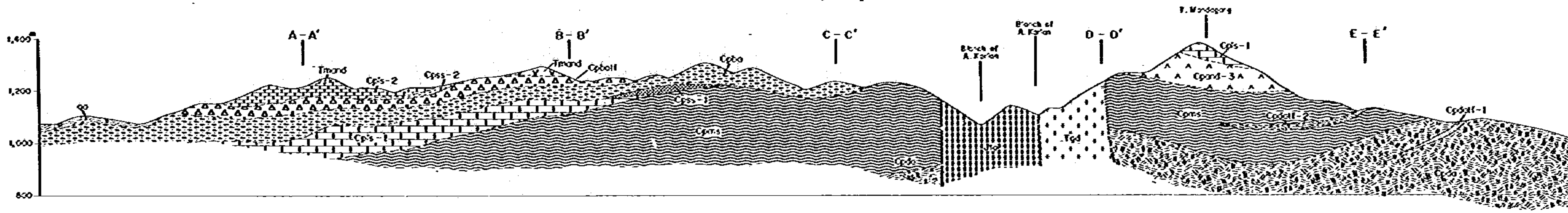


Fig. II-3-4 Geological Profile of Muara Sipongi Area B (1)

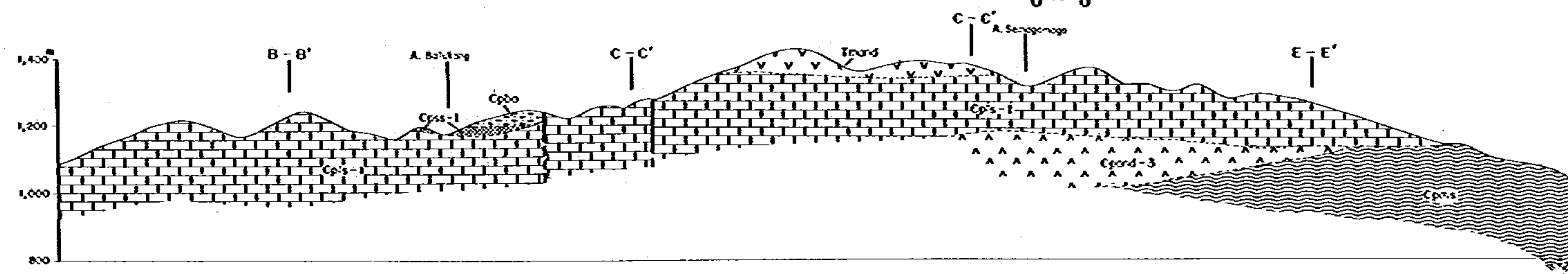
H – H'



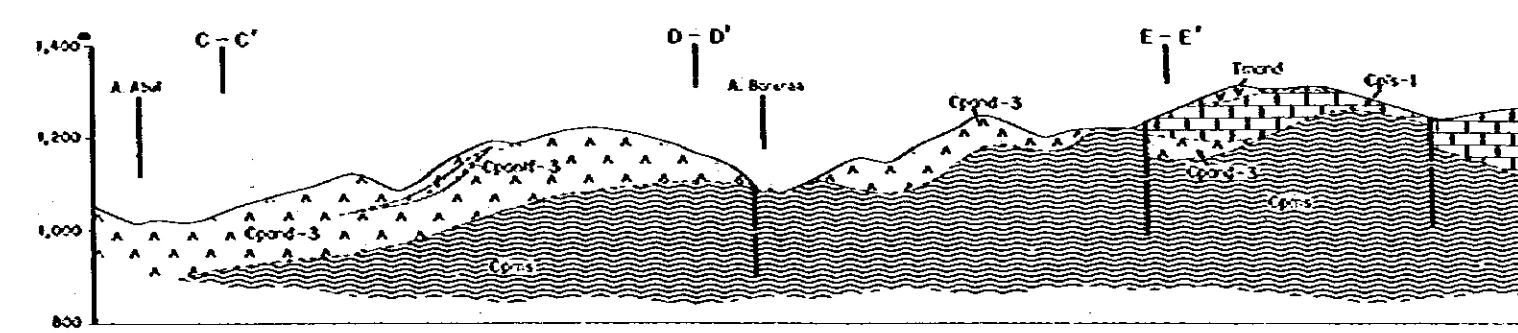
I – I'



