



1982 OFFSHORE GEOTECHNICAL
SITE INVESTIGATION
KOGYUK N-67 SITE
BEAUFORT SEA

Report to
GULF CANADA
RESOURCES INC.
Calgary, Alberta

by

EBA Engineering Consultants Ltd.



and

 **McClelland engineers, inc.**

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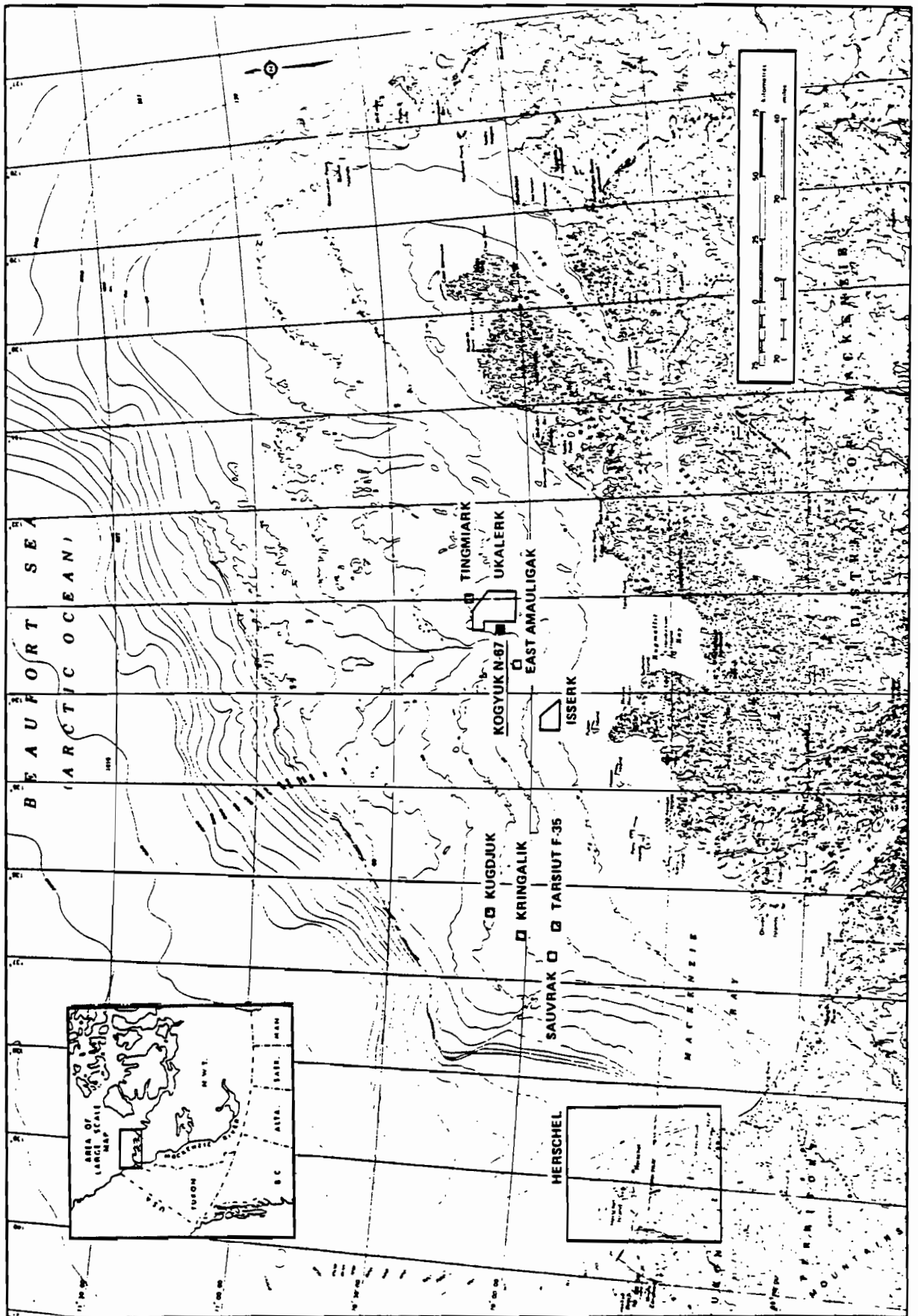


FIGURE 1 GENERAL LOCATION MAP

February 1983

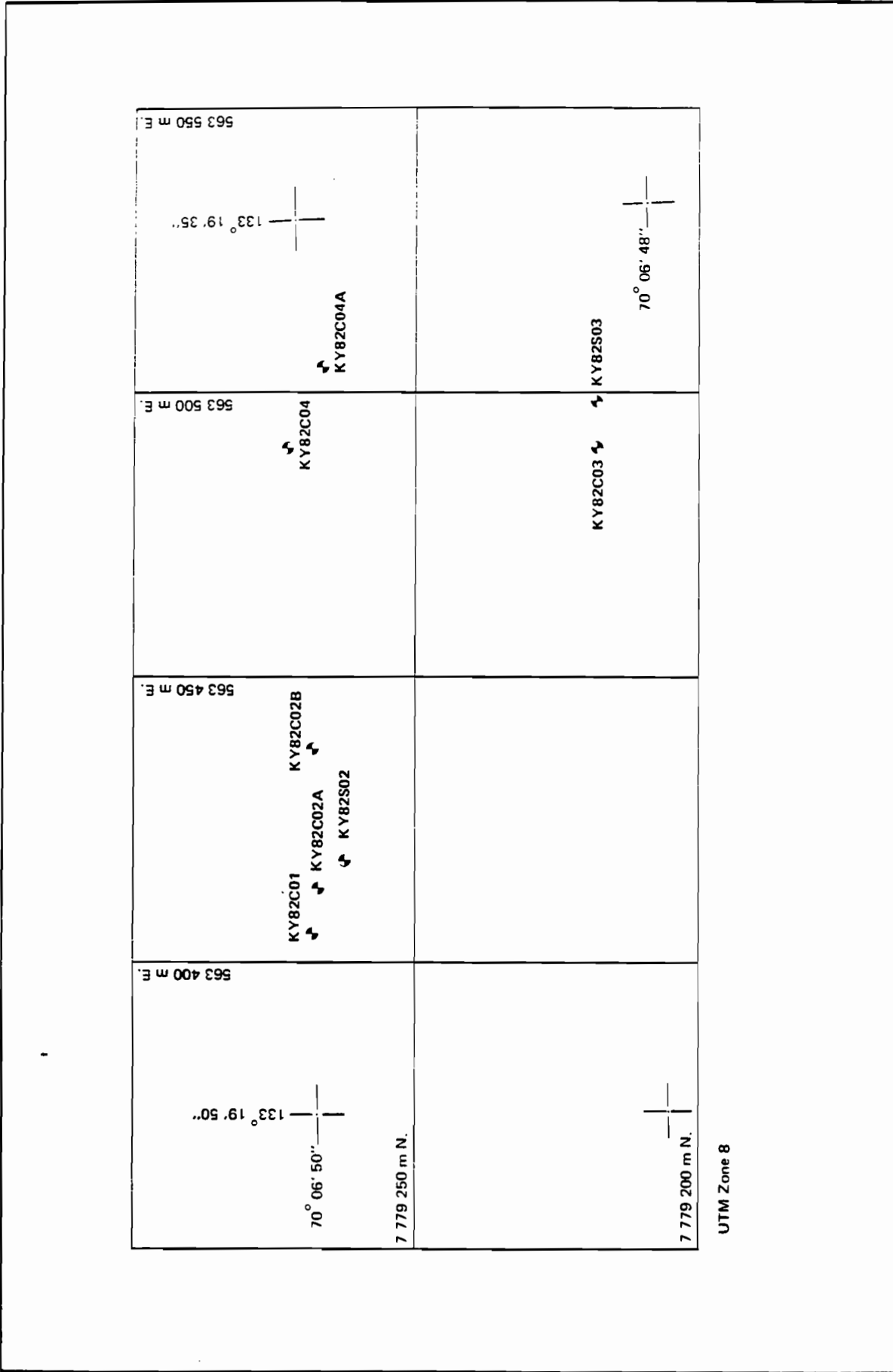


FIGURE 2 BOREHOLE LOCATION MAP KOGYUK AREA N-67

TABLE 1 KOGYUK N-67 SITE FIELDWORK 1982

TEST LOCATION		TEST	MAXIMUM PENETRATION	DATE
Latitude °N	Longitude °W		(metres below seabed)	
70°06'50"	133°19'46"	KY82C01	2.2	82-07-31
70°06'50"	133°19'46"	KY82C02A	3.0	82-07-31
70°06'50"	133°19'44"	KY82C02B	35.4	82-08-03 to 82-08-04 82-08-01
70°06'50"	133°19'46"	KY82S02	31.7	82-08-01
70°06'48"	133°19'39"	KY82C03	28.5	82-08-04
70°06'48"	133°19'38"	KY82S03	76.3	82-08-05
70°06'50"	133°19'39"	KY82C04	8.8	82-08-06 to 82-08-07

Note: 1. All coordinates supplied by CES Ltd.

2. KY82 denotes a borehole/probehole at the Kogyuk N-67 site drilled/tested in 1982. "S" refers to "sampled", "R" refers to "Remote Vane", "C" refers to "static cone", and "P" refers to "pressuremeter". The number following the letter designation is the borehole/probehole number.

February 1983

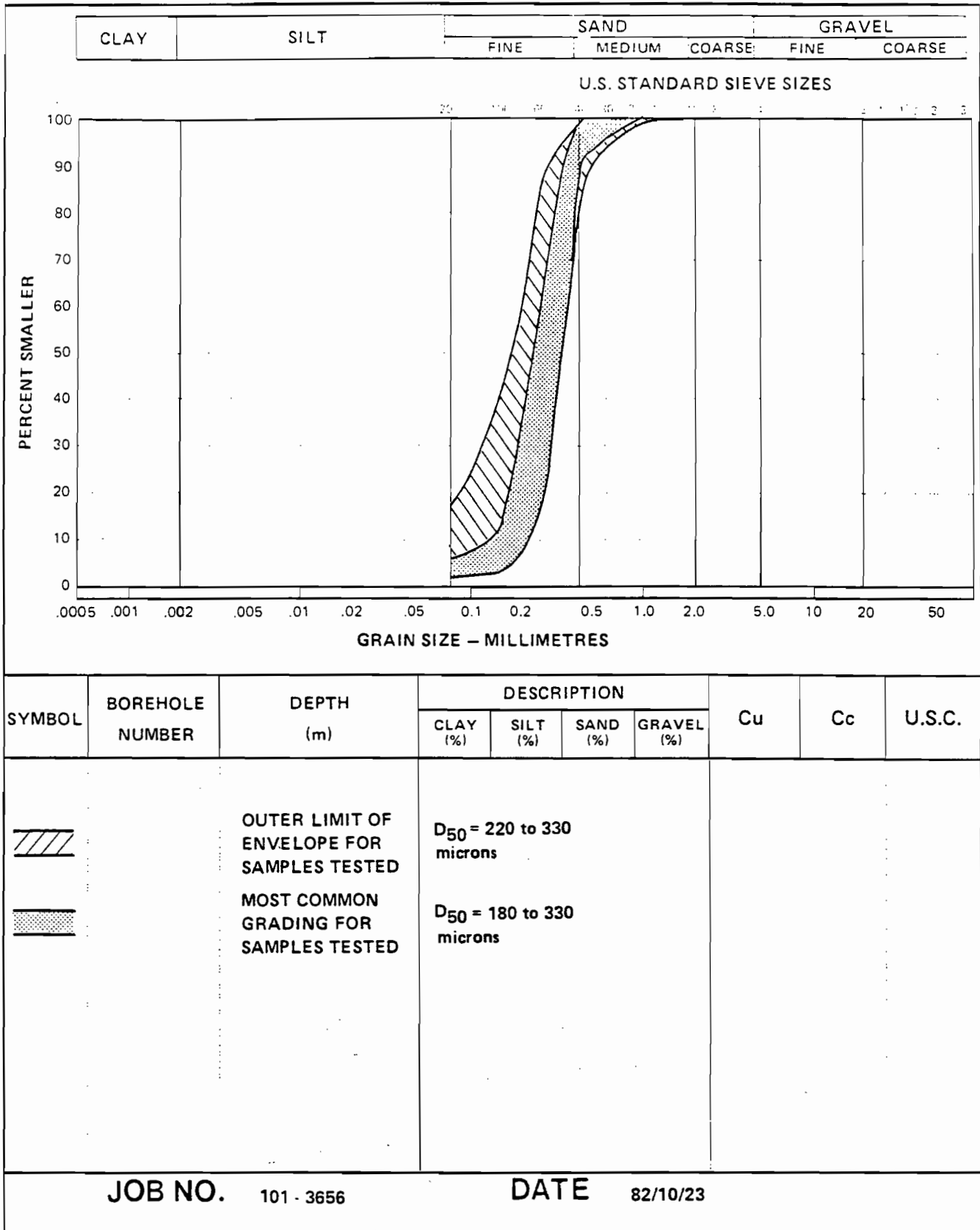


FIGURE 3

GRADING ENVELOPE FOR SANDS SAMPLED AT KOGYUK N-67 SITE

February 1983

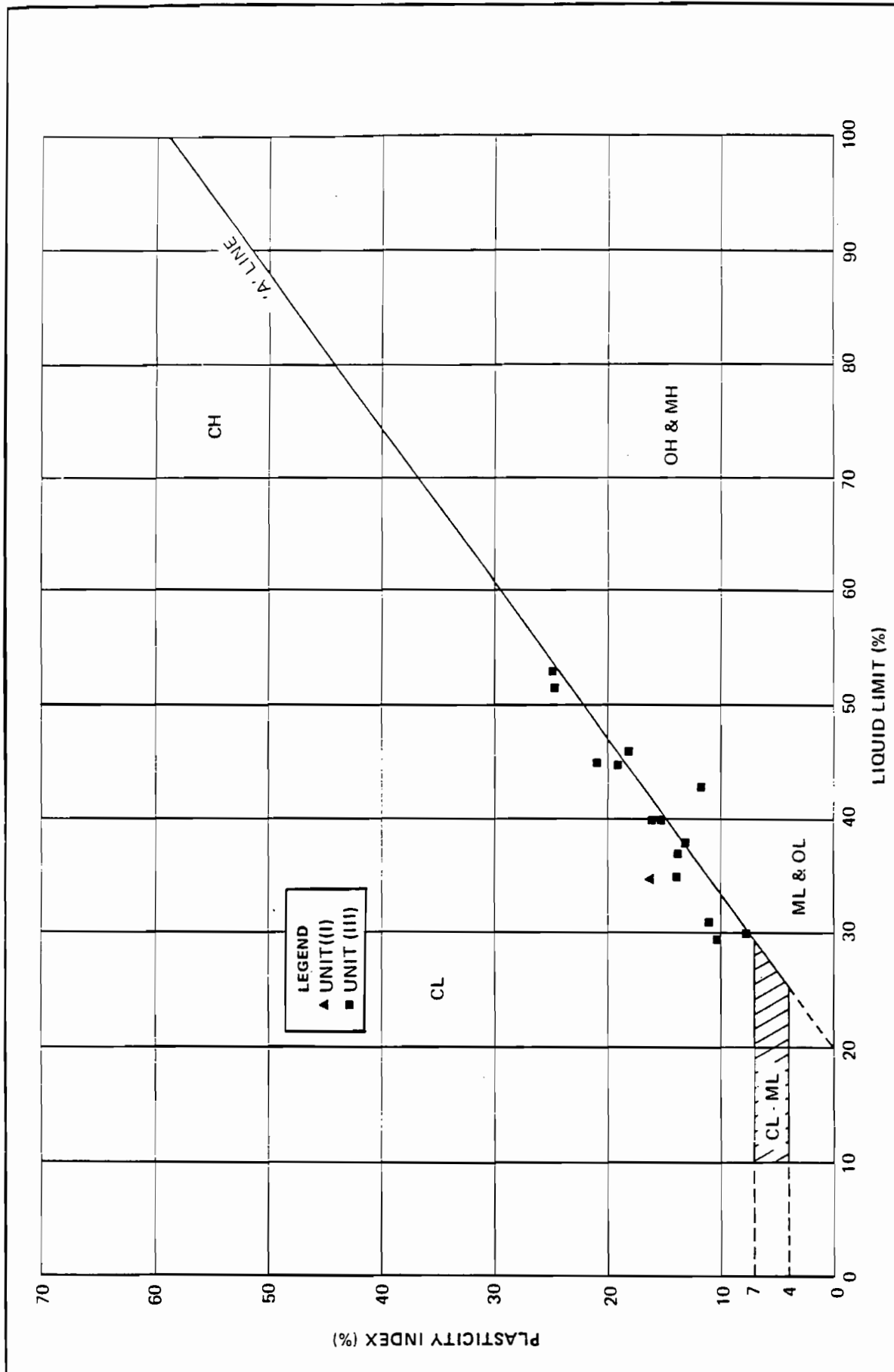


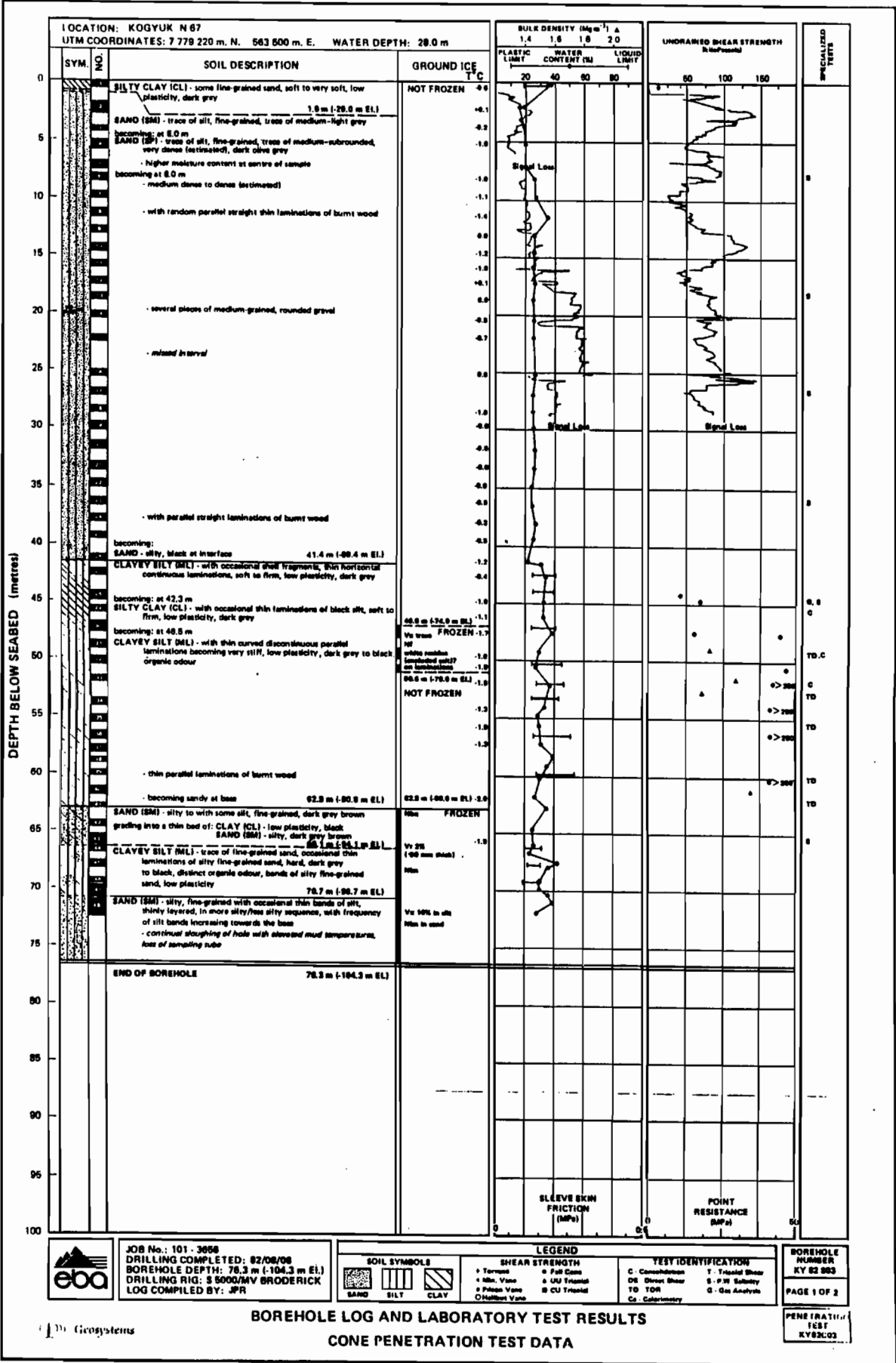
FIGURE 4 PLASTICITY CHART



APPENDIX A

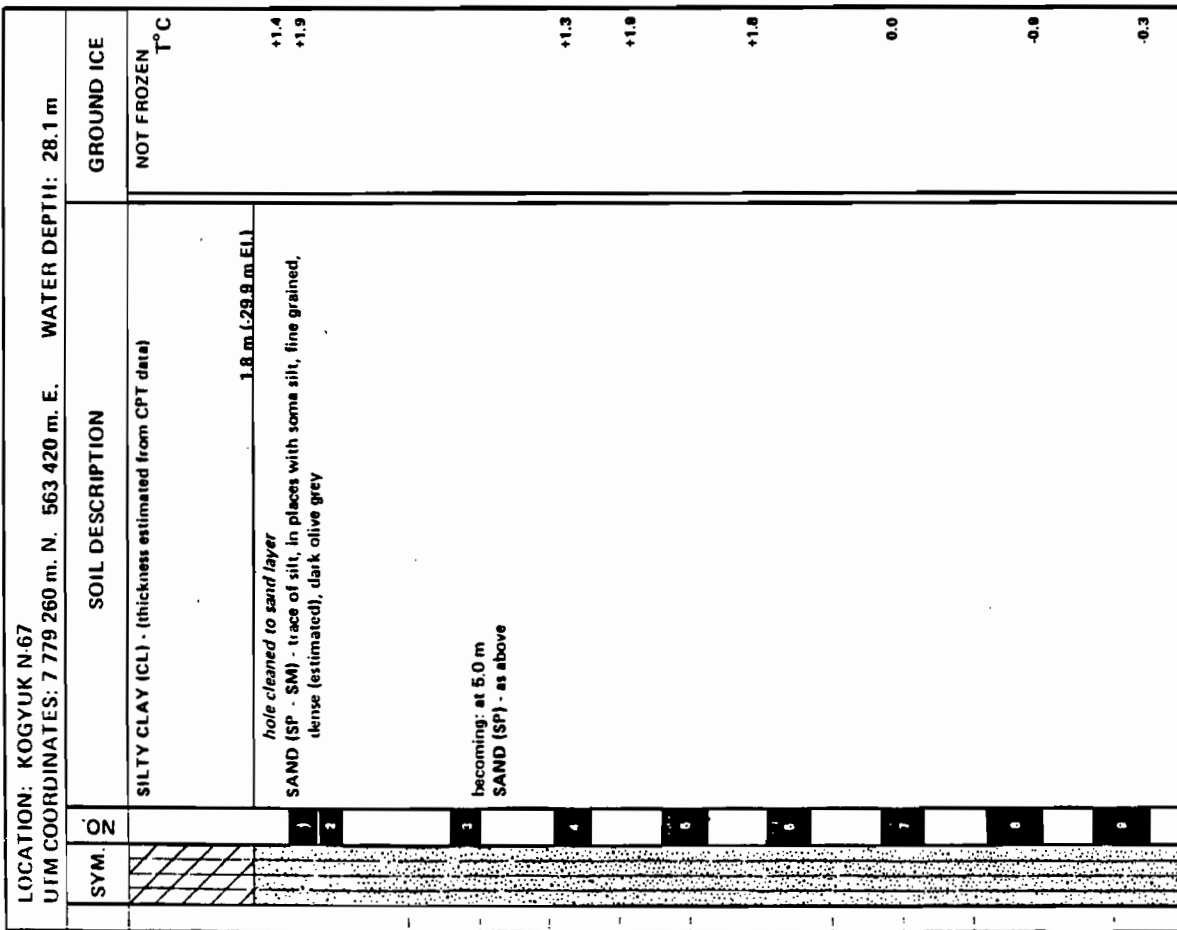
Borehole Logs

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LOCATION: KOGYUK N-67
 UTM COORDINATES: 7 779 260 m. N. 563 420 m. E. WATER DEPTH: 28.1 m

SYM. QZ	SOIL DESCRIPTION	GROUND ICE	PLASTIC LIMIT	WATER CONTENT (%)	LIQUID LIMIT	UNDRAINED SHEAR STRENGTH (kilo Pascals)	SPECIALIZED TESTS
	SILTY CLAY (CL) - (thickness estimated from CPT data)	NOT FROZEN					
	hole cleaned to sand layer	+1.4					
	SAND (SP - SM) - trace of silt, in places with some silt, fine grained, dense (estimated), dark olive grey	+1.9					
	1.8 m (-29.8 m EL)						
	becoming: at 5.0 m SAND (SP) - as above	+1.3					
		+1.8					
		+1.8					
		0.0					
		-0.8					
		-0.3					



BOREHOLE NUMBER
 KY 82 S02
 PAGE 2 OF 2

TEST IDENTIFICATION
 C: Consolidation T: Triaxial Shear
 DS: Direct Shear S: P W Salinity
 TD: TOR G: Gas Analysis
 Ca: Calorimetry

LEGEND
 SHEAR STRENGTH
 + Torvane
 x Min. Vane
 • Picon Vane
 • O'Hallibur Vane
 • Fall Cone
 • UU Triaxial
 • CU Triaxial

SOIL SYMBOLS
 SAND
 SILT
 CLAY

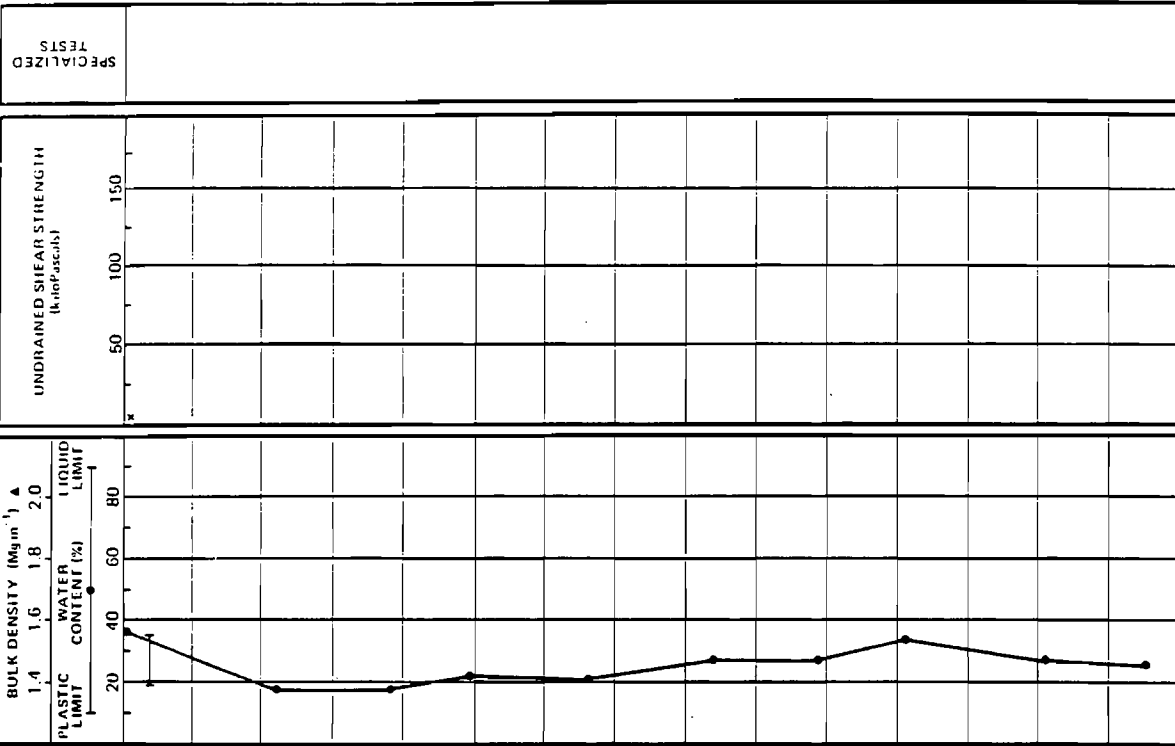
JOB No.: 101 - 3656
 DRILLING COMPLETED: 82/08/01
 BOREHOLE DEPTH: 31.7 m (-59.8 m EL)
 DRILLING RIG: S5000/MV BRODERICK
 LOG COMPILED BY: JPR



