Table II—15 Specifications of Diamond Bits

Size	Type	Carats per bit	Matrix	Stones per carat	Water way	Number	Remark
HX	HQ-WL	40	Z	1/35	6	H-535	Reset
		〃	〃	〃	〃	H-536	〃
		〃	〃	〃	〃	H-537	〃
		〃	〃	〃	〃	H-538	〃
		〃	Y	〃	〃	F-1010	〃
		〃	〃	〃	〃	F-1011	〃
		〃	〃	〃	〃	F-1012	〃
		〃	〃	〃	〃	F-1013	〃
		〃	T1	〃	〃	01	〃
		〃	〃	〃	〃	02	〃
		〃	〃	〃	〃	03	〃
		〃	〃	〃	〃	04	〃
		〃	〃	〃	〃	05	〃
		35	〃	〃	〃	H-31	〃
		〃	〃	〃	〃	H-32	〃
		〃	〃	〃	〃	H-33	〃
		〃	〃	〃	〃	H-34	〃
NX	NQ-WL	30	Z	1/35	6	E-2520	〃
		〃	〃	〃	〃	E-2521	〃
		〃	〃	〃	〃	E-2523	〃
		〃	〃	〃	〃	E-2524	〃
		〃	〃	〃	〃	E-2525	〃
		〃	Y	〃	〃	F-1016	〃
		〃	〃	〃	〃	F-1017	〃
		〃	〃	〃	〃	F-1018	〃
		〃	〃	〃	〃	F-1019	〃
		〃	〃	〃	〃	F-1020	〃
		〃	〃	〃	〃	F-1021	〃
		〃	T1	1/40	〃	N-2	〃
		〃	〃	〃	〃	N-3	〃
		〃	〃	〃	〃	N-4	〃
		〃	〃	〃	〃	N-5	〃
		〃	〃	〃	〃	010	〃
		〃	〃	〃	〃	011	〃
		〃	〃	〃	〃	012	〃
		〃	〃	〃	〃	013	〃
		〃	〃	〃	〃	014	〃
BX	BQ-WL	20	Z	1/35	4	F-1030	〃
		〃	〃	〃	〃	F-1031	〃
		〃	〃	〃	〃	F-1032	〃
		〃	〃	〃	〃	F-1033	〃
		〃	〃	〃	〃	F-1034	〃
		〃	〃	〃	〃	F-1035	〃
		〃	〃	〃	〃	H-541	〃
		〃	〃	〃	〃	H-542	〃
		〃	〃	〃	〃	H-543	〃
		〃	〃	〃	〃	H-544	〃
		〃	〃	〃	〃	H-545	〃
		〃	〃	〃	〃	H-546	〃
		〃	〃	〃	〃	H-547	〃
		〃	〃	〃	〃	H-548	〃
		〃	〃	〃	〃	H-549	〃

Table II-15 Specifications of diamond bits (continued)

Size	Type	Carats per bit	Matrix	Stones per carat	Water way	Number	Remark
	BQ-WL	20	Z	1/35	4	H-550	Reset
		"	T3	1/40	"	H-841	"
		"	"	"	"	H-842	"
		"	"	"	"	H-843	"
		"	"	"	"	H-844	"
		"	"	"	"	H-845	"
BX		"	"	"	"	H-846	"
		"	"	"	"	H-847	"
		"	"	"	"	H-848	"
		"	"	"	"	H-849	"
		"	"	"	"	H-850	"
		18	C	1/35	"	174565	"
		"	"	"	"	174566	"
		"	"	"	"	174567	"

