CHAPTER 3 Overall Discussion

3–1 Geological Structure of Mankadau Area

Hornfels of the lowest sequence, ultrabasic rock, spilitic basalt and sedimentary rocks of the uppermost are distributed in the area, trending northwest to southeast. Among these, ultrabasic rock is considered to have intruded in the later Cretaceous and to have been emplaced structurally in Miocene.

Spilitic basalt and sedimentary rocks in the upper sequence are reported to be the later Cretaceous flysh sediments (as the Chert-Spilite Formation) formed in the so-called "Northwest Borneo Geosyncline" (Haile, 1969) having an extent of 800 kilometers long and 300 kilometers wide.

However, a concept of ophiolite was introduced in recent years from the theory of the plate tectonics, and the area has been thought as belonging in the Darvel Bay-Labuk- Palawan ophiolite belt (C.S. Hatchison, 1975). As a result of geological survey of Phase II, a thrust structure and an occurrence of mélange and schistose structure associated with the former, were confirmed, supporting this concept. A pillow structure is also found in spilitic basalt lava. Therefore, it has become highly possible that the area is regarded as the area having a series of ophiolite sequence consisting of ultrabasic rock at the base, spilitic basalt and the uppermost sedimentary rocks.

The sequence, however, is not a complete one, lacking the dike swarms of gabbro and dolerite. Furthermore, the structure is very complicated due to the Kinabalu igneous activity.

It is thought that the more data are to be necessary for judgement of the ophiolite sequence in the area in comparison with the other region.

3–2 Ore Deposit

3–2–1 Massive Sulphide Copper Ore

It has been known that the floats of high grade massive sulphide copper ore scatter in the Lingangaa creek of upper reaches of the Mankadau River.

The detailed geochemical survey (soil) for the area of 4 km^2 and the CSAMT electrical survey for 100 km^2 were excuted in Phase I, and the semi-detailed geochemical survey (soil) for more wide area of 50 km^2 were carried out in this year as Phase II program. However, not only none of the outcrops of the ore deposit were discovered, but also no lower resistivity zones or no geochemical anomalous zones resulting from the mineralization were detected.

It can not be verified that the ore deposit is to be of the Cyprus-type associated with the

ophiolite sequence after studying the nature of the ore and from the local geology, because of unconfirmation of its original occurrence. Although the survey in Phase I and Phase II were concentrated in the northern reaches of the Mankadau River, where the original occurrence of the deposit would be confirmed with high potentiality, no anomalous zone suggesting the occurrence of the ore deposit were detected. Therefore, it is thought that the area has lower potential for finding the ore deposit. The regional exploration including the northern foot area of the Kinabalu mountain seems to be necessary to reveal the original source of the ore deposit.

3–2–2 Chromite Ore Deposit

As described in the section of mineralization in Chapter 1, the outcrop of the Paranchangan chromite ore deposit could not be observed because the old trenches appear to have been collapsed, and only the lump of massive chromite ore mixed up with the waste and the low-grade disseminated zone surrounding the massive ore deposit, can be observed. Therefore, it is difficult to verify the occurrence of the actual ore deposit.

According to the result of survey by Collenett P' (1957), lateral extent of the chromite ore body is approximately 15 m x 6 m, leading to the assumption that ore reserves might be in the order of 1,000 tons.

The quality of the deposits is as follows in comparison with the assay values of Collenett P.

	Lingangaa	Paranchangan (Collenette P.)	Buyer's specification
SiO_2	8.2%	4.4%	<5%
Al_2O_3	21.9%	28.4%	>25
Fe	9.4	10.0	>11
MgO	16.6	17.2	–
Cr_2O_3	31.2	31.4	>30
$Cr_2O_3 + Al_2O_3$	53.1	59.8	>60

The Paranchangan ore is barely on the border line for chromite to be used for refractory material, and it will have a problem to maintain the grade at the time of operation.

Regarding the chromite boulders collected in the uppermost reaches of the Lingangaa creek in Phase I, no new discovery was made in Phase II, and it is below the buyer's specification in quality, so that some hand picking will be required.

As discussed in the above,

(1) The ore reserves are rather small in scale as in the order of 1,000 tons even in the Paranchangan deposit which is considered to be best in the area, and

(2) the quality is on the border line of the specification for refractory use, and furthermore, the distribution of dunite, which is essential to the occurrence of large-scale chromite ore deposit, is rarely found in the area. Therefore, it is likely that the potential of chromite ore deposit is low in this area.

PART IV cII (PALIU) AREA

CHAPTER 1 Geology and Mineralization

1–1 Geology

The sedimentary rocks, correlated to the Trusmadi Formation are widely distributed in the area, and numerous dikes and stocks of granodiorite porphyry has intruded into the above rocks, which is assumed to be correlated to later Palaeocene.

Fig. 28 and Fig. 29 show the geological map and typical columnar section of the area respectively, and the outline of the geology is described as the followings.

1–1–1 Sedimentary Rocks

The sedimentary rocks mainly consist of sandstone intercalated with thin layers of mudstone and shale. They are roughly divided into three members, as the first member consisting of only sandstone, the second consisting of sandstone interbedded with thin layers of mudstone and the third consisting of sandstone intercalated with thin layers of shale in an ascending order. In general, the lower members are found in the northern part of the area, the middle in the central part and the upper in the southeastern part successively.

The sandstone is medium to fine-grained and light gray to gray in color. It is poorly bedded, and often massive and hard.

The sandstone often forms rhythmically alternating beds with thin layers (several to tens centimetres in thickness) of mudstone, with considerable changes in rock facies.

The mudstone is black and compact rock intercalated in sandstone as thin layers. It is well bedded and fairly continues laterally, and sometimes interbedded with thin layers of sandstone or siltstone.

The shale is reddish brown, silty, compact and fissile.

These sedimentary rocks have been metamorphosed to hornfels in the surrounding part of the intrusive bodies of granodiorite porphyry.

The total thickness reaches up to 500 meters.

1–1–2 Intrusive Rocks

The granodiorite porphyry is the only intrusive rock in the area, and the largest stock is found in the northeastern part of the area. Many stocks and dikes of various sizes are distributed from the northern part to the central part.

The rock is characterized by the phenocrysts of hornblende and biotite, with a porphyritic texture.

