2-3185-5

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

Report to
GULF CANADA RESOURCES INC.
on
BEAUFORT SEA GEOTECHNICAL INVESTIGATION - 1981

WEST AMAULIGAK

DISTRIBUTION: 15 copies - Gulf Resources Inc., Calgary, Alberta
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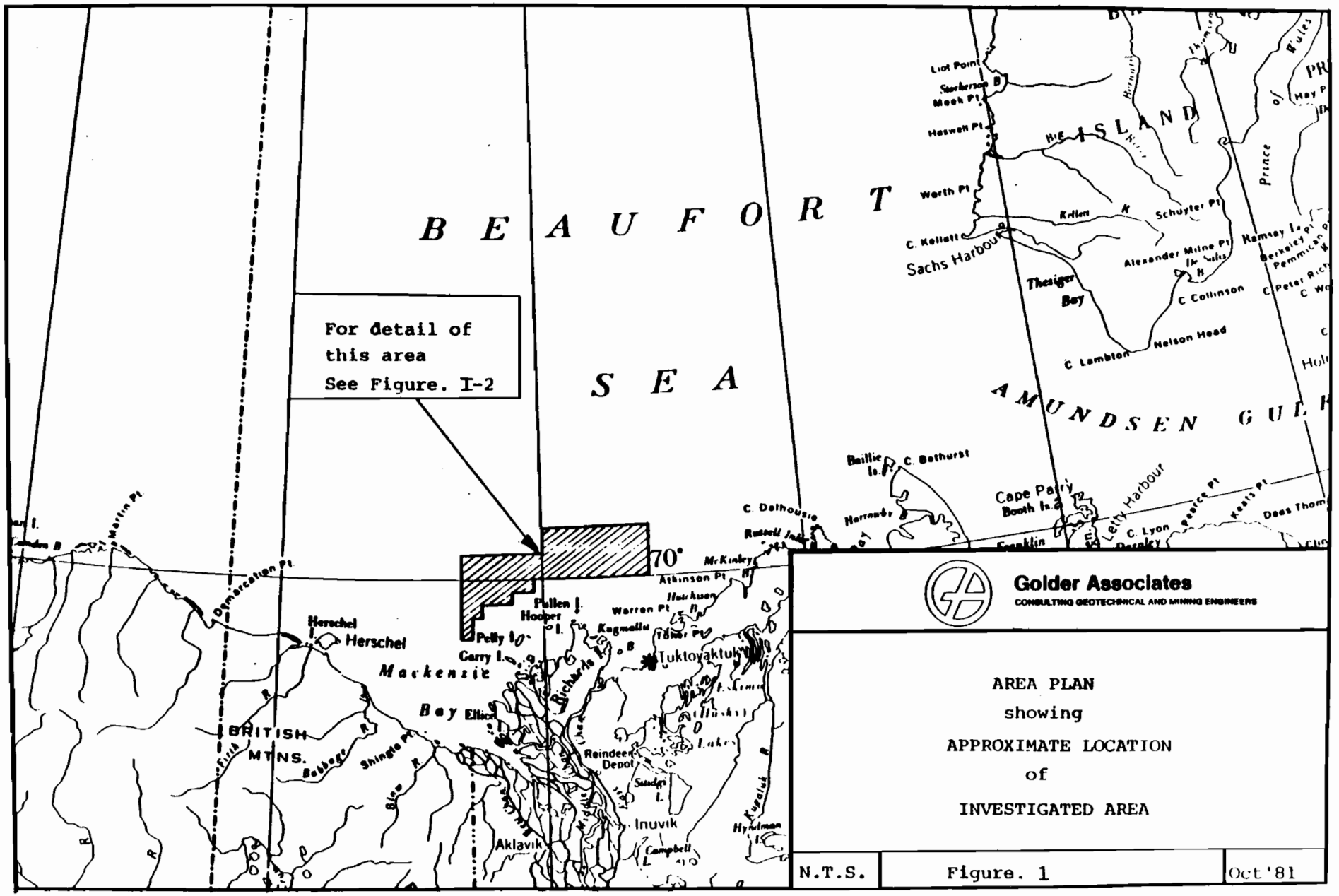
812-2102

February, 1982

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES



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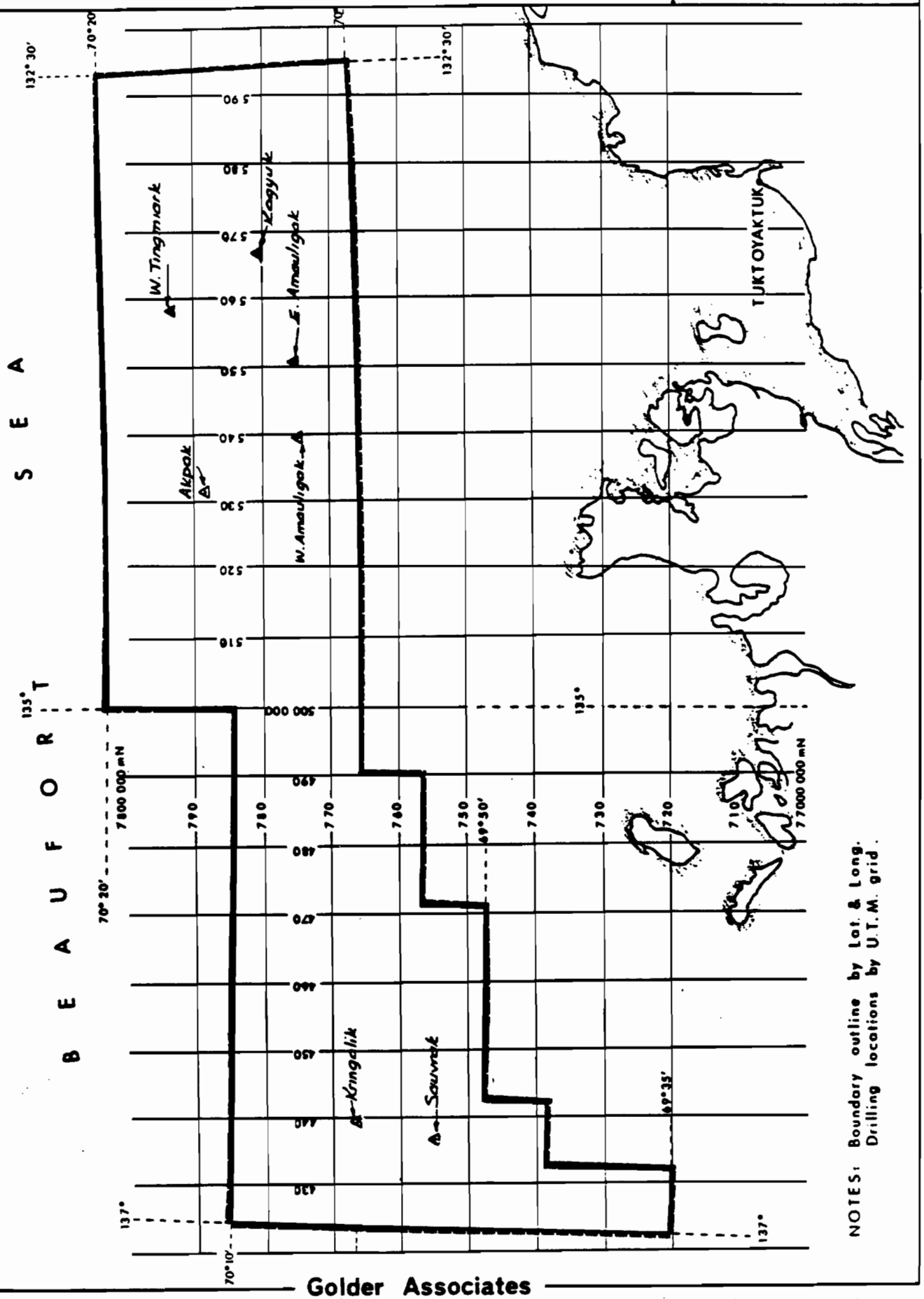
AREA PLAN
showing
APPROXIMATE LOCATION
of
INVESTIGATED AREA

N.T.S.	Figure. 1	Oct '81

AREA PLAN SHOWING APPROXIMATE LOCATIONS OF INVESTIGATED SITES

Figure 2



Project No. 81-1102 Drawn G.A. Reviewed ..... Date Apr. '81

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WEST AMAULIGAK : BOREHOLE LOCATIONS

Figure. 3

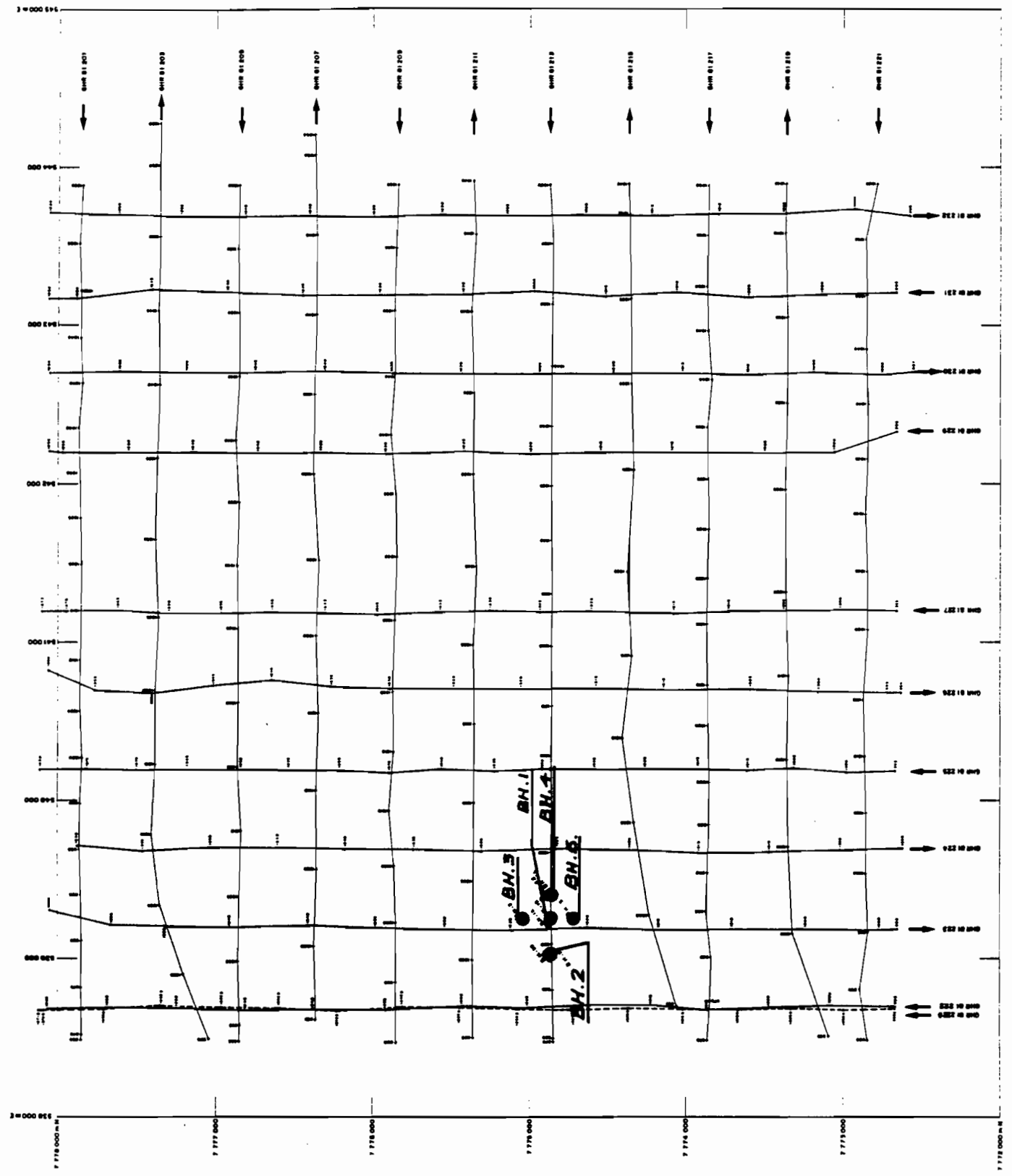
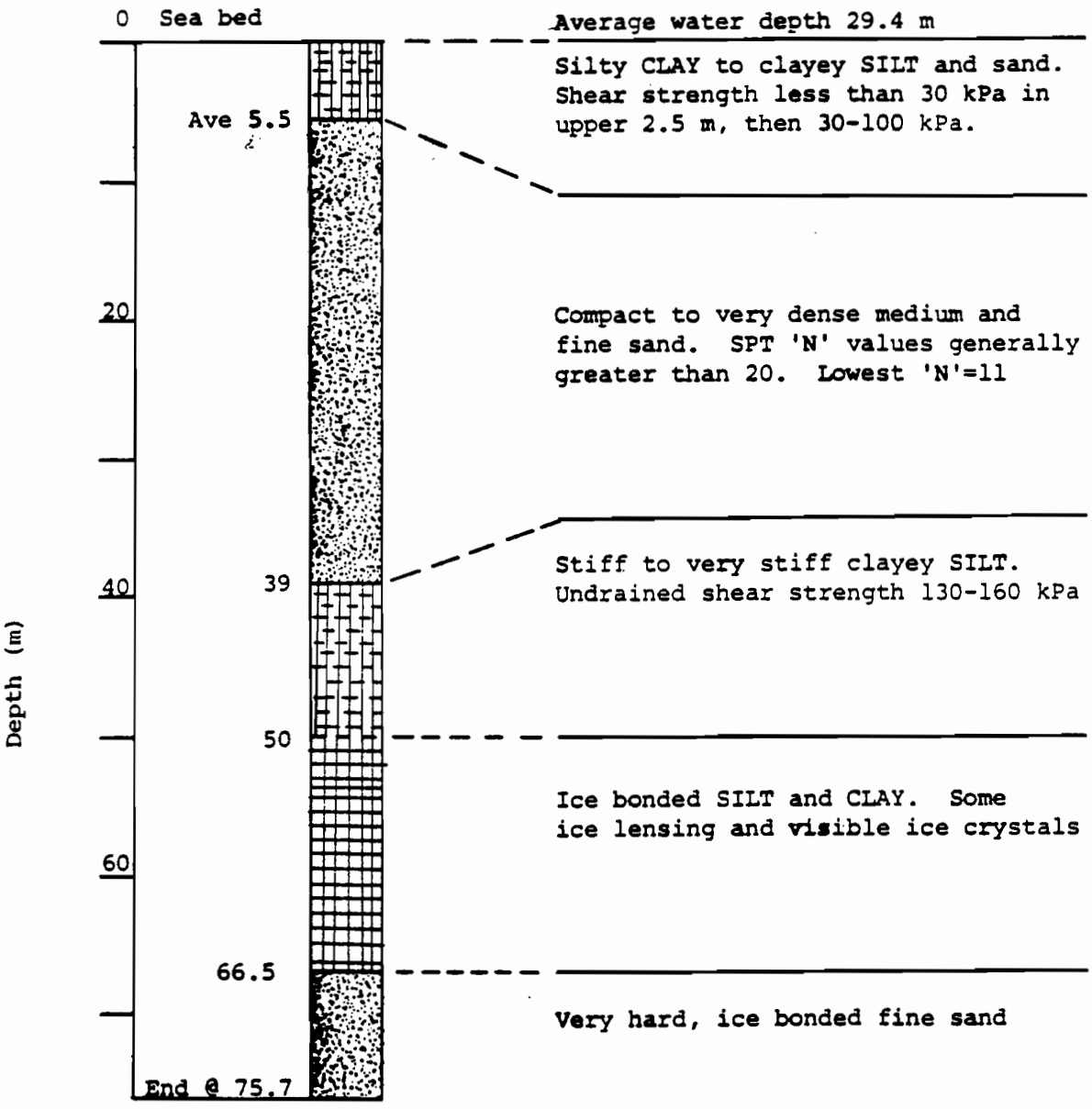


TABLE 1
Locations and Depths for West Amauligak Rotary Boreholes
(Locations in UTM Zone 8, WAD 72)

Borehole		BH1	BH2	BH3	BH4	BH5
Location	N	7 774 853	7 774 851	7 755 041	7 774 850	7 774 714
	E	539 267	539 024	539 269	539 402	539 264
Depth(m)		45.7	45.3	46.5	42.0	75.7

WEST AMAULIGAK: SUMMARY LOG

Figure 4



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PROJECT NO. 812-2102 DRAWN BAD REVIEWED DATE Dec. '81

GEOLOGICAL SECTION THROUGH WEST AMAULIGAK

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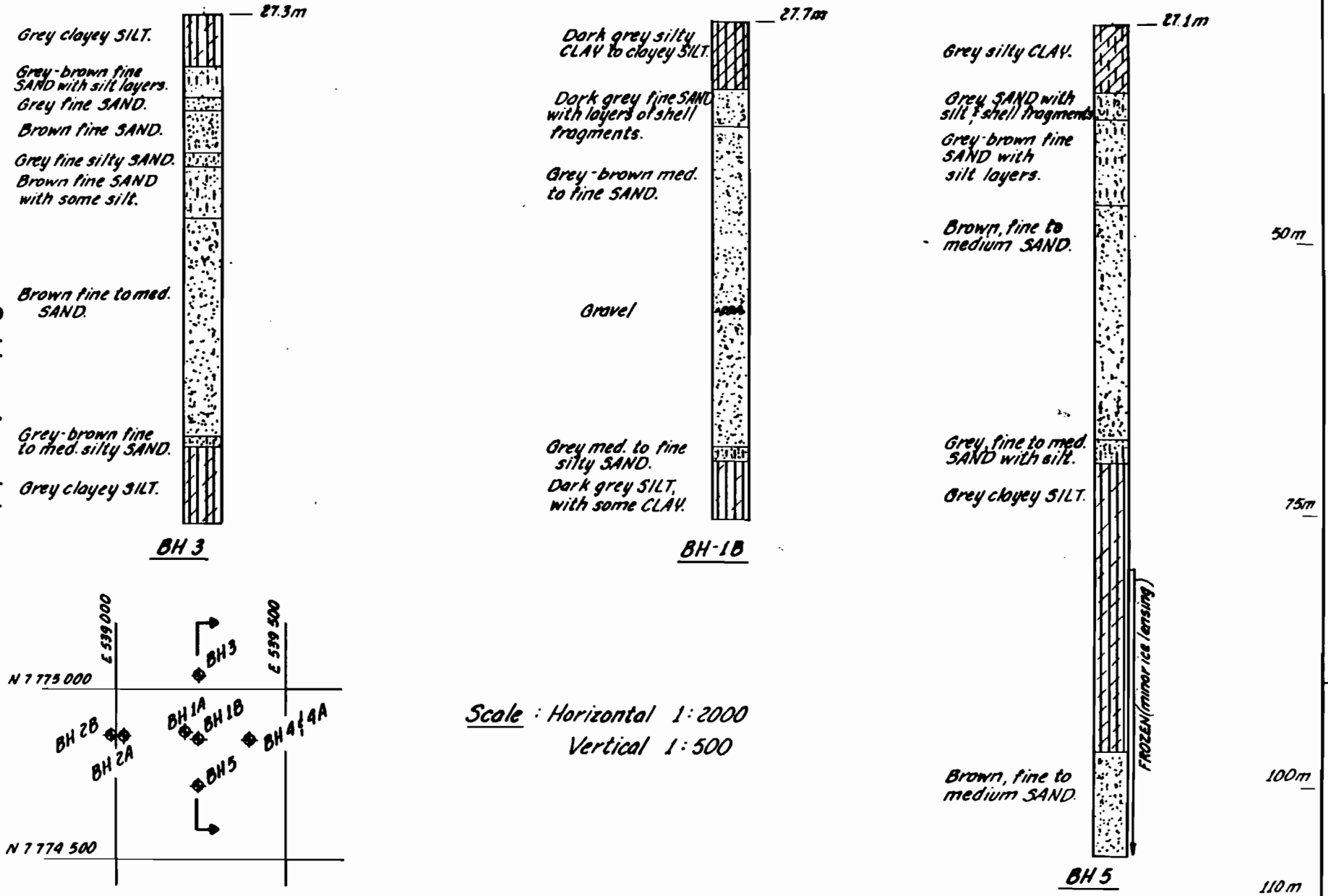
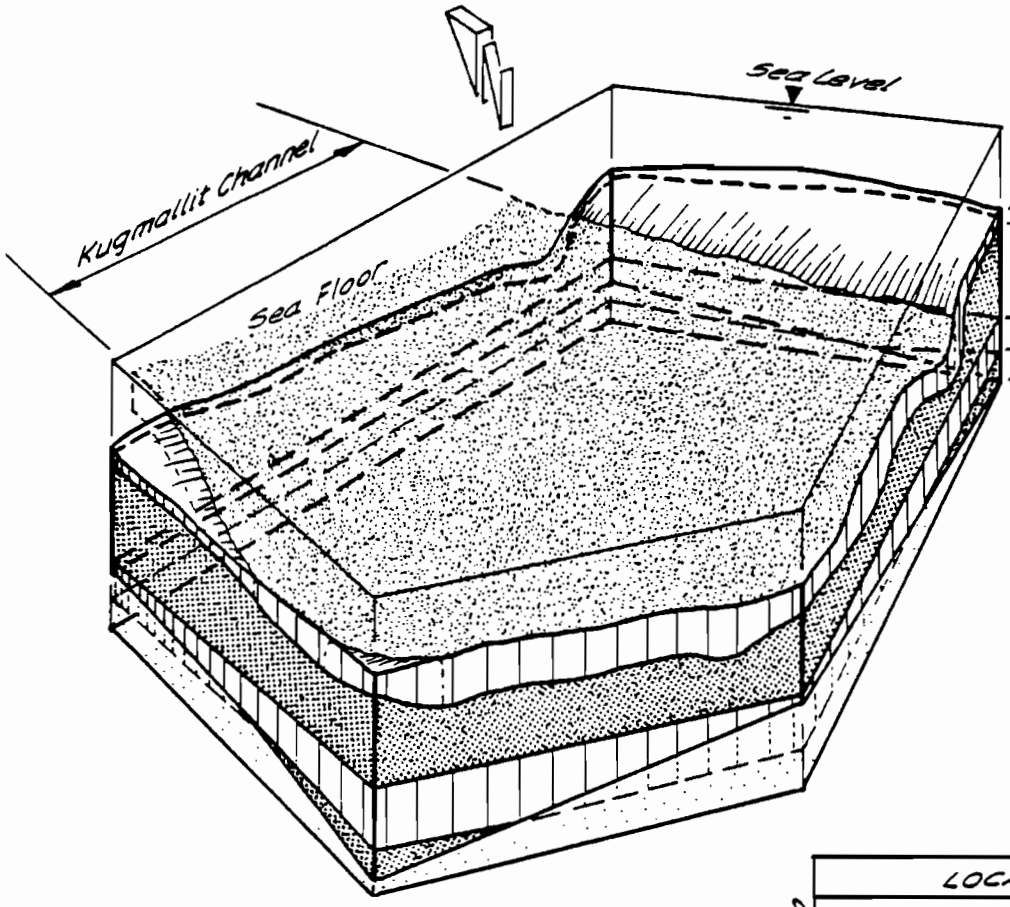


Scale : Horizontal 1:2000
Vertical 1:500

Figure 5

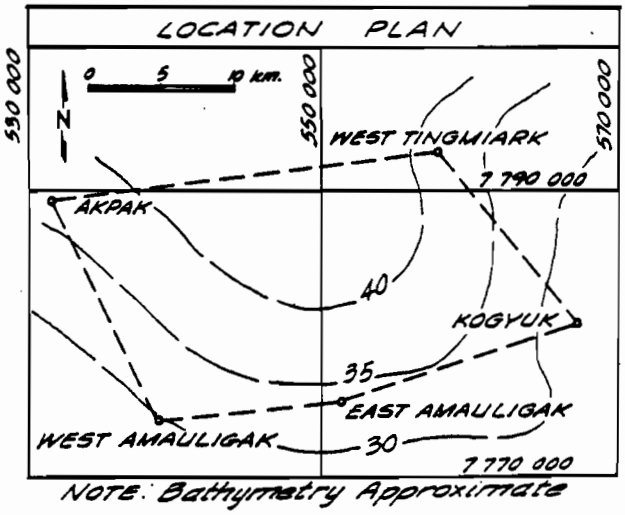
REGIONAL GEOLOGY IN EAST OF PROJECT AREA.

