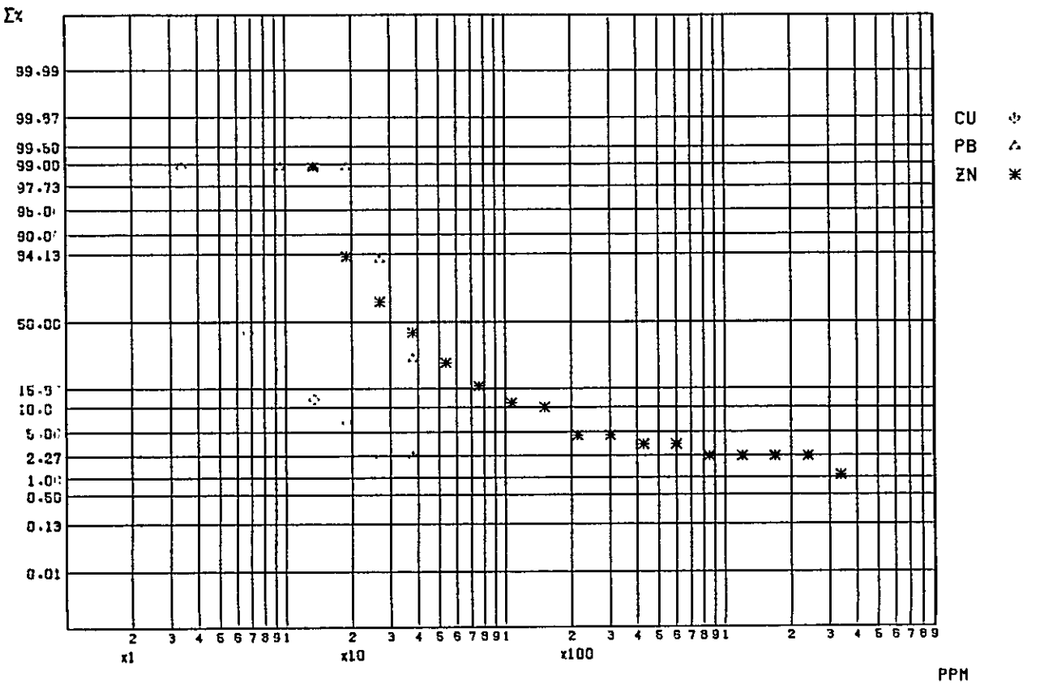
CUMULATIVE FREQUENCY DISTRIBUTION FOR CU PB AND ZN



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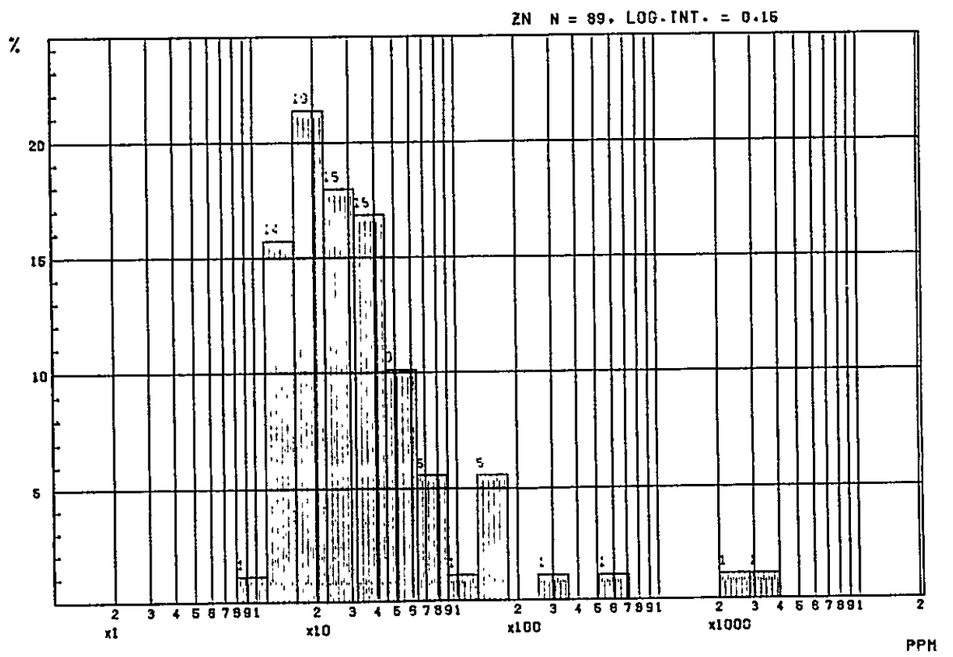

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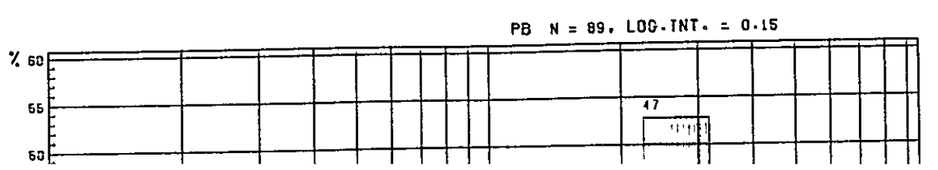
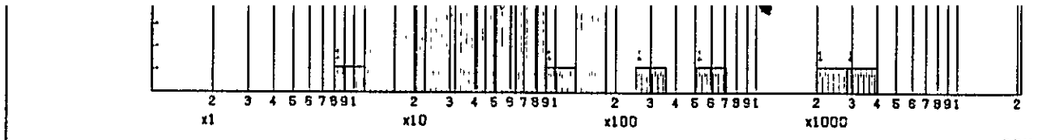
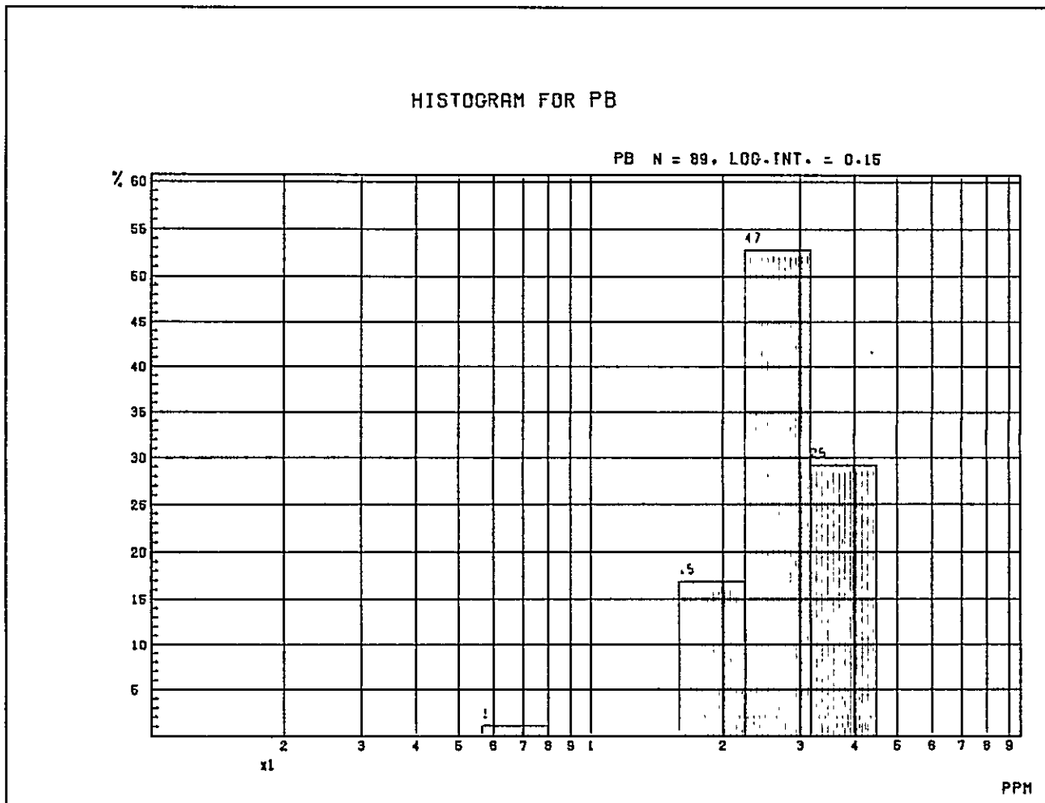






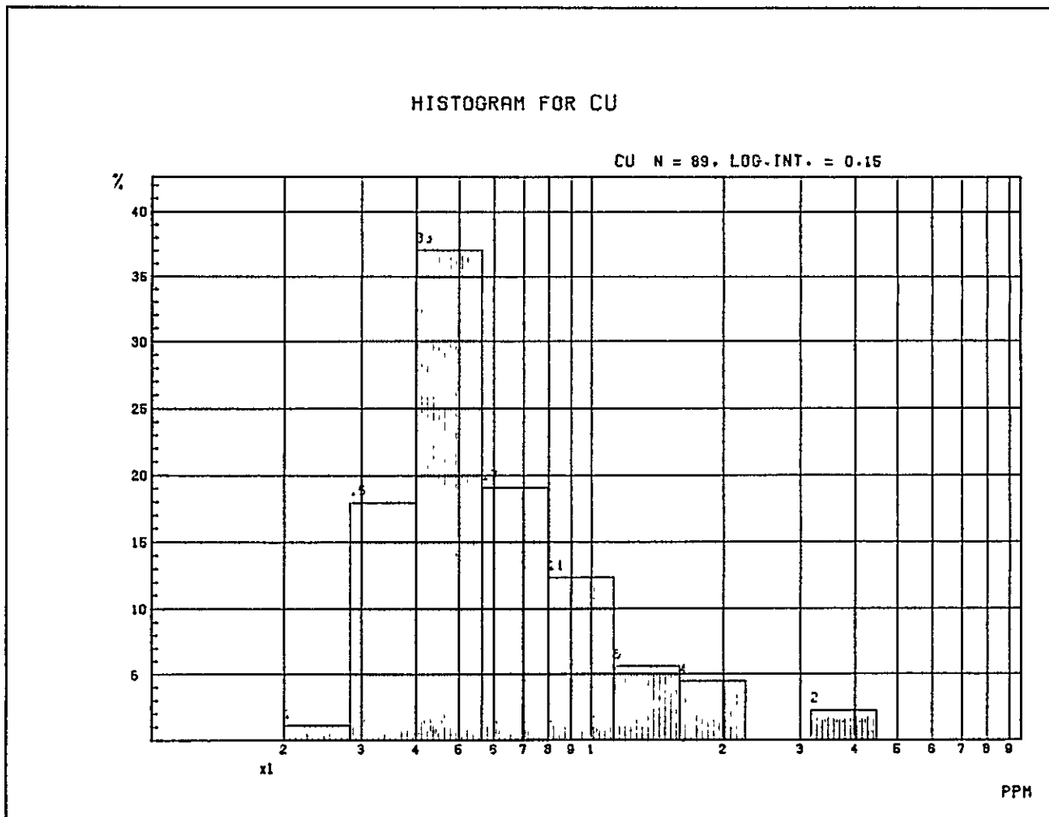
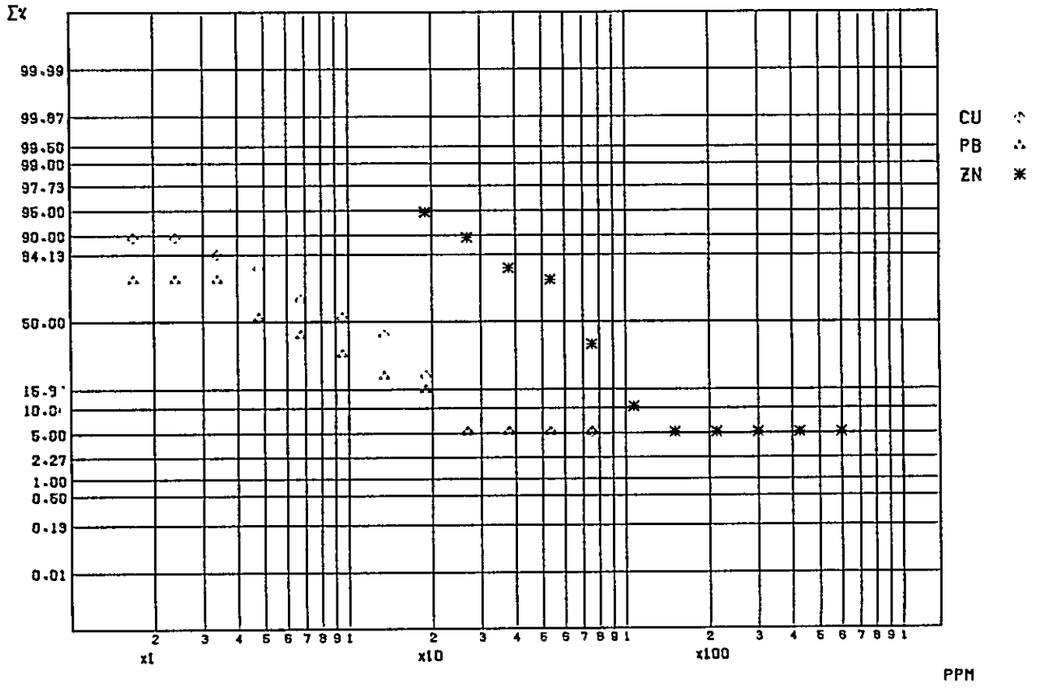


Fig. 16. Histogram and Cumulative Frequency Curve for Cu, Pb and Zn Contents in the Geochemical Samples

(5) Pariahuanca, Chulec, Pariatambo and Jumasha Formations

CUMULATIVE FREQUENCY DISTRIBUTION FOR CU. PB AND ZN



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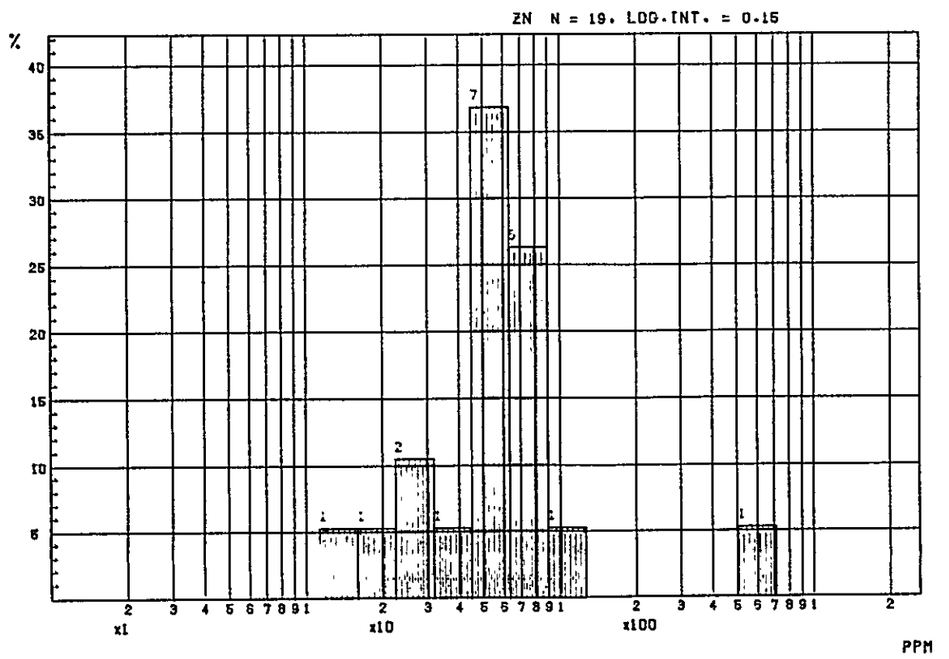

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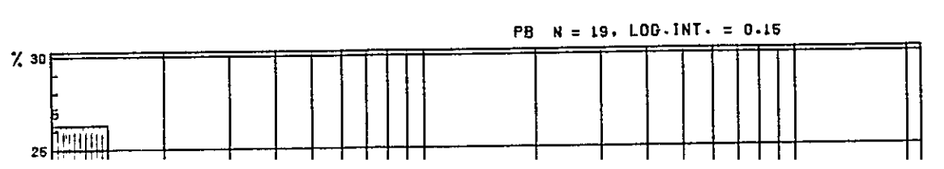
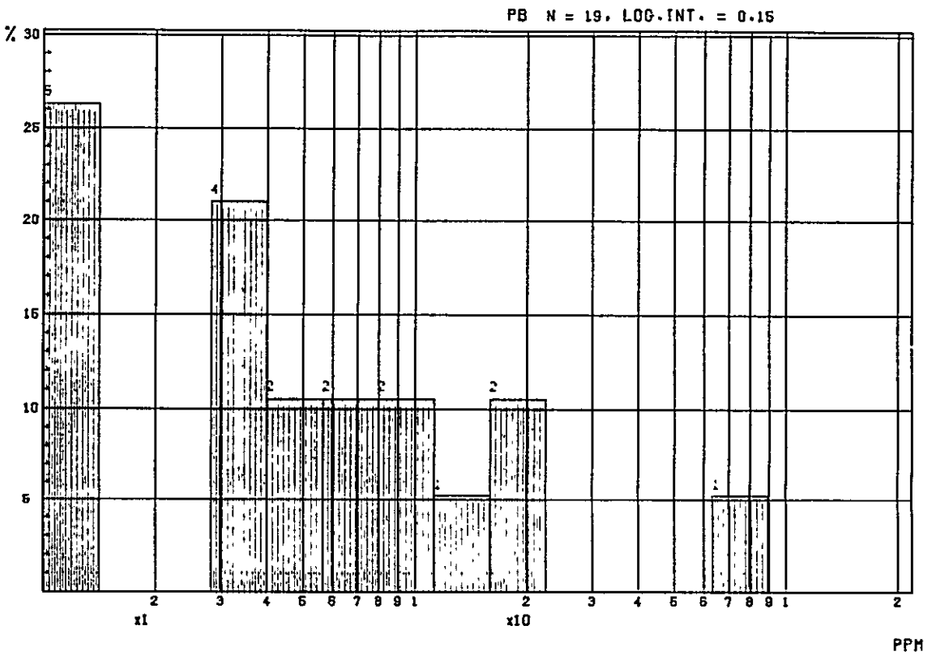




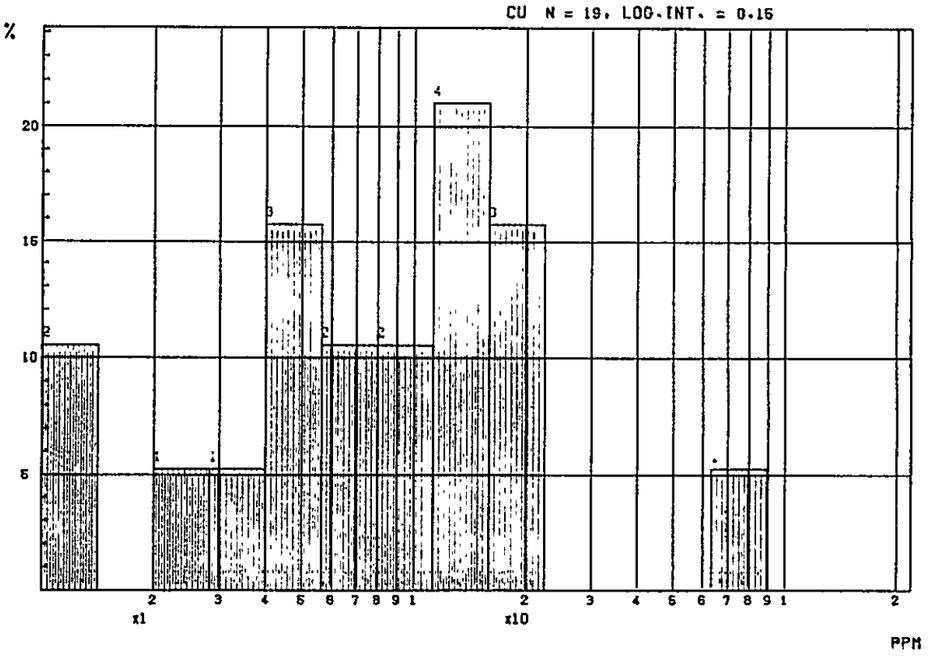
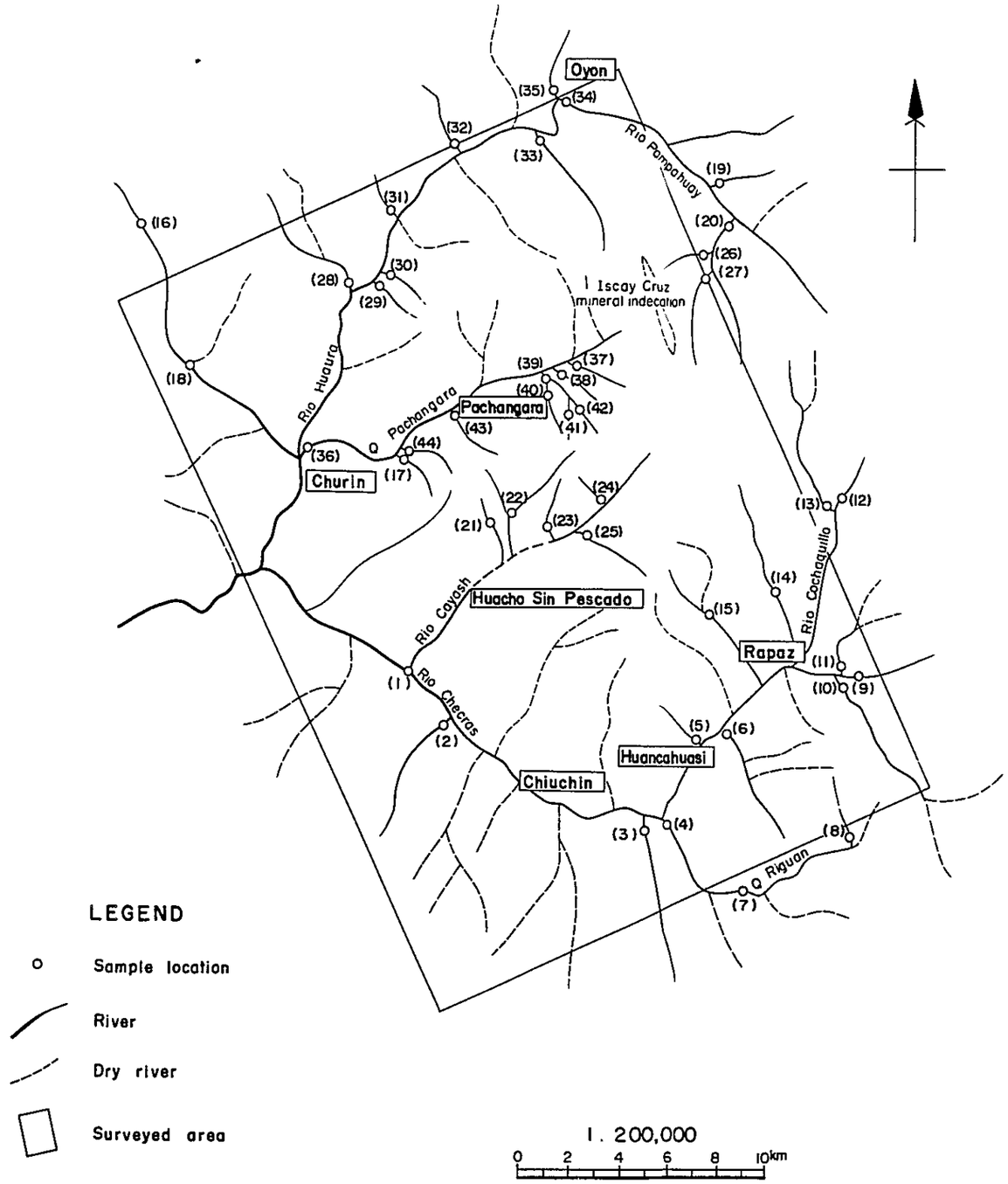