J – J'

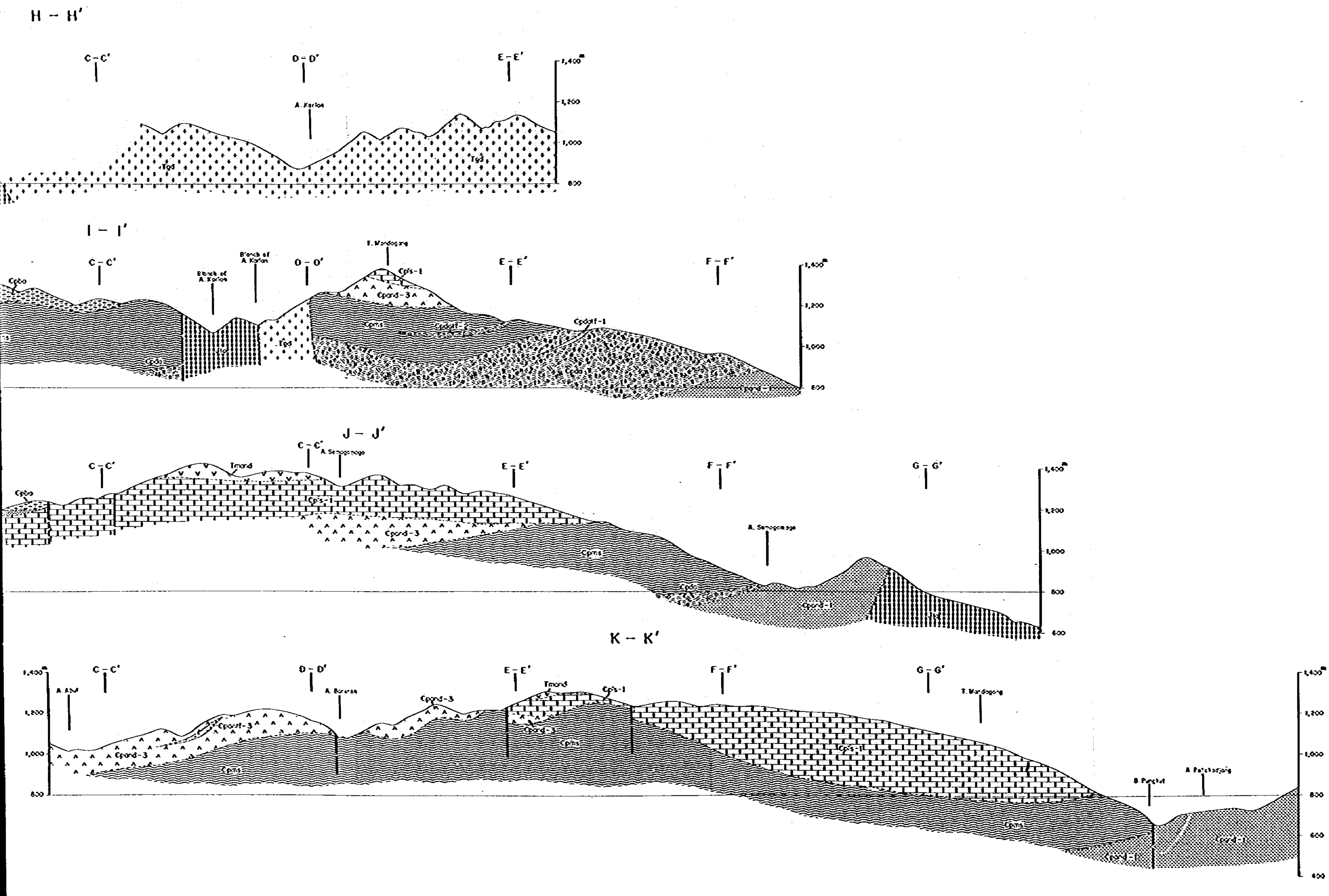


K – K'