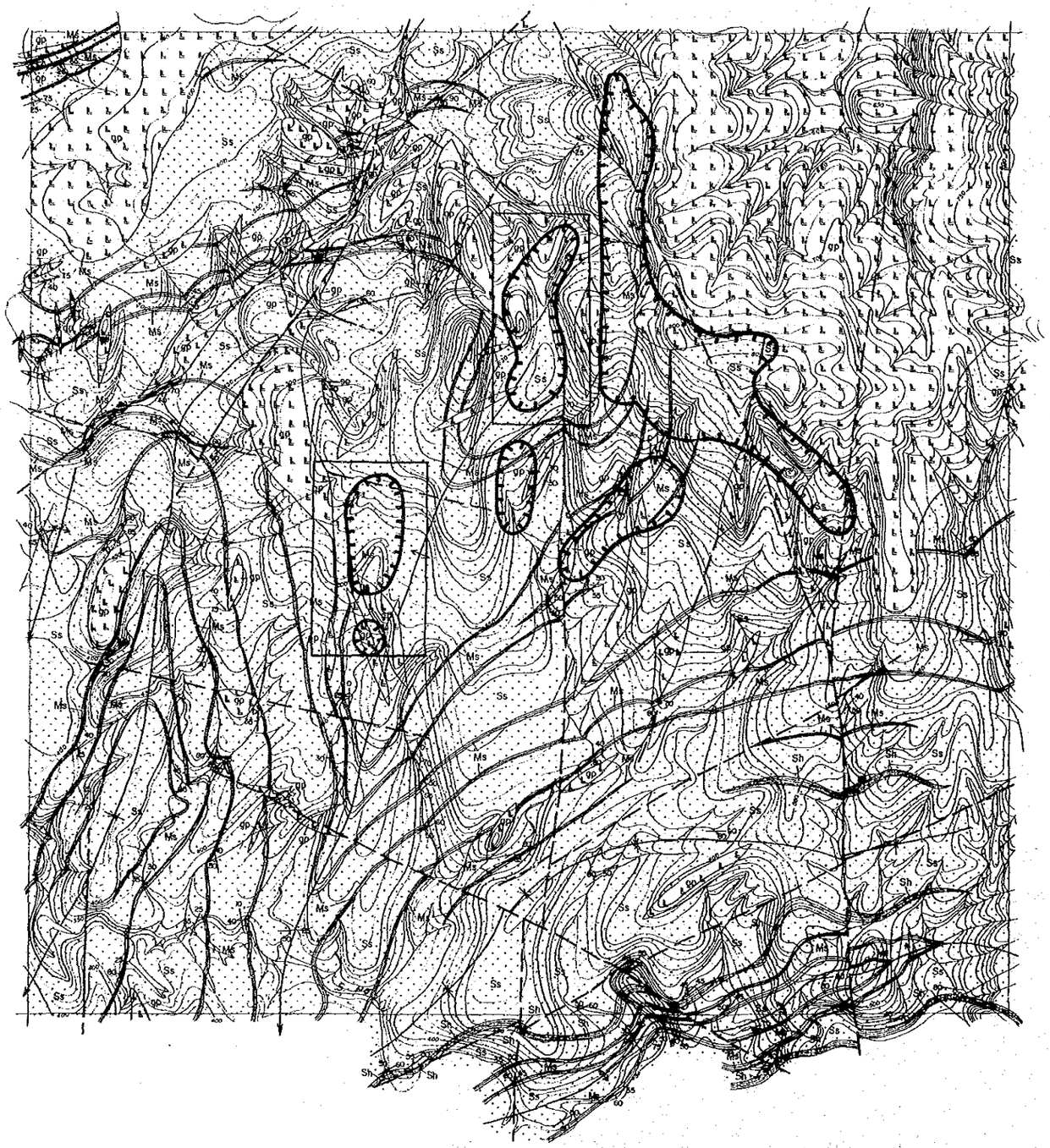


Fig. 28 Geological Map with Geochemical Anomalies in cII (Paliu) Area

LEGEND

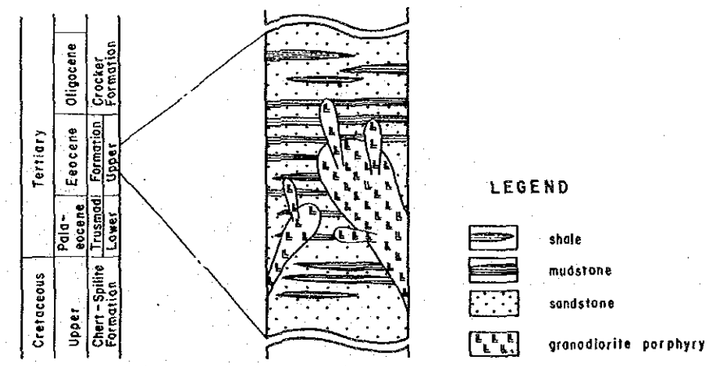
Trusmadi Formation

Ss sandstone
Ms mudstone
Sh shale

Intrusive Rock

gp granodiorite porphyry

Syncline
Anticline
Fault (certain)
Fault (inferred)
Strike and dip
Geochemical anomalous zone
Trenching area



note) Granodiorite porphyry is supposed to be intruded in Late Pliocene age.

Fig. 29 Generalized Stratigraphic Section of cII (Paliu) Area

The groundmass is holocrystalline, mainly consisting of quartz and plagioclase, with small quantities of biotite and hornblende. Although the rock is almost uniform in lithologic character, an equigranular texture is shown in a part of stock, showing an appearance of granodiorite.

The xenolithes of sandstone and mudstone are often observed at the contact with sedimentary rocks.

1–1–3 Geological Structure

The fault and fold structures formed in and after Neogene period are well developed in the area. The faults of N-S system are predominant, but those intersected in oblique angle are often found.

The intrusive rocks trending north to south are commonly found. The occurrence seems to be associated with the faults of the same direction. These faults show a small displacement and do not reflect a large-scaled geological structure, only controlling local structures. However, the faults of N-S and NE-SW systems show the same direction as the tectonic lines in Kinabalu mountains.

Although the fold structure seems to be complicated, the direction of fold axes tend to change radially from E-W to NE-SW through N-S successively from the east to the west part.

The formations dip 20° to 40° in the western part and 50° to 60° in the southeastern part.

1–2 Mineralization

The vein-type and dissemination-type mineralization associated with the intrusion of granodiorite porphyry is observed in the areas. Silicification and chloritization are associated with the mineralization.

The mineralization is observed in the zones from the eastern to the central part and from the northwestern part to the western part.

(1) Eastern Part and Central Part

The mineralization is distributed on the southern and southwestern sides of granodiorite porphyry stock, surrounding the stock, which is characterized by film-like and disseminated pyrite mainly along the cracks in sedimentary rocks. It is accompanied with irregular-shaped quartz veins in some places. The ore minerals consist of pyrite, pyrrhotite and very small quantities of chalcopyrite.

(2) Northwestern Part and Western Part

The mineralization is found around the dikes of various sizes, and characterized by dissemination and vein. The ore minerals are composed of pyrite, pyrrhotite and small quantities of

chalcopyrite, sphalerite, galena and molybdenite, which occur both in intrusive rocks and sedimentary rocks.

The geochemical survey by soil and stream sediments conducted in Phase I extracted the geochemical anomalous zones as shown in Fig. 28, all of which are found near the contact between intrusive rocks and sedimentary rocks.

CHAPTER 2 Trenching

2–1 Method of Survey

The trenching was conducted at ten places for the geochemical anomalous zones detected by geochemical survey in Phase I. The trenches were excavated in the perpendicular direction to the trend of mineralization, because the mineralized zones of the porphyry copper type are distributed in the surrounding part of granodiorite porphyry bodies.

The location of the trenches is shown in Fig. 30, and their specifications are as follows.

Trench No.	Location	Direction	Scale			
			Length (m)	Width (m)	Depth (m)	Volume (m)
1	C15-20	E-W	4.8	1.0	2.3	11.0
2	C15-21	N75°W	5.5	1.0	1.2	6.6
3	C15-22	N80°W	5.4	1.4	2.7	20.4
4	C15-23	N40°E	4.5	0.8	3.2	11.5
5	25 m SSW of C15-25	N60°E	4.7	0.7	1.6	5.3
6	10 m SSE of C15-26	N60°E	6.5	1.8	1.5	17.6
7	C22-12	N35°W	6.6	1.4	2.2	20.3
8	C22-13	N60°W	6.2	1.3	1.5	12.1
9	C22-14	N60°W	4.9	0.5	3.4	18.9
10	C22-15	N40°W	5.0	1.0	1.6	8.0

The geological sketch for all faces in each trench is shown on the Figs. 31–1, –2, –3.

2–2 Result of Survey

(1) Trench No.1

The basement rock consists of granodiorite porphyry, and the upper part has been disintegrated to sand by weathering. Weak joint is observed, and leaching and argillization have irregularly developed. Granules to cobbles of granodiorite are scattered in the soil. Mineralization is not accompanied.

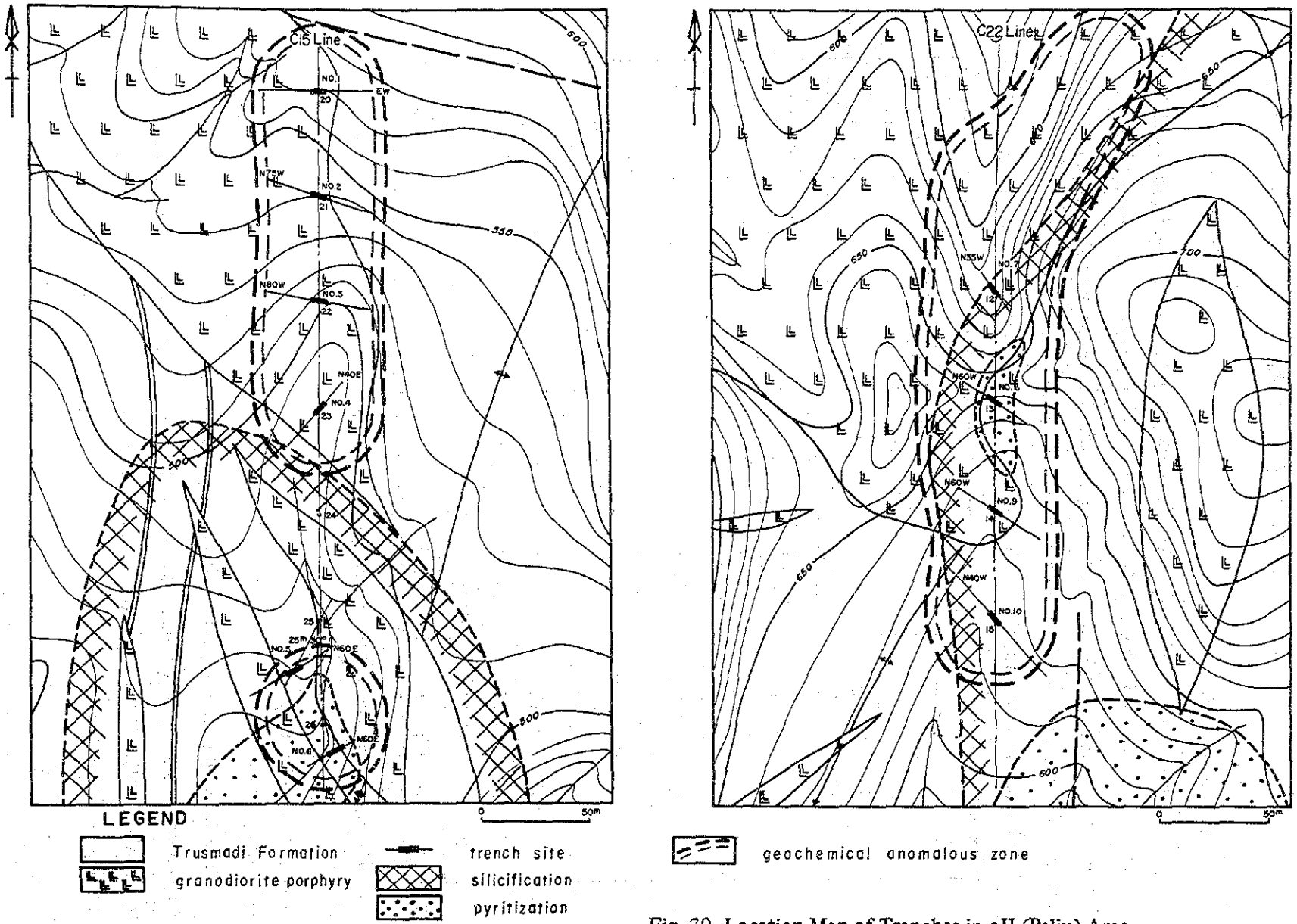
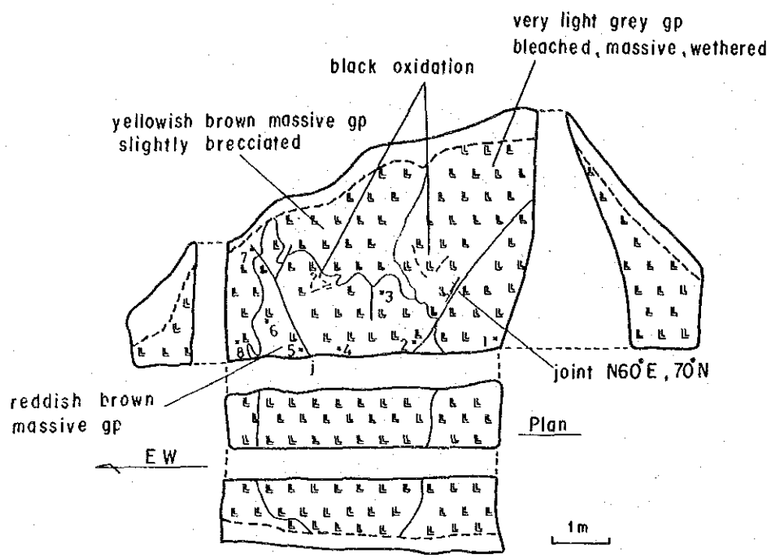
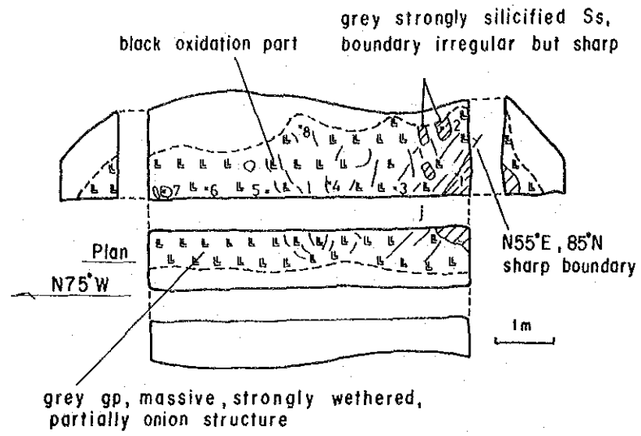


