Table II-1-10 Observation results of thin sections collected in Labuk area

Ser. No.	Sample No.	Location Coordinates N	Location Coordinates E	Geologic Units	Rock Name	Texture	Phenocrysts, big minerals: quartz	K-feldspar	plagioclase	biotite	hornblende	garnet	groundmass and accessory minerals: quartz	K-feldspar	plagioclase	biotite	hornblende	garnet	sphene	sphene	zircon	apatite	opaque minerals	Meramorphic and altered minerals: quartz	plagioclase	epidote	chlorite	prehnite	pumpellyte	sericite	calcite	opaque minerals
6	M542	1453.80	4682.45	I_1	Andesite porphyry	Porphilytic			○	○					◎									◎		○				○	○	●

◎ :abundant, ○ :common, ○ :a little, ● :rare.

Table II-1-11 Observation results of polished sections collected in Labuk area

Ser. No.	Sample No.	Coordinates		Descriptions	Detected mineral									Remarks
		N	E		Chalcopyrite	Bornite	Chalcocite	Pyrite	Magnetite	Hematite	Limonite/ Goethite	Malachite	Gangue minerals	
1	C505	1530.20	4681.75	Magnetite-(chalcopyrite) dissemination	•	•	•	•	o	•			◎	
2	F538	1454.15	4699.12	Limonite (gossan).				•		•	○	o	◎	

◎: abundant ○: common o: a little •: rare

the area. Pyrite, limonite, goethite and malachite were confirmed in this sample.

(3) Ore assaying

Five samples were collected from mineralized and altered zones in this area. Seven elements including Au, Ag, Cu, Pb, Zn, Mo and S were assayed in this survey. Results of this assaying are given in Table II-1-12. All samples give Au and Ag values of less than the detection limit. Sample number C511 (686 ppm Cu) and M610 (396 ppm Cu) give comparatively high contents of Cu. The sample C551 was collected from dolerite in Chert-Spilite formation situated in the south of Telupid. Sulfide dissemination is observed in this sample. The sample M610 was collected from gossanized zone in the area of the tributary of Sungai Imbak. This sample also shows comparatively high content (177 ppm) of Zn.

Table II-1-12 List of ore samples and their assay results in Labuk area

Labuk area

Ser. No.	Sample No.	Coordinates		Descriptions	Assay results							Remarks
		N	E		Au (g/t)	Ag (g/t)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Mo (ppm)	S (%)	
1	C505	1530.20	4681.75	Pyrite-chalcopyrite dissemination in dolerite.	< 0.1	< 0.1	86	16	83	11	0.15	
2	C507	1513.10	4678.70	Pyrite-chalcopyrite dissemination in dolerite and basalt.	< 0.1	< 0.1	51	17	88	9	0.11	
3	C511	1533.78	4691.00	Pyrite-chalcopyrite dissemination in dolerite.	< 0.1	< 0.1	686	16	70	13	1.49	
4	F538	1454.15	4699.12	Limonite and goethite along fractures in basalt.	< 0.1	< 0.1	135	19	90	6	0.09	
5	M610	1453.43	4682.55	Gossanized rock with limonite and goethite.	< 0.1	< 0.1	396	90	177	9	0.08	

Chapter 2 Semi-detailed geochemical survey

2-1 Survey methods and work amounts

2-1-1 Methodology

As the results of the regional geochemical survey for Segama and Semporna areas in Phase II, eight areas were selected as the potential areas of mineral resources. A semi-detailed geochemical survey was conducted for the following areas in this phase.

① Area A (Sungai Sabahan - Sungai Diwata area: Segama area)
② Area B (Upper stream of Sungai Danum area: Segama area)
③ Area C (Upper stream of Sungai Segama area: Segama area)
④ Area D (Middle stream of Sungai Tingkayu area: Segama area)
⑤ Area E (Most upper stream of Sungai Kalumpang area: Semporna area)
⑥ Area F (Tawau Hill area: Semporna area)
⑦ Area G (Sungai Apas area: Semporna area)
⑧ Area H (Sungai Sipit area: Semporna area)

Locations of these areas are shown in Fig II-2-1.

Soil was used as the sample media in this survey except Area B and Area C. Because of steep topography, soil and stream sediments were collected as the sample media along the stream in Area B and Area C. A geologic survey and sampling work for laboratorial studies were simultaneously carried out along the geochemical sampling routes. The soil sample was collected from upper part of B horizon based on the results of orientation survey in Phase I. The stream sediment sample was collected at the edge of stream as same as the regional geochemical survey. The sample is -60 mesh fraction sample. Density of soil sample is 4 samples/km^2.

At the each sampling site, description for the sampling site are made and sample list was prepared. More than 1 kg for soil sample and more than 150 g for stream sediment sample were collected at each sampling site. After drying up the soil sample, -80 mesh fraction sample were collected, then the sample was divided into to two samples. One is for chemical analyses and other is for storage in the Geological Survey of Malaysia, Sabah office. The samples for the chemical analyses were sent to the laboratories in Japan and Canada.

Base camp was established in the survey area for the survey of Area D and Area G. The survey for Area B, Area C and Area E were conducted by flying camp. The survey for Area F and Area H was conducted using the base camp in Area G.

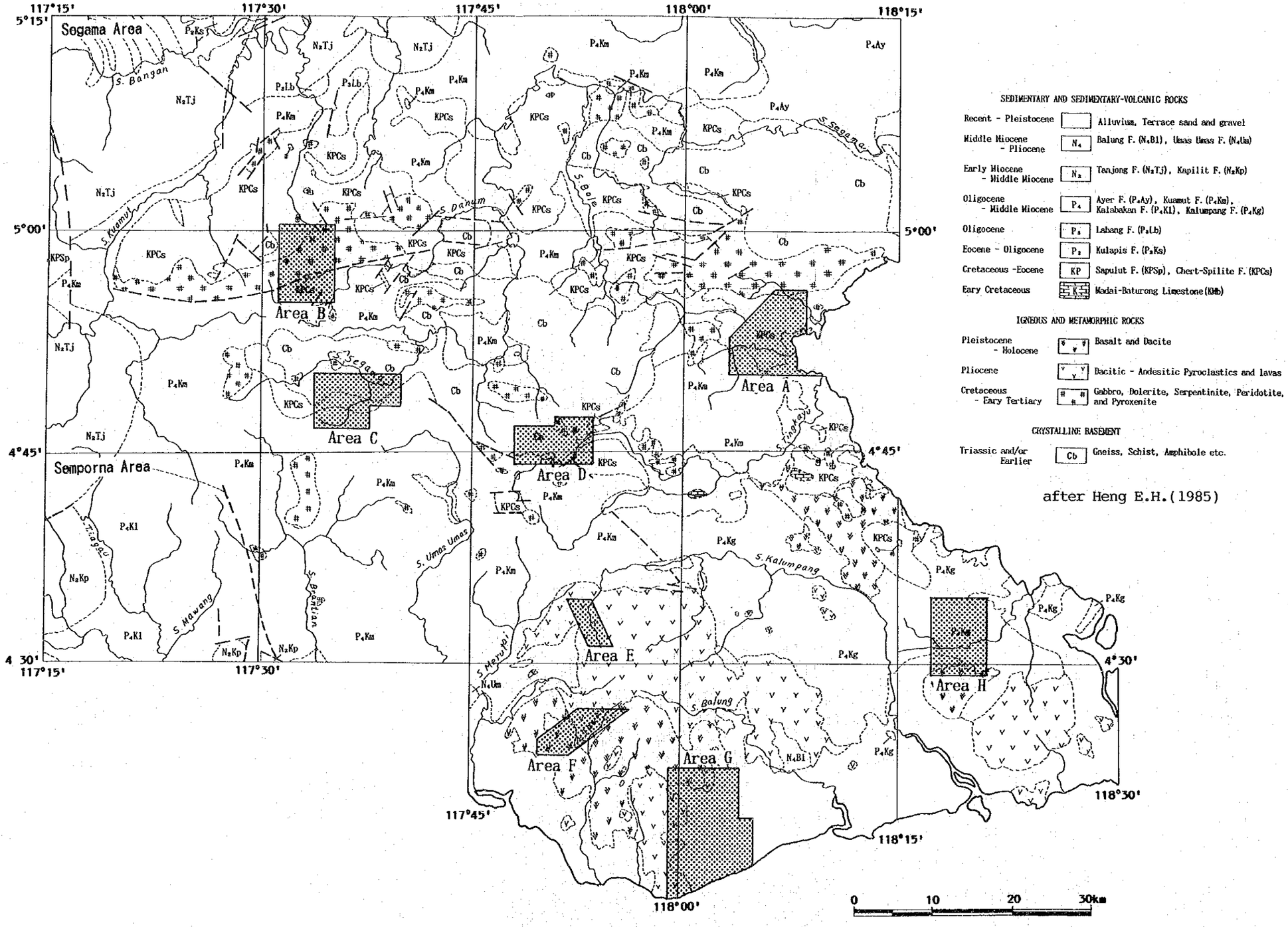


Fig. II-2-1 Location map of semi-detailed syrvey areas

2-1-2 Coverage of work

The work amount completed for each area is the following:

Area	Geochemical survey			Laboratorial studies			
	Soil	Stream sediment	Rock	Thin section	Polished section	X-ray diffract	Ore assaying
Area A	340 spls.	0 spls.	2 spls.	2 spls.	1 spls.	2 spls.	2 spls.
Area B	144 spls.	140 spls.	12 spls.	10 spls.	7 spls.	4 spls.	8 spls.
Area C	140 spls.	140 spls.	7 spls.	6 spls.	2 spls.	2 spls.	5 spls.
Area D	221 spls.	0 spls.	4 spls.	3 spls.	0 spls.	0 spls.	2 spls.
Area E	72 spls.	0 spls.	1 spls.	1 spls.	0 spls.	1 spls.	1 spls.
Area F	122 spls.	0 spls.	1 spls.	1 spls.	1 spls.	2 spls.	2 spls.
Area G	581 spls.	0 spls.	2 spls.	2 spls.	1 spls.	3 spls.	1 spls.
Area H	282 spls.	0 spls.	1 spls.	1 spls.	0 spls.	1 spls.	0 spls.

Twenty one elements were chemically analyzed for soil, stream sediment and rock samples. The elements and these detection limit are same as the regional geochemical survey in Kinabalu and Labuk areas.

The elements assayed for the ore samples and their detection limits are as the following:

Element	Detection limit	Element	Detection limit	Element	Detection limit
Au	0.1 g/t	Pb	1 ppm	S	0.01 %
Ag	0.1 g/t	Zn	1 ppm		
Cu	1 ppm	Mo	1 ppm		

The elements applied in this survey was selected based on the results of the orientation geochemical survey in Phase I.

1-1-3 Data processing and analyses

The analytical results of the geochemical samples were input in computer. Statistical data treatment, single element and multi element analyses were made using these input data.

In order to carry out the single element analyses, statistics for each element were calculated. A half value of the ditection limit was used for the sample indicating less than the detection limit of the element in this calculation. The mean values calculated are geometric means. Based on this calculated results, distribution map of each element was drawn by computer.

The drainage system of the survey areas were input in the computer using digitizer and distribution maps of each element were prepared. The correlation

matrix among the elements were also calculated. Exploratory Data Analysis (EDA) method was applied to delineate the threshold value (anomalous value) for each elment.

As the multi element analyses, factor analysis was utilized in this survey. The factor analysis is the method to delineate the factor which forms the relationship among the samples.

The number of rock sample is not enough to treat statistically. Therefore, studies were made for the results of the chemical analyses. The list of the sample and their analytical results are given in Table II-2-1. Location of these samples are shown in each geologic map.

The data analyses and interpretation were made using newly prepared geologic maps for the survey area.

2-2 Laboratorial studies

Geologic survey was carried out along the sampling route and also rock samples were collected for the laboratorial studies. Location of these samples are shown in the geologic map of each semi-detailed survey area.

The samples for the laboratorial studies are thin section, polished section and x-ray diffraction analysis.

Results of the observation of thin sections, observation of polished sections and x-ray diffraction analyses are shown in Table II-2-2, Table II-2-3 and Table II-2-4 respectively. Ore samples were also collected from mineralized zones. The list of ore sample and the assay results are shown in Table II-2-5.

Table II-2-1 List and analytical results of rock geochemical samples in the semi-detailed survey areas

Ser. No.	Sample No.	Area	Coordinates N	Coordinates E	1/50,000 Topo. Sheet	Name of Stream	Descriptions	Geol. Unit	As ppm	Au ppb	Ba ppm	Co ppm	Cr ppm	Cu ppm	Hg ppb	K %	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	S %	Sb ppm	Sc ppm	Ti %	U ppm	W ppm	Zn ppm
1	U574	A	1440.21	4799.95	Silam	—	basalt	Csba	4	<1	4	26	150	21	<10	0.32	2.16	403	<1	1.69	36	<2	0.042	7.5	136	0.45	<0.2	67	56
2	Y598	A	1437.93	4800.66	Silam	—	basalt	Csba	<1	<1	22	43	275	74	29	0.39	3.81	771	<1	2.25	77	<2	0.083	1.1	99	0.46	<0.2	56	78
3	B572	B	1449.50	4739.55	Ulu Segama	S. Malubuk	basalt	Csba	<1	<1	6	32	326	9	<10	0.09	3.67	613	<1	2.30	154	<2	0.048	9.7	157	0.73	<0.2	46	48
4	B580	B	1448.07	4734.95	Ulu Segama	S. Malubuk	chert	Csch	<1	<1	50	34	142	32	<10	0.03	0.06	337	<1	0.02	18	<2	0.009	0.2	27	0.02	1.8	311	13
5	N596	B	1451.30	4737.74	Ulu Segama	S. Malubuk	basalt	Csba	<1	<1	47	42	245	84	12	0.20	1.76	1169	3	2.81	193	<2	0.042	8.1	154	0.61	0.2	29	126
6	N599	B	1450.95	4739.57	Ulu Segama	S. Malubuk	gabbro (layered)	Gb	2	<1	9	23	736	146	<10	0.02	3.83	78	<1	1.28	176	<2	0.096	<0.2	70	0.09	<0.2	51	38
7	N600	B	1451.38	4738.90	Ulu Segama	—	dunite	Pr	9	<1	3	84	545	38	11	<0.01	16.97	731	<1	0.03	1562	8	0.061	<0.2	1	0.01	<0.2	<2	143
8	N601	B	1450.92	4736.30	Ulu Segama	S. Malubuk	sandstone	T_1	5	<1	46	16	99	6	15	0.38	0.28	183	2	0.62	15	4	0.226	2.3	28	0.13	1.0	138	24
9	N603	B	1451.24	4737.95	Ulu Segama	—	gabbro (hornbl.)	Csss	4	<1	16	38	206	64	<10	0.03	4.62	<5	2	1.59	237	<2	0.139	<0.2	101	0.06	<0.2	64	54
10	N605	B	1449.29	4738.69	Ulu Segama	—	dolerite	Csba	2	<1	24	32	213	58	11	0.19	3.32	797	<1	1.88	54	<2	0.077	4.3	151	0.56	<0.2	31	72
11	N606	B	1451.04	4738.72	Ulu Segama	—	peridotite	Pr	<1	<1	2	88	208	52	11	<0.01	14.96	935	<1	0.08	976	<2	0.049	<0.2	39	0.04	<0.2	8	140
12	P545	B	1446.20	4740.21	Ulu Segama	S. Karangan	sandstone	P_2Km	15	<1	2989	23	57	5	17	0.25	0.28	767	2	0.47	11	<2	0.128	4.1	83	0.10	<0.2	292	22
13	P546	B	1446.57	4739.30	Ulu Segama	S. Karangan	basalt	Csba	<1	<1	14	35	84	31	13	0.07	3.16	1052	<1	2.11	46	<2	0.098	9.4	126	0.85	1.0	29	74
14	P553	B	1444.70	4735.23	Ulu Segama	S. Danum	basalt	Csba	<1	<1	15	31	153	42	<10	0.21	3.42	840	<1	1.70	56	<2	0.073	10.2	51	0.61	<0.2	30	68
15	J512	C	1431.62	4745.36	Ulu Segama	S. Segama	green schist	Gs	<1	<1	21	23	55	54	<10	0.05	1.19	556	2	1.63	6	<2	0.606	11.6	218	0.61	<0.2	87	36
16	U601	C	1432.35	4756.55	Ulu Segama	S. Segama	peridotite	Pr	<1	<1	12	46	349	49	<10	0.13	3.81	899	<1	1.72	149	<2	0.049	6.3	137	0.29	<0.2	116	75
17	U603	C	1431.92	4749.13	Ulu Segama	S. Segama	tonalite	Tn	6	<1	59	12	51	3	<10	0.08	0.13	<5	<1	3.71	6	<2	0.012	1.6	196	0.06	<0.2	137	11
18	U606	C	1434.39	4746.94	Ulu Segama	S. Segama	phyllite	Ps	<1	<1	351	24	117	54	<10	1.37	2.31	659	2	2.48	50	<2	0.039	10.0	173	0.48	1.0	48	77
19	U607	C	1434.52	4747.32	Ulu Segama	S. Segama	green schist	Gs	<1	25	55	41	368	6	<10	0.45	5.91	860	<1	1.67	153	<2	0.048	1.9	250	0.19	<0.2	32	90
20	U608	C	1434.20	4747.90	Ulu Segama	S. Segama	gabbro (layered)	Gb	<1	<1	17	35	145	32	<10	0.06	4.87	574	2	1.16	59	<2	0.092	1.3	160	0.10	<0.2	38	64
21	U615	C	1433.52	4752.25	Ulu Segama	S. Segama	sandstone	P_2Km	8	<1	49	13	73	5	17	0.34	0.31	203	<1	0.49	12	4	0.031	2.0	33	0.13	1.2	115	24
22	U577	D	1425.47	4770.02	S. Tingkayu	S. Tingkayu	green schist	As	2	<1	14	23	281	20	20	0.13	2.40	1394	1	1.75	109	<2	0.038	2.1	136	0.38	<0.2	49	77
23	U578	D	1427.56	4772.80	S. Ulu Bole	—	diorite	Di	7	<1	69	22	47	45	<10	0.39	2.36	246	<1	1.49	16	<2	0.060	<0.2	309	0.40	<0.2	35	60
24	U579	D	1426.78	4772.90	S. Ulu Bole	—	amphibolite	As	<1	<1	10	37	299	<1	<10	0.01	3.65	862	<1	1.80	92	<2	0.034	7.3	109	0.21	<0.2	50	61
25	Y602	D	1427.08	4770.42	S. Ulu Bole	—	schist	As	2	<1	14	33	145	42	<10	0.03	3.41	579	<1	1.57	46	<2	0.043	5.3	160	0.39	<0.2	47	65
26	M602	E	1400.55	4777.90	S. Tingkayu	S. Langein	andesite	A_1	25	<1	270	18	50	43	<10	1.76	1.48	349	2	1.56	20	<2	0.024	5.8	233	0.36	2.0	34	63
27	M596	F	1387.50	4775.25	Tawau North	S. Tawau	andesite	A_1	4	4	310	22	53	38	<10	1.68	1.04	238	2	1.67	19	5	0.025	6.5	237	0.33	1.6	101	58
28	M593	G	1380.43	4785.40	Tawau North	—	andesite	A_1	2	<1	383	23	80	26	<10	1.35	1.34	759	2	1.64	18	<2	0.021	4.1	226	0.28	1.8	62	69
29	M594	G	1377.13	4788.33	Apas-Balang	—	andesite	A_1	13	1	326	19	153	20	43	<0.01	<0.01	3967	4	<0.01	4	10	0.014	55.7	11	0.27	1.8	134	14
30	M599	H	1395.57	4823.90	Kalumpang	—	andesite	A_1	<1	<1	95	25	20	52	<10	0.33	1.46	906	<1	1.31	7	<2	0.041	8.2	278	0.56	0.2	15	83

Table II-2-2 Observation results of thin sections in the semi-detailed survey areas

Ser. No.	Sample No.	Area	Location Coordinates N	Location Coordinates E	Geologic Units	Rock Name	Texture	Fragments, grains and minerals: basalt	quartz	plagioclase	hornblende	pyroxene	clinopyroxene	orthopyroxene	olivine	opaque minerals	Matrix, groundmass and accessory minerals: quartz	K-feldspar	plagioclase	pyroxene	clinopyroxene	orthopyroxene	glass	sphene	chromian spinel	opaque minerals	Metamorphic and altered minerals: quartz	K-feldspar	plagioclase	epidote	chlorite	prehnite	pumpellyite	tremolite	actinolite	serpentine	montmorillonite	sericite	barite	zeolite	calcite	saponite	limonite	opaque minerals
1	U574	A	1440.21	4799.95	Csba	Basalt	Intergranular			◎										◎	◎									○	○◎											○	●
2	Y598	A	1437.93	4800.66	Csba	Basalt	Ophitic													◎	◎						○			○	○◎	●	○									○		
3	B572	B	1449.50	4739.55	Csba	Dolerite	Ophitic			○		○								◎	◎					●	○			○							○							
4	N596	B	1451.30	4737.74	Csba	Basalt	Intergranular							○						◎	○	◎								○				●						○		○	○	
5	N599	B	1450.95	4739.57	Gb	Gabbro	Cumulus			◎		◎			●															○														
6	N605	B	1449.29	4738.09	Csba	Dolerite	Ophitic													◎	◎					●	○			○							○							○
7	N606	B	1451.04	4738.72	Pr	Ol-gabbro (Troctolite)	adcumulas			○		○	○	◎	●																○			◎										○
8	P546	B	1446.57	4739.30	Csba	Amphibolite	Granoblastic				○																			◎				◎										○
9	P547	B	1447.30	4739.05	Csba	Tuff	Pyloclastic			◎	○				○		○		○			◎								○	◎	○											○
10	P553	B	1444.70	4735.23	Csba	Basalt	Ophitic													◎	◎					●				○	○				○								●
11	P558	B	1446.06	4737.45	Csba	Dolerite	Ophitic													◎	◎									○	◎										○		○
12	P561	B	1448.02	4737.37	Csba	Dolerite	Ophitic																						◎	○	○	◎											○
13	U601	C	1432.35	4746.55	Pr	Greenschist	Cataclastic and nematoblastic																							○	○	○	○	○		◎							
14	U603	C	1431.92	4749.13	I_1	Tonalite (milonitized)	Cataclastic		◎	◎	○																			○	○					○							
15	U606	C	1438.39	4746.94	Ps	Phyllitic schist	Cataclastic			◎	○																		◎	○		○	○	◎									●

◎ :abundant, ○ :common, ○ :a little, ● :rare.

