| Sample No. | Location | Macroscopic description | Microscopic observation |
|---|---|---|---|
| QCPP 49 | Gitana-NW Q. 13 | Basaltic andesite | Metamorphosed Andesite<br>The rock is andesite fairly affected by a contact metamorphism remaining clearly the original porphyritic texture.<br>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.<br>Relic plagioclase phenocrysts, too, are often replaced by green amphibole and subordinate biotite chiefly along cracks and zoning planes.<br>Several veinlets of green amphibole cut the rock.<br>Magnetite is probably titaniferous and often leucoxenized marginally.<br>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<br>The rock is meta-andesite with the original porphyritie texture and completely rearranged matrix.<br>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.<br>Relic plagioclase phenocrysts are andesine in composition and are replaced fairly by fine-grained epidote, brown biotite, quartz and chlolite.<br>Accessory zircon, apatite and magnetite are possibly relic minerals.<br>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<br>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.<br>Accessory apatite, zircon, sphene and opaque minerals are present.<br>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<br>sphalerite ..... a few<br>chalcopyrite, galena, covelline, tetrahedrite .....scarcely<br>Arsenopyrite shows euhedral to anhedral crystal form and a part of of it is replaced by gangue mineral.<br>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.<br>Sphalerite is unhedral and contains a lot of chalcopyrite dot and is often associated with arsenopyrite.<br>Chalcopyrite, majority of it is a small dot in sphalerite, however, free crystal in gangue mineral or closely associated with pyrite is also found.<br>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<br>sphalerite, chalcopyrite, tetrahedrite... a few<br>covelline ..... few<br>electrum ..... much less<br>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.<br>Chalcopyrite and tetrahedrite are formed in the corroded part of pyrite. Covelline is a secondary mineral.<br>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<br>sphalerite, tetrahedrite ..... a few<br>chalcopyrite, covelline ..... scarcely<br>The same as MM 2A.<br>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<br>sphalerite ..... a few<br>covelline ..... few<br>electrum ..... scarcely<br>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.<br>A single crystal of electrum (Ca. 100 $\mu$m in size) is found in the skelton crystal of arsenopyrite. |
| MM 4A | Diamante Area Mina Marina | | Mineral assemblage: arsenopyrite ..... common<br>sphalerite ..... a few<br>covelline, galena, chalcopyrite ..... few<br>The occurrance of arsenopyrite, sphalerite and covelline is the same as MM 3.<br>galena (10 $\mu$m in size) is enclosed in the crystal of arsenopyrite.<br>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<br>sphalerite, chalcopyrite, covelline ..... few<br>Arsenpyrite is euhedral to anhedral crystal and a part of it is replaced with gangue mineral.<br>Sphalerite contains dotts of chalcopyrite and is often associated with arsenopyrite.<br>Chalcopyrite is found as a dot in sphalerite or inclusion of arsenopyrite.<br>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<br>galena, arsenopyrite ..... a few<br>chalcopyrite, tetrahedrite ..... few<br><br>Pyrite is anhedral and disseminates with one alignment.<br>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.<br>Chalcopyrite is found both in sphalerite and in the gangue mineral and it usually associates with tetrahedrite.<br>Tetrahedrite is also found in sphalerite as a veinlet. |
| DP-LB | Diamante Area Mina Diamante | Sphalerite-galena ore | Mineral assamblage: pyrite, sphalerite ..... common<br>galena, arsenopyrite .....a few<br>chalcopyrite, tetrahedrite ..... few<br><br>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.<br>Although tetrahedrite has strong paragenesis with chalcopyrite, it is noticed in part that tetrahedrite is intruding among chalcopyrite and sphalerite.<br>Tetrahedrite is later product than chalcopyrite and sphalerite. |
| N-13 | Mina Desquite | Arsenopyrite -sphalerite ore | Mineral assemblage: pyrite, arsenopyrite, sphalerite ..... common<br>covelline ..... few<br><br>Both pyrite and arsenopyrite show euhedral to anhedral crystal and disseminate in the vein.<br>Sphalerite contains much less chalcopyrite dot than the ore at Mina Marina and is commonly associated with arsenopyrite.<br>Covelline is the secondary mineral appearing periphery and cracks of sphalerite crystal.<br>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<br>galena, pyrite, chalcopyrite ..... a few<br>tetrahedrite ..... few<br><br>Sphalerite contains a lot of chalcopyrite dotts and it forms a vein-like precipitation.<br>galena is closely associated with sphalerite.<br>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.<br>Tetrahedrite usually associates with chalocpyrite. |
| N 57A | Paraiso Area Mina San Luis | Sphalerite-galena ore | Mineral assemblage: pyrite, sphalerite, galena, cerussite<br>tetrahedrite ..... common<br>argentite ..... few<br>electrum ..... scarcely<br><br>Pyrite is euhedral to anhedral. Sphalerite seldom contains chalcopyrite dot.<br>The marginal part of galena contains exsolutional dot of argentite. (a few to several tens $\mu$m in size)<br>Argentite is also found in sphalerite.<br>Electrum (5 to 75 $\mu$m 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<br>sphalerite, chalcopyrite, tetrahedrite... a few<br>covelline, arsenopyrite ..... few<br>electrum ..... scarcely<br><br>The occurrence of pyrite, sphalerite and chalcopyrite is the same as N 57A.<br>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.<br>Covelline is secondary product of chalcopyrite.<br>Electrum (20 $\mu$m in size) is found in the minute crack in pyrite. |
| N 57C | Paraiso Area<br>Mina San<br>Luis | Pyrite ore | Mineral assemblage: arsenopyrite ..... common<br>electrum .....scarcely<br><br>Arsenopyrite is in the form of euhedral to anhedral and is replaced by gangue mineral.<br>Electrum (17-30 $\mu$m in size) is found in the minute crack in arsenopyrite and crystal boundary between arsenopyrite and gangue mineral. |
| N 63B | Paraiso Area<br>Mina San<br>Luis | Pyrite-chalcopyrite ore | Mineral assemblage: pyrite ..... common<br>chalcopyrite, covelline ..... a few<br>sphalerite, galena ..... few<br><br>Pyrite disseminates in the vein and its crystal form is euhedral to anhedral.<br>Chalcopyrite also disseminates separately from pyrite and marginal part of chalcopyrite changes into covelline.<br>Sphalerite seldom contains chalcopyrite dot and appears near or inside of pyrite.<br>Galena is enclosed in pyrite. |

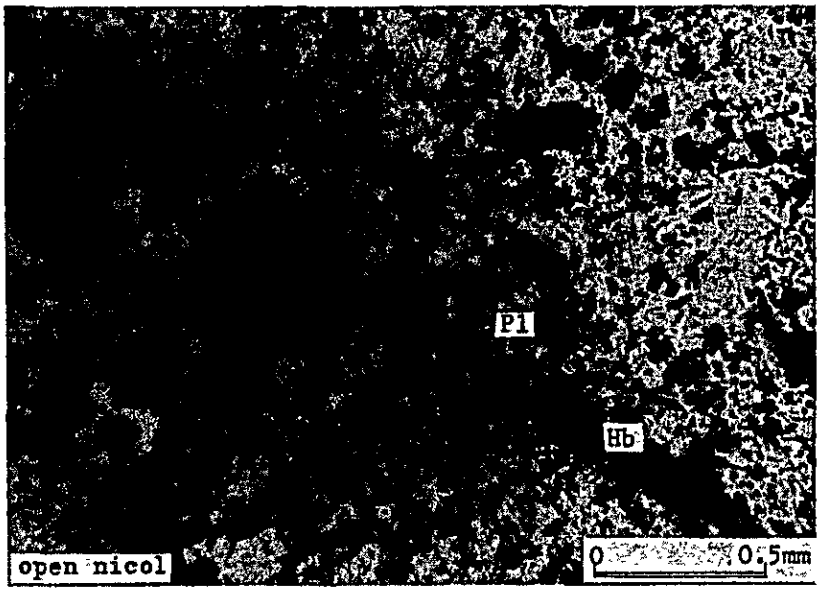
A. I-6 Photomicrographs

## 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

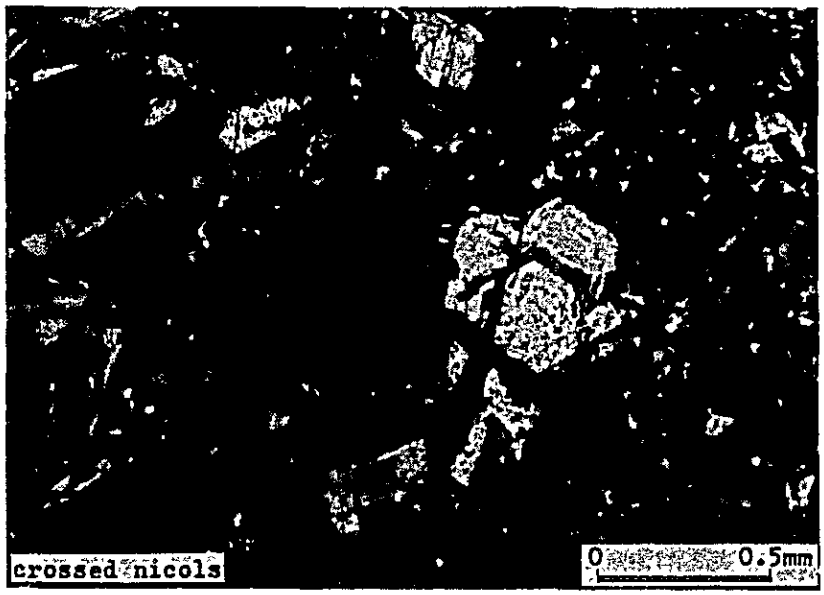
Qz : Quartz
Or : Orthoclase
Pl : Plagioclase
Bio : Biotite
Hb : Hornblende
Act : Actinolite
Diop : Diopside
Chl : Chlorite

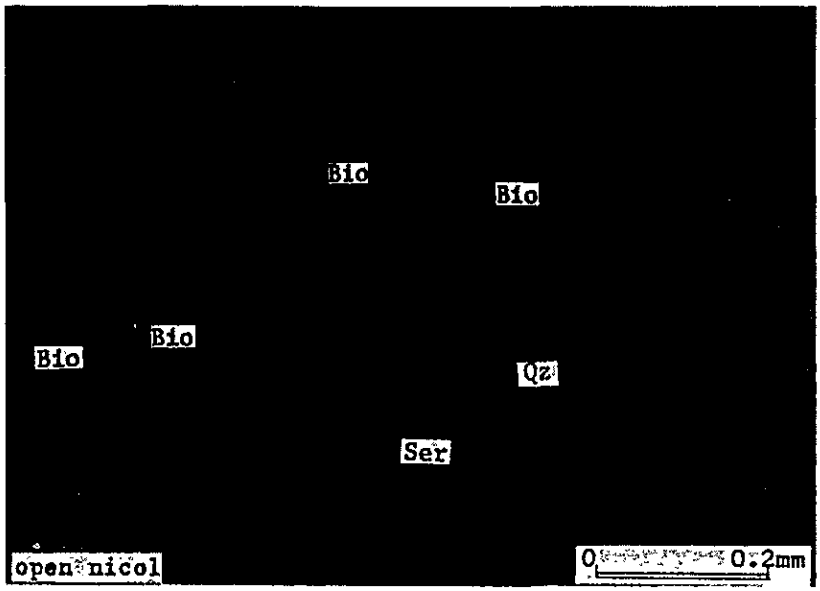



Sample No. QCPP49

Rock type:

Metamorphosed andesite

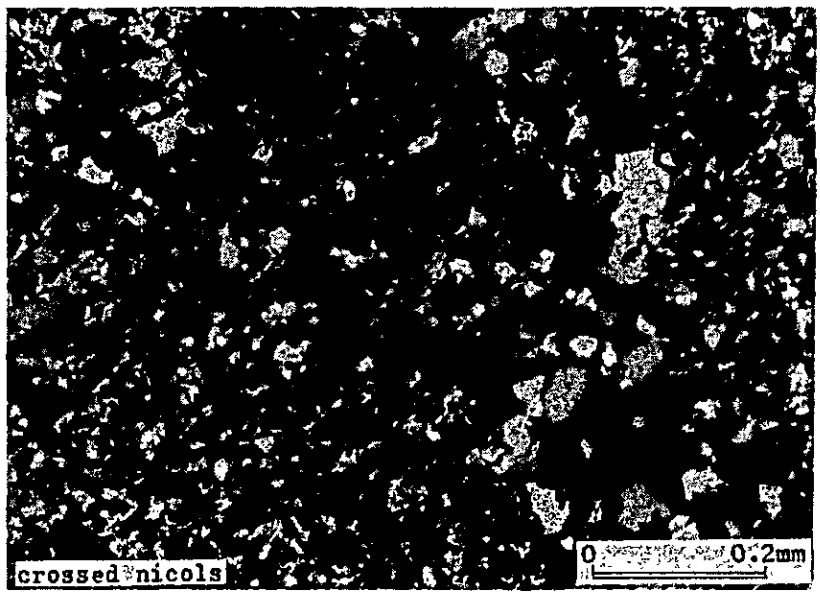


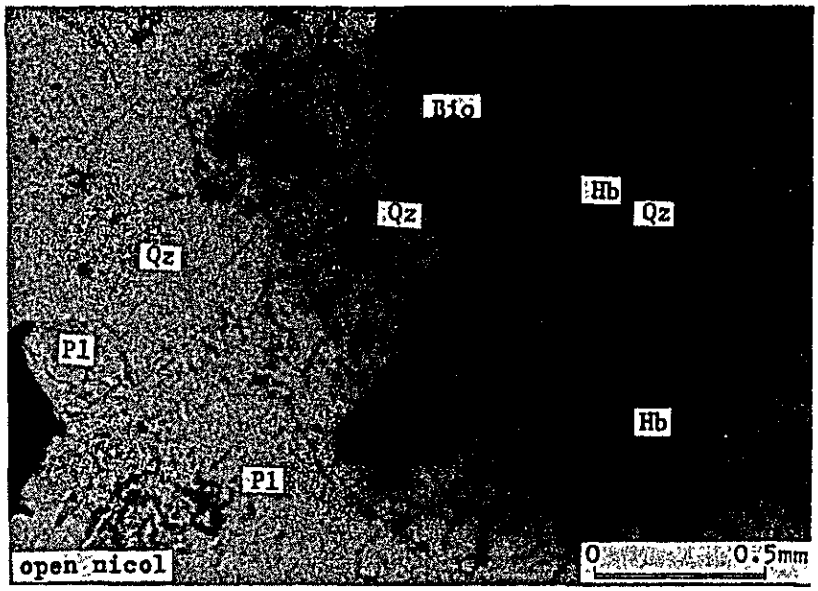



Sample No. Q1129

Rock type:

Sericite biotite quartz hornfels

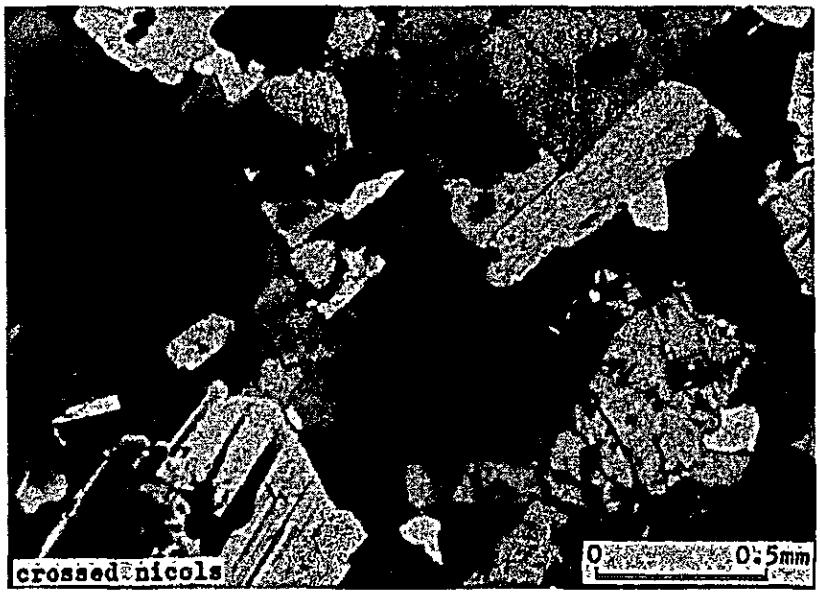





Sample No. Q1370

Rock type:

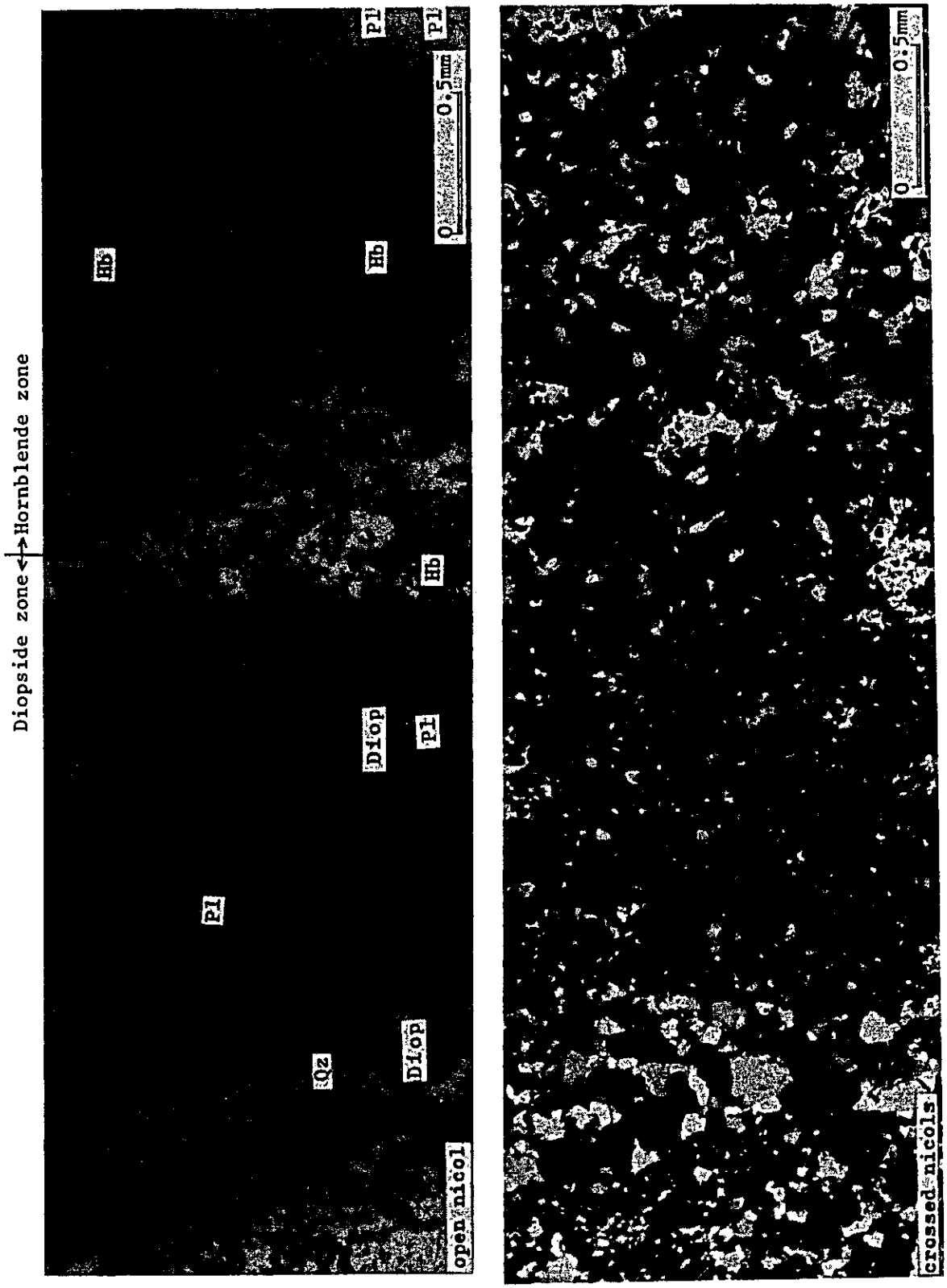
Biotite hornblende quartz diorite




Sample No. Q1327

Rock type:

