Fig. 5.8.47 Geological Log of Borehole

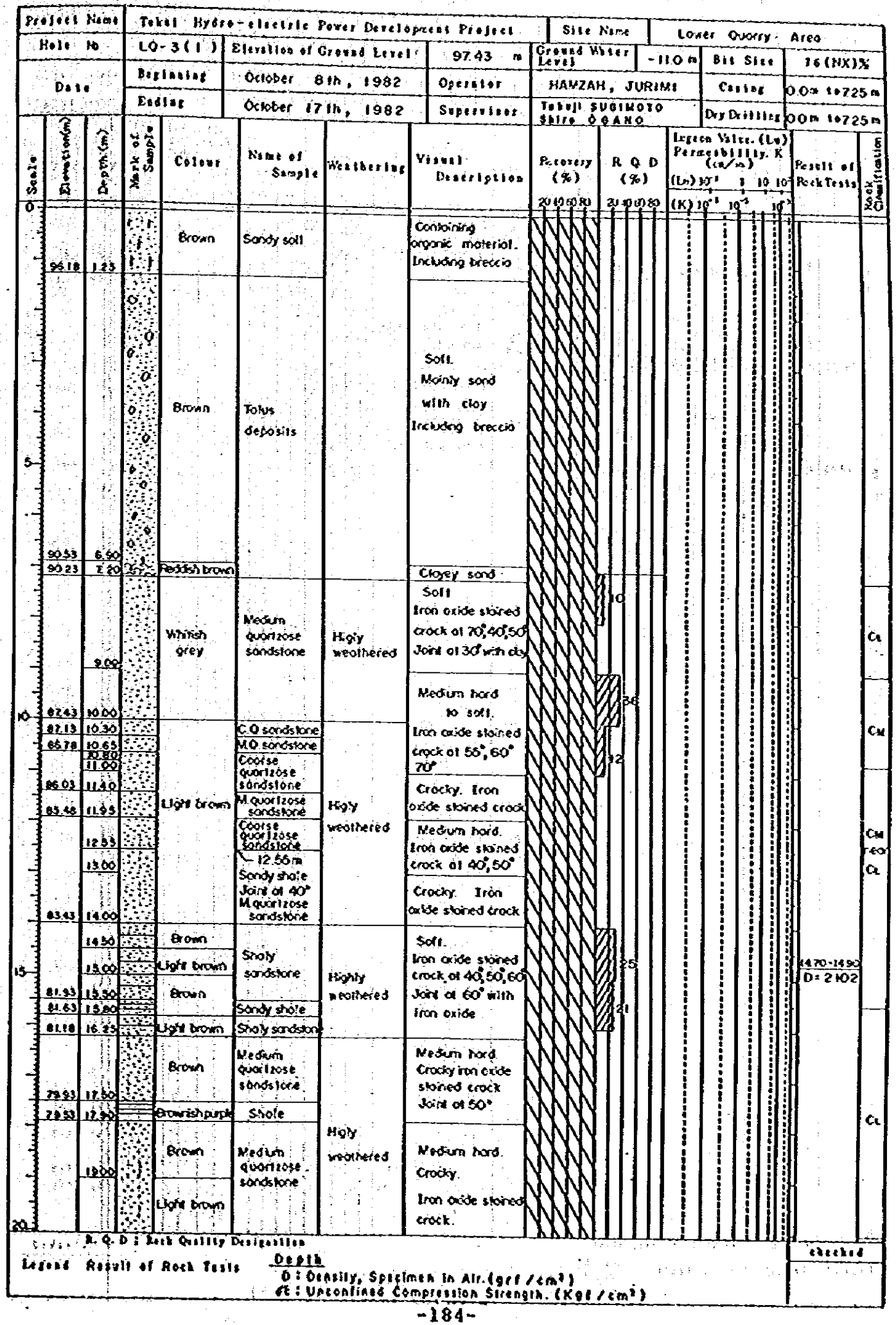


Fig. 5.8. 48 Geological Log of Borehole

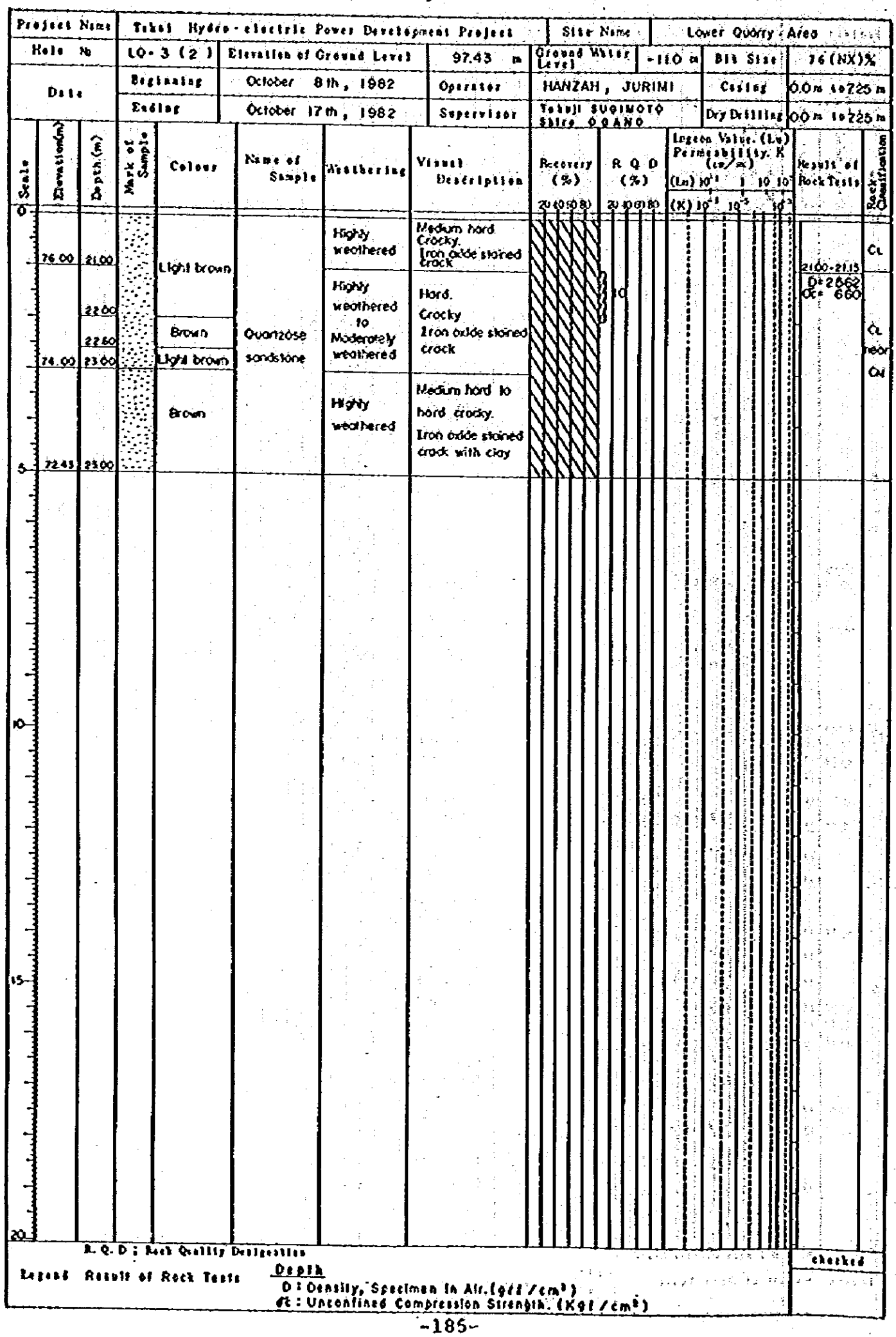


Fig. 5. 8. 49 Geological Log of Borehole

Project Name	Tekot Hydro-electric Power Development Project			Site Name	Lower Quarry Area
Hole No	LQ-4 (1)	Elevation of Ground Level	107.72 m	Ground Water Level	-80 m
Date	Beginning	October 13th, 1982	Operator	T. KRISHNAN	
	Ending	October 17th, 1982	Supervisor	Tetsuji SUGIMOTO, Shiro OBANO	

Bit Size: 76 (NX)%
Casing: 0.0m to 60 m
Dry Drilling: 0.0m to 5.9 m

Scale	Elevation (m)	Depth (m)	Mark of Sample	Colour	Name of Sample	Weathering	Visual Description	Recovery (%)	R Q D (%)	Lugeon Value (Lu) / Permeability K (cm/sec)	Result of Rock Tests	Rock Classification
0	107.42	0.30		Brown	Clayey soil		With organic material					
				Reddish brown	Shale	Completely weathered	Very soft Mainly clay with breccia					
		3.00										
	103.72	4.00		Brown								
5	101.87	5.85		Brownish grey	Clayey shale		Fractured zone					D
		7.00										
	100.07	7.65		Brown								
		8.00		Yellowish brown	Shale	Highly weathered	Crocky, Soft Iron oxide stained crack					Cr
	98.72	9.00		Purplish brown	Clayey shale		Fractured zone		24			D
	98.22	9.50			Sandy shale		Crack of 40°, 60° with clay		20			Cr
10	97.72	10.00		Purple	Shale		Fractured zone. Mainly breccia with clay.					D
	96.07	11.65		Brownish purple	Silty shale		Hard. Iron oxide stained crack of 50°, 40° with clay Joint of 45°		30			
	95.27	12.45		Purple	Shale				20			
	94.52	13.20										
		14.00		Purplish grey	Sandy shale	Moderately weathered	Medium hard Crocky Iron oxide stained crack with clay		30			Cr
15	92.72	15.00										
		15.45		Purplish brown			Medium hard Iron oxide stained. Crack of 60°					
		16.00		Purplish grey	Shale		Fractured zone Mainly breccia with clay					Cr
		17.00		Purple					40			neo D
	89.92	17.80		Light grey	Sandy shale		Crocky					
	89.42	18.30		Light grey	Fine sandstone	Moderately weathered	Hard to medium hard. Iron oxide stained crack of 20°, 40°, 60°		33		18.30-18.47 D=2.390 Qc=256	Cm
	88.72	19.00		Purplish grey	Shaly sandstone							
	88.37	19.35		Brownish grey	Fine sandstone				27			
20												

R. Q. D : Rock Quality Designation

Legend Result of Rock Tests — Depth
D : Density, Specimen in Air. (gf / cm³)
Qc : Unconfined Compression Strength. (Kgf / cm²)

checked

Fig. 5.8.50 Geological Log of Borehole

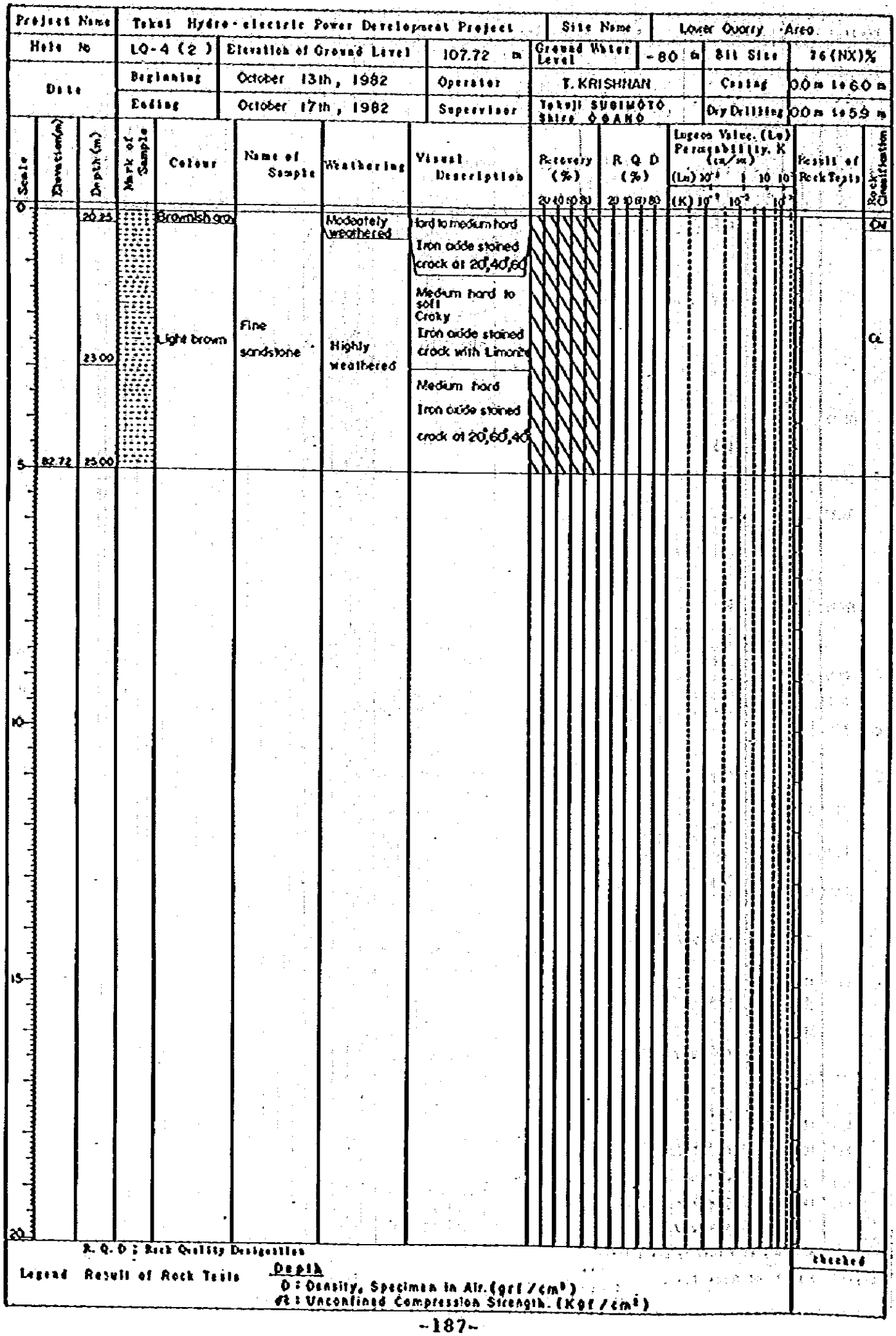


Fig. 5.8. 51 Geological Log of Borehole

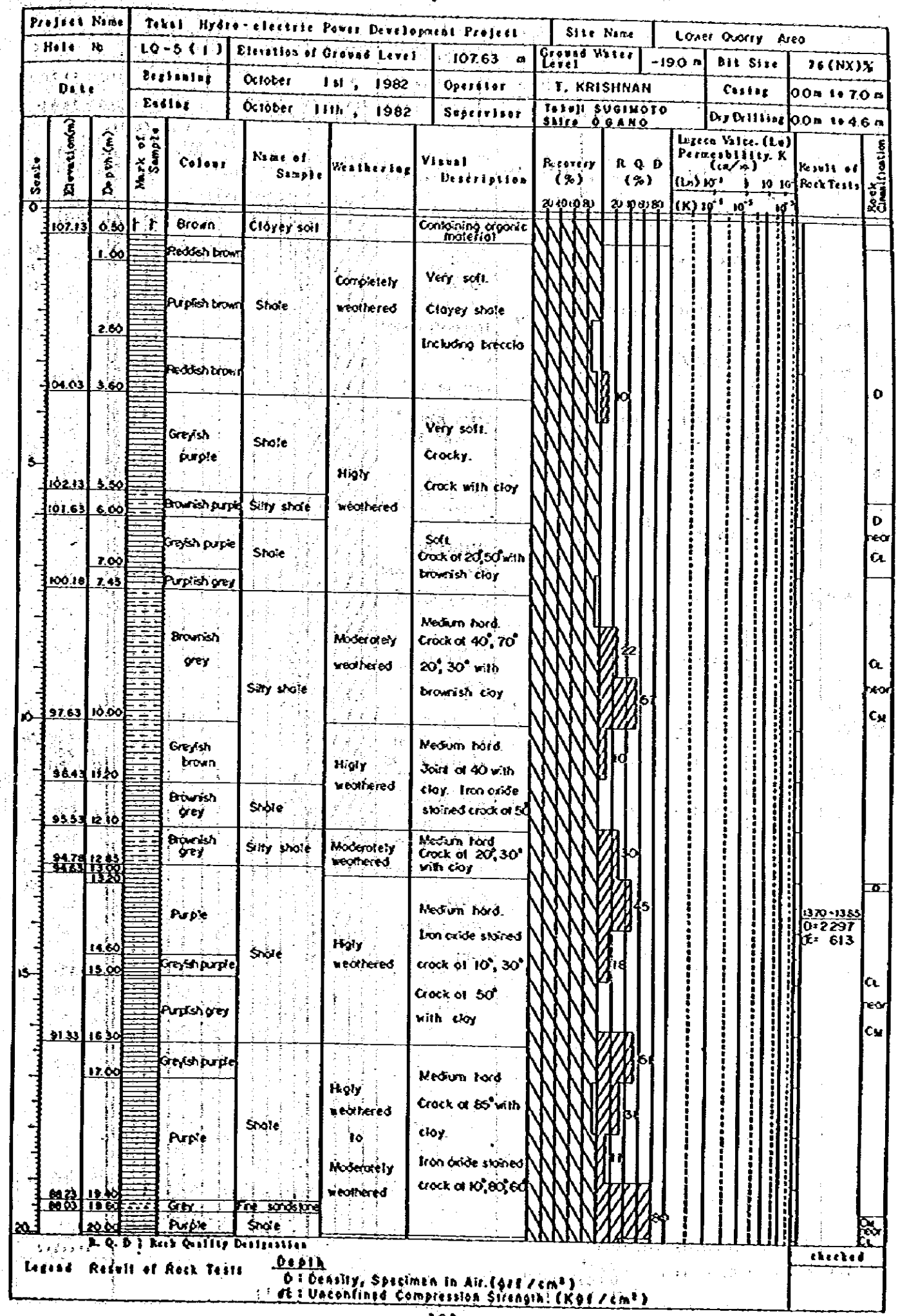


Fig. 5. 8.52 Geological Log. of Borehole

Project Name	Total Hydro-electric Power Development Project			Site Name	Lower Quarry	Area		
Hole No	LQ-5 (2)	Elevation of Ground Level	107.63 m	Ground Water Level	-19.0 m	Bit Size	76 (NX)%	
Date	Beginning	October 1st, 1982	Operator	T. KRISHNAN		Casing	0.0 m to 7.0 m	
	Ending	October 11th, 1982	Supervisor	Tetuji SUGIMOTO Shiro OGANO		Dry Drilling	0.0m to 4.6 m	

Scale	Elevation(m)	Depth(m)	Mark of Sample	Colour	Name of Sample	Weathering	Visual Description	Recovery (%)	R Q D (%)	Legeon Value, (Lu) Permeability K (cm/sec)	Result of Rock Tests	Rock Classification
0								20 40 60 80	20 40 60 80	(Lu) 10^{-1} 1 10 10^{2} (K) 10^{-3} 10^{-2} 10^{-1}		
	86.18	21.45		Purplish grey	Shale	Moderately weathered	Hard. Cracky.		32			CM near CL
	85.63	22.20		Brownish grey	Silty shale		Iron oxide stained crack.		81			
	84.53	23.10		Dark grey	Sandy shale		Joint at 35°		12			
	83.18	24.45		Dark grey	Silty shale		Clean joint at 35°		18			
		24.60			Fine sandstone							
5		25.10		Light grey								
		26.60		Purplish grey	Shale		Cracky zone. Medium hard.					CL
	80.13	27.50					Medium hard. Iron oxide stained crack at 60°,50°,70°		18			
		28.00		Light grey	Silty shale		Cracky. Iron oxide stained crack.		24			
	77.93	29.70				Moderately weathered						
10	77.38	30.25		Brownish grey	Fine sandstone		Hard. Iron oxide stained crack at 40°,50° Joint at 25°		33			CM
	76.63	31.00		Brownish grey	Sandstone						3045-3063 D=2.54 Qc=217	
	75.18	32.45		Greyish blue	Fine sandstone		Medium hard. Cracky zone		10			CL
				Purplish grey	Shale		Fractured zone Clayey With breccia					
	73.23	34.40										
15	72.63	35.00		Light blue	Shale sandstone		Hard. Clean crack at 85°					
20												

R. Q. D : Rock Quality Designation

Legend Result of Rock Tests Depth
D : Density, Specimen in Air. (gr f / cm³)
qt : Unconfined Compression Strength. (Kgf / cm²)

checked

Fig. 5. 8. 53 Geological Log of Borehole

Project Name	Tehri Hydro-electric Power Development Project			Site Name	Lower Quarry Area		
Hole No	LQ-6 (1)	Elevation of Ground Level	103.49 m	Ground Water Level	-18.0 m	Bit Size	76 (NX)%
Date	Beginning	September 22th, 1982	Operator	T. KRISHNAN		Casing	0.0m to 6.0 m
	Ending	September 27th, 1982	Supervisor	Tetuji SUGIMOTO Shire OGANO		Dry Drilling	0.0m to 5.8 m

Scale	Elevation(m)	Depth (m)	Mark of Sample	Colour	Name of Sample	Weathering	Visual Description	Recovery (%)	R Q D (%)	Lugeon Value (Lu) Permeability K (cm/sec)	Result of Rock Tests	Rock Classification
0	103.19	0.30		Dark brown			Sandy soil.					
	102.44	1.05		Brownish yellow	Talus deposits		Containing organic material					
	101.67	1.80					Sandy clay. Very soft.					
	101.29	2.20		Brown								
5	97.34	6.15		Brown	Shale	Completely weathered	Very soft. Clayey.					D
		6.20		Brownish yellow	Shale		Very soft. Crocky. Iron oxide stained crack with clay		16			
	95.79	7.70		Purplish brown	Shaly sandstone							
	93.49	8.00		Brownish grey	Shaly sandstone		Soft. Crocky		3			
	94.79	8.70		Greyish brown	Shale		Iron oxide stained crack with clay. Iron oxide stained joint at 40°					
	94.19	9.30										
	93.39	9.90										
10	93.14	10.35		Light brown	Sandy shale							CL
	91.59	11.90		Brown	Shale	Highly weathered	Soft, Crocky Iron oxide stained crack. Crack with clay					
	91.29	12.40					Crocky zone with limonite					
	89.54	13.75					Medium hard Crack at 50° with limonite. limonite sealed crack at 40°, 60°		0			
	89.29	14.20		Purplish brown	Sandy shale		Medium hard. Crocky, Iron oxide stained crack. Joint at 30°					
	88.89	15.00		Greyish brown	Shale							
15	88.04	15.45		Purplish brown	Medium quartzose sandstone	Moderately to Highly weathered						CM near CL
		16.00		Light brown			Hard. Crocky. Iron oxide stained crack		23			
	86.59	16.85										
		16.90		Reddish brown	16.65-16.90m shale 17.30m 17.90m shale 18.20m Medium sandstone	Highly weathered	Hard. Iron oxide stained crack at 30°, 50°					CL
	84.49	19.00		Brown			Medium hard. Crocky, Iron oxide stained crack					
	84.09	19.40		Whitish grey	Mq sandstone Clay	Highly weathered	Medium hard. Crocky, Iron oxide stained crack.		5			
20	83.49	20.00		Whitish grey	Medium quartzose sandstone Clay							

R. Q. D : Rock Quality Designation

Legend Result of Rock Tests Depth

O : Density, Specimen in Air. (gr f / cm³)

Qt : Unconfined Compression Strength. (Kg f / cm²)

checked

Fig. 5.8.54 Geological Log. of Borehole

Project Name	Tokai Hydro-electric Power Development Project			Site Name	Lower Quarry Area
Hole No	LQ-6 (2)	Elevation of Ground Level	103.49 m	Ground Water Level	-18.0 m
Date	Beginning	September 22nd, 1982	Operator	T. KRISHNAN	
	Ending	September 27th, 1982	Supervisor	Tokuji SUGIMOTO, Shiro OGANO	

Bit Size	76 (NX)%
Casing	0.0m to 6.0 m
Dry Drilling	0.0m to 6.8 m

Scale	Elevation (m)	Depth (m)	Mark of Sample	Colour	Name of Sample	Weathering	Visual Description	Recovery (%)	R Q D (%)	Lugeon Value, (Lu) Permeability, K (cm/sec) (Lu) 10^{-1} 1 10 10^{2} (K) 10^{-6} 10^{-4} 10^{-2}	Result of Rock Tests	Rock Classification
0								20 40 60 80	20 40 60 80			
	82.49	21.00		Brown	Medium quartzose sandstone	Higly weathered	Medium hard. Crocky, Iron oxide stained crack.		10		2.60 ± 2.75	CL
		22.00				Higly weathered to Moderately weathered	Hard. Iron oxide stained crack at 60°, 50°, 40°				De 2.574 σ_c 1 717	CL near CM
	80.89	22.60		Light brown	22.60 to 22.65m Shale							
	80.49	23.00			Coarse quartzose sandstone		Hard. Crocky. Iron oxide stained crack.					
	79.98	23.50										
	79.49	24.00		Light brown	Medium quartzose sandstone	Moderately weathered	Hard. Iron oxide stained crack at 40°, 60°, 20°		33			
5	78.49	25.00										
10												
15												
20												

R. Q. D : Rock Quality Designation

Legend Result of Rock Tests — Depth

D : Density, Specimen in Air. (gf / cm³)

σ_c : Unconfined Compression Strength. (Kgf / cm²)

checked

Table. 5. 9.1

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. L-1

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
26 July '81	5.00	9.70	14.70	4.1×10^{-4} (32)
27 July '81	5.00	14.70	19.70	1.7×10^{-4} (13)
28 July '81	5.00	19.70	24.70	3.7×10^{-4} (29)
8 Aug. '81	5.00	24.70	29.70	1.9×10^{-4} (15)
9 Aug. '81	5.00	29.70	34.70	0
11 Aug. '81	5.00	34.70	39.70	1.1×10^{-4} (8.6)
12 Aug. '81	5.00	39.70	44.70	1.8×10^{-4} (1.4)

Table. 5.9.2

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. L-2

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
7 Oct. '81	5.00	9.00	14.00	6.0×10^{-4} (47)
7 Oct. '81	5.00	14.00	19.00	4.2×10^{-4} (33)
8 Oct. '81	5.00	19.00	24.00	4.3×10^{-4} (34)
9 Oct. '81	5.00	24.00	29.00	4.2×10^{-4} (33)
9 Oct. '81	5.00	29.00	34.00	2.2×10^{-4} (17)
10 Oct. '81	5.00	34.00	39.00	2.0×10^{-4} (16)

Table. 5. 9. 3

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. L-3

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
21 Aug. '81	5.00	3.50	8.50	6.8×10^{-4} (53)
25 Aug. '81	4.75	8.50	13.25	6.3×10^{-4} (50)
28 Aug. '81	5.00	13.50	18.50	4.7×10^{-4} (37)
30 Aug. '81	5.00	18.50	23.50	2.6×10^{-4} (20)
2 Sep. '81	5.00	23.50	28.50	1.1×10^{-4} (8.6)
20 Sep. '81	3.80	29.50	33.30	2.5×10^{-4} (21)
23 Sep. '81	5.00	33.85	38.85	4.2×10^{-4} (33)

Table. 5. 9. 4

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. L-4

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
29 Sep. '81	5.00	9.70	14.70	4.8×10^{-4} (37)
30 Sep. '81	5.00	20.00	25.00	3.6×10^{-4} (28)
1 Oct. '81	5.00	25.00	30.00	2.5×10^{-4} (22)
3 Oct. '81	5.00	30.00	35.00	2.3×10^{-4} (18)
4 Oct. '81	5.00	35.00	40.00	3.4×10^{-4} (27)
5 Oct. '81	5.00	40.00	45.00	3.3×10^{-4} (26)
6 Oct. '81	5.00	45.00	50.00	3.2×10^{-4} (25)

Table. 5. 9. 5

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-2

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
15 July '82	5.00	10.00	15.00	5.1×10^{-4} (39.7)
16 July '82	5.00	15.00	20.00	2.8×10^{-4} (21.6)
17 July '82	5.00	20.00	25.00	3.6×10^{-4} (28.1)
20 July '82	5.00	25.00	30.00	3.0×10^{-4} (23.4)
27 July '82	5.00	30.00	35.00	1.6×10^{-4} (12.5)
29 July '82	5.00	35.00	40.00	1.1×10^{-4} (8.82)
30 July '82	5.00	40.00	45.00	6.9×10^{-5} (5.38)
30 July '82	5.00	45.00	50.00	5.4×10^{-5} (4.20)

Table . 5.9.6

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-3

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
16 July '82	5.00	5.00	10.00	3.0×10^{-4} (23.3)
17 July '82	5.00	10.00	15.00	3.0×10^{-4} (23.7)
19 July '82	5.00	15.00	20.00	2.0×10^{-4} (15.9)
20 July '82	5.00	20.00	25.00	2.8×10^{-4} (22.1)
5 Aug. '82	5.00	25.00	30.00	2.4×10^{-4} (19.0)
6 Aug. '82	5.00	30.00	35.00	2.2×10^{-4} (17.0)
12 Aug. '82	5.00	35.00	40.00	1.5×10^{-4} (11.6)
14 Aug. '82	5.00	40.00	45.00	1.5×10^{-4} (11.6)
19 Aug. '82	4.00	45.00	49.00	9.4×10^{-4} (7.37)

Table. 5. 9. 7

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-4 (1)

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
11 July '82	4.50	0.50	5.00	8.9×10^{-4} (70.6)
12 July '82	5.00	5.00	10.00	7.8×10^{-4} (61.2)
14 July '82	5.00	10.00	15.00	7.0×10^{-4} (54.3)
16 July '82	5.00	15.00	20.00	3.8×10^{-4} (29.8)
16 July '82	5.00	20.00	25.00	2.3×10^{-4} (18.3)
17 July '82	5.00	25.00	30.00	2.1×10^{-4} (16.3)
17 July '82	5.00	30.00	35.00	1.2×10^{-4} (9.21)
20 July '82	5.00	35.00	40.00	1.9×10^{-4} (14.5)
20 July '82	5.00	40.00	45.00	1.0×10^{-4} (8.04)
26 July '82	5.00	45.00	50.00	7.7×10^{-5} (5.99)

Table . 5 . 9 . 8

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. UD-4 (2)

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
27 July '82	5.00	50.00	55.00	3.0×10^{-4} (23.3)
5 Aug. '82	5.00	55.00	60.00	2.0×10^{-4} (15.8)
6 Aug. '82	5.00	60.00	65.00	2.1×10^{-4} (16.6)
7 Aug. '82	5.00	65.00	70.00	1.3×10^{-4} (10.4)
8 Aug. '82	5.00	70.00	75.00	3.2×10^{-4} (24.6)
10 Aug. '82	5.00	75.00	80.00	3.0×10^{-4} (23.7)

Table. 5.9.9

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-5

DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
27 July '82	3.00	7.00	10.00	2.5×10^{-4} (22.2)
29 July '82	5.00	10.00	15.00	2.4×10^{-4} (18.7)
30 July '82	5.00	15.00	20.00	1.8×10^{-4} (13.7)
30 July '82	5.00	20.00	25.00	1.4×10^{-4} (11.1)
31 July '82	5.00	25.00	30.00	1.9×10^{-4} (15.1)
1 Aug. '82	5.00	30.00	35.00	8.4×10^{-5} (6.54)
2 Aug. '82	5.00	35.00	40.00	1.7×10^{-4} (13.4)
2 Aug. '82	5.00	40.00	45.00	6.6×10^{-5} (5.17)
3 Aug. '82	5.00	45.00	50.00	3.0×10^{-5} (2.36)

Table. 5.9.10

SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-6

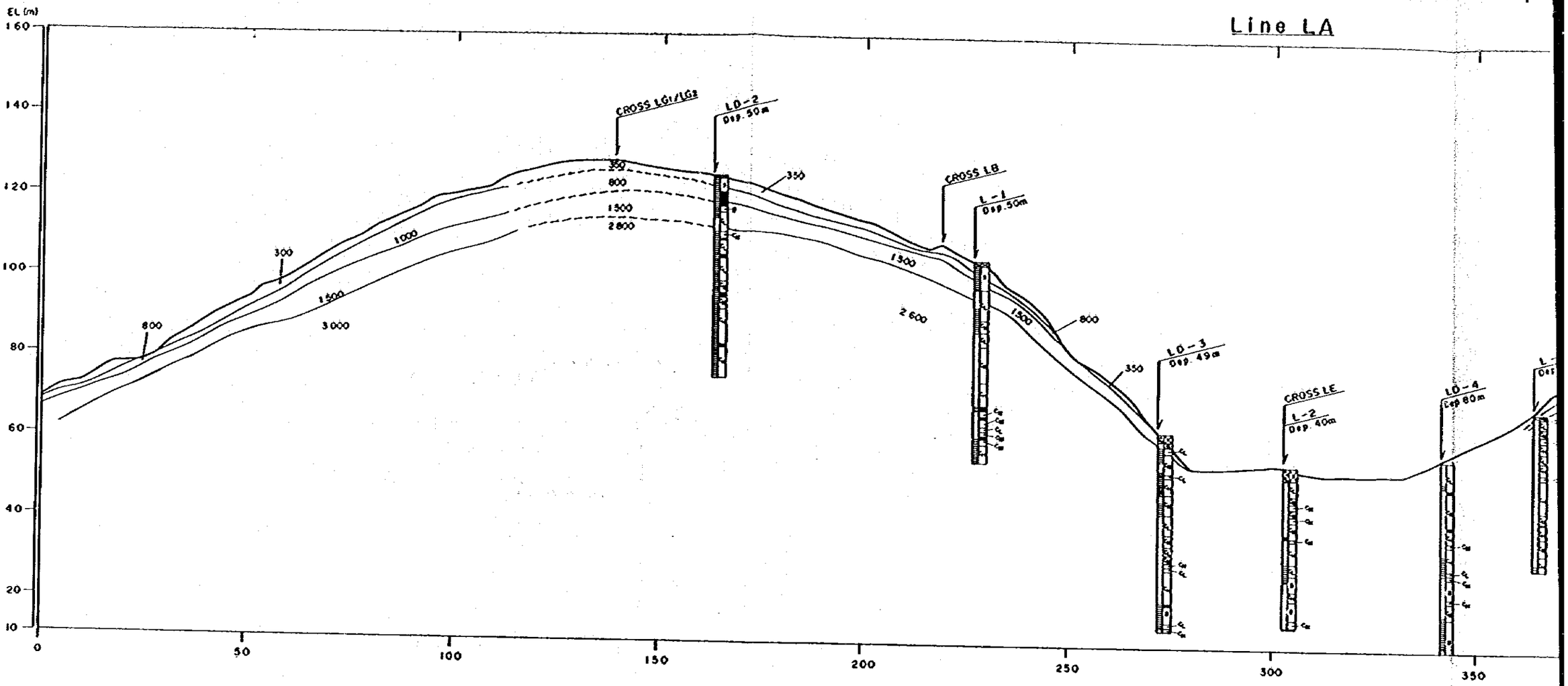
DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
17 July '82	5.00	5.00	10.00	2.8×10^{-4} (22.2)
20 July '82	5.00	10.00	15.00	2.1×10^{-4} (16.7)
26 July '82	5.00	15.00	20.00	2.8×10^{-4} (21.9)
26 July '82	5.00	20.00	25.00	1.6×10^{-4} (12.6)
27 July '82	5.00	25.00	30.00	1.6×10^{-4} (12.7)
28 July '82	5.00	30.00	35.00	1.3×10^{-4} (10.2)
29 July '82	5.00	35.00	40.00	1.6×10^{-4} (12.6)
31 July '82	5.00	40.00	45.00	1.5×10^{-4} (11.7)
1 Aug. '82	5.00	45.00	50.00	1.2×10^{-4} (9.60)

Table. 6. 9. 11

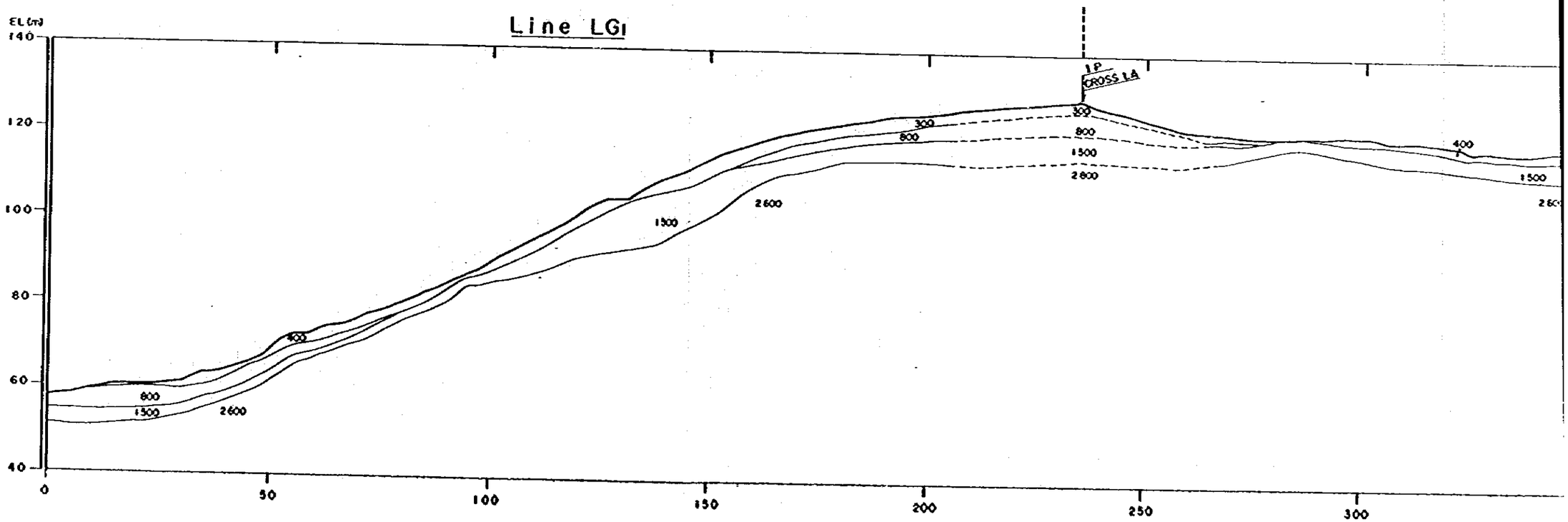
SUMMARY OF PERMEABILITY FOR BOREHOLE NO. LD-14

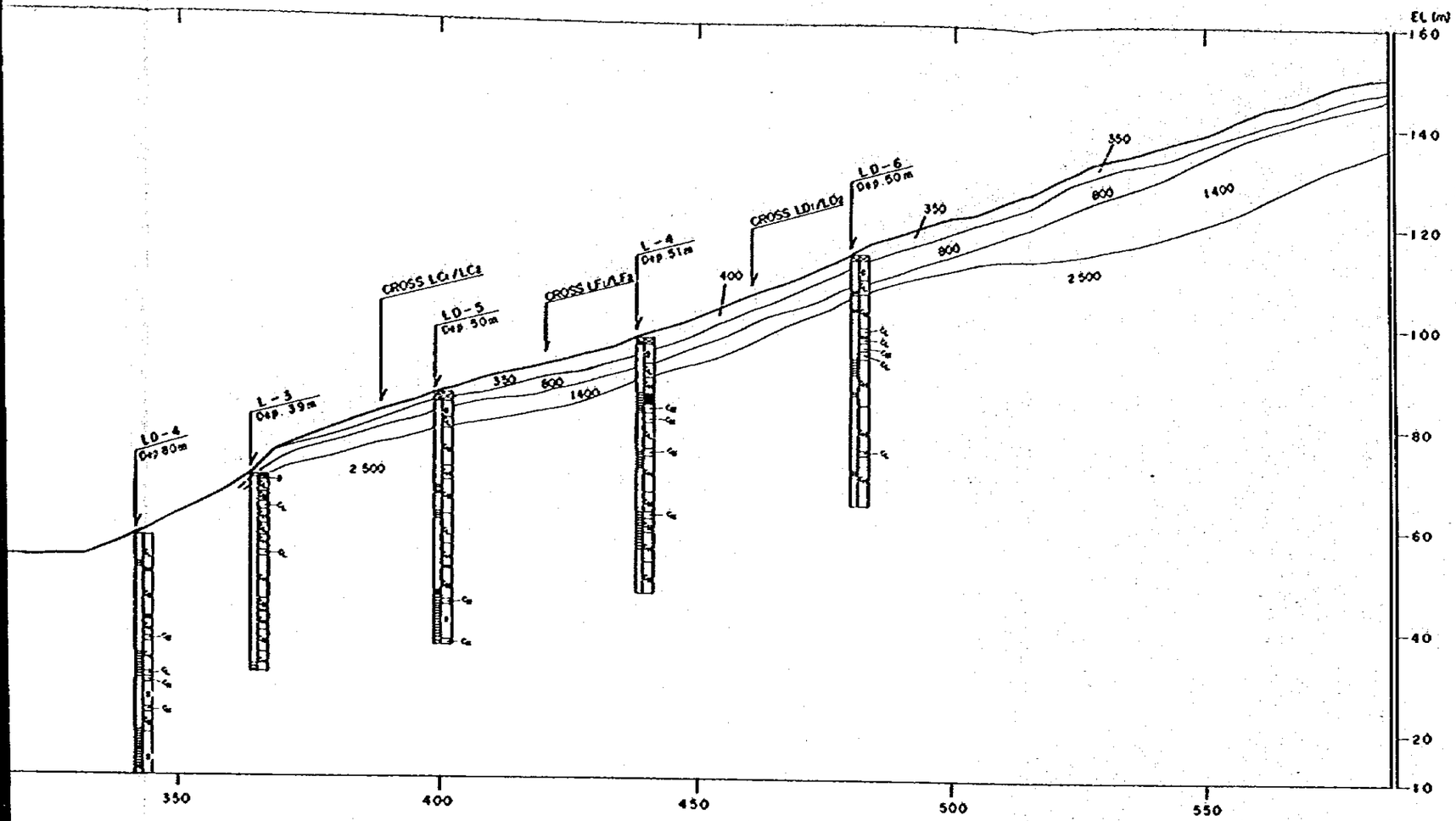
DATE	TESTING SECTION (M)	DEPTH (M)		PERMEABILITY (K) (LUGEON VALUE)
		FROM	TO	
2 Aug. '82	2.50	2.50	5.00	3.0×10^{-4} (27.4)
3 Aug. '82	5.00	5.00	10.00	2.6×10^{-4} (20.1)
4 Aug. '82	5.00	10.00	15.00	1.0×10^{-4} (7.80)
5 Aug. '82	5.00	15.00	20.00	2.9×10^{-4} (23.0)
5 Aug. '82	5.00	20.00	25.00	2.0×10^{-4} (15.7)
6 Aug. '82	5.00	25.00	30.00	1.2×10^{-4} (9.00)
10 Aug. '82	5.00	30.00	35.00	1.6×10^{-4} (12.3)
12 Aug. '82	5.00	35.00	40.00	1.5×10^{-4} (11.8)
14 Aug. '82	5.00	40.00	45.00	1.3×10^{-4} (9.84)
16 Aug. '82	5.00	45.00	50.00	1.0×10^{-4} (8.04)

Line LA



Line LG1





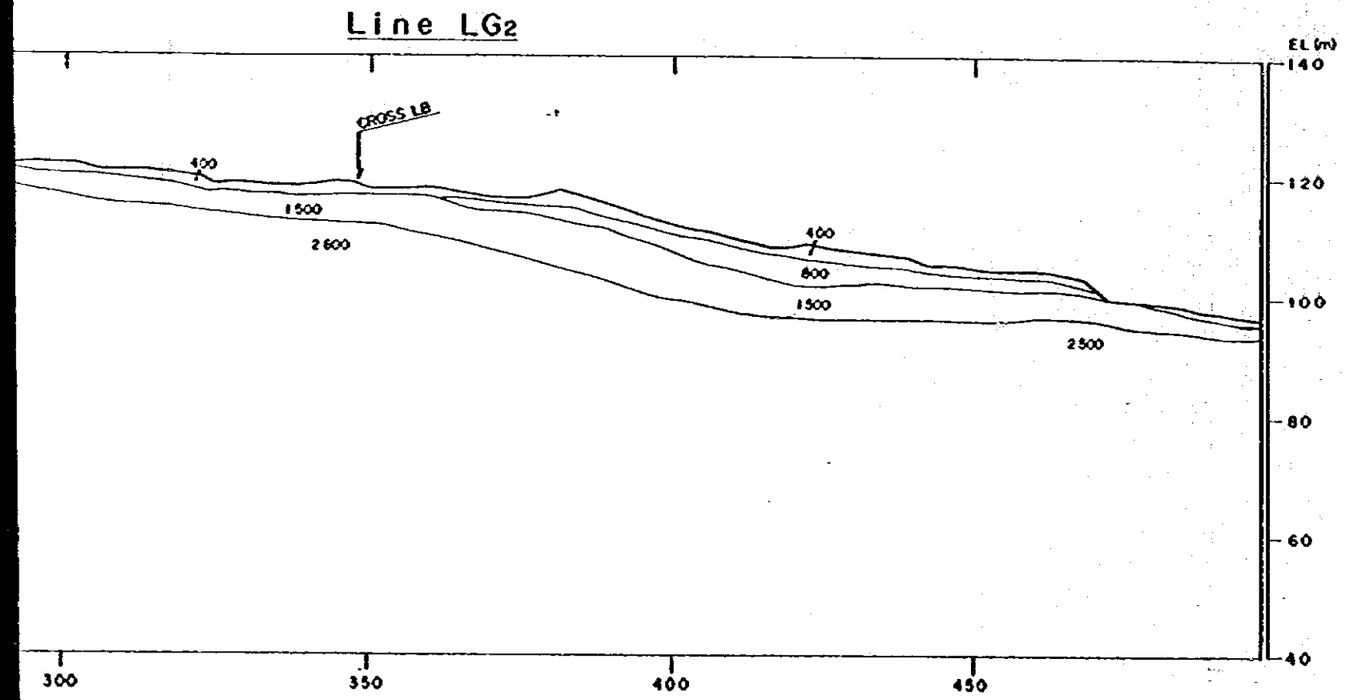
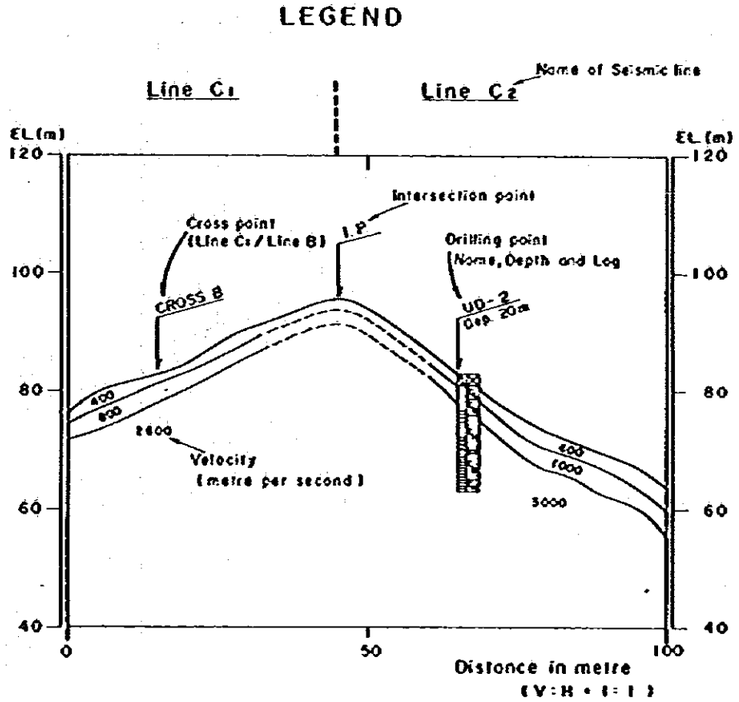
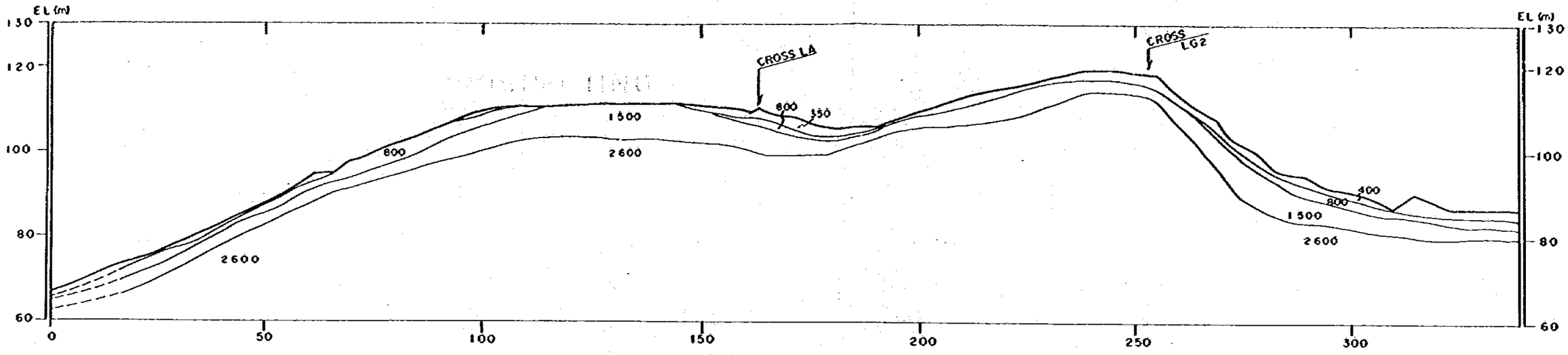


Fig. 5.9.1
SEISMIC PROSPECTING



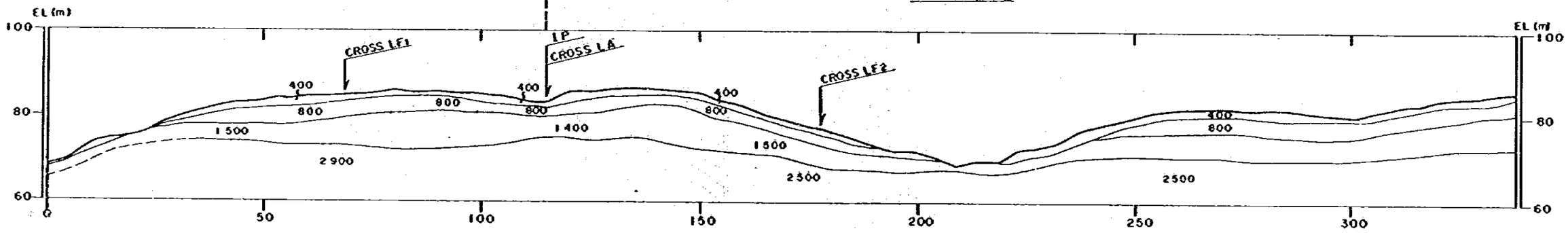
Line LA, LG1 / LG2
(Lower Dam Site)

Line LB



Line LC1

Line LC2



Line LD1

Line LD2

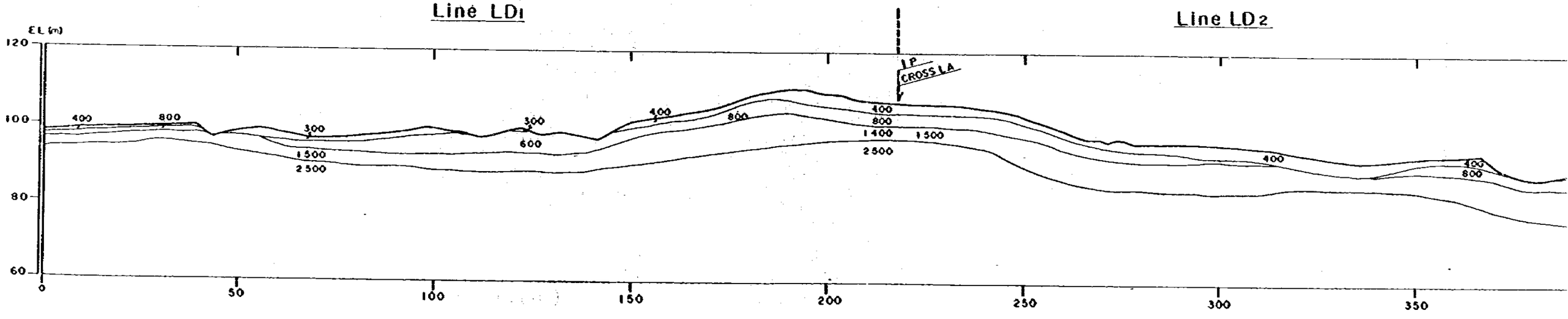
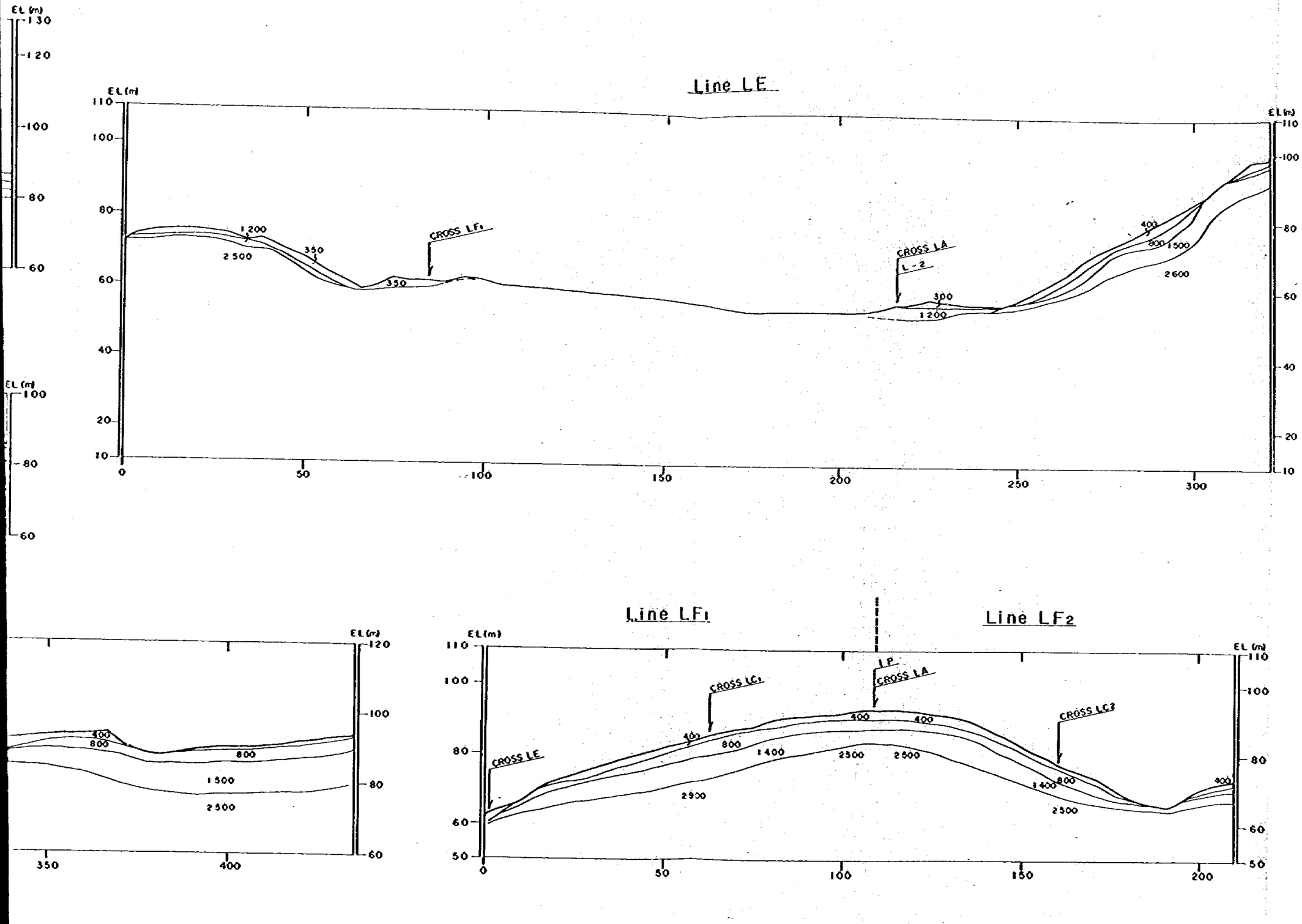
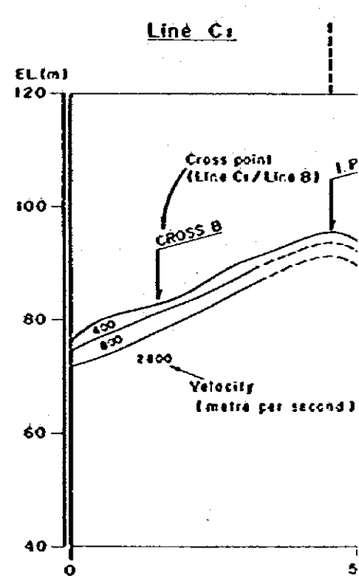


Fig. 5.9.2
SEISMIC PRO



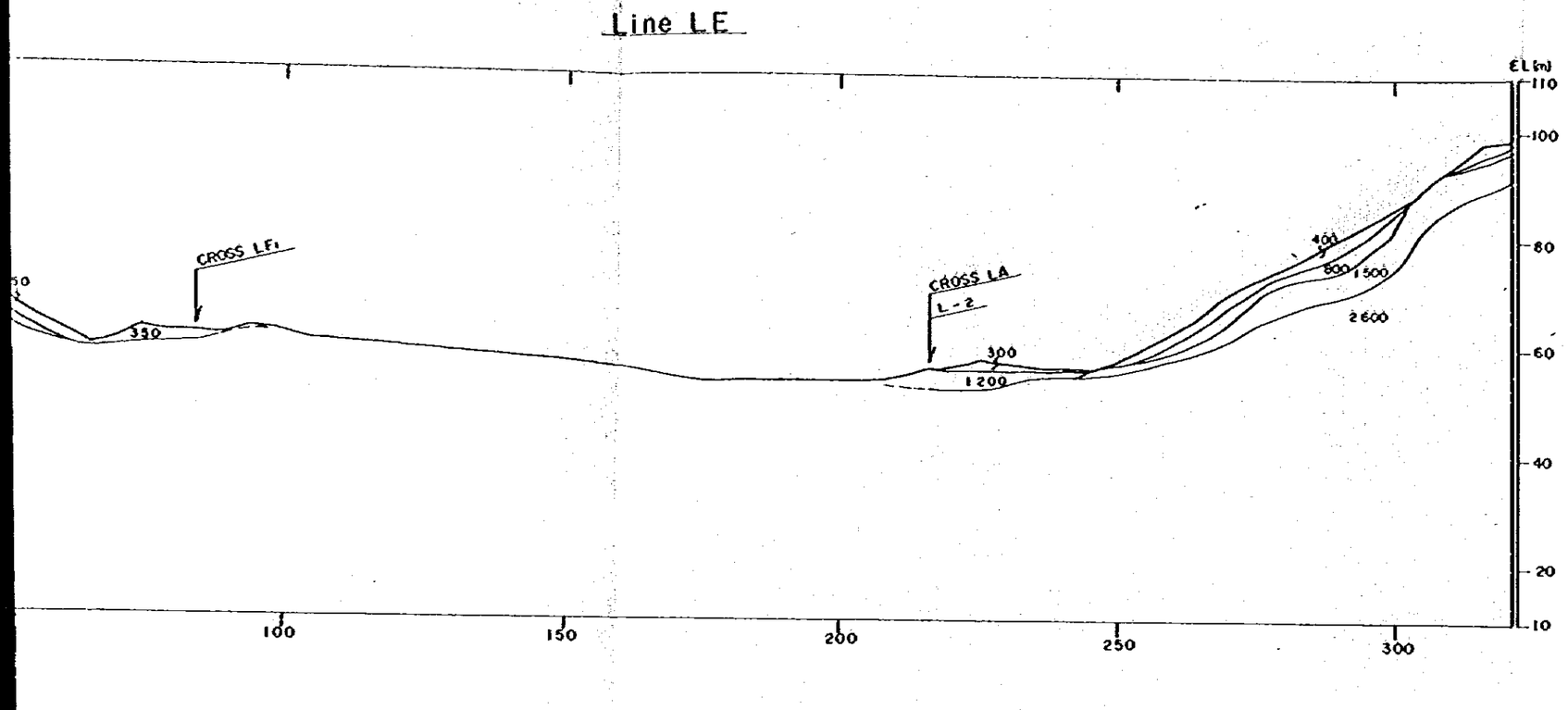


LEGE

Mark of Sample

- Talus Deposits
- Stratum of Predominantly Sandst
- Stratum of Predominantly Shale
- Conglomerate
- Alternation of Sandstone and Sh

Line LB, LC1/LC2
LE, LF1 / LI
(Lower Dam



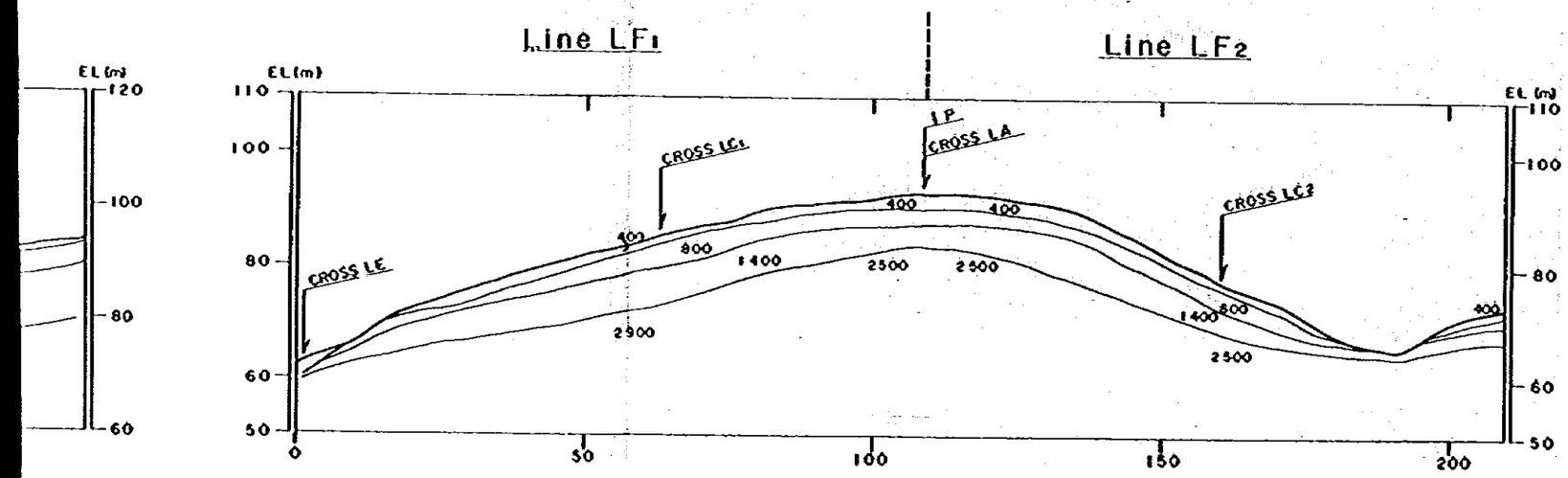
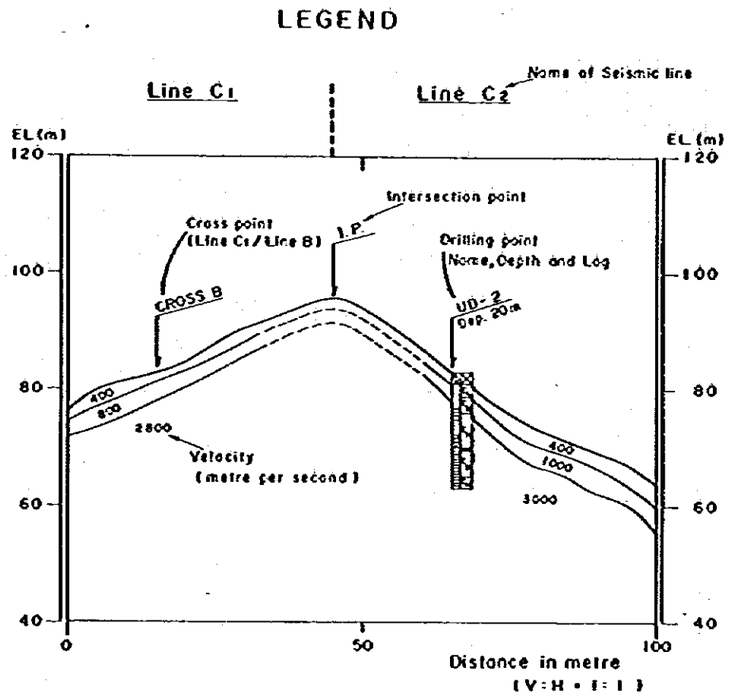
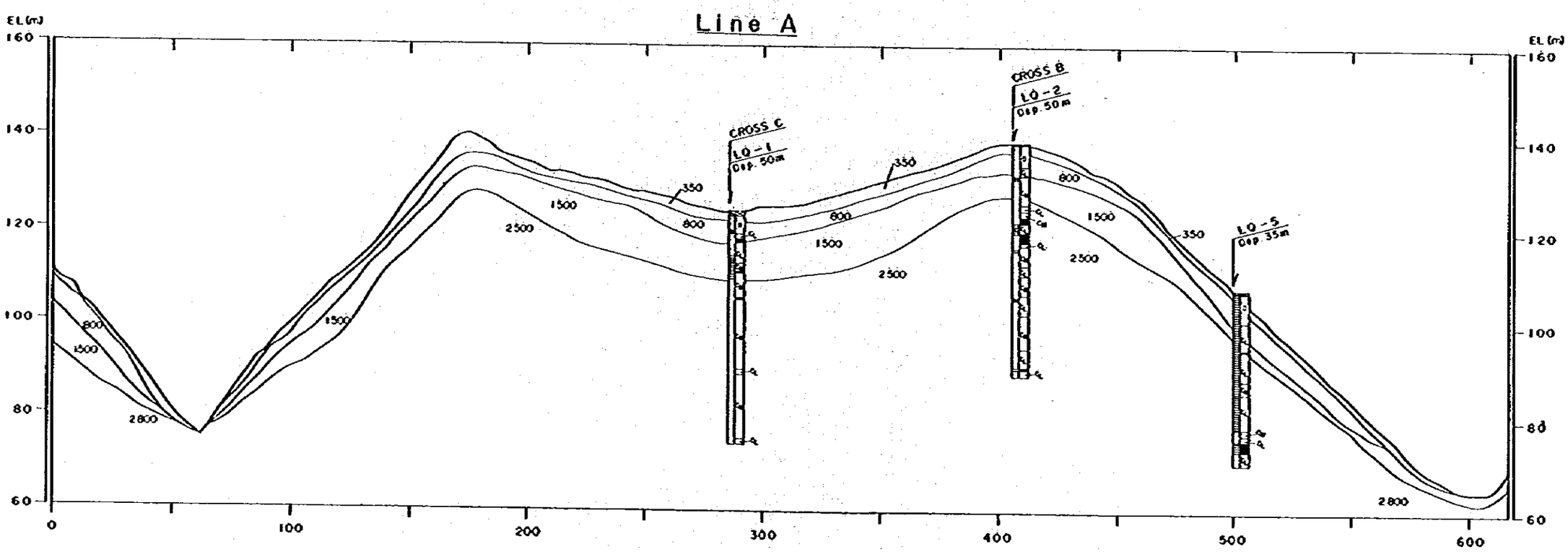


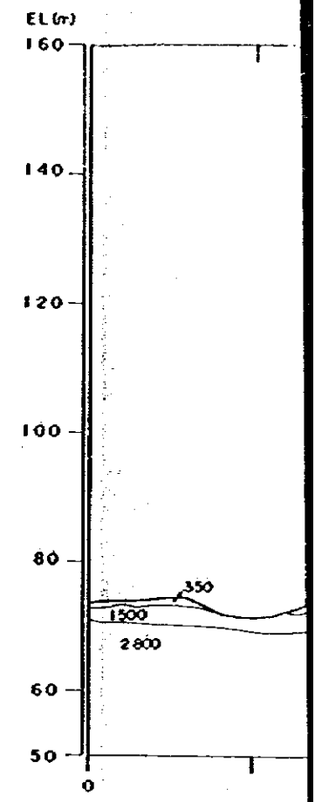
Fig. 5.9.2
SEISMIC PROSPECTING

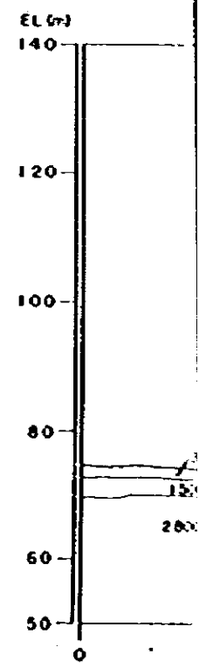


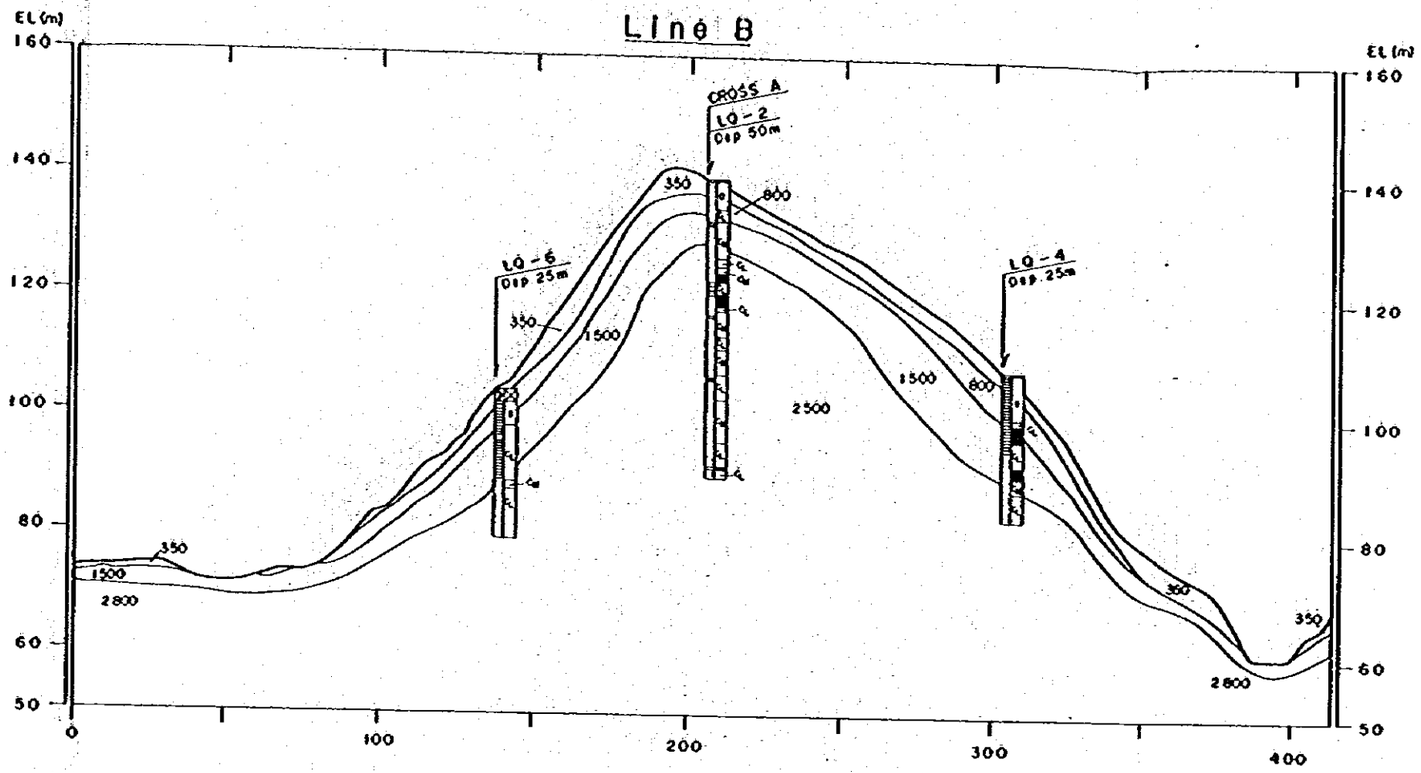
Line LB, LC1/LC2, LD1 / LD2,
LE, LF1 / LF2
(Lower Dam Site)

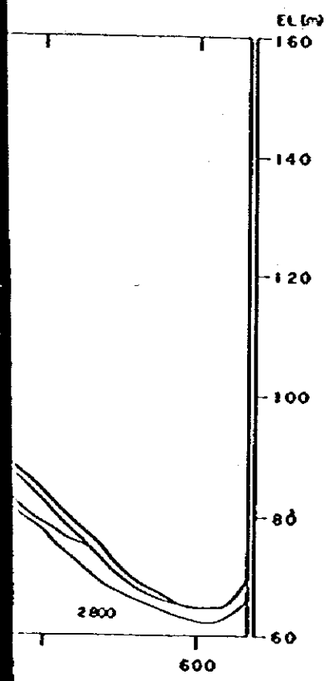
Line A


EL(m)
160
140
120
100
80
60
0
100
200
300
400
500
600
CROSS C
LO-1
Dep. 50m
CROSS B
LO-2
Dep. 50m
LO-5
Dep. 35m
350
800
1500
2500
2800


EL(m)
160
140
120
100
80
60
50
0
350
1500
2800


EL(m)
140
120
100
80
60
50
0





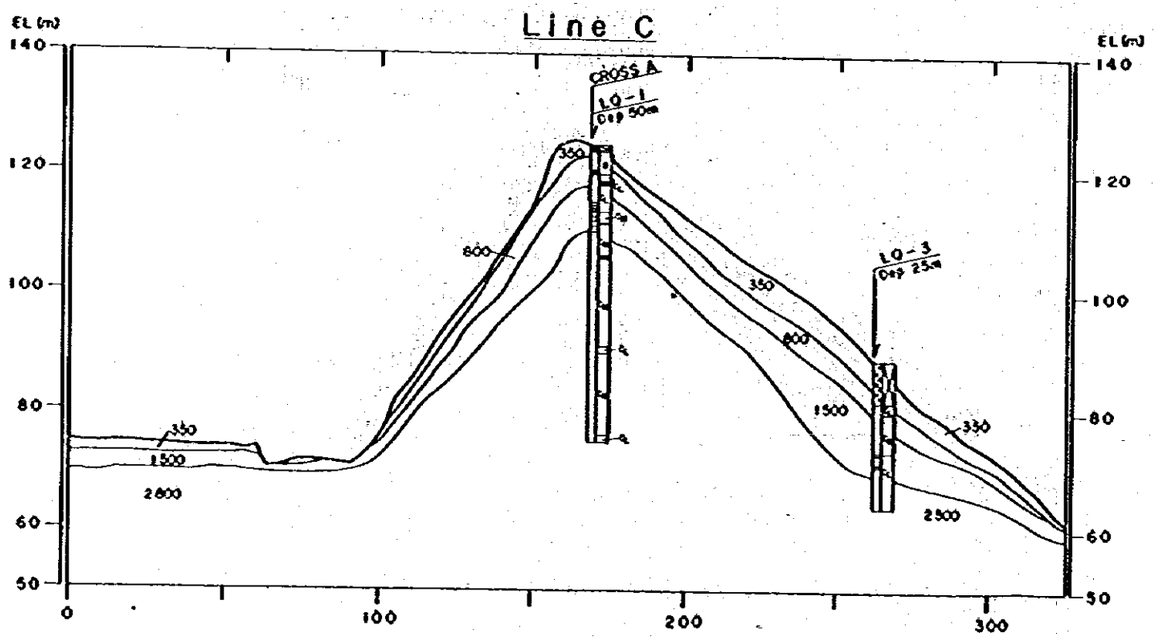
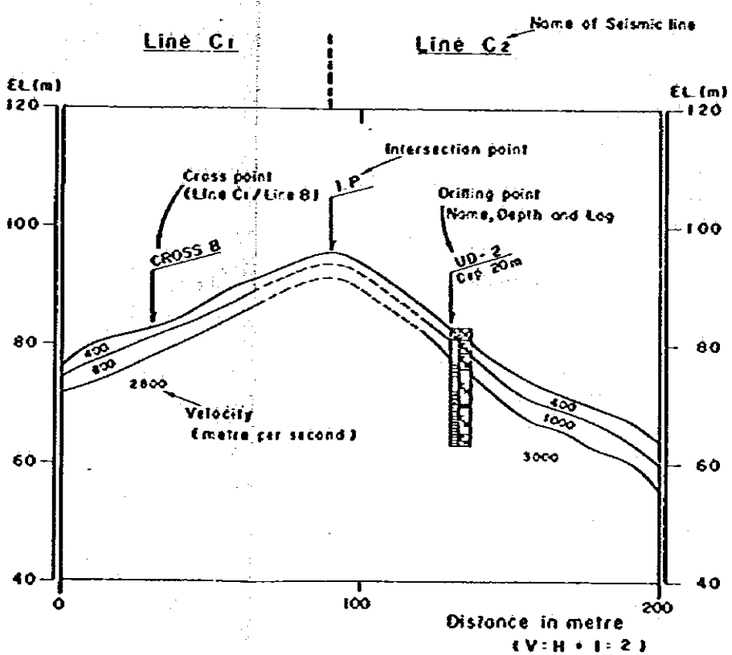


Fig. 5.10
SEISMIC PROSPECTING

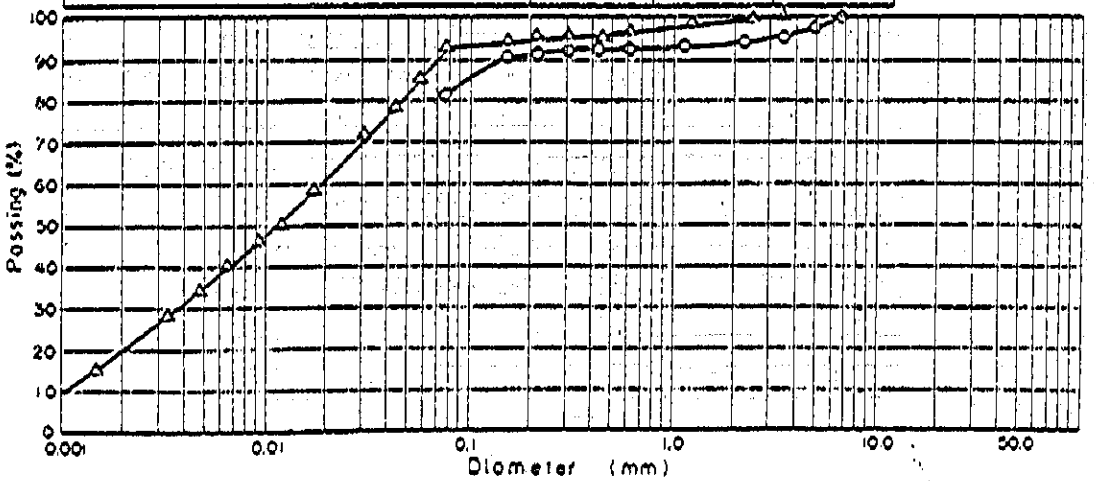


Line A,B,C
(Lower Quarry Area)

6. SOIL TESTING

Table-6.4.1 Result of Soil Test (Pit No P-1)

Test Number			1	2	3
Depth		m	1.0	1.8	
Grading	Max Diameter	mm	67	33.5	
	Grovel (2,000μm over)	%	6	1	
	Sand (74~2,000μm)	%	13	8	
	Silt (5~74μm)	%	81	58	
	Clay (5μm under)	%		33	
Specific Gravity (Gs)			2.69	2.70	
Moisture Content (Wn)		%	18	14	
Consistency	Liquid Limit (W_L)	%		34	
	Plastic Limit (W_P)	%		20	
	Plasticity Index (PI)			14	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	20.0	15.5	
	Max. Dry Density (γ_{dmax})	g/cm³	1.73	1.84	
	Void ratio (e)		0.56	0.47	
	Degree of Saturation (Sr)		97	90	
Permeability (Kn)		x10⁻⁷cm/sec	4.33	4.07	



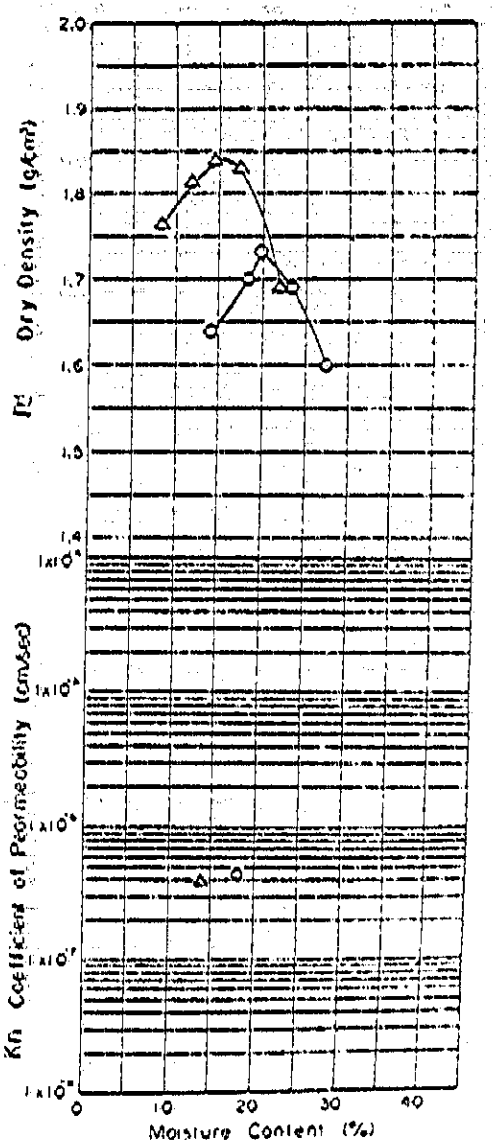
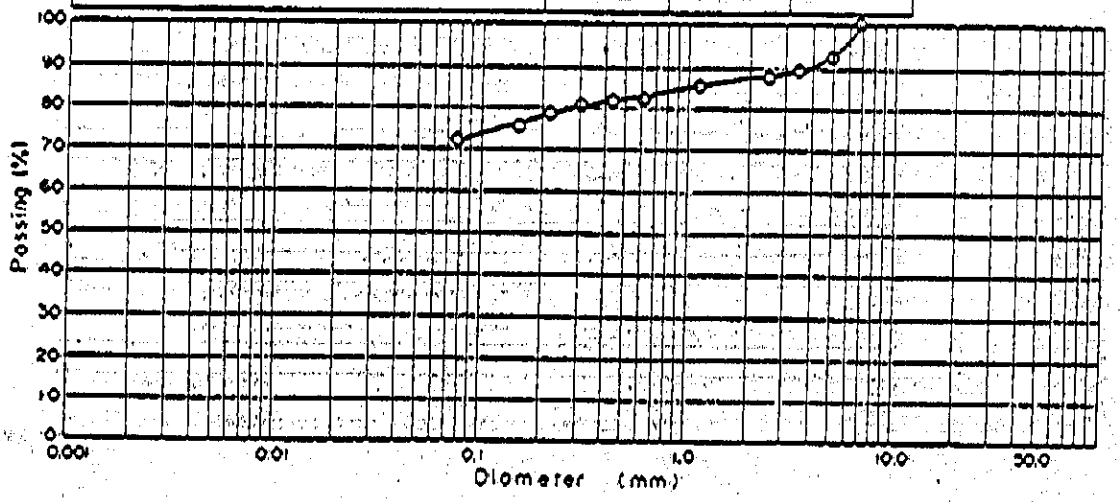


Table 6.4.2 Result of Soil Test (Pit No P-2)

Test Number			1	2	3
Depth		m	1.0		
Grading	Max Diameter	mm	67		
	Gravel (2,000μm over)	%	14		
	Sand (74~2,000μm)	%	14		
	Silt (5~74μm)	%	72		
	Clay (5μm under)	%			
Specific Gravity	(Gs)		2.69		
Moisture Content	(Wn)	%	19		
Consistency	Liquid Limit (WL)	%	48		
	Plastic Limit (Wp)	%	35		
	Plasticity Index (PI)		13		
	Classification (ASTM)		ML		
Moisture-Density	Optimum Moisture Content (Wopt)	%	16.9		
	Max. Dry Density (γdmax)	g/cm³	1.84		
	Void ratio (e)		0.46		
	Degree of Saturation (Sr)		99		
Permeability	(Kn) x10⁻⁴	cm/sec	6.92		



○ Test No. 1
△ Test No. 2
□ Test No. 3

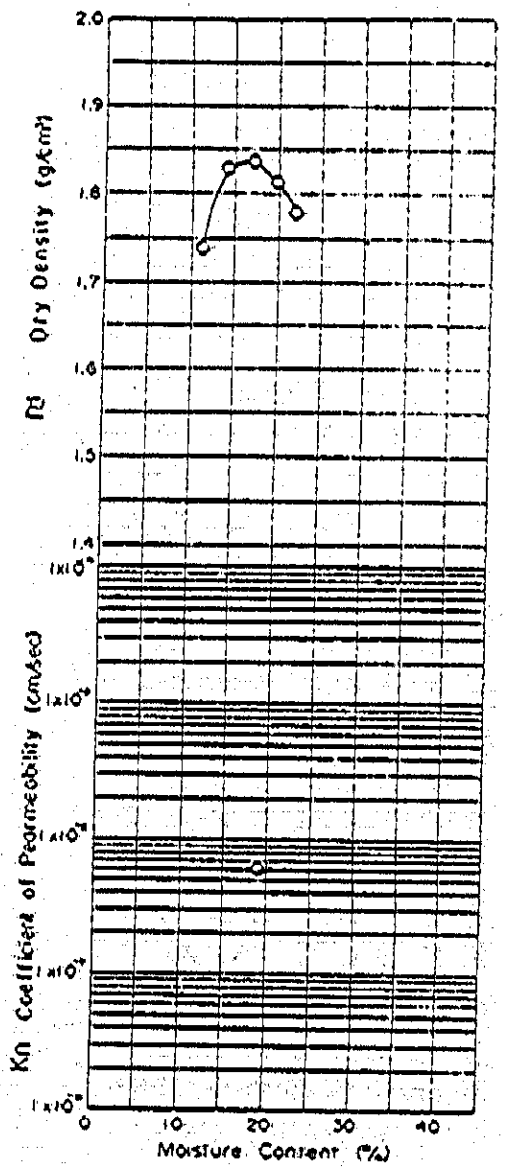
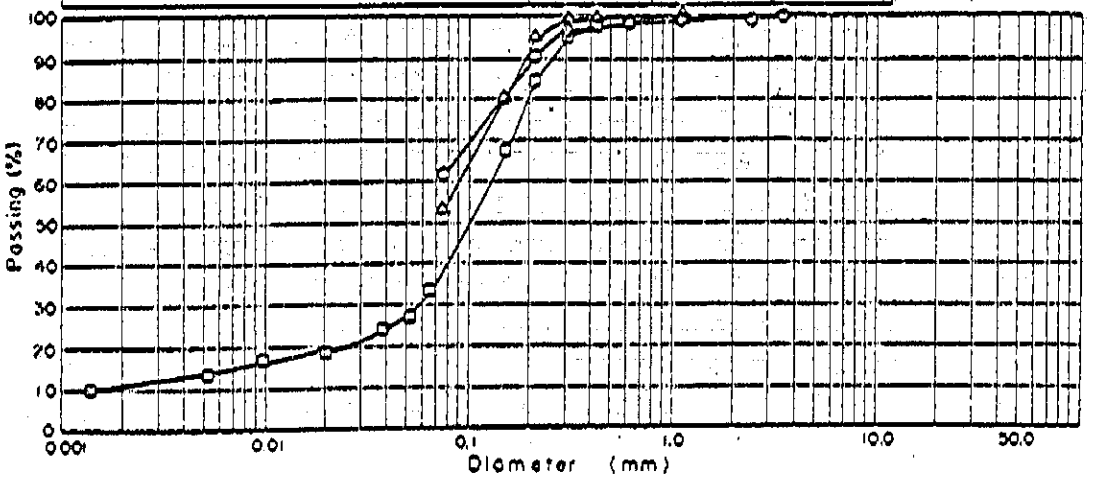


Table 6.4.3 Result of Soil Test (Pit No P-3)

			1	2	3
Test Number					
Depth		m	1.0	2.0	4.0
Grading	Max Diameter	mm	33.5	11.8	11.8
	Gravel (2,000μm over)	%	1	0	0
	Sand (74~2,000μm)	%	37	47	66
	Silt (5~74μm)	%	62	53	20
	Clay (5μm under)	%			14
Specific Gravity (Gs)			2.58	2.52	2.68
Moisture Content (Wn)		%	24	18	14
Consistency	Liquid Limit (W_L)	%			25
	Plastic Limit (W_P)	%			18
	Plasticity Index (PI)				7
	Classification (ASTM)				SC
Moisture-Density	Optimum Moisture Content (Wopt)	%	20.5	13.3	14.7
	Max. Dry Density (γ_{dmax})	g/cm³	1.75	1.82	1.87
	Void ratio (e)		0.47	0.39	0.43
	Degree of Saturation (Sr)		1.00	87	91
Permeability (Kn)		x10⁻⁴cm/sec	5.00	3.85	4.04



○ Test No. 1
△ Test No. 2
□ Test No. 3

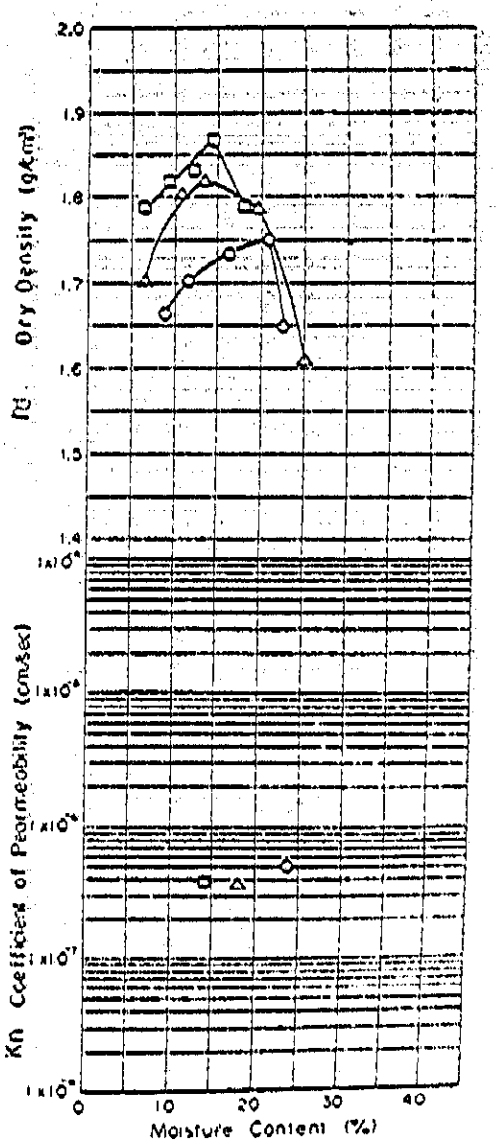
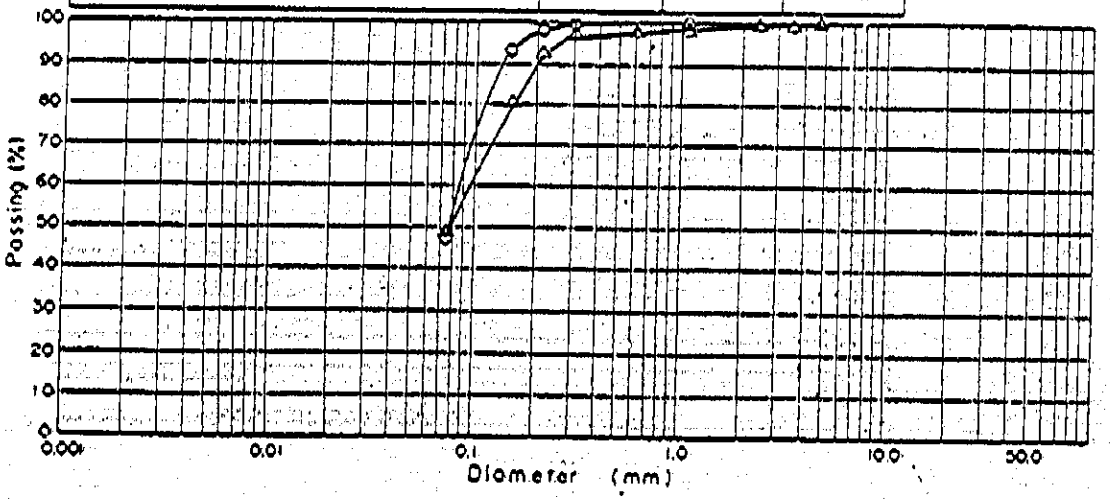


Table 6.4.4 Result of Soil Test (Pit No P-4)

Test Number			1	2	3
Depth		m	1.0	1.8	
Grading	Max Diameter	mm	11.8	4.75	
	Gravel (2,000μm over)	%	0	1	
	Sand (74~2,000μm)	%	52	50	
	Silt (5~74μm)	%	48	49	
	Clay (5μm under)	%			
Specific Gravity (Gs)			2.58	2.59	
Moisture Content (Wn)		%	22	11	
Consistency	Liquid Limit (W_L)	%		26	
	Plastic Limit (W_P)	%		21	
	Plasticity Index (PI)			5	
	Classification (ASTM)			CL-ML	
Moisture-Density	Optimum Moisture Content (Wopt)	%	18.3	13.1	
	Max. Dry Density (γ_{dmax})	g/cm³	1.80	1.87	
	Void ratio (e)		0.43	0.39	
	Degree of Saturation (Sr)		100	88	
Permeability (Kn)		x10⁻⁴cm/sec	5.46	5.32	



○ Test No. 1
△ Test No. 2
□ Test No. 3

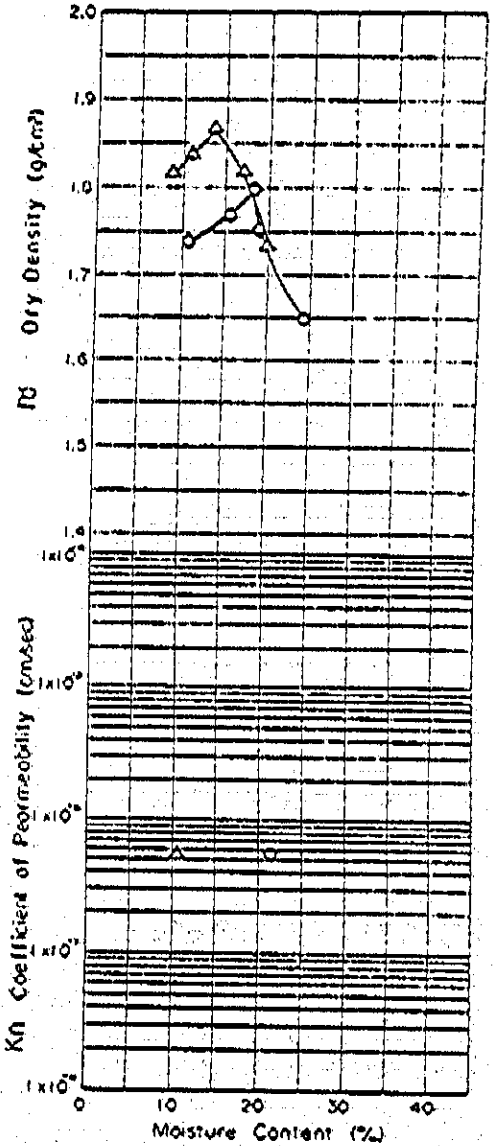
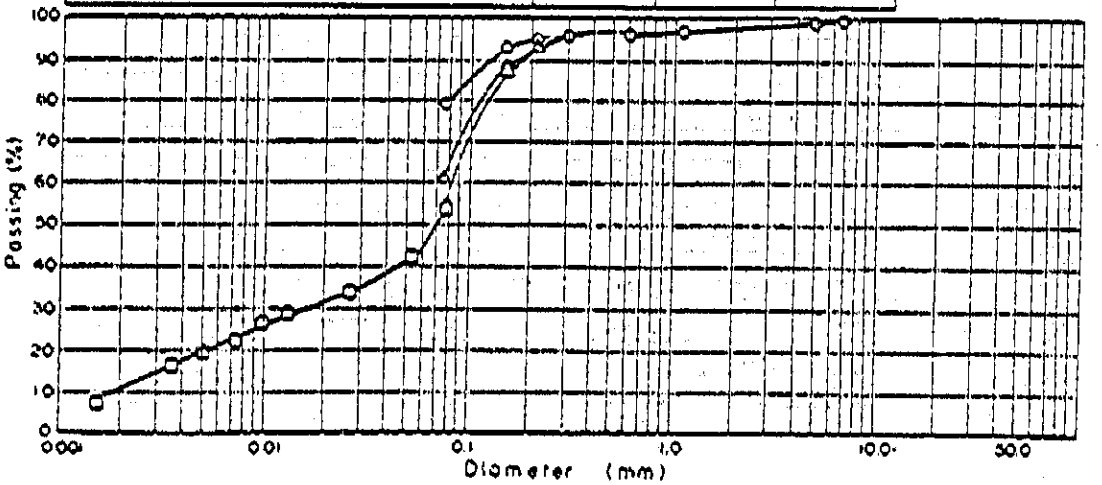


Table 6.4.5 Result of Soil Test (Pit No P-5)

Test Number			1	2	3
Depth		m	1.2	2.4	4.5
Grading	Max Diameter	mm	6.7	6.7	3.35
	Gravel (2,000μm over)	%	2	2	1
	Sand (74~2,000μm)	%	19	37	47
	Silt (5~74μm)	%	79	61	33
	Clay (5μm under)	%			19
Specific Gravity (Gs)			2.61	2.69	2.51
Moisture Content (Wn)		%	29	22	20
Consistency	Liquid Limit (W_L)	%			36
	Plastic Limit (W_P)	%			21
	Plasticity Index (PI)				15
	Classification (ASTM)				CL
Moisture-Density	Optimum Moisture Content (Wopt)	%	26.8	18.5	20.0
	Max. Dry Density (γ_{dmax})	g/cm³	1.57	1.72	1.75
	Void ratio (e)		0.66	0.56	0.43
	Degree of Saturation (Sr)		1.00	.98	1.00
Permeability	(Kn) x10⁻⁶cm/sec		8.14	7.04	4.26



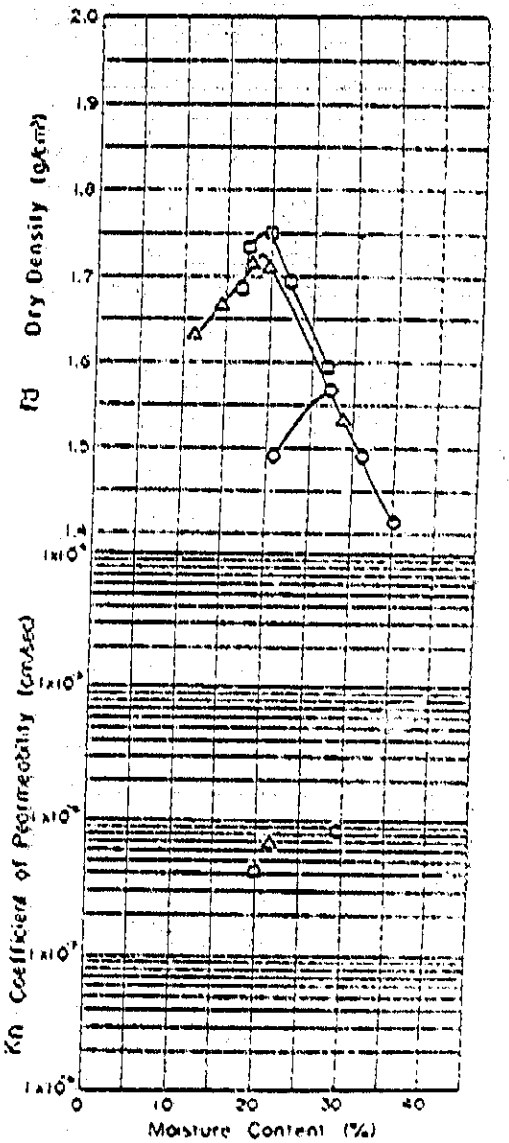
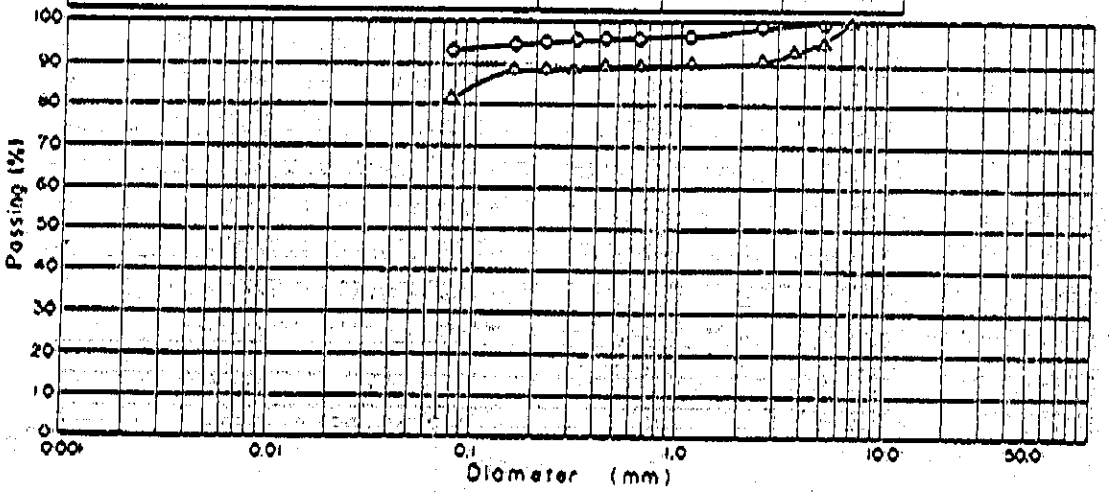


Table 6.4.6 Result of Soil Test (Pit No P-6)

Test Number			1	2	3
Depth		m	1.0	1.7	
Grading	Max. Diameter	mm	4.75	6.7	
	Gravel (2,000μm over)	%	2	9	
	Sand (74–2,000μm)	%	5	10	
	Silt (5–74μm)	%	93	81	
	Clay (5μm under)	%			
Specific Gravity (Gs)			2.55	2.59	
Moisture Content (Wn)		%	11	12	
Consistency	Liquid Limit (W_L)	%		32	
	Plastic Limit (Wp)	%		19	
	Plasticity Index (PI)			13	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	16.6	13.2	
	Max. Dry Density (γ_{dmax})	g/cm³	1.88	1.92	
	Void ratio (e)		0.36	0.35	
	Degree of Saturation (Sr)		100	98	
Permeability (Kn)		x10⁻⁴cm/sec	3.85	4.47	



○ Test No. 1
△ Test No. 2
○ Test No. 3

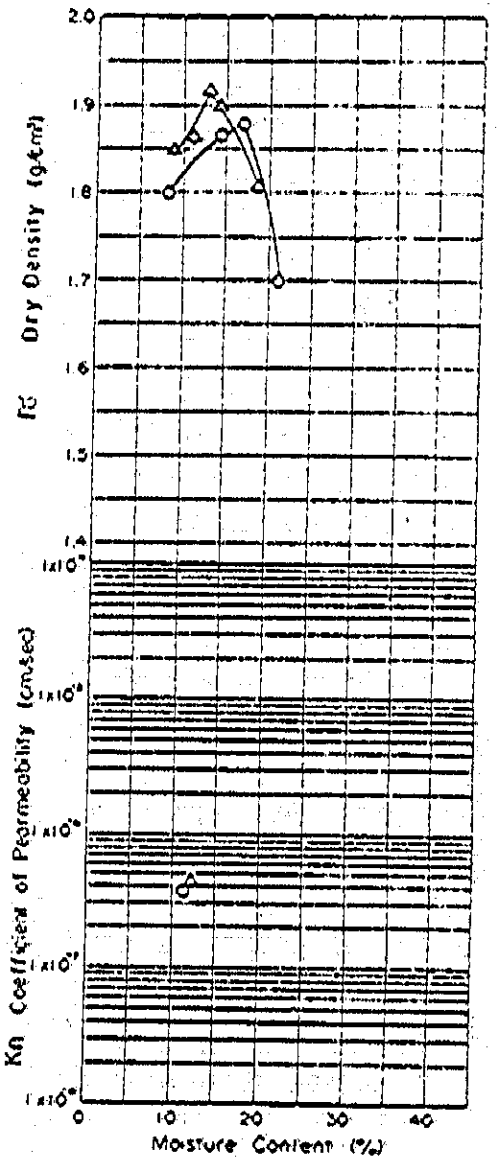
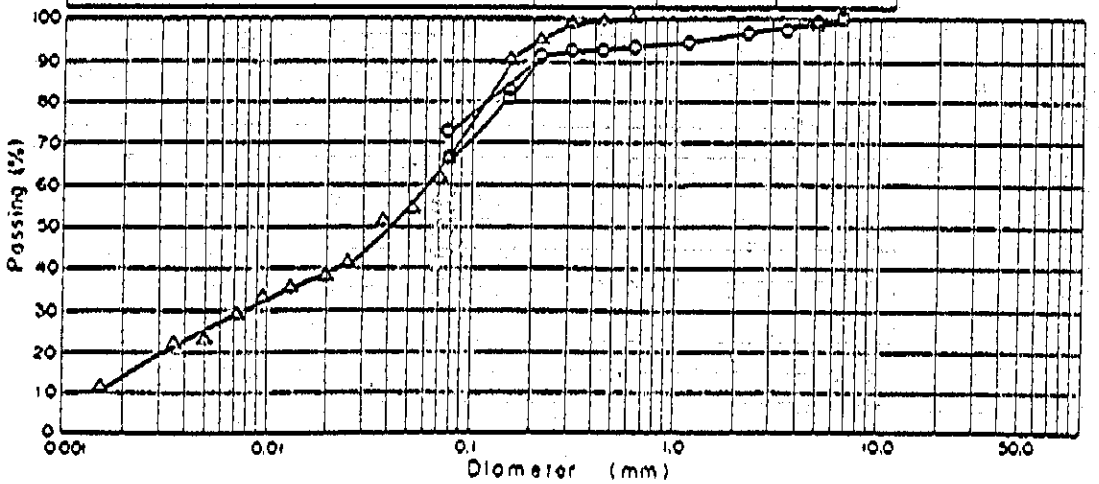


Table 6.4.7 Result of Soil Test (Pit No P-7)

Test Number			1	2	3
Depth		m	1.0	2.0	3.1
Grading	Max. Diameter	mm	4.75	0.60	6.7
	Gravel (2,000μm over)	%	4	0	4
	Sand (74~2,000μm)	%	23	33	27
	Silt (5~74μm)	%	73	42	67
	Clay (5μm under)	%		25	
Specific Gravity (Gs)			2.62	2.55	2.55
Moisture Content (Wn)		%	12	17	27
Consistency	Liquid Limit (W_L)	%		35	
	Plastic Limit (W_P)	%		17	
	Plasticity Index (PI)			18	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	15.3	17.7	16.5
	Max. Dry Density (γ_{dmax})	g/cm³	1.84	1.78	1.87
	Void ratio (e)		0.42	0.43	0.36
	Degree of Saturation (Sr)		95	100	100
Permeability (Kn)		x10⁻⁴cm/sec	5.39	5.04	4.33



○ Test No. 1
△ Test No. 2
○ Test No. 3

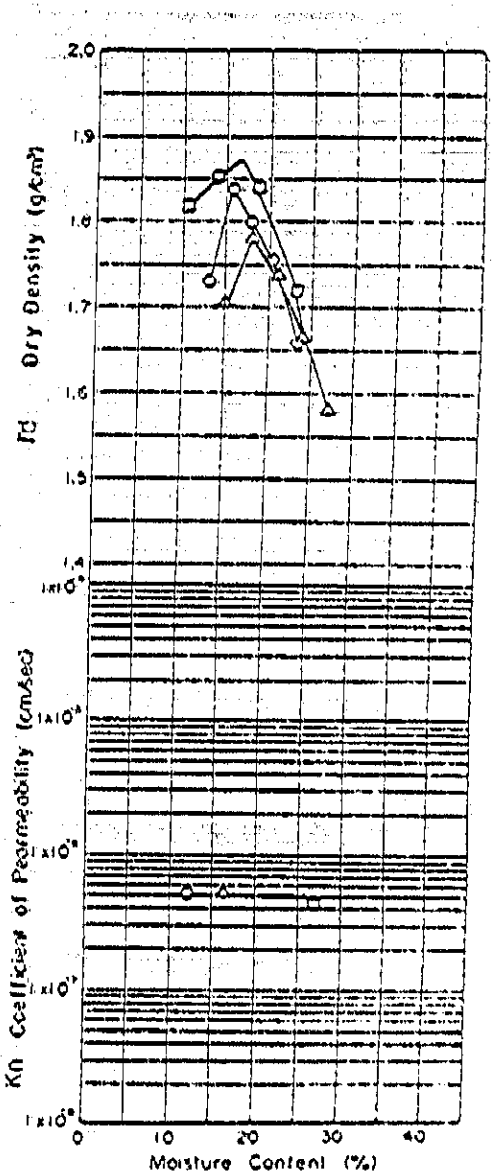
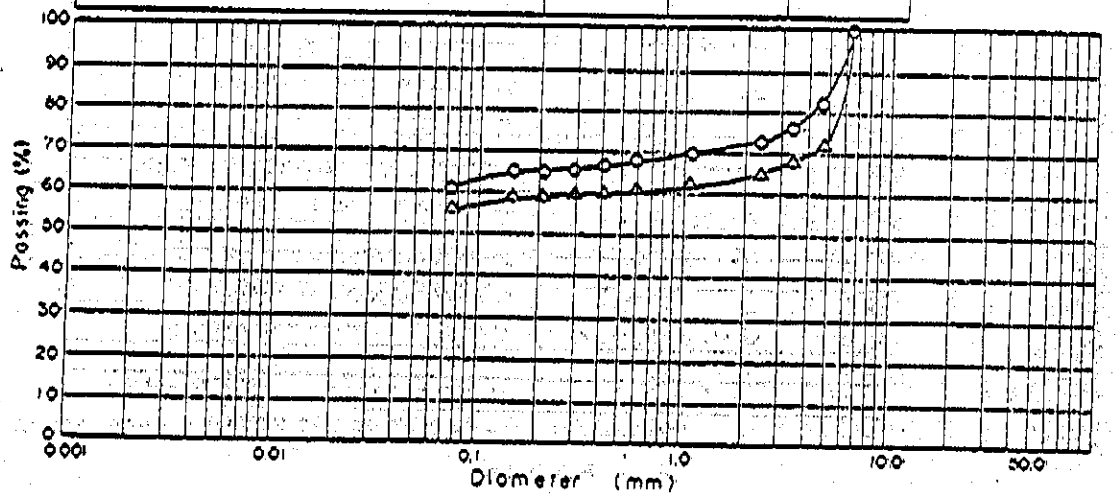


Table 6.4.8 Result of Soil Test (Pit No P-8)

			1	2	3
Test Number					
Depth		m	1.3	1.8	
Grading	Max Diameter	mm	6.7	6.7	
	Gravel (2,000μm over)	%	28	37	
	Sand (74~2,000μm)	%	11	6	
	Silt (5~74μm)	%	161	157	
	Clay (5μm under)	%			
Specific Gravity (Gs)			2.68	2.70	
Moisture Content (Wn)		%	22	20	
Consistency	Liquid Limit (W_L)	%		41	
	Plastic Limit (W_P)	%		20	
	Plasticity Index (PI)			21	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (W_{opt})	%	22.8	22.0	
	Max. Dry Density (γ_{dmax})	g/cm³	1.69	1.73	
	Void ratio (e)		0.59	0.56	
	Degree of Saturation (Sr)		100	100	
Permeability		(Kn) x10⁻⁶cm/sec	1.15	1.27	



○ Test No. 1
△ Test No. 2
□ Test No. 3

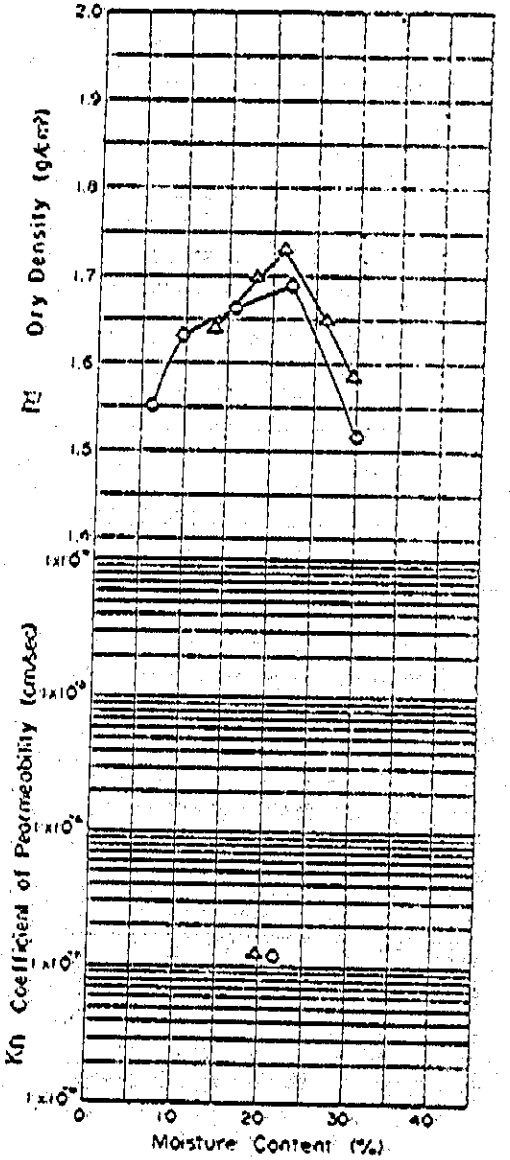
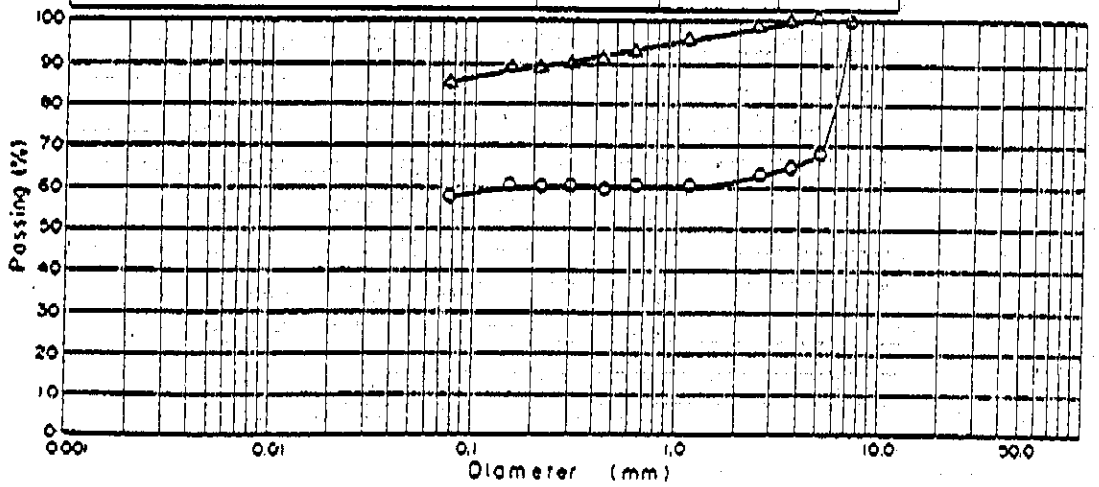


Table 6.4.9 Result of Soil Test (Pit No P-9)

Test Number			1	2	3
Depth		m	1.4	1.9	
Grading	Max Diameter	mm	67	475	
	Gravel (2,000μm over)	%	38	4	
	Sand (74~2,000μm)	%	5	12	
	Silt (5~74μm)	%	157	184	
	Clay (5μm under)	%	)	)	
Specific Gravity (Gs)			270	2.65	
Moisture Content (Wn)		%	15	17	
Consistency	Liquid Limit (WL)	%		35	
	Plastic Limit (Wp)	%		20	
	Plasticity Index (PI)			15	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	16.1	18.0	
	Max. Dry Density (γdmax)	g/cm³	1.75	0.46	
	Void ratio (e)		0.54	1.00	
	Degree of Saturation (Sr)		80	3.46	
Permeability	(Kn) x10⁻⁴cm/sec		4.94	3.46	



○ Test No. 1
△ Test No. 2
□ Test No. 3

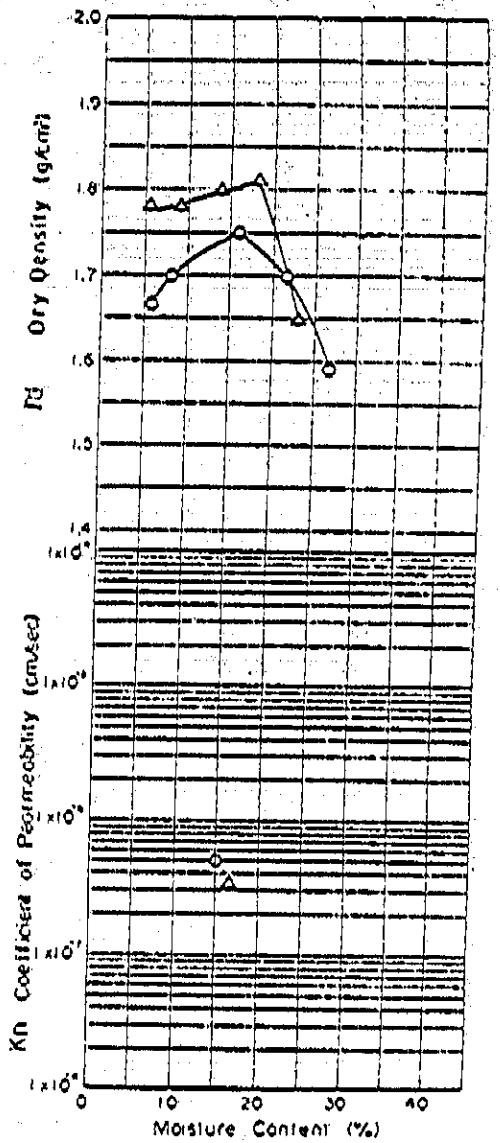
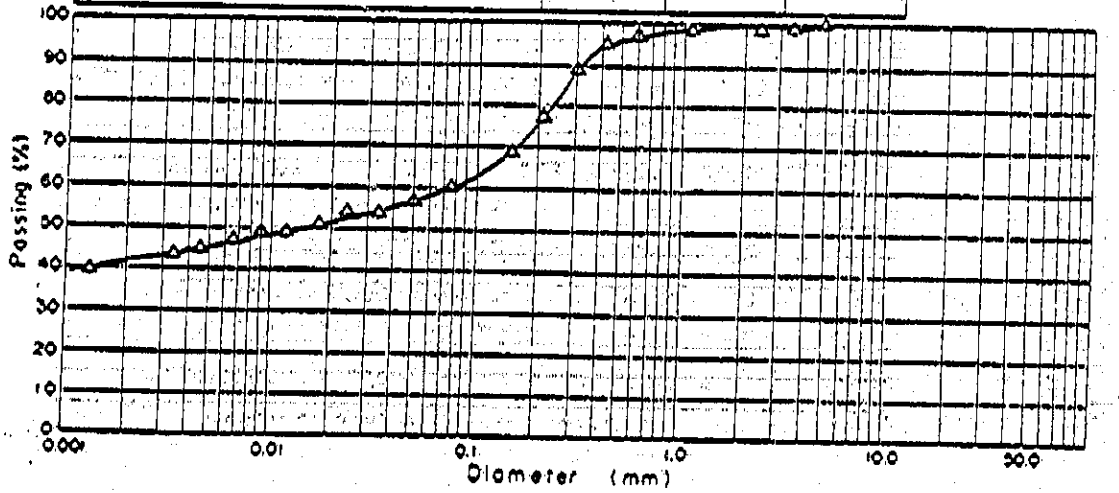


Table 6.4.10 Result of Soil Test (Pit No P-10)

Test Number			1	2	3
Depth		m	1	2.1	
Grading	Max Diameter	mm	11	4.75	
	Gravel (2,000μm over)	%		1	
	Sand (74~2,000μm)	%		39	
	Silt (5~74μm)	%		15	
	Clay (5μm under)	%		45	
Specific Gravity (Gs)			2.51	2.50	
Moisture Content (Wn)		%	21	23	
Consistency	Liquid Limit (WL)	%		65	
	Plastic Limit (Wp)	%		26	
	Plasticity Index (PI)			39	
	Classification (ASTM)			CH	
Moisture-Density	Optimum Moisture Content (Wopt)	%	21.1	25.0	
	Max. Dry Density (γdmax)	g/cm³	1.60	1.58	
	Void ratio (e)		0.57	0.56	
	Degree of Saturation (Sr)		93	100	
Permeability (Kn) x10⁻⁴cm/sec			1.23	2.66	



○ Test No. 1
△ Test No. 2
□ Test No. 3

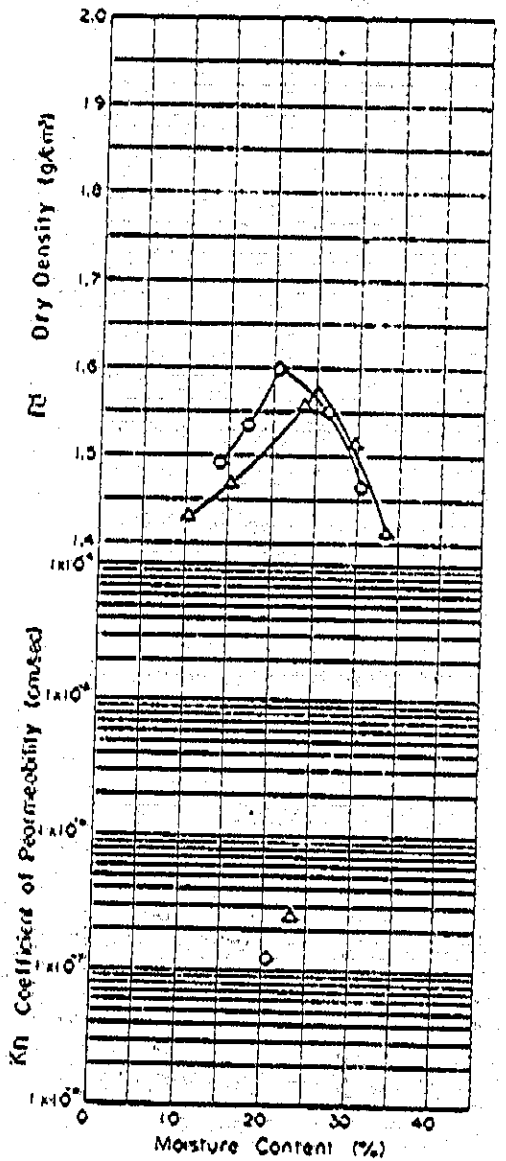
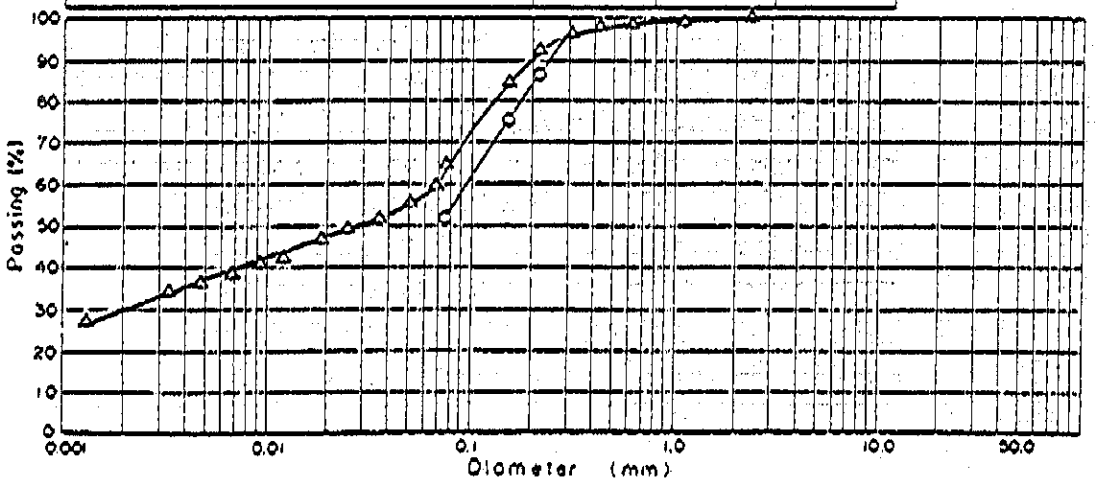


Table 6.4.12 Result of Soil Test (Pit No P-11)

Test Number			1	2	3
Depth		m	2.1	4.0	
Grading	Max Diameter	mm	118	235	
	Gravel (2,000μm over)	%	0	0	
	Sand (74~2,000μm)	%	48	36	
	Silt (5~74μm)	%	52	28	
	Clay (5μm under)	%		36	
Specific Gravity (Gs)			2.59	2.52	
Moisture Content (Wn)		%	18	22	
Consistency	Liquid Limit (WL)	%		47	
	Plastic Limit (Wp)	%		19	
	Plasticity Index (PI)			28	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	16.2	23.6	
	Max. Dry Density (γdmax)	g/cm³	1.79	1.70	
	Void ratio (e)		0.48	0.58	
	Degree of Saturation (Sr)		89	100	
Permeability (Kn)		x10⁻⁴cm/sec	5.76	1.46	



○ Test No. 1
△ Test No. 2
○ Test No. 3

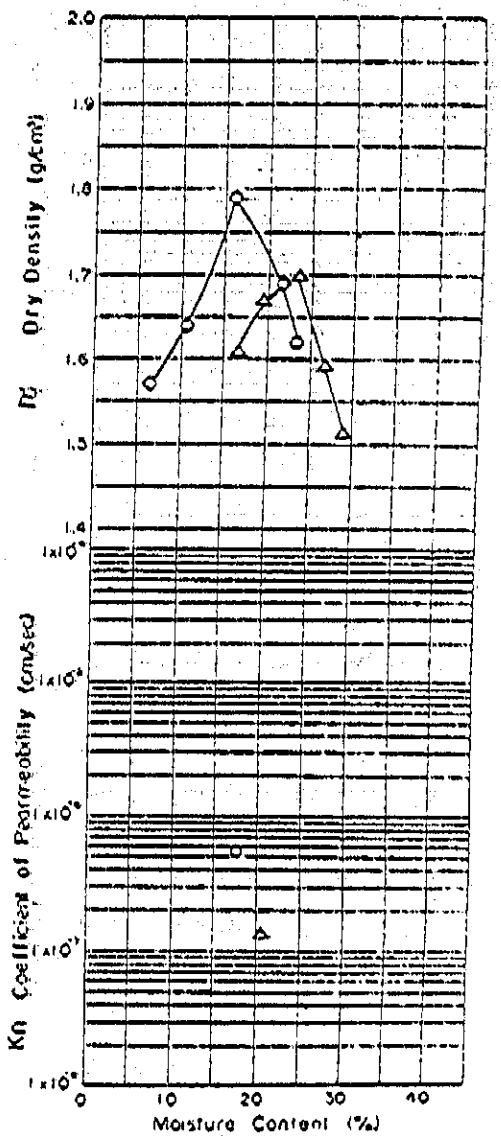
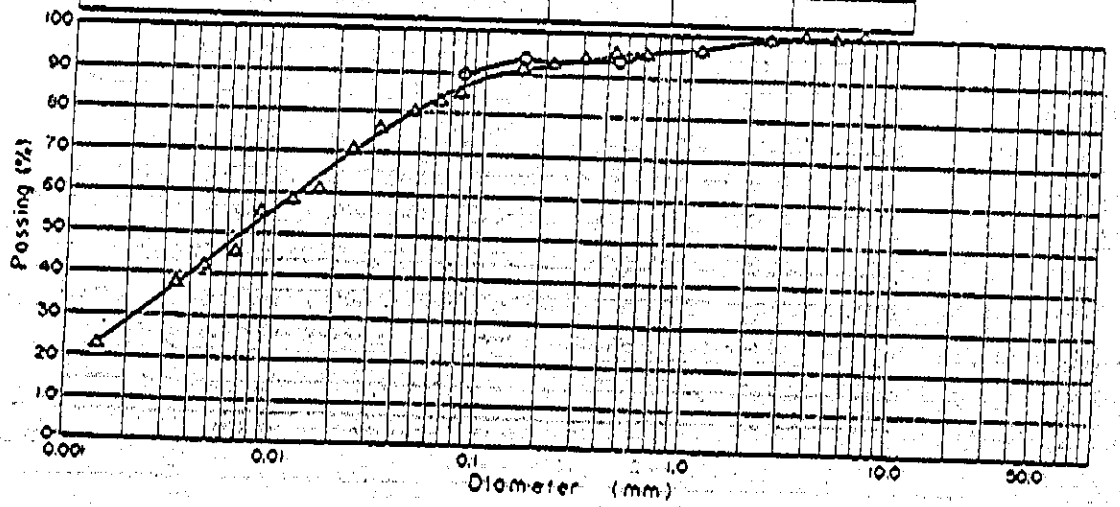


Table 6.4.12 Result of Soil Test (Pit No P-12)

Test Number			1	2	3
Depth		m	1.0	2.0	
Grading	Max. Diameter	mm	4.75	6.7	
	Gravel (2,000μm over)	%	3	2	
	Sand (74~2,000μm)	%	9	13	
	Silt (5~74μm)	%	88	41	
	Clay (5μm under)	%		44	
Specific Gravity (Gs)			2.65	2.68	
Moisture Content (Wn)		%	24	19	
Consistency	Liquid Limit (W_L)	%		49	
	Plastic Limit (W_P)	%		22	
	Plasticity Index (PI)			27	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	25.7	17.4	
	Max. Dry Density (γ_{dmax})	g/cm³	1.66	1.81	
	Void ratio (e)		0.60	0.48	
	Degree of Saturation (Sr)		1.00	97	
Permeability (Kn)		x10⁻⁴cm/sec	1.25	1.24	



○ Test No. 1
△ Test No. 2
○ Test No. 3

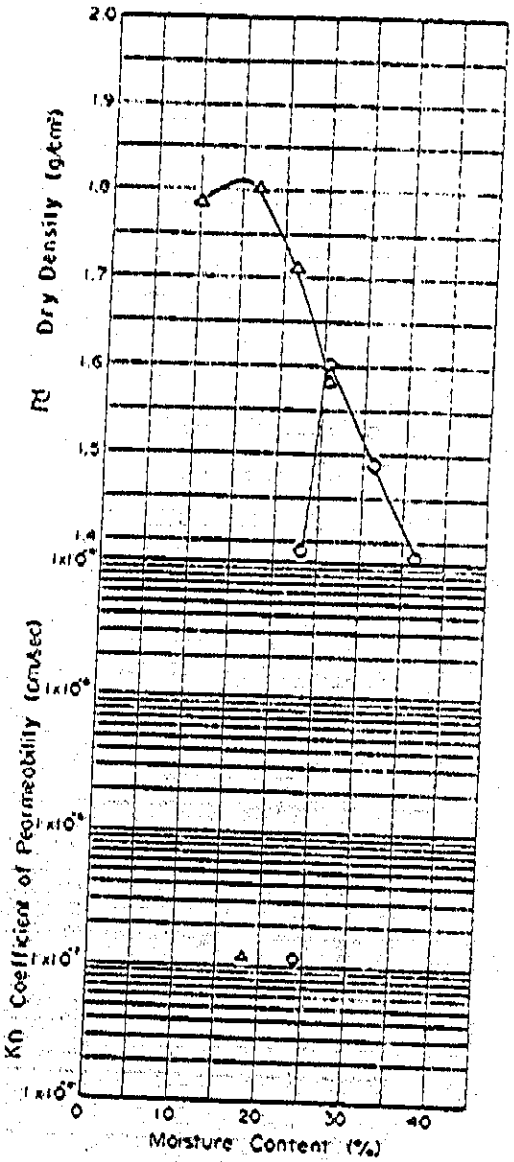
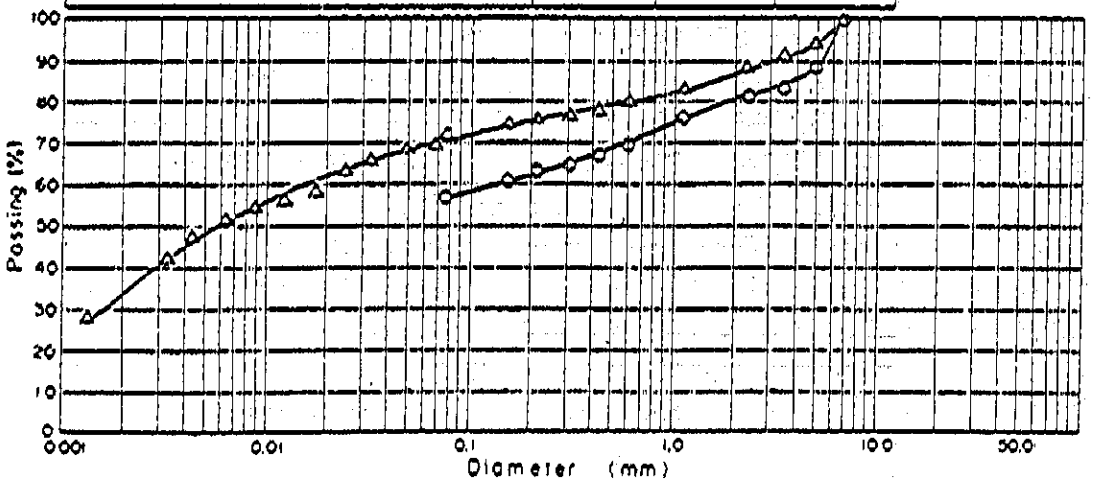


Table 6.c.13 Result of Soil Test (Pit No. P-13)

Test Number			1	2	3
Depth		m	2.4	3.4	
Grading	Max Diameter	mm	6.7	6.7	
	Gravel (2,000μm over)	%	20	13	
	Sand (74~2,000μm)	%	23	15	
	Silt (5~74μm)	%	57	22	
	Clay (5μm under)	%		50	
Specific Gravity (Gs)			2.59	2.70	
Moisture Content (Wn)		%	19	20	
Consistency	Liquid Limit (WL)	%		54	
	Plastic Limit (Wp)	%		25	
	Plasticity Index (PI)			29	
	Classification (ASTM)			CH	
Moisture-Density	Optimum Moisture Content (Wopt)	%	22.0	19.1	
	Max. Dry Density (γdmax)	g/cm³	1.71	1.77	
	Void ratio (e)		0.52	0.53	
	Degree of Saturation (Sr)		100	98	
Permeability (Kn)		x10⁻⁴cm/sec	1.10	1.44	



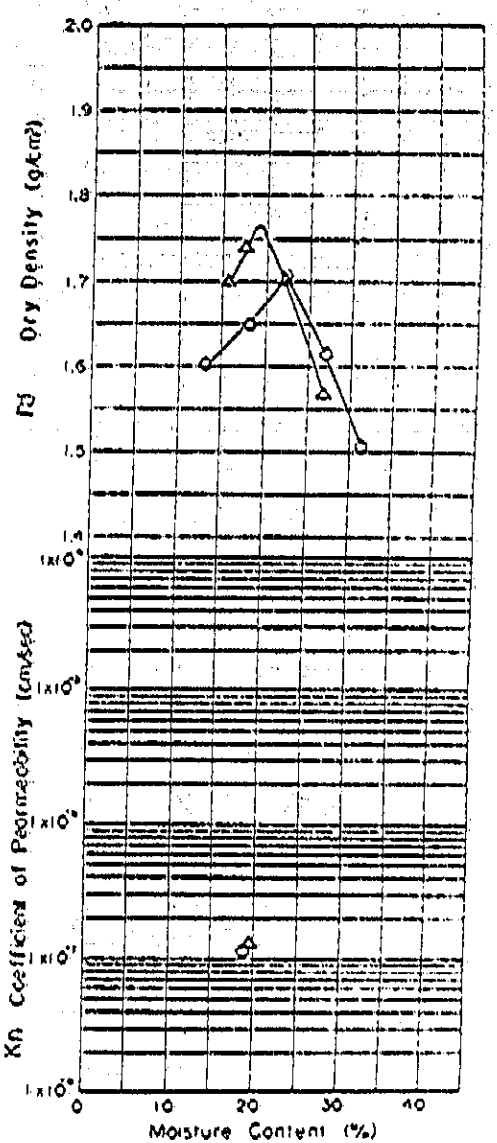
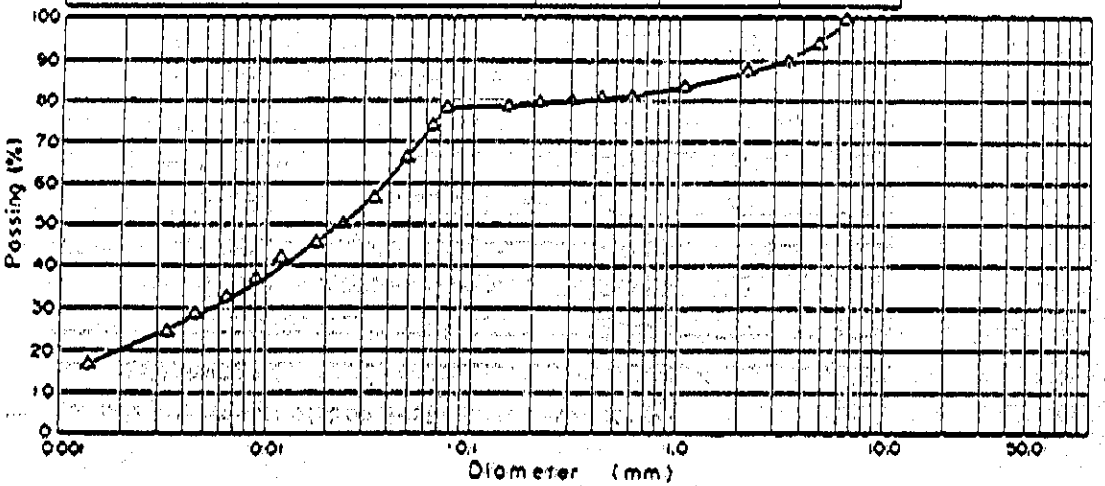


Table 6.4.14 Result of Soil Test (Pit No P-14)

Test Number			1	2	3
Depth		m	1.0	2.0	
Grading	Max Diameter	mm		67	
	Gravel (2,000μm over)	%		13	
	Sand (74~2,000μm)	%		9	
	Silt (5~74μm)	%		49	
	Clay (5μm under)	%		29	
Specific Gravity (Gs)			2.62	2.68	
Moisture Content (Wn)		%	18	19	
Consistency	Liquid Limit (WL)	%		49	
	Plastic Limit (Wp)	%		33	
	Plasticity Index (PI)			16	
	Classification (ASTM)			CL	
Moisture-Density	Optimum Moisture Content (Wopt)	%	19.0	18.0	
	Max. Dry Density (γdmax)	g/cm³	1.74	1.81	
	Void ratio (e)		0.51	0.45	
	Degree of Saturation (Sr)		98	100	
Permeability (Kn) x10⁻⁶		cm/sec	1.29	1.69	



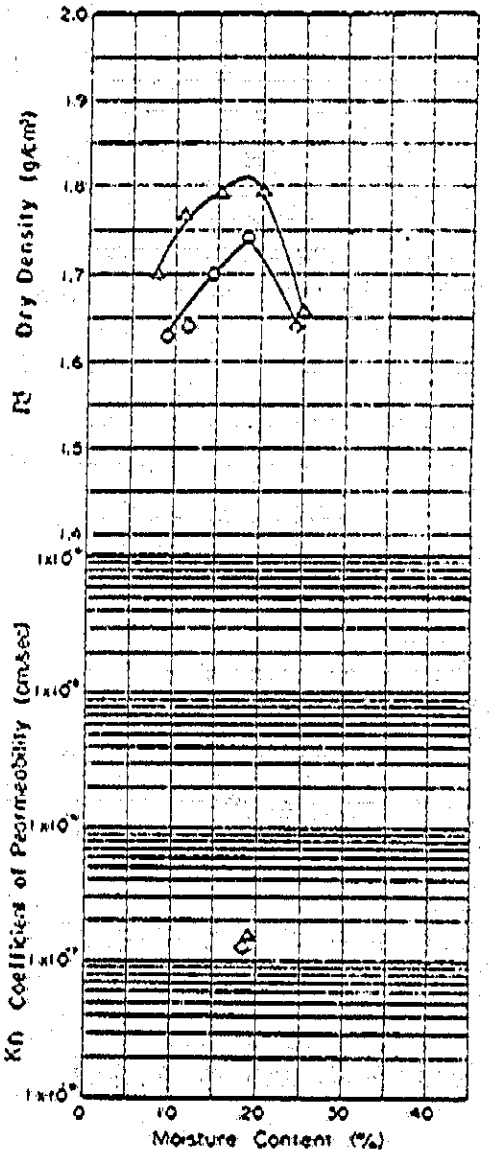
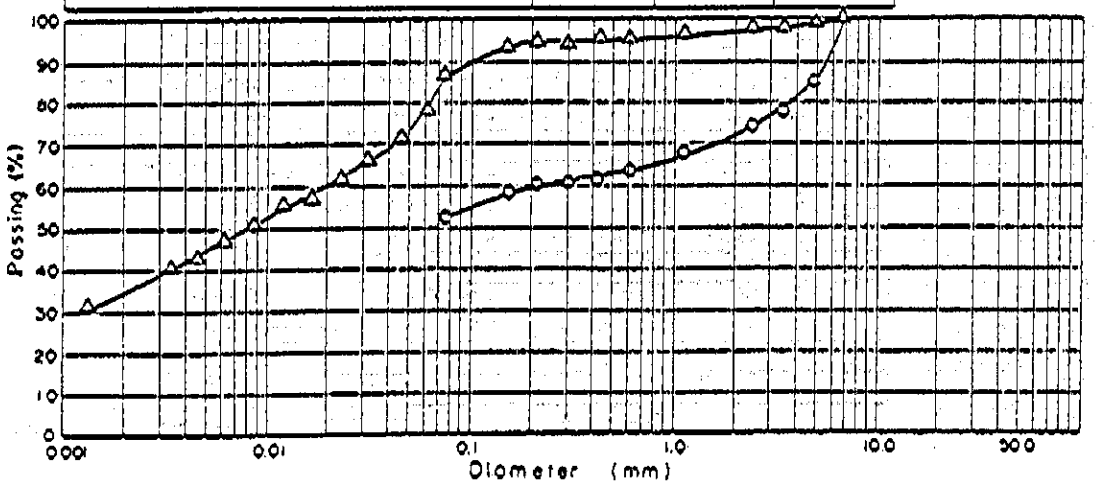


Table 6.4.15 Result of Soil Test (Pit No P-15)

Test Number			1	2	3
Depth		m	2.3	3.3	
Grading	Max Diameter	mm	67	67	
	Gravel (2,000μm over)	%	27	2	
	Sand (74~2,000μm)	%	20	11	
	Silt (5~74μm)	%	53	42	
	Clay (5μm under)	%		45	
Specific Gravity (Gs)			2.60	2.68	
Moisture Content (Wn)		%	19	12	
Consistency	Liquid Limit (W_L)	%		55	
	Plastic Limit (Wp)	%		23	
	Plasticity Index (PI)			32	
	Classification (ASTM)			CH	
Moisture-Density	Optimum Moisture Content (Wopt)	%	17.6	17.5	
	Max. Dry Density (γ_{dmax})	g/cm³	1.78	1.86	
	Void ratio (e)		0.46	0.44	
	Degree of Saturation (Sr)		99	100	
Permeability (Kn)		x10⁻⁶cm/sec	1.41	1.45	



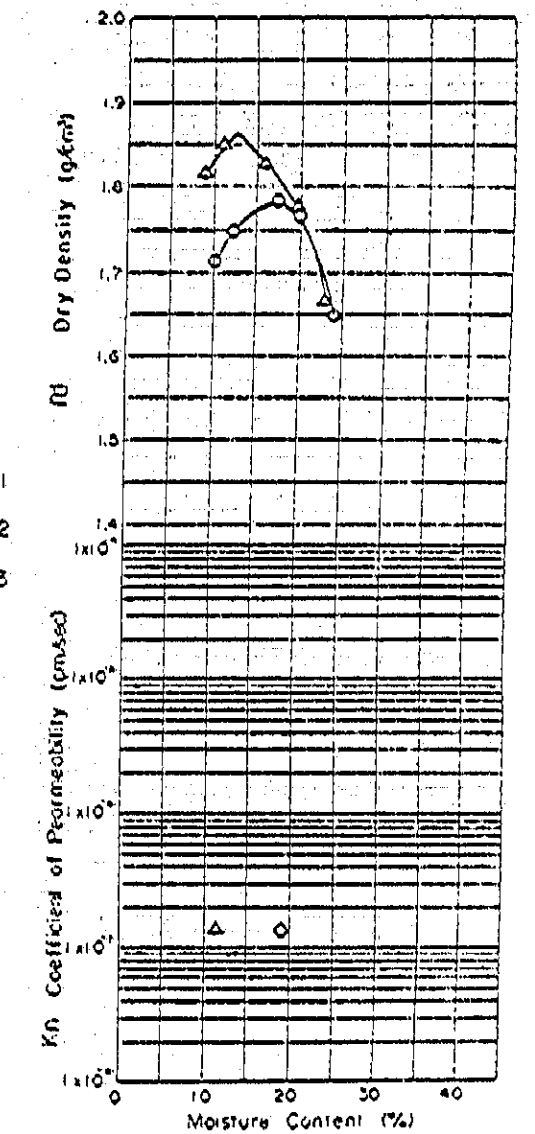
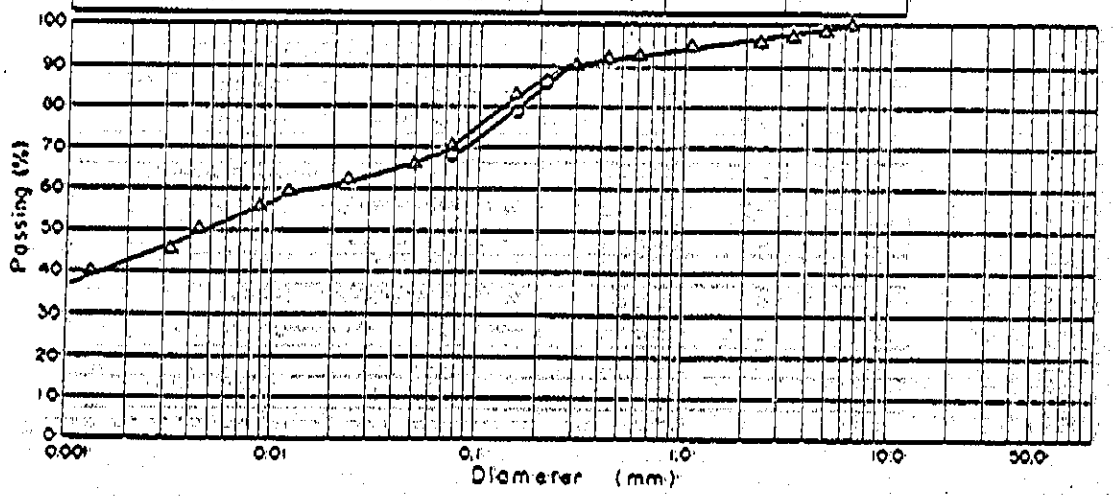


Table 6.4.16 Result of Soil Test (Pit No P-16)

Test Number			1	2	3
Depth		m	2.5	3.3	
Grading	Max Diameter	mm	67	67	
	Gravel (2,000μm over)	%	4	3	
	Sand (74~2,000μm)	%	27	26	
	Silt (5~74μm)	%	69	19	
	Clay (5μm under)	%		52	
Specific Gravity (Gs)			2.69	2.68	
Moisture Content (Wn)		%	18	18	
Consistency	Liquid Limit (W_L)	%		71	
	Plastic Limit (W_P)	%		22	
	Plasticity Index (PI)			49	
	Classification (ASTM)			CH	
Moisture-Density	Optimum Moisture Content (Wopt)	%	19.0	13.1	
	Max. Dry Density (γ_{dmax})	g/cm³	1.72	1.85	
	Void ratio (e)		0.56	0.45	
	Degree of Saturation (Sr)		86	78	
Permeability (Kn)		x10⁻⁴cm/sec	1.39	1.92	



○ Test No. 1
△ Test No. 2
□ Test No. 3

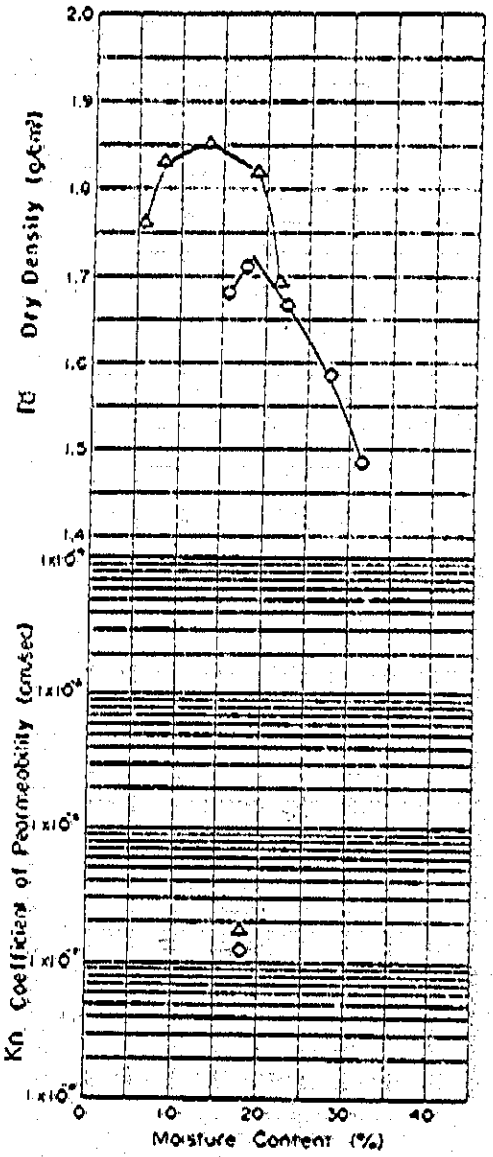
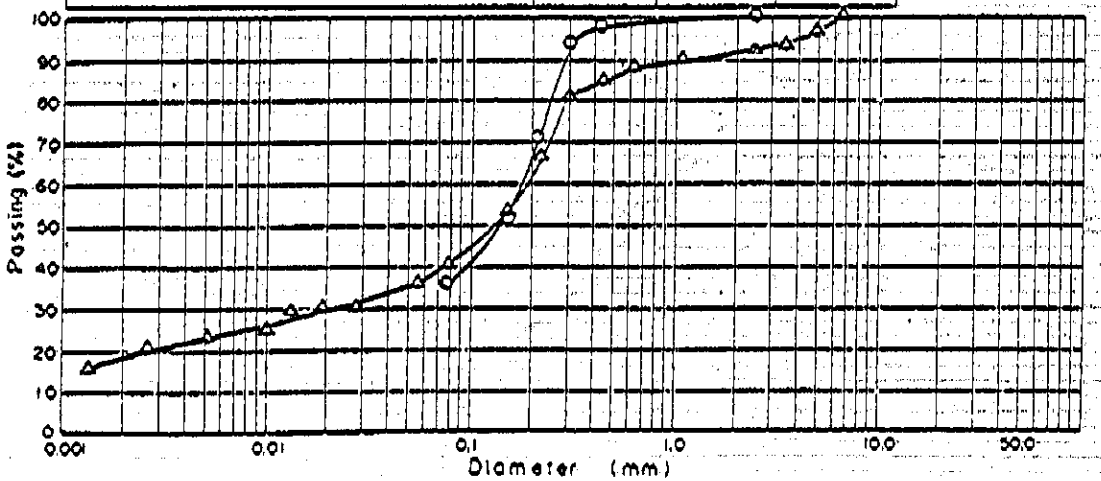


Table 6.4.17 Result of Soil Test (Pit No. P-17)

Test Number			1	2	3
Depth		m	2.5	3.2	
Grading	Max. Diameter	mm	2.36	6.7	
	Gravel (2,000μm over)	%	0	8	
	Sand (74~2,000μm)	%	63	51	
	Silt (5~74μm)	%	37	17	
	Clay (5μm under)	%		24	
Specific Gravity (Gs)			2.60	2.68	
Moisture Content (Wn)		%	16	17	
Consistency	Liquid Limit (WL)	%		34	
	Plastic Limit (Wp)	%		30	
	Plasticity Index (PI)			4	
	Classification (ASTM)			SM	
Moisture-Density	Optimum Moisture Content (Wopt)	%	15.0	13.2	
	Max. Dry Density (γdmax)	g/cm³	1.83	1.87	
	Void ratio (e)		0.42	0.43	
	Degree of Saturation (Sr)		93	82	
Permeability (Kn)		x10⁻⁴cm/sec	1.22	5.53	



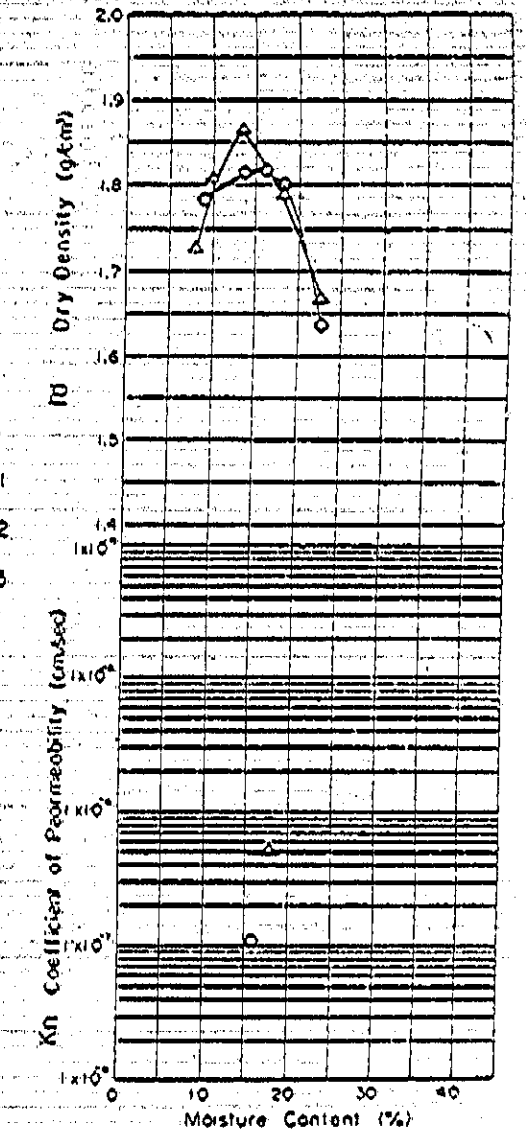
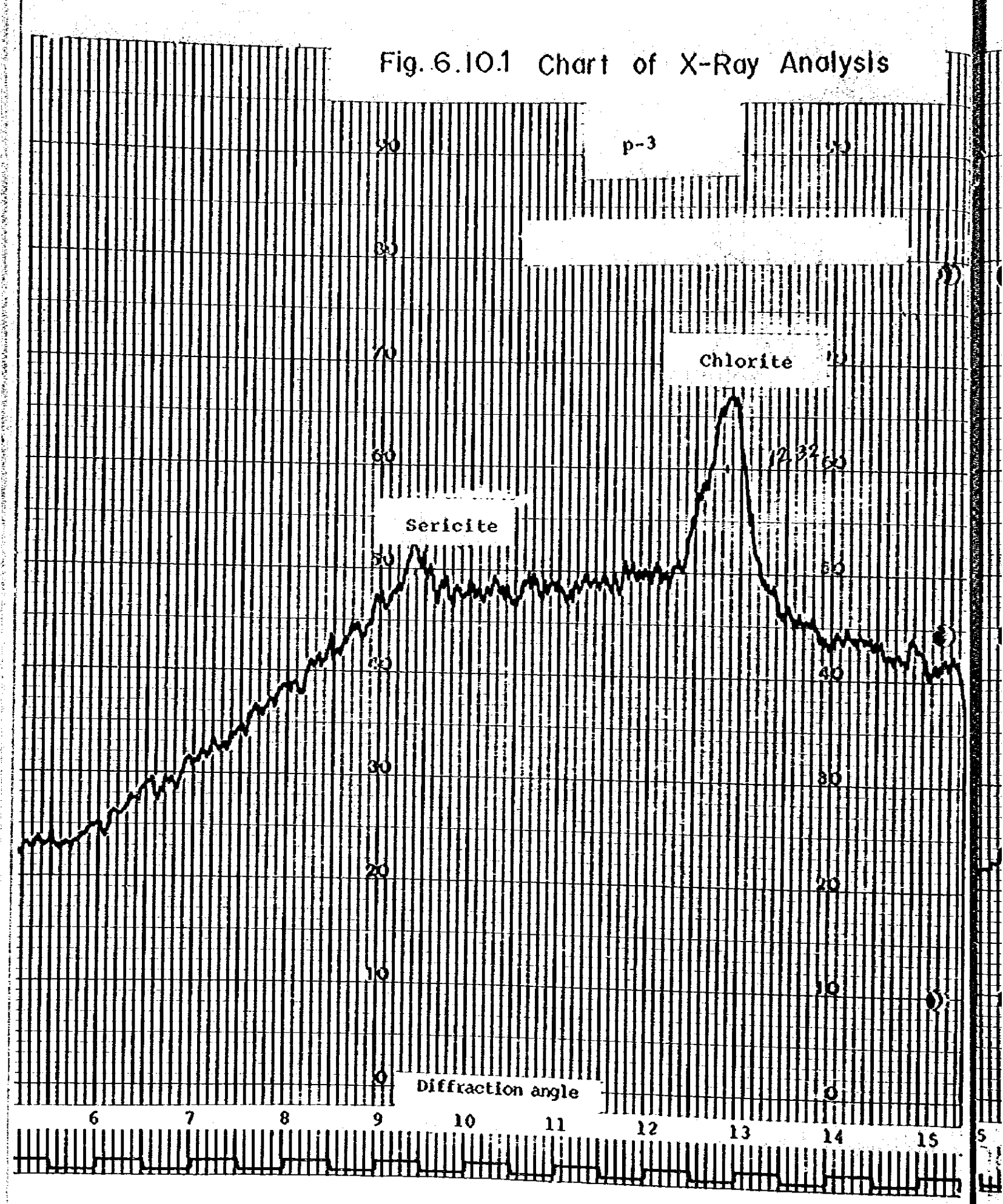


Fig. 6.10.1 Chart of X-Ray Analysis



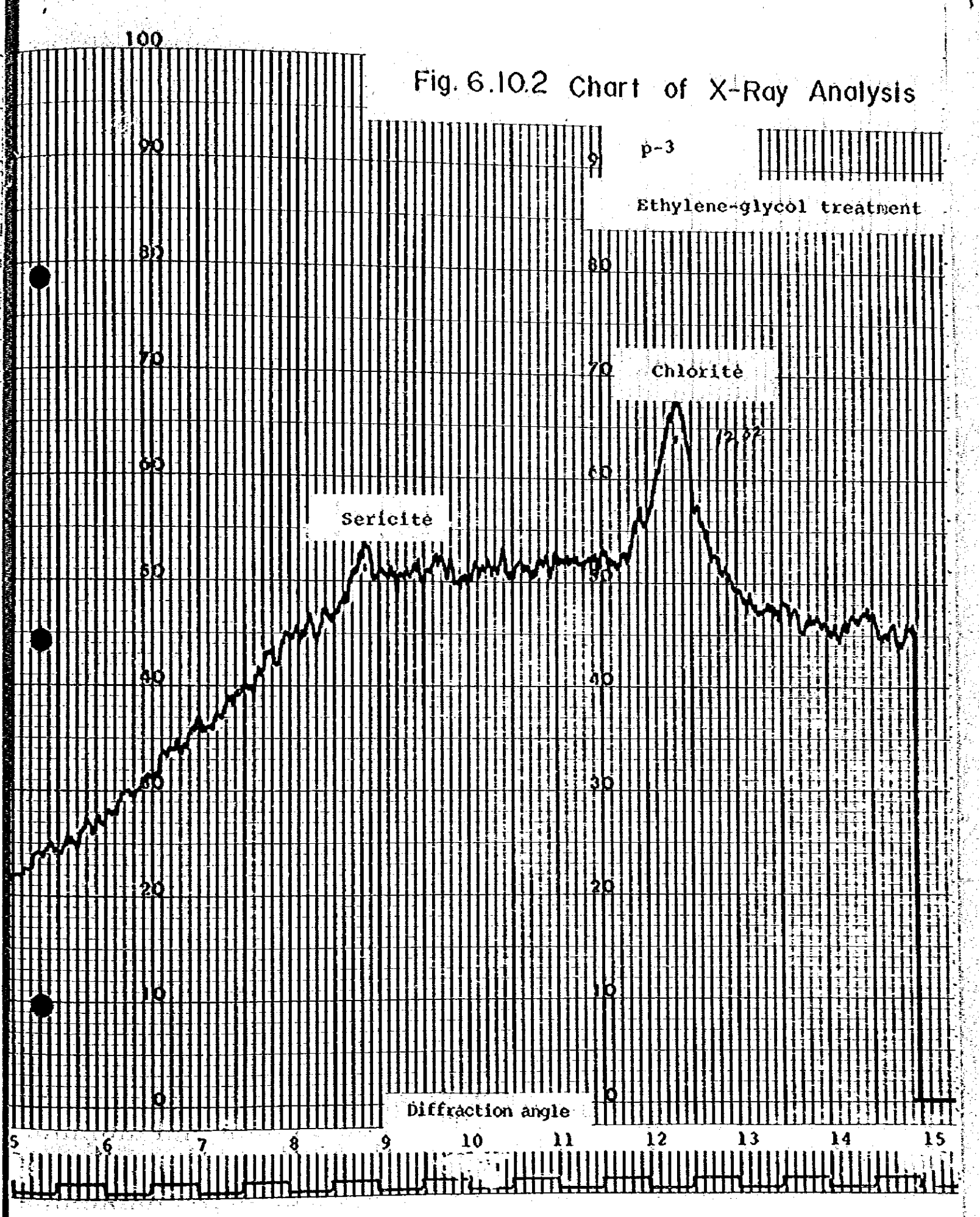
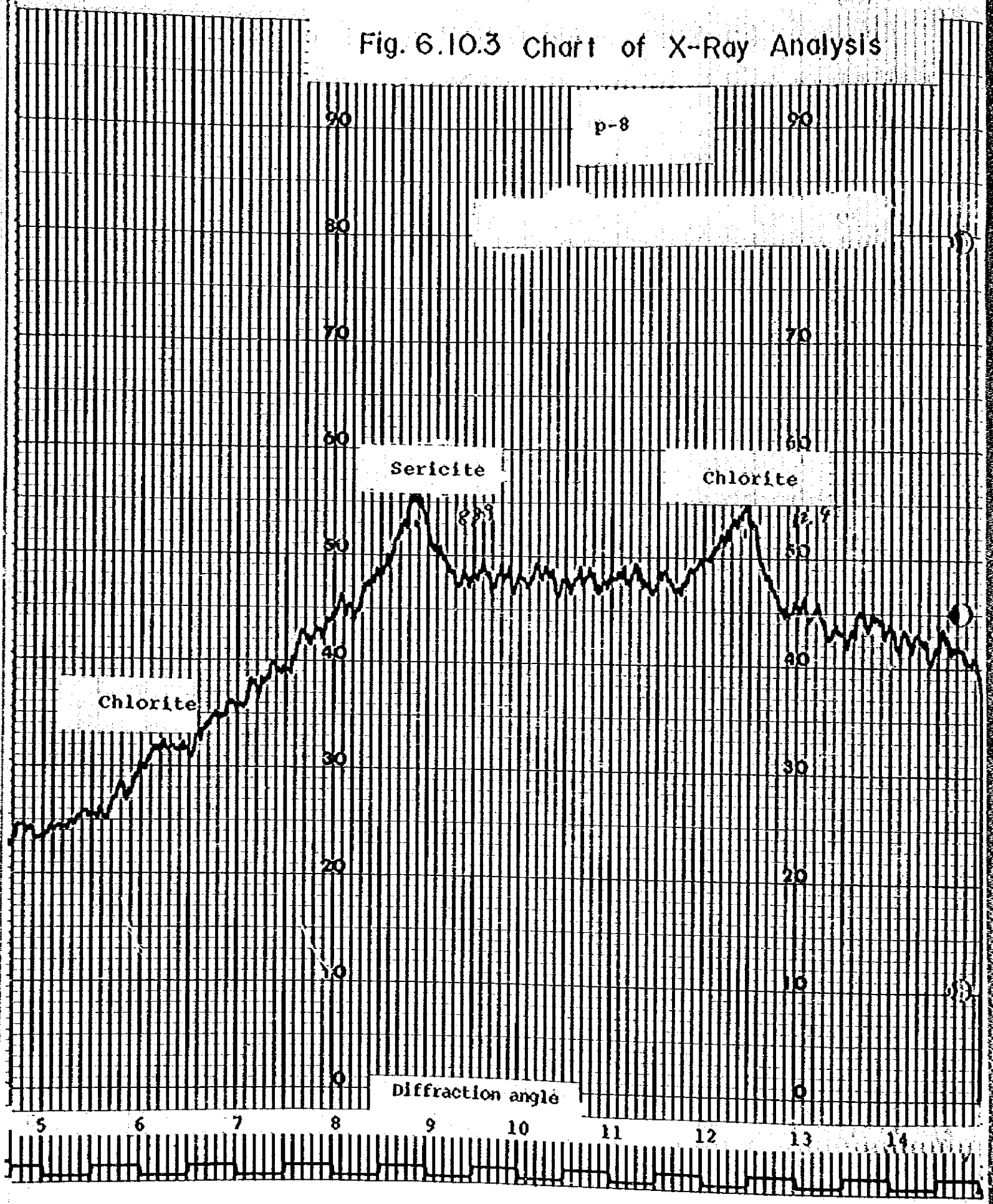


Fig. 6.10.2 Chart of X-Ray Analysis

Fig. 6.10.3 Chart of X-Ray Analysis



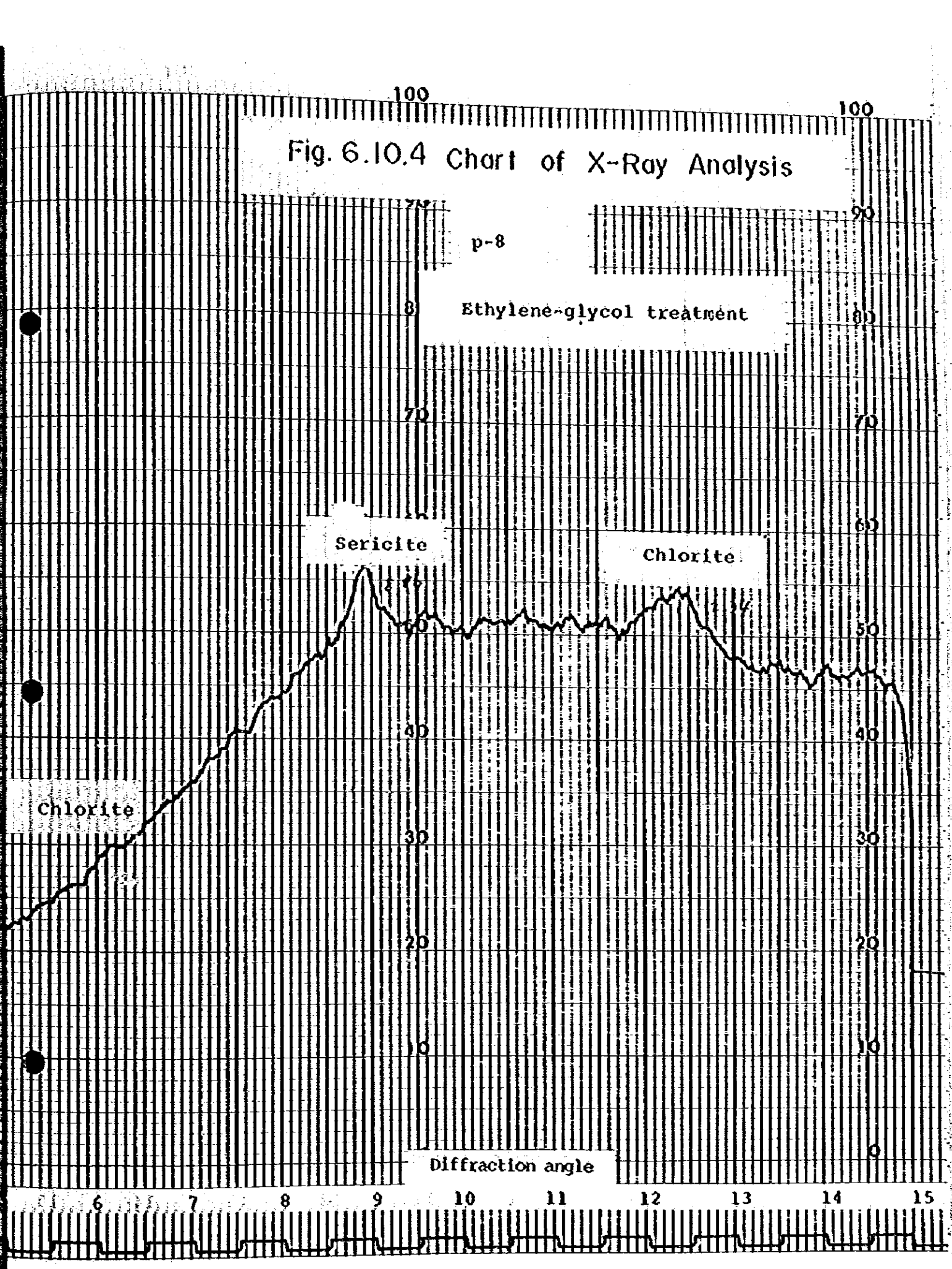


Fig. 6.10.4 Chart of X-Ray Analysis
p-8
Ethylene-glycol treatment
Sericite
Chlorite
Chlorite
Diffraction angle
100
90
80
70
60
50
40
30
20
10
0
6
7
8
9
10
11
12
13
14
15

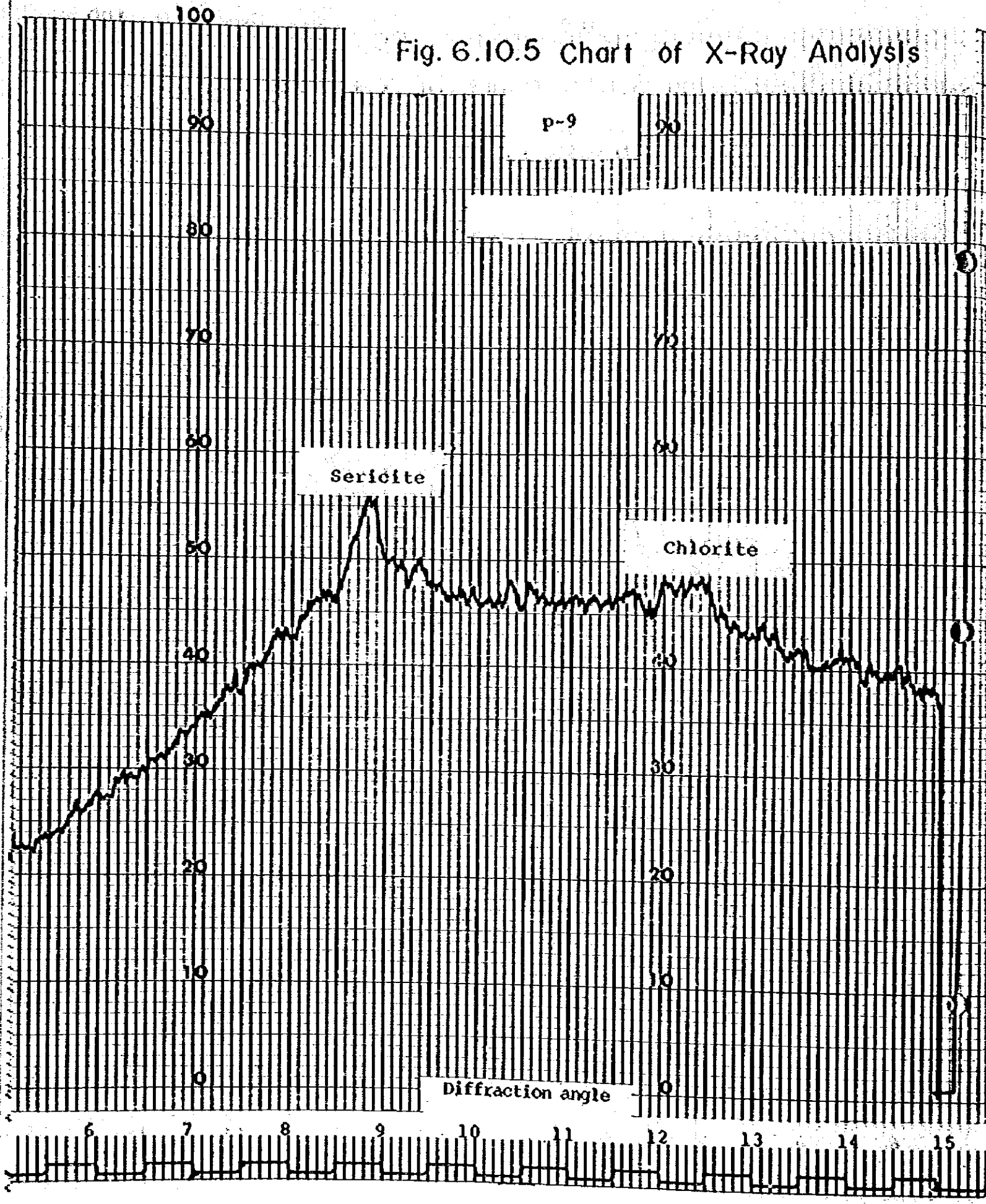


Fig. 6.10.5 Chart of X-Ray Analysis

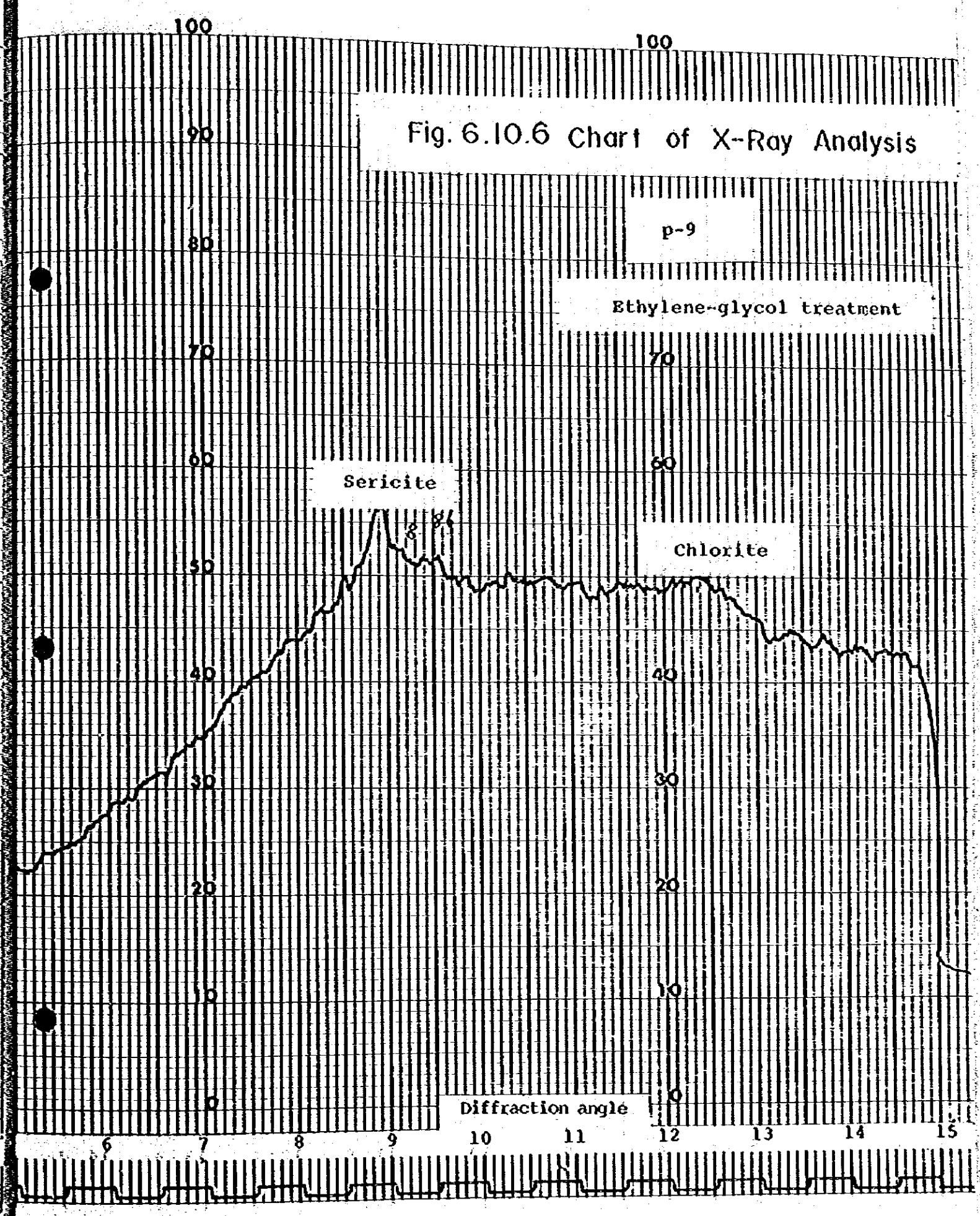


Fig. 6.10.6 Chart of X-Ray Analysis

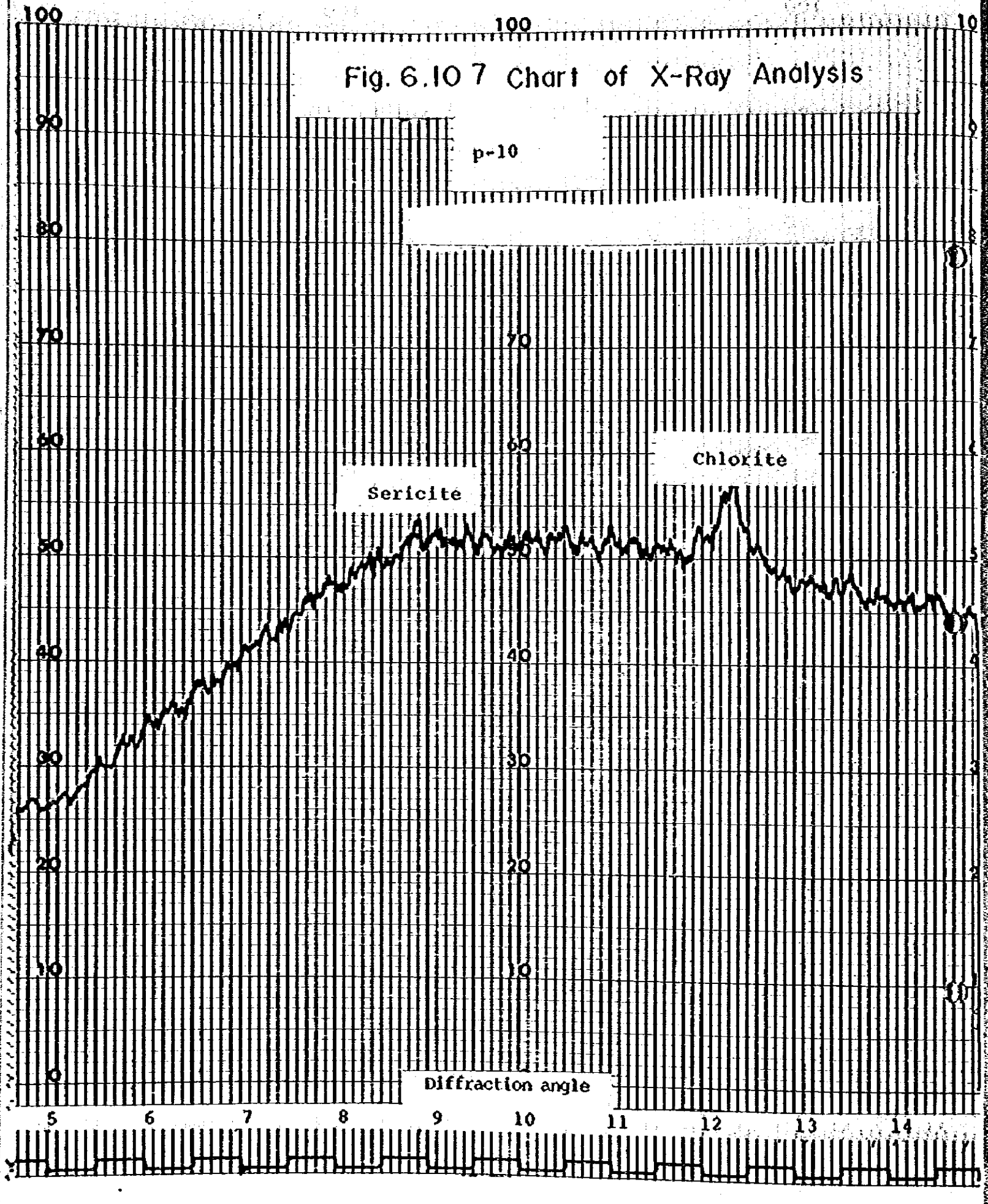


Fig. 6.10 7 Chart of X-Ray Analysis
p-10
Sericite
Chlorite
Diffraction angle
100
90
80
70
60
50
40
30
20
10
0
5
6
7
8
9
10
11
12
13
14

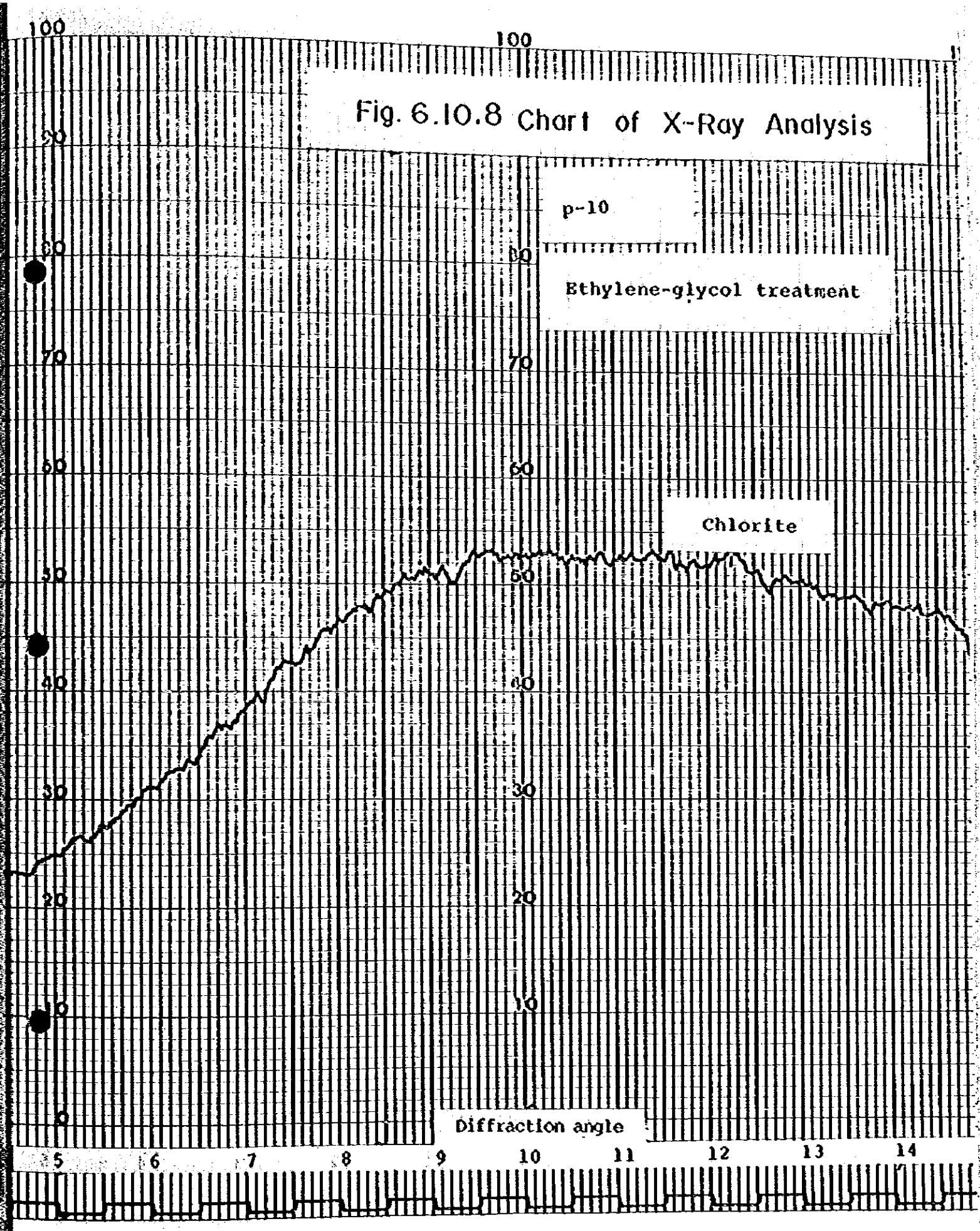


Fig. 6.10.8 Chart of X-Ray Analysis
p-10
Ethylene-glycol treatment
Chlorite
Diffraction angle
100
90
80
70
60
50
40
30
20
10
0
5
6
7
8
9
10
11
12
13
14

Fig. 6.10. 9 Chart of X-Ray Analysis

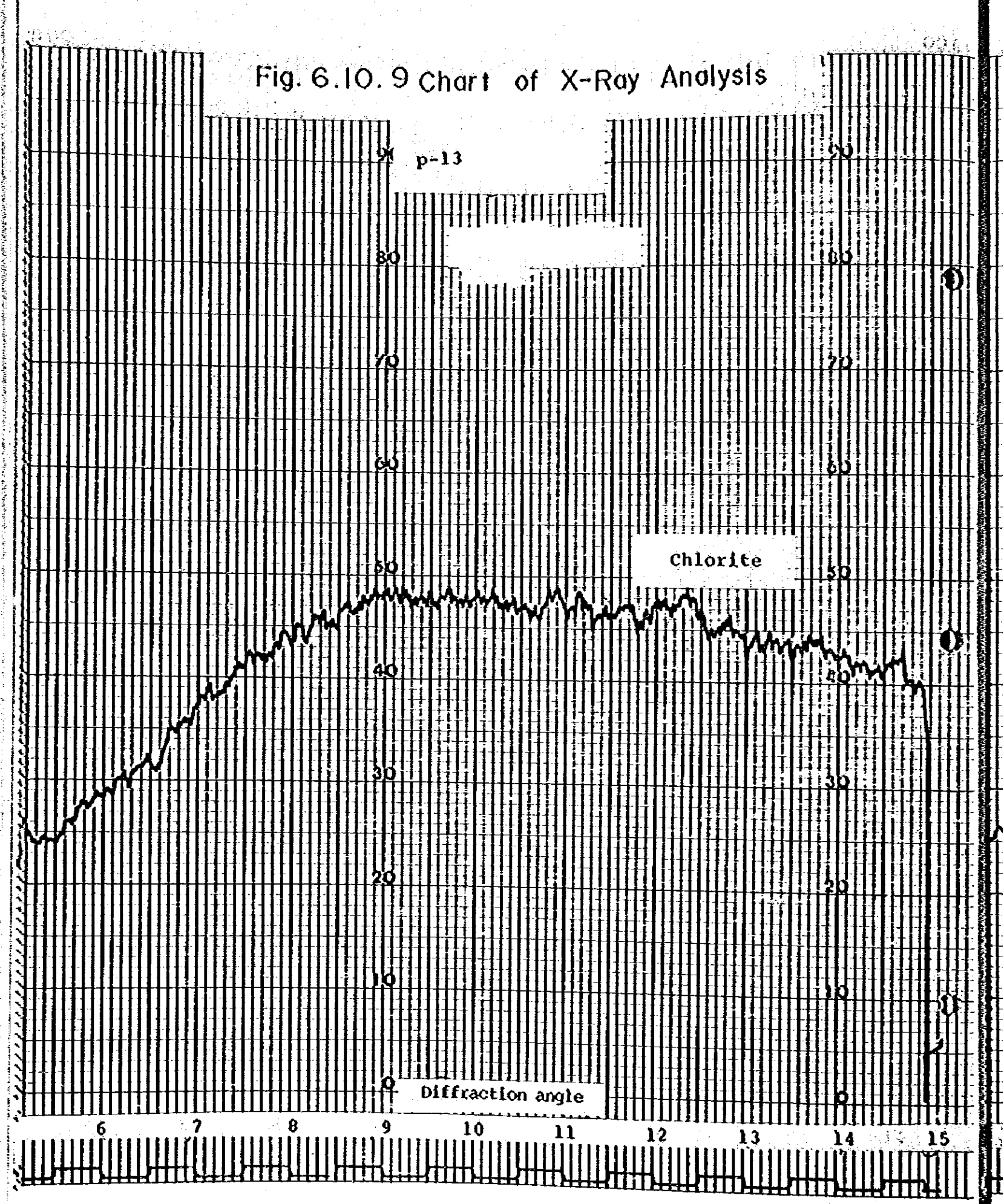
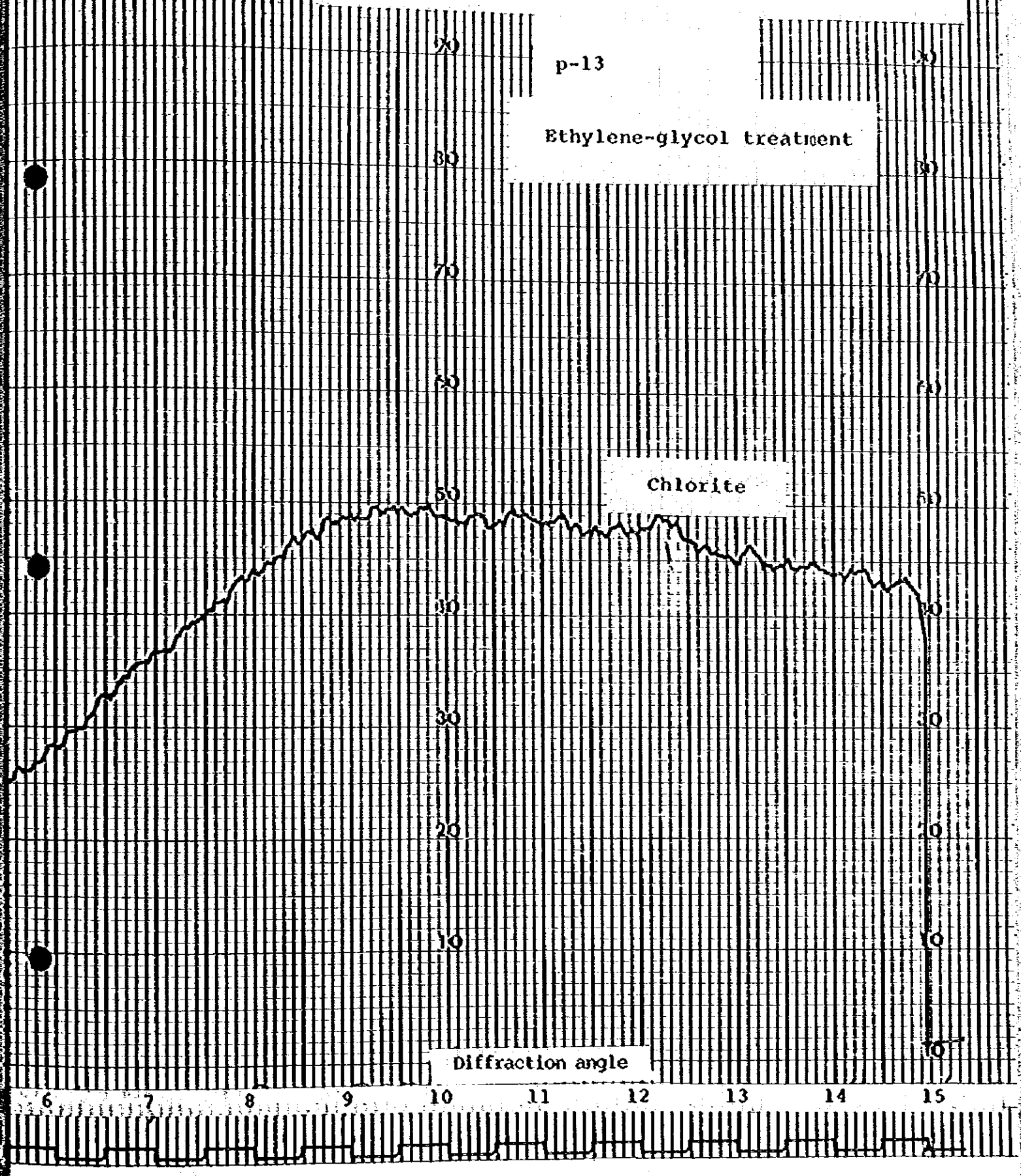


Fig. 6.10.10 Chart of X-Ray Analysis



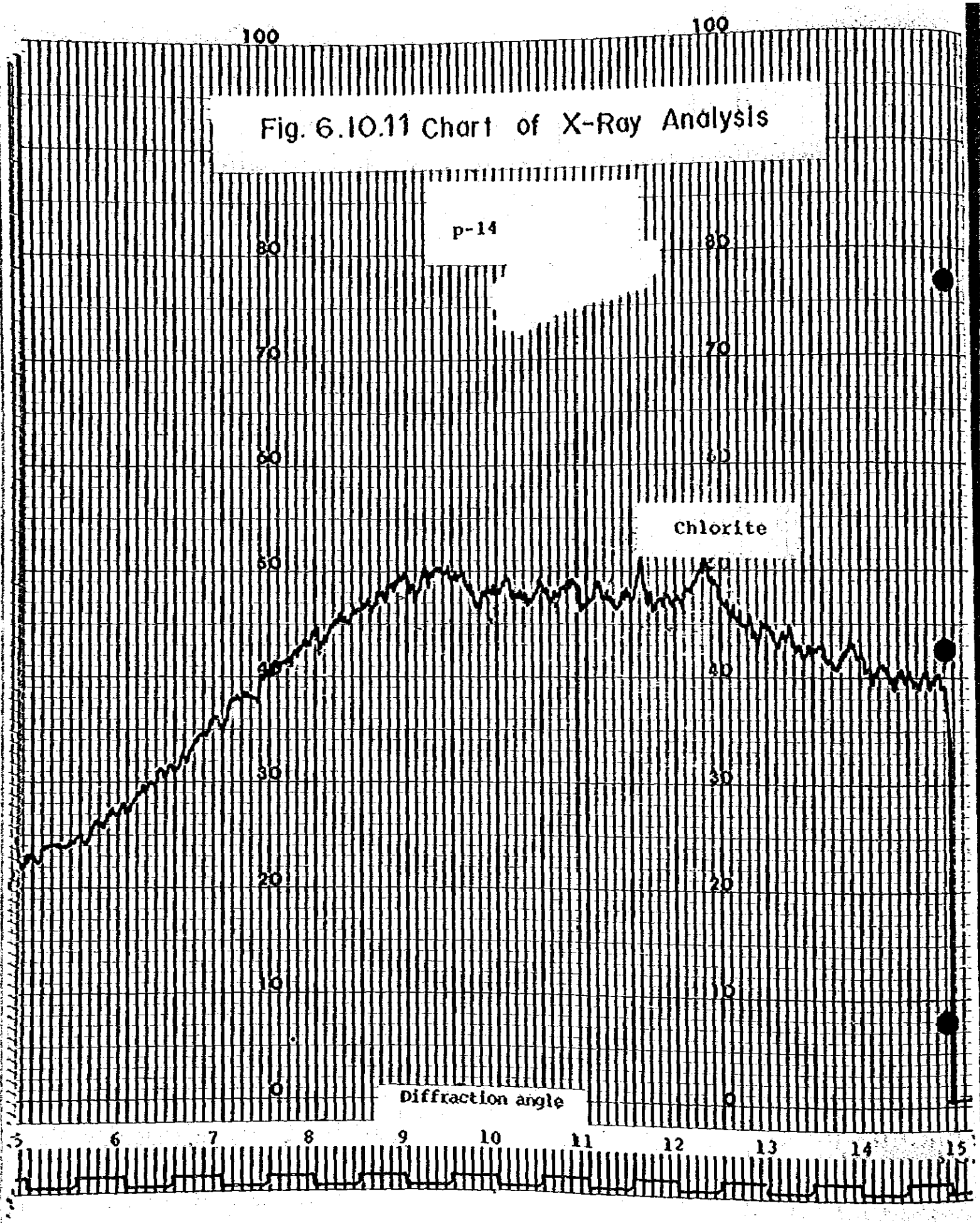


Fig. 6.10.11 Chart of X-Ray Analysis

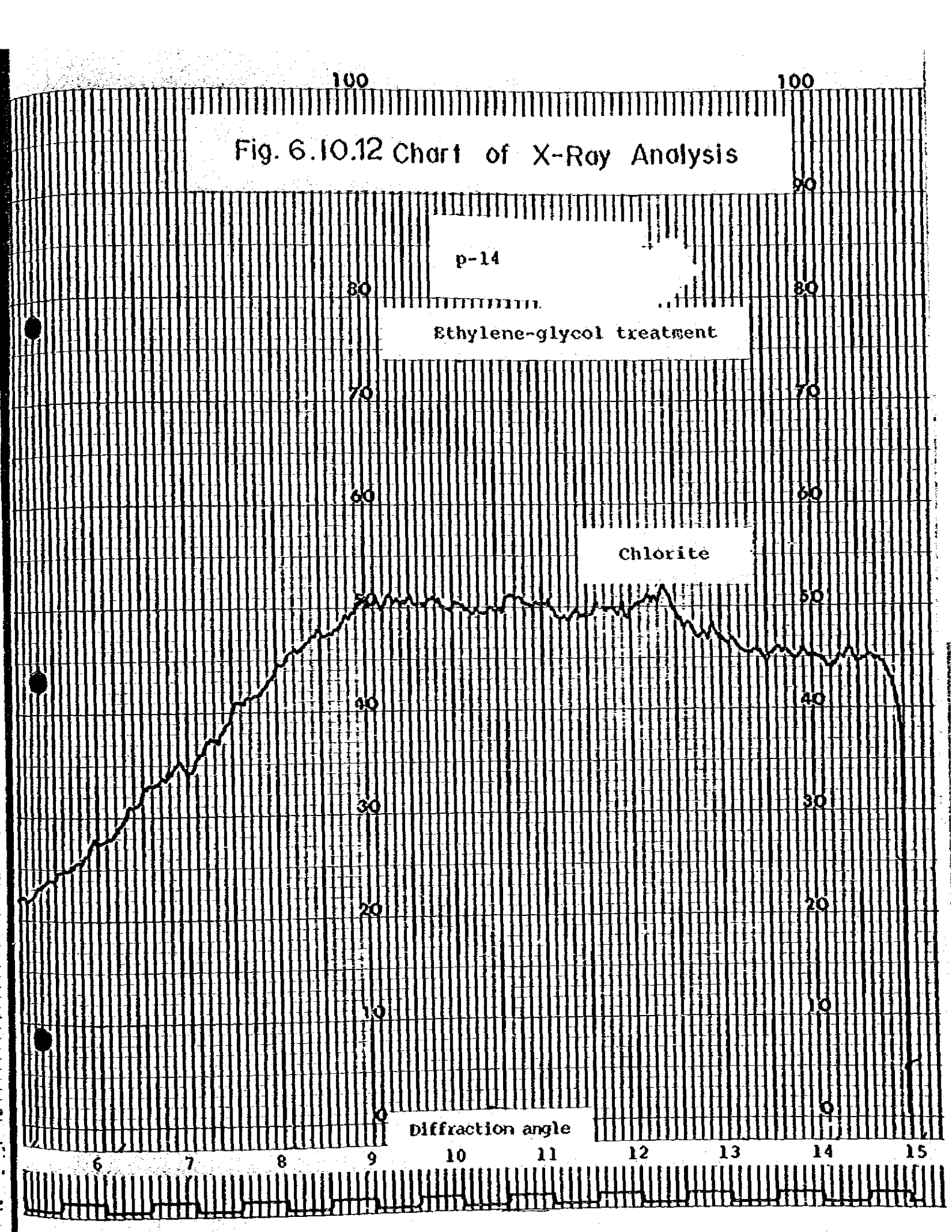


Fig. 6.10.12 Chart of X-Ray Analysis
p-14
Ethylene-glycol treatment
Chlorite
Diffraction angle
100
90
80
70
60
50
40
30
20
10
0
6
7
8
9
10
11
12
13
14
15