Continue

Ser. No.	Sample No.	Area	Location Coordinates N	Location Coordinates E	Geologic Units	Rock Name	Texture	Fragments, grains and minerals: basalt	quartz	plagioclase	hornblende	pyroxene	clinopyroxene	orthopyroxene	olivine	opaque minerals	Matrix, groundmass and accessory minerals: quartz	K-feldspar	plagioclase	pyroxene	clinopyroxene	orhtopyroxene	glass	sphene	chromian spinel	opaque minerals	Metamorphic and altered minerals: quartz	K-feldspar	plagioclase	epidote	chlorite	prehnite	pumpellyte	tremolite	actinolite	serpentine	montmorillonite	sericite	barite	zeolite	calcite	saponite	limonite	opaque minerals
16	U607	C	1434.52	4747.32	Gs	Greenschist	Porphyroblastic & nematoblastic																				○		○	●				◎										
17	U608	C	1434.20	4747.90	Gb	Gabbro	cumulus			◎			◎																	○	○							●						●
18	U614	C	1431.88	4753.50	P_4 Km	Basaltic lapillistone	pyroclastic	◎														○		○						◎										○	○	○		
19	U577	D	1425.47	4770.02	As	Greenschist	Subidioblastic																				○	○	○	◎		○	○										●
20	U578	D	1427.56	4772.80	I_1	Andesite porphyry	Porphyritic			◎								◎				○			○					○	○			○			○			○		○
21	U579	D	1426.78	4772.90	As	Amphibolite	Subidioblastic			◎	◎					●																											
22	M602	E	1400.55	4777.90	An_1	Andesite	Porphylitic			◎			○	○		○		○				◎				●				○										●			
23	M596	F	1387.50	4775.25	An_1	Andesite	Porphylitic			◎	○		○	○		●		◎			○	○	○			○				○													
24	M593	G	1380.43	4785.40	An_1	Andesite	Porphylitic			◎	○	○	○			●		◎								●	◎			○													○
25	M594	G	1377.13	4788.33	An_1	Dacite	Porphyritic			○								◎	○							○															◎	○	
26	M599	H	1395.57	4823.90	An_1	Andesite	Porphylitic			◎								○		○		◎				●				○								○	○				

◎ :abundant, ○ :common, ○ :a little, ● :rare.

Table II-2-3 Observation results of polished sections in the semi-detailed survey areas

Ser. No.	Sample No.	Area	Coordinates N	Coordinates E	Descriptions	Detected mineral: Chalcopyrite	Bornite	Chalcocite	Covellite	Sphalerite	Pyrite	Magnetite	Limonite/Goethite	Gangue minerals (Q: quartz)	Remarks
1	U572	A	1438.40	4794.88	Pyrite dissemination.	·				·	o		·	◎	Partly weathered
2	P548	B	1444.77	4737.70	Chalcopyrite-pyrite-quartz vein.	○		·	·		○			◎Q	
3	P554	B	1444.75	4735.07	Pyrite-magnetite ore.						◎	○		o	Magnetite in pseudomorph after hem.
4	P556	B	1444.40	4735.55	Pyrite-(chalcopyrite)-quartz vein.	·			·		◎		·	○Q	Partly weathered
5	P558	B	1446.06	4737.45	Chalcopyrite-sphalerite-pyrite-quartz vein.	◎				o	○			○Q	
6	P559	B	1447.33	4737.42	Pyrite dissemination.	·				·	○			◎	
7	P560	B	1447.44	4737.31	Chalcopyrite-pyrite-quartz vein.	o		·	·	·	○			◎Q	
8	P561	B	1448.02	4737.37	Chalcopyrite-sphalerite-pyrite-quartz vein.	◎		·	o	o	○			○Q	
9	J510	C	1430.88	4746.10	Sphalerite-magnetite-pyrite-chalcopyrite ore	o				○	◎	○		○	
10	J514	C	1434.60	4743.55	Pyrite-(chalcopyrite)-quartz veinlet and pyrite dissemination	·	·			·	○		·	◎Q	Partly weathered
11	M598	F	1388.25	4776.95	Limonite (gossan).								○	◎Q	
12	M595	G	1376.25	4786.05	Limonite (gossan).								○	◎Q	

◎: abundant ○: common o: a little ·: rare

Table II-2-4 Results of X-ray diffraction analyses in the semi-detailed survey areas

Ser. No.	Sample No.	Area	Coordinates N	Coordinates E	Descriptions	Detected mineral: Sericite/Montmorillonite	Kaolinite	Chlorite	Quartz	Calcite	Plageoclase	K-feldspar	Amphibole	Pyrite	Remarks
1	U572	A	1438.40	4794.88	Basic tuff with pyrite dissemination.				◎		○			o	
2	U573	A	1439.08	4797.24	Basic lapilli tuff with pyrite spots.			○			○	•	○	◎	
3	P556	B	1444.40	4735.55	Dark green altered basalt with pyrite diss.			◎	◎		o			○	
4	P558	B	1446.06	4737.45	Quartz-chalcopyrite-pyrite vein in alt. rock.			◎	◎	○					
5	P561	B	1448.02	4737.37	Quartz-chalcopyrite-pyrite-sphalerite vein.			◎	◎	○				o	
6	P562	B	1447.04	4737.00	Quartz-pyrite vein in altered rock.			○	◎					◎	
7	J505	C	1429.04	4745.23	Argillized breccia with pyrite dissemination.			◎	◎		○			o	
8	J511	C	1431.03	4746.05	Pyrite dissemination in sheared green schist.			o			◎	o	◎	○	
9	M603	E	1399.84	4778.20	Silicified andesite with pyrite dissemination.						◎	?			
10	M597	F	1388.90	4775.68	Strongly silicified andesite with pyrite diss.		○		◎					○	
11	M598	F	1388.25	4776.95	Strongly sili. & argi. ande. with pyrite diss.				◎					o	
12	M591	G	1371.34	4788.70	Strongly argillized andesite.	o	○		◎						
13	M594	G	1377.13	4788.32	Silicified andesite.				◎					o	
14	M595	G	1376.25	4786.05	Silicified breccia vein in andesite.				◎					◎	
15	M601	H	1393.55	4824.55	Strongly argillized rock.			o	◎		o			o	

◎: abundant ○: common o: a little •: rare

Table II-2-5 List of ore samples and their assay results in the semi-detailed survey area

Ser. No.	Sample No.	Area	Coordinates		Descriptions	Assay results							Remarks
			N	E		Au (g/t)	Ag (g/t)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Mo (ppm)	S (%)	
1	U572	A	1438.40	4794.88	Basic tuff w/pyrite diss.	< 0.1	< 0.1	4	14	18	9	1.13	
2	U573	A	1439.08	4797.24	Basic lapi.tuff w/pyrite spots	< 0.1	< 0.1	107	17	117	10	0.43	
3	P548	B	1444.77	4737.70	Qtz.-py.-hem.-cp.-bor. ore	< 0.1	6.6	21185	10	149	34	9.72	Float
4	P554	B	1444.75	4735.07	Fine grained pyrite ore	< 0.1	< 0.1	633	19	64	6	16.51	
5	P556	B	1444.40	4735.55	Pyrite diss. in altered rock	< 0.1	< 0.1	1234	5	517	9	15.45	
6	P558	B	1446.06	4737.45	Qtz.-py.-sp. stockwork ore	< 0.1	13.8	4	11	3517	23	7.51	
7	P559	B	1447.33	4737.42	Quartz-pyrite ore	< 0.1	< 0.1	77	< 1	137	12	15.78	
8	P560	B	1447.44	4737.31	Qtz.-py.-cp.-bor. ore	< 0.1	< 0.1	10631	6	117	39	14.04	
9	P561	B	1448.02	4737.37	Qtz.-py.-sp. vein in alt. rock	< 0.1	10.1	6	47	30431	11	7.84	
10	P562	B	1447.04	4737.00	Qtz.-py. stockwork vein	< 0.1	< 0.1	123	11	92	20	20.55	
11	J502	C	1430.45	4743.10	Gabbro with pyrite dissemination	< 0.1	< 0.1	10	18	47	8	0.33	
12	J510	C	1430.88	4746.10	lenticular massive pyrite	< 0.1	< 0.1	827	21	5761	9	8.86	
13	J511	C	1431.03	4746.05	Green schist with pyrite diss.	< 0.1	< 0.1	185	17	98	12	0.66	
14	J514	C	1434.60	4743.55	Qtz.-py. vein in green schist	< 0.1	< 0.1	57	19	49	15	2.53	
15	U617	C	1434.80	4752.30	Qtz.-epidote vein in green sch.	< 0.1	< 0.1	15	19	15	12	0.07	
16	Y611	D	1427.10	4770.33	Milky qtz. vein with limonite	< 0.1	< 0.1	12	8	8	7	0.08	
17	Y614	D	1427.10	4770.33	Limonitized schist	< 0.1	< 0.1	58	18	31	10	0.06	
18	M603	E	1399.84	4778.20	Sili. andesite with pyrite diss.	< 0.1	< 0.1	35	26	59	11	1.90	
19	M597	F	1388.90	4775.68	Sili. andesite with pyrite diss.	< 0.1	< 0.1	76	31	31	12	3.35	
20	M598	F	1388.25	4776.95	Sili. & argi.and. with py. diss.	< 0.1	< 0.1	95	213	13	12	0.18	
21	M595	G	1376.25	4786.05	Limonitized & brecciated rock	< 0.1	< 0.1	24	41	37	11	0.08	

2-3 Area A

2-3-1 Geology and mineralization

(1) Survey area

Based on the geology and the regional geochemical survey results, this area was selected as the potential area of Cyprus type copper deposits. A soil geochemical survey was carried out in this area.

This area is situated at eastern marginal part of Segama area. The survey area show hilly topography except a southeastern part of the area. The main river systems are Sungai Diwata at the north and Sungai Sabahan at the south.

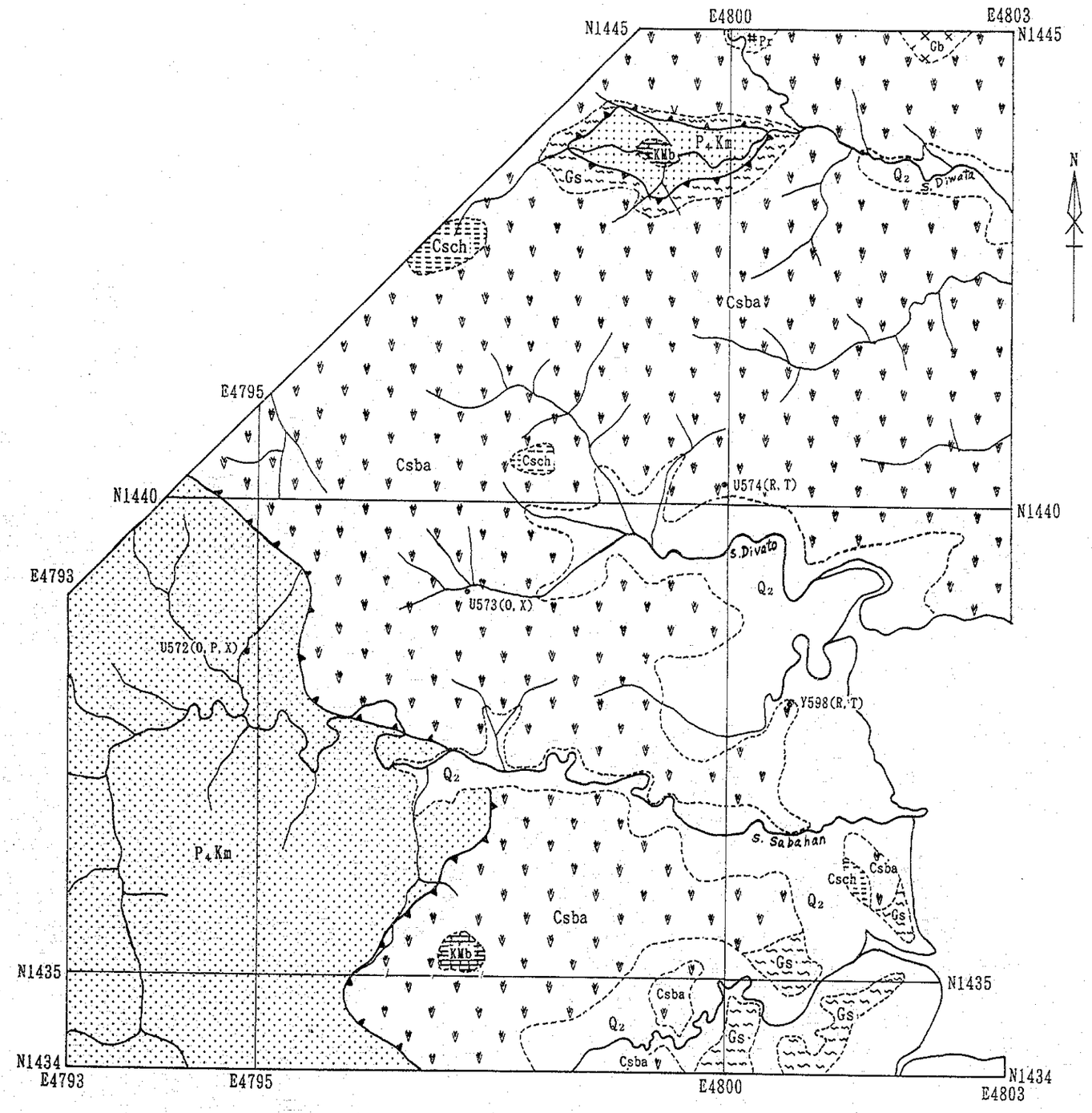
The southern part of this area is used as plantation and the northen part is the area of secondary forest.

(2) Geology

Geology in Area A consists of pre-Triassic crystalline basement (Gs), limestone (KMb) of early Cretaceous, ultra-basic rock (Pr), basic rock (Gb) and Chert-Spilite formation (Csch and Csba) of Cretaceous to Tertiary and Kuamut formation of Oligocene to middle Miocene. Alluvium (Q_2) are found along river and coast. Geologic map of Area A is shown in Fig. II-2-2.

Crystalline rocks (Gs) are distributed in the southeastern margin and northern part of the area. At the northern part, these rocks are found as fenster. This crystalline rocks consist of strongly sheared green schist with subordinate phyllite and serpentinite. Limestone (KMb) of early Cretaceous occurs in limited areas of southern and northern parts. Ultra-basic rock consists of peridotite and basic rock (Gb) consists of gabbro and these rocks are distributed in the northern marginal area. Chert-Spilite formation is widely distributed in western part of this area. This formation consists of basaltic pillow lavas and its pyroclastics (Csba) and sedimentary rocks which is mostly consists of chert (Csch). The basaltic volcanics widely occures but the distribution of chert is limited. Chlorite and epidote are confirmed under a microscope (Table II-2-2) for this bsaltic rocks. Kuamut formation (P_4Km) widely occurs in the south western part of this area. Kuamut formation also occurs as fenster in a limited area of the northern part. This formation consists of sandstone and tuffaceous mudstone. Alluvium sand and gravels are found along river and coast.

Judging from the geology in this area trust faults are inferred at the boundary between Chert-Spilite formation and Kuamut formation.



Recent — Q_2 — Coastal and riverine alluvium.

Oligocene-Middle Miocene — P_4Km — Kuamut Formation: sandstone and tuffaceous mudstone.

Cretaceous-Eocene — Csch — Chert-spilite Formation: chert.

Cretaceous-Eocene — Csba — Chert-spilite Formation: basalt.

Cretaceous-Early Tertiary — Gb — Gabbro.

Cretaceous-Early Tertiary — # Pr # — Peridotite and serpentinite.

Early Cretaceous — KMb — Madai-Baturong Limestone: limestone.

Metamorphic rocks — Gs — Green schist.

Thrust fault

0 500 1000 2000m

- Location of amples for laboratorial studies and sample number
  - (O);Ore assaying,
  - (P);Polished section,
  - (R);Geochemical analysis,
  - (T);Thin section,
  - (X);X-ray diffraction analysis

Fig. II-2-2 Geologic map of Area A

(2) Mineralization

No significant mineralized zones were confirmed. Pyrite disseminations were recognized in the mudstone of Kuamut formation at the upper stream of Sungai Sabahan and in lapilli tuff at the upper stream of Sungai Divato. Silicified and argillized zones were confirmed at the boundary between Chert-Spilite formation and Kuamut formation. Limonite is also observed at this boundary. Two samples (U527 and U537) were collected from pyrite dissemination zone for ore assaying. Location of these samples are shown in Table II-2-5 and the assay results are given in Table II-2-5. This results give slightly higher values of Cu (107 ppm) and Zn (117 ppm) for the sample of U527. Observation of a polished section (Table II-2-3) confirmed minor chalcopyrite and sphalerite. For these two samples, x-ray diffraction analysis was also conducted and the results (Table II-2-4) detected alteration minerals such as chlorite, quartz and K-feldspar.

2-3-2 Soil geochemical survey

(1) Sampling

Soil samples were adopted as the sample media in this survey, Locations of the samples are shown in Fig. II-2-3 and list of sample are given in Appendix 17. After drying up these samples, -80 mesh fraction samples were prepared for the sample of chemical analyses.

(2) Statistical data treatment

Analytical rsults are shown in Appendix 18. These analytical results were input in computer and statistically treated. The statistics of this survey are given in Table II-2-6.

The calculated geometric means give following tendencies comparing with other areas.

Elements indicating higher value: Co, Mg, K. Mn, Na, Zn.

Element indicating lower value: U.

Among 21 elements analyzed in this survey, two elements of Mo and W gave very low values. These two elements were not usefull in this survey.

In order to clarify the relationship between the elements, correlation coefficient was also calculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

Ba-K, Ba-U, Co-Cr, Co-Cu, Co-Mg, Co-Mn, Co-Ni, Co-Zn, Cr-Mg, Cr-Ni,
K-U, Mg-Ni, Mg-Sb, Mg-Zn, Mn-Na, Na-S, Na-Sr, Pb-U, S-Sr.