BOREHOLE LOG AND LABORATORY TEST RESULTS

LOCATION: KOGYUK N-67
 UTM COORDINATES: 7 779 220 m. N. 563 500 m. E. WATER DEPTH: 28.0 m

SYM.	SOIL DESCRIPTION	GROUND ICE
1	SILTY CLAY (CL) - with some fine grained sand, soft to very soft, low plasticity, dark grey	NOT FROZEN
2	SAND (SM) - fine grained, trace of silt, trace of medium grained sand, very dense (estimated), light grey	
3		
4		
5	becoming: at 5.0 m SAND (SP) - fine grained, trace to some silt, subangular to subrounded, dense (estimated), light grey	
6		
7		
8	becoming: at 8.0 m medium dense to dense (estimated)	
9		
10		
11	- as above, light grey, contains 12 - 15 random thin straight parallel laminations of burnt wood	
12		
13	- fine grained SAND, trace of silt, high M/C, subrounded, dark olive grey	
14		
15		



JOB No.: 101 - 3656
DRILLING COMPLETED: 82/08/06
BOREHOLE DEPTH: 76.3 m (-104.3 m EL.)
DRILLING RIG: S5000/MV BRODERICK
LOG COMPILED BY: JPR

LEGEND

SOIL SYMBOLS
 SAND
 SILT
 CLAY

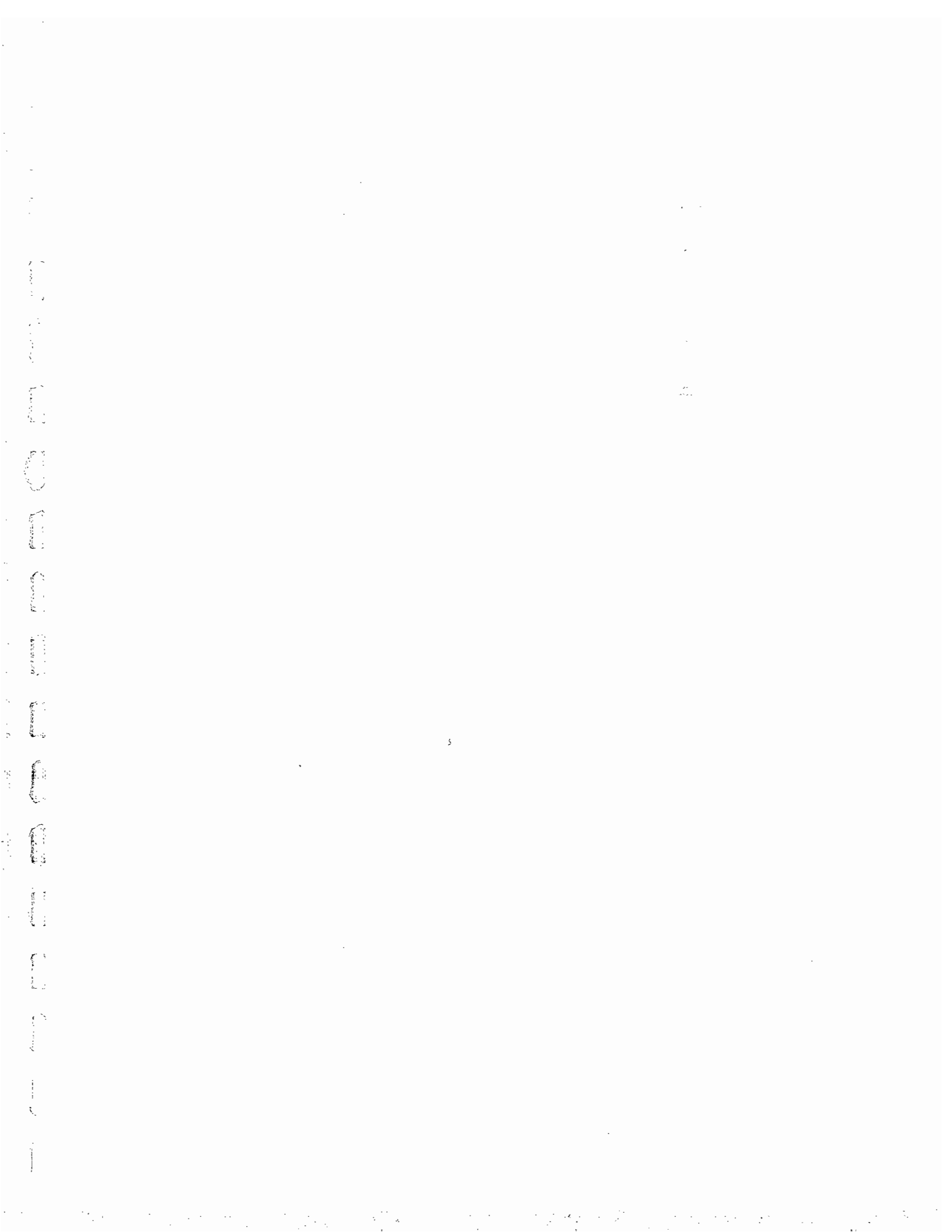
SHEAR STRENGTH
 † Torvane
 • Min. Vane
 • Picon Vane
 • Fall Cone
 • UU Triaxial
 • CU Triaxial

TEST IDENTIFICATION
 C Consolidation
 DS Direct Shear
 TD TOR
 Ca Calorimetry
 T Triaxial Shear
 S P W Satinity
 G Gas Analysis

BOREHOLE NUMBER
 KY 82 S03

PAGE 2 OF 2

BOREHOLE LOG AND LABORATORY TEST RESULTS



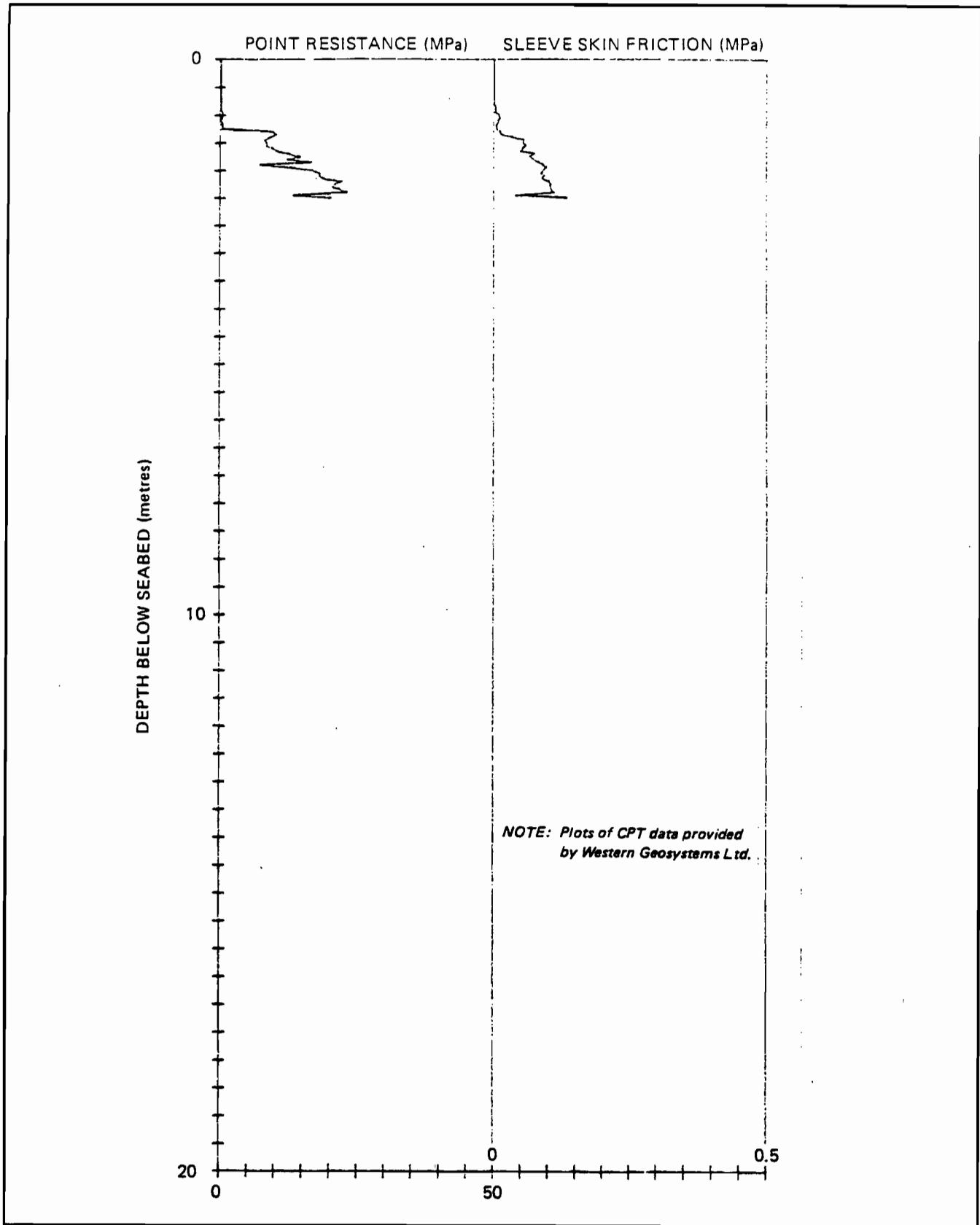
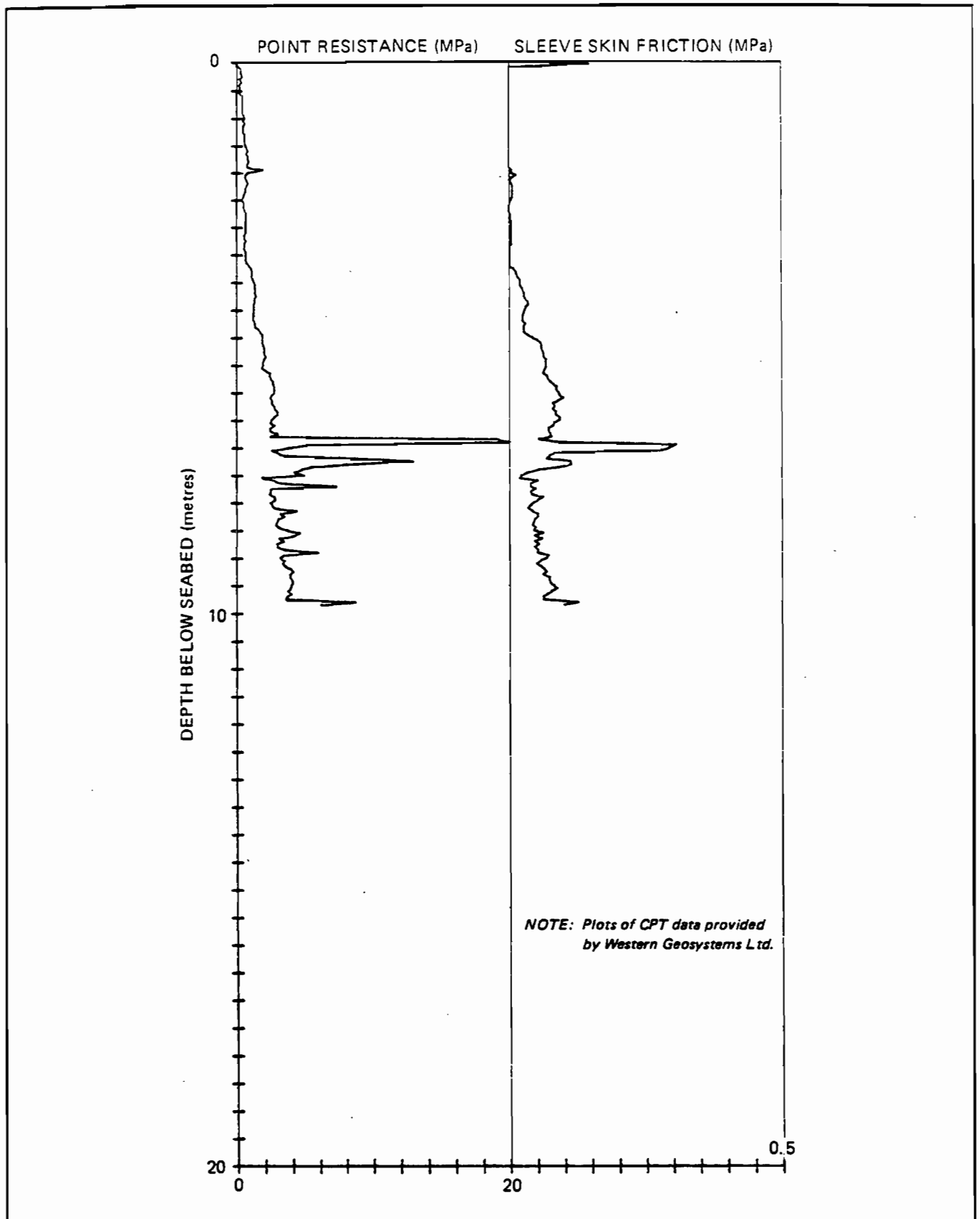