Figure 6



UNIT	DESCRIPTION
1	Clayey SILT
2	SAND
3	Clayey SILT
4	SAND

Schematic only - Not to Scale

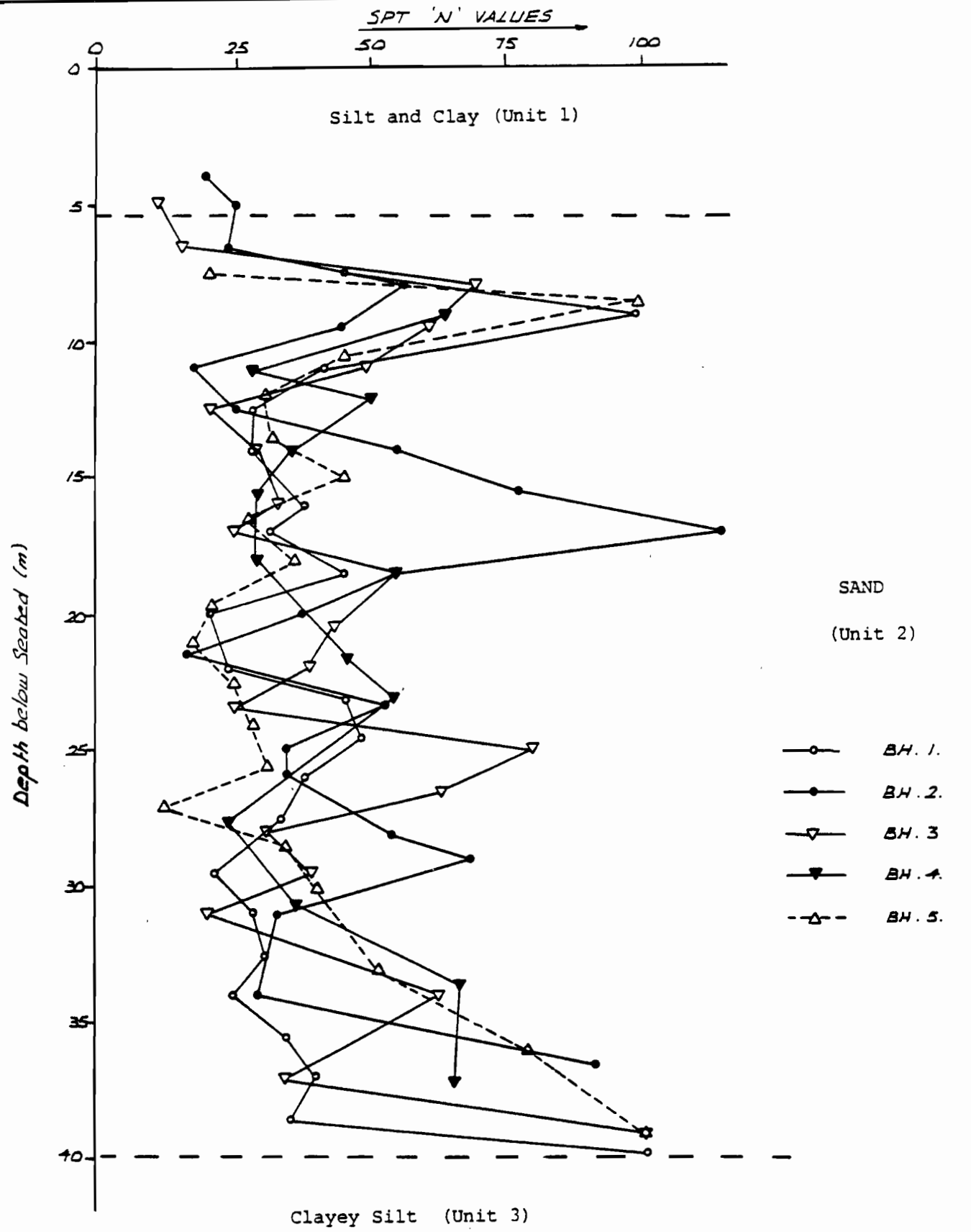


NOTE: Bathymetry Approximate

PROJECT NO. 812-2102 DRAWN BG REVIEWED ..... DATE Feb '92

WEST AMAULIGAK SPT 'N' VALUES (UNIT 2 - SAND)

Figure 7



Project No. 812-2102 Drawn GP Reviewed Date Dec '81

TABLE 2 WEST AMAULIGAK TRIAXIAL TESTS

Borehole No.	Sample No.	Depth (m)	Type of Test	Cell Pressure kPa	Back Pressure kPa	Ratio** σ'_3/σ'_v	Rate of Strain %/Hr	Failure: Deviator Stress (kPa)	Failure: % Strain	Failure: Pore Pressure (kPa)	Comments
1	3	4.2- 4.4	CU*	380	345	1.03	3.3	75	17.0	-	
1	4	5.3- 5.5	uncon	0	-	-	3.3				Not failed
2	27	41.5-42.1	CU*	690	276	1.06	3.8	390	7.7	503	
2	29	44.5-45.1	CU	369	49	0.77	1.0	305	4.9	204	
3	2	3.0- 3.7	UU*	324	-	-	3.2	53	15.0	310	u=269 kPa at start
3	24A	41.3-42.1	CU*	700	276	1.07	3.2	344	6.6	534	
3	24B	41.3-42.1	UU*	700	-	-	3.2	104	2.6	645	u=627 kPa at start
3	26A	42.7-43.4	CU	700	255	1.09	3.3	330	3.8	496	
3	26B	42.7-43.4	71mm UU	430	-	-	60.0	73	2.0	431	u=431 kPa at start
3	26C	42.7-43.4	35mm UU	430	-	-	60.0	179	3.6	403	u=428 kPa at start
3	29A	45.7-46.5	3 Pt CU	105	51	0.12	1.0	137	2.9	73	
				352	51	0.69	1.0	327	4.3	220	
				595	52	1.25	1.0	501	4.4	353	
3	29B	45.7-46.5	Anis-otropic CU	321 Cell 175 Dev.	62	-	1.0	338	3.9	162	Two additional tests tests at different cell & pore pressure
4	17	38.1-38.7	CU	283	54	0.63	1.0	272	6.0	177	
5	27A	46.6-47.2	71mm UU*	758	-	-	3.3	90	6.9	724	u=724 kPa at start
5	27B	46.6-47.2	35mm UU	760	-	-	12.0	371	9.0	601	u=546 kPa at start

*Denotes tests performed on FRANK BRODERICK

** σ'_3 = effective isotropic consolidation pressure

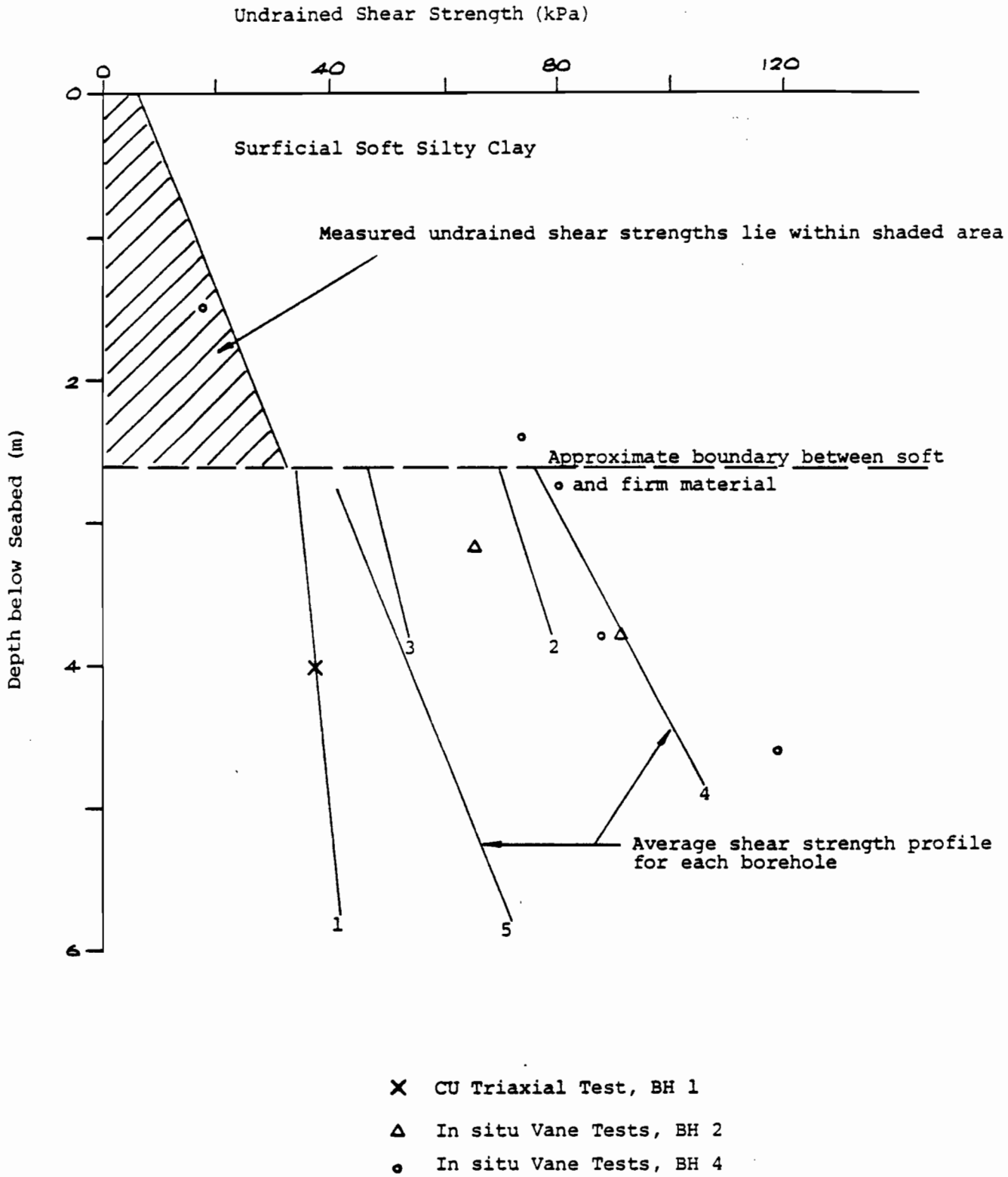
σ'_v = effective in-situ overburden pressure

TABLE 3 WEST AMAULIGAK CONSOLIDATION TESTS

BOREHOLE NO.	SAMPLE	DEPTH (m)	PRECONSOLIDATION PRESSURE kPa	OVER CONSOLIDATION RATIO(OCR)	COMPRESSION INDEX C_c
3	28	44.3-45.0	620	1.5	0.39
4	18	39.8-40.2	335	0.9	0.34
5	24	40.5-41.1	600	1.5	0.33
5	25	42.1-42.7	400	1.0	0.41
5	27	46.6-47.2	385	0.9	0.41

WEST AMAULIGAK
SHEAR STRENGTH OF SURFICIAL MATERIAL

Figure 8



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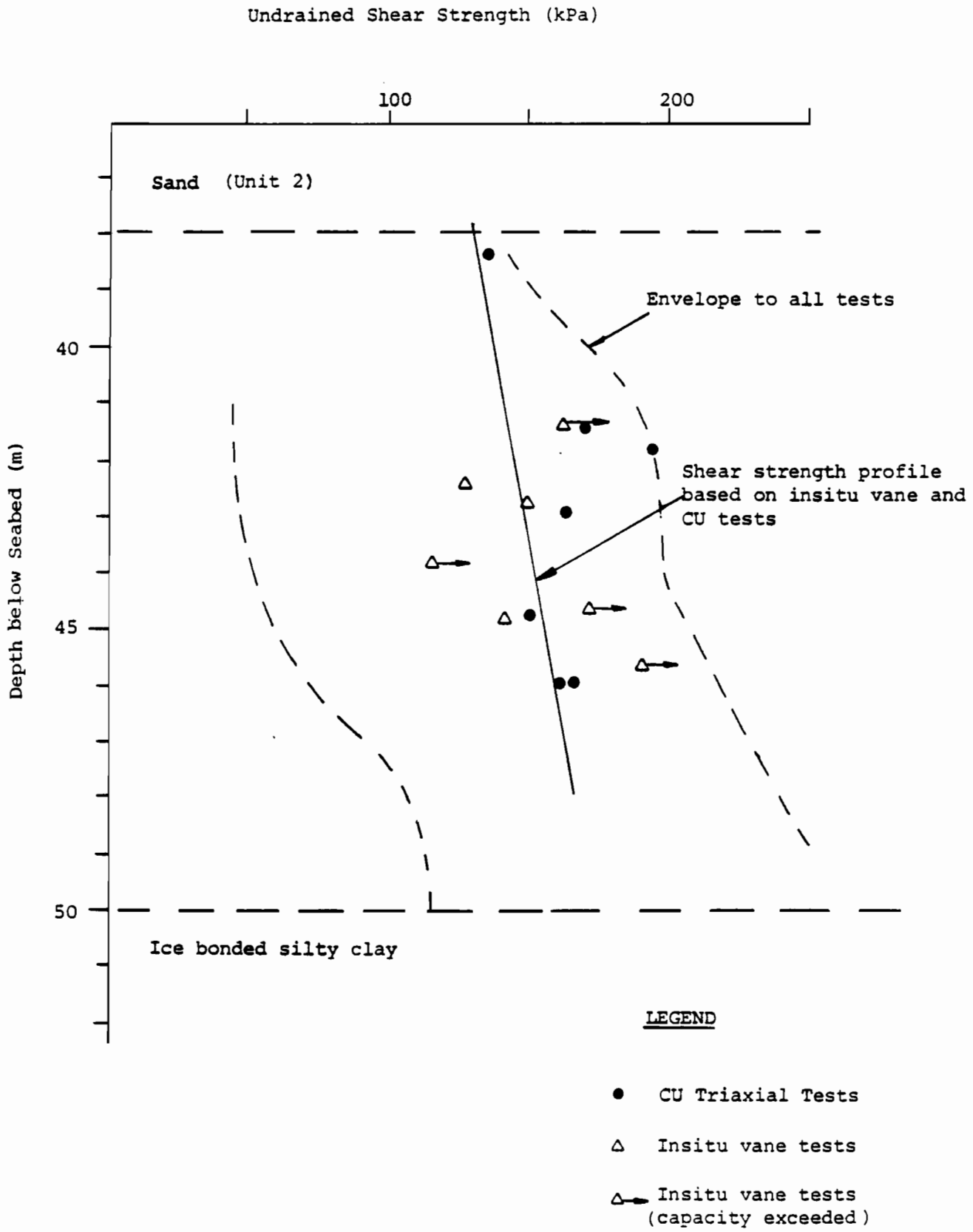
WEST AMAULIGAK SHEAR STRENGTH OF LOWER CLAYEY SILT MATERIAL
(Unit 3)

Figure 9



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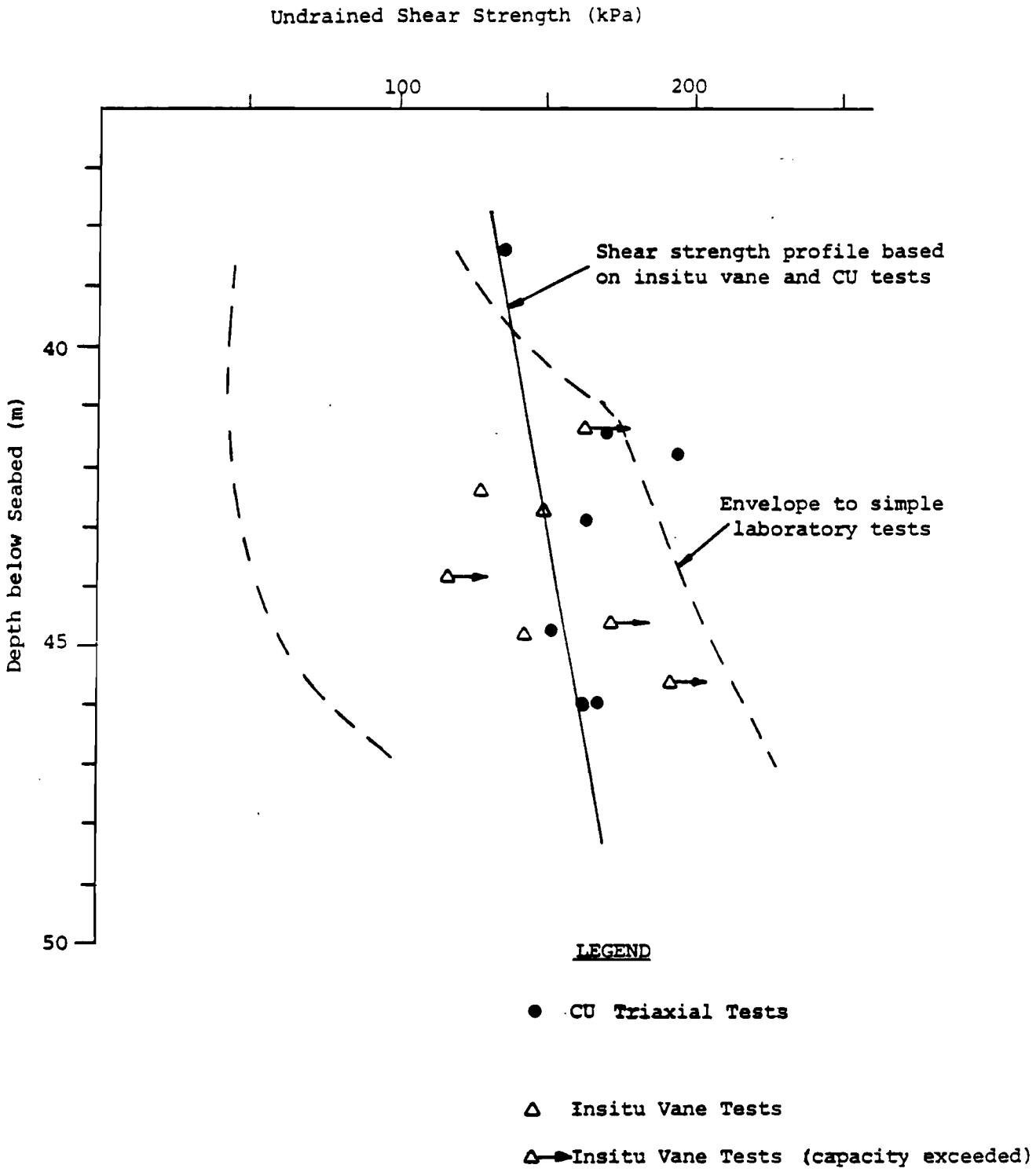
COMPARISON OF SHEAR STRENGTH MEASUREMENTS

Figure 10



APPENDIX A

Borehole Logs, Foundation Investigation

GRAIN SIZE SCALE: M.I.T. STANDARD

BOULDERS	Large than 200 mm
COBBLES	60 mm to 200 mm
GRAVEL	2 mm to 60 mm
SAND	0.06 mm to 2 mm
SILT	0.002 to 0.06 mm
CLAY	Smaller than 0.002 mm

COMPOSITION:

"and"	36 to 50%
"y" or "ey"	21 to 35%
"some"	11 to 20%
"trace"	0 to 10%

EXAMPLE:

Gravel 70% Sand 22%
Pass #200 Sieve 8%
Sandy Gravel, Trace of Silt

EXCEPTION:

Silt 70% Clay 30%
And plots above 'A' line
Silty clay not clayey silt

LIST OF ABBREVIATIONS

The abbreviations commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

I. SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
DS Denison type sample
FS foil sample
RC rock core
ST slotted tube
TO thin-walled, open
TP thin-walled, piston
WS wash sample

II. PENETRATION RESISTANCES

Dynamic Penetration Resistance: The number of blows by a 63.5 kg hammer dropped 760mm required to drive a 50mm diameter, 60 degree cone 0.3 m , where the cone is attached to 'A' size drill rods and casing is not used.

Standard Penetration Resistance, *N*: The number of blows by a 63.5 kg hammer dropped 760 mm required to drive a 50mmdrive open sampler

WH sampler advanced by static weight—weight, hammer

PH sampler advanced by pressure—pressure, hydraulic

PM sampler advanced by pressure—pressure, manual

III. SOIL DESCRIPTION

(a) *Cohesionless Soils*

Relative Density	*N, blows/0.3 m*
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) *Cohesive Soils*

Consistency	c_u, kPa
Very soft	Less than 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	over 200

IV. SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH combined analysis, sieve and hydrometer[1]
Q undrained triaxial[2]
R consolidated undrained triaxial[2]
S drained triaxial
U unconfined compression
V field vane test
F fall cone
L lab vane
P pocket penetrometer

NOTES:

[1]Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.
[2]Undrained triaxial tests in which pore pressures are measured are shown as $\bar{Q}$ or $\bar{R}$.

Summary of Ground Ice Descriptive System
(After Pihlainen and Johnston 1963, Linell and Kaplar 1966)

A. ICE NOT VISIBLE[a]

Group Symbol	Subgroup Description	Subgroup Symbol	Field Identification
N	Poorly bonded or friable	Nf	To determine presence of excess ice, use procedure under note[b] and hand magnifying lens as necessary. For soils not fully saturated, estimate degree of ice saturation: medium, low. Note presence of crystals or of ice coatings around larger particles.
	No excess ice Well-bonded	Nbn Nb	
	Excess ice	Nbe	

B. VISIBLE ICE—LESS THAN 1 INCH THICK[a]

Group Symbol	Subgroup Description	Subgroup Symbol	Field Identification
V	Individual ice crystals or inclusions	Vx	For ice phase, record the following when applicable: Location, Orientation, Thickness, Length, Spacing, Hardness, Structure, Colour } per Group C Size, Shape, Pattern of arrangement Estimate volume of visible segregated ice present as percentage of total sample volume.
	Ice coatings on particles	Vc	
	Random or irregularly oriented ice formations	Vr	
	Stratified or distinctly oriented ice formations	Vs	

C. VISIBLE ICE—GREATER THAN 1 INCH THICK

Group Symbol	Subgroup Description	Subgroup Symbol	Field Identification
ICE	Ice with soil inclusions	ICE + soil type	Designate material as ICE[c] and use descriptive terms as follows, usually one item from each group, when applicable: *Hardness*: HARD; SOFT (of mass, not individual crystals) *Structure*[d]: CLEAR, CLOUDY, POROUS, CANDLED, GRANULAR, STRATIFIED *Colour* (Examples): COLOURLESS, GRAY, BLUE *Admixtures* (Examples): CONTAINS FEW THIN SILT INCLUSIONS
	Ice without soil inclusions	ICE	

(a) Frozen soils in the N group may, on close examination, indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. The impression received by the unaided eye, however, is that none of the frozen water occupies space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.

(b) When visual methods are inadequate, a simple field test to aid evaluation of volume of excess ice can be made by placing some frozen soil in a small jar, allowing it to melt, and observing the quantity of supernatant water as a percentage of total volume.

(c) Where special forms of ice such as hoarfrost can be distinguished, more explicit description should be given.

(d) Observer should be careful to avoid being misled by surface scratches or frost coating on the ice.