Fig. 16 Histogram and Cumulative Frequency Curve for Cu, Pb and Zn Contents in the Geochemical Samples (6) Calipuy Volcanics and Igneous Rocks

Table 5 List of Anomalous Samples in the Surveyed Area

· Anomaly

Field No.	Content			Remarks
	Cu (ppm)	Pb (ppm)	Zn (ppm)	
BO-128	2	· 523	302	Gossan-like limestone (Santa formation) located about 2 km north of the Iscay Cruz mineralized zone.
BO-129	4	· 1,342	· 1,636	
BO-130	3	· 534	· 8,060	
BO-140	4	407	· 10,288	
BO-181	· 176	· 553	54	Santa limestone located in the Churin area.
CO-114	6	17	· 3,383	Pariahuanca massive limestone accompanied with many calcite veinlets.
CO-148	3	19	· 523	Santa limestone in the eastern side of the Iscay Cruz horizon.
CO-169	9	20	· 2,390	Pariahuanca limestone accompanied with calcite veinlets.
CO-177	40	17	· 618	Pariahuanca limestone.
NO-113	6	0	· 575	Dyke of granite porphyry intruded in sedimentary rocks.
NO-172	10	22	· 3,455	Skarn in the No. 5 mineralized zone of Iscay Cruz area.
NO-173	2	11	· 2,006	Gossan (Santa formation) in the No. 6 mineralized zone of Iscay Cruz area.
NO-174	8	120	· 4,429	
SO-135	9	· 5,580	· 20,938	Santa limestone near the gossan.
SO-140	3	· 2,901	· 5,169	
SO-143	3	186	· 12,188	Santa muddy limestone with calcite veinlets.
SO-167	1	· 1,317	· 2,848	Dolostone with vein-like gossan.



Field No	Cu ppm	Pb ppm	Zn ppm
SD- 1	20	52	85
SD- 2	15	38	106
SD- 3	21	20	156
SD- 4	17	29	92
SD- 5	16	29	191
SD- 6	21	20	69
SD- 7	10	23	67
SD- 8	22	20	42
SD- 9	39	40	223
SD-10	14	194	183
SD-11	14	17	56
SD-12	16	20	209
SD-13	18	22	124
SD-14	97	25	310
SD-15	16	19	46
SD-16	742	168	416
SD-17	21	60	83
SD-18	79	120	172
SD-19	32	27	287
SD-20	14	21	115
SD-21	18	26	74
SD-22	13	26	82
SD-23	16	23	77
SD-24	14	14	77
SD-25	28	26	83
SD-26	16	100	76
SD-27	6	0	77
SD-28	182	103	114
SD-29	12	37	78
SD-30	77	63	1,905
SD-31	73	83	147
SD-32	23	2,500	300
SD-33	20	77	395
SD-34	19	60	104
SD-35	36	134	240
SD-36	18	80	106
SD-37	11	49	88
SD-38	19	23	104
SD-39	15	26	104
SD-40	16	29	124
SD-41	16	29	127
SD-42	11	26	117
SD-43	12	34	79
SD-44	25	43	81

Fig. 17. Location Map and Assay Results of Stream Sediments

Chapter 6 Mineralization in the Iscay Cruz Area

The ore deposits distributed throughout Oyon and its peripheral areas are largely emplaced in the calcareous rocks except partially existing ore deposits in Calipuy volcanics. The Iscay Cruz ore deposit which is the most important and the major subject of this survey is distributed for 11 km in the calcareous rocks of the Santa formation. This deposit is exposed at the surface as gossan or sulfide ore bodies of lead (Pb) and zinc (Zn). They have been discussed in Chapter 4 as hydrothermal mineralization, but there remains the possibility of syngenetic mineralization. In this Chapter, problems concerned with these points are discussed.

6-1 Possibility of Strata-bound Type Ore Deposits

(1) Background values of lead and zinc elements

For the formation of strata-bound type lead and zinc ore deposits in the Cordillera Oriental of Peru, two depositional conditions were required: high concentrations of Pb and Zn elements deposited together with limestone, and followed by a diagenetic phase in which dolomitization takes place and primary precipitation of Pb and Zn elements are re-concentrated (JICA and others, 1978). Therefore by acknowledging the background values of Pb and Zn and the degree of development of delostone, it is possible to consider the possibility that a strata-bound type ore deposit will become formed.

The carbonate rocks in the surveyed area of Iscay Cruz and others possess background values of Pb 30 ppm and Zn 35 ppm, as mentioned in Chapter 5. These values are a little high compared with ordinary carbonate rocks, but low as background values of strata-bound type ore deposits. Furthermore the anomalous values in carbonate rocks are concentrated in dolostone

altered to gossan and in areas subjected to distinct mineralization. By excepting these values, the average values of Pb and Zn become 25 ppm and 22 ppm respectively, and for Zn the value falls to almost the same level as the value in the ordinary carbonate rocks.

For this fact, the Santa formation in the surveyed area is considered not to have been in a depositional environment for high concentration of Pb and Zn elements.

(2) Character of country rocks

The Santa formation in the Iscay Cruz area roughly divides into three strata: dolostone, limestone including nodules of chert, and massive limestone from the bottom upward. To investigate the composition of its carbonate rocks and depositional environments, analysis was performed for calcium (Ca), magnesium (Mg), strontium (Sr), barium (Ba), etc. in some geochemical samples.

The analysis results are given in Table 6, and related graph in Fig. 18. From these data, the following is to be noted: The maximum Mg content is 8.9 % and molar ratio of Mg/Ca is 0.82 maximum, but most samples had ratios of 0.7 to 0.8. As impurities in calcareous rock, amounts of Fe, Mn, Ba, etc. are very small.

The molar ratio of Mg/Ca in dolostone is 1:1 theoretically, and it is said that generally intermediate compositions of dolostone and limestone are rare. However numerous dolostones in this area have intermediate composition. These are considered to have formed in an environment of very poor dolomitization.

As described above, in the Santa formation, not only conspicuous primary concentration of Pb and Zn but dolomitization has clearly occurred. Indications have not been observed geochemically or mineralogically that Pb

and Zn deposition primarily had moved by dolomitization. Secondary concentration of Pb and Zn can not be also expected since dolomitization is weak. Therefore the possiblity of embedded strata-bound type ore deposits, like the Pucara Group in the Cordillera Oriental of Peru, can be said to be almost nil.

6-2 Ore Character and Mineral Zoning

Mineralization in the Iscay Cruz area is classified into the following 3 types including the Chupa ore deposits.

(1) Mineralization being altered to gossan at present

(2) Pb-Zn mineralization in carbonate rocks

(3) Cu-Zn mineralization in skarn

The type of (1) and (2) present in different indication on the surface but both are genetically formed by hydrothermal mineralization and can be regarded as the same in this sense. The No. 1 to the No. 4 minerals indication, the No. 6 indication, and the limestone altered to gossan 2 km north of the No. 1 minerals indication, all belong to this category. The gossan in chiefly consists of iron and quartz, and includes a fair amount of Pb and Zn. Most Pb and Zn occur as oxide minerals. Pb content is especially high in the northern part of the No. 1 minerals indication, and the Pb content decreases toward the south and north.

Furthermore, in the No. 3 and No. 4 minerals indications development of gossan is local, and in these minerals indications, Pb and Zn sulphides have crystallized directly in carbonate rocks. Contents of Pb and Zn are slightly lower than in gossan, and Cu is also present. Among these minerals indications, massive pyrite occurs in two places, and there extreme concentration of Pb is occassionally observed though the scale of ore body is small.

As minerals indications in which skarn is present, the No. 5 minerals indication and the Chupa ore deposit are located west of it. Here Pb is scarce and Cu content has increased as can be seen in the Chupa ore deposit. It is observed that the Chupa ore deposit which is rich in Zn is located in the central part, the Zn zone is located in the outer periphery, and that the Zn-Pb zone surrounding it further outside periphery. To make clear the above stated zonal arrangement of mineralization, the ratios of Cu, Pb, and Zn average ore grade of each outcrop of minerals indication were plotted in a triangular diagram (Fig. 19).

The analized percentage values of the three elements are expressed as quantitative ratios in place of concentrations in the mineralized zone. This is an attempt to show the change of each element's concentration through quantitative ratios. To clarify the distribution range of the composition ratios of the three components, Cu, Pb, and Zn, the grade of Cu was multiplied by ten. The ratios of the three components are symbolized by π-Cu, π-Pb, and π-Zn, respectively. The following results were found:

(1) In the Chupa ore deposit and the No. 4 minerals indication, π-Pb is low, and Cu and Zn are relatively rich.

(2) In the No. 5 and No. 6 minerals indications π-Zn is high and relatively rich in Zn.

(3) From the No. 1 minerals indication to the No. 3 minerals indication, π-Cu is low showing relatively rich in Zn and Pb.

Those findings support the case for the above stated existence of a zonal arrangement of Zn zone to Zn-Pb zone around Cu-Zn zone in center. And, the ore deposits accompanied by pyrite around the Oyon area, Cerro de Pasco, Huanzala and others are known. In the Cerro de Pasco ore deposit, a massive pyrite ore body (pyrite-quartz zone) exists in the center surrounded by a Sn-Cu-Zn zone or Zn zone → Pb-Zn zone → Pb zone from the center

to the outside, as reported by Einaudi, 1977. In the Huanzala ore deposit, the arrangement of Cu zone → Cu-Zn-Pb zone → Zn-Pb zone → Pb zone around the massive pyrite ore body is also observed. Also here gossan is conspicuously developed on the surface indicating ore deposit formed at a lower level (Horita et al, 1973; Sato et al, 1977). The mineralization in Iscay Cruz area can be regarded as closely resembling this.

6-3 Structural Control on Mineralization

The igneous rock confirmed in mineralized zone of the Iscay Cruz area is an acidic igneous rock which occurs as a dacite at the west of the No. 1 minerals indication and as a sheet-shaped dike in the lower stratum of the No. 4 minerals indication. The dacite stock penetrates chiefly the Jumasha formation in the synclinal zone. This exerts a weak influence on the surrounding rocks altering them to skarn. Igneous rocks have not been confirmed in the Chupa ore deposit which very probably have been formed by related igneous activity of dacite. The acidic igneous rocks of No. 4 minerals indication intruded along the lower part of the stratum have suffered severe alteration chiefly of argillization, making the textured of the original rock indistinct, and dissemination of goethite is observed. In the Huanzala ore deposit such acidic igneous rock exists in the mineralized zone, and is indirectly related to the mineralization.

In the mineralization of this area, zonal arrangement of elements, as stated above, exists. This fact leads to the assumption that it is possible that the igneous rock though unidentified which brought about the Chupa ore deposit dominated the entire mineralized zone, and this mineralization developed into the Chupa ore deposit and Iscay Cruz one deposit. But distribution of ore grade and zonal arrangement of this ore deposit extending for 11 km are by no means simple in form. The fault-fissure

system formed in the Santa formation may have played an important role in the mineralization. Dacite and other igneous rocks that lie in underground around Chupa area also relate to it. Clarification of this situation is at present very difficult. But to investigate the extent and the ore grade of mineralized zone and the concentration of ore minerals, these problems must be solved as early as possible. Therefore, further surveys should be promoted for the purpose of clarifing the distribution of igneous rocks, it's relation to mineralization, and the structural controls by the fissure systems.

Table 6 Assay Results of Minor Elements in the Carbonate Rocks

No.	Field No.	Location	Ca (%)	Mn (%)	Fe (%)	Mg (%)	Ba (%)	Sr (ppm)	Molal ratio Mg/Ca
1	AO-121	G3	30.00			3.75	0.019	0.046	0.205
2	AO-150	G4	18.20			8.79	0.024	0.015	0.795
3	AO-161	G4	19.51	0.04	0.83	7.96	0.032	0.055	0.672
4	AO-162	G4	25.08	0.02	0.45	2.10	0.045	0.043	0.137
5	AO-166	G4	36.07			0.19	0.027	0.029	0.007
6	AO-169	G3	33.93			0.16	0.012	0.070	0.007
7	BO-112	G2	30.33			2.43	0.026	0.035	0.130
8	BO-166	G4	19.18			8.83	0.021	0.011	0.759
9	BO-173	G3	16.39			7.21	0.033	0.010	0.725
10	CO-114	G1	32.30			0.53	0.030	0.025	0.026
11	CO-157	G2	37.21			0.44	0.036	0.023	0.019
12	CO-180	G3	24.59			6.92	0.052	0.021	0.463
13	NO-124	G1	22.30	0.03	0.40	6.05	0.096	0.092	0.446
14	NO-125	G1	18.85	0.03	0.89	7.39	0.066	0.073	0.646
15	NO-128	G1	27.87	0.14	1.37	6.67	0.051	0.026	0.394
16	SO-135	S1	12.04	2.59	4.69	5.98	0.042	0.066	0.820
17	SO-136	S1	36.39			0.21	0.039	0.043	0.008
18	SO-146	S1	22.13	0.03	0.17	8.04	0.038	0.035	0.597
19	SO-150	S1	35.74	0.07	0.44	0.18	0.042	0.037	0.007
20	SO-155	S1	31.80			0.40	0.029	0.064	0.020
21	SO-157	S1	20.49	0.05	1.16	8.14	0.044	0.070	0.653
22	SO-163	S1	30.66	0.03	0.11	1.96	0.022	0.032	0.104
23	SO-165	S1	22.62	0.04	0.12	7.89	0.032	0.023	0.574
24	SO-167	S1	19.34	0.36	0.36	8.95	0.019	0.006	0.763
25	SO-180	G4	15.15			5.44	0.072	0.014	0.591
26	SO-194	G2	7.37			1.79	0.192	0.008	0.398
27	SO-212	S1	29.34			0.42	0.058	0.021	0.023
28	IC-318	S2	12.18			5.37	0.060	0.003	0.726

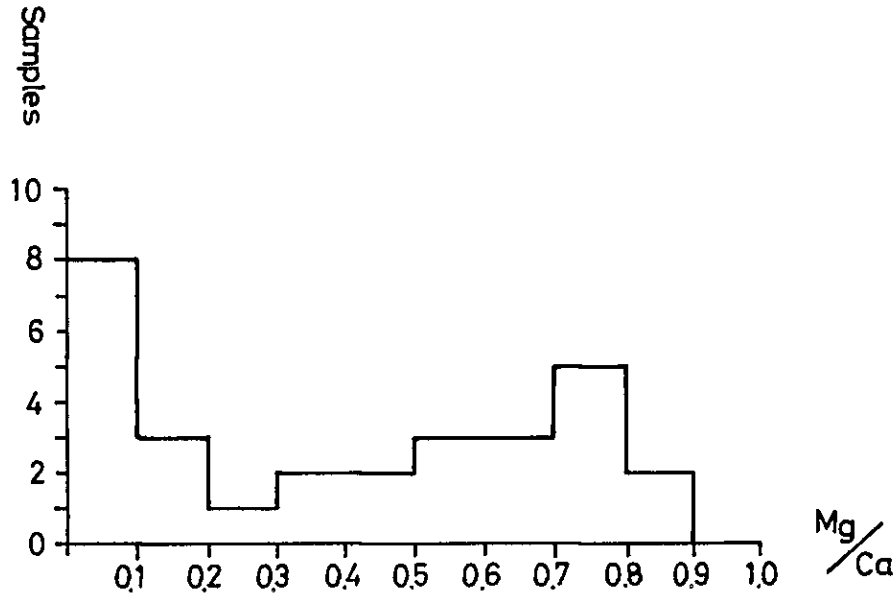


Fig.18. Histogram of Molar Ratio Between Mg and Ca in Carbonate Rocks in the Iscay Cruz Area

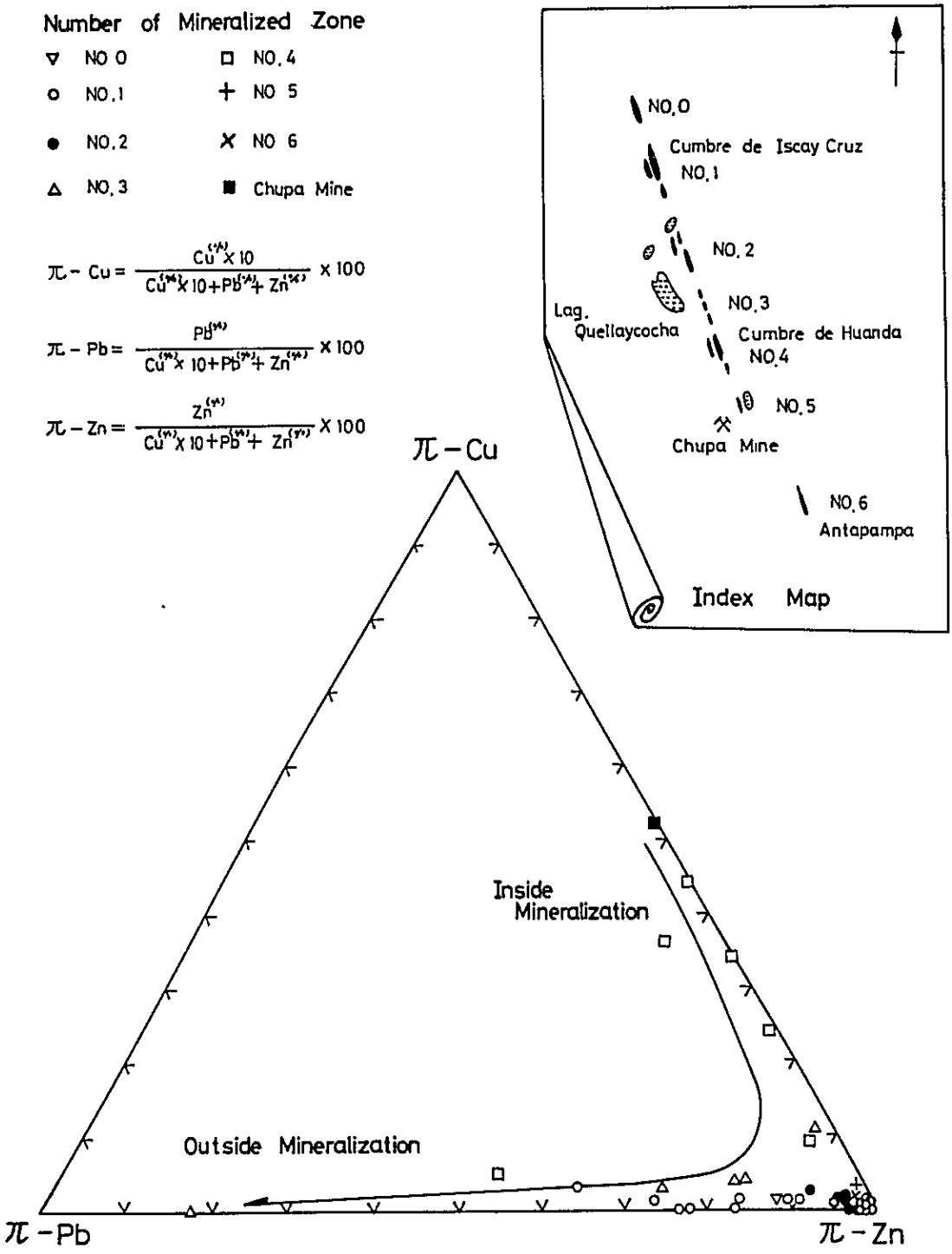


Fig.19. Ternary Diagram of Cu-Pb-Zn Ratio(π- ratio) in the Iscay Cruz Mineralized Zone

