determined statistically corresponds to the upper 3 % level of the second population.

It can be point out that the rock code 3 has a tendency to show positive skewness in 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 2-2-22 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, Cu-Zn, Cu-Ni, Cu-Fe, Zn-Ni, Zn-Fe, Cr-Ni, and Ni-Fe show correlations of medium degree. Negative medium correlation was also obtained by Ag-Cr, and Ag-Ni.

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

2-6-3 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 2-2-23.

General characteristics of each geological unit are summarized below:

Rock code 3 : As shown in TABLE 2-2-23(1), the contribution ratio for the first principal component to all the principal components is about 33%, occupying one third of all. The total to the ratio of the fifth principal component amounts to 81 % 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 component is rather higher than other rock codes. Each component, however, except for the first and second components drops gradually and does not change markedly.

For the first principal component, Cu shows a medium correlation value of 0.67. On the other hand Zn, Cr, Ni, and Fe have strong correlation values of 0.74~

0.94. Therefore, the first principal component is characterized by high concentration of these indicators.

The second principal component is characterized by medium correlations (0.48~0.69) of Ag, As, Cu, F, and Zn. On the other hand, a negative medium correlation(-0.43) is detected by Cr.

The third principal component has a strong correlation(0.86) with Au. Therefore, the component is worth notice for the exploration of gold. On the other hand, a negative medium correlation(-0.42) with Bi is observed.

The fourth principal component shows a strong correlation(0.81) with Bi. No geochemical characteristics are able to determine.

The fifth principal component is characterized by a medium correlation (0.65) with F. The contribution ratio, however, does not show any significant value indicating 9 %.

Rock code 5 : As shown in TABLE 2-2-23(2), the contribution ratio for the first principal component to all the principal components is about 30 %, occupying less than one third 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 generally small and not decisive. Each component, except for the first principal component, drops gradually and does not change markedly.

For the first principal component, As, Zn, and Cr show a medium correlation value(0.41 ~ 0.61) and strong correlations(0.85 ~ 0.88) 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(0.40 ~ 0.60) with Ag, Bi, F, and Zn. High scores are expected in the concentration of these indicators.

The third principal component has medium correlations(0.49~0.60) with Au, and Ag. Therefore, high scores are expected for the concentration of these indicators. On the other hand, the component also has a negative medium(-0.49) with Bi.

The fourth principal component is characterized by a strong correlation (0.81) with Au. The component is worth notice for the gold exploration , although the contribution ratio is as low as 10 %.

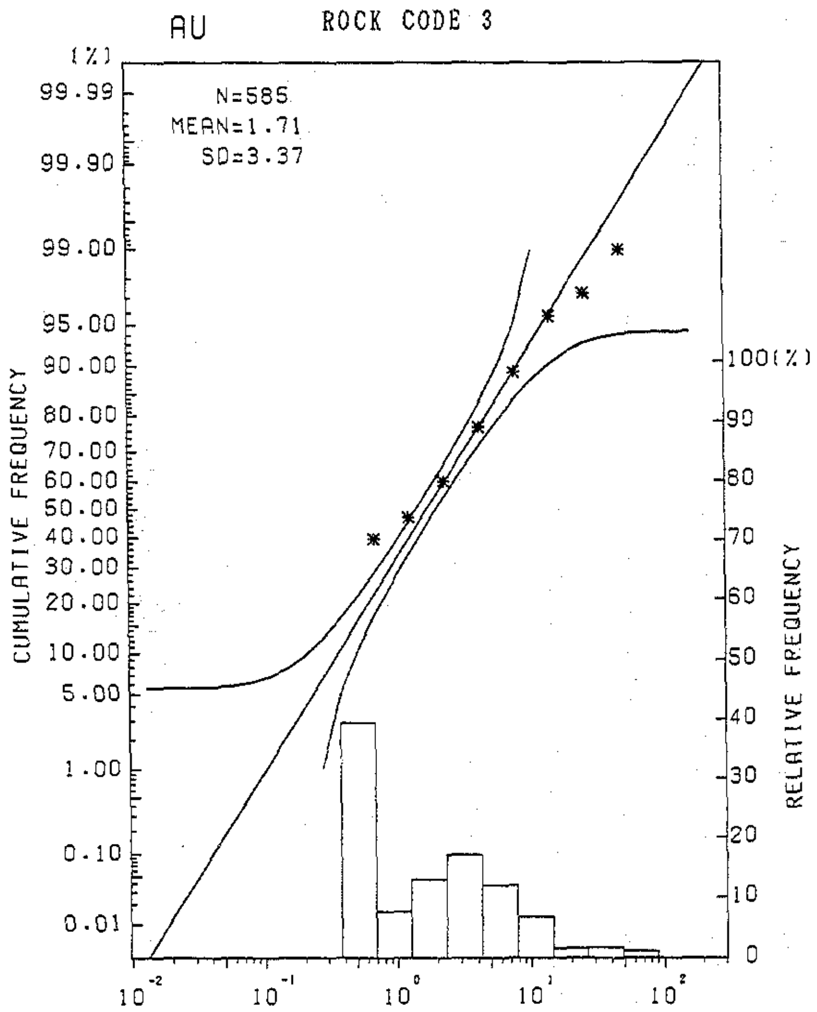
The fifth principal component show only a medium correlation(0.62) with As and a negative correlation(-0.44) with Cr. No any significant geochemical characteristics were detected.

Au Concentration and Principal Component Scores

The concentration distribution of Au in this surveyed zone indicates an anomalous zone (GM+ σ ~ GM+2 σ) with rather good continuity in the ENE-WSW direction, as shown in FIG. 2-2-18. The anomalous zone is located within mafic granulite and its extension direction parallels that of the country rock. Since the main distribution of the anomalies was found in the northeastern part of of mafic granulite, the main geological unit of this zone, the anomalous zone seems to be controlled by the distribution of mafic granulite.

For contrasts, no noteworthy high value was found, as shown in TABLE 2-3-24. This suggests that the extent of concentration of each indicator is not so high in this zone.

Principal components highly related to Au are the third component for code 3 and the fourth component for code 5. FIG. 2-2-19 indicates the distribution of such high scores. The figure shows that the distribution of the high scores overlaps with the anomalous zone shown in FIG. 2-2-18, reflecting the strong relationship between the factor loadings of the principal components and Au.



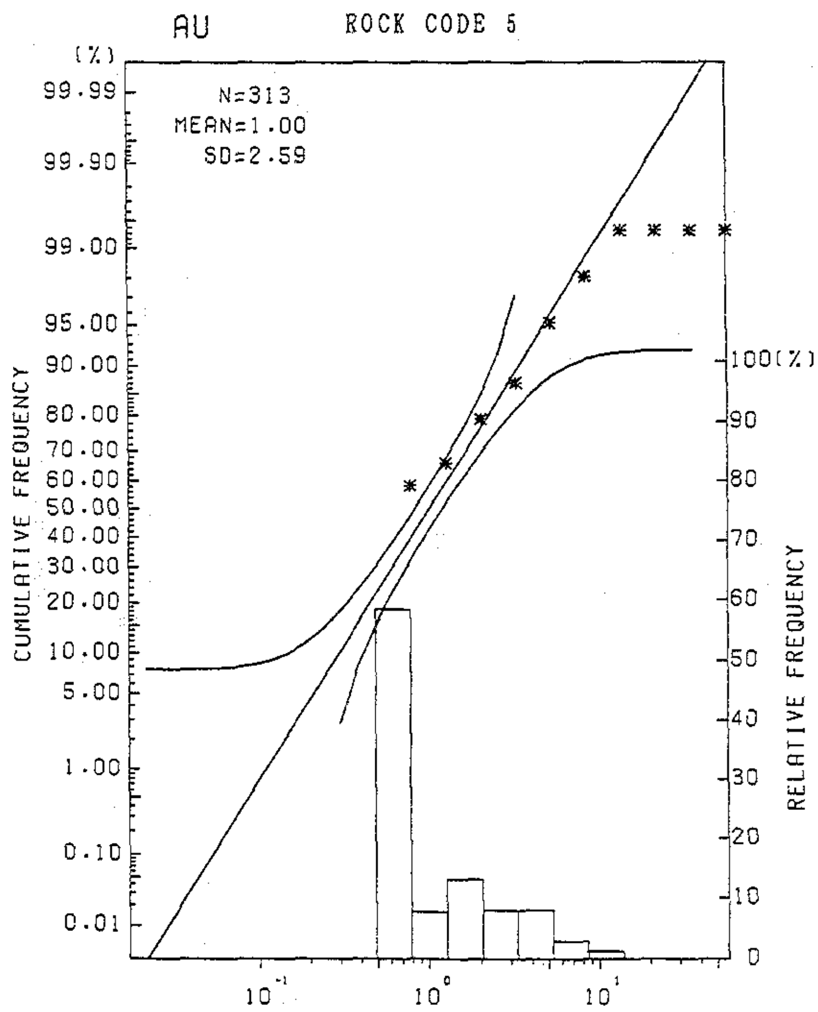


FIG. 2-2-17 Frequency Distribution and Cumulative Frequency Curve (Au;Chipfunde Zone)

