2-7-3 Geologic Description of Drill Holes

(1) Geology

The geology of the area where drilling exploration was carried out in the second phase is composed of shale, siltstone, tuffaceous shale, and andesite.

Saprolite of shale, tuff and lava occurs below the surface soil (10 to 80 cm thick), and extends to nearly 30 m deep along the drill hole (its inclination is -60 degrees in common). Saprolite of andesitic rocks frequently shows lateritic features. It means leaching of silica and alumina, and relative enrichment of iron oxides.

Fresh bedrock appears below 20 to 30 m in depth. Although the bedrock itself shows fresh features below the saprolite zone, oxidation process spreads over along numerous fractures within the bedrock. Most of the sulphide minerals such as pyrite and chalcopyrite filled in quartz veinlets and millimeter size fractures have been changed into limonite and malachite even at the bottom of the drill hole. In that meaning, the entire drill hole is situated within the oxidized zone of the weathering profile.

(2) Drill Hole Description

MJT-1 : The drill hole MJT-1 is located at 15 m at 120 degrees from the NE end of the trench T-3. It is aimed at examining the lower extension of quartz stockworks encountered in T-3. The geology of the area around the drill hole consists of andesite. Geology and mineralization in MJT-1 are described as follows:

0 ~ 0.20 m Brown soil.

0.20 ~ 33.10 m Saprolite which is composed of the alternation of andesite, shale and siltstone. Several thin layers of tuffaceous shale are intercalated within the shale. Several quartz veins and stockworks were caught in this zone; 6.00 ~ 6.14 m (14 cm, quartz vein), 8.20 ~ 11.30 m (310 cm, quartz stockwork), 17.36 ~ 17.40 m (4 cm, quartz veinlet), and 30.72 ~ 30.80 m (8 cm, quartz veinlet). Kaoline occurs partly accompanied by quartz. Limonite was commonly found in these veins and veinlets.

33.10 ~ 76.45 m Andesite. It shows green to greenish grey massive features in general. However some part shows hyaloclastic texture. Flow structure is also recognizable in this rock. It suggests that it is composed of several flow units of andesite lava. Three distinctive quartz veins were caught in the rock; 59.60 ~ 60.85 m (125 cm), 66.65 ~ 67.40 m (75 cm), and 68.15 ~ 76.45 m

(830 cm). These veins exhibit massive features. They are composed of white translucent (sometimes opaque) quartz. Small scale cracks of millimeter thickness are developed in quartz. They are filled by limonite. A small amount of pyrite, chalcopyrite and malachite was also observed in the cracks. Quartz stockworks were caught in three zones; 51.35 ~ 53.66 m (231 cm), 53.90 ~ 54.70 m (80 cm), and 55.40 ~ 57.30 m (190 cm). Limonite was commonly found in these stockworks. Silicification and chloritization (of moderate degree) were recognized in the country rock.

76.45 ~ 80.30 m (EOH) Black shale.

MJT-2 : The drill hole MJT-2 is located at 12 m at 120 degrees from the NE end of the trench T-2. It targets the lower extension of quartz veins and stockworks caught in T-2. The geology around the drill hole consists of andesite. Description of the drill hole is recorded as follows:

0 ~ 8.00 m Soil and gravel zone. The upper 6 m consists of brown to khaki soil. The lower 2 m consists of gravel zone comprising andesite and dacite gravels and quartz fragments.

8.00 ~ 28.40 m Saprolite. The upper part is yellowish brown to brown saprolite of andesite. Whereas the lower part changes into brownish grey saprolite of tuffaceous shale. Very thick massive quartz veins were caught in this saprolite (from 9.00 m to 21.30 m) with intercalation of several andesitic parts (now intensely weathered into clay). Quartz shows white to light grey color, translucent, and of medium to coarse grain. Some part shows sugary features, probably resulted from strong weathering. Limonite was found in quartz. A couple of quartz veinlets is associated in both hanging wall and foot-wall.

28.40 ~ 80.30 m (EOH) Andesite. This zone is divided into two; the upper brecciated andesite and the lower massive andesite. From 28.40 m to 56.60 m, the andesite shows brecciated texture. It has greenish grey color. Whereas the lower part shows green massive appearance. Numerous quartz veins and stockworks were caught in the andesite. The major quartz veins and stockworks are; 35.06 ~ 35.23 m (17 cm, quartz vein), 36.29 ~ 36.40 m (11 cm, quartz vein), 38.00 ~ 38.40 m (40 cm,quartz stockwork), 39.85 ~ 40.55 m (70 cm, quartz stockwork), 47.50 ~ 50.80 m (330 cm, quartz veins and associated stockworks), 54.20 ~

54.85 m (65 cm, quartz stockwork), 56.60 ~ 57.30 m (70 cm, quartz stockwork), 59.25 ~ 59.50 m (25 cm, quartz vein), 61.14 ~ 61.32 m (18 cm, quartz stockwork), and 66.50 ~ 67.20 m (70 cm, quartz stockwork). These quartz veins and stockworks commonly contain limonite. In the massive andesite zone, pyrite occurs together with limonite. A small amount of chalcopyrite was also detected in quartz.

MJT-3 : This hole was drilled at 7 m at 60 degrees from the NE end of the trench T-1. The target of this hole is the lower extension of quartz veins and stockworks found in T-1. The geology around the drill hole consists of andesite and tuffaceous shale. Description of the drill hole is explained as follows:

0 ~ 0.60 m Brown soil.

0.60 ~ 24.82 m Saprolite. This saprolite zone is divided into three; reddish brown saprolite of andesite (0.60 ~ 9.10 m), alteration of greyish tuffaceous shale and reddish brown andesite (9.10 ~ 17.00 m), and reddish brown andesite (17.00 ~ 24.82 m). Two significant zones of quartz stockworking were caught in this zone. One quartz stockwork of 360 cm in zone width (10.50 ~ 14.10 m), and another quartz stockwork of 65 cm in zone width (14.70 ~ 15.35 m). Microfractures of 0.5 to 3.0 mm wide were recognized in the depths between 7.10 m and 16.70 m. They are filled by quartz and limonite. Tuffaceous shale around the fractures is silicified.

24.82 ~ 35.55 m Andesite. It generally shows grey massive appearance. Some of the lower parts, however, exhibit brecciated texture. Thin layers of shale are intercalated in this part. It changes gradually into black shale. Quartz veins and stockworks occur from 25 m to 30 m. A quartz stockwork of 150 cm in zone width (25.10 ~ 26.60 m), a quartz vein of 10 cm wide (27.45 ~ 27.55 m),and a quartz stockwork of 15 cm in zone width (29.75 ~ 29.90 m). A small amount of pyrite and chalcopyrite was observed in quartz.

35.55 ~ 80.30 m (EOH) Black shale. Black massive shale occurs from 35.55 m till the end of hole. Pyrite is disseminated in black shale. Andesitic layers are intercalated within black shale (53.35 ~ 65.00 m). Several minor quartz stockworks with weak pyrite-chalcopyrite impregnation were caught in this zone.

MJT-4 : The drill hole MJT-4 is located at 11 m at 90 degrees from the NE end of the trench T-4. It targets to the lower extension of quartz veins and silicified zone found in T-4. The geology around the drill hole consists of shale and andesite. Geology and mineralization in MJT-4 are described as follows:

0 ~ 0.10 m Brown soil.

0.10 ~ 18.90 m Brown to brownish grey saprolite. It is composed of the alteration of tuffaceous shale and siltstone. Two zones of intensive quartz stockworking were caught in the saprolite; 4.80 ~ 5.50 m (70 cm) and 9.85 ~ 14.25 m (440 cm). The quartz shows white to light grey, translucent or milky features. It is 2 to 5 mm in thickness. Limonite, and in some part, pyrite were recognized in quartz. Tuffaceous shale around the stockworks is silicified and/or clayey. Microfractures filled with limonite were observed in such zones. These zones were correlated to the silicified zones in T-4.

18.90 ~ 53.60 m Black shale. Massive. Any significant indication of mineralization was not encountered in this zone except a few thin quartz veinlets.

53.60 ~ 80.30 m (EOH) Andesite. Grey to greenish grey, commonly massive and aphanitic. Intense brecciation and limonitization were observed near the boundary to black shale. One wide zone of quartz veining/stockworking and several minor quartz veins and stockworks were found; 53.55 ~ 59.75 m (620 cm, quarts veins and stockworks), 63.60 ~ 64.00 m (40 cm, quartz vein), and 79.27 ~ 79.55 m (28 cm, quartz stockwork). Quartz shows white to light grey color, and translucent features. Vein quartz is brecciated, and the cracks are filled by limonite.

MJT-5 : One hole was drilled at the northern flank of S. Bone. The drill hole MJT-5 is located at 47 m at 213 degrees from the SW end of the trench T-6. The purpose of this hole is to examine the lower extension of quartz vein caught in both T-5 and T-6. Surface of the steep creek was cut, and soil was removed for the preparation of drilling site. The drill hole is geologically situated in grey shale. Geology and mineralization in MJT-5 are described as follows:

0 ~ 3.80 m Light grey shale.

3.80 ~ 80.30 m (EOH) Andesite. Light greenish grey to green, generally massive and aphanitic. Several zones of brecciated and hyaloclastic texture were recognized in this rock. The extension of the quartz vein in trenches was caught just at the programmed depth -- 47.20 ~ 50.33 m. The vein, 313 cm in width, is composed of white massive quartz. A small amount of chalcopyrite, malachite, pyrite and limonite was found in quartz. These minerals occur in cracks within massive quartz. Silicified zones were accompanied both at the hanging wall and foot wall of the quartz vein. Several minor quartz stockworks were also caught in andesite.

2-7-4 Mineralization

The mineralization of quartz and sulphides caught in drill holes can be divided into two categories ; ① massive quartz veining with the dissemination of pyrite and chalcopyrite, and ② quartz stockworking which accompanies the impregnation of pyrite and chalcopyrite.

Quartz veins of the first category are composed mainly of white to light grey translucent quartz. They show no particular inner texture (such as banded texture). They have massive features. A small amount of pyrite and chalcopyrite is disseminated in quartz. Traces of sphalerite, covelline, chalcocite and azurite were observed under the microscope (Table 2-1-6). This sort of quartz vein was caught at the deep part of MJT-1, at the shallow part of MJT-2 and in MJT-5.

The extensive development of quartz stockworking was encountered in every drill hole in the second phase. The width of quartz in this category varies from a few centimeters up to tens of centimeters. Quartz stockworks are composed mainly of white to light grey translucent quartz. Silicification, chloritization, sericitization and carbonitization were recognized within the quartz stockwork zone. Kaoline of probably a supergene origin and montmorillonite were detected mainly in the shallow part of some of the drill holes through the X-ray diffraction analysis. Pyrite and chalcopyrite were recognized in quartz. Traces of arsenopyrite, sphalerite, covelline and azurite were observed under the microscope. Fractures of millimeter scale in thickness were sometimes observed in quartz and in the silicified rock, both of which belong to the quartz stockwork zone. Such fractures are filled by the later stage microcrystalline quartz. Tiny spots of pyrite (limonite), and in some cases, chalcopyrite were recognized in the fracture.

Gold was detected at several localities in drill holes.

A series of significant Au values was obtained from a bunch of quartz stockworks caught at the shallow part of MJT-3. Assay results of Au are anomalous to some extent from 8.50 m down to 16.70 m. The best result of 0.50 g/t Au was returned from a part of quartz stockwork zone (11.50 ~ 12.00 m).

Pyrite and limonite are comparatively rich in these zones(Fe> 4 %).

Significant assay results of Au were also obtained from quartz veins/ stockworks caught at the shallow part of MJT-4 (from 6.00 m down to 14.25 m). The best result is 0.53 g/t Au (7.00 ~ 7.90 m). It corresponds to the part where pyrite and limonite are intensively impregnated.

A group of massive quartz veins caught at the lower part of MJT-1 has shown no Au value at all. The similar quartz veins at the shallow part of MJT-2 also carry no gold except a very limited part (13.20 ~ 13.70 m) where a low level of Au up to 0.12 g/t was obtained. It corresponds to a part of the quartz vein which contains sulphide minerals -- pyrite and chalcopyrite.

A value of low level Au was returned from a part of massive quartz vein in MJT-5. It is 0.19 g/t Au (49.05 ~ 49.25 m) from a part of quartz vein which is relatively rich in pyrite and chalcopyrite (0.932 % Cu).

Gold was also detected from some sludges of drilling. Sludges were collected from a ditch of drilling site, then panned out, and examined under the microscope. Gold grains of very fine to fine carat were recognized from the following part of the drill holes ; shallow part (depth unknown) of MJT-1, 20 ~ 40 m and 40 ~ 60 m of MJT-2, and 25 ~ 50 m of MJT-3.

It is identical that some of the quartz veins/stockworks carry gold. The major assay results of drill cores are listed in Table 2-2-8.

The major results of fluid inclusion study are briefly summarized as follows:

① Values of homogenization temperature of each fluid inclusion range from 180°C to 280°C.

② The temperature difference between massive quartz and stockwork quartz is not significant.

③ Significant tendency has not been recognized in the vertical distribution of homogenization temperature.

Correlation among each vein caught in drill holes and trenches is, in most cases, difficult because of its stockwork nature in this area. The preliminary interpretation has been made.

A group of quartz veins caught at the lower part of MJT-1 is correlated to the similar quartz at the shallow part of MJT-2. Both have a massive nature in common. Only a small part of the massive veins has been caught in T-2 (quartz veins at around 79 m position). The other part can probably be correlated to the quartz floats and outcrops in the surrounding area. It is interpreted that this zone has the strike direction of NW to NNW and gentle E dip. Massive quartz vein in MJT-5 is correlated to the quartz vein/lens in T-5 and T-6 as expected originally.

Quartz stockworks caught at the shallow part of MJT-1 are correlated to two zones of quartz stockworks in T-3. Quartz stockworks at the shallow part of MJT-3 are correlated to the three zones of quartz veins/stockworks found in T-1. These extensions are probably connected with the quartz veins/stockworks at around 50 m of MJT-2. Quartz veins/stockworks at the shallow part of MJT-4 are correlated to the quartz veins and quartz stockworks in T-4. It is interpreted that the major zones of quartz veins/stockworks caught in drill holes (except MJT-5) have a general trend of NW to NNW strike and gentle E dip.

Table 2-2-8 Summary of Assay Results of Drilling (1)

Phase II

Sample No.	Depth (m) From	Depth (m) To	Width (m)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	Description
BD1-2	8.20	9.20	1.00	<0.06	<2	0.008	<0.001	0.009	6.86	Qz stockwork
BD1-3	9.20	10.20	1.00	<0.06	2	0.003	<0.001	0.009	5.76	Qz stockwork
BD1-4	10.20	11.30	1.10	<0.06	2	0.002	<0.001	0.010	6.35	Qz stockwork
BD1-7	38.35	38.60	0.25	<0.06	2	0.007	<0.001	0.005	5.10	Qz stockwork
BD1-9	51.35	52.35	1.00	<0.06	2	0.006	<0.001	0.008	6.23	Qz stockwork
BD1-10	52.35	53.00	0.65	<0.06	2	0.004	<0.001	0.006	6.09	Qz stockwork
BD1-11	53.00	53.66	0.66	<0.06	2	0.004	<0.001	0.007	6.39	Qz stockwork
BD1-12	53.90	54.70	0.80	<0.06	2	0.004	<0.001	0.007	5.85	Qz stockwork
BD1-13	55.40	56.40	1.00	<0.06	2	0.003	<0.001	0.009	4.88	Qz stockwork
BD1-18	60.85	61.05	0.20	<0.06	2	0.527	<0.001	0.022	3.61	Silicified zone
BD2-7	13.55	13.70	0.15	0.12	2	0.092	<0.001	0.020	4.08	Qz vein
BD2-27	47.50	48.74	1.24	<0.06	<2	<0.001	<0.001	0.007	5.71	Qz stockwork
BD2-29	49.20	50.00	0.80	<0.06	2	0.002	<0.001	0.008	6.66	Qz stockwork
BD2-33	59.25	59.50	0.25	<0.06	2	0.008	<0.001	0.006	4.67	Qz vein
BD2-35	66.50	67.20	0.70	<0.06	2	0.007	<0.001	0.006	4.94	Qz stockwork
BD3-18	7.50	8.50	1.00	<0.06	2	0.076	0.012	0.020	8.87	Qz stockwork
BD3-19	8.50	9.50	1.00	0.31	2	0.048	0.048	0.028	6.64	Qz stockwork
BD3-20	9.50	10.50	1.00	0.40	2	0.054	0.026	0.024	6.04	Qz stockwork
BD3-1	10.50	11.50	1.00	0.44	<2	0.017	0.004	0.019	4.63	Qz stockwork
BD3-21	11.50	12.00	0.50	0.50	2	0.010	0.001	0.015	5.23	Qz stockwork
BD3-22	12.00	12.50	0.50	0.22	2	0.007	0.001	0.013	4.05	Qz stockwork
BD3-3	12.50	13.55	1.05	0.25	<2	0.012	<0.001	0.012	4.34	Qz stockwork
BD3-4	13.55	14.10	0.55	0.12	<2	0.014	0.001	0.012	4.37	Qz stockwork
BD3-23	14.70	14.90	0.20	0.16	<2	0.007	<0.001	0.019	5.83	Qz stockwork
BD3-24	14.90	15.35	0.45	0.12	<2	0.008	<0.001	0.017	6.18	Qz stockwork
BD3-25	15.80	16.70	0.90	0.22	2	0.007	<0.001	0.011	5.45	Qz stockwork
BD3-6	25.10	25.50	0.40	<0.06	<2	0.010	<0.001	0.014	5.66	Qz stockwork
BD3-8	25.59	26.60	1.01	<0.06	<2	0.002	<0.001	0.008	7.01	Qz stockwork
BD3-10	29.75	29.90	0.15	<0.06	<2	0.007	<0.001	0.010	5.78	Qz stockwork
BD4-1	4.80	5.50	0.70	<0.06	2	0.008	0.003	0.018	5.59	Qz stockwork
BD4-27	5.50	6.00	0.50	<0.06	<2	0.008	0.002	0.017	6.01	Qz stockwork
BD4-28	6.00	7.00	1.00	0.06	2	0.008	0.003	0.016	5.78	Qz stockwork
BD4-26	7.00	7.90	0.90	0.53	<2	0.008	0.004	0.011	5.34	Qz stockwork
BD4-2	9.85	10.85	1.00	0.19	2	0.007	0.001	0.034	4.66	Qz stockwork
BD4-3	10.85	11.85	1.00	<0.06	2	0.007	0.001	0.051	4.71	Qz stockwork
BD4-4	11.85	12.85	1.00	0.37	<2	0.007	<0.001	0.062	4.72	Qz stockwork
BD4-5	12.85	13.15	0.30	0.12	<2	0.008	0.001	0.092	5.87	Qz stockwork
BD4-29	13.15	13.30	0.15	<0.06	<2	0.008	<0.001	0.061	4.65	Qz stockwork
BD4-7	13.90	14.25	0.35	0.37	2	0.003	0.001	0.008	1.34	Qz vein
BD4-31	17.10	17.30	0.20	<0.06	<2	0.006	0.002	0.016	5.70	Qz stockwork
BD4-8	18.90	19.20	0.30	<0.06	<2	0.006	0.004	0.018	5.15	Qz stockwork
BD4-10	53.55	53.65	0.10	<0.06	2	0.001	<0.001	0.012	6.05	Qz stockwork
BD4-12	53.75	54.35	0.60	<0.06	2	0.005	<0.001	0.010	5.35	Qz stockwork
BD4-14	54.45	55.45	1.00	<0.06	2	0.006	<0.001	0.010	6.09	Qz stockwork
BD4-15	55.45	56.45	1.00	<0.06	2	0.005	<0.001	0.008	5.13	Qz stockwork
BD4-16	56.45	56.85	0.40	<0.06	2	0.008	<0.001	0.012	6.23	Qz stockwork
BD4-18	56.95	57.70	0.75	<0.06	2	0.003	<0.001	0.010	5.27	Qz stockwork
BD4-19	57.70	58.70	1.00	<0.06	<2	0.004	<0.001	0.010	5.64	Qz stockwork
BD4-20	58.70	59.75	1.05	<0.06	<2	0.003	<0.001	0.012	5.52	Qz stockwork
BD5-3	47.20	47.60	0.40	<0.06	2	0.507	<0.001	0.021	3.47	Qz vein
BD5-5	49.05	49.25	0.20	0.19	2	0.932	<0.001	0.038	3.36	Qz vein

Table 2-2-8 Summary of Assay Results of Drilling (2)

