determined statistically corresponds to the upper 8 % level of the second population. The cumulative frequency curve of the second population shows a tendency of positive skewness.

Rock code 4 : Au shows a kind of dual distribution as shown in FIG.2-2-8. Geochemical values consist of principally two populations, that is, cumulative frequency of each population is about 90 %, and 10 %. The threshold value(GM + 2δ) determined statistically corresponds near the median value of the second population.

Rock code 5 : The cumulative frequency curve shows almost same characteristics to that of rock code 4 as shown in FIG.2-2-8.

Correlation Coefficient between Indicators

The correlation coefficients between indicators on a logarithmic base were calculated for each geological units. In the geological units, correlation coefficients between respective indicators were small, suggesting that the origins of individual indicators are different from each other.

TABLE 2-2-10 show the correlation coefficients on corresponding rock codes. Results of interpretation are summarized below:

Rock code 3 : The most numerous correlations among the indicators were obtained in this rock code. That is, Au-As, Au-Bi, As-Cu, As-Zn, As-Ni, As-Fe, Bi-Cu, Bi-Zn, Bi-Ni, Bi-Fe, Zn-Cr, and Cr-Ni show correlation of medium degree. On the other hand, As-Bi, Cu-Zn, Cu-Ni, Cu-Fe, Zn-Ni, Zn-Fe, and Ni-Fe show strong correlations.

These facts suggest that As, Bi, and Zn have relatively high correlation coefficients for other elements.

Rock code 4 : Indicators of Cu-Zn, Cu-Fe, Zn-Ni, and Ni-Fe show correlation of medium degree. On the other hand, Cu-Ni, and Zn-Fe show strong correlations.

Rock code 5 : Indicators of As-Fe, Cu-Zn, Zn-Ni, and Zn-Fe show medium correlations. On the other hand, Cu-Ni, Cu-Fe, and Ni-Fe show strong correlations.

2-3-3 Interpretation

Principal Component Analysis

After determining the correlation coefficients between indicators, which cannot be extracted by single variable analyses, from multi-dimensional distribution characteristics, these were applied to the determination of character and the evaluation of geochemical anomalies. Results of analysis are shown in TABLE 2-2-11.

General characteristics of each geological unit are summarized below:

Rock code 3 : As shown in TABLE 2-2-11(1), the contribution ratio for the first principal component to all the principal components is about 44 %, occupying nearly half of all. The total to the ratio of the fifth principal component amounts to 90 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is generally large. Each component, except for the first component, drops gradually and this code is characterized by the large contribution ratio of the first component.

For the first principal component, Au, As, Bi, and Cr show medium correlation values of 0.57~0.68. On the other hand Cu, Zn, Ni and Fe have strong correlations of 0.86~0.92. Therefore, the first principal component is characterized by high concentration of these indicators.

The second principal component is characterized by medium correlations of Au and Bi and a strong correlation(0.72) with As. On the other hand, Cr and Ni have negative medium correlations(-0.46~-0.52) for the component.

The third principal component has a strong correlation(0.72) with Ag and a negative strong correlation(-0.72) with F. It means anomalous concentrations of these indicators are shown as high score or negative score.

The fourth principal component shows medium correlation(0.60~0.64) with Ag and Fe.

The fifth principal component is characterized by a medium correlation(0.53) with Cr.

Rock code 4 : As shown in TABLE 2-2-11(2), the contribution ratio for the first principal component to all the principal components is about 28 %, occupying less than one third of all. The total to the ratio of the fifth principal component amounts to 80 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is not so big and not decisive. Each component, except the first principal component, drops gradually and does not change markedly.

For the first principal component, Zn show a medium correlation value(0.62) and strong correlations(0.75~0.86) with Cu, Ni, and Fe. Therefore, the first principal component correlates to the indicators and reflects as high scores to the concentration of the indicators.

The second principal component is characterized by medium correlations

(0.43～0.64) with Au, Zn, and Cr. On the other hand, negative medium correlations (-0.43～-0.53) with As and Ni. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has medium correlations(0.58～0.59) with Au, and Bi and a negative medium correlation(-0.56) with Zn.

The fourth principal component is characterized by a strong correlation (0.82) with F and a negative medium correlation(-0.66) with Ag.

The fifth principal component show only medium correlations(0.50～0.58) with Ag and As.

Rock code 5 : As shown in TABLE 2-2-11(3), the contribution ratio for the first principal component to all the principal components is about 41 %, occupying nearly half of all. The total to the ratio of the fifth principal component amounts to 84 % approximately, so that a greater part of the fluctuation of all components can be explained by them. However, the contribution ratio of each principal is rather large. Each component, except for the first principal component, drops gradually.

For the first principal component, As shows a medium correlation value (0.59) and strong correlations(0.83～0.95) with Cu, Zn, Ni, and Fe. Therefore, the first principal component correlates to the indicators and reflects as high scores to the concentration of the indicators.

The second principal component is characterized by medium correlations (0.56～0.63) with Ag, As, and Bi. On the other hand, a negative medium correlation (-0.41) with Cr. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has a strong correlation(0.80) with F and a negative medium correlation(-0.48) with Ag. Therefore, high or low negative scores are expected for the concentration of these indicators.

The fourth principal component is characterized by a medium correlation (0.56) with Ag and a negative medium correlation(-0.50) with Bi.

The fifth principal component show only a strong correlation(0.77) with Au and a negative medium correlation(-0.46) with F. The component is worth notice for the gold exploration, although the contribution ratio is as low as 9 %.

Au Concentration and Principal Component Scores

The concentration distribution of Au in the surveyed zone indicates no anomalous zone with good continuity (see FIG. 2-2-9). Since a Muchacha mineralized zone has been found in this zone, it was expected that an association between this zone and geochemical anomalies would be found. However, no noteworthy anomalous zone was found by geochemical soil exploration around the mineralized zone.

No special relationship was found between geochemical anomalies and geology for mafic granulite, felsic granulite and gneissose granulite distributed in this area.

The distribution of Au does not seem to be controlled by a specific geology, since Au is distributed in a scattered manner.

High contrasts against Au and As of soil on code 3 rock is noticeable. In addition, contrasts against Cr for codes 3, 4 and 5 have high values of 500.

Principal components highly related to Au are the second component for code 3, the third component for code 4 and the fifth component for code 5. FIG. 2-2-10 indicates the distribution of these high scores. From the figure showing scattered distribution of high scores, no promising zone could be specified. It may well be that, because of the above-mentioned weak contribution ratios of these principal components, their relationship with Au will be diluted by the effects of other indicators.

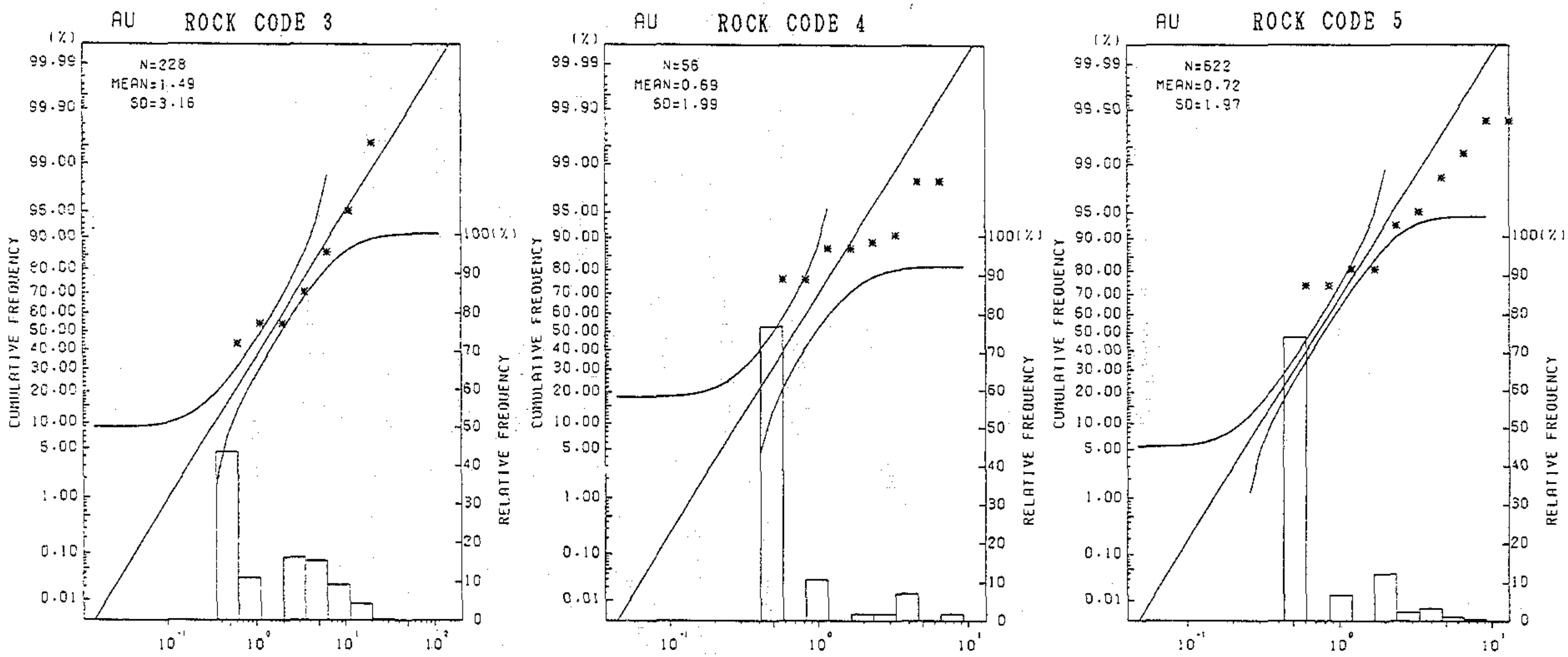

FIG. 2-2-8 Frequency Distribution and Cumulative Frequency Curve (Au;Muchacha Zone)

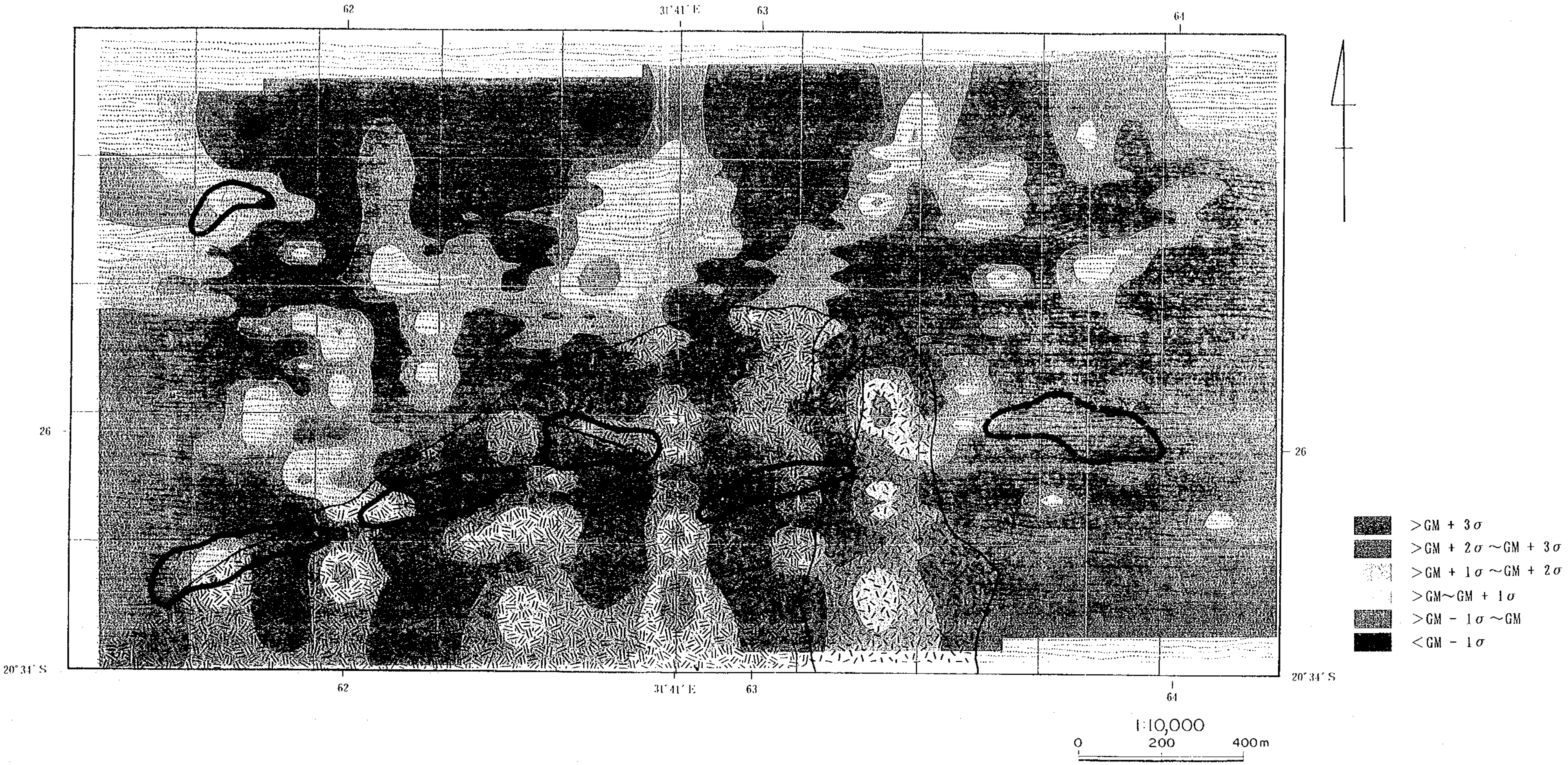

FIG. 2-2-9 Gold Distribution (Muchacha Zone)

