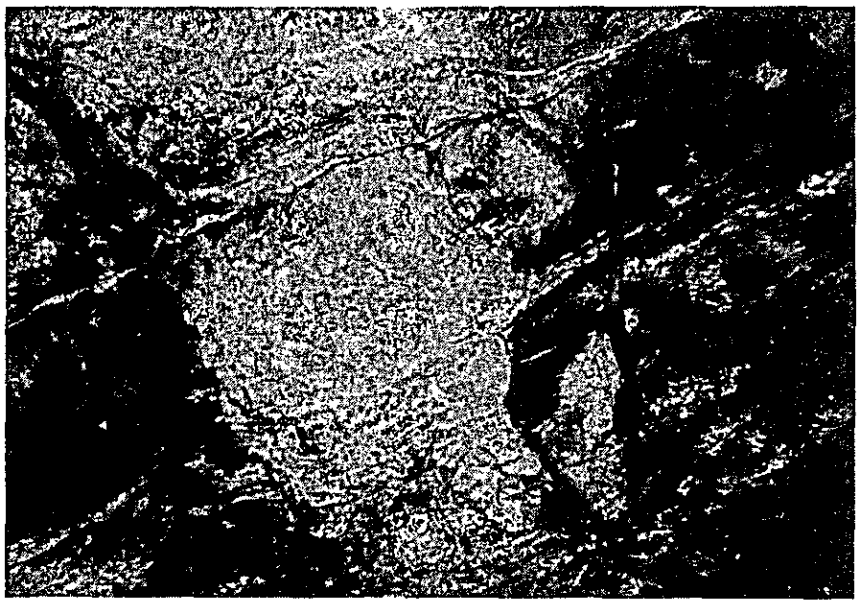
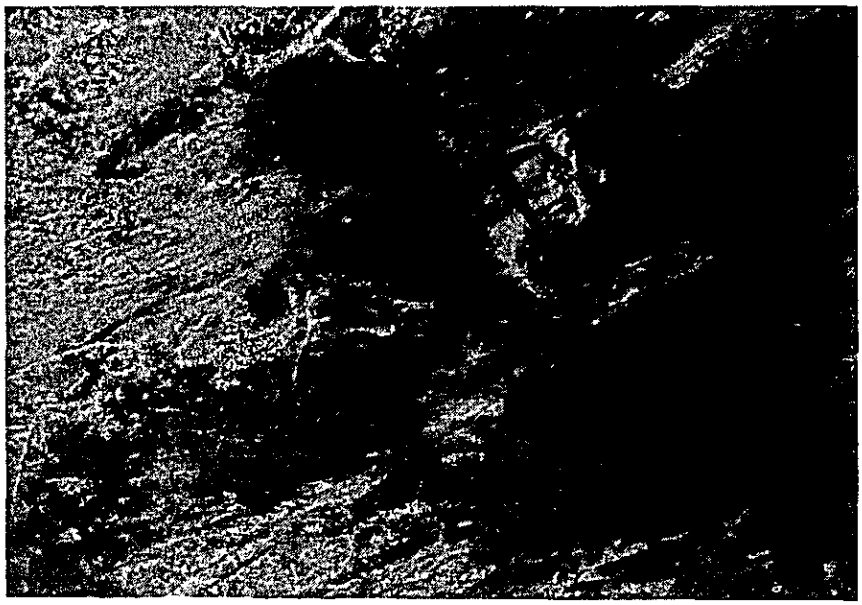


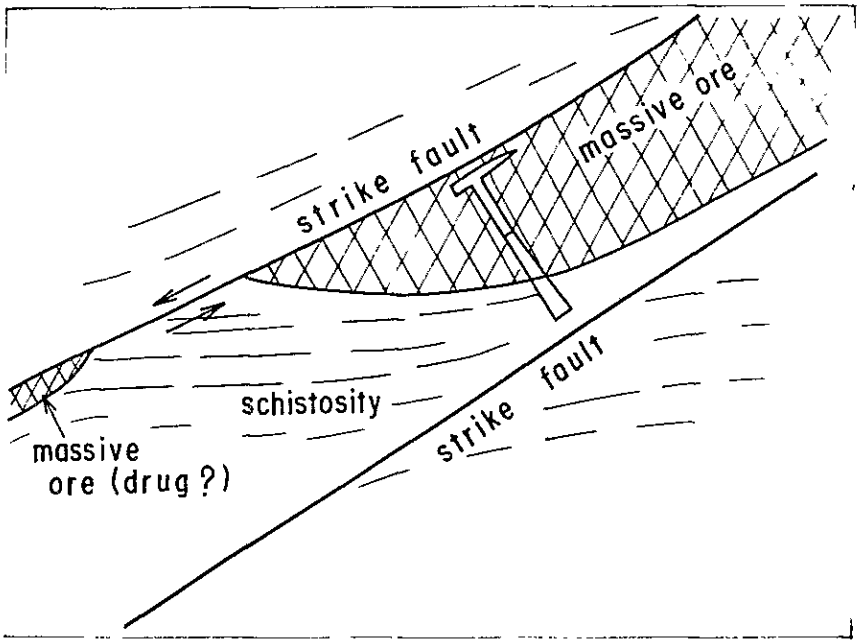
Location . Perau Mine G1L
Massive ore bearing fine fragments of host rock

Location : Perau Mine G3L
Folded massive ore with many cleavages

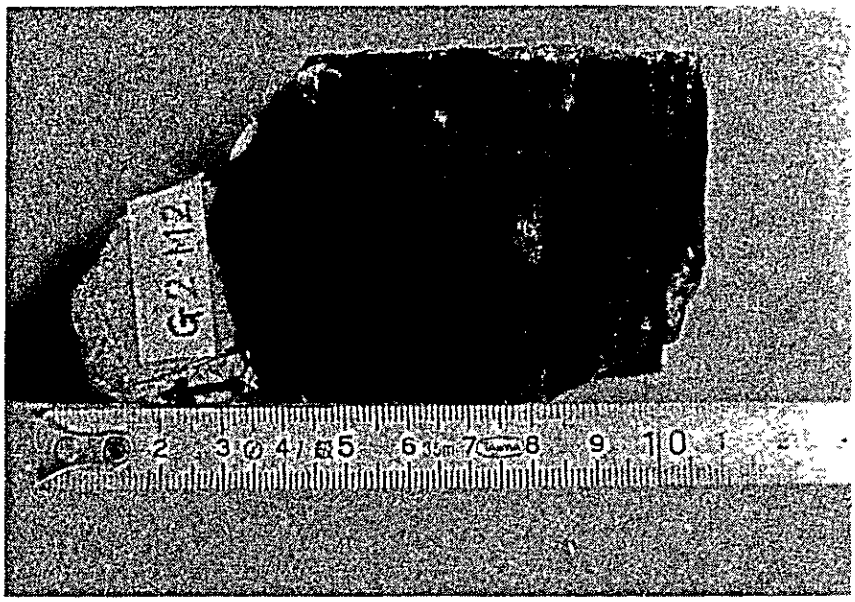


Location

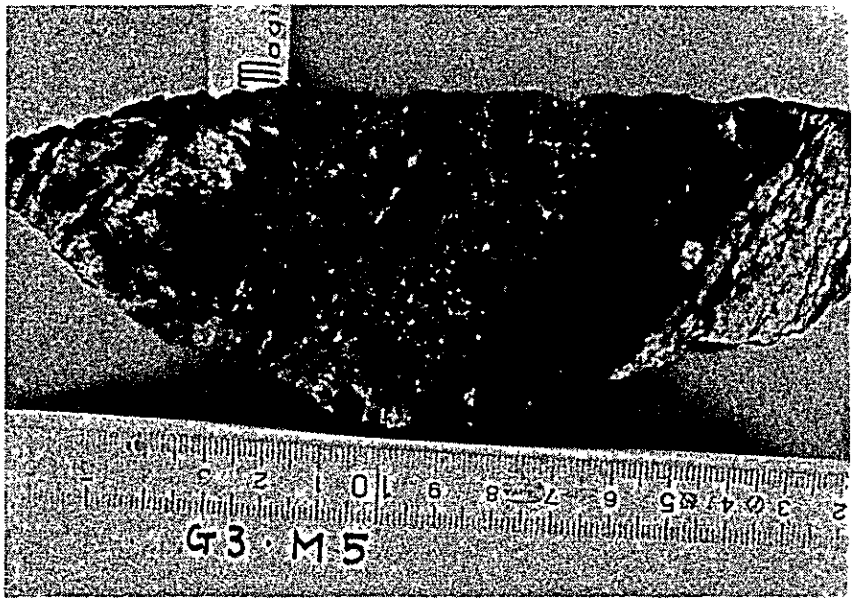
Perau Mine G3L
Strike faults are observed in both side of massive ore



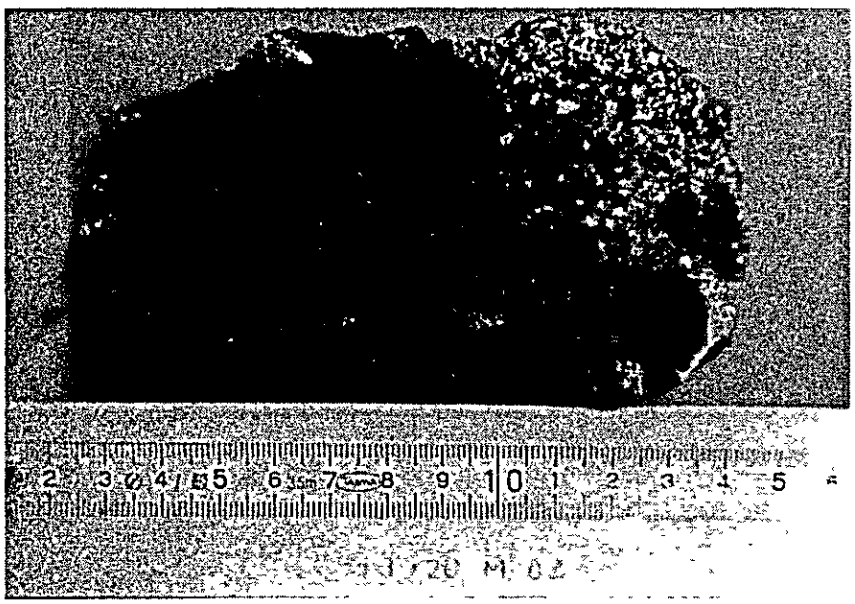
Explanation sketch of above photo



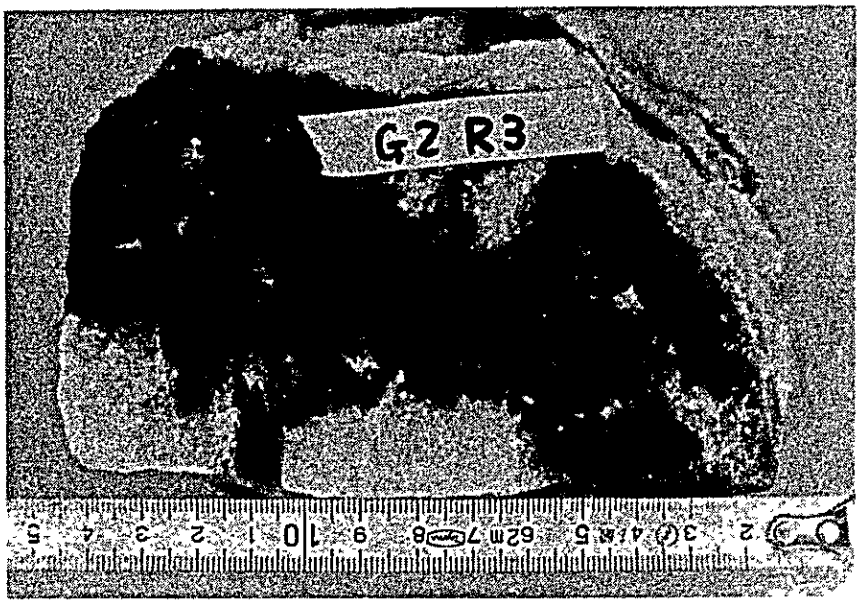
Location Perau Mine G2L
Banded pyrite



Location Perau Mine G3L
Massive ore bearing many fragments of host rock



Location Perau Mine G3 + 20 mL
Massive galena and banded pyrite



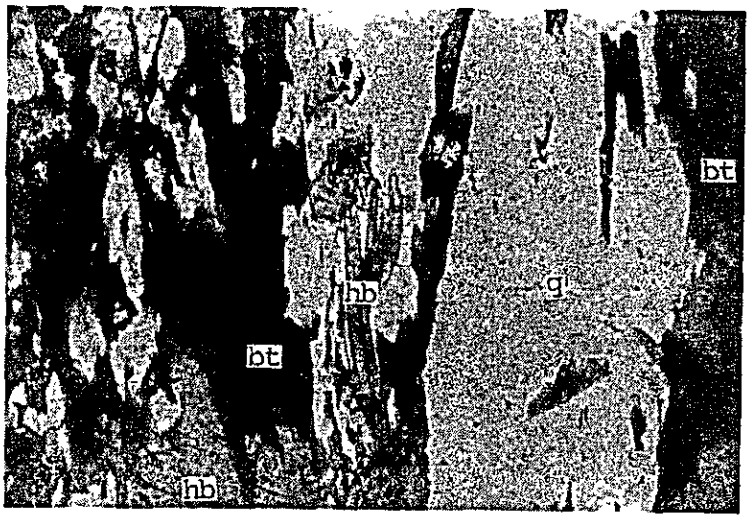
Location Perau Mine G2L
Massive barite with
galena impregnation

Photo A-2 Microphotograph of Thin Section

Abbreviations

q	:	quartz
pl		plagioclase
bt		biotite
mus		muscovite
hb		hornblende
tr	:	tremolite
gar	:	garnet
chl	:	chlorite
cal	:	calcite
cpx	:	clinopyroxene
act		actinolite
mcl		microcline
ol		olivine
sta		staurolite
hem	:	hematite

Sample No A-091
Rock name Hornblende-biotite-schist (Setuva F.)
Location Perau



It shows lepidoblastic texture

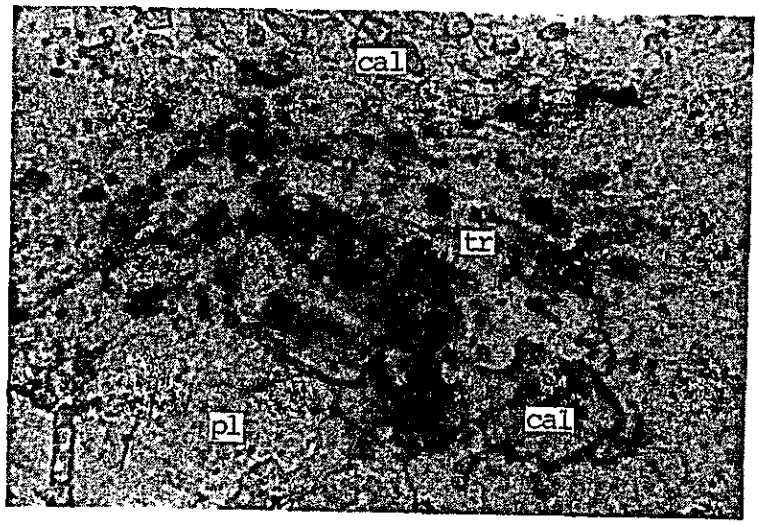
(only lower polar)

0 0.5mm

(corssed polars)

0 0.5mm

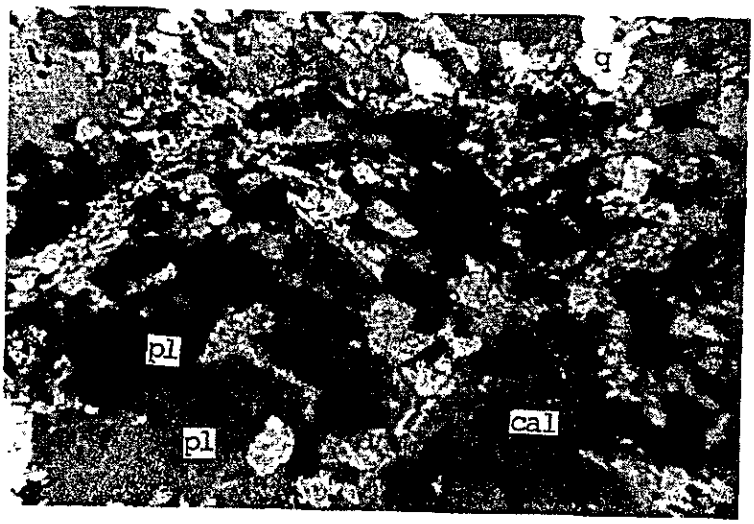
Sample No . A-063
Rock name Calc-schist (Açungui F.)
Location Quil Ometro Quarenta



(only lower polar)

0 0.5mm

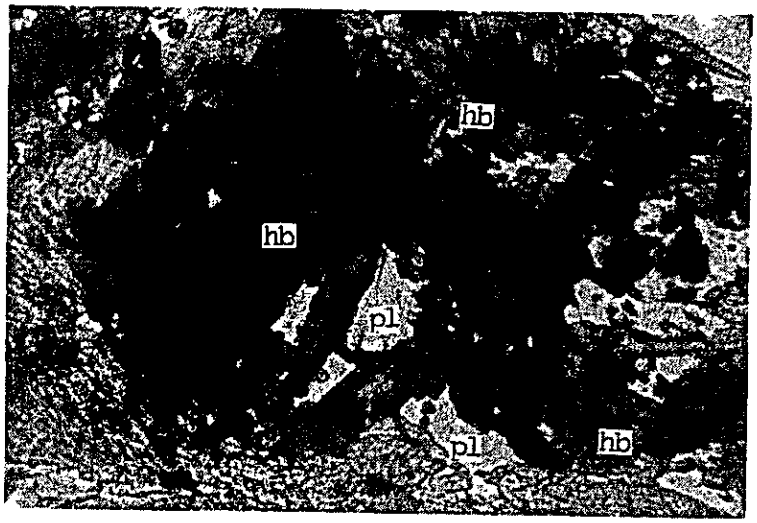
It shows equigranular texture, with partially lepidoblastic texture.
Tremolite is found as needle-shaped crystal



(crossed polars)

0 0.5mm

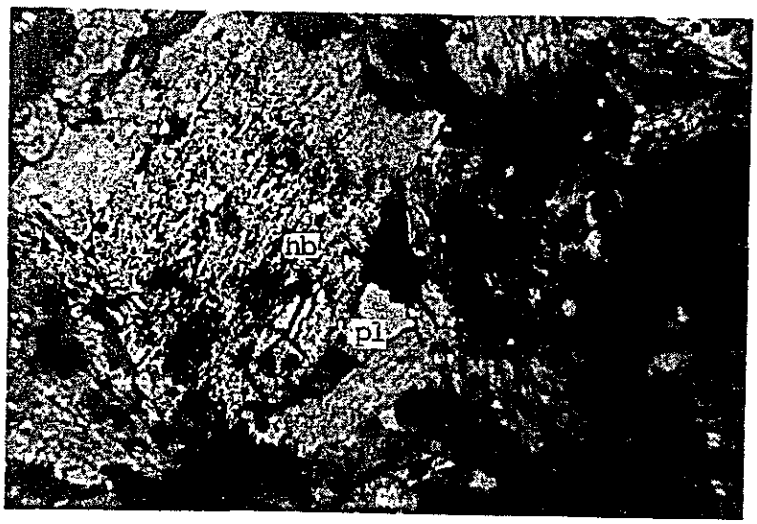
Sample No. A-077
Rock name Amphibolite (Açungui I F)
Location Perau



It shows nematoblastic texture

(only lower polar)

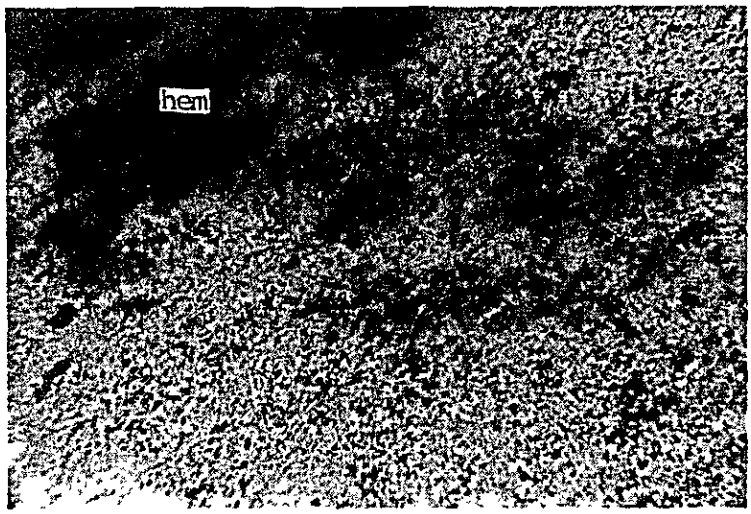
0 0.5mm



(crossed polars)

0 0.5mm

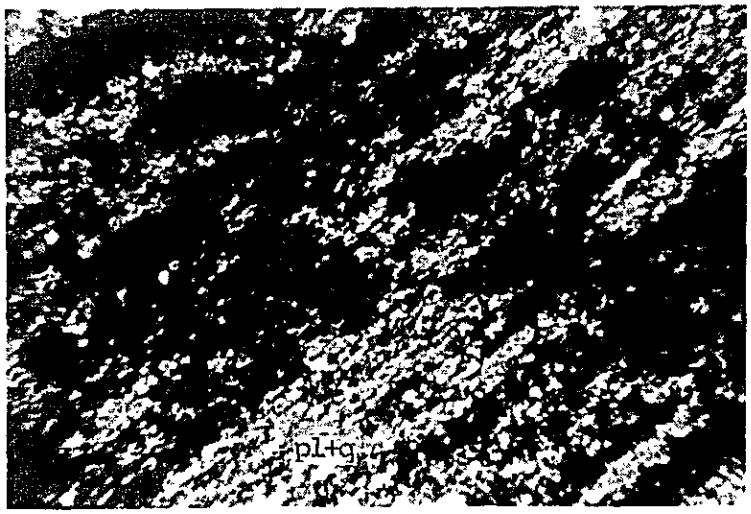
Sample No. . D-075
Rock name · Sericite-phyllite (Açungui I.F.)
Location Tunas



(only lower polar)

0 0.5mm

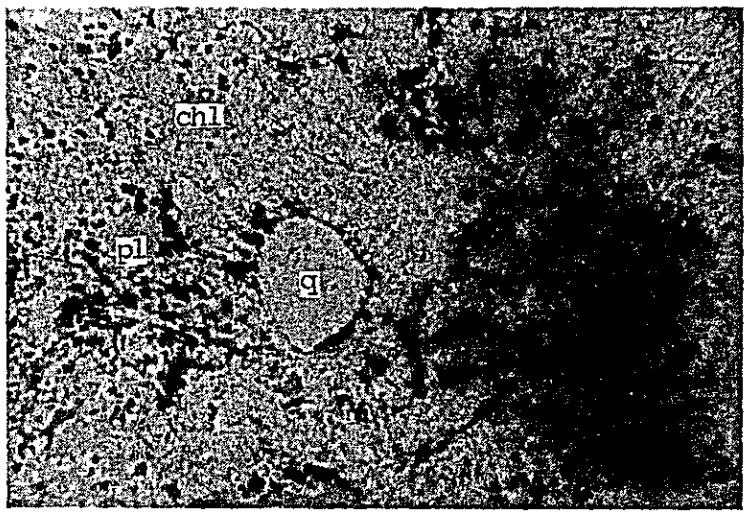
It shows lapidoblastic texture
Hematite is intercalated as lens in a matrix



(crossed polars)

0 0.5mm

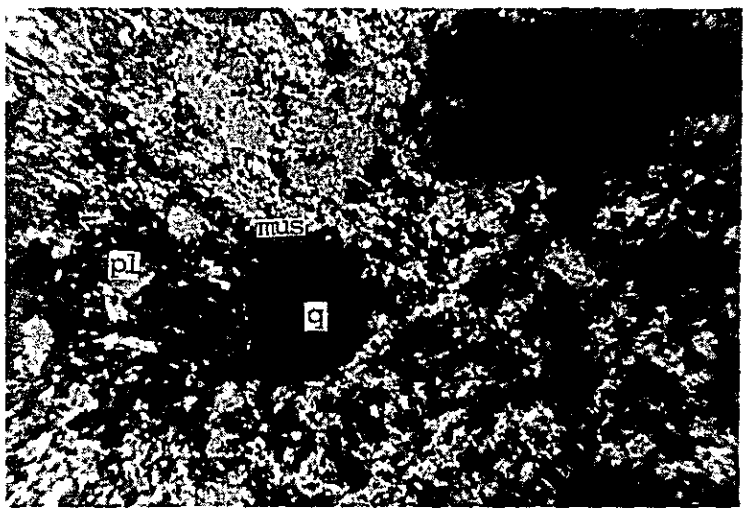
Sample No . C--068
Rock name Chlorite-muscovite-schist (Açungui II F.)
Location : Quil Ometro Quarenta



(only lower polar)

0 0.5mm

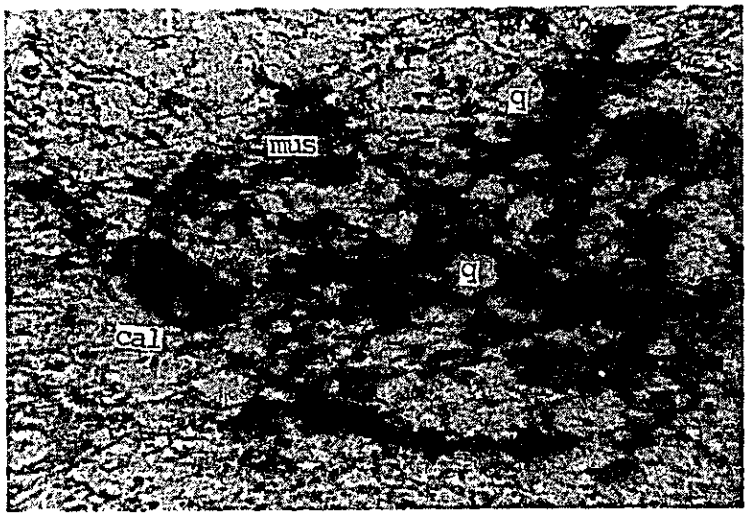
It shows porphyroblastic and partly lepidoblastic texture.
Porphyroblasts are composed of quartz and plagioclase.



