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Ernest Orlando Lawrence Berkeley National Laboratory

Lithological Conditions at the Box Canyon Site: Results of Drilling, Coring and Open Borehole Measurements

1995–1997 Data Report

Boris Faybishenko, Preston Holland,
Marque Mesa, David Burgess,
Carol Knutson, and Buck Sisson

Earth Sciences Division

September 1998

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LITHOLOGICAL CONDITIONS AT THE BOX CANYON SITE: RESULTS OF DRILLING, CORING AND OPEN BOREHOLE MEASUREMENTS

1995-1997 Data Report

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September 1998

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Acknowledgments

Drilling was conducted by Roger Danielson and Michael Towler of the INEEL drilling crew and Dwain Cook of McCabe Bros. Drilling, Inc. Don Boyce and Michael Greens of the USGS-Idaho provided caliper measurements, gamma measurements, and TV recording. This report was reviewed by Christine Doughty and Peter Zawislanski, and their comments and recommendations are very much appreciated. Michael Steiger assisted in report preparation. This work was supported by the Characterization, Monitoring, and Sensor Technology Crosscutting Program within the Office of Science and Technology, U.S. Department of Energy, Office of Environmental Management under Contract No. DE-AC03-76SF00098.

Introduction

Motivation

DOE faces the remediation of several contaminated sites in unsaturated fractured basalt where organic and radioactive wastes have migrated downward through fracture pathways that are difficult, if not impossible, to detect. Perched water zones located above zones of low permeability (massive basalt) create a complicated system of hydraulic baffles. Because of these large scale heterogeneities, the characterization of the lithology of the rock and the geometry of the subsurface fracture pattern is a crucial step in the development of a conceptual model of fluid flow and chemical transport, and eventually the design of a remediation system.

The overall objectives of the investigations at the Box Canyon site were:

(1) Develop a suite of reliable tools and methodologies that can be used together to characterize fluid flow and chemical transport.

(2) Develop a conceptual model of fluid flow and chemical transport in unsaturated fractured basalt based on the results of ponded infiltration tests and lithological studies.

To address these objectives, a series of ponded infiltration tests was conducted at the Box Canyon site using instruments and monitoring techniques specifically designed to study fluid flow and chemical transport in fractured basalt.

General Description of the Site

The Box Canyon site, an analog site for contaminated sites, in located in the Eastern Snake River Plain near the Idaho National Engineering and Environmental Laboratory (Figure 1). In order to install the instrumentation and obtain lithological data, 38 vertical and slanted boreholes were drilled over the course of three years (1995-1997). Table 1 summarized the well coordinates, inclination, and lengths. Figure 2 shows the borehole layout and boundaries of the infiltration pond.

The surface of the site consists of exposed weathered basalt and soils (clays and silts) which infill the near-surface fractures and basalt column joints (Figure 3). Along the cliff face, about 30 m from the pond, two distinct basalt flow fingers and a rubble zone between them can be seen. The characteristic fracture spacing in the basalt flow exhibits an increase in spacing with depth in the upper 2/3 of the flow. The lower 1/3 exhibits an inverted pattern, in which the fracture spacing decreases with depth. This pattern of fracture spacing is most likely due to differences in cooling rate and temperature gradient near the center of the flow as compared to the exposed surfaces.

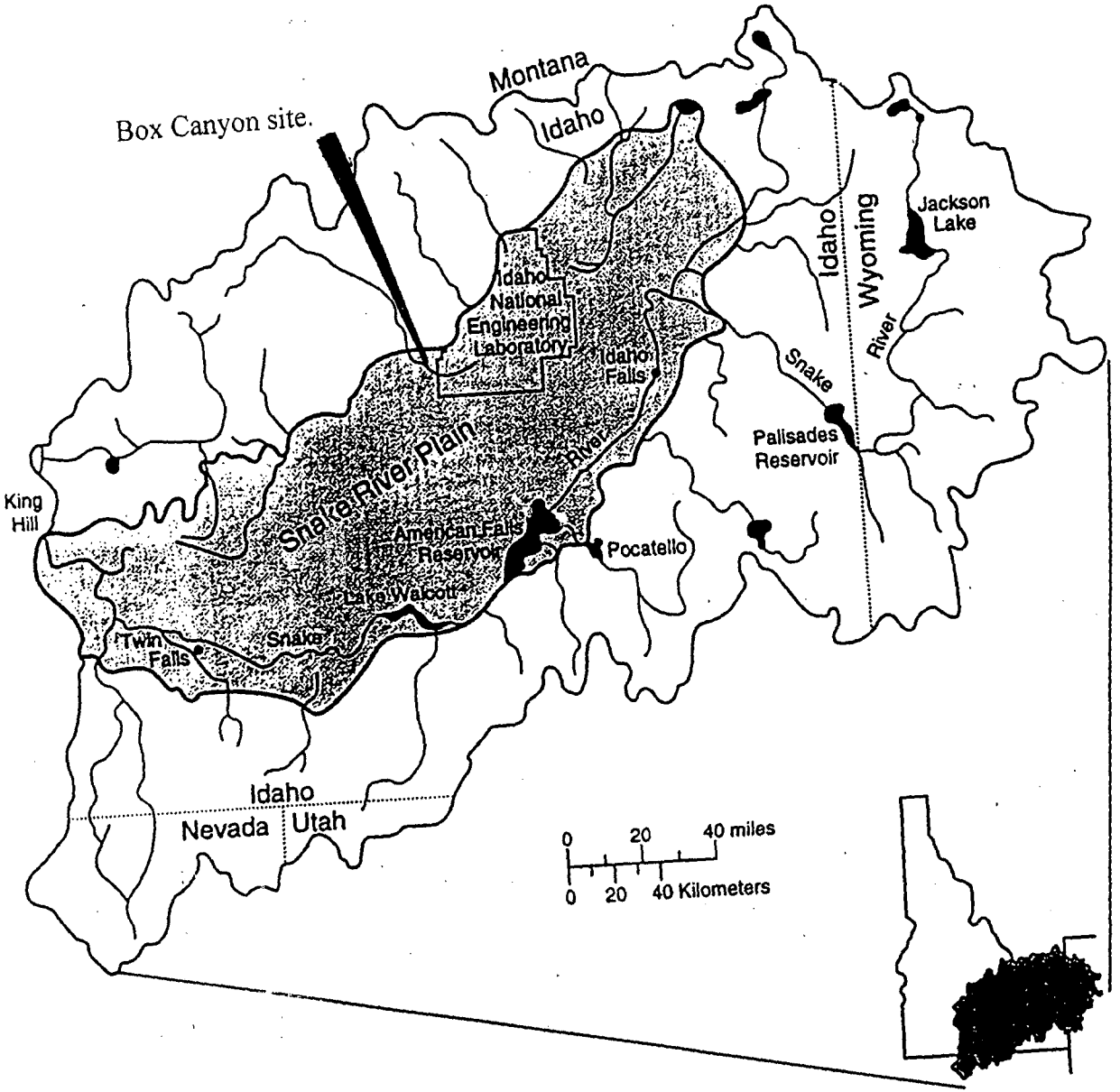


Figure 1. A map showing the location of the Box Canyon site.

Table 1. Well Information and Coordinate System for Box Canyon Site

well id	vertical/ slant	angle from vertical	length (ft)	length (m)	xtop (m) (east)	ytop (m) (north)	ztop (m) (elev.)	xbot (m) (east)	ybot (m) (north)	zbot (m) (elev.)
E-1	slant	45.0	60.0	18.29	57.90	61.80	1599.67	68.50	72.04	1586.74
E-2	slant	40.0	60.0	18.29	57.30	60.90	1599.69	64.43	70.25	1585.68
E-3	slant	35.0	60.0	18.29	56.20	60.00	1599.64	62.75	68.19	1584.66
E-4	slant	28.0	60.0	18.29	55.90	59.20	1599.63	61.14	66.00	1583.48
I-1	vertical	0.0	40.0	12.19	58.90	64.40	1599.64	58.90	64.40	1587.45
I-2	vertical	0.0	40.0	12.19	60.80	67.90	1599.70	60.80	67.90	1587.50
I-3	vertical	0.0	40.0	12.19	60.90	61.00	1599.65	60.90	61.00	1587.46
I-4	vertical	0.0	40.0	12.19	61.90	57.20	1599.57	61.90	57.20	1587.38
I-5	vertical	0.0	20.0	6.10	66.70	60.30	1599.46	66.70	60.30	1593.36
II-1	vertical	0.0	63.2	18.29	53.50	67.30	1599.82	53.50	67.30	1581.53
II-2	vertical	0.0	60.0	19.26	56.10	70.10	1599.68	56.10	70.10	1580.42
II-3	vertical	0.0	60.0	18.29	55.50	62.80	1599.65	55.50	62.80	1581.36
II-4	vertical	0.0	60.1	18.32	58.10	56.80	1599.57	58.10	56.80	1581.25
II-5	vertical	0.0	73.7	22.46	62.40	62.90	1599.70	62.40	62.90	1577.23
II-6	vertical	0.0	60.0	18.29	68.90	66.70	1599.34	68.90	66.70	1581.05
II-7	vertical	0.0	60.0	18.29	65.80	54.90	1599.50	65.80	54.90	1581.21
II-8	vertical	0.0	60.0	18.29	69.60	55.70	1599.35	69.60	55.70	1581.06
R-1	slant	27.5	65.0	19.81	72.79	62.84	1599.28	63.65	62.80	1581.71
R-2	slant	41.1	65.0	19.81	67.36	63.04	1599.57	54.38	63.00	1584.64
R-3	slant	27.3	65.0	19.81	71.80	67.89	1599.25	62.71	67.90	1581.65
R-4	slant	29.2	75.0	22.86	66.16	67.60	1599.53	55.05	67.60	1579.58
R-5	slant	25.9	60.0	18.29	70.43	62.94	1599.5*	59.43*	62.94*	1581.40*
R-6	slant	26.3	60.0	18.29	69.44	67.77	1599.5*	59.55*	67.77*	157.50*
S-1	slant	30.0	16.0	4.88	62.30	64.90	1599.60	61.04	62.81	1595.37
S-2	slant	30.0	20.1	6.13	63.30	66.10	1599.53	61.44	63.67	1594.22
S-3	slant	30.0	44.4	13.53	64.60	68.10	1599.58	60.71	62.56	1587.86
S-4	slant	30.0	69.4	21.15	66.50	71.80	1599.50	61.01	62.76	1581.18
T-1	vertical	0.0	20.0	6.10	57.30	63.00	1599.65	57.30	63.00	1593.56
T-2	vertical	0.0	20.0	6.10	67.00	64.50	1599.50	67.00	64.50	1593.41
T-3	vertical	0.0	20.0	6.10	63.30	69.20	1599.75	63.30	69.20	1593.65
T-4	vertical	0.0	20.0	6.10	63.10	58.20	1599.56	63.10	58.20	1593.46
T-5	vertical	0.0	10.0	3.05	62.10	63.40	1599.75	62.10	63.40	1596.70
T-6	vertical	0.0	22.0	6.71	60.70	63.10	1599.83	60.70	63.10	1593.13
T-7	vertical	0.0	20.0	6.10	59.70	62.80	1599.64	59.70	62.80	1593.54
T-8	vertical	0.0	10.0	3.05	59.70	64.30	1599.75	59.70	64.30	1596.70
T-8A	vertical	0.0	20.0	6.10	58.90	65.60	1599.60	58.90	65.60	1593.50
T-9	vertical	0.0	10.0	3.05	60.20	66.50	1599.68	60.20	66.50	1596.63
T-10	vertical	0.0	10.0	3.05	61.67	65.70	1599.67	61.70	65.70	1596.62

Notes: Coordinates of bottoms of slant wells have been calculated.

**approximate*

Figure 2. Borehole Layout at Box Canyon Site

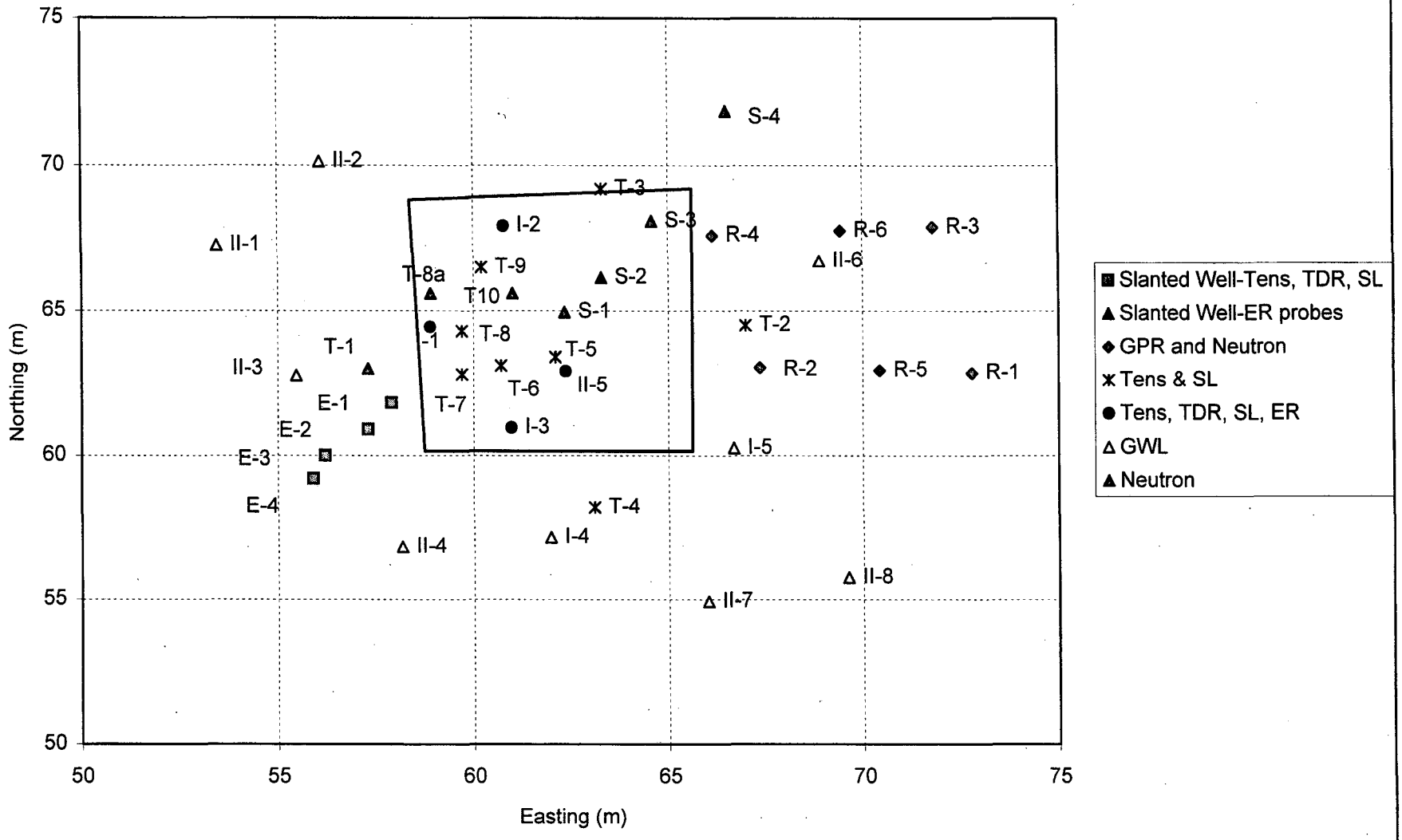


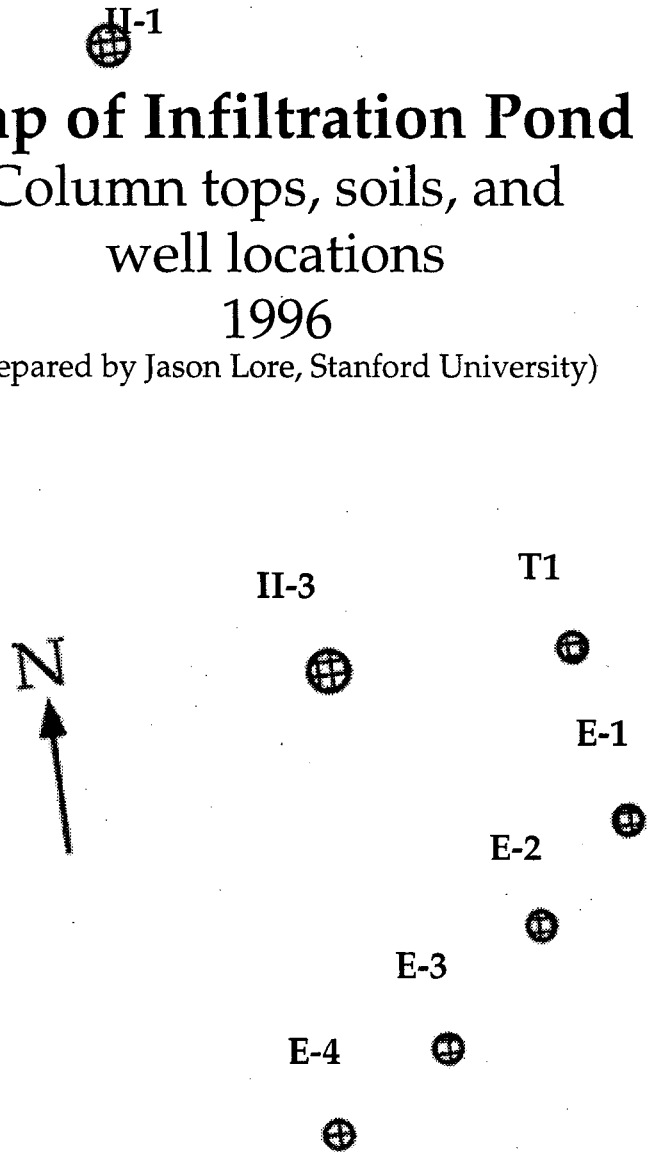
Figure 3

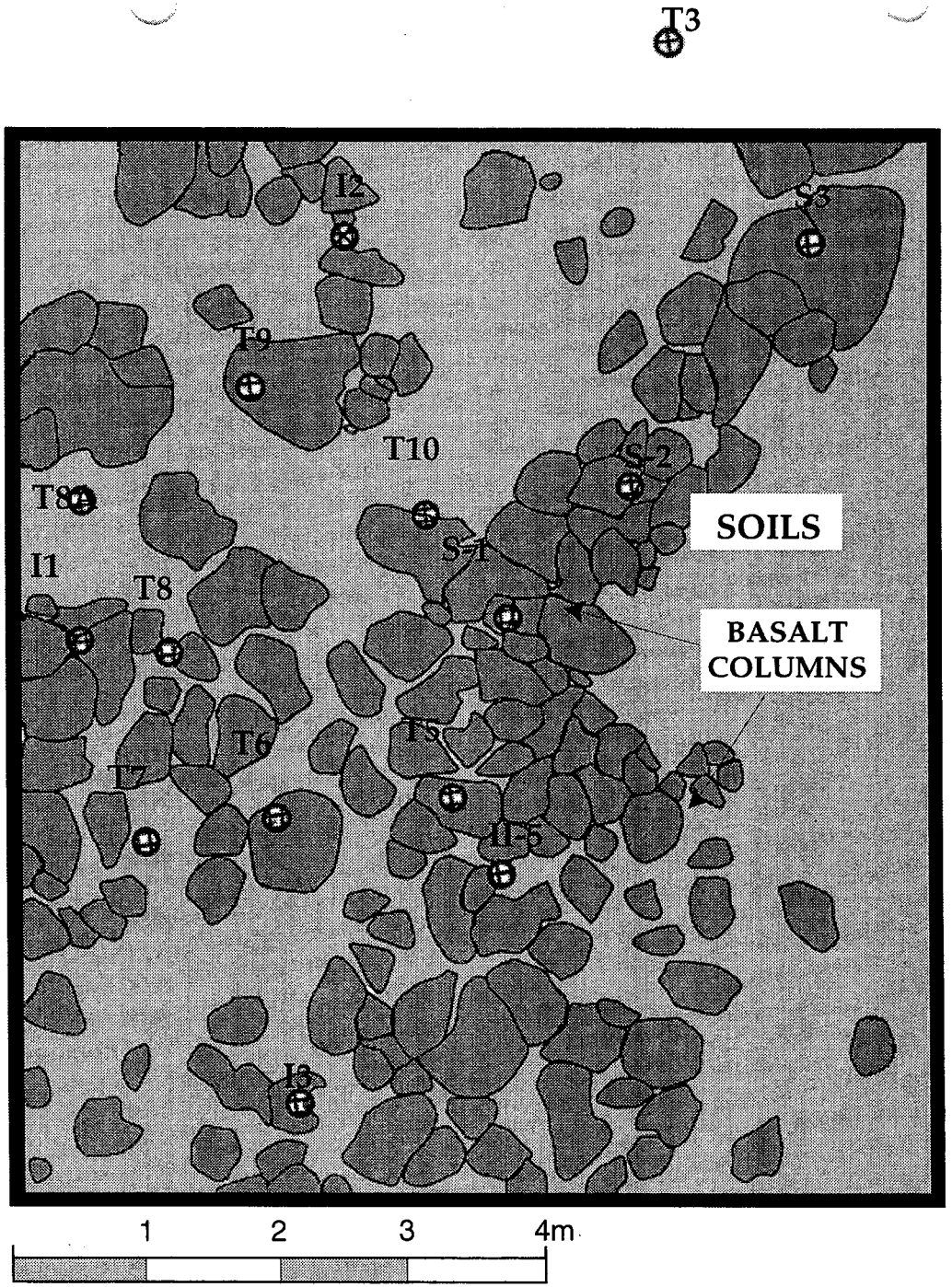
Map of Infiltration Pond

Column tops, soils, and well locations

1996

(Prepared by Jason Lore, Stanford University)





Studies of core and TV logs and cliff face mapping revealed that the fractured basalt vadose zone at the Box Canyon site is composed of the following geological components:

- Topsoil layer including flow-top rubble
- Upper vesicular zones with numerous near-surface soil-infilled fractures
- Massive basalt
- Vertical and sub-vertical column-bounding fractures
- Horizontal and sub-horizontal fractures
- Central fracture zone
- Lower vesicular zone
- Underlying rubble zone

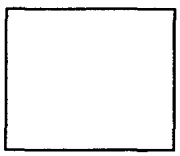
Purpose and Structure of the Report

The purpose of this data report is to compile and document the results of drilling and lithological studies conducted in open boreholes at the Box Canyon site. Lithological templates are included for each well and contain data such as drilling date, drilling method, logging method, well coordinates, lithological log, gamma measurements, caliper measurements, core run and recovery depth, vesicular intervals, single fracture depths and descriptions, fracture zone depths and descriptions, and general comments about the borehole lithology. The lithological features were mapped for each borehole, and a legend depicting each feature is given in Table 2. The gamma and caliper measurements are presented as separate plots using greater resolution. Color core photos and core descriptions are also included. TV logging was used to map the lithology of the boreholes that were not cored (E, R, and T wells). This information will be further used to create a comprehensive lithological model of the subsurface.

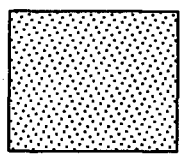
The TV logging of cored wells was viewed to compare the resolution and accuracy of TV logging to core logging. The TV logging method accurately showed large scale features such as zones of vesicularity, large fractures, fracture zones, rubble zones, and massive basalt zones, but it was difficult to detect hairline fractures, fracture orientation, and mineralization of fractures. Also, all depth measurements in increments less than 1 ft are estimated. TV logging is not as precise as logging directly from the core, but it is useful for mapping the major lithological features.

Table 2

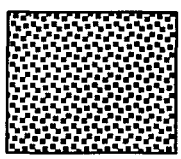
Lithological Legend
Box Canyon Site



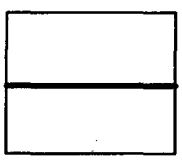
Massive Basalt



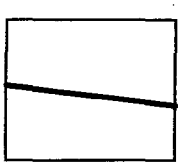
Vesicular Zone



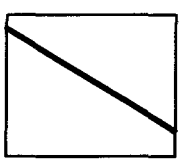
Rubble Zone



Horizontal Fracture



Low Angle Fracture

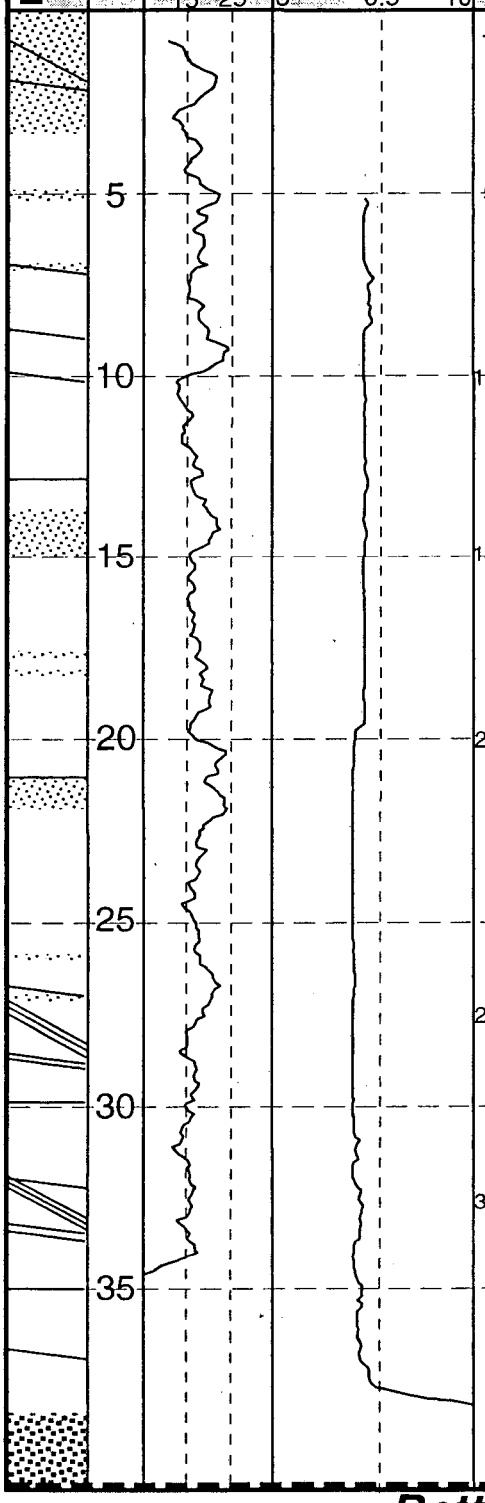


High Angle Fracture

Well I-1

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
I-1	July 17, 1995	T.V. Borehole Camera	Air Percussion	1/1

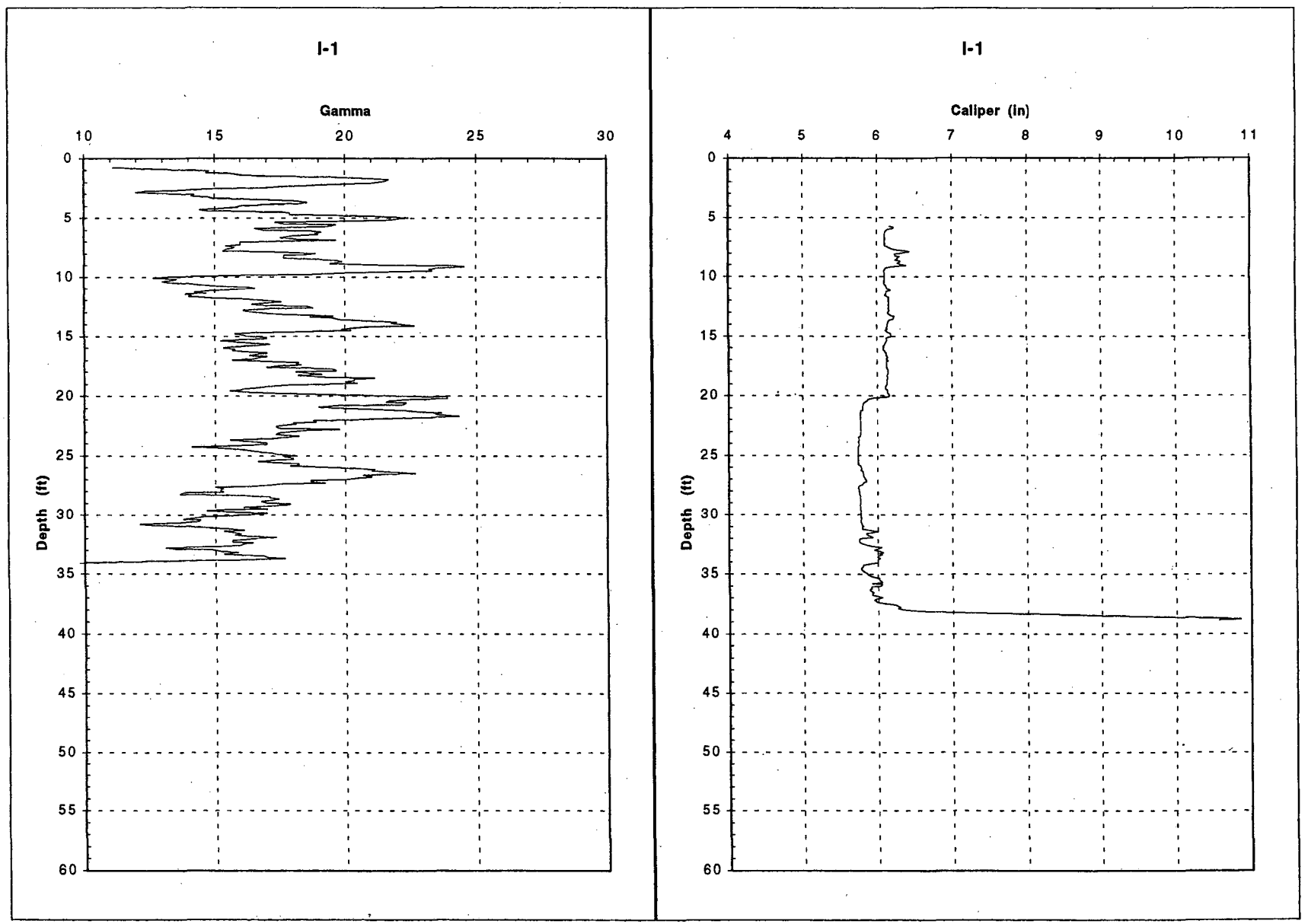
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	211.4 ft.	193.2 ft	5249.0 ft.



Lysimeter	Water: Before test	Water: During Test	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
1.0		▨		1.0	High angle.			Moderately Vesicular.
			3.0	2.0	Low angle.			
5.0		▨	5.0					Massive Basalt with sparse vesicles. Vesicular Bands.
			7.0	7.0	Low angle vesicular fracture.			
				9.0	Low angle.			
10.0		▨		10.0	Low angle.			
				12.9	Horizontal.			
			13.9					Vesicular.
15.0		▨	15.0					
			17.7					Vesicular Bands.
			18.3					
20.0	▨	▨						
			21.1	21.1	Horizontal.			Notice a decrease in Caliper from 6.1" to 5.75" at about 20 foot depth.
			22.0					
			26.0					Vesicular Bands. Slightly vesicular.
			27.0	26.8	Low angle.	27.0	3 high angle fractures.	
28.0	▨	▨		28.5	2 Low angle fractures.	28.5		
				29.9	Horizontal.			
				32.2	Low angle.	32.3	High angle fractures.	
33.0		▨		33.6	2 Low angle fractures.	33.0		
								Slightly vesicular.
				35.0	Horizontal.			
				36.9	Low angle.			
						38.0	Rubble Zone.	

Bottom of Well I-1 40.0'

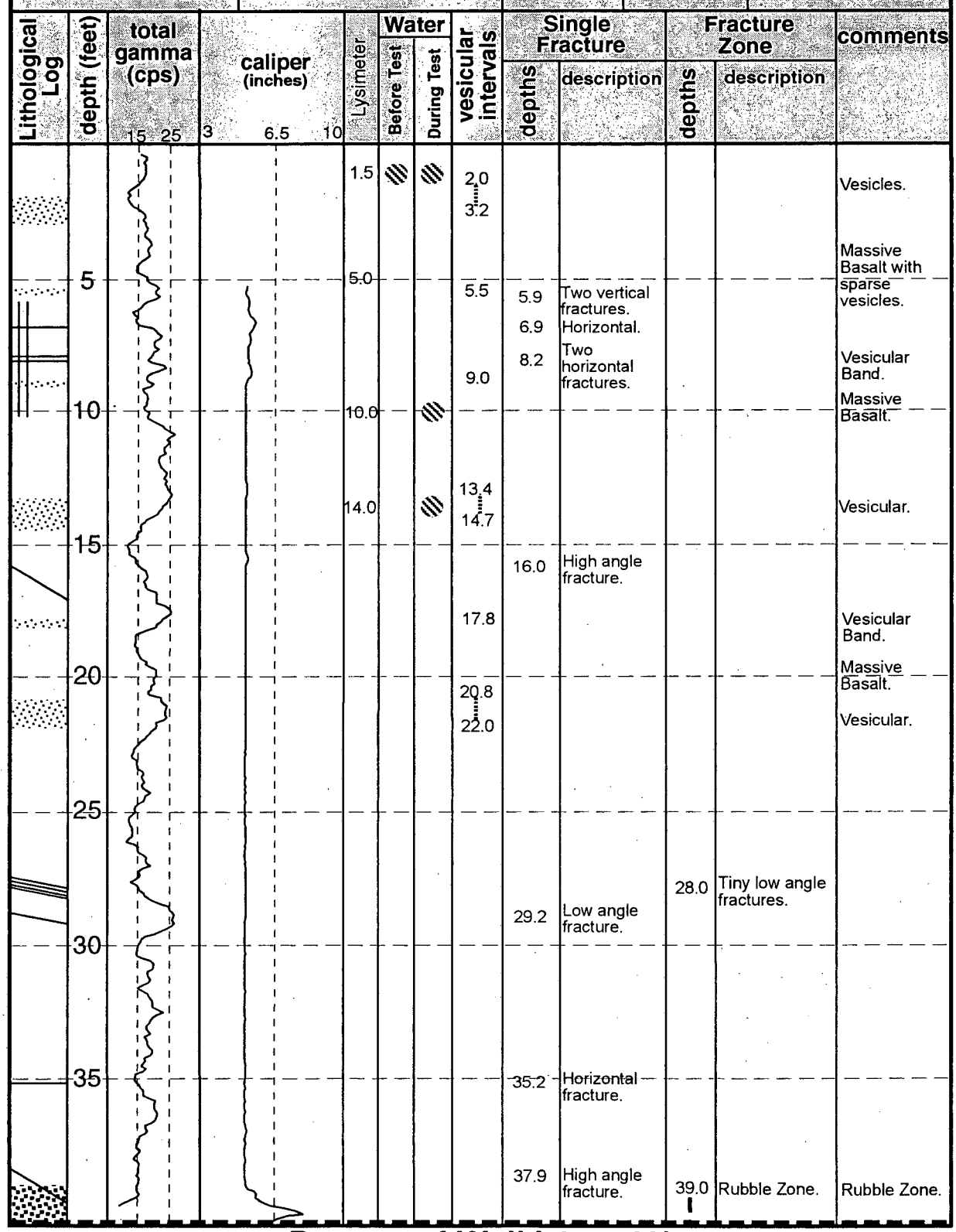
I1 Gamma and Caliper Data



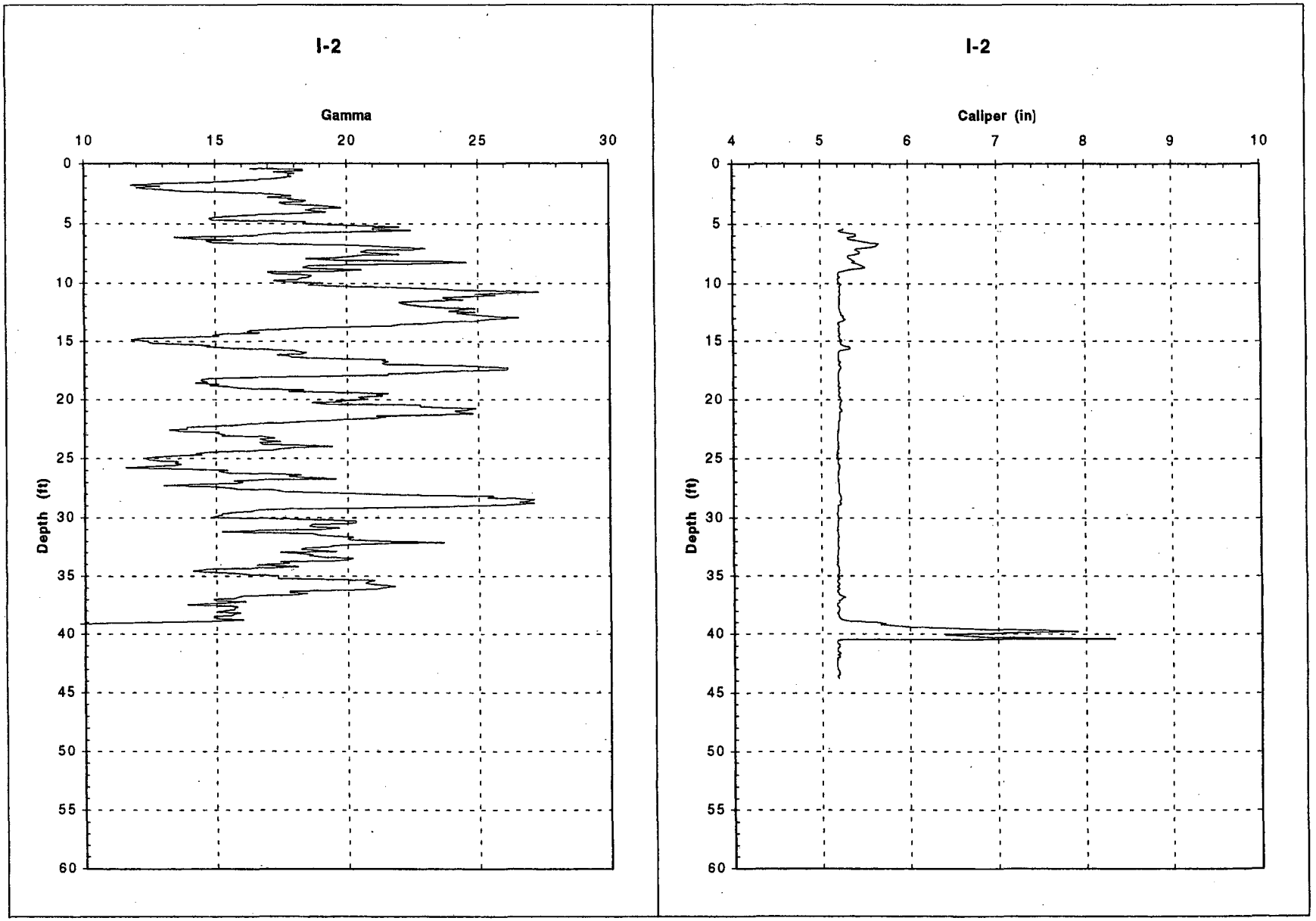
Well I-2

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
I-2	July 17, 1995	T.V. Borehole Camera	Air Percussion	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	222.9 ft.	199.4 ft	5248.8 ft.



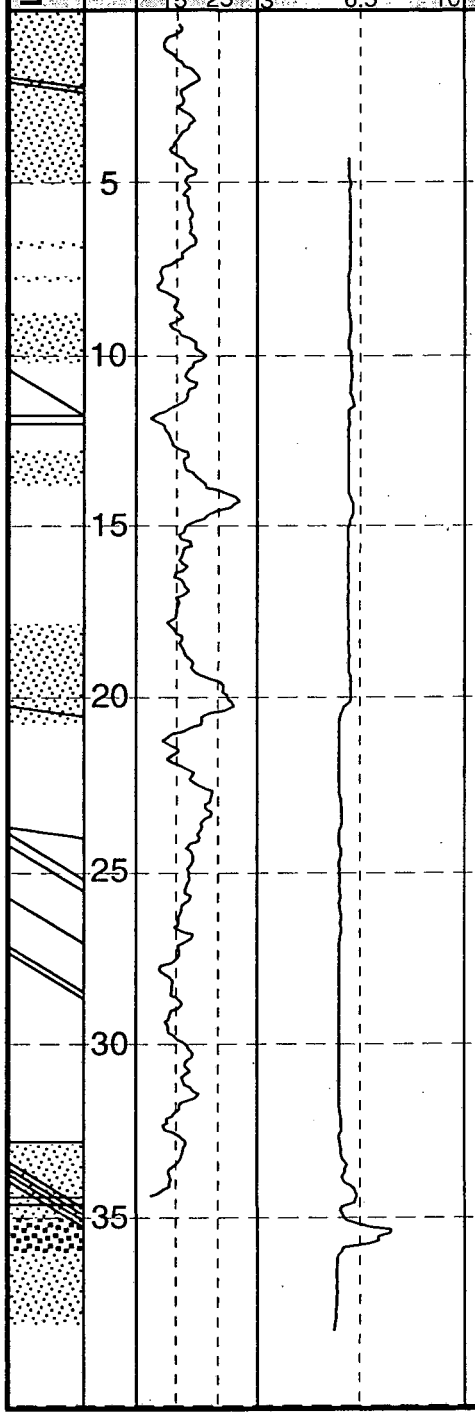
Bottom of Well I-2 40'


I-2
Gamma
10
15
20
25
30
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
I-2
Caliper (in)
4
5
6
7
8
9
10
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60

Well I-3

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
I-3	July 1995	T.V. Borehole Camera	Air Percussion	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	200.0 ft.	200.0 ft	5249.0 ft.

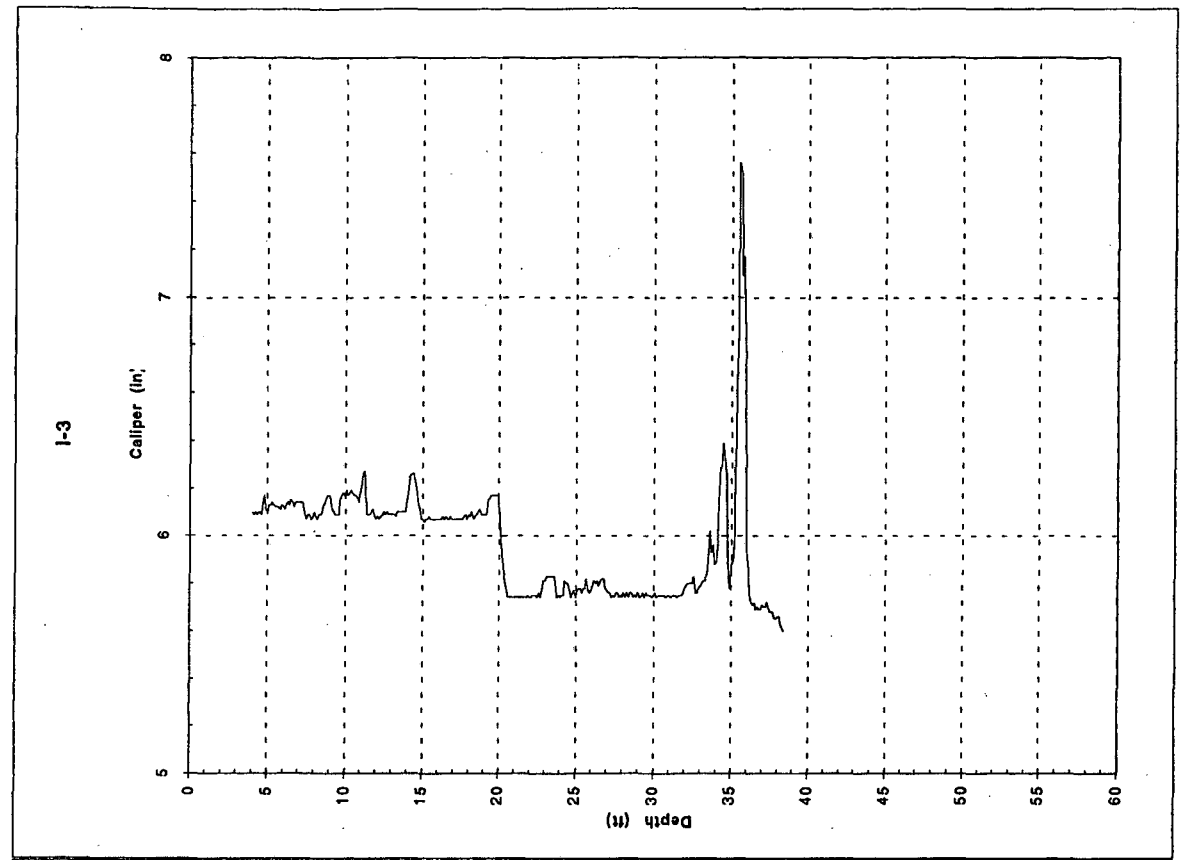


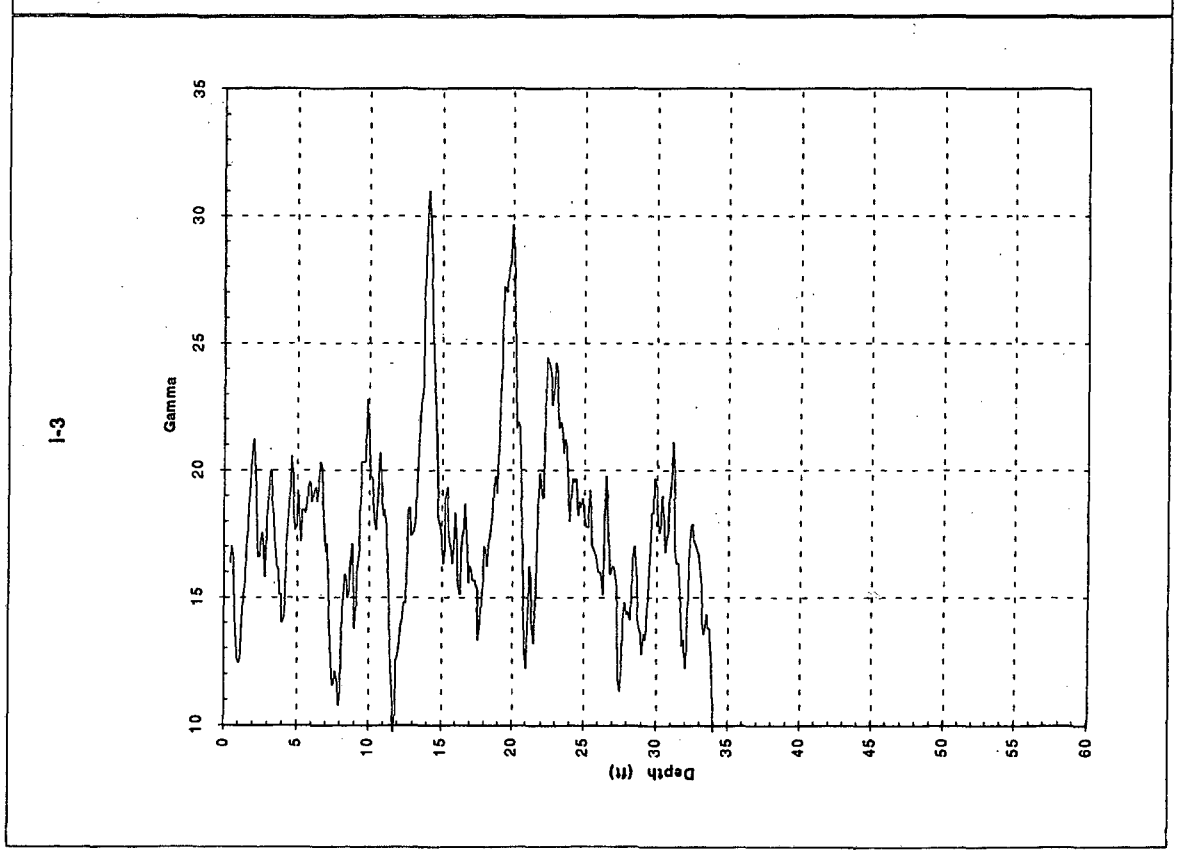
Lysimeter	Before	After	vesicular intervals
1.0			
5.0			5.0
			6.85
			7.9
			8.9
			10.2
			12.9
			13.9
			18.0
			20.9
			33.0
			35.0
			36.2
			38.0

Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
2.0 2.2	2 Low angle fractures.			Vesicular.
				Massive Basalt with sparse vesicels.
				Vesicular Bands.
10.8	High angle.			
11.8 12.2	2 Horizontal fractures.			Vesicular.
				Massive Basalt.
				Vesicular.
20.5	Low angle vesicular fracture.			Sudden and constant decrease in well diameter from 6.1" to 5.8" at 20'.
24.1 24.3	Low angle. 2 high angle fractures.			
25.9	High angle fracture.			1 Large single vesicle.
27.1 27.2	2 High angle fractures.			
				Massive Basalt.
32.9	Horizontal fracture.			
		33.9	Horizontal and high angle fracture zone.	Vesicular.
		35.0 36.2	Rubble Zone.	Rubble Zone.
				Vesicular.