Fig. Ⅱ-1 NO.54-1 PROGRESS RECORD OF DIAMOND DRILLING

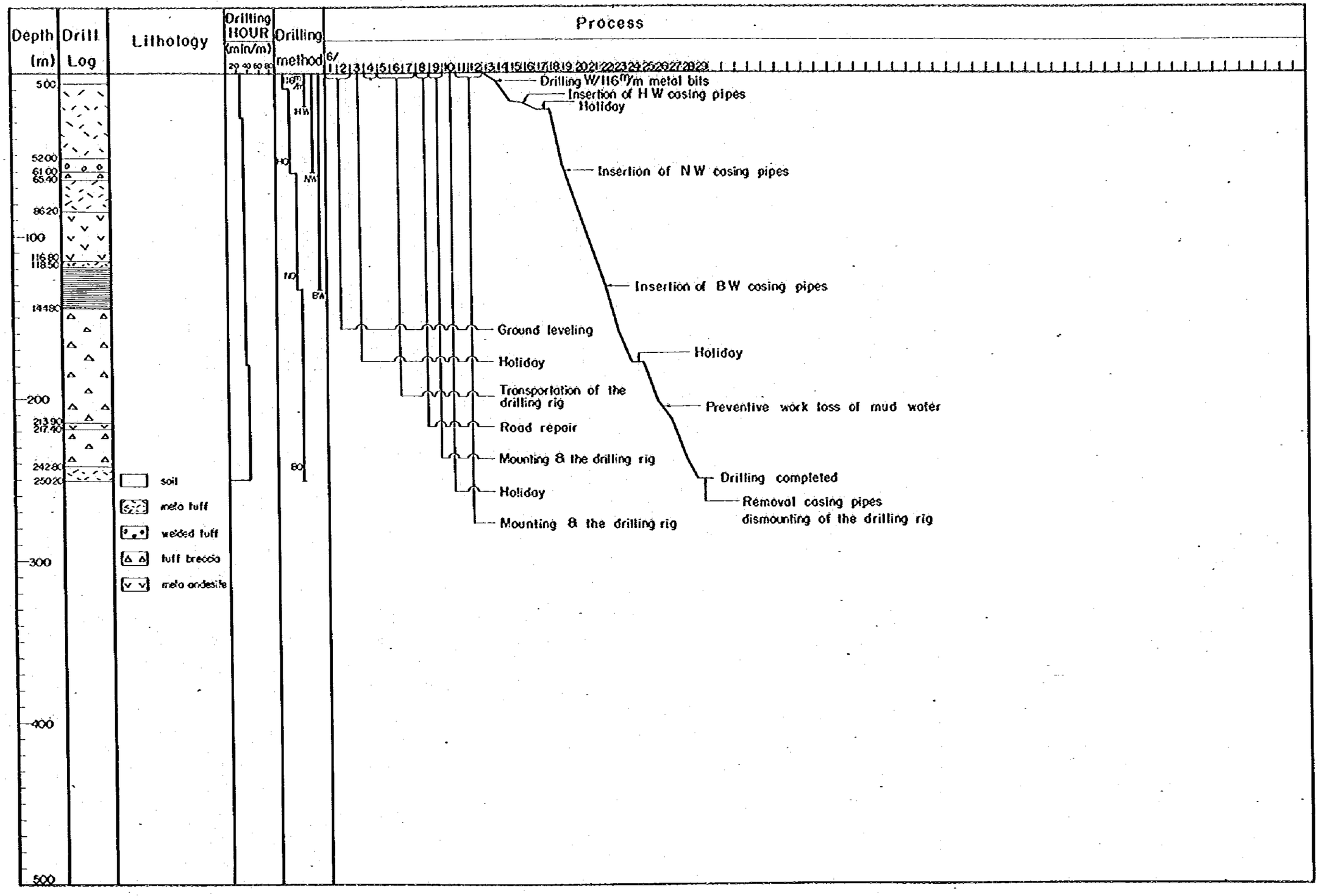


Fig. II-2 NO.54-2 PROGRESS RECORD OF DIAMOND DRILLING

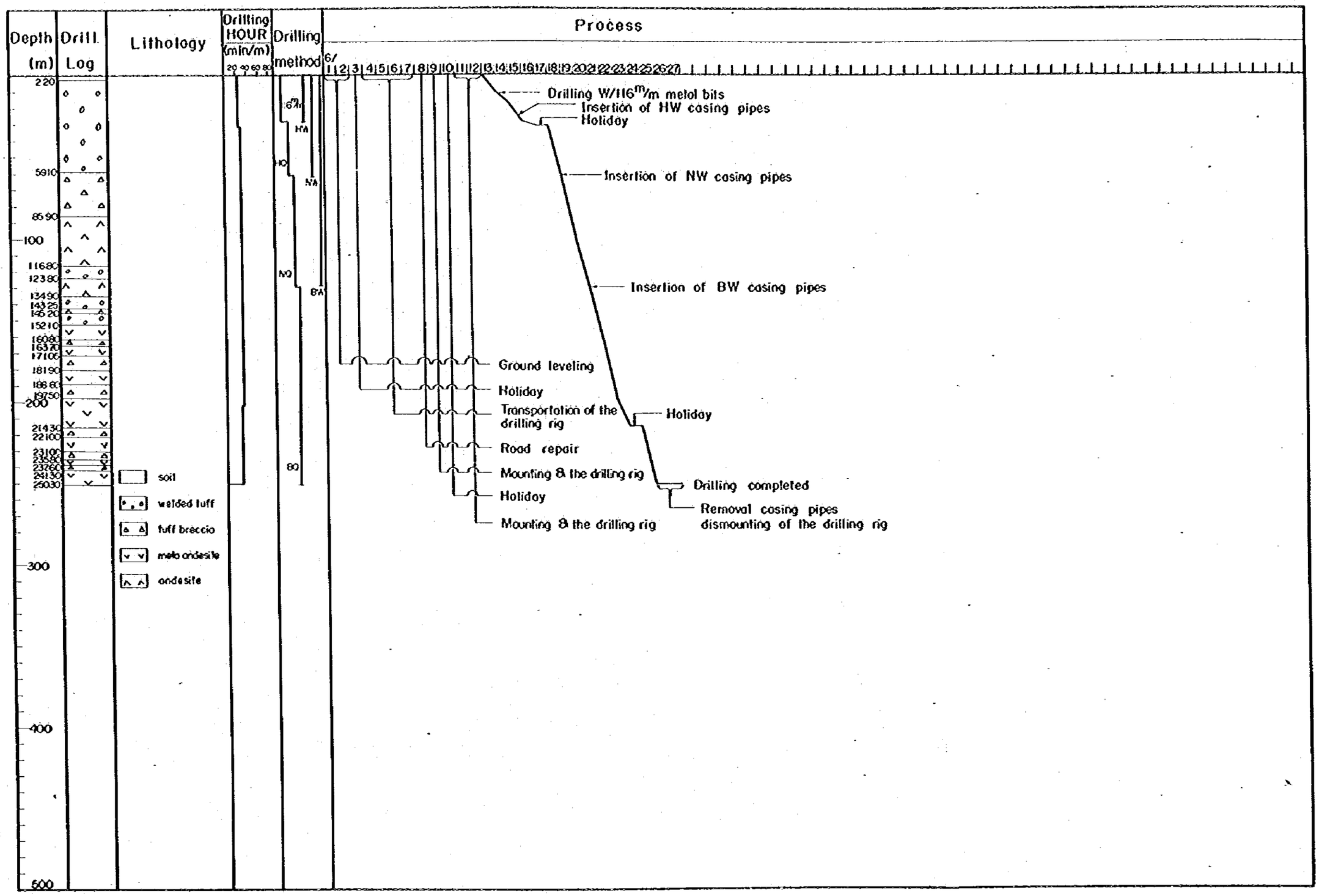


Fig. II-3 NO.54-3 PROGRESS RECORD OF DIAMOND DRILLING

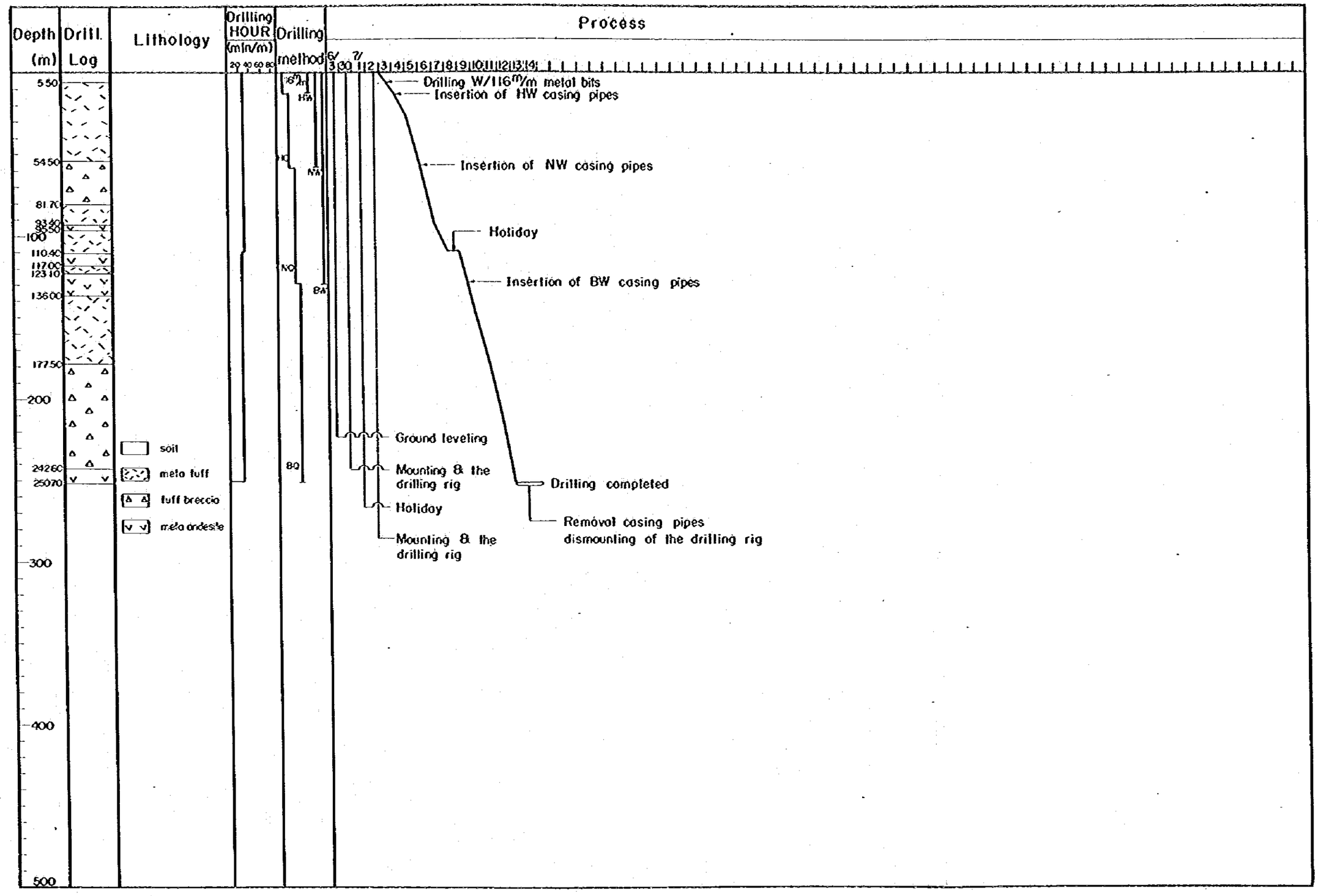


Fig. II-4 NO.54-4 PROGRESS RECORD OF DIAMOND DRILLING

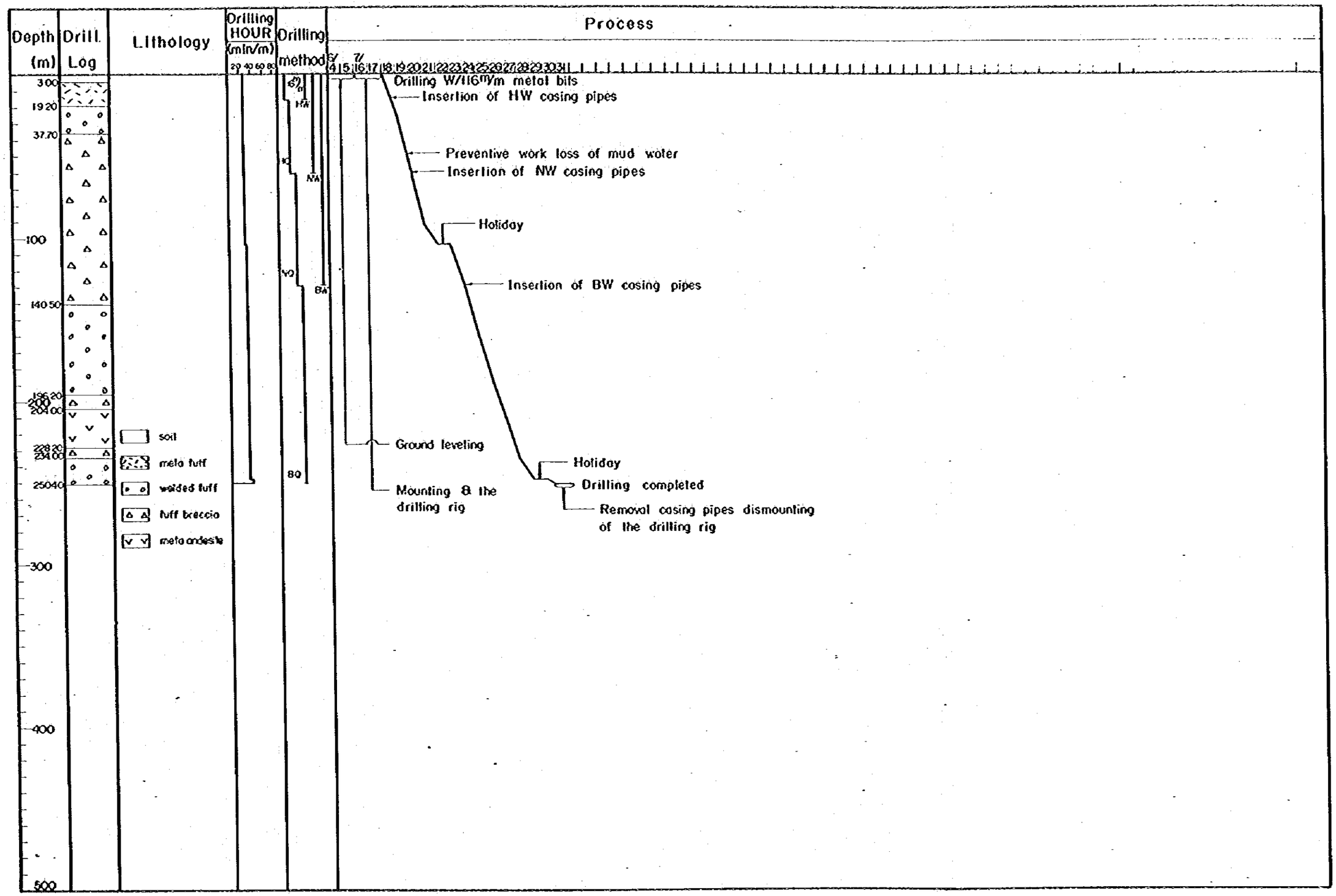


Fig. II-5 NO.54-5 PROGRESS RECORD OF DIAMOND DRILLING

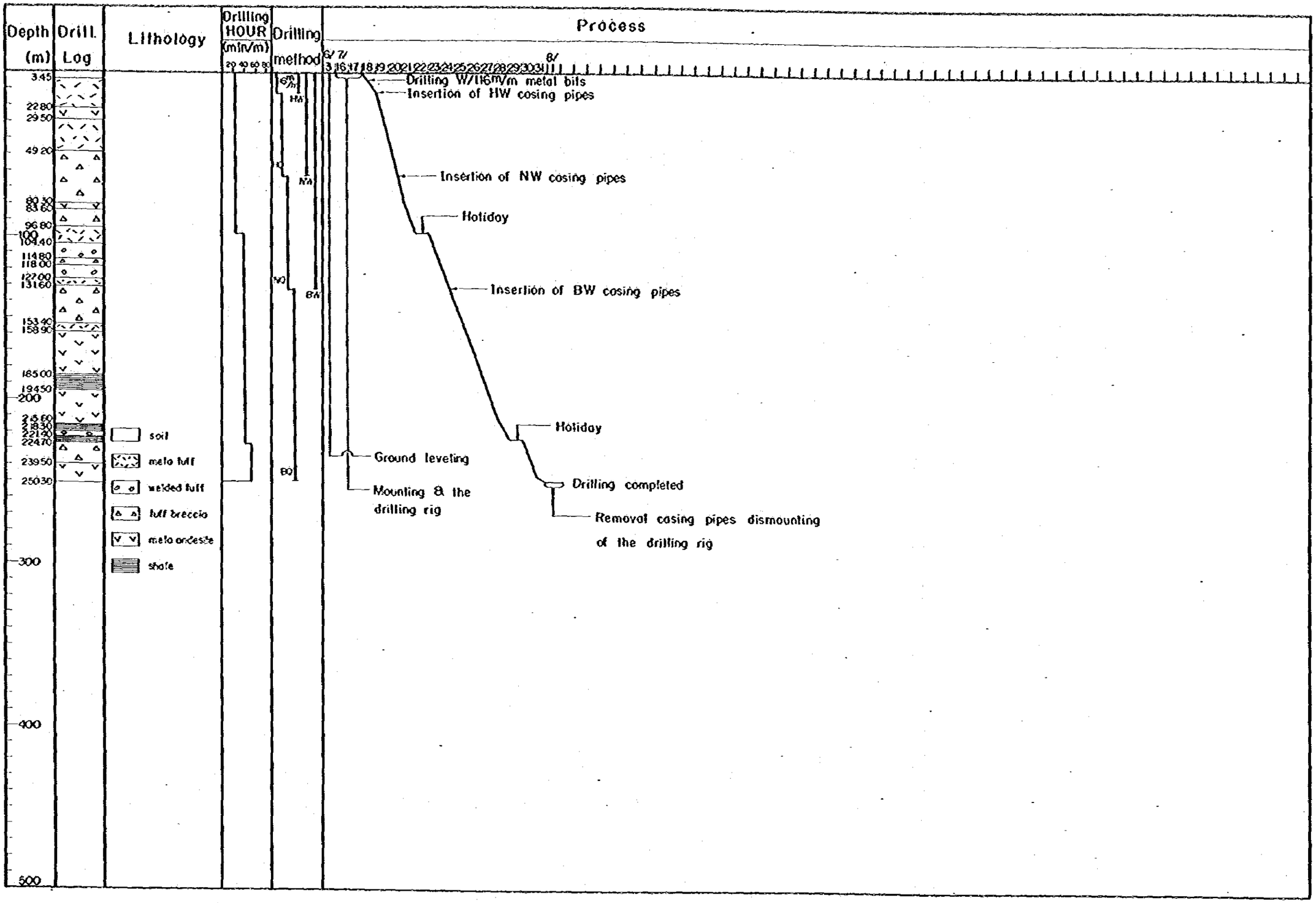


Fig. II-6 NO.54-6 PROGRESS RECORD OF DIAMOND DRILLING

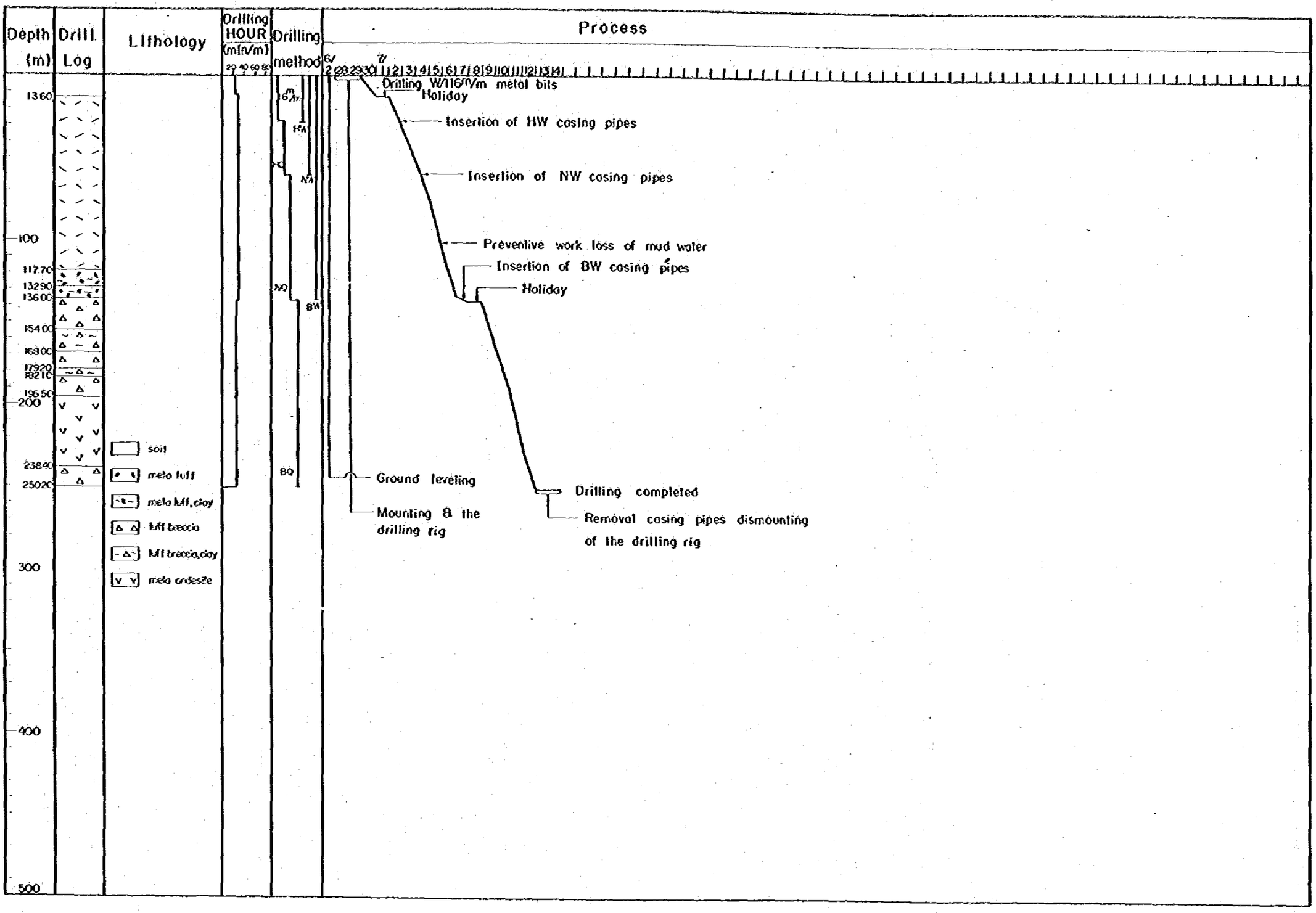


Fig. Ⅱ-7 NO.54-7 PROGRESS RECORD OF DIAMOND DRILLING

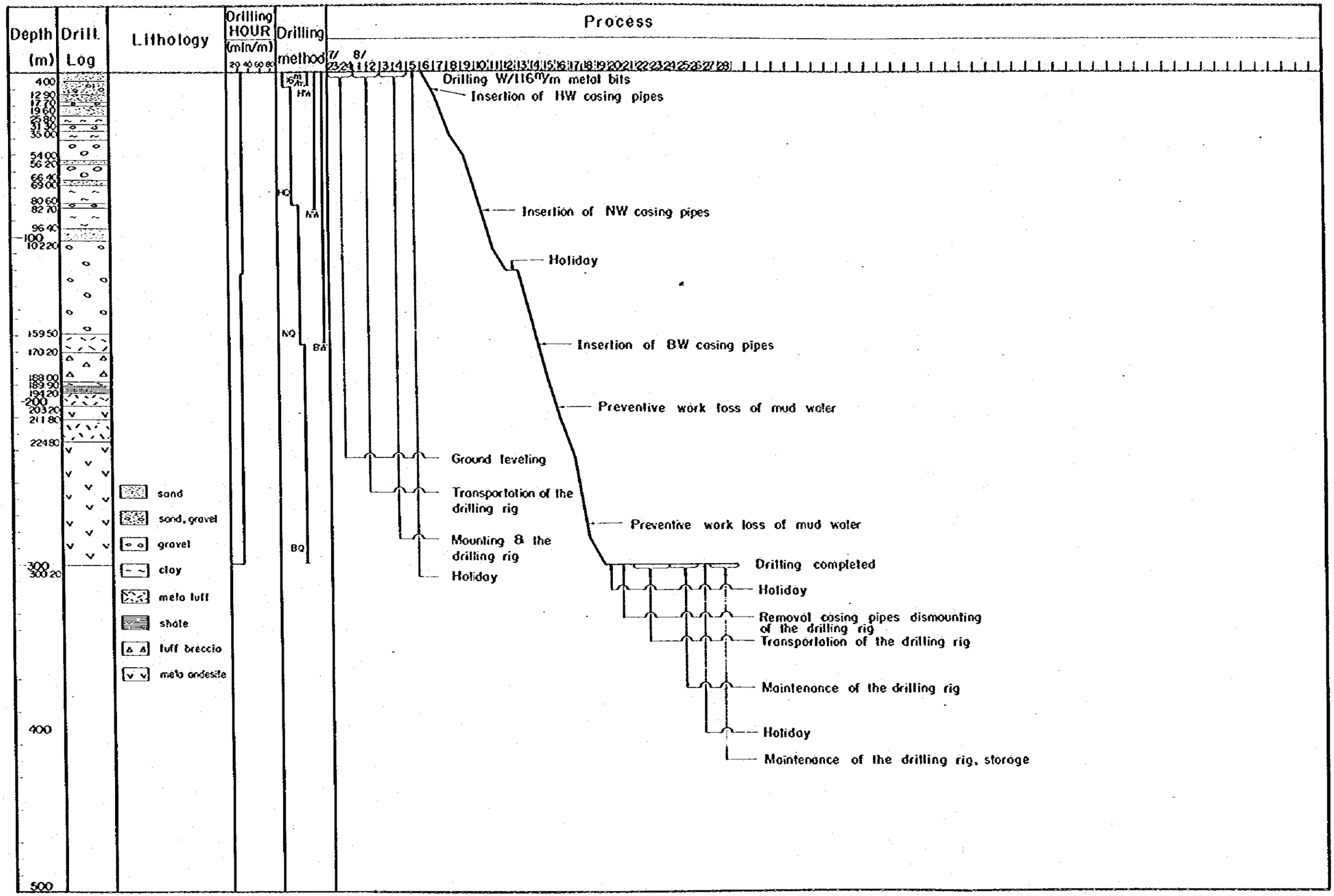


Fig. II-8 NO.54-8 PROGRESS RECORD OF DIAMOND DRILLING

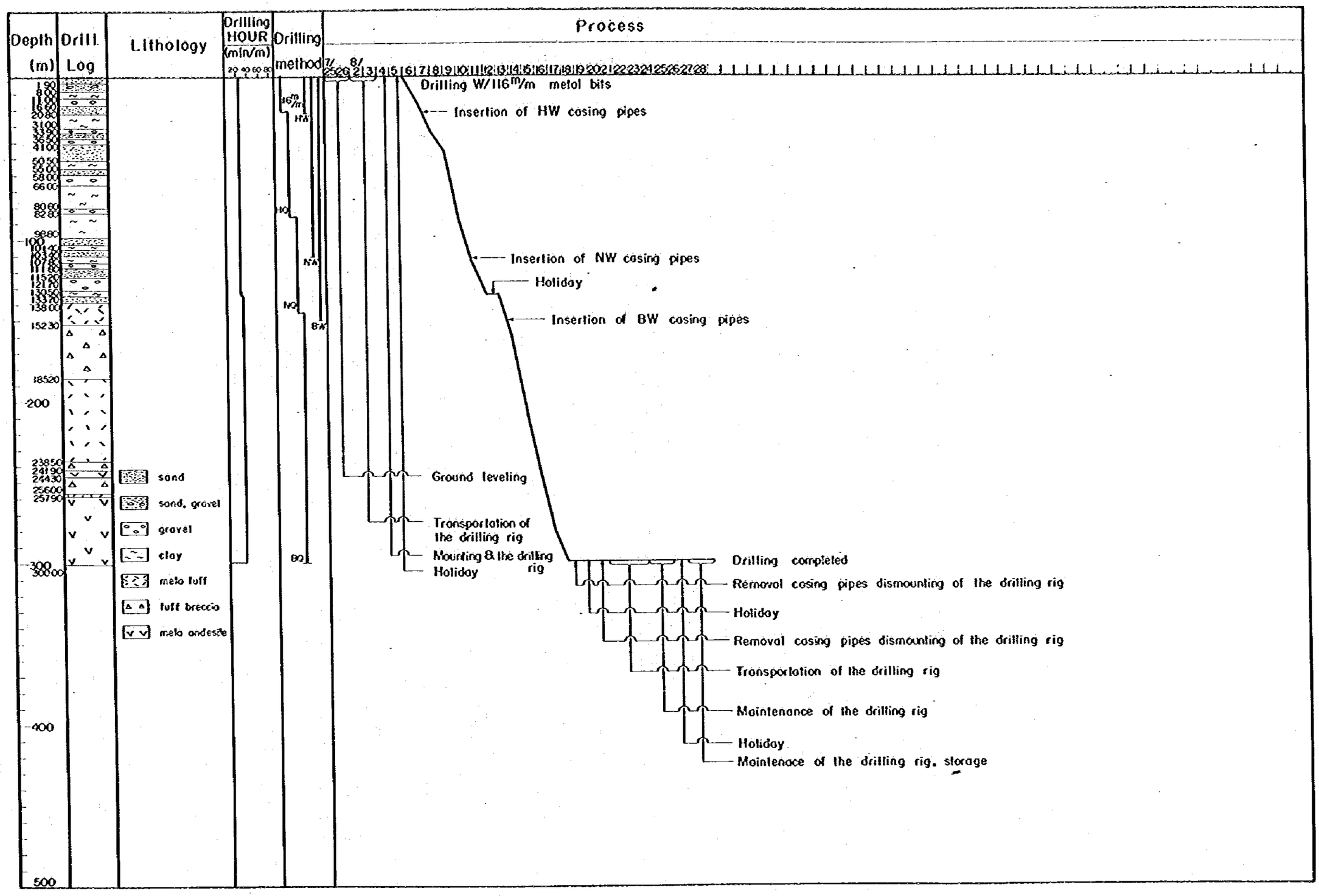
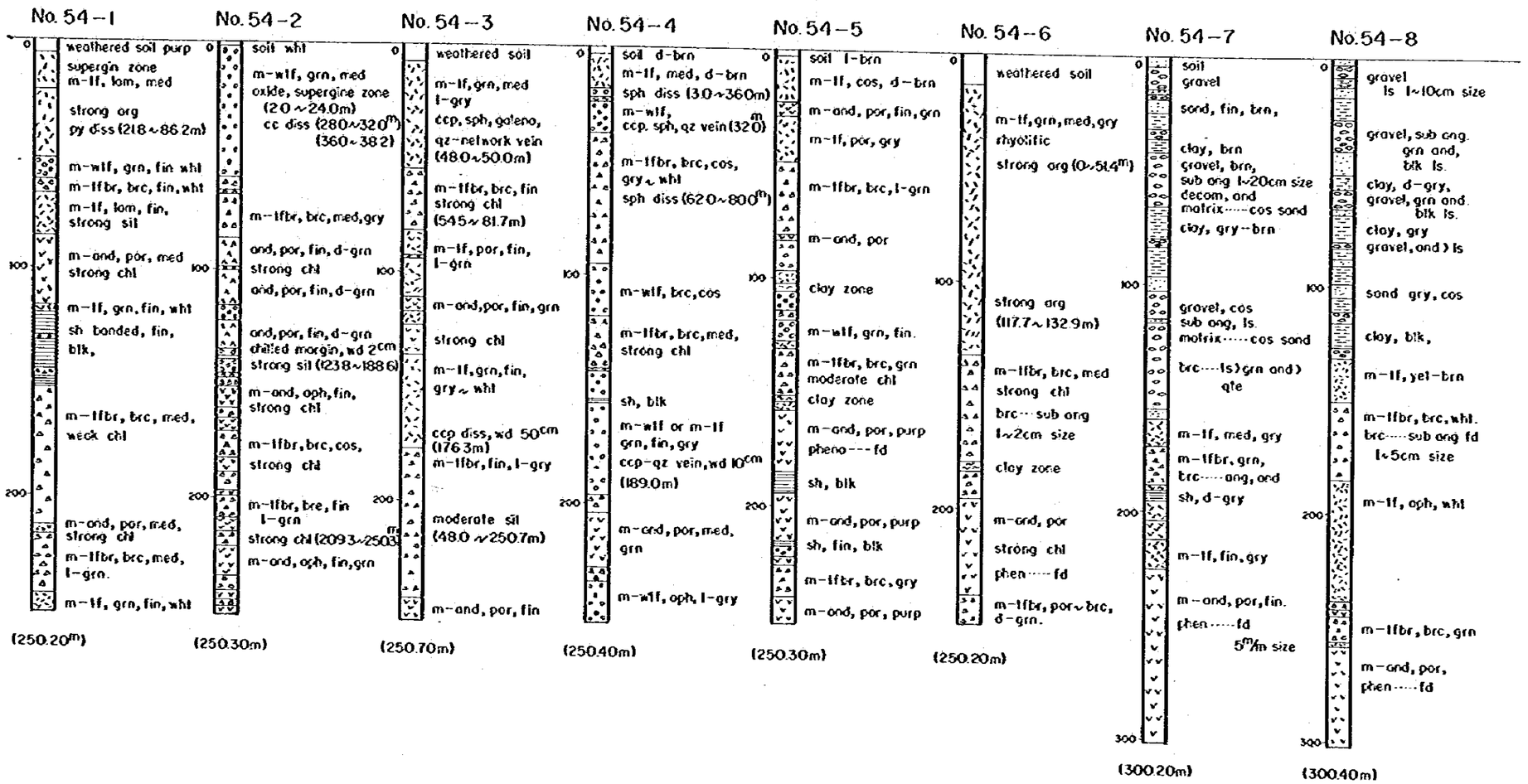


Fig. II – 9 SUMMARY OF CORE LOG IN THE VUELTAS DEL RIO SECTOR

(No. 54 – 1 ~ No. 54 – 8) 1979 year



IN

Symbol & Original Rock

	soil	soil
	clay	clay
	gravel	gravel
	sand	sand
	m-lf.	meta l
	m-lfbr.	meta l
	m-wlf.	meta w
	sh.	shale &
	mt-and.	meta or
	por-and.	porphyri
		clay zo

