3-4-3 Intrusive Rocks

Sibuyan Ultramafic Rocks (Su)

This rock unit consists of pyroxene peridotite (Lherzolite?), pyroxenite, amphibolite and gabbro, distribute at central Sibuyan Is. and north Tablas Is. Contact with the Tablas Volcanics is assumed to be a fault. In Sibuyan Is. rock facies is homogeneous and structure unclear; Highest peak of Sibuyan Is. constructed by this rocks. Age of this rock intrusion is assumed as Cretaceous to Paleogene.

Quartzdiorite (Qd)

Consists of quartzdiorite and hornblend diorite porphyry.
Stock shaped intrusions are observed at central Tablas Is. and west of northern Sibuyan Is;, These stocks penetrate the Romblon Metamorphic Rocks, Sibuyan Ultramafic Rocks and Tablas Volcanics.
The intrusion of these rocks are assumed to have occurred during the Paleogene.
(Microscopic Observation Results)
The sample of this rock (LR-10) which collected 6 kms SE of Magdiwang at north coast of Sibuyan Island is lherzolite which consists of clino pyroxene, olivine and small amount of ortho pyroxene, Picotite is occur as accessory minsal. It exhibits strong magnetism and weak alternation.

Banton Volcanics (Bv)

Consists of porphyritic andesite and pyroclastics.
Stratified outcrops expose at Alcantara (east coast of Tablas Is.)
From structure of pyroclastics, bedding of these rocks appears to be NW-SE strike and 20 -50°N dip.
Age of these rocks is assumed to be Pliocene.

3-4-4 Geological Structure

In Romblon Area, the basement metamorphic rocks and the intrusive ultramafic rocks and quartzdiorite in the basement rocks have occupied broad areas; Distribution of Neogene sediments on the other hand is narrow compared to Cebu and Panay Areas.

This tendency is recognized at the Buruanga Peninsula (northern part of Romblon Is.) as a result of the upheaving basement during the Antique Mountain Range formation. N-S fault system that accompanied the upheaval movement has controlled the direction of intrusive rocks.

3-4-5 Results of Mineral Showing Survey

In Romblon area 6 mineral showings were investigated. These localities are shown in Fig. and abstract of survey results in Table-6. Spot investigation data sheet and route maps and sketches are shown in Appendix-9 & 10. Contents of the 6 mineral showings are porphyry copper (2), nickel laterite (2), vein type ore (1) and placer gold (1).

The results of field survey and indoor testing for main mineral showings are as follows.

Nailog (spot investigation No. R-4)

Locality;	5.7 kms SW of Magdiwang in northern coast of Sibuyan Island. Topographic map (1/50,000) Cajidiocan (3557III) Easting 1,000 m, Northing 13,300 m				
Ore minerals;	Chalcopyrite, Galena, Sphalerite and Pyrite, (Ref. Microscopic Photograph JR-27 in Appendix-2)				
Situation;	About 20 gold panners are working in alternation zone. This zone elongate about 300 m along the stream.				
Ore Assay;	Au g/t	Ag g/t	Cu %	Pb %	Zn %
JR-27	2.12	172	0.93	3.68	6.62
Evaluation;	Ore contents predominate Au and Ag associated strong alternation zone, therefore under ground exploration is expectably.				

Fig-8 Locality Map of Mineral Showings (Romblon Area)

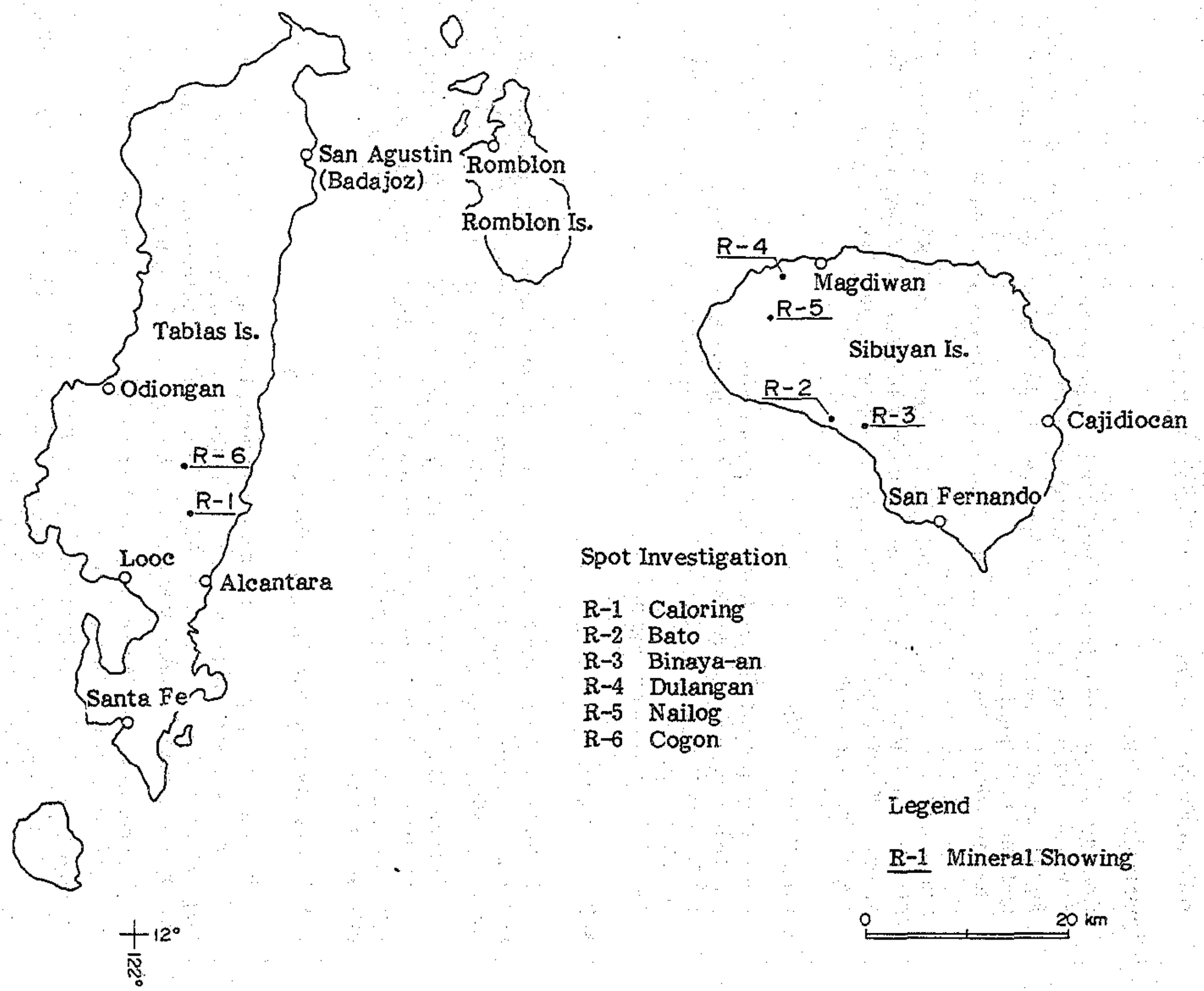


Table- 6 Abstract of Spot Investigation Results (Romblon Area)

No.	Name of Showing	Name of Topo. Map	Map No.	Coordinates		Type of Ore	Evaluation*	Remarks
				Easting	Northing			
R-1	Caloring	Looc	33561	19,150	15,900	Porphyry Cu.	D	Accompanied Tertiary diorite. Alteration is strong.
R-2	Bato	Cajidiocan	35573	6,300	5,300	Nickel Laterite	E	Derived from serpentinized peridotite. Thin laterite.
R-3	Binaya-an	Cajidiocan	35573	8,700	4,500	Nickel Laterite	D	Derived from serpentinized peridotite. Laterite thickness (+1 m.)
R-4	Dulangan	Cajidiocan	35573	2,300	1,375	Placer Gold	C	Country rock is Tertiary diorite. Residual placer.
R-5	Nailog	Cajidiocan	35573	900	1,650	Vein type	D	Vein type deposit in Tertiary diorite. Small scale high grade ore of Cu, Pb, and Zn.
R-6	Cogon	Odiongan	34573	13,500	1,100	Porphyry Cu.	D	Accompanied Tertiary diorite. Strong alteration but mineralization is weak.

* C: Further follow-up survey is highly recommended.
D: Necessity of follow up survey is not highly recommended.
E: Follow up survey is not needed.

4. GEOCHEMICAL SURVEY

4. Geochemical Survey

4-1 Survey Method

Geochemical survey was undertaken mainly to analyze the microchemical contents of the elements of stream sediments and heavy mineral samples. Sampling error was checked by taking duplicate samples from the same place of original sampling point at approximately every 50 stream sediment samples collected.

Stream sediment samples from Panay Area and all heavy mineral samples were analyzed by the Bureau of Mines and Geo-Sciences analytical laboratory (herein after called PETROLAB) by atomic absorption method.

While stream sediment samples for Cebu and Romblon Area only heavy mineral samples was analyzed herein, and the rests were analyzed by Chemex Co., in Canada using the same method.

Processing of geochemical data was done by Overseas Mineral Resources Development Co., Ltd. (hereinafter called OMRD) for all areas. Analyzing method is univariate analysis of the data.

4-1-1 Sample Location

Sampling was carried out along active channels of streams. The density of sampling is approximately 1 stream sediment sample for every 1 to 2 square kms. Sampling points are pre-determined in a 1/50,000 scale prior to the start of the survey.

4-1-2 Sampling method

Samples collected are wet sieved by using stainless sieve to 30 mesh fraction in situ by which they amounted to about 500 grams. They are washed thoughly to remove dirt and clay fractions before they are placed in a properly marked water resistant kraft bag. An accompanying data seet card (Fig. 9) is filled up to record observations like, location, grid coordinates, features of the stream, pH, Eh, topography etc. Samples are transported to base camp for drying and sieving to -80 mesh.

Heavy mineral samples are collected using wooden pans at pre-determined sampling points. About 50 grams of heavy mineral fractions are collected from each point and are placed in a plastic tube. These samples are sent to the laboratory through base camp. Similar to stream sediments, a corresponding data sheet form is filled up to describe the place.

4-1-3 Method of Indoor Testing

1) Adjustment method of analytical samples

Stream sediment and heavy mineral samples sent to PETROLAB are divided into 20 gram for analytical samples and the rest amount for spare samples.
On the analytical laboratory one gram of stream sediment sample and 10 grams of heavy mineral sample are weighed samples are stored for further use for AAS analysis.

Fig-9 Field data sheet of Geochemical Survey

AREA:

SAMPLE NO.	SAMPLE TYPE	EASTING	NORTHING	S T R E A M						B A N K		SEDIMENT OR SOIL SIZE	ORGANIC MATTER	PRECIPITATE
				Ord.	Width-m	Depth cm	Flow	PH	EH	Type	Ht-m			
1 5	6	7 10	11 14	15	16 17	18 20	21	22 23	24 25	26	27 28	29	30	31

CONTAMINATION	MINERALIZATION	ALTERATION	ROCK TYPE	OTHER SAMPLES
32	33	34	35 36	37

REMARKS:

CODES:

Cols.1-5 Sample number.

Col.6 Sample type.Enter one of the following codes:
- 1-stream sediments
- 2-soil
- 3-rock
- 4-heavy mineral concentrate (note original concentrate panned under REMARKS column)
- 5-duplicate sample (corresponding to preceeding sample number)

Cols.7-14 Coordinates.

Col.15 Stream order.

Cols.16-17 Stream width(m).Enter width of active channel;(enter 99 if > 99).

Cols.18-20 Water depth (cm).

Col.21 Flow.Enter one of the following codes:
- 0-dry
- 1-stagnant
- 2-slow
- 3-moderate
- 4-fast
- 5-artificial

Cols.22-23 PH.Leave blank if not recorded: if measurement is 6.4 enter 64.

Cols.24-25 Conductivity (μs / cm)

Col.26 Bank type:
- 1-colluvial
- 2-alluvial
- 3-scree
- 4-bedrock
- 5-colluvial and bedrock

Cols.27-28 Bank height(m).

Col.29 Sediment or soil size.Record grain size of material sampled (whether sediment or soil) using one of following codes:
- 1-coarse
- 2-medium (sandy)
- 3-fine (silty)
- 4-clayey

Col.30 Organic matter.Note presence and amount (abundant,moderate,minor).Use code 1 if present and 0 if absent.

Col.31 Precipitates.Note precipitates present,using codes:
- 0-absent or not detected
- 1-iron (red or brown stains)
- 2-manganese (black stains)
- 3-sulphur (yellow stains)
- 4-carbonate
- 5-other (specify)

Col.32 Contamination.Note presence and type. Use code 1 if present and 0 if absent.

Col.33 Mineralization.Note presence and type (sketch on reverse).Use code 1 if present and 0 if absent.