APPENDICES

A. 1. List of Rock Samples

Index of Geological Units

Sedimentary rocks

- Jm ..... Jumasha formation
- Pt ..... Pariatambo formation
- Cl ..... Chulec formation
- Ph ..... Pariahuanca formation
- Fr ..... Farrat formation
- Cz ..... Carhuaz formation
- St ..... Santa formation
- Cm ..... Chimu formation
- Oy ..... Oyon formation

Igneous rocks

- Cp ..... Calipuy volcanics
- Ig ..... Igneous rocks

Index of Analysis

- T ..... Thin section
- P ..... Polished section
- X ..... X-ray diffraction test
- E ..... EPMA (electron prove microanalysis)
- O ..... Chemical analysis of ore
- R ..... Chemical analysis of rock
- D ..... Isotopic age determination
- F ..... Fossil identification
- M ..... Minor element analysis

A. 1. List of Rock Samples

No.	Field No.	Location	Geological Unit	Rock Name	T	P	X	E	O	R	D	F	M
1	AO-101	G3	Cp	Tuff breccia	○								
2	AO-106	G3	Ig	Tonalite porphyry	○								
3	AO-115	G3	Cp	Ore (Pb, Zn)					○				
4	AO-116	G3	Cp	Andesite	○					○	○		
5	AO-117	G3	Cp	Syenitic porphyry	○								
6	AO-121	G3	St	Limestone									○
7	AO-148	G4	Cl	Limestone								○	
8	AO-150	G4	St	Dolostone									○
9	AO-161	G4	St	Dolostone									○
10	AO-162	G4	St	Limestone									○
11	AO-166	G4	St	Limestone									○
12	AO-169	G3	St	Limestone									○
13	BO-102	G2	Jm	Limestone								○	
14	BO-112	G2	St	Dolomitic limestone									○
15	BO-125	G4	St	Limestone					○				
16	BO-134	G1	Ig	Dacite porphyry					○				
17	BO-136	G1	Jm	Limestone					○				
18	BO-139	G4	Cl	Limestone								○	
19	BO-150	G4	Ph	Ore (Zn)					○				
20	BO-151	G4	Ph	Ore (Cu)					○				
21	BO-152	G4	Ph	Ore (Zn)					○				

No.	Field No.	Location	Geological Unit	Rock Name	T	P	X	E	O	R	D	F	M
22	BO-153	G4	Ph	Ore (Zn)					○				
23	BO-154	G4	Ph	Ore (Cu)					○				
24	BO-155	G4	Ph	Ore (Zn)					○				
25	BO-166	G4	St	Dolostone									○
26	BO-173	G3	St	Limestone									○
27	BO-175	G3	Cz	Shale	○								
28	CO-114	G1	Ph	Limestone									○
29	CO-121	G1	Ig	Tonalite	○					○	○		
30	CO-122	G1	Ig	Tonalite	○					○	○		
31	CO-157	G2	Ph	Limestone									○
32	CO-162	G2	Ig	Quartz porphyry	○								
33	CO-164	G2	Ig	Porphyrite	○								
34	CO-171	G3	Pt	Limestone	○								
35	CO-180	G3	St	Limestone									○
36	CO-186	G3	Ig	Porphyrite	○								
37	NO-113	G1	Ig	Granite porphyry	○								
38	NO-124	G1	St	Limestone									○
39	NO-125	G1	St	Dolostone									○
40	NO-128	G1	St	Dolostone									○
41	NO-131	G3	Cp	Andesite	○								
42	NO-132	G3	Cp	Diorite porphyry	○								
43	NO-146	G1	Ig	Andesite	○								
44	NO-148	G1	Ig	Dacite porphyry	○								

No.	Field No.	Location	Geological Unit	Rock Name	T	P	X	E	O	R	D	F	M
45	NO-149	G1	Cp	Dacitic tuff	○								
46	NO-161	G4	St	Garnet skarn	○								
47	NO-175	G3	Cm	Skarnized hornfels	○								
48	SO-101	G3	Cp	Andesitic tuff	○								
49	SO-103	G3	Cp	Andesite	○								
50	SO-106	G3	Cp	Andesitic tuff	○								
51	SO-135	S1	St	Limestone		○		○					○
52	SO 136	S1	St	Limestone									○
53	SO-137	S1	St	Gossan		○	○	○					
54	SO-142	S1	Cm	Siliceous sandstone	○								
55	SO-146	S1	St	Limestone			○						○
56	SO-150	S1	St	Limestone									○
57	SO-155	S1	St	Limestone									○
58	SO-157	S1	St	Limestone									○
59	SO-163	S1	St	Limestone									○
60	SO-165	S1	St	Dolostone									○
61	SO-167	S1	St	Dolostone									○
62	SO-176	G1	Ig	Dacite porphyry	○					○	○		
63	SO-180	G4	St	Limestone									○
64	SO-194	G2	St	Limestone									○
65	SO-212	S1	St	Dolostone									○
66	IC-103	S1	St	Gossan		○	○						
67	IC-234	S1	St	Gossan		○	○	○					

No.	Field No.	Location	Geological Unit	Rock Name	T	P	X	E	O	R	D	F	M
68	IC-246	S1	St	Gossan			○						
69	IC-301	S2	St	Ore (Zn)	○	○	○		○				
70	IC-313	S2	St	Gossan	○	○							
71	IC-318	S2	St	Dolostone	○	○			○				○
72	IC-324	S2	Ig	Altered rock		○							
73	IC-325	S2	St	Gossan	○	○	○						
74	IC-326	S2	St	Ore (Pyrite)		○							
75	IC-329	S2	St	Ore (Pb)					○				
76	IC-331	S2	St	Dolostone					○				
77	IC-342	S2	St	Gossan	○	○							
78	IC-349	S2	St	Oxides			○						
79	IC-350	S2	St	Oxides			○						

A. 2. Microscopic Observation of the Thin Sections

A.2. Microscopic Observation of the Thin Sections

(1)

Field No.	Rock Type	Microscopic Observation
AO-101	Tuff breccia (Cp)	The rock is porphyritic and is composed of quartz (rounded to subangular), altered feldspar and hornblende. Sandstone (only quartz) fragments occur in pale brown matrix which shows fluidal fexture.
AO-106	Tonalite porphyry (Ig)	Phenocrystic minerals are plagioclase (euhedral or subhedral, dirty clay occurs, An = 50-40, 8.60 x 3.60 ~ 0.58 x 0.40 mm, inclusion of biotite), quartz (anhedral, only three pieces, inclusion of rounded brown glass and subhedral plagioclase) and biotite (euhedral to subhedral, 4.30 x 1.30 ~ 0.44 x 0.05 mm, X = brown, Y = Y' = dark brown, Z = black, inclusion of plagioclase). Groundmass is pale brown, and consists of anhedral quartz (less than 0.06 x 0.05 mm), lath-shaped alkali-feldspar and plagioclase. A lot of sericite are seen as secondary minerals.
AO-116	Andesite (Cp)	The rock shows porphyritic (andesitic) texture, and is composed mainly of plagioclase. Phenocrystic plagioclase occurs euhedral in form and about 1.5 mm in length. It is affected by weak carbonitization and chloritization. Mafic minerals are perfectly altered to chlorite, and show chlorite aggregated patch in parts. Grandmass is composed of lath-like (0.1 ~ 0.2 mm) plagioclase, fine-grained recrystallize felsic minerals, chlorite and dotted opaque minerals.
AO-117	Syenitic porphyry (Cp)	The rock is porphyritic and is composed of alkali-feldspar (subhedral is to anhedral, fresh type is 6.80 x 5.56 ~ 2.26 x 1.58 mm, dirty type is 4.20 x 2.37 ~ 0.58 x 0.36 mm, clear Carlsbad twin, strong kaolinitization.), plagioclase (subhedral, 2.25 x 1.48 ~ 0.38 x 0.18 mm, Carlsbad-albite twin, altered to fine mixture of kaolinite and sericite), quartz (anhedral, 1.70 x 1.04 ~ 0.34 x 0.22 mm), hornblende (perfectly altered, fine-grained mixture of sericite and brown clay) and rarely iron minerals.

Field No.	Rock Type	Microscopic Observation
BO-175	Shale (Cz)	Argillaceous constituents consist of angular quartz grains and angular-subangular clay minerals after feldspar. A small quantity of sericite is seen. Quartz vein (less than 1.3 mm in width) occurs and irregular chlorite is seen in marginal part of the vein.
CO-121	Biotite-hornblende tonalite (Ig)	The rock shows granular texture. Main constituent is plagioclase, next in abundance is quartz, orthoclase, then mafic minerals. Plagioclase is subhedral in form and 3.0 mm in maximum size. It shows albite twinning and zonal structure. It also shows mirmekitic texture. Crystalline quartz is subhedral and about 2.0 mm in size. It shows wavy extinction. Orthoclase shows perthite structure and about 2.0 mm in size. Biotite shows subhedral, and 2.0 mm in maximum size. It is red to brownish yellow and affected by chloritization. Hornblende shows platy subhedral form and brownish green to green. It is often accompanied with sphene and suffered by chloritization. Fine-grained opaque minerals and apatite are dotted in the specimen.
CO-122	Biotite-hornblende tonalite (Ig)	The rock is similar to the No. CO-121, although grain sizes of all minerals are a little bit coarser than CO-121. Plagioclase occurs in less abundant and orthoclase occurs more than CO-121. Mafic minerals are minor amounts. These facts mean this rock is more acidic than the No. CO-121.
CO-162	Silicified quartz porphyry (Ig)	The rock is porphyritic and is composed of quartz (subhedral to euhedral, less than 2.54 x 2.00 mm) and altered feldspar (subhedral, less than 2.40 x 1.40 mm) as phenocrysts. Only one cordierite (radial structure, 0.40 x 0.34 mm) is seen in matrix. The rock is suffered strong silicification.

Field No.	Rock Type	Microscopic Observation
CO-164	Augite porphyrite (Ig)	The rock is porphyritic and is composed of plagioclase (euhedral to subhedral, 2.65 x 1.28 ~ 1.20 x 0.15 mm, Carlsbad-albite twin, zoning rarely, altered to kaolinite or sericite in the central part along the cleavage), hornblende (euhedral to subhedral, 4.26 x 1.48 ~ 2.09 x 0.86 mm, X = X' = pale browinish yellow, Z = yellowish brown, inclusions of plagioclase and iron ore), hypersthene (euhedral, less than 1.56 x 0.60 mm, weak pleochroism, oftenly associated with angite), and augite (subhedral or anhedral, 1.57 x 1.40 ~ 0.70 x 0.40 mm, slightly strong double refraction). Accessory mineral is iron ore. Pale grey groundmass shows intersertal texture and consists of lath-shaped plagioclase, short prismatic augite and prismatic or granular hypersthene. Amygdaroidal calcite in matrix and sericite in phenocrysts occur as secondary minerals.
CO-171	Limestone (Pt)	Calcite occurs as isolated rhombohedron and as aggregates bounded by the original grain margin. The rock shows mesh texture.
CO-186	Altered porphyrite (Ig)	Phenocrystic minerals are plagioclase (euhedral to subhedral, 1.72 x 1.56 ~ 0.85 x 0.35 mm, largely altered to clay minerals, fine mixture of sercite, chlorite, and calcite), hypersthene (euhedral to subhedral, a small quantity) and hornblende (euhedral to subhedral, perfectly altered to two types; one is chloritization and the other is sericitization). The ground-mass shows coarse hyalopilitic texture and only plagioclase is seen because of strong alternation. Secondary mineral is calcite.

Field No.	Rock Type	Microscopic Observation
NO-113	Biotite granite porphyry (Ig)	The rock is porphyritic and is composed mainly of quartz (euhedral to subhedral, 5.55 x 4.20 - 0.30 x 0.17 mm, very transparent, rarely embayed), alkali-feldspar (subhedral, 4.05 x 2.85 ~ 0.25 x 0.20 mm, weakly altered to clay), plagioclase (euhedral to subhedral, 4.10 x 3.75 ~ 0.40 x 0.28 mm, An = 55-30, clear twinning and zoning, alkali-feldspar in marginal part and biotite (subhedral to euhedral, 2.17 x 0.45 ~ 0.40 x 0.06 mm, X = pale brownish grey, Z = dark brown, plagioclase as inclusion). Only one hypersthene (anhedral, 0.5 x 0.5 mm) is seen. The groundmass shows fine granular texture after alteration.
NO-131	Pyroxene andesite (Cp)	The rock is porphyritic and is weakly altered to propyrite. Plagioclase (euhedral to subhedral, 1.82 x 1.44 ~ 0.08 x 0.06 mm, An = 80-55), and pyroxene (perfectly decomposed, mainly hypersthene by figure) are phenocrysts. Altered plagioclase is seen fine mixture of sericite and chlorite along the cleavage or central part. Groundmass is fine mixture of clay minerals.
NO-132	Altered diorite porphyry (Cp)	The rock is porphyritic and is perfectly altered. Plagioclase (subhedral to anhedral, 5.50 x 5.15 ~ 0.95 x 0.25 mm, largely altered to fine mixture of sericite, zoicite, chlorite, and unknown clay minerals) and pyroxene (perfectly decomposed and shows the mixture of zoicite and sericite) are phenocrystic minerals. Groundmass shows intergranular texture and is perfectly altered. Pyrrhotite (anhedral and prismatic) occurs as ore mineral and calcite is seen as secondary mineral.

Field No.	Rock Type	Microscopic Observation
NO-146	Hornblende trachyandesite (Ig)	The rock is porphyritic and is composed of plagioclase (euhedral or subhedral, 3.00 x 1.90 ~ 1.14 x 0.68 mm, Carlsbad-albite twin, An = 72-55, large crystals shows weak zoning), alkali-feldspar (euhedral to subhedral, sanidine by optical angel, 0.50 x 0.40 ~ 0.50 x 0.20 mm), quartz (anhedral, less than 0.10 x 0.08 mm), and hornblende (euhedral to subhedral, 5.20 x 1.15 ~ 1.20 x 0.40 mm, X = brownish yellow, Z = yellowish brown, central part is fresh but outer part altered to epidote and sericite) as phenocrysts. Octahedral magnetite (less than 0.14 x 0.10 mm) occurs as iron mineral. Groundmass shows trachytic texture and is composed of lath-shaped plagioclase, anhedral alkali-feldspar, anhedral quartz, and glass. Secondary minerals are calcite, epidote and sericite.
NO-148	Hornblende-biotite dacite porphyry (Ig)	The rock is porphyritic and is composed mainly of plagioclase (euhedral to subhedral, 8.96 x 3.30 ~ 1.08 x 0.59 mm, Carlsbad-albite twin, strong zoning, An = 65-32), hornblende (subhedral, 3.88 x 1.40 ~ 1.22 x 0.40 mm, X or X' = green, Z = greenish brown inclusions of apatite and anhedral biotite in central or marginal part, and biotite (euhedral to subhedral, X = brownish yellow, Z = dark brown, inclusions of apatite and plagioclase). Iron ore minerals is common. Groundmass shows hyalopilitic texture and is composed of lath-shaped plagioclase, globular phroxene and glass.
NO-149	Dacitic tuff (Cp)	Constituent minerals are plagioclase (subhedral to anhedral, 2.60 x 2.15 ~ 0.24 x 0.17 mm, An = 53 by fresh one), alkali-feldspar (a small quantity, subhedral, less than 1.01 x 0.70 mm), quartz (anhedral, 1.03 x 0.82 ~ 0.33 x 0.25 mm) and mafic mineral (not determined by strong alteration). Matrix shows pale brown and fine texture. Subrounded sandstone, rounded to subrounded pumice, and rounded tuff occur as fragments.

Field No.	Rock Type	Microscopic Observation
NO-161	Actinolite-garnet skarn (St)	Constituent minerals are garnet (subhedral to euhedral, 3.44 x 3.00 ~ 1.30 x 0.85 mm, accompanied with feldspar or chlorite along the small tiny fissures or in marginal part, clear zoning in margine), actinolite (needle figure; euhedral, less than 2.16 x 0.40 mm), quartz (angular or subhedral), calcite (anhedral, amoeba figgue), and a few amount of hornblende and iron ore minerals.
NO-175	Skarnized hornfels (Cm)	The rock is composed of calcite, garnet, tourmaline (anhedral, O = yellowish brown, E = brown, schorlite type by pleochroism), granular hedenbergite (very small, strong double refraction) and a small quantity of prismatic epidote.
SO-101	Andesitic tuff (Cp)	The rock shows clastic texture. Fragments are composed of andesite and plagioclase crystals. These sizes are about 1.0 mm. Matrix is composed of glass, fine-grained recrystalline felsic minerals, limonite and opaque minerals.
SO-103	Epidotized andesite (Cp)	The rock is thought to be originally andesite. Epidotization is very strong especially in phenocryst. Phenocrystic minerals, mafic minerals and plagioclase, are perfectly altered to epidote, a few amounts of quartz, calcite and chlorite. Grandmass is composed of plagioclase, recrystallized fine falsic minerals and dotted opaque minerals.
SO-106	Andesitic tuff (Cp)	The rock shows recrystallized clastic texture. Fragments are andesite (7.0 mm in maximum) and plagioclase crystals. Matrix is composed of plagioclase, quartz, dotted opaque minerals, carbonates and chlorite.
SO-142	Siliceous sandstone (Cm)	Constituent mineral is only quartz (granular, 1.75 x 1.55 ~ 0.16 x 0.16 mm) and cementing material is a small quantity of clay minerals.

Field No.	Rock Type	Microscopic Observation
SO-176	Biotite-hornblende dacite porphyry (Ig)	The rock is porphyritic and is composed of plagioclase (subhedral to euhedral, 9.50 x 3.35 ~ 0.94 x 0.76 mm, Carlsbad-albite-pericline twin, An = 76-60, zoning in marginal part, inclusions of hornblende, iron ore, and brown glass), hornblende (subhedral, 4.62 x 2.08 ~ 0.50 x 0.16mm, X = X' = yellowish green, Z = pale brownish yellow, partly altered to sericite, inclusions of iron ore and plagioclase), and biotite (euhedral to subhedral, 2.78 x 2.16 ~ 0.82 x 0.30 mm, X = pale brownish yellow, Z = dark brown). The groundmass is hyalopilitic and consists of lath-shaped plagioclase, short prismatic anorthoclase, irregular or granular quartz and glass.
IC-301	Zn-ore in dolomitic limestone (St)	The rock is dolomitic limestone with equicrystalline texture. A lot of fine-grained zinc mineral of needle, massive and wide lenticular figures is observed in the specimen.
IC-313	Hematite-siderite gossan (St)	The rock is composed of large anhedral siderite, prismatic iron ore (less than 2.55 x 0.10 mm), needle hematite (less than 1.05 x 0.18 mm), long prismatic alkali-feldspar (1.90 x 1.28 ~ 0.70 x 0.40 mm) and granular quartz (0.15 x 0.15 mm). Tiny quartz vein (less than 0.40 mm in width) runs in the rock.
IC-318	Dolostone (St)	Some dolomite veins (less than 0.70 mm in width) occur in fine granular dolomite.
IC-325	Hematite-siderite gossan (St)	The rock is similar as IC-313.
IC-342	Siderite gossan (St)	The rock is composed of quartz (0.85 x 0.70 ~ 0.50 x 0.40 mm), anhedral siderite, needle hematite and alkali-feldspar.

A. 3. Microscopic Observation of the Polished Sections

A.3. Microscopic Observation of the Polished Sections

(1)

Field No.	Rock Type	Micorscopic Observation
SO-135	Sphalerite gossan (St)	Chalcophanite, pyrite and sphalerite are observed in this polished section. Chalcophanite ((Zn, Mn, Fe) Mn_3O_7 $3H_2O$) occurs as veinlets of 0.3 ~ 0.1 mm in width, in which small subhedral sphalerite grains of about 0.05 mm in diameter are included. Although small amount of sphalerite is also found in the host rock as very small dots, a great part of sphalerite occurs closely with chalcophanite veinlets. Pyrite occurs as small auhedral grains of 0.2 x 0.1 mm - 0.05 x 0.05 mm in size scattering in host rock. Some parts of pyrite contains blueish light grey fine-grained mineral which is too small to determine. (This sample was tested by EPMA.)
SO-137	Zn-oxide gossan (St)	This rock have been completely repleced by secondary oxide and hydroxide minerals containing Mn, Fe and Zn elements, remained the part of quartz. Surrounding the pseudomorphs of probably pyrite, secondary Mn and An-bearing meneral occurs, which shows cryptocrystalline and is difficult to determine by microscopic observation. Judging from the X-ray and EPMA analysis, the cryptocrystalline mineral is inferred to be chalcophanite. The psendomorph mineral after pyrite is inferred to be Mn-bearing geothite. (This sample was tested by EPMA.)
IC-103	Pb - Zn - oxide ore (gossan) (St)	In this polished section, primary ore minerals are rare and secondary ore minerals are observed surrounding the spots of gangue minerals. The greater parts of ore minerals show holohyaline and cryptocrystalline, in which 2-3 mineral layers are supposed to be included. A few small aggregates of prismatic auhedral to subhedral crystals occur surrounding cavities. This mineral shows characteristic reflection pleochroism and strong anisotropy and is inferred to be chalcophanite. From the X-ray analysis, gangue minerals are composed of barite and quartz.