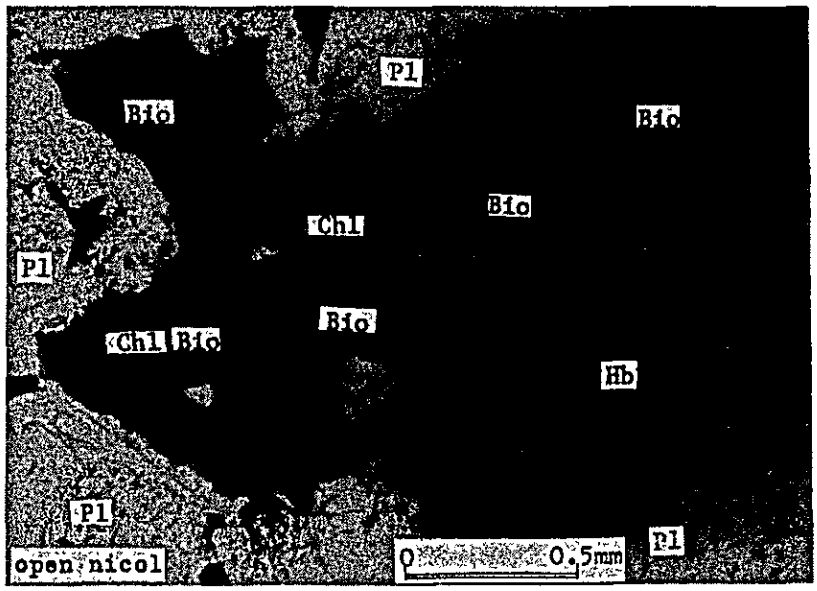
Metamorphosed andesitic tuff breccia




Sample No. HCA 12A

Rock type:

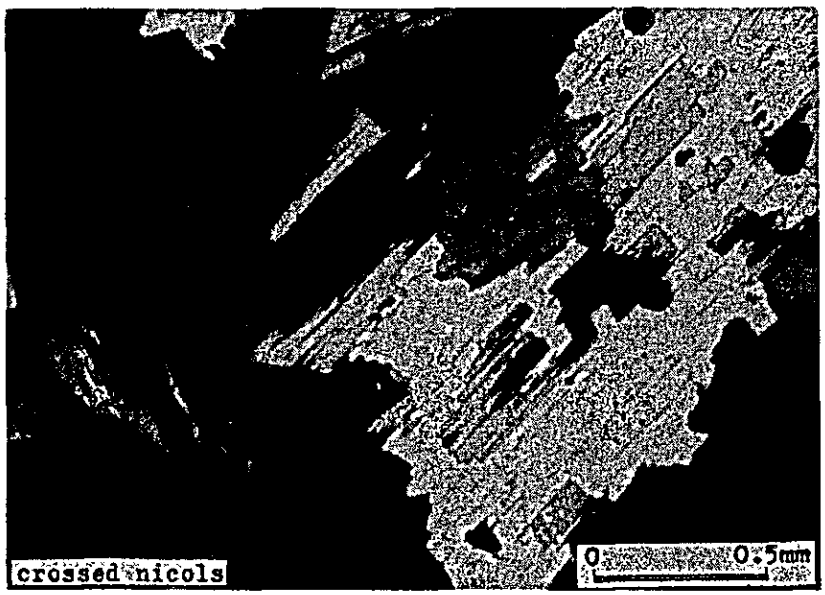
Diopside hornblende hornfels

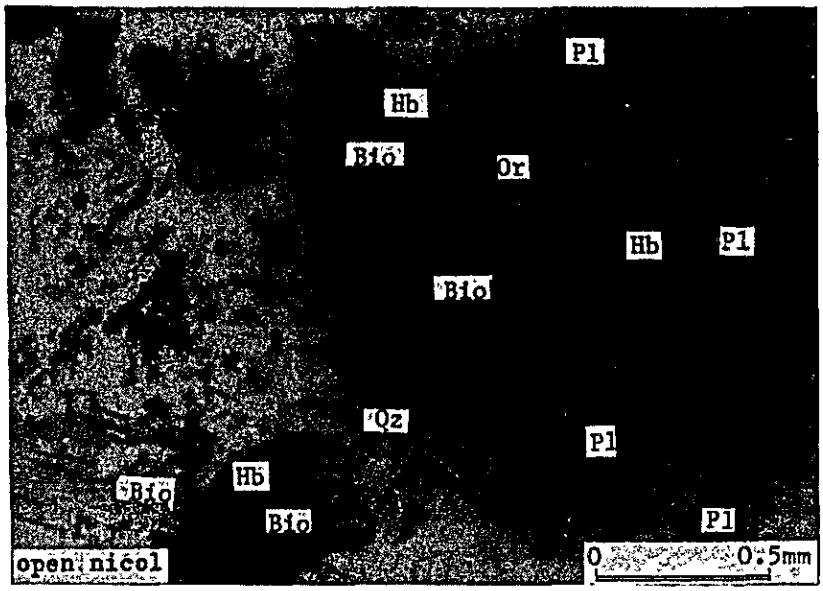



Sample No. HCA 12B

Rock type:

Hornblende biotite granodiorite

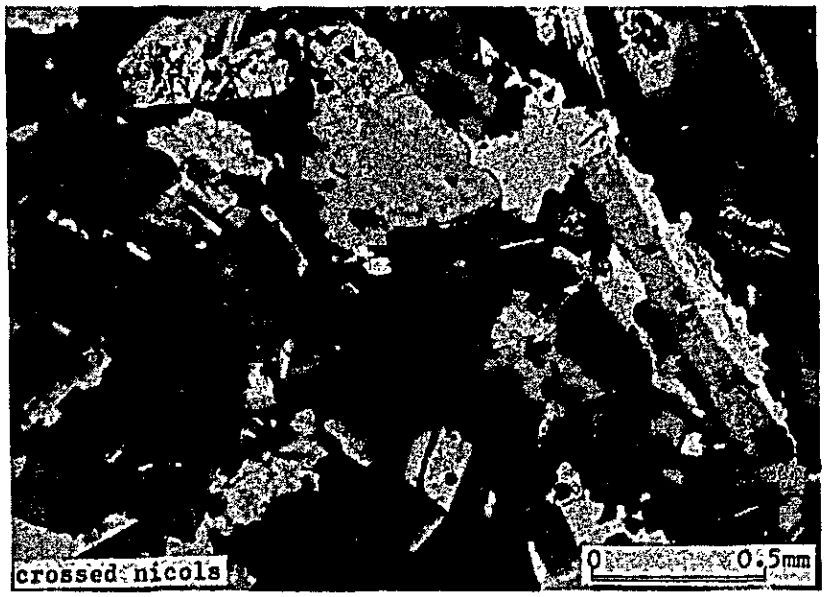


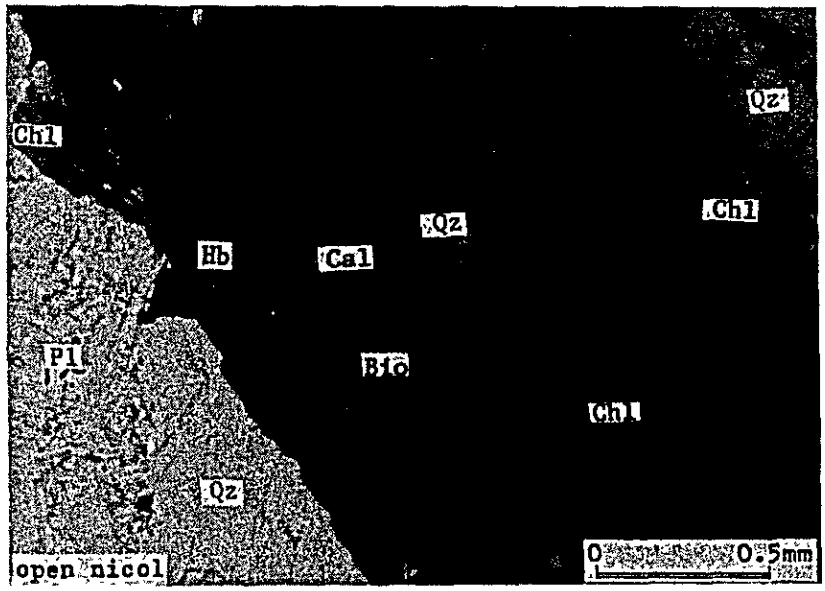



Sample No. F9

Rock type:

Biotite hornblende granodiorite

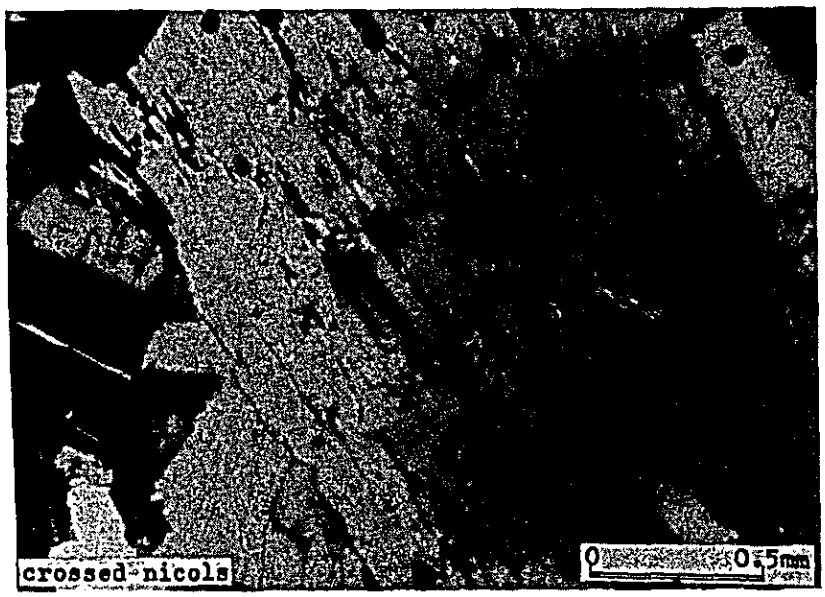





Sample No. RM6

Rock type:

Biotite hornblende granodiorite

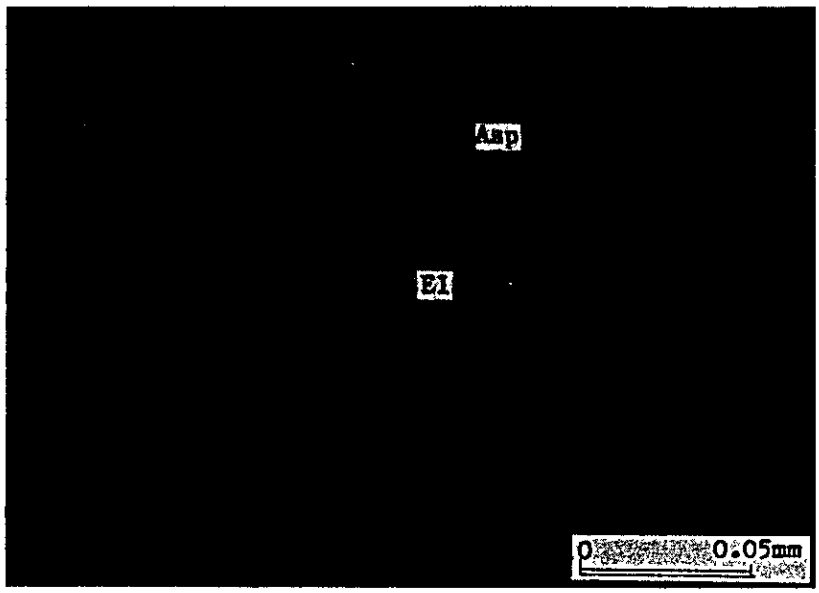


## A. I-6-2 Polished Section

| 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 |

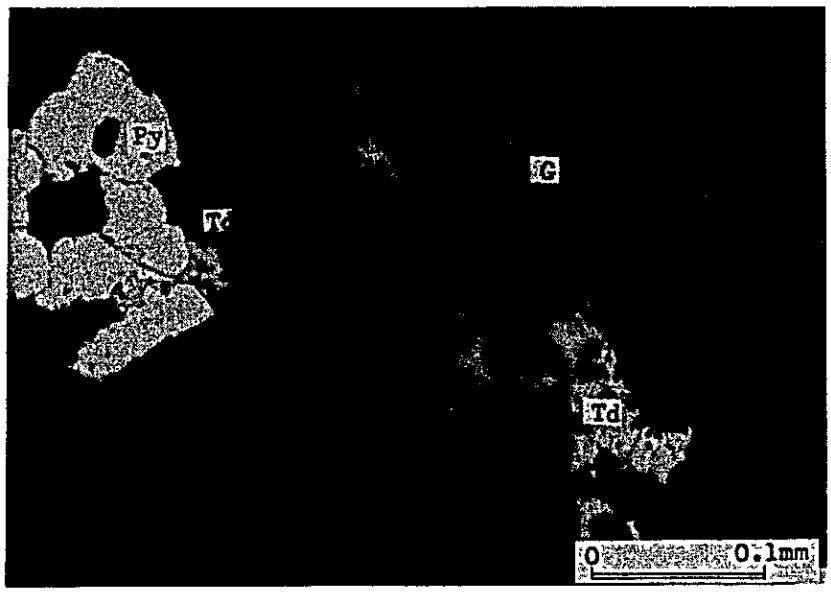
Abbreviations

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



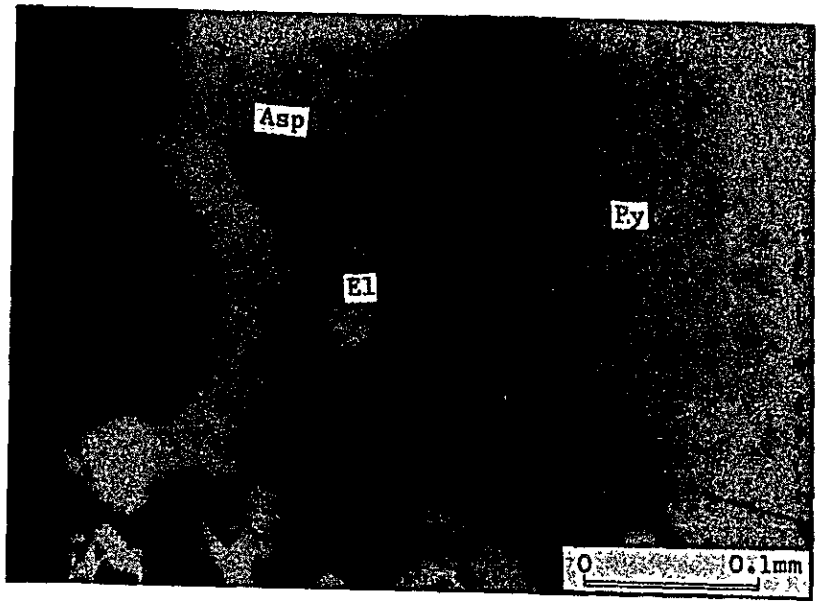

Sample No. MM2A

Electrum in arsenopyrite



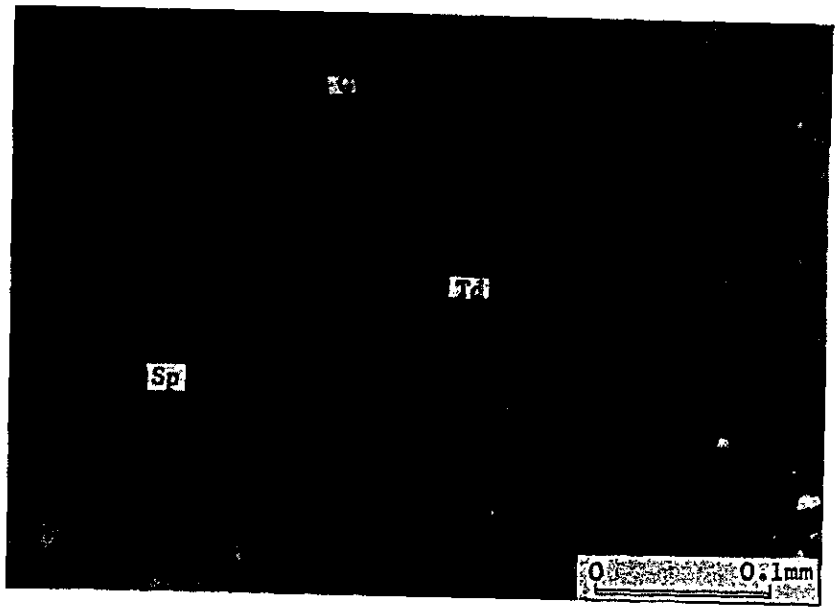

Sample No. MM2B

Ag bearing tetrahedrite
(conducted EPMA)



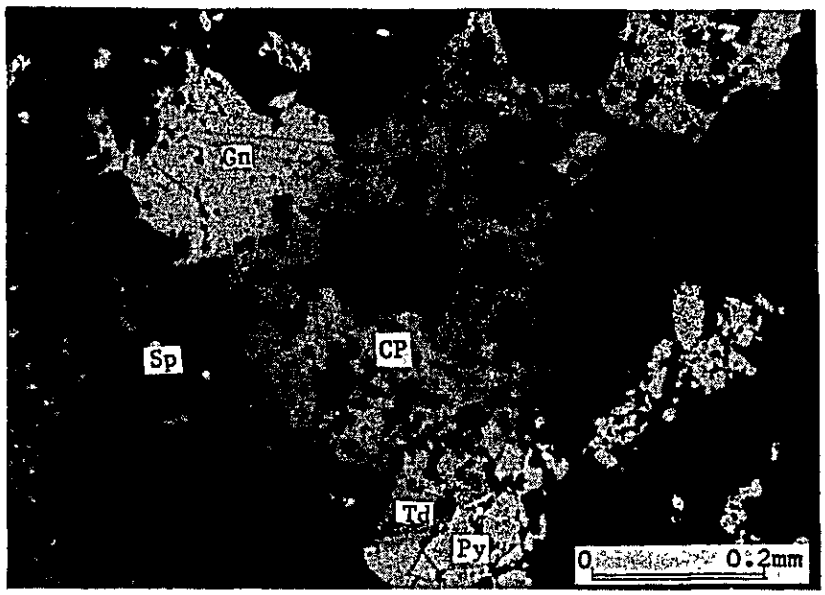

Sample No. MM3

Electrum with arsenopyrite
(conducted EPMA)



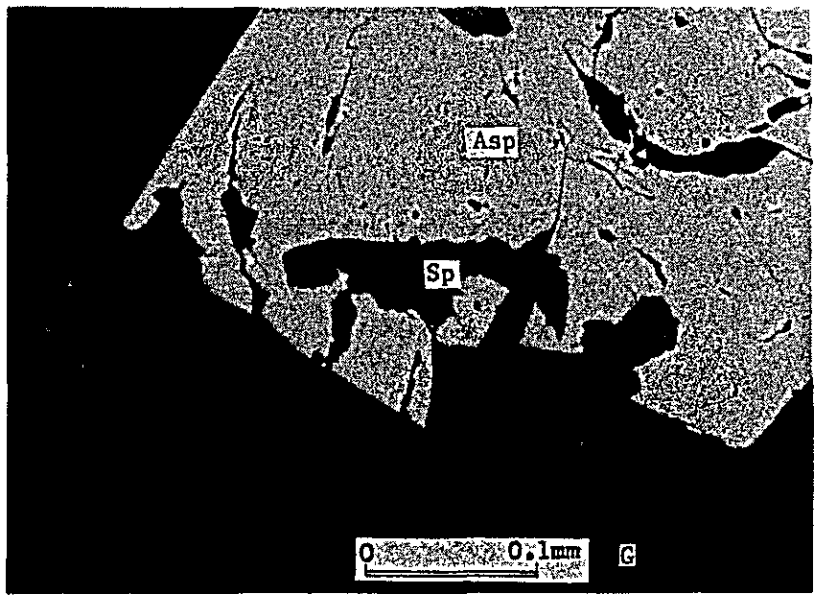

Sample No. DPL-A

Exsolution of sphalerite-
chalcopyrite-tetrahedrite
(conducted EPMA)