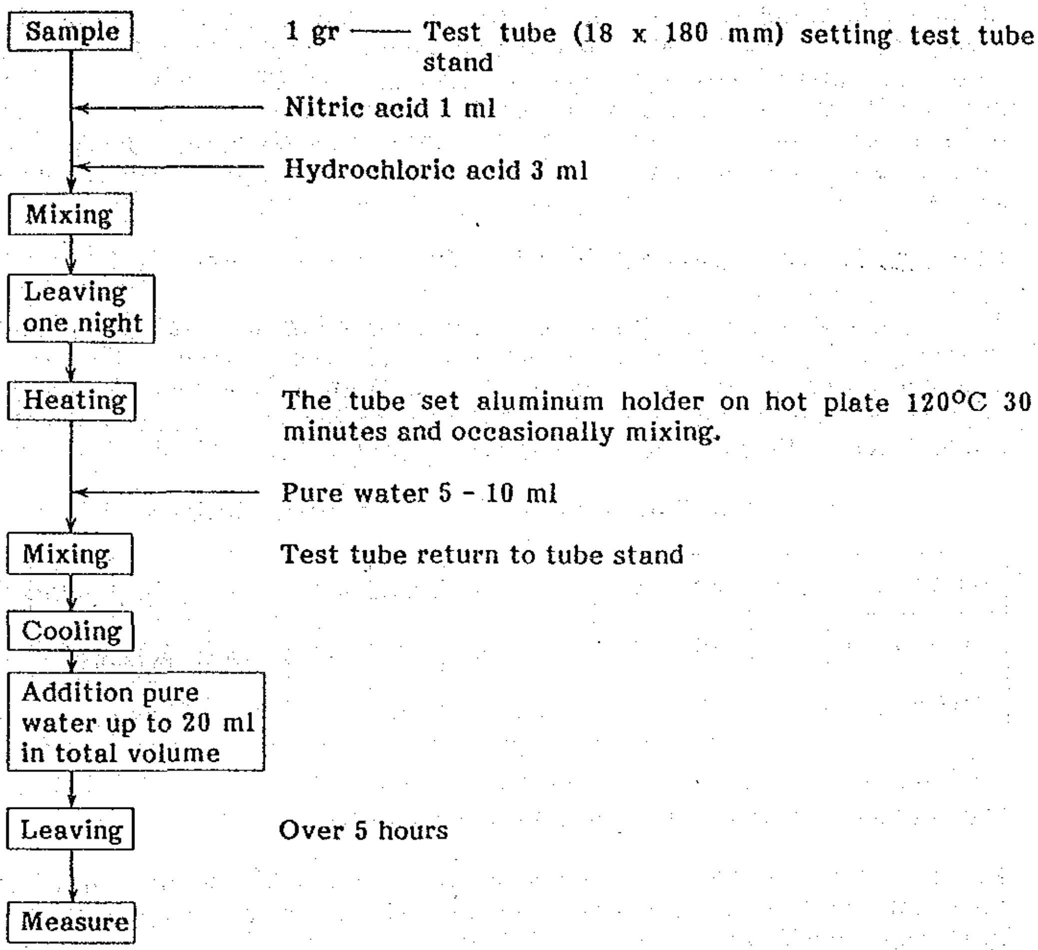
Col.34 Alteration.Note presence and type. Use code 1 if present and 0 if absent.

Cols.35-36 Rock type.Use one of the codes given on the reverse.

Col.37 Other samples.Note other samples collected at the same site.Use one of the following codes:
- 0-none
- 1-stream sediment
- 2-soil
- 3-rock
- 4-heavy mineral concentrate
- 5-duplicate
- 6-several types (specify)

Remarks.Enter any other pertinent information about the sampling locality

Fig. 10 Flow Chart of AAS Analysis



Element	Measuring Method	Flame	Wave Length (mm)
Ag	Direct Atomic Absorption	Air-C_2H_2	328.1
Cu	"	"	324.7
Mn	"	"	403.3
Pb	"	"	217.0
Zn	"	"	213.7
Mo	"	N_2O-C_2H_2	313.0
Hg	Reduction vapor - A.A.S.	Flameless	253.7
As	Hydration - A.A.S.	"	197.4

2) Microchemical analytical method (Foot note 1)

Weighed samples are analyzed by atomic absorption method according to the attached flow chart (Fig. 10).
Elements analyzed were Ag, Cu, Pb, Zn, As, Hg, Mo, Mn, Ni, Co (10) in all Area.
Heavy mineral samples were analyzed for Au, Ag, and Ga (3) in all Areas. The detection limits of those elements are shown in Table 8.
In PETROLAB 4 sets of atomic absorption spectrometer were utilized. One of which is flameless type. (Model GTA-95 while other two AS-1475, maker; Varian Tectron Co. and one set is made by Shimazu Model AA-670 which used for heavy mineral analysis)

Foot note 1

This method is a direct aqua-regina extraction from under 80 mesh samples unless further grinding, therefore, some amount of indication elements which are included in quartz grain etc., have the possibility to remain after extaction. Geochemical survey requires not only absolute contents but comparable value in each samples, so such convenience method is accepted in geochemical survey.

Table 7 Detection Limit of AAS of Both Laboratory

Laboratory	Cu	Pb	Zn	Ag	Ni	Co	Mn	As	Hg	Mo
PETROLAB	2	10	2	1	3	3	50	0.5	0.04	2
CHEMEX	2	1	1	0.1	1	1	5	0.5	0.005	1

3) The method of statistical analysis for geochemical results

The statistical analysis for geochemical results were applied in all the areas. Univariate analytical method are used to each population group using the procedure by C. Lepeltier (1969).

Procedure of analysis are as follows.

Previous Procedure of data

(1) Determination of lithological popluation

Country rocks which predominate in sampling area were divided into different lithological populations in reference to tendency of microchemical component of the rocks.
(generally 8 - 12 population in one area)

(2) Maing data file

Data file were made on sample number, analitical results in each lithological population and elements.

(3) Checking dispersion for results of microchemical analysis between original and duplicate samples.

Univariate Analysis

(1) The resulting data were rearranged in the order of value in each population and element.

(2) Mean, threshold, standard deviation, maximum, minimum, dispersion etc., statistical values were calculated.

(3) Histograms for each population and elements were made.

(4) Log normal data tables were made for each population and elements.

(5) 95% level student (t), and Snedecor (F) certification for dispersion of data were carried out between different population. If data dispersion range among some populations were the same, these populations were consolidated.

(6) Drawing cumulative frequency curve for each population and elements.

(7) Making the list to pick up anomalous data.

(8) Correlative coefficients between all populations and elements were calculated.

4-2 Statistical Analysis of Geo-Chemical Survey Results in Cebu Area

4-2-1 Basic Statistical Data

1) Statistical Data in each Rock Code

Country rocks are divided in following 12 populations (rock code) according to the geo-chemical feature of each rock.

Rock Code	Contents		Number of Sample
Qal	Alluvium		194
CAF	Quarternary	Limestone	1,181
BLF-1	Pliocene	Limestone	92
BLF-2	Pliocene	Sediments	367
MIF	Late Miocene	Sediments	62
TF	Middle Miocene	Sediments	103
MG-1	Early Miocene to Eocene	Limestone	81
MG-2	ditto	Sediments	119
LD	Lutopan	Diorite	21
BA	Other	Igneous Rocks	36
		Total	2,698 Duplicated Sample 54

Statistical Data of each rock code are as follows. (These values calculated logalithmic first then tranceform to normal value)

Rock Code Qa1 : Alluvium 194 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	39	3	55	0.1	4	27	16	11	598	1.3	
x̄ + 1.0σ value	104	9	108	1.3	9	41	38	26	1,320	2.2	
x̄ + 1.5σ value	170	15	151	1.5	13	50	60	41	1,961	2.9	Threshold value
x̄ + 2.0σ value	277	27	212	1.6	19	61	93	64	2,914	3.8	
Maximum	3,660	1,780	376	1.7	23	90	90	66	6,100	35	
Minimum	3	1	4	0.1	1	10	1	1	70	1	

Rock Code CAF : Quarternary Limestone 1,181 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	21	2.7	46	0.1	3.2	28	11	6.9	477	1.6	
x̄ + 1.0σ value	41	6.7	93	1.2	6.9	47	26	19.4	1,159	2.9	
x̄ + 1.5σ value	57	10.5	132	1.4	10.0	61	41	32.5	1,807	3.8	Threshold value
x̄ + 2.0σ value	79	16.5	188	1.5	14.5	79	63	54.4	2,819	5.2	
Maximum	245	128	431	2.2	205	270	92	75	11,700	12	
Minimum	4	1	9	0.1	1	1	1	1	60	1	

Rock Code BLF-1 : Plicene Limestone 92 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	17	2.6	33	0.1	2.6	26	9	5	338	2	
x̄ + 1.0σ value	32	5.7	52	0.13	5.3	37	23	11	690	3.7	
x̄ + 1.5σ value	44	8.4	65	0.14	7.5	44	37	17	985	5	Threshold value
x̄ + 2.0σ value	60	12.4	82	0.16	10.7	52	59	26	1,408	6.6	
Maximum	55	22	96	0.6	11	100	73	52	3,300	6	
Minimum	3	1	14	0.1	1	10	1	1	90	1	

Rock Code BFL-2 : Pliocene Sediments 367 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	26	4	45	0.1	5	28	19	8	555	2	
x̄ + 1.0σ value	39	9	68	1.4	9	41	36	18	1,247	3.5	
x̄ + 1.5σ value	49	13	84	1.6	12	50	51	26	1,869	4.7	Threshold value
x̄ + 2.0σ value	60	19	103	1.9	15	61	75	40	2,801	6.3	
Maximum	128	7	289	8.2	30	440	92	69	6,100	7	
Minimum	8	1	16	0.1	1	10	3	1	160	1	

Rck Code MIF : Late Miocene Sediments 62 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	36	2	44	0.1	4	23	13	11	539	1	
x̄ + 1.0σ value	73	4	73	0.11	6	37	29	20	990	1.2	
x̄ + 1.5σ value	105	5	94	0.12	9	48	44	28	1,341	1.2	Threshold value
x̄ + 2.0σ value	149	7	121	0.12	12	61	67	38	1,816	1.3	
Maximum	147	8	116	0.2	11	80	50	29	1,200	2	
Minimum	9	1	11	0.1	1	10	1	2	160	1	

Rock Code TF : Middle Miocene Sediments 103 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	34	2.6	45	0.1	4	31	15	10	618	1.2	
x̄ + 1.0σ value	68	6.5	74	1.6	7	52	34	21	1,156	1.8	
x̄ + 1.5σ value	96	10.2	94	2.0	10	67	50	31	1,582	2.2	Threshold value
x̄ + 2.0σ value	136	16.1	120	2.4	13	86	75	46	2,163	2.7	
Maximum	119	31	128	7.5	16	660	78	24	2,800	6	
Minimum	5	1	12	0.1	1	10	2	1	150	1	

Rock Code MB-1 : Early Miocene - Eocene Limestone 81 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	97	4	77	0.1	6	31	28	20	669	1.5	
x̄ + 1.0σ value	325	9	119	0.14	13	48	42	31	1,056	4.1	
x̄ + 1.5σ value	595	14	148	0.15	19	60	51	38	1,327	6.8	Threshold value
x̄ + 2.0σ value	1,090	22	184	0.18	29	75	61	47	1,668	11.4	
Maximum	3,550	68	920	0.4	53	290	64	72	1,400	55	
Minimum	25	1	14	0.1	1	0	10	8	60	1	

Rock Code MB-2 : Early Miocene - Eocene Sediments 119 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	70	4	70	0.1	6	33	24	17	719	1.1	
x̄ + 1.0σ value	114	8	94	0.14	11	48	41	24	1,077	1.7	
x̄ + 1.5σ value	207	12	108	0.15	15	59	54	29	1,319	2.2	Threshold value
x̄ + 2.0σ value	296	17	125	0.17	21	71	70	34	1,614	2.7	
Maximum	6,340	17	240	0.7	33	110	138	150	2,600	33	
Minimum	26	1	32	0.1	1	20	4	7	310	1	

Rock Code MG-1 : Eocene – Cretaceous Pyroclastics 316 Samples
(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	82	3	76	0.1	3	30	25	19	828	1.1	
x̄ + 1.0σ value	152	8	113	0.13	7	50	48	24	1,120	2.1	
x̄ + 1.5σ value	207	14	137	0.16	10	65	65	28	1,302	2.9	Threshold value
x̄ + 2.0σ value	312	25	168	0.18	15	84	90	32	1,513	4.0	
Maximum	3,970	9,500	930	2.9	41	260	99	67	1,700	110	
Minimum	14	1	24	0.1	1	10	3	7	100	1	

Rock Code MG-2 : Eocene – Cretaceous Sediments & Schist 126 Samples
(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	70	2	75	0.1	2	24	39	19	889	1.0	
x̄ + 1.0σ value	88	4	103	0.11	3	39	62	22	1,091	1.1	
x̄ + 1.5σ value	99	6	122	0.11	4	49	78	24	1,209	1.2	Threshold value
x̄ + 2.0σ value	111	8	143	0.11	5	61	99	26	1,339	1.3	
Maximum	128	11	200	0.2	11	100	252	29	1,600	2.0	
Minimum	40	1	36	0.1	1	10	15	12	500	1.0	

Rock Code LD : Lutopan Diorite 21 Samples
(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	75	2	62	0.1	4	34	15	15	720	1.0	
x̄ + 1.0σ value	103	3	88	-	9	83	30	20	968	1.2	
x̄ + 1.5σ value	121	5	105	-	13	130	42	22	1,123	1.3	Threshold value
x̄ + 2.0σ value	142	8	126	-	20	202	59	25	1,303	1.4	
Maximum	109	13	111	0.1	22	670	79	24	1,200	2.0	
Minimum	28	1	28	0.1	1	10	5	8	380	1.0	

Rock Code BA: Other Igneous Rocks 36 Samples
(Unit: ppm Except Hg)

	Cu	Pb	Zn	Ag	As	Hg (ppb)	Ni	Co	Mn	Mo	Remark
x̄	68	4	81	0.1	7	30	20	17	769	1.0	
x̄ + 1.0σ value	94	7	121	-	20	45	36	23	1,007	-	
x̄ + 1.5σ value	111	9	148	-	32	54	48	26	1,153	-	Threshold value
x̄ + 2.0σ value	131	13	181	-	51	66	64	30	1,321	-	
Maximum	156	24	299	0.1	255	70	75	41	1,500	1.0	
Minimum	23	1	37	0.1	1	20	7	9	370	1.0	

2) Histogram

Frequency dispersion histograms for each detective element in each lithological code are made by logarithmic scale with 1/2 standard deviation unit as shown in Appendix-5 .

