NO	AREA	LINE	ROCK	ZN	AS
MS 85	GT	D33	GR	106	300.0
MS 86	GT	D33	GR	32	20.0
MS 87	GT	D33	GR	54	6.0
MS 88	GT	D33	GR	40	20.0
MS 89	GT	D33	GR	46	6.0
MS 90	GT	D33	GR	39	10.0
MS 91	GT	D33	GR	33	12.0
MS 92	GT	D33	GR	47	20.0
MS 93	GT	D33	GR	41	11.0
MS 94	GT	D33	GR	48	13.0
MS 95	GT	D33	GR	57	9.0
MS 96	GT	D33	GR	25	7.0
MS 97	GT	D33	GR	33	6.0
MS 98	GT	D33	GR	23	5.0
MS 99	GT	D33	GR	20	10.0
MS 100	GT	D33	GR	32	15.0
MS 101	GT	D33	GR	39	35.0
MS 102	GT	D33	GR	27	5.0
MS 103	GT	D33	GR	56	<1.0
MS 104	GT	D31	GR	21	11.0
MS 105	GT	D31	GR	31	25.0
MS 106	GT	D31	GR	16	7.0
MS 107	GT	D31	GR	56	15.0
MS 108	GT	D31	GR	59	100.0
MS 109	GT	D31	GR	46	12.0
MS 110	GT	D31	GR	46	2.0
MS 111	GT	D31	GR	75	15.0
MS 113	GT	D31	GR	70	11.0
MS 114	GT	D31	GR	78	20.0
MS 115	GT	D31	GR	68	6.0
MS 116	GT	D31	GR	68	7.0
MS 117	GT	D31	GR	81	21.0
MS 118	GT	D31	GR	45	5.0
MS 119	GT	D31	GR	83	24.0
MS 120	GT	D31	GR	73	6.0
MS 121	GT	D33	GR	43	13.0
MS 122	GT	D33	GR	37	10.0
MS 123	GT	D33	GR	58	7.0
MS 124	GT	D33	GR	29	6.0
MS 125	GT	D33	GR	36	7.0
MS 126	GT	D33	GR	50	7.0
MS 127	GT	D33	GR	32	8.0
MS 128	GT	D33	GR	24	6.0
MS 129	GT	D33	GR	30	5.0
MS 130	GT	D33	GR	24	7.0
MS 131	GT	D33	GR	36	12.0
MS 132	GT	D33	GR	53	8.0
MS 133	GT	D33	GR	27	7.0
MS 134	GT	D33	GR	29	11.0
MS 135	GT	D33	GR	28	5.0
MS 136	GT	D33	GR	25	5.0
MS 137	GT	D33	GR	36	52.0
MS 138	GT	D33	GR	51	25.0
MS 139	GT	D33	GR	62	120.0
MS 140	GT	D33	GR	62	76.0
MS 141	GT	F09	GR	58	3.0
MS 142	GT	F09	GR	31	4.0
MS 143	GT	F09	GR	25	5.0
MS 144	GT	F09	GR	27	3.0
MS 145	GT	F09	GR	14	5.0
MS 146	GT	F09	GR	23	3.0
MS 147	GT	F09	GR	25	5.0
MS 148	GT	F09	GR	25	5.0
MS 149	GT	F09	GR	24	45.0
MS 150	GT	F09	GR	23	49.0
MS 151	GT	F09	GR	44	12.0
MS 152	PA	D06	GR	64	1.0
MS 153	PA	D06	GR	23	3.0
MS 154	PA	D06	GR	19	2.0
MS 155	PA	D06	GR	13	1.0
MS 156	PA	D06	GR	14	1.0
MS 157	PA	D06	GR	46	1.0
MS 158	PA	D06	GR	32	6.0
MS 159	PA	D06	GR	35	5.0
MS 160	PA	D06	GR	32	6.0
MS 161	PA	D06	GR	23	2.0
MS 162	PA	D06	GR	30	7.0
MS 163	PA	D06	GR	14	9.0
MS 164	PA	D06	GR	36	6.0
MS 165	PA	D06	GR	26	5.0
MS 166	PA	D06	GR	30	4.0
MS 167	PA	D06	GR	26	1.0
MS 168	PA	D06	GR	38	5.0
MS 169	PA	D06	GR	33	6.0
MS 170	PA	D06	GR	13	1.0
MS 171	PA	D06	GR	21	2.0
MS 172	PA	D06	GR	15	3.0
MS 173	PA	D06	GR	36	1.0
MS 174	PA	D06	GR	35	2.0
MS 175	PA	D06	GR	27	1.0
MS 176	PA	D06	GR	24	5.0
MS 177	PA	D06	GR	18	5.0
MS 178	PA	D06	GR	34	1.0
MS 179	PA	D06	GR	21	4.0
MS 180	PA	D06	GR	32	2.0
MS 181	PA	D06	GR	31	1.0
MS 182	PA	D06	GR	32	1.0
MS 183	PA	D06	GR	44	1.0
MS 184	PA	D07	GR	90	3.0
MS 185	PA	D07	GR	32	2.0
MS 186	PA	D07	GR	18	1.0
MS 187	PA	D07	GR	26	2.0

NO	AREA	LINE	ROCK	ZN	AS
MS 188	PA	D07	GR	14	1.0
MS 189	PA	D07	GR	26	2.0
MS 190	PA	D07	GR	18	2.0
MS 191	PA	D07	GR	26	2.0
MS 192	PA	D07	GR	17	2.0
MS 193	PA	D07	GR	42	3.0
MS 194	PA	D07	GR	38	2.0
MS 195	PA	D07	GR	22	6.0
MS 196	PA	D07	GR	16	1.0
MS 197	PA	D07	GR	12	1.0
MS 198	PA	D07	GR	19	1.0
MS 199	PA	D07	GR	21	2.0
Q 801	GT	Q08	GR	50	5.0
Q 802	GT	Q08	GR	70	4.0
Q 803	GT	Q08	GR	57	1.0
Q 804	GT	Q08	GR	33	1.0
Q 805	GT	Q08	GR	24	3.0
Q 806	GT	Q08	GR	31	3.0
Q 807	GT	Q08	GR	35	1.0
Q 808	GT	Q08	GR	26	1.0
Q 809	GT	Q08	GR	40	1.0
Q 810	GT	Q08	GR	32	2.0
Q 811	GT	Q08	GR	28	4.0
Q 812	GT	Q08	GR	35	4.0
Q 813	GT	Q08	GR	57	3.0
Q 814	GT	Q08	GR	28	2.0
Q 815	GT	Q08	GR	35	3.0
Q 816	GT	Q08	GR	51	4.0
Q 817	GT	Q08	GR	28	5.0
Q 818	GT	Q08	GR	46	13.0
Q 901	GT	Q09	GR	36	2.0
Q 902	GT	Q09	GR	49	0.1
Q 903	GT	Q09	GR	42	7.0
Q 904	GT	Q09	GR	48	7.0
Q 905	GT	Q09	GR	64	15.0
Q 906	GT	Q09	GR	64	24.0
Q 907	GT	Q09	GR	65	20.0
Q 908	GT	Q09	GR	55	17.0
Q 909	GT	Q09	GR	62	15.0
Q 910	GT	Q09	GR	44	12.0
Q 911	GT	Q09	GR	57	28.0
Q 912	GT	Q09	GR	77	50.0
Q 913	GT	Q09	GR	38	10.0
Q 914	GT	Q09	GR	40	7.0
Q 915	GT	Q09	GR	46	12.0
Q 916	GT	Q09	GR	24	42.0
Q 917	GT	Q09	GR	32	5.0
Q 918	GT	Q09	GR	22	5.0
Q 1101	GT	11N	SM	92	120.0
Q 1102	GT	11N	SM	68	18.0
Q 1103	GT	11N	GR	81	18.0
Q 1104	GT	11N	GR	117	20.0
Q 1105	GT	11N	SM	80	18.0
Q 1106	GT	11N	SM	83	43.0
Q 1107	GT	11N	SM	63	19.0
Q 1108	GT	11N	SM	54	200.0
Q 1109	GT	11N	SM	34	18.0
Q 1110	GT	11N	SM	92	48.0
Q 1111	GT	11N	SM	215	84.0
Q 1112	GT	11N	SM	142	40.0
Q 1113	GT	11N	SM	44	120.0
Q 1114	GT	11N	SM	69	8.0
Q 1115	GT	11N	SM	152	84.0
Q 1116	GT	11N	SM	820	19.0
Q 1202	GT	Q12	GR	41	5.0
Q 1203	GT	Q12	GR	39	8.0
Q 1204	GT	Q12	GR	48	4.0
Q 1205	GT	Q12	GR	38	5.0
Q 1206	GT	Q12	GR	37	2.0
Q 1207	GT	Q12	GR	49	7.0
Q 1208	GT	Q12	GR	47	9.0
Q 1209	GT	Q12	GR	28	9.0
Q 1210	GT	Q12	GR	44	6.0
Q 1211	GT	Q12	GR	36	6.0
Q 1301	GT	Q13	GR	43	28.0
Q 1302	GT	Q13	GR	63	5.0
Q 1303	GT	Q13	GR	65	6.0
Q 1304	GT	Q13	GR	81	18.0
Q 1305	GT	Q13	GR	77	12.0
Q 1306	GT	Q13	GR	67	4.0
Q 1307	GT	Q13	GR	56	2.0
Q 1308	GT	Q13	GR	38	5.0
Q 1309	GT	Q13	GR	43	5.0
Q 1310	GT	Q13	GR	47	6.0
Q 1311	GT	Q13	GR	42	5.0
Q 1312	GT	Q13	GR	35	5.0
Q 1313	GT	Q13	GR	39	4.0
Q 1314	GT	Q13	GR	41	3.0
Q 1315	GT	Q13	GR	47	6.0
Q 1316	GT	Q13	GR	65	6.0
Q 1317	GT	Q13	GR	54	18.0
Q 1318	GT	Q13	GR	40	20.0

	NO	AREA	LINE	ROCK	ZN	AS
D	3801	DA	D38	GR	44	16.0
D	3802	DA	D38	GR	45	20.0
D	3803	DA	D38	GR	43	14.0
D	3804	DA	D38	GR	20	13.0
D	3805	DA	D38	GR	39	5.0
D	3806	DA	D38	GR	28	5.0
D	3807	DA	D38	GR	38	6.0
D	3808	DA	D38	GR	21	12.0
D	3809	DA	D38	GR	27	10.0
D	3810	DA	D38	GR	26	6.0
D	3811	DA	D38	GR	32	18.0
D	3812	DA	D38	GR	49	15.0
D	3813	DA	D38	GR	62	23.0
D	3814	DA	D38	GR	57	32.0
D	3815	DA	D38	GR	53	5.0
D	3816	DA	D38	GR	71	13.0
D	3817	DA	D38	GR	61	3.0
D	3901	DA	D39	GR	92	8.0
D	3902	DA	D39	GR	44	7.0
D	3903	DA	D39	GR	45	8.0
D	3904	DA	D39	GR	32	6.0
D	3905	DA	D39	GR	50	4.0
D	3906	DA	D39	GR	33	6.0
D	3907	DA	D39	GR	32	5.0
D	3908	DA	D39	GR	53	20.0
D	3909	DA	D39	GR	32	3.0
D	4001	DA	D40	GR	38	17.0
D	4002	DA	D40	GR	18	21.0
D	4003	DA	D40	GR	45	19.0
D	4005	DA	D40	GR	28	24.0
D	4006	DA	D40	GR	47	15.0
D	4007	DA	D40	GR	160	8.0
D	4008	DA	D40	GR	65	8.0
D	4009	DA	D40	GR	34	20.0
F	801	GT	F08	CG	54	18.0
F	802	GT	F08	CG	37	5.0
F	803	GT	F08	CG	36	2.0

A. I-2 Chemical Analysis of Ore Samples

Sample No.	Locality	Description	Au g/t	Ag g/t	Cu %	Pb %	Zn %	As %
MAM 1	Mina Marina	arsenopyrite QV (40 cm)	2.6	21	0.05	0.18	0.04	2.32
MAM 2	"	arsenopyrite QV (30 cm)	2.3	15	0.11	0.09	0.15	2.12
MAM 3	"	arsenopyrite QV (20 cm)	8.2	39	0.08	1.07	0.18	2.67
MTM 1	Mina Marina	clayey QV (80 cm)	Tr	Tr	0.03	0.06	0.09	0.41
MTM 2	"	clayey QV (50 cm)	10.8	47	0.08	0.23	0.59	2.76
MTM 3	"	clayey QV (65 cm)	Tr	Tr	0.03	0.03	0.04	0.39
GITA 1	Gitana	pyrite QV (15 cm)	9.4	53	0.17	0.07	0.07	0.76
GIT E	"	clayey QV (60 cm)	2.0	34	0.07	0.05	0.17	2.07
GIT B	"	clayey OV (60 cm)	2.1	13	0.09	0.04	0.05	1.99
MMM 1	Mina Marina	pyrite-arsenopyrite QV (20 cm)	7.2	40	0.12	0.21	0.90	6.24
MMM 2	"	arsenopyrite QV (20 cm)	11.4	112	0.21	0.56	1.10	6.13
YELA 1	Gitana-NW	arsenopyrite QV	0.6	36	0.11	0.04	0.06	5.50
GIT C	Gitana	pyrite-arsenopyrite QV (15 cm)	11.8	114	0.98	0.07	0.14	14.5
Q1116	Gitana-NW	clayey QV	Tr	Tr	0.01	0.00	0.00	0.05
Q11S36	"	clayey QV	Tr	Tr	0.03	0.02	0.01	0.13
HCA 1	Paraiso San Antonio	black gossan (grab sample)	Tr	Tr	0.00	0.01	0.00	0.04
HCA 2	"	purplish clay (")	8.6	8	0.10	0.04	0.05	1.25
HCA 3	"	white clay (")	Tr	Tr	0.00	0.00	0.01	0.01
HCA 17	Desquite Q-6	silicified shale (")	Tr	Tr	0.01	0.00	0.00	0.02
N 3	Paraiso San Luis	clayey QV (50 cm)	Tr	Tr	0.01	0.02	0.01	0.02
N 9	Mina Desquite	clayey QV (10 cm)	5.1	9	0.00	0.05	0.06	0.03
N 10	"	" (15 cm)	Tr	Tr	0.00	0.02	0.03	0.02
N 11	"	" (15 cm)	Tr	Tr	0.00	0.03	0.05	0.02
N 20	"	QV (5 cm)	Tr	Tr	0.06	0.01	0.01	9.11
N 21	Delicia Q-3	clayey QV (32 cm)	Tr	Tr	0.01	0.01	0.03	0.06

N 23	Delicia Q-3	clayey QV (35 cm)	Tr	Tr	0.01	0.01	0.03	0.29
N 26	"	clayey V (55 cm)	7.3	7	0.01	0.01	0.01	0.07
N 27	"	clayey V (200 cm)	Tr	Tr	0.00	0.00	0.00	0.02
N 32	"	py - QV (5 cm)	1.8	6	0.00	0.04	0.01	0.69
N 35	Delicia Jaroe	clay VN (120 cm)	Tr	Tr	0.04	0.01	0.01	0.16
N 39	"	clay - QV (5 cm)	Tr	Tr	0.00	0.00	0.00	0.06
N 51	Paraiso San Luis	clayey QV (5 cm)	Tr	Tr	0.04	0.12	0.05	0.33
N 54	"	clayey V (80 cm)	Tr	Tr	0.03	0.14	0.03	0.32
N 56	"	clayey V (100 cm)	Tr	Tr	0.00	0.04	0.03	0.12
N 64	Paraiso Ruidosa	clayey V (80 cm)	6.7	149	0.13	0.35	0.15	0.56
N 73	Paraiso Lulo	clayey QV (10 cm)	Tr	Tr	0.00	0.00	0.00	0.01
S 9	Desquite	py - QV (15 cm)	Tr	Tr	0.00	0.00	0.00	0.04
S 16	Delicia	clayey V (20 cm)	Tr	Tr	0.00	0.01	0.00	0.11
S 32	Bombona-NW	py-Ars QV (15 cm)	5.7	27	0.01	0.16	0.01	2.33
S 39	"	py-cp QV (35 cm)	43.6	1144	0.28	0.44	0.06	3.09
S 44	"	clayey QV (15 cm)	Tr	Tr	0.00	0.05	0.03	0.23
S 49	"	clayey QV (80 cm)	0.7	7	0.00	0.01	0.00	0.27
RM 2	Paraiso Q-2	clayey QV (10 cm)	Tr	Tr	0.00	0.00	0.10	0.01
RM 5	"	old tunnel	Tr	Tr	0.01	0.05	0.04	0.04
RM 8	Delicia Q-3	gossan (rolling stone)	Tr	Tr	0.00	0.00	0.00	0.08
RM 8A	"	clayey QV	Tr	Tr	0.00	0.00	0.00	0.03
RM 8B	"	clayey QV (32 cm)	Tr	Tr	0.00	0.00	0.00	0.04
RM 9	"	clayey QV (15 cm)	Tr	Tr	0.02	0.01	0.01	0.17
RM 10	"	clayey V (55 cm)	2.6	3	0.01	0.01	0.01	0.05
RM 11	"	clayey QV (80 cm)	3.0	18	0.00	0.00	0.00	0.02

A. I-3 Chemical Analysis of Altered Rock Samples

Sample No.	Locality	Assay (%)				
		As	Sb	Ca	Si	S
CAN 58	Paraiso	5.13	0.02	0.04	31.38	0.91
59	"	0.09	0.01	0.02	26.30	0.01
60	"	0.20	0.03	0.25	23.86	0.03
61	"	0.17	0.03	0.46	24.61	0.03
62	"	0.06	0.02	2.17	25.52	0.02
CAS 32	Bombona-NW	2.26	0.03	0.03	32.67	1.90
33	"	0.03	0.003	0.09	31.69	0.005
34	"	0.14	0.01	0.10	26.28	0.01
35	"	0.08	0.02	1.41	25.91	0.02
36	"	0.08	0.005	0.12	31.82	0.004
37	"	0.08	0.005	0.13	31.94	0.005
38	"	0.06	0.02	1.90	27.67	0.01
CAGITAX 01	Mina Gitana	0.19	0.03	0.18	16.71	0.02
-ditto- 02	"	0.10	0.01	0.15	22.27	0.01
" 03	"	0.08	0.01	0.08	18.81	0.01
" 04	"	0.10	0.01	0.11	23.92	0.005
" 05	"	0.24	0.04	2.66	18.58	0.03
" 06	"	0.05	0.03	0.16	21.10	0.01
" 07	"	0.07	0.02	0.16	15.40	0.01
" 08	"	0.09	0.02	0.16	19.56	0.01
" 09	"	0.06	0.02	0.10	17.52	0.01
" 10	"	0.03	0.02	0.22	33.51	0.01
" 11	"	0.02	0.01	0.19	20.57	0.005
CAGITBX 01	"	0.36	0.03	0.26	20.15	0.02
-ditto- 02	"	0.08	0.01	0.10	25.67	0.003
" 03	"	0.19	0.03	0.28	13.89	0.01
" 04	"	0.15	0.04	0.40	18.36	0.02
" 05	"	0.06	0.03	0.32	12.15	0.01
" 06	"	0.21	0.04	1.72	11.76	0.02
CAMMXII 1	Mina Marina	0.12	0.03	0.40	16.25	0.01
-ditto- 2	"	0.07	0.02	0.29	17.81	0.01
" 3	"	1.19	0.03	0.06	16.61	0.05
" 4	"	0.39	0.04	0.57	13.37	0.02

A. I-4 Microscopic Observation of the Thin Sections

Sample No.	Location	Macroscopic description	Microscopic observation
HCA7	Delicia Q. 3-S	granodiorite	Biotite-Hornblende Granodiorite The rock has a coarse-grained hypidiomorphic and granular texture and consists mainly of unhedral to subhedral quartz up to 4.5 · 4 mm in size subhedral to euhedral plagioclase up to 4 × 3 mm, unhedral to subhedral potash feldspar up to 3 × 2 mm, subhedral to euhedral brown biotite up to 2.5 ′ 2.5 mm and subhedral green hornblende up to 3.5 × 2 mm. Plagioclase, the major of felsic constituents, is commonly twinned after albite law and zoned from andesine core to oligoclase margin. Accessory apatite, zircon and magnetite are present. Plagioclase is partly replaced by sericite, carbonates, epidote and albite. Mafic minerals are weakly altered to chlorite and epidote.
N43	Gitana-NW road to Paraiso	Cherty rock	Calcite-Diopside-Quartz Hornfels The rock shows a fine-grained and granoblastic texture and is mainly composed of mosaic quartz up to 0.1 mm sporadically filled with small amounts by diopside, calcite and opaque minerals. Quartz grains usually include minute and rounded salic minerals, one of which is plagioclase. A few veinlets of epidote-calcite-quartz-opaque mineral cut the rock. Leucoxene, sphene, apatite and zircon are present in a trace amount. There is a carbonaceous vug filled with carbonates, epidote, diopside and wollastonite, several diopside veinlets cut the rock. The original rock seems to be a siliceous sediment and somewhat calcareous.
Q1129	Gitana-NW Q. 11-N	Silicified shale	Biotite Hornfels The rock is pelitic hornfels, and phenoblastic pyrite, fragmental relic plagioclase and quartz up to 0.2 mm in size are scattered in a fine-grained and granoblastic matrix of quartz, brown biotite and plagioclase, up to 0.05 mm in size, with a little muscovite and microcline. Biotite veinlets and sericite-quartz veinlets are cut the rock.

Sample No.	Location	Macroscopic description	Microscopic observation
Q1232	Gitana-NW Q. 12	Siliceous shale	Biotite-bearing Muscovite Hornfels The rock is mainly composed of fine-grained and recrystalized quartz and muscovite up to 0.2 mm in size. Small to trace amounts of opaque minerals, leucoxene, biotite, plagioclase and primary zircon are acompanied. A crystal of chloritoid with 0.4 mm long is present. Texture of the rock is granoblastic although muscovite flakes are weakly orientated probably along sedimentary planes of the original rock.
Q1327	Gitana-NW Q. 13	gabbroic rock	Metamorphosed Andesitic Tuff Breccia The rock remains clearly an original clastic texture. Fragmental crystals of pseudomorphic to relic plagioclase, hornblende and fine-grained matrix. Plagioclase fragments and phenocrysts are replaced mainly by biotite with a little biotite. The matrix consists mainly of acicular actinolite, flaky biotite, short prismatic plagioclase and opaque minerals. Biotite aggregates fills abundant amygdaloidal cavities of an andesitic fragment.
HCA12	Desquite Q. 6	granodiorite	Biotite Granodiorite The rock shows a hypidiomorphic and granular texture and consists mainly of unhedral to subhedral quartz up to 3.5 x 3 mm in size, subhedral to euhedral plagioclase upto 2.6 x 2.2 mm, subhedral to unhedral patash feldsper up to 2.0 x 1.8 mm and subhedral to euhedral brown biotite up to 1.8 x 1.8 mm. Accessory apatite, zircon and magnetite are present. Plagioclase is commonly zoned and twinned after albite law with occasional pericline twinning. Potash feldspar is mostly of orthoclase and a few crystals twins after carlsbad law. Biotite is slightly chloritised and a few grains of epidote replace plagioclase.

Sample No.	Location	Macroscopic description	Microscopic observation
HCA12A	Desquite Q. 6	Autolith in granitic rock	Diopside-Hornblende Hernfels The rock is fairly sharpely divided into the diopside zone and hornblende zone. The diopside zone consists mainly of phenoblastic diopside, orthoclase, quartz, opaque mineral and residual subhedral plagioclase enclosed in a fine-grained granoblastic plagioclase mosaic, up to 0.05 mm in size, with diopside, opaque mineral and numerous micron-ordered sphene. Small amounts of coarser sphene, leucoxene, rutile, zircon and apatite are present. Diopside phenoblasts contains minute rounded grains of probable plagioclase poikilitically and co-exsists with a little green actinolitic hornblende mainly near the hornblende zone. There are lenticular bands of coarser quartz mosaic up to 1.5 mm in size and with diopside, opaque mineral and orthoclase. The hornblende zone is mainly composed of phenoblastic green hornblende, orthoclase, quartz, opaque mineral a little brown biotite and relic plagioclase enclosed by a fine-grained plagioclase mosaic with bornblende, opaque mineral, leucoxene, minute sphene, rutile, apatite and zircon. Hornblende, too, contains minute and rounded inclusions of plagioclase. Orthoclase and quartz phenoblasts are usually unhedral and often includes other minerals poikilitically, suggesting the product of later stage. There present diopside veinlets cutting the rock.
HCA12B	Desquite Q. 6	granodiorite	Hornblende-Biotite Granodiorite The rock shows a hypidiomorphic and granular texture and consists mainly of unhedral quartz up to 3 × 1.5 mm in size, subhedral to euhedral plagioclase up to 3 × 1 mm, subhedral green hornblende up to 5 × 2 mm and subhedral brown biotite up to 4 × 3 mm. Accessory magnetite, apatite, zircon and sphene are present in small to trace amounts. A little chlorite and epidote occur replacing mafic minerals and plagioclase.

Sample No.	Location	Macroscopic description	Microscopic observation
Q11S48	Gitana-NW Q. 11	Micro gabbroic diorite	Hornblende Granodiorite The rock shows a hypidiomorphic and granular texture and consists mainly of plagioclase, quartz, potash feldspar and green hornblende. Plagioclase is most abundant among felsic minerals. Accessory muscovite, magnetite, apatite, zircon and sphene occur in small to trace amounts. The grain size is less than 1 mm except for some crystals of plagioclase which come up to 3 × 1 mm. Plagioclase is subhedral to euhedral in form, and shows commonly zonal structure and twinning albite with occasional Pericline type. Quartz and potash feldspar are generally unhedral in form, filling among plagioclase and mafic crystals. Hornblende is often replaced by actinolite, biotite and quartz, suggesting a sort of thermal effect.
HCA13A	Desquite Q. 6	Strongly silicified granitic rock	Diopside-Hornblende Hornfels The rock consists of the diopside hornfels and the hornblende similar to Sample HCA12A. The diopside zone is essentially a fine-grained granoblastic hornfels composed mainly of diopside, plagioclase, orthoclase, sphene and opaque mineral up to 0.05 mm in size, filling microphenoblastic diopside, Quartz, orthoclase, opaque mineral and a little hornblende of 0.1 to 0.2 mm in size. The hornblende zone consists mainly of phenoblastic matrix composed chiefly of hornblende, plagioclase orthoclase, sphene and opaque mineral up to 0.1 mm in size. Many poikilitic inclusions of minute and rounded plagioclase and others are often present in hornblende and quartz phenoblasts. A network of coarser-grained quartz, up to 1.5 mm in size, developes in the hornblende zone, suggesting the presence of fine-cracks in the original rock.

Sample No.	Location	Macroscopic description	Microscopic observation
Q1370	Gitana-NW Q. 13	Micro granodiorite	Biotite-Hornblende Granodiorite The rock shows a hypidiomorplic and granular texture and consists mainly of subhedral to euhedral plagioclase up to 1.8 × 1.5 mm in size, unhedral to subhedral quartz up to 2 × 1.5 mm, unhedral to subhedral potash feldspar up to 2 × 1 mm, subhedral to euhedral green hornblende up to 1.8 × 1 mm. Potash feldspar occupies about 10 % of felsic constituents and the rock is one near quartz diorite. Plagioclase is essentially of andesine, but it is commonly zoned up to marginal oligoclase. It is usually twinned after albite law with occasional pericline twins. Magnetite, apatite and zircon are accessary. Biotite and hornblende are partly replaced by epidote and chlorite.
RM-6	Paraiso Q. 1-S	granodiorite	Biotite-Hornblende Granodiorite The rock shows a hypidiomorphic and granular texture and consists mainly of unhedral to euhedral quartz up to 5 × 4mm, subhedral to euhedral plagioclase up to 3 × 2mm, unhedral to subhedral potash feldspar up to 5 × 1mm, subhedral brown biotite up to 2 × 2.5 mm and subhedral green hornblende up to 3 × 2mm. A small myrmekite occurs between plagioclase and orthoclase crystals. Accessory opaque minerals, apatite, zircon and sphene are present in a small to trace amounts. Plagioclase is partly replaced by sericite and mafic minerals are partly replaced by chlorite and epidote.
HCA14	Desquite Q. 6	Strongly silicified sedimentary rock	Biotite-Muscovite Hornfels The rock is a granoblastic texture and consists mainly of quartz, muscovite, chlorite, brown biotite, opaque minerals and leucoxene. Quartz includes commonly minute grains of flaky muscovite and biotite, rounded plagioclase and opaque minerals. Biotite-muscovite veinlets and chlorite-muscovite films are cut the rock, suggesting developed micro-fractures in the original rock.