Bottom of Well I-3 40'

I3 Gamma and Caliper Data

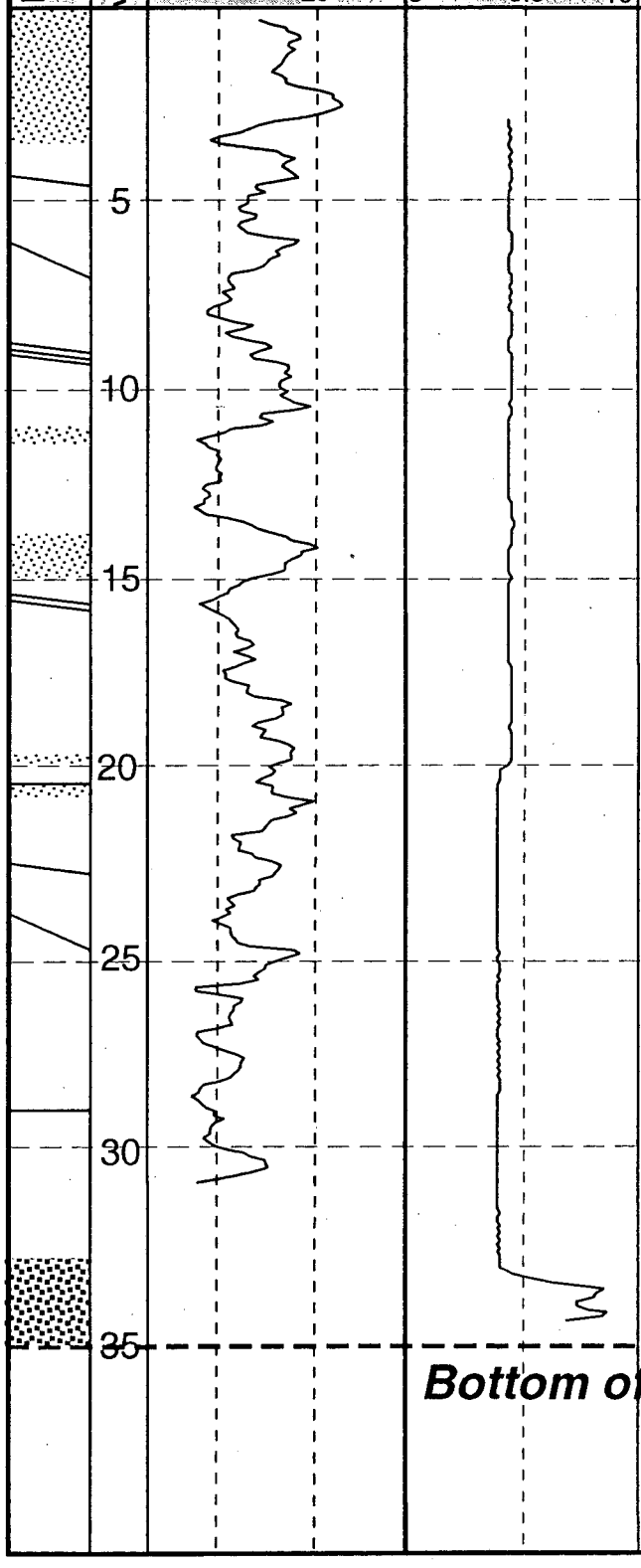




Well I-4

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
I-4	8/17/95	T.V Borehole Camera	Air Percussion	1/1

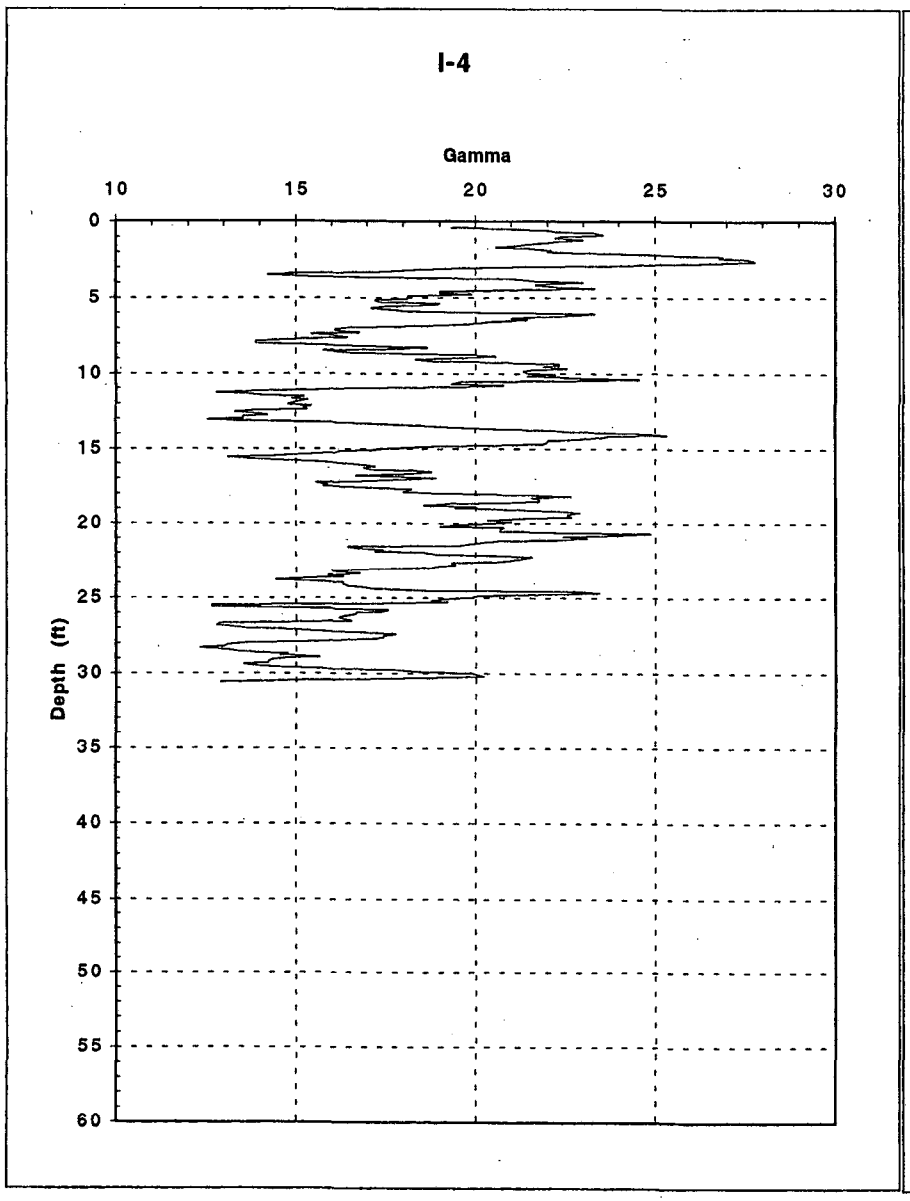
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	187.7 ft.	203.1 ft.	5249.6 ft.

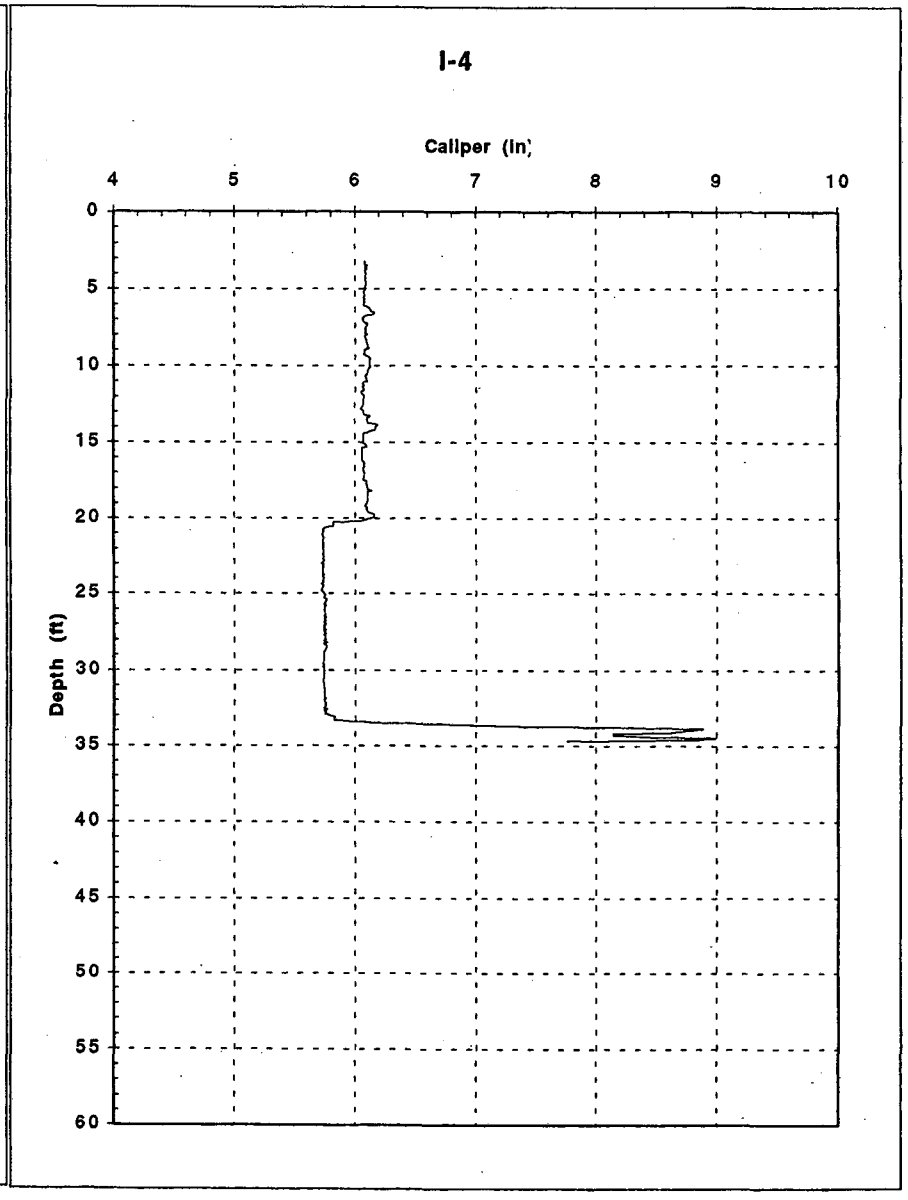


vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
					Vesicular.
3.6					2.9' one large vesicle. 4.0' one large vesicle.
	4.8	Low angle fracture.			5.0' basalt with random vesicles.
	6.8	High angle fracture.			
	9.3	3 Low angle fractures.			Vesicular fractures.
11.2					Vesicular Band.
11.5					
13.8					Massive Basalt.
14.9					Vesicular.
	15.7	2 Low angle fractures.			
					Massive Basalt.
19.8					2 Vesicular Bands.
20.6	20.5	Horizontal fracture.			Notice a sudden and constant decrease in well diameter from 6.1" to 5.75" at 20'.
	22.9	Low angle fracture.			
	24.4	High angle fracture.			
	29.1	Horizontal fracture.			Massive Basalt.
			32.9	Rubble Zone.	Rubble Zone.

Bottom of Well I-4 35.0'

I-4 Gamma and Caliper Data

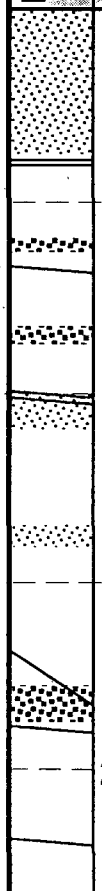




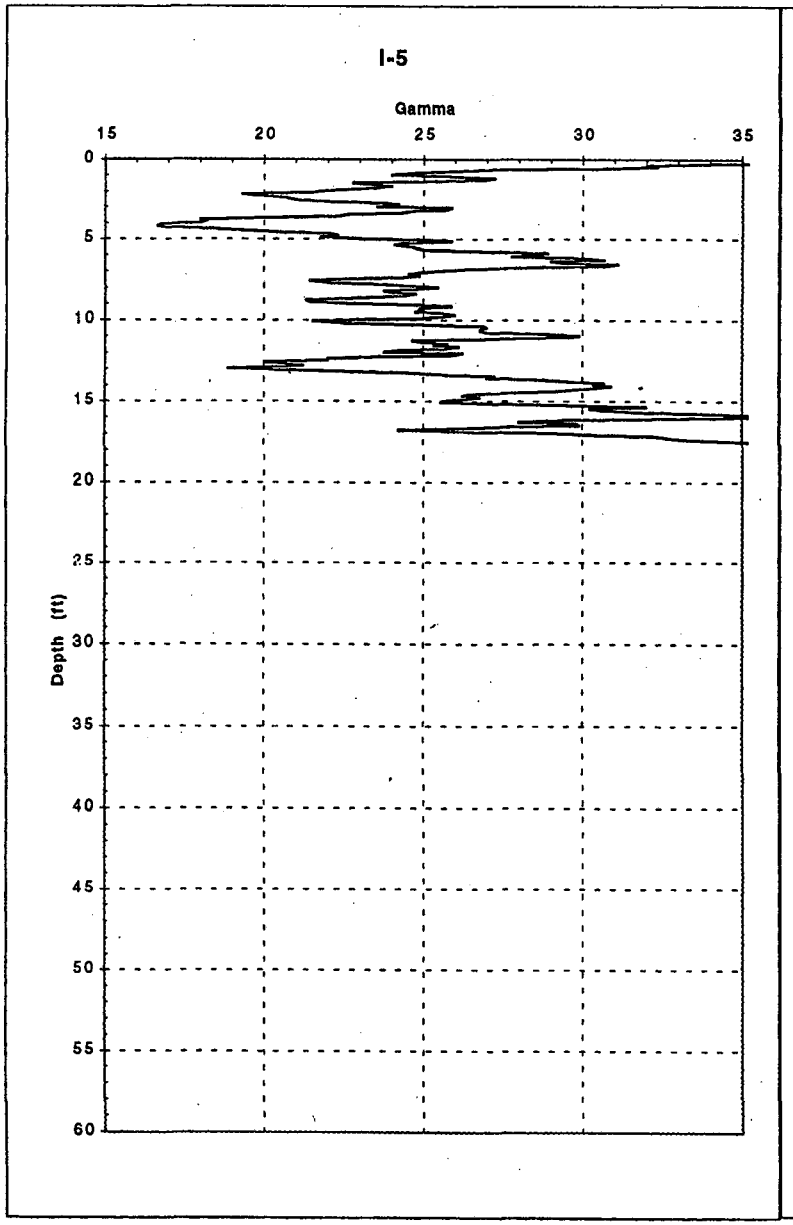
Well I-5

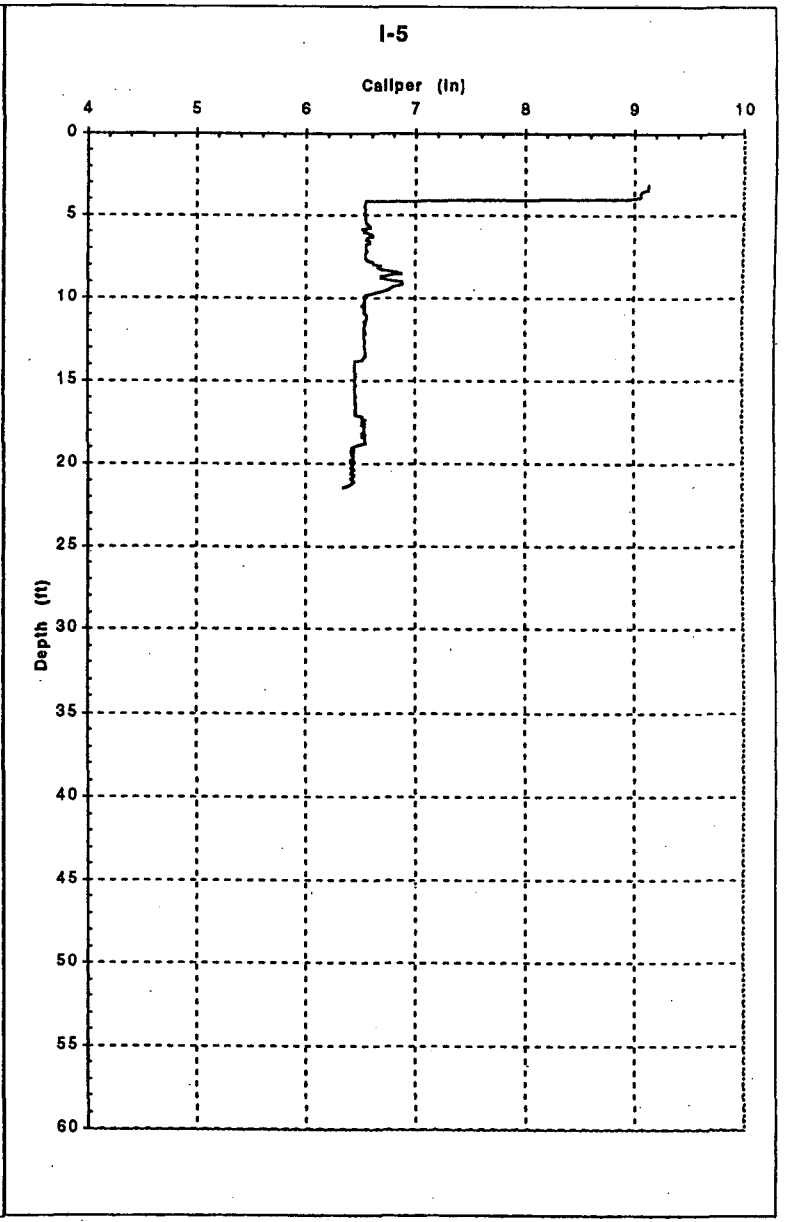
BORING #:	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
I-5	July 1995	T.V Borehole Camera	Air Percussion	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	197.8 ft.	218.8 ft.	5246.5 ft.



Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
				3.8	4.0 4.1	2 Horizontal fractures.			Vesicular Zone. Notice a sudden decrease in caliper.
	5				7.1	Low angle fracture.	6.1 6.3	Rubbly Area.	Rubbly Area.
							7.9 8.3	Rubbly Area.	Rubbly Area.
	10			10.0 11.2	10.1 10.3	2 Low angle fractures.			Vesicular Zone.
				13.7 14.1					
	15								Massive Basalt.
					17.1	High angle fracture.	17.5 18.5	Rubbly Area.	Rubbly Area.
					19.1	Low angle fracture.			
	20								Massive Basalt.
					21.8	Low angle fracture.			
			Bottom of Well I-5 23.3'						
	25								
	30								
	35								

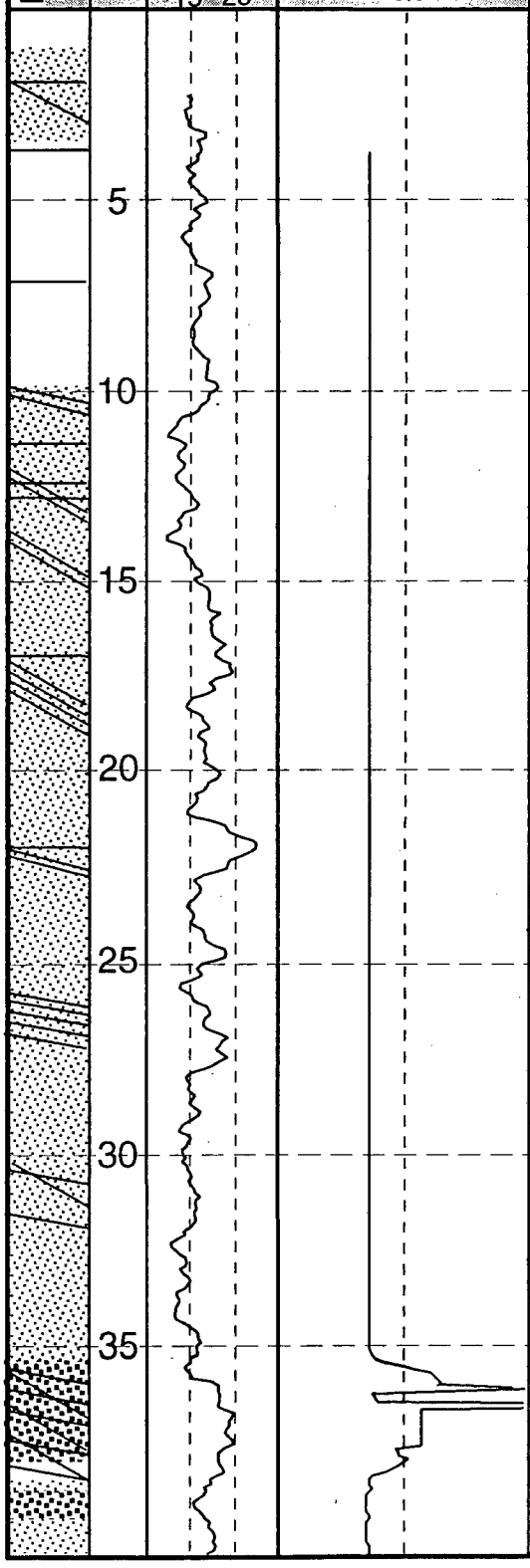

I-5
Gamma
15
20
25
30
35
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60


I-5
Caliper (in)
4
5
6
7
8
9
10
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60

Well II-1

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-1	07/02/95	Coring.	HX Coring using Water	1/2

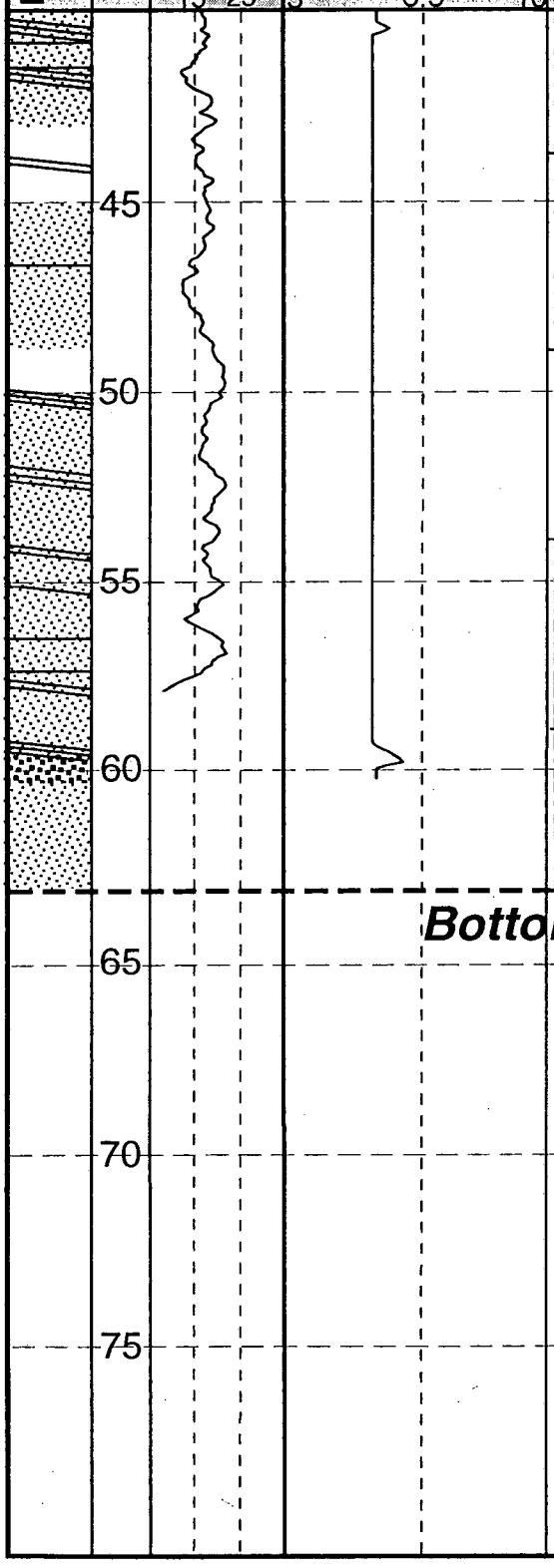
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	220.8 ft	175.5 ft	5246.5 ft



Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
				No Recovery.
2.3	Horizontal sed. stained.	2.3	High angle fractures with sed. staining.	Upper Vesicular.
3.8	Horizontal sed. staining with mineralization	3.1		Massive Zone.
7.3	Horizontal sed. stained.			
		10.0	Low angle fracture zone with sed. stain.	Massive Zone.
11.2	Horizontal sed. stained.			Moderately vesicular.
12.6	2 Horizontal fractures.	12.0	High angle sed. stained.	
13.0		13.5		
		14.5	High angle sed. stained.	Sediment staining.
				Massive Zone.
16.8	Horizontal sed. stained.	17.3	Highly fracture zone. Low and High angle. No sed. staining.	Moderately vesicular.
		18.3		
				Massive Basalt. Moderately vesicular.
22.2	Horizontal sed. stained.	23.0	Low angle fracture zone.	
		26.0	Low angle fracture zone with sed. staining.	
		27.5		
				Massive Zone.
		30.3	1 high angle and 1 low angle fracture. Sed. stained.	Moderately vesicular.
32.2	Low Angle sed. stained.			
				Lower Vesicular.
		35.5	Highly fractured zone. Low and high angle.	35.5 Flow Break. Rubble Zone.
		38.4		Partially sediment filled.

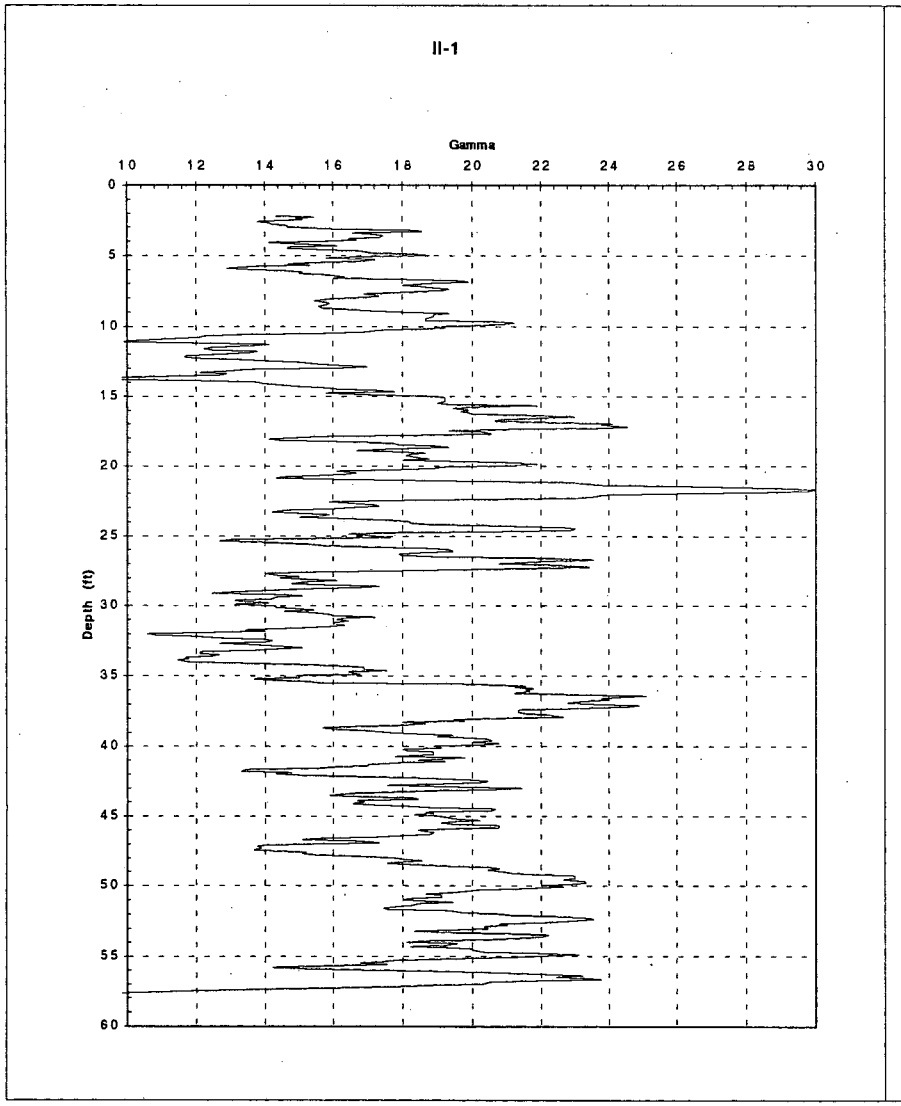
BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-1	07/02/95	Coring.	HX Coring using Water	2/2

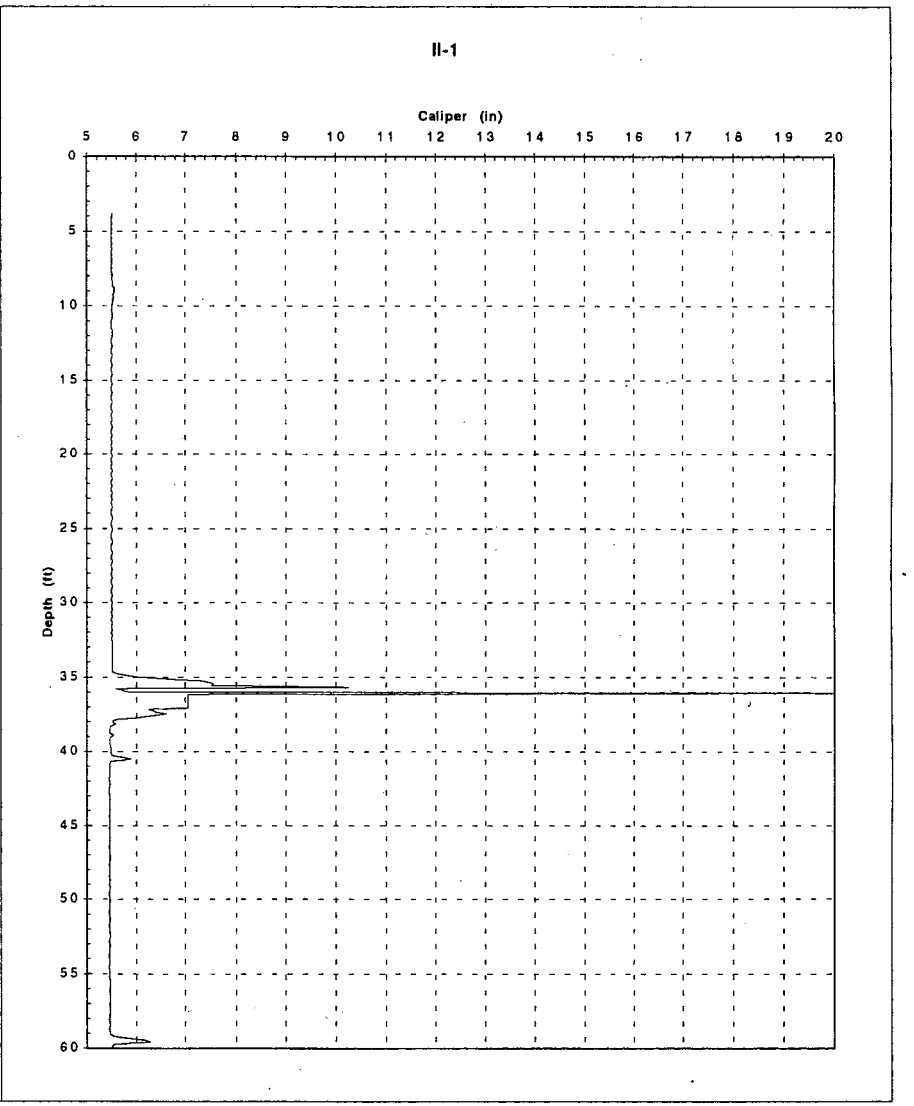
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	220.8 ft	175.5 ft	5246.5 ft



Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
40.6 41.2	2 Horizontal sed. stained fractures.	40.2 41.3 41.7	Highly fractured zone. Low angle with sed. staining.	Rubble-like.
	Low angle sed. stained.	43.8	Low angle sed. stained.	Massive Zone.
				Massive Zone.
46.7	Horizontal sed. stained.			Slightly vesicular.
				Massive Zone.
		50.2	Low angle sed. stained.	Highly vesicular.
		51.6 52.2	Low angle sed. stained. Low angle sed. stained.	Highly vesicular.
		54.6	Low angle sed. stained.	Massive Zone.
55.2	Low angle sed. stained.			Slightly vesicular.
56.7 57.5	2 Horizontal fractures.	57.8	Low angle sed. stained.	Lower vesicular.
		59.6 60.1	Highly fracture zone. Sed. staining. Rubble zone.	59.6' Flow Break. Rubble Zone.

Bottom of Well II-1 63.2'

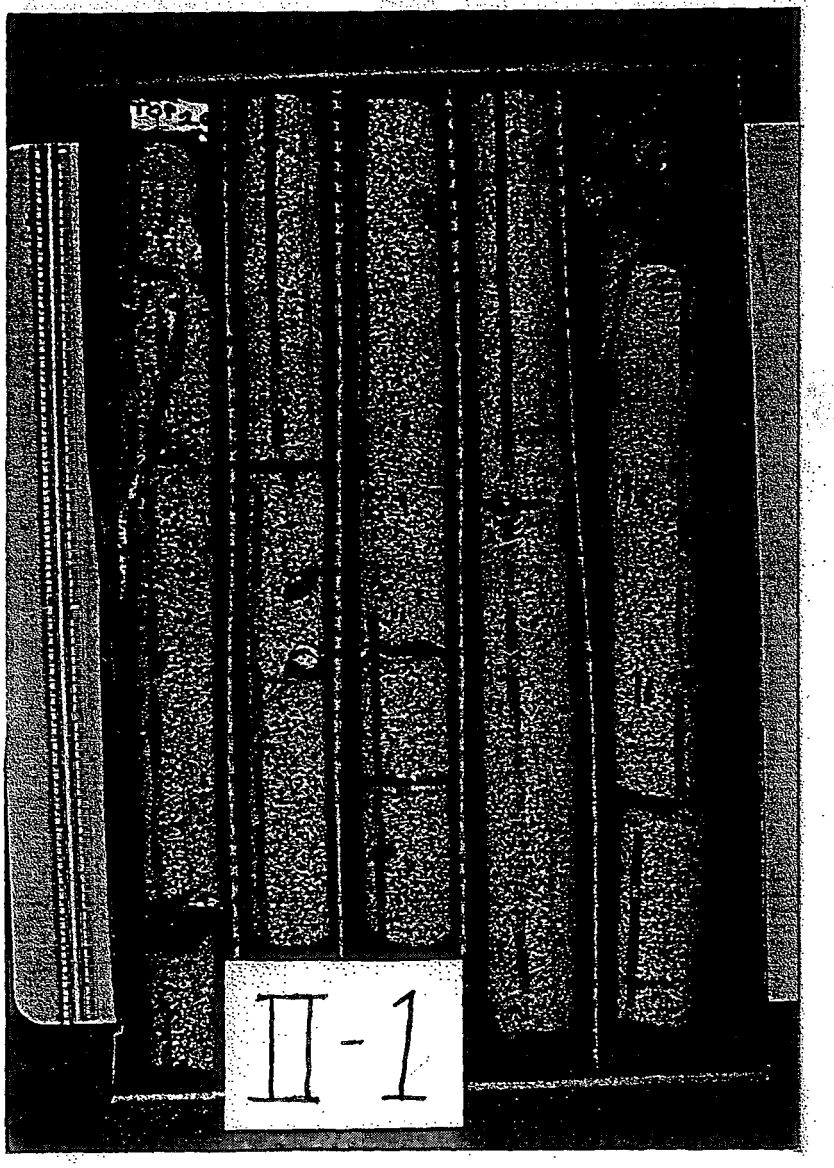

II-1
Gamma
10 12 14 16 18 20 22 24 26 28 30
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50 55 60

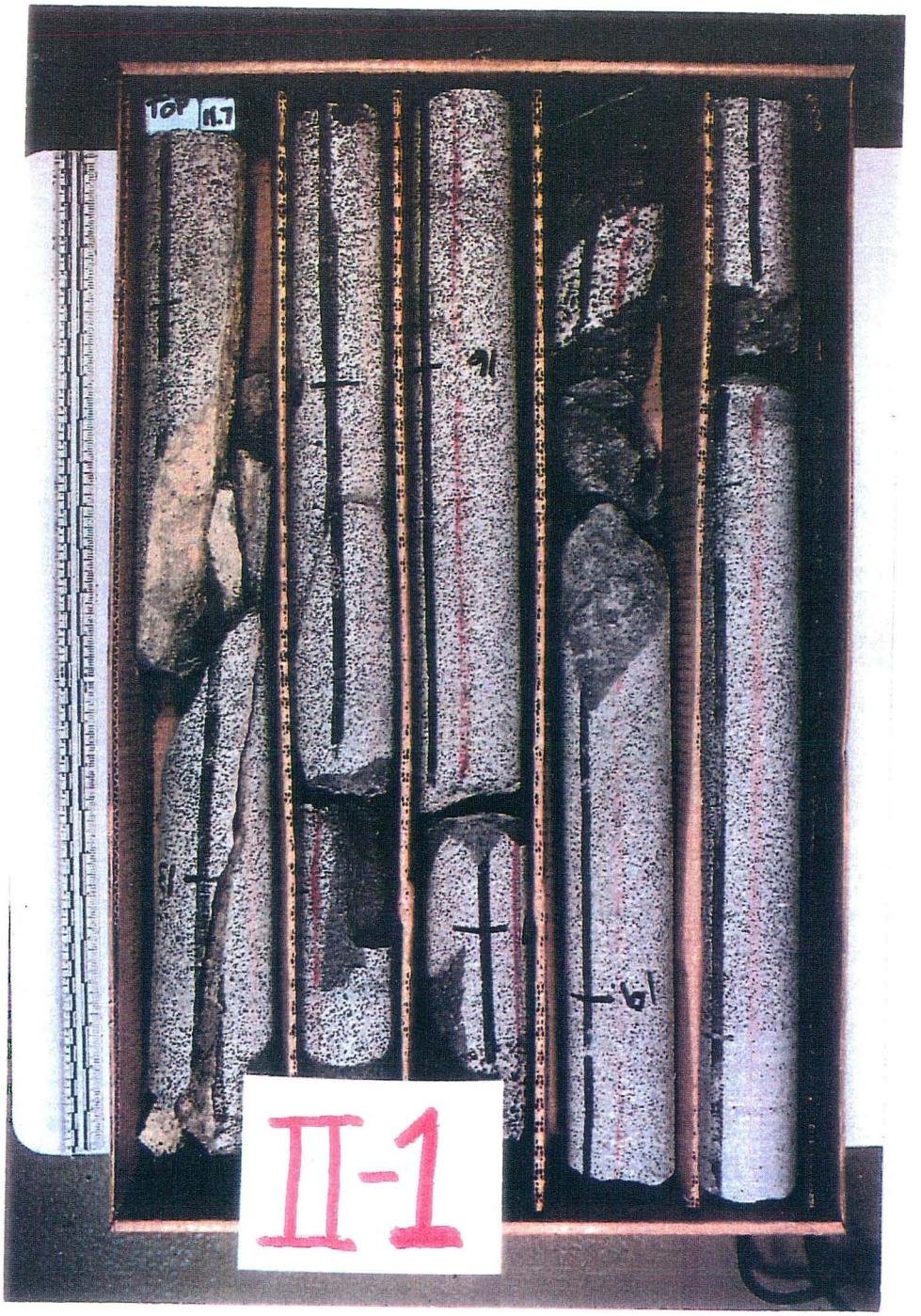

II-1
Caliper (in)
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50 55 60

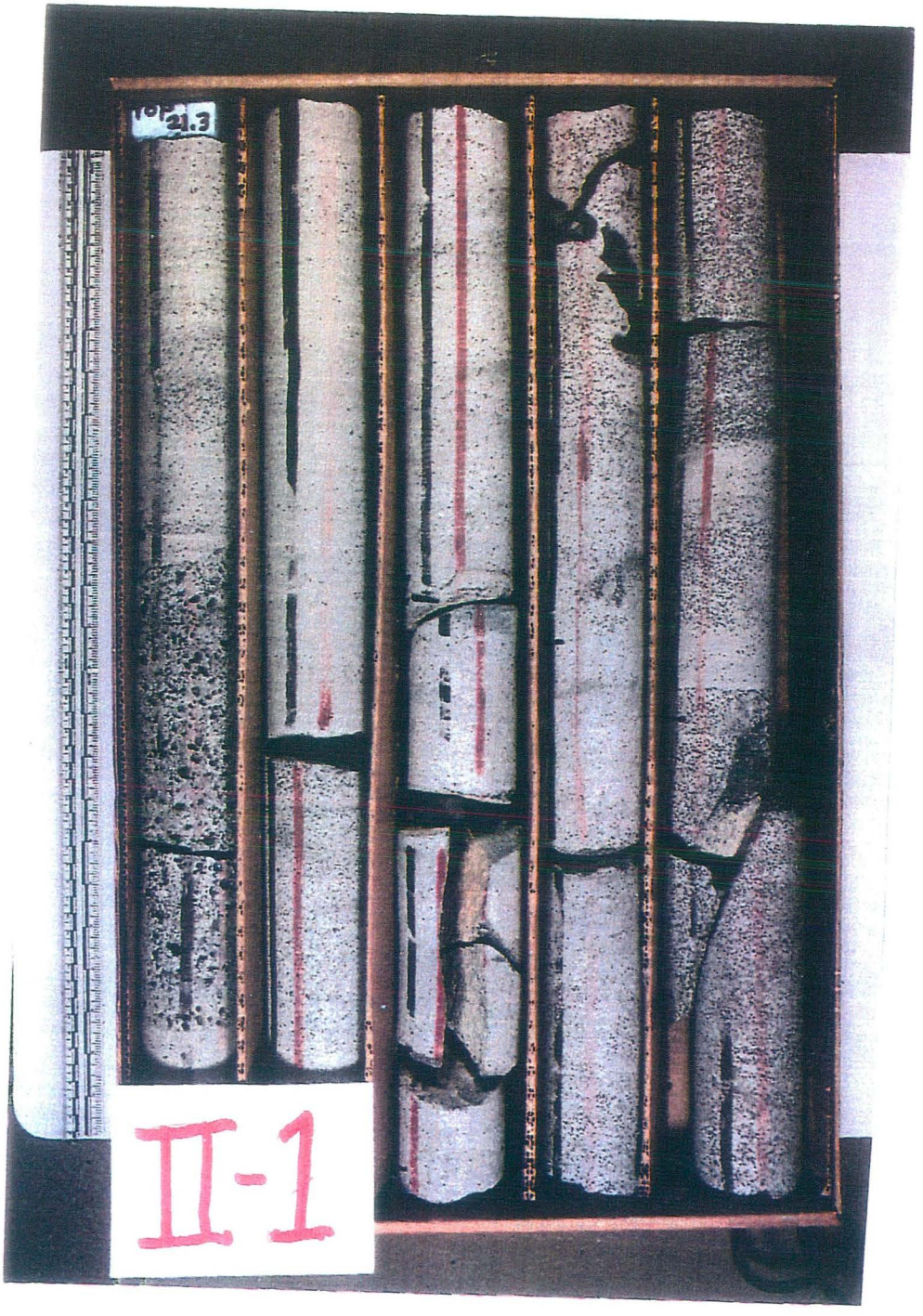
Well II-1 Vertical Well
Core logging by David Burgess on July 2, 1995

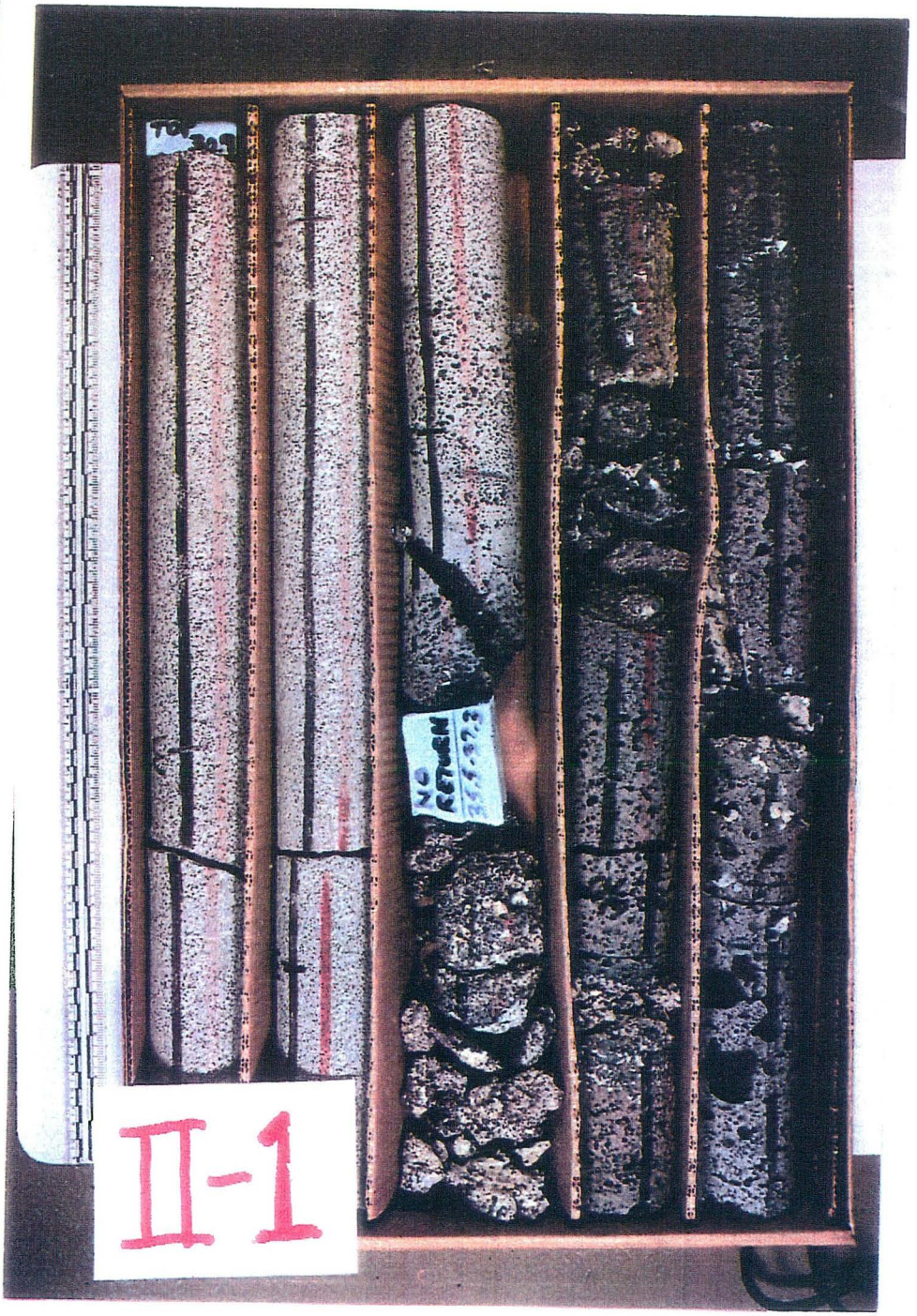
Core Run (feet)	Vertical Depth (feet)	Description
0-2.0	0-2.0	No recovery
2.0-4.7	2.0-3.5	Upper vesicular
	3.5-4.7	Massive basalt zone
	2.3	Horizontal fracture with sediment staining
	2.3-3.1	High angle fracture with sediment staining
	3.78	Horizontal fracture with sediment staining and mineralization
4.7-9.8	4.7-9.8	Massive zone
	7.3	Horizontal fracture with sediment staining
9.8-14.8	9.8-10.1	Massive zone, moderately vesicular
	10.1-14.8	Massive zone, slightly vesicular
	9.8-10.1	Massive zone, moderately vesicular
	11.2	Horizontal fracture with sedimentary staining
	12.0-13.5	High angle fractures with sedimentary staining
	14.3-14.8	High angle fracture with sedimentary staining
14.8-19.8	14.8-17.2	Massive zone, slightly vesicular
	17.2-17.5	Massive zone, moderately vesicular
	17.5-19.8	Massive zone, slightly vesicular
	16.8	Horizontal fracture with sedimentary staining
	17.3-18.3	Highly fracture zone-No sedimentary staining-Probably due to drilling
19.8-24.3	19.8-22.0	Massive basalt, slightly vesicular
	22.0-22.9	Massive zone, moderately vesicular
	22.9-24.3	Massive basalt, slightly vesicular
24.3-29.3	24.3-29.3	Massive basalt, slightly vesicular
	26.0-26.1	Low angle fracture with sedimentary staining
	26.3-26.8	Fracture zone with sedimentary staining
	27.1-27.5	Several low angle fractures with sedimentary staining
29.3-33.8	29.3-33.8	Massive basalt, slightly vesicular
	30.1-30.6	Fracture zone with sedimentary staining
	29.9	Horizontal fracture with sedimentary staining
	32.2	Low angle fracture with sedimentary staining
33.8-38.8	33.8-34.7	Massive zone, slightly vesicular
	34.7-35.5	Lower vesicular
	35.5-37.3	Flow Break. No returns--Probably rubble zone
	37.3-38.4	Rubble zone--Partially sediment filled
	38.4-38.8	Upper vesicular
	35.5-38.4	Highly fractured
38.8-43.8	38.8-39.5	Rubble Zone--Might be part of upper vesicular
	39.5-42.8	Upper vesicular
	42.8-43.8	Massive zone
	38.8-39.5	Rubbly
	40.2-40.3	Highly fracture zone almost completely filled with sediment
	40.6	Horizontal fracture with sediment staining
	41.2	Horizontal fracture with sediment staining
	41.3-41.7	Highly fracture zone with sediment staining
43.8-49.0	43.8-49.0	Massive zone, slightly vesicular
	43.8-43.9	Low angle fracture with sedimentary staining
	46.7	Horizontal fracture with sedimentary staining
49.0-54.0	49.0-49.8	Massive zone

	49.8-54.0	Massive zone, highly vesicular
	50.0-50.3	Several low angle fractures with sediment staining
	51.5-51.7	Low angle fracture with sediment staining
	52.2-52.3	Low angle fracture with sediment staining
		Must have been some earlier redrill--driller says bottom of hole is 53.1 According to core, the bottom is at 54.0
53.1-58.2	53.1-53.8	Massive zone, highly vesicular
	53.8-57.4	Massive zone, slightly vesicular
	57.4-58.2	Lower vesicular, moderately vesicular
	54.6-54.7	Low angle fracture with sediment staining
	55.2	Low angle fracture with sediment staining
	56.7	Horizontal fracture, no sediment staining
	5.5	Horizontal fracture, no sediment staining
	57.7-57.9	Several low angle fractures with sediment staining
58.2-63.2	58.2-59.6	Lower vesicular
	59.6-59.9	Rubble zone--flow break
	59.9-61.9	Upper vesicular
	61.9-63.2	Massive zone
	59.9-60.1	Highly fractured and sedimentary stained
	60.4-60.9	Highly fractured and sedimentary stained.