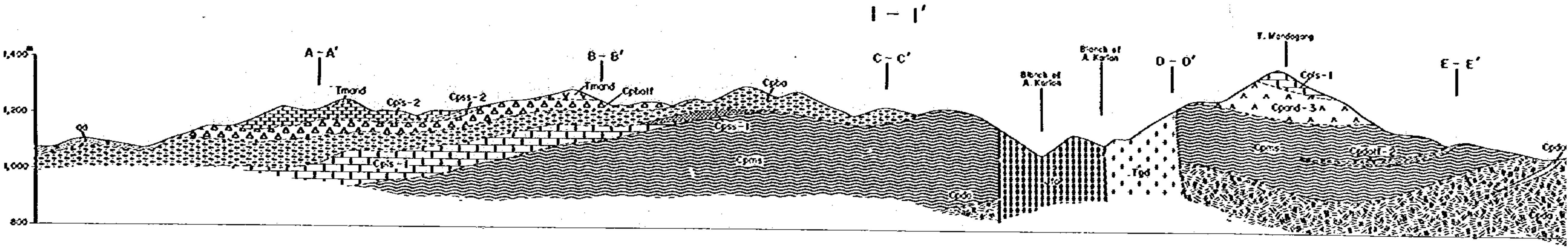
LEGEND

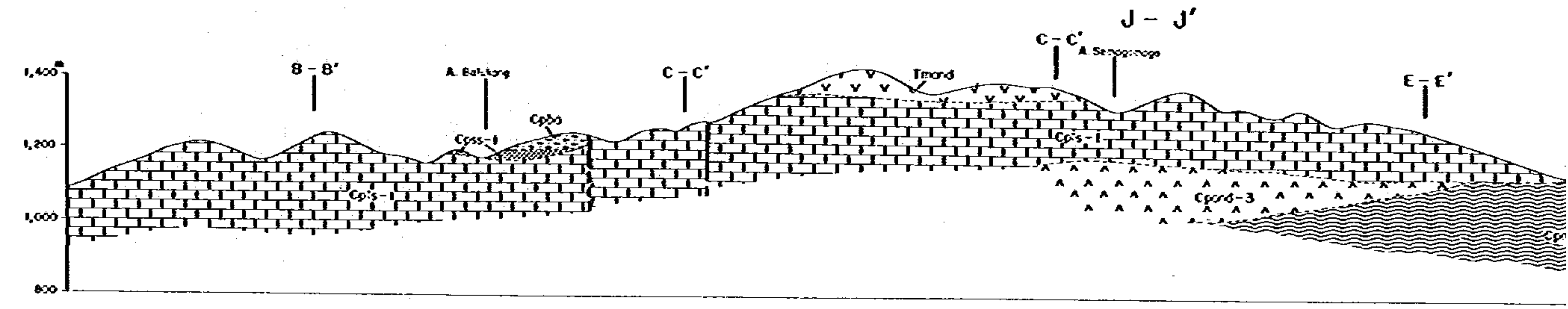
Geological Age		Geological unit		Sedimentary and volcanic rocks	Intrusive rocks
CENOZOIC	QUATERNARY			al Alluvium	
	TERTIARY			Tmand Pyroxene andesite	Tand Andesite
MESOZOIC	TRIASSIC – JURASSIC				Jtr Tonalite - Quartz Diorite (Muara Sipongi Granitoid Rocks); Tgd Granodiorite (inferred)
PALEOZOIC	CARBONIFEROUS – PERMIAN	[illegible] Formation	Upper Limestone Member	Cpls-2 Limestone; Cpss-2 Sandstone	
			Basic Volcanic rock Member	Cpbat Basic pyroclastic rock; Cpbo Basic volcanic rock	
			Lower Limestone Member	Cpss-1 Sandstone; Cpls-1 Limestone	Cpand Andesite
			Andesite Member	Cpand-3 Andesite; Cpandt-3 Andesitic tuff	
			Alternated Member of Clastic rock and Volcanic rock	Cpdat-2 Dacitic tuff; Cpandt-2 Andesitic tuff; Cpand-2 Andesite; Cpls Limestone; Cpms Mudstone & Sandstone	Cpda Dacite
			Dacite Member	Cpda Dacite; Cpdat-1 Dacitic tuff	
		Muara Bantal Formation	Andesite Member	Cpand-1 Andesite	