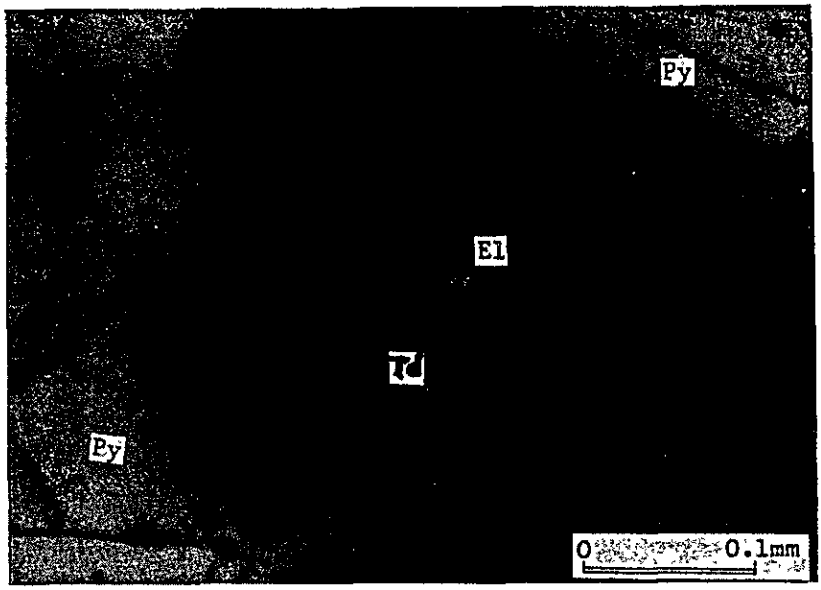

Sample No. DPL-B

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



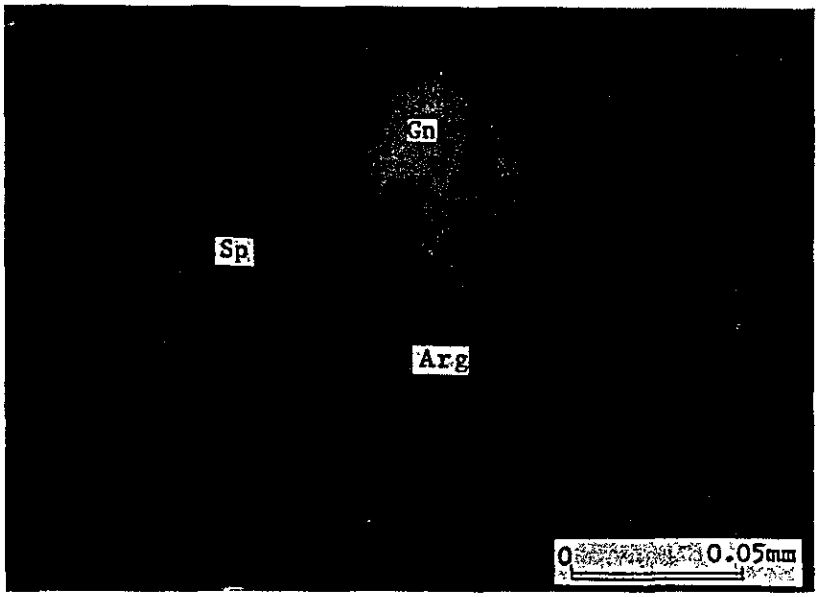

Sample No. N14

Sphalerite with exsolutional chalcopyrite replaces arsenopyrite



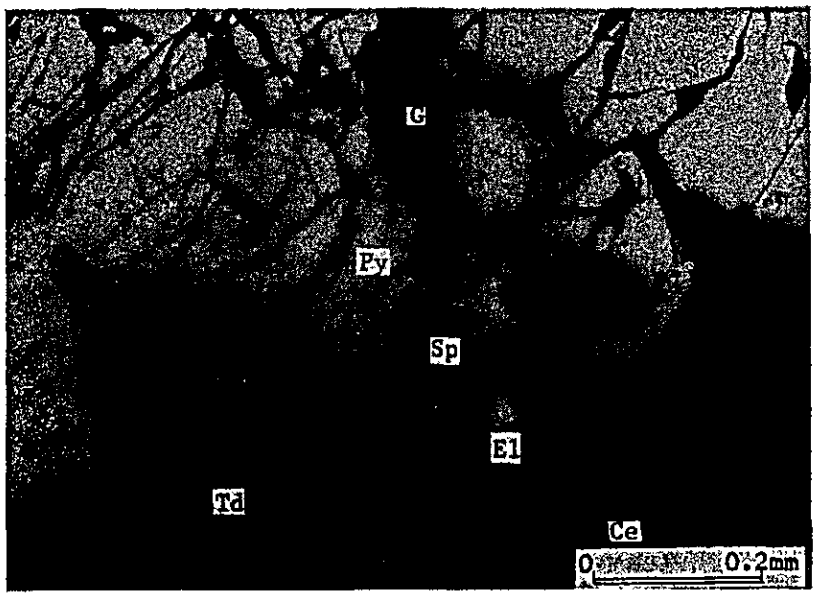

Sample No. N57A

Electrum in tetrahedrite




Sample No. N57A

Exsolution of galena and argentite

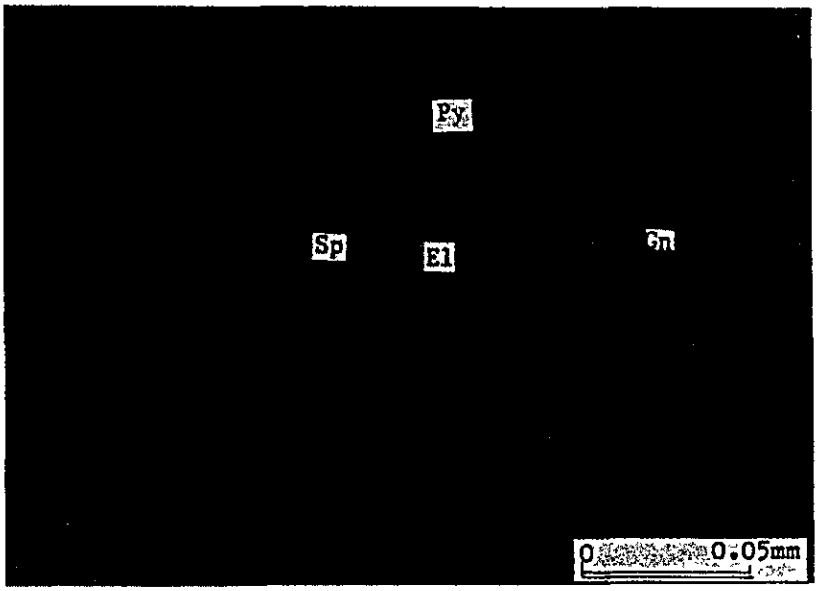



Sample No. N57A

Pyrite is replaced by tetrahedrite

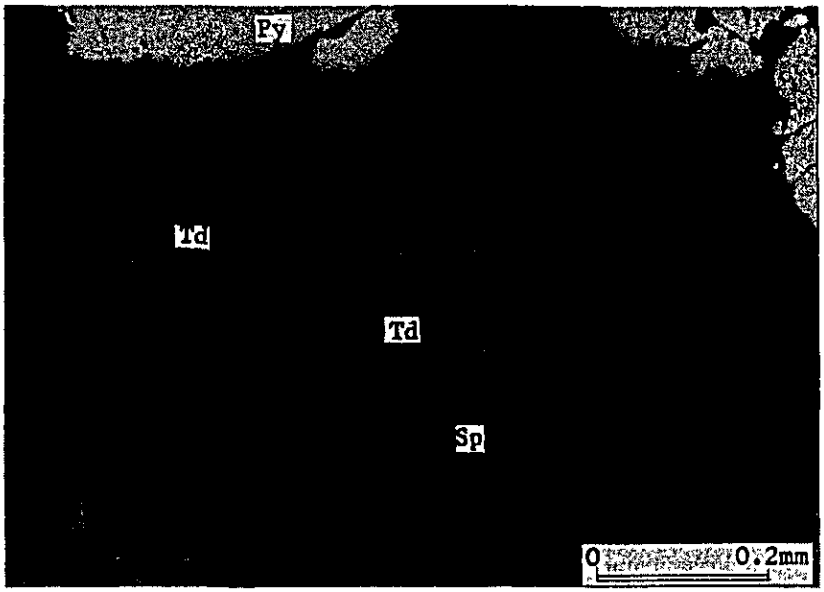

Sample No. N57A

Galena altered to cerrusite. Argentite coexists with cerrusite



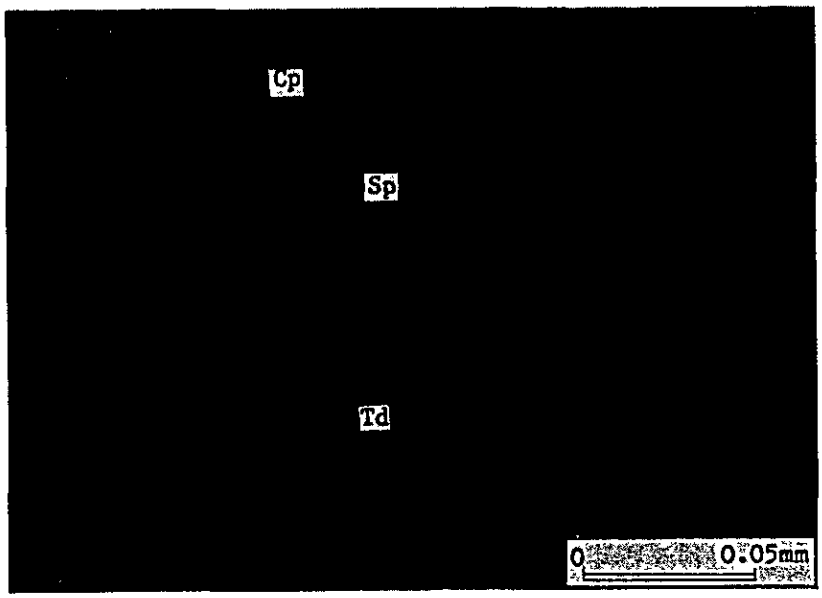

Sample No. N57B

Electrum in pyrite

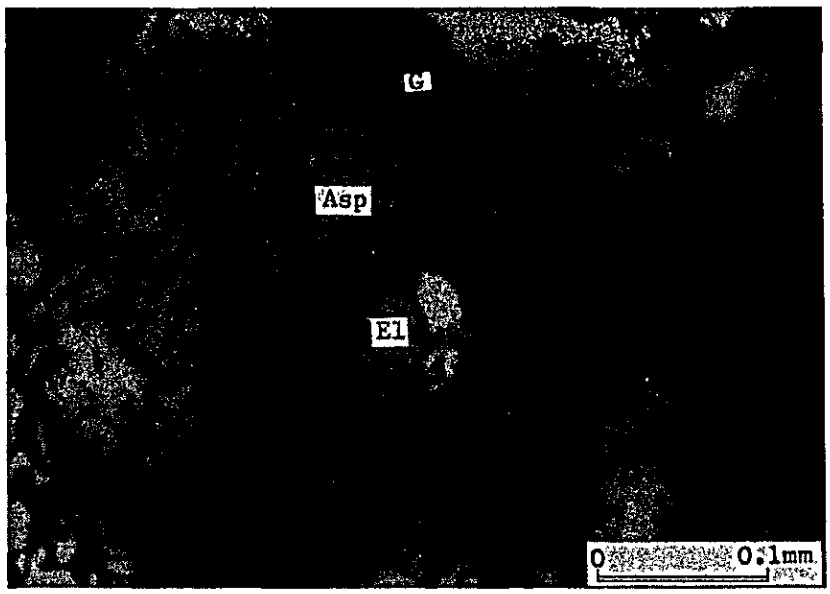



Sample No. N57B

Exsolution of sphalerite-chalcopyrite-tetrahedrite

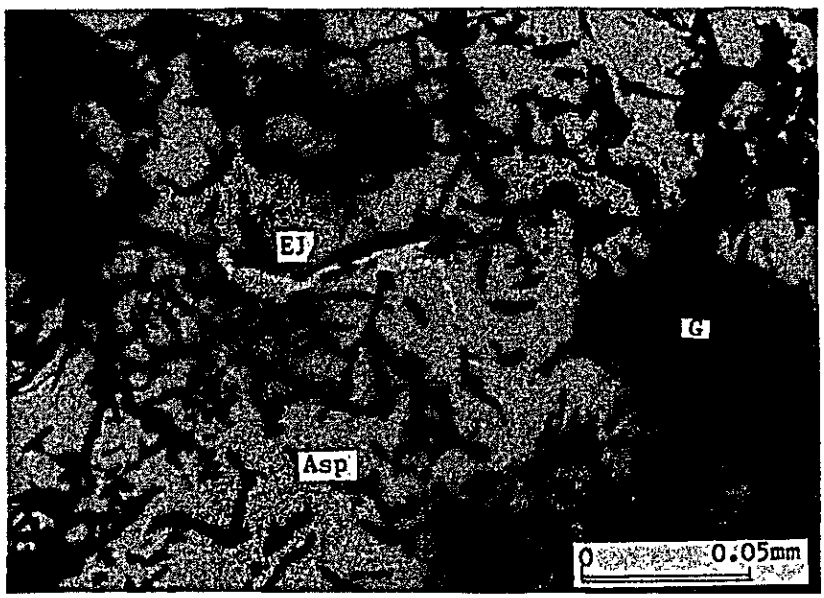



Enlarged above




Sample No. N63A

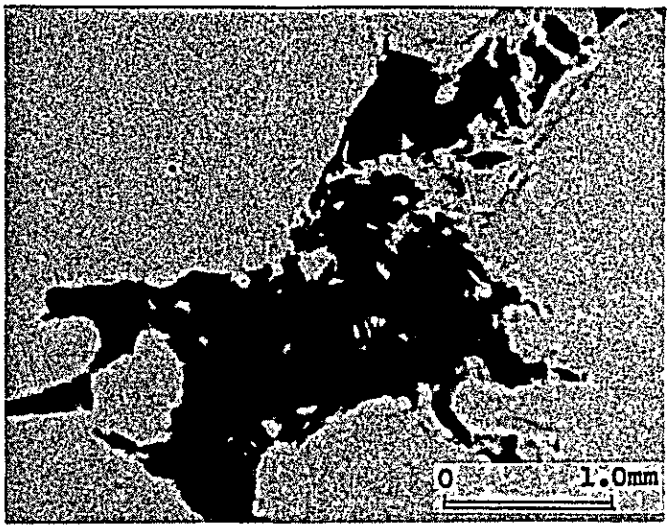
Electrum is a single crystal connected with a narrow channel




Enlarged above

Electrum in zigzag form in arsenopyrite (conducted EPMA)

A. I-6-3 EPMA



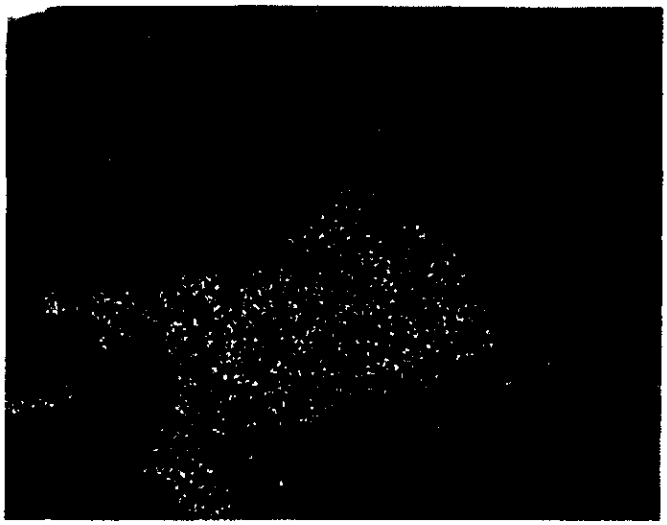

Absorted electron image

Freibergite (Ag bearing tetrahedrite) in gangue mineral

Ag X-ray image

Cu X-ray image

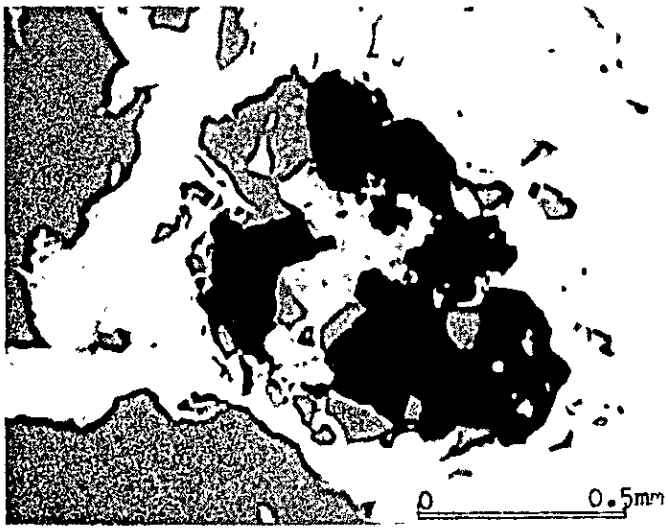
Sample No. : MM2B
Locality : Mina marina
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA



Sb X-ray image

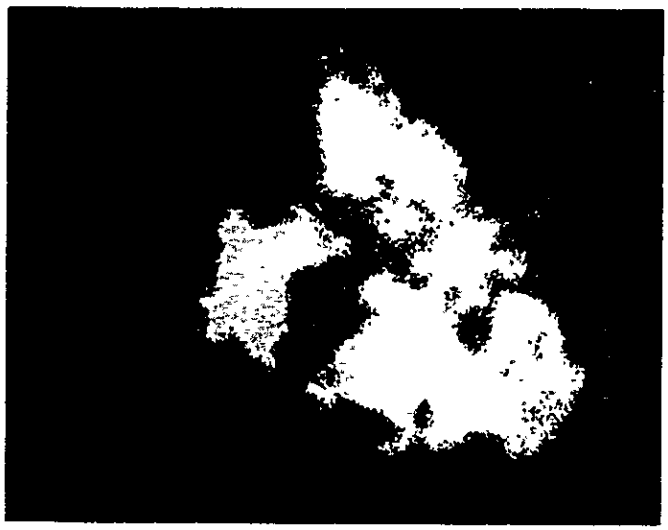
Fe X-ray image

S X-ray image

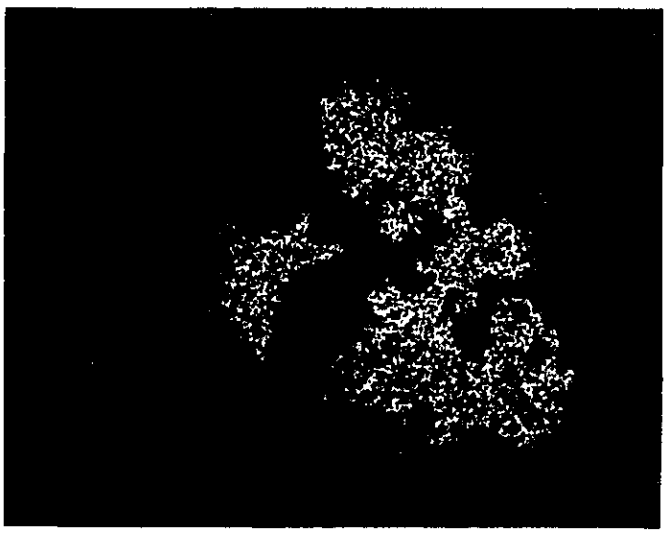



Absorbed electron image

Electrum is association with arsenopyrite.