Fig. 30 Location Map of Trenches in cII (Paliu) Area

Trench No. 1



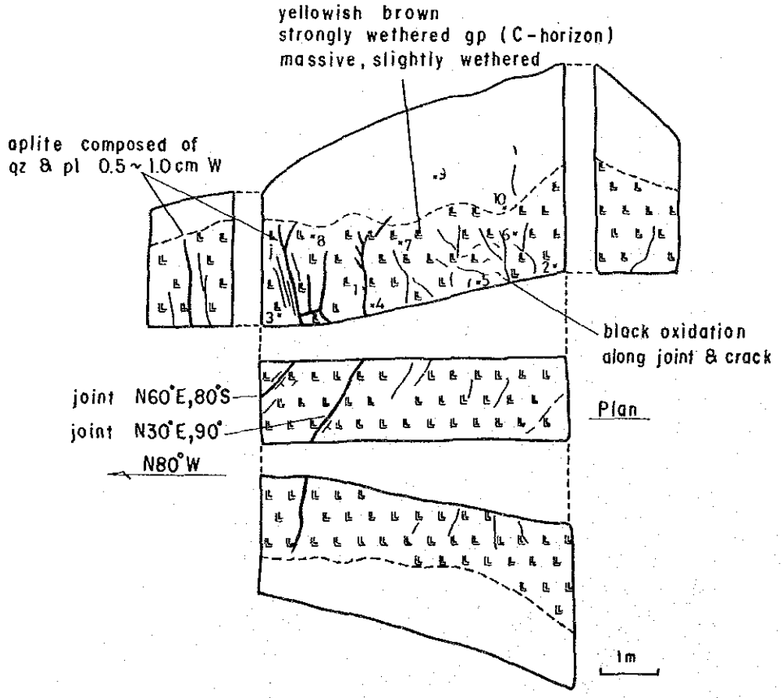
Trench No. 2



LEGEND

	soil	soil covered (a, b and c horizon)
	Ss	Sandstone
	Ms	Mudstone
	gp	granodiorite porphyry
	silic	silicification
diss	:	dissemination
j	:	joint
py	:	pyrite
qz	:	quartz
pl	:	plagioclase
x3	:	sample location and sample number

Trench No. 3



Trench No. 4

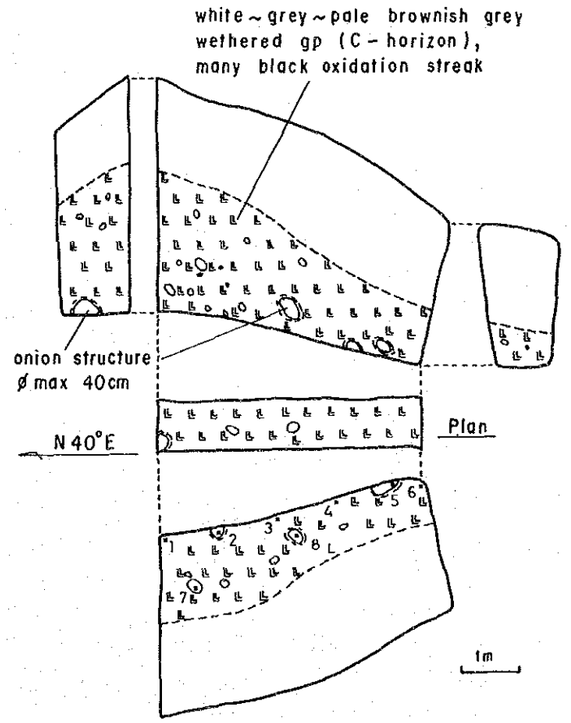
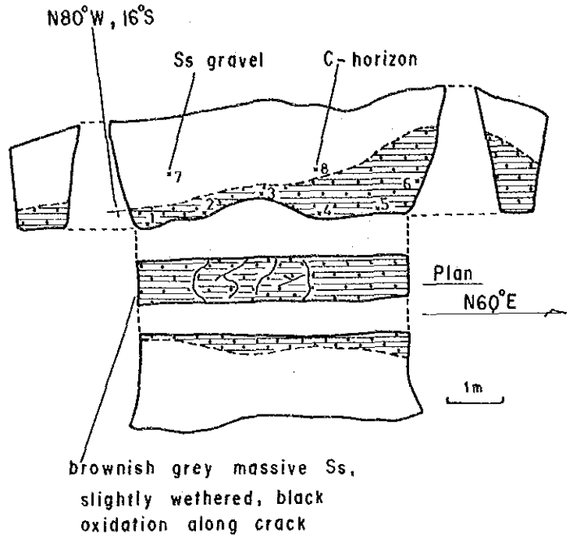
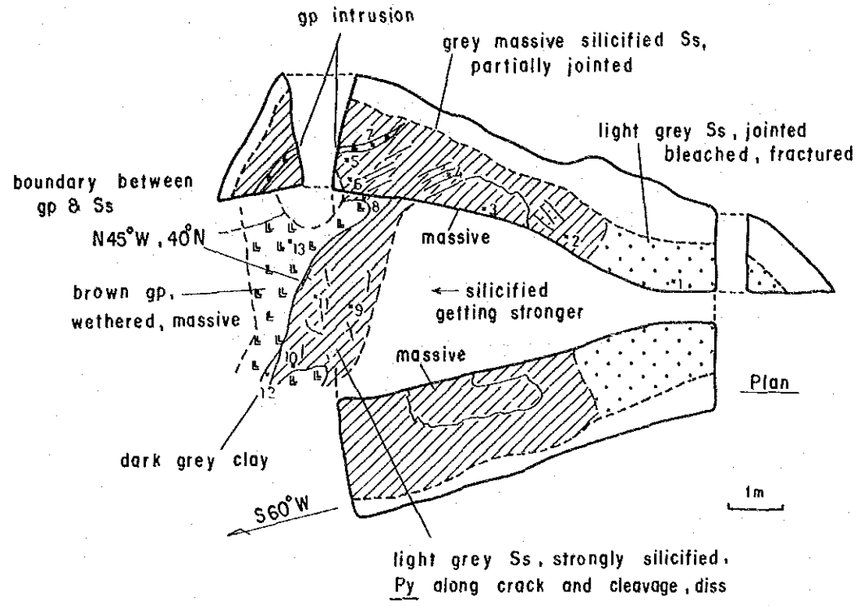


Fig. 31–1 Geological Sketch of Trenches in cII (Paliu) Area (No.1 ~ No.4) (1/100)