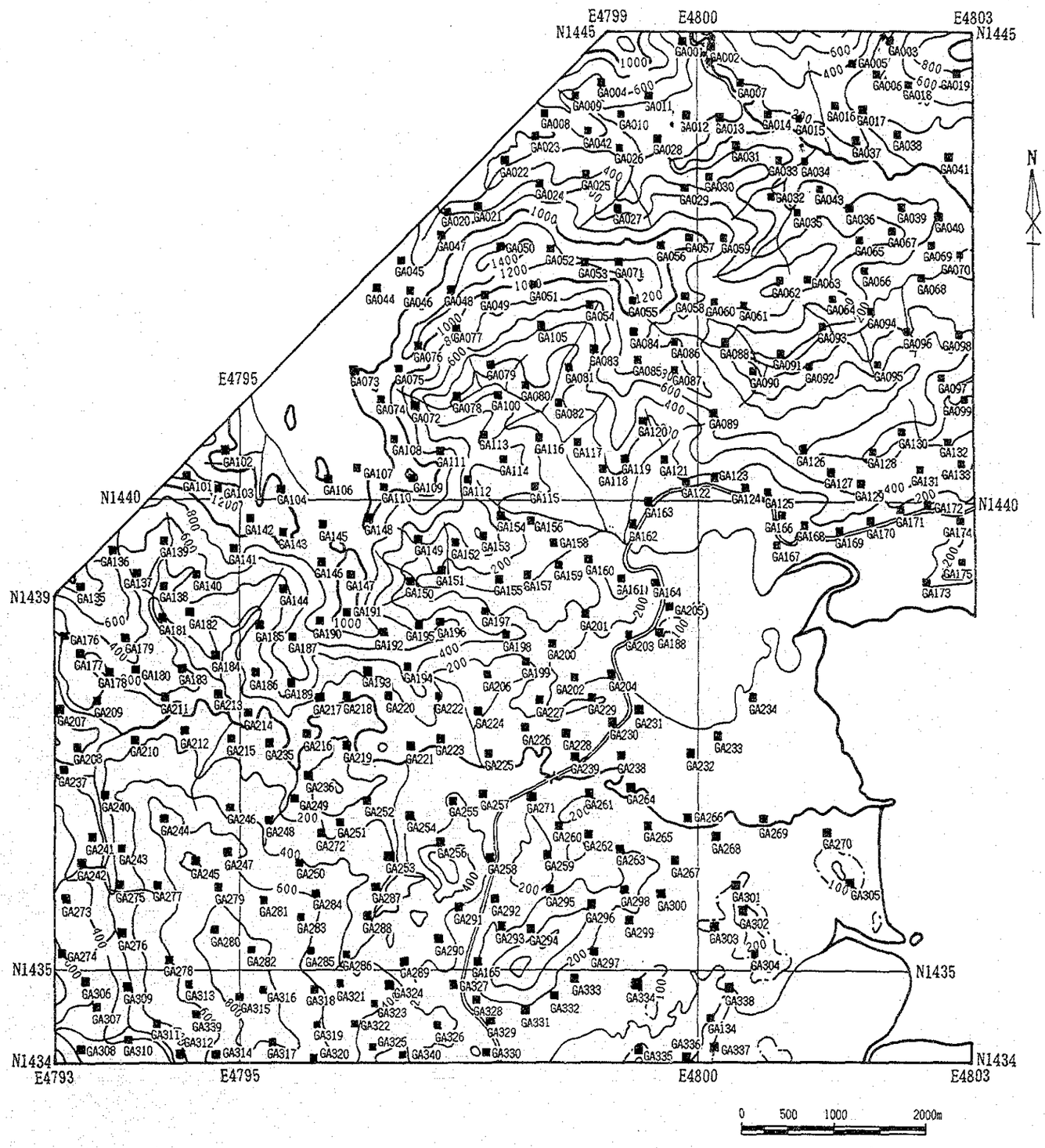
The elments including Co, Cr, Cu, Mg, Ni and Zn give good correlation among them.

Table II-2-6 Statistics of soil geochemical survey in Area A

Area A

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	80.6	54	< 1	0.9	0.506	8.8	0.5	2.0	0.5
Au (ppb)	89.1	62	< 1	0.6	0.245	1.8	0.5	0.5	0.5
Ba (ppm)	—	3,006	3	62.8	0.522	695.9	48.0	185.0	1,453.4
Co (ppm)	—	283	3	41.9	0.291	160.1	45.0	65.0	134.9
Cr (ppm)	—	5,908	6	183.2	0.408	1,201.9	194.5	349.0	1,917.4
Cu (ppm)	0.6	243	< 1	48.6	0.307	199.7	57.0	84.0	—
Hg (ppb)	0.3	246	5	47.2	0.212	125.6	49.0	70.0	151.1
K (%)	9.1	2.12	< 0.01	0.096	0.679	2.179	0.100	0.440	—
Mg (%)	—	13.83	0.05	1.242	0.354	6.352	1.410	2.270	9.167
Mn (ppm)	2.9	6,388	< 5	971.2	0.564	13,015.8	1,251.5	1,931.0	4,588.2
Mo (ppm)	47.9	7	< 1	1.0	0.308	4.0	1.0	2.0	—
Na (%)	—	3.56	0.01	0.875	0.503	8.876	1.380	2.030	—
Ni (ppm)	—	3,549	2	78.0	0.416	530.6	75.5	134.0	460.4
Pb (ppm)	84.7	1,017	< 2	1.4	0.359	7.1	1.0	1.0	1.0
S (%)	—	0.061	0.006	0.020	0.196	0.049	0.020	0.030	—
Sb (ppm)	5.0	27.5	< 0.2	5.92	0.491	56.78	8.30	12.20	—
Sr (ppm)	—	238	1	59.6	0.331	273.9	70.0	106.0	—
Ti (%)	—	3.87	0.02	0.686	0.258	2.255	0.730	1.030	2.220
U (ppm)	37.4	3.8	< 0.2	0.31	0.512	3.28	0.20	1.60	—
W (ppm)	97.9	3	< 2	1.0	0.051	1.3	1.0	1.0	1.0
Zn (ppm)	—	318	12	77.2	0.168	167.7	80.0	98.0	163.5

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)



GA257 Location of soil samples and sample number

Fig. II-2-3 Location map of geochemical samples in Area A

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element were prepared (Appendix 19) using the values delineated by EDA method. Distribution of each element is summarized as following;

As: High value samples tend to concentrate in the northern marginal part of the area. No clear tendencies can be observed in other parts of the area due to low absolute values.

Au: High value and anomalous zones are scattered and the values are also low.

Ba: high value zones are restricted in the area of Kuamut formation in the southern to south western part of the area.

Co: High value zones are scattered in the area of Chert-Spilite formation. Significant high value zone is found at the northern marginal part of the area where ultra-basic rocks occurs.

Cr: The distribution tendencies are same as Co and have relationship with ultra-basic rocks.

Cu: High value zones are restricted in the area of Chert-Spilite formation, but the zones are scattered. And the values are low.

Hg: High value zones are scattered. Low value zone is characteristically observed in the area along Sungai Sabahan.

K : High value and anomalous zones are concentrated in the area of Kuamut formation and indicate close relationship with sedimentary rocks.

Mg: The distribution tendencies are same as Co and Cr. The anomalous zones are restricted in the northern marginal part of the area. High value zones are found in the area of Chert-Spilite formation.

Mn: High value zones are scattered in the area of Chert-Spilite formation.

Mo: High value zones are scattered and no clear distribution tendencies are recognized.

Na: High value zones are scattered in the area of Chert-Spilite formation. Low value zones are characteristically found in the area of Kuamut formation.

Ni: High value zones are distributed northern, western and southeastern marginal parts of this area. Among them, the zone of northern marginal part is the most significant.

Pb: High value zones are mostly found in the area of Kuamut formation. The sample with the maximum value (1,017 ppm) is situated at southern bank of lower stream of Sungai Sabahan where basaltic lavas occur.

S : High value zones are scattered in the area of Chert-Spilite formation. No significant concentrated zones are recognized.

Sb: High value zones show similar distribution tendencies of S. Some anomalous zones are concentrated at southern bank of Sungai Sabahan.

Sr: High value zones are found in Chert-Spilite formation . Significant anomalous zone is situated at upper stream of Sungai Sabahan.

Ti: High value zones are distributed along the boundary between Chert-Spilite formation and Kuamut formation with a direction of NW-SE.

U : High value zones are restricted in the area of Kuamut formation. But the absolute values are low.

W : No clear distribution tendencies are recognized and the values are very low.

Zn: High value and anomalous zones are scattered in the area of Chert-Spilite formation. Significant anomalous zones are situated in the middle stream of Sungai Sabahan and the northern marginal part of the area.

According to the distribution maps, the elements which are possibly useful for the survey in this area were selected and anomaly map (Fig. II-2-4) of these elements was prepared.

(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of facter analysis are given in Table II-2-7. The relationship between the elements and facters are as follcwing;

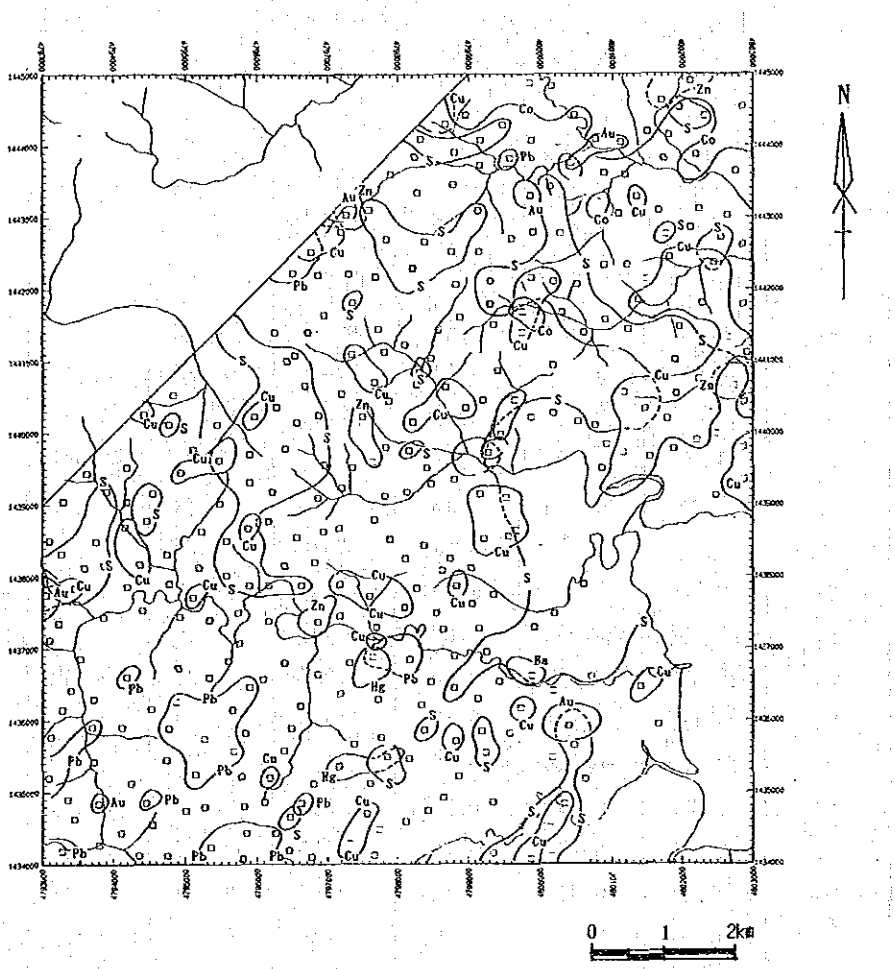
Factor 1 : Hg.
Factor 2 : (Co)-Cr-(Mg)-Ni.
Factor 3 : Ba-(Cu)-K-U.
Factor 4 : Co-Mn-Na-Sb-Ti-Zn.
Factor 5 : Na-S-Sr.
Factor 6 : (Au).

Judging from the relationship between the factor and the elements, factor 1 may related to alteration. Factor 2 has relation with ultra-basic rocks. Factor 4 indicates sedimentary rocks and weak copper mineralization. Factor 4 has some relation with Chert-Spilite formation and/or zinc mineralization. Factor 5 is not clear the relationship. Factor 6 may indicate weak relation with Au. Among these facters, three facters such as factor 2, 3 and 4 were selected and distribution map (Fig. II-2-5) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 2 : blue Factor 3 : yellow Factor 4 : red

Distribution tendencies for these factors are summarized as following;

Factor 2: High factor score zones are found at the northern marginal part of the area where ultra-basic rocks occur.



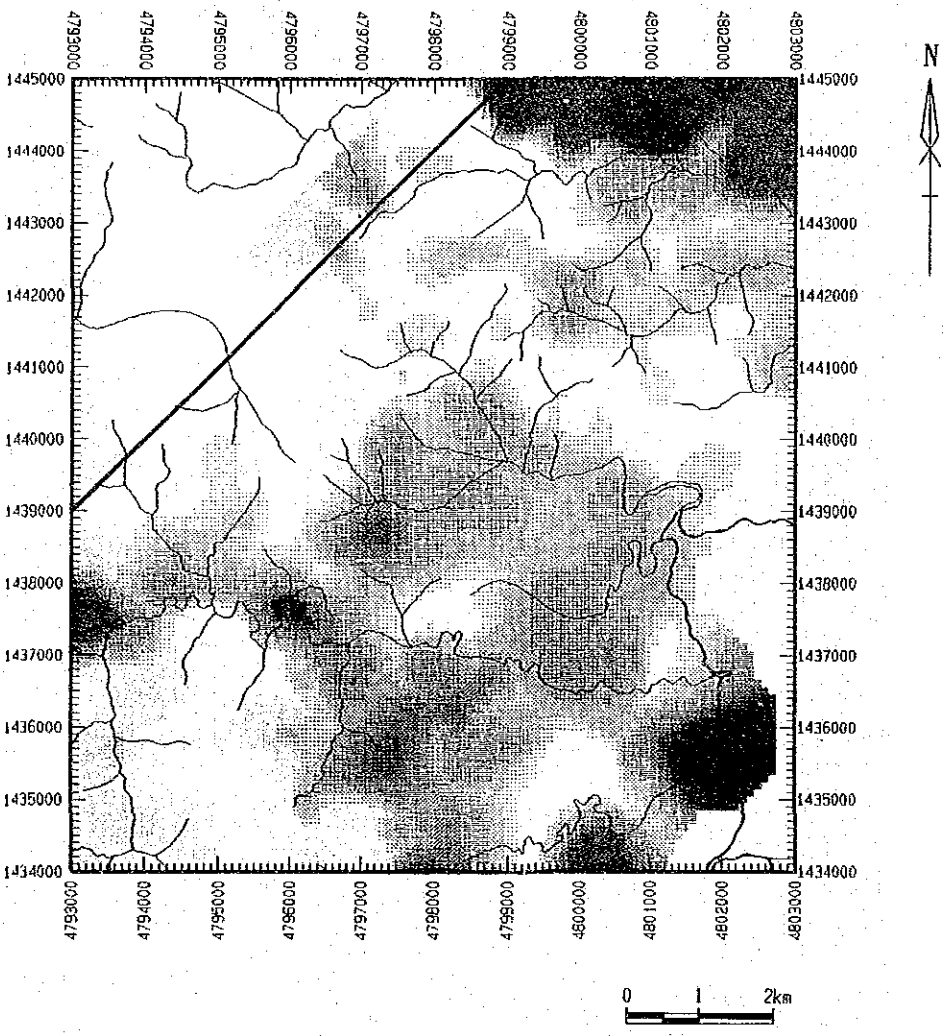
Au	> 1.8 ppb	Cu	> 84.0 ppm	S	> 0.030 %
Ba	> 1,453.4 ppm	Hg	> 151.1 ppb	Zn	> 163.5 ppm
Co	> 134.9 ppm	Pb	> 7.1 ppm		

Fig. II-2-4 Distribution map of geochemical anomalous zones in Area A

Table II-2-7 Results of factor analyses for soil samples in Area A

Element	Factor loading (Varimax rotation)						Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	
As	-0.082	0.208	-0.127	-0.079	-0.400	-0.432	0.4188
Au	-0.013	0.172	-0.036	0.070	-0.164	0.043	0.0649
Ba	0.026	-0.165	-0.820	-0.007	-0.033	-0.193	0.7380
Co	0.060	0.408	0.361	0.743	-0.023	-0.007	0.8538
Cr	-0.011	0.880	0.286	0.183	0.034	-0.185	0.9246
Cu	-0.233	0.263	0.323	0.410	0.296	0.330	0.5921
Hg	0.550	0.051	0.044	0.052	-0.090	0.123	0.3331
K	-0.124	-0.066	-0.801	-0.271	0.026	0.099	0.7458
Mg	-0.536	0.499	0.300	0.366	0.196	-0.146	0.8193
Mn	0.111	0.181	0.177	0.771	0.178	0.131	0.7194
Mo	0.069	-0.114	-0.003	0.012	-0.045	0.367	0.1543
Na	-0.332	-0.170	0.194	0.512	0.587	-0.039	0.7840
Ni	-0.139	0.907	0.160	0.165	-0.081	-0.235	0.9565
Pb	0.241	-0.013	-0.360	-0.445	-0.297	0.262	0.5419
S	-0.047	0.160	0.195	0.256	0.700	-0.017	0.6226
Sb	-0.157	0.148	0.225	0.504	0.321	-0.224	0.5049
Sr	-0.206	-0.275	-0.157	0.198	0.791	0.014	0.8082
Ti	0.074	-0.356	-0.058	0.515	0.367	0.170	0.5645
U	0.206	-0.064	-0.692	-0.406	-0.294	0.040	0.7789
W	0.109	0.229	-0.024	0.001	-0.162	-0.040	0.0927
Zn	-0.517	0.266	0.075	0.596	0.003	0.100	0.7090
F.C.*1	10.0 %	20.7 %	20.2 %	25.2 %	17.8 %	6.2 %	—

*1: Factor contribution



Factor 2 factor score: Blue Factor 3 factor score: Yellow
Factor 4 factor score: Red

Fig. II-2-5 Distribution map of factor scores in Area A

Factor 3: High factor score zones are restricted in the area of Kuamut formation. The high factor score zone situated at lower stream of Sungai Sabahan corresponds to the distribution of alluvium.

Factor 4: High factor score zones are found in the area of Sungai Sabahan and in the central part of this area.

According to the results of the factor analyses, the area with overlapping of factor 3 and 4 high factor score zones is interpreted as potential area. But the potentiality is not significant.

2-4 Area B

2-4-1 Geology and mineralization

(1) Survey area

Based on the result of regional geochemical survey in Phase II, this area was selected as a potential area of copper ore deposits. Soil and stream sediment geochemical surveys were adopted for the survey in this area.

The northern half of this area is situated at the upper stream of Sungai Malubuk and the southern half is situated at the upper stream of Sungai Danum. In the central part, mountainous range with a NE-SW direction are situated and give steep topography. The southern and northwestern parts of this area show comparatively mild topography.

(2) Geology

Geology of Area B consists of ultra-basic (Pr) to basic (Gb) rocks of Cretaceous to Tertiary in age, Chert-Spilite formation (Csba and Csch) of Cretaceous to Oligocene in age and Kuamut formation (P_4Km) of Eocene to middle Miocene in age. Geologic map of this area is shown in Fig. II-2-6.

Ultra-basic (Pr) rocks occur in limited areas with a NE-SW direction in the northern to western part of this area. This rocks consist of peridotite and serpentinite. Basic rocks (Gb) consisting of hornblende gabbro and cumulate gabbro are distributed in the surroundings of ultra-basic rocks with a direction of NE-SW. Gabbros (Gb) are also found eastern and southwestern parts of this area. The both side of this basic rocks is occupied by Chert-Spilite formation (Csba) consisting of dolerite, basaltic pillow lava and basaltic pyroclastics. The north side of the basic rocks is dominated by pillow lava and the south side is dolerite. Chert-Spilite formation intercalates chert beds (Csch) in places.