RECORD OF BOREHOLE BH 1

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 853 E 539 267 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** August 23, 1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
0	Soft, becoming firm to stiff, dark grey silty CLAY/clayey SILT, traces of organics and shell fragments	1	TO			L 5.5 F 7.8			MH
		2	TO			L 27 F 8.1 P 14			
						R 38			
		3	TO			L 47 L 19 F 41			γ = 18.4 kN/m^3 CU Triaxial
		4	TO			L 37 F 45			γ = 19.1 kN/m^3
6.2	Compact to dense, dark grey, fine SAND, trace of silt and shell fragments, some layering, organic layers	5	TO			L 37 F 34			M
		6	DO			F 29			
8.7	Dense to very dense, brown uniform, fine SAND, trace of medium sand & silt in various layers	7	DO						N = 107 for 225 mm
10.0									

RECORD OF BOREHOLE BH 1

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 853 E 539 267 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** August 23, 1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1 100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_P W W_L 20 40 60 80	ADDITIONAL LAB TESTING
10.0	Compact to dense, brown, uniform, fine SAND, trace of medium sand and silt in various layers	8	DO						M
		9	DO						
		10	DO						M
		11	DO						
15.7	Dense, grey/brown medium SAND, with some fine sand, clean, traces of darker particles, in layers	12	DO						M
		13	DO						
20.0									

RECORD OF BOREHOLE BII 1

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 853 E 539 267 **DATUM:** Sea floor

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20.0		14	DO						M
	Dense, grey/brown medium SAND, traces of darker particles in layers	15	DO						
		16	DO						M
		17	DO						
	Occasional fine gravel pieces @ 25.9-26.4 m	18	DO						M
		19	DO						
		20	DO						
30.0									

'N' VALUE BLOWS PER 300mm: 20 40 60 80

WATER CONTENT: W_p W W_L 20 40 60 80

RECORD OF BOREHOLE BH 1

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DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
30.0	Dense, grey/brown medium SAND	21	DO						M
	Occasional thin layers (50 mm typically) of grey silt @ 32.5-33.8 m	22	DO						
		23	DO						M
		24	DO						
		25	DO						
		26	DO						M
39.0	Very dense, grey, silty, medium and fine SAND								M
40.0		27	DO						N = 105 for 225 mm

'N' VALUE: 20 40 60 80

WATER CONTENT: 20 40 60 80

RECORD OF BOREHOLE BH 1

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 853 E 539 267 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** August 23, 1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
40.0	Very dense, grey, silty medium and fine SAND								
40.5	Stiff to very stiff, dark grey SILT, with some clay thinly layered	28	TO	0	V 130	L 106 L 28 F 112 F 125 P 150			
		30	TO	-1.1		F 80 L 42 P 115			
		31	TO	-1.7	V 146	L 50 F 120 P 137			
		33	TO						
45.7	End of Borehole								

RECORD OF BOREHOLE BH 2

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 851 E 539 024 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** September 21, 1981 **WATER DEPTH:** 29.4 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
0	Very soft to soft grey clayey SILT	4	TO	-1.1		L 6			W_n=111.4
		5	DO	0.6	V 66 V 90				
3.6	Stiff grey clayey SILT interlayered with brown fine to medium SAND	6	DO	0.6					
		7	DO	-0.6					
7.3	Dense to very dense brown fine to medium SAND	8	DO	0.6					M
		9	DO	0.6					M
10.0									

'N' VALUE △ BLOWS PER 300 mm: 20 40 60 80

WATER CONTENT W_p W W_L: 20 40 60 80

RECORD OF BOREHOLE BH 2

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 851 E 539 024 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** September 21, 1981 **WATER DEPTH:** 29.4 m

DEPTH (m) 1 100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
10.0							20 40 60 80	20 40 60 80	
10.4	Compact, grey silty fine SAND	10	DO	0.6					M
		11	DO	-0.6					M
14.0		12	DO	-1.1					M
	Dense to very dense, occasionaly compact brown medium SAND with some fine sand and a trace of silt	13	DO	0.6					M
		14	DO	-1.1					
		15	DO	0					M
20.0									

RECORD OF BOREHOLE BH 2

UTM GRID **ZONE 8** **WAD 72**

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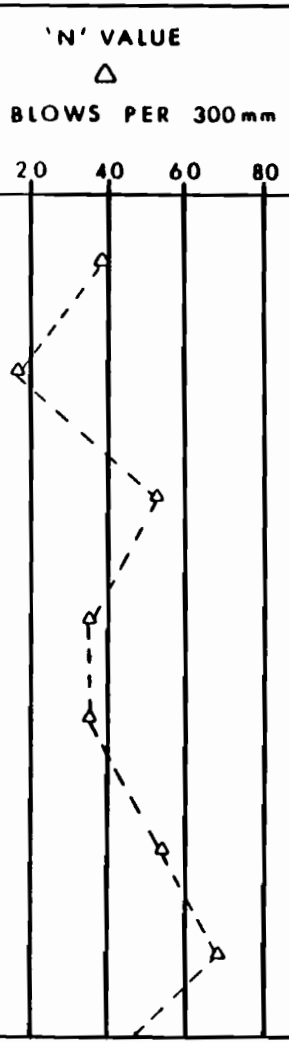
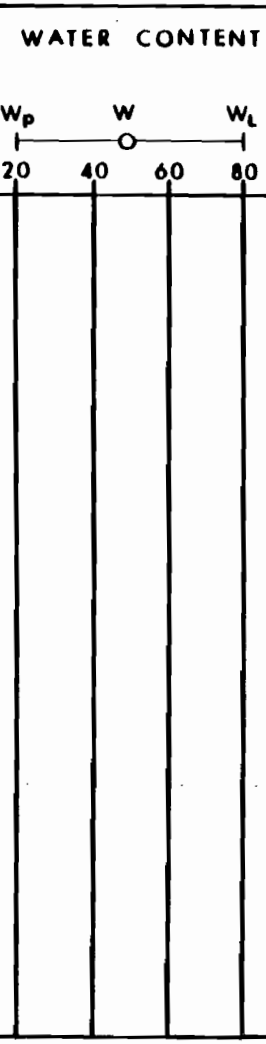
DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
20.0		16	DO	0.6					M
	Dense to very dense, occasionally compact brown medium SAND with some fine sand and a trace of silt	17	DO	0					M
		18	DO	0					M
		19	DO	0					M
		20	DO	0					M
		21	DO	0					M
	gravel, 0.12 m thick @ 29.3 m	22	DO	0					M
30.0									





RECORD OF BOREHOLE BH 2

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 851 E 539 024 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** September 21, 1981 **WATER DEPTH:** 29.4 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
30.0							20 40 60 80	20 40 60 80	
	Dense to very dense brown medium SAND with some fine sand and a trace of silt	23	DO	0					M
		24	DO	0					M
		25	DO	0					M
37.2	Dense grey fine to medium SAND								
37.9	Stiff to very stiff grey clayey SILT								
40.0									

RECORD OF BOREHOLE BH 2

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 851 E 539 024 **DATUM:** Sea floor

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DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
40.0		26	DO	0		F 108 F 83 L 46 P 96 R 195			
	Stiff to very stiff grey clayey SILT	27	TO	-0.6					CU Triaxial γ = 18.8 kN/m^3
		28	TO	-0.6		F 233 F 162 L 78 P 160			
		29	TO	-1.1		F 84 L 61 P 98 R 152			CU Triaxial γ = 18.8 kN/m^3
45.3	End of Borehole								

RECORD OF BOREHOLE BH 3

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 775 041 **E** 539 269 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE** September 22,1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
0	Very soft to firm grey clayey SILT	1	TO			F 16 L 18 P 6	20 40 60 80	20 40 60 80	UU Triaxial γ=18.2 kN/m^3
		2	TO	-1.1		F 55 L 53 P 42 Q 26			
4.6	Compact grey -brown fine SAND with grey silt interlayers	3	DO						
		4	DO	-0,6					M
7.6	Very dense grey fine SAND	5	DO	0					M
8.8	Dense to very dense brown fine SAND	6	DO	0.6					M
10.0									

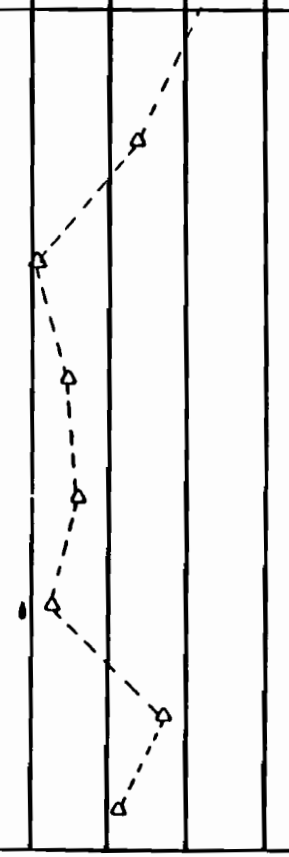
RECORD OF BOREHOLE BH 3

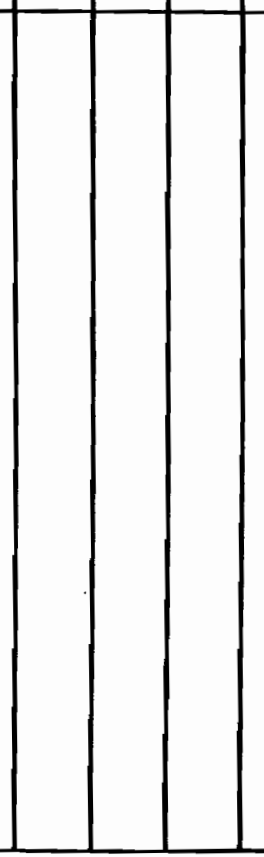
UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 775 041 E 539 269 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** September 22, 1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm	WATER CONTENT W_P W W_L	ADDITIONAL LAB TESTING
10.0	Dense to very dense brown fine SAND	7	DO	0.6					M
		8	DO	0					M
12.5	Grey silty fine SAND with brown fine sand interlayers								
13.7	Compact, to very dense brown uniform medium and fine SAND with trace of silt	9	DO	1.1					M
		10	DO	1.1					M
		11	DO	1.1					M
		12	DO	0					M
		13	DO	-0.6					M
20.0									





RECORD OF BOREHOLE BH 3

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 775 041 E 539 269 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** September 22,1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
20.0	Compact to very dense brown uniform medium and fine SAND with trace of silt	13					20 40 60 80	20 40 60 80	
		14	DO	1.1					M
		15	DO						
		16	DO	0.6					M
		17	DO	0.6					M
		18	DO	0					M
		19	DO	1.1					M
30.0									

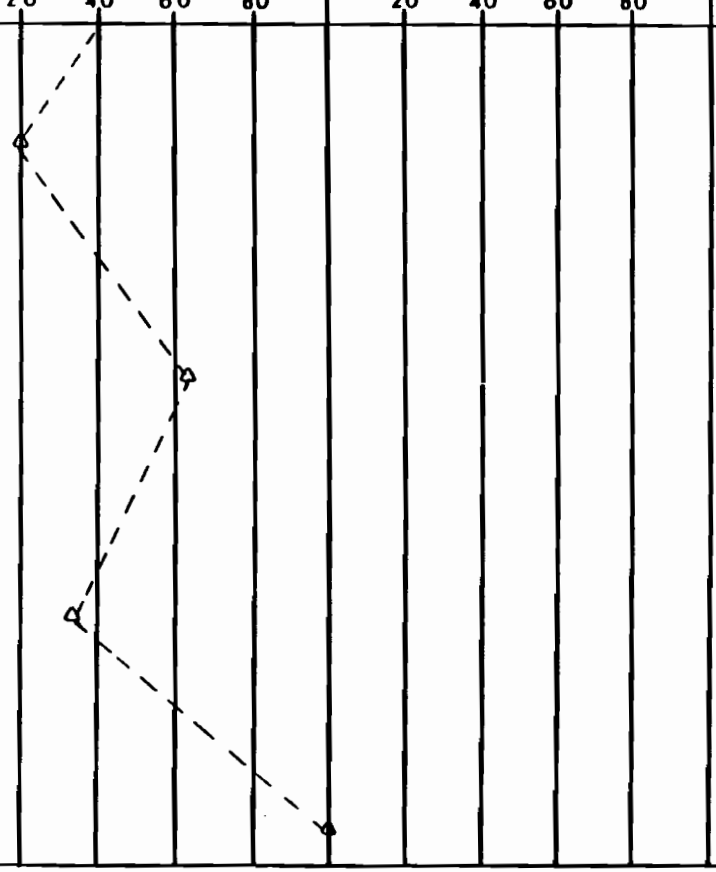
RECORD OF BOREHOLE BH 3

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 775 041 E 539 269 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** September 22, 1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
30.0	Compact to very dense brown uniform medium and fine SAND with trace of silt	20	DO	0.6					M
		21	DO	0.6					
		22	DO						
39.2	Very dense, grey-brown fine to medium silty SAND	23	DO	0.6					N = 100 for 225 mm
40.0									



RECORD OF BOREHOLE BH 3

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 775 041 E 539 269 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** September 22,1981 **WATER DEPTH:** 29.6 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
40.0	as above								
40.5	Very stiff grey clayey SILT	24	TO	-1.1	V 152	L 60 F 160 P 171 R 172 Q 52			γ=19.2 kN/m^3 CU,UU Triaxial
		26	TO	-0.6		*			H, γ=19.1 kn/m^3 CU,UU Triaxial
		28	TO	-0.6	V 117	L 88 F 230 F 116 P 142			H, γ=18.9 kn/m^3 Consolidation
		29	TO	-0.6	V>196	L 76 F 113 P 125 R 169			H, γ=18.9 kn/m^3 3Pt CU Triaxial Anisotropic CU Triaxial
46.5	End of Borehole								

*Sample #26: F 180
L 60
P 134
Q 90
Q 37
R 165

RECORD OF BOREHOLE BH 4

UTM GRID ZONE 8 WAD 72

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 850 E 539 402 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** October 13, 1981 **WATER DEPTH:** 30.2 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
0	Soft becoming stiff, grey silty CLAY, thinly laminated, thin lenses of organics				V 22				
					V 73				
		1	TO	-0.7	V 80	L 54 F 85 P 58			
					V 87				No recovery
		2	TO		V>118				
4.8	Interlayered, firm to stiff silty CLAY and brown fine to medium SAND	3	TO	-0.8		L 48 F 79			
6.8	Compact to very dense, brown, fine to medium SAND. Trace of silt, some organics and shell fragments @ 7.0-7.7 m	4	TO	-0.6		L 62			M
		5	DO						M
10.0									

RECORD OF BOREHOLE BH 4

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 850 E 539 402 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** October 13, 1981 **WATER DEPTH:** 30.2 m

DEPTH (m) 1 100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
10.0									
		6	DO						M
	Compact to very dense brown fine to medium SAND	7	DO						M
		8	DO						
		9	DO						M
		10	DO						M
19.0	Compact to very dense brown medium SAND with some fine SAND and trace of silt								
20.0									

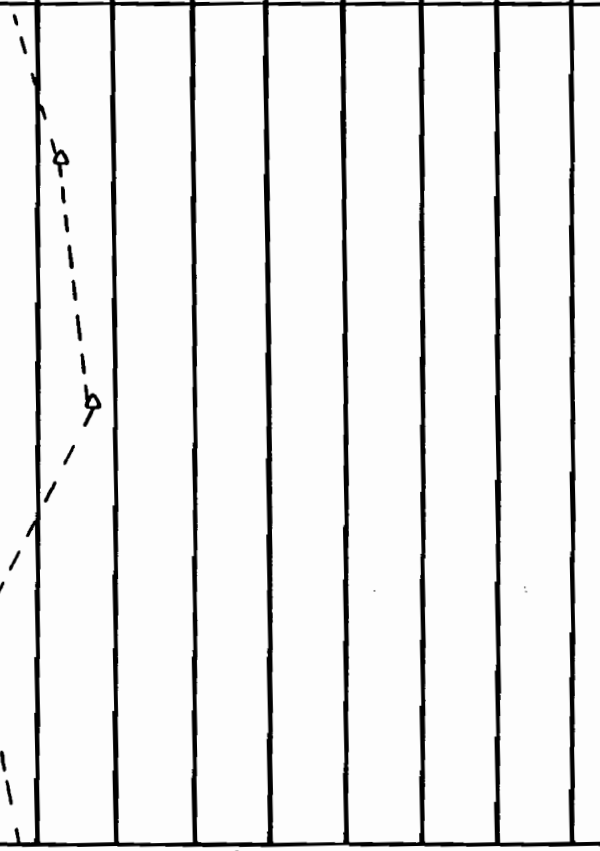
RECORD OF BOREHOLE BH 4

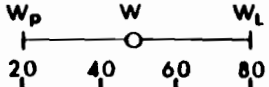
UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 850 E 539 402 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 13,1981 **WATER DEPTH:** 30.2 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
20.0	Comapct to very dense brown fine to medium SAND	11	DO						M
		12	DO						M
		13	DO						M
30.0									





RECORD OF BOREHOLE BH 4

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: Weat Amauligak **LOCATION CO-ORDS:** N 7 774 850 E 539 402 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 13, 1981 **WATER DEPTH:** 30.2 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm (20 40 60 80)	WATER CONTENT W_p W W_L (20 40 60 80)	ADDITIONAL LAB TESTING
30.0	Layered, occasional grey silty clay lenses, typically 6 mm thick, trace of minor organics @ 30.5-31.0 m	14	DO						M
		15	DO						M
36.0	Very dense, grey, fine to medium SAND, some layering occasional grey silty clay lenses	16	DO						M
37.6	Stiff, dark grey, clayey SILT, interbedded with thin layers of sandy silt up to 50 mm, trace of organics	17	TO	-0.6		L 70 F 59 P 144 P 90 R 136			CU Triaxial γ=19.0 kN/m^3
40.0									

RECORD OF BOREHOLE BH 4

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 850 E 539 402 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 13, 1981 **WATER DEPTH:** 30.2 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
40.0	Stiff, dark grey, claye SILT interbedded with thin layers of sandy silt up to 50mm, trace of organics	18	TO	-0.6		L 68 F 67 P 68			II, γ = 18.7 kN/m³ Consolidation
		19	TO	-0.8		L 84 F 120 P 126 F 73			
42.0	End of Borehole								

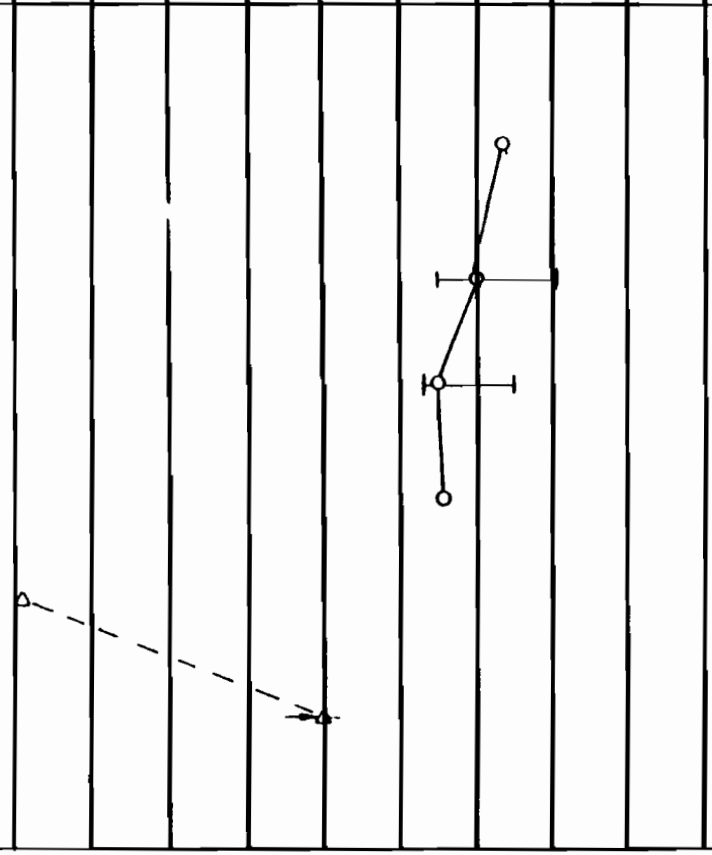
RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10, 1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1 100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
0	Very soft, becoming very stiff, grey, silty CLAY, thinly layered/laminated, occasional shell fragments, organic lenses	1	TO	-1.1					
		2	TO	-1.1		L 33 F 39 P 33			MH
		3	TO	-1.1		L 64 F 62 P 36			
		4	TO	-0.4		L 66 F 112 P 72			
6.0	Compact to dense, grey/ brown fine SAND with trace of silt, some layers of clayey silt, medium sand, shelly sand and black organic layers, typically 3-20 mm, occasionally up to 50 mm and 75 mm	5	DO						M
		6	DO						N=100 for 225 mm
10.0									M



RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10, 1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1 100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
10.0	Comapct to dense, grey/ brown fine SAND with trace of silt, some layers of silt and medium sand	7	DO						M
		8	DO	0.5					
		9	DO	0.6					M
		10	DO	0.6					
		11	DO						M
16.4	Compact to dense, brown, uniform medium SAND with some fine sand and trace of silt	12	DO	0.7					
		13	DO						M
20.0									

RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10, 1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
20.0							20 40 60 80	20 40 60 80	
		14	DO						
	Compact to dense, brown, uniform medium SAND with some fine sand and trace of silt	15	DO	0.7					M
		16	DO	0.6					
		17	DO						M
		18	DO						
		19	DO						M
30.0		20	DO						

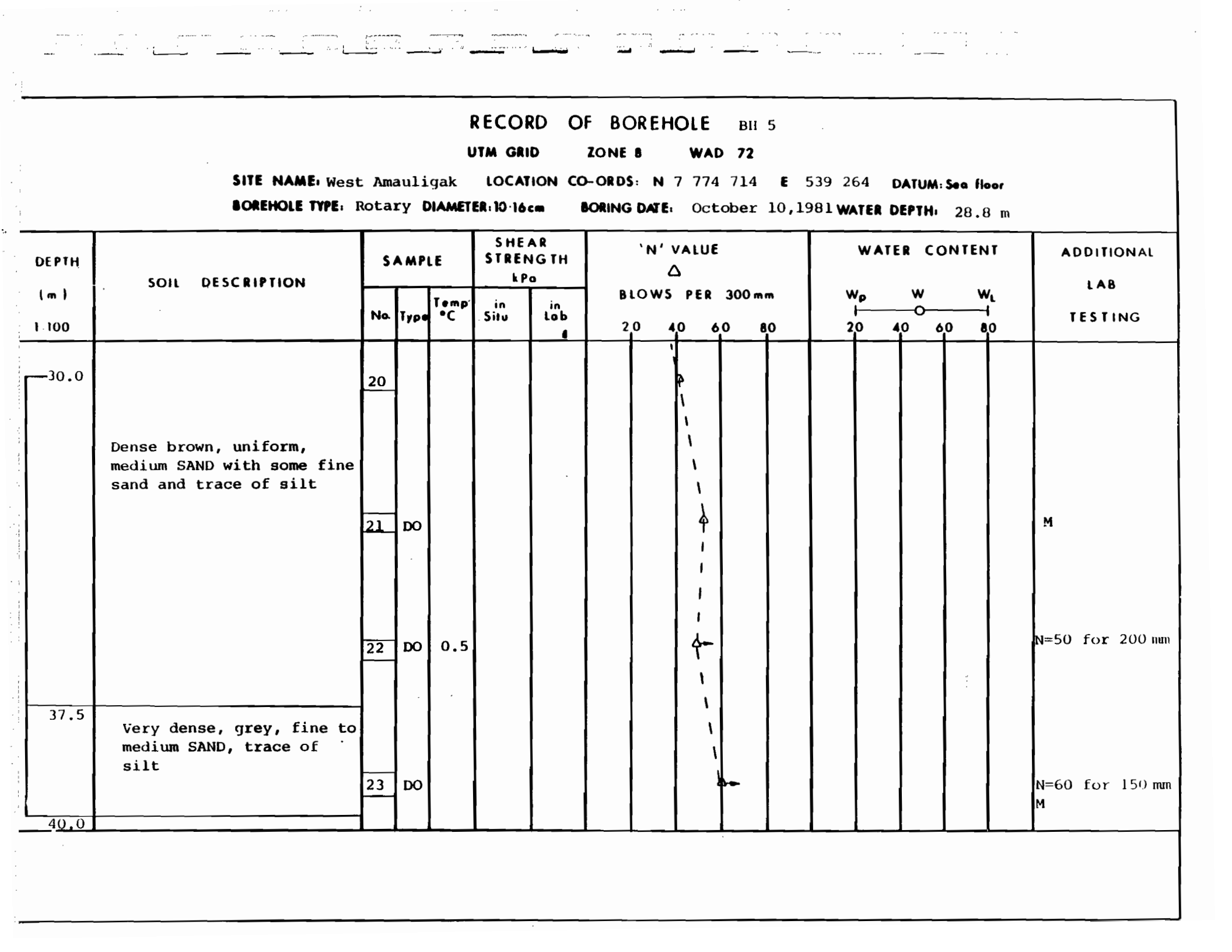
RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** October 10,1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT Wp W WL 20 40 60 80	ADDITIONAL LAB TESTING
30.0	Dense brown, uniform, medium SAND with some fine sand and trace of silt	20							
		21	DO						M
		22	DO	0.5					N=50 for 200 mm
37.5	Very dense, grey, fine to medium SAND, trace of silt	23	DO						N=60 for 150 mm M
40.0									



RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10,1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
40.0									
	Firm to stiff, grey, clayey SILT, clay layers up to 75 mm, occasional thin lenses of sand and thin organic seams	24	TO	-0.5	V>165	L 66 F 176 P 168			H, γ =19.0 kN/m^3 Consolidation
		25	TO	-0.6		L 68 F 176 P 168			γ =18.5 kN/m^3 Consolidation
		26	TO	-0.5	V>177	L 55 F 109 P 102			H
		27	TO	-0.8		L 113 F 230 P 156 Q 45 Q 185			Consolidation UU,UU Triaxial γ =19.0 kN/m^3
	as above								
50.0									

RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10,1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
50.0		28	TO	-1.0		L 120 F>250 P 172			H
	Ice bonded, hard, grey, clayey SILT/silty CLAY, organic streaks, ice lensing up to 1.5 mm thick on steeply sloping planes	29	TO	-1.6		L 110 F 225			
		30	TO	-1.8		F 250 P 174			
		31	TO	-1.6		L>125 F>250 P 174			MH
60.0									

RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10·16cm **BORING DATE:** October 10,1981 **WATER DEPTH:** 28.8 m

DEPTH (m) 1:100	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300 mm 20 40 60 80	WATER CONTENT W_p W W_L 20 40 60 80	ADDITIONAL LAB TESTING
60.0	Ice bonded, hard, grey, clayey SILT/silty CLAY, organic streaks, ice lensing up to 1.5 mm thick on steeply sloping planes	32	TO	-1.7		L>125 F>250 P 192			
		33	TO						
66.5	Ice bonded, very dense, brown, fine to medium SAND								
70.0									

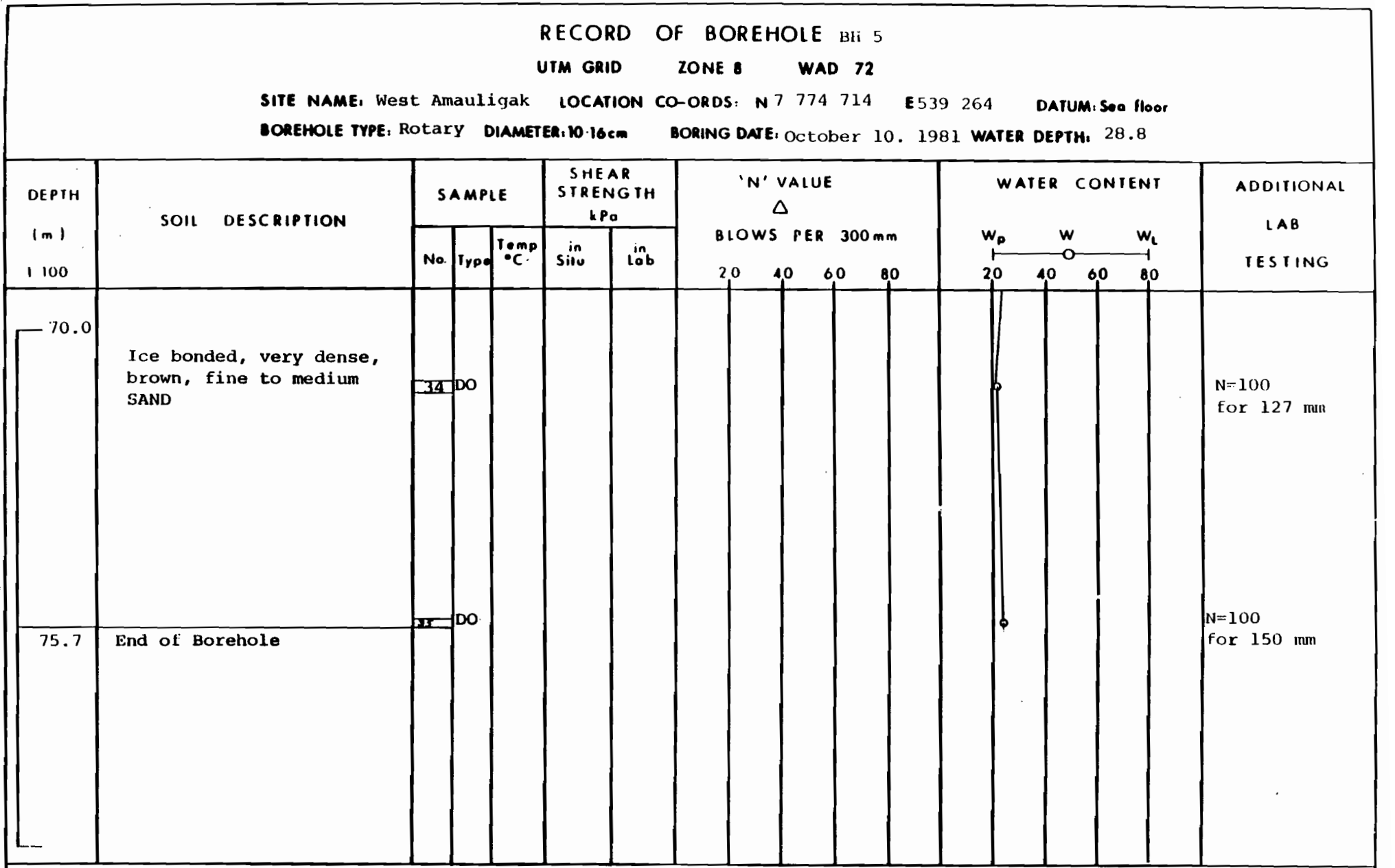
RECORD OF BOREHOLE BH 5

UTM GRID **ZONE 8** **WAD 72**

SITE NAME: West Amauligak **LOCATION CO-ORDS:** N 7 774 714 E 539 264 **DATUM:** Sea floor

BOREHOLE TYPE: Rotary **DIAMETER:** 10-16cm **BORING DATE:** October 10. 1981 **WATER DEPTH:** 28.8

DEPTH (m)	SOIL DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE Temp °C	SHEAR STRENGTH kPa in Situ	SHEAR STRENGTH kPa in Lab	'N' VALUE △ BLOWS PER 300mm	WATER CONTENT W_p W W_L	ADDITIONAL LAB TESTING
70.0	Ice bonded, very dense, brown, fine to medium SAND	34	DO						N=100 for 127 mm
		35	DO						N=100 for 150 mm
75.7	End of Borehole								



APPENDIX B

Laboratory Tests, Foundation Investigation

WEST AMAULIGAK BH1: LABORATORY TEST RESULTS

BOREHOLE TYPE: Rotary

DATUM: Sea Floor

Sample Number	Depth(m) From - To	W_n %	W_L %	W_P %	Plasticity Index	Unit Weight (kN/m^3)	Grain Size Analyses
1	0.5 - 1.4	56.3					x
2	1.8 - 2.7	35.3					
3	3.8 - 4.6	31.1	50	20	30	18.4	
4	5.0 - 5.8	30.7	44	21	23	19.1	
5	6.7 - 7.3						
6	7.3 - 7.8						x
7	8.8 - 9.2						
8	10.5 - 11.0						x
9	12.2 - 12.7						
10	13.7 - 14.2						x
11	15.4 - 15.9						
12	16.9 - 17.4						x
13	18.4 - 18.9						
14	19.8 - 20.3						x
15	21.3 - 21.8						
16	22.9 - 23.3						x
17	24.4 - 24.8						
18	25.9 - 26.4						x
19	27.4 - 27.9						
20	29.0 - 29.4						
21	30.5 - 30.9						x
22	32.0 - 32.5						
23	33.5 - 34.0						x
24	35.1 - 35.5						
25	36.6 - 37.0						
26	38.1 - 38.6						x
27	39.6 - 40.0						x
28	41.2 - 41.8	33.3	37	24	13		
29	42.6 - 43.4	33.8					
30	43.5 - 44.1	32.8	39	23	16		
32	45.1 - 45.7	36.8	39	25	14		

GRAIN SIZE DISTRIBUTION

Table: VI. 2

BOREHOLE 1 BOREHOLE TYPE: Rotary SITE NAME: West Amauligak

Depth		Sample No.	Gravel	Sand			Fines	Silt			Clay
From	To	—	—	C	M	F	—	C	M	F	—
0.5	1.4	1			1	2	97	5	9	17	66
7.3	7.8	6			5	69	26				
10.5	11.0	8			48	46	6				
13.7	14.2	10			23	58	19				
16.9	17.4	12			80	18	2				
19.8	20.3	14		1	81	17	1				
22.9	23.3	16		4	73	22	1				
25.9	26.4	18	1	7	84	8					
30.5	30.9	21		3	86	11					
33.5	34.0	23		1	62	37					
38.1	38.6	26			88	12					
39.6	40.0	27		1	57	17	25				

PROJECT NO. 812-2102

WEST AMAULIGAK BH2: LABORATORY TEST RESULTS

BOREHOLE TYPE: Rotary DATUM: Sea Floor

Sample Number	Depth(m) From - To	W_n %	W_L %	W_P %	Plasticity Index	Unit Weight (kN/m^3)	Grain Size Analyses
4	0.0 - 0.6	111.4					
5	3.1 - 4.1	38.3					
6	4.6 - 5.0	21.2					
7	6.1 - 6.6	27.2					
8	7.6 - 8.1						x
9	9.1 - 9.6						x
10	10.7 - 11.1						x
11	12.2 - 12.7						x
12	13.7 - 14.3						x
13	15.2 - 15.7						x
14	16.8 - 17.0						x
15	18.3 - 18.8						x
16	19.8 - 20.3						x
17	21.3 - 21.8						x
18	23.0 - 23.5						x
19	24.7 - 25.2						x
20	26.1 - 26.5						x
21	27.7 - 28.2						x
22	29.1 - 29.6						x
23	30.8 - 31.2						x
24	33.7 34.1						x
25	36.7 - 37.2						x
26	39.9 - 40.4						
27	41.5 - 42.1	32.7	36	23	13	18.8	
28	43.0 - 43.6	30.9	39	25	14		
29	44.7 - 45.3	34.5	40	22	18	18.8	

GRAIN SIZE DISTRIBUTION

Table: VI- 4

BOREHOLE 2 BOREHOLE TYPE: Rotary SITE NAME: West Amauligak

Depth		Sample No.	Gravel	Sand			Fines	Silt			Clay
From	To	—	—	C	M	F	—	C	M	F	—
4.7	5.3	2			3	54	43	3	5	10	25
7.6	8.1	8			58	33	9				
9.1	9.6	9			37	51	12				
10.7	11.2	10		1	59	28	12				
12.2	12.7	11		1	55	34	10				
13.7	14.2	12		2	78	17	3				
15.2	15.7	13		2	85	12	1				
18.3	18.8	15			63	20	7				
19.8	20.3	16		2	60	21	7				
21.3	21.8	17		8	84	7	1				
23.0	23.5	18	1	4	79	14	2				
24.7	25.2	19		1	82	15	2				
26.1	26.6	20			75	23	2				
27.7	28.2	21		12	73	14	1				
29.1	29.6	22		10	83	5	2				
30.1	30.6	23		4	89	6	1				
33.7	34.2	24			90	9	1				
36.7	37.2	25		1	85	12	2				

PROJECT NO. 812-2102

WEST AMAULIGAK BH3: LABORATORY TEST RESULTS

BOREHOLE TYPE: Rotary DATUM: Sea Floor

Sample Number	Depth(m) From - To	W_n %	W_L %	W_P %	Plasticity Index	Unit Weight (kN/m^3)	Grain Size Analyses
1	1.5 - 2.1	36.3	60	26	34		
2	3.1 - 3.7	30.4	56	22	34	18.2	
3	4.6 - 5.0						
4	6.1 - 6.6						x
5	7.6 - 8.1						x
6	9.1 - 9.6						x
7	10.7 - 11.1						x
8	12.3 - 12.8						x
9	13.9 - 14.3						x
10	15.4 - 15.9						x
11	16.9 - 17.4						x
12	18.4 - 18.9						x
13	20.0 - 20.4						x
14	21.6 - 22.4						x
15	23.3 - 23.8						x
16	24.5 - 25.0						x
17	26.1 - 26.5						x
18	27.6 - 28.0						x
19	29.1 - 29.6						x
20	30.6 - 31.1						x
21	33.7 - 34.1						x
22	36.9 - 37.3						
23	39.6 - 40.0						
24	41.3 -	31.6	39	24	15	19.3	
	42.1	30.0	45	23	22	19.1	
25	42.4 - 42.5						
26	42.7 - 43.4	31.3	40	25	15	19.1	x
27	43.9 -		50	27	23		
28	44.4 - 45.0	31.6	40	22	18	18.7,19.1	x
29	45.7 - 46.5	29.9	40	24	16	18.9	x

GRAIN SIZE DISTRIBUTION

Table VI. 6

BOREHOLE 3 BOREHOLE TYPE: Rotary SITE NAME: West Amauligak

Depth		Sample No.	Gravel	Sand			Fines	Silt			Clay
From	To	—	—	C	M	F	—	C	M	F	—
6.1	6.6	4			3	51	46				
7.6	8.1	5			3	69	28				
9.1	9.6	6			42	51	7				
10.7	11.1	7		1	65	30	4				
12.3	12.8	8			23	33	44				
13.9	14.3	9		1	68	27	4				
15.4	15.9	10		1	89	8	2				
16.9	17.4	11		1	86	11	2				
18.4	18.9	12		2	71	21	6				
20.0	20.5	13		2	78	16	4				
21.6	22.1	14		1	69	24	6				
24.5	25.0	16		1	55	39	9				
26.1	26.6	17		2	86	9	3				
27.6	28.1	18		1	82	15	2				
29.1	29.6	19		3	75	19	3				
30.6	31.1	20		8	84	7	1				
42.7	43.4	26					100	1	35	32	32
44.3	45.0	28			1		99	5	45	28	21
45.7	46.5	29					100	1	27	45	27

PROJECT NO. 812-2102

WEST AMAULIGAK BH4: LABORATORY TEST RESULTS

BOREHOLE TYPE: Rotary

DATUM: Sea Floor

Sample Number	Depth(m) From - To	Wn %	W_L %	W_P %	Plasticity Index	Unit Weight (kN/m³)	Grain Size Analyses
1	2.4 - 3.1	27.2	47	25	22		
2	4.0 - 4.6						
3	5.5 - 6.1	32.2					
4	7.0 - 7.6						x
5	9.0 - 9.5						x
6	10.7 - 11.1						x
7	12.0 - 12.5						x
8	13.6 - 14.0						
9	15.1 - 15.6						x
10	18.1 - 18.6						x
11	21.2 - 21.6						x
12	24.4 - 24.8						x
13	27.3 - 27.7						x
14	30.5 - 30.9						x
15	33.2 - 33.7						x
16	36.4 - 36.9						x
17	38.1 - 38.7	29.4	35	24	11	19.0	
18	39.8 - 40.2	34.7				18.7	x
19	40.8 - 41.5	28.0	41	24	17		

GRAIN SIZE DISTRIBUTION

Table: VI. 8

BOREHOLE 4 BOREHOLE TYPE: Rotary SITE NAME: West Amauligak

Depth		Sample No.	Gravel	Sand			Fines	Silt			Clay
From	To	—	—	C	M	F	—	C	M	F	—
7.0	7.6	4			1	91	8				
9.0	9.4	5			47	45	8				
10.7	11.2	6			30	58	12				
12.0	12.5	7			42	49	9				
15.1	15.6	9			52	40	8				
18.1	18.6	10			76	20	4				
21.2	21.7	11			82	16	2				
24.4	24.9	12		1	91	7	1				
27.3	27.8	13		1	92	6	1				
30.5	31.0	14		1	88	10	1				
33.2	33.7	15			84	14	2				
36.4	36.9	16		1	91	6	2				
39.8	40.2	18				2	98	10	43	20	25

PROJECT NO. 812-2102

WEST AMAULIGAK BH5: LABORATORY TEST RESULTS

BOREHOLE TYPE: Rotary DATUM: Sea Floor

Sample Number	Depth(m) From	To	W_n %	W_L %	W_p %	Plasticity Index	Unit Weight (kN/m^3)	Grain Size Analyses
1	0.9	1.5	48.6					
2	2.4	3.1	40.3	61	30	31		x
3	4.0	4.6	30.5	51	26	25		
4	5.5	6.1	31.4					
5	7.0	7.5						x
6	8.4	8.8						x
7	10.1	10.5						x
8	11.6	12.0						
9	13.1	13.6						x
10	14.6	15.1						
11	16.2	16.6						x
12	17.7	18.1						
13	19.2	19.7						x
14	20.7	21.2						
15	22.3	22.7						x
16	23.8	24.2						
17	25.3	25.8						x
18	26.8	27.3						
19	28.4	28.8						x
20	29.9	30.3						
21	33.1	33.5						x
22	36.0	36.4						
23	39.0	39.5						x
24	40.5	41.2	30.5	34	26	8	19.0	x
25	42.1	42.7	29.9	35	27	8	18.5	
26	43.6	44.2	33.3	43	30	17		x
27	46.6	47.2	30.1	40	27	13	19.0	
28	49.6	50.4	27.3	38	25	13		x
29	52.7	53.3	27.7	45	28	17		
30	55.8	56.4	30.5	50	27	23		
31	58.8	59.4	29.2	47	27	20		x
32	61.9	62.5	29.5					
33	66.5	66.6	28.9					
34	71.0	71.2	22.4					
35	75.6	75.7	24.1					

GRAIN SIZE DISTRIBUTION

Table VI. 10

BOREHOLE 5 BOREHOLE TYPE: Rotary SITE NAME: West Amauligak

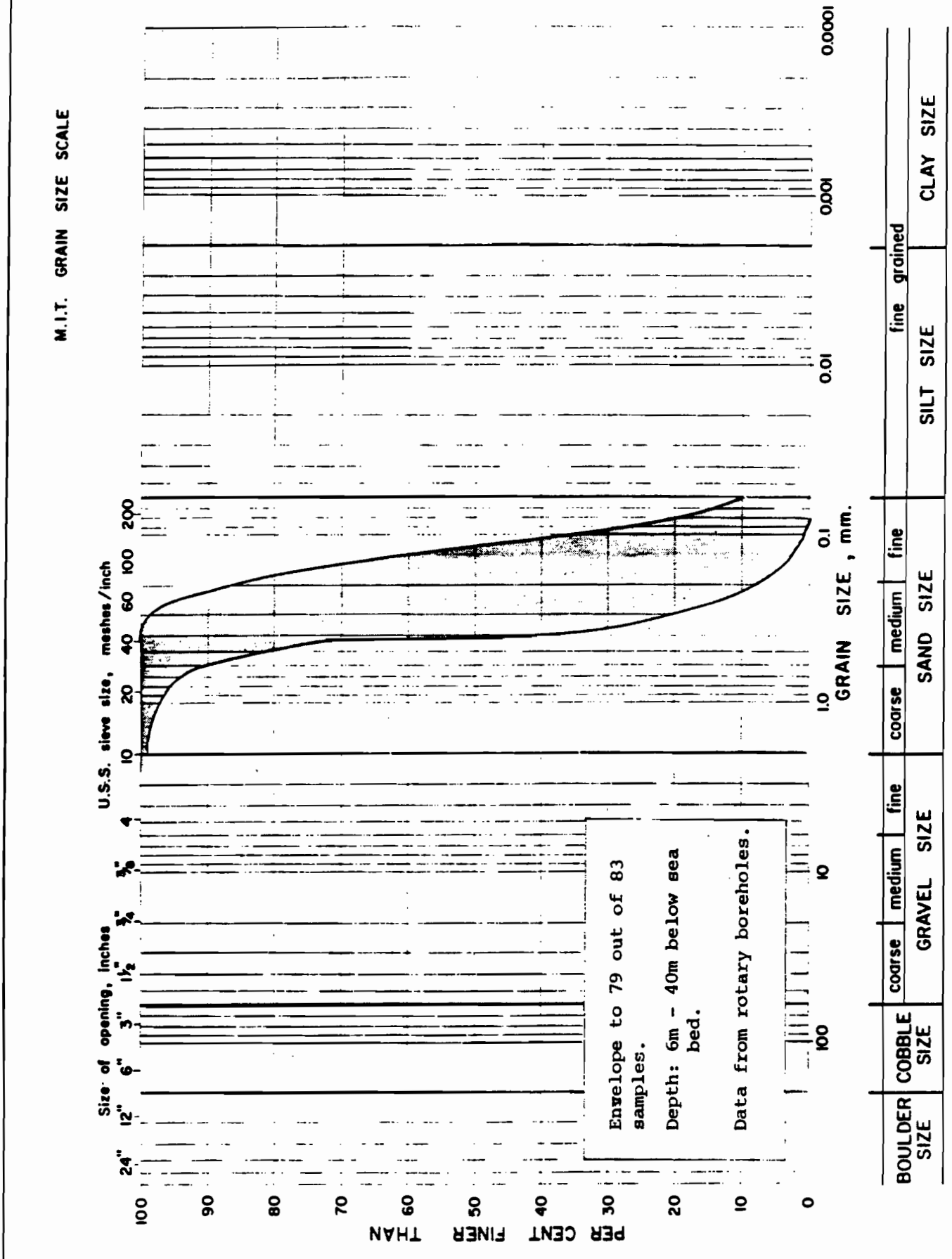
Depth		Sample No.	Gravel	Sand			Fines	Silt			Clay
From	To	—	—	C	M	F	—	C	M	F	—
2.4	3.0	2			1	5	94	5	9	25	55
7.0	7.5	5			13	81	6				
8.4	8.9	6			47	45	8				
10.1	10.6	7			45	50	5				
13.1	13.6	9			75	23	2				
16.2	16.7	11			50	48	12				
19.2	19.7	13		1	81	16	2				
22.3	22.8	15			84	14	2				
25.3	25.8	17			70	29	1				
28.3	28.8	19		1	89	9	1				
33.1	33.6	21		3	85	10	2				
39.0	39.5	23		1	77	20	2				
40.5	41.1	24				2	98	10	38	29	21
43.6	44.2	26				2	98	10	52	17	19
49.7	50.3	28				5	95	7	33	28	27
58.8	59.4	31					100	3	11	24	62

PROJECT NO. 812-2102

GRAIN SIZE DISTRIBUTION

WEST AMAULIGAK - SUMMARY GRADING CURVE ENVELOPE

Figure 4.3



Project No. 812-2102 Drawn GB Reviewed Date Dec '81

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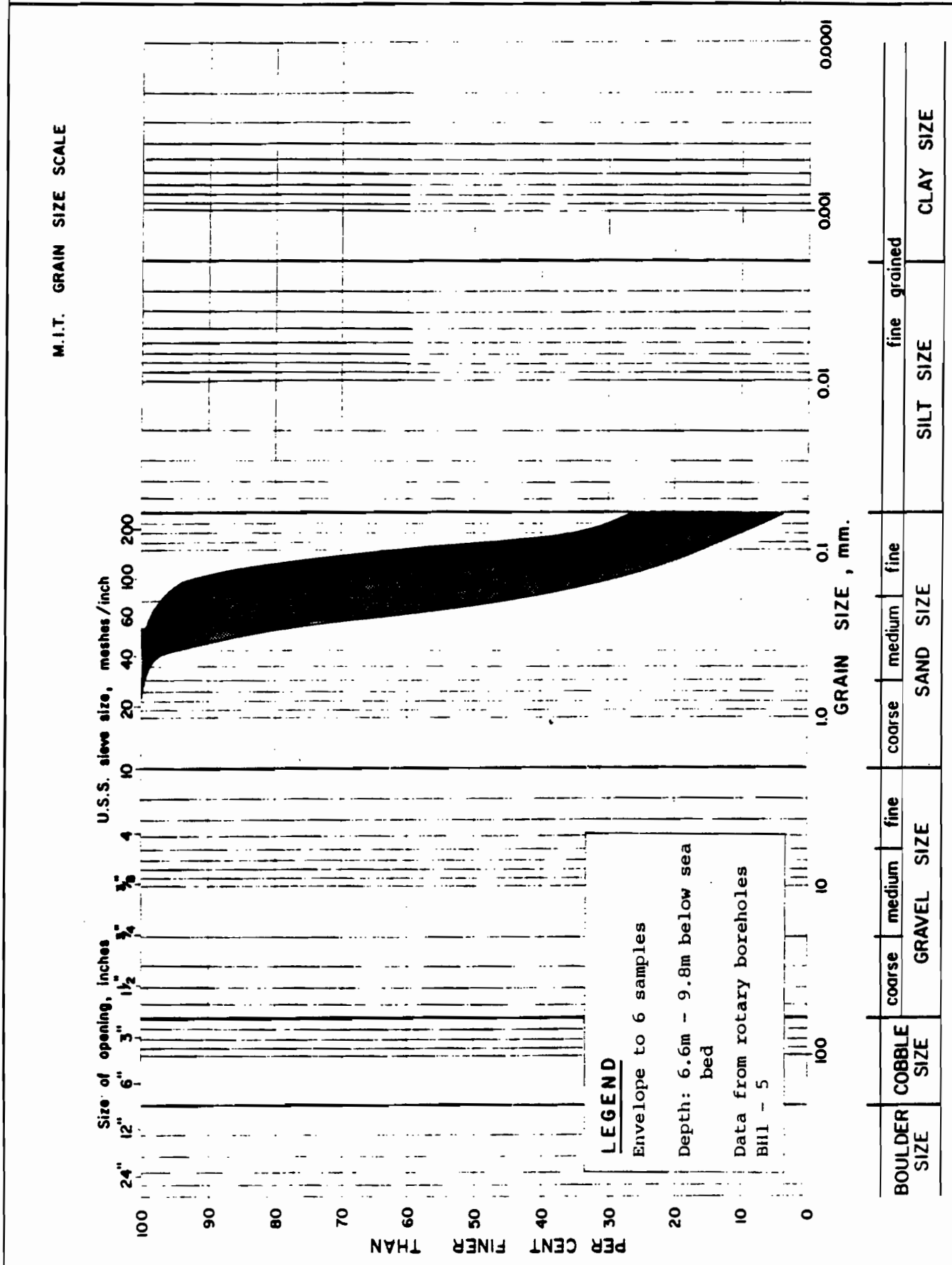
GRAIN SIZE DISTRIBUTION