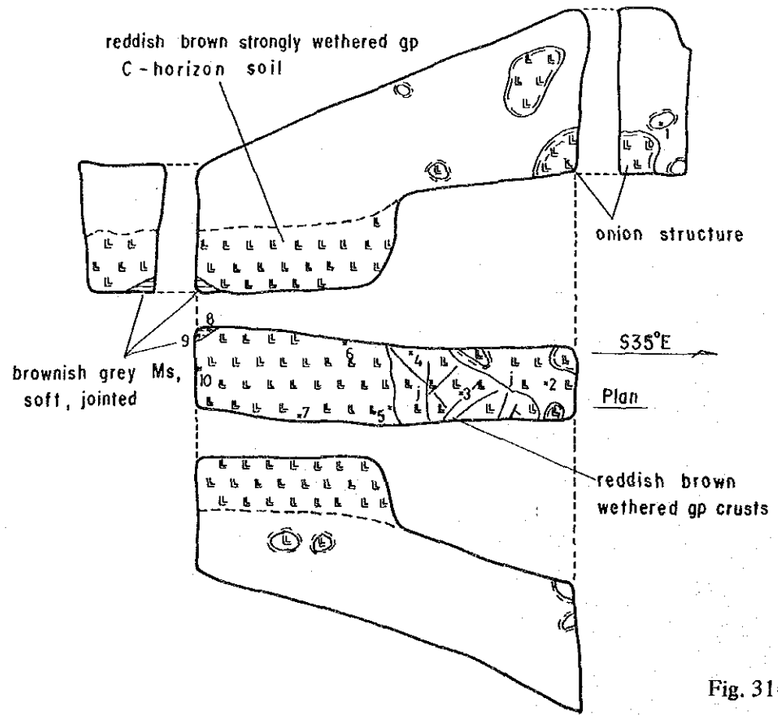
Trench No. 5



Trench No. 6



Trench No. 7



Trench No. 8

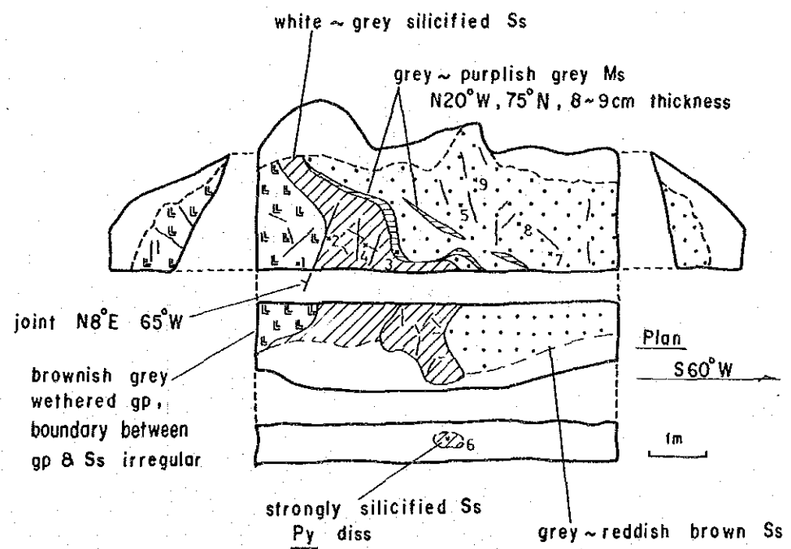
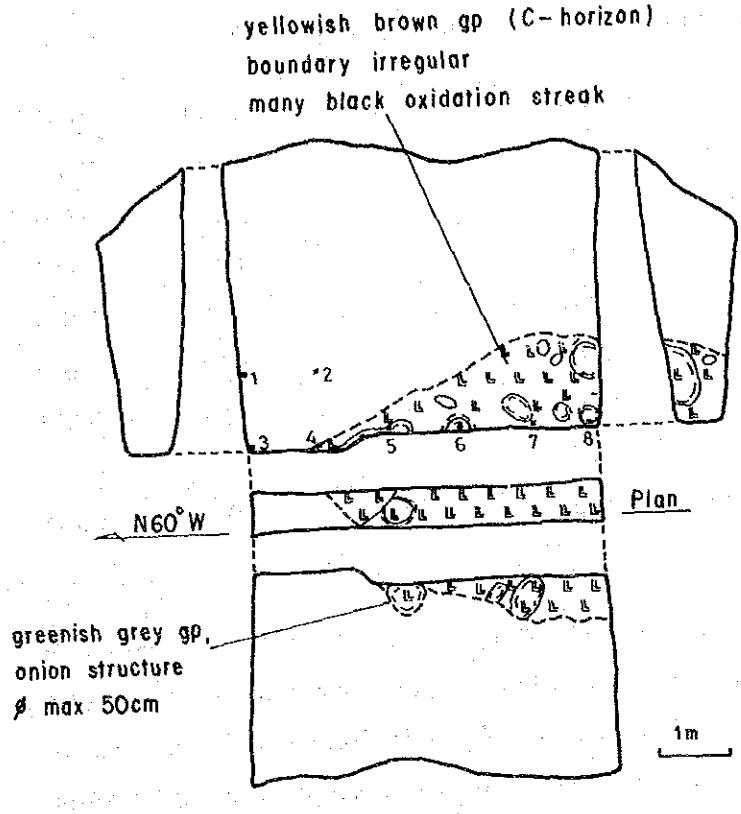


Fig. 31–2 Geological Sketch of Trenches in cII (Paliu) Area (No.5 ~ No.8) (1/100)

Trench No. 9



Trench No. 10

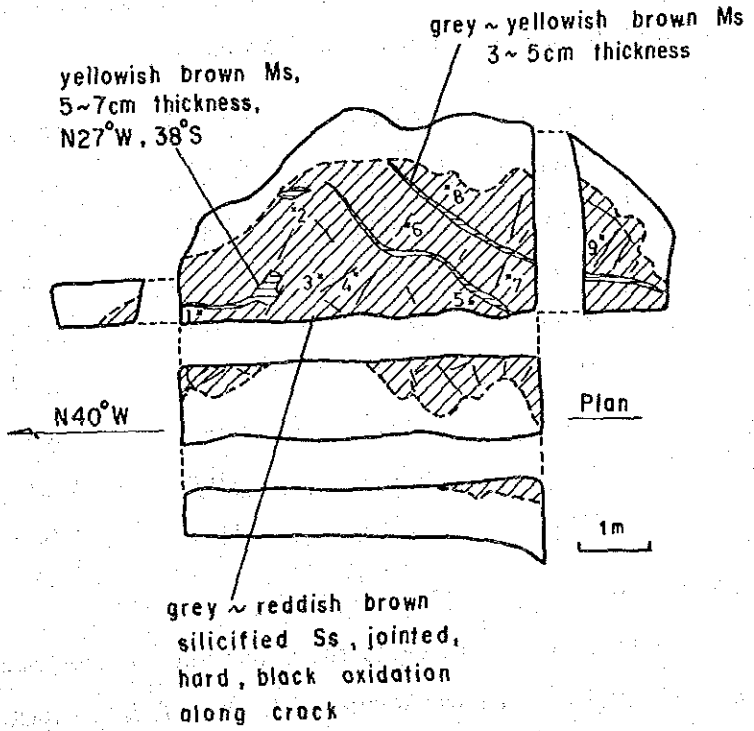


Fig. 31–3 Geological Sketch of Trenches in cII (Paliu) Area (No.9, No.10) (1/100)

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo ppm
1–1	0.07	0.037	0.016	0.002	1
1–2	0.07	0.025	0.025	0.003	1
1–3	0.06	0.027	0.035	0.003	1
1–4	0.06	0.021	0.025	0.004	1
1–5	0.04	0.039	0.039	0.014	1
1–6	0.06	0.077	0.233	0.031	1
1–7	0.04	0.105	0.190	0.046	1
1–8	0.03	0.022	0.013	0.018	1

(2) Trench No.2

The basement rock consists of granodiorite porphyry, and massive, hard and gray sandstone is found in places. The granodiorite porphyry, which bears an onion structure characteristically, has been disintegrated to sand by weathering. Weak joint is well observed. The sandstone has been metamorphosed to hornfels, being accompanied by strong silicification. The sandstone is occasionally found in granodiorite porphyry as a xenolith block. Although the boundary between two rocks is sharp, it is irregular in shape. The surface soil bears pebbles to cobbles of granodiorite porphyry, accompanied with small quantities of sandstone and mudstone.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo ppm
2–1	0.11	0.099	0.283	0.045	3
2–2	0.06	0.042	0.605	0.040	3
2–3	0.03	0.053	0.081	0.042	1
2–4	0.04	0.027	0.010	0.033	1
2–5	0.04	0.020	0.005	0.037	1
2–6	0.04	0.009	0.003	0.036	1
2–7	0.03	0.014	0.005	0.049	1
2–8	0.06	0.034	0.016	0.037	1

(3) Trench No.3

Granodiorite porphyry corresponding to the C horizon was confirmed below thick soil. Although granodiorite porphyry has been weathered to the soft sandy rock, an original texture still remains. The rock generally occurs as an appearance of blocks, and weakly argillized zones

are partly distributed. Irregular shape of aplite dikes with a width of about one centimetre each intrude in the rock. The aplite consists of quartz and plagioclase. Mineralization was not confirmed. The surface soil contains the pebbles of granodiorite porphyry of various sizes and very small quantities of sandstone granules.

The assay result of the collected sample is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
3–1	0.04	0.019	0.011	0.028	2
3–2	0.04	0.008	0.008	0.022	1
3–3	0.06	0.009	0.004	0.046	1
3–4	0.05	0.005	0.005	0.026	1
3–5	0.04	0.007	0.005	0.027	1
3–6	0.03	0.011	0.021	0.028	1
3–7	0.03	0.006	0.017	0.035	1
3–8	0.03	0.009	0.004	0.022	1
3–9	0.03	0.016	0.033	0.025	1
3–10	0.04	0.013	0.011	0.070	1

(4) Trench No.4

Weathered granodiorite porphyry which corresponds to C horizon was confirmed as well as in the trench No.3. An onion structure peculiar to the rock is often observed in weathered sandy rock, and hard boulders of the rock remain in the central core of the blocks. Mineralization is not confirmed. Surface soil bears small pebbles of granodiorite porphyry and sandstone.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
4–1	0.04	0.006	0.002	0.026	1
4–2	0.03	0.007	0.003	0.014	1
4–3	0.04	0.006	0.004	0.018	1
4–4	0.03	0.007	0.003	0.027	1
4–5	0.01	0.009	0.005	0.017	1
4–6	0.04	0.005	0.002	0.010	1
4–7	0.04	0.019	0.004	0.018	4
4–8	0.04	0.029	0.010	0.030	4

(5) Trench No.5

The basement rock consists of massive and hard sandstone with gray to brownish gray in color, showing fine-grained and silty facies, and is divided into blocks by joints. Weak silicification is observed along the joints. Although weak silicification is recognized throughout the rock, no mineralization is confirmed.

The surface soil mainly consists of the pebbles of sandstone and mudstone of various sizes with some amount of granodiorite porphyry floats of a cobble to boulder size.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
5–1	0.04	0.005	0.007	0.008	1
5–2	0.07	0.009	0.006	0.008	1
5–3	0.01	0.009	0.005	0.009	2
5–4	0.04	0.007	0.007	0.009	1
5–5	0.03	0.004	0.006	0.008	1
5–6	0.01	0.009	0.004	0.007	1
5–7	0.09	0.006	0.010	0.003	1
5–8	0.03	0.009	0.006	0.008	1

(6) Trench No.6

The basement rocks consist of gray to pale gray sandstone and granodiorite porphyry which has intruded into sandstone.