FIGURE A.1 CONE PENETRATION TEST PROFILE
 TEST KY82C01-KOGYUK N-67 SITE
 82/07/31



**FIGURE A.2 CONE PENETRATION TEST PROFILE
 TEST KY82C04-KOBYUK N-67 SITE
 82/08/08**



APPENDIX B

Diagnostic Profiles



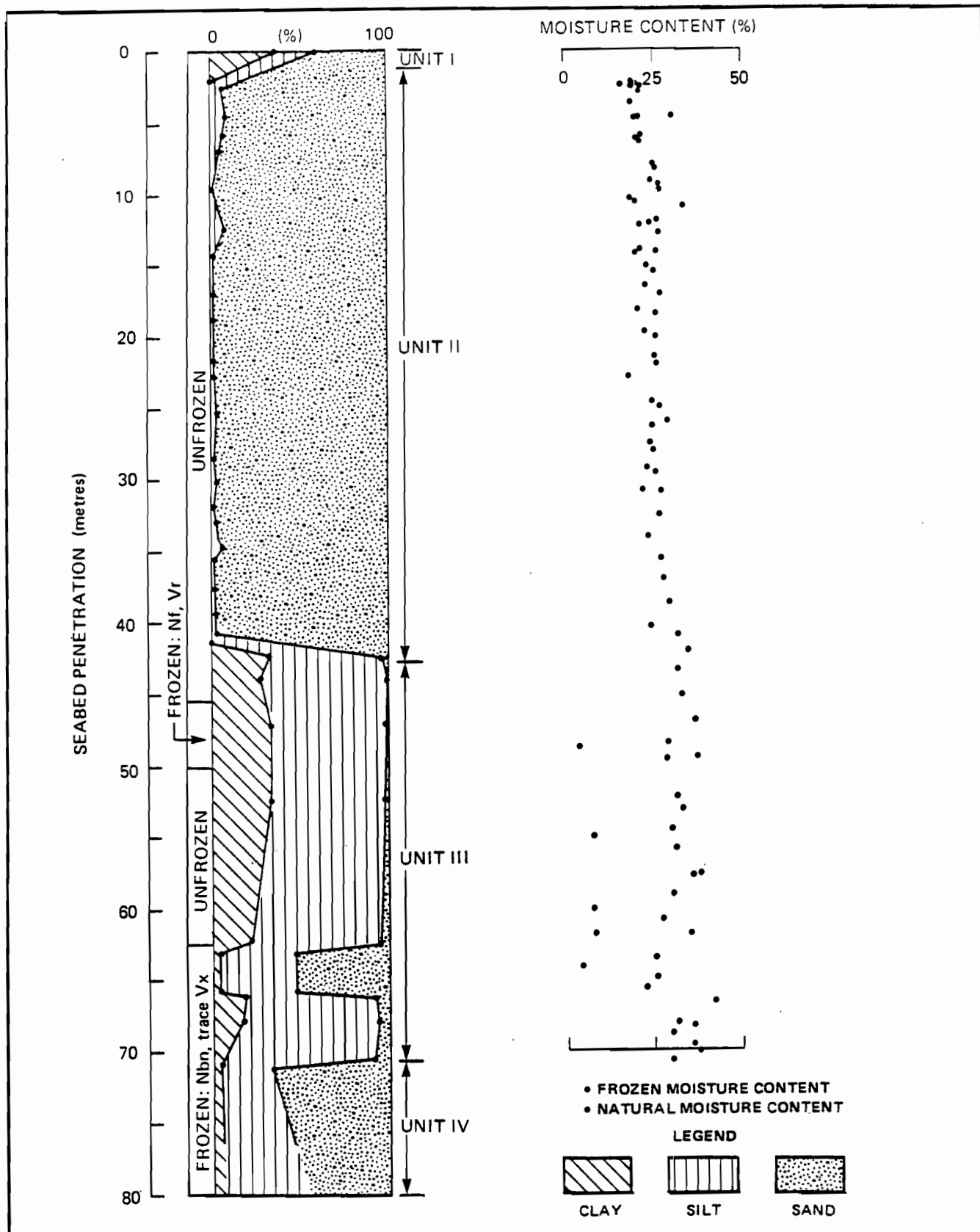


FIGURE B.1

NATURAL AND FROZEN MOISTURE CONTENT PROFILES
KOGYUK N-67 AREA

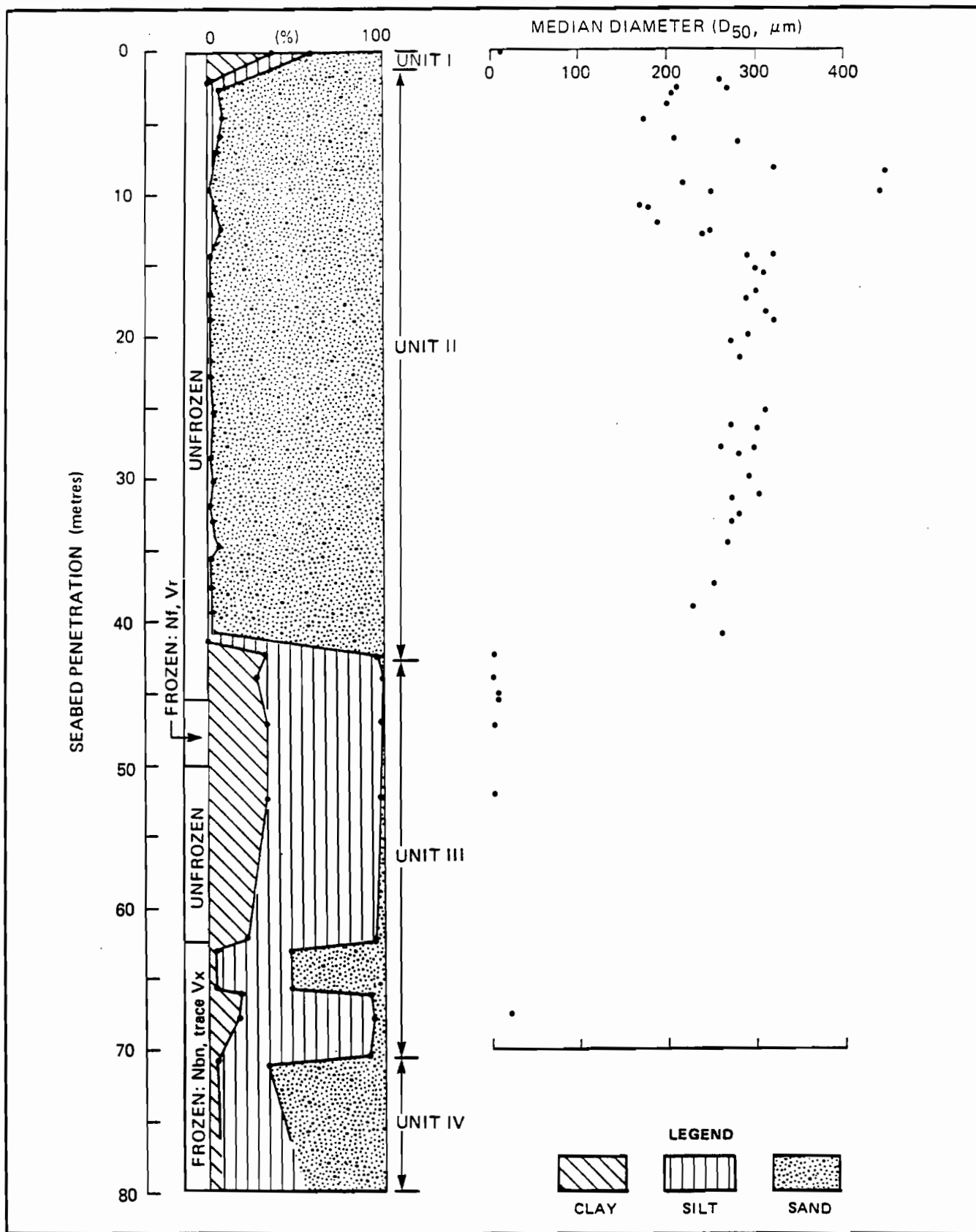


FIGURE B.2

MEDIAN DIAMETER PROFILE,
KOGYUK N-67 AREA

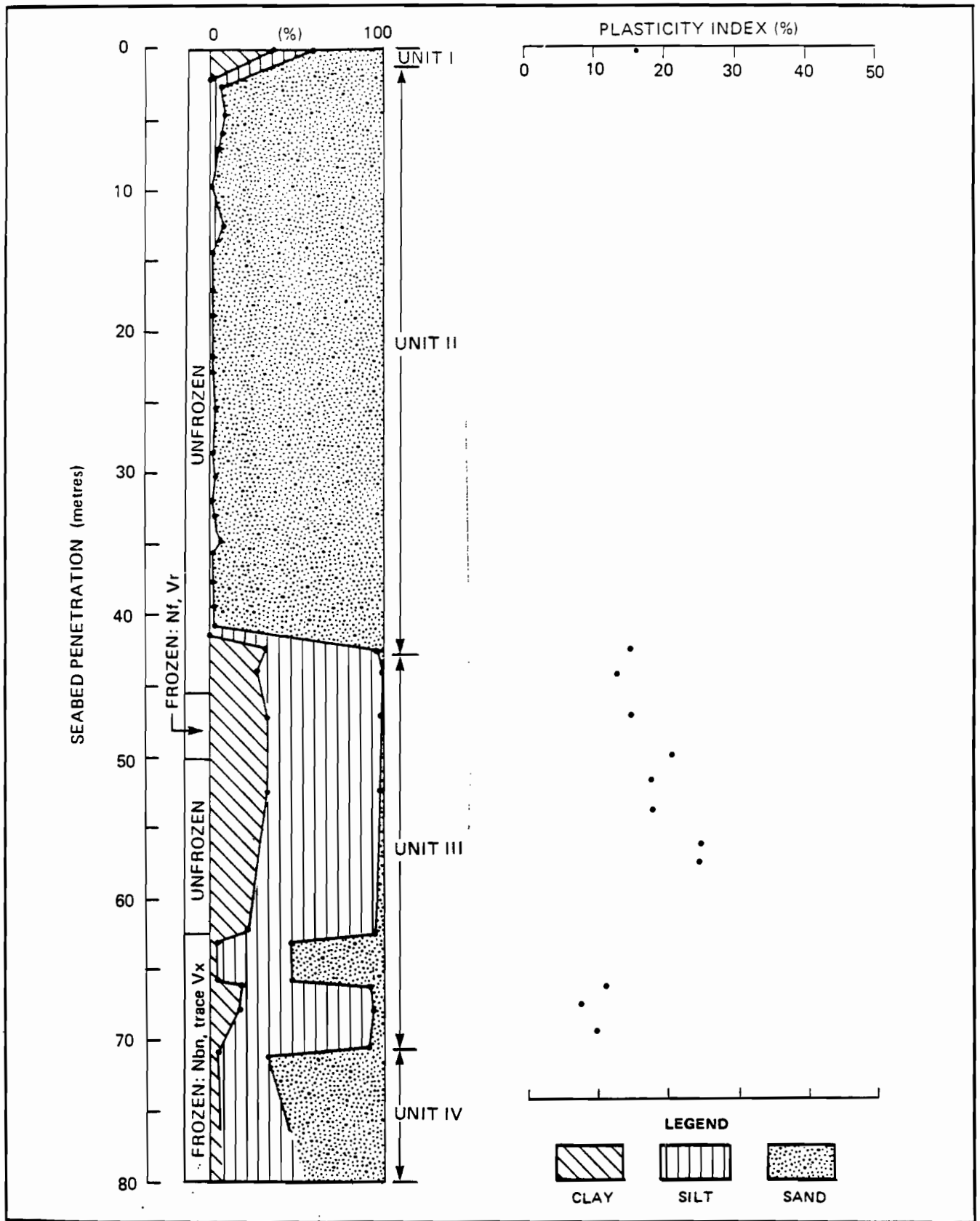


FIGURE B.3

PLASTICITY INDEX PROFILE,
KOGYUK N-67 AREA

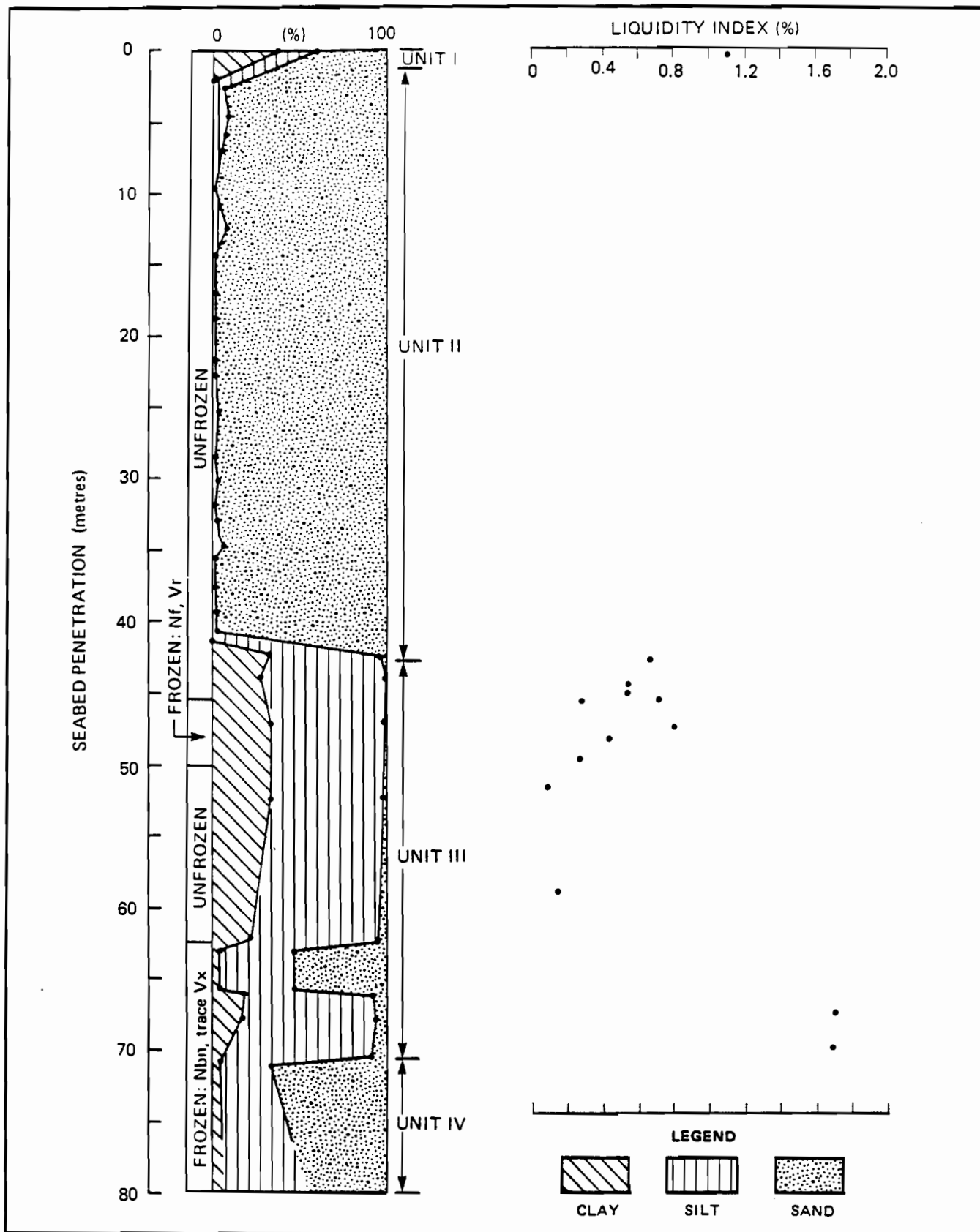


FIGURE B.4

LIQUIDITY INDEX PROFILE,
KOGYUK N-67 AREA

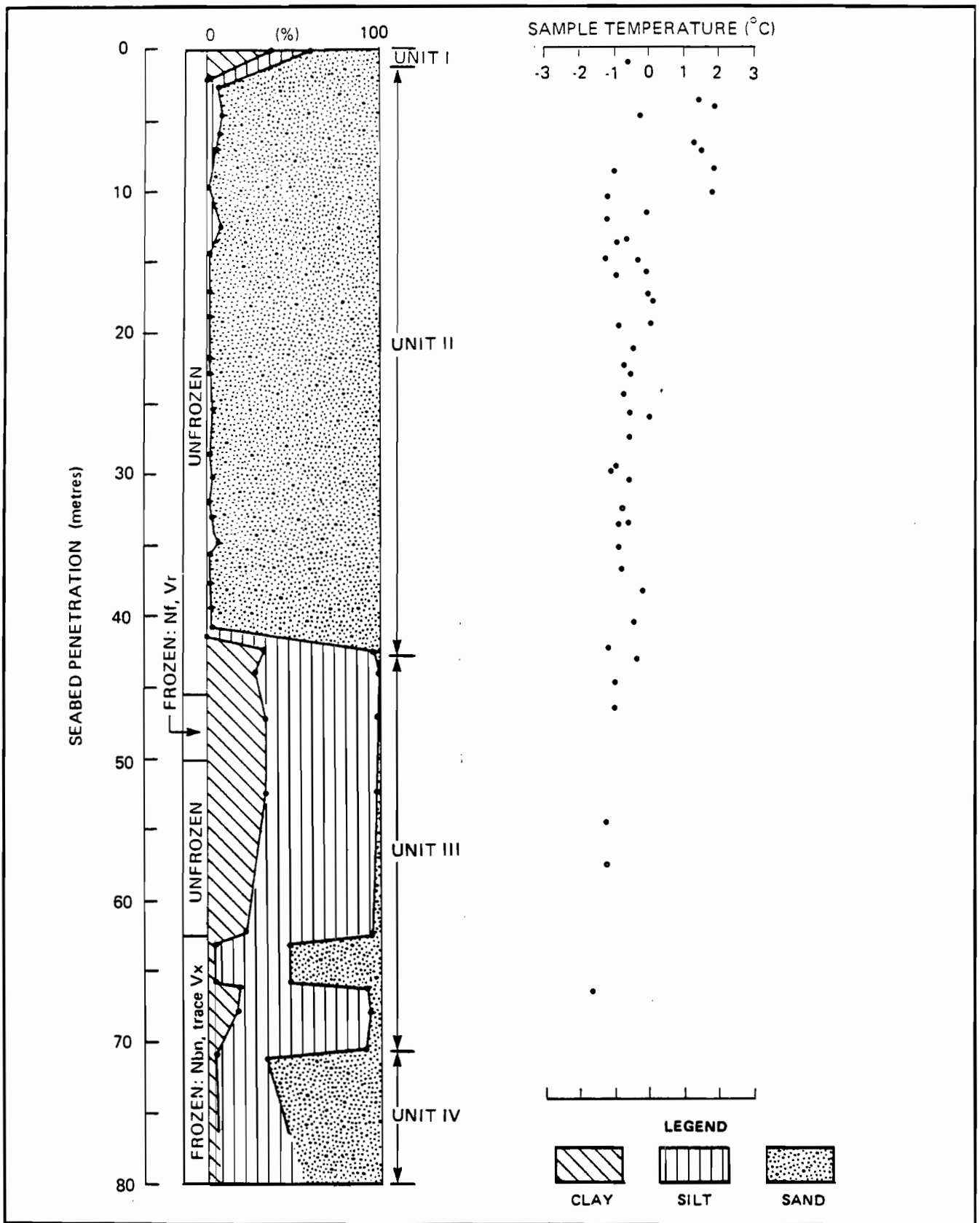


FIGURE B.5

SAMPLE TEMPERATURE PROFILE,
KOGYUK N-67 AREA

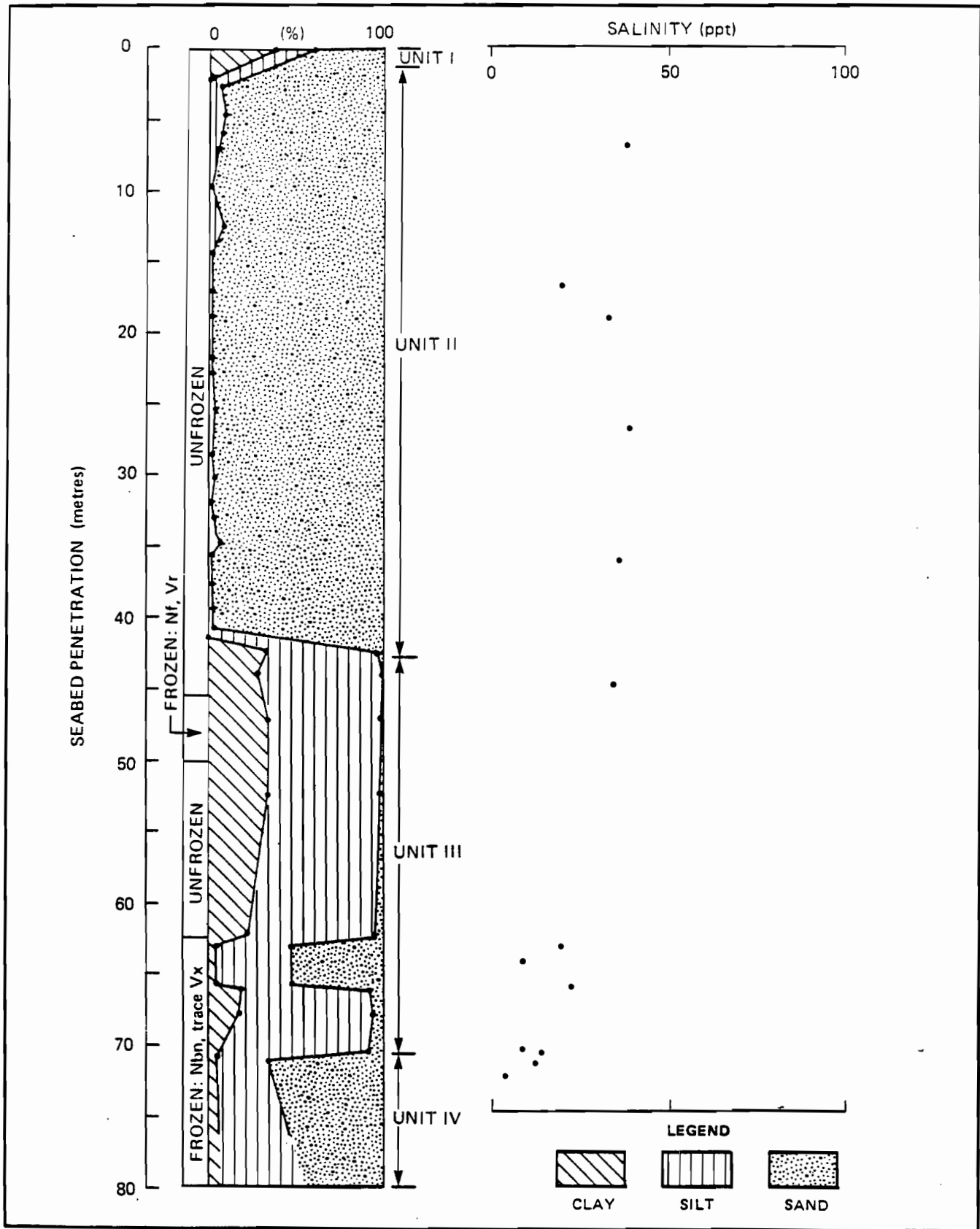


FIGURE B.6

SALINITY PROFILE,
KOGYUK N-67 AREA

APPENDIX C

Classification and Index Test Results

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Sample Number	KY82502	Depth (meters)	Unified Soil Classification	Ground Ice Description (%)	Temp (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density (Mg/m ³)	ATTERBERG LIMITS		CHAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULT SEPARATELY				
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _o (kPa)	P _u (kPa)		C _c			
01A	NS	2.29 - 2.67	SP-SH		1.4	20																				
01B	B	2.67	SP-SH			19																				
02A	NS	2.75 - 3.05	SP-SH		1.9	22																				
02B	B					21																				
03A	NS	4.93 - 4.97	SP-SH			21																				
03B	NS	4.79 - 4.93				21																				
03C	B	4.57 - 4.79																								
04A	NS	6.62 - 6.26	SP		1.3	21																				
04B	NS	6.26 - 6.40				20																				
04C	B	6.10 - 6.22																								
		6.40 - 6.60																								
05A	NS	8.20 - 8.25	SP		1.9	25																				
05B		8.00 - 8.20																								
05C	B	7.62 - 8.00																								
06A	NS	9.61 - 9.66	SP		1.8	27																				
06B		9.41 - 9.61				24																				
06C	B	9.14 - 9.41																								
07A	NS	11.00	SP		0.0	19																				
07B		10.66 - 11.27				20																				
07C	B																									
08A	NS	12.20 - 12.25	SP		-0.6	26																				

LEGEND AND NOTES

B: Wet Sample
 G: Gas Sample
 L: Liner Sample
 P: Piston Sample
 NR: No Recovery
 NS: No Sample Remaining

PF: Permafrost Sample
 PW: Porewater Sample
 T: Sample Stored in Tube
 W: Waxed Sample
 RC: Radiocarbon Sample

MV: Miniature
 FC: Fall Cone
 TV: Torvane
 PV: Pilon Vane
 RV: Remote Vane

UU: Unconsolidated Undrained Triaxial
 UUp: UU Triaxial with Pore Pressure Measurements
 CU: Consolidated Undrained Triaxial
 CUup: CU Triaxial with Pore Pressure Measurements
 CD: Consolidated Drained Triaxial

O: Organic Content
 S: Salinity
 TS: Thaw Strain

SUMMARY OF TEST RESULTS

Sample Number	KY02502	Depth (meters) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture (%)	Frozen Moisture (%)	Bulk Density (Mgm/3)	ATTERBERG LIMITS				GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (mm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _u (kPa)	P _c (kPa)	C _c	
08B		12.25 - 12.38				24				9	93					260							
08C		12.60 - 12.75				21				7	93					260							
08D	B	*12.75 - 12.95																					
09A	NS	14.49 - 14.54	SP		-0.3	20																	
09B		*14.34 - 14.49				21				2	98												
09C	B	13.71 - 14.34																					
10A	NS	15.35 - 15.50	SP		1.0	23				2	98												
10B	B	*15.24 - 15.50																					
11A	NS	16.88 - 17.04	SP		-0.6	23				2	98												
11B	S	*16.78 - 16.88																					
11C	B	17.04 - 17.14																					
12A	NS	18.60 - 18.66	SP		-0.9	21				2	98												
12B	B	*18.66 - 19.14																					
13A	NS	20.11 - 20.29	SP		-0.4	22				2	98												
13B	B	*20.29 - 20.97																					
14A	NS	*21.75 - 21.88	SP		-0.0	25				2	98												
14B	B	21.64 - 21.75																					
		21.88 - 22.15																					
15A	NS	*23.39 - 23.54	SP		-0.7	18																	
15B	B	23.17 - 23.39																					
		23.54 - 24.03																					

LEGEND AND NOTES

B - Bag Sample
 G - Gas Sample
 L - Liner Sample
 P - Piston Sample
 NR - No Recovery
 NS - No Sample Remaining

PF - Permafrost Sample
 PW - Porewater Sample
 T - Sample Stored in Tube
 W - Waxed Sample
 RC - Radiocarbon Sample

MV - Minivane
 FC - Fall Cone
 TV - Torvane
 PV - Plicon Vane
 RV - Remote Vane

UU - Unconsolidated Undrained Triaxial
 UU_p - UU Triaxial with Pore Pressure Measurements
 CU - Consolidated Undrained Triaxial
 CU_p - CU Triaxial with Pore Pressure Measurements
 CD - Consolidated Drained Triaxial

O - Organic Content
 S - Salinity
 TS - Thaw Strain

SUMMARY OF TEST RESULTS

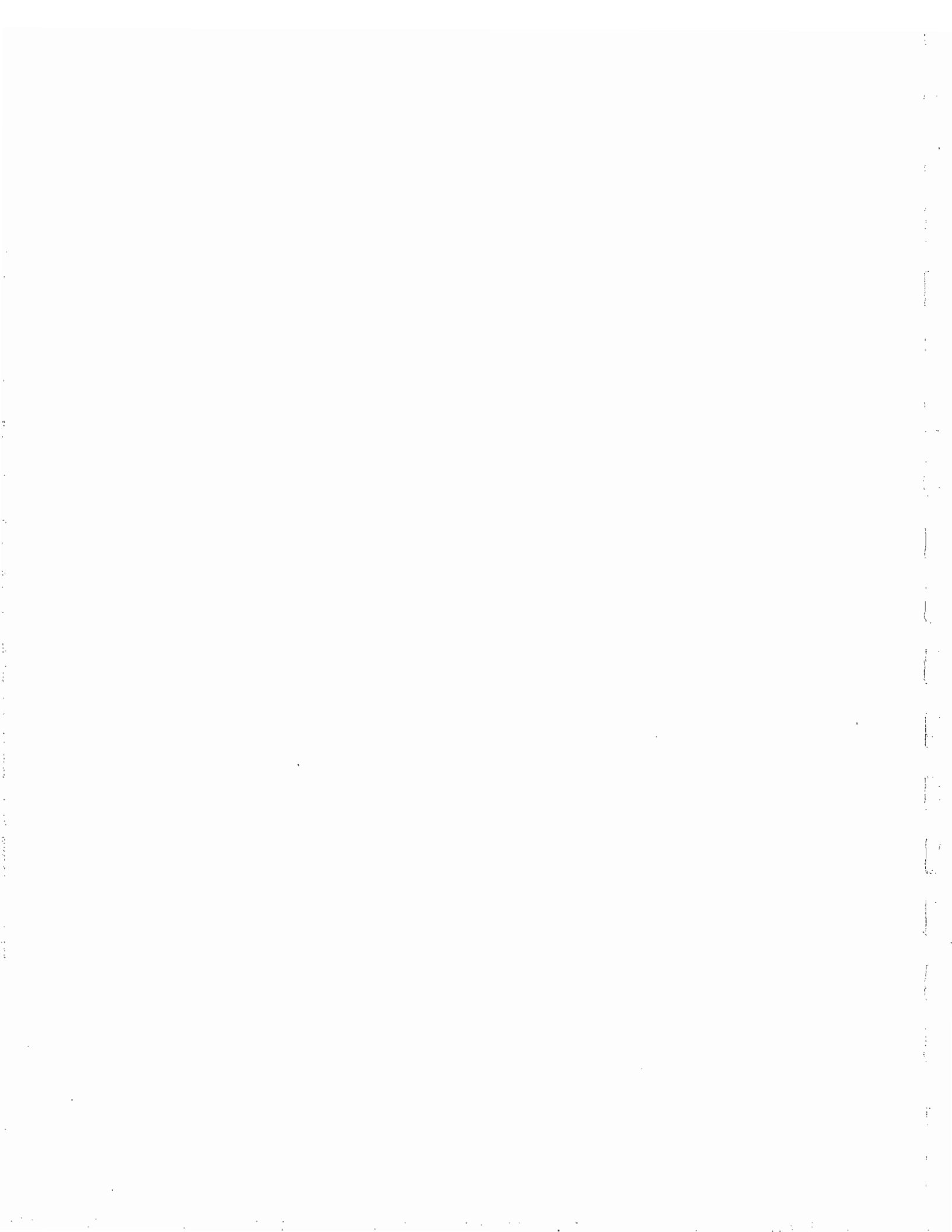
KY82502 Sample Number	Soil Type	Depth (metres) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density (Mgm ³)	ATTERBERG LIMITS					GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS SEPARATELY											
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P ₀ (kPa)	e _c (kPa)	C _c														
16A	NS	*24.69 - 25.03	SP		-0.4	25				3	97					280																				
16B	B	24.69 - 24.88																																		
		25.03 - 25.45																																		
17A	NS	26.36 - 26.51	SP		-0.4	29				2	98					280																				
17B	B	26.21 - 26.36																																		
		26.51 - 26.79																																		
18A	NS	*27.98 - 28.16	SP		1.1	24				3	97					300																				
18B	B	27.74 - 27.98																																		
		28.16 - 28.60																																		
19A	NS	*29.58 - 29.89	SP		2.6	23				8	92					300																				
19B	B	*29.28 - 29.58																																		
20A	NS	*31.32 - 31.37	SP		-0.9	22				2	98					290																				
20B	B	*31.37 - 31.77																																		

LEGEND AND NOTES

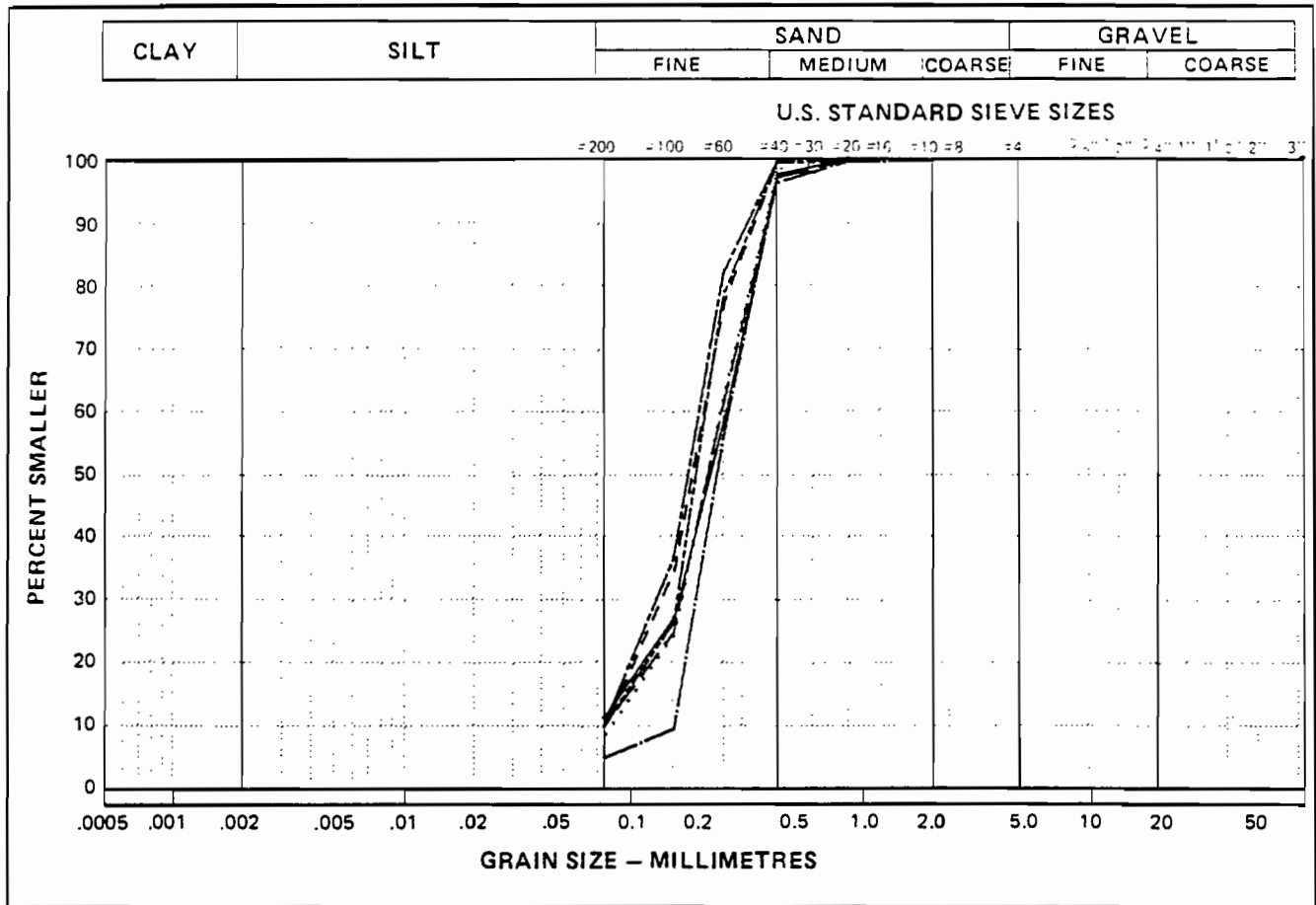
- B Bag Sample
- G Gas Sample
- L Liner Sample
- P Piston Sample
- NH No Recovery
- NS No Sample Remaining
- PF Permafrost Sample
- PW Potwater Sample
- T Sample Stored in Tube
- W Waxed Sample
- RC Radiocarbon Sample
- MV MiniVane
- FC Fall Cone
- TV Torvane
- PV Picon Vane
- RV Remote Vane
- UU Unconsolidated Undrained Triaxial
- UU_p UU Triaxial with Pore Pressure Measurements
- CU Consolidated Undrained Triaxial
- CU_p CU Triaxial with Pore Pressure Measurements
- CD Consolidated Drained Triaxial
- O Organic Content
- S Salinity
- TS Thaw Strain

Project Number: 101-3656

Reviewed By: _____ P. Eng.



PARTICLE - SIZE ANALYSIS OF SOILS

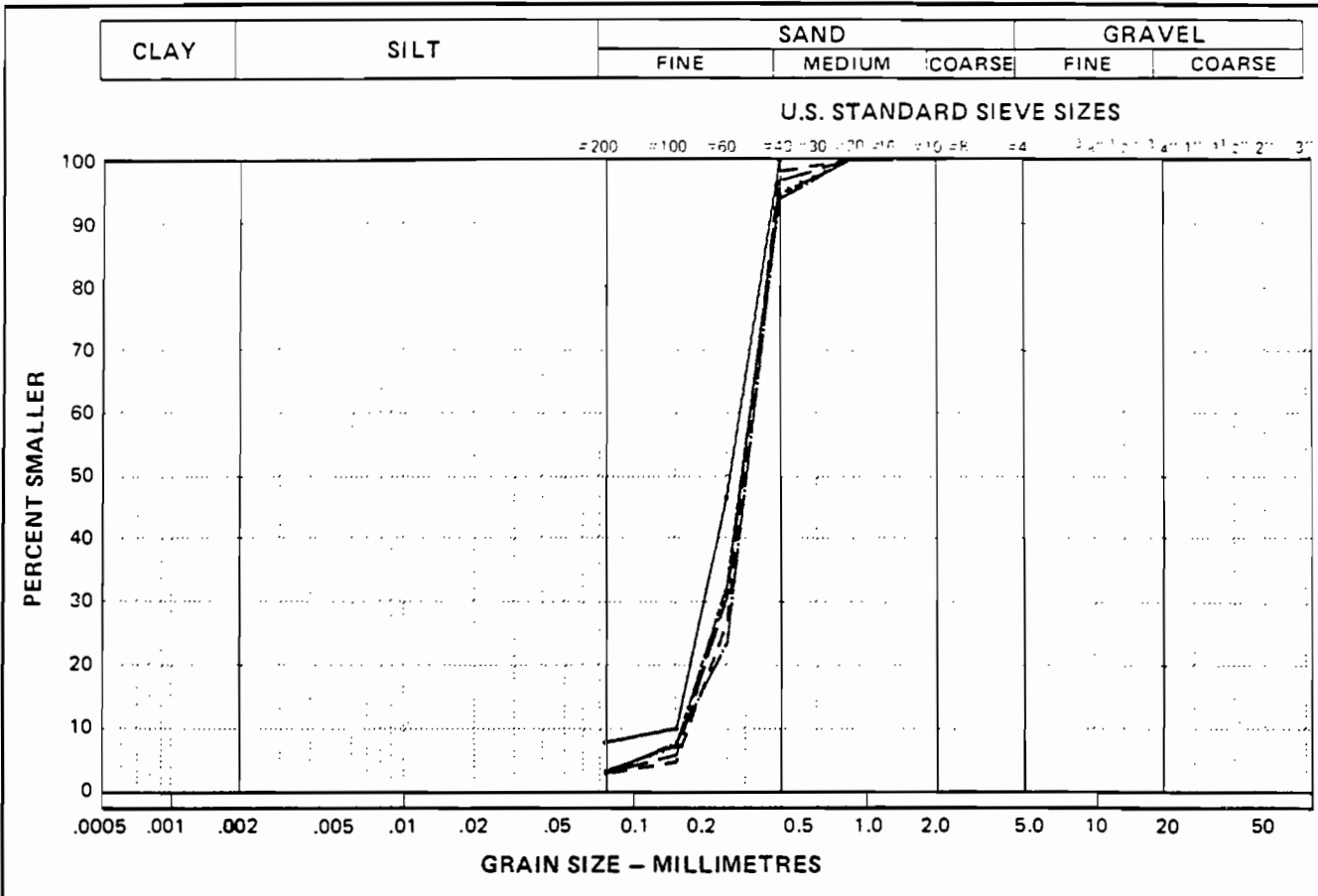


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S02	2.67 - 2.67	-	10.3	89.7	0.0	-	-	
.....	KY82S02	2.75 - 3.00	-	7.3	92.7	0.0	2.9	1.3	SP-SM
---	KY82S02	4.79 - 4.93	-	8.3	91.7	0.0	2.6	1.2	SP-SM
_____	KY82S02	6.26 - 6.40	-	9.0	91.0	0.0	3.2	1.4	SP-SM
_____	KY82S02	9.41 - 9.61	-	4.0	96.0	0.0	1.7	.9	SP
---	KY82S02	10.66 - 11.27	-	9.0	91.0	0.0	2.6	1.1	SP-SM
---	KY82S02	12.25 - 12.38	-	9.0	91.0	0.0	2.7	1.5	SP-SM

JOB NO. 101 -3656

DATE 82-08--0

PARTICLE - SIZE ANALYSIS OF SOILS

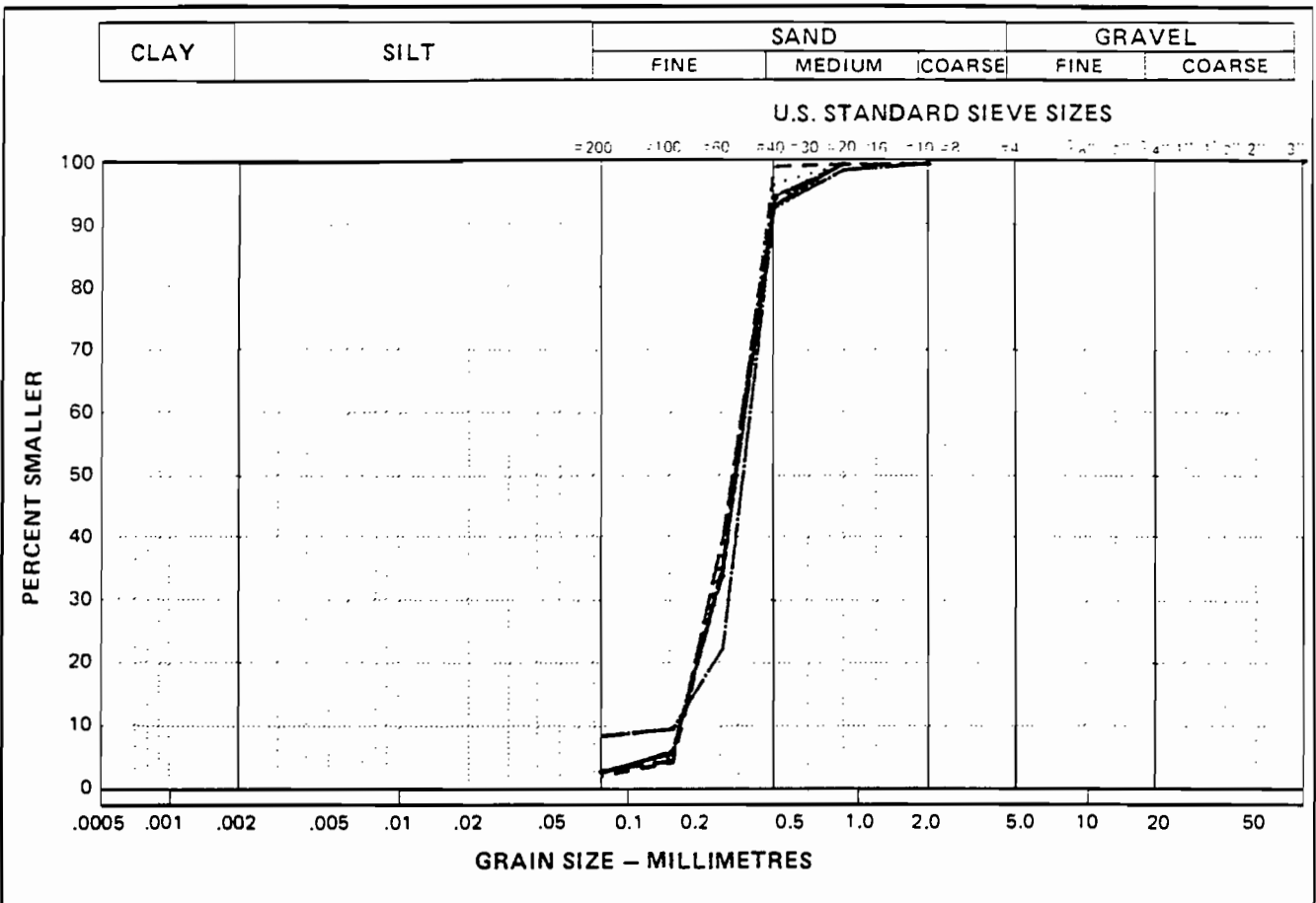


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S02	12.60 - 12.75	-	6.9	93.1	0.0	1.9	.9	SP-SM
.....	KY82S02	14.34 - 14.49	-	2.3	97.7	0.0	2.0	1.2	SP
-----	KY82S02	15.35 - 15.50	-	1.9	98.1	0.0	1.9	1.2	SP
_____	KY82S02	16.88 - 17.04	-	2.0	98.0	0.0	1.9	1.2	SP
_____	KY82S02	18.50 - 18.66	-	1.9	98.1	0.0	2.0	1.3	SP
_____	KY82S02	20.11 - 20.29	-	2.3	97.7	0.0	2.0	1.1	SP