Texture

oph. --- ophonitic
brc. --- brecciated
grn. --- granular
lam. --- lamella
por. --- porphyritic

Grain Size

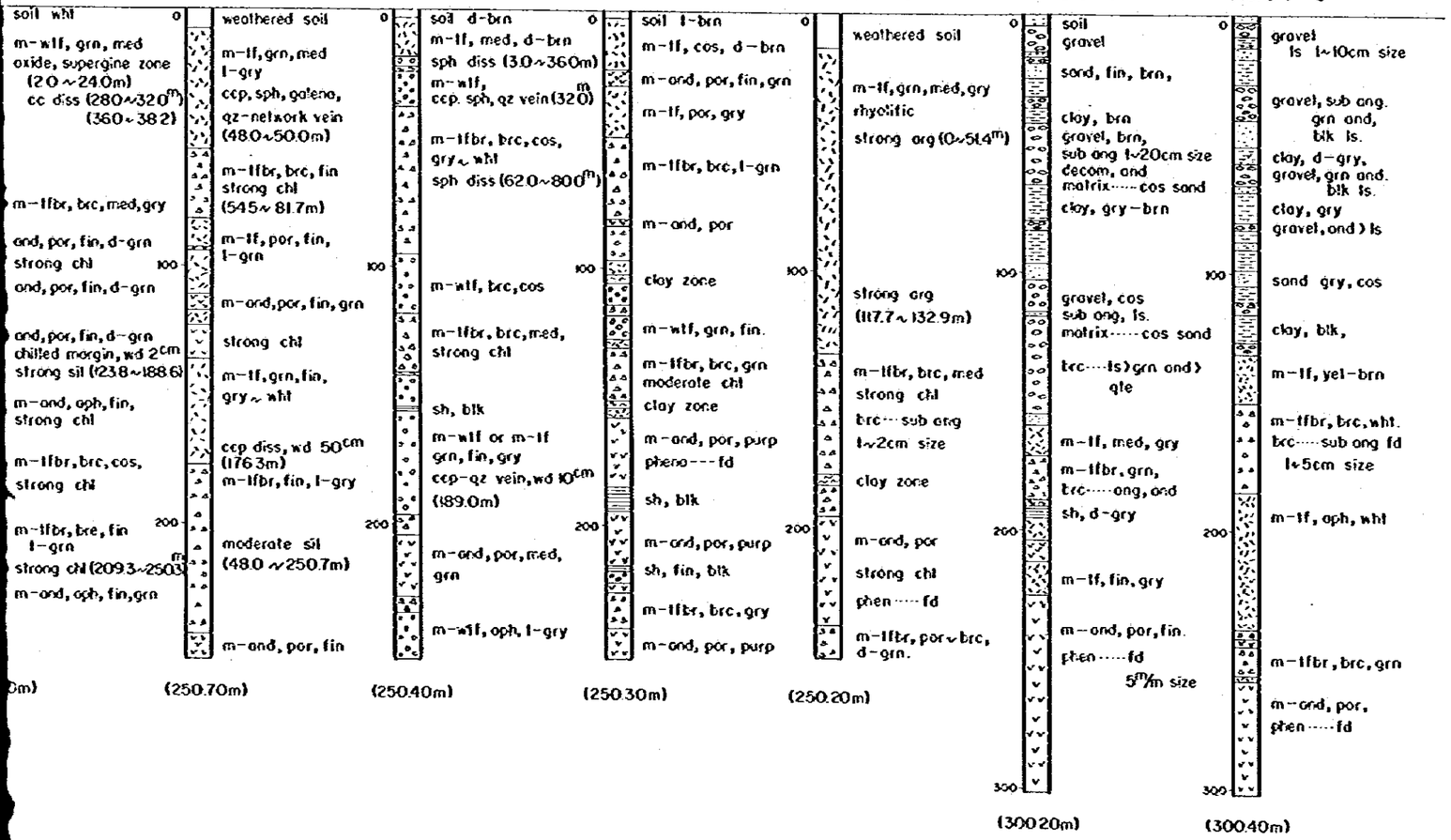
fin. --- fine grain
med. --- medium grain
cos. --- coarse grain

0 50

Fig. II – 9

SUMMARY OF CORE LOG IN THE VUELTAS DEL RIO SECTOR

(No. 54 – 1 ~ No. 54 – 8) 1979 year



INDEX

Symbol & Originol Rock

	soil	soil
	clay	clay
	gravel	gravel
	sand	sand
	m-tf.	meta tuff
	m-lfbr.	meta tuffbreccia
	m-wlf.	meta welded tuff
	sh.	shale & muddy tuff
	mt-and.	meta andesite
	por-and.	porphyrite & andesite
		clay zone

Texture

oph. --- ophanitic
brc. --- brecciated
grn. --- granular
lam. --- lamella
por. --- porphyritic

Grain Size

fin. --- fine grain
med. --- medium grain
cos. --- coarse grain

Phenocryst

cal. --- calcite
chl. --- chlorite
cly. --- clay
fd --- feldspar
hb. --- hornblende
qz. --- quartz

Color

d. --- dark
l. --- light
blk. --- black
brn. --- brown
grn. --- green
gry. --- grey
purp. --- purple
wht. --- white
yel. --- yellow

0 50 100 150 200m

APPENDICES

A. I—1 List of Rock Samples

Sample No.	Location			Rock Name	Thin Section	Polished Section	X-ray	Remarks
	X	Y	No. of Sketch Map					
S031	300 + 33.66	1600 + 82.28	PL.I-3-2	Tuff breccia		○	○	
S032	33.21	82.44	PL.I-3-1	Andesite	○			
S035	33.13	82.40	PL.I-3-1	Chalcopyrite in quartz vein		○	○	
TM6	33.16	82.40	PL.I-3-1	Quartz limonite vein			○	
TM7	33.12	82.40	PL.I-3-1	Quartz limonite vein		○	○	
TM12	33.34	82.46	PL.I-3-1	Altered tuff			○	
TM13	33.34	82.46	PL.I-3-1	Altered tuff		○	○	
TM33	33.76	82.38	PL.I-3-2	Quartz limonite vein			○	
TM45	33.20	81.84	PL.I-3-3	Quartz limonite vein		○	○	
T7	33.12	82.35	PL.I-3-1	Soil			○	
T43	32.93	82.22	PL.I-3-1	Soil			○	

A. I - 1 List of Rock Samples (continued)

Sample No.	Location		Rock Name	Thin Section	Polished Section	X-ray	Remarks
	DDH. No.	Depth m					
1014	54-1	14	Meta tuff			O	
1040	54-1	40	Altered andesitic tuff	O		O	
1135	54-1	135	Calcaleous shale	O			
1160	54-1	160	Tuff breccia	O			
1215	54-1	215	Meta dacite	O			
1248	54-1	248	Chalcopyrite in meta tuff		O		
2010	54-2	10	Meta welded tuff			O	
2043	54-2	43	Dacitic tuff (welded tuff)	O		O	
2066	54-2	66	Meta porphyrite	O			
2087	54-2	87	Meta porphyry	O			
2143	54-2	143	Altered dacitic tuff (welded tuff)	O			
2170	54-2	170	Meta andesite	O			
2210	54-2	210	Meta andesite	O			
3020	54-3	20	Meta tuff or Meta welded tuff			O	
3042	54-3	42	Altered dacitic tuff	O		O	
3054	54-3	54	Calcareous tuff breccia	O			
3086	54-3	86	Meta dacite	O			
3176	54-3	176	Chalcopyrite in altered tuff	O	O		
3196	54-3	196	Tuff breccia	O			
3248	54-3	248	Meta andesite breccia	O			
4010	54-4	10	Meta tuff			O	

A. I - 1 List of Rock Samples (continued)

Sample No.	Location		Rock Name	Thin Section	Polished Section	X-ray	Remarks
	DDH. No.	Depth m					
4083	54-4	83	Tuff breccia	O			
4109	54-4	109	Tuff breccia	O	O	O	
4160	54-4	160	Altered tuff	O			
4189	54-4	189	Meta tuff or welded tuff		O		
4210	54-4	210	Meta andesite	O			
5010	54-5	10	Meta tuff			O	
5029	54-5	29	Meta andesite	O			
5036	54-5	36	Altered dacitic tuff	O		O	
5062	54-5	62	Tuff breccia	O			
5082	54-5	82	Meta andesite	O			
5161	54-5	161	Meta andesite	O			
5192	54-5	192	Calcareous shale	O			
5228	54-5	228	Tuff breccia	O			
6006	54-6	6	Soil			O	
6063	54-6	63	Altered dacitic tuff	O			
6138	54-6	138	Altered tuff breccia	O			
6213	54-6	213	Andesite	O			
6243	54-6	243	Tuff breccia	O			
7165	54-7	165	Altered tuff	O			
7173	54-7	173	Meta tuff breccia	O	O		
7192	54-7	192	Taffaceous shale	O			

A. I - 1 List of Rock Samples (continued)

Sample	Location		Rock Name	Thin Section	Polished Section	X-ray	Remarks
	DDH. No.	Depth m					
7220	54-7	220	Altered rhyolitic tuff	O			
7242	54-7	242	Meta andesite	O			
7279	54-7	279	Meta andesite	O			
8180	54-8	180	Meta quartz latite	O			
8221	54-8	221	Altered rhyolitic tuff	O			
8241	54-8	241	Tuff breccia		O		
8242	54-8	242	Meta andesite	O			

A. I—2 Microscopic Observations (Thin Sections)

Sample No.	Location	Rock Name	Microscopic Observation
S032	Vueltas del Rio	Highly altered andesite	The completely decomposed feldspar crystals give the rock spotted appearance. Under the microscope, little remains of the original form of the ferromagnesians, but sericite, saussurite and quartz aggregates remain as pseudomorph of original plagioclase (phenocryst). These aggregates are enclosed in a matrix of chlorite, albite, quartz and epidote. A little leucoxene and some coarse chlorite are shown.
1040	No. 54-1 40m	Altered andesitic tuff	The rock consists of dominant carbonates, altered plagioclase laths, aggregates of ore minerals, and minor quartz set in a cryptocrystalline matrix of quartz, sericite, carbonates, and chlorite. Ore minerals rimmed by small quartz crystals, which are also associated with quartz veins, are fairly abundant.
1135	Vueltas del Rio No. 54-1 135m	Calcareous shale	This rock is composed of carbonate, chlorite, quartz, sericite and carbonaceous matter. Calcite is most abundant (rounded and anhedral, less than 0.3 x 0.3 mm), and surrounded by the aggregates of chlorite and quartz. Quartz (anhedral, less than 0.2 x 0.2 mm) - calcite (anhedral, 0.6 x 0.3 mm) vein is observed in the rock, which is about 1 mm in width.
1160	Vueltas del Rio No. 54-1 160m	Calcareous tuff breccia	The rock is made up of many volcanic fragments, the outline of which is still discernible despite high carbonitization and silicification of the matrix. Most of rock fragments are various type of intermediate volcanics such as andesite and dacite. Mafic minerals (both in fragments and matrix) are completely altered to chlorite, and other secondary minerals. Minor amounts of clasts or sedimentary fragments (chert) are also observed.
1215	Vueltas del Rio No. 54-1 215m	Meta-dacite	Phenocrysts of slightly sericitized plagioclase and chips of albitized plagioclase and quartz occur in a fine-grained matrix of quartz, feldspar, chlorite and rutile. Small euhedral grains of opaque minerals are rare, while no mafic minerals are seen.

Sample No.	Location	Rock Name	Microscopic Observation
2043	Vueltas del Rio No. 54-2 43m	Altered dacitic tuff	Phenocrysts of plagioclase and mafic minerals altered completely to carbonates, sericite, and quartz are set in an altered, fine-grained base of feldspar, carbonates, sericite, chlorite, and quartz. In the groundmass base relict trachytic texture composed of oriented tiny feldspar laths are rarely recognized. Aggregates of ore minerals are fairly abundant.
2066	Vueltas del Rio No. 54-2 66m	Meta-porphyrite	The rock shows typical porphiritic texture. Large plagioclase phenocryst forming glomeroporphiritic clusters (subhedral, less than 2.5 x 1.5 mm, completely altered to saussurite, sericite, and carbonate) are associated with hornblende prisms and flakes of biotite in a matrix of saussuritized feldspar, quartz, magnetite and carbonate. Most of hornblendes are also decomposed to chlorite and other secondary minerals, while biotite are fresh. Accessory minerals are apatite, magnetite and ilmenite.
2087	Vueltas del Rio No. 54-2 87m	Meta-porphyry	The rock is holocrystalline-porphyritic, and common alteration products are sericite, chlorite and pyrite. Phenocrysts of plagioclase (subhedral forms, less than 2.0 x 1.4 mm, completely altered to sericite, saussurite, chlorite and calcite) and chlorite and calcite with opaque recrystalized borders after original ferromagnesians are distributed through a rather coarse matrix of plagioclase, hornblende (Z = light greenish brown, X = pale orange) prisms, biotite flakes, and interstitial quartz. Accessory minerals are apatite and magnetite.
2143	Vueltas del Rio No. 54-2 143m	Altered dacitic tuff	The rock consists almost entirely of fine-grained carbonates, quartz, and opaque dusty materials. No primary igneous minerals and textures are observed. Some quartz grains less than 0.5 mm in size are present. Ore minerals rimmed with small quartz crystals are fairly abundantly disseminated.
2170	Vueltas del Rio No. 54-2 170m	Meta-andesite	Saussurite and albite replacing intermediate plagioclase with hornblende, quartz and carbonate are the main constituents of this rock. Needless or prismatic crystals of hornblende (less than 2 x 0.3 mm) surrounded by felsitic matrix are prevailing. There is a little chlorite, magnetite and apatite.

Sample No.	Location	Rock Name	Microscopic Observation
2210	Vueltas del Rio No. 54-2 210m	Meta andesite	This work is strongly altered andesite. Main constituent minerals are chlorite, sericite (acicular, less than 0.2 x 0.02 mm), plagioclase (less than 0.5 x 0.4 mm), calcite and quartz (anhedral, 0.15 x 0.10 mm). Most of plagioclases are completely replaced by calcite, chlorite, sericite and opaque minerals. Sphene is observed as a minor constituent.
3042	Vueltas del Rio No. 54-3 42m	Altered dacitic tuff	Carbonated and sericitized plagioclase (oligoclase?) crystals of 0.1 to 1 mm in size are set in a fine-grained matrix of quartz, feldspar, sericite, and carbonates showing hornfels-like texture. A small amount of mafic minerals (pyroxenes?) is completely altered into an aggregate of carbonates, chlorite, and opaque minerals.
3054	Vueltas del Rio No. 54-3 54m	Calcareous tuff breccia	The rock has many fragments which are embedded in and permeated by carbonate and small amounts of sericite. Some andesitic fragments constitute micro-phenocrysts of andesine laths and chlorite pseudomorph (after hornblende) in a matrix of glass with microlite. Others constitute of coarser equivalents (in a holochrystalline matrix of feldspar lath, quartz, and chlorite).
3086	Vueltas del Rio No. 54-3 86m	Meta dacite	The rock is composed of dominant sericitized feldspar and subordinate carbonated mafic mineral (pyroxene?) phenocrysts of 0.5 to 1 mm in size set in a fine-grained groundmass of carbonates, chlorite, sericite, and quartz. Ore minerals rimmed with small quartz crystals are fairly abundant. Epidote is also present.
3176	Vueltas del Rio No. 54-3 176m	Altered tuff	The rock consists mainly of fine-grained quartz, carbonates, sericite, and chlorite. Some larger carbonate aggregates (0.1-0.5 mm in size) may be relic of mafic minerals. Rare plagioclase relic and epidote are also observed. Disseminated ore minerals associated with quartz crystals are abundant.
3196	Vueltas del Rio No. 54-3 196m	Tuff breccia	Fragments of sericite-quartz rock and chips of quartz, sericite, titan-mineral, rather abundant pyrite? are embedded in and permeated by calcite. Predominant fine aggregates of sericite through the rock may be alteration products from feldspar.

Sample No.	Location	Rock Name	Microscopic Observation
3248	Vueltas del Rio No. 54-3 248m	Meta andesite breccia	The rock is made up of fragments of altered andesitic lava, some glassy, some porphyritic. Portions of matrix (among fragments), are glassy or feldspathic materials, and are partly carbonatized or silicified. Glassy fragments are composed mainly of laths of plagioclase, up to 0.6 mm in size, in a matrix of glass (replaced by chlorite) and lesser amounts of magnetite. Porphyritic fragments are composed of large subhedral plagioclase quartz chlorite filling amygdales in a pilotaxitic matrix of plagioclase lath, chlorite patches, quartz, magnetite and carbonate.
4083	Vueltas del Rio No. 54-4 83m	Tuff breccia	The rock is dark grey, and contains many lighter grey fragments (pumice) ranging from dust size particles to fragments as much as a few centimeters. Under the microscope, boundaries among particles are almost unidentified due to high silicification and carbonitization through the rock. Most of feldspar crystals are replaced by calcite, sericite and a little iron ore. Rounded quartz phenocrysts may be only original minerals remaining in the confused fine aggregates of quartz, albite, sericite and calcite.
4109	Vueltas del Rio No. 54-4 109m	Tuff breccia	The rock were subjected to conspicuous alteration (silicification and carbonitization) which causes the identification of original texture difficult. Subangular to rounded fragments of coarse-grained quartz-(± sericite) aggregate and sericite patches and carbonate rhombohedron are cemented by finer quartz (cherty materials). Irregular form of opaque minerals among carbonate and quartz assemblages may be pyrite or other iron sulfide.
4160	Vueltas del Rio No. 54-4 160m	Altered tuff	The rock consists almost entirely of fine-grained (less than 0.1 mm in size) carbonates, chlorite, sericite, quartz, and feldspar; no relict igneous minerals and textures are observed. Fine-grained ores (less than 0.5 mm) are occasionally present.

Sample No.	Location	Rock Name	Microscopic Observation
4210	Vueltas del Rio No. 54-4 210m	Meta andesite	Phenocrysts of plagioclase (subhedral, less than 3.1 mm) are completely altered to saussurite or aggregate of sericite and ferromagnesian (euhedral prismatic crystals, less than 2 x 0.4mm, pseudomorph after hornblende?) to chlorite and calcite. Groundmass is also highly altered, and composed of confused aggregates of albite, quartz, chlorite and sericite with accessory iron oxide.
5029	Vueltas del Rio No. 54-5 29m	Meta andesite	Abundant plagioclase and less abundant mafic mineral phenocrysts are set in an altered, fine-grained groundmass composed of carbonates, quartz, sericite, and chlorite. Plagioclase is altered completely to sericite and carbonate, and mafic minerals to carbonate. Apatite is also present. Occasional are minerals are observed.
5036	Vueltas del Rio No. 54-5 36m	Altered dacitic crystal tuff	Completely carbonated, sericitized, and chloritized plagioclase and mafic mineral crystals are set in a fine-grained matrix composed of quartz, sericite, chlorite, and carbonates. Rate quartz fragments of 0.1 - 0.5 mm in size are observed. Apatite of 0.1 to 0.2 mm in diameter is also present.
5062	Vueltas del Rio No. 54-5 62m	Tuff breccia	Igneous rock fragments are separated by streaks of argillaceous or cherty materials and patches of carbonate (a third of the section is occupied by calcite (± quartz vein). Rock fragments are mainly composed of large phenocrysts of albite (subhedral, less than 2.0 x 1.2 mm) and quartz (anhedral, less than 0.9 x 0.6 mm), in a rather coarse matrix of feldspar, quartz, sericite, leucoxene and iron ores.
5082	Vueltas del Rio No. 54-5 82m	Meta dacite (breccia)	Rounded quartz phenocryst (less than 1.3 x 0.9 mm) and subhedral crystals (less than 1.3 x 1.2 mm) and chips of plagioclase are embedded in a matrix of aggregate of feldspar, sericite, quartz with accessory iron oxide and leucoxene. Rutile and considerable carbonate are present. The matrix, highly altered and confused, show traces of a fragmental character.