Field No.	Rock Type	Microscopic Observation
IC-234	Pb - Zn - oxide ore (gossan)(St)	As for the zinc containing meneral, chalcophanite is found. There are two types in the occurrence of chalcophanite, one is small aggregates of cryptcrystallin chalcophanite scattering irregularly in various shapes, the other is aggregates of prismatic and acicular crystals filling in cracks and cavities showing banded colloform texture. According to the EPMA, the cryptcrystalline part is rich in Fe element and poor in Mn and Zn elements. On the contrary, banded colloform part is poor in Fe element and rich in Mn and Zn elements. Small amount of Fe-hydroxides is also observed, though primary sulfide minerals are not found. (This sample was tested by EPMA.)
IC-301	Sphalerite massive ore (St)	As for the ore minerals, sphalerite, magnetite and hematite are observed. Sphalerite occurs as massive large crystals which contains small chalcopyrite dots. Hematite occurs as massive large crystals which contains small prismatic crystals of 0.2 mm in length together closely with megnetite grains.
IC-313	Hematite-siderite gossan (St)	Hematite alone is observed. It appears as aggregates of prismatic and acicular crystals of around 0.5 mm in length.
IC-318	Gelena-sphalerite dissemination ore (St)	A lot of galena grains disseminated in the host rock are observed but sphalerite is not found in this section. Galena shows usually as various fine to coarse auhedral grains and seems to have a close paragenesis to the gangue minerals composed of mainly carbonates.
IC-324	Hematite dissemination in altered rock (St)	Hematite is only ore mineral in this rock. Usually, it appears as aggregates of prismatic and acicular crystals of around 0.4 mm in length. Hematite occurs also in druse which seems to be recrystalized products.
IC-325	Hematitesiderite gossan (St)	Hematite is only ore mineral in this section. It shows prismatic crystals and fluidal structure.

Field No.	Rock Type	Microscopic Observation
IC-326	Pyrite massive ore (St)	Pyrite and sphalerite are observed. Both minerals occur together closely as massive large crystals. In sphalerite grains, a small quantity of chacopyrite dots is found. Some parts of pyrite show bird-eye structure.
IC-342	Siderite-delomite gossan with sphalerite (St)	Sphalerite and pyrite are observed. Small anhedral sphalerite grains are dotted with the host rock. Small amount of pyrite exists in the sphalerite grains. Those sulfide minerals seem to occur in the carbonate veinlets.

A. 4. Photomicrographs of Rock and Ore Samples

4—1 Thin Section

Field No.	Location	Geological Unit	Rock Name
CO-121	G1	Ig	Tonalite
CO-122	G1	Ig	Tonalite
AO-116	G3	Cp	Andesite
SO-101	G3	Cp	Andesitic tuff
SO-103	G3	Cp	Epidotized andesite
SO-106	G3	Cp	Andesitic tuff
SO-142	S1	Cm	Siliceous sandstone
BO-175	G3	Cz	Shale
NO-131	G3	Cp	Pyroxene andesite
NO-149	G1	Cp	Dacitic tuff
CO-162	G2	Ig	Silicified quartz porphyry
CO-164	G2	Ig	Augite prophyrite
SO-176	G1	Ig	Biotite-hornblende dacite
CO-186	G3	Ig	Altered porphyrite
NO-146	G1	Ig	Hornblende trachyandesite
NO-148	G1	Ig	Hornblende-biotite dacite porphyry
NO-161	G4	St	Actinolite garnet skarn
IC-318	S2	St	Dolostone
IC-301	S2	St	Zn-ore in dolomitic limestone
IC-325	S2	St	Hematite-siderite gossan

Abbreviations

qt : quartz	au : augite	cal : calcite
pl : plagioclase	hy : hyperthine	dol : dolomite
kf : K-feldspar	ep : epidote	sid : siderite
snd : sanidine	crd : cordierite	dol-v : dolomite vein
bt : biotite	act : actinolite	alt-f : altered feldspar
hb : hornblend	gar : garnet	hm : hematite
px : pyroxene	chl : chlorite	Zn : Zn-ore

Field No. CO-121

Location : G1

Geological unit : Ig

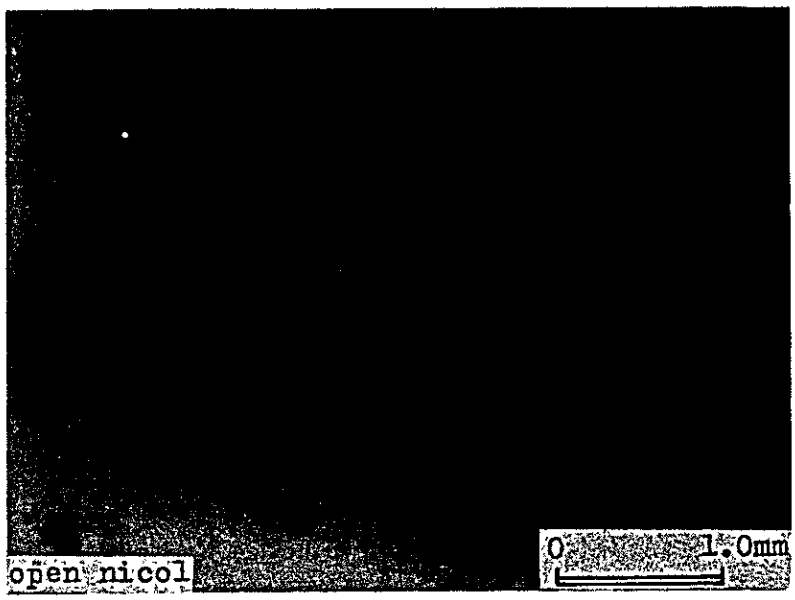
Rock name : Tonalite

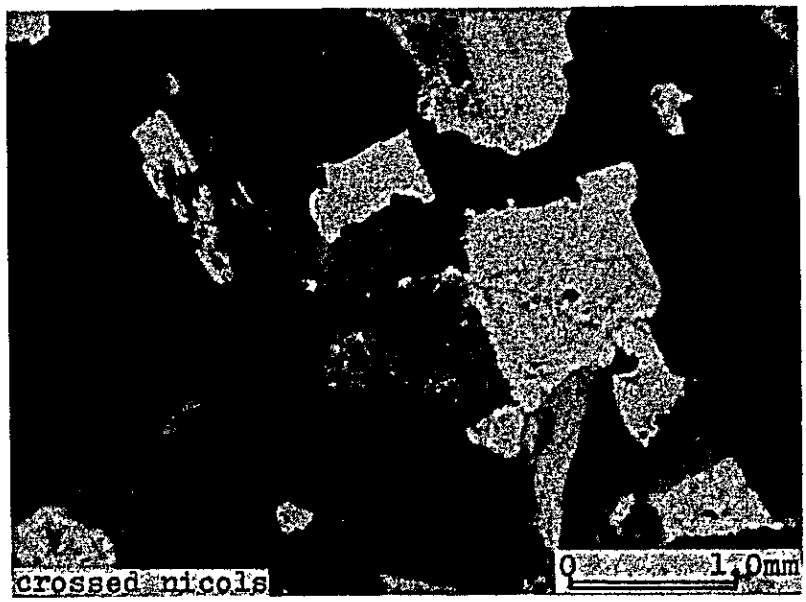
Field No. CO-122

Location : G1

Geological unit : Ig

Rock name : Tonalite





Field No. AO-116

Location : G3

Geoqical unit : Cp

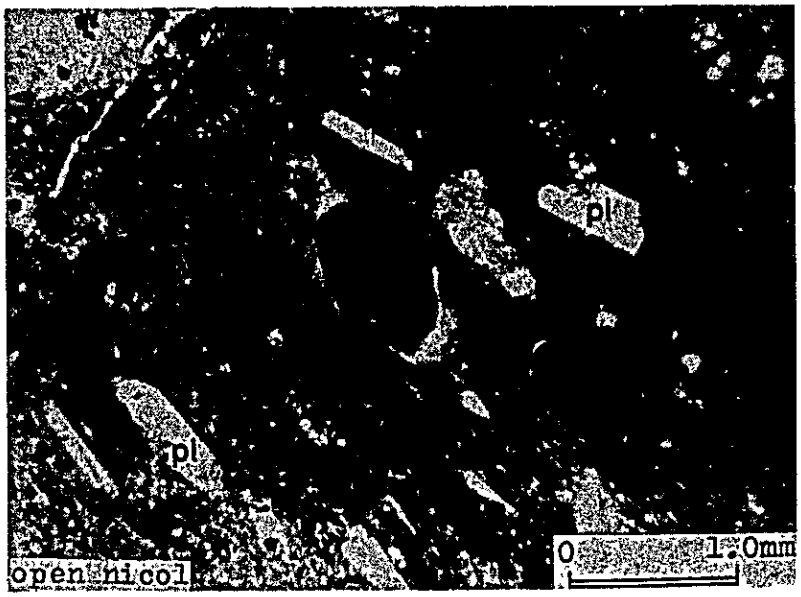
Rock name : Andesite

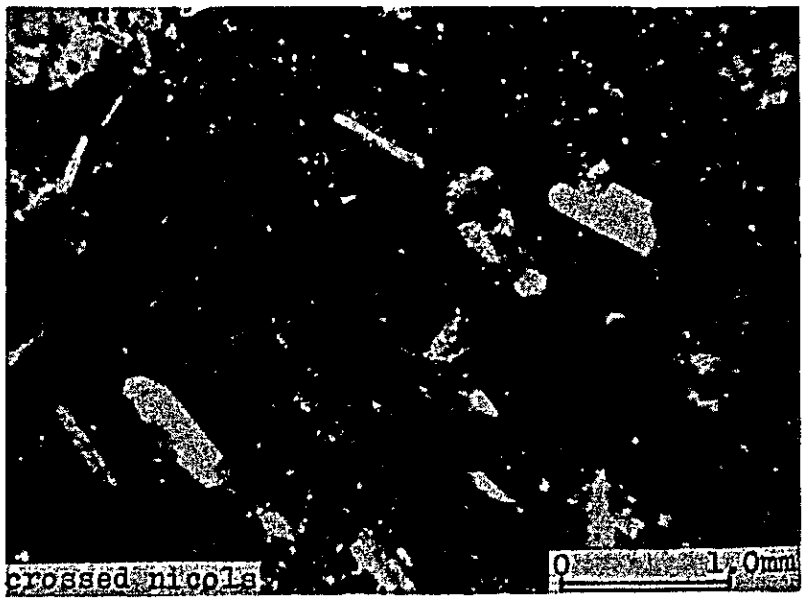
Field No. SO-101

Location : G3

Geological unit : Cp

Rock name : Andesitic tuff



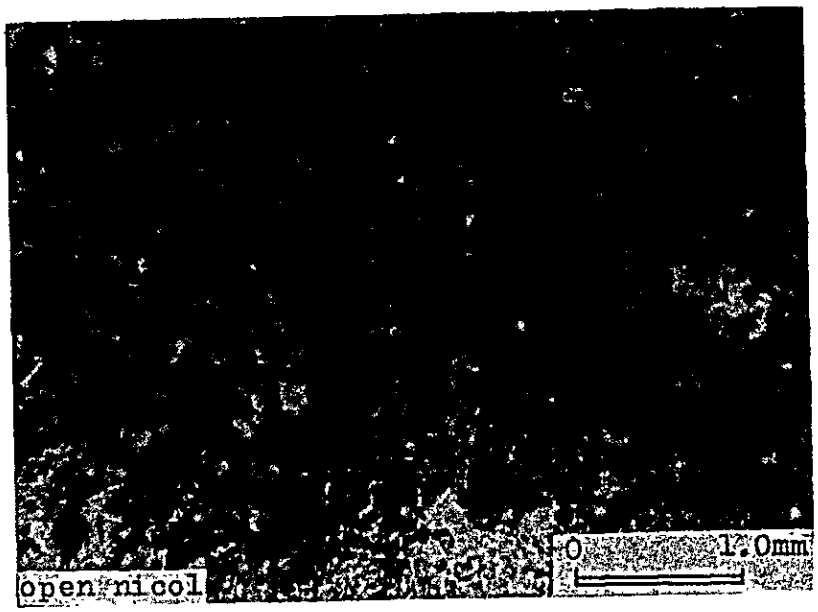


Field No. SO-103

Location : G3

Geological unit : Cp

Rock name : Epidotized andesite



Field No. SO-106

Location : G3

Geological unit : Cp

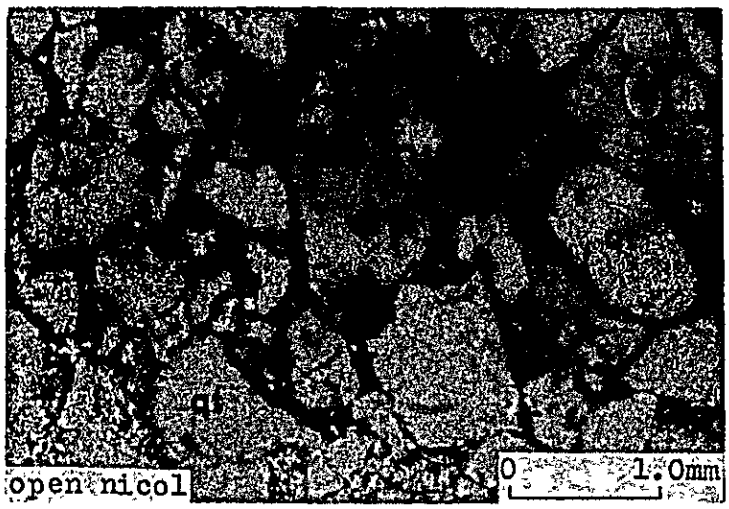
Rock name : Andesitic tuff

Field No. SO-142

Location : S1

Geological unit : Cm

Rock name : Siliceous sandstone

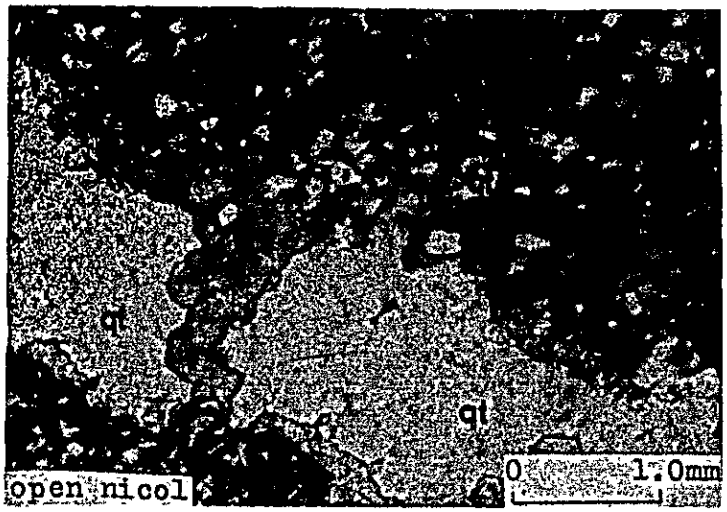


Field No. BO-175

Location : G3

Geological unit : Cz

Rock name : Shale



Field No. NO-131

Location : G3

Geological unit : Cp

Rock name : Pyroxene andesite

Field No. NO-149

Location : D1

Geological unit : Cp

Rock name : Dacitic tuff

Field No. CO-162

Location : D2

Geological unit : Ig

Rock name : Silicified quartz porphyry

Field No. CO-164

Location : D2

Geological unit : Ig

Rock name : Augite porphyrite

Field No. SO-176

Location : G1

Geological unit : Ig

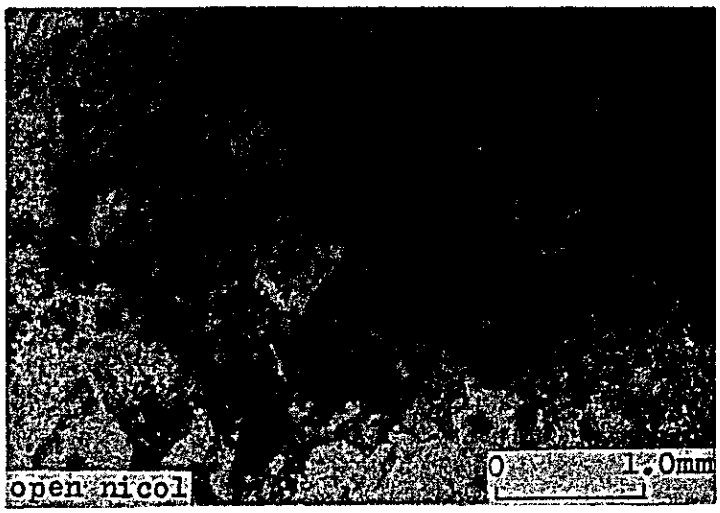
Rock name : Biotite-hornblende dacite

Field No. CO-186

Location : G3

Geological unit : Ig

Rock name : Altered porphyrite



Field No. NO-146

Location : G1

Geological unit : Ig

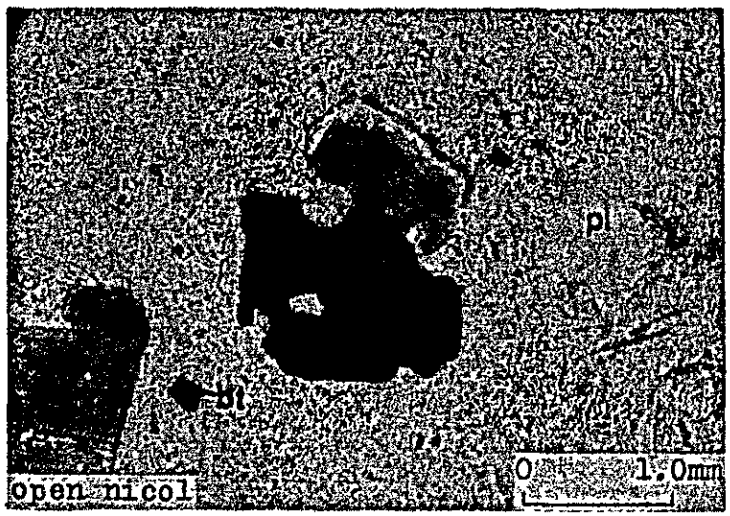
Rock name : Hornblende
trachyandesite

Field No. NO-148

Location : D1

Geological unit : Ig

Rock name : Hornblende-biotite
dacite porphyry



Field No. NO-161

Location : D4

Geological unit : St

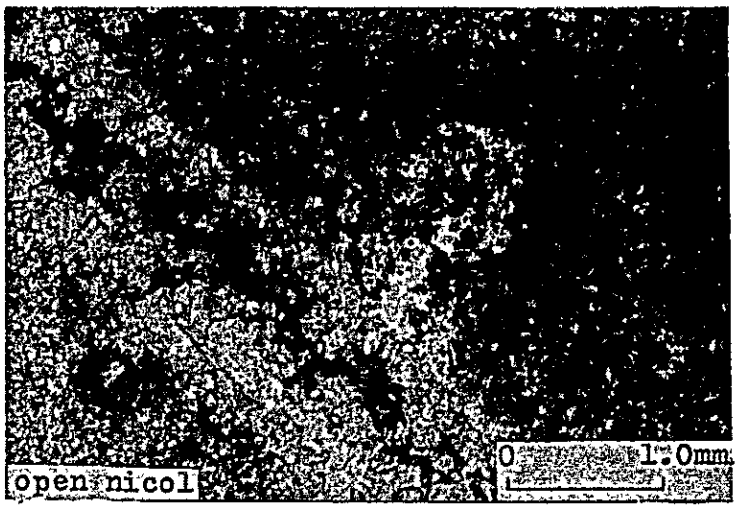
Rock name : Actinolite garnet skarn

Field No. IC-318

Location : S2

Geological unit : St

Rock name : Dolostone



Feild No. IC-301

Location : S2

Geological unit : St

Rock name : Zn-ore in dolomitic limestone

Field No. IC-325

Location : S2

Geological unit : St

Rock name : Hematite-siderite gossan

4—2 Polished Section

Field No.	Location	Geological Unit	
SO-135	S1	St	Sphalerite gossan
SO-137	S1	St	Zn-oxide gossan
IC-103	S1	St	Pb-Zn-oxide ore (gossan)
IC-234	S1	St	Pb-Zn-oxide ore (gossan)
IC-301	S2	St	Sphalerite massive ore
IC-313	S2	St	Hematite siderite gossan
IC-318	S2	St	Galena-sphalerite dissemination ore
IC-324	S2	Ig	Hematite dissemination in altered rock
IC-325	S2	St	Hematite-siderite gossan
IC-326	S2	St	Pyrite massive ore
IC-342	S2	St	Siderite dolomite gossan with sphalerite dissmination

Abbreviations

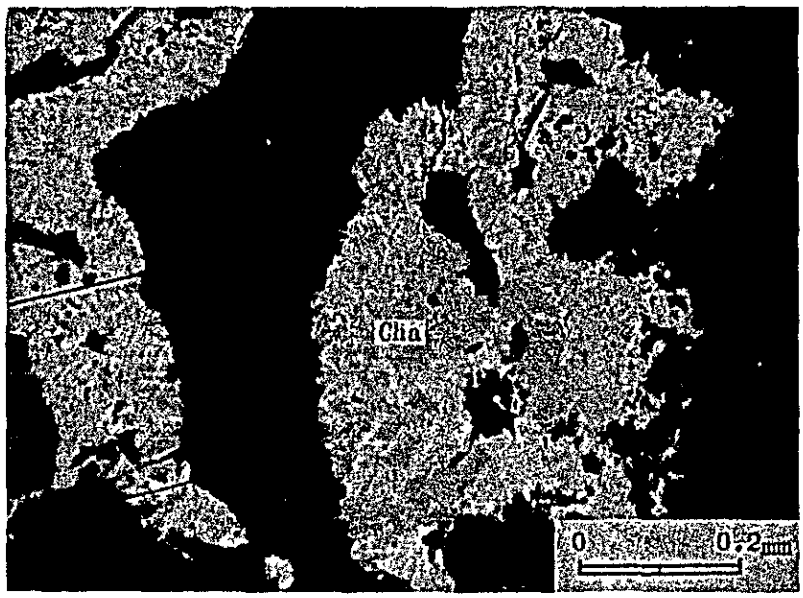
Cha : chalcophanite
Goe : goethite
Gl : galena
Sp : sphalerite
Py : Pyrite
Mt : Magnetite
Hm : Hematite