WEST AMAULIGAK MAC SITE - GRADING CURVE ENVELOPE from 6.6m - 9.8m

Figure 4.4

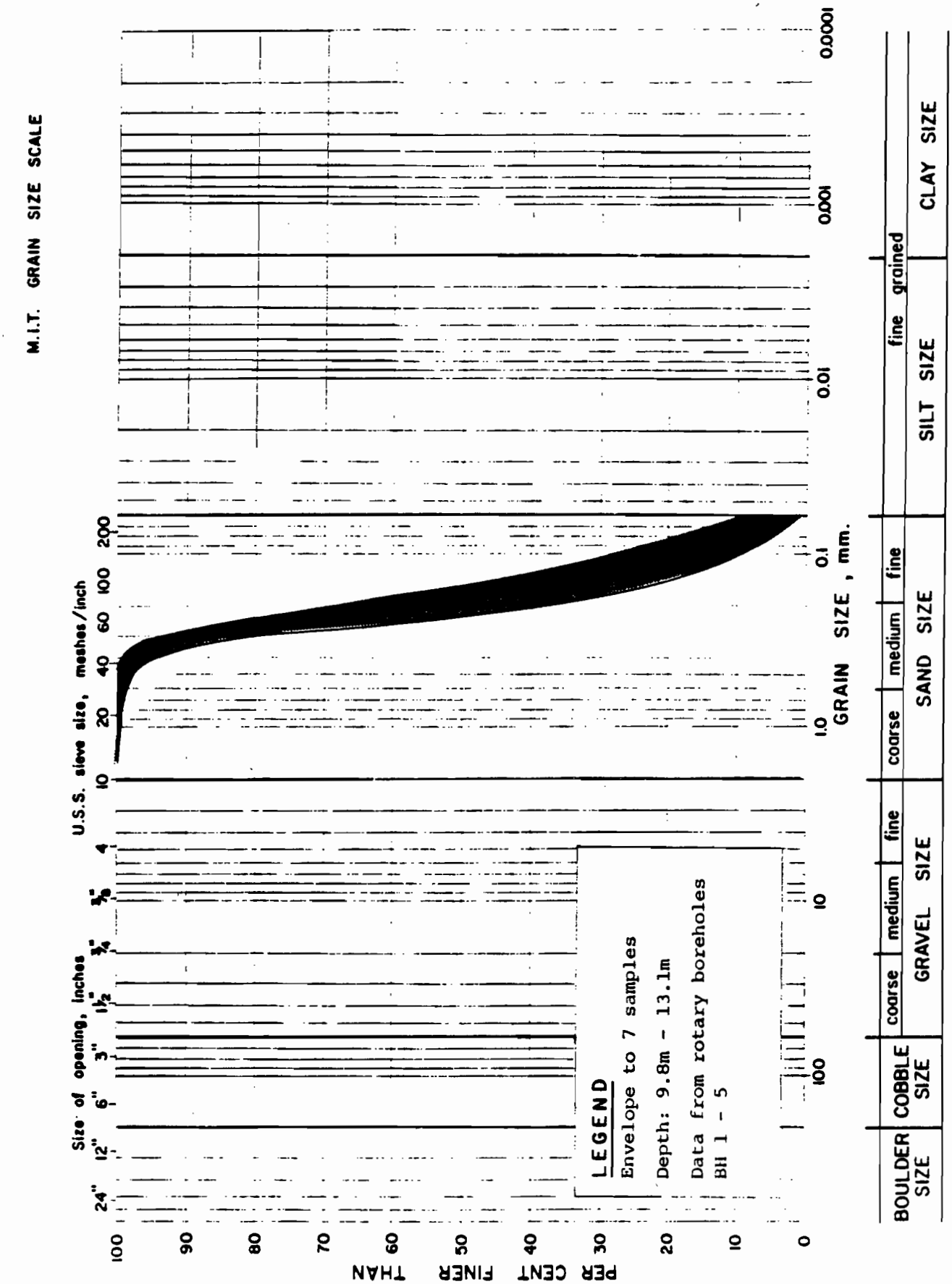


Project No. 812-2102 Drawn G.R.B. Reviewed Date Jan '92

GRAIN SIZE DISTRIBUTION

WEST AMAULIGAK MAC SITE - GRADING CURVE ENVELOPE from 9.8m - 13.1m

Figure 4.5



Project no. BIL-2102 Drawn G.R.S Reviewed Date Jan '92

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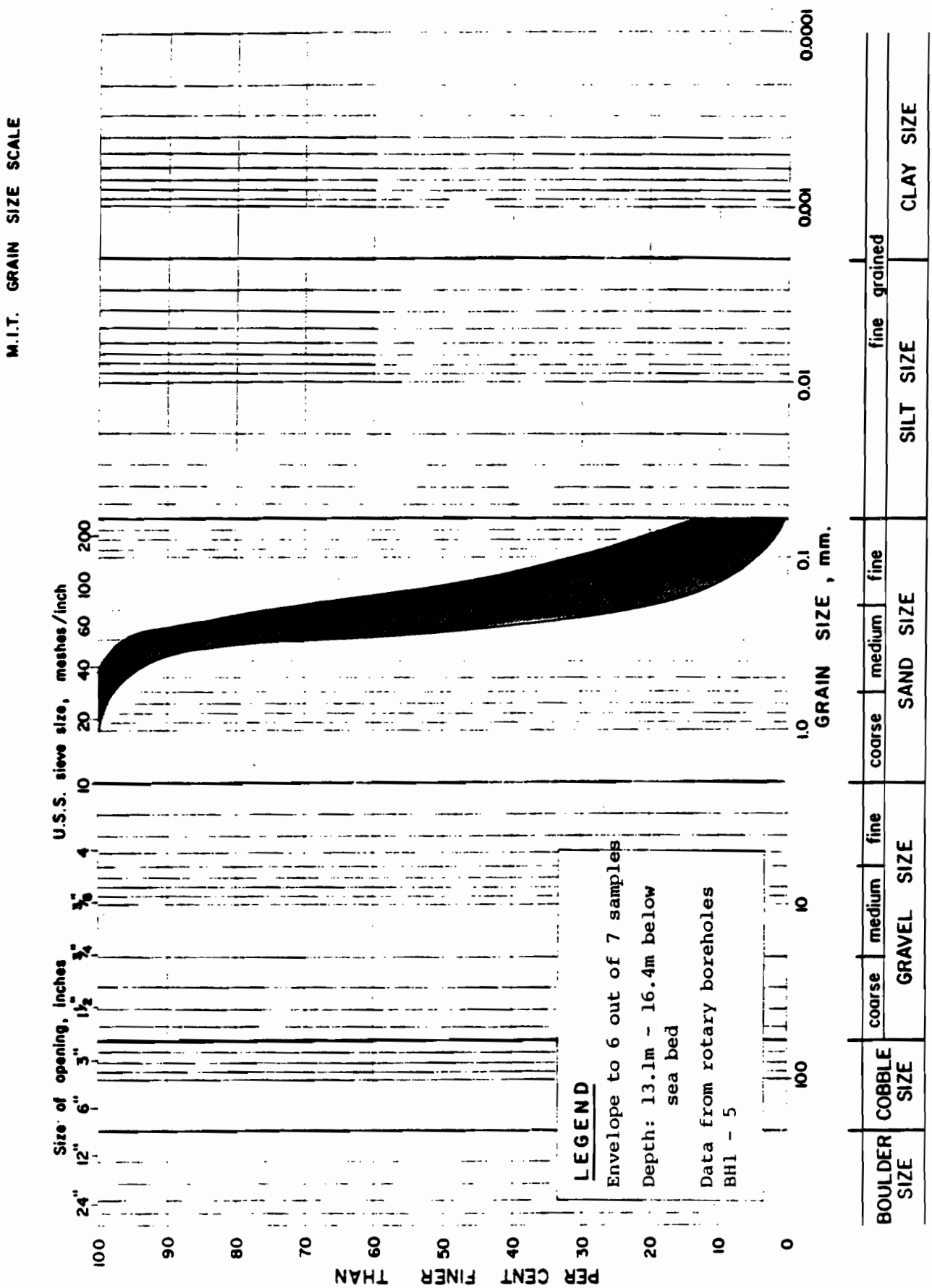
GRAIN SIZE DISTRIBUTION

WEST AMAULIGAK MAC SITE - GRADING CURVE ENVELOPE from 13.1m - 16.4 m

Figure 4.6



Project No. 5/2-2102 Drawn G.P.S Reviewed Date Jan '82

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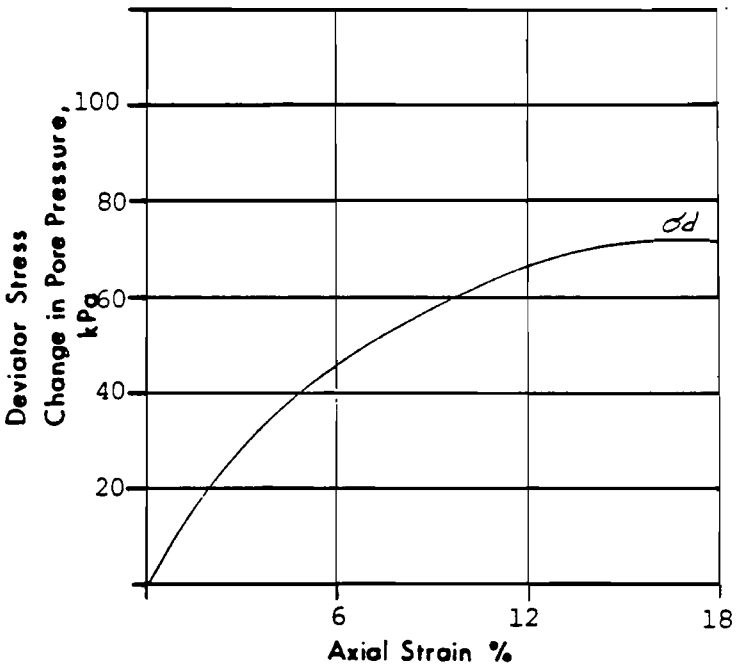
UNDRAINED TRIAXIAL TEST

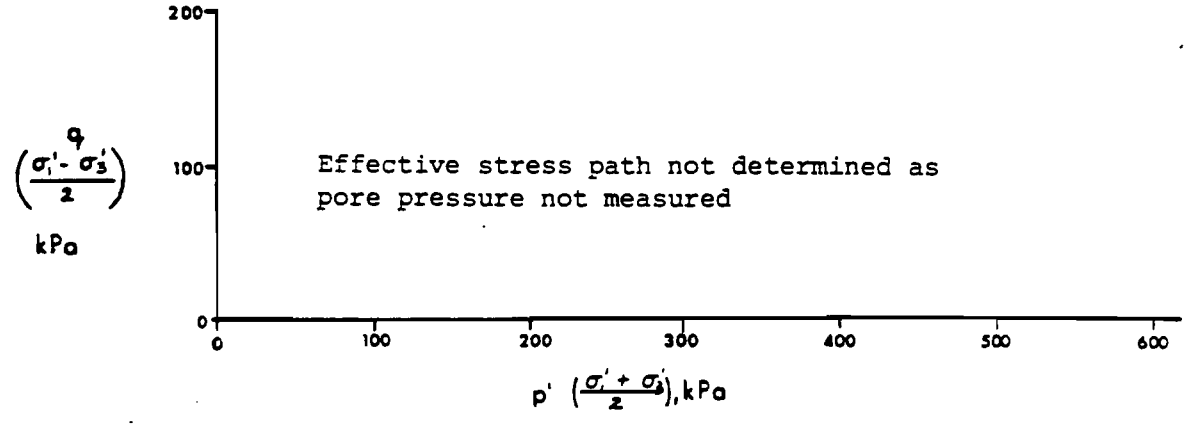
Figure. VI. 1

Site. West Amauligak **Borehole No.** 1

Sample No. 3 **Depth.** 4.2 - 4.4 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	380
Back Pressure	345
Effective Consolidation Pressure	35
Rate of Strain % per hour	3.3
Pore Pressure at Start of Shear	Not Measured
FAILURE	
Deviator Stress	75
% Strain	17
Change in Pore Pressure	Not Measured
$\bar{A}_f$	-
Undrained Shear Strength	38





EFFECTIVE STRESS PATH

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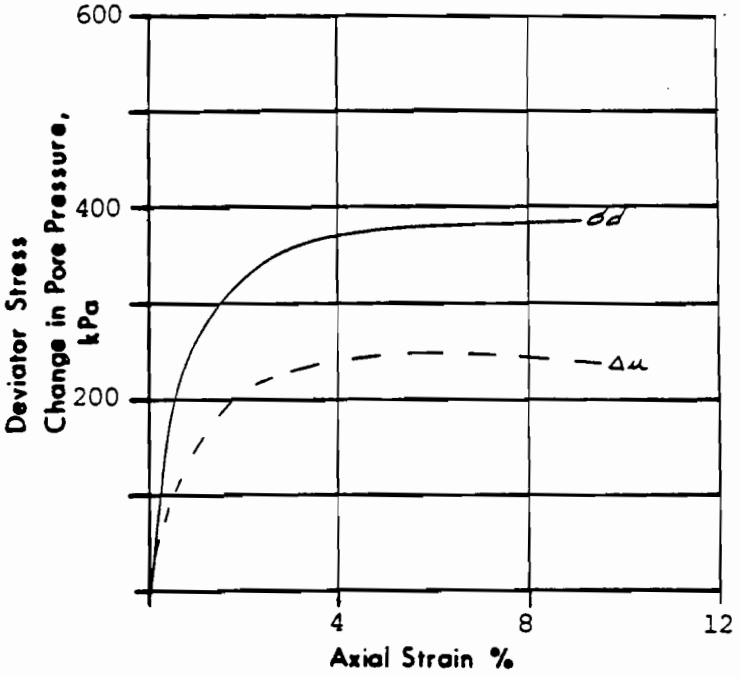
UNDRAINED TRIAXIAL TEST

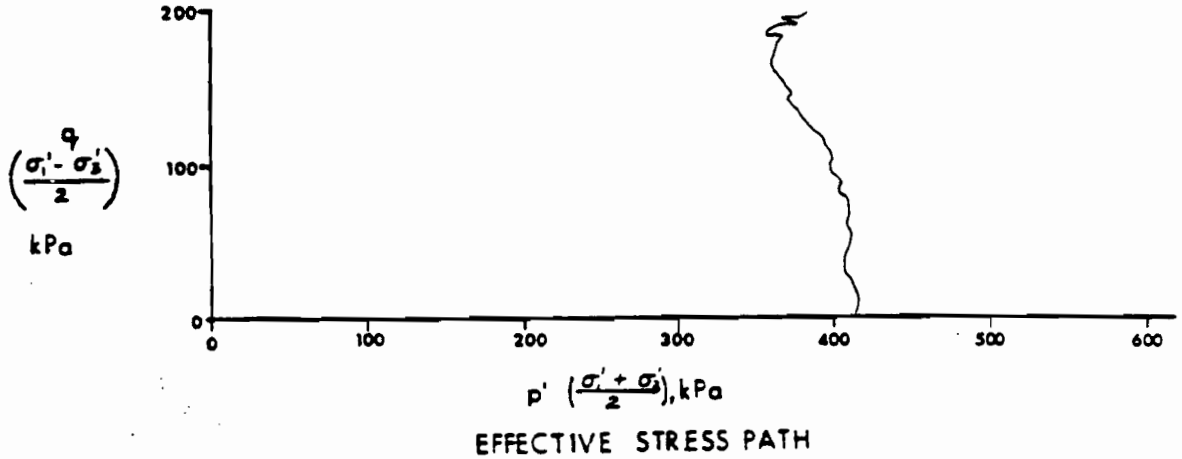
Figure. VI. 2

Site. West Amauligak **Borehole No.** 2

Sample No. 27 **Depth.** 41.5 - 42.1 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	690
Back Pressure	276
Effective Consolidation Pressure	414
Rate of Strain % per hour	3.8
Pore Pressure at Start of Shear	276
FAILURE	
Deviator Stress	390
% Strain	7.7
Change in Pore Pressure	227
$\bar{A}_f$	0.58
Undrained Shear Strength	195





EFFECTIVE STRESS PATH

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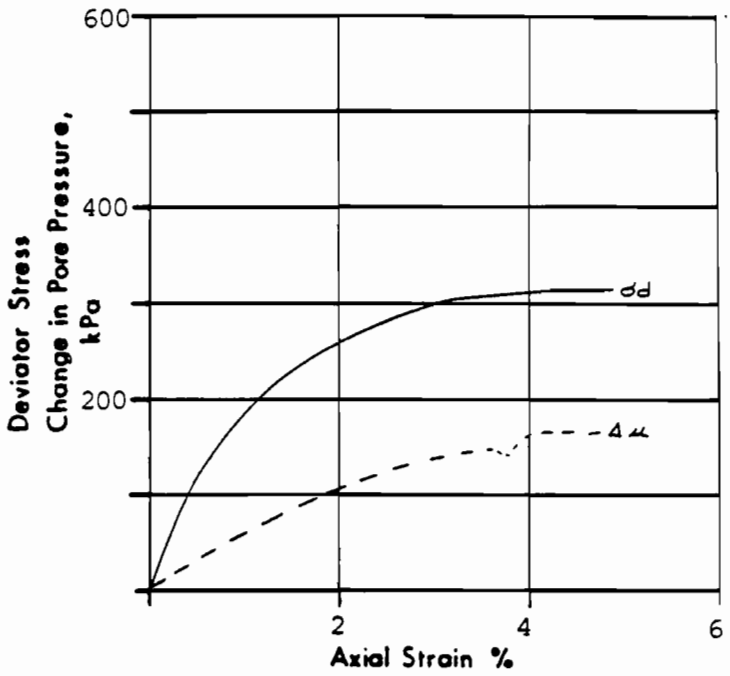
UNDRAINED TRIAXIAL TEST

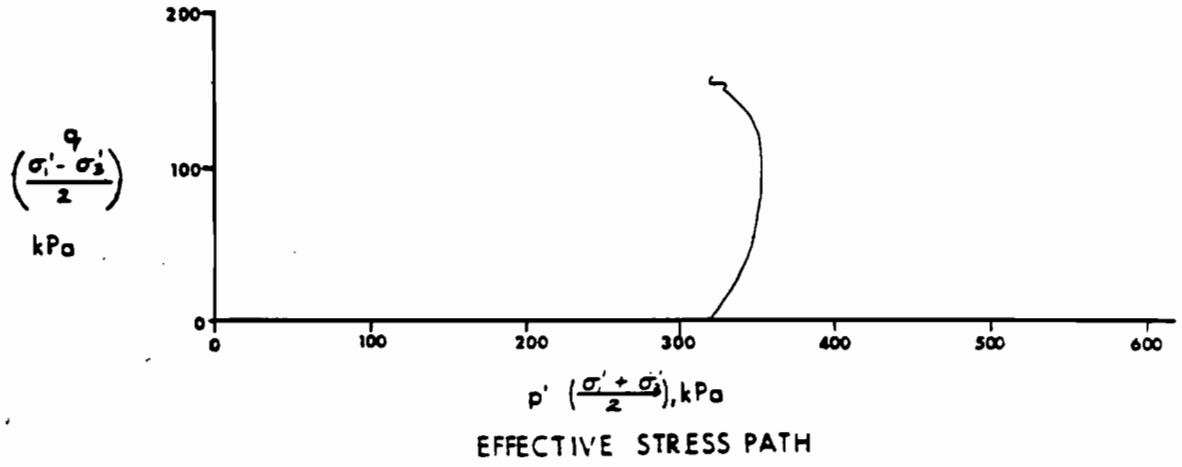
Figure. VI. 3

Site. West Amauligak **Borehole No.** 2

Sample No. 29 **Depth.** 44.5 - 45.1 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	369
Back Pressure	50
Effective Consolidation Pressure	319
Rate of Strain % per hour	1.0
Pore Pressure at Start of Shear	50
FAILURE	
Deviator Stress	305
% Strain	4.9
Change in Pore Pressure	154
$\bar{A}_f$	0.50
Undrained Shear Strength	152





EFFECTIVE STRESS PATH

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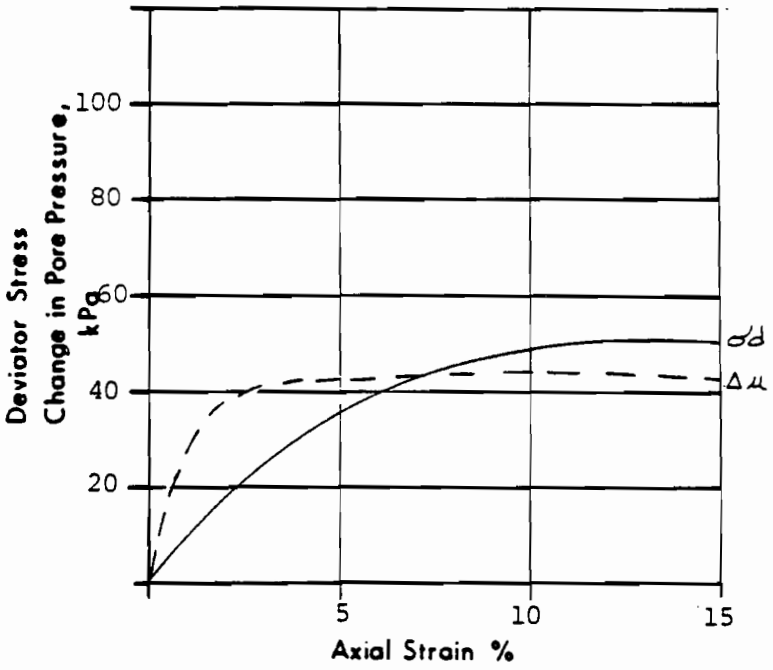
UNDRAINED TRIAXIAL TEST

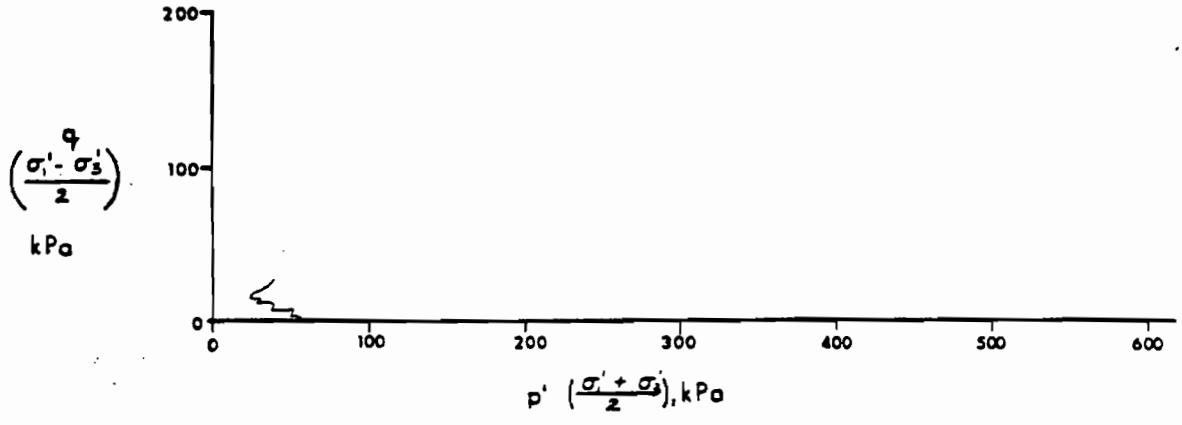
Figure. VI. 4

Site. West Amauligak **Borehole No.** 3

Sample No. 2 **Depth.** 3.0 - 3.7 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	UU (71 mm)
Cell Pressure	324
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	3.2
Pore Pressure at Start of Shear	269
FAILURE	
Deviator Stress	53
% Strain	15
Change in Pore Pressure	41
$\bar{A}_f$	0.77
Undrained Shear Strength	26