JOB NO. 101 -3656

DATE 82-08-03

PARTICLE - SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S02	21.75 - 21.88	-	2.3	97.7	0.0	1.9	1.1	SP
.....	KY82S02	26.36 - 26.51	-	2.3	97.7	0.0	1.9	1.0	SP
---	KY82S02	27.88 - 28.03	-	1.6	98.4	0.0	1.8	1.0	SP
_____	KY82S02	27.98 - 28.16	-	2.5	97.5	0.0	1.9	1.0	SP
_____	KY82S02	29.58 - 29.89	-	8.0	92.0	0.0	2.1	1.4	SP-SM
_____	KY82S02	31.32 - 31.37	-	2.0	98.0	0.0	1.9	1.0	SP

JOB NO. 101 -3656

DATE 82-08-03



SUMMARY OF TEST RESULTS

KY82S03 Sample Number	Type	Depth (metres) * Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density (Mgm./3)	ATTERBERG LIMITS					GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS TABULATED											
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P ₀ (kPa)	P _c (kPa)	C _c														
01A	NS	0.00 - 0.05	CL			37																														
01B	B	* 0.05 - 0.50	CL		-0.6																															
02A	NS	* 2.20 - 2.35	SH			19																														
02B	B	1.83 - 2.20	SH																																	
02C	B	2.35 - 2.64	SH																																	
02D	NS	2.64	SH		0.1	16																														
03A	NS	3.75 - 3.85	SH			19																														
03B	B	* 3.35 - 4.15	SH		-0.2																															
04A	NS	4.88 - 4.98	SP			20																														
04B	B	* 4.98 - 5.69	SP		-1.0																															
05A	NS	6.60 - 6.70	SP			21																														
05B	B	* 6.70 - 6.81	SP																																	
05C	S	6.81 - 6.91	SP		1.5																															
06A	NS	8.36 - 8.46	SP			26																														
06B	B	* 7.93 - 8.36	SP																																	
07A	NS	9.90 - 10.00	SP			27																														
07B	B	* 9.45 - 9.90	SP																																	
08A	NS	11.17 - 11.22	SP			34																														
08B	B	10.97 - 11.17	SP																																	
08C	B	* 11.22 - 11.62	SP																																	
09A	NS	13.06 - 13.16	SP			27																														

LEGEND AND NOTES

B - Ring Sample
 G - Gas Sample
 L - Liner Sample
 P - Piston Sample
 NR - No Recovery
 NS - No Sample Remaining

PF - Permafrost Sample
 PW - Porewater Sample
 T - Sample Stored in Tube
 W - Wax Sample
 RC - Radioactive Sample

MV - Mini-vane
 FC - Fall Cone
 TV - Torvane
 PV - Pilon Vane
 RV - Remote Vane

UU - Unconsolidated Undrained Triaxial
 UUp - UU Triaxial with Pore Pressure Measurements
 CU - Consolidated Undrained Triaxial
 CUup - CU Triaxial with Pore Pressure Measurements
 CD - Consolidated Drained Triaxial

D - Organic Content
 S - Salinity
 TS - Thaw Strain

SUMMARY OF TEST RESULTS

Sample Number	Type	Depth (metres) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture (%)	Frozen Moisture (%)	Bulk Density (Mg/m ³)	GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST TABULATION			
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (mm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency		P _o (kPa)	P _c (kPa)	C _c
09B	B	*12.50 - 13.06	SP																				
10A	NS	14.50 - 14.60	SP		-1.2	26																	
10B	B	*14.02 - 24.50	SP																				
11A	NS	15.86 - 15.96	SP		-1.0	25																	
11B	B	*15.55 - 15.86	SP																				
12A	NS	17.41 - 17.51	SP		0.1	27																	
12B	B	*17.07 - 17.41	SP																				
13A	NS	28.93 - 19.03	SP			26																	
13B	B	*18.59 - 18.93	SP																				
13C	S	19.03 - 19.09	SP		0.0																		
14A	NS	20.56 - 20.66	SP		-0.5	26																	
14B	B	*20.12 - 20.56	SP																				
15A	NS	22.36 - 33.41	SP		-0.7	26																	
15B	B	*21.95 - 22.36	SP																				
16A	NS	25.29 - 2.39	SP		0.0	27																	
16B	B	*24.99 - 25.47	SP																				
17A	NS	26.78 - 26.88	SP			25																	
17B	B	*26.52 - 26.78	SP																				
17C	S	26.88 - 27.08	SP																				
18A	NS	28.42 - 28.52	SP		-1.0	25																	
18B	B	*28.00 - 28.42	SP																				

LEGEND AND NOTES
 B - Bag Sample
 G - Gas Sample
 L - Liner Sample
 P - Piston Sample
 NR - N/A Recovery
 NS - No Sample Remaining
 PF - Permafrost Sample
 PW - Porewater Sample
 T - Sample Stored in Tube
 W - Wetted Sample
 RC - Radiocarbon Sample
 MV - MiniVane
 FC - Fall Cone
 TV - Torvane
 PV - Picon Vane
 RV - Ramote Vane
 UU - Unconsolidated Undrained Triaxial
 UUp - UU Triaxial with Pore Pressure Measurements
 CU - Consolidated Undrained Triaxial
 CU_p - CU Triaxial with Pore Pressure Measurements
 CD - Consolidated Drained Triaxial
 O - Organic Content
 S - Salinity
 TS - Thaw Strain

SUMMARY OF TEST RESULTS

KYR2503 Sample Number	Depth (metres) *Sample Photopoint (if any)	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density (Mg/m ³)	GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS	
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)		Consistency
28A NS	44.16 - 44.24	ML			32														35 / S
28B S	44.24 - 44.34	ML																	
28C G	44.34 - 44.39	ML		-1.0									PV	40		firm			
28D B	43.89 - 44.16	ML2											FC	73		stiff			
29A NS	45.86 - 45.92	CL		-1.1	33														
29B T	45.42 - 45.86	CL			28														
29B(2) NS	45.60 - 45.90	CL			27														
30A NS	47.60 - 47.71	CL		-1.7	37														
30B B	46.94 - 47.41	CL	Vx										FC	176		V. stiff			
30C B	47.41 - 47.60	CL	NF										PV	59		stiff			
31A NS	49.19 - 49.29	ML	NF		29	3													
31B B	49.04 - 49.12	ML																	
31C T	48.45 - 48.95	ML												UUp...	77	4	stiff		
32A NS	50.43 - 50.61	ML	NF		28									FC	162		V. stiff		
32B B	49.99 - 50.43	ML																	
33A NS	50.20 - 50.26	ML		-1.9	37														
33B B	51.80 - 52.20	ML												UUp	68	11	stiff		
33B(2) NS	51.80 - 52.20	ML		-1.3	28		1.93							UUp/FC	113, 250+	8	V. stiff		
34A NS	53.90 - 54.06	ML		-1.3	33		2.04							FC	250				
34B B	54.49 - 53.90	ML																	
35A NS	55.29 - 55.35	ML		-1.9	30														

LEGEND AND NOTES
 PF - Permafrost Sample
 PW - Porewater Sample
 T - Sample Stored in Tube
 W - Waxed Sample
 RC - Radiocarbon Sample
 MV - Miniature
 FC - Fall Cone
 TV - Torvane
 PV - Pileon Vane
 RV - Remote Vane
 UU - Unconsolidated Untrained Triaxial
 UUp - UU Triaxial with Pore Pressure Measurements
 CU - Consolidated Untrained Triaxial
 CUp - CU Triaxial with Pore Pressure Measurements
 CD - Consolidated Drained Triaxial
 O - Organic Content
 S - Salinity
 TS - Thaw Strain

2143

SUMMARY OF TEST RESULTS

Sample Number	KY82S03	Depth (metres) * Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Frozen Moisture Content (%)	Bulk Density (Mgm-3)	ATTENBERG LIMITS					GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS PARALLEL TO													
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D50 (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _o (kPa)	P _c (kPa)	C _c																
35B	T	54.86 - 55.29	ML																																		
36A	NS	*56.77 - 56.87	ML		-1.3																																
36B	B	56.39 - 56.67	ML																																		
36C	B	56.67 - 56.77	ML																																		
37A	NS	*58.52 - 58.62	ML			38																															
38A	NS	*58.70 - 58.85	ML			36																															
38B	G	58.60 - 58.70	ML																																		
39A	NS	60.05 - 60.09	ML			30	8																														
39B	G	59.97 - 60.05	ML																																		
39C	B	*59.74 - 59.97	ML																																		
40A	NS	61.74 - 61.84	ML			27	8																														
40B	B	61.26 - 61.79	ML																																		
41A	PF	62.84 - 63.00	ML																																		
41B	NS	62.79 - 62.84	ML																																		
42A	NS	*64.46 - 64.56	SH	Nbn	25																																
42B	PF	64.16 - 64.46	SH																																		
42C	B	64.50 - 64.62	SH																																		
43A	NS	65.85 - 66.14	SH																																		
43B	B	*65.30 - 65.75	SH			26																															
43C	S	65.75 - 65.85	SH																																		
44A	NS	66.62 - 66.74	ML		23		4																														

LEGEND AND NOTES

- B - Blow Sample
- G - Gas Sample
- L - Liner Sample
- P - Piston Sample
- NH - No Recovery
- NS - No Sample Remaining
- PF - Permafrost Sample
- PW - Potwater Sample
- T - Sample Stored in Tube
- W - Waxed Sample
- RC - Radiocarbon Sample
- MV - Minivane
- FC - Fall Cone
- TV - Torvane
- PV - Pileon Vane
- RV - Remote Vane
- UU - Unconsolidated Undrained Triaxial
- UUup - UU Triaxial with Pore Pressure Measurements
- CU - Consolidated Undrained Triaxial
- CUup - CU Triaxial with Pore Pressure Measurements
- CD - Consolidated Drained Triaxial
- O - Organic Content
- S - Salinity
- TS - Thaw Strain

Project Number: 101-3656

Reviewed By: P. Eng.

Page 5 of 6

SUMMARY OF TEST RESULTS

Sample Number	K152503	Depth (metres)	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density (Mgm ⁻³)	ATTENBERG LIMITS					GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS LABELLED SEPARATELY										
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D _{up} (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _u (kPa)	P _c (kPa)	C _c													
44B	B	66.28 - 66.55	HL	Vr 2%					31	28																									
44C	G	66.55 - 66.22	HL																																
45A	NS	67.62 - 67.72	ML				42																												
45B	NS	67.71 - 67.77	ML																																
45C	B	67.77 - 67.87	ML						30	22	17	76	7																						
46A	NS	69.19 - 69.29	HL	Nbn			31																												
46B	B	69.29 - 69.36	HL	Nbn			36																												
47A	NS	70.56 - 70.71	HL	Nbn			36																												
47B	PF	70.39 - 70.05	ML	Nbn																															
47C	NS	69.86 - 69.96	HL	Nbn			30																												
47D	B	69.21 - 69.63	HL	Nbn																															
47E	B	70.05 - 70.71	HL	Vx 10%																															
48A	NS	71.87 - 72.08	SH	Nbn			30																												
48B	PF	72.08 - 72.24	SH	Nbn																															
48C	PF	70.91 - 71.11	SH	Nbn																															
48D	NS	71.11 - 71.17	SH	Nbn			38																												
48E	PF	71.17 - 71.37	SH	Nbn																															
48F	B	71.37 - 71.87	SH	Nbn																															

LEGEND AND NOTES

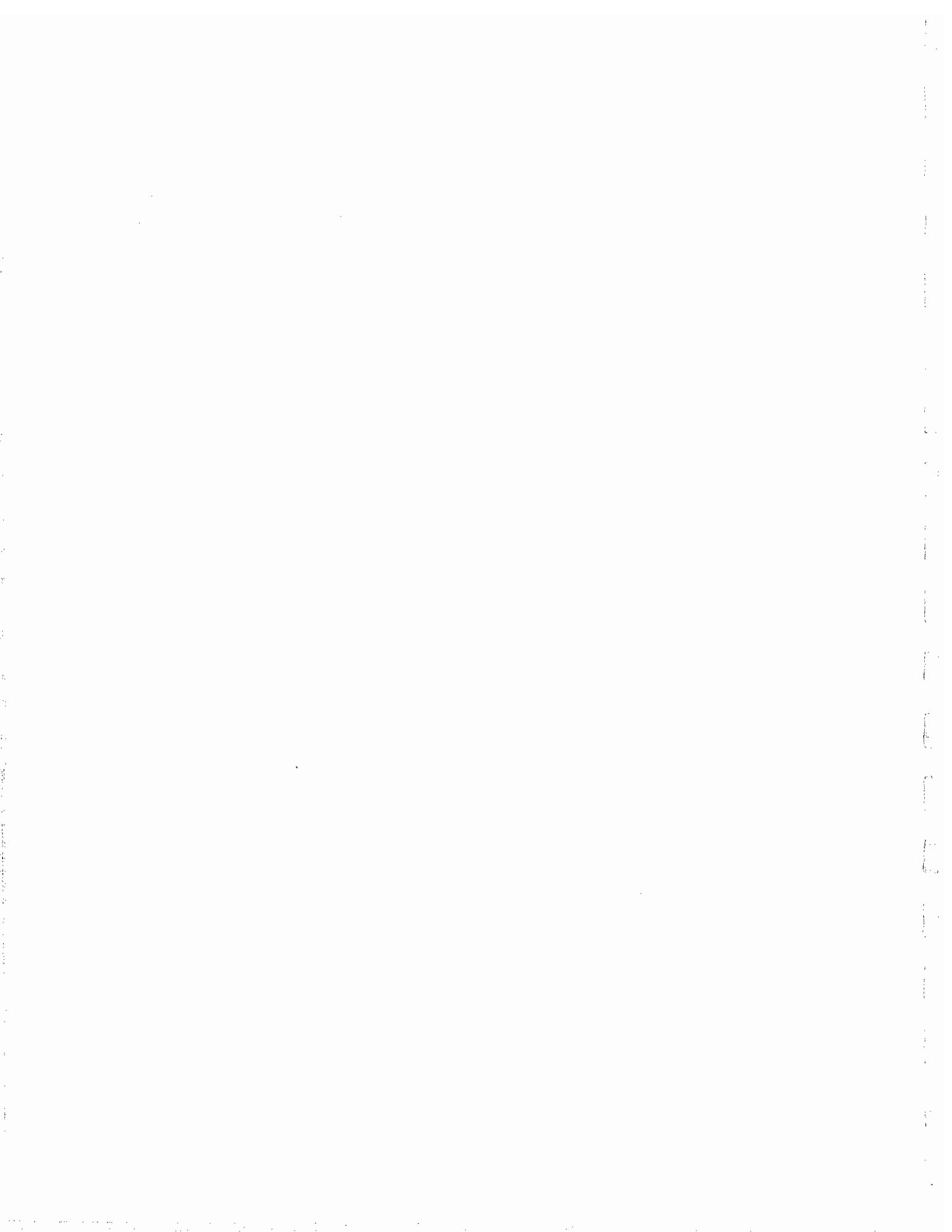
B - Bag Sample
 G - Gas Sample
 L - Limer Sample
 P - Piston Sample
 NR - No Recovery
 NS - No Sample Remaining

PF - Permafrost Sample
 PW - Porewater Sample
 T - Sample Stored in Tube
 W - Waxed Sample
 RC - Radiocarbon Sample

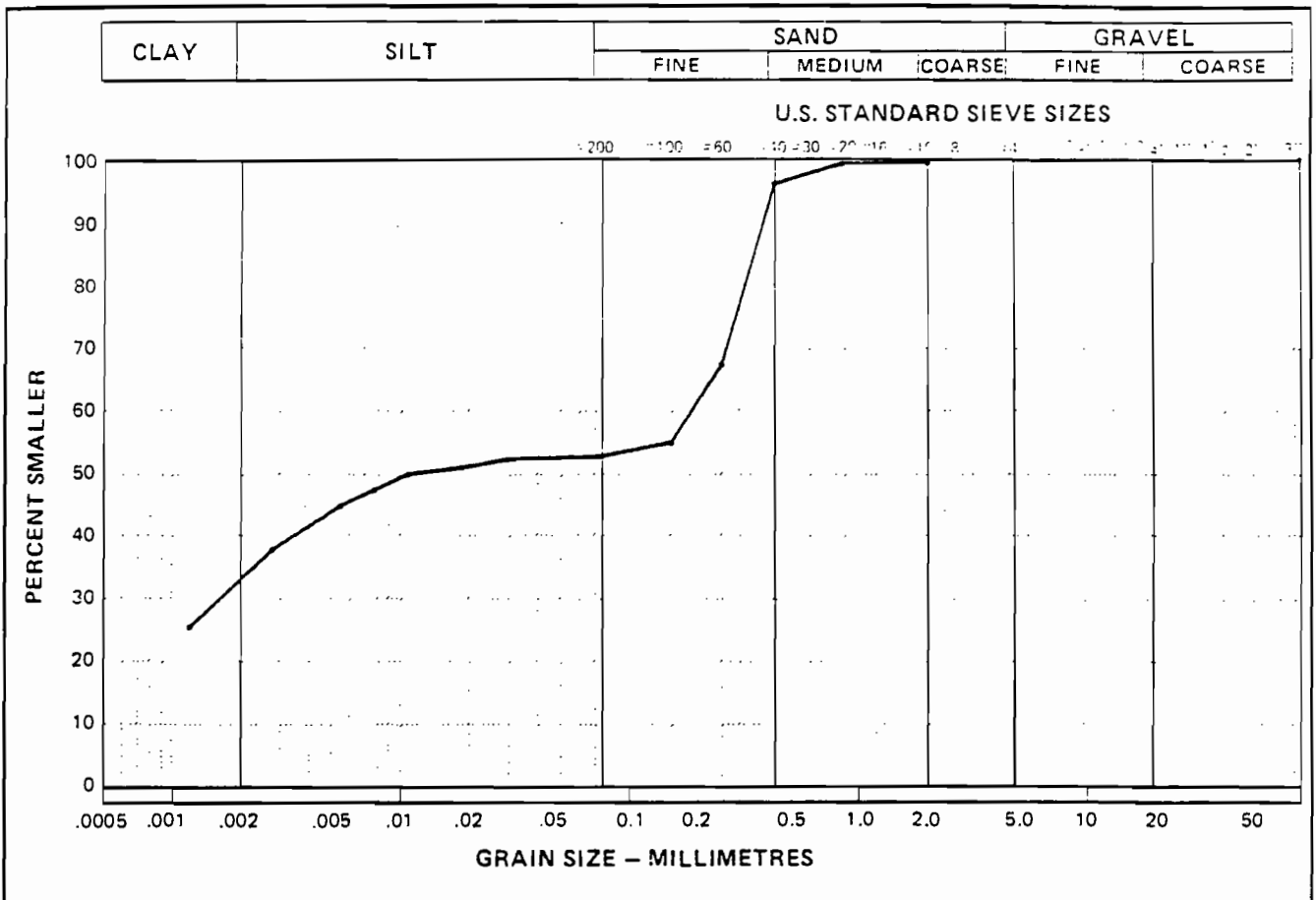
MV - Minivene
 FC - Fall Cone
 TV - Torvane
 PV - Plicon Vane
 RV - Remote Vane

UU - Unconsolidated Undrained Triaxial
 UUup - UU Triaxial with Pore Pressure Measurements
 CU - Consolidated Undrained Triaxial
 CUup - CU Triaxial with Pore Pressure Measurements
 CD - Consolidated Drained Triaxial

O - Organic Content
 S - Salinity
 TS - Thaw Strain



PARTICLE - SIZE ANALYSIS OF SOILS

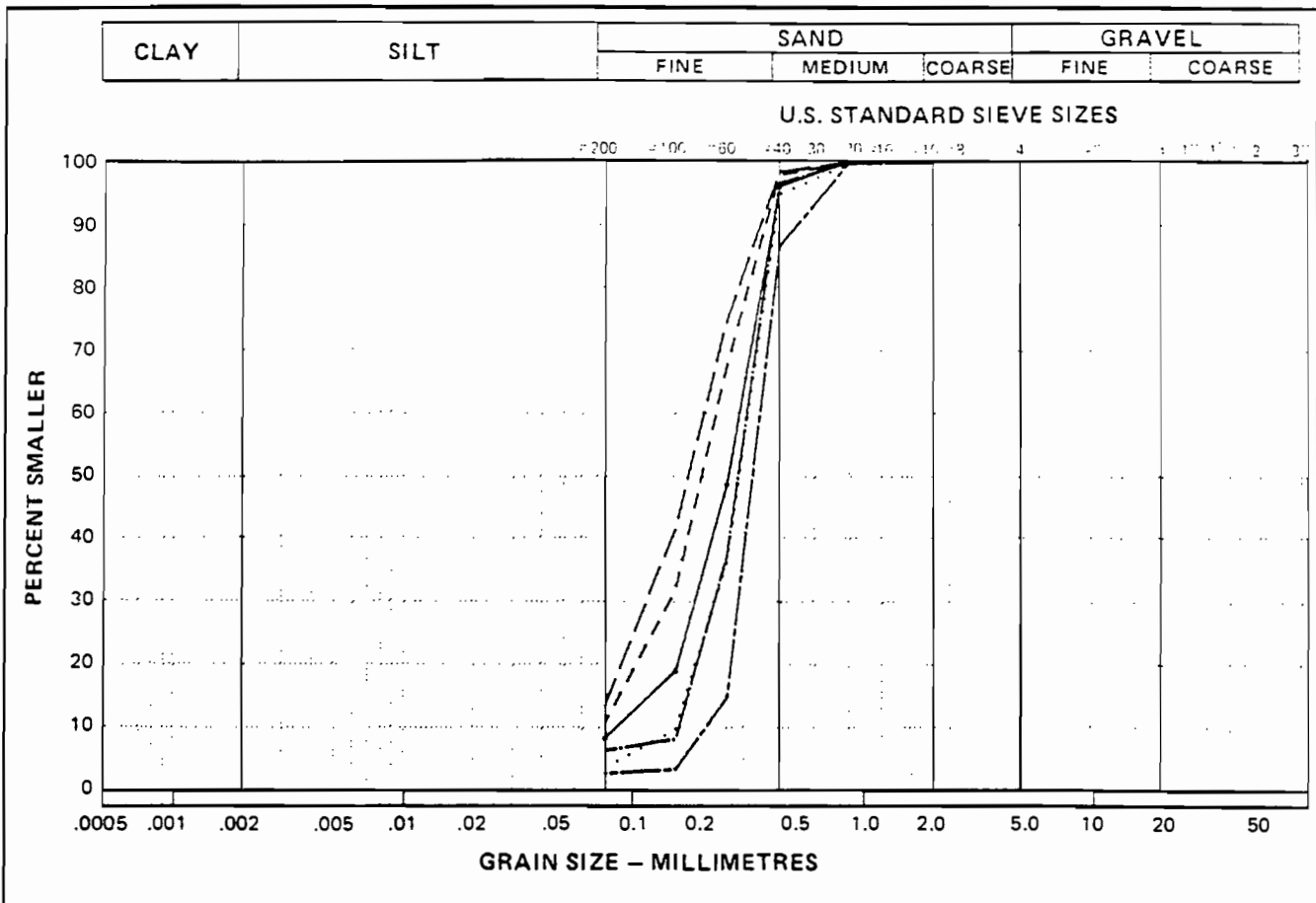


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	KY82S03	.05 - .50	33.2	19.5	47.3	0.0	-	-	

JOB NO. 101 -3656

DATE 82-10-01

PARTICLE - SIZE ANALYSIS OF SOILS

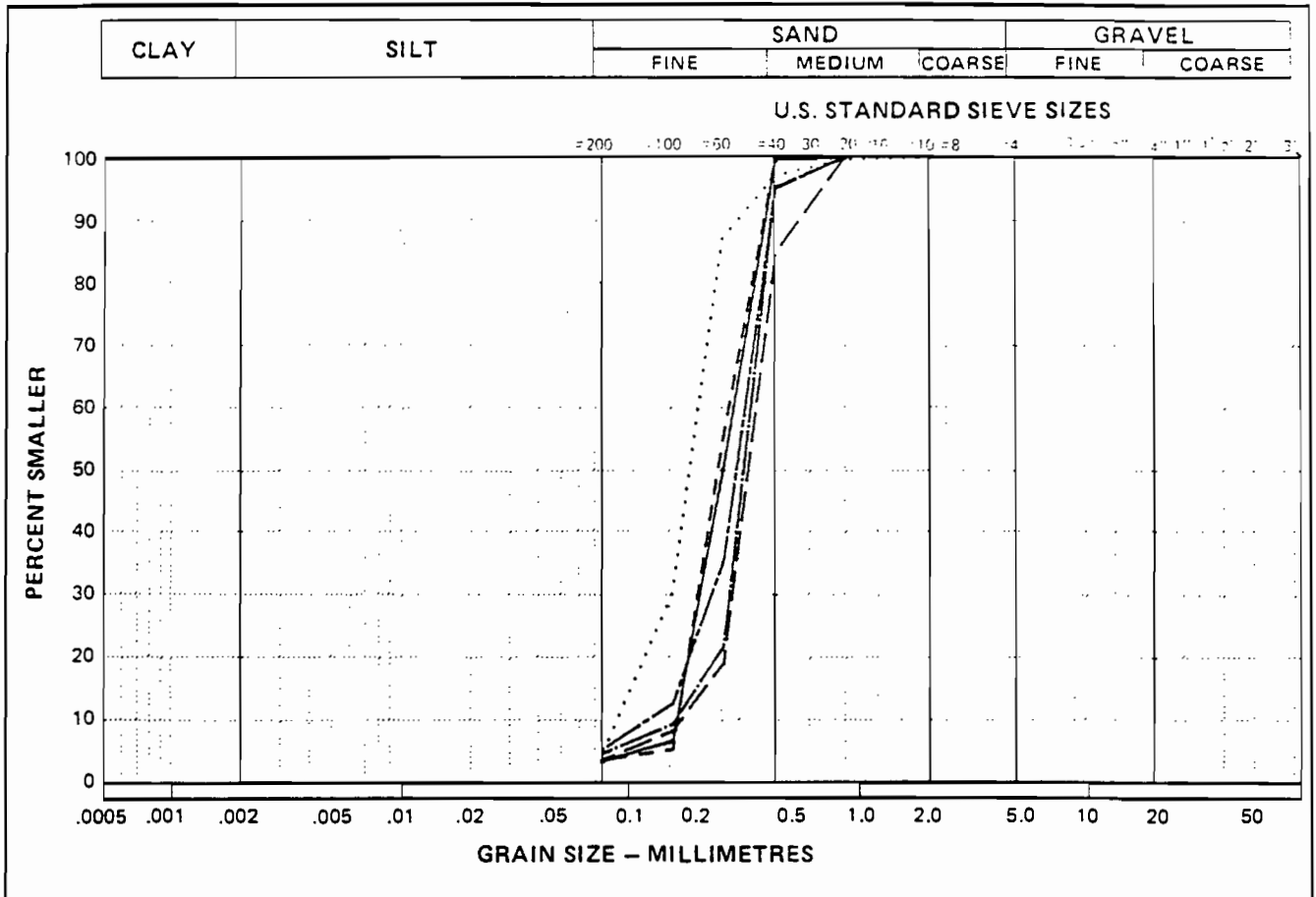


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S03	2.20 - 2.35	-	7.3	92.7	0.0	3.2	1.3	SP-SM
.....	KY82S03	2.64 - 2.64	-	2.6	97.4	0.0	2.0	1.1	SP
-----	KY82S03	3.75 - 3.85	-	9.8	90.2	0.0	3.0	1.2	SP-SM
_____	KY82S03	4.88 - 4.98	-	12.6	87.4	0.0	-	-	
_____	KY82S03	6.60 - 6.70	-	5.3	94.7	0.0	2.0	1.0	SP-SM
-----	KY82S03	8.36 - 8.46	-	1.6	98.4	0.0	1.7	1.1	SP