Field No. IC-234

Location : S1

Geological unit : St

Rock type : Pb-Zn-oxide ore
(gossan)

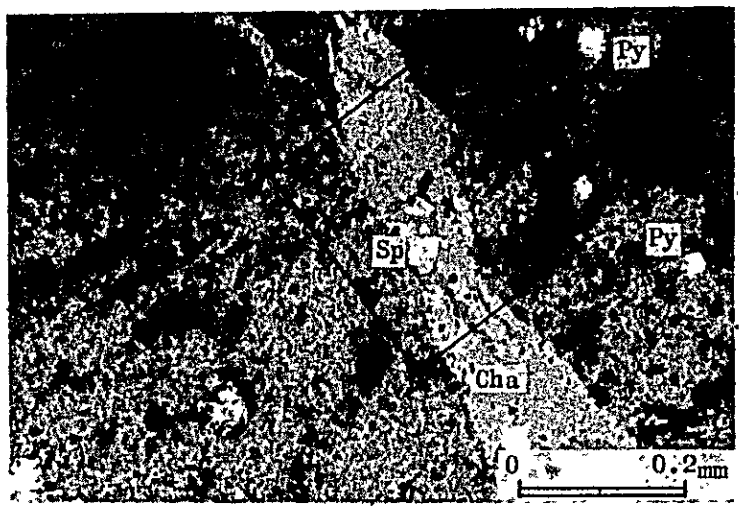


Field No. SO-135

Location : S1

Geological unit : St

Rock type : Sphalerite gossan

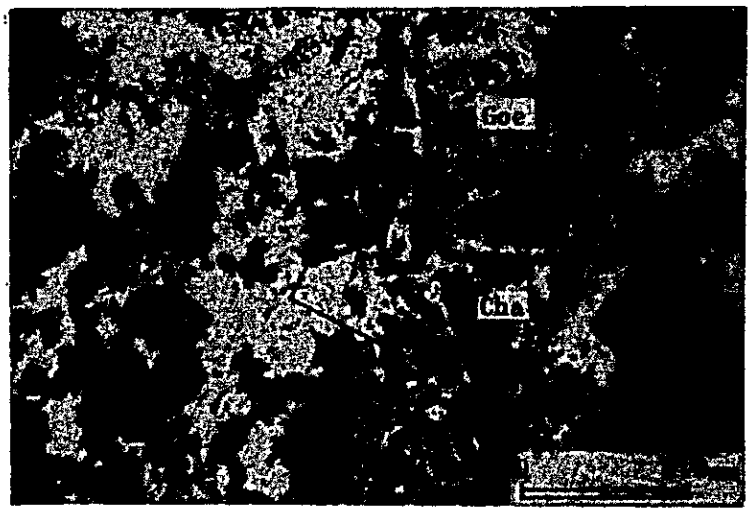


Field No. SO-137

Location : S1

Geological unit : St

Rock type : Zn-oxide gossan

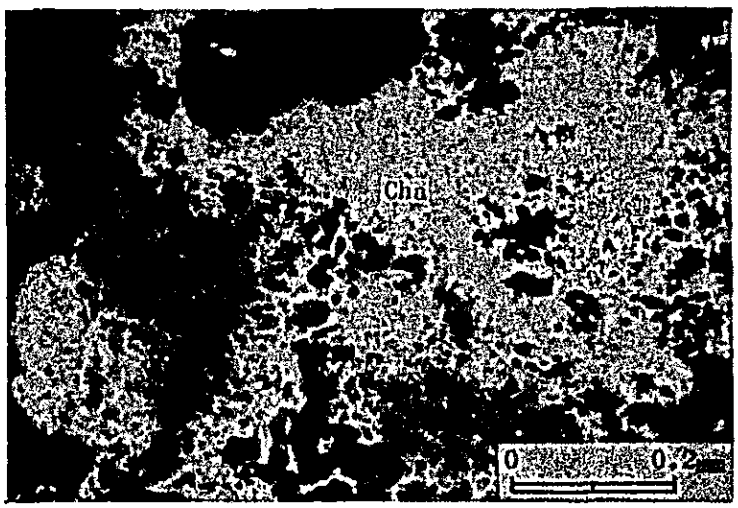


Field No. IC-103

Location : S1

Geological unit : St

Rock type : Pb-Zn-oxide ore
(gossan)

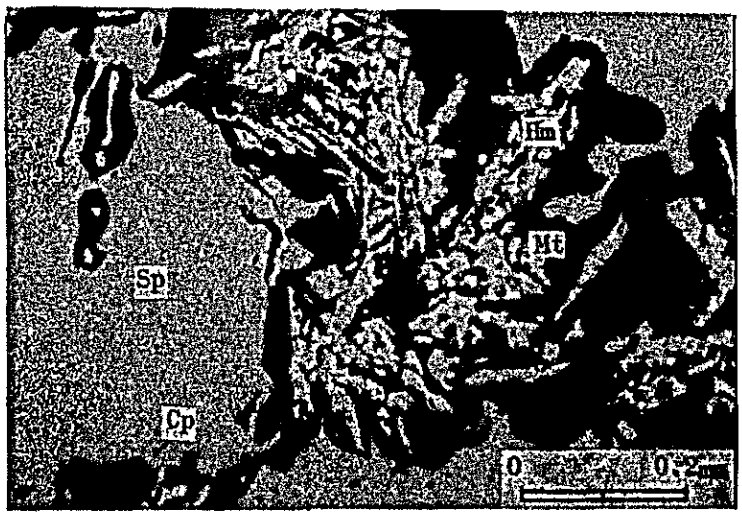


Field No. IC-301

Location : S2

Geological unit : St

Rock type : Sphalerite massive ore

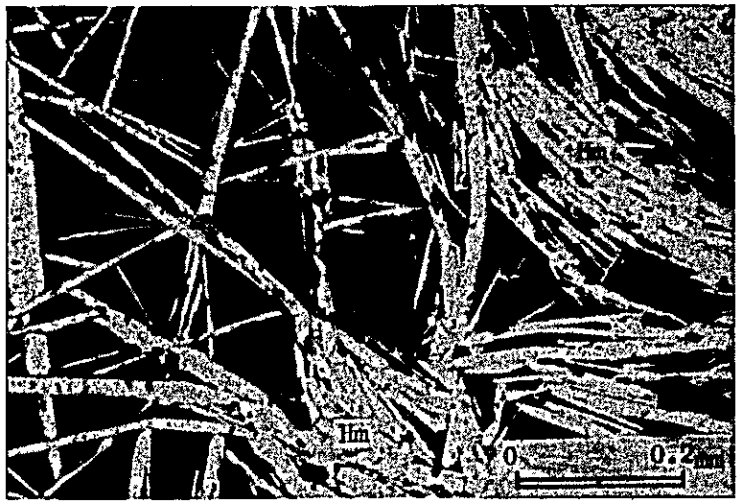


Field No. IC-313

Location : S2

Geological unit : St

Rock type : Hematite-siderite gossan



Field No. IC-318

Location : S2

Geological unit : St

Rock type : Galena-sphalerite dissemination ore

Field No. IC-324

Location : S2

Geological unit : Ig

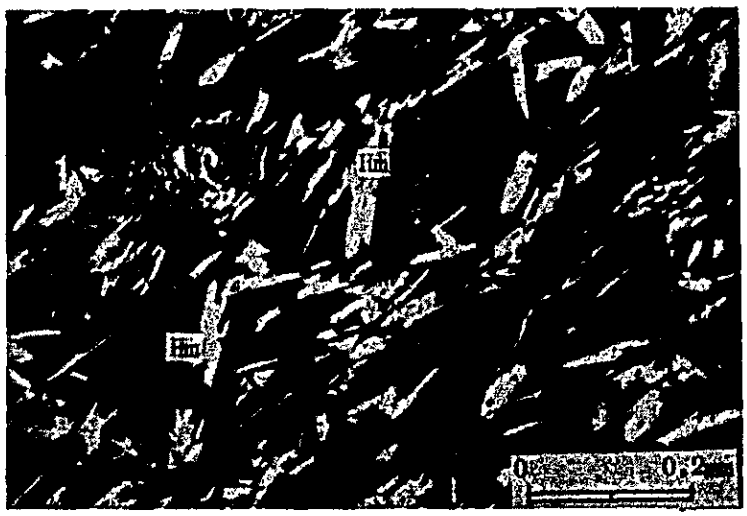
Rock type : Hematite dissemination
in altered rock

Field No. IC-325

Location : S2

Geological unit : St

Rock type : Hematite-siderite gossan

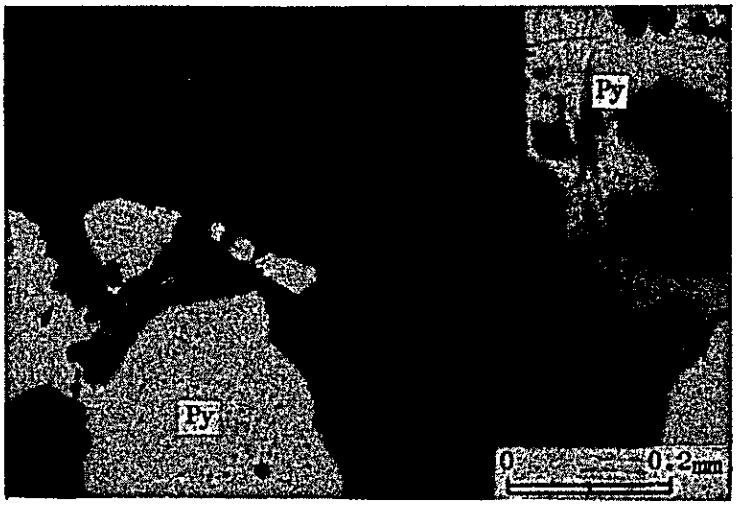


Field No. IC-326

Location : S2

Geological unit : St

Rock type : Pyrite massive ore

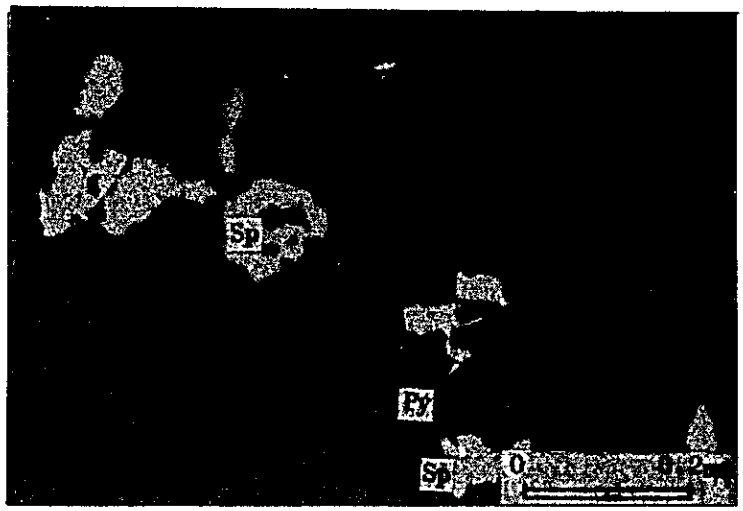


Field No. IC-342

Location : S2

Geological unit : St

Rock type : Siderite dolomite gossan
with sphalerite dissemination



4—3 EPMA Analysis

Field No.	Location	Geological Unit	Rock Type
SO-135	Sl	St	Sphalerite gossan
SO-137	Sl	St	Zn-oxide gossan
IC-234	Sl	St	Pb-Zn-oxide ore (gossan)

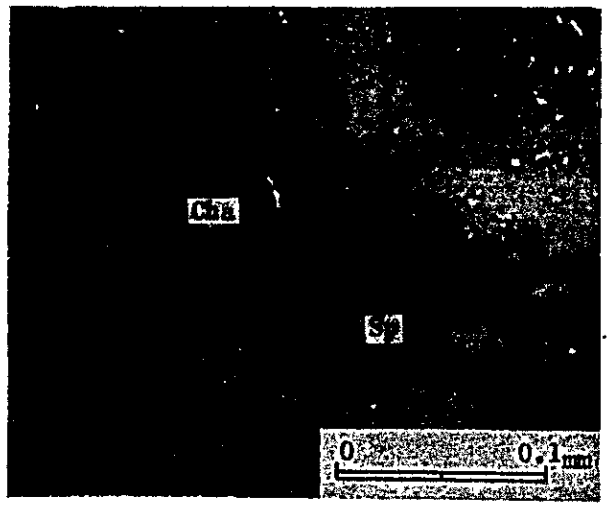
* EPMA (electron probe microanalysis)

Abbreviations

Cha : chalcophanite
Goe : goethite
Sp : sphalerite

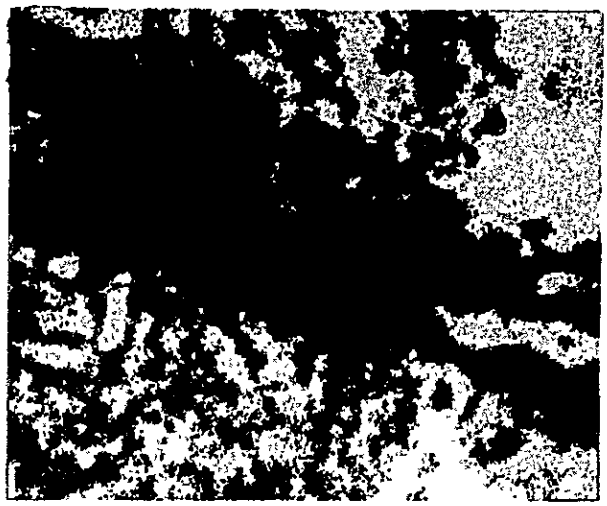
Field No. SO-135

Zn X-ray image



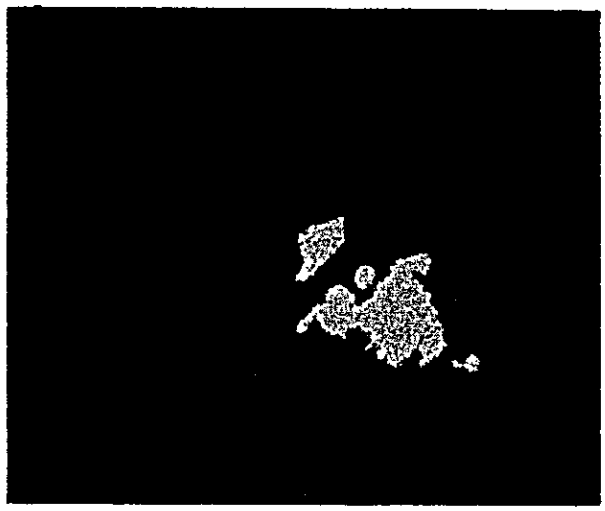
Absorbed electoron image

Mn X-ray image



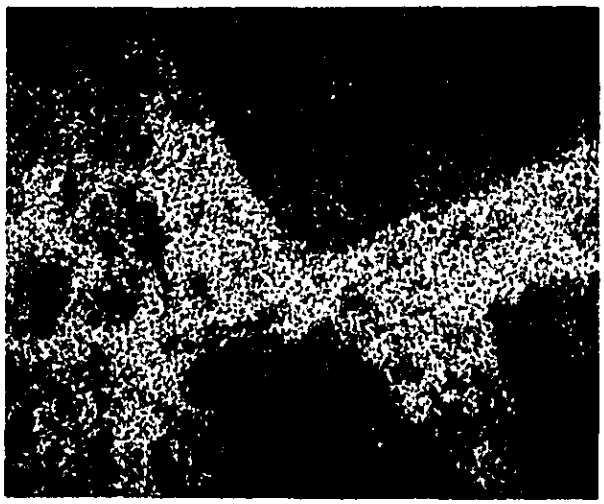
Si X-ray image

Fe X-ray image

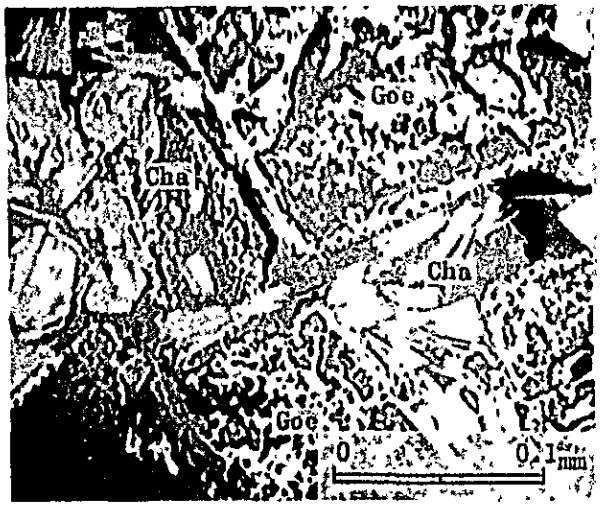


S X-ray image

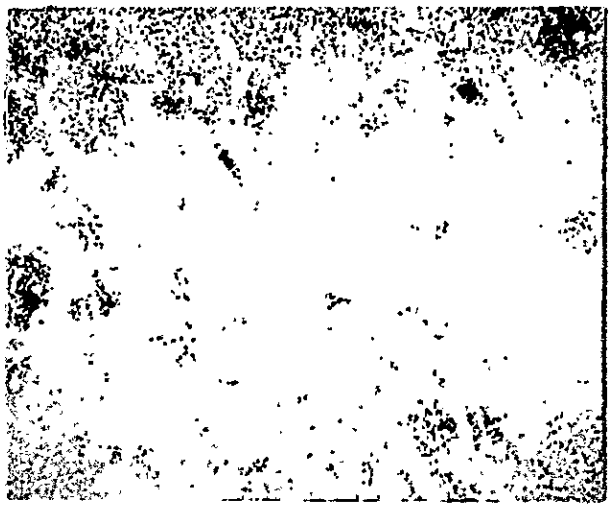
Field No. SO-137



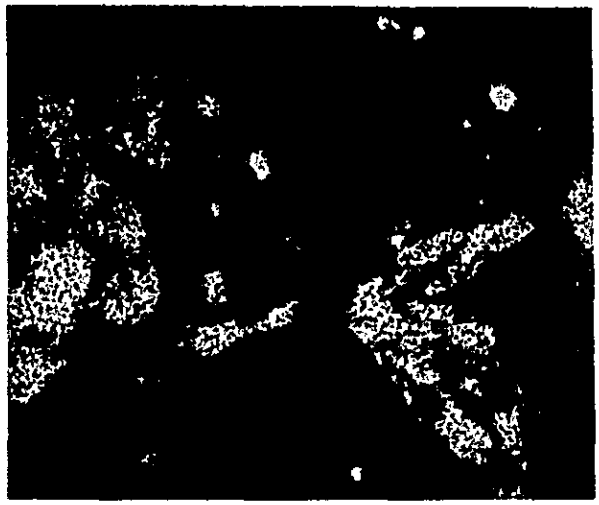
Zn X-ray image



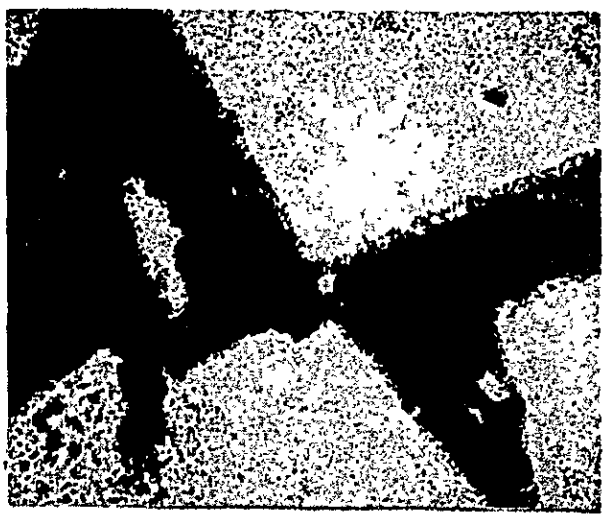
Absorbed electoron image



Mn X-ray image

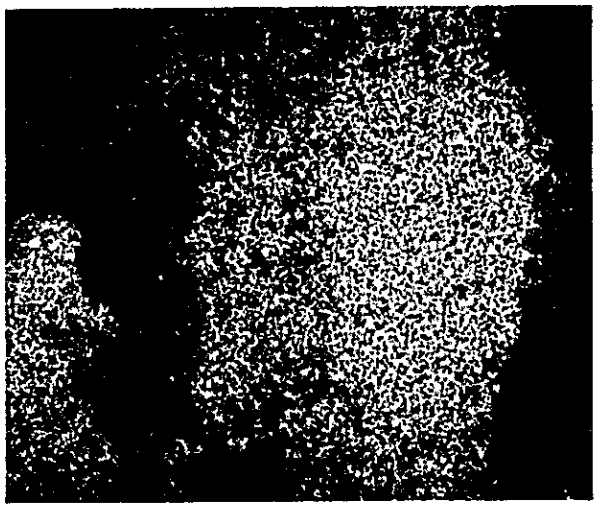


Si X-ray image

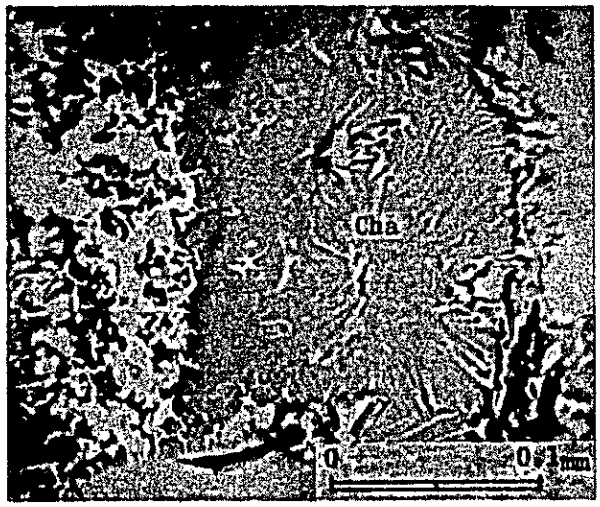


Fe X-ray image

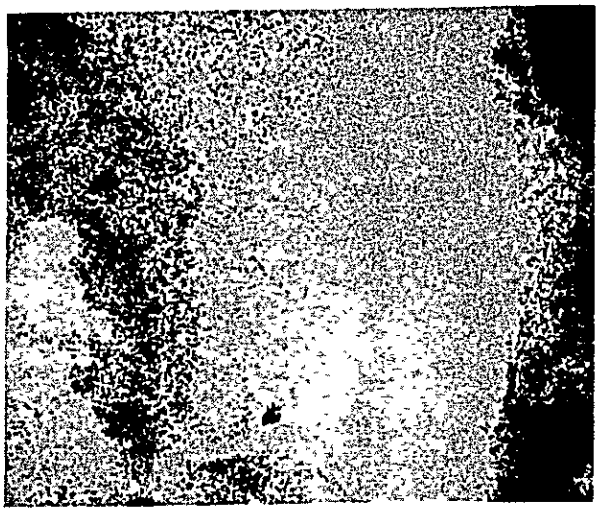
Field No. IC-234



Zn X-ray image



Absorbed electoron image



Mn X-ray image

Si X-ray image

Fe X-ray image

Accelerating voltage : 25 KV

Electron absorbed current : 0.2 uA

A. 5. List of Fossils

A.5. List of Fossils

Field No.	Location	Stratigraphical Unit	Fossils	Estimated Age	Remarks
BO-102	G2	Jumasha formation	Not identified		
AO-148	G4	Chulec formation	Inoceramus sp.	Albian	Bivalvia
BO-139	G4	Chulec formation	Prolyelliceras sp.	Lower Albian	Ammonitina
			Prolyelliceratidae gen. et sp. indet.	Albian	Ammonitina
			Modiolus? sp.	Albian	Bivalvia
			Lima? sp.	Albian	Bivalvia
			Helicanthus? sp.	Upper Jurassic-Lower Cretaceous	Gastropoda

(Determined by Prof. Tadashi Sato of Tsukuba Univ.)

