Table 2-16 Anomalous Zones Delineated from Panned Concentrate Geochemistry

No.	Location	Number of Anomalous Samples	Anomalous Elements and Range	Rank
1	S. Antan	1	Sn(>1,000ppm), Au(72ppb)	A
2	S. Antan	1	Sn(560ppm), Ce(580ppm)	B
3	S. Laki and S. Antan	2	Ce(390-420ppm)	B
4	S. Pinang and tributary of S. Antan	3	Sn(>1,000ppm)	A
5	S. Isahan-S. Tulang-S. Sikambu	9	Sn(600->1,000ppm) W(16-55ppm), Th(93ppm)	A
6	Tributary of of Tulang	1	Sn(>1,000ppm), W(27ppm)	A

2-3 Geochemical Exploration with Soil Samples

Soil geochemistry was carried out in an area of 6 km^2 in which the known mineralized zones such as the S.Isahan and the S.Sikambu are located, aiming at delineating the extension of known zones and also finding new zones in the area.

(1) Sampling and chemical analysis

Sampling locations were arranged systematically in a grid pattern of 100 m×100 m in the 3 km×2 km rectangular area extending in NW-SE direction. Samples which were taken from the B-layer 40 to 70 cm below the surface using hand auger, amounted to 600 in total number.

The samples were air-dried during the filed survey and were sent to the Chemex Lab. Inc. of Canada. Analysed elements and lower and upper limits of detection were the same as with the stream sediments.

(2) Results of statistical processing

① Method of statistical analysis

The assay values were converted to natural logarithm, and statistical figures were calculated. When the values were below the lower detection limit, half of the limit value was substituted in the calculation.

② Basic statistical figures

Table 2-17 shows the geometric mean, the maximum and minimum values for each element.

Table 2-17 Basic Statistics of Assay values of Soil Samples

	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
Geometric Mean	<5	3	6	23	85	3.3
Maximum	65	150	90	69	166	17.6
Minimum	<5	<2	<2	5	12	<0.2
Average Abundance of Crustal Rocks	4	2	1.5	7.2	60	1.8

③ Frequency distribution of assay values

The frequency distribution of assay values for each element is shown in Figure 2-12. The patterns for Th and U are similar to the normal distribution. Sn and W patterns have the highest value positioned to the left from the center. The highest value for Ce, on the other hand, is located to the right. The frequency distribution of Au is L-shaped, as many of the values is less than the lower detection limit.

④ Correlation among elements

Correlation coefficients of all samples are shown in Table 2-18. The combination of Sn-W has a correlation coefficient over 0.5. U has a correlation coefficient of only -0.3 to 0.3 with other elements.

Table 2-18 Correlation Coefficients of Assay values of Soil Samples

	Au	Sn	W	Th	Ce	U
Au	1.00	0.43	0.43	0.02	-0.21	0.10
Sn		1.00	0.62	0.17	-0.21	0.21
W			1.00	0.14	-0.12	0.09
Th				1.00	0.41	0.28
Ce					1.00	-0.04
U						1.00

⑤ Multivariate analysis

To summarize the significance of geochemical data and to facilitate the geology-mineralization correlation and the interpretation of these data, principal component analysis was carried out for six elements. Although calculation of all six principal components could be made, two principal components that were statistically significant (the ones having eigenvalues over 1.0) were chosen, and their eigenvectors, factor loading values, eigenvalues, proportions and cumulative proportions were calculated, as shown in Table 2-19.

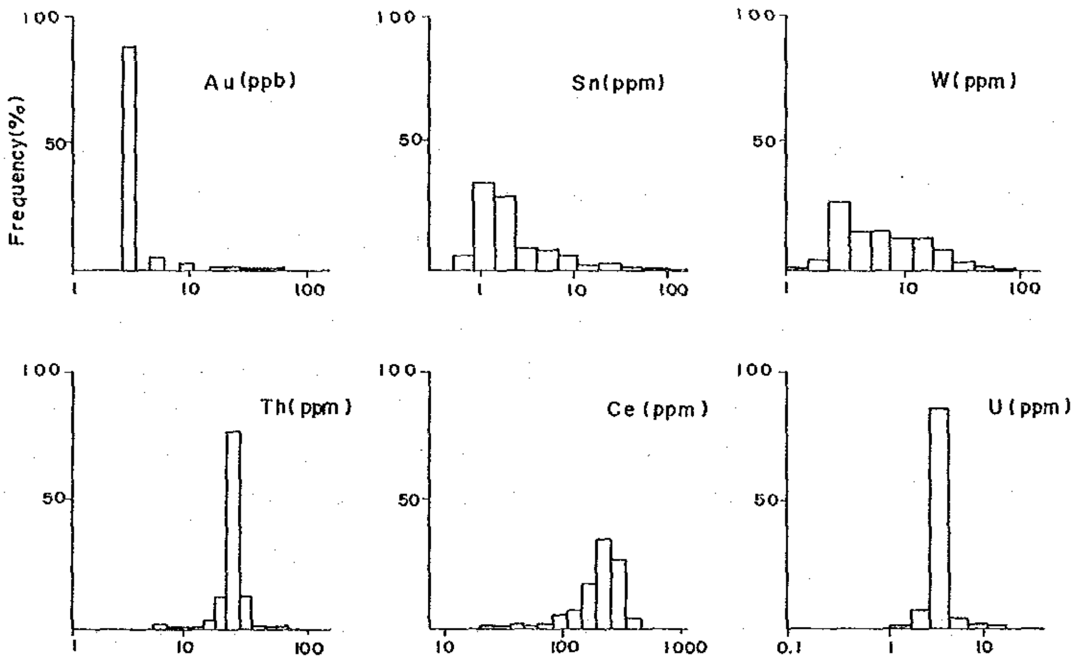


Fig.2-12 Histogram of Assay Values of Soil Samples

Table 2-19 Results of Principal Component Analysis of Assay values of Soil Samples

	1		2	
	Eigen-vector	Factor Loading	Eigen-vector	Factor Loading
Au	0.48	0.70	-0.15	-0.19
Sn	0.58	0.86	0.01	0.01
W	0.55	0.80	0.00	0.00
Th	0.15	0.22	0.70	0.85
Ce	-0.20	-0.30	0.61	0.75
U	0.26	0.38	0.33	0.40
Eigen.	2.16		1.49	
Propo.	0.36		0.25	
Cum. prop	0.36		0.61	

The characteristics of the two principal components are interpreted using factor loading which represents the correlation between the principal components and the variables (assay values) as follows.

The first principal component: High positive values are shown by Au, Sn and W. High factor scores are obtained in two zones; one which is elongated in WNW-ESE direction from the upper reaches of S.Isahan and another one which is at the junction of S.Sikambu and S.Tulang. This component is understood to represent Sn mineralization, because tin-mineralized zones are found in these zones.

The second principal component: Th and Ce shows high positive values. The high factor scores are obtained from the middle reaches of S.Tulang and the lower reaches of S.Sikambu, where leucocratic granites are expected to occur. Therefore, this principal component represents the nature of the leucocratic granite.

(3) Geochemical anomalies and anomalous zones

① Threshold setting

All samples were treated collectively. The value twice the standard deviation added to the geometric mean was regarded as an anomaly. The thresholds of the respective elements are shown in Table 2-20. Anomalous values were obtained from Au, Sn, W, Th and U.

Table 2-20 Thresholds for Assay Values of Soil Samples

Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
10	16	33	37	185	6.8

② Extraction of geochemically anomalous zones.

When samples from more than two adjacent sites contain anomalous amounts of the same element, that area was interpreted as an anomalous zone of those elements.

③ Distribution and assessment of anomalies

Three anomalous zones were identified in the survey area; the zone extending in approximately WNW-ESE direction from the upper reaches of S.Isahan to S.Tulang (named the S.Isahan-S.Tulang zone), the zone at the middle reaches of S.Isahan, and the zone near the junction of S.Sikambu and S.Tulang (Fig.2-13).

S.Isahan-S.Tulang: This zone is the largest (0.3× 2 km) of the three zones. The anomalies of Au, Sn and W overlap in greater part of the zone, and Sn, Th, U anomalies are observed at the eastern extension of this zone as well. Anomalous values are 10 to 65 ppb Au, 16 to 72 ppm Sn and 33 to 90 ppm W. Th (37 to 69 ppm) and U (6.8 to 13.2 ppm) are also anomalous. The S.Isahan tin-mineralized zone and the leucocratic granite are distributed in this zone.

Middle reaches of S.Isahan: This is composed of three Sn anomalies (23 to 150 ppm). Mineralization and intrusive bodies are not known in this zone.

Junction of S.Sikambu and S.Tulang: Anomalies of Au and Sn are distributed. Anomalous values of Au and Sn are 10 ppb and 16 to 68 ppm, respectively. The S.Sikambu mineralized zone and leucocratic granite are distributed in the zone.

2-4 Relationship of Geochemical Anomalies to Mineralization and Alteration

The zones where the geochemical anomalies of either stream sediments, panned concentrates or soils are correlated to mineralization and alteration are as follows.

(1) A-rank geochemical anomalous zones of stream sediments and panned concentrates

Those two anomalies overlap in five zones; namely S.Pinang, S.Isahan

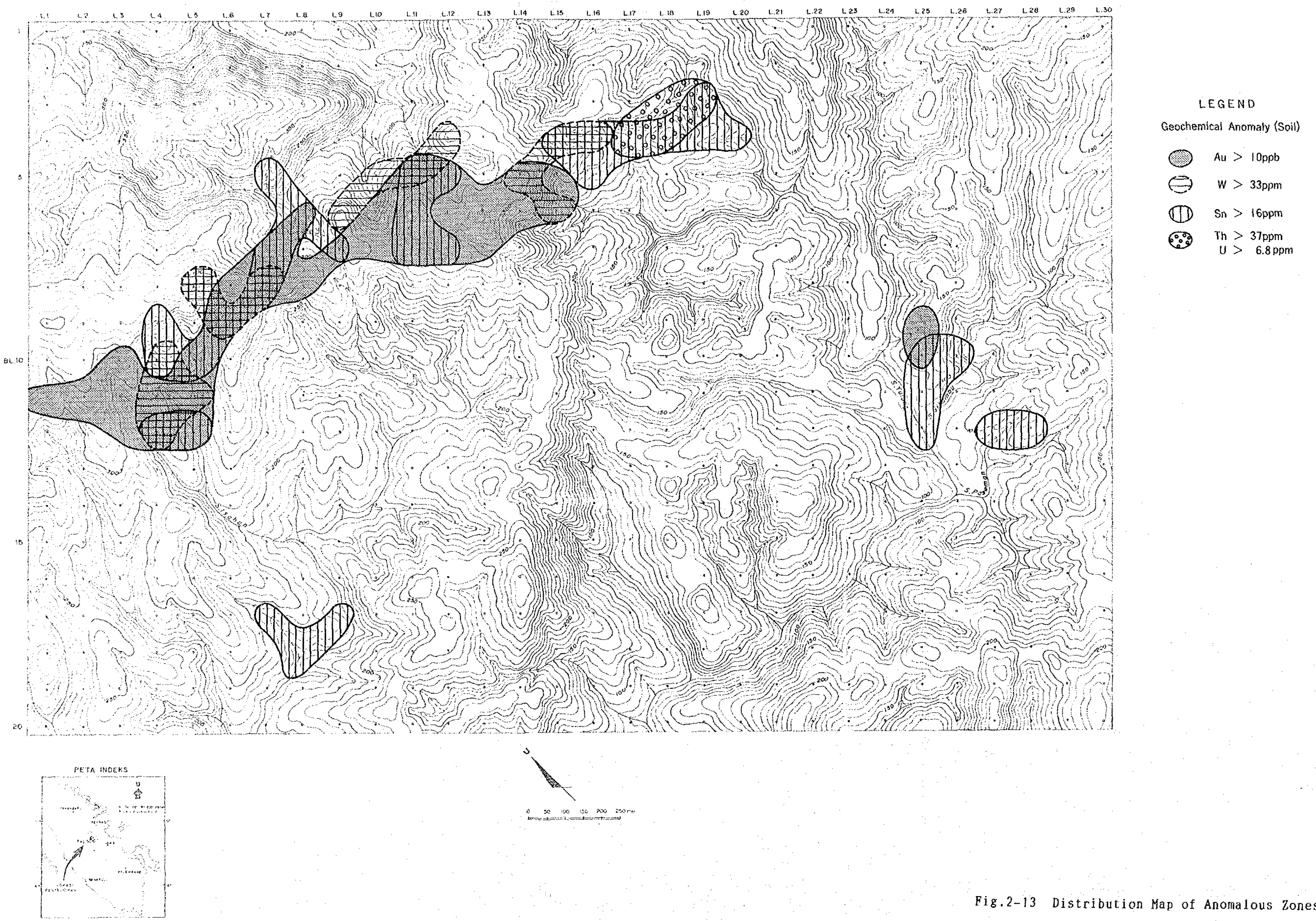


Fig.2-13 Distribution Map of Anomalous Zones Delineated by Soil Geochemical Exploration

(tin-mineralized zone), the branches of S.Tulang (leucocratic granite), the lower reaches of S.Sikambu (tin-mineralized zone) and the branches of S.Sikambu (leucocratic granite). Either leucocratic granite or tin-mineralized zone is found in these zones except S.Pinang.

(2) Soil geochemical anomalous zones

Three anomalous zones were identified; namely the zone extending in approximately the WNW-ESE direction from the upper reaches of S.Isahan to S.Tulang (the S.Isahan-S.Tulang zone), the zone at the middle reaches of S.Isahan, and the zone near the junction of S.Sikambu and S.Tulang. Mineralization and alteration are observed in two of these three zones.

At the zone from the upper reaches of S.Isahan to the branches of S.Tulang, leucocratic granite bodies occur at three localities. Tin mineralization occurs in one of the three zones (at the upper reaches of S.Isahan).

At the junction of S.Sikambu and S.Tulang, tin mineralization is developed (the S.Sikambu mineralized zone).

The A-rank anomaly of stream sediments at the middle reaches of S.Isahan is not reflected in the anomalies of either panned concentrates or soil samples. This zone, therefore, is regarded to be in the lower rank of overall geochemical assessment.

Chapter 3 Drilling

3-1 Background and Summary of Drilling Exploration

The initial discovery of primary tin mineralization in the second phase area was made during the panning survey jointly conducted by P.T.Timah and Geological Survey of Indonesia (Subandoro et al.,1975). Following that, the D.M.R. reported the occurrences of cassiterite in quartz veins which were developed in granites and along the contact of granite and sedimentary rocks (Harahap and Harmanto,1986 and Harmanto and Karno,1986).

Based on the results of the first phase geological survey and geochemical exploration covering an area of 1,000 km² including the current phase area, it was recommended that drilling exploration be conducted in the Bt.Pintutujuh area. Accordingly, a drilling programme consisting of four holes at S.Isahan and another two holes at S.Sikambu was carried out as a part of the work of the present phase. The localities and lengths of the drilling programme are summarized in Table 2-21. Figure 2-14 shows the drill hole location, geology and geologic section. The sequence of the holes drilled is from MJIT-1, 2 (S.Sikambu), to MJIT-3, 4, 6, 5 (S.Isahan).

Core sections (column) were prepared in 1:200 scale and the whole cores were photographed in colour. Twenty-one thin sections, 11 polished sections of mineralized parts, six samples for X-ray diffraction analysis and 209 samples for chemical analysis were collected from the drill cores, and fully utilized for evaluating the survey results.

Table 2-21 Localities and Lengths of Drilling Programme

Drill No.	Locality	Coordinates		Elevation	Inclination	Drilled length
		Latitude	Longitude			
MJIT-1	S. Sikambu	S0°49′28″	E102°20′30″	78m	-90°	101.0m
MJIT-2	ditto	S0°49′26″	E102°20′28″	102m	-90°	101.7m
MJIT-3	S. Isahan	S0°48′37″	E102°19′44″	167m	-90°	101.0m
MJIT-4	ditto	S0°48′39″	E102°19′41″	155m	-90°	101.4m
MJIT-5	ditto	S0°48′39″	E102°19′46″	238m	-90°	100.5m
MJIT-6	ditto	S0°48′34″	E102°19′41″	215m	-90°	100.4m

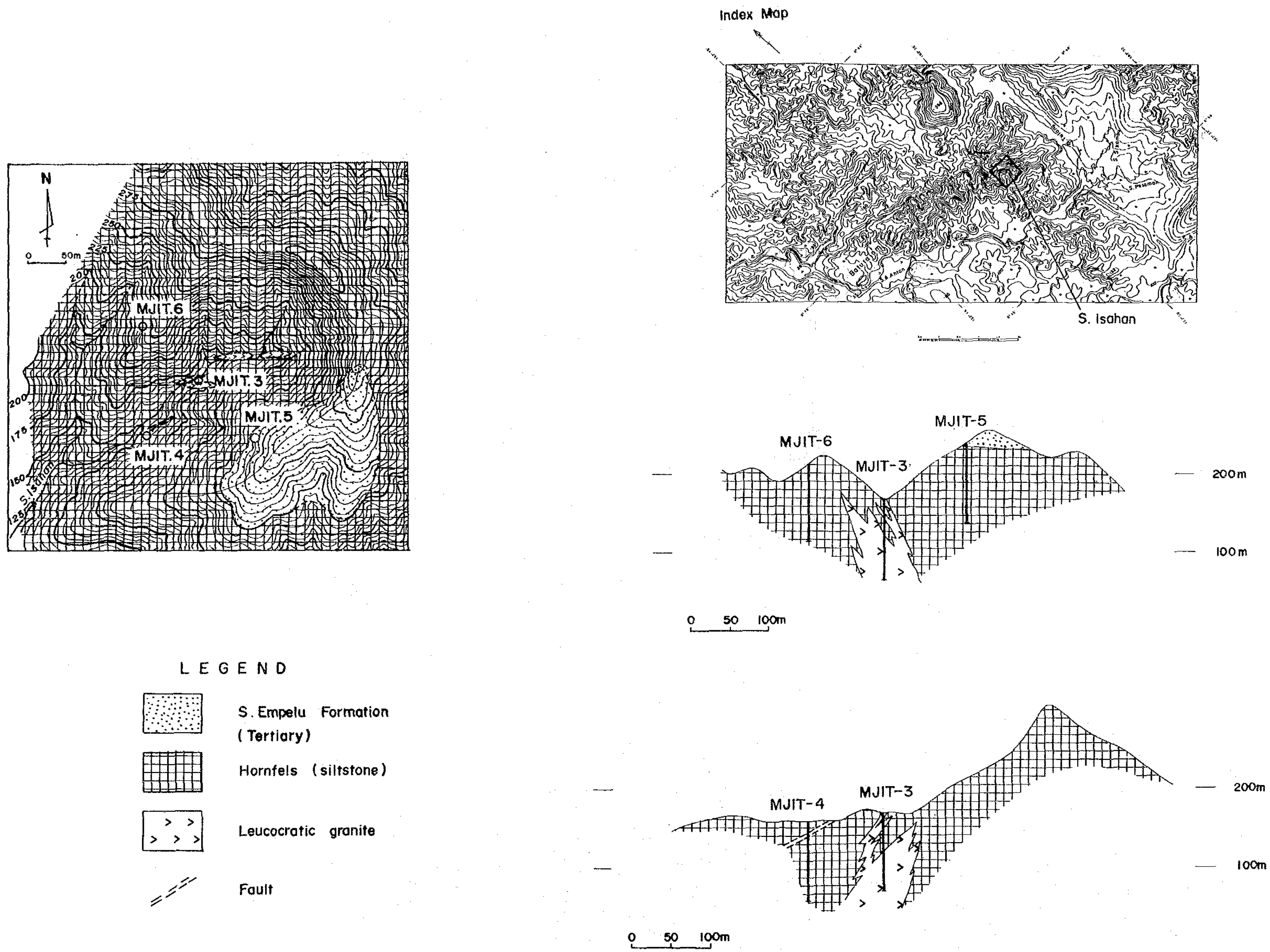
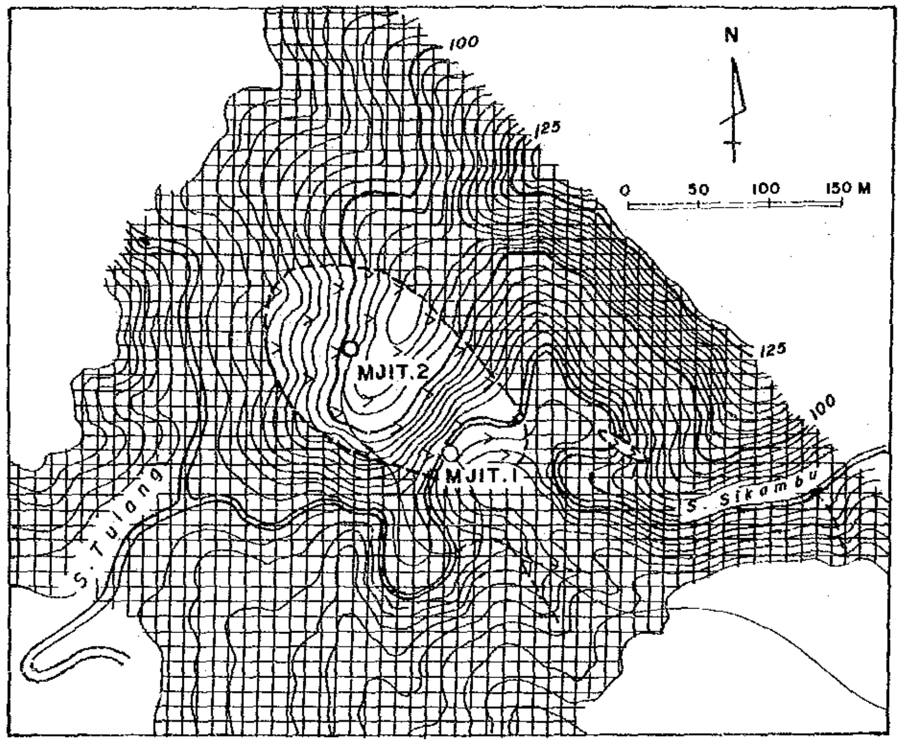
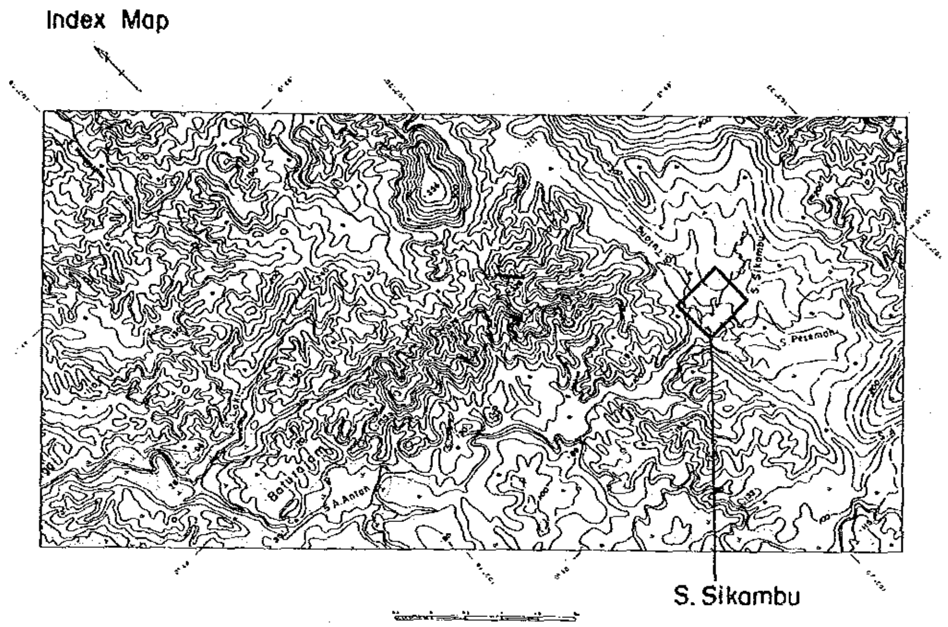
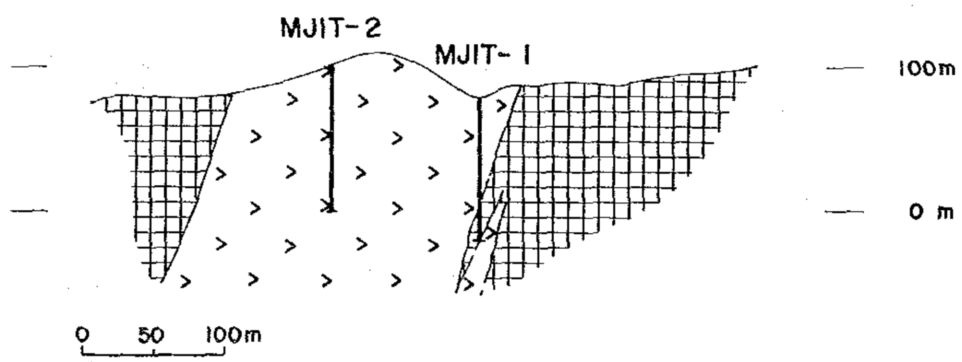