Sample No.	Location	Macroscopic description	Microscopic observation
QCPP 49	Gitana-NW Q. 13	Basaltic andesite	Metamorphosed Andesite The rock is andesite fairly affected by a contact metamorphism remaining clearly the original porphyritic texture. Residual phenocrysts of twinned and zoned plagioclase subhedra up to 1.5 × 1 mm in sixe, pseudomorphic mafic minerals now changed into aggregates of fine-grained green amphibole laths up to 1 mm in length and microphenocrystic relic magnetite grains are enclosed in a fine-grained granoblastic matrix of quartz and plagioclclase mosaics with abundant laths of green amphibole, small amounts of magnetite, leucoxene and brown biotite up to 0.05 mm in grain size. Relic plagioclase phenocrysts, too, are often replaced by green amphibole and subordinate biotite chiefly along cracks and zoning planes. Several veinlets of green amphibole cut the rock. Magnetite is probably titaniferous and often leucoxenized marginally. Green amphibole is mainly of hornblende with a preochloism of X=pale green, Y=green and Z=bluish green but actinolite and actinolitic hornblende occur commonly.
M8021	Diamante Mina Marina	Porphyritic andesite	Metamorphosed Andesite The rock is meta-andesite with the original porphyritie texture and completely rearranged matrix. Relic zoned plagioclase subhedras up to 3.5 × 3 mm in size and aggregates of brown biotite often with a little actinolite and epidote are enclosed in a granoblastic matrix composed mainly of brown biotite, yellowish epidote, plagioclase, quartz and leucoxene up to 0.1 mm in size. Relic plagioclase phenocrysts are andesine in composition and are replaced fairly by fine-grained epidote, brown biotite, quartz and chlolite. Accessory zircon, apatite and magnetite are possibly relic minerals. Original rock is andesite judging from the presence of abundant relic phenocrysts of plagioclace and pseudomorphic mafic minerals (now biotite aggregates) and the lack of quartz phenocryst.

Sample No.	Location	Macroscopic description	Microscopic observation
F-9	Bombona Q. 17-S	Micro granodiorite	Biotite-Hornblende Granodiorite The rock shows a fine-grained hypidiomorphic and granular texture and is mainly composed of unhedral quartz up to 1.5 × 1.0 mm, subhedral to euhedral plagioclase up to 2.0 × 1.5 mm, unhedral to subhedral potash feldspar up to 1.0 × 0.8 mm, subhedral green hornblende up to 2.5 × 0.3 mm, subhedral brown biotite up to 1.5 × 1.3 mm. Accessory apatite, zircon, sphene and opaque minerals are present. Small amounts of chlorite, epidote and sericite are present as alteration products.

A. I-5 Microscopic Observation of the Polished Section

Sample No.	Location	Macroscopic Description	Microscopic Observation
MM 1	Diamante Area Mina Marina	Arsenopyrite ore	Mineral assemblage: arsenopyrite, pyrite ..... common sphalerite ..... a few chalcopyrite, galena, covelline, tetrahedrite .....scarcely Arsenopyrite shows euhedral to anhedral crystal form and a part of of it is replaced by gangue mineral. Pyrite also shows euhedral to anhedral crystal form which contains small dotts of galena and sphalerite a few to several tens of μm in size. Sphalerite is unhedral and contains a lot of chalcopyrite dot and is often associated with arsenopyrite. Chalcopyrite, majority of it is a small dot in sphalerite, however, free crystal in gangue mineral or closely associated with pyrite is also found. Covelline is a secondary mineral found in a periphery of sphalerite or in a minute crack.
MM 2A	Diamante Area Mina Marina	Arsenopyrite -chalcopyrite ore	Mineral assemblage: arsenopyrite, pyrite ..... common sphalerite, chalcopyrite, tetrahedrite... a few covelline ..... few electrum ..... much less Both arsenopyrite and pyrite disseminate in the ore vein and have euhedral to anhedral crystal form. Sphalerite containing chalcopyrite dot is closely associated with arsenopyrite. Chalcopyrite and tetrahedrite are formed in the corroded part of pyrite. Covelline is a secondary mineral. Electrum, 2-25 μm in size, is found in pyrite crystal.
MM 2B	Diamante Area Mina Marina	Arsenopyrite -sphalerite ore	Mineral assemblage: arsenopyrite, pyrite ..... common sphalerite, tetrahedrite ..... a few chalcopyrite, covelline ..... scarcely The same as MM 2A. Aside from that, chalcopyrite commonly occurs as a dot in sphalerite but in rare case it is included in arsenopyrite crystal

Sample No.	Location	Macroscopic Description	Microscopic Observation
			and EPMA discloses that tetrahedrite contains lots of silver.
MM 3	Diamante Area Mina Marina	Arsenopyrite -sphalerite ore	Mineral assemblage: arsenopyrite ..... common sphalerite ..... a few covelline ..... few electrum ..... scarcely Arsenopyrite is euhedral to anhedral crystal. Sphalerite with dotted crystal of chalcopyrite is commonly associated with arsenopyrite. Covelline is found in the crack or at the margin of sphalerite crystal. A single crystal of electrum (Ca. 100 μm in size) is found in the skelton crystal of arsenopyrite.
MM 4A	Diamante Area Mina Marina		Mineral assemblage: arsenopyrite ..... common sphalerite ..... a few covelline, galena, chalcopyrite ..... few The occurrance of arsenopyrite, sphalerite and covelline is the same as MM 3. galena (10 μm in size) is enclosed in the crystal of arsenopyrite. Chalcopyrite commonly appears as a dot in sphalerite but a part of it is enclosed in arsenopyrite.
MM 4B	Diamante Area Mina Marina	Arsenopyrite ore	Mineral assemblage: arsenopyrite ..... common sphalerite, chalcopyrite, covelline ..... few Arsenpyrite is euhedral to anhedral crystal and a part of it is replaced with gangue mineral. Sphalerite contains dotts of chalcopyrite and is often associated with arsenopyrite. Chalcopyrite is found as a dot in sphalerite or inclusion of arsenopyrite. Covelline scattered in arsenopyrite is most probably derived from chalcopyrite.

Sample No.	Location	Macroscopic Description	Microscopic Observation
DP-LA	Diamante Area Mina Diamante	Sphalerite-galena ore	Mineral assemblage: pyrite, sphalerite ..... common galena, arsenopyrite ..... a few chalcopyrite, tetrahedrite ..... few Pyrite is anhedral and disseminates with one alignment. Sphalerite contains small dotts of chalcopyrite and a part of it occupies the minute cracks in pyrite and arsenopyrite. galena is closely associated with sphalerite and mode of occurrence is the same as sphalerite. Chalcopyrite is found both in sphalerite and in the gangue mineral and it usually associates with tetrahedrite. Tetrahedrite is also found in sphalerite as a veinlet.
DP-LB	Diamante Area Mina Diamante	Sphalerite-galena ore	Mineral assamblage: pyrite, sphalerite ..... common galena, arsenopyrite .....a few chalcopyrite, tetrahedrite ..... few The occurrence is the same as DP-LA, however, it is noted that arsenopyrite is mostly euhedral and a part of it is enclosed in pyrite. Although tetrahedrite has strong paragenesis with chalcopyrite, it is noticed in part that tetrahedrite is intruding among chalcopyrite and sphalerite. Tetrahedrite is later product than chalcopyrite and sphalerite.
N-13	Mina Desquite	Arsenopyrite -sphalerite ore	Mineral assemblage: pyrite, arsenopyrite, sphalerite ..... common covelline ..... few Both pyrite and arsenopyrite show euhedral to anhedral crystal and disseminate in the vein. Sphalerite contains much less chalcopyrite dot than the ore at Mina Marina and is commonly associated with arsenopyrite. Covelline is the secondary mineral appearing periphery and cracks of sphalerite crystal. Limonite is also noted as a secondary mineral.

Sample No.	Location	Macroscopic Description	Microscopic Observation
N-14	Mina Desquite	Sphalerite-galena ore	Mineral assemblage: sphalerite ..... common galena, pyrite, chalcopyrite ..... a few tetrahedrite ..... few Sphalerite contains a lot of chalcopyrite dotts and it forms a vein-like precipitation. galena is closely associated with sphalerite. Chalcopyrite appears not only as a dot in sphalerite, but also as paragenesis with galena and as a scattered single crystal in the gangue mineral. Tetrahedrite usually associates with chalocpyrite.
N 57A	Paraiso Area Mina San Luis	Sphalerite-galena ore	Mineral assemblage: pyrite, sphalerite, galena, cerussite tetrahedrite ..... common argentite ..... few electrum ..... scarcely Pyrite is euhedral to anhedral. Sphalerite seldom contains chalcopyrite dot. The marginal part of galena contains exsolutional dot of argentite. (a few to several tens μm in size) Argentite is also found in sphalerite. Electrum (5 to 75 μm in size) is found in tetrahedrite or in the crystal boundary of pyrite and tetrahedrite.
N 57B	Paraiso Area Mina San Luis	Pyrite ore	Mineral assemblage: pyrite ..... common sphalerite, chalcopyrite, tetrahedrite... a few covelline, arsenopyrite ..... few electrum ..... scarcely The occurrence of pyrite, sphalerite and chalcopyrite is the same as N 57A. Tetrahedrite appears as crack-filling or periphery-coating of pyrite, scattered single crystal in the gangue mineral and a part

Sample No.	Location	Macroscopic Description	Microscopic Observation
			of it as a veinlet in sphalerite. Covelline is secondary product of chalcopyrite. Electrum (20 μm in size) is found in the minute crack in pyrite.
N 57C	Paraiso Area Mina San Luis	Pyrite ore	Mineral assemblage: arsenopyrite ..... common electrum .....scarcely Arsenopyrite is in the form of euhedral to anhedral and is replaced by gangue mineral. Electrum (17-30 μm in size) is found in the minute crack in arsenopyrite and crystal boundary between arsenopyrite and gangue mineral.
N 63B	Paraiso Area Mina San Luis	Pyrite-chalcopyrite ore	Mineral assemblage: pyrite ..... common chalcopyrite, covelline ..... a few sphalerite, galena ..... few Pyrite disseminates in the vein and its crystal form is euhedral to anhedral. Chalcopyrite also disseminates separately from pyrite and marginal part of chalcopyrite changes into covelline. Sphalerite seldom contains chalcopyrite dot and appears near or inside of pyrite. Galena is enclosed in pyrite.

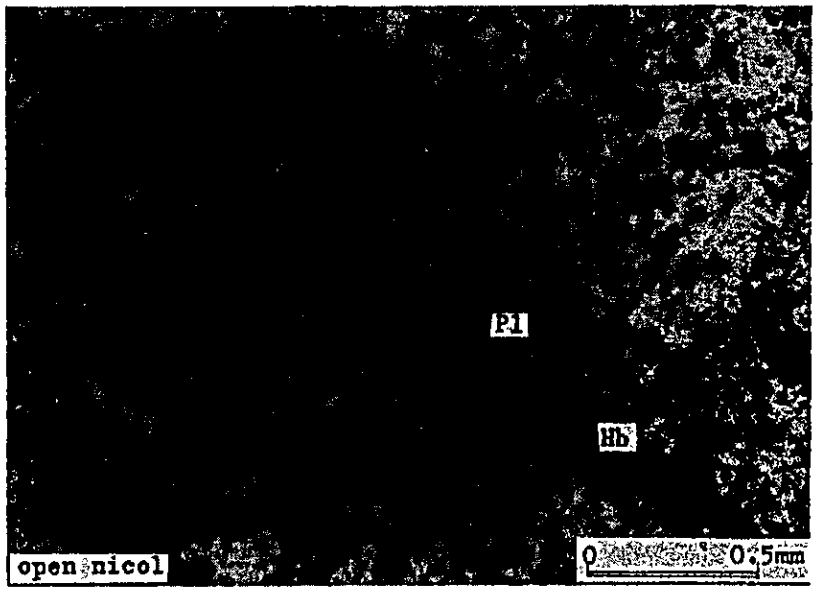
A. I-6 Photomicrographs

A. I-6-1 Thin Section

Sample No.	Location	Rock type
QCPP49	Gitana-NWQ-13	Metamorphosed andesite
Q1129	Gitana-NWQ-11	Sericite biotite quartz hornfels
Q1370	Gitana-NWQ-13	Biotite hornblende quartz diorite
Q1327	Gitana-NWQ-13	Metamorphosed andesitic tuff breccia
HCA 12A	Desquite Q-6	Diopside hornblende hornfels
HCA 12B	Desquite Q-6	Hornblende biotite granodiorite
F9	Bombona-NWQ-17	Biotite hornblende granodiorite
RM6	Paraiso Q-2	Biotite hornblende granodiorite

Abbreviations

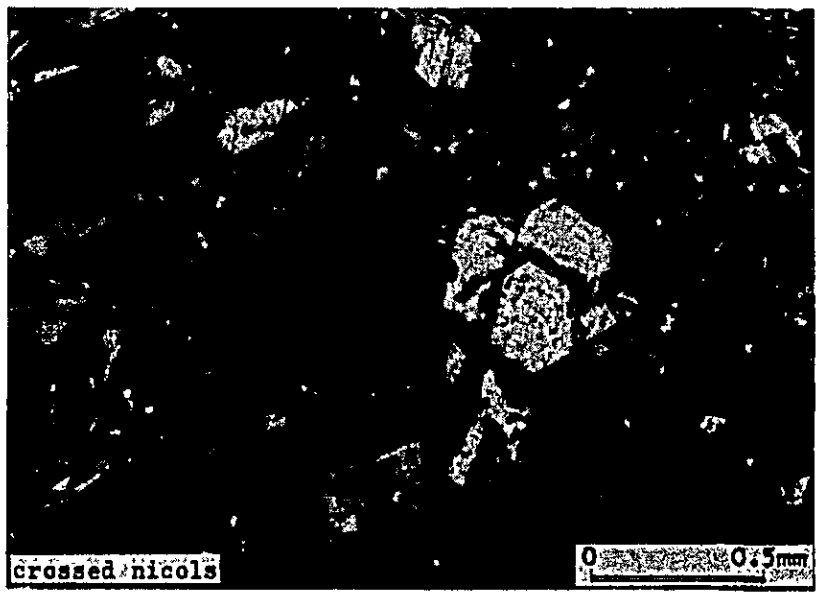
Qz : Quartz
Or : Orthoclase
Pl : Plagioclase
Bio : Biotite
Hb : Hornblende
Act : Actinolite
Diop : Diopside
Chl : Chlorite

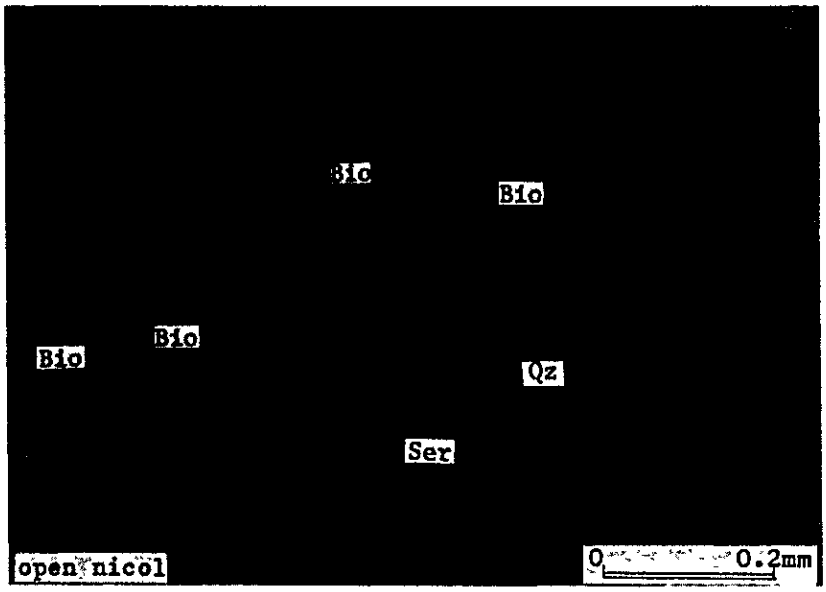


Sample No. QCPP49

Rock type:

Metamorphosed andesite

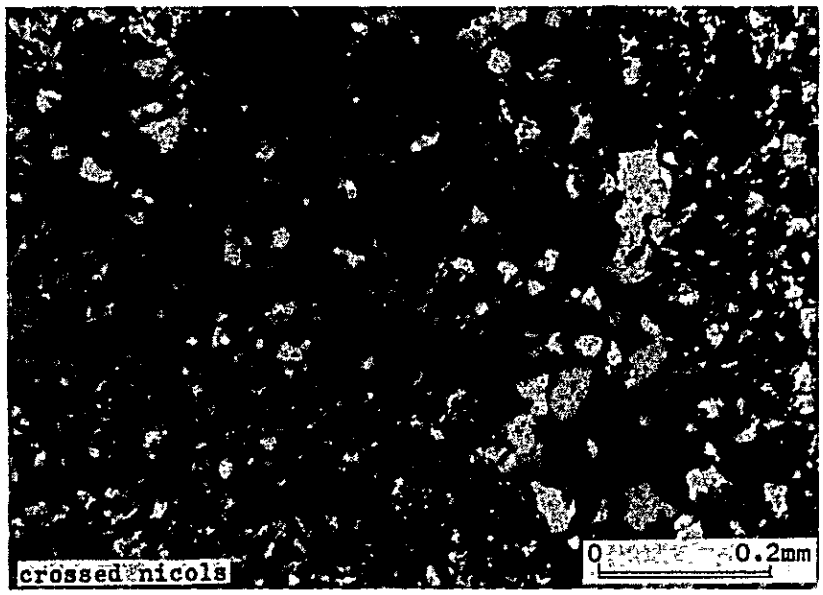


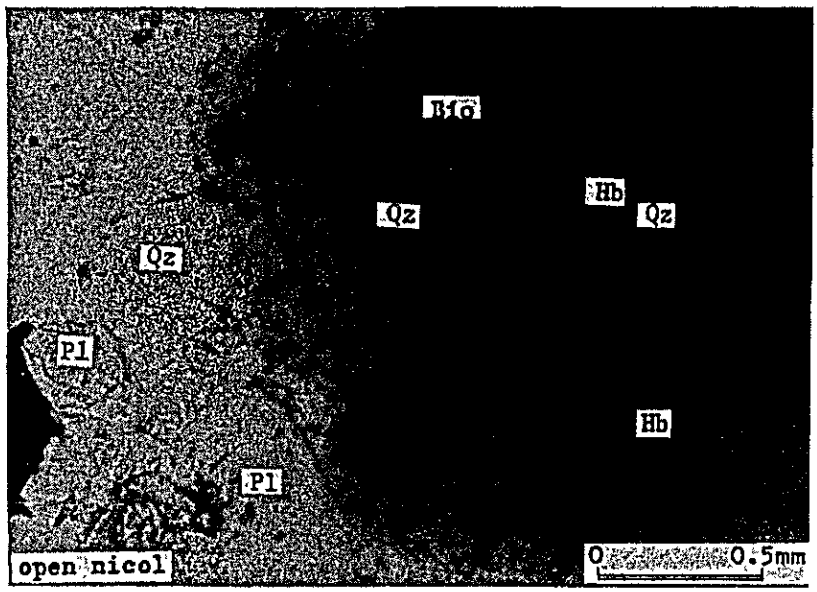


Sample No. Q1129

Rock type:

Sericite biotite quartz hornfels



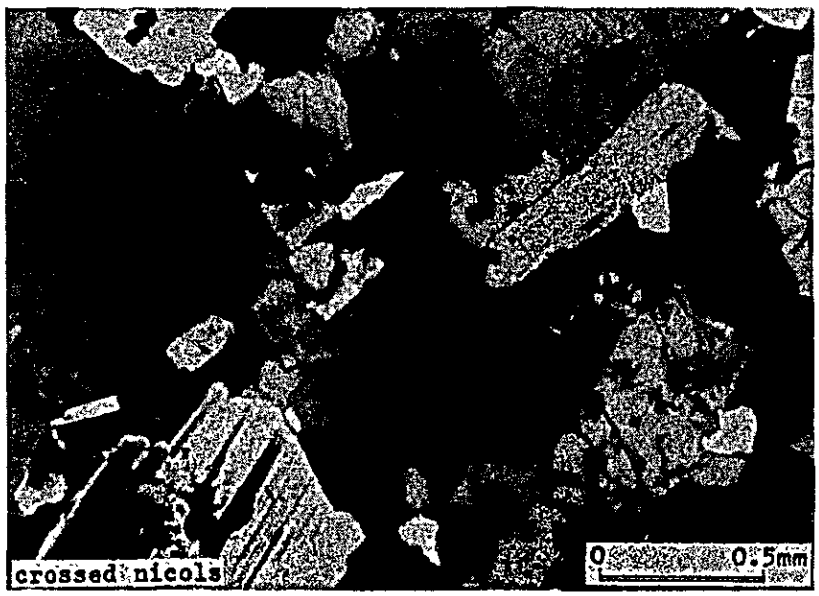


Sample No. Q1370

Rock type:

Biotite hornblende

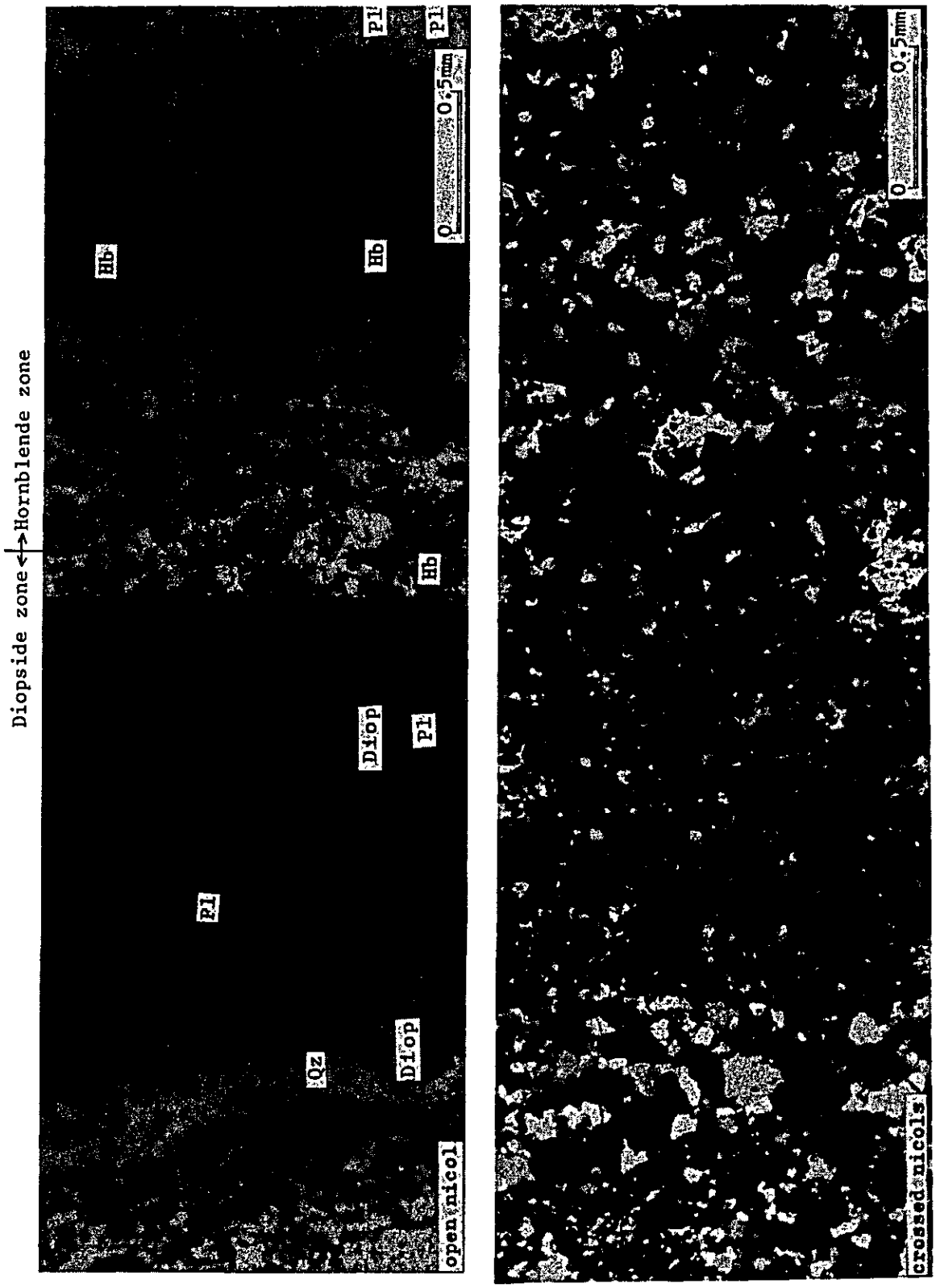
quartz diorite



Sample No. Q1327

Rock type:

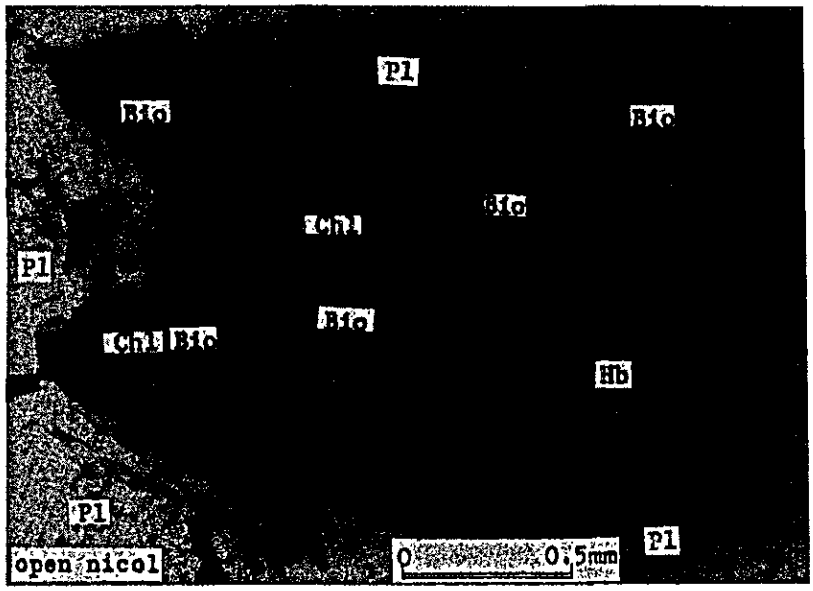
Metamorphosed andesitic tuff breccia



Sample No. HCA 12A

Rock type:

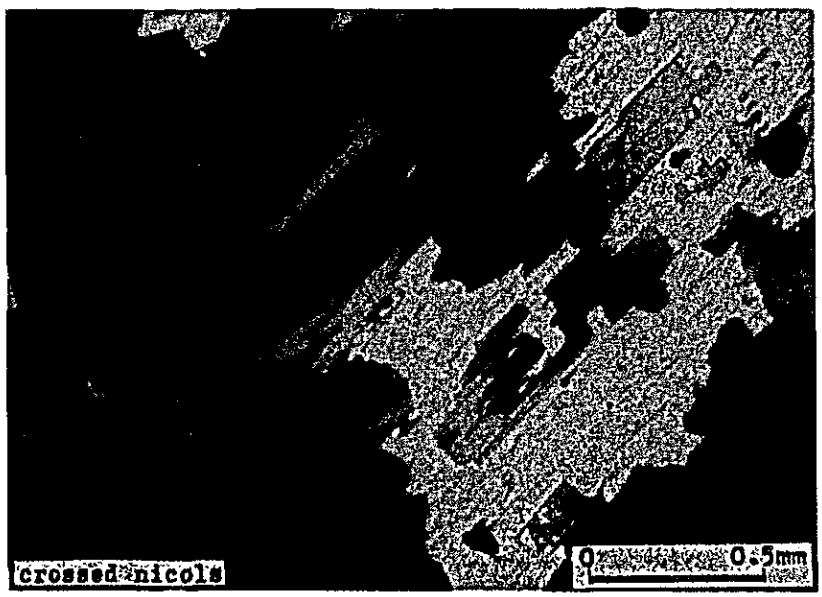
Diopside hornblende hornfels

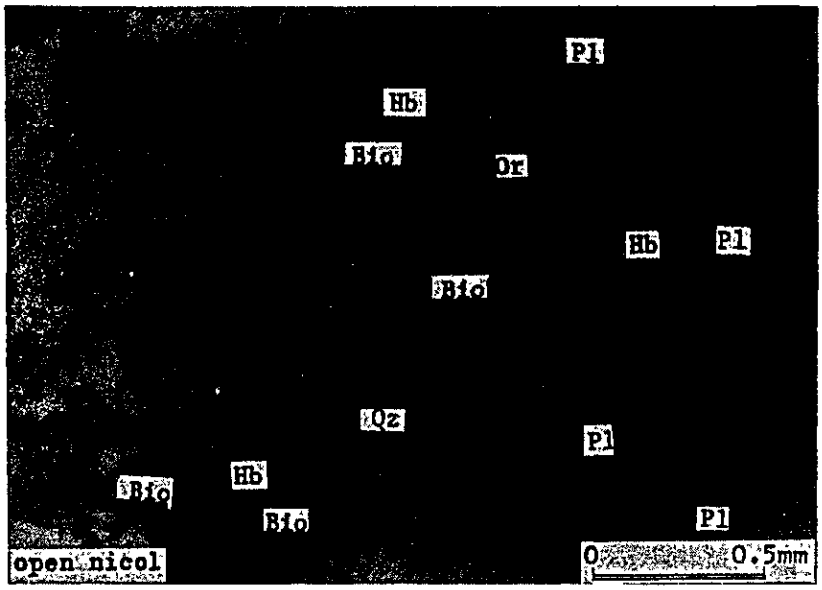


Sample No. HCA 12B

Rock type:

Hornblende biotite granodiorite

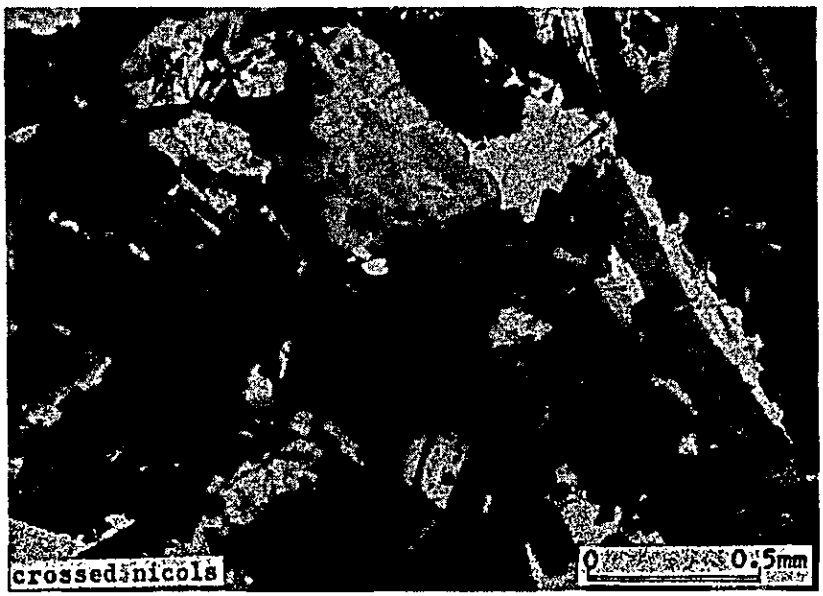


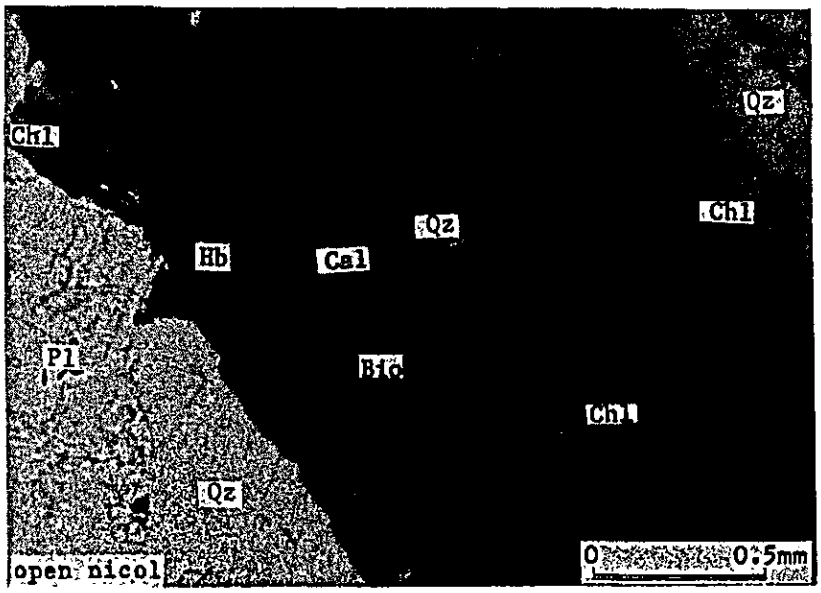


Sample No. F9

Rock type:

Biotite hornblende granodiorite





Sample No. RM6

Rock type:

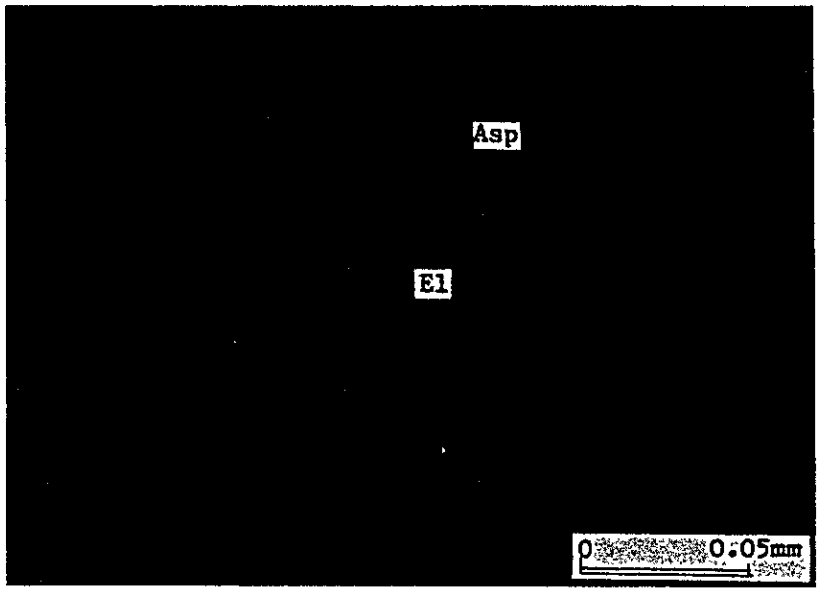
Biotite hornblende granodiorite

A. I-6-2 Polished Section

Sample No.	Location
MM2A	Mina Marina
MM2B	Mina Marina
MM3	Mina Marina
DPL-A	Mina Diamante
DPL-B	Mina Diamante
N14	Mina Desquite
N57A	San Luis
N57B	San Luis
N63A	San Antonio

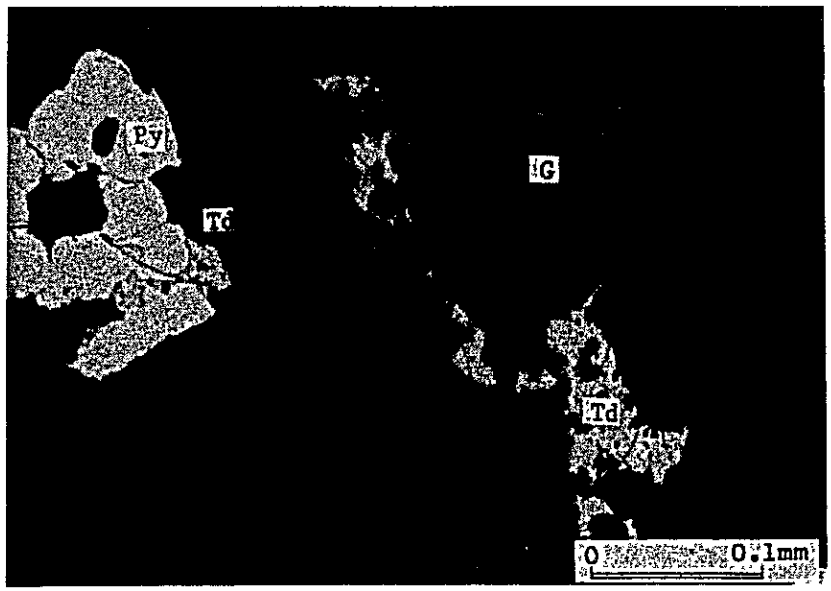
Abbreviations

Sp : Sphalerite
Gn : Galena
Cp : Chalcopyrite
Td : Tetrahedrite
El : Electrum
Arg : Argentite
Py : Pyrite
Asp : Arsenopyrite
Ce : Cerrusite
G : Gangue mineral



Sample No. MM2A

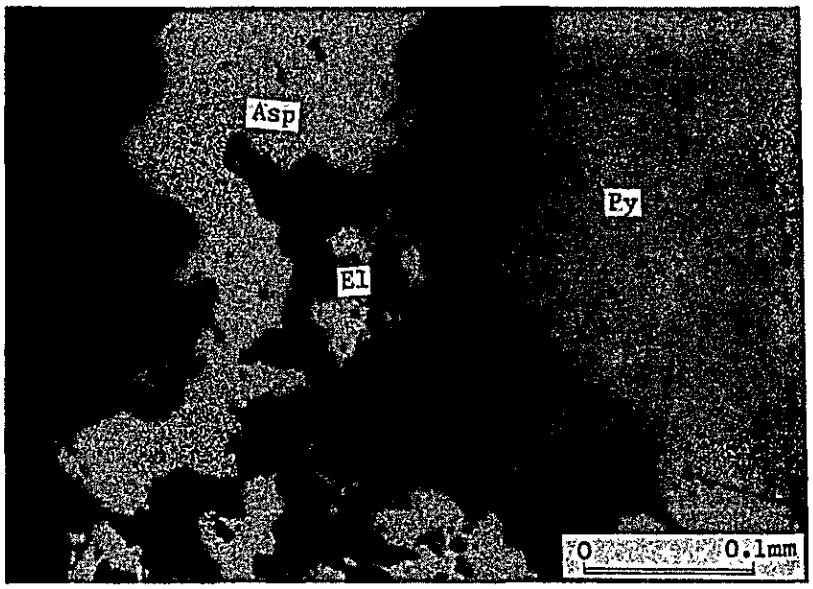
Electrum in arsenopyrite



Sample No. MM2B

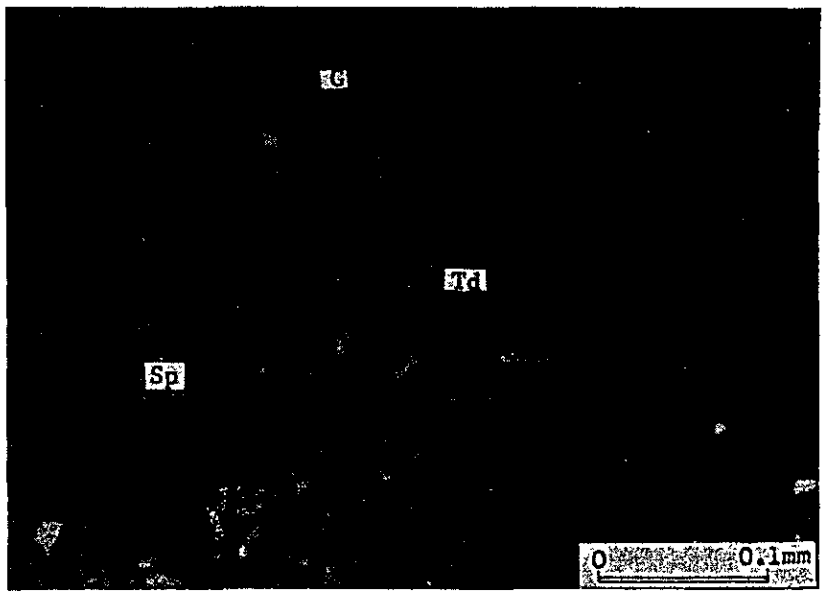
Ag bearing tetrahedrite

(conducted EPMA)



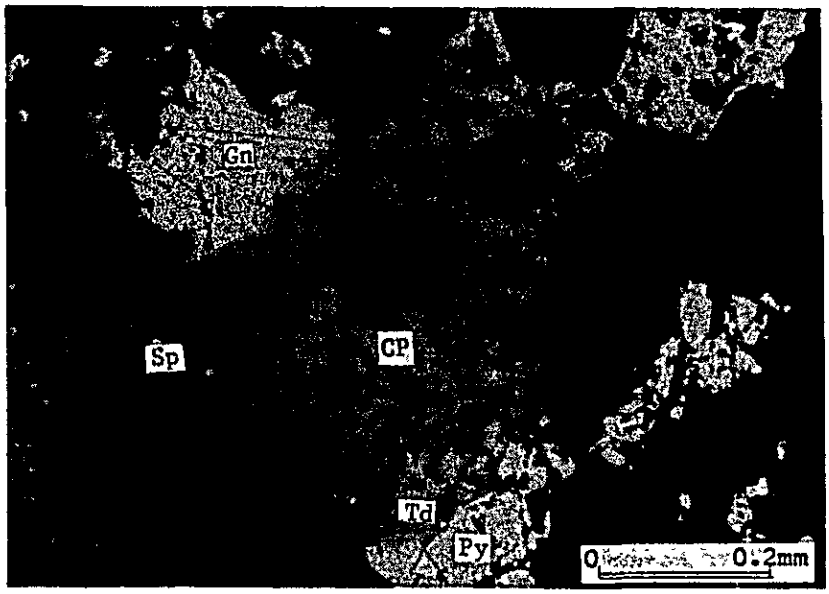
Sample No. MM3

Electrum with arsenopyrite
(conducted EPMA)



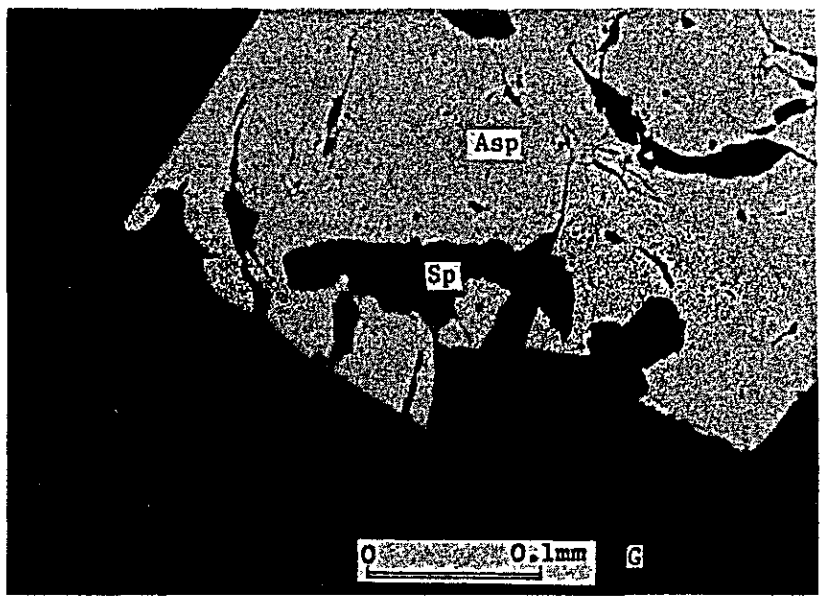
Sample No. DPL-A

Exsolution of sphalerite-
chalcopyrite-tetrahedrite
(conducted EPMA)



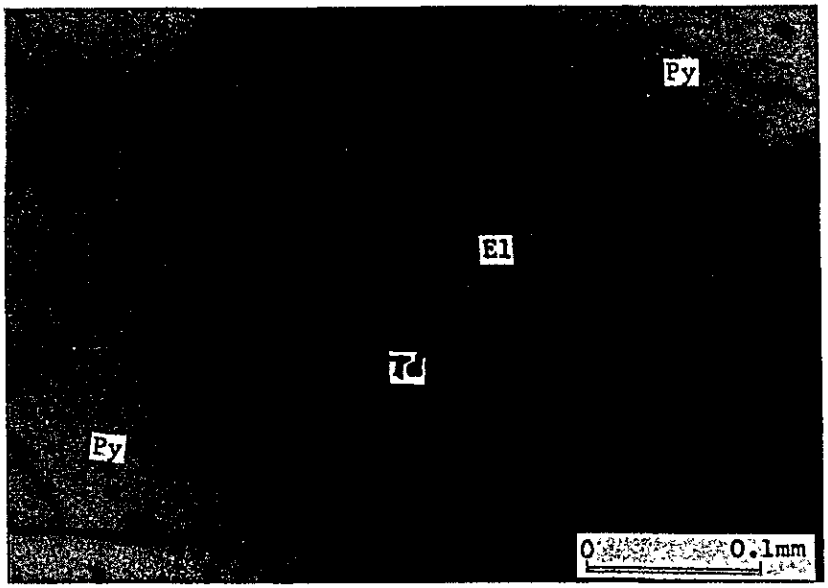
Sample No. DPL-B

Paragenesis of galena-sphalerite-chalcopyrite with latest mineral of tetrahedrite



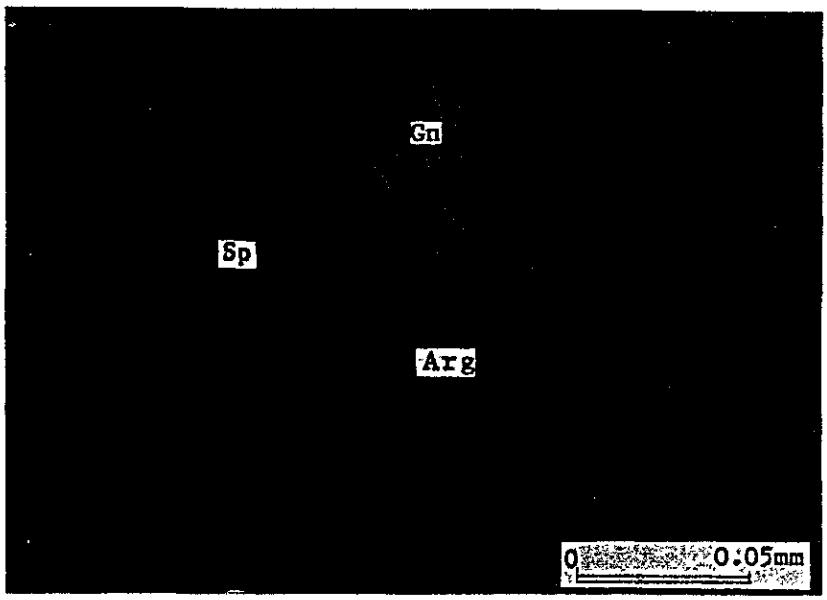
Sample No. N14

Sphalerite with exsolutional chalcopyrite replaces arsenopyrite



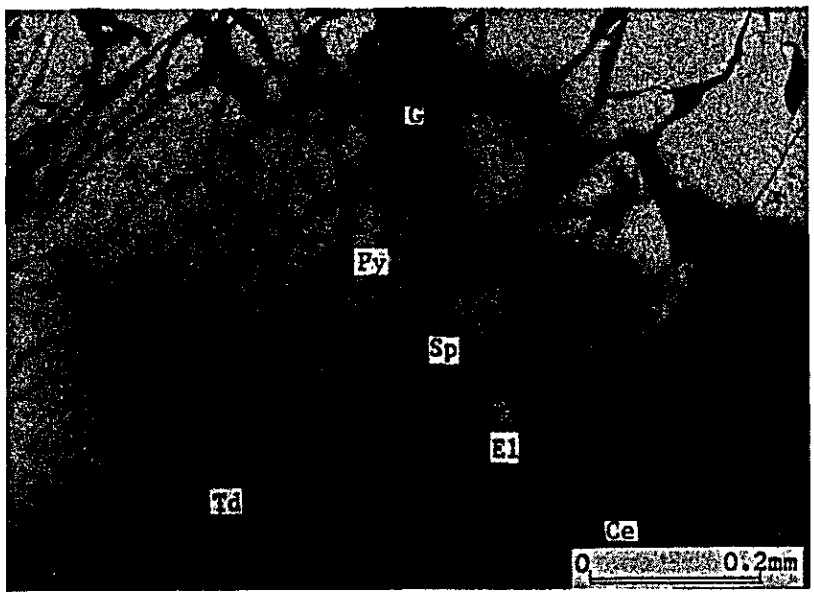
Sample No. N57A

Electrum in tetrahedrite



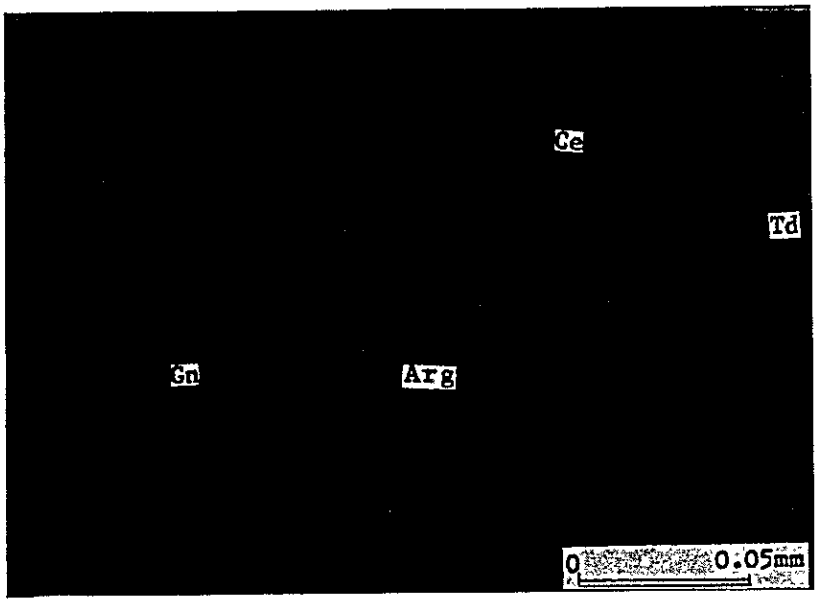
Sample No. N57A

Exsolution of galena and argentite



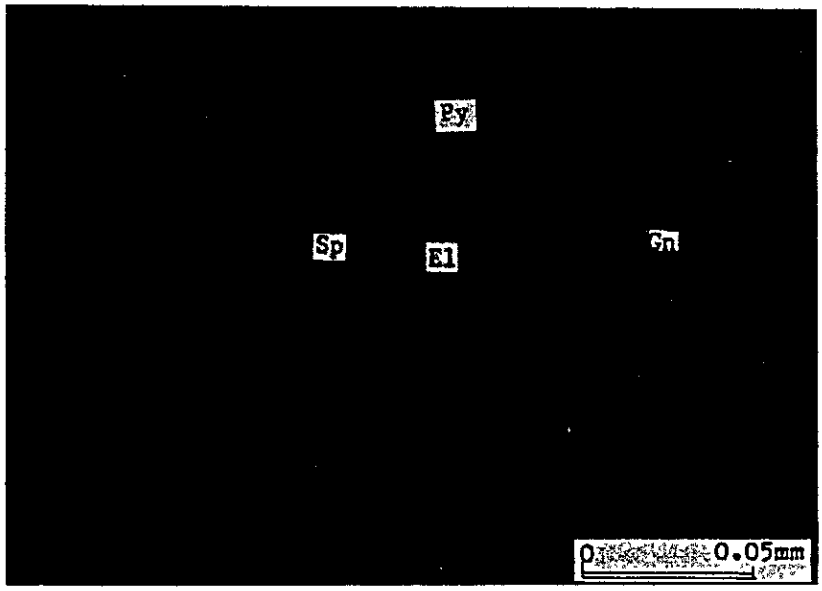
Sample No. N57A

Pyrite is replaced by tetrahedrite



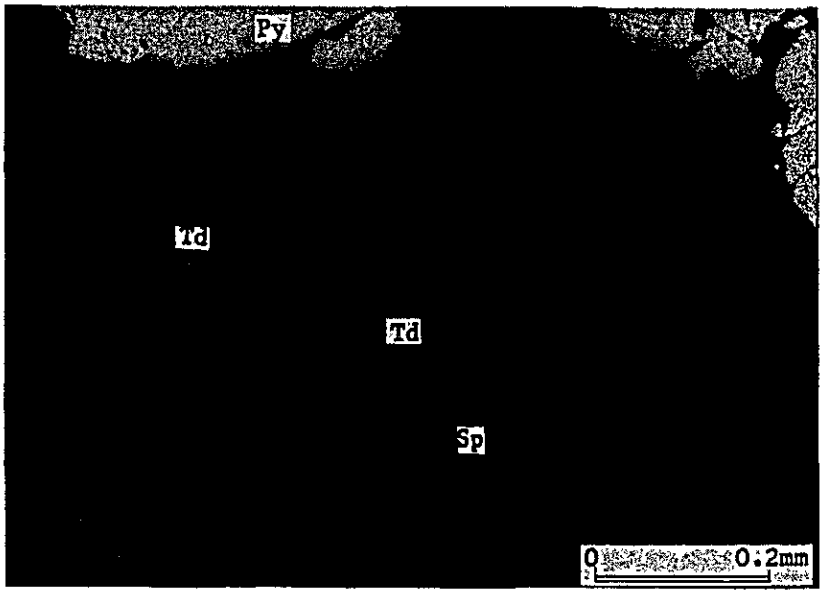
Sample No. N57A

Galena altered to cerrusite. Argentite coexists with cerrusite



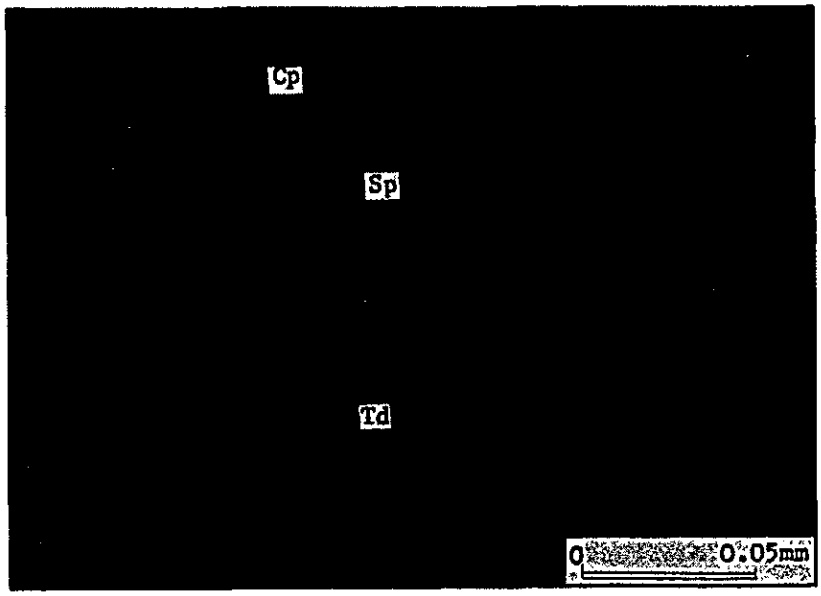
Sample No. N57B

Electrum in pyrite

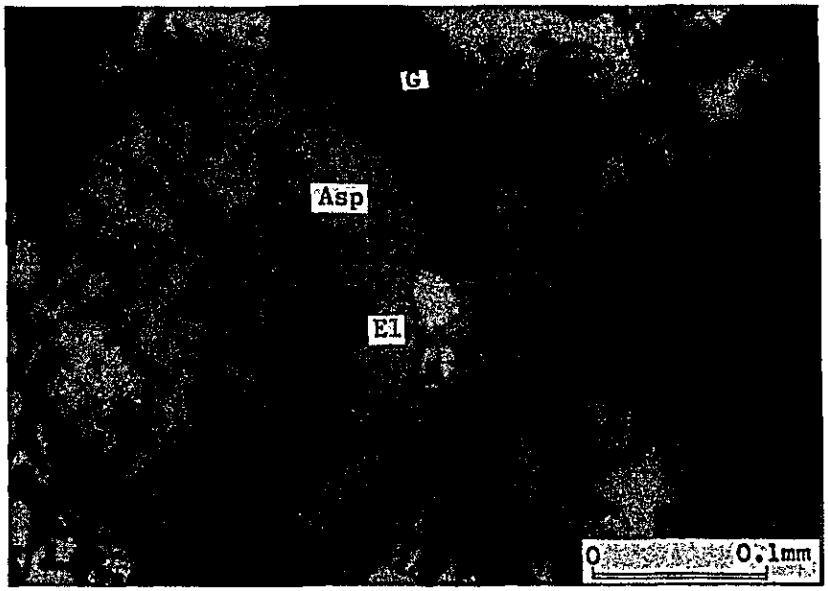


Sample No. N57B

Exsolution of sphalerite-chalcopyrite-tetrahedrite

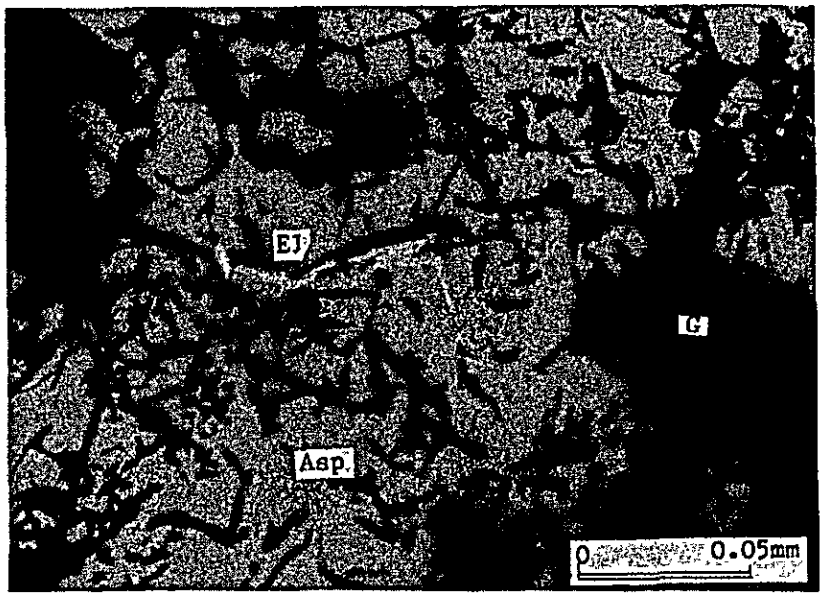


Enlarged above



Sample No. N63A

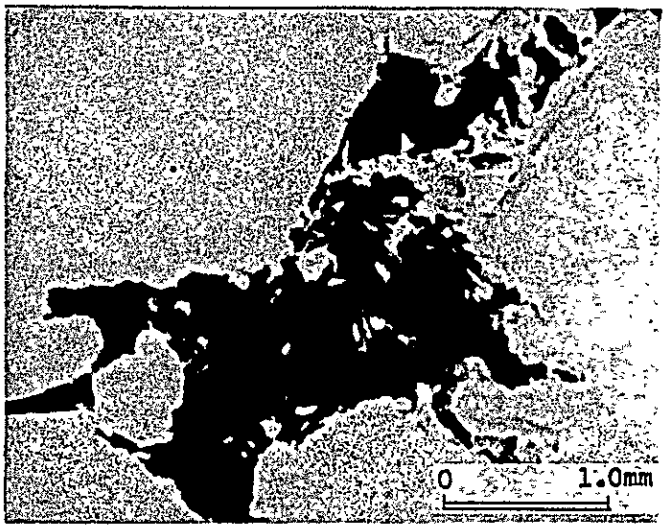
Electrum is a single crystal connected with a narrow channel



Enlarged above

Electrum in zigzag form in arsenopyrite (conducted EPMA)

A. I-6-3 EPMA



Absorted electron image

Freibergite (Ag bearing tetrahedrite) in gangue mineral

Ag X-ray image

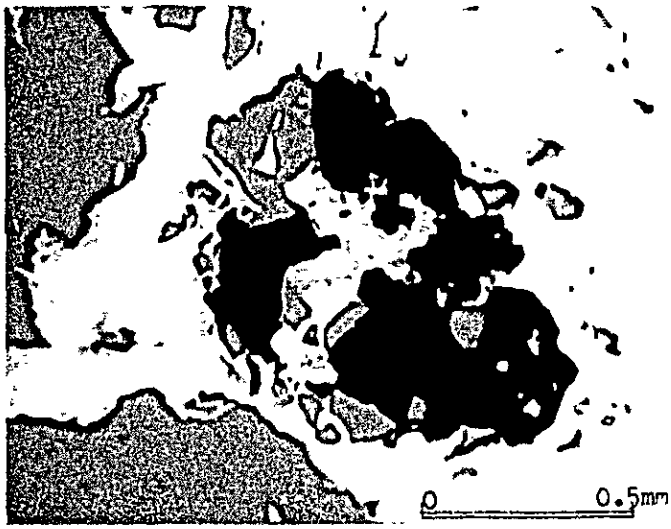
Cu X-ray image

Sample No. : MM2B
Locality : Mina marina
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA

Sb X-ray image

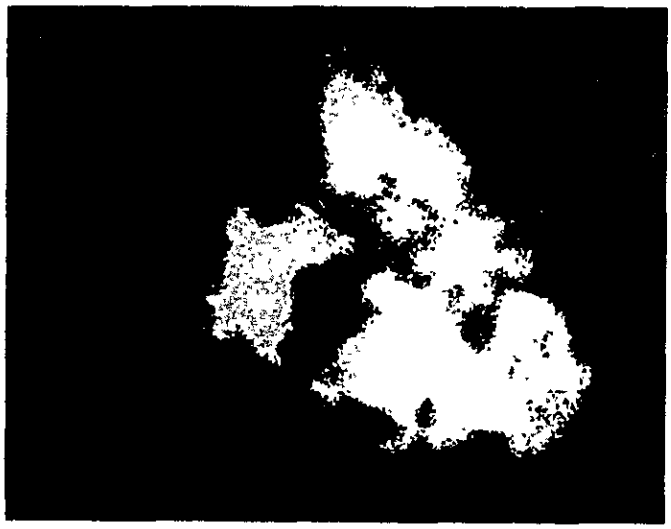
Fe X-ray image

S X-ray image



Absorbed electron image

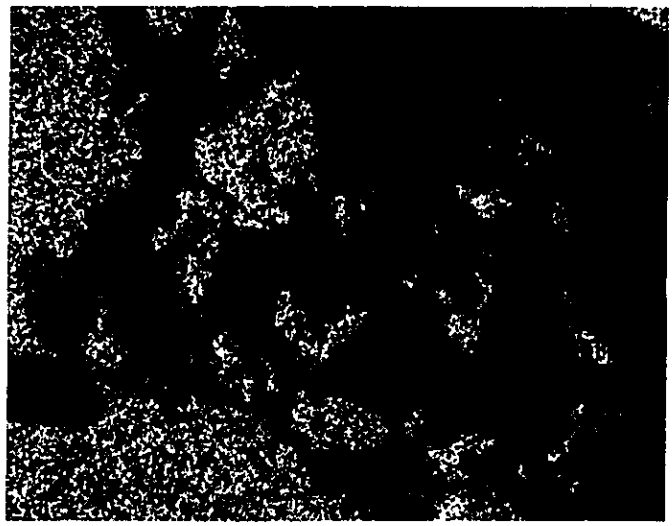
Electrum is association with arsenopyrite.