JOB NO. 101 -3656

DATE 82-08-03

PARTICLE - SIZE ANALYSIS OF SOILS

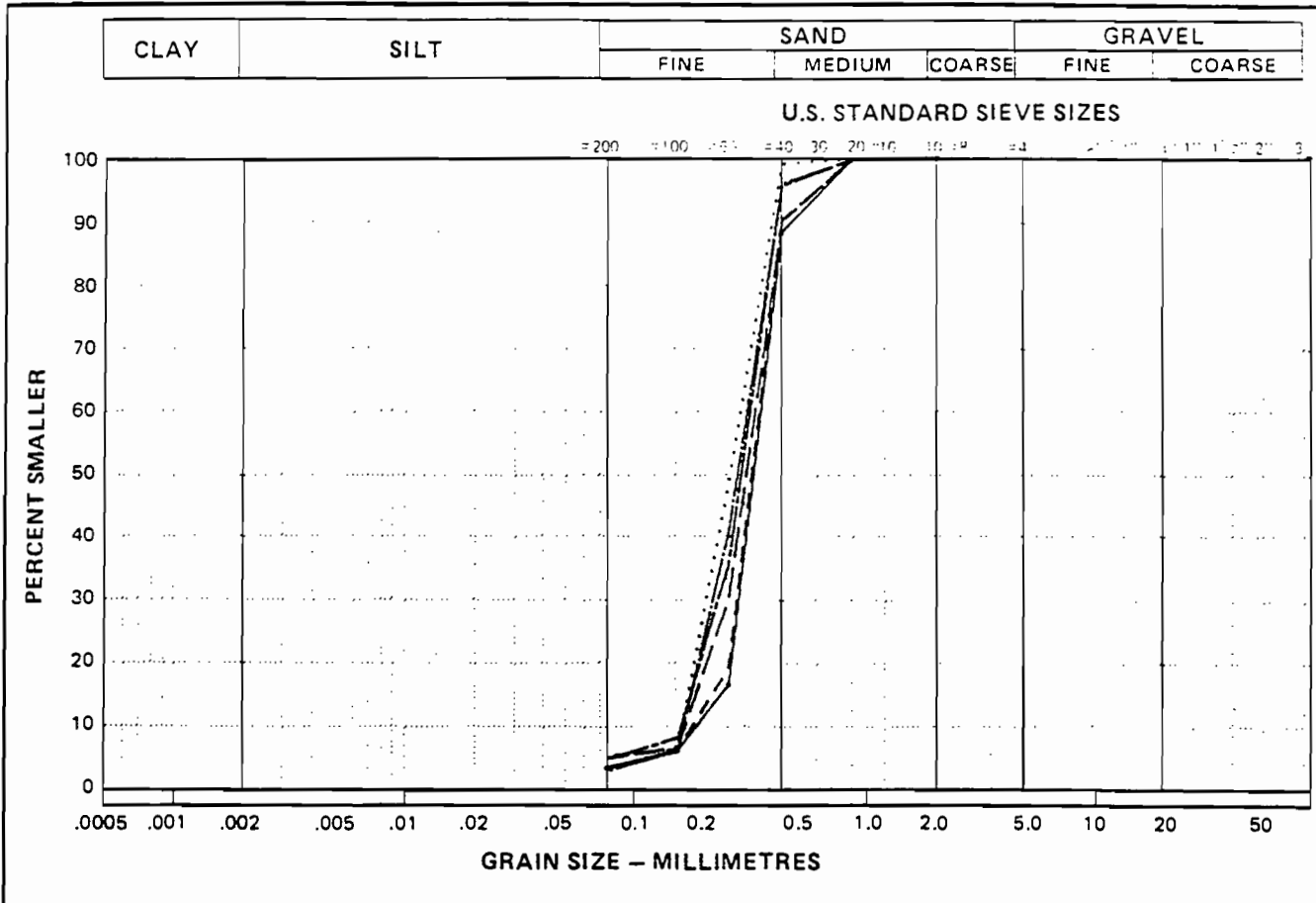


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S03	9.90 - 10.00	-	2.3	97.7	0.0	1.8	.9	SP
.....	KY82S03	11.17 - 11.22	-	3.5	96.5	0.0	2.2	1.3	SP
-----	KY82S03	13.06 - 13.10	-	2.5	97.5	0.0	1.7	.9	SP
_____	KY82S03	14.50 - 14.60	-	2.5	97.5	0.0	2.0	1.3	SP
_____	KY82S03	15.86 - 15.96	-	3.5	96.5	0.0	2.0	1.3	SP
_____	KY82S03	17.41 - 17.51	-	4.2	95.8	0.0	2.4	1.3	SP

JOB NO. 101 -3656

DATE 82-08-03

PARTICLE - SIZE ANALYSIS OF SOILS

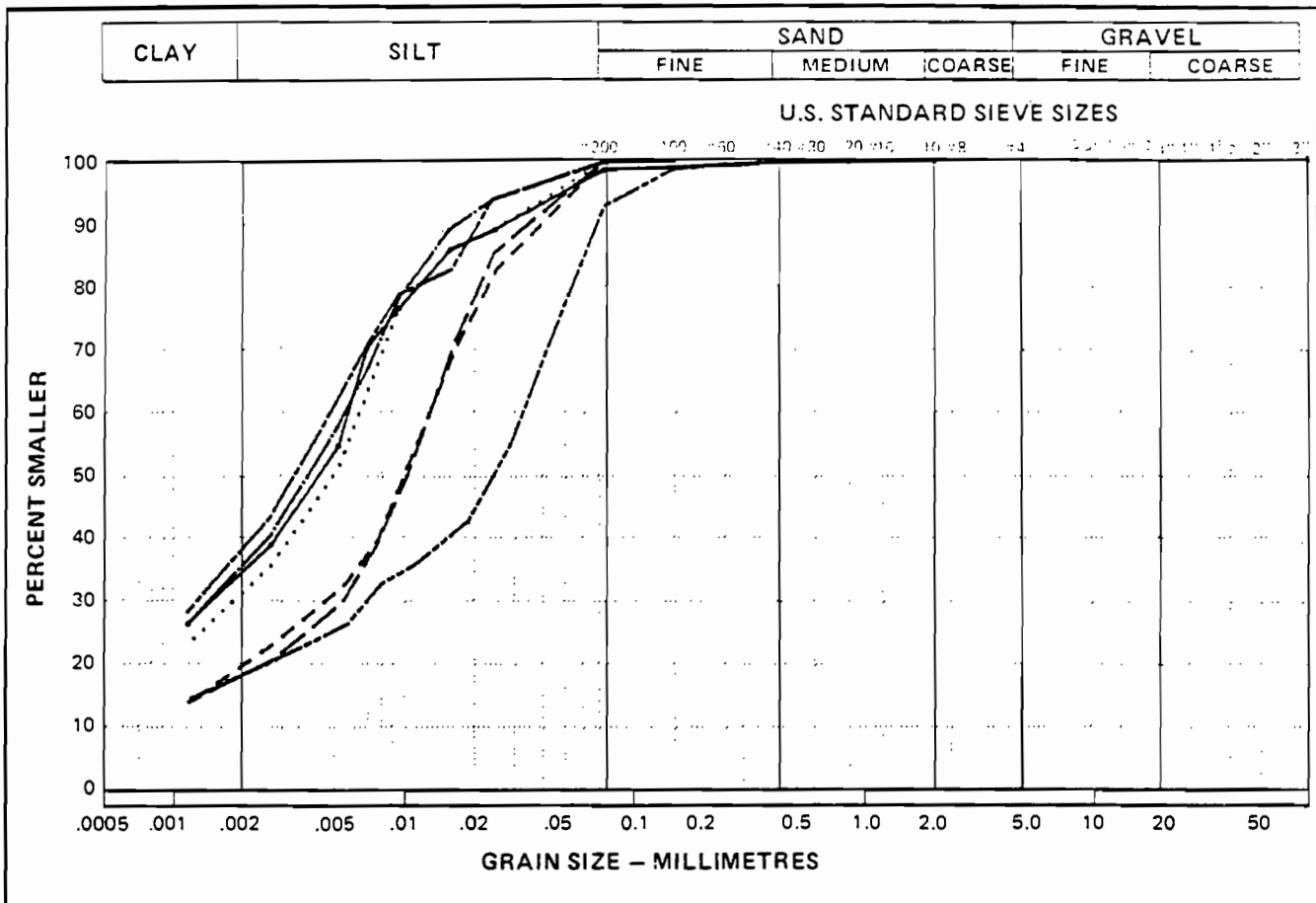


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
—	KY82S03	18.93 - 19.03	-	2.3	97.7	0.0	1.8	1.2	SP
.....	KY82S03	20.56 - 20.66	-	2.0	98.0	0.0	1.8	.9	SP
---	KY82S03	25.29 - 25.39	-	4.1	95.9	0.0	1.9	1.2	SP
—	KY82S03	26.78 - 26.88	-	3.8	96.2	0.0	2.0	1.2	SP
---	KY82S03	28.42 - 28.52	-	1.8	98.2	0.0	1.9	1.0	SP
---	KY82S03	30.00 - 30.12	-	3.6	96.4	0.0	2.0	1.1	SP

JOB NO. 101 -3656

DATE 82-08-03

PARTICLE - SIZE ANALYSIS OF SOILS

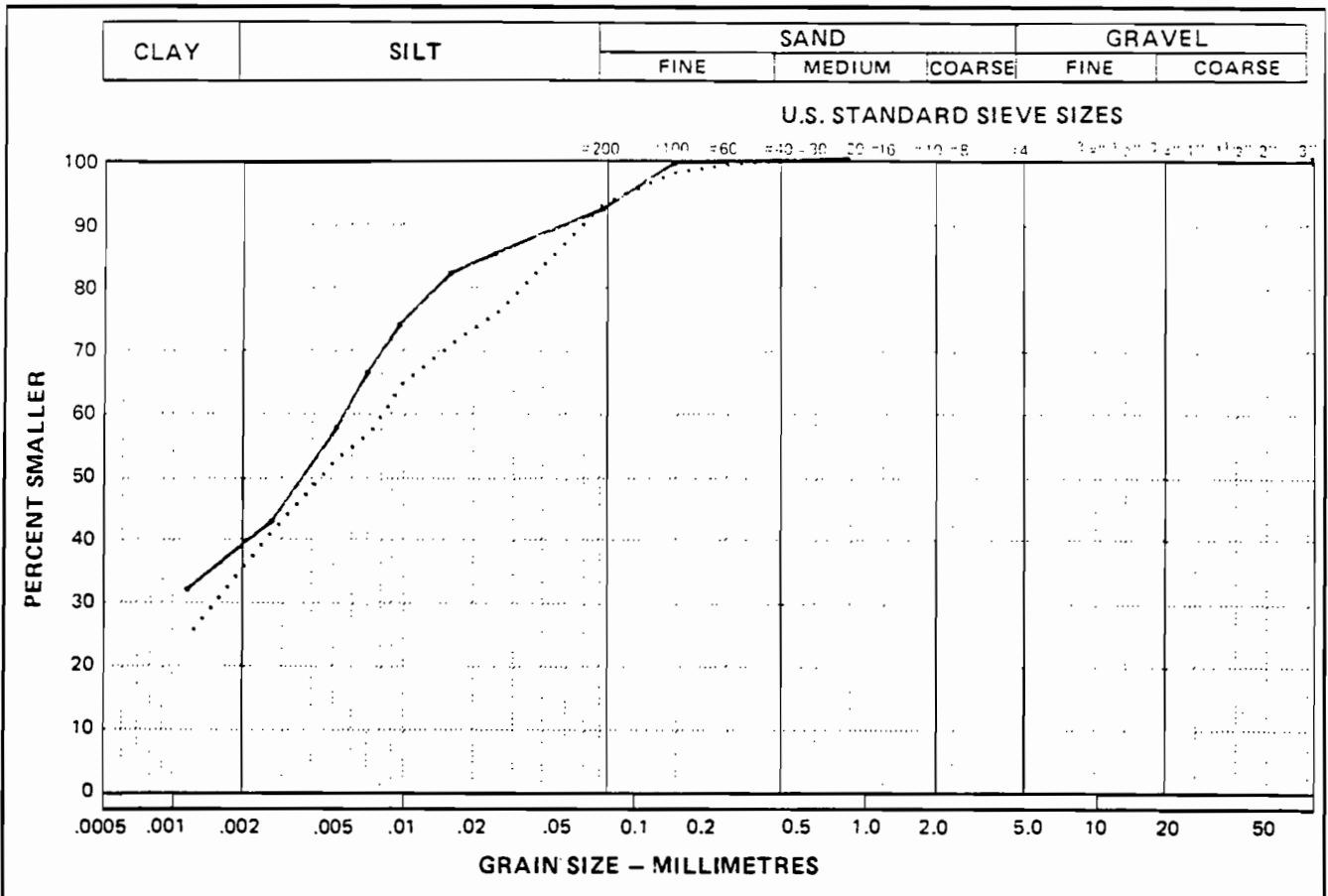


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
---	KY82S03	42.37 - 42.65	33.1	65.3	1.6	0.0	-	-	
.....	KY82S03	43.89 - 44.16	29.8	70.1	.1	0.0	-	-	
---	KY82S03	45.40 - 45.60	18.1	81.8	.1	0.0	-	-	
---	KY82S03	45.60 - 45.90	16.7	83.2	.1	0.0	-	-	
---	KY82S03	46.94 - 47.41	34.1	65.8	.1	0.0	-	-	
---	KY82S03	51.80 - 52.20	36.8	62.9	.3	0.0	-	-	
---	KY82S03	67.77 - 67.87	16.8	75.9	7.3	0.0	-	-	

JOB NO. 101 -3656

DATE 82-10-01

PARTICLE - SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	KY82S03	48.46 - 48.95	38.0	54.2	7.8	0.0	-	-	
.....	KY82S03	61.26 - 61.79	33.9	59.2	6.9	0.0	-	-	

JOB NO. 101 -3659

DATE 82-12-3

APPENDIX D

Shear Strength Test Results



APPENDIX D

GLOSSARY OF TERMS RELATED TO SHEAR STRENGTH

- Axial Stress : Vertical stress applied to a sample (Force/X-Sectional Area)
- B : The ratio of pore pressure response to a change in isotropic pressure. Indicative of the degree of saturation.
- Back Pressure : An increase in pore pressure applied to a sample for the purpose of increasing saturation.
- c' : Effective value of cohesion.
- Cell Pressure : Isotropic confining pressure to which a sample is subjected during triaxial testing.
- Consolidation : Volumetric change in soil with time resulting from loading under drained condition.
- Deviator Stress : The net applied axial stress during triaxial testing. Mathematically, the difference between the major and minor principal stresses ($\sigma_1' - \sigma_3'$).
- Effective Stress : The net stress present in a saturated soil after the pore pressure has been subtracted. The stress difference between the total and measured pore pressure.
- Epore : Computer output heading for excess pore pressure
- Excess Pore Pressure : The pore pressure generated or developed during shear.
- Jacketed : A sample is enclosed in a thin, impermeable, latex membrane.
- K_0 : The ratio of the effective horizontal stress to the effective vertical stress. σ_3' / σ_1'
- ParA : Computer output heading for Skempton's pore pressure parameter A. A is the ratio of change in excess pore pressure to change in deviator stress.
- Peak Strength : The maximum deviator stress that can be applied to a sample.

GLOSSARY (continued)

- ϕ' : Internal angle of friction under effective stress conditions.
- Pore Pressure Response: A change in pore pressure resulting from a change in stress condition.
- Reshaped Strength : Analogous to remoulded strength. Shear strength measured after soil structure completely removed.
- Strain : Ratio of deformation over a fixed reference length to the initial reference length. Expressed as a percent.
- s1 : Computer output heading for the effective major principal stress, σ_1' . In triaxial testing this represents the total vertical stress.
- s3 : Computer output heading for the effective minor principal stress, σ_3' . In triaxial testing, this represents the cell pressure.
- Tpore : Computer output heading for total pore pressure.
- VolCh : Computer output heading for the volume changes a sample undergoes during loading.
- Wet Density : Mass of the soil particles and water in a unit volume of soil.
- Dry Density : Mass of the dry soil particles in a unit volume of soil.

Test Hole..... KYB2503 J1C
 Depth..... 48.46-48.95 m
 Test Number..... 1
 Cell Pressure...(Kpa).. 980.0
 Back Pressure...(Kpa).. 945.0
 Parameter B..... .99

Water Content (%) 22.65 23.77
 Wet Density (Mg/cu.m) 1.89 1.90
 Dry Density (Mg/cu.m) 1.54 1.54

INITIAL FINAL

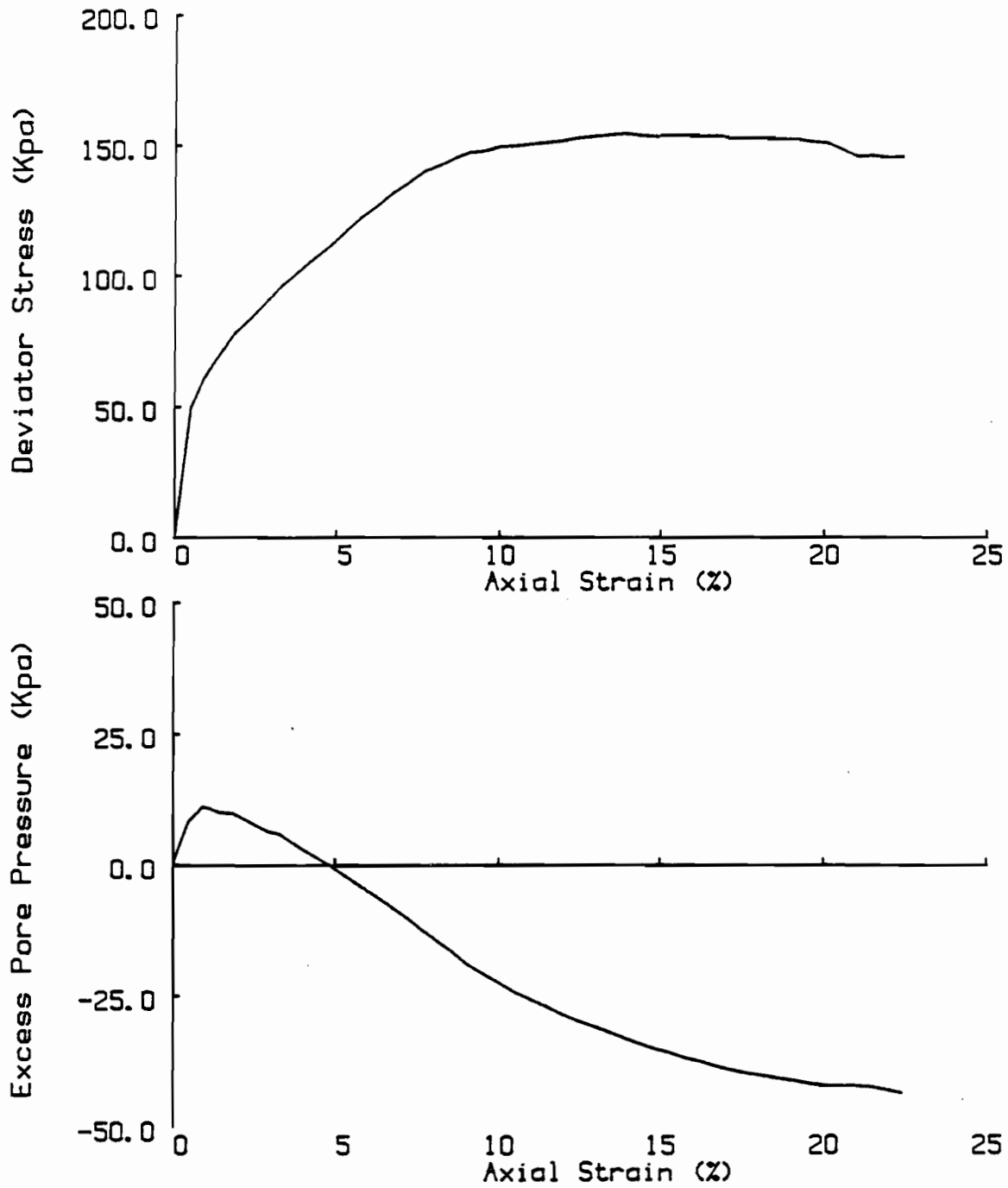
Strn	sl-s3	Tpore	Erore	Para	Voich	st/s3	s-s/2	sts/2	Water Content (%)	Wet Density (Mg/cu.m)	Dry Density (Mg/cu.m)	INITIAL	FINAL				
0.00	0.0	944.7	0.0	0.00	0.0	1.00	0.0	35.3	14.81	153.3	809.9	-35.1	-23	0.0	3.19	76.7	146.8
.50	49.8	953.5	8.5	.17	0.0	2.88	24.8	51.4	15.30	153.8	809.1	-35.9	-23	0.0	3.17	76.9	147.8
.92	81.4	956.2	11.2	.18	0.0	3.58	30.7	54.5	15.78	153.9	808.1	-36.9	-24	0.0	3.14	76.9	148.8
1.43	70.7	955.0	10.0	.14	0.0	3.93	35.4	80.4	16.26	153.4	807.4	-37.8	-25	0.0	3.11	76.7	149.4
1.96	78.4	954.8	9.8	.12	0.0	4.11	39.2	64.4	16.75	153.5	806.5	-38.5	-25	0.0	3.09	76.7	150.2
2.38	84.4	953.1	8.1	.10	0.0	4.14	42.2	89.1	17.23	152.6	805.7	-39.3	-26	0.0	3.05	76.3	150.5
2.88	90.8	951.5	6.5	.07	0.0	4.19	45.4	73.9	17.71	152.6	805.1	-39.9	-26	0.0	3.04	76.3	151.1
3.30	96.2	950.8	5.8	.06	0.0	4.29	48.1	77.3	18.19	152.6	804.6	-40.4	-26	0.0	3.02	76.3	151.7
3.82	101.5	948.6	3.6	.04	0.0	4.23	50.7	82.1	18.68	152.2	804.1	-40.9	-27	0.0	3.01	76.1	152.0
4.32	106.7	946.7	1.7	.02	0.0	4.20	53.3	86.7	19.13	152.2	803.7	-41.3	-27	0.0	2.99	76.1	152.4
4.81	111.8	944.9	-1.1	-.00	0.0	4.18	55.9	91.0	19.59	151.3	803.1	-41.9	-28	0.0	2.97	75.6	152.5
5.29	117.4	942.9	-2.1	-.02	0.0	4.16	58.7	95.8	20.06	150.8	802.7	-42.3	-28	0.0	2.95	75.4	152.7
5.77	122.5	940.9	-4.1	-.03	0.0	4.13	61.2	100.3	20.53	148.2	802.7	-42.3	-29	0.0	2.92	74.1	151.4
6.25	126.9	939.0	-8.0	-.05	0.0	4.10	63.5	104.4	20.99	145.6	802.7	-42.3	-29	0.0	2.88	72.8	150.2
6.72	131.9	936.9	-8.1	-.08	0.0	4.06	65.9	109.0	21.46	146.1	802.5	-42.5	-29	0.0	2.88	73.0	150.5
7.20	135.7	934.8	-10.2	-.08	0.0	4.00	67.9	113.1	21.93	145.2	801.9	-43.1	-30	0.0	2.86	72.6	150.7
7.67	140.1	932.5	-12.5	-.09	0.0	3.95	70.0	117.5	22.41	145.6	801.3	-43.7	-30	0.0	2.85	72.8	151.5
8.14	142.4	930.4	-14.8	-.10	0.0	3.87	71.2	120.8									
8.61	145.1	928.3	-16.7	-.12	0.0	3.80	72.6	124.3									
9.08	147.3	925.9	-19.1	-.13	0.0	3.73	73.7	127.7									
9.55	148.0	924.1	-20.9	-.14	0.0	3.85	74.0	130.0									
10.02	149.7	922.4	-22.6	-.15	0.0	3.60	74.9	132.5									
10.50	149.9	920.6	-24.4	-.16	0.0	3.53	75.0	134.3									
10.97	150.6	919.3	-25.7	-.17	0.0	3.48	75.3	136.0									
11.45	151.2	918.0	-27.0	-.18	0.0	3.44	75.6	137.6									
11.92	151.8	918.5	-28.5	-.19	0.0	3.39	75.9	139.4									
12.40	152.9	915.3	-29.7	-.19	0.0	3.38	76.5	141.1									
12.88	153.5	914.3	-30.7	-.20	0.0	3.34	76.7	142.4									
13.36	154.1	913.2	-31.8	-.21	0.0	3.31	77.0	143.8									
13.84	154.6	912.0	-33.0	-.21	0.0	3.27	77.3	145.3									
14.32	153.7	910.9	-34.1	-.22	0.0	3.22	76.8	146.0									

FIGURE D.1 UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS
 KOGYUK N-67 AREA

Test no.
1

σ'_{3c} (kPa)
35.0

Dry dens. (Mg/cu. m)
1.54



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D.2

Test no.