Sample No.	Location	Rock Name	Microscopic Observation
5161	Vueltas del Rio No. 54-5 161m	Meta andesite	This highly altered green rock have fine reddish grey stripes visible (due to the concentration of ferruginous materials?). Under the microscope, lath or plate (saussurrite and muscovite, pseudomorph after plagioclase) and prismatic crystals (chlorite, magnetite, leucoxene and carbonate, pseudomorph after ferro-magnesians?) are recognizable in a matrix of less clearly defined aggregate of sericite, chlorite, carbonate, magnetite and other secondary minerals.
5192	Vueltas del Rio No. 54-5 192m	Calcareous shale	The rock is composed of an aggregates of carbonate, chlorite, quartz, carbonaceous matter and opaque minerals. Calcite vein is observed in the rock, which is about 0.8 mm in width.
5228	Vueltas del Rio No. 54-5 228m	Tuff breccia	Rock fragments and chips of quartz and sericitized and/or carbonatized feldspar are embedded in a matrix of white mica, brownish clay or chlorite, and carbonate. Rock fragments are those of altered intermediate volcanics with lesser amount of chert. Some calcite and chlorite veinlets are seen. Accessory minerals are leucoxene and iron ore.
6063	Vueltas del Rio No. 54-6 63m	Altered dacitic tuff	Completely carbonated plagioclase and mafic mineral crystals less than 1 mm in size are set in a fine-grained matrix of quartz, feldspar, sericite, chlorite, and carbonates. Occasional sphene less than 0.1 mm is also observed.
6138	Vueltas del Rio No. 54-6 138m	Altered tuff breccia	Fragments of quartz crystals and andesites showing relict hyalopilitic texture are set in a fine-grained, intensely altered base of carbonates, sericite, quartz, and chlorite. Mafic minerals (pyroxenes?) are altered completely into carbonates.

Sample No.	Location	Rock Name	Microscopic Observation
6213	Vueltas del Rio No. 54-6 213m	Andesite	The rock shows typical porphiritic texture. Phenocrysts of subhedral andesine (some have carbonatized core) and aggregates of calcite and/or chlorite (that may be completely altered mafic minerals such as olivine) are in a fine-grained matrix of plagioclase lath (albite?), quartz, chlorite, calcite and strings of sericite. Small amounts of euhedral magnetite, irregular form of leucoxene, and ore dust are also seen in the matrix.
6243	Vueltas del Rio No. 54-6 243m	Tuff breccia (lithic tuff)	Fragments of basaltic andesite, glass shard, plagioclase chips are recognizable in a matrix of fine-grained quartz, calcite, sericite and altered glass (?). Most of the fragments are basaltic andesite, containing clusters of (= glomeroporphiritic) plagioclase and a little ferromagnesian (altered to chlorite, calcite, quartz and iron ore) in a glassy matrix. Abundant vesicules filled with quartz, chlorite, sericite and hematite are also observed in some fragments.
7165	Vueltas del Rio No. 54-7 165m	Altered tuff	The constituent minerals are almost completely altered into carbonates, sericite, chlorite, and quartz. Rare elongated pseudomorphs after plagioclase are observed. Cubic ore minerals less than 1 mm in size are abundant.
7173	Vueltas del Rio No. 54-7 173m	Meta tuff breccia	Completely carbonated phenocrysts (plagioclase and mafic minerals) are set in a very fine-grained matrix of quartz, sericite, and chlorite. Ore minerals and titanomagnetite or ilmenite are fairly abundant.
7192	Vueltas del Rio No. 54-7 192m	Tuffaceous shale	This rock is made up of silty and argillaceous layers, in which the chief minerals are quartz, white mica, carbonate, and a little chlorite. Some layers are delineated by carbonate, and stipped with abundant euhedral pyrite? crystals. A little sphene is also seen.
7220	Vueltas del Rio No. 54-7 220m	Altered rhyolitic tuff	Broken crystals of sericitized feldspar, resolved quartz, and rare carbonated mafic minerals are set in a fine-grained base composed of dominant quartz, subordinate feldspar, sericite, carbonates, and chlorite. Aggregates of fine-grained cubic ore minerals associated with quartz are abundant.

Sample No.	Location	Rock Name	Microscopic Observation
7242	Vueltas del Rio No. 54-7 242m	Meta dacite	The main constituent minerals are felsic mineral and quartz. The rock is traversed by some veinlets of calcite. Phenocrysts of rounded quartz and subhedral plagioclase (highly saussuritized) are in a matrix of quartz, feldspar, chlorite, calcite and sericite. Rims of sodic feldspar around quartz are common. Aggregates of chlorite, calcite, and magnetite (pseudomorph after hornblende?) are rarely observed. The rock is traversed by some veinlets of carbonate.
7279	Vueltas del Rio No. 54-7 279m	Meta dacite	Phenocrysts of sericitized plagioclase (subhedral, less than 1 x 2 mm), rounded quartz, and large prisms (pseudomorph after hornblende, aggregate of secondary chlorite and calcite, locally stained with ferruginous material, and rimmed by minor dusts of magnetite) lie in a matrix of quartz, feldspar and secondary chlorite and calcite. Plates or laths of plagioclase are poikilitically enclosed in some (hornblende) prisms. Considerable amounts of apatite (or topaz?) are present.
8180	Vueltas del Rio No. 54-8 180m	Meta quartz latite	Phenocrysts of quartz (rounded and corroded grains, less than 1.2 x 1.2 mm) and sericitized and carbonatized feldspars (less than 1.4 x 0.7 mm) occur in a matrix of fine-grained quartz, albite and sericite. Abundant pyrite (euhedral to subhedral, up to 0.4 x 0.3 mm) are disseminated through the rock. Accessory minerals are rutile and leucoxene.
8221	Vueltas del Rio No. 54-8 221m	Altered rhyolitic tuff	The rock is composed mainly of fine-grained crystals (less than 0.05 mm in size) of quartz, carbonate, sericite, and chlorite. Broken crystals of quartz less than 1 mm are occasionally present. Ores are rare.
8242	Vueltas del Rio No. 54-8 242m	Meta dacite	Completely carbonated phenocrysts (plagioclase and mafic minerals) of 0.1 to 0.5 mm in size are set in a fine-grained matrix composed of abundant quartz, minor sericite, chlorite, and carbonates. Ore minerals are rare.

A. I—2 Microscopic Observations (Polished Sections)

Sample No.	Location			Ore Mineral	Microscopic Observation
	X	Y	No. of Sketch Map		
S031	300 + 33.66	1600 + 82.28	PL.I-3-2 (Nelson Trench)	Native gold	It is composed largely of the secondary iron hydro-oxide minerals with a small amount of gold. They show colloform bands in cracks and cavities. Two phases are observed in colour in the colloform bands. One is greyish white and shows spherolitic aggregates and a distinct anisotropy. The other is light grey and shows the cryptocrystalline and does not show the anisotropy. Both are anhedral goethite. A small amount of gold occurs in the gangue minerals. The shapes of gold crystals are irregular and/or rounded. They are golden yellow and are 20 to 5 μ across. They are native gold rather than electrum in the color.
S035	33.13	82.40	PL.I-3-1 (San Martin Adit)	Fe ore	Ore minerals in this sample are all secondary products, which show a colloform texture and form veinlets in cracks and cavities. They are light grey and show a distinct anisotropy and internal reflections of reddish brown. They are goethite. The crystals in the cavity show spherolitic aggregates and a zonal texture. It is observed partly to be goethite pseudomorphs after pyrite. A small amount of hematite is seen to be idiomorphic needle like crystals. And then, a few small crystal like a native gold or electrum is seen in the gangue minerals. But they

Sample No.	Location			Ore Mineral	Microscopic Observation
	X	Y	No. of Sketch Map		
					couldn't be identified as a gold because of the very small size.
TM7	33.12	82.40	PL.I-3-1 (San Martin Adit)	Fe ore	Megascopically, it is composed largely of white secondary minerals with limonite veinlets forming a network structure. Colloform bands of goethite are observed in cracks and cavities under the microscope. A small amount of goethite pseudomorphs after pyrite occurs also in less abundance. On the other hand, white secondary minerals is dark grey under the microscope and show the characteristic internal reflections of white.
TM13	33.34	82.46	PL.I-3-1 (San Martin Adit)	Fe ore	It is composed largely of the secondary iron-hydro-oxide minerals with a small amount of pyrite. They show colloform bands and spherolitic aggregates with a zonal structure in cavities and cracks. A few pseudomorphs after pyrite is seen in the center of the zonal structure. They are anhedral crystals of goethite.
TM45	33.20	81.84	PL.I-3-3	Fe ore	In this sample primary ore minerals are not found. It is composed mainly of secondary iron minerals, which forming veinlets and network structure replace the gangue minerals. They have two phases in color and are observed in cracks and cavities with colloform bands. One phase is greish

Sample No.	Location			Ore Mineral	Microscopic Observation
	X	Y	No. of Sketch Map		
					white with a blueish tint and shows a distinct anisotropy. It situates an inner part of the colloform texture and also shows spherolitic aggregates. The other is light grey and shows internal reflections of reddish brown and/or brownish yellow. It situates an outer part of the texture. It is seemed to be a product of the later stage. It appear that they are all goethite.

Sample No.	Location	Ore Mineral	Microscopic Observation
4189	DDH. No. 54-4 Depth 189m	Chalcopyrite in Meta tuff	Chalcopyrite is the most abundant sulfide mineral in the rock. It forms disseminated grains measuring 0.1 to 0.5 millimeters across and also occurs in hair-line thick veinlets. Pyrite is relatively sparse and occurs in disseminated grains. A trace of sphalerite in sometimes associated with chalcopyrite.
7173	DDH. No. 54-7 Depth 173m	Sphalerite in meta tuff breccia	Pyrite is the most abundant in the rock and shows disseminated grains ranging from 0.05 to 5 millimeters in size. Galena and sphalerite are sometimes associated with pyrite in appreciable amounts and fills some inter-stices of pyrite crystals. Sphalerite contains minute inclusions of chalcopyrite and galena. A small amount of disseminated rutile is ubiquitously observed in the rock.
8241	DDH. No. 54-8 Depth 241m	Chalcopyrite in meta tuff breccia	The opaque minerals present are pyrite and chalcopyrite. Pyrite shows a euhedral crystal measuring 0.1 to 1.0 millimeters across. It forms major veinlets in the rock and rarely disseminated grains. Chalcopyrite fills some interstices among the pyrite crystals and replaces some pyrite. It also forms hair-line thin veinlets and is sparsely disseminated in the rock.

Sample No.	Location	Ore Mineral	Microscopic Observation
1248	DDH. No. 54-1 Depth 248m	Chalcopyrite in Meta tuff	Chalcopyrite is the most abundant sulfide mineral. It forms a most part of hair-line thin veinlets in the rock and is also disseminated in the wall rock. Pyrite is a subordinate sulfide mineral and occurs in the chalcopyrite rich veinlets. Pyrite is partly replaced by chalcopyrite. Sphene is sparsely disseminated in the rock.
3176	DDH. No. 54-3 Depth 176m	Chalcopyrite in Altered tuff	Opaque minerals are rarely observed in the rock, and only a few minute grains of chalcopyrite is present. Rutile also occurs in sparsely disseminated grain.
4109	DDH. No. 54-4 Depth 109m	Pyrite and chalcopyrite in tuff breccia	Predominant sulfide minerals are pyrite and chalcopyrite. Pyrite forms disseminated grains measuring 0.05 to 4 millimeters in size. Chalcopyrite is the most abundant sulfide mineral and fills some interstices among pyrite crystals. A trace of galena is rarely observed. Sphene is also present in a small amount.

A. I—3 Photomicrographs of Rocks and Ores

Abbreviation

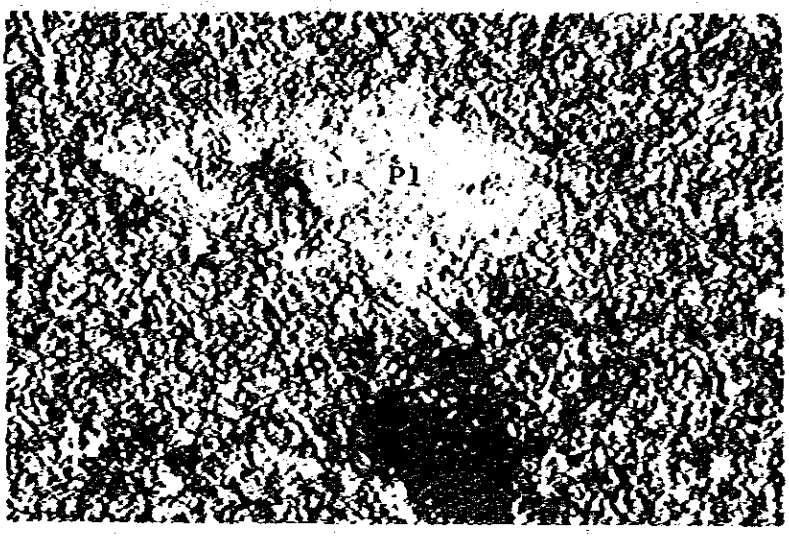
Minerals

Au : Native Gold
Goe: Goethite
Q : Quartz
F : Feldspar
Pl : Plagioclase
Mv : Muscovite
Hb : Hornblende
Cc : Calcite