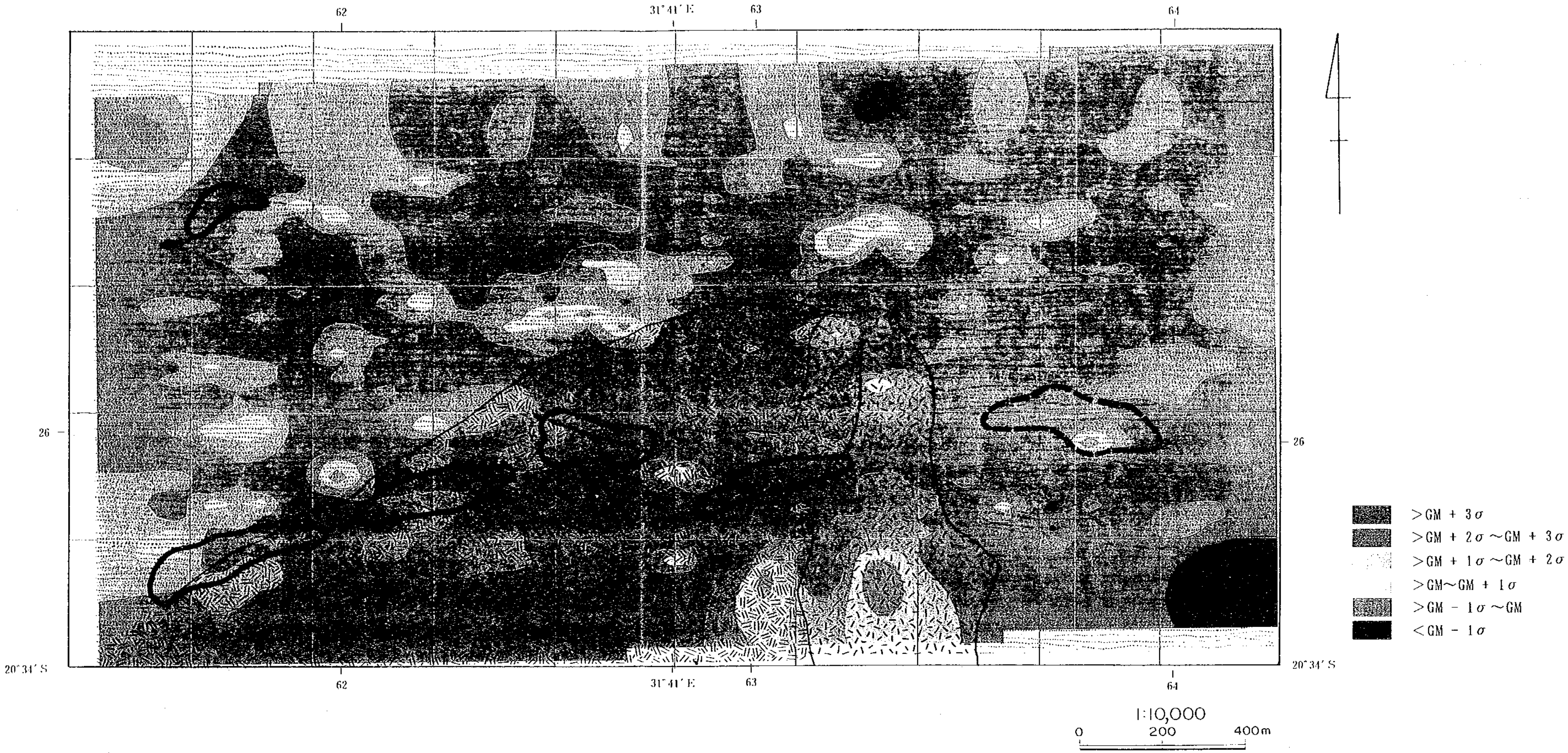

FIG. 2-2-10 Distribution of Principal Component Scores (Muchacha Zone)

TABLE 2-2-9 Statistical Parameter of Indicators (Muchacha Zone)

SOIL <ROCK CODE>	NO. OF SAMPLE	Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	
		GEOMETRIC MEAN (PPM)										
MAFIC GRANULITE <3>	228	1.50	0.34	5.38	0.09	33.74	25.97	59.03	163.97	75.45	5.09	←g.m.
		3.16	1.56	7.75	2.17	4.60	2.07	3.33	3.22	4.63	2.89	←s.d.
FELSIC GRANULITE <4>	56	0.69	0.33	0.58	0.05	5.74	15.24	25.48	77.32	11.48	1.55	←g.m.
		2.00	1.49	1.33	1.14	1.85	1.75	3.04	1.75	1.66	1.49	←s.d.
GNEISSOSE GRANULITE <5>	622	0.72	0.46	0.73	0.05	6.55	20.61	22.22	53.07	21.69	1.53	←g.m.
		1.97	2.39	1.86	1.26	2.41	2.01	2.18	3.26	1.93	1.63	←s.d.
		MINIMUM VALUE (PPM)										
MAFIC GRANULITE <3>	228	0.50	0.25	0.50	0.05	2.00	10.00	3.00	1.00	5.00	0.87	
FELSIC GRANULITE <4>	56	0.50	0.25	0.50	0.05	1.00	10.00	0.50	19.00	5.00	0.67	
GNEISSOSE GRANULITE <5>	622	0.50	0.25	0.50	0.05	0.50	10.00	0.50	0.50	5.00	0.41	

SOIL <ROCK CODE>	Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	
	THRESHOLD (PPM)										
MAFIC GRANULITE <3>	4.74	0.53	41.73	0.18	155	54	197	527	349	14.70	←g.m.+ s.d
	14.98	0.82	323.59	0.40	714	111	656	1,695	1,619	42.49	←g.m.+2 s.d.
	47.36	1.27	2,509	0.87	3,284	230	2,185	5,449	7,498	――	←g.m.+3 s.d.
FELSIC GRANULITE <4>	1.38	0.50	0.77	0.06	11	27	78	135	19	2.31	←g.m.+ s.d
	2.76	0.74	1.03	0.06	20	47	236	236	32	3.43	←g.m.+2 s.d.
	5.52	1.10	1.37	0.07	36	82	717	413	52	5.10	←g.m.+3 s.d.
GNEISSOSE GRANULITE <5>	1.42	1.10	1.36	0.07	16	41	49	173	42	2.49	←g.m.+ s.d
	2.80	2.64	2.54	0.09	38	83	106	562	81	4.06	←g.m.+2 s.d.
	5.53	6.31	4.72	0.11	92	168	231	1,830	157	6.62	←g.m.+3 s.d.
	MAXIMUM VALUE (PPM)										
MAFIC GRANULITE <3>	23.00	1.50	1,120	1.00	302	150	349	3,950	1,820	17.20	
FELSIC GRANULITE <4>	7.00	0.80	1.00	0.10	22	68	92	310	56	2.91	
GNEISSOSE GRANULITE <5>	27.00	14.20	15.00	0.30	149	310	159	777	372	12.08	

g.m. : geometric mean s.d. : standard deviation

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
MUCHACHA ZONE (SOIL)										
R.C.3	1.50	0.34	5.38	0.09	33.74	25.97	59.03	163.97	75.45	5.09
R.C.4	0.69	0.33	0.58	0.05	5.74	15.24	25.48	77.32	11.48	1.55
R.C.5	0.72	0.46	0.73	0.05	6.55	20.61	22.22	53.07	21.69	1.53

ROCK TYPE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
MAFIC ROCK	4.00	0.10	2.00	0.01	100	370	130	200	160	8.56
INT. ROCK	――――	0.07	2.40	0.01	35	500	72	50	55	5.85
FELSIC ROCK	4.50	0.05	1.50	0.01	20	800	6	25	8	2.70
GRANITE	1.00	0.05	0.25	0.43	12	1,250	85	7	5	1.85
MICA SCHIST	――――	0.30	――――	――――	30	――――	70	70	50	4.90
<After Flanagan(1976) & Vinogradov(1962)>										
MUCHACHA ZONE (ROCK)										
R.C.3	0.50	0.25	2.00	0.05	123	60	63	1	84	7.33
R.C.4	1.00	0.25	2.00	0.05	4	31	21	5	12	0.32
R.C.5	0.50	0.25	1.00	0.05	14	234	79	1	39	2.67

INT. ROCK : INTERMEDIATE ROCK
―――― : NO DATA

TABLE 2-2-10(1) Matrix of Correlation Coefficients (Muchacha Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.05	1.00								
As	0.50	-0.07	1.00							
Bi	0.47	-0.18	0.80	1.00						
Cu	0.29	-0.10	0.64	0.58	1.00					
F	-0.08	-0.09	0.05	0.01	0.02	1.00				
Zn	0.31	-0.05	0.64	0.58	0.91	-0.04	1.00			
Cr	0.17	-0.04	0.31	0.32	0.44	-0.06	0.42	1.00		
Ni	0.29	-0.08	0.57	0.53	0.94	0.03	0.87	0.56	1.00	
Fe	0.27	-0.10	0.57	0.55	0.95	0.07	0.91	0.36	0.90	1.00

TABLE 2-2-10(2) Matrix of Correlation Coefficients (Muchacha Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.07	1.00								
As	-0.03	0.00	1.00							
Bi	0.39	-0.14	0.13	1.00						
Cu	0.18	-0.07	0.20	0.30	1.00					
F	0.07	-0.19	0.06	0.01	-0.11	1.00				
Zn	0.10	0.02	0.02	0.03	0.44	0.02	1.00			
Cr	0.36	0.04	-0.18	-0.05	0.11	0.01	0.11	1.00		
Ni	0.09	-0.07	0.21	0.25	0.74	-0.16	0.43	-0.17	1.00	
Fe	0.23	0.08	0.08	0.25	0.55	0.06	0.74	0.00	0.49	1.00

TABLE 2-2-10(3) Matrix of Correlation Coefficients (Muchacha Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.00	1.00								
As	0.10	0.20	1.00							
Bi	0.18	0.13	0.22	1.00						
Cu	0.09	-0.19	0.31	0.03	1.00					
F	0.10	0.00	-0.03	0.18	0.11	1.00				
Zn	0.15	0.06	0.28	0.09	0.55	0.06	1.00			
Cr	-0.06	-0.20	0.13	-0.06	0.35	-0.06	0.16	1.00		
Ni	0.09	0.13	0.36	0.12	0.70	0.11	0.49	0.21	1.00	
Fe	0.16	0.01	0.41	0.08	0.79	0.12	0.67	0.31	0.73	1.00

TABLE 2-2-11(1) Results of Principal Component Analysis (Muchacha Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	4.4120	0.4412 (0.4412)	0.57	-0.15	0.58	0.68	0.86	-0.10	0.92	0.63	0.74	0.86	2.230	-1.604
Z2	1.7200	0.1720 (0.6132)	0.52	-0.03	0.72	0.56	-0.18	0.24	-0.12	-0.46	-0.52	-0.17	8.735	-1.014
Z3	1.1280	0.1128 (0.7260)	0.26	0.74	0.02	0.00	-0.04	-0.70	0.07	0.02	-0.04	-0.15	6.815	-1.630
Z4	0.8950	0.0895 (0.8155)	-0.08	0.64	-0.06	-0.09	0.09	0.60	0.14	-0.14	-0.03	0.23	5.159	-1.027
Z5	0.7610	0.0761 (0.8916)	0.32	0.08	0.07	-0.07	-0.35	0.28	-0.11	0.53	0.25	-0.29	4.483	-1.041