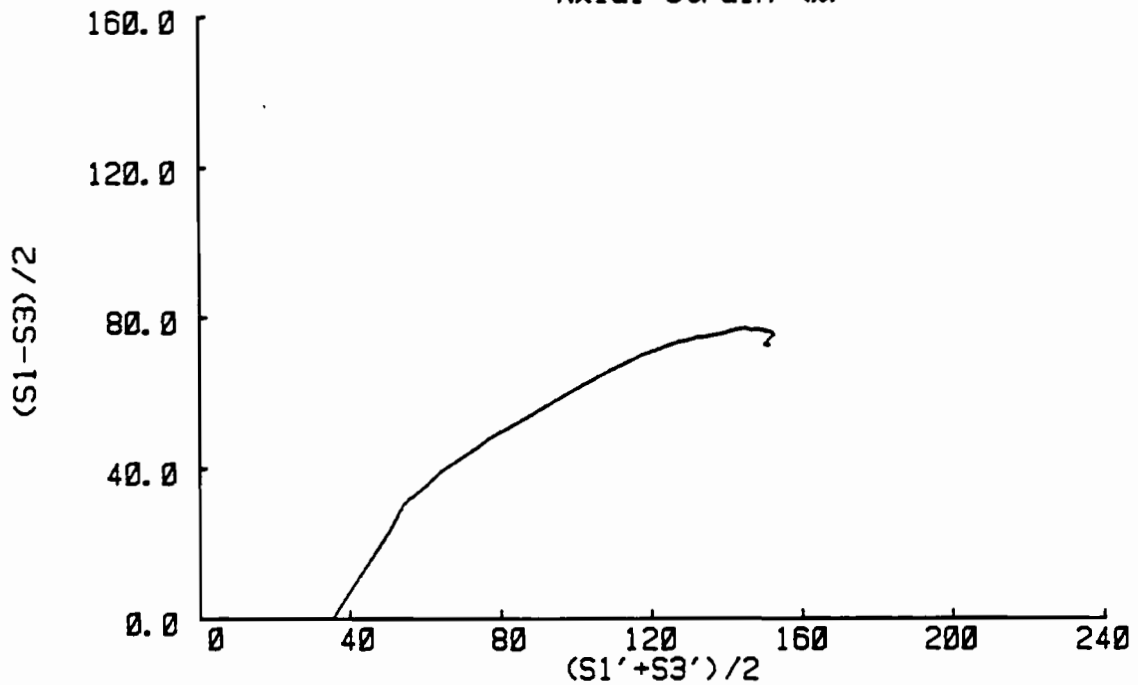
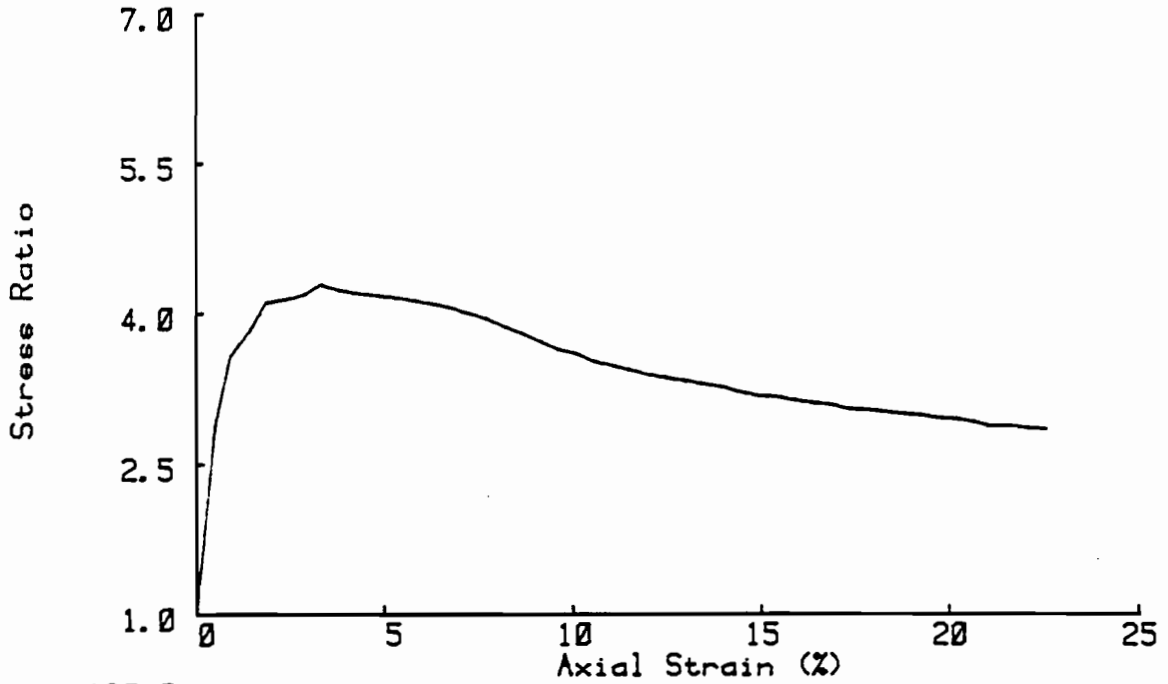
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σ'_{30} (kPa)

35.0

Dry dens. (Mg/cu. m)

1.54



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D. 3

Test Hole..... KYB2503 33B
 Depth..... 51.8-52.2 m
 Test Number..... 1
 Cell Pressure...(Kpa).. 405.0
 Back Pressure...(Kpa).. 380.0
 Parameter B..... .96

INITIAL FINAL
 Water Content (%) 31.60 32.80
 Wet Density (Mg/cc) 1.93 1.95
 Dry Density (Mg/cc) 1.47 1.47

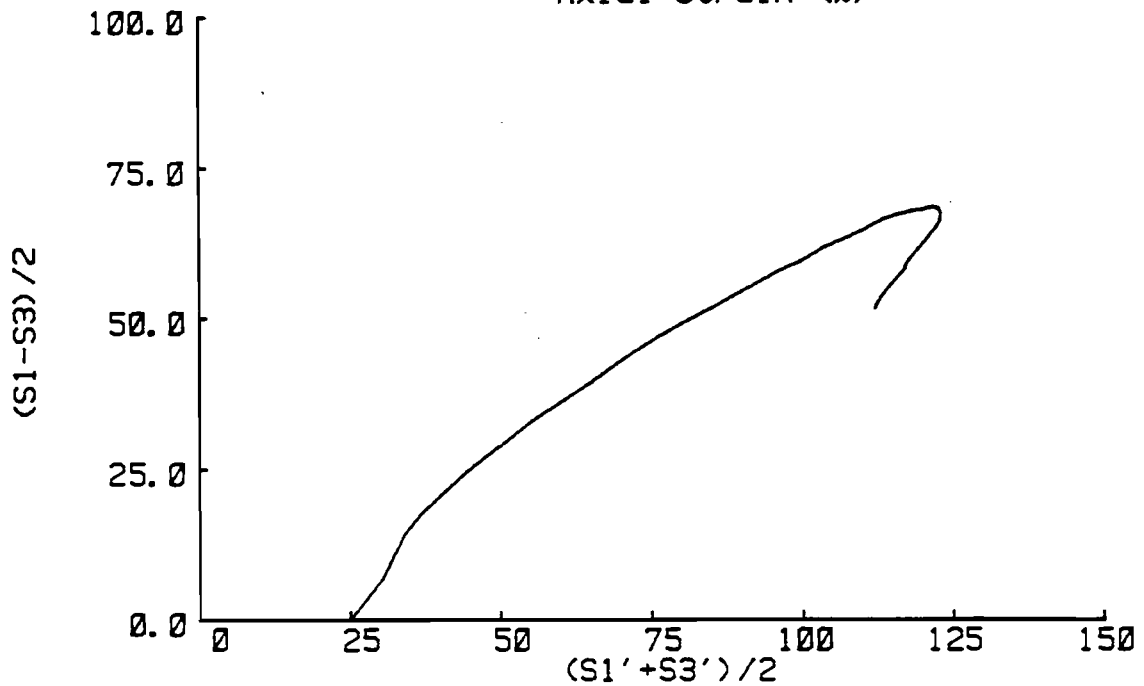
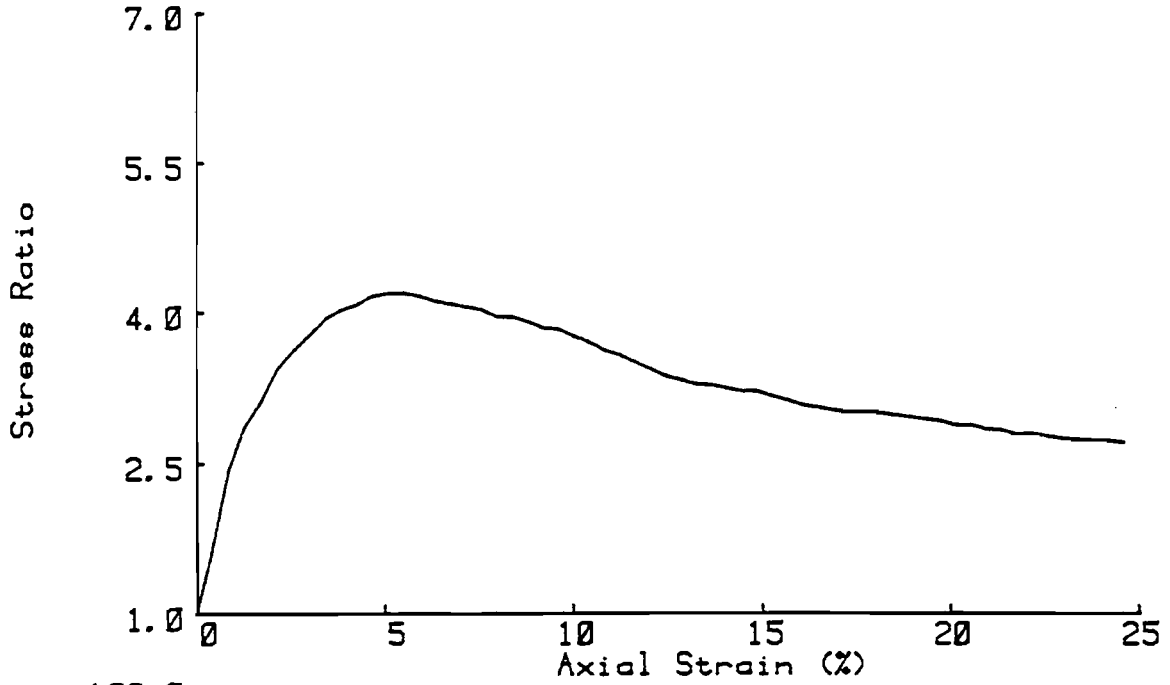
Strn	si-s3	Force	Epara	Para	Voilch	si/s3	s-s/2	s+s/2	Water Content (%)	INITIAL	FINAL	3-34	66.4	123.1				
0.00	0.0	380.0	0.0	0.00	0.0	1.00	0.0	23.0		12.48	132.7	348.2	-31.8	-24	0.0	3.30	65.4	122.4
.37	13.6	381.5	1.5	-11	0.0	1.58	6.8	30.3		13.25	130.9	348.1	-31.9	-24	0.0	3.29	65.5	122.6
.82	28.5	385.1	5.1	-18	0.0	2.43	14.3	34.1		13.63	129.1	347.8	-32.2	-25	0.0	3.26	64.6	121.8
1.23	35.5	385.9	5.8	-17	0.0	2.88	17.7	36.9		14.01	127.9	347.7	-32.3	-25	0.0	3.23	64.0	121.2
1.66	41.0	385.6	5.6	-14	0.0	3.12	20.5	38.9		14.41	127.8	347.6	-32.4	-25	0.0	3.23	64.0	121.3
2.09	48.6	385.1	5.1	-11	0.0	3.44	24.3	44.2		14.80	125.5	347.5	-32.5	-26	0.0	3.18	62.8	120.3
2.52	53.9	384.5	4.5	-8	0.0	3.63	27.0	47.5		15.18	123.7	347.3	-32.7	-26	0.0	3.14	61.9	119.6
2.92	59.3	383.7	3.7	-6	0.0	3.78	29.7	51.0		15.60	121.3	347.1	-32.8	-27	0.0	3.10	60.7	118.5
3.33	66.0	382.6	2.6	-4	0.0	3.95	33.0	55.4		15.99	120.1	347.0	-33.0	-27	0.0	3.07	60.1	118.0
3.73	73.3	380.8	.8	-1	0.0	4.04	36.7	60.8		16.39	119.0	346.9	-33.1	-28	0.0	3.05	59.5	117.6
4.13	81.1	378.2	-1.8	-2	0.0	4.17	42.5	69.4		16.79	117.8	346.7	-33.3	-28	0.0	3.02	58.8	117.2
4.94	90.9	376.6	-3.4	-4	0.0	4.20	45.4	73.8		17.19	118.4	346.6	-33.4	-28	0.0	3.03	59.2	117.6
5.34	95.9	375.1	-4.9	-5	0.0	4.21	48.0	77.9		17.60	117.3	346.4	-33.5	-28	0.0	3.01	58.9	117.5
5.75	100.2	373.5	-6.5	-7	0.0	4.18	50.1	81.8		17.98	117.3	348.3	-33.7	-29	0.0	3.00	58.8	117.4
6.16	103.9	371.8	-8.2	-8	0.0	4.12	51.9	85.2		18.38	116.1	348.1	-33.9	-29	0.0	2.97	58.1	117.0
6.56	108.1	370.1	-9.9	-9	0.0	4.10	54.1	88.9		18.77	115.0	346.1	-33.9	-29	0.0	2.95	57.5	116.4
6.96	112.3	368.3	-11.7	-10	0.0	4.06	56.2	92.8		19.18	113.9	346.0	-34.0	-30	0.0	2.93	56.9	115.9
7.36	116.5	366.6	-13.4	-11	0.0	4.04	58.3	96.6		19.56	112.2	345.8	-34.2	-30	0.0	2.90	56.1	115.2
7.76	119.3	364.8	-15.2	-13	0.0	3.97	59.7	99.8		19.96	112.2	345.8	-34.2	-30	0.0	2.90	56.1	115.3
8.15	124.1	363.2	-16.8	-14	0.0	3.97	62.0	103.8		20.34	109.9	345.7	-34.3	-31	0.0	2.85	55.0	114.2
8.55	126.8	361.5	-18.5	-15	0.0	3.92	63.4	108.8		20.73	109.4	345.6	-34.4	-31	0.0	2.84	54.7	114.1
8.95	129.6	359.7	-20.3	-16	0.0	3.86	64.8	110.1		21.13	107.7	345.5	-34.5	-32	0.0	2.81	53.8	113.4
9.32	133.6	358.1	-21.9	-18	0.0	3.85	66.8	113.7		21.52	108.3	345.4	-34.6	-32	0.0	2.82	54.1	113.7
9.72	134.9	356.5	-23.5	-17	0.0	3.78	67.5	115.9		21.91	106.6	345.1	-34.9	-33	0.0	2.78	53.3	113.2
10.12	136.3	354.8	-25.2	-18	0.0	3.72	68.1	118.3		22.31	106.1	345.1	-34.9	-33	0.0	2.77	53.0	113.0
10.51	137.0	353.2	-26.8	-20	0.0	3.64	68.5	120.3		22.69	105.6	344.9	-35.1	-33	0.0	2.76	52.8	112.9
10.91	137.6	351.8	-28.2	-20	0.0	3.59	68.8	122.0		23.08	105.0	344.8	-35.2	-34	0.0	2.74	52.5	112.7
11.31	137.0	350.5	-29.5	-22	0.0	3.52	68.5	123.0		23.48	105.0	344.7	-35.3	-34	0.0	2.74	52.5	112.8
11.70	135.8	349.6	-30.4	-22	0.0	3.45	67.9	123.3		23.87	104.5	344.6	-35.4	-34	0.0	2.73	52.2	112.6
12.09	133.8	348.8	-31.2	-23	0.0	3.38	67.0	123.1										

FIGURE D.4 UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS
 KOGYUK N-67 AREA

Test no.
1

$\sigma'_{3.0}$ (kPa)
25.0

Dry dens. (Mg/cu. m)
1.47



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D. 6

Test Hole..... KVB2903 338
 Depth..... 51.8-52.2 m
 Test Number..... 2
 Cell Pressure...(kPa)... 1045.0
 Back Pressure...(kPa)... 858.5
 Parameter B..... 1.00

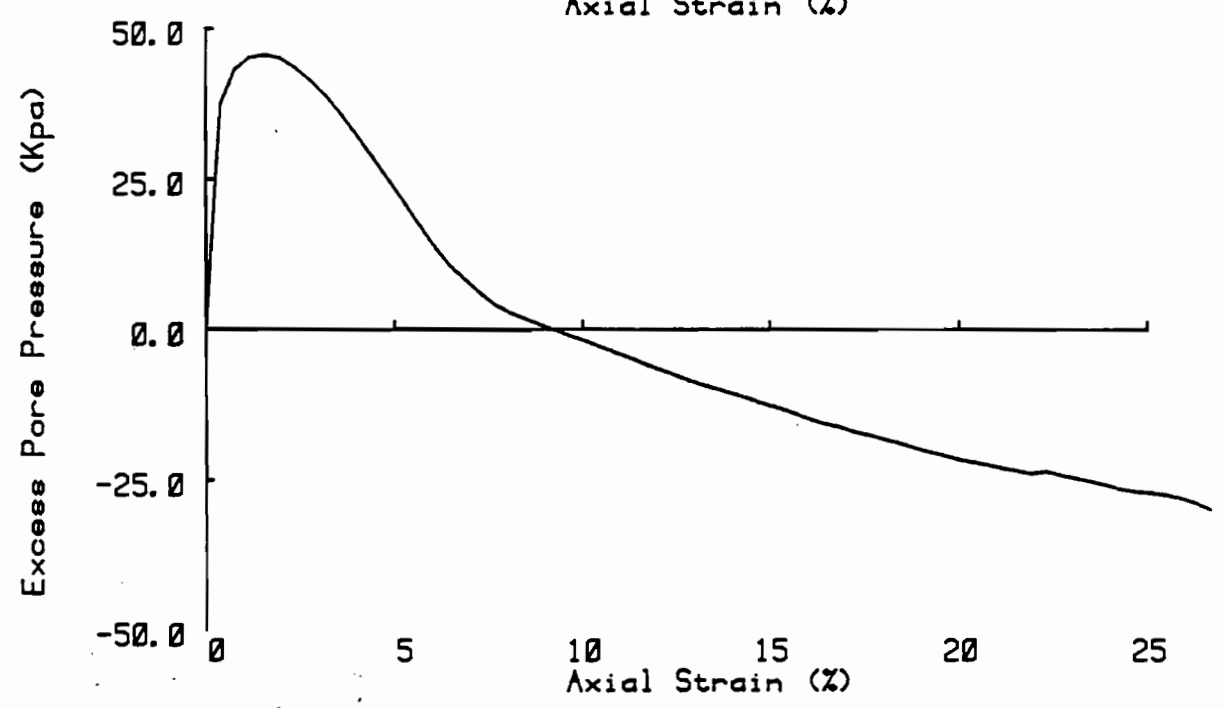
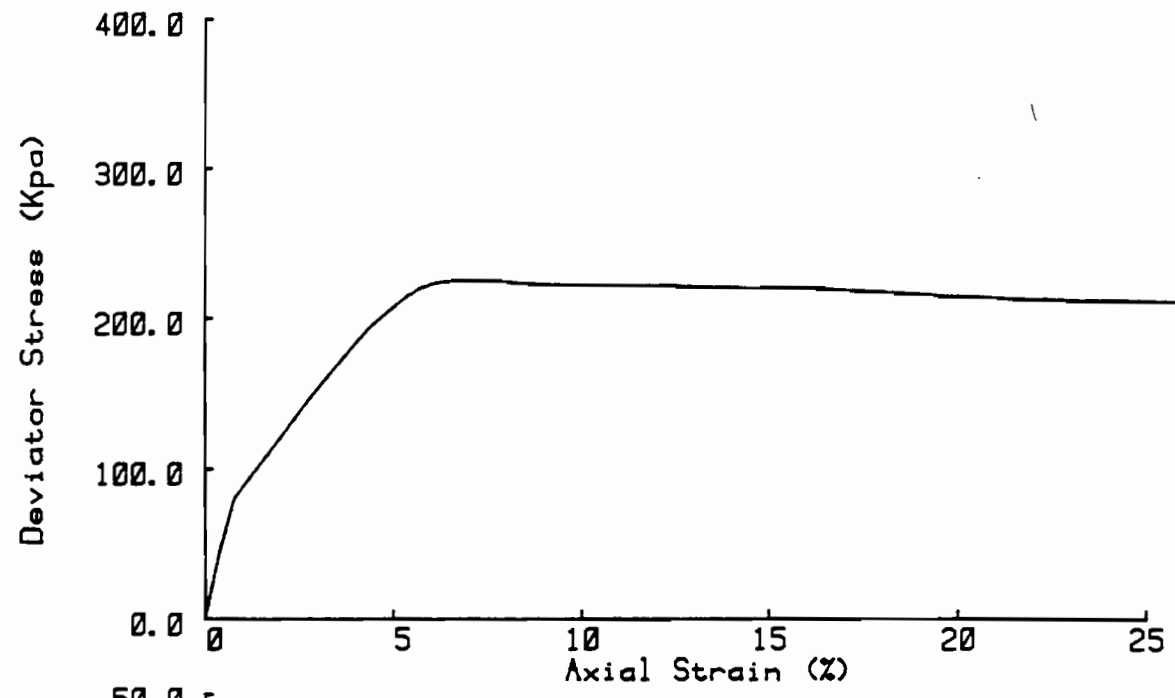
	INITIAL	FINAL
Water Content (%)	28.21	28.48
Wet Density (Mg/cu.m)	2.04	2.04
Dry Density (Mg/cu.m)	1.58	1.59

Strn	sl-s3	Teore	Esore	Para	Velch	sl/s3	s-s/2	s+/2
0.00	0.0	970.2	0.0	0.00	0.0	1.00	0.0	74.8
.39	44.9	996.1	37.6	.84	0.0	1.92	22.5	71.3
.79	80.2	1001.8	43.3	.54	0.0	2.86	40.1	83.3
1.19	94.1	1003.8	45.3	.48	0.0	3.29	47.1	88.2
1.59	107.1	1004.2	45.7	.43	0.0	3.83	53.6	94.4
1.98	120.1	1003.7	45.2	.38	0.0	3.90	60.0	101.4
2.39	133.6	1002.1	43.6	.33	0.0	4.12	66.8	109.7
2.80	147.0	1000.0	41.5	.28	0.0	4.27	73.5	118.5
3.22	160.3	997.3	38.8	.24	0.0	4.36	80.2	127.8
3.63	172.7	994.2	35.7	.21	0.0	4.40	86.4	137.2
4.05	185.0	990.7	32.2	.17	0.0	4.41	92.5	146.8
4.46	196.1	987.0	28.5	.15	0.0	4.38	98.1	156.1
4.88	205.3	983.2	24.7	.12	0.0	4.32	102.6	164.4
5.30	213.9	979.4	20.9	.10	0.0	4.26	107.0	172.6
5.70	220.0	975.7	17.2	.08	0.0	4.17	110.0	179.3
6.11	223.8	972.0	13.5	.08	0.0	4.07	111.8	184.9
6.52	225.0	968.9	10.4	.05	0.0	3.96	112.5	188.6
6.92	224.8	966.6	8.1	.04	0.0	3.87	112.4	190.8
7.33	225.2	964.3	5.8	.03	0.0	3.79	112.6	193.3
7.73	224.8	962.4	3.9	.02	0.0	3.72	112.5	195.1
8.13	224.0	961.1	2.6	.01	0.0	3.67	112.0	195.9
8.54	223.3	960.1	1.6	.01	0.0	3.63	111.7	186.6
8.95	222.7	959.1	.6	.00	0.0	3.59	111.3	187.3
9.35	222.4	958.2	-.3	.00	0.0	3.56	111.2	198.0
9.75	221.8	957.2	-1.3	-.01	0.0	3.53	110.8	198.7
10.15	222.2	956.4	-2.1	-.01	0.0	3.51	111.1	199.7
10.55	221.9	955.4	-3.1	-.01	0.0	3.48	110.9	200.6
10.95	221.6	954.5	-4.0	-.02	0.0	3.45	110.8	201.3
11.35	221.6	953.6	-4.8	-.02	0.0	3.42	110.8	202.2
11.74	221.7	952.6	-5.9	-.03	0.0	3.40	110.8	203.3
12.13	221.7	951.7	-6.8	-.03	0.0	3.38	110.9	204.1

12.53	221.4	950.8	-7.7	-.03	0.0	3.35	110.7	204.9
12.81	220.8	949.8	-8.6	-.04	0.0	3.32	110.4	205.5
13.31	220.4	949.1	-9.4	-.04	0.0	3.30	110.2	206.2
13.70	220.5	948.4	-10.1	-.05	0.0	3.28	110.2	206.9
14.10	220.4	947.7	-10.8	-.05	0.0	3.27	110.2	207.5
14.49	219.8	946.9	-11.6	-.05	0.0	3.24	109.8	208.0
14.87	220.1	946.1	-12.4	-.06	0.0	3.23	110.1	208.9
15.26	220.1	945.4	-13.1	-.06	0.0	3.21	110.0	209.7
15.65	220.4	944.5	-14.0	-.06	0.0	3.19	110.2	210.7
16.04	220.0	943.6	-14.9	-.07	0.0	3.17	110.0	211.4
16.43	219.3	942.8	-15.7	-.07	0.0	3.15	109.7	211.9
16.82	218.6	942.3	-16.2	-.07	0.0	3.13	109.3	212.0
17.21	218.3	941.5	-17.0	-.08	0.0	3.11	109.1	212.6
17.61	217.8	940.9	-17.6	-.08	0.0	3.09	108.9	213.0
18.00	217.4	940.2	-18.3	-.08	0.0	3.08	108.7	213.5
18.40	216.7	939.6	-18.9	-.09	0.0	3.06	108.4	213.7
18.79	216.3	938.9	-19.6	-.09	0.0	3.04	108.1	214.3
19.18	215.9	938.2	-20.3	-.09	0.0	3.02	107.9	214.8
19.58	214.8	937.6	-20.9	-.10	0.0	3.00	107.4	214.8
19.97	214.7	936.9	-21.6	-.10	0.0	2.99	107.4	215.5
20.36	214.3	936.4	-22.1	-.10	0.0	2.97	107.1	215.8
20.75	213.9	936.0	-22.5	-.11	0.0	2.96	106.8	216.0
21.14	213.4	935.4	-23.1	-.11	0.0	2.95	106.7	216.3
21.53	213.0	935.0	-23.5	-.11	0.0	2.94	106.5	216.5
21.92	212.5	934.5	-24.0	-.11	0.0	2.92	106.3	216.7
22.31	212.7	934.9	-23.6	-.11	0.0	2.93	106.3	216.4
22.71	212.2	934.2	-24.3	-.11	0.0	2.92	106.1	216.8
23.10	212.0	933.7	-24.8	-.12	0.0	2.90	106.0	217.3
23.49	212.1	933.2	-25.3	-.12	0.0	2.90	106.0	217.8
23.88	212.2	932.6	-25.9	-.12	0.0	2.89	106.1	218.5
24.29	212.0	931.8	-26.6	-.13	0.0	2.87	106.0	219.0
24.69	212.0	931.3	-27.0	-.13	0.0	2.86	105.7	219.5
25.09	211.5	931.3	-27.2	-.13	0.0	2.86	105.7	219.5
25.48	211.2	931.0	-27.5	-.13	0.0	2.85	105.6	219.6
25.88	211.5	930.5	-28.0	-.13	0.0	2.85	105.8	220.3
26.27	211.0	929.7	-28.8	-.14	0.0	2.83	105.5	220.6
26.67	209.8	928.6	-29.9	-.14	0.0	2.80	104.9	221.3

FIGURE D.7 UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS
 KOGYUK N-67 AREA

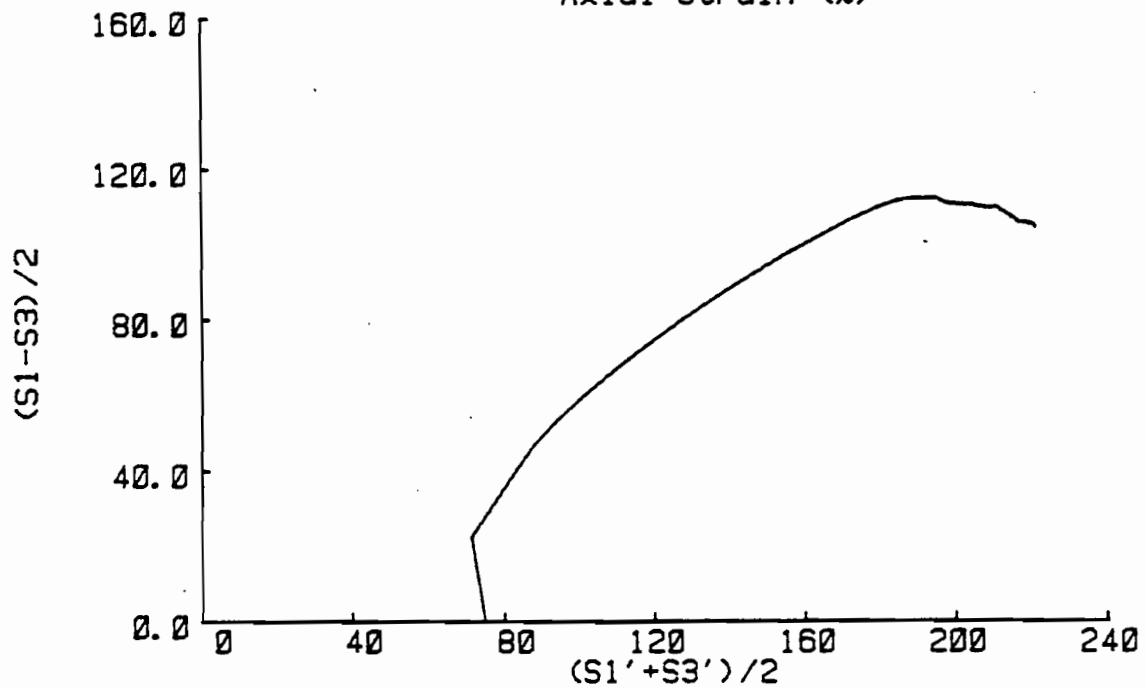
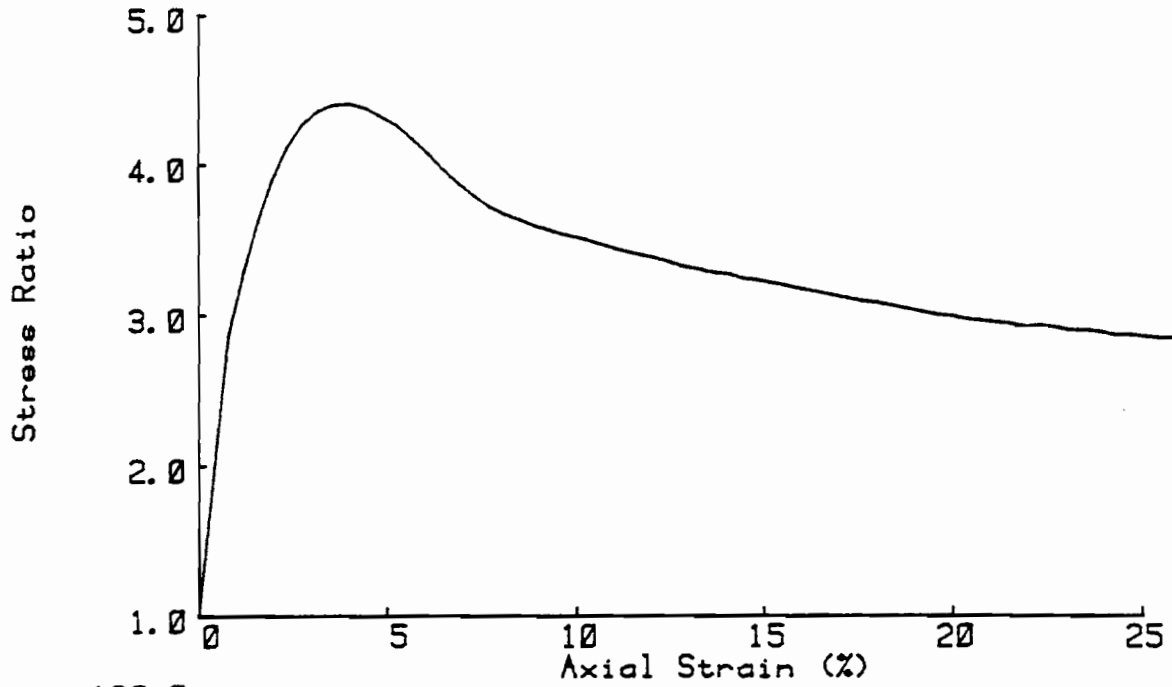
Test no.	σ'_3 (kPa)	Dry dens. (Mg/cu. m)
2	86.5	1.59