Each histogram freatures for each element are as follows.

Cu; Histogram of copper for each lithological code except BLF-1 and MB-1 shows normal logarithmic dispersion, in BLF-1 and MB-1 code low grade side dispersion is not enough. Maximum content (6,340 ppm) sample is involved in MG-2 Code.

Mo; Almost all samples are under detection limit, so statistically analysis is impossible. Maximum content sample (110 ppm) is included in code MG-1.

Pb; Pb content is almostly under the detection limit, so extreme accumulation of dispersion is observed at 5 ppm which is assumed grade of under detection limit sample. Then Pb histograms do not show normal logarithmic dispersion.
Maximum content of 44 ppm is included in code MG-1.

Zn; Zn histograms in each code except CAF, MG-1 and LD show logarithmic dispersion, in CAF and MG-1 code low grade side dispersion are not enough, in code of LD histogram is out of logarithmic dispersion as small amount of samples.
Maximum content (930 ppm) sample include in code MG-1.

Ag; Ag histogram does not show normal logarithmic dispersion, because of extreme accumulation of dispersion is observed at 0.5 ppm which is assumed grade of under detective limit sample. Maximum content (8.2 ppm) sample include in code BLF-2.

As; As histograms show normal logarithmic dispersion in the codes except Qal, CAF, BLF-1, MG-1 and MG-2. In above mentioned codes average grade are low, so under detection limit sample influence is too much. Maximum grade (225 ppm) sample include in code BA.

Hg; Hg histograms of code: Qal, CAF, BLF-1 and BA are out of logarithmic dispersion, because of under detection limit samples are too much. Maximum grade sample is included in code LD.

Ni; Ni histograms show logarithmic dispersion in each code. Maximum grade (252 ppm) sample is included in code MG-2.

Co; Histograms of Co show almostly logarithmic dispersion, but in code TF and MIF high grade side dispersion are not enough. Maximum grade sample is included in code MB-2.

Mn; Histograms of Mn show normal logarithmis dispersion. Maximum grade sample (11,700 ppm) is included in code CAF.

3) Cumulative frequency

Cumulative frequency curves corresponding to the above mentioned histograms are shown in Appendix-5 .
They have a transition point between mean value $\bar{x} + 0.5\sigma$ to $\bar{x} + 2\sigma$ in many codes. This justifies an estimation $\bar{x} + 1.5\sigma$ value as threshold value.

The feature of the curve for each element is as follows.

Cu; Transition points are observed at $\bar{x} + 2.5\sigma$ value in code BLF-2 at $\bar{x} + 2\sigma$ value in codes MB-1 and MB-2, at $\bar{x} + 1.5\sigma$ value in codes Qal, BA and at $\bar{x} + 1\sigma$ value at TF, MG-1 and MG-2.

Pb; Transition points are observed at $\bar{x} + 2.5\sigma$ value in code BA, at $\bar{x} + 2\sigma$ value in codes CAF, BLF-1, MB-1 and MG-2 and at $\bar{x} + 1.5\sigma$ value in codes MIF, TF, MG-1 and LD.

Zn; Transition points are observed at $\bar{x} + 2\sigma$ value in codes CAF, BLF-1, MB-1, and MG-2, at $\bar{x} + 1\sigma$ value in code MG-1, at $\bar{x} + 0.5\sigma$ value and at $\bar{x} + 1.5\sigma$ value in other codes.

As; Transition points are observed at $\bar{x} + 2\sigma$ value in codes CAF and MB-1, at $\bar{x} + 1\sigma$ value in codes Qal, TF, MG-1, LB, and BA, and at $\bar{x} + 1.5\sigma$ value in the other codes.

Hg; Transition points are observed at $\bar{x} + 2\sigma$ value in code TF, at $\bar{x} + 0.5\sigma$ value in code CAF and at $\bar{x} + 1\sigma$ value and $\bar{x} + 1.5\sigma$ value in the other codes.

Ni; Transition points are observed at $\bar{x} + 0.5\sigma$ value in codes CAF and MB-1, at $\bar{x} + 1.5\sigma$ value in codes Qal, TF, MB-2 and MG-1 and at $\bar{x} + 1\sigma$ value in the other codes.

Co; Transition points are observed at $\bar{x} + 1\sigma$ value in codes Qal, BLF-1, LD and BA, at $\bar{x} + 1.5\sigma$ value in codes MG-1, MG-2, at $\bar{x} + 0.5\sigma$ value in codes MB-1 and BLF-2 and at $\bar{x} + 2\sigma$ value in code MG-2.

Mn; Transition points are observed at $\bar{x} + 0.5\sigma$ value in codes BLF-2 and LD, at $\bar{x} + 1\sigma$ value in codes TF, MB-1 and MB-2, and at $\bar{x} + 1.5\sigma$ value in the other codes.

4) Correlation coefficient

Correlation coefficient between elements for all samples in Cebu Area is shown in Table - 8.
High correlation is observed between Cu and Zn, Ni, Co and Mn. Zn and Ni, Co and Mn. Ni and Co, Mn. Co and Mn.

Table - 8 Correlation Coefficient between Each Element in Cebu Area

ALL DATA 2,698 samples

	Cu	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg
Cu	1.000									
Mo	-.194	1.000								
Pb	.157	.068	1.000							
Zn	.639	-.377	.164	1.000						
Ag	.078	-.004	.219	.131	1.000					
Ni	.660	-.351	.177	598	.044	1.000				
Co	.775	-.471	.139	.785	.063	.810	1.000			
Mn	.594	-.494	.188	.751	.076	.755	.876	1.000		
As	.171	-.045	.370	.112	.101	.212	.201	.210	1.000	
Hg	.098	-.051	.205	.186	.039	.229	.209	.247	.243	1.000

4-2-2 Analysis for Heavy Mineral Samples

1) Analytical Method

Total of 201 heavy mineral samples were collected and analized by statistical procedure.
These samples were taken from down side of the junction of streams. They were reduced amount from 3 kg to 20 grams by panning in each places.
On these samples microchemical analysis for Au, Ag and Ga were carried out by atomic absorption method similar to the stream sediments. The results of the analysis are shown in Appendix-7.
Mean value and standard deviation are calculated by the hypothesis that these values show logalithmic normal dispersion.
Anomalous values are classified by threshold value which has $\bar{x} + 1.5\sigma$ value.
The statistical values are shown in Table.

Table -9 Statistical Values on Geochemical Analysis of Heavy Mineral Samples in the Cebu Area

	$\bar{x}$ value	$\bar{x} + 1\sigma$ value	$\bar{x} + 1.5\sigma$ value	$\bar{x} + 2\sigma$ value	Maximum value	Minimum value
Au (ppb)	71.2	292.4	592.4	1,200.8	1,900	10
Ag (ppb)	109.6	268.7	420.7	658.7	1,100	50
Ga (ppm)	12.2	18.6	23.0	28.4	29.6	1

2) Identification of constituent minerals in heavy mineral samples

Constituent minerals are classified by binocular microscope for random selected 10 heavy mineral samples in the Cebu Area.
Magnetite is recognized as main mineral and other constituent minerals are in the order of hornblend, plagioclase and quartz. Details are shown in Table. 10

Table-10 Constituent Minerals in Heavy Mineral Samples

Order	1	2	3	4	5	6	7	8	9	10
Mineral	Magnetite Quartz	Hornblend	Quartz	Plagioclase	Hematite	Pyroxene	Ilmenite	Limonite	Pyrite	Others
Range %	50 - 2	45 - 2	35 - 4	20 - 4	40 - 2	20 - 5	10 - 3	10 - 2	15 - 0	
Mean % contents	29	23	10	10	9.8	9	4.8	2.0	1.6	0.8

4-2-3 Local Distribution of Anomalous Values in the Cebu Area

1) Univariate analysis for stream sediment samples

Anomalous values in each lithological code are classified in following range. These classified anomalous values were plotted in 1 : 250,000 scale sample locality map with symbol ○, △ and □.
Following descriptions on local features of anomalous value in each element depend on this distribution map of anomalous value (Ref. Attached map 5-1·2).

Classification Range	Symbol	Rank
$\bar{x} + 1\sigma$ value $\leq Z < \bar{x} + 1.5\sigma$ value	●	Possibly
$\bar{x} + 1.5\sigma$ value $\leq Z < \bar{x} + 2\sigma$ value	▲	Probably
$\bar{x} + 2\sigma$ value $\leq Z$	■	Highly

(Z: analytical result)

Cu; Accumulation zones of high and probable anomalous values are observed around Mt. Uling 10 km ESE Toledo City accompanied Lutopan Diorite (maximum value 3,970 ppm), around santa Rito mineral showing 35 km NE Toledo City accompanied pre-Tertiary Formation, around Copalawan mineral showing NNW 38 km Danao in East Coast accompanied Carcar Formation and along East Coast between Danao and Mandawe as influence of upstream material.
At northern Bogo north town of Cebu Is. high and probable anomalous values are dispersed in Carcar Formation area.

Pb; Accumulation zones of high and probable anomalous values are observed at Compostala between Danao and Mandawe in East Coast, this anomalous zone seems to derive from Bulacao Andesite in west side.
At northern part of Bogo (North town of Cebu Is.) some high and probable anomalous value are dispersing, the origine of anomalies is not clear.

Zn; Accumulation zones of high and probable anomalous values are observed overlapping Cu anomalies 10 km SE Toledo City in West Coast, surrounding Pb anomalous zone around Compostela in Eastcoast and in limestone area of Carcar and Barili Formation in northern part of Cebu Is., this limestone area include considerable amount of heavy minerals and unknown mineralization is assumed.

Ag; Accumulation zones of high and probable anomalous values around Canocanao 16 km south of Bogo, in this site about 30 high anomalous values accumulate and south side of Cu and Zn anomalous zone 10 km SE Toledo City.

As; Accumulation zones of high and probable anomalous values are observed around Consolation mineral showing 15 km NE of Cebu City extend to east side plane, in northern part of Bogo and around Angilon mineal showing 20 km SSW of Toledo City.

Hg; Accumulation zones of high and probable anomalous zones are observed in pre-Tertiary exposed area west side of Santa Rito mineral showing 35 km NE of Toledo City which extend to West Coast, around the boundary Paleocene - Cretaceous Series and Miocene - Eocene Series in central highland and surround Bulacao Andesite exposure 15 km north of Mandawe in East Coast.

Ni; Accumulation zones of high and probable anomalous values are observed at north of Bogo, around 16 km south of Bogo and from 10 km north of Danao (East Coast) to central highland.

Co; Accumulation zones of high and probable anomalous values are observed from Toledo to Sigpit Lutupan (7 km ESE Toledo) and limestone area northern part of Cebu Is.

Mn; Accumulation ones of high and probable anomalous values are observed in limestone area northern part of Cebu Is., Bulacao Andesite exposed area 10 - 20 km north of Manbawe and Lutopan Diorite exposed area.

Mo; Accumulation zones of high and probable anomalous values are observed around Sigpit Lutupan mineral showing 10 km SE of Toledo accompanied Cu, Pb and Zn anomalous zone and in limestone area southern Cebu Is. as scattered anomalous values.