TABLE 2-2-11(2) Results of Principal Component Analysis (Muchacha Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.7830	0.2783 (0.2783)	0.29	-0.15	0.18	0.45	0.85	0.06	0.62	0.16	0.75	0.86	3.409	-2.001
Z2	1.5490	0.1549 (0.4332)	0.53	0.14	-0.53	-0.17	-0.25	0.21	0.43	0.64	-0.43	0.23	2.114	-1.431
Z3	1.3410	0.1341 (0.5673)	0.59	-0.24	0.10	0.58	0.12	-0.21	-0.56	0.36	-0.06	-0.28	3.876	-1.180
Z4	1.2250	0.1225 (0.6898)	0.06	-0.66	0.07	0.15	-0.14	0.82	0.04	-0.23	-0.12	-0.02	2.768	-2.701
Z5	1.0130	0.1013 (0.7911)	0.29	0.58	0.50	0.28	-0.25	0.20	0.05	-0.28	-0.22	0.19	2.217	-2.474

TABLE 2-2-11(3) Results of Principal Component Analysis (Muchacha Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	4.1260	0.4126 (0.4126)	0.32	-0.03	0.59	0.36	0.95	0.07	0.83	0.53	0.89	0.94	7.649	-1.331
Z2	1.3240	0.1324 (0.5450)	0.28	0.56	0.56	0.63	-0.08	0.00	-0.09	-0.41	-0.16	-0.13	10.011	-1.488
Z3	1.0890	0.1089 (0.6539)	0.35	-0.48	-0.10	0.24	0.00	0.80	-0.03	-0.15	-0.06	-0.04	8.816	-2.862
Z4	0.9570	0.0957 (0.7496)	0.22	0.56	-0.26	-0.50	0.05	0.32	0.13	-0.33	0.15	0.15	10.168	-1.816
Z5	0.9010	0.0901 (0.8397)	0.77	-0.23	-0.05	-0.16	-0.01	-0.46	0.04	-0.08	-0.07	-0.05	16.998	-2.394

TABLE 2-2-12 Contrast (Muchacha Zone)

SOIL & ROCK R. C. <3, 4, 5>	NO. OF SAMPLE	CONTRAST									
		Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
SOIL<3> TH2		29.95	3.28	161.80	8.01	5.80	1.85	10.41	1,695	19.27	5.80
SOIL<3> TH1	228	9.47	2.11	20.87	3.69	1.26	0.89	3.12	527.17	4.16	2.01
SOIL<3>GM		3.00	1.36	2.69	1.70	0.27	0.43	0.94	163.97	0.90	0.69
R O C K <3>(GM.PPM)	2	0.50	0.25	2.00	0.05	123.00	60.00	63.00	1.00	84.00	7.33
SOIL<4> TH2		2.76	2.96	0.51	1.20	4.90	1.51	11.23	47.25	2.63	10.72
SOIL<4> TH1	56	1.38	1.98	0.39	1.05	2.65	0.86	3.69	27.03	1.59	7.21
SOIL<4>GM		0.69	1.33	0.29	0.93	1.44	0.49	1.21	15.46	0.96	4.85
R O C K <4>(GM.PPM)	1	1.00	0.25	2.00	0.05	4.00	31.00	21.00	5.00	12.00	0.32
SOIL<5> TH2		5.61	10.56	2.54	1.72	2.72	0.36	1.34	562.26	2.08	1.52
SOIL<5> TH1	622	2.84	4.42	1.36	1.36	1.13	0.18	0.61	172.74	1.08	0.93
SOIL<5>GM		1.44	1.85	0.73	1.08	0.47	0.09	0.28	53.07	0.56	0.57
R O C K <5>(GM.PPM)	2	0.50	0.25	1.00	0.05	14.00	234.00	79.00	1.00	39.00	2.67

TH2:THRESHOLD (GM+2 STANDARD DEVIATION)
TH1:THRESHOLD (GM+1 STANDARD DEVIATION)
GM:GEOMETRIC MEAN

2-4 BENZI ZONE

2-4-1 Sampling

Soil sampling lines were set on north-south direction due to east-west occurrences of mineralized signs such as Fe-hydroxide, pegmatite quartz etc. and B-horizon soils were taken. Soil colour in the zone poorly reflects the basement geology. In general, brown soils are predominant in the zone and gray soils prevail on central portion of the zone. Soils taken over the mafic granulite, felsic granulite, and gneissose granulite are 123, 157, and 448, respectively.

2-4-2 Geochemical Indicators

Several mineralized signs were found within the zone. Analytical results of the soils also roughly agreed with the observations which confirmed the sulphide mineralization in the field. The contents on geochemical indicators compared with other area and all studied zone by phase II are shown as follows.

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
BENZI ZONE (SOIL)										
R.C.3	3.24	0.57	0.60	0.06	14.88	24.05	37.17	33.32	25.12	3.10
R.C.4	2.00	1.23	0.50	0.05	11.27	26.62	65.97	15.63	12.07	3.77
R.C.5	2.06	0.79	0.59	0.06	10.90	25.27	49.53	25.99	16.16	2.65

Background Geology and Indicator Content

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-13. According to this table, geochemical characteristics on each element are summarized as follows:

Au : Geometric means(GMs) of rock code 3, rock code 4, and rock code 5 of all zones are 1.73, 0.98, and 0.93 ppb, respectively but rock code 3 in the zone has the largest value of 3.24 ppb. On the other hand, the smallest GM is 2.00 ppb of rock code 5. A comparison on the content of indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Au content in the zone can be pointed out to be rather low. The maximum value in the zone is 922 ppb.

Ag : GMs of rock code 3, rock code 4, and rock code 5 of all zones are 0.63, 0.48, and 0.53 ppm, respectively but rock code 4 in the zone has the largest value of 1.23 ppm. On the other hand, the smallest GM is 0.57 ppm of rock code 3. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Ag content in the zone is higher than that of the areas, with a maximum value of 5.10 ppm.

As : Since approximately 60 % of data indicated content below its detection limit(1.00 ppm), it is difficult to clarify its geochemical character in the zone. GMs of rock code 3, rock code 4, and rock code 5 of all zones are 2.25, 0.58 and 0.66 ppm, respectively but rock code 3 in the zone has the largest value of 0.60 ppm and other rock codes of the zone also have similar contents.
A comparison on content of the indicator between the zone and other area based on data by Flanagan(1976) and Vinogradov(1962) was made. Content of rock code 3 in the zone is fairly low, with maximum value of 3 ppm.

Bi : Since approximately 80 % of data indicated content below its detection limit(0.10 ppm), it is difficult to clarify its geochemical character in the zone. GMs of all zones are 0.06, 0.05, and 0.05 ppm, respectively. There is no difference among the GMs of elements. A comparison on content of the indicator between the zone and other area based on data by Flanagan(1976) and Vinogradov(1962) was made. Content in the zone is nearly the same. Maximum value in the zone is 1.50 ppm.

Cu : GMs of rock code 3, rock code 4, and rock code 5 of all zones are 61.57, 8.82, and 12.86 ppm, respectively but rock code 3 in the zone has the largest value of 14.88 ppm. On the other hand, the smallest GM is 10.90 ppm of rock code 5. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Copper contents of the zone are fairly low for the that of the areas compared. The maximum value in the zone is 162 ppm.

F : GMs of rock code 3, rock code 4, and rock code 5 of the zone are 26.42, 23.02, and 30.30 ppm, respectively but rock code 4 in the zone has the largest value of 26.62 ppm. On the other hand, the smallest GM is 24.05 ppm of rock code 3. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. F content in the zone is fairly low, with maximum value of 520 ppm.

Zn : GMs of rock code 3, rock code 4, and rock code 5 of the zone are 90.47, 40.41, and 37.45 ppm, respectively but rock code 4 in the zone has the largest value of 65.97 ppm. On the other hand, the smallest GM is 37.17 ppm of rock code 3. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Zn content in the zone is rather low compared with that of the areas. The maximum value in the zone is 287 ppm.

Cr : GMs of rock code 3, rock code 4, and rock code 5 of the zone are 215.97, 30.92, and 44.07 ppm, respectively but rock code 3 in the zone has the largest value of 33.32 ppm. On the other hand, the smallest GM is 15.63 ppm of rock code 4. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Cr contents of the zone is rather low. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 679 ppm.

Ni : GMs of rock code 3, rock code 4, and rock code 5 of the zone are 153.32, 11.77, and 19.23 ppm but rock code 3 in the zone has the largest value of 25.12 ppm. On the other hand, the smallest GM is 12.07 ppm of rock code 4. A comparison on content of the indicator between the zone and other area based on data by Flanagan(1976) and Vinogradov(1962) made clear that Ni content of the zone is fairly low for that of the area compared. However, values of Flanagan's data fluctuate greatly for various rock types. The maximum value in the zone is 268 ppm.

Fe : GMs of rock code 3, rock code 4, and rock code 5 of the zone are 6.89, 1.96, and 1.90 %, respectively but rock code 3 in the zone has the largest value of 3.77 %. On the other hand, the smallest GM is 2.65 % of rock code 5. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Fe content in the zone is rather low. The maximum value in the zone is 8.72 %.

Determination of Threshold Values

An interpretation was conducted on the cumulative frequency curve of Au in each geological unit. The results are summarized as follows:

Rock code 3 : Au shows a kind of dual distribution as shown in FIG.2-2-11. Geochemical values principally consist of two populations, frequency of each population is about 30 %, and 70 %. The threshold value(GM + 2δ) determined statistically corresponds to the upper 3 % level of the second population. The second population shows a log normal distribution.

Rock code 4 : Au shows a kind of dual distribution as shown in FIG.2-2-11.

Geochemical values principally consist of two populations, frequency of each population is about 40 %, and 60 %. The threshold value(GM + 2δ)determined statistically corresponds to the upper 4 % level of the second population. The second population shows a log normal distribution.

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-11. Geochemical values principally consist of two populations, frequency of each population is about 40 %, and 60 %. The threshold value(GM + 2δ)determined statistically corresponds to the upper 4 % level of the second population.

Each rock code in the zone shows similar cumulative frequency curve pattern, suggesting that geochemical characteristics over the rock codes are nearly identical.

Correlation Coefficient between Indicators

The correlation coefficients between indicators on a logarithmic base were calculated for each geological units. In the geological units, correlation coefficients between respective indicators were small, suggesting that the origins of individual indicators are different from each other.

TABLE 2-2-14 shows the correlation coefficients on corresponding rock codes. Results of interpretation are summarized below:

Rock code 3 : The medium correlation coefficient was obtained in this rock code. That is, Au-Cu, Au-Cr, Au-Ni, Cu-Cr, Cu-Ni, and Cr-Ni shown correlation of medium degree. No strong correlation is detected in the rock code 3.

Rock code 4 : Indicators of Cu-Zn, Cu-Ni, Cu-Fe, and Zn-Fe show correlation of medium degree. On the other hand, Ag-Ni show a negative medium correlation.

Rock code 5 : Only medium correlation are shown in Cu-Ni, and Cr-Ni. On the other hand, As-Zn shows a negative medium correlation.

2-4-3 Interpretation

Principal Component Analysis

After determining the correlation coefficients between indicators, which cannot be extracted by single variable analyses, from multi-dimensional distribution characteristics, these were applied to the determination of character and the evaluation of geochemical anomalies. Results of analysis are shown in TABLE 2-2-15.

General characteristics of each geological unit are summarized below:

Rock code 3 : As shown in TABLE 2-2-15(1), the contribution ratio for the first principal component to all the principal components is about 29%, occupying less than one fourth of all. The total to the ratio of the fifth principal component amounts to 73 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is general small and not decisive. Each component drops gradually and does not change markedly.

For the first principal component, Ag, Zn, Cr, Ni, and Fe show a medium correlation value of 0.41～0.66. On the other hand Au and Cu has strong correlation value of 0.73～0.88. Therefore, the first principal component is characterized by high concentration of these indicators.