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D.8

Test no.	σ'_3 (kPa)	Dry dens. (Mg/cu. m)
2	86.5	1.59



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D. 9

Test Hole..... KYB2503 40B
 Depth..... 61.26-61.79 m
 Test Number..... 2
 Cell Pressure...(KPa).. 1165.0
 Back Pressure...(KPa).. 1072.0
 Parameter B..... .95

INITIAL FINAL
 Water Content (Z) 26.96 27.64
 Wet Density (Ns/cu.m) 2.00 2.01
 Dry Density (Ns/cu.m) 1.58 1.58

Strn	sl-s3	Isore	Epre	Para	VolCh	sl/s3	s-1/2	sts/2	Water Content (Z)	Wet Density (Ns/cu.m)	Dry Density (Ns/cu.m)	INITIAL	FINAL	Water Content (Z)	Wet Density (Ns/cu.m)	Dry Density (Ns/cu.m)	INITIAL	FINAL			
0.00	0.0	1074.5	0.0	0.00	0.0	1.00	0.0	90.5	15.05	285.3	1049.9	-22.1	-0.08	0.0	0.0	0.0	0.0	0.0	3.31	132.7	247.7
.51	13.7	1073.3	1.3	.10	0.0	1.15	6.8	98.5	15.95	284.2	1048.6	-23.4	-0.09	0.0	0.0	0.0	0.0	0.0	3.27	132.1	248.5
.95	17.5	1075.1	3.1	.18	0.0	1.19	8.8	98.7	16.04	283.5	1047.4	-24.6	-0.09	0.0	0.0	0.0	0.0	0.0	3.24	131.7	249.3
1.46	23.5	1078.9	7.9	.27	0.0	1.35	14.8	99.8	16.94	282.3	1046.2	-25.8	-0.10	0.0	0.0	0.0	0.0	0.0	3.21	131.2	250.0
1.94	46.7	1086.8	14.8	.32	0.0	1.60	23.4	101.6	17.04	280.3	1045.3	-26.7	-0.10	0.0	0.0	0.0	0.0	0.0	3.17	130.2	249.9
2.40	95.4	1105.3	33.3	.35	0.0	2.60	47.7	107.4	17.94	280.4	1044.2	-27.8	-0.11	0.0	0.0	0.0	0.0	0.0	3.16	130.2	251.0
2.94	119.2	1108.7	36.7	.31	0.0	3.11	59.6	115.9	18.05	280.4	1043.1	-28.9	-0.11	0.0	0.0	0.0	0.0	0.0	3.14	130.2	252.1
3.39	132.4	1108.9	36.9	.28	0.0	3.36	66.2	122.3	18.95	280.0	1042.1	-29.9	-0.12	0.0	0.0	0.0	0.0	0.0	3.12	130.0	252.9
3.91	145.3	1107.7	35.7	.25	0.0	3.53	72.7	130.0	19.05	280.4	1041.2	-30.8	-0.12	0.0	0.0	0.0	0.0	0.0	3.10	130.2	254.0
4.33	156.0	1106.4	34.4	.22	0.0	3.66	78.0	136.6	19.95	280.4	1040.2	-31.8	-0.12	0.0	0.0	0.0	0.0	0.0	3.09	130.2	255.0
4.85	168.2	1104.1	32.1	.19	0.0	3.76	84.1	145.0	20.05	299.5	1039.2	-32.8	-0.13	0.0	0.0	0.0	0.0	0.0	3.06	129.8	255.5
5.35	180.8	1101.2	29.2	.18	0.0	3.83	90.4	154.2	20.55	298.3	1038.3	-33.7	-0.13	0.0	0.0	0.0	0.0	0.0	3.04	129.2	255.9
5.84	192.8	1098.1	26.1	.14	0.0	3.88	96.4	163.3	21.03	296.0	1037.4	-34.6	-0.14	0.0	0.0	0.0	0.0	0.0	3.01	128.0	255.6
6.33	202.8	1094.8	22.8	.11	0.0	3.89	101.4	171.6	21.53	294.3	1036.4	-35.6	-0.14	0.0	0.0	0.0	0.0	0.0	2.98	127.2	255.7
6.82	213.7	1091.3	19.3	.09	0.0	3.90	106.9	180.5	22.01	293.2	1035.7	-36.3	-0.14	0.0	0.0	0.0	0.0	0.0	2.96	126.6	255.9
7.30	223.1	1087.7	15.7	.07	0.0	3.89	111.5	188.8	22.50	291.6	1034.7	-37.3	-0.15	0.0	0.0	0.0	0.0	0.0	2.93	125.8	256.1
7.79	231.4	1084.2	12.2	.05	0.0	3.88	115.7	196.5	22.99	290.7	1033.8	-38.2	-0.15	0.0	0.0	0.0	0.0	0.0	2.91	125.4	256.6
8.28	240.5	1080.6	8.6	.04	0.0	3.85	120.3	204.6	23.47	289.9	1033.0	-39.0	-0.16	0.0	0.0	0.0	0.0	0.0	2.89	125.0	257.0
8.76	249.1	1077.2	5.2	.02	0.0	3.79	122.6	210.3	23.96	289.1	1033.3	-39.7	-0.16	0.0	0.0	0.0	0.0	0.0	2.89	124.5	256.2
9.23	249.2	1074.0	2.0	.01	0.0	3.74	124.6	215.6	24.45	281.5	1034.3	-37.7	-0.15	0.0	0.0	0.0	0.0	0.0	2.92	125.8	256.5
9.71	251.9	1070.9	-1.1	-.00	0.0	3.68	125.9	220.0	24.94	284.3	1034.6	-37.4	-0.15	0.0	0.0	0.0	0.0	0.0	2.95	127.2	257.5
10.18	254.5	1068.0	-4.0	-.02	0.0	3.62	127.3	224.3	25.43	285.6	1034.4	-37.6	-0.15	0.0	0.0	0.0	0.0	0.0	2.96	127.8	258.4
10.65	256.2	1065.3	-6.7	-.03	0.0	3.57	128.1	227.8	25.82	286.8	1033.8	-38.2	-0.15	0.0	0.0	0.0	0.0	0.0	2.96	128.4	259.7
11.13	257.5	1062.8	-9.4	-.04	0.0	3.51	128.7	231.1	26.41	287.7	1033.3	-38.7	-0.15	0.0	0.0	0.0	0.0	0.0	2.96	128.8	260.5
11.62	258.7	1060.3	-11.7	-.05	0.0	3.47	129.3	234.1	26.92	287.3	1032.3	-39.7	-0.15	0.0	0.0	0.0	0.0	0.0	2.94	128.7	261.4
12.11	260.7	1058.0	-14.0	-.05	0.0	3.44	130.4	237.3	27.41	286.7	1031.7	-40.3	-0.16	0.0	0.0	0.0	0.0	0.0	2.93	128.3	261.7
12.59	261.4	1056.1	-15.9	-.06	0.0	3.40	130.7	239.6	27.91	285.3	1031.0	-41.0	-0.16	0.0	0.0	0.0	0.0	0.0	2.90	127.6	261.7
13.10	262.0	1054.6	-17.4	-.07	0.0	3.37	131.0	241.4	28.41	283.5	1030.5	-41.5	-0.16	0.0	0.0	0.0	0.0	0.0	2.88	126.7	261.3
13.58	263.1	1053.5	-18.5	-.07	0.0	3.36	131.6	243.1	28.91	282.1	1030.3	-41.7	-0.17	0.0	0.0	0.0	0.0	0.0	2.87	126.0	260.8
14.07	263.8	1052.4	-19.5	-.07	0.0	3.36	132.9	245.5													
14.57	265.2	1051.2	-20.8	-.08	0.0	3.33	132.6	246.4													

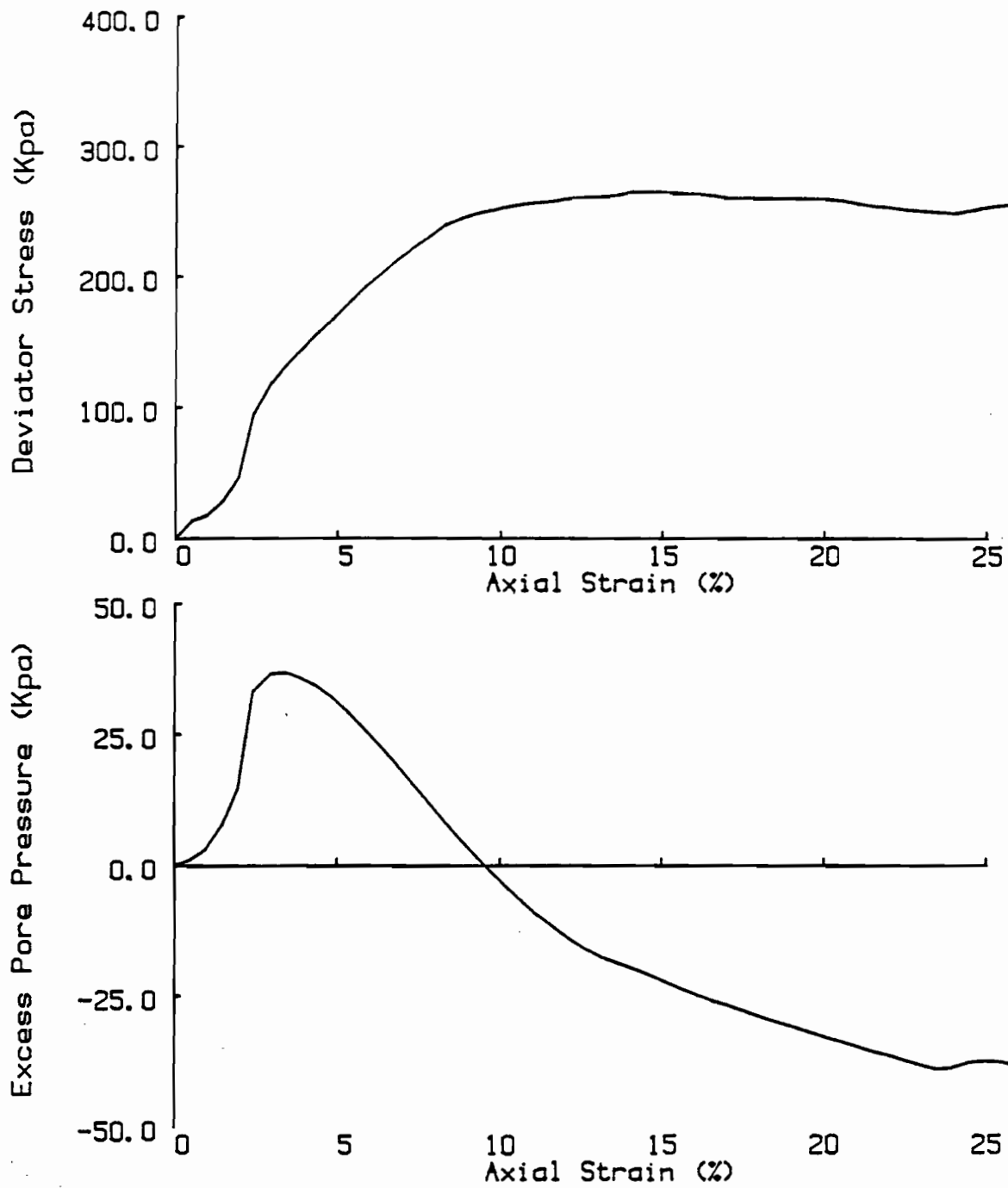
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS
 KOGYUK N-67 AREA

FIGURE D.10

Test no.
2

σ'_{3e} (kPa)
93.0

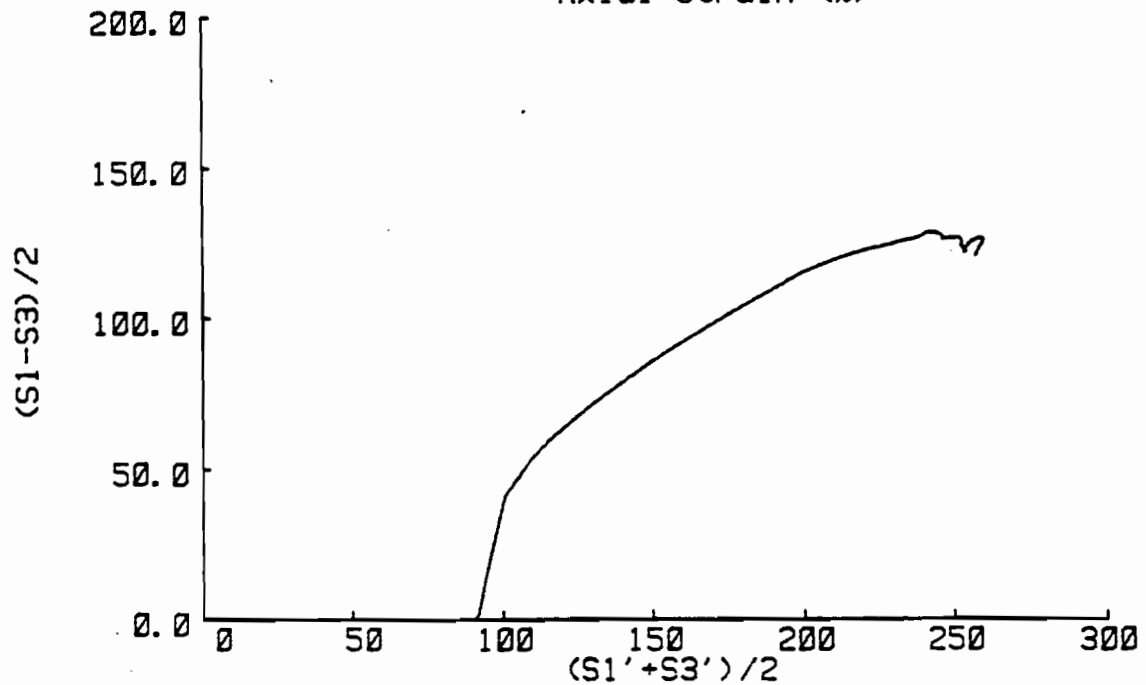
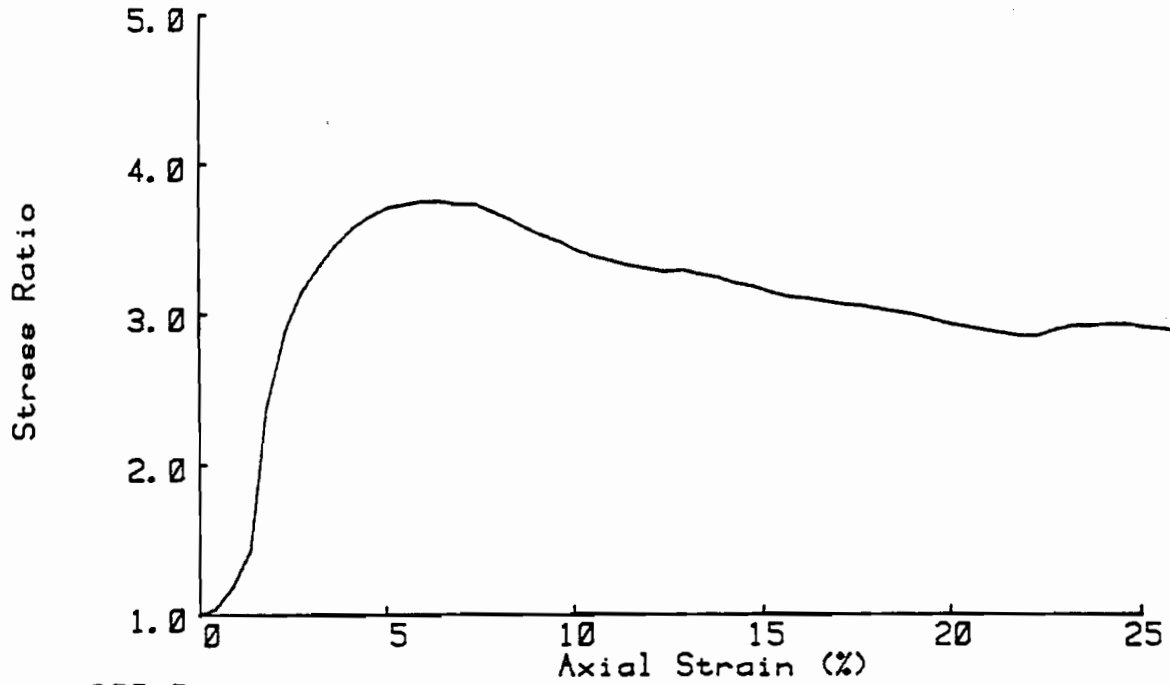
Dry dens. (Mg/cu. m)
1.58



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D.11

Test no.	σ'_{3_0} (kPa)	Dry dens. (Mg/cu. m)
2	93.0	1.58



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE WATER PRESSURE MEASUREMENTS

FIGURE
D. 12

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APPENDIX E

Consolidation Test Results

CONSOLIDATION TEST DATA

Date Computed..... 0151 PM FEB., 8 FEB., 1982

Date Tested..... 02 10 84

Lab Number..... 101-3855

Test Hole..... KY82S03 29B

Depth..... 45.4 - 45.6 m

Test Number..... 2

SOOT File

		INITIAL	FINAL
Height	(mm)	25.82	23.75
Water Content	(%)	25.05	20.05
Wet Density	(Mg/cu.m)	1.52	2.06
Dry Density	(Mg/cu.m)	1.50	1.67
Void Ratio		.8054	.6177
Saturation	(%)	54.11	100.00 (Assumed)

Load (KPa)	Void ratio	CV(sq.m/yr)	MV(sq.m/MN)	K(m/s)
0.00	.8054	.000E+00	.000E+00	.000E+00
20.25	.8012	.485E+02	.196E-00	.283E-06
40.50	.7935	.489E+02	.215E+00	.334E-06
81.00	.7823	.107E+03	.155E+00	.662E-06
162.00	.7553	.154E+03	.180E+00	.805E-06
324.00	.7212	.100E+03	.102E+00	.493E-06
40.50	.7576	.000E+00	.000E+00	.000E-00
81.00	.7544	.172E+03	.464E-01	.248E-06
162.00	.7252	.156E+03	.444E-01	.213E-06
324.00	.7148	.155E+03	.423E-01	.236E-06
645.00	.6752	.134E+03	.723E-01	.002E-06
1285.00	.6196	.116E+03	.531E-01	.152E-06
162.00	.6403	.000E+00	.000E+00	.000E+00
324.00	.6365	.132E+03	.150E-01	.315E-06
645.00	.6262	.133E+03	.157E-01	.678E-06
1285.00	.6110	.145E+03	.165E-01	.745E-06
2562.00	.5451	.167E+03	.328E-01	.171E-06
5124.00	.4770	.676E+02	.173E-01	.540E-06
645.00	.6018	.000E+00	.000E-00	.000E+00
81.00	.6445	.000E+00	.000E+00	.000E+00
162.00	.6751	.000E+00	.000E+00	.000E+00
1.30	.6177	.000E+00	.000E+00	.000E+00

FIGURE E.1

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

Project:

Test No.:

2

Address:

Borehole No.:

KY82S03 5B

Project No.: 101-3656

Depth (m):

45.4-45.9

Date Tested: 82-10-08

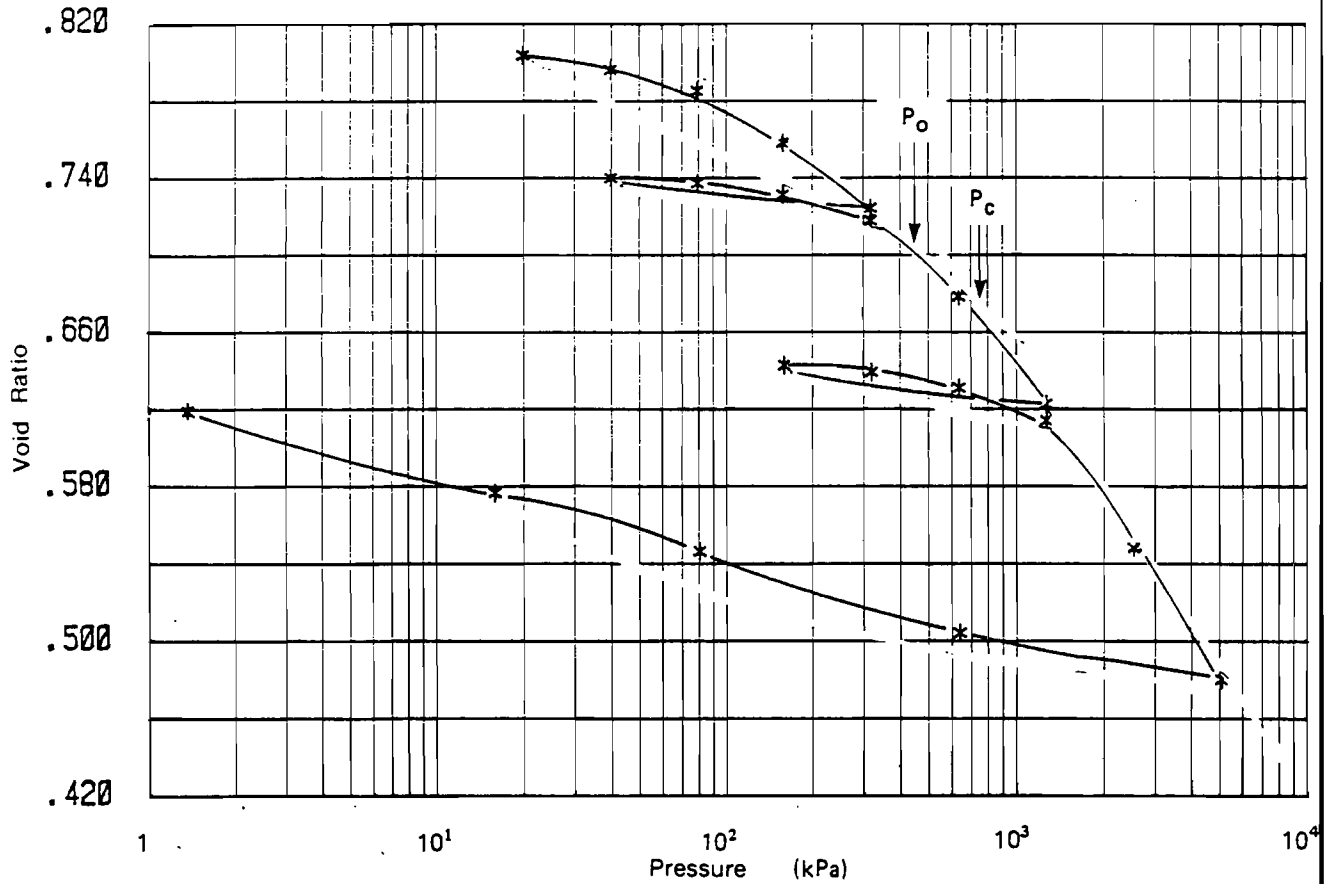
By: GJB

Diameter (mm):

49.92

Specific Gravity:

2.68



	INITIAL	FINAL
Height (mm):	26.62	23.78
Water Content (%):	28.39	23.05
Wet Density (Mg/m ³):	1.92	2.06
Dry Density (Mg/m ³):	1.50	1.67
Void Ratio	.8087	.6177
Saturation (%):	94.08	100.00

Sample Description:	CLAY, silty, soft, friable, gray	
Overburden Pressure	P _O	446 kPa
Swelling Pressure	P _S	_____ kPa
Pre-Consolidation Pressure	P _C	750 kPa
Compression Index	C _C	0.22

Note: 1 kPa = 1.044 x 10⁻² T_f/ft.²

FIGURE E.2

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

CONSOLIDATION TEST DATA

Date Computed..... 4:01 PM WED., 8 FEB., 1983

Date Tested..... 32 10 82

Job Number..... 10-383E

Test Hole..... KY 82303 203

Depth..... 45.6-45.9 m

Test Number..... C

SOFT FILE

		INITIAL	FINAL
Height	(mm)	25.55	24.35
Water Content	(%)	27.40	24.13
Wet Density	(Mg/cu.m)	1.83	2.08
Dry Density	(Mg/cu.m)	1.53	1.86
Void Ratio		.7755	.6466
Saturation	(%)	84.00	100.00 (Assumed)

Load (KPa)	Void ratio	CV(sq.m/yr)	MV(sq.m/MN)	K(m/s)
0.00	.7755	.000E+00	.000E+00	.000E+00
20.25	.7689	.267E-02	.288E+00	.240E-03
40.50	.7553	.406E+02	.286E+00	.376E-08
81.00	.7419	.487E+02	.283E+00	.652E-08
162.00	.7134	.408E+02	.180E+00	.250E-08
20.25	.7235	.000E+00	.000E+00	.000E+00
40.50	.7240	.670E+02	.438E-01	.612E-08
81.00	.7200	.102E+03	.362E-01	.176E-08
162.00	.7120	.810E+02	.583E-01	.147E-08
324.00	.6853	.088E+02	.525E-01	.106E-08
648.00	.6444	.651E+02	.791E-01	.663E-09
81.00	.6843	.000E+00	.000E+00	.000E+00
162.00	.6613	.572E+02	.245E-01	.740E-09
324.00	.6534	.121E+03	.283E-01	.110E-08
648.00	.6375	.119E+03	.255E-01	.111E-08
1256.00	.5833	.236E+02	.323E-01	.464E-09
2552.00	.5255	.413E+02	.285E-01	.681E-09
324.00	.5510	.000E+00	.000E+00	.000E+00
20.25	.6056	.000E+00	.000E+00	.000E+00
1.00	.6466	.000E+00	.000E+00	.000E+00

FIGURE E.3

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

Project:

Test No.:

3

Address:

Borehole No.:

KY82S03 29B

Project No.: 101-3656

Depth (m):

45.4-45.9

Date Tested: 82-10-08

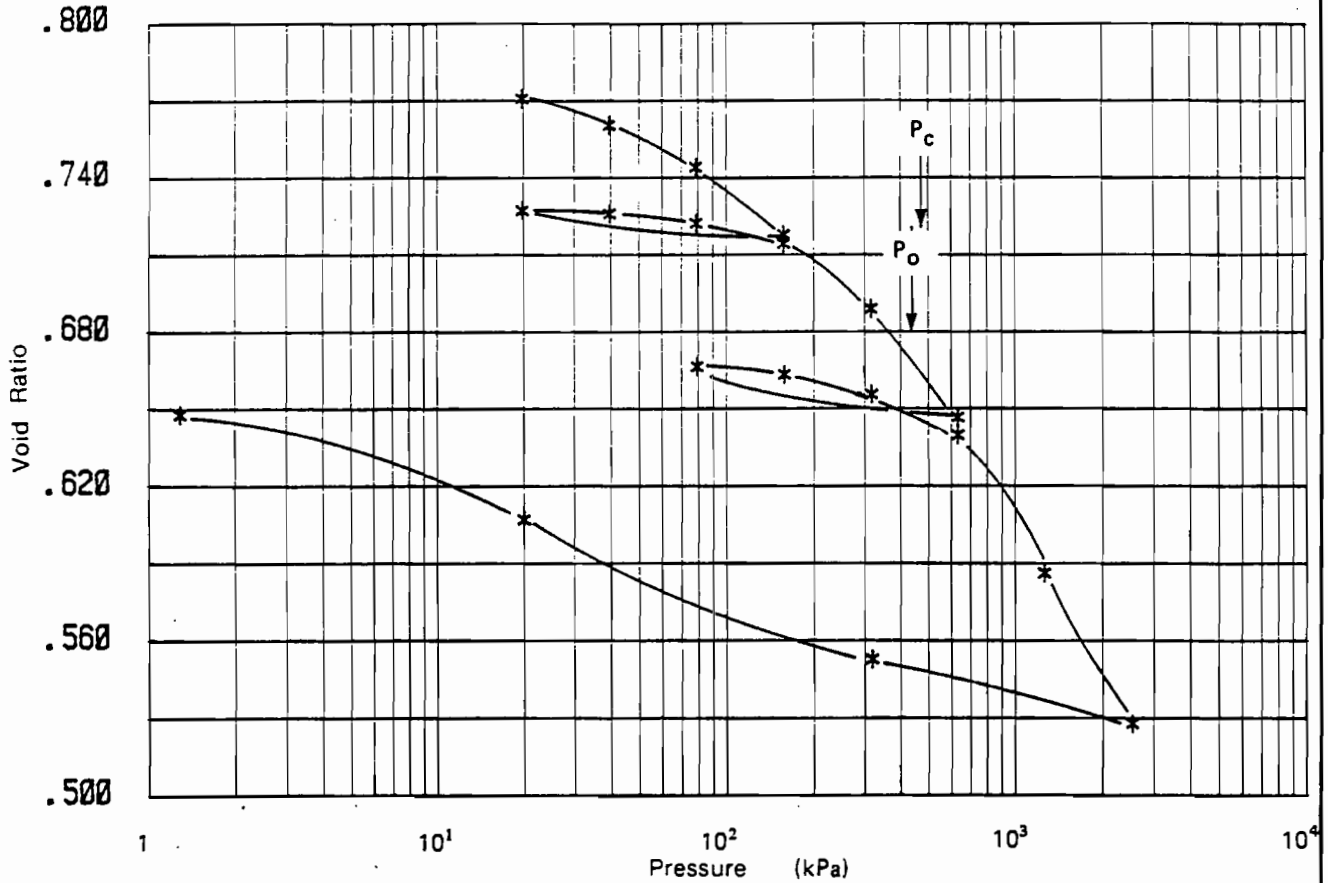
By: SK

Diameter (mm):