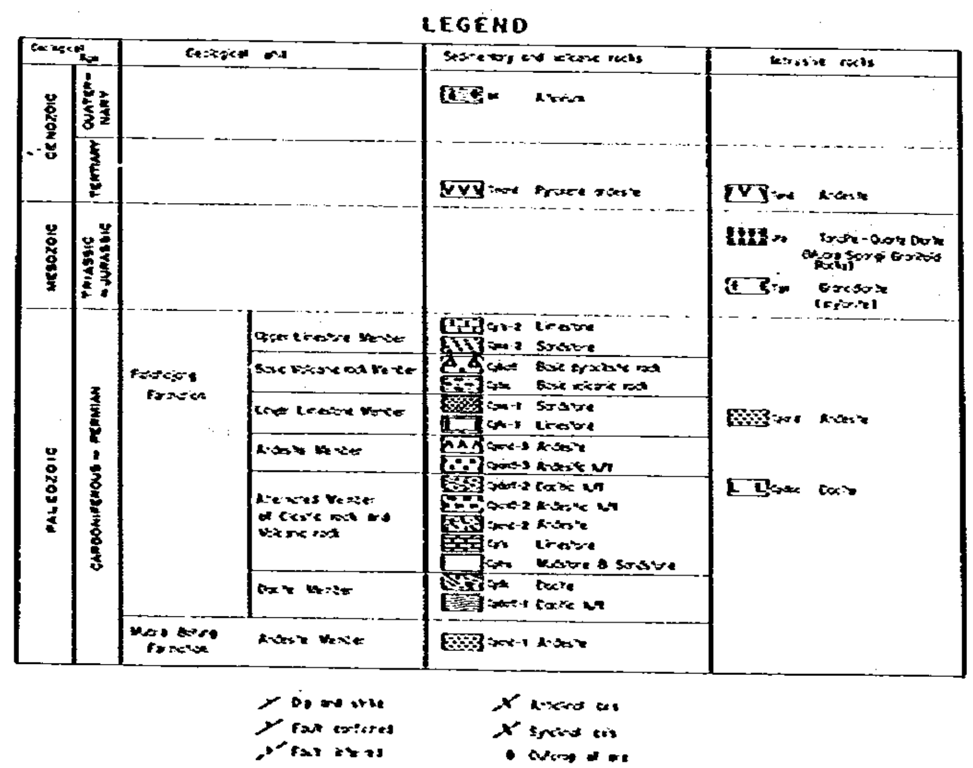


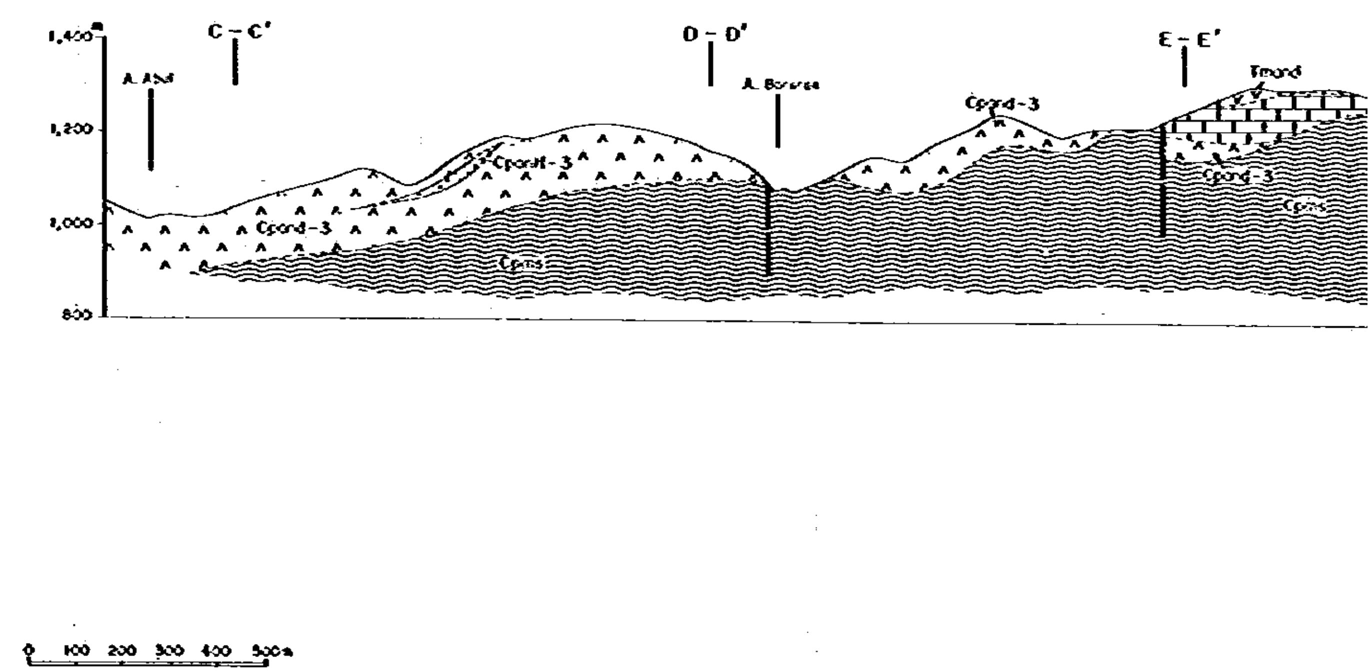
H – H′
C – C′
D – D′
E – E′
A. Karlon
Tgd
1,400m
1,200
1,000
800
I – I′
Branch of A. Karlon
T. Mandogang
Cpls-1
Cpand-3
Cpms
Cpbo
F – F′
Cpand-1
J – J′
Tmand
G – G′
K – K′
600
400


1,000
800
Cpms
Tgd


I – I′
1,400m
1,200
1,000
800
A – A′
B – B′
C – C′
D – D′
E – E′
Tmand
Cpls-2
Cpss-2
Cpbo
Cpss-1
Cpls-1
Cpms
Cpand-3
Tgd
T. Mandogong


J – J′
1,400m
1,200
1,000
800
B – B′
C – C′
E – E′
A. Batulang
Cpss-1
Cpbo
Cpls-1
Tmand
Cpand-3


LEGEND
CENOZOIC
QUATERNARY
TERTIARY
MESOZOIC
TRIASSIC – JURASSIC
PALEOZOIC
CARBONIFEROUS – PERMIAN


1,400m
1,200
1,000
800
C – C′
D – D′
E – E′
A. Abut
A. Boranga
Cpand-3
Cpms
Tmand
0 100 200 300 400 500m