Phase III

Sample No.	Depth (m) From	Depth (m) To	Width (m)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	Description
BD6-1	15.60	16.60	1.00	0.06	<2	0.008	0.003	0.016	4.71	Qz stockwork
BD6-2	16.60	17.60	1.00	0.08	<2	0.011	0.023	0.018	6.60	Qz stockwork
BD6-3	17.60	18.60	1.00	0.11	<2	0.009	0.013	0.019	5.76	Qz stockwork
BD6-4	18.60	19.60	1.00	0.14	<2	0.008	0.006	0.016	6.26	Qz stockwork
BD6-5	19.60	20.50	0.90	0.11	<2	0.008	0.003	0.022	4.92	Qz stockwork
BD6-6	27.62	28.05	0.47	0.06	<2	0.003	0.025	0.017	1.44	Qz vein
BD6-7	79.80	80.23	0.43	<0.02	<2	0.010	0.003	0.022	2.02	Qz stockwork
BD6-8	103.75	103.87	0.12	<0.02	<2	0.004	0.001	0.004	4.01	Qz vein
BD6-9	109.39	109.44	0.05	0.03	<2	0.186	0.001	0.072	7.00	Qz veinlet
BD6-10	109.55	109.76	0.21	0.02	<2	0.100	0.001	0.497	1.90	Qz vein
BD6-31	119.75	119.88	0.13	0.06	2	0.003	<0.001	0.005	4.09	Qz stockwork
BD6-32	119.88	120.00	0.12	35.68	4	0.004	<0.001	0.009	3.19	Qz stockwork
BD6-33	120.00	120.10	0.10	1.60	2	0.006	0.001	0.012	3.40	Qz stockwork
BD6-34	120.10	120.35	0.25	1.66	2	0.015	0.001	0.015	6.23	Qz stockwork
BD6-13	120.35	120.75	0.40	0.11	2	0.127	0.001	0.015	4.39	Qz stockwork
BD6-29	120.75	121.25	0.50	0.03	<2	0.038	<0.001	0.058	2.52	Qz stockwork
BD6-14	121.60	121.67	0.07	<0.02	<2	0.030	<0.001	0.121	1.93	Qz stockwork
BD6-15	121.76	121.80	0.04	<0.02	<2	0.109	0.002	0.103	5.43	Qz stockwork
BD6-16	121.88	121.94	0.06	<0.02	<2	0.023	0.001	0.059	4.85	Qz stockwork
BD6-17	122.27	122.34	0.07	<0.02	<2	0.122	<0.001	0.194	4.63	Qz stockwork
BD6-18	122.43	122.47	0.04	<0.02	<2	0.012	0.001	0.047	4.74	Qz stockwork
BD6-19	122.50	122.60	0.10	<0.02	<2	0.041	0.002	0.041	1.07	Qz stockwork
BD6-20	122.62	122.70	0.08	<0.02	<2	0.012	<0.001	0.047	1.22	Qz stockwork
BD6-21	123.62	123.67	0.05	<0.02	2	0.004	0.001	0.012	3.34	Qz stockwork
BD6-22	123.79	123.88	0.09	<0.02	2	0.011	<0.001	0.050	2.33	Qz stockwork
BD6-23	124.44	124.51	0.07	0.12	2	0.022	0.002	0.044	10.25	Qz stockwork
BD6-24	124.60	124.70	0.10	<0.02	<2	0.008	<0.001	0.015	2.54	Qz stockwork
BD6-25	124.80	124.90	0.10	<0.02	2	0.003	0.001	0.009	2.11	Qz stockwork
BD6-26	125.30	126.20	0.90	<0.02	<2	0.057	0.001	0.088	0.90	Qz vein
BD6-28	135.68	135.73	0.05	<0.02	<2	0.004	<0.001	0.003	3.53	Qz veinlet
BD7-1	30.90	31.90	1.00	<0.02	4	0.005	0.001	0.014	6.79	Qz stockwork
BD7-2	31.90	32.60	0.70	<0.02	2	0.006	0.001	0.018	6.88	Qz stockwork
BD7-3	33.30	34.30	1.00	<0.02	2	0.033	0.002	0.012	5.25	Qz stockwork
BD7-4	34.30	35.30	1.00	<0.02	2	0.017	0.001	0.010	7.22	Qz stockwork
BD7-5	35.30	36.10	0.80	<0.02	2	0.006	0.001	0.011	5.24	Qz stockwork
BD7-6	38.10	39.10	1.00	0.05	<2	0.004	0.001	0.013	6.40	Qz stockwork
BD7-7	39.10	40.10	1.00	<0.02	2	0.003	0.001	0.016	6.11	Qz stockwork
BD7-8	40.10	41.10	1.00	0.02	2	0.023	0.001	0.049	6.01	Qz stockwork
BD7-9	41.10	42.10	1.00	0.05	2	0.067	0.001	0.075	6.44	Qz stockwork
BD7-10	42.10	43.10	1.00	<0.02	2	0.007	0.001	0.015	4.82	Qz stockwork
BD7-11	43.10	43.50	0.40	<0.02	2	0.009	0.001	0.011	5.21	Qz stockwork
BD7-12	44.50	45.50	1.00	<0.02	2	0.022	0.001	0.010	4.09	Qz stockwork
BD7-13	88.05	88.09	0.04	<0.02	<2	0.005	<0.001	0.007	3.89	Qz veinlet
BD7-14	89.63	89.70	0.07	<0.02	<2	0.020	<0.001	0.003	2.26	Qz veinlet
BD7-15	90.30	91.30	1.00	<0.02	<2	0.004	0.001	0.006	5.49	Qz stockwork
BD7-16	91.30	92.30	1.00	0.05	2	0.001	0.002	0.006	6.12	Qz stockwork
BD7-17	92.30	93.30	1.00	0.11	2	0.009	0.001	0.008	6.64	Qz stockwork
BD7-18	93.30	94.40	1.10	0.08	2	0.002	0.001	0.007	6.88	Qz stockwork
BD7-38	94.70	96.00	1.30	0.05	<2	0.011	0.001	0.008	7.28	Clayey zone
BD7-19	96.00	96.05	0.05	0.02	<2	0.004	<0.001	0.006	6.56	Qz veinlet
BD7-20	96.05	96.55	0.50	0.86	<2	0.002	0.001	0.005	5.19	Qz stockwork
BD7-21	96.55	96.76	0.21	28.55	4	0.002	<0.001	0.004	3.49	Qz vein
BD7-22	96.76	96.91	0.15	56.61	8	0.004	0.001	0.007	3.39	Qz stockwork

Table 2-2-8 Summary of Assay Results of Drilling (3)

Phase III

Sample No.	Depth (m) From	Depth (m) To	Width (m)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	Description
BD7-24	134.20	134.75	0.55	<0.02	<2	0.061	<0.001	0.006	3.87	Qz stockwork
BD7-25	151.85	152.40	0.55	<0.02	2	0.003	<0.001	0.007	5.59	Qz stockwork
BD7-26	158.10	158.35	0.25	0.03	2	0.019	0.001	0.018	4.36	Qz stockwork
BD7-40	160.75	160.80	0.05	0.25	6	5.090	0.001	0.162	26.00	Qz stockwork
BD7-27	161.40	161.80	0.40	<0.02	2	0.598	<0.001	0.033	5.63	Qz stockwork
BD7-28	164.25	164.60	0.35	<0.02	<2	0.045	<0.001	0.006	4.43	Qz stockwork
BD7-29	164.80	165.60	0.80	<0.02	<2	0.222	0.001	0.021	5.62	Qz stockwork
BD7-30	165.60	166.10	0.50	<0.02	<2	0.264	0.001	0.028	6.44	Qz stockwork
BD7-31	172.20	172.30	0.10	<0.02	4	1.090	0.001	0.023	6.70	Qz stockwork
BD7-32	172.70	172.80	0.10	<0.02	<2	0.021	<0.001	0.008	6.14	Qz stockwork
BD7-33	173.55	174.30	0.75	<0.02	2	0.357	<0.001	0.042	8.27	Qz stockwork
BD7-34	174.30	175.00	0.70	<0.02	<2	0.096	<0.001	0.033	5.92	Qz stockwork
BD7-35	176.95	177.45	0.50	<0.02	<2	0.118	<0.001	0.678	5.12	Qz stockwork
BD7-36	191.45	192.05	0.60	0.06	<2	0.009	0.001	0.014	4.19	Qz stockwork
BD7-37	192.05	192.65	0.60	<0.02	<2	0.027	0.006	0.015	6.77	Qz stockwork
BD7-39	192.65	193.45	0.80	0.02	<2	0.008	0.001	0.014	6.77	Qz stockwork
BD8-1	67.00	67.50	0.50	0.03	<2	0.008	0.004	0.013	5.88	Qz stockwork
BD8-3	107.50	107.73	0.23	<0.02	<2	0.014	<0.001	0.013	2.10	Qz stockwork
BD8-4	107.73	108.70	0.93	<0.02	<2	0.021	<0.001	0.009	2.19	Qz stockwork
BD8-5	108.70	109.30	0.60	0.19	18	4.870	0.004	0.198	10.35	Qz stockwork
BD8-6	109.30	110.30	1.00	<0.02	2	0.437	<0.001	0.021	3.79	Qz stockwork
BD8-7	110.30	111.05	0.75	0.06	<2	0.009	0.001	0.069	2.84	Qz stockwork
BD8-8	111.27	111.90	0.63	<0.02	<2	0.122	0.001	0.009	1.86	Qz stockwork
BD8-9	112.05	112.30	0.25	<0.02	4	0.858	0.001	0.043	5.17	Qz stockwork
BD8-10	112.30	112.85	0.55	<0.02	2	0.544	0.001	0.022	3.36	Qz stockwork
BD8-11	112.98	113.20	0.22	<0.02	<2	0.011	<0.001	0.009	4.73	Qz stockwork
BD8-12	113.38	113.83	0.45	<0.02	2	0.024	0.001	0.006	1.62	Qz stockwork
BD8-13	113.90	114.44	0.54	<0.02	2	0.142	0.001	0.009	3.68	Qz stockwork
BD8-14	117.63	117.87	0.24	0.08	2	0.018	<0.001	0.006	4.87	Qz stockwork
BD8-15	118.20	119.10	0.90	0.08	<2	0.025	<0.001	0.027	3.49	Qz stockwork
BD8-16	122.85	123.33	0.48	0.08	2	0.008	0.001	0.010	5.20	Qz stockwork
BD8-17	124.40	124.57	0.17	0.17	2	0.012	0.001	0.004	3.62	Qz stockwork
BD8-20	130.70	130.77	0.07	0.42	2	0.016	0.016	0.047	7.14	Qz veinlet
BD8-21	133.26	133.92	0.66	14.31	2	0.037	0.002	0.019	4.94	Qz stockwork
BD8-22	136.80	137.22	0.42	<0.02	4	0.117	0.001	0.018	3.11	Qz stockwork
BD8-23	137.32	137.50	0.18	0.09	<2	0.004	<0.001	0.041	2.64	Qz stockwork
BD8-24	182.05	182.55	0.50	0.03	<2	0.003	<0.001	0.006	3.45	Qz stockwork
BD8-26	184.60	185.35	0.75	0.06	4	1.510	0.001	0.105	5.59	Qz vein
BD8-29	199.80	200.20	0.40	<0.02	<2	0.011	<0.001	0.003	3.87	Qz stockwork
BD9-1	8.50	8.65	0.15	<0.02	<2	0.010	<0.001	0.009	5.94	Py spotted
BD9-2	9.10	9.30	0.20	<0.02	<2	0.025	<0.001	0.010	3.87	Py spotted
BD9-3	47.10	47.30	0.20	<0.02	<2	0.006	0.003	0.015	6.03	Ca-Py network
BD9-4	69.00	69.10	0.10	<0.02	<2	0.002	0.008	0.008	3.66	Qz-Ca network
BD9-11	69.75	69.80	0.05	<0.02	<2	0.003	0.008	0.013	7.29	Qz-Ca network
BD9-6	77.40	77.55	0.15	<0.02	2	0.004	0.003	0.013	4.67	Qz-Ca network
BD9-7	78.50	78.65	0.15	<0.02	<2	0.003	0.003	0.013	6.27	Qz-Ca network
BD9-8	79.80	79.95	0.15	<0.02	2	0.005	0.003	0.013	4.70	Qz-Ca network

2-8 Drilling (Phase III)

2-8-1 Outline of Drilling

A diamond drilling programme comprising three holes totalling 600 m was planned at the Tondoratte zone in the Batuisi prospect. The drilling area is situated over one of the most significant soil anomalous zones which were discovered during the second phase soil survey. The geology around the drill sites is composed of shale and andesite of the Latimojong Formation. Only small blocks of quartz float were observed on the surface. The drilling programme was directed toward; ① the extension of auriferous quartz stockworks caught in trenches (1.52 g/t Au at 3.2 m in T-1 and 1.17 g/t Au at 2.0 m in T-4), ② the extension of the most significant soil anomaly (1,340 ppb Au), and ③ the extension of one of the significant soil anomalies (585 ppb Au). The programme consisted of three inclined holes of 200 m deep each. The target depth was set at 50～150 m from the surface.

A small diamond drilling programme consisting of one hole of 80 m deep was planned at the middle reaches of S. Bone zone. The drilling area is situated over the significant soil and rock-chip anomalous zone which was caught during the second phase detailed survey. The geology around the drill hole is composed of shale and andesite of the Latimojong Formation. A couple of quartz veins and quartz stockworks was observed on the surface. The target zone for drilling corresponds to the extension of the most significant rock-chip anomaly (1,685 ppb Au). The programme consisted of one inclined hole of 80 m deep. The target depth was set at 50 m from the surface.

Details of the holes are summarized in the table below. The location map of drill holes is shown in Fig. 2-2-4.

Hole No.	Locality	Grid Coordinates		Elevation	Azimuth	Inclination	Hole Length
		N	E				
MJT-6	Tondoratte	0 N	1,500 E	570 m	235 °	-70 °	200.2 m
MJT-7	ditto	200 S	1,820 E	630	235	-70	200.2
MJT-8	ditto	100 S	1,650 E	625	270	-70	200.2
MJT-9	Middle Reaches of S.Bone	350 N	890 E	390 m	235 °	-70 °	80.2 m
Total							680.8 m

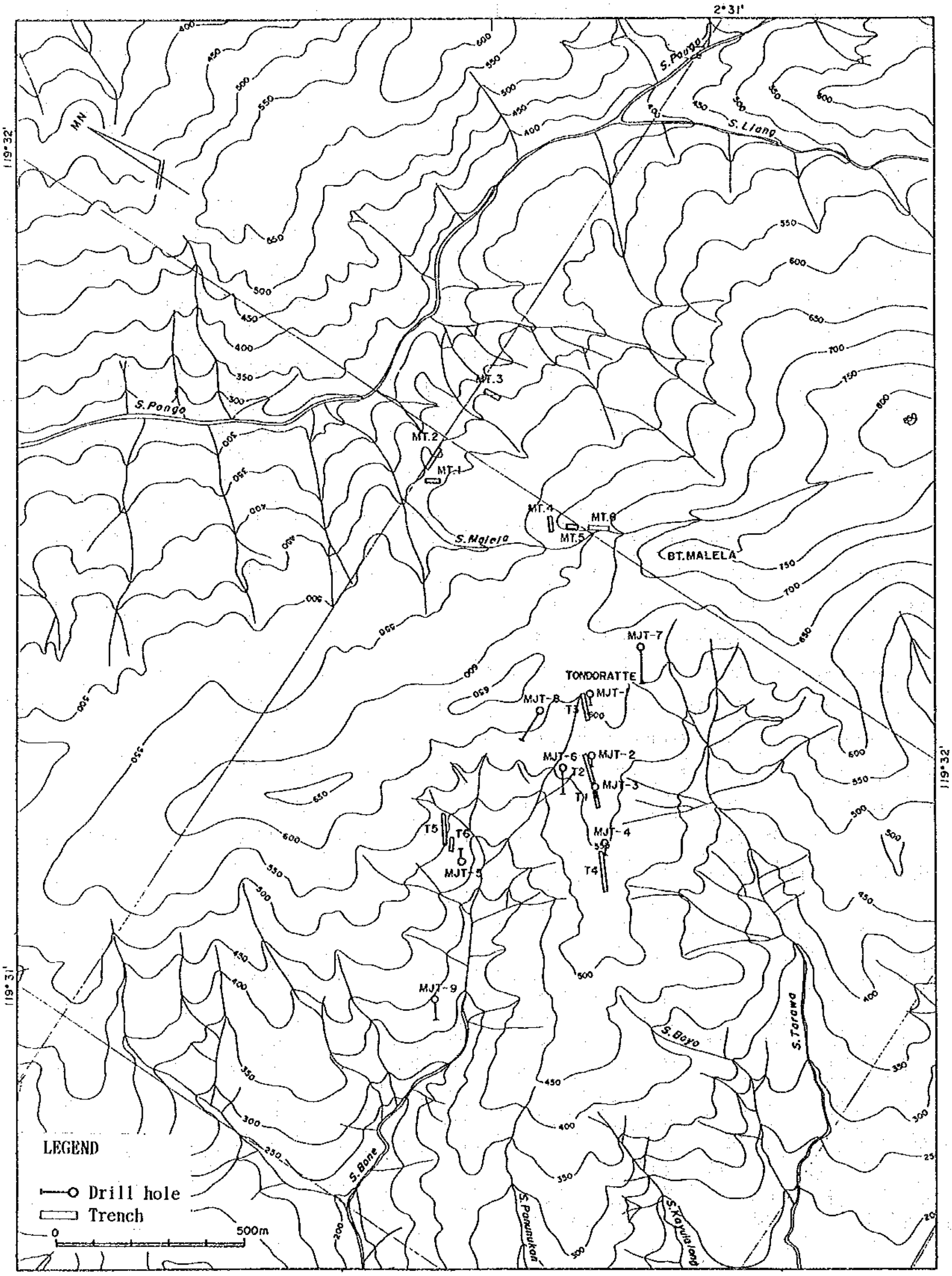


Fig. 2-2-4 Location Map of Drill Holes in the Batuisi Prospect

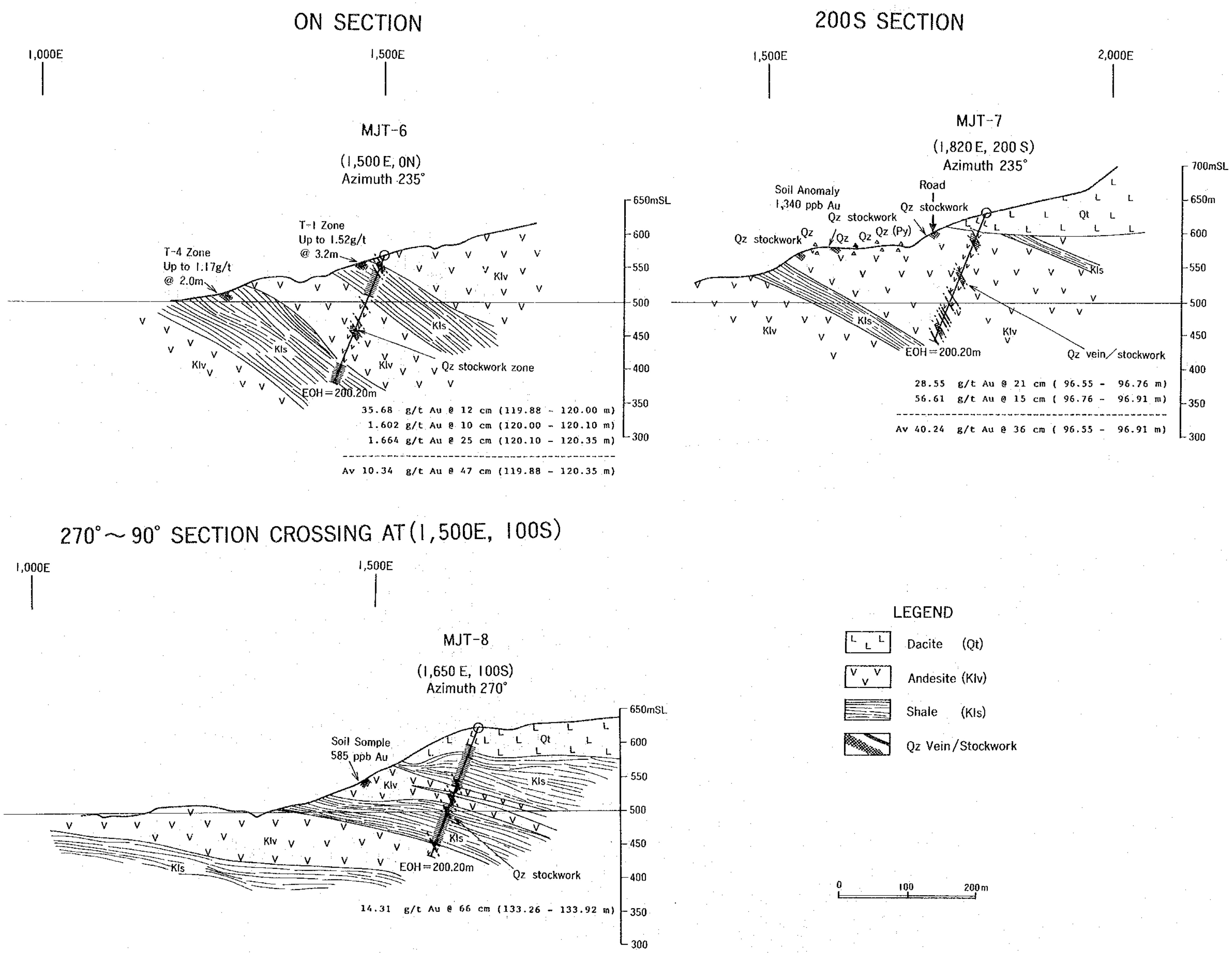


Fig. 2-2-5 Geologic Section along the Drill Holes in the Tondorrate Zone

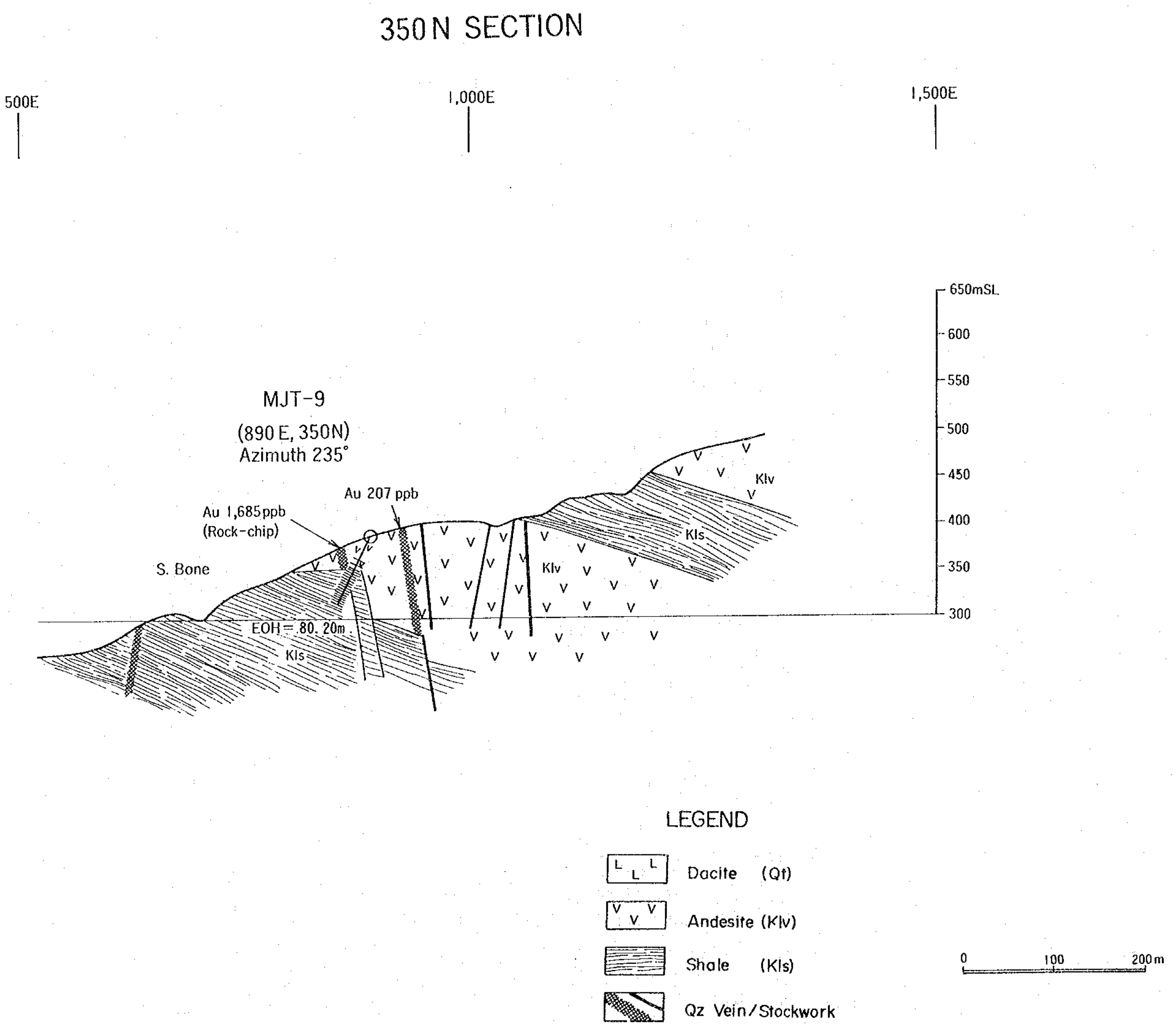


Fig. 2-2-6 Geologic Section along the Drill Holes in the Middle Reaches of S. Bone Zone

A series of drill logs of 1:200 scale was prepared, and the whole drill cores were photographed in color. One hundred and seven samples for ore assay were obtained. Six elements (Au, Ag, Cu, Pb, Zn, Fe) were analyzed for ore assay. Twenty-five polished sections for ore microscopy and five thin sections for petrography were produced from the cores. Twenty altered rock and clay samples were examined for X-ray powder analysis. Twenty quartz chips were prepared for fluid inclusion studies.