The southern and northwestern parts of this area are occupied by Kuamut

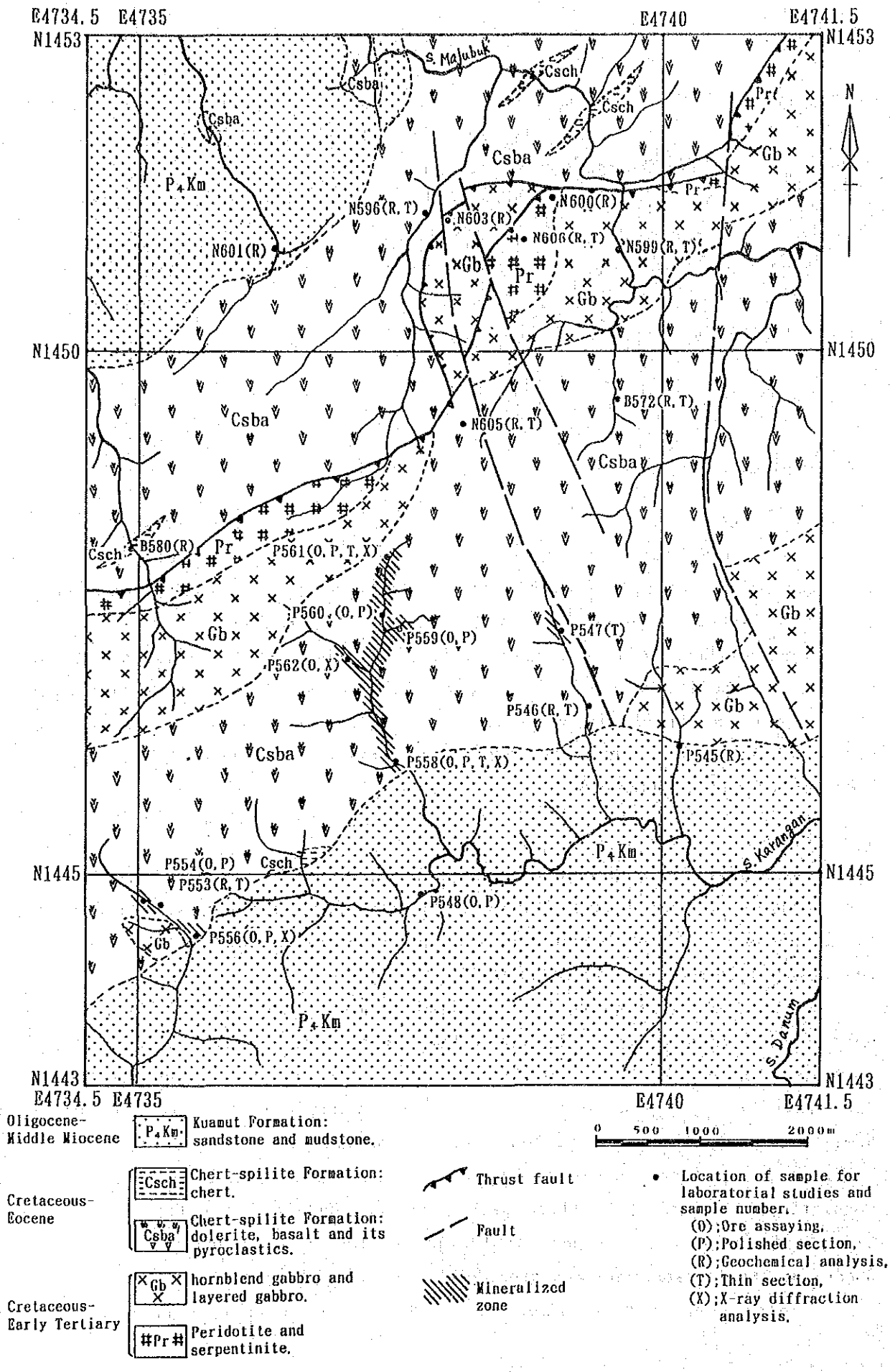


Fig. II-2-6 Geologic map of Area B

formation (P_4Km). This formation consists of sandstone and mudstone.

Geologic structure in this area is characterized by a NE-SW trending distribution of ultra-basic and basic rocks and a N-S trending fault system. Judging from the geology, thrust fault system is inferred at the boundary between ultra-basic rocks and Chert-Spilite formation.

(3) Mineralization

Significant mineralized zones were confirmed in dolerite at the tributary of Sungai Karangan and most upper stream of Sungai Danum. This mineralized zone consists of sulfide stockwork veins and dissemination of sulfide minerals. The sulfide minerals confirmed are pyrite, chalcopyrite and sphalerite. Because of strong alteration, origin of the host rock is not clear. But it is inferred to be basaltic rocks, judging from the surrounding geology. Observation results of polished sections (Table II-2-3) detected chalcopyrite, chalcocite, covellite, sphalerite pyrite and magnetite as the ore minerals and quartz as the gangue minerals. Assay results give 2.12 % Cu and 3.04 % Zn at the best. As the results of x-ray diffraction analysis (Table II-2-4) alteration minerals such as chlorite, quartz and calcite were detected.

This mineralized zone extends 5 km x 2 km in a NE-SW direction, and is significant.

2-4-2 Soil geochemical survey

(1) Sampling

Soil and stream sediment samples were collected along the streams in this survey. Locations of these geochemical samples are given in Fig. II-2-7. List of soil samples collected in this srvey are shown in Appendix 20. After drying up these samples, -80 mesh fraction samples were collected and chemical analyses were conducted for these fraction samples.

(2) Statistic data treatment

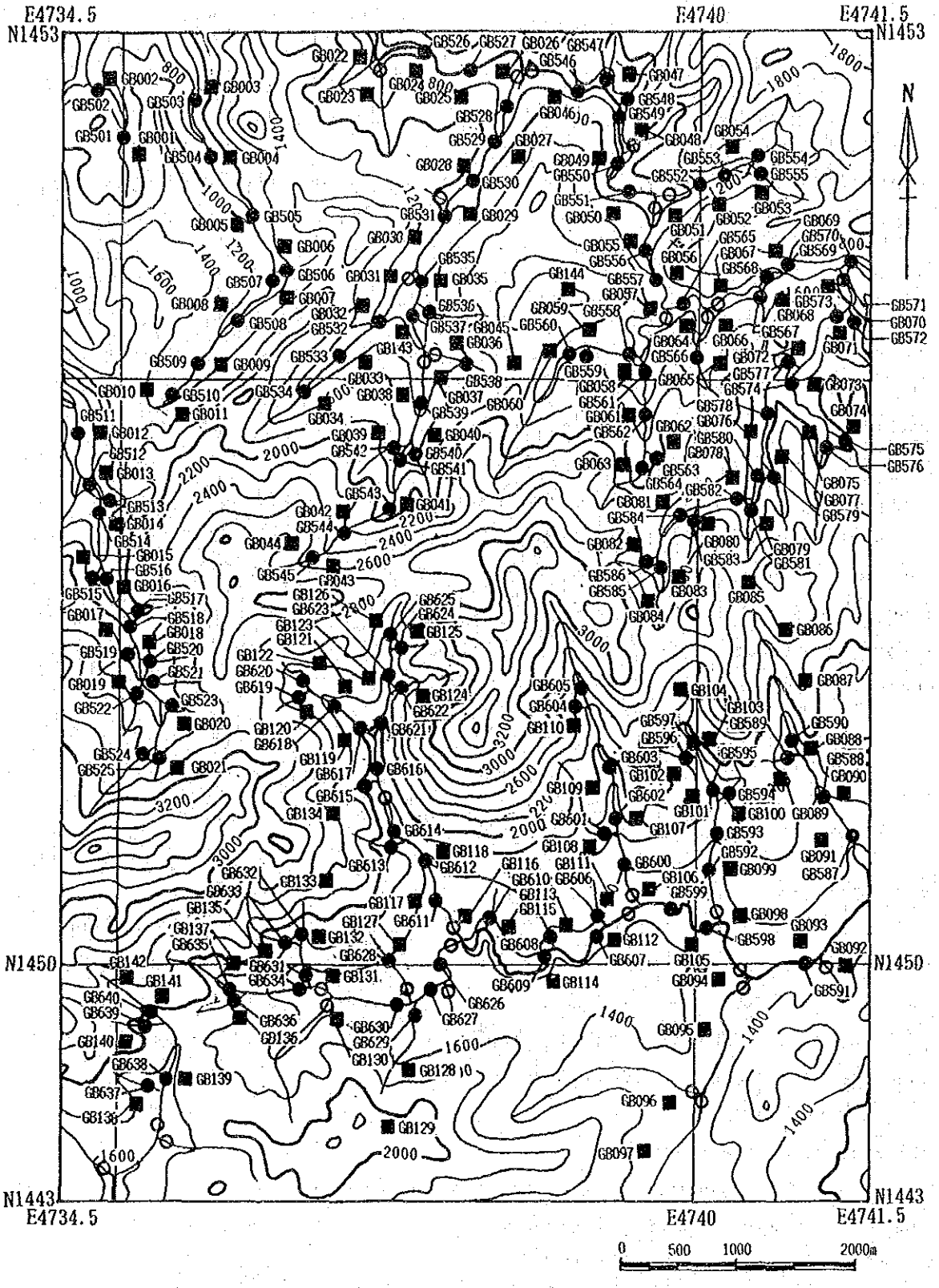
Analytical results of soil samples are shown in Appendix 21. The results were input in computer and the data were statistically treated. The statistics calculated are given in Table II-2-8.

The caluculated geometric means give following tendencies comparing with other areas.

Elements indicating higher value: Co, Cr, Cu, Mg, Na, Ni, Zn.

Element indicating lower value: Ba, Hg, U.

Among 21 elements analyzed in this survey, three elements of Au, Pb and W



● GB612 Location of stream sediment sample and sample number.

■ GB128 Location of soil sample and sample number.

○ Location of stream sediment sample collected in phase II.

Fig. II-2-7 Location map of geochemical samples in Area B

Table II-2-8 Statistics of soil geochemical survey in Area B

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	73.6	48	< 1	1.0	0.558	13.5	0.5	4.0	16.0
Au (ppb)	88.9	46	< 1	0.6	0.248	1.8	0.5	0.5	0.5
Ba (ppm)	—	679	1	39.7	0.545	488.2	41.0	138.0	—
Co (ppm)	0.7	592	< 1	39.4	0.395	242.4	49.5	68.0	221.2
Cr (ppm)	—	5,537	30	278.7	0.396	1,727.3	287.0	583.0	2,057.9
Cu (ppm)	—	828	11	56.5	0.310	235.0	66.5	96.0	350.8
Hg (ppb)	3.5	144	< 10	33.9	0.287	127.0	37.0	56.0	—
K (%)	9.7	2.32	< 0.01	0.112	0.812	4.721	0.105	0.790	—
Mg (%)	—	15.96	0.31	1.521	0.345	7.447	1.820	2.920	14.221
Mn (ppm)	13.2	6,297	< 5	379.0	0.958	31,287.9	971.0	1,652.0	—
Mo (ppm)	77.8	5	< 1	0.7	0.239	2.0	0.5	1.0	0.5
Na (%)	0.7	2.18	< 0.01	0.460	0.468	3.972	0.560	1.260	—
Ni (ppm)	—	7,351	12	131.0	0.466	1,122.1	113.0	306.0	1,906.7
Pb (ppm)	88.2	14	< 2	1.3	0.282	4.6	1.0	1.0	1.0
S (%)	—	0.103	0.004	0.018	0.249	0.057	0.019	0.031	0.100
Sb (ppm)	11.8	20.1	< 0.2	4.05	0.656	83.11	7.10	11.40	—
Sr (ppm)	—	179	1	28.4	0.396	175.7	36.0	52.0	—
Ti (%)	—	2.58	0.02	0.617	0.360	3.237	0.715	1.290	—
U (ppm)	50.7	2.4	< 0.2	0.30	0.539	3.53	0.10	1.60	—
W (ppm)	99.3	3	< 2	1.0	0.040	1.2	1.0	1.0	1.0
Zn (ppm)	—	674	32	82.2	0.198	204.8	76.5	119.0	265.9

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)

gave less than the detection limit for most the samples.

In order to clarify the relationship between the elements, correlation coefficient was also caluculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

Ba-K, Ba-U, Co-Cr, Co-Cu, Co-Mg, Co-Mn, Co-Ni, Co-S, Co-U(-), Co-Zn, Cr-Cu, Cr-K(-), Cr-Mg, Cr-Ni, Cr-S, Cr-U(-), Cu-Ni, Cu-Zn, K-U, Mg-Mn, Mg-Ni, Mg-U(-), Mn-Zn, Na-Sr, Pb-U, S-Sr.

Among the elments including Co, Cr, Cu, Mg, Ni and Zn give good correlation each other and U has negative correlation with these elements.

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element were prepared (Appendix 19) using the ranks delineated by EDA method. Distribution of each element is summarized as following;

As: High value zones are distributed with a direction of NE-Sw in the northern part of this area. This area is the same area of ultra-basic rocks.

Au: High value zones are scattered and no clear distribution tendencies are recognized.

Ba: High value zone is restricted in the area of Kuamut formation in the southern and northwestern parts of this area.

Co: High value zones are found from northeastern part to southwestern part of this area where ultra-basic and basic rocks are distributed.

Cr: Distribution tendencies are similar to Co. The high value zones are restricted in the area of ultra-basic and basic rocks.

Cu: High value zones are distributed from the northeastern to southwestern part of this area. The most significant zones are situated in the central and southwestern parts (maximum value 828 ppm) of this area and form conspicuous anomalous zones. These anomalous zones are situated in the area of Chert-Spilite formation.

Hg: High value zones are scattered from northern part to western part where Chert-Spilite formation occurs.

K : High value zones are restricted in the area of Kuamut formation and indicates close relationship with sedimentary rocks.

Mg: High value zones are found in the area of ultra-basic rocks, basic rocks and Chert-Spilite formation. Anomalous zones are restricted in a area of ultra-basic rocks.

Mn: Distribution of high value zones are same as Mg. Anomalous zones are found in the area of Chert-Spilite formation.

Mo: High value zones are scattered and no clear distribution tendencies are recognized.

Na: High value zones are recognized in the area of dolerite in the Chert-Spilite formation.

Ni: High value zones are distributed in the north eastern to south western part of the area. These tendencies are same as the distribution of Co and Cr. The anomalous zones are restricted in the area of ultra-basic rocks.

Pb: High value zones are sporadically observed in the area of Kuamut formation. No clear distribution tendencies are recognized.

S : High value samples are scattered in the central part of this area. No clear distrbution tendencies are recognized.

Sb: The distribution tendencies are same as S. Low values are recognized in the area of Kuamut formation.

Sr: High value zones are sporadically found in the are of Chert-spilite formation. Anomalous zones are recognized in the western marginal part of the area.

Ti: High value zones are restricted in the area of Chert-Spilite formation. Comparatively low values are found in the area of Kuamut formation, ultra-basic rocks and basic rocks.

U : High value zones are restricted in the area of Kuamut formation, but the values are low.

W : Because of low value, no clear distribution tendencies are recognized.

Zn: High value and anomalous zones are scattered in the area of Chert-Spilite formation. Significant anomalous zones are found in the central part where anomalous zones of Cu are also situated.

Based on the results of the distribution tendencies of each element, the elements possibly usefull for the survey in this area were selected and distribution map (Fig. II-2-8) anomalous zones for these elements was prepared.

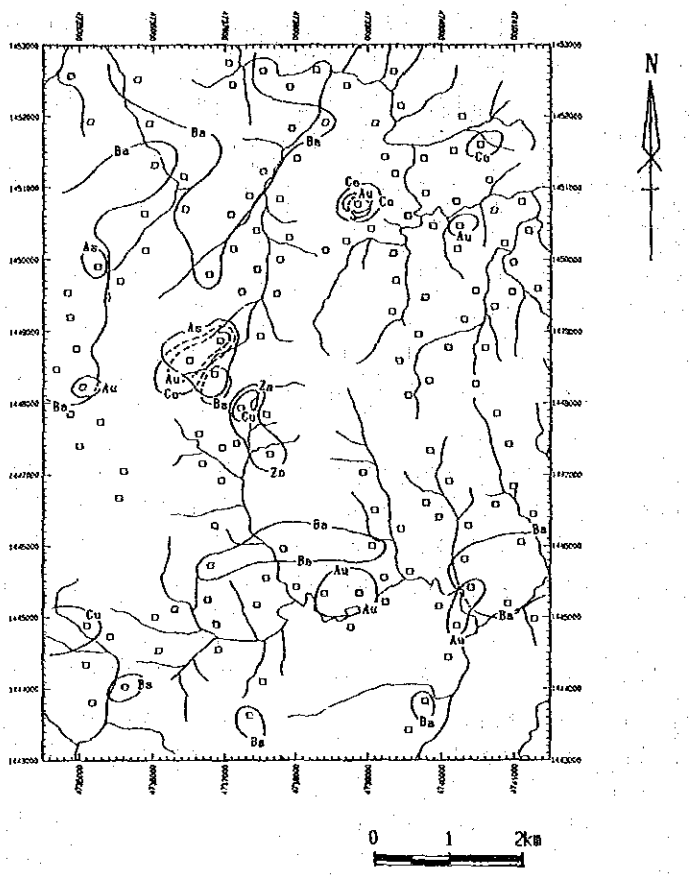
(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of factor analysis are given in Table II-2-9. The relationship between the elements and factors are as following;

Factor 1 : Co-Cr-Cu-Mg-Ni-Zn
Factor 2 : Na-Sr
Factor 3 : Ba-K-U.
Factor 4 : As
Factor 5 : Hg

Among these factors, factor 1, 2 and 3 have negative relationship with the related elements.

Judging from the relationship between the factor and the elements, factor 1 have related with ultra-basic to basic rocks and copper mineralization. Factor 3 has relation with sedimentary rocks. Other factors are not clear the relationship. Among these factors, three factors such as factor 1, 3 and 4 were selected and



As	>	16.0 ppm	Co	>	221.2 ppm	Zn	> 265.9 ppm
Au	>	1.8 ppb	Cu	>	350.8 ppm		
Ba	>	138.0 ppm	S	>	0.100 %		

Fig. II-2-8 Distribution map of geochemical anomalous zones for soil in Area B

Table II-2-9 Results of factor analyses for soil samples in Area B

Element	Factor loading (Varimax rotation)					Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
As	-0.152	0.157	-0.029	0.610	0.071	0.4253
Au	0.074	0.063	-0.079	0.324	0.085	0.1280
Ba	0.184	-0.057	-0.885	0.061	0.181	0.8568
Co	-0.852	-0.073	0.280	-0.062	0.154	0.8373
Cr	-0.752	0.080	0.436	0.285	0.292	0.9284
Cu	-0.712	0.165	0.218	-0.148	0.039	0.6054
Hg	-0.178	0.105	-0.039	-0.061	0.563	0.3649
K	0.210	-0.038	-0.913	-0.024	-0.070	0.8838
Mg	-0.713	-0.371	0.241	0.039	-0.174	0.7363
Mn	-0.630	-0.409	-0.009	-0.296	0.035	0.6533
Mo	-0.088	0.224	-0.415	-0.116	0.134	0.2615
Na	-0.072	-0.734	0.170	-0.399	-0.151	0.7548
Ni	-0.818	0.161	0.221	0.376	0.200	0.9253
Pb	0.291	-0.100	-0.384	0.381	-0.053	0.3900
S	-0.470	-0.315	0.329	-0.063	0.371	0.5696
Sb	-0.384	-0.376	0.102	-0.285	0.100	0.3904
Sr	0.087	-0.772	-0.187	-0.140	-0.306	0.7515
Ti	-0.091	-0.149	-0.223	-0.702	0.103	0.5836
U	0.467	0.034	-0.795	0.189	0.025	0.8884
W	-0.014	-0.052	0.049	-0.068	-0.196	0.0485
Zn	-0.702	0.043	-0.352	-0.248	-0.009	0.6801
F.C.*1	37.1 %	14.8 %	26.5 %	14.5 %	7.0 %	—

*1: Factor contribution

distribution map (Fig. II-2-9) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 1 : red Factor 3 : yellow Factor 4 : blue

Distribution tendencies of factor scores for these factors are summarized as following;

Factor 1: High factor score zones are found from the north eastern part to south western part of the area where gabbro and peridotite are distributed. This high factor score zone extent to the south over the mineralized zones confirmed in this survey.