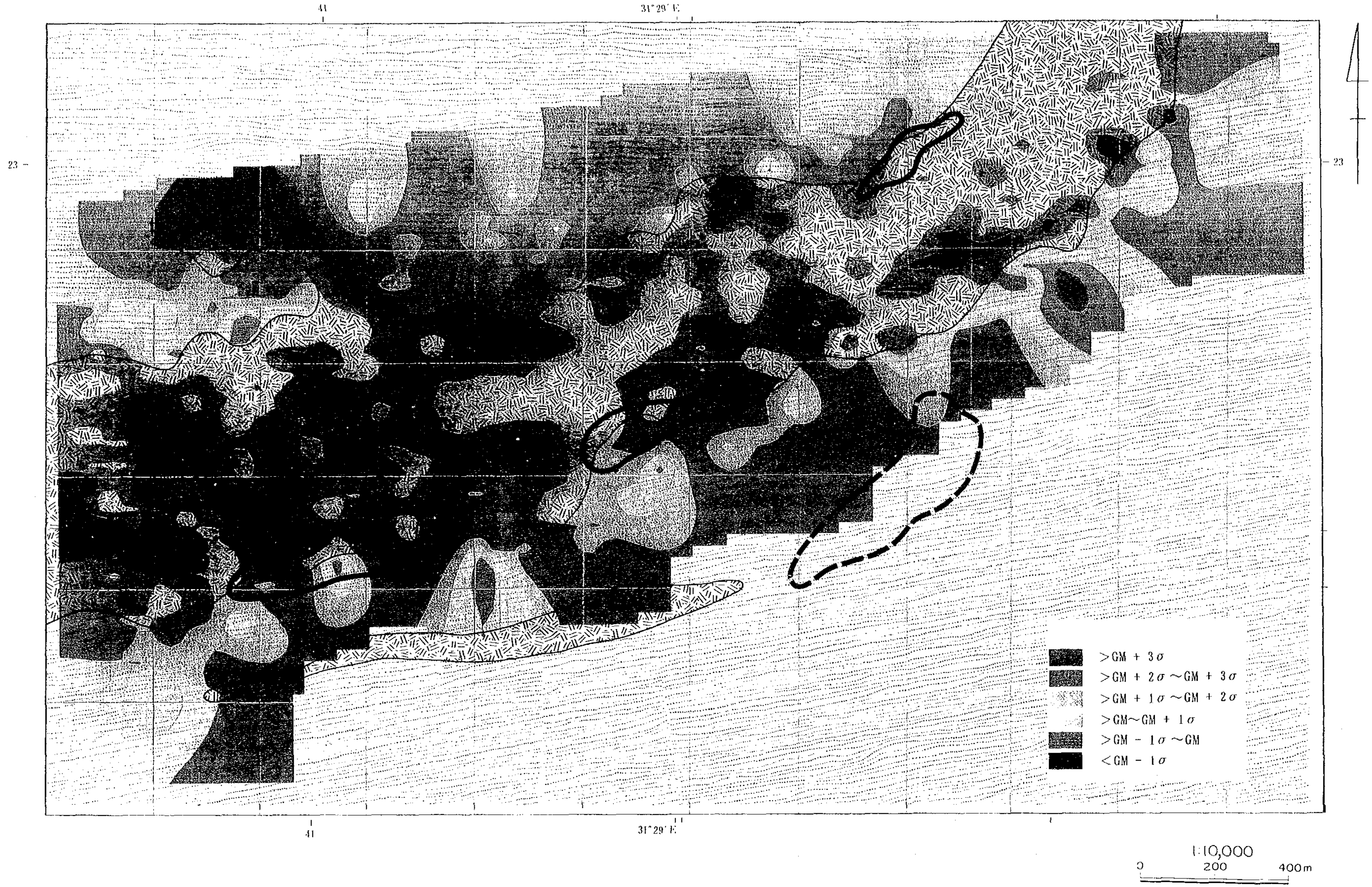


FIG. 2-2-18 Gold Distribution (Chipfunde Zone)

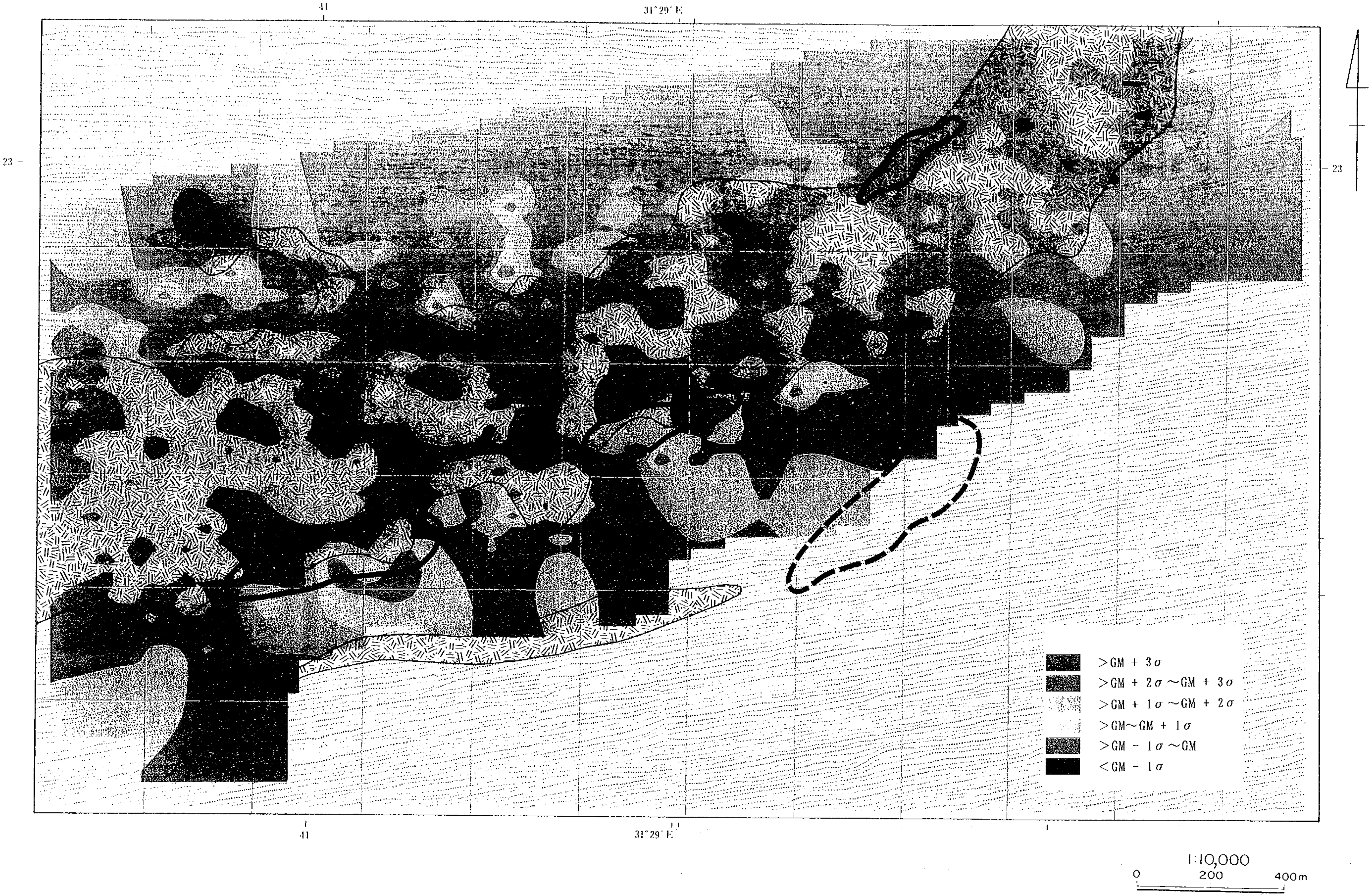


FIG. 2-2-19 Distribution of Principal Component Scores (Chipfunde Zone)

TABLE 2-2-21 Statistical Parameter of Indicators (Chipfunde Zone)

S O I L <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(%)	
													5.77	0.86	1.75	0.08	147	46	147	1,423	440	14.55	←g.m.+ s.d
MAFIC GRANULITE	585	1.71	0.51	0.88	0.06	98.21	21.86	101.62	330.44	231.47	9.50	←g.m.	19.47	1.45	3.46	0.11	220	95	211	6,127	838	22.29	←g.m.+2 s.d.
<3>		3.37	1.69	1.98	1.40	1.50	2.09	1.44	4.31	1.90	1.53	←s.d.	65.68	2.44	6.85	0.15	328	199	305	26,382	1,595	34.15	←g.m.+3 s.d.
FELSIC GRANULITE	0	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	
<4>		—	—	—	—	—	—	—	—	—	—												
													2.60	0.91	0.71	0.09	53	35	77	445	115	5.44	←g.m.+ s.d
GNEISSOSE GRANULITE	313	1.00	0.56	0.55	0.06	27.77	18.27	51.69	128.59	50.31	3.21	←g.m.	6.76	1.46	0.91	0.14	100	69	116	1,539	263	9.22	←g.m.+2 s.d.
<5>		2.60	1.62	1.29	1.55	1.90	1.94	1.50	3.46	2.29	1.69	←s.d.	17.57	2.37	1.18	0.22	191	133	174	5,326	602	15.62	←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>	585	0.50	0.25	0.50	0.05	11.00	10.00	30.00	1.00	22.00	0.23	83.00	2.40	9.00	0.50	314	190	314	6,550	1,590	20.84
FELSIC GRANULITE <4>	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	313	1.00	0.25	0.50	0.05	0.50	10.00	9.00	1.00	5.00	0.56	115.00	11.00	240.00	1.10	432	650	5,050	5,400	294	22.09

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
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
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)>					
CHIPFUNDE ZONE (ROCK)										
R.C.3	1.00	0.25	0.50	0.05	164	140	81	234	134	7.49
R.C.4	0.50	0.25	0.50	0.05	4	250	31	224	4	0.96
R.C.5	0.71	0.25	0.59	0.05	10	282	46	191	30	1.86

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

TABLE 2-2-22(1) Matrix of Correlation Coefficients (Chipfunde Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.17	1.00								
As	0.16	0.19	1.00							
Bi	0.03	0.16	0.13	1.00						
Cu	0.09	-0.06	0.36	0.15	1.00					
F	0.07	0.24	0.23	0.05	0.09	1.00				
Zn	0.17	0.04	0.33	0.21	0.67	0.06	1.00			
Cr	-0.28	-0.44	-0.37	-0.03	-0.04	-0.27	0.02	1.00		
Ni	-0.15	-0.35	-0.15	-0.06	0.43	-0.12	0.48	0.56	1.00	
Fe	-0.03	-0.18	0.13	0.10	0.66	0.01	0.61	0.19	0.60	1.00

TABLE 2-2-22(2) Matrix of Correlation Coefficients (Chipfunde Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	0.01	1.00								
As	0.01	0.05	1.00							
Bi	-0.10	0.10	0.09	1.00						
Cu	0.06	-0.09	0.25	0.15	1.00					
F	-0.02	0.10	0.08	0.10	0.10	1.00				
Zn	-0.06	0.25	0.20	0.21	0.51	0.22	1.00			
Cr	0.05	0.07	0.10	0.13	0.33	-0.13	0.07	1.00		
Ni	0.07	-0.04	0.18	0.06	0.82	-0.02	0.34	0.47	1.00	
Fe	0.02	-0.01	0.24	0.10	0.82	0.01	0.28	0.39	0.83	1.00

TABLE 2-2-23(1) Results of Principal Component Analysis (Chipfunde Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	3.3440	0.3344 (0.3344)	-0.06	-0.28	0.01	0.07	0.67	-0.12	0.74	0.77	0.88	0.94	4.442	-1.789
Z2	1.8750	0.1875 (0.5219)	0.24	0.52	0.69	0.31	0.56	0.50	0.48	-0.43	-0.29	0.12	5.355	-1.847
Z3	1.0010	0.1001 (0.6220)	0.86	0.18	-0.15	-0.42	-0.10	0.04	0.07	0.09	0.11	0.00	7.324	-1.631
Z4	0.9650	0.0965 (0.7185)	0.31	0.12	-0.37	0.81	-0.05	-0.23	0.03	0.05	-0.02	-0.04	8.494	-1.548
Z5	0.8750	0.0875 (0.8060)	-0.22	0.39	-0.34	0.04	-0.23	0.65	-0.02	0.21	0.18	0.20	8.287	-1.720

TABLE 2-2-23(2) Results of Principal Component Analysis (Chipfunde Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.9970	0.2997 (0.2997)	0.02	-0.02	0.41	0.15	0.85	0.06	0.43	0.61	0.87	0.88	3.277	-1.649
Z2	1.3870	0.1387 (0.4384)	-0.26	0.60	0.29	0.40	-0.02	0.49	0.60	-0.26	-0.20	-0.11	6.423	-2.347
Z3	1.0320	0.1032 (0.5416)	0.49	0.60	0.06	-0.49	-0.13	-0.34	0.23	0.07	0.05	0.00	3.595	-1.728
Z4	0.9660	0.0966 (0.6382)	0.81	-0.24	0.19	0.29	0.10	0.25	-0.02	-0.20	-0.11	-0.02	6.066	-1.233
Z5	0.9320	0.0932 (0.7314)	-0.18	-0.29	0.62	-0.28	0.14	-0.33	0.14	-0.44	-0.15	0.02	12.396	-0.427

TABLE 2-2-24 Contrast (Chipfunde 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		19.47	5.78	6.92	2.14	1.34	0.68	2.61	26.18	6.26	2.98
SOIL<3> TH1	585	5.77	3.43	3.50	1.54	0.90	0.33	1.81	6.08	3.29	1.94
SOIL<3>GM		1.71	2.03	1.77	1.10	0.60	0.16	1.25	1.41	1.73	1.27
ROCK <3>(GM.PPM)	1	1.00	0.25	0.50	0.05	164.00	140.00	81.00	234.00	134.00	7.49
SOIL<5> TH2		9.53	5.86	1.55	2.83	10.05	0.24	2.52	8.06	8.77	4.96
SOIL<5> TH1	313	3.67	3.62	1.20	1.83	5.28	0.13	1.68	2.33	3.84	2.93
SOIL<5>GM		1.41	2.24	0.93	1.18	2.78	0.06	1.12	0.67	1.68	1.73
ROCK <5>(GM.PPM)	4	0.71	0.25	0.59	0.05	10.00	282.00	46.00	191.00	30.00	1.86

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

2-7 FUMURE ZONE

2-7-1 Sampling

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

Soils taken over the mafic granulite and gneissose granulite are 374 and 322, respectively.

2-7-2 Geochemical Indicators

Several mineralized signs were found within the zone. Analytical results of the soils also roughly agreed with the observations which confirmed the mineralized signs in the field. The contents on geochemical indicators compared with the zone 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
FUMURE ZONE(SOIL)										
R.C.3	2.89	0.77	14.29	0.07	66.60	36.17	114.06	518.51	398.48	8.99
R.C.4	----	----	----	----	-----	-----	-----	------	-----	----
R.C.5	0.91	0.51	0.97	0.07	12.71	31.23	45.77	49.18	32.85	1.62

Background Geology and Indicator Content

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-25. According to this table, geochemical characteristics on each element are summarized as follows:

Au : 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 2.89 ppb. On the other hand, smaller GM is 0.91 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 content in the zone can be pointed out to be rather high. The maximum value in the zone is 221 ppb.

Ag : GMs of rock code 3 and rock code 5 of all zone are 0.63 and 0.53 ppm, respectively but rock code 3 in the zone has larger value of 0.77 ppm. On the other hand, smaller GM is 0.51 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. Ag content in the zone rather high, with a maximum value of 4.70 ppm.

As : Since approximately 50 % of 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 zone are 2.25 and 0.66 ppm, respectively but rock code 3 in the zone has larger value of 14.29 ppm. On the other hand, smaller GM is 0.97 ppm of rock code 5. 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 high, with maximum value of 1,360 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 zone are 0.06 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 2.40 ppm.

Cu : GMs of rock code 3 and rock code 5 of all zone are 61.57 and 12.86 ppm, respectively but rock code 3 in the zone has larger value of 66.60 ppm. On the other hand, smaller GM is 12.71 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 content in rock code 3 and rock code 5 of the zone is nearly the same as the area.
The maximum value in the zone is 295 ppm.

F : GMs of rock code 3 and rock code 5 of the zone are 26.42 and 30.30 ppm, respectively but rock code 3 in the zone has larger value of 36.17 ppm. On the other hand, smaller GM is 31.23 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. F content in the zone is fairly low, with maximum value of 340 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 114.06 ppm. On the other hand, smaller GM is 45.77 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 normal. The maximum value in the zone is 299 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 5 in the zone has larger value of 518.51 ppm. On the other hand, smaller GM is 49.18 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 Cr content of rock code 5 of the zone is almost same but the content of rock code 3 is nearly twice as much as the area compared. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 5,710 ppm.

Ni : Ni has almost same characteristics with that of Cr. GMs of rock code 3 and rock code 5 of the zone are 153.32 and 19.23 ppm but rock code 3 in the zone has larger value of 398.48 ppm. On the other hand, smaller GM is 32.85 ppm of rock code 5. 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 rock code 5 of the zone is almost the same for the area compared but rock code 3 of the zone has fairly higher than the area. However, values of Flanagan's data fluctuate greatly for various rock types. The maximum value in the zone is 3,150 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 in the zone has larger value of 8.99 %. On the other hand, smaller GM is 1.90 % 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 normal. The maximum value in the zone is 18.58 %.

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.2-2-20. Geochemical values principally consist of two populations, frequency of each population is about 30 %, and 70 %. The threshold value(GM + 2δ)determined statistically indicates the upper 2.5 % level of the second population.

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-20. 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 5 % level 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 2-2-26 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-As, As-Zn, Cu-Fe, Zn-Fe, Cr-Ni, Cr-Fe and Ni-Fe show correlation of medium degree.

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

In general, correlation coefficient among indicators in the zone can be evaluated to be 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 2-2-27(1) and (2).

General characteristics of each geological unit are summarized below:

Rock code 3 : As shown in TABLE 2-2-27(1), the contribution ratio for the first principal component to all the principal components is about 27%, occupying less than one fourth 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 general small and not decisive. Each component drops gradually and does not change markedly.

For the first principal component, Cu, Cr, and Ni show a medium correlation value of 0.54～0.58. On the other hand Zn and Fe has strong correlation value of 0.76～0.81. Therefore, the first principal component is characterized by high concentration of these indicators.

The second principal component is characterized by a high correlation(0.80 ～0.82) of Au and Ag. Therefore, the principal component is worth notice for the exploration of gold and silver, although the contribution ratio is as small as 17 %.

The third principal component has medium correlation(0.59～0.66) with Cr, and Ni. It means anomalous concentrations of these indicators are shown as high core values. Strong negative values(-0.71) also are detected by Cu.

The fourth principal component shows medium correlation(0.60) with Ag and strong correlation(0.76) with F. No geochemical characteristics are unable to determine.

The fifth principal component is characterized by a strong correlation (0.83) with Bi.

Rock code 5 : As shown in TABLE 2-2-27(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 the first principal component, drops gradually and does not change markedly.

For the first principal component, As, Cr, and Ni show a medium correlation value(0.46～0.57) and strong correlation(0.77～0.95) with Cu, Zn, 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 (0.49～0.66) with Ag, Bi, and F. On the other hand, a medium negative correlation (-0.44) with Au and Ni. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has a medium correlation(0.52～0.60) with F, and Cr. Therefore, high scores are expected for the concentration of these i-ndicators.

The fourth principal component is characterized by a medium correlation (0.44～0.64) with Au, As, and 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 medium correlation(0.65) with Bi.

No any significant geochemical characteristics were detected.

Au Concentration and Principal Component Scores

As shown in FIG. 2-2-21, the concentration distribution of Au in the surveyed zone indicates continuous anomalies (GM+ σ ~ GM+2 σ), which form an elliptical figure, a little to the south of the central part of this zone. These anomalies can also be estimated to be similar to those of the Jegede zone, i.e., hydromorphic anomalies in which Au has been transported from a higher portions.

The anomalies are mainly distributed in mafic granulite. This can be understood from the contrasts mentioned below.

High contrasts were found against Au, As and Cu for code 3, and against Cr and Ni for code 5 (TABLE 2-2-28).

Principal components highly related to Au are the second component for code 3 and the fourth component for code 5. FIG. 2-2-22 shows the distribution conditions of high scores for principal components. Despite the weak relationship with the concentration distribution of Au shown in the FIG. 2-2-22, the distribution of the high scores is scattered, indicating no promising zone. This is probably because the relationship between the main components and Au is diluted due to the effects of As and Bi content, which has a correlation with the principal components in the same manner as Au.

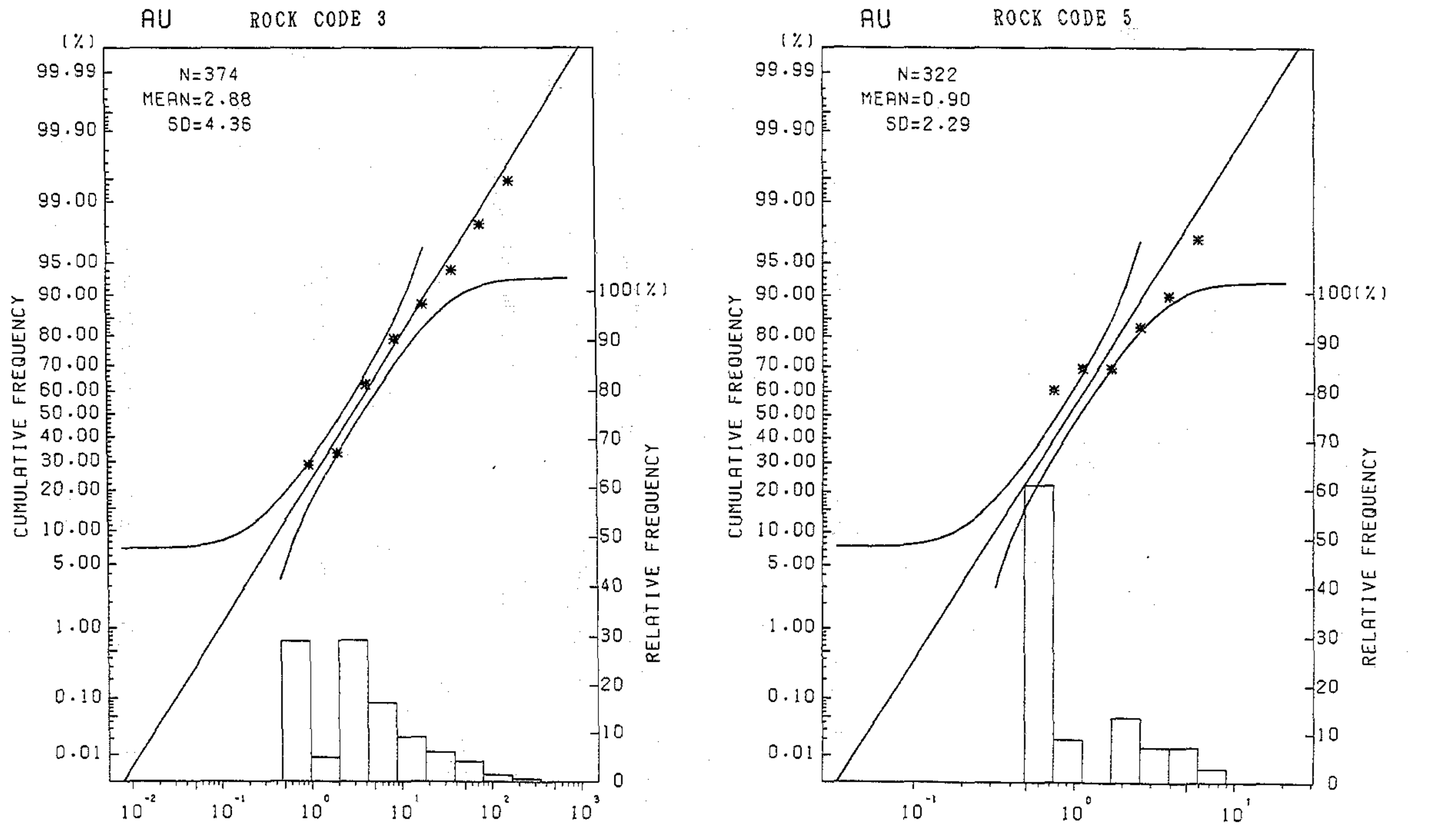


FIG. 2-2-20 Frequency Distribution and Cumulative Frequency Curve (Au;Fumure Zone)

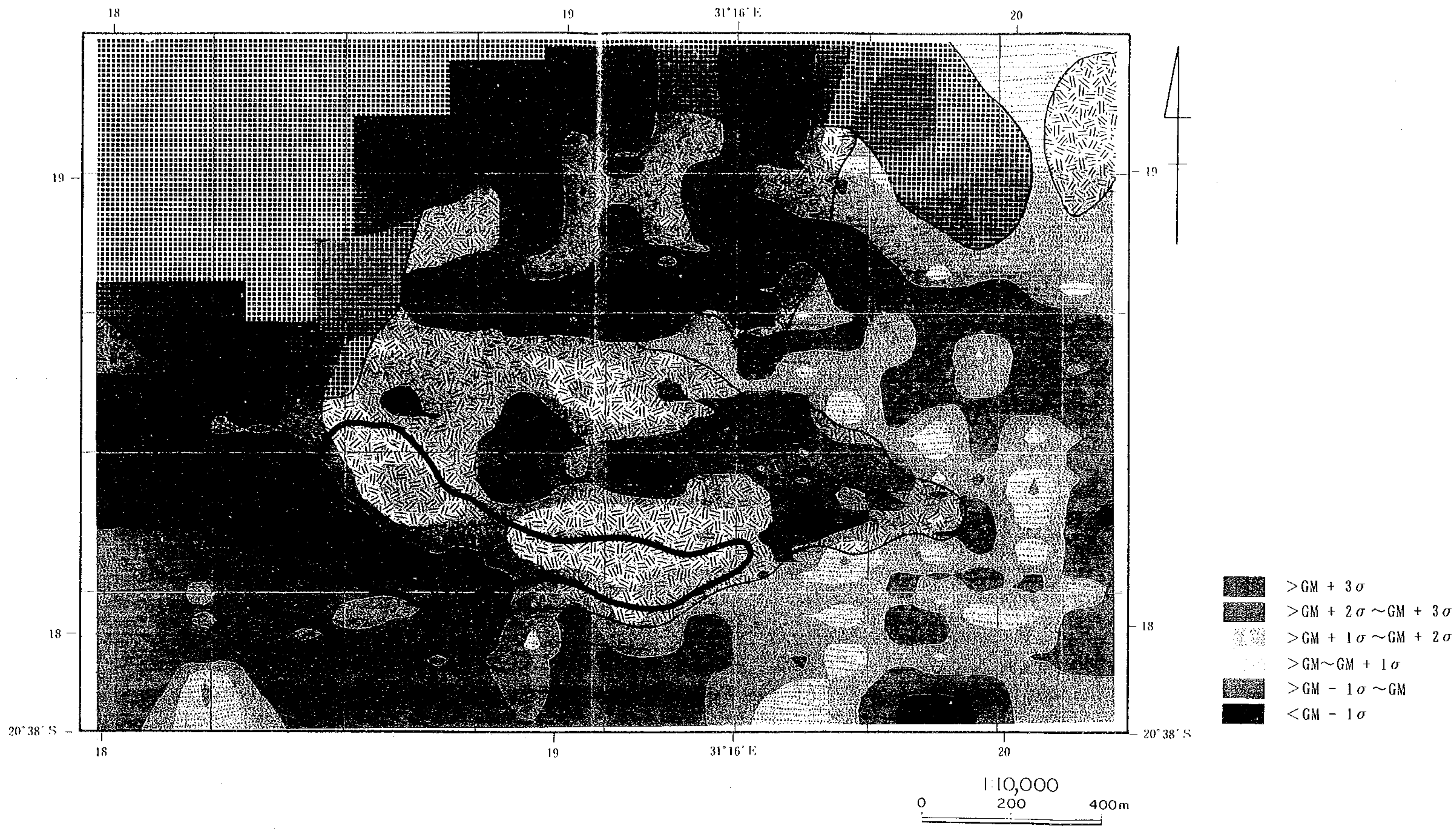


FIG. 2-2-21 Gold Distribution(Fumure Zone)

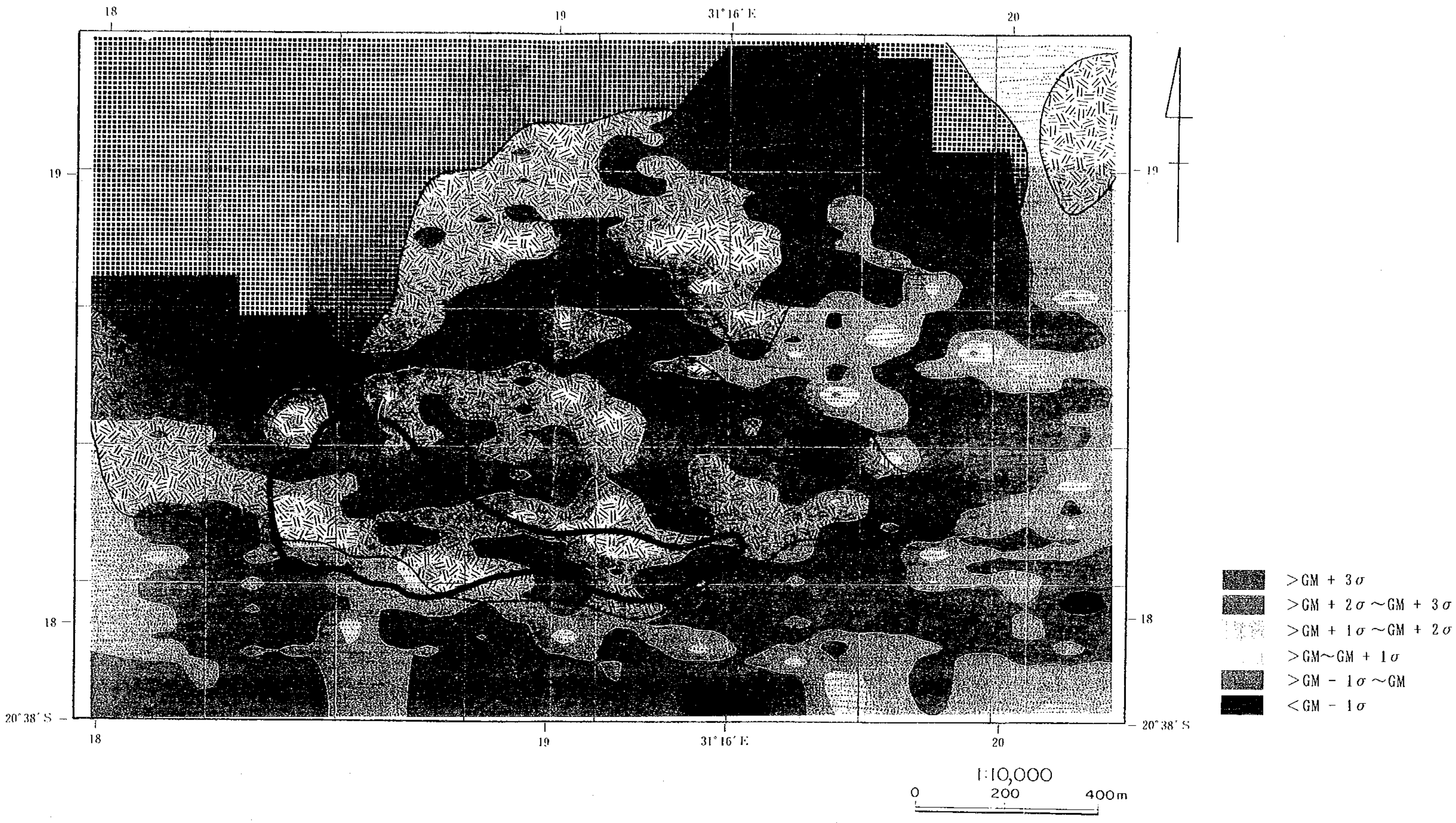


FIG. 2-2-22 Distribution of Principal Component Scores (Fumure Zone)

TABLE 2-2-25 Statistical Parameter of Indicators (Fumure 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>	374	←g.m.	2.89	0.77	14.29	0.07	66.60	36.17	114.06	518.51	398.48	8.99
		←s.d.	4.36	1.78	6.30	1.88	1.60	2.20	1.40	3.55	2.82	1.42
FELSIC GRANULITE <4>	0		—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	322	←g.m.	0.91	0.51	0.97	0.07	12.71	31.23	45.77	49.18	32.85	1.62
		←s.d.	2.23	2.04	2.87	2.32	1.95	2.21	1.40	4.09	3.73	1.82

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>	←g.m.+ s.d	12.61	1.37	90.07	0.13	107	80	159	1,838	1,123	12.80
	←g.m.+2 s.d.	54.99	2.44	567.71	0.24	171	175	222	6,516	3,167	18.23
	←g.m.+3 s.d.	239.86	4.35	3,578	0.44	273	385	310	23,100	8,927	25.96
FELSIC GRANULITE <4>		—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	←g.m.+ s.d	2.03	1.03	2.77	0.16	25	69	64	201	122	2.94
	←g.m.+2 s.d.	4.52	2.11	7.97	0.38	48	152	90	824	456	5.35
	←g.m.+3 s.d.	10.08	4.31	22.88	0.89	94	335	127	3,372	1,702	9.72

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(%)
MAFIC GRANULITE <3>	374	MINIMUM VALUE (PPM)	0.50	0.25	0.50	0.05	16.00	10.00	50.00	1.00	40.00	2.20
		MAXIMUM VALUE (PPM)	221.00	4.70	1,360	2.10	295	340	299	5,710	3,150	18.58
FELSIC GRANULITE <4>	0	MINIMUM VALUE (PPM)	—	—	—	—	—	—	—	—	—	—
		MAXIMUM VALUE (PPM)	—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	1,154	MINIMUM VALUE (PPM)	0.50	0.25	0.50	0.05	4.00	10.00	21.00	0.50	2.00	0.54
		MAXIMUM VALUE (PPM)	8.00	4.00	74.00	2.40	98	210	174	883	1,310	12.77

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	0.58	0.66	0.05	12.86	30.30	37.45	44.07	19.23	1.90
FUMURE ZONE (SOIL)										
R.C.3	2.89	0.77	14.29	0.07	66.60	36.17	114.06	518.51	398.48	8.99
R.C.4	----	----	----	----	----	----	----	----	----	----
R.C.5	0.91	0.51	0.97	0.07	12.71	31.23	45.77	49.13	32.85	1.62

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)>										
FUMURE ZONE (ROCK)										
R.C.3	0.50	0.25	6.00	0.05	8	93	101	1,585	472	7.42
R.C.4	----	----	----	----	----	----	----	----	----	----
R.C.5	0.50	0.25	1.00	0.05	7	68	45	3	12	1.16

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

TABLE 2-2-26(1) Matrix of Correlation Coefficients (Fumure Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.14	1.00								
As	0.58	-0.30	1.00							
Bi	0.16	-0.17	0.08	1.00						
Cu	0.07	0.05	0.23	0.18	1.00					
F	-0.03	0.24	-0.23	-0.09	-0.18	1.00				
Zn	0.16	-0.12	0.41	0.24	0.61	-0.04	1.00			
Cr	0.12	0.07	0.10	0.18	0.02	-0.07	0.18	1.00		
Ni	0.14	-0.20	0.27	0.28	-0.08	-0.01	0.37	0.61	1.00	
Fe	0.02	-0.13	0.26	0.25	0.52	-0.24	0.57	0.51	0.57	1.00

TABLE 2-2-26(2) Matrix of Correlation Coefficients (Fumure Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.08	1.00								
As	0.05	-0.08	1.00							
Bi	-0.10	0.29	-0.16	1.00						
Cu	0.03	0.16	0.34	0.03	1.00					
F	-0.04	0.15	-0.09	-0.03	0.14	1.00				
Zn	0.00	0.21	0.30	0.05	0.74	0.15	1.00			
Cr	0.08	-0.02	0.07	-0.15	0.27	0.10	0.09	1.00		
Ni	0.16	-0.16	0.44	-0.34	0.62	0.12	0.33	0.40	1.00	
Fe	0.04	0.08	0.48	-0.12	0.88	0.10	0.67	0.24	0.76	1.00

TABLE 2-2-27(1) Results of Principal Component Analysis (Fumure Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.6600	0.2660 (0.2660)	0.13	-0.38	0.23	0.39	0.54	-0.30	0.76	0.58	0.57	0.81	5.588	-2.063
Z2	1.6800	0.1680 (0.4340)	0.82	-0.39	0.80	0.12	-0.24	-0.18	-0.14	-0.08	-0.07	-0.28	4.018	-1.304
Z3	1.4740	0.1474 (0.5814)	-0.03	0.01	-0.04	-0.05	-0.71	0.26	-0.32	0.59	0.66	0.03	8.514	-0.707
Z4	1.2450	0.1245 (0.7059)	0.32	0.60	0.17	0.32	0.15	0.76	0.24	0.00	0.03	-0.04	6.628	-1.409
Z5	0.9170	0.0917 (0.7976)	0.01	-0.22	-0.35	0.83	-0.09	-0.03	-0.19	-0.06	-0.07	-0.09	13.692	-1.715

TABLE 2-2-27(2) Results of Principal Component Analysis (Fumure Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	3.0880	0.3088 (0.3088)	0.13	0.04	0.46	-1.15	0.88	0.17	0.77	0.46	0.57	0.95	6.788	-1.225
Z2	1.6220	0.1622 (0.4710)	-0.44	0.66	-0.18	0.53	0.23	0.49	0.35	-0.26	-0.44	0.02	5.217	-1.706
Z3	1.1040	0.1104 (0.5814)	0.28	0.34	-0.24	0.07	-0.16	0.52	-0.29	0.60	0.31	-0.11	4.548	-2.618
Z4	0.9620	0.0962 (0.6776)	0.64	0.24	0.47	0.44	-0.07	-0.12	-0.04	-0.23	-0.02	-0.02	6.116	-1.234
Z5	0.8510	0.0851 (0.7627)	-0.34	-0.16	-0.07	0.65	-0.04	-0.30	-0.14	0.14	0.38	0.09	7.061	-0.981

TABLE 2-2-28 Contrast (Fumure 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		109.98	9.76	94.62	4.73	21.34	1.88	2.20	4.11	6.71	2.46
SOIL<3> TH1	374	25.21	5.47	15.01	2.52	13.33	0.86	1.58	1.16	2.38	1.73
SOIL<3>GM		5.78	3.07	2.38	1.34	8.32	0.39	1.13	0.33	0.84	1.21
R O C K <3>(GM.PPM)	2	0.50	0.25	6.00	0.05	8.00	93.00	101.00	1,585	472.00	7.42
SOIL<5> TH2		9.04	8.44	7.97	7.66	6.89	2.23	2.01	274.64	38.04	4.61
SOIL<5> TH1	322	4.06	4.13	2.77	3.30	3.54	1.01	1.43	67.10	10.20	2.54
SOIL<5>GM		1.82	2.02	0.97	1.42	1.82	0.46	1.02	16.39	2.74	1.40
R O C K <5>(GM.PPM)	3	0.50	0.25	1.00	0.05	7.00	68.00	45.00	3.00	12.00	1.16

TH2:THRESHOLD (GM+2 STANDARD DEVIATION)

TH1:THRESHOLD (GM+1 STANDARD DEVIATION)

GM:GEOMETRIC MEAN

2-8 NYAHONDO ZONE

2-8-1 Sampling

Soil sampling lines were set on north-south direction due to east-west occurrence of mineralized signs concordant with the foliation of gneissose granulite and B-horizon soil was taken. Soil colour in the zone weakly reflects the basement geology. In general, gray soils are predominant in the north, west and north-eastern portions of the zone and the rest of the zone is characterized by brown soils. Soils taken over gneissose granulite are 1,057.

2-8-2 Geochemical Indicators

No promising geochemical anomalies were detected although several mineralized signs were found within the zone. The contents on geochemical indicators compared with the zone 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
NYAHONDO ZONE(SOIL)										
R.C.3	----	----	----	----	-----	-----	-----	------	------	----
R.C.4	----	----	----	----	-----	-----	-----	------	------	----
R.C.5	1.05	0.59	0.57	0.05	31.41	38.26	37.74	40.03	19.73	1.79

Background Geology and Indicator Content

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-29. According to this table, geochemical characteristics on each element are summarized as follows:

Au : Geometric means(GMs) of rock code 5 of all zones are 0.93 ppb but rock code 5 in the zone has larger value of 1.05 ppb. 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 133 ppb.

Ag : GMs of rock code 5 of all zone are 0.53 ppm but GM is 0.59 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. Ag content in the zone rather high, with a maximum value of 2.70 ppm.

As : Since more than 80 % of data indicated content below its detection limit(1.00 ppm), it is difficult to clarify its geochemical character in the zone. GM of rock code 5 of all zone are 0.66 ppm but rock code 5 has value of 0.57 ppm. A comparison on content of the indicator between the zone and other areas based on data by Flanagan(1976) and Vinogradov(1962) was made. Content of rock code 5 in the zone is fairly low, with maximum value of 3.00 ppm.

Bi : Since almost all 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 and the zone are both 0.05 ppm. There is no difference among the GMs of the element. A comparison on content of the indicator between the zone and other areas 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 0.10 ppm.

Cu : GM of rock code 5 of all zones is 12.86 ppm but rock code 5 in the zone has value of 31.41 ppm. 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 content in rock code 5 of the zone is nearly the same as the areas. The maximum value in the zone is 324 ppm.

F : GM of rock code 5 of all zones is 30.30 but rock code 5 in the zone has value of 38.26 ppm. 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 640 ppm.

Zn : GM of rock code 5 of all zone is 37.45 ppm but rock code 5 in the zone has value of 37.74 ppm. 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 nearly same. The maximum value in the zone is 279 ppm.

Cr : GM of rock code 5 of all zone is 44.07 ppm but rock code 5 in the zone has value of 40.03 ppm. 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 content of rock code 5 of the zone is almost same to that of the areas compared. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 313 ppm.

Ni : Ni has almost same characteristics with that of Cr. GM of rock code 5 of all zones is 19.23 ppm but rock code 5 has value of 19.73 ppm. 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 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 302 ppm.

Fe : GM of rock code 5 of all zones are 1.90 % but rock code 5 in the zone has value of 1.79 %. 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 almost the same for the area compared. The maximum value in the zone is 5.54 %.

Determination of Threshold Values

An interpretation was conducted on the cumulative frequency curve of Au in rock code 5. The results are summarized as follows:

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-23. Geochemical values principally consist of two populations, frequency of each population is about 55 %, and 45 %. The threshold value(GM + 2δ)determined statistically corresponds to the higher portion(upper 6 % level) of the second population.

The cumulative frequency curve of the second population shows negative skewness.

Correlation Coefficient between Indicators

The correlation coefficients between indicators on a logarithmic base were calculated for rock code 5. In the geological units, correlation coefficients between respective indicators were small, suggesting that the origins of individual indicators are different from each other.

TABLE 2-2-30 show the correlation coefficients on corresponding rock code 5. Results of interpretation are summarized below:

Rock code 5 : Indicators of Cu-Ni, Cu-Fe, Zn-Fe, and Ni-Fe show correlation of medium degree. The code, in general, is characterized by poor correlation.

2-8-3 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 2-2-31.

General characteristics of rock code 5 are summarized below:

Rock code 5 : As shown in TABLE 2-2-31, the contribution ratio for the first principal component to all the principal components is about 23%, occupying less than one fourth of all. The total to the ratio of the fifth principal component amounts to 67 % 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, Cu, F, Zn, Cr, and Ni show a medium correlation value(0.40～0.69) and a strong correlation(0.82) with 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 strong correlation(0.73) with Ag. On the other hand, a medium negative correlation(-0.48) with Cr. High scores and low negative scores are expected in the concentration of these indicators.

The third principal component has a medium correlation(0.65) with Bi, and negative correlation(-0.51) with Au also was detected. Therefore, high score or low negative score are expected for the concentration of these indicators. This component is worth notice for the gold exploration, although the contribution ratio is as low as 11%.

The fourth principal component is characterized by medium correlations (0.47～0.61) with Au, As, and Bi. The component is also worth notice for the gold exploration, although the contribution ratio is as low as 10 %.

The fifth principal component show medium correlations(0.68) with As and a negative medium correlation(-0.62) with Au. No any significant geochemical characteristics were detected. The component must be also worth notice for the gold exploration, although the contribution ratio is as low as 10 %.

Au Concentration and Principal Component Scores

As shown in FIG.2-2-24, the concentration distribution of Au in the surveyed area indicates anomalies distributed in a restricted zone and showing weak sense in the E-W direction. The anomalous zone of this zone may be a combination of the above anomalies and those stretching in the N-W direction. However, no noteworthy results were observed either in continuity or anomalous values.

No notable relationship was found between geochemical soil anomalies and the geology. Moreover, it is not clear whether the above-mentioned anomalies distributed in the N-W direction is related to any potential tectonic line or not. Mineralized signs observed in the field were found to be distributed in the ENE-WSW direction.

No indicators with noteworthy contrasts were detected as shown in TABLE 2-2-32.

The principal component highly related to Au is the fifth component for code 5 (negative correlation). FIG. 2-2-25 indicates the distribution of these scores. From the figure showing scattered distribution of scores, no promising zone could be specified. It can be estimated that the relationship between the principal component and Au is diluted because it is affected by As, Bi and Zn content, which have negative correlations with the principal component, in the same manner as Au.

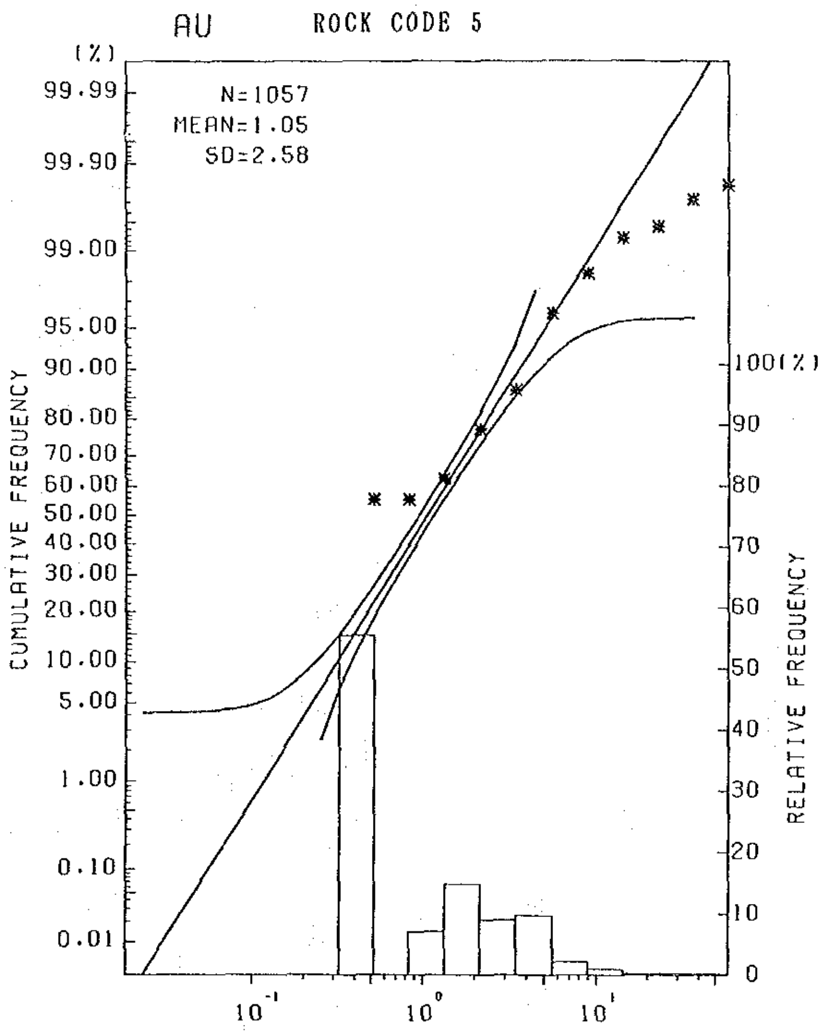


FIG. 2-2-23(1) Frequency Distribution and Cumulative Frequency Curve
(Au;Nyahondo Zone)

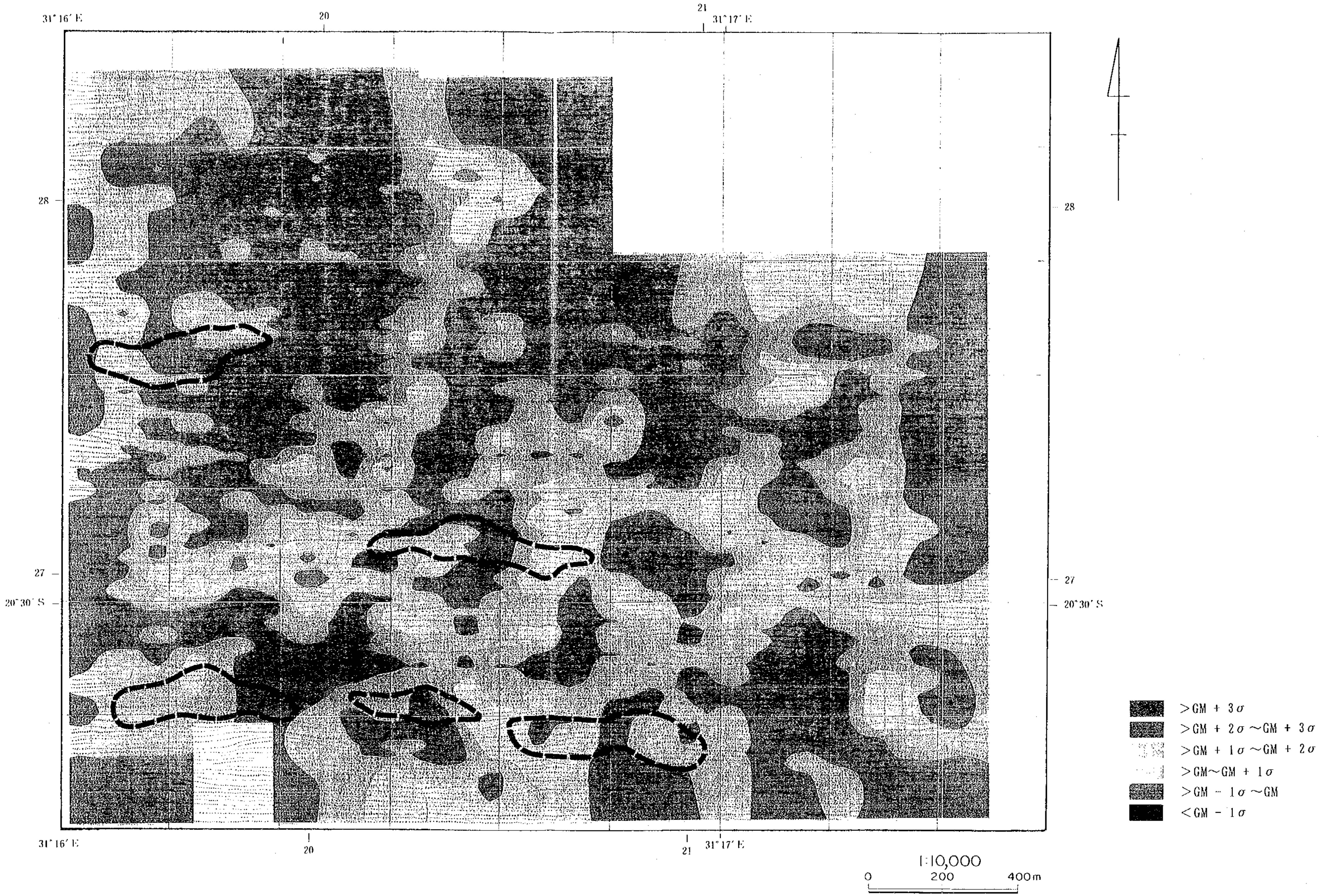


FIG. 2-2-24 Gold Distribution (Nyahondo Zone)

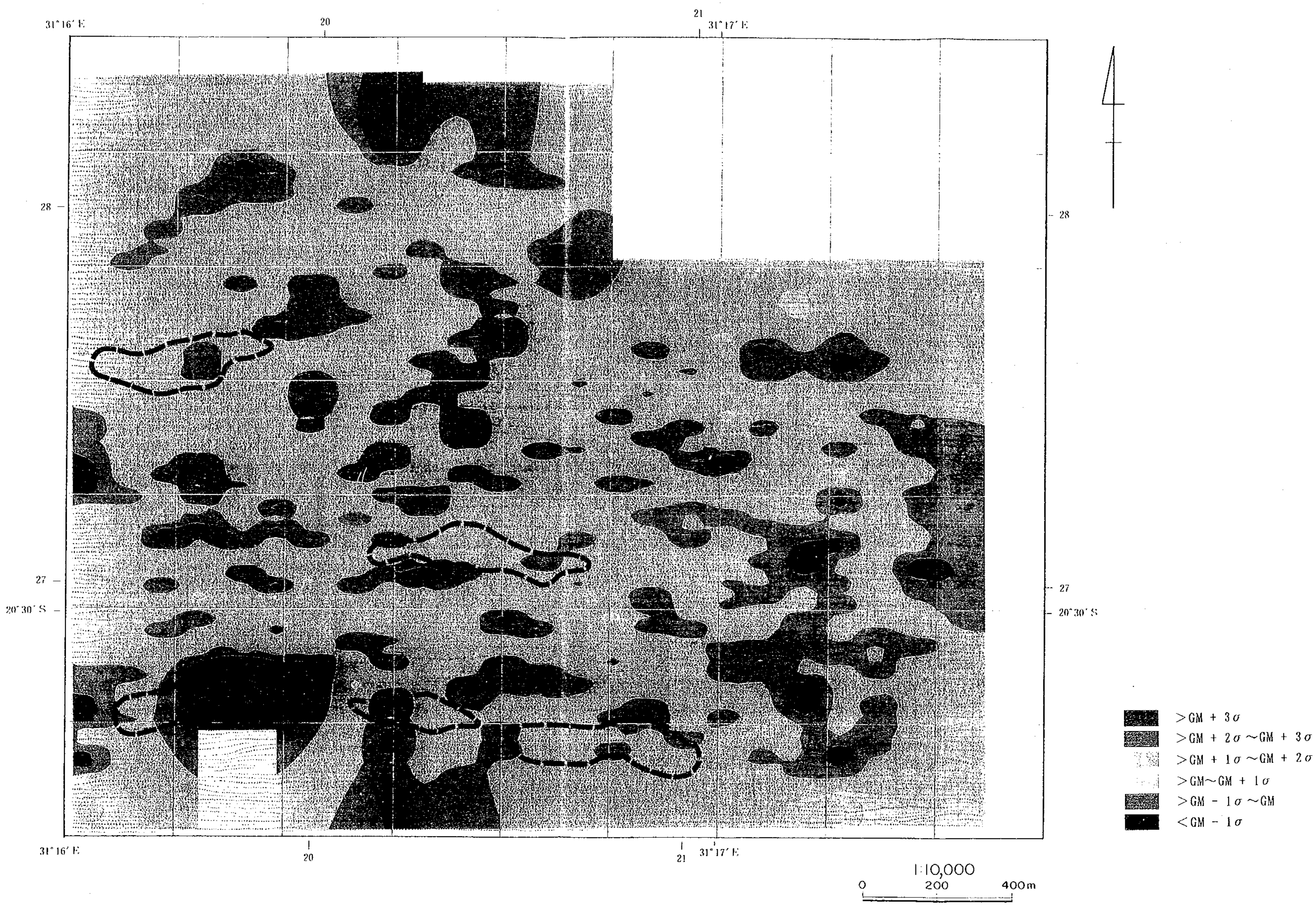


FIG. 2-2-25 Distribution of Principal Component Scores

FIG. 2-2-29 Frequency Distribution and Cumulative Frequency Curve (Nyahondo 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(%)	
MAFIC GRANULITE <3>	0	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	
FELSIC GRANULITE <4>	0	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	
GNEISSOSE GRANULITE <5>	1,057												2.14	0.93	1.20	0.06	94	97	81	107	85	3.70	←g.m.+ s.d
		1.05	0.59	0.57	0.05	31.41	38.26	37.74	40.03	19.73	1.79	←g.m.	4.33	1.47	2.55	0.07	280	248	174	284	365	7.66	←g.m.+2 s.d.
		2.03	1.58	2.12	1.16	2.99	2.55	2.15	2.66	4.30	2.07	←s.d.	8.79	2.32	5.39	0.08	838	631	374	757	1,569	15.86	←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>	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
FELSIC GRANULITE <4>	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
GNEISSOSE GRANULITE <5>	1,057	0.50	0.25	0.50	0.05	5.00	10.00	13.00	1.00	3.00	0.46	133.00	2.70	3.00	0.10	324	640	279	313	302	5.54

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 (%)
A L L Z O N E S										
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
N Y A H O N D O Z O N E (S O I L)										
R. C. 3	----	----	----	----	-----	-----	-----	------	------	----
R. C. 4	----	----	----	----	-----	-----	-----	------	------	----
R. C. 5	1.05	0.59	0.57	0.05	31.41	38.26	37.74	40.03	19.73	1.79

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)>					
N Y A H O N D O Z O N E (R O C K)										
R. C. 3	----	----	----	----	-----	-----	-----	-----	-----	-----
R. C. 4	0.50	0.25	1.00	0.05	33	31	17	219	9	0.95
R. C. 5	1.82	0.25	0.63	0.05	12	133	39	19	18	1.71

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

After Flanagan(1976) & Vinogradov(1962)

TABLE 2-2-30 Matrix of Correlation Coefficients (Nyahondo Zone)

	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
Au	1.00									
Ag	-0.01	1.00								
As	-0.03	0.06	1.00							
Bi	-0.02	0.00	-0.02	1.00						
Cu	0.10	-0.06	-0.05	0.07	1.00					
F	-0.01	0.17	0.03	-0.05	0.25	1.00				
Zn	0.01	0.20	-0.08	0.06	0.32	0.17	1.00			
Cr	0.03	-0.02	0.02	0.02	0.20	0.05	0.09	1.00		
Ni	0.06	-0.02	-0.05	0.02	0.40	0.23	0.38	0.31	1.00	
Fe	0.01	0.30	0.05	0.11	0.60	0.30	0.57	0.18	0.58	1.00

TABLE 2-2-31 Results of Principal Component Analysis (Nyahondo Zone)

PRINCIPAL COMPONENT	EIGEN-VALUE	CONTRIBUTION RATIO	FACTOR LOADING										SCORE	
			Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe	MAXIMUM	MINIMUM
Z1	2.3830	0.2383 (0.2383)	0.13	0.14	-0.05	0.13	0.68	0.40	0.51	0.55	0.69	0.82	3.919	-1.958
Z2	1.2350	0.1235 (0.3618)	-0.03	0.73	0.32	0.05	-0.02	0.37	0.13	-0.48	-0.38	0.27	8.577	-2.580
Z3	1.0990	0.1099 (0.4717)	-0.51	-0.18	-0.32	0.65	0.14	-0.24	0.29	-0.30	-0.15	0.14	16.663	-3.758
Z4	0.9980	0.0998 (0.5715)	0.47	-0.03	0.51	0.61	-0.02	-0.30	-0.17	0.11	-0.02	0.06	19.186	-1.252
Z5	0.9760	0.0976 (0.6691)	-0.62	-0.26	0.68	-0.12	0.10	0.06	-0.12	0.07	0.09	0.05	8.766	-2.545

TABLE 2-2-32 Contrast (Nyahondo Zone)

SOIL & ROCK	NO. OF	CONTRAST									
R. C. <3, 4, 5>	SAMPLE	Au	Ag	As	Bi	Cu	F	Zn	Cr	Ni	Fe
SOIL<5> TH2		2.38	5.87	4.04	1.34	23.37	1.86	4.46	14.95	20.27	4.48
SOIL<5> TH1	1,057	1.17	3.72	1.91	1.16	7.82	0.73	2.08	5.61	4.71	2.16
SOIL<5>GM		0.58	2.36	0.90	1.00	2.62	0.29	0.97	2.11	1.10	1.04
ROCK <5>(GM. PPM)	3	1.82	0.25	0.63	0.05	12.00	133.00	39.00	19.00	18.00	1.71

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

2-9 CHAMBURUKIRA ZONE

2-9-1 Sampling

Soil sampling lines were set on north-south direction due to east-west occurrence of mineralized signs such as Fe-hydroxide, quartz, k-feldspar, etc., and B-horizon soil was taken. Soil colour in the zone poorly reflects the basement geology. In general, gray soils are predominant in the northern portion of the zone and brown soils in the central to southern portions. Soils taken over the felsic granulite and gneissose granulite are 571 and 760, respectively.

2-9-2 Geochemical Indicators

Several mineralized signs were found within the zone. Analytical results of the soils did not agreed with the observations which confirmed the mineralized signs such as Fe-hydroxide, quartz, k-feldspar, etc. in the zone.

The contents on geochemical indicators compared with the zone and all studied zones 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
CHAMBURUKIRA ZONE (SOIL)										
R.C.3	----	----	----	----	----	----	----	----	----	----
R.C.4	0.98	0.30	0.56	0.05	10.88	12.88	35.64	28.63	14.59	1.73
R.C.5	0.86	0.38	0.63	0.05	10.63	18.08	36.48	31.89	16.21	1.69

Background Geology and Indicator Content

Accordingly, geochemical characteristics for respective geological units are shown in TABLE 2-2-33. According to this table, geochemical characteristics on each element are summarized as follows:

Au : Geometric means(GMs) of rock code 4 and rock code 5 of all zones are 0.98 and 0.93 ppb, respectively but rock code 4 in the zone has larger value of 0.98 ppb. On the other hand, smaller GM is 0.86 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 content in the zone can be pointed out to be low. The maximum value in the zone is 8 ppb.

Ag : GMs of rock code 4 and rock code 5 of all zones are 0.48 and 0.53 ppm, respectively but rock code 5 has larger value of 0.38 ppm. On the other hand, smaller GM is 0.30 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) was made. Ag content in the zone is rather high, with a maximum value of 2.00 ppm.

As : Since approximately 70 % 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 4 and rock code 5 of all zones are 0.58 and 0.66 ppm, respectively but rock code 5 in the zone has larger value of 0.63 ppm. On the other hand, smaller GM is 0.56 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) was made. Content of the indicator in the zone is fairly low, with maximum value of 36 ppm.

Bi : Since almost all 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 0.05 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 5.00 ppm.

Cu : GMs of rock code 4 and rock code 5 of all zones are 8.82 and 12.86 ppm, respectively but rock code 4 has larger value of 10.88 ppm. On the other hand, smaller GM is 10.63 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 in rock code 3 and rock code 5 of the zone are fairly low. The maximum value in the zone is 93 ppm.

F : GMs of rock code 4 and rock code 5 of all zones are 23.02 and 30.30 ppm, respectively but rock code 5 in the zone has larger value of 18.08 ppm. On the other hand, smaller GM is 12.88 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) was made. F content in the zone is fairly low, with maximum value of 450 ppm.

Zn : GMs of rock code 4 and rock code 5 of all zones are 40.41 and 37.45 ppm, respectively but rock code 5 in the zone has larger value of 36.48 ppm. On the other hand, smaller GM is 35.64 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 Zn content in the zone is lower than that of the areas compared. The maximum value in the zone is 2,350 ppm.

Cr : GMs of rock code 4 and rock code 5 of the zone are 30.92 and 44.07 ppm, respectively but rock code 5 in the zone has larger value of 31.89 ppm. On the other hand, smaller GM is 28.63 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 content of rock code 5 of the zone is almost same but the content of rock code 3 is nearly same to that of the areas compared. However, the indicator's values fluctuate greatly for rock types according to Flanagan's data. The maximum value in the zone is 569 ppm.

Ni : GMs of rock code 4 and rock code 5 of the zone are 11.77 and 19.23 ppm but rock code 5 in the zone has larger value of 16.21 ppm. On the other hand, smaller GM is 14.59 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 rock code 5 of the zone is almost the same for the areas compared. However, values of Flanagan's data fluctuate greatly for various rock types. The maximum value in the zone is 621 ppm.

Fe : GMs of rock code 4 and rock code 5 of the zone are 1.96 and 1.90 %, respectively but rock code 4 in the zone has larger value of 1.73 %. On the other hand, smaller GM is 1.69 % 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 lower than that of the areas. The maximum value in the zone is 8.14 %.

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 4 : Au shows a kind of dual distribution as shown in FIG.2-2-26. Geochemical values principally consist of two populations, frequency of each population is about 55 %, and 45 %. The threshold value(GM + 2δ) determined statistically indicates the upper 2 % level of the second population.

Rock code 5 : Au shows a kind of dual distribution as shown in FIG.2-2-26. Geochemical values principally also consist of two populations like rock code 4, frequency of each population is about 70 %, and 30 %. The threshold value(GM + 2δ) determined statistically indicates the upper 2 % level of the second population.

No positive skewness were observed on the cumulative frequency curves of