(crossed polars)

0 0.5mm

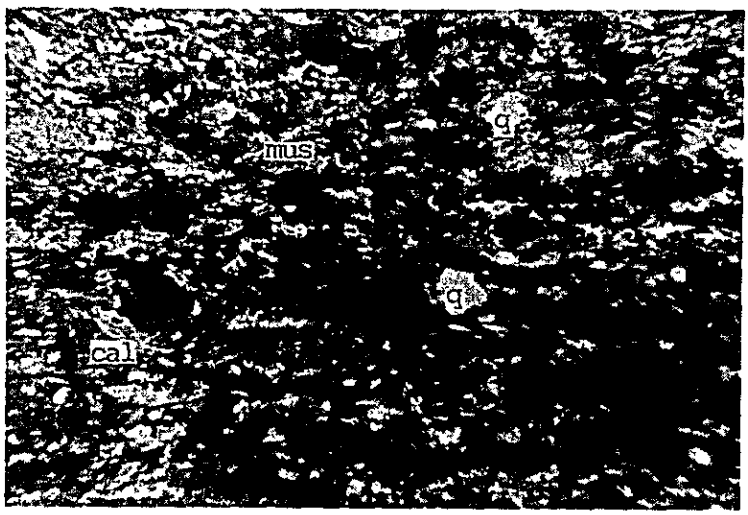
Sample No A-016
Rock name Muscovite schist (Açungui III.F)
Location Rio Ribeira



(only lower polar)

0 0.5mm

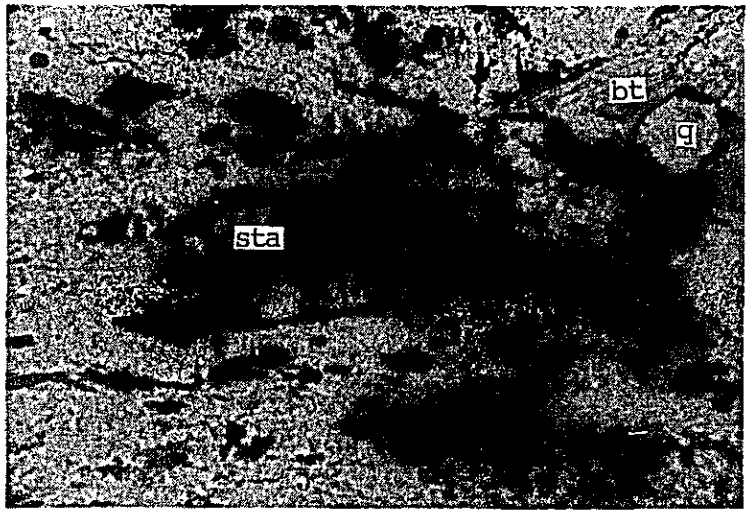
It shows lepidoblastic texture.
A half amounts of muscovite is composed of phengitic muscovite.



(crossed polars)

0 0.5mm

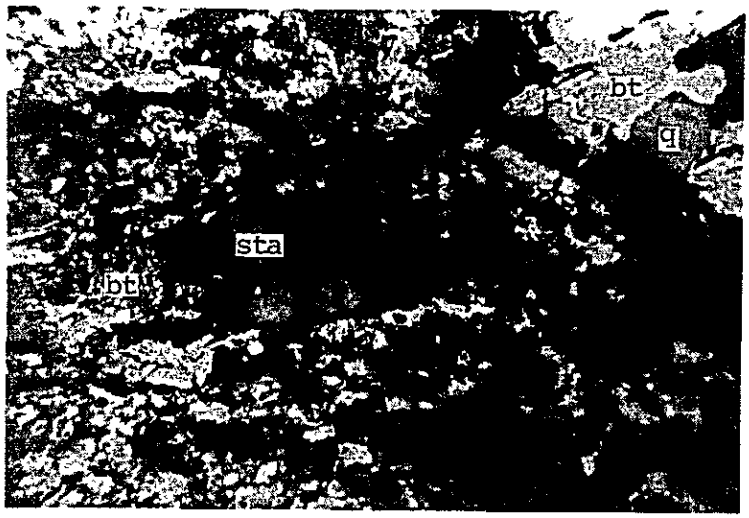
Sample No　A-021
Rock name　Staurolite-muscovite-biotite-schist (Açungui III.F.)
Location　Rio Ribeira



(only lower polar)

0　0.5mm

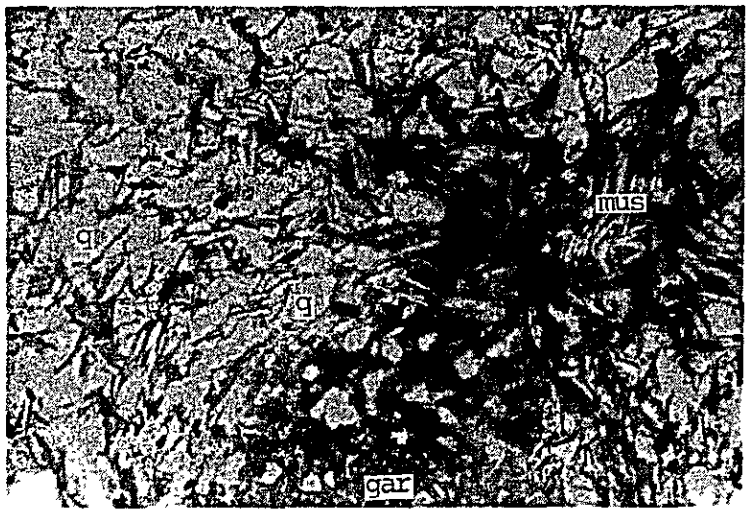
It shows lepidoblastic texture.
Staurolite is a slender prism in shape.



(crossed polars)

0　0.5mm

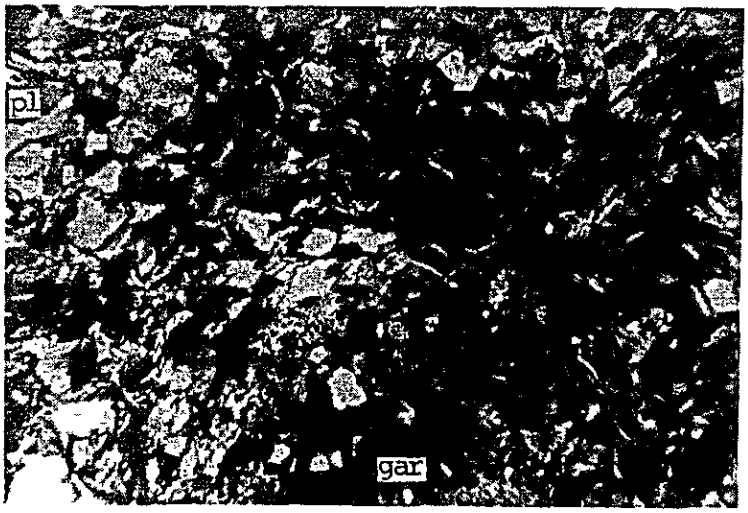
Sample No C−004
Rock name Garnet bearing chlorite-biotite-muscovite schist (Açungui III.F)
Location Paneras



(only lower polar)

0 0 5mm

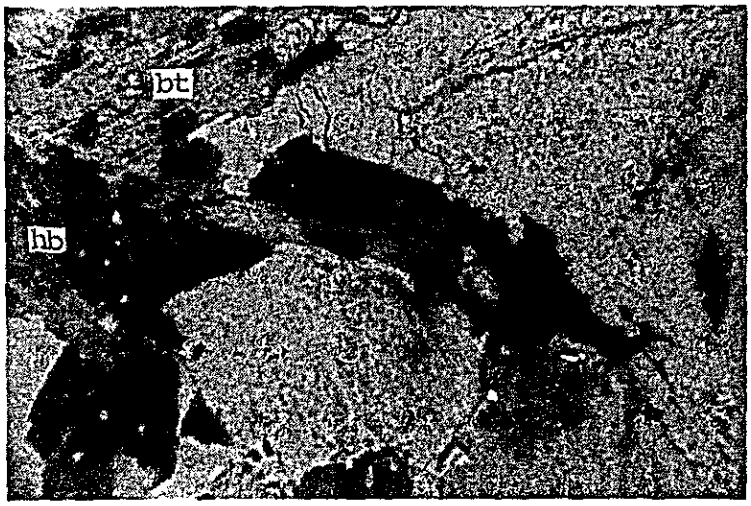
It shows lepidoblastic texture
Needles of muscovite crystals are aggregated and micro-folded.
Garnet crystal is fringed with minute crystals of biotite.



(crossed polars)

0 0.5mm

Sample No A -001
Rock name Biotite-hornblende-granodiorite (Intrusive rock)
Location Panelas



It shows porphyritic texture

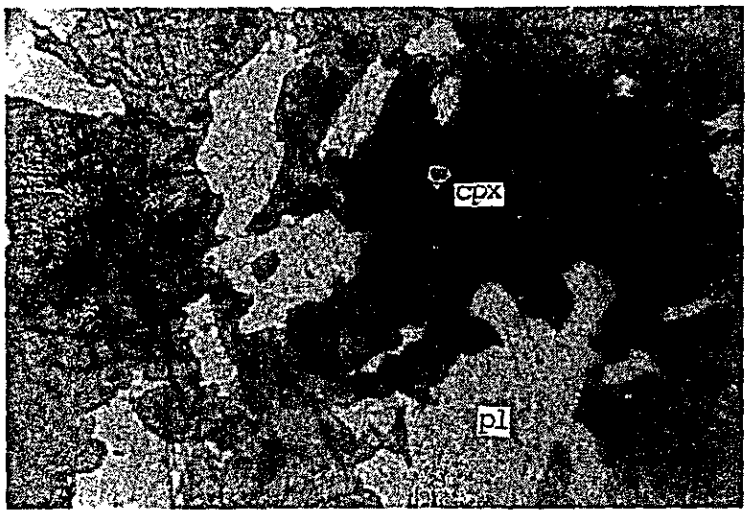
(only lower polar)

0 0 5mm

(crossed polars)

0 0 5mm

Sample No A–018
Rock name Hornblende-Gabbro (Intrusive Rock)
Location Rio Ribeira



It shows ophitic texture.

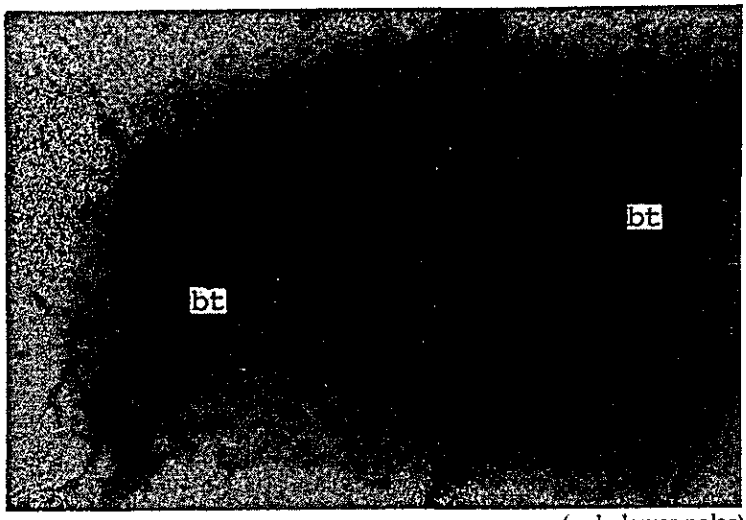
(only lower polar)

0 0.5mm

(crossed polars)

0 0.5mm

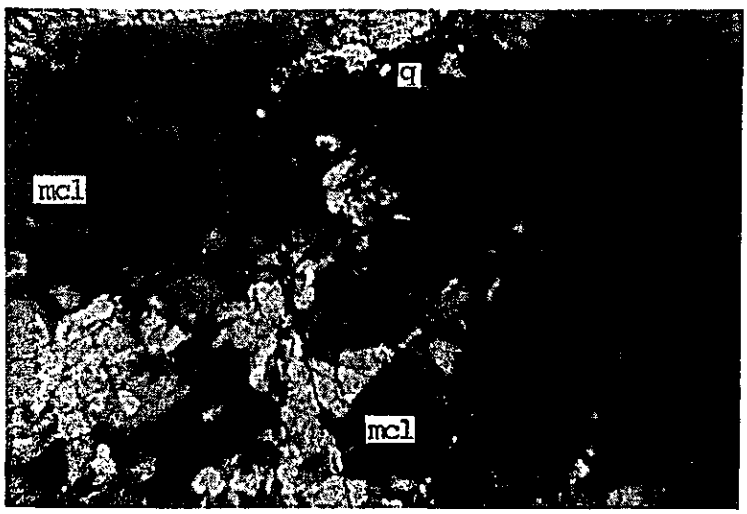
Sample No B-032
Rock name Mylonitized biotite-granite (Intrusive rocks)
Location : Mato Preto



(only lower polar)

0 0.5mm

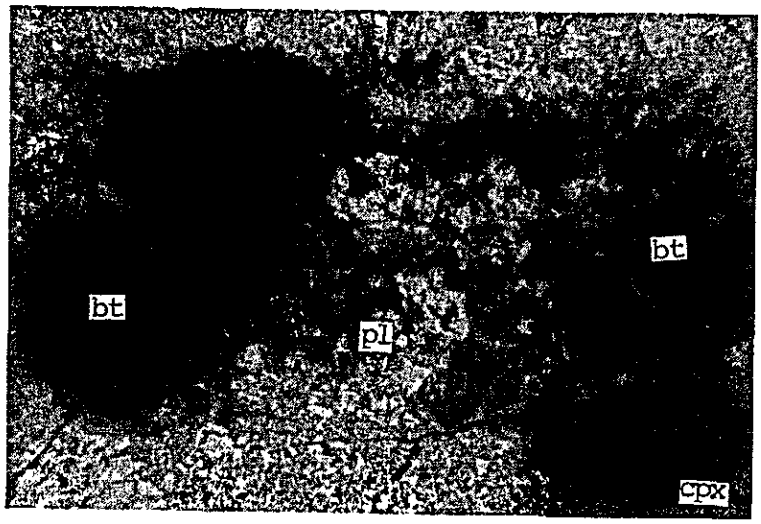
It shows porphyroblastic texture
Microcline forming porphyroblasts frequently shows parthite texture and poikilitically encloses minute crystals of quartz and plagioclase.



(crossed polar)

0 0.5mm

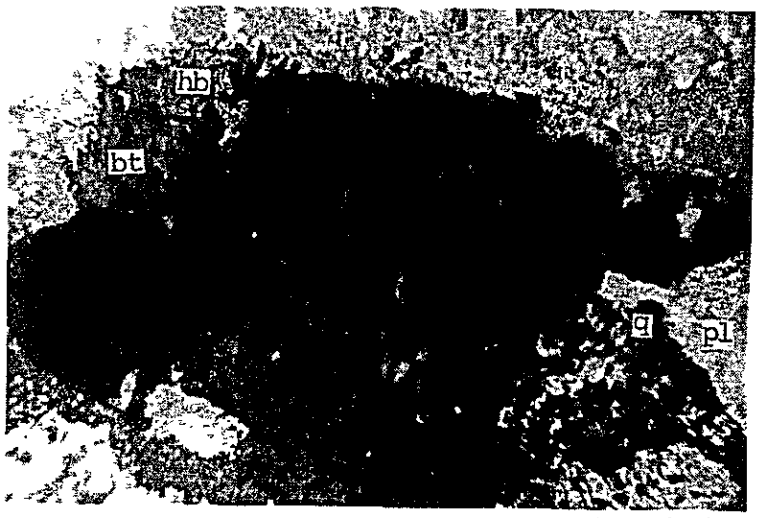
Sample No C-073
Rock name . Hornblende-augite-biotite-syenite (Intrusive Rock)
Location Tunas



It shows equigranular texture.

(only lower polar)

0 0.5mm



(crossed polars)

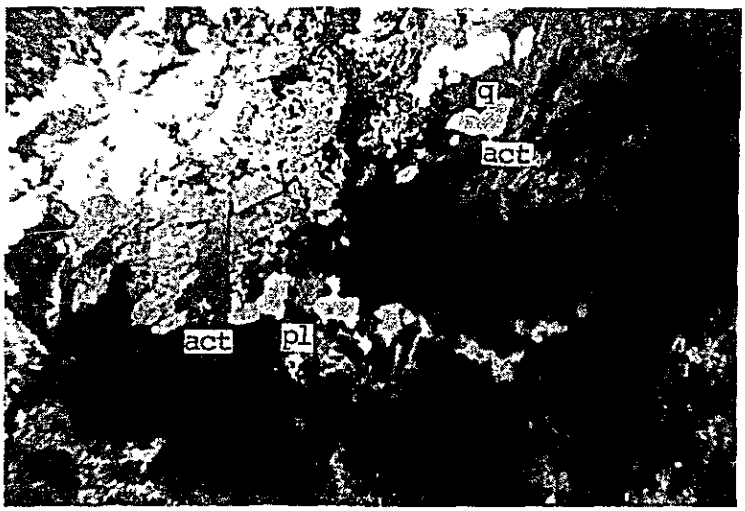
0 0.5mm

Sample No D-015
Rock name Meta gabbro (Intrusive Rock)
Location Rio Ribeira

(only lower polar)

0 0 5mm

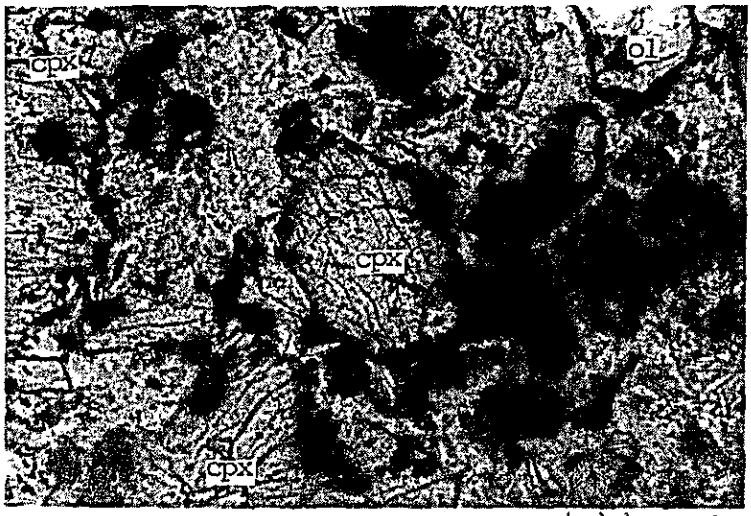
It shows poikiloblastic texture. Hornblende, actinolite and plagioclase are the main constituents in this rock Crystals of hornblende and actinolite poikilitically enclose scattered minute crystals of biotite, quartz and plagioclase



(crossed polars)

0 0 5mm

Sample No D-113
Rock name Olivine-basalt (Intrusive Rock)
Location Cricium



(only lower polar)

0 0.5mm

It shows porphyritic and intergranular texture.
Clinopyroxine showing zoned texture is the main components.

(zoned polars)

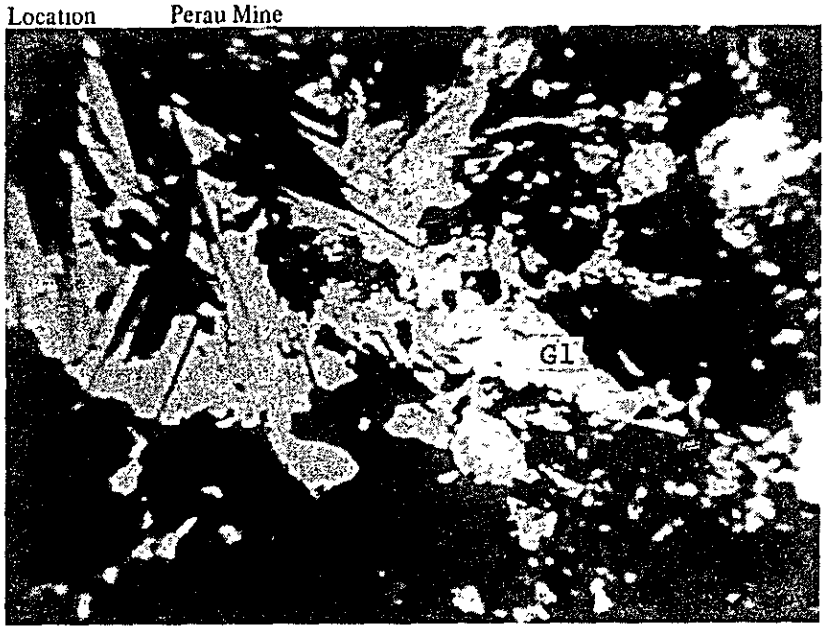
0 0.5mm

Photo A-3 Microphotograph of Polished Section

Abbreviation

Gl galena
Py : pyrite
Tt tetrahedrite
Sp : sphalerite
Cp : chalcopyrite
Po : pyrrhotite
Mc : malachite

Sample No : G1 M-05
Location Perau Mine



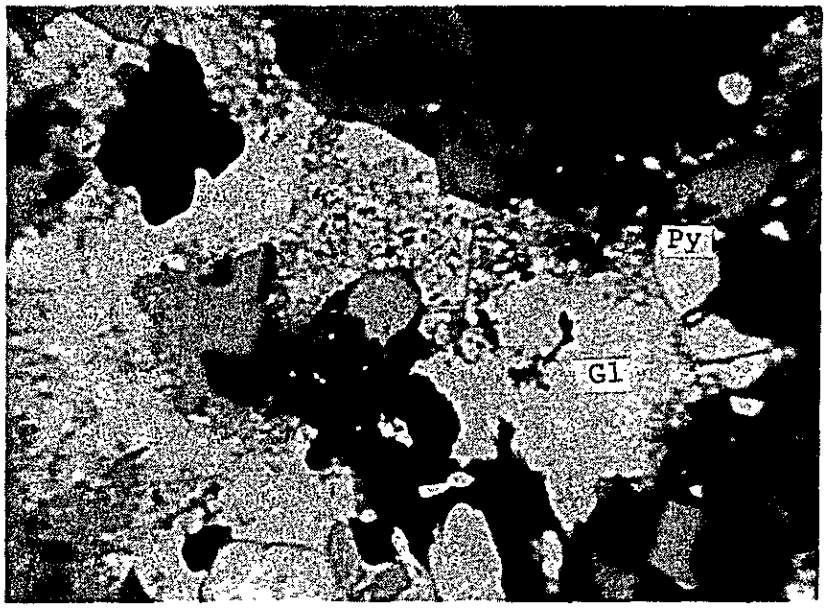
(only lower polar) 0.2mm

Galena fills the interstices of foliated gangue minerals.

(only lower polar) 0.05mm

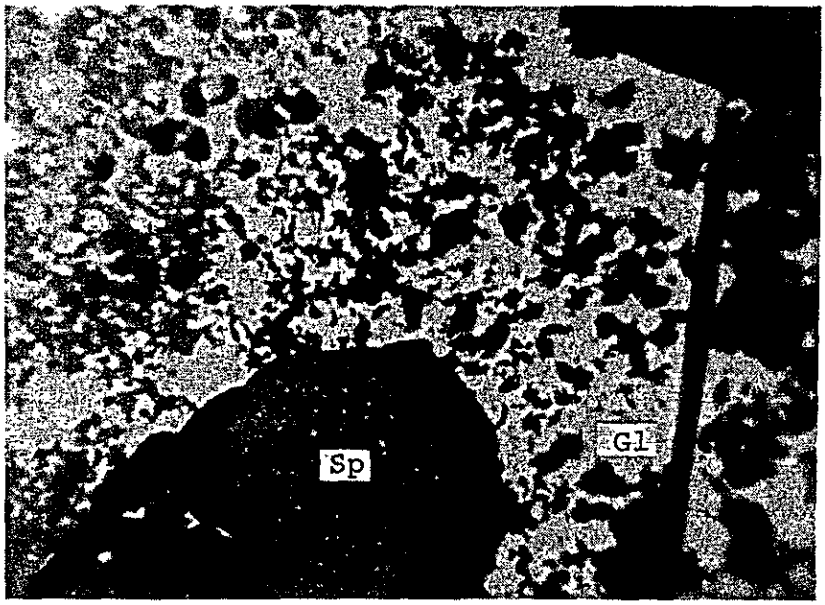
Tetrahedrite occurs intimately associated with galena.

Sample No. : G1 M-08
Location : Perau Mine



(only lower polar) 0.2mm

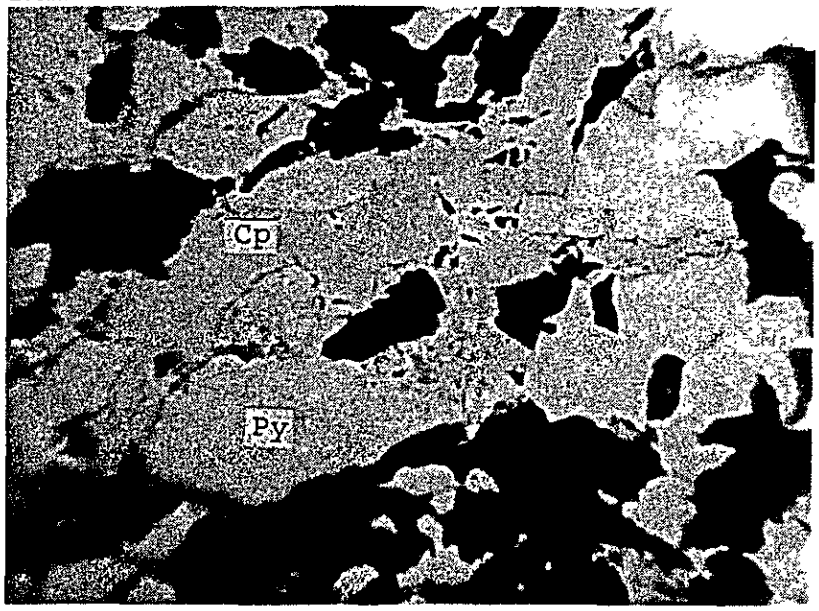
Galena is partly replaced by fine grains of gangue minerals



(only lower polar) 0.05mm

Sphalerite having minute chalcopyrite blebs and a gangue mineral which disseminates finely in galena and fills cleavages.