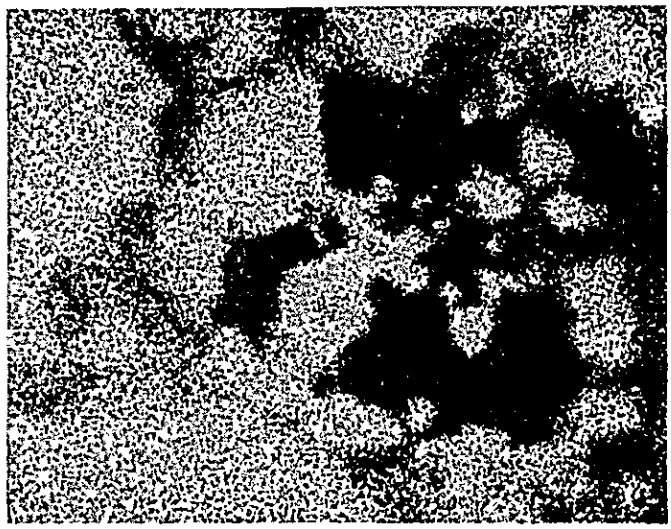
Au X-ray image

Ag X-ray image

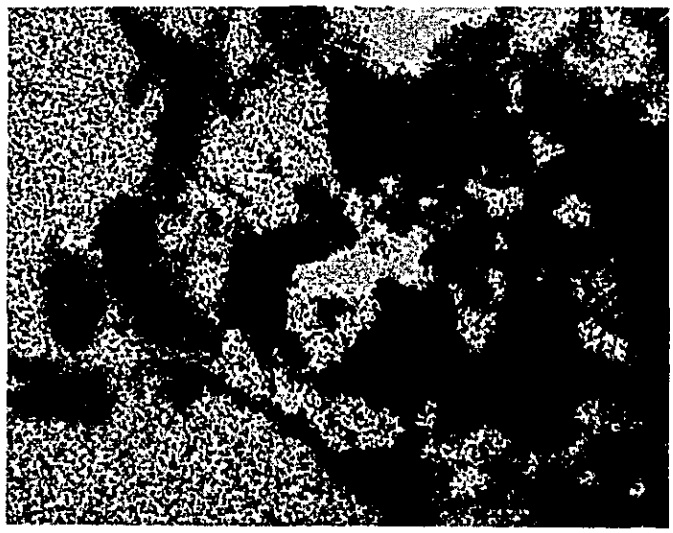
Sample No. : MM3
Locality : Mina marina
Accel. volt. : 25 kV
Absorb. elect. : 0.2 μA



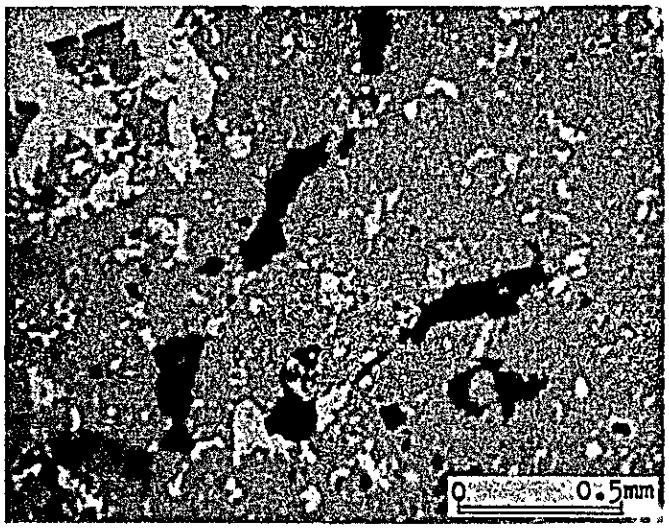
As X-ray image



Fe X-ray image

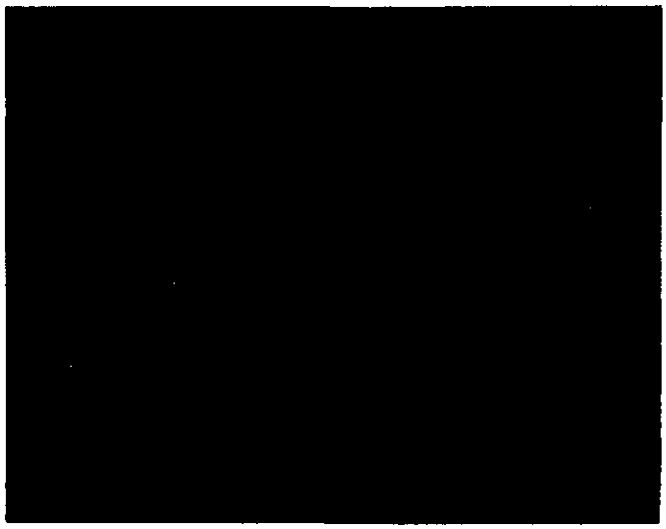


S X-ray image

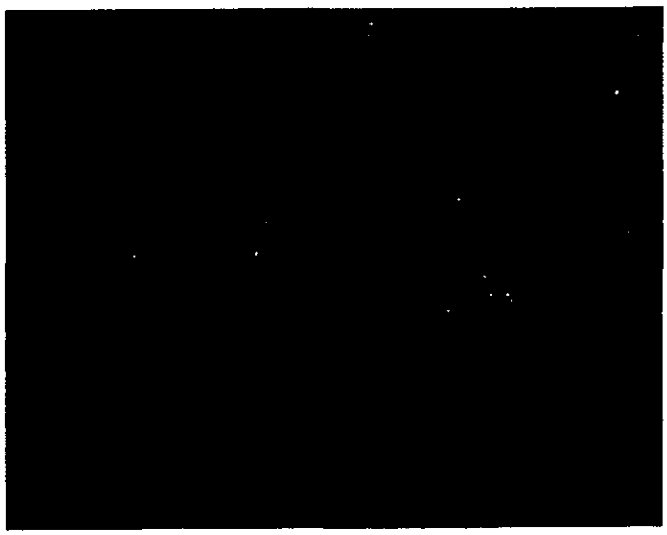


Absorbed electron image

Exsolution of Ag bearing
tetrahedrite(black in the photo)
- chalcopyrite
- sphalerite.



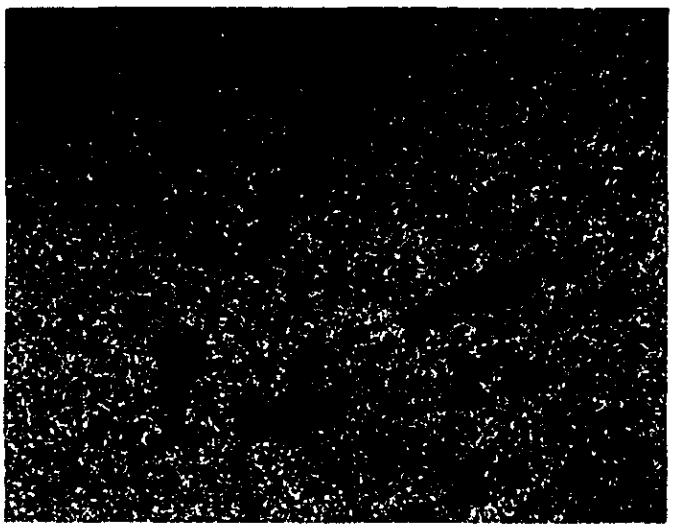
Ag X-ray image



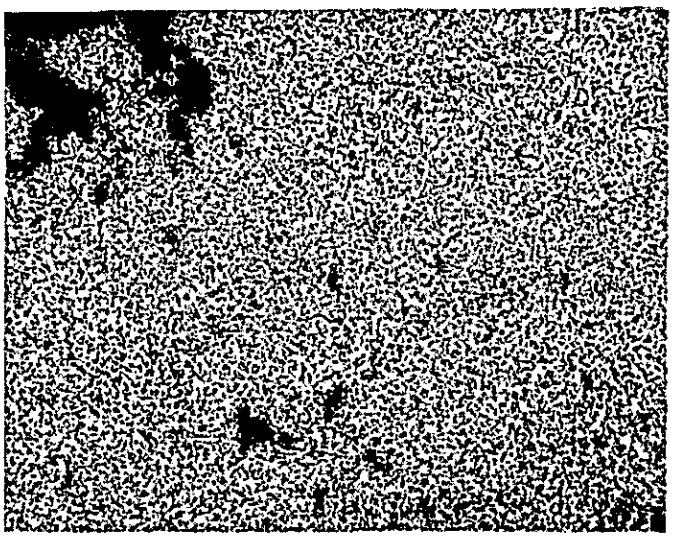
Cu X-ray image

Sample No. : DPL-A
Locality : Diamante
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA

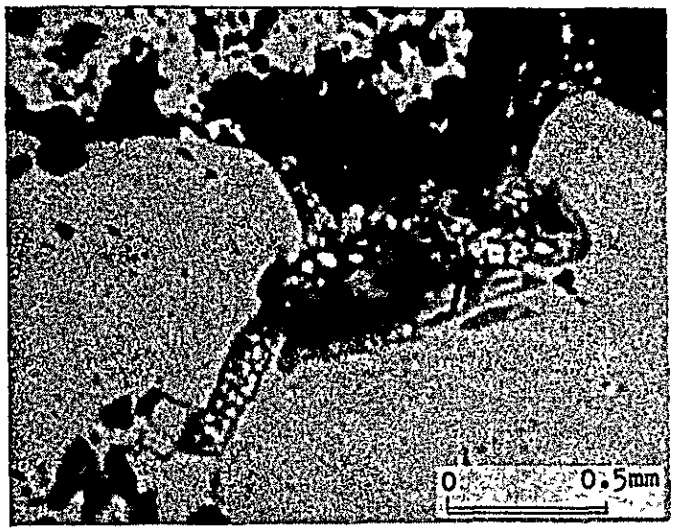
Sb X-ray image



Zn X-ray image



S X-ray image



Absorbed electron image

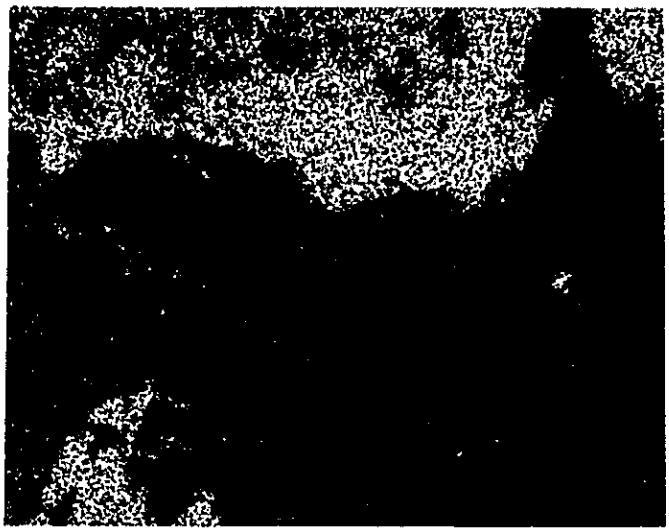
Freibergite

Ag X-ray image

Cu X-ray image

Sample No. : N57A
Locality : San Luis
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA

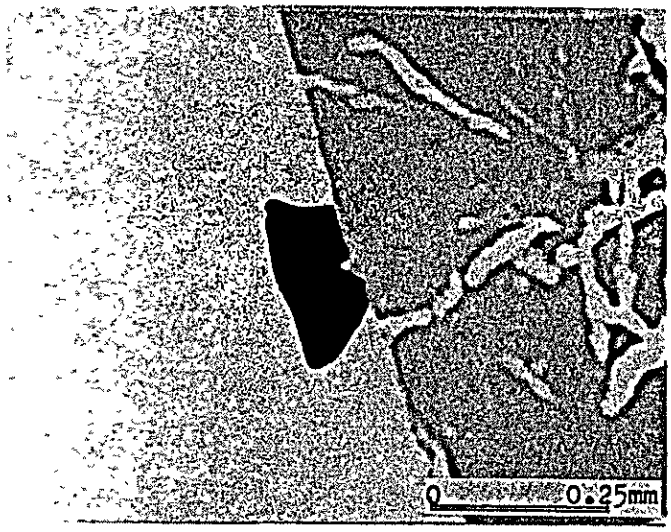
Sb X-ray image



Pb X-ray image

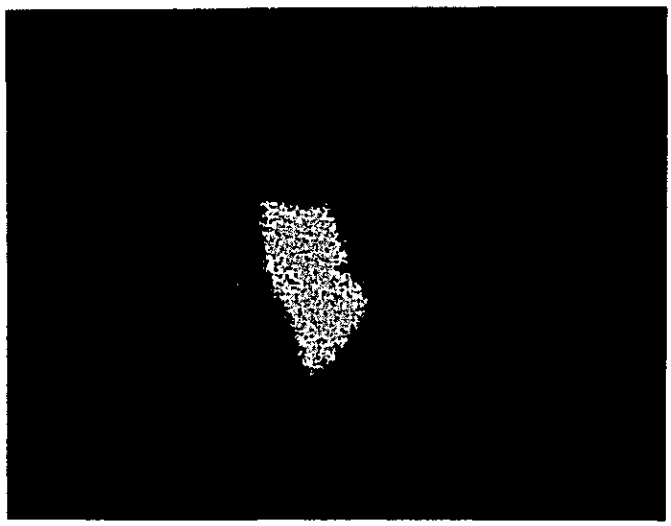
Fe X-ray image

S X-ray image

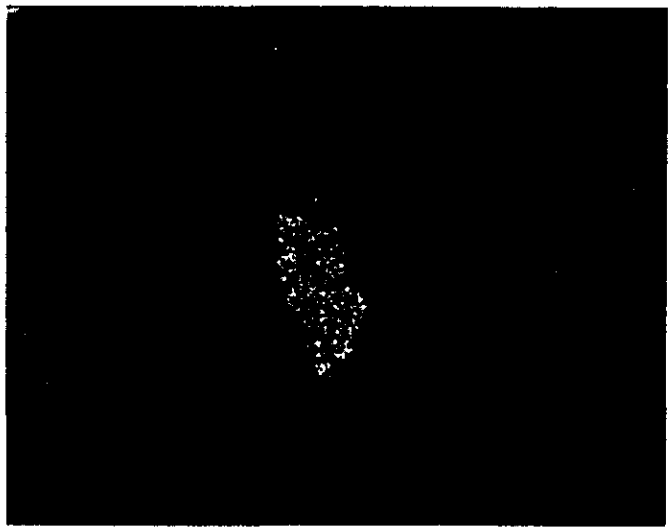


Absorbed electron image

Electrum

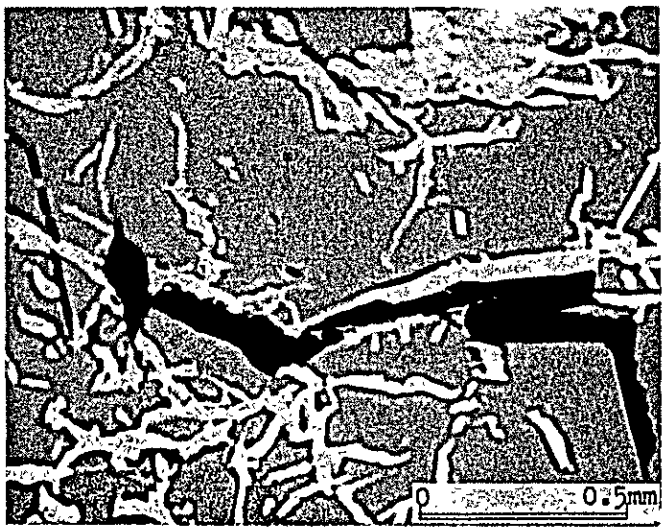


Au X-ray image



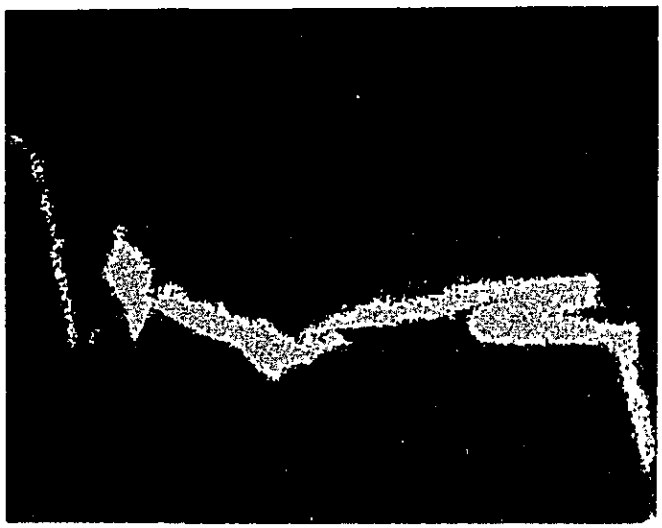
Ag X-ray image

Sample No. : N57C
Locality : San Luis
Accel. volt. : 25 kV
Absorb. elect. : 0.2 μA

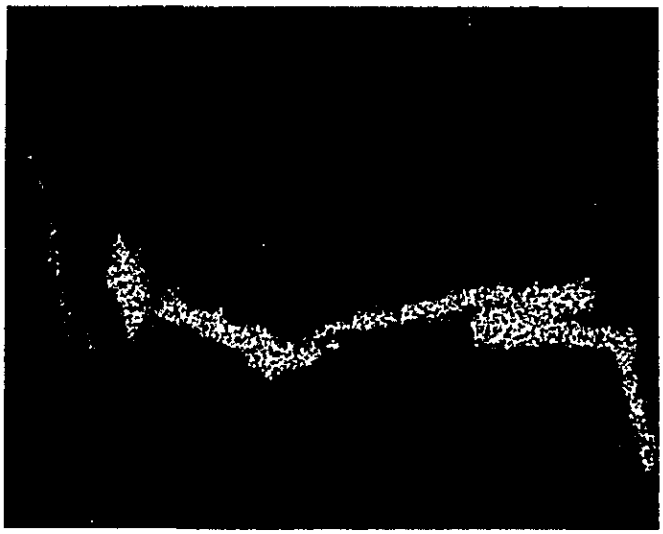


Absorbed electron image

Electrum in zigzag form
in arsenopyrite.

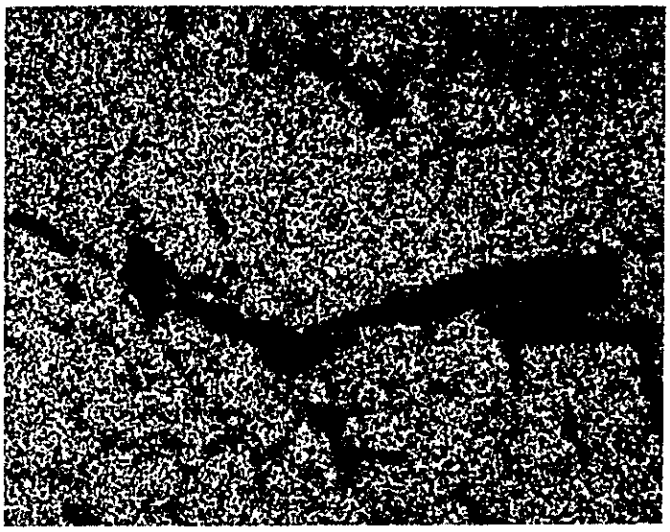


Au X-ray image

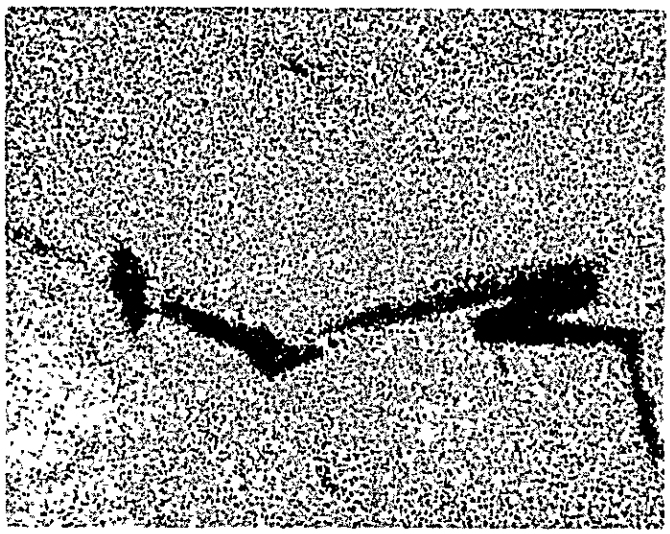


Ag X-ray image

Sample No. : N63A
Locality : San Antonio
Accel. volt. : 25 kV
Absorb. elect. : 0.2 μA



As X-ray image



Fe X-ray image

S X-ray image

A. I-7-1 Summary of X-ray Diffractive Analysis

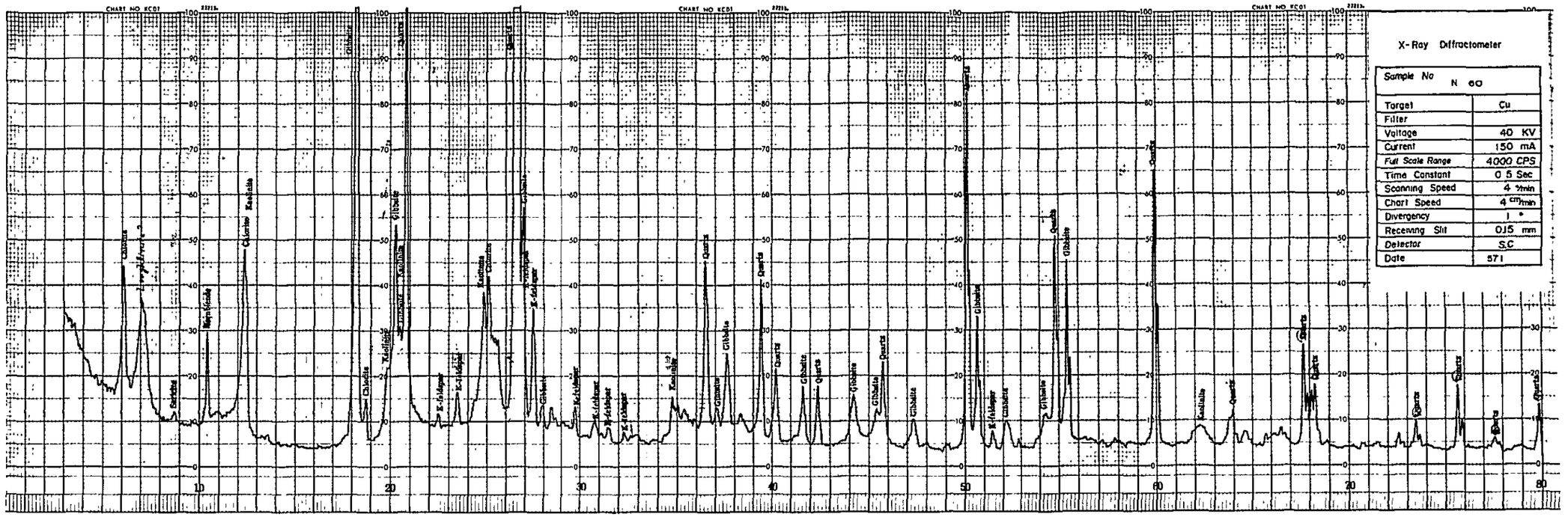
Ser. No.	Sample	Quartz	Plagioclase	K-feldspar		Hornblende	Chlorite	Sericite	Phlogopite	Montmorillonite	Kaolinite	Halloysite	Gibbsite	Anatase	Loughlinite?	Talc?	dA 8.10?	dA 7.73	Pyrite	Arsenopyrite	Goethite	Scorodite
1	N58	V						C									L			L		L
2	N59	V		L				L			M		S									
3	N60	V		L			L	S			L		V		L							
4	N61	V		V			V	S					V		L							
5	N62	V	V	L												M		M				
6	S32	V						M											S			L
7	S33	V		C				V		L												
8	S34	V		M			M	S					L									
9	S35	V	V	L		C	C		L													
10	S36	V		S				C		C												
11	S37	V		L				C		C												
12	S38	V	V	L		L	L		M													
13	GITAX-01	M						C			C			S	L							
14	GITAX-02	V						C		C	L			S								
15	GITAX-03	V						V		C				S							S	
16	GITAX-04	V						M						L								
17	GITAX-05	V	M			M	S		M													
18	GITAX-06	V						C		C	L			S								
19	GITAX-07	V						C		C				L							S	
20	GITAX-08	V						S			V											
21	GITAX-09	V					S	S				M										
22	GITAX-10	V						C		C	L			L								

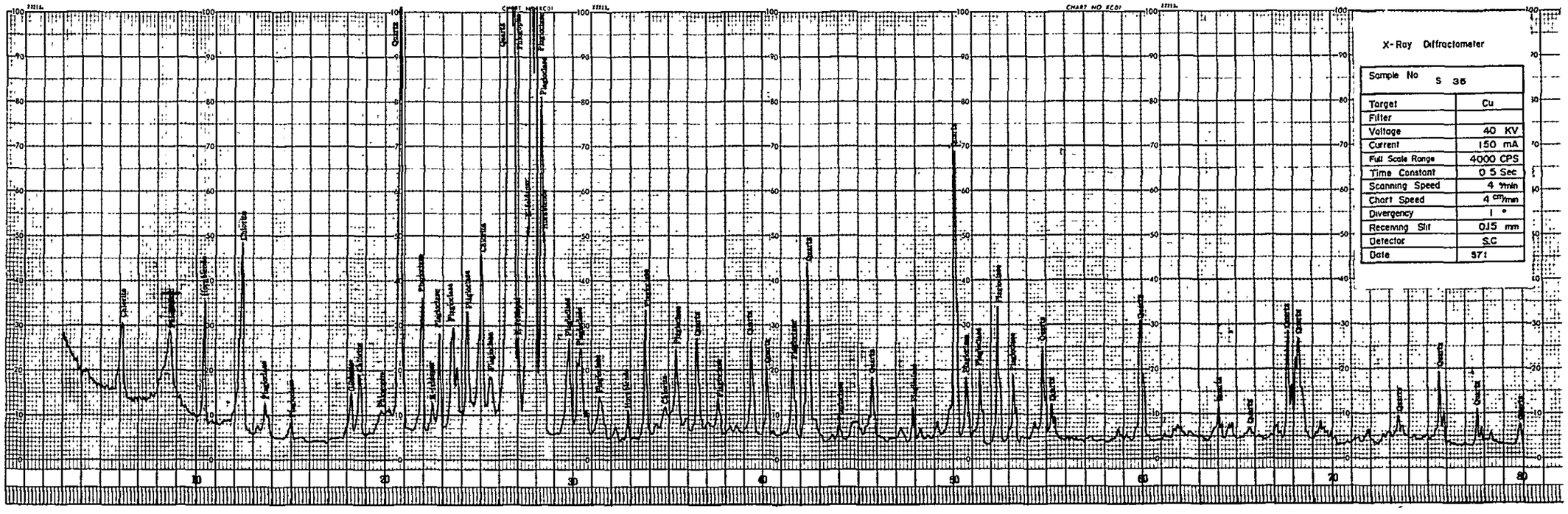
Foot Note V:very much M:much C:common L:less S:scarcely

