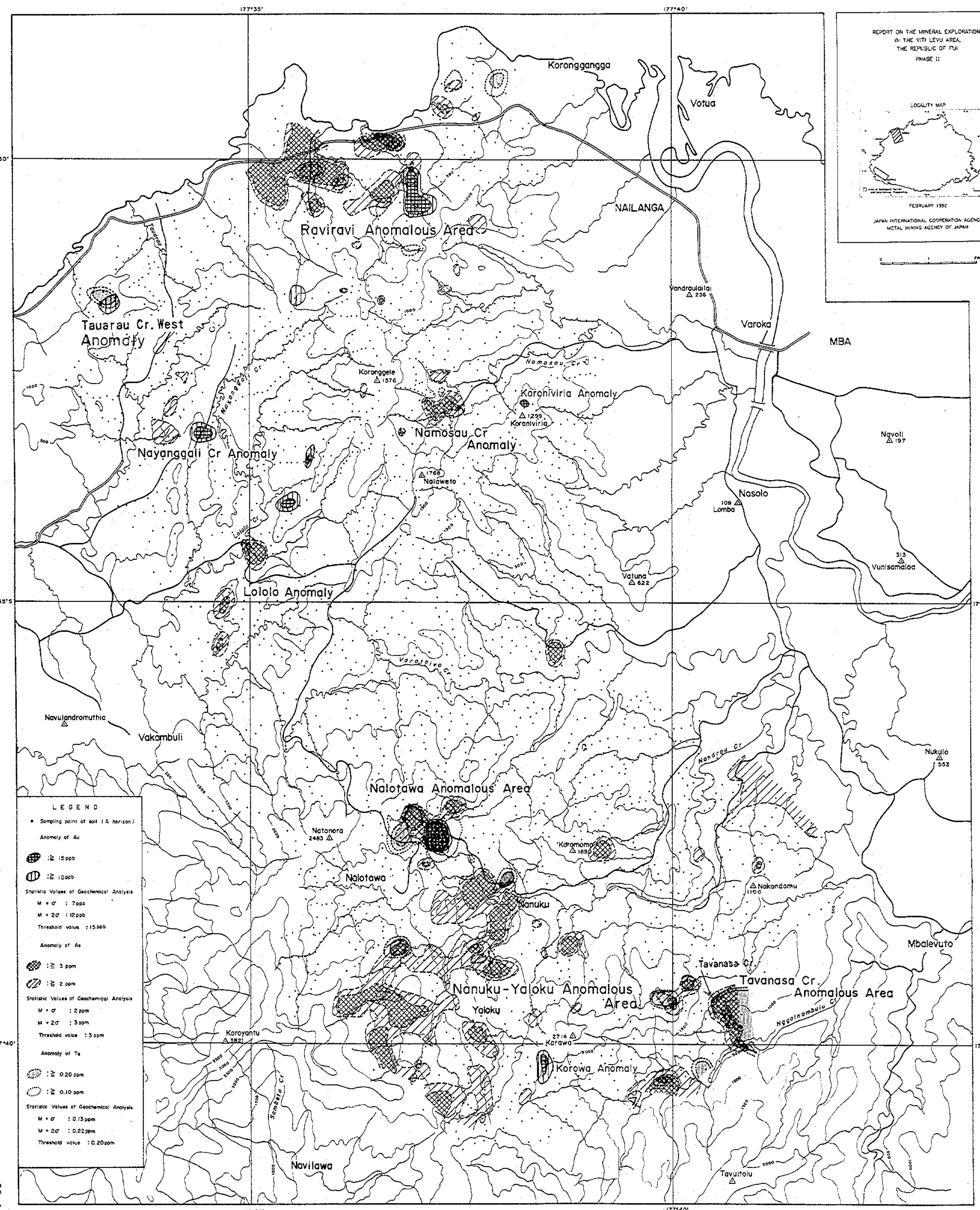


Fig.2-2-12 Distribution of Au.As and Te Anomalies in Soils (Mba-west Area)

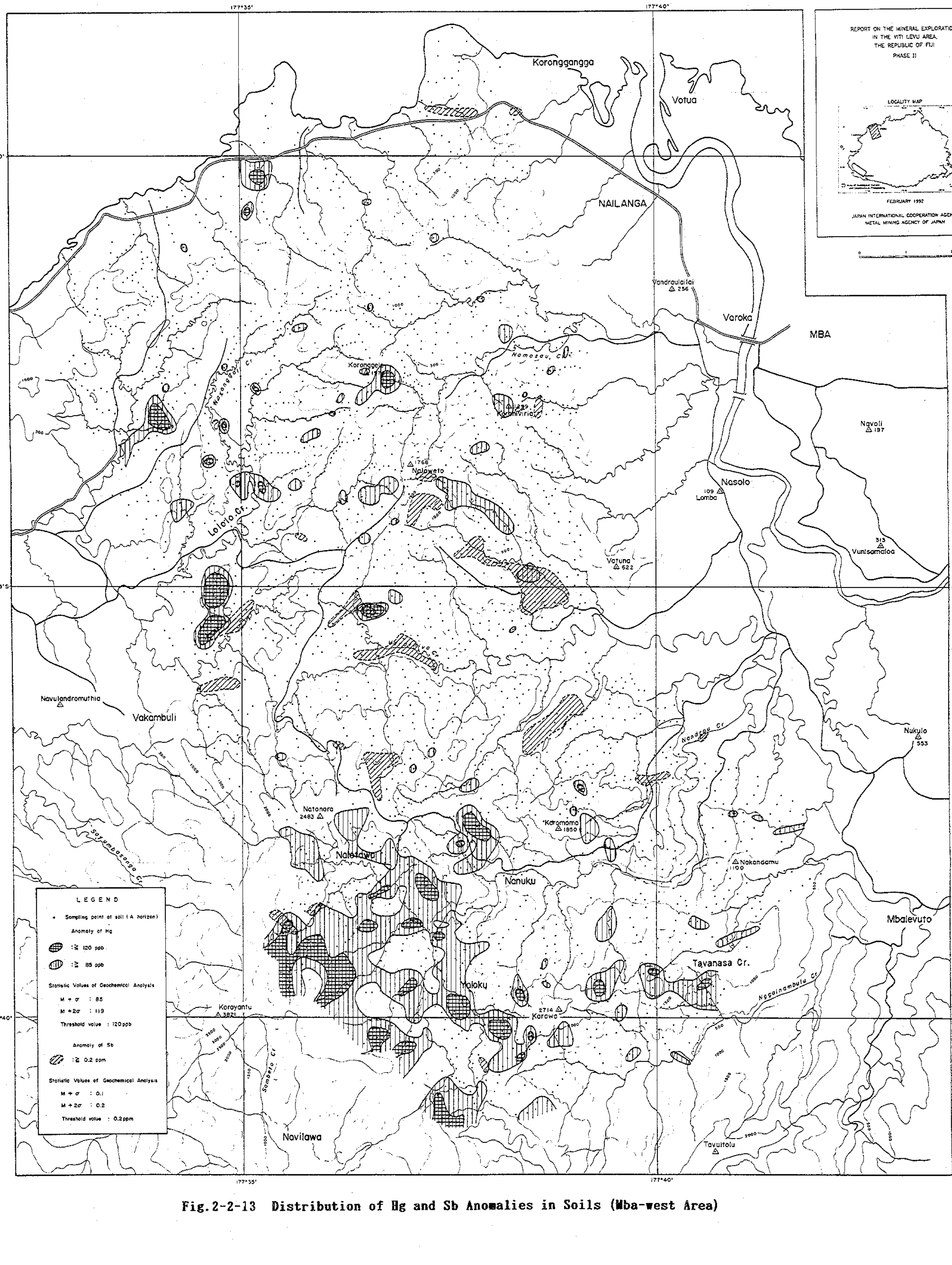


Fig.2-2-13 Distribution of Hg and Sb Anomalies in Soils (Mba-west Area)

2-4-4 Distribution of geochemical anomalies

The zones with contents higher than the threshold were extracted from the iso-grade maps for each element and were graded as geochemical anomalies (Figs.2-2-12 & 2-2-13). For elements other than Sb, m + σ value was also graded as secondary anomalies on the maps. The following discussion on anomalous zones will include the above secondary anomalies.

Although weak, correlation is observed between As and Te and these two elements behave similarly and many of their anomalous zones overlap or are close to each other. The distribution of the anomalous zones of the three elements, Au, As, Te, coincide well with the mineralized zones mentioned earlier, and thus these elements are considered to be path finder elements for mineralization.

The Hg anomalies coincide with the mineralized and altered zones in some localities, but mostly they are off the mineralized zones and appear to occur in the peripheries of mineralization.

The Sb anomalies have no relation to mineralization whatsoever, and occurs scattered in the unmineralized parts of the central Mba-west. It is not understood what controls their distribution.

When the "geochemical anomalous zones" are defined as the zones where Au, As, Te anomalies occur in significant concentration, the following four major geochemical anomalous zones are identified in this area.

Raviravi Anomalous Area

This area coincides with the Raviravi Alteration Zone and As anomalies are widely developed in pattern similar to that of the alteration zone. Te anomalies are small and overlap the As anomalies. Au anomalies are distributed to the southwest of the altered zone overlapping the As anomalies. The Au, As, Te concentration in the anomalies appears to be unrelated to the intensity of alteration, a tendency of high concentration of these elements occurring in the weakly argillized and propylitized zones is observed.

Nalotawa Anomalous Area

This area occurs in the northern half of the Nalotawa-Nanuku Alteration Zone. As and Te anomalies occur overlapping propylitization. Smaller Au anomalies occur in the central part.

Nanuku-Yaloku Anomalous Area

This is a large anomalous area extending from the southern half of the Nalotawa-Nanuku Alteration Zone to the Yaloku Alteration Zone. Most of it consists of As anomalies and small Te anomalies overlap locally. Au anomalies are not found.

Tavanasa Creek Anomalous Area

This area coincides with the Tavanasa Creek Alteration Zone. As and Te anomalies overlap, but Au anomaly is not observed.

Although not extensive enough to name anomalous areas, there are smaller but notable geochemical anomalies as follows.

Namosau Creek Anomaly

As anomalies somewhat smaller than alteration zone are developed in the central part of the Namosau Creek Alteration Zone which was drilled during the present phase. Te anomalies overlap. The Te anomalies are smaller than those of As. Au anomaly is not found.

Lololo Creek Anomaly

There are As and Au anomalies distributed along the ridge to the west of Lololo Creek. Individual anomalies are small, but they continue with NNE-SSW trend and could be a reflection of some geologic structure. Corresponding altered zones could not be identified by geological survey.

Nayanggali Creek Anomaly

There are small As and Au anomalies distributed along the ridge to the west of Nayanggali Creek. The As and Au anomalies are independent from each other. Corresponding altered zones could not be identified on the surface.

Tauarau Creek West Anomaly

There are small As anomalies distributed along the ridge to the west of Tauarau Creek. A part of them overlap with Au anomalies. Corresponding alteration zones could not be identified on the surface.

Koroniviria Anomaly

A maximum Au content of 180 ppb was obtained from a soil sample collected near the Koroniviria Triangulation Station on the southern side. This, however, is the only one high content sample with low Au content in the samples from adjoining localities and with no other anomalous elements. This could be a singular value from "nugget effect".

Karawa Anomaly

Small Au anomalies occur independently near the Karawa Triangulation Station. These are located in the unaltered zone between the Yaloku and the Tavanasa Creek Alteration Zones. This also could be a singular point.

2-4-5 Results of the geochemical prospecting

Average Au content of 47.8 ppb and maximum content of 788 ppb from A soil horizon are reported from Tavua Caldera which is the representative gold producing area of Fiji (JICA, MMAJ, 1991).

In comparison, the values obtained in Mba-west (average 2.7ppb, maximum 180 ppb) are in the order of a tenth of those in Tavua. The contents of As and Te which are considered to be related to mineralization are also low in Mba-west while those of Hg and Sb which are not related to mineralization are in the same order of magnitude.

In the above report, the values are listed in natural logarithm, this comparison was made after conversion of these figures to anti-logarithm.

The geochemical anomalies of this area are somewhat weak in their intensity, but the "anomalous zones" extracted from the Au, As, Te anomalies are in good harmony with the distribution of the alteration zones related to mineralization. Therefore, it is considered that these elements would be a useful path finder for mineral exploration.

The anomalies at Lololo Creek, Nayanggali Creek and Taurau-rau Creek West are not associated with mineralized zones or altered zones at the surface. It is quite possible that these anomalies are the surface manifestations of blind altered zones in the shallow subsurface parts.

The geochemical anomalies in the northern to the central part of the Mba-west area, occur in the depression structures extracted by photogeologic studies and also in the short-wavelength high gravity anomaly zones (over 2 mgal). Thus, these anomalies are inferred to be related to mineralization, alteration, and local subsurface structures.

Contrast of Soil Assay between Tavua Caldera and Mba-west Area

	Number of Samples		Average		Maximum		Minimum		unit
	Tavua	Mba	Tavua	Mba	Tavua	Mba	Tavua	Mba	
Au	62	3005	47.8	2.7	788	180	1	<5	ppb
Ag	62	3005	-	-	<0.2	<0.2	<0.2	<0.2	ppm
As	62	3005	7.8	1.0	59	30	1	<1	ppm
Sb	60	3005	0.1	0.1	0.8	1.0	<0.2	<0.2	ppm
Hg	58	3005	52	50	330	580	20	10	ppb
Te	59	3005	0.14	0.04	3.00	3.10	<0.05	<0.05	ppm

2 - 5 Drilling

2-5-1 Target and geology of the general area

Drilling was conducted in the upper reaches of the Namosau Creek in the northern part of Mba-west. Photogeologic caldera structures occur in this area, and the drilling sites are approximately in the center of this annular enclosed depression (Fig. 2-2-14). Basalt lava of the Pliocene Namosau Volcanics occurs widely in the general area. White argillized zone is distributed in the vicinity of the sites, and N-S trending silicified belts occur in several localities within the argillized zone. Austpac Gold N.L., prospected these silicified zones in 1987-1988 and obtained Au content of 0.017-0.019 ppm by rock geochemical prospecting.

The target of the drilling was the lower part of the above silicified belt.

The sites and length of drilling are as follows.

Drill No.	Locality	Coordinates		Elevation	Inclination	Drilled length
		Latitude	Longitude			
MJF-1	Namosau Cr.	S17°32.65′	E177°37.45′	91m	-30°	301.00m
MJF-2	Namosau Cr.	S17°32.65′	E177°37.45′	91m	-30°	301.00m

2-5-2 Drilling methods, equipment and operations

(1) Method

The surface weathered zone was drilled by HX single bit, then reamed by HX casing metal shoe and HX casing pipe was inserted. Wireline method with NQ (79mm) and BQ (62mm) oversized bits was used. The rocks were mostly basalt and tuff breccia. Argillized zones caused collapses and loss of circulation at several points. Extension of the casing pipe and increase of the concentration of the bentonite mud prevented the collapse and "TELSTOP" was injected at each loss of circulation in order to check the loss.

(2) Equipment

Koken Industries RK-3A was the drilling rig used. The specifications of the rig, pump and other equipment are listed in Table 2-2-7, the conditions of the diamond bits in Table 2-2-8 and the used consumables in Table 2-2-9.

(3) Operations

① Operations

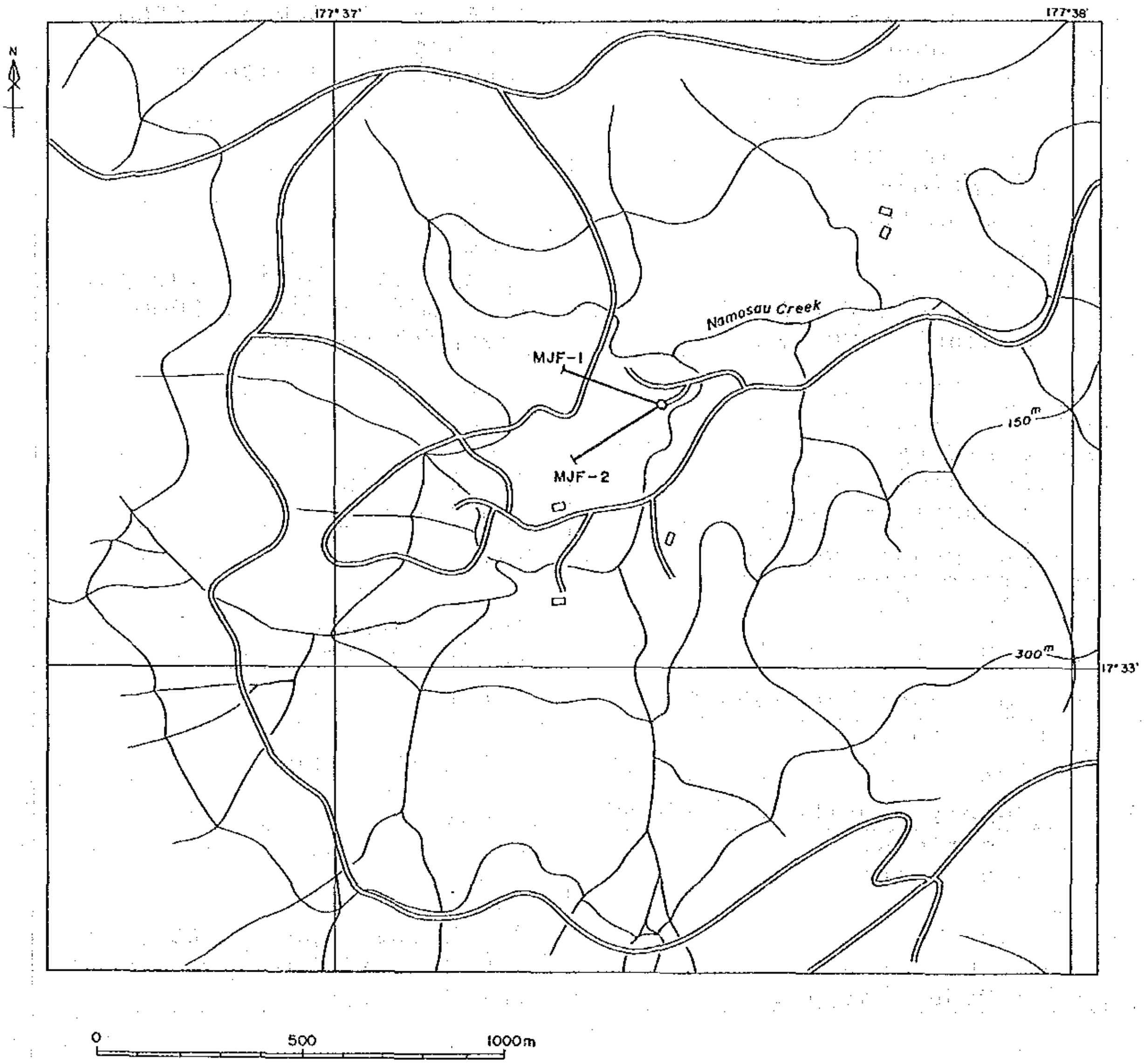


Fig.2-2-14 Location Map of Drill Holes in the Namosau Creek District.