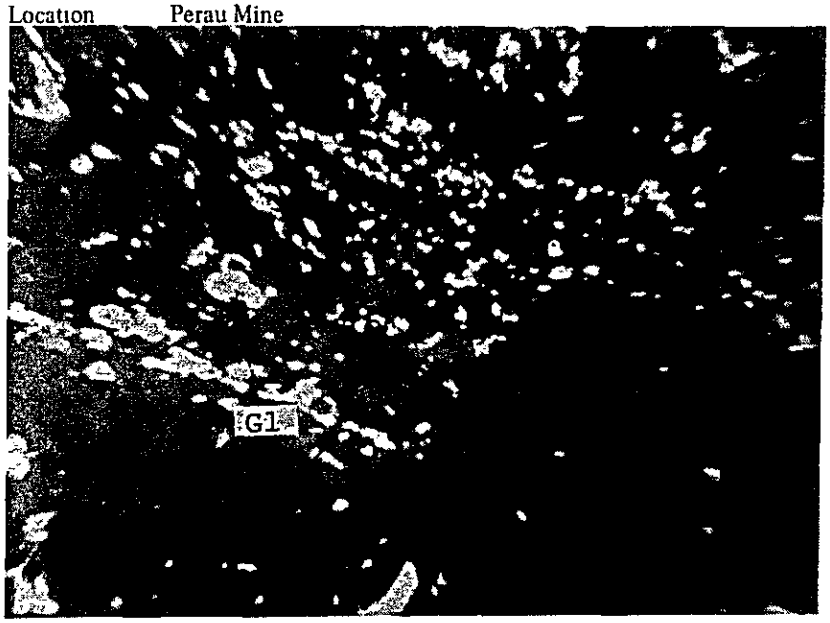
Sample No G1 M-04
Location . Perau Mine



(only lower polar) 0.2mm

Pyrite is corroded by chalcopyrite Some parts of pyrite are changed to fine-grained pyrite in chalcopyrite

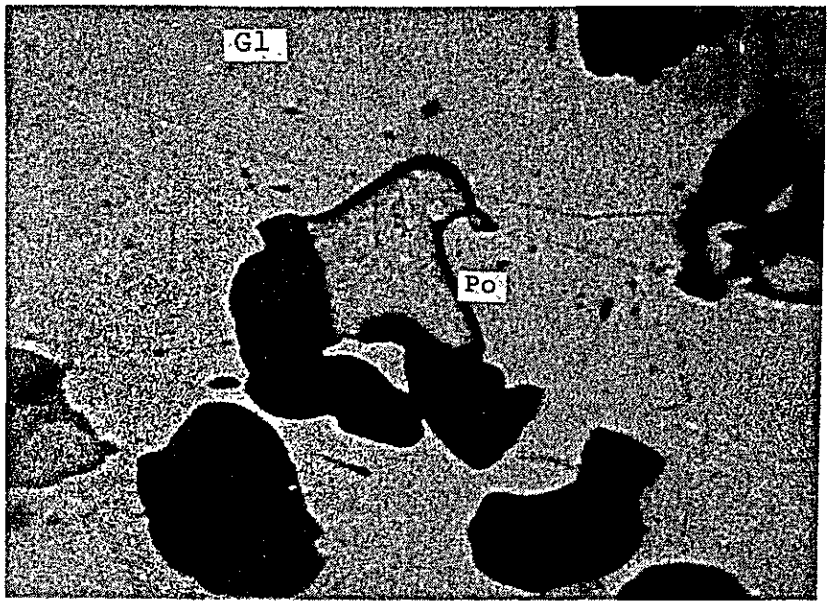
Sample No. G2 M-05
Location Perau Mine



(only lower polar) 0.2mm

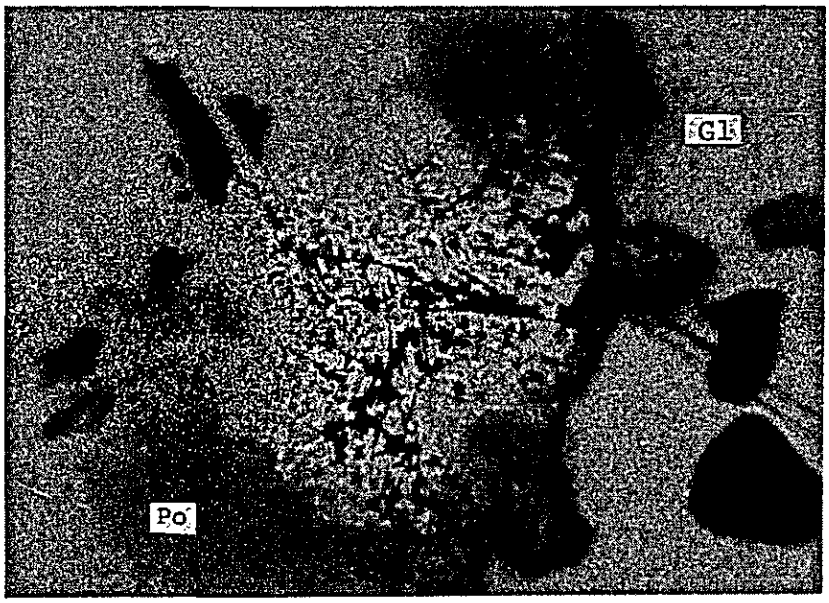
Dissemination of galena is controlled by the original structure of rock

Sample No G2 M-03
Location Perau Mine



(only lower polar) 0.2mm

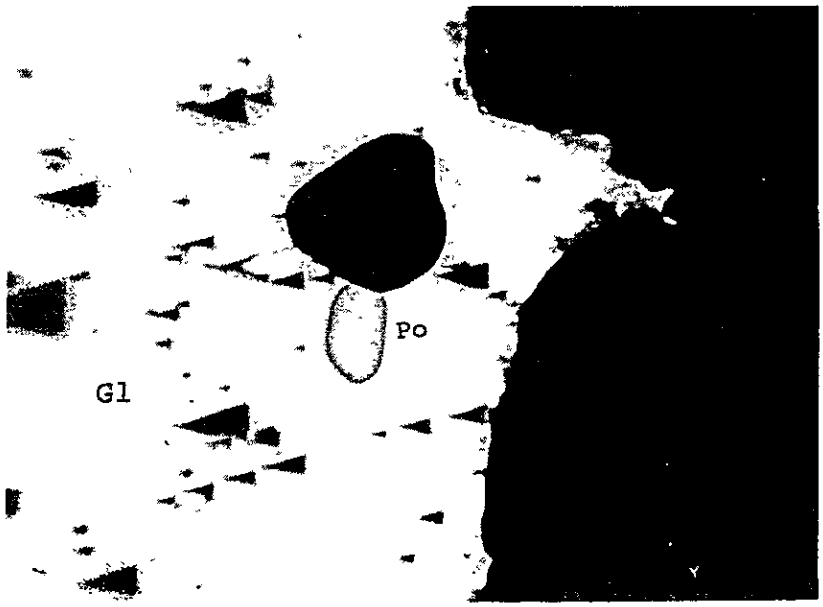
Pyrrhotite grain corroded by galena and replaced partly by pyrite.



(only lower polar) 0.05mm

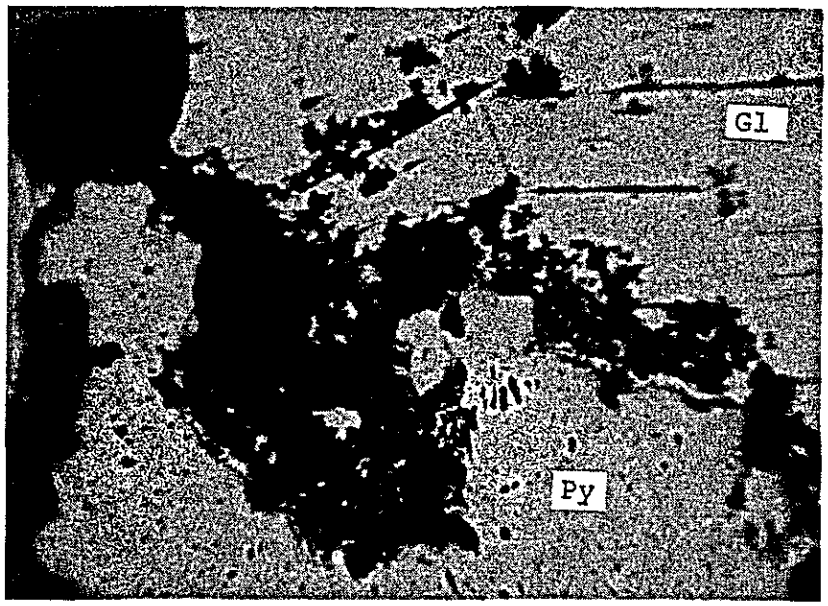
Fine-grained pyrite and gangue replace pyrrhotite along thin cracks

Sample No . G2 M-04
Location Perau Mine



Pyrrhotite grain in galena

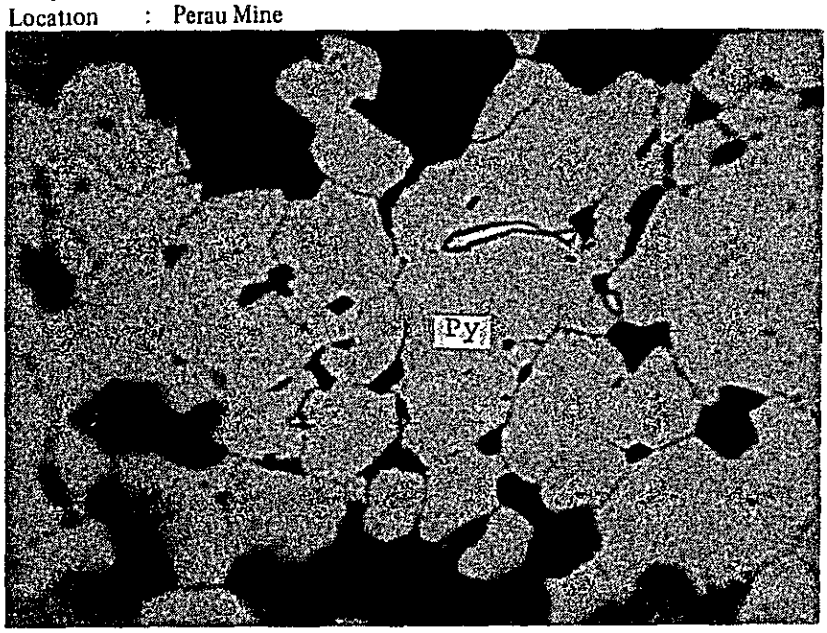
(only lower polar) 0.2mm



Fine-grained gangue mineral replaces a part of galena along boundaries and cleavages

(only lower polar) 0.2mm

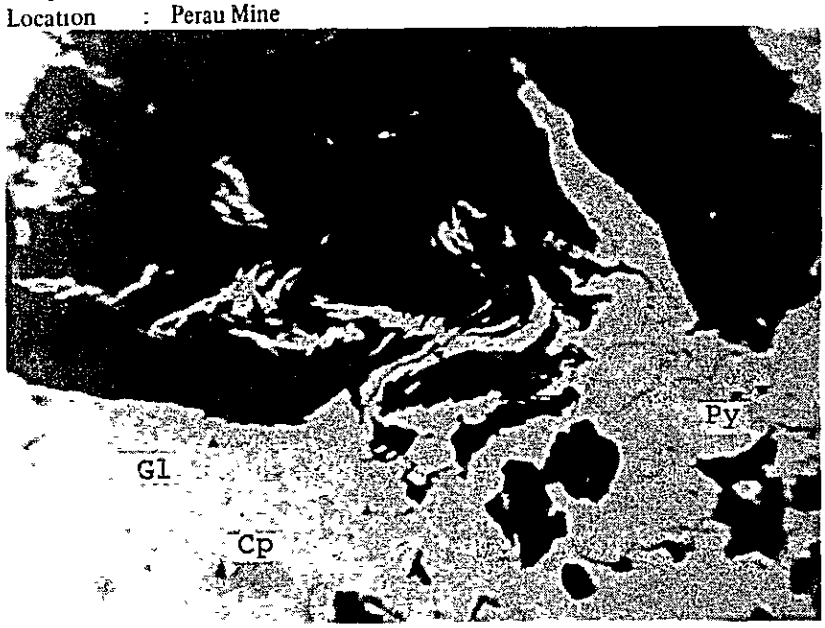
Sample No . G3 M-03
Location : Perau Mine



(only lower polar) 0.2mm

Pyrite occurs in a mozaic texture

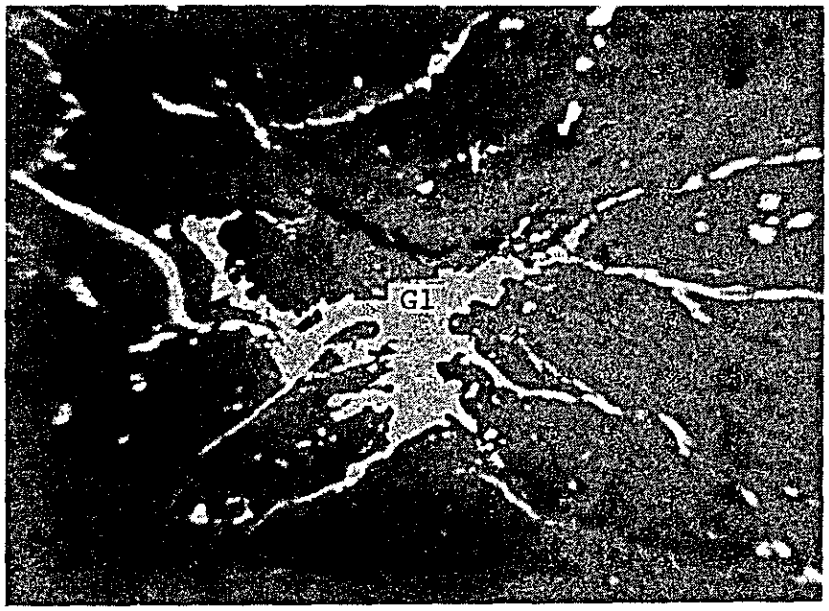
Sample No. G3 M-04
Location : Perau Mine



(only lower polar) 0.2mm

Galena fills the interstices of the original structure of rock.

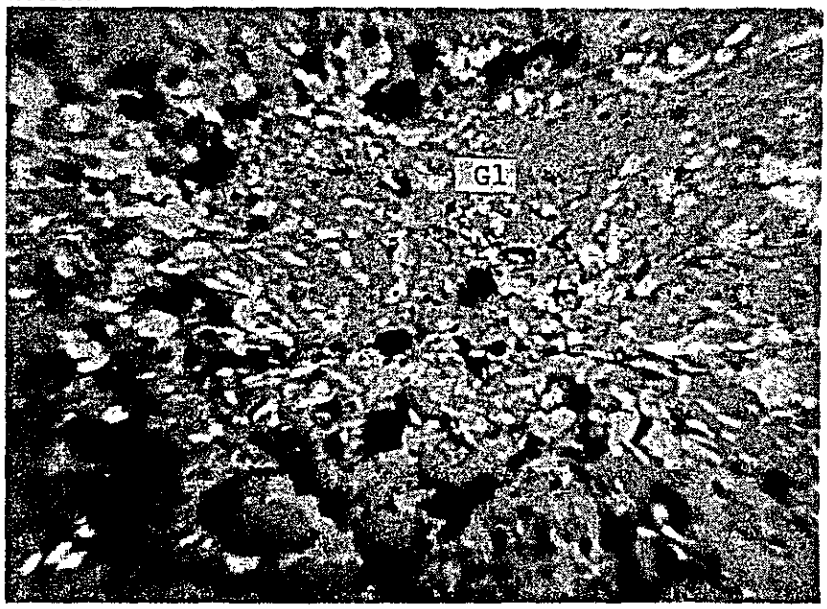
Sample No. G3 + 20 M-01
Location Perau Mine



(only lower polar) 0.2mm

Irregular veinlets filled by galena

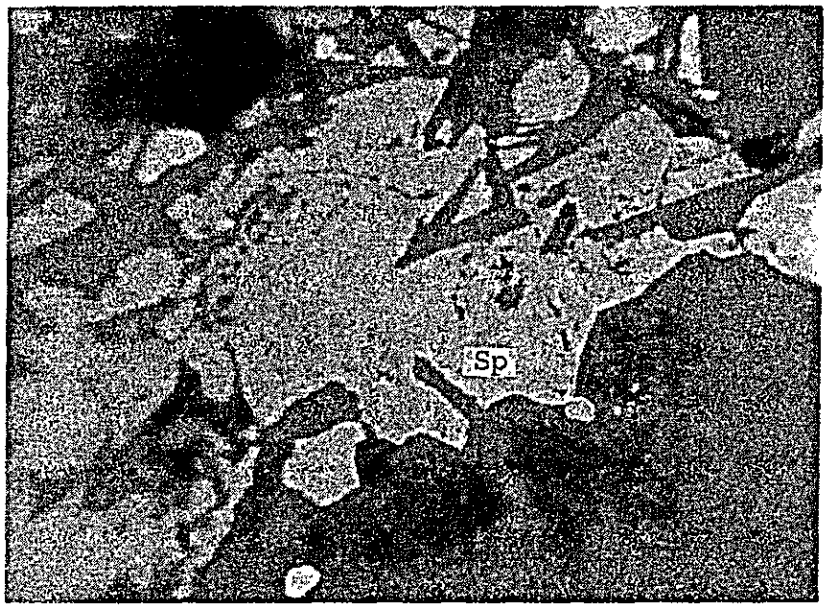
Sample No. G4 M-02
Location Perau Mine



(only lower polar) 0.2mm

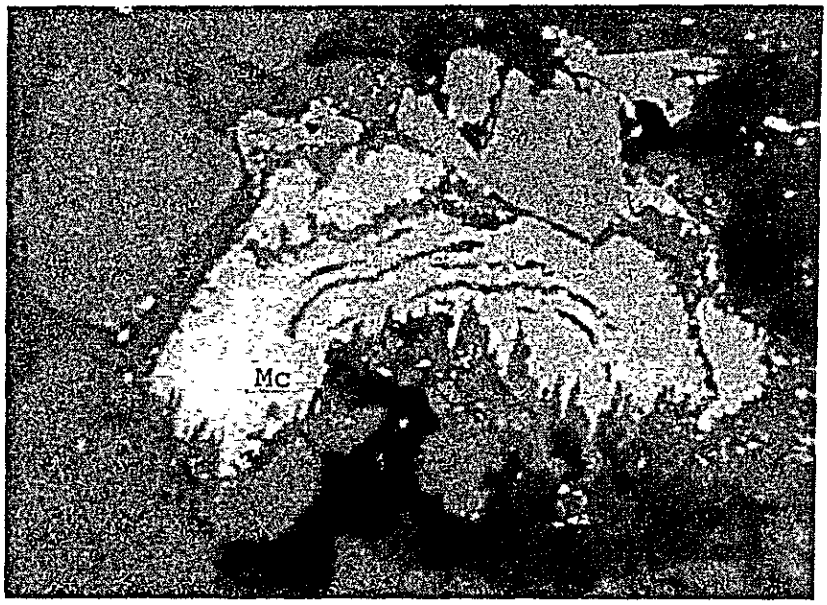
Galena fills the interstices of gangue forming fine and flaky grains.

Sample No G4 M-02
Location Perau Mine



(only lower polar) 0 05mm

Concentric texture of a sphalerite grain. The texture is shown by the arrangement of fine grains of gangue minerals.



(only lower polar) 0.05mm

Concentric texture found in a marcasite grain.

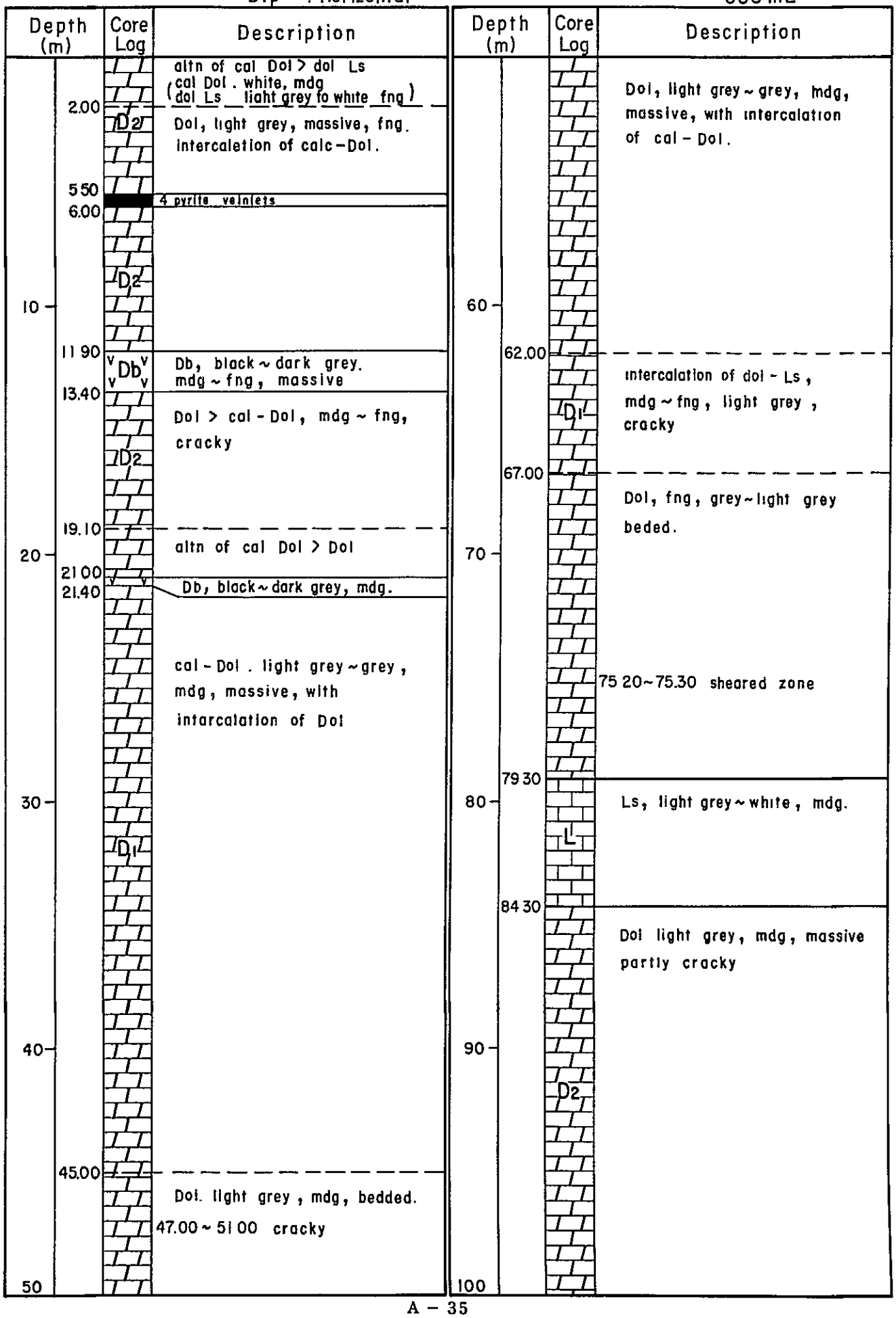
No	Name of Drilling	Location of Drilling set	Strike of Drilling	Dip of Drilling	Length of Drilling
1	I - 112	308 mL	S 68°W	0°	126 10 m
2	I - 122	308 mL	N 76°E	0°	103 70 m
3	I - 124	308 mL	S 68°W	0°	141.00 m
4	I - 139	308 mL	S 78°W	0°	83.00 m
5	I - 141	308 mL	N 40°W	0°	70.80 m
6	I - 142	308 mL	N 74°E	0°	120 00 m
7	I - 95	403 mL	N 40°W	0°	104.00 m
8	I - 113	403 mL	S 76°E	0°	82.30 m
9	I - 125	403 mL	N 50°W	0°	103 50 m
10	I - 129	403 mL	N 68°E	0°	90.00 m
11	I - 130	480 mL	N 90°W	0°	117.50 m

Fig. A-1 Columnar Section of Core Logs in Rocha Mine

No. 1
I-112(1)