Factor 3: High factor score zones are restricted in the area of Kuamut formation. The high factor score zones are also found in the northern part of the area where Chert-Spilite formation occurs.

Factor 4: High factor score zones are found in the area of gabbro and peridotite. A part of the area of kuamut formation, high factor score zones are also recognized.

According to the results of the factor analyses, the area with overlapping of factor 1 and 4 high factor score zones is interpreted as potential area.

2-4-3 Stream sediment geochemical survey

(1) sampling

Locations of stream sediment sample collected in this survey are shown in Fig. II-2-7. List of samples are shown in Appendix 22.

(2) Statistic data treatment

Analytical results of the stream sediment samples are given in Appendix 23. These data were input in computer and were statistically treated. Statistics calculated are shown in Table II-2-10.

The calculated geometric means give following tendencies comparing to the stream sediments in Area C.

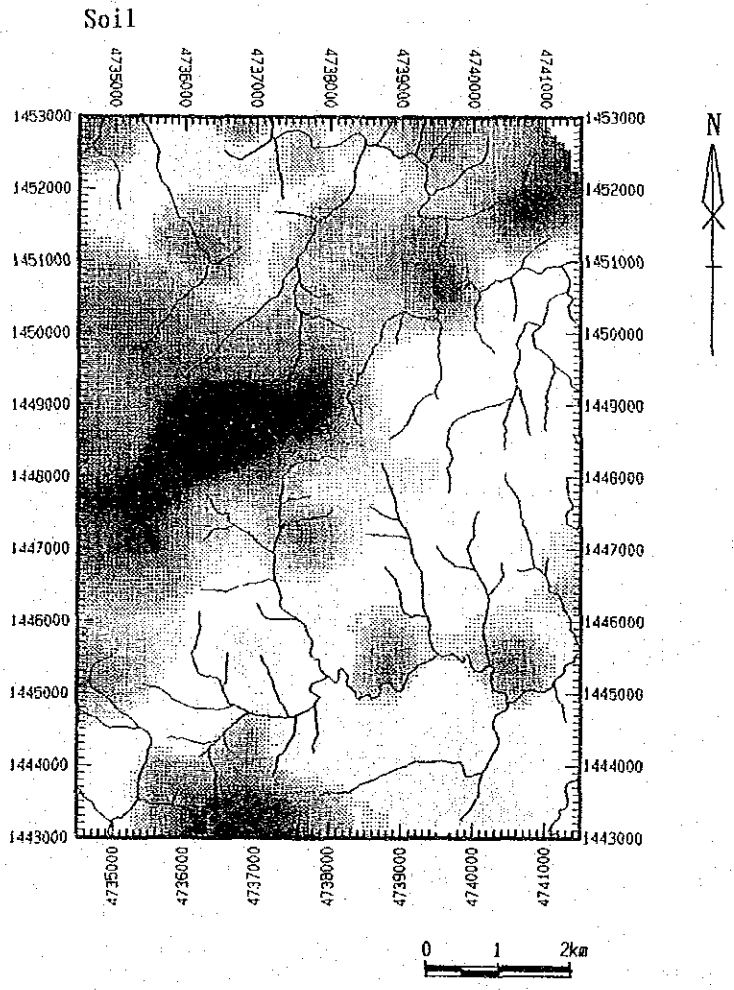
Elements indicating higher value: Co, Cr, Cu, Mg, Mn, Na, Ni, S, Ti, Zn.

Element indicating lower value: Ba, Hg, K, Pb, Sr, U.

Among 21 elements analyzed in this survey, five elements of As, Au, Mo, Pb and W gave less than the detection limit for most the samples.

In order to clarify the relationship between the elements, correlation coefficient was also calculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

Ba-K, Ba-Mg(-), Ba-U, Co-Mg, Co-Mn, Co-Ni, Co-Zn, Cr-Mg, Cr-Ni, Cu-S



Factor 1 factor score: Red Factor 3 factor score: Yellow
Factor 4 factor score: Blue

Fig. II-2-9 Distribution map of factor scores for soil in Area B

Table II-2-10 Statistics of stream sediment geochemical survey in Area B

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	89.3	7	< 1	0.6	0.258	2.0	0.5	0.5	0.5
Au (ppb)	95.7	20	< 1	0.5	0.201	1.4	0.5	0.5	0.5
Ba (ppm)	—	182	2	23.7	0.511	—	19.5	77.0	—
Co (ppm)	—	94	5	36.7	0.152	74.0	38.0	48.0	70.9
Cr (ppm)	—	8,314	135	508.2	0.260	1,680.1	412.0	812.0	1,895.5
Cu (ppm)	—	635	11	40.3	0.255	130.4	38.0	59.0	138.0
Hg (ppb)	76.4	26	< 10	6.3	0.188	14.9	5.0	11.0	5.0
K (%)	3.6	1.48	< 0.01	0.169	0.635	—	0.280	0.600	—
Mg (%)	—	7.22	0.38	3.566	0.189	—	3.895	4.720	—
Mn (ppm)	—	2,054	126	1,194.2	0.162	—	1,351	1,542.0	—
Mo (ppm)	86.4	3	< 1	0.6	0.167	1.2	0.5	0.5	0.5
Na (%)	—	2.57	0.26	1.074	0.209	—	1.195	1.600	—
Ni (ppm)	—	965	21	113.4	0.285	420.8	92.0	193.0	598.8
Pb (ppm)	95.0	7	< 2	1.1	0.149	2.1	1.0	1.0	1.0
S (%)	—	0.494	0.011	0.051	0.262	0.172	0.048	0.067	0.129
Sb (ppm)	0.7	36.1	< 0.2	12.33	0.247	—	13.20	17.50	35.52
Sr (ppm)	—	134	20	58.1	0.121	101.4	60.0	70.0	95.2
Ti (%)	—	2.55	0.14	1.025	0.198	2.547	1.135	1.500	—
U (ppm)	52.9	2.0	< 0.2	0.22	0.412	1.47	0.10	0.60	—
W (ppm)	94.3	5	< 2	1.1	0.119	1.8	1.0	1.0	1.0
Zn (ppm)	—	218	29	92.6	0.130	168.1	91.0	117.0	192.7

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)

Cu-Zn, K-U, Mg-Mn, Mg-Ni, Mg-U(-), Mn-Na, Mn-Ti, Mn-Zn, Na-S, Na-Ti, Na-U(-), Ni-Zn, Sr-Ti, Ti-U(-), Pb-U, S-Sr

( ) indicates negative correlation (less than -0.500).

The elments including Co, Cr, Mg, Ni and Zn give good correlation among them.

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element (Appendix 24) were prepared using the ranks delineated by EDA method. Distribution of each element is summarized as following;

As: High value zones are scattered from northern to western part in the area. No clear distibution tendencies are recognized. And the values are also low.

Au: High value and anomalous zones are sporadically found but the values are low.

Ba: High value zones are distibuted in the southern and northwestern parts of the area where Kuamut formation occurs.

Co: High value zones are found from north eastern part to south western part of the area. These areas correspond to the areas of ultra-basic to basic rocks and Chert-Spilite formation

Cr: Distribution tendencies are similar to Co. The high value and anomalous zones are found from north eastern to south western part of the area.

Cu: High value and anomalous zones are distributed in the central and south western parts of the area where dolerite occurs.

Hg: High value zones are scattered in the north western part and southern part of the area wher Kuamut formation occurs.

K : High value and anomalous zones are restricted in the area of Kuamut formation and indicates close relationship with sedimentary rocks.

Mg: The distribution tendencies are similar to Co and Cr. High value zones are found in the area of ultra-basic rocks and basic rocks.

Mn: High value zones are distributed with a NE-SW ditection and are found in the area of Chert-Spilite formation.

Mo: High value zones are scattered and no clear distribution tendencies are recognized.

Na: High value zones are recognized in the area of dolerite in the Chert-Spilite formation.

Ni: High value zones are distributed in the north eastern to south western part of the area. These high value zones are restricted in the area of ultra-basic rocks.

Pb: High value zones are sporadically observed and no clear distribution tendencies are recognized.

S : High value and anomalous zones show similar distribution tendencies of Cu. The most significant anomalous zones are found southern central part and south western part of the area.

Sb: The distribution tendencies are same as S. Anomalous zones are also found in the same places of S anomalous zones.

Sr: High value zones are found along the boundary between Chert-spilite formation and Kuamut formation.

Ti: High value zones are restricted in the area of dolerite. Low values are found in the area of Kuamut formation.

U : High value zones are restricted in the area of Kuamut formation, but the values are low.

W : Because of low value, no clear distribution tendencies are recognized.

Zn: High value and anomalous zones are scattered in the area of Chert-Spilite formation. Significant anomalous zones are found in the central part where anomalous zones of Cu are also situated.

Based on the distribution tendencies, the elements which are possibly useful for the survey in this area were selected and anomaly map (Fig. II-2-10) of these elements was prepared.

(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of factor analysis are given in Table II-2-11. The relationship between the elements and factors are as following;

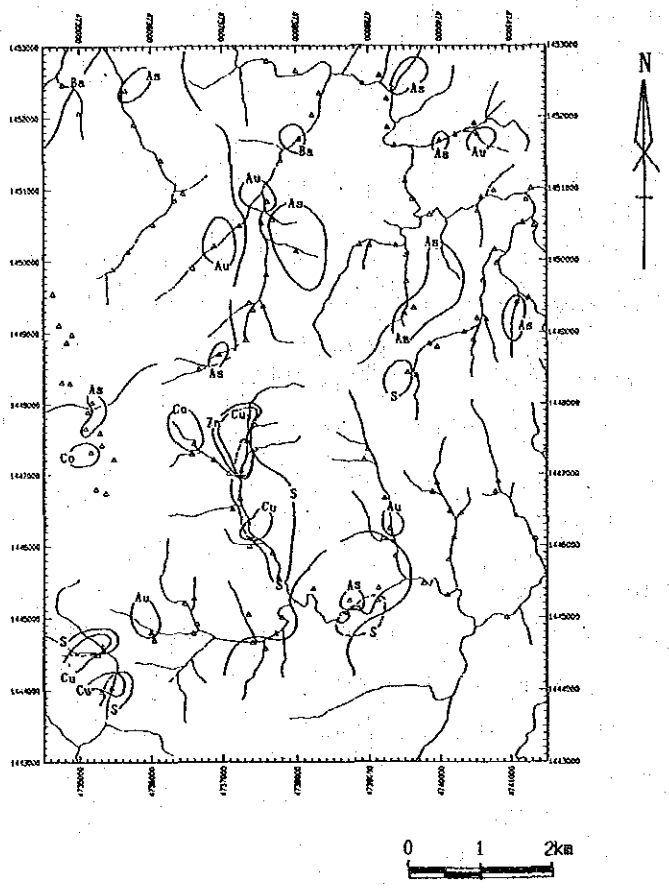
Factor 1 : Ba-K-U
Factor 2 : Cu-Na-S
Factor 3 : Co-Cr-Mg-Ni-Zn
Factor 4 : Co-Mn-Sb-Sr-Ti-Zn
Factor 5 : As-Pb

Among these factors, factor 4 and 5 have negative relationship with the related elements.

Judging from the relationship between the factor and the elements, factor 1 has relation with sedimentary rocks. Factor 2 possibly indicates copper mineralization. Factor 3 has relation with ultra-basic to basic rocks. Other factors are not clear the relationship. Among these facters, three factors such as factor 1, 2 and 3 were selected and distribution map (Fig. II-2-11) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 1 : yellow Factor 2 : red Factor 3 : blue

Distribution tendencies of factor scores for these factors are summarized as following;



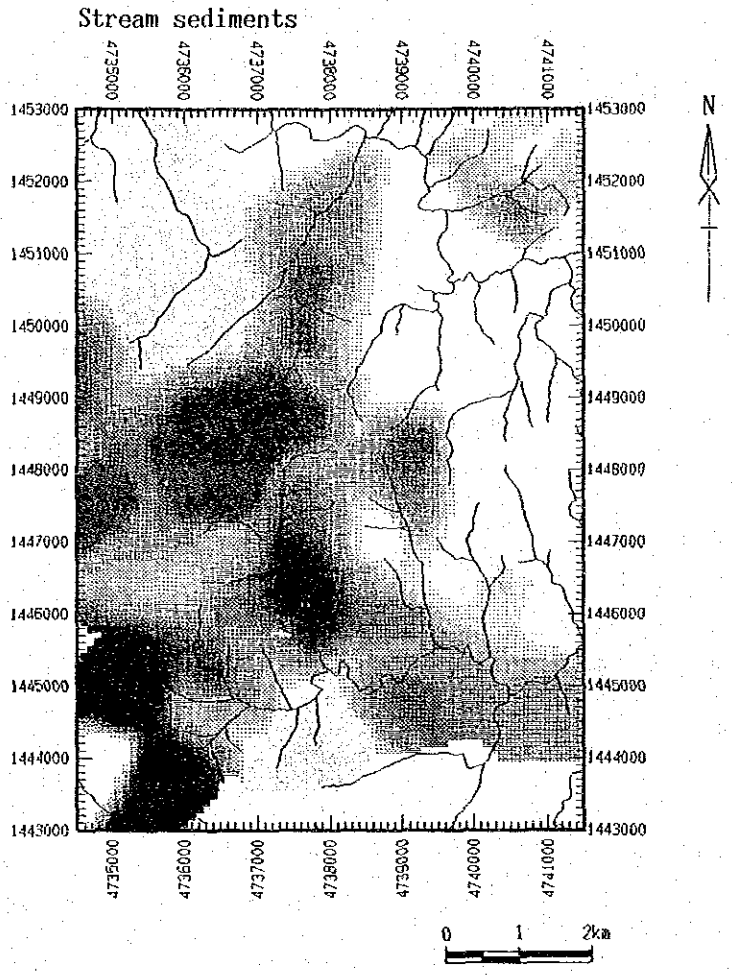
As >	2.0 ppm	Co >	70.9 ppm	Zn >	192.7 ppm
Au >	1.4 ppb	Cu >	138.0 ppm		
Ba >	77.0 ppm	S >	0.129 %		

Fig. II-2-10 Distribution map of geochemical anomalous zones for stream sedimentsin Area B

Table II-2-11 Results of factor analyses for stream sediments in Area B

Element	Factor loading (Varimax rotation)					Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
As	-0.047	-0.042	0.181	0.095	-0.581	0.3831
Au	0.068	-0.124	0.066	-0.109	0.071	0.0411
Ba	0.948	-0.085	-0.019	0.066	0.001	0.9113
Co	-0.232	0.307	0.607	-0.562	0.095	0.8405
Cr	-0.135	-0.052	0.873	0.077	0.038	0.7897
Cu	0.249	0.727	0.418	-0.126	0.087	0.7882
Hg	0.464	0.073	-0.050	0.123	-0.361	0.3682
K	0.926	0.090	0.070	-0.048	0.115	0.8857
Mg	-0.554	0.195	0.583	-0.333	0.183	0.8296
Mn	-0.355	0.214	0.248	-0.739	0.281	0.8590
Mo	0.453	-0.025	-0.127	-0.038	-0.292	0.3084
Na	-0.403	0.501	-0.368	-0.334	0.291	0.7455
Ni	0.126	-0.125	0.916	-0.073	-0.049	0.8788
Pb	0.169	-0.083	-0.056	0.169	-0.545	0.3647
S	-0.132	0.794	-0.028	-0.123	0.079	0.6707
Sb	-0.034	-0.008	0.226	-0.511	0.026	0.3140
Sr	0.062	0.077	-0.331	-0.568	0.072	0.4479
Ti	-0.349	0.051	-0.217	-0.775	0.262	0.8401
U	0.819	-0.238	-0.041	0.348	-0.089	0.8567
W	0.019	-0.029	-0.203	0.003	0.044	0.0444
Zn	0.296	0.363	0.548	-0.534	0.057	0.8088
F.C.*1	29.7 %	14.3 %	25.4 %	21.5 %	9.1 %	—

*1: Factor contribution



Factor 1 factor score: Yellow Factor 2 factor score: Red
Factor 3 factor score: Blue

Fig. II-2-11 Distribution map of factor scores for stream sediments in Area B

Factor 1: High factor score zones are found from the north western part to southern part of the area where Kuamut formation is distributed.

Factor 2: High factor score zones are widely distributed in the south western part of the area. These zones correspond to the mineralized zones confirmed on the surface. The scale of these zones are significant.

Factor 3: High factor score zones are found in the north eastern to southern parts where gabbro and peridotite occur.

According to the rsults of the factor analyses, the high factor score zones of factor 2 clearly delineates mineralized zones. This areas are interpreted as potential area.

2-5 Area C

2-5-1 Geology and mineralization

(1) Survey area

Based on the geology and the regional geochemical survey results, this area was selected as the potential area of Cyprus type copper deposits. Soil and Stream sediment geochemical survey were carried out in this area.

Area C is situated at southern central part of Segama area. The survey area show steep topography. Main river systems is Sungai Segama at the central part of the area. The survey area is in the area of secondary forest.

(2) Geology

Geology of Area C consists of pre-Triassic phyllitic schist (Ps) and green schist (Gs), Cretaceous to Tertiary ultra-basic rock (Pr), basic rock (Gb) and Chert-Spilite formation (Csba) and Kuamut formation (P_4Km) of Oligocene to middle Miocene. Geologic map of Area C is shown in Fig. II-2-12.

Pre-Triassic basement consists of phyllitic schist (Ps) at the lower part and green schist at the upper part. Amphibolite occurs within the green schist. These rocks occur along the streams in the northern part of the area. Ultra-basic rocks (Pr) consist of dark gray to dark greenish gray peridotite and are widely distributed in the northern part of the area. Basic rocks (Gb) mainly consists of cumulate gabbro and are found over the ultra-basic rocks in central to western part of the area. Chert-Spilite formation (Csba) is distributed over the basic rocks in the central to south western part of the area. This formation consists of dolerite and basalt. Chert beds are also recognized in this formation in the western marginal part of the area. The southen half of the area is occupied with Kuamut formation (P_4Km). This formation bounds the ultra-basic to basic rocks and Chert-

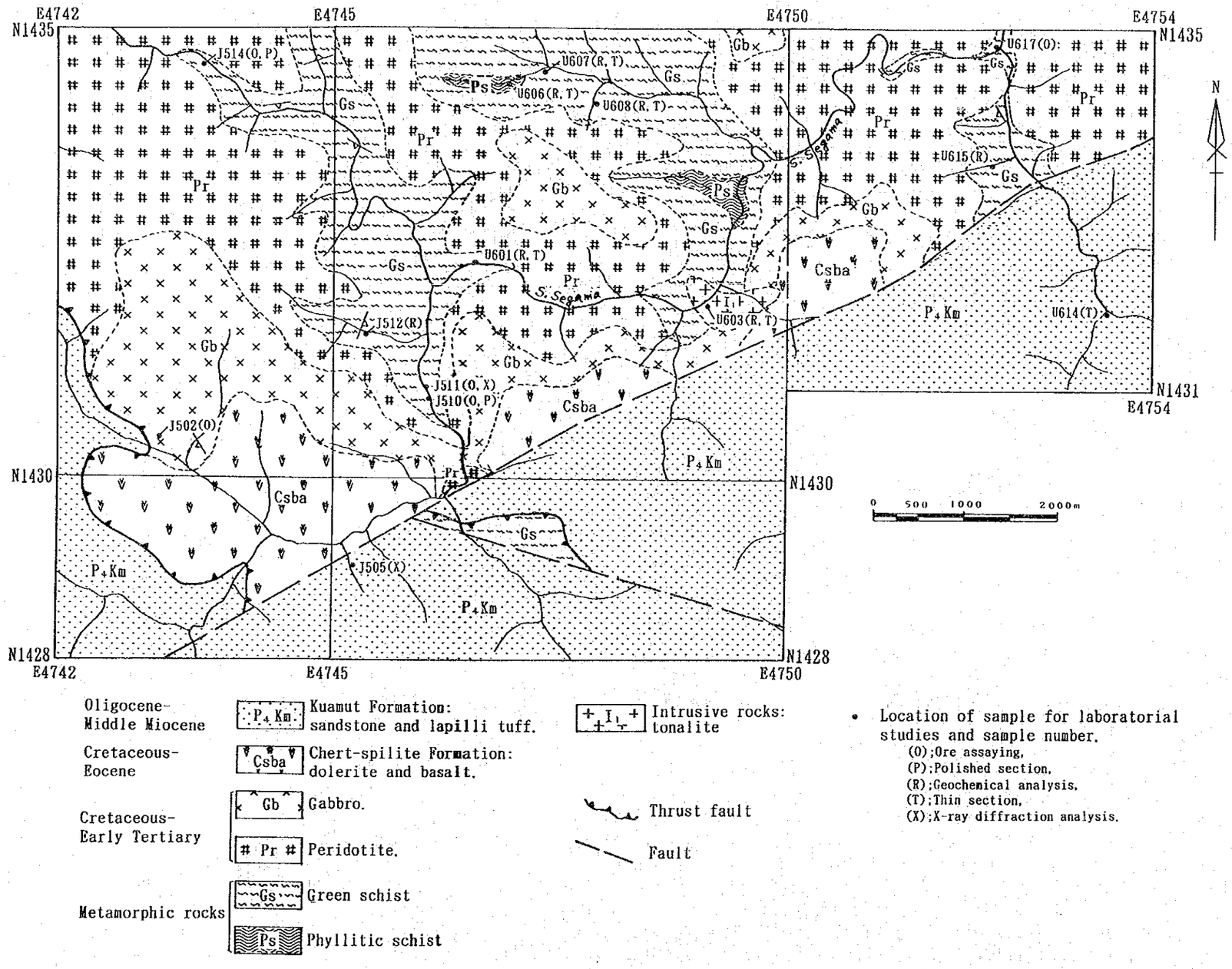


Fig. II-2-12 Geologic map of Area C

Spilite formation with a ENE-WSW trending fault. Kuamut formation mainly consists of gray sandstone with subordinate tuff breccia and lapilli tuff.