Table 2-2-7 Drilling Machine and Equipment Used

Drilling Machine Model "RK-3A"	1 set		
Specifications:			
Capacity	500m (BQ-WL)		
Dimensions L x W x H	2,260mm× 1,050mm× 1,560mm		
Hoisting capacity	3,000kg		
Spindle speed	Forward 50,120,220,355rpm		
Engine Model "F3L912"	41ps/1,800rpm		
Drilling Pump Model "WLMG-15h"	1 set		
Specifications:			
Piston diameter	85mm		
Stroke	75mm		
Capacity	discharge capacity 190ℓ/min		
Dimensions L x W x H	2,350mm× 720mm× 1,120mm		
Engine Model "NFD-13E"	12.5ps/2,400rpm		
Wire line Hoist Model "WLH-4"	1 set		
Specifications:			
Rope capacity	500m		
Hoisting speed	8～ 105m/min		
Engine Model "NS-75C"	8ps/2,400rpm		
Mud mixer Model "HM-250"	1 set		
Specifications:			
Capacity	200ℓ/600rpm		
Engine Model "NS-90C"	9ps/2,200rpm		
Generator Model "YDG3005E"	1 set		
Specifications:			
Capacity	2.7KW 50Hz 100V		
Water supply pump Model "MG-5h"	1 set		
Specifications:			
Piston diameter	68mm		
Stroke	60mm		
Capacity	discharge capacity 65ℓ/min		
Dimensions L x W x H	1,630x465x675mm		
Engine Model "NS-90C"	9ps/2,200rpm		
Derrick	1 set		
Specifications:			
Height	9.5m		
Max load capacity	4,000Kg		
Drilling tools			
Drilling rod	NQ-WL	3.0m	60 pcs
	BQ-WL	3.0m	120 pcs
Casing pipe	HW	1.0m	10 pcs
	NW	1.0m	6 pcs
	NW	3.0m	20 pcs
	BW	1.0m	6 pcs
	BW	3.0m	60 pcs

Table 2-2-8 Drilling Meterage of Diamond Bit Used

Item	Size	Bit No.	Drilling Meterage by Unit:Meter		
			MJF-1	MJF-2	Total (m)
Diamond bit	HX-SW	192024	3.10	3.00	6.10
		Total	3.10	3.00	6.10
			Drilling length/bit		6.10
	NQ-WL	111298	57.90		57.90
		111299	50.70		50.70
		111300	38.40		38.40
		111301		48.50	48.50
		111302		49.10	49.10
		111303		49.50	49.50
		Total	147.00	147.10	294.10
			Drilling length/bit		49.02
	BQ-WL	111304	73.00		73.00
		111305	38.00		38.00
		111306	39.90		39.90
		111307		47.90	47.90
		111308		51.00	51.00
		111335		52.00	52.00
		Total	150.90	150.90	301.80
			Drilling length/bit		50.30
Diamond bit (Reaming)	HX-SW	192024	27.00		27.00
		192025		29.10	29.10
		Total	27.00	29.10	56.10
			Reaming length/bit		28.05

Table 2-2-9 Consumables Used

Description	Specifications	Unit	Quantity		Total
			MJF－1	MJF－2	
Light oil		ℓ	2,720	3,200	5,920
Hydraulic oil		ℓ	40	10	50
Engine oil		ℓ	40	80	120
Gear oil		ℓ	30		30
Grease		kg	6	8	14
Bentonite	25kg/sx	kg	3,125	3,100	6,225
C.M.C	10kg/sx	kg	65	80	145
Telnite-BX	20kg/sx	kg	118	105	223
Tel-stop (G)	20kg/sx	kg	35	30	65
Tel-stop (P)	25kg/sx	kg	13	20	33
Seaclay	20kg/sx	kg	55	85	140
Mud oil	18ℓ/can	ℓ	50	50	100
Cement		kg	400	200	600
Diamond bit	HX－SW	pc	1	(1)	1
Diamond bit	NQ－WL	pc	3	3	6
Diamond bit	BQ－WL	pc	3	3	6
Diamond reamer	HX－ST	pc	1	(1)	1
Diamond reamer	NQ－WL	pc	2	1	3
Diamond reamer	BQ－WL	pc	2	1	3
Casing diamond shoe	NX－NW	pc	1	(1)	1
Casing metal shoe	H X	pc	1	1	2
Casing metal shoe	N X	pc	1	1	2
Casing metal shoe	B X	pc	1	1	2
Core barrel Ass'y	NQ－WL	set	1	(1)	1
Core barrel Ass'y	BQ－WL	set	1	(1)	1
Inner tube Ass'y	NQ－WL	set	1	(1)	1
Inner tube Ass'y	BQ－WL	set	1	(1)	1
Core lifter case	NQ－WL	pc	3	3	6
Core lifter case	BQ－WL	pc	3	3	6
Core lifter	NQ－WL	pc	3	3	6
Core lifter	BQ－WL	pc	3	3	6
Stop ring	NQ－WL	pc	2	2	4
Stop ring	BQ－WL	pc	2	2	4
Thrust ball bearing	NQ－WL	pc	2	4	6
Thrust ball bearing	BQ－WL	pc	2	4	6
Hanger bearing	NQ－WL	pc	2	2	4
Innertube stabilizer	NQ－WL	pc	2	1	3
Innertube stabilizer	BQ－WL	pc	2	1	3
Chack piece	NQ－WL	set	1	(1)	1
Chack piece	BQ－WL	set	1	(1)	1
Cylinder liner	MG－15h 85mm	pc		2	2
Piston rod	MG－15h	pc		2	2
Piston rubber	MG－15h 85mm	pc	4	4	8
V－packing	MG－15h	pc		14	14
Hoisting wire rope	20mm x 25m	roll		1	1
Wire line rope	6mm x 500m	roll	1		1
Waste		kg	10	15	25
Core box	NQ－WL	pc	22	22	44
Core box	BQ－WL	pc	16	16	32

Transportation to the site, installation and dismantling of the rig were carried out by single shift per day. Drilling was done by three eight-hour shifts per day. Each drilling shift consisted of five personnel, namely one Japanese engineer, one MRD driller and three workers. Both Fijian and Japanese teams rented a house and commuted 11 km to the site by four-wheeled vehicle every day.

② Equipment transportation

The drilling equipment was transported from Japan by sea and landed at Lautoka Port, passed customs, transported overland by large truck for 36km to Mba and then by crane truck for the last 11km to the site.

③ Drilling water

Creek water was pumped and piped for a distance of about 40m (head) to the drilling site.

④ Withdrawal

After the completion of the survey, all the equipment was transported to the MRD camp in Mba by truck. They were cleaned, checked, repaired and housed in containers. The drilling cores were taken to the MRD warehouse and stored.

2-5-3 Progress of Drilling

(1) MJF-1

Soil and weathered zone was drilled to 3.10m depth by HX single bit, reamed to the same depth by HX casing metal shoe and HX casing pipe was inserted. Further down, NQ wireline with bentonite BX water was used. Upon reaching 33.00m, the interval 3.10m to 30.10m was reamed by HX single bit and then NX-NW casing pipe was inserted.

There was some loss of circulation near 33.00m and TELSTOP was injected to check the loss, drilled to 150.10m and BX casing pipe was inserted. BQ wireline method with bentonite water and mud-oil was used to the target depth of 301.00m.

(2) MJF-2

Soil and weathered zone was drilled to 3.00m depth by HX single bit, reamed to the same depth by HX casing shoe and HX casing pipe was inserted. Further down, NQ wireline with bentonite BX water was used. Upon reaching 32.10m, the interval 3.00m to 32.10m was reamed by HX single bit and NX-NW casing pipe was inserted.

It was further drilled down to 150.10m and BX casing pipe was inserted. BQ wireline method with bentonite water and mud-oil

Table 2-2-10 Summary of the Drilling Operation on MJF-1

	Survey Period				Total man day	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			days	days	man	man
Preparation	31.10.1991~10.11.1991	11	10	1	40	120
Drilling	11.11.1991~26.11.1991	16	Drilling 16	0	64	200
			Recovering 0	0	-	-
Removing	27.11.1991~28.11.1991	2	2	0	8	24
Total	31.10.1991~28.11.1991	29	28	1	112	344

Drilling length			
Length planed	300.00 m	Overburden	-m
Increase or Decrease in length	-m	Core length	299.20 m
Length drilled	301.00 m	Core recovery	% 99.4

Core recovery of 100 m hole		
Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0 ~ 102.70	98.2	98.2
102.70 ~ 201.10	100.0	99.1
201.10 ~ 301.00	100.0	99.4

Working hours	h	%	%
Drilling	174°00′	42.6	35.1
Other working	234°00′	57.4	47.2
Recovering			
Total	408°00′	100.0	82.3
Reassemblage	56°00′		11.3
Dismantlement	8°00′		1.6
Water transportation			
Road construction and transportation	24°00′		4.8
G.Total	496°00′		100.0

Efficiency of Drilling	
Total m/work period (m/day)	301.00 m/16 days (18.81 m/day)
Total m/work shift (m/shift)	301.00 m/48 shifts (6.27 m/shift)

Drilling length/bit(each sized bit)			
Bit size	HX	NQ	BQ
Drilled length	3.1 m	147.00 m	150.90
Core length	3.1 m	145.20 m	150.90

Casing pipe inserted			
Size	Meterage (m)	Meterage drilling × 100 length (%)	Recovery (%)
H W	3.10	1.0	100
N W	30.10	10.0	100
B W	150.10	49.9	100

Table 2-2-11 Summary of the Drilling Operation on MJF-2

	Survey Period: Period	Days	Work day	Off day	Total man day: Engineer	Worker
Operation			days	days	man	man
Preparation	29.11.1991～ 1.12.1991	3	3	0	12	36
Drilling	2.12.1991～17.12.1991	16	Drilling 16	0	64	206
			Recovering 0	0	-	-
Removing	18.12.1991～25.12.1991	8	8	0	32	96
Total	29.11.1991～25.12.1991	27	27	0	108	338

Drilling length			
Length planed	300.00 m	Overburden	- m
Increase or Decrease in length	- m	Core length	296.30 m
Length drilled	301.00 m	Core recovery	% 98.4

Core recovery of 100 m hole

Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0 ～ 100.60	96.3	96.3
100.60 ～ 201.00	98.9	97.7
201.00 ～ 301.00	100.0	98.4

Working hours	h	%	%
Drilling	158°00′	38.7	31.9
Other working	250°00′	61.3	50.4
Recovering			
Total	408°00′		82.3
Reassemblage	32°00′		6.4
Dismantlement	16°00′		3.2
Water transportation			
Road construction and transportation	40°00′		8.1
G.Total	496°00′		100.0

Efficiency of Drilling

Total m/work period(m/day)	301.00 m/16 days (18.81 m/day)
Total m/work shift (m/shift)	301.00 m/48 shifts (6.27 m/shift)

Drilling length/bit(each sized bit)

Bit size	HX	NQ	BQ
Drilled length	3.00 m	147.10 m	150.90
Core length	3.00 m	142.40 m	150.90

Casing pipe inserted

Size	Meterage (m)	Meterage / drilling length × 100 (%)	Recovery (%)
H W	3.00	1.0	100.0
N W	32.10	10.7	100.0
B W	150.10	49.9	64.6

Table 2-2-12 Record of the Drilling Operation on MJF-1

	Drilling length			Total		Shift		Working man	
	shift 1	shift 2	shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
October	m	m	m	m	m	shift	shift	man	man
31	Trans								
November									
1	Pds-Tra								
2	Tra-Reas						3	12	36
3	Tra-Reas								
4	Reassmb								
5	Reassmb								
6	Reassmb								
7	Reassmb								
8	Reassmb								
9	Reassmb						7	28	84
10	Holi day								
11	6.00	6.70	6.00	18.70	17.30				
12	6.00	8.30	Reaming	14.30	14.30				
13	Reaming	9.00	4.30	13.30	12.90				
14	7.40	7.30	3.80	18.50	18.50				
15	8.80	7.80	6.20	22.80	22.80				
16	9.10	9.00	6.00	24.10	24.10	16	18	24	66
17	2.30	6.10	6.20	14.60	14.60				
18	9.20	8.30	6.30	23.80	23.80				
19	Ins-C.P	Ins-C.P	9.10	9.10	9.10				
20	6.00	9.10	8.80	23.90	23.90				
21	6.00	9.00	9.00	24.00	24.00				
22	9.00	6.00	3.00	18.00	18.00				
23	9.00	6.00	6.00	21.00	21.00	19	21	28	98
24	9.00	6.00	3.00	18.00	18.00				
25	9.00	9.00	6.00	24.00	24.00				
26	6.00	6.00	0.90	12.90	12.90				
27	Out-C.P	Out-C.P	Out-C.P						
28	Dismant					9	13	20	60
Total	102.80	113.60	84.60	301.00	299.20	44	62	112	344

Abbreviation

Pds : Preparation for drilling site
Trans : Transportation
Tra-Reas : Transportation and Reassemblage
Reassemb : Reassemblage
Dismant : Dismantlement
Ins-C.P : Inserting casing pipe
Out-C.P : Taking out casing pipe
Reaming : Reaming for casing
Change-b : Exchange for drilling bit

Table 2-2-13 Record of the Drilling Operation on MJF-2

	Drilling length			Total		Shift		Working man	
	shift 1	shift 2	shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
November	m	m	m	m	m	shift	shift	man	man
29	Reassemb								
30	Reassemb						2	8	24
December									
1	Reassemb	Reassmb							
2	5.00	7.60	8.30	20.90	19.30				
3	11.30	Reaming	Ins-C.P	11.30	10.30				
4	7.10	9.10	3.10	19.30	19.30				
5	9.20	8.70	6.00	23.90	23.90				
6	5.30	8.20	7.30	20.80	20.10				
7	4.40	6.80	5.50	16.70	15.30	16	20	28	92
8	6.40	8.30	7.30	22.00	22.00				
9	9.20	6.00	Ins-C.P	15.20	15.20				
10	Ins-C.P	6.00	8.90	14.90	14.90				
11	9.00	9.00	6.00	24.00	24.00				
12	6.00	3.00	Change-b	9.00	9.00				
13	9.00	9.00	6.00	24.00	24.00				
14	9.00	6.00	6.00	21.00	21.00	18	21	28	90
15	6.00	Change-b	10.40	16.40	16.40				
16	9.20	4.90	8.70	22.80	22.80				
17	5.10	7.10	6.60	18.80	18.80				
18	Out-C.P	Out-C.P	Out-C.P						
19	Dismant								
20	Dismant								
21	Trans					8	15	28	84
22	Trans								
23	Trans								
24	Trans								
25	Trans						4	16	48
Total	111.20	99.70	90.10	301.00	296.30	42	62	108	338

Table 2-2-14 Working Time Analysis of the Drilling Operation

Hole No	Drilling			Shift		Working man		Working Time							
	Bit siz	Drilling length (m)	Core length (m)	Drill-ing (shift)	Total (shift)	Engin-eer (man)	Worker (man)	Drilling (h)	Other working (h)	Recove-ring (h)	Total (h)	Reassem-blage (h)	Dismantl-ement (h)	Road con-struction and Tran-sportation (h)	G.Total (h)
MJF-1	HX	3.10	1.30	1	11	41	124	1° 00′	2° 00′	-	3° 00′	56° 00′	-	24° 00′	83° 00′
	NQ	147.00	147.00	21	25	34	100	85° 00′	120° 00′	-	205° 00′	-	-	-	205° 00′
	BQ	150.90	150.90	22	26	37	120	88° 00′	112° 00′	-	200° 00′	-	8° 00′	-	208° 00′
	Total	301.00	299.20	44	62	112	344	174° 00′	234° 00′	-	408° 00′	56° 00′	8° 00′	24° 00′	496° 00′
MJF-2	HX	3.00	1.40	1	5	14	42	1° 00′	2° 00′	-	3° 00′	32° 00′	-	-	35° 00′
	NQ	147.10	144.00	20	24	32	105	77° 00′	120° 00′	-	197° 00′	-	-	-	197° 00′
	BQ	150.90	150.90	21	33	62	191	80° 00′	128° 00′	-	208° 00′	-	16° 00′	40° 00′	264° 00′
	Total	301.00	296.30	42	62	108	338	158° 00′	250° 00′	-	408° 00′	32° 00′	16° 00′	40° 00′	496° 00′
Grand Total		602.00	595.50	86	124	220	682	332° 00′	484° 00′	-	816° 00′	88° 00′	24° 00′	64° 00′	992° 00′