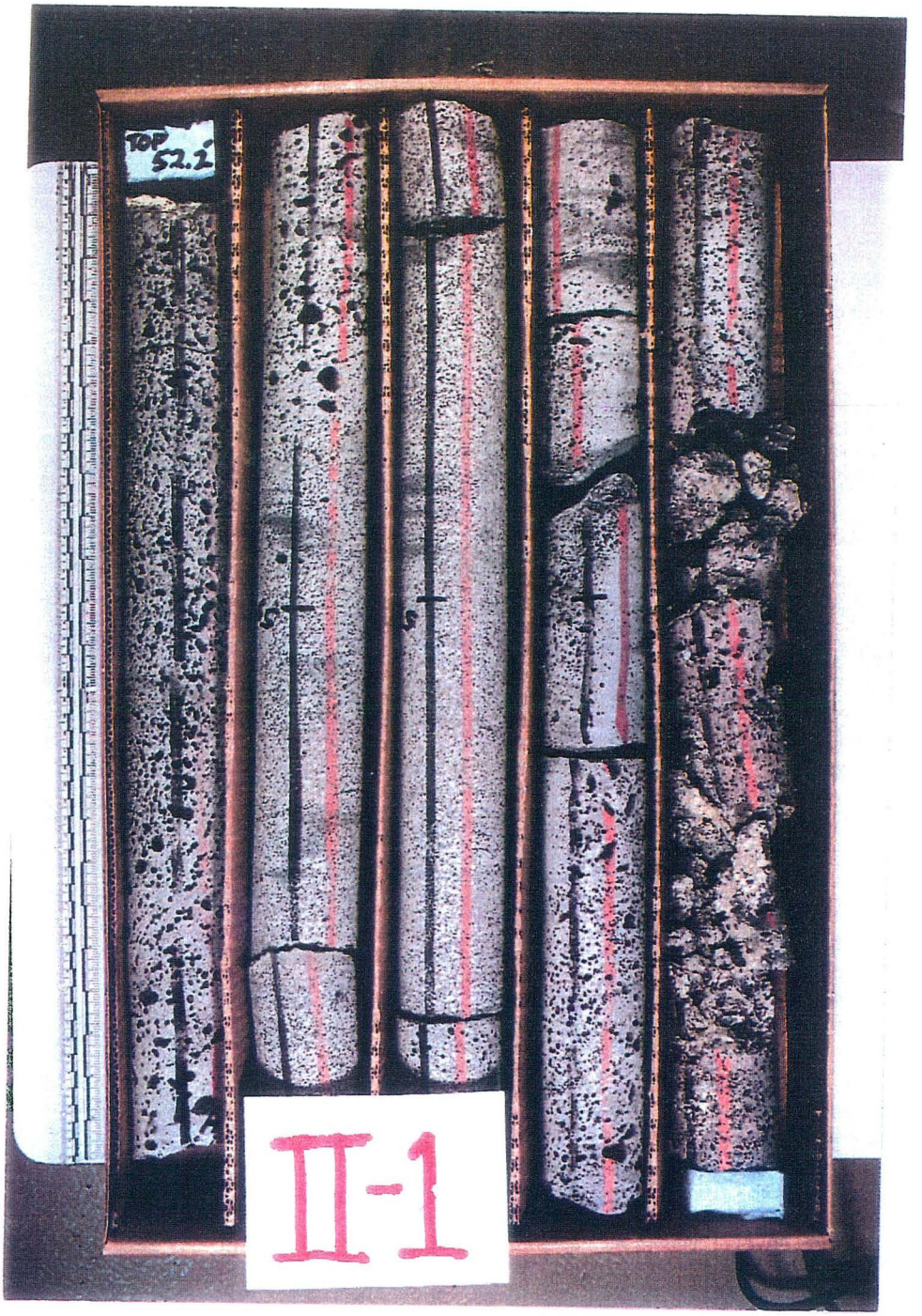

II-1


TOP
11.7
II-1


21.3
II-1


II-1

II-1

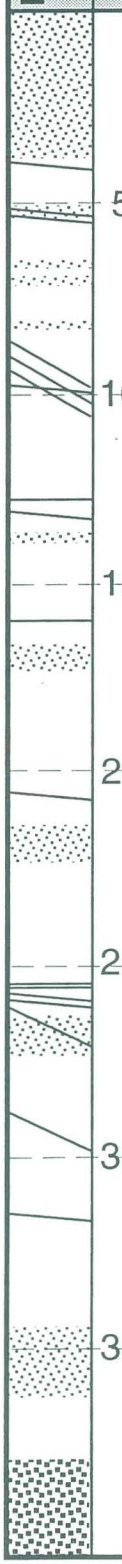

TOP
52.2'
II-1

T.D. 63.2'
II-1

Well II-2

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-2	August 1995	T.V Borehole Camera	Air Percussion	1/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	230.1 ft.	184.0 ft.	5248.7 ft.



Lithological Log	depth (feet)	caliper (inches) 3 – 6.5 – 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
			Not Cored.	Not Cored.	None Installed.	Not Applicable.	Not Applicable.					Vesicular.
							3.9	4.2	Low angle.			
	5						5.1	5.2 5.3	Low angle. Low angle.			5.1' vesicular band.
							6.9 7.2					6.9' & 7.2' vesicular bands.
							8.5	9.1	High angle fracture.	9.1 11.2	High angle fracture zone. One wide horizontal fracture.	Massive Basalt.
	10											
							14.2	13.0 13.2	Horizontal. Low angle fracture.			Vesicular Bands.
	15											
							16.8 17.2	16.2	Horizontal fracture.			Vesicular.
	20											Massive Basalt.
							21.7 22.3	21.1	Low angle fracture.			Vesicular.
												Massive Basalt.
	25						26.8 27.2	25.6 26.0 26.1	2 Horizontal. 2 Low angle. High angle fracture.			Vesicular.
								29.5	High angle fracture.			
	30							31.9	Low angle fracture.			
							34.7 36.0					Vesicular.
	35									37.0	Rubble Zone.	Rubble Zone.

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-2	August 1995	T.V Borehole Camera	Air Percussion.	2/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	230.1 ft.	184.0 ft.	5248.7 ft.

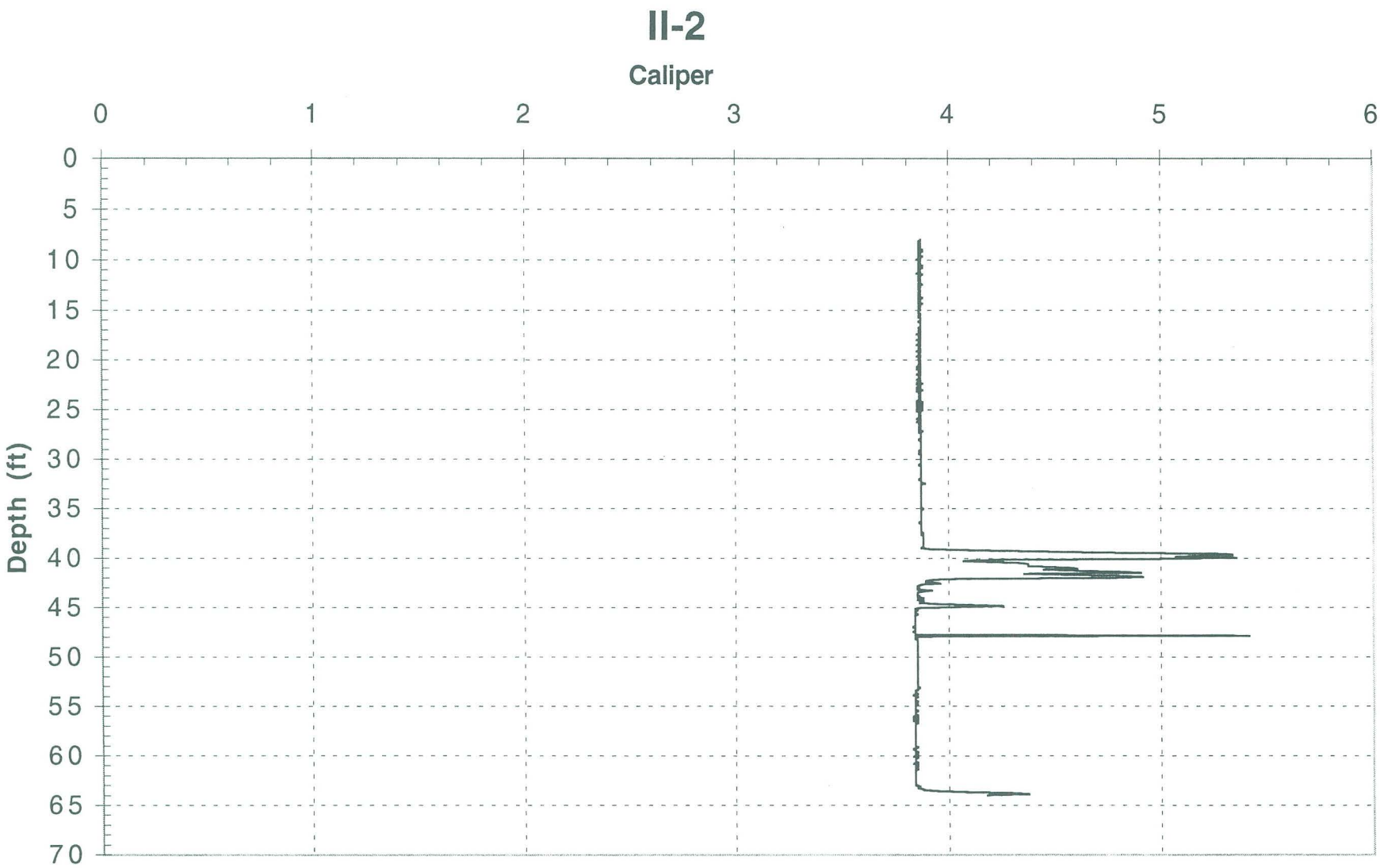
Lithological Log	depth (feet)	caliper (inches)	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
			Not Cored.	None Installed.	Not Applicable.	Not Applicable.	44.7	42.5	Horizontal fracture.	42.0	Rubble Zone.	Rubble Zone.
								43.0	2 Low angle fractures.			
								44.7	Low angle fracture.			
	45											Vesicular.
							45.5	45.4	Low angle fracture.			
							49.0	49.4	Horizontal fracture.			Vesicular.
	50											
							54.0	54.3	Low angle fracture.			
	55											Massive Basalt.
							56.9					
							59.0			59.1	Rubble Zone.	
	60						60.0			60.1		60' Water Table.

Bottom of Well II-2 62.0'

65

70

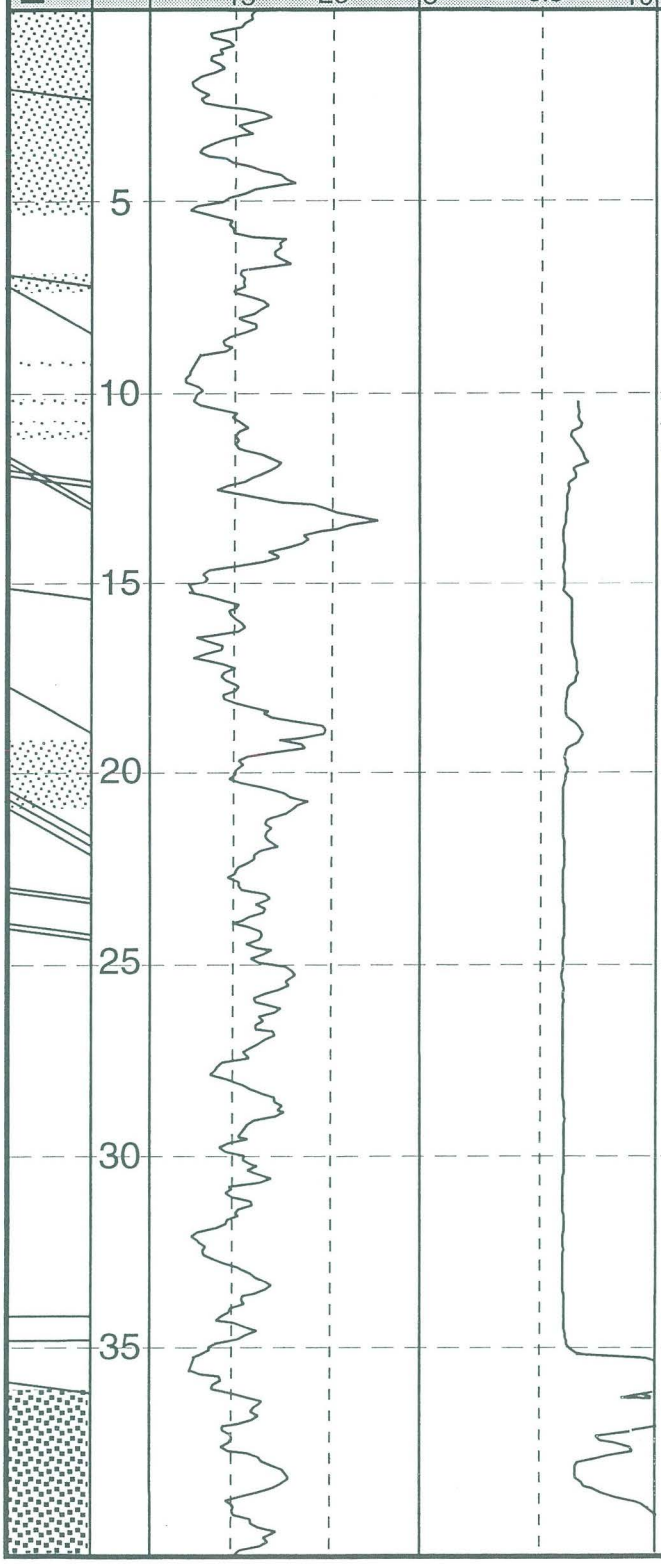
75


II-2
Caliper
0
1
2
3
4
5
6
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70

Well II-3

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-3	July 1995	T.V. Borehole Camera	Air Percussion	1/2

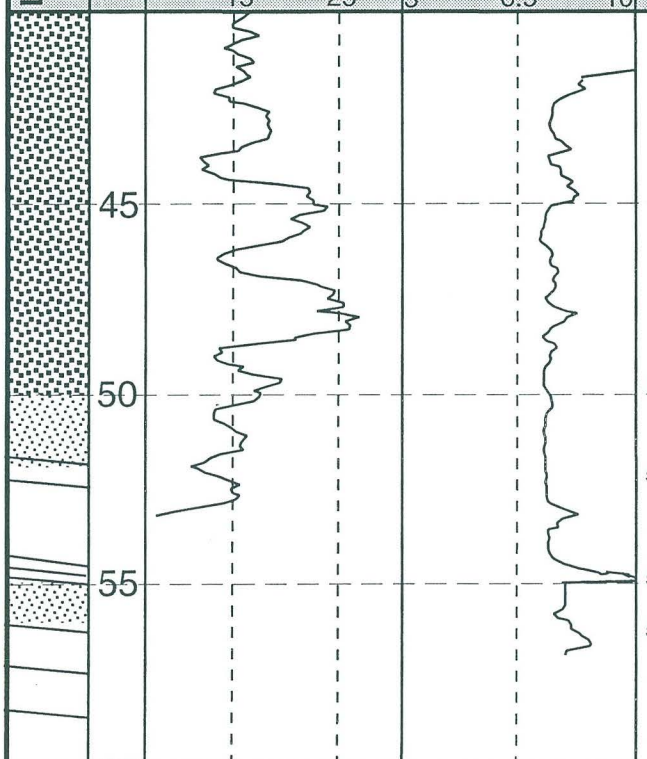
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	205.9 ft.	182.0 ft	5249.0 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
	2.1	Low angle.			Vesicular.
5.5					Massive Basalt with sparse vesicles.
7.0 7.5	7.0	Low angle.	7.0 8.0	High angle fracture.	
9.5					
10.2 10.9 11.2	12.4	Two low angle fractures.	12.0 14.0	Two high angle fractures.	Vesicular Bands.
	15.2	Low angle.			Massive Basalt.
	17.9	High angle.			
19.2					Vesicular.
20.9			20.5 22.1	High angle fracture zone.	
	23.2	Two low angle fractures.	24.1 25.0	Low angle fractures.	
					Massive Basalt.
					Massive Basalt.
	34.2 34.8	2 Horizontal fractures.			
	36.0	Low angle.	36.1	Rubble Zone. Massive Rubble.	Rubble Zone.

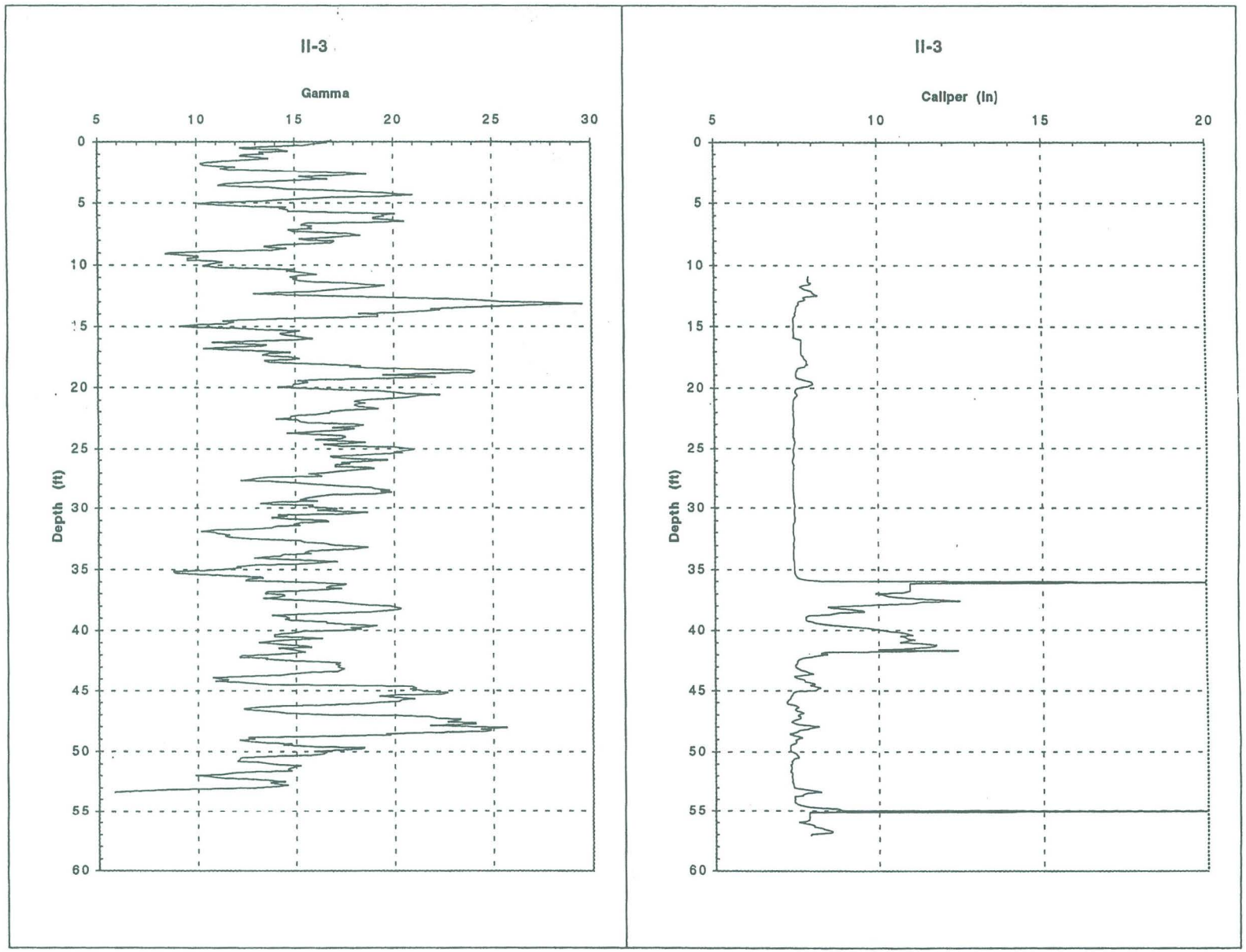
BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-3	July 1995	T.V. Borehole Camera	Air Percussion	2/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	205.9 ft.	182.0 ft	5249.0 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
				Rubble Zone.	Rubble Zone from 36.1' to 50'.
50.0			50.0	Rubble Zone.	
52.0	51.8	Low angle.			
	52.5	Low angle.	54.0	Fracture Zone.	
55.0			55.0		
56.0	56.0	Low angle.			
	57.0	Low angle.			Loose Rock Matter at bottom of the well.
	58.0	Low angle.			

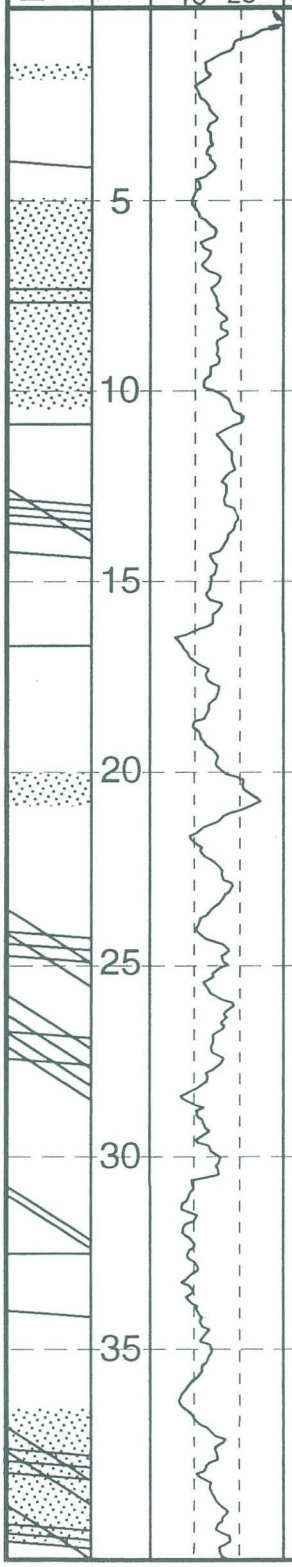
Bottom of Well II-3 60.0'


II-3
Gamma
5
10
15
20
25
30
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
II-3
Caliper (In)
5
10
15
20
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60

Well II-4

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-4	July 14, 1995	Coring	HX Coring using Water	1/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	186.4 ft.	190.8 ft.	5248.7 ft.

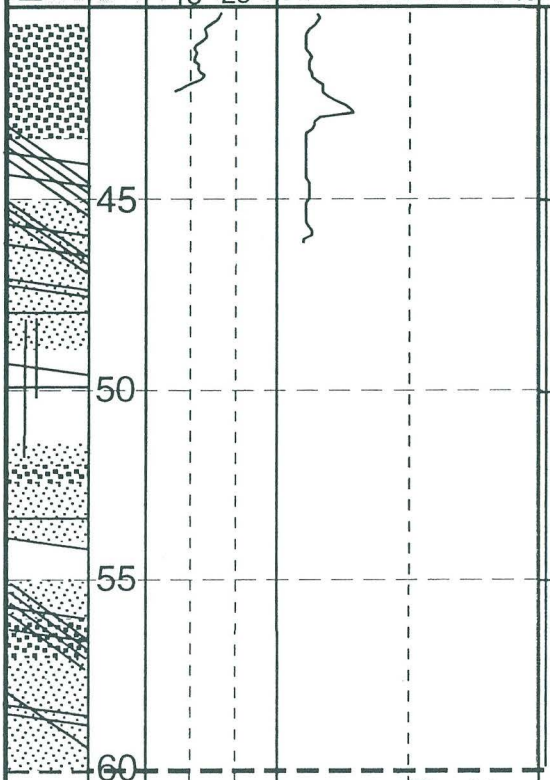


core run and recovery depth	vesicular intervals
1.5	1.7
4.9	4.9 – 10.6
9.9	
15.0	
20.0	20.0 – 20.8
25.0	
30.1	
35.1	36.6 – 39.6

Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
				Massive Zone.
4.4	Low angle fracture.			Vesicular.
				Massive Zone.
7.5, 7.8	2 Horizontal clean fractures.			Vesicular.
11.0	Horizontal.			
		13.0 – 14.0	Low and high angle fracture zone.	Massive Zone with some vesicles.
14.4	Low angle fracture.			
				Massive Zone.
16.8	Horizontal with sediment staining.			Some vesicles present.
				Massive Zone with some vesicles.
		24.0 – 25.0	Low and high angle fracture zone.	Massive Zone.
		25.6 – 28.1	Majority high angle fracture zone with some low angle fractures.	Massive Zone.
		31.1 – 31.9	High angle fracture with tan silt tanning. Possibly from drilling.	Massive Zone.
32.6	Horizontal.			
34.2	Low angle fracture with sediment staining.			
		37.1 – 38.2	Low and high angle fracture zone.	37.1 Flow Break.
		39.2 – 39.6	Low and high angle fracture zone.	Highly fractured.

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-4	July 14, 1995	Coring	HX Coring using Water	2/2

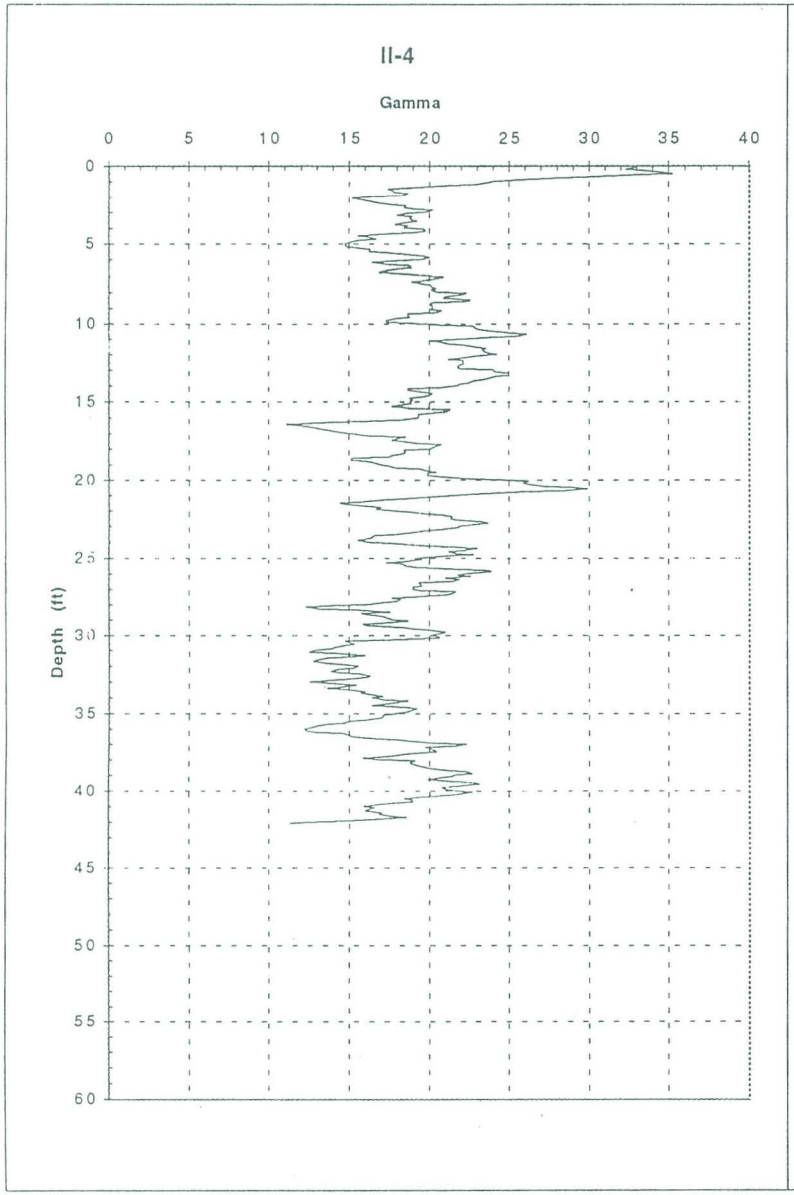
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	186.4 ft.	190.8 ft.	5248.7 ft.

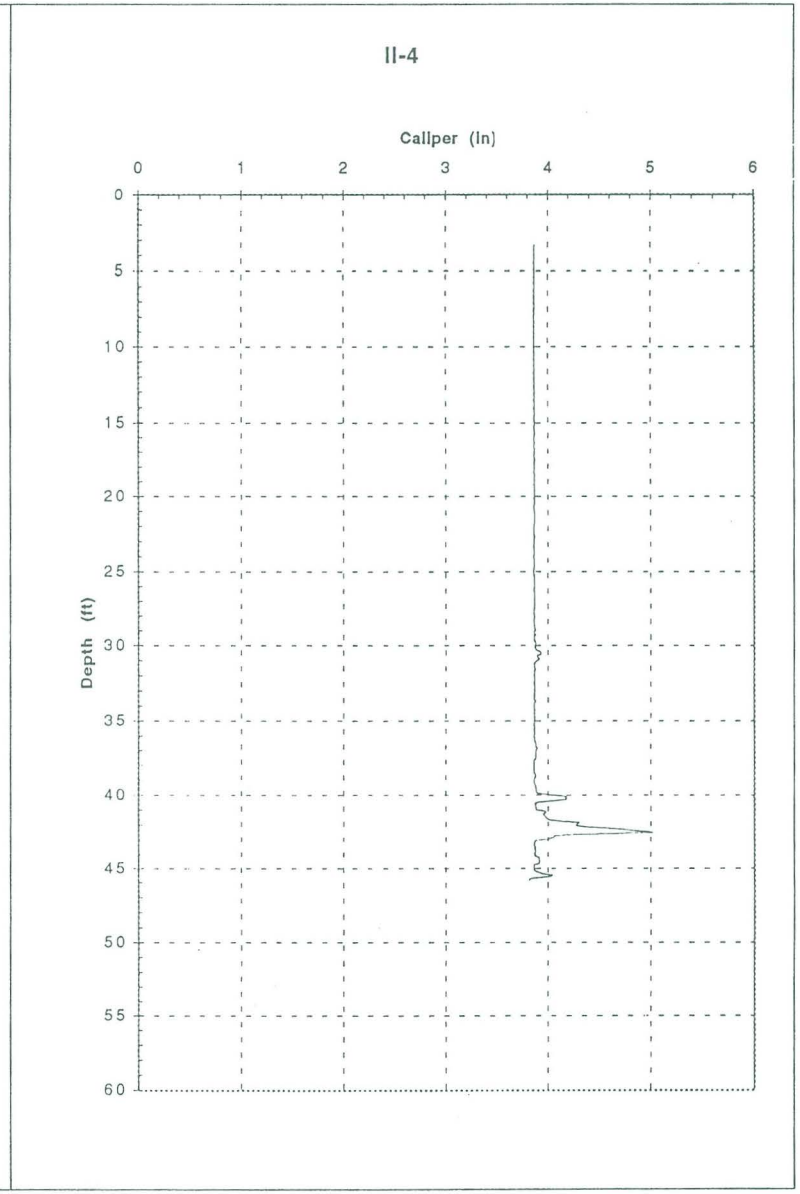


vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
					40.5' Flow Break. Rubble Zone 40.5' to 43.6'.
45.1			43.6 – 45.1	Low, high, & vertical fractures w/ sediment staining.	Upper/Lower vesicular.
			46.6		46.1 Flow Break.
	48.2	Horizontal. Sed. stained.	47.4 – 48.2	Low angle fracture zone.	
49.2	49.5	Low angle.		2 Near vertical fractures.	
	49.9	Horizontal. Sed. stained.	50.1		
51.6			52.2		52.2 Flow Break. Rubble zone 52.2' to 52.7'.
			52.7 – 53.6	High angle zone with sed. staining.	
54.1	53.5	Horizontal.			
	54.3	Low angle.			
55.1			55.1 – 57.2	Low and high angle fracture zone with sed. staining.	56.3 Flow Break. Rubble Zone 56.3' to 57.2'.
			58.5	Low and high angle fracture zone with sed. staining.	

Bottom of Well II-4 60.0'

II-4 Gamma and Caliper Data

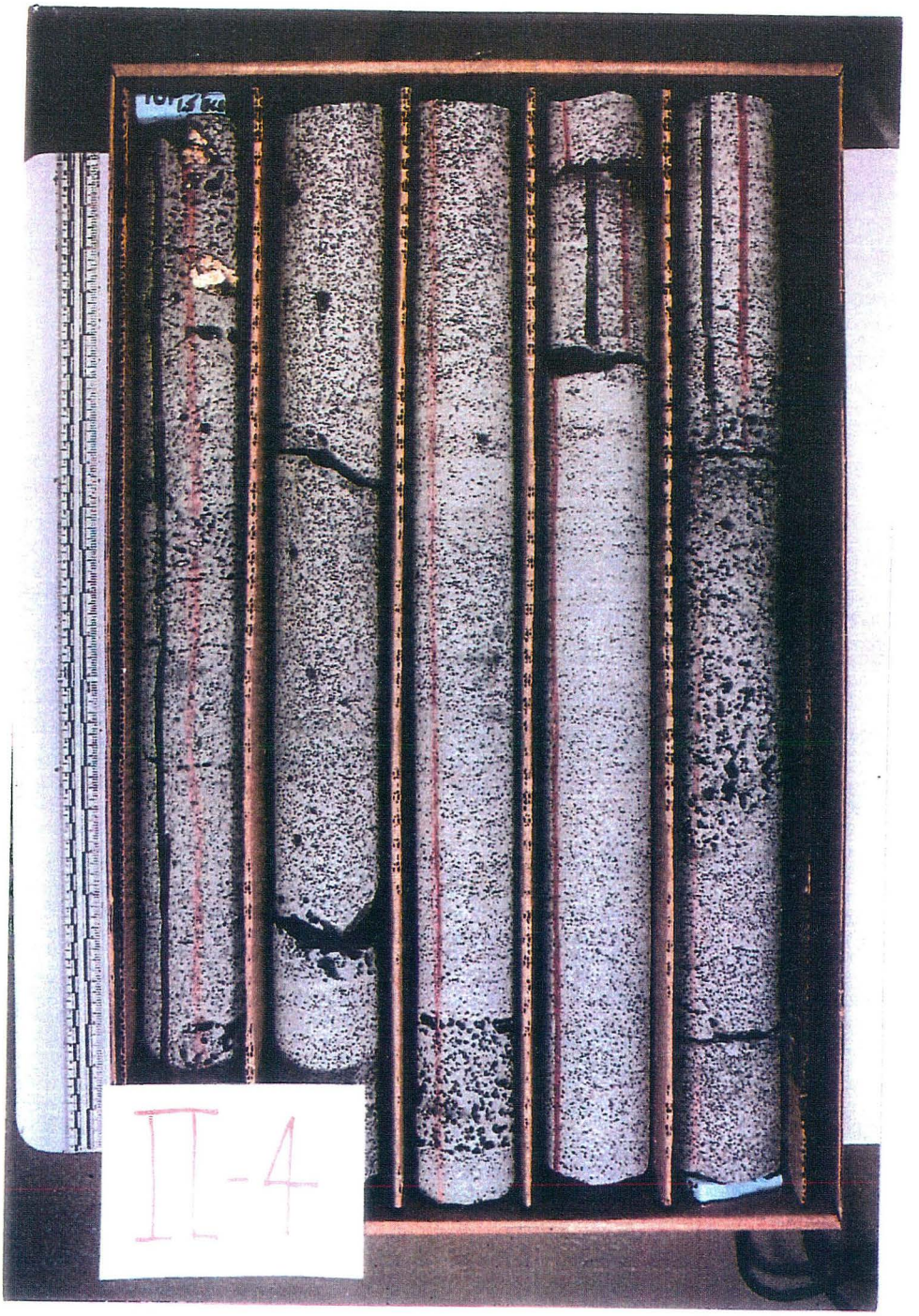




Well II-4	Vertical Well
Core logging by David Burgess on July 14, 1995	

Core Run (feet)	Vertical Depth (feet)	Description
1.5-4.9	1.5-1.9	Upper vesicular, significant calcite crystals filling void spaces
	1.9-4.9	Massive zone
	4.1	Horizontal to low angle fracture, void of sediment or mineralization-This fracture may have been caused during the coring process
4.9-9.9	4.9-6.5	Massive zone with air bubbles/vesicular
	6.5-7.0	Massive zone
	7.0-7.3	Massive zone with air bubbles/vesicular
	7.3-9.7	Massive zone
	9.7-9.9	Massive zone with air bubbles/vesicular
	7.5	Horizontal fracture, clean
	7.8	Horizontal fracture, clean
9.9-14.9	9.9-10.6	Massive zone with air bubbles/vesicular
	10.6-13.0	Massive zone
	13.0-14.6	Massive zone, with tan silt infill, highly fractured
	14.6-14.9	Massive zone
	11.0	Horizontal fracture
	13.0-14.0	Fracture zone, high angle and horizontal fractures
	14.3-14.5	Moderate angle fracture
14.9-20.0	14.9-20.0	Massive zone
20.0-25.0	20.0-20.8	Massive zone, air bubbles/vesicular
	20.8-25.0	Massive zone
	24.0-25.0	Highly fractured zone, low to high angle fractures, some of these fractures may have been caused during removal from core barrel-however some sediment staining is present
25.0-30.1	25.0-30.1	Massive zone, non-vesicular more vesicular beginning at 28.1'
	25.6-28.0	Highly fracture zone-mostly to low angle fractures with some horizontal fractures
30.1-35.1	30.1-35.1	Massive zone
	31.1-31.9	High angle fractures with tan silt staining
	32.6	Horizontal fracture-possible caused during drilling recovery-No sediment staining
	34.2-34.3	Low angle fracture with sediment staining
35.1-40.1	35.1-36.6	Massive zone
	36.6-37.1	Lower vesicular
	37.1-38.2	Flow break-lower vesicular-highly fractured
	38.2-39.2	Upper vesicular
	39.2-39.6	Upper vesicular, highly fractured
	39.6-40.1	Massive zone
	37.1-38.2	Highly fractured zone with sediment staining
	38.7-38.9	Low angle fracture with no sediment staining
	39.2-39.6	Highly fractured zone
	39.6-40.1	Massive zone
40.1-45.1	40.1-40.5	Massive zone
	40.5-43.6	Rubble zone with only partial returns
	43.6-45.1	Upper vesicular
	44.2-45.1	High angle and vertical fractures with sediment staining
45.1-50.1	45.1-46.1	Upper/lower vesicular
	46.1	Flow break
	46.1-49.2	Upper vesicular

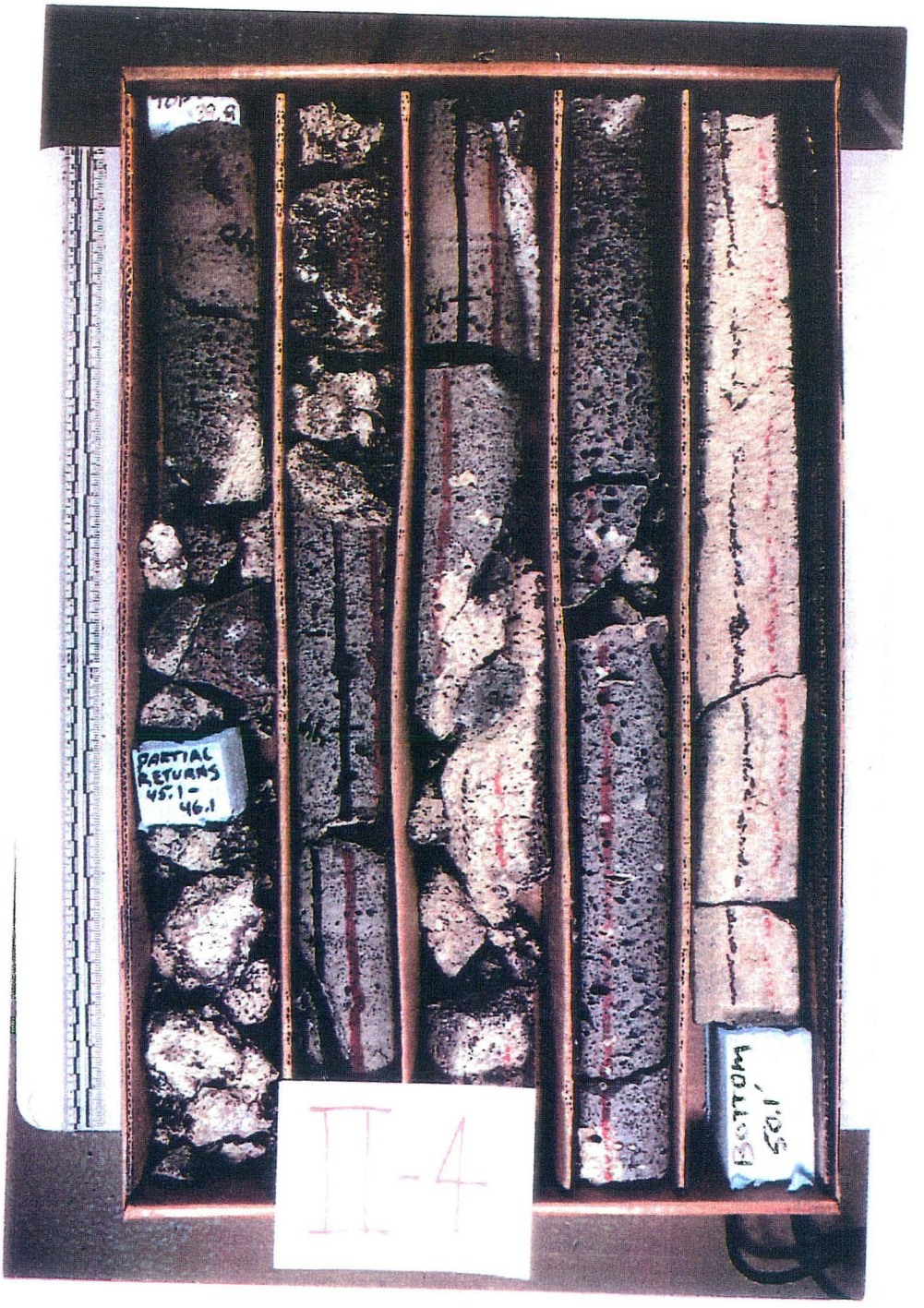
	49.2-50.1	Massive zone
	45.1-46.6	Highly fractured zone-sediment staining-oxidized
	47.2-47.4	Several low angle fractures-sediment staining
	48.2	Horizontal fracture-sediment stained
	48.2-50.1	Near vertical fracture
	49.5	Low angle fracture with sediment staining
	49.9	Horizontal fracture with sediment staining
50.1-55.1	50.1-51.6	Massive zone
	51.6-52.2	Lower vesicular
	52.2-52.7	Rubble zone-flow break
	52.7-54.1	Upper vesicular
	54.1-55.0	Massive zone, minimal air bubbles
	55.0-55.1	Lower vesicular
	48.2-52.2	High angle-vertical fracture-sediment stained
	52.7-53.6	High angle fracture-sediment stained
	53.5	Horizontal fracture-sediment stained
	54.2-54.4	Low angle fracture-sediment stained
55.1-60.1	55.1-56.3	Lower vesicular zone
	56.3-57.2	Flow break-rubble zone
	57.2-60.1	Upper vesicular
	55.1-57.2	Highly fractured zone-sediment stained
	58.3-58.7	Moderately high angle fractures-sediment stained