EFFECTIVE STRESS PATH

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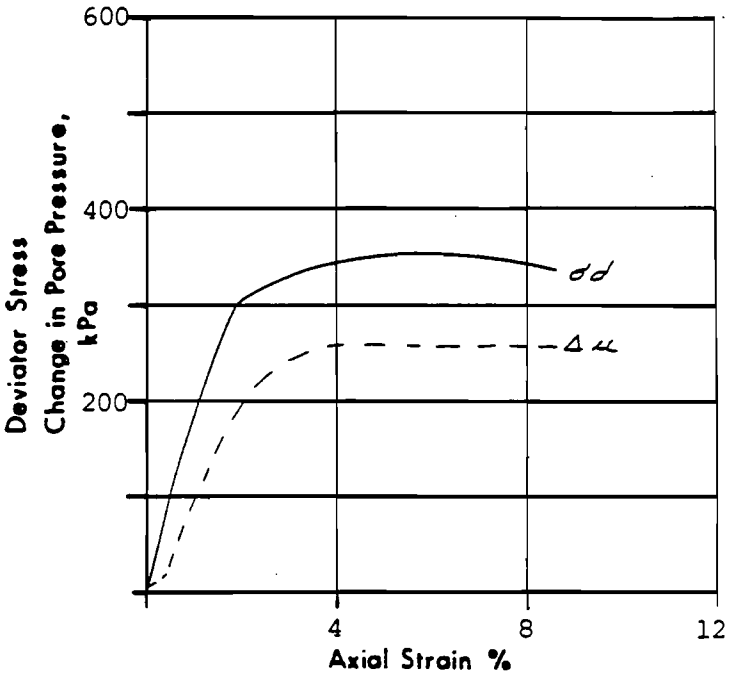
UNDRAINED TRIAXIAL TEST

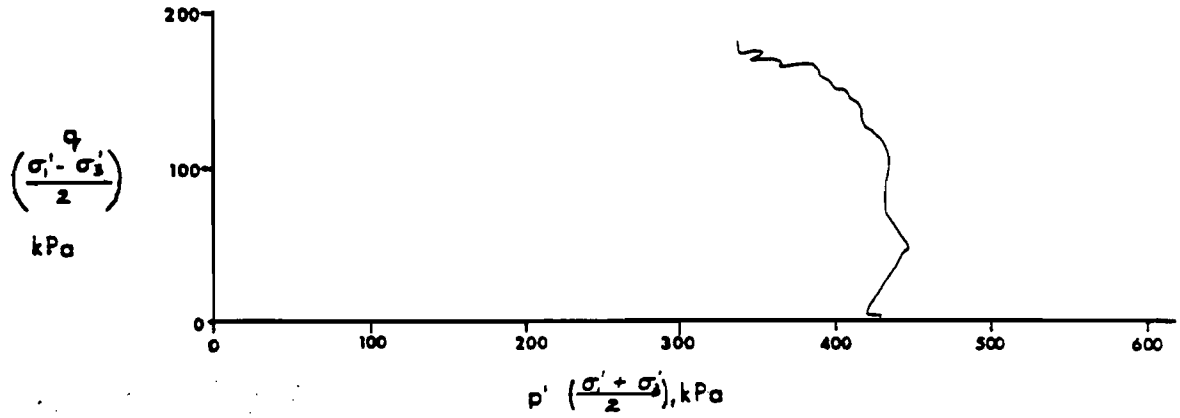
Figure. VI. 5

Site. West Amauligak **Borehole No.** 3

Sample No. 24A **Depth.** 41.3 - 42.1 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	700
Back Pressure	276
Effective Consolidation Pressure	424
Rate of Strain % per hour	3.2
Pore Pressure at Start of Shear	276
FAILURE	
Deviator Stress	344
% Strain	6.6
Change in Pore Pressure	258
$\bar{A}_f$	0.75
Undrained Shear Strength	172





EFFECTIVE STRESS PATH

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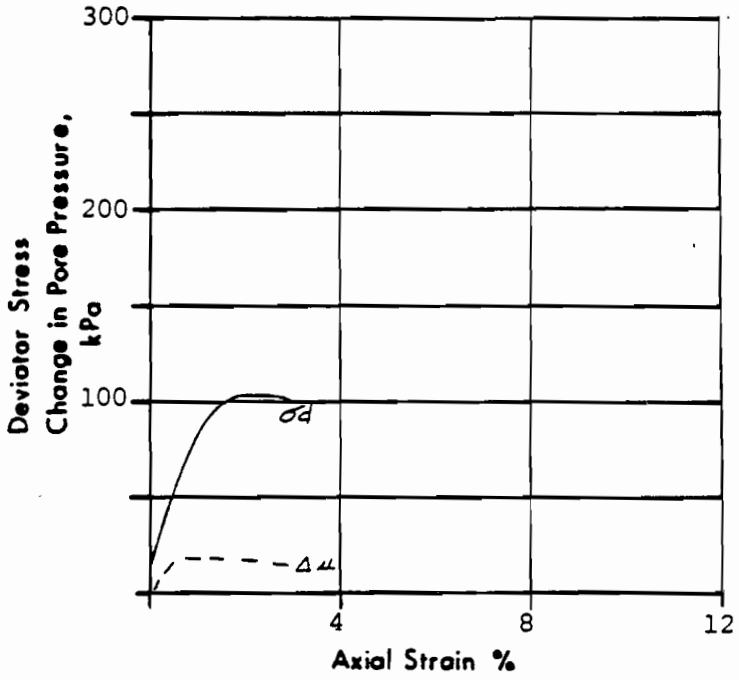
UNDRAINED TRIAXIAL TEST

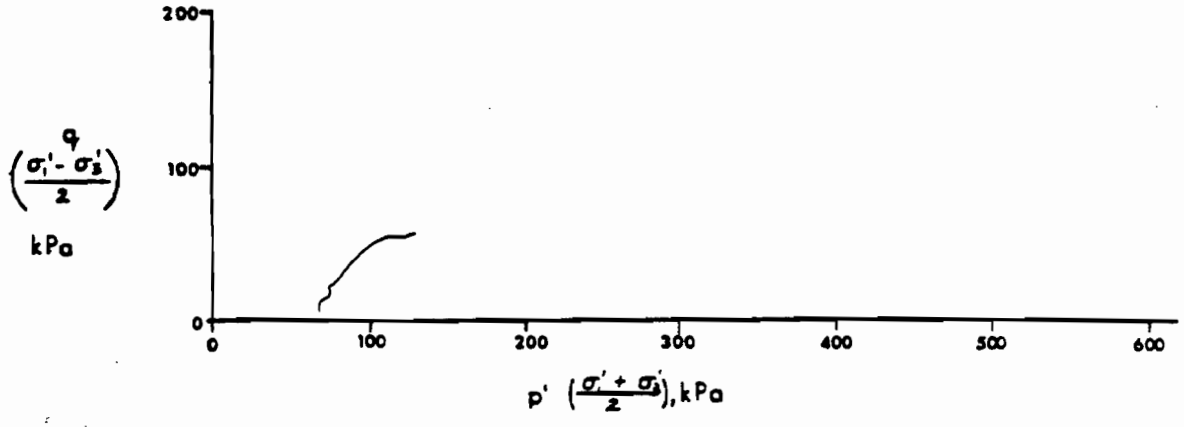
Figure. VI. 6

Site. West Amauligak **Borehole No.** 3

Sample No. 24B **Depth.** 41.3 - 42.1 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	UU (71 mm)
Cell Pressure	700
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	3.0
Pore Pressure at Start of Shear	627
FAILURE	
Deviator Stress	105
% Strain	2.6
Change in Pore Pressure	14
$\bar{A}_f$	0.13
Undrained Shear Strength	52





EFFECTIVE STRESS PATH

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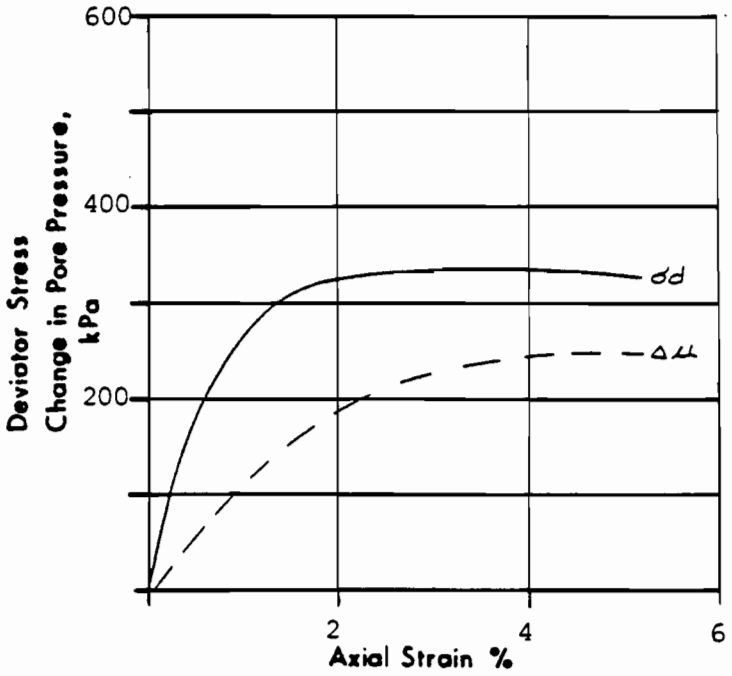
UNDRAINED TRIAXIAL TEST

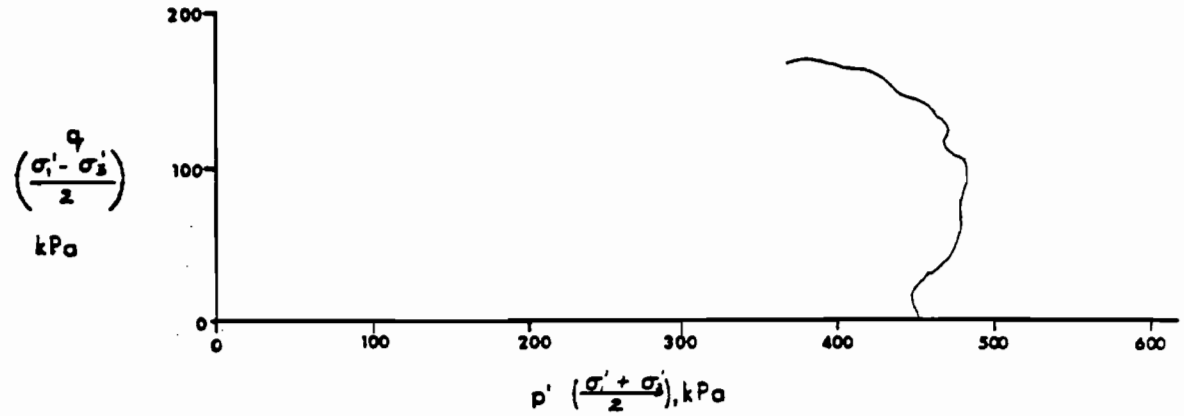
Figure. VI. 7

Site. West Amauligak **Borehole No.** 3

Sample No. 26A **Depth.** 42.7 - 43.4 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	700
Back Pressure	255
Effective Consolidation Pressure	445
Rate of Strain % per hour	3.3
Pore Pressure at Start of Shear	252
FAILURE	
Deviator Stress	330
% Strain	3.8
Change in Pore Pressure	244
$\bar{A}_f$	0.74
Undrained Shear Strength	165





EFFECTIVE STRESS PATH

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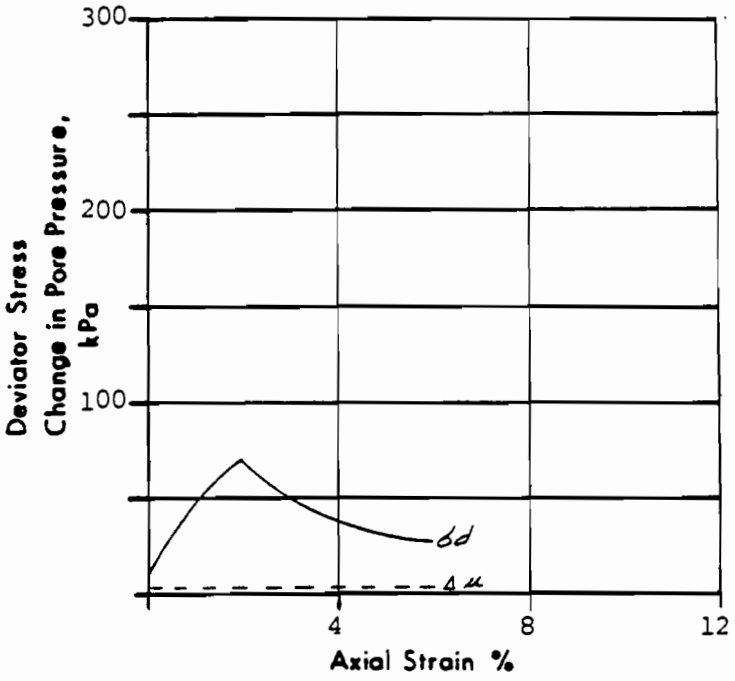
UNDRAINED TRIAXIAL TEST

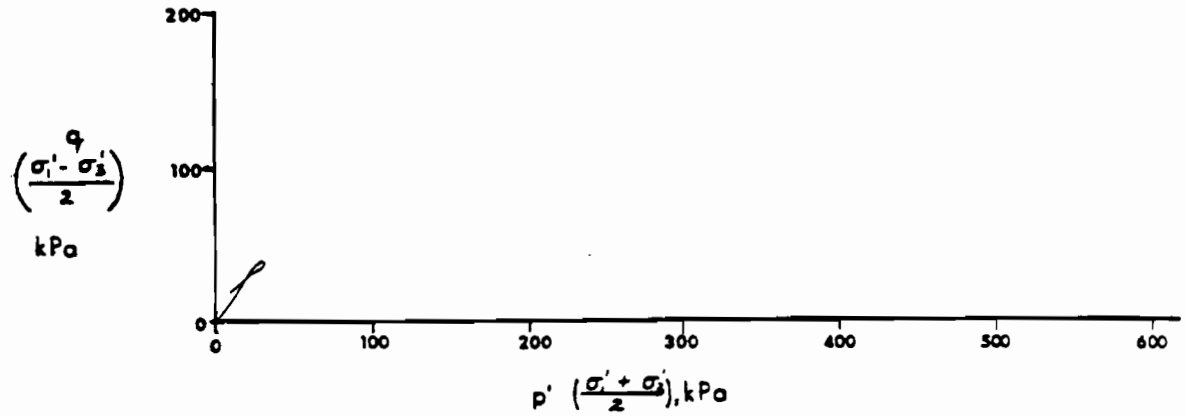
Figure. VI. 8

Site. West Amauligak **Borehole No.** 3

Sample No. 26B **Depth.** 42.7 - 43.4 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	71 mm UU
Cell Pressure	430
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	60.6
Pore Pressure at Start of Shear	431
FAILURE	
Deviator Stress	73
% Strain	2.0
Change in Pore Pressure	0
$\bar{A}_f$	0
Undrained Shear Strength	36





EFFECTIVE STRESS PATH

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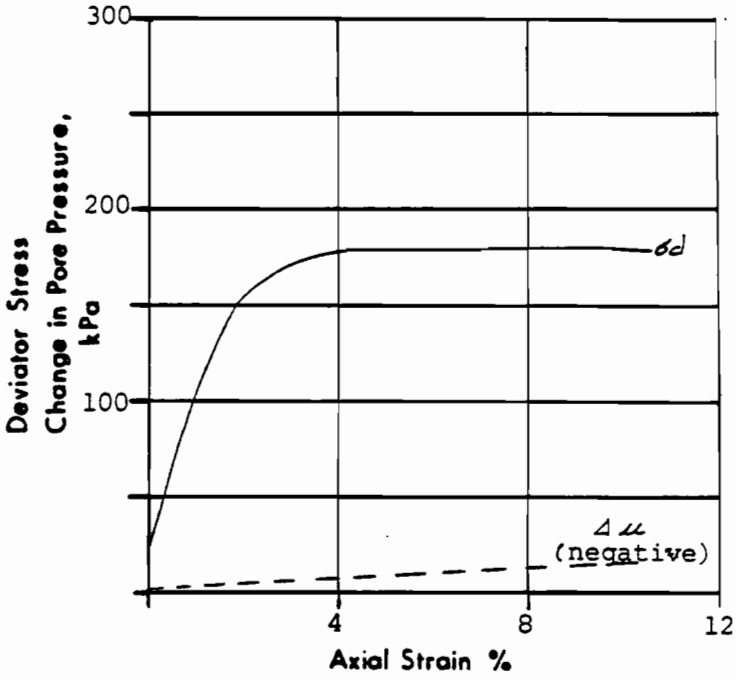
UNDRAINED TRIAXIAL TEST

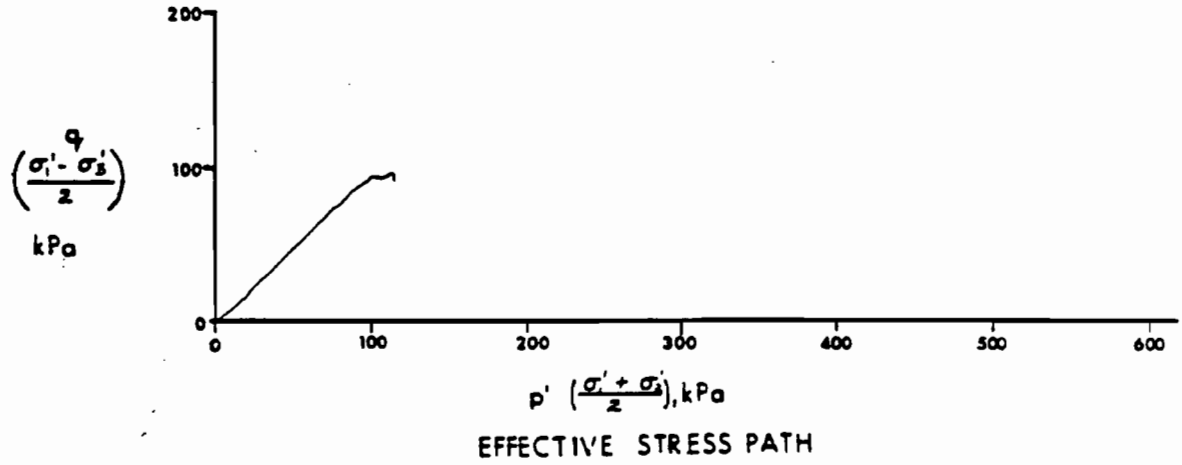
Figure. VI. 9

Site. West Amauligak **Borehole No.** 3

Sample No. 26C **Depth.** 42.7 - 43.4

SUMMARY (All pressures and stresses in kPa)	
Type of test	35 mm UU
Cell Pressure	430
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	63.3
Pore Pressure at Start of Shear	428
FAILURE	
Deviator Stress	189
% Strain	10.0
Change in Pore Pressure	-16
$\bar{A}_f$	-0.04
Undrained Shear Strength	90





EFFECTIVE STRESS PATH

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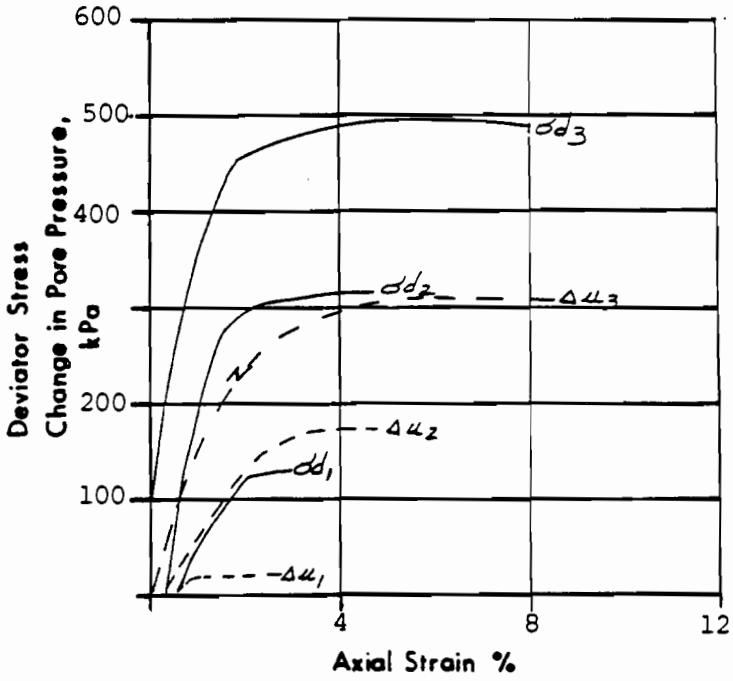
UNDRAINED TRIAXIAL TEST

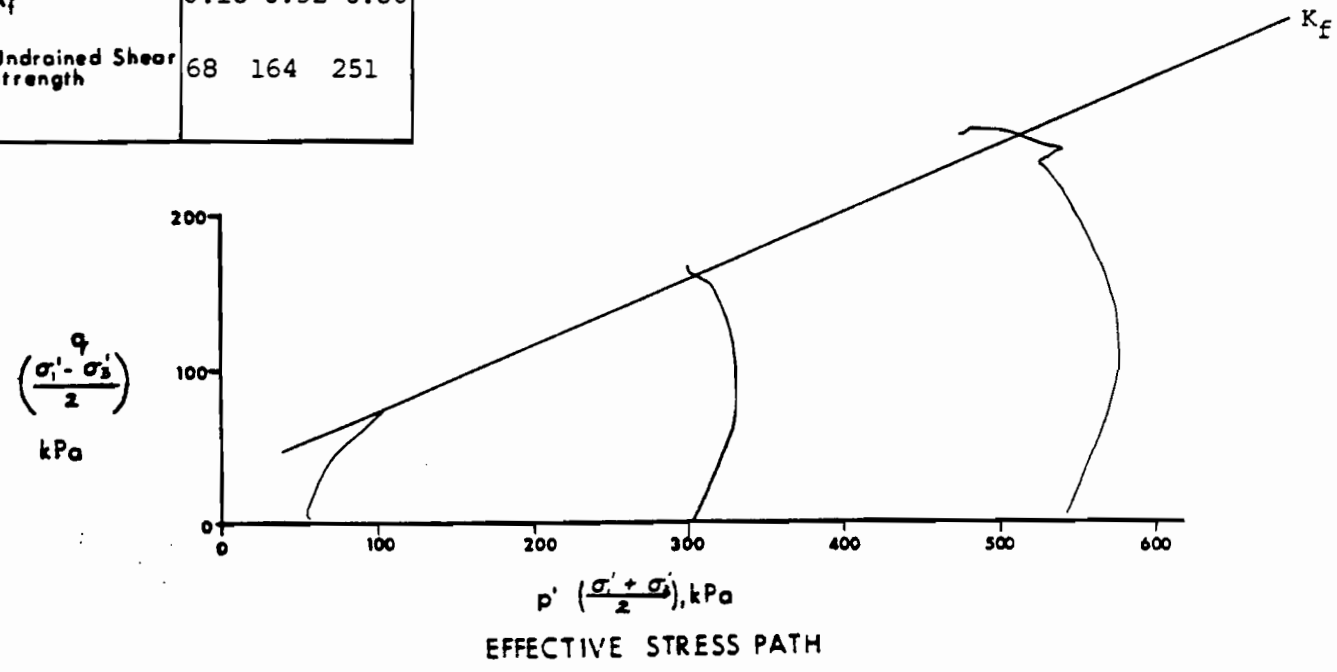
Figure. VI. 10

Site. West Amauligak Borehole No. 3

Sample No. 29A Depth. 45.7 - 46.5

SUMMARY (All pressures and stresses in kPa)			
Type of test	3 Pt CU		
Cell Pressure	105	352	595
Back Pressure	51	51	52
Effective Consolidation Pressure	54	301	543
Rate of Strain % per hour	1.0	1.1	1.1
Pore Pressure at Start of Shear	51	51	52
FAILURE			
Deviator Stress	137	327	502
% Strain	2.9	4.3	4.4
Change in Pore Pressure	21	169	301
$\bar{A}_f$	0.16	0.52	0.60
Undrained Shear Strength	68	164	251