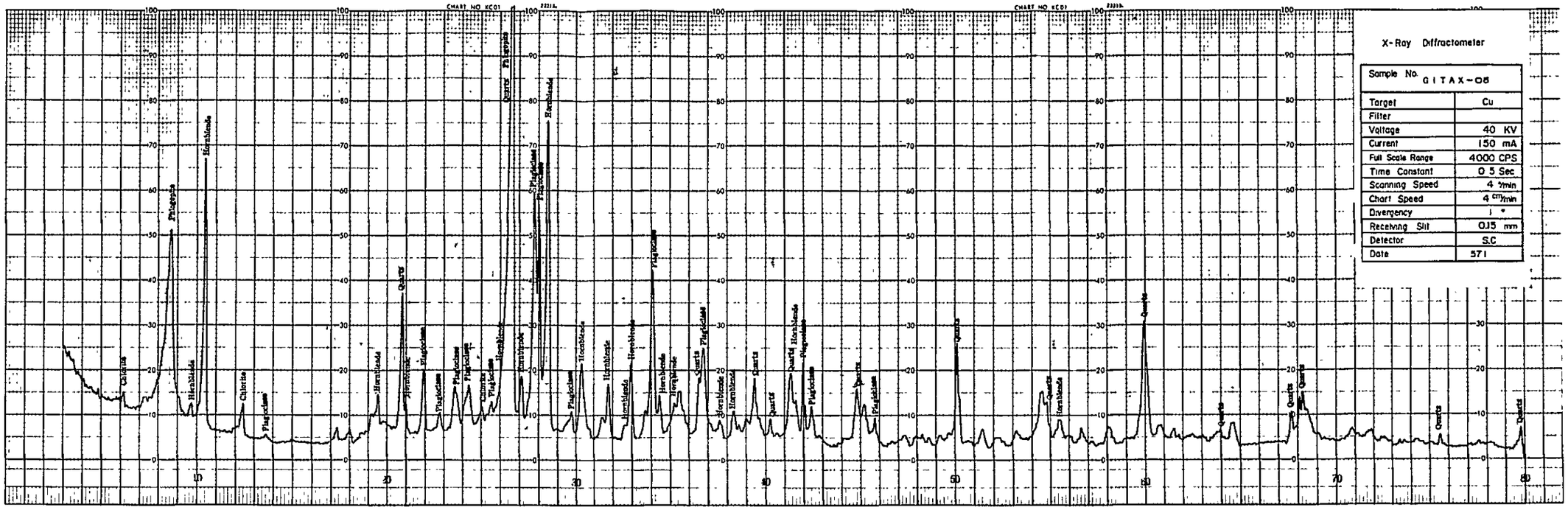
Ser. No.	Sample	Quartz	Plagioclase	K-feldspar		Hornblende	Chlorite	Sericite	Phlogopite	Montmorillonite	Kaolinite	Halloysite	Gibbsite	Anatase	Loughlimite?				Pyrite	Arsenopyrite	Goethite	Scorodite
23	GITAX-11	V						C		C	L			S								
24	GITBX-01	V				S	C	S							C							
25	GITBX-02	V						M						S								
26	GITBX-03	V						L		M	M			S								
27	GITBX-04	V													M							
28	GITBX-05	V						L		M	C			S	S							
29	GITBX-06	V				M									M							
30	MMX11- 1	V		L				L		C	S			L								
31	MMX11- 2	V						L		C	S			L								
32	MMX11- 3	V	S					C						L								L
33	MMX11- 4	V	V				C	L		L												

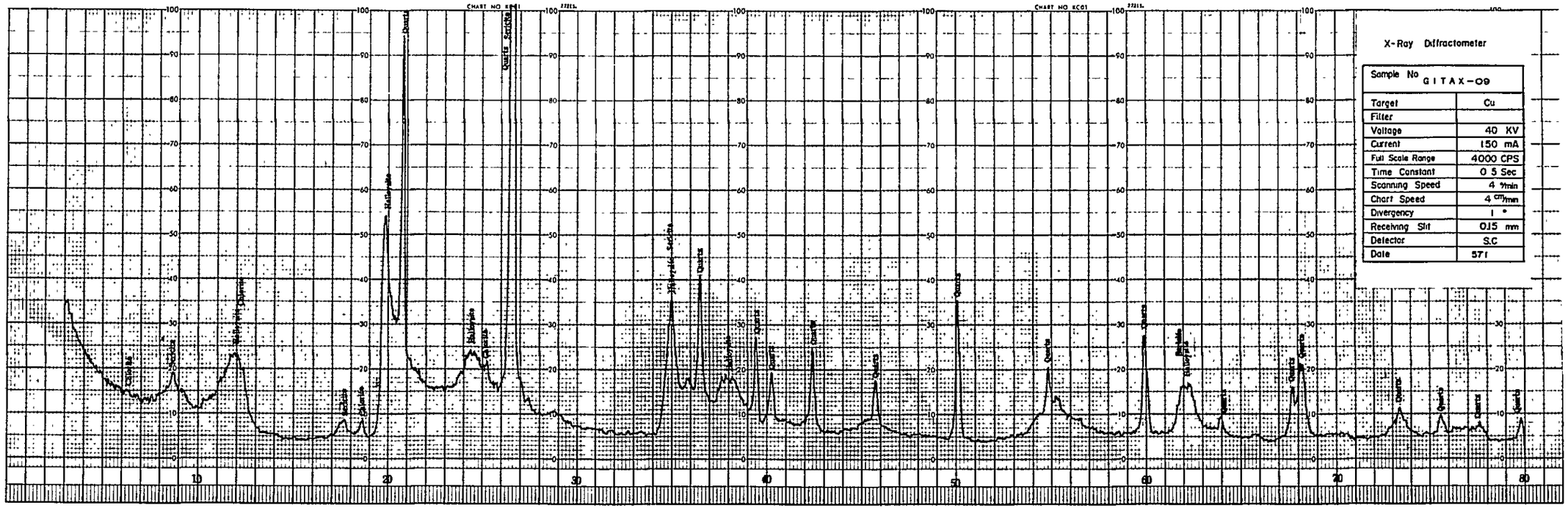
Foot Note V:very much M:much C:common L:less S:scarcely

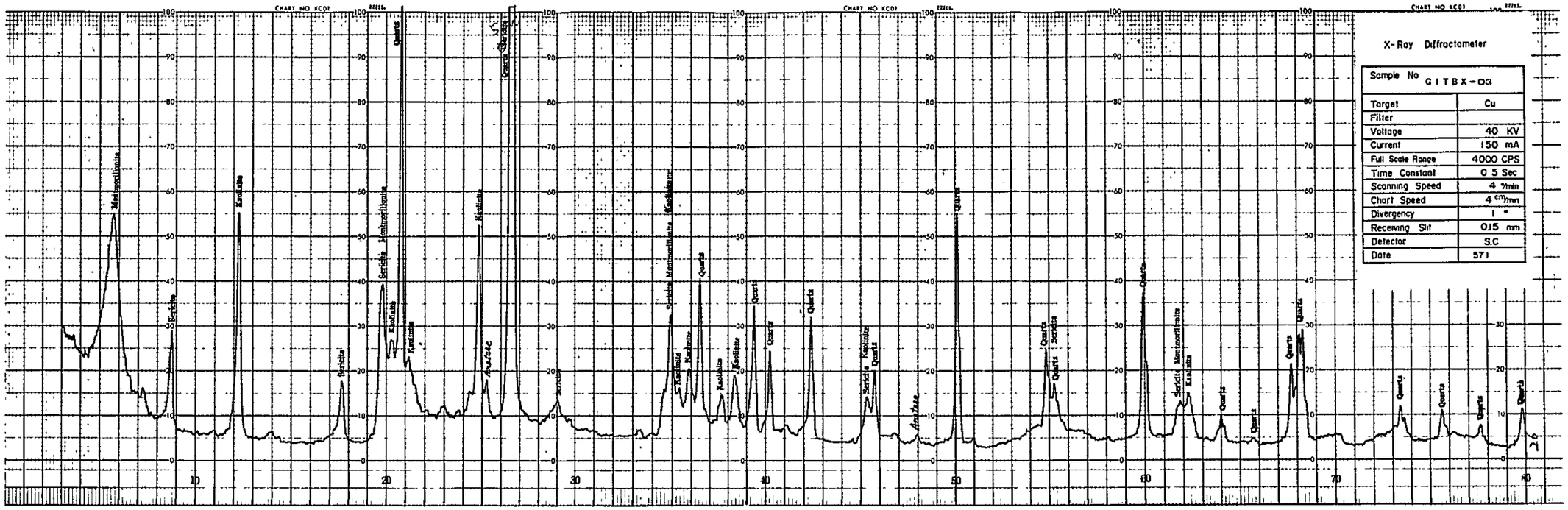
A. I-7-2 X-ray Diffraction Chart

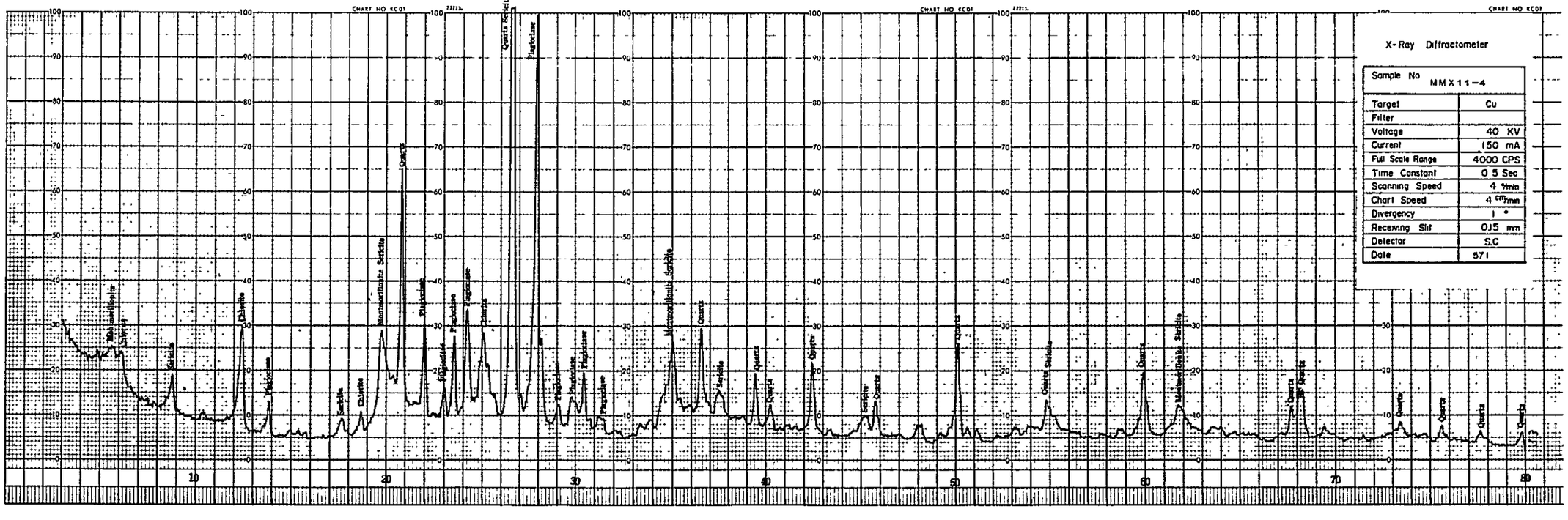

X-Ray Diffractometer
Sample No N 60
Target Cu
Filter
Voltage 40 KV
Current 150 mA
Full Scale Range 4000 CPS
Time Constant 0 5 Sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector S.C
Date 571


X-Ray Diffractometer
Sample No S 35
Target Cu
Filter
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 S.C
Date 571


X-Ray Diffractometer
Sample No. GITAX-08
Target Cu
Filter
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 S.C
Date 571


X-Ray Diffractometer
Sample No. GITAX-09
Target Cu
Filter
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 S.C
Date 571


X-Ray Diffractometer
Sample No GITBX-03
Target Cu
Filter
Voltage 40 KV
Current 150 mA
Full Scale Range 4000 CPS
Time Constant 0 5 Sec
Scanning Speed 4 °/min
Chart Speed 4 cm/mn
Divergency 1 °
Receiving Slit 0.15 mm
Detector S.C
Date 571


X-Ray Diffractometer
Sample No MMX11-4
Target Cu
Filter
Voltage 40 KV
Current 150 mA
Full Scale Range 4000 CPS
Time Constant 0 5 Sec
Scanning Speed 4 °/min
Chart Speed 4 cm/mn
Divergency 1 °
Receiving Slit 0.15 mm
Detector S.C
Date 571

APPENDICES
PART II
DRILLING DATA

LIST OF APPENDICES

A. II - I List of the used equipments for drilling

Item	Model	Quantity	Capacity, Type, and Specification
Drilling Machine	TOM-3B	1	Capacity NQ 590m BQ 750m Inner Diameter of Spindle 92mm Weight (except engine) 120,250,600,120R
Engine for Drill	F3L-912	1	Diesel Engine 1,800 rpm/41 PS ∿ 1,500 rpm/35 PS
Pump	NAS-2A	1	Piston ϕ 63mm Capacity 62 ∿ 45 ℓ/min Pressure 27 ∿ 37 Kg/cm^2
Engine for pump	NS-110C	1	Diesel Engine 1,800 rpm/9.5 PS
Generator	YSG-5SN	1	5KVA, 110V, 50 C/S
"	YSG-3	1	3KVA, 110V, 50 C/S
Engine for Generator	NS-90C	1	Diesel Engine 1,800 rpm/8.5 PS
"	NS-50C	1	Diesel Engine 1,800 rpm/4.5 PS
Pump	HOPE-F	1	Piston ϕ 13.8mm Capacity 60 ∿ 80 ℓ/min Pressure 40 ∿ 30 Kg/cm^2
Engine for pump	NS-90C	1	Diesel Engine 1,800 rpm/8.5 PS
Mud Mixer	MCE-100A	1	Volume 100ℓ, 800 ∿ 1,000 rpm/min
Derrick		1	Wooden
Rod Holder	RH-85	1	Hand Type
Drill Rods	NQ-WL	50	3.00 M/PC
	BQ-WL	70	3.00 M/PC
Casing Pipes	NW	30	3.00 M/PC
	"	3	1.00 M/PC
	BW	50	3.00 M/PC

A. Ⅱ-2 Supplis and consumed parts for drilling

Description	Specification	Unit	Quantity							
			PD-8	PD-9	PD-10	PD-11	PD-12	PD-13	PD-14	PD-15
Light oil		ℓ	2,112	1,760	2,100	1,980	1,950	1,430	2,720	1,890
Mobil oil		ℓ	90	60	20	20	10	-	20	40
Hydraulic oil		ℓ	20	-	-	-	-	-	30	-
Grease		kg	20	-	-	20	-	-	-	15
Bentonite	50 kg/bag	bag	40	26	52	34	56	26	50	36
Libonite		kg	25	50	75	100	75	50	100	50
Tel-cellose		kg	15	12	20	15	18	11	16	20
Cement	50 kg/bag	bag	3	25	4	9	4	6	9	5
Tel-stop		kg	25	30	25	100	75	50	50	-
Emale 20C		ℓ	10	10	-	20	-	-	-	-
Metal crown	101mm	pc	-	-	3	3	4	3	2	1
Single core tube 99mm x 0.5m		set	-	-	1	-	1	-	1	-
Double core tube 99mm x 1.5m		"	-	1	-	-	-	-	-	-
Wire line core barrel	x 0m	"	-	-	-	-	-	-	-	-
"	NQ x 3.00m	"	-	-	-	-	1	-	-	1
"	BQ x 3.00m	"	-	-	-	-	1	-	-	1
Inner tube assembly	x 0m	"	-	-	-	-	-	-	-	-
"	NQ x 3.00m	"	-	1	-	-	1	-	-	-
"	BQ x 3.00m	"	-	1	-	-	1	-	-	-
Outer tube	x 0m	pc	-	-	-	-	-	-	-	-
"	NQ x 3.00m	"	1	-	-	1	-	-	1	-
"	BQ x 3.00m	"	1	-	-	1	-	-	1	-
Inner tube	x 3.00m	"	-	-	-	-	-	-	-	-
"	NQ x 3.00m	"	1	-	-	1	-	-	1	-
"	BQ x 3.00m	"	1	-	-	1	-	-	1	-
Casing metal shoe		"	-	-	-	-	-	-	-	-
"	NW	"	1	2	2	1	2	2	1	1
"	BW	"	1	1	1	1	2	2	1	1
Rag		kg	10	10	10	10	10	20	10	30
Core box		pc	30	20	30	20	30	18	30	25

Description	Specification	Unit	Quantity							
			PD-8	PD-9	PD-10	PD-11	PD-12	PD-13	PD-14	PD-15
Wire	10	kg	20	10	10	10	10	10	10	10
"	12	"	20	20	20	20	20	20	20	10
Nail		"	10	10	10	5	5	10	10	5
Wire rope	6mm x 300m	roll	-	0.5	-	-	0.5	-	-	-
"	12mm x 90m	"	-	-	1	-	-	1	-	-
Manila rope	18mm x 100m	pc	1	-	-	-	-	-	-	-
Vinyl rope	9mm x 300m	"	0.5	-	-	-	0.5	-	-	-
Pump packing		"	-	1	-	-	1	-	-	-
Valve steel ball	38.1ϕ	"	-	-	1	-	-	-	-	-
Piston rod		"	-	-	1	-	-	-	-	-
Guide pipe		"	-	-	-	-	-	-	-	-
"	NQ	"	-	-	1	-	-	-	-	-
"	BQ	"	-	1	-	-	-	-	-	-
Guide coupling		"	-	-	-	-	-	-	-	-
"	NQ	"	-	-	1	-	-	-	-	-
"	BQ	"	-	-	-	1	-	-	-	-
Suction hose	38mm x 3.0m	"	-	1	-	-	-	-	-	-
Water swivel packing		"	-	1	-	-	-	1	-	-
Water swivel spindle		"	1	-	1	-	-	-	-	-
V-belt	TOM-3 F31-912	set	-	1	-	-	-	-	-	-
"	YSG-3	"	-	1	-	-	-	1	-	-
Core lifter		pc	-	-	-	-	-	-	-	-
"	NQ	"	3	2	4	3	4	3	5	4
"	BQ	"	3	2	3	2	2	4	4	4
Core lifter case		"	-	-	-	-	-	-	-	-
"	NQ	"	2	1	2	3	2	2	3	2
"	BQ	"	2	1	2	2	3	2	3	2

A. Ⅱ-3 Preparation and removal

Item \ Hole No.		PD-8		PD-9		PD-10		PD-11		PD-12		PD-13		PD-14		PD-15	
Preparation and removal	In	13th. Jul. '82		26th. Jul. '82		8th. Aug. '82		24th. Aug. '82		10th. Sep. '82		26th. Sep. '82		10th. Sep. '82		26th. Oct. '82	
		14th. Jul. '82		28th. Jul. '82		8th. Aug. '82		28th. Aug. '82		11th. Sep. '82		30th. Sep. '82		10th. Oct. '82		31st. Oct. '82	
	Out	25th. Jul. '82		7th. Jul. '82		22nd. Aug. '82		8th. Sep. '82		24th. Sep. '82		9th. Oct. '82		24th. Oct. '82		12th. Nov. '82	
		25th. Jul. '82		7th. Jul. '82		23rd. Aug. '82		9th. Sep. '82		26th. Sep. '82		9th. Oct. '82		25th. Oct. '82		13th. Nov. '82	
	-	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts	Days	Man-shifts
Preparation	Access road			0.5	9					1.0	28			0.5	20		
	Haulage			1.0	26			2.5	86	1.0	20	2.4	117	0.5	23	3.0	120
	Installation	1.5	36	1.0	14	0.8	18	2.0	58			1.5	24			2.5	38
	Water pipe	0.3	4	0.5	7	0.2	4	0.5	6			0.5	4			0.5	8
	Test run, etc.	0.2	2														
	Total	2.0	42	3.0	56	1.0	22	5.0	150	2.0	48	4.4	145	1.0	43	6.0	166
Removal	Dismounting	0.4	8	0.2	4	1.0	16	1.0	26	1.0	20	0.5	12	1.0	18	1.0	16
	Pipe removal	0.3	6	0.1	3	1.0	30	1.0	20	1.4	42	0.5	11	1.0	28	0.7	20
	Haulage																
	Road reinstatement																
	Others																
	Total	0.7	14	0.3	7	2.0	46	2.0	46	2.4	62	1.0	23	2.0	46	1.7	36
Grand Total		2.7	56	3.3	63		68	7.0	196	4.4	110	5.4	168	3.0	89	7.7	186

A. Ⅱ-4 Operational results of drill hole, PD-8

Working Period

	Period	Number of Days	Actual Working Days	Day Off	Total Number of Workers
Preparation	13th Jul.82∿14th Jul.82	2.0	2.0	-	42
Drilling	15th Jul.82∿25th Jul.82	10.3	10.3	-	217
Removing	25th Jul.82∿25th Jul.82	0.7	0.7	-	14
Total	13th Jul.82∿25th Jul.82	13.0	13.0	-	273

Drilling Length

Planned Length	180.00m	Over-burden	4.50m	Core Recovery for each 100m section	
Increase or Decrease in Length	- m	Core Length	173.50m	Depth of Hole	Section / Total
Length Drilled	180.50m	Core Recovery	98.5%	0∿100.00m	99.5% / 99.5%

Working Time

Drilling	131°00	51.2%	46.1%	100∿180.50m	97.5% / 98.5%
Hoisting & Lowering Rod	23°00'	9.0%	8.1%		
Hoisting & Lowering I.T.	98°00'	38.3%	34.5%		
Miscellaneous	4°00'	1.5%	1.4%		
Repairing	-	-	-		
Others	-	-	-		
Sub Total	256°00'	100.0%	90.1%		
Removing: Preparation	20°00'	-	7.1%		
Removing: Moving	8°00'	-	2.8%		
Grand Total	284°00'	-	100.0%		

Efficiency of Drilling

180.50m/Working Period	13.88 m/day
180.50m/Working Days	13.88 m/day
180.50m/Drilling Period	17.52 m/day
180.50m/Net Drilling Days	17.52 m/day
Total workers/180.50m	1.51 Man/m
Total Drilling Workers/180.50m	1.20 Man/m

Casing Pipe Inserted

Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe
NW 4.50m	2.5%	100%
BW 132.80m	73.5%	100%

Hoisting & Lowering Rod 26 Times	Hoisting & Lowering I.T. 312 Times

A. Ⅱ-5 Operational results of drill hole, PD-9

Working Period

	Period	Number of Days	Actual Working Days	Day off	Total Number of Workers
Preparation	26th Jul.82∿28th Jul.82	3.0	3.0	-	56
Drilling	29th Jul.82∿ 7th Aug.82	9.7	9.7	-	203
Removing	7th Aug.82∿ 7th Aug.82	0.3	0.3	-	7
Total	26th Jul.82∿ 7th Aug.82	13.0	13.0	-	266

Drilling Length

Planned Length	130.00m	Over-burden	10.00m	Core Recovery for each 100 m section	
Increase or Decrease in Length	-	Core Length	103.30m	Depth of Hole	Section / Total
Length Drilled	131.00m	Core Recovery	85.3%	0∿100.00m	79.5% / 79.5%

Working Time

Drilling	96°00'	40.9%	35.6%	100∿131.00m	100.0% / 85.4%
Hoisting & Lowering Rod	16°00'	6.8%	5.9%		
Hoisting & Lowering I.T.	83°00'	35.3%	30.7%		
Miscellaneous	16°00'	6.8%	5.9%	Efficiency of Drilling	
Repairing	-	-	-	131.00m/Working Period	10.08 m/day
Others	24°00'	10.2%	8.9%	131.00m/Working Days	10.08 m/day
Sub Total	235°00'	100.0%	87.0%	131.00m/Drilling Period	13.51 m/day
Removing: Preparation	15°00'	-	5.6%	131.00m/Net Drilling Days	13.51 m/day
Removing: Moving	20°00'	-	7.4%	Total workers/131.00m	2.03 Man/m
Grand Total	270°00'	-	100.0%	Total Drilling Workers/131.00m	1.55 Man/m

Casing Pipe Inserted

Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe
NW 9.20m	7.0%	100%
BW 74.20m	56.6%	100%

Hoisting & Lowering Rod 23 Times	Hoisting & Lowering I.T. 163 Times

A. Ⅱ-6 Operational results of drill hole, PD-10

Working Period

	Period	Number of Days	Actual Working Days	Day Off	Total Number of Workers
Preparation	8th Aug.82∿ 8th Aug.82	1.0	1.0	-	22
Drilling	9th Aug.82∿21th Aug.82	13.0	13.0	-	299
Removing	22nd Aug.82∿23rd Aug.82	2.0	2.0	-	46
Total	8th Aug.82∿23rd Aug.82	16.0	16.0	-	367

Drilling Length

Planned Length	200.00m	Over-burden	8.70m	Core Recovery for each 100 m section	
Increase or Decrease in Length	-	Core Length	183.30m	Depth of Hole	Section / Total
Length Drilled	200.50m	Core Recovery	95.6%	0∿100.00m	93.9% / 93.9%

Working Time

Drilling	180°00'	55.5%	52.0%	100∿200.50m	97.0% / 95.6%
Hoisting & Lowering Rod	18°00'	5.6%	5.2%		
Hoisting & Lowering I.T.	108°00'	33.3%	31.2%		
Miscellaneous	18°00'	5.6%	5.2%	Efficiency of Drilling	
Repairing	-	-	-	200.50m/Working Period	12.53 m/day
Others	-	-	-	200.50m/Working Days	12.53 m/day
Sub Total	324°00'	100.0%	93.6%	200.50m/Drilling Period	15.42 m/day
Removing: Preparation	8°00'	-	2.3%	200.50m/Net Drilling Days	15.42 m/day
Removing: Moving	14°00'	-	4.1%	Total workers/200.50m	1.49 Man/m
Grand Total	346°00'	-	100.0%	Total Drilling Workers/200.50m	1.83 Man/m

Casing Pipe Inserted

Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe
NW 17.90m	8.9%	100%
BW 120.20m	60.0%	100%

Hoisting & Lowering Rod 23 Times	Hoisting & Lowering I.T. 311 Times

A. Ⅱ-7 Operational results of drill hole, PD-11

Working Period

	Period	Number of Days	Actual Working Days	Day Off	Total Number of Workers
Preparation	24th Aug.82∿28th Aug.82	5.0	5.0	-	150
Drilling	29th Aug.82∿ 7th Sep.82	10.0	10.0	-	230
Removing	8th Sep.82∿ 9th Sep.82	2.0	2.0	-	46
Total	24th Aug.82∿ 9th Sep.82	17.0	17.0	-	426

Drilled Length

				Core Recovery for each 100 m section		
Planned Length	140.00m	Over-burden	13.20m			
Increase or Decrease in Length	-	Core Length	124.90m	Depth of Hole	Section	Total
Length Drilled	140.50m	Core Recovery	98.1%	0∿700.00m	98.0%	98.0%

Working Time

Drilling	106°00'	42.4%	34.2%	100∿140.50m	98.2%	98.1%
Hoisting & Lowering Rod	11°00'	4.4%	3.5%			
Hoisting & Lowering I.T.	84°00'	33.6%	27.1%			
Miscellaneous	25°0'	10.0%	8.1%	Efficiency of Drilling		
Repairing	24°00'	9.6%	7.7%	140.50m/Working Period		8.26 m/day
Others	-	-	-	140.50m/Working Days		8.26 m/day
Sub Total	250°00'	100.0%	80.6%	140.50m/Drilling Period		14.05 m/day
Removing: Preparation	25°00'	-	8.1%	140.50m/Net Drilling Days		14.05 m/day
Removing: Moving	35°00'	-	11.3%	Total workers/140.50m		3.03 Man/m
Grand Total	310°00'	-	100.0%	Total Drilling Workers/140.50m		1.64 Man/m

Casing Pipe Inserted

Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe	Hoisting & Lowering Rod 18 Times	Hoisting & Lowering I.T. 168 Times
NW 20.30m	14.4%	100%		
BW 83.60m	59.2%	100%		

A. Ⅱ-8 Operational results of drill hole, PD-12

Working Period

	Period	Number of Days	Actual Working Days	Day Off	Total Number of Workers
Preparation	10th Sep.82∿11th Sep.82	2.0	2.0	-	48
Drilling	12th Sep.82∿24th Sep.82	12.3	12.3	-	300
Removing	24th Sep.82∿26th Sep.82	2.4	2.4	-	62
Total	10th Sep.82∿26th Sep.82	16.7	16.7	-	410