2-8-2 Method, Equipment and Progress

(1) Drilling Method and Equipment

Method

At the Tondoratte zone, the following method was taken for drilling.

For surface soil and gravel layer (up to 4 m), drilling was done by HW casing shoe with inserting of HW casing pipes. Weathered bedrock and the upper part of bedrock zone were drilled by the conventional drilling method using NX diamond bit and core-pack tube. The weathered bedrock continued down to 20 ~ 30 m deep. NW casing pipes were inserted in this zone. For the upper part of bedrock zone, BW casing pipes were inserted down to 80 m. From 80 m to 200 m (the end of hole), drilling was made with BQ oversized diamond bit (62.0 mm in outer diameter and 36.5 mm in inner diameter) and BQ-WL core tube. Bentonite mud, lubricant chemical (Mud Oil), and CMC were usually mixed in the circulating drilling water. When the water was lost in the hole where fractures were developed, Tel-Stop and Seaclay (asbestos) were injected to recover the trouble. Borehole cementation was applied where water loss and the collapse of wall happened at the same time.

At the middle reaches of S. Bone zone, drilling was made as follows.

For surface soil and gravel layer (down to 3 m), drilling was done by NW casing shoe with inserting of NW casing pipes. Weathered bedrock was drilled by the conventional drilling method with NX diamond bit and NX-STH core tube. The weathered bedrock continued down to 20 m deep, and BW casing pipes were inserted in this zone. For the bedrock zone, the wireline method was adopted with BQ oversized diamond bit (62 mm in outer diameter) and BQ-WL core tube. Bentonite mud, lubricant chemical (Mud Oil), and CMC were usually mixed in the circulating drilling water. When the water was lost in the hole where fractures were developed, Tel-Stop and Seaclay (asbestos) were injected to recover the trouble.

Equipment

The drilling site is located in the remote place. No vehicle road is available in the area. Transportaion is usually made by horses and labors. Because of this condition of transportation, drilling machine and equipment were selected on the basis of light weight and easy maintenance. A set of OE-8B drilling machine of Koken Boring Machine, and MG-15h drilling pump were brought into operation at the Tondoratte zone. At the middle reaches of S. Bone zone, the drilling machine and drilling pump are YBM-05DA of Yoshida Boring Machines and MG-5h, which are same as in the second phase.

Specifications of drilling machine and equipment are shown in Table 2-2-7.

Working system

Drilling operation was carried out by three shifts per day (8 hours per shift), while the appurtenant works, such as rig construction, mobilization and demobilization, were done by one shift per day. A shift crew consisted of one drilling engineer and four workers normally. Additional thirty workers (round figures) were involved in case of the appurtenant work. A base camp for drilling operation was built near the drilling sites. A series of footpaths was cleared from Kp. Batuisi to the hill-top on which the base camp and drilling sites were located.

Transportation

The machine and equipment were shipped from Yokohama to Ujung Pandang via Jakarta. After landed, they were transported to Mamuju by trucks. A Sikorsky helicopter was chartered for the transportation of heavy machine and equipment. Approximately 12 t of heavy cargoes were transported by helicopter between Mamuju and Tondoratte. Other cargoes, such as light weight parts, drilling mud, cement, fuel, and logistics were transported by the conventional method: They were transported by small trucks from Mamuju to Tarailu. From Tarailu to Galumpang (about 60 km along S. Karama), they were carried by engine canoes whose loading capacity was 400 ~ 600 kg. From Galumpang to Batuisi (16 km), they were carried by horses and labors. From Kp. Batuisi a footpath (short-cut) was constructed up to the drilling site, and the machine and equipment were carried up on labors' back. A little caterpillar carrier which can carry up to 300 kg was brought into site-to-site transportation this year.

Supply for the camp was made at least once in four weeks. Fuel and foods were bought at Ujung Pandang and Mamuju, and were transported along the same route as described above.

Drilling water

Water for drilling was pumped up from the middle reaches of S. Bone to the hill-top. Two stages of pumping station were established for the water head of 300 m. Piping length installed was more than 1,000 m.

Withdrawal

After the completion of drilling programme, the machine and equipment was withdrawn by helicopter through the same route to Mamuju. Then they were trucked until Ujung Pandang, and shipped back to Yokohama. The drill holes were capped, and drilling sites were cleaned and reclaimed. The drilling cores, of which the half was taken for assay samples, were kept in the storage house in Batuisi.

(2) Progress of Drilling

The progress of each drill hole is described as follows.

MJT-6 : For surface soil, saprolite and strongly weathered bedrock zones, the conventional drilling method by means of core-pack tubes was adopted aiming at the maximum core recovery. From 0 to 3.70 m, drilling was made by HW metal casing shoe, and HW casing pipes were inserted. From 3.70 to 22.35 m, drilling was made by NX (76 mm) core-pack bit, and NW casing pipes were inserted.

From 22.35 to 80.20 m, drilling was conducted by the wireline method using NQ-WL bit. BW casing pipes were inserted in this zone. Some part of this zone, especially in black shale, is clayey. Bentonite mud with CMC was used as a circulating drilling mud for this zone. A small amount of water was lost around 27.70 m where quartz veins occur. Telstop and Seaclay were injected to prevent the water loss. The weak vibration of drill rods happened around 40 m. Lubricant chemicals were mixed with mud and were sent in this case.

From 80.20 m down to the end of hole (200.20 m), drilling was made by the wireline method using BQ-WL bit. The wirelining went fairly well in andesitic rock, despite a few water losses in quartz stockwork zones. Whereas in black shale, which was encountered in the deeper horizon, many incomplete wirelinings were practiced. The cores were stacked frequently in the inner tube. Because it is easily broken into wedges. The recovery of cores was 97.8 % in total.

MJT-7 : HW casing pipes were inserted to 3.30 m. Drilling for the major part of surface soil and Quaternary rock (dacite) was undertaken by the conventional drilling method with NX core-pack bit and core-pack tube. NW casing pipes were inserted to 28.60 m.

From 28.60 to 80.20 m, drilling was carried out by the wireline method with

NQ-WL diamond bit and NQ-WL core tube. BW casing pipes were inserted to 80.20 m. A small amount of water was lost at 49.00 and 72.00 m where quartz veins and veinlets occur.

From 80.20 m down to the end of hole (200.20 m), drilling was made by the wireline method using BQ-WL diamond bit and BQ-WL core tube. Bentonite and CMC were used as the major mud materials. Water was lost at 139.60 and 143.20 m where andesite is silicified to a certain degree. Telstop and Seaclay were injected to prevent the problem. Overall core recovery was 98.2 % in this hole.

MJT-8 : From 0 to 3.30 m, drilling was done by HW metal casing shoe, and HW casing pipes were inserted. Drilling for the major part of Quaternary rocks (a member of the Barupu Tuffs) was undertaken by the conventional drilling method using NX core-pack bit and core-pack tube. NW casing pipes were inserted to 25.10 m.

From 25.10 to 80.20 m, drilling was conducted by the wireline method with NQ-WL diamond bit and NQ-WL core tube. BW casing pipes were inserted to 80.20 m.

From 80.20 m down to the end of hole (200.20 m), drilling was made by the wireline method with BQ-WL diamond bit and BQ-WL core tube. Bentonite and CMC were used as the major mud materials. Water was lost at around 90.90, 170.90, and 185.00 m. These depths correspond to quartz veins and strongly silicified rocks. Telstop and Seaclay were injected to prevent the water loss. Overall core recovery was 95.0 % in this hole.

MJT-9 : For near-surface weathered zone, drilling was done by NW diamond casing shoe, and NW casing pipes were inserted to 7.50 m deep. Weathered andesite down to 32.60 m deep was drilled by the conventional drilling method with NX diamond bit and NX-STH core tube. BW casing pipes were inserted to 32.60 m. Thick bentonite mud and core-pack tube were adopted for weathered zone to increase the recovery of cores.

From 32.60 m down to the end of hole (80.20 m), drilling was carried out by the wireline method using BQ-WL diamond bit and BQ-WL core tube. Bentonite, CMC, Libonite and Mud-Oil were mixed with circulating water. Soft and clayey zones occurred at two depths; 24.70 ~ 31.00 m and 40.20 ~ 47.10 m. Although thick bentonite mud was used and careful drilling (slow spindle revolution and very low feed pressure) was conducted, only cutting sludge was returned in these zones. As a result of these clayey zones, the overall core recovery of 82.8 % was produced in this hole.

2-8-3 Geologic Description of Drill Holes

MJT-6 : The geology around the drill hole MJT-6 is composed of an alternating bed of andesite and black shale of the Latimojong Formation. It is located approximately 100 m north of the trench T-1, and approximately 250 m northeast of the trench T-4. The purpose of this hole is to test the lower extension of quartz stockwork zones which were caught in T-1 (1.52 g/t Au at 3.2 m) and T-4 (1.17 g/t Au at 2.0 m). The geology of the drill hole is described as follows:

0 ~ 15.60 m	Soil and gravel zone. Light brown to brownish grey. The gravels consist mainly of andesite and dacite of the Barupu Tuffs member. Fragments of vein quartz were observed near the bottom of this zone.
15.60 ~ 20.50 m	Saprolite. Yellow brown. Originally shale. Five quartz veinlets of 0.7 to 1.5 cm in width were found in this zone. Limonite and partly pyrite are associated with quartz veinlets.
20.50 ~ 42.15 m	Black shale. Massive. Numerous quartz veinlets of probably segregation origin were developed, and patchy aggregates of pyrite were contained. One quartz vein was caught at 27.62 ~28.05 m (43 cm). Limonite is weakly impregnated. The footwall side of the vein (about 1 m) is clayey.
42.15 ~ 45.45 m	Andesite. Pale green. Glassy, and partly hyaloclastic. A couple of shale blocks occurs in andesite lava.
45.45 ~ 68.85 m	Black shale. Massive. Quartz segregation veinlets and pyrite patches are contained.
68.85 ~ 175.50 m	Andesite. Greenish grey to light greenish grey, massive. Partly brecciated. Several quartz veins and stockworks were caught in this zone. The major ones are; 79.80 ~ 80.23 m (43 cm, quartz vein), 109.55 ~ 109.76 m (21 cm, quartz vein), 116.24 ~ 116.60 m (36 cm, quartz vein), 119.88 ~ 120.35 m (47 cm, quartz stockwork), 120.35 ~ 121.25 m (90 cm, quartz stockwork), 121.60 ~ 121.94 m (34 cm, quartz stockwork), 122.27 ~ 122.70 m (43 cm, quartz stockwork), 124.44 ~ 124.90 m (46 cm, quartz stockwork), 125.30 ~ 126.20 m (90 cm, quartz vein). Pyrite and chalcopyrite are disseminated in these quartz veins/stockworks. Pyrite is replaced by limonite in some case. Vein quartz shows white, medium- to coarse-grained, and massive features in common. A thin layer of black shale is intercalated at the lower part

(160.00 to 160.30 m).

175.50 ~ 200.20 m (EOH) Black shale. Massive. Partly clayey, and partly silicified. One barren quartz vein (198.40 ~ 198.53 m, 13 cm) occurs in this zone.

MJT-7 : The drill hole MJT-7 is situated at the flank of high ridge which is composed of dacite and dacitic tuff of the Barupu Tuffs. The target of this hole is the lower extension of quartz veins and quartz stockwork zones which were found at S. Tarawa. It also aimed at one of the significant soil anomaly (1,340 ppb Au) found during the second phase survey in this area. The geology of the drill hole is described as follows:

0 ~ 7.75 m Soil. Yellow brown.

7.75 ~ 27.00 m Dacite of the Barupu Tuffs. The upper part consists of massive dacite, and the lower part consists of dacitic boulders. Weathered.

27.00 ~ 200.20 m (EOH) Andesite. Mostly massive, partly brecciated. Grey to greenish grey. Propylitic. Three major zones of quartz veins and stockworks with a small amount of sulphide minerals -- upper, middle, and lower -- were caught in andesite. The upper zone occurs at 30.90 to 45.50 m. It is composed of four quartz stockwork zones; 30.90 ~ 32.60 m (170 cm), 33.30 ~ 36.10 m (280 cm), 38.10 ~ 43.50 m (540 cm), and 44.50 ~ 45.50 m (100 cm). Pyrite and limonite are weakly disseminated in quartz stockworks. The middle zone occurs at 88.05 to 96.91 m. It is composed of several quartz veinlets and quartz stockworks. The major ones are; 90.30 ~ 94.40 m (410 cm, quartz veinlets/stockworks), 96.00 ~ 96.05 m (5 cm, quartz veinlet), and 96.55 ~ 96.91 m (36 cm, quartz stockwork). Pyrite and limonite are disseminated moderately. Some part of these zones show brownish earthy features.

From 151.85 m down to the end of hole, the lower zone which is composed of several quartz stockwork zones occurs. Those are; 151.85 ~ 152.40 m (55 cm), 158.10 ~ 158.35 m (25 cm), 161.40 ~ 161.80 m (40 cm), 164.25 ~ 164.60 m (35 cm), 164.80 ~ 166.10 m (130 cm), 172.20 ~ 172.30 m (10 cm), 172.70 ~ 172.80 m (10 cm), 173.55 ~ 175.00 m (145 cm), 176.40 ~ 177.57 m (117 cm), 183.25 ~ 183.45 m (20 cm), and 191.45 ~ 192.65 m (120 cm). Pyrite, chalcopyrite and arsenopyrite are strongly disseminated in some part of these quartz stockworks.

It is a remarkable feature in this depth that pyrite is partly replaced by limonite, and chalcopyrite by malachite. Some part of the quartz stockwork systems show clayey.

MJT-8 : The drill hole MJT-8 is located at the upper-most stream of S. Bone where is covered by the Barupu Tuffs. The purpose of this hole is to test the lower extension of quartz veins and quartz stockwork zones which were found at the upper reaches of S. Bone. It also aimed at one of the significant soil anomaly (585 ppb Au) detected during the second phase survey in this area. The geology of the drill hole is described as follows:

0 ~ 37.95 m The Barupu Tuffs. The upper part consists of andesitic to dacitic tuffs, and the lower part consists of sandstone and conglomerate. Weathered.

37.95 ~ 183.10 m The alternation of black shale and andesite. The clastic facies is dominant. Lavas are interbedded within black shale. The major occurrences of lavas are; 92.80 ~ 98.90 m, 105.80 ~ 114.80 m, 125.00 ~ 128.70 m, 141.60 ~ 143.60 m, and 167.65 ~ 171.10 m.

Many quartz veins and quartz stockworks were caught in this zone. The most significant one, which was found at 107.50 ~ 114.44 m, occurs within andesite. The second one occurs within black shale at the depth of 133.26 ~ 133.92 m (66 cm). Pyrite and chalcopyrite are disseminated in quartz stockwork systems.

183.10 ~ 200.20 m (EOH) Andesite. Greenish grey.

A massive quartz vein was caught in this zone; 184.60 ~ 185.35 m (75 cm). Pyrite and chalcopyrite are disseminated within quartz.

MJT-9 : One short hole (MJT-9) was drilled at the northern side of the middle reaches of S. Bone. The purpose of this hole is to test the lower extension of one of quartz stockwork zones, which was caught at this area at the early stage of this phase and was interpreted to be connected to the significant rock-chip anomaly (1,685 ppb Au) found during the second phase survey. The geology around the drill hole consists mainly of andesite. A thin layer of shale/siltstone is intercalated within andesite.

The geological description of the drill hole is given as follows:

0 ~ 36.60 m Andesite. Brown grey to greenish grey. Massive, partly brecciated. Pyrite is spotted at 8.50 ~ 9.30 m. A clayey part occurs at 24.70 ~ 31.00 m. It was interpreted as a fault zone.

36.60 ~ 80.20 m (EOH) Black shale. Calcite ± quartz veinlets are developed in this rock. A clayey part, which was interpreted as a fault zone, occurs at 40.20 ~ 47.10 m.

2-8-4 Mineralization

Numerous quartz veins and stockworks were found in drill holes in the Tondoratte mineralized zone. The major veins/stockworks were caught nearly at the right depths which have been expected in the drilling programme. Although the distance between outcrops (including those found in trenches) and drill intersections are fairly large, some veins/stockworks can be correlated with their surface indications. It is only tentative interpretations that they show a general trend of gentle NE dipping.

The extensive development of veins was mainly found in andesite. Several veins were caught in shale. However, the comparative density and intensity of veining in andesite are overwhelming. Most of veins, which are composed of quartz and calcite and are accompanied by spotted pyrite, were thought as of segregation origin in black phyllitic shale.

Quartz veins and stockworks commonly contain a small amount of sulphide minerals. The major sulphides are pyrite, chalcopyrite, and sphalerite. Traces of arsenopyrite, galena, covelline and chalcocite were observed in vein quartz under the ore microscope.

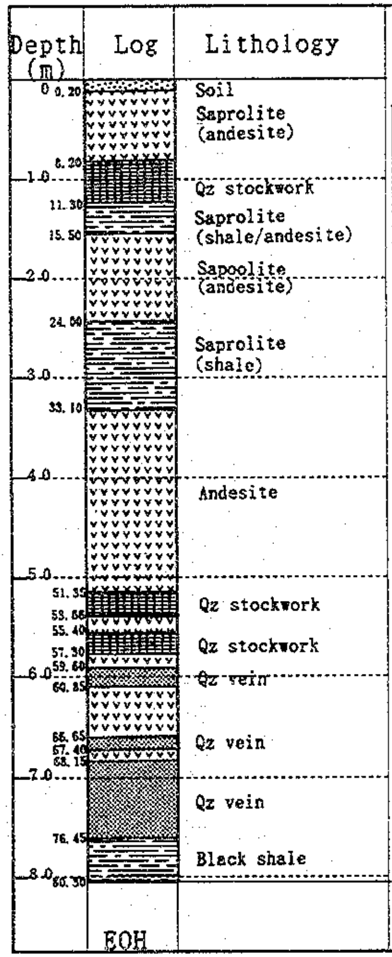
The oxidation of sulphide minerals was recognized in the deeper part of drill holes in the Tondoratte zone. Limonite after pyrite and malachite after chalcopyrite were sometimes found in drill cores from the near-surface down to of more than 100m deep. In MJT-7, strong limonitization was observed even at the end of hole. Clayey zones which are composed of quartz-calcite-chlorite(-montmorillonite)-limonite were caught in such depths in MJT-7. These zones were thought of fault origin.

Gangue minerals of quartz veins consist mainly of quartz, calcite, and ankerite.

Silicification, chloritization and sericitization were sometimes observed in the vicinity of quartz veins and stockworks. Chlorite in quartz veins and alteration zones is mainly Fe-chlorite. A small amount of montmorillonite and mixed layer minerals was found in some part of weathered zone and fault-related clayey zone. A small amount of epidote, which was interpreted to have been altered from mafic minerals in andesite, was detected in some of the major quartz stockwork zones of MJT-7 by petrographic studies.

Significant gold intersections were obtained in every hole at the depths of 96 m ~ 134 m. An intersection of 10.33 g/t Au at 47 cm in width was returned from quartz stockwork in silicified andesite in MJT-6 (119.88 ~ 120.75 m). It is located at the upper part of a thick quartz stockwork zone developed from 119.88 to 126.20 m. The best assay is 35.68 g/t Au at 12 cm (119.88 ~ 120.00 m). *Pyrite, arsenopyrite, chalcopyrite, sphalerite and limonite are* disseminated in and around the gold ore. An intersection of 40.24 g/t Au at 36 cm was returned from quartz vein/stockwork in andesite in MJT-7 (96.55 ~ 96.91 m). It is composed of 28.55 g/t at 21 cm (96.55 ~ 96.76 m, quartz vein) and 56.61 g/t at 15 cm (96.76 ~ 96.91 m, quartz stockwork). Pyrite and limonite are disseminated moderately in this zone. A clayey zone occurs at the hanging wall of the intersection. A significant gold value (0.86 g/t Au at 50cm) was obtained in clayey andesite adjacent to the ore. An assemblage of quartz-calcite-chlorite-montmorillonite was detected in this clayey zone by X-ray diffraction analysis. An intersection of 14.31 g/t Au at 66 cm was caught from quartz stockwork in MJT-8 (133.26 ~ 133.92 m). Black shale which hosts this quartz stockwork is weakly silicified. Pyrite, chalcopyrite, sphalerite and limonite were observed in quartz and altered black shale. Several significant gold values were obtained in the vicinity of this horizon (0.42 g/t Au at 7 cm, etc.). Quartz-ankerite-chlorite was detected in such zones.

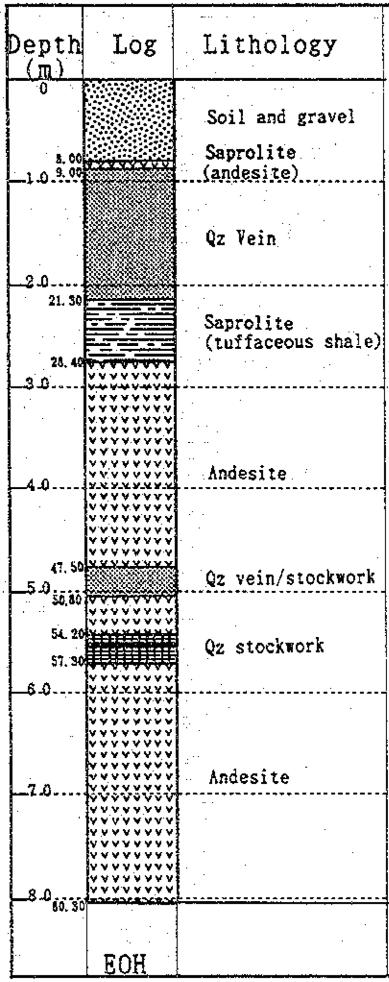
Although the extensive development of auriferous quartz veins/stockworks was watched on the surface at the middle reaches of S. Bone area, no significant indication of mineralization, such as quartz vein or disseminated sulphide, has *been obtained in the drill hole MJT-9. Some part of shale and andesite in drill* hole show an alteration mineral assemblage of quartz-chlorite-calcite. As far as the surface indications are concerned, gold mineralization in the middle reaches of S. Bone zone could be similar to that in the Tondoratte zone. Only the structural trend is different. Most of quartz veins and quartz stockworks dip steeply in this zone.