Strike : S68°W
Dip : Horizontal

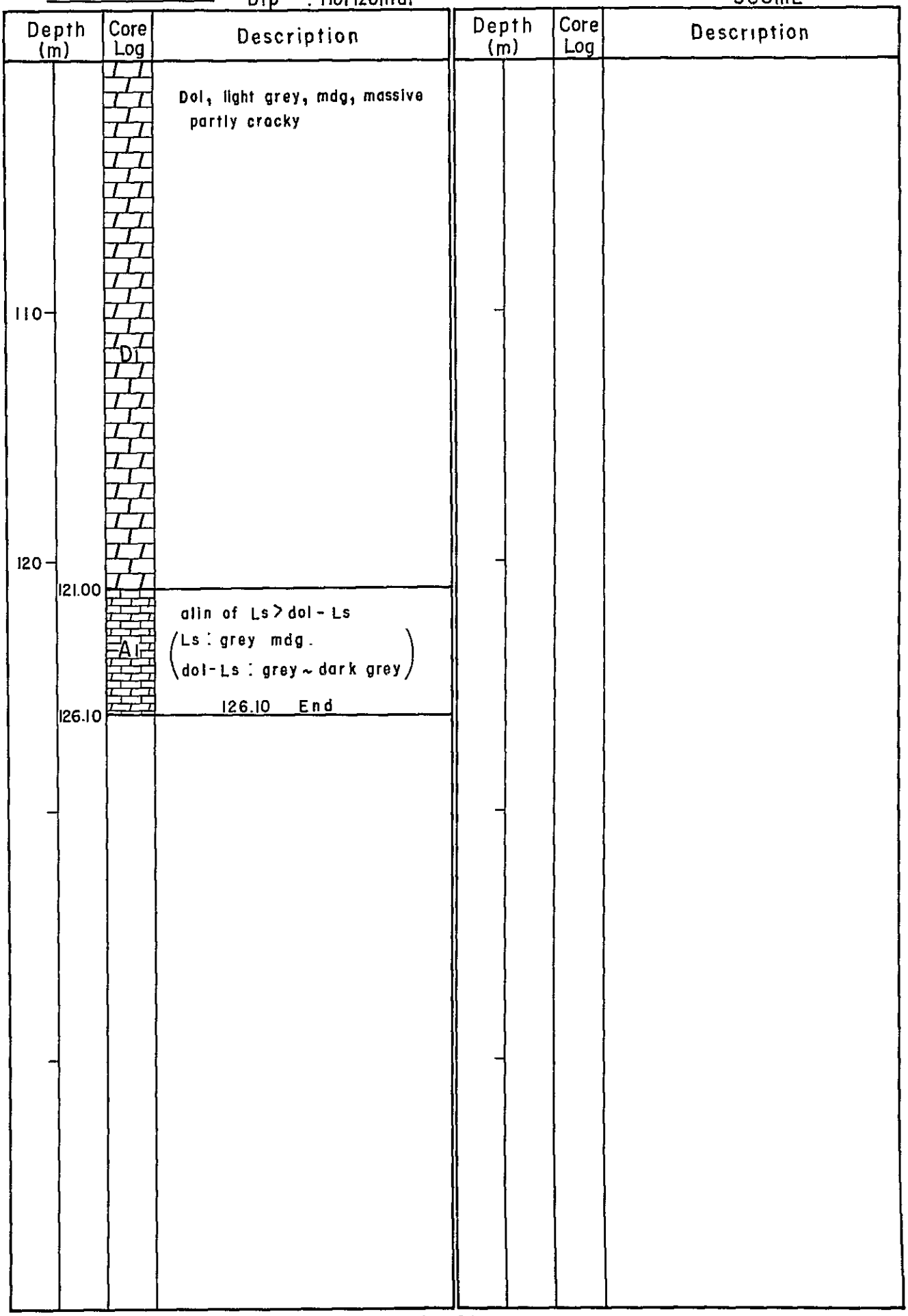
Rocha Mine
308 mL



No. 1
I-112 (2)

Strike : S 68°W
Dip : Horizontal

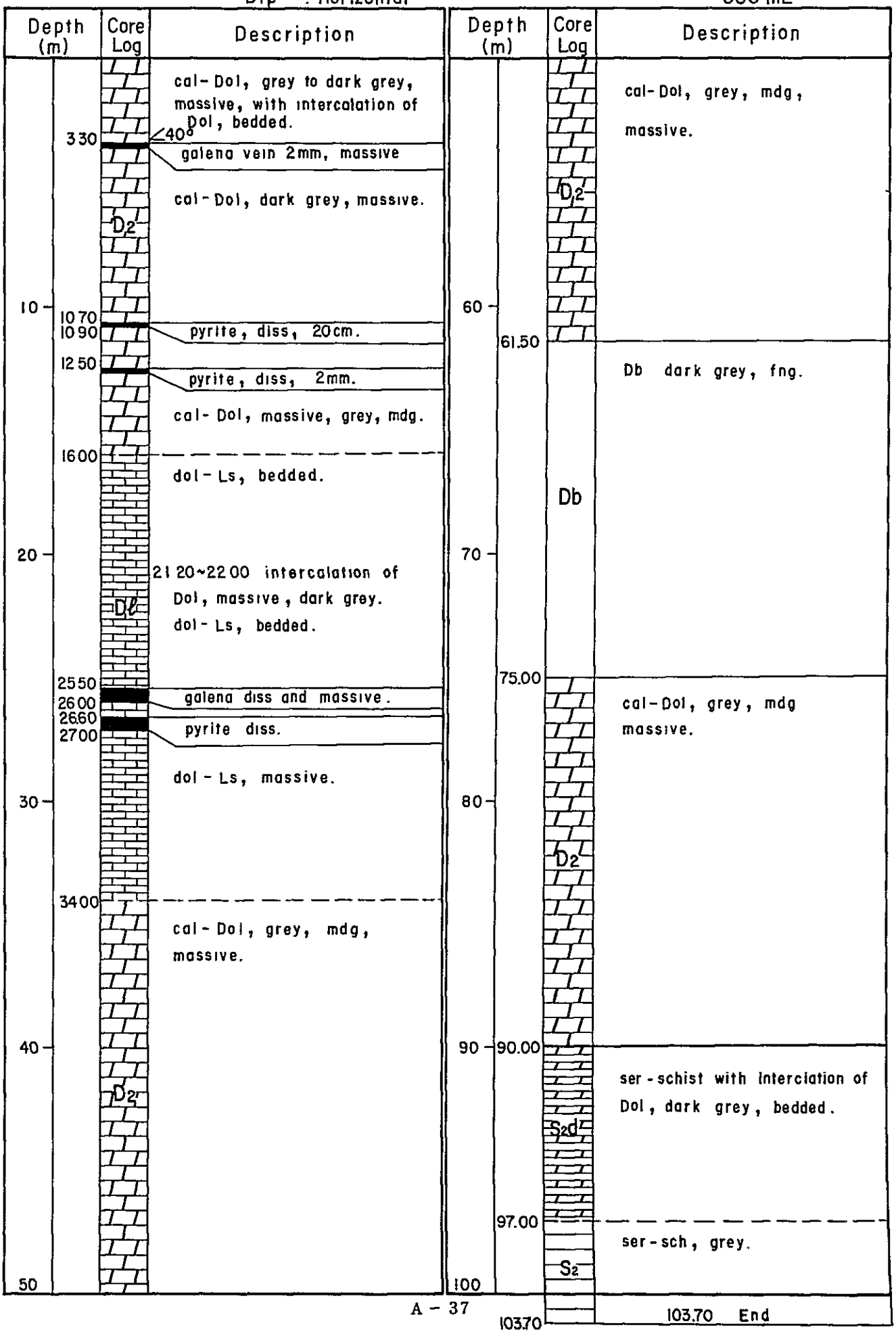
Rocha Mine
308mL



No. 2
I – 122

Strike : N76°E
Dip : Horizontal

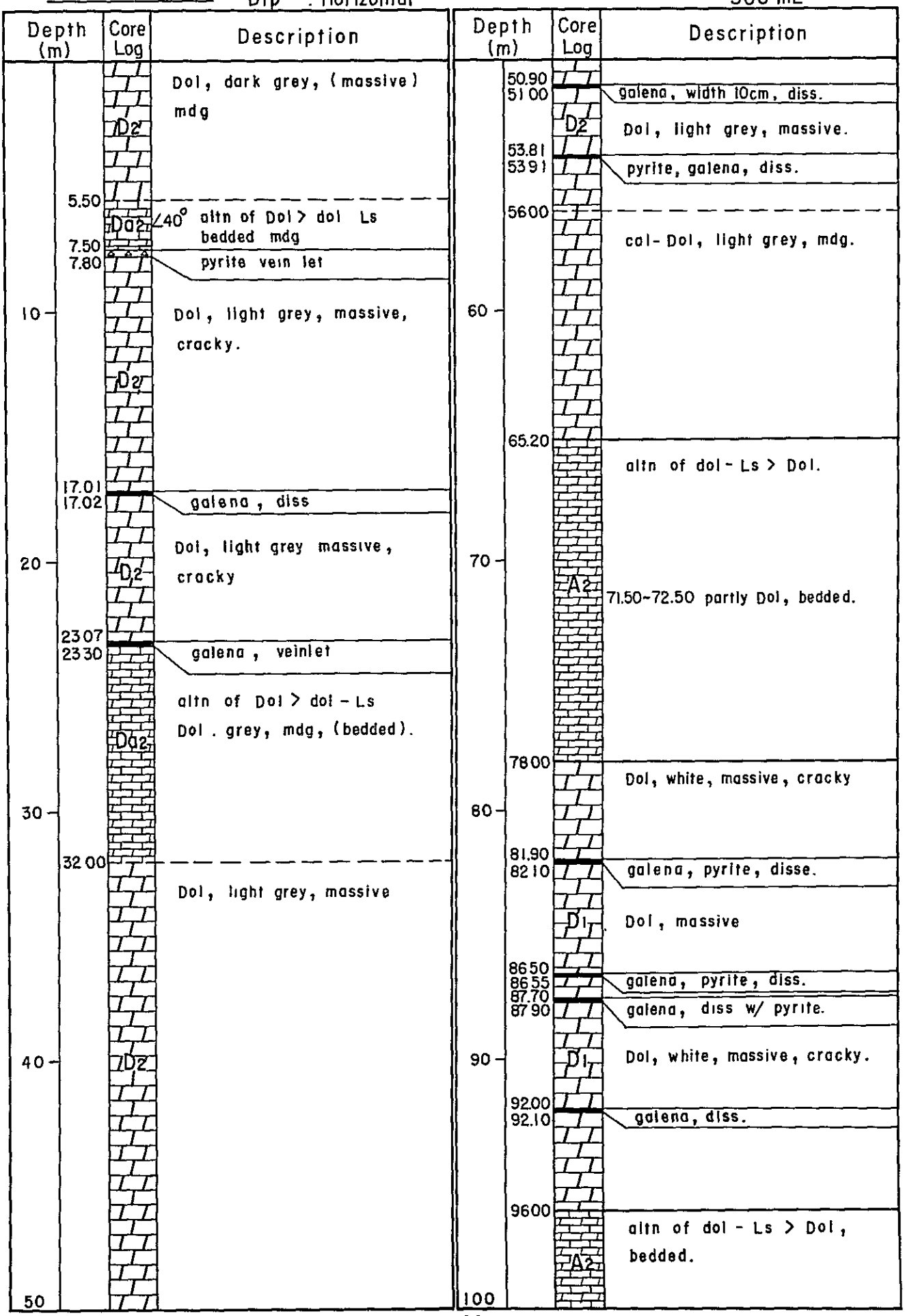
Rocha Mine
308 mL



No. 3
I - 124 (1)

Strike : S 68°W
Dip : Horizontal

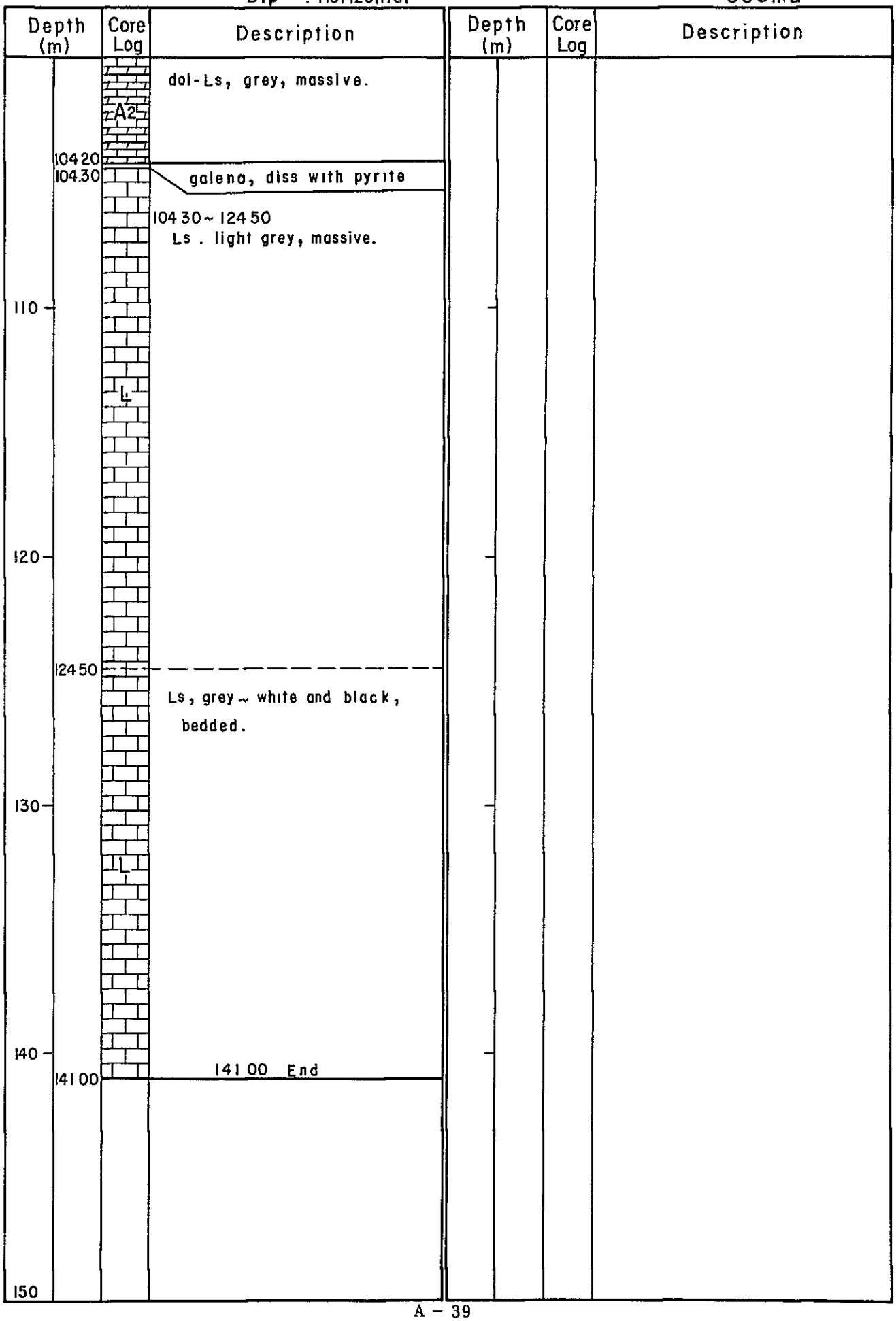
Rocha Mine
308 mL



No. 3
I – 124 (2)

Strike : S 68°W
Dip : Horizontal

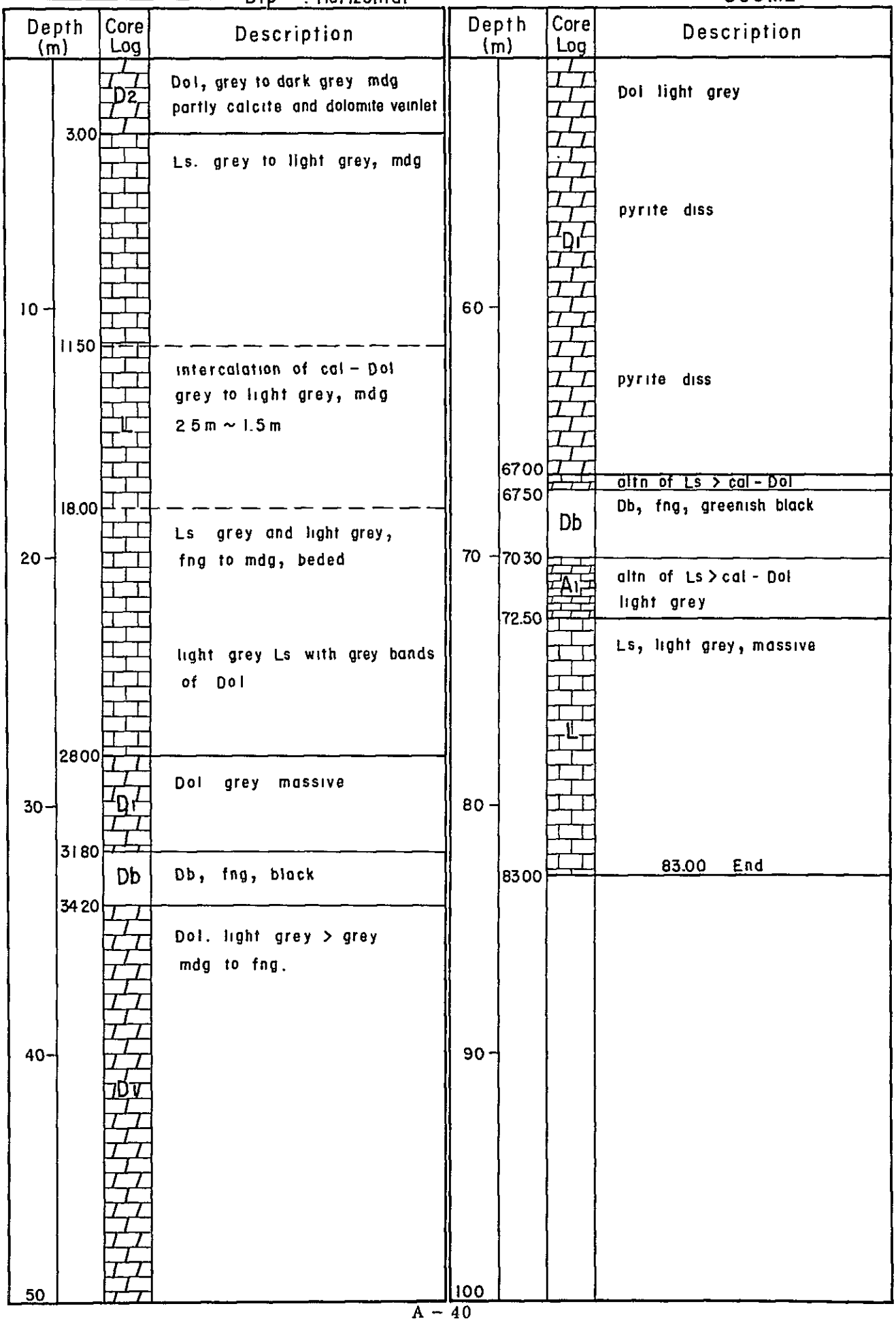
Rocha Mine
308mL



No. 4
I – 139

Strike : S 78°W
Dip : Horizontal

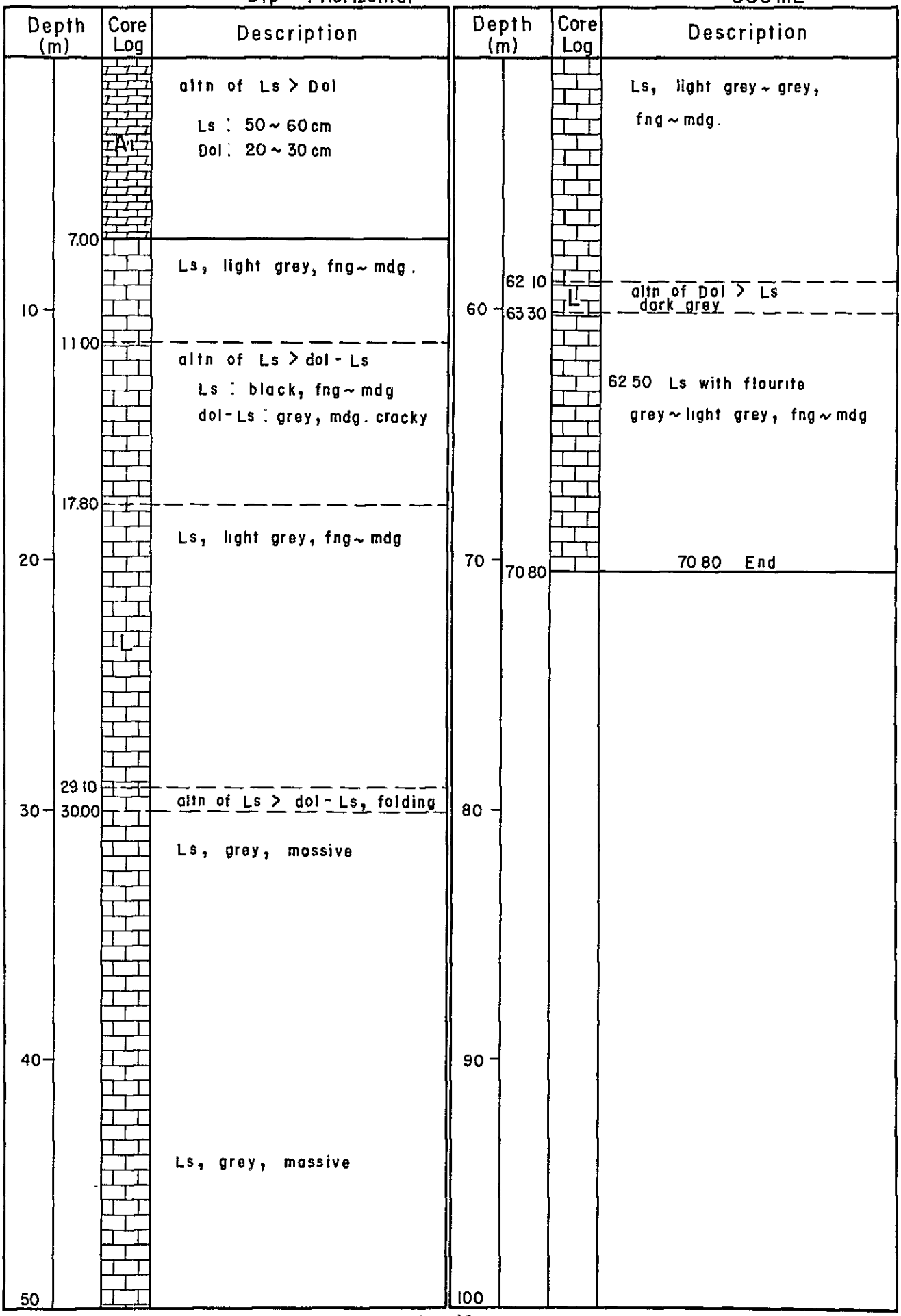
Rocha Mine
308 mL



No. 5
I - 14 I

Strike . N40°W
Dip : Horizontal

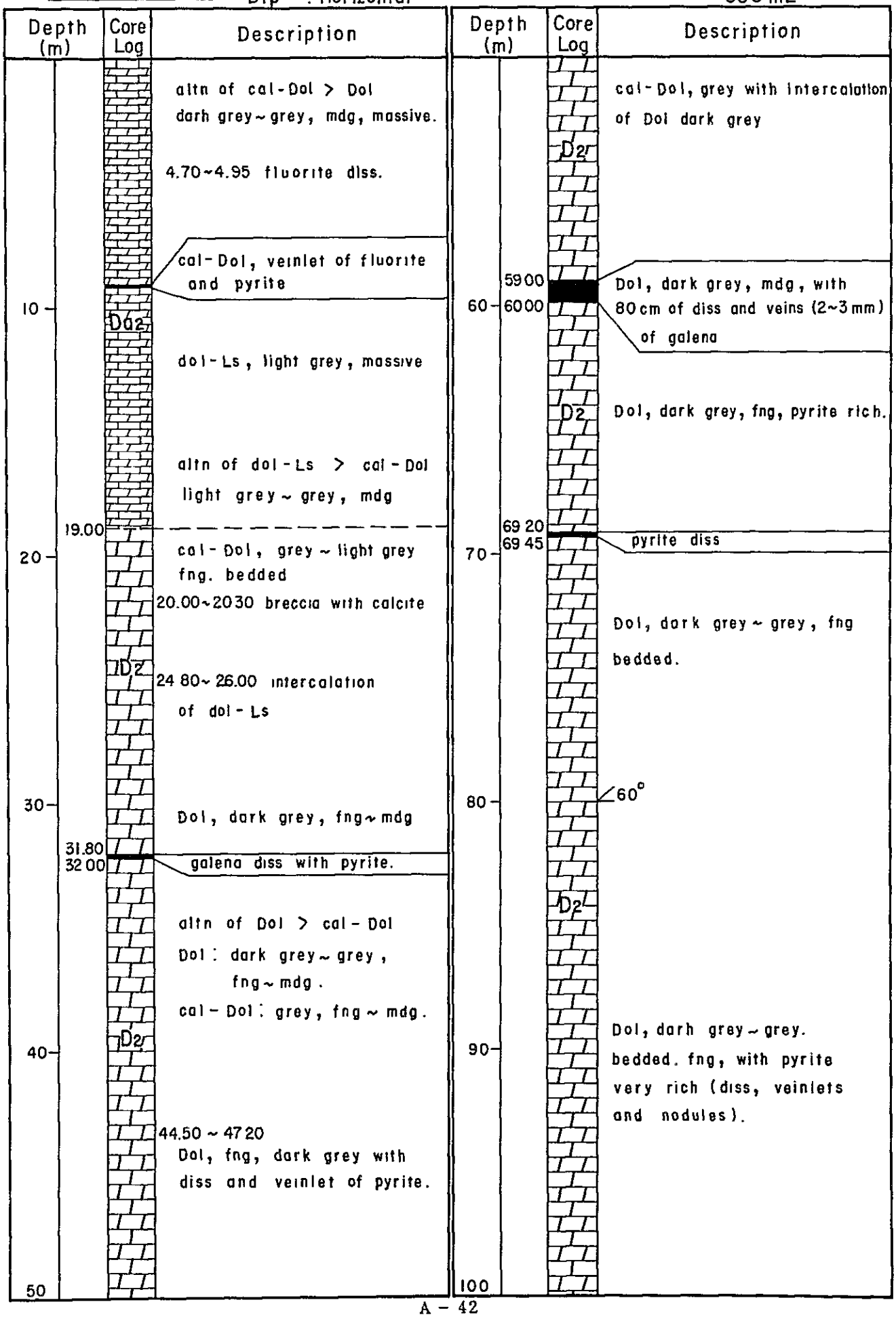
Rocha Mine
308 mL



No. 6
I-142 (1)

Strike : N 74°E
Dip : Horizontal

Rocha Mine
308 mL



No. 6
I-142 (2)

Strike : N 74° E
Dip : Horizontal

Rocha Mine
308 mL

Depth (m)	Core Log	Description
	D_2	Dol dark grey ~ grey bedded
102.00		
		altn of ser-sch and Dol
		ser-sch . dark grey ~ black
		Dol : grey ~ dark grey ,
	S_2d	bedded
110		
114.00		
		ser-sch, dark grey to black,
	S_2	80° ~ 90°
120		120 00 End
120.00		