Drilled Length

				Core Recovery for each 100 m section		
Planned Length	200.00m	Over-burden	17.20m			
Increase or Decrease in Length	-	Core Length	178.20m	Depth of Hole	Section	Total
Length Drilled	200.20m	Core Recovery	97.4%	0∿100.00m	99.1%	99.1%

Working Time

Drilling	154°00'	47.8%	43.8%	100∿200.20m	95.9%	97.4%
Hoisting & Lowering Rod	18°00'	5.6%	5.1%			
Hoisting & Lowering I.T.	110°00'	34.2%	31.2%			
Miscellaneous	24°00'	7.4%	6.8%	Efficiency of Drilling		
Repairing	-	-	-	200.20m/Working Period		11.99 m/day
Others	16°00'	5.0%	4.5%	200.20m/Working Days		11.99 m/day
Sub Total	322°00'	100.0%	91.5%	200.20m/Drilling Period		16.28 m/day
Removing: Preparation	15°00'	-	4.3%	200.20m/Net Drilling Days		16.28 m/day
Removing: Moving	15°00'	-	4.3%	Total workers/200.20m		2.05 Man/m
Grand Total	352°00'	-	100.0%	Total Drilling Workers/200.20m		1.50 Man/m

Casing Pipe Inserted

Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe
NW 17.20m	8.6%	100%
BW 120.20m	60.0%	100%

Hoisting & Lowering Rod 21 Times	Hoisting & Lowering I.T. 315 Times

A. II-9 Operational results of drill hole, PD-13

		Period	Number of Days	Actual Working Days	Day Off	Total Number of Workers
Working Period	Preparation	26th Sep.82∿30th Sep.82	4.3	4.3	-	145
	Drilling	1st Oct.82∿ 8th Oct.82	8.0	8.0	-	196
	Removing	9th Oct.82∿ 9th Oct.82	1.0	1.0	-	23
	Total	26th Sep.82∿ 9th Oct.82	13.3	13.3	-	364

Drilled Length	Planned Length	120.00m	Over-burden	10.00m	Core Recovery for each 100 m section	
	Increase or Decrease in Length	-	Core Length	104.70m	Depth of Hole	Section / Total
	Length Drilled	121.50m	Core Recovery	93.9%	0∿100.00m	92.7% / 92.7%

Working Time	Drilling	93°00'	46.5%	35.1%	100∿121.50m	99.0% / 93.9%
	Hoisting & Lowering Rod	10°00'	5.0%	3.8%		
	Hoisting & Lowering I.T.	70°00'	35.0%	26.4%		
	Miscellaneous	27°00'	13.5%	10.1%	Efficiency of Drilling	
	Repairing	-	-	-	121.50m/Working Period	9.14 m/day
	Others	-	-	-	121.50m/Working Days	9.14 m/day
	Sub Total	200°00'	100.0%	75.5%	121.50m/Drilling Period	15.19 m/day
	Removing Preparation	24°00'	-	9.1%	121.50m/Net Drilling Days	15.19 m/day
	Removing Moving	41°00'	-	15.5%	Total workers/121.50m	3.00 Man/m
	Grand Total	265°00'	-	100.0%	Total Drilling Workers/121.50m	1.61 Man/m

Casing Pipe Inserted	Pipe Size & Meterage	Inserted Length (%) / Drilling Length	Recovery of Casing Pipe	Hoisting & Lowering Rod 15 Times	Hoisting & Lowering I.T. 112 Times
	NW 20.50m	16.9%	100%		
	BW 72.00m	59.3%	100%		

A. Ⅱ-10 Operational results of drill hole, PD-14

Working Period		Period		Number of Days	Actual Working Days	Day Off	Total Number of Workers
	Preparation	10th Oct.82∿10th Oct.82		1.0	1.0	-	43
	Drilling	11th Oct.82∿23rd Oct.82		13.0	13.0	-	419
	Removing	24th Oct.82∿25th Oct.82		2.0	2.0	-	46
	Total	10th Oct.82∿25th Oct.82		16.0	16.0	-	508
Drilled Length	Planned Length	200.00m	Over-burden 12.00m	Core Recovery for each 100 m section			
	Increase or Decrease in Length	-	Core Length 184.50m	Depth of Hole		Section	Total
	Length Drilled	200.20m	Core Recovery 98.0%	0∿100.00m		98.7%	98.7%
Working Time	Drilling	163°00'	50.3% 46.9%	100∿200.20m		97.4%	98.0%
	Hoisting & Lowering Rod	19°00'	5.9% 5.5%				
	Hoisting & Lowering I.T.	90°00'	27.8% 25.9%				
	Miscellaneous	20°00'	6.1% 5.7%	Efficiency of Drilling			
	Repairing	-	- -	200.20m/Working Period			12.51m/day
	Others	32°00'	9.9% 9.2%	200.20m/Working Days			12.51m/day
	Sub Total	324°00'	100.0% 93.1%	200.20m/Drilling Period			15.40 m/day
	Removing Preparation	12°00'	- 3.4%	200.20m/Net Drilling Days			15.40 m/day
	Removing Moving	12°00'	- 3.4%	Total workers/200.20m			2.54 Man/m
	Grand Total	348°00'	- 100.0%	Total Drilling Workers/200.20m			2.09 Man/m

Casing Pipe Inserted					
	Pipe Size & Meterage	Inserted Length (%) Drilling Length	Recovery of Casing Pipe	Hoisting & Lowering Rod 26 Times	Hoisting & Lowering I.T. 315 Times
	NW 12.00m	6.0%	100%		
	BW 120.90m	60.4%	100%		

A. Ⅱ-11 Operatinoal results of drill hole, PD-15

Working Period		Period		Number of Days	Actual Working Days	Day Off	Total Number of Workers
	Preparation	26th Oct.82∿31st Oct.82		6.0	6.0	-	166
	Drilling	1st Nov.82∿12th Nov.82		11.3	11.3	-	273
	Removing	12th Nov.82∿13th Nov.82		1.7	1.7	-	38
	Total	26th Oct.82∿13th Nov.82		19.0	19.0	-	477
Drilled Length	Planned Length	160.00m	Over-burden 1.00m	Core Recovery for each 100 m section			
	Increase or Decrease in Length	-	Core Length 158.30m	Depth of Hole		Section	Total
	Length Drilled	161.50m	Core Recovery 98.6%	0∿100.00m		100%	100%
Working Time	Drilling	158°00'	54.9% 44.1%	100∿161.50m		96.4%	98.6%
	Hoisting & Lowering Rod	18°00'	6.2% 5.0%				
	Hoisting & Lowering I.T.	106°00'	36.8% 29.6%				
	Miscellaneous	6°00'	2.1% 1.7%	Efficiency of Drilling			
	Repairing	-	- -	161.50m/Working Period			8.50 m/day
	Others	-	- -	161.50m/Working Days			8.50 m/day
	Sub Total	288°00'	100.0% 80.4%	161.50m/Drilling Period			14.29 m/day
	Removing Preparation	30°00'	- 8.4%	161.50m/Net Drilling Days			14.29 m/day
	Removing Moving	40°00'	- 11.2%	Total workers/161.50m			2.95 Man/m
	Grand Total	358°00'	- 100.0%	Total Drilling Workers/161.50m			1.69 Man/m
Casing Pipe Inserted	Pipe Size & Meterage	Inserted Length (%) Drilling Length	Recovery of Casing Pipe	Hoisting & Lowering Rod 19 Times		Hoisting & Lowering I.T. 254 Times	
	NW 1.00m	0.6%	100%				
	BW 96.00m	59.4%	100%				

A. Ⅱ-12 Summarized operational data of each drill hole

Drill hole No.	Type of machine	Drilling period	Drilling length	Length	Recovery	Drilling	Casing etc.	Total	* m/shift	** m/shift	Remarks
PD-8	TOM-3	15th Jul. '82 ∿ 25th Jul. '82	180.50	173.50	98.5	30	1	31	6.02	5.82	
PD-9	TOM-3	29th Jul. '82 ∿ 7th Aug. '82	131.00	103.30	85.4	25	4	29	5.24	4.52	
PD-10	TOM-3	9th Aug. '82 ∿ 21st Aug. '82	200.50	183.30	95.6	37	2	39	5.42	5.14	
PD-11	TOM-3	29th Aug. '82 ∿ 7th Sep. '82	140.50	124.90	98.1	24	6	30	5.85	4.68	
PD-12	TOM-3	12th Sep. '82 ∿ 24th Sep. '82	200.20	178.20	97.4	32	5	37	6.26	5.41	
PD-13	TOM-3	1st Oct. '82 ∿ 8th Oct. '82	121.50	104.70	93.9	22	2	24	5.52	5.06	
PD-14	TOM-3	11th Oct. '82 ∿ 23rd Oct. '82	200.20	184.50	98.0	34	5	39	5.89	5.13	
PD-15	TOM-3	1st Nov. '82 ∿ 12th Nov. '82	161.50	158.30	98.6	33	1	34	4.90	4.75	
	Total		1,335.90	1,210.70	96.1	237	26	263	5.64	5.08	

* Drilled per one shift covering net drilling operations.

** Drilled per one shift covering total works conducted.

A. II-13 Working time of each drill hole

Drill Hole No.	Drilling	Hoisting & lowering of rod & I.T.		Miscellaneous			Repairs	Others	Moving operation	Total
		Rod	Inner tube	Casing insertion	Hole reaming	Others				
PD-8	131°00'	23°00'	98°00'	4°00'	-	-	-	-	28°00'	284°00'
PD-9	96°00'	16°00'	83°00'	8°00'	-	8°00'	-	24°00'	35°00'	270°00'
PD-10	180°00'	18°00'	108°00'	10°00'	8°00'	-	-	-	22°00'	346°00'
PD-11	106°00'	11°00'	84°00'	9°00'	16°00'	-	24°00'	-	60°00'	310°00'
PD-12	154°00'	18°00'	110°00'	24°00'	-	-	-	16°00'	30°00'	352°00'
PD-13	93°00'	10°00'	70°00'	6°00'	18°00'	3°00'	-	-	65°00'	265°00'
PD-14	163°00'	19°00'	90°00'	10°00'	8°00'	2°00'	-	32°00'	24°00'	348°00'
PD-15	158°00'	18°00'	106°00'	6°00'	-	-	-	-	70°00'	358°00'
Total	1,081°00'	133°00'	749°00'	77°00'	50°00'	13°00'	24°00'	72°00'	334°00'	2,533°00'
					140°00'					

A. Ⅱ-14 Drilling meterage of diamond bits

Item	Size	Type	Bit No.	Drilling meterage by drill hole Unit meter								Total
				PD-8	PD-9	PD-10	PD-11	PD-12	PD-13	PD-14	PD-15	
Bit	NX	NQ-WL	481180	10.20								10.20
			481181	13.80								13.80
			481182	13.50								13.50
			481183	14.60								14.60
			481184	20.60								20.60
			481185	30.60								30.60
			481186	25.00								25.00
			481205		11.10							11.10
			481206		14.80							14.80
			481207		18.10							18.10
			481208		21.00							21.00
			M-6557			9.80						9.80
			M-6558			12.50						12.50
			M-6559			13.90						13.90
			M-6560			15.80						15.80
			M-6561			20.00						20.00
			M-6562			23.00						23.00
			M-6563			15.10						15.10
			M-9741				15.20					15.20
			M-9742				18.50					18.50
			M-9743				17.50					17.50
			M-9744				25.20					25.20
			M-9745					13.50				13.50
			M-9746					12.00				12.00
			M-9747					19.00				19.00
			M-9748					20.00				20.00
			M-9749					19.50				19.50
			M-9750					19.00				19.00
			M-9751						9.50			9.50
			M-9752						10.80			10.80
			M-9753						13.60			13.60
			M-9754						13.50			13.50
			M-9755						14.60			14.60

Item	Size	Type	Bit No.	Drilling meterage by drill hole Unit meter								Total
				PD-8	PD-9	PD-10	PD-11	PD-12	PD-13	PD-14	PD-15	
Bit	NX	NQ-WL	11410							11.50		11.50
			11411							14.00		14.00
			11412							18.50		18.50
			11413							18.00		18.00
			11414							20.00		20.00
			11415							15.30		15.30
			48117							15.00		15.00
			48118								8.50	8.50
			48119								15.00	15.00
			N-583								21.00	21.00
			N-584								18.00	18.00
			N-585								15.00	15.00
			N-586								17.50	17.50
			Total	128.30	65.00	110.10	76.40	103.00	62.00	112.30	95.00	752.10
Bit	BX	BQ-WL	471795	13.00								13.00
			471796	15.00								15.00
			471797	10.00								10.00
			471798	9.70								9.70
			471799		15.00							15.00
			471800		18.00							18.00
			11422		23.80							23.80
			M-1969			11.50						11.50
			M-1970			13.00						13.00
			M-1971			20.00						20.00
			M-1972			15.00						15.00
			M-1973			20.80						20.80
			M-6559				10.00					10.00
			M-6560				8.00					8.00
			M-6923				18.00					18.00
			M-6924				20.90					20.90
			11423					13.00				13.00
			11424					15.00				15.00
			471790					19.00				19.00
			471791					15.00				15.00
			471792					18.00				18.00

Item	Size	Type	Bit No.	Drilling meterage by drill hole Unit meter								Total
				PD-8	PD-9	PD-10	PD-11	PD-12	PD-13	PD-14	PD-15	
Bit			471793						8.00			8.00
			471794						9.00			9.00
			N-588						15.00			15.00
			N-589						17.50			17.50
			N-590							9.50		9.50
			N-591							8.00		8.00
			M-6925							10.00		10.00
			M-6926							11.80		11.80
			M-6927							19.00		19.00
			11425							21.00		21.00
			11426								15.00	15.00
			11427								16.00	16.00
			471811								15.00	15.00
			471812								19.50	19.50
			Total	47.70	56.80	80.30	56.90	80.00	49.50	79.30	65.50	516.00

A. Ⅱ-15 Specifications of diamond bits

Size	Type	Carats per bit	Matrix	Stones per carat	Water way	Number	Remark
NX	NQ-WL	30	E	1/30	4	481180	Reset
		30	E	1/30	4	481181	"
		30	E	1/30	4	481182	"
		30	C	1/30	4	481183	"
		30	C	1/30	4	481184	"
		30	E	1/30	4	481185	"
		30	E	1/30	4	481186	"
		30	E	1/30	4	481205	"
		30	E	1/30	4	481206	"
		30	C	1/30	4	481207	"
		30	E	1/30	4	481208	"
		30	ZZ	1/30	4	M-6557	"
		30	Z	1/30	4	M-6558	"
		30	ZZ	1/30	4	M-6559	"
		30	Z	1/30	4	M-6560	"
		30	Z	1/30	4	M-6561	"
		30	Z	1/30	4	M-6562	"
		30	ZZ	1/30	4	M-6563	"
		30	ZZ	1/30	4	M-9741	"
		30	Z	1/30	4	M-9742	"
		30	Z	1/30	4	M-9743	
		30	Z	1/30	4	M-9744	"
		30	ZZ	1/30	4	M-9745	"
		30	ZZ	1/30	4	M-9746	"

Size	Type	Carats per bit	Matrix	Stones per carat	Water way	Number	Remark
	NQ-WL	30	Z	1/30	4	M-9747	Reset
		30	Z	1/30	4	M-9748	"
		30	Z	1/30	4	M-9749	"
		30	Z	1/30	4	M-9750	"
		30	ZZ	1/30	4	M-9751	"
		30	ZZ	1/30	4	M-9752	"
		30	Z	1/30	4	M-9753	"
		30	Z	1/30	4	M-9754	"
		30	Z	1/30	4	M-9755	"
NX		30	T_1	1/30	4	11410	"
		30	T_1	1/30	4	11411	"
		30	T_1	1/30	4	11412	"
		30	T_2	1/30	4	11413	"
		30	T_2	1/30	4	11414	"
		30	T_1	1/30	4	11415	"
		30	C	1/30	4	48118	"
		30	C	1/30	4	48119	"
		30	ZZ	1/30	4	N-583	"
		30	Z	1/30	4	N-584	"
		30	Z	1/30	4	N-585	"
		30	Z	1/30	4	N-586	"
BX	BQ-WL	20	E	1/30	4	471795	"
		20	E	1/30	4	471796	"
		20	C	1/30	4	471797	"
		20	C	1/30	4	471798	"
		20	C	1/30	4	471799	

Size	Type	Carats per bit	Matrix	Stones per carat	Water way	Number	Remark
	BQ-WL	20	E	1/30	4	471800	Reset
		20	T_2	1/30	4	11422	"
		20	ZZ	1/30	4	M-1969	"
		20	ZZ	1/30	4	M-1970	"
		20	Z	1/30	4	M-1971	"
		20	Z	1/30	4	M-1972	"
		20	Z	1/30	4	M-1973	"
		20	Z	1/30	4	M-6559	"
		20	Z	1/30	4	M-6560	"
		20	Z	1/30	4	M-6923	"
		20	Z	1/30	4	M-6924	"
BX		20	T_1	1/30	4	11423	"
		20	T_1	1/30	4	11424	"
		20	E	1/30	4	471790	"
		20	E	1/30	4	471791	"
		20	C	1/30	4	471792	"
		20	C	1/30	4	471793	"
		20	E	1/30	4	471794	"
		20	ZZ	1/30	4	N-588	"
		20	ZZ	1/30	4	N-589	"
		20	Z	1/30	4	N-590	"
		20	Z	1/30	4	N-591	"
		20	ZZ	1/30	4	M-6925	"
		20	Z	1/30	4	M-6926	"
		20	Z	1/30	4	M-6927	"

Size	Type	Carate per bit	Matrix	Stones per carat	Water way	Number	Remark
BX	BQ-WL	20	T_1	1/30	4	11425	Reset
		20	T_1	1/30	4	11426	"
		20	T_1	1/30	4	11427	"
		20	E	1/30	4	471811	"
		20	C	1/30	4	471812	"

A. Ⅱ-16 Assay results of the drilled core

Sample No.	Length (m)	Au g/t	Ag g/t	Cu %	Pb %	Zn %	As %
PD 859	59.1∿ 59.45	6.0	4	0.03	0.01	0.01	0.08
878	77.9∿ 79.3	1.1	4	0.02	0.05	0.07	0.07
890	90.2∿ 90.7	5.3	5	<0.01	0.03	0.09	0.52
8119	119.5∿119.8	<0.1	<1	<0.01	0.02	0.03	0.06
8136	136.0∿137.4	0.8	3	0.02	0.01	0.42	0.69
8142	142.3∿142.8	<0.1	13	<0.01	0.01	0.01	0.05
8154	154.6∿155.8	<0.1	<1	0.01	0.01	0.01	0.07
8155	155.8∿156.4	0.5	2	0.02	0.07	0.52	0.16
8157	157.1∿158.1	<0.1	29	0.17	0.02	1.20	0.12
8158	158.1∿158.6	<0.1	6	0.10	0.02	0.23	0.07
8166	166.4∿167.4	1.0	13	0.10	0.03	1.60	2.10
8167	167.4∿168.3	<1.0	<1	0.01	0.02	0.12	0.12
8168	168.3∿169.5	1.3	37	0.01	0.03	0.40	5.20
8169	169.5∿170.5	<0.1	13	0.04	0.02	0.04	0.28
8170	170.5∿171.4	0.2	2	0.01	0.02	0.07	0.21
977	77.3∿ 78.0	<0.1	<1	<0.01	0.03	0.26	0.96
978	78.0∿ 79.0	1.9	15	0.02	0.05	1.40	9.70
979	79.0∿ 80.0	0.4	6	0.03	0.03	0.22	1.10
980	80.0∿ 81.0	<0.1	<1	0.01	0.02	0.02	0.09
981	81.0∿ 82.0	<0.1	<1	0.01	0.02	0.03	0.12
982	82.0∿ 83.0	<0.1	<1	<0.01	0.03	0.03	0.20
983	83.0∿ 84.7	0.4	17	0.01	0.04	0.08	0.11
984	84.7∿ 85.3	0.1	3	0.01	0.06	0.32	2.80
10105	105.2∿105.8	5.2	17	0.05	0.11	1.73	2.42
10106	105.8∿107.4	0.5	8	0.03	0.02	0.04	0.11
10107	107.4∿108.0	4.3	25	0.08	0.09	1.20	1.60
10108	108.0∿109.0	0.4	4	0.01	0.03	0.26	0.40
10109	109.0∿110.0	24.8	42	0.13	0.16	2.09	2.54
10110	110.0∿111.0	3.4	70	0.22	0.13	4.98	4.26
10111	111.0∿111.8	1.9	50	0.18	0.06	4.33	2.30
10112	111.8∿112.8	tr	tr	0.01	0.02	0.17	0.15
10113	112.8∿113.6	2.1	11	0.04	0.01	1.35	0.64
10114	113.6∿114.8	1.9	19	0.12	0.03	1.49	0.47

Sample No.	Length (m)	Au g/t	Ag g/t	Cu %	Pb %	Zn %	As %
PD 10115	114.8∿116.1	15.0	84	0.25	0.13	5.53	12.6
11132	131.8∿132.55	tr	tr	0.01	0.04	0.20	0.66
11133	133.0∿134.2	tr	tr	0.00	0.02	0.02	0.13
11134	134.2∿135.0	tr	tr	0.00	0.04	0.06	0.12
11135	135.0∿136.0	tr	tr	0.01	0.02	0.03	0.10
11136	136.0∿137.0	tr	tr	0.01	0.03	0.17	0.20
11137	137.0∿138.0	tr	tr	0.01	0.02	0.08	0.10
12180	180.0∿180.8	tr	tr	0.02	0.03	0.04	0.11
12181	180.8∿182.2	tr	tr	0.02	0.02	0.07	0.14
12182	182.2∿183.0	tr	tr	0.01	0.00	0.04	0.05
12183	183.0∿184.0	tr	tr	0.01	0.01	0.13	0.05
12184	184.0∿185.0	tr	tr	0.00	0.01	0.03	0.07
12185	185.0∿186.0	tr	tr	0.07	0.01	0.06	0.08
12186	186.0∿187.0	0.9	10	0.11	0.02	0.07	0.09
12187	187.0∿188.0	tr	tr	0.00	0.00	0.02	0.06
12188	188.0∿188.9	tr	tr	0.02	0.02	0.04	0.10
12191	190.8∿192.0	tr	tr	0.01	0.01	0.01	0.06
12192	192.0∿193.0	tr	tr	0.00	0.01	0.00	0.06
12193	193.0∿193.6	tr	73	0.00	0.01	0.00	0.06
1376	76.1∿ 76.5	tr	tr	0.53	0.07	0.13	0.17
13765	76.5∿ 77.0	tr	276	2.09	0.03	0.12	0.11
1377	77.0∿ 78.1	tr	tr	0.01	0.03	0.02	0.11
13100	100.6∿101.4	tr	tr	0.01	0.02	0.03	0.10
13101	101.4∿101.8	tr	tr	0.01	0.04	0.07	0.31
14124	123.7∿125.0	tr	9	0.03	0.05	0.45	0.15
14125	125.0∿126.0	tr	tr	0.00	0.06	0.06	0.13
14126	126.0∿127.0	tr	tr	0.00	0.03	0.03	0.12
14127	127.0∿128.0	tr	6	0.01	0.08	0.20	0.14
14128	128.0∿129.0	tr	tr	0.00	0.06	0.06	0.13
14141	141.0∿141.7	tr	tr	0.00	0.02	0.01	0.08
14158	158.3∿159.3	tr	tr	0.01	0.03	0.15	0.10
14159	159.3∿160.0	tr	tr	0.01	0.02	0.02	0.09
14160	160.0∿161.3	4.6	8	0.02	0.04	0.32	0.35
14161	161.3∿162.3	tr	10	0.02	0.04	0.40	0.10

Sample No.		Length (m)	Au g/t	Ag g/t	Cu %	Pb %	Zn %	As %
PD	14162	162.3∿163.3	tr	tr	0.01	0.02	0.06	0.07
	14163	163.3∿164.4	2.0	35	0.12	0.13	2.56	2.62
	15110	110.1∿111.2	2.0	54	0.34	0.09	0.33	0.70
	15111	111.2∿112.4	2.5	69	0.40	0.13	0.18	0.70
	15112	112.4∿113.4	1.5	16	0.07	0.14	0.24	1.13
	15113	113.4∿114.5	tr	15	0.05	0.05	0.26	0.82
	15114	114.5∿115.5	tr	15	0.04	0.02	0.04	0.06
	15115	115.5∿116.0	0.4	39	0.25	0.05	0.11	0.24
	15120	120.8∿121.4	1.6	43	0.24	0.03	0.64	1.73
	15121	121.4∿122.0	0.9	12	0.00	0.03	0.31	5.70
	15147	147.5∿148.5	2.8	9	0.00	0.05	0.13	0.26
	15148	148.5∿149.3	tr	tr	0.00	0.01	0.01	0.05
	15152	152.1∿153.1	0.9	9	0.01	0.03	0.13	1.13

A. Ⅱ-17 Microscopic observation of the thin sections

Sample No.	Location	Macroscopic description	Microscopic observation
PD-811.5	PD-8	granodiorite	Biotite-hornblende granodiorite Hypidiomorphic and granular texture Felsic mineral compositions of the rock are a little quartz (0.2~0.4 mm in size) and a large amount of potash feldspar and plagioclase (Ca. 1.5 mm in size). As mafic minerals, it is observed that majority is green hornblende with subordinate amount of brown hornblende and biotite. Accompanied also are a few amount of zircon, apatite and opaque mineral. Hornblende sometimes shows glomerophyric texture and is altered to actinolite. It suffered strong epidotization and sericitization with a few chlorite.
PD-898	PD-8	Altered andesite	Hornblende andesite Strong alteration made it difficult to identify an original rock. Main constituent minerals are hornblende, lath-shaped subhedral plagioclase (1.0×0.5 mm in size), subhedral potash feldspar (0.2×0.3 mm in size) and subhedral quartz with accessory magnetite and leucoxine. Plagioclase shows albite twinning and is partly altered to actinolite and sericite. Hornblende shows sub to euhedral crystal form and grain size varies 1.8×1.0 mm to 2.0×2.5 mm. Axial color of hornblende is green and a part of it changes into actinolite. The rock suffers from various alteration such as silicification, sericitization, carbonitization, epidotization and minor chloritization.
PD-910.5	PD-9	tuff breccia	Pyroxene-andesitic tuff Fragments are composed mainly of prismatic eu-subhedral plagioclase (1.0×0.5 mm) and coarse grained clinopyroxene (2.0 1.5 mm) which suffers fragmentation. Interstice is composed of devitrified glass and plagioclase.

Sample No.	Location	Macroscopic description	Microscopic observation
			Alteration is strong to produce lots of amphibole, chlorite, epidote and sericite.
PD-987.6	PD-9	tuff breccia	Two pyroxene-andestic tuff Fragments are fractured crystals of monoclinic pyroxene (2.0 × 1.5 mm ~ 3.0 × 2.5 mm in size), lath-shaped plagioclase (1.5 × 0.5 mm in size) and a small amount of orthorhombic pyroxene. Interstice is filled with glass and minute plagioclase. Sericitization and chloritization are observed.
PD-1088	PD-10	basaltic andesite	Hornblende andesite Porphyritic texture Phenocryst is composed of euhedral to subhedral lath-shaped plagioclase (2 × 0.8 mm) and euhedral hornblende (0.5 × 0.5 ~ 1 × 1 mm). Groundmass is filled with minute lath-shaped plagioclase. The rock suffers strong alteration to hornblende (probably actinolite) and sericite. Weak silicification and argillization producing kaoline are also observed.
PD1242.3	PD-12	Lithic tuff	Hornblende-pyroxene andesitic tuff Lithic fragment (3.5 × 2.0 mm) and crystal fragments of euhedral pyroxene and green hornblende are observed. Interstice is composed of minute plagioclase, quartz and glassy material. Strong alteration is observed such as uralitization, epidotization, sericitization and silicification.
PD1282.8	PD-12	tuff breccia	Pyroxene-andesitic tuff Porphyroclastic texture Crystal fragment is mainly pyroxene which suffers uralitization-chloritization along the crack and a small amount of plagioclase. Interstices are filled with minute crystals of plagioclase and amphibole and of quartz which is product of silicification.