ASSAY RESULTS OF ORE SAMPLES (MJT-1)

SAMPLE NO	DEPTH FROM	DEPTH TO	WIDTH m	AU g/t	AG g/t	CU %	PB %	ZN %	FE %	DESCRIPTION
BD1-2	8.20	9.20	1.00	<0.06	<2	0.008	<0.001	0.009	6.86	Quartz stockwork
BD1-3	9.20	10.20	1.00	<0.06	2	0.003	<0.001	0.009	5.76	Quartz stockwork
BD1-4	10.20	11.30	1.10	<0.06	2	0.002	<0.001	0.010	6.35	Quartz stockwork
BD1-5	17.36	17.40	0.04	<0.06	<2	0.003	<0.001	0.012	3.08	Qz-kaolinite veinlet
BD1-7	38.35	38.60	0.25	<0.06	2	0.007	<0.001	0.005	5.10	Quartz stockwork
BD1-9	51.35	52.35	1.00	<0.06	2	0.006	<0.001	0.008	6.23	Quartz stockwork
BD1-10	52.35	53.00	0.65	<0.06	2	0.004	<0.001	0.006	6.09	Quartz stockwork
BD1-11	53.00	53.66	0.66	<0.06	2	0.004	<0.001	0.007	6.39	Quartz stockwork
BD1-12	53.90	54.70	0.80	<0.06	2	0.004	<0.001	0.007	5.85	Quartz stockwork
BD1-13	55.40	56.40	1.00	<0.06	2	0.003	<0.001	0.009	4.88	Quartz stockwork
BD1-14	56.40	57.30	0.90	<0.06	2	0.034	<0.001	0.011	3.27	Quartz stockwork
BD1-16	59.60	60.25	0.65	<0.06	<2	0.040	<0.001	0.004	1.85	Quartz vein
BD1-17	60.25	60.85	0.60	<0.06	2	0.078	<0.001	0.024	2.61	Quartz vein
BD1-18	60.85	61.05	0.20	<0.06	2	0.527	<0.001	0.022	3.61	Silicified zone
BD1-20	66.65	67.40	0.75	<0.06	2	0.040	<0.001	0.015	1.25	Quartz vein
BD1-21	68.15	69.15	1.00	<0.06	2	0.016	<0.001	0.002	0.78	Quartz vein
BD1-22	69.15	70.15	1.00	<0.06	2	0.014	<0.001	0.002	0.52	Quartz vein
BD1-23	70.15	71.15	1.00	<0.06	2	0.011	<0.001	0.001	0.38	Quartz vein
BD1-24	71.15	72.15	1.00	<0.06	<2	0.013	<0.001	0.001	0.45	Quartz vein
BD1-25	72.15	72.70	0.55	<0.06	<2	0.036	<0.001	0.003	0.93	Quartz vein
BD1-26	72.70	73.10	0.40	<0.06	2	0.089	<0.001	0.012	3.41	Quartz vein
BD1-27	73.10	74.10	1.00	<0.06	2	0.021	0.001	0.004	1.71	Quartz vein
BD1-28	74.10	75.10	1.00	<0.06	2	0.009	<0.001	0.001	0.40	Quartz vein
BD1-29	75.10	76.20	1.10	<0.06	4	0.036	<0.001	0.005	1.14	Quartz vein
BD1-30	76.20	76.45	0.25	<0.06	<2	0.031	<0.001	0.012	3.11	Quartz vein
BD1-31	72.70	72.90	0.20	<0.06	2	0.079	<0.001	0.011	3.33	Quartz vein
BD1-32	72.90	73.10	0.20	<0.06	4	0.072	<0.001	0.013	3.17	Quartz vein

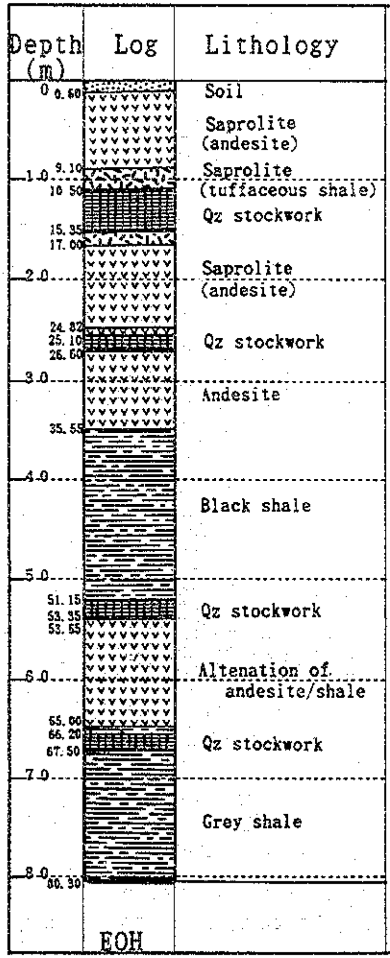
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-1)



ASSAY RESULTS OF ORE SAMPLES (MJT-2)

SAMPLE NO	DEPTH FROM	DEPTH TO	WIDTH m	AU g/t	AG g/t	CU %	PB %	ZN %	FE %	DESCRIPTION
BD2-2	9.00	9.80	0.80	<0.06	4	0.009	0.001	0.002	1.21	Quartz vein
BD2-3	10.10	11.50	1.40	<0.06	2	0.020	0.001	0.009	1.87	Bosa quartz
BD2-4	11.50	12.80	1.30	<0.06	2	0.018	0.002	0.008	1.29	Bosa quartz
BD2-5	12.80	13.20	0.40	<0.06	2	0.014	<0.001	0.003	1.67	Quartz vein
BD2-6	13.20	13.55	0.35	0.06	2	0.030	0.001	0.010	2.87	Bosa quartz
BD2-7	13.55	13.70	0.15	0.12	2	0.092	<0.001	0.020	4.08	Quartz vein
BD2-8	14.15	14.55	0.40	0.06	2	0.029	<0.001	0.006	1.43	Quartz vein
BD2-9	15.20	15.92	0.72	<0.06	2	0.024	0.001	0.012	1.77	Bosa quartz
BD2-10	15.92	16.00	0.08	<0.06	4	0.014	<0.001	0.006	1.62	Quartz veinlet
BD2-11	16.00	16.65	0.65	<0.06	4	0.022	0.001	0.011	1.55	Bosa quartz
BD2-12	16.65	16.70	0.05	<0.06	2	0.008	<0.001	0.002	0.54	Quartz veinlet
BD2-13	16.70	17.25	0.55	<0.06	2	0.017	0.001	0.008	1.36	Bosa quartz
BD2-14	17.25	17.30	0.05	<0.06	2	0.007	0.001	0.002	1.52	Quartz veinlet
BD2-15	17.87	18.00	0.13	<0.06	4	0.005	0.001	0.002	0.82	Quartz vein
BD2-16	18.00	19.35	1.35	<0.06	2	0.017	0.001	0.011	1.62	Bosa quartz
BD2-17	19.35	20.10	0.75	<0.06	2	0.009	<0.001	0.001	0.92	Quartz vein
BD2-18	20.10	20.80	0.70	<0.06	2	0.010	0.001	0.002	1.00	Quartz vein
BD2-19	20.80	21.10	0.30	<0.06	2	0.020	<0.001	0.008	1.04	Bosa quartz
BD2-20	21.10	21.30	0.20	<0.06	2	0.017	0.001	0.004	0.87	Quartz vein
BD2-22	33.80	33.84	0.04	<0.06	2	0.006	0.001	0.016	2.30	Quartz veinlet
BD2-23	35.06	35.23	0.17	<0.06	<2	<0.001	<0.001	<0.001	1.17	Quartz vein
BD2-24	36.29	36.40	0.11	<0.06	2	0.002	<0.001	0.004	3.26	Quartz vein
BD2-27	47.50	48.74	1.24	<0.06	<2	<0.001	<0.001	0.007	5.71	Quartz stockwork
BD2-28	48.74	49.20	0.46	<0.06	<2	<0.001	<0.001	0.001	0.92	Quartz vein
BD2-29	49.20	50.00	0.80	<0.06	2	0.002	<0.001	0.008	6.66	Quartz stockwork
BD2-30	50.00	50.80	0.80	<0.06	2	0.002	<0.001	0.005	4.47	Quartz stockwork
BD2-33	59.25	59.50	0.25	<0.06	2	0.008	<0.001	0.006	4.67	Quartz vein
BD2-35	66.50	67.20	0.70	<0.06	2	0.007	<0.001	0.006	4.94	Quartz stockwork

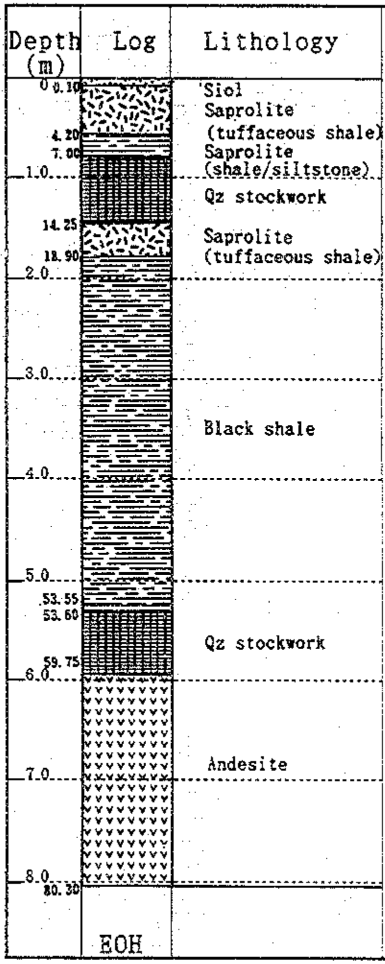
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-2)



ASSAY RESULTS OF ORE SAMPLES (MJT-3)

SAMPLE NO	DEPTH FROM	DEPTH TO	WIDTH m	AU g/t	AG g/t	CU %	PB %	ZN %	FE %	DESCRIPTION
BD3-1	10.50	11.50	1.00	0.44	<2	0.017	0.004	0.019	4.63	Quartz stockwork
BD3-2	11.50	12.50	1.00	0.40	<2	0.014	0.003	0.016	5.00	Quartz stockwork
BD3-3	12.50	13.55	1.05	0.25	<2	0.012	<0.001	0.012	4.34	Quartz stockwork
BD3-4	13.55	14.10	0.55	0.12	<2	0.014	0.001	0.012	4.37	Quartz stockwork
BD3-5	14.70	15.35	0.65	0.12	<2	0.007	<0.001	0.016	5.22	Quartz stockwork
BD3-6	25.10	25.50	0.40	<0.06	<2	0.010	<0.001	0.014	5.66	Quartz stockwork
BD3-7	25.50	25.59	0.09	<0.06	<2	0.003	<0.001	0.001	1.36	Quartz veinlet
BD3-8	25.59	26.60	1.01	<0.06	<2	0.002	<0.001	0.008	7.01	Quartz stockwork
BD3-9	27.45	27.55	0.10	<0.06	2	0.149	<0.001	0.039	1.85	Quartz vein
BD3-10	29.75	29.90	0.15	<0.06	<2	0.007	<0.001	0.010	5.78	Quartz stockwork
BD3-18	7.50	8.50	1.00	<0.06	2	0.076	0.012	0.020	8.87	Quartz stockwork
BD3-19	8.50	9.50	1.00	0.31	2	0.048	0.048	0.028	6.64	Quartz stockwork
BD3-20	9.50	10.50	1.00	0.40	2	0.054	0.026	0.024	6.04	Quartz stockwork
BD3-21	11.50	12.00	0.50	0.50	2	0.010	0.001	0.015	5.23	Quartz stockwork
BD3-22	12.00	12.50	0.50	0.22	2	0.007	0.001	0.013	4.05	Quartz stockwork
BD3-23	14.70	14.90	0.20	0.16	<2	0.007	<0.001	0.019	5.83	Quartz stockwork
BD3-24	14.90	15.35	0.45	0.12	<2	0.008	<0.001	0.017	6.18	Quartz stockwork
BD3-25	15.80	16.70	0.90	0.22	2	0.007	<0.001	0.011	5.45	Quartz stockwork

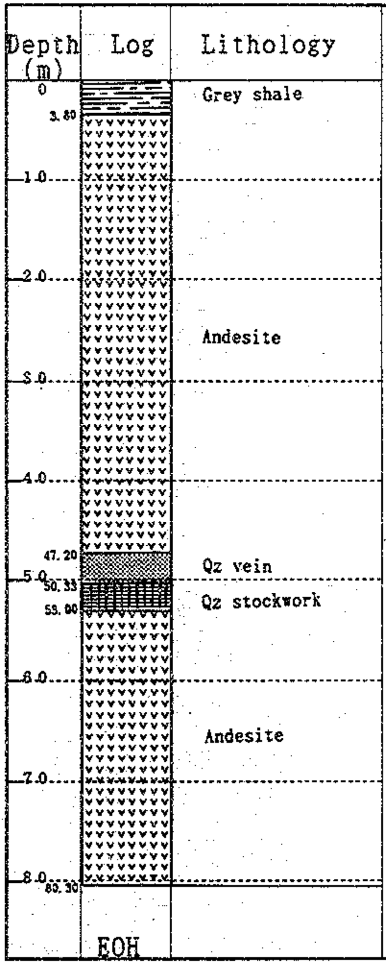
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-3)



ASSAY RESULTS OF ORE SAMPLES (MJT-4)

SAMPLE NO	DEPTH FROM	DEPTH TO	WIDTH m	AU g/t	AG g/t	CU %	PB %	ZN %	FE %	DESCRIPTION
BD4-1	4.80	5.50	0.70	<0.06	2	0.008	0.003	0.018	5.59	Quartz stockwork
BD4-2	9.85	10.85	1.00	0.19	2	0.007	0.001	0.034	4.66	Quartz stockwork
BD4-3	10.85	11.85	1.00	<0.06	2	0.007	0.001	0.051	4.71	Quartz stockwork
BD4-4	11.85	12.85	1.00	0.37	<2	0.007	<0.001	0.062	4.72	Quartz stockwork
BD4-5	12.85	13.15	0.30	0.12	<2	0.008	0.001	0.092	5.87	Quartz stockwork
BD4-6	13.15	13.90	0.75	<0.06	2	0.007	<0.001	0.050	3.68	Quartz stockwork
BD4-7	13.90	14.25	0.35	0.37	2	0.003	0.001	0.008	1.34	Quartz vein
BD4-8	18.90	19.20	0.30	<0.06	<2	0.006	0.004	0.018	5.15	Quartz stockwork
BD4-10	53.55	53.65	0.10	<0.06	2	0.001	<0.001	0.012	6.05	Quartz stockwork
BD4-11	53.65	53.75	0.10	<0.06	<2	0.003	<0.001	0.008	4.00	Quarzt vein
BD4-12	53.75	54.35	0.60	<0.06	2	0.005	<0.001	0.010	5.35	Quartz stockwork
BD4-13	54.35	54.45	0.10	<0.06	2	0.005	<0.001	0.005	2.84	Quartz vein
BD4-14	54.45	55.45	1.00	<0.06	2	0.006	<0.001	0.010	6.09	Quartz stockwork
BD4-15	55.45	56.45	1.00	<0.06	2	0.005	<0.001	0.008	5.13	Quartz stockwork
BD4-16	56.45	56.85	0.40	<0.06	2	0.008	<0.001	0.012	6.23	Quartz stockwork
BD4-17	56.85	56.95	0.10	<0.06	2	0.007	<0.001	0.009	2.14	Quartz vein
BD4-18	56.95	57.70	0.75	<0.06	2	0.003	<0.001	0.010	5.27	Quarzt stockwork
BD4-19	57.70	58.70	1.00	<0.06	<2	0.004	<0.001	0.010	5.64	Quarzt stockwork
BD4-20	58.70	59.75	1.05	<0.06	<2	0.003	<0.001	0.012	5.52	Quarzt stockwork
BD4-23	63.60	64.00	0.40	<0.06	2	0.002	<0.001	0.003	2.02	Quartz vein
BD4-26	7.00	7.90	0.90	0.53	<2	0.008	0.004	0.011	5.34	Quartz stockwork
BD4-27	5.50	6.00	0.50	<0.06	<2	0.008	0.002	0.017	6.01	Quartz stockwork
BD4-28	6.00	7.00	1.00	0.06	2	0.008	0.003	0.016	5.78	Quartz stockwork
BD4-29	13.15	13.30	0.15	<0.06	<2	0.008	<0.001	0.061	4.65	Quartz stockwork
BD4-30	13.30	13.90	0.60	0.06	<2	0.007	<0.001	0.048	3.58	Quartz stockwork
BD4-31	17.10	17.30	0.20	<0.06	<2	0.006	0.002	0.016	5.70	Quartz stockwork

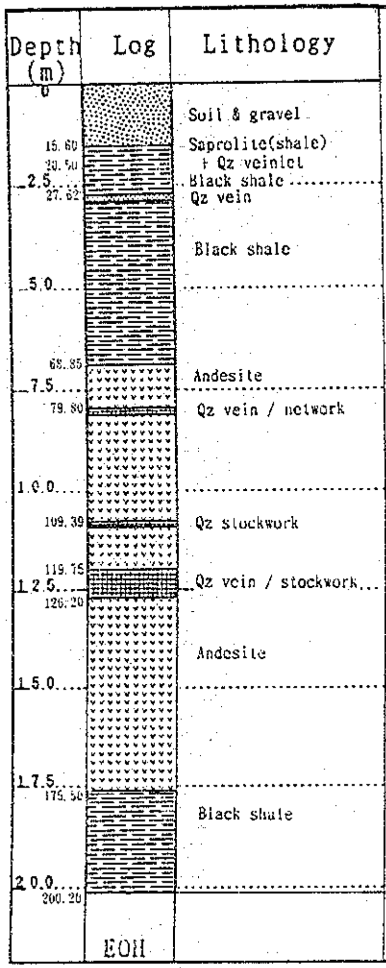
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-4)



ASSAY RESULTS OF ORE SAMPLES (MJT-5)

SAMPLE NO	DEPTH FROM	DEPTH TO	WIDTH m	AU g/t	AG g/t	CU %	PB %	ZN %	FE %	DESCRIPTION
BD5-2	46.50	47.20	0.70	<0.06	<2	0.065	<0.001	0.079	4.44	Silicified zone
BD5-3	47.20	47.60	0.40	<0.06	2	0.507	<0.001	0.021	3.47	Quartz vein
BD5-4	48.20	49.05	0.85	<0.06	<2	0.055	<0.001	0.013	1.08	Quartz vein
BD5-5	49.05	49.25	0.20	0.19	2	0.932	<0.001	0.038	3.36	Quartz vein
BD5-6	49.25	50.33	1.08	<0.06	2	0.161	<0.001	0.014	1.64	Quartz vein
BD5-7	47.60	48.20	0.60	<0.06	2	0.050	<0.001	0.013	0.97	Quartz vein

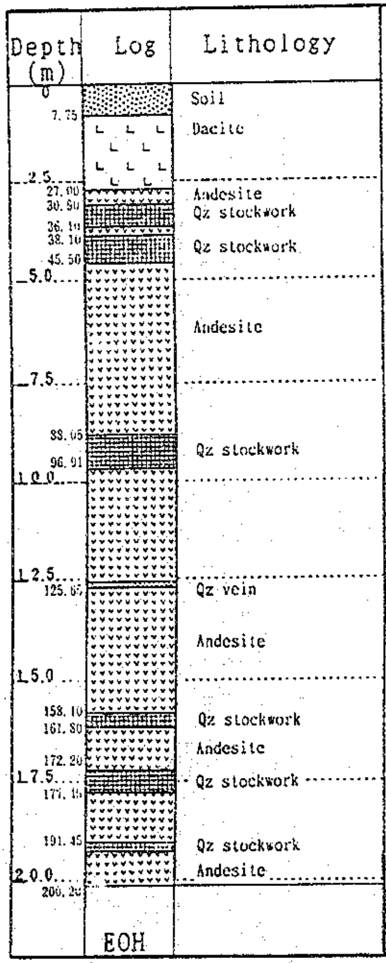
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-5)



ASSAY RESULTS OF ORE SAMPLES (MJT-6)

Sample No.	Depth From	Depth To	Width m	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Fe %	Description
BD6-1	15.60	16.60	1.00	0.06	<2	0.008	0.003	0.016	4.71	Quartz stockwork
BD6-2	16.60	17.60	1.00	0.08	<2	0.011	0.023	0.018	6.60	Quartz stockwork
BD6-3	17.60	18.60	1.00	0.11	<2	0.009	0.013	0.019	5.76	Quartz stockwork
BD6-4	18.60	19.60	1.00	0.14	<2	0.008	0.006	0.016	6.26	Quartz stockwork
BD6-5	19.60	20.50	0.90	0.11	<2	0.008	0.003	0.022	4.92	Quartz stockwork
BD6-6	27.62	28.05	0.47	0.06	<2	0.003	0.025	0.017	1.44	Quartz vein
BD6-7	79.80	80.23	0.43	<0.02	<2	0.010	0.003	0.022	2.02	Quartz stockwork
BD6-8	103.75	103.87	0.12	<0.02	<2	0.004	0.001	0.004	4.01	Quartz vein
BD6-9	109.39	109.44	0.05	0.03	<2	0.186	0.001	0.072	7.00	Quartz veinlet
BD6-10	109.55	109.76	0.21	0.02	<2	0.100	0.001	0.497	1.90	Quartz vein
BD6-11	116.24	116.60	0.36	<0.02	<2	0.038	0.001	0.133	2.49	Quartz vein
BD6-31	119.75	119.88	0.13	0.06	2	0.003	<0.001	0.005	4.09	Quartz stockwork
BD6-32	119.88	120.00	0.12	35.68	4	0.004	<0.001	0.009	3.19	Quartz stockwork
BD6-33	120.00	120.10	0.10	1.60	2	0.006	0.001	0.012	3.40	Quartz stockwork
BD6-34	120.10	120.35	0.25	1.66	2	0.015	0.001	0.015	6.23	Quartz stockwork
BD6-13	120.35	120.75	0.40	0.11	2	0.127	0.001	0.015	4.39	Quartz stockwork
BD6-29	120.75	121.25	0.50	0.03	<2	0.038	<0.001	0.058	2.52	Quartz stockwork
BD6-14	121.60	121.67	0.07	<0.02	<2	0.030	<0.001	0.121	1.93	Quartz stockwork
BD6-15	121.76	121.80	0.04	<0.02	<2	0.109	0.002	0.103	5.43	Quartz stockwork
BD6-16	121.88	121.94	0.06	<0.02	<2	0.023	0.001	0.059	4.85	Quartz stockwork
BD6-17	122.27	122.34	0.07	<0.02	<2	0.122	<0.001	0.194	4.63	Quartz stockwork
BD6-18	122.43	122.47	0.04	<0.02	<2	0.012	0.001	0.047	4.74	Quartz stockwork
BD6-19	122.50	122.60	0.10	<0.02	<2	0.041	0.002	0.041	1.07	Quartz stockwork
BD6-20	122.62	122.70	0.08	<0.02	<2	0.012	<0.001	0.047	1.22	Quartz stockwork
BD6-21	123.62	123.67	0.05	<0.02	2	0.004	0.001	0.012	3.34	Quartz stockwork
BD6-22	123.79	123.88	0.09	<0.02	2	0.011	<0.001	0.050	2.33	Quartz stockwork
BD6-23	124.44	124.51	0.07	0.12	2	0.022	0.002	0.044	10.25	Quartz stockwork
BD6-24	124.60	124.70	0.10	<0.02	<2	0.008	<0.001	0.015	2.54	Quartz stockwork
BD6-25	124.80	124.90	0.10	<0.02	2	0.003	0.001	0.009	2.11	Quartz stockwork
BD6-26	125.30	126.20	0.90	<0.02	<2	0.057	0.001	0.088	0.90	Quartz vein
BD6-27	130.30	130.45	0.15	<0.02	<2	0.033	0.001	0.017	0.34	Quartz vein
BD6-28	135.68	135.73	0.05	<0.02	<2	0.004	<0.001	0.003	3.53	Quartz veinlet
BD6-30	198.40	198.53	0.13	<0.02	<2	0.002	0.001	0.002	0.93	Quartz vein