Fig.2-14(1) Map Showing Location of Drill Holes and Geology of Drilling Exploration Areas (S.Sikambu)







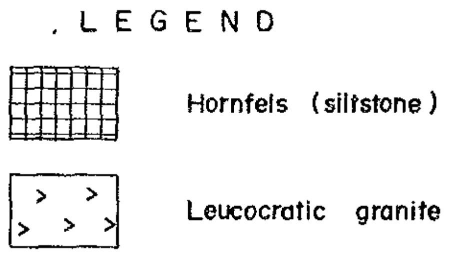


Fig.2-14(2) Map Showing Location of Drill Holes and Geology of Drilling Exploration Areas (S.Isahan)

3-2 Geology and Mineralization

3-2-1 Outline of Geology

The geology of S.Isahan is composed of siltstone and shale of the S.Tulang Member of the Paleozoic Bt.Pintutujuh Formation, leucocratic granite and sandstone of the Neogene S.Empelu Formation. The dykes of leucocratic granite crop out at three localities, extending approximately in the WNW-ESE direction.

The geology of S.Sikambu is composed of siltstone and shale of the S.Tulang Member, and leucocratic granite. The leucocratic granite forms a stock with the surface areal extent of 100 m× 200 m and a thin dyke of about 1 m in width.

3-2-2 Mineralization

(1) S.Isahan

Quartz veins 1 to 40 cm wide form network in the leucocratic granite dyke. The quartz veins contain cassiterite, muscovite, tourmaline, arsenopyrite, pyrite and a trace amount of beryl. Thick quartz veins are sometimes accompanied by 1 to 5 cm wide alteration band of muscovite-kaolinite-potassium feldspar assemblage at the marginal part of the veins.

A 10 cm wide quartz-muscovite vein is observed in slate directly in contact with the leucocratic granite.

Major parts of potassium feldspar and plagioclase are muscovitized in the leucocratic granite. Kaolinite, beryl and limonite are also observed in parts of the leucocratic granite.

Shales adjacent to the leucocratic granite is bleached into greyish white colour, and sometimes show a quartz-kaolinite-sericite mineral assemblage. Siltstone distributed near the leucocratic granite contains greisenitized parts (silicified-muscovitized rocks).

(2) S.Sikambu

Five quartz veins of 2 to 20 cm in width were found in the leucocratic granite. Cassiterite, muscovite, tourmaline and arsenopyrite were observed, and muscovite are associated in the marginal part of the veins.

The host rocks are muscovitized and kaolinized. The degree of alteration, however, is weak. Most of the potassium feldspar and plagioclase remain unaltered.

3-3 Drilling Methods, Equipment and Progress

3-3-1 Methods and Equipment

(1) Methods

For the surface weathered soil with gravel layers (up to 4 m thick), drilling was done by normal method using NX-CP metal shoe (diameter 92 mm), and NX casing pipes were inserted. For the bedrock, wireline method was used with NQ (diameter 79 mm) and BQ (diameter 62 mm) oversized diamond bit. Drilling fluid was often lost in the holes where fractures were developed. This trouble were prevented by injecting the Tel-stop and oil bentonite.

(2) Equipment

The rig used was Longyear L-24 and the specifications of the major machines and pumps are shown in Table 2-22. The diamond bits and the expendable items used are listed in Table 2-23 and Table 2-24, respectively.

(3) Working system

Drilling operation was carried out by three shifts per day (8 hours per shift), while the appurtenant works such as construction, mobilization and demobilization were carried out by one shift per day. Each shift consisted of one Japanese and four Indonesian personnel. Additional fifteen Indonesian workers participated in the appurtenant work. All of the team members stayed in the camps established near the drilling sites during the work. Drilling crew commuted to the drilling site on foot.

(4) Construction of transportation tracks

An existing road for timber transportation passes the point 1.5 km east of S.Sikambu. From that point, two tracks (7 m wide), one 3.6 km long to the S.Sikambu area and another 5.0 km long to the S.Isahan area, were newly constructed by bulldozer for transporting the drilling equipment. Construction periods were 17 days in the S.Sikambu and 42 days in the S.Isahan.

(5) Transportation

Most of the equipment were shipped from Japan and landed at Padang in west Sumatra. From there to the base camp in Pangkalankasai, they were transported by truck and unloaded temporarily. Four wheel drive trucks carried the equipment from the base camp to the end of the existing road. From that point to the sites, they were transported by bulldozer.

Table 2-22 Specifications of Drilling Machines and Equipment Used

Dilling machine ; Model "L-24"	1 set
Specifications:	
Capacity	170m (BQ-WL)
Dimensions LxWxH	1,600x830x1,380mm
Hoisting capacity	1,000kg
Spindle speed	Forward 148, 329, 611rpm
Engine ; Model "NF120EK"	11.5ps/2,400rpm
Drilling pump ; Model "WLMG10"	1 set
Specifications:	
Piston diameter	68mm
Stroke	60mm
Capacity	Discharge capacity 120ℓ/min
Dimensions LxWxH	1,860x600x690mm
Engine ; Model "NF90K"	9ps/2,400rpm
Wire line hoist ; Model "WLH-S"	
Specifications:	
Rope capacity	300m
Hoisting speed	8～105m/min
Engine ; Model "NSA50C-G"	6ps/2,400rpm
Mud mixer ; Model "MM-135"	1 set
Specifications:	
Capacity	100ℓ/600rpm
Engine ; Model "NSA50C-G"	6ps/2,400rpm
Generator ; Model "YDG3000"	2 sets
Specifications:	
Capacity	2.7KW 50Hz 100V
Water supply pump ; Model "WLMG5h"	1 set
Specifications:	
Piston diameter	68mm
Stroke	60mm
Capacity	Discharge capacity 65ℓ/min
Dimensions LxWxH	1,630x465x675mm
Derrick	1 set
Specifications:	
Height	7.5m
Max load capacity	2,000kg
Drilling Tools	
Drilling rod	NQ-WL 3m 15pcs
	BQ-WL 3m 60pcs
Casing pipe	NX-NU 0.5m 8pcs
	NX-NU 1.0m 1pcs
	NX-NU 1.5m 2pcs
	BX-NU 1.0m 2pcs
	BX-NU 3.0m 20pcs

Table 2-23 Drilling Meterage of Diamond Bits Used

Item	Size	Bit No.	Drilling Meterage by Unit : Meter						Total
			MJIT-1	MJIT-2	MJIT-3	MJIT-4	MJIT-5	MJIT-6	(m)
Diamond Bit	NQ	10862	14.0	11.6					25.6
		10860					25.1		25.1
		10861			11.7	4.7			16.4
		10863						12.8	12.8
		Total	14.0	11.6	11.7	4.7	25.1	12.8	80.0
			Drilling Length/Bit 20.0m						
	BQ	10870	18.9						18.9
		10874	64.0						64.0
		10864						37.5	37.5
		10865						45.7	45.7
		10866			18.3				18.3
		10867					38.2		38.2
		10868		43.8					43.8
		10869				40.8			40.8
		10871		42.3					42.3
		10872			69.8				69.8
		10873					32.2		32.2
		10875				51.7			51.7
		Total	82.9	86.1	88.1	92.5	70.4	83.2	503.2
			Drilling Length/Bit 41.9m						
Diamond Shoe	NX	10876			1.2	4.2		4.2	9.6
		10877					5.0		5.0
		Total			1.2	4.2	5.0	4.2	14.6
			Drilling Length/Bit 7.3m						

Table 2-24 Expendable Items Used

Description	Specifications	Unit	Quantity						Total
			MJIT-1	MJIT-2	MJIT-3	MJIT-4	MJIT-5	MJIT-6	
Light oil		ℓ	1,300	1,200	1,280	1,120	1,040	1,120	7,060
Hydraulic oil		ℓ	60			10			70
Engine oil		ℓ	80	48	40	36	25	25	254
Greas		kg	6	4	4	4	4	4	26
Bentonite		kg	500	550	750	500	650	650	3,600
CMC		kg	25	26	35	30	35	35	186
Tel-stop		kg			30		60	60	150
Mud oil		ℓ	45	40	60	60	45	60	310
Cement		kg	200	200	200	200	200	200	1,200
Diamond bit	NQ-WL	pc	1		1		1	1	4
Diamond bit	BQ-WL	pc	2	2	2	2	2	2	12
Diamond reamer	NQ-WL	pc	1						1
Diamond reamer	BQ-WL	pc	1		1				2
Diamond shoe	NX	pc			1		1		2
Casing metal shoe	NX	pc	1						1
Core barrel Ass'y	NQ-WL	set	1						1
Core barrel Ass'y	BQ-WL	set	1			1			2
Inner tube	NQ-WL	pc	2				1		3
Inner tube	BQ-WL	pc	2			1			3
Core lifter case	NQ-WL	pc	2			2			4
Core lifter case	BQ-WL	pc	2		2		2		6
Core lifter	NQ-WL	pc	2			2		2	6
Core lifter	BQ-WL	pc	2		2	1	2		7
Thrust ball bearing	NQ-WL	pc			2				2
Thrust ball bearing	BQ-WL	pc		2		2			4
Innertube stabilizer	NQ-WL	pc	1			1			2
Innertube stabilizer	BQ-WL	pc	1		1		1		3
Chack piece	NQ-WL	set	1						1
Chack piece	BQ-WL	set	1						1
Cylinder liner	MG-10	pc				2			2
Piston rod	MG-10	pc				2			2
Piston rubber	MG-10	pc				2			2
V-packing	MG-10	pc				14			14
Wire rope		m	200						200
Core box	NQ-WL	pc	3	3	2	2	5	16	31
Core box	BQ-WL	pc	9	9	9	9	8		44

(6) Water

Water for drilling was pumped from S.Sikambu or S.Isahan. Pumping length was up to 650 m, and water head up to 90 m.

(7) Withdrawal

After the completion of operation, most of the equipment were sent back to Japan. Drilled cores were transported to Bandung and stored in the D.M.R..

3-3-2 Progress of Drilling

The progress of each drill holes is summarized below. Summary of working time (Table 2-25), records of drilling work (Tables 2-26 to 2-31), summaries of drilling performance (Tables 2-32 to 2-37), and charts of drilling progress (Figs.2-15 to 2-20) were prepared in tables and charts.

(1) MJIT-1

NX-CP metal shoe and bentonite mud were used to 4.0 m depth, and NX casing pipes were inserted. NQ wireline with bentonite mud and mud oil was used from 4.0 m to 18.1 m. The hole was reamed, and BX casing pipes were inserted to the depth of 18.0 m. BQ wireline with bentonite mud and mud oil was used from 18.1 m to 101.0 m. Rocks in the hole were generally fragile and showed a very low RQD (Rock Quality Designation) index. The hole was cleaned by water injection during drilling, because loss of fluid occurred at several parts of the hole and collapse of wall occurred at the depth of 82.0 m.

(2) MJIT-2

NX-CP metal shoe and bentonite mud were used in weathered horizon to the depth of 4.2 m. NX casing pipes were inserted to 4.0 m. NQ wireline with bentonite mud and mud oil was used from 4.2 m to 15.6 m. The hole, then, were reamed and BX casing were inserted to 15.5 m. To the end of the hole at 101.7 m in depth, BQ wireline with bentonite mud and mud oil was used. Rocks from surface to the depth of 29.0 m were intensely weathered and clayey. Therefore, frequent wirelining were adapted aiming to collect cores little by little. Thick bentonite mud was used for preventing collapse of wall in the hole. Rocks deeper than 29.0 m were fragile and showed almost zero RQD index.

Table 2-25 Summary of Working Time

Hole No.	Drilling			Shift		Men Working		Working Time						
	Bit size	Drilling length	Core	Drilling	Total	Engineer	Worker	Drilling	Other work	Total	Assemblage	Dismantlement	Transportation	Grand Total
		m	m	shift	shift	Number of men		h	h	h	h	h	h	h
MJIT-1	NX/NQ/BQ	101.0	93.7	16.0	23.0	78	260	61.0	67.0	128.0	16.0	16.0	24.0	184.0
MJIT-2	NX/NQ/BQ	101.7	87.5	15.0	21.0	66	220	63.7	56.3	120.0	16.0	16.0	16.0	168.0
MJIT-3	NX/NQ/BQ	101.0	93.4	15.6	20.5	60	200	63.1	61.9	125.0	16.0	7.0	16.0	164.0
MJIT-4	NX/NQ/BQ	101.4	99.7	14.0	16.5	40	200	53.8	58.2	112.0	8.0	8.0	4.0	132.0
MJIT-5	NX/NQ/BQ	100.5	98.9	12.5	15.0	36	180	52.1	47.9	100.0	8.0	4.0	8.0	120.0
MJIT-6	NX/NQ/BQ	100.4	97.7	14.0	17.0	40	200	52.3	59.7	112.0	8.0	8.0	8.0	136.0
Total	NX/NQ/BQ	606.0	570.9	87.1	113.0	320	1260	346.0	351.0	697.0	72.0	59.0	76.0	904.0

Table 2-26 Record of Drilling Work (MJIT-1)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Sep/11	Transportation								
12	ditto								
13	ditto								
14	Assemblage								
15	ditto								
16	4.00	-	-	4.00	-				
17	7.70	6.40	6.60	20.70	19.80				
18	5.90	5.90	6.40	18.20	17.90				
19	8.70	5.50	6.60	20.80	20.80				
20	6.20	6.80	6.10	19.10	18.80				
21	6.50	6.90	4.80	18.20	16.40				
22	Dismantlement								
23	ditto					16	23	78	260
Total				101.00	93.70	16	23	78	260

Table 2-27 Record of Drilling Work (MJIT-2)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Sep/24	Transportation								
25	ditto								
26	Assemblage								
27	ditto								
28	4.20	7.10	5.70	17.00	7.50				
29	6.90	7.50	7.60	22.00	17.30				
30	6.00	7.40	7.10	20.50	20.50				
Oct/1	7.60	7.20	7.80	22.60	22.60				
2	6.10	7.40	6.10	19.60	19.60				
3	Dismantlement								
4	ditto					15	21	66	220
Total				101.70	87.50	15	21	66	220

Table 2-28 Record of Drilling Work (MJIT-3)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Oct/ 6	Transportation								
7	ditto								
8	ditto,	Assemblage							
9	Assemblage								
10	4.00	5.50	6.10	15.60	13.40				
11	6.50	6.50	5.60	18.60	14.80				
12	6.50	6.50	6.50	19.50	19.50				
13	6.40	5.40	7.90	19.70	18.10				
14	7.80	8.50	8.20	24.50	24.50				
15	3.10,	Dismantlement		3.10	3.10	15.6	20.5	60	200
Total				101.00	93.40	15.6	20.5	60	200

Table 2-29 Record of Drilling Work (MJIT-4)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Oct/16	Transportation								
17	Assemblage								
18	6.40	10.20		16.60	16.60				
19	10.10	6.40		16.50	16.50				
20	2.20	3.50		5.70	5.40				
21	8.50	9.80		18.30	18.30				
22	8.50	6.60		15.10	15.10				
23	6.60	6.00		12.60	11.20				
24	8.80	7.80		16.60	16.60				
25	Dismantlement					14	16.5	40	200
Total				101.40	99.70	14	16.5	40	200

Table 2-30 Record of Drilling Work (MJIT-5)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Nov/ 5	Transportation								
6	Assemblage								
7	10.00	10.80		20.80	20.80				
8	9.30	8.30		19.60	17.20				
9	8.20	6.60		14.80	13.60				
10	7.30	7.80		15.10	15.10				
11	6.70	6.80		13.50	13.50				
12	8.10	8.10		16.20	16.20				
13	2.50,	Dismantlement		2.50	2.50	12.5	15	36	180
Total				100.50	98.90	12.5	15	36	180

Table 2-31 Record of Drilling Work (MJIT-6)

	Drilling Length			Total		Shift		Working Man	
	Shift 1	Shift 2	Shift 3	Drilling	Core Length	Drilling	Total	Enginneer	Worker
	m	m	m	m	m	shift	shift	man	man
Oct/26	Transportation								
27	Assemblage								
28	8.20	5.40		13.60	13.10				
29	5.40	3.00		8.40	6.60				
30	5.10	7.50		12.60	12.20				
31	9.90	10.00		19.90	19.90				
Nov/ 1	8.40	10.00		18.40	18.40				
2	8.50	7.00		15.50	15.50				
3	7.00	5.00		12.00	12.00				
4	Dismantlement					14	17	40	200
Total				100.40	97.70	14	17	40	200

Table 2-32 Summary of Drilling Performance (MJIT-1)

Operation	Survey Period: Period	Days	Work Day	Off Day	Total Man Day: Engineer	Worker
Preparation	11. 9.1990~15. 9.1990	5	5	-	30	100
Drilling	16. 9.1990~21. 9.1990	6	6	-	36	120
Removing	22. 9.1990~23. 9.1990	2	2	-	12	40
Total	11. 9.1990~23. 9.1990	13	13	-	78	260

Drilling Length			
Length Planned	100.0 m	Overburden	4.0 m
Increase or Decrease in Length		Core Length	93.7 m
Length Drilled	101.0 m	Core Recovery	92.8 %

Core Recovery of 50m Hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 59.2	91.2	91.2
59.2 ~ 101.0	95.0	92.8

Working Hours	h	%	%
Drilling	61.0	47.7	33.2
Other working Recovery	67.0	52.3	36.4
Total	128.0	100.0	69.6
Assembly	16.0		8.7
Dismantling	16.0		8.7
Water Transportation			
Transportation	24.0		13.0
Grand Total	184.0		100.0

Efficiency of Drilling

Total m/Work Period(m/day)	101.0m/ 6days (16.8m/day)
Total m/Total Shift(m/shift)	101.0m/ 16shifts (6.3m/shift)

Drilled Length/Bit(Each Size Bit)

Bit Size	NX	NQ	BQ
Drilled Length	4.0m	14.1m	82.9m
Core Length	-	13.2m	80.5m

Casing Pipe Inserted

Size	Meterage (m)	Meterage Drillingx100 Length (%)	Recovery (%)
NX	4.0	4.0	100
BX	18.0	17.8	100

Table 2-33 Summary of Drilling Performance (MJIT-2)

Operation	Survey Period: Period	Days	Work Day	Off Day	Total Man Day: Engineer	Worker
Preparation	24. 9.1990~27. 9.1990	4	4	-	24	80
Drilling	28. 9.1990~ 2.10.1990	5	5	-	30	100
Removing	3.10.1990~ 4.10.1990	2	2	-	12	40
Total	24. 9.1990~ 4.10.1990	11	11	-	66	220

Drilling Length			
Length Planned	100.0 m	Overburden	m
Increase or Decrease in Length		Core Length	87.5 m
Length Drilled	101.7 m	Core Recovery	86.0 %

Core Recovery of 50m Hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 52.4	72.9	72.9
52.4 ~ 101.7	100.0	86.0

Working Hours	h	%	%
Drilling	63.7	53.1	37.9
Other Working Recovery	56.3	46.9	33.5
Total	120.0	100.0	71.4
Assembly	16.0		9.6
Dismantling	16.0		9.5
Water Transportation			
Transportation	16.0		9.5
Grand Total	168.0		100.0

Efficiency of Drilling

Total m/Work Period(m/day)	101.7m/ 5days (20.3m/day)
Total m/Total Shift(m/shift)	101.7m/ 15shifts (6.8m/shift)

Drilled Length/Bit(Each Size Bit)

Bit Size	NX	NQ	BQ
Drilled Length	4.2m	11.6m	86.1m
Core Length	4.2m	2.7m	80.6m

Casing Pipe Inserted

Size	Meterage (m)	Meterage Drillingx100 Length (%)	Recovery (%)
NX	4.0	3.9	100
BX	15.5	15.2	100

Table 2-34 Summary of Drilling Performance (MJIT-3)

Operation	Survey Period: Period	Days	Work Day	Off Day	Total Man Day: Engineer	Worker
Preparation	6.10.1990~ 9.10.1990	4	4	-	24	80
Drilling	10.10.1990~15.10.1990	5.5	5.5	-	33	110
Removing	15.10.1990~15.10.1990	0.5	0.5	-	3	10
Total	6.10.1990~15.10.1990	10	10	-	60	200