The sandstone is a fine to medium-grained hard rock with a joint structure. It has been altered to hornfels at the contact with granodiorite porphyry, having been highly silicified and leached out, especially along marginal zone and changed to pale gray sandstone. The granodiorite porphyry has irregularly intruded into sandstone in a shape of small dikes. The boundary is sharp and sometimes pale gray zones are found along the boundary. The rock is highly weathered and has been changed to sandy soft facies.

Regarding to the mineralization, dissemination and fine streaks of pyrite and very small quantities of chalcopyrite are recognized around the boundary between sandstone and granodiorite porphyry. The mineralized zone is almost consistent with the silicified zone. A similar mineralization is also observed in sandstone and granodiorite porphyry exposed in a small creek adjacent to the trench. The overburden contains granules to cobbles of sandstone and mudstone.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
6–1	0.14	0.008	0.003	0.005	1
6–2	0.16	0.006	0.003	0.003	1
6–3	0.11	0.006	0.005	0.003	2
6–4	0.14	0.005	0.003	0.003	1
6–5	0.11	0.005	0.002	0.002	1
6–6	0.11	0.009	0.003	0.005	2
6–7	0.10	0.009	0.003	0.004	1
6–8	0.17	0.021	0.006	0.010	11
6–9	0.14	0.007	0.003	0.004	15
6–10	0.19	0.010	0.004	0.008	2
6–11	0.13	0.008	0.003	0.003	8
6–12	0.13	0.006	0.003	0.006	1
6–13	0.11	0.006	0.004	0.009	1

(7) Trench No.7

The excavation of the trench has not encountered the basement rock, having confirmed only weathered granodiorite corresponding to B and C horizons. Brownish grey mudstone distributes in the horizons. The granodiorite porphyry has been softened by weathering, however great boulders which size is up to three metres in diameter with abundant joint are found. The mudstone is silty and massive, showing a sharp boundary in irregular shape with granodiorite porphyry. No mineralization was distinguished. The overburden contains boulders of granodiorite porphyry and of small numbers of sandstone.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
7–1	0.04	0.008	0.023	0.031	1
7–2	0.04	0.008	0.019	0.023	1
7–3	0.03	0.013	0.013	0.043	1
7–4	0.05	0.009	0.068	0.035	2
7–5	0.07	0.006	0.038	0.023	1
7–6	0.03	0.006	0.076	0.025	2
7–7	0.04	0.006	0.038	0.024	3
7–8	0.03	0.007	0.039	0.033	3
7–9	0.03	0.005	0.026	0.029	2
7–10	0.07	0.005	0.056	0.024	3

(8) Trench No.8

The basement rock consists of sandstone intercalated with thin layers of bluish brown mudstone and intrusive bodies of granodiorite porphyry. Sandstone is gray, massive and hard rock with irregular joints. The prominent silicification is observed around the contact with granodiorite porphyry, and has been stained by limonite along the joint.

The mudstone is rather soft as compared sandstone and forms thin layers with the thickness of about 10 centimetres, with an abundant schistosity. The granodiorite porphyry has a sharp contact with sandstone and mudstone.

The mineralization is characterized by disseminated pyrite and very small quantities of tetrahedrite in silicified zone of sandstone layers.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
8–1	0.01	0.0072	0.043	0.053	2
8–2	0.03	0.006	0.095	0.039	1
8–3	0.08	0.003	0.018	0.033	1
8–4	0.05	0.002	0.047	0.017	1
8–5	0.06	0.003	0.022	0.028	2
8–6	0.04	0.012	0.071	0.055	1
8–7	0.03	0.007	0.095	0.047	1
8–8	0.04	0.003	0.061	0.027	1
8–9	0.05	0.003	0.086	0.027	1

(9) Trench No.9

Only weathered granodiorite porphyry corresponding to C horizon distributes in the trench without the occurrence of basement rock. An onion structure is common in weathered sandy rock, and the core consists of hard rock showing an appearance of pebbles. Limonite stain is observed along the weak joint. No mineralization was distinguished. Overburden soil contains abundant breccias of silicified sandstone.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
9–1	0.08	0.004	0.035	0.015	1
9–2	0.08	0.004	0.051	0.016	1
9–3	0.13	0.005	0.024	0.022	1

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
9–4	0.13	0.005	0.005	0.017	1
9–5	0.71	0.006	0.006	0.019	1
9–6	0.09	0.004	0.006	0.019	1
9–7	0.11	0.004	0.003	0.014	2
9–8	0.10	0.003	0.005	0.014	1

(10) Trench No.10

The basement rock consists of gray massive sandstone intercalated with thin layers of brownish gray mudstone. The sandstone is massive with irregular joints. The mudstone is soft and forms layers of three to five centimetres thick, striking north-northwest.

Weak silicification is observed throughout the sandstone. No mineralization is observed. Only boulders of sandstone are distributed in overburden.

The assay result of the collected samples is as follows:

Sample No.	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	Mo (ppm)
10–1	0.03	0.004	0.029	0.008	1
10–2	0.10	0.009	0.008	0.012	1
10–3	0.01	0.007	0.004	0.005	1
10–4	0.07	0.039	0.038	0.012	1
10–5	0.01	0.007	0.009	0.022	1
10–6	0.04	0.006	0.003	0.006	1
10–7	0.03	0.005	0.003	0.010	1
10–8	0.04	0.004	0.004	0.009	1
10–9	0.04	0.005	0.010	0.069	1

CHAPTER 3 Overall Discussion

The recent history of the exploration in the area is as follows:

As the result of the collaborative survey between Malaysia and West Germany in 1982, two soil geochemical anomalies have been detected.

The geochemical detailed survey of soil and stream sediments for the area of 4 km^2 including above mentioned two areas was performed in 1985 as Phase I program. As the result of the evaluation, weak geochemical anomalies in limited zone have been detected in the central part of the area.

Total ten trenches were excavated within the geochemical anomalous zone.

The trenches are situated in and around the boundary of granodiorite porphyry and the Trusmadi Formation. However no distinct mineralization has been found in the trenches except some of anomalous values have been obtained from some trenches, such as

Cu : 0.1% in No.1, Pb : 0.2 ~ 0.6% in No.2

Au : 0.1 ~ 0.19 g/t in No.6.

As stated above, the mineralization has been confirmed in the area is of a small scale and weak, so it is advisable that no further follow-up work is necessary for this area.

PART V CONCLUSION AND RECOMMENDATION

Conclusion and Recommendation for Phase III Survey

I. Conclusion

The conclusions drawn out from the result of the overall study on the data collected from Phase II survey are as follows:

(1) aII (Banbangan) area

As the result of overall study on the data obtained from surface geology and core logging of the drill holes (MJM-11 and MJM-12 of Phase II and MJM-2, MJM-4 and MJM-8 of Phase I), the following two points became clear;

(a) the mineralization extends to hornfels of the Trusmadi Formation and to peridotite, both of which are the host rock, from adamellite porphyry which is also being mineralized as the source of the mineralization;

(b) the occurrence of micro-diorite, intruded in the period of the later stage or immediately after the mineralization, has controlled the zone of mineralization, and the intensity of mineralization in micro-diorite has been weakened.

However, as a result of studying the geological map and profiles in the mineralized area, it is presumed that the area for further detailed exploration is the area in an oval shape, extending about 600 m in N-S direction and about 300 m in E-S direction on the horizontal level of 1,300 m ASL, including both holes of MJM-8 and MJM-12.

The zone of pyrite dissemination found in the drill hole of MJM-5 in Phase I could not be confirmed in the drill hole of MJM-13 which was executed in the northern side. Therefore, no possibilities can be verified for the development to the mineralized zone in a large scale from the zone of pyritization.

(2) bII (Mankadau) area

Regarding the floats of massive copper sulphide ore, its source and occurrence were unrecognizable, despite of the geological survey and the soil geochemistry covering wide areas in Phase II.

It is almost confirmed that the indication of chromite mineralization is partial and small in scale, due to the discovery of the floats during Phase I and the survey of the Paranchangan outcrop in Phase II.

It is assumed that the zone of pyrite impregnation at the west part of the survey area has no potentiality to develop into a large scaled ore deposit due to its limited occurrence.

(3) cII (Paliu) area

The result of ten trenches excuted in the weakly anomalous zone shows a little significant

values of the chemical analysis for both Pb content in No.2 trench and the Au content in No.6 trench, but no continuity of the mineralization could be traced as well as those in the other trenches.

II. Recommendation for Phase III Survey

The recommendation for Phase III survey based on the result of Phase II survey is as follows:

Regarding aII (Bambangan) area, the diamond drilling is recommended to confirm the extention of the mineralized zone, detected in the central zone, which is delineated as porphyry copper type mineralization.

For bII (Mankadau) area and cII (Paliu) area, no further survey is advisable, since the area shows a poor mineralization and is not worthwhile for the exploration.