Sample No.	Location	Macroscopic description	Microscopic observation
			Alteration is chloritization and epidotization.
PD-1424	PD-14	Massive basaltic andesite	Pyroxene andesite Porphyrytic texture Coarse-grained (max 3.0 × 3.0 mm) euhedral clinopyroxene and a small amount of plagioclase comprise phenocrysts. Plagioclase remains as a pseudomorph and pyroxene suffers uralitization. Groundmass is composed of fine-grained plagioclase and pyroxene and is changed into aggregates of actinolite-tremolite. Very fine-grained crystals of biotite and chlorite are also observed within a groundmass.
PD-1505	PD-15	Tuff breccia	Pyroxene andesite Porphyritic texture and porphyroclastic texture Phenocryst is mainly composed of sub to euhedral medium grained (2.0 × 1.8 mm) pyroxene which shows a zonal structure and changes into amphibole along and/or in the crystal. Groundmass is composed mainly of plagioclase with subordinate amount of pyroxene which is changed to amphibole. It suffers epidotization and argillization.
PD-1522	PD-15	Altered tuff breccia	Hornblende andesite Porphyritic texture The rock suffers strong silicification, uralitization, epidotization and argillization. Phenocryst is composed of hornblende and plagioclase (1.0 × 0.5 mm and 0.3 × 0.1 mm respectively). Groundmass is composed of minute plagioclase and is suffered from various alterations such as silicification, epidotization and uralitization. Secondary quartz is also observed as a vein-let, coarse-grained crystal and dissemination.
PD-1551	PD-15	Tuff breccia	Hornblende andesite Porphyritic texture and porphyroclastic texture

Sample No.	Location	Macroscopic description	Microscopic observation
			Phenocryst is composed of euhedral hornblende (1.0×0.8 mm) and plagioclase which show a porphyroclastic texture. Groundmass is mainly composed of fine lath-shaped plagioclase and a small amount of quartz. It suffers strong sericitization, chloritization and epidotization. Noted also is a quartz veinlet with tremolite and sericite. As opaque minerals, iron hydro-oxide mineral and leucoxene are observed.
PD-1510	PD-15	Aphanitic basaltic andesite	Hornblende andesite Porphyritic texture Phenocryst is composed of coarse-grained (2.0×1.8 mm) green hornblende and plagioclase which shows albite twinning and obscure crystal boundary due to sericitization. Groundmass is composed of minute plagioclase. Epidots, epidote-sericite-quartz veinlets and a small amount of leucoxene are observed.
PD-15146	PD-15	Altered rock	Tuff breccia The rock suffers bitter alteration producing a lot of chlorite, sericite, carbonate and quartz. A lithic fragment (2.5×1.5 mm in size) which is changed into sericite aggregate suggests the tuff breccia origin.
PD-15155	PD-15	Tuff breccia	Andesitic tuff Fragments are lithic material and plagioclase crystals both of which are replaced by fine-grained quartz and chlorite and vein-formed amphibole. Plagioclase shows albite twinning and glomeroporphyritic texture. Interstice is mainly composed of fine lath-shaped plagioclase and spherulite filled with chlorite, chalcedony and zeolite. The rock as a whole suffers silicification, chloritization, carbonitization and argillization.
PD8169.6	PD-8	Silicified-argillized rock	Altered rock The rock is composed mainly of quartz, calcite and chlorite with

Sample No.	Location	Macroscopic description	Microscopic observation
			subordinate amount of sericite and sphene.
PD979.6	PD-9	Argillized altered rock	Altered rock The rock is highly altered and pyritized. Mineral composition is nearly the same as PD 8169.6.

A. Ⅱ-18 Microscopic observation of the polished sections

Sample No.	Location	Macroscopic Description	Microscopic Observation
PD 867.3	PD-8	Chalcopyrite ore	Mineral assemblage : Chalcopyrite ..... a little Pyrite ..... rare Ore shows a brecciated texture and mineralization is restricted only in the breccia. Chalcopyrite is a very fine grain (a few μm to several tens μm) in association with eu-anhedral pyrite.
PD 978.0	PD-9	Arsenopyrite-sphalerite ore	Mineral assemblage : Arsenopyrite ..... common Sphalerite ..... a few Galena, chalcopyrite, pyrite ..... few Arsenopyrite aggregates in anhedral to euhedral crystal. Sphalerite containing chalcopyrite dotts replaces a part of arseno-pyrite. Galena is enclosed in an arsenopyrite crystal. Chalcopyrite appears as a dot in sphalerite. Pyrite is euhedral to anhedral crystal in association with arseno-pyrite or gangue mineral. A part of pyrite is changed into marcasite.
PD 10109	PD-10	Sphalerite ore	Mineral assemblage : Pyrite, sphalerite ..... common Arsenopyrite, chalcopyrite, galena .... a few Pyrite has two types of occurrence, one is dissemination or aggregates of euhedral to subhedral crystal, the other is fine grained vein type pyrite which surrounds euhedral pyrite crystal. Sphalerite usually contains sphalerite dot and replaces a part of pyrite and arsenopyrite. Arsenopyrite shows euhedral to anhedral crystal and occurs dissemination or coparagenesis with pyrite. Chalcopyrite appears as a dot in sphalerite and minor crack filling in pyrite and arsenopyrite. All mineral but veintype pyrite and marcasite is shatterd and brecciated.

Sample No.	Location	Macroscopic Description	Microscopic Observation
PD 10110.0	PD-10	Sphalerite-chalcopyrite ore	Mineral assemblage : Sphalerite ..... abundant Chalcopyrite, arsenopyrite ..... common Pyrite, galena, Ag bearing pb-Bi mineral.. a few Spalerite with chalcopyrite dot is massive replacement of arsenopyrite. Chalcopyrite fills crack and marginal part of sphalerite and replaces arsenopyrite and pyrite. Arsenopyrite usually takes euhedral crystal. Pyrite has two crystal form as is a case in PD10109 and later pyrite is cutting sphalerite and replacing chalcopyrite. Ag bearing pb-Bi mineral is often associated with chalcopyrite. This sample is also brecciated.
PD 10111	PD-10	Sphalerite ore	Mineral assemblage : Pyrite ..... abundant Sphalerite, arsenopyrite ..... common Galena, chalcopyrite ..... a few Electrum ..... scarce Pyrite is euhedral to anhedral crystal form and presents either massive or dissemination in gangue mineral. Arsenopyrite, in most of the cases, shows euhedral crystal presenting massive or dissemination. Sphalerite with chalcopytite dot replaces pyrite and arsenopyrite. Chalcopyrite is, aside from inclusion in sphalerite, fracture filling in and around pyrite and sphalerite. Electrum, 200 μm and 100 μm in size, was found at crystal boundary of arsenopyrite and whithin a gangue mineral.
PD 10111.4	PD-10	Arsenopyrite-sphalerite ore	Mineral assemblage : Pyrite, arsenopyrite, sphalerite ..... common Galena, chalcopyrite ..... a few Pyrite shows two type of occurrance, one is massive taking euanhedral crystal form and the other is vein-let cutting sphalerite or gangue mineral and surrounding pyrite crystal. The latter used to change marcasite.

Sample No.	Location	Macroscopic Description	Microscopic Observation
			Sphalerite contains chalcopyrite dot and replaces arsenopyrite and pyrite. Galena replaces pyrite and intrudes in sphalerite and arsenopyrite. Chalcopyrite also cuts arsenopyrite and encloses sphalerite.
PD10114	PD-10	Sphalerite ore	Mineral assemblage : Sphalerite, pyrite, arsenopyrite ..... common Chalcopyrite ..... a few Eledctrum ..... scarse Arsenopyrite takes euhedral crystal form and interstices are filled with pyrite. Sphalerite containds lotds of chalcopyrite dot and replaces arsenopyrite or pyrite. Electrum shows various occurrence; paragenesis with grain boundary between arsenopyrite and pyrite, and within arsenopyrite crystal. EPMA discloses electrum contains about 40 percent of silver.
PD 10115.7	PD-10	Arsenopyrite-sphalerite ore	Mineral assemblage : Pyrite, arsenopyrite, sphalerite ..... common Chalcopyrite ..... a few Pyrite shows eu-anhedral crystal form and appears either dissemination or massive aggregates. Arsenopyrite is coarse grain and euhedral crystal which is surrounded by pyrite. Sphalerite contains chalcopyrite dot and replaces arsenopyrite.
PD11181	PD-11	Pyrite ore	Mineral assemblage : Pyrite ..... a few Chalcopyrite, galena, sphalerite ..... few Pyrite shows eu-anhedral crystal accompanyed by quartz vein in the form of dissemination and veinlet. Sphalerite is divided into two groupes, one contains chalcopyrite dot and the other not. Galena replaces pyrite. Chalcopyrite disseminates in the gangue mineral.
PD11183	PD-11	Pyrite ore	Mineral assemblage : Pyrite, marcasite ..... common Chalcopyrite, sphalerite ..... a few Pyrite is anhedral crystal and appeards inquartz vein.

Sample No.	Location	Macroscopic Description	Microscopic Observation
			Marcasite ids fine grained veinlert or aggregate surrounding pyritec crystal or in gangue mineral. Both chalcopyrite and sphalerite containing little dot of chalcopyrite appeards in the form of dissemination in quartz vein.
PD11187	PD-11	Pyrite ore	Mineral assemblage : Marcasite ..... a few Sphalerite ..... scarce The amount of ore mineral is very poor. Marcasite shows veinlet or dissemination.
PD 12181.7	PD-12	Pyrite ore	Mineral assemblage : Pyrite, marcasite ..... common Chalcopyrite ..... a few Chalcopyrite is accompanied by quartz vein with its anhedral crystal form. Marcasite is fine grained and cutting quartz and other gangue mineral. Chalcopyrite fills in the periphery of minute crack of pyrite.
PD 12190.9	PD-12	Pyrite ore	Mineral assemblage : Pyrite, marcasite ..... a few Chalcopyrite ..... few Pyrite is anhedral crystal and accompanied by quartz vein changing a part of it into marcasite. Both marcasite and chalcopyrite present in the form of dissemination.
PD1376.4	PD-13	Chalcopyrite ore	Mineral assemblage : Chalcopyrite, pyrite, marcasite ..... common Sphalerite, pyrrhotite ..... a few Argentite, pyrargyrite ..... few Chaldcopyrite id is massive and contains eu-anhedral pyrite. Marcasite replaces apart of chalcopyrite. Sphalerite which contains fine dot of chalcopyrite ocupies periphery of and id is enclosed by chalcopyrite. Pyrrhotite also id is enclosed by chalcopyrite. Argentite and pyragyrite are cutting chalcopyrite.

Sample No.	Location	Macroscopic Description	Microscopic Observation
PD1376.5	PD-13	Chalcopyrite ore	Mineral assemblage : Chacopyrite ..... abundant Pyrite, marcasite ..... common Sphalerite ..... a few Pyragyrite, argentite .....scarce Chalcopyrite appears in massive crystal which contains eu-anhedral pyrite. Pyrite has at least two stages of crystalization, the earlier one is enclosed in chalcopyrite and latter is fine grained pyrite which coexists with marcasite filling the periphery of euhedral pyrite and replacing chalcopyrite. Sphalerite with very fine grained chalcopyrite dot appears in the periphery of or as a inclusion of chalcopyrite. Argentite and pyrargyrite cut chalcopyrite and sphalerite.
PD 1378	PD-13	Chalcopyrite ore	Mineral assemblage : Chalcopyrite, pyrite ..... common Sphalerite ..... a few Pyrargyrite, pyrrhotite ..... scarce Chalcopyrite is accompanied by quartz vein. pyrite shows two type of lccurrence, one is enclosed in shalcpyrite crystal and the other is surrounding, fracture-filling and replacing chalcopyrite. Both sphalerite and pyrrhotite are enclosed in chalcopyrite crystal. Pyrrargyrite is cutting foth chalcopyrite and later stage pyrite.
PD 14124	PD-14	Sphalerite ore	Mineral assemblage : Sphalerite, pyrite ..... common Pyrrhotite, galena ..... a few Chalcopyrite, Ag bearing pb-Bi minerd ..... few Pyrite shoues two types of occurrence, one is eu-anhedral crystal form and massivi the other is fine grained veinlet. Sphalerite which contains lots of pyrrhotite dot coexists with pyrite. A few grains of pyrrhotite are included in pyrite also. Galena is eithev inclusion of sphalerite or single crystal in gangue mineralv. Ag bearing pb-Bi mineral was found in galena showing exsolution lamellas. A part of pyrite changes into marcaste.

Sample No.	Location	Macroscopic Description	Microscopic Observation
PD 14163.6	PD-14	Sphalerite ore	Mineral assemblage : Pyrite, sphalerite ..... common Chalcopyrite, galena ..... a few Pyrargyrite ..... scarce Pyrite shows eu-anhedral crystal form and is accompanied by quaryz vein. Sphalerite usually contains chalcopyrite . Galena replaces pyrite and occupies the peripheries of sphalerite and pyrite. Chalcopyrite also occurs near pyrite crystal. Pyrargyrite coexists with chalcopyrite.
PD 14164.1	PD-14	Arsenopyrite-sphalerite ore	Mineval assemblage : Pyrite, arsenopyrite, sphalerite ... common Galena ..... a few Pyrite is massive with eu-anhedral crystal form. Arsenopyrite also shows eu-anhedral crystal andmost of the cases coexists with pyrite. Both pyrite and arsenopyrite are breciated. Sphalerite replaces purite and arsenopyrite. galena is enclosed in pyrite and arsenopyrite crystals.
PD 15115.6	PD-15	Chalcopyrite ore	Mineral assemblage : Chalcopyrite, marcasite ..... common Pyrite, sphalerite ..... a few Pyrargyrite ..... scarce Most of the eu-anhedral pyrite ehanges into mancasite. Chalcopyrite replaces a part of marcasite. Sphalerite with no chalcopyrite dot coexists with chalcopyrite. Pyraghrite, 20-30 μm in size, appears in chalcopyrite crystal.
PD 15121.4	PD-15	Arsenopyrite ore	Mineral assemblage : Arsenopyrite ..... abundant Pyrite, marcasite ..... common Sphalerite, galena ..... a few Arsenopyrite with euhedral crystal form appears as dissemenation

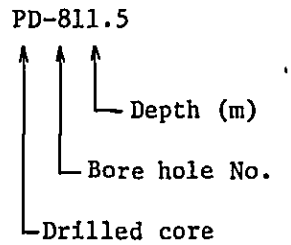
Sample No.	Location	Macroscopic Description	Microscopic Observation
			or aggregates. Pyrite is the same as arsenopyrite. Marcasite appears; (1) Vein-forming withen gangue mineral and (2) the periphery of pyrite crystal. Sphalerite with chalcopyrite dot disseminates independently in gangue mineral. Galena is enclosed both in pyrite and arsenopyrite.
PD 15121.7	PD-15	Arsenopyrite ore	Mineral assemblage : Arsenopyrite ..... abundant Pyrite, sphalerite, galena ..... a few Arsenopyrite is the same as in PD15121.4. Pyrite has two type of occurrence, one is euhedral dissemination and the other is vein type. Sphalerite which contains a small amount of chalcopyrite dot shows massive crystalization or isolated inclusion in arsenopyrite.
PD 15129	PD-15	Pyrite ore	Mineral assemblage : Pyrite ..... abundant Sphalerite, arsenopyrite, marcasite... common Chalcopyrite, galena ..... a few Tetrahedrite ..... scarce Pyrite presets massive appearana with eu-anhedral crystal. Arsenopyrite is either dissemination or aggregates with euhedral crystal form. Sphalerite replaces arsenopyrite. Chalcopyrite appears; (1) a small dot in sphalerite, (2) dissemination in gangue mineral and (3) fracture filling in arsenopyrite. Galena exists mear and in arsenopyrite crystal. Tetrahedrite cut chalcopyrite as a veinlet. Marcasite used to occur with pyrite.
PD 15148.7	PD-15	Arsenopyrite ore	Mineral assemblage : Arsenopyrite ..... abundant Sphalerite, Pyrite ..... common Galena, chalcopyrite ..... a few Electrum ..... scarce Arsenopyrite with eu-anhedral crystal appears near pyrite crystal

Sample No.	Location	Macroscopic Description	Microscopic Observation
			or gangue mineral in the form of dissemination and aggregates. Pyrite also exhibits eu-anhedral crystal. Sphalerite replaces arsenopyrite and pyrite. Galena is enclosed in arsenopyrite. Electrum, teo grains with size of 50 μm and 100 μm, was found adjacent to arsenopyrite.

A. II - 19 Photomicrographs

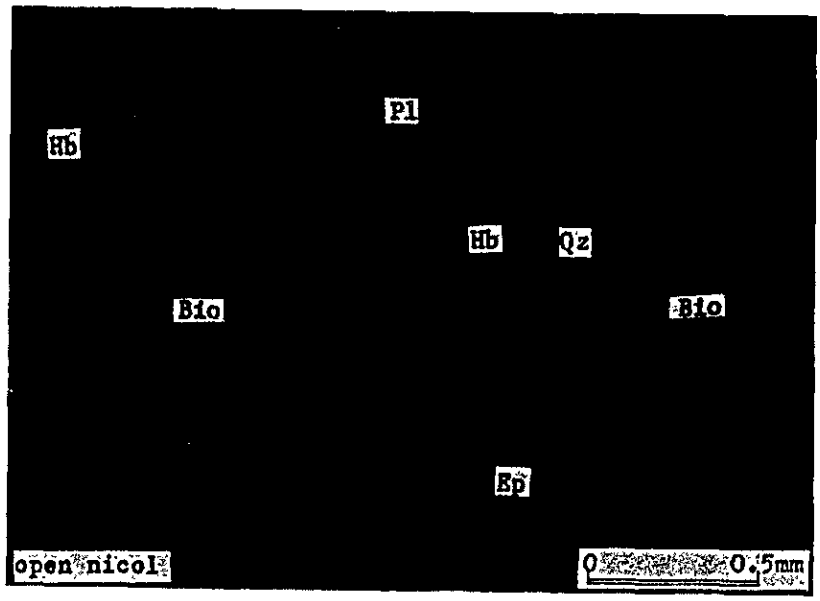
A. Ⅱ-19-1 Thin section

Sample No.	Rock Type
PD-811.5	Biotite-hornblende granodiorite
PD-910.5	Pyroxene andesitic tuff
PD-1088	Hornblende andesite
PD-1282.8	Pyroxene andesitic tuff?
PD-1505	Pyroxene andesite



Abbreviations

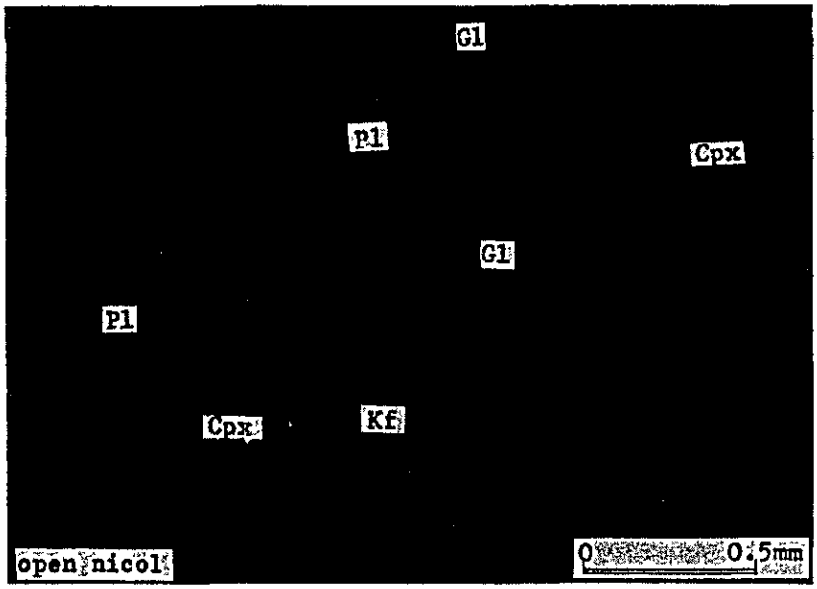
Pl : Plagioclase
Qz : Quartz
Chl : Chlorite
Hb : Hornblende
Cpx : Clinopyroxene
Ep : Epidote
Bio : Biotite
Kf : Potash feldspar
Gl : Glass
Clay : Clay



Sample No. PD-811.5

Rock type:

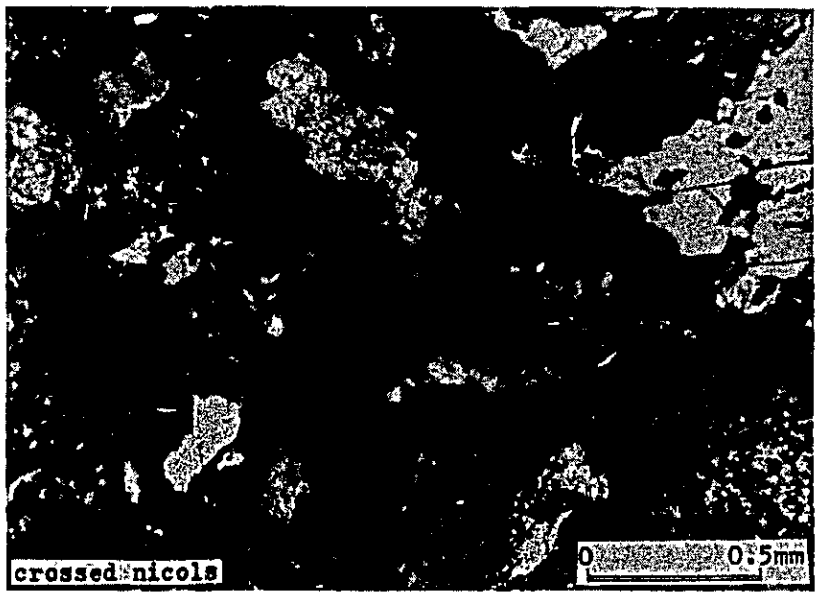
Biotite-hornblende granodiorite

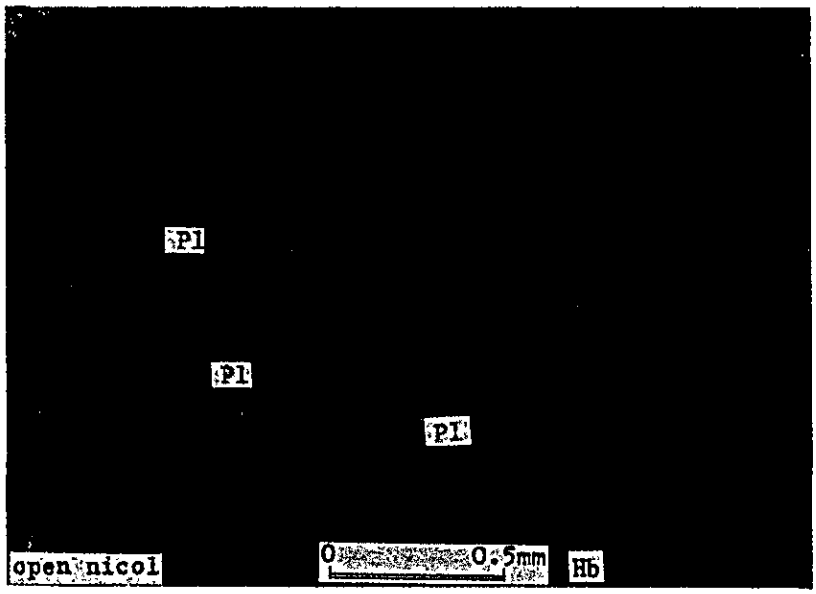


Sample No. PD-910.5

Rock type:

Pyroxene andesitic tuff

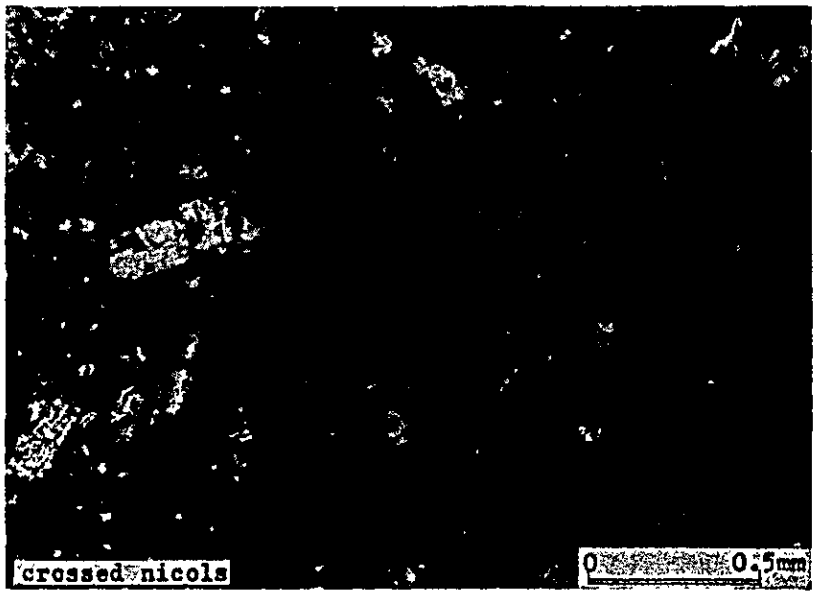


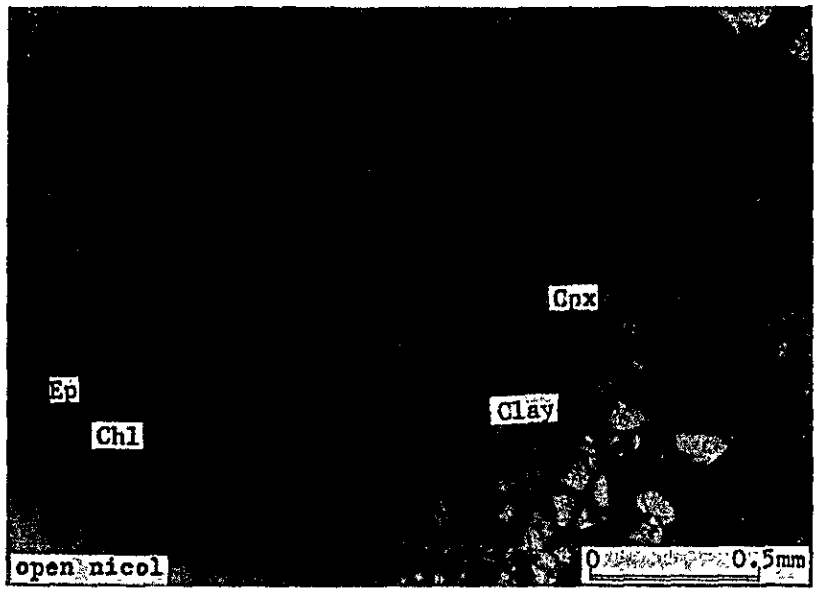


Sample No. PD-1088

Rock type:

Hornblende andesite

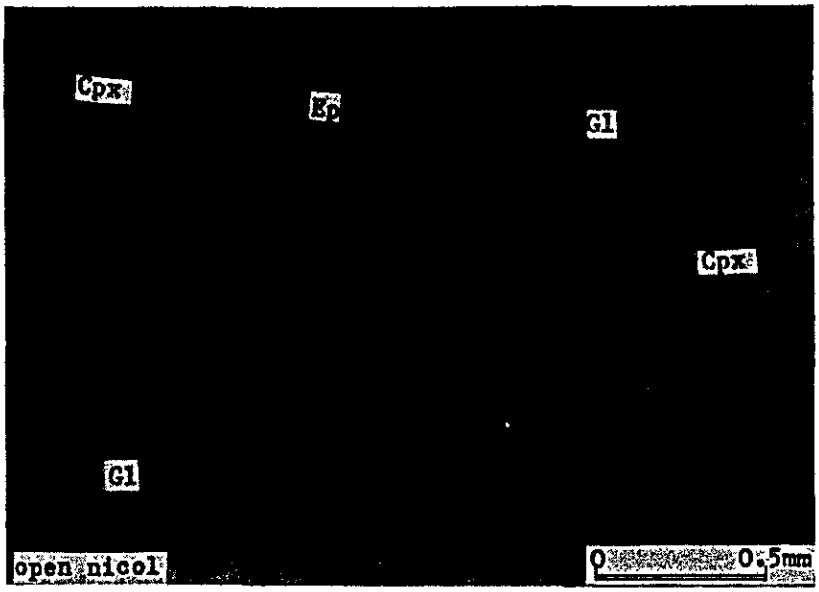




Sample No. PD-1282.8

Rock type:

Pyroxene andesitic tuff ?