II-4

TOP
SPACER
SPACER
II-4
BOTTOM

II-4

II-4

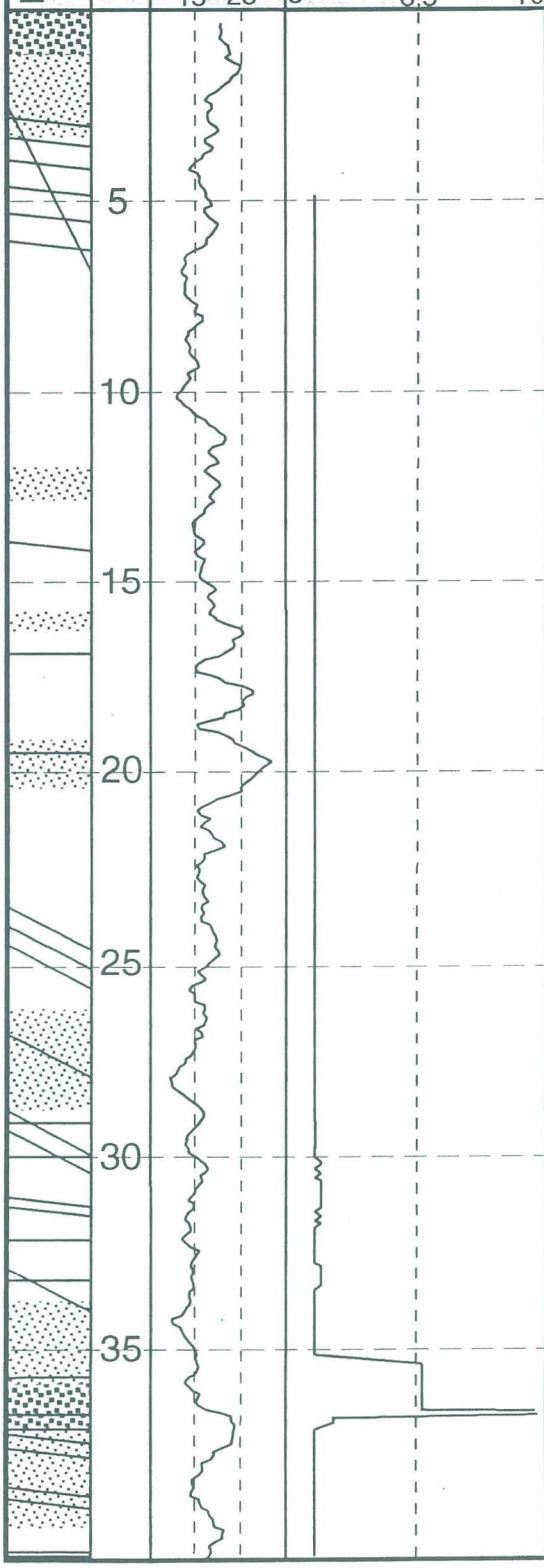

PARTIAL
RETURNS
45.1-
46.1
BOTTOM
50.1
II-4

TOP
II-4

Well II-5

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-5	7/13/95	Coring	HX Coring using Water	1/2

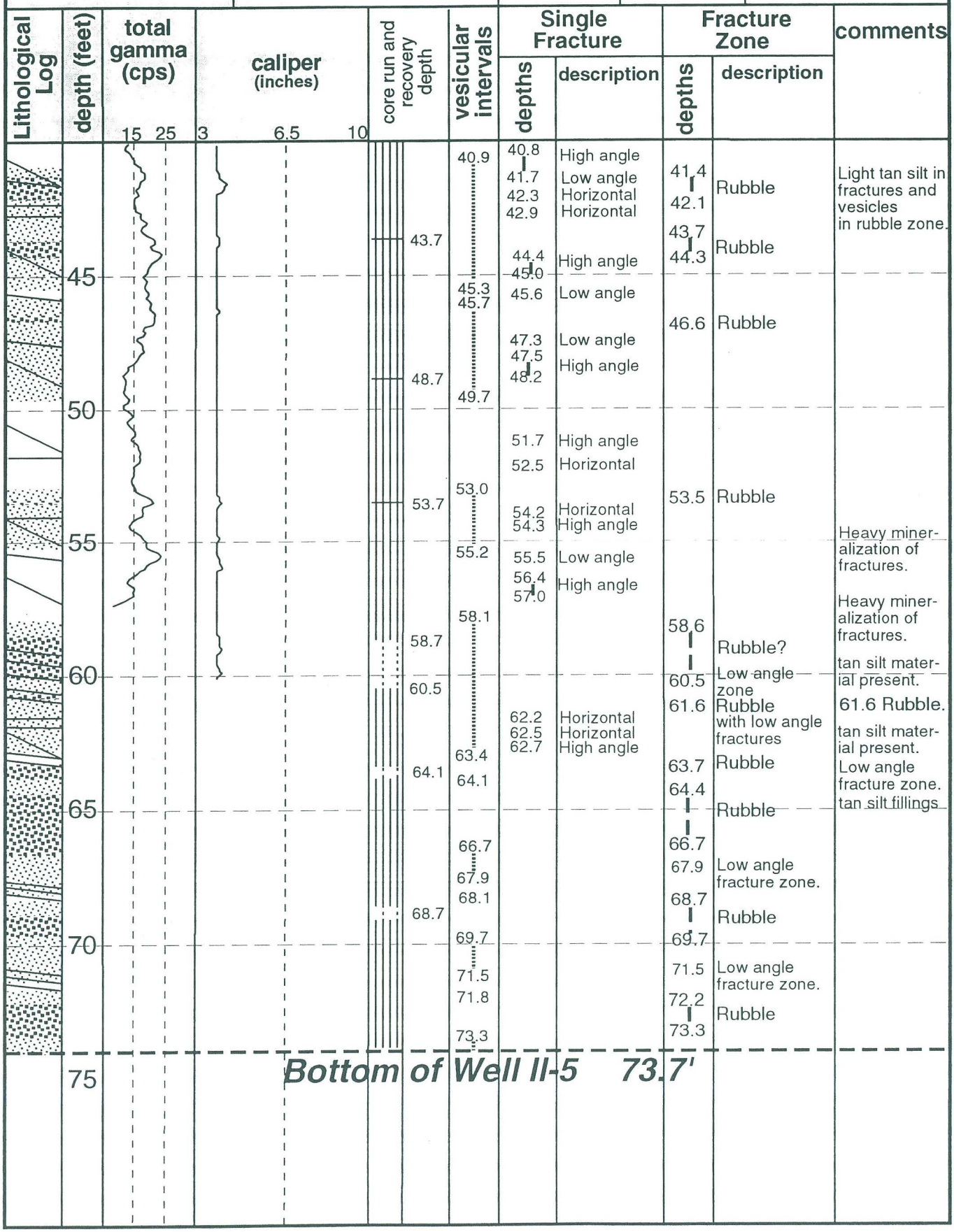
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	206.4 ft	204.6 ft	5249.0 ft



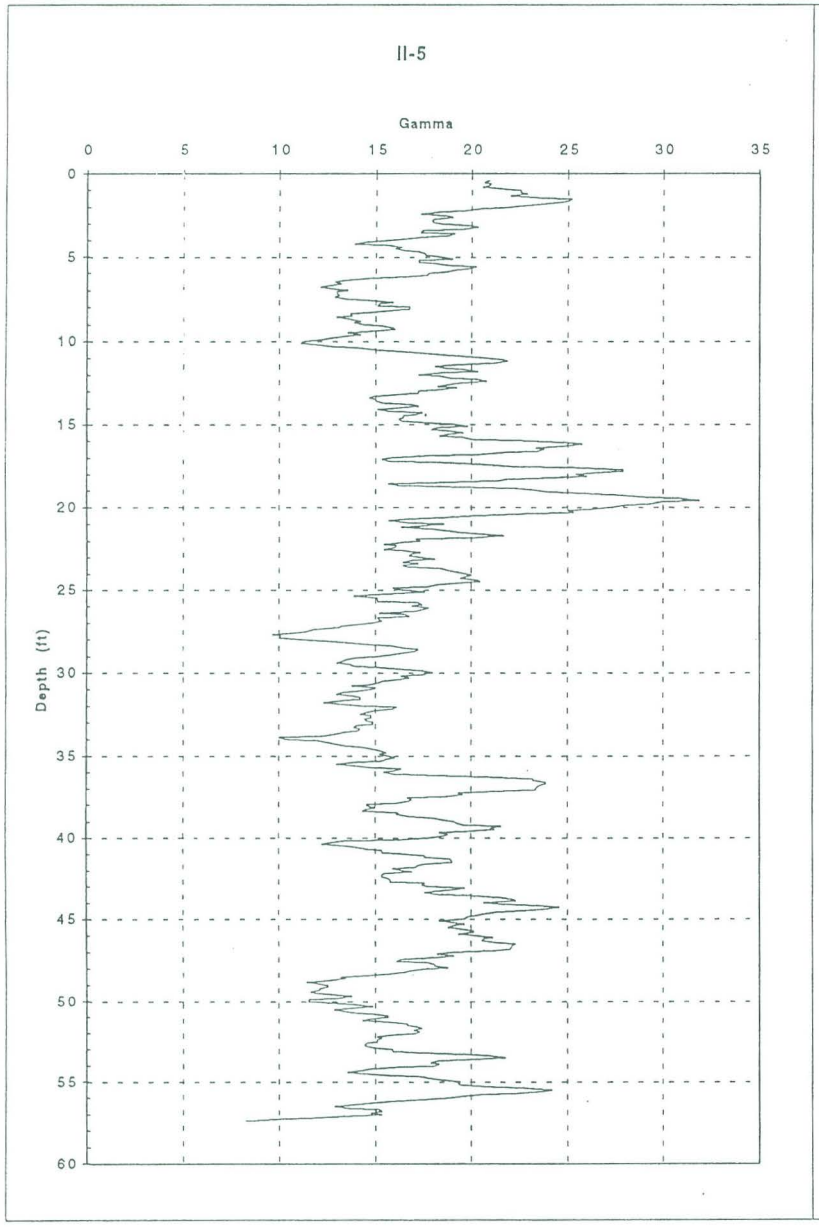
vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
1.2–3.5	2.5–5.8	High angle	1.2–5.8	Rubble? Low angle fracture zone.	-Calcite deposits from 1.2'-2.5'. -Vesicles decrease with depth. -Fracture zone at 3'-5.8' from coring?
12.1–12.7	14.2	Low Angle			
15.8–16.3					
19.4–20.4	19.6	Horizontal			
			23.7–26.0	High Angle	
26.7–28.7	27.3	High Angle			Slightly Vesicular. Lost circulation at 28 feet.
			28.7–31.3	High angle and horizontal zone.	
33.7–39.3	31.9–32.1	Low angle			
	32.9	Horizontal			
	33.4–33.9	High angle and horizontal			
	36.1	Horizontal	35.7–36.8	Rubble.	Rubble and no recovery from core run.
	37.0–37.3	Horizontal			
	37.6–37.7	Low angle			
	38.4–39.1	Low angle			
	40.0	Horizontal			

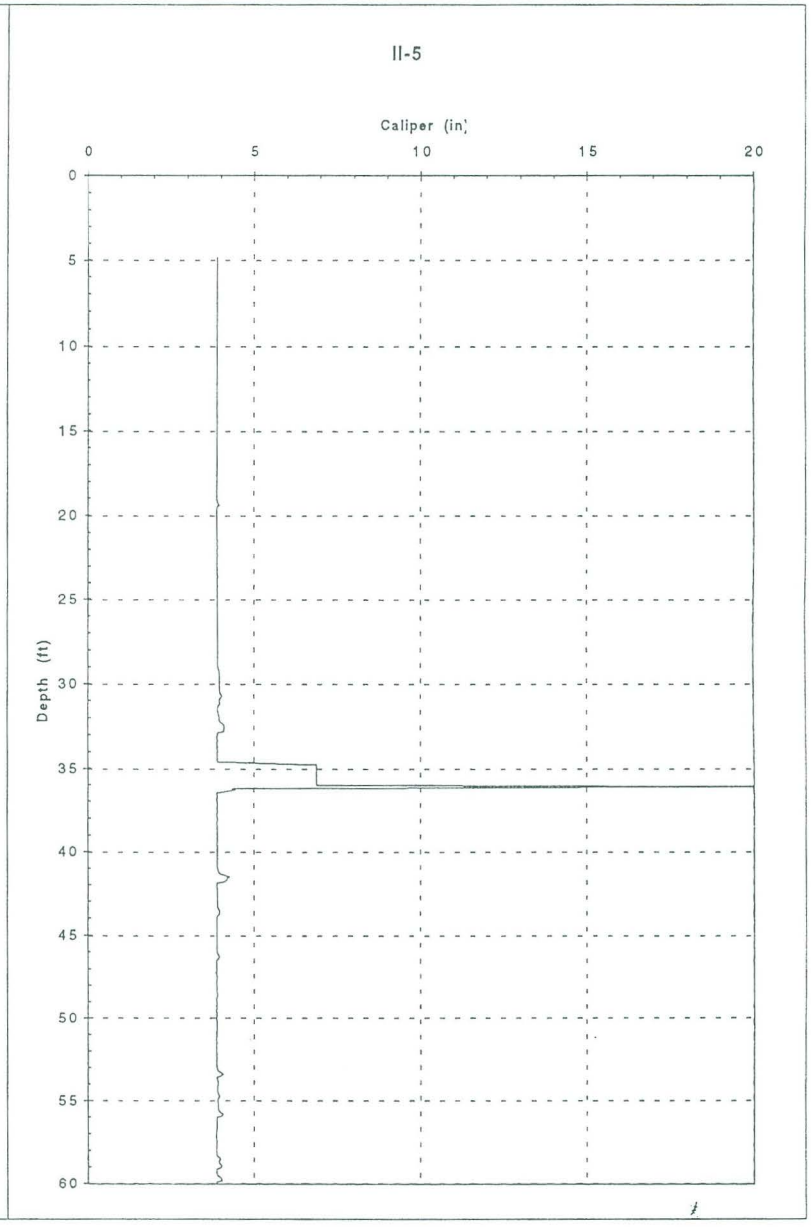
BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-5	7/13/95	Coring	HX Coring using Water	2/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	206.4 ft.	204.6 ft	5249.0 ft



II-5 Gamma liper Data





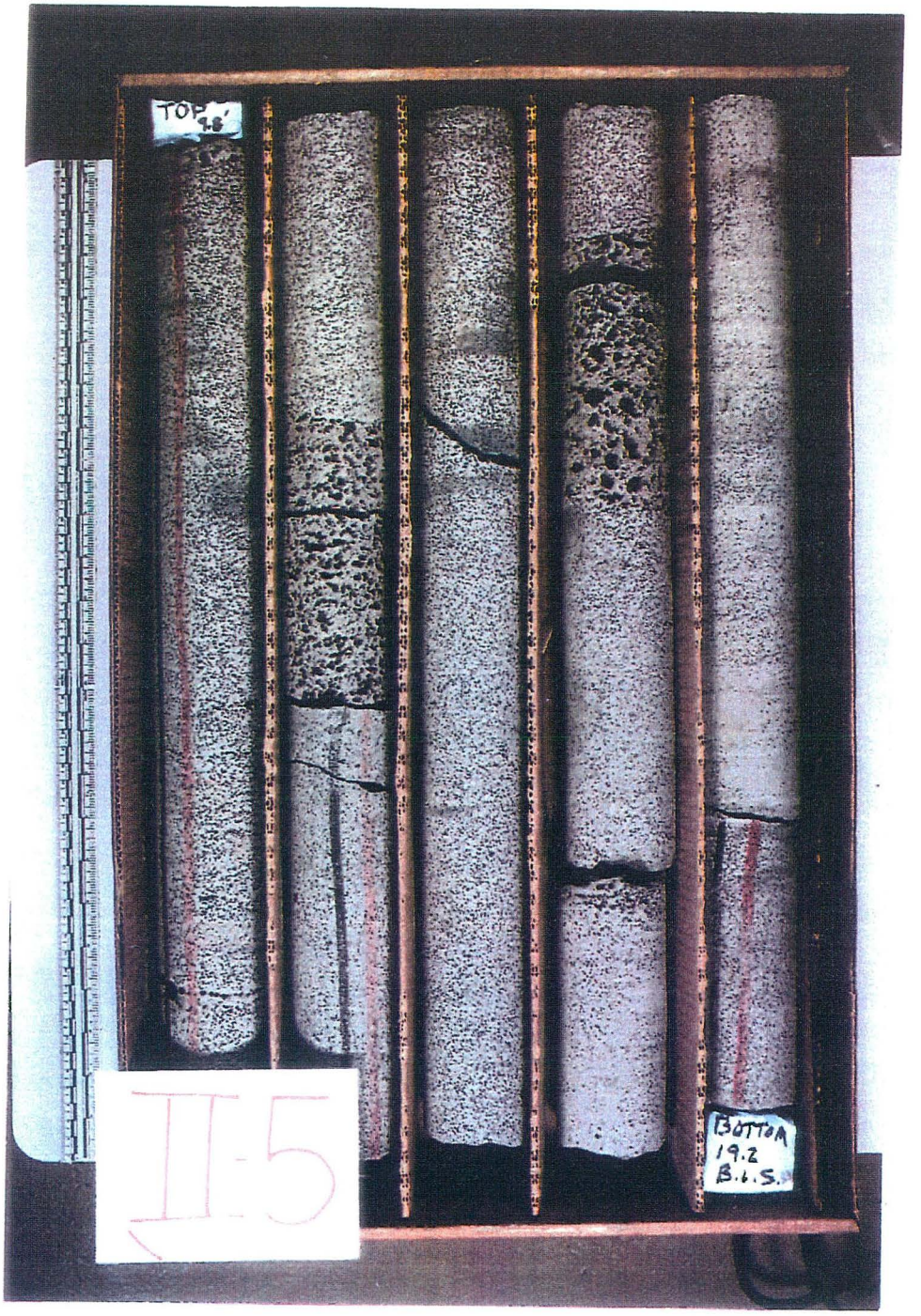
Well II-5	Vertical Well	
Core logging by David Burgess on July 13, 1995		

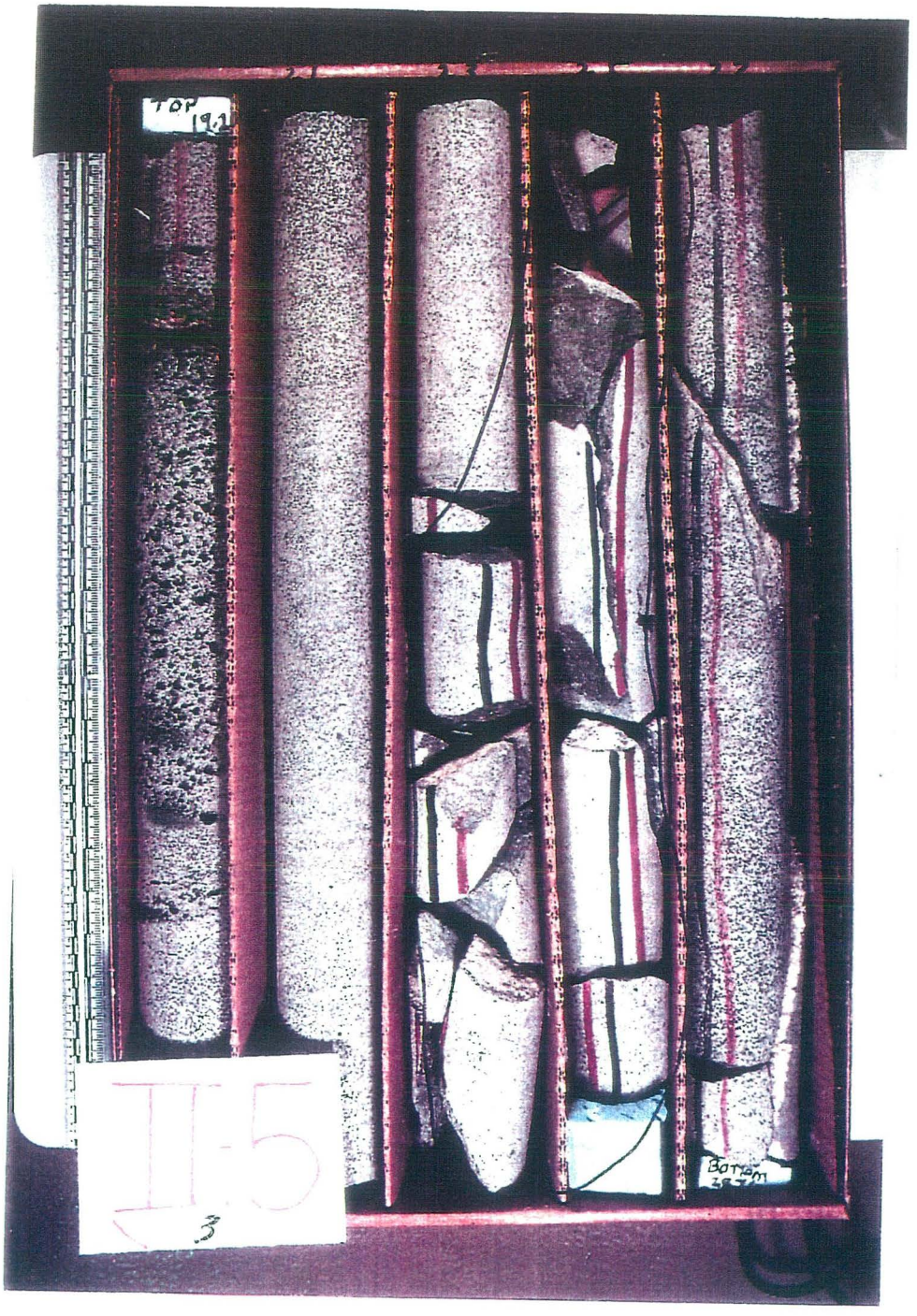
Core Run (feet)	Vertical Depth (feet)	Description
0-5.8	0-5.8	Upper vesicular, highly fractured from 3' to 5.8'. Some fractures seem to be induced by coring. Lost approximately 1' of core during retrieval. Calcite deposits and highly vesicular at 1.2'-2.5'. Vesicle density decreases with depth in this run. Vertical high angle fracture from 2.5'-5.8'.
5.8-9.3	5.8-9.3	Massive zone.
9.3-13.7	9.3-12.1	Massive zone.
	12.1-12.7	Massive zone-Very vesicular. Fracture caused by handling of core.
13.7-18.7	13.7-15.8	Massive zone.
	14.2	35° Fracture.
	15.8-16.3	Massive zone, very vesicular.
	16.3-18.7	Massive zone. 16.9° fracture.
18.7-23.7	18.7-19.4	Massive zone.
	19.4-20.4	Massive zone, highly vesicular.
	19.6	Horizontal fractures.
	20.4-23.7	Massive zone.
23.7-28.7	23.7-26	High angle fracture zone.
	23.7-26.7	Massive zone.
	26.7-28.7	Massive zone, slightly vesicular.
	27.3	High angle fracture to 28'.
28.7-33.7	28.7-33.7	Massive zone.
	28.7-31.3	Highly fractured with horizontal and high angle fractures.
	31.9-32.1	Moderate angle fractures.
	32.9	Horizontal fractures.
	33.4-33.9	High angle fracture.
	33.7	Horizontal fractures.
33.7-38.7	33.7-35.7	Upper/lower vesicular.
	35.7-36.2	Rubble zone, no recovery.
	35.7-36.8	Flow break. Rubble zone.
	36.8-38.7	Upper vesicular.
	36.1	Horizontal fracture.
	37.0	Horizontal fracture.
	37.3-37.6	Moderate angle fracture.
	37.6	Horizontal fracture.
	37.7-38.4	High angle fracture.
	38.5	Horizontal fracture.
38.7-43.7	38.7-39.3	Upper vesicular.
	39.3-40.9	Massive.
	40.9-41.4	Lower vesicular.
	41.4-42.1	Flow break. Rubble zone. Light tan silt in fractures and vesicles in the rubble zone.
	42.1-43.7	Upper vesicular.
	39.1-39.3	Moderate angle fractures.
	40.0	Horizontal fractures.
	40.8-41.7	High angle fractures.
	42.5	Horizontal fractures.
	42.3-42.6	Moderate angle fractures.
	42.9	Horizontal fractures.
43.7-48.7	43.7-44.3	Flow break. Rubble zone.

	44.3-45.3	Upper vesicular.
	45.3-45.7	Massive zone.
	45.7-46.6	Lower vesicular.
	46.6-46.8	Rubble zone.
	46.8-48.7	Upper vesicular.
	43.7-44.3	Highly fractured.
	44.4-45.3	Highly fractured.
	45.6-46.7	Moderate to low angle fracture.
	46.6-46.8	Highly fractured zone.
	47.3-47.4	Low angle fracture.
	47.5-48.2	High angle fracture.
48.7-53.7	48.7-49.7	Upper vesicular.
	49.7-53.0	Massive zone.
	53.0-53.5	Lower vesicular.
	53.5-53.7	Rubble zone and highly fractured.
	51.7-52.1	High angle fracture.
	52.5	Horizontal fracture.
53.7-58.7	53.7-55.2	Upper vesicular. Top of this run is the very beginning of the upper vesicular zone.
	55.2-58.1	Massive zone.
	58.1-58.6	Lower vesicular.
	58.6-58.7	Flow break. Rubble zone.
	54.2	Horizontal fractured.
	54.3-55.0	High angle fracture. Heavy mineralization.
	55.5-55.8	Low angle fracture. Heavy mineralization.
	56.4-57.0	High angle fracture. Heavy mineralization.
58.7-63.7	58.7-60.5	No recovery. Probably rubble zone or small interbed. Heavy mineralization and silt material in recovered portion of this zone.
	58.7-61.2	Flow break. Rubble zone. Significant tan silt present with broken basalt.
	61.2-61.6	Upper vesicular/lower vesicular zone.
	61.6-61.9	Flow break. Rubble zone. Significant tan silt.
	61.9-63.4	Upper vesicular zone.
	63.4-63.7	Flow break. Top of rubble zone or interbed highly fractured with black and tan silt filling all vesicles and fractures.
	60.5-61.2	Highly fractured.
	61.6-61.9	Highly fractured.
	62.2	Horizontal fracture, minimal silt material present in fracture.
	62.5	Horizontal fracture zone. Zone is approximately 0.1" thick with significant tan silt.
	63.4-63.7	Highly fractured with silt filling all available vesicles and fracture spaces.
63.7-68.7	63.7-64.1	No recovery in rubble zone.
	64.1-64.4	Upper/lower vesicular.
	64.4-66.7	Rubble zone with tan silt fill all vesicles and fractures.
	66.7-68.1	Fracture zone or small rubble zone filled with tan silt sediment.
	68.1-68.4	Upper/lower vesicular zone.
	68.4-68.7	Flow break. Rubble zone.
		Note: from 66.7 to 68.4 may be combined to form a single upper/lower vesicular zone.
68.7-73.7	68.7-69.1	No recovery. Probably rubble zone.
	68.7-69.7	Rubble zone with tan silt filling all voids.
	69.7-71.5	Upper/lower vesicular.
	71.5-71.8	Fracture zone within upper/lower vesicular zone.

	71.8-72.2	Upper/lower vesicular zone.
	72.2-73.3	Flow break. Rubble zone with tan silt in most fractures.
	73.3-73.7	Upper vesicular.

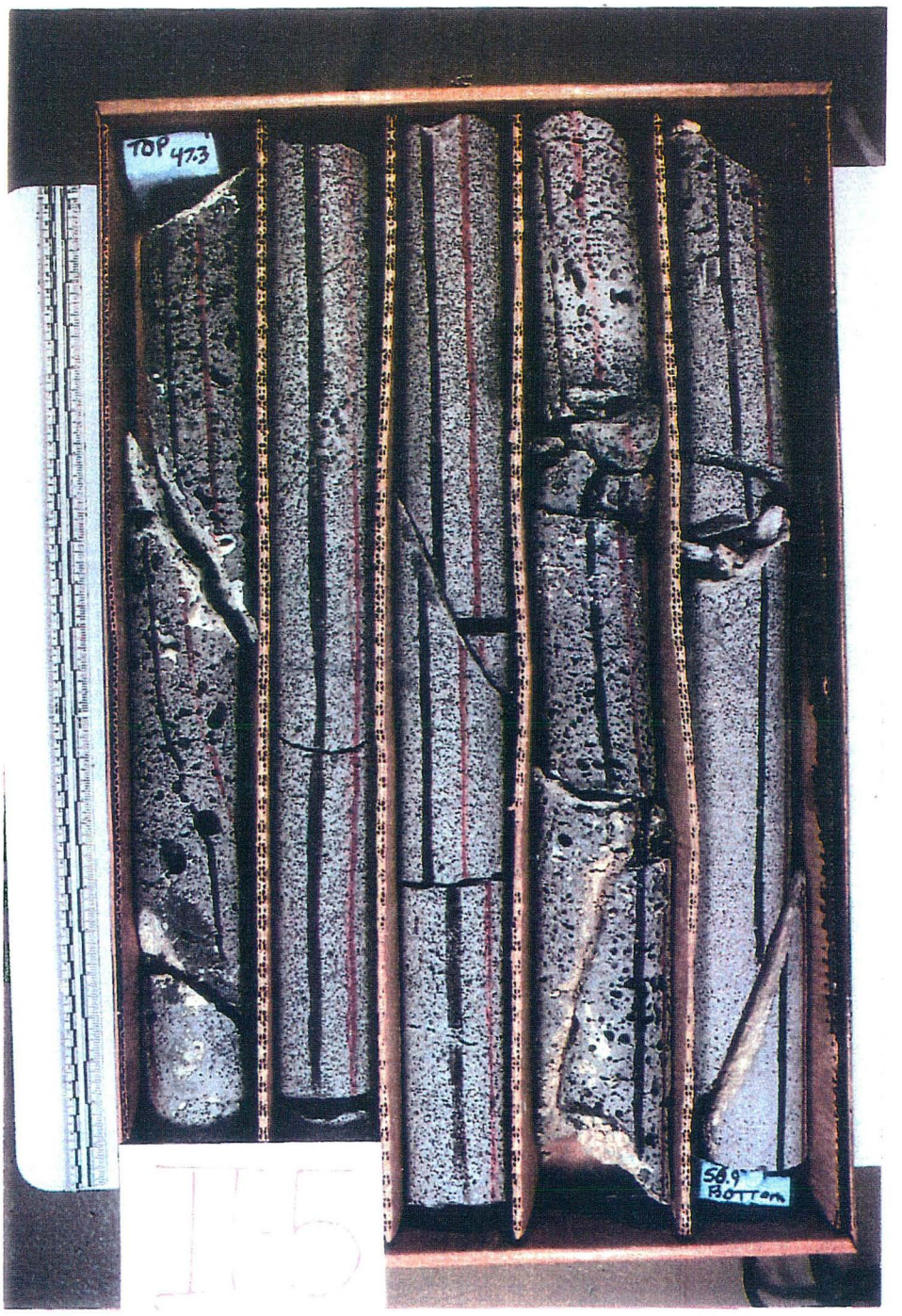
II-5
Bottom
9.8'
B.L.S.


TOP
BOTTOM
19.2
B.L.S.
II-5


TOP
Bottom
II-5
3

II-5
4

TOP
BOTTOM
47.3'
BLS


TOP 47.3
56.9
BOTTOM

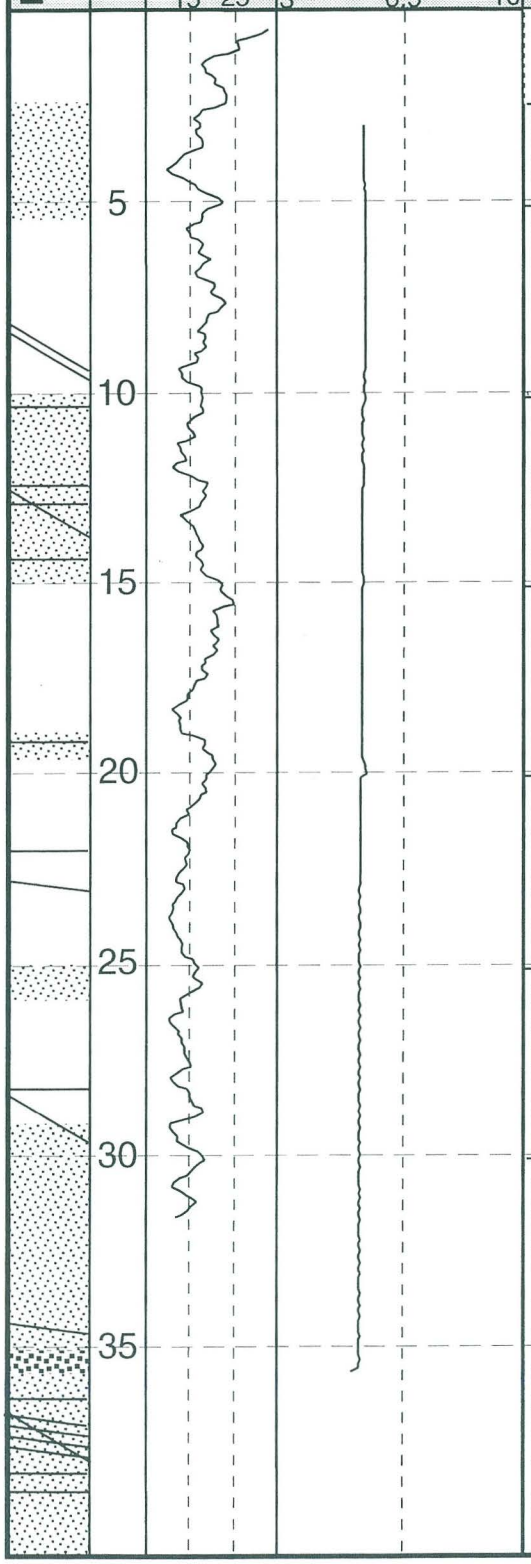
TOP 56.9
NO RECOVERY 58.7-60.5
II-5
BOTTOM 67.7

TOP 67.7
NO RECOVERY 68.7-69.1
SPACER
BOTTOM OF HOLE 73.7' BLS
SPACER
II-5

Well II-6

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-6	July 17, 1995	Coring	HX Coring using Water	1/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	218.9 ft.	226.0 ft.	5249.9 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
2.5					No Recovery. Upper Vesicular. No staining or mineralization.
5.5					
			8.6–9.2	Two high angle fractures.	Sediment staining.
10.0	10.3	Horizontal.			Massive Zone.
	12.6	Horizontal.			12.8' fracture Sed. stained & mineralization.
	12.8	High angle.			
	13.0	Horizontal.			
	14.5	Horizontal.			Sediment staining.
15.0					Massive Zone.
					Massive Zone.
19.0–19.7	19.3	Horizontal. Filled with tan sediment.			Very vesicular.
					Massive Zone No sediment staining.
	22.2	Horizontal with sed. staining.			
	23.0	Low angle fracture.			Sediment staining.
25.0–26.0					
	28.4	Horizontal.	28.7	High angle sed. stained.	Massive. Slightly vesicular.
28.3					
					Massive Basalt. Slightly vesicular.
					Sediment stained.
	34.7	Low angle fracture.			
35.1–35.4			35.1–36.0	Rubble Zone.	Rubble.
	36.5	Horizontal. Sed. stained.	36.8–37.5	Low and High angle fracture zone.	Upper Vesicular.
	38.4	Horizontal.			
	38.8	Horizontal. Sed. stained.			

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-6	July 17, 1995	Coring	HX Coring using Water	2/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	David Burgess	218.9 ft.	226.0 ft.	5249.9 ft.

Lithological Log	depth (feet)	total gamma (cps) (15 – 25)	caliper (inches) (3 – 6.5 – 10)	core run and recovery depth	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
						41.7 42.3	Horizontal. Horizontal. Sed. stained.	40.4 41.6 42.6 43.2 44.3	Low and high angle fracture zone. High angle. Low and high angle zone w/ sed. staining.	Rubble Zone. 40.6 Flow Break. No recovery.
	45			45.0	45.0 46.1	44.5 44.7 45.4 46.6	2 Horizontal fractures. Horizontal. Low angle sed. stained.			Sediment stained. Massive zone.
	50			50.0		49.9 51.7	Low angle sed. stained. Horizontal. Sed. stained.	52.3 53.1 53.4 54.2	Low angle sed. staining. High angle sed. staining.	
	55			55.0						Massive zone.
	60				57.5 58.1 58.6 59.3			59.6	Low and high angle zone with sediment staining.	Lower Vesicular. No Returns. Rubble Zone.

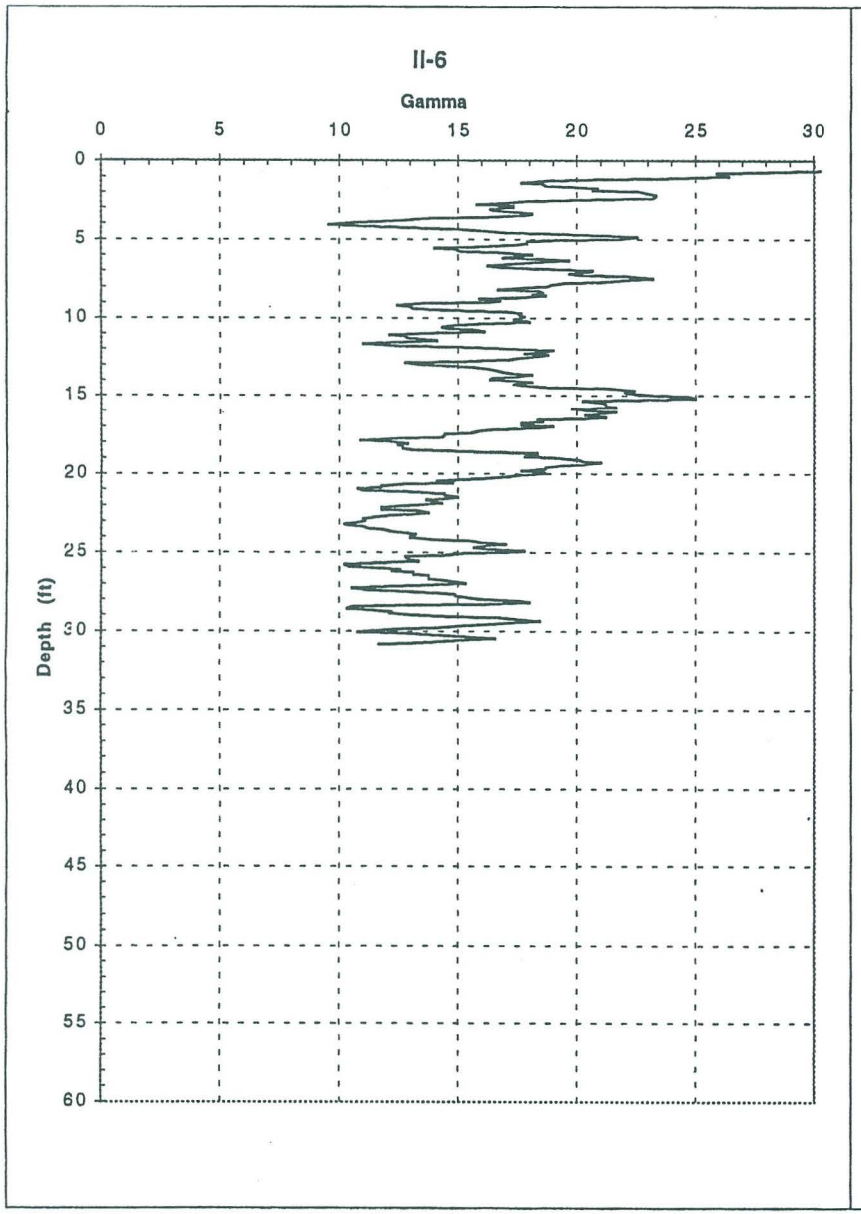
Bottom of Well II-6 60'

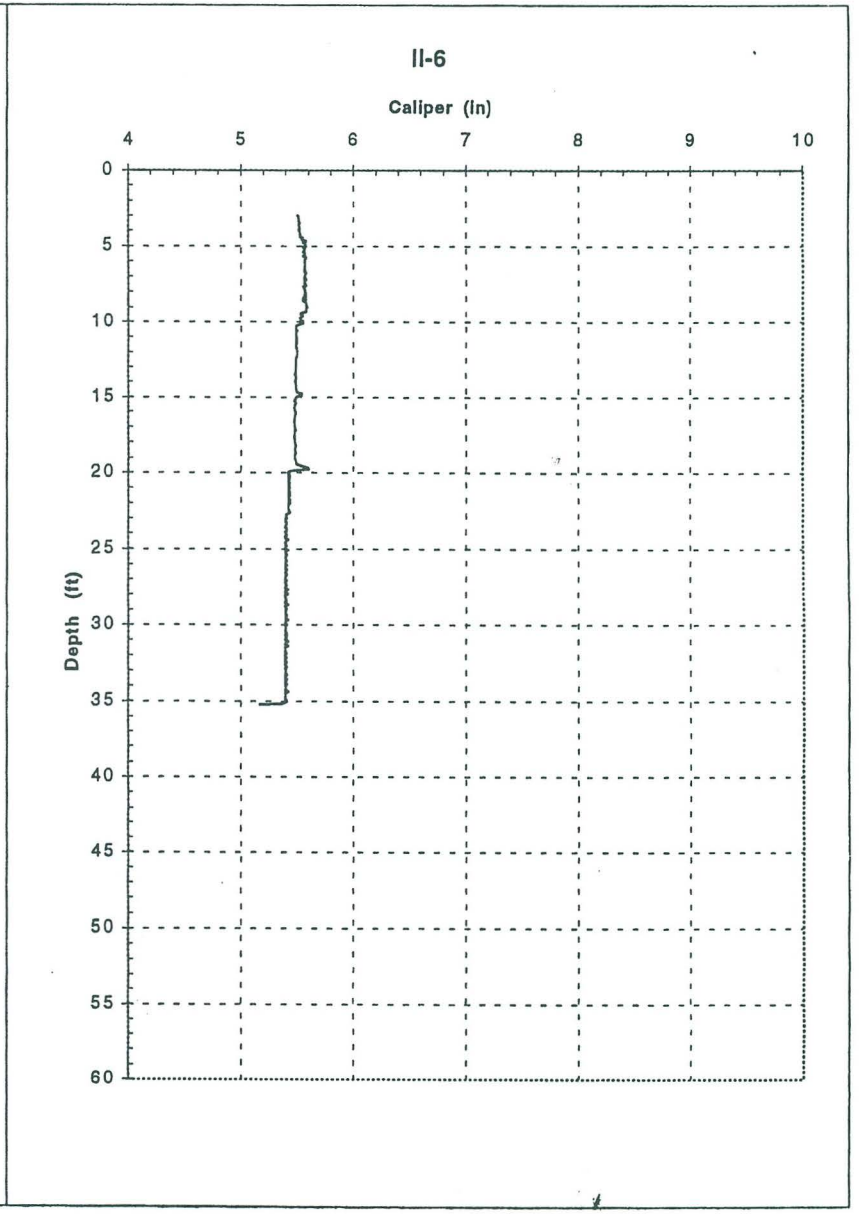
65

70

75

II-6 Gamma Caliper Data

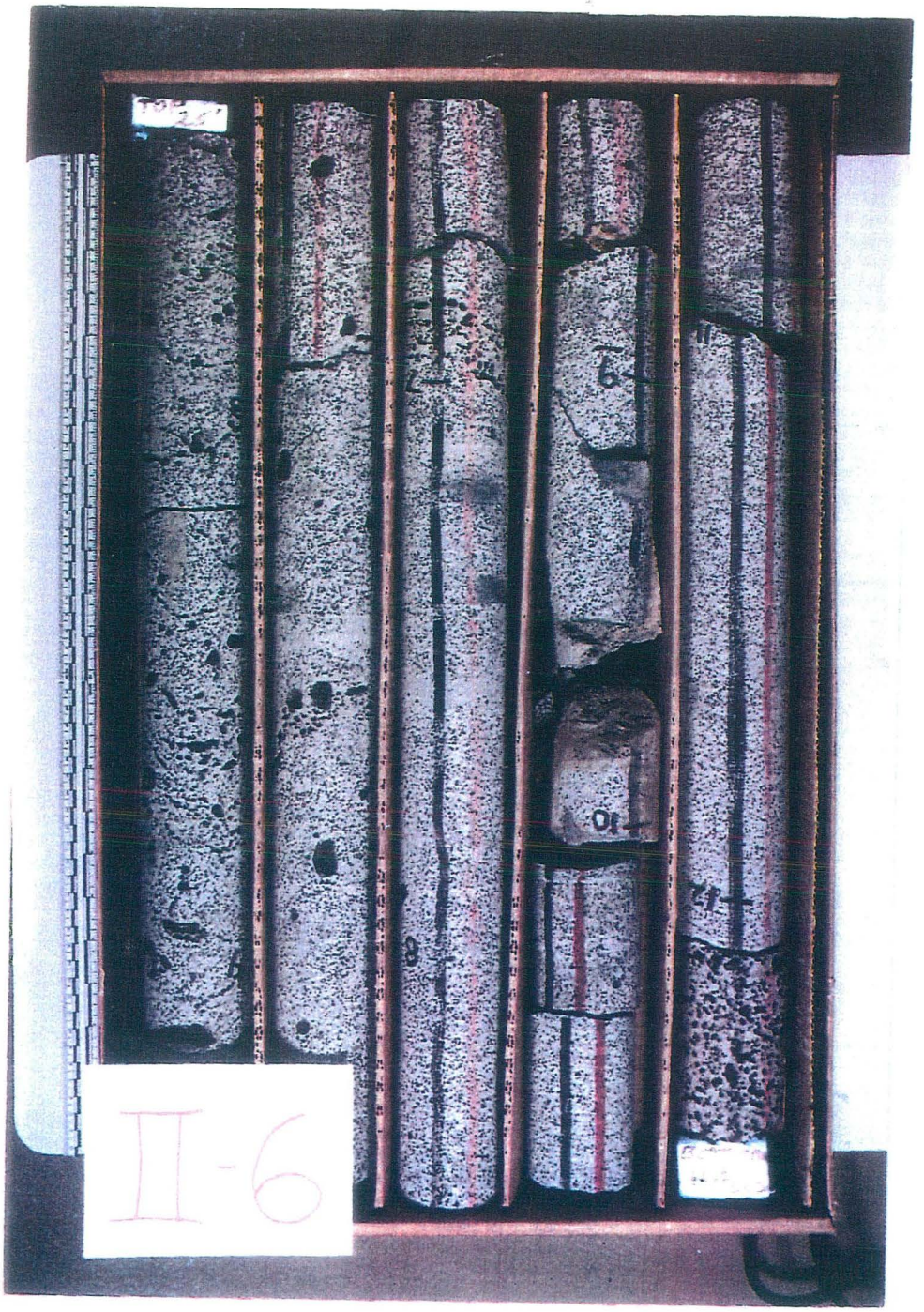


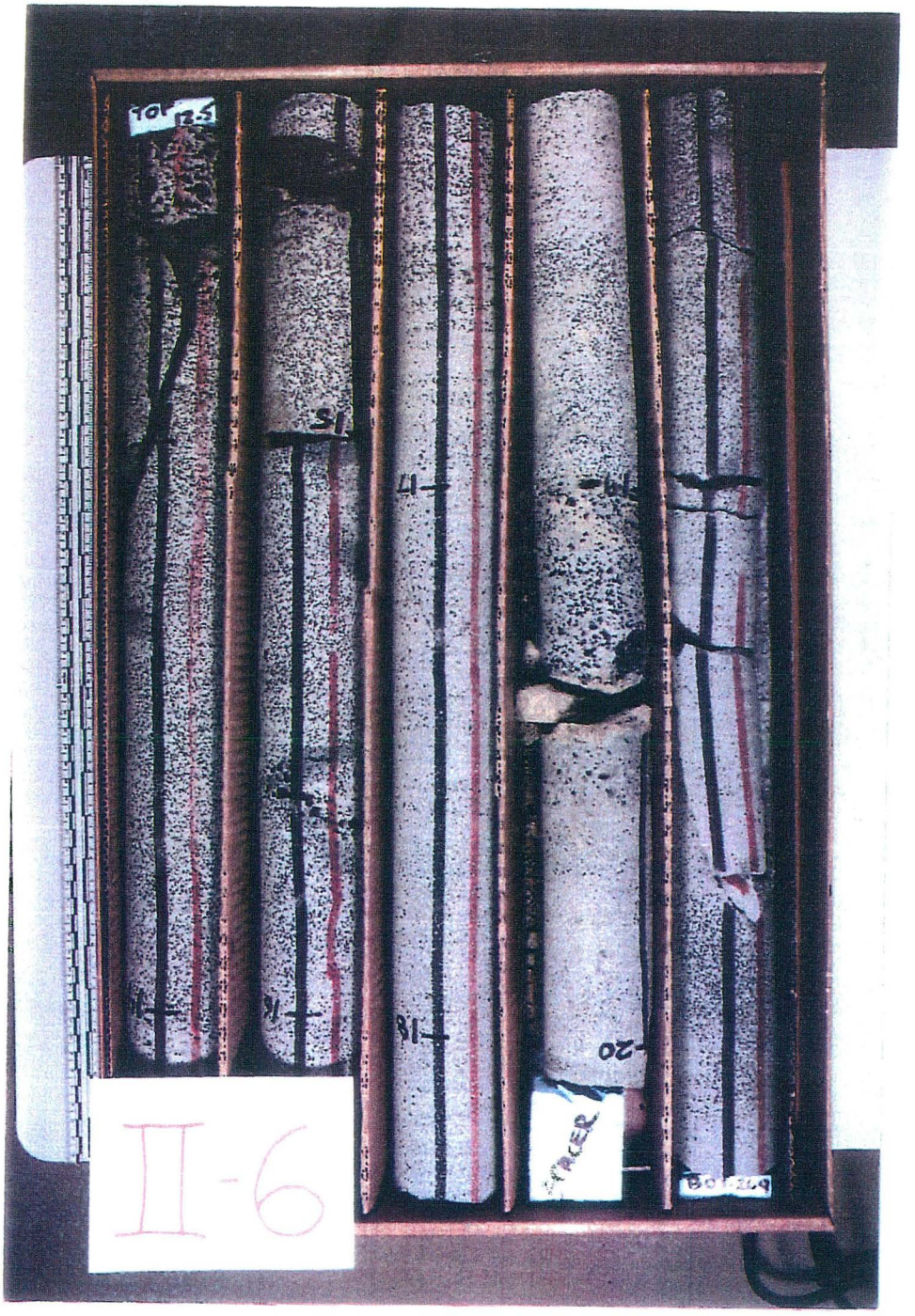


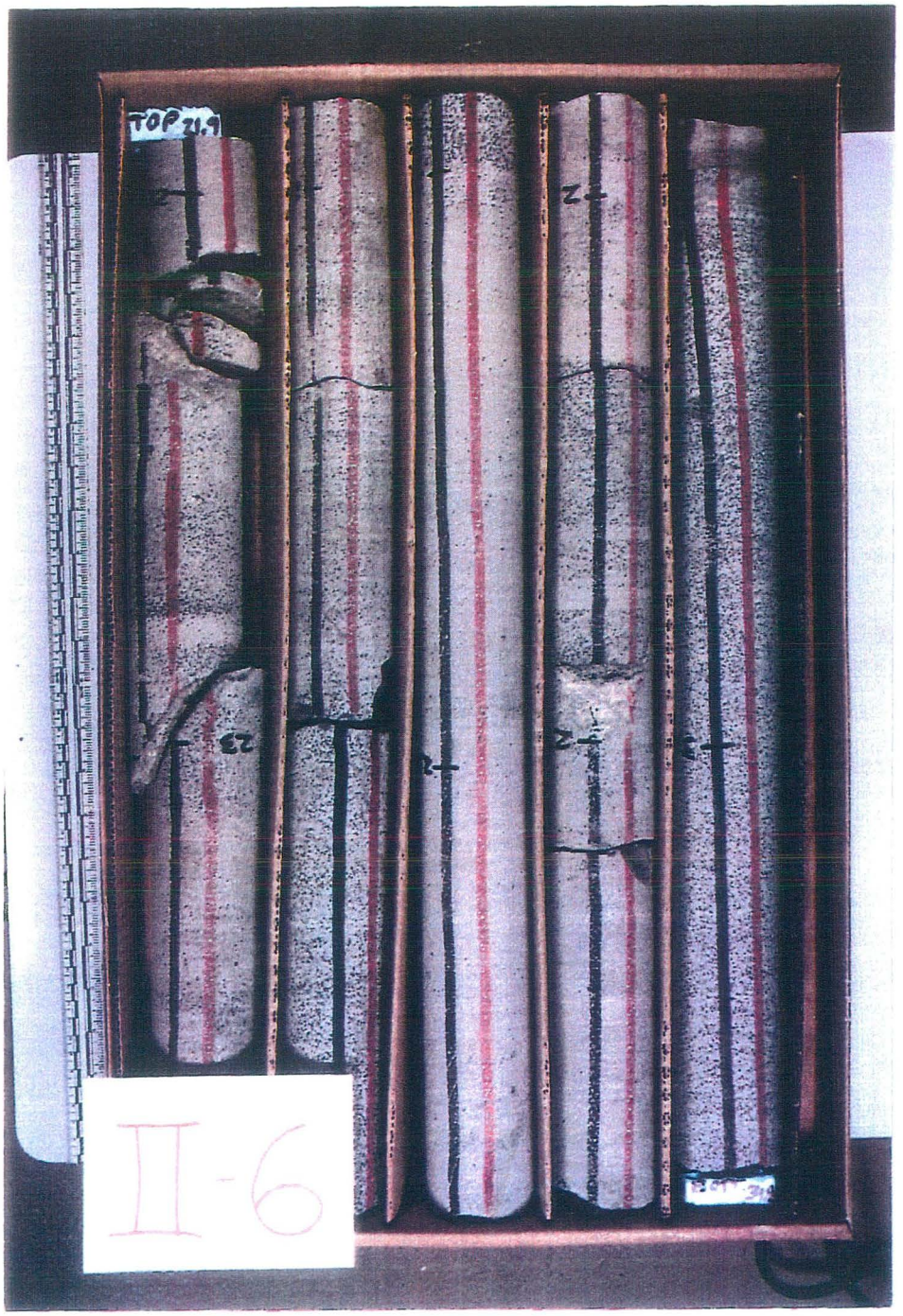
Well II-6	Vertical Well
Core logged by David Burgess on July 17, 1995	

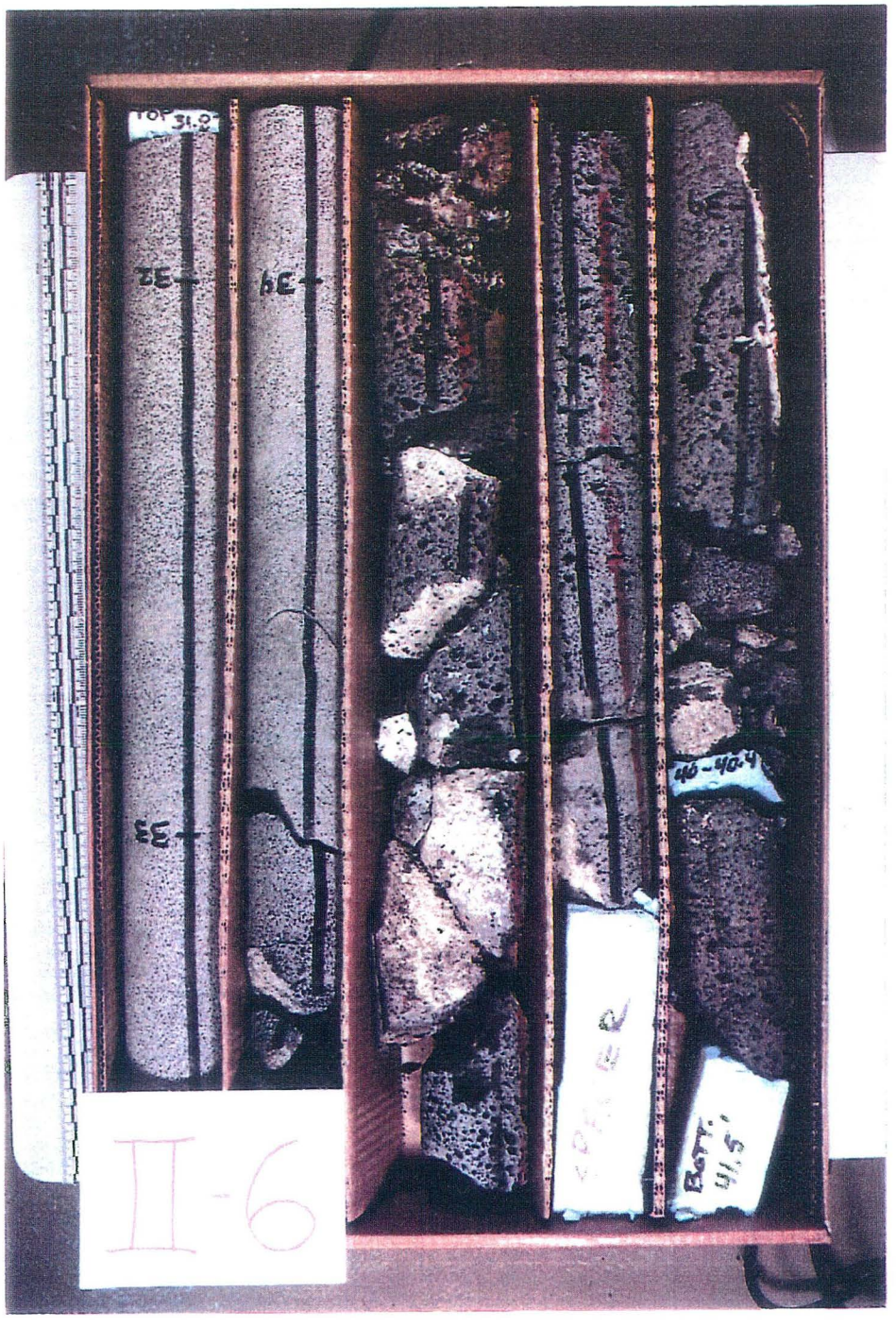
Core Run (feet)	Vertical Depth (feet)	Description
2.5-5.0	2.5-5.0	Upper vesicular
	3.2	Induced fracture during drilling or removal. No sediment staining or mineratization
5.0-10.0	5.0-5.5	Upper vesicular
	5.5-10.0	Massive
	8.6-9.2	Two high angle fractures with sediment staining
10.0-15.0	10.0-12.1	Massive and slightly vesicular
	12.1-12.8	Massive very vesicular
	12.8-15.0	Massive and slightly vesicular
	10.3	Horizontal fracture. No sediment staining, probably caused by drilling
	13.0	Horizontal fracture. No sediment staining, probably caused by drilling
	12.6	Horizontal fracture with sediment staining and mineralization
	12.6-13.1	High angle fracture with no sediment staining
	14.5	Horizontal fracture with sediment staining
15.0-20.0	15.0-19.0	Massive zone
	19.0-19.7	Massive zone, very vesicular
	19.3	Horizontal fracture filled with tan silt sediment
20.0-25.0	20.0-25.0	Massive zone
	20.3-21.5	High angle fractures may have been caused during drilling. No sediment staining
	22.2	Horizontal fracture with sediment staining
	22.9-23.1	Low angle fracture with sediment staining
	23.9	Horizontal fracture caused when removing core from remaining shell
	24.4	Horizontal fracture caused when removing core from remaining shell
25.0-30.0	25.0-26.0	Massive, slightly vesicular
	26.0-28.3	Massive zone, non-vesicular
	28.3-30.0	Massive zone, slightly vesicular
	28.4	Horizontal fracture with sediment staining
	28.4-29.0	Moderately-high angle fracture with sediment staining
	24.2	Horizontal fracture caused when removing remaining shell
30.0-35.0	30.0-35.0	Massive basalt slightly vesicular
	34.6-34.8	Moderate angle fracture with sediment staining
35.0-40.0	35.0-35.1	Massive zone
	35.1-35.4	Lower vesicular
	35.4-36.0	Flow break. Rubble zone.
	36.0-38.7	Upper vesicular
	38.7-39.4	Massive zone
	39.4-40.0	Lower vesicular
	35.4-36.0	Rubble zone with no sediment filling

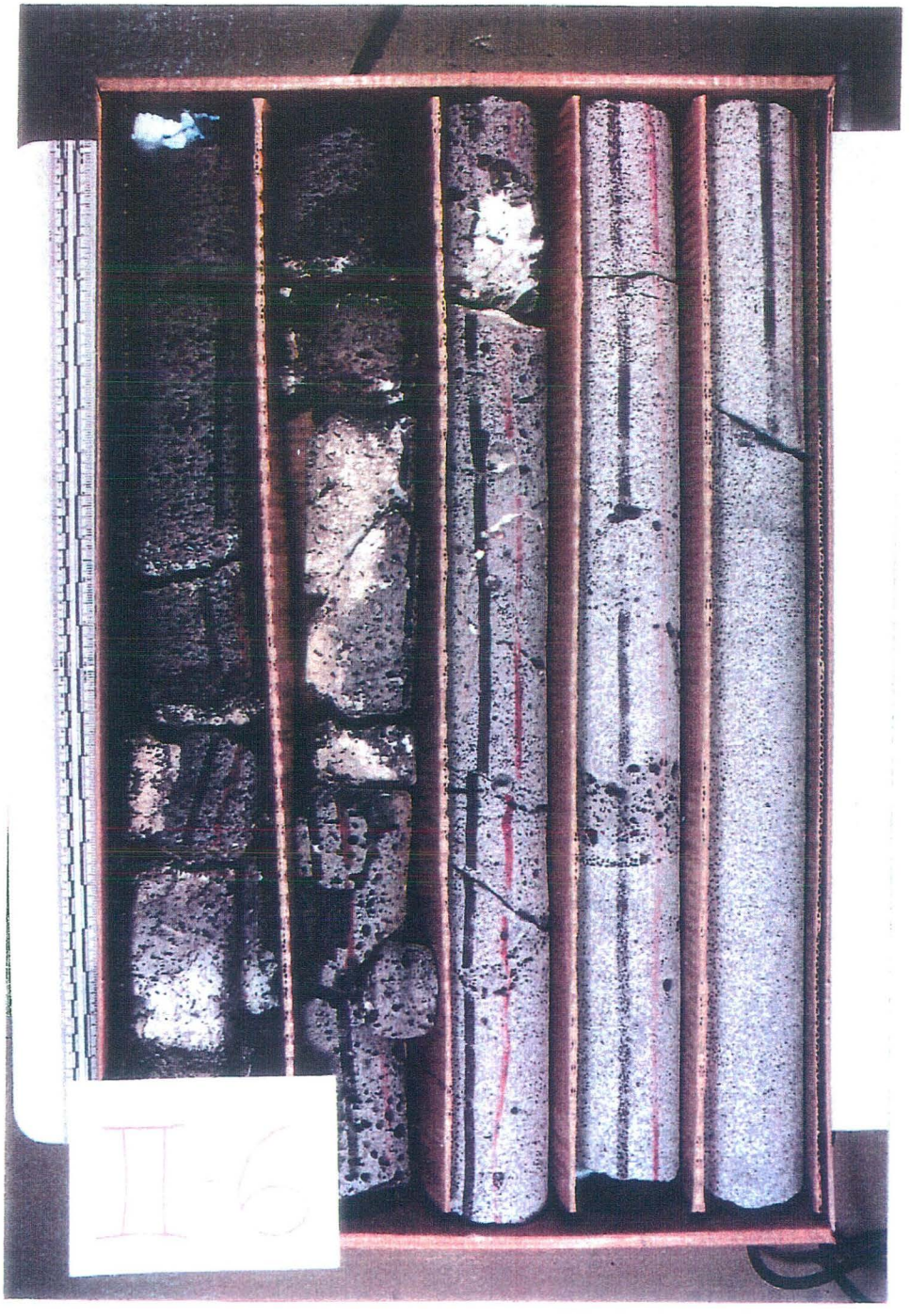
	36.5	Horizontal fracture with sediment staining
	36.8-37.5	Highly fractured zone
	38.4	Horizontal fracture with no sediment staining
	38.8	Horizontal fracture with staining
40.0-45.0	40.0-40.4	No recovery, probably rubble zone
	40.6	Flow break
	40.4-41.2	Rubble zone, no sediment in rubble, although staining is present
	41.2-41.6	Moderate angle and high angle fracture with no sediment staining
	41.7	Horizontal fracture. No sediment staining
	42.3	Horizontal fracture with sediment staining
	42.4-42.7	Highly fractured zone with sediment staining
	43.2-44.3	Highly fractured zone with sediment staining
	44.5-44.7	Horizontal fracture with sediment staining
45.0-50.0	45.0-46.1	Upper vesicular, possible flow break at 45.8'
	46.1-50.0	Massive zone
	45.4	Horizontal fracture with sediment staining
	45.8	Horizontal fracture with sediment staining
	46.6	Low angle fracture with sediment staining
	49.9-50.0	Moderate angle fracture with sediment staining
50.0-55.0	50.0-55.0	Massive zone
	51.7	Horizontal fracture with sediment staining
	52.3-53.5	High angle fracture with sediment staining
	52.3-53.1	Moderate angle fracture with sediment staining
	53.4-54.2	High angle fracture with sediment staining
	54.2-55.0	Extremely fractured zone probably due to coring. No sediment staining
55.0-60.0	55.0-57.5	Massive zone
	57.5-58.1	Lower vesicular
	58.1-58.4	Lower vesiuclar
	58.1-58.6	Flow break. Rubble zone
	58.6-59.3	Upper vesicular
	59.3-59.5	Massive zone. May be upper/lower vesicular. However this zone had significantly less air bubbles than above or below
	59.5-60.0	Lower/Upper vesicular
	58.1-58.6	Some sediment filling and sediment staining
	59.6-60.0	Highly fractured zone with some sediment staining


II-6


101 12.5
15
17
19
14
16
18
20
SPACER
II-6


TOP 21.9
II-6


II-6
TOP 31.0
32
34
33
40-40.4
BOTT. 41.5

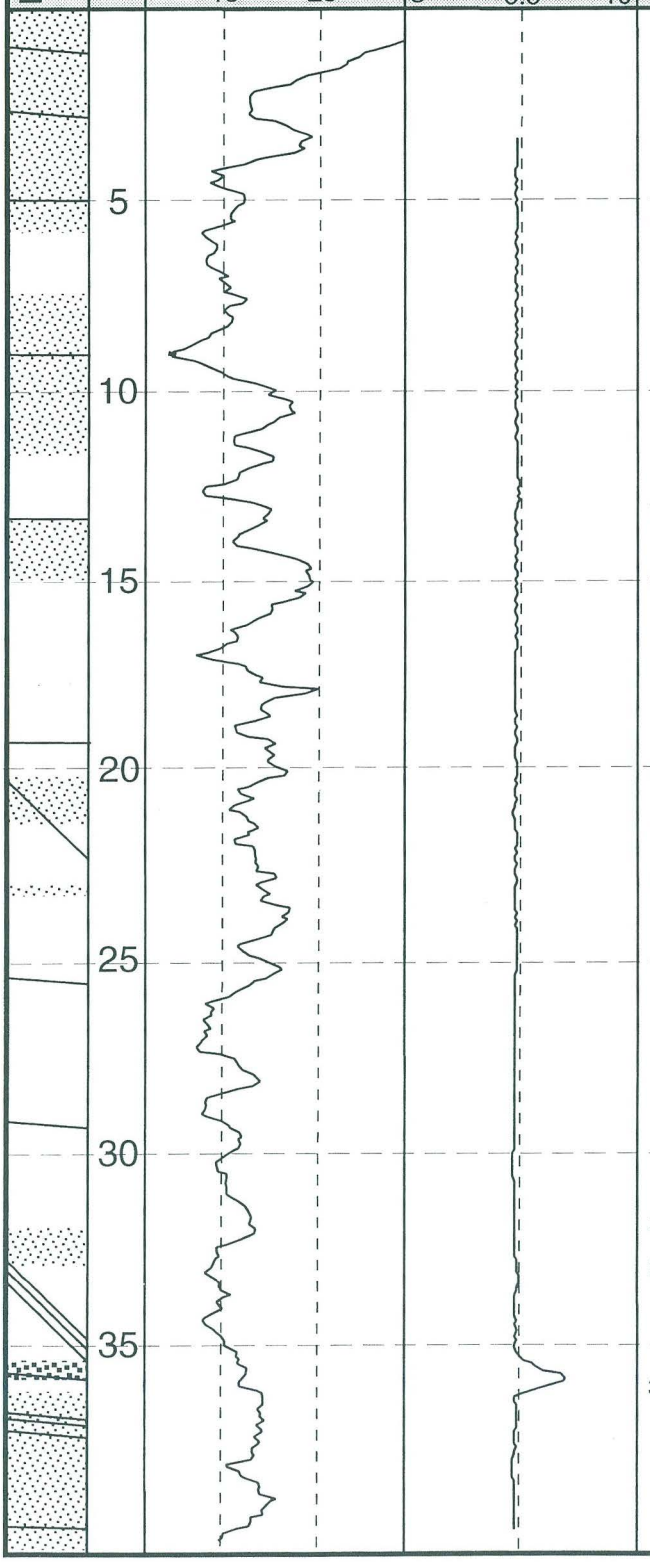

II-6

51.5
54
53
NO RECOV.
58.1-58.4
II-6

Well II-7

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-7	July 1995	T.V. Borehole Camera	Air Percussion	1/2

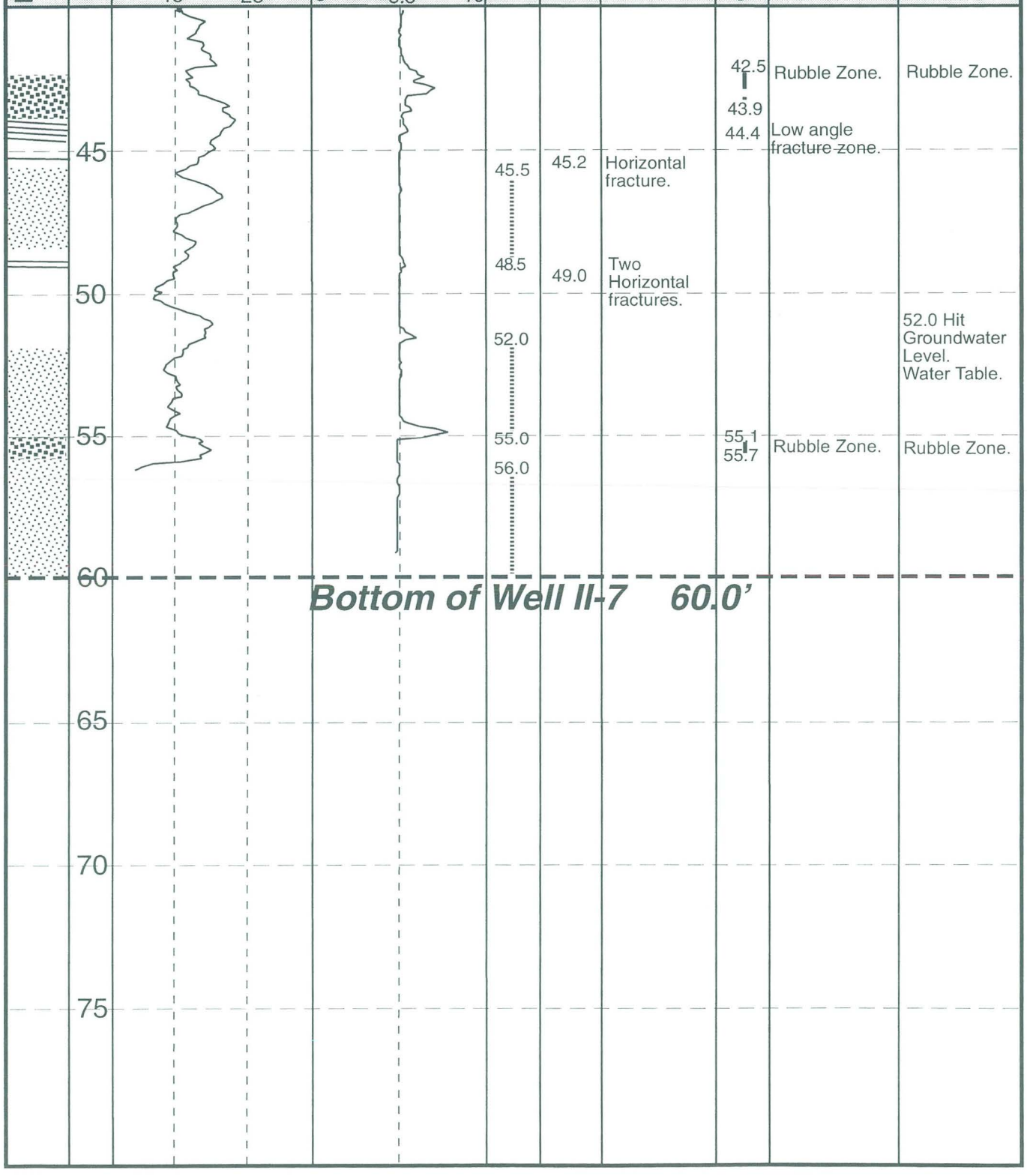
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	180.2 ft.	216.6 ft	5249.4 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
	1.0	Low angle vesicular fracture.			
	3.2	Low angle vesicular fracture.			
	5.0	Horizontal fracture.			Sparse vesicles.
6.0					
	3				
7.5					
	9.2	Horizontal vesicular fracture.			
11.9					
13.5	13.5	Horizontal vesicular fracture.			
15.0					Massive Basalt.
	19.3	Horizontal fracture.			
20.2	20.3	High angle fracture.			
21.5					
23.2					
	25.3	Low angle fracture.			Massive Basalt.
	29.2	Low angle fracture.			
32.0					
33.0	33.1	Three high angle fractures.			
			35.5	Rubble Zone.	Rubble Zone.
36.2	36.2	Low angle fracture.	36.0		
			37.0	Low angle fracture zone.	
			37.6		
	39.2	Horizontal fracture.			

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-7	July 1995	T.V. Borehole Camera	Air Percussion	2/2

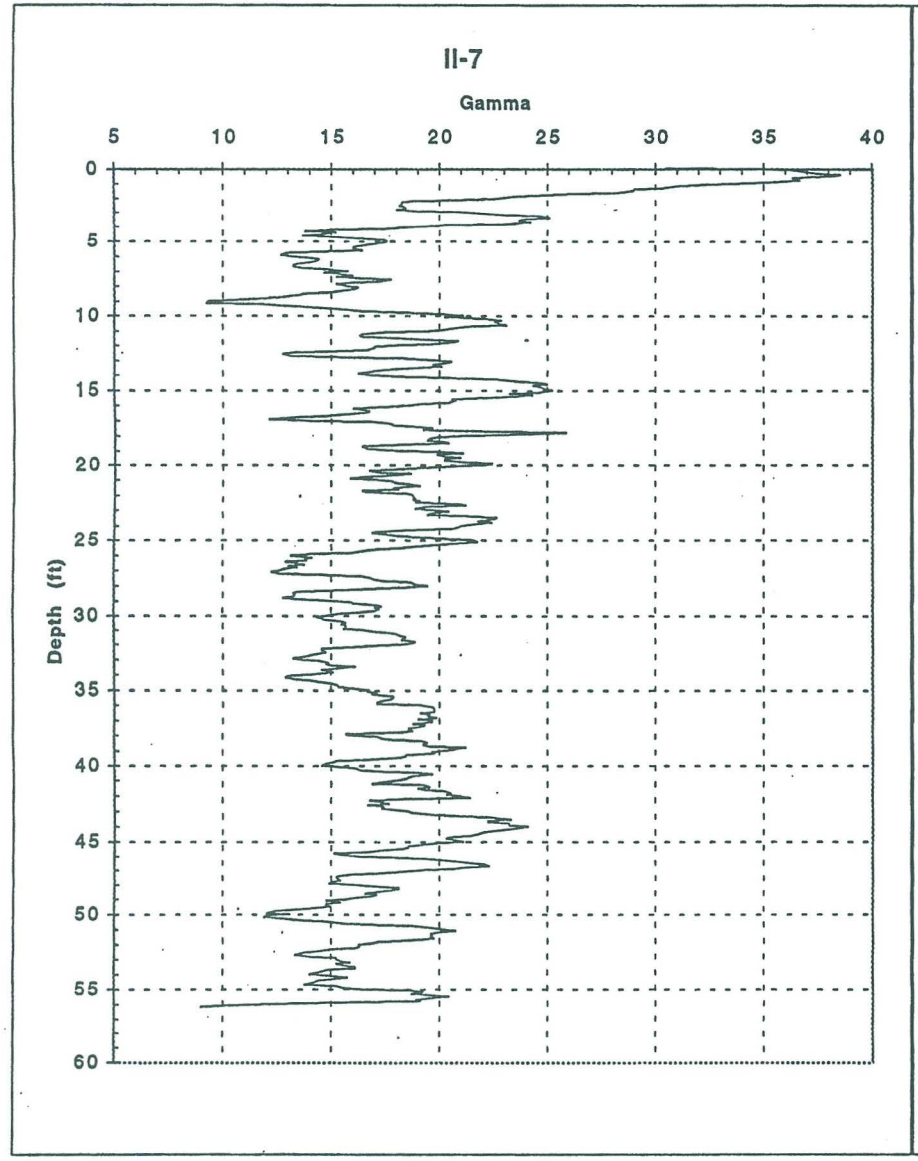
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	180.2 ft.	216.6 ft	5249.4 ft.

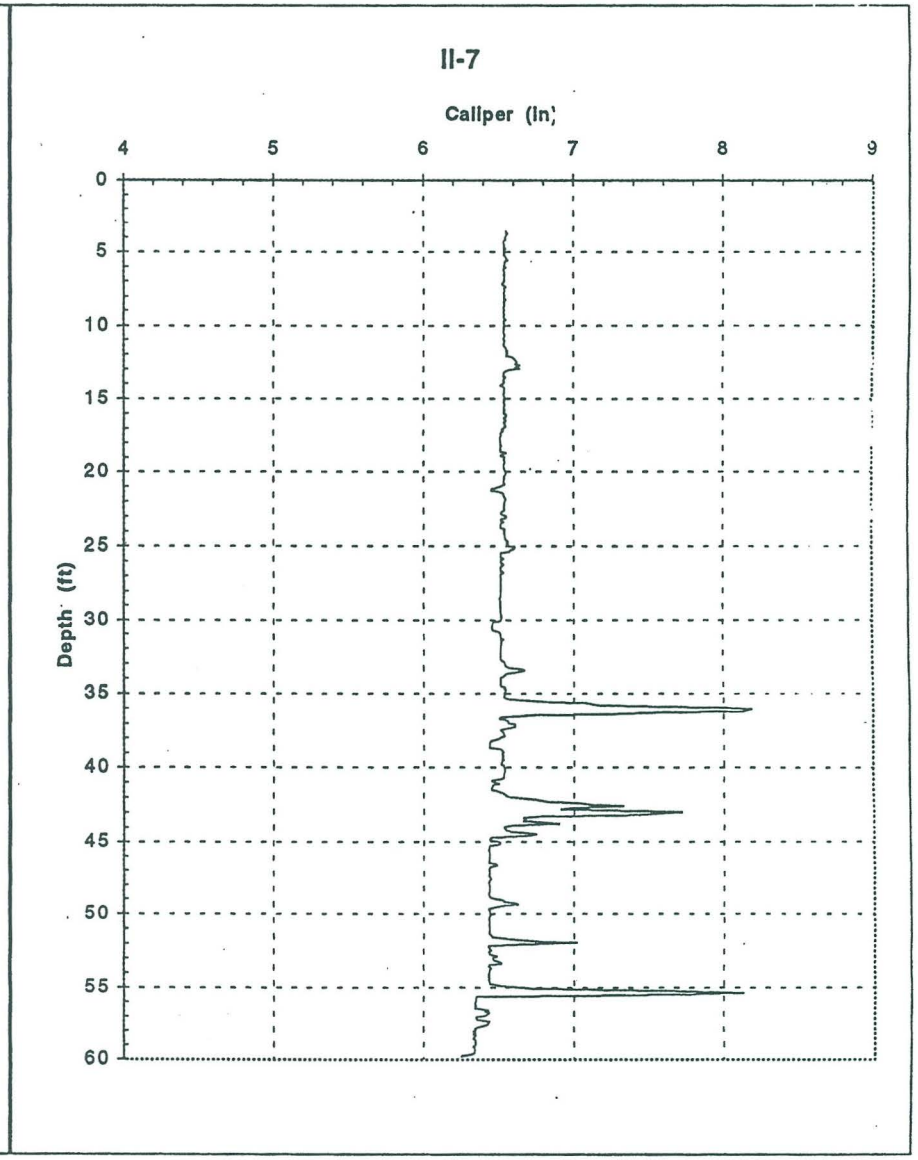


Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
		42.5	Rubble Zone.	Rubble Zone.
		43.9		
		44.4	Low angle fracture zone.	
45.2	Horizontal fracture.			
49.0	Two Horizontal fractures.			
				52.0 Hit Groundwater Level. Water Table.
		55.1	Rubble Zone.	Rubble Zone.
		55.7		

[redacted]

II-7 Gamm[illegible] Caliper Data

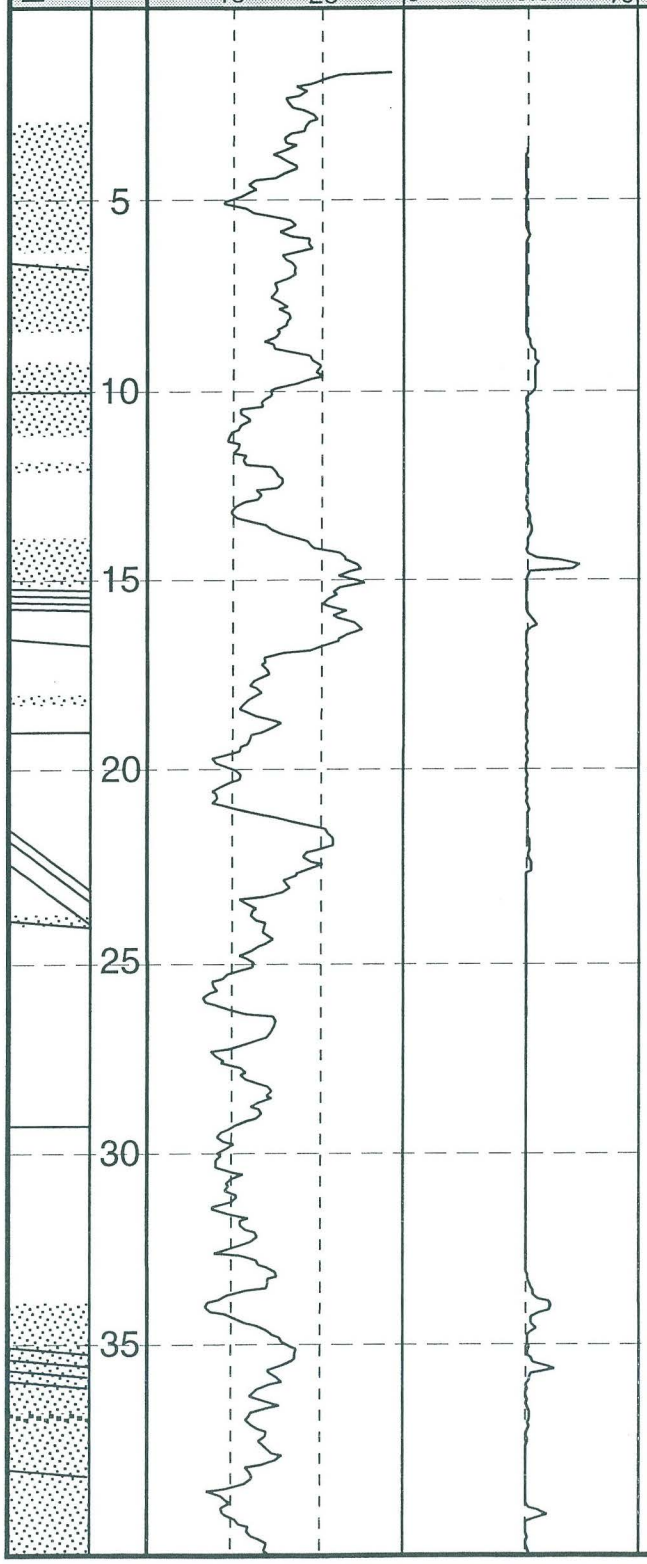




Well II-8

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-8	July 1995	T.V. Borehole Camera	Air Percussion	1/2

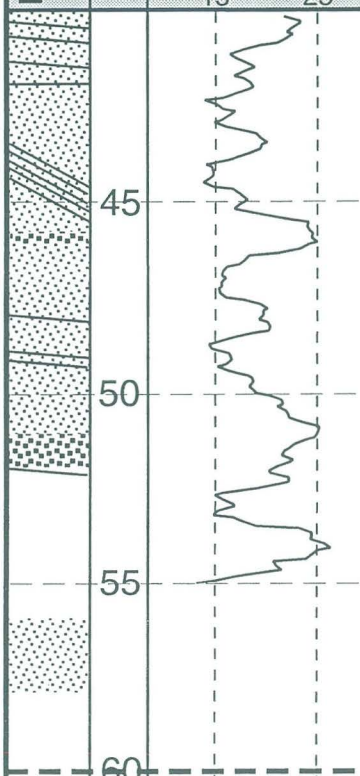
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	182.9	228.4 ft	5250.0 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
3.0					
6.2					
6.6	6.8	Low angle fracture.			Massive Basalt.
8.5					
9.3					
	10.0	Horizontal fracture.			
11.2					
12.0					Slightly Vesicular.
14.0					
15.2			15.2–16.0	Large Horizontal fracture.	
	16.9	Low angle fracture.			
18.3					
	19.3	Horizontal fracture. Slightly vesicular.			
			21.9–22.8	Two high angle fractures.	
	23.2	High angle.			
24.0	24.0	Low angle fracture.			Slightly Vesicular.
	29.2	Horizontal fracture.			Slightly Vesicular.
34.0					
			35.0–36.2	Low angle fracture zone.	
			37.0	Rubble Zone.	Rubble Zone.
	38.2	Low angle fracture.			

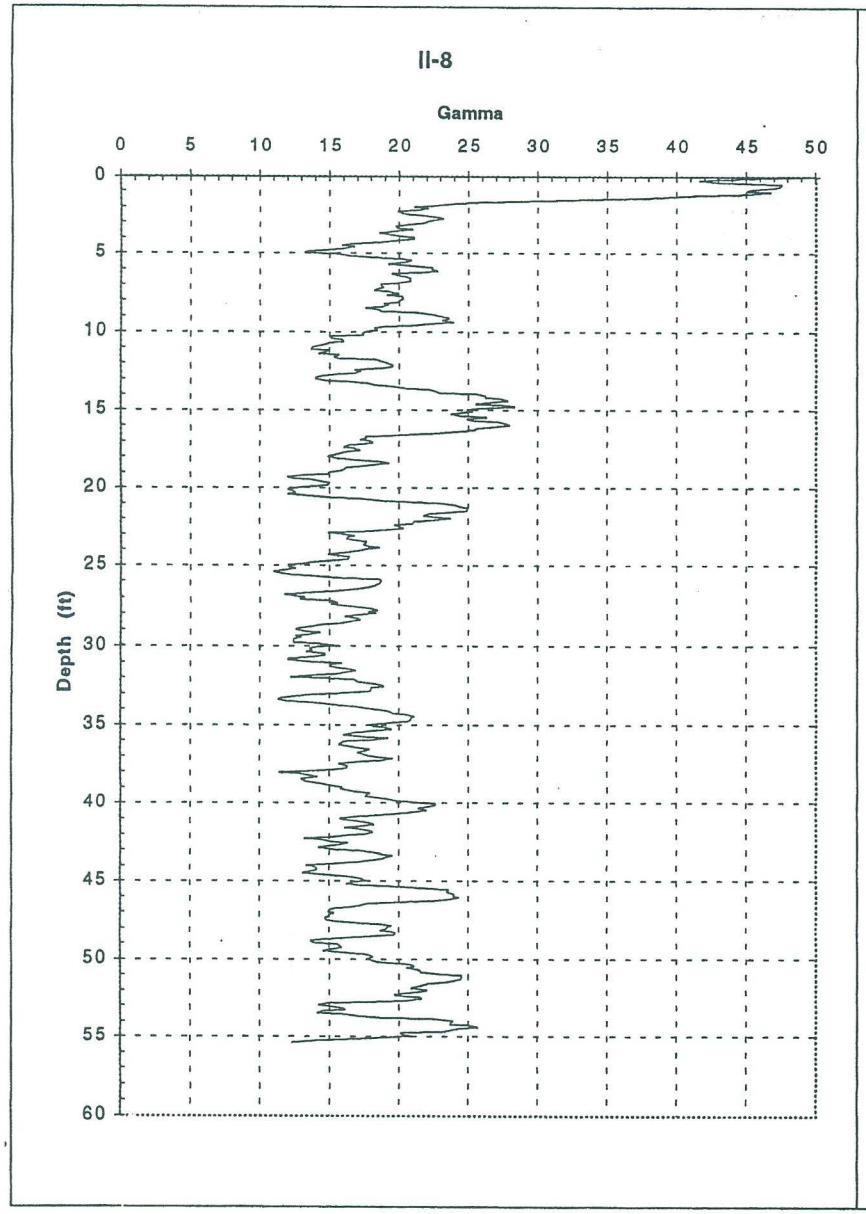
BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
II-8	July 1995	T.V. Borehole Camera	Air Percussion	2/2

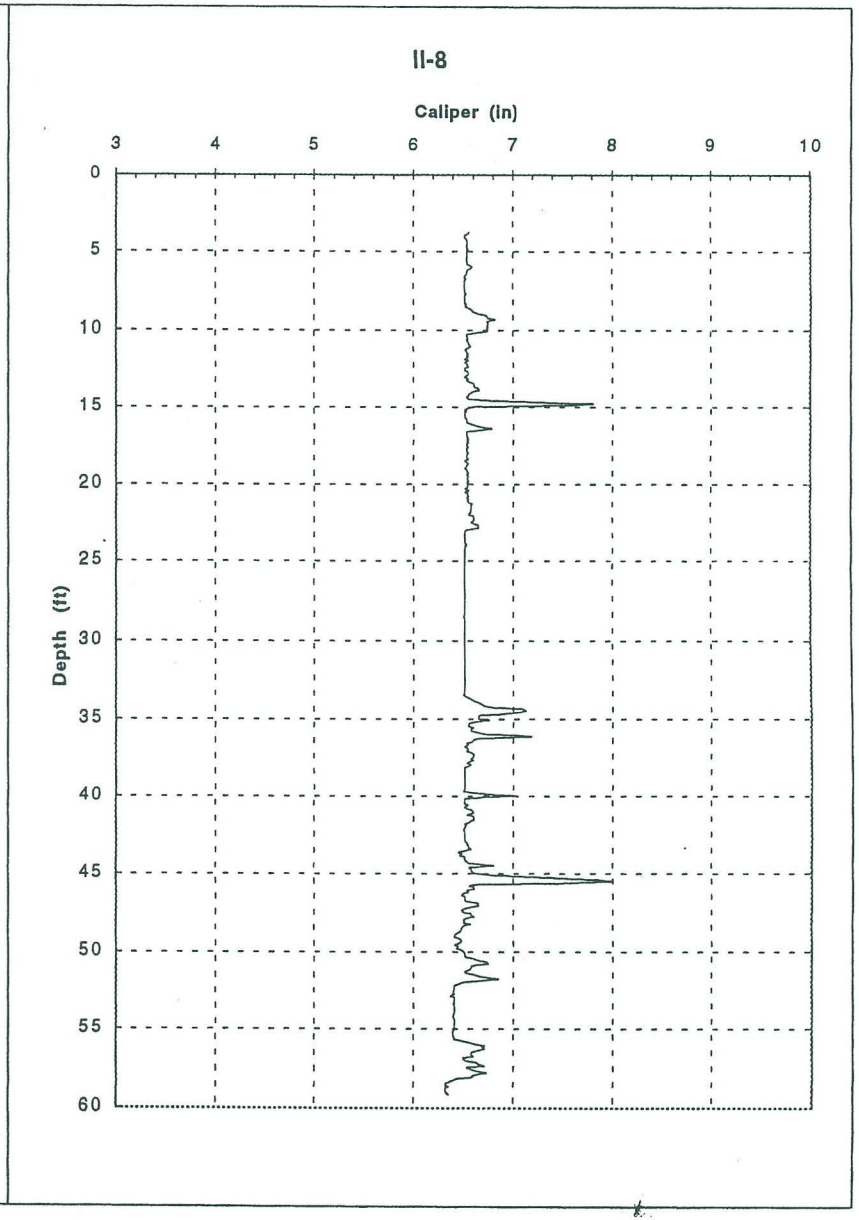
DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	182.9	228.4 ft	5250.0 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
	40.3 40.8 41.4 42.0	3 Low angle fractures. Horizontal fracture.			
			43.9 45.2	High angle fracture zone.	
			45.9 46.2	Rubble Zone.	Rubble Zone.
	48.0 49.0 49.2	Low angle fracture. 2 Low angle fractures.			
51.3	52.1	Low angle fracture.	51.3 52.0	Rubble Zone.	Rubble Zone. 53.9' Groundwater Level. Water table at 53.9'.
56.0 58.0					

Bottom of Well II-8 60.0'

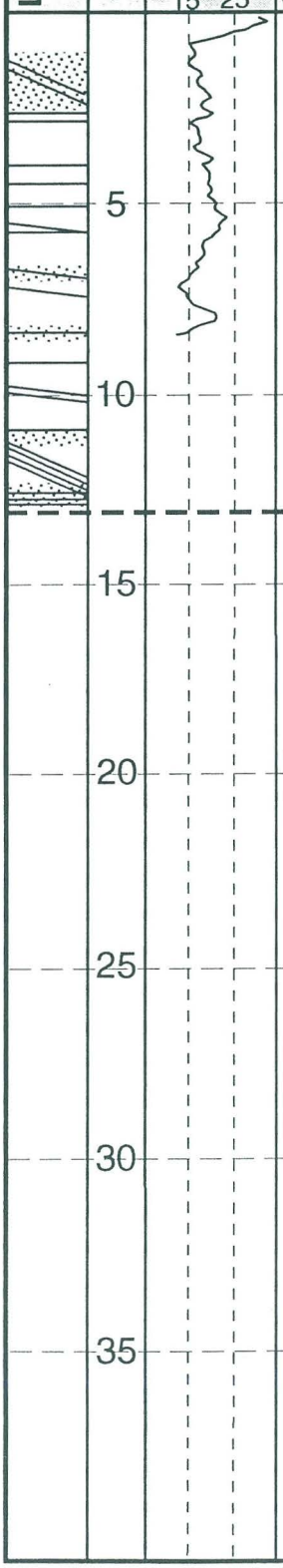

II-8
Gamma
0 5 10 15 20 25 30 35 40 45 50
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50 55 60

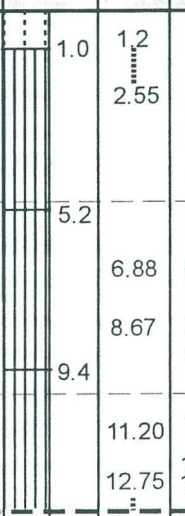

II-8
Caliper (in)
3 4 5 6 7 8 9 10
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50 55 60

Well S-1

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
S-1	7/17/95	Coring	HX Coring using water	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL (30 degree slant from vertical)	David Burgess	213.1	204.5	5248.9

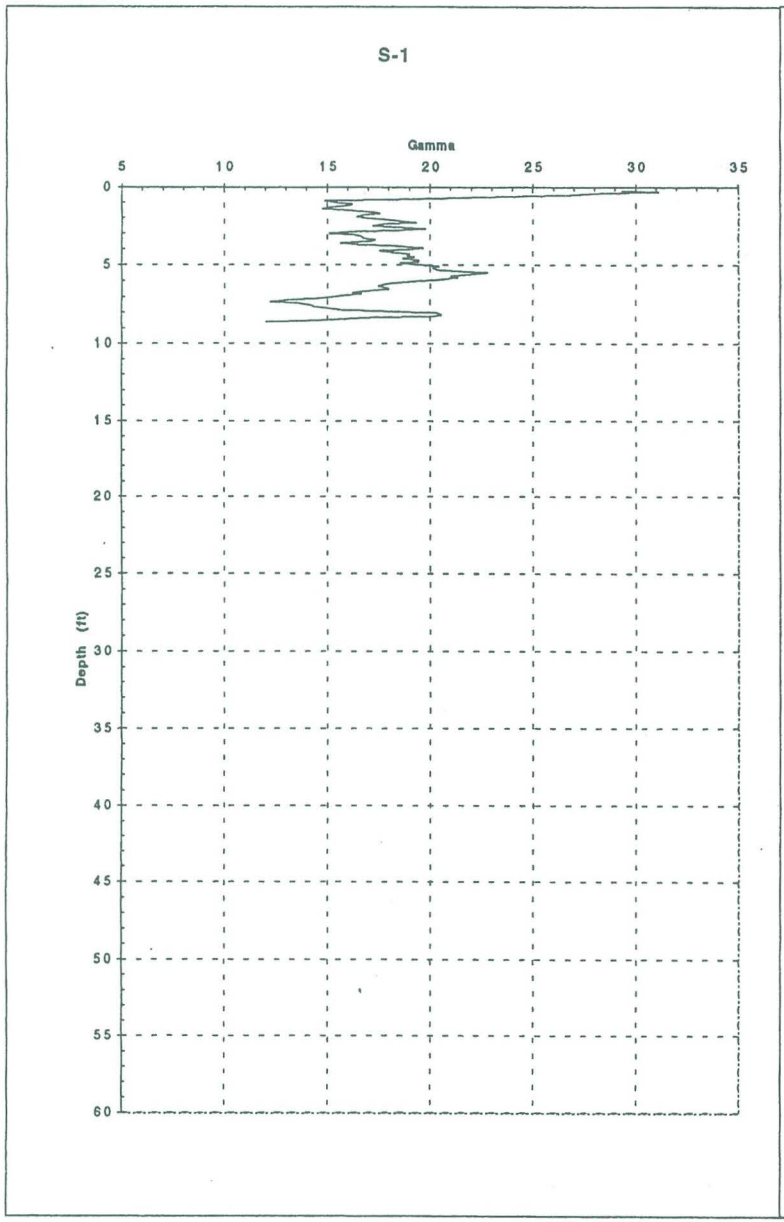


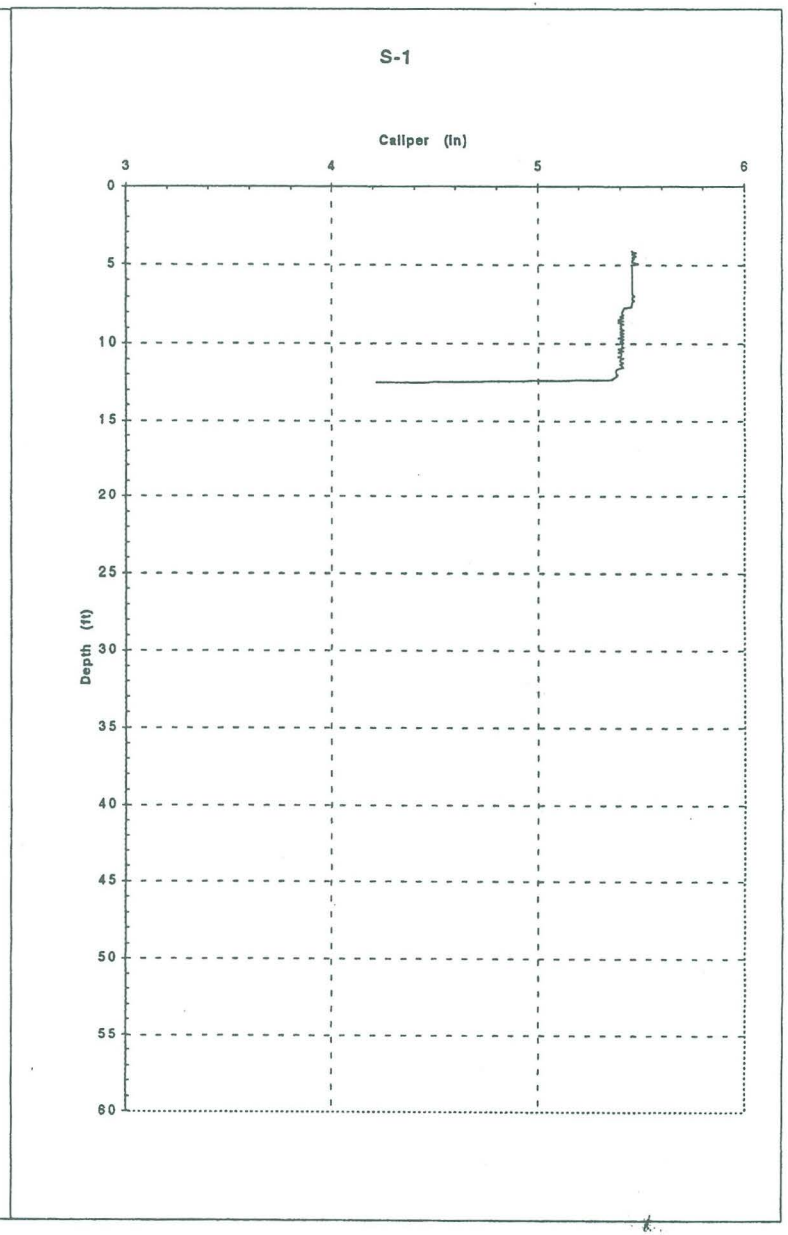


vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
1.2			1.81–2.46	High angle fractures with sed. stain.	No Recovery.
2.55	2.63–2.72	2 Horizontal w/ sed stain.			Massive Zone.
	4.16–4.50	2 Horizontal w/ sed stain.			
	5.01–5.86	Horizontal. Horizontal w/ sed. stain.	5.75	Low angle fractures with sed. stain.	Massive Zone.
6.88	6.88–7.14	2 Low angle w/ sed. stain.			
8.67	8.67–9.35	2 Horizontal w/ sed. stain.			Massive Zone.
			10.0	Low angle w/ sed. stain.	
11.20	11.05	Horizontal w/ sed stain.	11.8	High angle fractures with sed. stain.	Massive Zone.
12.75	12.58–12.75–13.0	3 Horizontal w/ sed stain.			Massive Zone.

Vertical Depth of Well S-1 13.6'

S-1 Gamma and Caliper Data

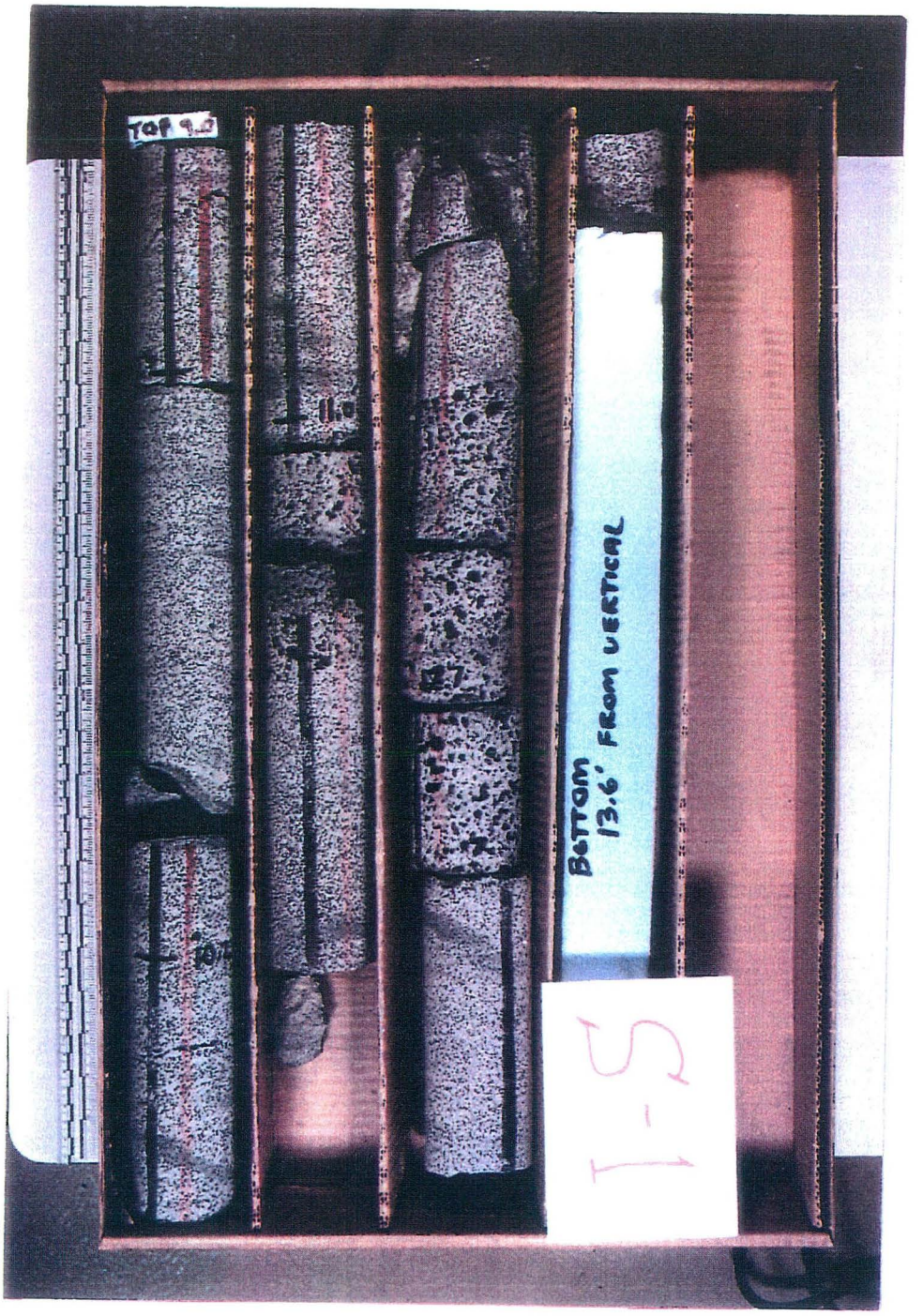




Well S-1	Slant Well at ≅30° from vertical
Core logged by David Burgess on July 19,1995	

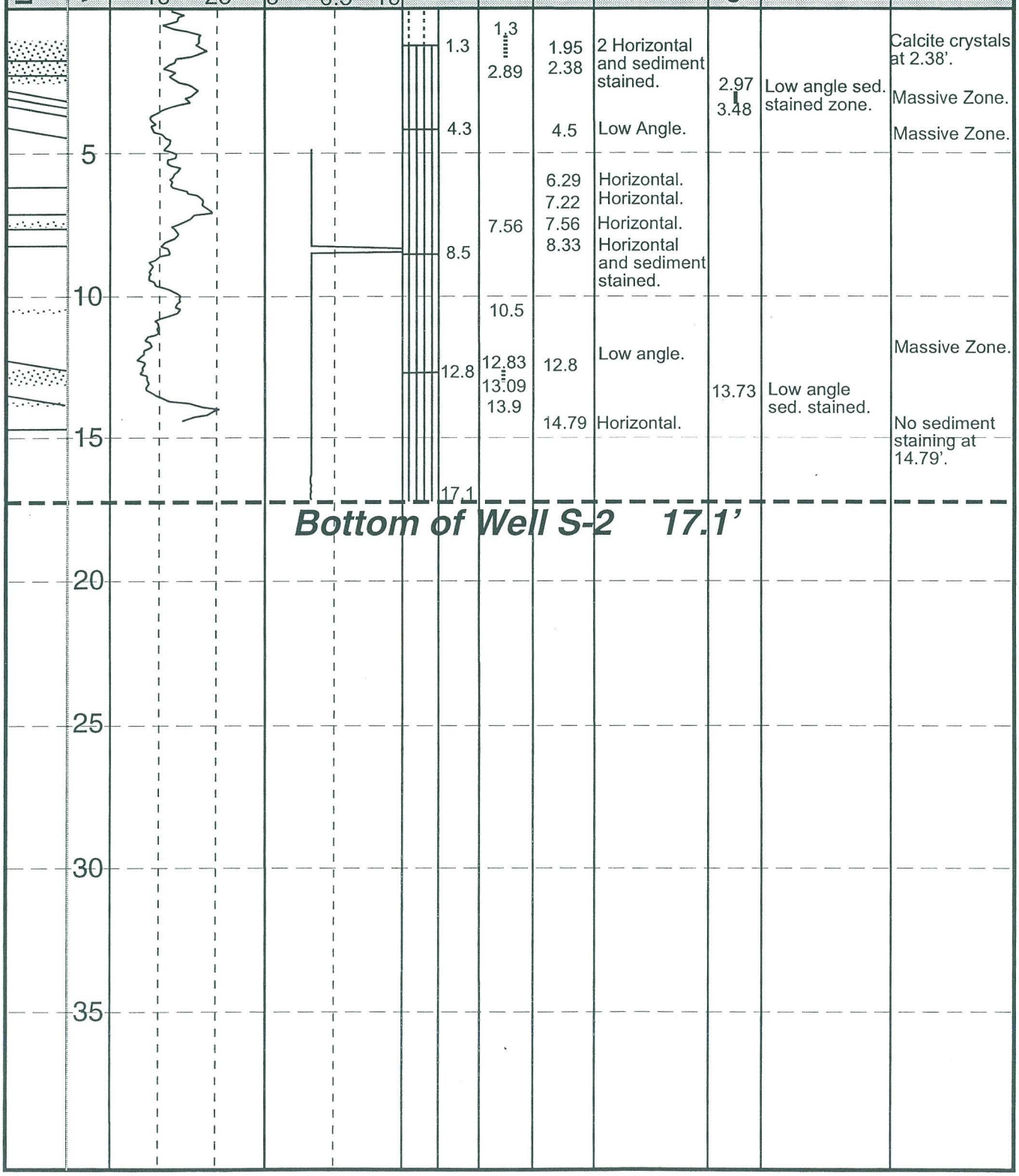
Core Run Length (feet)	Core Run Depth (feet)	Vertical Depth (feet)	Description
1.2-6.2	1.2-5.2	1.2-2.55	Upper vesicular.
		2.55-5.27	Massive zone.
		1.81-2.46	Medium to high angle fracture with sediment staining.
		2.63	Horizontal fracture with sediment staining.
		2.72	Horizontal fracture with sediment staining.
		4.16	Horizontal fracture with sediment staining.
		4.50	Horizontal fracture with sediment staining.
		5.01	Horizontal fracture. No sediment staining. Probably caused during drilling.
6.2-11.0	5.27-9.35	5.27-9.35	Massive zone.
		5.69-5.86	Low angle fracture with sediment staining.
		5.86	Horizontal fracture with sediment staining.
		6.88	Low angle fracture with sediment staining.
		7.14	Low angle fracture with sediment staining.
		8.67	Horizontal fracture with sediment staining.
		9.01	Horizontal fracture caused from removing core from reaming shell. No sediment staining.
11.0-16.0	9.35-13.6	9.35-11.05	Massive zone.
		11.05-11.39	Massive zone. Moderately vesicular.
		11.39-12.32	Massive zone.
		12.32-13.0	Massive zone. Moderately vesicular.
		13.0-13.6	Massive zone.
		9.35	Horizontal fracture with sediment staining.
		9.94-10.03	Low angle fracture with sediment staining.
		11.05	Horizontal fracture with sediment staining.
		11.56-12.24	High angle fracture zone with sediment staining.
		12.58	Horizontal fracture with sediment staining.
		12.75	Horizontal fracture with sediment staining.
		13.0	Horizontal fracture. No sediment staining. Fracture probably caused during removal of core from reaming shell.
		13.6	Bottom of Well S-1

S-1

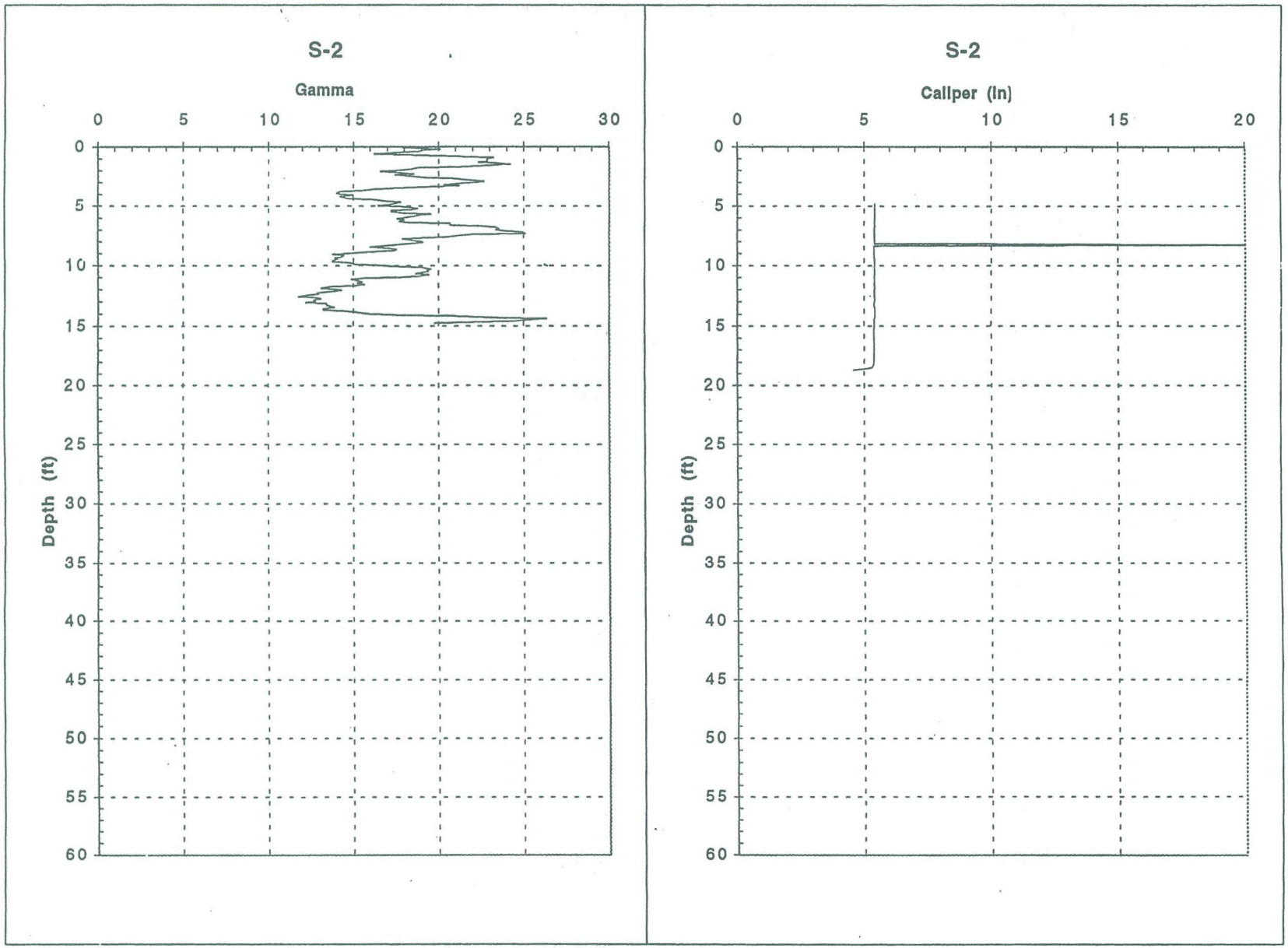

TOP 9.0
BOTTOM
13.6' FROM VERTICAL
I-5

Well S-2

BORING # S-2 (~30 degree slant from vertical)	DATE DRILLED: 7/14/95	LOGGED FROM: Coring.	METHOD: HX coring using water	PAGE: 1/1
DRILLED BY: INEL	LOGGED BY: David Burgess	NORTHING: 217.0 ft	EASTING: 207.6 ft	SURFACE ELEVATION: 5249.2 ft

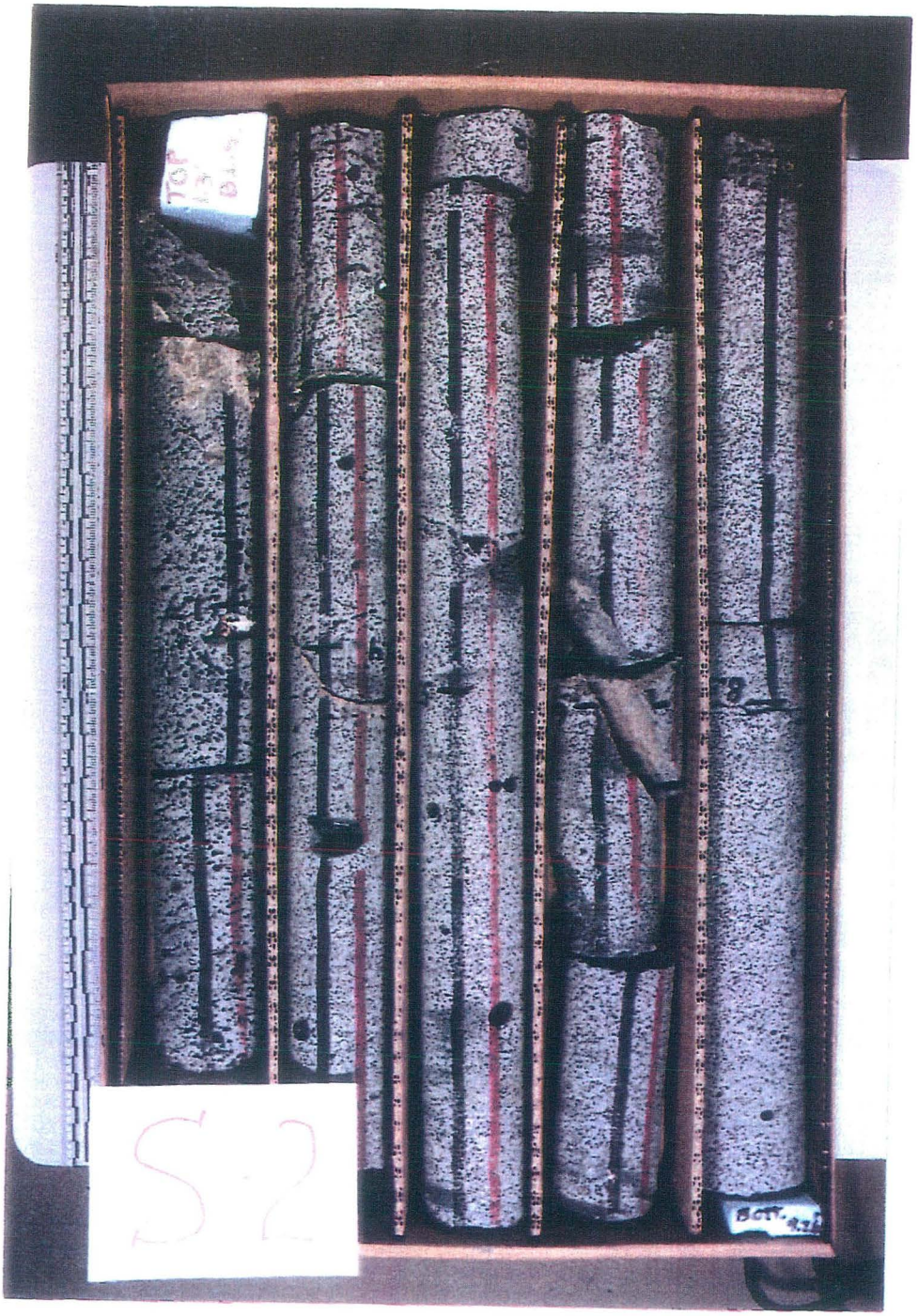


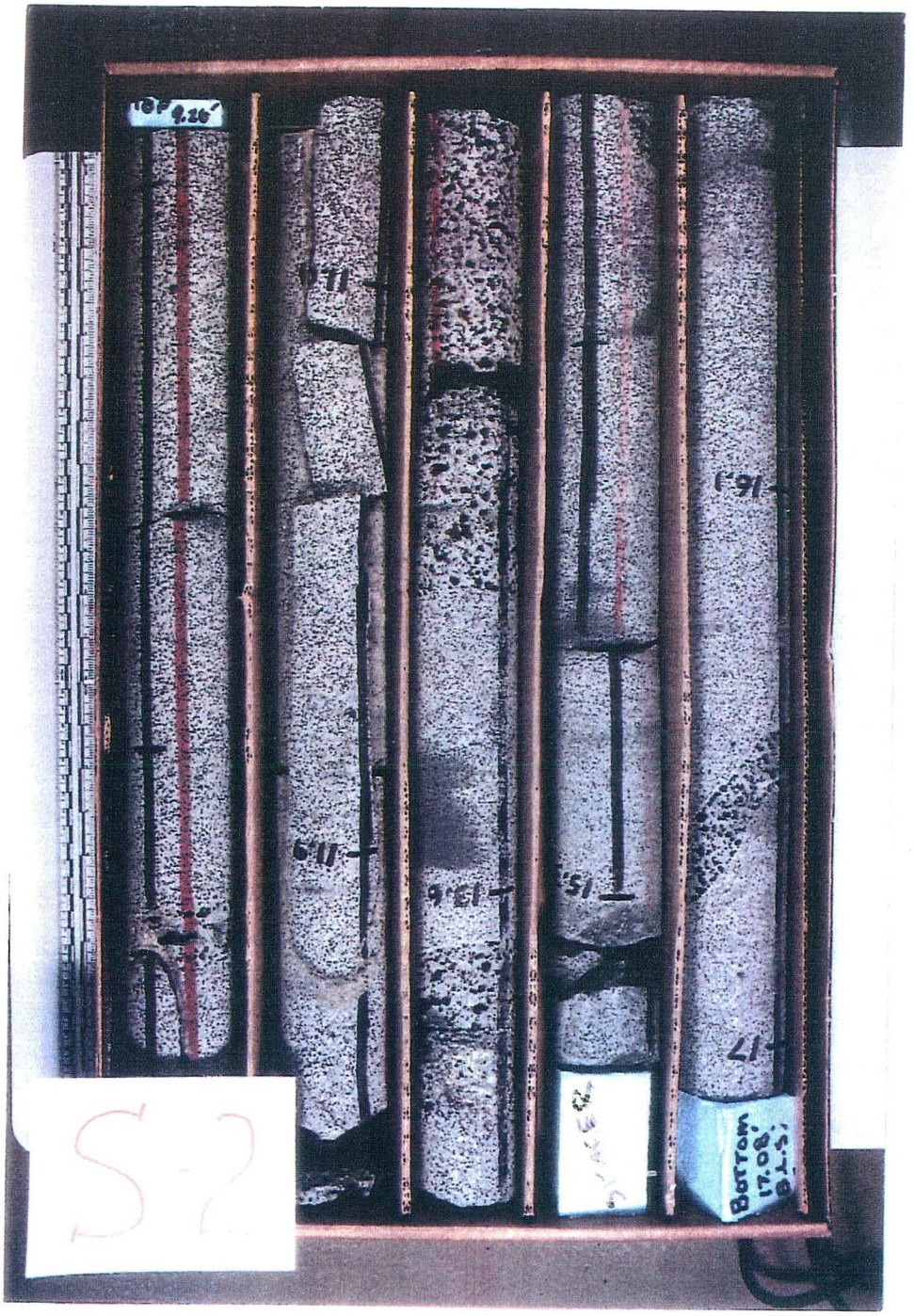
S-2 Gamma and Caliper Data



Well S-2	Slant Well at ≅30° from vertical
Core logged by David Burgess on July 17,1995	

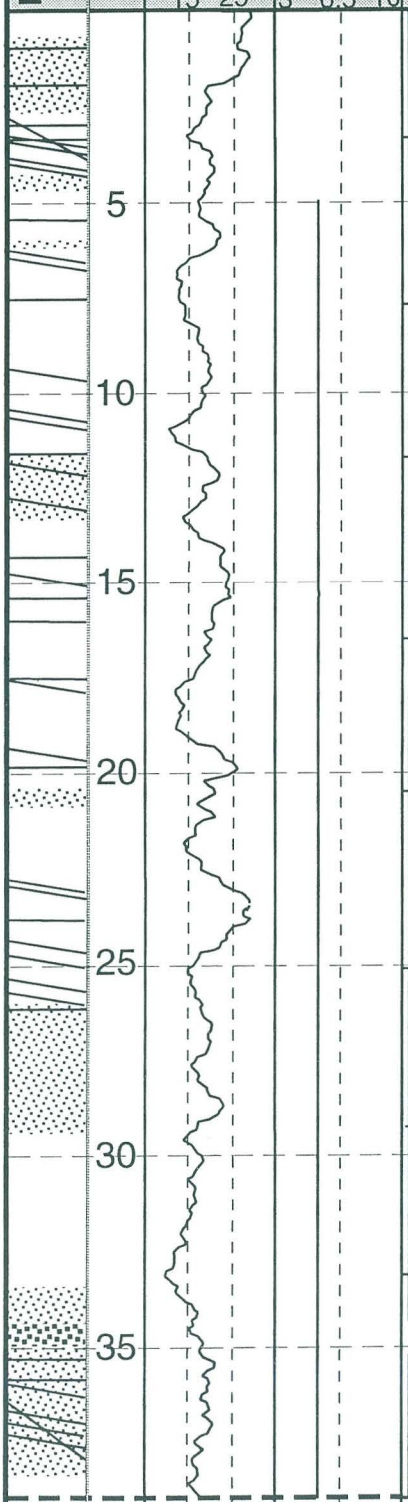
Core Run Length (feet)	Core Run Depth (feet)	Vertical Depth (feet)	Description
1.3-5.1	1.3-4.33	1.3-2.89	Upper vesicular
		2.89-4.33	Massive zone
		1.3-1.4	Moderate angle fracture with sediment staining
		1.95	Horizontal fracture with sediment staining
		2.38	Horizontal fracture with sediment staining and calcite crystals
		2.97-3.06	Low angle fracture with sediment staining
		3.31-3.48	Low angle fracture with sediment staining
5.1-10.0	4.33-8.5	4.33-8.5	Massive zone
		6.29	Horizontal fracture-no sediment staining
		7.22	Horizontal fracture-no sediment staining
		7.56	Horizontal fracture at small vesicular zone with sediment staining
		8.33	Horizontal fracture-no sediment staining
10.0-15.0	12.83-17.08	12.83-13.09	Massive zone, moderately vesicular
		13.09-17.08	Massive zone
		13.68-13.85	Low angle fracture with sediment staining
		14.79	Horizontal fracture-no sediment staining
		15.3	Horizontal fracture with sediment staining
		15.47	Horizontal fracture-no sediment staining
		17.08	Bottom of Well S-2


S2


TOP 9.26'
11
11.9
13.6
15
16.1
17
Bottom 17.08' B.T.S.
S2

Well S-3

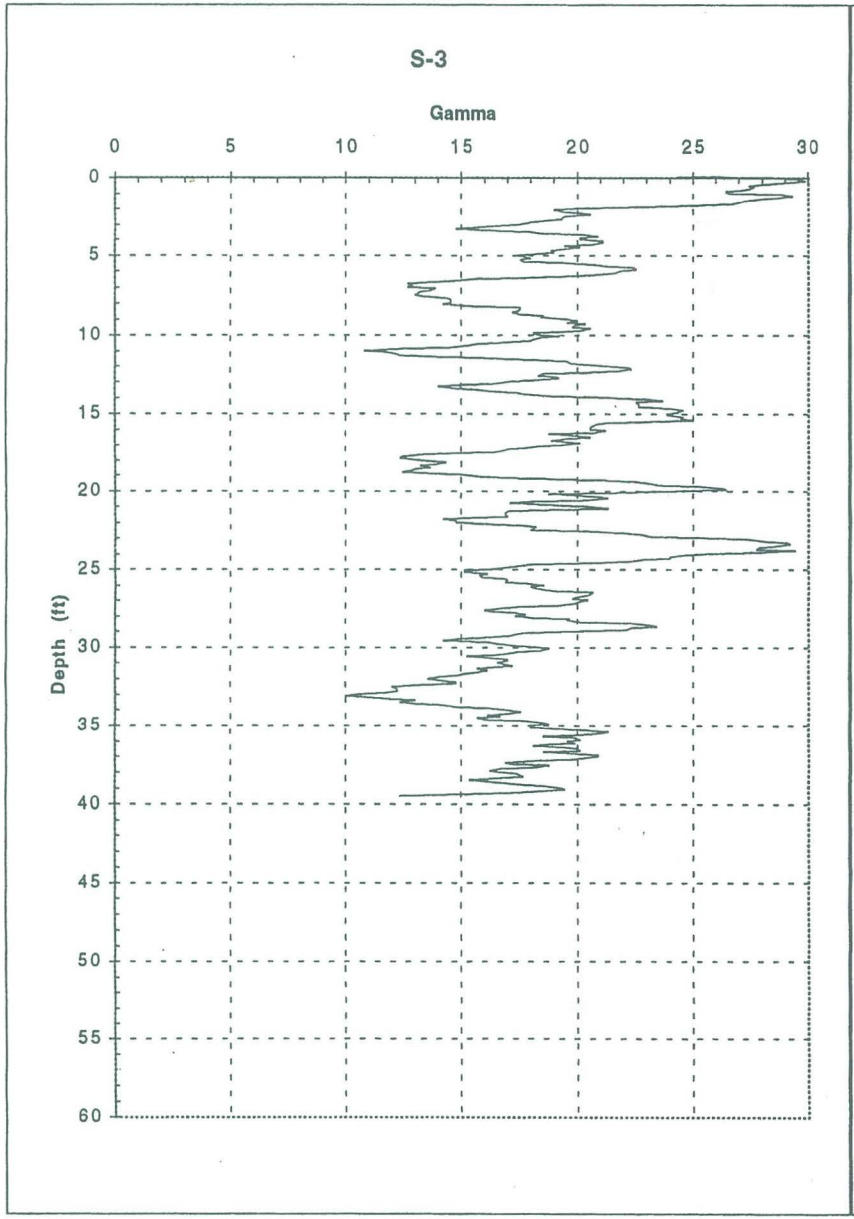
BORING # S-3 (~30 degree slant from vertical)	DATE DRILLED: 07/20/95	LOGGED FROM: Coring.	METHOD: HX Coring using water.	PAGE: 1/1
DRILLED BY: INEL	LOGGED BY: David Burgess	NORTHING: 223.4 ft.	EASTING: 211.9 ft.	SURFACE ELEVATION: 5249.3 ft.

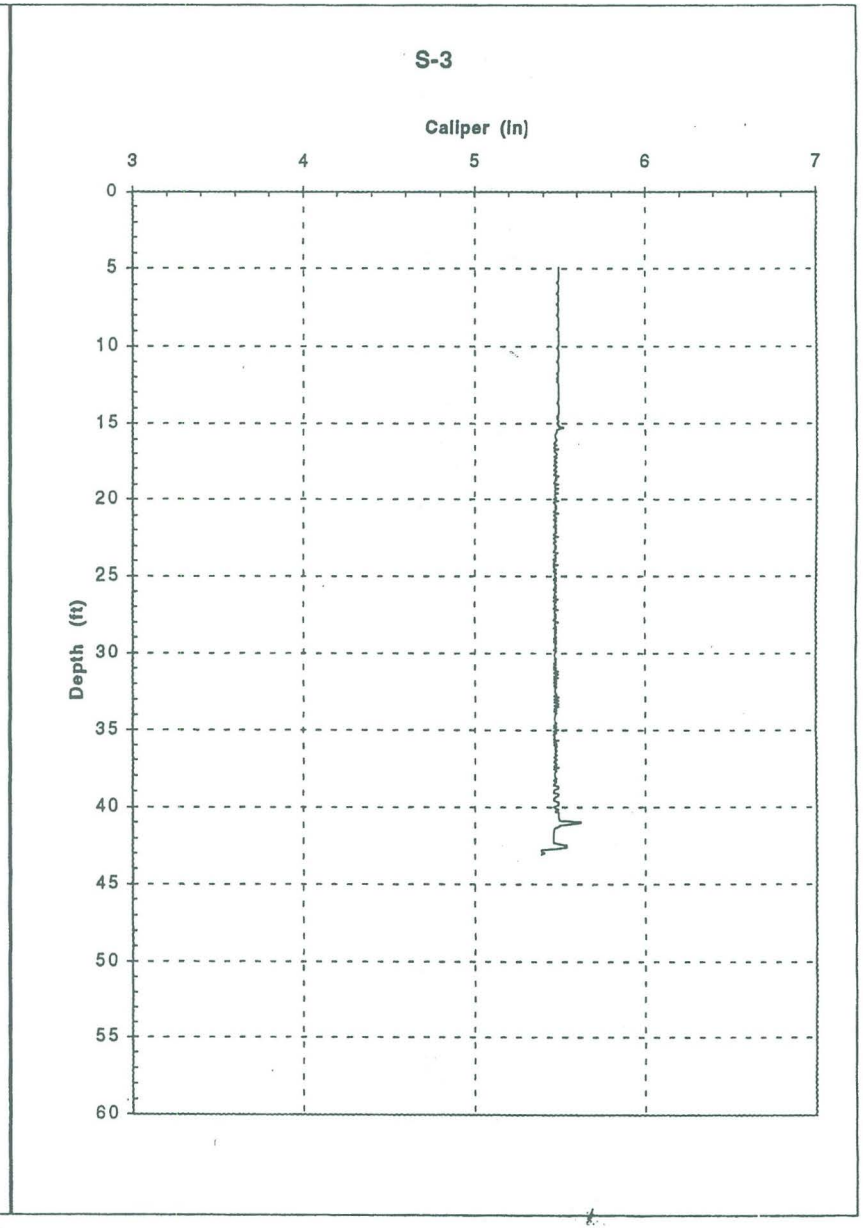


Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
1.19	Horizontal sed. stain.			All fractures in the first 5' have mineralization.
2.04	Horizontal.	2.89–4.25	Low angle fractures with sediment staining.	
3.14	Horizontal.			
3.48	Horizontal.			
4.33	Horizontal.			Massive Zone.
5.52	Horizontal.	6.54–6.8	Low angle fractures with sediment staining.	
6.54	Low angle.			
7.65	Horizontal.			Massive Zone.
		9.3	Low angle with sed. staining.	
11.9	Horizontal.	10.96–11.22	Low angle with sed. staining.	
13.26	Low angle sed. staining.	12.45		Massive Zone.
14.7	Horizontal.	14.87–15.0	Low angle with sed. staining.	
15.21	Horizontal.			
16.06	Horizontal.			
17.59	Horizontal with sediment staining.	17.85	Low angle sed. staining.	Massive Zone.
19.8	Horizontal.	19.5	Low angle sed. staining.	
				Massive Zone.
24.0	Horizontal sediment staining.	23.4–23.75	Low angle sed. staining.	
		24.55–25.07	Low angle sed. staining.	
25.7	Low angle.			Massive Zone.
26.3	Horizontal.	26.0	Low angle sed. staining.	
				N 15% intergranular porosity. Massive Grey Basalt.
35.4	Horizontal w/ sed. staining	36.4–37.2	Low angle Highly fractured zone with sed. staining and mineralizaiton.	Fracture at 35.4' has mineralization.
36.1	Horizontal w/ sed. staining			

Vertical Depth of Well S-3 37.7'

S3 Gamma and Caliper Data

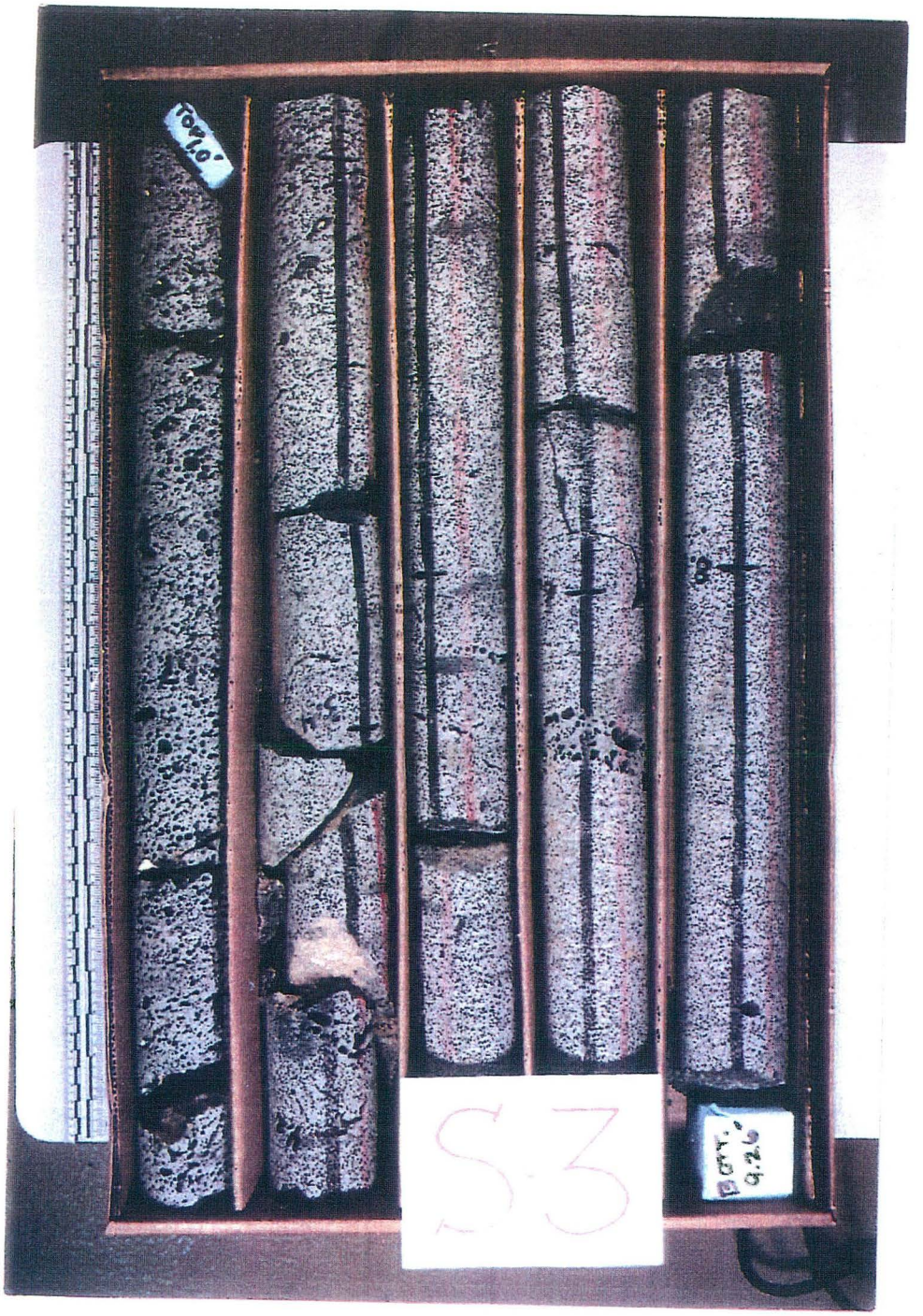


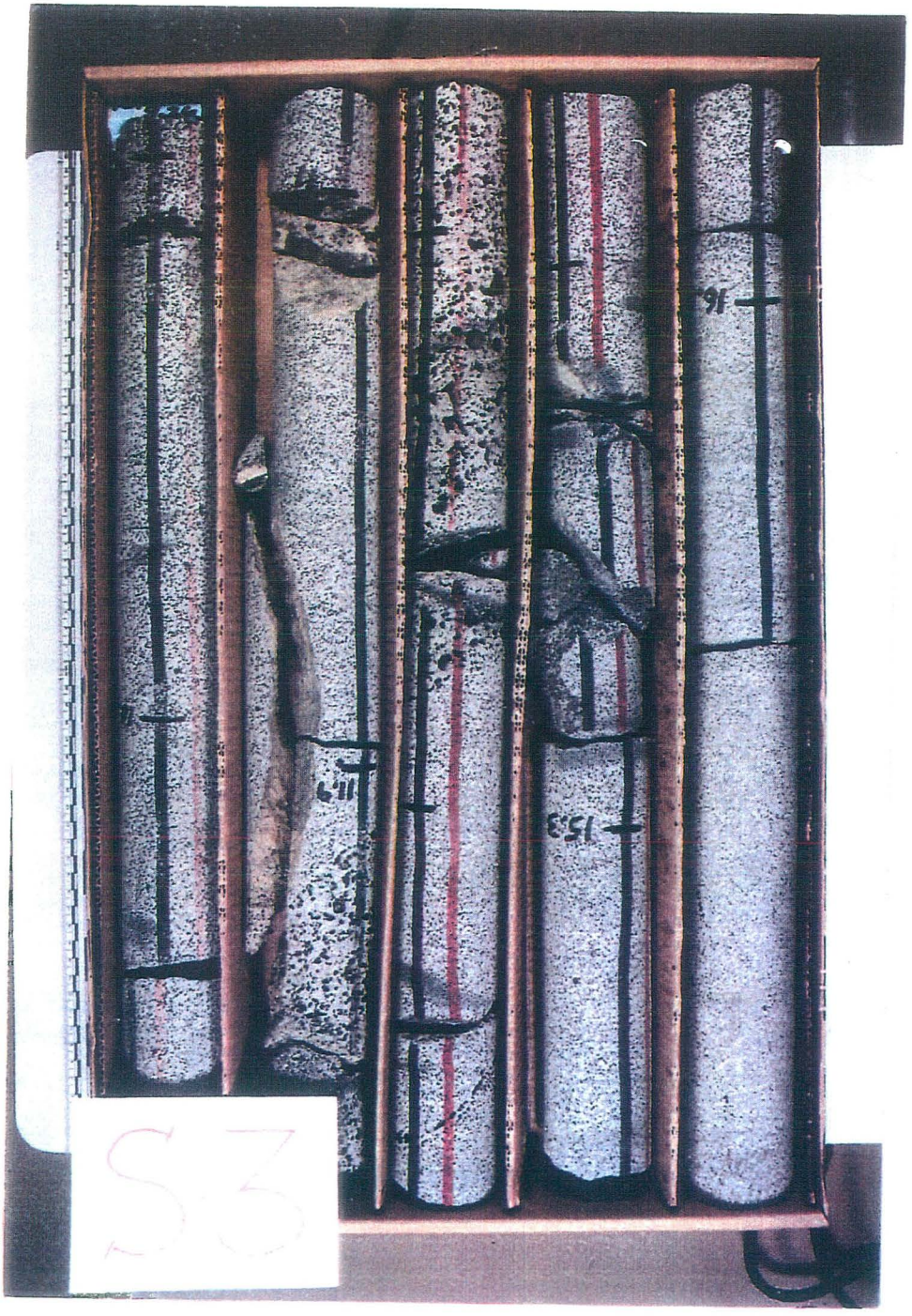


Well S-3	Slant Well at ≅30° from vertical
Core logged by David Burgess on July 19, 20, 27, 1995	

Core Run Length (feet)	Core Run Depth (feet)	Vertical Depth (feet)	Description
1.0-4.3	1.0-3.65	1.0-2.72	Upper vesicular
		2.72.-3.65	Massive zone
		1.19	Horizontal fracture with mineralization and sediment stain
		2.04	Horizontal fracture with mineralization. No sediment stain
		3.14	Horizontal fracture with mineralization. No sediment stain
		3.48	Horizontal fracture. No mineralization or sediment stain
		3.4-3.65	Low to moderate angle fracture with sediment staining
4.3-9.6	3.65-8.16	3.65-8.16	Massive zone
		2.89-3.82	Continued fracture from above run
		3.91-4.25	Moderate angle fracture with sediment staining
		4.33	Low angle to horizontal fracture with no sediment staining
		5.52	Horizontal fracture with sediment staining
		6.54	Low angle fracture with sediment staining
		6.54-6.8	Moderate angle fracture with no sediment staining
		7.65	Horizontal fracture. No sediment staining
			The following data was logged on July 20
9.6-14.6	8.16-12.4	8.16-11.98	Massive zone
		11.98-12.4	Massive zone, moderately vesicular
		9.26-9.35	Low angle fracture with sediment staining
		10.96-11.22	Two low angle fractures with sediment staining
		11.9	Horizontal fracture. No sediment staining
14.6-19.6	12.4-16.7	12.4-13.4	Massive zone, moderately vesicular
		13.4-16.6	Massive zone
		12.4-12.49	Low angle fracture with sediment staining
		13.26	Low angle fracture with sediment staining
		14.7	Horizontal fracture with sediment staining
		14.87-15.0	Low angle fracture with sediment staining
		15.21	Horizontal fracture with no sediment staining
		16.06	Horizontal fracture with no sediment staining
19.6-24.5	16.7-20.82	19.21-20.4	Massive zone
		20.4-20.82	Massive zone. Moderately vesicular
		17.59	Horizontal fracture with sediment staining

		17.76-17.93	Low angle fracture with sediment staining
		19.46-19.55	Low angle fracture with sediment staining
		19.80	Horizontal fracture with no sediment staining
24.5-29.5	20.82-25.07	20.82-25.07	Massive zone
		23.2-23.6	Moderate angle fracture with sediment staining
		23.7-23.8	Low angle fracture with sediment staining
		24.0	Horizontal fracture with sediment staining
		24.22-24.9	Fracture zone due to drilling. No sediment staining
		24.55-24.73	Low angle fracture with sediment staining
		24.9-25.07	Low angle fracture with sediment staining
			The following data was logged on July 27
29.5-34.3	25.07-29.1	25.0-26.2	Massive zone. No vesicles.
		26.2-29.1	Massive zone. Slightly vesicular
		25.07-25.5	Moderate angle. Moderate angle fractures due to drilling. No sediment staining.
		25.7	Moderate angle fractures probably due to drilling.
		26.0-26.1	Low angle fractures with sediment staining
		26.3	Horizontal fracture with sediment staining
		28.3	Horizontal fracture due to drilling
		29.1-33.5	N 15% intergranular porosity, Massive grey basalt.
34.3-39.4	29.1-33.5	33.5-34.6	Massive zone, slightly vesicular
		34.6-34.9	Lower vesicular, locally oxidized
		34.9-35.2	Flow Break. Rubble zone. Oxidized and sediment stained. No recovery from 41.3-41.5
		35.2-37.3	Upper vesicular, oxidized near rubble zone
		37.3-37.7	Massive zone, slightly vesicular
		34.8-35.2	Highly fractured rubble zone.
		35.4	Horizontal fracture with sedimentation and mineralization
		36.1	Horizontal fracture with sediment staining
		36.4-36.46	Low angle fracture with sediment staining
		36.8-37.2	Highly fractured zone with sediment staining mineralization
	37.7	37.7	Bottom of Well S-3


TOP 1.0'
BOTT. 9.26'
S3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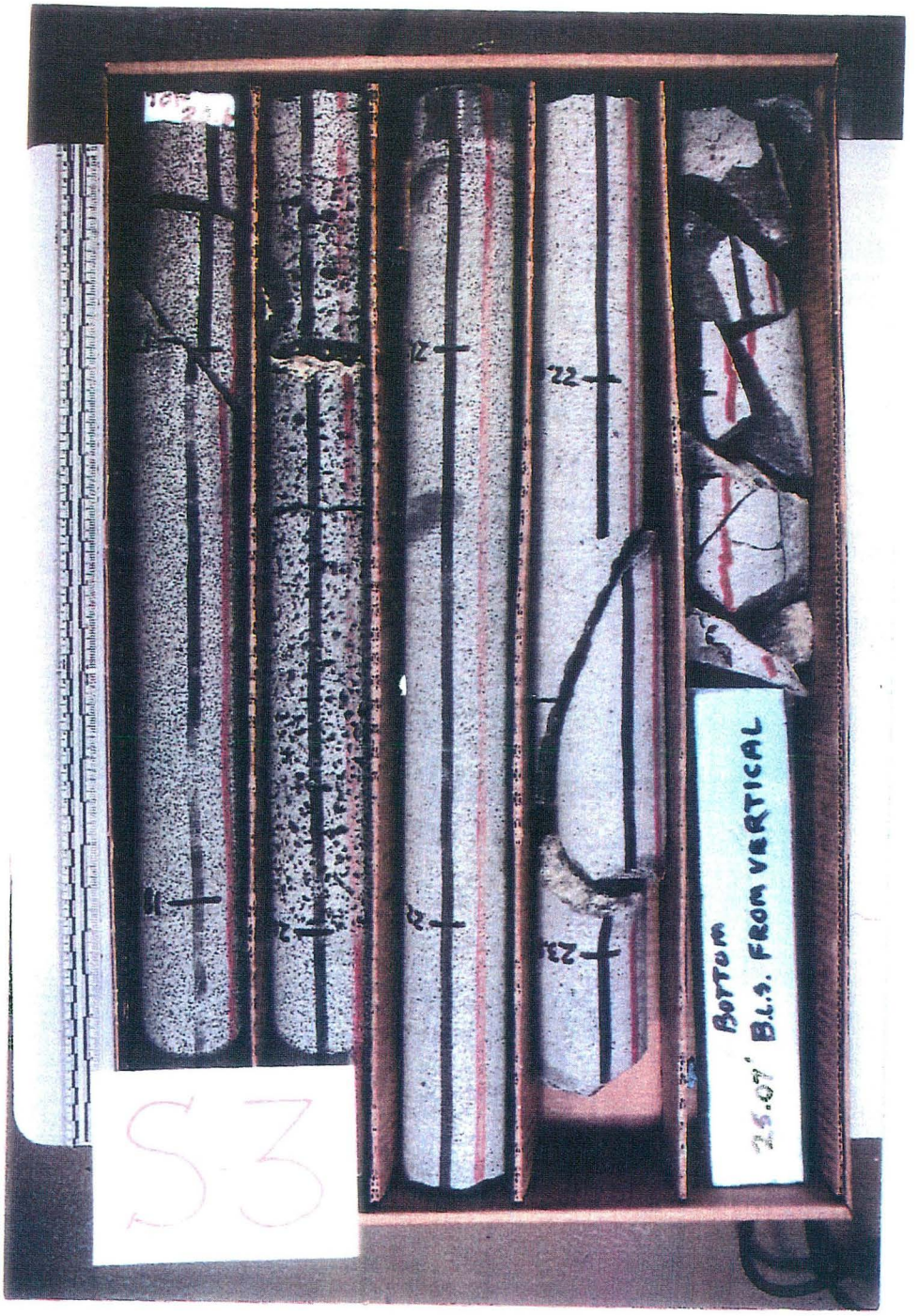
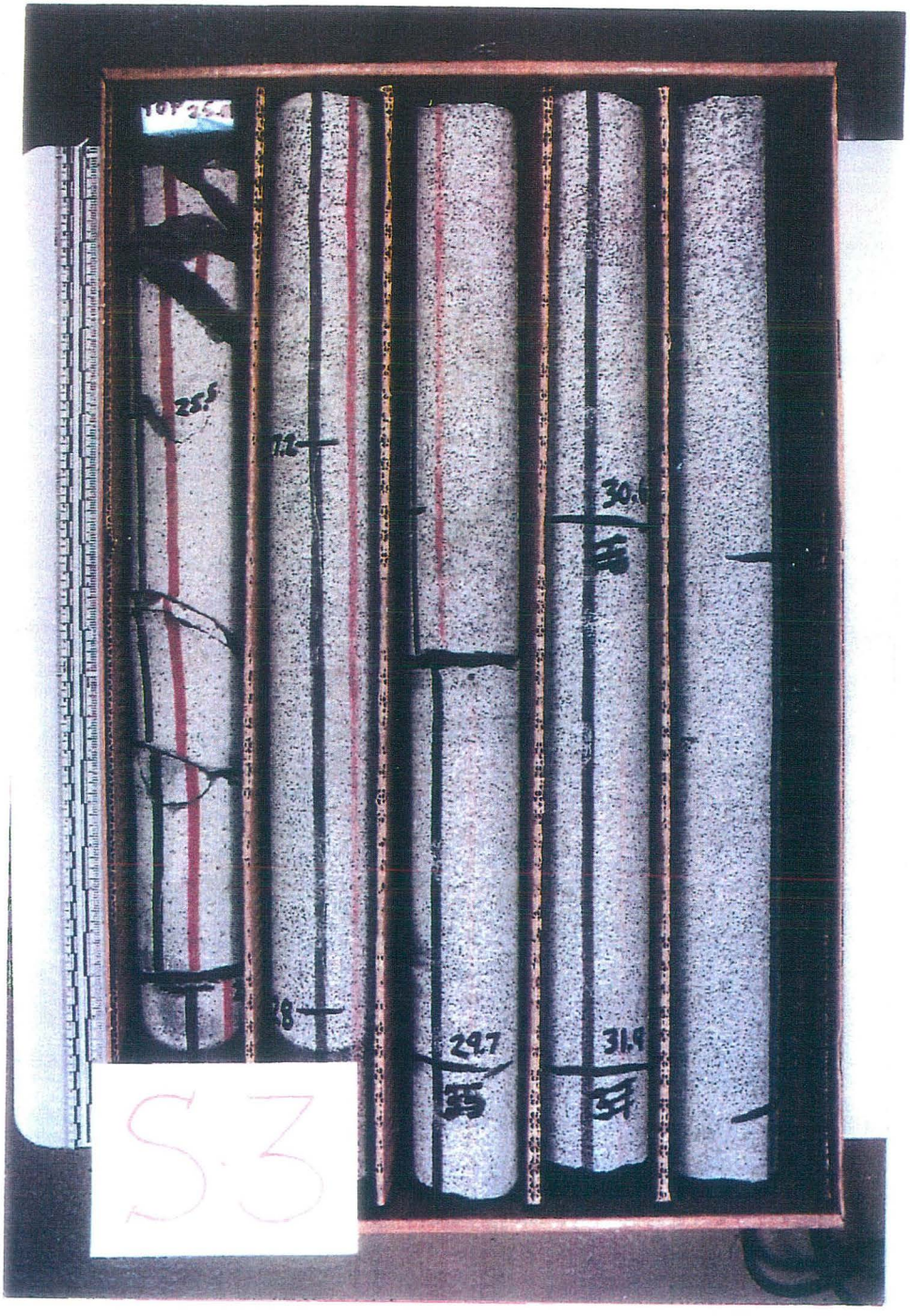
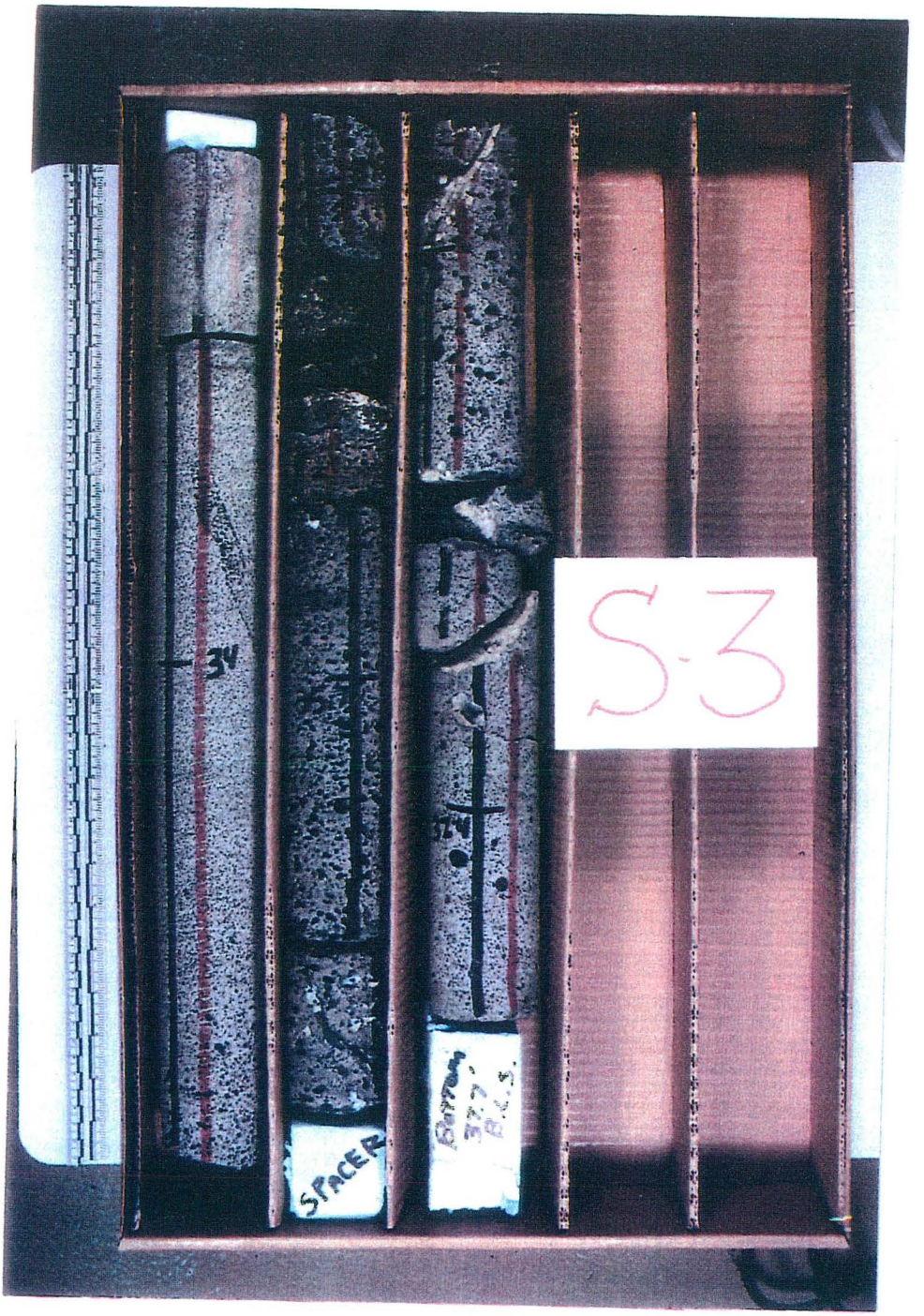
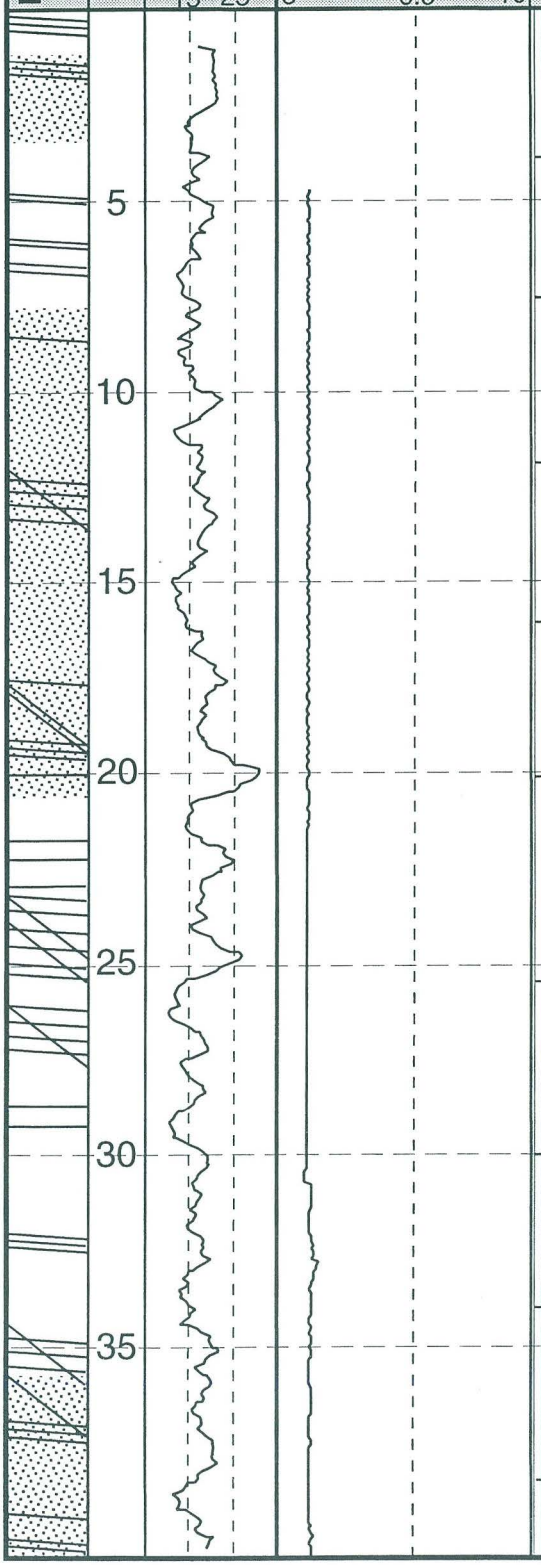

S3
BOTTOM
25.07' B.L.S. FROM VERTICAL


S3
29.7
31.9


S-3
SPACER

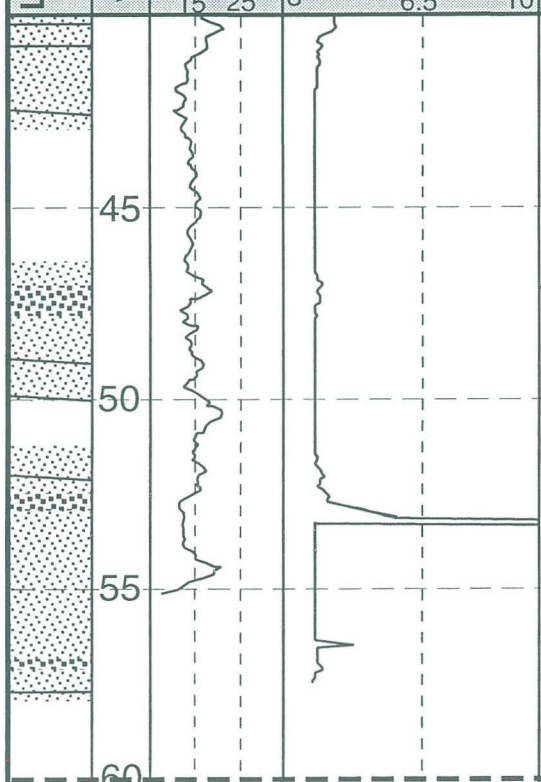
Well S-4

BORING # S-4 (~30 degree angle from vertical)	DATE DRILLED: July27-Aug.28 1995	LOGGED FROM: Coring	METHOD: HX Coring using Water	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: David Burgess	NORTHING: 235.7 ft.	EASTING: 218.2 ft.	SURFACE ELEVATION: 5249.5 ft.



vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
1.3–3.57			1.27, 1.4, 2.7	2 Low angle fracture zones with sediment staining.	
			4.95	Low angle.	Heavy calicte mineralization.
7.9–20.57	8.8	Low angle. Sediment stained.	6.5, 7.0	2 Low angle fracture zones with sediment staining.	Massive Zone.
			12.5–13.7	Low and high angle fracture zone.	Highly fractured. Moderate-high vesicularity. Slightly oxidized.
					Massive Zone.
	17.7	Low angle sediment stained.	18.2–19.0	High angle fractures.	Sediment staining.
	20.1	Horizontal sediment stained.	19.5	Low angle fractures.	Sediment staining.
	21.9, 22.3, 23.0	3 Horizontal fractures with sediment staining.	23.2	Low and high angle fracture zone.	Sediment staining.
			25.5–26.2–27.6	Low and high angle fracture zone.	Sediment staining.
	28.8, 29.4	Horizontal. Horizontal with sediment staining.			Massive Zone.
					Lower Vesicular. Flow Break.
			32.5	Low angle fracture zone.	Sediment staining.
			34.8–35.7	High angle fracture zone.	Sediment staining.
	37.3	Low angle with sediment staining.	37.5	Low angle fracture zone.	
	38.6	Low angle with sediment staining.	39.8	Low angle fracture zone.	Upper Vesicular. Flow Break.

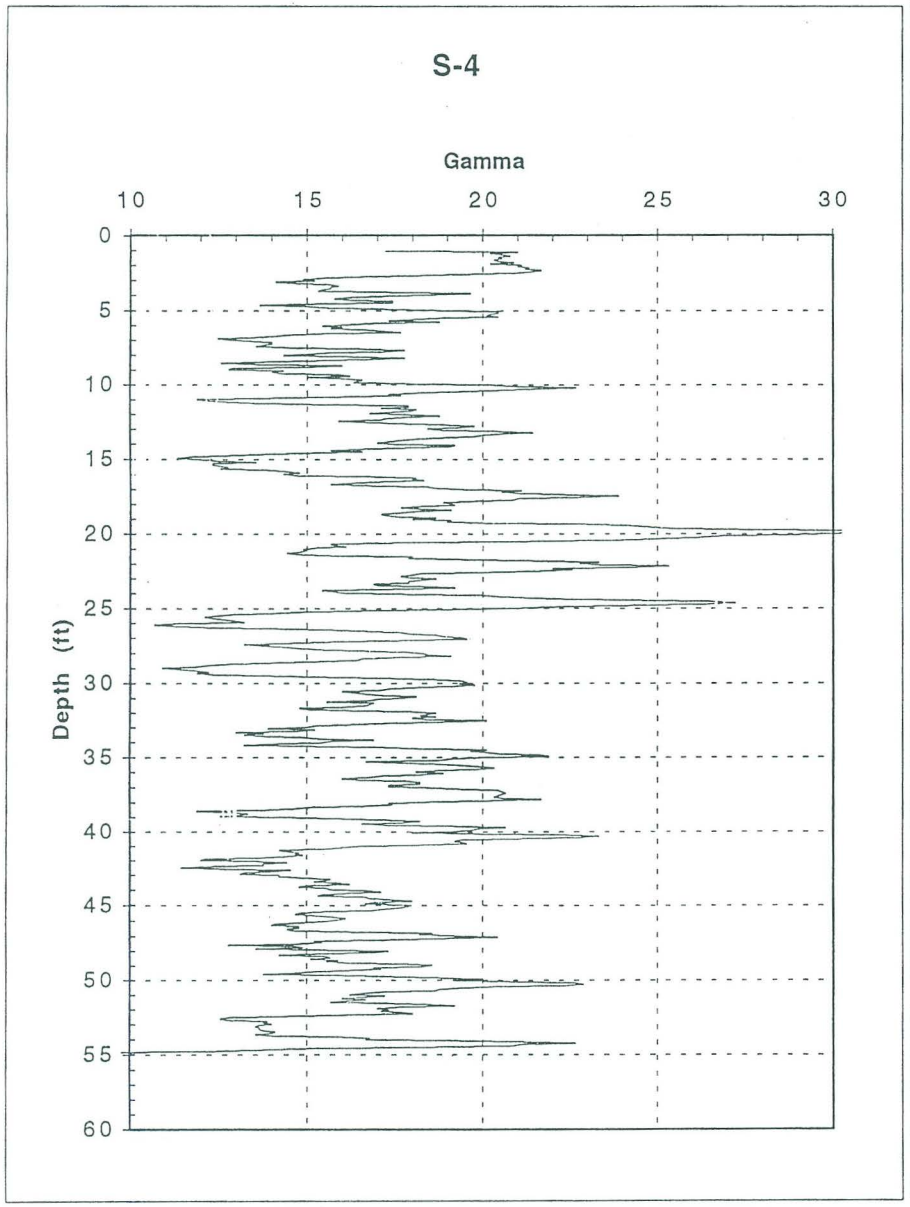
BORING # S-4 (~30 degree angle from vertical)	DATE DRILLED: July27-Aug.28 1995	LOGGED FROM: Coring	METHOD: HX Coring using Water	PAGE: 2/2
DRILLED BY: INEL	LOGGED BY: David Burgess	NORTHING: 235.7 ft.	EASTING: 218.2 ft.	SURFACE ELEVATION: 5249.5 ft.

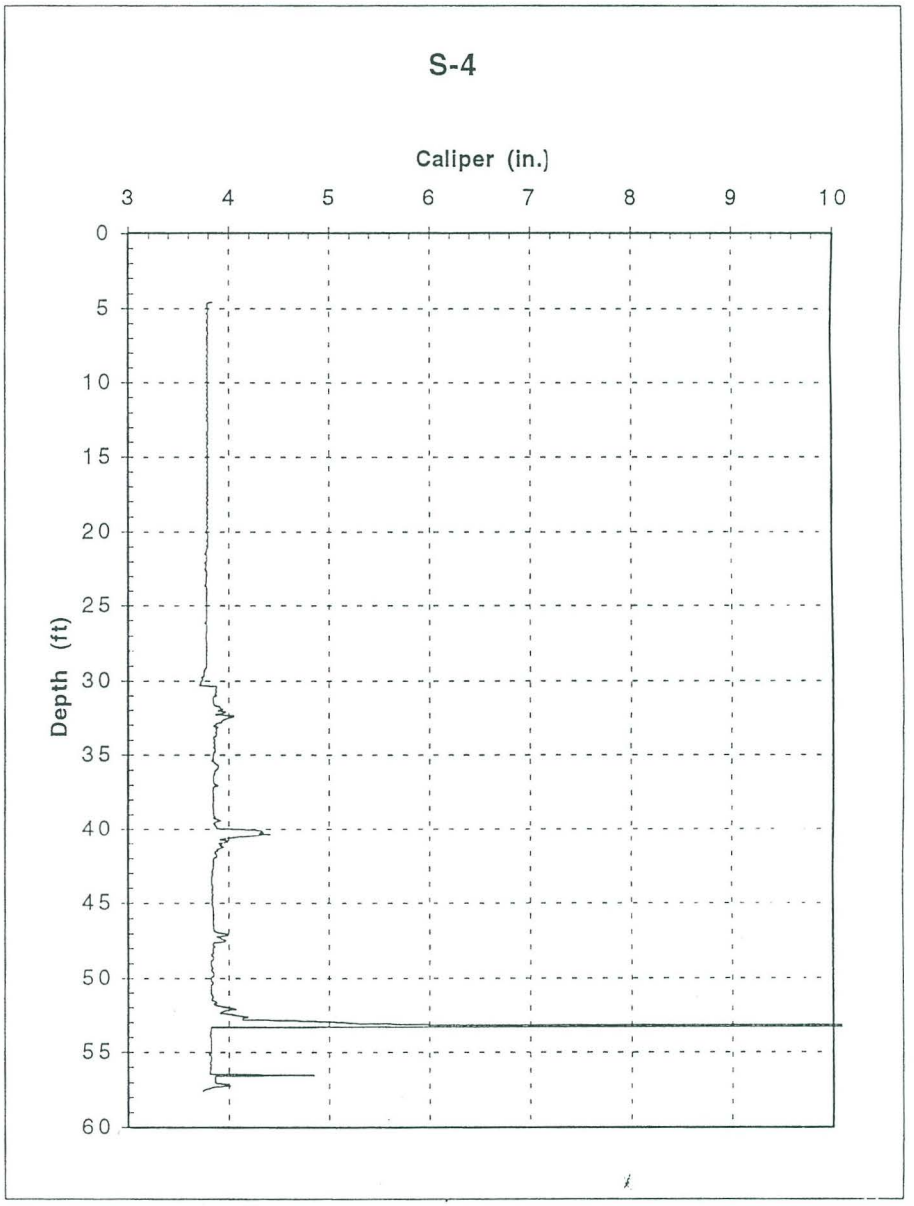


core run and recovery depth	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
41.6	43.0	40.3 40.9 42.7	2 horizontal fractures with sed. staining. Low angle fracture with sediment staining.	40.3 42.2	Low and high angle fracture zone with sediment staining.	Minimal recovery. Massive Zone.
44.2						
47.2	46.6 47.17 47.8			48.3	Low angle fracture zone with sediment staining.	47.2-47.8 Rubble Zone
50.1	50.0	49.2 50.0	2 Low angle fractures with sediment staining.			Massive Zone.
	51.3	52.3	Low angle fracture with sediment staining.	52.6 53.1 53.4 53.5	High angle fracture zone. Two low angle fractures.	Lower Vesicular. Flow Break. Rubble Zone Sed. stain. Massive Zone.
55.5				55.5 55.9	Low angle fracture zone Sed. staining.	Upper vesicular.
58.7	58.7	57.9	Horizontal.	57.9 58.3	High angle fracture zone. Sediment staining.	57.3-57.5 Rubble Zone. Flow Break.

Vertical Depth of Well S-4 60.0'

S4 Gamma Caliper Data



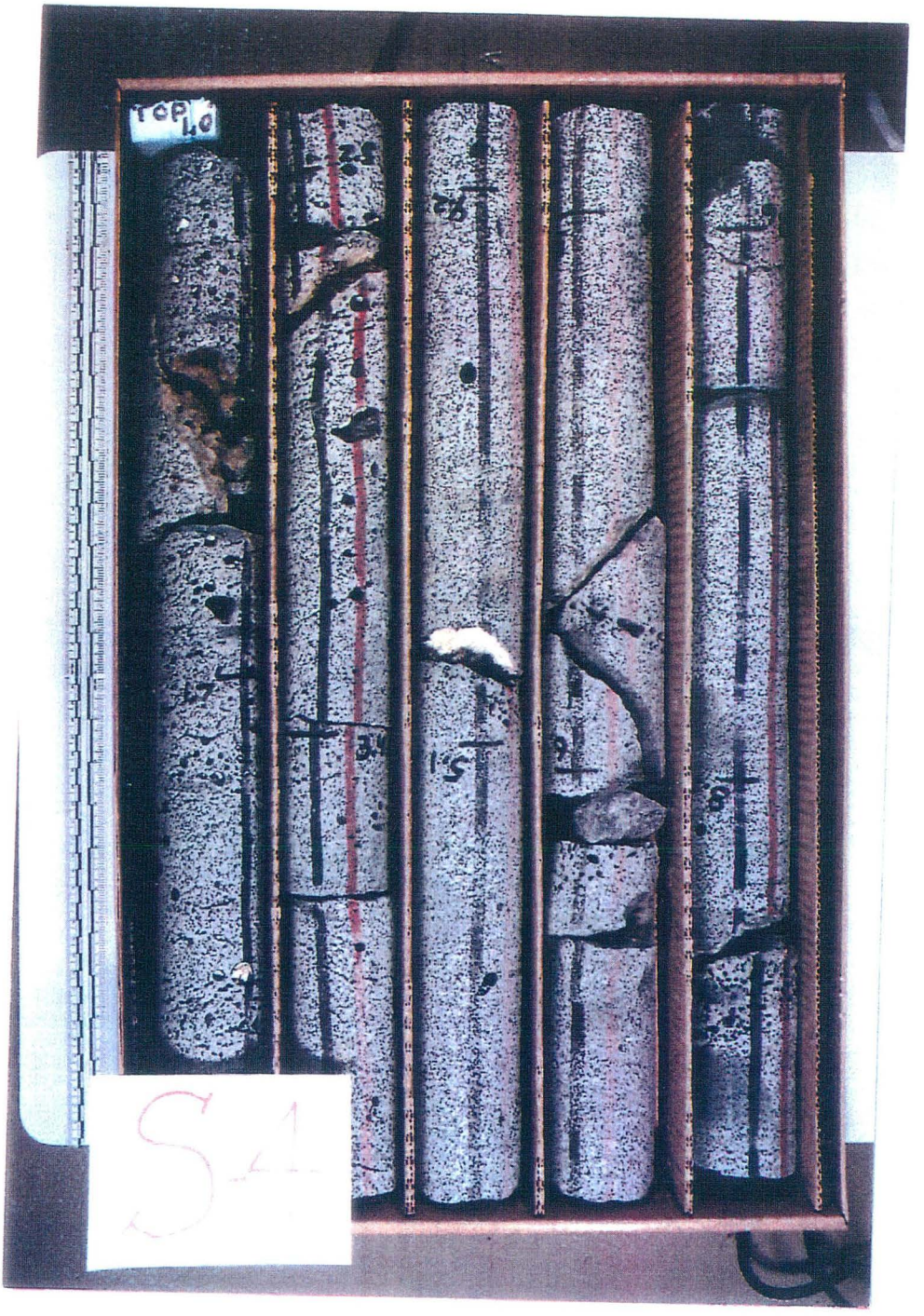


Well S-4	Slant Well at ≅30° from vertical
Core logged by David Burgess on July 27 & 28 and August 28, 1995	

Core Run Length (feet)	Core Run Depth (feet)	Vertical Depth (feet)	Description
1-4.3	1-3.65	1-3.57	Upper vesicular
		3.57-3.65	Massive zone, slightly vesicular
		1.27-1.4	Several low angle fractures with sediment staining
		2.6-2.8	Two low angle fractures with sediment staining
		3.4	Horizontal fractures due to removal of core from reaming shell
			The following data was logged on July 28, 1995
4.3-9.3	3.65-7.9	3.65-7.9	Massive zone, slightly vesicular
		4.93-5.0	Low angle fractures with heavy calcite mineralization
		6.37-6.63	Moderate angle fracture with sediment staining
		6.88-7.22	Moderate angle fracture with sediment staining
		7.4-7.65	Fractures due to removal of reaming shell
9.3-14.2	7.9-12.07	7.9-12.07	Massive zone, slightly vesicular
		8.75	Low angle fracture with sediment staining
14.2-19.2	12.07-16.32	12.07-12.5	Massive zone
		12.5-13.34	Massive zone, moderate to highly vesicular, and slightly oxidized
		13.34-16.32	Massive zone, slightly vesicular
		12.5-13.68	Highly fractured zone with sediment staining and oxidation
19.2-24.2	16.32-20.57	16.32-18.9	Massive zone, slightly vesicular
		18.9-19.97	Massive zone, moderate to highly vesicular. Not oxidized
		19.97-20.57	Massive zone, slightly vesicular
		17.68-17.76	Low angle fracture with sediment staining
		18.2-18.95	Fracture zone. Mostly low angle with sediment staining
		19.38-19.72	Fracture zone. Mostly low angle with sediment staining
		20.06	Horizontal fracture probably caused when removing core from reaming shell. No sediment staining
			The following data was logged on August 28, 1995
24.2-30	20.6-25.5	20.6-25.5	Massive zone
		21.9	Horizontal fracture with sediment staining
		22.3	Horizontal fracture with sediment staining
		23.0	Horizontal fracture. No sediment staining

		23.0	Horizontal fracture. No sediment staining
		23.2-25.5	Highly fracture zone with sediment staining. Extremely fractured from 24.0-25.5
30.0-35.5	25.5-29.7	25.5-29.7	Massive zone
		26.2-27.6	Fracture zone with sediment staining
		28.8	Horizontal fracture. No sediment staining
		29.4	Horizontal fracture with sediment staining
35.0-40.0	29.7-34.0	29.7-34.0	Massive zone
		30.3	Horizontal fracture from drilling
		32.4-32.6	Several low angle fractures with sediment staining
		32.8	Horizontal fracture form drilling
40.0-45.0	34.0-38.2	34.0-35.8	Massive zone
		35.8-36.2	Lower vesicular
		36.2-36.4	Lower/upper vesicular
		37.2-37.4	Moderate angle fracture with sediment staining
		37.5-37.6	Fracture zone with sediment staining
45.0-49.0	38.2-41.65	38.2-38.5	Upper vesicular
		38.5-39.0	Massive zone
		39.0-39.8	Lower vesicular
		39.8-39.86	Flow Break. Lower/upper vesicular
		39.86-41.65	Upper vesicular
		38.6-38.7	Moderate angle fracture with sediment staining
		39.8-39.86	Fracture zone with sediment and sediment staining
		40.3	Horizontal fracture with sediment staining
		40.3-40.7	Moderate angle fracture with sediment staining
		40.9	Horizontal fracture with sediment staining
		41.0-41.5	Highly fracture zone with sediment staining. Missing about 1" of core. Probably fell out the bottom of the core barrel
49.0-52.0	41.65-44.2	41.65-43.0	Upper vesicular
		43.0-44.2	Massive zone
		41.65-42.2	Highly fracture zone with minimal recovery
		42.7	Low angle fracture with sediment staining
55.5-59.0	44.2-47.17	47.17 -47.8	Flow Break. Rubble zone
		47.8-50.0	Upper vesicular
		50.0-50.1	Massive zone
		47.15-47.8	Minimal returns. Rubble
		48.2-48,4	Fracture zone with sediment staining
		49.2-49.3	Low angle fracture with sediment staining
		50.0	Low angle fracture with sediment staining
59.0-64.1	50.1-54.5	50.1-51.3	Massive zone
		51.3-52.8	Lower vesicular
		52.8-52.9	Flow Break. Upper/lower vesicular

		52.9-54.5	Upper vesicular
		52.3	Low angle fracture with sediment staining
		52.6-53.1	Highly fracture zone with sediment staining
		53.4-53.5	Two low angle fractures with sediment staining
64.1-69.1	54.5-58.7	54.5-55.0	Upper vesicular
		55.0-56.9	Massive zone
		56.9-57.3	Lower vesicular
		57.3-57.5	Flow Break. No returns. Assume rubble zone
		57.5-58.7	Upper vesicular
		55.5-55.9	Moderate angle fracture with sediment staining
		57.3-57.5	Rubble zone
		57.9	Moderate angle fracture. No sediment staining
		57.9-58.3	Moderate angle fracture with sediment staining
			Note: A flow break had to occur between 57.3' and 57.9' vertical depth due to no returns. The Flow break at 57.3' was an approximate value.
	60.0'	60.0'	Bottom of Well S-4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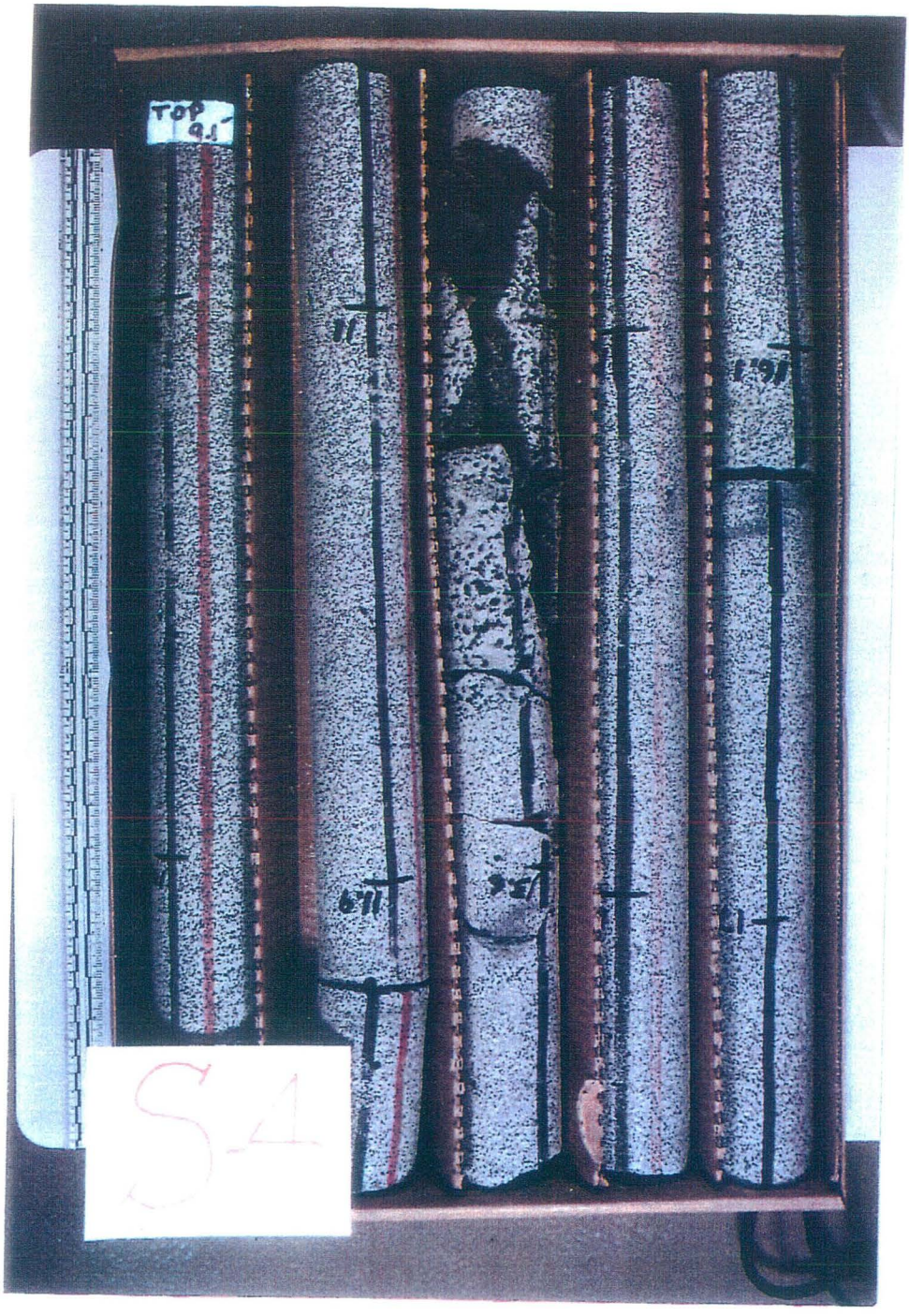
S1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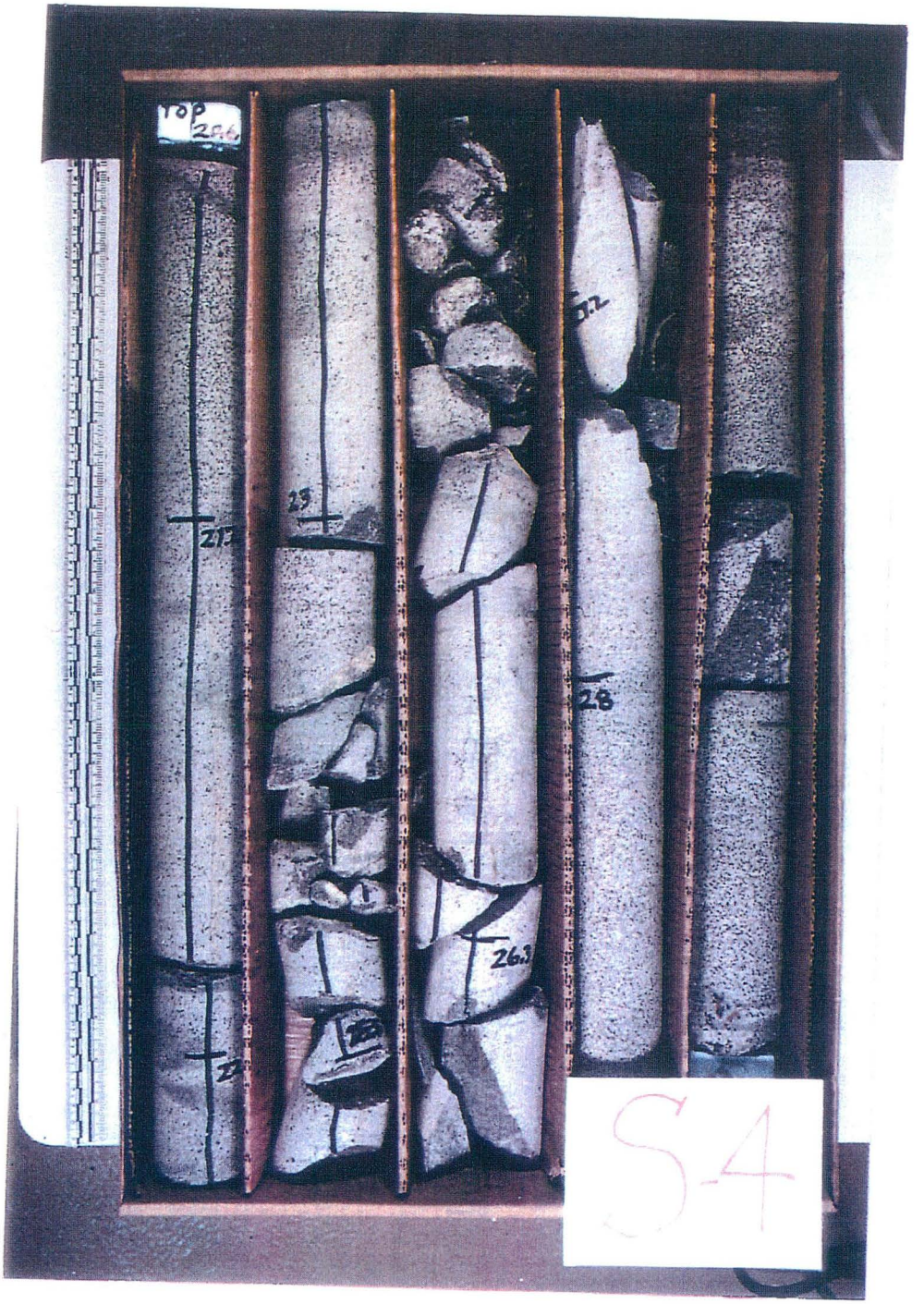
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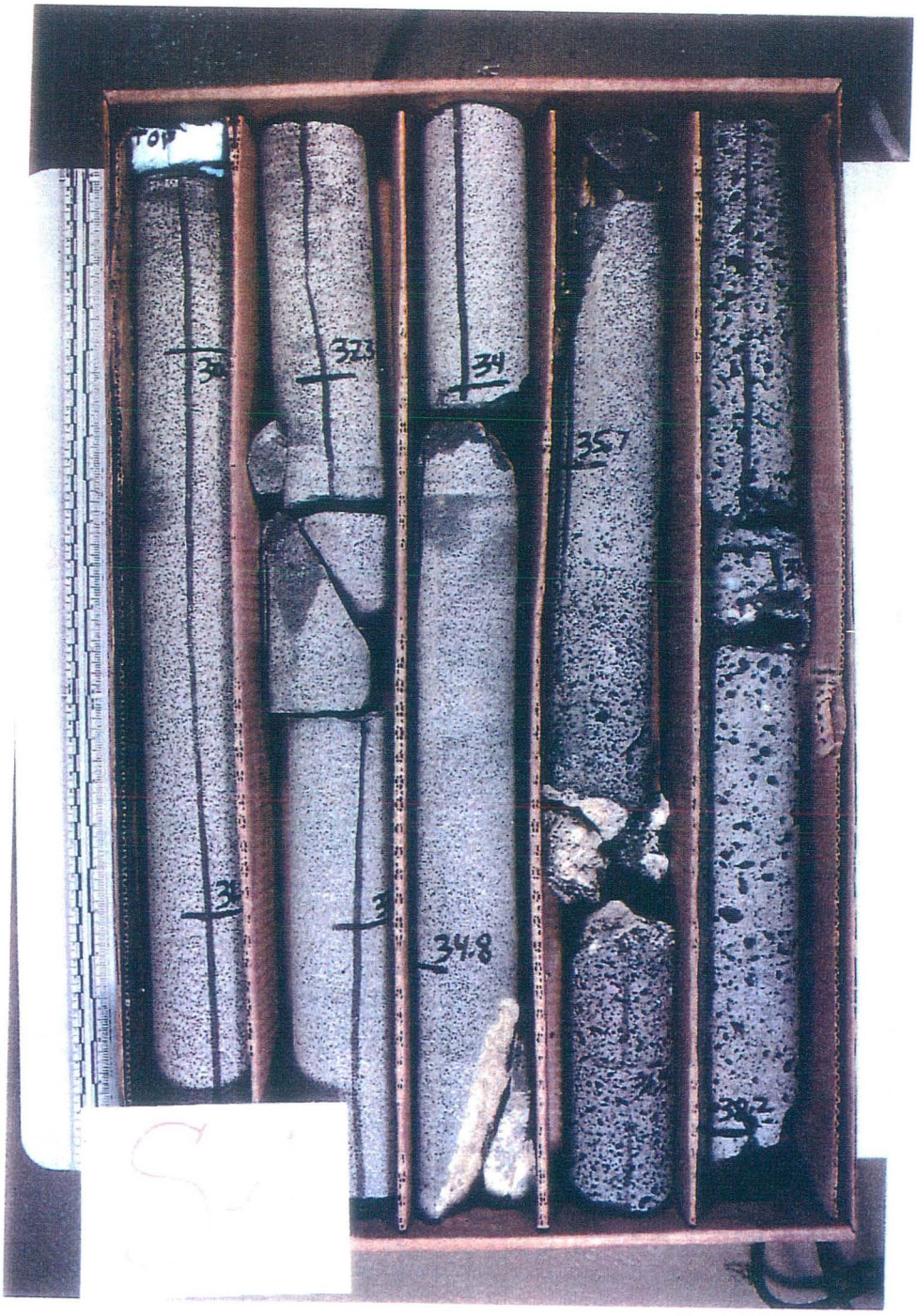
29
28
26.3
S4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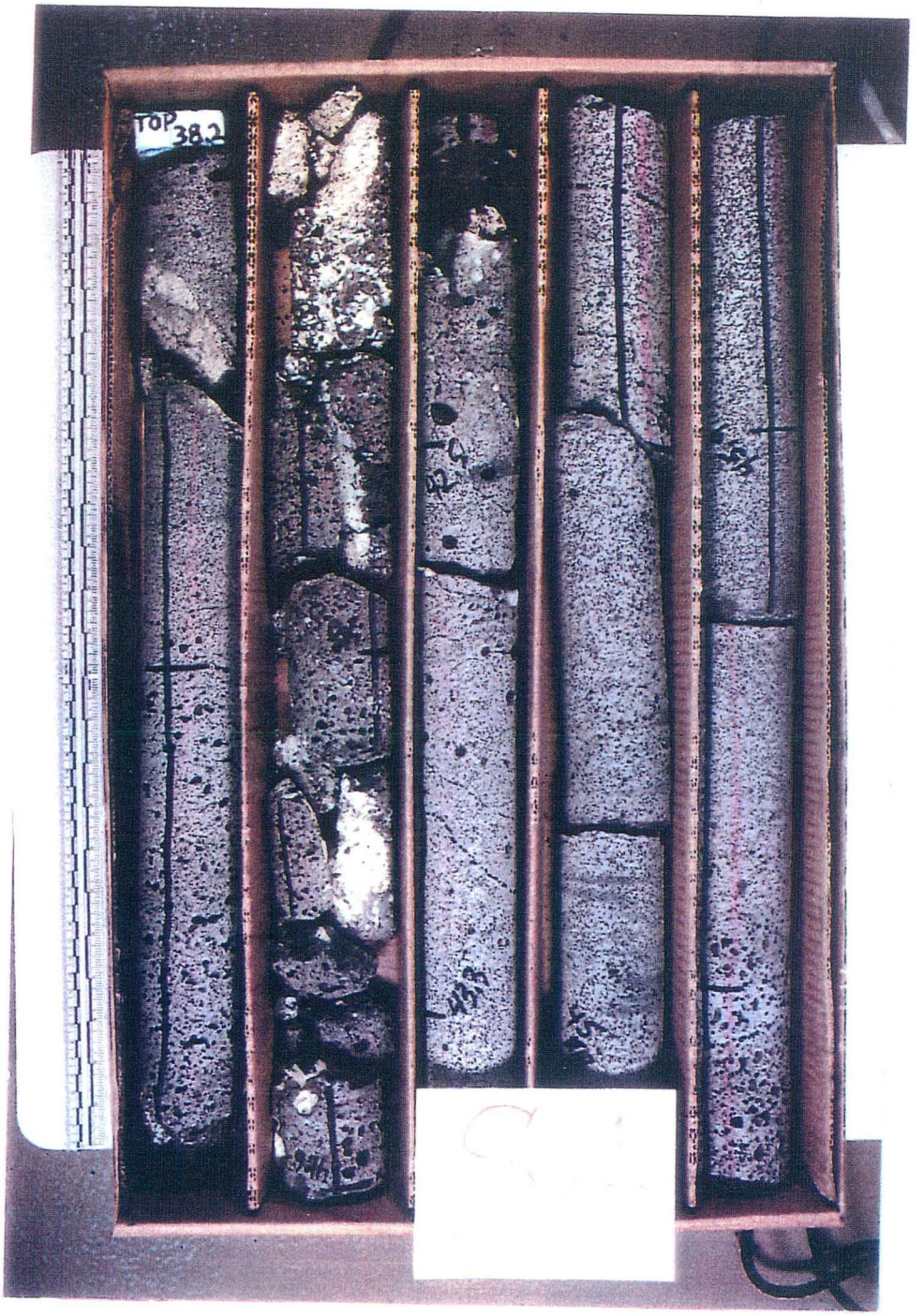
32.3
34
35.7
34.8
38.2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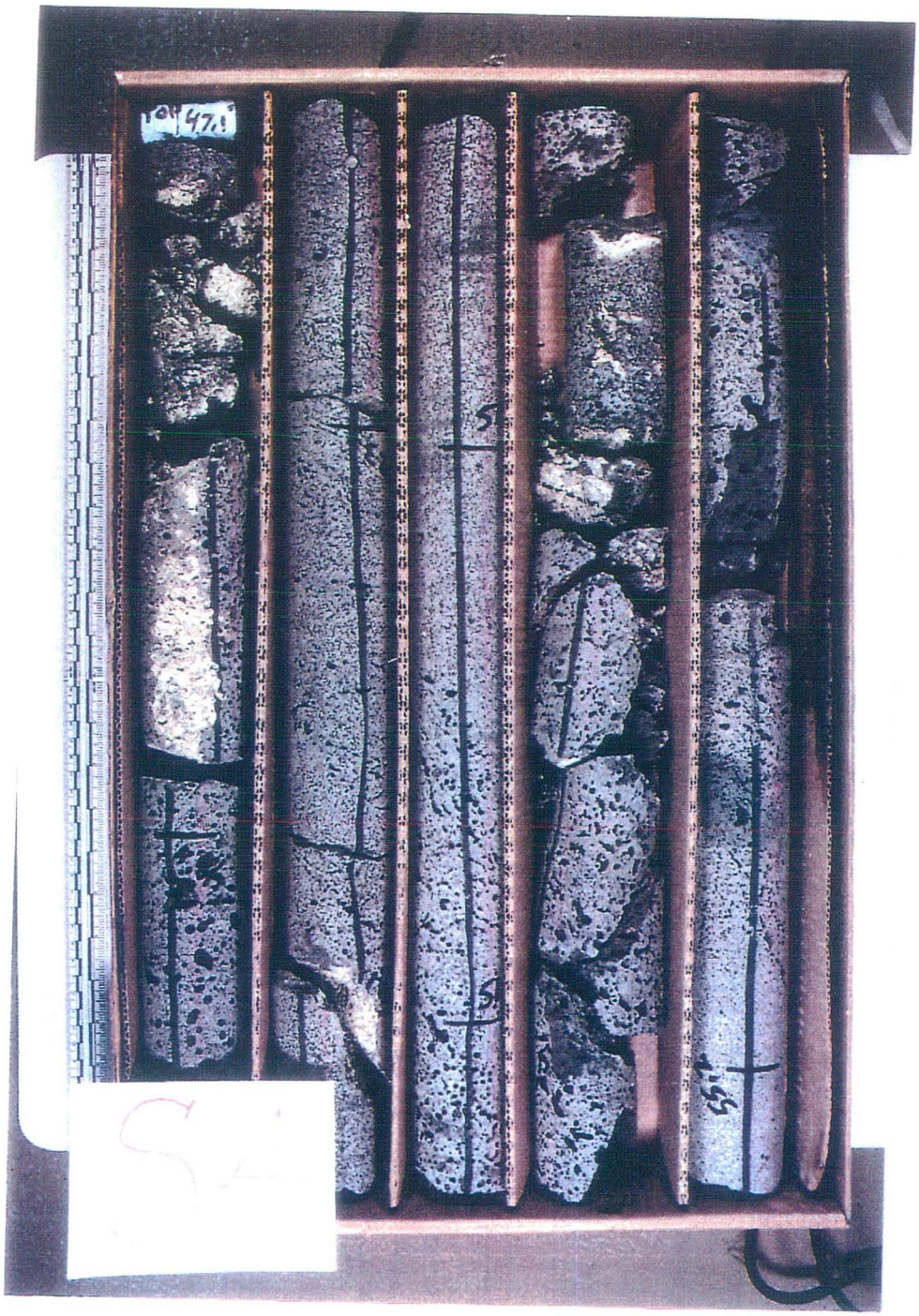

4.75
5
5
4.65

55.4
NO
RETURN
57.3-57.5
S-4

Well E-1

BORING # E-1 (45 degree slant from vertical.)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 202.8 ft.	EASTING: 190.0 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored				1.4					Vesicular.
	5				4.9				4.9	2 High angle fractures.			
					8.5				8.5	Low angle fracture.			
	10								9.9	High angle fracture.			
								12.7					Vesicular.
	15								14.8	High angle fracture.			
													Massive Basalt.
									18.4	High angle.			
	20								19.8	Low angle fracture.			
								20.5 21.2	21.2	Low angle fracture.			Vesicular.
									23.3	High angle.			Massive Basalt.
	25												
													Massive Basalt.
	30				30.4				31.1	Low angle fracture.			
									33.2	Low angle fracture.			Massive Basalt.
	35				36.1				36.1	High angle fracture.			Large Vesicle.
									36.8	Low angle fracture.	37.5 38.9	Rubble Zone.	
								39.6					Vesicular.

BORING # E-1 (45 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2

DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 202.8 ft.	EASTING: 190.0 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
									40.3 41.0	2 Horizontal. Low angle fracture.			
	45	Not Gamma Logged	Not Caliper Logged	Not Cored									
	50												
	55												
	60												
	65												
	70												
	75												

Vertical Depth of Well E-1 42.4'

Well E-2

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
E-2 40 degree slant from vertical	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	199.8 ft.	188.0 ft.	5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
								2.3					Vesicular.
					4.5			3.8					
	5	Not Gamma Logged	Not Caliper Logged	Not Cored				5.4					Vesicular.
								8.3					Vesicular.
	10												Massive Basalt.
								12.2 13.0					Vesicular.
	15				15.3				15.3	Horizontal fracture.			Massive Basalt.
									19.1	Horizontal.			
	20								20.6	Low angle fracture.			
								22.2					Vesicular.
					23.5			23.6	24.4	Low angle fracture.			
	25												Massive Basalt.
									27.4 28.3	2 Low angle fractures.			
	30												Massive Basalt.
								32.1	32.8	Low angle fracture.			Vesicular.
								34.3					
	35								35.0 35.3	2 Low angle fractures. High angle fracture.			
								35.9 37.1					Vesicular.
					38.1						38.1	Rubble Zone.	Rubble Zone.

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
E-2 40 degree slant from vertical.	May 2, 1996	T.V Borehole Camera	Air Percussion Method	2/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	199.8 ft.	188.0 ft.	5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored				41.2			40.4	Rubble Zone.	Vesicular.
	45										43.9	Rubble Zone.	Rubble Zone.
	50												
	55												
	60												
	65												
	70												
	75												

Vertical Depth of Well E-2 46.0'

Well E-3

BORING # E-3 (35 degree slant from vertical.)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 196.9 ft.	EASTING: 184.4 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored									@2'-3' Large vesicles widely spaced. Massive Basalt.
	5								5.6	Low angle fracture.			Massive Basalt.
	10								12.1	Low angle fracture.			
					13.9								
	15								17.4 18.7	2 Low angle fractures.			Sparse vesicles.
					18.0			19.5					
	20												
					23.7								
	25								25.4 26.6	Low angle fracture. Low angle fracture.	25.0 26.7	Low angle fracture zone.	Low angle fracture zone.
								28.7 30.5					
	30												Massive Basalt.
	35								35.6	Low angle fracture.			
											37.1 39.9	Rubble Zone.	Rubble Zone.

BORING # E-3 35 degree slant from vertical.	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 196.9 ft.	EASTING: 184.4 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
	45	Not Gamma Logged	Not Caliper Logged	Not Cored					44.7 45.1 46.0	3 Low angle fractures.	46.6	Rubble Zone.	Massive Basalt. Rubble Zone.
	50												
	55												
	60												
	65												
	70												
	75												

Vertical Depth of Well E-3 49.1'

Well E-4

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
E-4 30 degree slant from vertical	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/2

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	194.2 ft.	183.4 ft.	5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored.				3.5					Sparse Vesicles.
	5												
													Massive Basalt.
	10												
									13.0	Low angle fracture.			
	15												
								17.3					Large Vesicles.
								19.2					
	20				19.9			19.9					
					24.2								
	25												
													Massive Basalt.
	30												
									32.0	Low angle.			
									33.8	2 Horizontal fractures.			
	35												
									37.2	Low angle fracture.			
											38.1	Rubble Zone.	Rubble Zone.
								39.0			39.0		

BORING # E-4 30 degree slant from vertical.	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 194.2 ft.	EASTING: 183.4 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
	45	Not Gamma Logged	Not Caliper Logged	Not Cored	43.3			47.6 48.5	42.4 44.2 45.0 46.8 47.6	Low angle fracture. Low angle. High angle. 2 Low angle fractures.	43.3 44.2	3 High angle fractures.	Large Vesicles.
	50							50.2					

Vertical Depth of Well E-4 52.0'

55

60

65

70

75

Well R-2

BORING # R-2 (41.4 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 206.7 ft.	EASTING: 221.1 ft.	SURFACE ELEVATION: 5248.1 ft.

Lithological Log	Vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water Before Test	Water During Test	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed			4.5					
	5							6.0–6.7	5.2	Low angle fracture.			Massive Basalt.
											8.2–9.7	High angle fracture zone.	
	10												Massive Basalt.
	15								17.2	High angle fracture.			
	20							20.1–20.8	20.1	Low angle fracture.			Massive Basalt.
	25								25.3	Horizontal fracture.			
									27.6, 28.4, 29.0	3 Low angle fractures.			
	30												Massive Basalt.
	35							35.0–35.8	37.3	Low angle fracture.	37.3	Rubble Zone.	

BORING # R-2 (41.4 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2

DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 206.7 ft.	EASTING: 221.1 ft.	SURFACE ELEVATION: 5248.1 ft.

Lithological Log	Vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Intsalled						40.2	Rubble Zone.	
								42.5			42.5	Low angle fracture zone.	
											44.0		
	45								44.7	Low angle fracture.			
								45.5					
									47.0	Low angle fracture.			
	50												
	55												
	60												
	65												
	70												
	75												

Vertical Depth of Well R-2 48.5'

Well R-3

BORING # R-3 (28.8 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 222.8 ft.	EASTING: 235.6 ft.	SURFACE ELEVATION: 5250.2 ft.

Lithological Log	Vertical depth (ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
													Massive Basalt.
									3.5	Low angle fracture.			
	5												Massive Basalt.
									6.9	Horizontal.			
									7.8	Low angle fracture.			
													Massive Basalt.
	10												
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed				12.2	Low angle fracture.			
													Massive Basalt.
	15												
													Massive Basalt.
	20							20.0 – 20.9	20.0	Low angle fracture.			
									21.8	High angle fracture.			
	25								25.3	High angle fracture.			
													Massive Basalt.
	30												
	35												
									37.5	Low angle fracture.	38.4 – 39.3	Rubble Zone.	Rubble Zone.

BORING # R-3 (28.8 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 222.8 ft.	EASTING: 235.6 ft.	SURFACE ELEVATION: 5250.2 ft.

Lithological Log	Vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
								40.2			41.1	Rubble Zone.	Rubble Zone.
								41.9					
								42.8					
									43.7	Horizontal.			
									44.6	Low angle fracture.			
	45	Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed								
								47.1	47.1	Horizontal.			
	50												
									50.6	Horizontal.			
									51.5	Horizontal.			
											53.3	Low angle fracture zone.	
											54.2		
	55												
								55.9					
	60												
	65												
	70												
	75												

Vertical Depth of Well R-3 56.8'

Well R-4

BORING # R-4 (29.8 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 1/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 221.8 ft.	EASTING: 217.1 ft.	SURFACE ELEVATION: 5249.6 ft.

Lithological Log	Vertical depth(ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed			3.0					Vesicular Zone.
	5							5.1	5.3	High angle.			Massive Basalt.
									6.1	Low angle.			
									8.4	High angle.			
								8.9	8.6	Low angle.			
	10								10.3	Low angle.			
								11.9			12.1	Low angle fracture zone.	
								12.3	13.0	Low angle.			Massive Basalt.
	15												
									16.3	Low angle.	16.5	2 High angle fractures.	
								17.7			17.7	Highly fractured zone.	
								17.9					
	20								20.5	2 Low angle fractures.			
													Massive Basalt.
	25												
													Massive Basalt.
	30												
	35							34.1					
								36.8					Massive Basalt.
								38.5					

BORING # R-4 (29.8 degree slant from vertical)	DATE DRILLED: May 2, 1996	LOGGED FROM: T.V Borehole Camera	METHOD: Air Percussion Method	PAGE: 2/2
DRILLED BY: INEL	LOGGED BY: Marque Mesa	NORTHING: 221.8 ft.	EASTING: 217.1 ft.	SURFACE ELEVATION: 5249.6 ft.

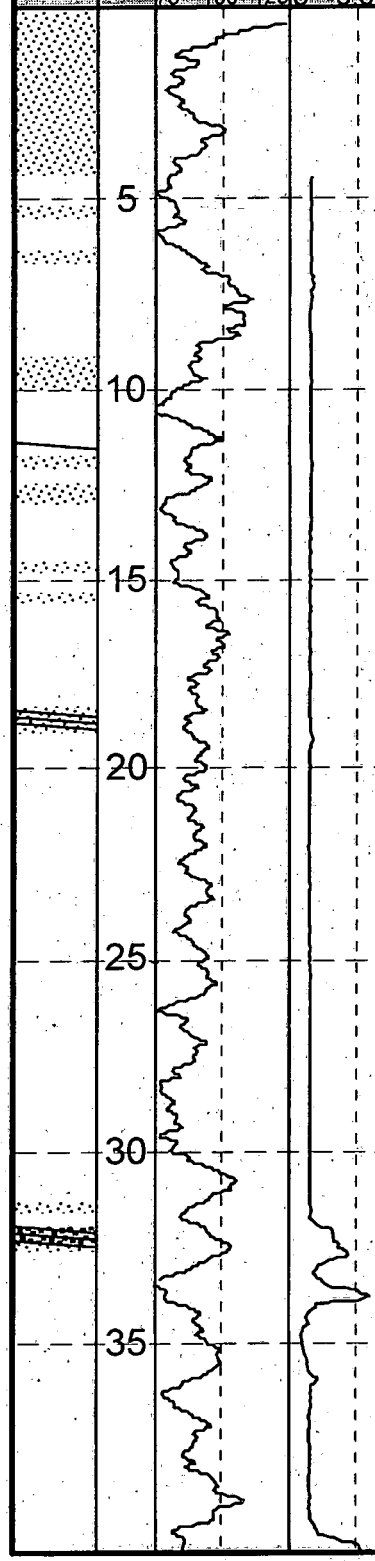
Lithological Log	Vertical depth (ft)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed			41.0	41.1	Low angle fracture.			
									42.7	Low angle fracture.			Massive Basalt.
	45								44.6	3 Low angle fractures.			
									45.3				
									46.2		46.4 – 48.1	Rubble Zone.	Rubble Zone.
								49.0					
	50												
								50.8 – 51.1					
	55												
	60												
	65												
	70												
	75												

Vertical Depth of Well R-4 53.4'

Well R-5

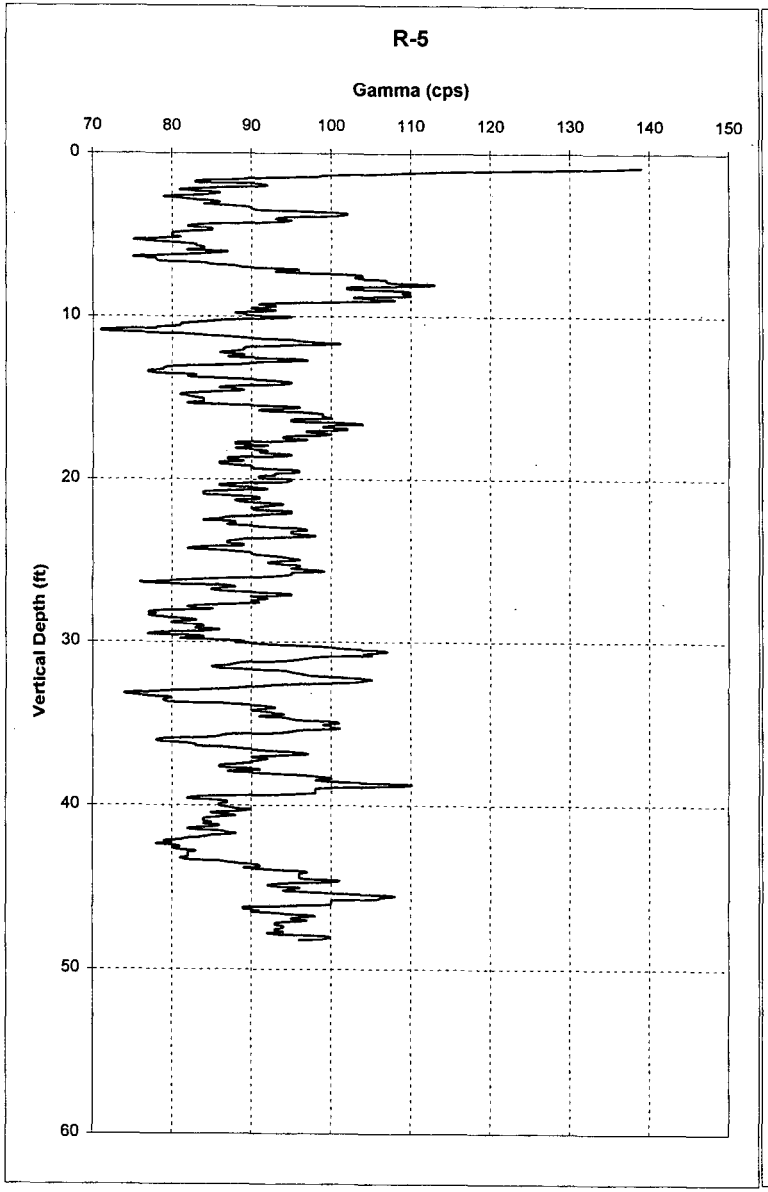
BORING #	DATE DRILLED	LOGGED FROM	METHOD	PAGE
R-5 (25.9 degree start from vertical)	July 1997	T.V Borehole Camera	Air Percussion Method	1/1

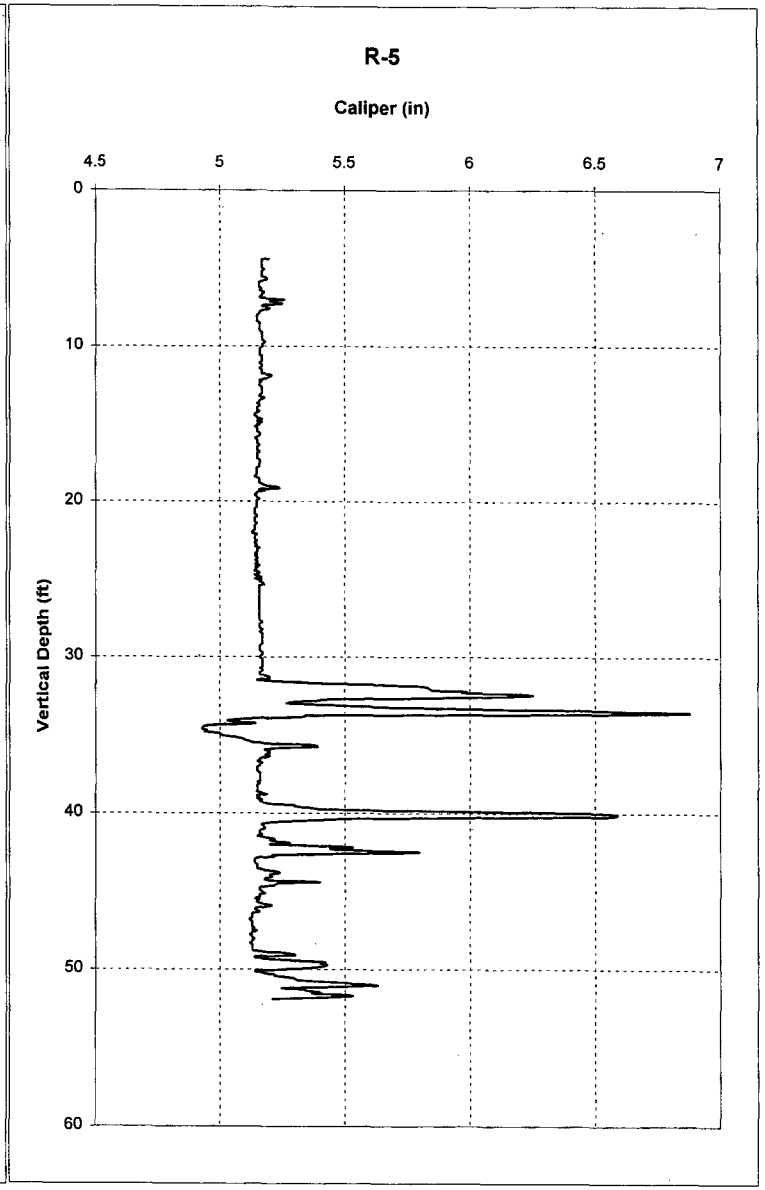
DRILLED BY	LOGGED BY	NORTHING	EASTING	SURFACE ELEVATION
INEL	Marque Mesa	206.4 ft.	231.0 ft.	5246.36 ft.



Water: Before Test	Water: During Test	Vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
							In 0'-4.5' zone the vesicle density decreases with depth.
		4.5–5.3					~~5.3' Vesicular Band.~~
		6.7–6.8					5.4'-6.4' massive basalt with sparse vesicles.
		9.3–10.0					6.9'-9.8' massive basalt
							~~10'-11.6~~ massive basalt.
		11.9	11.7	Low angle fracture.			11.9' vesicular band.
							12'-12.8' massive basalt
							13'-14.6' massive basalt.
		14.7–15.6					~~14.8'-15.5'~~ massive basalt.
							15.7'-18.9' massive basalt.
			18.9–19.0		18.9–19.0	Low angle fracture zone.	Fractures have vesicles.
							19.2'-31.5' massive basalt
		31.6					
					32.2–32.5	Highly fractured zone. Possibly rubble zone.	*Below 32.6' the caliper of the well decreased making it impossible for the camera to capture the underlying lithology. Depth of Well is 53 ft.

R-5 Gamma Caliper Data



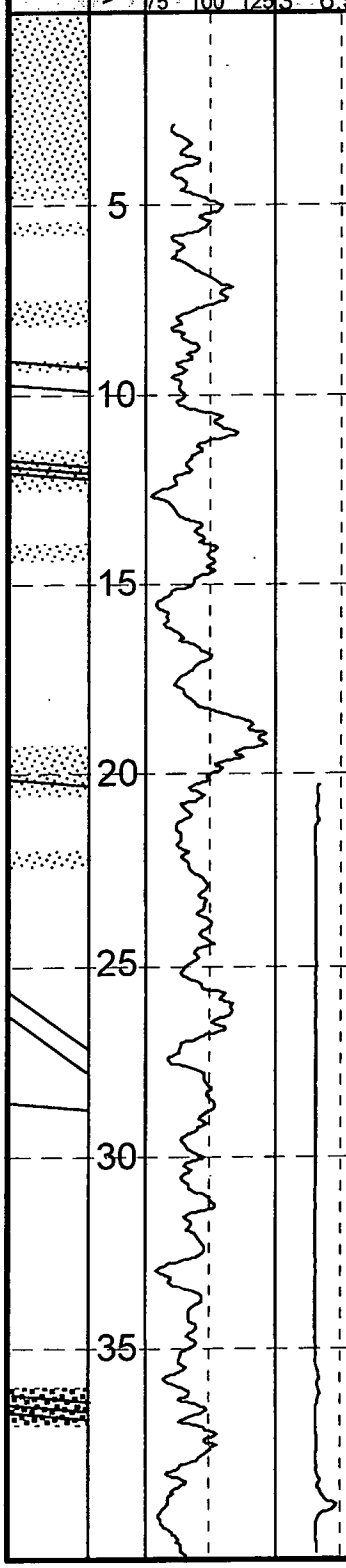


Well R-6

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
R-6 26.3 degree slant from vertical	July 1997	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	222.3 ft.	227.8 ft.	5246.36 ft.

Lithological Log | Vertical depth(ft) | total gamma (cps) 9 point average 75 100 125 | caliper (inches) 3 6.5 10 | core run and recovery depth | Lysimeter | Water: Before Test, During Test | vesicular intervals | Single Fracture: depths, description | Fracture Zone: depths, description | comments

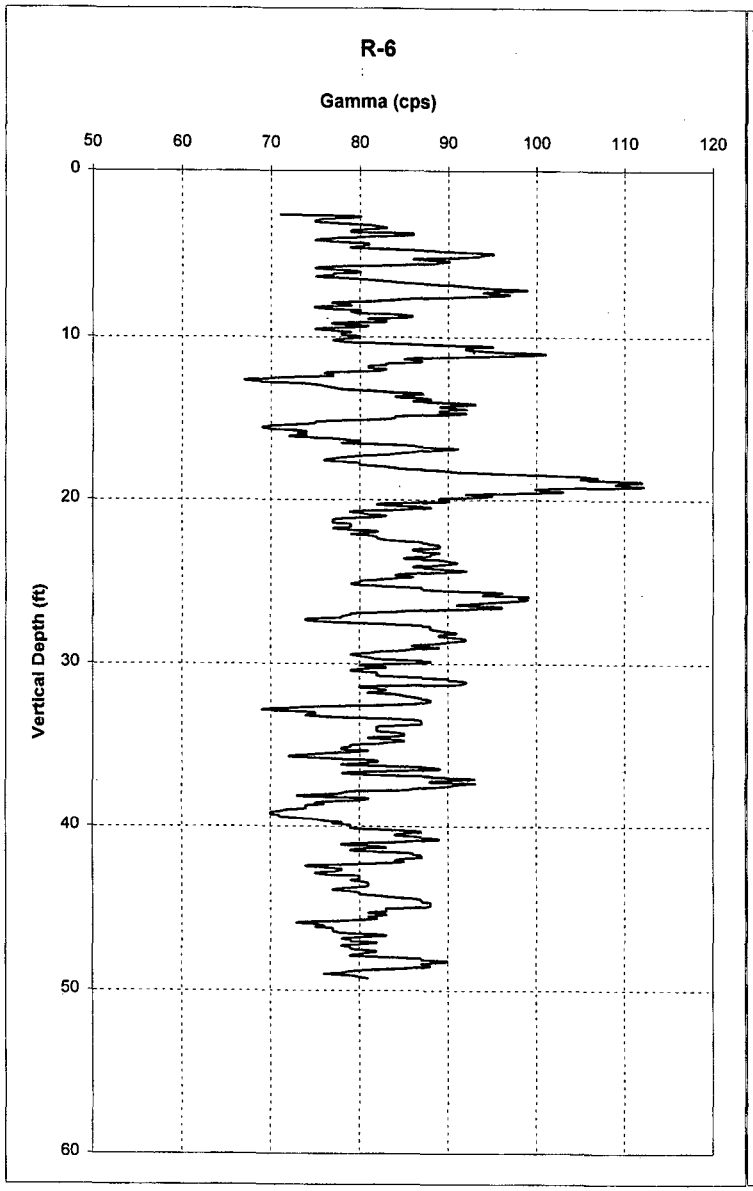


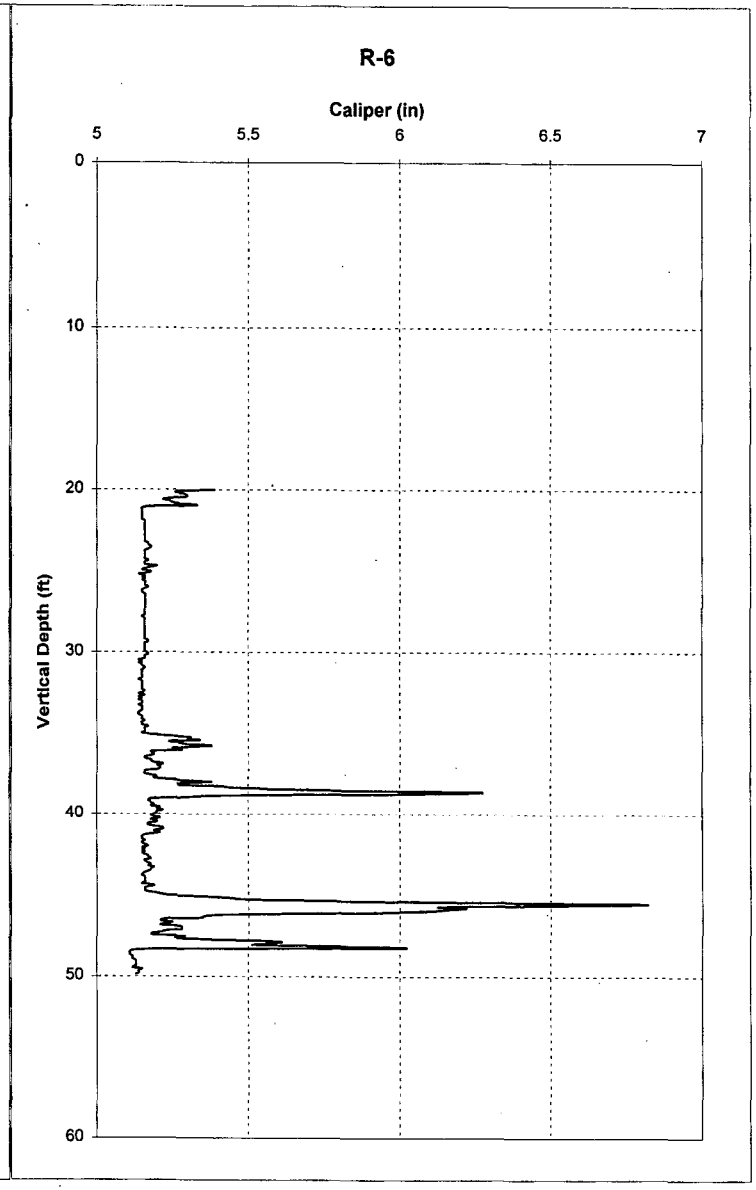
Not Cored

No Lysimeters Installed

vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
					In 0'-4.5' zone the vesicle density decreases with depth.
4.5–4.7					4.7' & 5.7' Vesicular Band.
5.7					4.8'-5.8' massive basalt with sparse vesicles.
7.7–8.0					
9.1	9.1	Low angle fracture.			9.1' vesicular band.
	9.8	Low angle fracture.			10'-10.8' massive basalt
11.7–12.6			11.7–12.6	Large width low angle fracture zone.	Fractures have vesicles. 12.7'-14.1' massive basalt.
14.1–14.4					
					14.4'-19.4' massive basalt
19.4–20.7	20.5	Low angle fracture.			Fracture has vesicles.
21.9					21.9' vesicular band. 21.9'-36.1' massive basalt
	26.3	Two small high angle fractures.			
	28.7	Low angle fracture.			
			36.2–37.0	Highly fractured zone. Possibly rubble zone.	*Below 37.0' the caliper of the well decreased making it impossible for the camera to capture the underlying lithology. Depth of Well is 54'.

R-6 Gamma Caliper Data





Well T-1

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-1	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	206.7 ft.	188.0 ft.	5249.3 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
								2.0–3.0					Massive Basalt with few vesicles. 4.0 One large vesicle.
	5							5.8–6.2					Massive Basalt with few vesicles.
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed								Massive Basalt.
	10												Massive Basalt.
								13.0–13.7	14.0	Horizontal Fracture.			Massive Basalt.
	15												
									18.1	Low Angle Fracture.			Massive Basalt.
								19.7					
	20												

Bottom of Well T-1 20.0'

25
30
35

Well T-2

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-2	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	211.6 ft.	219.8 ft.	5249.6 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
					2.0			2.0–2.9	3.0	Low Angle Fracture.			Massive Basalt.
	5				6.0								One Large Vesicle.
	10	Not Gamma Logged	Not Caliper Logged	Not Cored	9.8				10.2	Low Angle Fracture.			Massive Basalt.
					14.5			13.0–14.0					One Large Vesicle.
	15								15.1	Low Angle Fracture.			
													Massive Basalt.
								19.3	19.0	Low Angle Fracture.			
	20												
	25												
	30												
	35												

Bottom of Well T-2 20.0'

Well T-3

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-3	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	227.0 ft.	207.7 ft.	5249.0 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water Before Test	Water During Test	vesicular intervals	Single Fracture depths	Single Fracture description	Fracture Zone depths	Fracture Zone description	comments
					2.0			3.0	3.0	Low Angle Fracture.			Vesicular Zone. Massive Basalt.
	5				6.0			6.0					Vesicular Band One Large Vesicle.
								6.9 7.3					
								8.1					
	10	Not Gamma Logged	Not Caliper Logged	Not Cored	10.0			10.1					Massive Basalt.
								12.0 13.0					
	15				15.0				15.0	High angle fracture.			Sparse Vesicles.
								17.0					Vesicular Band Massive Basalt.
								19.5					
	20				20.0								

Bottom of Well T-3 20.0'

Well T-4

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-4	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	191.0 ft.	207.0 ft.	5249.3 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
					2.0		▨	4.1					Highly spaced vesicles.
	5								5.1	Horizontal fracture.			Massive Basalt.
		Not Gamma Logged	Not Caliper Logged	Not Cored	9.0	▨	▨	8.7 9.3					Large Vesicles.
	10												Massive Basalt.
					14.0	▨	▨	13.1 15.2					Vesicular Zone.
	15												Massive Basalt.
					19.0		▨	19.1					Vesicular Zone.
	20												
	25												
	30												
	35												

Bottom of Well T-4 20.0'

Well T-5

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-5	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	208.0 ft.	203.8 ft.	5249.8 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	1.0								Vesicular Zone.
	5				5.0			5.1					Massive Basalt.
								9.1					Vesicular Zone.
	10				10.0								
	15												
	20												
	25												
	30												
	35												

Bottom of Well T-5 10.0'

Well T-6

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-6	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	207.0 ft.	199.2 ft.	5249.8 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6 5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
					2.0			4.0					Spaced large vesicles.
	5	Not Gamma Logged	Not Caliper Logged	Not Cored.	6.0								Massive Basalt.
									8.0	Horizontal fracture.			
	10				10.0				10.0	Low angle fracture.			Massive Basalt.
								13.0					
	15				15.0			15.0					Massive Basalt.
	20							20.0	20.0	2 Horizontal fractures.			
					21.0			22.0					Large Vesicles.
	25												
	30												
	35												

Bottom of Well T-6 22.0'

Well T-7

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-7	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	206.0 ft.	195.8 ft.	5248.2 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	2.0			3.8					Spaced large vesicles. 3.5' vesicular band. 4.9' vesicular band.
	5				6.0			7.8 8.2			6.1 6.3	Low angle and horizontal fracture zone.	5.2' two large vesicles.
	10				10.0			12.1 14.0	10.8 14.1	Low angle fracture. High angle fracture.			Massive Basalt. Vesicular.
	15				15.0			18.1 20.0	18.0 18.3 20.0	2 Low angle fractures. Horizontal fracture.			Massive Basalt. Large Vesicles.
	20				19.0								
	25												
	30												
	35												

Bottom of Well T-7 20.0'

Well T-8

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-8	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	195.9	202.4 ft.	5249.3 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6 5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	1.0			2.0 – 4.0			1.0 – 2.0	Low and High angle fracture zone.	Large Vesicles.
	5				5.0				5.0	High angle fracture.			Massive Basalt.
									7.9	Horizontal fracture.			
					9.0			8.4	9.0	Low angle fracture.			
	10												

Bottom of Well T-8 10.0'

15

20

25

30

35

Well T-8A

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-8a	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	215.2 ft.	193.3 ft.	5249.3 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed			1.0–3.0	3.1	Low angle fracture.			Massive Basalt.
	5							8.0					Vesicular Band Massive Basalt.
	10								10.0 10.9	Horizontal. Low angle fracture.			
								12.2–13.1	12.9	High angle fracture.			Massive Basalt.
	15							16.1					Vesicular Band Massive Basalt.
								18.5					
	20												
	25												
	30												
	35												

Bottom of Well T-8a 20.0'

Well T-9

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-9	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	218.2 ft.	197.5 ft.	5249.1 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
					1.0			1.0 – 4.0					Widely spaced vesicles.
	5				5.0				5.0	Low angle fracture.			Massive Basalt.
		Not Gamma Logged	Not Caliper Logged	Not Cored				7.9	8.2 8.5 9.1	2 Horizontal fractures. 2 Low Angle fractures.			Massive Basalt.
	10				10.0								
	15												
	20												
	25												
	30												
	35												

Bottom of Well T-9 10.0'

Well T-10

BORING #	DATE DRILLED:	LOGGED FROM:	METHOD:	PAGE:
T-10	May 2, 1996	T.V Borehole Camera	Air Percussion Method	1/1

DRILLED BY:	LOGGED BY:	NORTHING:	EASTING:	SURFACE ELEVATION:
INEL	Marque Mesa	215.6 ft.	202.4 ft.	5249.1 ft.

Lithological Log	depth (feet)	total gamma (cps) 15 25	caliper (inches) 3 6.5 10	core run and recovery depth	Lysimeter	Water: Before Test	Water: During Test	vesicular intervals	Single Fracture: depths	Single Fracture: description	Fracture Zone: depths	Fracture Zone: description	comments
		Not Gamma Logged	Not Caliper Logged	Not Cored	No Lysimeters Installed			4.1					Large Vesicles widely spaced apart.
	5								5.1 6.0 7.1 8.2	Low angle. Horizontal. Horizontal. Low angle.			Massive Basalt.
	10												
	15												
	20												
	25												
	30												
	35												

Bottom of Well T-10 10.0'

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