4-3 *Statistical Analysis of Geo-Chemical Survey Results in Whole Panay Is.*

4-3-1 Basic Statistical Data

Rock Code	Contents	Number of Samples
Group 7 (QA1)	Alluvium	1,807
Group 6 (Sd)	Sedimentary rocks	3,367
Group 5 (Pr)	Andesitic pyroclastics	1,182
Group 4 (Mp)	Meta Volcanics	275
Group 3 (P1)	Plutonic rocks	391
Group 2 (Op)	Ultramafic rocks	215
Group 1 (Sch)	Schists	140
	Total	7,377 *Excluding 95 Duplicate Samples*

Statistical Data of each rock code are as follows. (These values calculate first in logalithmic value then transform to natural value)

Panay Area

Lithological Code : Group 1 (Sch) 140 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	34	5	0.5	65	45	18	714	1.0	7	21	
$\bar{x}+1\sigma$ value	51	7	-	90	82	28	1,349	1.1	19	30	
$\bar{x}+1.5\sigma$ value	62	9	-	107	111	35	1,854	1.1	30	35	Threshold
$\bar{x}+2.0\sigma$ value	76	11	-	126	150	43	2,547	1.1	47	41	
Maximum	134	20	0.5	129	132	42	15,500	2.0	70	170	
Minimum	7	5	0.50	19	8	6	190	1.0	1	20	

Lithological Code : Group 2 (Op) 215 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	51	6	0.50	63	215	38	785	1.0	1	20	
$\bar{x}$ + 1 σ value	75	9	-	91	537	56	1,138	-	2	26	
$\bar{x}$ + 1.5 σ value	91	10	-	110	848	68	1,369	-	2	29	Threshold
$\bar{x}$ + 2.0 σ value	111	13	-	133	1,338	82	1,648	-	4	33	
Maximum	280	30	0.50	442	2,000	545	1,790	1.0	5	113	
Minimum	6	5	0.50	24	13	11	85	1.0	1	20	

Lithological Code : Group 3 (P1) 391 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	29	5	0.51	32	13	12	482	1.0	1	20	
$\bar{x}$ + 1 σ value	74	7	0.60	72	71	28	896	1.2	2	21	
$\bar{x}$ + 1.5 σ value	117	9	0.65	109	162	43	1,222	1.3	4	22	Threshold
$\bar{x}$ + 2.0 σ value	186	11	0.70	164	367	66	1,666	1.4	8	24	
Maximum	3,300	75	4.00	540	1,053	232	3,070	7.0	35	105	
Minimum	2	5	0.50	1	1	1	65	1.0	1	20	

Lithological Code : Group 4 (Mp) 275 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	53	5	0.50	73	42	21	829	1.0	1	21	
$\bar{x}$ + 1 σ value	67	5	0.52	93	93	29	1,118	1.1	1	26	
$\bar{x}$ + 1.5 σ value	75	6	0.53	105	138	34	1,297	1.2	2	29	Threshold
$\bar{x}$ + 2.0 σ value	85	6	0.54	119	205	40	1,506	1.2	3	32	
Maximum	111	18	1.00	212	1,490	92	7,300	6.0	7	49	
Minimum	16	5	0.50	14	6	2	100	1	1	20	

Lithological Code : Group 5 (Pr) 1,182 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	51	5	0.50	67	38	25	861	1.0	1	20	
$\bar{x}+1\sigma$ value	85	7	0.51	115	127	45	1,479	1.2	3	23	
$\bar{x}+1.5\sigma$ value	110	8	0.52	151	232	59	1,938	1.2	4	25	Threshold
$\bar{x}+2.0\sigma$ value	142	9	0.52	197	423	79	2,539	1.3	7	28	
Maximum	1,150	80	1.00	275	809	81	3,200	11.0	42	222	
Minimum	3	5	0.50	3	1	1	25	1.0	1	20	

Lithological Code : Group 6 (Sch) 140 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	46	5	0.50	70	53	22	701	1.0	1	20	
$\bar{x}+1\sigma$ value	70	6	0.52	100	134	34	1,045	1.0	4	25	
$\bar{x}+1.5\sigma$ value	86	7	0.53	119	213	41	1,275	1.1	6	28	Threshold
$\bar{x}+2.0\sigma$ value	106	7	0.55	143	338	51	1,556	1.1	9	31	
Maximum	800	63	4.00	280	2,700	186	4,550	4.0	76	180	
Minimum	4	4	0.50	5	1	1	70	1.0	1	20	

Lithological Code : Group 7 (Qal) 1,807 Samples

(Unit: ppm Except Hg)

	Cu	Pb	Ag	Zn	Ni	Co	Mn	Mo	As	Hg (ppb)	Remark
$\bar{x}$	35	5	0.50	53	29	20	657	1.0	1	20	
$\bar{x}+1\sigma$ value	64	6	0.53	103	101	39	1,217	1.1	3	23	
$\bar{x}+1.5\sigma$ value	86	6	0.54	144	186	54	1,656	1.2	6	25	Threshold
$\bar{x}+2\sigma$ value	115	7	0.56	200	343	75	2,254	1.3	11	27	
Maximum	1,400	61	2.00	640	1,200	139	4,100	13.0	65	101	
Minimum	2	5	0.50	3	1	1	25	0.5	1	20	

2) Histogram

Frequency dispersion histograms for each detective element in each lithological code are made by logarithmic scale as shown Appendix-5.
Each histogram features for each element are as follows.

Cu; Histograms of Cu for each code show almostly logarithmic normal dispersion, but only Group 3 histogram has shortage of highgrade side dispersion.
Maximum content (3,300 ppm) sample is included in Group 3 code.

Pb; Many samples are under detective limit, so histograms show out of logarithmic normal dispersion. Maximum content sample (80 ppm) is included in Group 5 code.

Ag; Over half samples are under detective limit, so histograms show out of logarithmic normal dispersion. Maximum content sample (4.0 ppm) is included in Group 3 code.

Zn; Each histogram shows logarithmic normal dispersion. Maximum content sample (640 ppm) is included in Group 7 code.

Ni; Each histogram except Group 3 code shows logarithmic normal dispersion, in Group 3 code high grade side dispersion is shortage. Maximum content sample (2,700 ppm) is included in Group 6 code.

Co; Each histogram except Group 1 shows logarithmic normal dispersion, in Group 1 code high grade side dispersion is shortage. Maximum content sample (545 ppm) is included Group 2 code.

Mn; Each histogram except group 5 shows logarithmic normal dispersion, in Group 5 low grade side dispersion is shortage. Maximum content sample (15,500 ppm) is included in Group 1 code.

Mo; Over half samples are under detective limit, so each histogram show out of logarithmic normal dispersion. Maximum content sample (13 ppm) is included in Group 7 code.

As; Histograms of Group 3 & 6 show logarithmic normal dispersion, but in other codes many samples are under detective limit and show out of logarithmic normal dispersion. Maximum conent sample (76 ppm) is included in Group 6 code.

Hg; Over half samples are under detective limit so each histogram shows out of logarithmic normal dispersion. Maximum content sample (222 ppm) is included in Group 5 code.

3) Cumulative frequency

Cumulative frequency curves corresponding to the above mentioned histograms are shown in Appendix-5.
They have a transition point between mean value ($\bar{x}$) + 0.5σ to $\bar{x} + 2.5\sigma$ in many codes.
This justifies an estimation to select $\bar{x} + 1.5\sigma$ value as threshold value.
The feature of the curve for each element is as follows.

Cu; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 2 code, at $\bar{x} + 1.5\sigma$ value in Group 1,3 & 5 and at $\bar{x} + 2.0\sigma$ value in Group 4,6 & 7 code.

Pb; Transition points are not clear, because many samples show under detective limit content.

Ag; Transition points are not clear as same reason on Pb.

Zn; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 1 & 2 code, at $\bar{x} + 1.5\sigma$ value in Group 3 & 4 value, at $\bar{x} + 2\sigma$ value at Group 5 and at over $\bar{x} + 2.5\sigma$ value in Group 6 & 7.

Ni; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 1 & 3, at $\bar{x} + 1.5\sigma$ value in Group 2 and $\bar{x} + 0.5\sigma$ value in Group 4, in Group 5, 6 & 7 Transition points are not clear.

Co; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 1 & 2 code, at $\bar{x} + 2\sigma$ value in Group 3, 4 & 7 code, at $\bar{x} + 1.5\sigma$ value in Group 5 code and at $\bar{x} + 2.5\sigma$ value in Group 6 code.

Mn; Transition points are observed at $\bar{x} + 1\sigma$ value in group 1, 2 & 4 code, at $\bar{x} + 1.5\sigma$ value in Group 3 & 5 code and at $\bar{x} + 3\sigma$ value in Group 6 & 7 code.

Mo; Transition points are not clear because many samples have under detective limit content.

As; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 1 & 5 code, at $\bar{x} + 1.5\sigma$ value in Group 2 & 4 code, at $\bar{x} + 2\sigma$ value in Group 6 & 7 and at $\bar{x} + 3\sigma$ value in Group 3 code.

Hg; Transition points are not clear because many samples have under detective limit content.

4) Correlation coefficient

Correlation coefficient between elements for all samples in whole Panay Area is shown in Table 11.
High correlation is observed between Cu and Zn Ni Co Mn, Ag and Mo, Zn and Ni Co Mn, Ni and Co Mn, Co and Mn.

Table-11 Correlation Coefficient between each Element in Whole Panay Area

7,377 samples

PANAY

Correlations:	LOGCU	LOGPB	LOGAG	LOGZN	LOGNI	LOGCO	LOGMN	LOGMO	LOGAS	LOGHG
LOGCU	1.0000									
LOGPB	.1573**	1.0000								
LOGAG	.1417**	.1766**	1.0000							
LOGZN	.6355**	.0969**	.0671**	1.0000						
LOGNI	.5161**	.1179**	.0207	.5239**	1.0000					
LOGCO	.6216**	.1044**	.0668**	.7469**	.7243**	1.0000				
LOGMN	.5874**	.1252**	.0386**	.6949**	.4468**	.7452**	1.0000			
LOGMO	.1005**	.1350**	.3035**	-.0181	-.0294*	-.0260	-.0328*	1.0000		
LOGAS	.1366**	.1611**	.0415**	.0894**	.0722**	-.0624**	-.0402**	.0386**	1.0000	
LOGHG	.0154	.0021	-.0038	.0548**	.0557**	.0298	.0081	-.0110	.0592**	1.0000

4-3-2 Analysis for Heavy Mineral Samples

1) Analytical method

Total 349 heavy mineral samples were collected in the whole Panay Area and analyzed by satistical procedure.
These samples were taken from down side of the junction of streams. They were reduced amount from 3 kg to 20 grams by panning in each places.
On these samples microchemical analysis for Au, Ag and Ga were carried at PETROLAB out by atomic absorption method similar to the stream sediments. The results of the analysis are shown in Appendix- 7 .
Mean values and standard deviations are calculated by the hypothesis that these values show logarithmic normal dispersion.
Anonalous values are classified by threshold value which is $\bar{x} + 1.5\sigma$ value .
The statistical values are shown in Table-12.

Table-12 Statistical Values on Geochemical Analysis of Heavy Mineral Samples in the whole Panay Area

	$\bar{x}$ value	$\bar{x}+1\sigma$ value	$\bar{x}+1.5\sigma$ value	$\bar{x}+2\sigma$ value	Maximum value	Minimum value
Au (ppb)	2,378.0	27,446.1	93,242.7	316,774.3	370,000	10
Ag (ppb)	363.0	3,476.8	10,760.1	33,300.7	38,000	50
Ga (ppm)	10.9	17.2	21.5	27.0	30.2	1

2) Identification ofconstituent minerals in heavy mineral samples

Constituent minerals are classified by binocular microscope for random selected 16 heavy mineal samples in whole Panay area.
Magnetite is recognized as main mineral and other constituent minerals are in the order of pyroxene and hematite. Details are shown in Table-13.

Order	1	2	3	4	5	6	7
Mineral	Magnetite	Pyroxene	Hematite	Plagioclase	Hornblend	Menite	Others
Range (%)	94 - 10	65 - 2	20 - 2	10 - 0	22 - 0	8 - 0	-
Mean content (%)	66	16	5	4	3	2	4

Table-13

4-3-3 Local Distribution of Anomalous Values in the Whole Panay Area

1) Univariate analysis for stream sediment samples

Anomalous values in each lithological code are classified in following range. These classified anomalous values were plotted in 1 : 250,000 scale sample locality map with symbol ●, ▲ and ■.
Following descriptions on local features of anomalous value in each element depend on this distribution map of anomalous value (Ref. Attached map 7-1·2).

Classification Range	Symbol	Rank
$\bar{x} + 1\sigma$ value $\leqq$ Z < $\bar{x} + 1.5\sigma$ value	●	Possibly
$\bar{x} + 1.5\sigma$ value $\leqq$ Z < $\bar{x} + 2.0\sigma$ value	▲	Probably
$\bar{x} + 2.0\sigma$ value $\leqq$ Z	■	Highly

(Z: analytical result)

Cu; Accumulation zones of high and probable anomalous values are observed around Mt. Tubo of Antique Mountain Range 35 km NE of Patunongon in West Coast, which connect to Igpaco volcanics and elongate NE-SW direction, in Sibara Formation and Pilar Monzonite at southern part of President Roxas in North Coast, around contact zone between Igpaco Volcanics and intrusive body of diorite and gabbro at 20 km SW of Kalibo in North west part of Panay Is. and in Middle Miocene Sediments at 7 km NE of San Pedro in West Coast.