No. 7
I - 95

Strike : N40°W
Dip : Horizontal

Rocha Mine
403 mL

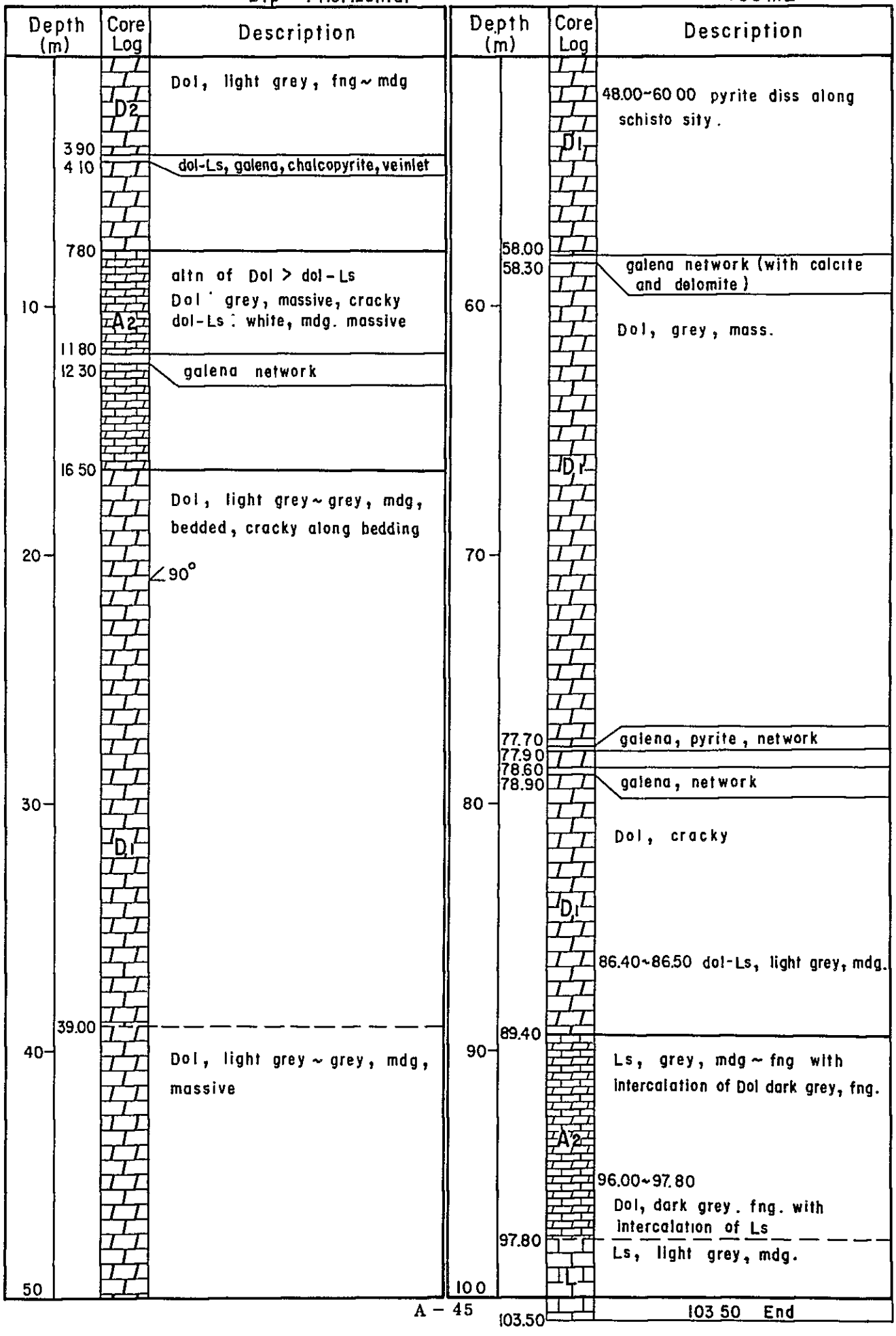
Depth (m)	Core Log	Description
0	A2	altn of Dol > Ls Ls : light grey, fng, massive 60~210 cm Dol : grey, massive~bedded 20~200 cm
10		1080~1450 Dol light grey, mass, fng, cracky with intercalation of cal-Dol
14.50	A1	∠10° altn of Ls > Dol Ls : light grey, massive, 30~120cm Dol : grey massive, 20cm ∠20°
18.80	A2	altn of Dol > Ls Dol : grey, massive Ls : white, mdg
20		
26.70	D1	Dol, light grey, fng. 27.00~50.00 · · cracky 30.00 32.00 ·· cal-Dol
30		
40		
50		

Depth (m)	Core Log	Description
0	DT	Dol white, fng, massive
59.00	A2	altn of Dol > Ls Dol : white, massive Ls : grey, massive
60		
62.00	A1	altn of Ls > dol-Ls
65.70	L	Ls, mass white
70		
78.60	L	∠85° Ls, light grey, bedded,
80		
		∠90°
90		
		∠90°
96.00		Ls, light grey, massive
100		
104.00		104.00 End

No. 9
I-125

Strike : N50°W
Dip : Horizontal

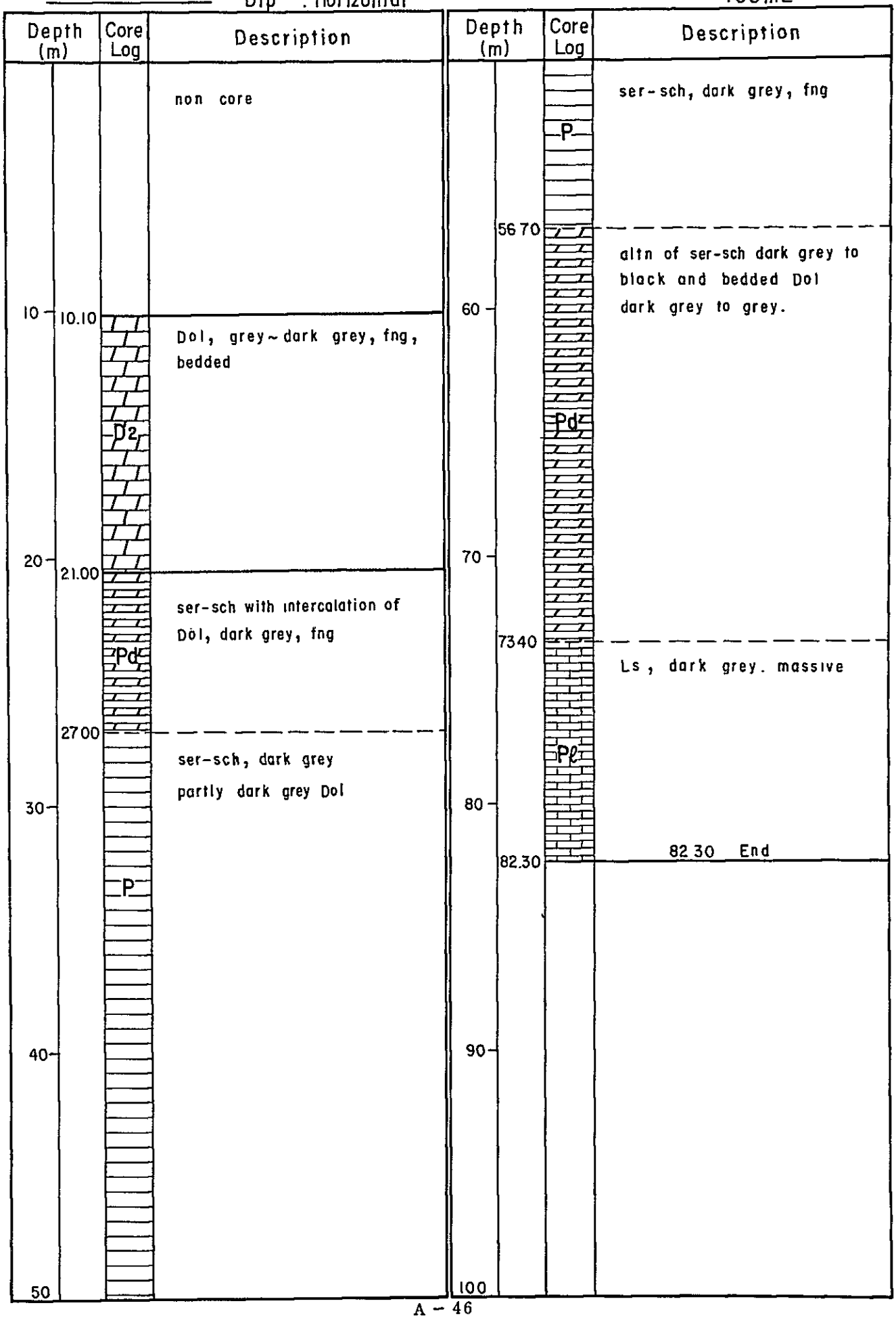
Rocha Mine
403 mL



No. 8
I-113

Strike : S 76°E
Dip : Horizontal

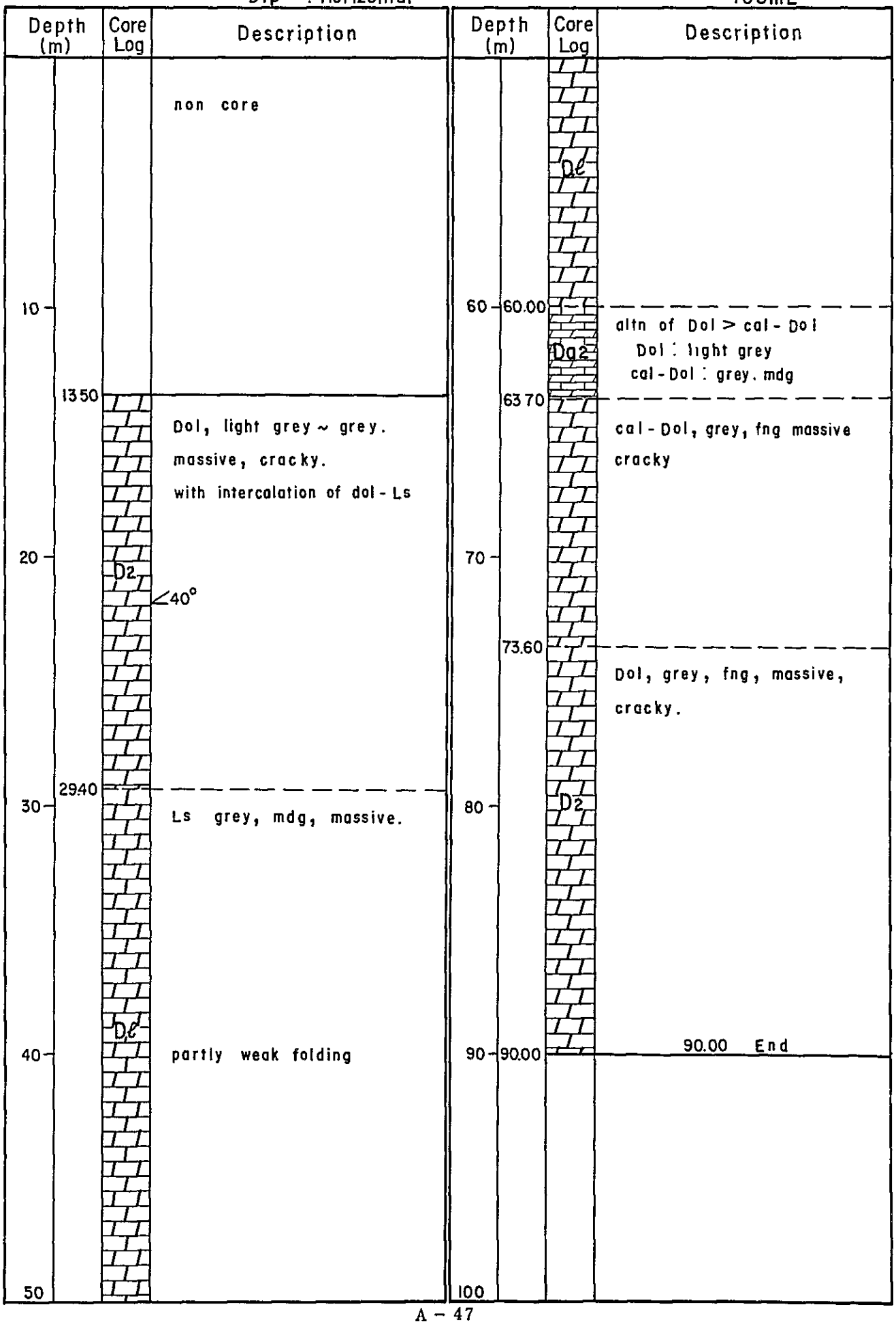
Rocha Mine
403mL



No. 10
I - 129

Strike : N68°E
Dip : Horizontal

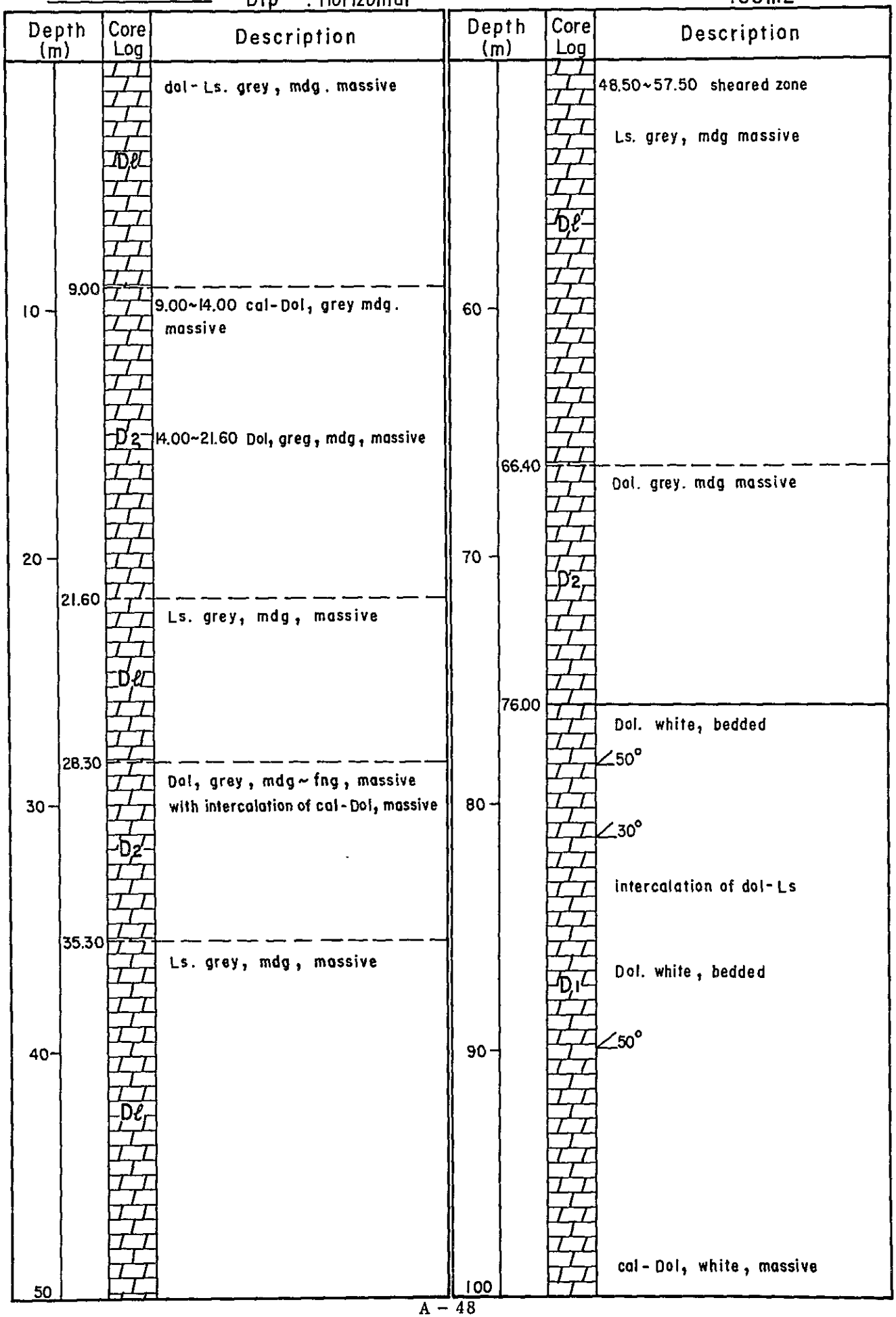
Rocha Mine
403mL



No. 11
I-130 (1)

Strike : N90°W
Dip : Horizontal

Rocha Mine
480mL



No. 11
I-130 (2)

Strike . N90°W
Dip : Horizontal

Rocha Mine
480mL

Depth (m)	Core Log	Description
		∠40° Dol, bedded
	Di	107.00~108 30 Dol pink sheared zone weathered.
110		
		Cal - Dol white, massive
117 50		117 50 End
120		

Depth (m)	Core Log	Description

Table A-1 List of Mines and Showing

Ser. No.	Name of Mine & Showing	Kind of Ores	Type	Status Quo	Location	Host Rock	Ore Deposits				Grade					Ore-Mineral	Remarks
							Strike & Dip	Lateral Extension	Longitudinal Extension	Average Width	Au g/t	Ag g/t	Cu (%)	Pb (%)	Zn (%)		
1.	Perau	Pb, Ag	stratiform	operating do	Estado Paraná Municipio Adrianopolis	Açungui I F calc-silicate rock	N10E 30W	300+	200	0.50	0	120	0.2	18.7	2.0	Ga, Sp, Cp, Py	production (1981) 1,500T/M Pb:8.5% Ag:100g/T
2.	Agua Clara	Cu Pb Ba	do	closed	do	Açungui I F dolomite	E–W 40S	10	50	0.20	–	–	–	–	–	Ga, Cp, Ba	
3.	Pretinhoe	Ba	do	operating	do	Açungui I F calc-silicate rock	N40E 35S	1,000	100+	1.50	($BaSO_4$) 85	(S) 0 5	ppm 800	ppm 50	ppm 60	Ba	production (1980) 140T/Y
4.	Panelas	Pb	bedded vein & vein	operating	do	Açungui III F L_2 limestone	N40E 50N	900	200	0.30	0	130	0.3	24 0	0.0	Ga, Sp, Py, Po	total production 1,200,000T Pb:7.0% production (1981) 2,500T/M Pb 5.8% Ag·100g/T
5.	Laranjal	Pb	bedded vein do	closed	do	do	N70E 60N		–	0 50	1	223	0.6	17 4	0.1	Ga	
6	Cecrisa	Pb	do	do	do	Açungui III F L_2 calcareous shale	E–W 60N		–	0.10~0.50	0	187	0.1	7 9	0 0	Ga, Cer	
7.	Barrinha	Pb, Ag	do	under Exploration	do	Açungui III F L_2 limestone & calcareous shale	N50~70E 40~80N	50~70	70~200	0.50~14.00	1	150	0.1	30 6	0.0	Ga, Sp, Cp, Py Cer, Pyro	
8.	Diogo Lopes	Pb, Ag	do	closed	do	Açungui III I L_3 limestone	N75~85E 50~70S	10	50	0 80	1	221	0.1	16 1	0 4	Ga, Py	total production 144T Pb:9.72%
9.	Bueno	Pb, Ag	do	do	do	do	N35E 50S	15	20	1.50	1	70	0.2	23 1	0 0	Ga, Py	total production 66T Pb 10.6%
10.	Paqueiro	Pb, Ag	bedded vein & vein	do	do	do	N50~60E 80N~80S	1~70	40	0 20~1 20	1	214	0 5	9.6	0.0	Ga, Sp, Cp, Py	total production 16,300T Pb.9%
11.	Carumbe	Pb, Cu	vein	do	do	do	–	–	–	–	–	–	–	–	–	Ga, Py, Cp, F.	
12.	Braz	F	do	do	do	Açungui III F L_1 limestone	–	–	–	–	–	–	–	–	–	F, Ca, Py, Cp	
13.	Quarenta Oitava	Pb	do	do	do	Açungui III F S_2 ls limestone	N10E, 90	–	–	–	–	–	–	–	–	Ca, Lim, Py, Sp, Tt	
14.	Onça I	Pb	do	do	do	do	–	–	–	0.30	–	–	–	–	–	Ga	
15.	Onça II	Pb	do	do	do	Açungui III F L_3 limestone	N10L, 85NW	–	–	–	–	–	–	–	–	Ga, Lim, Py, Tt, Cp, Sp	
16.	Rocha	Pb, Ag	do	operating	do	Açungui III F L_2 dolomite	N10~30W 60N, 60S	180~400	150~300	0.10~2.00	1	130	0.5	18.0	0.4	Ga, Sp, Cp, Py	production (1981) 2,500T/M Pb:65% Ag:130g/T

Ga : Galena Cer : Cerussite Py : Pyrite Ba : Barite
Sp : Sphalerite Pyro : Pyromorphite Lim : Limonite Tt : Tetrahedrite
Cp : Chalcopyrite Po : Pyrrhotite F : Fluorite

Table A-2 Microscopic Observations(Thin Section)

Abbreviations
Rock froming minerals

q	:	quartz
pl	:	plagioclase
ser	:	sericite
gaph	.	graphite
chl	·	chlorite
mus	:	muscovite
bt	:	biotite
ep	:	epidote
act	:	actinolite
gar	.	garnete
hb		hornblende
st	.	staurolite
cal	:	calcite

Metamorphic Rocks

(1)

Group & Formation	Sample No	Location	Rock Name	Texture	quartz	plagioclase	K-feldspar	apatite	zircon	sphene	calcite	dolomite	magnetite	hematite	sericite	graphite	tourmaline	tremolite	actinolite	chlontoid	andalusite	garnet	chlorite	staurolite	phlogopite	biotite	muscovite	epidote	zoisite	clinozoisite	anthophyllite	hornblende	clinopyroxine	Remarks
Setuva Formation	A091	Perau	hb-bt-sch	lepidoblastic	◎	◎			•																	◎						○		
	A092	Perau	mus-bt-sch	lepidoblastic with micro folding	◎	◎																				◎	○							
	A093	Perau	bt-ep-hb-sch	nematoblastic	•	○					•					•										•		○				◎		
	A095	Perau	ep-hb-bt-gneiss	porphyroblastic	◎	◎	○																			◎		•				○		
	A096	Perau	bt-mus-sch	lepidoblastic	◎	•		•																		◎	◎							
	C103	Perau	bt-sch	lepidoblastic and porphyroblastic	◎	○																				○								
Açungui Group / Açungui Formation 1	A063	Quil Ometro Quarenta	calc-sch	granoblastic	◎	•					○							○						•			○	•						
	A070	Perau	bt-mus-sch	lepidoblastic	◎	•										•										◎	◎							
	A071	Perau	calc-sch	granoblastic and lepidoblastic	•						◎							○	○															
	A074	Perau	calc-sch	lepidoblastic	◎	◎		•			○					•										◎	•			◎				
	A076	Perau	calc-sch	nematoblastic	•	•												◎										◎						
	A077	Perau	amphibolite	nematoblastic		◎																										◎		
	A080	Perau	gar-ep-act-amphibole-sch	porphyroblastic	○	◎													○				○				•				○		
	A081	Perau	act-amphibole-sch	nematoblastic	•	◎										•			◎												◎		
	A084	Perau	gaph-bt-mus-sch	lepidoblastic	◎	○										○										○	◎				○		
	A090	Perau	ep-act-amphibole-sch	nematoblastic	•	◎													◎							•		○			○		
	B056	Perau	mus-gaph-sch	lepidoblastic	○											◎											○						
	B061	Perau	bt-ser-phyllite	lepidoblastic	◎	•									○											○							
	B070	Perau	calc-sch	lepidoblastic	◎						○								○							◎							
	B084	Olho Dágua	calc-sch (skarn)	porphyroblastic									○										○										○
	B086	Olho Dágua	calc-sch	nematoblastic		◎												•	•									•					
	B088	Olho Dágua	mus-gar-bt-staurolite-sch	porphyroblastic	◎	○																	○	◎		○	•					◎		
	B089	Olho Dágua	act-sch	nematoblastic	•	○													◎															
	B091	Olho Dágua	cal-hb-ga-bt-sch	lepidoblastic	◎	○					•												•			○						•		
	B094	Cricium	mus-bt-sch	lepidoblastic	◎	○																				◎	•							
	B095	Cricium	calc-sch	nematoblastic	○						◎							•	○									○						
	C040	Perau	anthophyllite-tr-st -phlogopite-gar-sch	lepidoblastic	○	○												○					◎		○	◎					•			

Group & Formation	Sample No	Location	Rock Name	Texture	quartz	plagioclase	K-feldspar	apatite	zircon	sphene	calcite	dolomite	magnetite	hematite	sericite	graphite	tourmaline	tremolite	actinolite	chloritoid	andalusite	garnet	chlorite	staurolite	phlogopite	biotite	muscovite	epidote	zoisite	clinozoisite	anthophyllite	hornblende	clinopyroxine	Remarks
Açungui Group / Açungui Formation I	C043	Perau	gar-tr-sch	nematoblastic														◎				◎												with micro folding
	C047	Olho Dágua	act-sch	nematoblastic		◦													◎									○						
	C054	Olho Dágua	hb-bearing ep-act-sch	nematoblastic		◦													◎													•		
	C074	Sumidouro	bt-act-clinz-sch	nematoblastic	•	◦				•									◎								○							
	C094	Olho Dágua	mus-gar-tr-sch	lepidoblastic	◦	◦				•								◦				○					•							
	C099	Olho Dágua	mus-bt-sch	lepidoblastic	◎	◦								◦												◎	○							
	D075	Tunas	ser-phyllite	lepidoblastic	◎	◦								◦	◎																			
	D092	Ribeirão Grande	gaph-ser-sch	lepidoblastic	◦	•			◦					◦	◎	◦																		
	D106	Olho Dágua	gar-tr-sch	porphyroblastic	◦													◎				○												
	D109	Cricium	gar-bearing bt-mus-sch	lepidoblastic	◎	•																•				○	◎						
	D112	Cricium	gaph-ga-ser-bt-sch	lepidoblastic and porphyroblastic	◦	◦									◦	•						○				◎							
	G035		calc-sch	granoblastic	•						◦																						
	A022	Carumbé	mus-gaph-phyllite	lepidoblastic	◎	◦										◎											◦							with micro folding
	A025	Carumbé	mus-gaph-sch	lepidoblastic	◎	•										◦											◎							
	A027	Carumbé	chl-mus-sch	lepidoblastic	◎												•			◎							◎							
	A028	Carumbé	mus-ep-chl-sch	lepidoblastic	◎	◦											•			◎							•		•					
	A033	Carumbé	mus-q-sch	lepidoblastic	◎	•																					◎							
	B040	Mato Preto	bt-bearing ser phyllite	lepidoblastic	•										◎																			
	C012	Panelas	gar-bearing bt-mus-sch	lepidoblastic	◎	◦																•				○	◎						
	C020	Panelas	gar-bearing bt-mus-sch	lepidoblastic	◎	◦																•				○	◎						
	C066	Quil Ometro Quarenta	gaph-ser-phyllite	lepidoblastic	◦										◎	◎																	
	C067	Quil Ometro Quarenta	bt-mus-sch	lepidoblastic	◎	◦																				○	◎						
	C068	Quil Ometro Quarenta	chl-mus-sch	porphyroblastic	◎	◎																•					○						
	D063	Rio Rocha	gaph-ser-sch	lepidoblastic	◎	•									◦	◦																	
	D066	Rio Rocha	ser-bt-chl-cal-sch	lepidoblastic	◎	◦					◎											◎				○							
	D067	Rio Rocha	mus-bt-sch	granoblastic	◎	◦																				○	•						
	D117	Morro Grande	mus-sch or metamorphosed meta sandstone	granoblastic	◎	•																					•						