Others

rf : rock fragment
or : ore minerals (mainly pyrite)
G : gangue minerals

Thin Sections

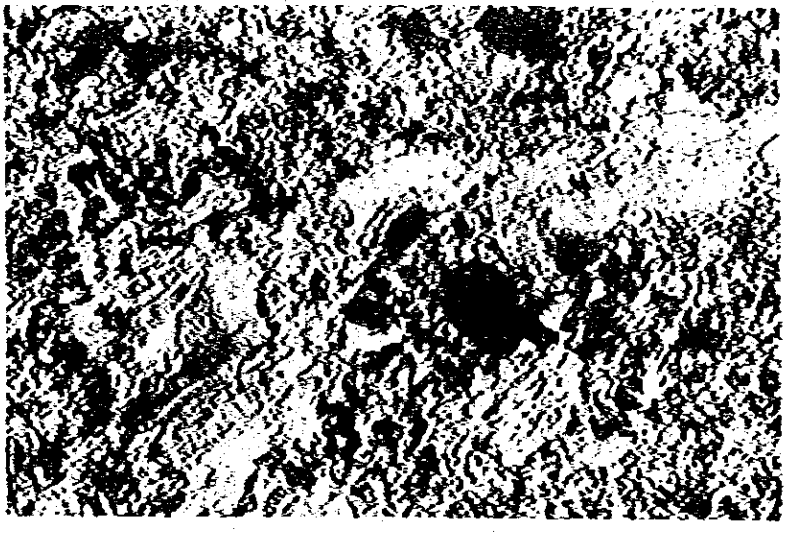


Sample No.: S032

Rock Name : Highly altered andesite

Crossed Nicols

0.5 mm

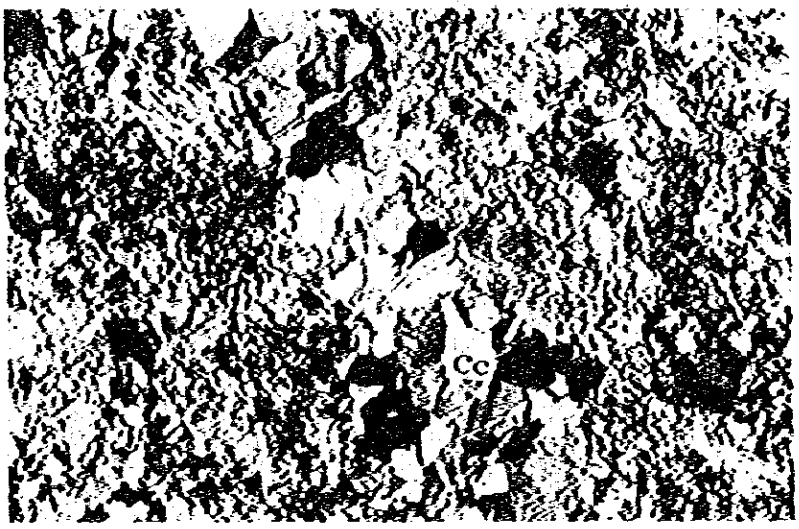


Sample No.: 1040

Rock Name : Altered andesitic tuff

Crossed Nicols

0.5 mm

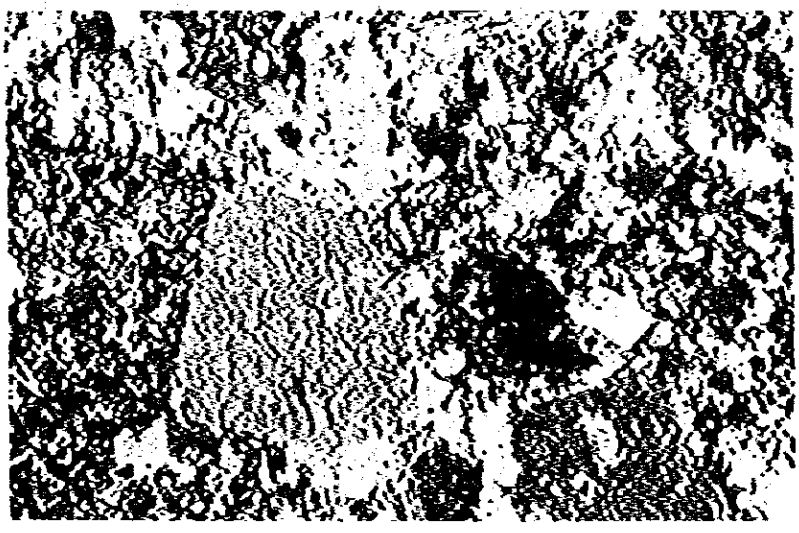


Sample No.: 1135

Rock Name : Calcareous shale

Crossed Nicols

0.5 mm

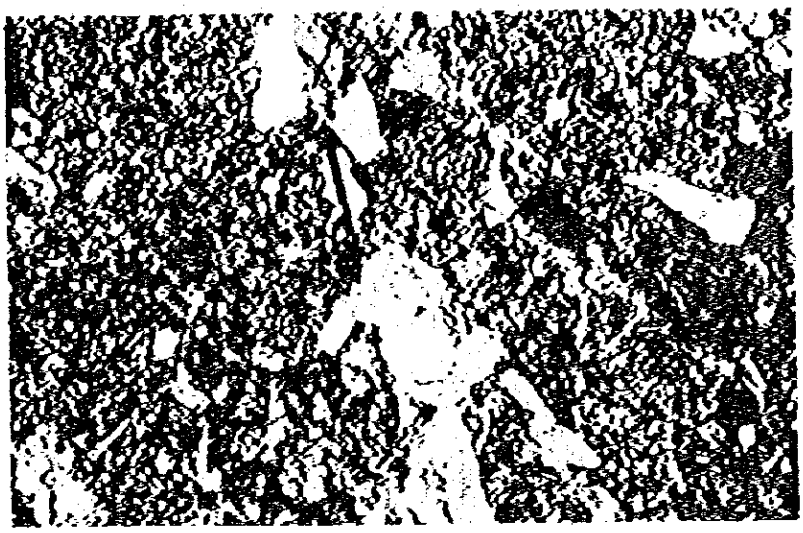


Sample No.: 1160

Rock Name : Calcareous tuff breccia

Crossed Nicols

0.5 mm

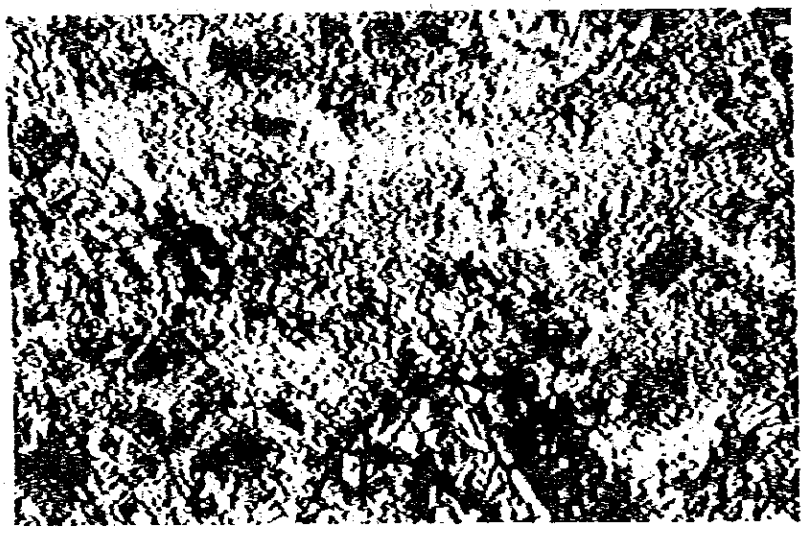


Sample No.: 1215

Rock Name : Meta decite

Crossed Nicols

0.5 mm



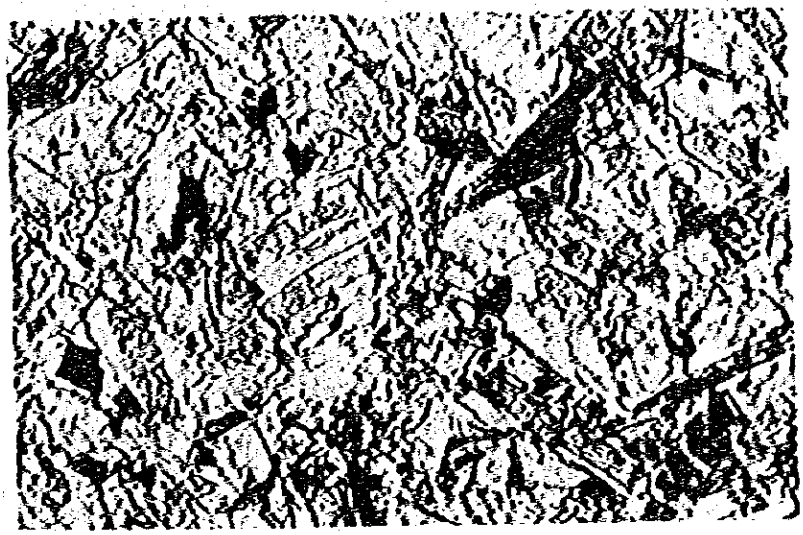
Sample No.: 2043

Rock Name : Altered dacitic tuff

Crossed Nicols

0.5 mm

Sample No.: 2066



Rock Name : Meta-porphyry

Open Nicol

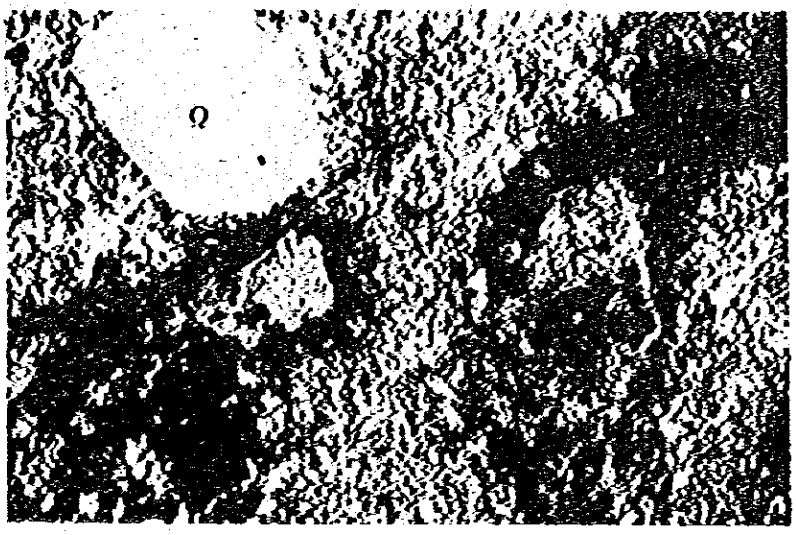
0.5 mm

Sample No.: 2087

Rock Name : Meta-porphyry

Crossed Nicols

0.5 mm



Sample No.: 2143

Rock Name : Altered decitic tuff

Crossed Nicols

0.5 mm

Sample No.: 2170

Rock Name : Meta-porphyry

Crossed Nicols

0.5 mm

Sample No.: 2210

Rock Name : Meta-andesite

Crossed Nicols

0.5 mm

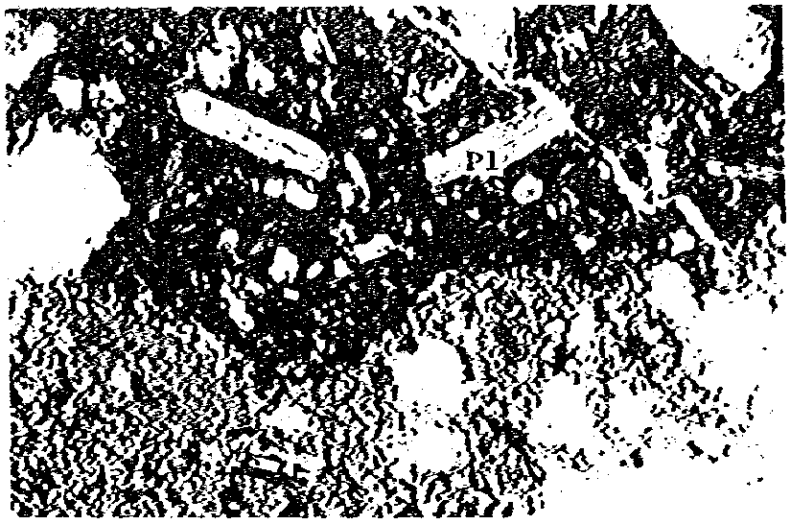
Sample No.: 3042

Rock Name : Altered dacitic tuff

Crossed Nicols

0.5 mm

Sample No.: 3054

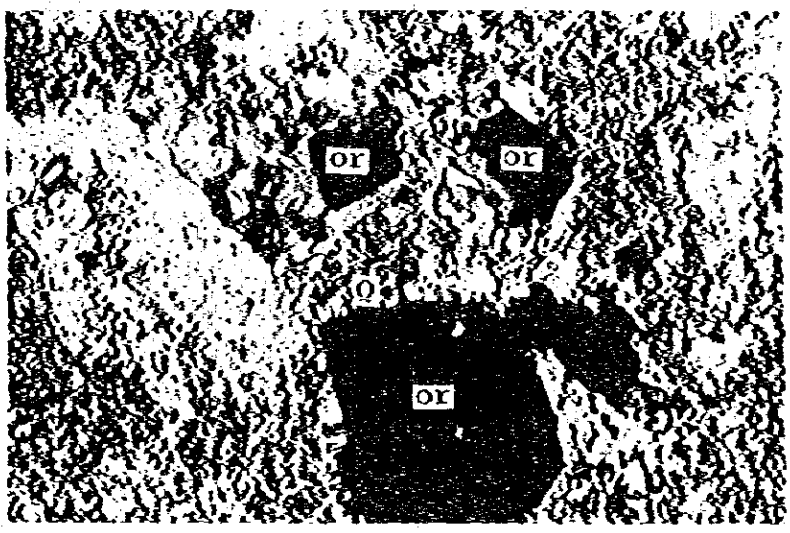


Rock Name : Calcareous tuff breccia

Crossed Nicols

0.5 mm

Sample No.: 3086



Rock Name : Meta-dacite

Crossed Nicols

0.5 mm

Sample No.: 3176

Rock Name : Altered tuff

Crossed Nicols

0.5 mm

Sample No.: 3196

Rock Name : Tuff breccia

Crossed Nicols

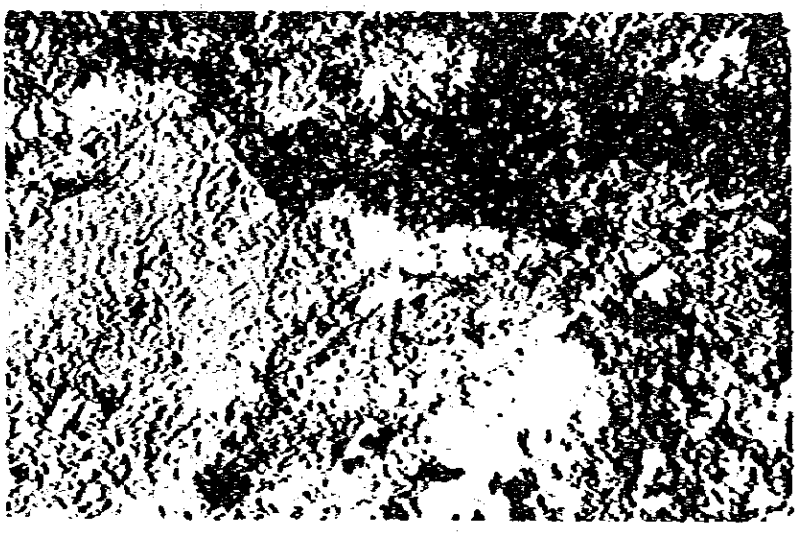
0.5 mm

Sample No.: 3248

Rock Name : Meta-andesite breccia

Crossed Nicols

0.5 mm



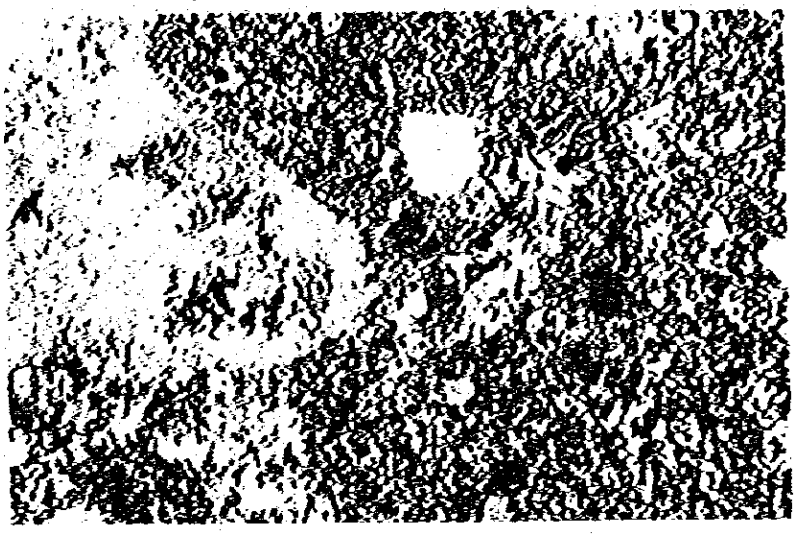
Sample No.: 4083

Rock Name : Tuff breccia

Crossed Nicols

0.5 mm

Sample No.: 4109

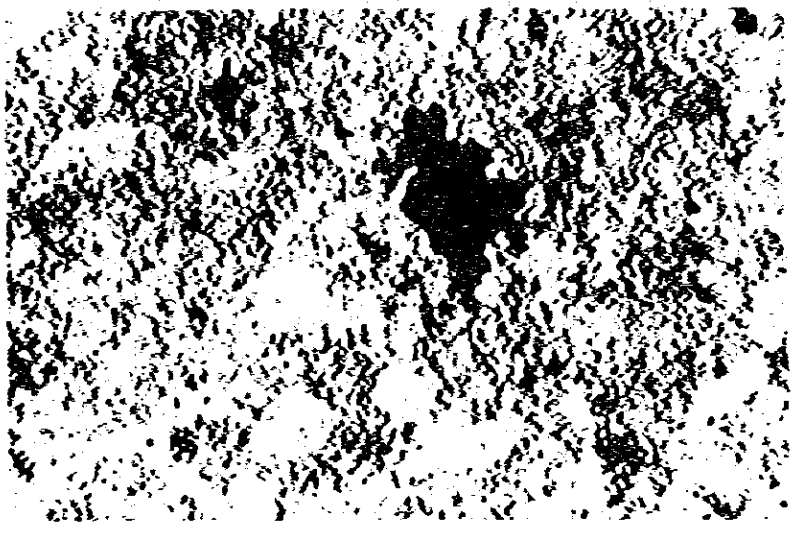


Rock Name : Tuff breccia

Crossed Nicols

0.5 mm

Sample No.: 4160



Rock Name : Altered tuff

Crossed Nicols

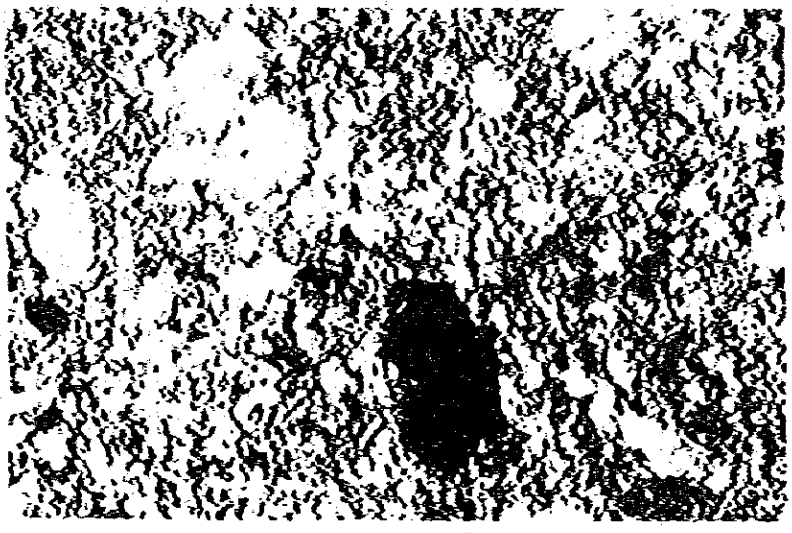
0.5 mm

Sample No.: 4210

Rock Name : Meta-andesite

Crossed Nicols

0.5 mm



Sample No.: 5029

Rock Name : Meta-andesite

Crossed Nicols

0.5 mm

Sample No.: 5036

Rock Name : Altered dacitic crystal tuff

Crossed Nicols

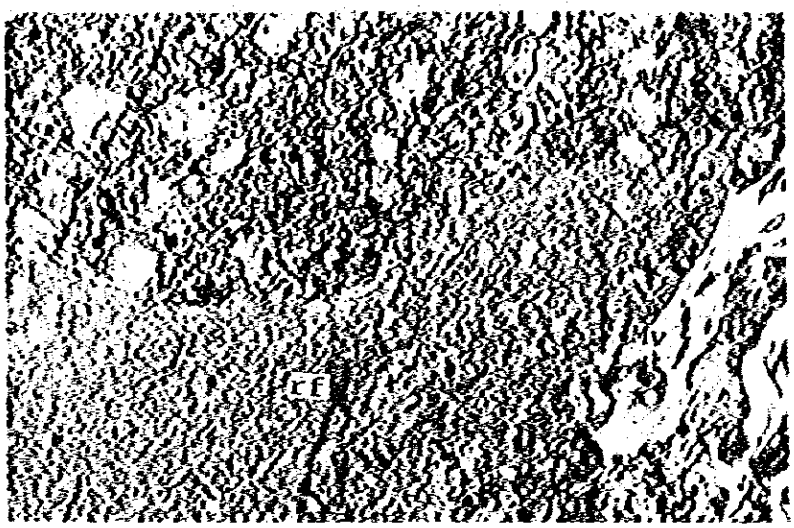
0.5 mm

Sample No.: 5062

Rock Name : Tuff breccia

Crossed Nicols

0.5 mm



Sample No.: 5228

Rock Name : Tuff breccia

Open Nicol

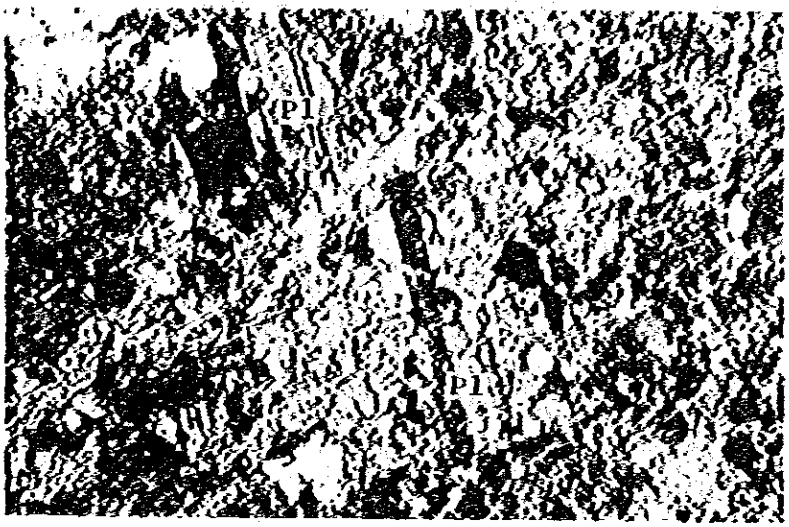
0.5 mm

Sample No.: 5228

Rock Name : Tuff breccia

Crossed Nicols

0.5 mm

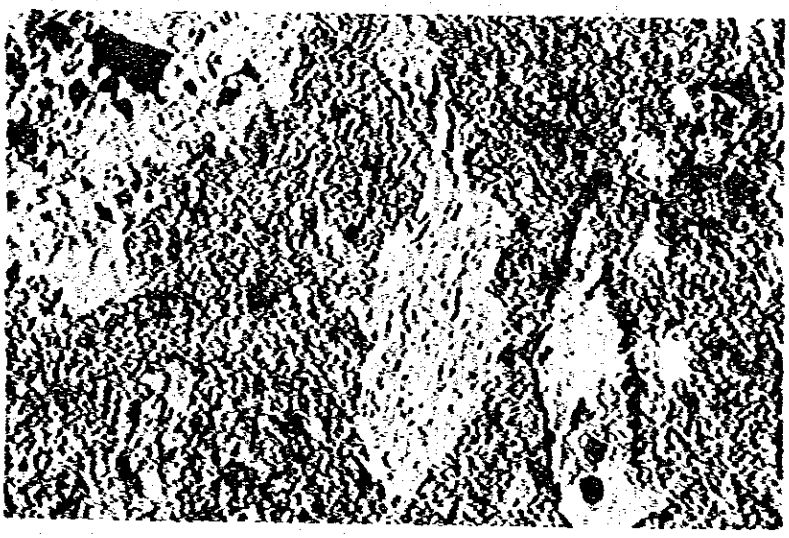


Sample No.: 5082

Rock Name : Meta-dacite (breccia)