Drilling Length			
Length Planned	100.0 m	Overburden	m
Increase or Decrease in Length		Core Length	93.4 m
Length Drilled	101.0 m	Core Recovery	92.5 %

Core Recovery of 50m Hole: Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 53.7	88.8	88.8
53.7 ~ 101.0	96.6	92.5

Working Hours	h	%	%
Drilling	63.1	50.5	38.5
Other Working	61.9	49.5	37.7
Recovery			
Total	125.0	100.0	76.2
Assembly	16.0		9.8
Dismantling	7.0		4.2
Water Transportation			
Transportation	16.0		9.8
Grand Total	164.0		100.0

Efficiency of Drilling	
Total m/Work Period(m/day)	101.0m/ 5.5days (18.4m/day)
Total m/Total Shift(m/shift)	101.0m/15.5shifts (6.5m/shift)

Drilled Length/Bit(Each Size Bit): Bit Size	NX	NQ	BQ
Drilled Length	1.2m	11.7m	88.1m
Core Length	1.2m	11.4m	80.8m

Casing Pipe Inserted: Size	Meterage (m)	Meterage/Drilling Length x100 (%)	Recovery (%)
NX	4.1	4.1	100
BX	13.1	13.0	100

Table 2-35 Summary of Drilling Performance (MJIT-4)

Operation	Survey Period: Period	Days	Work Day	Off Day	Total Man Day: Engineer	Worker
Preparation	16.10.1990~17.10.1990	2	2	-	8	40
Drilling	18.10.1990~24.10.1990	7	7	-	28	140
Removing	25.10.1990~25.10.1990	1	1	-	4	20
Total	16.10.1990~25.10.1990	10	10	-	40	200

Drilling Length			
Length Planned	100.0 m	Overburden	m
Increase or Decrease in Length		Core Length	99.7 m
Length Drilled	101.4 m	Core Recovery	98.3 %

Core Recovery of 50m Hole: Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 57.1	99.5	99.5
57.1 ~ 101.4	96.8	98.3

Working Hours	h	%	%
Drilling	53.8	48.0	40.8
Other Working	58.2	52.0	44.0
Recovery			
Total	112.0	100.0	84.8
Assembly	8.0		6.1
Dismantling	8.0		6.1
Water Transportation			
Transportation	4.0		3.0
Grand Total	132.0		100.0

Efficiency of Drilling	
Total m/Work Period(m/day)	101.4m/ 7days (14.5m/day)
Total m/Total Shift(m/shift)	101.4m/ 14shifts (7.2m/shift)

Drilled Length/Bit(Each Size Bit): Bit Size	NX	NQ	BQ
Drilled Length	4.2m	4.7m	92.5m
Core Length	4.2m	4.7m	90.8m

Casing Pipe Inserted: Size	Meterage (m)	Meterage/Drilling Length x100 (%)	Recovery (%)
NX	4.2	4.1	100
BX	28.0	27.6	100

Table 2-36 Summary of Drilling Performance (MJIT-5)

	Survey Period				Total Man Day	
Operation	Period	Days	Work Day	Off Day	Engineer	Worker
Preparation	5.11.1990~ 6.11.1990	2	2	-	8	40
Drilling	7.11.1990~13.11.1990	6.5	6.5	-	26	130
Removing	13.11.1990~13.11.1990	0.5	0.5	-	2	10
Total	5.11.1990~13.11.1990	9	9	-	36	180

Drilling Length			
Length Planned	100.0 m	Overburden	m
Increase or Decrease in Length		Core Length	98.9 m
Length Drilled	100.5 m	Core Recovery	% 98.4

Core Recovery of 50m Hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 53.2	97.0	97.0
53.2 ~ 101.4	100.0	98.4

Working Hours	h	%	%
Drilling	52.1	52.1	43.4
Other Working	47.9	47.9	39.9
Recovery			
Total	100.0	100.0	83.3
Assembly	8.0		6.7
Dismantling	4.0		3.3
Water Transportation			
Transportation	8.0		6.7
Grandtotal	120.0		100.0

Efficiency of Drilling

Total m/Work Period(m/day)	100.5m/ 6.5days (15.5m/day)
Total m/Total Shift(m/shift)	100.5m/12.5shifts (8.0m/shift)

Drilled Length/bit(Each Size Bit)

Bit Size	NX	NQ	BQ
Drilled Length	5.0m	25.1m	70.4m
Core Length	5.0m	25.1m	68.8m

Casing Pipe Inserted

Size	Meterage (m)	Meterage / Drilling Length x100 (%)	Recovery (%)
NX	5.0	5.0	100
BX	30.1	30.0	100

Table 2-37 Summary of Drilling Performance (MJIT-6)

	Survey Period				Total Man Day	
Operation	Period	Days	Work Day	Off Day	Engineer	Worker
Preparation	26.10.1990~27.10.1990	2	2	-	8	40
Drilling	28.10.1990~ 3.11.1990	7	7	-	28	140
Removing	4.11.1990~ 4.11.1990	1	1	-	4	20
Total	26.10.1990~ 4.11.1990	10	10	-	40	200

Drilling Length			
Length Planned	100.0 m	Overburden	m
Increase or Decrease in Length		Core Length	97.7 m
Length Drilled	100.4 m	Core Recovery	% 97.3

Core Recovery of 50m hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0 ~ 54.5	95.0	95.0
54.5 ~ 100.4	100.0	97.3

Working hours	h	%	%
Drilling	52.3	46.7	38.5
Other Working	59.7	53.3	43.9
Recovery			
Total	112.0	100.0	82.4
Assembly	8.0		5.9
Dismantling	8.0		5.9
Water Transportation			
Transportation	8.0		5.8
Grandtotal	136.0		100.0

Efficiency of Drilling

Total m/Work Period(m/day)	100.4m/ 7days (14.3m/day)
Total m/Total Shift(m/Shift)	100.4m/ 14shifts (7.2m/Shift)

Drilled Length/Bit(Each Size Bit)

Bit Size	NX	NQ	BQ
Drilled Length	4.2m	12.8m	83.4m
Core Tength	4.2m	12.1m	81.4m

Casing Pipe Inserted

Size	Meterage (m)	Meterage / Drilling Length x100 (%)	Recovery (%)
NX	4.2	4.2	100
BX	22.0	21.9	100

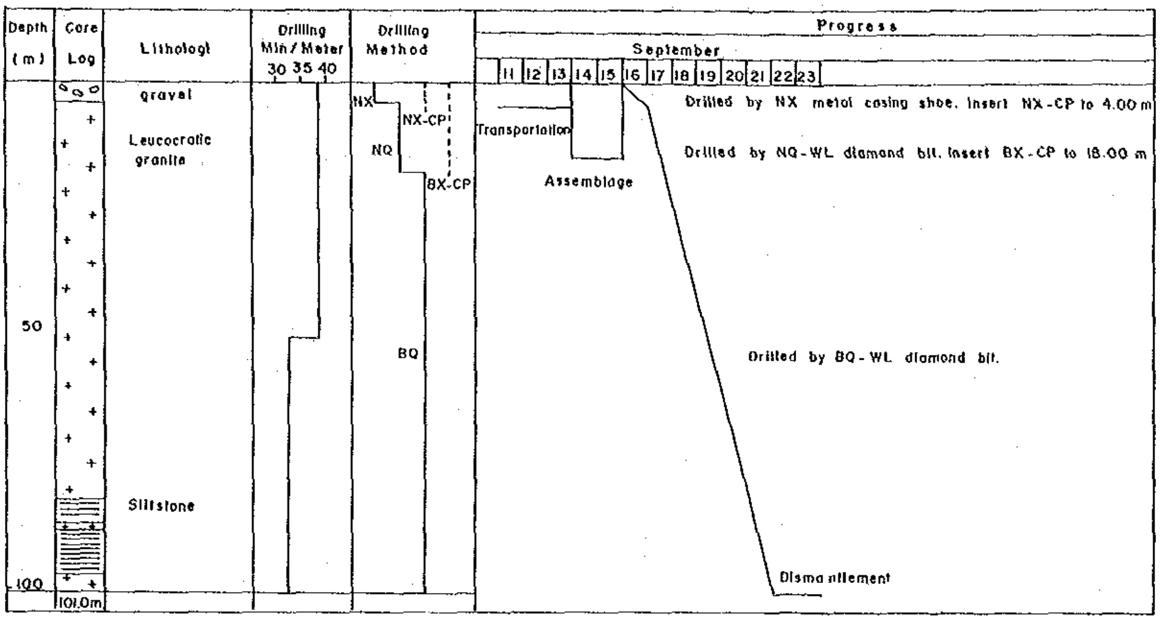


Fig.2-15 Chart of Drilling Progress (MJIT-1)

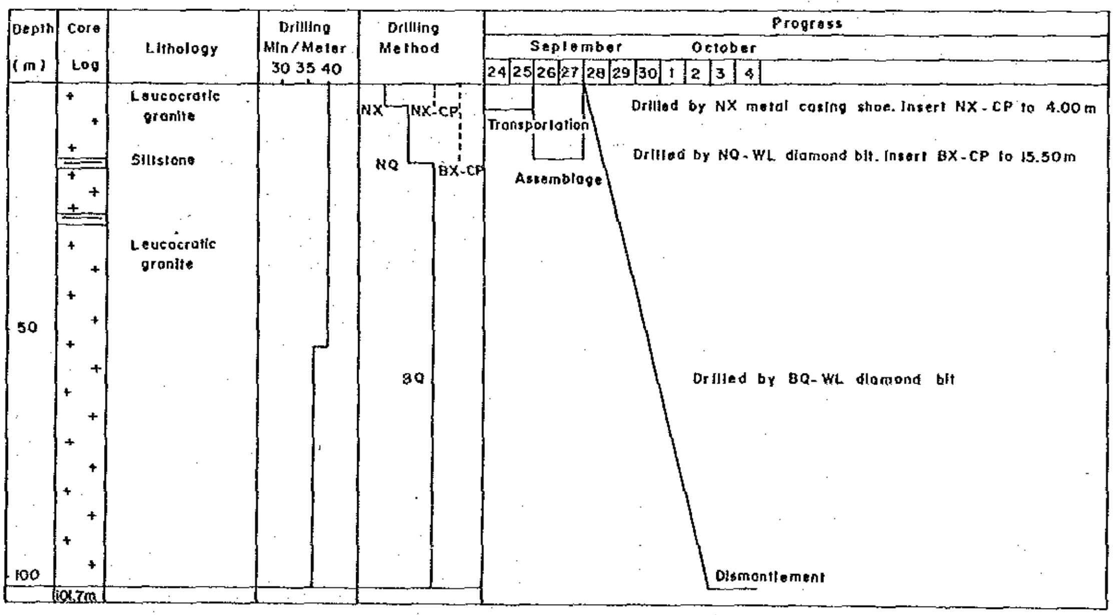


Fig.2-16 Chart of Drilling Progress (MJIT-2)

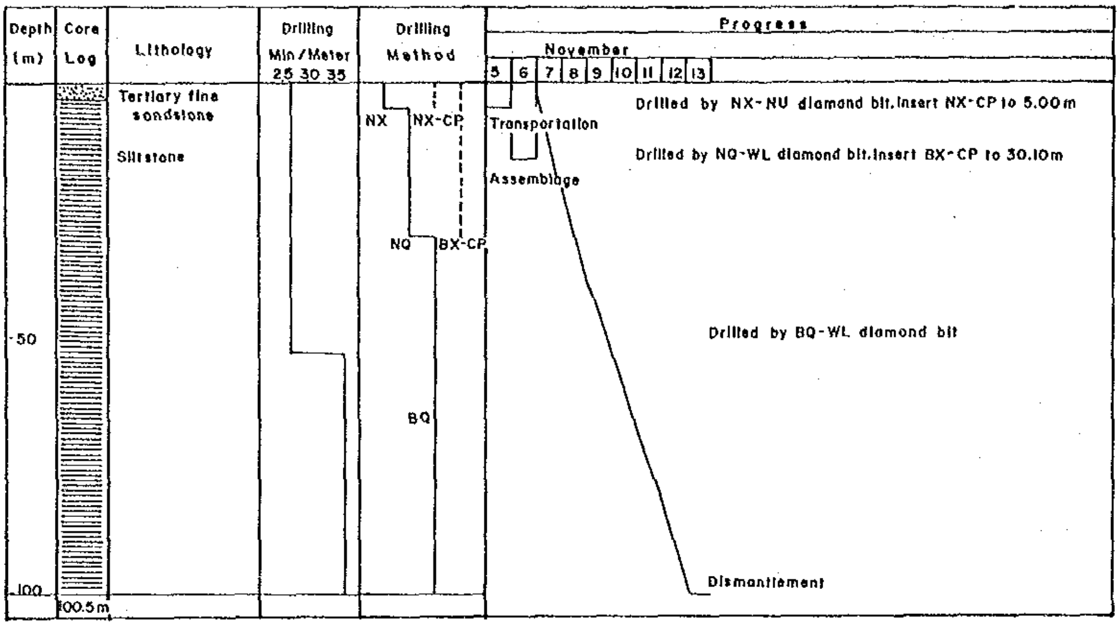


Fig.2-17 Chart of Drilling Progress (MJIT-3)

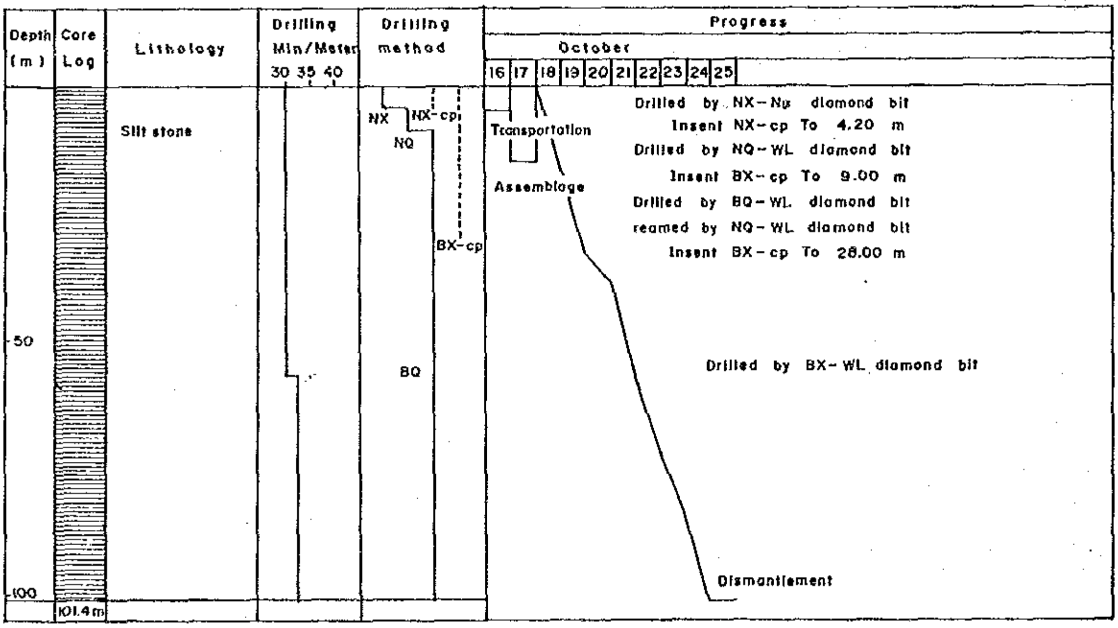


Fig.2-18 Chart of Drilling Progress (MJIT-4)

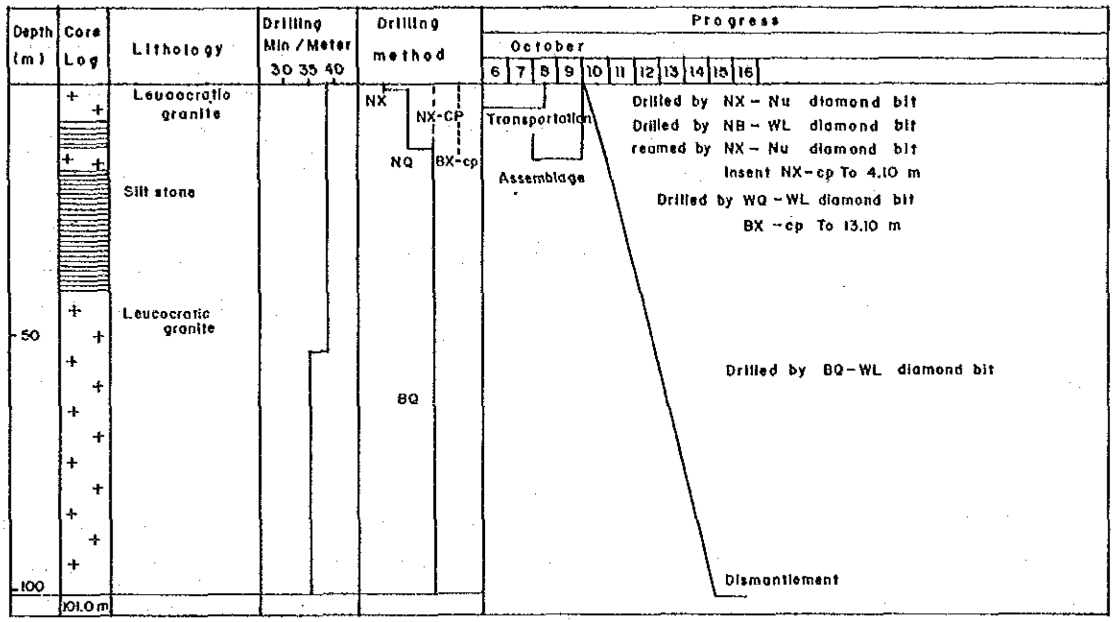


Fig.2-19 Chart of Drilling Progress (MJIT-5)

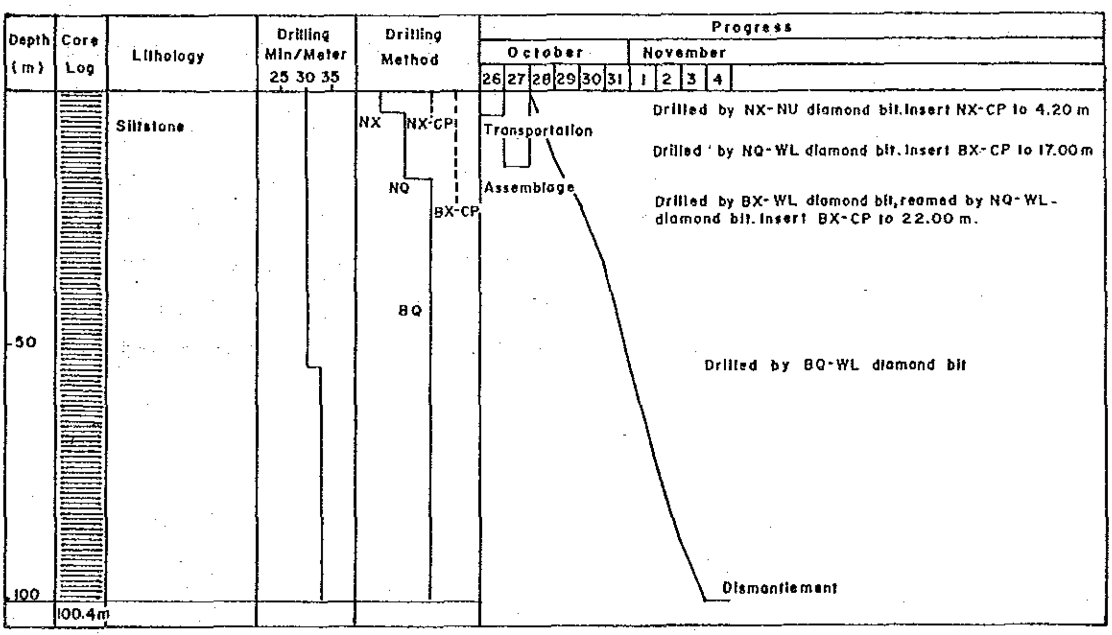


Fig.2-20 Chart of Drilling Progress (MJIT-6)

(3) MJIT-3

NX-CP metal shoe with bentonite mud as used in weathered zone to 1.2 m, and NQ diamond bit was used further to 4.0 m. The hole was reamed by NX-CP shoe, and NX casing pipes were inserted to 4.0 m. NQ wireline with bentonite mud and mud oil was used from 4.0 m to 12.9 m. BX casing pipes were inserted to the depth of 13.1 m. Further to 101.0 m, BQ wireline with bentonite mud and mud oil was used. Whole fluid was lost at 63.0 m. Loss of fluid continued during the deeper drilling, although Tel-stop and oil bentonite were injected. Amount of returned water was 20 litre per minute compared to 60 litre sent.

(4) MJIT-4

NX-CP shoe and bentonite mud were used in weathered rock to 4.2 m, and NX casing pipes were inserted to 4.2 m. NQ wireline with bentonite mud and mud oil was used from 4.2 m to 8.9 m. BX casing pipes were inserted to the depth of 9.0 m. BQ wireline with bentonite mud and mud oil was used to 101.4 m. When water flowed at the depth of 26.8 m, the hole between 8.9 m and 28.0 m was reamed using NQ diamond bit, then BX casing pipes were inserted. Water gushed out again at 78.8 m (21 litre per minute). Amount of water flowed was 90 litre per minute during drilling at the end of the hole.

(5) MJIT-5

NX-CP shoe drilling with bentonite mud and NX casing were used in weathered horizon to 5.0 m. From 5.0 m to 30.1 m, NQ wireline with bentonite mud and mud oil, and BX casing were used. BQ wireline with bentonite mud and mud oil was used to the end of the hole (100.5 m). Fluid losses frequently occurred at the depth of 7.0 m, 38.0 m to 38.4 m, 64.5 m. Tel-stop and oil bentonite were injected for trying to stop the escapes. Those materials were ineffective in this hole. At the depth of below 64.5 m, no fluid was returned, and drilling was made with injecting water and bentonite mud.

(6) MJIT-6

NX-CP shoe and bentonite were used in weathered horizon to 4.2 m. The hole was reamed and NX casing pipes were inserted to the depth of 4.2 m. NQ wireline with bentonite mud and mud oil was used from 4.2 m to 17.2 m. After inserting BX casing pipes to 17.0 m, drilling was carried out by BQ wireline method with bentonite mud and mud oil to the depth of 100.5 m. Drilling fluid was lost at 7.2 m, 8.8 m and 19.1 m. Fluid losses continued after Tel-stop and oil bentonite were injected. Reaming was carried out by NQ diamond bit, and BX casing pipes were extended to the depth of 22.0 m.