Group & Formation		Sample No	Location	Rock Name	Texture	quartz	plagioclase	K-feldspar	apatite	zircon	sphene	calcite	dolomite	magnetite	hematite	sericite	graphite	tourmaline	tremolite	actinolite	chlorltoid	andalusite	garnet	chlorite	staurolite	phlogopite	biotite	muscovite	epidote	zoisite	clinozoisite	anthophyllite	hornblende	clinopyroxine	Remarks
Açungui Group	Açungui Formation III	A016	Rio Ribeira	mus-sch	lepidoblastic	◎	○					•																◎							
		A017	Panelas	mus-sch	lepidoblastic	◎	○																				○	◎							
		A020	Panelas	calc-sch	granoblastic	•						◎																•							
		A021	Rio Ribeira	st-mus-bt-sch	lepidoblastic and nematoblastic	◎	○		•									•							○		◎	○							
		A036	Carumbé	calc-sch	granoblastic	•						◎																							
		A046	Rio Rocha	calc-sch	granoblastic							•	◎																						
		A050	Rio Rocha	calc-sch	granoblastic							◎												○											
		B005t	Rio Ribeira	calc-sch	nematoblastic		◎												◎											•					
		B010	Rio Ribeira	calc-sch	granoblastic	•	•					◎																	○							
		B012	Rio Ribeira	gar & and-bearing mus-bt-sch	lepidoblastic	◎	◎															•		•				○	○						
		B014	Rio Ribeira	calc-sch	granoblastic	•						◎																	•							
		B019	Rio Ribeira	calc-sch	granoblastic	○						◎					•												•							
		B028	Carumbé	chl-chlorltoid mus-sch	lepidoblastic	○															○			○					◎							
		C004	Panelas	gar-bearing chl-bt-mus-sch	lepidoblastic	◎																	•	○				○	◎							with micro fording
		C031	Panelas	gaph-mus-sch	lepidoblastic	◎	○										◎												◎							
		C058	Carumbé	bt-gaph-mus-sch	granoblastic	◎	○										○											•	◎							
		D001	Rio Ribeira	calc-sch	granoblastic	○	•					◎																•	•							
		D003	Rio Ribeira	calc-sch	granoblastic	◎						◎																	○							
		D008	Rio Ribeira	calc-sch	granoblastic	○																													
		D010	Rio Ribeira	ep-cal-act-sch	nematoblastic	•	•					•							◎											•					
		D033	Rio Ribeira	calc-sch	nematoblastic and porphyroblastic	○						◎						◎										•	•						
		F007	Mato Preto	mus-q-sch	lepidoblastic	◎																							○						
Meta Iguneous Rocks		A-039	Carumbé	meta diabase	ophitic						•								◎										○	○					
		A-069	Perau	meta basalt	basaltic	•	◎					○												○					○							
		D-015	Rio Ribeira	meta gabbro	poikiloblastic	•	○				•								◎														○		
		D-023B	Rio Ribeira	hb-act-schist	nematoblastic		○												◎											○			•		

Igneous Rocks

(4)

Rock Group		Sample No	Location	Rock Name	Texture	Constituent mineral: quartz	K-feldspar	plagioclase	biotite	muscovite	hornblende	augite	hypersthene	olivine	garnet	zircon	rutile	Secondary mineral: calcite	sericite	chlorite	epidote	sphene	actinolite	idingsite	serpentin	Remarks
Granite	Itaoca mass	A 001	Panelas	granodiorite	porphyritic foliated														•	•		•				
		A 013	Panelas	granodiorite	granular						•					•			•		•	•				
	Vergunha mass	A 030	Carumbé	granite	granular										•				•	•	•					
		A 054	Carumbé	granite	granular				•	•							•	•	•		•					
	Três Cofregos mass	B 032	Mato Preto	mylonitized granite	porphyroblast				•																	
		B 102	Rio Bonsucesso	mylonite	cataclastic																					
		D 017	Rio Ribeira	granodiorite	porphyritic hypidiomorphic																					
		D 042	Rio Ribeira	granodiorite	hypidiomorphic granular																					
Gabbro		A 018	Panelas	gabbro	ophitic						•		•								•		•			
		A 031	Carumbé	gabbro	ophitic	•													•		•					
		B 110	Rio Bonsucesso	quartz diorite		•																				
		C 023	Carumbé	quartz diorite	hypidiomorphic granular	•					•															
		C 112	Rio Borsucesso	gabbro	poikilitic																					
Syenite		C 073	Tunas	syenite	hypidiomorphic granular			•			•	•										•	•			
diabase dyke		A 057	Rio Rocha	diabase	ophitic						•															
		D 023A	Rio Ribeira	basalt	porphyritic intergranular			•				•										•				
		D 113	Cricium	basalt	porphyritic intergranular																					
dacite dyke		B 090	Olho Dagua	altered dacite	porphyritic	•		•									•	•	•	•	•	•				
		C 050	Olho Dágua	altered dacite	porphyritic	•		•										•	•	•	•	•				

Sample No	Location	Rock Name	Texture	fragment: andesite	fragment: trachyte	fragment: dolerite	aggregate: felspar	aggregate: actinolite-biotite	fragment of crystal: biotite	Remarks
G–012	Tunas	lapilli tuff	pyroclastic				•		•	in Syenite Mass

Table A-3 Microscopic Observations(Polished Section)

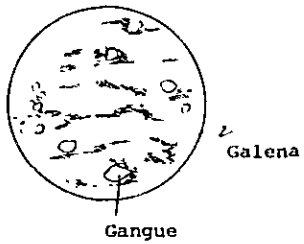
No	Sample Name	Location	Ore Name	Galena	Sphalerite	Pyrite	Pyrrhotite	Arsenopyrite	Marcasite	Chalcopyrite	Tetrahedrite	Chalcocite (second)	Covellite (second)	Magnetite	Ilmenite	Hematite (second)	Goethite
1	G1 M 01	Perau Mine G1L	Galena Ore	●	·	·											
2	M 02	do	Galena-Sphalerite Ore	●		·											
3	M 03	do	Pyrite-Galena Ore	●		·											
4	M 04	do	Calcopyrite-Pyrite Ore	·	·					●							
5	M 05	do	Pyrite-Galena Ore	●		●					·						
6	M 06	do	Galena-Ore	c	·	·											
7	M 07	do	Pyrite-Galena Ore		·	●				·							
8	M 08	do	Pyrite-Galena Ore		●	●											
9	M 09	do	Pyrite-Galena Ore		●												
10	M 10	do	Sphalerite-Pyrite Galena Ore		●												
11	M 11	do	Pyrite-Galena Ore		·	●											
12	G1 + 10 M 03	do G1 + 10mL	Pyrite-Galena Ore		·	●											
13	G1 + 20 M 02	do G1 + 20mL	Pyrite-Galena Ore		·	●				·							
14	G1 + 30 M 03	do G1 + 30mL	Pyrite-Galena Ore	●	·	·				·							
15	G1 + 30 M 05	do G1 + 30mL	Pyrite-Galena Ore		·	●				·							
16	G1 + 40 M 03	do G1 + 40mL	Pyrite-Galena Ore			●				·							
17	G2 M 03	do G2L	Sphalerite-Galena Ore		●	●	·										
18	M 04	do	Sphalerite-Galena Ore		●												
19	M 05	do	Pyrite-Galena Ore	●	·	·				·							
20	M 06	do	Pyrite-Galena Ore	●	·	·				·							
21	G2 + 20 M 04	do G2 + 20mL	Pyrite-Galena Ore			·				·							
22	G3 M 01	do G3L	Pyrite-Galena Ore		·					·							
23	M 02	do	Pyrite-Galena Ore			·				·							
24	M 03	do	Pyrite Ore	·	·												
25	M 04	do	Galena Pyrite Ore		·					●							
26	M 08	do	Pyrite-Galena Ore	●	·	●			·	·							
27	G3 + 20 M 01	do G3 + 20mL	Galena Ore	●		·											
28	G4 M 01	do G4	Sphalerite-Pyrite Ore	·						·							
29	M 02	do	Galena-Sphalerite Ore	●	●	·			·	·							
30	B 1	do Drilling Core SP4 130m	Marcasite-Sphalerite Ore	●							·						
31	B 2	do Drilling Core SP11 to 10m	Sphalerite-Galena Ore		●	·					·						
32	B 3	do Drilling Core SP11 17 80m	Galena Ore	●						·							
33	A 40	Carumbe	Sphalerite-Magnetite Ore												●	·	
34	RP 1	Rocha Mine 308mL + 55m Filao GAVETA III	Pyrite-Galena Ore	·		·				·							
35	2	do	Pyrite-Galena Ore	●		·				·	·						
36	4	do	Pyrite-Galena Ore			●				·	·						
37	5	do	Galena Pyrite Ore	●	·	●				·	·						
38	6	do	Galena-Pyrite Ore		·	●				·	·						
39	7	do	Pyrite-Galena Ore		·					·	·						
40	8	do	Galena Ore		·	·					·						
41	9	do 308mL near Filao Ingara	Chalcopyrite-Galena Ore		·	·	·			●	·						
42	10	do	Galena Ore Ore		·	·				·	·						
43	11	do 308mL Filao GAVETA IV	Galena Ore	●		·				·	·						
44	12	do	Pyrite-Galena Ore	·		·				·	·						
45	14	do 308mL Filao Nova Esperança	Pyrite-Tetrahedrite Galena Ore	●	·	●					·	●	·				
46	15	do	Tetrahedrite Pyrite Galena Ore					·				●	·				
47	17	do 308mL near Filao GAVETA IV	Pyrite-Galena Ore	●		·				·	·		·				
48	18	Onça II mineral showing	Galena Ore	c	·	·				·	·	·	·				
49	19	Quarenta Oitava mineral showing	Galena-Pyrite Ore	●	·	●				·	·		·				·
50	20	do	Pyrite-Galena Ore	·	·	·											·

Remarks abundant common ● little · rare

1. Gl M-01

A. Constituent minerals:

Galena	12%
Pyrite	3
Sphalerite	less than 1
Chalcopyrite	trace
Gangue	85



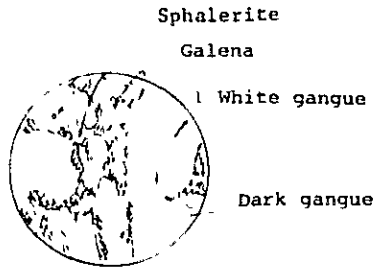
B. Texture

Galena forms fine streaks and disseminates in gangue minerals. In galena streaks, corroded pyrite and sphalerite grains are included. Pyrite shows round euhedral grains in some cases, but mostly irregular shapes corroded or cut by galena. Sphalerite contacts with galena by irregular boundaries. Some grains of sphalerite include a large number of minute chalcopyrite blebs arranging along the crystallographic structures and parallel to the boundaries. Grain size: Galena, 2-500μm, Pyrite, 40-1000μm, Sphalerite, 15-80μm.

2. Gl M-02

A. Constituent minerals:

Sphalerite	20%
Galena	15
Pyrrhotite	trace
Gangue	65



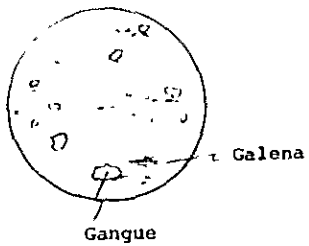
B. Texture:

Sphalerite and galena fill the interstices of grains and bebbles of gangue minerals. Boundaries between sphalerite and galena are irregular but it is observed microscopically that sphalerite crystallized earlier than galena. Galena surrounds the grains of sphalerite and pebbles of gangue, and disseminates finely along the margin of pebbles. Very fine blebs of pyrrhotite are observed in sphalerite along fissures, boundaries and crystallographic structure. Grain size: Sphalerite, 300-1000μm, Galena, 1-500μm, Pyrrhotite, 1-3μm.

3. Gl M-03

A. Constituent minerals:

Galena	15%
Pyrite	3
Sphalerite	less than 1
Chalcopyrite	less than 1
Gangue	80



B. Texture

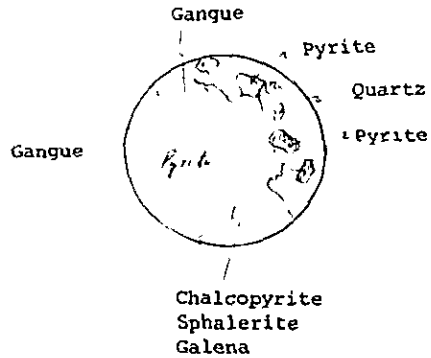
Galena makes fine streaks in rocks. Microscopically it fills irregular bands and disseminates finely filling the interstices of gangue minerals. Galena includes round grains of gangue, pyrite and sphalerite. Pyrite occurs in round grains of erroded euhedral grains, and also occurs in gangue separated from galena. Sphalerite occurs sporadically in galena with irregular contact. It has many chalcopyrite blebs in it. Chalcopyrite occurs scarcely in galena with irregular contact boundaries.

Grain size: Galena, 1-400μm; Pyrite, 50-200μm; Sphalerite, 10-160μm.

4. Gl M-04

A. Constituent minerals:

Pyrite	43%
Chalcopyrite	12
Sphalerite	3
Galena	2
Unknown mineral	trace
Gangue	40



B. Texture

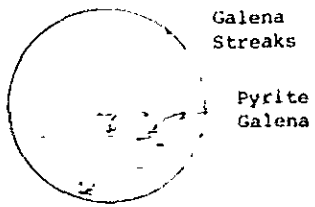
Aggregates of large grains of pyrite filled with chaclopyrite and a small amount of galena and sphalerite, cut through gangue minerals. Chalcopyrite also occurs disseminated in gangue minerals. Some parts of margin of pyrite grain have been changed to aggregates of fine-grained pyrite and transparent minerals having a rugged surface, especially when pyrite contacts with chalcopyrite. Sphalerite contains a great number of minute blebs of chalcopyrite arranged along crystallographic structures and parallel to the grain boundaries.

Grain size: Pyrite 1000-2000μm, Galena, 30-500μm, Sphalerite, 30-300μm.

5. Gl M-05

A. Constituent minerals:

Pyrite	10%
Galena	10
Tetrahedrite	
Gangue	80



B. Texture:

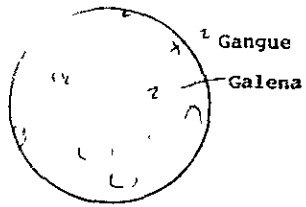
Aggregates of galena and pyrite form fine streaks and irregular masses which connect the fine streaks. Galena also disseminates finely in gangue minerals. Large grains of pyrite are corroded by galena forming irregular boundaries. A small amount of tetrahedrite occurs in galena at the contact with pyrite.

Grain size: Pyrite, 60-800μm, Galena, ca.10μm in gangue and 300-600μm in streaks, Tetrahedrite , 10-20μm.

6. Gl M-06

A. Constituent minerals:

Galena	85%
Pyrite	3
Sphalerite	less than 1
Gangue	12



B. Texture:

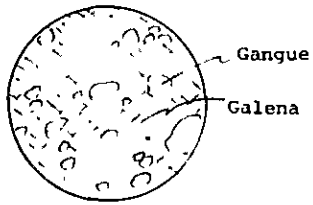
Galena includes round or erroded euhedral grains of pyrite, irregular grains of sphalerite and gangue minerals, and round aggregates of foliated transparent minerals. Galena fills up the interstices of aggregates of foliated minerals. Round gangue grains are probably quartz.

Grain size: Pyrite, 50-400μm, Gangue, 400-1200μm, Sphalerite, 10-30μm.

7. Gl M-07

A. Constituent minerals:

Galena	75%
Pyrite	6-7%
Sphalerite	2-3%
Chalcopyrite	2-3%
Gangue	14-15%



B. Texture:

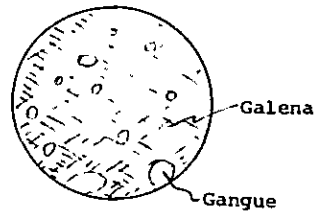
Round grains of pyrite and sphalerite occur in galena matrix sporadically. Pyrite and sphalerite are observed to be replaced by galena. Chalcopyrite occurs in small irregular forms distributed evenly in galena, indicating that it deposited coevally with galena.

Grain size: Pyrite, 70-1000μm; Sphalerite, 20-200μm;. Chalcopyrite, 20-200μm.

8. Gl M-08

A. Constituent minerals:

Galena	70%
Pyrite	10
Sphalerite	5
Gangue	15



B. Texture:

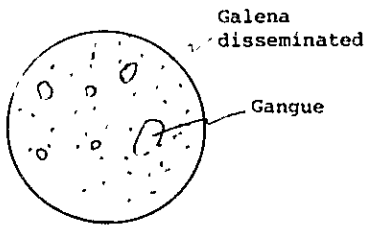
Galena fills up the interstices of grains of pyrite, sphalerite and gangue minerals. Pyrite shows corroded euhedral shapes and sphalerite shows irregular shapes. Occasionally sphalerite occurs in aggregates of fine grains formed in galena along fissures or the boundaries of larger sphalerite grains.

Grain size: Pyrite, 100-600μm; Sphalerite, 60-100μm.

9. G1 M-09

A. Constituent minerals:

Galena	40%
Pyrite	20
Sphalerite	6
Gangue	34
Unknown	



B. Texture:

The texture is similar to those of No. G1-06, -07 and -08. Galena includes many corroded euhedral grains of pyrite and a less amount of irregular grains of sphalerite. Gangue minerals included in galena show fine-grained aggregates or larger round single grains.

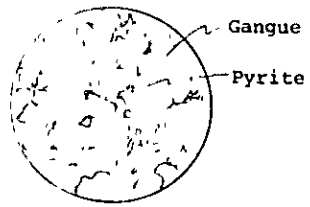
A trace amount of unknown mineral occurs in galena in contact with sphalerite.

Grain size: Pyrite, 60-400μm; Sphalerite, 50-300μm.

10. G1 M-10

A. Constituent minerals:

Galena	30%
Pyrite	30
Sphalerite	10
Gangue	30



B. Texture:

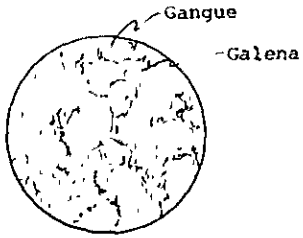
Round or corroded euhedral grains of pyrite in medium size are surrounded by galena which fills up the interstices of gangue minerals. A less amount of sphalerite having irregular shapes distributes sporadically in galena.

Grain size: Pyrite, 200-1500μm; Sphalerite, 30-120μm.

11. G1 M-11

A. Constituent minerals:

Galena	40%
Pyrite	10
Sphalerite	2
Gangue	48



B. Texture:

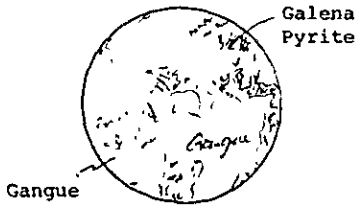
Galena fills fissures cutting gangue minerals or disseminated in them. Pyrite grains distributes sporadically in galena and in gangue minerals. They show round shapes or corroded euhedral shapes. A small amount of sphalerite is observed replaced partly by galena.

Grain size: Pyrite, 100-500μm, Sphalerite, 30-300μm.

12. G1+10 M-03

A. Constituent minerals:

Galena	20%
Pyrite	5
Chalcopyrite	2
Sphalerite	trace
Gangue	73



B. Texture:

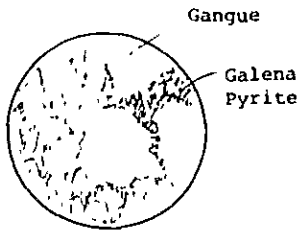
Galena fills the interstices of gangue minerals, the margin of which is often corroded by galena (Photograph). Pyrite having round shapes occurs in galena as well as in gangue. Chalcopyrite is found intimately associated with galena, and in some parts it surrounds pyrite grains. Chalcopyrite is also found in gangue filling the interstices.

Grain size: Pyrite, 100-500μm; Chalcopyrite, 200-600μm.

13. G1+20 M-02

A. Constituent minerals:

Galena	10%
Pyrite	4
Sphalerite	less than 1
Chalcopyrite	less than 1
Gangue	85



B. Texture

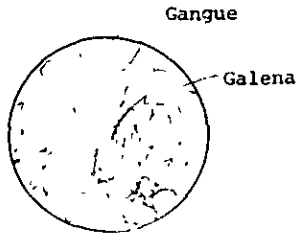
Galena fills microfissures, interstices and microcavities. Dissemination of galena is remarkable. Pyrite is corroded intensely by galena (Photograph), and in some parts by sphalerite. Chalcopyrite occurs intimately associated with galena in microfissures but partly in the interstices of gangue minerals separated from galena.

Grain size: Galena, 5-30μm; Pyrite, 100-600μm; Chalcopyrite, 100-500μm.

14. G1+30 M-03

A. Constituent minerals:

Galena	50%
Pyrite	7
Sphalerite	3
Chalcopyrite	trace
Gangue	



B. Texture

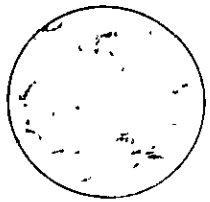
Galena occupies most parts of the sample including a minor amount of round pyrite grains and a less amount of sphalerite. Galena replaces the margin of carbonate gangue mineral and impregnates slightly from the surface into the crystal. Rectangular shaped transparent mineral occurs in galena showing their euhedral shapes. Galena includes large round grains of gangue minerals, the diameter of which reaches several millimeters.

Grain size: Pyrite, 200-600μm; Sphalerite, 60-200μm.

15. G1+30 M-05

A. Constituent minerals:

Galena	10%
Pyrite	1
Gangue	89



B. Texture:

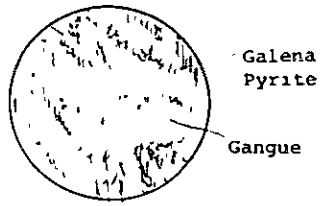
Galena and pyrite form irregular streaks in rocks. They also disseminate finely in gangue. Galena forms irregular bands and veinlets cutting through gangue minerals, the width of which is 10-500um. They are somewhat irregular having small masses in some places though they are arranged to some directions.

Grain size: Pyrite, 50-300μm; Galena, 2-400μm.

16. G1+40 M-03

A. Constituent minerals

Galena	24%
Pyrite	15
Chalcopyrite	1
Gangue	60



B. Texture

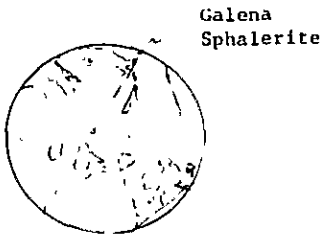
Galena occurs in fine i-regular streaks and also in the interstices of gangue minerals, accompanying corroded pyrite grains and occasionally irregular grains of chalcopyrite. Round grains of pyrite also occurs in gangue minerals as well as in galena streaks. Chalcopyrite is intimately associated with galena.

Grain size: Galena, 10-1500μm; Pyrite, 200-1000μm; Chalcopyrite, 10-200μm.

17. G2 M-03

A. Constituent minerals

Galena	30%
Sphalerite	15
Pyrite	7
Pyrrhotite	1
Gangue	47



B. Texture

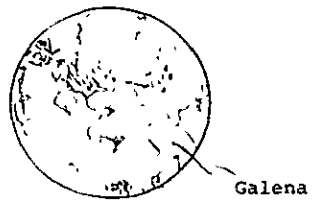
Galena fills up the interstices of gangue minerals occupying a larger area of the sample, and includes many grains of sphalerite and pyrite. Pyrite occurs either in slightly erroded euhedral forms or round shapes. Some parts of pyrite grains are replaced by aggregates of fine-grained pyrite and transparent minerals, and show a rugged surface. Pyrrhotite occurs as a single crystal of irregular shapes or including fine-grained aggregates of pyrite. Some parts of the margin of pyrrhotite is replaced by pyrite. Microscopically it is observed that pyrrhotite was formed earlier than pyrite. Sphalerite is found in irregular shapes mainly in galena but scarcely in gangue minerals. Chalcopyrite is very svarcely observed with galena.

Grain size: Sphalerite, 200-1000μm; Pyrite, 400-700μm, Pyrrhotite, 100-400μm.