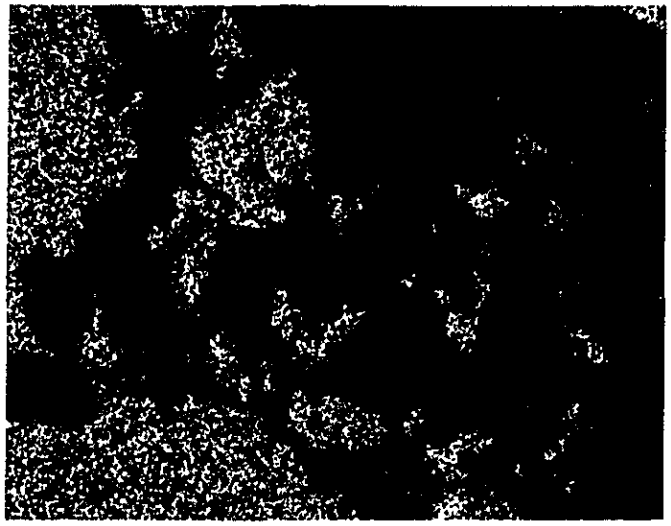


Au X-ray image

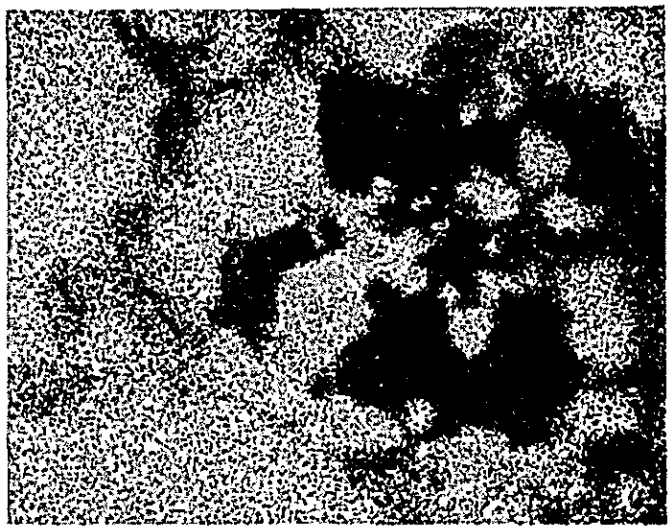


Ag X-ray image

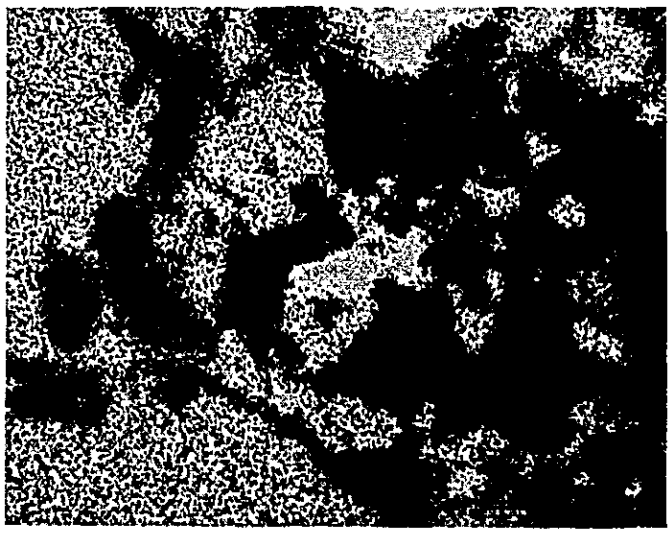
| | |
|---|---|
| Sample No. | : MM3 |
| Locality | : Mina marina |
| Accel. volt. | : 25 kV |
| Absorb. elect. | : 0.2 μA |



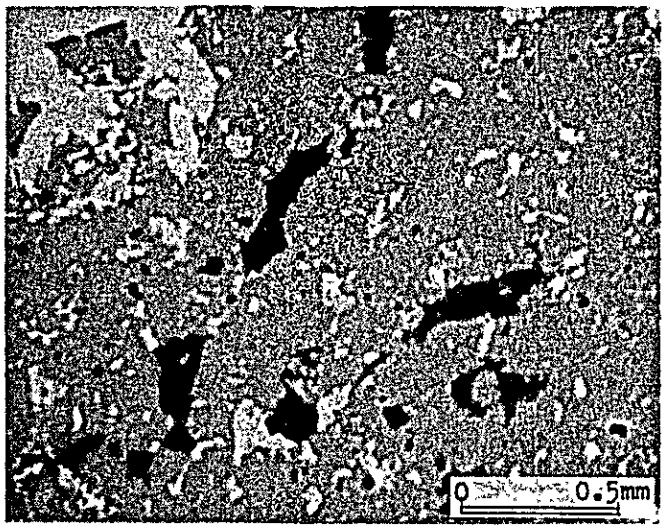
As X-ray image



Fe X-ray image



S X-ray image




Absorbed electron image

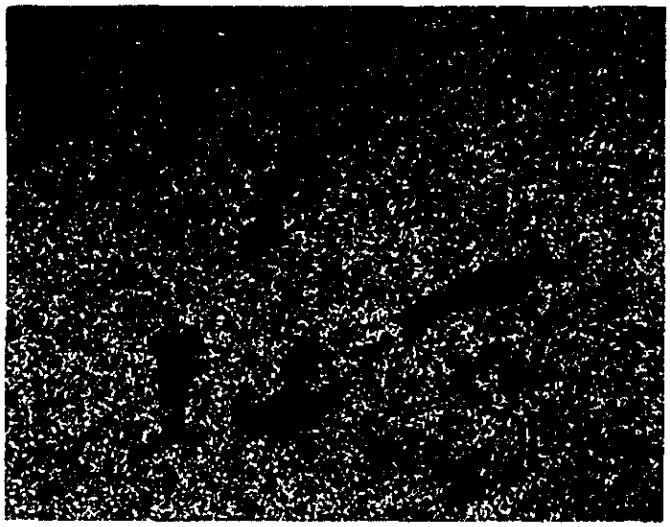
Exsolution of Ag bearing
tetrahedrite(black in the photo)
- chalcopyrite
- sphalerite.

Ag X-ray image

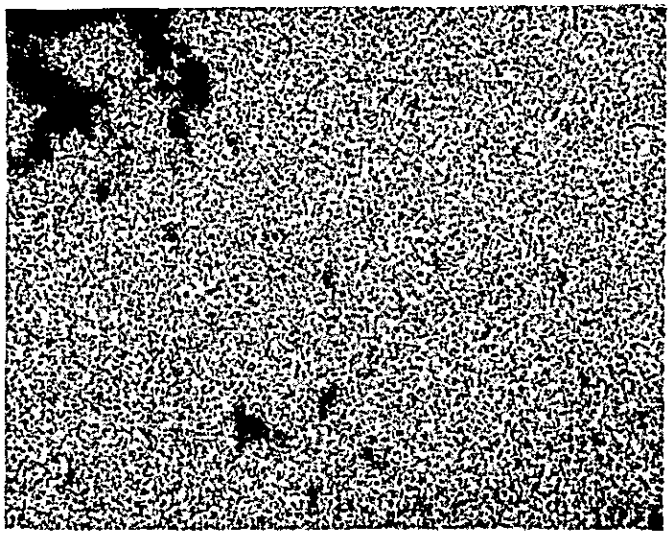
Cu X-ray image

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

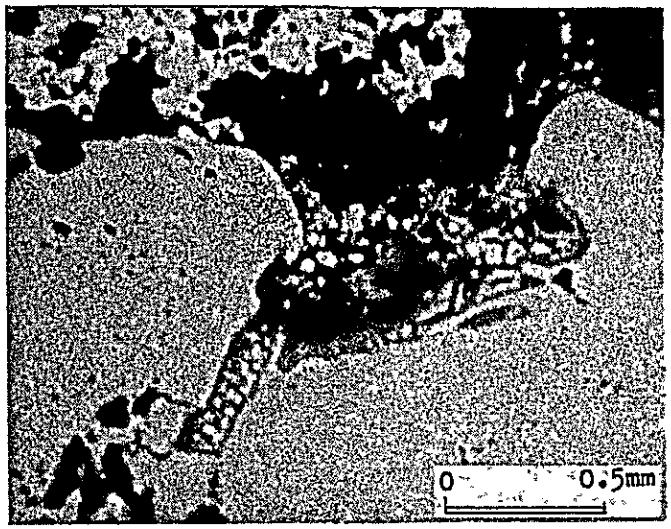
Sb X-ray image



Zn X-ray image



S X-ray image




Absorbed electron image

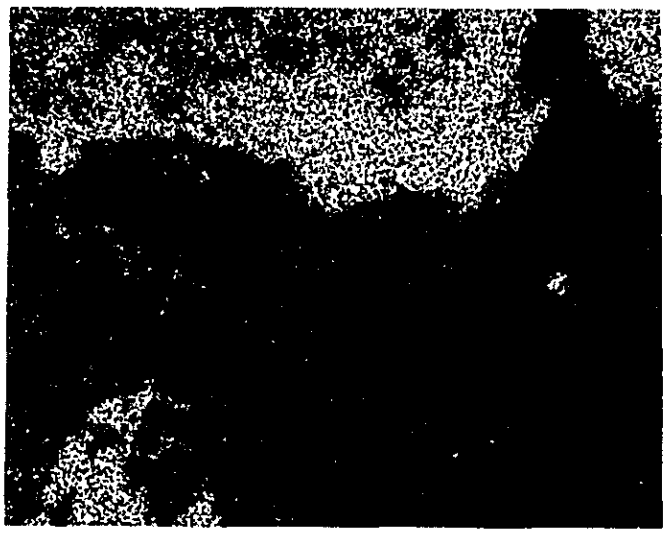
Freibergite

Ag X-ray image

Cu X-ray image

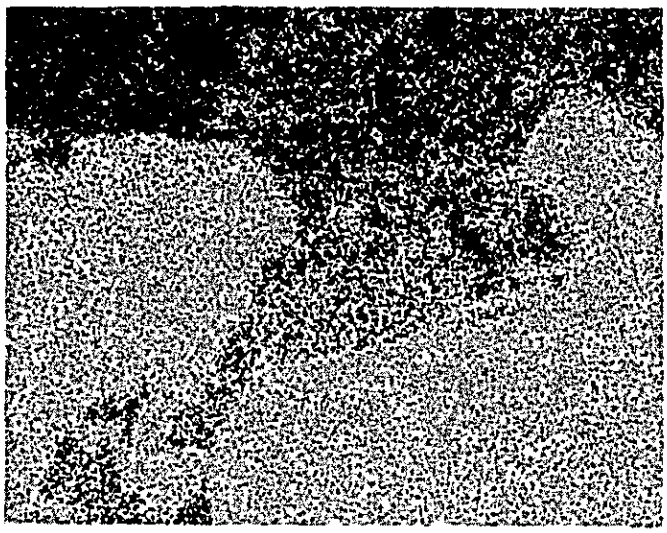
Sample No. : N57A
Locality : San Luis
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA

Sb X-ray image

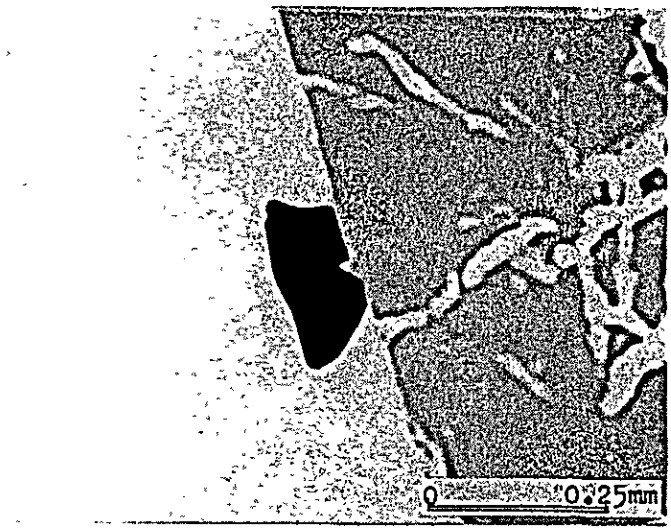


Pb X-ray image

Fe X-ray image

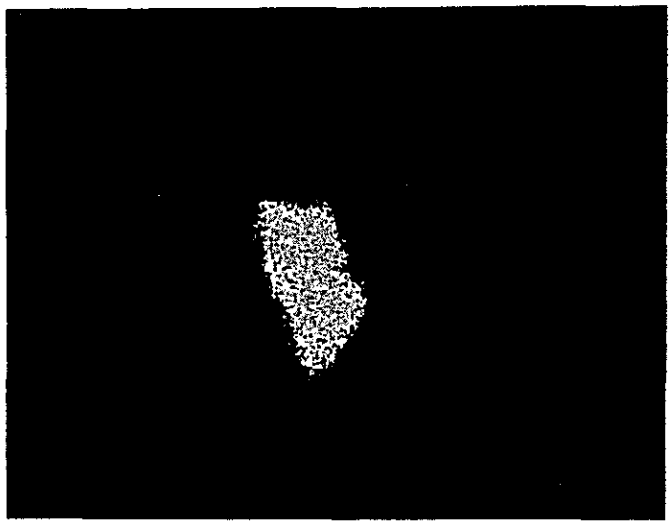


S X-ray image

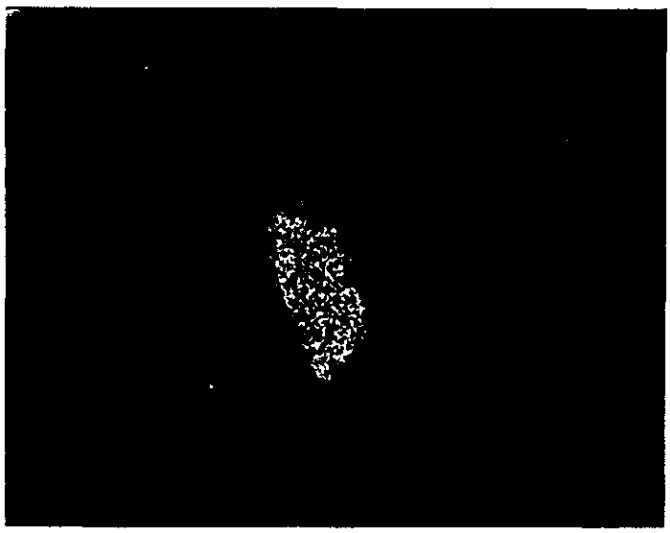



Absorbed electron image

Electrum

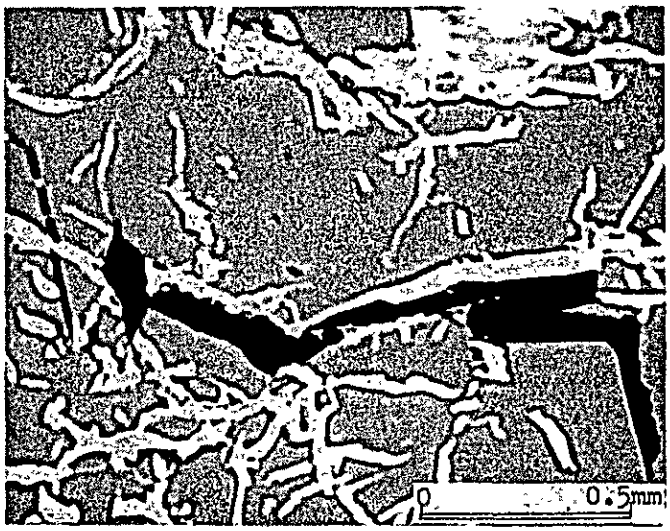


Au X-ray image



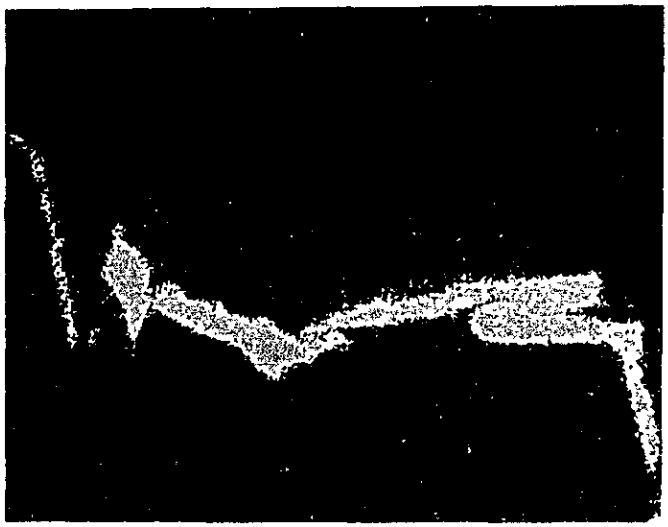
Ag X-ray image

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

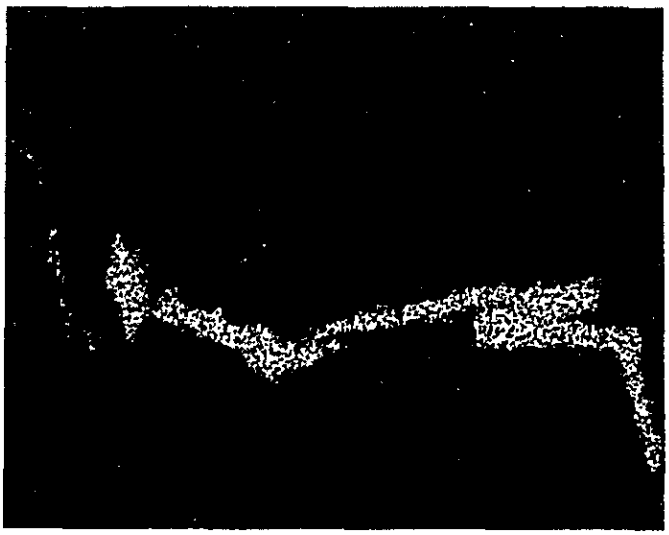



Absorbed electron image

Electrum in zigzag form
in arsenopyrite.

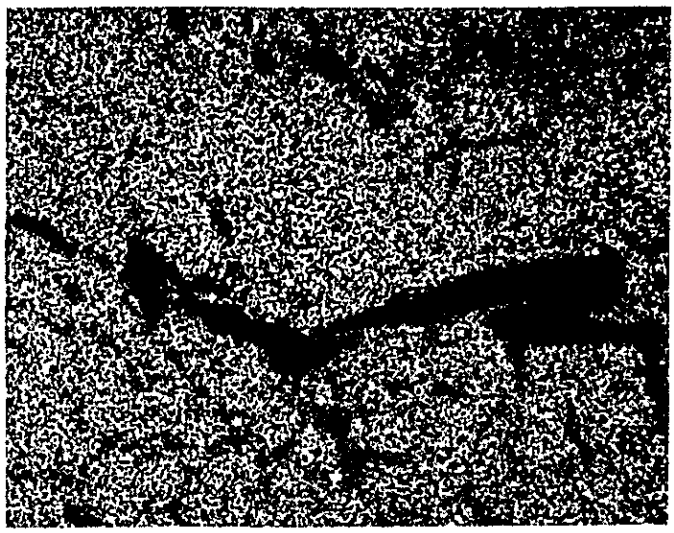


Au X-ray image

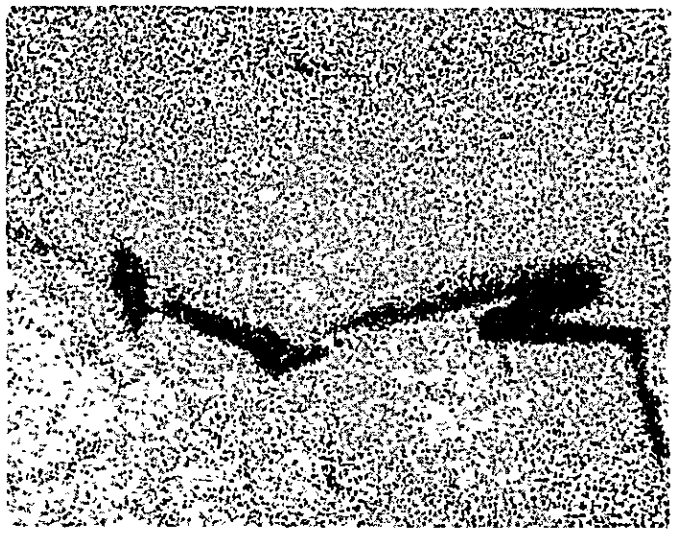


Ag X-ray image

| | |
|---|---|
| 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

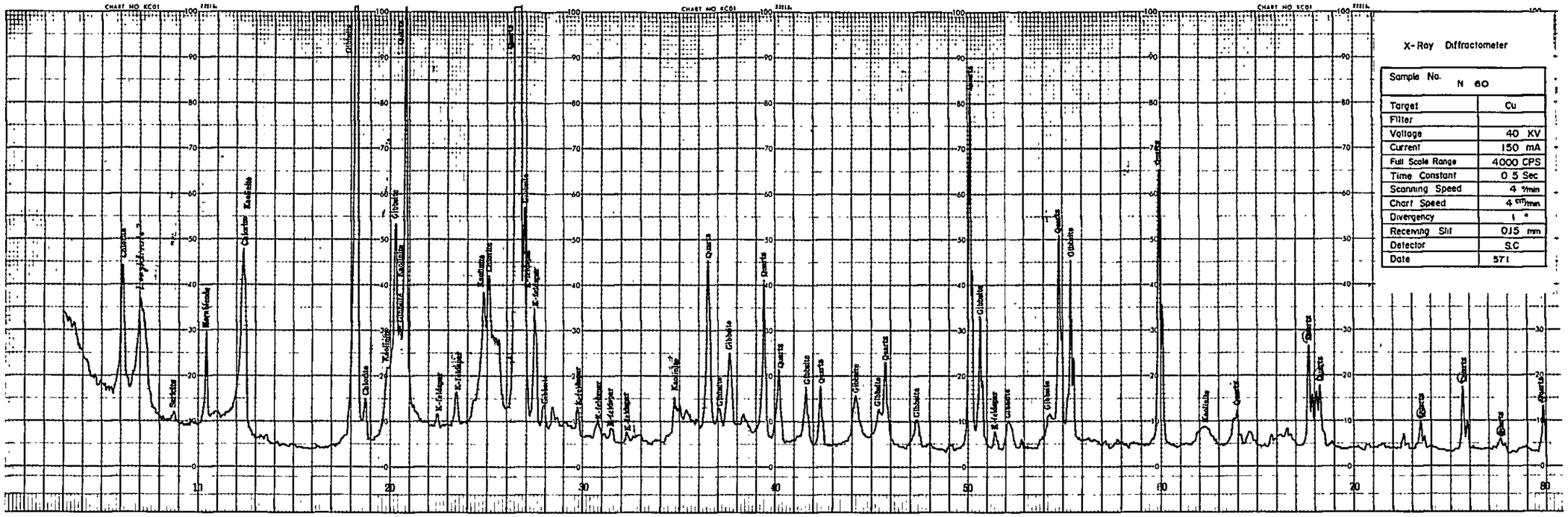
| Ser. No. | Sample | Quartz | Plagioclase | K-feldspar | | Hornblende | Chlorite | Sericite | Phlogopite | Montmorillonite | Kaolinite | Halloysite | Gibbsite | Anatase | Loughlinite? | Talc? | dA 8.10? | dA 7.73 | Pyrite | Arsenopyrite | Goethite | Scorodite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |

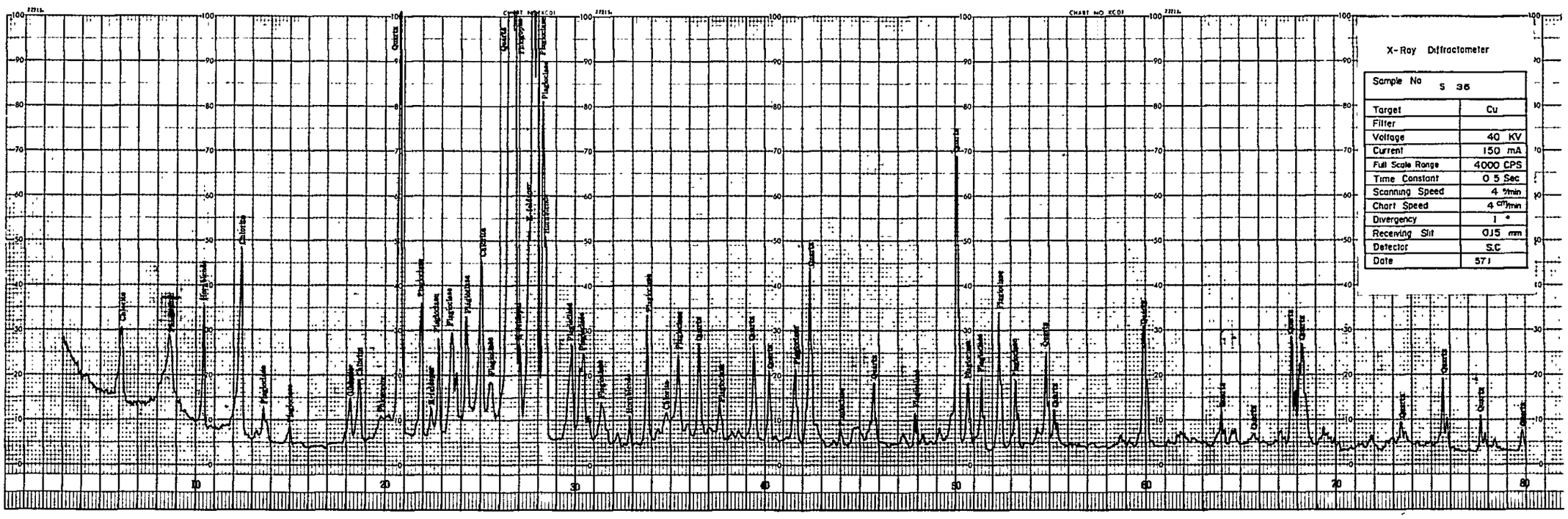
Foot Note V:very much M:much C:common L:less S:scarcely

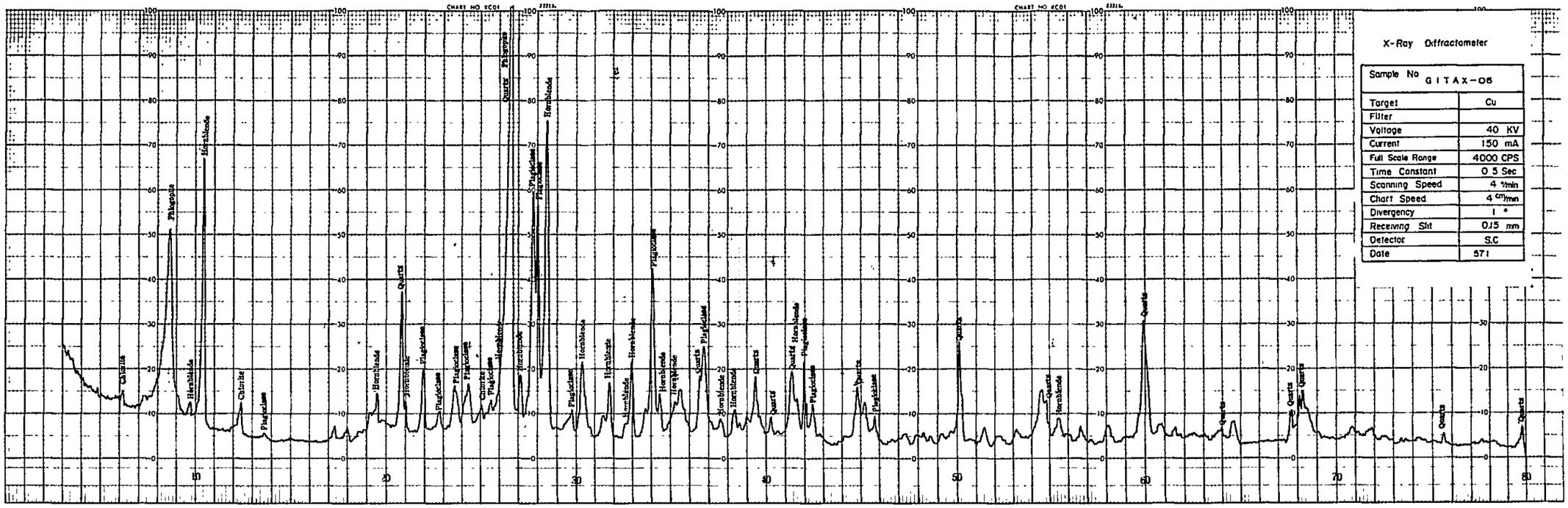
| Ser. No. | Sample | Quartz | Plagioclase | K-feldspar | | Hornblende | Chlorite | Sericite | Phlogopite | Montmorillonite | Kaolinite | Halloysite | Gibbsite | Anatase | Loughlimite? | | | | Pyrite | Arsenopyrite | Goethite | Scorodite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | |

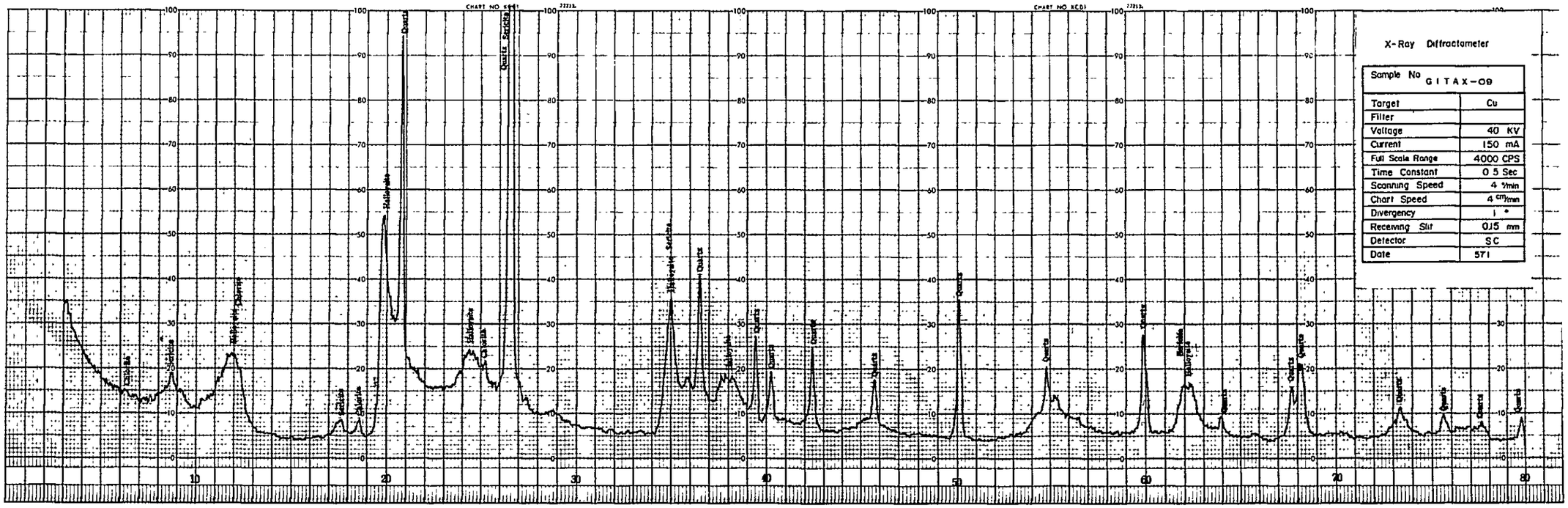
Foot Note V:very much M:much C:common L:less S:scarcely

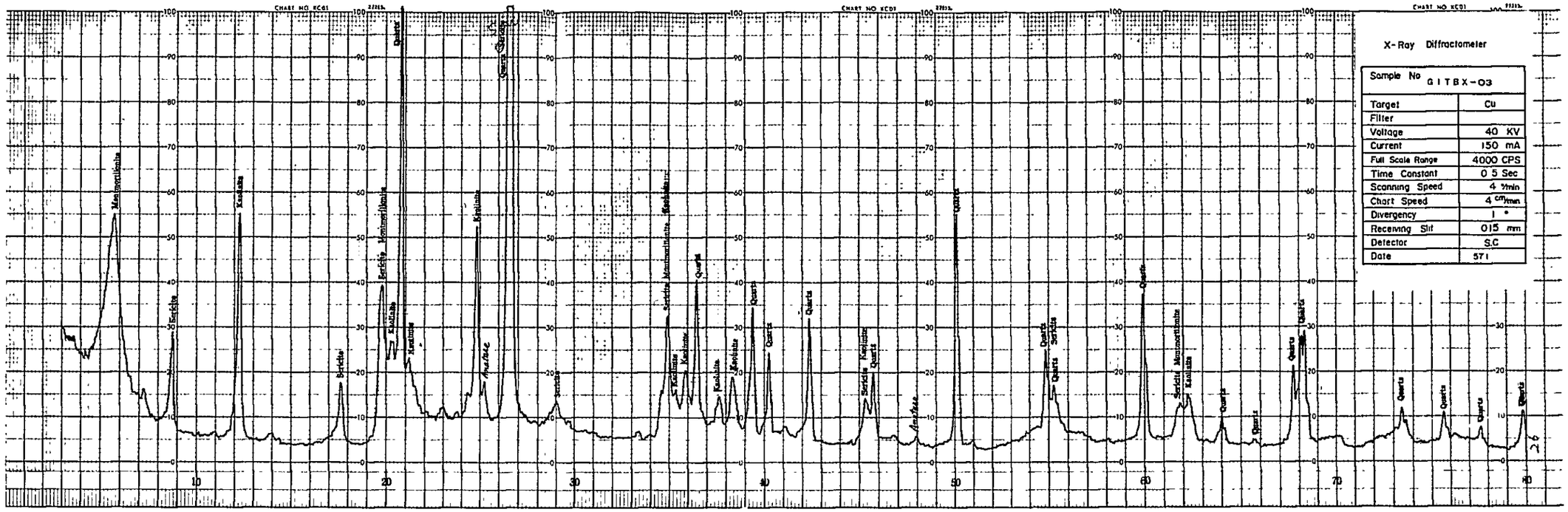
A. I-7-2 X-ray Diffraction Chart

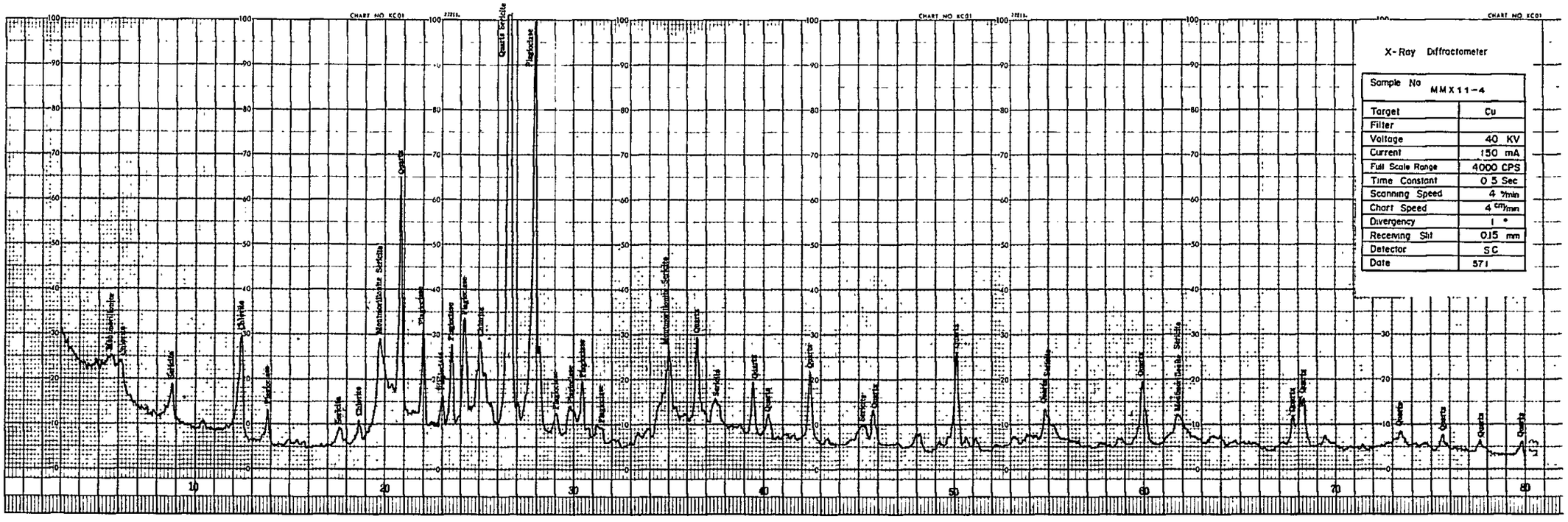

X-Ray Diffractometer
Sample No. N 60
Target Cu
Filter
Voltage 40 KV
Current 150 mA
Full Scale Range 4000 CPS
Time Constant 0.5 Sec
Scanning Speed 4 °/min
Chart Speed 4 cm/min
Divergency 1 °
Receiving Slit 0.15 mm
Detector S.C
Date 5.7.1


X-Ray Diffractometer
Sample No S 36
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 5.7.1


X-Ray Diffractometer
Sample No GITAX-05
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 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/mn
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 015 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 - 1 List of the used equipments for drilling

| Item | Model | Quantity | Capacity, Type, and Specification |
|---|---|---|---|
| Drilling Machine | TOM-3B | 1 | Capacity NQ 590m BQ 750m<br>Inner Diameter of Spindle 92mm<br>Weight (except engine) 120,250,600,120R |
| Engine for Drill | F3L-912 | 1 | Diesel Engine<br>1,800 rpm/41 PS ∿ 1,500 rpm/35 PS |
| Pump | NAS-2A | 1 | Piston ϕ 63mm Capacity 62 ∿ 45 ℓ/min<br>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<br>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

| | | Period | | Number of Days | Actual Working Days | Day Off | Total Number of Workers |
|---|---|---|---|---|---|---|---|
| Working Period | 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% | Efficiency of Drilling | | | |
| | Repairing | - - | - | 180.50m/Working Period | | | 13.88 m/day |
| | Others | - - | - | 180.50m/Working Days | | | 13.88 m/day |
| | Sub Total | 256°00' 100.0% | 90.1% | 180.50m/Drilling Period | | | 17.52 m/day |
| | Removing Preparation | 20°00' - | 7.1% | 180.50m/Net Drilling Days | | | 17.52 m/day |
| | Removing Moving | 8°00' - | 2.8% | Total workers/180.50m | | | 1.51 Man/m |
| | | | | | | | |
| | Grand Total | 284°00' - | 100.0% | Total Drilling Workers/180.50m | | | 1.20 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. 312 Times |
|---|---|---|---|---|---|
| | NW 4.50m | 2.5% | 100% | | |
| | BW 132.80m | 73.5% | 100% | | |
| | | | | | |

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

| | | Period | | Number of Days | Actual Working Days | Day off | Total Number of Workers |
|---|---|---|---|---|---|---|---|
| Working Period | 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 | Hoisting & Lowering Rod 23 Times | | Hoisting & Lowering I.T. 163 Times | |
| | NW 9.20m | 7.0% | 100% | | | | |
| | BW 74.20m | 56.6% | 100% | | | | |
| | | | | | | | |

## 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 | Hoisting & Lowering Rod 23 Times | Hoisting & Lowering I.T. 311 Times |
|---|---|---|---|---|
| NW 17.90m | 8.9% | 100% | | |
| BW 120.20m | 60.0% | 100% | | |
| | | | | |

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

| | | Period | | Number of Days | Actual Working Days | Day Off | Total Number of Workers |
|---|---|---|---|---|---|---|---|
| Working Period | 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 | Planned Length | 140.00m | Over-burden 13.20m | Core Recovery for each 100 m section | | | |
| | 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**

| | | | | | |
|---|---|---|---|---|---|
| Planned Length | 200.00m | Over-burden | 17.20m | Core Recovery for each 100 m section | |
| 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 | Hoisting & Lowering Rod 21 Times | Hoisting & Lowering I.T. 315 Times |
|---|---|---|---|---|
| NW 17.20m | 8.6% | 100% | | |
| BW 120.20m | 60.0% | 100% | | |
| | | | | |