EFFECTIVE STRESS PATH

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UNDRAINED TRIAXIAL TEST

Figure. VI. 11

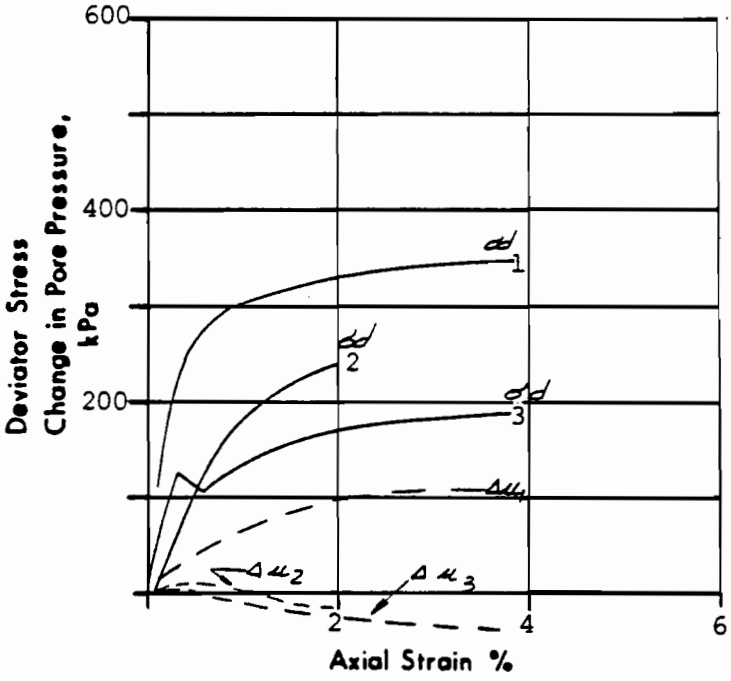
Site. West Amauligak **Borehole No.** 3

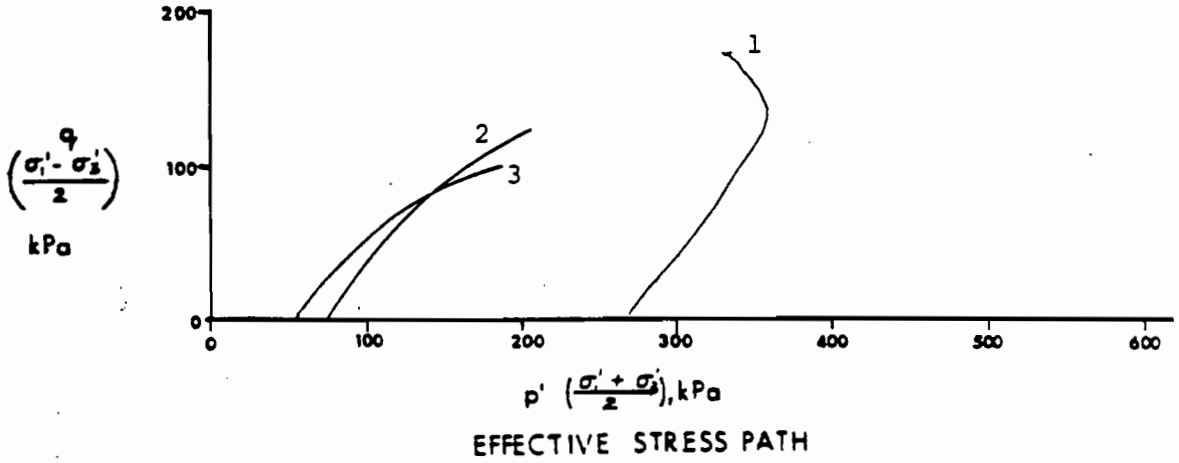
Sample No. 29B **Depth.** 45.7 - 46.5 m

SUMMARY (All pressures and stresses in kPa)			
Type of test	Anisotropic CU		
Cell Pressure	321	121	120
Back Pressure	62	-	-
Effective Consolidation Pressure	259	-	-
Rate of Strain % per hour	1.0	1.0	1.0
Pore Pressure at Start of Shear	54	46	65
FAILURE			
Deviator Stress	338	235	190
% Strain	3.9	2.0	3.8
Change in Pore Pressure	108	-16	-37
$\bar{A}_f$	0.32	*	**
Undrained Shear Strength	169	118	95

* $\bar{A}_f$ = -0.07

** $\bar{A}_f$ = -0.19





EFFECTIVE STRESS PATH

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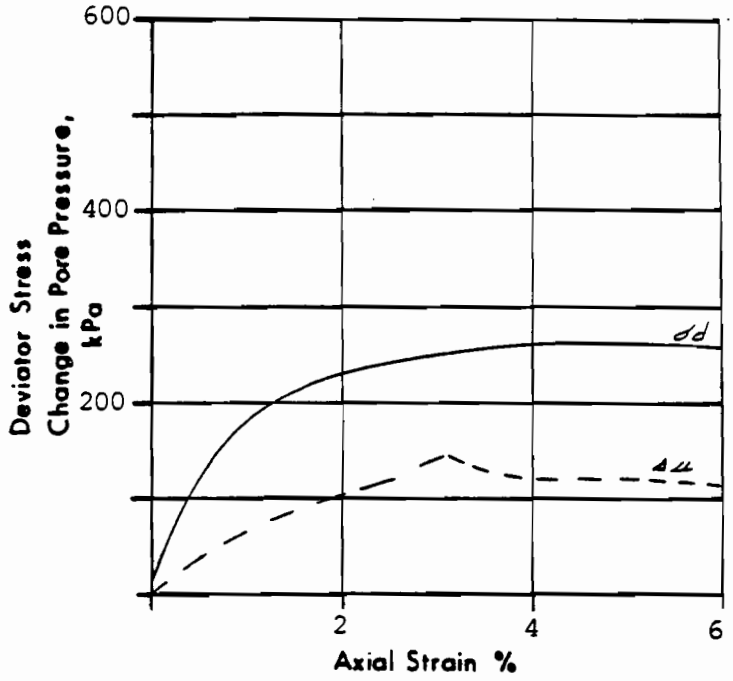
UNDRAINED TRIAXIAL TEST

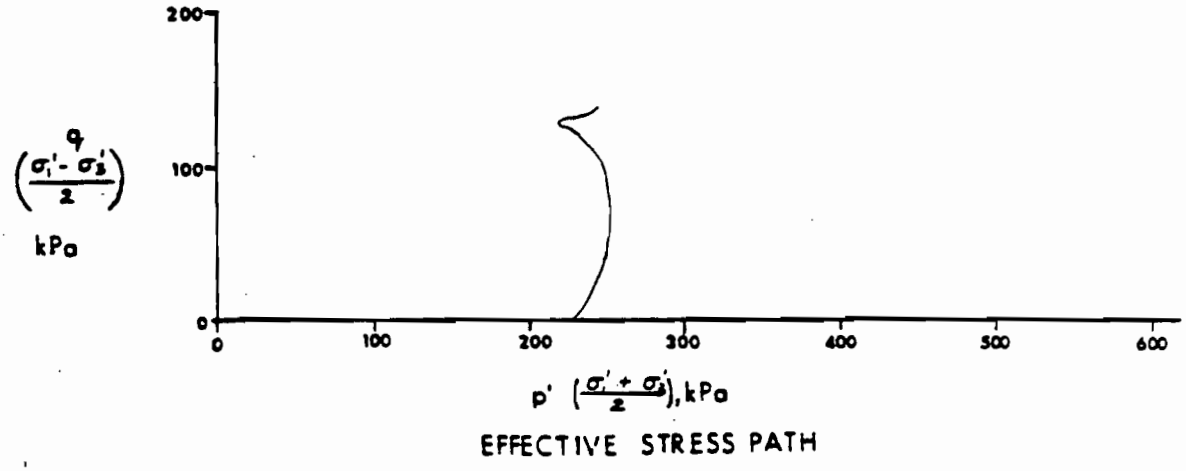
Figure. VI. 12

Site. West Amauligak **Borehole No.** 4

Sample No. 17 **Depth.** 38.1 - 38.7 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	CU
Cell Pressure	283
Back Pressure	54
Effective Consolidation Pressure	229
Rate of Strain % per hour	1.0
Pore Pressure at Start of Shear	54
FAILURE	
Deviator Stress	272
% Strain	6.1
Change in Pore Pressure	123
$\bar{A}_f$	0.45
Undrained Shear Strength	136





EFFECTIVE STRESS PATH

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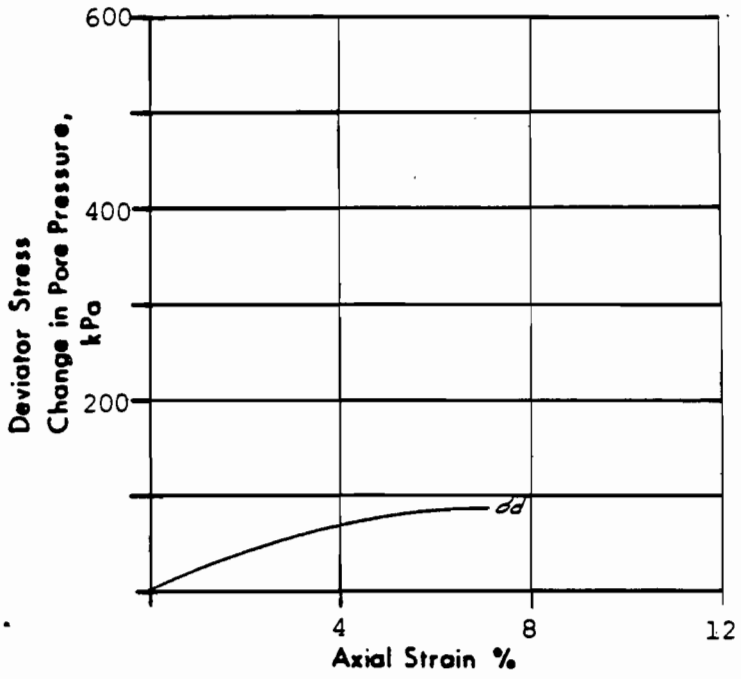
UNDRAINED TRIAXIAL TEST

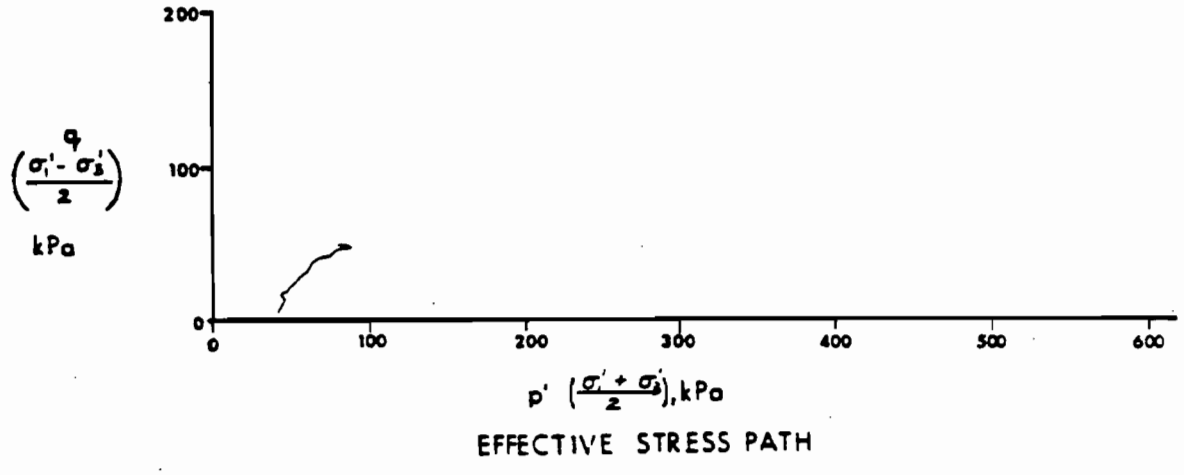
Figure. V1. 13

Site. West Amauligak **Borehole No.** 5

Sample No. 27A **Depth.** 46.6 - 47.2 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	71 mm UU
Cell Pressure	758
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	3.2
Pore Pressure at Start of Shear	724
FAILURE	
Deviator Stress	90
% Strain	6.9
Change in Pore Pressure	0
$\bar{A}_f$	0
Undrained Shear Strength	45





EFFECTIVE STRESS PATH

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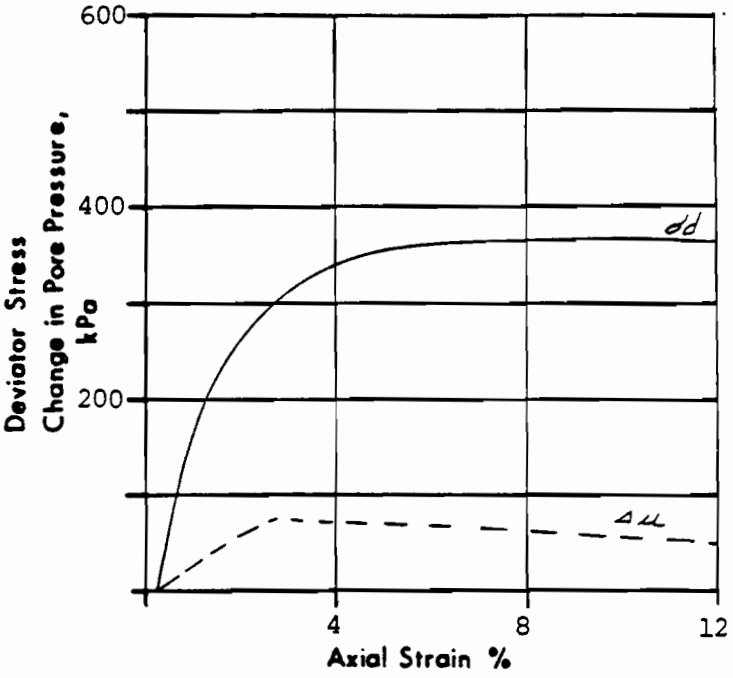
UNDRAINED TRIAXIAL TEST

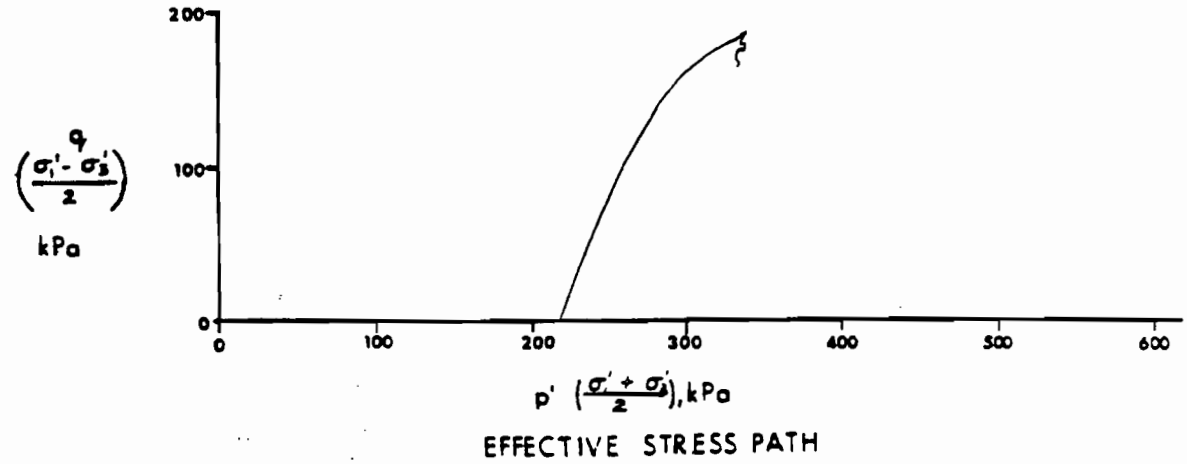
Figure. V1. 14

Site. West Amauligak **Borehole No.** 5

Sample No. 27B **Depth.** 46.6 - 47.2 m

SUMMARY (All pressures and stresses in kPa)	
Type of test	35 mm UU
Cell Pressure	760
Back Pressure	-
Effective Consolidation Pressure	-
Rate of Strain % per hour	12.6
Pore Pressure at Start of Shear	546
FAILURE	
Deviator Stress	371
% Strain	9.0
Change in Pore Pressure	62
$\bar{A}_f$	0.17
Undrained Shear Strength	136

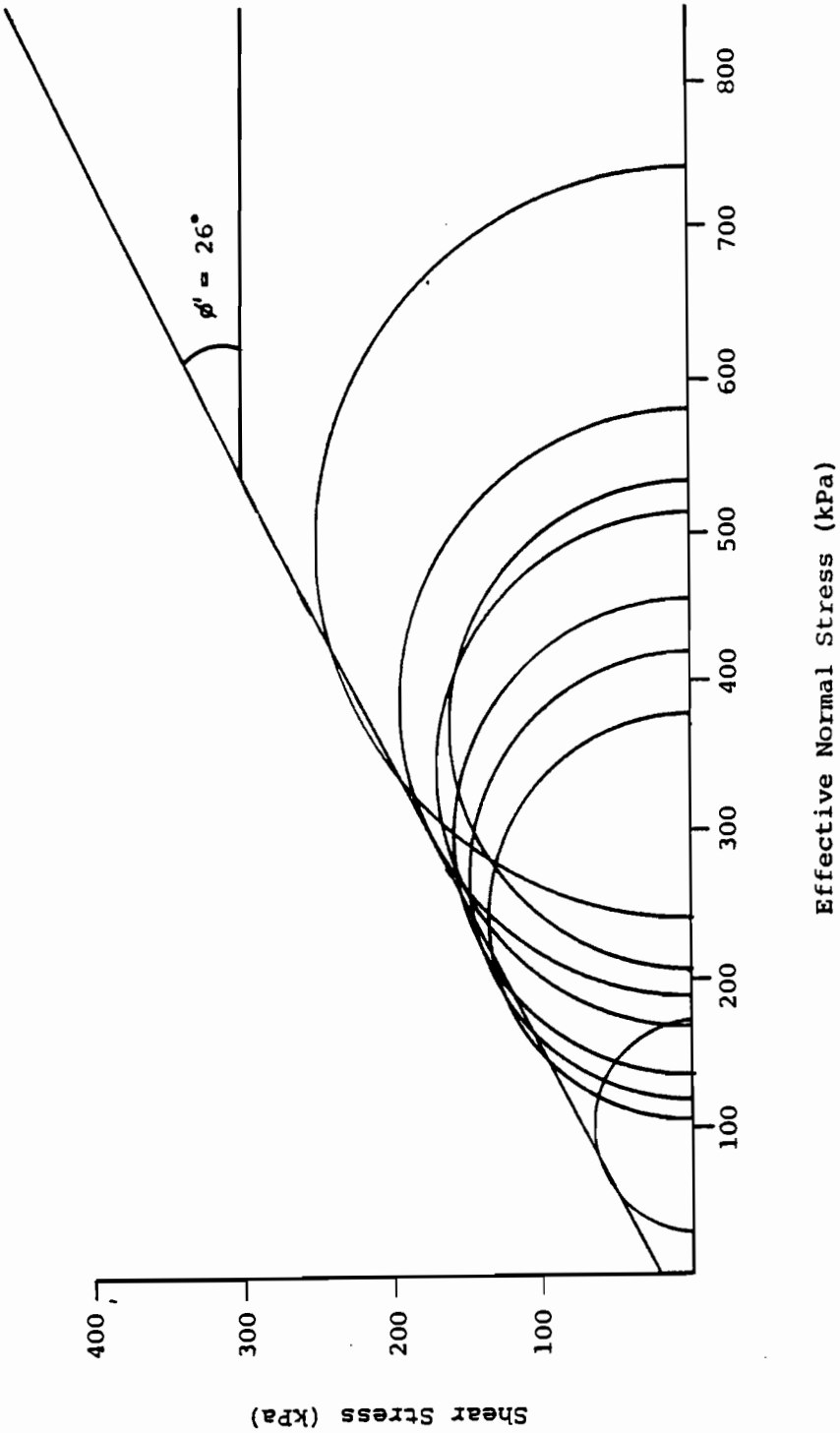




EFFECTIVE STRESS PATH

WEST AMAULIGAK CONSOLIDATED UNDRAINED TRIAXIAL TESTS
MOHR CIRCLES OF EFFECTIVE STRESS AT FAILURE

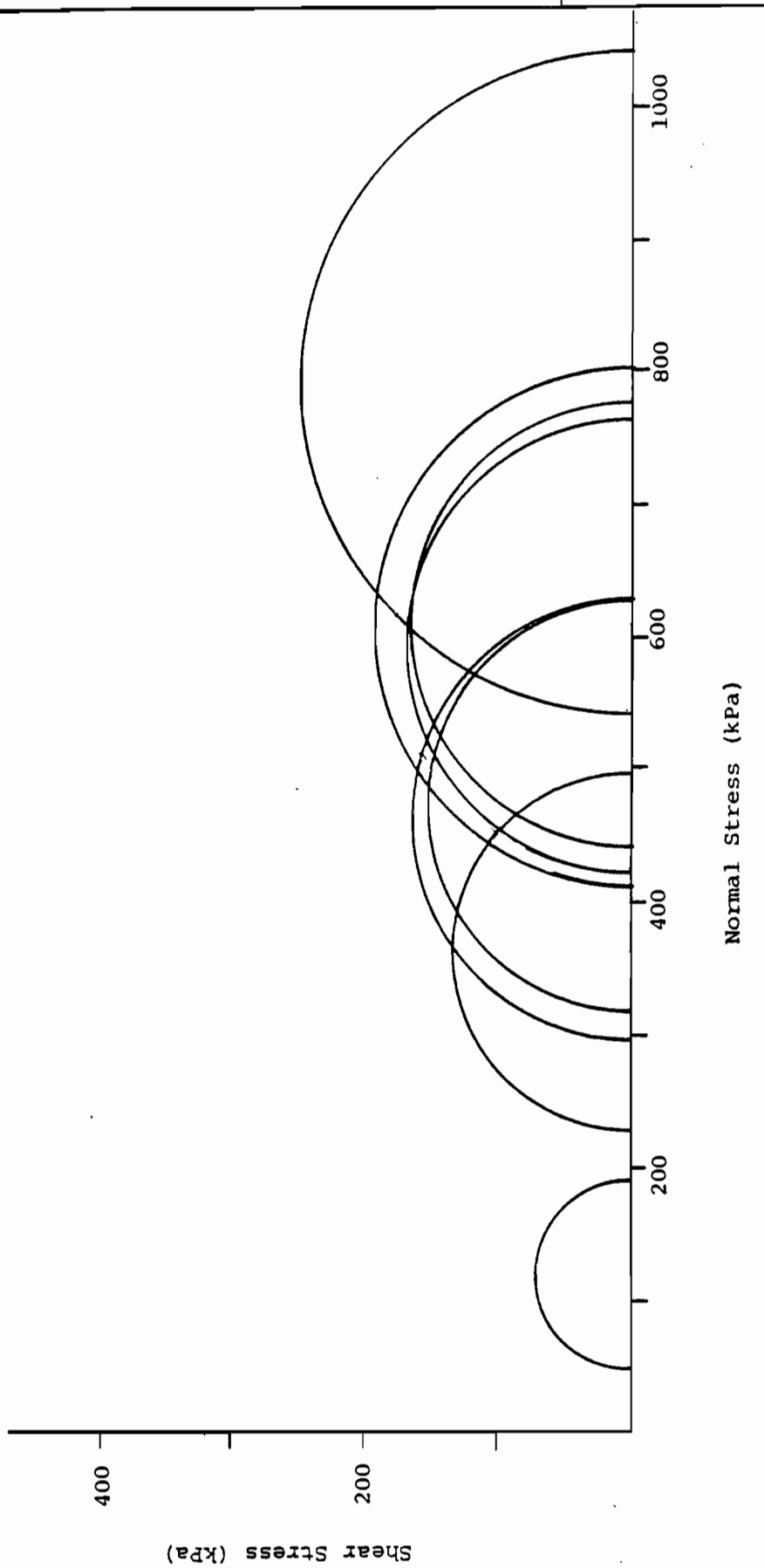
Figure .5.5



Project No. 882-2/82 Drawn [illegible] Reviewed ..... Date [illegible]

WEST AMAULIGAK CONSOLIDATED UNDRAINED TRIAXIAL TESTS
MOHR CIRCLES OF TOTAL STRESS AT FAILURE

Figure .5.4



Project No. 912-2192 Drawn G.B. Reviewed ..... Date Dec. '91

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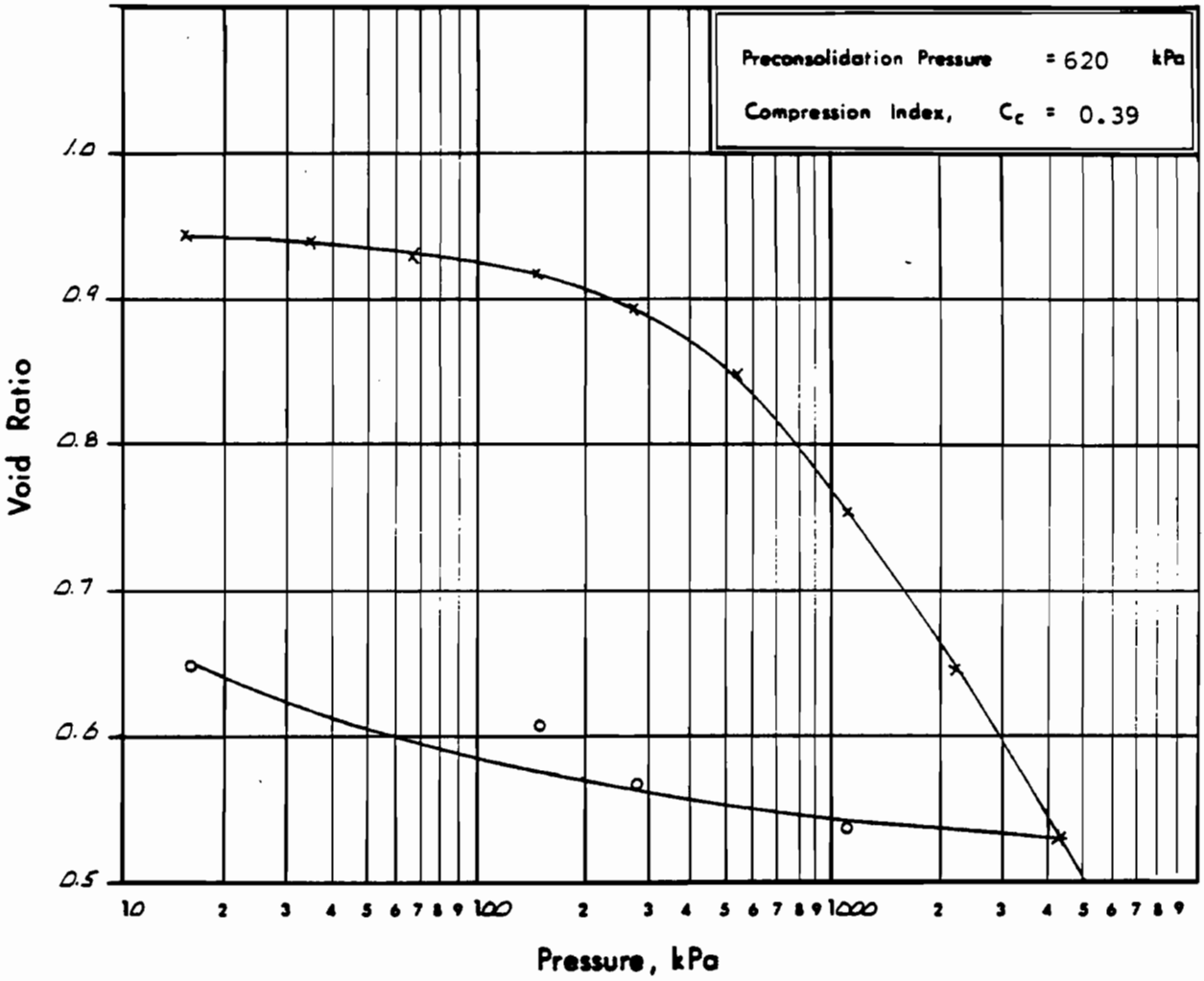
Figure. VI. 13

Site. West Amauligak Borehole No. 3

Sample No. 28 Depth. 44.3 - 45.0 m



PRESSURE kPa	VOID RATIO	m_v kPa^{-1}	c_v cm^2/sec	k cm/sec
17.1	0.942	3.0×10^{-3}	1.7×10^{-2}	5.2×10^{-6}
34.2	0.938	1.44×10^{-4}	7.7×10^{-2}	1.1×10^{-6}
68.6	0.927	1.52×10^{-4}	1.6×10^{-2}	2.3×10^{-7}
137.3	0.915	9.25×10^{-5}	3.8×10^{-1}	3.5×10^{-6}
274.7	0.890	9.52×10^{-5}	4.2×10^{-2}	3.9×10^{-7}
549.4	0.844	8.82×10^{-5}	3.4×10^{-2}	3.0×10^{-7}
1098.8	0.752	9.12×10^{-5}	3.7×10^{-2}	3.3×10^{-7}
2197.6	0.642	5.71×10^{-5}	1.9×10^{-2}	1.0×10^{-7}
4395.2	0.523	3.30×10^{-5}	3.5×10^{-2}	1.1×10^{-7}

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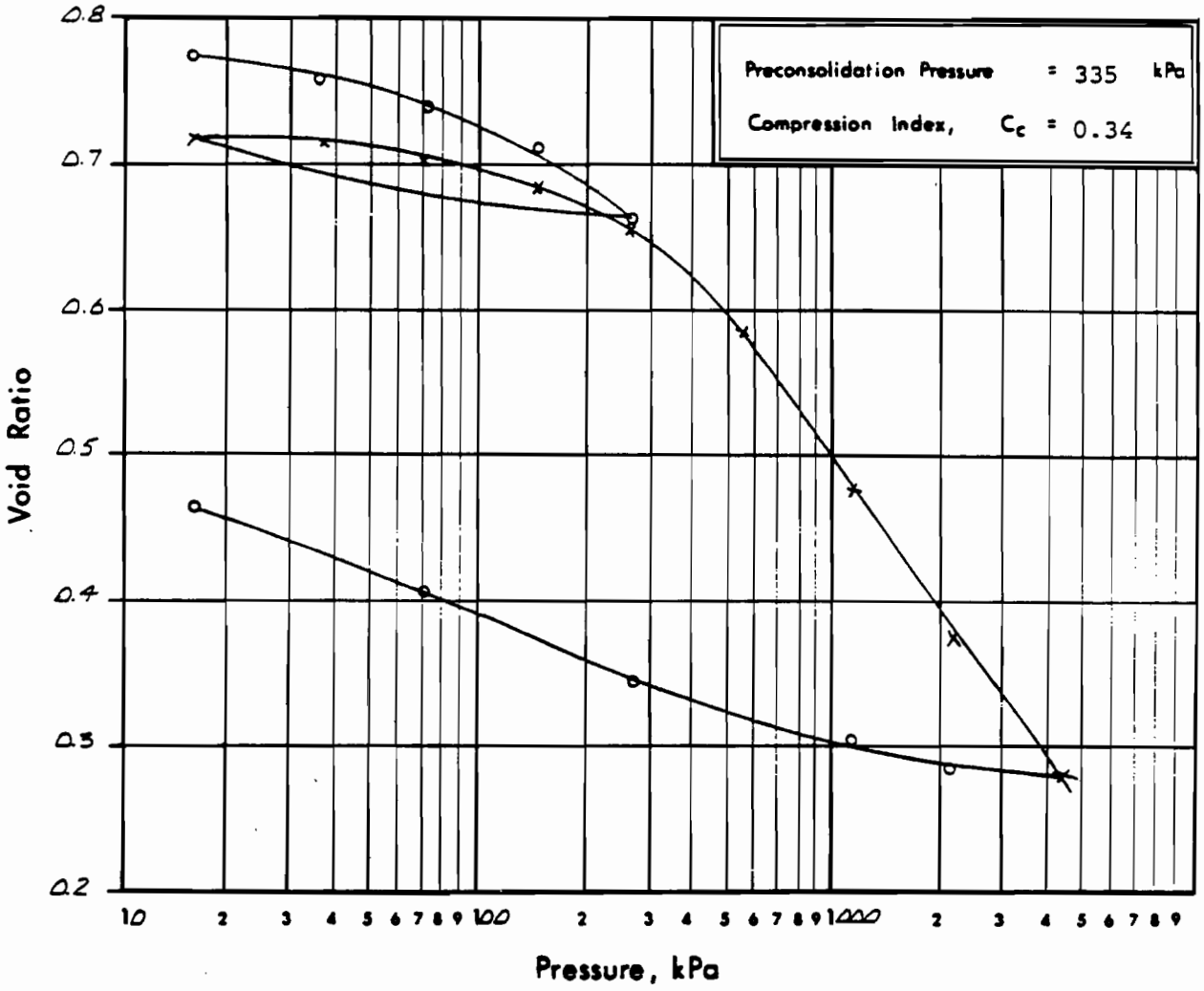
Figure. VI. 14

Site. West Amauligak Borehole No. 4

Sample No. 18 Depth. 39.8 - 40.2 m



PRESSURE kPa	VOID RATIO	m_v kPa^{-1}	c_v cm^2/sec	k cm/sec
17.7	0.715	1.07×10^{-4}		
35.4	0.710	1.60×10^{-4}	3.9×10^{-2}	6.1×10^{-7}
71.0	0.700	1.62×10^{-4}	9.7×10^{-3}	1.5×10^{-7}
141.9	0.683	1.38×10^{-4}	1.9×10^{-2}	2.5×10^{-7}
283.9	0.656	1.14×10^{-4}	1.3×10^{-2}	1.4×10^{-7}
567.8	0.584	1.54×10^{-4}	8.3×10^{-3}	1.2×10^{-7}
1135.5	0.474	1.22×10^{-4}	1.1×10^{-2}	1.3×10^{-7}
2271.1	0.376	5.86×10^{-5}	9.3×10^{-3}	5.3×10^{-8}
4542.2	0.279	3.11×10^{-5}	8.0×10^{-3}	2.4×10^{-8}

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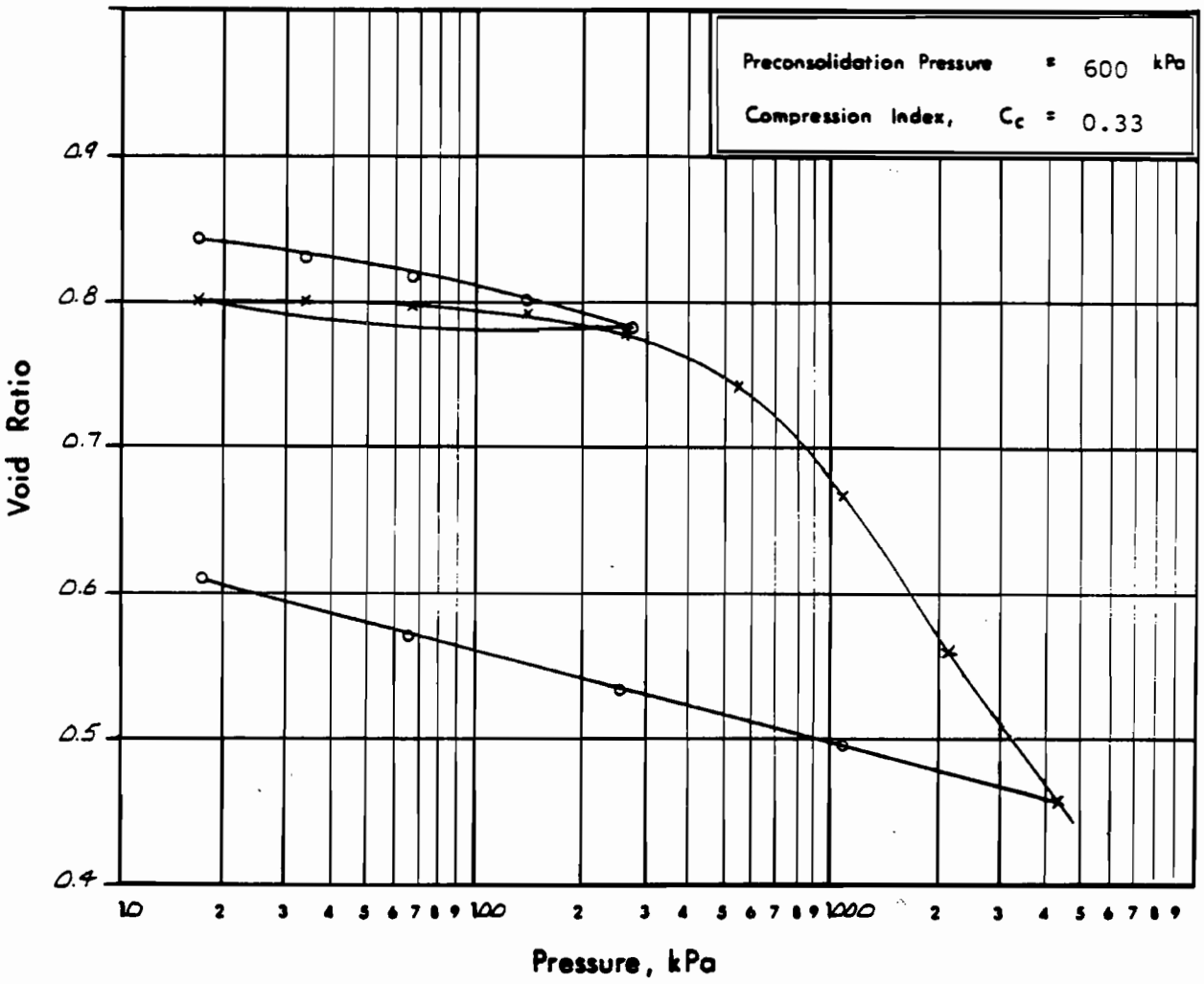
Figure. VI. 15

Site. West Amauligak **Borehole No.** 5

Sample No. 24 **Depth.** 40.5 - 41.1 m



PRESSURE kPa	VOID RATIO	m_v kPa^{-1}	c_v cm^2/sec	k cm/sec
17.1	0.805			
34.2	0.804	5.06×10^{-5}	1.5×10^{-1}	7.4×10^{-7}
68.6	0.798	8.95×10^{-5}	2.1×10^{-2}	1.8×10^{-7}
137.3	0.790	6.58×10^{-5}	9.2×10^{-3}	6.0×10^{-8}
274.7	0.776	5.83×10^{-5}	8.2×10^{-2}	4.7×10^{-7}
567.8	0.741	6.71×10^{-5}	$3.5 \times 10-2$	2.3×10^{-7}
1098.8	0.667	7.96×10^{-5}	9.9×10^{-3}	7.7×10^{-8}
2197.6	0.560	5.86×10^{-5}	5.5×10^{-3}	3.2×10^{-8}
4395.2	0.465	2.77×10^{-5}	7.8×10^{-3}	2.1×10^{-8}

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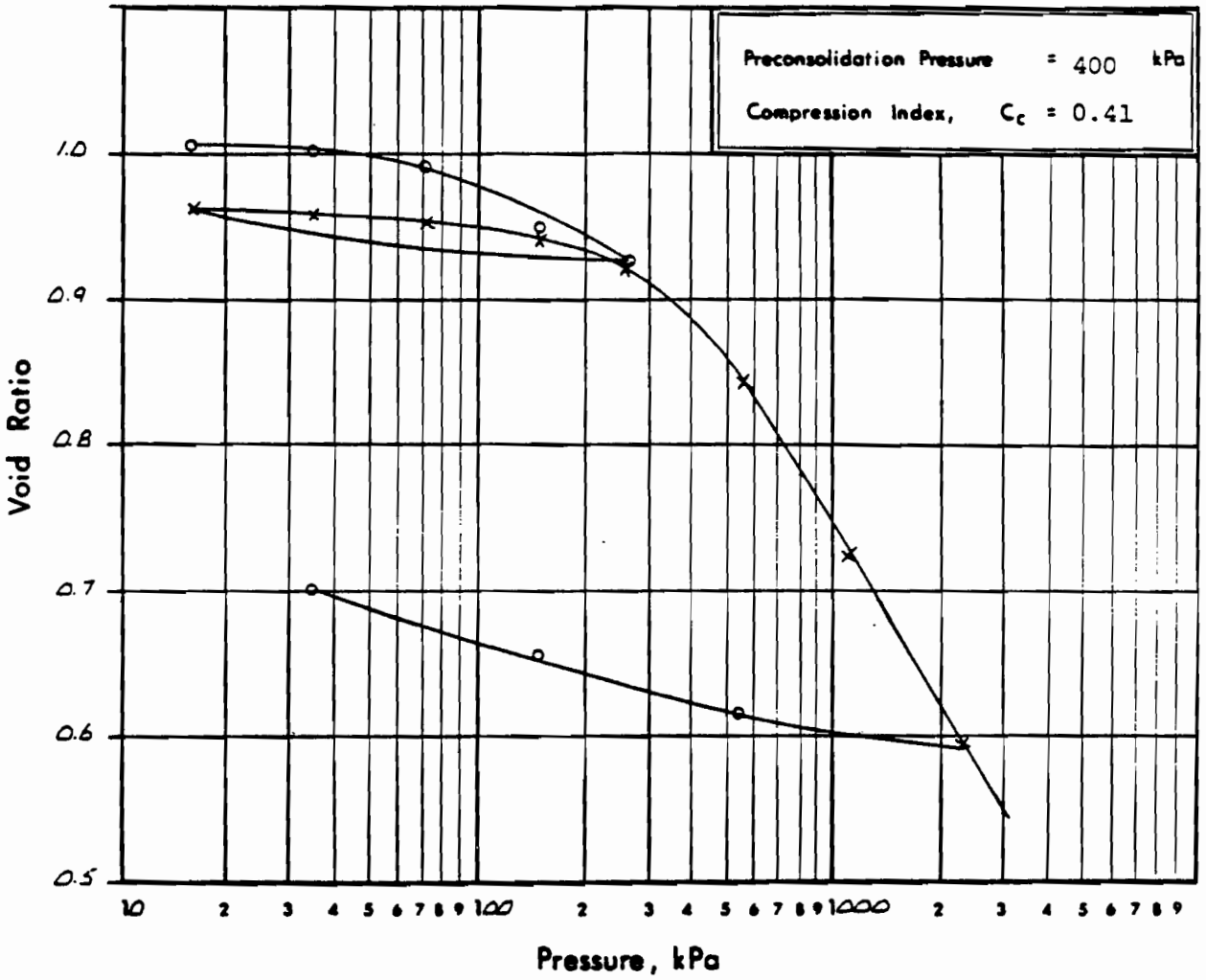
Figure. VI. 16

Site. West Amauligak Borehole No. 5

Sample No. 25 Depth. 42.1 - 42.7 m



PRESSURE kPa	VOID RATIO	m_v kPa^{-1}	c_v cm^2/sec	k cm/sec
17.7	0.965			
35.4	0.961	1.13×10^{-4}	1.4×10^{-2}	1.5×10^{-7}
71.0	0.955	9.36×10^{-5}	3.2×10^{-2}	2.9×10^{-7}
141.9	0.942	9.45×10^{-5}	1.1×10^{-1}	1.1×10^{-6}
283.9	0.923	6.77×10^{-5}	3.6×10^{-2}	2.4×10^{-7}
567.8	0.845	1.42×10^{-4}	1.0×10^{-2}	1.4×10^{-7}
1135.5	0.723	1.17×10^{-4}	1.2×10^{-2}	1.3×10^{-7}
2271.1	0.595	6.52×10^{-5}	4.0×10^{-2}	2.6×10^{-7}

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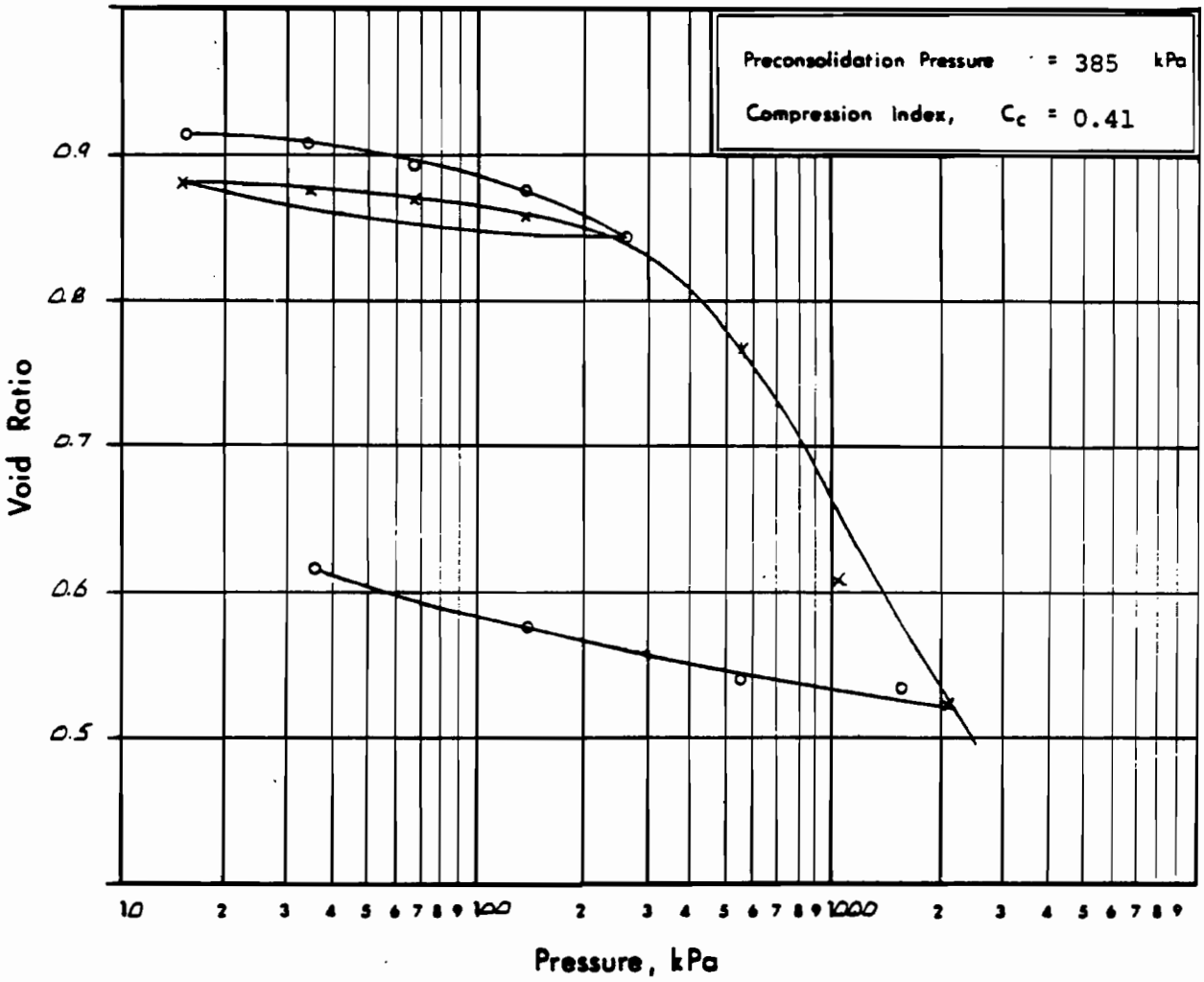
Figure. VI. 17

Site. West Amauligak Borehole No. 5

Sample No. 27 Depth. 46.6 - 47.2 m



PRESSURE kPa	VOID RATIO	m_v kPa^{-1}	c_v cm^2/sec	k cm/sec
17.1	0.878			
34.2	0.875	1.13×10^{-4}	2.1×10^{-2}	2.3×10^{-7}
68.6	0.868	1.07×10^{-4}	3.7×10^{-2}	3.9×10^{-7}
137.3	0.857	8.15×10^{-5}	3.7×10^{-2}	3.0×10^{-7}
274.7	0.841	6.23×10^{-5}	3.6×10^{-2}	2.2×10^{-7}
549.4	0.764	1.53×10^{-4}	1.0×10^{-2}	1.6×10^{-7}
1098.8	0.605	1.64×10^{-4}	1.2×10^{-2}	1.9×10^{-7}
2197.6	0.522	4.73×10^{-5}	1.9×10^{-2}	8.9×10^{-8}