The second principal component is characterized by a medium correlation (0.45～0.65) of Ag, As, and Zn. Therefore, the component is characterized by high concentration of these indicators.

The third principal component has a medium correlation(0.68) with As, and negative medium correlation(-0.65) with Bi. It means anomalous concentrations of these indicators are shown as high and negative score values.

The fourth principal component only shows a strong correlation(0.85) with F. Geochemical characteristics in the zone are unable to determine .

The fifth principal component is characterized by a medium correlation (0.53) with Bi and a negative medium correlation(-0.52) with Fe. The contribution ratio, however, does not show any significant value indicating 9 %.

<u>Rock code 4</u> : As shown in TABLE 2-2-15(2), the contribution ratio for the first principal component to all the principal components is about 27%, occupying less than one third of all. The total to the ratio of the fifth principal component amounts to 75 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is generally small and not decisive. Each component, except the first principal component, drops gradually and does not change markedly.

For the first principal component, Zn, Cr, and Fe show a medium correlation value(0.45～0.61) and strong correlation(0.86～0.89) with Cu and Ni. Therefore, the first principal component correlates to the indicators and reflects as high scores to the concentration of the indicators. And a negative medium correlation(-0.47) with Ag was found.

The second principal component is characterized by medium correlations (0.58～0.68) with Zn, and Fe. On the other hand, a negative medium correlation (-0.58) with Cr. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has medium correlations(0.40～0.54) with Au, and Bi. On the other hand, a negative medium correlation(-0.59) with F. Therefore, high scores and low negative scores are expected for the concentration of these indicators.

The fourth principal component is characterized by a medium correlation (0.65) with Au and a negative medium correlation(-0.65) with Bi. The component is worth notice for the gold exploration, although the contribution ratio is as low as 10 %.

The fifth principal component show only a strong correlation(0.88) with As. No any significant geochemical characteristics were detected.

Rock code 5 : As shown in TABLE 2-2-15(3), the contribution ratio for the first principal component to all the principal components is about 19%, occupying less than one fifth of all. The total to the ratio of the fifth principal component amounts to 69 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is generally small and not decisive. Each component, except the first principal component, drops gradually and does not change markedly.

For the first principal component, Cr, and Ni show strong correlation value(0.73～0.79) and negative correlations(-0.46～-0.56) with Ag and Fe. Therefore, the first principal component correlates to the indicators and reflects as high scores to the concentration of the indicators.

The second principal component is characterized by medium correlations (0.43～0.66) with Zn, Ni, and Fe. On the other hand, a strong correlation(0.80) with Cu. High scores are expected in the concentration of these indicators.

The third principal component has a strong correlation(0.85) with As. Therefore, high scores are expected for the concentration of these indicators.

The fourth principal component is characterized by a medium correlation (0.65) with Au and a negative medium correlation(-0.64) with Bi. The component is worth notice for the gold exploration, although the contribution ratio is as low as 10 %.

The fifth principal component show only medium correlations(0.59～0.69) with Bi. The component is worth notice for the gold exploration, although the contribution ratio is less than 10 %.

Au Concentration and Principal Component Scores

The concentration distribution of Au in the surveyed area indicates an anomalous zone (GM+σ ~ GM+2σ) with good continuity in the ENE-WSW direction, as shown in FIG. 2-2-12. Since mineralized signs have been found in the south of the anomalous zone, it was expected that an association between the mineralized signs and geochemical anomalies would be found. A noteworthy anomalous zone was found by soil geochemical survey. The center of the above anomalous zone was found to lie 200 ~ 300m north of the distribution zone of mineralized signs. Since the anomalous zone is located on a gentle slope, it may well be that it represents hydromorphic anomalies in which Au has been transported from a higher portions, although this is not so remarkably indicated as the Jegede anomalous zone. Nevertheless, it is naturally possible that the extension in the ENE-WSW direction indicated by the anomalous zone suggests the existence of a mineralized zone directly relating to the anomalous zone.

Anomalies are most widely distributed in mafic granulite. But they are also distributed in other geological units, i.e., felsic granulite and gneissose granulite, indicating that the distribution is not limited to a specific geology.

Contrasts can be characterized by high values of Au in soil on rock code 3, 4, and 5 (TABLE 2-2-16).

Principal components highly related to Au are the first component for code 3 and the fourth component for code 4 and 5. The condition of the distribution of such high component scores is shown in FIG.2-2-13. Since the figure shows scattered distribution of the high scores, except those for code 3, no promising place could be specified. Again in this case, it is possible that, because of the weak contribution ratios of such principal components, their relationship with Au is diluted by the effects of other indicators.

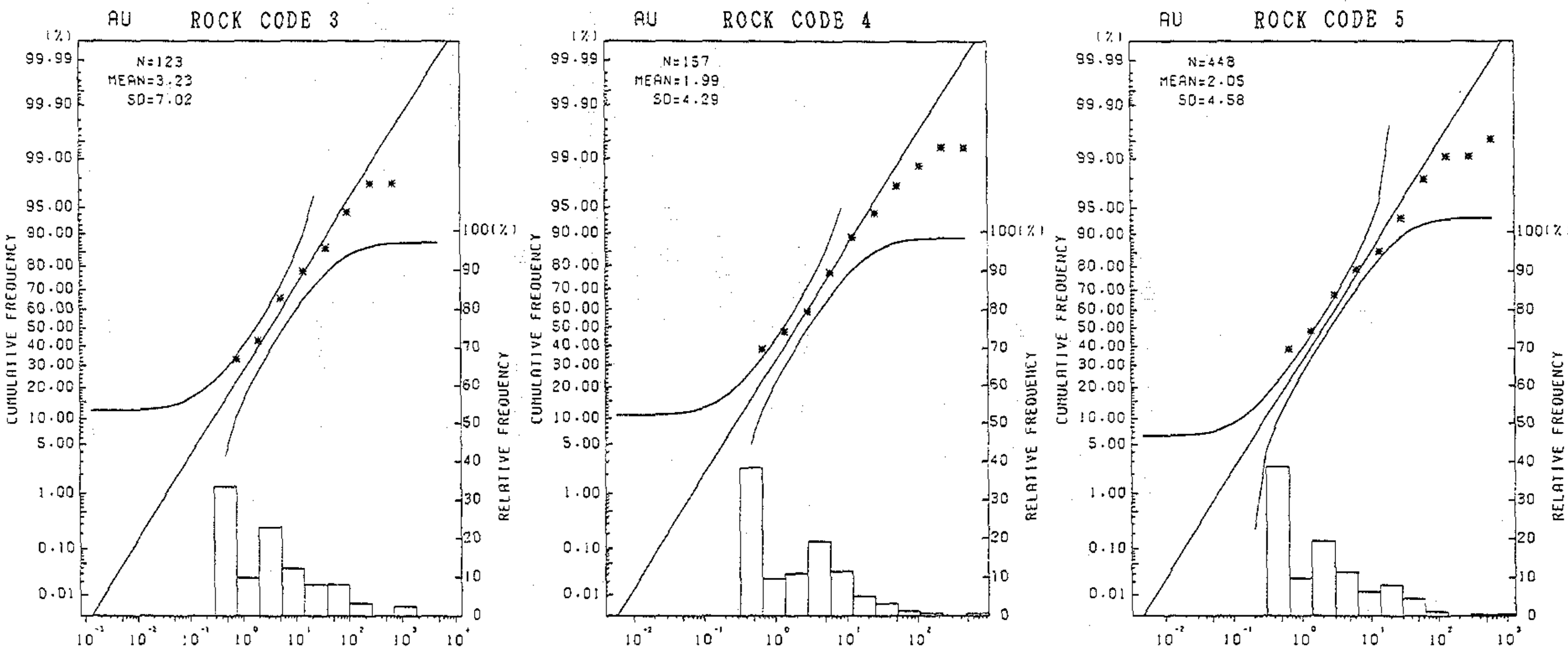

FIG. 2-2-11 Frequency Distribution and Cumulative Frequency Curve (Au;Benzi Zone)

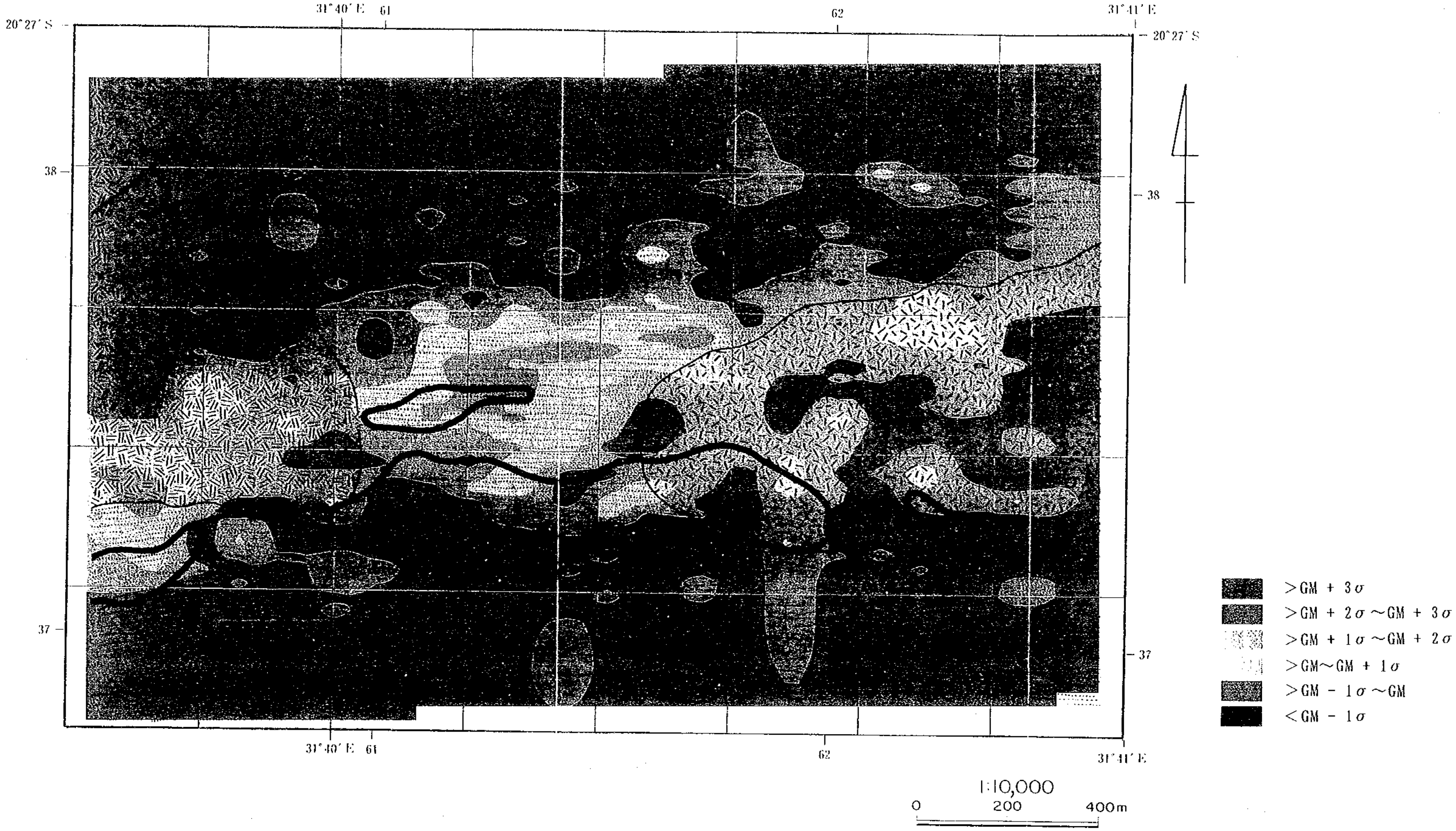

FIG. 2-2-12 Gold Distribution (Benzi Zone)