3-4 Geology and Mineralization of Drill Holes

3-4-1 Geology

The subsurface geology of the area confirmed from the study of drill cores is composed of siltstone, shale and pebbly siltstone of the S.Tulang Member of the Paleozoic Bt.Pintutujuh Formation, leucocratic granite which intruded into the Paleozoic System, fine-grained sandstone and conglomerate of the Neogene S.Empelu Formation, and the Quaternary sand and gravel.

The leucocratic granite was penetrated in three holes; MJIT-1, 2 and 3. The rock is composed of quartz, potassium feldspar, plagioclase and muscovite as major rock-forming minerals. A part of the potassium feldspar and plagioclase was saussuritized. The phenocrysts were cracked and muscovite (sericite) filled voids among the fragments. Secondary quartz was crystallized. Kaoline is observed as an alteration product.

The Paleozoic rocks sometimes contain fragments of quartzite and quartz. Muscovite, biotite, calcite and dolomite were formed in the matrix.

3-4-2 Description of Each Hole

Geology and mineralization of each hole are described below. Description of mineralization is limited to the veins with more than 1 cm in thickness.

MJIT-1

① Geology

0-4.7m	Sand and gravel.
4.7-82.8m	Leucocratic granite. Generally it is whitish grey, but is pale brownish grey in limonite-stained parts at 14.1-14.4m and 18.3-37.5m. It is strongly argillized by weathering at 4.7-5.3m.

82.8-87.2m	Pale greenish grey siltstone.
87.2-88.3m	Leucocratic granite.
88.3-97.6m	Pale grey or dark grey siltstone. The contact with leucocratic granite altered into biotite-hornfels. Due to the hydrothermal alteration, some parts decolourized to pale grey from dark grey.
97.6-98.8m	Leucocratic granite. The boundary with siltstone has 70° to 80° dip.
98.8-99.9m	Pale greenish grey siltstone.
99.9-100.3m	Leucocratic granite, weakly argillized.
100.3-100.6m	Pale greenish grey siltstone, silicified.
100.6-101.0m	Leucocratic granite.

② Mineralization and alteration

7.0-8.5m	Silicification, disseminated with pyrite (limonite), muscovite and tourmaline.
11.7-12.0m	Silicification, disseminated with muscovite and small amount of pyrite.
12.0-14.1m	Weak dissemination of pyrite.
17.5-17.6m	Silicification, disseminated with muscovite and tourmaline.
18.0-18.3m	Silicification, disseminated with muscovite.
28.5-28.9m	Partly silicified, with small amount of muscovite and rare amount of pyrite.
34.5-34.9m	Quartz vein with a very small quantity of muscovite, arsenopyrite and tourmaline.
43.0-44.3m	Strong dissemination of tourmaline.
52.0-52.8m	Strong dissemination of tourmaline.
52.8-59.2m	Dissemination of a small quantity of pyrite and tourmaline.
63.9-64.5m	Tourmaline network and dissemination.
81.9-82.8m	Tourmaline network and dissemination.

<u>MJIT-2</u>

① Geology

0-15.1m	Leucocratic granite. Strongly weathered. Whitish grey, pale brown or brown. Minerals apart from quartz are argillized.
15.1-15.6m	Pale whitish brown argillized siltstone.
15.6-16.1m	Argillized leucocratic granite.
16.1-17.0m	Reddish brown argillized siltstone.
17.0-26.0m	Argillized leucocratic granite, partly limonite stained.
26.0-26.6m	Pale greenish grey decolourized siltstone.

26.6-27.4m	Argillized leucocratic granite.
27.4-28.2m	Pale greenish grey siltstone.
28.2-101.7m	Leucocratic granite.

② Mineralization and alteration

29.4-30.5m	Weak silicification and pyrite-dissemination.
45.2-46.4m	Tourmaline(-quartz) vein.
49.8m	Tourmaline vein, width 1cm, dip 80°.
50.6m	Quartz-tourmaline vein,width 1cm, dip 80°.
51.4m	Quartz-tourmaline-pyrite vein, width 1cm, dip 80°.
52.8m	Tourmaline-quartz vein, width 1cm, 80°.
54.1m	Quartz-tourmaline vein, width 1cm, dip 85°.
66.6m	Black clay vein, width 1cm, dip 80°.
67.1m	Dissemination of cassiterite grains (diameter 0.5mm).
69.8m	Black clay vein, width 1cm, dip 70°.
78.8-79.1m	Pyrite-quartz network (width 2-5mm).
80.2m	Pyrite-quartz-grey clay vein, width 2cm, dip 70°.
97.1m	Quartz(-pyrite-calcite) vein, width 1cm.

MJIT-3

① Geology

0-7.7m	Leucocratic granite. From 0 to 6.3m in depth, weathered intensely.
7.7-12.7m	Pale whitish grey (decolourized) to dark grey siltstone. Pebbles are elongated, dip 30°.
12.7-17.2m	White to brown argillized leucocratic granite.
17.2-24.4m	Pale bluish-greenish grey shale. Partly silty.
24.4-26.7m	Leucocratic granite, containing secondary feldspar crystals (up to 1cm).
26.7-40.8m	Pale greenish grey, grey to whitish grey siltstone.
40.8-101.0m	Leucocratic granite.

② Mineralization and alteration

2.9-3.8m	Quartz-muscovite(-tourmaline-limonite) vein.
4.0-4.4m	Quartz(-muscovite-potassium feldspar) vein.
5.0-5.2m	Quartz-muscovite vein.
6.2m	Quartz(-muscovite-tourmaline) vein, width 1cm, two veins with 60° and 80° dips.
8.7m	Quartz-pyrite vein, width 1cm, dip 30°.
9.6m	Quartz(-tourmaline-pyrite) vein, width 1cm, dip 70°.

11.7m	Quartz(-pyrite) vein, width 1cm, dip 70°.
11.9-12.1m	Quartz(-tourmaline-pyrite) vein.
12.2m	Quartz-pyrite vein, width 1cm, dip 50°.
12.8m	Quartz(-muscovite-tourmaline) vein, width 1cm, dip 75°.
13.6m	Quartz(-muscovite-molybdenite) vein, width 5cm.
14.5m	Quartz-pyrite vein, width 1cm, dip 70°.
17.3m	Quartz(-muscovite-pyrite) vein, width 5cm.
18.0m	Quartz(-tourmaline-muscovite-pyrite) vein, width 5cm, dip 80°
18.3m	Quartz(-tourmaline) vein, width 5cm.
19.3m	Quartz(-molybdenite-pyrite) vein, width 5cm.
20.5m	Quartz(-potassium feldspar-tourmaline) vein, width 5cm.
21.0-21.2m	:Quartz(-tourmaline-pyrite) vein.
26.1-26.3m	:Quartz(-pyrite) vein.
26.8m	Quartz-potassium feldspar(-tourmaline-pyrite) vein, width 4cm, dip 80°.
28.4m	Quartz-limonite vein, width 1cm, dip 50°.
28.8m	Quartz vein, width 4cm.
28.9m	Quartz-potassium feldspar vein, width 1cm, dip 70°.
29.1-29.3m	Quartz-limonite vein.
30.5m	Muscovite-quartz vein, width 1cm.
34.2m	Quartz-limonite-cassiterite-muscovite vein, width 2cm, dip 80°.
34.9m	Quartz-fluorite-cassiterite-muscovite-tourmaline-pyrite vein, width 1cm, dip 80°.
35.7-36.7m	Silicification and muscovite dissemination.
36.8m	Quartz-cassiterite-tourmaline-pyrite vein, width 1cm.
38.6m	Quartz-potassium feldspar vein (with small amount of pyrite), width 10cm.
40.5m	Potassium feldspar-quartz-tourmaline vein, width 7cm.
42.9-43.5m	Silicification and dissemination of muscovite(-pyrite).
43.5m	Quartz vein, width 1cm, dip 50°.
44.6-45.0m	Silicification and dissemination of muscovite and tourmaline.
45.3m	Quartz(-pyrite) vein, width 5cm, dip 70°.
47.4-47.8m	Silicification and dissemination of muscovite and pyrite.
55.1-55.2m	Quartz(-pyrite-muscovite) vein.
56.4-56.5m	Silicification and dissemination of muscovite.
62.5m	Quartz-pyrite vein, width 5cm, dip 85°. Both wall rocks silicified and disseminated by muscovite and pyrite (3cm wide each).
63.3m	Quartz-pyrite-arsenopyrite vein, width 2cm.

63.4m	Quartz-pyrite-arsenopyrite vein, width 2cm.
65.1m	Quartz-pyrite-arsenopyrite vein, width 3cm.
68.8m	Quartz(-muscovite) vein, width 1cm.
74.4m	Quartz(-muscovite-tourmaline) vein, width 1cm.
75.2m	Quartz(-muscovite-tourmaline) vein, width 2cm, dip 70°.
75.3m	Quartz(-muscovite-tourmaline) vein, width 1cm, dip 60°.
78.2m	Quartz(-muscovite) vein, width 1cm, dip 70°.
91.8m	Quartz(-muscovite) vein, width 2cm, dip 20°.
95.4m	Pyrite-black clay vein, width 2cm, dip 30°.
97.5m	Quartz(-tourmaline) vein, width 1cm, dip 70°.

MJIT-4

① Geology

0-101.4m	Siltstone; pale grey, grey to dark grey. From 0 m to 2.3 m, strongly weathered and reddish brown. From 12.6 m to 19.4 m, fault clay. From 56.5 m to 61.8 m, pebbly siltstone. Generally contact metamorphosed with formation of secondary biotite.

② Mineralization and alteration

7.3-7.8m	Quartz(-tourmaline-potassium feldspar) vein.
7.9-8.0m	Quartz(-tourmaline) vein.
37.6-37.9m	Quartz(-pyrite-calcite) vein.
38.6m	Quartz vein, width 5cm.
38.8m	Quartz-pyrite vein, width 3cm.
41.3m	Quartz(-pyrite) vein, width 1cm, dip 70°.
61.9m	Quartz(-pyrite) vein, width 1cm.
71.4m	Quartz(-pyrite) vein, width 5cm.
100.9m	Quartz(-pyrite) vein, width 2cm, dip 40°.

MJIT-5

① Geology

0-3.0m	Tertiary fine-grained sandstone.
3.0-3.2m	Tertiary conglomerate.
3.2-100.5m	Siltstone; pale grey, grey to dark grey. From 3.2 m to 6.0 m, strongly weathered and pale reddish brown. Generally contact metamorphosed with formation of secondary biotite.

② Mineralization and alteration

63.7m	Calcite vein, width 6cm, dip 30°.
69.3-69.4m	Quartz-pyrite vein, dip 30°.
85.3m	Quartz vein, width 6cm, dip 60°.
91.6m	Quartz-pyrite-tourmaline vein, width 1cm, dip 50°.

MJIT-6

① Geology

0-100.4m	Siltstone; pale grey, grey to dark grey. From 0m to 4.5m, strongly weathered and pale reddish brown. Mostly contact metamorphosed with formation of secondary biotite.

② Mineralization and alteration

8.7m	Quartz-muscovite vein, width 1cm, dip 60°, 2 veins.
13.7m	Quartz-arsenopyrite-pyrite vein, width 4cm.
17.2-17.7m	Quartz-arsenopyrite vein.
17.8-18.2m	Quartz-arsenopyrite vein.
18.5-18.6m	Quartz-arsenopyrite vein.
22.1m	Quartz-arsenopyrite vein, width 1cm.
23.2m	Quartz-muscovite vein, width 1cm.
28.5m	Quartz-muscovite vein, width 2cm.
31.9m	Quartz vein, width 1cm.
46.1m	Quartz vein, width 1cm.
53.8m	Quartz(-arsenopyrite) vein, width 2cm, dip 60°.
74.5m	Quartz-pyrite vein, width 1cm, dip 80°.
85.3m	Potassium feldspar-quartz(-pyrite-molybdenite) vein, width 1cm, dip 50°.
88.2-89.4m	Quartz(-arsenopyrite-pyrite-tourmaline) vein, dip 80°.
91.3m	Quartz-pyrite vein, width 1cm, dip 50°.
92.1m	Quartz-feldspar vein, width 1cm.
95.4m	Quartz vein, width 1cm, dip 30°.

3-4-3 Mineralization

Ore minerals observed in drill cores are pyrite, arsenopyrite, cassiterite, molybdenite, chalcopyrite and sphalerite. Gangue minerals are quartz, calcite, potassium feldspar, tourmaline, muscovite and fluorite. These minerals occur as veinlets or dissemination.

The widest vein is in MJIT-3. It is a quartz-muscovite (-tourmaline-limonite) vein and is 43 cm wide. The numbers of veins which are wider than 1 cm and 5 cm in each hole are listed in the following table.

Hole No.	Numbers of veins(>1cm)	Numbers of veins(>5cm)
MJIT-1	1	1
MJIT-2	10	1
MJIT-3	45	18
MJIT-4	9	5
MJIT-5	4	3
MJIT-6	17	5

Quartz is the major constituent in these veins, followed by pyrite, muscovite, tourmaline, calcite and arsenopyrite in the order of abundance. Cassiterite and molybdenite occur very rarely. Cassiterite-bearing quartz vein was found in MJIT-3 only. Molybdenite was intersected in MJIT-3 and MJIT-4. Most of the thin veins less than 1 cm ranges between 0.5 mm and 3 mm in width. They are network veinlets, and the frequency of occurrence is 5 to 40 veins in 1 m of drill core. The mineral assemblages of the veinlets are quartz-muscovite (-tourmaline-pyrite-potassium feldspar), quartz (-potassium feldspar), quartz (-pyrite), quartz-calcite (-pyrite), and pyrite only. The quartz-calcite (-pyrite) veinlets are limited to Paleozoic siltstone, while quartz-muscovite (-tourmaline-pyrite-potassium feldspar) is limited to leucocratic granite.

The sequence of mineralization is inferred from the mineral assemblages as follows; quartz-potassium feldspar-tourmaline-muscovite-pyrite- arsenopyrite (-cassiterite or-molybdenite), quartz-potassium feldspar-pyrite, quartz-pyrite and calcite-quartz-pyrite.

The disseminated ore mineral is mainly pyrite, and is limited to leucocratic granite. Cassiterite is observed only at 67.1 m of MJIT-2.

The nature of alteration observed in this area is silicification, argillization and dissemination of muscovite and tourmaline. Both silicification and muscovite dissemination (tourmaline or pyrite associated in rare cases) were observed to occur in leucocratic granites in MJIT-1 and MJIT-3. The alteration, greisenization, was intersected at five different depths in MJIT-1 (10 to 150 cm wide), and also at five depths in MJIT-3 (10 to 100 cm wide). Tourmaline dissemination was found in leucocratic granite in MJIT-1. Argillization consisting of muscovite (sericite) and kaoline was observed in leucocratic granite and Paleozoic strata. Occurrence of chlorite was reported in some of the leucocratic granite bodies.

As already mentioned above, most veins are not thick (nearly 1 cm in average width). The network veinlets are also thin with less than 1 cm in width. Also cassiterite is observed to occur disseminated and it is concluded the these mineral deposits should be treated as massive bodies for evaluation purpose.

Samples for assaying were collected from every 1.5 m in MJIT-1, 2 and 3. In case of MJIT-4 and 6, samples were collected in parts where quartz veins and networks were developed. A drill core was cut into four columns and one column was used for assay samples. Six elements - Au, Sn, W, Th, Ce and U - were analysed. Analytical results are shown in the appendices. The results are summarized as follows.

Au: Rather low with highest at 0.07 g/t.
Sn: Up to 0.24 %. Most of them are less than 0.01 % (93 % of all samples).
W: All less than 0.01 %.
Th: ditto
Ce: All less than 0.02 %
U: All less than 0.01 %

It is seen that they are all very low grade. Of these, samples with Sn content of more than 0.1 % were obtained from the following depths.

Hole No.	Depth(m)	Width	Sn(%)
MJIT-2	51.0-52.5	1.5m	0.24
(S.Sikambu)	55.5-57.0	1.5m	0.22

The average grade of Sn at 49.5 to 57.0 m (7.5 m in length) in MJIT-2 including the two samples in the above table is 0.11 %.

Relationship between Sn-grade and mineralization was considered as follows. Geological column and Sn-grade are shown in the figure below. Regarding the constituent minerals and the Sn grade of the veins, high Sn values occur in the parts of the vein samples in which quartz-tourmaline-pyrite veins are densely developed. The zones of quartz-calcite-pyrite assemblage, on the other hand, have relatively low content of Sn. High Sn values were also observed in the zones of cassiterite dissemination in leucocratic granite.

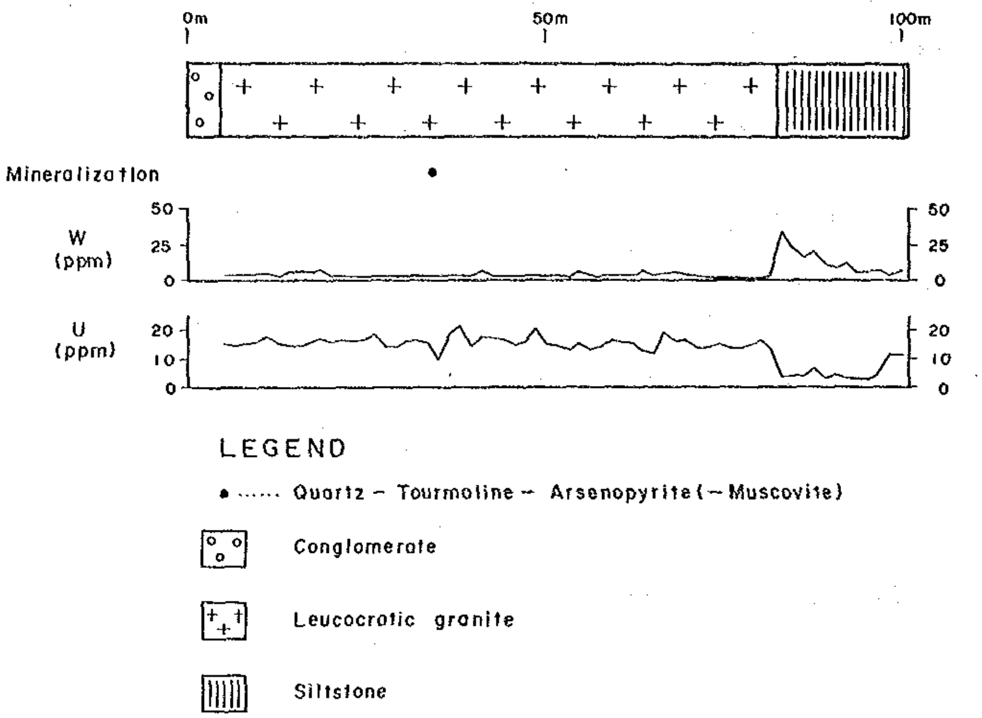
Correlation coefficients for six analysed elements (Au, Sn, W, Th, Ce and U) are shown below.

	Au	Sn	W	Th	Ce	U
Au	1.00	-0.07	-0.12	0.09	-0.05	0.12
Sn		1.00	0.07	-0.04	0.03	-0.00
W			1.00	-0.50	0.24	-0.67
Th				1.00	0.38	0.48
Ce					1.00	-0.39
U						1.00

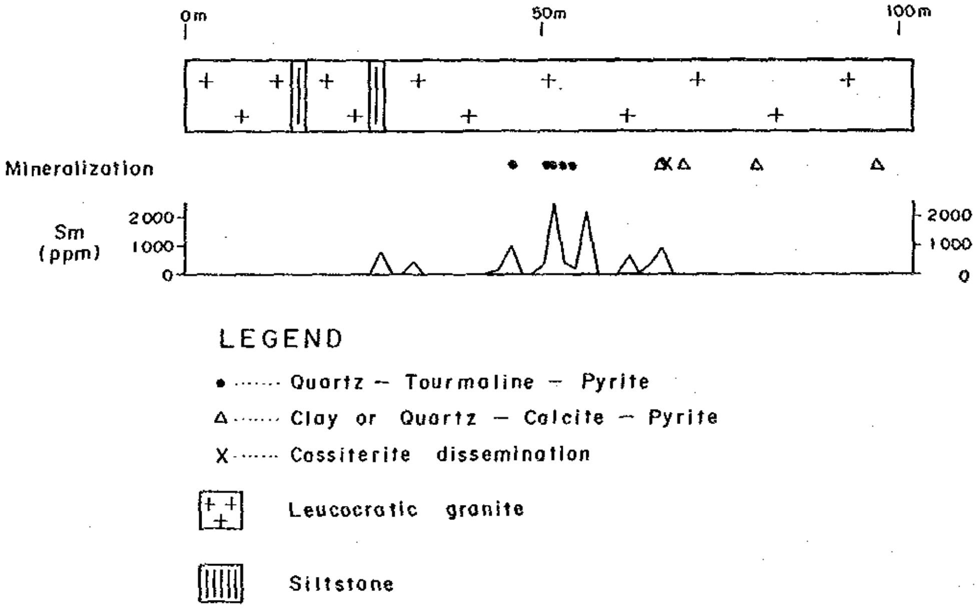
Of the six elements, W-U showed negative correlation. This relationship is also seen in the following figure showing the drill geology of MJIT-1 and the W and U contents and in the table below showing the average content of each element in each rock type. Siltstone has high content of W, while U is high in the leucocratic granite.

	No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
S. Sikambu							
Granite	121	<5	5	4	41	64	14
Paleozoic	10	<5	3	13	19	98	4
S. Isahan							
Granite	49	<5	4	3	25	7	22
Paleozoic	29	<5	5	20	17	55	5

MJIT－1


0m
50m
100m
Mineralization
50
25
0
W
(ppm)
U
(ppm)
20
10
0
LEGEND
• ...... Quartz – Tourmoline – Arsenopyrite (– Muscovite)
Conglomerate
Leucocratic granite
Siltstone

MJIT－2


0m
50m
100m
Mineralization
Sm
(ppm)
2000
1000
0
LEGEND
• .... Quartz – Tourmaline – Pyrite
Δ .... Clay or Quartz – Calcite – Pyrite
X .... Cassiterite dissemination
Leucocratic granite
Siltstone

Chapter 4 Discussions

4-1 Characteristics of Geologic Structure and Mineralization and Factors which Control Mineralization

The geology of the Bt.Pintutujuh area is composed of the Carboniferous to Permian sedimentary strata, the Jurassic to early Cretaceous granitic rocks and the Neogene Tertiary sedimentary strata.

The granitic rocks in the area belong to the ilmenite series, based upon the results of the whole rock analysis carried out during this year and the results of magnetic susceptibility measured during the previous phase.

The granitic rocks of this area are classified into three groups, biotite granite, leucocratic granite and aplite, from their lithology and chemical composition.