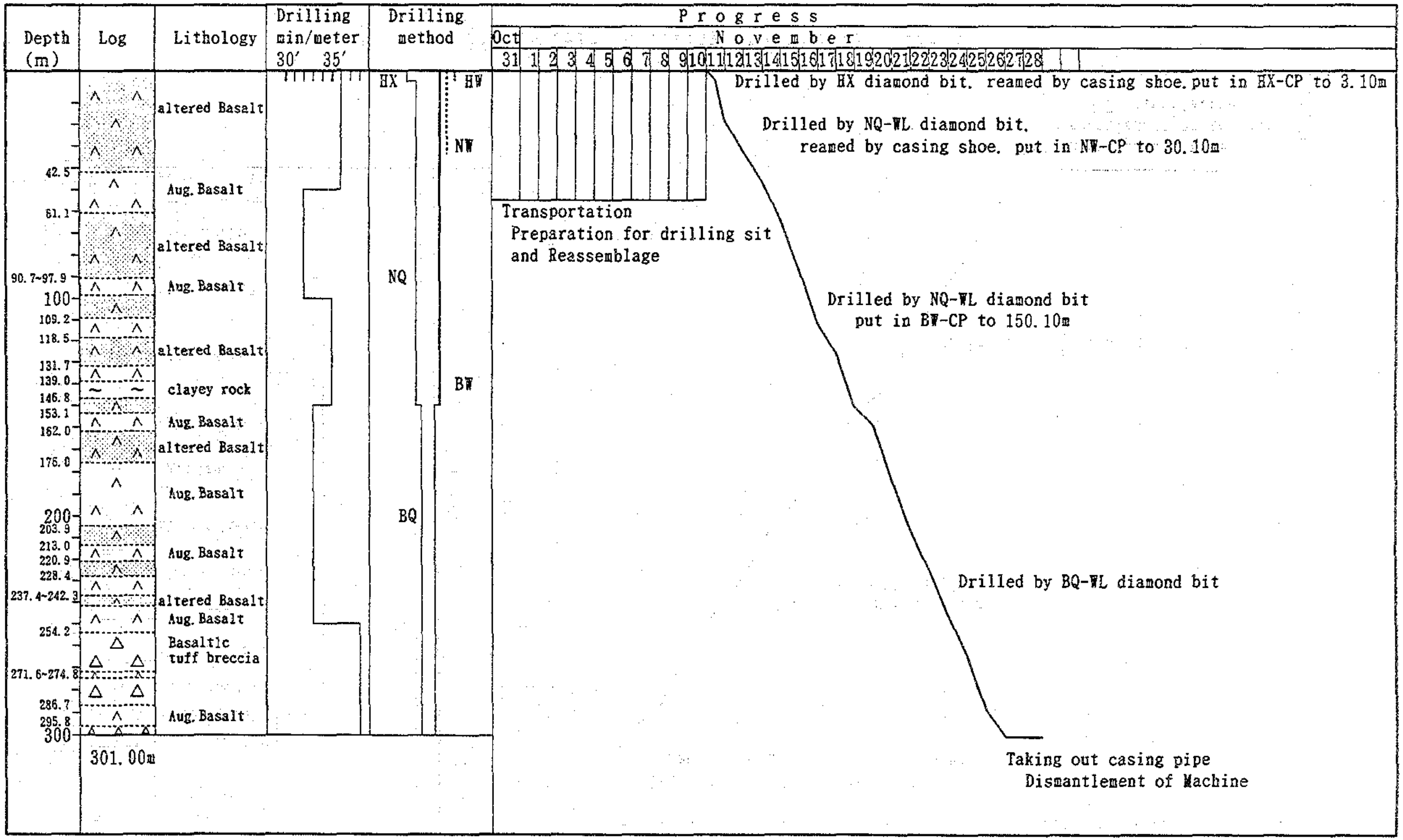


Fig 2- 2-15 Drilling Progress of MJF—1

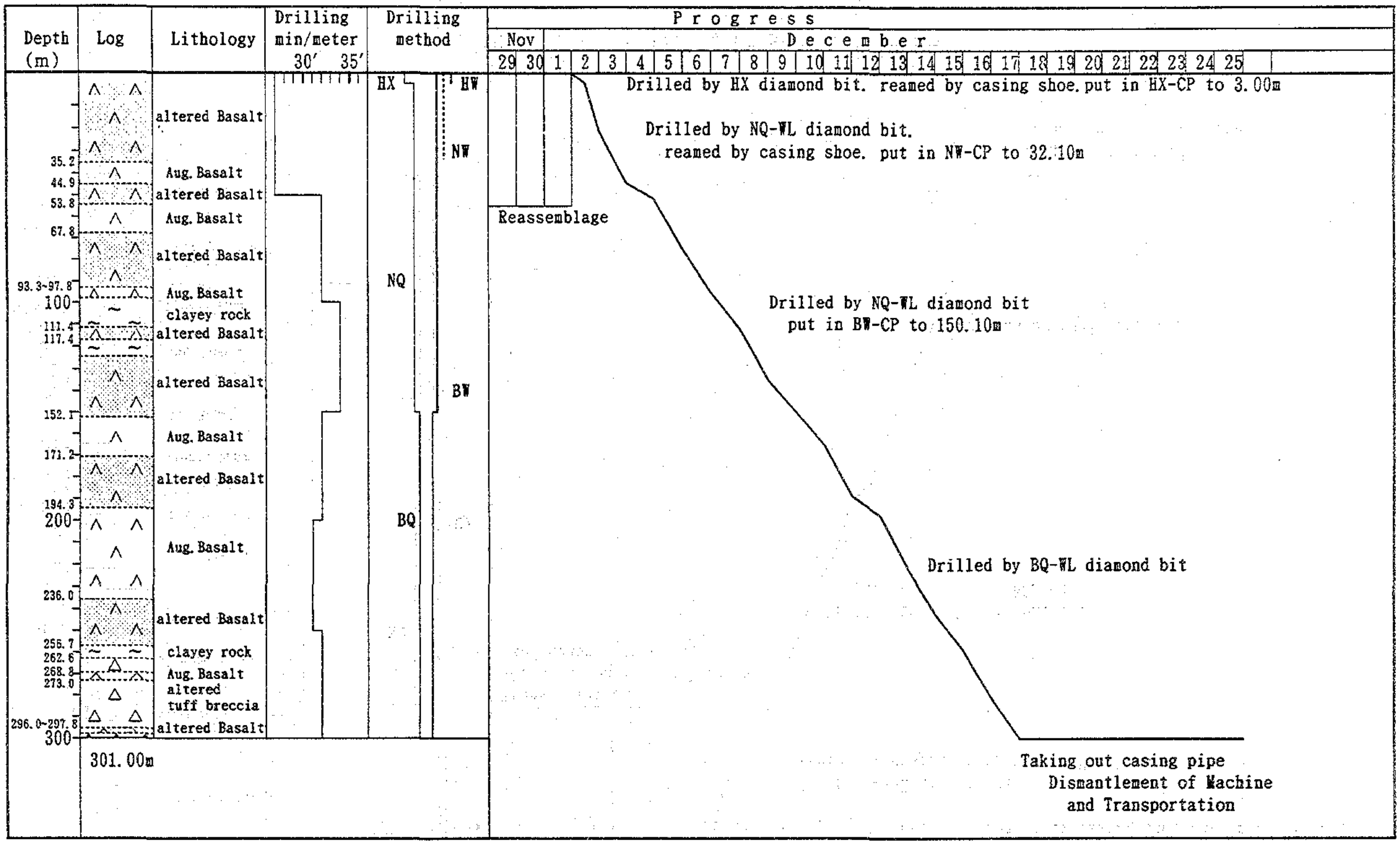


Fig 2- 2-16 Drilling Progress of MJF−2

was used to the target depth of 301.00m.

The entire circulation was lost near 39.30m and TELSTOP was repeatedly injected, but it was not possible to check the loss completely. The injected amount was 60 l/min, but the discharge was 40 l/min. The drill hole was extensively collapsed between 258.00m to 268.60m and maintenance of the drill hole was attempted by adjusting the concentration of the bentonite mud. It was successful and the target depth was achieved.

2-5-4 Geology, mineralization, alteration of drill holes

(1) Geology

Both holes were drilled through basalt lava and basaltic pyroclastics of the Pliocene Namosau Volcanics and confirmed the wide occurrence of argillized zone accompanied by pyrite dissemination.

The geology, mineralization and alteration confirmed by each hole are laid out below (Appended columnar sections, Table 2-2-15, Table 2-2-16).

[MJF-1]

① Geology

0.0- 8.8m : Basalt weathered.

8.8-254.2m : Compact olivine augite basalt. Intercalation of thin fine tuffaceous rocks at 70.1 & 228.8m. Fractured lavas between 170.8 & 175.0m, between 204.5 & 205.6m, between 250.9 & 254.2m.

254.2-271.6m : Basaltic pyroclastic rocks, many augite phenocrysts (5mm) in matrix. Tuff breccias between 254.2 & 260.9m, between 268.0 & 271.6m. Lapilli tuff between 260.9 & 268.0m. Andesite fragments at 255.6m.

271.6-274.8m : Compact olivine augite basalt.

274.8-286.7m : Basaltic tuff breccia, many augite phenocrysts(1cm) in matrix.

286.7-295.8m : Compact olivine augite basalt. Fractured lava between 288.1 & 290.1m. Intercalation of tuff between 291.7 & 292.1m.

295.8-301.0m : Basaltic tuff breccia, large augite phenocrysts in matrix.

② Alteration and mineralization

7.0- 42.5m : Propylitization - Weak white argillization - Dissemination of pyrite. Soft between 24.2

Table 2-2-15 Results of Microscopic Observation of Thin Section (Drilling Cores)

Sample	Locality	Rock Name	Formation	Texture	Phenocryst/ Crystal Fragment								Groundmass/ Matrix									Altered Mineral
					Qz	Kf	Pl	Bi	Hb	Au	Ol	Op	Si	Kf	Pl	Bi	Hb	Au	Ol	Op	Gl	
Ts-1	MJF-1 44.5m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Mont(Ol, Gl-p), op-inc(Au), dev(Gl)
Ts-2	MJF-1 94.7m	Ol-Bs.	Bnm	Porph.			◎			○	△	△			◎			△		○	◎	Mont-Op(Ol, Gl-p), Ca(Ol), Goe(Gl-p), op-inc(Au), dev(Gl)
Ts-3	MJF-1 133.0m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Chl(Ol, Gl-p), Ca Goe(Ol), Mont(Gl-p), op-inc(Au), dev(Gl), Ca-Vein
Ts-4	MJF-1 255.6m	V-Br. (Hb-Ad.)	Bnm	Porph.			○		△	△		○			○					△	◎	Ca(Pl-p, Hb-p, Au-p), Ep(Pl-p), Chl(Hb-p, Au-p, Gl), Opa(Hb-p), Mont(Gl)
Ts-5	MJF-1 272.0m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Ca(Au-f-p, Ol, Gl-p), Op(Ol), Mont(Gl-p), dev(Gl), Ca-Vein
Ts-6	MJF-2 35.5m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Ca(Au-f-p, Ol, Gl-p), Op(Ol), Mont(Gl-p), dev(Gl), Ca-Vein
Ts-7	MJF-2 57.4m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Mont(Ol, Gl-p), op-inc(Au), dev(Gl)
Ts-8	MJF-2 158.0m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Mont(Ol, Gl-p), op-inc(Au), dev(Gl)
Ts-9	MJF-2 202.0m	Ol-Bs.	Bnm	Porph.			◎			◎	△	△			◎			△		○	◎	Mont(Ol, Gl-p), op-inc(Au), dev(Gl)
Ts-10	MJF-2 274.1m	Alt. V-Br.	Bnm																			Completely altered to Qz-Ca-Chl-Ab-Se-Op, Ca-Vein, Ca-Chl pseudomorph after mafic minerals

Abundance of minerals: ◎; abundant, ○; common, △; a few

Abbreviations
Texture: Porph; Porphyritic
Mineral: Qz;Quartz, Kf;Alkali feldspar, Pl;Plagioclase, Bi;Biotite, Hb;Hornblende, Au;Augite, Ol;Olivine, Op;Opaque mineral, Si;Silica mineral, Gl;Glass
Ab;Albite, Ca;Carbonate, Chl;Chlorite, Ep;Epidote, Goe;Goethite, Mont;Montmorillonite, Opa;opasite, Se;Sericite, dev;devitrified, -f;along fissure, -p;partly, op-inc;opaque inclusion
Rock : Ad;Andesite, Bs;Basalt, V-Br;Volcanic Breccia, Alt;altered

Table 2-2-16 Results of Microscopic Observation of Polished Section (Drilling cores)

No.	Location	Description	Cp	Po	Py	Mg	Il	Goe	Hem	Remarks
PS-1	MJF-1, 87.9m	Qtz-Alu vein			◎			▲	▲	
PS-3	112.9	Py dis brec rock	▲		◎					
PS-5	232.6	Py dis brec rock	▲		◎					
PS-6	MJF-2, 117.1	Qtz-Alu vein			◎				*▲	*partly replaced by goethite
PS-7	287.8	Py dis brec rock		▲	◎	▲	▲			

AAbbreviations:
◎:Abundant ○:Common △:Few ▲:Rare
Cp:Chalcopyrite:Po:Pyrrhotite,Py:Pyrite,Mg:Magnetite,Il:Ilmenite:Goe:Goethite,Hem:Hematite
Alu:Alunite,dis:disseminated,brec:brecciated

& 24.7m between 36.6 & 39.0m, between 39.9 & 41.8m.

55.9- 58.2m : White argillization - Dissemination of pyrite, Soft between 57.7 & 58.2m.

58.2- 61.1m : Propylitization.

61.1- 66.9m : White argillization - Dissemination of pyrite, soft. Shear zone between 61.1 & 63.0m.

66.9- 68.2m : Propylitization.

72.3- 81.4m : White argillization - Dissemination of pyrite.

81.4- 82.5m : Propylitization.

82.5- 87.8m : White argillization - Dissemination of pyrite.

87.8- 89.3m : Vein of Alunite - Quartz - Dissemination of pyrite.

89.3- 90.7m : White argillization - Dissemination of pyrite, soft.

90.7- 93.5m : Propylitization - Weak white argillization.

97.9-101.0m : White argillization - Dissemination of pyrite.

103.8-105.2m : White argillization - Dissemination of pyrite.

105.2-105.9m : Propylitization.

105.9-109.2m : White argillization - Dissemination of pyrite, soft.

109.2-111.75m: Propylitization.

111.75-113.6m: White argillization - Dissemination of pyrite. Breccia structure.

118.5-122.5m : White argillization - Dissemination of pyrite.

122.5-127.3m : White argillization - Partial propylitization - Dissemination of pyrite.

129.0-129.4m : Propylitization - Weak white argillization - Dissemination of pyrite.

130.5-131.7m : Propylitization - White argillization - Dissemination of pyrite.

135.3-135.5m : Breccia structure, Weak silicification? - Dissemination of pyrite.

139.0-143.8m : White argillization - Dissemination of pyrite, soft.

143.8-145.0m : Propylitization - White argillization - Dissemination of pyrite, soft.

145.0-150.0m : White argillization - Dissemination of pyrite, soft.

150.0-153.1m : Propylitization - White argillization - Dissemination of pyrite.

155.6-155.8m : White argillization - Dissemination of pyrite, soft.

162.0-171.0m : White argillization - Propylitization - Dissemination of pyrite.

171.0-176.0m : Propylitization - Dissemination of pyrite.

187.1-193.3m : Propylitization.

201.1-203.9m : Partial propylitization.

203.9-208.2m : Propylitization - Dissemination of pyrite. White clay veinlets in fractures sheared.

220.9-228.4m : White argillization - Dissemination of pyrite, soft between 224.2 & 228.4m.

232.1-233.2m : White argillization - Weak silicification? - Dissemination of pyrite. Breccia structure.

237.4-238.1m : Propylitization.

238.1-238.4m : White argillization - Dissemination of pyrite, soft.

239.3-239.8m : White argillization - Dissemination of pyrite.

239.8-240.2m : Propylitization - Dissemination of pyrite.

240.2-241.3m : White argillization - Dissemination of pyrite.

241.3-242.3m : Propylitization - Weak white argillization - Dissemination of pyrite.

250.9-301.0m : Propylitization. Intercalation of thin White argillization - Dissemination of pyrite (290.7-290.9m, 291.7-292.1m, 299.4-299.6m). Soft between 299.4 & 299.6m.

[MJF-2]

① Geology

0.0- 6.5m : Basalt weathered.

6.5-260.4m : Compact olivine augite basalt. Fractured lavas between 13.0 & 15.0m. Porous silicified rock between 29.3 & 29.4m. Intercalation of thin fine tuff at 46.9m between 154.7 & 155.1m.

260.4-296.0m : Basaltic tuff breccia. Many basalt boulders between 270.4 & 273.0m, between 277.0 & 285m.

296.0-297.8m : Fractured basalt lava.

297.8-301.0m : Basaltic tuff breccia.

② Alteration and mineralization

8.0- 21.0m : Propylitization - Dissemination of pyrite.

21.0- 35.2m : White argillization - Propylitization - Dissemination of pyrite.

44.9- 53.8m : White argillization - Propylitization - Dissemination of pyrite.

67.8- 69.2m	:	Propylitization - Partial dissemination of pyrite.
69.2- 71.3m	:	White argillization - Propylitization - Dissemination of pyrite.
71.3- 72.4m	:	Propylitization - Dissemination of pyrite.
75.7- 79.2m	:	White argillization - Dissemination of pyrite. Soft between 76.5 & 77.5m.
79.2- 81.9m	:	Weak propylitization.
81.9- 93.3m	:	White argillization - Dissemination of pyrite. Soft between 86.7 & 86.8m, between 88.5 & 88.9m, between 90.9 & 92.2m.
93.3- 97.8m	:	Weak propylitization.
97.8-105.6m	:	White argillization - Dissemination of pyrite. Soft between 97.8 & 103.5m.
105.6-117.1m	:	Propylitization - White argillization Dissemination of pyrite. Soft between 107.2 & 111.4m.
117.1-117.4m	:	Vein of Alunite - Quartz - Dissemination of pyrite.
117.4-124.3m	:	White argillization - Propylitization - Dissemination of pyrite. Soft between 117.6 & 119.3m, between 119.8 & 123.2m, between 123.7 & 124.3m.
124.3-127.5m	:	Propylitization. Intercalation of White argillization - Dissemination of pyrite between 126.5 & 126.9m.
127.5-129.1m	:	White argillization - Dissemination of pyrite. Shear zone at 128.5.
129.1-138.5m	:	Many intercalations of thin White argillization - Dissemination of pyrite in propylitized zone.
138.5-140.9m	:	White argillization - Propylitization - Dissemination of pyrite.
140.9-152.1m	:	Propylitization.
171.2-175.0m	:	White argillization - Dissemination of pyrite. Soft between 174.7 & 175.0m.
175.0-176.3m	:	Propylitization - White argillization - Dissemination of pyrite.
180.4-181.7m	:	White argillization - Weak propylitization - Dissemination of pyrite.
181.7-184.6m	:	Propylitization.
184.6-188.5m	:	Propylitization - White argillization - Dissemination of pyrite.
188.5-194.3m	:	White argillization - Dissemination of pyrite. Soft between 193.7 & 194.0m.
222.6-222.95m	:	White argillization - Dissemination of pyrite, soft.
236.0-238.7m	:	White argillization - Dissemination of

pyrite.

238.7-241.5m : White argillization - Weak propylitization - Dissemination of pyrite.

241.5-247.8m : Propylitization - Partial white argillization - Dissemination of pyrite.

247.8-260.4m : White argillization - Dissemination of pyrite. Soft between 248.1 & 248.5m, between 252.2 & 252.4m, between 256.7-260.4m.

260.4-268.8m : Propylitization - Weak dissemination of pyrite. Soft between 260.4 & 262.6m.

268.8-270.4m : Propylitization - Partial white argillization - Dissemination of pyrite.

270.4-273.9m : Propylitization - Partial white argillization - Dissemination of pyrite.

273.9-275.9m : White argillization - Weak dissemination of pyrite.

275.0-298.5m : Propylitization - White argillization - Dissemination of pyrite. Soft shear zone between 287.3 & 288.0m. Soft between 275.0 & 275.9m, between 293.3 & 294.6m.

298.5-301.0m : White argillization - Partial weak silicification- Dissemination of pyrite.

2-5-5 Drilling results

The 61 samples collected from the cores of MJF-1 and MFJ-2 were chemically analyzed by Chemex Labs Ltd., in Canada. Seven elements, Au, Ag, Cu, Pb, Zn, Mo, Te, were analyzed and the results are shown in Table 2-2-17. Ag 1.4g/t was obtained at 238.1-238.4m of MJF-1, but otherwise significant metal content was not found.

Twenty two samples collected from the drilling cores were studied by X-ray diffraction (Table 2-2-18).

Concentric zonal arrangement of altered minerals has been clarified by surface survey near the sites. It is, from the center outward; Silicification-Alunite subzone(Subzone Ⅰ) → Kaolinite subzone(Subzone Ⅱ) → Sericite subzone(Subzone Ⅲ) → Mixed-layer mineral subzone(Subzone Ⅳ) → Smectite-chlorite subzone(Subzone Ⅴ)

The sites are at the edge of the kaolinite subzone. Drilling was done toward the part directly under the silicified-alunite subzone, and thus it was anticipated that kaolinite and silicified-alunite subzones would be encountered on a large scale.

Most of the units confirmed, however, were non-altered augite basalt and propylite (Subzone V, smectite-chlorite) with pyrite dissemination. And small clay rocks belonging to the sericite and kaolinite subzones were developed as dykes and pipes (Figs. 2-2-17, 2-2-18).

Silicification - alunite occurs only as several veins (about 2 m wide) in this *kaolinite. Mixed layer mineral subzone which* is identified on the surface does not occur in the drill cores. This is interpreted that the acidic altered zone which is widely developed on the surface has a mushroom-shaped profile and the drilling penetrated its stem. The silicification - alunite subzone is inferred to be developed in the central part of this mushroom-shaped acidic altered zone and extend in the vertical direction as veins or pipes.

If Summitville type (silicified pipe) or Nansatsu type (network mineralization in strata·bound silicified rocks) deposits were to occur in the Namosau Creek area, the location of the bonanza would be higher than the present surface and most probably would have been eroded out.

Table 2-2-17 Results of Chemical Analysis of Ore Samples (Drilling Cores)

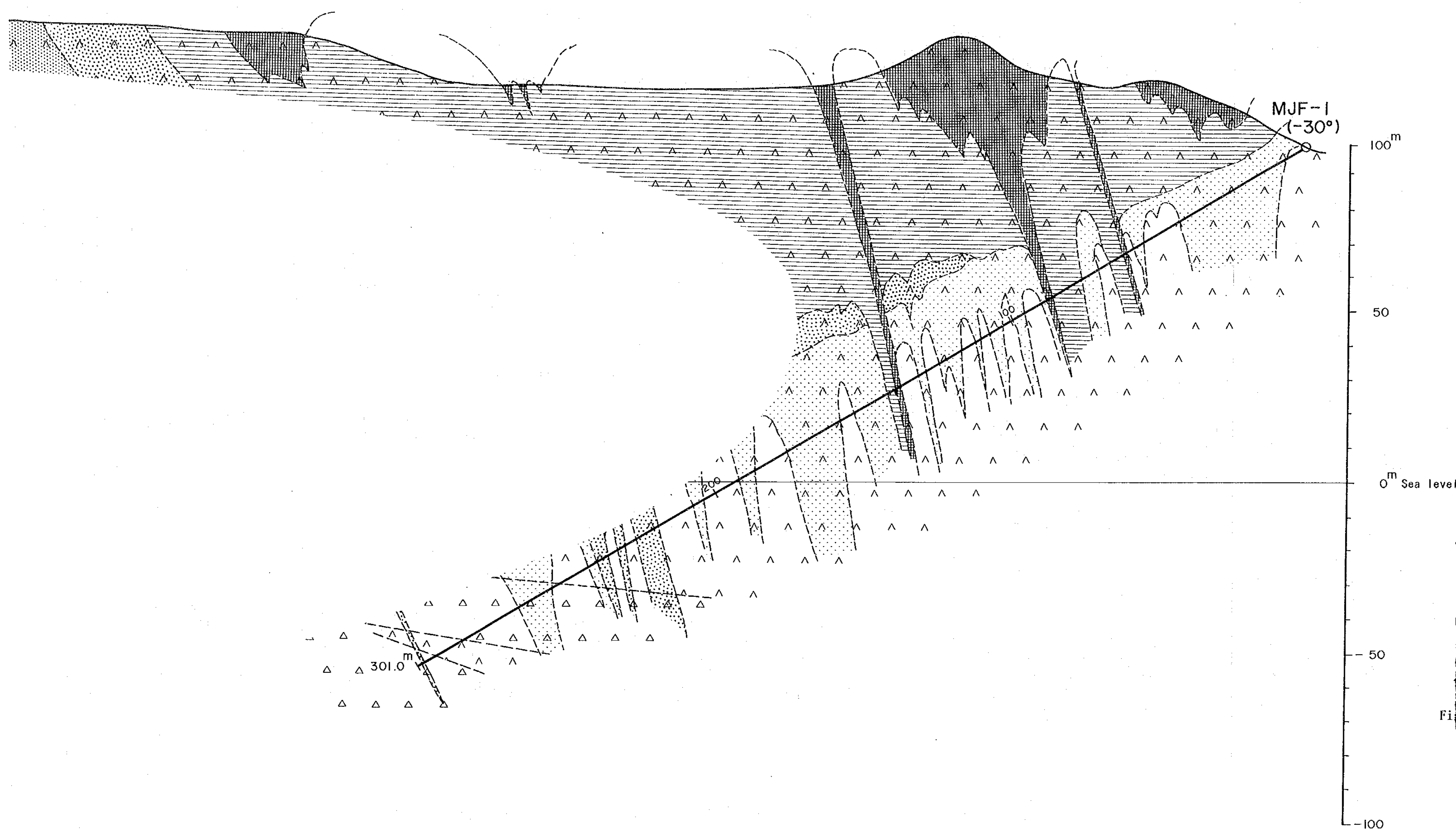
Sample No.		Depth m ~ m	Width (m)	Ore Grade Au g/t	Ag g/t	Cu %	Pb %	Zn %	Mo %	Te ppm
MJF-1	OA-1-1	24.2 ~ 24.7	0.5	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.25
	OA-2-1	36.6 ~ 37.6	1.0	<0.07	<0.3	0.02	<0.01	0.01	<0.001	0.30
	OA-2-2	37.6 ~ 39.0	1.4	<0.07	<0.3	0.02	<0.01	0.01	<0.001	0.20
	OA-3-1	61.0 ~ 62.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.30
	OA-3-2	62.0 ~ 63.0	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.10
	OA-4-1	86.8 ~ 87.8	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.35
	OA-4-2	87.8 ~ 88.8	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	<0.05
	OA-4-3	88.8 ~ 89.3	0.5	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.05
	OA-4-4	89.3 ~ 90.7	1.4	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.35
	OA-5-1	105.9 ~106.9	1.0	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.50
	OA-6-1	111.75~112.75	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	<0.05
	OA-6-2	112.75~113.6	0.85	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.10
	OA-7-1	139.0 ~140.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.40
	OA-7-2	140.0 ~141.0	1.0	<0.07	<0.3	0.02	<0.01	0.01	<0.001	0.25
	OA-7-3	141.0 ~142.0	1.0	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.40
	OA-7-4	142.0 ~143.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.15
	OA-7-5	143.0 ~144.0	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.10
	OA-7-6	144.0 ~145.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.20
	OA-7-7	145.0 ~146.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.25
	OA-7-8	146.0 ~147.0	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	<0.05
	OA-8-1	164.5 ~165.5	1.0	<0.07	<0.3	0.01	<0.01	0.01	<0.001	0.20
	OA-9-1	222.2 ~223.2	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.30
	OA-9-2	223.2 ~224.2	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.35
	OA-9-3	224.2 ~225.2	1.0	<0.07	0.3	0.01	<0.01	<0.01	<0.001	0.30
	OA-9-4	225.2 ~226.2	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.30
	OA-9-5	226.2 ~227.2	1.0	<0.07	0.3	<0.01	<0.01	<0.01	<0.001	0.40
	OA-9-6	227.2 ~228.4	1.2	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.35
	OA-10-1	232.1 ~233.2	1.1	<0.07	<0.3	0.03	<0.01	<0.01	<0.001	0.55
	OA-11-1	238.1 ~238.4	0.3	<0.07	1.4	0.02	0.04	0.10	<0.001	0.30
	OA-12-1	299.4 ~299.6	0.2	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.30
MJF-2	OA-13-1	29.1 ~ 30.1	1.0	<0.07	<0.3	0.02	<0.01	0.01	<0.001	<0.05
	OA-14-1	76.5 ~ 77.5	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.20
	OA-15-1	90.9 ~ 92.2	1.3	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.30
	OA-16-1	97.8 ~ 98.8	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.25
	OA-16-2	98.8 ~ 99.8	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.40
	OA-16-3	99.8 ~100.8	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.30
	OA-16-4	100.8 ~101.8	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.40
	OA-16-5	101.8 ~102.8	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.10
	OA-16-6	102.8 ~103.5	0.7	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.20
	OA-17-1	107.2 ~108.2	1.0	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.15
	OA-17-2	108.2 ~109.2	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.10
	OA-17-3	109.2 ~110.2	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.20
	OA-17-4	110.2 ~111.4	1.2	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.15
	OA-18-1	116.1 ~117.1	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.15
	OA-18-2	117.1 ~117.4	0.3	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.05
	OA-18-3	117.4 ~118.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.15
	OA-18-4	118.4 ~119.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.30
	OA-18-5	119.4 ~120.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.35
	OA-18-6	120.4 ~121.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.35
	OA-18-7	121.4 ~122.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.40
	OA-18-8	122.4 ~123.4	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.15
	OA-18-9	123.4 ~124.3	0.9	<0.07	<0.3	0.01	<0.01	<0.01	<0.001	0.05
	OA-19-1	193.0 ~194.0	1.0	<0.07	<0.3	0.02	<0.01	<0.01	<0.001	0.95
	OA-20-1	256.7 ~257.7	1.0	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	0.05
	OA-20-2	257.7 ~258.7	1.0	<0.07	<0.3	0.01	<0.01	0.01	<0.001	0.05
	OA-20-3	258.7 ~259.7	1.0	<0.07	<0.3	0.01	<0.01	0.01	<0.001	<0.05
	OA-20-4	259.7 ~260.7	1.0	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	<0.05
	OA-20-5	260.7 ~261.7	1.0	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	<0.05
	OA-20-6	261.7 ~262.6	0.9	<0.07	<0.3	<0.01	<0.01	<0.01	<0.001	<0.05
	OA-21-1	275.0 ~275.9	0.9	<0.07	<0.3	<0.01	0.01	<0.01	<0.001	0.05
	OA-22-1	287.3 ~288.0	0.7	<0.07	<0.3	<0.01	0.01	<0.01	0.003	0.05

Table 2-2-18 Results of X-Ray Diffraction Analysis (Drilling Cores)

Sample		Clay minerals										Silica m.			Feldspar		Sulfates			Carbon.		Oxides			Sulfides		Others		
No.	Location	SME	CHL	SER	KAO	PYP	SRP	S/M	C/M	K/M	ZEO	QTZ	ACR	TRI	PLA	KFL	ALU	JAR	GYP	CAL	DOL	GOE	HEM	MAG	PYR	SPH	OLI	AMP	PX
XR3	MJF-1, 38.0m	△	▲									△			○					▲?					△				
XR4	61.5											◎					○								△				
XR6	87.1				○	△					△?	○													○				▲
XR7	88.2				▲?							◎					○								▲?				
XR8	101.1	△	△								△	○			○					△					△				▲
XR9	106.4	△	△									○								○					△				
XR10	111.9	△	△									○			○					△					△				▲
XR12	139.6				○	△						◎			○	▲?	△								△				
XR13	165.0		△								△	○			○					△					○				▲?
XR15	228.0			△								○			△					△?					○				
XR18	262.8		△								▲	△			△										△			○	△
XR20	299.5	▲	△	△							△	○			△					▲?					△				▲
XR21	MJF-2, 10.0	△										○			○					△					▲				▲
XR22	29.3											◎																	
XR23	76.7			▲	○	△					△	◎													△				▲?
XR24	117.4				▲	▲					△	◎					○								▲				▲?
XR25	118.0			▲								○													○				
XR26	134.3	△			▲?						○	○					◎			△					△				▲?
XR27	193.8			△								○													△				
XR28	258.0		△	▲								○													△				
XR29	275.3			▲	▲							○													△				▲?
XR30	298.6	▲?	▲	△							▲	◎			○					○					△				

Abbreviations:
◎:Abundant ○:Common △:Few ▲:Rare

SME:Smectite, CHL:Chlorite, SER:Sericite, KAO:Kaolinite, PYP:pyrophyllite, SRP:Serpentine, MON/Montmorillonite, S/M:Ser/Mon mixed layer mineral, C/M:Chl/Mon mixed layer mineral, K/M:Kao/Mon mixed layer mineral, ZEO:Zeolite, QTZ:Quartz, ACR: α-Cristobalite, TRI:Tridymite, PLA:Plagioclase, KFL:Potassium feldspar, ALU:Alunite, JAR:Jarosite, GYP:Gypsum, CAL:Calcite, DOL:Dolomite, GOE:Goethite, HEM:Hematite, MAG:Magnetite, PYR:Pyrite, SPH:Sphalerite, OLI:Olivine, AMP:Amphibole, PX:Pyroxene



Fi

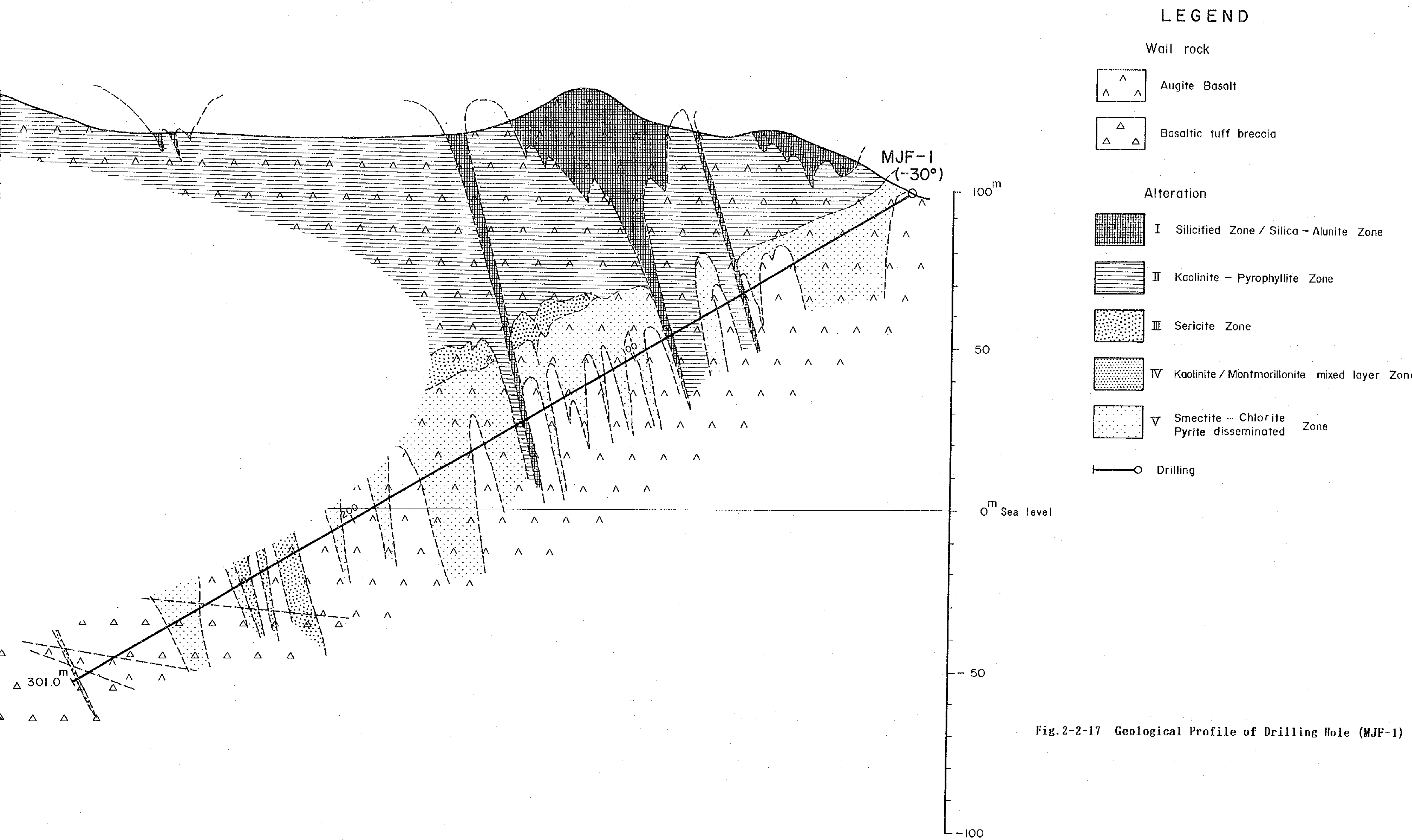


Fig. 2-2-17 Geological Profile of Drilling Hole (MJF-1)

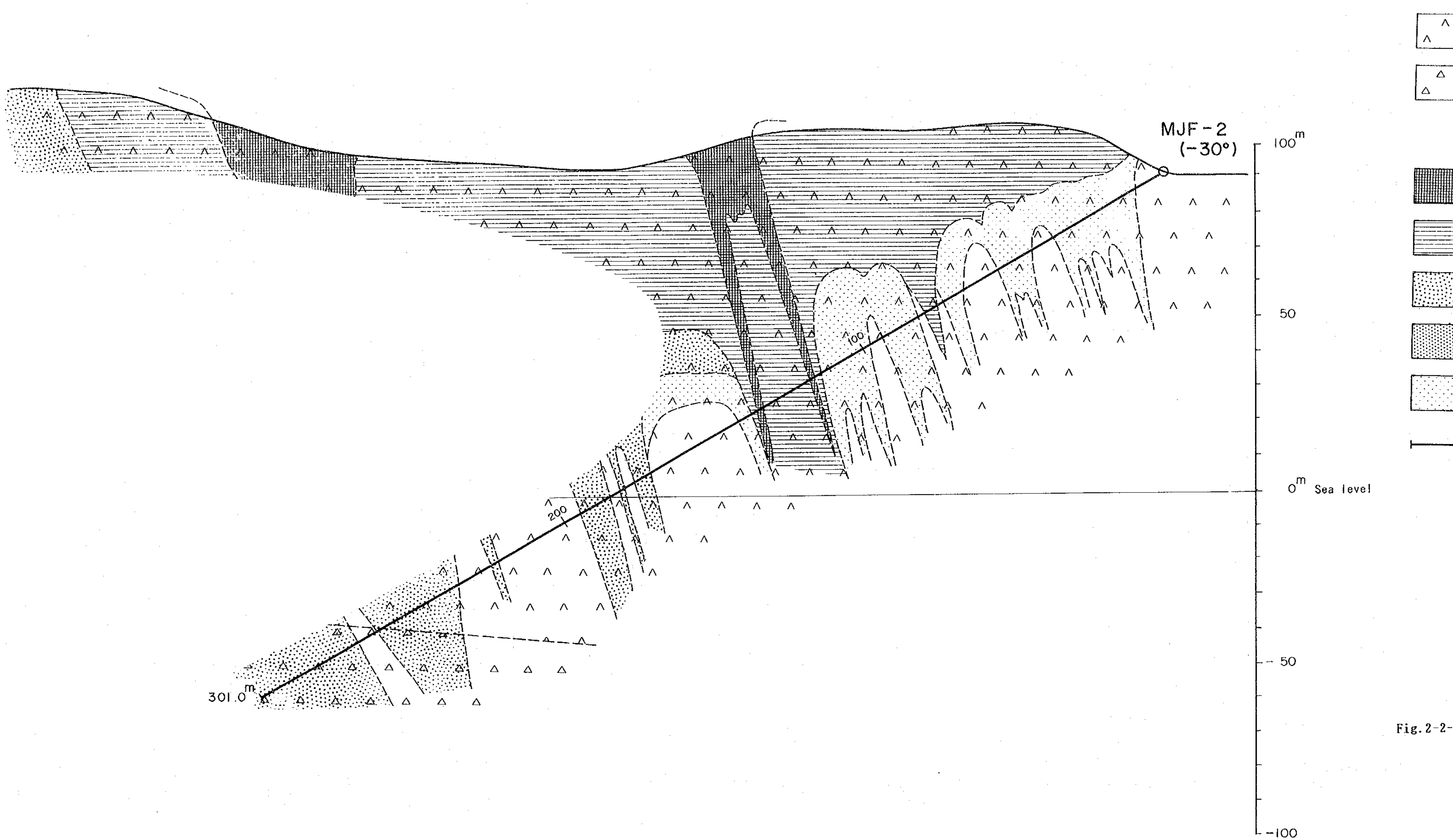


Fig. 2-2-1

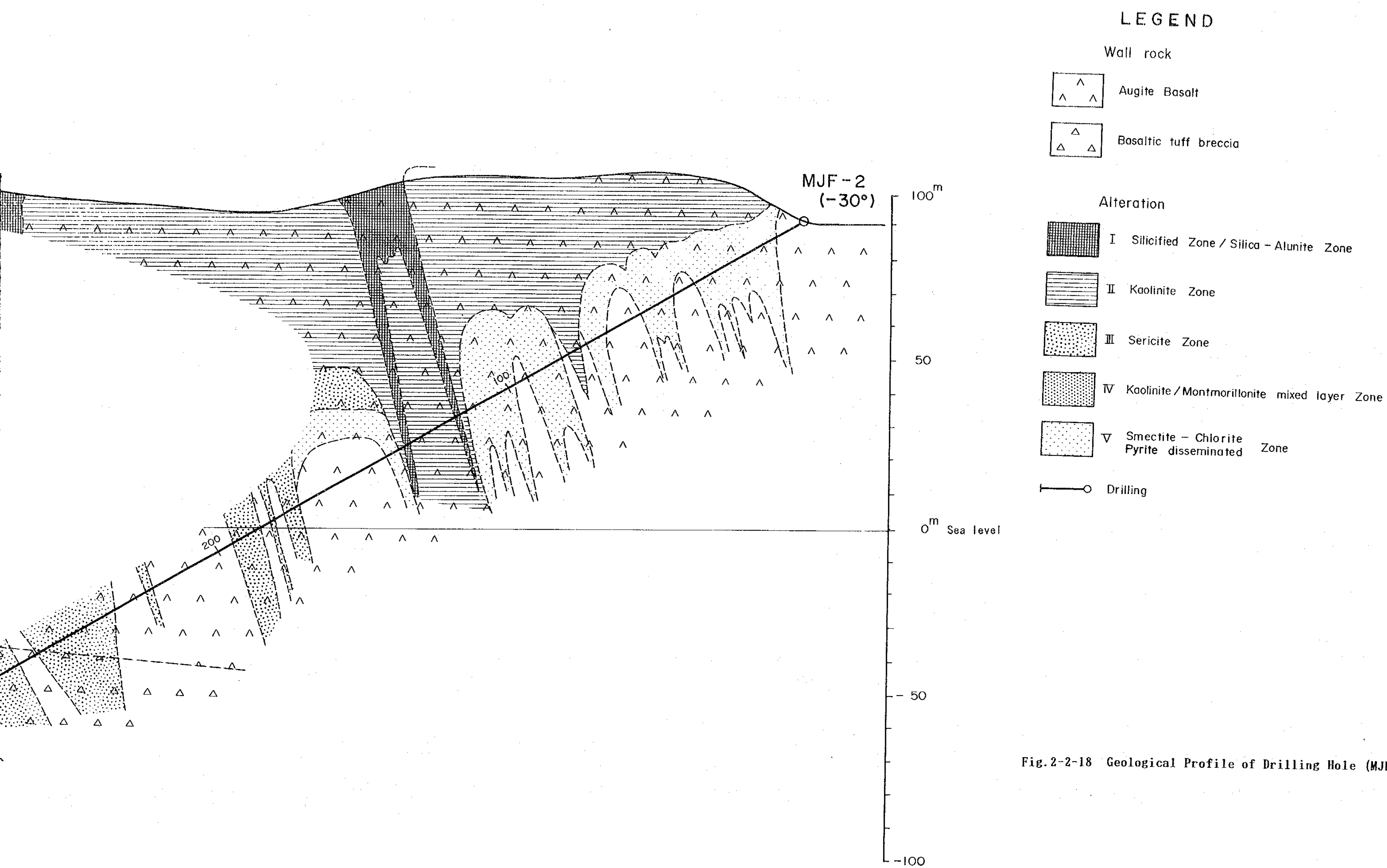


Fig. 2-2-18 Geological Profile of Drilling Hole (MJF-2)

Chapter 3 Sigatoka

3-1 Method of Survey

In the Sigatoka area, Colo Plutonic Suite occurs widely throughout the area, and there are wide zones of alteration and mineralization (porphyry copper type, skarn type etc.,) associated with these plutonic bodies. Based on these facts, it was considered that the area should be delineated as having relatively high resource potential. And it was selected for geological survey, geochemical prospecting and gravity survey in the second phase of this project.

The geological survey and geochemical prospecting were conducted simultaneously along the creeks and on the ridges, geochemical samples were usually collected at 400 m intervals.

The geochemical samples were collected from the B soil horizon in this area.

The details of the survey methods used for this survey are laid out in the "OVERVIEW 1-3-3".

3-2 Geology

3-2-1 Outline of geology

The geology of this area consists of Miocene Series, Pleistocene (?) Series, and igneous bodies intruded into the Miocene Series.

The Miocene Series consists of the Lower Tari and Upper Tari Formations of the Wainimala Group.

The Lower Tari Formation is composed mainly of basaltic volcanic products and associated andesite lava and limestone.

The Upper Tari Formation is composed of andesitic volcanic products and sedimentary rocks such as mudstone and sandstone.

The Pleistocene (?) Series consists of fluviatile conglomerate.

The intrusive bodies are Colo Plutonic Suite and volcanic dykes which intrude into the Upper Tari Formation.

The Colo Plutonic Suite is grouped into, age-wise, granodiorite-diorite porphyry bodies; and granodiorite, diorite, diorite porphyry, granite, quartz porphyry and aplite. The former group is older than the latter group.

The volcanic dykes are composed of basalt, andesite, dacite, and rhyolite.

The Miocene Series of this area generally has a superimposed and southwestward dipping structure.

3-2-2 Geological description

(1) Lower Tari Formation

Distribution

Throughout the area with the exception of the vicinity of Kambisi Village in the southwest side of the survey area and also west of Mt. Korokitu.

Lithology

The formation consists mainly of basalt lava and basaltic pyroclastics associated with andesite lava, silicic pyroclastics and limestone.

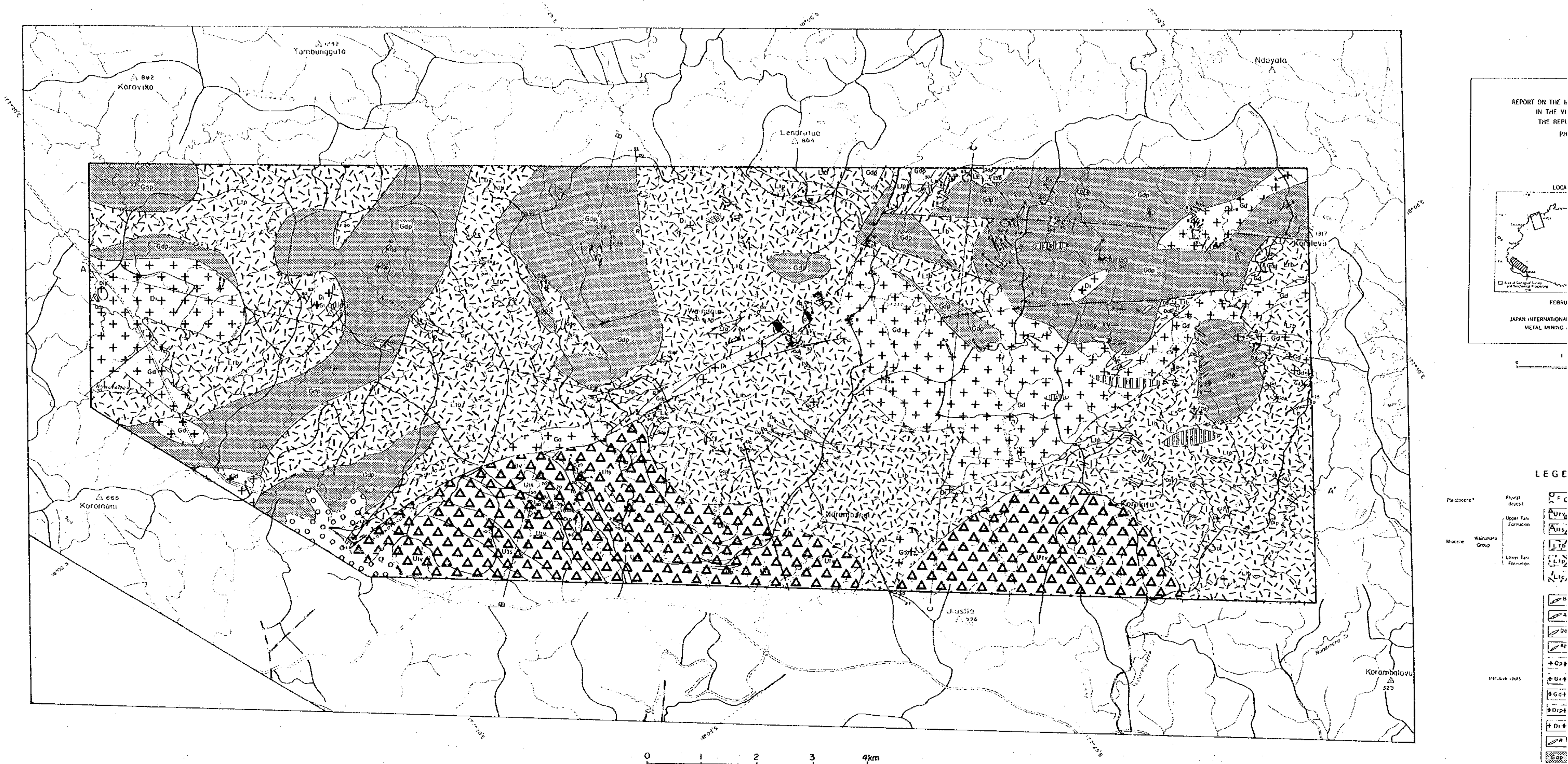
The basalt lava is dark green, compact, hard rock.It occuars as massive and also as brecciated lava and hyaloclastite. This rock usually contains augite phenocrysts of 1 mm in size and often is porous with amygdaloidal texture. It is also propylitized in many cases.

The basaltic pyroclastics is composed of tuff breccia, lapilli tuff, and tuff associated with tuffaceous sandstone and volcanic conglomerate consisting of granules. It is propylitized in many cases. The pyroclastics is well-sorted, the granules are propylitic basalt and the matrix is strongly compacted.

Andesite lava was identified by microscopic study of dark green brecciated lava from Tumbaivaka Creek in the north of Emuri Village and cannot be distinguished from basalt lava by unaided eyes. Thus, it was not possible to indicate the distribution of this rock in the geological map.

The silicic pyroclastics is composed of greenish white lapilli tuff and tuff distributed in the central part of the northeastern side of the area. It includes aphyric dacite to rhyolitic pebbles. In parts of this rock, it contains flat pumice and green patches, and show eutaxitic structure.

The limestone is dark gray, compact, hard, and homoge-



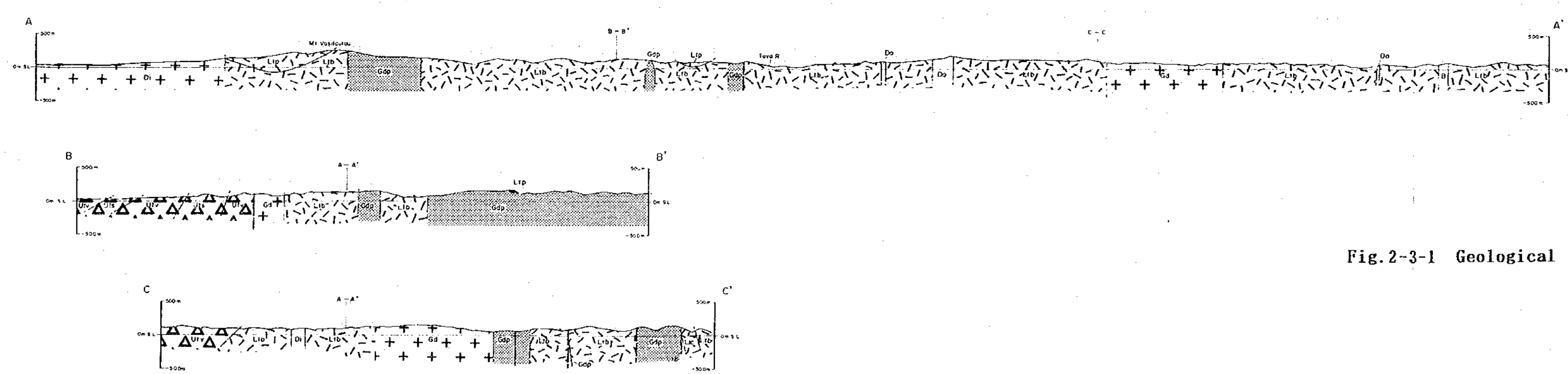


Fig.2-3-1 Geological Map with Geological Profiles of t

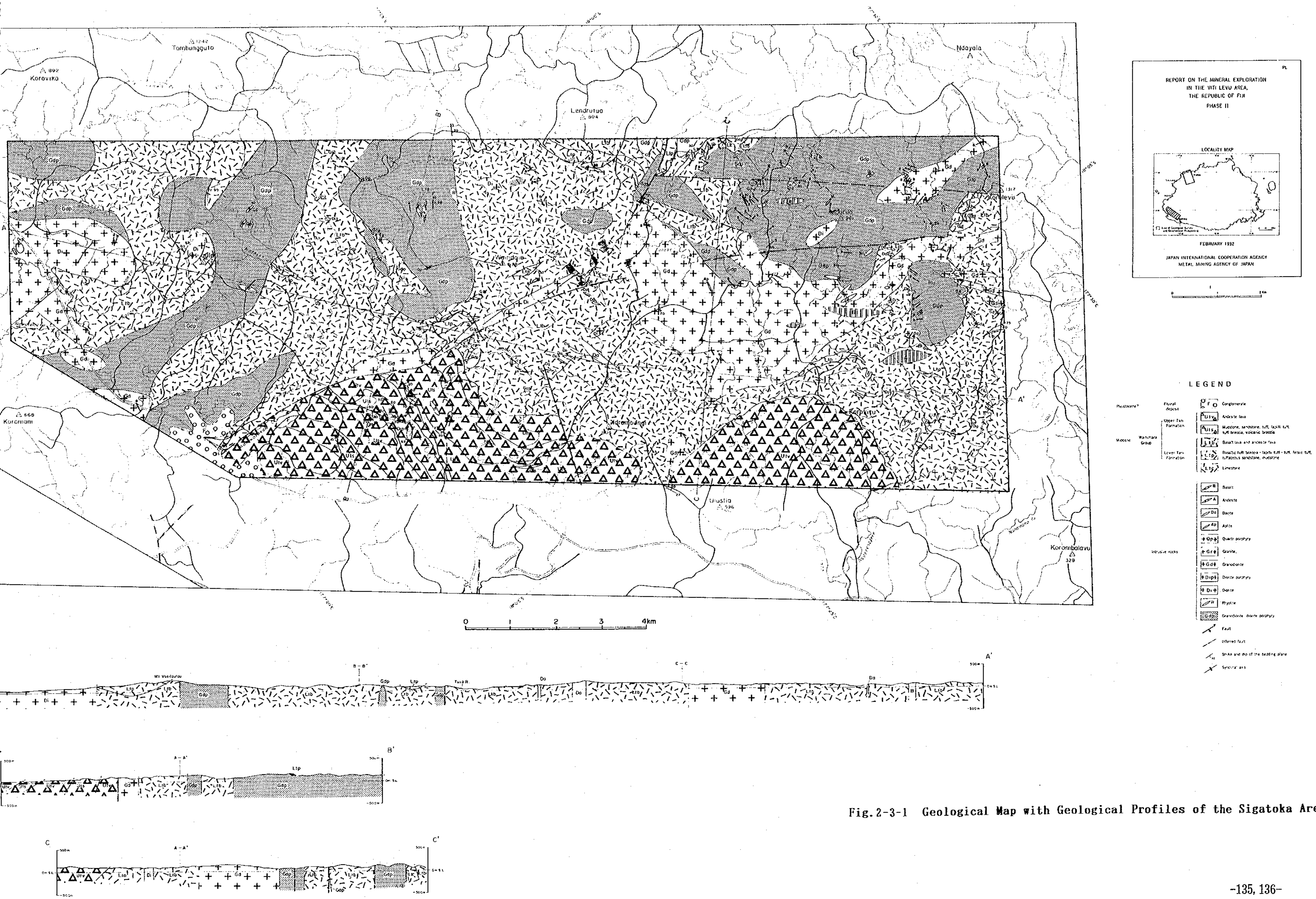


Fig. 2-3-1 Geological Map with Geological Profiles of the Sigatoka Area

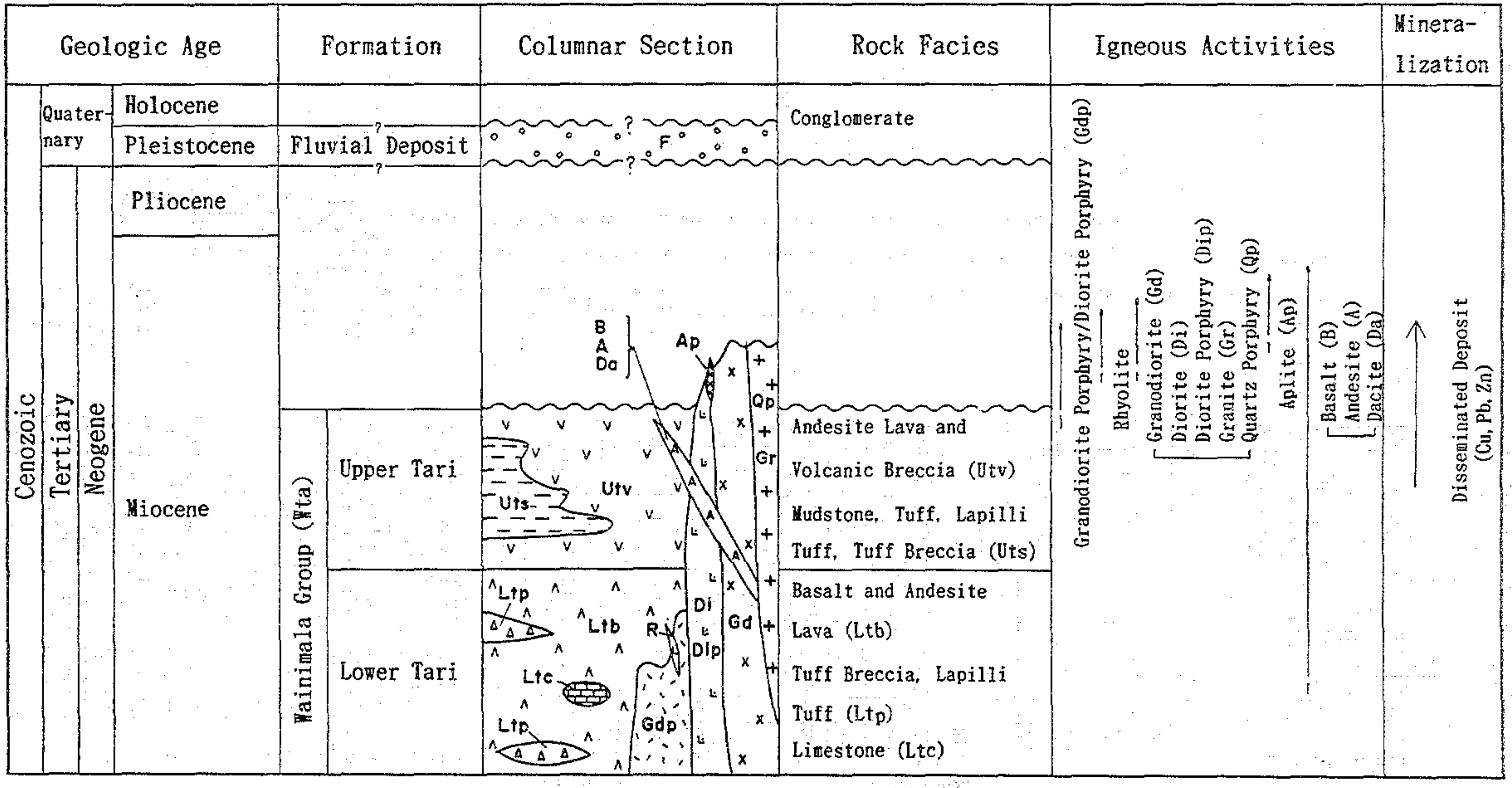


Fig.2-3-2 Schematic Stratigraphic Columns (Sigatoka Area)

Table 2-3-1 Results of Microscopic Observation of Thin Section (Sigatoka Area)

Sample No.	Locality	Rock Name	Formation	Texture	Phenocryst/ Crystal Fragment									Groundmass/ Matrix											Altered Mineral
					Qz	Kf	Pl	Bi	Hb	Au	Zr	Ap	Op	Si	Kf	Pl	Bi	Hb	Au	Hy	Ol	Op	Gl	Ap	
SM2-206	N of Waindolo	Dio	Int.	Oph.	△		◎		◎	○			○												Il(Pl-p) Chl Ca Mg(Hb) Sph(Op)
SM2-208	N of Korokitu	Qz-Po.	Int.	Porph.	◎		◎	△	△				△	○	◎	○							△		Il(Pl-p) Se(Bi, Gl) Chl(Bi, Hb, Gl) Mg(Hb)
SM2-209	Tumbaivaka Cr	Ad.	Wta	Porph.		◎			△					○		○		○				○			Se(Kf-p, Pl) Chl(Hb) gr-Amph(Hb) Qz-Chl-Opa(amygdaloidal)
SM2-210	SE of Waindolo	Dio.	Int.	Suboph.	△	△	◎		○	△			△												Ep Ca Sph(Hb) Ep Chl(interstitial min)
AY2-281	Voua Cr	Dio.	Int.	Suboph.	△		◎		◎				○												Act(Qz-f, Hb) Se-Ep(Pl) Mg(Hb) Ep(vein)
OK2-238	Tulasewa Cr	Gr-d.	Int.	Granul.	○		◎	○	○		△	△	△												Chl(Bi-p)
OK2-242	NW of Mburua	Bs.	Dyke	Porph.			△			△				△		◎			△			○	◎		Se(Pl) Ca(Pl, Au, Ol?) Chl(Au, Gl)
OK2-244	NW of Mburua	Dio-Po.	Int.	Porph.			○		△				△	○		◎		△				△	△		Se(Pl) Chl(Hb, Gl) Mg(Hb) Ep(Gl)
OK2-258	S of Waindolo	Ad.	Wta	Porph.			○		△				△	○		○						△	◎		Se(Pl-p) Chl(Hb, Gl) Mg Ep(Hb) Sph(Op-p)
KK2-290	S of korovika	Dio-Po.	Int.	Int-gra.			○			○			△	△	△	◎		○	○	△			○	△	Se(Hy)
KK2-291	S of Korovika	Gr-d-Po.	Int.	Porph.			◎		○				△	△	○	◎		△				△			Ep(Pl-p, Hb-p) Sph(Op-p)

Abundance of minerals: ◎ ; abundant, ○ ; common, △ ; a few

Abbreviations Texture: Granul; Granular, Porph; Porphyritic, Suboph; Subophitic, Oph; Ophitic, Int-gra; Intergranular

Mineral: Qz;Quartz, Kf;Alkali feldspar, Pl;Plagioclase, Bi;Biotite, Hb;Hornblende, Au;Augite, Zr;Zircon, Ap;Apatite, Op;Opaque mineral, Si;Silica mineral
Hy;Hypersthene, Ol;Olivine, Gl;Glass
Act;Actinolite, Ca;Carbonate, Chl;Chlorite, Ep;Epidote, gr-amph;green amphibole, Il;Illite, Mg;magnetite, Opa;opasite, Se;Sericite, Sph;Sphene,
-p;partly, -f;along fissur

Rock : Ad;Andesite, Bs;Basalt, Dio;Diorite, Dio-Po;Diorite Porphyry, Gr-d;Granodiorite, Gr-d-Po;Granodiorite Porphyry, Qz-Po;Quartz Porphyry

Formation: Int.;Intrusive rock

neous. It occurs as very small scale thin beds.

Stratigraphy

This formation is overlain conformably by Upper Tari Formation. The relation with the lower units is not clear. The pyroclastics and limestone of this formation is intercalated in the basalt-andesite lava.

(2) Upper Tari Formation

Distribution

Vicinity of Kambisi Village and to the west of Korokitu.

Lithology

It is composed of andesite lava, andesitic pyroclastics and sedimentary rocks.

The andesite lava is dark green to gray, compact, hard, and characteristically contains relatively large phenocrysts of hornblende (3-7 mm) and plagioclase (3 mm). It is propylitized in some places.

Andesitic pyroclastics is composed of volcanic breccia, tuff breccia, lapilli tuff and tuff. The volcanic breccia is intercalated locally in andesite lava as thin beds; tuff breccia, volcanic breccia, and tuff form alternation with the sedimentary rocks.

The sedimentary rocks consists of black to purple mudstone and sandstone, and thin beds of andesitic pyroclastics, basaltic tuff, and basalt are intercalated, and often form alternation. The compaction of this rock is high.

Stratigraphy

This formation overlies the Lower Tari Formation conformably and is overlain unconformably by fluviatile sediments.

In this formation, pyroclastics and sedimentary rocks are intercalated in andesite lava.

(3) Fluviatile sediments

Distribution

Small scale in the northwestern part of the area.

Lithology

This unit is weathered and is reddish brown. Pebbles and subangular boulders (20-30 cm) of volcanic rocks and matrix are weakly consolidated. It is argillized and the details are not clear.

Stratigraphy

This overlies the Upper Tari Formation unconformably.

This is considered to be of Pleistocene age from the degree of consolidation.

3-2-3 Intrusive rocks

(1) Granodiorite porphyry-diorite porphyry (Colo Plutonic suite)

Distribution

Many large stocks in the northeast side of the area.

Lithology

This rock is pale green to grayish white, compact, and contains plagioclase phenocrysts (2-4 mm) and very fine-grained mafic minerals, also phenocrysts of quartz and hornblende are often observed. This is often weathered brown to yellowish white and is considered to be dacite to andesite by the unaided eyes, but it was identified as porphyry microscopically. It is difficult to determine the boundary of granodiorite porphyry and diorite porphyry because of the strong weathering, thus it is treated as one unit. It is partly propylitized and argillized.

Time of Intrusion

This porphyry intrudes into the Lower Tari Formation, and is intruded by other members of the Colo Plutonic Suite and volcanic dykes.

According to the report of the first phase survey, the radiometric age of a rock in the northwest which is inferred to be this porphyry is 10.1 ± 1.6 Ma.

(2) Rhyolite

Distribution

As small dykes and stocks in the northern part of Mt. Mburua in the southeastern and northern part of Mt. Waindolo.

Lithology

White silicic rock with quartz and feldspar phenocrysts.

Time of intrusion

This intrudes into the granodiorite porphyry-diorite porphyry. The relation with other intrusive rocks is not clear. Since this rhyolite bodies occur only within the granodiorite porphyry -diorite porphyry bodies, the possibility of this rock being a segregation product from the magma which formed the Colo Plutonic Suite is considered.

(3) Diorite (Colo Plutonic Suite)

Distribution

Many large to small scale stocks distributed almost throughout the entire area.

Lithology

Many parts are weathered to sandy state and fresh parts are very rare. The rock consists of augite, hornblende, plagioclase of 1-2 mm size, and is partly micro-dioritic. Also some parts are argillized and pyritized.

Time of intrusion

This diorite intrudes into granodiorite porphyry-diorite porphyry.

(4) Diorite porphyry (Colo Plutonic Suite)

Distribution

As small stocks in the northwest, central, and southwestern part of the area.

Lithology

This porphyry is dark greenish gray, and has porphyritic texture composed of 2-3 mm size phenocrysts of hornblende and plagioclase. Parts of this rock is propylitized.

Time of intrusion

This porphyry intrudes into the Upper and Lower Tari-Formations.

(5) Granodiorite (Colo Plutonic Suite)

Distribution

Many stocks of varying size occur throughout the area.

Lithology

Many parts are weathered to sandy state and fresh parts are rare. The rock consists of 2 mm size biotite, hornblende, plagioclase, quartz, and others. It is argillized and pyritized in some parts.

Time of intrusion

This granodiorite intrudes into granodiorite porphyry-diorite porphyry bodies and is intruded by aplite, basalt, and andesite dykes.

According to the report of the first phase of this project, the radiometric age of a rock which is inferred to be this granodiorite is 8.1 ± 0.3 Ma.

(6) Granite (Colo Plutonic Suite)

Distribution

As very small stocks within the granodiorite porphyry-diorite porphyry in the southeast.

Lithology

The rock consists of 0.5-2 mm size quartz, potash feldspar, and chloritized mafic minerals. It is partly propylitized.

Time of intrusion

This intrudes into granodiorite porphyry-diorite porphyry.

(7) Quartz porphyry (Colo Plutonic Suite)

Distribution

As very small bodies within mainly granodiorite porphyry-diorite porphyry in the northwest and near granodiorite bodies in the southeast.

Lithology

This porphyry contains phenocrysts of quartz, plagioclase, hornblende, and biotite. It is often silicified and pyritized.

Time of intrusion

This rock intrudes into granodiorite porphyry-diorite porphyry bodies and the Lower Tari Formation.

(8) Aplite (Colo Plutonic Suite)

Distribution

As small bodies in the southeast.

Lithology

This is a leucocratic granitic rock forming dykes of several to 50 cm wide.

Time of intrusion

This rock intrudes into the granodiorite bodies and Lower Tari Formation.

(9) Basalt

Distribution

As dykes (often dyke swarms) within and vicinity of the plutonic bodies in the central to southeastern part of the area, only very few occurrences in the northwest.

Lithology

There are dark green, fine-grained, and compact type and doleritic type. They are both propylitized.

Time of intrusion

This basalt intrudes into the Upper and Lower Tari Formations, granodioritic bodies, and granodiorite porphyry-diorite porphyry bodies.

(10) Andesite

Distribution

As dykes in the central and southeastern part, and the distribution is to the southwestern side of the plutonic predominant zone.

Lithology

This andesite contains phenocrysts of plagioclase and hornblende, and is lithologically similar to the andesite lava in the Upper Tari Formation. It is silicified in the southeast.

Time of intrusion

This intrudes into the Upper and Lower Tari Formations, granodiorite and the granodiorite porphyry-diorite porphyry bodies.

(11) Dacite

Distribution

As dykes in the central and southeastern part of the area.

Lithology

This dacite is white to pale green and mostly aphyric and rarely with hornblende phenocrysts. Parts of this rock are silicified, argillized and pyritized.

Time of intrusion

This intrudes into the Lower Tari Formation and granodiorite porphyry-diorite porphyry bodies.

3-2-4 Geologic structure

The Yavuna Group which forms the basement of Viti Levu occurs 8-13 km north of this area.

The formations of this area is generally superimposed with southwestward dip.

There is a large WNW-ESE trending fault which extends from the northwest to the southeastern part of the area. It is partly estimated, but is confirmed in the Upper and Lower Tari Formations and in the granodiorite porphyry-diorite porphyry bodies. In the southeast, a fault parallel to the above and an estimated NW-SE trending fault exist in the Lower Tari Formation and granodiorite porphyry-diorite porphyry bodies and are cut by ENE-WSW trending estimated fault. Also in the central part of the area, NNE-SSW trending fault (partly estimated) exist in the upper and Lower Tari Formations.

Regarding the fold structure of this area, a ENE-WSW trending synclinal axis is observed in the Lower Tari Formation in the northeast, but data on the strike and the dip of the axis in this formation are insufficient and the structure cannot be clarified.

The following features are observed regarding the arrangement of the intrusive bodies in this area (Figs.1-3 & 2-3-3).

The granodiorite porphyry-diorite porphyry bodies are arranged in the WNW-ESE direction and the elongation of many individual bodies is in the ENE-WSW direction.

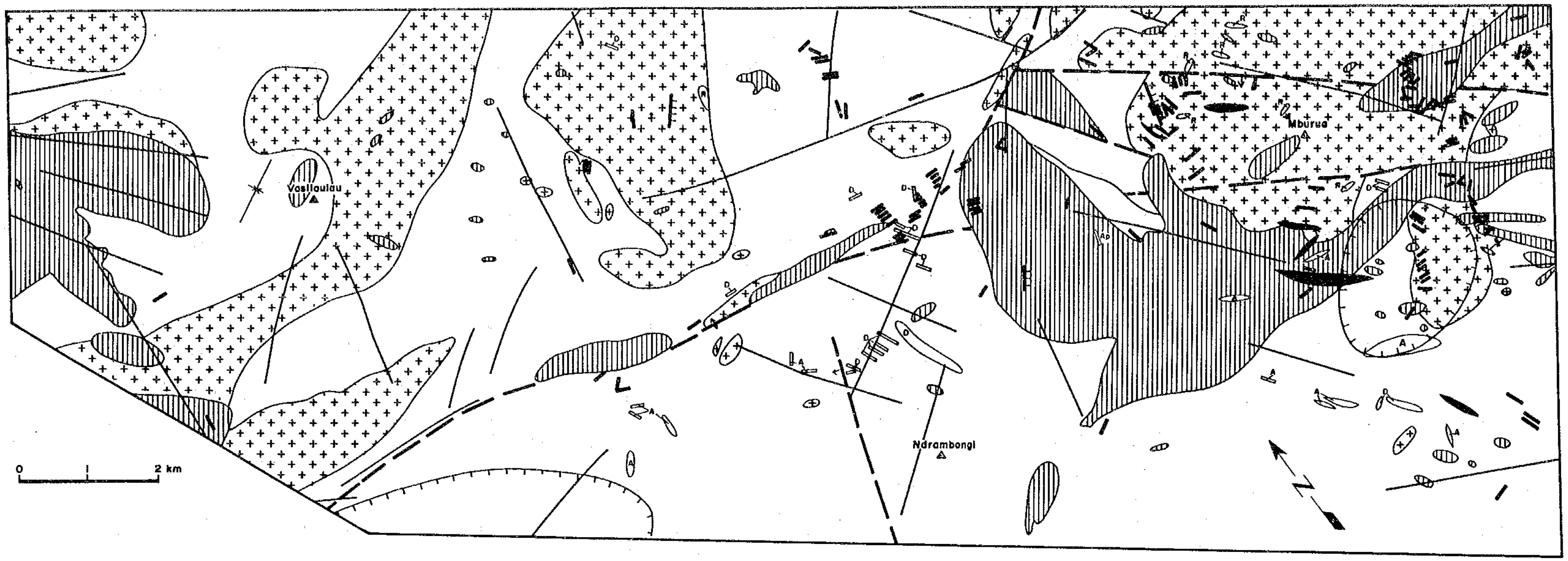
The granodiorite and diorite bodies are arranged in the WNW-ESE direction and the elongation of many individual bodies is in the E-W to WNW-ESE direction.

Regional airborne magnetic survey indicates the existence of a very large body (15km x 40km) extending in the WNW-ESE direction in subsurface zone. And it is considered that the small surface bodies are stocks or plugs branching out from this large body (Colly,1976).

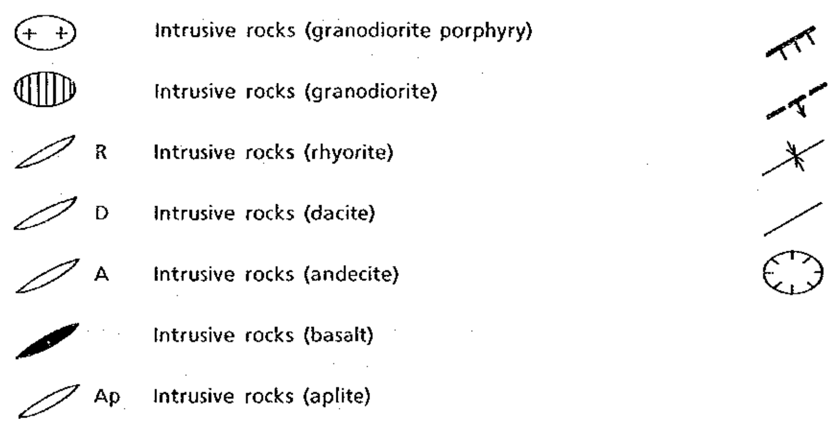
Many dacite dykes trend in the NW-SE to NNW-SSE direction and in the central part of the area, they form echelon dykes arranged in the E-W and N-S directions.

Many of the andesite dykes trend in the NW-SE to WNW-ESE direction.

The basalt dykes trend in various directions, but they have characteristic trends in each subarea. These trends are; ENE-WSW to WNW-ESE direction in the central part near the WNW-ESE fault system, NNW-SSE to NNE-SSW direction west of Mt.Mburua, and NW-SE direction southwest of Mt.Mburua. The basalt trends in many direction and is partly distributed in radial pattern in the northeast side of the southeast margin of the Sigatoka area.



LEGEND



	Intrusive rocks (granodiorite porphyry)
	Intrusive rocks (granodiorite)
R	Intrusive rocks (rhyorite)
D	Intrusive rocks (dacite)
A	Intrusive rocks (andecite)
	Intrusive rocks (basalt)
Ap	Intrusive rocks (aplite)
	Fault
	Inferred fault
	Synclinal axis
	Lineament on SLAR
	Short-wavelength gravity low (<-2 mgal)

Fig. 2-3-3 Structural Map (Sigatoka Area)

The andesite, dacite, and basalt form echelon dykes arranged in the NW-SE direction.

Lineaments identified to occur in this area by SLAR image analysis during the first phase survey trend in NW-SE, WNW-ESE, and NNE-SSW to NE-SW. The latter lineaments occur widely from the northwestern part to the central part of the area.

3-3 Mineralization and Alteration

3-3-1 Known mineral showings and past mineral exploration

A large number of small mineral showings have been known in this area (Fig.1-6) and various exploration activities have been undertaken in the past.

Many of these showings occur near the contact of Colo Plutonic Suite and Wainimala Group and the mineralization is of skarn or porphyry copper type.

The existence of Colo Plutonics has not necessarily been confirmed near these mineral showings by the present survey, but it is believed that the plutonic body in the shallow zone is related to mineralization. Although the Colo Plutonic Suite occurs as small independent bodies on the surface, drilling results and regional airborne magnetic survey conducted by Barringer Fiji Ltd., indicates the existence of a very large body (15 km × 40 km) extending in the WNW-ESE direction in subsurface zone. And it is considered that the small surface bodies are stocks or plugs branching out from this large body.

These showings are as follows.

(1) Tulasewa Prospect

It is located in the southeastern part of the survey area. The mineralization is of skarn type.

Amoco Minerals Fiji Ltd., (Amoco) conducted geochemical prospecting, surface magnetic survey, IP, resistivity, PEM (Pulse electromagnetic method), and drilling (5 holes, 591.2 m) in 1976-1977. But noteworthy mineralization was not found.

(2) Korokitu Tig. Prospect

It is located in the southeastern part of the survey area.

Consolidated Gold Field (Fiji) Ltd., carried out geochemical prospecting (stream sediments, rocks) in 1980-1981, but both gold and base metal occurrences were of low grade. The type of mineralization is not clear.

(3) Voua Creek Mineral Showing

It is located in the southeastern part of the survey area. This is said to be formed by Cu-Pb-Zn mineralization, but the type is not known.

(4) Tuva River Mineral Showing

It is located in the central part of the survey area. This is said to be formed by skarn type Cu mineralization.

(5) Natualevu Prospect

It is located in the central part of the survey area.

Amoco conducted geochemical prospecting (soil, rocks), surface magnetics, IP, long drilling (2 holes, 479.1 m), and short percussion drilling (10 holes, 257 m). They located weak Au-Ag-Cu-Zn mineralized zone. It is said to be skarn type.

(6) Naitaki Creek Prospect

It is located in the central part of the survey area.This is said to be formed by porphyry copper type mineralization.

Amoco conducted geochemical prospecting (stream sediments) and located very large Au geochemical anomaly zone (Au over 100 ppb) extending for 15 kl 1974-1979. Further investigation by Consolidated Gold Field (Fiji) Ltd., could not confirm the anomaly and they refute the results of Amoco.

(7) Kule Prospect and Kule Creek Prospect

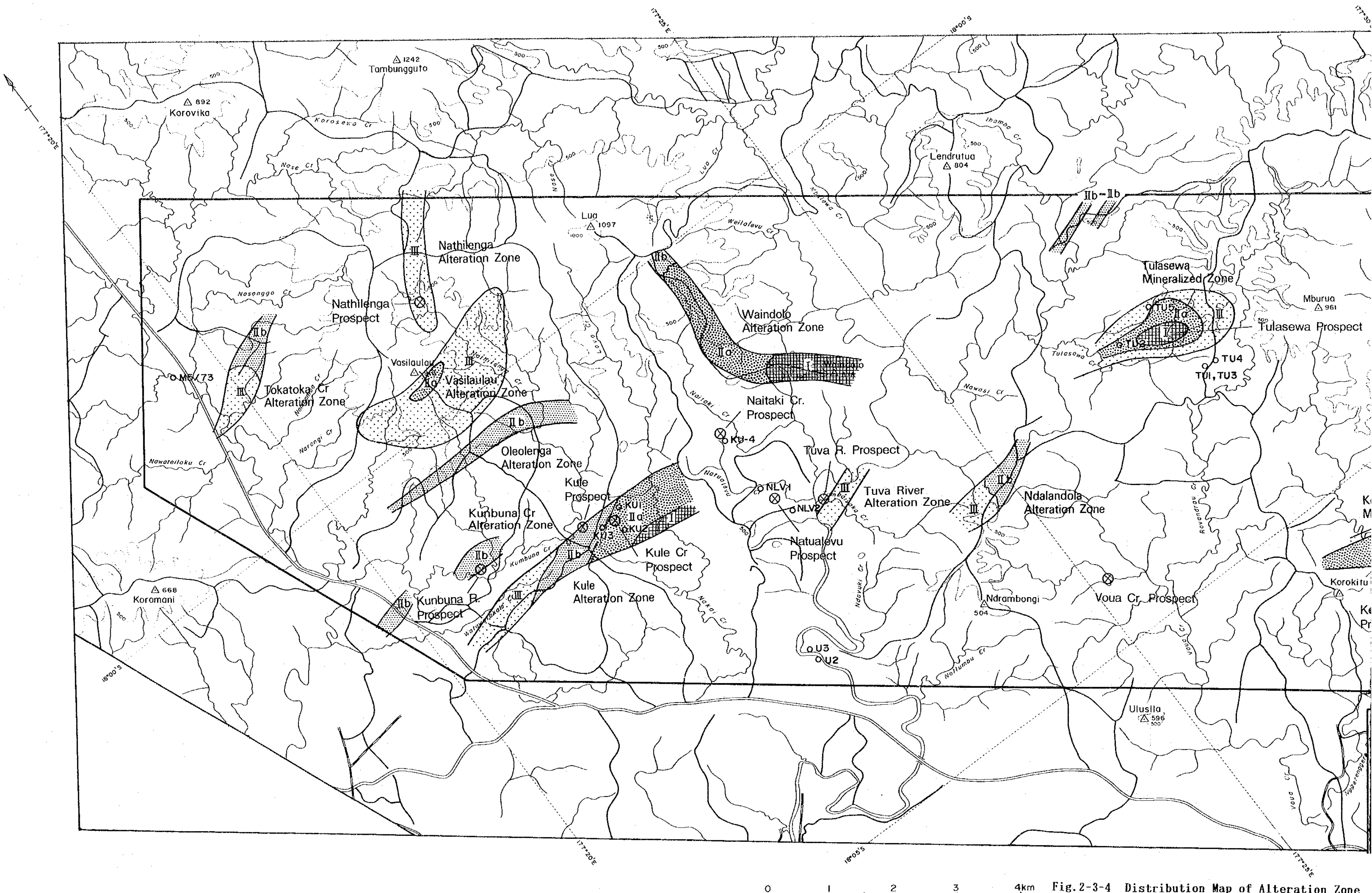
It is located in the northwestern part of the survey area. These are said to be formed by porphyry copper type mineralization.

Amoco carried out rock geochemical prospecting, surface magnetic survey, IP, and drilling (4 holes, 610.0 m) in 1977 and located weak Cu-Zn mineralization.

(8) Nathilenga (Nacilega) Prospect

It is located in the northwestern part of the survey area. This is said to be formed by porphyry copper type mineralization.

Aomco carried out soil geochemical prospecting, surface magnetic survey, IP, resistivity, and drilling (5 holes, 766.5 m) and located weak Cu-Mo mineralization in 1976. But it was concluded not to be economically feasible.



0 1 2 3 4km

Fig.2-3-4 Distribution Map of Alteration Zone (Sigatoka Area)

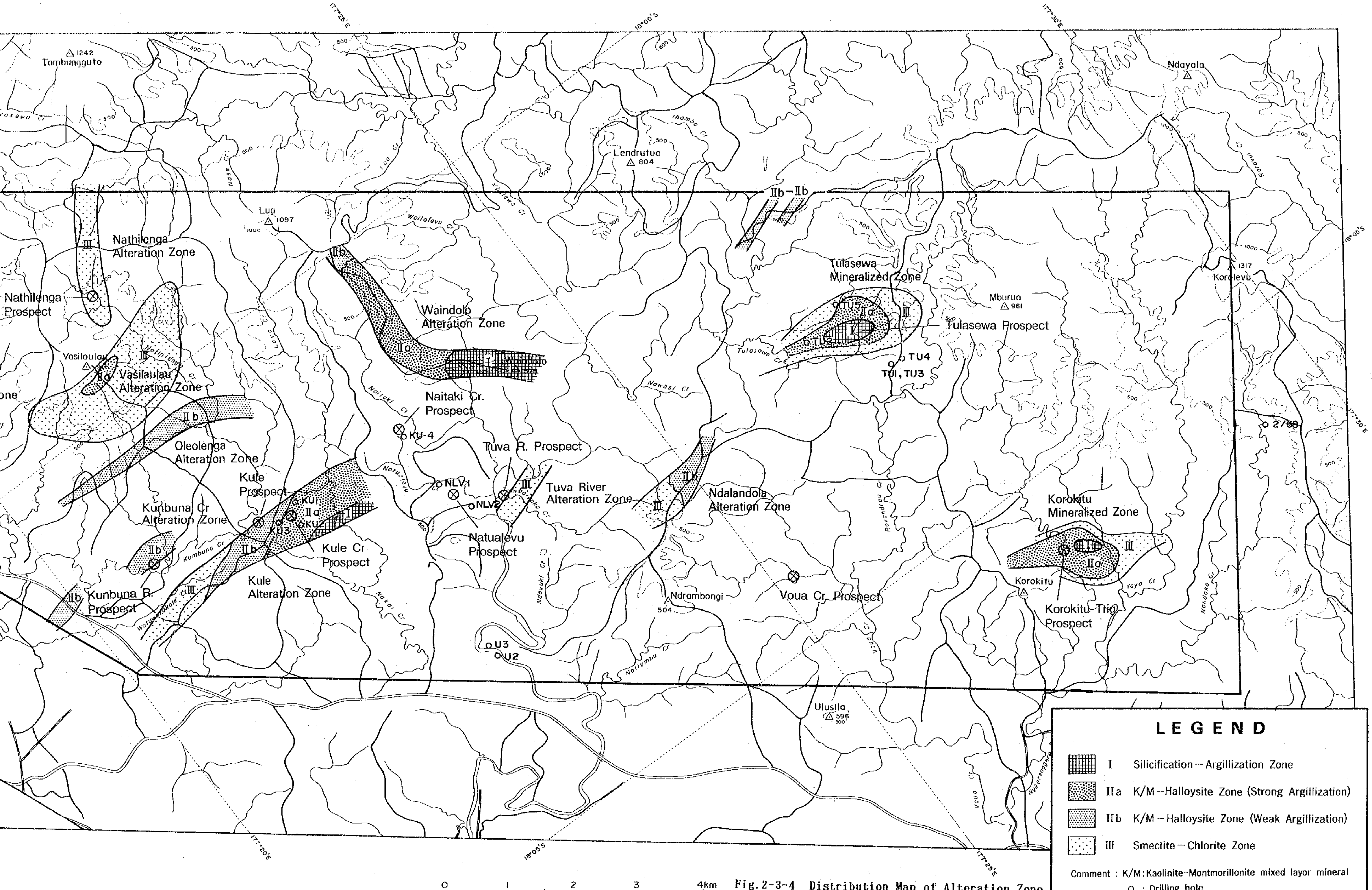


Fig. 2-3-4 Distribution Map of Alteration Zone (Sigatoka Area)

(9) Kumbuna (Kubuna) River Prospect

It is located in the northwestern part of the survey area. This is said to be formed by skarn type mineralization.

Mineralization was located in siliceous limestone exposures (Cu 0.15% ,Pb 1.45% ,Zn 3.8% ,Mo 375ppm), but it has not been drilled.

3-3-2 Mineralization and alteration

The following mineralized and altered zones were discovered by the present survey. But many of them coincide with the above prospects (Fig.1-6,Fig.2-3-4).

Surface weathering is very intense and distinction between the altered zones and weathered zones were often difficult in this area. Thus, even those areas described as altered were treated as weathered zones unless significant alteration minerals were identified by X-ray diffraction (Table 2-3-2).

Also, as in Mba West, ethylene glycol treatment, heating, and hydrochloric acid treatment were used in alteration mineral identification when necessary.

(1) Tulasewa Alteration Zone

This is an argillized zone developed in the WNW-ESE direction with areal extent of 1 km x 2.5 km. It is located to the east of Tulasewa Village. Silicified and pyrite dissemination occur scattered in this zone.

Zonal arrangement of altered minerals are confirmed by X-ray diffraction, but the mineral assemblage differs considerably from that of Mba-west (Fig.2-3-5). Namely, silicified-argillized subzone (Subzone Ⅰ) composed of quartz-kaolinite occurs in the center and argillized subzone (Subzone Ⅱ) composed of halloysite-kaolinite/montmorillonite mixed layer assemblage occurs on the outerside.

Subzone Ⅱ of this zone is strongly argillized and plagioclase does not remain. But in other altered zones of this subzone, weak argillization with similar mineral assemblage but with remaining plagioclase is observed . Thus, that without remnant plagioclase is termed Subzone Ⅱ-a, and that with remnant plagioclase Subzone Ⅱ-b.

On the outerside of Subzone Ⅱ, weak argillized subzone (Subzone Ⅲ) composed of smectite-chlorite assemblage is dis-

Table 2-3-2 Results of X-Ray Diffraction Analysis (Sigatoka Area)

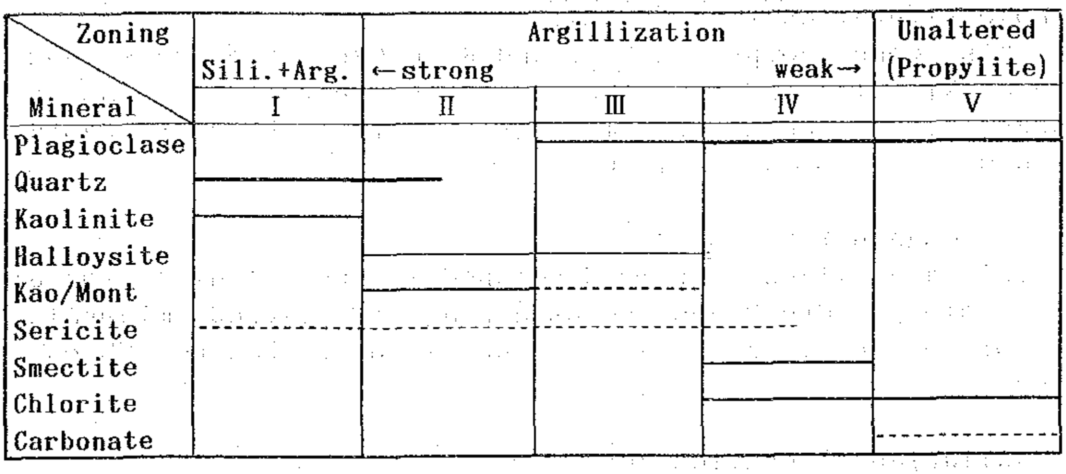
Sample	Clay minerals									Silica		Feldspar		Carbonates			Oxides		Sulfides		Others		
No.	SME	CHL	SER	KAO	HA	SRP	C/M	K/M	ZEO	QTZ	TRI	PLA	KFL	CAL	ARA	DOL	GOE	HEM	PYR	SPH	OLI	AMP	PX
ST204	▲?									◎		◎											△
ST205	▲?							▲		◎		◎		▲?									△?
SM211			△					▲		◎													
SM212			△					▲		○		○											▲
SM216			▲?							◎		◎											
AY210	○	△							△	○		◎										○	
AY211	▲?							△	○	△?		○										△	
AY212										◎		◎											
KK205			△					▲		◎		△?							▲?				
KK206								○		○									▲				
ST208	△									◎		○											▲?
ST209	▲		△							◎									▲				▲?
OK2248		△								◎		◎											
OK2252	△	△							△?		▲	○	△?	△?	△?							△	
SM201			△	△						◎		△?											
SM202			△	▲						◎							▲?						
SM203			△							◎		○						▲					
KK204								△		○								▲?	▲				
KK210						▲?		△		◎		○											
SM217	△	○	▲							◎		○											
SM206								▲		◎		◎											
SM214			▲					▲		○		○					▲?						
SM215	△			▲						◎		◎											
OK204			△					△		◎													
OK205			△					▲		◎													
OK206									▲	○		◎											
KK208	▲									○		◎											
AY2232		△								○		○				○?			△?			○	
OK202					▲			△		○													
SM207			△	○			△			◎									▲?				
SM208					△			△		◎													
AY201					△?			△		◎		▲?											
AY203	△	△								◎		○											
AY213								▲	▲	○									▲?	△			
AY2306		△							△	○		○							△				

Abbreviations

◎:Abundant ○:Common △:Few ▲:Rare

SME:Smectite, CHL:Chlorite, SER:Sericite, KAO:Kaolinite, HA:Halloysite, SRP:Serpentine, MON:Montmorillonite, C/M:Chl/Mon mixed layer mineral, K/M:Kao/Mon mixed layer mineral, ZEO:Zeolite, QTZ:Quartz, TRI:Trydymite PLA:Plagioclase, KFL:Potassium feldspar, CAL:Calcite, ARA:Aragonite, DOL:Dolomite, Goethite, HEM:Hematite, PYR:Pyrite, SPH:Sphalerite, OLI:Olivine, AMP:Amphibole, PX:Pyroxene tributed. Subzones Ⅰ to Ⅲ are accompanied by some sericite.

Green rocks composed of chlorite-(carbonates) are widely distributed outward from Subzone Ⅲ. This is not a product of alteration associated with mineralization, but is considered to be formed by diagenesis after the burial of Wainimala Group, or by regional metamorphism by the intrusion of the Colo Plutonic suite in shallow subsurface zones. In this report, this green rock will be treated as the host rock (unaltered) of alteration.



Kao/Mont:Interstratified Kaolinite/Montmorillonite
Sili.:Silicification, Arg.:Argillization,

Fig.2-3-5 Alteration zoning by mineral assemblage (Sigatoka area)

2) Korokitu Alteration Zone

This is a silicified-argillized zone extending in the NW-SE direction and developed into 1 km × 2 km scale. Mineral zoning similar to Tulasewa Alteration Zone is evident. It is located on the northeast side of the Korokitu Triangulation Point. It is, namely, concentric arrangement of, center outward, quartz-kaolinite subzone (Subzone Ⅰ), halloysite-kaolinite/montmorillonite mixed layer subzone (Subzone Ⅱ-a), smectite-chlorite subzone (Subzone Ⅲ).

(3) Ndalandola Alteration Zone

This is a small E-W extending argillized zone distributed in the upper reaches of the Ndalandola River. The zonal arrangement of altered minerals of this zone is, Subzone Ⅱ-b to Subzone Ⅲ from the east westward. Pyritization is strong and some chalcopyrite dissemination is observed. Mineral prospect related to this altered zone has not been reported.

(4) Waindolo Alteration Zone

This is an altered zone extending from the southeastern side of the Lua Triangulation Point to Waindolo Triangulation Point. This zone has belt-form and its trend near Lua is N-S and bends to NW-SE near the Waindolo Point. This is the strongest altered zone confirmed in Sigatoka, but there is no record of mineralized prospect.

The zonal arrangement of altered minerals is Subzones I → II-a → II-b from the southeast northward.

(5) Kule Alteration Zone

This zone comprises Kule and Kule Creek Prospects and is 0.5-0.8 km wide and 4 km long in the E-W direction. The zonal arrangement of the altered minerals is, from the east westward; Subzones I → II-a → II-b → III.

(6) Oleolonga Alteration Zone

This argillized zone is developed in the E-W direction along the Oleolonga Creek and the assemblage of altered minerals is that of Subzone II-b. Related mineralization has not been reported.

(7) Vasilaulau Alteration Zone

This is a weakly argillized zone which is 1 km wide and 3 km long in the E-W direction and is located to the south of the Vasilaulau Triangulation Point. The mineral assemblage is mostly that of Subzone III, but there are locally strongly argillized Subzone II-a alteration.

(8) Nathilenga Alteration Zone

This is a weakly argillized zone in the upper reaches of the Nathilenga Creek. The assemblage of altered minerals of this zone is of Subzone III. The zone has NE-SW trend and coincides with the Nathilenga Prospect.

(9) Tokatoka Creek Alteration Zone

This is a weakly argillized zone developed in the NE-SW direction along the Tokatoka Creek. The assemblage of altered minerals are of Subzones II-b and III.

There are further, in Sigatoka area, the following small altered zones; Tuva River (ENE-WSW, Subzone III), Kumbuna Creek (E-W, Subzone II-b), Watawatakala (E-W, Subzone II-b) and others. Related mineralization have been reported in former two altered zones but have not in the last one.

Regarding Voua Creek, Natualevu, and Naitaki Creek Prospects, local pyrite-silicified parts were found, but corresponding altered zones could not be confirmed.

3-3-3 Discussions regarding mineralization and alteration

Ten (10) samples (including accidentals) collected from quartz veins, silicified rocks, and pyrite disseminated parts were analyzed at the Chemex Labs Ltd., in Canada. Total of six elements, namely Au, Ag, Cu, Pb, Zn, and Mo were analyzed.

The analytical results are laid out in Table 2-3-3. It is seen that minor amounts of Ag and Cu were detected in the gossan of Natualevu Prospect, but otherwise noteworthy grades were not found (OK204, Ag 7g/t, Cu 0.09 %).

Although many prospects and mineral showings occur in this area, the associated alteration is relatively weak and some are without notable altered zones.

The host rocks of porphyry copper type deposits generally have the following zonal arrangement of altered rock assemblages; potash zone (quartz-potash feldspar-biotite) → phyllic zone(quartz-sericite-pyrite) → argillized zone (quartz-kaolin-chlorite) → propylite zone (chlorite/epidote-calcite-adularia albite).

Although there are local strongly altered zones with quartz-kaolinite assemblage, the altered zones of Sigatoka mostly consist of weakly acidic alteration with halloysite-kaolinite/montmorillonite mixed layered mineral assemblage and neutral alteration with smectite-chlorite mineral assemblage and are quite different from those of the typical porphyry type mineralization.

It appears reasonable to consider that alteration characteristic of porphyry copper type mineralization is not developed in Sigatoka. Although there are examples of bona fide porphyry copper deposits such as the Namosi of Fiji which do not show typical porphyry alteration zoning. The prospects , which were considered to be porphyry type mineralization in Sigatoka, are treated here as small dissemination type mineralization associated with the intrusion of Colo Plutonic Suite.

Concerning mineralization classified as the skarn type, it was not possible to confirm the mineralized body itself, but judging from the very thin limestone lenses intercalated in the Wainimala Group, and also from the fact that skarn minerals were not detected in the associated altered zones, the possibility of locating large skarn deposits in the area is very low.

Table 2-3-3 Results of Chemical Analysis of Ore Samples (Sigatoka Area)

Sample No.	Location	Descriptipn	Dip-strike	Width (m)	Ore Grade					
					Au g/t	Ag g/t	Cu %	Pb %	Zn %	Mo %
KK203	Tulasewa Creek	Gossan	N80°E, 60°N	0.4	<0.07	<0.5	<0.01	0.01	0.01	<0.001
OK201	"	Quartz vein	N57°W, 70°S	1.0	<0.07	<0.5	<0.01	<0.01	0.01	<0.001
SM202	"	Silicified rock	N87°W, 55°S	1.2	<0.07	<0.5	<0.01	<0.01	<0.01	<0.001
SM203	"	Quartz float		φ1.5	<0.07	<0.5	<0.01	<0.01	<0.01	<0.001
OK204	Natualevu Creek	Gossan			<0.07	7.0	0.09	0.01	0.02	<0.001
KK204	Kule	Py dissem. ore			<0.07	<0.5	<0.01	<0.01	0.01	<0.001
SM201	Nathilenga Creek	Sil-lim gossan	N53°W, 75°N	0.5	<0.07	0.7	<0.01	<0.01	<0.01	0.001
ST204	Watawatakala Cr.	Argill. rock			<0.07	<0.5	<0.01	0.01	<0.01	<0.001
ST202	Vunayasi Creek	Quartz vein			<0.07	<0.5	<0.01	0.01	<0.01	<0.001
AY2305	Korokitu	Py-sil. rock			<0.07	<0.5	<0.01	<0.01	<0.01	<0.001

Abbreviation Py:Pyrite, dissem:disseminated, Argill:Argillizated, Sil:Silicified

3-4 Geochemical Prospecting

3-4-1 Methods employed

Geochemical prospecting using B horizon soil samples was carried out over an area of 160 k㎡ in order to extract promising mineral prospects.

The collected soil samples were dried naturally under the sun, sieved to -80 mesh, and chemically analyzed at Chemex Labs Ltd., of Canada.

A total of 660 samples were collected and the contents of nine elements, Au, Ag, Cu, Pb, Zn, As, Sb, Hg, Mo were analyzed. The analytical methods for each element and the limit of detection are as follows.

Analytical Procedures (Sigatoka Area)

Element	Method	Detection Limit	Upper Limit
Au	Fuse, FA-AAS	5ppb	10,000ppb
Ag	HNO_3/Aqua Regia digestion, AAS	0.2ppm	100.0ppm
Cu	HNO_3/Aqua Regia digestion, AAS	1ppm	10,000ppm
Pb	HNO_3/Aqua Regia digestion, AAS	1ppm	10,000ppm
Zn	HNO_3/Aqua Regia digestion, AAS	1ppm	10,000ppm
As	HNO_3/Aqua Regia digestion, AAS	1ppm	10,000ppm
Sb	$HCl/KClO_3$ digestion, extraction, AAS	0.2ppm	1,000ppm
Hg	HNO_3/HCl digestion, AAS	10ppb	100,000ppb
Mo	HNO_3/Aqua Regia digestion, AAS	0.05ppm	100.0ppm

FA :Fire Assay

AAS:Atomic Absorption Spectrometrys

3-4-2 Results of analysis

The analytical results are laid out in Appendix 2.

The contents of heavy metals are generally low. Of the total of 660 samples; Au content was below the limit of detection in 656 samples (99.4%), Ag in 656 samples (99.4%), Pb in 502 samples (76.1%), As in 606 samples (91.8%), Sb in 653 samples (98.9%), and Mo in 640 samples (97.0%). The contents of Cu, Zn, Hg were above the detection limit in all samples.

3-4-3 Statistical treatment

With the samples of this area, as in the case of Mba West, there are many samples containing elements below the detection limit and the correlation among the components is very weak. Thus, it was concluded that multivariate analysis of these data would not produce meaningful results.

Therefore, anomalous zones were extracted by threshold values for each component in the same process as for the Mba West samples.

Anti-logarithm was used rather than the natural logarithm for the following analysis and 1/2 of the detection limit was used as the content for elements under the detection limit.

Basic statistic values are shown below (Table 2-3-4).

Table 2-3-4 Basic statistics (Sigatoka Area)

	Au	Ag	Cu	Pb	Zn	As	Sb	Hg	Mo
	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Average (m)	2.6	0.1	36	2	81	0.6	0.4	28	0.6
Standard deviation(σ)	0.8	0.0	38	11	74	0.8	0.7	16	0.4
Maximum	20	0.3	500	250	800	10	4.0	140	5
Minimum	<5	<0.2	2	<1	1	<1	<0.2	10	<1
Detection limit	5	0.2	1	1	1	1	0.2	10	1
m+σ	3.4	0.1	74	13	155	1.4	1.1	44	1.0
m+2σ	4.2	0.1	112	34	229	2.2	1.7	60	1.3
Threshold	5	0.2	120	30	230	1	0.2	60	1

(2) Correlation of components

One half (1/2) of the detection limit values were used as the contents of the components existing in amounts less than the limit of detection. Since there are many such samples, the correlation among the individual components is very low. Only some correlation can be observed between Pb and Zn (correlation coefficient 0.4299).

Correlation coefficients of Soil Assay (Sigatoka Area)

	Au	Ag	Cu	Pb	Zn	As	Sb	Hg	Mo
Au	1.0000	-0.0052	0.1581	-0.0078	-0.0396	-0.0103	-0.0038	0.0110	-0.0096
Ag		1.0000	0.1211	0.2033	0.2212	0.1122	-0.0045	0.0963	0.1617
Cu			1.0000	0.1709	0.1869	0.1240	-0.0413	0.0891	0.0877
Pb				1.0000	0.4299	0.1856	-0.0016	0.0532	0.0402
Zn					1.0000	0.0795	-0.0257	0.0783	0.0436
As						1.0000	0.0175	0.0785	0.1576
Sb							1.0000	-0.0033	-0.0027
Hg								1.0000	0.0237
Mo									1.0000

(3) Distribution pattern of geochemical data

Logarithmic frequency distribution diagrams for each component were prepared in order to clarify the statistical distribution types of the geochemical data of this area (Fig.2-3-6). From the results, it is inferred that Hg show lognormal distribution and Zn normal distribution. Cu clearly show non-normal distribution and the types of other components cannot be determined.

(4) Determination of threshold values

Cumulative frequency distribution diagram for each component was drawn on logarithmic probability graph paper (Fig.2-3-7).

The Pb diagram shows a clear breaking point at 5 ppm (probability 4%) and this was determined as the threshold value.

The Zn diagram shows a gentle breaking point near 160 ppm (prob. 7%) and as this is close to $m + \sigma$ (160 ppm), $m + \sigma$ was used as the threshold.

The Cu diagram shows breaking point only in the very low probability parts and it was not possible to determine the threshold. Thus $m + \sigma$ (74 ppm) was used as the threshold.

The Hg diagram shows only an insignificant break near 60 ppb (prob. 5 %), but this coincides with $m + 2\sigma$ (60 ppb) and thus was used.

Breaking points reflecting the population do not occur in the diagrams for Au, Ag, As, Sb, Mo. When $m + \sigma$ was used as the threshold, anomalies would appear in a very small number of samples, namely four samples for Au, four for Ag, 23 for As, two for Sb, and 20 for Mo. Thus, all values exceeding the detection limit were treated as anomalies for the above five elements.

3-4-4 Distribution of geochemical anomalies

Zones with contents higher than the threshold were extracted from the iso-grade maps for each element and were graded as geochemical anomalies (from Figs.2-3-8 to Fig.2-3-12).

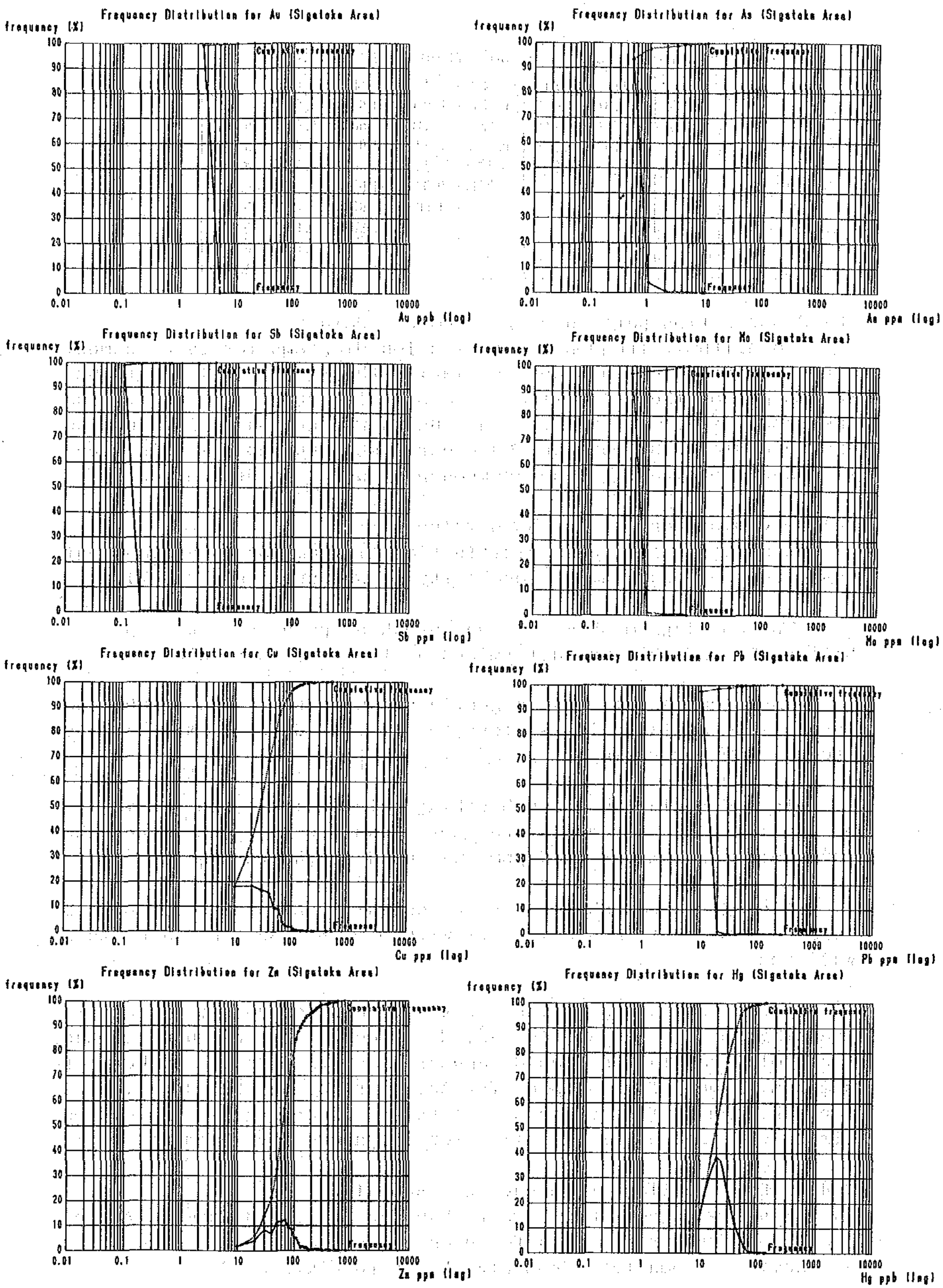


Fig.2-3-6 Frequency Distribution and Cumulative Frequency Distribution of Soil Assey (Sigatoka Area)

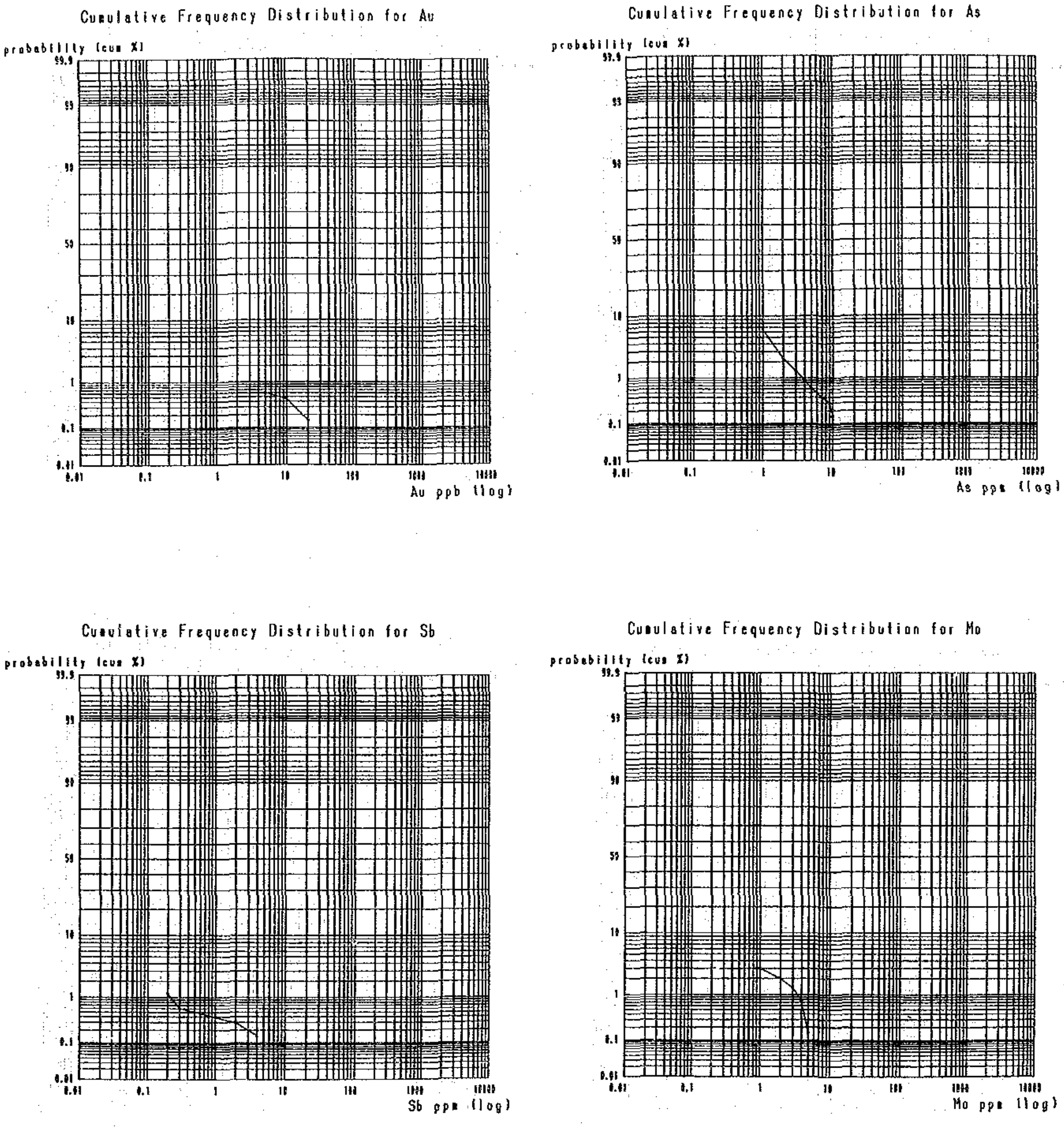


Fig. 2-3-7 Cumulative Frequency Distribution on Logarithmic Probability Paper (Sigatoka Area)-1

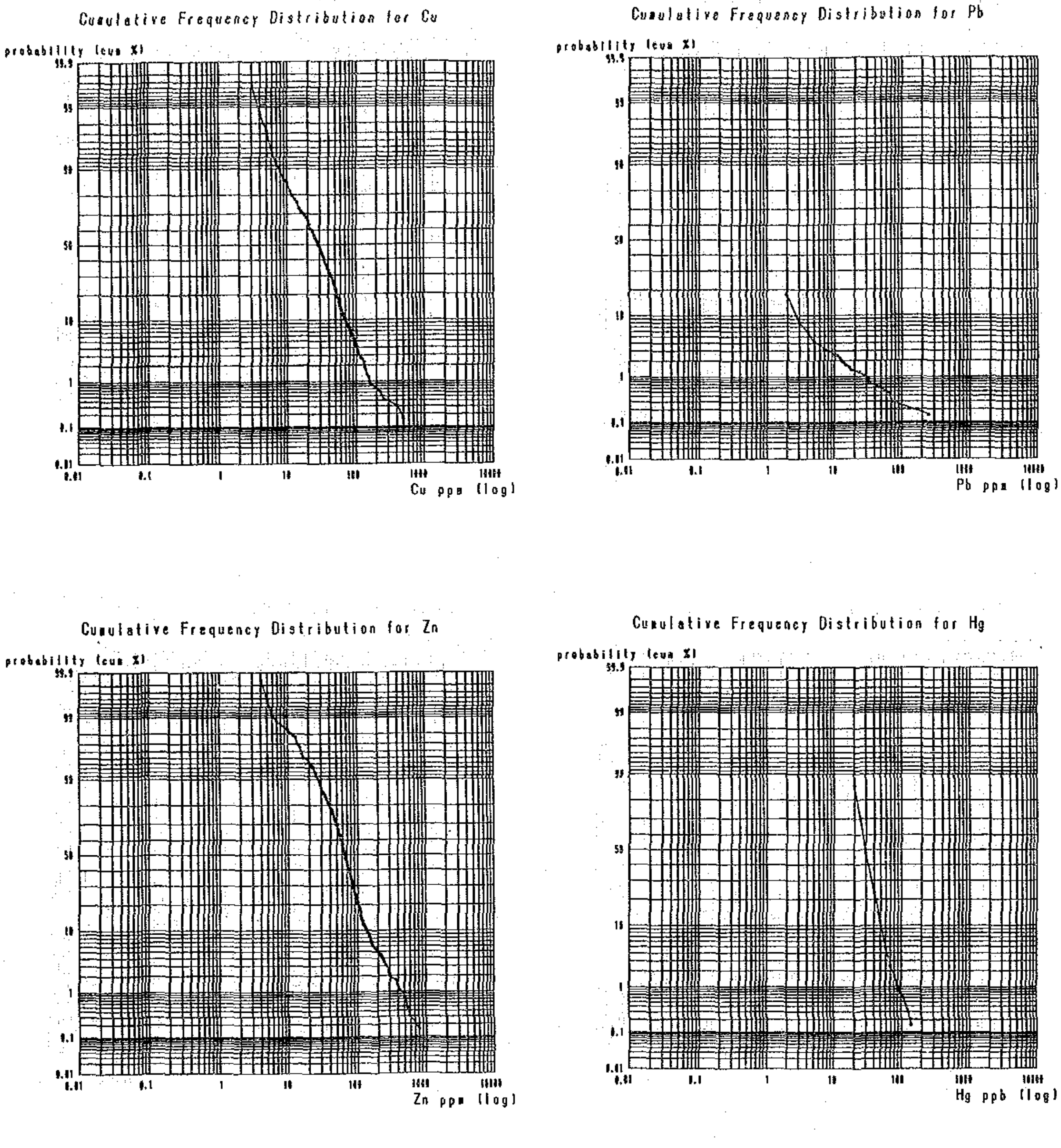


Fig.2-3-7 Cumulative Frequency Distribution on Logarithmic Probability Paper (Sigatoka Area)-2