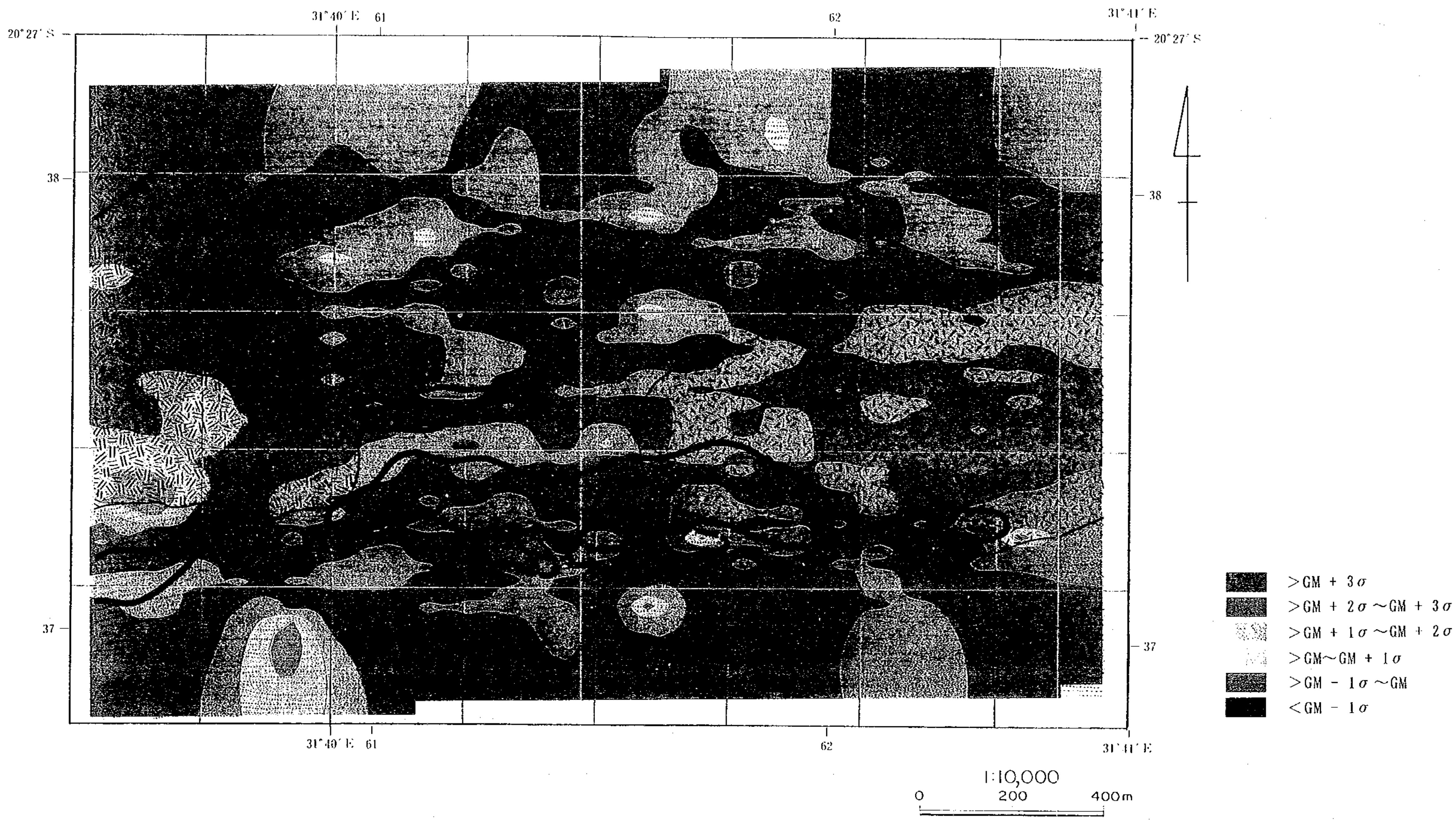

FIG. 2-2-13 Distribution of Principal Component Scores (Benzi Zone)

TABLE 2-2-13 Statistical Parameter of Indicators (Benzi Zone)

SOIL <ROCK CODE>	NO. OF SAMPLE	GEOMETRIC MEAN (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)		THRESHOLD (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	
													22.73	0.85	0.96	0.10	28	50	64	84	51	4.14	←g.m.+ s.d
MAFIC GRANULITE <3>	123	3.24	0.57	0.60	0.06	14.88	24.05	37.17	33.32	25.12	3.10	←g.m.	159.74	1.28	1.54	0.16	53	103	110	211	104	5.54	←g.m.+2 s.d.
		7.03	1.50	1.61	1.66	1.88	2.07	1.72	2.52	2.03	1.34	←s.d.	1,122	1.92	2.46	0.26	99	214	188	532	211	7.41	←g.m.+3 s.d.
													8.56	2.08	0.53	0.05	19	59	136	48	21	5.95	←g.m.+ s.d
FELSIC GRANULITE <4>	157	2.00	1.23	0.50	0.05	11.27	26.62	65.97	15.63	12.07	3.77	←g.m.	36.75	3.51	0.56	0.06	33	133	279	145	36	9.39	←g.m.+2 s.d.
		4.29	1.69	1.06	1.06	1.72	2.23	2.06	3.05	1.74	1.58	←s.d.	157.73	5.94	0.59	0.06	57	296	573	441	63	14.83	←g.m.+3 s.d.
													9.44	1.31	0.91	0.09	19	55	87	75	32	4.14	←g.m.+ s.d
GNEISSOSE GRANULITE <5>	448	2.06	0.79	0.59	0.06	10.90	25.27	49.53	25.99	16.16	2.65	←g.m.	43.25	2.19	1.40	0.15	34	119	152	216	64	6.49	←g.m.+2 s.d.
		4.58	1.67	1.54	1.57	1.76	2.17	1.75	2.88	1.99	1.57	←s.d.	198.20	3.67	2.15	0.23	59	259	267	623	128	10.16	←g.m.+3 s.d.

	NO. OF SAMPLE	MINIMUM VALUE (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	MAXIMUM VALUE (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)
MAFIC GRANULITE <3>	123	0.50	0.25	0.50	0.05	4.00	10.00	7.00	6.00	2.00	1.42	922.00	1.20	3.00	1.50	162	230	165	604	252	6.75
FELSIC GRANULITE <4>	157	0.50	0.25	0.50	0.05	3.00	10.00	6.00	1.00	4.00	1.10	753.00	3.20	1.00	0.10	45	240	222	193	97	8.72
GNEISSOSE GRANULITE <5>	448	0.50	0.25	0.50	0.05	2.00	10.00	6.00	1.00	3.00	0.87	848.00	5.10	3.00	0.60	51	520	287	679	268	8.64

g.m. : geometric mean s.d. : standard deviation

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
BENZI ZONE (SOIL)										
R.C.3	3.24	0.57	0.60	0.06	14.88	24.05	37.17	33.32	25.12	3.10
R.C.4	2.00	1.23	0.50	0.05	11.27	26.62	65.97	15.63	12.07	3.77
R.C.5	2.06	0.79	0.59	0.06	10.90	25.27	49.53	25.99	16.16	2.65

ROCK TYPE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
MAFIC ROCK	4.00	0.10	2.00	0.01	100	370	130	200	160	8.56
INT. ROCK	----	0.07	2.40	0.01	35	500	72	50	55	5.85
FELSIC ROCK	4.50	0.05	1.50	0.01	20	800	6	25	8	2.70
GRANITE	1.00	0.05	0.25	0.43	12	1,250	85	7	5	1.85
MICA SCHIST	----	0.30	----	----	30	----	70	70	50	4.90
<After Flanagan(1976) & Vinogradov(1962)>										
BENZI ZONE (ROCK)										
R.C.3	0.50	0.25	1.00	0.05	28	186	66	234	151	5.15
R.C.4	0.50	0.25	1.00	0.05	3	39	19	10	6	0.58
R.C.5	0.63	0.25	1.58	0.05	3	22	40	30	11	1.05

INT. ROCK : INTERMEDIATE ROCK
---- : NO DATA

TABLE 2-2-14(1) Matrix of Correlation Coefficients (Benzi Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.08	1.00								
As	-0.02	0.01	1.00							
Bi	0.04	0.14	-0.18	1.00						
Cu	0.69	0.13	-0.09	0.12	1.00					
F	0.31	-0.01	-0.02	0.02	0.28	1.00				
Zn	0.08	0.36	0.05	0.16	0.24	0.16	1.00			
Cr	0.64	0.08	-0.07	0.03	0.47	0.31	0.12	1.00		
Ni	0.52	-0.00	-0.01	-0.03	0.62	0.20	0.26	0.54	1.00	
Fe	0.08	0.22	-0.13	0.12	0.52	0.15	0.29	-0.12	0.28	1.00

TABLE 2-2-14(2) Matrix of Correlation Coefficients (Benzi Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.00	1.00								
As	-0.08	0.04	1.00							
Bi	0.00	0.09	-0.01	1.00						
Cu	0.06	-0.35	-0.02	-0.03	1.00					
F	-0.13	-0.23	-0.10	-0.10	0.14	1.00				
Zn	0.06	0.06	0.09	0.04	0.58	-0.08	1.00			
Cr	-0.01	-0.10	-0.06	0.02	-0.03	0.08	-0.24	1.00		
Ni	-0.07	-0.43	-0.06	-0.04	0.65	0.23	0.18	0.38	1.00	
Fe	-0.01	-0.05	0.09	-0.18	0.67	0.00	0.59	-0.30	0.36	1.00

TABLE 2-2-14(3) Matrix of Correlation Coefficients (Benzi Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.10	1.00								
As	-0.10	-0.18	1.00							
Bi	-0.13	0.05	-0.05	1.00						
Cu	0.26	-0.01	-0.04	-0.08	1.00					
F	0.04	-0.15	0.09	-0.08	0.07	1.00				
Zn	0.18	0.12	-0.48	-0.14	0.36	-0.02	1.00			
Cr	0.10	-0.20	-0.02	-0.09	0.09	0.13	-0.11	1.00		
Ni	0.03	-0.27	0.11	-0.05	0.43	0.05	0.03	0.56	1.00	
Fe	-0.08	0.36	0.05	0.03	0.39	-0.02	0.33	-0.39	0.00	1.00

TABLE 2-2-15(1) Results of Principal Component Analysis (Benzi Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.8690	0.2869 (0.2869)	0.73	0.41	-0.14	0.04	0.88	0.31	0.42	0.61	0.66	0.54	5.338	-0.817
Z2	1.3500	0.1350 (0.4219)	-0.22	0.61	0.45	0.29	-0.11	-0.09	0.65	-0.29	-0.20	0.25	3.691	-1.897
Z3	1.2090	0.1209 (0.5428)	0.00	-0.17	0.68	-0.65	-0.02	0.12	0.29	0.25	0.13	-0.36	4.450	-1.509
Z4	0.9830	0.0983 (0.6411)	-0.15	-0.01	-0.15	-0.24	-0.08	0.85	0.04	-0.17	-0.21	0.26	8.593	-1.314
Z5	0.8760	0.0876 (0.7287)	0.12	-0.02	0.02	0.53	-0.03	0.33	0.13	0.35	-0.25	-0.52	6.519	-2.154

TABLE 2-2-15(2) Results of Principal Component Analysis (Benzi Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.7180	0.2718 (0.2718)	-0.07	-0.47	-0.01	-0.12	0.89	0.26	0.45	0.57	0.86	0.61	6.222	-1.302
Z2	1.6580	0.1658 (0.4376)	-0.25	0.27	0.32	0.00	0.19	0.38	0.68	-0.58	-0.34	0.58	2.010	-2.637
Z3	1.1090	0.1109 (0.5485)	0.40	0.35	0.09	0.54	0.04	-0.59	0.09	0.38	0.17	-0.05	8.592	-3.588
Z4	1.0290	0.1029 (0.6514)	0.65	-0.11	0.34	-0.65	-0.05	-0.19	-0.06	0.03	-0.05	0.10	10.900	-3.351
Z5	0.9550	0.0955 (0.7469)	-0.20	-0.11	0.88	0.21	-0.11	0.20	-0.07	0.10	0.07	-0.13	12.371	-0.359

TABLE 2-2-15(3) Results of Principal Component Analysis (Benzi Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	1.9050	0.1905 (0.1905)	0.05	-0.56	0.11	-0.15	0.17	0.31	-0.25	0.79	0.73	-0.46	8.679	-1.509
Z2	1.8450	0.1845 (0.3750)	0.06	0.32	-0.14	-0.16	0.80	-0.01	0.61	0.23	0.43	0.66	3.812	-1.740
Z3	1.1090	0.1109 (0.4859)	-0.33	-0.20	0.85	-0.05	0.08	0.32	0.00	-0.26	0.02	0.27	5.059	-3.110
Z4	1.0790	0.1079 (0.5938)	0.65	-0.15	0.09	-0.64	-0.02	0.26	0.24	-0.16	-0.23	-0.12	13.500	-1.272
Z5	0.9620	0.0962 (0.6900)	0.59	-0.15	0.05	0.69	0.16	0.23	-0.11	-0.10	0.01	0.14	7.596	-2.052