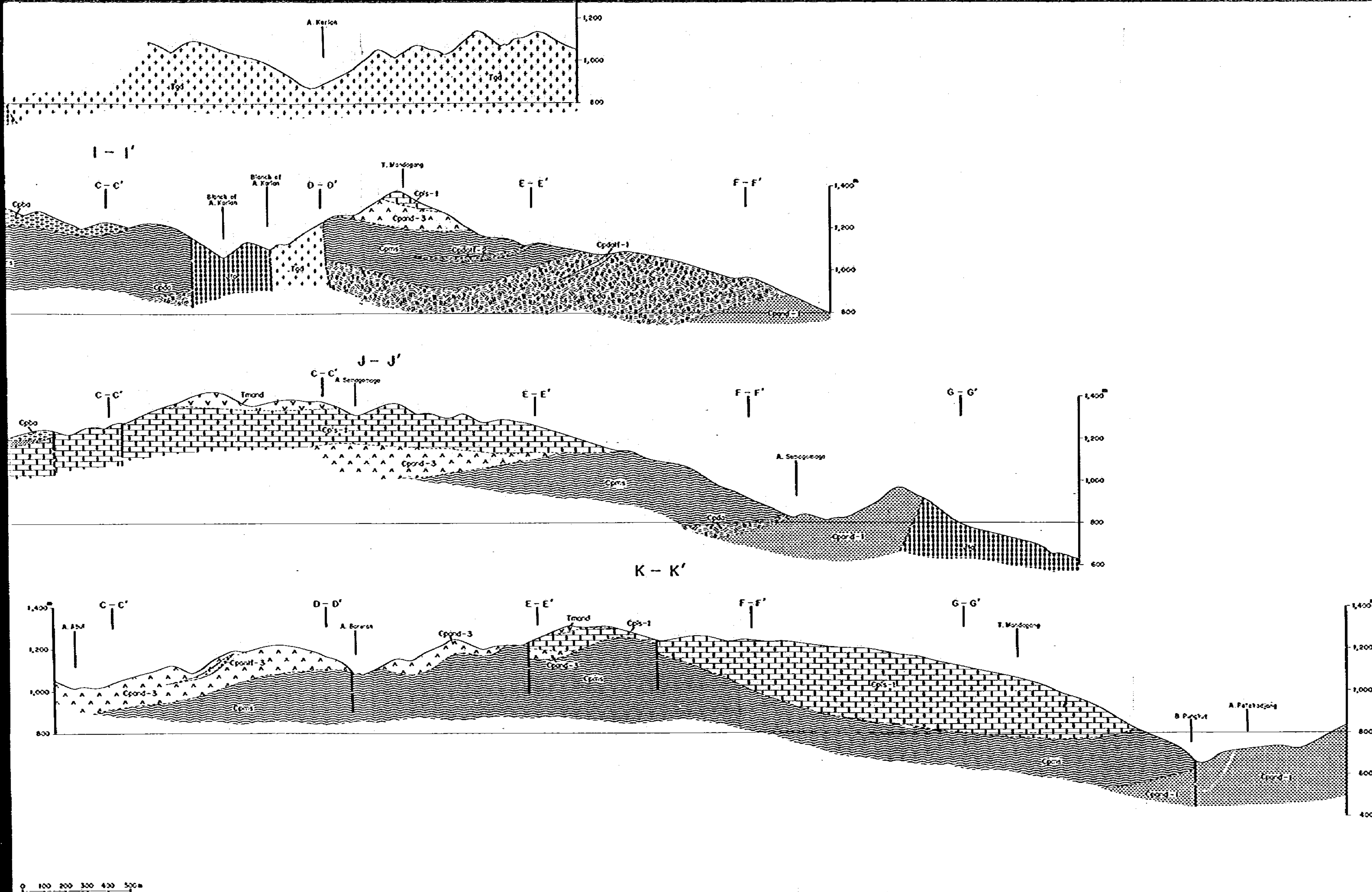


Fig. II-3-4 Geological Profile of Muara Sipongi Area B (2)

CHAPTER 3 GEOLOGICAL STRUCTURE

Clastic rock Formation at the north of the survey area strikes, approximately N 70° - 90° W and dips 30° - 70° S, while at the south area, strikes N 70° - 90° W and dips 30° - 70° N, thus there is a synclinal structure. The synclinal axis runs from Pagar Gunung where Upper Limestone and Lower Limestone are distributed, past the summit of T. Mandagang, in the direction of N 60° W. The tonalite and quartz diorite is approximately distributed in parallel with the synclinal axis. This direction is the same as that of the extension of Muara Sipongi granitoid rock batholith, as revealed in the First Phase Survey.

Small drag folds frequently appear in the mudstone stratum of the Pagar Gunung deposits. The mudstone has formed schistosity, and metamorphosed into phyllite or slate. The muscovite granodiorite distributed north of the mudstone stratum shows a bedded structure, altered into mylonite. It suggests these have been caused by Palaeozoic-Mesozoic geological tectonics, including synclinal structure.

Alternated Member of Clastic Rock and Volcanic Rock of area near K. Simpang Pining is disturbed in strike and dip. The Member apparently has a local anticlinal or upheaval structure, its axis in N 20° W direction, running obliquely against the above-mentioned general direction (N 60° W).

A surface investigation has revealed no major fault except for a thrust fault of N-S in strike and 30° W in dip along the A. Pungkut of Patahajang village. Through interpretation of aerial photographs, (1/120,000), several lineaments suggesting faults have been recognized, and they are noted as inferred faults in the 1/10,000-scale geological map (PL. II-3-1).