Crossed Nicols

0.5 mm



Sample No.: 5161

Rock Name : Meta-andesite

Open Nicol

0.5 mm

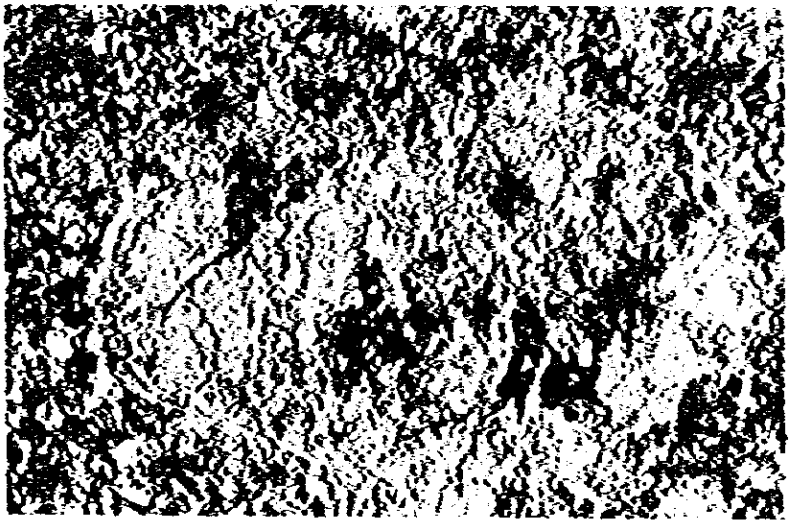
Sample No.: 5192

Rock Name : Calcareous shale

Crossed Nicols

0.5 mm

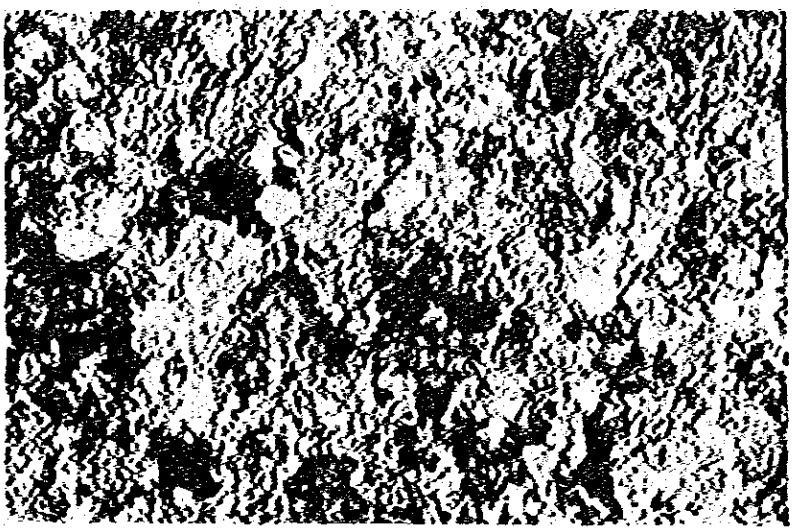
Sample No.: 6063



Rock Name : Altered dacitic tuff

Crossed Nicols

0.5 mm

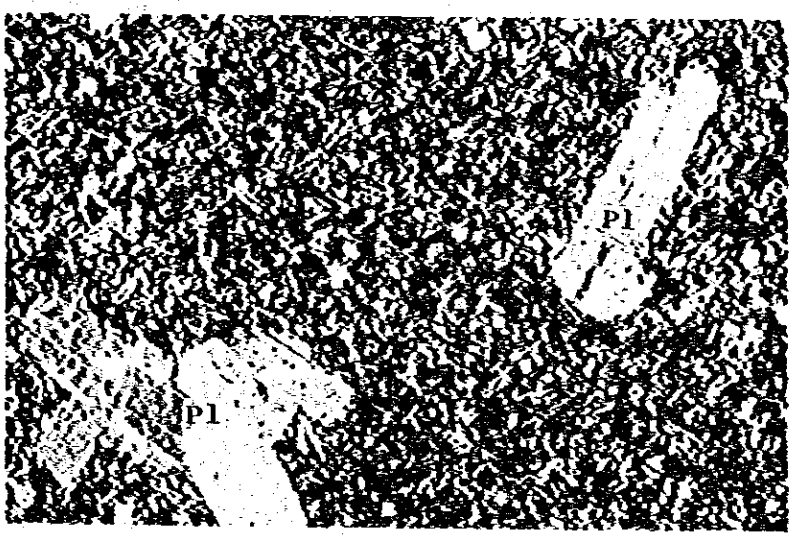


Sample No.: 6138

Rock Name : Altered tuff breccia

Crossed Nicols

0.5 mm



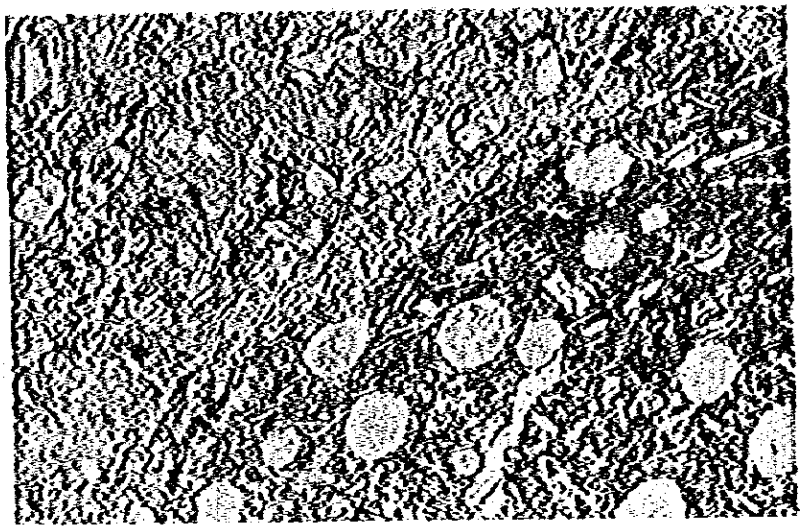
Sample No.: 6213

Rock Name : Andesite

Crossed Nicols

0.5 mm

Sample No.: 6243

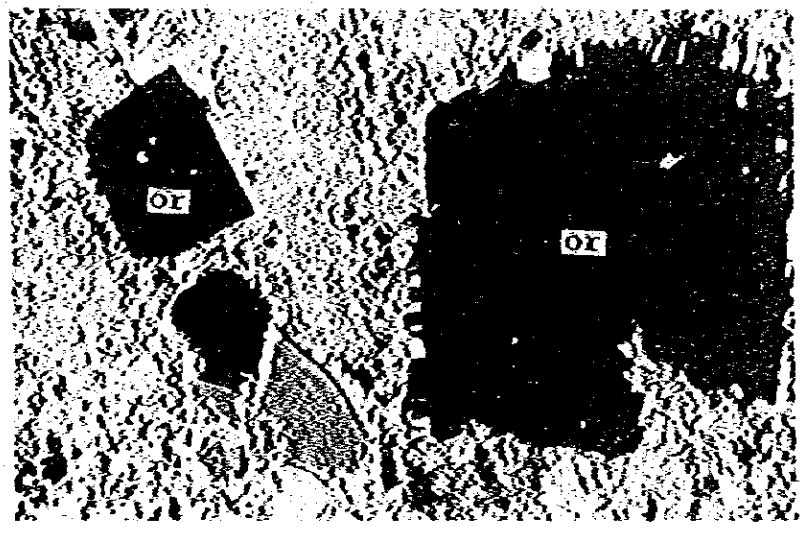


Rock Name : Tuff breccia
(Lithic tuff)

Open Nicol

0.5 mm

Sample No.: 7165



Rock Name : Altered tuff

Crossed Nicols

0.5 mm

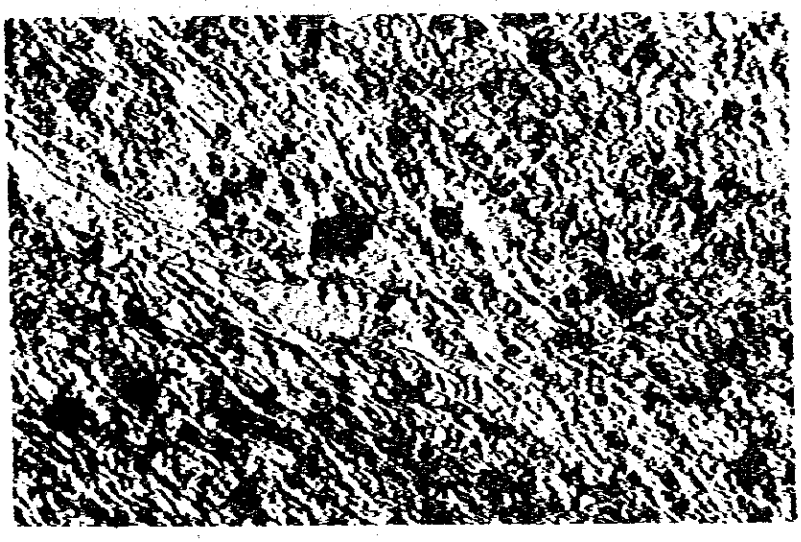
Sample No.: 7173

Rock Name : Meta andesite

Crossed Nicols

0.5 mm

Sample No.: 7192

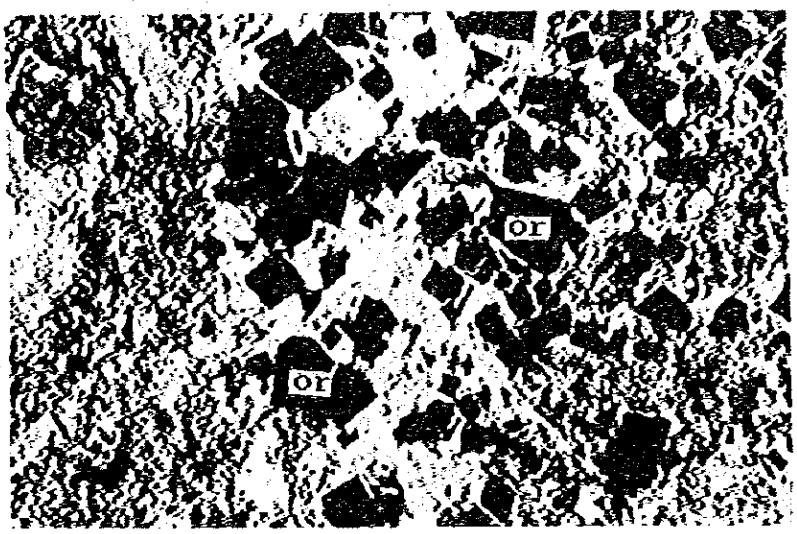


Rock Name : Tuffaceous shale

Crossed Nicols

0.5 mm

Sample No.: 7220



Rock Name : Altered rhyolitic tuff

Crossed Nicols

0.5 mm

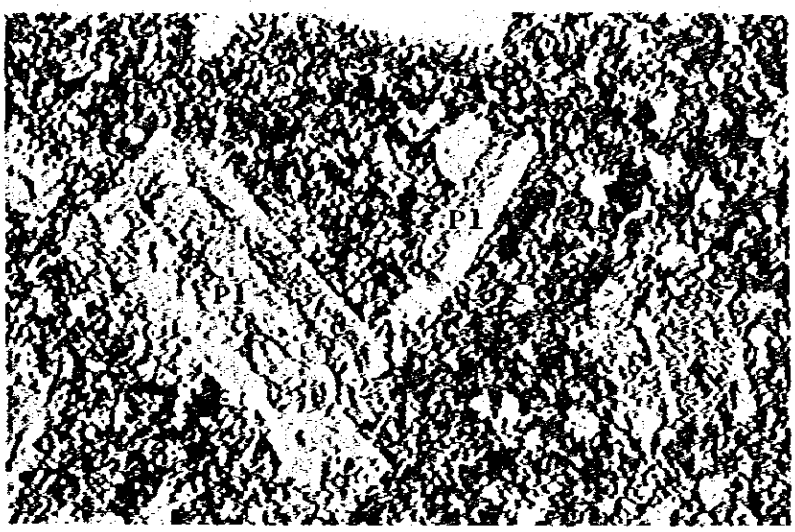
Sample No.: 7242

Rock Name : Meta-decite

Crossed Nicols

0.5 mm

Sample No.: 7279

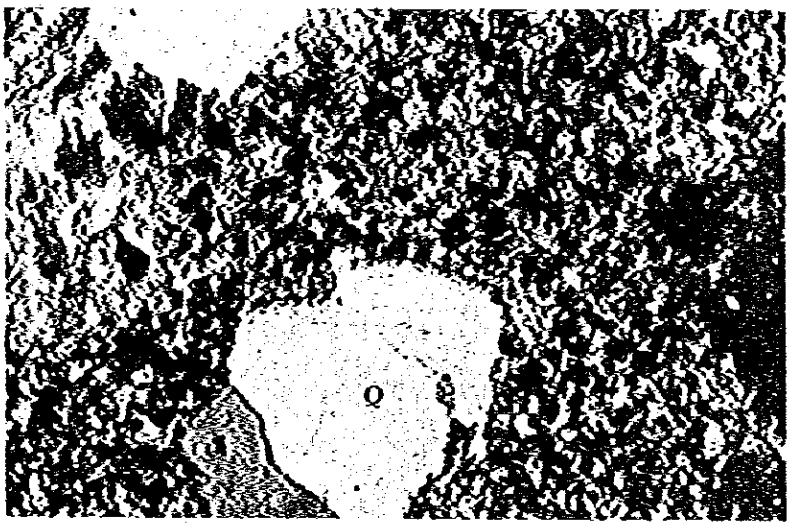


Rock Name : Meta decite

Crossed Nicols

0.5 mm

Sample No.: 8180

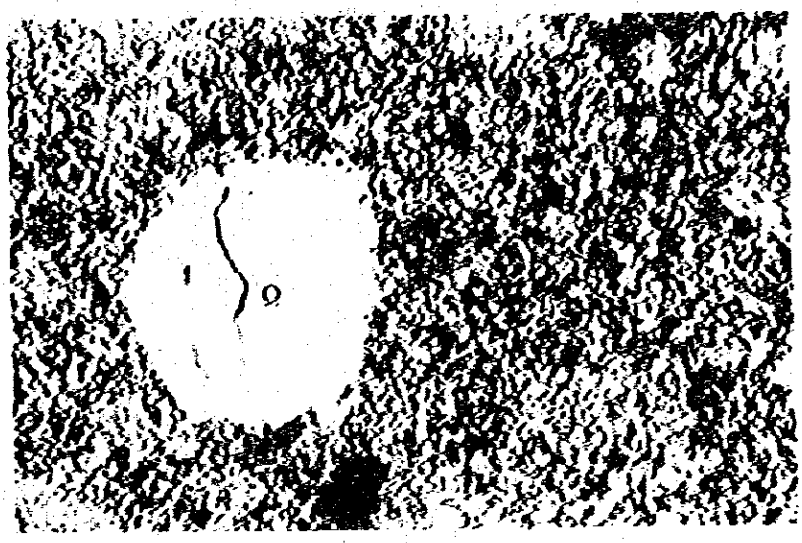


Rock Name : Meta-quartz latite

Crossed Nicols

0.5 mm

Sample No.: 8221

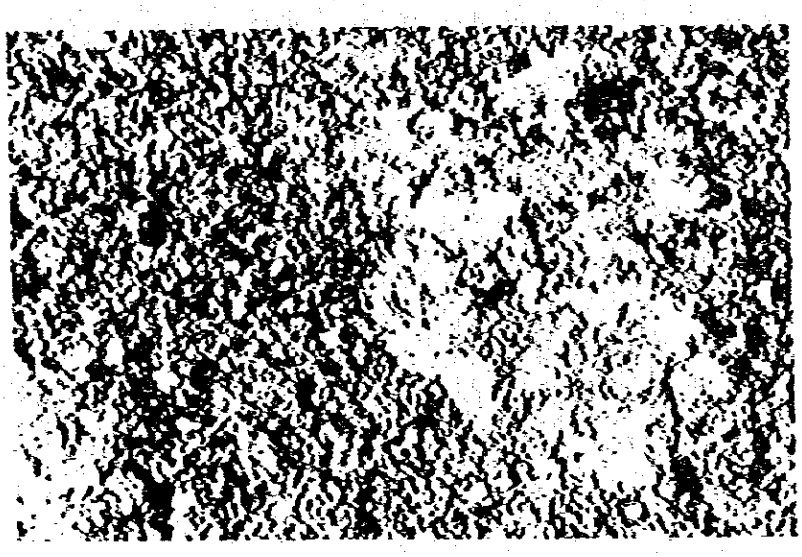


Rock Name : Altered rhyolitic tuff

Crossed Nicols

0.5 mm

Sample No.: 8242

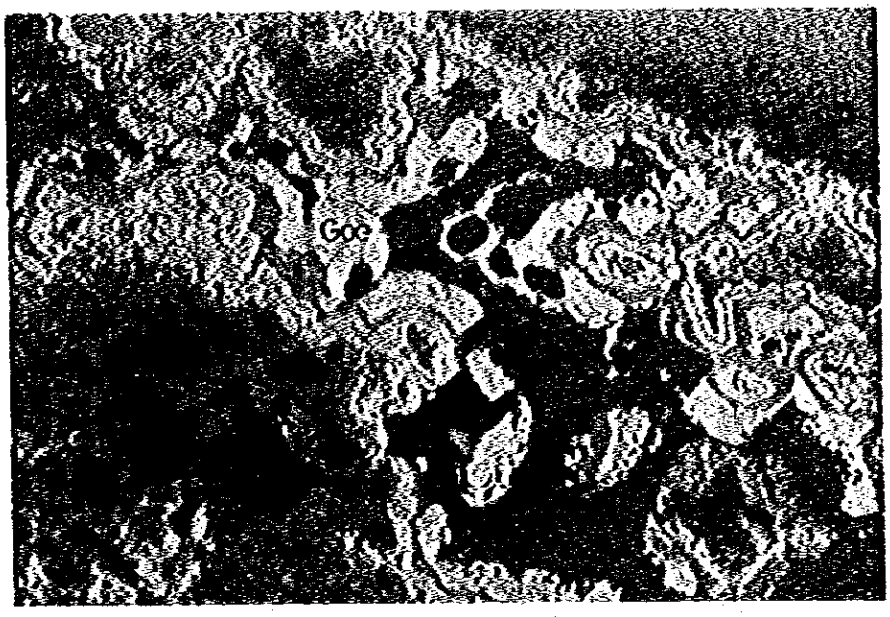


Rock Name : Meta-dacite

Crossed Nicols

0.5 mm

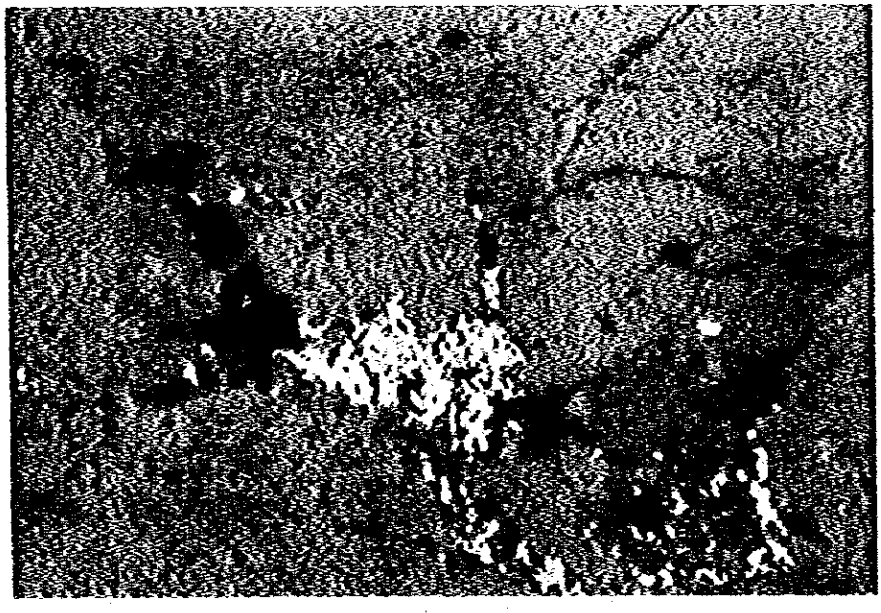
Polished Sections



0 0.2mm

Sample No.: S031

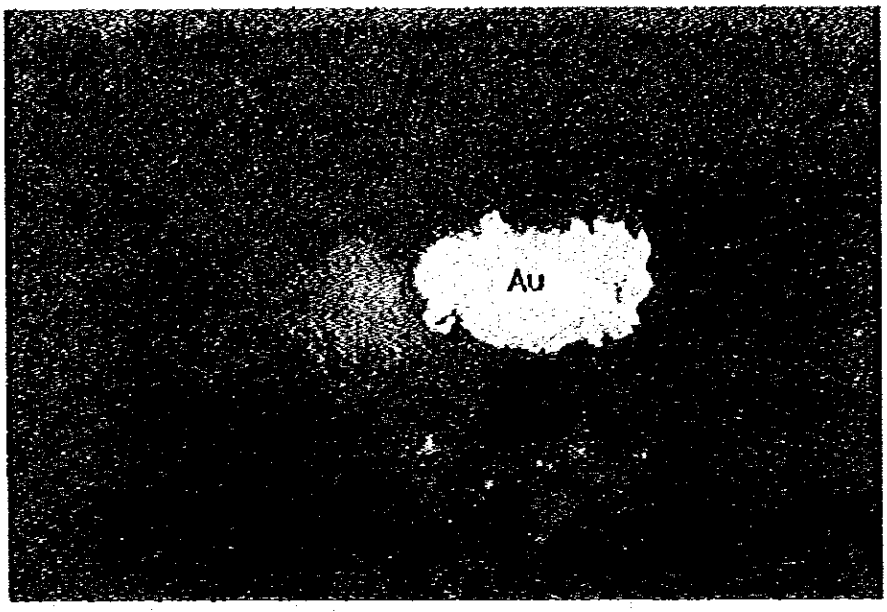
Ore Mineral:
Goethite



0 0.2mm

Sample No.: S031

Ore Mineral:
Native Gold

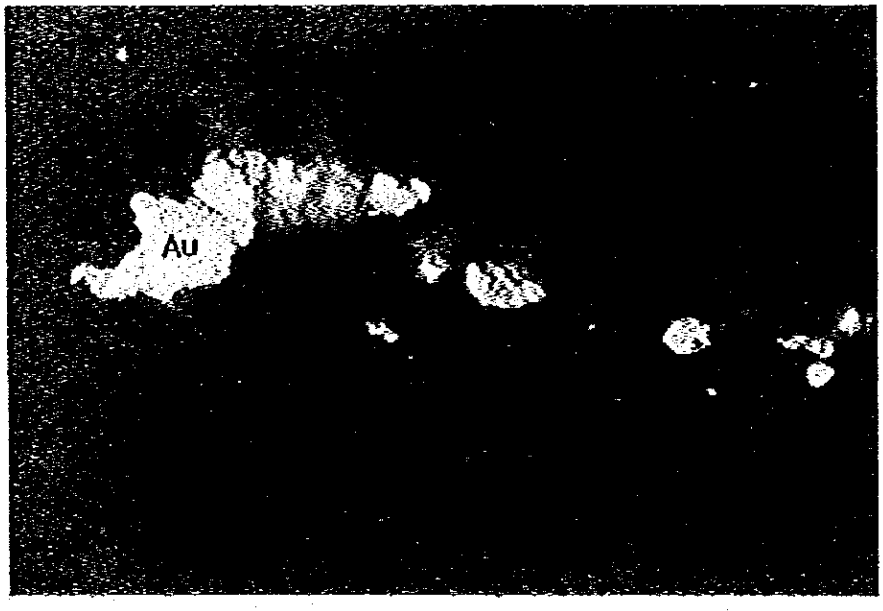


0 0.02mm

Sample No.: S031

Ore Mineral:
Native Gold

One Nicol

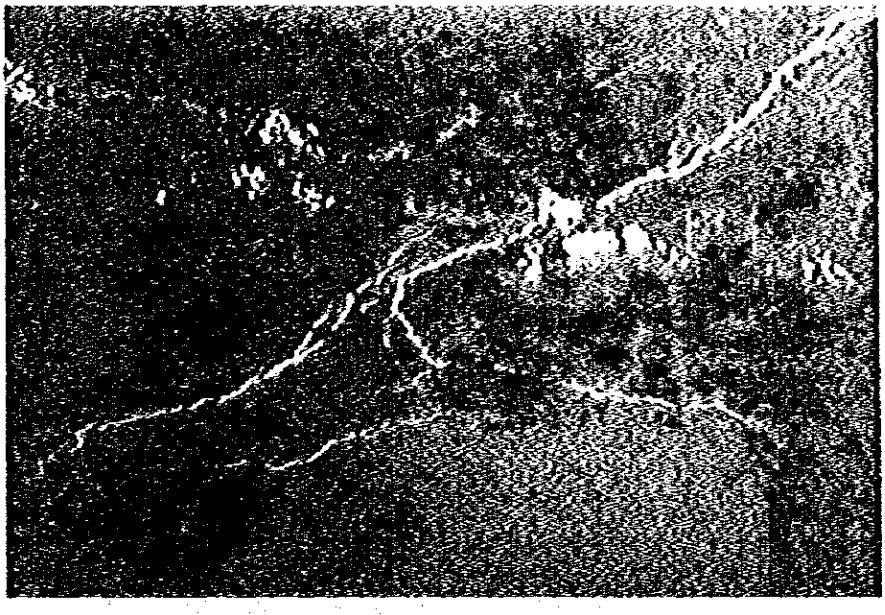


0 0.02mm

Sample No.: S031

Ore Mineral:
Native Gold

One Nicol



Sample No.: S035

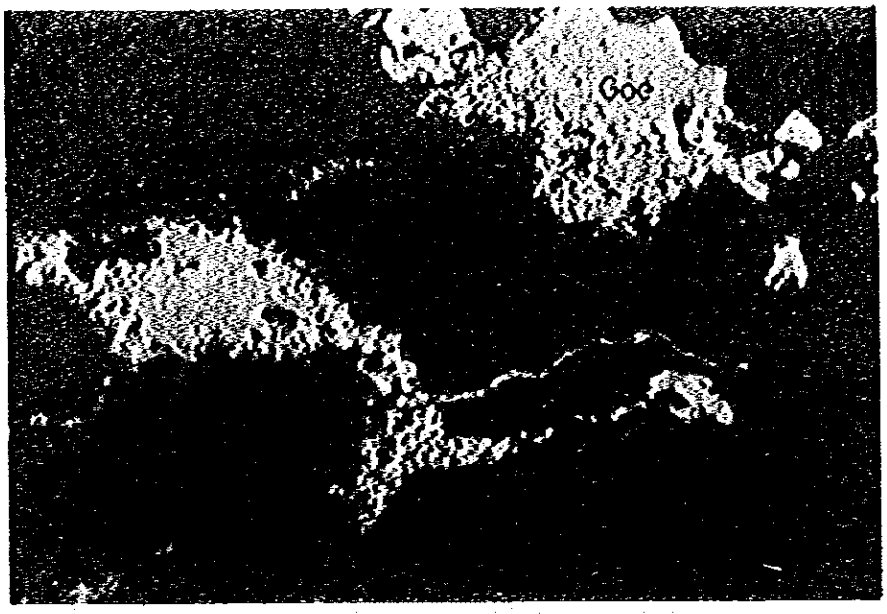
Ore Mineral:
Goethite

0 0.2mm

Sample No.: S035

Ore Mineral:
Goethite

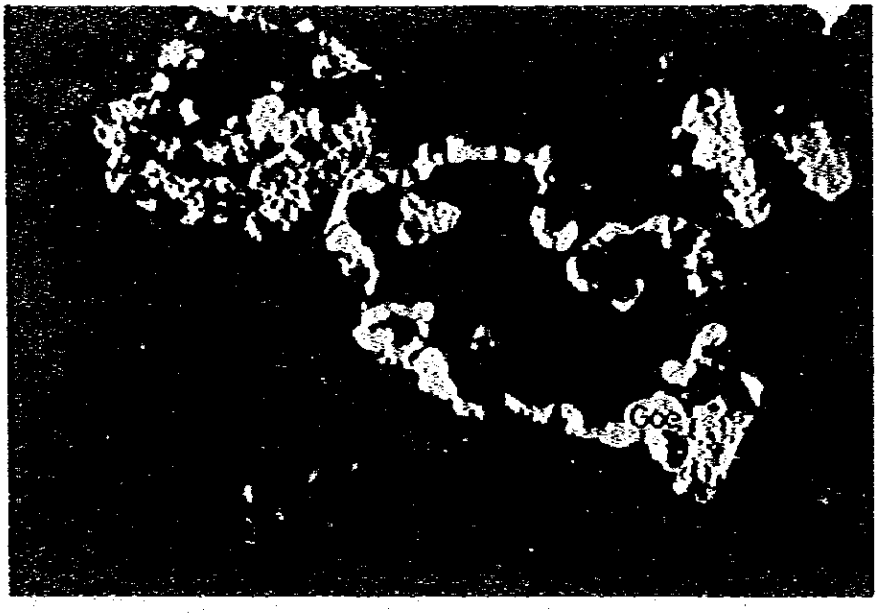
0 0.2mm



Sample No.: TM7

Ore Mineral:
Goethite

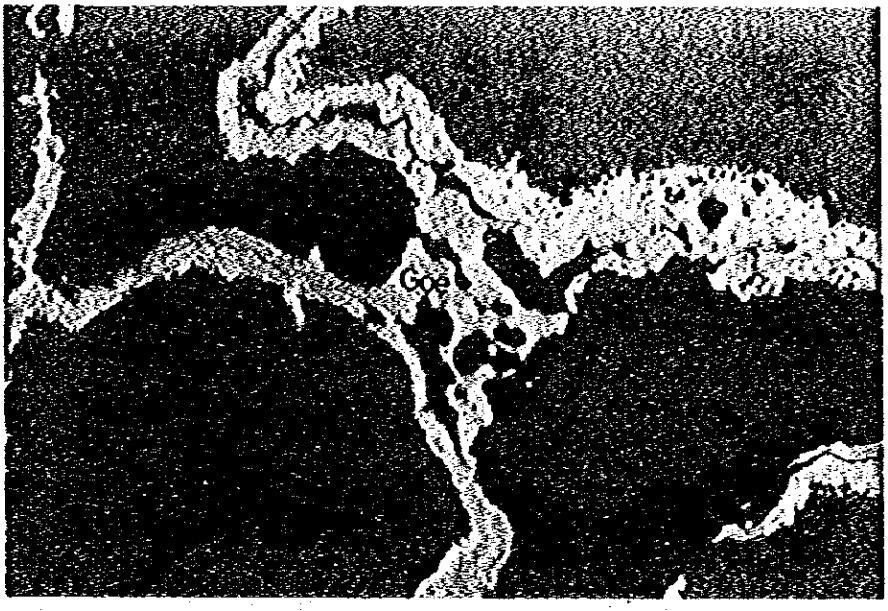
0 0.2mm



Sample No.: TM7

One Mineral:
Goethite

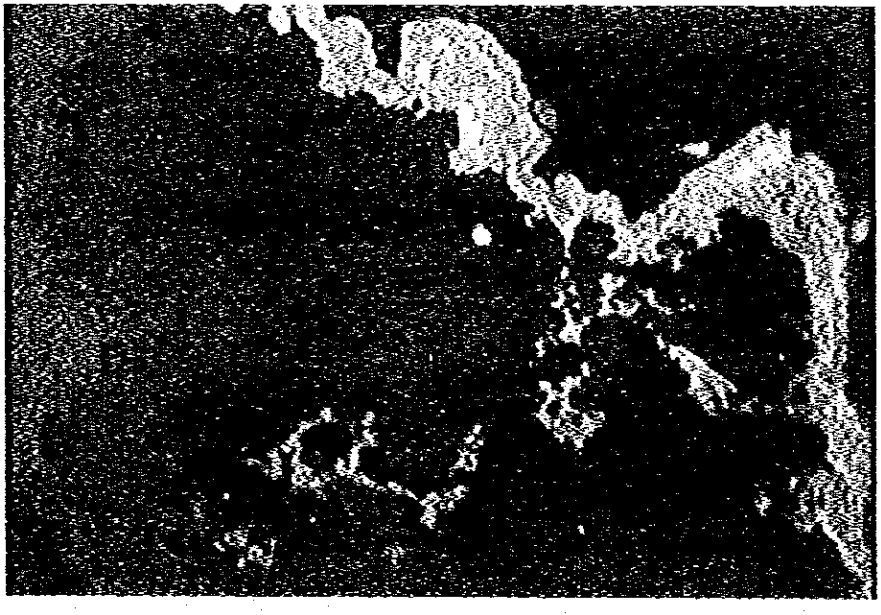
0 0.2mm



Sample No.: TM13

Ore Mineral:
Goethite

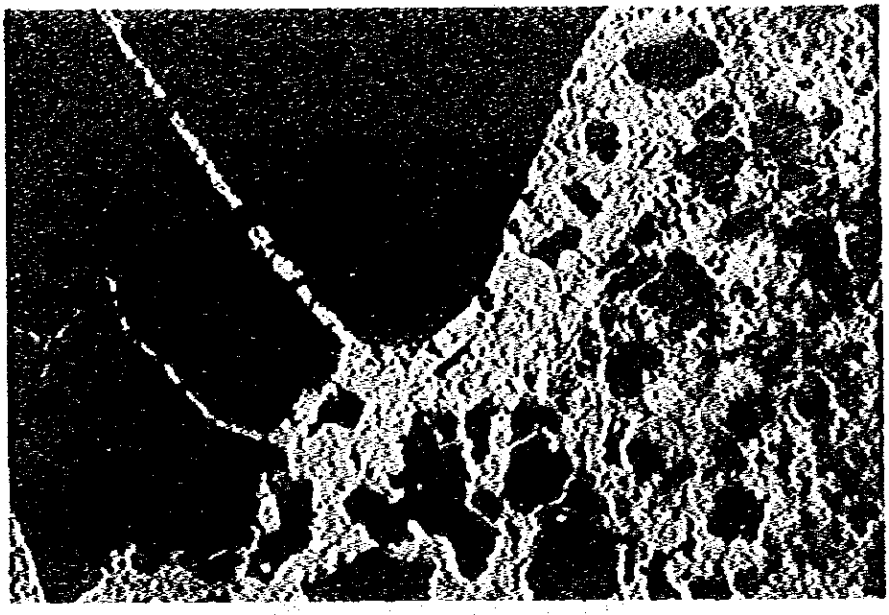
0 0.2mm



Sample No.: TM13

Ore Mineral:
Pyrite

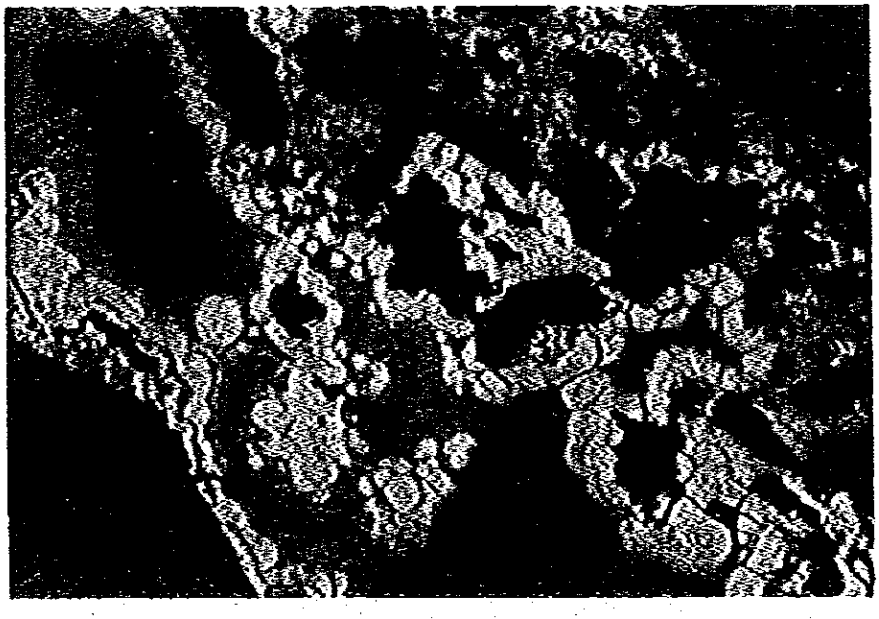
0 0.05mm



Sample No.: TM45

Ore Mineral:
Goethite

0 0.2mm



Sample No.: TM45

Ore Mineral:
Goethite

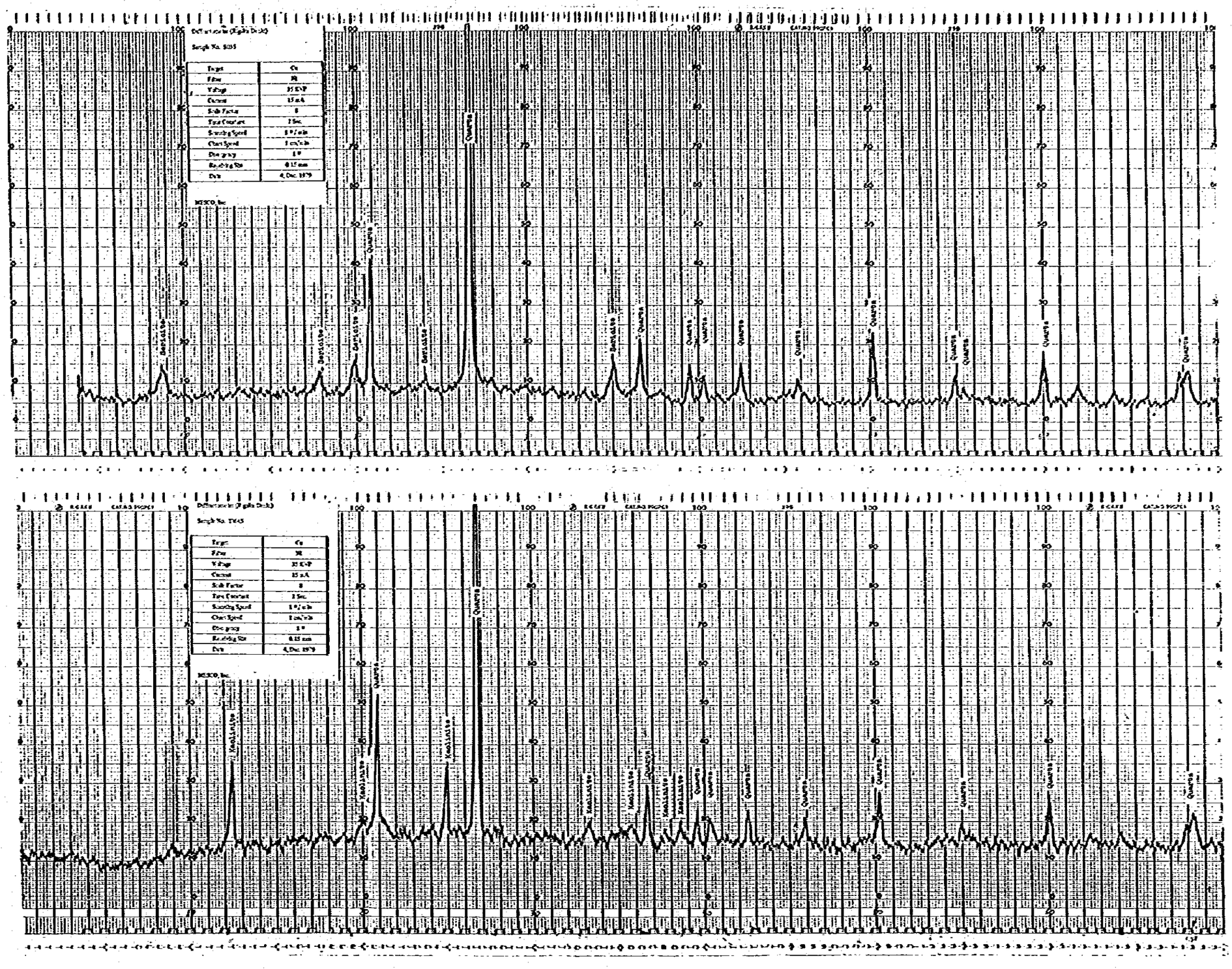
0 0.2mm

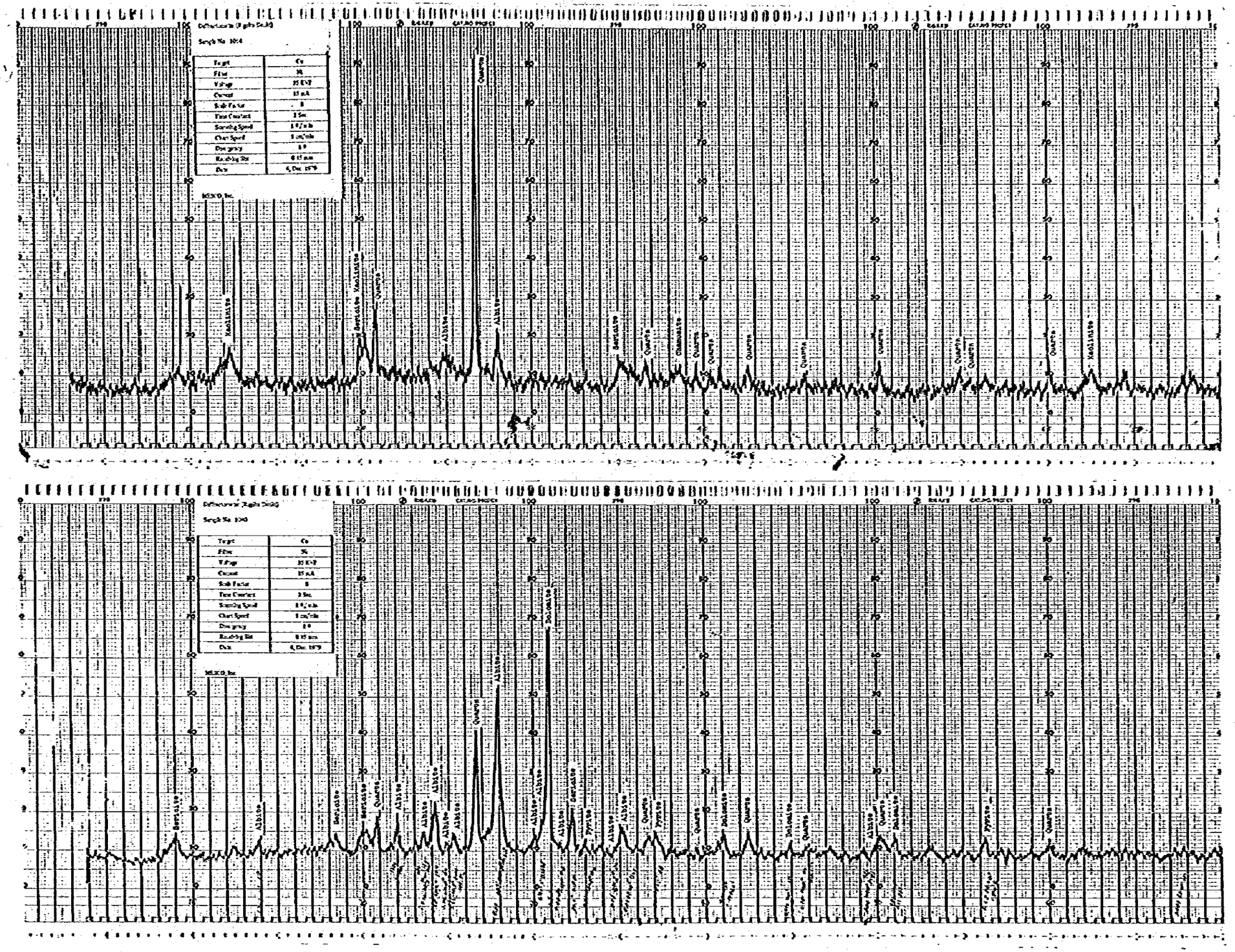
◎ very abundant　　△ Rare
◎ Abundant　　X very rare
○ common

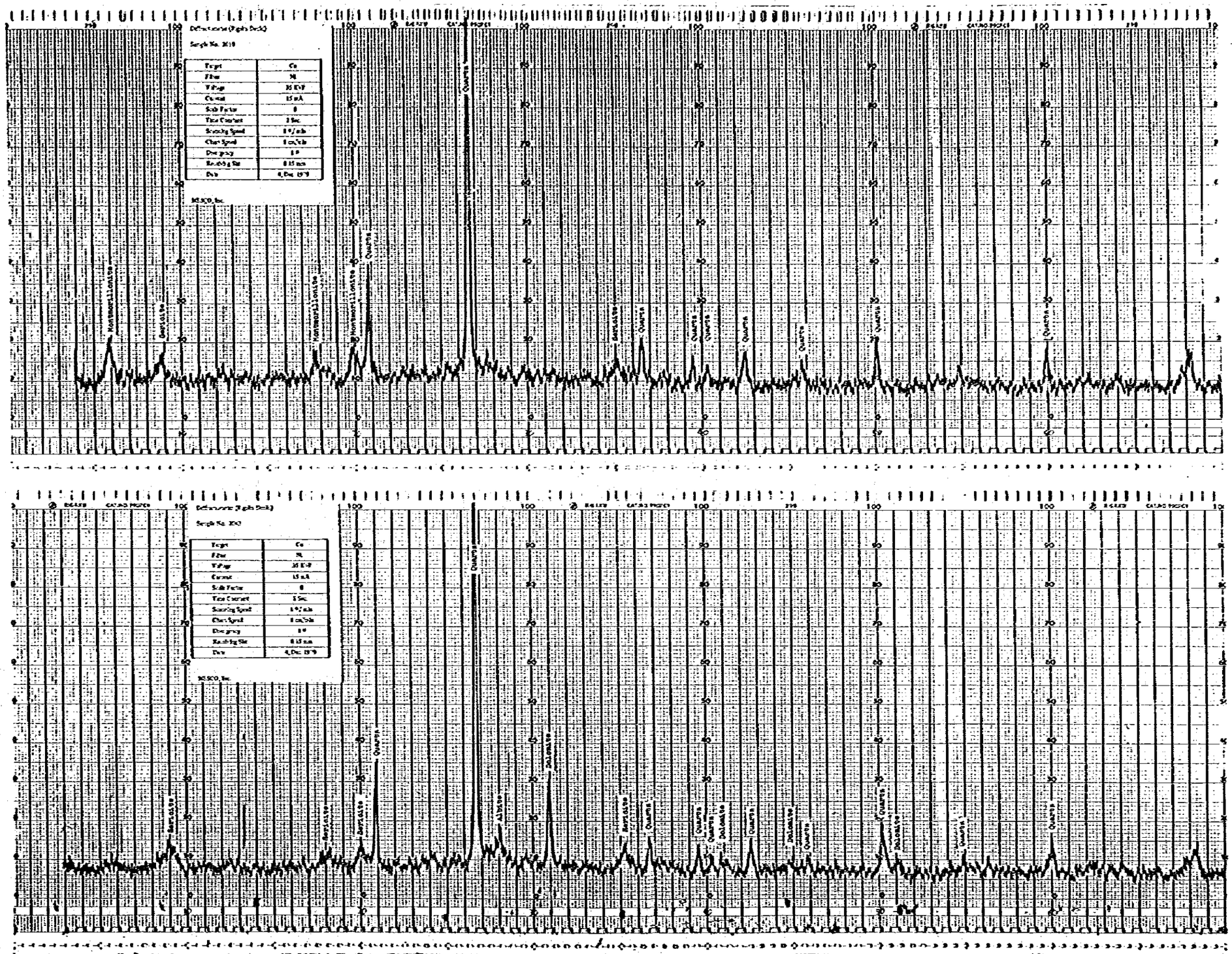
A. I—4 Results of X-ray Diffraction Test

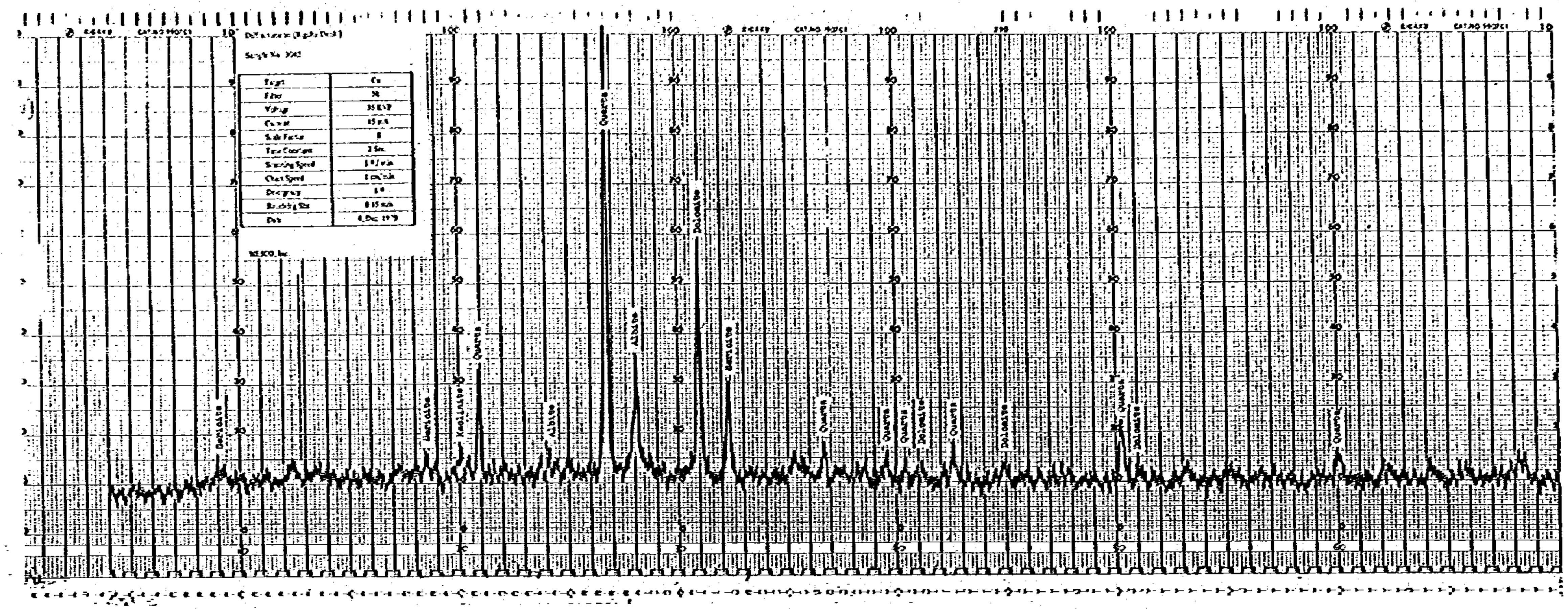
Minerals \ Sample No.	S031	S035	TM6	TM7	TM12	TM13	TM33	TM45	T7	T43	1014	1040	2010	2043	3020	3042	4010	4109	5010	5036	6006
DDH No.											54-1	54-1	54-2	54-2	54-3	54-3	54-4	54-4	54-5	54-5	54-6
Depth m											14	40	10	43	20	42	10	9	10	36	6
Quartz	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	◎	◎	◎	◎	◎	◎	◎	◎	◎
Albite											○	○		X		X			X	X	
Sericite	△	△	△	△	△	△	△		○	△	○	△	△	△	○	○	△	△	△	X	△
Kaolinite								○	X	X	X				X						△
Montmorillonite													○								
Chlorite	△																				
Dolomite												◎		○		○		○		○	
Calcite																			○		
Pyrite												X								X	

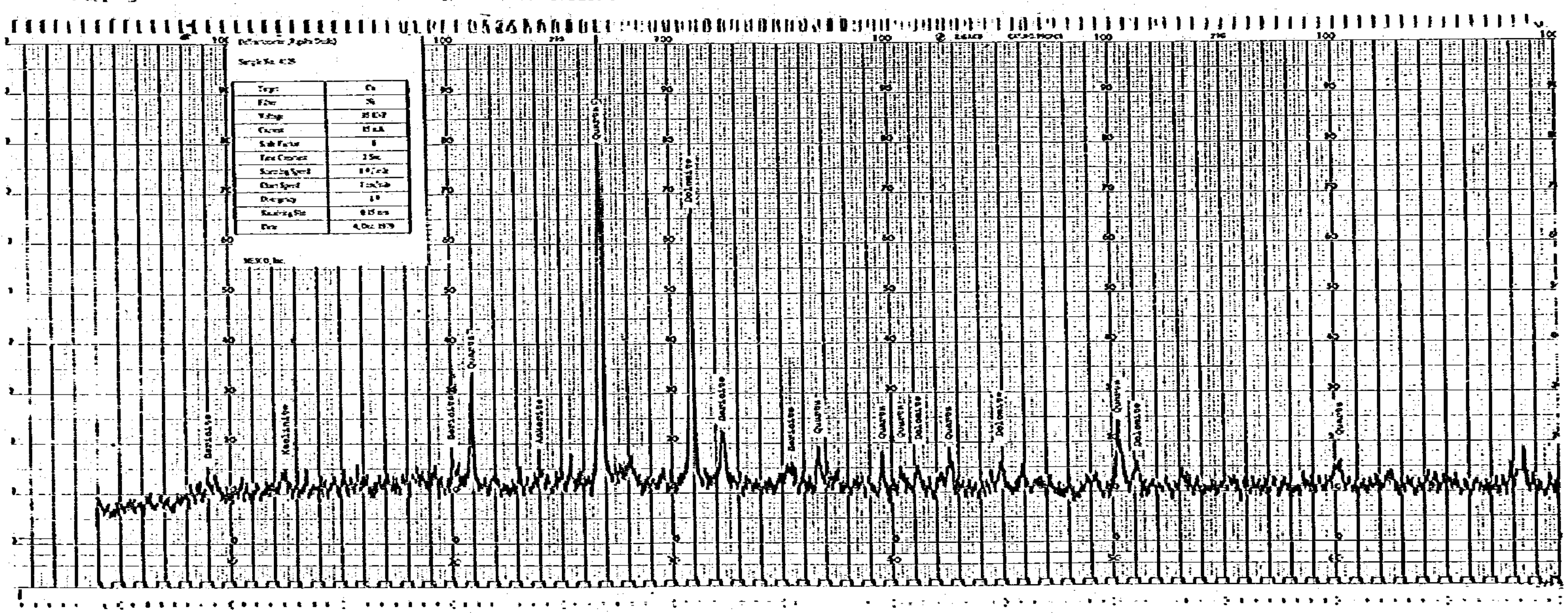
A. I—5 Chart of X-ray Diffraction Test




Target Cu
Filter Ni
Voltage 35 KV
Current 15 mA
Scale Factor 1
Time Constant 2 Sec
Scanning Speed 1°/min
Chart Speed 1 cm/min
Divergency 1°
Receiving Slit 0.15 mm
Date 6 Dec 1979
MEXICO, Inc.
Quartz
Albite
Dolomite
Pyrite


Target Cu
Filter Ni
Voltage 35 KV
Current 15 mA
Scale Factor 8
Time Constant 2 Sec.
Scanning Speed 1°/min
Chart Speed 1cm/min
Divergency 1°
Receiving Slit 0.15 mm
Date 4 Dec 1979
SCINTAG, Inc.
Montmorillonite
Dolomite
Quartz
Albite
Barytes


Sericite
Sericite
Kaolinite
Quartz
Albite
Quartz
Albite
Dolomite
Sericite
Quartz
Quartz
Quartz
Dolomite
Quartz
Dolomite
Quartz
Dolomite
Quartz


Sericite
Kaolinite
Sericite
Quartz
Ankerite
Quartz
Dolomite
Sericite
Sericite
Quartz
Quartz
Quartz
Dolomite
Quartz
Dolomite
Quartz
Dolomite
Quartz