Pb; Accumulation zones of high and probable anomalous values are observed in Miocene and Eocene Sediments at NE side of San Pedro in West Coast and around a west side of Sara Diorite Batholith near Viejo, San Rafael and President Roxas in Middle to north part of Panay Is.

Zn; Accumulation zones of high and probable anomalous values are observed in Miocene Series around Pampanga 30 km south of Calibo in north east Panay Is., at north east of San Pedro in West Coast which overlap to Cu, Pb and Ag anomalous zone and in Pliocene limestone at West Coast of Guimaras Is.

Ag; Accumulation zone of about 10 highly anomalous values is observed at north east side of San pedro in West Coast.

Hg; Accumulation zones of high and probable anomarous values are observed in crystalline limestone of Pre-Tertiary which elongate to crystalline schist of north west side and contact zone of Igpaco Volcanics and doirite at 30 km SSW of Kalibo in northwest Palawan Is.

As; Characteristic ring shape anmalous zones surround Pleistocene volcano in East coast, NE-SW extended anomalous zone in Miocene Series and fringe shape anomalous zone west side of Sara Diorite Batholith are observed in middle Panay, other anomalous zones are observed at limestone area west side Guimaras Is., at west side of contact zone Igupaco Volcanics and diorite intrusive body in north west Panay and at north side of Buranga Peninsula which overlap Hg anomalous zone.

Co; Possibly anomalous values are observed in Igpaco Volcanics and ultramafic rocks at north east side of San Pedro in West Coast but accumulation zone of highly and probably anomalous values is not observed.

Ni; Same feature as Co.

Mn; Accumulation zone of high and probable anomalous values is observed in north part of Buranga Peninsula.

Mo; Many samples are under detective limit content so accumulation of anomalous values are generally not clear, but several high anomalous values accumulate at north east side of San Piedro in West Coast, At south east of Jordan in North Guimaras Is. and west side of Caragnaan Is. in East Coast.

4-4 Statistical Analysis of Geochemical survey Results in Romblon Area

4-4-1 Basic Statistical Data

1) Statistical Data in each Rock Code

Country rocks are divided in following 6 populations (rock code) according to the geochemical feature of each rock.

Rock Code	Contents	Number of Samples
Group 7 (QA1)	Alluvium	221
Group 6 (Sd)	Sedimentary rocks	185
Group 5 (Pr)	Andesitic pyroclastics	86
Group 3 (P1)	Plutonic rocks	53
Group 2 (Op)	Ultramafic rocks	116
Group 1 (Sch)	Schists	219
	Total	880 Excluding 20 Duplicate Samples

Statistical data of each rock code are as follows. (These values calculated first in logarithmic value then transform to natural value)

Rock Code : Group 1 (Sch) 219 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
$\bar{x}$	20	1.0	5	43	0.10	22	9	362	2	24	
$\bar{x}$ + 1.0 σ value	40	1.2	12	71	0.12	81	22	762	4	36	
$\bar{x}$ + 1.5 σ value	57	1.2	19	91	0.13	155	34	1,106	6	45	Threshold value
$\bar{x}$ + 2.0 σ value	82	1.3	29	117	0.14	296	54	1,604	10	56	
Maximum	90	4.0	46	210	0.30	2,280	93	2,200	45	90	
Minimum	3	1.0	1	6	0.10	1	1	20	1	10	

Rock Code : Group 2 (Op) 116 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
$\bar{x}$	26	1.0	1	44	0.10	369	48	804	1	131	
$\bar{x}$ + 1.0 σ value	48	1.1	5	80	0.15	2,388	113	1,392	4	51	
$\bar{x}$ + 1.5 σ value	65	1.2	8	107	0.19	6,077	174	1,831	7	66	Threshold value
$\bar{x}$ + 2.0 σ value	89	1.3	15	144	0.22	15,462	267	2,408	11	85	
Maximum	111	2.0	290	660	1.30	4,580	383	3,399	45	200	
Minimum	8	1.0	1	11	0.10	8	8	220	1	10	

Rock Code : Group 3 (Pl) 53 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
x̄	29	1.0	8	76	0.12	48	18	729	4	37	
x̄ + 1.0 σ value	56	1.0	33	139	0.21	335	37	1,263	15	85	
x̄ + 1.5 σ value	77	1.0	68	188	0.27	882	53	1,661	28	128	Threshold value
x̄ + 2.0 σ value	107	1.0	140	255	0.35	2,320	76	2,186	54	194	
Maximum	131	1.0	155	395	0.80	1,470	87	2,000	39	540	
Minimum	4	1.0	1	22	0.10	1	3	50	1	10	

Rock Code : Group 5 86 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
x̄	45	1.0	1	68	0.11	42	24	791	1	23	
x̄ + 1.0 σ value	66	1.1	2	96	0.14	107	33	1,020	3	44	
x̄ + 1.5 σ value	79	1.1	3	114	0.16	170	39	1,159	4	59	Threshold value
x̄ + 2.0 σ value	95	1.2	4	136	0.18	270	45	1,317	7	80	
Maximum	110	2.0	12	161	0.30	2,150	81	1,200	110	750	
Minimum	12	1.0	1	22	0.10	7	12	310	1	10	

Rock Code : Group 6 (Sd) 185 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
x̄	29	1.0	2	54	0.10	36	17	624	2	34	
x̄ + 1.0 σ value	50	1.1	6	84	0.12	103	29	988	5	64	
x̄ + 1.5 σ value	66	1.2	9	105	0.13	174	38	1,244	6	87	Threshold value
x̄ + 2.0 σ value	87	1.3	14	130	0.14	295	51	1,565	9	119	
Maximum	95	2.0	14	198	0.40	4,300	279	2,500	16	2,200	
Minimum	5	1.0	1	15	0.10	2	2	120	1	10	

Rock Code : Group 7 (Qal) 221 Samples

(Unit: ppm Except Hg)

	CU	Mo	Pb	Zn	Ag	Ni	Co	Mn	As	Hg (ppb)	Remark
x̄	23	1.0	3	52	0.10	39	14	509	2	32	
x̄ + 1.0 σ value	44	1.1	10	87	0.13	176	38	1,039	6	69	
x̄ + 1.5 σ value	61	1.1	17	113	0.15	371	62	1,438	10	100	Threshold value
x̄ + 2.0 σ value	85	1.1	29	147	0.16	784	102	2,118	17	145	
Maximum	98	2.0	135	261	1.40	3,649	237	2,299	48	810	
Minimum	2	1.0	1	12	0.10	3	1	70	1	10	

2) Histogram

Frequency dispersion histogram for each detective element in each lithological code are made by logarithmic scale as shown Appendix-5 .
Each histogram features for each element are as follows.

Cu; Histograms of Cu for each code show almostly logarithmic normal dispersion, in Group 6 & 7 code high grade dispersion have some shortage.
Maximum content sample (131 ppm) is included in Group 3 code.

Mo; Many samples are under detection limit content, so each histrogram is out of logarithmic normal dispersion. Maximum content sample (4 ppm) is included in Group 1 code.

Pb; Many samples are under detection limit content, so each histogram is out of logarithmic normal dispersion.
Maximum content sample (290 ppm) is included Group 2 code.

Zn; Histogram of each code show logarithmic normal dispersion.
Maximum content sample (395 ppm) is included in Group 3 code.

Ag; Many samples are under detective limit content, so each histogram is out of logarithmic normal dispersion. Maximum content sample (1.4 ppm) is included in Group 7 code.

Ni; Each code except Group 2 & 3 shows logalithmic normal dispersion, in Group 2 & 3 two divided peaks are observed so these histograms are out of logarithmic normal dispersion. Maximum content sample (4,580 ppm) is included in Group 2 code.

Co; Each histogram except Group 2 shows logarithmic normal dispersion, in Group 2 two divided peak are observed so this histogram is out of logarithmic normal dispersion. Maximum content sample (383 ppm) is included in Group 2 code.

Mn; Each histogram shows almost logarithmic normal dispersion, but some shortage of high grade side dispersion are seen in Group 5, 6 & 7 codes.
Maximum content sample (3,399 ppm) is included in Group 2 code.

As; Many samples are under detective limit content, so histograms are out of logarithmic normal dispersion. Maximum content sample (110 ppm) is included in Group 5 code.

Hg; Many samples are under detective content, so histograms are out of logalithmic normal dispersion. Maximum content sample (2,200 ppb) is included in Group 6 code.

3) Cumulative frequency

Cumulative frequency curve corresponding to the above mentioned histograms are shown in Appendixs-5 .
They have a transition point between mean value ($\bar{x}$) + standard deviation (σ) to $\bar{x}$ + 2σ in many codes. This justifies an estimation to select $\bar{x} + 1.5\sigma$ value as threshold value.
The feature of the curve for each element is as follows.

Cu; Transition points are observed at $\bar{x} + 1\sigma$ value in Group 3 & 5 and at $\bar{x} + 1.5\sigma$ value in other codes.

Mo; Transition points are not clear because many samples are under detective limit content.

Pb; Transition points are observed at $\bar{x} + 1.0\sigma$ value in Group 3 & 5 code, at $\bar{x} + 2.0\sigma$ value in Group 2 code and at $\bar{x} + 1.5\sigma$ value in the other codes.

Zn; Transition points are observed at $\bar{x} + 1.5\sigma$ value in Group 1, 2 & 3 codes and at $\bar{x} + 2\sigma$ value in Group 5, 6 & 7 value.

Ag; Transition points are not clear because many samples are under detective limit content.

Ni; Transition points are observed at $\bar{x} + 1.0\sigma$ value in Group 1 code, at $\bar{x} + 2.0\sigma$ value in Group 7 code and at $\bar{x} + 1.5\sigma$ value in the other codes.

Co; Transition points are observed at $\bar{x} + 1.0\sigma$ value in Group 5 code, at $\bar{x} + 1.5\sigma$ value in group 3 & 6 codes and at $\bar{x} + 2.0\sigma$ value in the other codes.

Mn; Transition points are observed at $\bar{x} + 1.0\sigma$ value in Group 3, 5 & 7 codes and at $\bar{x} + 1.5\sigma$ value in the other codes.

As; Transition points are observed at $\bar{x} + 1.5\sigma$ value in Group 3 code, at $\bar{x} + 2.0\sigma$ value in Group 5 code and at $\bar{x} + 1.0\sigma$ value in the other codes.

Hg; Many samples are under detective limit content so identification of trasition point is hard, but they are observed at $\bar{x} + 1.5\sigma$ value in some codes.

4) Correlation coefficient

Correlation coefficient between elements for all samples in the Romblon Area is shown in Table-14.
High correlation is observed between Cu and Zn Co Mn, Pb and As, Zn and Mn, Ni and Co, Co and Mn, As and Hg.

Table-14 Correlation Coefficient between each element in Romblon Area

ROMBLON

Correlations:	LOGCU	LOGPB	LOGAG	LOGZN	LOGNI	LOGCO	LOGMN	LOGMO	LOGAS	LOGHG
LOGCU	1.0000									
LOGMO	-.0479	1.0000								
LOGPB	-.1073**	-.0260	1.0000							
LOGZN	.6183**	-.1156**	.2122**	1.0000						
LOGAG	.1298**	-.0022	.1769**	.1791**	1.0000					
LOGNI	.2229**	-.0788*	-.1768**	.2246**	.0455	1.0000				
LOGCO	.5137**	-.0787*	-.3097**	.4516**	.0615	.8689**	1.0000			
LOGMN	.6869**	-.0731	-.1154**	.6944**	.0382	.6342**	.8475**	1.0000		
LOGAS	-.0107	-.0097	.5303**	.1804**	.1975**	.0324	-.0494	.0398	1.0000	
LOGHG	.1432**	.0250	.2799**	.2230**	.0631	.2222**	.2166**	.2788**	.4898**	1.0000

4-4-2 Analysis for Heavy Mineral Samples

1) Analytical method

Total 61 heavy mineral samples were collected in the Romblon Area and analyzed by statistical procedure.
These samples were taken from down side of junction of streams. They were reduced amount from 3 kg to 20 grams by panning in each places.
On these samples microchemical analysis for Au, Ag and Ga were carried out at PETROLAB by atomic absorption method similar to the stream sediments. The results of the analysis are shown Appendix 7.

Table-15 Statistical Values on Geochemical Analysis of Heavy Mineral Samples in the Romblon Area

	$\bar{x}$ value	$\bar{x}+1\sigma$ value	$\bar{x}+1.5\sigma$ value	$\bar{x}+2\sigma$ value	Maximum value	Minimum value
Au (ppb)	387.1	2,504.5	6,370.4	16,203.8	17,800	10
Ag (ppb)	143.8	465.4	873.3	1,506.2	2,660	50
Ga (ppm)	13.1	22.9	30.3	40.4	30.7	1

Mean values and standard deviation values are calculated by the hypothesis that these values show logatrithmic normal dispersion, these values are shown in Table 15.
Anomalous values are classsified by the threshold value which is $\bar{x}+1.5\sigma$ value.

2) Identification of constituent minerals are classified by binocular microscope for random selected 4 heavy mineral samples in Romblon Area.
Magnetite is recognized as main mineral and other constituent minerals are in the order of hornblende, pyroxene and plagioclase.
Details are shown in Table 16.

	1	2	3	4	5	6	7	8	9
Minerals	Magnetite	Hornblende	Pyroxene	Plagioclase	Hematite	Quartz	Zircon	Epidote	Others
Range (%)	72 - 36	25 - 0	20 - 5	10 - 3	5 - 3	8 - 0	5 - 0	3 - 0	
Mean content (%)	36	22	14	9	6	6	4	2	1

Table-16
Constituent Minerals in Heavy Mineral Samples (Romblon Area)

4-4-3 Local Distribution of Anomalous Values in the Romblon Area

1) Univariate analysis for stream sediment samples.

Anomalous values in each lithological code are classified in following range. These classified anomalous were plotted in 1 : 250,000 scal sample locality map with symbol ○, △ and □.
Following descriptions on local feature of anomalous value in each element depend on this distribution map of anomalous value (Ref. Attached map 7-1·2).

Classification Range	Symbol	Rank
$\bar{x} + 1.0\sigma$ value $\leq Z < \bar{x} + 1.5\sigma$ value	●	Possibly
$\bar{x} + 1.5\sigma$ value $\leq Z < \bar{x} + 2.0\sigma$ value	▲	Probably
$\bar{x} + 2.0\sigma$ value $\leq Z$	■	Highly

(Z: analytical result)

Cu; Accumulation zones of high and probable anomalous values are observed around diorite stocks which intrude at central east and northern part of Tables Is. and near the contact zone schist and ultramafic rock at western part of Sibuyan Is.

Pb; Accumulation zones of high and probable anomalous values are observed in schist at northeast Tablas Is. and in Binoog Formation at middle-west Tablas Is. and around diorite stocks in ultramafic rock at western part of Sibuyan Is.

Zn; Accumulation zones of high and probable anomalous values are observed around diorite stocks in the northeast part and in Pleistocene and Pliocene series in the middle part of Tablas Is. In Sibuyan Is. high and probable anomalas values accumulate around diorite stocks in ultramafic rock at northwest part.

Ag; Several anomalous values accumulate in Miocene series and schist at the west side of Concepcion and Alcantala in East Coast of Tablas Is. and around the diorite stocks in ultramafic rock in the western part of Sibuyan Is.

Ni; Accumulation zones of high and probable anomalous values are observed around the mouth of Binayan River at the middle west part, around Maguiwan at the north coast and around Camanglad at the north-west part of Sibuyan Is.

Co; Accumulation zones show similar distribution to Ni at the surrounding part of Sibuyan Is.

Mn; Accumulation zones of high and probable anomalous values are observed in the west side schist and in the north-east side schist to the west side ultramafic rock in Sibuyan Is.

As; Accumulation zones are observed in the west side ultramafic rock in Sibuyan Is. and in Miocene series at the east side of Camagtong in the West Coast of Tablas Is.

Hg; Accumulation zones of high and probable anomalous values are observed in the west side ultramafic rock, in schist from the southern to eastern part and at the contact zone of schist and ultramafic rock at the northeastern part of Sibuyan Is.
In Tablas Is. high and probable anomalous values accumulate in Miocene series and at contact zone of schist and diorite in the middle northern part.

Mo; About 10 anomalous values are dotted at northwestern part of Tablas Is. in spite of small amount of anomalous values.

5. SYNTHESIS

5. Synthesis

5-1 Summary

5-1-1 Geology and Structure

The survey area is located in central part of Visayan Region in Middle Philippines.

Cebu and Eastern Panay Area belongs to "Central Physiographic Province". In this area, the basement rocks which consist of Pre-Cretaceous and Cretaceous System and Paleocene Series are upheaved by Neogene Orogenic Movement.

Neogene and some Paleogene Series which compose mainly limestone interbedded normal sediments and pyroclastics overlie the basement rocks as above mentioned.

Western Panay and Romblon Area belongs to "Western Physiographic Province".

In this area, the basement rocks which consist of Pre-Tertiary metamorphic rocks, Paleogene pyroclastic rocks and Neogene ophiolitic rocks are strongly deformed by orogenic movement of Antique Mountain Range.

As for intrusive rocks, Lutopan Diorite in Cebu Is., Sara Diorite in Panay Is. and Guimaras Diorite in Guimaras Is. are observed as Paleocene intrusive body.

In western Panay and Romblon Area, Miocene diorite stocks and mafic to ultramafic rocks are observed in places, similar rocks locate in Eastern Panay and Cebu Is., and Pliocene andesite volcano locate in East Coast of Panay Is.

5-1-2 Mineralization

Mineralization of survey area corresponds well to above mentioned igneous activity, namely orthomagmatic deposit at weathering part of ophiolite, stratabound massive suphide or manganese deposit in schist and hydrothermal vein or disseminated type deposit which accompany intrusion of dioritic rocks are observed in places. Placer deposit is also observed at weathering part of hydrothermal deposit.

5-1-3 Conclusion of summary

Mineralization in Cebu, Panay and Romblon Area are hydrothermal and contact metamorphic type accompanied diorite intrusion, weathered residual nickeliferous laterite and stratabound manganese deposits, as for non-metallic deposits, phosphate, dolomite, kaoline and coal deposits are encountered.

The mineralization accompanied diorite intrusion is intense in Cebu Is. but in Panay and Romblon area is not so strong, especially Sara Diorite and Guimaras Diorite show weak mineralization.

The results of inspection between mineralization feature and geo-chemical anomalies show priority order as follows:

1) Cu-Pb-Ag-Zn-Co-Mo polymetallic anomaly near Sigpit Lutupan mineral showing 10 km SE Toledo of West Coast of Cebu Is.

   This anomaly locate in Mananga Formation accompanied Lutopan Diorite intrusion and fracture zone NE direction passing near site. In such situation porphyry type deposit is expected.

2) Cu-Pb-Zn-As-Hg-Mn polymetallic anomaly near Consolacion mineral showing at 15 km northeast of Cebu City.

This showing is explained as hydrothermal deposit concerned Bulcao Andesite but broad mineralization is expected because volatile component As and Hg anomaly accompanied to this zone.

3) Cu-Pb-Zn-Ag-Co-Ni-Mn-Mo polymetallic anomaly 7 km NE of San Pedro at West Coast of Panay Is. (UNDP area)

This anomaly has not so broad area but many first class anomalous values accumulated and they elongate NE direction. High grade vein type deposit is expected.

4) Cu-Zn-Hg-As anomalous zone around diorite and gabbro stocks in Igpaco volcanics.

From above combination of elements porphyry type deposit is expected.

5) Cu-Pb-Zn-Ag-Ni-Co-As-Hg polymetallic anomaly in ultramafic rocks accompanied diorite intrusion at middle to north area of west Sibuyan Is.

Such polymetallic mineralization is not reported in this area, but hydrothermal mineralization accompanied diorite intrusion is expected.

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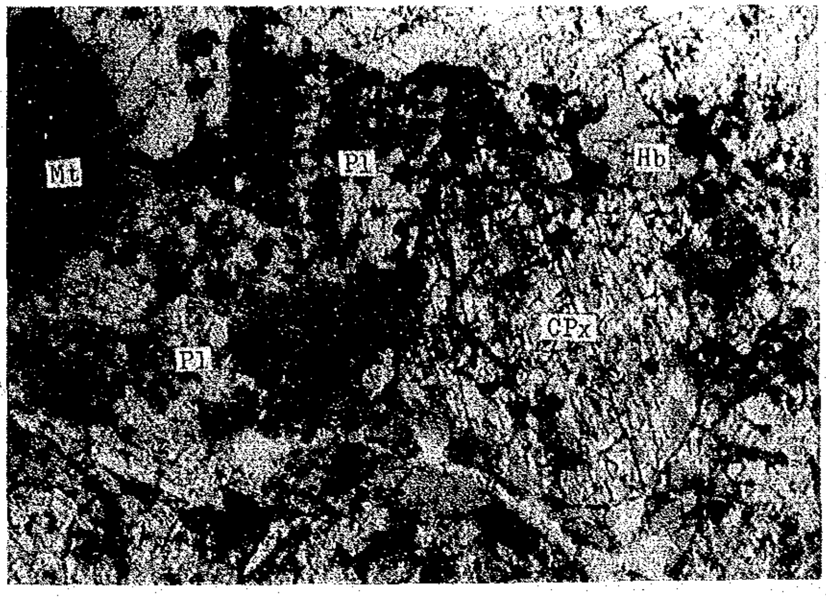
APPENDICS

Appendix 1 (Thin Section Micro-photograph)

APPENDIX 1
Cebu Area

(Thin Section Micro-photograph)



Pl: Plagioclase
CPx: Clinopyroxene
Hb: Hormblende
Mt: Magnetite

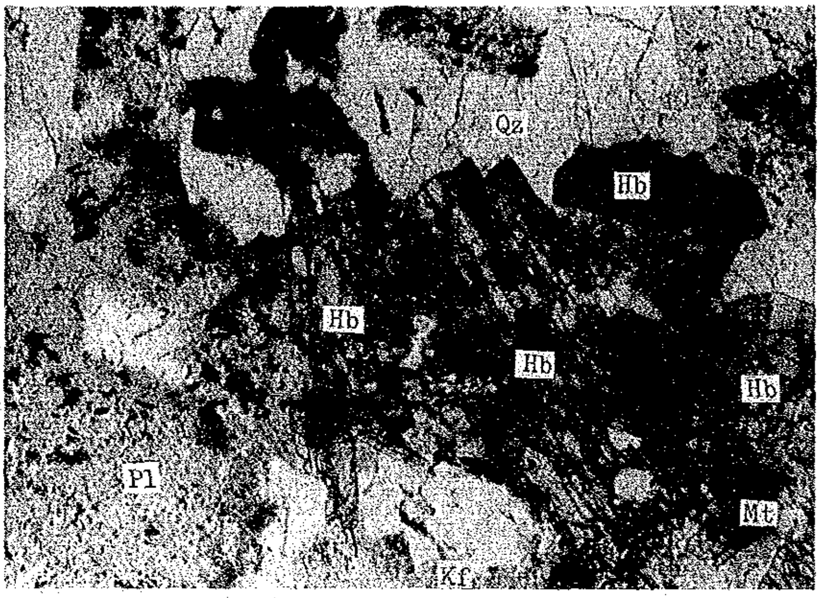
Parallel Nicol

0 2mm

Diorite (Sample No. CF-042R)
Locality; 12 km ENE of Toledo
Main Mineral; Plagioclase, Clinopyroxene, Hornblende
Accessary Mineral; Quartz, Biotite, Magnetite, Apatite
Secondary Mineral; Chlorite, Sericite, Epidote, Calcite

Crossed Nicol

0 2mm



Qz: Quartz
Kf: K-feldspar
Pl: Plagioclase
Hb: Hornblende
Mt: Magnetite

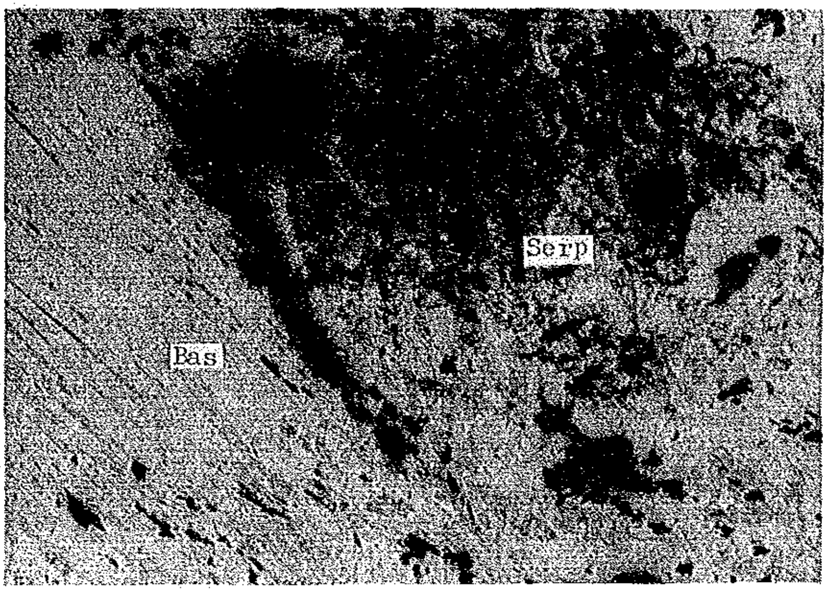
Parallel Nicol

0 2mm

Hornblende Tonalite (Sample No. CM-019R)
Locality; 11 km W of Douao of East Coast
Main Mineral; Quartz, K-feldspar, Plagioclase, Hornblende
Accessary Mineral; Magnetite, Shene, Apatite
Secondary Mineral; Chlorite, Sericite, Calcite, Epidote

Crossed Nicol

0 2mm

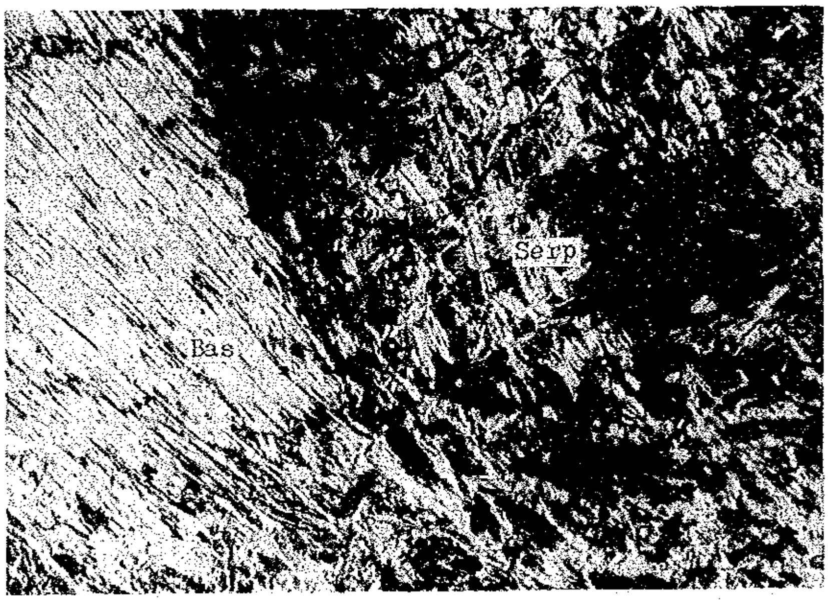


Serp: Serpentine
Bas: Bastite

Parallel Nicol

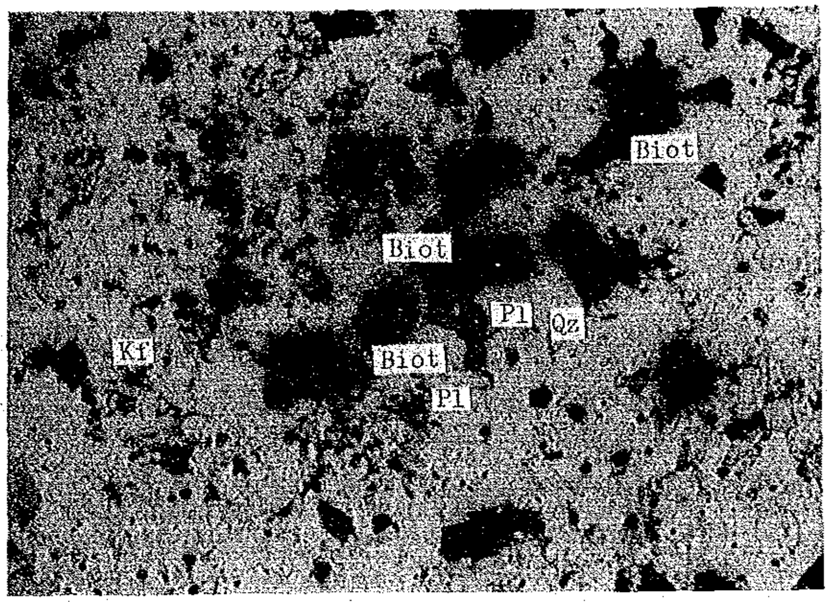
0 2mm

Serpentinized Peridotite (Sample No. CA-101R)
Locality; 19 km W of Cebu City
Main Mineral; Olivine, Orthopyroxene
Secondary Mineral; Serpentine (Mesh-structure in olivine),
Bastite (Replacing Orthopyroxene)



Crossed Nicol

0 2mm

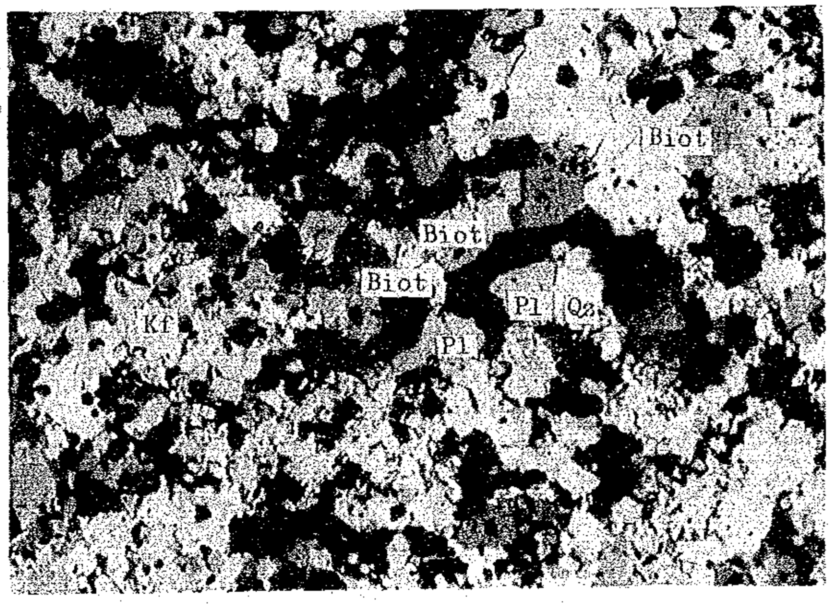


Qz: Quartz
Kf: K-feldspar
Pl: Plagioclase
Biot: Biotite

Parallel Nicol

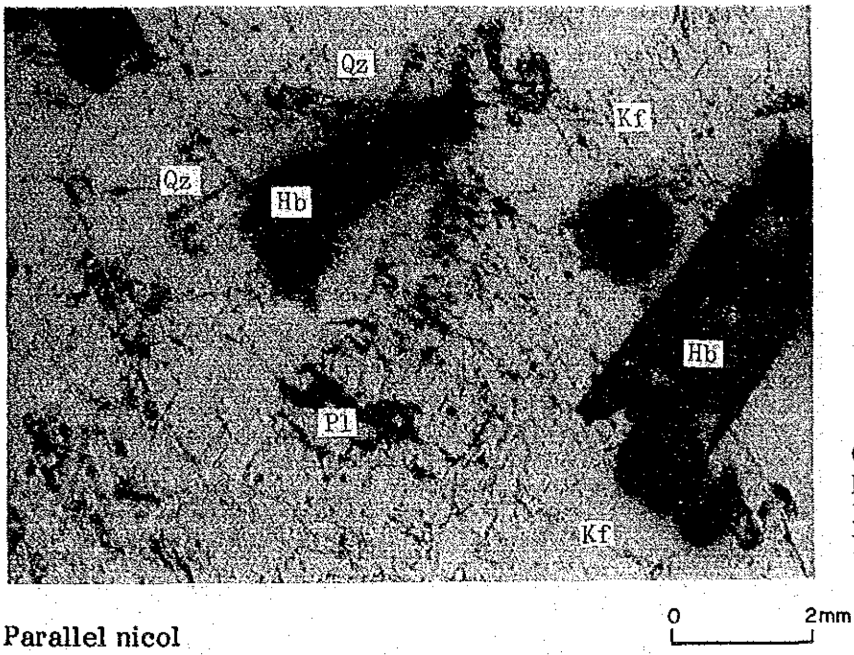
0 2mm

Fine-Grained Two-Mica Granite (Sample No. CE-003R)
Locality; 9 km N of Cebu City
Main Mineral; Quartz, K-feldspar, Plagioclase, Biotite, Muscovite
Accessary Mineral; Pyrite, Zircon



Crossed Nicol

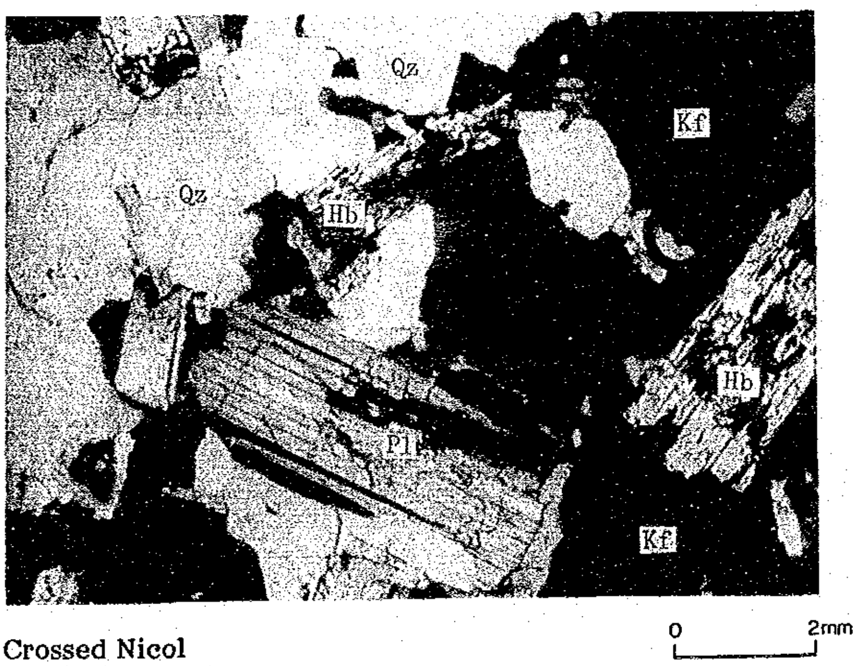
0 2mm



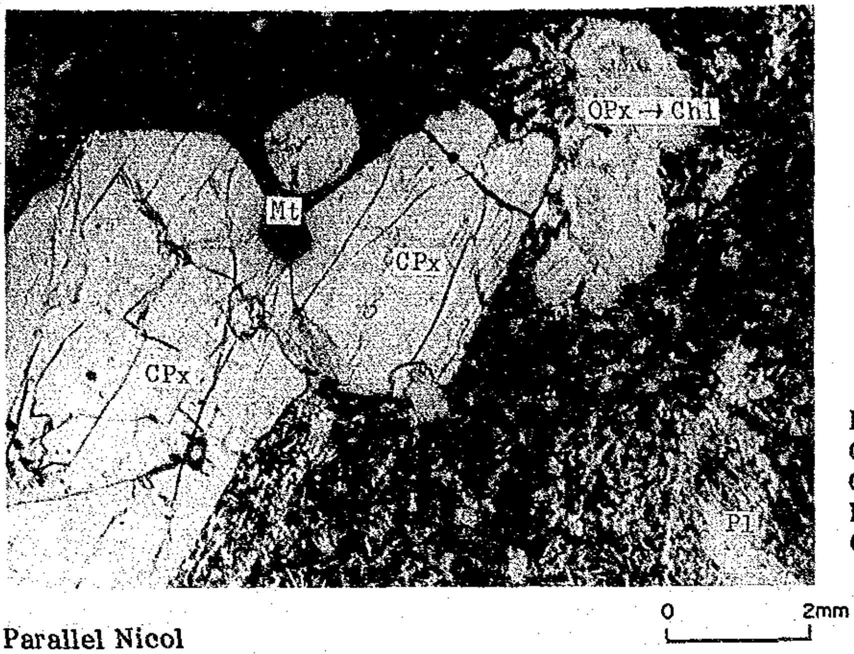
Qz: Quartz
Kf: K-feldspar
Pl: Plagioclase
Hb: Hornblende

Parallel nicol

Biotite-Hornblende Adamellite (Sample No. CG-005R)
Locality; 3 km N of Cebu City
Main Mineral; Quartz, K-feldspar, Plagioclase, Hornblende, Biotite
Accessary Mineral; Magnetite, Sphene, Apatite
Secondary Mineral; Chlorite (in Hornblende)



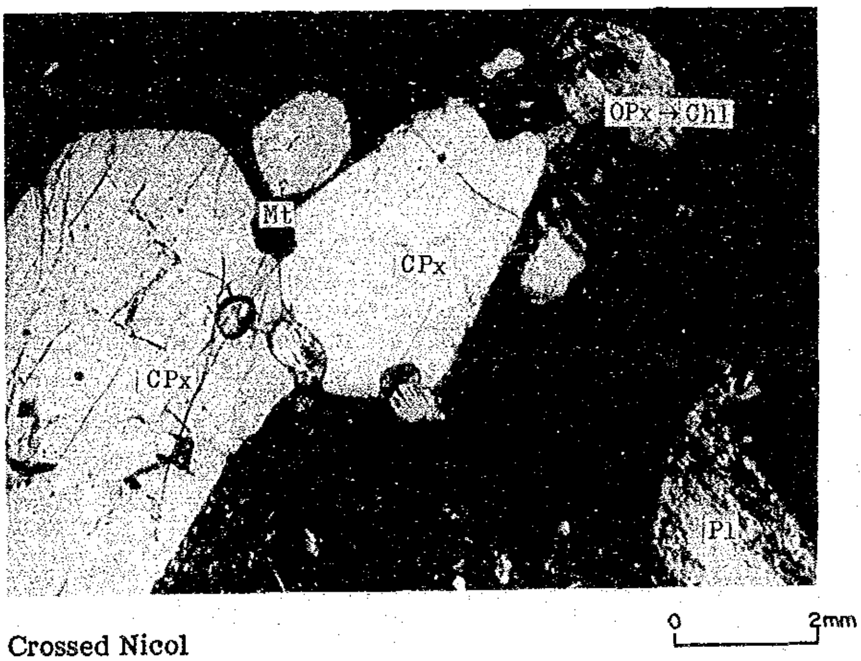
Crossed Nicol



Pl: Plagioclase
CPx: Clinopyroxene
Opx: Orthopyroxene
Mt: Magnetite
Chl: Chlorite

Parallel Nicol

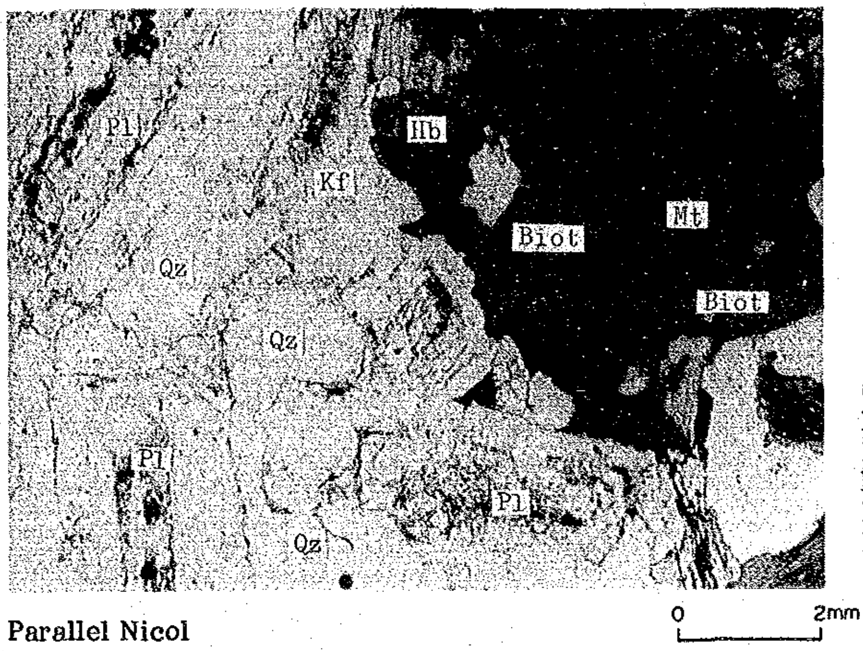
Two-Pyroxene Andesite (Sample No. CK-016R)
Locality; 15 km N of Mandaue of East Coast
Phenocryst; Plagioclase, Clinopyroxene, Orthopyroxene
Groundmass; Plagioclase, Quartz, Monoclinic pyroxene, Ortho pyroxene, Magnetite, Glass
Secondary Mineral; Chlorite (Replacing orthopyroxene)



Crossed Nicol

Eastern Panay Area

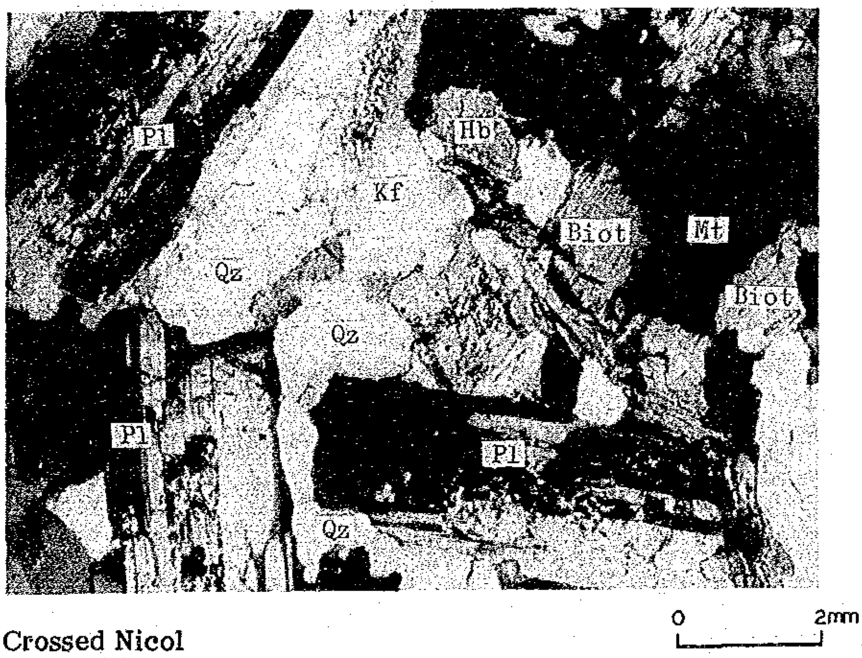
(Thin Section Micro-Photograph)



Qz: Quartz
Kf: K-feldspar
Pl: Plagioclase
Biot: Biotite
Hb: Hornblende
Mt: Magnetite

Parallel Nicol

Biotite-Hornblende Granodiorite (Sample No. AB-31)
Locality; 10 km N of San Francisco of South Coast
Main Mineral; Quartz, K-feldspar, Plagioclase, Biotite, Hornblende, Magnetite
Accessary Mineral; Clinopyroxene, Sphene, Apatite
Secondary Mineral; Chlorite (in Biotite)
Sericite (in Plagioclase)



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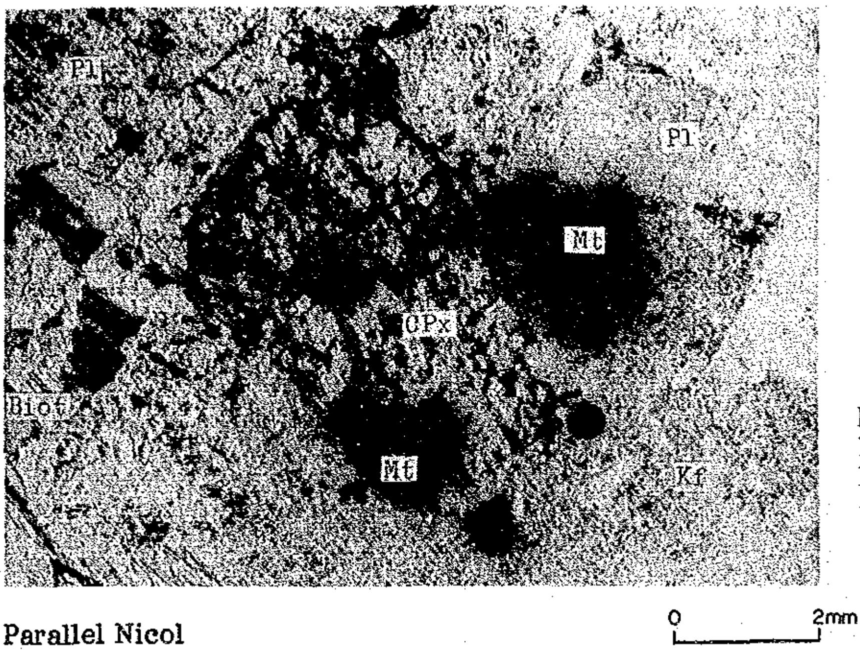
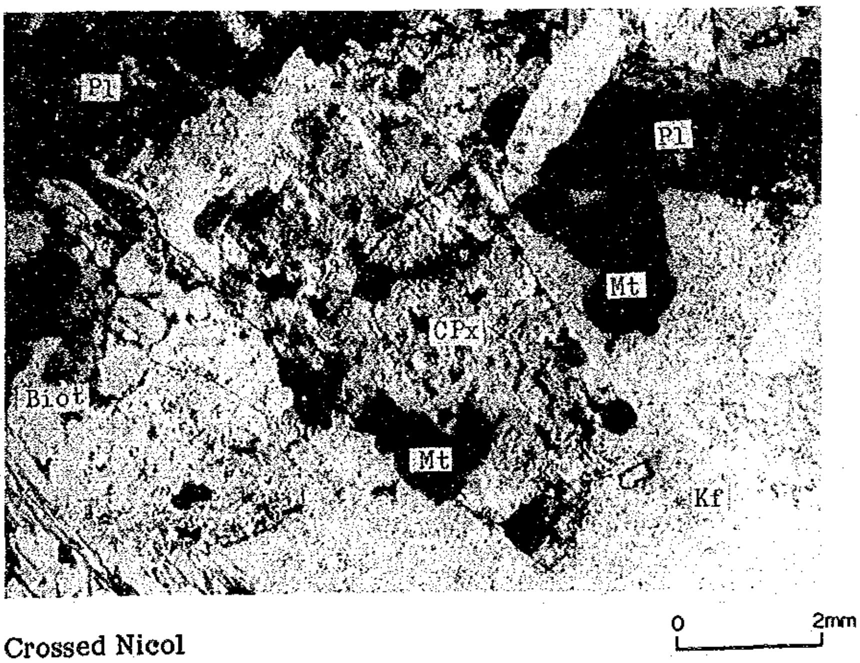


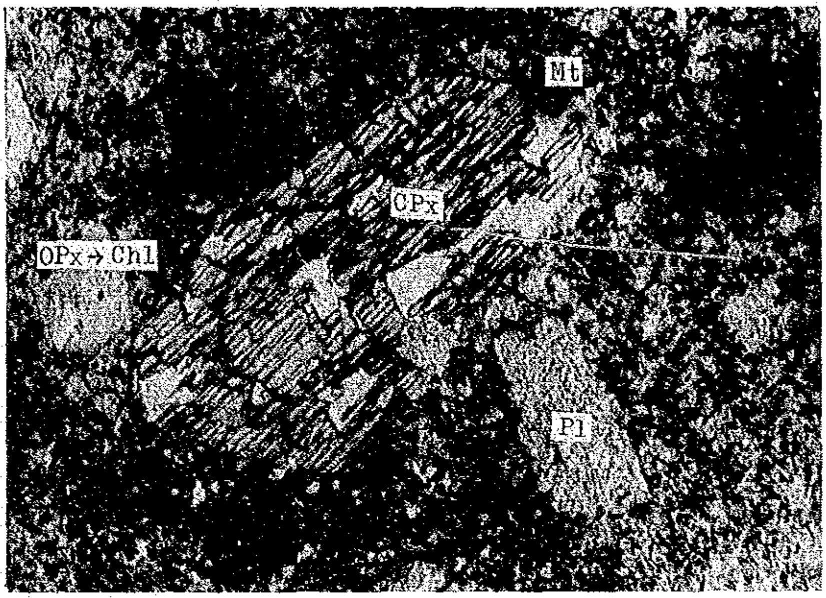
Kf: K-feldspar
Pl: Plagioclase
Biot: Biotite
CPx: Clinopyroxene
Mt: Magnetite

Parallel Nicol

Porphyritic Monzonite (Sample No. AR-96R)
Locality; 6 km E of President Roxas of North Coast
Main Mineral; K-feldspar, Plagioclase, Green Hornblende, Biotite, Clinopyroxene, Orthopyroxene
Accessary Mineral; Magnetite, Sphene, Apatite
Secondary Mineral; Chlorite (in Biotite), Sericite (in Plagioclase)



Crossed Nicol

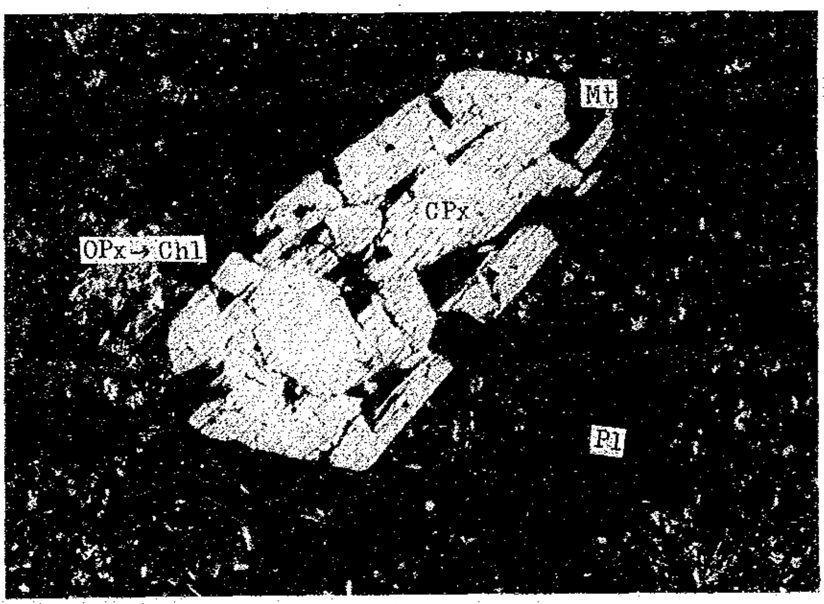


Pl: Plagioclase
Cpx: Clinopyroxene
OPx: Orthopyroxene
Mt: Magnetite
Chl: Chorite

Parallel Nicol

0 2mm

Two-Pyroxene Andesite (Sample No. AK-075)
Locality; North Anilao of 36 km NE of Iloilo City
Phenocryst; Plagioclase, Clinopyroxene, Orthopyroxene, Magnetite
Groundmass; Plagioclase, Clinopyroxene, Orthopyroxene, Magnetite, Ilmenite (?), Apatite, Glass
Secondary Mineral; Chlorite (Replacing Orthopyroxene), Zeolite



Crossed Nicol

0 2mm