TABLE 2-2-16 Contrast (Benzi Zone)

SOIL & ROCK	NO. OF	CONTRAST									
R. C. <3, 4, 5>	SAMPLE	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
SOIL<3> TH2		319.48	5.12	1.54	3.18	1.88	0.56	1.66	0.90	0.69	1.08
SOIL<3> TH1	123	45.46	3.41	0.96	1.92	1.00	0.27	0.97	0.36	0.34	0.80
SOIL<3>GM		6.47	2.27	0.60	1.16	0.53	0.13	0.56	0.14	0.17	0.60
R O C K <3>(GM.PPM)	2	0.50	0.25	1.00	0.05	28.00	186.00	66.00	234.00	151.00	5.15
SOIL<4> TH2		73.50	14.05	0.56	1.03	11.07	3.40	14.68	14.49	6.06	16.19
SOIL<4> TH1	157	17.13	8.31	0.53	0.98	6.45	1.52	7.14	4.76	3.49	10.25
SOIL<4>GM		3.99	4.91	0.50	0.93	3.76	0.68	3.47	1.56	2.01	6.49
R O C K <4>(GM.PPM)	2	0.50	0.25	1.00	0.05	3.00	39.00	19.00	10.00	6.00	0.58
SOIL<5> TH2		68.65	8.78	0.88	2.92	11.23	5.41	3.80	7.21	5.83	6.18
SOIL<5> TH1	448	14.98	5.26	0.57	1.86	6.39	2.49	2.17	2.50	2.93	3.94
SOIL<5>GM		3.27	3.15	0.37	1.18	3.63	1.15	1.24	0.87	1.47	2.52
R O C K <5>(GM.PPM)	3	0.63	0.25	1.58	0.05	3.00	22.00	40.00	30.00	11.00	1.05

TH2:THRESHOLD (GM+2 STANDARD DEVIATION)
TH1:THRESHOLD (GM+1 STANDARD DEVIATION)
GM:GEOMETRIC MEAN

2-5 RUPIRI ZONE

2-5-1 Sampling

Soil sampling lines were set on north-south direction due to east-west occurrences of mineralized signs and B-horizon soils were taken. Soil colour in the zone poorly reflects the basement geology. In general, gray and brown soils are predominant in the zone. Soils taken over the mafic granulite and gneissose granulite are 279 and 1,314, respectively.

2-7-2 Geochemical Indicators

Several mineralized signs were found within the zone. Analytical results of the soils poorly agreed with the observations which confirmed mineralized signs in the zone. The contents on geochemical indicators compared with all zones studied and Rupiri zone are shown as follows:

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
RUPIRI ZONE(SOIL)										
R.C.3	0.95	0.84	0.64	0.05	28.66	44.04	68.17	145.10	59.52	2.53
R.C.4	----	----	----	----	-----	-----	-----	------	-----	----
R.C.5	0.90	0.69	0.53	0.05	8.23	34.00	26.26	31.91	14.48	1.25

Background Geology and Indicator Content

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-17. According to this table, geochemical characteristics on each indicator are summarized as follows:

Au : Geometric means(GMs) of rock code 3 and rock code 5 of all zones are 0.95 and 0.90 ppb, respectively but rock code 3 in the zone has larger value of 0.95 ppb. On the other hand, smaller GM is 0.90 ppb of rock code 5. A comparison on the contents of indicators between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Au contents in the zone can be pointed out to be rather low. The maximum value in the zone is 10 ppb.

Ag : GMs of rock code 3 and rock code 5 of all zones are 0.63 and 0.53 ppm, respectively but rock code 3 in the zone has larger value of 0.84 ppm. On the other hand, smaller GM is 0.69 ppm of rock code 5. A comparison on contents of the indicators between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Ag contents in the zone are rather high, with a maximum value of 4.40 ppm.

As : Since almost all data indicated content below its detection limit(1.00 ppm) except rock code 3, it is difficult to clarify its geochemical character in the zone. GMs of rock code 3 and rock code 5 of all zones are 2.25 and 0.66 ppm, respectively but rock code 3 in the zone has larger value of 0.64 ppm. On the other hand, smaller GM is 0.53 ppm of rock code 5. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. As content in the zone is fairly low, with maximum value of 5 ppm.

Bi : Since almost all data indicated content below its detection limit(0.10 ppm) except rock code 3, it is difficult to clarify its geochemical character in the zone. GMs of the indicator of all zones are 0.06 and 0.05 ppm, respectively. There is no difference among the GMs of indicators between the zone studied and all zones. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. As content in the zone is nearly to that of the areas compared same. Maximum value in the zone is 0.10 ppm.

Cu : GMs of rock code 3 and rock code 5 of all zones are 61.57 and 12.86 ppm, respectively but rock code 3 in the zone studied has larger value of 28.66 ppm. On the other hand, smaller GM is 8.23 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Copper content in rock code 3 and rock code 5 of the zone is fairly low compared to that of the areas compared. The maximum value in the zone is 188 ppm.

F : GMs of rock code 3 and rock code 5 of all zones are 26.42 and 30.30 ppm, respectively but rock code 3 in the zone has larger value of 44.04 ppm. On the other hand, smaller GM is 34.00 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. F content in the zone is fairly low, with maximum value of 380 ppm.

Zn : GMs of rock code 3 and rock code 5 of all zones are 90.47 and 37.45 ppm, respectively but rock code 3 in the zone has larger value of 68.17 ppm. On the other hand, smaller GM is 26.26 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Zn content in the zone is normal. The maximum value in the zone is 275 ppm.

Cr : GMs of rock code 3 and rock code 5 of all zones are 215.97 and 44.07 ppm, respectively but rock code 3 in the zone has larger value of 145.10 ppm. On the other hand, smaller GM is 31.91 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Cr contents of rock code 5 of the zone are almost same. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 2,110 ppm.

Ni : GMs of rock code 3 and rock code 5 of all zones are 153.32 and 19.23 ppm but rock code 3 in the zone has larger value of 59.52 ppm. On the other hand, smaller GM is 14.48 ppm of rock code 5. A comparison on contents of the indicator between the zone and other area based on data by Flanagan(1976) and Vinogradov(1962) made clear that Ni contents of rock code 5 of the zone is almost the same for the area compared. However, values of Flanagan's data fluctuate greatly for various rock types. The maximum value in the zone is 482 ppm.

Fe : GMs of rock code 3 and rock code 5 of all zones are 6.89 and 1.90 %, respectively but rock code 3 in the zone has larger value of 2.53 %. On the other hand, smaller GM is 1.25 % of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Fe contents in the zone is rather low. The maximum value in the zone is 12.26 %.

Determination of Threshold Values

An interpretation was conducted on the cumulative frequency curve of Au in each geological unit. The results are summarized as follows:

Rock code 3 : Au shows a kind of dual distribution as shown in FIG.2-2-14. Geochemical values principally consist of two populations, frequency of each population is about 60 %, and 40 %. The threshold value(GM + 2δ) determined statistically corresponds to the upper 3 % level of the second population.

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-14. Geochemical values principally consist of two populations, frequency of each population is about 60 %, and 40 %. The threshold value(GM + 2δ) determined statistically corresponds to upper 3 % level of the second population. It can be observed positive skewness on the cumulative frequency curve of the second population.

Correlation Coefficient between Indicators

The correlation coefficients between indicators on a logarithmic base were calculated for each geological units. In the geological units, correlation coefficients between respective indicators were small, suggesting that the origins of individual indicators are different from each other.

TABLE 2-2-18 shows the correlation coefficients on corresponding rock codes. Results of interpretation are summarized below:

Rock code 3 : The strong correlations were obtained in this rock code. Indicators of Cu-Zn, Cu-Ni, Cu-Fe, Zn-Ni, Zn-Fe, and Ni-Fe show correlation of medium degree.

Rock code 5 : Indicators of Zn-Ni, Zn-Fe, Cr-Ni, and Cr-Fe show correlation of medium degree. On the other hand, Cu-Zn, Cu-Ni, Cu-Fe, and Ni-Fe show strong correlation degree.

Correlation coefficients in the zone can be evaluated to be rather low.

2-7-3 Interpretation

Principal Component Analysis

After determining the correlation coefficients between indicators, which cannot be extracted by single variable analyses, from multi-dimensional distribution characteristics, these were applied to the determination of character and the evaluation of geochemical anomalies. Results of analysis are shown in TABLE 2-2-19.

General characteristics of each geological unit are summarized below:

Rock code 3 : As shown in TABLE 2-23-19(1), the contribution ratio for the first principal component to all the principal components is about 31%, occupying less than one third of all. The total to the ratio of the fifth principal component amounts to 77 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is general small and not decisive. Each component, except for the first principal component drops gradually and does not change markedly.

For the first principal component, Cu, Zn, Ni, and Fe show strong correlation values of 0.77～0.90. Therefore, the first principal component is characterized by high concentration of these indicators.

The second principal component is characterized by medium correlations (0.45～0.64) of As, Bi, and F, and a negative medium correlation(-0.56) with Ag.

The third principal component has a strong correlation(0.76) with Cr, and negative correlations(-0.40 ~ -0.45) with Ag and Bi. It means anomalous concentrations of these indicators are shown as high score or low negative scores.

The fourth principal component shows a strong correlation(0.89) with Au. Therefore, the component is worth notice for the exploration of gold, although the contribution ratio is as small as 10 %.

The fifth principal component is characterized by a medium correlation (0.67) with As and a negative medium correlation(-0.52) with F.

Rock code 5 : As shown in TABLE 2-2-19(2), the contribution ratio for the first principal component to all the principal components is about 31%, occupying less than one third of all. The total to the ratio of the fifth principal component amounts to 76 % approximately, so that a greater part of the fluctuation of all the components can be explained by them. However, the contribution ratio of each principal is generally small and not decisive. Each component, except for the first and second principal components, drops gradually and does not change markedly.

For the first principal component, F, Zn, Cr, show medium correlations(0.42 ~ 0.69) and strong correlations(0.78~0.85) with Cu, Ni, and Fe. Therefore, the first principal component correlates to the indicators and reflects as high scores to the concentration of the indicators.

The second principal component is characterized by a medium correlation (0.40) with Au and a strong correlation(0.72) with Ag. On the other hand, medium negative correlations(-0.49 ~ -0.52) with Bi and F. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has medium correlations(0.44 ~ 0.66) with Au, As, and Bi. Therefore, high scores are expected for the concentration of these indicators.

The fourth principal component is characterized by a medium correlation (0.66) with As and a negative medium correlation(-0.48) with Bi.

The fifth principal component show a medium correlation(0.52) and negative correlations(-0.43~-0.46) with Au and F.

Au Concentration and Principal Component Scores

The concentration distribution of Au in this surveyed zone indicates anomalies(GM+ σ ~ GM+2 σ) with continuity in the NNW-SSE direction, which can roughly be divided into three zones, as shown in FIG.2-2-15. The anomalous zones of this surveyed zone may be combinations of the above anomalies and those stretching in the ENE-WSW direction. These anomalies are not so remarkable, thus no geological results relating to them could be extracted by the field survey.

Anomalies are distributed over multiple geological units, indicating that the distribution is not limited to a specific geology.

For contrasts, no noteworthy indicators was noted (TABLE 2-2-20).

Principal components highly related to Au are the fourth component for code 3 and the third component for code 5. FIG.2-2-16 indicates the distribution of such high scores. From the figure, showing the scattered distribution of high scores, no promising zone could be specified. It may well be that because of the small contribution ratios of principal components, their relationship with Au will be diluted by the effects of other indicators.