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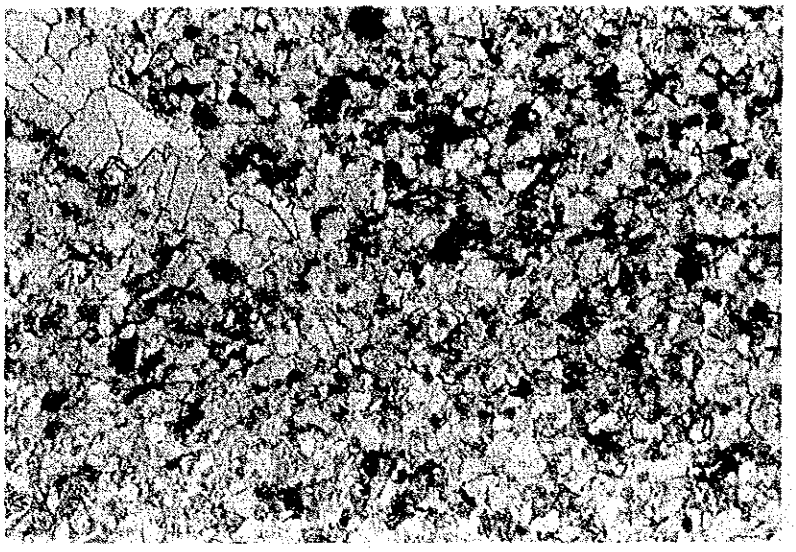
APPENDICES

A–1 Microphotograph of Thin Sections

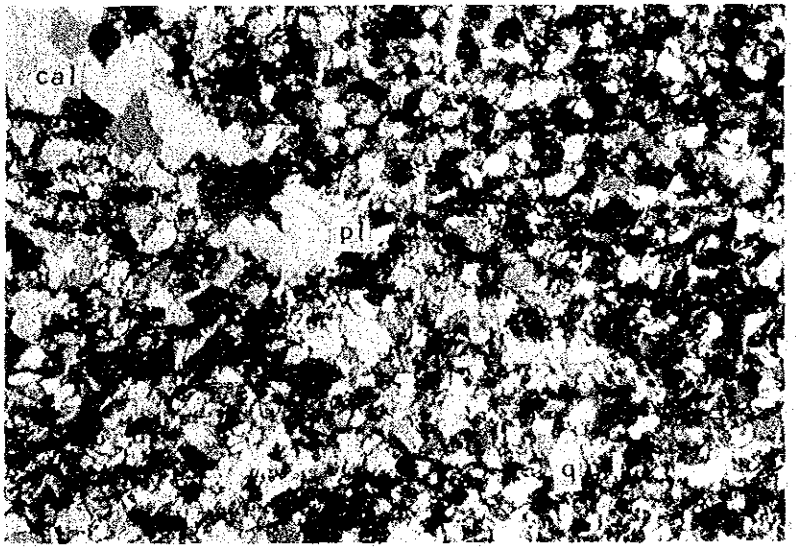
Abbreviation

q : quartz
kf : k-feldspar
pl : plagioclase
bi : biotite
hb : hornblende
au : augite
opx : orthopyroxene
cpx : clinopyroxene
ol : olivine
chr : chromite
gl : glass
cal : calcite
ser : sericite
chl : chlorite
srp : serpentine
act : actinolite
zeo : zeolite
ht : hematite
op : opaque mineral

( ) : pseudomorph



Plane light



X-nicols

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Sample No. K–05
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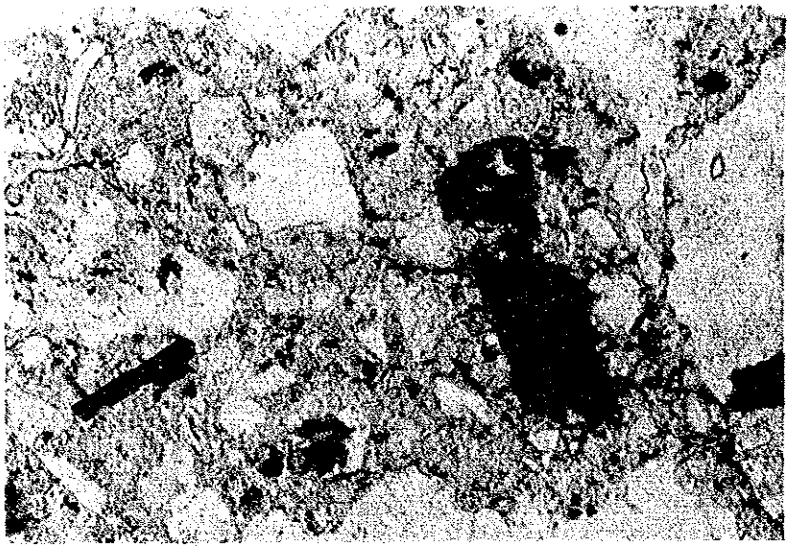
Rock name : Sandstone



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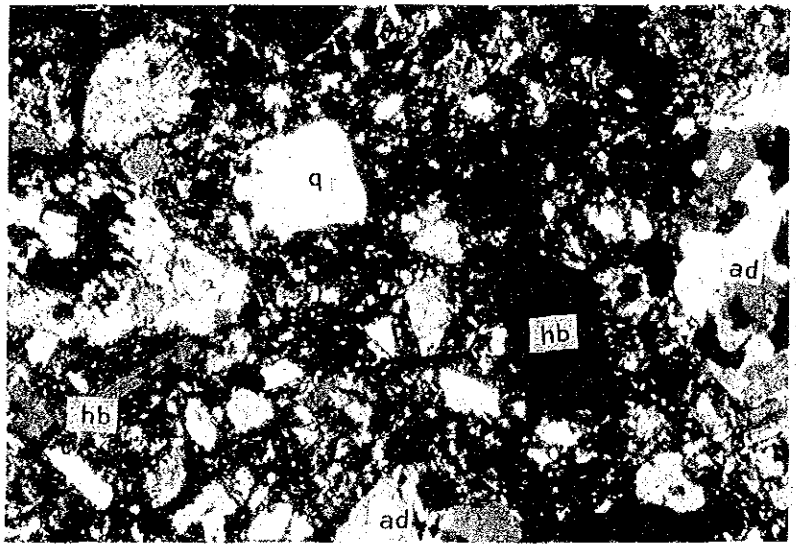

X-nicols

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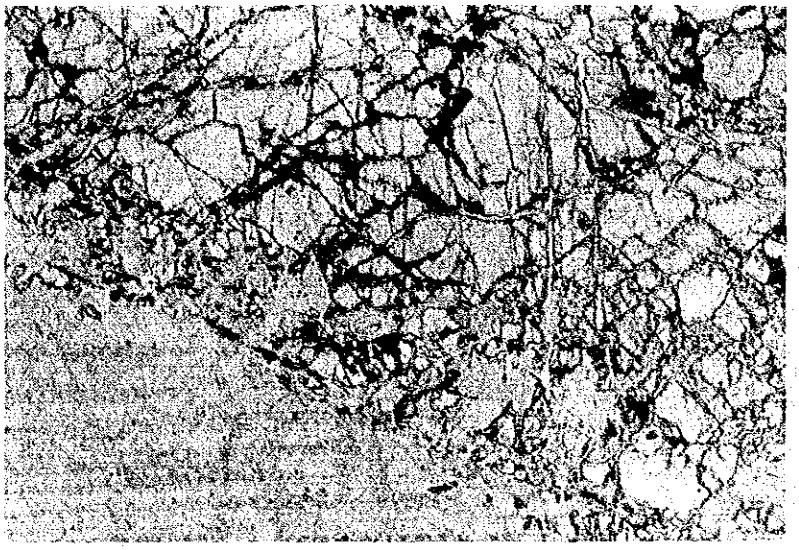
Location : Bambangan cr. (aII Area)
Rock name : Pinosuk Gravels



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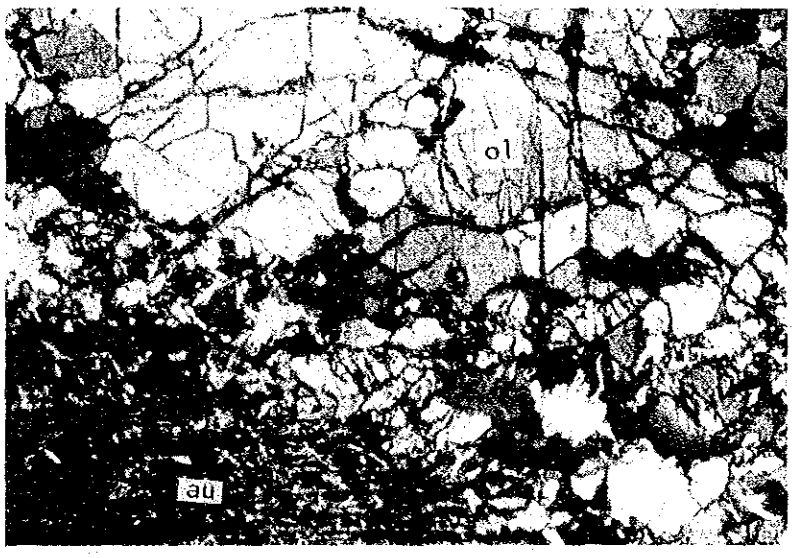

X-nicols

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Sample No. N–05
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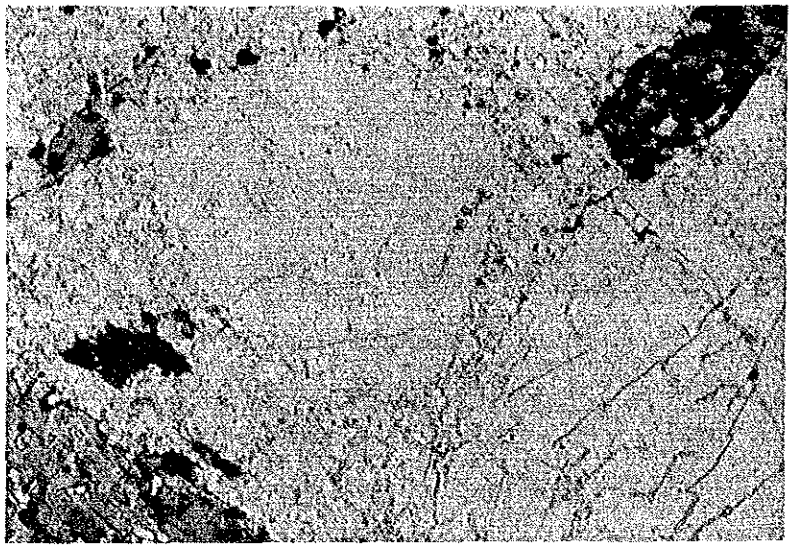
Rock name : Lherzolite