As the intrusive rocks, tonalite (I_1) occurs along Sungai Segama in the central part of the area. Amphibolite is recognized within tonalite as xenolith.

Geologic structure in this area is characterized with a significant ENE-WSW trending fault in the central part of the area. A trust fault is inferred in the south western part of the area.

(2) Mineralization

During the survey, dissemination and concentration of pyrite were recognized in the sheared zones of green schist. Observation of polished section (Table II-2-3) confirmed chalcopyrite and sphalerite for the samples collected from this mineralized zone. Quartz veins with pyrite dissemination were confirmed in the north eastern margin and north western margin of the area where green schist occurs. Under the microscope, pyrite with minor chalcopyrite and sphalerite were confirmed within the quartz vein. Five samples were collected for ore assaying as shown in Table II-2-5. The sample (J510) collected in the central part indicated the best values of 0.08 % Cu and 0.58 % Zn. As the results of X-ray diffraction analyses, chlorite, quartz and pyrite were detected for a sample (J505) collected from argillized zone in Kuamut formation at the south. Chlorite, K-feldspar and pyrite were detected for the sample (J511) collected from the mineralized zone in green schist.

Because similar mineralized zones were confirmed in the green schist and Kuamut formation, the mineralized zones were formed after the deposition of Kuamut formation.

2-5-2 Soil geochemical survey

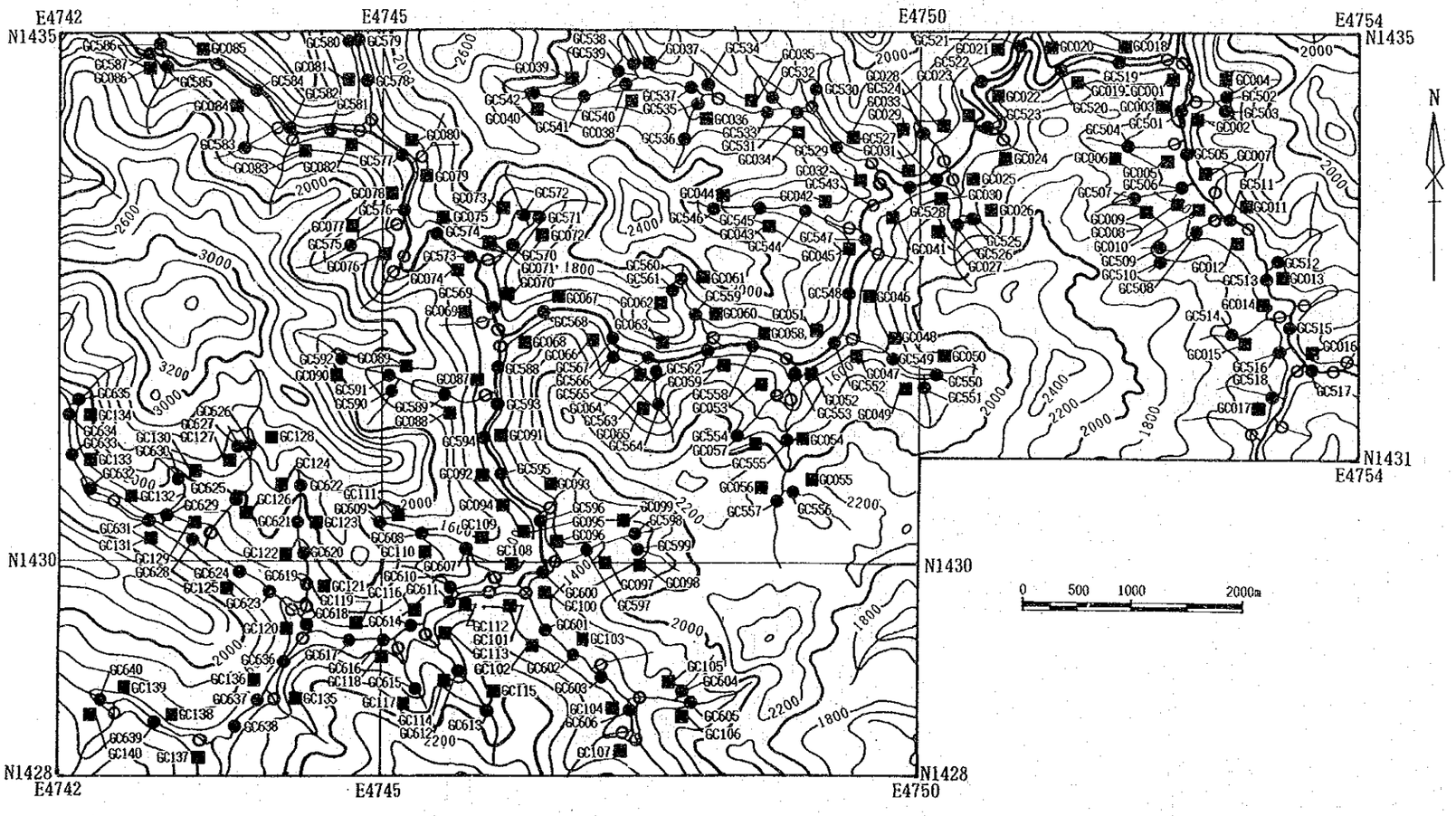
(1) Sampling

Soil samples were used as the sample media in this survey. Locations of samples are shown in Fig. II-2-13. List of soil samples collected in this srvey are shown in Appendix 25. After drying up these samples, -80 mesh fraction samples were used for the chemical analyses.

(2) Statistic data treatment

Analytical results of soil samples are shown in Appendix 26. The results were input in computer and the data were statistically treated. The statistics calculated are given in Table II-2-12.

The calculated geometric means give following tendencies comparing with other



● GC599 Location of stream sediment sample and sample number.

■ GC098 Location of soil sample and sample number.

○ Location of stream sediment sample collected in phase II.

Fig. II-2-13 Location map of geochemical samples in Area C

Table II-2-12 Statistics of soil geochemical survey in Area C

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	86.4	30	< 1	0.7	0.346	3.3	0.5	0.5	0.5
Au (ppb)	76.3	41	< 1	0.8	0.408	4.9	0.5	1.0	0.5
Ba (ppm)	—	398	10	67.6	0.321	296.8	69.0	123.0	336.8
Co (ppm)	1.4	241	< 1	28.3	0.390	170.4	34.0	46.0	86.1
Cr (ppm)	—	6,612	32	210.8	0.416	1,433.3	211.4	377.0	1,640.8
Cu (ppm)	—	366	5	47.1	0.309	195.4	53.5	74.0	162.1
Hg (ppb)	1.4	189	< 10	36.6	0.235	108.1	38.5	56.0	125.4
K (%)	1.4	1.15	< 0.01	0.177	0.533	2.064	0.250	0.460	3.987
Mg (%)	—	16.62	0.24	1.163	0.375	9.343	1.985	3.180	12.786
Mn (ppm)	10.0	2,893	< 5	499.2	0.831	22,921.1	933.0	1,407.0	2,714.1
Mo (ppm)	96.4	2	< 1	0.5	0.071	0.7	0.5	0.5	0.5
Na (%)	—	3.61	< 0.03	0.852	0.482	7.851	1.230	1.950	—
Ni (ppm)	—	2,617	6	91.9	0.454	744.4	92.5	169.0	821.2
Pb (ppm)	86.4	284	< 2	1.3	0.359	7.0	1.0	1.0	1.0
S (%)	—	0.734	0.007	0.023	0.255	0.073	0.023	0.034	0.077
Sb (ppm)	5.7	16.5	< 0.2	4.77	0.505	48.72	6.65	10.30	—
Sr (ppm)	—	223	5	70.3	0.321	308.4	84.5	133.0	—
Ti (%)	—	1.69	0.11	0.480	0.199	1.199	0.490	0.700	1.458
U (ppm)	16.4	2.8	< 0.2	0.44	0.463	3.67	0.40	1.60	—
W (ppm)	98.6	3	< 2	1.0	0.057	1.3	1.0	1.0	1.0
Zn (ppm)	—	1,398	23	78.4	0.206	202.1	80.0	98.0	148.7

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)

areas.

Elements indicating higher value: Cr, K, Na, Sr.

Element indicating lower value: Hg, Ti.

Among 21 elements analyzed in this survey, two elements of Mo (maximum value; 2 ppm) and W (maximum value; 3 ppm) gave very low values. These two elements were not usefull in this survey.

In order to clarify the relationship between the elements, correlation coefficient was also calculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

As-Mo, As-Zn, Ba-K, Co-Cr, Co-Mg, Co-Mn, Co-Ni, Cr-Mg, Cr-Ni, Cu-Pb, Cu-S, Cu-Zn, K-U, Mg-Mn, Mg-Ni, Mn-U(-), Mo-Pb, Mo-S, Mo-Zn, Na-Sr, Na-U(-), Pb-S, Pb-Zn, Sb-U(-), Sr-U(-).

(-) indicate negative correlation. Among the elments including Co, Cr, Cu, Mg and Ni give good correlation each other. The elements including Cu, Pb, S and Zn characteristically indicate good correlation among them.

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element were prepared (Appendix 29) using the values delineated by EDA method. Distribution of each element is summarized as following;

As: High value zones are found along a fault in the southern part of the area.

Au: High value and anomalous zones are scattered and the values are also low.

Ba: High value zones are restricted in the area of Kuamut formation and phyllitic schist.

Co: High value and anomalous zones are mostly found in the area of ultra-basic rocks.

Cr: The distribution tendencies are same as Co and have relationship with ultra-basic rocks in the central part of the area.

Cu: High value anomalous zones are mostly found in the area of green schist.

Hg: High value zones are found along an ENE-WSW trending fault and in Kuamut formation at the south.

K : High value zones are found in the eastern and south western parts of the area. Higher values are found in the area of Kuamut formation.

Mg: The distribution tendencies are similar to Co and Cr. The anomalous zones are restricted in the area of ultra-basic rocks.

Mn: High value zones are scattered in the arera of green schist, ultra-basic to basic rocks.

Mo: The maximum value is 2 ppm and no clear distribution tendencies are recognized.

Na: High value zones are concentrated in the area of green schist. Low values are

characteristically found in the area of Kuamut formation.

Ni: High value and anomalous zones are mostly found in the area of ultra-basic rocks.

Pb: High value zones are in the area of Kuamut formation at the south western part of the area. The sample with the maximum value (284 ppm) is situated at southern central part of the area.

S : High value zones are restricted in the area of green schist and Kuamut formation.

Sb: High value and anomalous zones are concentrated in the area of green schist. The distribution tendencies area similar to the distribution of S.

Sr: High value zones are concentrated in the area of Chert-Spilite formation.

Ti: High value zones are concentrated in the area of Chert-Spilite formation and gabbros. Low values are found in the area of Kuamut formation.

U : High value zones are restricted in the area of Kuamut formation. But the values are low.

W : No clear distribution tendencies are recognized and the values are very low.

Zn: High value and anomalous zones are found in the area of Chert-Spilite formation and the surroundings. Significant anomalous sample (1,398 ppm) was found in the area of Kuamut formation at the southern margin.

According to the distribution maps, the elements which are possibly useful for the survey in this area were selected and anomaly map (Fig. II-2-14) of these elements was prepared. As shown on this map, the anomalous zones of Cu, Pb, S and Zn are overlapped in the southern marginal part of the area where Kuamut formation occurs. This zone is interpreted to be potential area.

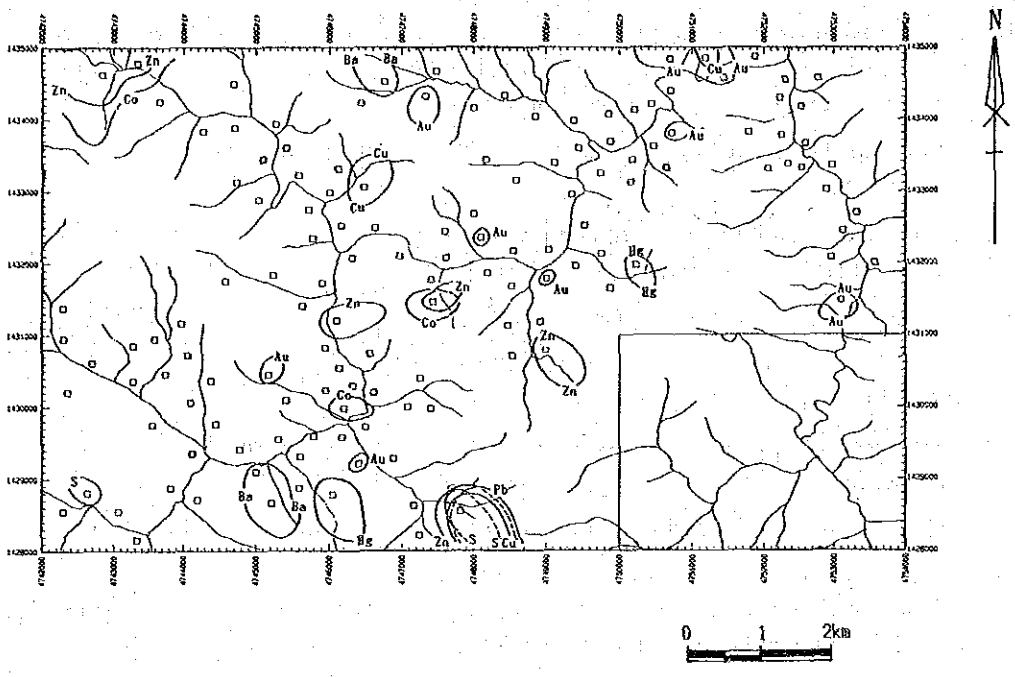
(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of factor analysis are given in Table II-2-13. The relationship between the elements and factors are as following;

Factor 1 : Cu-Mn-Na-Sb-Sr-Ti.
Factor 2 : Co-Cr-Mg-Ni-Zn.
Factor 3 : As-Mo-Pb-S.
Factor 4 : Ba-K-U.
Factor 5 : Hg.

Among these factors, factor 1, 2, 3 and 4 have negative relation with the related elements. Judging from the relationship between the factor and the elements, factor 1 may relates to green schist, Chert-Spilite formation and copper mineralization. Factor 2 has relation with ultra-basic rocks. Factor 4 indicates sedimentary rocks. Factor 3 and 5 are not clear the relationship.

Among these factors, three factors such as factor 1, 2 and 4 were selected



Au	>	4.9 ppb	Cu	>	162.1 ppm	S	>	0.077 %
Ba	>	336.8 ppm	Hg	>	125.4 ppb	Zn	>	148.7 ppm
Co	>	86.1 ppm	Pb	>	7.0 ppm			

Fig. II-2-14 Distribution map of geochemical anomalous zones for soil in Area C

Table II-2-13 Results of factor analyses for soil samples in Area C

Element	Factor loading (Varimax rotation)					Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
As	0.197	0.098	-0.557	-0.144	0.176	0.4107
Au	0.000	-0.019	0.016	-0.135	-0.271	0.0925
Ba	0.002	0.102	-0.118	-0.897	0.016	0.8299
Co	-0.499	-0.709	0.132	0.287	0.136	0.8698
Cr	0.050	-0.962	0.043	0.082	-0.138	0.9564
Cu	-0.766	-0.305	-0.109	0.162	-0.071	0.7225
Hg	0.061	0.022	-0.108	-0.095	0.449	0.2269
K	0.171	0.141	-0.162	-0.787	-0.355	0.8207
Mg	-0.368	-0.696	0.191	0.384	-0.291	0.8900
Mn	-0.689	-0.511	0.185	0.170	0.014	0.7984
Mo	0.013	-0.002	-0.670	-0.080	0.062	0.4587
Na	-0.861	-0.168	0.081	0.242	-0.227	0.8853
Ni	-0.059	-0.977	0.000	0.009	-0.033	0.9594
Pb	0.340	0.157	-0.584	-0.283	0.128	0.5771
S	-0.410	-0.377	-0.500	0.160	-0.168	0.6135
Sb	-0.581	-0.070	0.262	0.053	-0.210	0.4578
Sr	-0.781	0.001	0.075	0.026	-0.437	0.8073
Ti	-0.570	0.157	0.121	-0.016	0.371	0.5018
U	0.445	0.225	-0.132	-0.704	0.110	0.7744
W	-0.050	-0.010	0.018	-0.008	-0.119	0.0173
Zn	-0.497	-0.582	-0.412	0.157	0.121	0.7942
F.C.*1	31.7 %	28.8 %	13.3 %	18.3 %	8.0 %	—

*1: Factor contribution

and distribution map (Fig. II-2-15) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 1 : red Factor 2 : blue Factor 4 : yellow

Distribution tendencies for these factors are summarized as following;

Factor 1: High factor score zones are found in the area of green schist. These zones also correspond to mineralized zones confirmed on the surface.

Factor 2: High factor score zones are mostly found in the area of ultra-basic rocks. The high factor score zone is also found in the Kuamut formation at the central south.

Factor 4: High factor score zones are found in the area Kuamut formation.

According to the results of the factor analyses, the area of factor 1 high factor score zones is interpreted as potential area. But the potentiality is not significant.

2-5-3 Stream sediment geochemical survey

(1) sampling

Locations of stream sediment sample collected in this survey are shown in Fig. II-2-13. List of samples are shown in Appendix 27.

(2) Statistic data treatment

Analytical results of the stream sediment samples are given in Appendix 28. These data were input in computer and were statistically treated. Statistics calculated are shown in Table II-2-14.

The calculated geometric means give following tendencies comparing to the stream sediments in Area C.

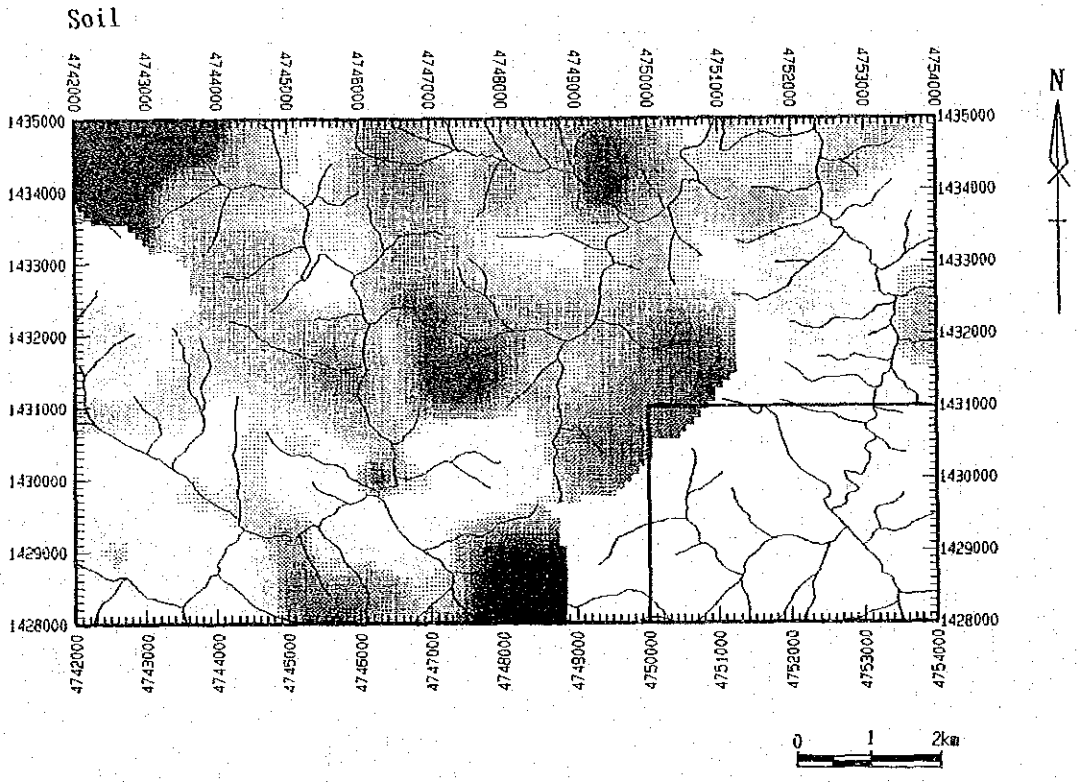
Elements indicating higher value: Ba, Hg, K, Pb, Sr, U.

Element indicating lower value: Co, Cr, Cu, Mg, Mn, Na, Ni, S, Ti, Zn.

Among 21 elements analyzed in this survey, five elements of As, Au and Mo gave less than the detection limit for most the samples.

In order to clarify the relationship between the elements, correlation coefficient was also calculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

Ba-K, Co-Cr, Co-Cu, Co-Mg, Co-Mn, Co-Na, Co-Ni, Co-S, Co-Sb, Co-Sr, Co-Ti, Co-U(-), Co-Zn, Cr-Mg, Cr-Mn, Cr-Ni, Cr-Zn, Cy-Mg, Cu-Mn, Cu-Na, Cu-Ni, Cu-S, Cu-Sb, Cu-Sr, Cu-Ti, Cu-U(-), Cu-Zn, Mg-Mn, Mg-Na, Mg-Ni, Mg-S, Mg-Sr, Mg-Ti, Mg-U(-), Mg-Zn, Mn-Na, Mn-Ni, Mn-S, Mn-Sb, Mn-Sr, Mn-Ti, Mn-U(-), Mn-Zn, Na-Ni, Na-S, Na-Sb, Na-Sr, Na-Ti, Na-U(-), Na-Zn, S-Sr,



Factor 1 factor score: Red Factor 2 factor score: Blue
Factor 4 factor score: Yellow

Fig. II-2-15 Distribution map of factor scores for soil in Area C

Table II-2-14 Statistics of stream sediment geochemical survey in Area C

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	92.1	15	< 1	0.6	0.258	1.9	0.5	0.5	0.5
Au (ppb)	96.4	45	< 1	0.5	0.234	1.6	0.5	0.5	0.5
Ba (ppm)	—	257	11	64.5	0.214	172.5	65.0	84.0	126.3
Co (ppm)	—	79	3	17.8	0.261	59.3	18.5	33.0	—
Cr (ppm)	—	5,414	120	391.4	0.289	1,479.6	358.0	726.0	2,268.0
Cu (ppm)	—	55	7	22.3	0.213	59.4	22.0	37.0	—
Hg (ppb)	47.9	24	< 10	8.0	0.207	20.8	10.0	13.0	44.6
K (%)	—	0.86	0.03	0.264	0.221	0.731	0.265	0.380	0.753
Mg (%)	—	11.74	0.20	1.470	0.343	7.123	1.305	3.030	—
Mn (ppm)	—	2,605	60	535.5	0.312	2,257.9	521.8	1,042.0	—
Mo (ppm)	93.6	2	< 1	0.5	0.105	0.9	0.5	0.5	0.5
Na (%)	—	3.17	0.09	0.839	0.354	—	0.750	1.960	—
Ni (ppm)	—	1,124	15	61.5	0.310	256.4	59.0	120.0	551.1
Pb (ppm)	72.9	44	< 2	1.8	0.452	14.1	1.0	5.0	5.7
S (%)	—	1.714	0.009	0.034	0.271	0.119	0.037	0.047	0.122
Sb (ppm)	—	54.9	1.7	10.07	0.259	33.21	9.85	15.00	38.76
Sr (ppm)	—	347	16	84.1	0.295	327.3	82.5	163.0	—
Ti (%)	—	3.01	0.15	0.491	0.256	1.521	0.515	0.790	2.729
U (ppm)	7.1	2.8	< 0.2	0.61	0.379	—	0.80	1.20	—
W (ppm)	77.9	6	< 2	1.3	0.196	3.1	1.0	2.0	1.0
Zn (ppm)	—	178	19	53.9	0.212	143.0	56.0	85.0	—

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)

S-Ti, S-Zn, Sb-Ti, Sb-Zn, Sr-Ti, Sr-U(-), Sr-Zn, Ti-U(-), Ti-Zn, U-Zn(-).

( ) indicates negative correlation (less than -0.500) each other.

Among the elments, the elements including Co, Cr, Cu, Mg, Mn, Na, Ni, S, Sb, Sr, Ti and Zn give good correlation each other. The correlation among the elements give different nature compare with Area B. (-) indicates negative correlation between them. The elements including Co, Cr, Mg, Mn, Na, Sr, Ti and Zn have characteristically negative correlation with U.

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element (Appendix 29) were prepared using the ranks delineated by EDA method. Distribution of each element is summarized as following;

As: High value zones are scattered in the southern part of the area. The maximum value is low (15 ppm) and the distribution tendencies are not clear.

Au: High value and anomalous zones are sporadically found but the values are low.

Ba: High value zones are distibuted in the area of green schist. The sample with the maximum value (257 ppm) is situated in this green schist area.

Co: High value and anomalous zones are mostly found in the area of ultra-basic rocks.

Cr: Distribution tendencies are similar to Co. The high value and anomalous zones are found in the northern central part of the area.

Cu: High value and anomalous zones are mostly found in the area of green schist. Comparatively large in scale anomalous zones are found in the northern part of the area.

Hg: High value and anomalous zones are found along the ENE-WSW trending fault and in the area of Kuamut formation.

K : High value zones are found in the northern and southern parts of the area where green schist and Kuamut formation occur.

Mg: The distribution tendencies are similar to Co and Cr. High value zones are found in the area of ultra-basic rocks.

Mn: High value zones are scattered in the area of green schist, ultra-basic rocks and basic rocks.

Mo: The maximum value is 2 ppm and no clear distribution tendencies are recognized.

Na: High value zones are concentrated in the area of green schist. Low value zones are found in the area of Kuamut formation.

Ni: These high value zones are restricted in the area of ultra-basic rocks.

Pb: High value zones are concentrated in the southern central part of the area. Anomalous zones are also found in this part, but the values (maximum value; 44 ppm) are low.

S : High value zones are found in the area of green schist. Anomalous zones are scattered.

Sb: High value and anomalous zones are concentrated in the area of green schist. The distribution tendencies are similar to S.

Sr: High value zones are concentrated in the area of Chert-spilite formation and green schist.

Ti: High value zones are restricted in the area of Chert-Spilite formation and gabbros. Low value zones are found in the area of Kuamut formation.

U : High value zones are restricted in the area of kuamut formation, but the values are low.

W : Because of low value, no clear distribution tendencies are recognized.

Zn: High value zones are found in the area of Chert-Spilite formation and the surroundings. Significant anomalous zones are found in the northern part of the area where anomalous zones of Co and Cu are distributed.

Based on the distribution tendencies, the elements which are possibly useful for the survey in this area were selected and anomaly map (Fig. II-2-16) of these elements was prepared. As shown on this map, anomalous zones of Cu, Co and Zn overlap in the northern part of the area, but te values of these elements are low.

(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of facter analysis are given in Table II-2-15. The relationship between the elements and factors are as following;

Factor 1 : Co-Cu-Mg-Mn-Na-Ni-Sb-Sr-Ti-Zn

Factor 2 : Ba-K.-S

Factor 3 : Pb-W.

Factor 4 : Cr-Ni.

Factor 5 : (Au)

Factor 6 : (S)

Factor 7 : (Hg)-(Mo)

Among these factors, factor 1, 3, 5 and 6 have negative relationship with the related elements. The elements within ( ) indicate weak relation to the factor.

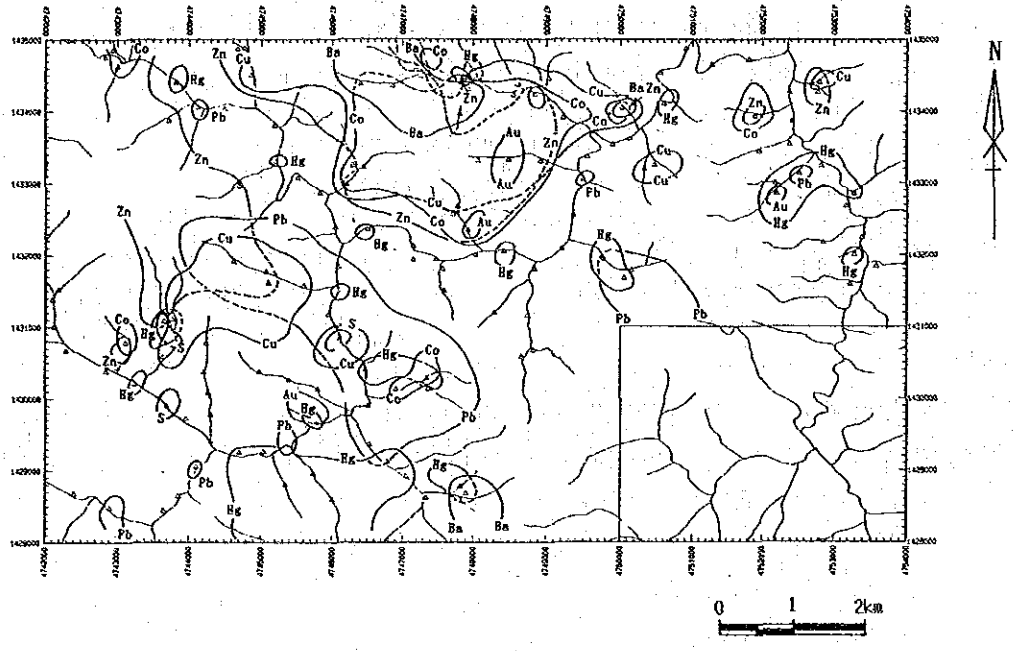
Judging from the relationship between the factor and the elements, factor 1 has relation with ultra-basic and basic rocks, Chert-Spilite formation and copper mineralization. Factor 2 possibly indicates sedimentary rocks. Factor 4 has relation with ultra-basic rocks. Because the elements related to factor 3 have low values, and factor 5, 6 and 7 have weak relationship with the elements, the relation of these factors are not clear.

Among these factors, three factors such as factor 1, 2 and 4 were selected and distribution map (Fig. II-2-17) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 1 : red Factor 2 : yellow Factor 3 : blue

Distribution tendencies of factor scores for these factors are summarized as following;

Factor 1: High factor score zones are found in the area of ultra-basic rocks.



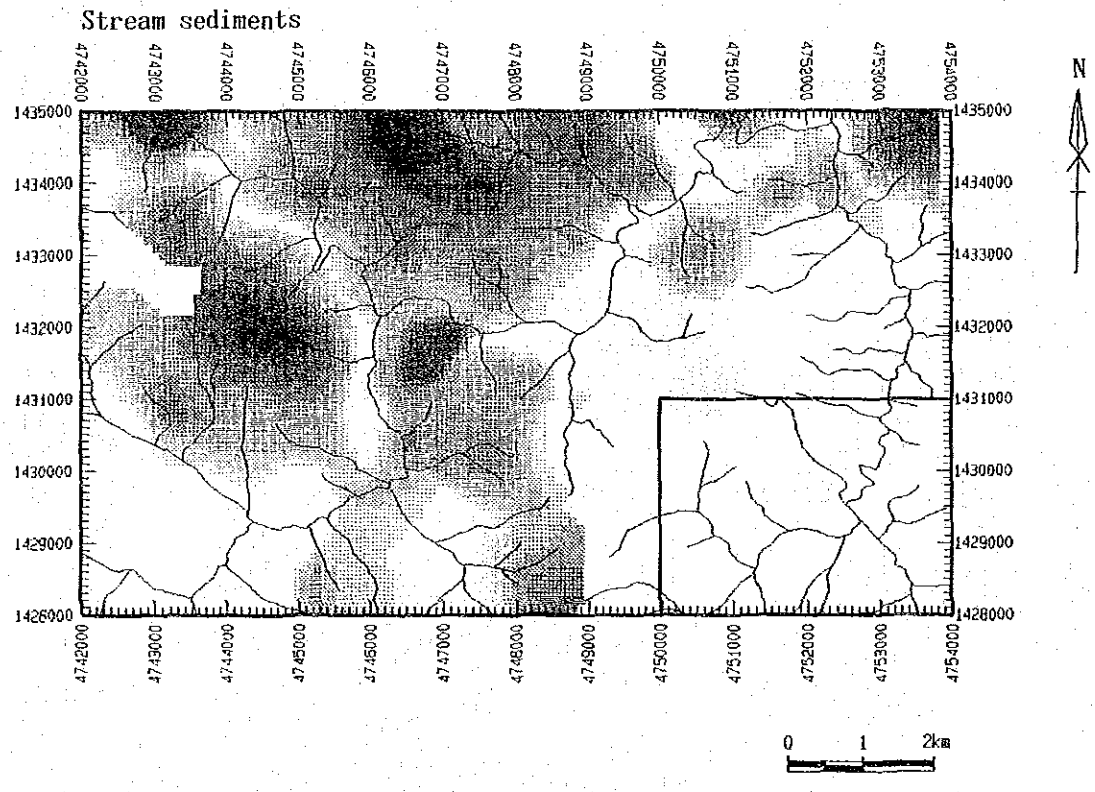
Au >	1.6 ppb	Cu >	37.0 ppm	S >	0.122 %
Ba >	126.3 ppm	Hg >	13.0 ppb	Zn >	85.0 ppm
Co >	33.0 ppm	Pb >	5.7 ppm		

Fig. II-2-16 Distribution map of geochemical anomalous zones for stream sediments in Area C

Table II-2-15 Results of factor analyses for stream sediments in Area C

Element	Factor loading (Varimax rotation)							Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	
As	0.048	-0.008	-0.397	-0.115	-0.143	0.135	0.114	0.2250
Au	-0.078	0.000	-0.052	0.094	-0.422	-0.006	0.053	0.1984
Ba	0.083	0.914	0.135	0.125	0.043	0.043	0.143	0.9004
Co	-0.865	-0.010	0.015	0.372	-0.052	-0.026	-0.180	0.9231
Cr	-0.345	0.198	0.230	0.750	-0.191	-0.069	-0.145	0.8357
Cu	-0.899	0.112	0.019	0.028	-0.070	-0.280	-0.186	0.9406
Hg	0.359	0.095	-0.088	-0.024	-0.185	-0.076	0.470	0.4066
K	0.027	0.932	0.153	0.053	-0.069	0.002	0.060	0.9033
Mg	-0.870	0.080	0.116	0.350	-0.147	0.019	-0.193	0.9584
Mn	-0.940	-0.031	0.149	0.237	0.024	-0.072	-0.033	0.9691
Mo	0.144	0.088	-0.051	-0.093	-0.004	0.105	0.426	0.2321
Na	-0.962	0.005	0.077	-0.040	-0.068	-0.010	-0.164	0.9639
Ni	-0.598	0.180	0.233	0.593	-0.250	-0.021	-0.153	0.8821
Pb	0.160	-0.230	-0.594	-0.054	0.276	-0.090	0.087	0.5265
S	-0.582	-0.103	-0.019	0.097	-0.017	-0.585	-0.232	0.7557
Sb	-0.559	-0.274	-0.368	0.249	0.288	-0.185	-0.101	0.7122
Sr	-0.912	0.056	0.188	0.019	-0.100	-0.089	-0.187	0.9228
Ti	-0.857	-0.254	0.123	0.169	0.113	-0.150	-0.014	0.8783
U	0.792	0.273	-0.039	0.009	0.123	-0.166	0.241	0.8050
W	0.111	-0.090	-0.679	-0.054	-0.094	-0.057	-0.026	0.4975
Zn	-0.883	-0.014	0.153	0.303	-0.093	-0.097	-0.124	0.9295
F.C.*1	54.8 %	13.7 %	9.0 %	9.6 %	3.8 %	3.8 %	5.2 %	—

*1: Factor contribution



Factor 1 factor score: Red Factor 2 factor score: Yellow

Factor 4 factor score: Blue

Fig. II-2-17 Distribution map of factor scores for stream sediment in Area C

Factor 2: High factor score zones are found in the area of Kuamut formation and green schist.

Factor 3: High factor score zones are found along Sungai Segama. No clear relationship with the geology are recognized.

According to the rsults of the factor analyses, the high factor score zones of factor 2 clearly deliniated mineralized zones. This areas may have some potentiality.

2-6 A r e a D

2-6-1 Geology and mineralization

(1) Survey area

Based on the results of regional geochemical survey, this area was selected as the potential area of copper deposits. A soil geochemical survey was carried out in this area.

Area D is situated at southern part of Segama area. The norther part of the survey area show hilly topography and southern part is flat. Main river systems is Sungai Tingkayu at the central part of the area. The southern half of the survey area is developed as plantation.

(2) Geology

Geology of Area C consists of pre-Triassic amphibolite schist (As) and green schist (Gs), Cretaceous to Tertiary ultra-basic rock (Pr), basic rock (Gb) and Chert-Spilite formation (Csba) and Kuamut formation (P_4Km) of Oligocene to middle Miocene. An andesite porphyry intruded in amphibolite schist. Alluvium gravels are found along Sungai Tingkayu. Geologic map of Area D is shown in Fig. II-2-18.