The leucocratic granite hosts greisen whose radiometric age is Jurassic (160 to 150 Ma). This age is much closer to that of the porphyritic biotite granite (167 to 134 Ma), which was distributed in the area of the first phase survey, than that of the biotite granite (113 to 110 Ma) in the present survey area.

It is considered from the results of the geological survey and drilling exploration during this year that the leucocratic granite is an intrusive facies of granite. This fact and the age relationship, combined with the general phase relationship between muscovite granite and porphyritic biotite granite in Belitung, Indonesia (the muscovite granite is as the dyke facies of the porphyritic granite according to Schwartz, 1990), suggest the existence of porphyritic biotite granite intruded beneath the leucocratic granite.

During the first phase survey, it was considered from the spatial distribution of the granitic rocks that biotite granite is related to mineralization. However, the results of this year shows that the porphyritic biotite granite has much closer relationship to mineralization.

The relationship between geologic structure and mineralization has been studied as follows.

The photogeological interpretation carried out during the previous phase pointed out that the trend of the majority of lineaments in the pre-Tertiary units is in the WNW-ESE and NNW-SSE direction. The geological survey of the present phase survey indicated that the strike of the major faults is WNW-ESE and NNW-SSE. Regarding the distribution of leucocratic granites which host the known tin mineralization, they are predominantly arranged in the WNW-ESE direction from the upper reaches of S.Isahan to S.Tulang. The exposures of granite dykes have E-W strike. The small bodies of leucocratic granite near S.Sikambu are distributed approximately in the NNW-SSE direction.

The characteristics of mineralization have been studied as follows.

Mineralization in the S.Isahan and S.Sikambu tin-mineralized zones resulted in veinlets and dissemination. Quartz is the major constituent of the veins followed by pyrite, muscovite, tourmaline, calcite and arsenopyrite in decreasing order. Cassiterite and molybdenite occur very sparsely in the veins. The sequence of mineralization, which are inferred from the mineralization of the veins, is quartz-potassium feldspar-tourmaline-muscovite- pyrite- arsenopyrite (-cassiterite or -molybdenite), quartz-potassium feldspar-pyrite, quartz-pyrite, calcite-quartz-pyrite.

Cassiterite, pyrite, tourmaline and muscovite are disseminated in the rock. Disseminated ore minerals are mainly composed of pyrite, and the distribution is limited in leucocratic granite. Cassiterite dissemination which can be observed by unaided eyes occur only in the leucocratic granite at the S.Sikambu zone.

The highest grade detected from cassiterite-bearing quartz vein outcrops is 3.84 % Sn, 0.07 % W and 0.02 % Ce. Samples from trenches 1 to 2 m in width which were excavated in the leucocratic granite contained 0.2 to 0.5 % Sn, and 0.08 to 0.24 % Ce.

Regarding drill cores, analysis showed that the contents of Au, W, Th, Ce and U are all low. The highest Sn content was 0.24 % and most of the samples contained less than 0.01 % (93% of all samples). One of the relatively high Sn zone (sampled 7.5 m in length from 49.5 m to 57.0 m in MJIT-2, leucocratic granite) contained an average 0.11 % Sn.

Phenocrysts of quartz, potassium feldspar, plagioclase and muscovite in the leucocratic granite are fractured and muscovite (sericite) or secondary fine quartz occur among the broken pieces. Greisen was observed in some of the drill holes both in S.Sikambu and S.Isahan. Kaoline was also detected as an alteration mineral. There is no distinct relation between the numbers of veins and alteration in leucocratic granite.

Muscovite (sericite), biotite, calcite or dolomite were observed in the matrices of Paleozoic siltstone, shale and pebbly siltstone. They are often bleached adjacent to quartz vein, producing fine-grained secondary quartz.

There is no clear relation between alteration and grades. High grade assay values were expected in greisen, but it showed no clear tendency of increase in the greisenized parts.

4-2 Geochemical Anomalies and Mineralization

Geochemical explorations of both stream sediments and panned concentrates covered the entire survey area of the present phase. In addition to that, soil geochemistry focusing on the area of 6 km^2 including the known mineralized zones was carried out on this year. Six elements, Au, Sn, W, Th, Ce and U, were analysed.

From the stream sediment geochemistry, six A-rank anomalies of Sn or the combination of Sn and other elements were picked up. These anomalies are distributed in the central part of the survey area arranged in approximately the WNW-ESE direction. Two of the anomalies correspond to the known mineralized zones. Three Sn-anomalies (70 to 400 ppm), two Au-anomalies (10 to 15 ppb) and five W-anomalies (7 to 32 ppm) were detected near the S.Isahan mineralized zone. One Sn-anomaly (710 ppm) was detected near the S.Sikambu mineralized zone.

Exploration by panned concentrates detected four A-rank anomalies in the survey area. They consist of ten Sn-anomalies (600 to >1,000 ppm), three W-anomalies (16 to 55 ppm) and one Th-anomaly (93 ppm) from the upper reaches of S.Isahan to the lower reaches of S.Sikambu. The S.Isahan and S.Sikambu mineralized zones are located in the area.

Overlap of A-rank anomalous zones of both stream sediments and panned concentrates was observed in the following five localities; S.Pinang, S.Isahan (tin-mineralized zone), the branches of S.Tulang (leucocratic granite), the lower reaches of S.Sikambu (tin-mineralized zone), and the branches of S.Sikambu (leucocratic granite). In these localities with the exception of S.Pinang, either leucocratic granite or tin mineralization in the leucocratic granite are found to occur.

From the soil geochemistry, three anomalies were identified; one extending from the upper reaches of S.Isahan to S.Tulang in approximately WNW-ESE direction (the S.Isahan-S.Tulang zone), the middle reaches of S.Isahan, and the junction of S.Sikambu and S.Tulang.

Of the above three soil anomalous zones, the S.Isahan-S.Tulang zone occupies the biggest area and Au, Sn and W-anomalies overlap. Au content is 10 to 65 ppb, Sn 16 to 72 ppm, and W 33 to 90 ppm. The S.Isahan tin-mineralized zone and three bodies of leucocratic granite are distributed in the zone. Approximately half of the above anomalous zone overlaps with either the A-rank stream sediment anomalous zone or the A-rank panned concentrate anomalous zone.

The zone in middle reaches of S.Isahan is composed of three anomalies of Sn only (23 to 150 ppm) without overlap of other elements. Any mineralization or intrusive body is not recognized in the zone. No anomalous value is detected from panned concentrates.

There are Au and Sn anomalies distributed at the junction of S.Sikambu and S.Tulang. Au content is 10 ppb, and Sn 16 to 68 ppm. The S.Sikambu tin-mineralized zone and leucocratic granite are included in the zone.

The elements which constitute the A-rank anomalous zone in stream sediments/panned concentrates and soil anomalies are Sn and W. Thus the geochemical exploration results indicate the possibility of Sn-W mineralization in the survey area. All three geochemical methods showed the trend of anomalous zones arranged or extending in the WNW-ESE direction. This coincides with one of the directions which controlled the intrusions of leucocratic granite. Mineralization, thus, is assumed to be controlled by the structural trend of the same direction as well.

Statistical analysis of correlation coefficients of six elements -Au, Sn, W, Th, Ce and U- analysed in drilling exploration, showed that one of them, W-U, had the negative correlation. W has the tendency to have higher content in siltstone, while U has the high values in leucocratic granite. Tin-tungsten mineralization was expected to occur from the results of geochemical exploration in the survey area. Drilling results, however, showed that the mineralization which could be expected in the area was only tin mineralization.

4-3 Resource Potential

The study of resource potential of the survey area was carried out separately for two parts, namely the drill-tested zone of S.Isahan and S.Sikambu, and other zones.

【 S.Isahan and S.Sikambu 】

The element which can be expected to occur in the S.Isahan and S.Sikambu mineralized zones is Sn, from the results of geological and geochemical surveys and drilling. Drilling exploration showed that the ore grade tin mineralization could occur as either cassiterite-bearing quartz veins (whose mineral assemblage is quartz-potassium feldspar-tourmaline-muscovite-pyrite-arsenopyrite-cassiterite) or cassiterite dissemination in leucocratic granite. Leucocratic granite bodies which can be found to host mineralization cannot be expected to be very large, because it is the intrusive facies of porphyritic biotite granite. The data obtained and presently available is insufficient to conduct ore reserve calculation. However, since the grade exceeds 0.1 % Sn at only two points of MJIT-2 with width of 1.5 m and the maximum content is low at 0.24 % Sn, it is concluded that economically feasible deposits do not occur in the S.Isahan and S.Sikambu zones.

【 Other zones 】

Evaluation of the resource potential was carried out on the basis of the soil geochemistry as follows. The Sn geochemical anomalies ranging from 16 to 72 ppm were detected in the broad anomalous zone in the S.Isahan-S.Tulang zone (excluding the drill-tested area at S.Isahan). These anomalous values are similar to the Sn content obtained from soil samples at the drilling site. As leucocratic granite is distributed, tin mineralization can be expected in this zone. It is concluded from the values and the areal extent of the anomalies of the soil geochemical work that the grade and scale of the mineralization which can be expected here would be similar to those of the S.Isahan and S.Sikambu zones. Other soil anomalies are not of interest, because they are either independent anomalies not overlapping with results of other methods or their areal extent is small.

Examination of geochemical anomalies other than those of soil is as follows.

A-rank geochemical anomalies of stream sediments and panned concentrate are obtained in only one locality, at the S.Pinang zone west of the S.Isahan mineralized zone. Anomalous values are distributed along the main stream of S.Pinang, which shows the possibility of mineralization at the upper reaches. The upper reaches of S.Pinang is located at the western extension of leucocratic granite developed between S.Isahan and S.Tulang.

PART Ⅲ CONCLUSIONS

PART III CONCLUSIONS

Chapter 1 Conclusions

During the course of the second phase survey of the Pegunungan Tigapuluh area, geological survey, geochemical exploration and drilling were carried out in the western part (Bt.Pintutujuh area) with an areal extent of 70 km^2. The conclusions which were obtained from the survey are as follows.

The geology in the Bt.Pintutujuh area is composed of Carboniferous to Permian sedimentary strata, Jurassic to Early Cretaceous granitic rocks and Neogene sedimentary strata.

The granitic rocks distributed in the area are classified into biotite granite, leucocratic granite and aplite from their lithology and chemical composition. They belong to the ilmenite series of granitoids.

It is considered that the leucocratic granite is the intrusive facies of granite, and thus it is inferred that the porphyritic biotite granite which is distributed in the area of the first phase survey, exist beneath the leucocratic granite without surface exposures.

Fault systems of WNW-ESE and NNW-SSE trends are developed in the survey area. From the distribution of the leucocratic granites which host the known tin mineralization, they are predominantly arranged approximately in the WNW-ESE direction from the upper reaches of S.Isahan to S.Tulang. Some of the leucocratic granite dykes crop out with E-W strike. The small bodies of leucocratic granite near S.Sikambu are distributed approximately in the NNW-SSE direction. These facts indicate that the intrusion of the leucocratic granite bodies was controlled by the structure which was parallel to the fault system.

Mineralization is composed of small veins and dissemination in the S.Isahan and S.Sikambu tin-mineralized zones. Quartz is the major constituent mineral in veins. Pyrite, muscovite, tourmaline, calcite and arsenopyrite are associated with quartz in decreasing order. Cassiterite and molybdenite are very seldom found in veins. The sequence of mineralization, which is assumed from the vein mineralization, is quartz-potassium feldspar-tourmaline- muscovite- pyrite- arsenopyrite (-cassiterite or-molybdenite), quartz-potassium feldspar-pyrite, quartz-pyrite and calcite-quartz-pyrite.

Cassiterite, pyrite, tourmaline and muscovite are disseminated in the host rock. Dissemination of ore mineral is mainly composed of pyrite, and the distribution is limited in leucocratic granite. Cassiterite dissemination was only observed in the leucocratic granite at the S.Sikambu zone.

The highest grade detected from cassiterite-bearing quartz vein outcrops was 3.84 % Sn, 0.07 % W and 0.02 % Ce. Samples from trenches 1 to 2 m wide including the quartz veins in the leucocratic granite have composition ranging from 0.2 to 0.5 % Sn and 0.08 to 0.24 % Ce.

Whole survey area of this phase was covered by geochemical exploration using stream sediments and panned concentrates. In addition to that, soil geochemical survey was carried out over an area of 6 km^2 in which the known mineralized zones were located. Six elements, Au, Sn, W, Th, Ce and U, were analysed.

From the stream sediment geochemistry, six A-rank anomalous zones of Sn or the combination of Sn and other elements were delineated. These zones are distributed in the central part of the survey area extending approximately in the WNW-ESE direction. Two of them correspond to the known mineralized zones.

Survey of panned concentrates indicated four A-rank anomalous zones in the survey area. The A-rank anomalous zones of both stream sediments and panned concentrates overlap in five localities; S.Pinang, S.Isahan (tin mineralized zone), branches of S.Tulang (leucocratic granite), lower reaches of S.Sikambu (tin-mineralized zone), and branches of S.Sikambu (leucocratic granite). Either leucocratic granite or tin mineralization in the leucocratic granite are distributed in four of the five localities excluding S.Pinang.

Three anomalous zones were identified from the soil geochemistry; one extending from the upper reaches of S.Isahan to S.Tulang in approximately WNW-ESE direction (the S.Isahan-S.Tulang zone), the middle reaches of S.Isahan, and the junction of S.Sikambu and S.Tulang. Among the three soil anomalous zones, the S.Isahan-S.Tulang zone occupies the largest area (0.3 × 2 km).

The elements which constitute A-rank anomalous zones for both stream sediments, panned concentrates and soil anomalies are Sn and W. All these geochemical surveys showed a trend of anomalous zones arranged or extending in the WNW-ESE direction. It coincides with one of the directions which controlled the intrusions of leucocratic granite.

Assay results of drill cores are summarized as follows:

Au: Rather low grade in general, up to 0.07 g/t.
Sn: Up to 0.24 %. Most of them are less than 0.01 % (93 % of total samples).
W: All less than 0.01 %.

Th: ditto

Ce: All less than 0.02 %

U: All less than 0.01 %

Zones of the drill cores which contain more than 0.1 % Sn are as follows.

Hole No.	Depth(m)	Width	Sn(%)
MJIT-2	51.0-52.5	1.5m	0.24
(S.Sikambu)	55.5-57.0	1.5m	0.22

The average grade of the core from MJIT-2, 7.5 m in total length from 49.5 m to 57.0 m including the above listed two samples, is 0.11 % Sn.

The leucocratic granite is composed mainly of quartz, potassium feldspar, plagioclase and muscovite. Phenocrystals of these minerals are broken. Muscovite (sericite) is recrystallized in the matrix filling the void among the fragments of these phenocrysts. Secondary fine-grained quartz is also formed. Greisen was observed in some of the drill cores both in the S.Sikambu and S.Isahan zones. Kaoline was detected as an alteration product. There is no close relationship between the numbers of veins and the alteration in leucocratic granite.

Siltstone, shale and pebbly siltstone of the S.Tulang Member of the Paleozoic Bt.Pintutujuh Formation contain fragments of quartzite and quartz. They also contain muscovite, biotite, calcite or dolomite in the matrices. Parts of the rock adjacent to quartz veins are bleached, often containing secondary fine quartz.

There is no clear relation between alteration and grades. High grade assay values have been expected in greisen, but there is no clear tendency of the increase of grade in the greisenized parts. The type of ore deposit which are expected to occur in the survey area can be cassiterite-bearing primary deposit, based on the results of geological survey, geochemical exploration and drill. The possibility in each zone are summarized as follows.

【 S.Isahan and S.Sikambu 】

The element which can be expected to occur in the S.Isahan and S.Sikambu mineralized zones is Sn, from the results of geological and geochemical surveys and drilling. Drilling exploration showed that the ore garde tin mineralization could occur as either cassiterite-bearing quartz veins (whose mineral assemblage is quartz-potassium feldspar-tourmaline-muscovite-pyrite-arsenopyrite-cassiterite) or cassiterite dissemination in leucocratic granite. Leucocratic granite bodies which can be found to host mineralization cannot be expected to be very large, because it is the intrusive facies of porphyritic biotite granite. The data obtained and presently available is insufficient to conduct ore reserve calculation. However, since the grade exceeds 0.1 % Sn at only two points of MJIT-2 with width of 1.5 m and the maximum content is low at 0.24 % Sn, it is concluded that economically feasible deposits do not occur in the S.Isahan and S.Sikambu zones.

【 Other zones 】

Evaluation of the resource potential was carried out on the basis of the soil geochemistry as follows. The Sn geochemical anomalies ranging from 16 to 72 ppm were detected in the broad anomalous zone in the S.Isahan-S.Tulang zone (excluding the drill-tested area at S.Isahan). These anomalous values are similar to the Sn content obtained from soil samples at the drilling site. As leucocratic granite is distributed, tin mineralization can be expected in this zone. It is concluded from the values and the areal extent of the anomalies of the soil geochemical work that the grade and scale of the mineralization which can be expected here would be similar to those of the S.Isahan and S.Sikambu zones. Other soil anomalies are not of interest, because they are either independent anomalies not overlapping with results of other methods or their areal extent is small.

Examination of geochemical anomalies other than those of soil is as follows.

A-rank geochemical anomalies of stream sediments and panned concentrate are obtained in only one locality, at the S.Pinang zone west of the S.Isahan mineralized zone. Anomalous values are distributed along the main stream of S.Pinang, which shows the possibility of mineralization at the upper reaches. The upper reaches of S.Pinang is located at the western extension of leucocratic granite developed between S.Isahan and S.Tulang.

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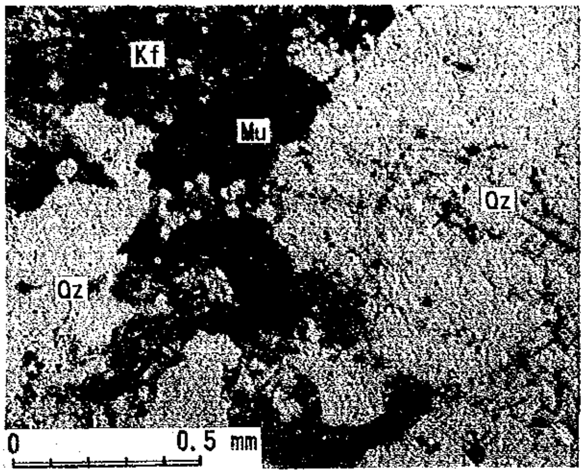
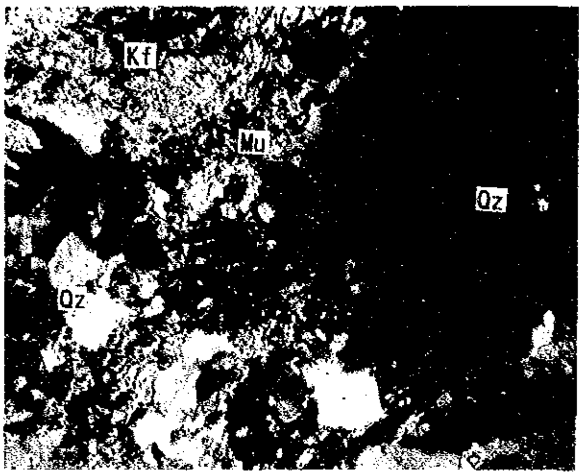
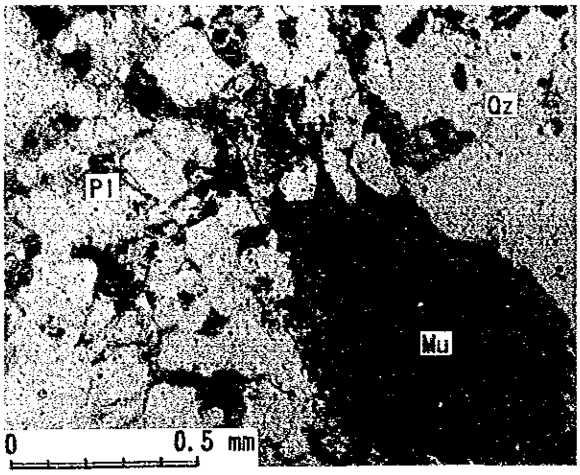
PHOTOGRAPHS

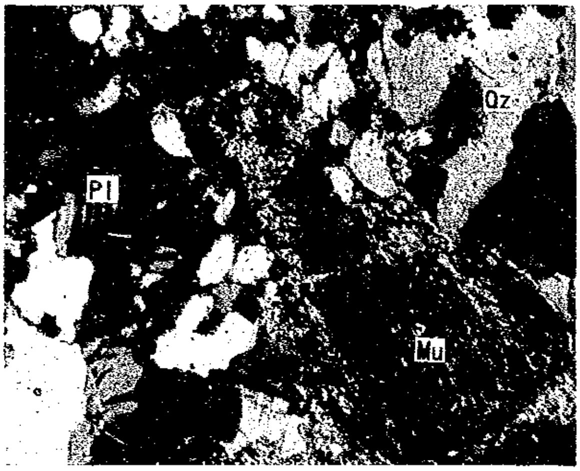
Leucocratic granite MJIT-2, 34.7 m(S.Sikambu)



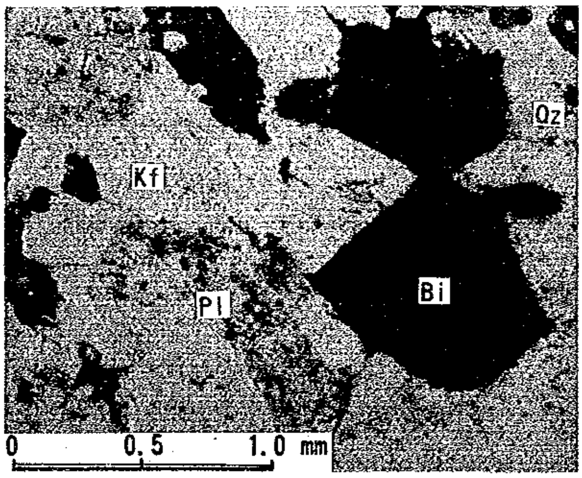


Leucocratic granite MJIT-3, 89.0 m(S.Isahan)





Biotite granite GR63 (S.Tulang)