49.90

Specific Gravity:

2.68



	INITIAL	FINAL	Sample Description:	CLAY, trace to some
Height (mm):	26.56	24.56		silt, dark brown
Water Content (%):	27.40	24.13	Overburden Pressure	P _O 440 kPa
Wet Density (Mg/m ³):	1.95	2.06	Swelling Pressure	P _S kPa
Dry Density (Mg/m ³):	1.53	1.66	Pre-Consolidation Pressure	P _C 480 kPa
Void Ratio	.7787	.6466	Compression Index	C _C 0.20
Saturation (%):	94.29	100.00		

Note: 1 kPa = 1.044 x 10⁻² T_f/ft.²

FIGURE E.4

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

CONSOLIDATION TEST DATA

Date Computed..... 2:57 PM WED., 15 DEC., 1982

Date Tested.....82 12 02

Job Number.....101-3859

Test Hole.....KY 62S03 31C

Depth.....48.48 - 48.95 m

Test Number.....1

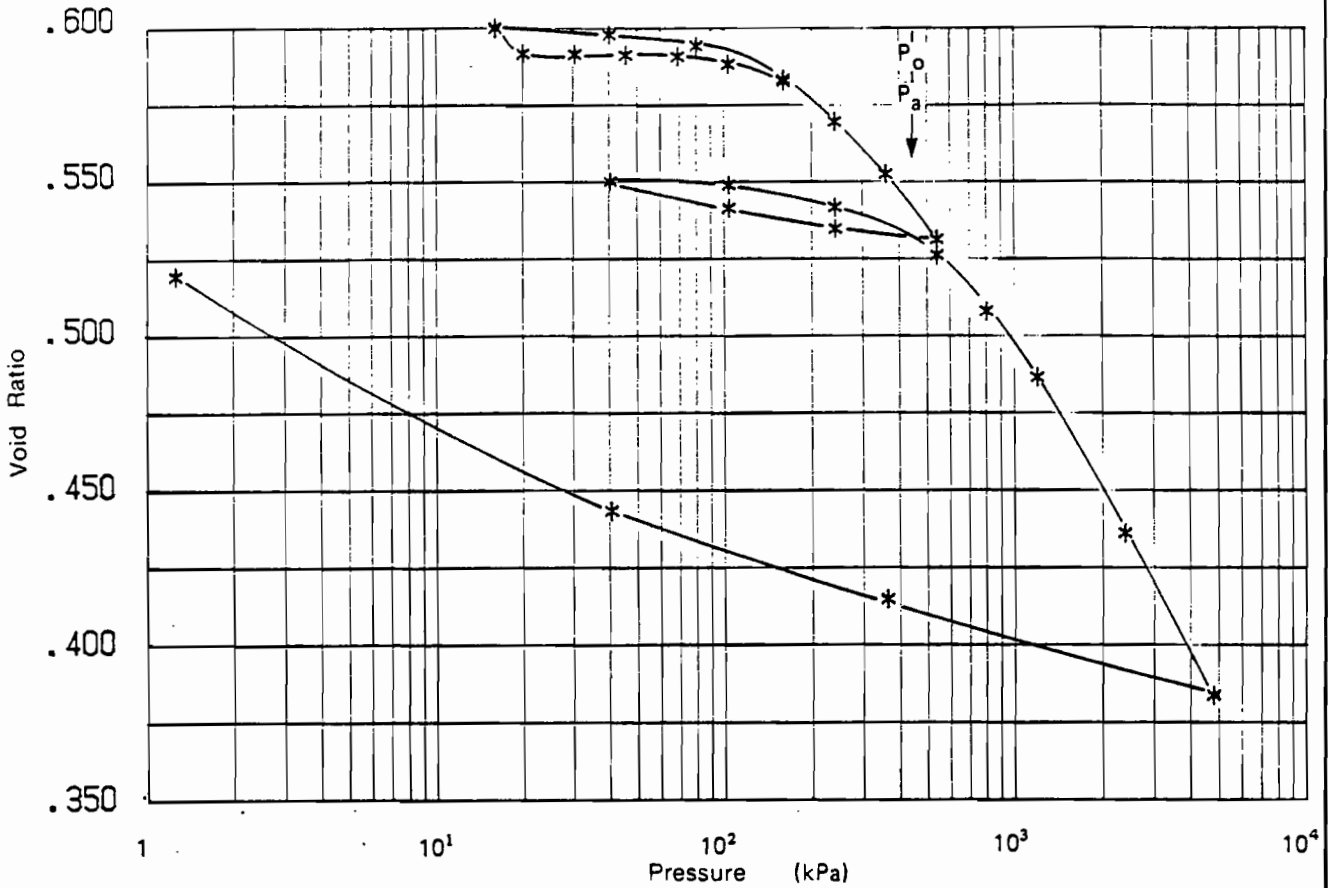
ROOT Fit

		INITIAL	FINAL		
Height	(mm)	25.36	25.00		
Water Content	(%)	20.97	19.24		
Wet Density (Ms/cu.m)		2.07	2.15		
Dry Density (Ms/cu.m)		1.71	1.80		
Void Ratio		.5990	.5175		
Saturation	(%)	94.17	100.00 (Assumed)		

Load (KPa)	Void ratio	CV(sq.m/yr)	MV(sq.m/MN)	K(m/s)
0.00	.5990	.000E+00	.000E+00	.000E+00
16.10	.5967	.368E+02	.868E-01	.593E-09
40.30	.5943	.321E+02	.615E-01	.614E-09
80.60	.5907	.415E+02	.573E-01	.740E-09
161.30	.5798	.248E+02	.852E-01	.658E-09
20.10	.5885	.000E+00	.000E+00	.000E+00
30.60	.5681	.170E+03	.215E-01	.114E+28
46.00	.5678	.763E+02	.127E-01	.301E-09
69.40	.5672	.270E+02	.167E-01	.140E-09
104.10	.5648	.264E+02	.443E-01	.363E-09
161.30	.5791	.182E+02	.630E-01	.357E-09
241.90	.5661	.909E+01	.103E+00	.291E-09
362.90	.5491	.150E+02	.907E-01	.424E-09
544.40	.5279	.362E+01	.753E-01	.858E-10
241.90	.5315	.000E+00	.000E+00	.000E+00
104.10	.5384	.000E+00	.000E+00	.000E+00
40.30	.5472	.000E+00	.000E+00	.000E+00
104.10	.5458	.374E+02	.144E-01	.168E-09
241.90	.5386	.215E+02	.342E-01	.229E-09
544.40	.5229	.112E+02	.340E-01	.118E-09
806.50	.5049	.133E+02	.458E-01	.190E-09
1209.70	.4836	.356E+01	.356E-01	.394E-10
2419.40	.4339	.244E+01	.287E-01	.216E-10
4838.80	.3817	.279E+01	.156E-01	.135E-10
362.90	.4130	.000E+00	.000E+00	.000E+00
40.30	.4418	.000E+00	.000E+00	.000E+00
1.25	.5175	.000E+00	.000E+00	.000E+00

FIGURE E.5 CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

Project: Test No.: 1
 Address: Borehole No.: KY 82S03 31C
 Depth (m): 48.46 - 48.95 m
 Project No.: 101-3659 Diameter (mm): 50.00
 Date Tested: 82 12 02 By: GJB Specific Gravity: 2.69



	INITIAL	FINAL	Sample Description:
Height (mm):	26.36	25.00	SILTY CLAY, tr. organic, sand seam
Water Content (%):	20.97	19.24	Overburden Pressure P_o 440 kPa
Wet Density (Mg/m^3):	2.07	2.15	Swelling Pressure P_s — kPa
Dry Density (Mg/m^3):	1.71	1.80	Pre-Consolidation Pressure P_c 400 - 450 kPa
Void Ratio	.5990	.5175	Compression Index C_c 0.16
Saturation (%):	94.17	100.00	

Note: $1 \text{ kPa} = 1.044 \times 10^{-2} \text{ T}_f/\text{ft.}^2$

FIGURE E.6

CONSOLIDATION TEST RESULTS
 KOGYUK N-67 AREA

CONSOLIDATION TEST DATA

Date Computed..... 0140 PM WED., 8 FEB., 1988

Date Tested..... 02 08 87

Job Number..... 101-3355

Test Hole..... 4V 32903 333

Depth..... 31.30 - 32.20 m

Test Number..... 1

LOG File

		INITIAL	FINAL
Height	(mm)	28.30	34.74
Water Content	(%)	24.87	22.88
Wet Density	(Mg/cu.m)	1.45	1.50
Dry Density	(Mg/cu.m)	1.16	1.22
Void Ratio		.7244	.6132
Saturation	(%)	32.31	100.00 (Assumed)

Load (KPa)	Void ratio	CV(sq.m/yr)	MV(sq.m/MN)	K(m/s)
0.00	.7244	.000E+00	.000E+00	.000E+00
20.25	.7244	.170E+00	.000E+00	.000E+00
40.50	.7238	.885E+02	.180E-01	.488E-08
81.00	.7200	.895E+02	.854E-01	.156E-08
162.00	.7103	.811E+02	.704E-01	.134E-08
40.50	.7171	.000E+00	.000E+00	.000E+00
81.00	.7153	.744E+02	.251E-01	.582E-08
162.00	.7083	.848E+02	.457E-01	.129E-08
324.00	.6995	.828E+02	.354E-01	.851E-08
648.00	.6503	.488E+02	.821E-01	.138E-08
81.00	.6723	.000E+00	.000E+00	.000E+00
162.00	.6682	.658E+02	.251E-01	.515E-08
311.00	.6617	.108E+03	.305E-01	.104E-08
648.00	.6444	.852E+02	.311E-01	.324E-08
1296.00	.6543	.507E+02	.483E-01	.766E-08
2592.00	.6120	.352E+02	.420E-01	.458E-08
5184.00	.4327	.342E+02	.214E-01	.227E-08
1296.00	.4536	.000E+00	.000E+00	.000E+00
162.00	.5085	.000E+00	.000E+00	.000E+00
20.25	.5709	.000E+00	.000E+00	.000E+00
1.30	.6132	.000E+00	.000E+00	.000E+00

FIGURE E.7

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

Project:

Test No.:

1

Address:

Borehole No.:

KY82S03 33B

Project No.: 101-3656

Depth (m):

51.8 - 52.2

Date Tested: 82-10-05

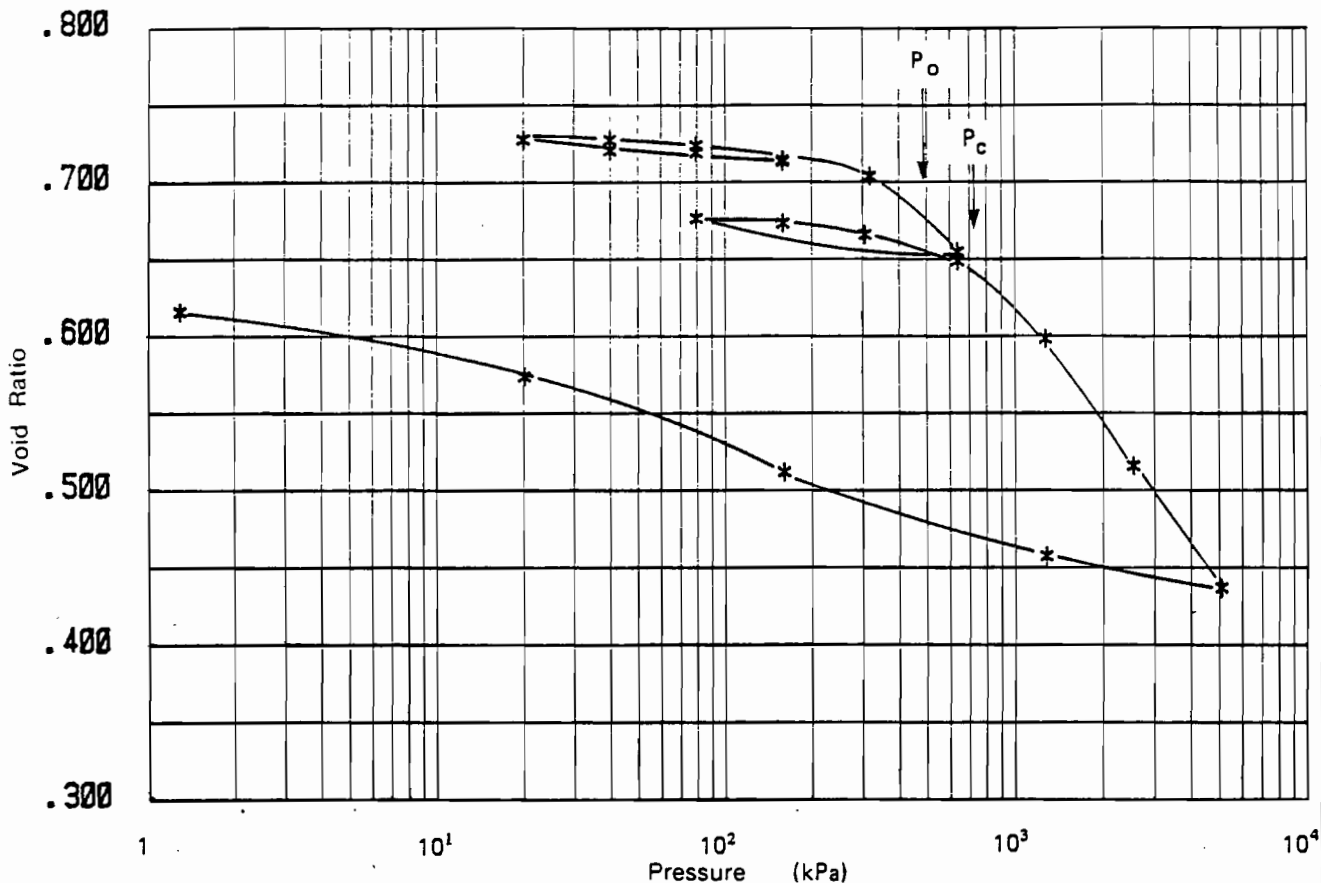
By: SK

Diameter (mm):

49.70

Specific Gravity:

2.68



	INITIAL	FINAL
Height (mm):	26.50	24.74
Water Content (%):	24.95	22.88
Wet Density (Mg/m ³):	2.00	2.10
Dry Density (Mg/m ³):	1.60	1.71
Void Ratio	.7244	.6132
Saturation (%):	92.31	100.00

Sample Description:	CLAY, silty, dark gray	
Overburden Pressure	P _o	495 kPa
Swelling Pressure	P _s	_____ kPa
Pre-Consolidation Pressure	P _c	810 kPa
Compression Index	C _c	0.26

Note: 1 kPa = 1.044 x 10⁻² T_f/ft.²

FIGURE E.8

CONSOLIDATION TEST RESULTS
KOGYUK N-67 AREA

APPENDIX F

Subconsultants Results



REPORT ON
HYDROCARBON GAS ANALYSES
BOREHOLE KY82S03 - KOGYUK N-67

JOB 101-3656.4

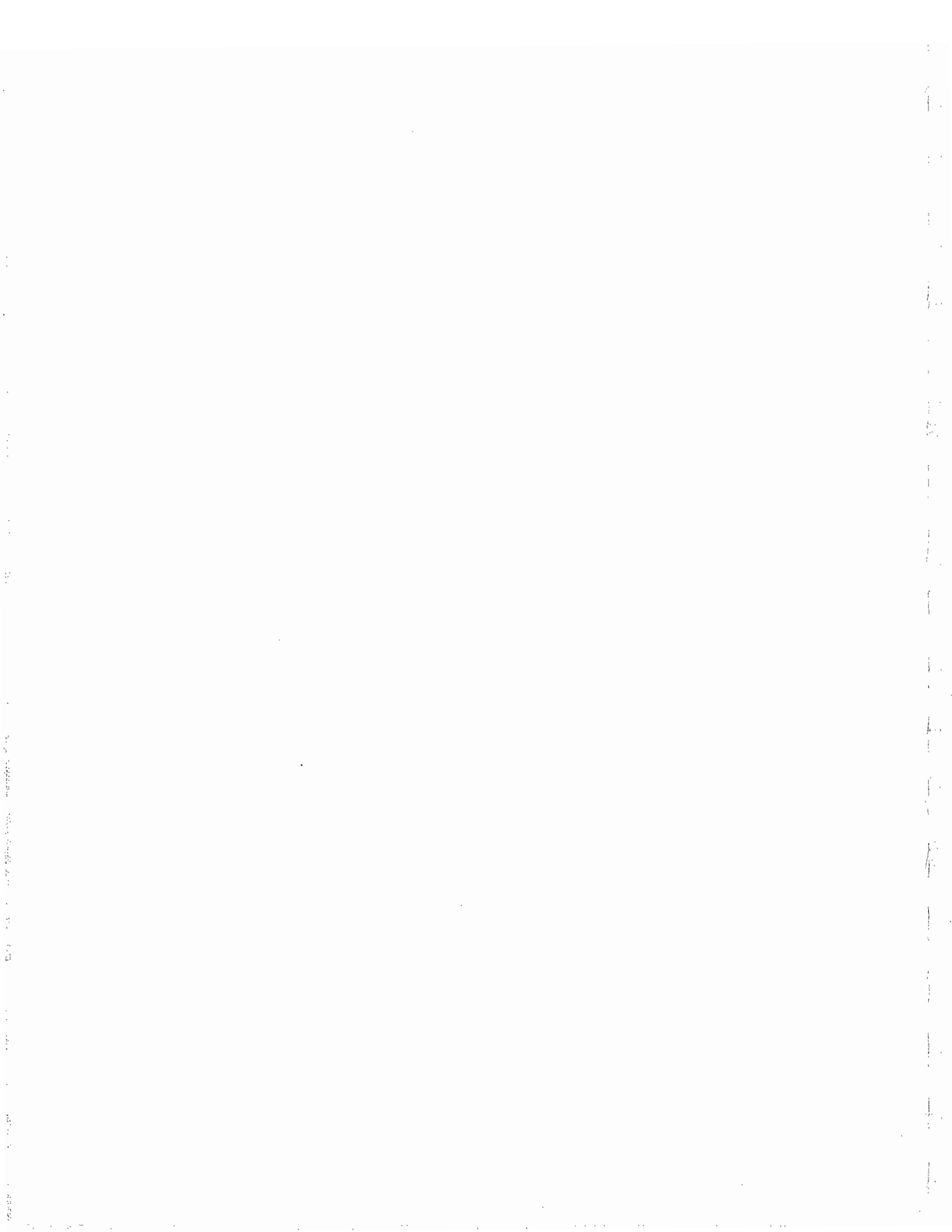
FOR

EBA ENGINEERING CONSULTANTS LTD.
J.P. RUFFELL

PREPARED BY

Dr. J.F. BARKER
DEPARTMENT OF EARTH SCIENCES
UNIVERSITY OF WATERLOO

JANUARY 7, 1983



METHODS

At the drill site, fresh core material is placed in cans with water so as to eliminate any head space. In the laboratory, 100 cm³ of helium is added and 100 cm³ of water withdrawn via gas-tight septa. The sediment/water/helium mixture is vigorously shaken so that hydrocarbon gases will be taken into the helium gas phase. A few microlitres of the gas phase is analyzed by gas chromatography for methane, ethane, ethylene, propane, and propylene. A commercial, analyzed gas mixture is used as standards. The concentration of each component is reported in parts per million (ppm) on a volume basis (v/v). That is, 10⁴ ppm, v/v indicates that there is 1 cm³ of that gas per 100 cm³ of wet sediment. It is assumed that 100 cm³ (100 ml) of wet sediment has been canned at the drill site. In addition, the sediment was dried and weighed so that the amount of gas per dry weight of sediment can be reported if the client wishes.

RESULTS

Hydrocarbon gas analyses for the two core samples are as follows:

SAMPLE	DEPTH (m)	GAS CONTENT (ppm, v/v)	
		Methane	Ethane
39B	59.97 - 60.05	1.2 x 10 ⁴	3
44C	66.55 - 66.62	8.8 x 10 ³	2

Dashes indicate the component was not detected. Ethylene (ethene), propane and propylene also were not detected. The cans were generally rusted and the sample indicated by "*" was obviously leaking and some gases could have been lost. The lack of significant petrogenic components (ethane and propane) and the total lack of biogenic components ethylene and propylene makes it difficult to identify the origin of the dominantly-methane gases. The very low levels of ethane would indicate only very minor contribution of petrogenic gas to dominantly-biogenic methane. Even the highest concentrations of methane are very unlikely to exceed the solubility of methane in the porewaters. The gases probably exist as dissolved components and are not contributing to pore pressure build-up.

APPENDIX G

Laboratory Test Procedure



LABORATORY TEST PROCEDURES

Procedures Specified

1. Classification and Index Tests
2. Triaxial Shear Tests
3. Direct Shear Tests
4. Laboratory Miniature Vane
5. Swedish Fall Cone Shear Strength Determination
6. Consolidation Tests
7. Porewater Salinity Tests
8. Organic Content Determination
9. Radiography

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LABORATORY TEST PROCEDURES

1. CLASSIFICATION AND INDEX TESTS

These tests are quite routine and the standard ASTM procedures employed are listed below:

<u>TEST</u>	<u>ASTM DESIGNATION</u>
Moisture Content	D 2216
Liquid Limit (1)	D 423
Plastic Limit and Plasticity Index	D 424
Grain Size	D 421 & 422
Specific Gravity	D 854
Relative Density	D 2049
Unified Soil Classification	D 2487

NOTE: 1. All liquid limits reported were obtained from 3 point determinations.

2. SHEAR STRENGTH TESTS

Procedure #1 - Unconfined Compression

Procedure #2 - Unconsolidated Undrained Triaxial
With and without pore pressure measurement

Test specimen is mounted in triaxial cell and jacketed. Cell pressure equivalent to estimated in situ total horizontal stress ($K_0 = 0.7$) is applied without sample drainage. A pore pressure response test is carried out prior to shear. If $B < 0.95$, sample is loaded to failure at rate of 1%/min with no pore pressure measurement. If $B > 0.95$ specimen loaded to failure at rate of 0.02%/min with pore pressures monitored continuously. Frozen samples are permitted to thaw (undrained condition) prior to measurement of B value.

For quick UU tests, data is presented in the form of stress-strain curves. Where pore pressure is monitored, the following curves are obtained:

1. Stress-strain
2. Effective stress ratio-strain
3. Excess pore pressure-strain
4. P/Q stress path

CONSOLIDATED-UNDRAINED TRIAXIAL TESTS

Procedure 1 - Sample is mounted in triaxial cell and jacketed. A pore pressure response test is carried out prior to shearing. If further saturation is required, back pressure can be applied to the sample. Frozen samples are placed in a pre-chilled triaxial cell, then permitted to thaw before commencing consolidation. Cell pressure equivalent to estimated total horizontal stress is applied with drainage allowed. Once consolidation is complete, drainage is shut off. Samples are sheared by increasing axial stress at controlled rate of strain based on the consolidation characteristics of the material determined during the consolidation phase of the test. Stress-strain curve and other diagnostic plots are produced.

CONSOLIDATED-DRAINED TRIAXIAL TESTS

Procedure 1 - Sample is mounted in triaxial cell and jacketed, then thawed under a nominal pressure of 35 kPa. A pore pressure response test is carried out prior to shearing. If further saturation is required, back pressure can be applied to the sample. Sample is consolidated to cell pressure equivalent to estimated mean horizontal in situ effective stress. With drainage open, sample is sheared by increasing the axial stress at a controlled rate of strain. The rate of strain is selected on the basis of consolidation properties of the soil determined during the consolidation phase of the test. Stress-strain curve and other diagnostic plots are produced.

Procedure 2 - Lack of undisturbed samples of sand from certain strata necessitate reconstituting disturbed samples for strength testing. Relative density test is conducted on the sand and reconstituted samples are then prepared to approximately 70% relative density. A pore pressure response test is carried out prior to shearing. If saturation is required, back pressure is applied to the sample. Sample is consolidated to cell pressure equivalent to the estimated in situ mean horizontal effective stress. With the drainage open, the sample is sheared by increasing the axial stress at a controlled rate of strain as detailed in Procedure 1. Stress-strain curve and other diagnostic plots are produced.

- NOTES:
1. Standard UU triaxial procedure ASTM D2850.
 2. Standard CU and CD triaxial procedures taken from Bishop & Henkel (1969).
 3. Samples reconstituted according to procedures outlined in Bjerrum, Kringstad, and Kummeneje (1961).

3. DIRECT SHEAR TESTS

Procedure 1 - Standard direct shear procedure. Frozen samples are permitted to thaw and consolidate under applied normal pressure before commencing shear. Resheared strength is measured on plane cut after peak strength has been determined. Generally, a minimum of 3 tests are performed on each material type to define effective stress parameters c' and ϕ' . Shear stress - deformation curve and other diagnostic plots produced.

Procedure 2 - If no undisturbed sample is available, an appropriate sample may be reconstituted for testing following the same general procedure indicated above.

- NOTES:
1. Standard direct shear procedure ASTM D 3080.
 2. Samples reconstituted according to procedures outlined in Bjerrum, Kringstad, and Kummeneje (1961).

4. LABORATORY MINIATURE VANE

Procedure 1 - Sample is either retained in sampling tube or extruded into split ring. Vane is lowered into sample ensuring total submergence of the vane. Vane is rotated at 10 degrees/min. Test is run until steady post-peak value is reached. Stress-strain curves, peak and post-peak shear strengths are produced.

5. FALL-CONE SHEAR STRENGTH DETERMINATION

Procedure 1 - Small portion of sample is extruded into testing cup. Cone is selected with reference to expected shear strength of soil. Cone is lowered to contact the surface of the sample and is then released. Depth of penetration of cone is measured. Shear strength is interpreted from cone strength correlation charts.

6. STANDARD OEDOMETER/CONSOLIDATION TESTS

Procedure 1 - Sample is set up in oedometer with dry stones. Standard incremental loading is applied done to a specified vertical effective stress that exceeds the in situ effective overburden pressure. The oedometer is then flooded with a saline solution similar to that of the soil, unloaded and permitted to rebound. After rebound, the specimen is reloaded in increments of 50% increase until a specified vertical effective stress, is reached. Thereafter, the standard doubling of pressures is resumed to test completion. All load increments are left on for a time interval determined by the root time method. e-log-p' curve, c_v , k , m_v , and P_c' data produced.

Procedure 2 - Sample is set up frozen in oedometer, then moved from cold room to standard apparatus. Stress is applied to seat load cap and sample is then thawed under nominal pressure. Procedure continues as for Procedure 1. e-log-p' curve, c_v , k , m_v , and P_c' data produced.

NOTE: 1. Modifications made to standard procedure (ASTM D 2435) are taken from Andresen et al. (1979) and Broms (1980), as recommended for overconsolidated soils. Procedure is appropriate in view of large reduction in total stress that typically occurs upon sampling.

In addition to the specific procedures described above, all samples programmed for testing may have other basic tests performed as follows:

1. Moisture content
2. Bulk density
3. Core photography (where practical)
4. Detailed description of sedimentological features, and
5. Identification and preservation of discrete organic matter when present.

7. POREWATER SALINITY TESTS

Procedure 1 - Sample is trimmed to remove disturbed material. Porewater is extruded from thawed sample and chloride titration is performed to establish equivalent salinity (NaCl).

NOTES: 1. A silver nitrate titration is performed to determine the chloride ion content (ASTM D 512 Method B).

2. Chloride ion content was converted to an equivalent salinity using the following empirical relationship.

$$\text{Salinity (o/oo)} = 0.03 + (1.805 \times \text{Chlorinity (o/oo)})$$

8. ORGANIC CONTENT DETERMINATION

Procedure 1 - Small portion of sample is weighed then oven dried. Dried sample is mixed with hydrogen peroxide solution (H₂O₂) and boiled. After reaction ceases sample is oven dried and reweighed. Loss in weight is inferred as organic content.

9. RADIOGRAPHY

Procedure 1 - Samples are transported to be radiographed on subcontractors premises. Samples are returned with processed film negatives.

Procedure 2 - Samples are radiographed at EBA. Samples are removed from storage area and returned immediately. Film is processed on site and results reviewed.

NOTE: 1. For report presentation, radiography subcontractor can prepare high quality B/W prints from film negatives.