18. G2 M-04

A. Constituent minerals

Galena	40%
Sphalerite	6
Pyrite	4
Gangue	50



B. Texture

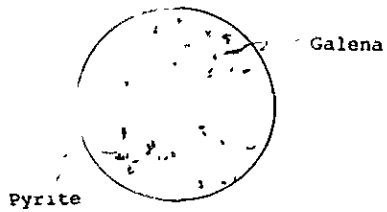
Galena fills up the interstices of gangue minerals accompanying grains of pyrite, sphalerite and a minor amount of pyrrhotite. Pyrite and sphalerite occur in round grains. Two pieces of euhedral crystal of pyrrhotite are found in galena with sphalerite. Some parts of grains of galena, sphalerite and pyrite are replaced by aggregates of a fine-grained transparent mineral which also fills the cleavage cracks of galena (Photograph).

Grain size: Sphalerite, 100-1000μm; Pyrite, 50-1100μm, Pyrrhotite, 150-180μm.

19. G2 M-05

A. Constituent minerals:

Galena	9%
Pyrite	1
Chalcopyrite	less than 1
Sphalerite	less than 1
Gangue	90



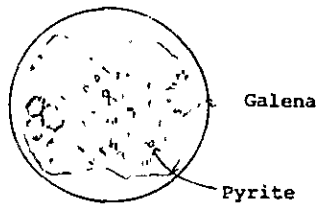
B. Texture:

Galena finely disseminates in rocks. It fills the interstices of gangue minerals accompanying a small amount of chalcopyrite and sphalerite, and it distributes evenly and in irregular shapes. No fissures of galena cutting through gangue minerals are observed. Pyrite occurs in irregular forms and corroded euhedral shapes by galena, chalcopyrite or sphalerite. The mode of occurrence of chalcopyrite and sphalerite indicates the crystallization of galena, chalcopyrite and sphalerite was coeval.
Grain size: Galena, 6-100μm; Pyrite, 100-700μm; Chalcopyrite, 10-200μm; Sphalerite, 7-100μm.

20. G2 M-06

A. Constituent minerals:

Galena	5%
Pyrite	3
Sphalerite	3
Chalcopyrite	1
Gangue	88



B. Texture

Galena distributes evenly in the sample. It fills the interstices of grains of gangue minerals forming irregular shapes and also disseminates finely in gangue minerals. It accompanies sphalerite and pyrite.
A number of pyrite grains are subhedral or anhedral. Some of them are corroded by galena and sphalerite. Chalcopyrite generally associates with galena and sphalerite, but it is rarely included in sphalerite.
Grain size: Galena, 5-700μm; Pyrite, 50-800μm; Sphalerite, 20-300μm; Chalcopyrite, 10-100μm.

21. G2+20 M-04

A. Constituent minerals

Galena	22%
Pyrite	6
Chalcopyrite	2
Gangue	70

B. Texture

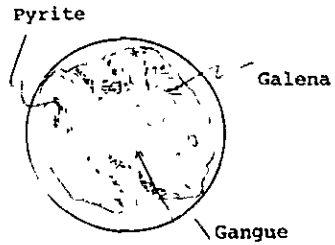
Galena forms irregular streaks with veinlets and masses. Pyrite occurs among gangur minerals and is partly replaced by chalcopyrite. Some grains of pyrite include clayey minerals. Chalcopyrite occurs mostly around pyrite grains but rarely in galena in irregular shapes.

Grain size: Pyrite, 20-1000μm; Galena, 20-700μm.

22. G3 M-01

A. Constituent minerals:

Galena	30%
Pyrite	20
Sphalerite	trace
Chalcopyrite	trace
Gangue	50



B. Texture

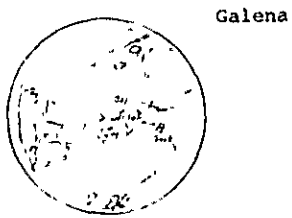
Galena and pyrite occupy more than a half of the area of the polished section. Macroscopically, the section is divided into two parts, i.e., pyrite-rich and galena-rich portions. Massive part of galena is partly characterized by the development of cleavages and triangular pits. Pyrite grains in galena are round anhedral or subhedral shapes. Some of them are partly corroded by galena. Chalcopyrite is often included in pyrite grains but occurs also as isolated irregular grains in galena. In the pyrite-rich part, pyrite fills the interstices of gangue minerals, but it is in turn filled by a less amount of galena.

Grain size: Galena, 5-3000μm; Pyrite, 30-1000μm; Sphalerite 5-50μm; Chalcopyrite, 20-100μm.

23. G3 M-02

A. Constituent minerals:

Galena	30%
Pyrite	5
Chalcopyrite	trace
Gangue	65



B. Texture

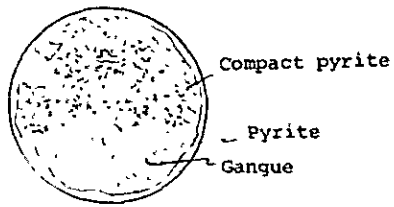
Galena occurs in irregular masses filling the interstices of gangue minerals with large round subhedral grains of pyrite, and partly disseminated along the structure of the original rock. Pyrite grains are generally subhedral but rarely in slightly corroded euhedral. Chalcopyrite occurs in small isolated particles associated with galena.

Grain size: Galena, 5-6000μm; Pyrite, 50-1000μm; Chalcopyrite, 5-40μm.

24. G3 M-03

A. Constituent minerals:

Pyrite	80%
Galena	1
Chalcopyrite	1
Sphalerite	trace
Gangue	18



B. Texture

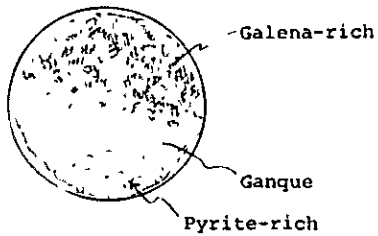
Most pyrite grains show anhedral or subhedral shapes, but some of them are slightly corroded euhedral. They occupy most of the area of the sample accompanied with a minor amount of galena, sphalerite and gangue minerals. Galena and chalcopyrite occur among pyrite grains intimately associated with each other. Sphalerite occurs in a trace amount associated with galena and chalcopyrite.

Grain size: Pyrite, 20-1000μm; Galena, 20-400μm; Chalcopyrite, 20-50μm; Sphalerite, 5-20μm.

25. G3 M-04

A. Constituent minerals:

Pyrite	40%
Galena	20
Chalcopyrite	5
Sphalerite	trace
Gangue	35



B. Texture

The polished section is divided into two parts, i.e., pyrite-rich and galena-rich parts. Pyrite grains show round anhedral shapes and include small amounts of chalcopyrite and galena. Most of galena and chalcopyrite in the pyrite-rich part occur among anhedral pyrite grains. Chalcopyrite is especially found along the rim of pyrite grains, or associated with galena, but also as small blebs in sphalerite. Galena in the galena-rich part includes anhedral grains of pyrite, and is characterized by the abundance of triangular pits compared with those in the pyrite-rich part. Pyrite grains are intensely corroded by galena in this part, and some small round grains of pyrite are found in galena separated from each other.
Grain size: Pyrite, 5-1000μm; Galena, 5-3000μm; Chalcopyrite, 5-500μm; Sphalerite, 50-500μm.

26. G3 M-08

A. Constituent minerals:

Galena	10%
Pyrite	5
Sphalerite	2
Chalcopyrite	1
Marcasite	2
Gangue	80

B. Texture

Galena occurs in irregular masses as well as fine disseminated particles in gangue. It is characterized by the abundance of cleavages and triangular pits. Sphalerite occurs generally in contact with galena and pyrite, and includes abundant chalcopyrite blebs. Chalcopyrite is occasionally accompanied with pyrite and marcasite which also occur together in a close association. Marcasite occurs intimately associated with pyrite. Some grains of marcasite consist of fine foliated aggregates which are surrounded by chalcopyrite. Those minerals occur in thin layers parallel to the possibly original trend of bedding of rock.
Grain size: Galena, 5-1000μm; Pyrite, 5-100μm; Sphalerite, 100-400μm; Marcasite, 50-1000μm; Chalcopyrite, 10-500μm.

27. G3+20 M-01

A. Constituent minerals:

Galena	10%
Pyrite	1
Gangue	90

B. Texture

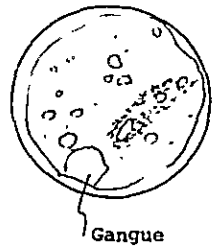
Galena occurs in irregular shapes filling the interstices of gangue minerals, and in veinlets which connect irregular patches. Pyrite is generally included in galena as round anhedral grains, but it rarely exists as a single grain in gangue.

Grain size: Galena, 5-6000μm; Pyrite, 20-500μm.

28. G4 M-01

A. Constituent minerals:

Pyrite	30%
Sphalerite	20
Galena	trace
Chalcopyrite	trace
Gangue	50



B. Texture

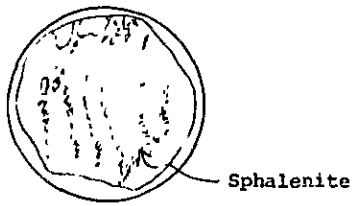
The sample is an aggregate of equigranular fine grains of pyrite and sphalerite including round aggregates of gangue minerals which distribute evenly in the sample. Microscopically aggregates of sulphide minerals form the matrix of round grains of gagnue. A trace amount of chalcopyrite is found as small irregular grains associated with sphalerite.

Grain size: Pyrite, 5-200μm; Sphalerite, 10-100μm; Galena, 20-50μm; Chalcopyrite, 3-10μm.

29. G4 M-02

A. Constituent minerals:

Sphalerite	10%
Galena	5
Pyrite	trace
Chalcopyrite	trace
Marcasite	2
Gangue	83



B. Texture

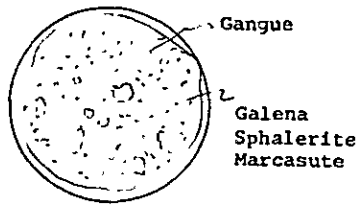
Sphalerite and galena disseminate finely in gangue forming slender and discontinuous streaks. Some grains of galena occur among foliated gangue minerals or replacing them showing a distribution of extended lath-shaped grains along the original structure of rock. Most of marcasite occur in isolated subhedral to euhedral grains, but some of them occur along the margin of grain or in slender cracks. It is occasionally replaced by fine grains of pyrite. In a few grains, the relict of probable original concentric structure is shown by the distribution of fine grains of pyrite in sphalerite. A concentric structure is also shown on marcasite grain.

Grain size: Sphalerite, 5-250μm; Galena, 5-300μm; Marcasite, 10-150μm, Pyrite, 10-100μm, Chalcopyrite, 20μm.

30. B-1(sp4-130)

A. Constituent minerals:

Sphalerite	50%
Marcasite	20
Galena	5
Tetrahedrite	trace
Gangue	25



B. Texture

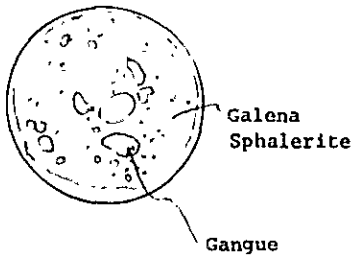
Sphalerite forms the matrix of subangular and round grains of gangue minerals, accompanied with scattered grains of marcasite and galena. Marcasite occurs mostly in contact with sphalerite and it is corroded by sphalerite from the margin. Galena and some amounts of sphalerite and marcasite disseminated among foliated gangue minerals showing a slender flaky appearance but trend of distribution of them is random. A minor amount of tetrahedrite occurs in galena besides the grains of sphalerite and marcasite.

Grain size: Galena, 5-500μm; Sphalerite, 50-5000μm, Marcasite, 10-500μm, Tetrahedrite, 5-40μm.

31. B-2(spll-36.10)

A. Constituent minerals:

Galena	20%
Sphalerite	10
Pyrite	1
Tetrahedrite	trace
Gangue	70



B. Texture

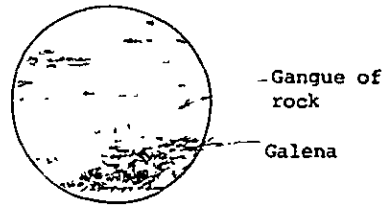
Aggregates of sphalerite and galena grains fill the matrix of subangular or round grains of gangue minerals. Fine grains of the two minerals are also scattered evenly filling the interstices of gangue minerals intimately associated with each other. Large sphalerite grains contain a large number of small chalcopyrite blebs. A small amount of pyrite is observed in galena. The pyrite grains show fairly irregular shapes and they are partly corroded mainly by galena. A trace amount of tetrahedrite occurs also in galena in contact with sphalerite.

Grain size: Galena, 5-5000μm; Sphalerite, 10-200μm; Pyrite, 20-300μm; Tetrahedrite, 5-10μm.

32. B-3(spll-37.80)

A. Constituent minerals:

Galena	15%
Pyrite	1
Chalcopyrite	trace
Gangue	85



B. Texture

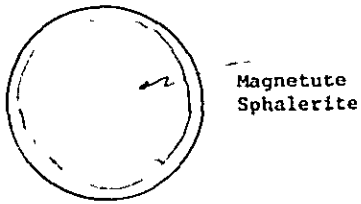
Macroscopically galena occurs in thin layers which probably represent the structure(bedding) of the original rock. Microscopically it occurs in fine irregular shapes filling the interstices of round grains of transparent minerals. Round or subhedral grains of pyrite are generally included in galena. A trace amount of chalcopyrite is observed in pyrite.

Grain size: Galena 5-5000μm; Pyrite, 20-400μm; Chalcopyrite, 5-15μm.

33. A-40

A. Constituent minerals:

Magnetite	70%
Sphalerite	20
Ilmenite	5
Hematite	1
Gangue	4



B. Texture

Aggregates of magnetite and sphalerite grains occupy the most part of the sample. Sphalerite grains are generally replaced more or less by magnetite, and even a less replaced grain of sphalerite contains a great number of fine magnetite grains along the crystallographic direction. Ilmenite occurs as grains among magnetite grains or as exsolution lamellae in magnetite grains. Hematite occurs in slender foliated shapes in ilmenite and magnetite mostly along cracks or grain boundaries. Grain size: Magnetite, 20-1000μm; Sphalerite, 50-500μm; Ilmenite, 10-200μm.

34. RP-1

A. Constituent minerals:

Galena	3%
Pyrite	1
Chalcopyrite	trace
Gangue	96

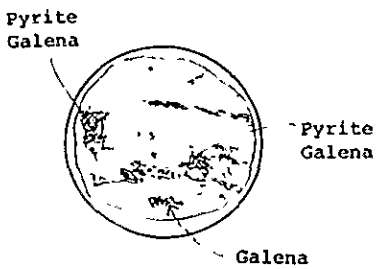
B. Texture

Macroscopically galena distributes in very thin and intermittent layers and as small masses of irregular shapes. Microscopically galena occurs in irregular shapes filling the interstices of grains of gangue minerals and in irregular veinlets. Pyrite grains are round or irregular in shapes and occur as isolated grains in gangue. Grains of these two minerals distribute roughly parallel to a trend. Chalcopyrite occurs as tiny grains in pyrite. Grain size: Galena, 5-5000μm; Pyrite, 20-300μm; Chalcopyrite, 2-10μm.

35. RP-2

A. Constituent minerals:

Galena	5%
Pyrite	2
Chalcopyrite	trace
Tetrahedrite	trace
Gangue	93



B. Texture

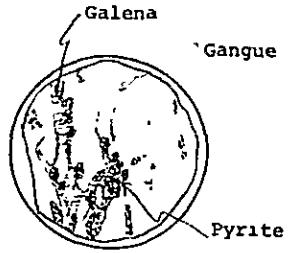
Fine irregularly shaped grains of galena occur filling the interstices of grains of gangue minerals and also in irregular discontinuous veinlets. Fine grains of chalcopyrite and pyrite are also observed in gangue. Pyrite grains which contact with galena, are intensely corroded by galena. Irregular patches of galena are also observed in pyrite grains. Smaller grains of pyrite in gangue, however, are left intact. Some pyrite grains are cut by network of gangue minerals. Chalcopyrite occurs as irregular and isolated grains in pyrite. Tetrahedraite occurs in contact with chalcopyrite and pyrite.

Grain size: Galena, 5-3000μm; Pyrite, 30-400μm; Chalcopyrite, 20-60μm; Tetrahedrite, 5-30μm.

36. RP-4

A. Constituent minerals:

Galena	22%
Pyrite	6
Tetrahedrite	1
Chalcopyrite	trace
Gangue	70



B. Texture

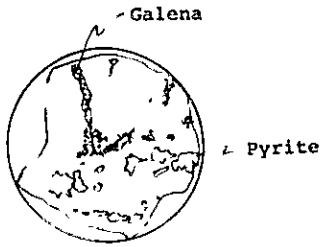
Galena occurs in irregular veins and also disseminated irregularly in gangue minerals. Pyrite is mostly found in galena veins but it is also found in gagnue minerals. Most grains of pyrite in galena veins are intensely replaced by galena. Small amounts of chalcopyrite, tetrahedrite, sphalerite and undetermined mineral A occur intimately associated with galena. Marginal parts of galena and chalcopyrite grains are occasionally replaced by chalcocite.

Grain size: Galena, 40-1000μm; Pyrite, 30-1500μm; Tetrahedrite, 10-300μm; Chalcopyrite, 30-800μm.

37. RP-5

A. Constituent minerals

Pyrite	7%
Galena	5
Chalcopyrite, Sphalerite Tetrahedrite	trace
Gangue	88



B. Texture

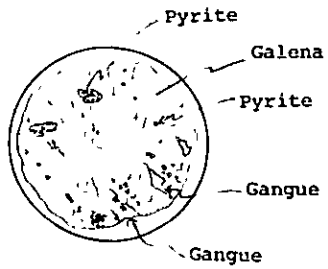
Large euhedral pyrite grains are intensely replaced by galena and chalcopyrite and include various shapes of inclusions of these minerals. Tetrahedrite is also contained in pyrite grains. A trace amount of undetermined mineral A is found in pyrite and gangue. Some grains of chalcopyrite, galena and tetrahedrite in gangue are rimmed with chalcocite of secondary origin. Galena occurs filling the interstices or fractures of gangue minerals.

Grain size: Pyrite, 50-2000μm; Galena 30-1000μm; Chalcopyrite, 30-500μm; Sphalerite, 10-100μm; Tetrahedrite, 10-100μm.

38. RP-6

A. Constituent minerals:

Galena	85%
Pyrite	5
Chalcopyrite	3
Tetrahedrite	2
Sphalerite	trace
Gangue	5



B. Texture

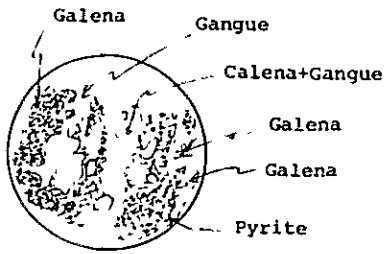
Galena occupies almost of the area of the sample, including round grains of pyrite, irregularly shaped grains of tetrahedrite, sphalerite, chalcopyrite and undetermined mineral A. Most of pyrite grains are corroded partly by galena, and some grains include minute blebs of galena, sphalerite, chalcopyrite, tetrahedrite and undetermined mineral A. Chalcopyrite is occasionally associated with sphalerite and tetrahedrite.

Grain size: Galena, 10-90um; Pyrite, 30-1000um; chalcopyrite, 10-500μm; Tetrahedrite, 10-300μm. Undetermined mineral A, 10-50μm.

39. RP-7

A. Constituent minerals:

Galena	65%
Pyrite	20
Chalcopyrite	2
Tetrahedrite	2
Sphalerite	trace
Gangue	10



B. Texture

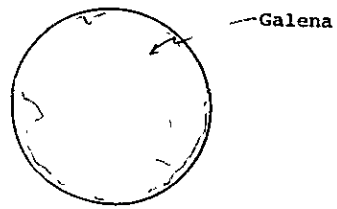
Galena includes pyrite, chalcopyrite, tetrahedrite and sphalerite. Pyrite grains are generally corroded intensely by galena to round shapes. Minute blebs of chalcopyrite, sphalerite and tetrahedrite are included in some grains of pyrite, especially in large grains of the pyrite-rich part. In some parts of the sample, tetrahedrite predominates galena and distributes ubiquitou in gangue as small particles. Chalcopyrite often coexists with sphalerite or tetrahedrite.

Grain size: Galena 100-2000μm; Pyrite, 10-200μm; Chalcopyrite, 10-500μm; Tetrahedrite, 30-2000μm; Undetermined mineral, 10-50μm.

40. RP-8

A. Constituent minerals:

Galena	97%
Tetrahedrite	1
Pyrite Sphalerite	trace
Gangue	3



B. Texture

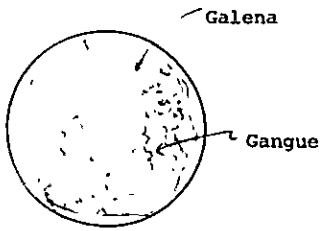
The sample is almost occupied by galena which includes small grains of pyrite and tetrahedrite. Cleavages of galena are filled with gangue minerals which disseminate in galena along the cleavages as fine aggregates of fine flakes. Covelline is observed on some boundaries of galena grains.

Grain size: Galena, 500-3000μm; Tetrahedrite, 30-200μm; Pyrite, 10-100μm; Sphalerite, 5-50μm.

41. RP-9

A. Constituent minerals:

Galena	63%
Chalcopyrite	7
Sphalerite	trace
Pyrite	
Pyrrhotite	
Tetrahedrite	
Marcasite	
Gangue	30



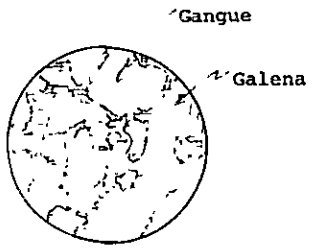
B. Texture

Galena occupies almost of the area including grains of chalcopyrite and less amounts of pyrite, pyrrhotite and marcasite. A few grains of sphalerite and tetrahedrite are also included. They generally show irregular shapes and are corroded by galena. Chalcopyrite contains many minute blebs of tetrahedrite, sphalerite, pyrrhotite, and two kinds of undetermined minerals. Most of pyrrhotite grains occur associated with chalcopyrite.
Grain size: Chalcopyrite, 10-200μm; Pyrrhotite, 20-500μm; Sphalerite, 20-700μm, Marcasite, 20-600μm.

42. RP-10

A. Constituent minerals:

Galena	36%
Chalcopyrite	4
Sphalerite	trace
Pyrite	1
Tetrahedrite	trace
Gangue	60



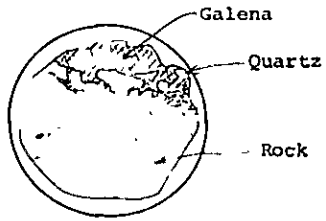
B. Texture

Galena fills the interstices of gangue minerals accompanied with chalcopyrite grains of irregular shapes and a less number of euhedral pyrite grains. Sphalerite and tetrahedrite associate with chalcopyrite. Some grains of pyrite are corroded by galena.
Grain size: Galena, 50-1000μm; Chalcopyrite, 30-500μm; Pyrite, 50-500μm; Sphalerite, 10-50μm, Tetrahedrite, 50μm.

43. RP-11

A. Constituent minerals:

Galena	10%
Tetrahedrite	trace
Pyrite	
Chalcopyrite	
Undetermined A	
Gangue	90



B. Texture

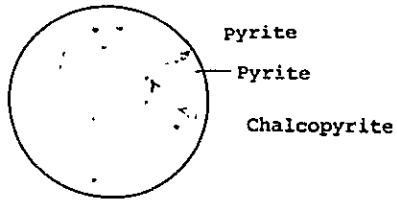
Galena occurs in a quartz vein which contains some of round pyrite grains and small tetrahedrite grains. Galena also sparcely disseminates in gangue minerals as irregular particles. Fractures in galena are partly filled with gangue minerals.

Grain size: Galena, 60-3000μm; Tetrahedrite, 40-300μm; Pyrite, 20-200μm; Undetermined mineral A, 20-100μm.

44. RP-12

A. Constituent minerals:

Pyrite	trace
Galena	"
Chalcopyrite	"
tetrahedrite	"
Gangue	99%



B. Texture

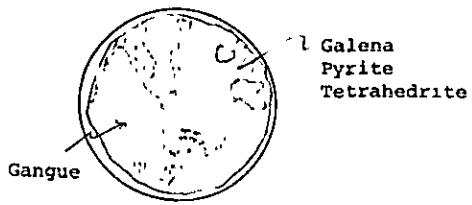
The sample contains only a small amount of sulphide minerals. They occur as small grains filling the interstices or replacing gangue minerals. Pyrite grains are partly corroded by gangue minerals. Galena is generally accompanied by tetrahedrite. Small grains of galena, chalcopyrite and rarely tetrahedrite are found in pyrite grains.

Gain size: Pyrite, 30-200μm; Galena, 30-200μm; Chalcopyrite, 5-30μm; Tetrahedrite, 6-30μm.

45. RP-14

A. Constituent minerals:

Galena	17%
Pyrite	15
Tetrahedrite	15
Chalcocite	2
Chalcopyrite	1
Undetermined A	trace
Undetermined C	"
Gangue	50



B. Texture

Galena and tetrahedrite coexist with mutual contact boundaries and include round or angular pyrite grains. Some parts of pyrite grains are replaced by galena and tetrahedrite. A small amount of chalcopyrite occurs in contact with galena and tetrahedrite. Galena and tetrahedrite also contain trace amounts of two kinds of undetermined minerals which are intimately associated with tetrahedrite. Undetermined mineral C is especially observed on the marginal parts of the fine grained aggregates of gangue minerals which replace tetrahedrite and galena. Some parts of margins of galena, tetrahedrite and pyrite grains are replaced by chalcocite. Some euhedral grains of arsenopyrite are observed in gangue and tetrahedrite. Most of pyrite grains are found in galena, tetrahedrite or chalcopyrite, but the rest are scattered in gangue minerals. Some pyrite grains are partly corroded by galena, tetrahedrite or chlcopyrite. Grain size: Galena, 100-3000μm; Pyrite, 40-500μm; Tetrahedrite, 50-3000μm; Chlcopyrite, 30-500μm.