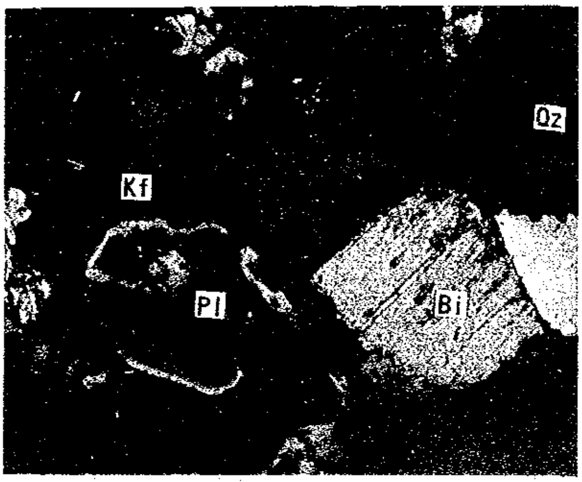


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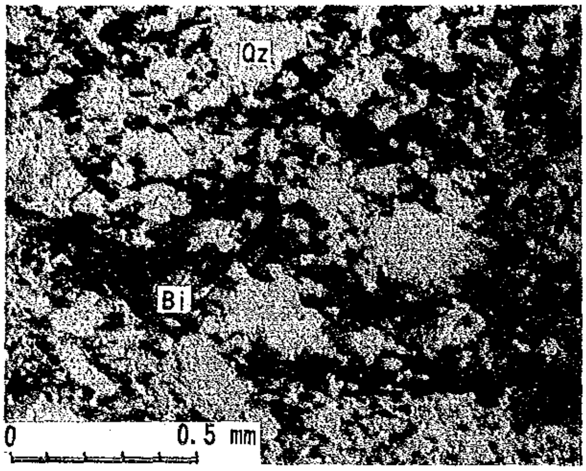
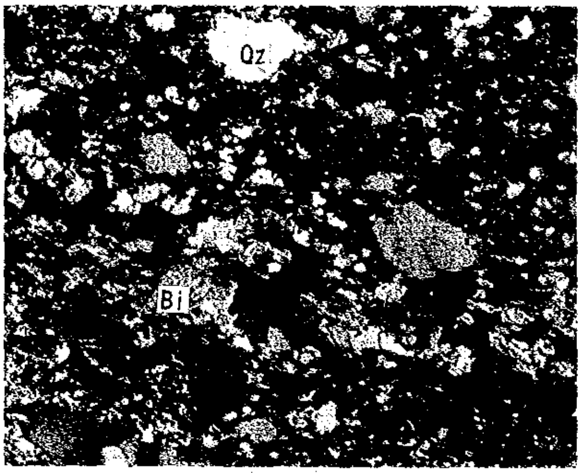
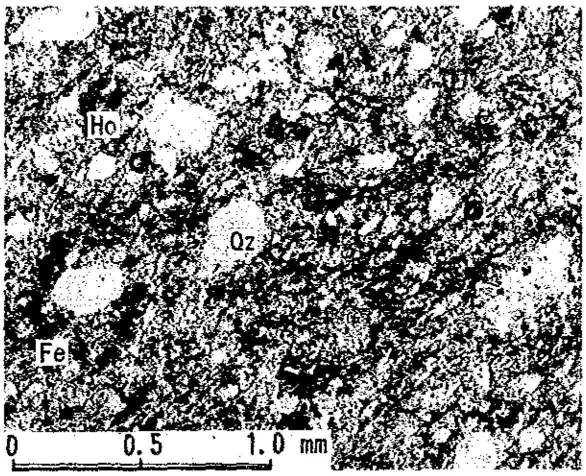
Photo.1 Microscopic photograph (thin section)

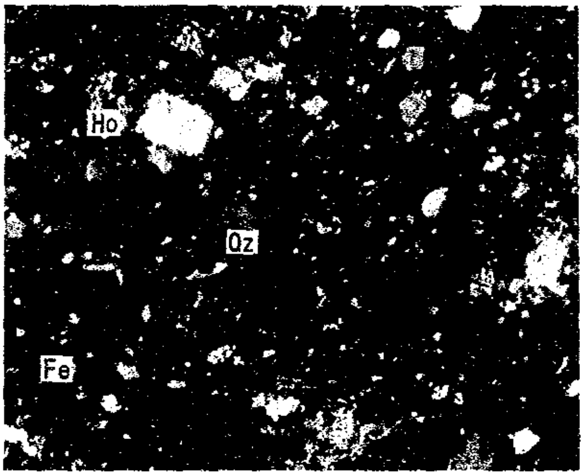
Siltstone MJIT-6, 85.3 m(S. Isahan)





Siltstone GR47 (S. Isahan)





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Abbreviation

Qz:Quartz

Mu:Muscovite

Kf:K-feldspar

Pl:Plagioclase

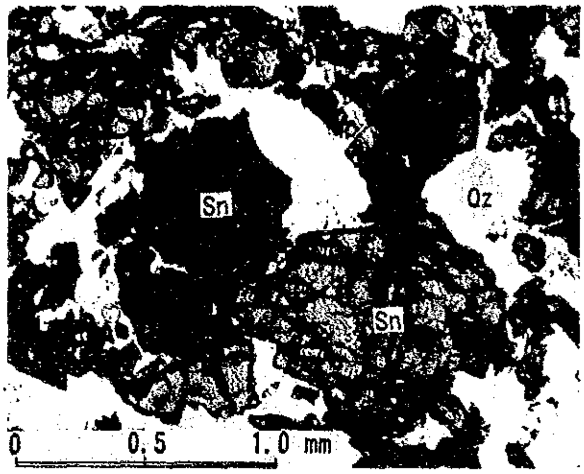
Bi:Biotite

Ho:Hornblende

Fe:Fe mineral

Photo. 2 Microscopic photograph (thin section)

Cassiterite-bearing quartz vein FR33 (S. Isahan)



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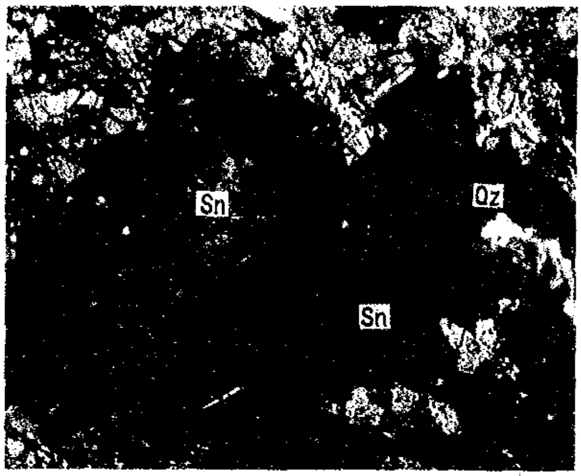

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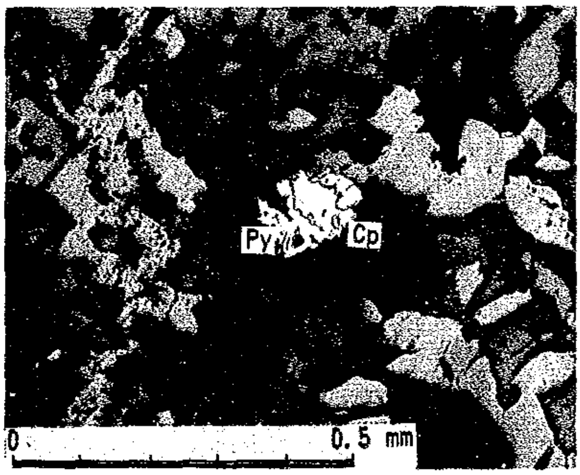
K-feldspar-quartz vein MJIT-6, 85.3 m(S. Isahan)



Abbreviation

Sn:Cassiterite

Qz:Quartz

Cp:Chalcopyrite

Py:Pyrite

Ap:Arsenopyrite

Quartz-pyrite-arsenopyrite vein MJIT-3, 63.3 m(S. Isahan)

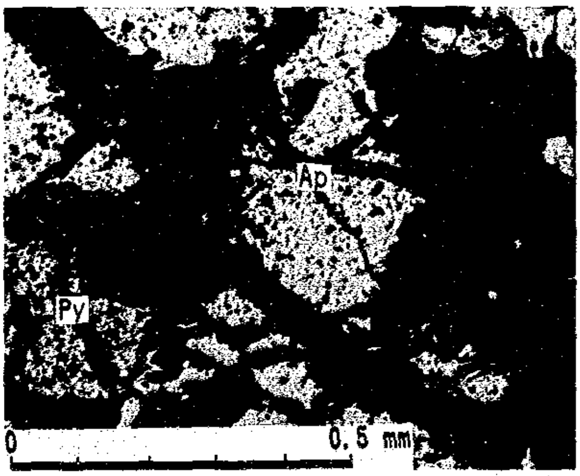


Photo.3 Microscopic photograph (thin section & polished section)

APPENDICES

App. 1 Results of Microscopic Observation of Thin Sections (1)

Sample No. (Drill No.)	Locality (Depth)	Rock name	Texture	Phenocryst											Alteration
				Qz	Kf	Pl	Bi	Mu	Ho	Ac	Cu	Ca	Zr	Fe	
FR5	S. Sikambu	La	Ophi	△		◎	◎	○		○		○		△	
FR6	ditto	Ap-Qv	Apli	○	○	◎	△	△				○			Bi-Ch, Pl-Sa
FR7	ditto	Gd	Equi	△	○	◎	○		○		○		△		Pl-Sa
FR9	S. Peseman	Da	Apli	○		△									→Qz, Se, Fe
FR10	ditto	Gr	Equi	○	○	◎		◎						·	Pl, Kf-Sa
FR16	S. Sikambu	Gr	Equi	◎	○	◎		○						·	Pl, Kf-Sa
FR19	ditto	Gr	Equi	○	△	○									Pl, Kf-Mu, Ch
GR29	S. Tulang	Gr	Equi	◎	◎	◎	○		○		○			·	Pl-Sa
GR59	S. Lemang	Ap	Apli	◎	·	·		◎							
GR63	S. Tulang	Qd	Equi	◎	◎	◎	○		○			○		·	Bi-Ch
MJIT-1	26.7m	Gr	Equi	◎	◎	○		△						·	→Mu, Pl, Kf-Sa
MJIT-1	42.5m	Gr	Porp	◎	◎	◎		△							→Mu, Qz Pl, Kf-Sa
MJIT-1	51.2m	Gr	Equi	◎	◎	○		○						·	→Mu, Pl, Kf-Sa
MJIT-1	80.4m	Gr	Equi	◎	○	◎								·	→Se, Pl, Kf-Sa
MJIT-2	67.0m	Gr	Porp	◎	○	◎									→Se, Qz Pl, Kf-Sa
MJIT-2	86.5m	Gr	Equi	◎	○	△		△							Pl, Kf-Sa
MJIT-2	94.7m	Gr	Equi	◎	△	○		○							→Se, Qz Pl, Kf-Sa
MJIT-3	56.7m	Gr	Equi	◎	○	○		△							→Se, Qz, To Pl, Kf-Sa
MJIT-3	89.0m	Gr	Equi	◎	○	△	·	△							→Qz Pl, Kf-Sa
MJIT-3	93.0m	Gr	Equi	◎	○	○									→Mu, Qz Pl, Kf-Sa

Abbreviations

Rock Name

- Gr ; Granite
- Gd ; Granodiorite
- Qd ; Quartz diorite
- Ap ; Aplite
- Da ; Dacite
- La ; Lamprophyre
- Qv ; Quartz vein
- Hr ; Hornfels
- Si ; Siltstone
- Sr ; Silicified rock

Texture

- Equi; Equigranular
- Porp; Porphyritic
- Apli; Aplitic
- Ophi; Ophitic

Mineral

- Qz ; Quartz
- Kf ; K-feldspar
- Pl ; Plagioclase
- Bi ; Biotite
- Mu ; Muscovite
- Ho ; Hornblende
- Ac ; Actinolite
- Cu ; Cummingtonite
- Ca ; Calcite
- Zr ; Zircon
- Fe ; Fe mineral
- Ch ; Chrolite
- Sa ; Saussurite
- Se ; Sericite
- Ct ; Chert
- Cl ; Clay
- Sn ; Cassiterite
- To ; Tourmaline

App. 1 Results of Microscopic Observation of Thin Sections (2)

Sample No. (Drill No.)	Locality (Depth)	Rock Name	Rock and Mineral Chips			Matrix						
			Ct	Qz	Ho	Qz	Mu	Bi	Ho	Cl	Ca	Fe
FR2	S. Sikambu	Hr	△	◎			◎	◎				•
FR12	S. Peseman	Hr		◎			◎	◎			•	•
FR13	S. Sikambu	Hr		◎			◎					•
FR32	ditto	Hr	△	◎	•		◎	◎			•	•
GR38	S. Tulang	Si		◎	•					◎		
GR39	ditto	Si		◎					•			•
GR47	S. Isaban	Si		◎		◎			•			•
GR61	S. A. Antan	Hr	△	◎			◎	◎				•
MJIT-1	89.7m	Si	△	◎		○	◎				○	
MJIT-2	95.0m	Si	○	◎		○	◎	○				
MJIT-3	34.9m	Si	△	◎		○				◎		
MJIT-4	52.0m	Si		◎		○	△				△	
MJIT-4	82.0m	Si	○	○		○	◎					•
MJIT-4	96.0m	Si		◎		◎	○				△	•
MJIT-4	98.0m	Si		◎		◎				◎		
MJIT-5	60.5m	Si	△	◎			○					•
MJIT-6	84.0m	Si	△	◎			○			○		•
MJIT-6	85.3m	Si		◎			◎					•
MJIT-6	99.3m	Si		◎		○				◎	○	•

Sample No. (Drill No.)	Locality (Depth)	Rock Name	Mineral			
			Qz	Mu	Sn	Fe
FR30	S. Isaban	Sr	◎	○		•
FR33	ditto	Qv	◎		◎	
MJIT-3	26.0m	Sr	◎	◎		•

App. 2 Results of Absolute Age Determination

Sample No.	Sample Type	Potassium (K wt%)	Rad. ^{40}Ar (10^{-6}cc/g)	K-Ar Age (Ma)	Air Cont. (%)
GR63	Whole rock	3.13	14.2 ±0.2	113 ±2	4.1
		±0.06	14.1 ±0.2	113 ±2	3.9
MJIT-1	Whole rock	5.42	35.2 ±0.5	160 ±4	2.0
44.7m		±0.11	35.1 ±0.6	160 ±4	1.9
MJIT-3	Whole rock	4.19	25.2 ±0.4	149 ±4	1.8
11.8m		±0.08	25.5 ±0.3	150 ±3	1.7

App. 3 Results of Microscopic Observation of Polished Sections

Boring No.	Depth	Py	Cp	Sp	Ap
MJIT-1	8.0m	△	•		
MJIT-1	15.2m	△			
MJIT-1	79.0m	△			
MJIT-2	94.4m	△	•	•	
MJIT-3	19.3m	△			
MJIT-3	36.8m	•			
MJIT-3	63.8m	◎			◎
MJIT-4	82.5m	△			
MJIT-6	13.7m	△			
MJIT-6	85.3m	○	△	•	
MJIT-6	88.2m				△

Abbreviations

Py;Pyrite, Cp;Chalcopyrite, Sp;Sphalerite, Ap;Arsenopyrite

◎;Abundant, ○;Common, △;Rare, •;Trace

App. 4 Results of X-ray Diffraction Analysis

Sample No. (Drill No.)	Locality (Depth)	Mineral										
		Qz	Kf	Pl	Ch	Ka	Mu	Bi	Gi	Ca	Do	Py
FR1	S. Sikambu	◎	○			△	△			•		
FR14	S. Isahan	◎				•	•					
FR15	ditto	◎	△	•		•	△			•		
FR17	S. Sikambu	◎	△			△	•					
FR18	ditto	◎	•	•	•	△	•					
FR19	ditto	◎				•	△		•			
FR20	ditto	◎	•		•	△	•					
FR22	S. Isahan	◎	•					○				
FR23	ditto	◎				•		△				
FR24	ditto	○	•			•		△				
FR25	ditto	◎				△		•				
FR26	ditto	◎		•			△					
FR27	ditto	◎	○			△	△					
FR28	ditto	◎	•			△	•					
FR29	ditto	◎				△						
FR30	ditto	◎					○					
FR31	ditto	◎				△	•					
GR20	S. Laki	◎	△			•	△			•		
GR59	S. Lemang	◎	△	○		•	○			•		
GR60	S. A. Antan	◎	•				•					○
MJIT-1	74.0m	◎	◎			•	•			•		
MJIT-2	72.5m	◎	△				△					•
MJIT-3	65.1m	◎	△			•	△					
MJIT-3	84.6m	◎	△			•	△					
MJIT-3	89.0m	◎	◎	△	•	•	△			•		
MJIT-4	96.0m	◎					△				○	

Abbreviations

Qz;Quartz, Kf;Potassium feldspar, Pl;Plagioclase, Ch;Chlorite, Ka;Kaolinite

Mu;Muscovite, Bi;Biotite, Gi;Gibbsite, Ca;Calcite, Do;Dolomite, Py;Pyrite

App. 5 Results of Chemical Analysis (Stream Sediments -1)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
FS 1	<5	<2	<2	9.0	36	2.2	FS 56	<5	6	2	7.0	38	2.8
FS 2	5	<2	<2	11.0	44	2.8	FS 57	<5	2	<2	9.0	44	2.2
FS 3	<5	<2	2	9.0	30	2.4	FS 58	<5	<2	<2	8.0	36	3.6
FS 4	<5	<2	<2	12.0	50	2.2	FS 59	<5	2	<2	7.0	26	2.4
FS 5	5	<2	2	13.0	48	2.2	FS 60	<5	<2	<2	7.0	34	2.2
FS 6	<5	<2	2	10.0	36	2.0	FS 61	<5	<2	<2	10.0	38	2.4
FS 7	<5	290	7	23.0	76	3.6	FS 62	<5	<2	<2	9.0	38	2.4
FS 8	5	2	<2	10.0	46	2.0	FS 63	<5	<2	<2	8.0	28	2.2
FS 9	<5	67	7	11.0	44	2.0	FS 64	<5	19	2	7.0	30	2.2
FS 10	<5	2	<2	14.0	48	2.8	FS 65	<5	110	3	9.0	44	2.2
FS 11	<5	<2	2	22.0	70	3.6	FS 66	<5	50	3	11.0	38	3.2
FS 12	<5	5	3	16.0	52	2.4	FS 67	<5	80	4	12.0	38	3.0
FS 13	<5	2	2	18.0	54	3.4	GS 3	<5	<2	2	9.0	32	3.8
FS 14	<5	47	6	11.0	44	2.4	GS 4	<5	<2	2	13.0	56	2.4
FS 15	<5	37	7	12.0	46	2.2	GS 5	<5	<2	3	11.0	34	3.4
FS 16	5	230	28	10.0	34	3.2	GS 6	<5	<2	3	11.0	44	2.4
FS 17	5	<2	2	15.0	42	2.2	GS 7	<5	<2	<2	8.0	26	2.8
FS 18	<5	10	3	9.0	30	3.0	GS 8	<5	<2	<2	5.0	20	1.6
FS 19	<5	<2	2	10.0	36	2.2	GS 9	<5	<2	<2	7.0	28	1.8
FS 20	<5	290	3	11.0	46	2.4	GS 10	<5	<2	<2	6.0	22	3.0
FS 21	<5	<2	<2	10.0	38	3.2	GS 11	<5	<2	<2	14.0	50	3.2
FS 23	<5	<2	2	14.0	62	3.0	GS 13	<5	<2	<2	12.0	44	4.6
FS 25	<5	2	2	15.0	56	3.4	GS 14	5	<2	<2	4.0	14	1.8
FS 26	<5	<2	2	12.0	50	2.0	GS 15	<5	<2	<2	4.0	12	2.2
FS 27	<5	<2	<2	10.0	38	3.2	GS 16	<5	<2	<2	6.0	20	3.0
FS 28	<5	<2	2	16.0	54	3.2	GS 17	<5	<2	<2	11.0	40	2.4
FS 29	10	<2	<2	20.0	66	3.6	GS 18	<5	<2	<2	7.0	24	3.2
FS 30	<5	<2	3	16.0	50	3.0	GS 19	<5	<2	<2	9.0	32	2.0
FS 31	<5	2	7	31.0	22	<0.2	GS 20	<5	<2	3	26.0	96	4.2
FS 32	<5	<2	<2	18.0	66	2.0	GS 21	5	<2	<2	6.0	24	1.8
FS 33	<5	<2	3	16.0	50	3.8	GS 23	<5	<2	<2	10.0	40	2.0
FS 34	<5	80	<2	10.0	36	3.0	GS 24	<5	<2	<2	12.0	40	3.0
FS 35	<5	27	<2	14.0	40	3.2	GS 28	<5	<2	<2	7.0	18	2.2
FS 36	<5	13	<2	10.0	32	2.6	GS 29	<5	<2	<2	16.0	60	3.2
FS 37	<5	59	2	14.0	46	3.4	GS 30	<5	<2	<2	6.0	20	1.8
FS 38	<5	<2	2	12.0	38	2.6	GS 31	<5	<2	<2	7.0	24	1.2
FS 39	<5	<2	2	12.0	40	2.8	GS 32	<5	<2	<2	8.0	22	2.6
FS 40	<5	<2	2	12.0	34	3.0	GS 34	<5	<2	<2	14.0	38	4.4
FS 41	<5	2	2	11.0	30	2.2	GS 35	<5	<2	<2	9.0	24	2.8
FS 43	<5	<2	2	12.0	44	2.4	GS 36	<5	<2	<2	15.0	50	4.6
FS 44	<5	<2	2	18.0	54	4.0	GS 37	<5	<2	<2	8.0	20	3.0
FS 45	<5	<2	2	10.0	28	2.6	GS 38	<5	<2	<2	8.0	20	2.0
FS 46	5	<2	2	11.0	28	3.6	GS 39	<5	<2	<2	12.0	32	2.4
FS 47	<5	<2	2	10.0	30	4.4	GS 40	<5	<2	<2	16.0	54	2.4
FS 48	<5	<2	2	11.0	30	3.0	GS 41	<5	<2	<2	15.0	36	2.2
FS 49	<5	<2	3	11.0	24	2.8	GS 42	<5	<2	<2	11.0	36	3.4
FS 50	<5	<2	2	10.0	36	2.0	GS 43	<5	<2	<2	9.0	34	2.6
FS 51	<5	<2	<2	12.0	38	4.4	GS 44	<5	<2	<2	9.0	34	2.0
FS 52	<5	<2	2	15.0	44	2.6	GS 45	<5	<2	<2	10.0	38	2.2
FS 53	<5	<2	3	12.0	38	3.2	GS 46	<5	<2	<2	8.0	36	1.6
FS 54	<5	12	3	11.0	34	3.0	GS 47	<5	<2	<2	9.0	24	2.4
FS 55	<5	27	2	10.0	30	3.2	GS 48	<5	<2	<2	9.0	28	2.0