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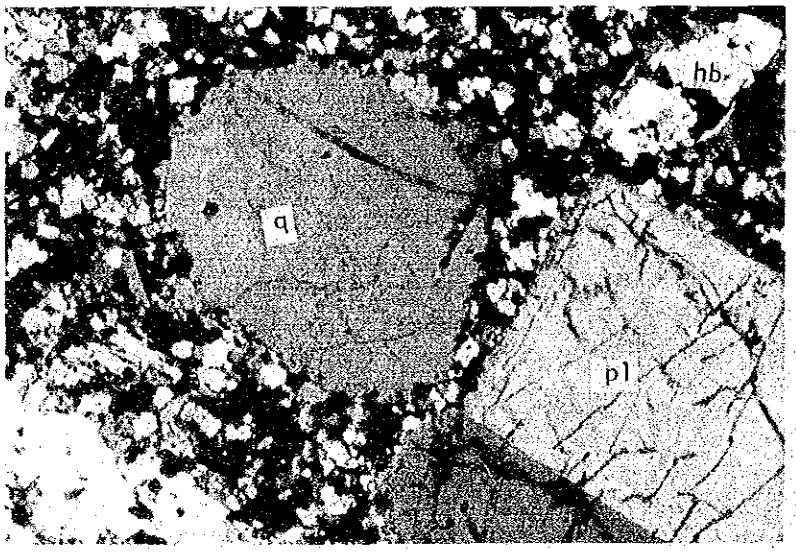

X-nicols

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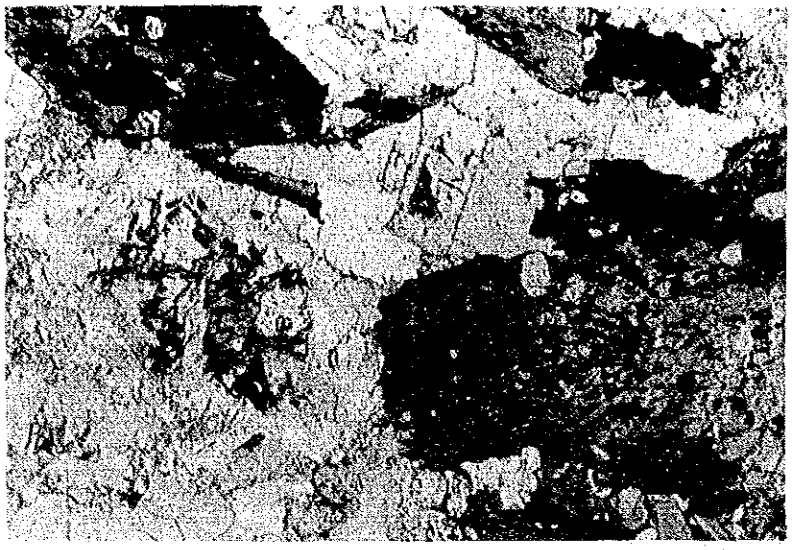
Rock name : Adamellite Porphyry



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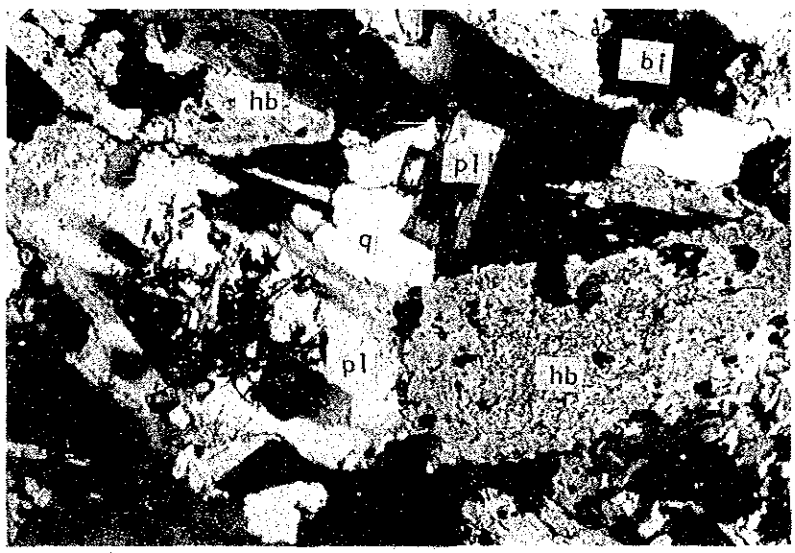

X-nicols

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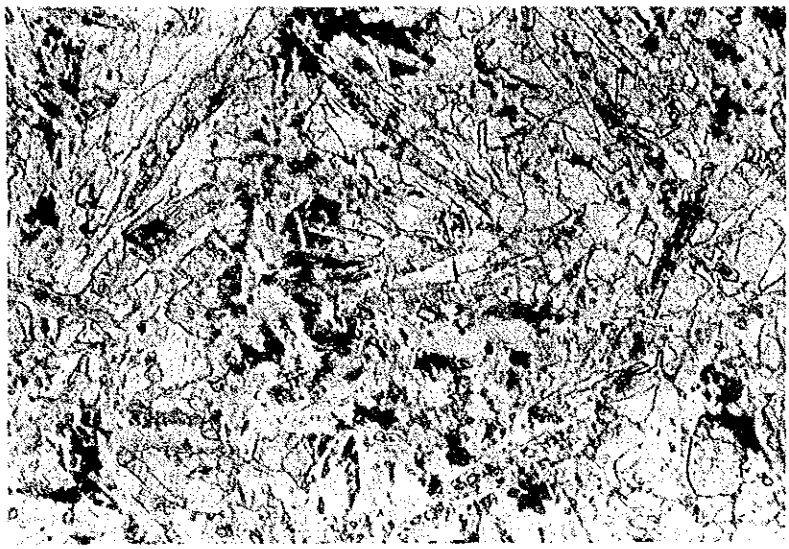
Rock name : Microdionite



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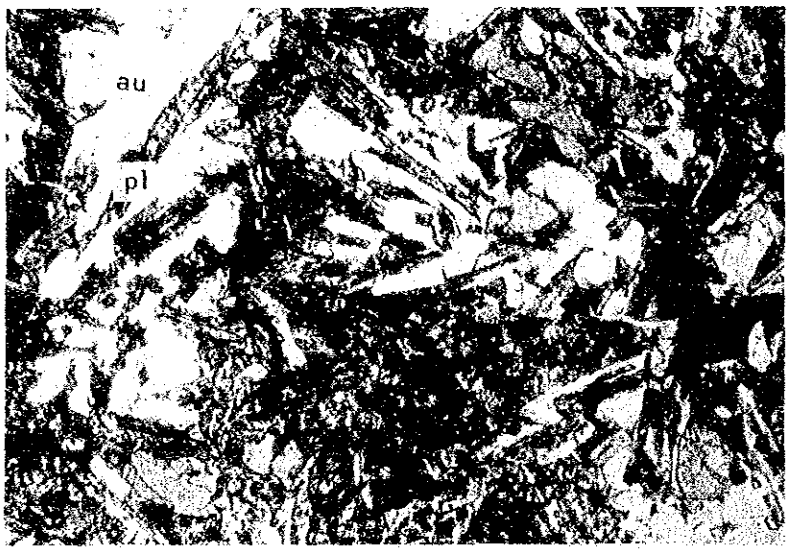

X-nicols

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Sample No. Y–06
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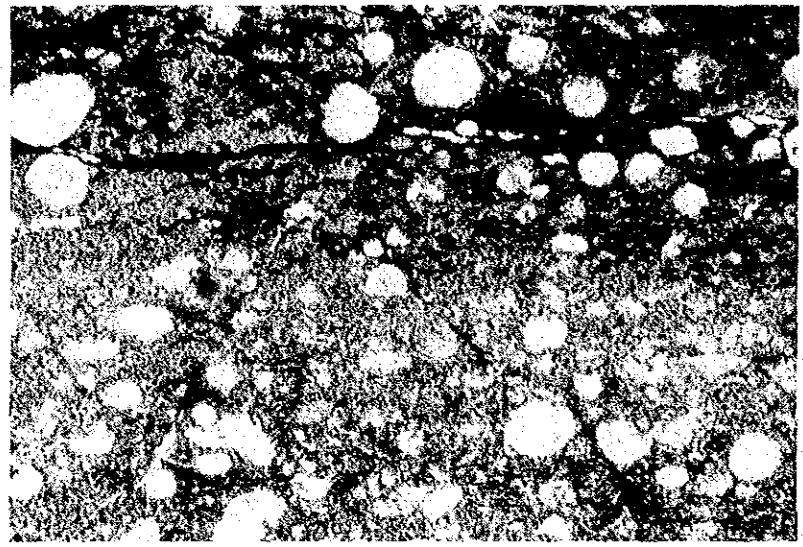
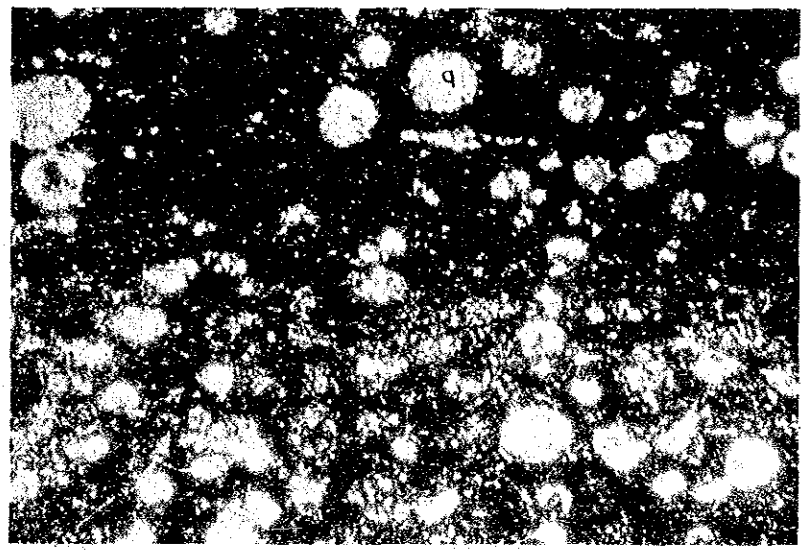
Rock name : Doleritic basalt



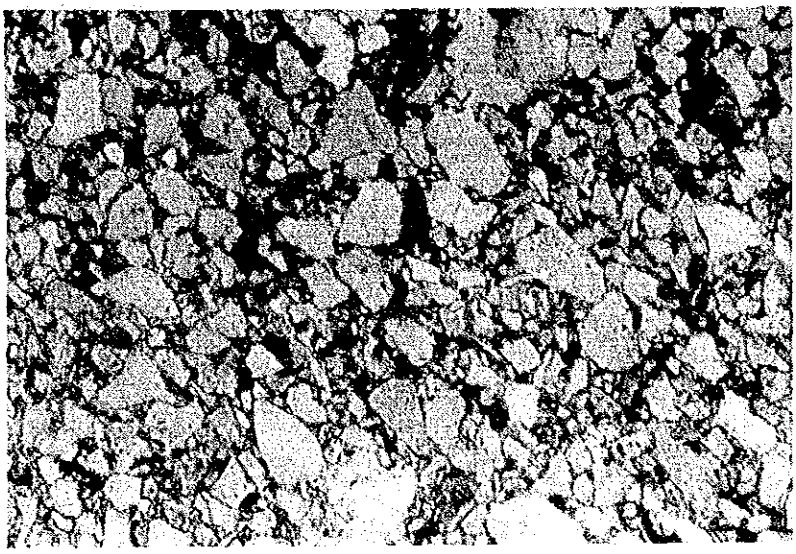
Plane light



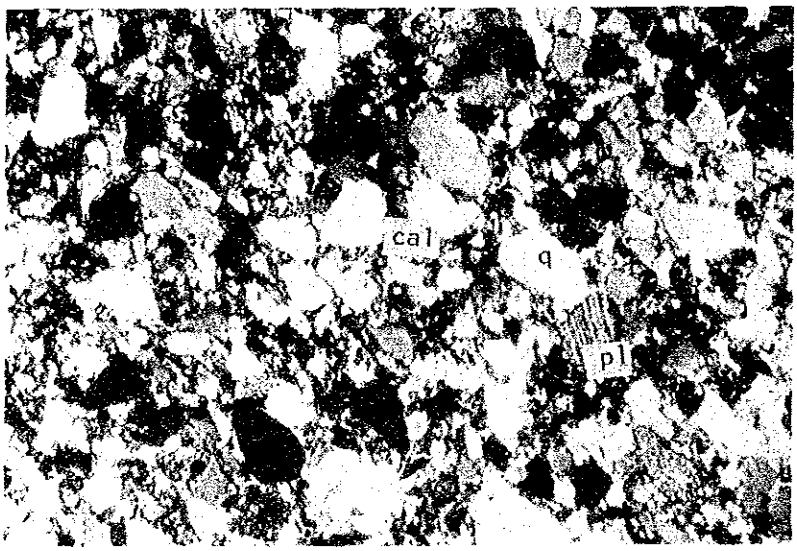
X-nicols

0 1.0 mm

Sample No. Y--32
Location : Sansogan cr. (bII Area)
Rock name : Radioralian chert



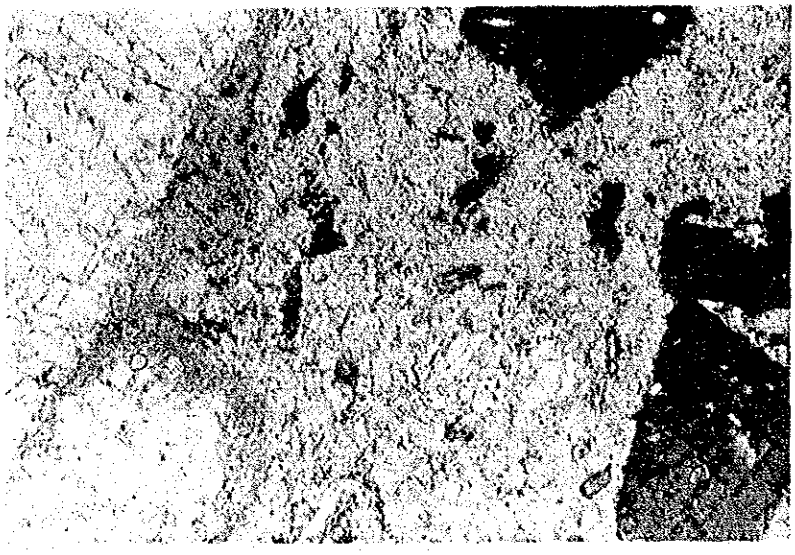
Plane light



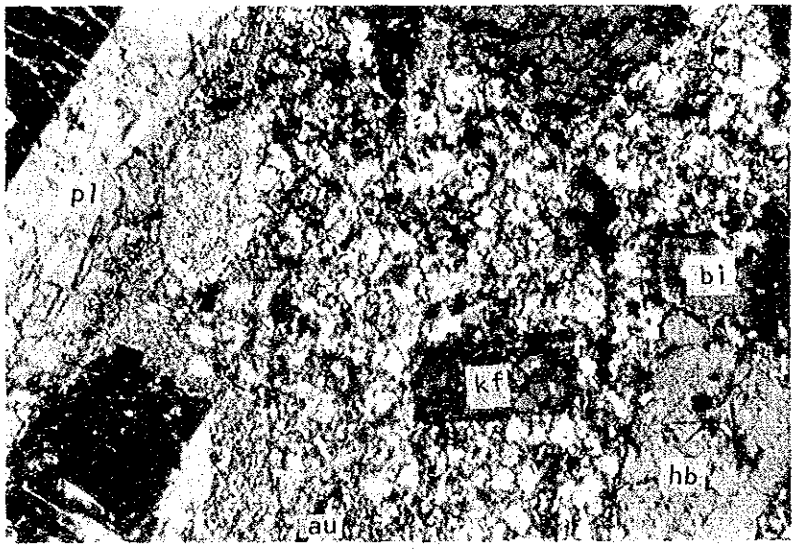
X-nicols

0 1.0 mm

Sample No. Y–03
Location : Marili R. (all Area)
Rock name : Sandstone



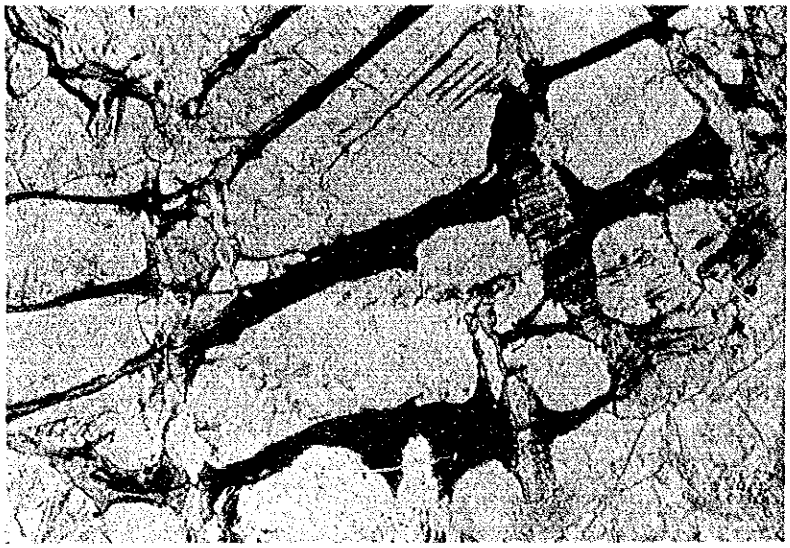
Plane light



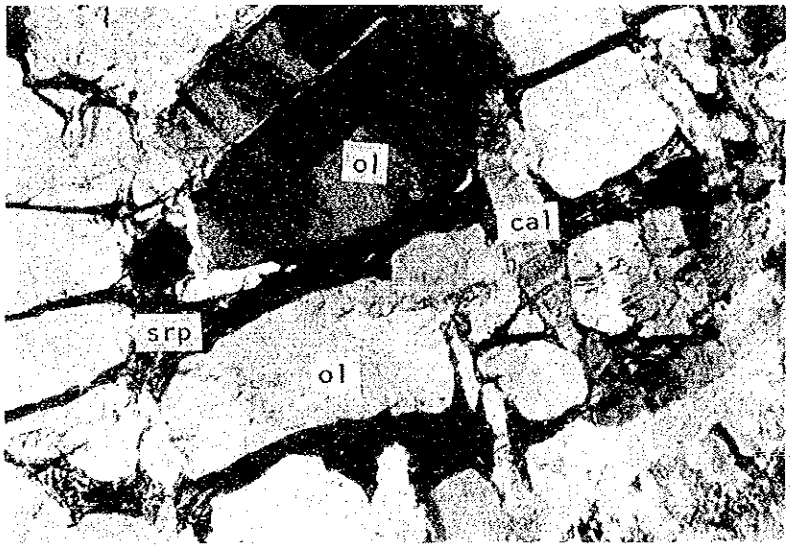
X-nicols

0 1.0 mm

Sample No. Y–10
Location : Mankadau R. (bII Area)
Rock name : Adamellite porphyry



Plane light



X-nicols

0 1.0 mm

Sample No. Y–05b
Location : Sasapan cr. (bII Area)
Rock name : Dunite