46. RP-15

A. Constituent minerals:

Galena	35%
Pyrite	25
Tetrahedrite	20
Chlcocite	5
Chlcopyrite	2
Arsenopyrite	2
Covelline	trace
Undetermined A	"
Undetermined C	"
Gangue	10

B. Texture

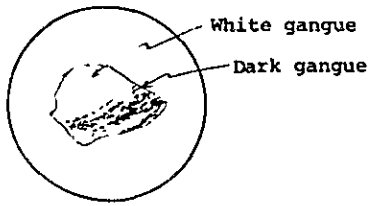
Most parts of the area are filled by galena and partly by tetrahedrite. Round grains of pyrite, euhedral grains of arsenopyrite and irregular grains of chalcopyrite are included by galena and tetrahedrite. Chlcocite occurs replacing galena, tetrahedrite or chalcopyrite along cracks and partly fills the interstices of gangue minerals. Covelline is also found, especially along fractures in galena. Undetermined mineral A occurs in galena or tetrahedrite.

Grain size: Pyrite, 50-1000μm; Tetrahedrite, 50-1500μm; Chalcocite, 10-500μm; Arsenopyrite, 20-500μm; Undetermined mineral A, 10-200μm; Undetermined mineral C, 3-10μm.

47. RP-17

A. Constituent minerals:

Galena	7%
Pyrite	1
Tetrahedrite	trace
Chalcopyrite	"
Covelline	"
Gangue	92



B. Texture

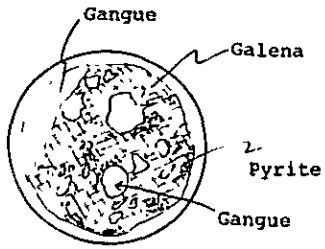
Most of galena grains occur in a banded area where galena fills the interstices of gangue minerals arranged along several streaks parallel to the band. Pyrite occurs in the same zone as isolated and slightly corroded euhedral grains or as aggregates of fine round grains. The fine-grained pyrite aggregates suggest a crystallization from framboidal pyrite.

Grain size: Galena, 100-1000μm; Pyrite, 5-200μm; Tetrahedrite, 20-100μm; Chalcopyrite, 10-50μm; Covelline, 10-200μm.

48. RP-18

A. Constituent minerals:

Galena	75%
Pyrite	3
Tetrahedrite	1
Undetermined A	1
Sphalerite	trace
Chalcopyrite	"
Chalcocite	"
Covelline	"
Gangue	20



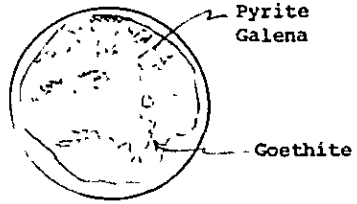
B. Texture

Galena occupies most parts of the sample including round grains of pyrite and fine aggregates of tetrahedrite and undetermined mineral A. Some parts of the margin of pyrite grain are corroded by galena. Aggregates of tetrahedrite and undetermined mineral A also replace some parts of pyrite and galena grains. Pyrite grains contain minute blebs of galena, tetrahedrite, sphalerite, chalcopyrite and undetermined mineral A. Tetrahedrite grains which occur in galena, are often associated with fine grains of chalcopyrite and undetermined mineral A.
Grain size: Pyrite, 50-500μm; Tetrahedrite, 10-700μm; Undetermined mineral A, 10-300μm.

49. RP-19

A. Constituent minerals:

Pyrite	9%
Galena	5
Tetrahedrite	trace
Sphalerite	"
Chalcopyrite	"
Covelline	"
Gangue & Goethite	85



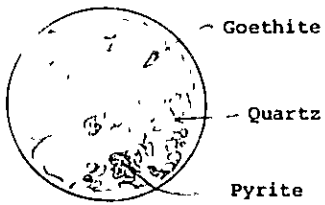
B. Texture

Pyrite occurs as round grains in goethite and gangue masses. Galena also shows corroded shapes. Small grains of tetrahedrite, chalcopyrite, sphalerite and bornite occur intimately associated but only in a part of galena. Minute grains of covelline are commonly observed along the boundaries of grains.
Grain size: Pyrite, 50-500μm; Galena, 30-1000μm; tetrahedrite, 5-50μm; chalcopyrite, 5-10μm; Sphalerite, 5-10μm; Covelline, 3-10μm; Bornite, 3-10μm.

50. RP-20

A. Constituent minerlas:

Galena	2%
Pyrite	2
Sphalerite	trace
Gangue & Hydroxides	95



B. Texture

The sample is an oxide ore. It shows a complicate texture and it is difficult to identify the consituent minerals microscopically. X-ray analysis would be necessary for the identification of minerals.

Grains of galena and pyrite show corroded boundaries and thin film of covelline is generally observed on the margins of grains.

Grain size: Galena, 20-1000μm; Pyrite, 3-10μm: Sphalerite, 2-10μm.

Table A-4 X-ray Diffractive Analysis

No.	Sample No.	Location	Rock Name	Occurrence	α-Quartz	Plagioclase	Alkali-feld	Biotite	Muscovite (Sericite)	Chlorite	Tremolite	Calcite	Dolomite	Barite	Fluorite
1	G1-R01	Perau Mining G1L	calc-schist	foot wall					•		○	○	○		
2	R02	do	calc-schist	hanging wall							○	●	•		
3	R03	do	muscovite-schist	hanging wall	◎				◎		•				
4	R04	do	calc-schist	gangue rock				◎				◎			
5	R05	do	muscovite-schist	foot wall			○		●			•			
6	R06	do	dolomite	do				◎				○	◎		
7	R07	do	calc-schist	hanging wall			•	◎			•	○			
8	R08	do	muscovite-schist	foot wall			◎		●			•			
9	R09	do	diabase	dyke rock		●			•	•					
10	R10	do	muscovite-schist	foot wall	◎				○						
11	R11	do	muscovite-schist	do	◎				◎						
12	R12	do	calc-schist	do	○			◎				○			
13	G2-R01	G2L	calc-schist	gangue rock				●			●	◎			
14	R05	do	barite	hanging wall	◎			◎				•			
15	R06	do	calc-silicate rock	do				●			◎	◎			
16	R07	do	barite	do	◎			◎			•	●			
17	G3-R01	G3L	seritie-schist	gangue rock	◎			◎	◎						
18	R02	do	do	gangue rock	◎				◎						
19	R03	do	do	gangue rock	◎				◎						
20	A-046	carumbé	dolomite	Asungi III F, L_1,									◎		
21	050	do	dolomite	Asungi III F, L_3,								◎	◎		○
22	RA-1	Rocha Mining 308mL	limestone	L_1, fng dark grey	•	•			•			◎	•		
23	2	do	do	L_1, mdg grey	○				•	•		◎	●		
24	3	do	do	L_1, mdg grey	○				●	•		•	◎		
25	4	do	do	L_1, mdg grey					•			◎			
26	5(1)	do	do	A, mdg light grey	•				•			◎			
27	5(2)	do	dolomite	A, fng dark grey	•				●			●	◎		
28	6(1)	do	limestone	A, light grey	•				•			◎	•		
29	6(2)	do	dolomite	A, mdg dark grey	•				○				◎		
30	7(1)	do	limestone	A, mdg light grey	•?				•			◎	•		
31	7(2)	do	dolomite	A, mdg dark grey	○				○				◎		
32	8	do	do	D_1, mdg grey	•				●				◎		
33	RA-10	do	do	D_1, mdg light grey	○				●	•			◎		
34	12	do	do	D_1, mdg light grey	○	●			●				◎		
35	14	do	do	D_1, mdg grey	◎	•			●				◎		
36	16	do	do	D_2, mdg grey	•	•			•	•			◎		
37	17	do	do	D_2, mdg light grey					●				◎		
38	18	do	do	D_2, mdg dark grey	•				●	•			◎		
39	19	do	do	D_2, mdg dark grey	○								◎		
40	20	do	do	D_2, mdg dark grey	○				○	•?			◎		
41	21	do	do	D_2, mdg grey	●							•	◎		
42	RB-1	403mL	do	A, mdg grey	•				●	•		◎	◎		
43	2	do	limestone	L, mdg light grey					•			◎	•		
44	3	do	dolomite	A, mdg light grey	◎				○	•			◎		
45	4	do	do	D_1, mdg grey	◎				○	•			◎		
46	5	do	do	D_1, mdg grey	•							○	◎		
47	6	do	do	D_1, mdg grey	●							•	◎		
48	7	do	do	A, mdg grey	●							○	◎		
49	8	do	do	D_2, mdg light grey	●	•							◎		
50	9	do	do	D_2, mdg light grey	•	●			●			◎	◎		
51	10	do	do	D_2, mdg grey	○				●	•			◎		
52	RC-1	near Rocha Mining	limestone	L, mdg white		•						◎	•		
53	2	do	limestone	L, mdg	●	●						◎	◎		
54	D084	Ouro firo	dolomite	Açungui III F,	•?								◎		
55	D089	Agua-Clara	do	Açungui I F Alls	◎				•				◎		
56	D090	do	barite	ore										◎	

Table A-5 Result of Chemical Analysis of Ores

No.	Sample No.	Location	Occurrence		Au g/t	Ag g/t	Cu %	Pb %	Zn %
1	G1-M01	Perau Mine G1L	galena impregnation	W:10	0.3	270.9	0.003	11 14	0.42
2	M02	do do	sphalerite, galena impregnation	W:30	0.0	267.4	0.015	9 34	4.23
3	M03	do do	galena, banded ore	W:20	0 0	177.1	0 037	11.86	1.19
4	M04	do do	pyrite rich massive ore	W:30	0.4	51.9	0 887	1.42	0 44
5	M05	do do	fine banded galena	W·80	0 0	97.1	0 005	8.62	0 01
6	M06	do do	massive galena	W 40	1.3	320 0	0 026	8 26	0 56
7	M07	do do	do	W 10	0 6	453 7	0 180	12 93	0 85
8	M08	do do	massive galena vein, cutting schistosity of wall rock	W·10	0 1	316.6	0.051	12 46	0.61
9	M09	do do	massive galena	W.20	0.5	226.3	0.374	11 86	1 21
10	M10	do do	massive galena-pyrite	W 170	0 1	193 1	0 179	4.85	0 50
11	M11	do do	galena impregnation	W 70	0 1	264 0	0 013	12 28	0.06
12	M12	do do	galena impregnation	W·30	0 0	116 3	0 156	4.33	0 79
13	G1+10 M03	do G1+10mL	do	W:30	0.3	268 5	0.186	8 13	0 02
14	G1+20 M02	do G1+20mL	galena impregration (clasted ore)	W·50	0.0	238.0	0 023	10 47	0.59
15	G1+30 M03	do G1+30mL	massive galena	W:20	0 0	629 3	0.023	11.93	0 17
16	G1+30 M05	do do	galena impregnation	W:50	0.3	164.1	0.005	10.58	0.01
17	G1+40 M03	do G1+40mL	massive galena-pyrite	W:10	0.1	254.3	0.687	12.22	0.03
18	G2-M03	do G2L	massive galena-sphalelite	W:10	0.0	560.9	0.005	12.40	1.24
19	M04	do G2L	massive galena	W·20	0.0	230.4	0.018	10.70	0.38
20	M05	do G2L	galena impregnation in Barite Zone	W 30	0.0	53 1	0.018	4 21	0.03
21	M06	do G2L	galena fine impregnation	W:10	0.0	168 5	0.003	12.47	2 29
22	G2+20 M4	do G2+20mL	galena impregnation	W:20	0.5	389 1	0.002	6 40	0.61
23	G3-M01	do G3L	banded galena-pyrite	W:40	0 0	94.6	0.020	3.00	0.01
24	M02	do do	banded galena	W:20	0.2	259.8	0.008	11 74	0.04
25	G3-M03	do do	massive pyrite with galena	W·10	0.0	22.2	0.014	1.11	0.01
26	M04	do do	banded pyrite-galena	W:40	0 4	226 1	0.301	5.06	0.41
27	M08	do do	galena impregnation	W·10	0.0	61.8	0.059	9.55	0.62

No.	Sample No.	Location	Occurrence	Au g/t	Ag g/t	Cu %	Pb %	Zn %
28	G3+20 M01	Peron Mining G3+20mL	galena impregnation W:110	0.0	167.4	0.001	10.84	0.01
29	G4-M01	do G4L	sphalerite-galena impregnation W·10	0.0	93.5	0.019	1.47	6.39
30	M02	do G4L	pyrite-sphalerite-galena impregnation W:20	0.0	116.3	0.007	3.82	9.99

Table A-6 Result of Chemical Analysis of Host Rocks

No.	Sample No.	Location	Rock Name	Occurrence	CaO %	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	MgO %
1	G1- R01	Perau Mine G1L	calc-schist	foot wall	18 00	18.20	4.68	0.49	19.63
2	R02	do do	calc-schist	hanging wall	23.34	16 40	9.90	1.11	14.51
3	R03	do do	muscovite-schist	hanging wall	3.86	54.92	3.75	10 87	4 13
4	R04	do do	calc-schist	gangue rock	23.07	18.90	5 02	8.84	12.09
5	R05	do do	muscovite-schist	foot wall	20.51	15.44	5.61	4.58	12.67
6	R06	do do	dolomite	do	27 65	6.20	4 23	3.09	17.46
7	R07	do do	calc-schist	hanging wall	15.26	26.32	4.75	9.21	11.03
8	R08	do do	muscovite-schist	foot wall	3.21	38.78	2 46	5.12	2 27
9	R09	do do	diabase	dyke rock	7 14	31.16	9.79	11.85	11 64
10	R10	do do	muscovite-schist	foot wall	0 56	58.52	3.24	5.27	2.18
11	R11	do do	muscovite-schist	do	0.22	63.04	2.79	3.27	1.52
12	R12	do do	calc-schist	do	12.95	36.14	3.99	7.38	7.79
13	G2- R01	do G2L	calc-schist	gangue rock	20 47	22.52	4 39	5.65	9.27
14	R05	do do	barite	hanging wall	3.46	58.44	1.40	3.62	4.01
15	R06	do do	calc-silicate rock	do	16.79	35.02	4 30	7.04	11 16
16	R07	do do	barite	do	4.40	27.44	54.58	3.53	2.97
17	G3- R01	do G3L	muscovite-schist	gangue rock	0.34	58.59	3.42	10.37	7.04
18	R02	do do	do	gangue rock	0 18	57.12	6.61	8 43	2.37
19	R03	do do	do	gangue rock	0.18	61.10	2 28	11.10	2.00
20	RA- 1	Rocha Mine 308mL	limestone	dark grey L, fng	29.85	19.64	1.19	3 03	9.51
21	2	do do	do	grey L, mdg	33.83	22.64	0 78	0.83	5.48
22	3	do do	do	grey L, mdg	32.81	24.12	0.85	1.30	5.64
23	4	do do	do	grey L, mdg	51.68	2 84	0.26	0.06	1.34
24	5 (1)	do do	do	light grey A, mdg	45.96	9.20	0.41	0.48	2.13
25	5 (2)	do do	dolomite	dark grey A, fng	22.94	24.54	1.07	1.16	10.01
26	6 (1)	do do	limestone	light grey A, mdg	42.25	17.52	0.40	0.77	1.56

No.	Sample No.	Location	Rock Name	Occurrence	CaO %	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	MgO %
27	RA- 6(2)	Rocha Mine 308mL	dolomite	dark grey A, mdg	22.66	13.44	1.45	1.49	14.54
28	7(1)	do do	limestone	light grey A, mdg	47.84	6.72	0.38	0.17	1.66
29	7(2)	do do	dolomite	dark grey A, mdg	19.12	26.10	1.51	1.39	12.72
30	8	do do	do	grey D_1, mdg	24.01	14.40	2.13	1.45	15.62
31	10	do do	do	light grey D_1, mdg	19.19	27.22	2.21	2.67	13.36
32	12	do do	do	light grey D_1, mdg	16.38	34.90	2.04	1.37	11.04
33	14	do do	do	grey D_1, mdg	23.54	7.48	3.24	2.09	16.62
34	16	do do	do	grey D_2, mdg	24.91	8.04	2.69	2.12	17.93
35	17	do do	do	light grey D_2, mdg	22.42	15.74	2.40	3.16	14.20
36	18	do do	do	dark grey D_2, mdg	20 82	18.92	2.78	3.28	14.22
37	19	do do	do	dark grey D_2, mdg	24.01	18.30	1.47	0.45	15.75
38	20	do do	do	dark grey D_2, mdg	20.67	23.54	1.03	2.30	13.96
39	21	do do	do	dark grey D_2, mdg	25.58	16.64	0.71	0.30	16.14
40	RB- 1	do 403mL	do	grey A, mdg	33.59	12.80	1.23	1.65	9.25
41	2	do do	limestone	grey L, mdg	50.89	2.90	0.42	0.17	1.64
42	3	do do	dolomite	light grey A, mdg	18.58	28.00	2.27	2.24	13.41
43	4	do do	do	light grey D_1, mdg	16.72	29.96	2.23	3.90	13.65
44	RB- 5	do do	do	grey D_1, mdg	26.93	4.26	0.44	0.13	20.63
45	6	do do	do	grey D_1, mdg	26.97	9.30	0.78	0.92	17.62
46	7	do do	do	grey A, mdg	33.73	8.54	0.46	0.19	14.30
47	8	do do	do	grey D_2, mdg	23.25	20.66	1.29	1.04	15.54
48	9	do do	do	light grey D_2, mdg	20.42	27.76	2.13	2.93	11.16
49	10	do do	do	light grey D_2, mdg	22.22	17.66	2.53	2.18	16.02
50	RC- 1	near Rocha Mine	limestone	grey L, mdg	45.19	7.96	0.94	3.23	2.68
51	2	do	limestone	white L, mdg	31.64	17.96	1.29	1.03	8.54

Table A-7 Result of Chemical Analysis of Geochemical Samples in Perau Area

Sample No	Sampling Point	Cu(ppm)	Pb(ppm)	Zn(ppm)	Co(ppm)	Ni(ppm)	Mn(ppm)
1	A-18	40	18	65	24	12	1500
2	18.5	50	14	45	14	17	820
3	19	110	12	100	50	55	2500
4	19.5	40	18	55	24	26	1700
5	20	40	14	95	28	35	2500
6	20.5	60	10	80	16	35	1200
7	21	80	28	70	10	24	840
8	21.5	65	24	55	13	19	540
9	22	30	6	75	24	35	980
10	22.5	40	26	40	40	18	1900
11	23	65	6	90	23	30	1800
12	B-19	35	12	60	29	35	2000
13	19.5	210	30	80	30	14	1500
14	20	120	50	120	30	7	2900
15	20.5	18	6	85	20	28	1600
16	21	45	22	27	29	14	2300
17	21.5	65	22	40	7	26	400
18	22	16	22	15	5	3	240
19	22.5	45	6	40	15	18	360
20	23	95	16	55	30	70	1100
21	23.5	50	22	35	22	35	400
22	24	45	8	45	27	28	1200
23	C-19	75	30	80	35	50	780
24	19.5	45	50	95	24	35	2300
25	20	100	26	80	19	45	1800
26	20.5	13	20	35	17	20	2200
27	21	28	20	50	15	19	2100
28	21.5	15	24	30	6	11	780
29	22	40	40	35	16	7	2300
30	22.5	30	24	12	3	3	55
31	23	40	55	25	4	5	75
32	23.5	35	14	11	3	4	60
33	24	50	28	26	4	14	75
34	24.5	40	12	16	6	11	200
35	25	110	8	35	30	70	660

Sample No.	Sample Point	Cu(ppm)	Pb(ppm)	Zn(ppm)	Co(ppm)	Ni(ppm)	Mn(ppm)
36	D-19	27	60	26	7	10	280
37	19.5	24	50	29	4	6	200
38	20	16	50	45	8	12	460
39	20.5	13	45	29	5	4	280
40	21	45	45	45	3	10	380
41	21.5	11	30	17	3	6	40
42	22	10	30	15	3	6	28
43	22.5	50	40	27	3	12	100
44	23	50	12	21	10	23	170
45	23.5	20	5	35	22	50	460
46	24	80	10	45	30	55	820
47	24.5	29	5	28	20	30	2000
48	E-16	30	16	85	30	23	3000
49	16.5	18	8	35	10	8	460
50	17	8	24	15	17	3	800
51	17.5	65	35	35	7	12	380
52	18	45	40	75	21	28	1700
53	18.5	65	140	390	15	20	2000
54	19	75	80	220	9	17	1000
55	19.5	55	40	55	5	10	280
56	20	60	40	55	7	12	280
57	20.5	65	22	40	4	8	740
58	21	60	30	35	7	8	3600
59	21.5	50	40	20	4	7	60
60	22	45	35	19	4	6	60
61	F-13	65	14	55	25	35	1800
62	13 5	60	16	65	30	40	2100
63	14	45	30	80	26	28	1300
64	14.5	60	22	65	22	29	1200
65	15	80	30	70	40	35	1900
66	15.5	40	60	50	29	22	1600
67	15.8	75	100	90	30	26	1300
68	17	70	18	8	3	5	120
69	17.5	45	24	8	3	6	95
70	18	29	50	10	3	3	30

Sample No	Sample Point	Cu(ppm)	Pb(ppm)	Zn(ppm)	Co(ppm)	Ni(ppm)	Mn(ppm)
71	G-12	15	22	40	13	12	800
72	12.5	40	16	85	15	24	520
73	13	12	28	40	24	19	1500
74	13.5	65	45	50	40	27	1800
75	14	95	150	70	45	45	2300
76	15	2400	10000	4500	440	290	1900
77	16	600	3500	360	100	70	1300
78	16.5	45	75	29	8	8	460
79	17	22	12	6	3	3	60
80	H-11	45	16	26	4	14	50
81	11.5	45	18	30	5	78	45
82	12	30	14	50	18	25	200
83	12.5	24	26	45	13	16	360
84	13	80	140	95	29	40	3700
85	13.5	580	95	50	50	50	3800
86	14	45	12	7	4	4	80
87	14.5	70	30	16	3	6	40
88	15	75	40	10	3	4	35
89	15.5	55	24	21	4	5	220
90	16	140	30	25	6	7	400
91	I- 10	17	12	55	16	20	1500
92	10 5	9	6	30	9	11	740
93	11	27	20	85	23	30	2700
94	11.5	35	16	120	26	35	3700
95	12	35	30	120	24	35	2600
96	12 5	170	10	27	9	7	940
97	13	400	14	26	9	11	880
98	13.5	410	26	40	11	15	1100
99	14	1000	22	45	13	15	1300
100	14.5	95	40	95	28	35	1400
101	15	35	12	55	17	27	760
102	J- 14	85	26	50	29	45	2000
103	15	23	40	65	24	18	1000
104	16	75	10	26	11	11	1000
105	17	90	22	45	40	27	5700

Sample No	Sample Point	Cu(ppm)	Pb(ppm)	Zn(ppm)	Co(ppm)	Ni(ppm)	Mn(ppm)
106	J- 18	90	18	40	30	20	3200
107	19	130	24	85	27	35	5000
108	20	80	35	45	50	25	4900
109	21	55	18	20	40	13	3400
110	22	27	12	12	25	8	2200
111	23	65	18	18	55	16	3900
112	24	110	14	13	40	14	2300
113	25	150	16	20	75	10	4000

Table A-8 Result of Factor Analysis of Geochemical Data in Perau Area

Sample No	Factor Score	
	Factor 1	Factor 2
1	4352	−3660
2	1818	−3923
3	1.4868	−.2030
4	.7102	−4457
5	1 1269	−.5423
6	1.3333	−7893
7	1132	.3890
8	−.0022	1893
9	9634	−1.1171
10	.6521	−3376
11	1 0606	−7968
12	1 0302	−7870
13	.4315	.7666
14	3587	8448
15	.9985	−1.3827
16	4597	−4903
17	−2290	1341
18	−1 3704	−6198
19	1611	−.8855
20	1.0076	−0860
21	.2587	−.1065
22	8083	−9099
23	.7996	3468
24	7828	.3405
25	.7942	3049
26	5079	−1.0306
27	.4689	−5641
28	−4164	−.6432
29	−.0609	−456
30	−2 0312	−050
31	−1.7136	7013
32	−1.8175	−.3758
33	−1.2130	3654
34	−.7989	−.5718
35	9223	−.4914
36	−.9138	.3248
37	−1 3158	2839
38	−.5071	0145
39	−1 2433	−.1273
40	−.9841	.5313
41	−1 8123	−2712
42	−1.9281	−2923
43	−1.3560	.5787
44	−.3641	−4243
45	7664	−1.5012
46	.9100	−4634
47	8931	−1 5937
48	1.0155	−6440
49	−.2457	−1 1582
50	−.6102	−1 1579
51	−6364	4193
52	.5781	.2002
53	4212	1.5889
54	.0022	1.3019
55	−.8358	.6148
56	−.6585	.6286
57	−.6723	.1036

Sample No	Factor Score	
	Factor 1	Factor 2
58	−.1368	−0546
59	−1 6404	.5745
60	−1.6724	.4313
61	8765	−.3959
62	1.0353	−3457
63	6513	0621
64	5975	−0294
65	.9330	2042
66	.4338	.2914
67	.4267	1 0839
68	−1 6919	−.0864
69	−1.7319	−0792
70	−2.3794	.4304
71	−.0390	−6829
72	3050	−1923
73	4647	−7841
74	.6886	.2920
75	7741	1 2584
76	1 9471	6 3162
77	6315	4 5525
78	−.8590	6518
79	−1.9813	−8381
80	−1 2024	0252
81	−1.0625	.1316
82	.0647	−4116
83	−1437	−2132
84	.7872	1 1708
85	9399	1.6429
86	−1.7032	−5347
87	−1.9002	.5789
88	−2.2295	.7033
89	−1.2973	1151
90	−.9288	.6098
91	.5626	−1 0494
92	0178	−1.7774
93	.9468	−.5242
94	1.2287	−.5167
95	.9757	−.0594
96	−.3239	−1337
97	−.2945	.4693
98	−1037	.9266
99	.0190	1.2309
100	.7174	.6155
101	4759	−.6174
102	.8880	0644
103	.3264	−.0667
104	−0515	−5595
105	1.1148	−.2134
106	7728	−2545
107	1.1204	.2163
108	1.0330	.0351
109	6276	−.6802
110	.1936	−1.2890
111	.8216	−.6764
112	.4908	−.5657
113	.7798	−3469