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

**Working Period**

| | Period | Number of Days | Actual Working Days | Day Off | Total Number of Workers |
|---|---|---|---|---|---|
| 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

| | | Period | Number of Days | Actual Working Days | Day Off | Total Number of Workers |
|---|---|---|---|---|---|---|
| Working Period | 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

| | | Period | | Number of Days | Actual Working Days | Day Off | Total Number of Workers |
|---|---|---|---|---|---|---|---|
| Working Period | 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<br>Hypidiomorphic and granular texture<br>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).<br>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.<br>Hornblende sometimes shows glomerophyric texture and is altered to actinolite.<br>It suffered strong epidotization and sericitization with a few chlorite. |
| PD-898 | PD-8 | Altered andesite | Hornblende andesite<br>Strong alteration made it difficult to identify an original rock.<br>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.<br>Plagioclase shows albite twinning and is partly altered to actinolite and sericite.<br>Hornblende shows sub to euhedral crystal form and grain size varies 1.8×1.0 mm to 2.0×2.5 mm.<br>Axial color of hornblende is green and a part of it changes into actinolite.<br>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<br>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.<br>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<br>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.<br>Interstice is filled with glass and minute plagioclase.<br>Sericitization and chloritization are observed. |
| PD-1088 | PD-10 | basaltic andesite | Hornblende andesite<br>Porphyritic texture<br>Phenocryst is composed of euhedral to subhedral lath-shaped plagioclase (2 × 0.8 mm) and euhedral hornblende (0.5 × 0.5 ~ 1 × 1 mm).<br>Groundmass is filled with minute lath-shaped plagioclase.<br>The rock suffers strong alteration to hornblende (probably actinolite) and sericite.<br>Weak silicification and argillization producing kaoline are also observed. |
| PD-1242.3 | PD-12 | Lithic tuff | Hornblende-pyroxene andesitic tuff<br>Lithic fragment (3.5 × 2.0 mm) and crystal fragments of euhedral pyroxene and green hornblende are observed.<br>Interstice is composed of minute plagioclase, quartz and glassy material.<br>Strong alteration is observed such as uralitization, epidotization, sericitization and silicification. |
| PD-1282.8 | PD-12 | tuff breccia | Pyroxene-andesitic tuff<br>Porphyroclastic texture<br>Crystal fragment is mainly pyroxene which suffers uralitization-chloritization along the crack and a small amount of plagioclase.<br>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<br>Porphyrytic texture<br>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.<br>Groundmass is composed of fine-grained plagioclase and pyroxene and is changed into aggregates of actinolite-tremolite.<br>Very fine-grained crystals of biotite and chlorite are also observed within a groundmass. |
| PD-1505 | PD-15 | Tuff breccia | Pyroxene andesite<br>Porphyritic texture and porphyroclastic texture<br>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.<br>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<br>Porphyritic texture<br>The rock suffers strong silicification, uralitization, epidotization and argillization.<br>Phenocryst is composed of hornblende and plagioclase (1.0 × 0.5 mm and 0.3 × 0.1 mm respectively).<br>Groundmass is composed of minute plagioclase and is suffered from various alterations such as silicification, epidotization and uralitization.<br>Secondary quartz is also observed as a vein-let, coarse-grained crystal and dissemination. |
| PD-1551 | PD-15 | Tuff breccia | Hornblende andesite<br>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.<br>Groundmass is mainly composed of fine lath-shaped plagioclase and a small amount of quartz.<br>It suffers strong sericitization, chloritization and epidotization.<br>Noted also is a quartz veinlet with tremolite and sericite.<br>As opaque minerals, iron hydro-oxide mineral and leucoxene are observed. |
| PD-1510 | PD-15 | Aphanitic basaltic andesite | Hornblende andesite<br>Porphyritic texture<br>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.<br>Groundmass is composed of minute plagioclase.<br>Epidots, epidote-sericite-quartz veinlets and a small amount of leucoxene are observed. |
| PD-15146 | PD-15 | Altered rock | Tuff breccia<br>The rock suffers bitter alteration producing a lot of chlorite, sericite, carbonate and quartz.<br>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<br>Fragments are lithic material and plagioclase crystals both of which are replaced by fine-grained quartz and chlorite and vein-formed amphibole.<br>Plagioclase shows albite twinning and glomeroporphyritic texture.<br>Interstice is mainly composed of fine lath-shaped plagioclase and spherulite filled with chlorite, chalcedony and zeolite.<br>The rock as a whole suffers silicification, chloritization, carbonitization and argillization. |
| PD8169.6 | PD-8 | Silicified-argillized rock | Altered rock<br>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<br>The rock is highly altered and pyritized.<br>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<br>Pyrite ..... rare<br>Ore shows a brecciated texture and mineralization is restricted only in the breccia. Chalcopyrite is a very fine grain (a few $\mu$m to several tens $\mu$m) in association with eu-anhedral pyrite. |
| PD 978.0 | PD-9 | Arsenopyrite-sphalerite ore | Mineral assemblage : Arsenopyrite ..... common<br>Sphalerite ..... a few<br>Galena, chalcopyrite, pyrite ..... few<br>Arsenopyrite aggregates in anhedral to euhedral crystal.<br>Sphalerite containing chalcopyrite dotts replaces a part of arsenopyrite.<br>Galena is enclosed in an arsenopyrite crystal.<br>Chalcopyrite appears as a dot in sphalerite.<br>Pyrite is euhedral to anhedral crystal in association with arsenopyrite or gangue mineral. A part of pyrite is changed into marcasite. |
| PD 10109 | PD-10 | Sphalerite ore | Mineral assemblage : Pyrite, sphalerite ..... common<br>Arsenopyrite, chalcopyrite, galena .... a few<br>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.<br>Sphalerite usually contains sphalerite dot and replaces a part of pyrite and arsenopyrite.<br>Arsenopyrite shows euhedral to anhedral crystal and occurs dissemination or coparagenesis with pyrite.<br>Chalcopyrite appears as a dot in sphalerite and minor crack filling in pyrite and arsenopyrite.<br>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<br>Chalcopyrite, arsenopyrite ..... common<br>Pyrite,galena,Ag bearing pb-Bi mineral..a few<br><br>Spalerite with chalcopyrite dot is massive replacement of arsenopyrite.<br>Chalcopyrite fills crack and marginal part of sphalerite and replaces arsenopyrite and pyrite.<br>Arsenopyrite usually takes euhedral crystal.<br>Pyrite has two crystal form as is a case in PD10109 and later pyrite is cutting sphalerite and replacing chalcopyrite.<br>Ag bearing pb-Bi mineral is often associated with chalcopyrite.<br>This sample is also brecciated. |
| PD 10111 | PD-10 | Sphalerite ore | Mineral assemblage : Pyrite ..... abundant<br>Sphalerite, arsenopyrite ..... common<br>Galena, chalcopyrite ..... a few<br>Electrum ..... scarce<br><br>Pyrite is euhedral to anhedral crystal form and presents either massive or dissemination in gangue mineral.<br>Arsenopyrite, in most of the cases, shows euhedral crystal presenting massive or dissemination.<br>Sphalerite with chalcopytite dot replaces pyrite and arsenopyrite.<br>Chalcopyrite is, aside from inclusion in sphalerite, fracture filling in and around pyrite and sphalerite.<br>Electrum, 200 $\mu$m and 100 $\mu$m 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<br>Galena, chalcopyrite ..... a few<br><br>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.<br>Galena replaces pyrite and intrudes in sphalerite and arsenopyrite.<br>Chalcopyrite also cuts arsenopyrite and encloses sphalerite. |
| PD10114 | PD-10 | Sphalerite ore | Mineral assemblage : Sphalerite, pyrite, arsenopyrite ..... common<br>Chalcopyrite ..... a few<br>Eledctrum ..... scarse<br>Arsenopyrite takes euhedral crystal form and interstices are filled with pyrite. Sphalerite containds lotds of chalcopyrite dot and replaces arsenopyrite or pyrite.<br>Electrum shows various occurrence; paragenesis with grain boundary between arsenopyrite and pyrite, and within arsenopyrite crystal.<br>EPMA discloses electrum contains about 40 percent of silver. |
| PD 10115.7 | PD-10 | Arsenopyrite-sphalerite ore | Mineral assemblage : Pyrite, arsenopyrite, sphalerite ..... common<br>Chalcopyrite ..... a few<br>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.<br>Sphalerite contains chalcopyrite dot and replaces arsenopyrite. |
| PD11181 | PD-11 | Pyrite ore | Mineral assemblage : Pyrite ..... a few<br>Chalcopyrite, galena, sphalerite ..... few<br>Pyrite shows eu-anhedral crystal accompanyed by quartz vein in the form of dissemination and veinlet.<br>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<br>Chalcopyrite, sphalerite ..... a few<br>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.<br>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<br>Sphalerite ..... scarce<br>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<br>Chalcopyrite ..... a few<br>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<br>Chalcopyrite ..... few<br>Pyrite is anhedral crystal and accompanied by quartz vein changing a part of it into marcasite.<br>Both marcasite and chalcopyrite present in the form of dissemination. |
| PD1376.4 | PD-13 | Chalcopyrite ore | Mineral assemblage : Chalcopyrite, pyrite, marcasite ..... common<br>Sphalerite, pyrrhotite ..... a few<br>Argentite, pyrargyrite ..... few<br>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.<br>Pyrrhotite also id is enclosed by chalcopyrite.<br>Argentite and pyragyrite are cutting chalcopyrite. |

| Sample No. | Location | Macroscopic Description | Microscopic Observation |
|---|---|---|---|
| PD1376.5 | PD-13 | Chalcopyrite ore | Mineral assemblage : Chacopyrite ..... abundant<br>Pyrite, marcasite ..... common<br>Sphalerite ..... a few<br>Pyragyrite, argentite .....scarce<br>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.<br>Sphalerite with very fine grained chalcopyrite dot appears in the periphery of or as a inclusion of chalcopyrite.<br>Argentite and pyrargyrite cut chalcopyrite and sphalerite. |
| PD 1378 | PD-13 | Chalcopyrite ore | Mineral assemblage : Chalcopyrite, pyrite ..... common<br>Sphalerite ..... a few<br>Pyrargyrite, pyrrhotite ..... scarce<br>Chalcopyrite is accompanied by quartz vein.<br>pyrite shows two type of lccurrence, one is enclosed in shalcpyrite crystal and the other is surrounding, fracture-filling and replacing chalcopyrite.<br>Both sphalerite and pyrrhotite are enclosed in chalcopyrite crystal.<br>Pyrrargyrite is cutting foth chalcopyrite and later stage pyrite. |
| PD 14124 | PD-14 | Sphalerite ore | Mineral assemblage : Sphalerite, pyrite ..... common<br>Pyrrhotite, galena ..... a few<br>Chalcopyrite, Ag bearing pb-Bi minerd ..... few<br>Pyrite shoues two types of occurrence, one is eu-anhedral crystal form and massivi the other is fine grained veinlet.<br>Sphalerite which contains lots of pyrrhotite dot coexists with pyrite.<br>A few grains of pyrrhotite are included in pyrite also.<br>Galena is eithev inclusion of sphalerite or single crystal in gangue mineralv.<br>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<br>Chalcopyrite, galena ..... a few<br>Pyrargyrite ..... scarce<br>Pyrite shows eu-anhedral crystal form and is accompanied by quaryz vein.<br>Sphalerite usually contains chalcopyrite .<br>Galena replaces pyrite and occupies the peripheries of sphalerite and pyrite.<br>Chalcopyrite also occurs near pyrite crystal.<br>Pyrargyrite coexists with chalcopyrite. |
| PD 14164.1 | PD-14 | Arsenopyrite-sphalerite ore | Mineval assemblage : Pyrite, arsenopyrite, sphalerite ... common<br>Galena ..... a few<br>Pyrite is massive with eu-anhedral crystal form.<br>Arsenopyrite also shows eu-anhedral crystal andmost of the cases coexists with pyrite.<br>Both pyrite and arsenopyrite are breciated.<br>Sphalerite replaces purite and arsenopyrite.<br>galena is enclosed in pyrite and arsenopyrite crystals. |
| PD 15115.6 | PD-15 | Chalcopyrite ore | Mineral assemblage : Chalcopyrite, marcasite ..... common<br>Pyrite, sphalerite ..... a few<br>Pyrargyrite ..... scarce<br>Most of the eu-anhedral pyrite ehanges into mancasite.<br>Chalcopyrite replaces a part of marcasite.<br>Sphalerite with no chalcopyrite dot coexists with chalcopyrite.<br>Pyraghrite, 20-30 $\mu$m in size, appears in chalcopyrite crystal. |
| PD 15121.4 | PD-15 | Arsenopyrite ore | Mineral assemblage : Arsenopyrite ..... abundant<br>Pyrite, marcasite ..... common<br>Sphalerite, galena ..... a few<br>Arsenopyrite with euhedral crystal form appears as dissemenation |

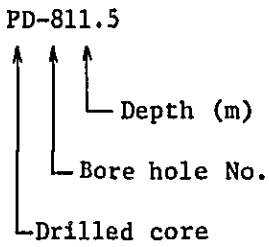
| Sample No. | Location | Macroscopic Description | Microscopic Observation |
|---|---|---|---|
| | | | or aggregates.<br>Pyrite is the same as arsenopyrite.<br>Marcasite appears; (1) Vein-forming withen gangue mineral and (2) the periphery of pyrite crystal.<br>Sphalerite with chalcopyrite dot disseminates independently in gangue mineral.<br>Galena is enclosed both in pyrite and arsenopyrite. |
| PD 15121.7 | PD-15 | Arsenopyrite ore | Mineral assemblage : Arsenopyrite ..... abundant<br>Pyrite, sphalerite, galena ..... a few<br>Arsenopyrite is the same as in PD15121.4.<br>Pyrite has two type of occurrence, one is euhedral dissemination and the other is vein type.<br>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<br>Sphalerite, arsenopyrite, marcasite... common<br>Chalcopyrite, galena ..... a few<br>Tetrahedrite ..... scarce<br>Pyrite presets massive appearana with eu-anhedral crystal.<br>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.<br>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<br>Sphalerite, Pyrite ..... common<br>Galena, chalcopyrite ..... a few<br>Electrum ..... scarce<br>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.<br>Pyrite also exhibits eu-anhedral crystal.<br>Sphalerite replaces arsenopyrite and pyrite.<br>Galena is enclosed in arsenopyrite.<br>Electrum, teo grains with size of 50 $\mu$m and 100 $\mu$m, was found adjacent to arsenopyrite. |

## A. II-19 Photomicrographs

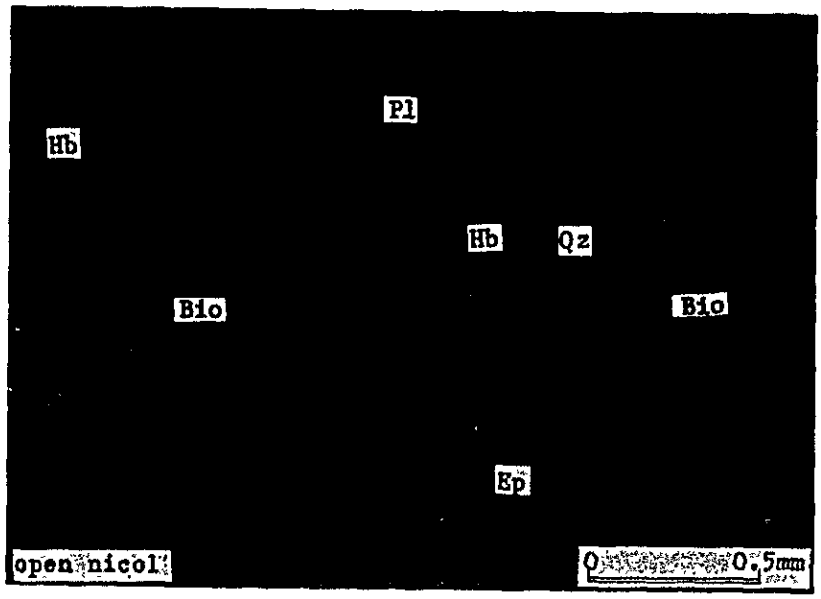
## A. Ⅱ-19-1 Thin section

| 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

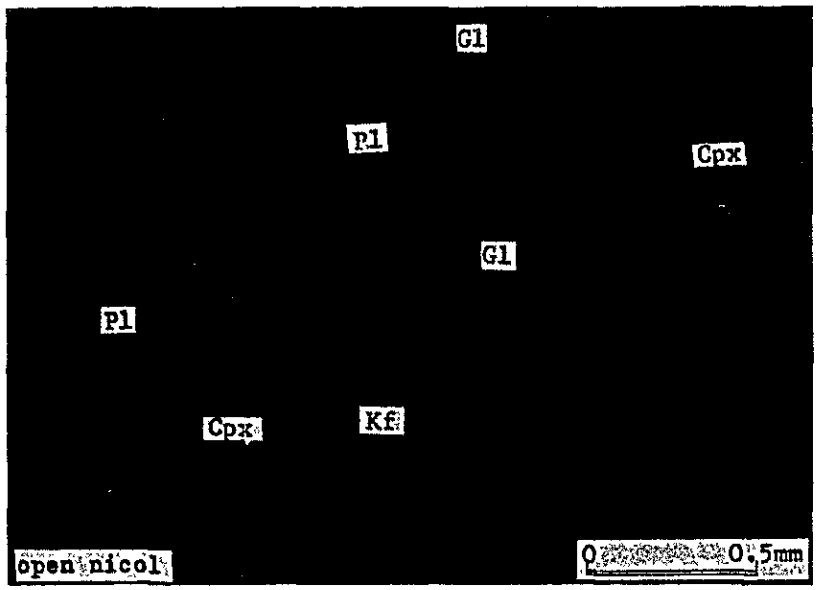
Pl : Plagioclase
Qz : Quartz
Chl : Chlorite
Hb : Hornblende
Cpx : Clinopyroxene
Ep : Epidote
Bio : Biotite
Kf : Potash feldspar
Gl : Glass
Clay : Clay




Sample No. PD-811.5

Rock type:

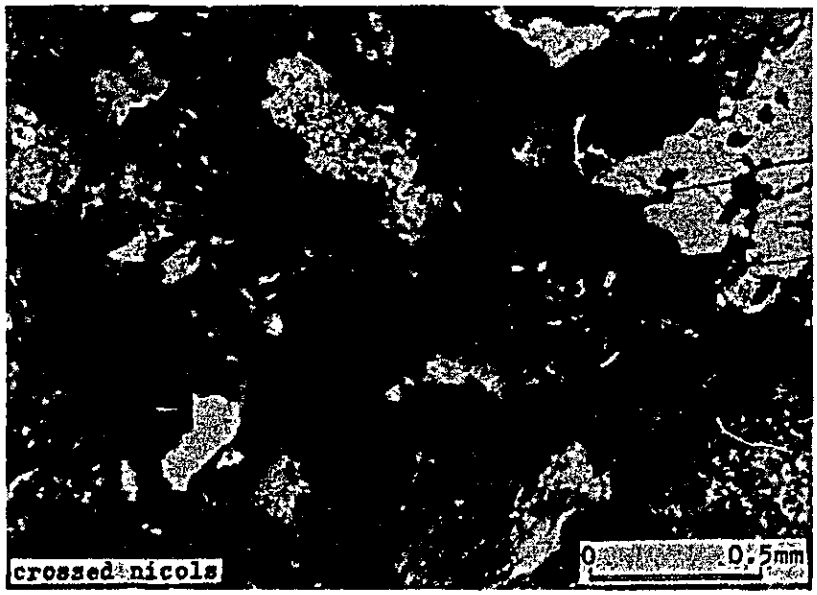
Biotite-hornblende granodiorite

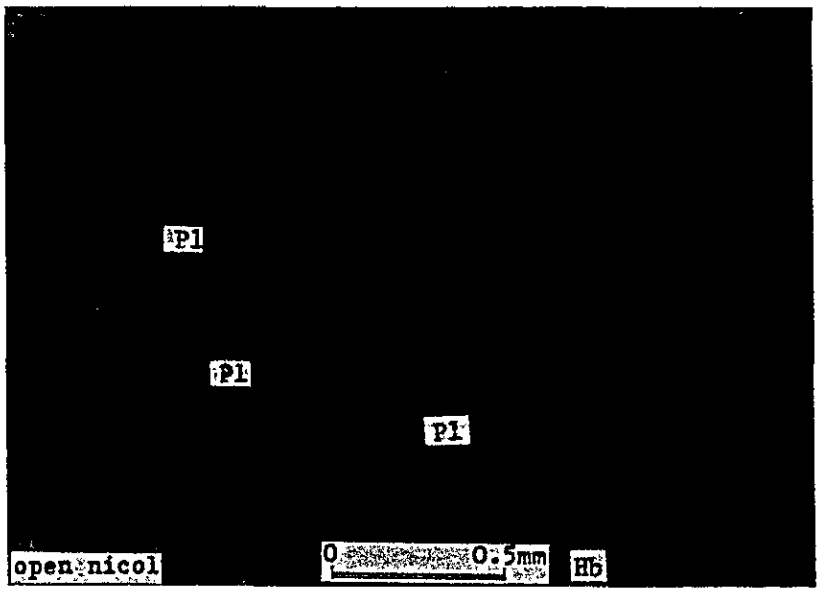



Sample No. PD-910.5

Rock type:

Pyroxene andesitic tuff

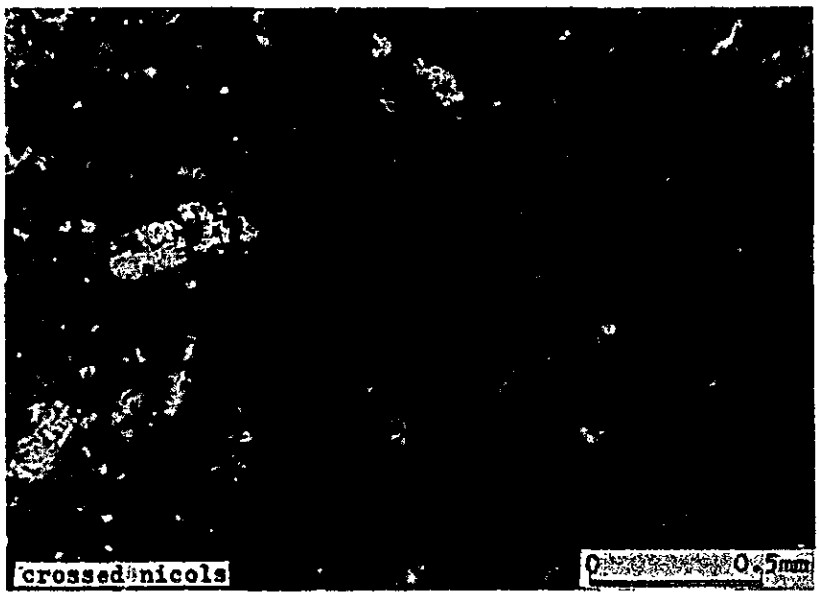


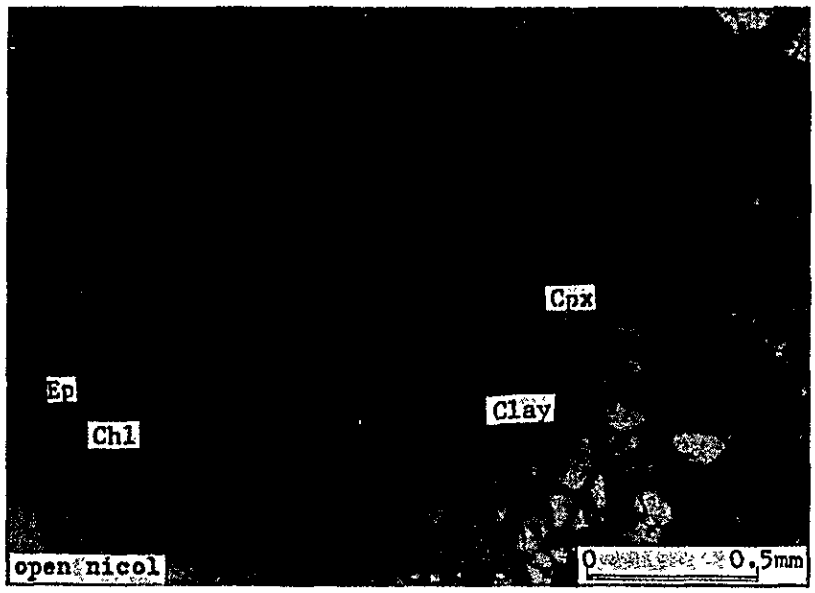



Sample No. PD-1088

Rock type:

Hornblende andesite

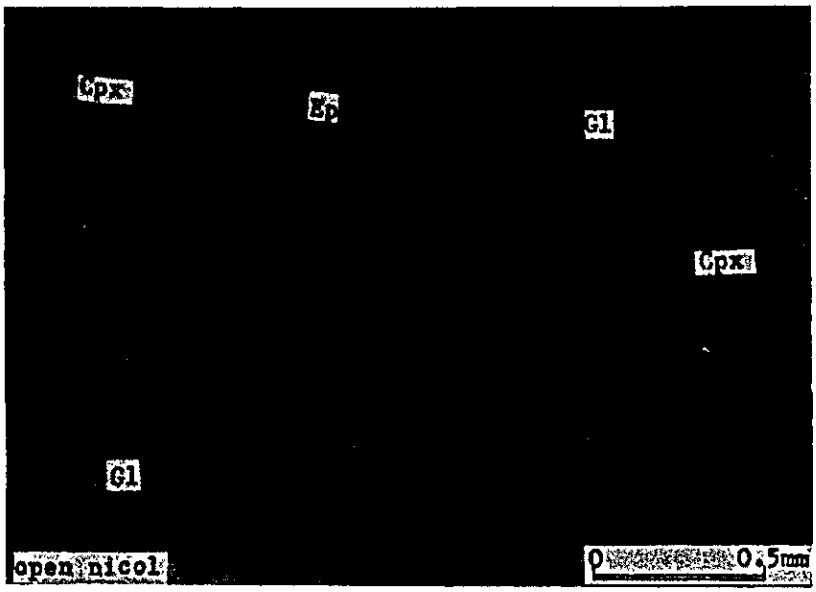





Sample No. PD-1282.8

Rock type:

Pyroxene andesitic tuff ?