A. 6. Photographs of Fossils

Plate 1

Fig. 1. Lyelliceratidae gen. et sp. indet.

Side view of a poorly preserved specimen showing the straight simple ribs dominated by small tubercles. BO-139, Chulec formation, x 1.

Fig. 2 - 4. Prolyelliceras sp.

Fig. 2. Side view of a fragment of whorl showing the straight simple ribs on flank dominated by small clavi. BO-139, Chulec formation, x 1.

Fig. 3a,b. Fragment of ultimate and penultimate whorls showing weakly sinuated simple ribs, continuous through siphonal area, dominated by 5 rows of clavi. 3a, side view; 3b, siphonal view. BO-139, Chulec formation, x 1.

Fig. 4a,b. Fragment of fully grown whorl showing weakly sinuated simple ribs dominated by 5 rows of flattened clavi. 4a, side view; 4b, siphonal view. BO-139, Chulec formation, x 1.

Fig. 5. Inoceramus sp.

Right valve of a fragmentary specimen showing concentric ribs. AO-148, Chulec formation, x 1.

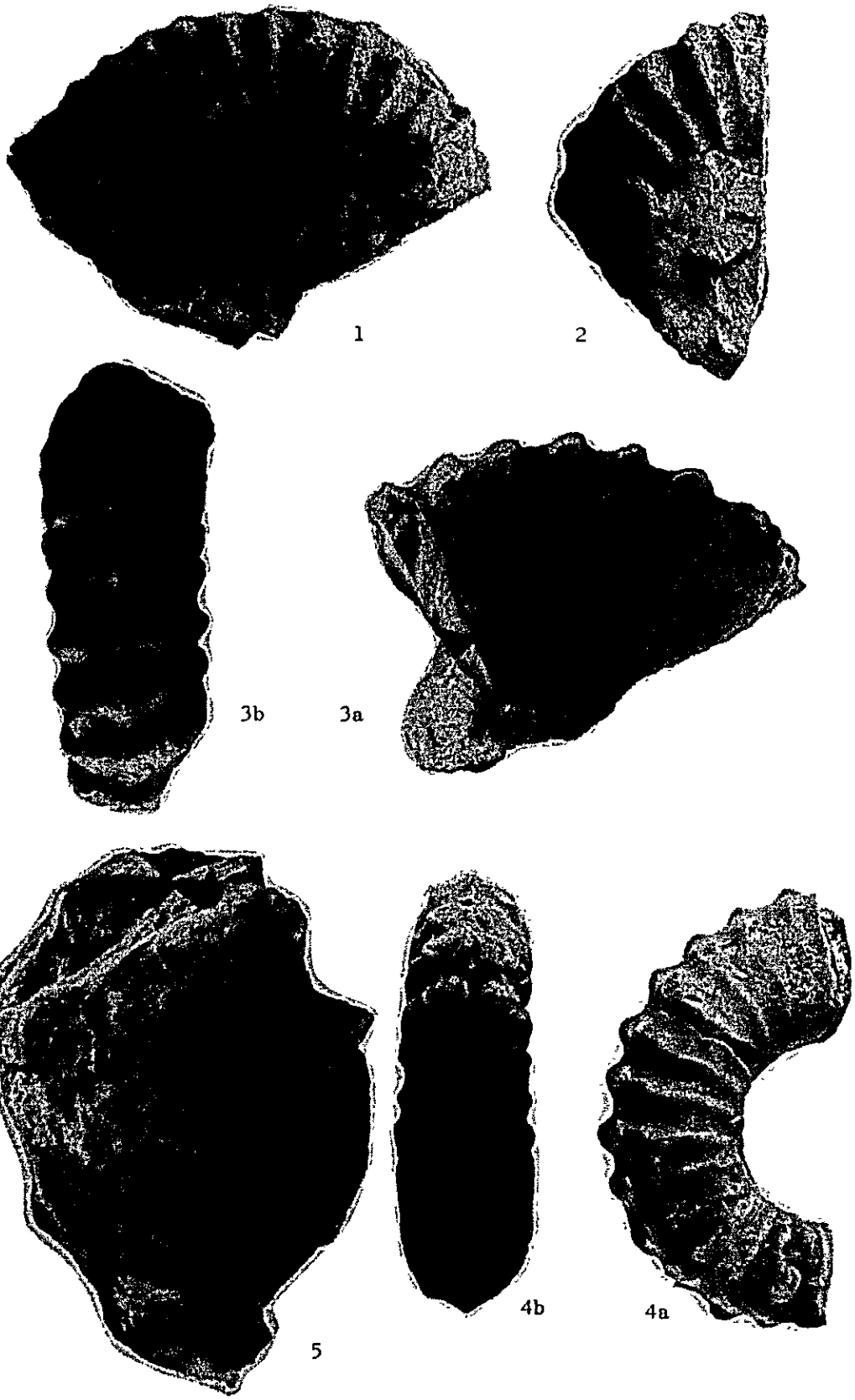

1
2
3b
3a
5
4b
4a

Plate 2

Fig. 1 - 2. Modiolus? sp.

Fig. 1. Right valve of a fragmentary specimen. BO-139, Chulec formation, x 1.5.

Fig. 2. Left valve of another specimen, BO-139, Chulec formation, x 1.3.

Fig. 3. Lima? sp.

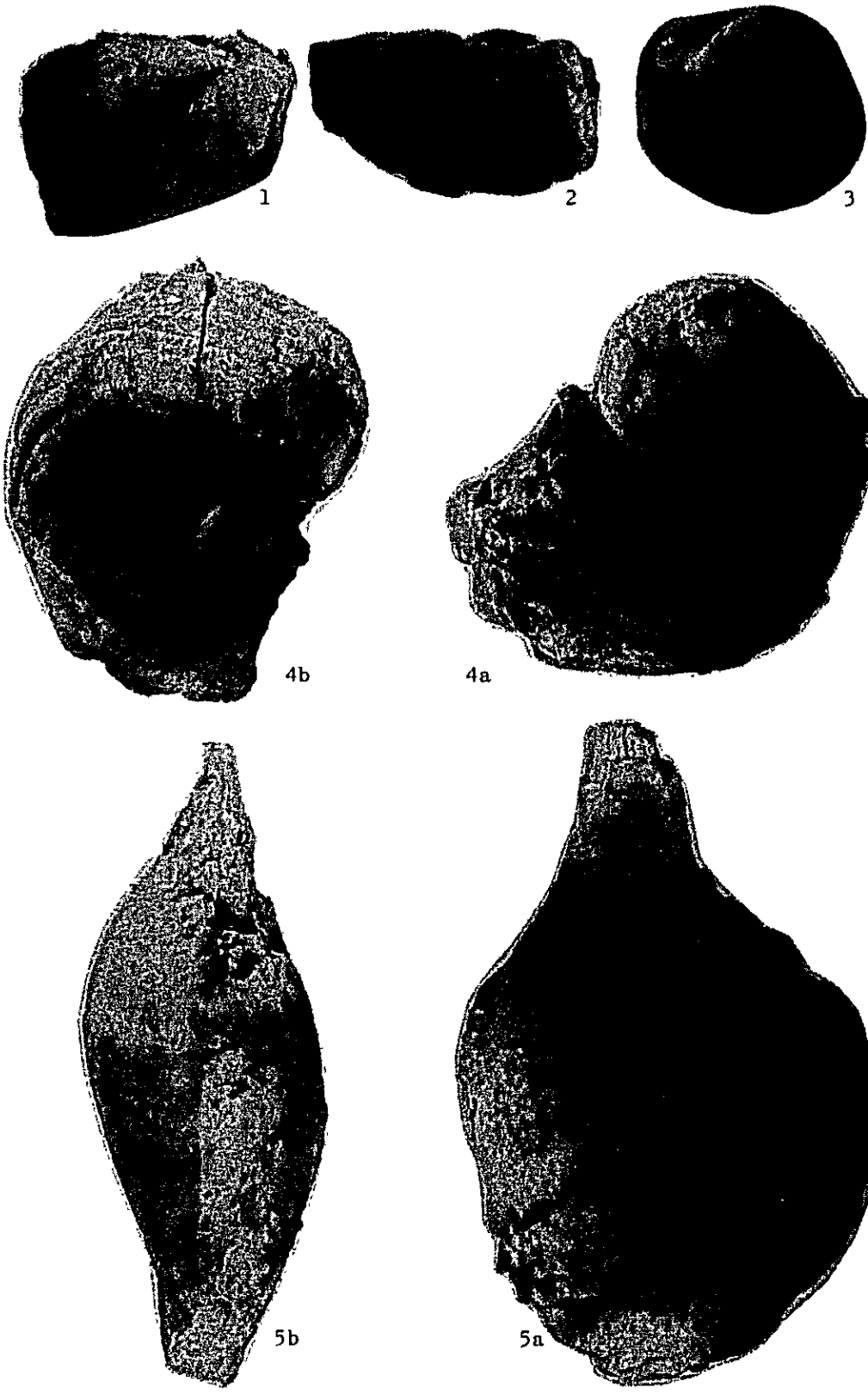
Left valve showing radial ribs. BO-139, Chulec formation, x 1.2.

Fig. 4a, b. Helicanthus? sp.

Slighly deformed specimen. 4a, apical view; 4b, umbilical view. BO-139, Chulec formation, x 1.

Fig. 5a, b. Unidentifiable specimen

Internal mould? of unidentifiable Bivalve? 5a, side view; 5b, lateral view. BO-102, Jumasha formation, x 1.


1
2
3
4b
4a
5b
5a

A. 7. Summary of X-ray Diffraction Test

◉ Very abundant

◎ Abundant

○ Common

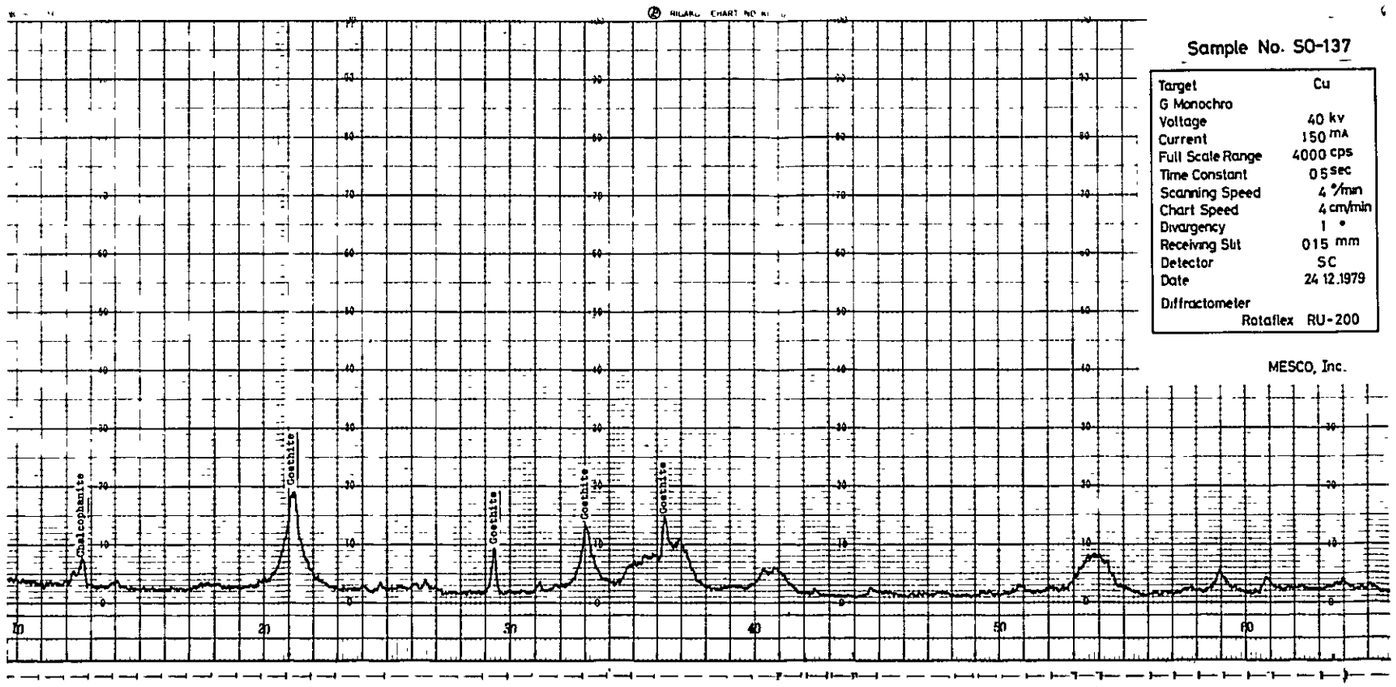
o Rare

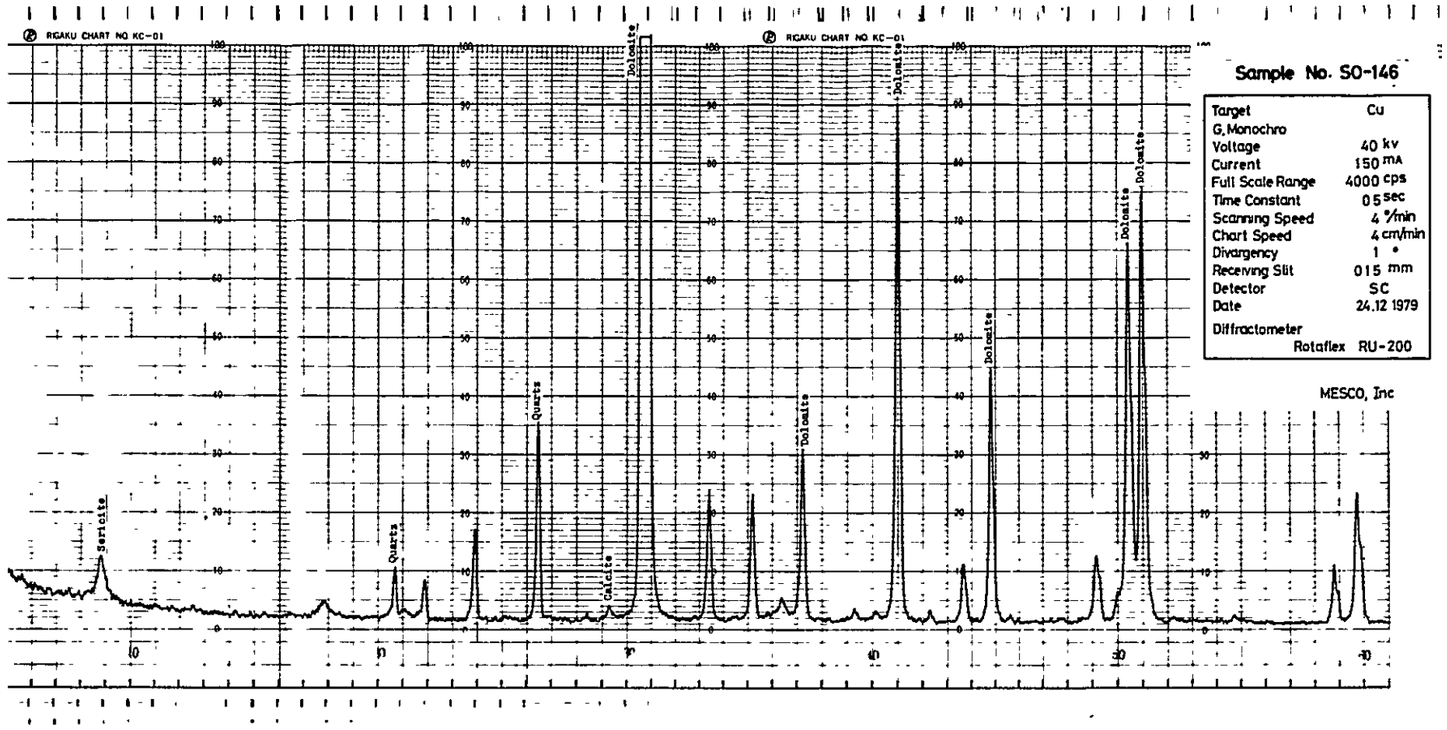
● Very rare

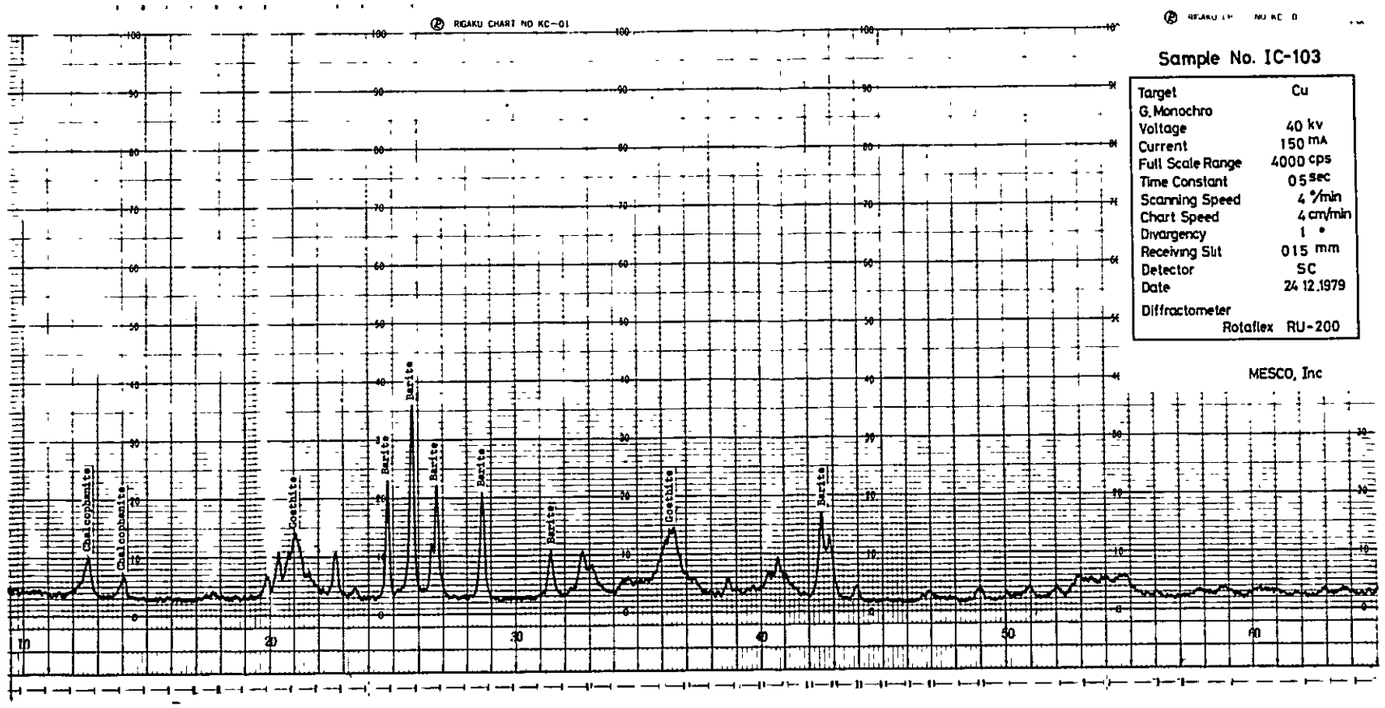
A.7. Summary of X-ray Diffraction Test

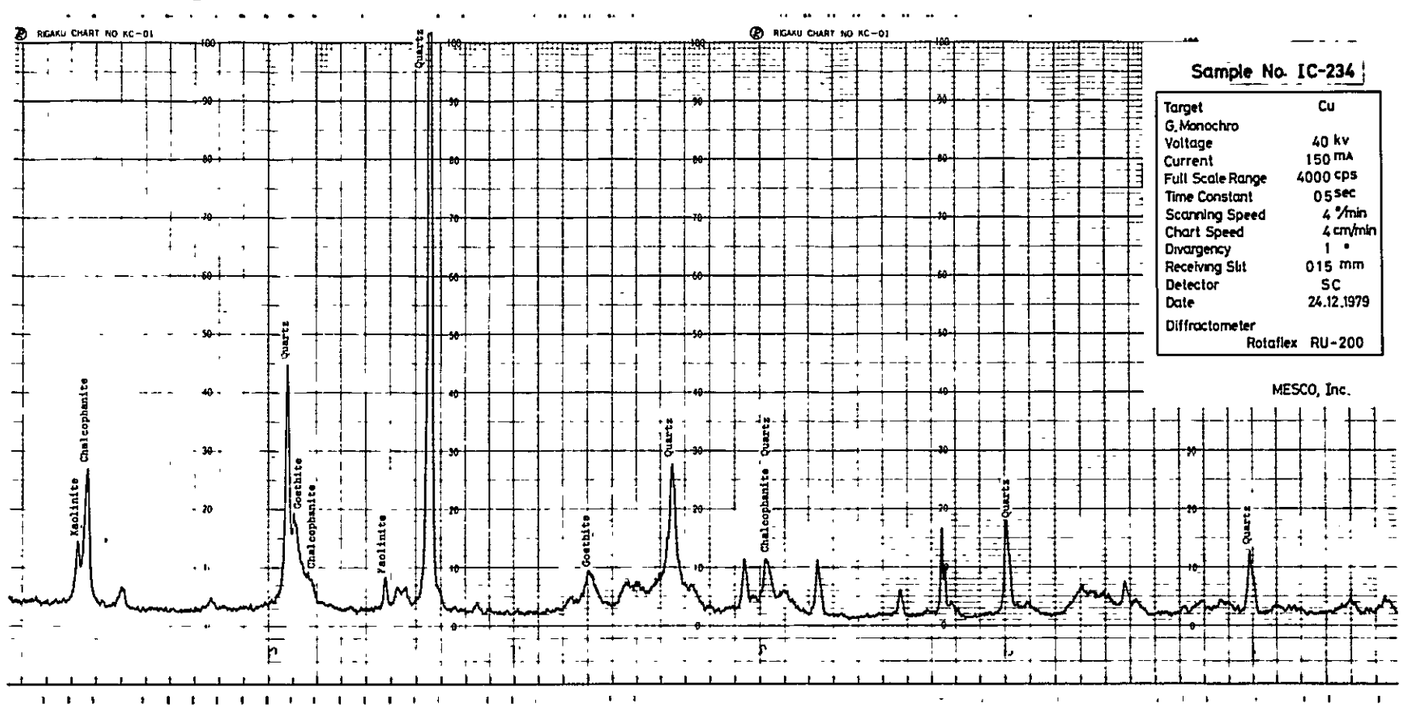
Field No. / Minerals	Sphalerite	Chalcophanite	Bianchite	Magnetite	Hematite	Goethite	Siderite	Rozenite	Siderotil	Fibroferrite	Gypsum	Gibbsite	Barite	Quartz	Calcite	Dolomite	Sericite	Kaolinite	Chlorite
SO-137		o				◎									o				
SO-146														o		◎	o		
IC-103		o				○							◎	o					
IC-234		o				o								◎					
IC-246	◎	o												◎		•		◎	
IC-301				○	o	o	◎												
IC-325				o	○							o		◎					◎
IC-349								◎											
IC-350			○						◎	○	o								

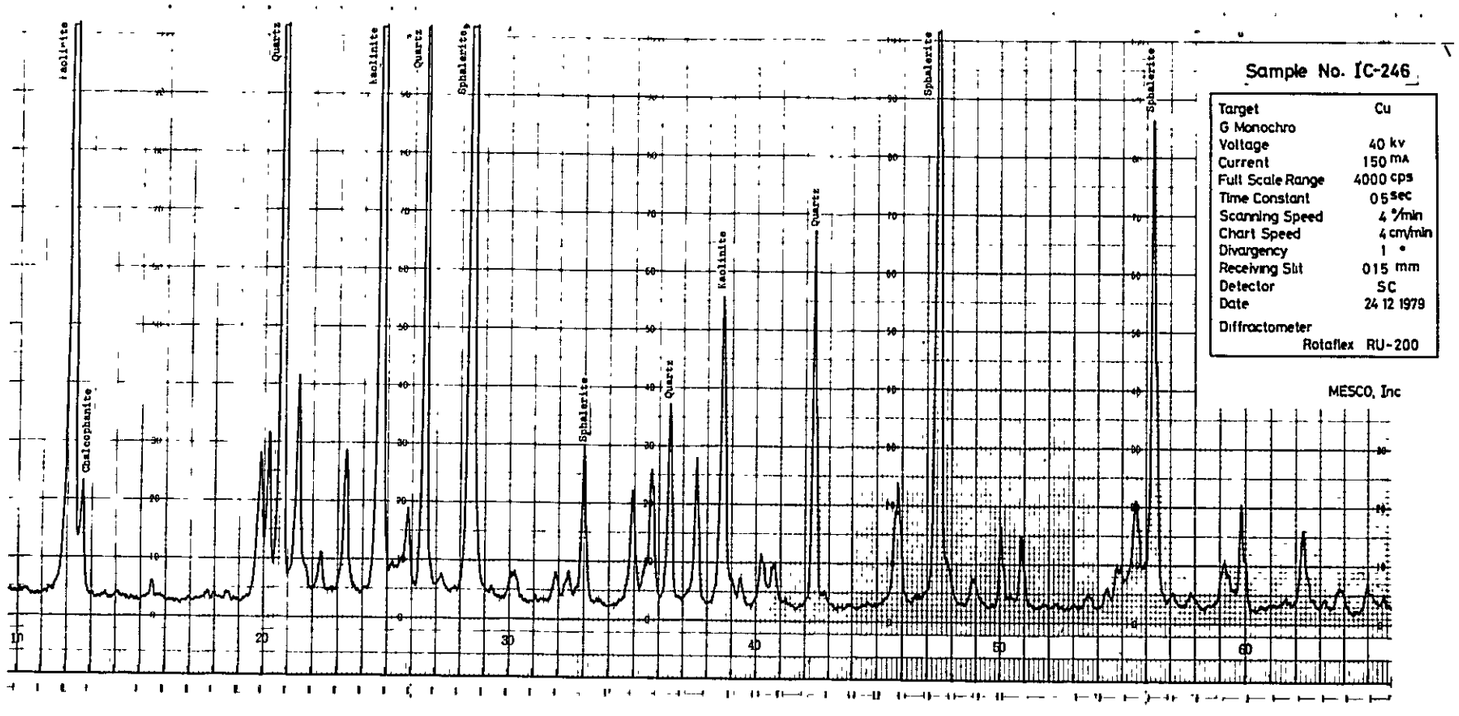
A. 8. Charts of X-ray Diffraction Test

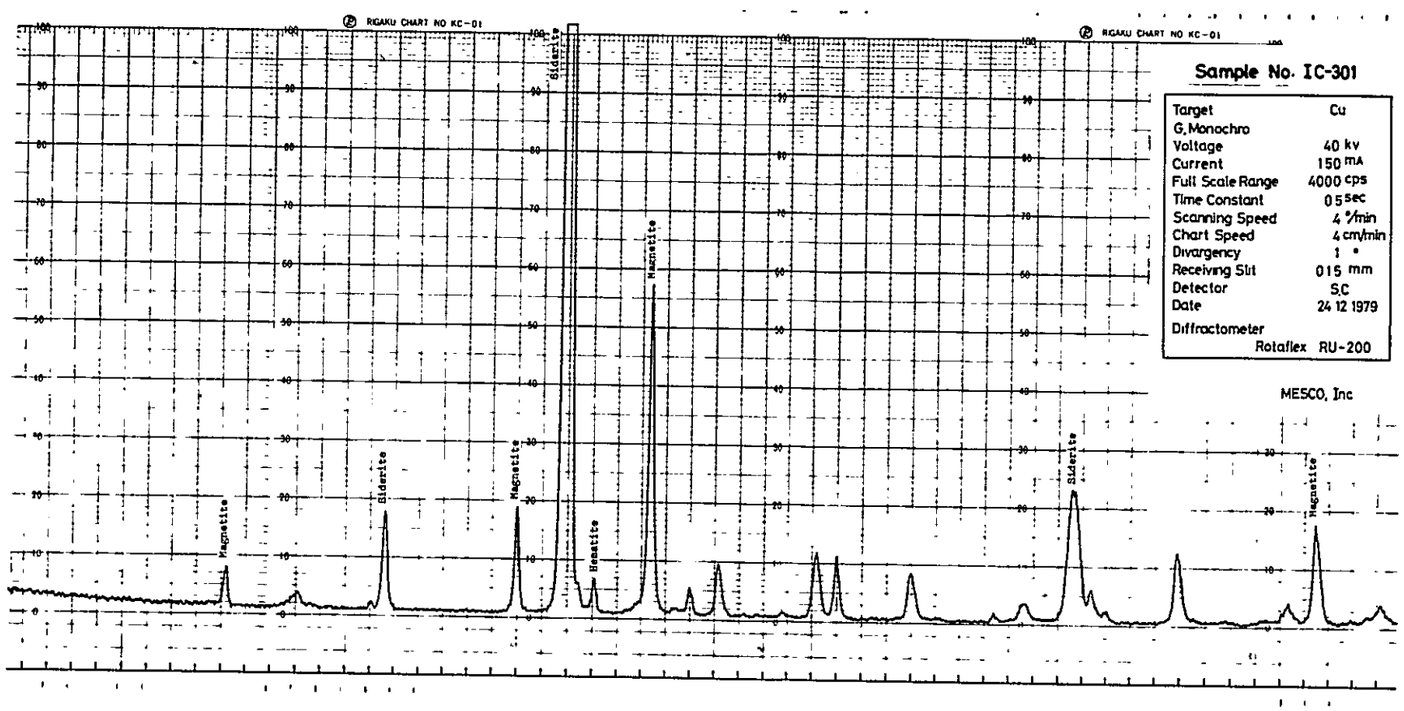

Chalcophanite
Goethite
Goethite
Goethite
Goethite
Sample No. SO-137
Target Cu
G Monochro
Voltage 40 kv
Current 150 mA
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/mn
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24.12.1979
Diffractometer
Rotaflex RU-200
MESCO, Inc.


Dolomite
Dolomite
Dolomite
Dolomite
Dolomite
Dolomite
Quartz
Quartz
Calcite
Sericite
Sample No. SO-146
Target Cu
G. Monochro
Voltage 40 kv
Current 150 mA
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24.12.1979
Diffractometer
Rotaflex RU-200
MESCO, Inc


RIGAKU CHART NO KC-01
Sample No. IC-103
Target Cu
G.Monochro
Voltage 40 kv
Current 150 ma
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24.12.1979
Diffractometer
Rotaflex RU-200
MESCO, Inc
Chalcopyrite
Chalcopyrite
Goethite
Barite
Barite
Barite
Barite
Barite
Goethite
Barite


RIGAKU CHART NO KC-01
RIGAKU CHART NO KC-01
Sample No. IC-234
Target Cu
G.Monochro
Voltage 40 kv
Current 150 ma
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24.12.1979
Diffractometer
Rotaflex RU-200
MESCO, Inc.
Kaolinite
Chalcopyrite
Quartz
Goethite
Chalcopyrite
Feolinite
Quartz
Goethite
Quartz
Chalcopyrite
Quartz
Quartz
Quartz


Sample No. IC-246
Target Cu
G Monochro
Voltage 40 kv
Current 150 ma
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24 12 1979
Diffractometer
Rotaflex RU-200
MESCO, Inc
Kaolinite
Quartz
Chlorophanite
Sphalerite
Kaolinite
Quartz
Sphalerite
Quartz
Kaolinite
Quartz
Sphalerite
Sphalerite
10
20
30
40
50
60


RIGAKU CHART NO KC-01
Sample No. IC-301
Target Cu
G, Monochro
Voltage 40 kv
Current 150 mA
Full Scale Range 4000 cps
Time Constant 0.5 sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector SC
Date 24 12 1979
Diffractometer
Rotaflex RU-200
MESCO, Inc
Magnetite
Siderite
Magnetite
Siderite
Hematite
Magnetite
Siderite
Magnetite

A. 9. Assay Results of Ore Samples

A.9. Assay Results of Ore Samples

No.	Location	Field No.	Geological Index	Cu (%)	Pb (%)	Zn (%)	Ag (g/t)
1	G3	AO-115	Cp-Or	0.05	7.60	11.00	6.75
2	G4	BO-125	St-Ls	tr	0.02	0.12	0.04
3	G1	BO-134	Ig-Or	tr	0.05	0.13	0.30
4	G1	BO-136	Jm-Ls	tr	0.06	0.09	9.94
5	G4	BO-150	Ph-Or	0.48	0.04	32.00	0.24
6	G4	BO-151	Ph-Or	3.25	0.01	0.48	0.70
7	G4	BO-152	Ph-Or	0.33	0.05	22.90	0.20
8	G4	BO-153	Ph-Or	0.17	0.05	17.20	0.09
9	G4	BO-154	Ph-Or	4.90	0.01	0.55	1.35
10	G4	BO-155	Ph-Or	0.23	0.01	10.20	0.10
11	S2	IC-301	St-Or	tr	0.02	2.00	0.05
12	S2	IC-318	St-Do	tr	2.18	1.00	1.98
13	S2	IC-329	St-Or	tr	49.25	0.75	28.40
14	S2	IC-331	St-Do	tr	0.35	0.90	0.40

Abbreviation

Cp .... Calipuy volcanics
St .... Santa formation
Ig .... Igneous rock
Jm .... Jumasha formation
Ph .... Pariahuanca formation
Or .... Ore
Ls .... limestone
Do .... dolostone

A. 10. Assay Results of Composite Samples

No.	Composite Sample No.	No. of Original Samples	Ag Grade (g/t)
1	IC-1-1	IC-101, 102, 103, 104, 105, 106	0.2
2	IC-1-2	IC-107, 108, 109, 110	tr
3	IC-1-3	IC-230, 231, 232, 233, 234, 235	1.6
4	IC-1-4	IC-269, 270	3.4
5	IC-1-5	IC-228, 229	4.1
6	IC-1-6	IC-236, 237, 238, 239, 240, 241, 242	tr
7	IC-1-7	IC-226, 227	tr
8	IC-1-8	IC-243, 244	4.4
9	IC-1-9	IC-262, 263, 264, 265, 266, 267, 268	tr
10	IC-1-10	IC-223, 224, 225	0.4
11	IC-1-11	IC-221, 222	1.0
12	IC-1-12	IC-212, 213, 214, 215, 216	0.2
13	IC-1-13	IC-210, 211	tr
14	IC-1-14	IC-217, 218, 219, 220	tr
15	IC-1-15	IC-208, 209	0.6
16	IC-1-16	IC-201, 202, 203, 204, 205, 206, 207	2.4
17	IC-2-1	IC-246, 247	68.8
18	IC-2-2	IC-245	3.7
19	IC-2-3	IC-248, 249	2.3
20	IC-2-4	IC-250, 251	2.3
21	IC-2-5	IC-252	4.7
22	IC-2-6	IC-253, 254, 255, 256, 257, 258, 259 260	11.5
23	IC-3-1	IC-332, 333	7.8
24	IC-3-2	IC-334, 335	116.4
25	IC-3-3	IC-336, 337, 338	36.8
26	IC-3-4	IC-339, 340, 341	12.9
27	IC-3-5	IC-327, 328, 329	70.4
28	IC-4-1	IC-319, 320, 321	4.2
29	IC-4-2	IC-314, 315, 316, 317	11.2
30	IC-4-3	IC-309, 310, 311, 312	12.9
31	IC-4-4	IC-302, 303, 304, 305, 306, 307	4.2

Composites were prepared using original samples in proportion to the sampling lengths.

A. 11. Assay Results of Geochemical Samples

GEOLOGICAL INDEX

FORMATION

Jm ..... Jumasha formation
Pt ..... Pariatambo formation
Cl ..... Chulec formation
Ph ..... Pariahuanca formation
Fr ..... Farrat formation
Cz ..... Carhuaz formation
St ..... Santa formation
Cm ..... Chimu formation
Oy ..... Oyon formation
Cp ..... Calipuy volcanics

SEDIMENTARY ROCK

Do ..... Dolostone
Ls ..... Limestone
Sh ..... Shale
Qz ..... Quartzite
Ss ..... Sandstone
Mr ..... Marl

IGNEOUS ROCK

Dc ..... Dacite & porphyrite
Dp ..... Dacite porphyry
Tp ..... Tonalite porphyry
Gp ..... Phyolite & granite porphyry
Tn ..... Tonalite
Tf ..... Tuff & tuff breccia
Ad ..... Andesite

MINERALIZATION

Or ..... Ore
Gs ..... Gossan
Gy ..... Skarn

(1) Rocks

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
1	G3	AO-104	St-Ls	6	36	18
2	G3	AO-105	St-Ls	4	30	34
3	G4	AO-108	Ph-Ls	5	34	20
4	G4	AO-109	Ph-Ls	12	35	24
5	G4	AO-110	Jm-Ls	4	32	12
6	G4	AO-111	Ph-Ls	5	40	14
7	G4	AO-112	Fr-Ss	6	16	5
8	G3	AO-113	St-Ls	7	34	24
9	G3	AO-114	St-Ls	6	35	20
10	G3	AO 118	St-Ls	5	32	19
11	G3	AO-119	St-Ls	7	35	15
12	G3	AO-120	St-Ls	7	33	40
13	G3	AO-121	St-Ls	7	28	17
14	G3	AO-122	St-Ls	5	33	12
15	G2	AO-123	St-Ls	5	27	9
16	G2	AO-124	St-Ls	5	32	14
17	G2	AO-125	Ph-Ls	5	30	17
18	G2	AO-126	Ph-Ls	9	35	38
19	G2	AO-127	St-Ls	7	33	162
20	G4	AO-128	St-Do	4	27	13
21	G4	AO-129	Cz-Ss	7	28	43
22	G4	AO-130	Fr-Ss	2	3	12
23	G4	AO-131	Ph-Ls	4	28	17
24	G4	AO-132	Cl-Ls	6	36	45
25	G4	AO-133	Pt-Ls	8	24	17
26	G4	AO 134	Jm-Ls	3	29	32
27	G4	AO 135	St-Ls	3	24	15
28	G4	AO-136	Cm-Qz	tr	10	8
29	G4	AO-137	St-Ls	4	28	11
30	G4	AO-138	Fr-Ss	1	tr	14
31	G4	AO-139	Ph-Ls	4	37	158
32	G4	AO-140	Pt-Ls	3	29	18
33	G4	AO-141	Jm-Ls	4	27	15

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
34	G4	AO-142	Oy-Ss	5	2	21
35	G4	AO-143	Cm-Qz	tr	tr	7
36	G4	AO-146	Fr-Ss	4	11	7
37	G4	AO-148	Cl-Ls	12	42	155
38	G4	AO-149	St-Ls	3	27	12
39	G4	AO-150	St-Do	2	34	21
40	G4	AO-151	St-Ls	3	32	20
41	G4	AO-152	Ig-Dc	16	16	60
42	G4	AO-153	St-Ls	6	32	15
43	G4	AO-154	St-Ls	6	29	13
44	G4	AO-155	Oy-Ss	9	tr	13
45	G4	AO-156	St-Ls	5	36	37
46	G4	AO-157	Ph-Ls	7	32	22
47	G4	AO-158	Cl-Sh	18	29	42
48	G4	AO-159	Cl-Ls	16	26	43
49	G4	AO-160	St-Sh	3	tr	8
50	G4	AO-161	St-Do	19	26	21
51	G4	AO-162	St-Ls	27	29	16
52	G4	AO-163	St-Ls	3	32	42
53	G4	AO-164	Ig-Dc	67	8	76
54	G4	AO-166	St-Ls	5	37	27
55	G3	AO-168	St-Ls	5	31	16
56	G3	AO-169	St-Ls	5	38	20
57	G3	AO-170	St-Ls	4	32	33
58	G2	BO-104	St-Ls	4	33	11
59	G1	BO-106	Cz-Ss	4	15	16
60	G1	BO-107	Fr-Ss	6	25	9
61	G1	BO-109	St-Do	8	37	49
62	G1	BO-111	Pt-Ls	6	28	39
63	G2	BO-112	St-Ls	5	31	12
64	G2	BO-114	St-Ls	4	28	12
65	G2	BO-115	St-Ls	3	28	33
66	G4	BO-116	St-Ls	13	28	32
67	G4	BO-117	St-Ls	8	25	12
68	G4	BO-118	St-Ls	4	28	10