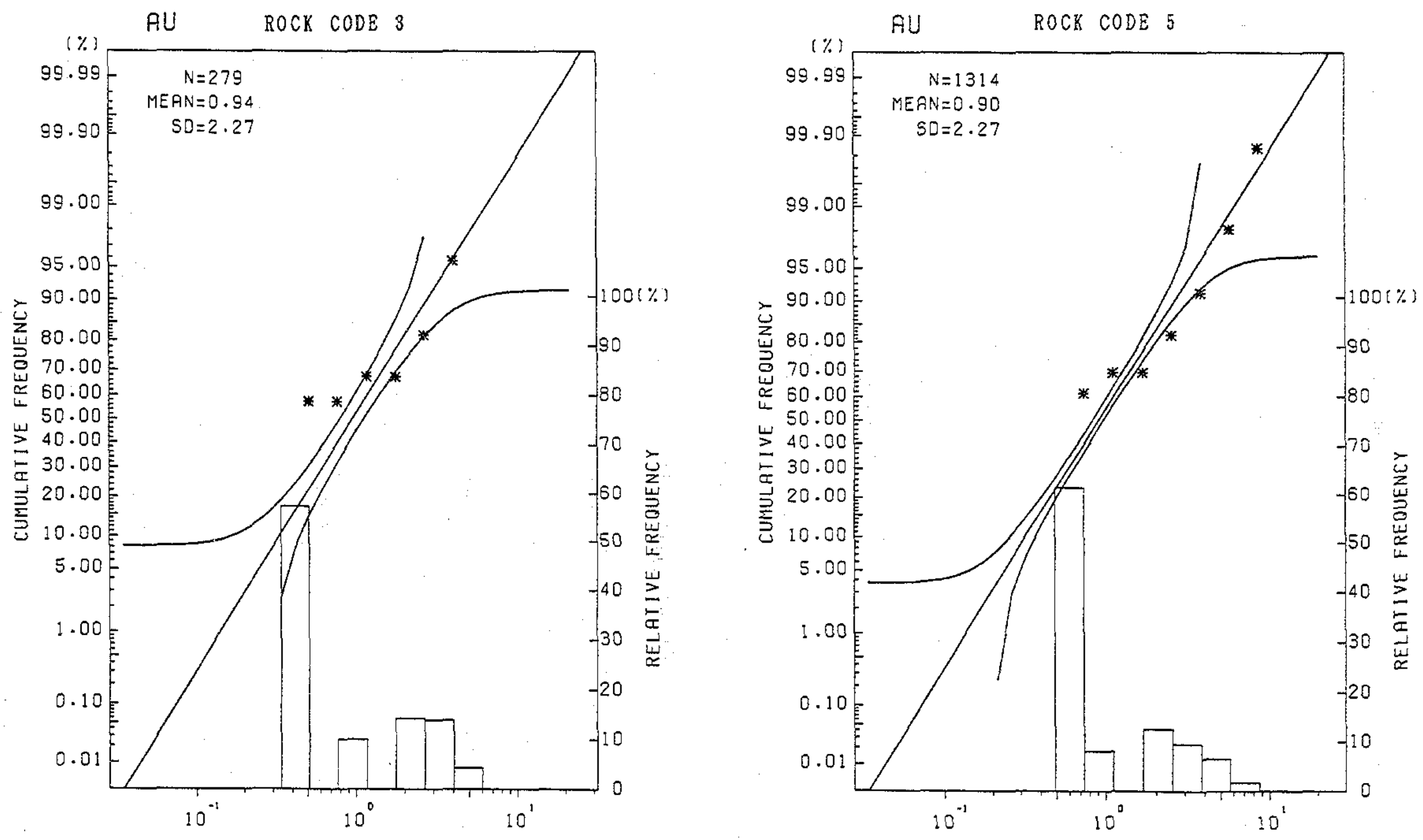

FIG. 2-2-14 Frequency Distribution and Cumulative Frequency Curve (Au;Rupiri Zone)

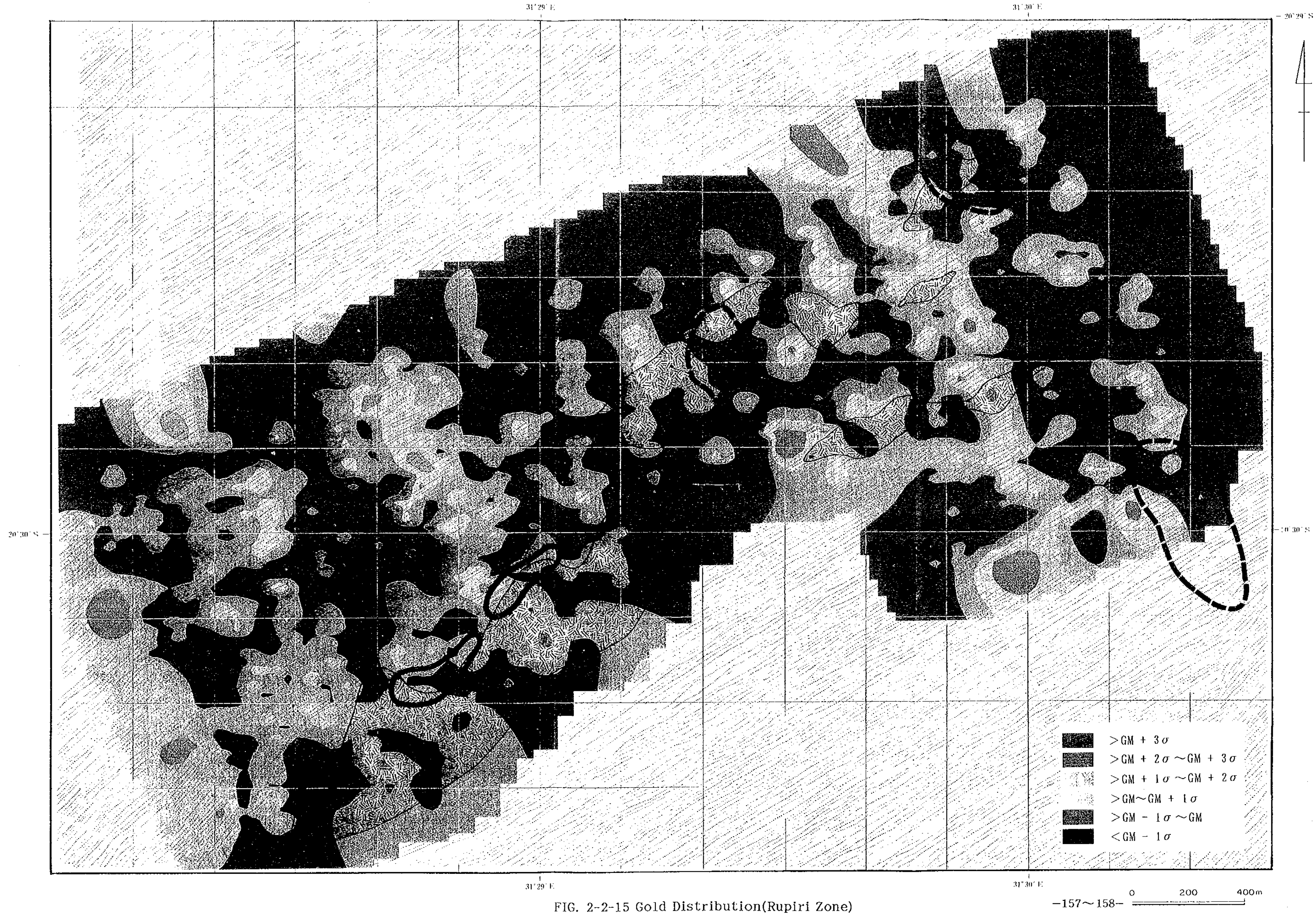

FIG. 2-2-15 Gold Distribution(Rupiri Zone)

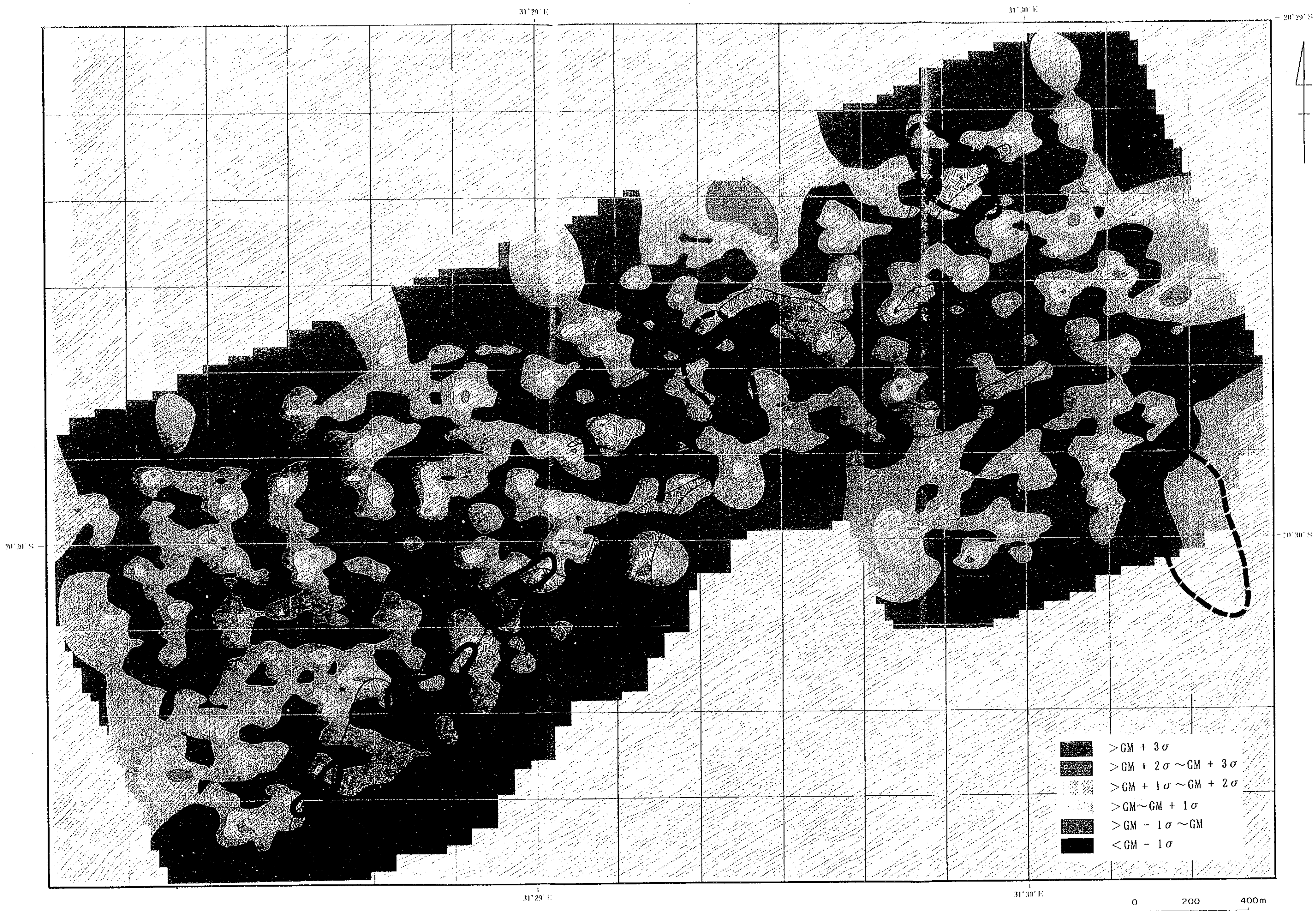

FIG. 2-2-16 Distribution of Principal Component Scores (Rupiri Zone)

TABLE 2-2-17 Statistical Parameter of Indicators (Rupiri Zone)

SOIL <ROCK CODE>	NO. OF SAMPLE	GEOMETRIC MEAN (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	
MAFIC GRANULITE <3>	279	0.95	0.84	0.64	0.05	28.66	44.04	68.17	145.10	59.52	2.53	←g.m.
		2.28	1.83	1.43	1.10	2.04	1.88	1.78	3.02	2.09	1.64	←s.d.
FELSIC GRANULITE <4>	0	—	—	—	—	—	—	—	—	—	—	
GNEISSOSE GRANULITE <5>	1,314	0.90	0.69	0.53	0.05	8.23	34.00	26.26	31.91	14.48	1.25	←g.m.
		2.27	2.07	1.24	1.12	1.97	2.00	2.06	3.21	2.43	1.92	←s.d.

SOIL <ROCK CODE>	THRESHOLD (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)	
MAFIC GRANULITE <3>	2.16	1.53	0.91	0.05	59	83	121	438	124	4.15	←g.m.+ s.d
	4.92	2.80	1.30	0.06	120	156	215	1,323	260	6.82	←g.m.+2 s.d.
	11.22	5.12	1.86	0.07	244	294	382	3,997	543	11.18	←g.m.+3 s.d.
FELSIC GRANULITE <4>	—	—	—	—	—	—	—	—	—	—	
GNEISSOSE GRANULITE <5>	2.05	1.42	0.66	0.06	16	68	54	103	35	2.41	←g.m.+ s.d
	4.66	2.93	0.82	0.06	32	137	111	329	86	4.64	←g.m.+2 s.d.
	10.58	6.07	1.02	0.07	63	274	229	1,058	208	8.92	←g.m.+3 s.d.