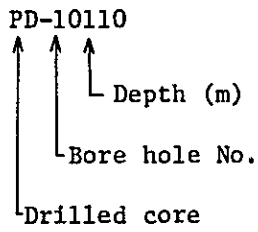



Sample No. PD-1505

Rock type:

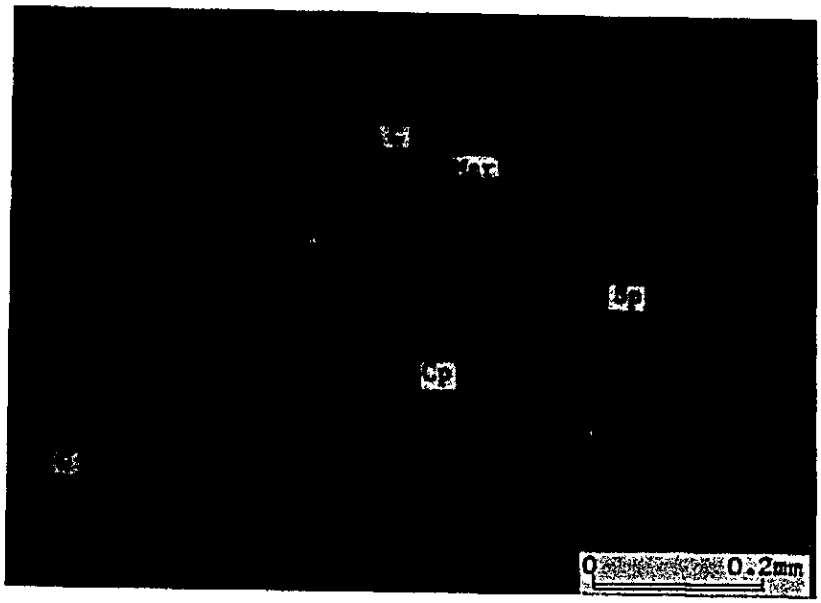
Pyroxene andesite

A. Ⅱ-19-2 Polished section



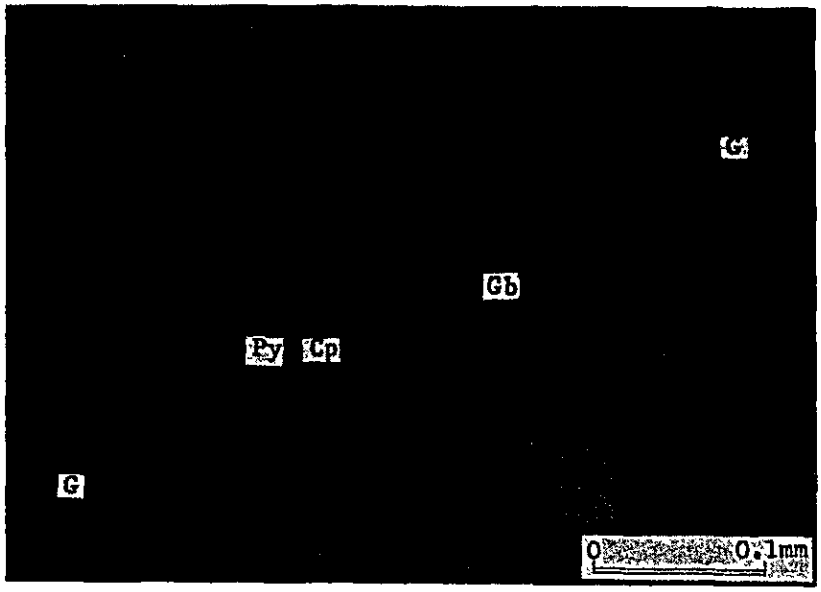

Abbreviations

| | | |
|---|---|---|
| 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 |



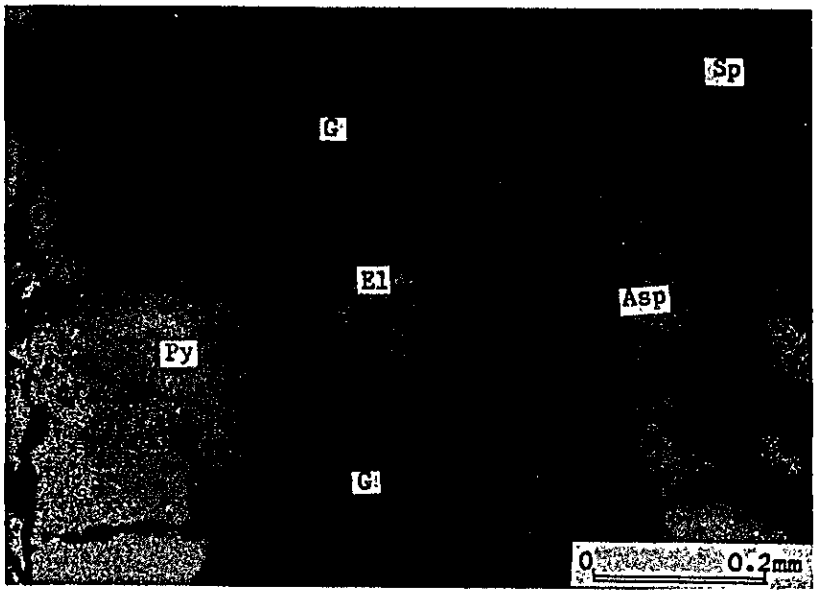

Sample No. PD-10110

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



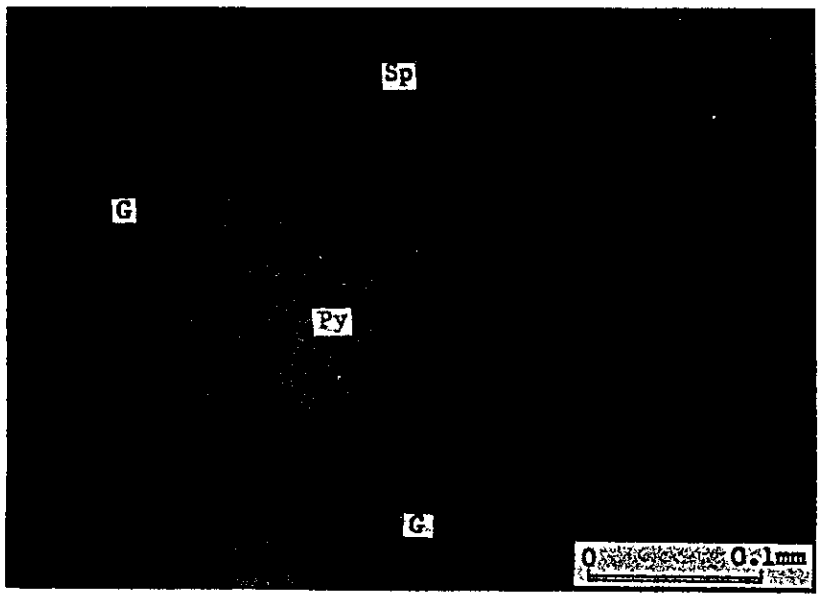

Sample No. PD-10110

Ag-Pb-Bi mineral coexists with chalcopyrite.



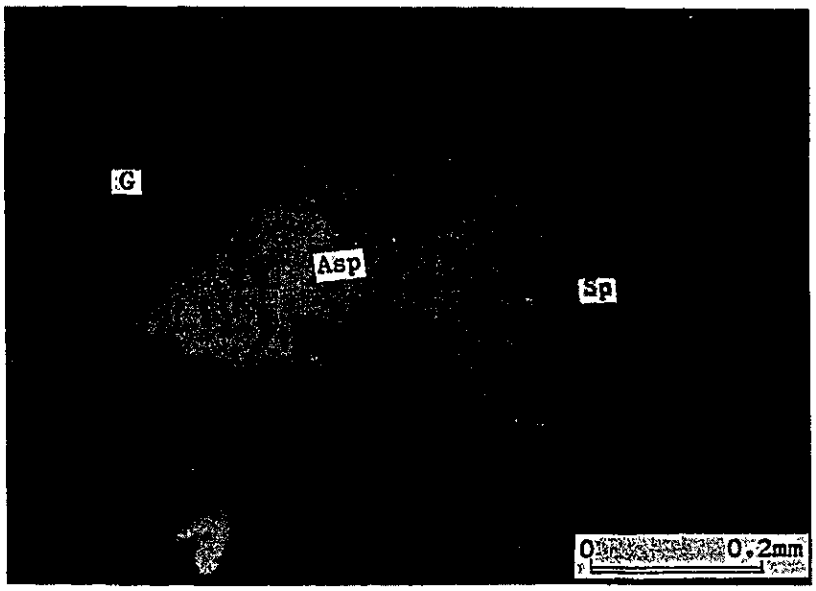

Sample No. PD-10111

Electrum within gangue mineral.



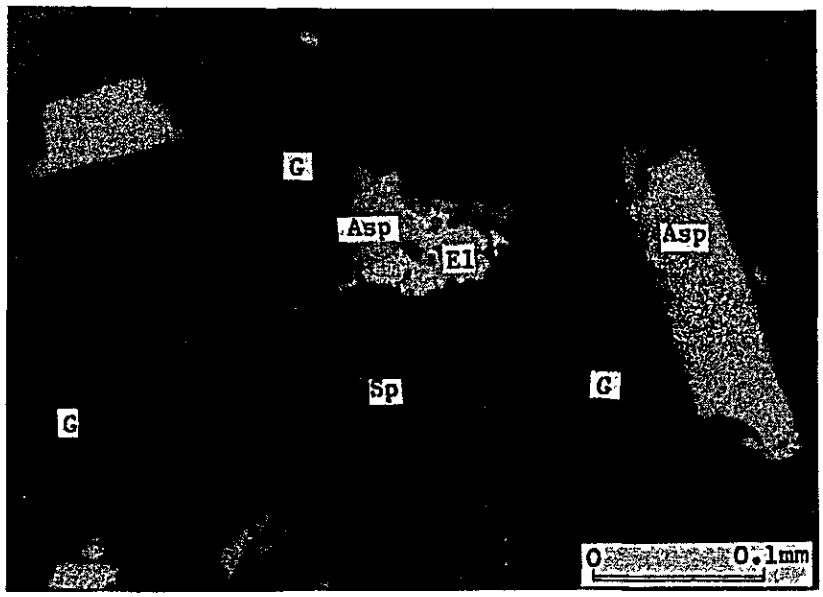

Sample No. PD-10111

Pyrite is replaced by sphalerite with chalcopyrite dot.



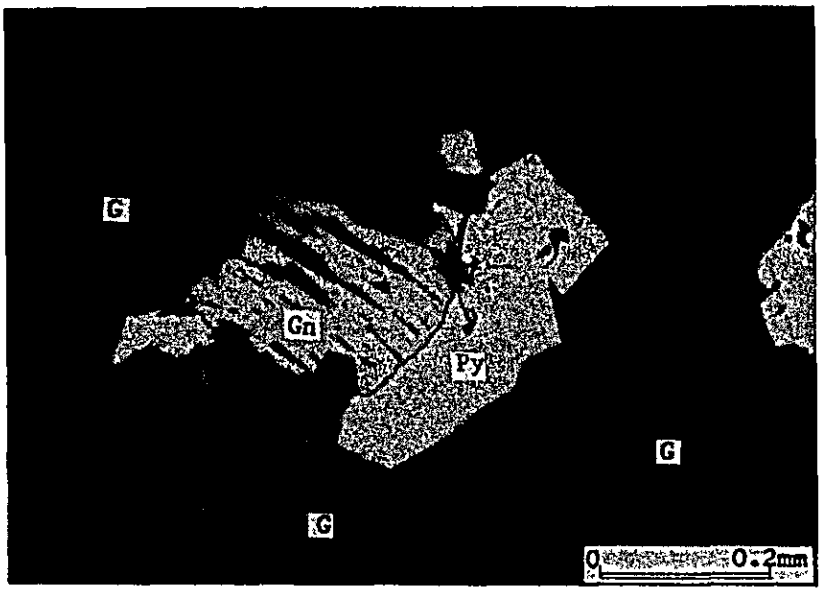

Sample No. PD-10111.4

Arsenopyrite is replaced by sphalerite.



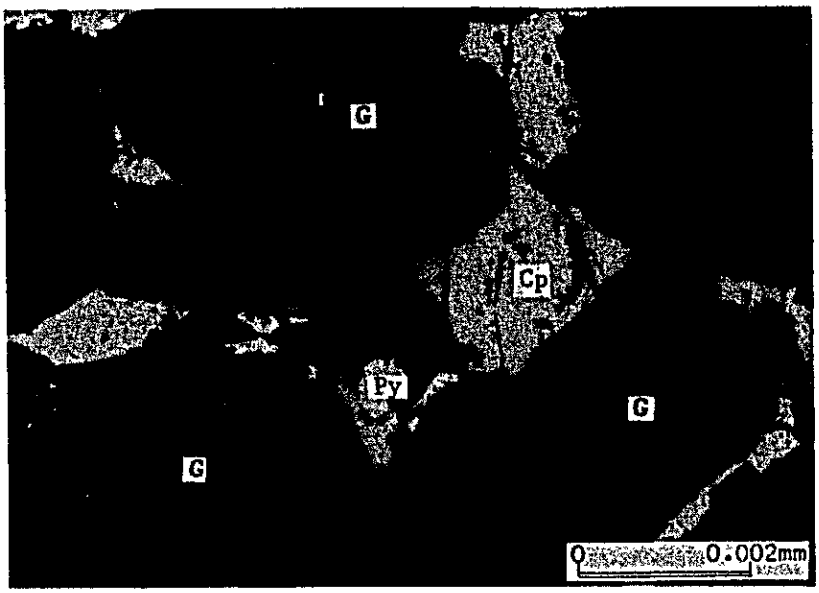

Sample No. PD-10114

Electrum coexists with arsenopyrite.



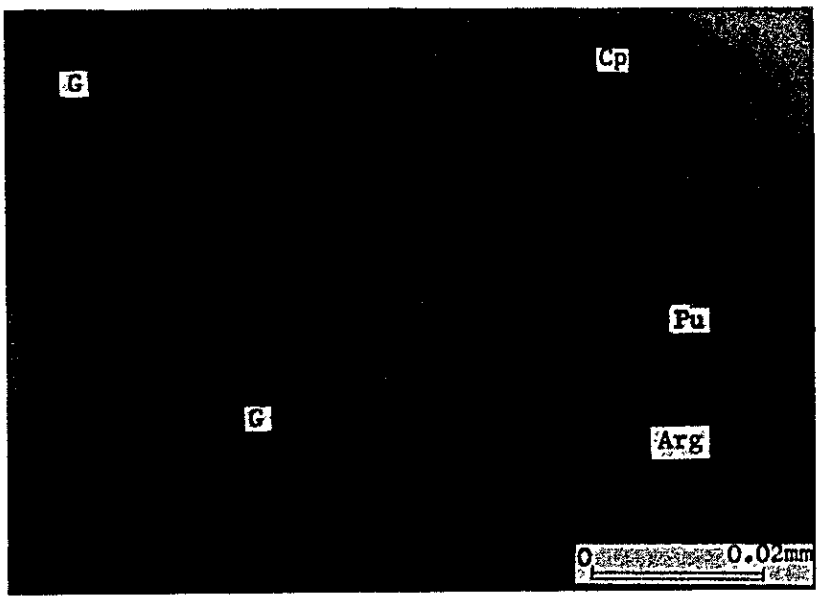

Sample No. PD-11181

Galena with triangular pit replaces pyrite.



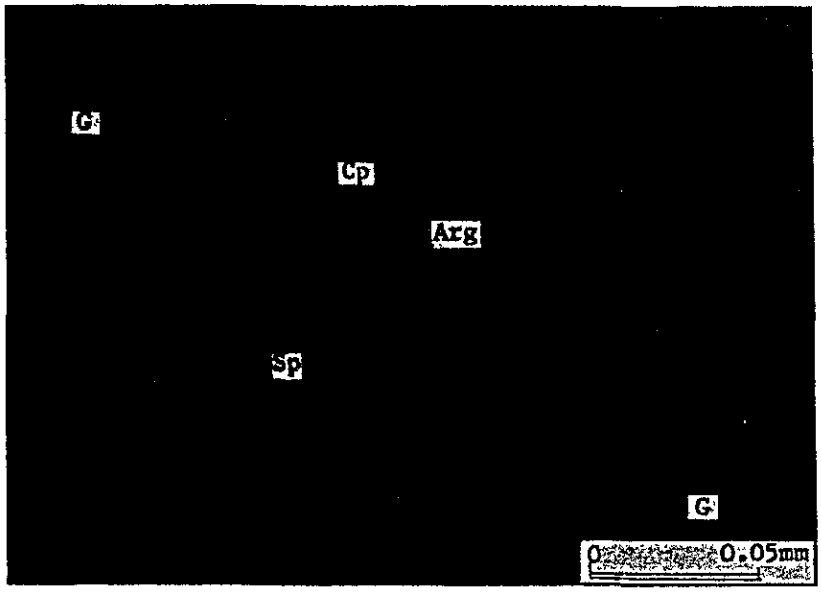

Sample No. PD-1376.4

Paragenesis of chalcopyrite -pyrite-pyrargyrite-argentite.



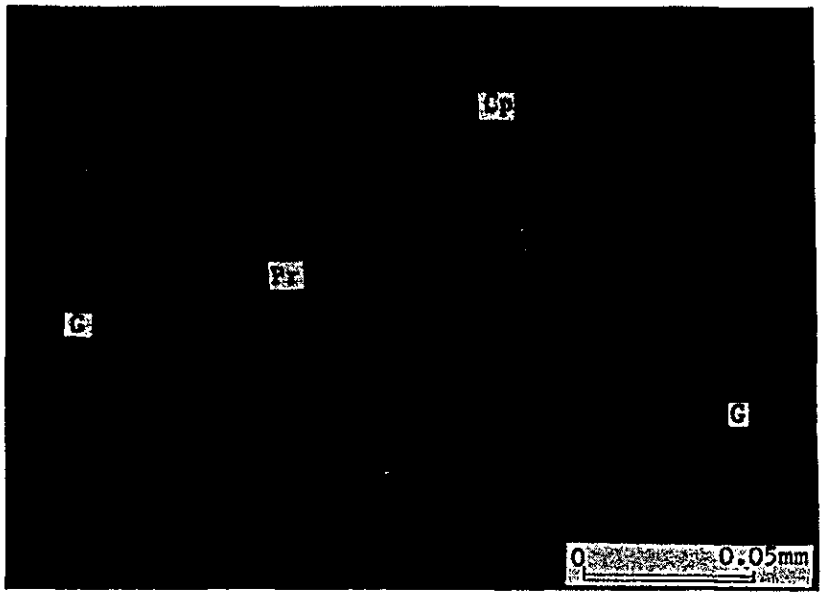

Sample No. PD-1376.4

Enlarged above.