App.5 Results of Chemical Analysis (Stream Sediments -2)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
GS 49	<5	<2	<2	14.0	40	3.6	GS113	<5	70	4	8.0	22	1.6
GS 51	<5	<2	<2	10.0	32	2.8	GS115	<5	12	<2	6.0	42	5.0
GS 52	<5	<2	<2	10.0	32	2.8	GS116	<5	10	3	9.0	24	2.6
GS 53	<5	<2	<2	6.0	22	2.4	GS117	<5	2	6	9.0	30	2.0
GS 54	<5	<2	<2	11.0	40	3.4	GS118	<5	12	3	10.0	34	1.6
GS 55	<5	<2	<2	10.0	42	2.4	GS119	<5	<2	3	6.0	24	2.0
GS 56	<5	<2	<2	8.0	34	2.6	GS120	<5	5	2	8.0	32	3.2
GS 58	<5	<2	<2	4.0	14	2.6	GS121	<5	<2	2	7.0	34	2.4
GS 59	<5	<2	<2	7.0	30	3.0	GS122	<5	<2	2	6.0	22	2.6
GS 60	<5	<2	<2	9.0	40	2.0	GS124	<5	<2	<2	11.0	50	2.6
GS 61	<5	<2	<2	6.0	20	2.0	GS125	<5	<2	<2	7.0	24	2.2
GS 62	<5	<2	<2	6.0	20	2.4	GS126	<5	<2	<2	5.0	22	2.2
GS 63	<5	<2	<2	5.0	24	2.2	GS127	<5	<2	<2	9.0	34	2.4
GS 64	<5	<2	2	7.0	32	2.6	GS128	<5	<2	<2	6.0	16	2.8
GS 67	<5	<2	<2	10.0	36	2.6	GS131	<5	<2	2	9.0	24	2.2
GS 68	<5	<2	<2	4.0	10	2.8	GS132	<5	<2	<2	7.0	26	1.4
GS 70	<5	<2	2	6.0	22	2.4	GS134	<5	4	<2	11.0	34	2.0
GS 71	<5	<2	<2	5.0	16	3.0	GS136	<5	<2	2	10.0	32	2.2
GS 72	<5	<2	<2	7.0	26	2.0	GS137	<5	27	3	14.0	44	2.0
GS 73	<5	<2	<2	4.0	12	2.0	GS138	<5	12	4	15.0	48	2.2
GS 74	<5	<2	<2	6.0	18	1.6	GS139	<5	7	7	11.0	36	1.6
GS 75	<5	<2	<2	10.0	28	4.2	GS140	<5	<2	2	10.0	32	2.2
GS 76	<5	<2	<2	7.0	18	2.2	GS141	5	<2	4	12.0	38	2.6
GS 77	<5	<2	<2	7.0	22	2.2	GS142	<5	<2	4	8.0	20	2.2
GS 78	<5	<2	<2	4.0	10	1.8	GS143	<5	<2	2	8.0	32	2.2
GS 79	<5	<2	<2	5.0	26	1.6	GS144	<5	<2	2	9.0	32	3.0
GS 80	<5	<2	<2	4.0	14	1.6	GS147	40	<2	2	9.0	30	2.0
GS 81	<5	<2	<2	6.0	18	2.2	GS148	<5	<2	2	7.0	22	2.2
GS 82	<5	<2	<2	7.0	22	2.2	GS152	<5	<2	<2	8.0	22	1.8
GS 83	<5	<2	<2	7.0	22	2.2	GS153	<5	<2	<2	8.0	30	1.4
GS 84	<5	<2	<2	6.0	16	3.2	GS154	<5	<2	<2	5.0	18	1.8
GS 86	<5	<2	<2	4.0	10	2.0	GS156	<5	<2	<2	9.0	26	1.6
GS 87	15	<2	<2	4.0	12	1.6	GS157	<5	<2	<2	9.0	26	1.4
GS 88	<5	<2	2	5.0	12	2.8	GS158	<5	<2	<2	7.0	26	1.2
GS 90	<5	<2	<2	4.0	8	2.6	GS161	<5	<2	<2	10.0	34	1.8
GS 91	<5	<2	2	7.0	22	2.2	GS162	<5	<2	<2	6.0	20	1.6
GS 92	<5	<2	2	4.0	6	2.0	GS163	<5	<2	<2	10.0	34	1.6
GS 93	<5	<2	2	5.0	14	2.6	GS164	<5	<2	<2	10.0	38	1.4
GS 94	<5	<2	2	4.0	14	2.4	GS165	<5	<2	<2	9.0	32	2.2
GS 95	<5	<2	2	6.0	18	2.0	GS166	<5	9	2	12.0	40	2.0
GS 97	10	16	3	6.0	20	2.0	GS167	<5	40	3	15.0	52	2.6
GS100	<5	<2	2	12.0	50	2.0	GS168	<5	13	<2	7.0	24	2.0
GS101	<5	77	4	9.0	32	2.0	GS169	<5	55	2	10.0	34	2.8
GS103	<5	4	4	12.0	40	3.2	GS171	<5	42	2	15.0	48	2.8
GS104	<5	4	3	10.0	40	3.2	GS173	<5	57	2	13.0	46	2.2
GS105	<5	5	6	10.0	40	2.0	GS174	<5	5	2	8.0	30	2.4
GS106	<5	8	4	15.0	52	4.8	GS175	<5	3	<2	10.0	36	2.2
GS107	<5	42	6	21.0	68	9.2	GS179	<5	<2	2	9.0	36	2.0
GS108	<5	21	4	9.0	30	3.8	GS180	<5	<2	4	9.0	28	1.2
GS110	<5	5	2	13.0	40	3.6	GS182	<5	2	3	9.0	30	2.8
GS111	<5	23	3	17.0	50	3.2	GS189	<5	<2	<2	10.0	34	2.6
GS112	<5	19	3	8.0	28	2.6	GS190	<5	2	3	11.0	42	2.0

App. 5 Results of Chemical Analysis (Stream Sediments -3)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
GS192	<5	<2	3	14.0	44	2.6	GS276	<5	100	2	10.0	38	2.8
GS194	<5	<2	2	8.0	28	2.6	GS277	<5	16	3	7.0	32	2.4
GS195	<5	2	3	8.0	28	2.4	GS281	<5	55	6	7.0	30	1.8
GS196	<5	<2	4	9.0	36	2.2	GS282	<5	400	22	11.0	44	3.0
GS198	<5	<2	3	8.0	30	1.4	GS283	15	70	7	10.0	60	2.4
GS199	<5	<2	3	10.0	46	2.2	GS284	10	60	21	14.0	80	2.2
GS200	<5	2	3	10.0	44	2.4	GS285	<5	78	9	11.0	62	2.4
GS207	<5	6	6	11.0	50	2.2	GS286	<5	64	32	12.0	60	2.4
GS208	<5	<2	2	8.0	34	2.4	GS287	<5	19	3	16.0	68	2.4
GS209	<5	4	8	12.0	50	2.0	GS288	<5	20	2	7.0	32	3.0
GS210	<5	2	3	11.0	38	2.2	GS289	<5	4	2	11.0	52	2.0
GS211	<5	2	3	12.0	34	3.2	GS290	<5	6	4	9.0	40	2.2
GS213	<5	7	3	15.0	54	3.4	GS291	<5	3	4	8.0	42	1.6
GS214	<5	<2	3	21.0	62	4.0	GS292	<5	45	3	9.0	36	2.2
GS215	<5	15	2	13.0	60	3.2	GS293	<5	18	4	6.0	42	1.8
GS217	<5	<2	3	11.0	46	2.0	GS294	<5	3	4	9.0	58	2.0
GS219	<5	77	8	12.0	36	2.8	GS295	<5	11	7	11.0	64	2.0
GS220	<5	2	5	13.0	44	2.4	GS296	<5	29	3	8.0	28	2.0
GS221	<5	40	7	13.0	54	2.0	GS297	<5	2	2	5.0	20	2.6
GS225	<5	2	2	8.0	28	3.2	GS298	<5	<2	2	7.0	36	1.6
GS230	<5	<2	3	16.0	54	2.4	GS299	<5	22	4	7.0	36	2.0
GS232	<5	<2	4	14.0	62	3.0	GS300	<5	38	6	14.0	64	2.0
GS234	<5	11	3	14.0	58	2.2	GS301	<5	25	5	12.0	50	2.4
GS235	<5	<2	3	14.0	54	2.4	GS302	<5	3	5	10.0	44	3.0
GS236	<5	5	24	37.0	48	7.4	GS303	<5	5	3	8.0	36	2.4
GS239	<5	<2	<2	7.0	26	2.4	GS304	<5	6	5	9.0	36	2.0
GS240	<5	<2	<2	10.0	36	2.2	GS305	<5	11	6	10.0	38	3.0
GS245	<5	2	2	7.0	18	3.2	GS306	10	2	<2	13.0	52	2.2
GS246	<5	26	2	8.0	24	3.2	GS307	<5	13	<2	11.0	44	3.4
GS247	<5	7	2	9.0	34	2.6	GS309	<5	2	<2	8.0	24	2.6
GS249	<5	65	2	15.0	32	3.0	GS310	<5	2	<2	6.0	20	1.6
GS251	<5	6	3	11.0	34	2.6	GS311	<5	2	<2	4.0	12	<0.2
GS253	<5	<2	3	11.0	42	2.4	GS312	<5	5	<2	5.0	24	2.2
GS254	<5	<2	2	12.0	40	2.0	GS313	<5	55	2	30.0	44	2.6
GS255	<5	<2	2	14.0	40	3.6	GS314	<5	<2	3	12.0	54	2.2
GS256	<5	11	3	10.0	34	2.6	GS315	<5	7	3	9.0	40	2.2
GS257	<5	<2	<2	6.0	22	2.0	GS316	5	4	5	10.0	46	2.0
GS258	<5	<2	<2	6.0	18	2.6	GS317	<5	<2	3	11.0	44	2.6
GS259	<5	<2	<2	7.0	26	2.2	GS318	<5	<2	<2	8.0	34	2.0
GS260	<5	<2	2	9.0	32	2.8	GS319	5	<2	2	10.0	42	2.2
GS262	<5	17	3	12.0	32	4.0	GS320	10	<2	2	12.0	57	2.4
GS263	<5	16	2	10.0	36	2.4	GS321	5	2	3	12.0	60	2.2
GS264	5	2	2	8.0	32	2.8	GS322	<5	<2	<2	11.0	34	2.2
GS265	<5	<2	2	7.0	24	3.0	GS323	<5	5	<2	8.0	26	3.0
GS266	<5	<2	<2	8.0	32	2.4	GS324	<5	2	<2	9.0	32	1.8
GS267	<5	30	2	11.0	36	3.2	GS325	20	2	<2	10.0	52	3.2
GS268	<5	<2	2	10.0	40	2.6	GS326	<5	2	<2	11.0	48	2.6
GS269	<5	5	2	15.0	58	3.6	GS328	<5	<2	<2	11.0	36	2.8
GS270	<5	<2	2	10.0	38	2.4	GS329	<5	<2	2	13.0	40	2.6
GS271	<5	3	4	11.0	34	2.4	GS330	<5	<2	2	13.0	40	3.0
GS273	<5	2	<2	5.0	18	2.2	GS331	<5	4	<2	12.0	38	2.0
GS275	<5	77	3	5.0	14	2.4	GS332	<5	<2	<2	12.0	46	2.4

App. 5 Results of Chemical Analysis (Panned Concentrates)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
FP 1	<5	87	2	25.0	66	4.6
FP 2	<5	>1000	55	93.0	244	8.6
FP 3	<5	35	<2	6.0	28	1.6
FP 4	<5	19	9	54.0	196	5.2
FP 5	<5	4	<2	30.0	108	3.0
FP 6	<5	70	3	40.0	174	6.4
FP 7	5	15	<2	52.0	202	4.6
FP 8	<5	>1000	6	40.0	148	7.2
GP 1	<5	3	<2	40.0	138	4.0
GP 2	<5	3	<2	22.0	86	2.0
GP 3	<5	11	<2	62.0	198	7.0
GP 4	<5	6	<2	10.0	40	2.2
GP 6	<5	2	<2	24.0	86	2.8
GP 7	<5	<2	<2	22.0	74	4.4
GP 9	<5	12	<2	15.0	52	3.4
GP 12	<5	190	<2	19.0	64	4.0
GP 13	<5	5	2	19.0	70	3.0
GP 14	<5	>1000	6	19.0	64	4.4
GP 15	<5	640	5	22.0	88	5.6
GP 16	<5	>1000	5	17.0	52	3.8
GP 17	<5	100	3	29.0	116	7.8
GP 18	<5	180	3	17.0	54	3.6
GP 19	<5	360	4	22.0	72	4.4
GP 20	<5	10	2	9.0	30	4.0
GP 21	<5	53	3	14.0	54	3.4
GP 22	<5	16	<2	15.0	64	2.4
GP 23	<5	6	<2	16.0	54	3.0
GP 24	<5	11	2	9.0	26	3.0
GP 26	<5	4	2	10.0	32	2.0
GP 27	<5	2	2	24.0	78	3.0
GP 28	<5	10	3	7.0	28	1.6
GP 29	<5	4	3	10.0	42	2.2
GP 30	<5	62	3	101.0	314	11.8
GP 31	<5	3	3	61.0	40	8.8
GP 32	5	22	4	8.0	32	2.0
GP 34	<5	>1000	27	15.0	68	3.2
GP 35	<5	8	2	13.0	46	2.8
GP 37	<5	10	2	29.0	124	4.2
GP 38	<5	3	2	7.0	34	1.4
GP 42	<5	100	2	18.0	76	3.2
GP 43	<5	>1000	4	26.0	92	4.4
GP 44	<5	>1000	3	24.0	90	4.8
GP 48	<5	290	4	12.0	58	2.4
GP 49	<5	>1000	14	10.0	46	1.6
GP 50	<5	>1000	21	9.0	42	2.0
GP 51	<5	>1000	13	14.0	40	2.0
GP 52	<5	43	2	9.0	30	2.0
GP 55	<5	30	3	17.0	48	2.6
GP 56	5	19	3	12.0	42	<0.2
GP 57	<5	9	<2	13.0	38	1.6
GP 58	<5	5	<2	19.0	56	2.6
GP 59	<5	3	2	12.0	38	2.0
GP 60	<5	3	2	17.0	46	2.0

App. 5 Results of Chemical Analysis (Soil Samples -1)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L 101	<5	2	3	22.0	138	3.0	L 313	5	3	14	24.0	90	3.4
L 102	<5	2	4	21.0	122	3.0	L 314	5	2	7	23.0	110	3.2
L 103	<5	2	3	23.0	112	2.6	L 315	<5	2	7	24.0	104	2.8
L 104	<5	4	14	27.0	110	3.2	L 316	<5	2	7	24.0	122	3.0
L 105	<5	3	3	23.0	112	2.6	L 317	5	3	12	25.0	100	3.2
L 106	<5	2	13	21.0	110	2.6	L 318	<5	2	8	20.0	76	2.8
L 107	<5	4	9	25.0	126	2.8	L 319	<5	2	5	27.0	76	3.0
L 108	<5	6	13	29.0	68	3.4	L 320	<5	2	6	26.0	126	3.0
L 109	<5	10	22	29.0	28	4.0	L 401	<5	<2	8	22.0	84	3.0
L 110	<5	8	16	24.0	64	3.2	L 402	<5	<2	6	22.0	116	2.8
L 111	15	5	19	26.0	114	2.6	L 403	<5	2	6	22.0	64	3.4
L 112	5	2	13	26.0	116	2.8	L 404	<5	<2	3	20.0	98	2.8
L 113	<5	2	11	27.0	114	3.4	L 405	<5	2	15	25.0	94	3.6
L 114	<5	2	7	25.0	84	2.8	L 406	35	8	14	23.0	112	2.8
L 115	<5	2	4	22.0	104	2.6	L 407	5	14	21	21.0	84	2.8
L 116	<5	2	7	21.0	102	2.8	L 408	<5	2	28	25.0	108	3.0
L 117	<5	13	7	20.0	70	3.0	L 409	<5	16	17	22.0	130	3.2
L 118	<5	2	5	21.0	120	3.2	L 410	5	34	60	23.0	78	2.8
L 119	<5	3	5	27.0	94	3.6	L 411	45	12	80	23.0	102	3.2
L 120	<5	3	3	27.0	130	3.4	L 412	10	72	55	26.0	86	3.6
L 201	<5	2	3	28.0	128	3.4	L 413	<5	2	12	23.0	96	2.8
L 202	<5	2	3	23.0	108	2.8	L 414	55	<2	11	25.0	82	2.6
L 203	<5	2	3	6.0	20	3.0	L 415	5	<2	7	22.0	88	2.6
L 204	<5	2	3	24.0	86	3.2	L 416	5	2	8	23.0	95	3.0
L 205	<5	2	7	28.0	104	2.8	L 417	15	2	5	22.0	98	3.2
L 206	<5	3	6	29.0	112	3.6	L 418	5	3	6	22.0	86	2.8
L 207	<5	2	8	28.0	92	3.0	L 419	<5	3	6	26.0	108	3.4
L 208	<5	3	10	28.0	50	3.2	L 420	<5	2	6	25.0	90	3.8
L 209	<5	2	7	24.0	84	2.6	L 501	<5	2	3	23.0	104	3.0
L 210	<5	12	11	27.0	76	3.2	L 502	<5	2	4	20.0	90	2.8
L 211	10	10	22	26.0	64	3.4	L 503	<5	2	7	22.0	86	3.4
L 212	<5	12	16	20.0	114	3.0	L 504	<5	<2	10	21.0	102	3.0
L 213	<5	3	17	19.0	114	3.0	L 505	<5	2	8	25.0	156	3.0
L 214	<5	2	8	23.0	86	2.6	L 506	<5	3	16	21.0	96	3.0
L 215	<5	3	22	22.0	82	3.0	L 507	<5	6	32	23.0	96	3.2
L 216	<5	3	7	20.0	96	2.6	L 508	<5	25	35	29.0	158	3.2
L 217	<5	7	12	19.0	60	3.0	L 509	<5	9	32	24.0	104	2.8
L 218	<5	2	7	23.0	80	3.4	L 510	10	50	32	30.0	82	9.6
L 219	<5	2	9	26.0	100	3.6	L 511	20	4	55	26.0	166	3.4
L 220	<5	2	7	25.0	108	3.4	L 512	10	37	25	24.0	88	4.0
L 301	<5	2	3	22.0	124	3.2	L 513	<5	2	6	27.0	106	2.8
L 302	<5	2	7	24.0	124	3.2	L 514	<5	2	13	28.0	116	2.6
L 303	<5	2	6	22.0	110	2.8	L 515	<5	2	6	26.0	128	3.0
L 304	<5	2	9	24.0	60	3.8	L 516	<5	3	12	29.0	108	3.2
L 305	<5	2	8	25.0	122	3.2	L 517	<5	2	14	24.0	104	3.6
L 306	<5	2	7	24.0	88	2.8	L 518	5	2	6	23.0	112	3.2
L 307	<5	3	9	23.0	82	2.8	L 519	<5	2	6	24.0	132	2.8
L 308	<5	2	24	27.0	56	3.0	L 520	<5	2	7	24.0	86	3.0
L 309	<5	2	17	21.0	86	2.8	L 601	<5	2	2	25.0	130	3.2
L 310	55	4	20	24.0	88	3.6	L 602	<5	2	4	23.0	90	3.4
L 311	15	2	22	27.0	146	3.2	L 603	<5	2	13	25.0	58	3.2
L 312	10	2	14	24.0	72	2.8	L 604	<5	2	5	23.0	88	3.4

App.5 Results of Chemical Analysis (Soil Samples -2)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L 605	<5	2	3	23.0	88	3.0	L 818	<5	150	9	18.0	76	3.0
L 606	<5	5	13	22.0	102	2.6	L 819	<5	2	5	27.0	108	3.4
L 607	5	6	23	24.0	92	3.0	L 820	<5	2	8	23.0	64	2.8
L 608	10	3	12	10.0	14	2.0	L 901	<5	2	6	26.0	102	3.2
L 609	20	26	90	21.0	92	3.2	L 902	<5	2	7	25.0	98	3.8
L 610	<5	4	21	19.0	110	2.8	L 903	<5	2	4	28.0	96	3.6
L 611	<5	3	11	25.0	80	2.6	L 904	5	3	32	24.0	62	3.0
L 612	<5	2	7	23.0	96	2.8	L 905	<5	4	11	26.0	120	3.2
L 613	<5	2	6	24.0	114	2.6	L 906	5	3	35	28.0	102	2.2
L 614	<5	4	6	24.0	86	3.4	L 907	25	41	32	34.0	60	5.0
L 615	<5	2	6	27.0	88	3.6	L 908	<5	7	24	26.0	72	3.2
L 616	<5	2	12	23.0	118	3.4	L 909	<5	3	10	24.0	106	3.6
L 617	<5	2	7	25.0	90	3.6	L 910	<5	2	9	26.0	116	3.4
L 618	<5	2	12	25.0	50	3.4	L 911	<5	6	14	27.0	122	3.6
L 619	<5	2	5	26.0	68	2.6	L 912	<5	3	6	26.0	42	3.2
L 620	<5	2	6	25.0	120	3.0	L 913	<5	4	6	28.0	40	3.6
L 701	<5	2	7	19.0	90	3.0	L 914	<5	3	7	26.0	100	3.6
L 702	<5	2	6	22.0	116	3.2	L 915	<5	2	7	21.0	76	3.2
L 703	<5	3	11	26.0	80	3.4	L 916	<5	5	6	26.0	130	3.0
L 704	<5	3	4	26.0	138	3.8	L 917	<5	28	14	18.0	72	3.0
L 705	5	29	21	23.0	82	5.8	L 918	<5	12	9	18.0	74	2.6
L 706	<5	6	25	22.0	102	3.2	L 919	<5	4	3	25.0	132	3.6
L 707	10	29	28	25.0	72	5.6	L 920	<5	7	8	22.0	88	2.8
L 708	20	55	45	21.0	102	4.4	L1001	<5	2	7	23.0	94	3.4
L 709	<5	11	7	20.0	86	2.8	L1002	<5	2	7	23.0	126	2.6
L 710	<5	5	23	20.0	84	3.0	L1003	<5	<2	6	22.0	90	3.2
L 711	<5	11	14	19.0	56	2.8	L1004	<5	2	8	25.0	76	3.6
L 712	<5	2	10	21.0	68	3.0	L1005	5	8	34	26.0	86	3.4
L 713	<5	2	4	24.0	158	3.4	L1006	15	9	21	36.0	22	8.0
L 714	<5	2	7	24.0	80	3.2	L1007	20	4	32	19.0	58	3.0
L 715	<5	7	20	17.0	46	3.0	L1008	5	3	23	23.0	164	3.0
L 716	<5	2	9	29.0	82	3.2	L1009	<5	2	3	25.0	98	3.0
L 717	<5	23	2	22.0	102	3.0	L1010	<5	5	18	24.0	120	3.2
L 718	<5	2	7	23.0	70	3.2	L1011	<5	3	8	27.0	124	3.2
L 719	<5	10	8	17.0	66	2.6	L1012	<5	2	7	26.0	118	3.2
L 720	<5	29	12	16.0	64	2.8	L1013	<5	3	4	24.0	50	3.6
L 801	<5	<2	12	24.0	134	3.0	L1014	<5	5	11	21.0	92	3.2
L 802	<5	<2	11	23.0	94	3.2	L1015	<5	2	3	27.0	104	3.8
L 803	<5	2	4	25.0	62	3.6	L1016	<5	2	4	23.0	100	3.4
L 804	<5	<2	13	24.0	112	3.0	L1017	<5	<2	6	24.0	116	3.4
L 805	<5	2	11	25.0	100	3.2	L1018	<5	2	2	24.0	116	3.0
L 806	20	22	29	32.0	130	4.2	L1019	<5	2	3	19.0	92	3.2
L 807	<5	3	7	25.0	78	3.2	L1020	<5	2	3	23.0	108	3.4
L 808	15	2	32	24.0	164	2.8	L1101	<5	2	3	21.0	94	3.0
L 809	<5	2	25	25.0	136	3.0	L1102	<5	2	3	22.0	92	2.6
L 810	<5	2	11	23.0	136	3.0	L1103	<5	2	16	21.0	102	3.0
L 811	<5	3	7	25.0	96	3.2	L1104	5	6	16	27.0	98	3.4
L 812	<5	2	9	24.0	20	3.0	L1105	15	45	45	28.0	76	3.4
L 813	<5	2	11	25.0	40	3.0	L1106	65	24	21	21.0	16	3.8
L 814	20	11	14	30.0	54	8.2	L1107	60	25	20	15.0	14	2.4
L 815	<5	28	16	18.0	62	3.0	L1108	<5	3	12	24.0	90	2.8
L 816	<5	2	5	26.0	60	3.2	L1109	10	2	17	22.0	116	2.8
L 817	<5	6	8	28.0	70	3.2	L1110	<5	<2	8	23.0	126	2.8

App.5 Results of Chemical Analysis (Soil Samples -3)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L1111	<5	2	11	27.0	90	3.0	L1402	<5	2	5	23.0	96	3.6
L1112	5	2	14	18.0	64	2.8	L1403	<5	3	11	26.0	74	3.4
L1113	<5	2	12	21.0	42	3.0	L1404	<5	7	12	22.0	108	3.0
L1114	<5	2	7	21.0	66	3.0	L1405	15	10	45	21.0	82	2.4
L1115	<5	<2	3	24.0	112	3.2	L1406	25	6	27	43.0	40	8.0
L1116	<5	3	4	23.0	76	3.0	L1407	<5	2	8	20.0	140	3.0
L1117	<5	2	4	23.0	126	2.8	L1408	<5	2	3	23.0	116	0.2
L1118	<5	2	3	23.0	94	3.2	L1409	<5	2	22	23.0	86	3.2
L1119	<5	2	4	23.0	106	3.0	L1410	<5	2	13	23.0	86	3.0
L1120	<5	2	9	24.0	102	2.8	L1411	<5	2	6	25.0	112	3.2
L1201	<5	2	7	18.0	86	3.0	L1412	<5	2	7	26.0	68	2.6
L1202	<5	2	7	24.0	116	3.6	L1413	<5	2	7	25.0	114	3.0
L1203	<5	3	8	45.0	102	6.2	L1414	<5	2	3	22.0	122	2.6
L1204	<5	6	45	28.0	98	3.4	L1415	<5	2	5	25.0	110	2.6
L1205	45	46	25	23.0	70	2.8	L1416	<5	2	7	26.0	90	3.2
L1206	40	12	20	18.0	52	3.0	L1417	<5	2	6	25.0	80	2.6
L1207	30	33	16	13.0	12	2.6	L1418	<5	2	3	24.0	102	3.0
L1208	5	2	16	22.0	44	2.8	L1419	<5	2	3	23.0	102	3.2
L1209	<5	2	8	24.0	118	2.6	L1420	<5	<2	4	15.0	48	2.4
L1210	<5	2	9	22.0	130	3.2	L1501	<5	2	7	26.0	96	3.4
L1211	<5	4	11	26.0	138	3.6	L1502	<5	2	9	24.0	102	4.2
L1212	<5	3	7	26.0	120	3.0	L1503	<5	10	9	22.0	88	3.6
L1213	<5	4	12	24.0	122	3.6	L1504	<5	19	45	24.0	84	3.6
L1214	<5	<2	6	24.0	66	2.8	L1505	20	13	24	26.0	84	3.6
L1215	<5	<2	3	20.0	114	3.2	L1506	20	11	35	30.0	44	6.0
L1216	<5	2	11	25.0	86	3.6	L1507	<5	2	13	21.0	92	3.0
L1217	<5	<2	6	23.0	54	3.0	L1508	<5	2	18	25.0	116	4.0
L1218	<5	<2	5	19.0	68	3.2	L1509	<5	2	12	22.0	104	3.0
L1219	<5	<2	3	22.0	102	2.4	L1510	<5	2	12	22.0	46	3.0
L1220	<5	<2	3	23.0	130	3.0	L1511	<5	2	13	24.0	104	3.8
L1301	<5	2	4	23.0	90	3.6	L1512	<5	2	11	21.0	108	3.2
L1302	<5	2	11	23.0	106	3.4	L1513	<5	2	6	22.0	84	3.0
L1303	<5	4	11	25.0	128	3.0	L1514	<5	2	5	25.0	100	3.4
L1304	<5	3	3	25.0	38	3.2	L1515	<5	2	3	22.0	92	3.2
L1305	<5	6	23	25.0	62	3.4	L1516	<5	2	3	26.0	110	3.6
L1306	30	12	32	13.0	18	3.6	L1517	<5	2	3	23.0	62	3.6
L1307	10	2	24	22.0	68	2.4	L1518	<5	2	3	20.0	98	2.8
L1308	<5	2	17	23.0	96	2.6	L1519	<5	2	3	24.0	104	3.8
L1309	<5	2	13	24.0	78	3.0	L1520	<5	2	3	23.0	42	3.2
L1310	<5	2	21	21.0	48	3.0	L1601	<5	2	8	20.0	50	3.2
L1311	<5	2	4	21.0	88	2.8	L1602	<5	2	14	27.0	94	3.8
L1312	<5	2	5	23.0	102	2.8	L1603	5	5	32	28.0	78	3.6
L1313	<5	2	7	24.0	82	3.0	L1604	<5	20	35	25.0	78	3.6
L1314	<5	2	8	24.0	136	3.0	L1605	5	20	7	29.0	94	3.2
L1315	<5	<2	4	22.0	136	3.0	L1606	5	5	5	21.0	78	3.0
L1316	<5	2	4	22.0	112	3.2	L1607	<5	2	5	25.0	112	3.0
L1317	<5	2	3	22.0	92	2.8	L1608	<5	<2	9	19.0	96	3.0
L1318	<5	2	4	25.0	114	3.2	L1609	<5	2	6	23.0	104	3.2
L1319	<5	<2	6	21.0	66	2.0	L1610	<5	2	9	22.0	90	3.2
L1320	<5	<2	3	20.0	102	2.6	L1611	<5	2	8	22.0	112	2.8
L1401	<5	2	5	23.0	110	3.4	L1612	<5	2	8	25.0	100	3.4

App.5 Results of Chemical Analysis (Soil Samples -4)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L1613	<5	2	4	22.0	88	3.2	L1906	<5	5	16	17.0	44	2.4
L1614	<5	2	3	20.0	90	2.6	L1907	<5	2	6	26.0	82	3.6
L1615	<5	2	3	24.0	112	3.2	L1908	<5	2	3	21.0	92	3.2
L1616	<5	2	3	24.0	118	3.6	L1909	<5	2	13	20.0	76	3.0
L1617	<5	2	3	23.0	80	3.6	L1910	<5	2	12	25.0	108	3.4
L1618	<5	3	3	20.0	74	3.4	L1911	<5	<2	7	21.0	126	3.0
L1619	5	2	3	24.0	118	3.0	L1912	<5	2	3	26.0	68	3.2
L1620	<5	2	3	25.0	58	3.2	L1913	<5	<2	4	22.0	96	2.8
L1701	<5	<2	3	25.0	82	3.2	L1914	<5	2	3	24.0	110	3.0
L1702	<5	<2	16	23.0	82	3.2	L1915	<5	2	3	25.0	142	3.6
L1703	10	8	18	26.0	90	3.0	L1916	<5	2	3	24.0	62	3.2
L1704	5	32	23	69.0	46	11.2	L1917	<5	2	3	23.0	60	3.4
L1705	<5	2	22	23.0	108	2.8	L1918	<5	2	3	28.0	92	3.4
L1706	<5	5	22	18.0	44	3.0	L1919	<5	2	3	23.0	110	3.0
L1707	<5	2	19	23.0	92	3.2	L1920	<5	2	3	14.0	32	3.2
L1708	<5	<2	11	20.0	90	3.0	L2001	<5	2	2	21.0	102	2.6
L1709	<5	2	6	23.0	110	3.0	L2002	<5	2	4	22.0	70	3.2
L1710	<5	2	2	23.0	98	3.2	L2003	<5	2	4	16.0	76	4.6
L1711	<5	2	7	24.0	82	3.8	L2004	<5	21	12	21.0	68	3.4
L1712	<5	2	4	24.0	84	3.2	L2005	<5	12	12	21.0	74	4.0
L1713	<5	<2	3	21.0	76	3.0	L2006	10	22	14	18.0	74	3.2
L1714	<5	<2	4	24.0	74	3.0	L2007	<5	3	7	24.0	60	3.4
L1715	<5	3	5	23.0	90	3.2	L2008	<5	<2	3	23.0	68	2.8
L1716	<5	<2	4	20.0	96	3.0	L2009	<5	2	5	23.0	100	3.2
L1717	<5	2	3	23.0	78	4.6	L2010	<5	2	14	23.0	114	3.4
L1718	<5	2	3	26.0	88	3.4	L2011	<5	2	6	23.0	80	3.4
L1719	<5	2	3	23.0	100	3.4	L2012	<5	2	6	19.0	30	0.2
L1720	<5	<2	3	25.0	96	3.0	L2013	<5	2	3	24.0	72	3.0
L1801	<5	2	14	24.0	114	4.2	L2014	<5	2	4	21.0	62	3.2
L1802	<5	4	21	25.0	62	4.2	L2015	<5	2	3	22.0	90	3.2
L1803	<5	10	8	61.0	68	13.2	L2016	<5	<2	3	21.0	116	3.4
L1804	<5	58	25	61.0	54	11.6	L2017	<5	<2	3	18.0	94	2.6
L1805	5	4	25	23.0	114	3.4	L2018	<5	<2	3	23.0	102	3.0
L1806	<5	4	22	26.0	108	3.6	L2019	<5	2	4	16.0	64	3.4
L1807	<5	2	7	26.0	100	2.8	L2020	<5	5	4	18.0	80	3.4
L1808	<5	3	6	27.0	86	3.0	L2101	<5	2	3	23.0	100	3.2
L1809	<5	2	18	23.0	84	0.2	L2102	<5	<2	4	25.0	98	3.2
L1810	<5	2	11	24.0	68	3.6	L2103	<5	6	5	20.0	52	4.2
L1811	<5	2	7	24.0	74	3.4	L2104	<5	2	6	23.0	66	5.0
L1812	<5	2	9	22.0	92	3.2	L2105	<5	11	16	17.0	66	3.2
L1813	<5	2	6	24.0	102	3.2	L2106	<5	4	14	27.0	118	3.4
L1814	<5	2	3	23.0	98	2.6	L2107	<5	3	4	24.0	60	3.6
L1815	<5	2	3	22.0	74	3.0	L2108	<5	2	3	27.0	116	3.4
L1816	<5	2	3	22.0	90	3.8	L2109	<5	2	4	21.0	109	3.2
L1817	<5	<2	3	23.0	102	3.0	L2110	<5	2	8	24.0	106	3.2
L1818	<5	2	4	23.0	56	3.0	L2111	<5	2	3	26.0	124	3.6
L1819	<5	2	4	24.0	110	3.4	L2112	<5	2	3	21.0	104	3.0
L1820	<5	2	3	23.0	82	3.4	L2113	<5	2	4	26.0	110	3.4
L1901	<5	<2	4	25.0	102	3.4	L2114	<5	2	3	22.0	40	3.2
L1902	35	11	8	19.0	70	4.8	L2115	<5	2	3	19.0	116	3.0
L1903	5	72	14	47.0	44	12.2	L2116	<5	2	3	25.0	112	3.8
L1904	5	65	17	35.0	64	6.2	L2117	<5	2	4	17.0	64	3.6
L1905	<5	3	16	21.0	78	3.2	L2118	<5	3	4	17.0	76	3.8

App.5 Results of Chemical Analysis (Soil Samples -5)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)	Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L2119	<5	2	4	21.0	72	3.2	L2412	<5	4	4	18.0	34	3.8
L2120	<5	2	3	24.0	86	3.4	L2413	<5	2	3	19.0	90	3.2
L2201	<5	2	3	22.0	94	3.0	L2414	<5	2	2	19.0	128	3.4
L2202	<5	2	3	24.0	86	3.4	L2415	<5	2	3	20.0	140	3.0
L2203	<5	<2	2	14.0	54	2.4	L2416	<5	2	2	22.0	98	4.2
L2204	<5	<2	3	21.0	82	3.4	L2417	<5	2	3	19.0	114	3.0
L2205	<5	11	13	14.0	56	3.2	L2418	<5	2	3	27.0	104	3.4
L2206	<5	4	13	17.0	52	3.4	L2419	<5	2	3	30.0	106	3.4
L2207	<5	2	7	22.0	92	3.6	L2420	<5	2	3	29.0	120	4.0
L2208	<5	2	4	17.0	58	3.0	L2501	<5	2	3	27.0	94	3.4
L2209	<5	2	3	24.0	104	3.6	L2502	<5	2	3	27.0	106	3.4
L2210	<5	2	4	26.0	86	3.4	L2503	<5	2	3	29.0	104	4.0
L2211	<5	<2	4	24.0	102	3.2	L2504	<5	<2	3	29.0	100	2.8
L2212	<5	2	4	24.0	98	3.4	L2505	<5	<2	4	23.0	84	2.8
L2213	<5	2	3	25.0	108	3.2	L2506	<5	<2	4	26.0	108	3.6
L2214	<5	2	3	24.0	82	3.2	L2507	<5	<2	4	23.0	114	3.2
L2215	<5	2	2	25.0	128	3.6	L2508	<5	2	5	28.0	70	4.0
L2216	<5	2	3	21.0	68	3.0	L2509	10	8	8	32.0	88	5.0
L2217	<5	7	4	23.0	30	3.6	L2510	10	60	40	40.0	96	6.6
L2218	<5	2	3	26.0	66	4.4	L2511	5	22	11	23.0	36	4.2
L2219	<5	<2	3	23.0	110	3.2	L2512	<5	38	12	13.0	40	3.2
L2220	<5	2	3	29.0	108	4.0	L2513	<5	3	3	25.0	96	3.4
L2301	<5	<2	3	6.0	105	3.4	L2514	<5	2	3	20.0	84	3.6
L2302	<5	<2	2	5.0	12	3.4	L2515	<5	<2	2	26.0	80	3.0
L2303	<5	<2	3	6.0	20	3.4	L2516	<5	<2	2	23.0	94	3.4
L2304	<5	2	8	7.0	18	4.4	L2517	<5	<2	2	24.0	96	3.6
L2305	<5	<2	4	6.0	16	3.6	L2518	<5	<2	3	24.0	90	3.2
L2306	<5	<2	35	24.0	110	3.6	L2519	<5	2	3	24.0	110	3.6
L2307	<5	3	4	16.0	52	4.0	L2520	<5	2	3	24.0	118	3.2
L2308	<5	2	8	22.0	72	4.0	L2601	<5	2	2	26.0	88	3.4
L2309	<5	2	6	25.0	76	5.2	L2602	<5	2	3	28.0	134	3.6
L2310	<5	10	5	19.0	64	4.6	L2603	<5	2	3	27.0	130	3.4
L2311	<5	2	3	28.0	132	3.2	L2604	<5	<2	4	27.0	90	3.4
L2312	<5	2	3	28.0	86	3.4	L2605	<5	<2	4	25.0	98	3.6
L2313	<5	2	3	26.0	108	3.0	L2606	<5	2	7	27.0	82	3.6
L2314	<5	2	3	25.0	124	3.2	L2607	<5	<2	4	22.0	106	<0.2
L2315	<5	2	3	19.0	58	3.0	L2608	<5	<2	4	30.0	110	3.2
L2316	<5	2	4	20.0	82	3.4	L2609	<5	<2	3	14.0	70	2.6
L2317	10	2	3	26.0	46	3.6	L2610	<5	28	7	68.0	118	17.6
L2318	<5	<2	3	24.0	40	3.8	L2611	<5	2	3	20.0	82	3.4
L2319	<5	2	3	25.0	92	3.4	L2612	<5	6	24	22.0	44	5.0
L2320	<5	<2	2	20.0	82	3.2	L2613	45	3	4	18.0	66	4.0
L2401	<5	<2	3	14.0	52	2.4	L2614	<5	2	6	26.0	90	4.6
L2402	<5	2	3	28.0	112	1.8	L2615	<5	<2	3	24.0	108	3.0
L2403	<5	<2	3	23.0	114	3.0	L2616	<5	2	2	30.0	118	4.0
L2404	<5	<2	4	23.0	80	3.0	L2617	10	2	3	26.0	116	4.2
L2405	<5	2	4	25.0	72	3.6	L2618	<5	3	3	25.0	104	3.6
L2406	<5	<2	4	24.0	94	3.6	L2619	<5	2	3	25.0	100	3.6
L2407	<5	<2	4	26.0	86	3.8	L2620	<5	2	3	26.0	100	3.0
L2408	<5	2	6	19.0	80	3.4	L2701	<5	2	3	26.0	80	3.4
L2409	<5	10	28	21.0	110	6.2	L2702	<5	<2	3	26.0	106	3.6
L2410	<5	9	9	23.0	60	8.0	L2703	<5	<2	2	28.0	90	3.6
L2411	<5	2	3	21.0	126	4.0	L2704	<5	<2	3	26.0	94	3.6

App.5 Results of Chemical Analysis (Soil Samples -6)

Sample No.	Au (ppb)	Sn (ppm)	W (ppm)	Th (ppm)	Ce (ppm)	U (ppm)
L2705	<5	<2	3	22.0	74	3.4
L2706	<5	<2	3	28.0	128	3.4
L2707	<5	<2	4	21.0	70	3.0
L2708	<5	3	7	27.0	88	3.6
L2709	<5	4	10	35.0	120	5.0
L2710	<5	12	32	30.0	106	4.4
L2711	<5	7	23	29.0	32	3.4
L2712	<5	16	16	19.0	34	3.0
L2713	<5	<2	2	11.0	46	2.0
L2714	<5	5	6	16.0	74	3.2
L2715	<5	2	3	24.0	120	3.2
L2716	<5	2	3	21.0	94	3.0
L2717	<5	2	<2	25.0	82	3.4
L2718	<5	2	5	28.0	56	3.6
L2719	<5	2	3	29.0	140	4.6
L2720	<5	2	4	29.0	60	3.6
L2801	<5	2	<2	22.0	100	3.4
L2802	<5	<2	<2	23.0	64	3.6
L2803	<5	<2	3	24.0	142	3.4
L2804	<5	<2	2	19.0	80	2.8
L2805	<5	<2	3	18.0	60	3.0
L2806	<5	<2	2	27.0	98	3.6
L2807	<5	<2	3	19.0	38	3.2
L2808	<5	4	4	28.0	88	3.6
L2809	<5	15	12	37.0	72	7.4
L2810	<5	13	27	31.0	94	3.4
L2811	<5	3	14	29.0	138	3.2
L2812	<5	41	12	24.0	38	3.0
L2813	10	2	3	13.0	56	2.6
L2814	<5	8	17	18.0	44	4.2
L2815	<5	5	20	25.0	90	3.4
L2816	<5	3	3	24.0	108	3.4
L2817	<5	2	4	23.0	100	3.2
L2818	<5	2	8	26.0	78	3.8
L2819	<5	2	7	22.0	92	1.6
L2820	<5	<2	3	25.0	126	3.0
L2901	<5	2	3	23.0	68	3.8
L2902	<5	<2	3	20.0	56	3.2
L2903	10	<2	3	28.0	98	4.0
L2904	5	<2	3	23.0	80	3.4
L2905	<5	<2	2	20.0	74	3.2
L2906	<5	<2	3	24.0	124	4.2
L2907	<5	<2	2	26.0	88	3.4
L2908	<5	6	8	26.0	78	4.0
L2909	<5	20	21	30.0	94	7.0
L2910	<5	8	18	33.0	84	3.8
L2911	<5	2	11	26.0	74	4.0
L2912	<5	<2	3	17.0	48	3.0
L2913	<5	<2	4	23.0	136	3.4
L2914	<5	7	22	15.0	46	3.4
L2915	<5	3	12	15.0	40	3.6
L2916	<5	<2	6	20.0	96	3.4
L2917	<5	2	<2	21.0	90	3.4
L2918	<5	<2	3	25.0	78	3.4
L2919	<5	<2	3	24.0	120	3.6
L2920	<5	2	3	25.0	66	3.2
L3001	<5	<2	3	17.0	24	2.8
L3002	<5	<2	3	23.0	80	3.6
L3003	<5	<2	4	18.0	22	3.4
L3004	<5	<2	3	26.0	114	2.8
L3005	<5	2	3	25.0	124	3.4
L3006	<5	<2	3	26.0	92	3.2
L3007	<5	<2	3	25.0	100	3.6
L3008	<5	<2	3	19.0	90	2.8
L3009	<5	<2	3	16.0	54	3.4
L3010	<5	7	12	29.0	70	3.6
L3011	<5	3	11	23.0	106	3.4
L3012	<5	2	4	25.0	90	3.4
L3013	<5	2	3	24.0	102	3.6
L3014	<5	7	5	19.0	94	5.8
L3015	<5	4	26	24.0	58	5.4
L3016	<5	8	16	27.0	66	3.2
L3017	<5	<2	2	21.0	100	3.4
L3018	<5	<2	2	25.0	90	3.8
L3019	<5	<2	3	25.0	94	3.8
L3020	<5	<2	3	25.0	50	3.4