SOIL <ROCK CODE>	NO. OF SAMPLE	MINIMUM VALUE (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)
MAFIC GRANULITE <3>	279	0.50	0.25	0.50	0.05	4.00	10.00	14.00	1.00	6.00	0.54
FELSIC GRANULITE <4>	0	—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	1,314	0.50	0.25	0.50	0.05	0.50	10.00	0.50	1.00	1.00	0.21

SOIL <ROCK CODE>	MAXIMUM VALUE (PPM) Au(PPB)	Ag(PPM)	As(PPM)	Bi(PPM)	Cu(PPM)	F(PPM)	Zn(PPM)	Cr(PPM)	Ni(PPM)	Fe(%)
MAFIC GRANULITE <3>	6.00	4.20	4.00	0.10	188	380	275	2,110	482	10.74
FELSIC GRANULITE <4>	—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	10.00	4.40	5.00	0.10	114	370	222	475	431	12.26

g.m. : geometric mean　　s.d. : standard deviation

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
RUPIRI ZONE (SOIL)										
R.C.3	0.95	0.84	0.64	0.05	28.66	44.04	68.17	145.10	59.52	2.53
R.C.4	----	----	----	----	----	----	----	----	----	----
R.C.5	0.90	0.69	0.53	0.05	8.23	34.00	26.26	31.91	14.48	1.25

ROCK TYPE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
MAFIC ROCK	4.00	0.10	2.00	0.01	100	370	130	200	160	8.56
INT. ROCK	----	0.07	2.40	0.01	35	500	72	50	55	5.85
FELSIC ROCK	4.50	0.05	1.50	0.01	20	800	6	25	8	2.70
GRANITE	1.00	0.05	0.25	0.43	12	1,250	85	7	5	1.85
MICA SCHIST	----	0.30	----	----	30	----	70	70	50	4.90
					<After Flanagan(1976) & Vinogradov(1962)>					
RUPIRI ZONE (ROCK)										
R.C.3	----	----	----	----	----	----	----	----	----	----
R.C.4	----	----	----	----	----	----	----	----	----	----
R.C.5	0.50	0.25	0.50	0.05	36	57	84	28	21	1.53

INT. ROCK : INTERMEDIATE ROCK
---- : NO DATA

TABLE 2-2-18(1) Matrix of Correlation Coefficients (Rupiri Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.02	1.00								
As	0.01	-0.13	1.00							
Bi	0.02	-0.04	0.22	1.00						
Cu	-0.01	-0.03	0.35	0.06	1.00					
F	0.00	-0.20	0.06	0.18	0.11	1.00				
Zn	-0.05	0.05	0.27	0.04	0.86	0.11	1.00			
Cr	-0.05	-0.08	0.15	-0.13	0.17	-0.01	0.18	1.00		
Ni	0.01	-0.06	0.21	0.01	0.79	0.07	0.72	0.37	1.00	
Fe	0.02	-0.04	0.28	0.03	0.83	0.06	0.82	0.29	0.78	1.00

TABLE 2-2-18(2) Matrix of Correlation Coefficients (Rupiri Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.14	1.00								
As	0.08	-0.03	1.00							
Bi	-0.01	-0.11	0.02	1.00						
Cu	-0.03	-0.09	0.09	-0.04	1.00					
F	0.03	-0.22	0.07	0.08	0.28	1.00				
Zn	0.05	0.09	0.07	0.07	0.70	0.20	1.00			
Cr	0.00	-0.00	0.05	-0.02	0.40	0.11	0.30	1.00		
Ni	0.00	-0.11	0.10	-0.04	0.81	0.33	0.62	0.51	1.00	
Fe	-0.03	-0.08	0.05	-0.10	0.77	0.28	0.61	0.42	0.76	1.00

TABLE 2-2-19(1) Results of Principal Component Analysis (Rupiri Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	3.1230	0.3123 (0.3123)	-0.01	-0.14	0.35	0.10	0.85	0.16	0.86	0.30	0.77	0.90	3.281	-1.462
Z2	1.4260	0.1426 (0.4549)	-0.13	-0.56	0.45	0.63	-0.03	0.64	-0.16	0.14	-0.17	-0.16	6.725	-2.443
Z3	1.1720	0.1172 (0.5721)	-0.34	-0.40	-0.01	-0.45	-0.23	-0.13	-0.14	0.76	0.18	-0.04	5.182	-2.239
Z4	0.9880	0.0988 (0.6709)	0.89	-0.12	0.25	-0.03	-0.03	-0.17	-0.15	0.24	0.06	-0.04	7.561	-1.813
Z5	0.9740	0.0974 (0.7683)	-0.26	0.30	0.67	0.17	0.04	-0.52	0.01	0.13	-0.21	-0.05	3.412	-0.984

TABLE 2-2-19(2) Results of Principal Component Analysis (Rupiri Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	3.1280	0.3128 (0.3128)	-0.05	-0.14	0.14	0.03	0.85	0.42	0.69	0.66	0.82	0.78	6.302	-1.628
Z2	1.2670	0.1267 (0.4395)	0.40	0.72	0.07	-0.52	0.11	-0.49	0.19	0.13	-0.02	0.06	3.594	-6.061
Z3	1.0920	0.1092 (0.5487)	0.66	0.09	0.59	0.44	-0.07	0.26	0.03	-0.04	0.03	-0.16	5.665	-2.627
Z4	0.9790	0.0979 (0.6466)	-0.22	-0.25	0.66	-0.48	-0.12	-0.05	-0.32	0.24	0.13	-0.05	17.116	-1.840
Z5	0.8820	0.0882 (0.7348)	-0.46	0.26	0.24	0.52	-0.05	-0.43	0.13	0.24	0.07	-0.15	6.715	-1.394

TABLE 2-2-20 Contrast (Rupiri Zone)

SOIL & ROCK R. C. <3, 4, 5>	NO. OF SAMPLE	CONTRAST									
		Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
SOIL<5> TH2		9.31	11.73	1.63	1.27	0.89	2.40	1.33	11.76	4.07	3.03
SOIL<5> TH1	1,314	4.10	5.67	1.31	1.14	0.45	1.20	0.64	3.66	1.68	1.58
SOIL<5>GM		1.81	2.74	1.06	1.02	0.23	0.60	0.31	1.14	0.69	0.82
ROCK <5>(GM.PPM)	3	0.50	0.25	0.50	0.05	36.00	57.00	84.00	28.00	21.00	1.53

TH2:THRESHOLD (GM+2 STANDARD DEVIATION)

TH1:THRESHOLD (GM+1 STANDARD DEVIATION)

GM:GEOMETRIC MEAN

2-6 CHIPFUNDE ZONE

2-6-1 Sampling

Soil sampling lines were set on north-south direction due to east-west occurrences of mineralized signs and B-horizon soil was taken. Soil colour in the zone possibly reflects the basement geology. In general, gray and brown soils are predominant in the southern and northern portions of the zone and red soils in the central portion underlain by mafic granulite.

Soils taken over the mafic granulite and gneissose granulite are 585 and 313, respectively.

2-6-2 Geochemical Indicators

Several mineralized signs were found within the zone. Analytical results of the soils poorly agreed with the observations which confirmed the mineralized sings in the zone. The content on geochemical indicators compared with all zones studied Chipfunde zone are shown as follows:

ROCK CODE	Au (PPB)	Ag (PPM)	As (PPM)	Bi (PPM)	Cu (PPM)	F (PPM)	Zn (PPM)	Cr (PPM)	Ni (PPM)	Fe (%)
ALL ZONES										
R.C.3	1.73	0.63	2.25	0.06	61.57	26.42	90.47	215.97	153.32	6.89
R.C.4	0.98	0.48	0.58	0.05	8.82	23.02	40.41	30.92	11.77	1.96
R.C.5	0.93	0.53	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
CHIPFUNDE ZONE (SOIL)										
R.C.3	1.71	0.51	0.88	0.06	98.21	21.86	101.62	330.44	231.47	9.50
R.C.4	----	----	----	----	----	----	----	----	----	----
R.C.5	1.00	0.56	0.55	0.06	27.77	18.27	51.69	128.59	50.31	3.21

<u>Background Geology and Indicator Content</u>

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-21. According to this table, geochemical characteristics on each element are summarized as follows:

<u>Au</u> : Geometric means(GMs) of rock code 3 and rock code 5 of all zones are 1.73 and 0.93 ppb, respectively but rock code 3 in the zone has larger value of 1.71 ppb. On the other hand, smaller GM is 1.00 ppb of rock code 5. A comparison on the content of indicator between the zone and other area based on data by Flanagan(1976) and Vinogradov(1962) was made. Au contents in the zone can be pointed out to be low. The maximum value in the zone is 115 ppb.

<u>Ag</u> : GMs of rock code 3 and rock code 5 of all zone are 0.63 and 0.53 ppm,

respectively but rock code 5 in the zone has larger value of 0.56 ppm. On the other hand, smaller GM is 0.51 ppm of rock code 3. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Ag content in the zone rather high, with a maximum value of 11 ppm.

As : Since approximately 50 % of data indicated content below its detection limit(1.00 ppm), it is difficult to clarify its geochemical character in the zone. GMs of rock code 3 and rock code 5 of all zone are 2.25 and 0.66 ppm, respectively but rock code 3 in the zone has larger value of 0.88 ppm. On the other hand, smaller GM is 0.55 ppm of rock code 5. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov (1962) was made. As contents of the zone is fairly low, with maximum value of 240 ppm.

Bi : Since approximately 95 % of data indicated content below its detection limit(0.10 ppm), it is difficult to clarify its geochemical character in the zone. GMs of all zone are 0.06 and 0.05 ppm, respectively. There is no difference among the GMS of the indicator. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Bi content in the zone is nearly the same. Maximum value in the zone is 1.10 ppm.

Cu : GMs of rock code 3 and rock code 5 of all zones are 61.57 and 12.86 ppm, respectively but rock code 3 in the zone has larger value of 98.21 ppm. On the other hand, smaller GM is 22.77 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Copper contents in rock code 3 and rock code 5 of the zone is nearly the same as the areas compared.
The maximum value in the zone is 432 ppm.

F : GMs of rock code 3 and rock code 5 of all zones are 26.42 and 30.30 ppm, respectively but rock code 3 in the zone has larger value of 21.86 ppm. On the other hand, smaller GM is 18.27 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. F contents in the zone is fairly low, with maximum value of 650 ppm.

Zn : GMs of rock code 3 and rock code 5 of the zone are 90.47 and 37.45 ppm, respectively but rock code 3 in the zone has larger value of 101.62 ppm. On the other hand, smaller GM is 51.69 ppm of rock code 5. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Zn content in the zone is rather low. The maximum value in the zone is 5,050 ppm.

Cr : GMs of rock code 3 and rock code 5 of the zone are 215.97 and 44.07 ppm, respectively but rock code 3 has larger value of 330.44 ppm. On the other hand, smaller GM is 128.59 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Cr contents of the zone is almost same. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 6,550 ppm.

Ni : GMs of rock code 3 and rock code 5 of the zone are 153.32 and 19.23 ppm but rock code 3 has larger value of 231.47 ppm. On the other hand, smaller GM is 50.31 ppm of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Ni content of the zone is almost the same for the area compared. However, values of Flanagan's data fluctuate greatly for various rock types. The maximum value in the zone is 1,590 ppm.

Fe : GMs of rock code 3 and rock code 5 of the zone are 6.89 and 1.90 %, respectively but rock code 3 has larger value of 9.50 %. On the other hand, smaller GM is 3.21 % of rock code 5. A comparison on contents of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) made clear that Fe content in the zone is normal. The maximum value in the zone is 22.09 %.

Determination of Threshold Values

An interpretation was conducted on the cumulative frequency curve of Au in each geological unit. The results are summarized as follows:

Rock code 3 : Au shows a kind of dual distribution as shown in FIG.2-2-17. Geochemical values principally consist of two populations, that is, cumulative frequency of each population is about 40 %, and 60 %. The threshold value(GM + 2 δ)determined statistically corresponds to the upper 4 % level of the second population.

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-17. Geochemical values principally consist of two populations, that is, cumulative frequency of each population is about 60 %, and 40 %. The threshold value(GM + 2 δ)