Among pre-Triassic basement rocks, amphibolite schist is widely distributed from northern to erstern part of the area. Green schist is scattered in the eastern part of the area. Ultra-basic rocks consisting of peridotite are found over the green schist. Peridotite is also found as small bodies along the ENE-WSW trending fault in the central part of the area. In limited areas in the eastern and south eastern parts of the area, Chert-Spilite formation occurs over the green schist. This formation mainly consists of basalt lava (Csba) and intercalate some chert beds. Kuamut formation (P_4Km) occurs from the eastern to south western part of the arera and consists of sandstone and mudstone. This formation has fault contact with other formations. An andesite porphyry stock occurs in the area of amphibolite schist at the north eastern margine of the area. Alluvium are found along Sungai

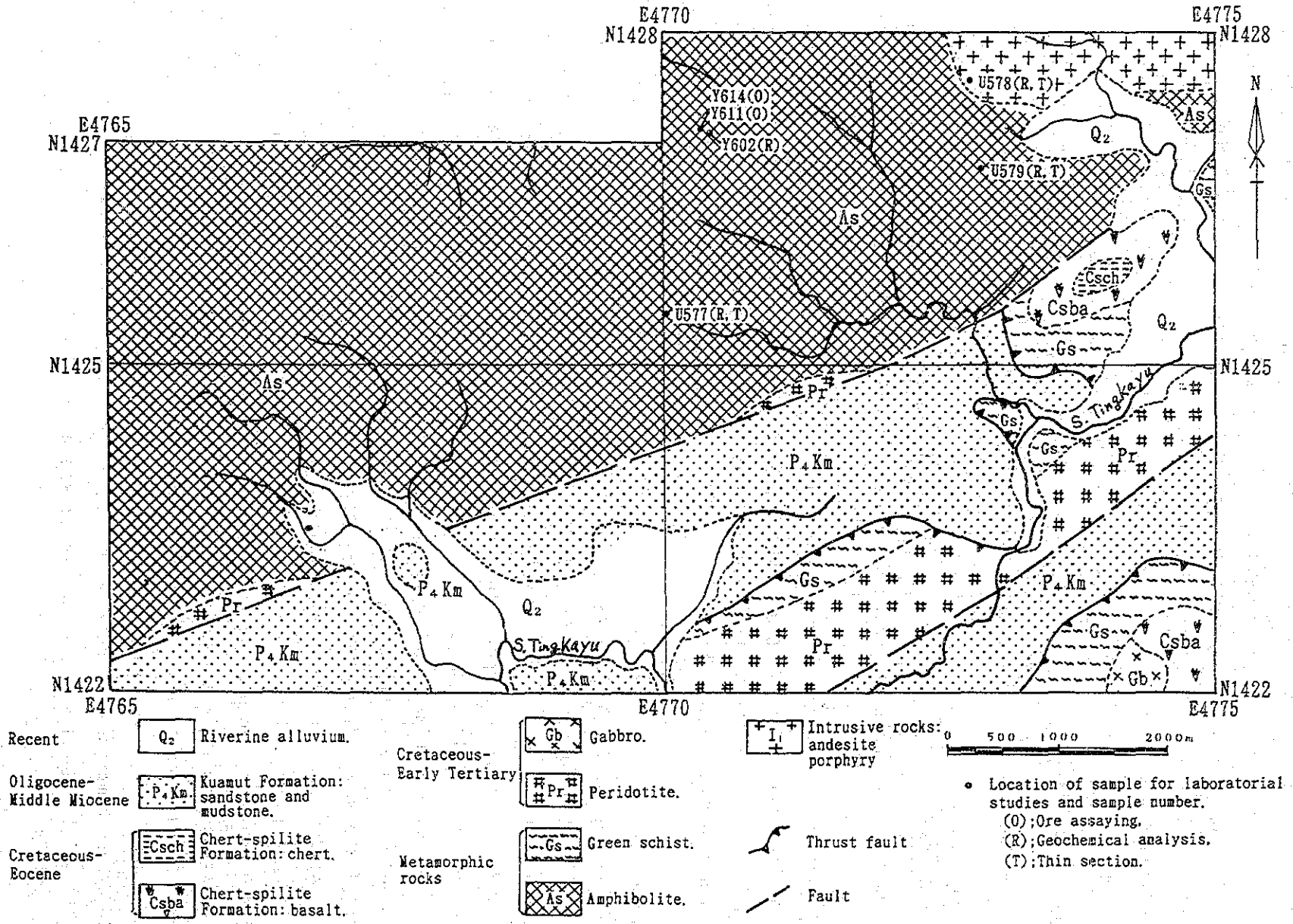


Fig. II-2-18 Geologic map of Area D

Tingkayu.

Geologic structure in this area is characterized with two significant ENE-WSW trending faults and several inferred thrust faults. Because of these fault system, the geologic structure in this area is complicated.

(2) Mineralization

No significant mineralized zones are recognized in this area. Quartz veins with limonite were confirmed in the northern central part of the area. Two quartz vein samples were collected and assayed but the results were not attractive.

2-6-2 Soil geochemical survey

(1) Sampling

Locations of soil samples are shown in Fig. II-2-19. List of soil samples collected in this srvey are shown in Appendix 30. After drying up these samples, -80 mesh fraction samples were used for the chemical analyses.

(2) Statistic data treatment

Analytical results of the soil samples are given in Appendix 31. These data were input in computer and were statistically treated. Statistics calculated are shown in Table II-2-16.

The calculated geometric means give following tendencies comparing to the other areas..

Elements indicating higher value: Co, Sb.

Element indicating lower value: Ba, K, Ti.

Among 21 elements analyzed in this survey, five elements of Mo, Pb and W gave less than the detection limit for most the samples.

In order to clarify the relationship between the elements, correlation coefficient was also calculated. As the results, following pair of element give comparatively good (correlation coefficient: more than 0.500) correlations.

AS-Cr, As-Ni, Co-Cr, Co-Hg, Co-Mg, Co-Mn, Co-Ni, Co-Sb, Cr-Hg, Cr-Mg, Cr-Ni, Cr-Sb, Cu-Zn, Hg-Ni, K-Mo, K-U, Mg-Ni, Na-Sr, Pb-U, S-Sr.

The elements including Co, Cr, Cu, Mg, and Ni give good correlation each other. These elements are relared to ultra-basic rocks.

(3) Single element analysis

Based on the results of statistical data treatment, the threshold values were determined using EDA method. Distribution maps of each element (Appendix 32) were prepared using the ranks delineated by EDA method. Distribution of each element is summarized as following;

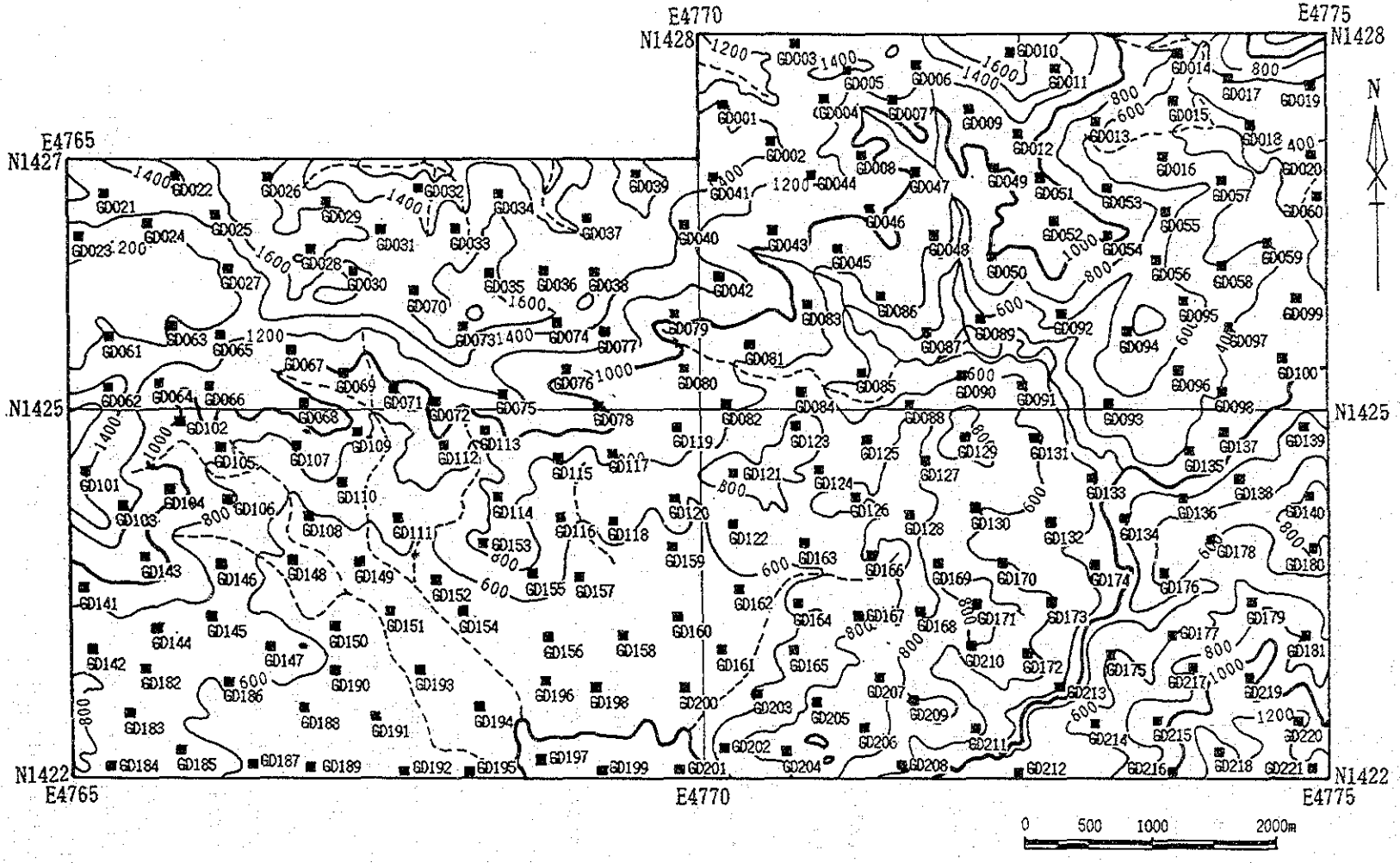


Fig. II-2-19 Location map of geochemical samples in Area D

Table II-2-16 Statistics of soil geochemical survey in Area D

Element	Statistics						EDA method*3		
	Below detection limit (%)	Maximum value	Minimum value	Mean*1 value (b)	Standard deviation	b + 2S.D. *2	Median	Upper Wisker	Upper Fence
As (ppm)	78.7	44	< 1	0.9	0.519	9.7	0.5	2.0	0.50
Au (ppb)	74.7	47	< 1	0.8	0.415	5.4	0.5	1.0	0.50
Ba (ppm)	—	1,020	5	49.5	0.594	764.6	36.0	179.0	—
Co (ppm)	0.9	384	< 1	37.4	0.423	261.9	41.0	67.0	150.3
Cr (ppm)	—	8,419	21	206.8	0.486	1,938.4	203.0	354.0	1,978.7
Cu (ppm)	—	550	4	50.1	0.337	236.2	60.0	94.0	378.9
Hg (ppb)	2.3	228	< 10	55.4	0.280	201.5	61.0	96.0	—
K (%)	28.1	3.01	< 0.01	0.039	0.772	1.365	0.040	0.240	—
Mg (%)	—	12.39	0.04	1.005	0.480	9.190	1.240	2.580	—
Mn (ppm)	14.5	5,215	< 5	434.5	0.978	—	1,006.0	1,701.0	—
Mo (ppm)	89.6	6	< 1	0.6	0.165	1.2	0.5	0.5	0.5
Na (%)	0.5	4.06	< 0.01	0.466	0.739	—	0.960	2.180	—
Ni (ppm)	—	5,711	8	84.2	0.534	986.0	72.0	144.0	544.0
Pb (ppm)	89.6	11	< 2	1.2	0.225	3.3	1.0	1.0	1.0
S (%)	—	0.083	0.008	0.025	0.218	0.067	0.024	0.042	—
Sb (ppm)	1.4	47.5	< 0.2	6.53	0.389	39.11	8.10	11.70	36.45
Sr (ppm)	0.9	299	< 1	39.8	0.585	—	52.0	137.0	—
Ti (%)	—	4.76	0.01	0.566	0.335	2.644	0.670	0.940	2.504
U (ppm)	26.2	3.8	< 0.2	0.32	0.484	3.00	0.20	1.20	—
W (ppm)	99.5	3	< 2	1.0	0.032	1.2	1.0	1.0	1.0
Zn (ppm)	—	489	12	72.1	0.214	193.0	75.0	101.0	210.2

*1: geometric mean *2: background value + 2 x standard deviation *3: Exploratory Data Analysis (Kurzl H.,1988)

As: High value and anomalous zones are found in the eastern and southern part of the area where ultra-basic rocks and Kuamut formation occur.

Au: High value and anomalous zones are sporadically found but the values are low.

Ba High value zones are distibuted in the central part of the area where amphibolite schist and Kuamut formation occur.

Co: High value and anomalous zones are mostly found in the area of ultra-basic rocks at the south eastern part of the area.

Cr: Distribution tendencies are similar to Co. The high value and anomalous zones are found in the area of ultra-basic rocks.

Cu: High value zones are scattered in the area of amphibolite schist. The anomalous zones are found in the north western part of the area, but are small in scale.

Hg: High value zones are scattered and no clear distribution tendencies are recognized.

K : High value zones are concentrated in the area of Kuamut formation.

Mg: The distribution tendencies are similar to Co and Cr. High value zones are found in the area of ultra-basic rocks. High value zones are also found in the area of amphibolite schist.

Mn: High value zones tend to occur in the area of ultra-basic rocks and amphibolite schist.

Mo: No clear distribution tendencies are recognized and the values are low.

Na: High value zones are concentrated in the area of amphibolite schist. Low value zones are found in the area of Kuamut formation.

Ni: These high value zones are restricted in the area of ultra-basic rocks.

Pb: High value zones are concentrated in the area of Kuamut formation. But the values (maximum value; 11 ppm) are low.

S : High value zones are found in the area of amphibolite. The western part has higher values than other parts.

Sb: High value zones are scattered and no clear tendencies are recognized.

Sr: Distribution tendencies are similar to that of S.

Ti: High value zones are found at the boundary between amphibolite and Kuamut formation.

U : High value zones are restricted in the area of Kuamut formation, but the values are low.

W : Because of low value, no clear distribution tendencies are recognized.

Zn: High value and anomalous zones are found in the area of amphibolite and ultra-basic rocks.

Based on the distribution tendencies, the elements which are possibly useful

for the survey in this area were selected and anomaly map (Fig. II-2-20) of these elements was prepared. As shown on this map, anomalous zones are scattered.

(4) Multi element analysis

Factor analysis was adopted as the multi element analysis in this survey. The results of facter analysis are given in Table II-2-17. The relationship between the elements and facters are as following;

Factor 1 : Co-Cr-(Cu)-Mg-Mn-Ni-(S)-(Sb)-Zn
Factor 2 : Na-(S)-Sr-Ti
Factor 3 : Ba-K-U
Factor 4 : (Hg)
Factor 5 : (Zn)

Among these factors, factor 1, 2, 3 and 5 have negative relationship with the related elements. The elements within ( ) indicate weak relation to the factor.

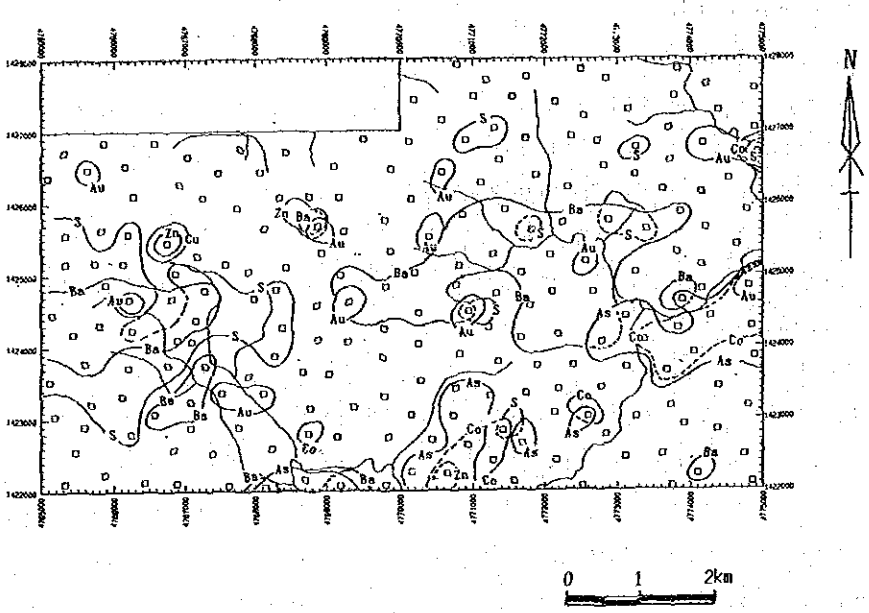
Judging from the relationship between the factor and the elements, factor 1 has relation with ultra-basic and basic rocks and copper mineralization. Factor 2 has weak relation with amphibolite. Factor 3 has relation with sedimentary rocks. Factor 4 has weak relation with Hg. Relation of factor 5 is not clear. Among these facters, three factors of factor 1, 3 and 4 were selected and distribution map (Fig. II-2-21) of factor scores were prepared using different colors for each factor. The relationship between the color and the factor are as following;

Factor 1 : blue Factor 3 : yellow Factor 4 : red

Distribution tendencies of these factor scores are summarized as following;

Factor 1: High factor score zones are found in the area of ultra-basic rocks.
Factor 3: High factor score zones are found in the area of Kuamut formation and
Factor 4: High factor score zones are found along the boundary between Kuamut formation and amphibolite.

According to the rsults of the factor analyses, the area overlapping the Factor 1 and 4 high factor scores may have some potentiality.



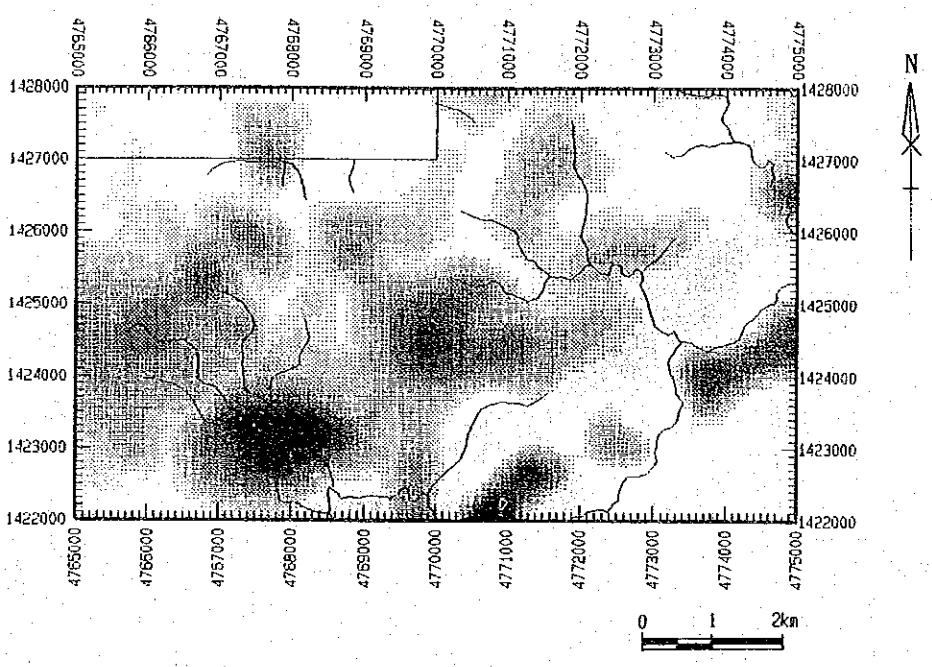
As	>	9.7 ppm	Co	>	150.3 ppm	Zn	> 210.2 ppm
Au	>	5.4 ppb	Cu	>	378.9 ppm		
Ba	>	179.0 ppm	S	>	0.042 %		

Fig. II-2-20 Distribution map of geochemical anomalous zones in Area D

Table II-2-17 Results of factor analyses for soil samples in Area D

Element	Factor loading (Varimax rotation)					Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
As	-0.021	0.685	-0.227	0.026	-0.076	0.5282
Au	-0.053	-0.030	0.085	0.353	-0.099	0.1451
Ba	0.009	-0.075	-0.816	0.083	0.045	0.6799
Co	-0.815	0.029	0.201	0.331	0.065	0.8199
Cr	-0.664	0.534	0.099	0.373	0.182	0.9070
Cu	-0.465	-0.453	0.146	0.435	-0.189	0.6668
Hg	-0.091	0.143	-0.080	0.578	0.136	0.3876
K	0.225	0.036	-0.791	-0.258	-0.081	0.7505
Mg	-0.767	0.043	0.123	-0.336	-0.102	0.7286
Mn	-0.710	-0.218	0.108	0.044	0.107	0.5768
Mo	0.201	0.075	-0.171	0.040	-0.441	0.2711
Na	-0.389	-0.769	0.080	-0.297	-0.142	0.8581
Ni	-0.749	0.551	0.082	0.286	0.047	0.9551
Pb	0.330	0.315	-0.330	-0.226	-0.158	0.3925
S	-0.503	-0.499	0.044	-0.068	0.259	0.5753
Sb	-0.575	-0.110	0.025	-0.007	0.237	0.4002
Sr	-0.222	-0.635	-0.209	-0.598	0.027	0.8546
Ti	0.120	-0.746	-0.156	0.111	0.008	0.6081
U	0.564	0.366	-0.507	-0.008	-0.012	0.7089
W	-0.013	-0.025	0.053	-0.019	-0.381	0.1495
Zn	-0.686	-0.029	-0.028	0.274	-0.424	0.7267
F.C.*1	37.6 %	26.7 %	15.3 %	13.8 %	6.5 %	—

*1: Factor contribution



Factor 1 factor score: Blue　　Factor 3 factor score: Yellow
Factor 4 factor score: Red

Fig. II-2-21　Distribution map of factor scores in Area D