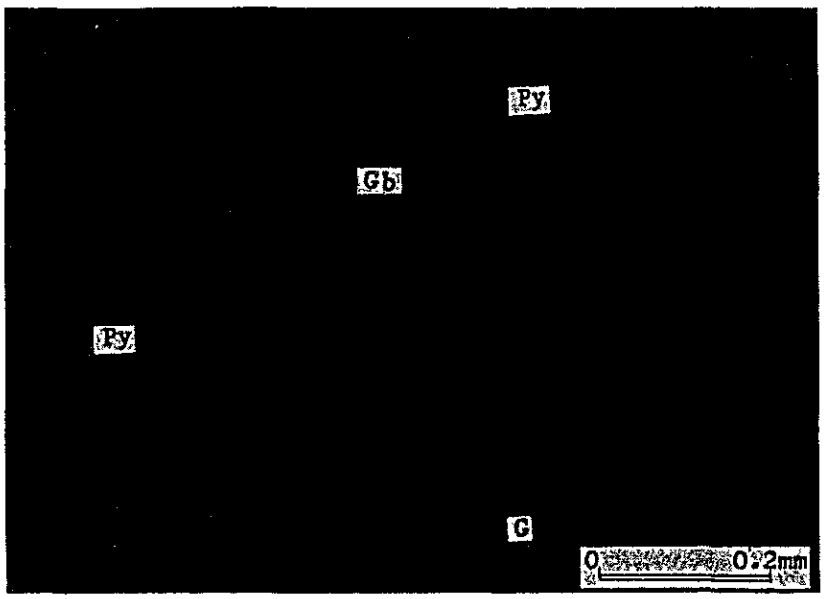

Sample No. PD-1376.5

Argentite is cutting both sphalerite and chalcopyrite.



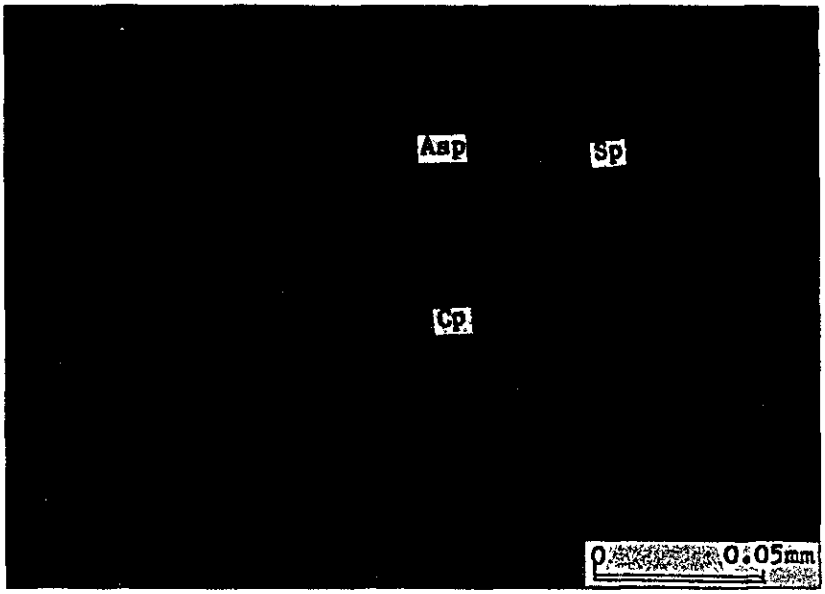

Sample No. PD-1378

Pyrargyrite vein cuts chalcopyrite.



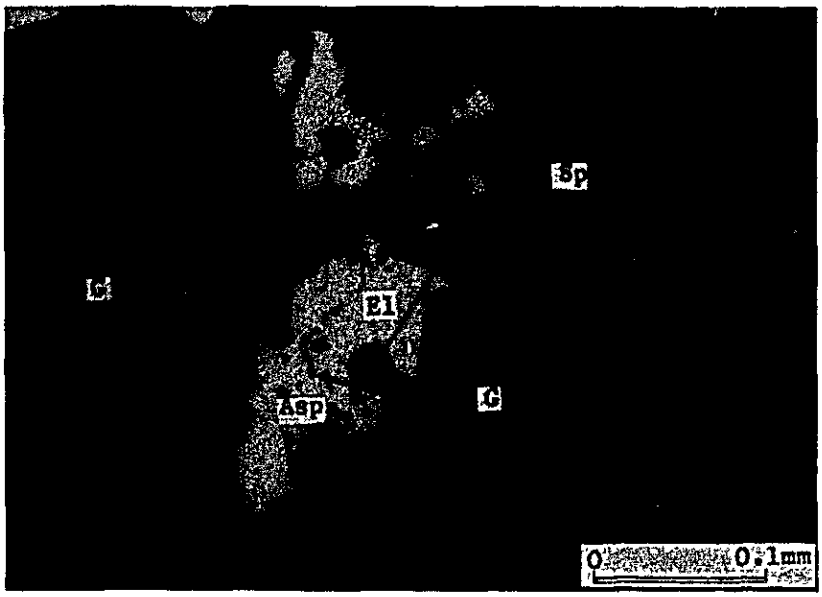

Sample No. PD-14124

Ag-Pb-Bi mineral within pyrite.




Sample No. PD-15121.7

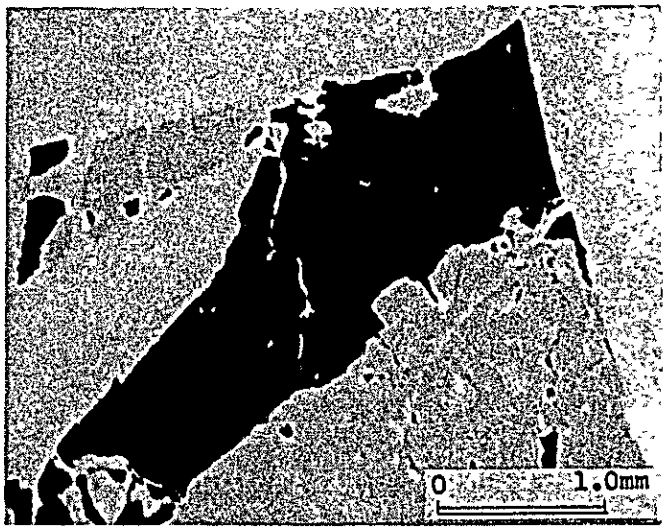
Arsenopyrite-sphalerite-chalcopyrite in crystallization order.




Sample No. PD-15148.7

Electrum with arsenopyrite.

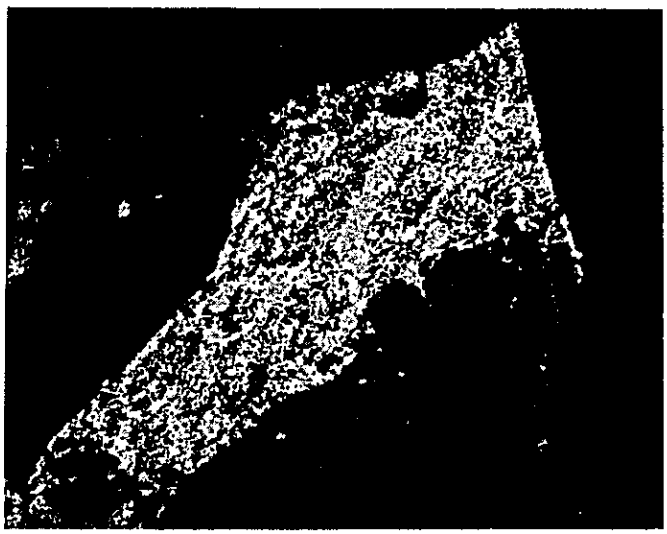
A. Ⅱ-19-3 EPMA




Absorbed electron image

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

Ag X-ray image

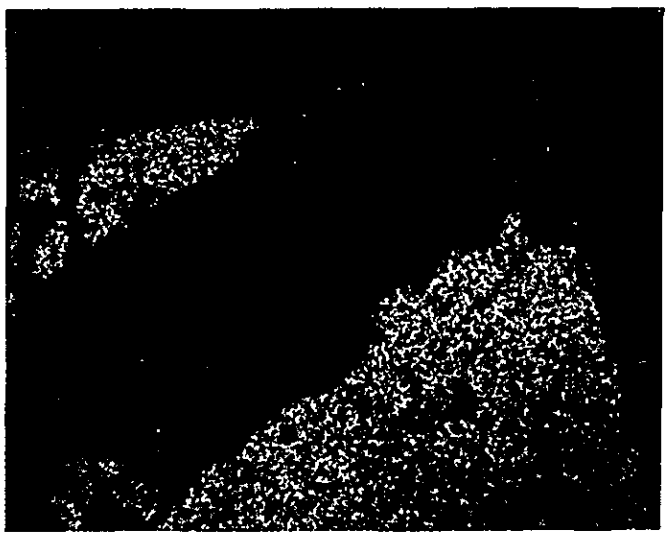


Pb X-ray image

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

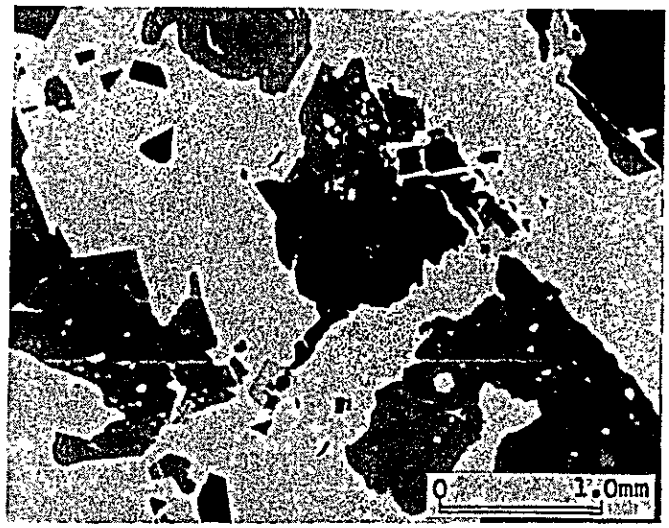
Bi X-ray image

Cu X-ray image



Fe X-ray image

S X-ray image



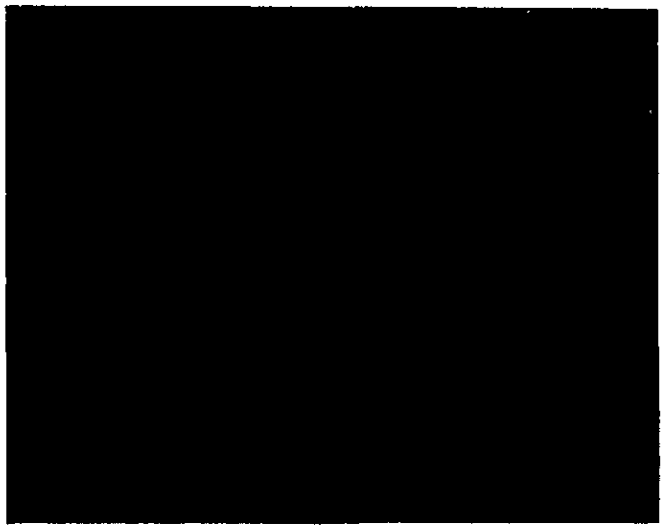

Absorbed electron image

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

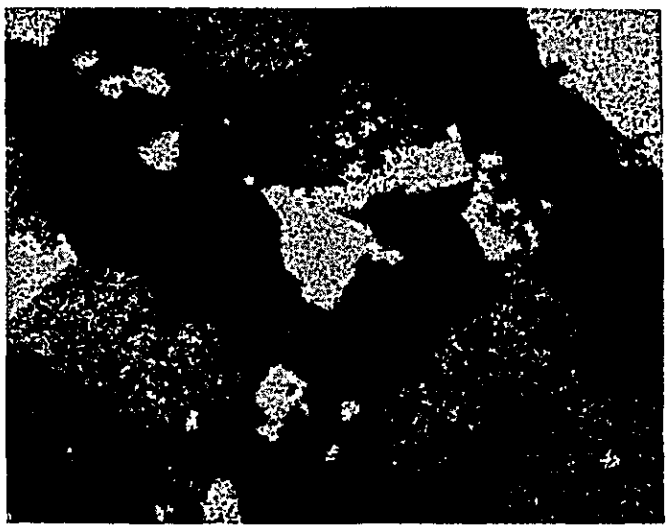
Au X-ray image

Ag X-ray image

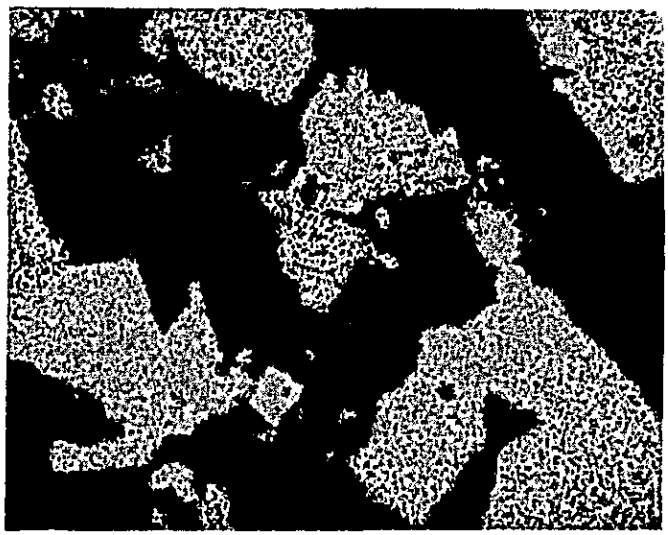
Sample No. : PD-10114
Locality : Diamante
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA



As X-ray image



Fe X-ray image

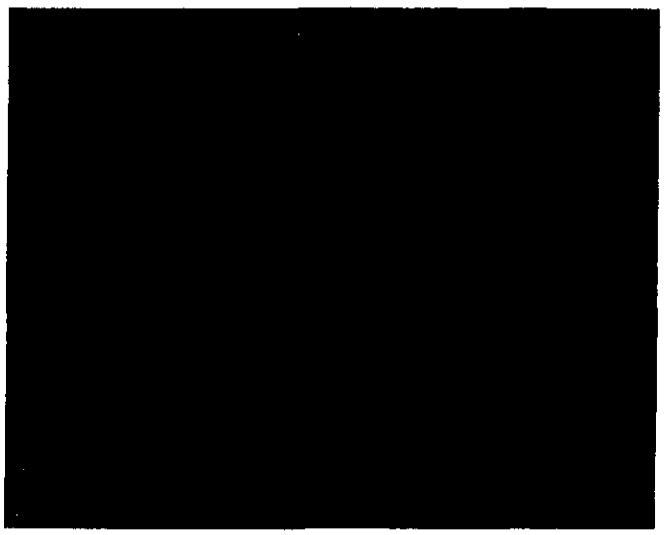


S X-ray image


Absorbed electron image

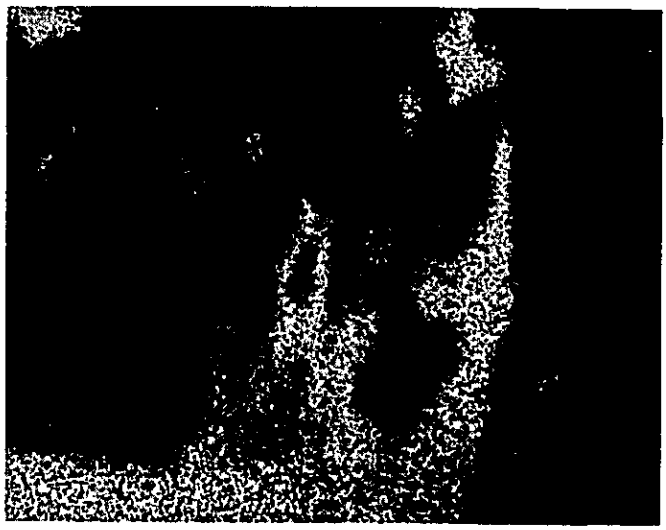
Proustite ($3\ Ag_2S \cdot As_2S_3$)

Ag X-ray image

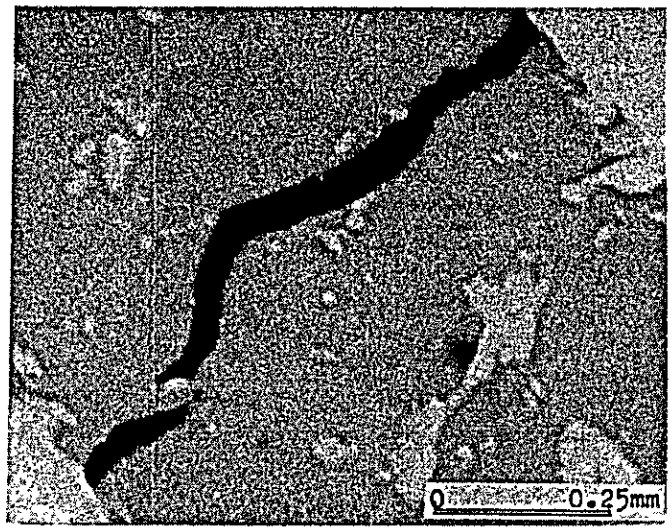


As X-ray image

Sample No. : PD-1376.4
Locality : Diamante
Accel. volt. : 15 kV
Absorb. elect. : 0.1 μA

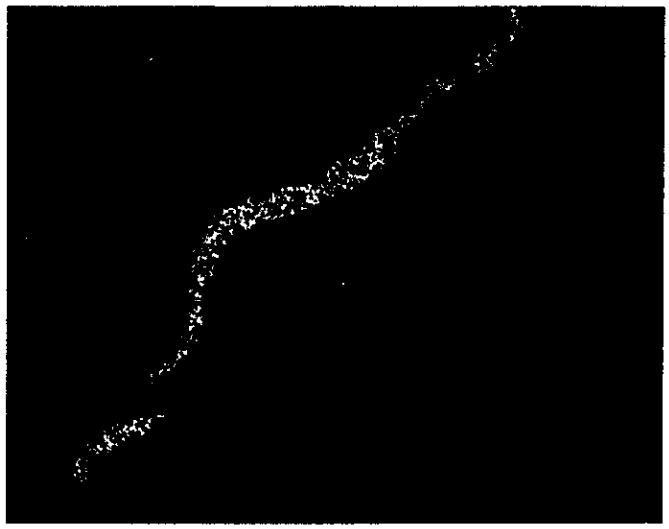


S X-ray image

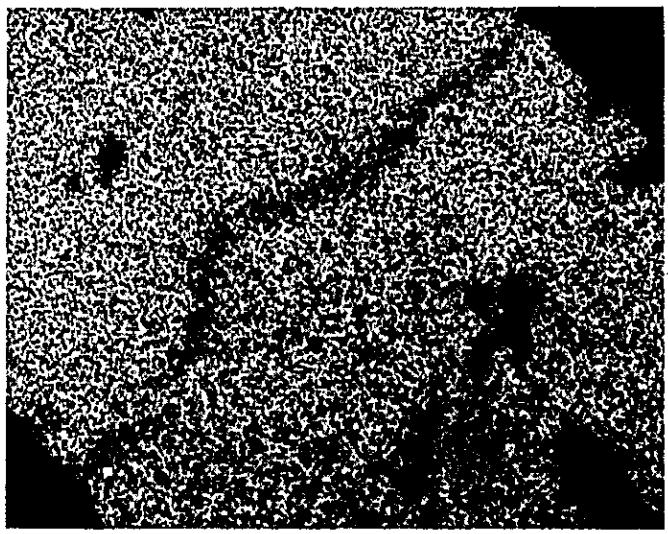



Absorbed electron image

Veinlet of argentite cutting both sphalerite and chalcopyrite.



Ag X-ray image



S X-ray image

Sample No. : PD-1376.5
Locality : Diamante
Accel. volt. : 25 kV
Absorb. elect. : 0.2 μA