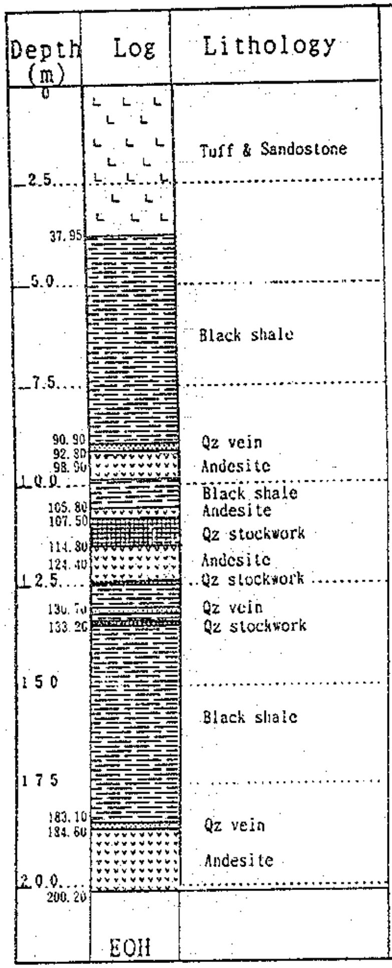
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-6)



ASSAY RESULTS OF ORE SAMPLES (MJT-7)

Sample No.	Depth From	Depth To	Width m	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Fe %	Description
BD7-1	30.90	31.90	1.00	<0.02	4	0.005	0.001	0.014	6.79	Quartz stockwork
BD7-2	31.90	32.60	0.70	<0.02	2	0.006	0.001	0.018	6.88	Quartz stockwork
BD7-3	33.30	34.30	1.00	<0.02	2	0.033	0.002	0.012	5.25	Quartz stockwork
BD7-4	34.30	35.30	1.00	<0.02	2	0.017	0.001	0.010	7.22	Quartz stockwork
BD7-5	35.30	36.10	0.80	<0.02	2	0.006	0.001	0.011	5.24	Quartz stockwork
BD7-6	38.10	39.10	1.00	0.05	<2	0.004	0.001	0.013	6.40	Quartz stockwork
BD7-7	39.10	40.10	1.00	<0.02	2	0.003	0.001	0.016	6.11	Quartz stockwork
BD7-8	40.10	41.10	1.00	0.02	2	0.023	0.001	0.049	6.01	Quartz stockwork
BD7-9	41.10	42.10	1.00	0.05	2	0.067	0.001	0.075	6.44	Quartz stockwork
BD7-10	42.10	43.10	1.00	<0.02	2	0.007	0.001	0.015	4.82	Quartz stockwork
BD7-11	43.10	43.50	0.40	<0.02	2	0.009	0.001	0.011	5.21	Quartz stockwork
BD7-12	44.50	45.50	1.00	<0.02	2	0.022	0.001	0.010	4.09	Quartz stockwork
BD7-13	88.05	88.09	0.04	<0.02	<2	0.005	<0.001	0.007	3.89	Quartz veinlet
BD7-14	89.63	89.70	0.07	<0.02	<2	0.020	<0.001	0.003	2.26	Quartz veinlet
BD7-15	90.30	91.30	1.00	<0.02	<2	0.004	0.001	0.006	5.49	Quartz stockwork
BD7-16	91.30	92.30	1.00	0.05	2	0.001	0.002	0.006	6.12	Quartz stockwork
BD7-17	92.30	93.30	1.00	0.11	2	0.009	0.001	0.008	6.64	Quartz stockwork
BD7-18	93.30	94.40	1.10	0.08	2	0.002	0.001	0.007	6.88	Quartz stockwork
BD7-38	94.70	96.00	1.30	0.05	<2	0.011	0.001	0.008	7.28	Clayey zone
BD7-19	96.00	96.05	0.05	0.02	<2	0.004	<0.001	0.006	6.56	Quartz veinlet
BD7-20	96.05	96.55	0.50	0.86	<2	0.002	0.001	0.005	5.19	Quartz stockwork
BD7-21	96.55	96.76	0.21	28.55	4	0.002	<0.001	0.004	3.49	Quartz vein
BD7-22	96.76	96.91	0.15	56.61	8	0.004	0.001	0.007	3.39	Quartz stockwork
BD7-23	125.65	125.95	0.30	<0.02	<2	0.068	0.001	0.043	1.79	Quartz vein
BD7-24	134.20	134.75	0.55	<0.02	<2	0.061	<0.001	0.006	3.87	Quartz stockwork
BD7-25	151.85	152.40	0.55	<0.02	2	0.003	<0.001	0.007	5.59	Quartz stockwork
BD7-26	158.10	158.35	0.25	0.03	2	0.019	0.001	0.018	4.36	Quartz stockwork
BD7-40	160.75	160.80	0.05	0.25	6	5.090	0.001	0.162	26.00	Quartz stockwork
BD7-27	161.40	161.80	0.40	<0.02	2	0.598	<0.001	0.033	5.63	Quartz stockwork
BD7-28	164.25	164.60	0.35	<0.02	<2	0.045	<0.001	0.006	4.43	Quartz stockwork
BD7-29	164.80	165.60	0.80	<0.02	<2	0.222	0.001	0.021	5.62	Quartz stockwork
BD7-30	165.60	166.10	0.50	<0.02	<2	0.264	0.001	0.028	6.44	Quartz stockwork
BD7-31	172.20	172.30	0.10	<0.02	4	1.090	0.001	0.023	6.70	Quartz stockwork
BD7-32	172.70	172.80	0.10	<0.02	<2	0.021	<0.001	0.008	6.14	Quartz stockwork
BD7-33	173.55	174.30	0.75	<0.02	2	0.357	<0.001	0.042	8.27	Quartz stockwork
BD7-34	174.30	175.00	0.70	<0.02	<2	0.096	<0.001	0.033	5.92	Quartz stockwork
BD7-35	176.95	177.45	0.50	<0.02	<2	0.118	<0.001	0.678	5.12	Quartz stockwork
BD7-36	191.45	192.05	0.60	0.06	<2	0.009	0.001	0.014	4.19	Quartz stockwork
BD7-37	192.05	192.65	0.60	<0.02	<2	0.027	0.006	0.015	6.77	Quartz stockwork
BD7-39	192.65	193.45	0.80	0.02	<2	0.008	0.001	0.014	6.77	Quartz stockwork

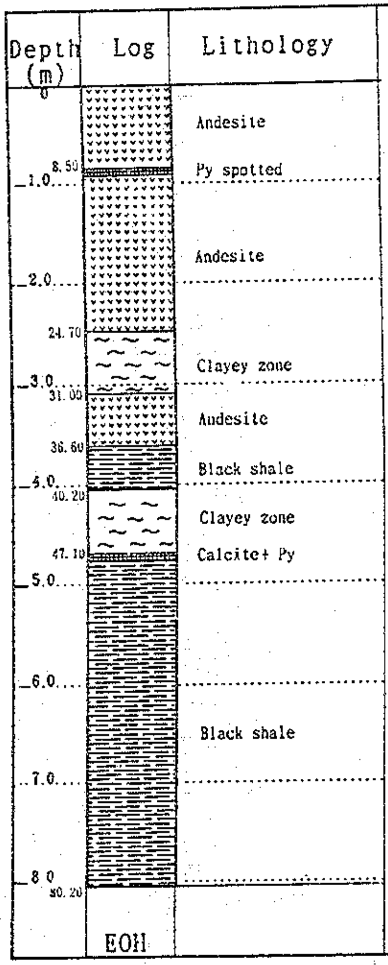
Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-7)



ASSAY RESULTS OF ORE SAMPLES (MJT-8)

Sample No.	Depth From	Depth To	Width m	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Fe %	Description
BD8-1	67.00	67.50	0.50	0.03	<2	0.008	0.004	0.013	5.88	Quartz stockwork
BD8-2	90.90	91.04	0.14	<0.02	<2	0.003	0.001	0.007	2.10	Quartz vein
BD8-3	107.50	107.73	0.23	<0.02	<2	0.014	<0.001	0.013	2.10	Quartz stockwork
BD8-4	107.73	108.70	0.93	<0.02	<2	0.021	<0.001	0.009	2.19	Quartz stockwork
BD8-5	108.70	109.30	0.60	0.19	18	4.870	0.004	0.198	10.35	Quartz stockwork
BD8-6	109.30	110.30	1.00	<0.02	2	0.437	<0.001	0.021	3.79	Quartz stockwork
BD8-7	110.30	111.05	0.75	0.06	<2	0.009	0.001	0.069	2.84	Quartz stockwork
BD8-8	111.27	111.90	0.63	<0.02	<2	0.122	0.001	0.009	1.86	Quartz stockwork
BD8-9	112.05	112.30	0.25	<0.02	4	0.858	0.001	0.043	5.17	Quartz stockwork
BD8-10	112.30	112.85	0.55	<0.02	2	0.544	0.001	0.022	3.36	Quartz stockwork
BD8-11	112.98	113.20	0.22	<0.02	<2	0.011	<0.001	0.009	4.73	Quartz stockwork
BD8-12	113.38	113.83	0.45	<0.02	2	0.024	0.001	0.006	1.62	Quartz stockwork
BD8-13	113.90	114.44	0.54	<0.02	2	0.142	0.001	0.009	3.68	Quartz stockwork
BD8-14	117.63	117.87	0.24	0.08	2	0.018	<0.001	0.006	4.87	Quartz stockwork
BD8-15	118.20	119.10	0.90	0.08	<2	0.025	<0.001	0.027	3.49	Quartz stockwork
BD8-16	122.85	123.33	0.48	0.08	2	0.008	0.001	0.010	5.20	Quartz stockwork
BD8-17	124.40	124.57	0.17	0.17	2	0.012	0.001	0.004	3.62	Quartz stockwork
BD8-20	130.70	130.77	0.07	0.42	2	0.016	0.016	0.047	7.14	Quartz veinlet
BD8-21	133.26	133.92	0.66	14.31	2	0.037	0.002	0.019	4.94	Quartz stockwork
BD8-22	136.80	137.22	0.42	<0.02	4	0.117	0.001	0.018	3.11	Quartz stockwork
BD8-23	137.32	137.50	0.18	0.09	<2	0.004	<0.001	0.041	2.64	Quartz stockwork
BD8-24	182.05	182.55	0.50	0.03	<2	0.003	<0.001	0.006	3.45	Quartz stockwork
BD8-25	183.02	183.55	0.53	<0.02	<2	0.002	0.001	0.009	2.44	Quartz stockwork
BD8-26	184.60	185.35	0.75	0.06	4	1.510	0.001	0.105	5.59	Quartz vein
BD8-29	199.80	200.20	0.40	<0.02	<2	0.011	<0.001	0.003	3.87	Quartz stockwork

Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-8)



ASSAY RESULTS OF ORE SAMPLES (MJT-9)

Sample No.	Depth From	Depth To	Width m	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Fe %	Description
BD9-1	8.50	8.65	0.15	<0.02	<2	0.010	<0.001	0.009	5.94	Pyrite spotted
BD9-2	9.10	9.30	0.20	<0.02	<2	0.025	<0.001	0.010	3.87	Pyrite spotted
BD9-3	47.10	47.30	0.20	<0.02	<2	0.006	0.003	0.015	6.03	Calcite-Py network
BD9-4	69.00	69.10	0.10	<0.02	<2	0.002	0.008	0.008	3.66	Qz-calcite network
BD9-11	69.75	69.80	0.05	<0.02	<2	0.003	0.008	0.013	7.29	Qz-calcite network
BD9-5	72.85	73.25	0.40	<0.02	<2	<0.001	<0.001	0.001	2.85	Silicified zone
BD9-6	77.40	77.55	0.15	<0.02	2	0.004	0.003	0.013	4.67	Qz-calcite network
BD9-7	78.50	78.65	0.15	<0.02	<2	0.003	0.003	0.013	6.27	Qz-calcite network
BD9-8	79.80	79.95	0.15	<0.02	2	0.005	0.003	0.013	4.70	Qz-calcite network

Fig. 2-2-7 Summary of Drill Logs and Assay Results of Core Samples(MJT-9)

2-9 Discussions

2-9-1 Geology, Geologic Structure and Mineralization

The extensive development of auriferous quartz veins and quartz stockworks was confirmed over an area of 2,500 m x 1,500 m including S. Tarawa, S. Bone, Tondoratte, S. Malela, and S. Pongo. Quartz veins and quartz stockworks are hosted by volcanic-sedimentary strata of the Cretaceous Latimojong Formation.

From the structural point of view, the prospect is situated on the western flank of an anticlinorium (whose axis is N-S) formed by the emplacement of the Mamasà granite. The Mamasa granite batholith is exposed several kilometers to the south of the prospect. Small stocks of diorite occur within the prospect, and a granite body is believed to exist beneath the prospect. This geologic setting is the most important factor for the formation of vein pattern in the prospect. Several vein systems were distinguished in the prospect; NNW, N-S, and NW systems.

Two styles of quartz and sulphide mineralization -- massive quartz vein (single vein) and quartz stockwork system -- were distinguished in the Batuisi prospect. The major single veins occur at the lower to the middle reaches of S. Tarawa, the middle reaches of S. Bone, and S. Malela. Whereas stockworks are mainly developed at the Tondoratte area. Of course there are many places where these two styles coexist. From the lower reaches of S. Tarawa up to Tondorrate, the relative abundance of massive quartz veins of moderate to steep dip decreases. By contrast to this, the occurrence of quartz stockwork zones of mostly gentle dipping increases near the Tondoratte area. No displacement of wall-rocks has been recognized in quartz stockwork system. It means that stockworks at the Tondoratte zone were formed in tension cracks. The force which caused such tension cracks is unknown. On the contrary, massive quartz veins were probably deposited in faults. There is no evidence of chronological difference between single vein and stockwork system.

The comparative density and intensity of quartz veining between volcanic facies and clastic facies are matters worthy to be considered. Most of quartz veins and stockworks were found in andesite in the Tondoratte zone. It is probably caused by the brittle property of the volcanic rock.

Based on the results of the reconnaissance drilling in the second phase, which indicated the possibility of the occurrence of gently NE-dipping quartz veins and stockwork zones in this area, the drilling programme of the third phase was designed. Significant results have been obtained from the drilling. Good intersections were caught in all three drill holes at the Tondoratte mineralized zone. Each of these major intersections can be correlated to the surface indications of gold mineralization. The dip of the veins, however, was only tentatively interpreted to be gentle NE by the evidence at hand. The distance of outcrops and drill intersections are quite large. It is still in an early stage of exploration. It is, of course, well known that steeply dipping veins are more common than gentle ones, and such possibility must be carefully considered in planning for future work.

Gold mineralization in this area shows the following five distinctive features which are characteristic to mesothermal gold-bearing quartz veins:

① Auriferous quartz veins often show massive features.
② Gold grains are comparatively coarse.
③ Gold is associated with sulphide minerals such as pyrite and chalcopyrite.
④ The major gangue minerals are quartz, ankerite, and calcite.
⑤ Hydrothermal alteration is mainly composed of silicification, chloritization, and sericitization.

Gold-bearing quartz veins and quartz stockworks in this area are hosted mainly by low-grade metamorphosed (sub-greenschist facies) Cretaceous volcanic-sedimentary strata. Quartz veins sometimes show hard, thick, and massive features. Quartz crystals have subrounded to subhedral morphology, and are white to light grey with silky or resin bright tint. It sometimes has chalcedonic appearance. The quartz grains are coarse, from slightly less than 1 mm up to several millimeters. Banded texture was rarely observed in quartz veins. The vein quartz in this area exhibits that of mesothermal veins morphologically.

The grain size of gold is estimated to be coarse from the study of pan concentrates in which a gold grain of up to 500 microns was reported during the first phase survey. Coarse gold is characteristic of mesothermal deposits, which often bear an erratic nature of gold mineralization.

Gold assays, some of which show significant grades, were obtained from a part of quartz veins where a small amount of sulphide minerals was impregnated. Pyrite and chalcopyrite are the minerals most closely associated with gold. Traces of arsenopyrite, sphalerite, galena and bornite were also found in such part. Silver mineral has not been identified in the sulphide mineral association yet.

Quartz, ankerite and calcite are accounted for the major part of gangue minerals. Adularia was seldom observed in quartz veins. Neither alunite nor hypogene kaolin has been found.

Silicification, chloritization and sericitization were recognized in andesite and shale around quartz veins and quartz stockworks. The other alterations identified within mineralized zones were pyritization and carbonatization. Pervasive propylitization was observed in this area. Wall-rock alteration in a hydrothermal system generally changes from silicification-propylitization in the deeper zone to argillic alteration in the upper part. Advanced-argillic alteration appears at the top of the system in some cases. The alteration in this area is very similar to the lower facies of the typical hydrothermal system.

The results of fluid inclusion studies in the Batuisi prospect provide the geochemical framework of vein formation.

Most of fluid inclusions in quartz are of two-phase liquid-rich type. The homogenization temperature of individual fluid inclusion ranges from 180°C up to 370°C. Although the salinity of fluid inclusions has not been measured, it was assumed to be medium from the microscopic observation of liquid-vapor phase relationship. Polyphase inclusions were discovered in some quartz samples. One of the daughter minerals is halite.

The indication which implies boiling phenomena has not been observed in fluid inclusions. Fluid boiling might have been occurred in much higher part of the hydrothermal system in this area.

Assay results of drill cores in the second phase and the third phase are interesting. Ore-grade values of gold were obtained approximately 100 m below surface. Only low grade values were returned from intersections in the shallow parts. There is a possibility of gold depletion by the lateritic weathering process. Strong weathering was recognized in trenches and drill holes at the Tondoratte zone. The oxidation of sulphide minerals was recognized from surface down to the deeper part of drill holes. In MJT-7, strong limonitization was observed even at the end of hole. Clayey zones which were thought as faults were caught in such depths in MJT-7. It was interpreted that the oxidation of sulphide minerals within quartz veins/stockworks was caused by surface water introduced along the faults. It is a remarkable feature of the Tondoratte area that the influence of weathering is recognizable in such depths. The results of drilling in this phase, together with those in the previous phase, indicate that the degree of weathering is an important factor for gold depletion. It may be a horizon of gold depletion from surface down to approximately 100 m. From 100 m deep there occur a primary (or slightly depleted) horizon. It probably corresponds to the lower part of oxidized zone.

The erratic nature of gold grade is another characteristic feature of gold mineralization in this area. Gold is thought to be associated with sulphide dissemination. Sulphide minerals, especially pyrite, are disseminated widely in and around the zone of quartz veining. However, ore grade parts occur in a limited zone of sulphide mineralization. The surrounding zone, still within a quartz vein or a quartz stockwork system, has very low grade in gold. High grade ores show a kind of nugget effect. It is a specific character of mesothermal gold deposit.

On the basis of these examinations, the process of vein formation in the Batuisi prospect is inferred as follows.

The Batuisi prospect is situated at the north of the Mamasa granite batholith. A granite body -- batholith or cupola -- may exist beneath the prospect. The current surface corresponds to the lower part of a hydrothermal system which was originated from the deeper igneous body. An epithermal environment, which might produce a pervasive gold mineralization, was probably formed at much higher levels than the present surface. The convecting hydrothermal system was driven by heat derived from the igneous body beneath the area at a depth of several kilometers.

The origin of ore-forming fluid has not been identified. Generally speaking, there are three possibilities; fractional crystallization of felsic magma emplaced in the upper crust, devolatilization reaction during prograding metamorphism, and surfacial water infiltrating through deep fractures. The participation of magmatic water from granite body in some degrees is highly speculated. The timing of ore deposition has not been ascertained yet. The results of age dating on the Mamasa granite indicate that it may be at least sometime between the late Miocene and Pliocene.

2-9-2 Geochemistry

In the first phase, panning prospecting, stream sediment survey and reconnaissance soil survey were carried out for an area covering approximately 50 km^2 in the Batuisi prospect. The soil sampling was made along creeks and ridge lines. Two hundred forty-nine soil samples were taken and provided for chemical analysis. Data were statistically processed. The results of geochemistry were examined together with the results of geological survey, and the central part of the prospect was highlighted for the next exploration.

The geochemical works during the second phase survey consisted of grid soil survey and rock-chip sampling. A total of 1,514 soil samples and 214 rock-chip samples was collected from an area of 15 km^2. Chemical analysis was made for eight elements; Au, Ag, As, Sb, Hg, Cu, Pb, and Zn. Statistical data processings including principal components analysis were practiced for extracting some efficient combination of elements.

Three distinctive Au anomalies and several minor anomalies were delineated from grid soil survey and rock-chip geochemistry in the second phase. The major anomalies are located at; ① the upper reaches of S. Tarawa and S. Bone (the Tondoratte mineralized zone), ② the area between S. Malela and S. Pongo (the Malela-Pongo mineralized zone), and ③ the middle reaches of S. Bone (the middle reaches of S. Bone mineralized zone). These anomalies are distributed within an area of 2,500 m (NE-SW) x 1,500 m (NW-SE) centered at the top of the ridge. They are composed of significant Au values of soil samples (threshold value of Au$>$8.8 ppb). Au values greater than 100 ppb were obtained from more than 20 samples. The maximum value is 1,340 ppb Au found in the zone ①. Anomalies of Cu and Zn almost overlap on the Au anomalies.

The geochemical anomalies agree well with the areas where intensive quartz veins/stockworks were found.

An outstanding Au anomaly was outlined at the area extending over the upper reaches of S. Tarawa and the upper reaches of S. Bone (1,000 m × 500 m). This anomaly corresponds to the area of intensive quartz stockworking. Anomalies of Cu and Zn were also recognized in this area. Several anomalous values of rock-chip samples of up to 300 ppb Au were obtained within the area.

Au anomaly disappears towards the higher part near the ridge. It is assumed that the anomaly once existed there, but the slash-and-burn farming disturbed the original geochemical conditions. The highest part of the ridge is covered by dacitic volcanics of the Barupu Tuffs. Considering these two factors, the area between the upper reaches of S. Tarawa and S. Malela may have a significant potential of gold-quartz mineralization.

A distinctive Au anomaly was found at the area between S. Malela and S. Pongo (500 m × 400 m). This is roughly correlated to the area of quartz veins. Anomalies of Cu and Zn were also confirmed in this area. Assay results of up to 0.40 g/t Au were returned from quartz float samples in this area.

A group of Au anomalies was detected at the area extending over the middle reaches of S. Tarawa and the middle reaches of S. Bone (600 m × 400 m). Several massive quartz veins crop out within this anomaly. Anomalous values of rock-chip samples of up to 172 ppb Au were obtained from this area. A remarkable value of 1,685 ppb Au was found from a rock-chip sample adjacent to this area along the middle reaches of S. Bone.

These mineralized zones show common features mentioned above, although they have a minor difference in several aspects. Therefore, it is interpreted to be formed under the similar conditions. The area of geochemical anomalies on the surface may correspond roughly to the area of subsurface gold mineralization.

2-9-3 Potential of Resources

During the first phase, surface indications of gold mineralization were found through semi-detailed geological survey, stream sediment geochemical survey, and reconnaissance soil survey in the Batuisi prospect. In the second phase, significant mineralized zones were delineated through detailed geological survey, grid soil survey, trenching, and reconnaissance drilling. It is composed of significant Au anomalies of soil and rock-chip geochemistry, outcrops of auriferous quartz veins and quartz stockworks, and hydrothermal alteration zones. It has an area of 2,500 m × 1,500 m centered at the top of the ridge. It was interpreted that the type of mineralization was mesothermal gold-quartz veins occurred in the Cretaceous Latimojong Formation. The development of quartz veins and quartz stockworks is strong. Anomalies occur densely. The size and magnitude of gold mineralization were estimated to be medium from the geochemical features. The results of drilling in the second phase were disappointing. Only low grade gold mineralization came out from drill holes. No ore-grade value has been obtained. However a limited part of the mineralized zone was tested. It was composed of short holes. It was assumed that there was a possibility of near-surface gold depletion by lateritic weathering process in this area.

Based on these considerations, drilling exploration for testing the vertical extensions of some of the most significant gold indications was conducted in the third phase. The results are encouraging. Significant gold mineralization was confirmed in three drill holes at the Tondoratte zone. The intersections are composed of gold-bearing quartz veins of up to 40.24 g/t Au at 36 cm in width. They were obtained from rather deep parts of drill holes (96 ~ 134 m in depth). The gold potential of this area is rather difficult to assess at this stage, because the data is not sufficient. There are two possibilities; one is the existence of several gentle dipping fairly large auriferous quartz veins which was considered by the results of the survey of the previous phase, the other is the possibility of a significant network zone of relatively thin veins.

The existence of ore-grade gold mineralization was confirmed by the third phase exploration. It is interpreted that the Tondoratte mineralized zone may represent a part of extensive gold mineralization whose figure is expressed as geochemical anomalies on the surface. Further drilling is necessary for the full-evaluation of this deposit. The next stage programme has two purposes; ① to make an evaluation of the entire mineralized zones, and ② to follow-up the Tondoratte mineralized zone. For the purpose ①, the other mineralized zones, such as the middle reaches of S. Bone zone and the Malela-Pongo zone, must be tested by several drill holes. At the top of ridge, a slightly deep hole should be drilled to test below the Quaternary cover of the Barupu Tuffs. The details of gold mineralization, especially the nature of grade distribution and the structure of vein system, can be investigated through the follow-up drilling at the Tondoratte area. The integrated interpretation of the survey results in the Batuisi prospect is shown in Fig. 1-7.

Chapter 3 Bau Prospect

3-1 Outline of the Prospect

The Bau prospect is located along S. Salole and its tributaries in the central northern part of the survey area. The area, situated in one of the most inland part of the central western Sulawesi, is surrounded by steep hills and mountains of more than 1,000 m above sea level. Altitudes of the prospect are in the proximity between 460 m (at the bridge of S. Salole) and 1,000 m. Access from the outer world is very difficult.

The geology of the prospect is composed mainly of black shale, andesite and dolerite of the Latimojong Formation. The prospect is structurally located on the eastern wing of the regional anticlinorium which was interpreted to be formed by the emplacement of the Mamasa granite batholith. Small stocks and dykes of granitic rocks occur in the Latimojong Formation.

Semi-detailed exploration comprising geological survey, panning prospecting and reconnaissance soil survey was carried out for the area covering approximately 50 km^2 in the first phase. As a result of the exploration, several mineralized zones were delineated within the prospect. These zones are composed of outcrops of quartz veins and alteration zones (mainly pyrite dissemination), panning and stream sediment anomalies, and Au soil anomalies. The eastern anomalous zone, running from Kp. Bau down to the junction of S. Salole and S. Belopi, is characterized by the development of quartz veins and veinlets with a small amount of sulphide minerals. The western anomalous zone, running along the lower reaches of S. Salole and S. Balimbing, is tracked by the sporadic occurrences of gold anomalies in either pan concentrates or stream sediment samples. The distribution of quartz floats and pyrite dissemination was also recognized in the zone. The strike direction of each zone was interpreted to be almost NNW from the arrangement of mineral showings.

Based on the results of the first phase exploration, the western part was selected for the further exploration area. The area was about 15 km^2. Detailed exploration was conducted in the second phase. It was composed of geological survey, soil survey, and geochemical rock-chip sampling.

3-2 Geological Survey

3-2-1 Survey Method

Detailed geological survey was carried out together with soil survey and geochemical rock-chip sampling in the Bau prospect in the second phase. A base camp was set up at Kp. Bau. Flying camp survey was also utilized together with the base camp. The survey was carried out along creeks and ridge lines. The sampling points were tried to be distributed uniformly. However some of the survey points were slightly offset from the proper position because of the steep topography. A 1:10,000 scale route map was produced. The results of the geological survey were compiled on a 1:10,000 scale geological map. A total of 50 km was traversed, and 27 ore samples were collected. Numbers of samples for polished sections and X-ray powder analysis were 7 and 11 respectively in the second phase.

3-2-2 Geology and Geologic Structure

Latimojong Formation (Klv) : It consists of shale, andesite lava, andesitic tuff and dolerite. Shale is widely distributed in the Bau prospect. Color of this rock is dark grey to black. It shows massive texture in general. Slatey cleavage was recognized only in the vicinity of fault. It was observed at the contact of shale and granite intrusive bodies that the indurated shale became much darker and showed resin brightness due to the maturation of organic matters.

Andesite lava shows propylitic features. Hyaloclastic texture was often recognized in the peripheral zone of the extension. This rock sometimes contains shale units, and it was interpreted as an effusive facies on the sea floor.

Fine tuff and lapilli tuff occur in the prospect. These pyroclastic units are interbedded within the alternation of black shale and andesite.

Dolerite crops out almost covering the southern half of the prospect. This rock unit often shows intrusive nature. It has steep contact with black shale and andesite in some part. The host rocks are intensively indurated. Silicification and pyritization were observed in the host rocks near the contact.

Intrusive rocks : Several small stocks and sills of granodiorite and diorite are distributed in the northern part of the prospect.

The sedimentary and pyroclastic sequences of the Latimojong Formation generally strike NW-SE and dip W at 20 to 40°. The intrusive bodies are arranged in the NW-SE direction at the north of S. Saloie.

Several faults were inferred to exist in the southern part of the prospect. They exhibit a spatial arrangement enclosing dolerite mass.

The geology and geologic profile of the Bau prospect are shown in Fig. 2-3-1.

3-2-3 Mineralization and Associated Alteration

Two styles of mineralization and associated alteration were distinguished in the Bau prospect. One is fissure filling quartz mineralization accompanied by a small amount of sulphide minerals, and another is the pyrite dissemination near the intrusive bodies.

Quartz veins in the prospect can be divided into two groups on the basis of their strike-dip patterns; NNW-SSE system with dipping E, and NE system with dipping SE or NW. The width of quartz veins ranges from 1 cm up to nearly 2 m for both systems. However the majority is less than 30 cm in width.

Sulphide minerals are frequently associated with NE system. They occur as disseminated fine grains in quartz. Quartz veins of NNW system tend to contain a very small amount of sulphides. Pyrite, arsenopyrite and chalcopyrite were observed in common. Sphalerite and galena were also observed in some quartz samples. Bornite was found in quartz samples from S. Balimbing. It was observed at S. Salubongi that the quartz vein of NE system was crosscut by NNW system. Quartz vein which contains a small amount of sulphide minerals carries some gold. The best result returned from assay samples is 2.18 g/t Au at 10 cm in width (BAC17A).

Gangue minerals identified in the field are quartz, chlorite, montmorillonite, and sericite. The wall rock alteration of quartz veins is dominated by silicification, chloritization, and carbonitization.

Pyrite dissemination was observed within diorite intrusives. Black shale intruded by igneous bodies is affected by pyritization and silicification. The occurrence of pyrite dissemination was found mainly at the northern part of the prospect. This is spatially correlated to the distribution of gold anomalies outlined through the geochemical survey (stream sediments and panning) in the first phase. It suggests that the pyrite dissemination is the source of low level gold anomalies in the prospect.

3-3 Soil Survey

3-3-1 Sampling and Chemical Analysis

Detailed soil sampling was conducted for the entire 15 km^2 area in the Bau prospect in the second phase. Soil samples were taken from the B-layer of residual soil at depths of 40 to 70 cm from the surface using hand-auger. The sampling points were set along creeks and ridge lines in order to be uniformly arranged as much as possible within the topographic restriction.

Methods of soil sampling and chemical analysis were the same as in the Batuisi prospect. A total of 506 soil samples was collected in the second phase.

3-3-2 Statistical Data Processing

The same methods and procedures as in the Batuisi prospect were adopted in the data processing of soil samples in the Bau prospect.

3-3-3 Anomalies of Soil Geochemistry

Although anomalous values of a certain level (up to 165 ppb Au) have been obtained in the prospect; they are isolated each other. No important correlation has been recognized between Au and the other basemetal elements through the statistical analysis.

Some of the significant anomalies are explained as follows. Anomalies of soil geochemistry are shown in Fig. 2-3-2 together with rock-chip geochemistry.

S. Salubongi

From the junction of S. Salole and S. Belopi up to the middle reaches of S. Salubongi, several anomalous Au values (up to 22 ppb) were obtained. They are roughly correlated with the occurrences of quartz veins which contain pyrite and chalcopyrite. They are distributed sporadically.

Western side of S. Belopi

Anomalous values of Cu and Zn are densely arranged at the western side of S. Belopi.

S. Balimbing

Several Au anomalies were caught at the middle reaches of S. Balimbing. The biggest one (about 1 km long) was found within massive andesite. It is an Au anomaly of up to 64 ppb.

Lower reaches of S. Salole

Several Au anomalous values were found along the lower reaches of S. Saloie. They occur sporadically. As anomalies are associated with them. They are roughly correlated with pyrite dissemination within black shale.

3-4 Geochemical Rock-Chip Sampling

3-4-1 Sampling and Chemical Analysis

Geochemical rock-chip sampling was conducted during the detailed geological survey in the Bau prospect in the second phase. The samples were gathered from most of the outcrops of quartz veins, mineralized and altered rocks, and quartz float zones within the prospect. The description of samples was recorded in the same manner as in the Batuisi prospect. Geochemical rock-chip samples were treated and analyzed in the same method as in the Batuisi prospect as well. A total of 104 samples was collected and provided for chemical analysis in the second phase.

3-4-2 Statistical Data Processing

The same methods and procedures as in the Batuisi prospect were adopted in the data processing of geochemical rock-chip samples in the Bau prospect.

3-4-3 Anomalies of Rock-Chip Geochemistry

There are many outcrops and float zones in the prospect. However, anomalous values have been returned from only limited rock-chip samples.

S. Salubongi

Significant Au values were obtained from quartz veins at S. Salubongi. Anomalous values of Cu, Zn, and Ag were also detected in these samples. Au, Ag, and basemetal anomalies are sporadically distributed along the area from the junction of S. Saloie and S. Belopi up to Kp. Bau.

Lower reaches of S. Salole

Anomalous values of low level Au were found at the lower reaches of S. Salole. They correspond to the pyrite mineralization associated with dioritic intrusives.

3-5 Discussions

Two styles of mineralization were distinguished in the Bau prospect. One is fissure filling quartz mineralization accompanied with a small amount of sulphide minerals, and another is pyrite dissemination near diorite stocks. The geologic environment is similar to that of the Batuisi prospect. The prospect is structurally located on the eastern wing of the anticlinorium which is interpreted to be formed by the emplacement of the Mamasa granite. The dominant direction of vein system is NNW. Several small stocks of diorite and granodiorite are arranged in the direction of NNW～N-S. The Mamasa granite batholith is exposed several kilometers to the south of the prospect. Auriferous quartz veins show similar characteristic features as those of the Batuisi prospect. Therefore, the same structural and hydrothermal conditions of formation were assumed in the prospect.

Pyrite dissemination near the contact of dioritic stocks was interpreted to be genetically related to the intrusion of the igneous bodies.

Panning prospecting, stream sediment survey and reconnaissance soil survey were carried out for an area covering approximately 50 km^2 in the Bau prospect in the first phase. The soil sampling was made along creeks and ridge lines, and 261 soil samples were taken and provided for chemical analysis.

The geochemical works during the second phase consisted of detailed soil survey and rock-chip sampling. A total of 506 soil samples and 104 rock-chip samples was collected from an area of 15 km^2 in the second phase.

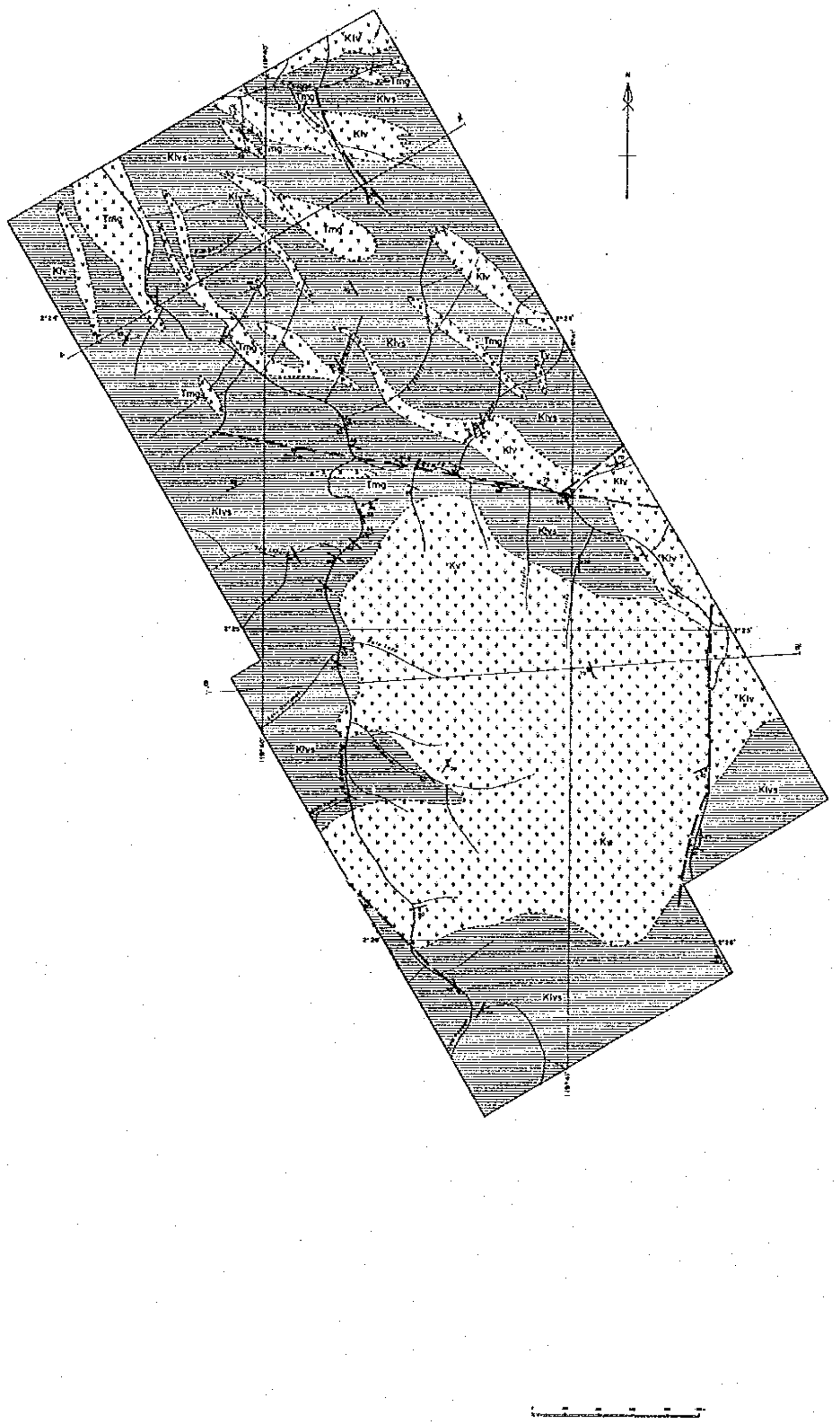
Au anomalies were obtained from four places through the soil geochemistry. They are low level anomalies (threshold value of Au$>$3.8 ppb), and are isolated each other. Significant correlation has not been recognized between Au and the other elements. Anomalous values of rock-chip samples were detected at only limited localities.

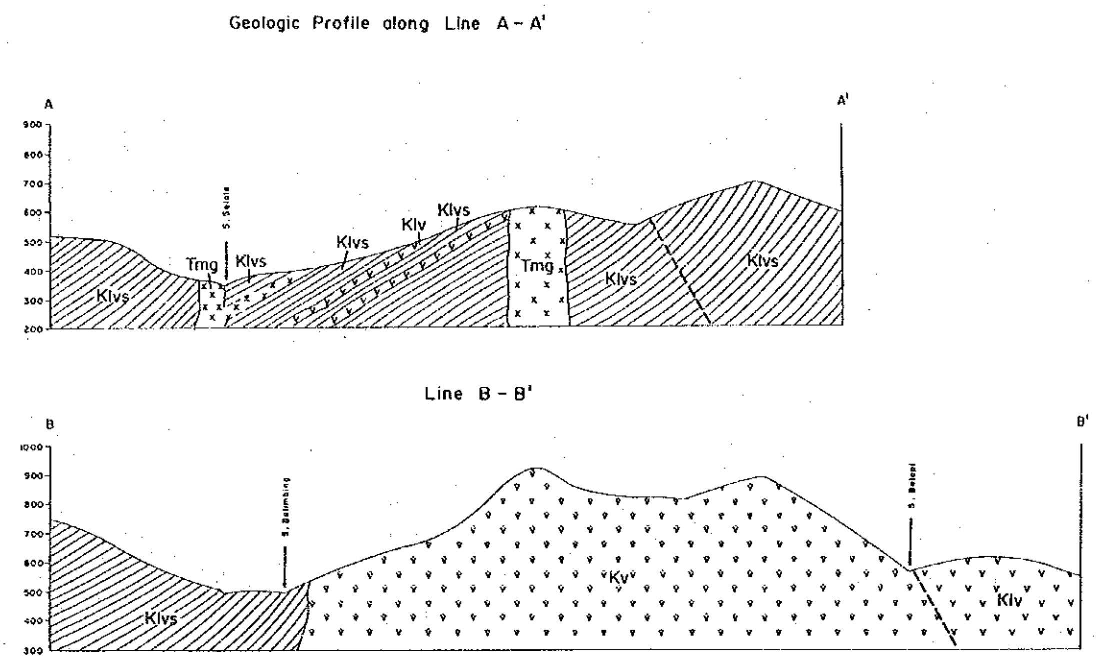
These Au anomalies of soil and rock-chip samples were roughly correlated to the small scale outcrops of auriferous quartz veins and pyrite dissemination.

Gold-bearing quartz veins similar to the Batuisi prospect were found in the Bau prospect. Some of the quartz veins showed significant assay results (up to

2.18 g/t Au). Each of the veins is small (10 cm or so in width) and seems to be discontinuous. Soil anomalies of Au and Cu in the area are of low level and sporadic. From these evidences, it is believed that the gold mineralization of this style has no sign of extensive development.

Pyrite dissemination was found at the northern part of the prospect. Assay results were discouraging. Au anomalies of soil and rock-chip samples found near the pyrite dissemination are of low level and patchy. This style of mineralization seems to have little potential. The integrated interpretation of the survey results in the Bau prospect is shown in Fig. 1-8.





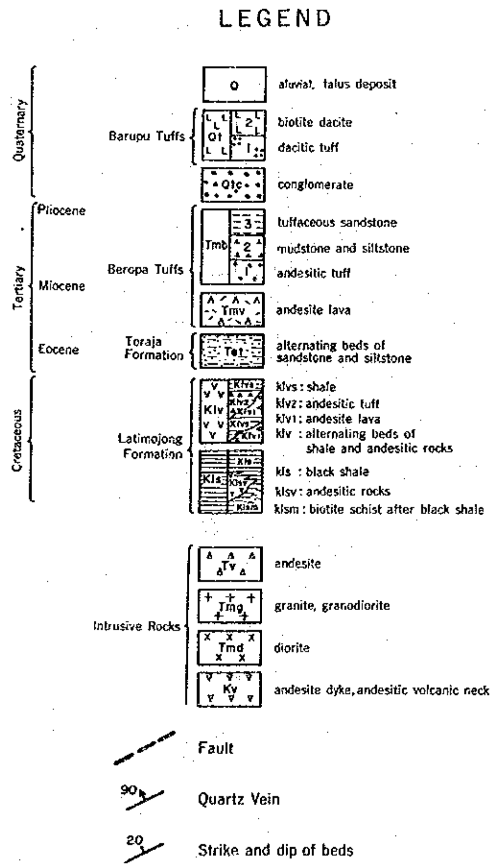


Fig. 2-3-1 Geology and Geologic Profile of the Bau Prospect

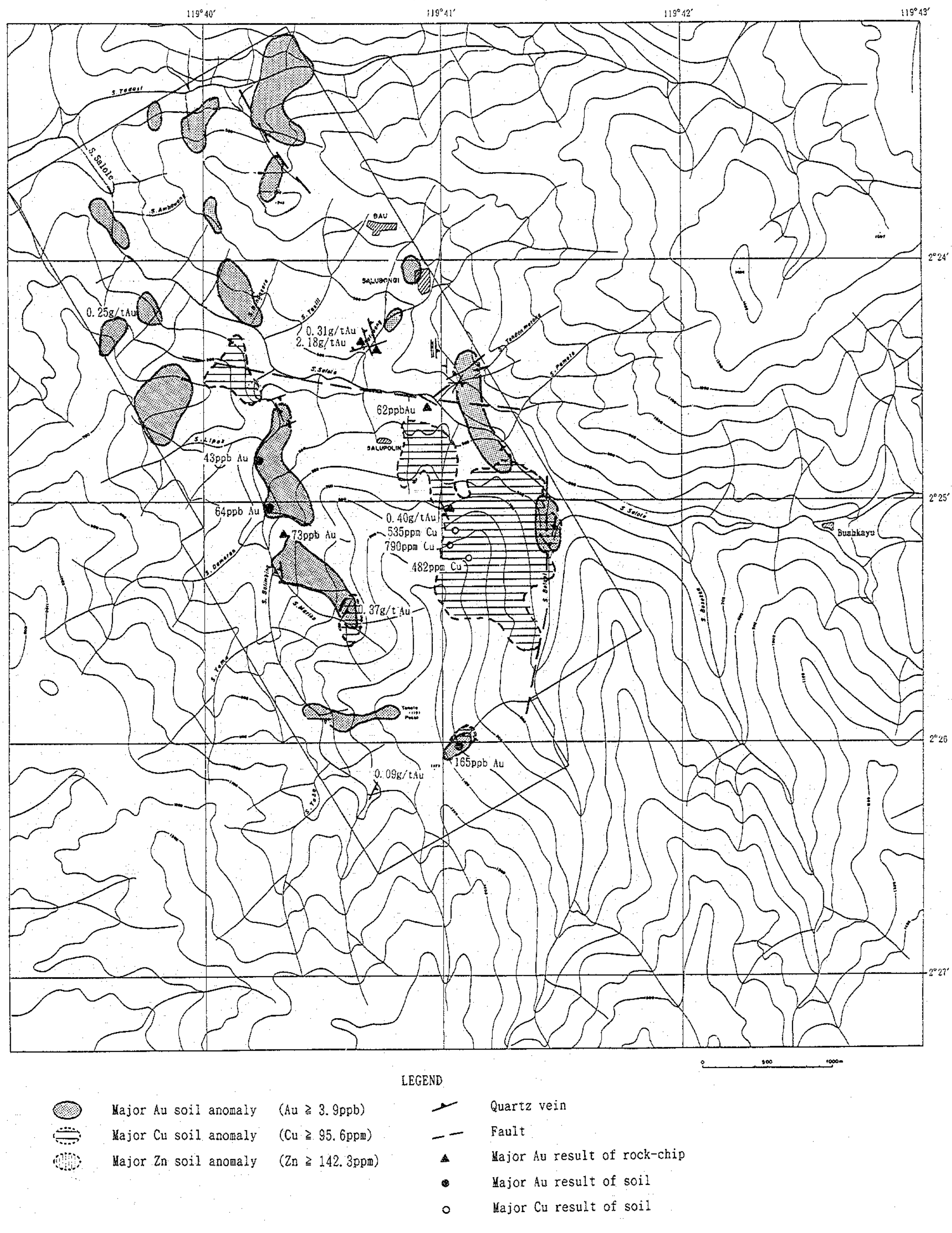


Fig. 2-3-2 Anomalies of Soil and Rock-Chip Geochemistry in the Bau Prospect

Table 2-3-1 Assay Results of Ore Samples in the Bau, S. Lebutang and Kariango Prospects (1992)

Sample No.	Width (cm)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	Sample type and locality
								Bau
BAB2A	9	0.09	10	0.032	0.056	0.101	8.15	Qz veinlet, S.Patoso
BAB4A	7	0.37	26	0.330	0.007	0.304	38.40	Limo veinlet, S.Mariku
BAB9A	--	0.25	<2	0.010	<0.001	0.006	7.24	Limo diss, S.Salole
BAC16A	15	0.31	2	0.048	<0.001	0.202	1.64	Qz vein, S.Salubongi
BAC17A	10	2.18	2	0.096	<0.001	0.001	0.81	Qz vein, S.Salubongi
BAC93A	--	<0.06	<2	0.003	0.006	0.008	6.03	Sili rock, S.Tadasi
BAD2A	--	<0.06	2	0.016	<0.001	0.010	5.69	Sili rock, S.Beropi
BAD8A	--	<0.06	2	0.004	<0.001	0.008	9.00	Qz float, S.Belopi
BAH3A	70	0.40	4	0.371	<0.001	0.017	7.23	Qz vein, Gn.Salupolin
								S.Lebutang
LEB5A	--	<0.06	<2	0.007	0.003	0.013	12.75	Qz float, S.Lebutang
LEB6A	--	<0.06	2	0.006	0.001	0.009	11.30	Andesite boulder, S.Taroto
LEB7A	--	<0.06	2	0.011	<0.001	0.007	9.72	Andesite boulder, S.Taroto
LEB11A	--	<0.06	2	0.001	<0.001	0.006	8.43	Andesite boulder, S.Taroto
LEB13A	5	<0.06	<2	0.001	0.001	0.009	9.10	Qz veinlet, S.Taroto
LEB17A	35	<0.06	2	0.011	<0.001	0.018	9.14	Shear zone, S.Taroto
LEB21A	5	<0.06	2	0.016	<0.001	0.009	10.35	Limo veinlet, S.Taroto
LEB22A	7	<0.06	4	0.011	0.001	0.015	14.40	Qz veinlet, S.Taroto
LEC9A	3	<0.06	2	0.045	0.001	0.042	4.71	Qz veinlet, S.Peko
LEC10A	2	<0.06	2	0.047	0.001	0.153	9.83	Qz veinlet, S.Peko
LEC11A	5	<0.06	2	0.066	<0.001	0.061	8.49	Sili andesite, S.Peko
LEC18A	--	<0.06	2	0.004	0.001	0.017	9.34	Shear zone, S.Peko
LED5A	2	<0.06	2	0.010	0.001	0.013	7.94	Qz veinlet, S.Penasean
LED32A	--	<0.06	4	0.866	<0.001	0.005	1.11	Qz float, S.Lelating
LEF1A	--	<0.06	4	0.129	0.001	0.013	24.30	Py float, S.Lelating
LEG12A	--	0.09	6	0.626	0.002	0.016	33.10	Py veinlet, S.Peko
								Kariango
KAB2A	--	<0.06	4	0.006	0.003	0.057	42.30	Limo diss, S.Ledan
KAB3A	--	<0.06	2	0.003	0.001	0.068	47.30	Limo diss, S.Ledan
KAB9A	--	<0.06	2	0.001	<0.001	0.002	8.02	Limo float, S.Suluan
KAB10A	10	<0.06	2	0.008	<0.001	0.019	7.72	Shear zone, S.Suluan
KAB11A	--	<0.06	2	0.008	0.001	0.017	14.35	Sili zone, Jl.Kariango
KAF2A	--	<0.06	10	0.027	<0.001	0.005	11.50	Limo network, S.Uroh

※ Details of assaying same as in Table 2-14

Table 2-3-2 Analytical Results of Geochemical Rock-Chip Samples in the Bau Prospect (1992)

Sample No.	Au (ppb)	Ag (ppm)	As (ppm)	Sb (ppm)	Hg (ppb)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Sample type and locality
BAC16R	260	0.34	5.8	<0.2	600	398	5.0	1350	Qz vein, S.Salubongi
BAC17R	5340	0.92	7.4	1.2	40	1230	<0.5	13	Qz vein, S.Salubongi
BAD30R	4	0.94	3.4	<0.2	60	3810	0.5	52	And, S.Tendanmetang
BAH3R	162	0.20	7.4	<0.2	170	835	0.5	56	Qz vein, Gn.Salupolin

Chapter 4 S. Lebutang Prospect

4-1 Outline of the Prospect

The S. Lebutang prospect is located along S. Lebutang and its tributaries -- S. Petangunan, S. Lelating, S. Talodo, and S. Taroto. It lies just between the Batuisi prospect and Bau prospect. There is only one little village called Kp. Petangunan at the western corner of the prospect. Major part of the prospect consists of ragged hills and steep mountains. Access to the prospect is most difficult. The prospect is geologically situated within the distribution of metasediments of the Cretaceous Latimojong Formation. It is immediately north of the Mamasa granite.

During the regional survey in the first phase, significant indications of gold mineralization were caught in the prospect. A series of strong Au anomalies of stream sediments was obtained from the prospect. Some distinctive gold anomalies of pan concentrate were also detected in the prospect.

The occurrence of quartz floats was observed in several localities. These quartz floats often contain pyrite and chlorite. At the upper reaches of S. Taroto, strong pyrite dissemination was found in altered andesitic rock. Old alluvial diggings were located in the area, and a quartz float zone with some limonite lay nearby.

Semi-detailed geological survey, panning prospecting and reconnaissance soil survey were carried out for the area of approximately 60 km^2 in the second phase.

4-2 Geological Survey

4-2-1 Survey Method

Semi-detailed geological survey was carried out along with panning prospecting and soil sampling in the S. Lebutang prospect in the second phase. The field survey was conducted mostly by flying camping, because there was very few people living in the area. A 1:10,000 route map was produced. The results of survey were compiled on a 1:25,000 map. The total length of traverses was more than 100 km. Ore samples for assay, ore samples for polished sections, rock samples for thin sections and altered rock samples for X-ray powder analysis amounted to 37, 6, 12 and 7 respectively in the second phase.

4-2-2 Geology and Geologic Structure

Geology of the S. Lebutang prospect is composed of shale, tuff, and andesite of the Latimojong Formation, and dacitic volcanic rocks of the Barupu Tuffs. Granite and andesite dykes are intruded into the Latimojong Formation.

Latimojong Formation : The upper members of the Latimojong Formation (Kls and Klv) occur in the prospect.

The Kls member is dominated by grey to black shale which is interbedded with thin layers of grey fine sandstone (greywacke). It is developed at the middle to the lower reaches of S. Lebutang, S. Talodo, and S. Lelating. Shale shows grey to black color. The well-bedded shale is brittle to be broken into flaky fragments. Whereas the massive unit sometimes exhibits very hard nature. Some part of shale is metamorphosed into phyllite and biotite schist at the upper reaches of S. Lebutang. The Mamasa granite batholith lies close to the southern rim of the metamorphosed zone. Shale adjacent to the contact with andesite stock (described below) is indurated and silicified. It is accompanied by weak pyrite dissemination.

The Klv member consists of the alternating beds of shale, andesite lava, and andesitic pyroclastic rocks. This member outcrops mainly at the north of S. Petangunan striking NE-SW and dipping NW gently. Andesite lava shows green color. Four units of lavas were counted. Their thickness ranges from 50 to 250 m. Andesitic pyroclastic rocks consist mainly of pale green to green coarse-grained tuff and tuff breccia. Thin layers of sandy or fine tuff occur within them in some place.

An andesite intrusive body, possibly stock, occupies the southern part of the area stretching from the south of S. Talodo to S. Lelating. The outline of this body shows an ellipse of 2.7 km (N-S) × 6 km (E-W). Andesite is massive, compact and hard, and shows green to greenish grey color. Intensive silicification was recognized in this body. Pyrite dissemination and epidotization were observed in some part of the rock.

Barupu Tuffs (Qt) : Several rock units were distinguished.

Grey coarse-grained dacite. This is characterized by coarse feldspar and biotite crystals. The rock unit occurs mainly at Gn. Tammapupu.

Dacite containing megacrysts of feldspars. Outcrops of this unit are limited to the west and the south of S. Lelating.

Alternation of coarse tuff, fine tuff and volcanic breccia. It is distributed at the upper reaches of S. Talodo.

Greenish grey andesitic rocks (agglomerate and lava) lie at the ridge over 600 m above sea level in the northern side of S. Petangunan.

Congromerate occurs at S. Lelating over 900 m in altitude. It appears to overlie on granite body. It sometimes contains rounded fragments of shale, granite and andesite.

Intrusive rocks : Granite (Tmg) and andesite dykes occur in the prospect.

Two stocks of granite were recognized. One occurs at the area over 1,200 m above sea level along S. Lebutang. Biotite, amphibole, and megacryst of feldspar were observed as phenocryst. Another granite body outcrops at S. Piku -- a tributary of S. Lelating. The phenocryst consists of feldspar, biotite, amphibole, and quartz.

Andesite dykes from 10 to 150 m wide occur within the pyroclastic units of the Latimojong Formation at the north of S. Talodo. The younger andesite is green to pale greenish grey. It shows compact appearance.

The stratigraphically top member of the Latimojong Formation, Klv which lies in the northern part of the prospect, strikes NE-SW and dips NW gently. In the area from the central to the eastern and the western parts, Kls member (the second from the top) of the Latimojong Formation is widespread in the form of surrounding Klv. From the central to the southern parts is broadly intruded by an andesite body which is elongated in the E-W direction.

The Mamasa granite batholith lies to the south of the prospect. The effect of granite emplacement was recognized at the surrounding zone in the Latimojong Formation as the heat conduction from the granite.

Three faults were identified in the prospect. Two faults, striking N70-80°E, were interpreted to have moved after andesite intrusion. The geology and geologic profile of the S. Lebutang prospect are shown in Fig. 2-4-1.

4-2-3 Mineralization and Associated Alteration

A total of more than thirty quartz veins and limonite veinlets was counted in the prospect. Most of them are thin veins of 1 to 50 cm in width. Quartz veins are generally composed of fine-grained white to milky quartz. They are usually massive and show no particular inner structure. Some of the quartz veins accompany a small amount of white clay and calcite. Sulphide minerals were found in two styles. One is pyrite-chalcopyrite dissemination occurring in the wall rock adjacent to quartz veins. Another is limonite (probably after pyrite) filling shears and/or fractures which crosscut quartz veins.

Three areas have been highlighted for the development of quartz veins; S. Petangunan, S. Talodo, and S. Taroto.

At S. Petangunan, quartz veinlets of 1 to 5 cm wide occur in andesite lava, andesitic pyroclastic rocks, and shale of the Latimojong Formation. Veins are divided into two groups in terms of their strike direction: N10-55°E, and N10-15°W. Both systems were interpreted as tension fracture filling. No sulphide mineral has yet been found in this locality.

Two groups of veins -- N20-50°E and N5-30°W -- were recognized at the southern slope of S. Talodo. This zone lies along the northern rim of andesite stock. Quartz veins of this zone accompany weak dissemination of pyrite and chalcopyrite. The host rocks, comprising shale and andesite, are totally silicified. Epidotization and pyritization were recognized in some part.

At S. Taroto and the upper reaches of S. Peko, quartz-pyrite mineralization which was probably controlled by shear zones was found. This zone lies at the eastern part of andesite stock. Many quartz float zones are spread over the place. The width of quartz veins ranges from a few centimeters to 35 cm. The host rock is altered by silicification and pyritization. Pyrite and chalcopyrite were found in shears/fractures. Four quartz chips from this area were provided to the fluid inclusion studies. The range of homogenization temperature of each fluid inclusion is slightly higher (220 ~ 320°C) than that of in the Batuisi prospect.

S. Taroto is a once-active pan mining place in the prospect. Gold is recovered from the following geological situation.

Steep slopes and floors of the creek are widely covered by andesite talus deposit. It consists of gravel to boulder size subangular fragments of andesite. The surface of fragments is coated by limonite. The interspace of fragments is filled with sand-sized particles of andesite and brown soil. The lower part of the fragment zone gradually changes into weathered andesite. Andesite is strongly silicified and moderately chloritized. Dissemination and stringer of pyrite were observed in andesite.

Gold was detected in both andesite fragments and interspace soil at this locality. It was assumed that gold was associated with pyrite mineralization within andesite.

The surface indications of mineralization are distributed within an area of nearly 1,200 m (N-S) × 500 m (E-W) along S. Taroto and S. Peko.

Sulphide minerals identified under the microscope are pyrite, arsenopyrite, chalcopyrite, and sphalerite. Pyrite is replaced by iron oxide (limonite). Chalcopyrite is partly replaced by covelline.

The major alteration minerals associated with the mineralization are quartz and chlorite in the S. Lebutang prospect.

4-3 Panning Prospecting

4-3-1 Sampling and Heavy Minerals Analysis

Panning prospecting was carried out in the S. Lebutang prospect.

Pan concentrate samples were collected from trap sites in the active drainage channels. A bucketful of sand and gravel which was about 2 liters was gathered and carefully panned out. A panned sample of about 5 grams was obtained finally at every point. Fineness and number of gold grains were measured, and heavy mineral composition was examined roughly by loupe in the field and carefully under the microscope in the laboratory.

One hundred and twenty-six panned samples were checked in the S. Lebutang prospect.

4-3-2 Results of Microscopic Observation

Gold was detected in 9 samples in the S. Lebutang prospect. It is composed of fine to very fine carat gold of up to 500 microns in diameter. The major heavy minerals observed in pan concentrates are; garnet, epidote, zircon, ilmenite, pyrite, and iron oxide. Corundum, rutile and barite were identified at a few places.

4-3-3 Anomalies of Panning Prospecting

Among 9 localities where gold was detected in pan concentrates, 8 are situated along S. Taroto and its branch creeks. The other one, which was detected in S. Kanan, is located about 1 km south-southeast of S. Taroto. These localities are arranged within a narrow zone running approximately in the N-S direction.

4-4 Soil Survey

4-4-1 Sampling and Chemical Analysis

Semi-detailed soil sampling was conducted in the S. Lebutang prospect in the second phase. Samples were taken from the B-layer of residual soil using hand-auger. The sampling points were arranged along creeks and ridge lines in the prospect.

The same methods of sample treatment and chemical analysis as in the Batuisi prospect were applied. A total of 606 soil samples was collected in the second phase. It corresponds to the sampling density of nearly 10 samples per 1 km^2.

4-4-2 Statistical Data Processing

The same methods and procedures as in the Batuisi prospect were adopted in the data processing of soil samples in the S. Lebutang prospect.

4-4-3 Anomalies of Soil Geochemistry

Several Au anomalies were distinguished in the S. Lebutang prospect. No significant correlation has been recognized between Au and the other basemetal elements. Anomalies of soil geochemistry in the S. Lebutang prospect are shown in Fig. 2-4-2.

S. Taroto

A distinctive soil anomaly (up to 90 ppb Au) was caught along S. Taroto. It extends in the N-S direction over 1,200 m to the upper reaches of S. Peko. It roughly coincides with both the areas of pyrite mineralization and Au anomalies of pan concentrates.

A small anomaly was found at S. Kanan where gold was detected in pan concentrate. It is situated at the south-southeastern extension of the Au anomaly at S. Taroto.

S. Talodo Basisi

This anomaly is located about 2 km north of the S. Taroto anomaly. It is composed of several sampling points of low level Au values (up to 22 ppb) arranging in the NNW-SSE direction. Three anomalies -- S. Taroto, S. Kanan, and S. Talodo Basisi -- are distributed along a line extending over 4 km.

S. Pamonde

Anomalous values of Au were obtained from soil samples at S. Pamonde (a branch creek of S. Talodo). It roughly overlaps on the area of quartz float zones.

Middle reaches of S. Lebutang

Several anomalous values of Au in soil samples were obtained at the middle reaches of S. Lebutang. It is sporadic, and is composed of low level Au values of up to 23 ppb.

4-5 Discussions

Gold mineralization is hosted by andesite of the Latimojong Formation. The prospect is structurally located on the central part of the anticlinorium. The dominant direction of vein system is NNW～N-S. The Mamasa granite batholith is exposed a few kilometers to the south of the prospect. These geologic circumstances indicate structural conditions similar to the Batuisi prospect at the time of mineralization in the prospect.

The characteristic features of gold mineralization at S. Taroto are summarized as follows:

① Gold mineralization was found mainly in massive andesite of the Latimojong Formation.
② Gold is intimately associated with pyrite dissemination or stringers which are accompanied with strong silicification.
③ It is overprinted on the zones of intensive quartz veining which are probably controlled by shear zones.

These features are somewhat unique compared with the mineralization in the Batuisi prospect. Tentative measurements of homogenization temperature of fluid inclusions of quartz showed rather high values, higher than the data in the Batuisi prospect. It probably comes from the relative nearness to the granite body.

Panning prospecting and reconnaissance soil survey were conducted in the S. Lebutang prospect in the second phase. A total of 606 soil samples was collected from an area of 60 km^2.

A distinctive soil anomaly (threshold value of Au$>$3.0 ppb) was caught along S. Taroto extending to the upper reaches of S. Peko. It roughly coincides with the zone of gold bearing pyrite dissemination/stringers.

Several other Au anomalies were found in the prospect. They are small in scale and sporadic.

Gold mineralization associated with pyrite dissemination or stringers in massive andesite was found at S. Taroto. It shows some unique features compared with the mineralization in the Batuisi prospect. The details of mineralization have not been fully investigated. A series of Au anomalies of moderate to low degrees arranged from S. Kanan through S. Taroto and S. Peko up to S. Talodo Basisi was identified. The total strike length is over 4 km. The surface indications of this zone are significant. However assay results of ore samples were disappointing. It was interpreted that this was a gold mineralization probably associated with pyrite dissemination within shear zones. The gold mineralization of this style appears to be of rather low-grade from the results of surface investigation so far.

The other outcrops of quartz veins and geochemical anomalies are estimated to be of minor importance. The integrated interpretation of the survey results in the S. Lebutang prospect is shown in Fig. 1-9.

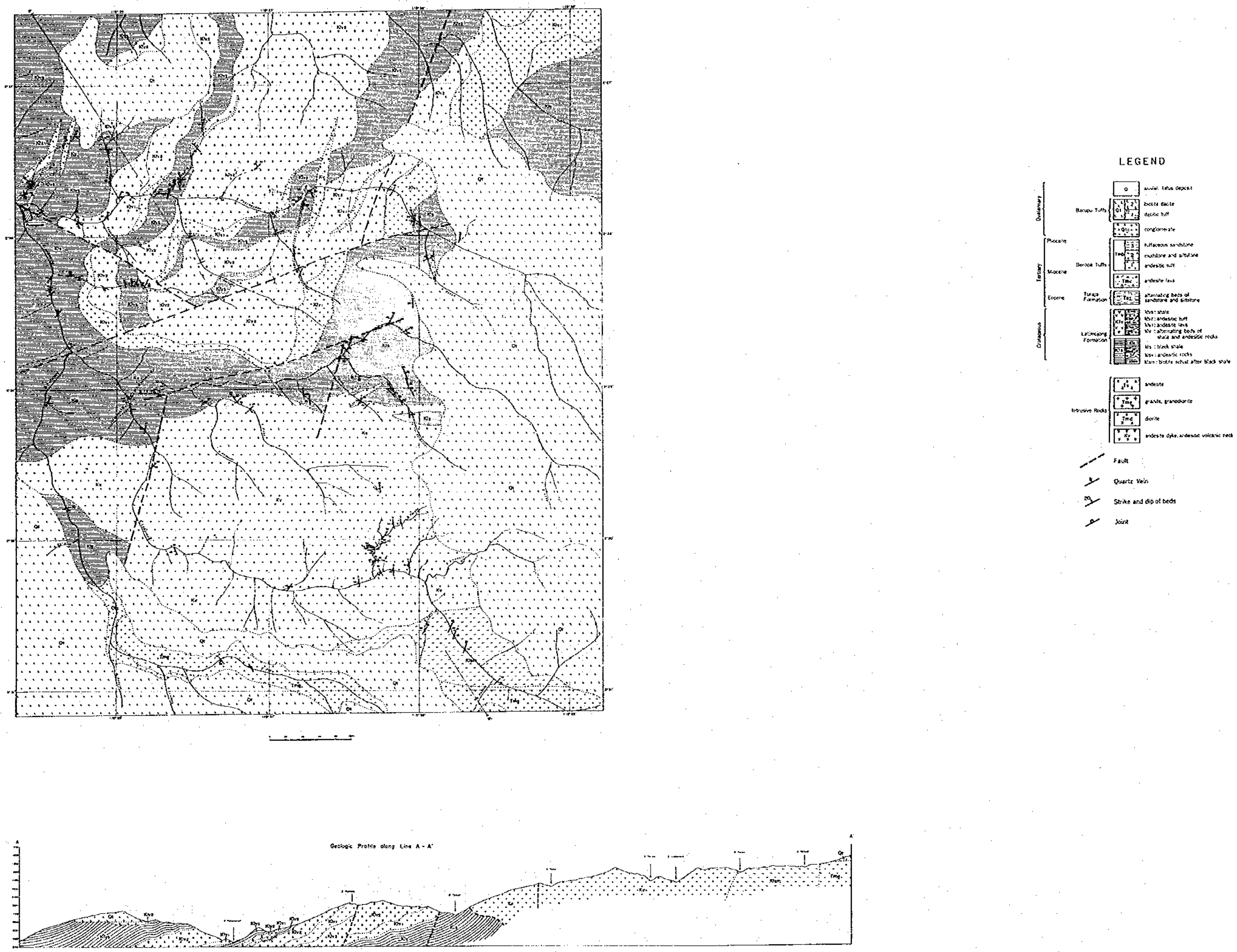
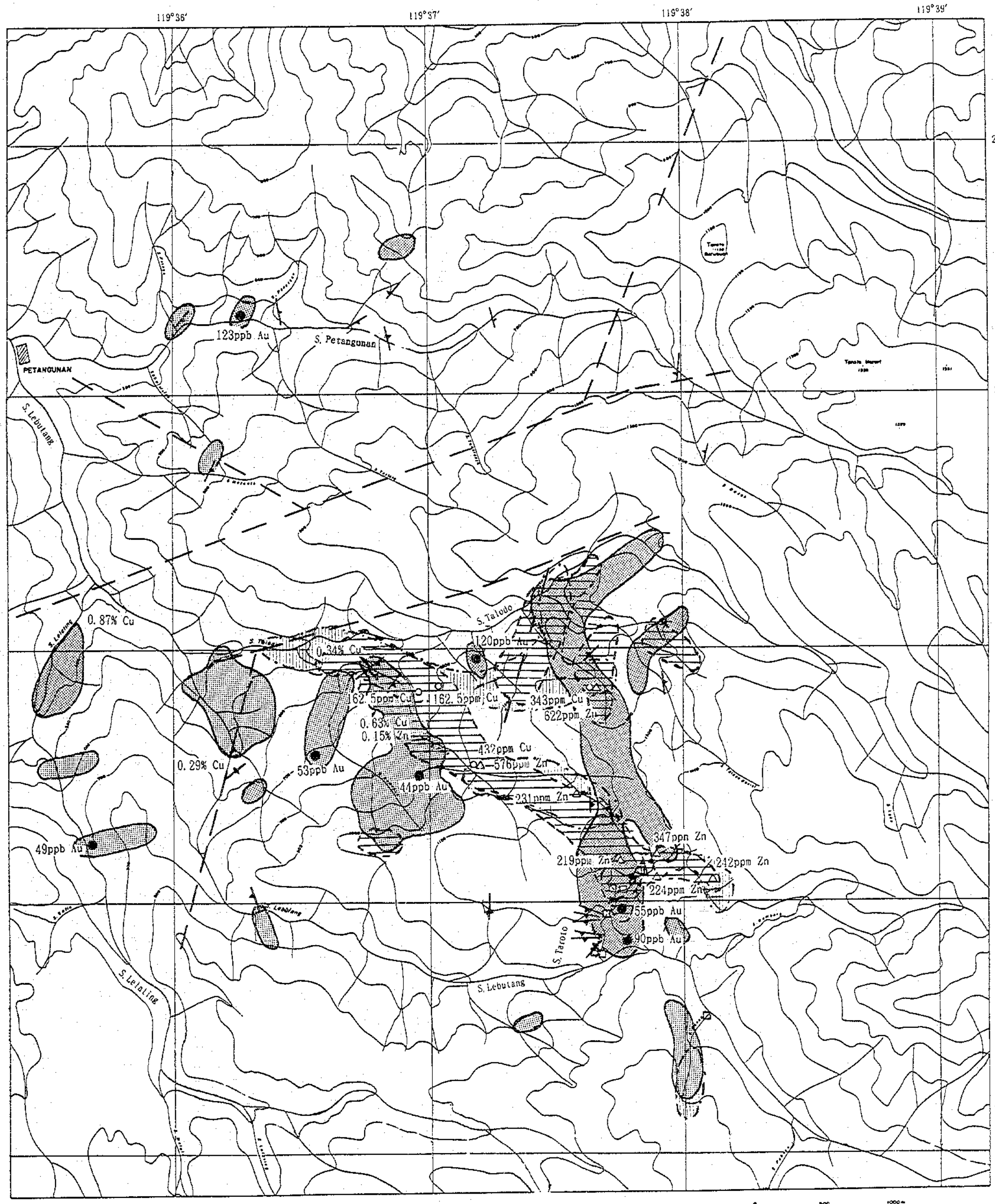


Fig. 2-4-1 Geology and Geologic Profile of the S. Lebutang Prospect



LEGEND

	Major Au soil anomaly	(Au ≧ 3.0ppb)		Quartz vein
	Major Cu soil anomaly	(Cu ≧ 61.5ppm)		Fault
	Major Zn soil anomaly	(Zn ≧ 102.2ppm)	●	Major Au result of soil
			○	Major Cu result of soil
			△	Major Zn result of soil
			□	Pan concentrate anomaly

Fig. 2-4-2 Anomalies of Soil Geochemistry in the S. Lebutang Prospect

Chapter 5 Kariango Prospect

5-1 Outline of the Prospect

The Kariango prospect is located to the northeast of the Bau prospect, and is at the area along the lower reaches of S. Uroh. The geology is different from the other three prospects. It consists of the strata of the middle to the upper Miocene series. The southern half is composed of andesitic tuff and siltstone of the Beropa Tuffs. Dacitic tuff and lava of the Barupu Tuffs cover at the high altitude in the prospect. Whereas in the northern half, a thick sequence of sandstone and black shale of the Toraja Formation crops out on the surface.

During the regional survey in the first phase, several Au anomalies of stream sediments were detected at the north of Kp. Kariango. Anomalies of Cu, Pb, Zn and Ag were scattered to some extent in the area. No indication of mineralization on the surface, however, has been found in the area. The area was not fully traversed at all.

Semi-detailed survey area of approximately 40 km^2 was picked up. Geological survey, panning prospecting and reconnaissance soil survey were conducted in the prospect in the second phase.

5-2 Geological Survey

5-2-1 Survey Method

Semi-detailed geological survey was carried out in the Kariango prospect in the second phase. The field survey was conducted by a combination system of base camping in Kp. Kariango and flying camping. The route map was prepared at a scale of 1:10,000. The results of survey were compiled on a 1:25,000 geologic map. Traverses of more than 70 km were made. Numbers of ore samples for assay, ore samples for polished sections, rock samples for thin sections, and altered rock samples for X-ray powder analysis were 13, 4, 7 and 3 respectively in the second phase.

5-2-2 Geology and Geologic Structure

The prospect is underlain by the Toraja Formation, the Beropa Tuffs, and the Barupu Tuffs in ascending order. The lower two sequences are intruded by diorite, andesite, and gabbroic rock.

Toraja Formation (Tet) : This formation outcrops along S. Kariango and S. Kanan. The eastern edge of the exposure is bounded with the upper member of the Beropa Tuffs by an NNW-SSE fault. The western and the northern limits of the exposure are contacted with the middle member of the Beropa Tuffs by an N-S fault at the west and an NE-SW fault at the north respectively.

The formation consists mainly of sandstone. It is dark grey well sorted rock, and is interbedded with thin layers of black shale.

Beropa Tuffs (Tmb) : The Beropa Tuffs is subdivided into three members; the lower (Tmb_1), middle (Tmb_2), and upper member (Tmb_3).

The lower member is the sequence mainly composed of greenish grey andesitic tuff and grey siltstone. It occurs along S. Suluan stretching in the N-S direction. Andesitic tuff changes their facies from lapilli tuff to tuff breccia. Tuff breccia appears at the south of S. Kariango. Whereas fine tuff and lapilli tuff dominate in the area around S. Ledan and S. Suluan.

The middle member is exposed within a zone extending from Kp. Poyahaang to the west of S. Uroh with the strike direction of NNW-SSE. It is a sedimentary sequence comprising tuff, grey mudstone, and siltstone. The middle member gradually changes into the upper member.

The upper member occurs in the eastern area with the strike direction of NNE-SSW. It consists mainly of sandstone and siltstone. They are interbedded with andesitic tuff and lava.

Barupu Tuffs (Qt) : It is composed of dacitic tuff (the upper member) and dacite (the lower member). They lie on the high plain covering from Kp. Ledan to Kp. Beroppa. The other distribution was observed at Gn. Lemo which was situated near the junction of S. Suluan and S. Uroh.

Intrusive rocks : Intrusive rocks of gabbro, diorite and andesite were distinguished in the prospect.

Gabbroic rocks occur at S. Uroh and S. Ruruh. They are stocks extending in the directions of NNE-SSW, N-S, and NNW-SSE. They are arranged along inferred faults.

Several stocks of diorite are exposed at S. Uroh. They extend mainly in the NNE-SSW direction. Diorite stocks are lined up along faults as well.

Andesite dykes occur at the middle reaches of S. Suluan and the upper reaches of S. Ledan. They show the elongated form of N-S.

The Toraja Formation has the unconformable relationship to the overlying strata within the prospect. The contact between them is bounded by faults.

An anticlinal structure with NNE-SSW axis was recognized in the Toraja Formation. The structure does not extend to the overlying rocks. Therefore it was interpreted that the Toraja Formation had the deformation structure formed before the deposition of the Beropa Tuffs. The Beropa Tuffs has been deformed to show a gentle anticlinal structure or a flexure whose axis lies near S. Suluan trending in the N-S direction. Consequently the either sides from the axis show the monoclinal structure striking N-S. The Beropa Tuffs in the northeastern area, however, changes to the structure with striking E-W and dipping N.

Several faults were observed in the prospect. They strike N-S to NNW-SSE. Most of the intrusive rocks occur along these faults.

The geology and geologic profile of the Kariango prospect are shown in Fig. 2-5-1.

5-2-3 Mineralization and Associated Alteration

No significant mineralization has yet been recognized in the Kariango prospect, except a minor occurrence of iron oxide. There is a small limonite network near the hilltop east of S. Suluan. It occurs within the lower member of the Beropa Tuffs. The network zone has the N-S elongation of 300 m × 20 m. Pyrite is almost replaced by iron oxide minerals such as limonite, specularite, and hematite. Magnetite was observed in this zone.

5-3 Panning Prospecting

5-3-1 Sampling and Heavy Minerals Analysis

Panning prospecting was carried out in the Kariango prospect. The same methods for pan concentrate sampling and sample processing as in the S. Lebutang prospect were taken in the prospect.

Eighty panned samples were collected and processed for gold and heavy minerals analysis in the second phase.

5-3-2 Results of Microscopic Observation

Gold was detected in only one pan concentrate sample in the Kariango prospect in the second phase. It is very fine carat gold. The major heavy minerals observed in pan concentrates are; garnet, epidote, zircon, ilmenite, pyrite, and iron oxide. Cinnabar, corundum and marcasite were found in one locality each.

5-3-3 Anomalies of Panning Prospecting

The only one place where gold was detected in pan concentrates is located near the junction of S. Uroh and S. Kariango. There is no other anomaly in the prospect.

5-4 Soil Survey

5-4-1 Sampling and Chemical Analysis

Soil survey for reconnaissance purpose was conducted in the Kariango prospect in the second phase. Samples were taken from the B-layer of residual soil using hand-auger. The sampling points were arranged along creeks and ridge lines in the prospect.

The same methods of sample treatment and chemical analysis as in the Batuisi prospect were applied in the Kariango prospect. A total of 404 soil samples was collected. It corresponds to the sampling density of approximately 10 samples per 1 km^2.

5-4-2 Statistical Data Processing

The same methods and procedures as in the Batuisi prospect were adopted in the data processing of soil samples in the Kariango prospect.

5-4-3 Anomalies of Soil Geochemistry

One broad Au anomaly and one small anomaly were obtained in the prospect. Significant correlation has not been distinguished between Au and the other basemetal elements. Anomalies of soil geochemistry in the Kariango prospect are shown in Fig. 2-5-2.

Southwestern side of S. Uroh

A broad Au anomaly was obtained at the southwestern side of the middle reaches of S. Uroh. It is composed of low level Au values of up to 17 ppb. It has an area of 1,500 m (N-S) × 1,000 m (E-W). This anomaly is situated at the downstream side of the limonite network zone in the Beropa Tuffs (Tmb_1).

Lower reaches of S. Kariango

This is a small Au anomaly (up to 12 ppb). It is located near the anomaly of pan concentrate.

5-5 Discussions

The geology of the Kariango prospect is different from the other three prospects. It consists of volcanic-sedimentary strata of the Middle to the Upper Miocene series. Significant mineralization has not been discovered in the prospect, except for a small scale limonite network. It occurs within the lower member of the Beropa Tuffs. The network zone has the N-S elongation of 300 m × 20 m. Significant result has not been obtained from ore assay. This network was interpreted to be the product of small scale hydrothermal activity probably caused by some kind of subsurface igneous body.

Panning prospecting and reconnaissance soil survey were carried out in the Kariango prospect in the second phase. A total of 404 soil samples was collected from an area of 40 km^2.

A low level Au anomaly (threshold value of Au > 3.7 ppb) was found at the southwestern side of S. Uroh. It has an area of 1,500 m × 1,000 m. The source of the anomaly was interpreted to be the limonite network zone in andesitic tuff.

The limonite network zone and the subordinate Au anomaly of low level near S. Suluan were interpreted to be the product of small scale hydrothermal activity by a subsurface igneous intrusion. No other indication of gold mineralization has been discovered in the prospect. The potential of this prospect appears to be very small. The integrated interpretation of the survey results in the Kariango prospect is shown in Fig. 1-10.

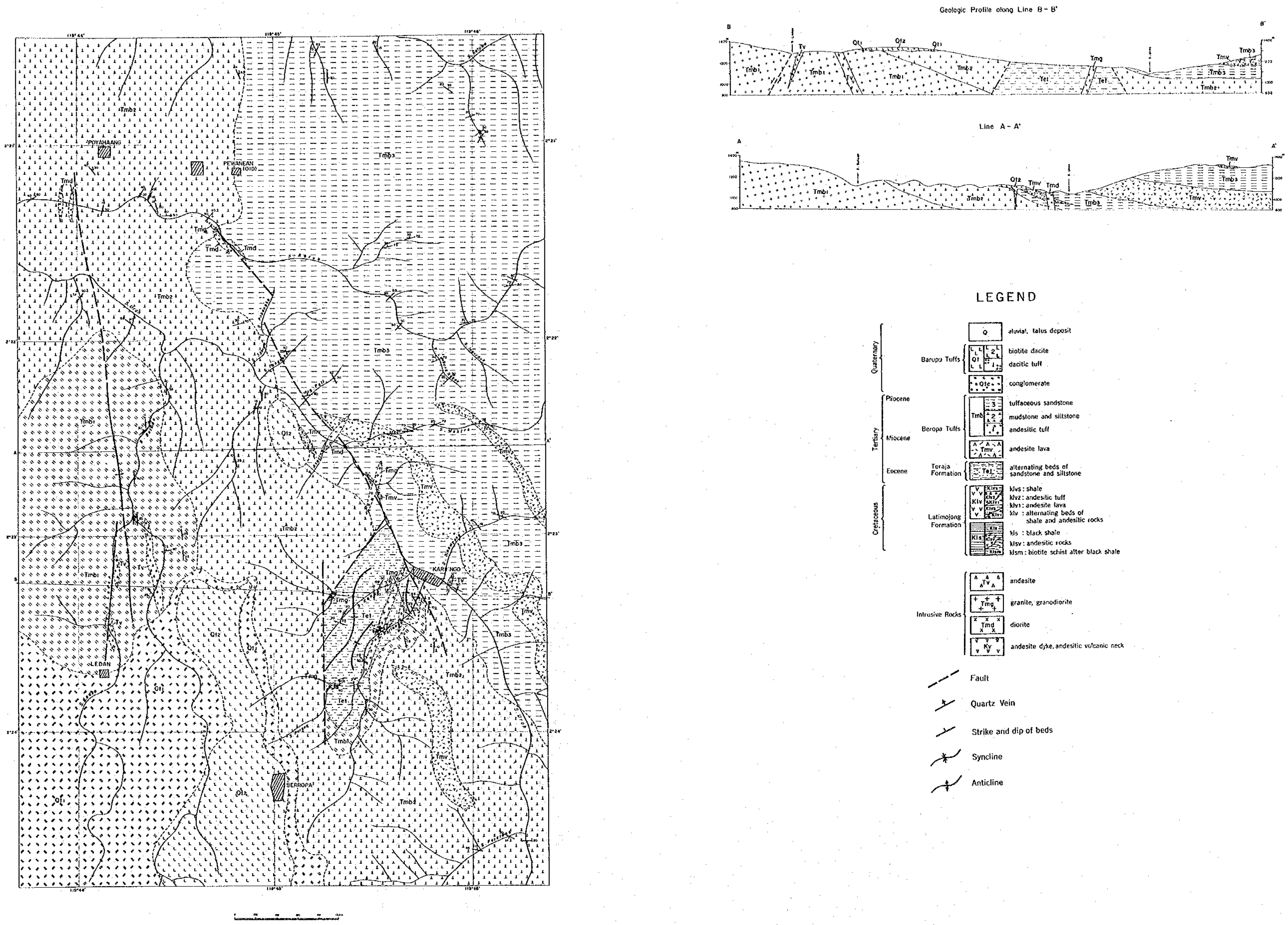


Fig. 2-5-1 Geology and Geologic Profile of the Kariango Prospect

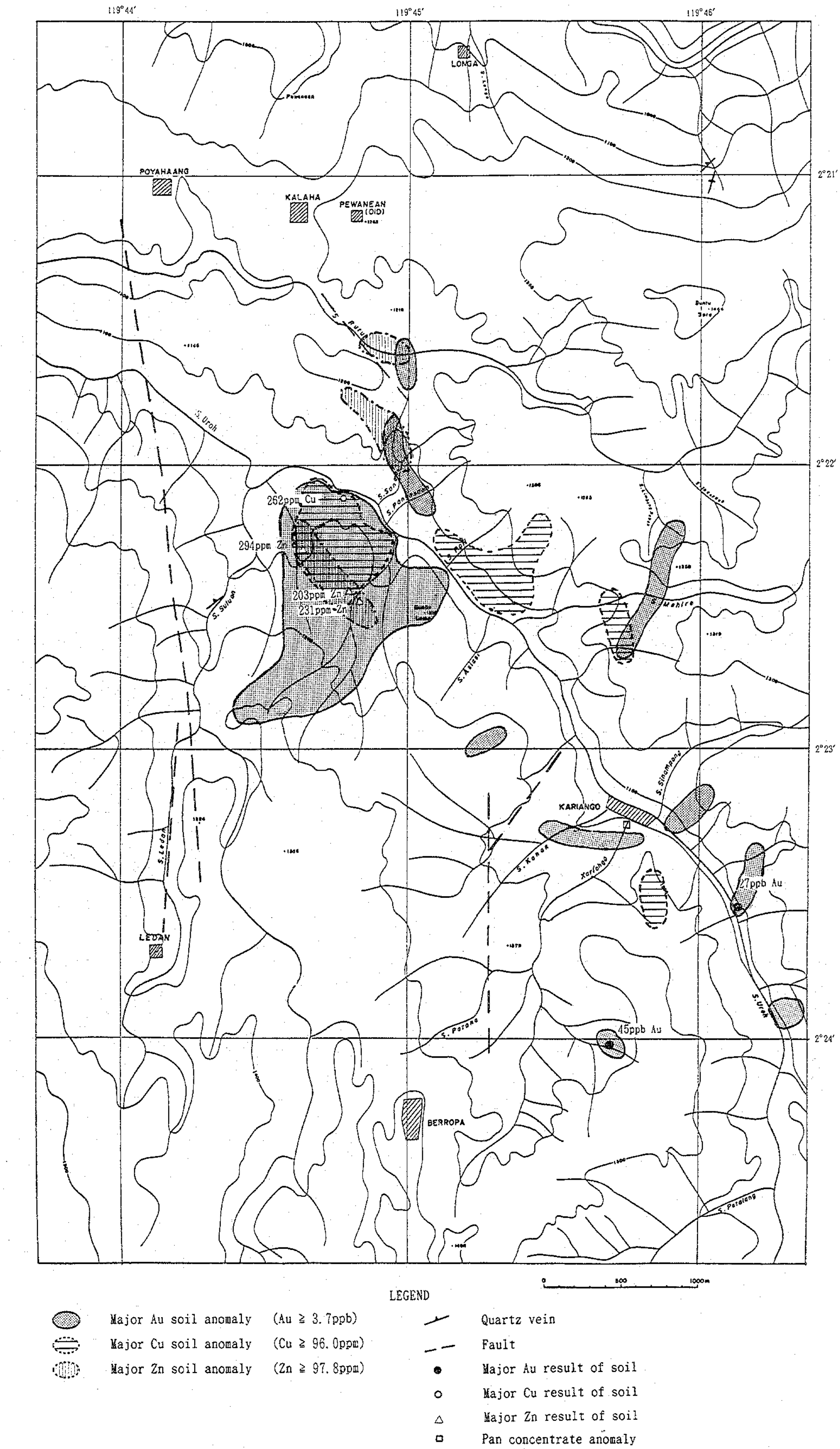


Fig. 2-5-2 Anomalies of Soil Geochemistry in the Kariango Prospect