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
69	G4	BO-119	St-Do	4	25	16
70	G4	BO-120	St-Ls	5	31	29
71	G4	BO-121	St-Ls	2	25	15
72	G4	BO-122	St-Do	3	25	23
73	G4	BO-123	St-Ls	2	26	16
74	S1	BO-127	Cm-Ss	5	36	184
75	S1	BO-128	St-Gs	2	523	302
76	S1	BO-129	St-Gs	4	1,342	1,636
77	S1	BO-130	St-Gs	3	534	8,060
78	S1	BO-131	St-Gs	4	407	10,288
79	G4	BO-133	Jm-Ls	4	28	26
80	G4	BO-140	Pt-Ls	5	28	33
81	G3	BO-158	St-Ls	24	34	61
82	G3	BO-159	St-Gy	4	21	10
83	G3	BO-162	Pt-Ls	10	24	31
84	G3	BO-164	Jm-Ls	4	30	17
85	G3	BO-165	Ph-Ls	7	32	33
86	G4	BO-166	St-Do	4	20	18
87	G3	BO-167	Fr-Ss	26	tr	37
88	G3	BO-168	Cz-Sh	4	12	29
89	G3	BO-169	Ph-Ls	5	25	12
90	G3	BO-171	Pt-Ls	21	27	37
91	G4	BO-172	Jm-Ls	3	29	14
92	G3	BO-173	St-Ls	3	15	32
93	G3	BO-174	St-Ls	4	34	16
94	G3	BO-175	Cz-Sh	14	2	75
95	G3	BO-176	Pt-Ls	13	21	37
96	G3	BO-177	St-Ls	6	15	29
97	G3	BO-178	St-Ls	4	30	27
98	G3	BO-179	Cz-Sh	14	20	38
99	G3	BO-181	St-Ls	176	553	54
100	G1	CO-114	Ph-Ls	6	17	3,383
101	G1	CO-115	Cl-Ls	7	19	29
102	G1	CO-117	Pt-Ls	3	21	25
103	G1	CO-118	Pt-Ls	6	35	84

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
104	G1	CO-119	Cl-Ls	16	25	60
105	G1	CO-120	Ph-Ls	10	27	38
106	G1	CO-125	Jm-Ls	4	33	14
107	G1	CO-126	Jm-Ls	7	39	88
108	G1	CO-130	Ph-Ls	7	29	133
109	G1	CO-134	Cl-Ls	7	39	16
110	G1	CO-135	Pt-Ls	3	22	13
111	G2	CO-147	St-Ls	6	19	15
112	G2	CO-148	St-Ls	3	19	523
113	G2	CO-149	Ph-Ls	6	26	27
114	G2	CO-150	Cl-Ls	6	41	22
115	G2	CO-152	St-Ls	7	30	14
116	G2	CO-153	St-Ls	5	30	17
117	G2	CO-155	Ph-Ls	9	37	26
118	G2	CO-156	Cl-Ls	5	33	19
119	G2	CO-157	Ph-Ls	3	37	34
120	G2	CO-159	St-Ls	4	16	20
121	G2	CO-162	Ig-Gp	tr	4	27
122	G2	CO-166	St-Ls	3	21	11
123	G2	CO-167	Cl-Ls	4	26	29
124	G2	CO-168	Cl-Ls	6	29	49
125	G2	CO-169	Ph-Ls	9	20	2,390
126	G3	CO-170	Pt-Ls	8	19	54
127	G3	CO-171	Pt-Ls	3	17	14
128	G3	CO-172	Jm-Ls	3	19	13
129	G3	CO-173	Jm-Ls	3	25	14
130	G3	CO-174	Jm-Ls	3	26	17
131	G3	CO-175	Jm-Ls	3	23	135
132	G3	CO-176	Cl-Ls	4	16	16
133	G3	CO-177	Ph-Ls	40	17	618
134	G3	CO-178	St-Ls	3	21	15
135	G3	CO-179	St-Ls	5	22	16
136	G3	CO-180	St-Ls	3	19	14
137	G3	CO-181	St-Ls	3	27	20
138	G3	CO-182	Pt-Ls	3	28	110

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
139	G3	CO-183	Pt-Ls	4	18	15
140	G3	CO-184	Pt-Ls	4	25	55
141	G3	CO-185	Cl-Ls	5	25	33
142	G3	CO-187	Pt-Ls	4	28	23
143	G3	CO-189	Pt-Ls	8	21	35
144	G3	CO-190	Ph-Ls	4	28	18
145	G3	CO-191	Cl-Ls	5	28	30
146	G3	CO-193	Cl-Ls	5	25	39
147	G3	CO-196	Pt-Ls	4	25	14
148	G3	CO-197	Jm-Ls	3	25	17
149	G3	CO-199	Ph-Ls	4	28	20
150	G3	CO-202	Cz-Ss	10	5	23
151	G3	CO-206	Cz-Ss	13	4	55
152	G3	CO-208	Cz-Ss	30	9	84
153	G1	NO-111	Ph-Ls	9	35	41
154	G1	NO-112	Pt-Ls	5	23	27
155	G1	NO-113	Ig-Gp	6	tr	575
156	G1	NO-114	St-Ls	3	26	14
157	G1	NO-115	St-Ls	7	25	11
158	G1	NO-116	St-Ls	5	37	85
159	G1	NO-117	St-Ls	4	28	22
160	G1	NO-118	St-Do	4	25	20
161	G1	NO-119	St-Do	7	28	15
162	G1	NO-120	St-Ls	3	32	45
163	G1	NO-122	St-Ls	7	25	12
164	G1	NO-123	Cm-Qz	8	92	14
165	G1	NO-124	St-Ls	6	25	19
166	G1	NO-125	St-Do	5	25	24
167	G1	NO-126	St-Do	6	25	16
168	G1	NO-127	St-Ls	4	28	10
169	G1	NO-128	St-Do	3	28	11
170	G3	NO-134	Cp-Tf	5	3	51
171	G3	NO-135	Cp-Tf	4	6	13
172	G3	NO-138	Cp-Tf	5	12	76
173	G1	NO-141	Cp-Tf	2	11	19

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
174	G1	NO-142	Cp-Tf	12	74	45
175	G1	NO-145	Ig-Dp	13	tr	61
176	G1	NO-146	Ig-Ad	12	tr	82
177	G1	NO-148	Ig-Dp	13	tr	63
178	G1	NO-149	Cp-Tf	6	18	46
179	G1	NO-150	Jm-Ls	12	32	46
180	G1	NO-151	Cp-Gs	10	3	27
181	G1	NO-152	Cp-Tf	16	3	101
182	G1	NO-153	Jm-Ls	4	20	144
183	G1	NO-154	St-Do	8	tr	40
184	G1	NO-155	St-Do	3	26	133
185	G3	NO-156	St-Do	4	19	18
186	G4	NO-161	St-Sk	10	22	3,455
187	G4	NO-162	St-Do	2	11	2,006
188	G4	NO-163	St-Do	8	120	4,429
189	G3	NO-172	Cm-Ss	15	63	153
190	G3	NO-173	Cm-Sh	19	3	71
191	G3	NO-174	Cm-Sh	63	10	13
192	G3	NO-176	St-Ls	4	39	22
193	G3	NO-177	St-Ls	4	51	28
194	G3	NO-178	Cm-Sh	25	16	20
195	G3	NO-179	Cm-Ss	17	22	23
196	G3	NO-180	Cm-Qz	tr	10	7
197	G3	NO-181	St-Ls	6	38	19
198	G3	NO-182	St-Ls	17	45	22
199	G3	NO-183	Cz-Sh	41	15	104
200	G3	NO-184	Cp-Tf	tr	4	91
201	G3	NO-185	Cp-Tf	tr	1	86
202	G3	NO-191	St-Ls	7	31	26
203	G3	NO-192	St-Ls	tr	1	39
204	G3	NO-193	Cm-Qz	4	38	21
205	G3	NO-194	Cz-Sh	8	32	58
206	G3	NO-195	Cz-Sh	2	9	42
207	G3	NO-196	Fr-Ss	1	12	6
208	G3	NO-197	Ph-Ls	4	33	64

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
209	G3	NO-198	St-Ls	7	72	366
210	G3	NO-199	Cl-Ls	10	20	28
211	G3	NO-200	Cl-Mr	36	34	307
212	G3	NO-201	Cl-Sh	6	28	26
213	G3	NO-202	Ig-Tn	10	3	65
214	G3	NO-203	Cz-Ss	9	7	57
215	G3	NO-204	St-Ls	5	109	55
216	G3	NO-205	St-Ls	4	41	71
217	G3	NO-206	Ig-Tn	20	5	58
218	G3	NO-207	Cl-Ls	5	29	25
219	G3	NO-208	Cl-Mr	8	36	52
220	G3	NO-209	Pt-Ls	6	28	21
221	G3	NO-210	Pt-Ls	3	25	19
222	G3	NO-211	Pt-Ls	12	27	63
223	G3	NO-212	Jm-Ls	3	27	85
224	G3	NO-213	Cl-Ls	2	27	15
225	G3	SO-103	Cp-Ad	tr	1	69
226	G3	SO-106	Cp-Tf	3	7	42
227	G3	SO-109	Ph-Ls	5	32	16
228	G3	SO-110	Ph-Do	3	7	15
229	G4	SO-112	St-Ls	4	33	101
230	G4	SO-113	Cz-Ls	4	31	137
231	G3	SO-115	St-Ls	4	28	26
232	G3	SO-117	St-Do	3	31	13
233	G3	SO-120	St-Ls	4	36	27
234	G3	SO-123	Cz-Ls	7	39	50
235	G3	SO-124	St-Ls	4	52	23
236	G3	SO-126	St-Ls	3	39	31
237	G3	SO 128	St-Ls	6	120	283
238	G3	SO-130	Cz-Ss	23	16	112
239	S1	SO-135	St-Ls	9	5,580	20,938
240	S1	SO-136	St-Ls	4	35	53
241	S1	SO-140	St-Do	3	2,901	5,167
242	S1	SO-142	Cm-Ss	1	9	36
243	S1	SO-143	St-Ls	3	186	12,188

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
244	S1	SO-146	St-Ls	6	25	62
245	S1	SO-147	St-Ls	4	25	15
246	S1	SO-148	St-Ls	5	31	13
247	S1	SO-149	St-Ls	9	29	25
248	S1	SO-150	St-Ls	4	25	17
249	S1	SO-151	St-Ls	7	25	20
250	S1	SO-152	St-Ls	5	31	18
251	S1	SO-153	St-Ls	7	24	14
252	S1	SO-154	St-Ls	6	28	29
253	S1	SO-155	St-Ls	8	27	128
254	S1	SO-156	St-Ls	8	22	14
255	S1	SO-157	St-Ls	7	22	21
256	S1	SO-158	St-Ls	2	tr	11
257	S1	SO-159	St-Ls	6	24	14
258	S1	SO-160	St-Ls	5	22	12
259	S1	SO-161	St-Ls	6	24	13
260	S1	SO-162	St-Ls	5	24	21
261	S1	SO-163	St-Ls	4	24	21
262	S1	SO-164	St-Ls	5	27	18
263	S1	SO-165	St-Do	4	33	26
264	S1	SO-166	St-Ls	5	44	107
265	S1	SO-167	St-Do	1	1,317	2,848
266	S1	SO-212	St-Do	13	36	65
267	S1	SO-175	Ph-Ls	5	30	72
268	G2	SO-177	Ph-Ls	4	33	20
269	G4	SO-178	Cz-Ss	22	6	149
270	G4	SO-179	St-Ls	6	20	15
271	G4	SO-180	St-Ls	7	20	27
272	G4	SO-182	St-Ls	3	26	21
273	G2	SO-183	Ph-Ls	6	29	28
274	G2	SO-184	Cz-Sh	11	32	35
275	G2	SO-185	Cz-Sh	5	12	29
276	G4	SO-186	Cz-Sh	6	12	40
277	G4	SO-187	St-Ls	3	26	21
278	G4	SO-188	St-Ls	7	6	15

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn ppm
279	G4	SO-191	St-Ls	5	17	10
280	G4	SO-192	St-Ls	3	32	25
281	G2	SO-193	St-Ls	16	29	14
282	G2	SO-194	St-Ls	5	12	19
283	G2	SO-197	St-Ls	3	26	10
284	G3	SO-198	Ph-Ls	6	29	25
285	G4	SO-199	St-Do	2	23	14
286	G4	SO-200	St-Ls	3	23	13
287	G4	SO-203	Cz-Ss	2	6	33
288	G3	SO-204	Ph-Ls	4	26	63
289	G3	SO-208	St-Ls	3	29	16

(2) Gossan in Iscay Cruz

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn %
1	S1	IC-101	St-Gs	15	1.98 (%)	6.80
2	S1	IC-102	St-Gs	20	1.50 (%)	5.10
3	S1	IC-103	St-Gs	18	1.95 (%)	6.65
4	S1	IC-104	St-Gs	40	0.70 (%)	4.05
5	S1	IC-105	St-Gs	22	1.02 (%)	4.05
6	S1	IC-106	St-Gs	19	2.05 (%)	6.30
7	S1	IC-107	St-Gs	17	1.48 (%)	8.20
8	S1	IC-108	St-Gs	22	0.80 (%)	5.95
9	S1	IC-109	St-Gs	20	1.20 (%)	5.80
10	S1	IC-110	St-Gs	54	1.85 (%)	6.10
11	S1	IC-201	St-Gs	30	900	4.25
12	S1	IC-202	St-Gs	28	390	3.38
13	S1	IC-203	St-Gs	26	450	4.65
14	S1	IC-204	St-Gs	24	880	5.10
15	S1	IC-205	St-Gs	24	380	4.05
16	S1	IC-206	St-Gs	22	690	5.30
17	S1	IC-207	St-Gs	24	700	3.50
18	S1	IC-208	St-Gs	34	0.74 (%)	2.40
19	S1	IC-209	St-Gs	33	2,550	2.80
20	S1	IC-210	St-Gs	28	280	3.58
21	S1	IC-211	St-Gs	23	200	3.10
22	S1	IC-212	St-Gs	22	680	4.50
23	S1	IC-213	St-Gs	28	900	4.65
24	S1	IC-214	St-Gs	25	380	2.55
25	S1	IC-215	St-Gs	32	320	2.80
26	S1	IC-216	St-Gs	31	400	3.10
27	S1	IC-217	St-Gs	29	480	4.70
28	S1	IC-218	St-Gs	22	320	6.55
29	S1	IC-219	St-Gs	30	312	4.65
30	S1	IC-220	St-Gs	21	122	4.85
31	S1	IC-221	St-Gs	24	270	3.80
32	S1	IC-222	St-Gs	18	450	4.25
33	S1	IC-223	St-Gs	21	490	5.18

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn %
34	S1	IC-224	St-Gs	28	400	4.50
35	S1	IC-225	St-Gs	36	650	4.55
36	S1	IC-226	St-Gs	22	3,220	3.40
37	S1	IC-227	St-Gs	27	0.72 (%)	5.80
38	S1	IC-228	St-Gs	26	1,580	6.05
39	S1	IC-229	St-Gs	29	1,220	6.45
40	S1	IC-230	St-Gs	33	1.90 (%)	5.20
41	S1	IC-231	St-Gs	70	2.50 (%)	7.80
42	S1	IC-232	St-Gs	23	1.90 (%)	7.60
43	S1	IC-233	St-Gs	33	2.90 (%)	8.20
44	S1	IC-234	St-Gs	22	1.75 (%)	8.25
45	S1	IC-235	St-Gs	32	1.86 (%)	6.30
46	S1	IC-236	St-Gs	22	1,510	4.15
47	S1	IC-237	St-Gs	35	2,500	4.90
48	S1	IC-238	St-Gs	21	3,440	4.92
49	S1	IC-239	St-Gs	29	4,520	5.55
50	S1	IC-240	St-Gs	24	0.90 (%)	4.76
51	S1	IC-241	St-Gs	26	0.68 (%)	4.90
52	S1	IC-242	St-Gs	29	0.68 (%)	5.60
53	S1	IC-243	St-Gs	26	850	4.50
54	S1	IC-244	St-Gs	28	3,420	4.72
55	S1	IC-245	St-Gs	24	1,400	5.60
56	S1	IC-246	St-Gs	37	1,150	12.20
57	S1	IC-247	St-Gs	32	1,450	3.10
58	S1	IC-248	St-Gs	24	2,400	3.70
59	S1	IC-249	St-Gs	42	580	3.72
60	S1	IC-250	St-Gs	26	1,600	3.55
61	S1	IC-251	St-Gs	24	620	4.35
62	S1	IC-252	St-Gs	27	780	2.95
63	S1	IC-253	St-Gs	25	800	2.40
64	S1	IC-254	St-Gs	19	420	3.90
65	S1	IC-255	St-Gs	40	750	4.37
66	S1	IC-256	St-Gs	33	600	1.58
67	S1	IC-257	St-Gs	22	3,700	0.62
68	S1	IC-258	St-Gs	24	1,100	0.45

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn %
69	S1	IC-259	St-Gs	23	1,250	0.70
70	S1	IC-260	St-Gs	124	2,830	0.92
71	S1	IC-262	St-Gs	28	1.58 (%)	5.38
72	S1	IC-263	St-Gs	38	2.35 (%)	5.40
73	S1	IC-264	St-Gs	29	3.35 (%)	3.80
74	S1	IC-265	St-Gs	28	4,100	2.30
75	S1	IC-266	St-Gs	32	1.15 (%)	3.10
76	S1	IC-267	St-Gs	20	0.50 (%)	5.02
77	S1	IC-268	St-Gs	36	0.62 (%)	3.45
78	S1	IC-269	St-Gs	158	1.05 (%)	1.55
79	S1	IC-270	St-Gs	40	1.07 (%)	2.30
80	S2	IC-302	St-Do	128	330	4.60
81	S2	IC-303	St-Do	70	1,550	1.66
82	S2	IC-304	St-Do	495	320	3.95
83	S2	IC-305	St-Do	298	2,150	1.15
84	S2	IC-306	St-Do	34	550	0.03
85	S2	IC-307	St-Do	303	600	0.90
86	S2	IC-308	St-Do	30	680	450 (ppm)
87	S2	IC-309	St-Gs	2,175	250	5.60
88	S2	IC-310	St-Gs	615	150	4.45
89	S2	IC-311	St-Gs	425	150	1.72
90	S2	IC-312	St-Gs	0.64 (%)	0.02 (%)	0.30
91	S2	IC-314	St-Gs	0.12 (%)	0.05 (%)	0.21
92	S2	IC-315	St-Gs	0.01 (%)	0.44 (%)	1.10
93	S2	IC-316	St-Gs	75	100	0.60
94	S2	IC-317	St-Gs	466	350	2.08
95	S2	IC-319	St-Do	1,070	200	1.00
96	S2	IC-320	St-Do	55	280	1.60
97	S2	IC-321	St-Do	540	200	2.60
98	S2	IC-322	St-Ss	27	300	710 (ppm)
99	S2	IC-323	St-Ss	26	260	200 (ppm)
100	S2	IC-324	St-Gs	42	950	390 (ppm)
101	S2	IC-327	St-Or	68	0.88 (%)	4.90
102	S2	IC-328	St-Gs	22	0.74 (%)	2.25
103	S2	IC-332	St-Do	20	1,200	0.55

No.	Location	Field No.	Geological Index	Cu ppm	Pb ppm	Zn %
104	S2	IC-333	St-Do	28	480	0.30
105	S2	IC-334	St-Do	28	2,250	0.65
106	S2	IC-335	St-Do	37	3,950	1.20
107	S2	IC-336	St-Do	43	700	0.80
108	S2	IC-337	St-Do	26	1,480	0.75
109	S2	IC-338	St-Do	30	1,550	0.30
110	S2	IC-339	St-Do	228	150	1.90
111	S2	IC-340	St-Do	75	180	0.45
112	S2	IC-341	St-Do	88	300	0.80
113	S2	IC-342	St-Do	15	460	2.05
114	S2	IC-343	St-Do	1,700	180	3.25
115	S2	IC-344	St-Or	105	0.69 (%)	150 (ppm)
116	S2	IC-345	St-Or	62	0.78 (%)	100 (ppm)
117	S2	IC-346	St-Do	16	500	1.80

(3) Stream Sediments

No.	Location	Field No.	Cu ppm	Pb ppm	Zn ppm
1	G3	SD-1	20	52	85
2	G3	SD-2	15	38	106
3	G4	SD-3	21	20	156
4	G4	SD-4	17	29	92
5	G4	SD-5	16	29	191
6	G4	SD-6	21	20	69
7	G4	SD-7	10	23	67
8	G4	SD-8	22	20	42
9	G4	SD-9	39	40	223
10	G4	SD-10	14	194	183
11	G4	SD-11	14	17	56
12	G4	SD-12	16	20	209
13	G4	SD-13	18	22	124
14	G4	SD-14	97	25	310
15	G4	SD-15	16	19	46
16	G2	SD-16	742	168	416
17	G3	SD-17	21	60	83
18	G3	SD-18	79	120	172
19	G2	SD-19	32	27	287
20	G2	SD-20	14	21	115
21	G3	SD-21	18	26	74
22	G3	SD-22	13	26	82
23	G3	SD-23	16	23	77
24	G3	SD-24	14	14	77
25	G3	SD-25	28	26	83
26	G2	SD-26	16	100	76
27	G2	SD-27	6	tr	77
28	G2	SD-28	182	103	114
29	G2	SD-29	12	37	78
30	G2	SD-30	77	63	1,905
31	G2	SD-31	73	83	147
32	G2	SD-33	23	2,500	300
33	G2	SD-33	20	77	395

No.	Location	Field No.	Cu ppm	Pb ppm	Zn ppm
34	G2	SD-34	19	60	104
35	G2	SD-35	36	134	240
36	G3	SD-36	18	80	106
37	G3	SD-37	11	49	88
38	G3	SD-38	19	23	104
39	G3	SD-39	15	26	104
40	G3	SD-40	16	29	124
41	G3	SD-41	16	29	127
42	G3	SD-42	11	26	117
43	G3	SD-43	12	34	79
44	G3	SD-44	25	43	81