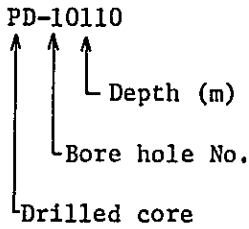


Sample No. PD-1505

Rock type:

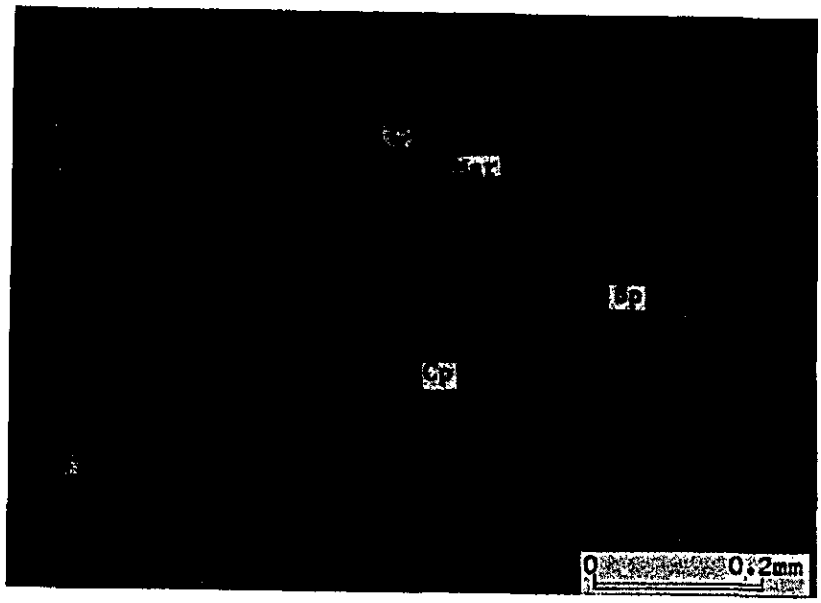
Pyroxene andesite

A. Ⅱ-19-2 Polished section



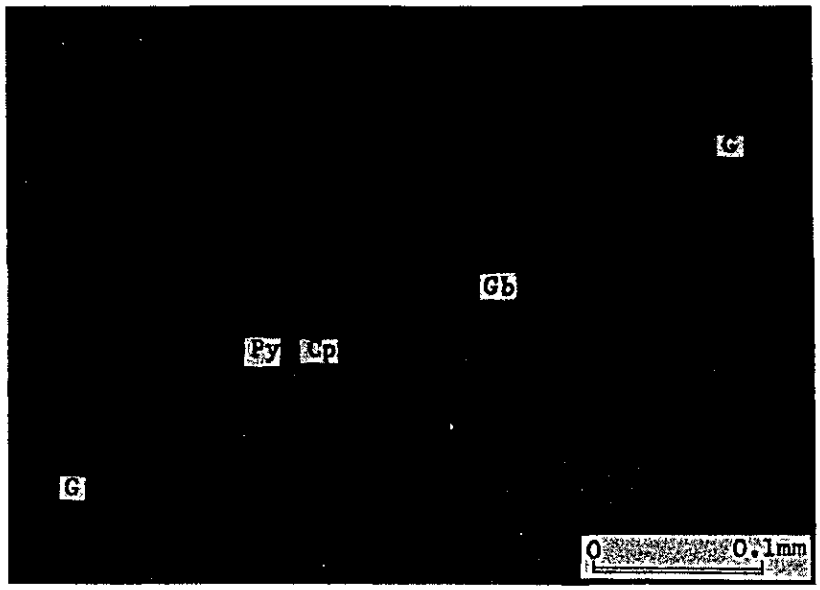
Abbreviations

Sp	:	Sphalerite
Gn	:	Galena
Cp	:	Chalcopyrite
Gb	:	Ag-Pb-Bi mineral
El	:	Electrum
Arg	:	Argentite
Pr	:	Pyrargyrite
Py	:	Pyrite
Asp	:	Arsenopyrite
Mar	:	Marcasite
G	:	Gangue mineral
Pu	:	Proustite



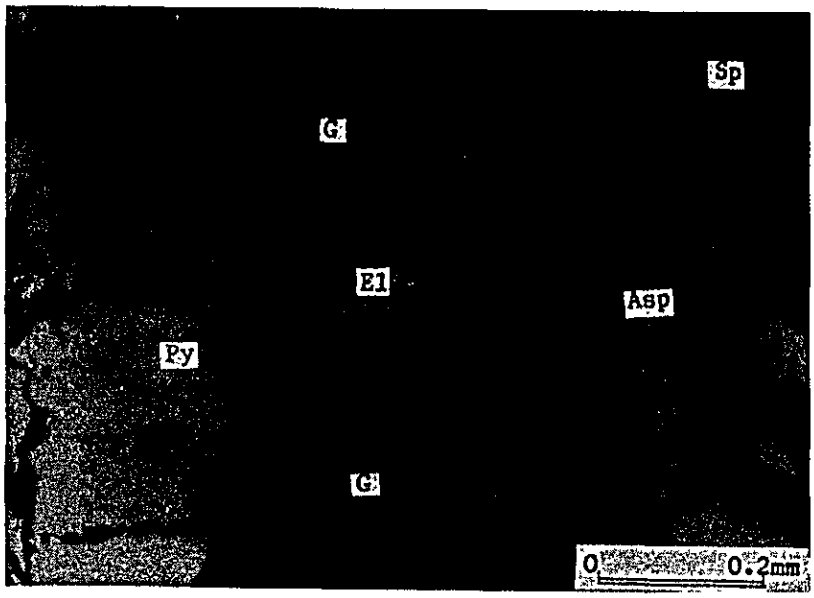
Sample No. PD-10110

Paragenesis of chalcopyrite and sphalerite.
Marcasite is the latest mineral cutting both Cp and Sp.



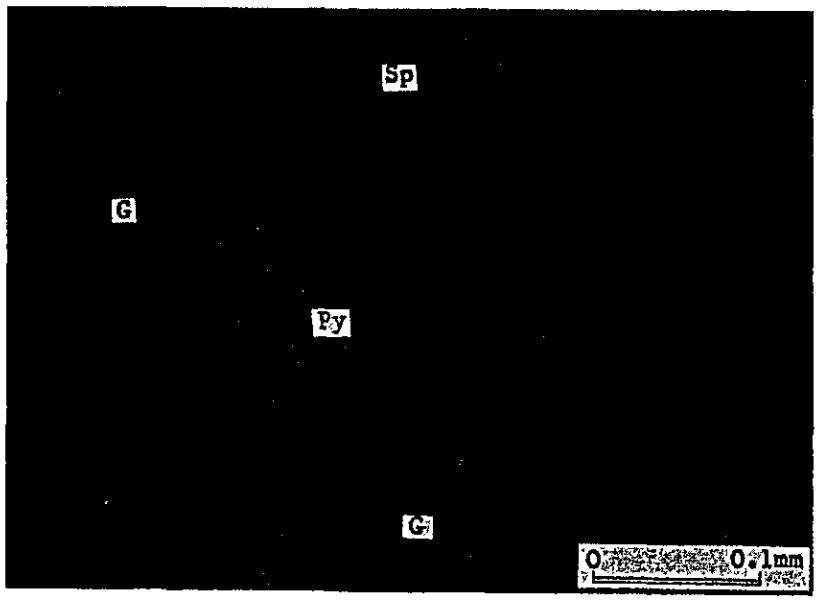
Sample No. PD-10110

Ag-Pb-Bi mineral coexists with chalcopyrite.



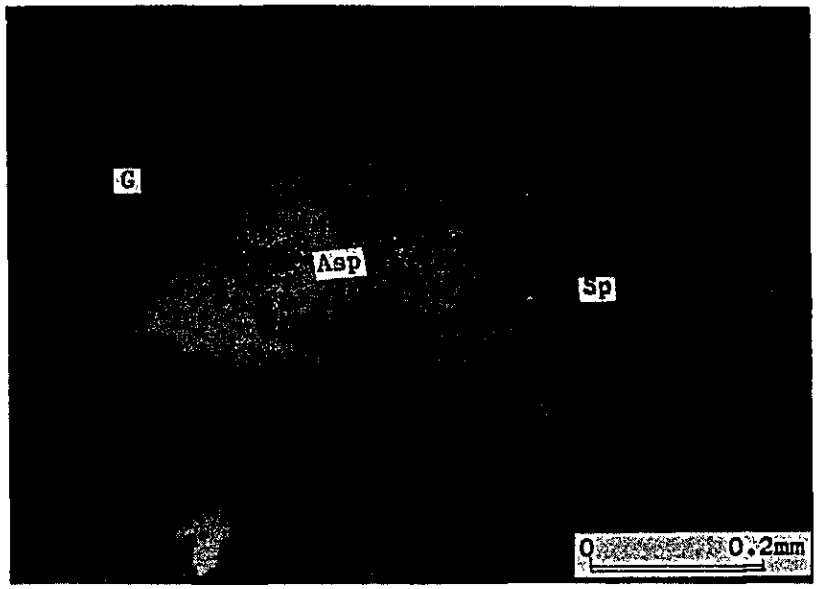
Sample No. PD-10111

Electrum within gangue mineral.



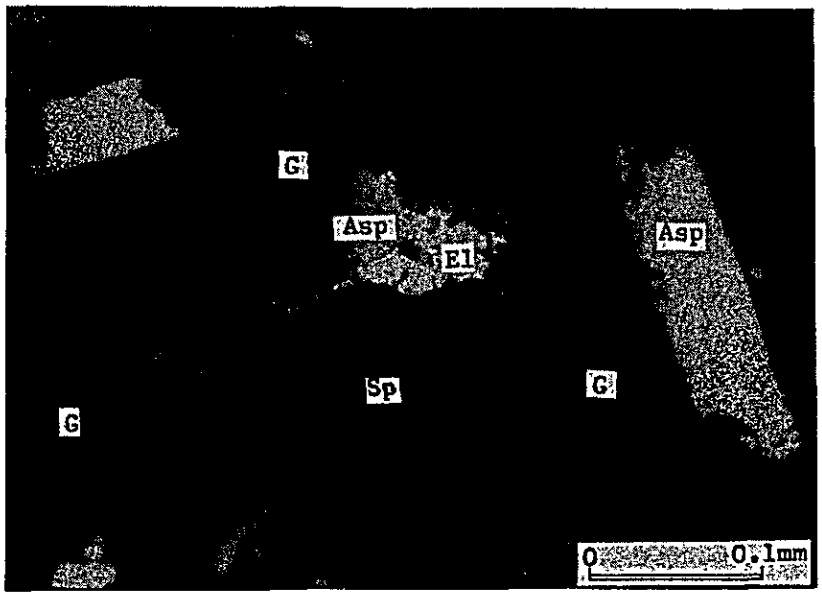
Sample No. PD-10111

Pyrite is replaced by sphalerite with chalcopyrite dot.



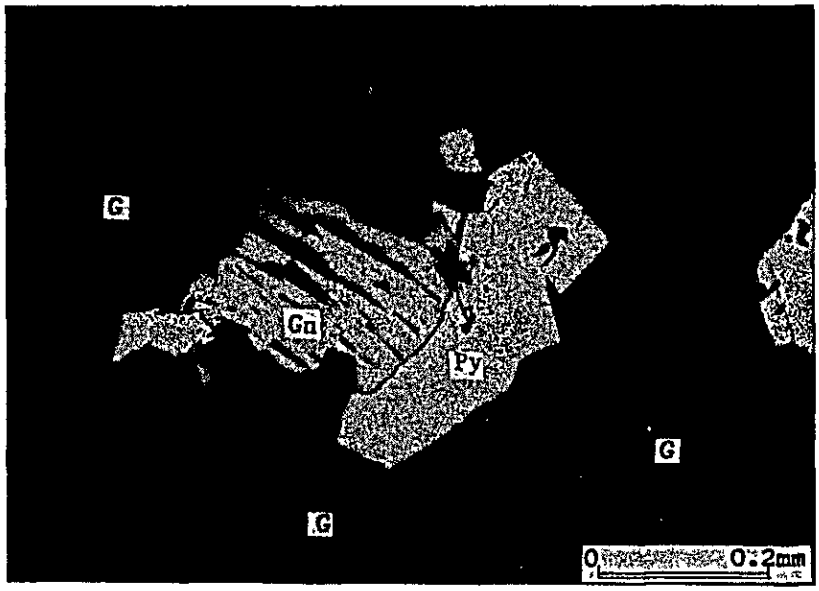
Sample No. PD-10111.4

Arsenopyrite is replaced by sphalerite.



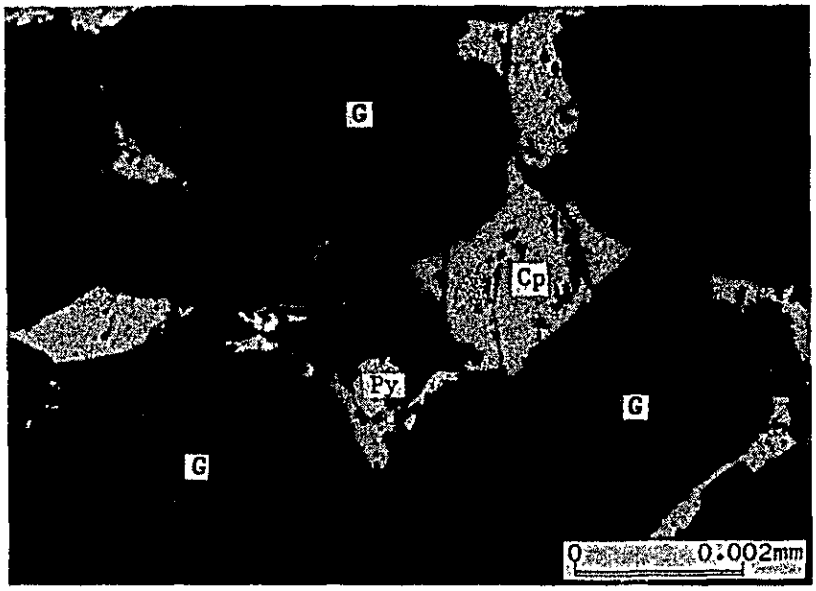
Sample No. PD-10114

Electrum coexists with arsenopyrite.



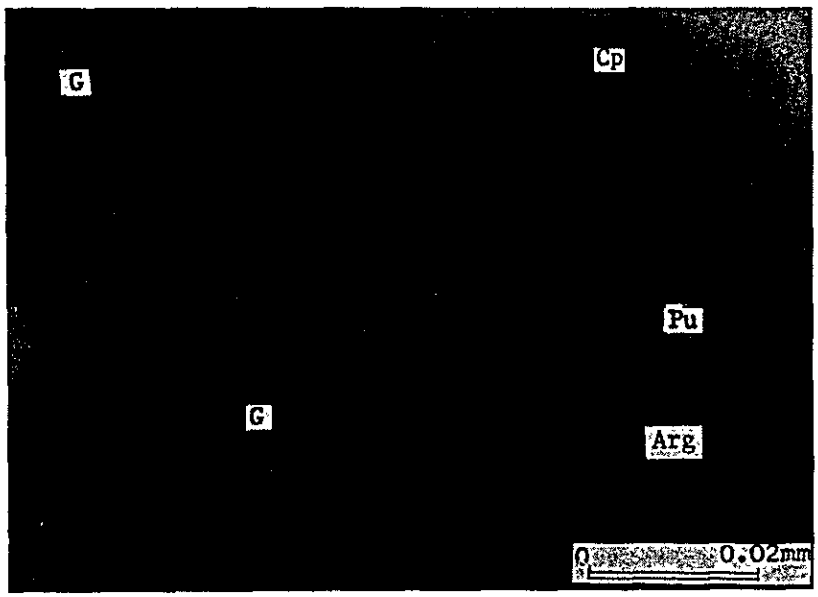
Sample No. PD-11181

Galena with triangular pit replaces pyrite.



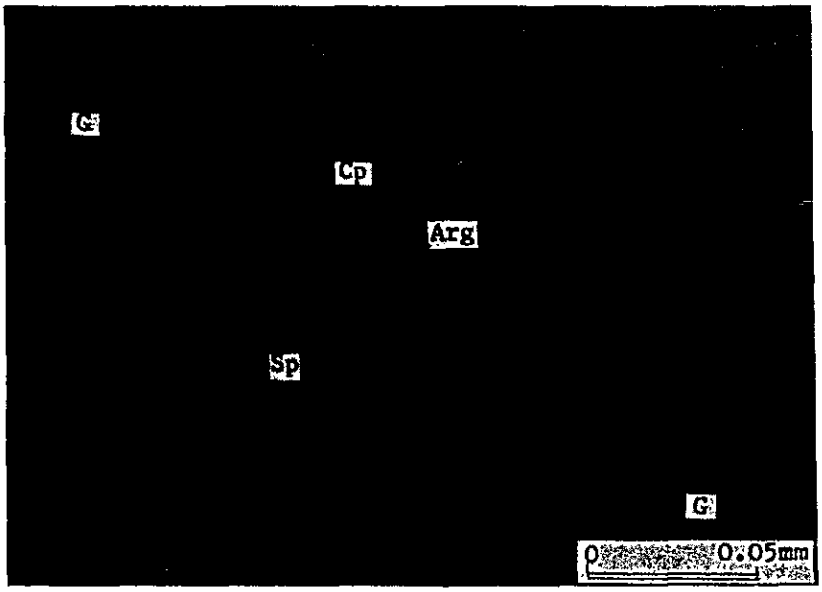
Sample No. PD-1376.4

Paragenesis of chalcopyrite -pyrite-pyrargyrite-argentite.



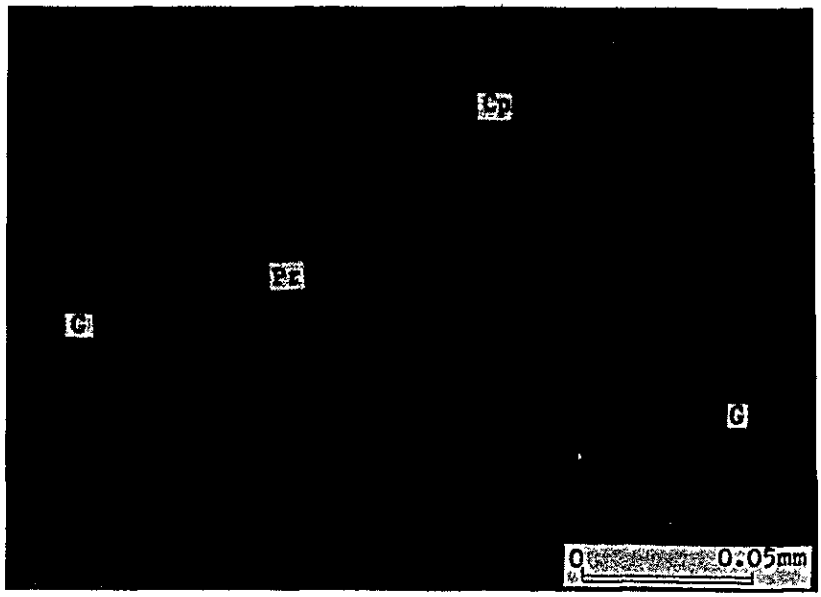
Sample No. PD-1376.4

Enlarged above.



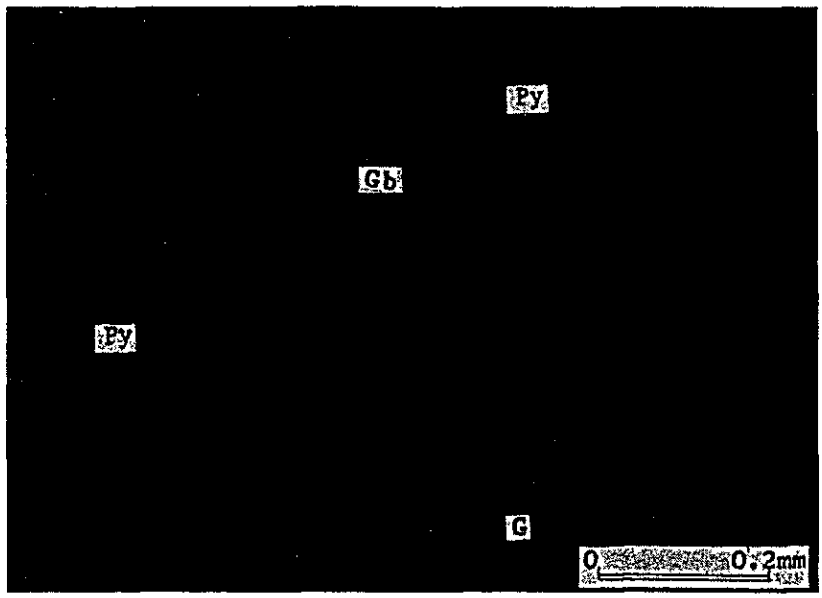
Sample No. PD-1376.5

Argentite is cutting both sphalerite and chalcopyrite.



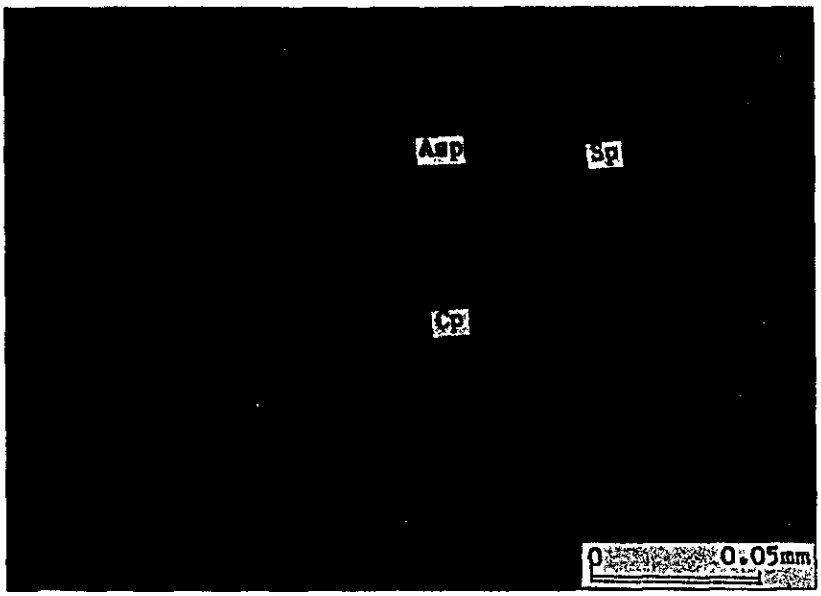
Sample No. PD-1378

Pyrargyrite vein cuts chalcopyrite.



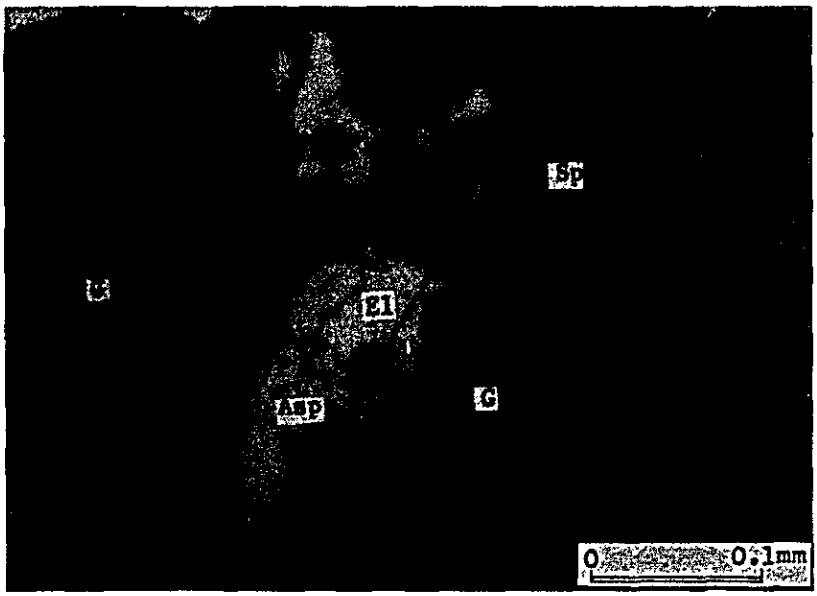
Sample No. PD-14124

Ag-Pb-Bi mineral within pyrite.



Sample No. PD-15121.7

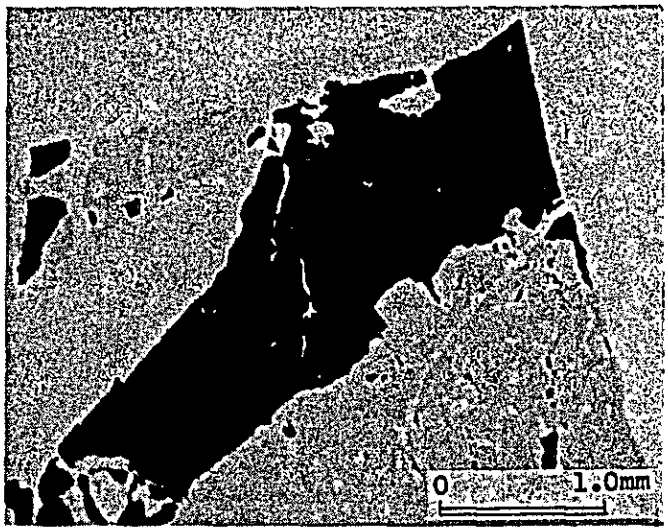
Arsenopyrite-sphalerite-chalcopyrite in crystallization order.



Sample No. PD-15148.7

Electrum with arsenopyrite.

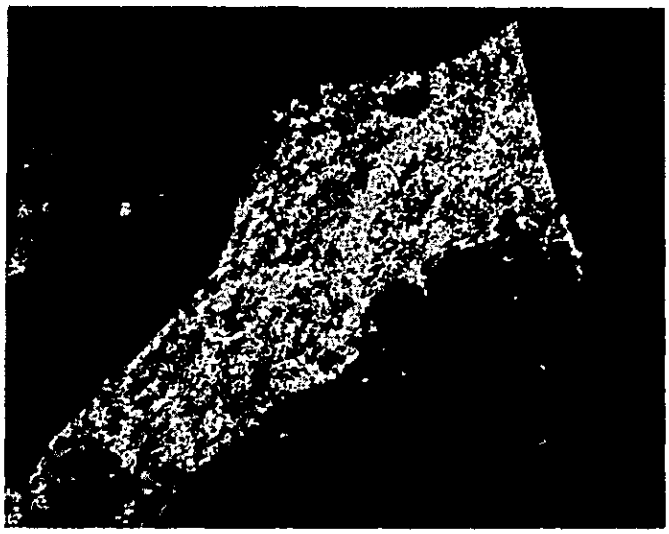
A. II-19-3 EPMA



Absorbed electron image

Ag-Pb-Bi mineral
(Cosalite-galenobithmuthinite
-gustarite series)

Ag X-ray image

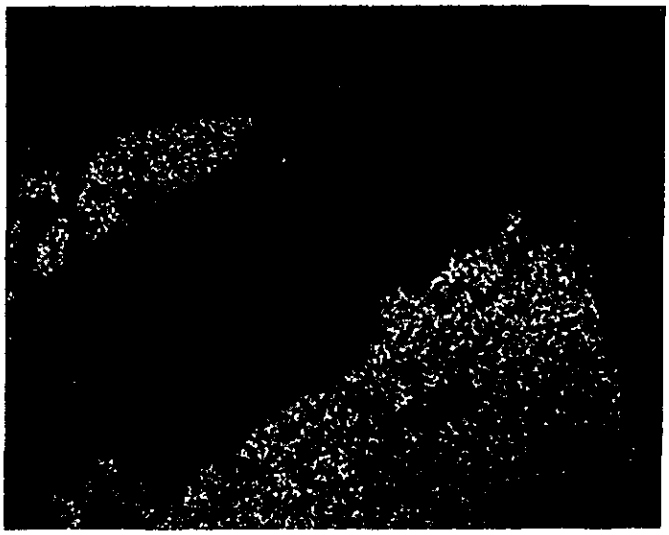


Pb X-ray image

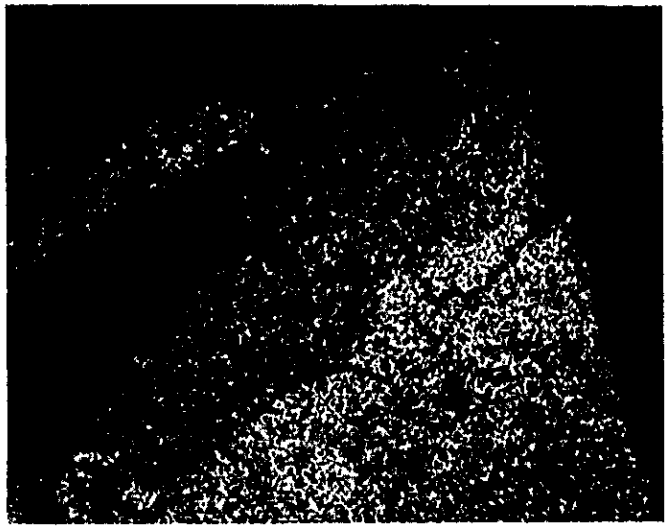
Sample No. : PD-10110
Locality : Diamante
Accel. volt : 15 kV
Absorb. elect. : 0.1 μA

Bi X-ray image

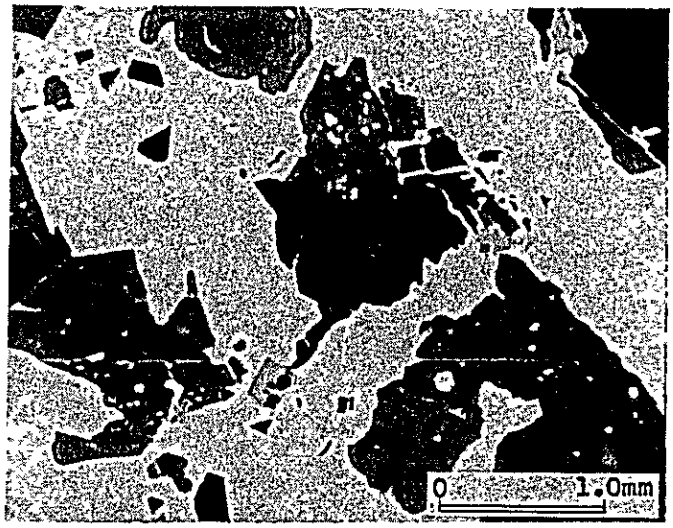
Cu X-ray image



Fe X-ray image

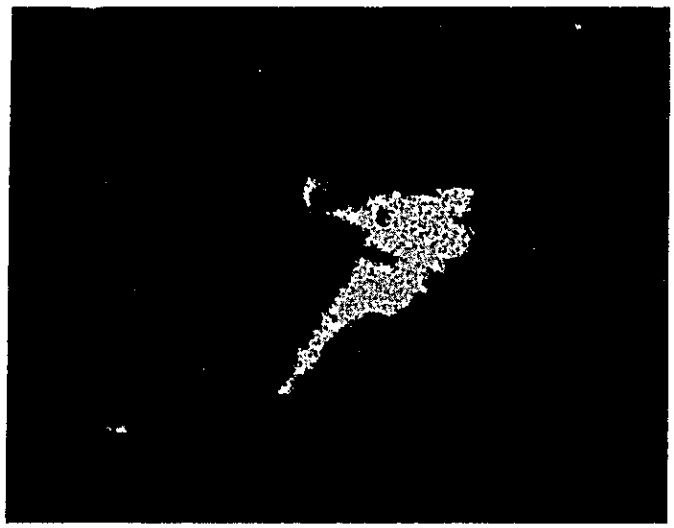


S X-ray image



Absorbed electron image

Electrum (black in the photo) in association with arsenopyrite.



Au X-ray image

Ag X-ray image

Sample No. : PD-10114
Locality : Diamante
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA