

**ATTACHMENT 3**  
**DATA REPORT E**

**NORCAL Geophysical Consultants, Inc. Report**

**"Borehole Geophysical Logging Survey, Interim Spent Fuel Storage  
Installation, Diablo Canyon Power Plant, San Luis Obispo, CA"**

**June 1, 2001**



**BOREHOLE GEOPHYSICAL LOGGING SURVEY  
INTERIM SPENT FUEL STORAGE INSTALLATION  
DIABLO CANYON POWER PLANT  
SAN LUIS OBISPO, CALIFORNIA**

NORCAL Job Number 01-390.04B

A report prepared for

**WILLIAM LETTIS AND ASSOCIATES, Inc.  
1777 Botelho Drive, Suite 262  
Walnut Creek, California 94596**

Attention: Jeff Bachhuber

by

A handwritten signature in black ink, appearing to read "William J. Henrich", written over a horizontal line.

William J. Henrich  
California Registered Geophysicist GP-893

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Petaluma, California  
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June 1, 2001

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## **I. INTRODUCTION**

A borehole geophysical logging survey was conducted at Pacific Gas and Electric's (PGE) Diablo Canyon Power Plant (DCPP) in San Luis Obispo County, California. This survey is in support of a geotechnical investigation for a proposed Interim Spent Fuel Storage Installation (ISFSI). The geophysical logging was conducted in three phases as follows; (1) April 20 and 21, (2) April 23 and 24 and (3) April 28, 2001 by NORCAL Geophysicists William J. Henrich and Dan Jones. Field activities and logistical support was provided by Jeff Bachhuber, John Helms and Charles Brankman of William Lettis Associates, Inc.

The purpose of the survey is to characterize bedrock fracture frequency, calculate fracture orientation and identify bedding attitudes in ten exploratory borings which penetrated the Obispo formation. The following presents a description of the borehole methodologies and results of the survey.

## **II. SCOPE OF WORK**

We conducted a suite of geophysical logs consisting of caliper and optical televiewer (OPTV) in ten borings designated as 01-CTF-A and 01-A thru -I. Depths of these borings ranged from 58 to 320 feet. This logging was performed in accordance with NORCAL Geophysical Consultants Work Plan, Geophysical Investigation for the DCP-IFSI Site dated December 4, 2000.

## **III. SITE CONDITIONS**

The study site is situated on a north facing hill slope within Diablo Canyon two to three hundred yards east of the main plant and reactor facilities. The general geology consists of a thin (2-5 feet) layer of alluvium overlying mostly thinly to massively bedded sandstone of the Obispo formation (Tertiary Age). Exploratory boreholes were drilled with a nominal 4-inch diamond core bit (HQ-size) which penetrated the underlying rock to depths ranging from 58 to 321 feet below ground surface. In general, encountered static water levels ranged from about 15 feet above total depth to completely dry conditions. Boreholes were drilled vertically and generally included shallow conductor casing collared into stable bedrock. The ground surface at each borehole was used as the geophysical logging reference datum.

## **IV. DATA ACQUISITION, CALIBRATION QUALITY CONTROL**

Geophysical logging consists of lowering a series of instrumentation (probes) downhole to measure borehole environmental and formation characteristics. In this logging phase, our survey consisted of borehole diameter measurements and acquisition of high resolution optical images of the borehole sidewall. Borehole diameter and optical images were made with three-arm



caliper and digital optical televiewer probes, respectively. The caliper probe contains spring-loaded arms that record the variations in average borehole diameter (in inches) as a function of depth. The optical televiewer (OPTV) probe consists of a fixed CCD camera that records an analog video image of the borehole sidewall wall. A two-dimensional "unwrapped" sidewall image of the borehole is created by a reflecting hyperbolic mirror below the camera and oriented to magnetic north from a reference signal generated by an on-board compass during digitization. The OPTV probe contains a complete orientation package (3-axis magnetometer and 3-axis inclinometer) that in addition to the north reference, the bearing and inclination of the borehole axis is recorded with the video image. These probes were manufactured by Robertson Geologging, Ltd. and operated with the manufacture's *Winlogger-OPTV* logging acquisition system. In addition to the probes, the logging system consisted of a PC based control console (Windows 98 OS), thermal printer, four-conductor logging cable and a portable 12 VDC powered winch.

All geophysical log data were acquired in the up-hole direction. Logging speed for caliper runs averaged 10 feet per minute. The data sampling rate was every 0.05 feet. OPTV logging runs were operated at 3 feet per minute at a data sample rate of 0.003 feet. Prior to actual logging, caliper log response was calibrated with a series of known diameters. The value of caliper diameters ranged from 2 to 8 inches. We used primarily 3 different diameters to compute a calibration curve (polynomial fit). Exact calibration measurements relating the probe output (counts per second) to calibration values can be found at the end of Appendix A, Caliper Logs. We verified OPTV tool's north reference (magnetic north) with a *Brunton* compass and a probe sleeve before and after each log. This procedure was witness by the on-site QA/QC manager.

Quality control and stability of logging measurements were verified by re-recording or repeating portions of each geophysical log. Our caliper and OPTV repeats were conducted in the lower 25 and 20 feet of each borehole, respectively. These repeats can be found following the main log section in Appendix A, Caliper Logs and Appendix B, Interpreted OPTV Plots. In general, caliper logs repeated by better than 5 percent compared to the main log section except in zones where the borehole breakouts were measured as several inches greater than the nominal bit diameter. OPTV logs were identical with respect to north direction with a maximum of 0.10 feet difference in depth.

## V. DATA REDUCTION

Continuous caliper data were transformed by daily calibration curves to measured borehole diameter in inches and smoothed with an 11- point center box car filter. These logs have been plotted with the *WINLOGGER (Version 2.01)* acquisition and replay software. The OPTV logs were corrected for true geographic north by adding 14 degrees to magnetic referenced directional azimuths in the interpretation software program *RGLDIP (Version 5.3)* by Robertson Geologging, Ltd.

## **VI. DATA PRESENTATION**

### **1.0 Caliper Logs**

Continuous caliper log plots have been presented at a vertical scale of 1 inch equal 10 feet. The repeat caliper section follows the main log section. These plots can be found in Appendix A beginning with Borehole 01-CTF-A and subsequently followed in alphabetical order by Boreholes 01-A through 01-I.

### **2.0 Optical Televiewer Logs**

The color OPTV plots images are presented in Appendix B in the same order as the caliper logs with the repeat section trailing the main log section. These OPTV plots contain from left to right; (1) a perspective view of the borehole as a core projection, (2) "unwrapped" oriented OPTV image, (3) arrow (tadpole) plot which represents interpreted fracture or bedding in terms of dip magnitude (Y-axis) and azimuth (direction of the tadpole symbol "tail") and (4) a COMMENT column that describes fracture/bedding features as planar, irregular or discontinuous. The rightmost graph (5) shows a deviation plot of the borehole trajectory in arrow plot form. For the ten borings surveyed, the deviation data indicated all boreholes deviated was less than 3 degrees from vertical. The details of the above interpretation are presented in the respective summary data tabulations (See Appendix C, Interpreted Fracture and Bedding Tables). These tables list depth, dip azimuth, dip angle, number of points (n) nominated along a fracture or bedding trace, classification of a feature as either a fracture (2) or bedding (0), upper and lower depth of the feature trace and borehole deviation in terms of azimuth and inclination at the specific depth of each borehole feature.

## **VII. INTERPRETATION AND DISCUSSION**

### **1.0 General Borehole Conditions**

Our caliper logs indicated that borehole diameter for all ten borings was a constant four inches. Most boreholes, however, showed several breakouts measuring several inches in diameter in excess of four inches and up to several feet in vertical length. These breakouts when viewed by the OPTV logs correlated to highly fractured zones or clay beds. Some of these fracture zones collapsed and blocked transit of probes in Borings 01-A, -E and -I. This necessitated the need to log these boreholes in stages after the blockage was cleared or stemmed with a protective casing. Over 95 percent of the OPTV logging footage was conducted under unsaturated (dry) conditions. Cloudy or turbid fluid conditions prevented the acquisition of an interpretable video image in Boring 01-E.

## 2.0 Fracture Analysis

Planar orientation of fractures were calculated with the interpretation program RGLDIP Version 5.3 written by Robertson Geologging, Ltd. Within this program, OPTV images are replayed on a PC computer screen. At this stage several interpretation options are available which basically require the interpreter to interactively fit an ideal sinusoidal trace representing a plane to an observed fracture trace. These options are as follows: (1) nominating points along the trace of the fracture, (2) fit a flexible sinusoid to a fracture trace or (3) employing a semi-automated picking procedure whereby the interpreter selects points at the minimum (trough) and the maximum (peak) extent of the observed fracture trace. In the first method, typically 5 to 15 points were chosen along each fracture trace for interpolation. Regardless of the interpretation method, the program at this point mathematically calculates a "best fit" ellipse that represents the plane of the fracture in terms of dip magnitude and dip direction. The ellipse in turn is represented as continuous red sinusoid that has been superimposed over complete or partially viewable fracture traces on the unwrapped OPTV image plots (second plot from the left) as shown in Interpreted OPTV Plots (see Appendix B). Numeric dip angle and azimuth are represented in the adjacent arrow plot. The determination of dip angle assumes that the borehole can be approximated as a cylinder of a constant diameter which for this survey was four inches.

Most fracture features in this survey appeared continuous (360 degrees) across the unwrapped OPTV image plot. However, in highly fractured zones or in log sections containing high angle fractures (60 degrees or greater), only a segment or discontinuous segments of fracture traces were observed. The apparent segmentation of fracture traces maybe related variations cementation and fracture aperture of the fracture or spalling along the intersection of the fracture plane and borehole wall. Though segmented, the program has the facility to interpolate a dip magnitude and dip direction given that a sinusoid overlaps the various segments. Whether continuous or discontinuous, not all fractures traces can be fitted with a simple sinusoid. This is because rock properties are not completely homogeneous with the result that certain rock fractures did not propagate along an exact plane. Also, borehole enlargements and the resulting probe decentralization will geometrically distort the image trace of a fracture feature and thus appear irregular with respect to an overlapping sinusoidal trace representing a best fit ellipse. In these above instances we have noted whether a fracture is discontinuous or irregular in the "COMMENT" column of the Interpreted OPTV Plots.

Not all fractures have been analyzed. As an example, near vertical features such as those shown in Boring 01-I at depths ranging from 119 to 124 feet (see Appendix B) are not interpreted because of the difficulty of fitting a sinusoid to fractures traces greater than 87 degrees. High density, complexly fractured intervals such as the one shown between 135 and 139 feet in the same Boring are not analyzed because the fracture traces, though seen in the OPTV replay, are either too irregular or discontinuous from intervening fracture offsets to be confidently assessed as distinct features.

In the 10 borings analyzed, we identified a total of 643 features of which about 90 percent were classified as fractures (see Fracture and Bedding Table, Appendix C). As described in the above paragraphs, not all fractures were analyzed. This is to say the rock mass is probably more fractured than number of individual fractures indicated in the Table and that the number of very high angle fractures are under represented. Also, as a generalization, most of the fracture dips tabulated exceeded 45 degrees.

### **3. Bedding Identification**

Orientation of bedding traces were calculated in the same manner as fractures. The determination of whether a planar or near planar borehole feature is classified as a fracture or bedding is subjective. Bedding on a optical televiewer image is usually displayed as a series of banding or fine laminations where the contrast between individual beds is either tonal or textural. We observed mostly tonal (color) changes that indicated bedding in this survey. An example can be found in Boring 01-I at depths ranging from 172 to 176 feet. Bedding planes here are characterized by variations in color. A continuous green colored sinusoid superimposed on bedding trace represents our interpreted best fit. Bedding attitudes determined by the RGLDIP program at this locale dips show shallow dips ranging from 9 to 14 degrees with dip direction to the northwest. Taking all borings as a whole, the predominate bedding dip angle is shallow (6-14 degrees) with dip direction towards the west-northwest. Bedding features which depart significantly from this general attitude are related sheared clay beds or discoloration due to oxidation.



## **Appendix A**

### **CALIPER LOGS**

**BORINGS: 01-CTF-A, 01-A, -B, -C, -D, -E, -F, -G, -H and -I**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY WLA  
WELL 01-CTF-A  
FIELD DCPPI ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.: NA  
LONG.:

OTHER SERVICES

OPTV

Perm. Datum

Elev 307

Log. Datum GROUND

Drill Datum GROUND

KB 0.00

DF 0.00

GL 0.00

DATE RUN#	04/20/01 1	04/20/01 0	04/20/01 0
TYPE OF LOG	3ACS	3ACS	
DEPTH DRILLER	58.60	58.00	0.00
DEPTH LOGGER	56.35	56.00	0.00
LOG DEEPEST	56.35	56.00	0.00
LOG SHALLOW	3.00	25.00	0.00
FLUID IN HOLE	WATER	WATER	
SALINITY			
DENSITY			
LEVEL	48	?	
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	DJONES	d jones	
WITNESSED BY	C BRANKMAN	C BRANKMAN	

RUN#

BIT RECORD

BIT

FROM

TO

CASING RECORD

BIT

WEIGHT

FROM

TO

1	3.75	0.00	58.60	4.00	0.00	0.00	3.60
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01ctfa.hed )

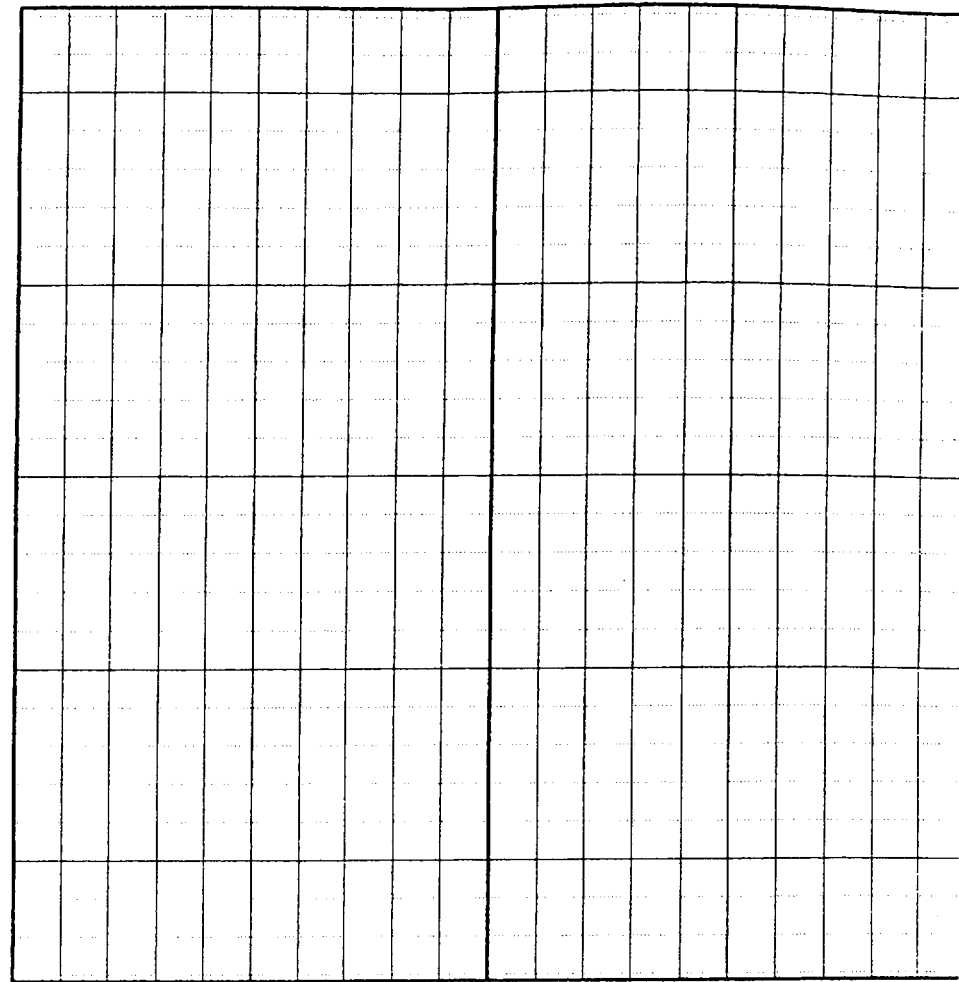
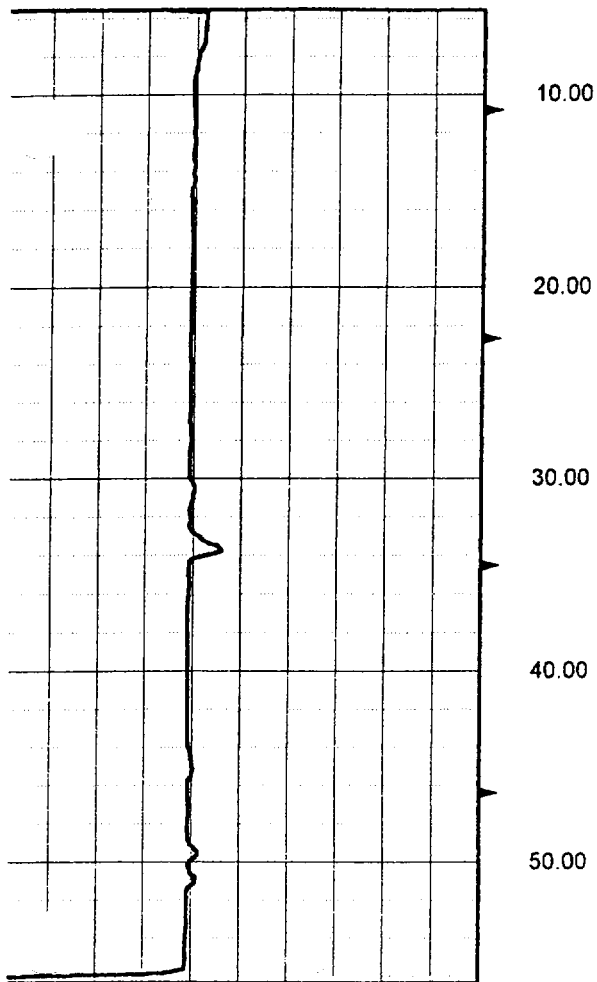
WELL FLUSHED WITH FRESHWATER

RUN 2 = REPEAT CALIPER LOG

CALP Inch

0.00

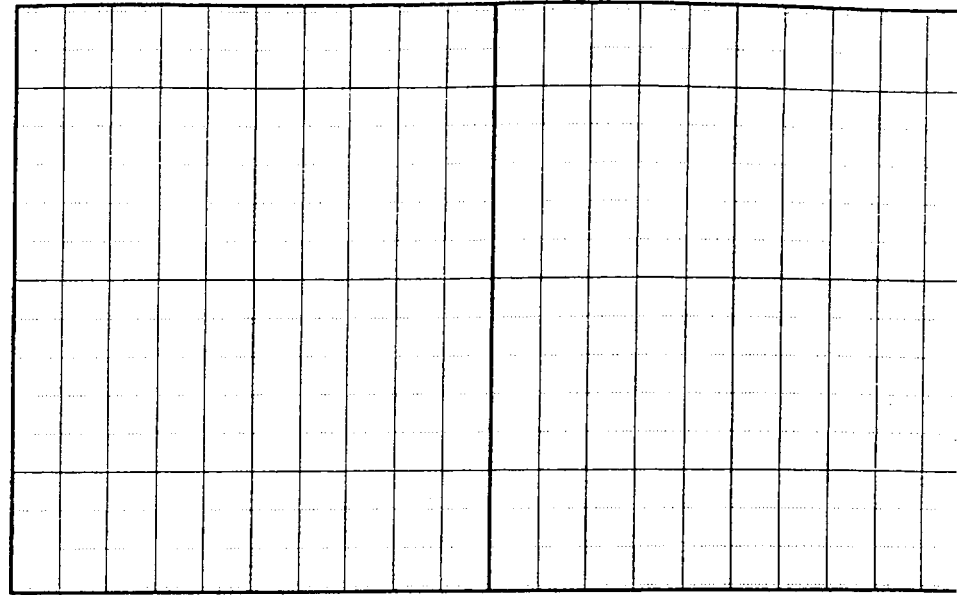
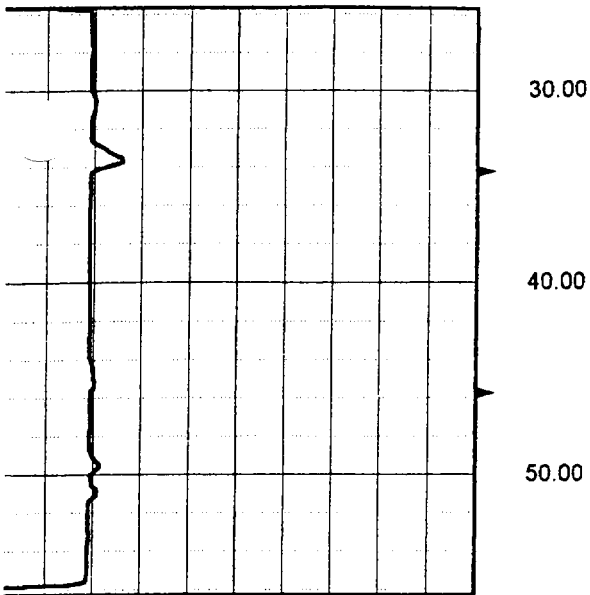
10.00



CALP Inch

2.00

12.00



**RUN 2 REPEAT**





ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY WLA  
WELL 01-A  
FIELD DCPD ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.: NA  
LONG.:

OTHER SERVICES  
  
OPTV

Perm. Datum Elev 305.7  
Log. Datum GROUND  
Drill Datum GROUND

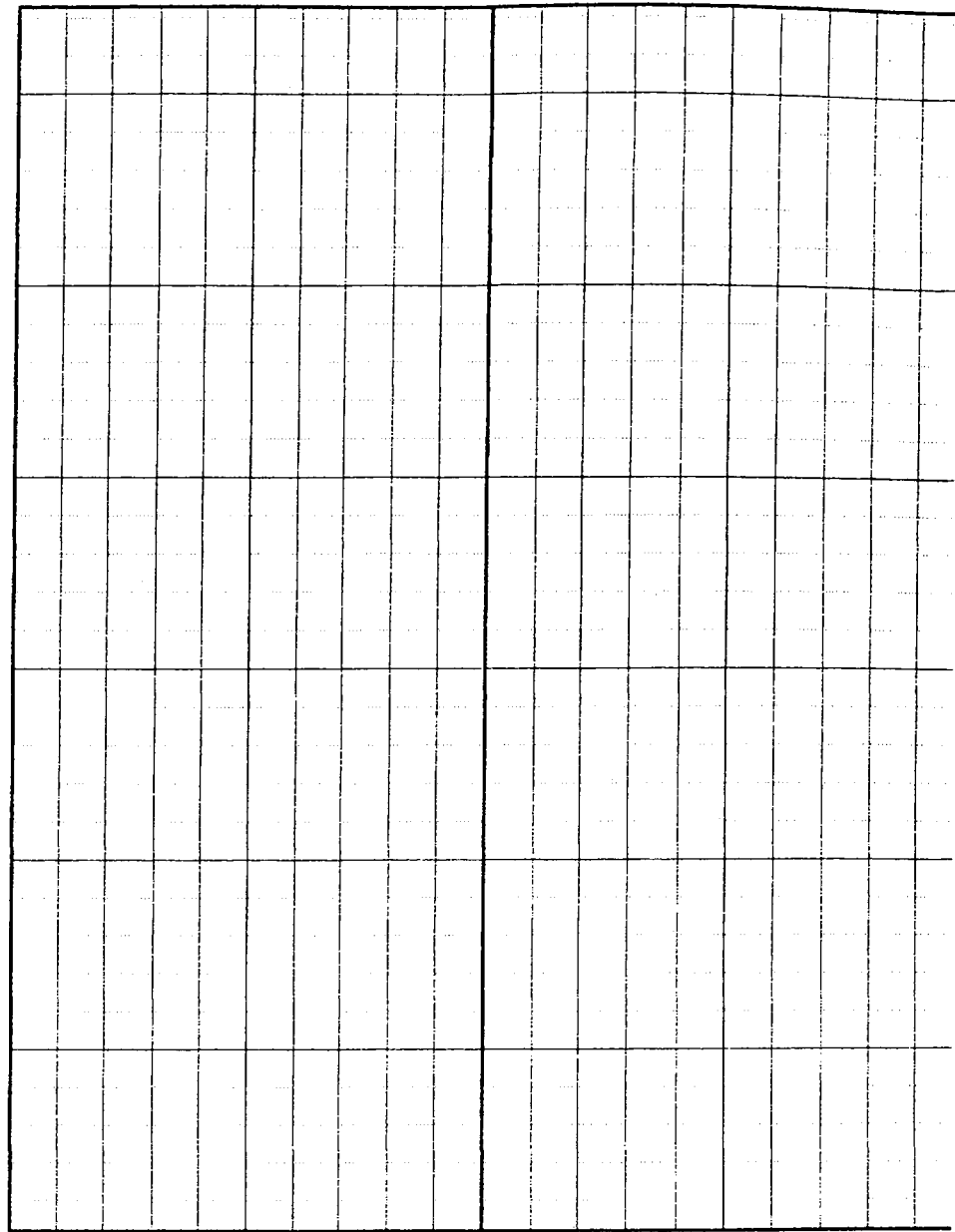
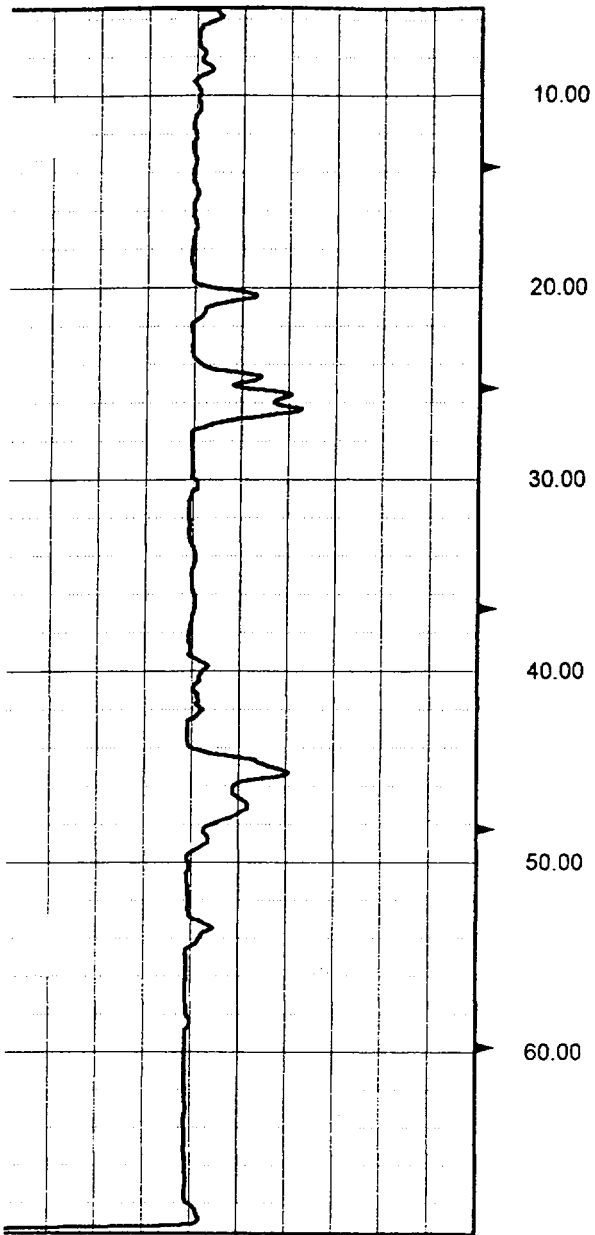
KB 0.00  
DF 0.00  
GL 0.00

DATE	04/20/01	04/20/01	04/20/01
RUN#	1	0	0
TYPE OF LOG	3ACS		
DEPTH DRILLER	72.00	0.00	0.00
DEPTH LOGGER	0.00	0.00	0.00
LOG DEEPEST	69.65	0.00	0.00
LOG SHALLOW	7.00	0.00	0.00
FLUID IN HOLE	WATER		
SALINITY			
DENSITY			
LEVEL	?		
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	DJONES		
WITNESSED BY	J HELMS		

RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	3.75	0.00	72.00	4.00	0.00	0.00	3.50
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01A-1.hed )

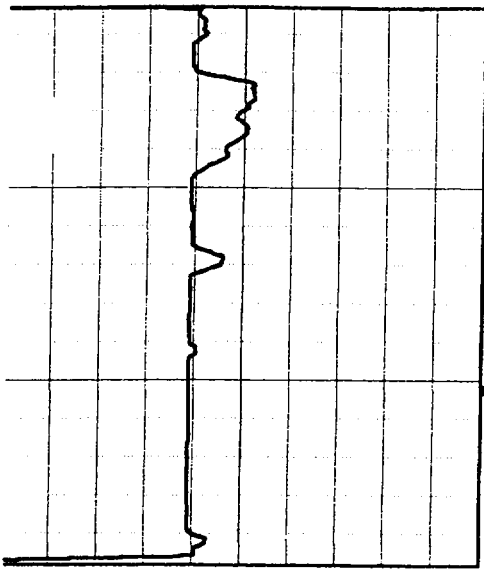
RUN 2 = REPEAT CALIPER LOG



CALP Inch

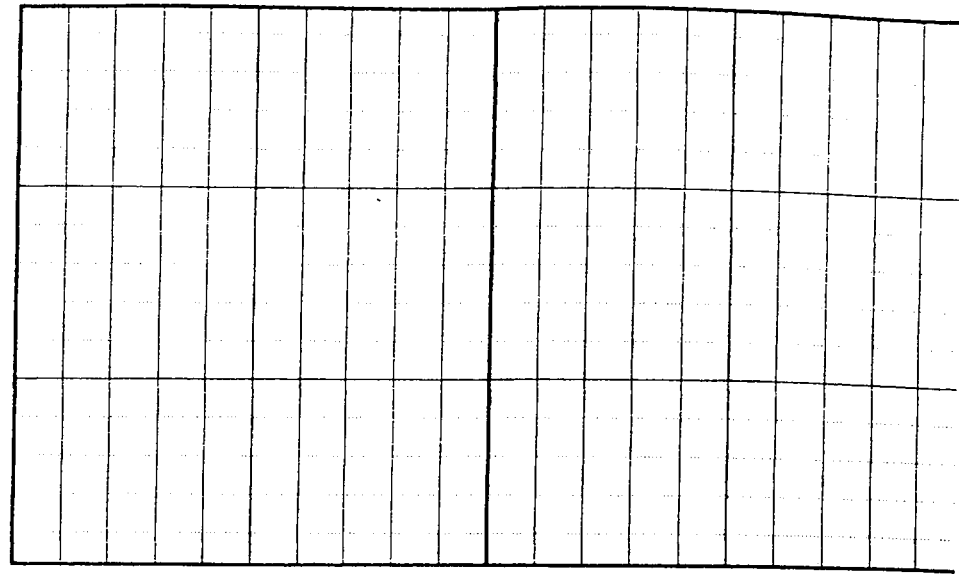
0.00

10.00



50.00

60.00



**RUN 2 REPEAT**

**01-A**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY  
WELL 01-B  
FIELD DCPD ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.:  
LONG.:

OTHER SERVICES  
  
OPTV

Log. Datum GROUND  
Drill Datum GROUND

Elev ?

KB 0.00  
DF 0.00  
GL 0.00

DATE	04/23/01	04/23/01	
RUN#	1	0	0
TYPE OF LOG	3ACS	3ACS	
DEPTH DRILLER	72.00	72.00	0.00
DEPTH LOGGER	72.00	72.00	0.00
LOG DEEPEST	70.25	70.25	0.00
LOG SHALLOW	5.50	40.00	0.00
FLUID IN HOLE	WATER	water	
SALINITY			
DENSITY			
LEVEL	?		
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	DJONES	D JONES	
WITNESSED BY	J HELMS	J HELMS	

RUN#	BIT RECORD			CASING RECORD			
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0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

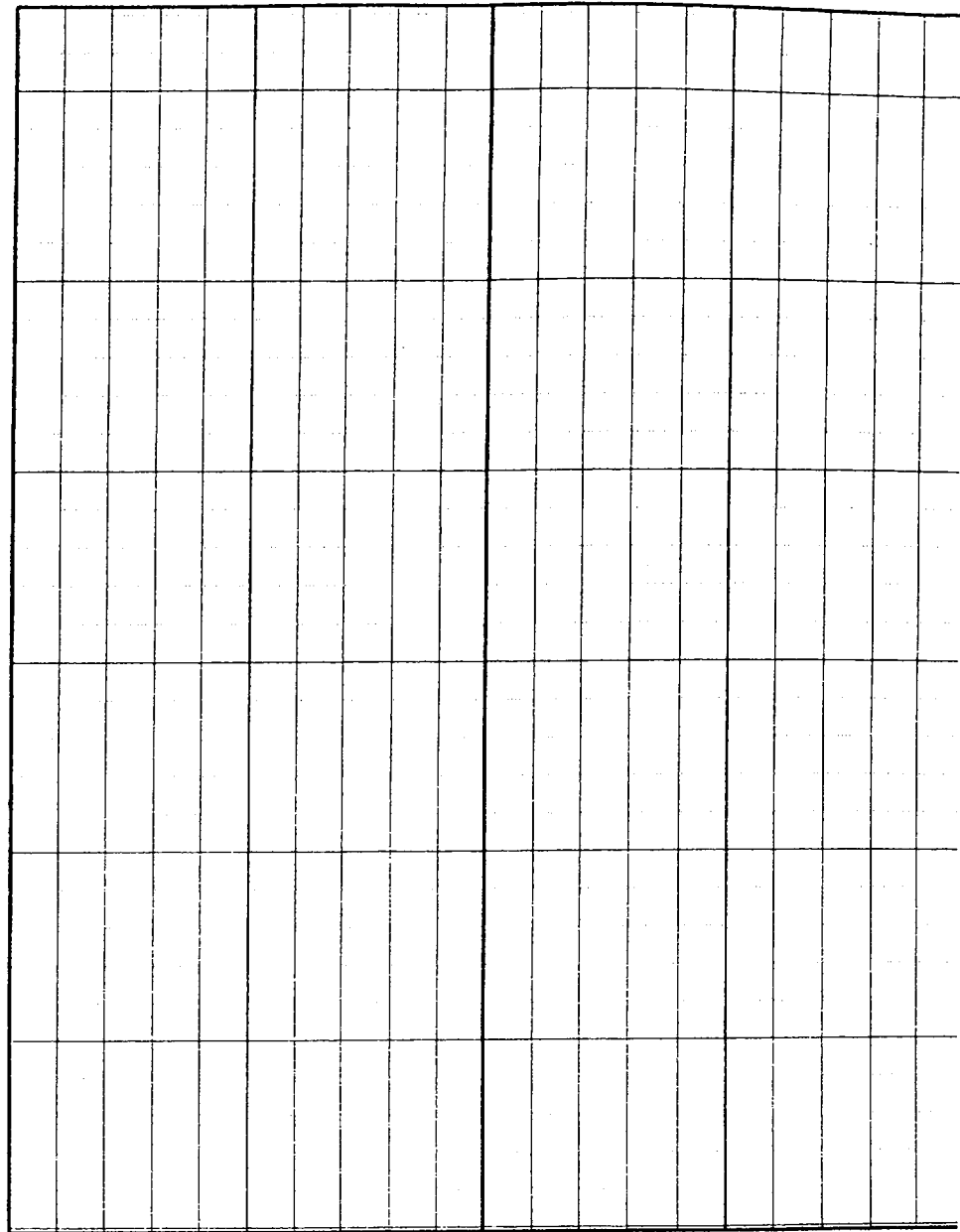
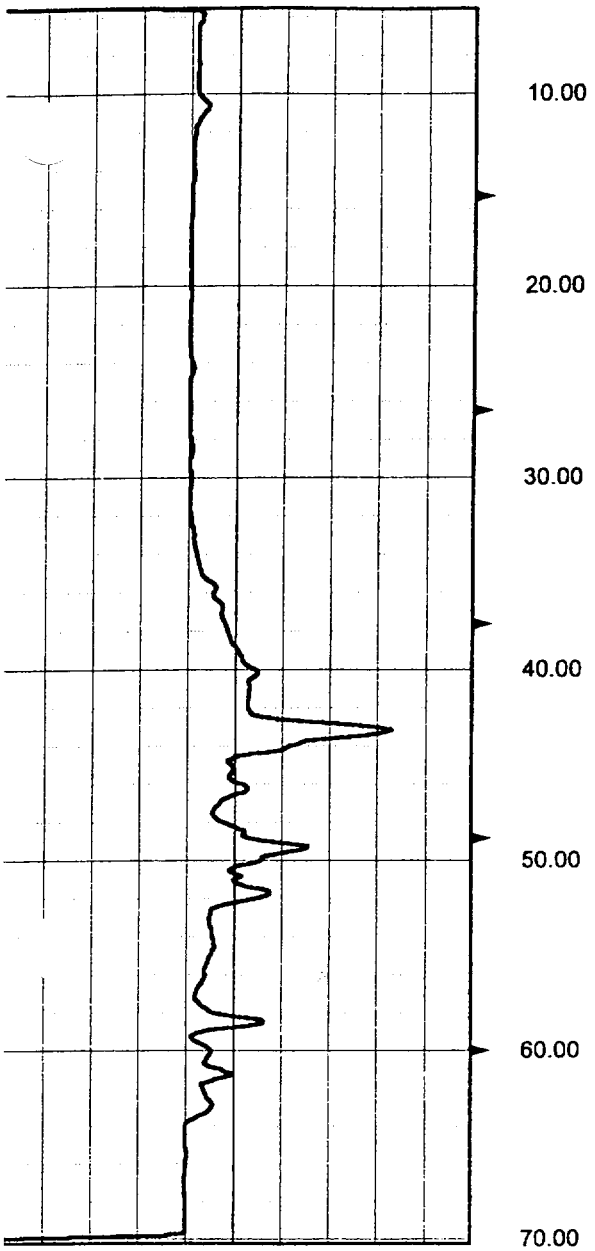
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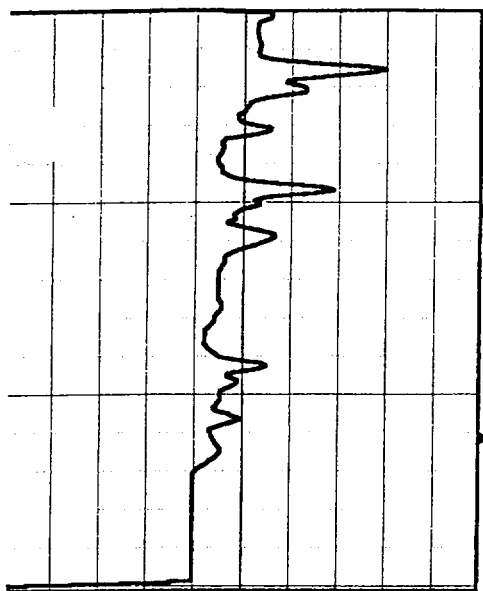
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CALP Inch

0.00

10.00

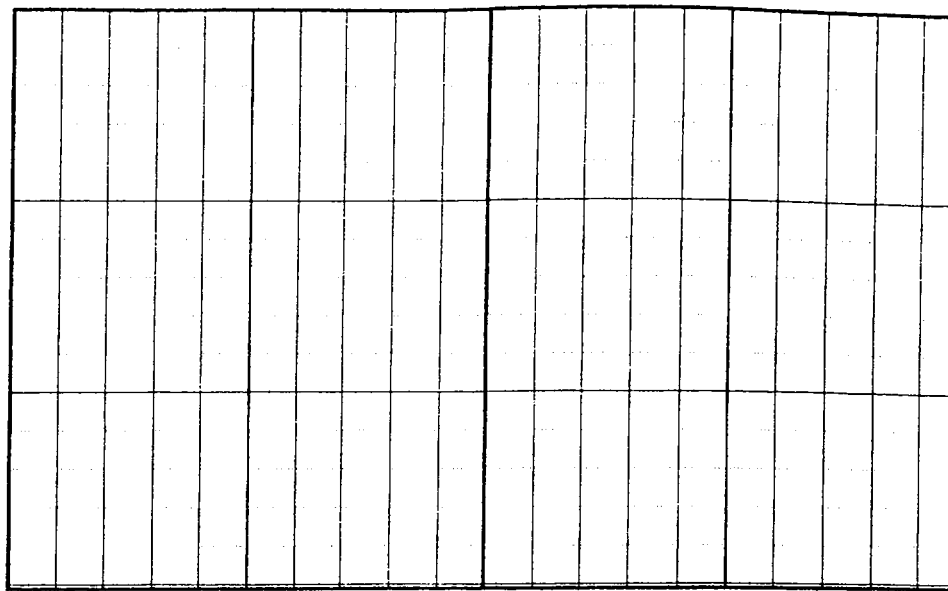


40.00

50.00

60.00

70.00



**RUN 2 REPEAT**

**01-B**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY  
WELL 01-C  
FIELD DCPPI ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.:  
LONG.:

OTHER SERVICES

OPTV

Log. Datum GROUND  
Drill Datum GROUND

Elev ?

KB 0.00  
DF 0.00  
GL 0.00

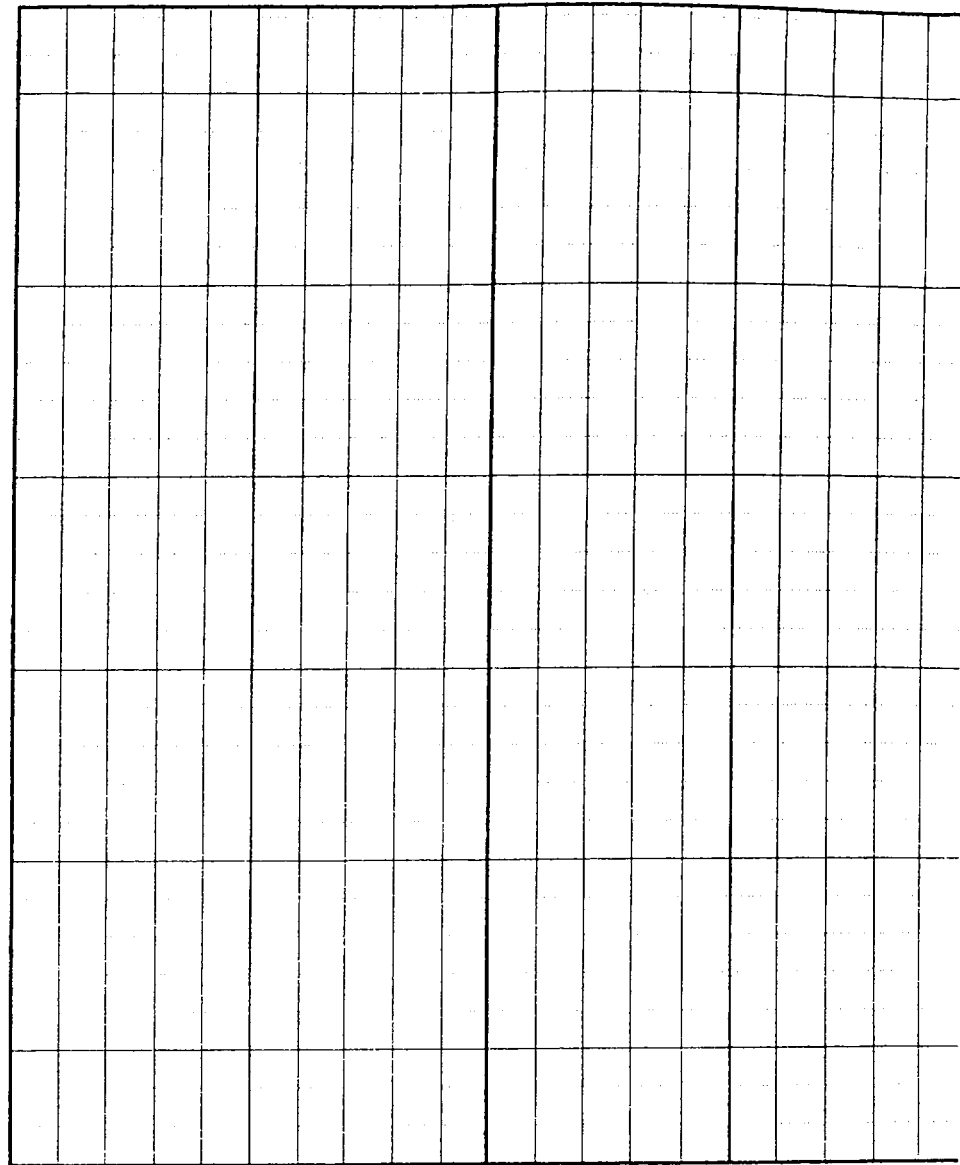
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DEPTH LOGGER	66.00	66.00	0.00
LOG DEEPEST	66.05	66.00	0.00
LOG SHALLOW	5.50	5.00	0.00
FLUID IN HOLE	WATER	water	
SALINITY			
DENSITY			
LEVEL	?	?	
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	D JONES	D JONES	
WITNESSED BY	J HELMS	J HELMS	

RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
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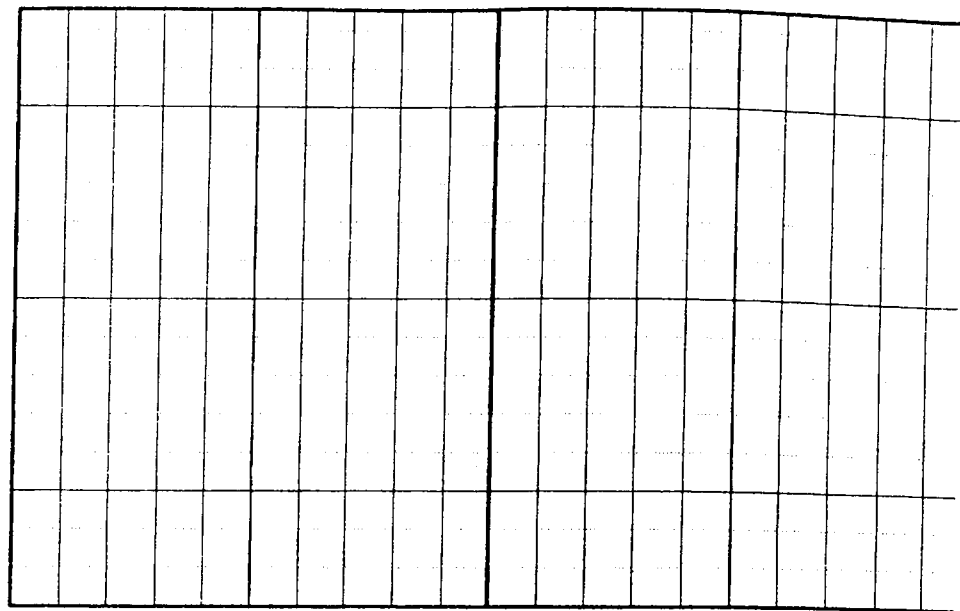
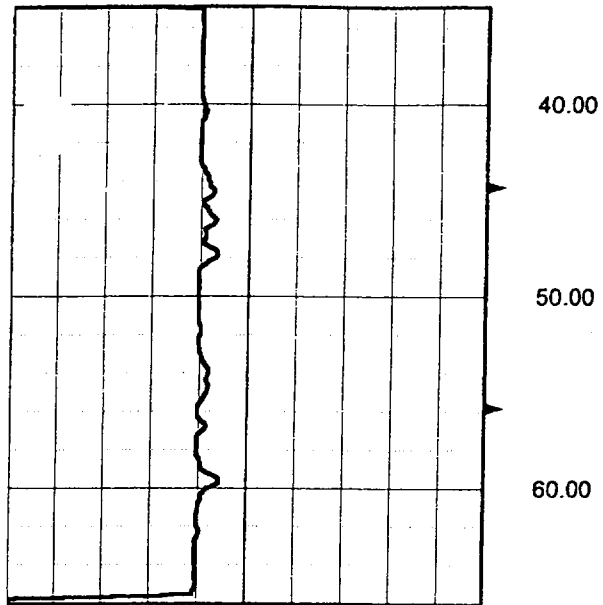
REMARKS ( C:\boreholeclients\diablo2\01CC.hed )

FLUSHED WITH FRESH WATER  
RUN 2 = REPEAT SECTION

10.00







**RUN 2 REPEAT**

## ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

## COMPANY

WELL 01-D  
 FIELD DCPD ISFSI  
 COUNTRY USA  
 STATE CA  
 COUNTY  
 LAT.: NA  
 LONG.:

## OTHER SERVICES

OPTV

Perm. Datum

Elev 327

Log. Datum GROUND

Drill Datum GROUND

KB 0.00

DF 0.00

GL 0.00

DATE

RUN#

TYPE OF LOG

DEPTH DRILLER

DEPTH LOGGER

LOG DEEPEST

LOG SHALLOW

FLUID IN HOLE

SALINITY

DENSITY

LEVEL

MAX TEMP °C

RIG TIME

RECORDED BY

WITNESSED BY

21/04/01

1

3ACS

68.50

59.00

59.00

6.00

WATER

?

0.00

DJONES

C WEAVER

21/04/01

0

3ACS

68.50

59.00

59.00

25.00

WATER

?

0.00

D JONES

C WEAVER

21/04/01

0

0.00

0.00

0.00

0.00

0.00

RUN#

BIT RECORD

BIT

FROM

TO

CASING RECORD

BIT

WEIGHT

FROM

TO

1

4.00

0.00

68.50

4.00

0.00

0.00

4.00

0

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0

0.00

0.00

0.00

0.00

0.00

0.00

0.00

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FLUSHED WITH FRESH WATER

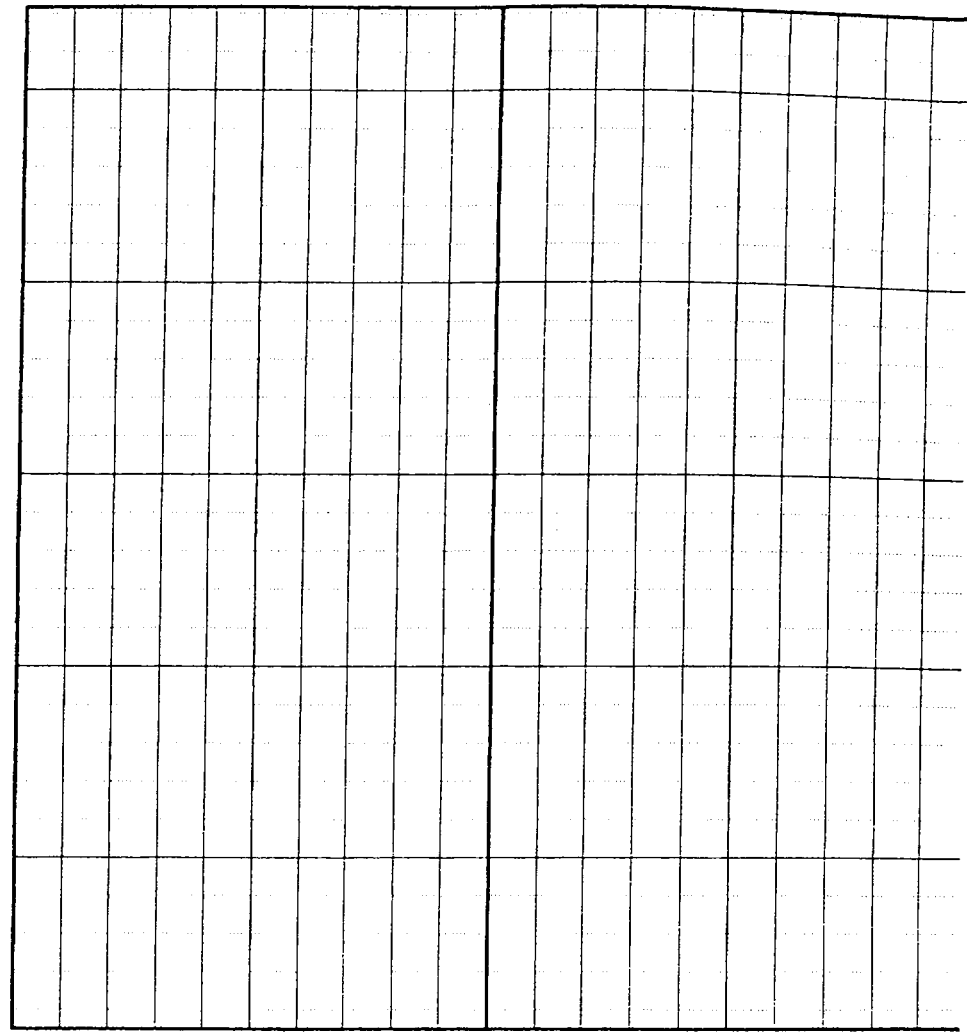
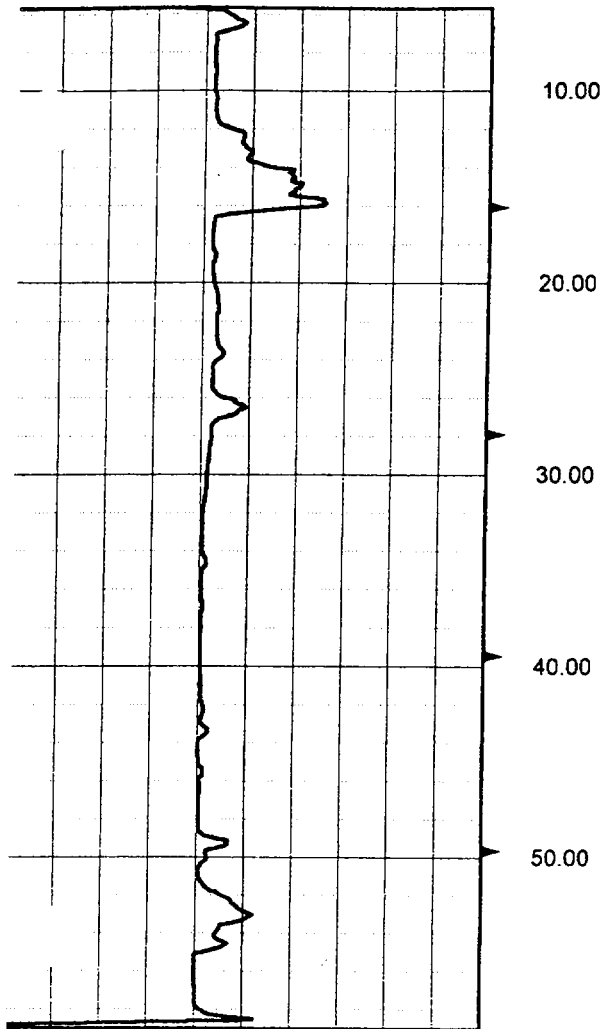
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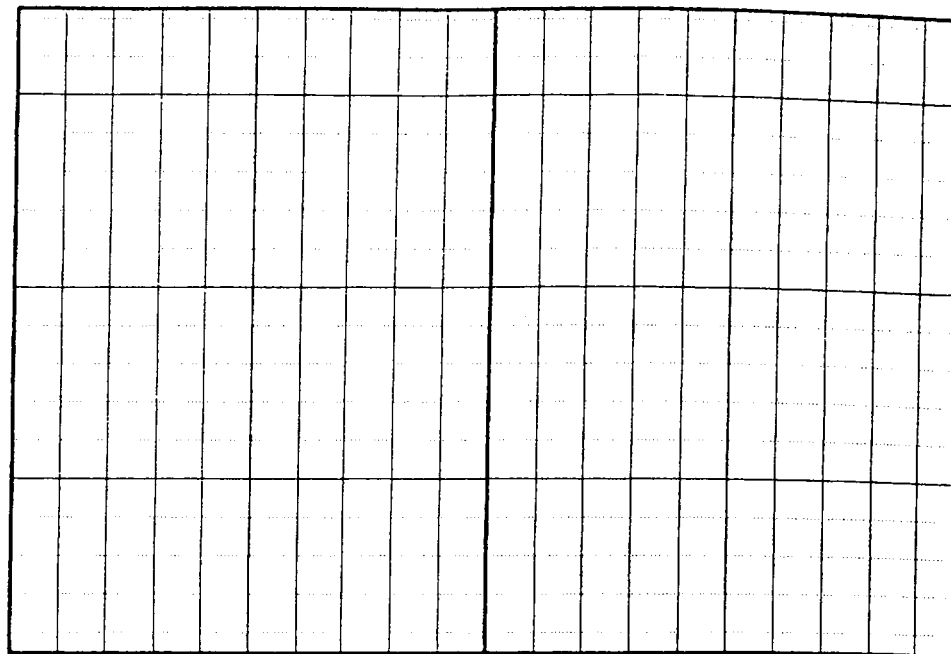
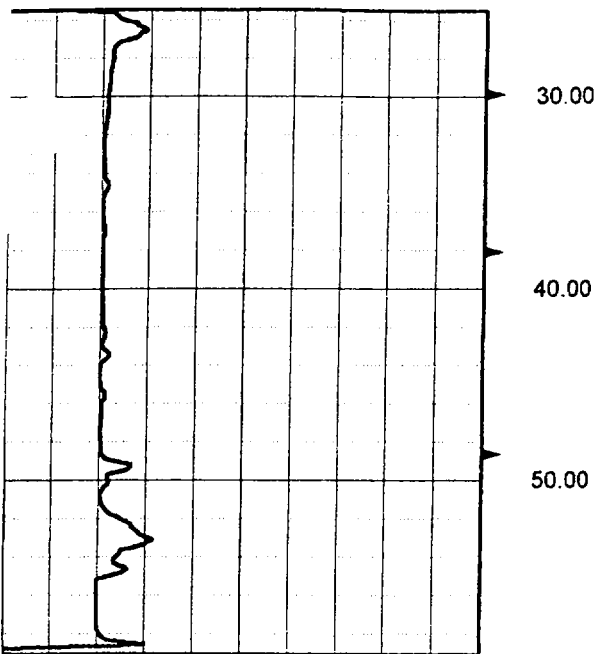
RUN 2 = REPEAT CALIPER LOG

CALP Inch

0.00

10.00





**RUN 2 REPEAT**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY WLA  
WELL 01-E  
FIELD DCPD ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.:  
LONG.:

OTHER SERVICES  
  
OPTV

Perm. Datum Elev 339  
Log. Datum GROUND  
Drill Datum GROUND

KB 0.00  
DF 0.00  
GL 0.00

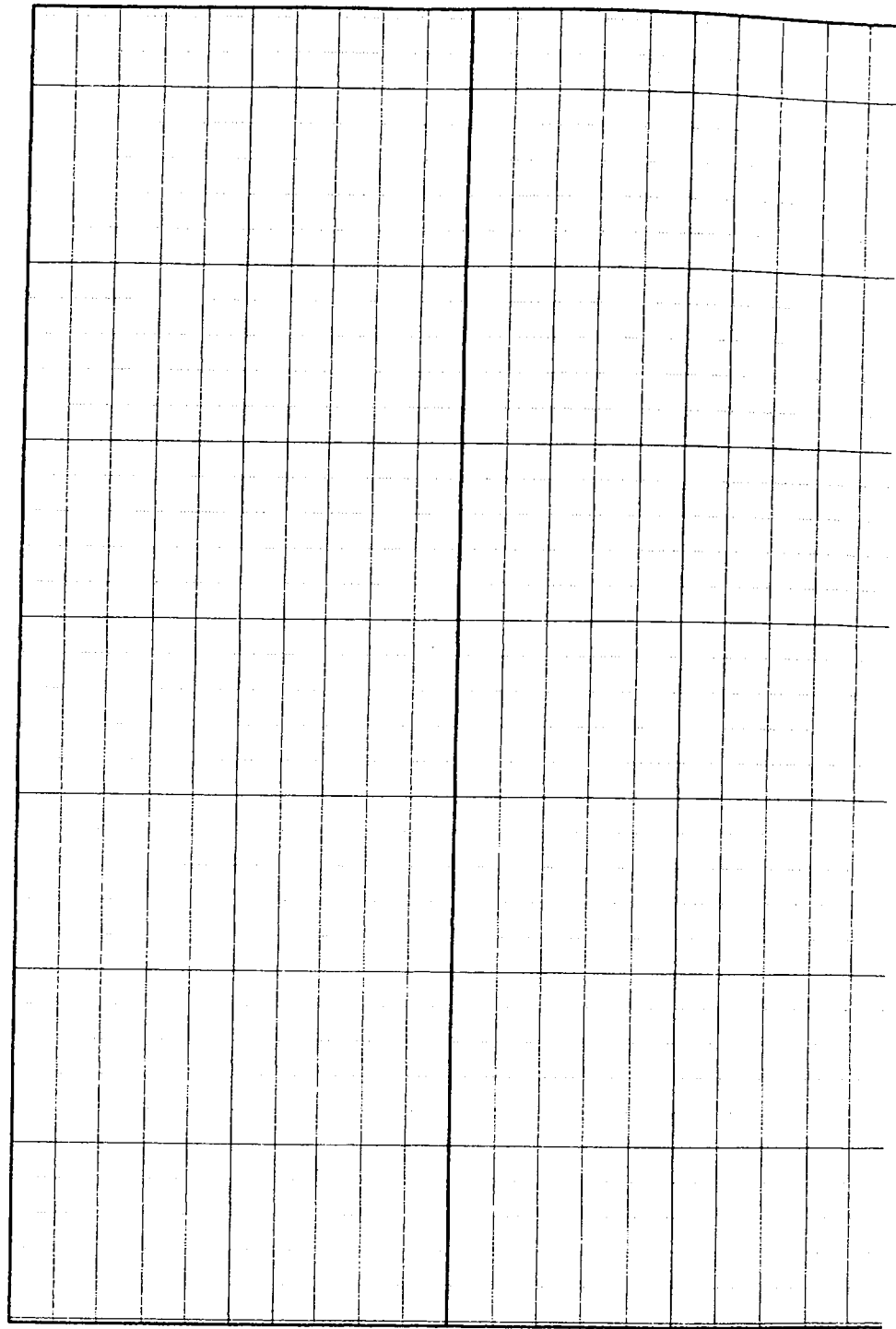
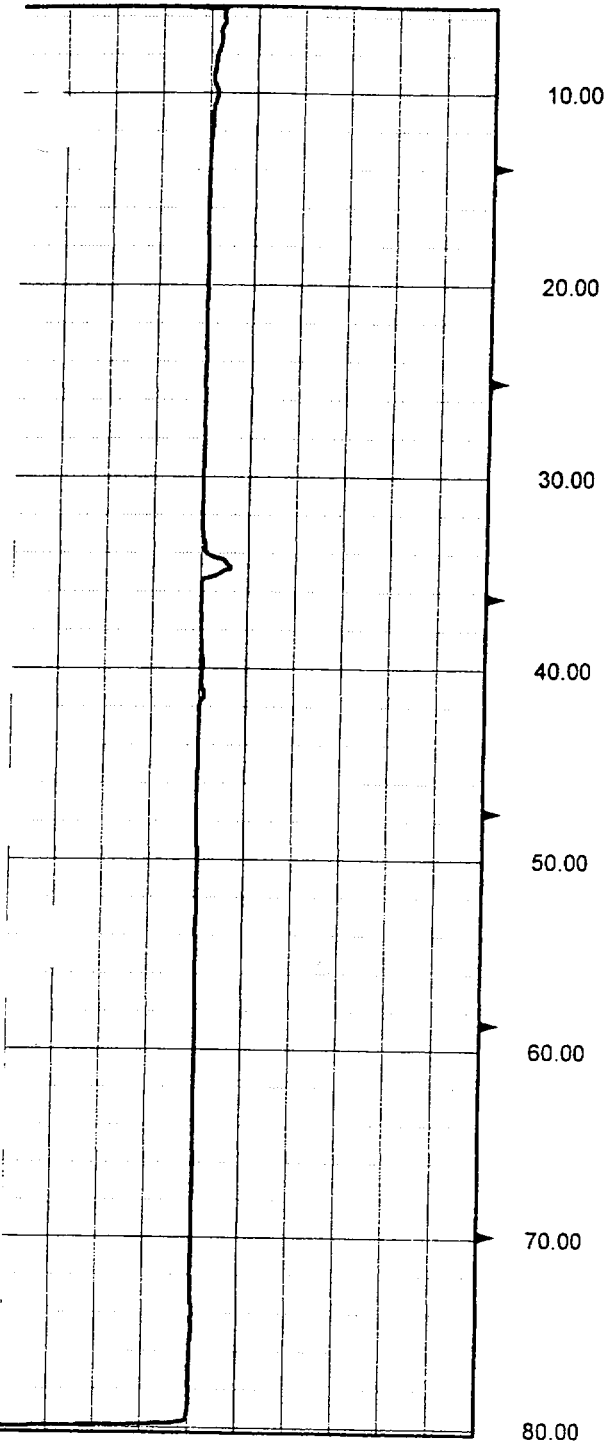
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DEPTH LOGGER	80.25	80.20	0.00
LOG DEEPEST	80.25	80.20	0.00
LOG SHALLOW	5.50	50.00	0.00
FLUID IN HOLE	WATER	water	
SALINITY			
DENSITY			
LEVEL	?		
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	D JONES	D JONES	
WITNESSED BY	J HELMS	J HELMS	

RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	4.00	0.00	81.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0		0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01ECL.hed )

HAMMERED AND CLEARED HOLE TO 80'  
RUN 2 = REPEAT SECTION

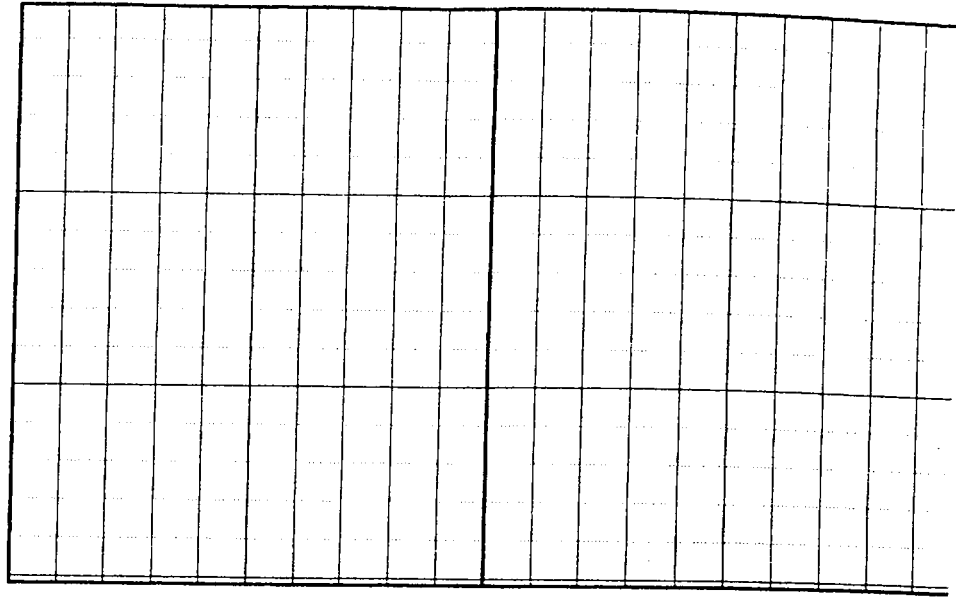
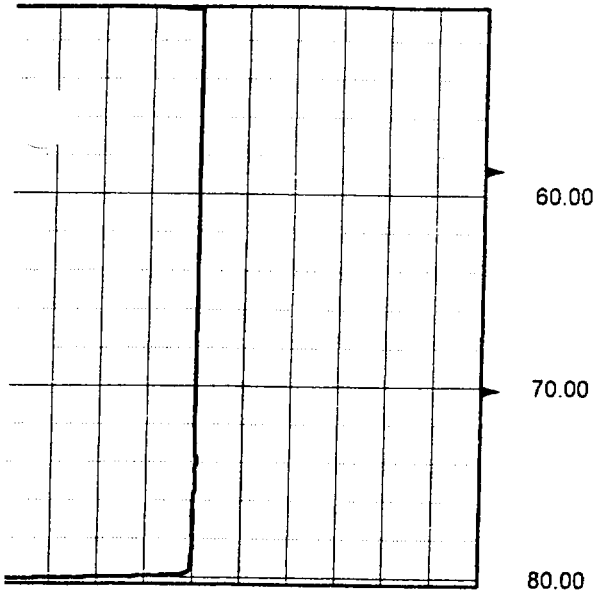
0.00 CALP Inch 10.00



CALP Inch

0.00

10.00



**RUN 2 REPEAT**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY  
WELL 01-F  
FIELD DCPD ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.:  
LONG.:

OTHER SERVICES  
  
OPTV

Perm. Datum Elev ?

Log. Datum GROUND  
Drill Datum GROUND

KB 0.00  
DF 0.00  
GL 0.00

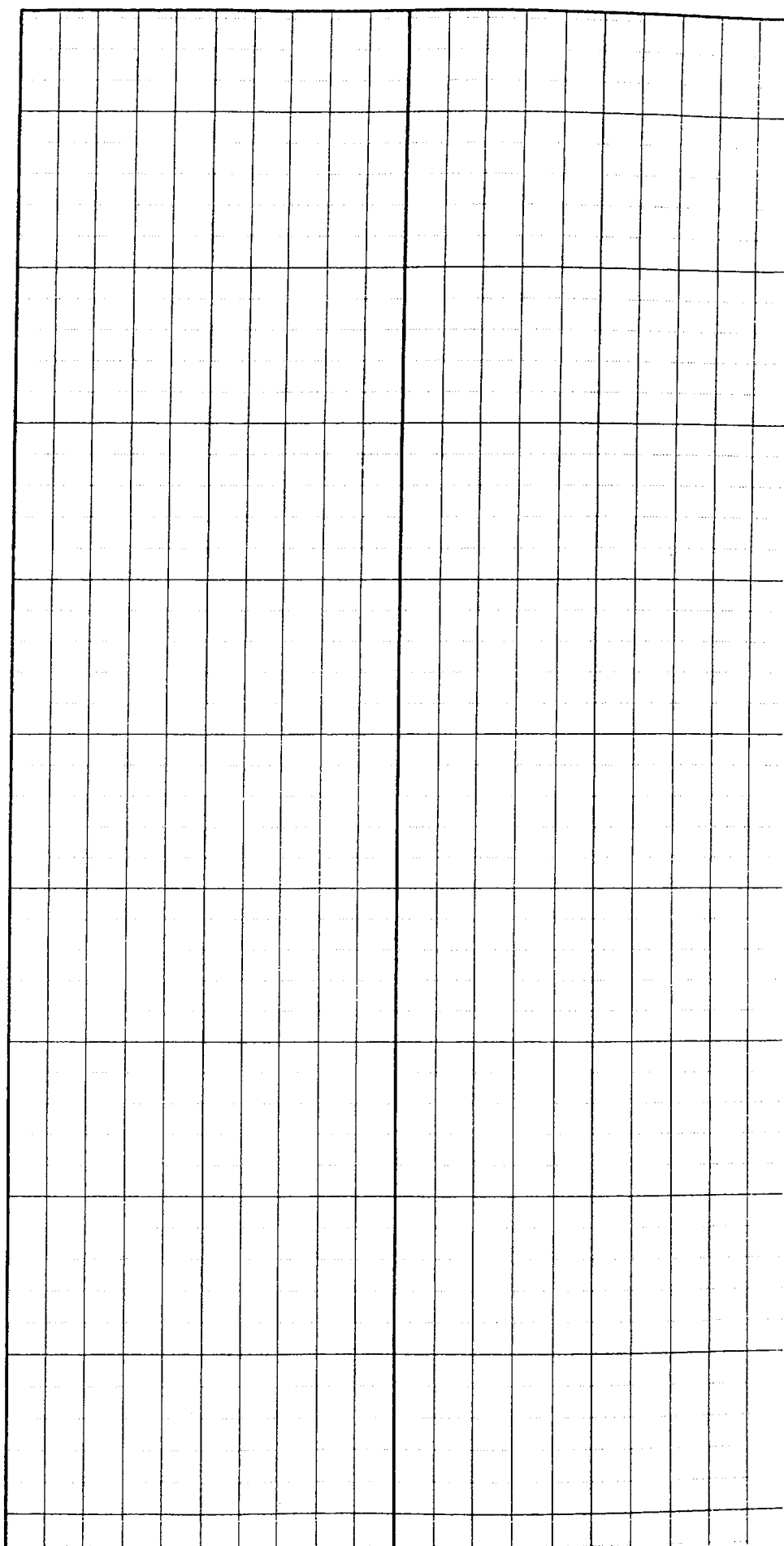
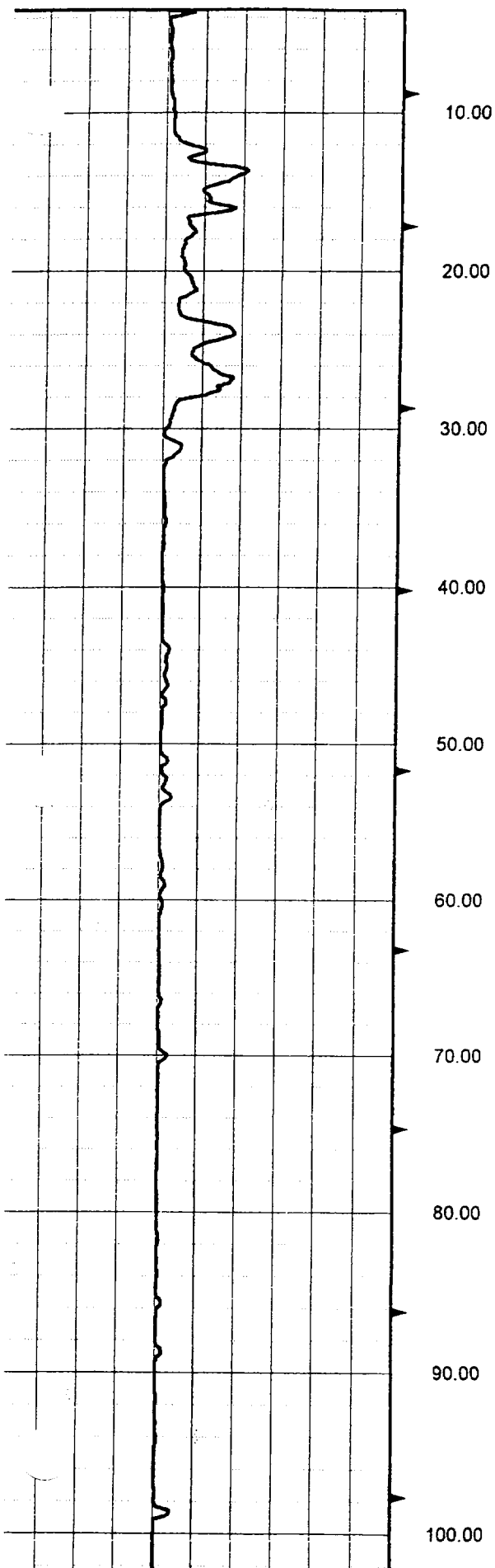
DATE	04/23/01	04/23/01	
RUN#	1	0	0
TYPE OF LOG	3ACS	3ACS	
DEPTH DRILLER	130.00	130.00	0.00
DEPTH LOGGER	128.70	128.50	0.00
LOG DEEPEST	128.60	0.00	0.00
LOG SHALLOW	7.00	0.00	0.00
FLUID IN HOLE	WATER	WATER	
SALINITY			
DENSITY			
LEVEL	?	?	
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	DJONES	d jones	
WITNESSED BY	J HELMS	j helms	

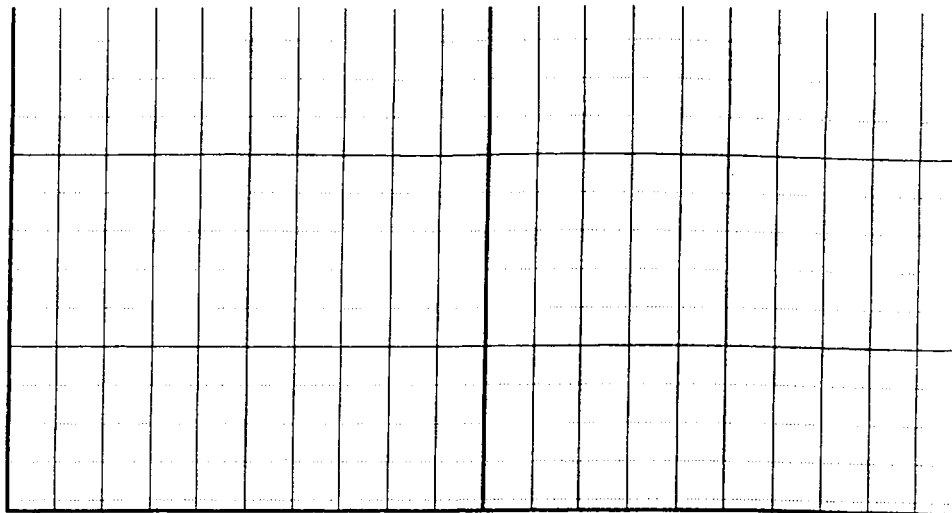
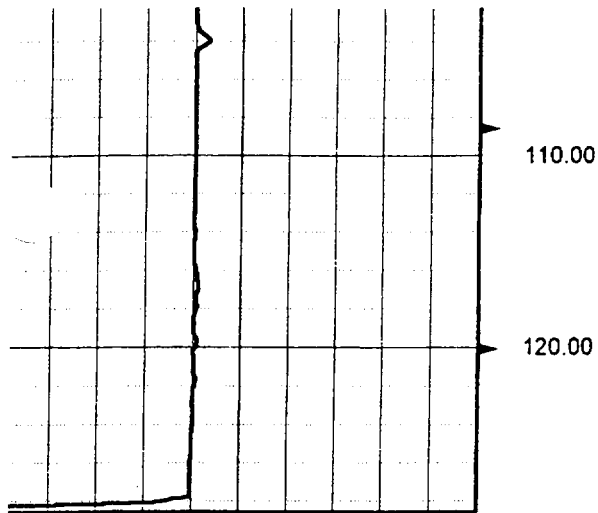
RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	4.00	0.00	130.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01FC.hed )

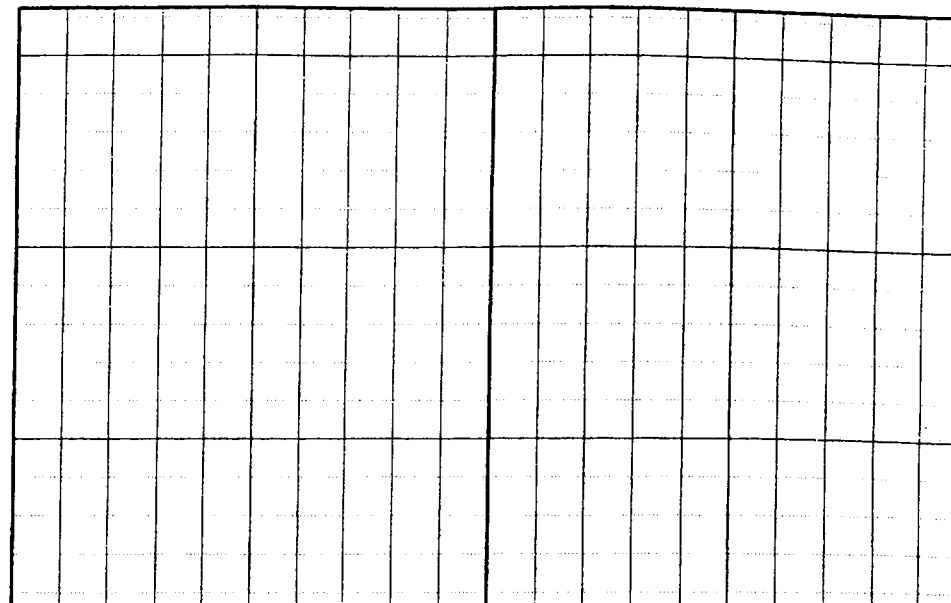
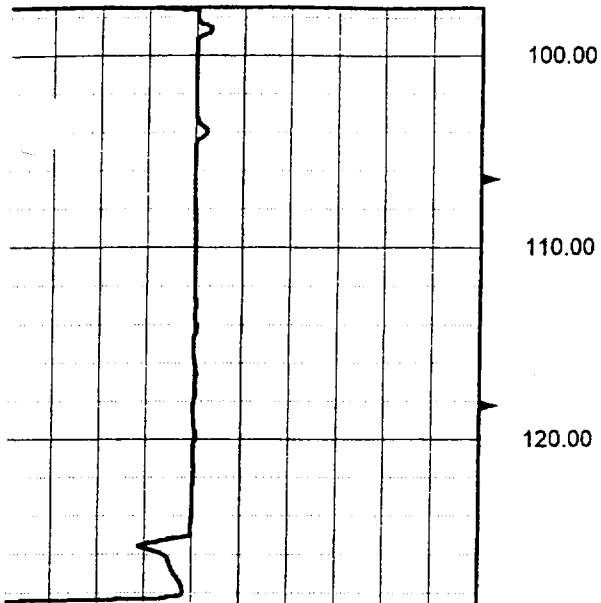
run 2 = repeat caliper log







0.00 CALP Inch 10.00



**RUN 2 REPEAT**



# ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY  
WELL 01-G  
FIELD DCPD ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.: NA  
LONG.:

OTHER SERVICES  
OPTV

Perm. Datum Elev 315  
Log. Datum GROUND  
Drill Datum GROUND

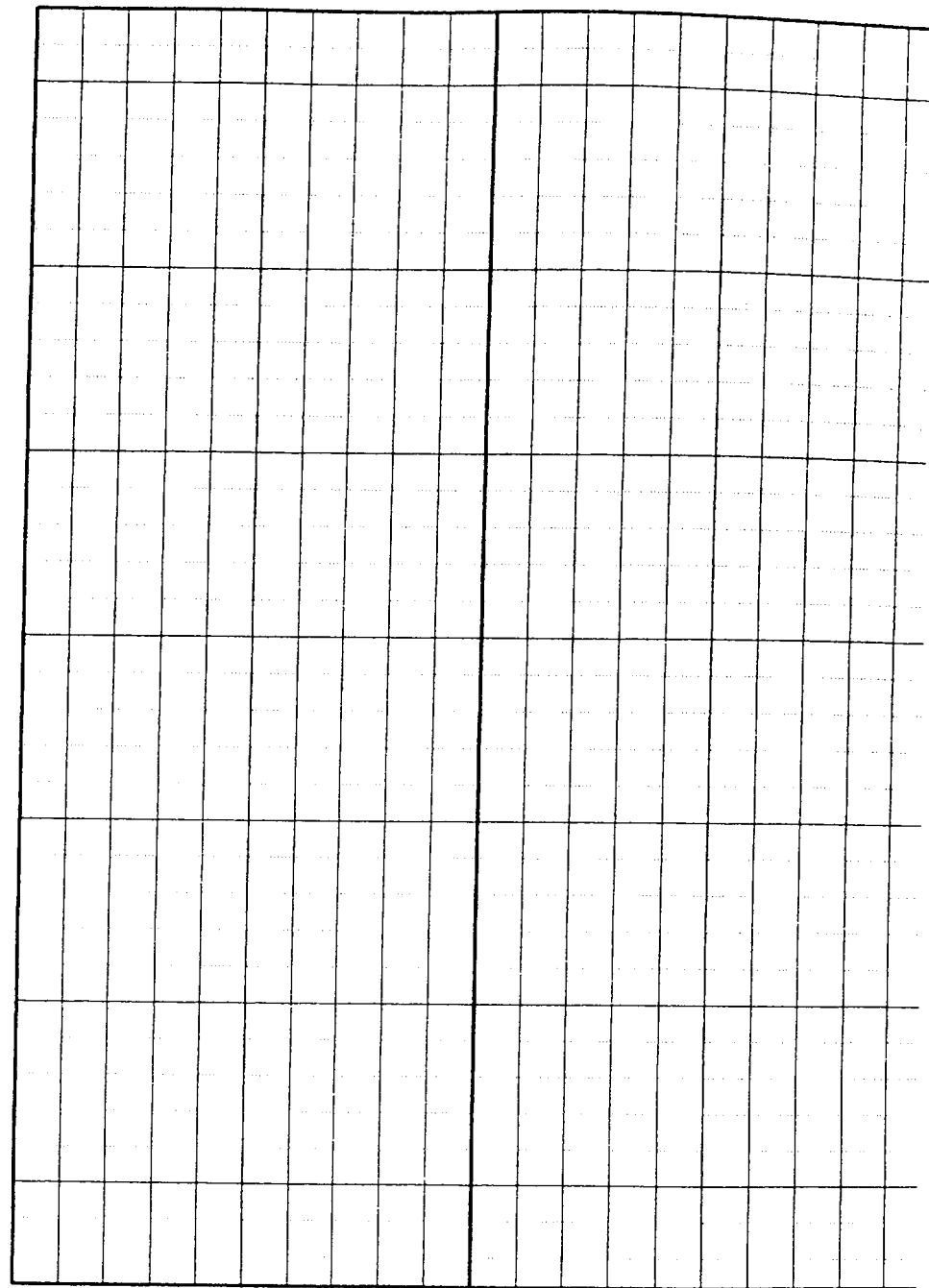
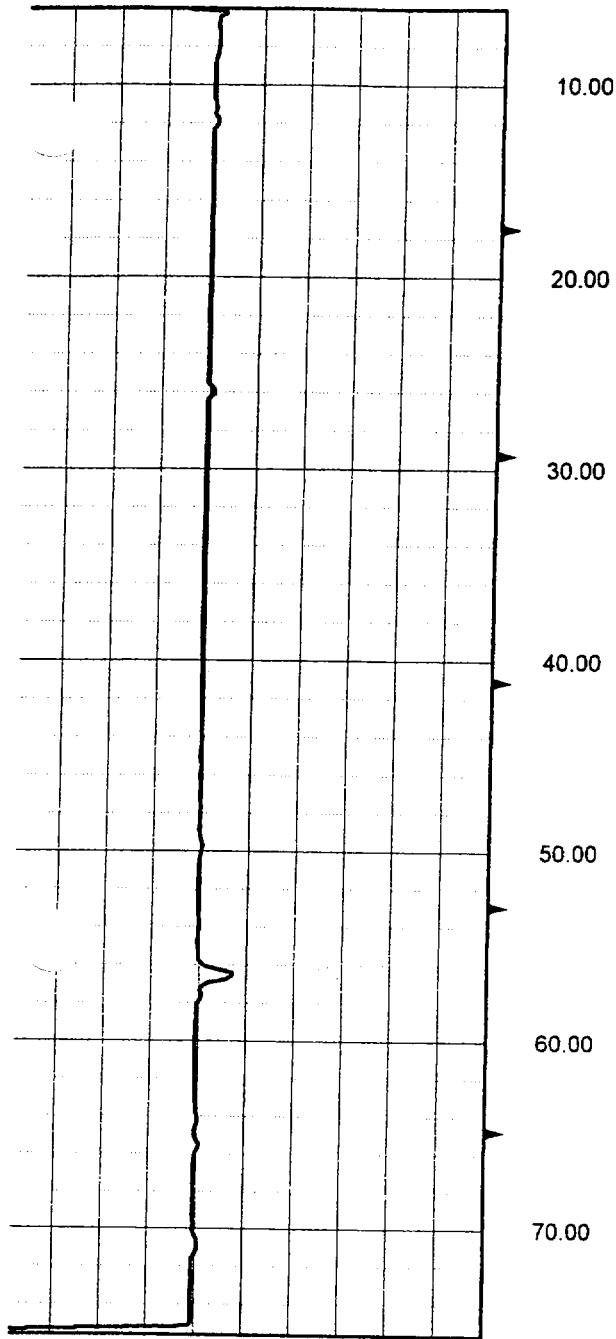
KB 0.00  
DF 0.00  
GL 0.00

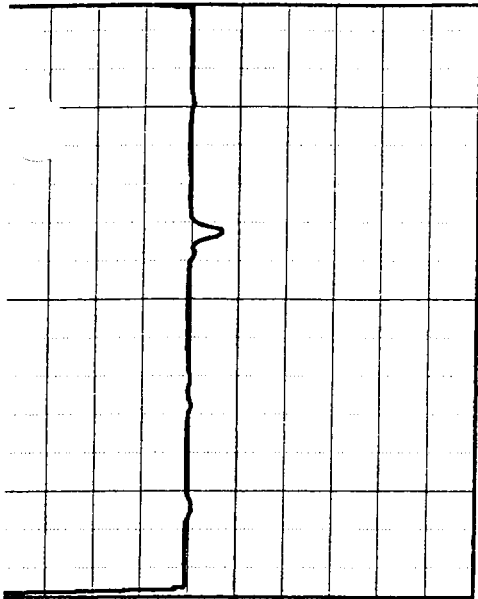
DATE	04/20/01	04/20/01	04/20/01
RUN#	1	0	0
TYPE OF LOG	3ACS	3acs	
DEPTH DRILLER	75.00	75.00	0.00
DEPTH LOGGER	75.55	75.50	0.00
LOG DEEPEST	75.55	75.50	0.00
LOG SHALLOW	45.00	44.60	0.00
FLUID IN HOLE	WATER	WATER	
SALINITY			
DENSITY			
LEVEL	71	?	
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	DJONES	D JONES	
WITNESSED BY	J HELMS	J HELMS	

RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	4.00	0.00	76.00	6.00	0.00	0.00	0.50
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01G.hed )

ALL TERRAIN DRILLING  
RUN 2 = REPEAT CALIPER LOG

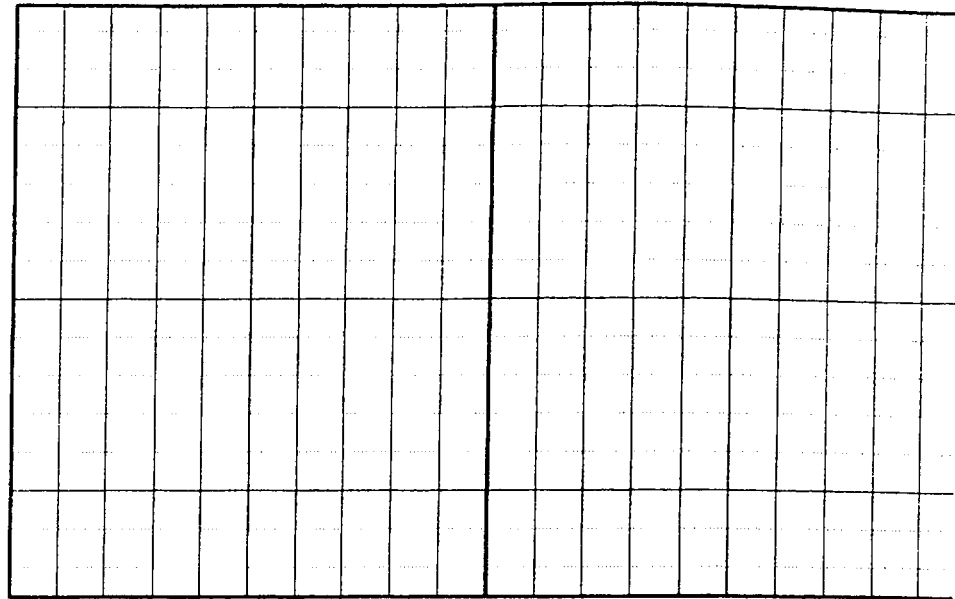




50.00

60.00

70.00



**RUN 2 REPEAT**



# ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY WLA  
WELL 01-H  
FIELD DCPPI SFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.: NA  
LONG.:

OTHER SERVICES

OPTV

Perm. Datum Elev 346  
Log. Datum GROUND  
Drill Datum GROUND

KB 0.00  
DF 0.00  
GL 0.00

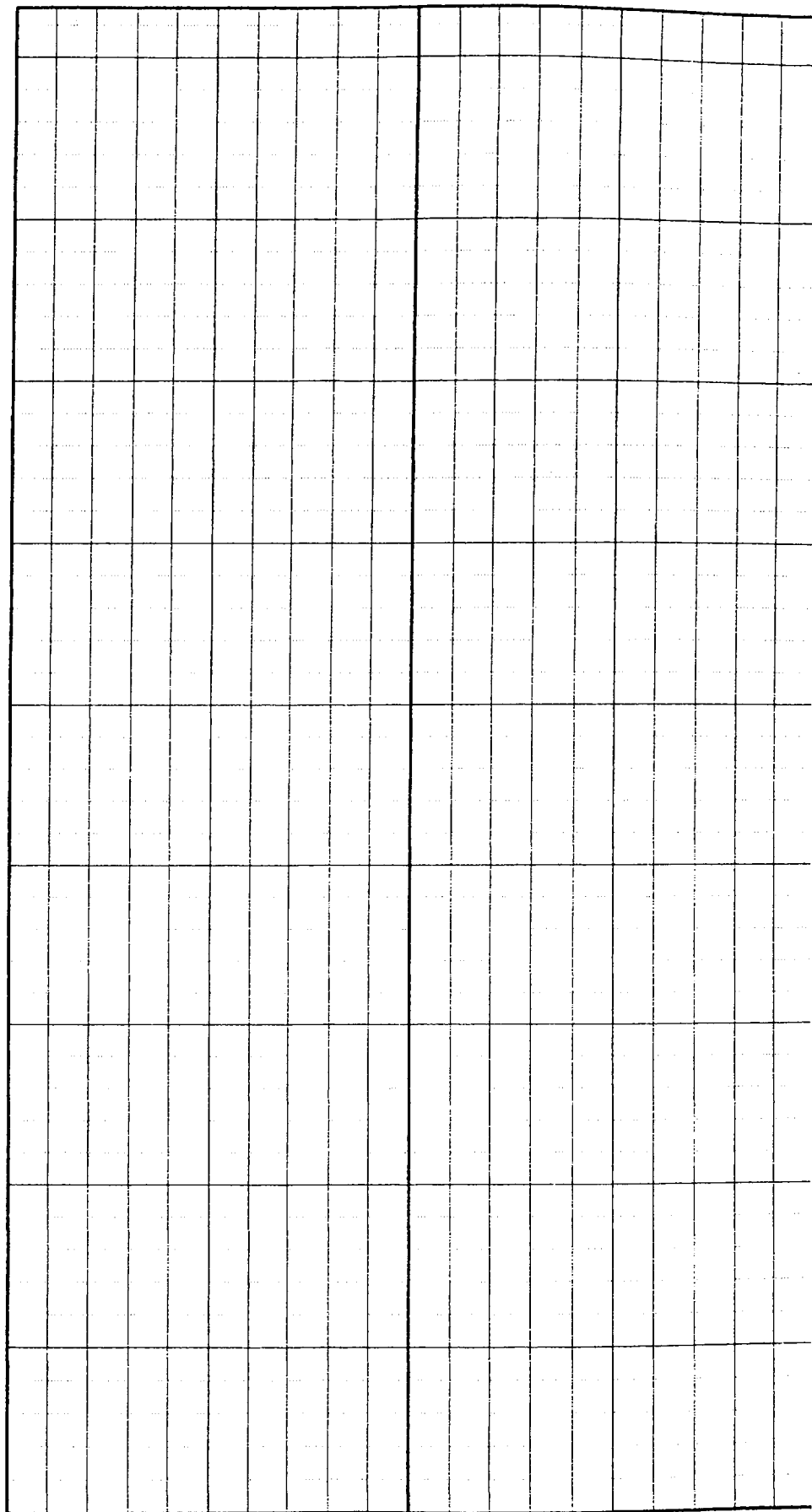
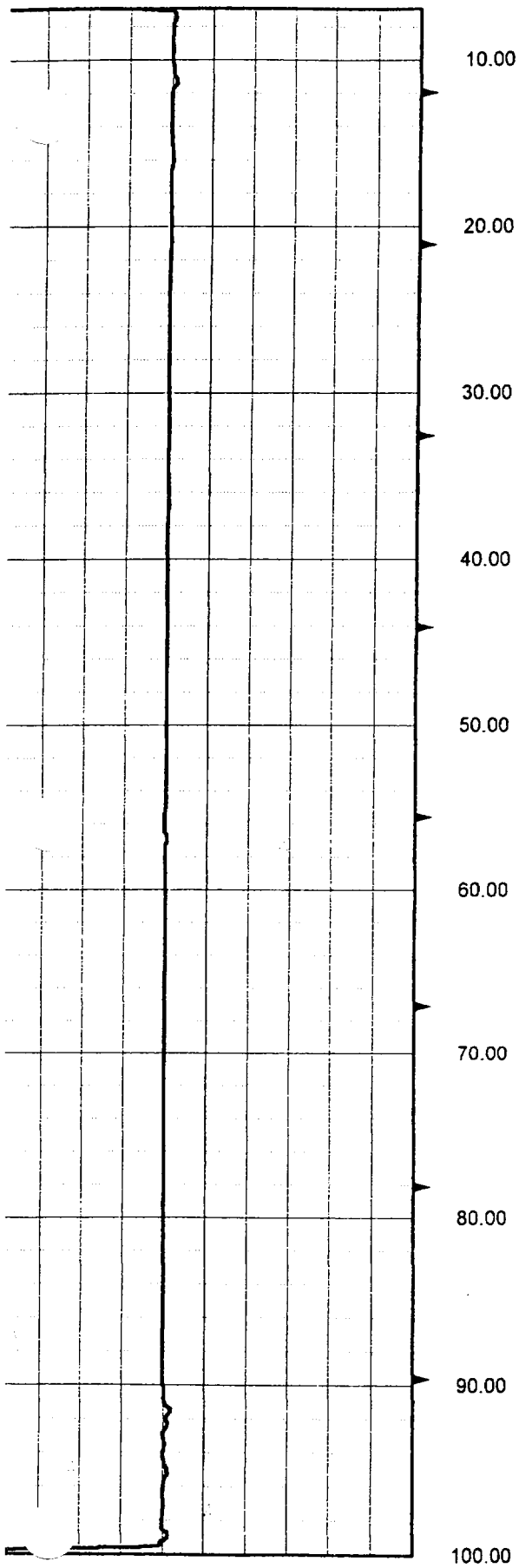
DATE	21/04/01	21/04/01	04/20/01
RUN#	1	0	0
TYPE OF LOG	3ACS	3ACS	
DEPTH DRILLER	101.00	101.00	0.00
DEPTH LOGGER	0.00	100.00	0.00
LOG DEEPEST	100.00	100.00	0.00
LOG SHALLOW	7.00	70.00	0.00
FLUID IN HOLE	WATER	WATER	
SALINITY			
DENSITY			
LEVEL	?	?	
MAX TEMP °C	0.00	0.00	20.00
RIG TIME			
RECORDED BY	DJONES	D JONES	
WITNESSED BY	C WEAVER	c weaver	

RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	4.00	0.00	101.00	0.00	0.00	0.00	0.00
0	4.30	6.00	200.00	6.00	0.00	0.00	6.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REMARKS ( C:\boreholeclients\diablo2\01HC1.hed )

FLUSHED WITH FRESH WATER

run 2 = repeat caliper section

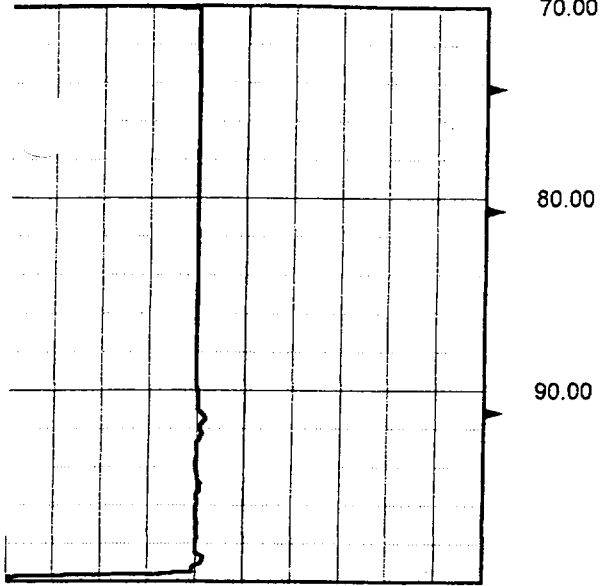




CALP Inch

0.00

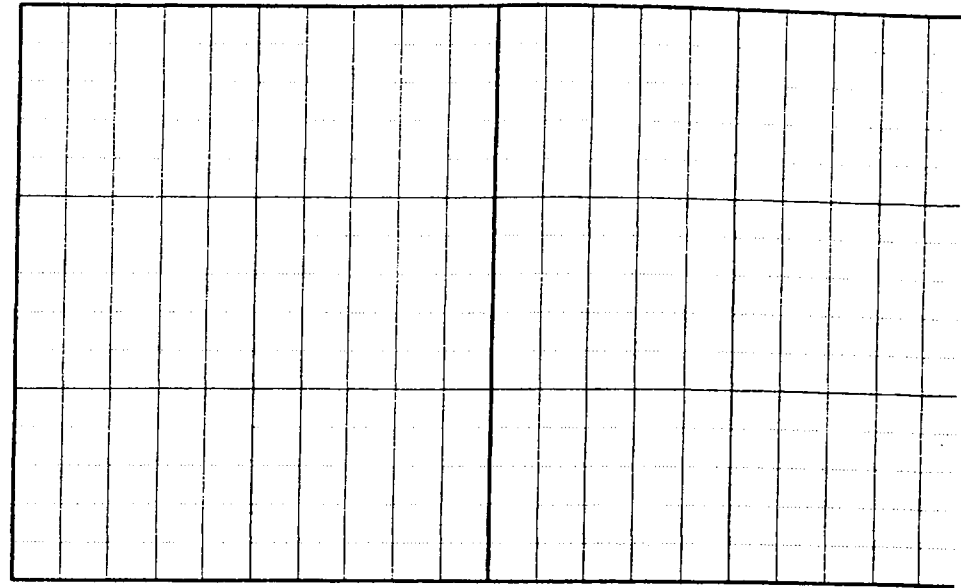
10.00



70.00

80.00

90.00



**RUN 2 REPEAT**



ROBERTSON GEOLOGGING TECHNOLOGY

DIABLO CANYON

THREE-ARM CALIPER

COMPANY  
WELL 01-I  
FIELD DCPPI ISFSI  
COUNTRY USA  
STATE CA  
COUNTY  
LAT.:  
LONG.:

OTHER SERVICES  
OPTV

Perm. Datum	Elev	575	KB	0.00
Log. Datum	GROUND		DF	0.00
Drill Datum	GROUND		GL	0.00

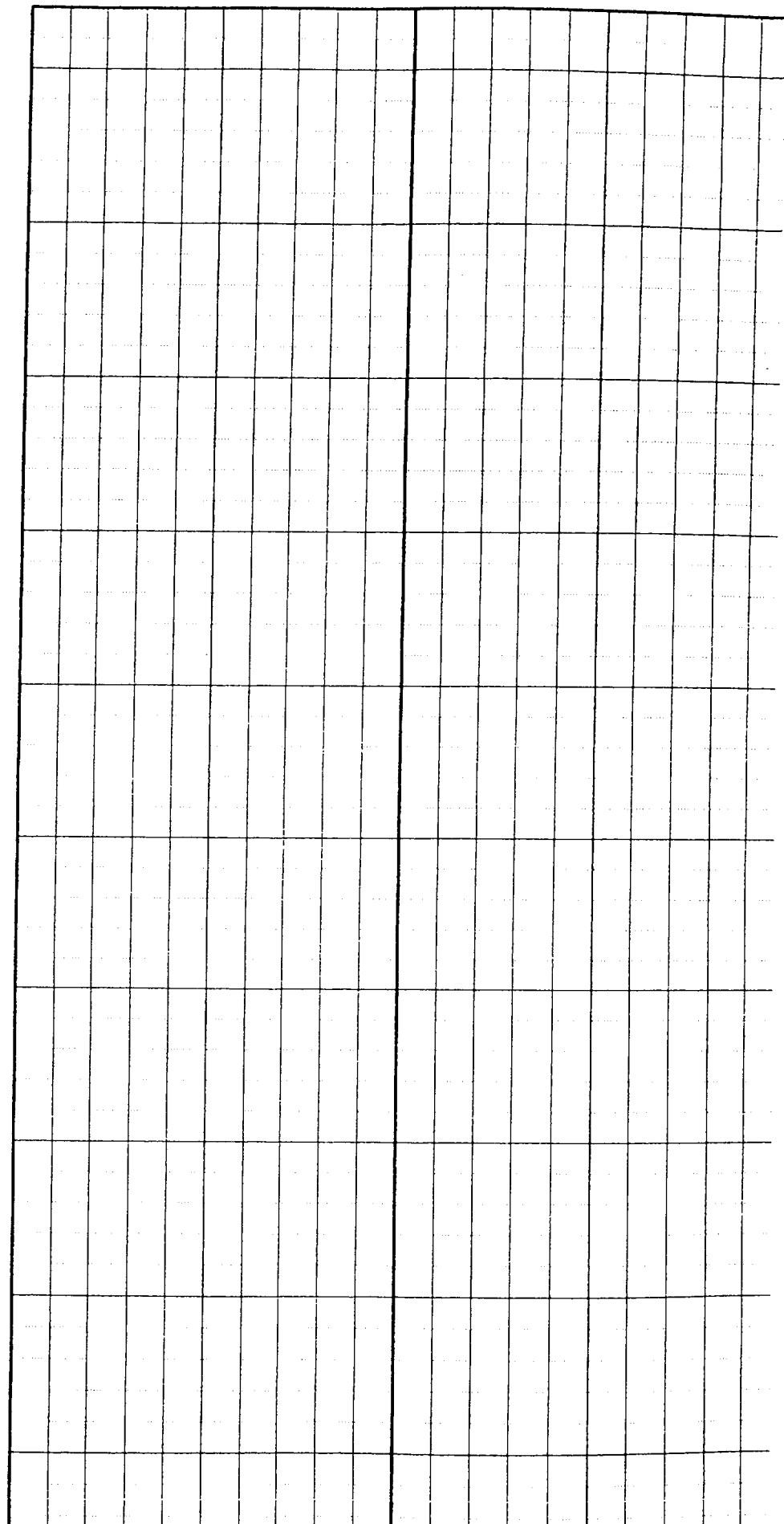
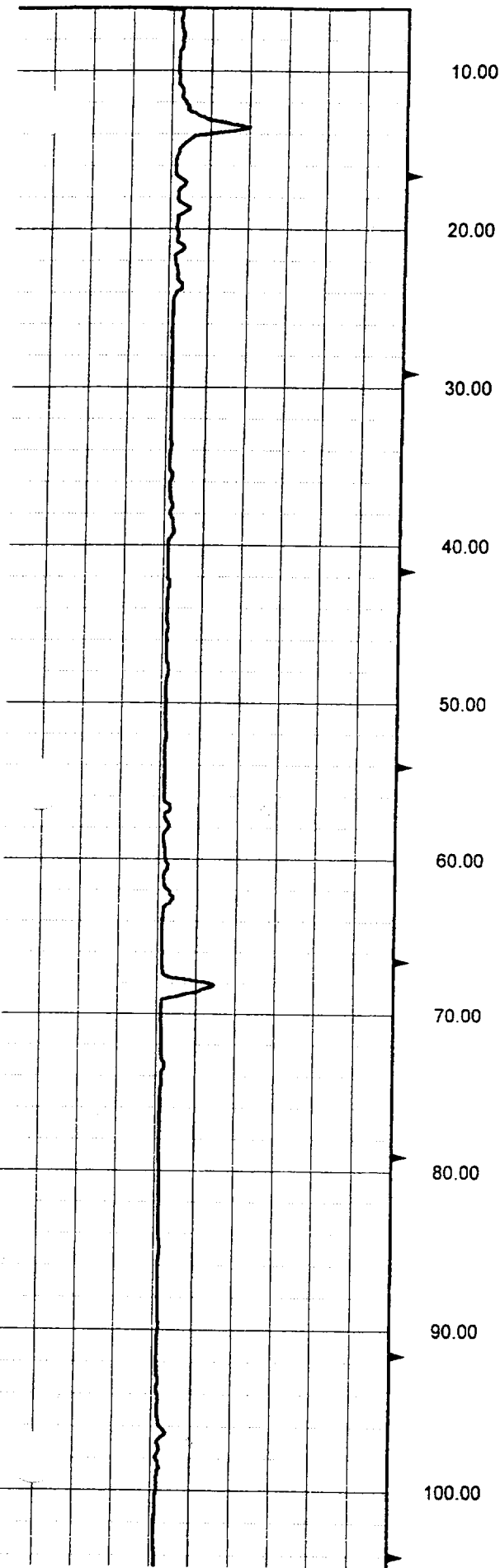
DATE	28/04/01	28/04/01	0
RUN#	1	0	0
TYPE OF LOG	3ACS	3acs	
DEPTH DRILLER	321.00	321.00	0.00
DEPTH LOGGER	320.20	320.00	0.00
LOG DEEPEST	320.20	320.00	0.00
LOG SHALLOW	5.50	269.00	0.00
FLUID IN HOLE	WATER	water	
SALINITY			
DENSITY			
LEVEL	?		
MAX TEMP °C	0.00	0.00	0.00
RIG TIME			
RECORDED BY	w henrich	W HENRICH	
WITNESSED BY	c brankman	c brankman	

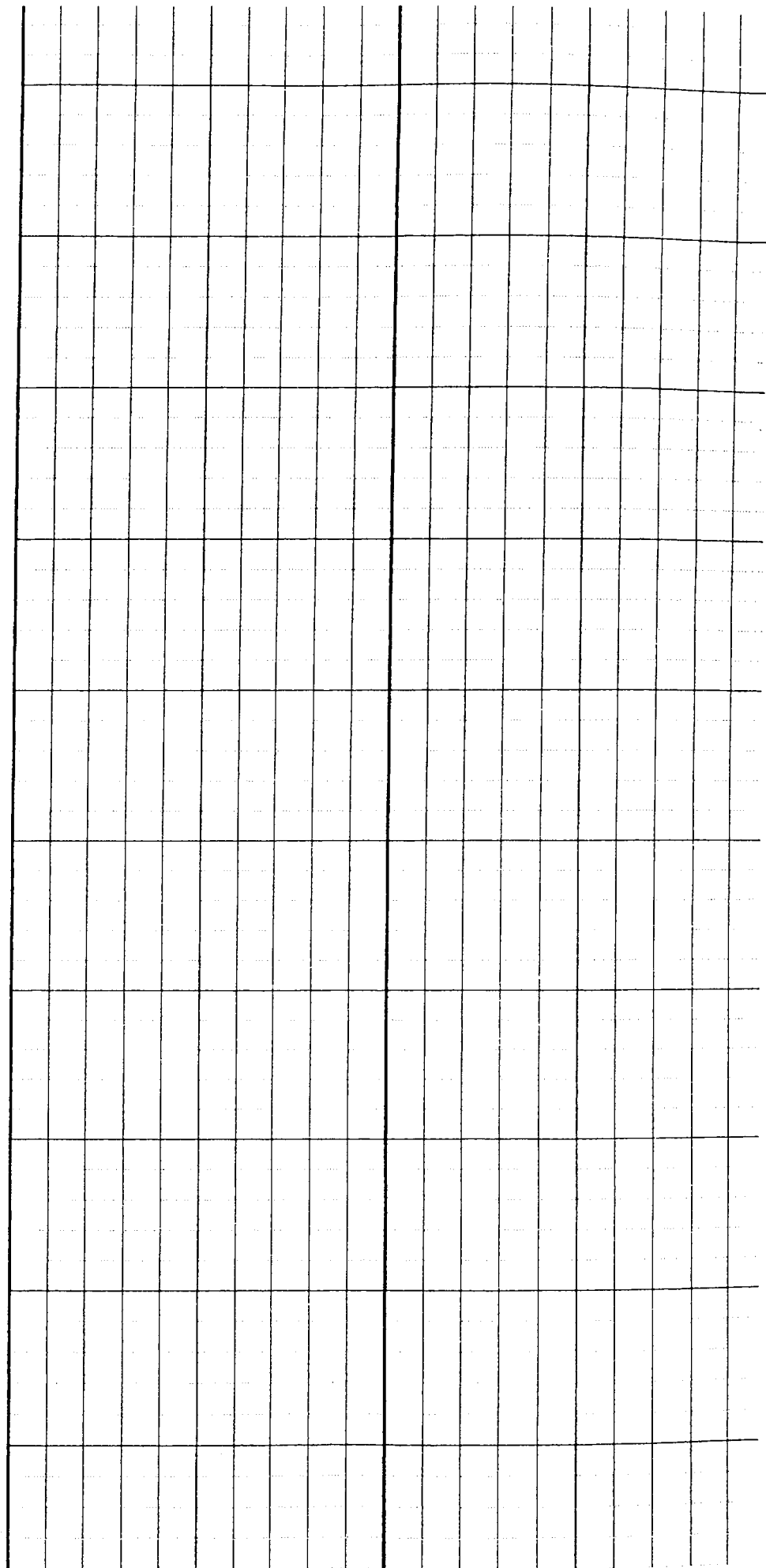
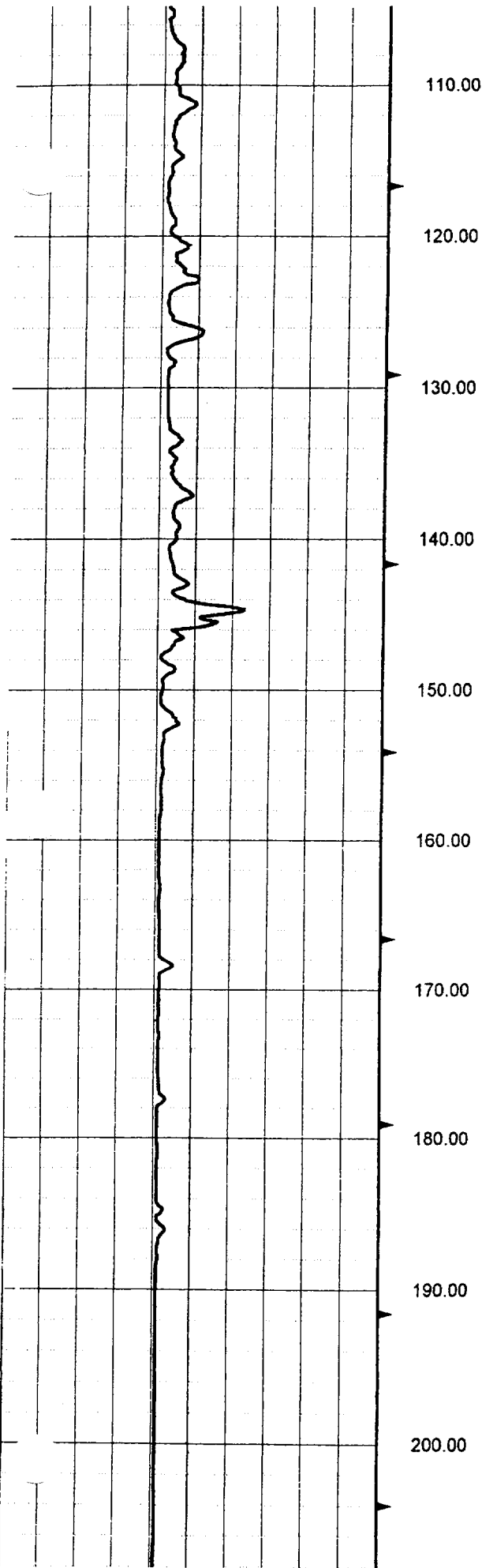
RUN#	BIT RECORD			CASING RECORD			
	BIT	FROM	TO	BIT	WEIGHT	FROM	TO
1	4.00	0.00	81.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	4	4.00	320.20	6.00	0.00	0.00	4.0

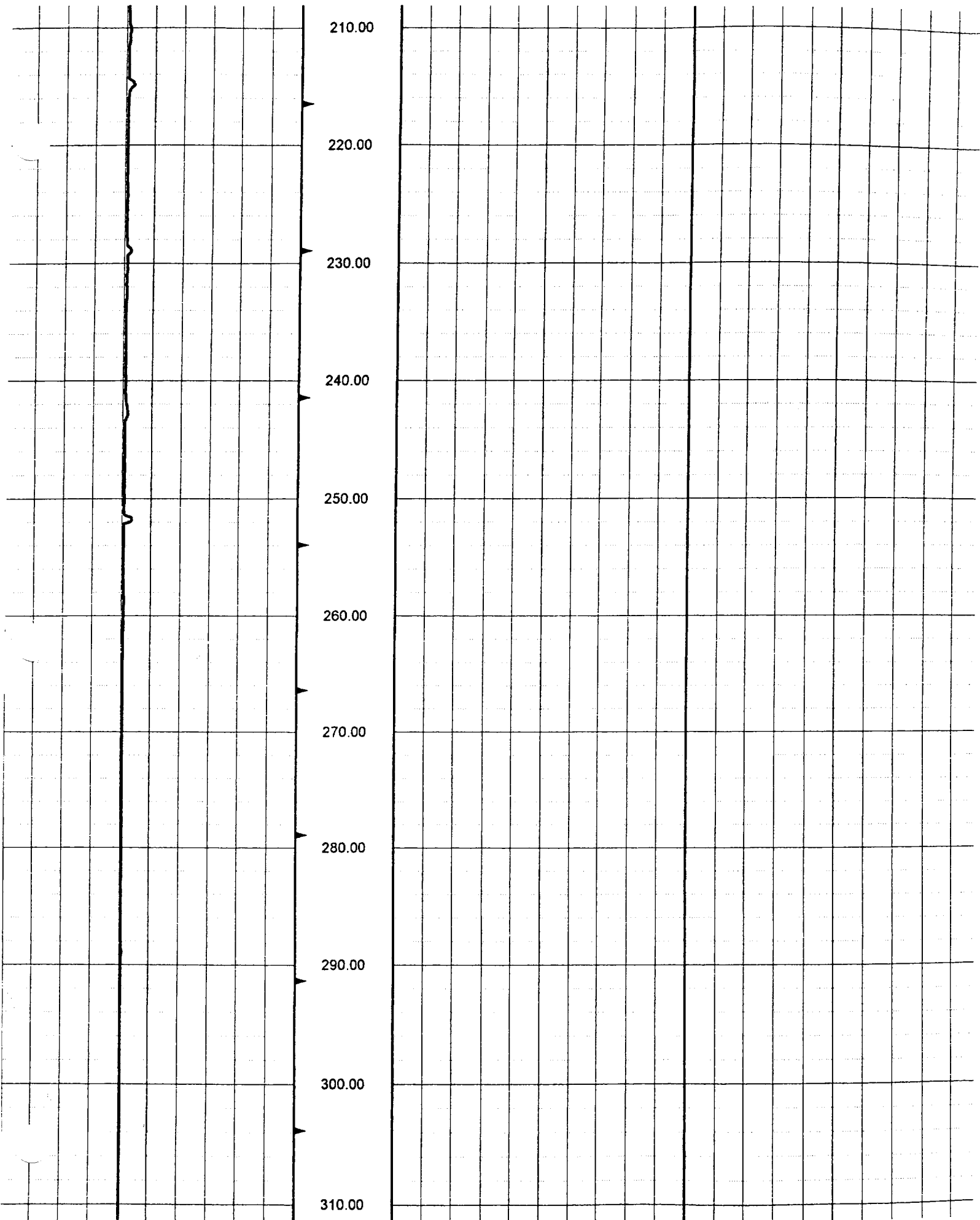
REMARKS ( C:\boreholeclients\diablo2\01-ic.hed )

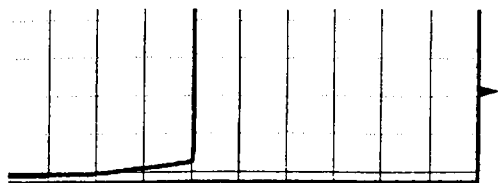
run 2 = caliper repeat.  
borehole completed on 04-23-01

SPUDDING BOREHOLE WITH CALIPER PROBE

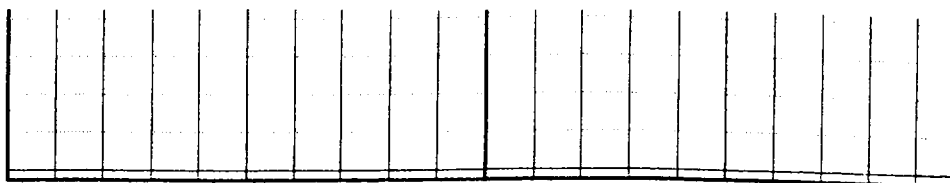


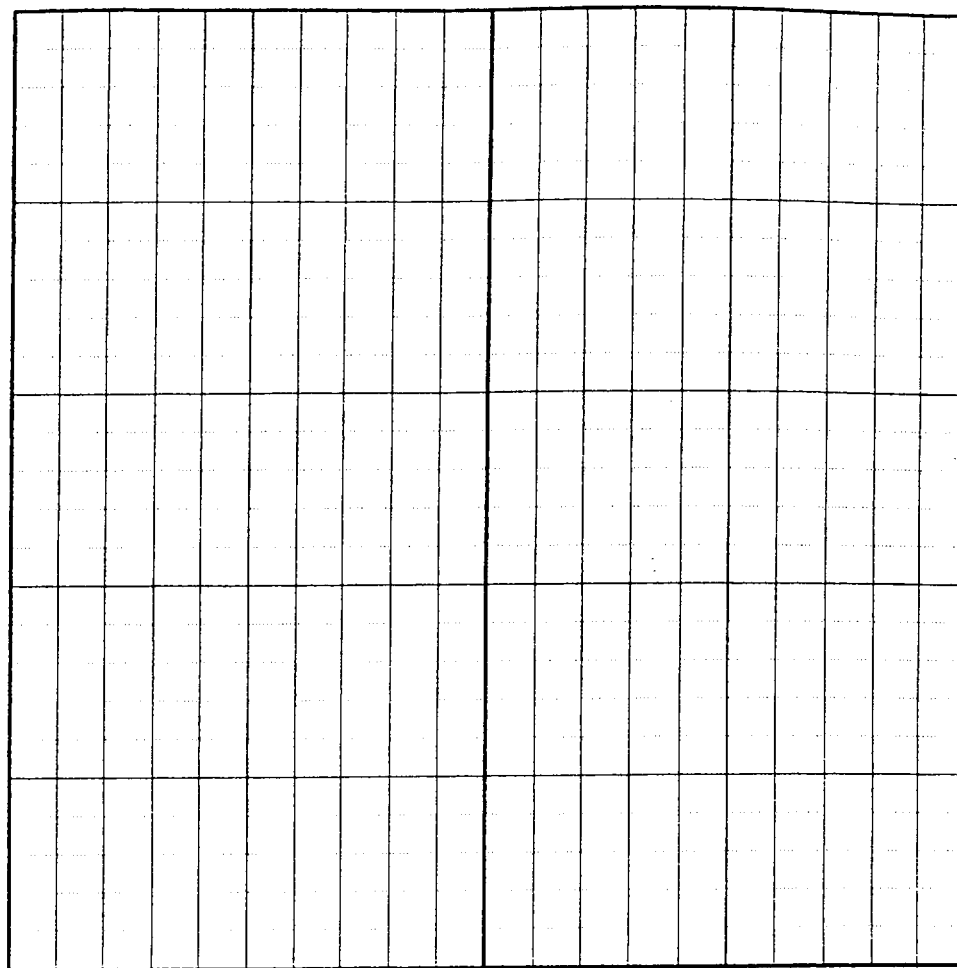
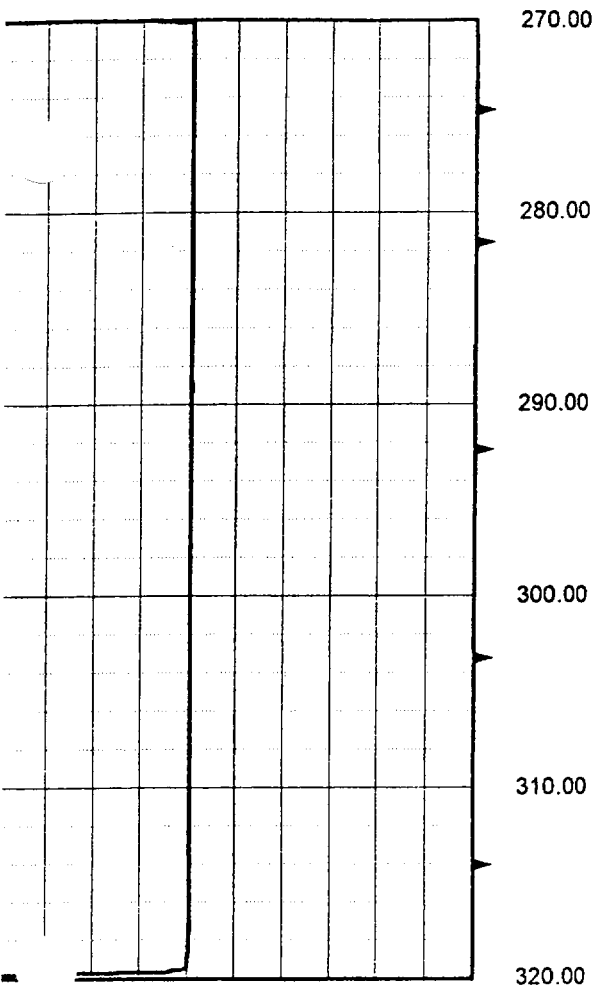






320.00





**RUN 2 REPEAT**

CALIBRATION FILE GENERATED BY RG - WINLOGGER  
for CALIPER BOREHOLES: 01-CTF-A, 01-A, 01-G

[General]

LastModified=20/04/01

Sonde=3ACS

SerialNo=3555

[Channel2]

LastCalibration=20/04/01

NextCalibration=20/04/01

CalibrationInterval=0 days

CalibrationMethod=Polynom

Coefficient0=-7.535512965

Coefficient1=0.001127395716

Coefficient2=0

Coefficient3=0

JigCount=2

ReferencePoint0=8458 CPS at 2 Inch

ReferencePoint1=12006 CPS at 6 Inch

ReferencePoint2=13789 CPS at 8 Inch



CALIBRATION FILE GENERATED BY RG - WINLOGGER  
for CALIPER LOG BOREHOLES: 01-D, 01-E, 01-H

[General]

LastModified=21/04/01

Sonde=3ACS

SerialNo=3555

[Channel2]

LastCalibration=21/04/01

NextCalibration=21/04/01

CalibrationInterval=0 days

CalibrationMethod=Polynom

Coefficient0=-7.281423804

Coefficient1=0.001112347052

Coefficient2=0

Coefficient3=0

JigCount=2

ReferencePoint0=8344 CPS at 2 Inch

ReferencePoint1=11940 CPS at 6 Inch

ReferencePoint2=13789 CPS at 8 Inch

CALIBRATION FILE GENERATED BY RG - WINLOGGER  
for CALIPER LOG BOREHOLES 01-B, 01-F, 01-E LOWER SECTION

[General]

LastModified=23/04/01

Sonde=3ACS

SerialNo=3555

[Channel2]

LastCalibration=23/04/01

NextCalibration=23/04/01

CalibrationInterval=0 days

CalibrationMethod=Polynom

Coefficient0=-7.137665198

Coefficient1=0.001101321586

Coefficient2=0

Coefficient3=0

JigCount=2

ReferencePoint0=8297 CPS at 2 Inch

ReferencePoint1=11929 CPS at 6 Inch

ReferencePoint2=13789 CPS at 8 Inch

CALIBRATION FILE GENERATED BY RG - WINLOGGER  
for CALIPER BOREHOLES: 01-A LOWER SECTION, 01-C

[General]

LastModified=24/04/01

Sonde=3ACS

SerialNo=3555

[Channel2]

LastCalibration=24/04/01

NextCalibration=24/04/01

CalibrationInterval=0 days

CalibrationMethod=Polynom

Coefficient0=-7.506685633

Coefficient1=0.001137980085

Coefficient2=0

Coefficient3=0

JigCount=2

ReferencePoint0=8354 CPS at 2 Inch

ReferencePoint1=11869 CPS at 6 Inch

ReferencePoint2=13789 CPS at 8 Inch

CALIBRATION FILE GENERATED BY RG - WINLOGGER  
for CALIPER BOREHOLE 01-I

[General]

LastModified=28/04/01

Sonde=3ACS

SerialNo=3555

LastModified=28/04/01

Sonde=3ACS

SerialNo=3555

channel=CALP

CalibrationMethod=Polynom

Coefficient0=-7.84944564

Coefficient1=0.001239176197

Coefficient2=-5.827235083E-009

Coefficient3=0

JigCount=3

ReferencePoint0=8270 CPS at 2 Inch

ReferencePoint1=10036 CPS at 4 Inch

**Appendix B**

**INTERPRETED OPTV PLOTS**

LETTIS PGE

Borehole: 01-CTF-A COMPLETE

DCPP ISFSI

top of borehole.....

East:

North:

Al807

North ref. is true

Depth units are feet

Vertical scale: 1/8

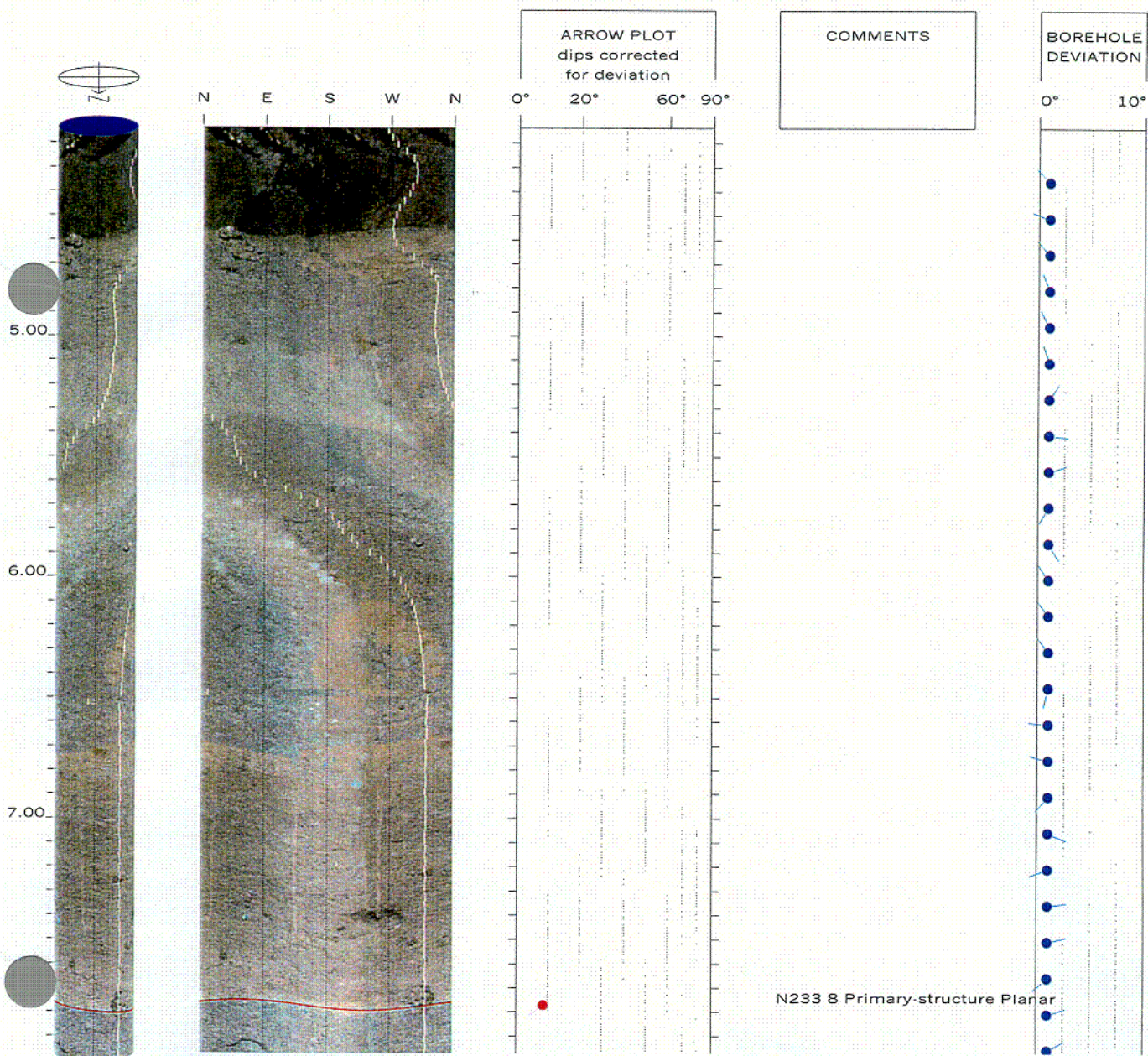
Horiz scale = vert scale

Zone from 47.475 to 4.137ft

Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE  
● Identified units



01-CTF-A COMPLETE  
Diablo Canyon ISFSI  
Data Report E, Rev. 0

7.974 to 4.137ft

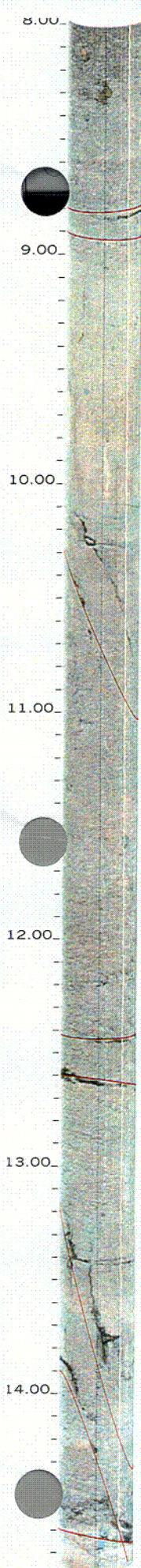
E-162 of 350

07 May 2001

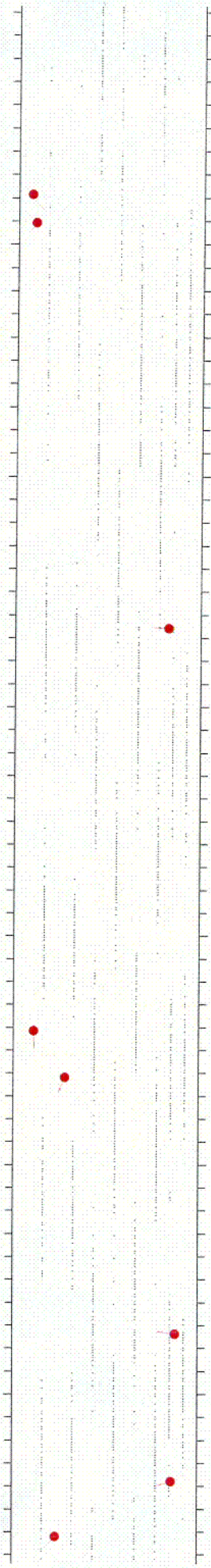
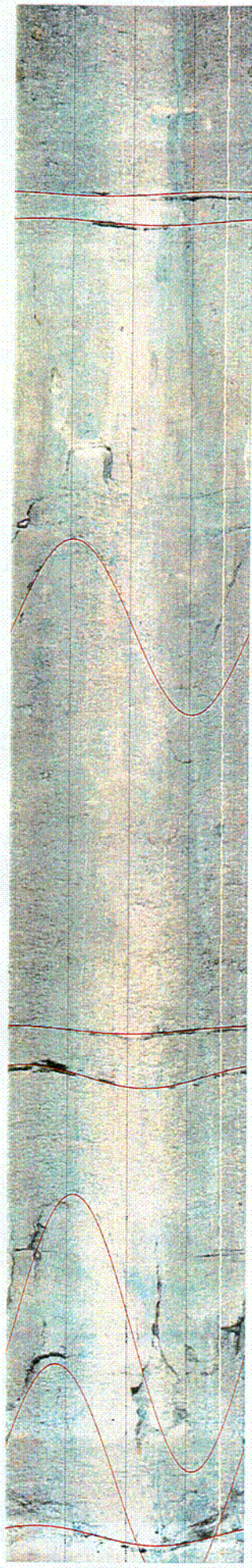
COL

## **VIII APPENDICES A THROUGH C**





01-CTF-A COMPLETE  
Diablo Canyon ISFSI  
Data Report E, Rev. 0



N144 4 Fracture Irregular  
N217 6 Fracture Irregular

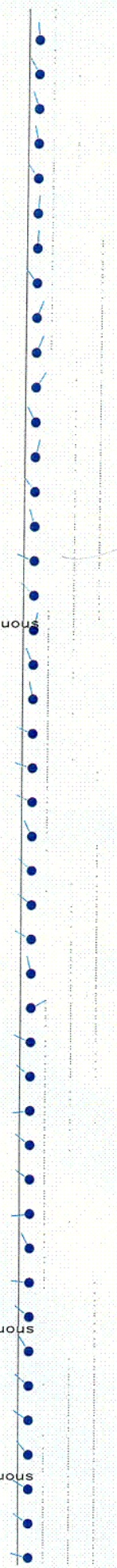
N274 67 Fracture Discontinuous

N178 7 Fracture Irregular  
N204 17 Fracture Irregular

N279 74 Fracture Discontinuous

N254 71 Fracture Discontinuous

N223 14 Fracture Irregular



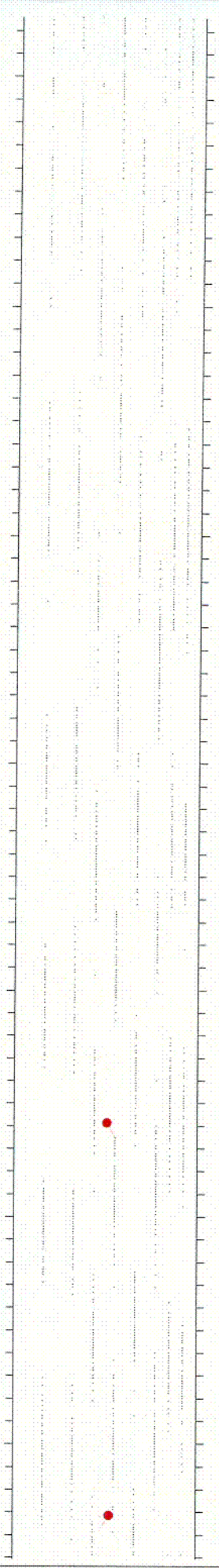
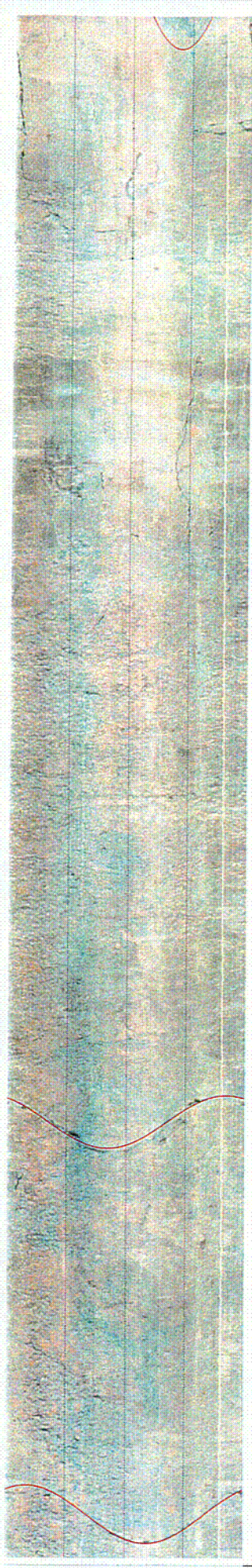
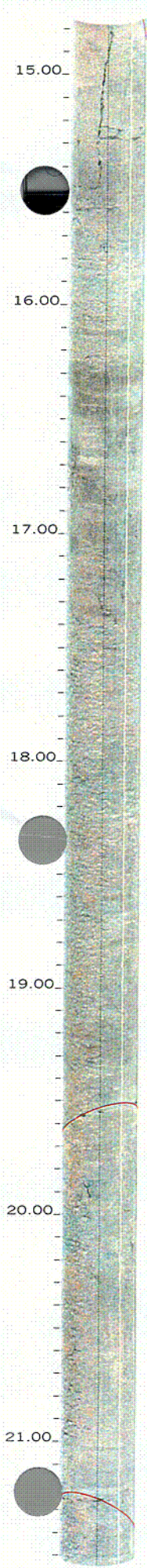
14.742 to 7.974ft

07 May 2001

E-164 of 350

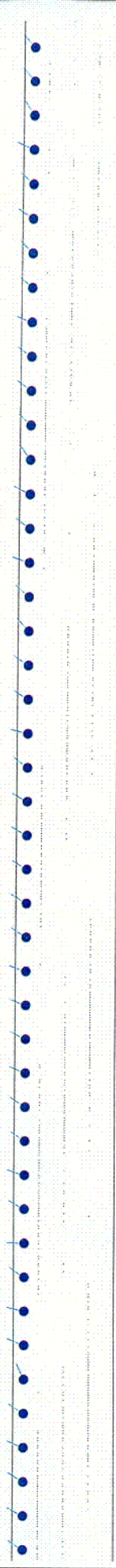
002





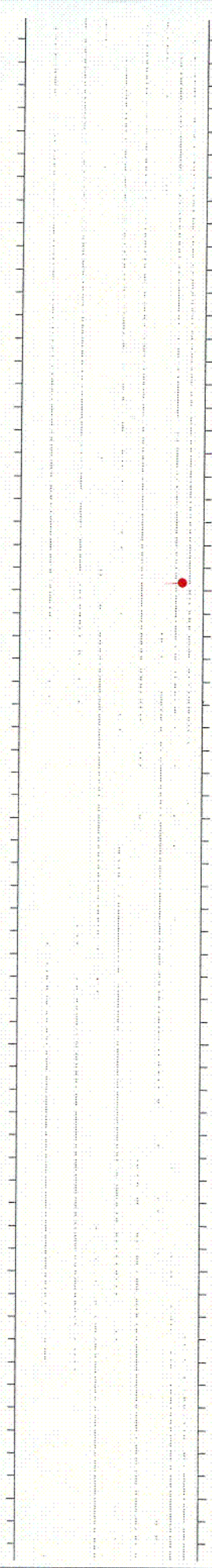
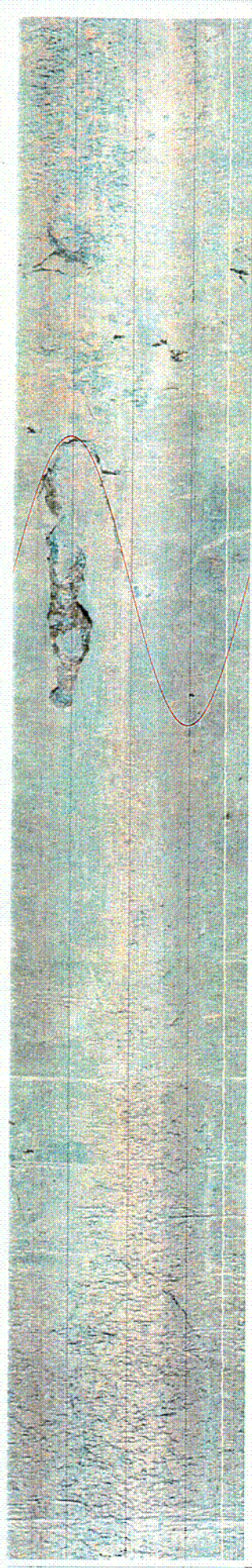
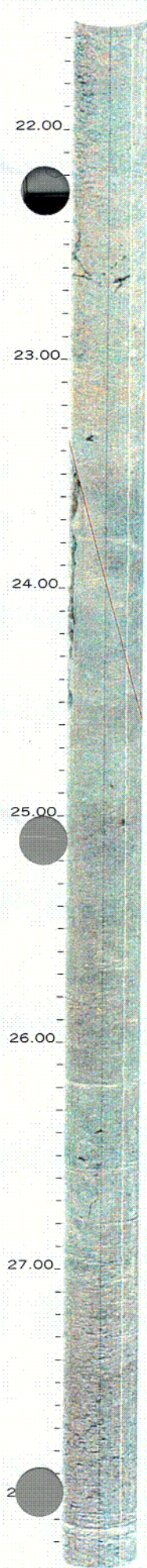
N151 36 Fracture Planar

N211 37 Fracture Planar

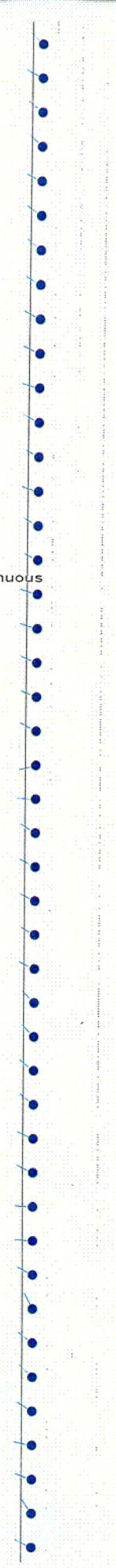


C03



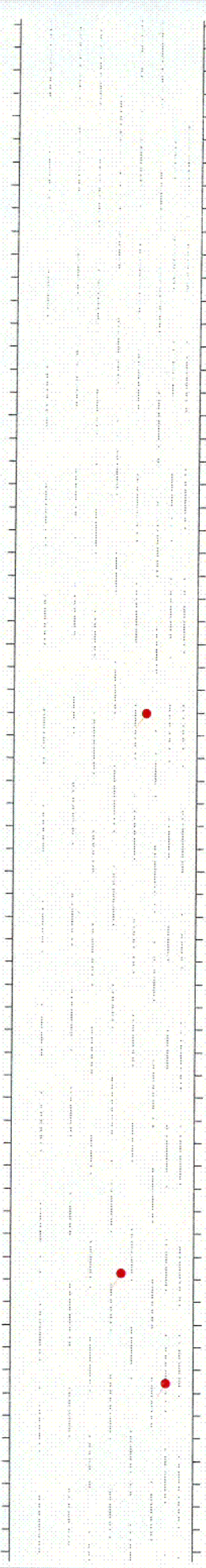
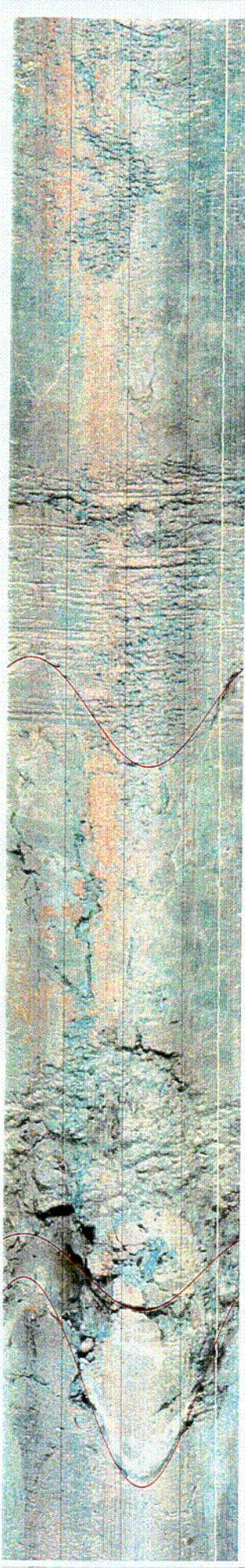
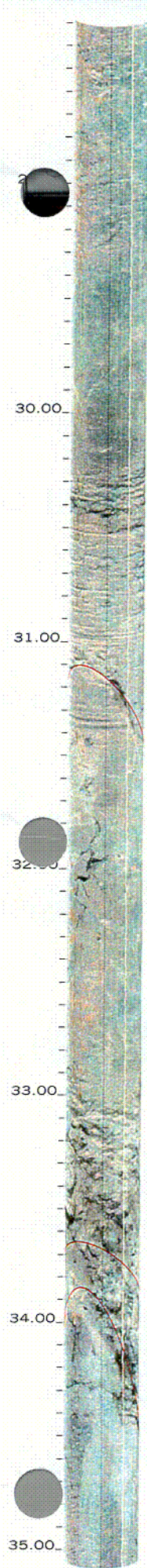


N267 74 Fracture Discontinuous



C024

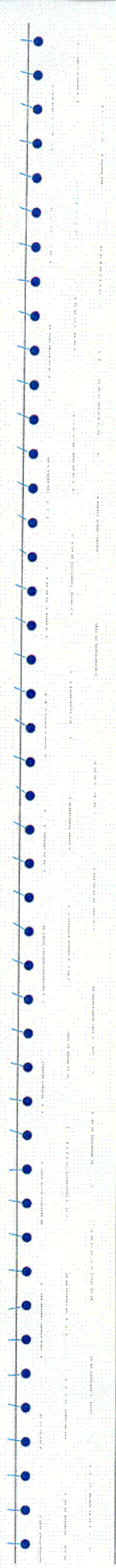




N216 55 Fracture Irregular

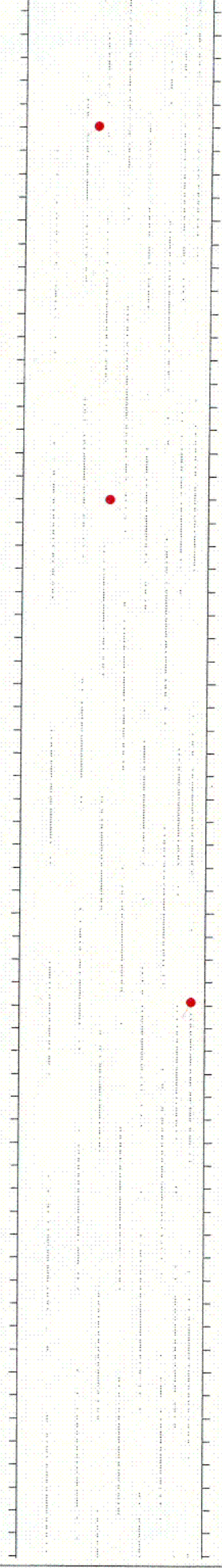
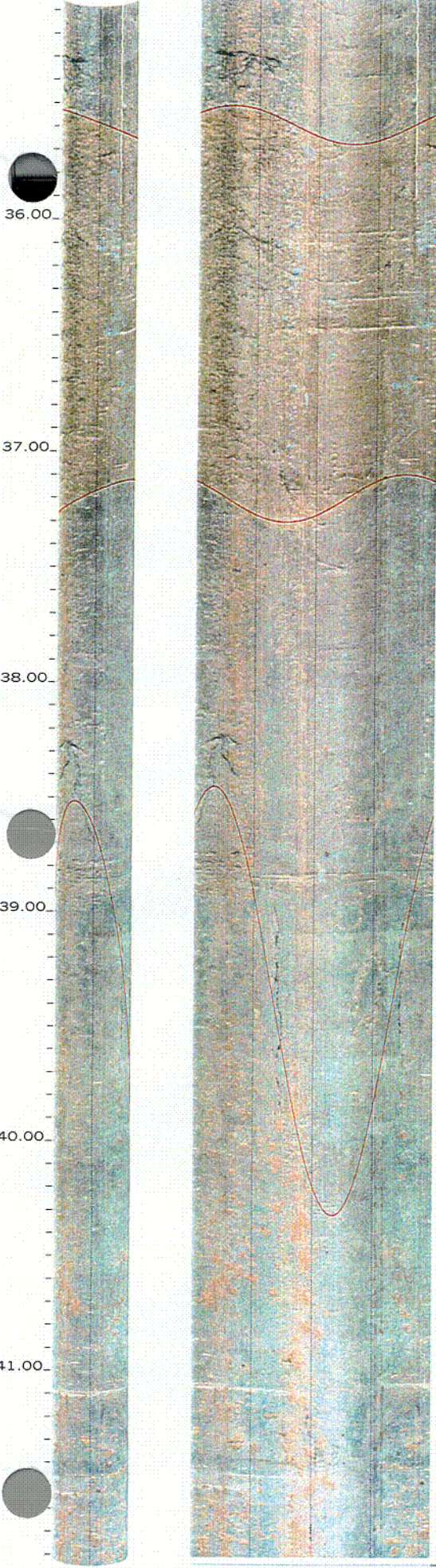
N211 45 Fracture Irregular

N212 70 Fracture Irregular



C05

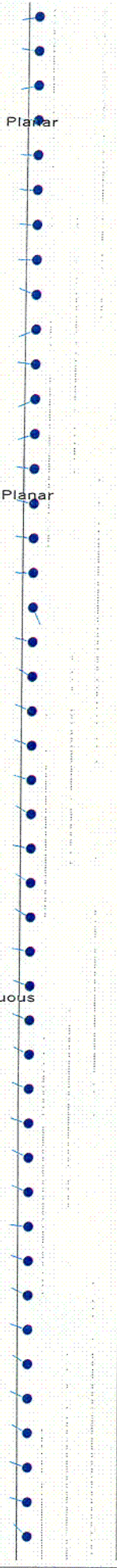




N232 25 Primary-structure Planar

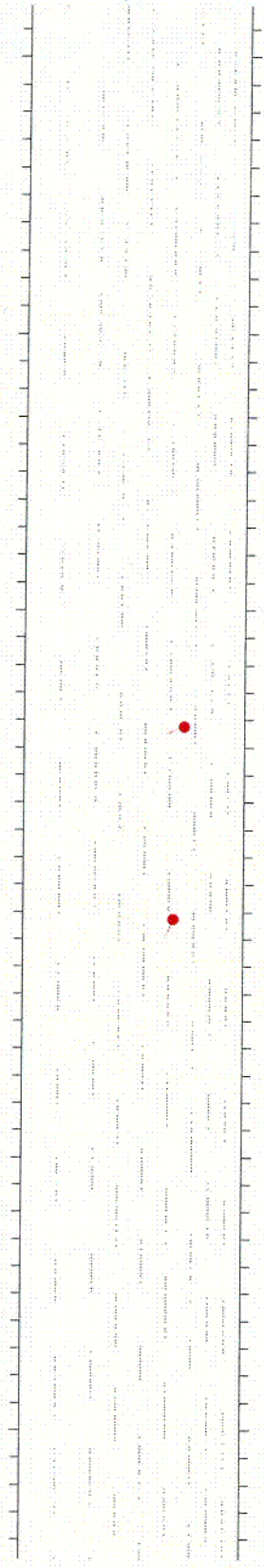
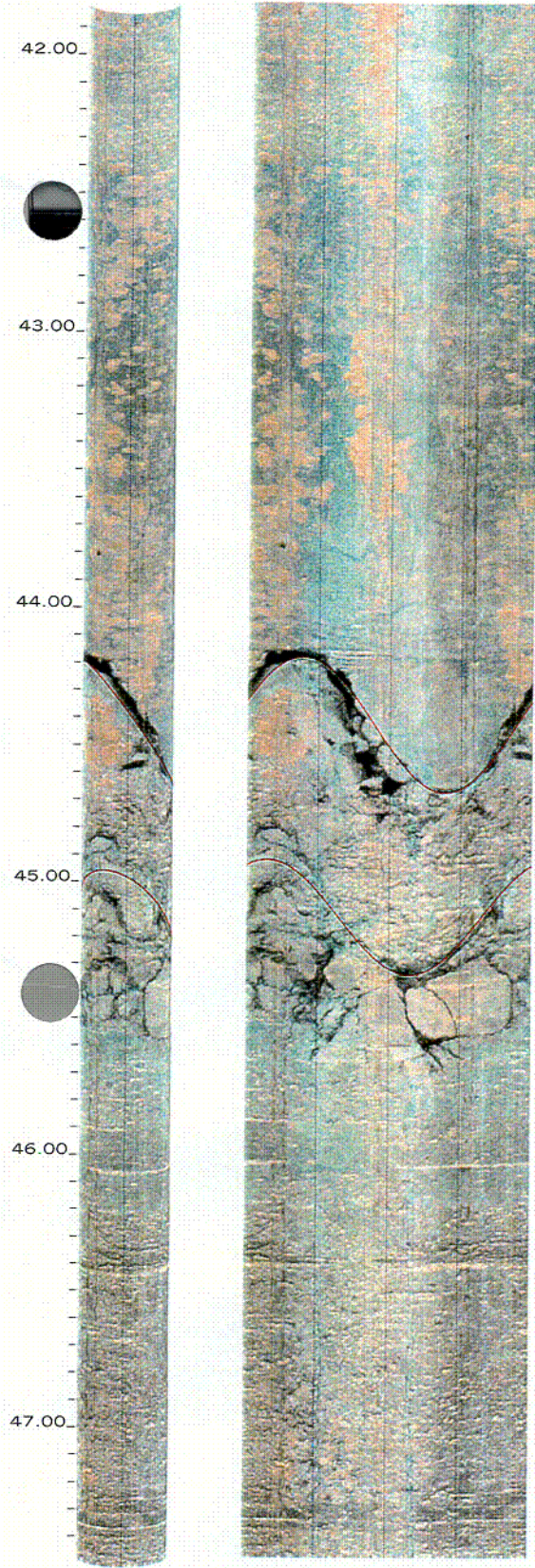
N134 33 Primary-structure Planar

N210 80 Fracture Discontinuous



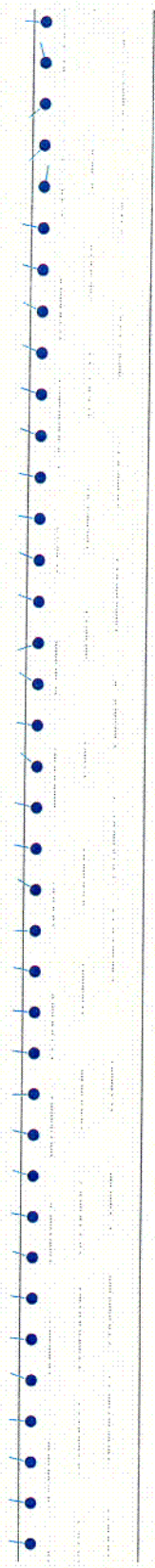
006





N250 55 Fracture Planar

N205 51 Fracture Irregular



007



LETTIS PGE

Borehole: 01CTF-A water

DCPP ISFSI

top of borehole.....

East:

North:

Al807

North ref. is true

Depth units are feet

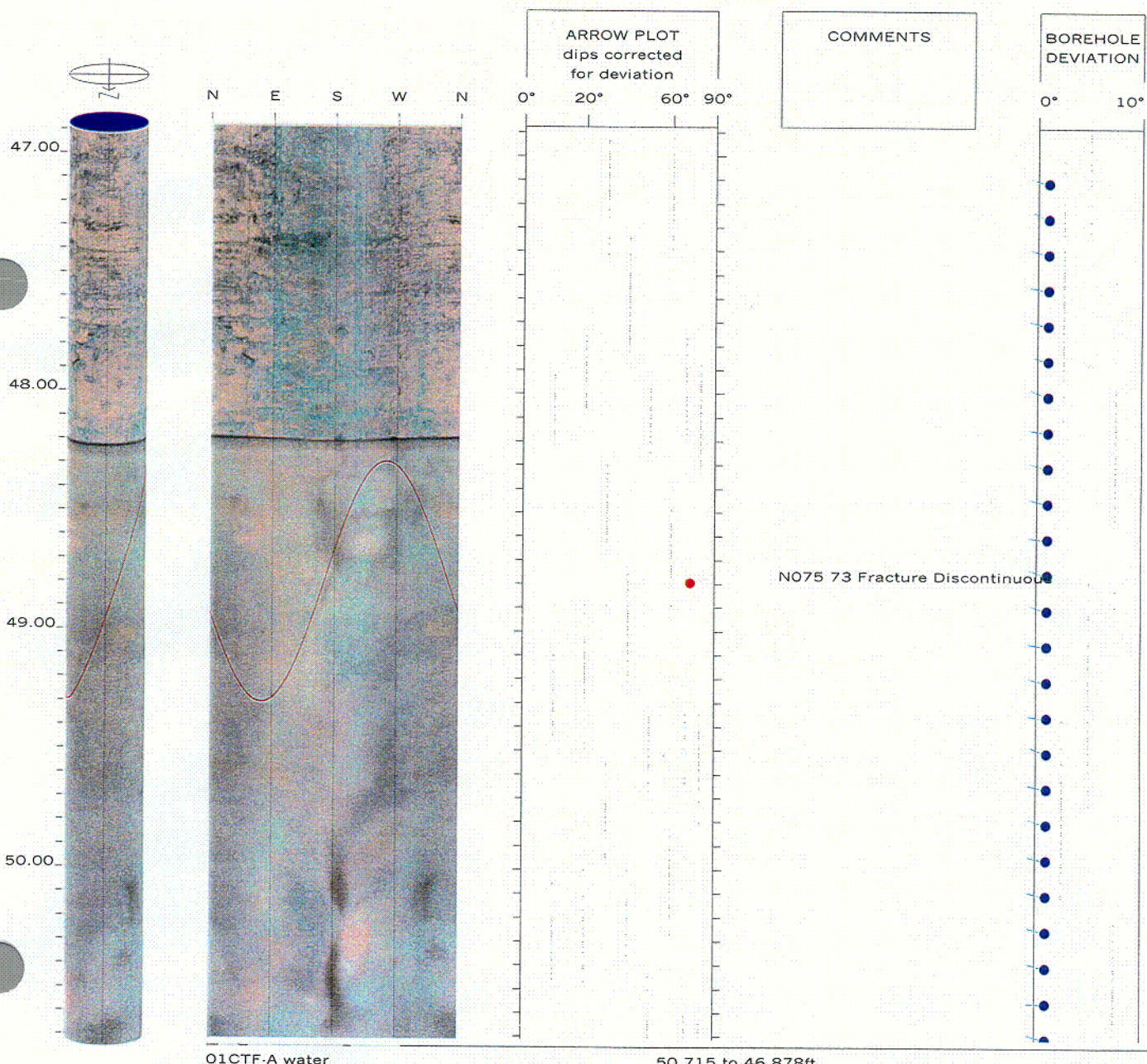
Vertical scale: 1/8

Horiz scale = vert scale

Zone from 55.449 to 46.878ft  
Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE  
● Identified units



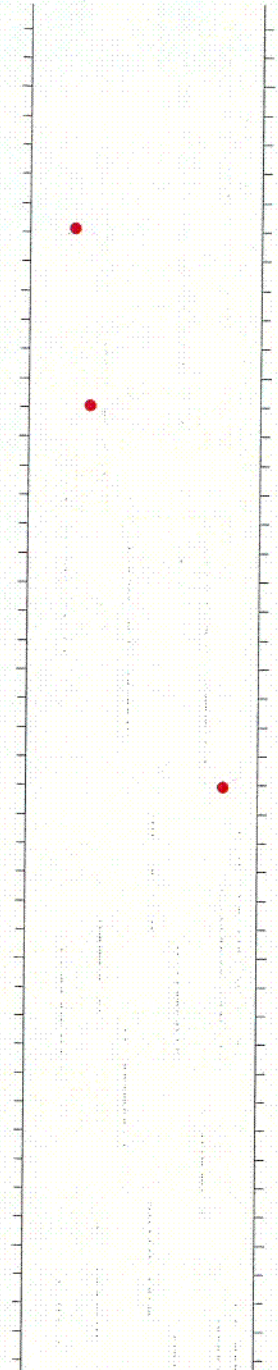
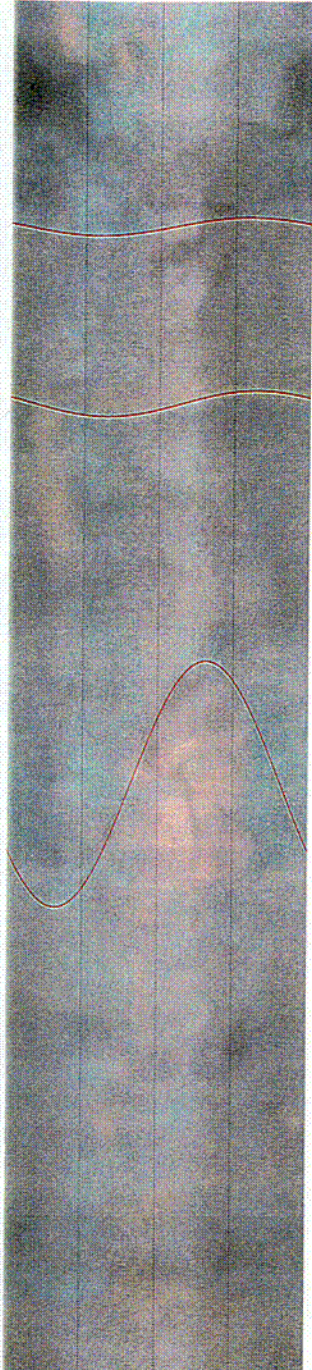
01CTF-A water

50.715 to 46.878ft

09 Jun 2001



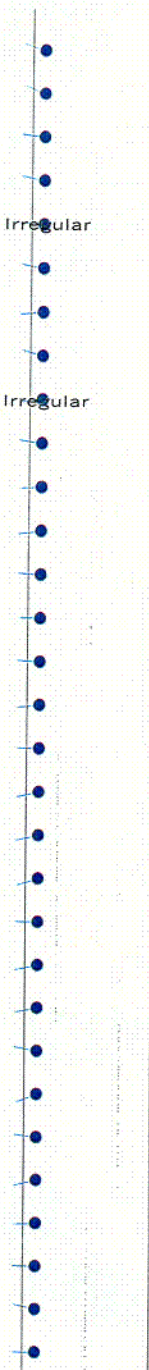
51.00  
52.00  
53.00  
54.00  
55.00



N106 12 Primary-structure Irregular

N114 16 Primary-structure Irregular

N057 70 Fracture



C09



LETTIS-PGE

Borehole: 01-A UPPER SECTION

DCPP ISFSI

top of borehole.....

East:

North:

Al805

North ref. is true

Depth units are feet

Vertical scale: 1/8

Horiz scale = vert scale

Zone from 25.860 to 5.200ft

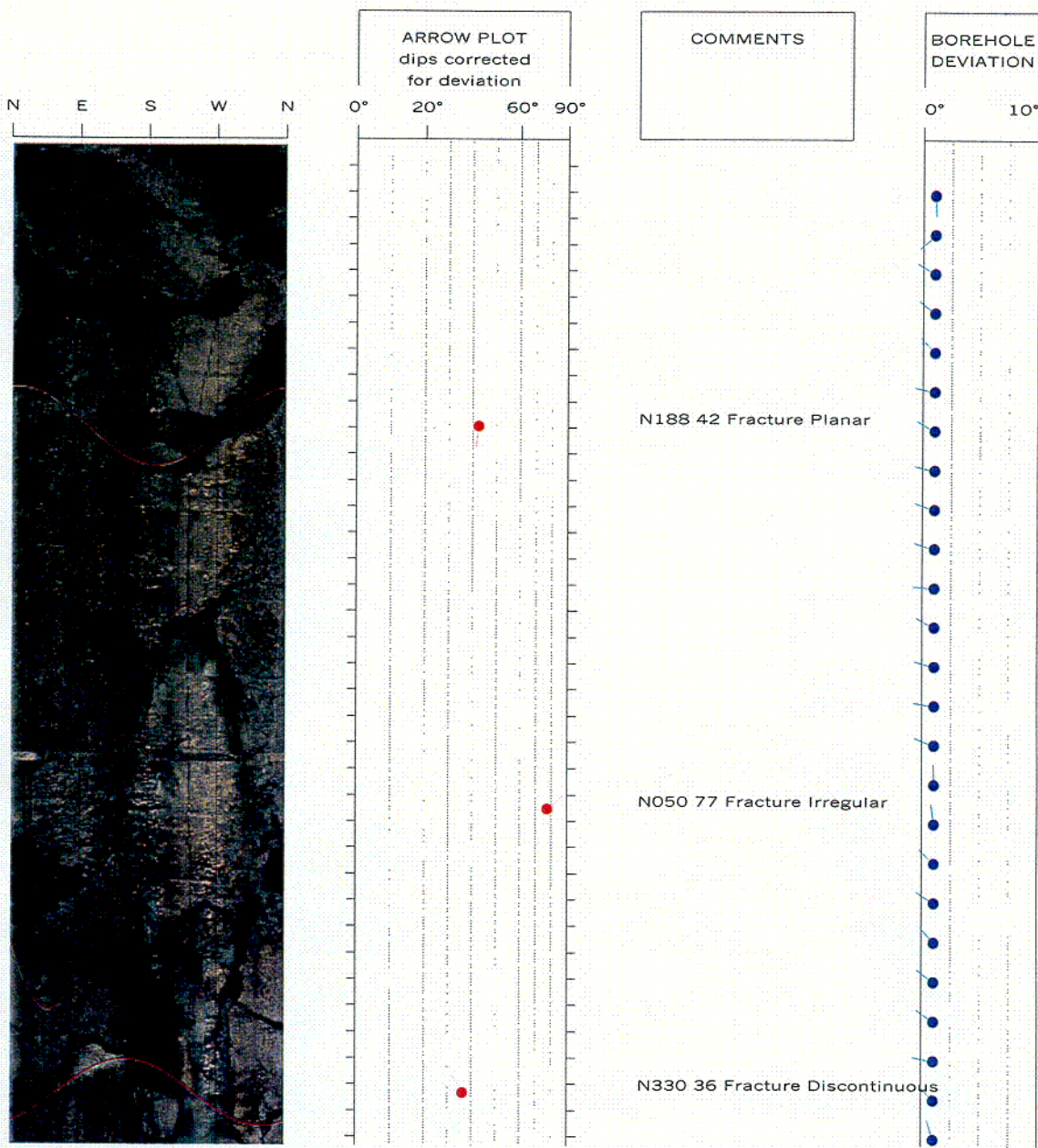
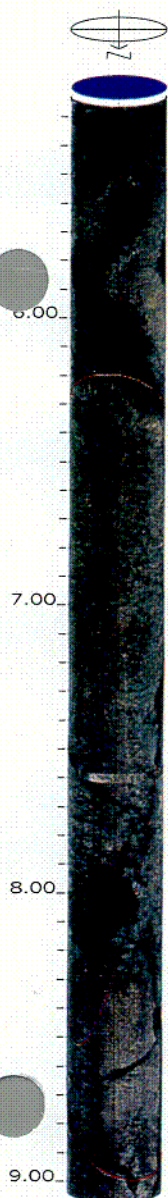
Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE

Identified units

Identified units



01-A UPPER SECTION

9.037 to 5.200ft

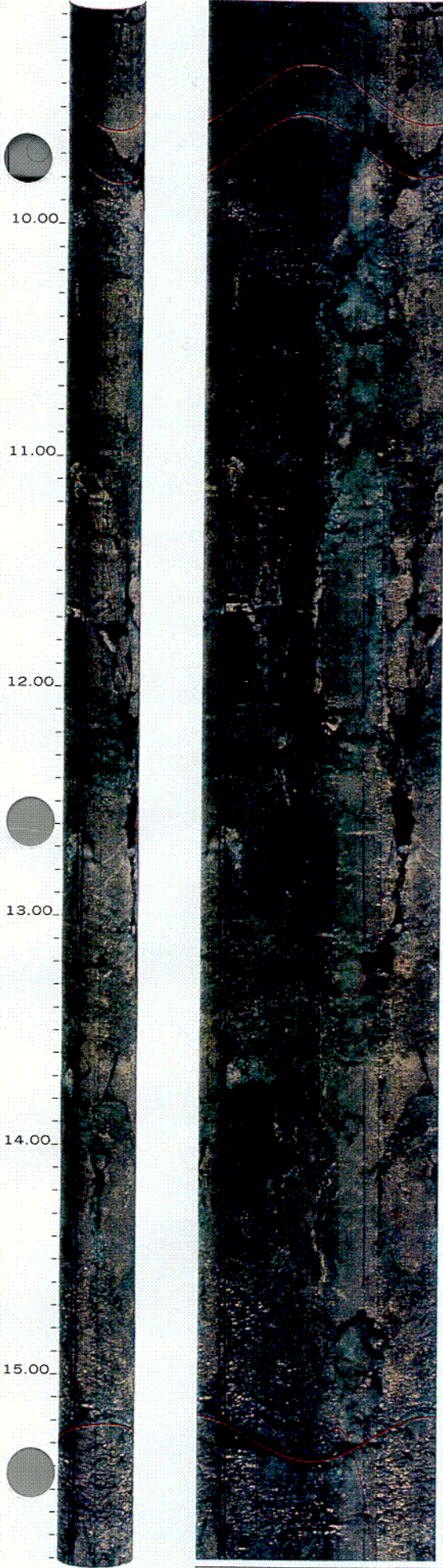
04 May 2001

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C10





10.00

11.00

12.00

13.00

14.00

15.00

01-A UPPER SECTION

Diablo Canyon ISFSI  
Data Report E, Rev. 0

15.805 to 9.037ft

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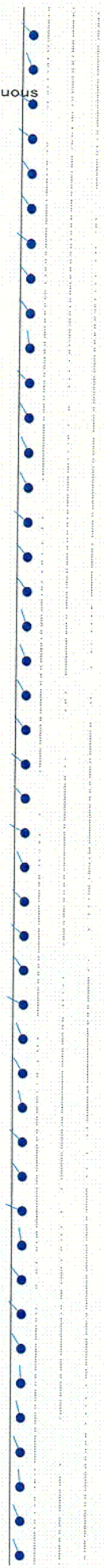
04 May 2001

N335 37 Fracture Discontinuous

N327 38 Fracture Irregular

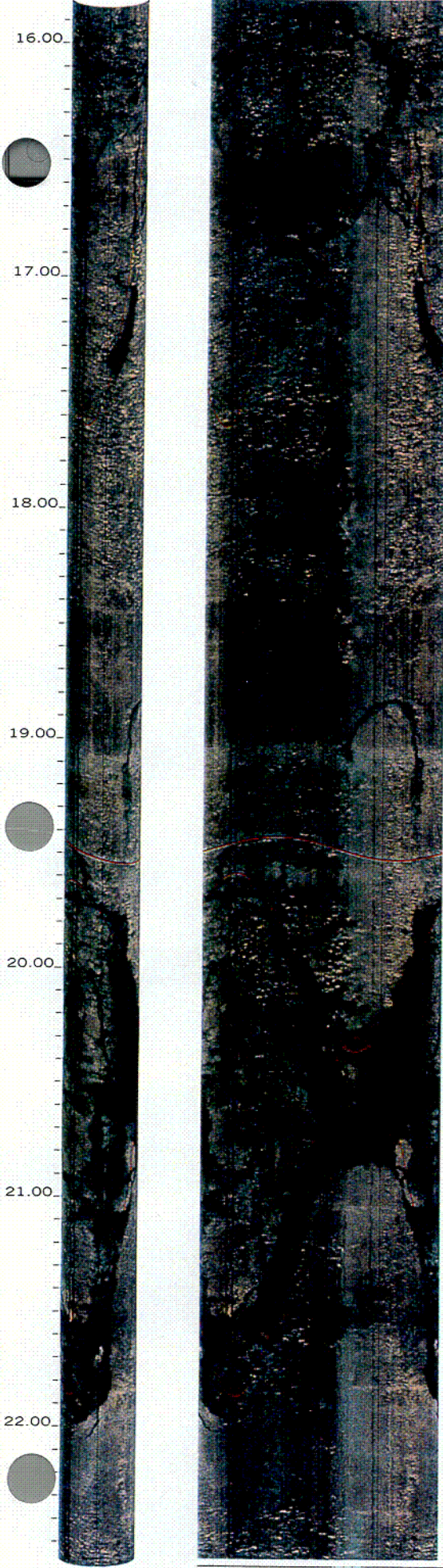
N222 82 Fracture Irregular

N171 31 Fracture Irregular

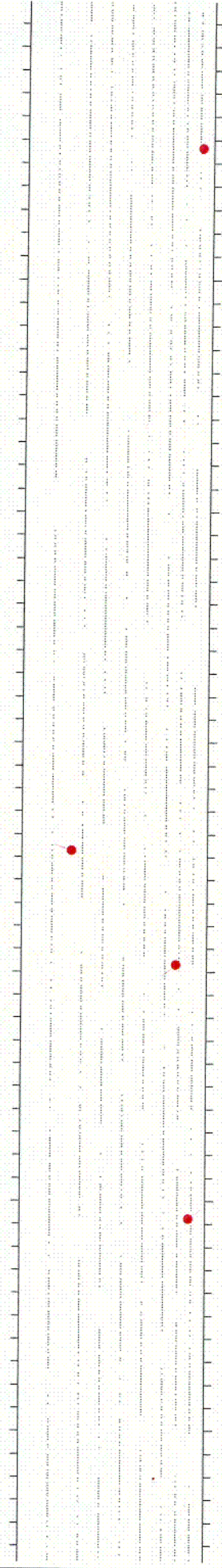


C11





01-A UPPER SECTION  
Diablo Canyon ISFSI  
Data Report E, Rev. 0

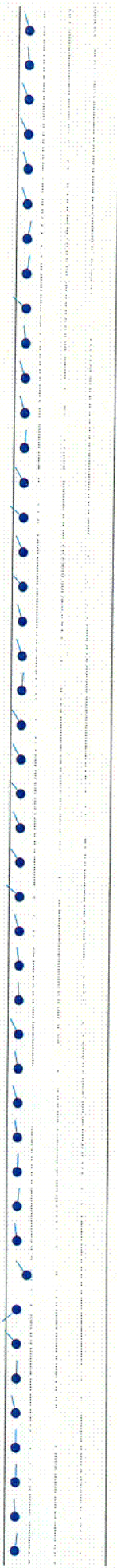


N030 82 Fracture Irregular

N289 16 Fracture Planar

N231 67 Fracture Irregular

N054 77 Fracture Irregular

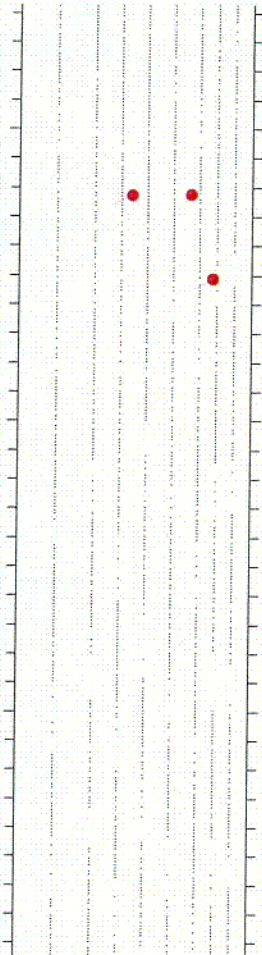
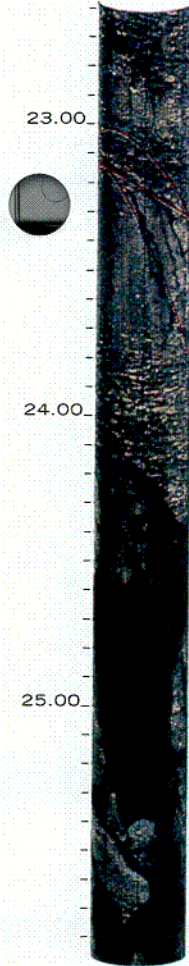


22.573 to 15.805ft

04 May 2001

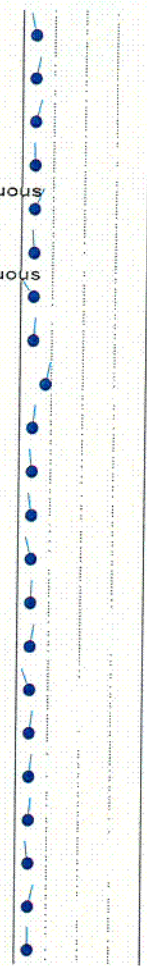
C12





N226 34 Fracture Discontinuous

N244 67 Fracture Discontinuous



C13



LETTIS - PG&E

Borehole: 01-A (LOWER)

DCPP ISFSI

top of borehole.....

East:

North:

Alb05.7

North ref. is true

Depth units are feet

Vertical scale: 1/8

Horiz scale = vert scale

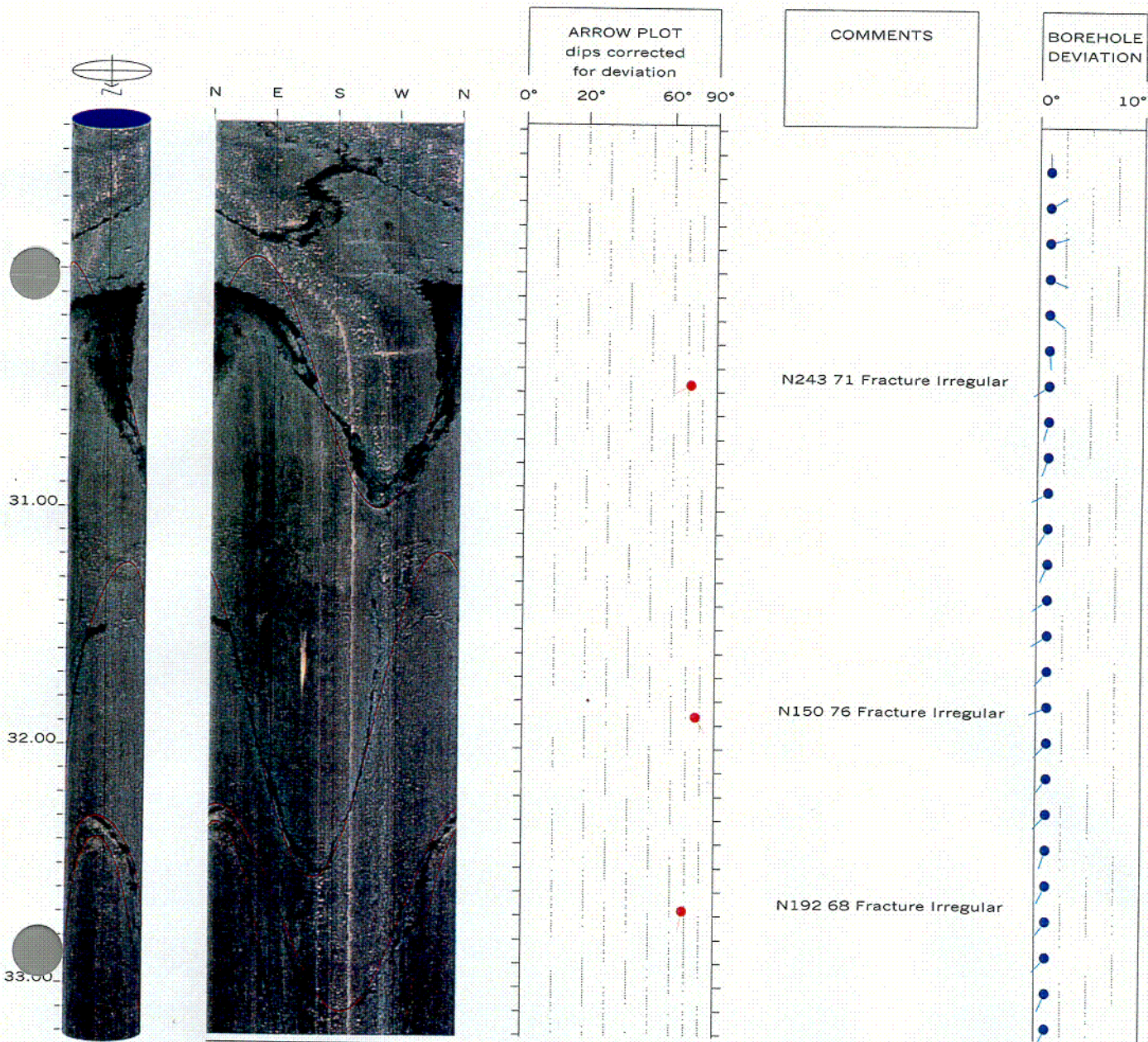
Zone from 69.100 to 29.376ft  
Vertical = borehole-axis

Borehole diam: 3.996inch

— BEDDING  
— FRACTURE



Identified units



01-A (LOWER)

33.213 to 29.376ft

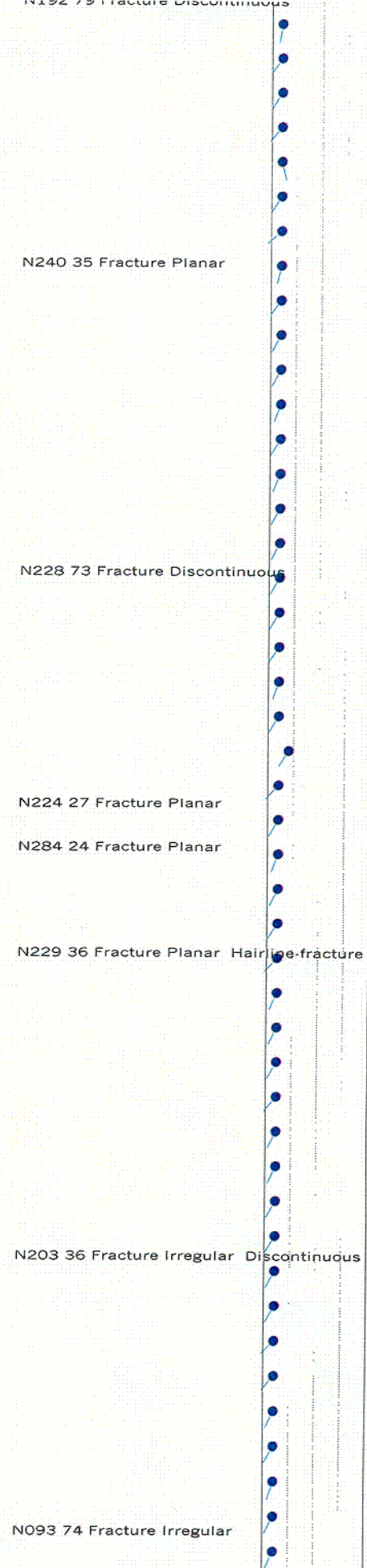
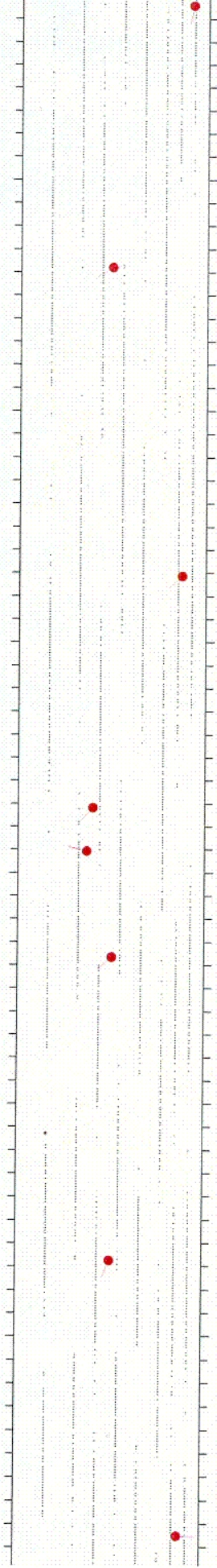
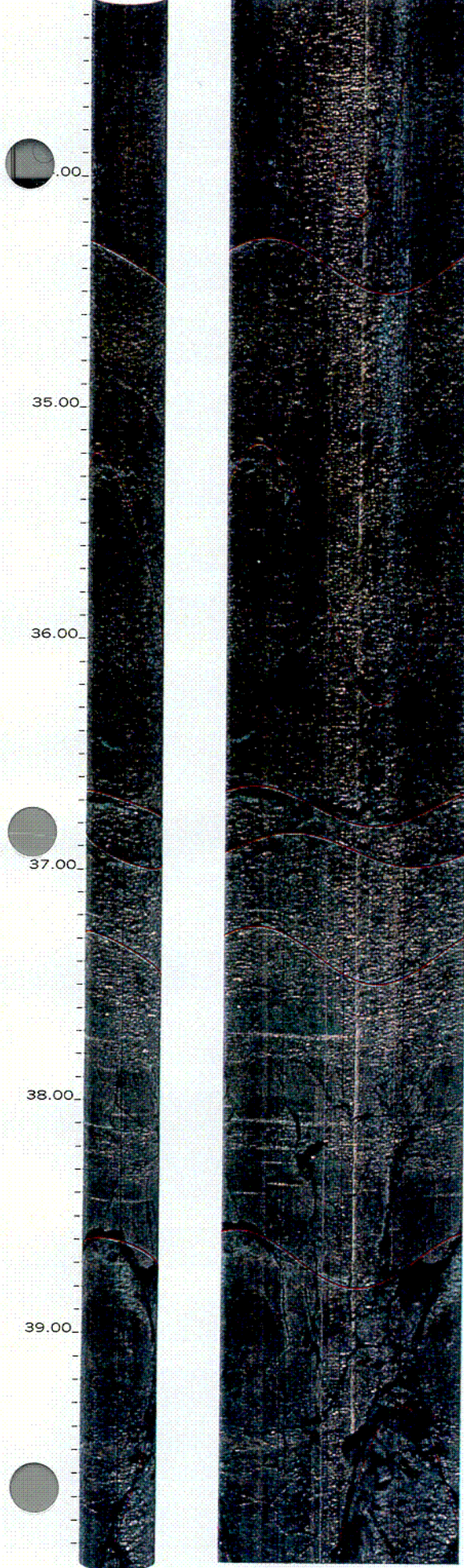
17 May 2001

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Data Report E, Rev. 0

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C14





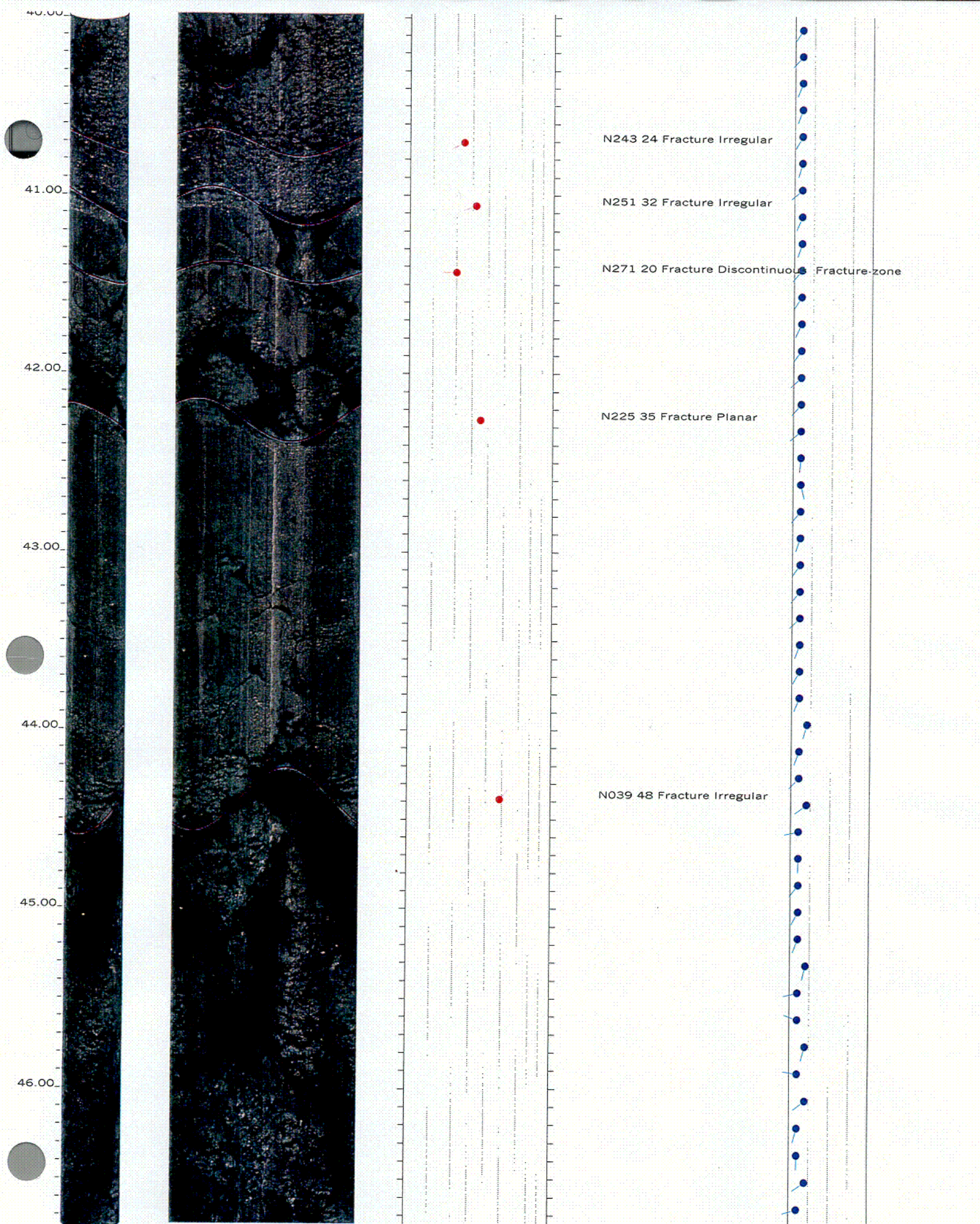
01-A (LOWER)  
Diablo Canyon ISFSI  
Data Report E, Rev. 0

39.981 to 33.213ft  
E-177 of 350

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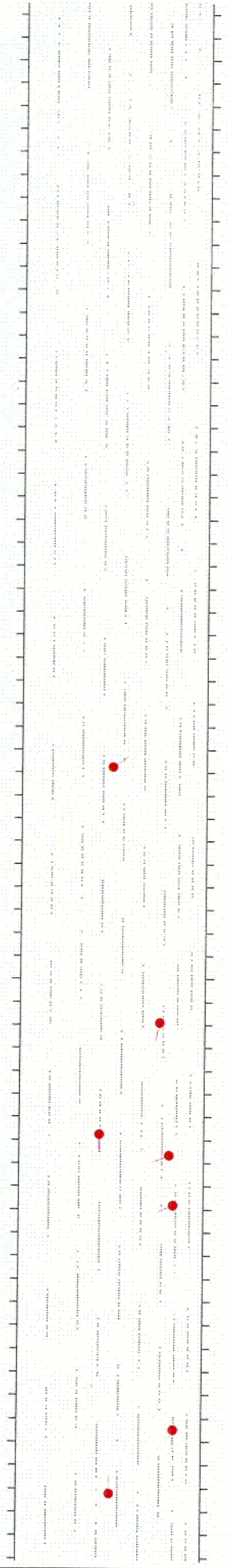
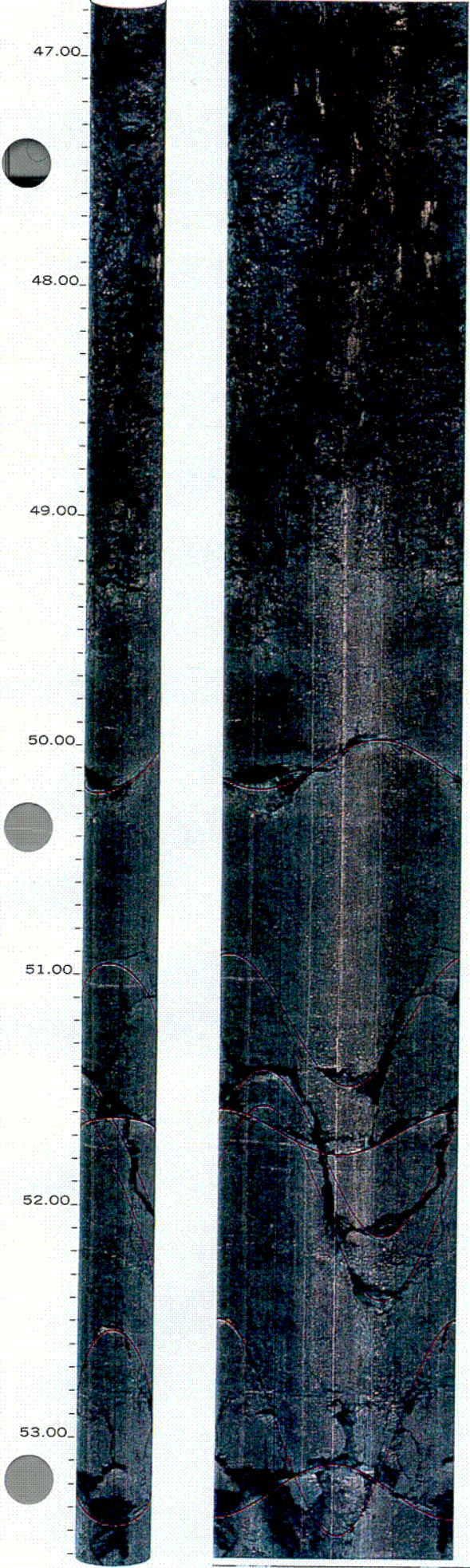
C15





C16





N055 34 Fracture Irregular

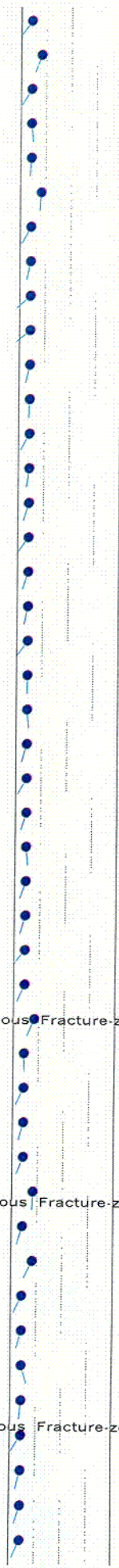
N194 58 Fracture Discontinuous Fracture-zone

N182 29 Fracture Planar  
N248 64 Fracture Irregular

N249 68 Fracture Discontinuous Fracture-zone

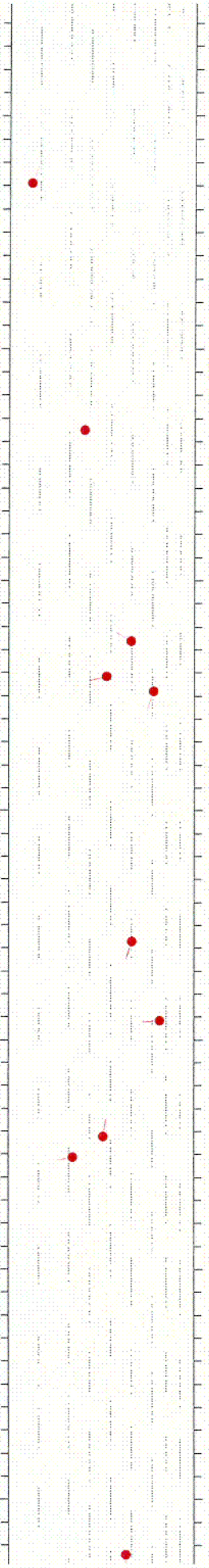
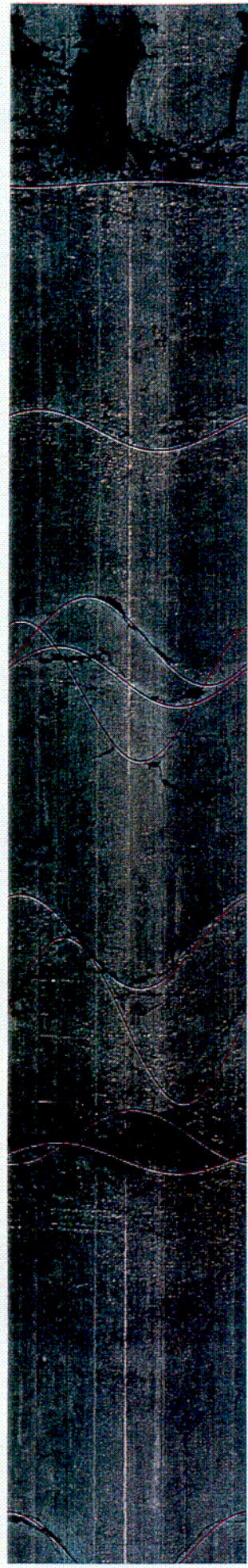
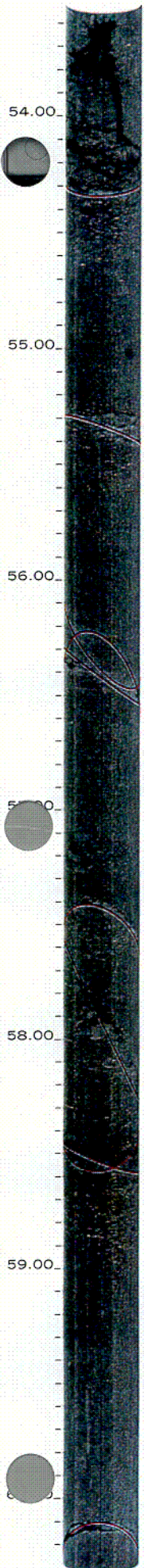
N184 69 Fracture Discontinuous Fracture-zone

N358 36 Fracture Irregular



C17





N021 7 Primary-structure CONTACT

N226 27 Fracture Irregular Discontinuous

N301 49 Fracture Planar

N257 38 Fracture Irregular  
N200 60 Fracture Discontinuous

N199 50 Fracture Planar

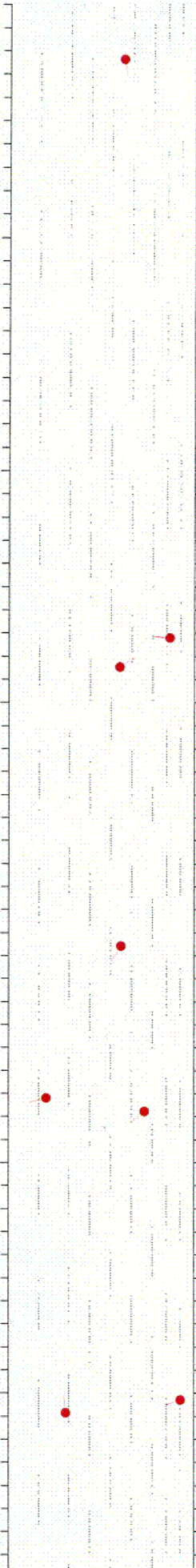
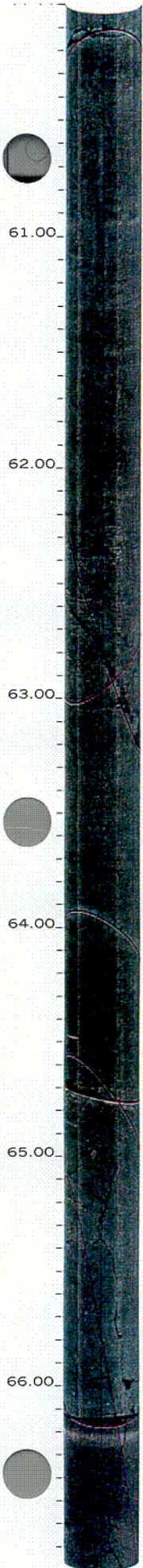
N265 65 Fracture Irregular

N009 36 Fracture Irregular  
N259 22 Fracture Irregular

N182 47 Fracture Planar Fresh

C18













N171 45 Fracture Irregular

N275 72 Fracture Discontinuous  
N058 44 Fracture Irregular

N213 45 Fracture Irregular

N256 12 Fracture Planar Z        

N252 80 Fracture Irregular  
N354 19 Fracture Planar Z        

O1-A (LOWER)

66.768 to 60.000ft

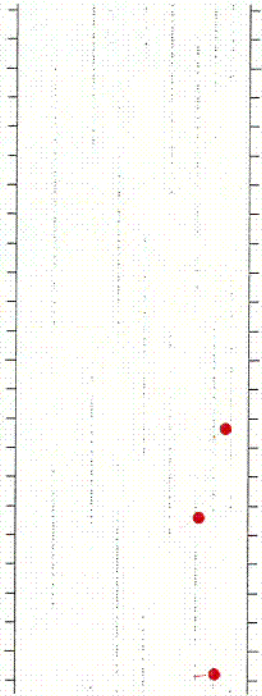
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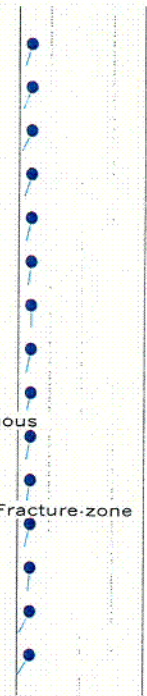




N235 77 Fracture Discontinuous

N240 61 Fracture Irregular Fracture-zone

N264 70 Fracture Irregular



C20



LETTIS and PG&E

Borehole: 01-A REPEAT

DCPP ISFSI

top of borehole.....

East:

North:

Al805.7

North ref. is true

Depth units are feet

Vertical scale: 1/8

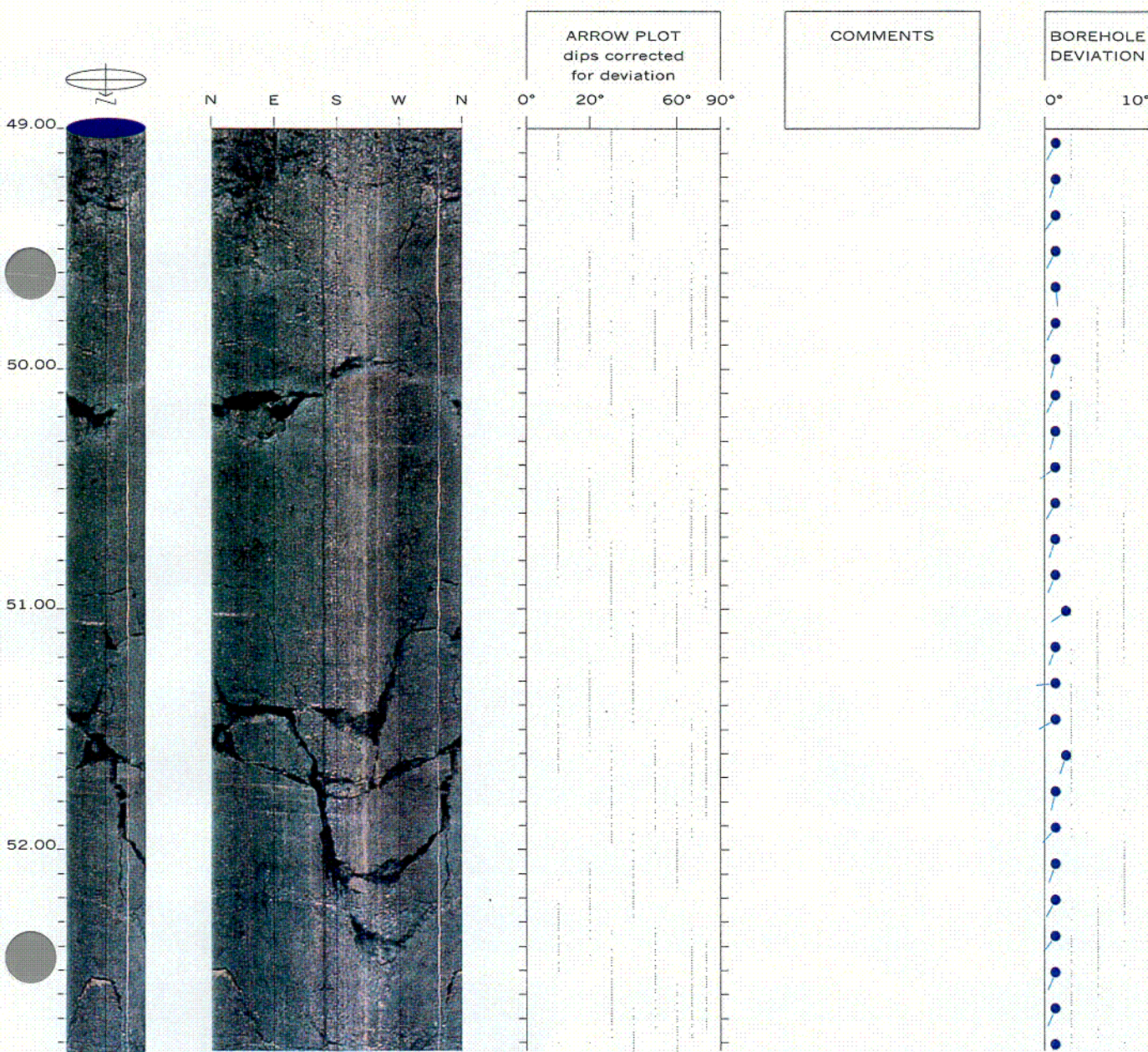
Horiz scale = vert scale

Zone from 69.132 to 49.000ft

Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE  
● Identified units



01-A REPEAT

52.837 to 49.000ft

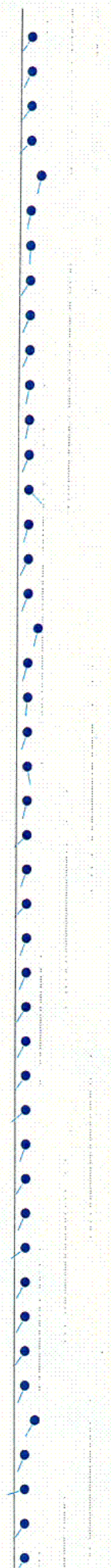
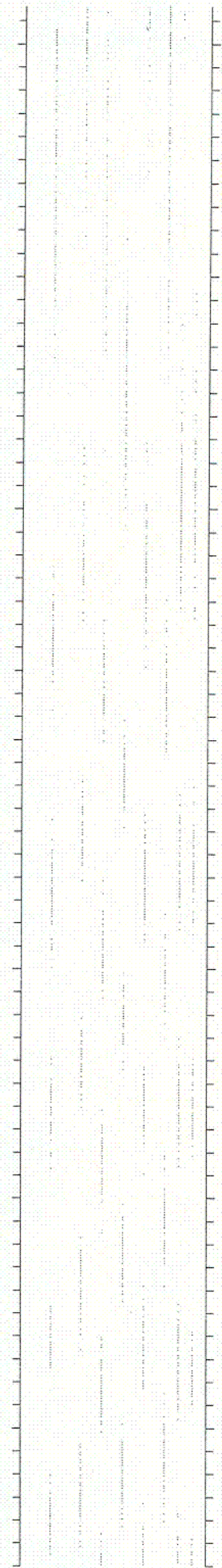
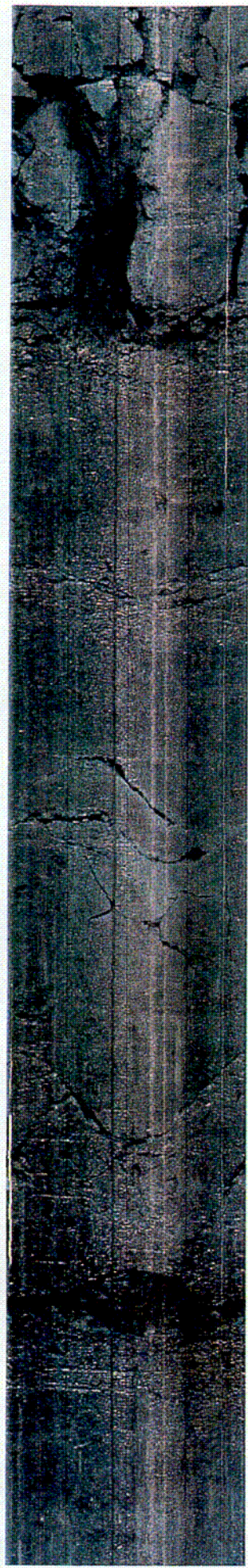
17 May 2001

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C21





01-A REPEAT

59.605 to 52.837ft

17 May 2001

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C22



60.00

61.00

62.00

63.00

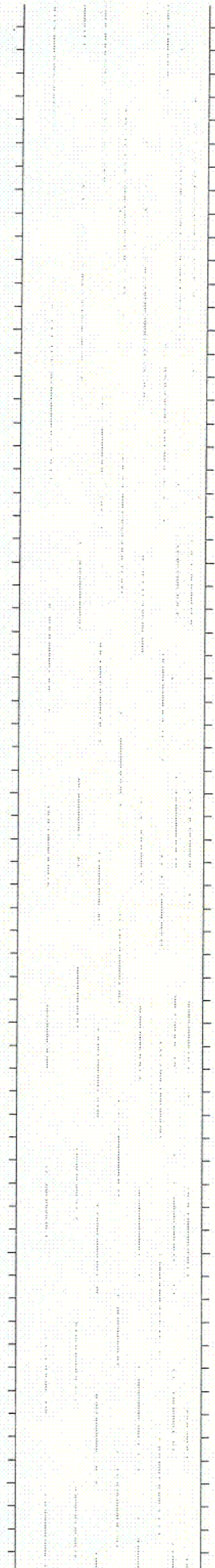
64.00

65.00



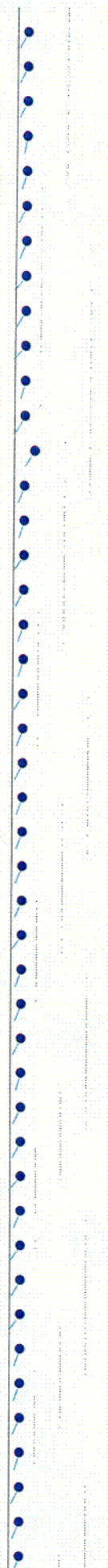
01-A REPEAT

Diablo Canyon ISFSI  
Data Report E, Rev. 0



66.373 to 59.605ft

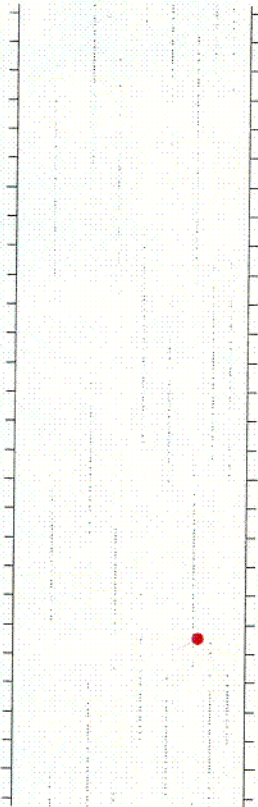
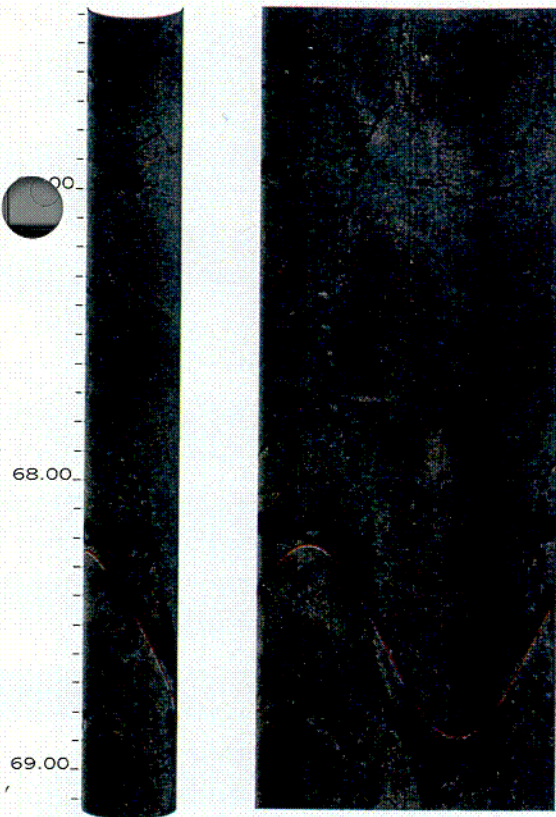
E-185 of 350



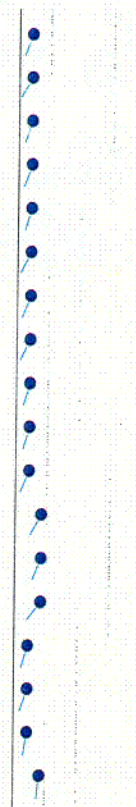
17 May 2001

C23





N242 62 Fracture





ROBERTSON GEOLOGGING TECHNOLOGY

Borehole: 01-B

DCPP ISFSI

top of borehole.....

East:

North:

AlB22

North ref. is true

Depth units are feet

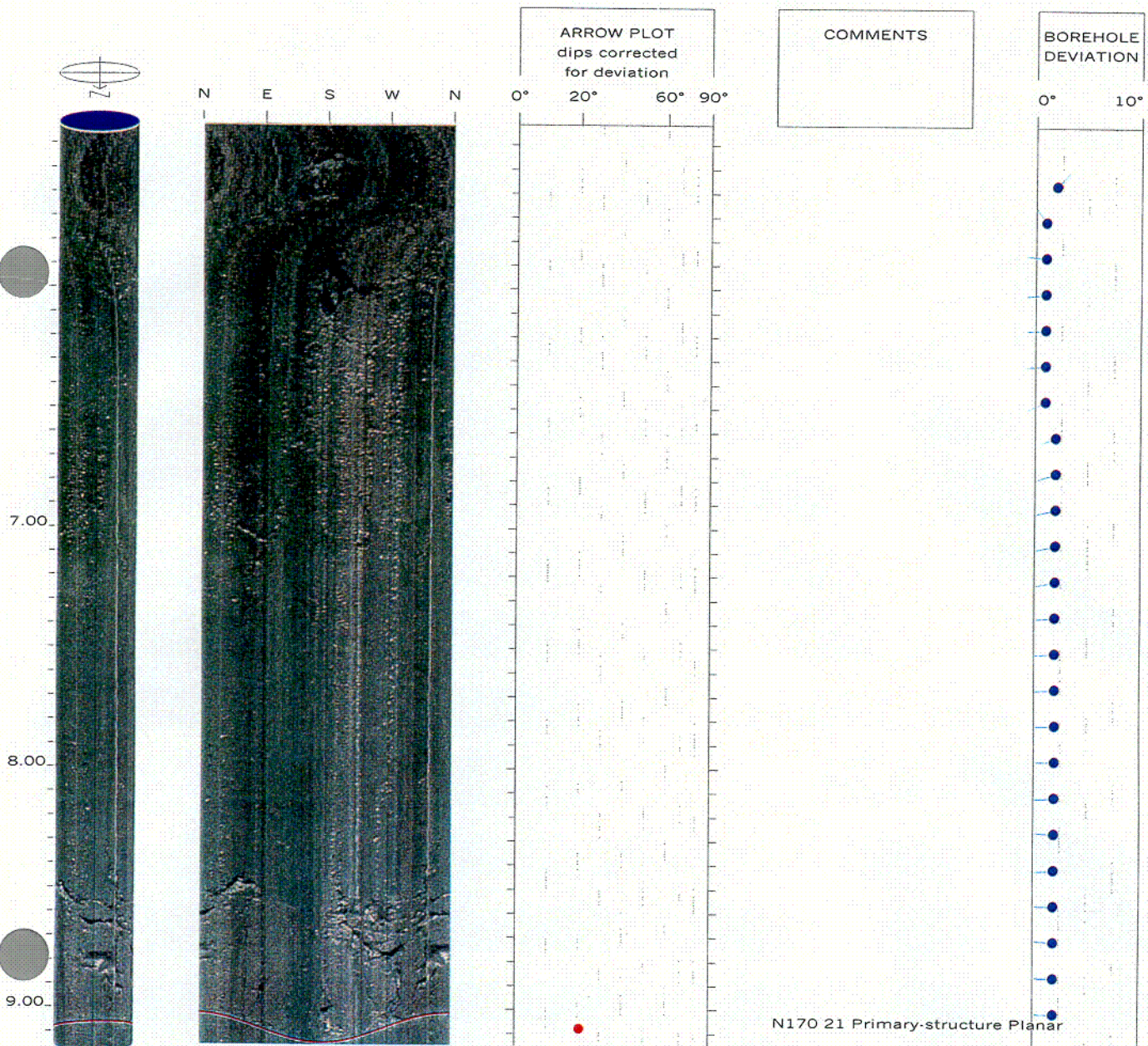
Vertical scale: 1/8

Horiz scale = vert scale

Zone from 69.447 to 5.316ft  
Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING — Identified units  
— FRACTURE —

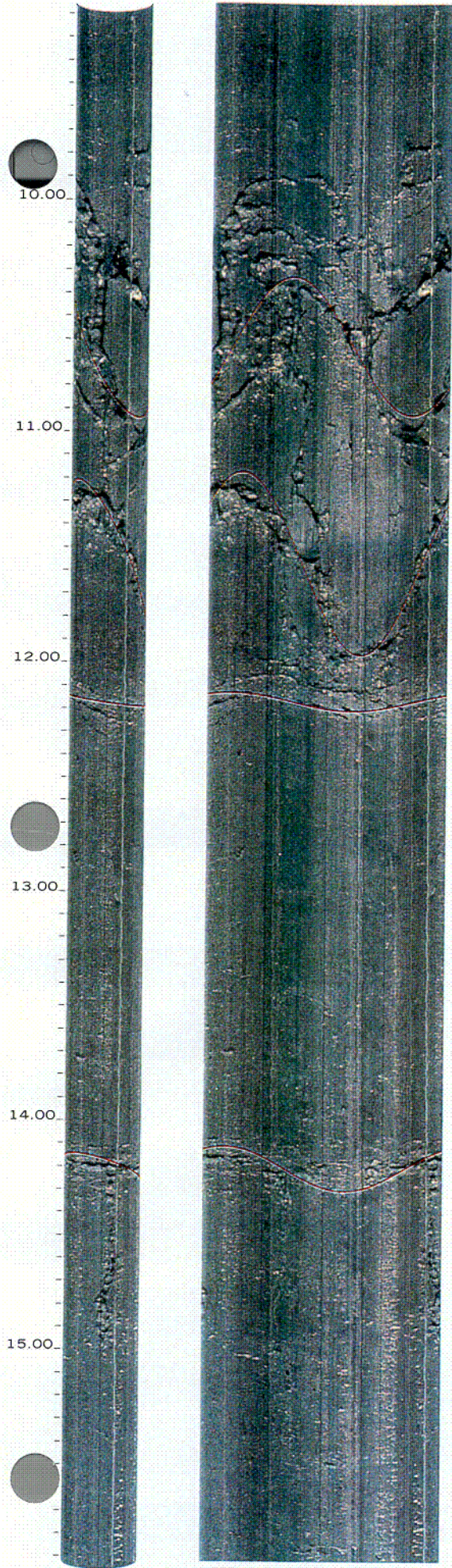


01-B

9.153 to 5.316ft

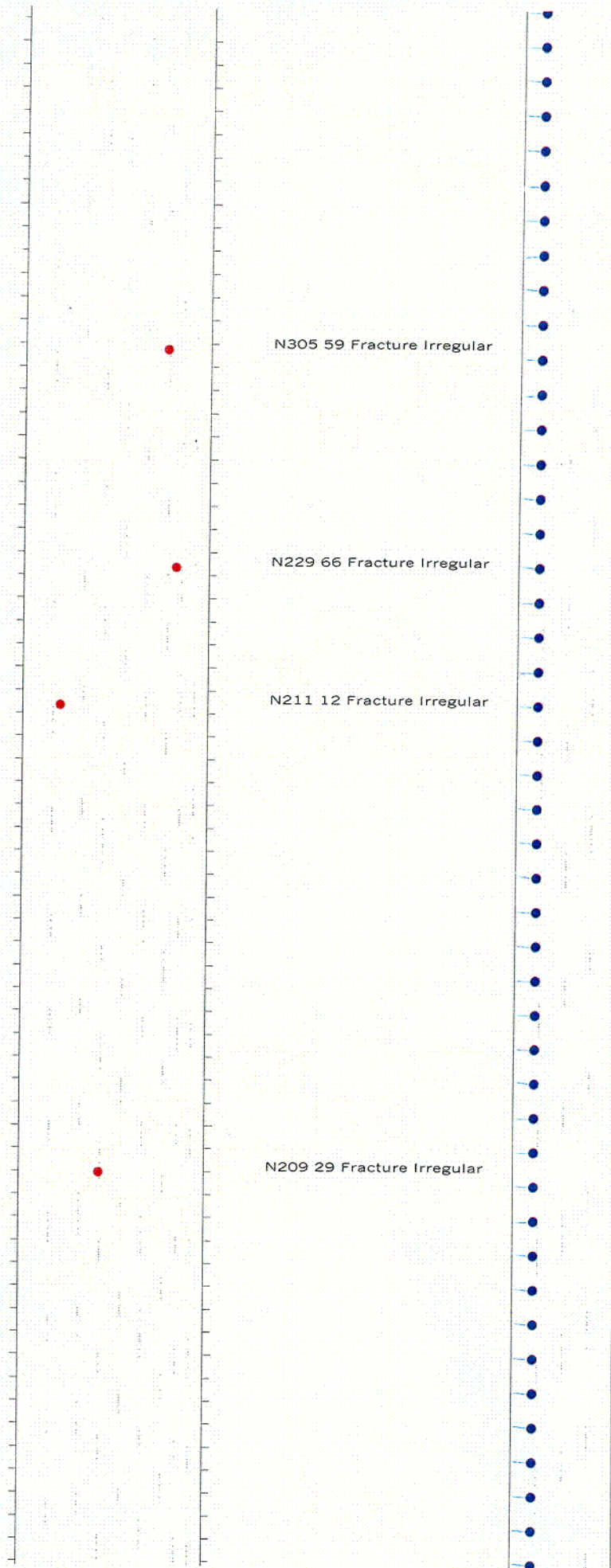
04 May 2001





01-B

Diablo Canyon ISFSI  
Data Report E, Rev. 0



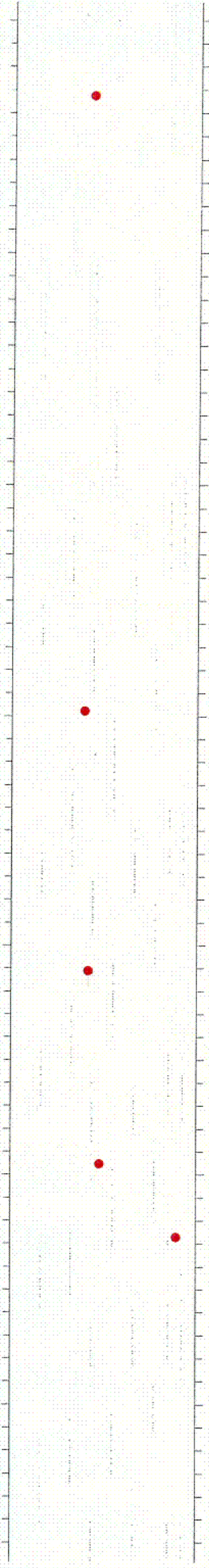
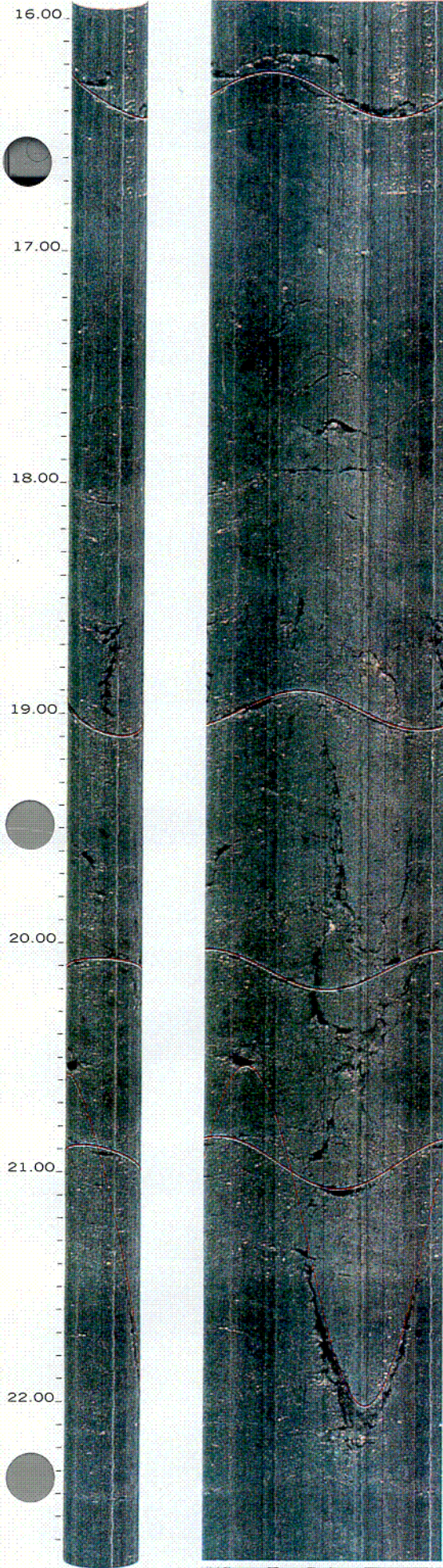
15.921 to 9.153ft

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C26





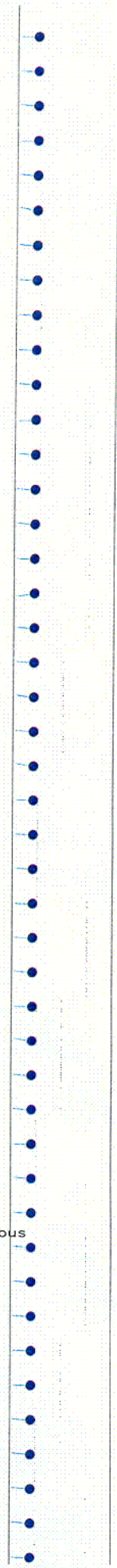
N273 29 Fracture Irregular

N326 26 Fracture Planar

N180 28 Fracture Planar

N199 33 Fracture Irregular

N243 76 Fracture Discontinuous



01-B

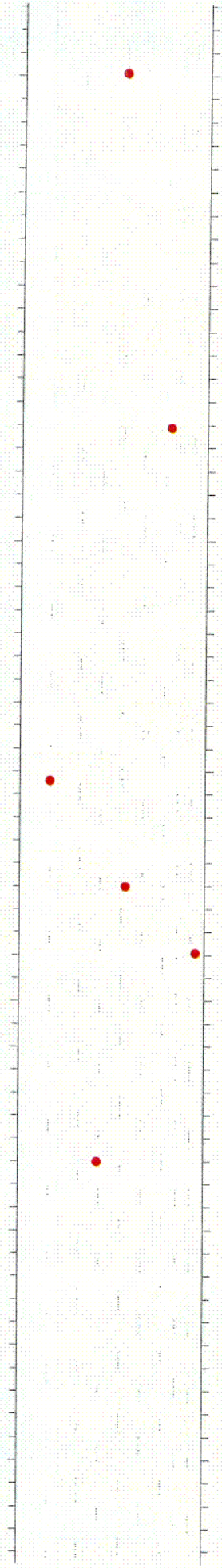
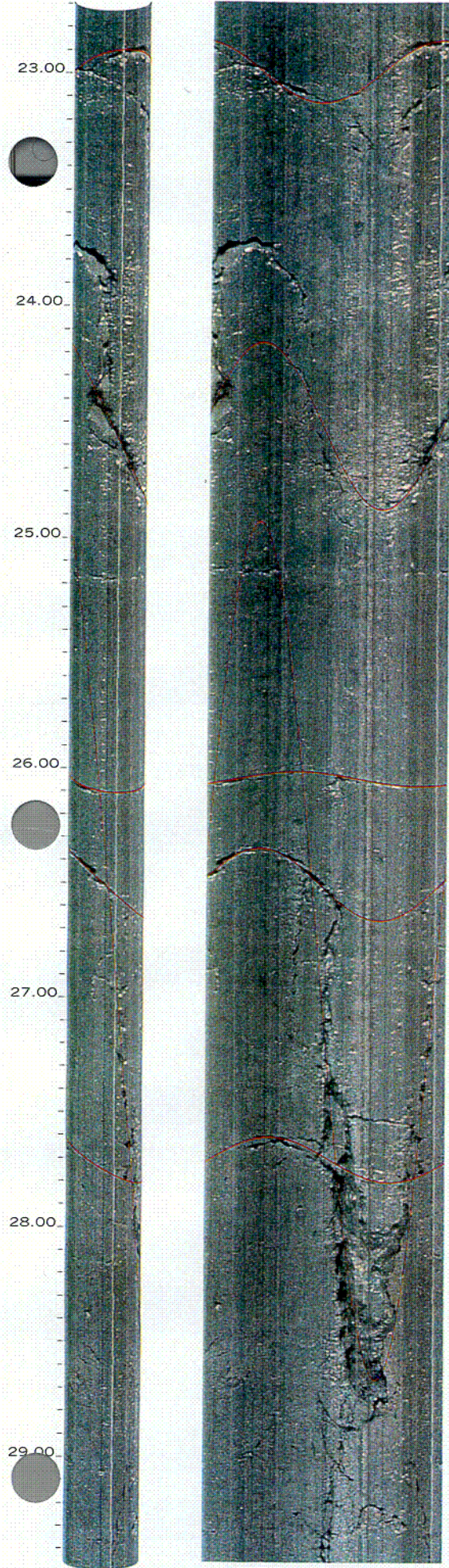
Diablo Canyon ISFSI  
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22.689 to 15.921ft  
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C27





N163 39 Fracture Irregular	
N260 63 Fracture Discontinuous	
N325 9 Fracture Discontinuous	Hairline-fracture
N259 41 Fracture Discontinuous	
N257 83 Fracture Irregular	
N277 28 Fracture Discontinuous	

01-B

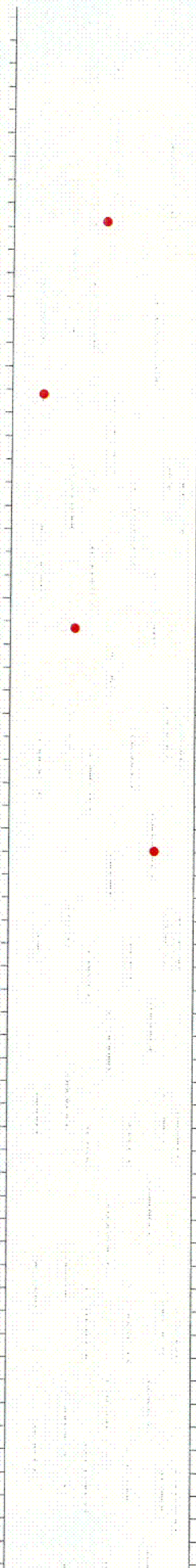
29.457 to 22.689ft

04 May 2001

C 28



30.00  
31.00  
32.00  
34.00  
35.00  
36.00

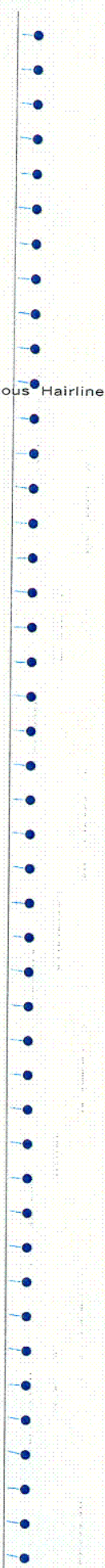


N260 36 Fracture Irregular

N140 10 Fracture Discontinuous Hairline fracture

N258 22 Fracture Irregular

N266 61 Fracture Irregular



01-B

36.225 to 29.457ft

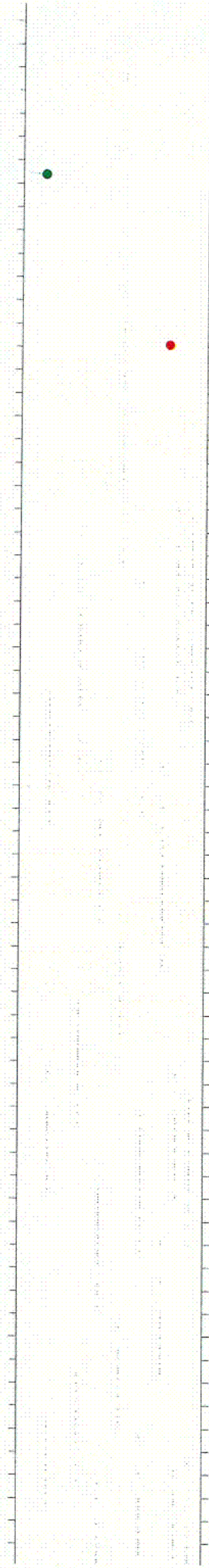
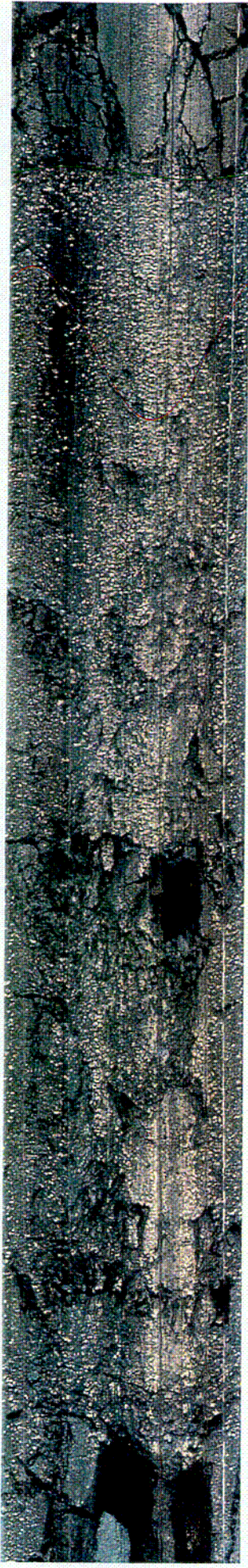
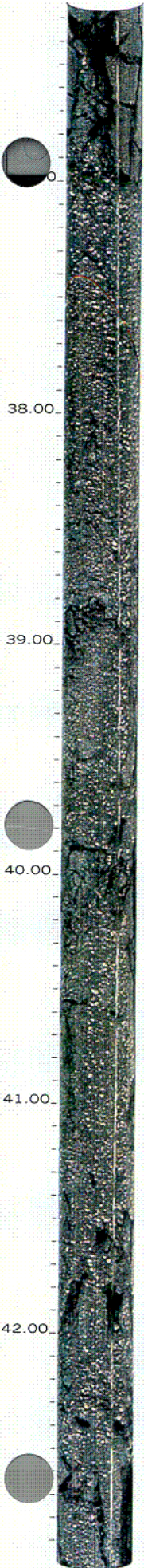
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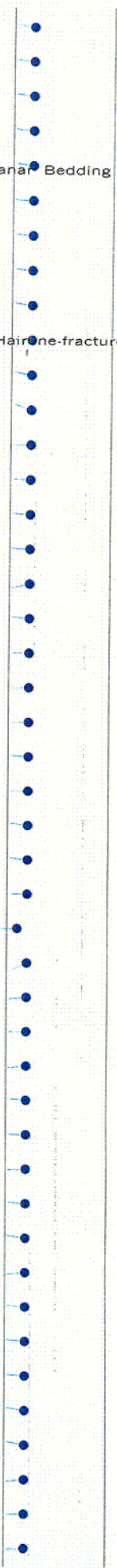
C29



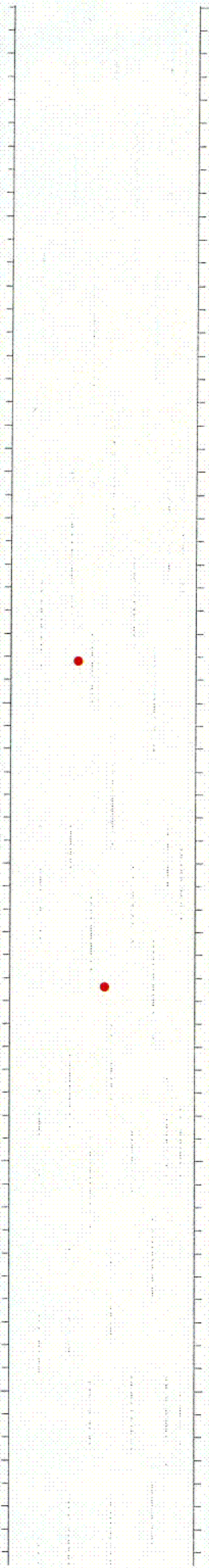
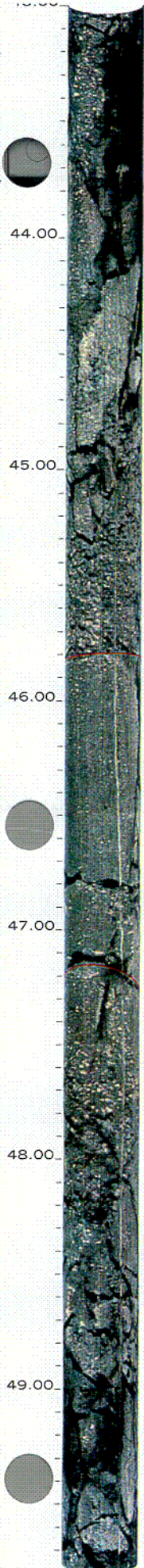


N276 7 Primary-structure Planar Bedding

N214 62 Fracture Irregular Hairline-fracture

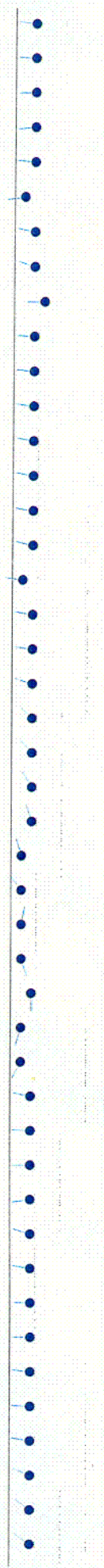






N171 23 Fracture Planar

N194 36 Fracture Planar



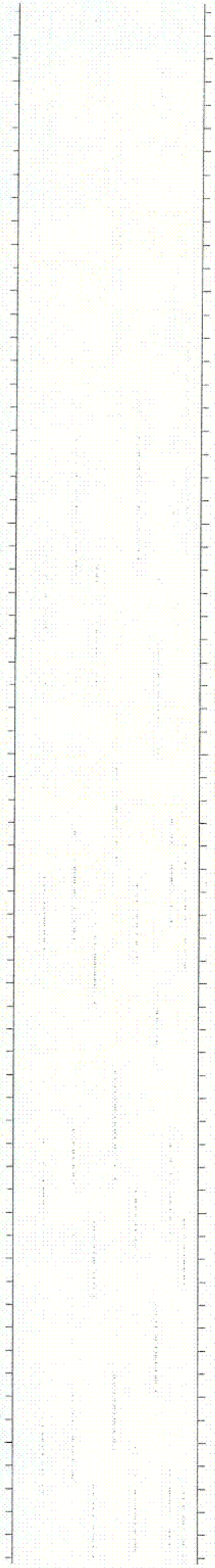
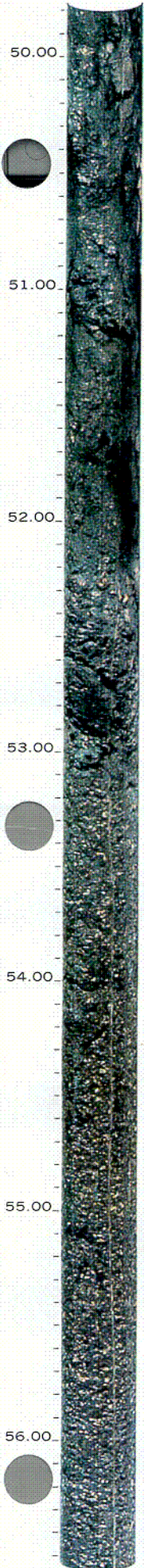
01-B

49.761 to 42.993ft

04 May 2001

C31





01-B

56.529 to 49.761ft

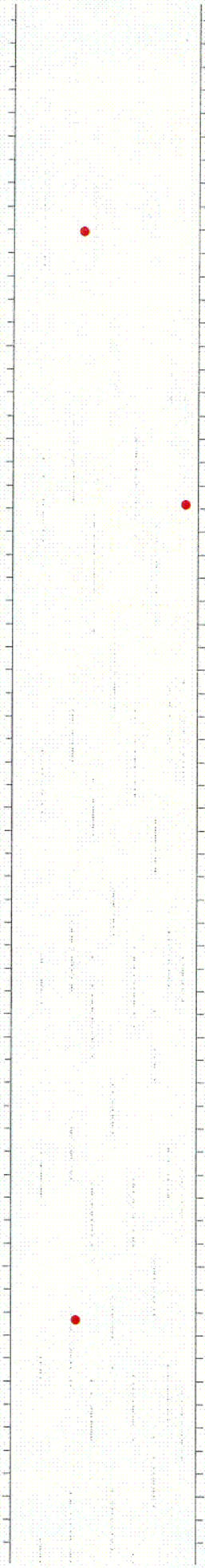
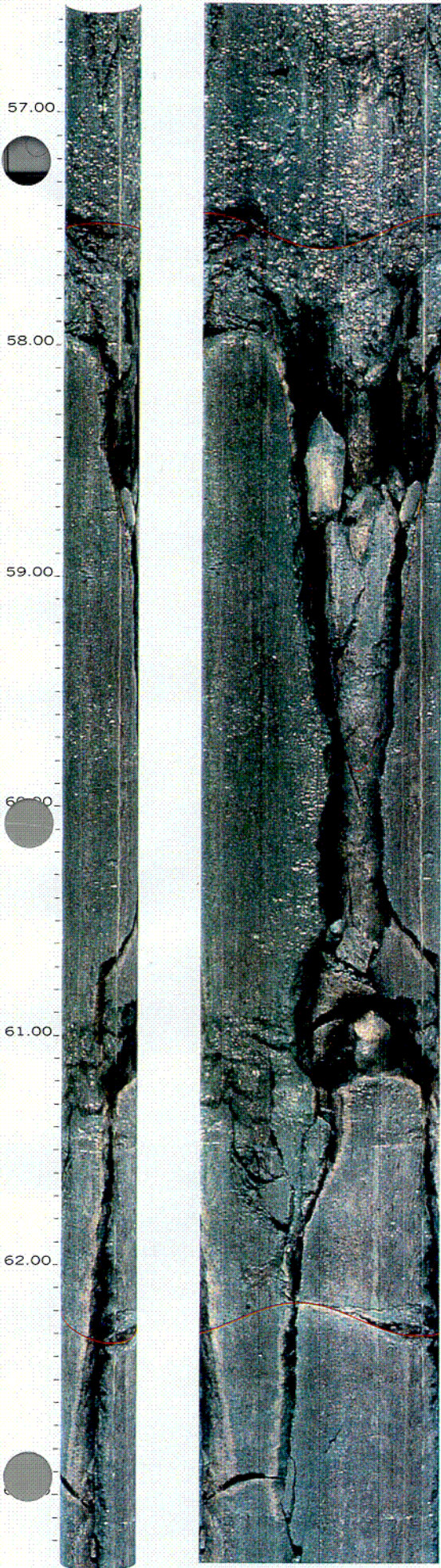
04 May 2001

Diablo Canyon ISFSI  
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C32





N179 24 Fracture Discontinuous

N236 80 Fracture Irregular

N332 22 Fracture Discontinuous



01-B

63.297 to 56.529ft

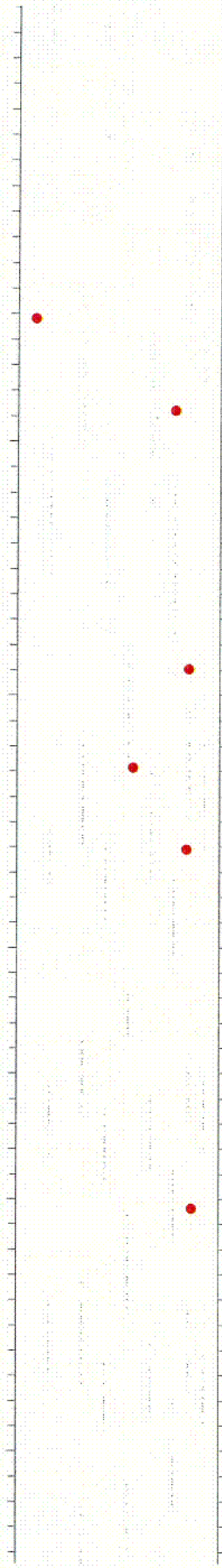
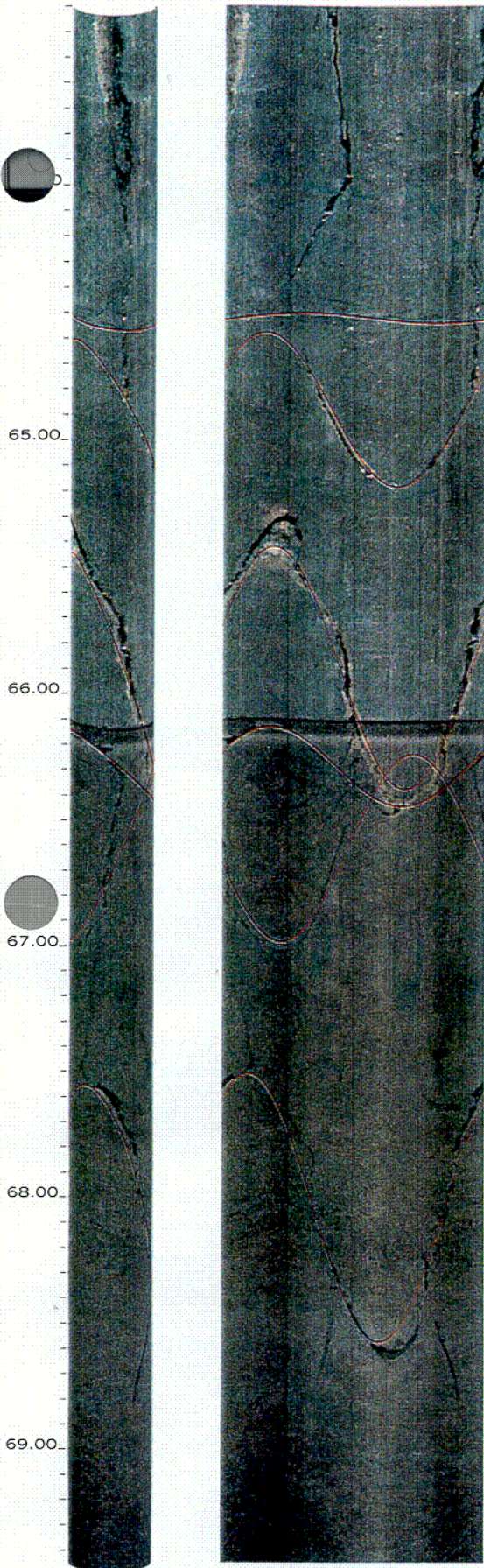
04 May 2001

Diablo Canyon ISFSI  
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C33





N298 5 Primary-structure Irregular

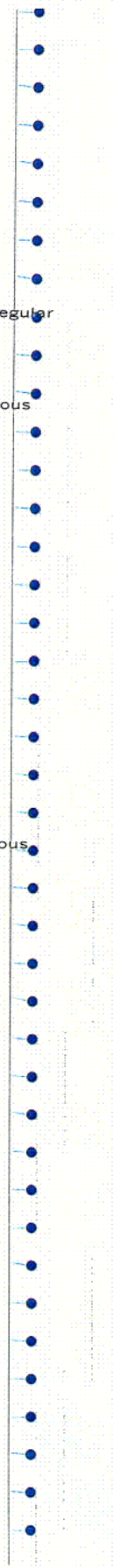
N237 60 Fracture Discontinuous

N250 69 Fracture Irregular

N245 42 Fracture Planar

N081 68 Fracture Discontinuous

N215 72 Fracture Irregular





LETTIS - PG&E

Borehole: 01-C

DCPP ISFSI

top of borehole.....

East:

North:

AlB23

North ref. is true

Depth units are feet

Vertical scale: 1/8

Horiz scale = vert scale

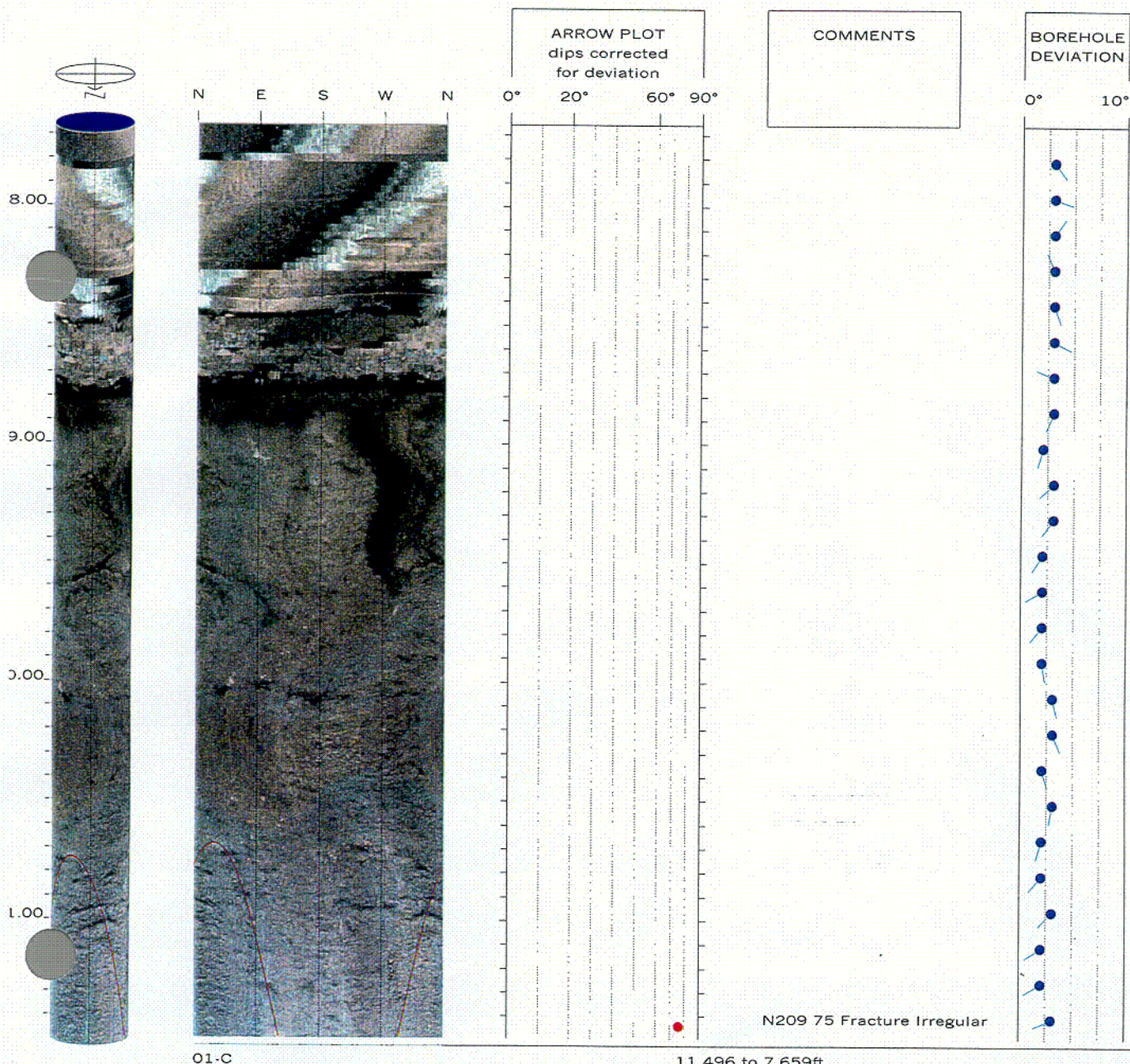
Zone from 65.448 to 7.659ft  
Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE



Identified units

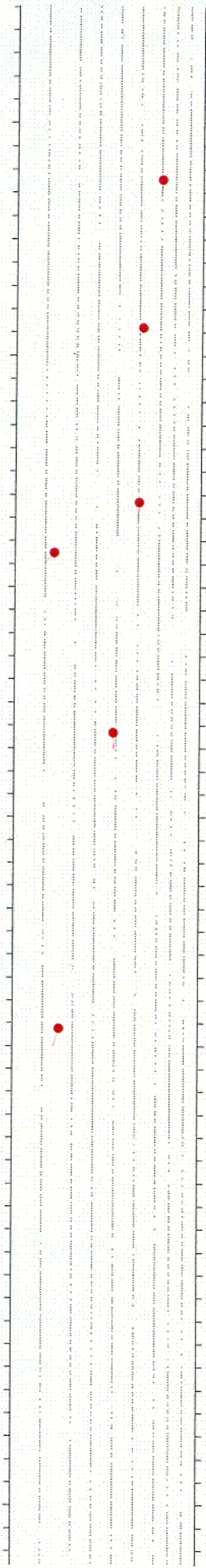
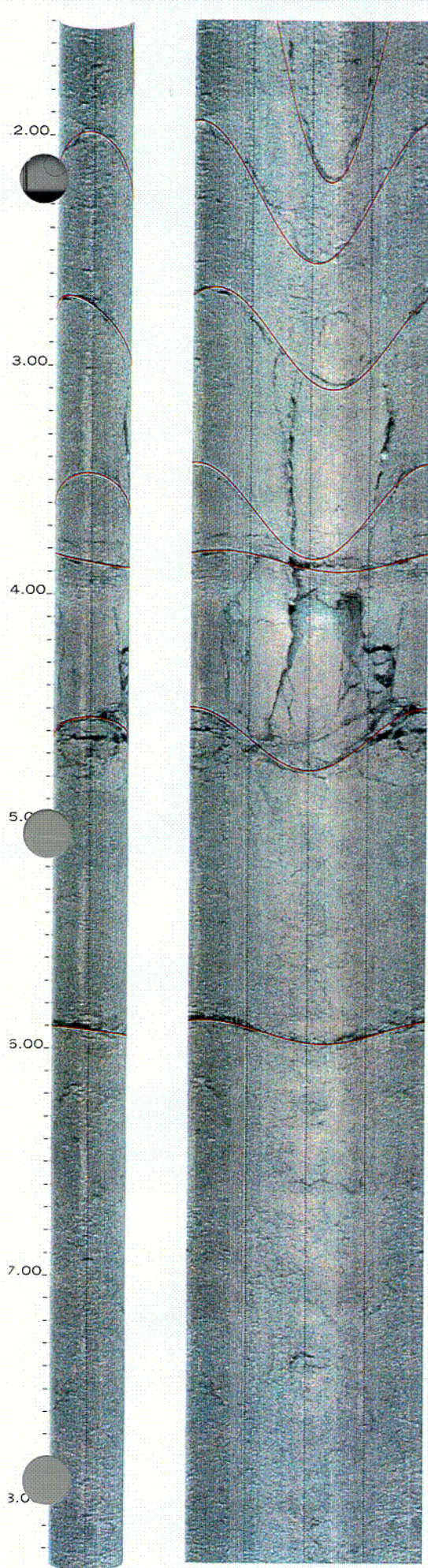


01-C

11.496 to 7.659ft

02 May 2001





N187 60 Fracture Planar

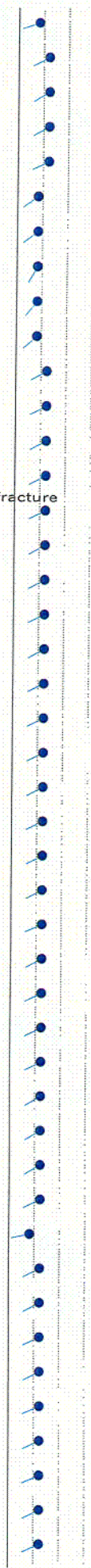
N214 51 Fracture Planar

N184 50 Fracture Hairline-fracture

N221 13 Fracture

N178 38 Fracture Irregular

N197 15 Fracture Planar



01-C

18.264 to 11.496ft

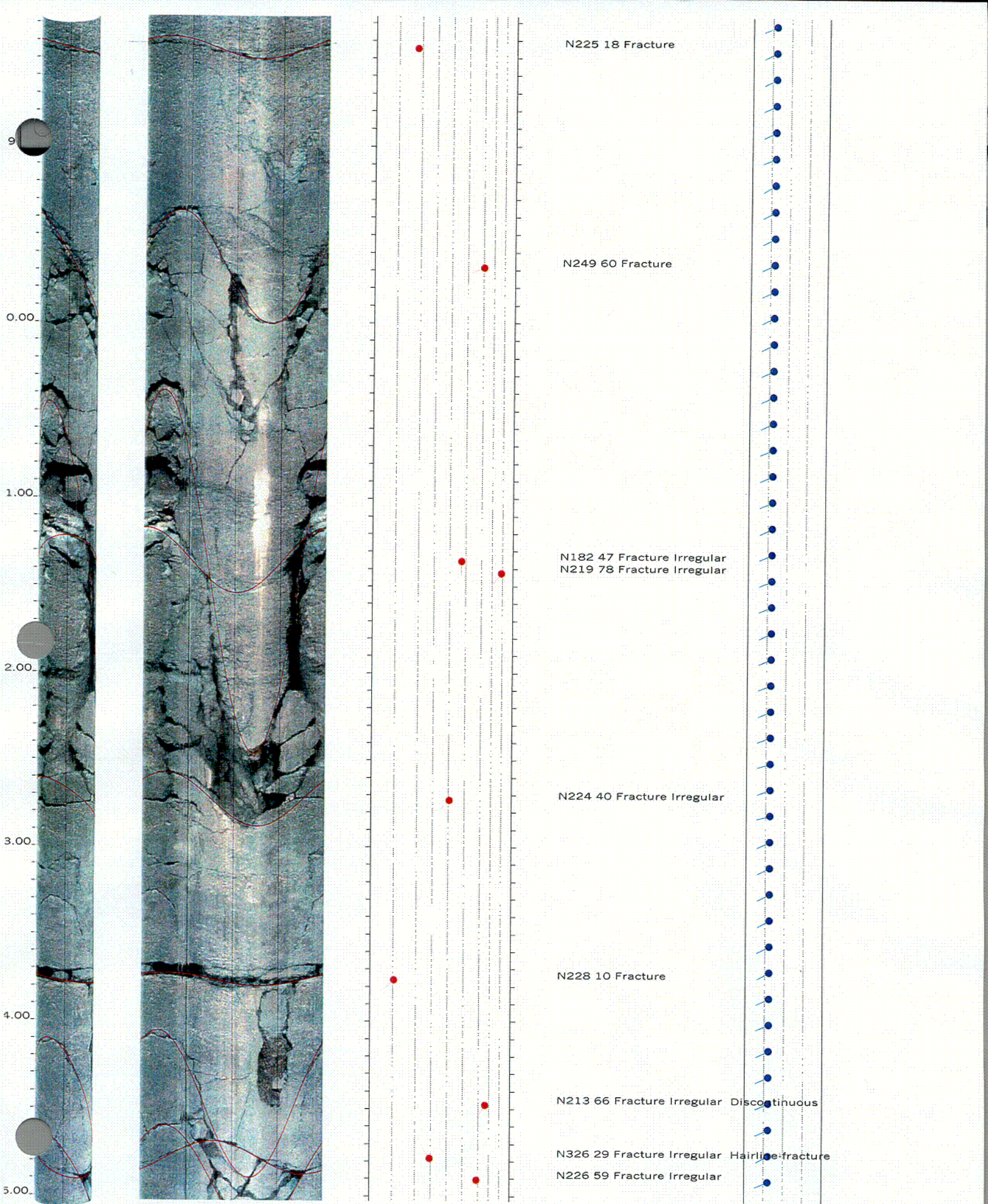
02 May 2001

Diablo Canyon ISFSI  
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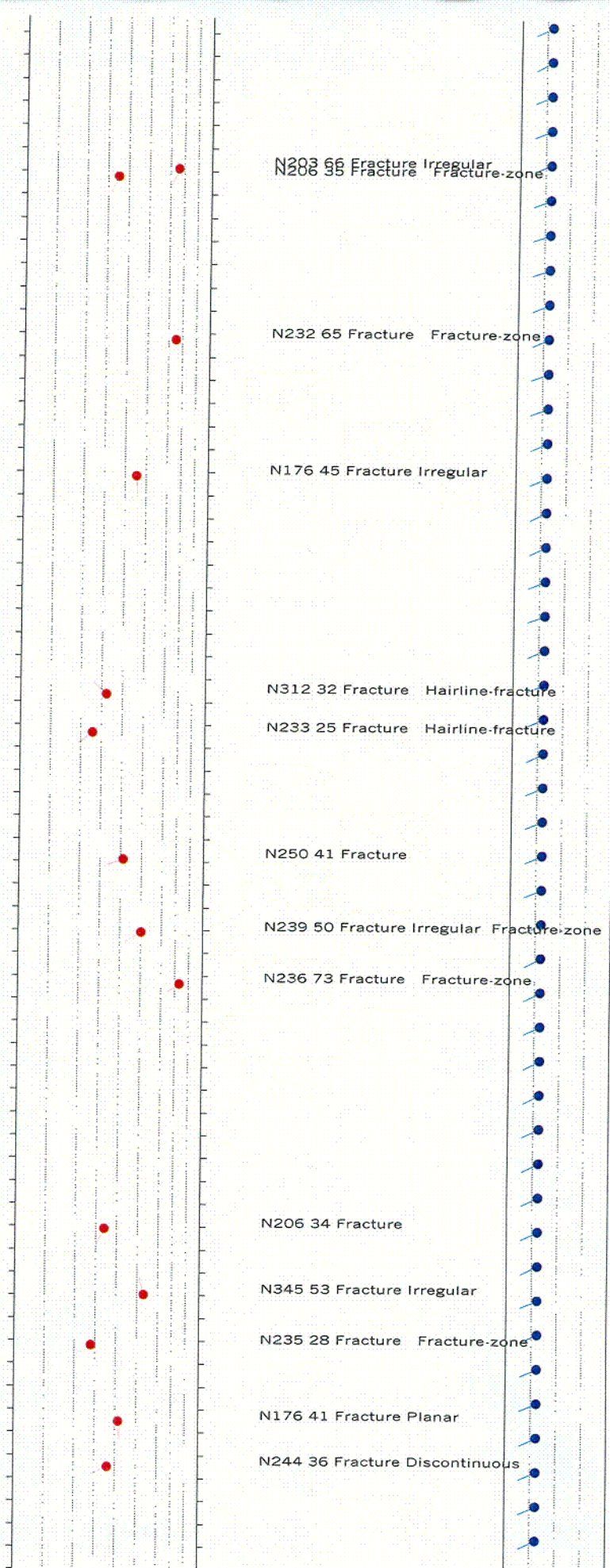
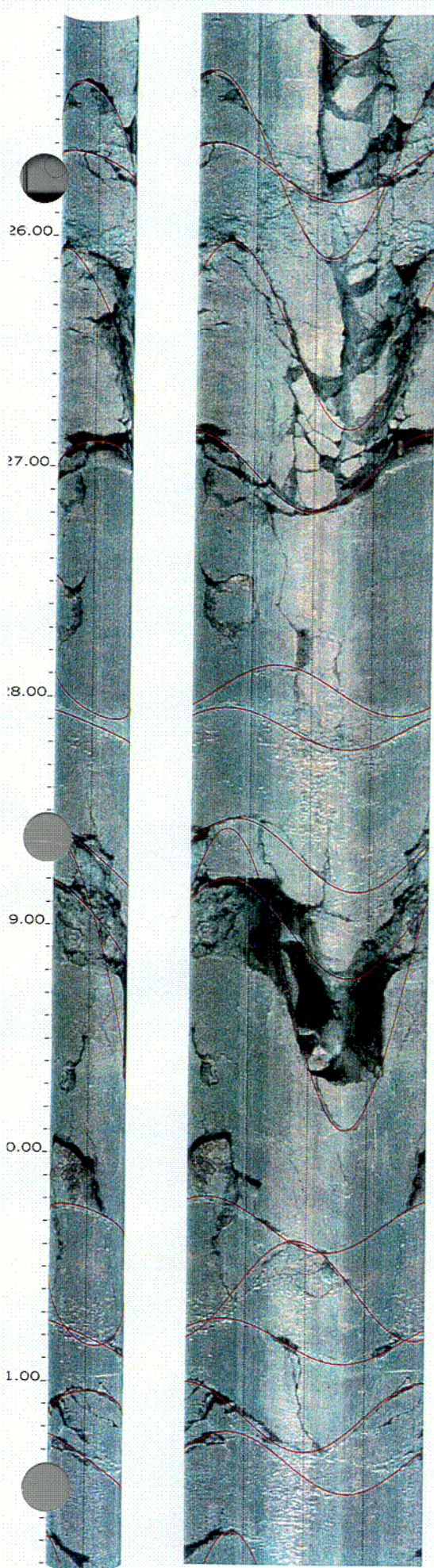
C36





C37





01-C

31.800 to 25.032ft

02 May 2001

Diablo Canyon ISFSI  
Data Report E, Rev. 0

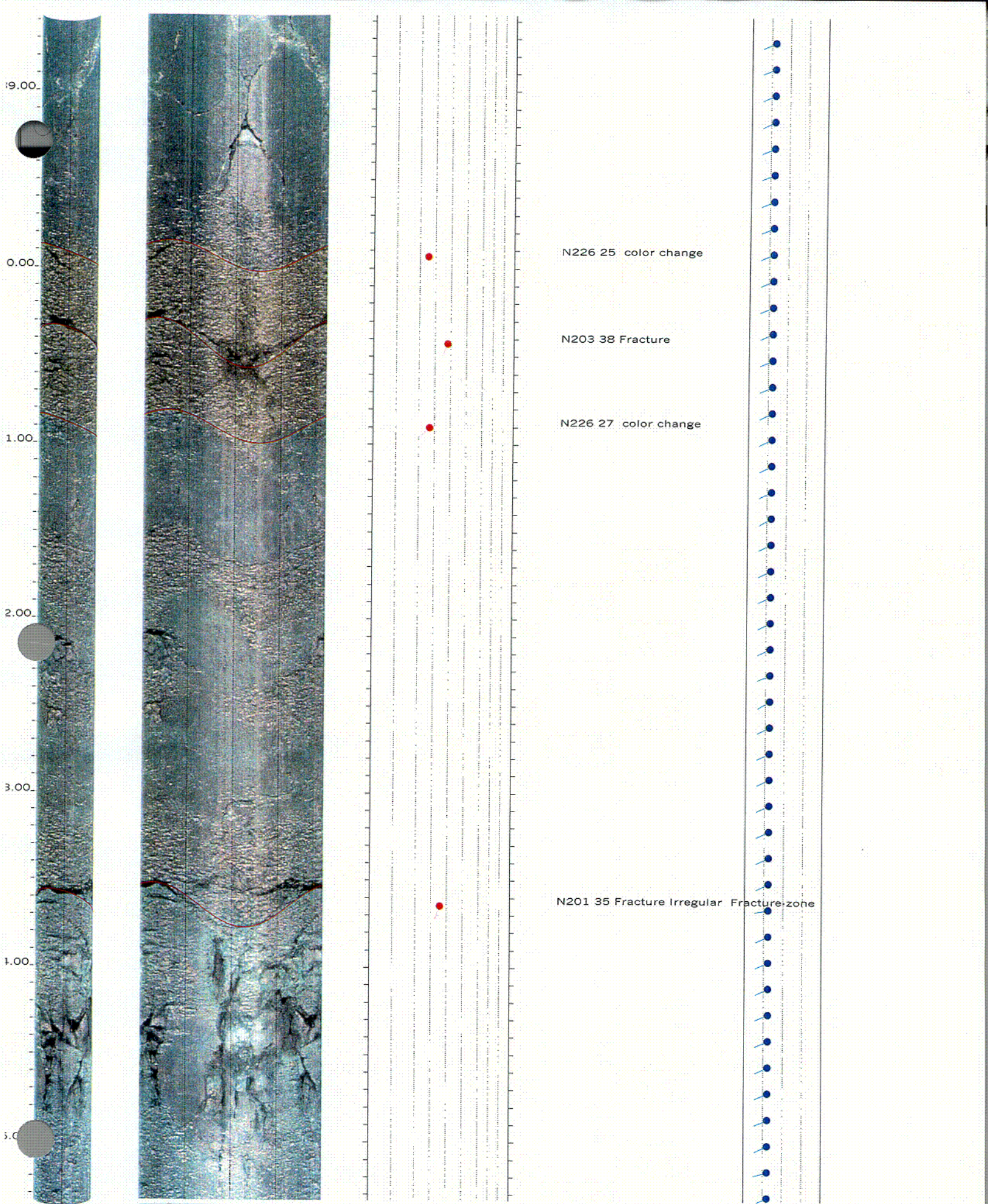
E-200 of 350

C38









01-C

45.336 to 38.568ft

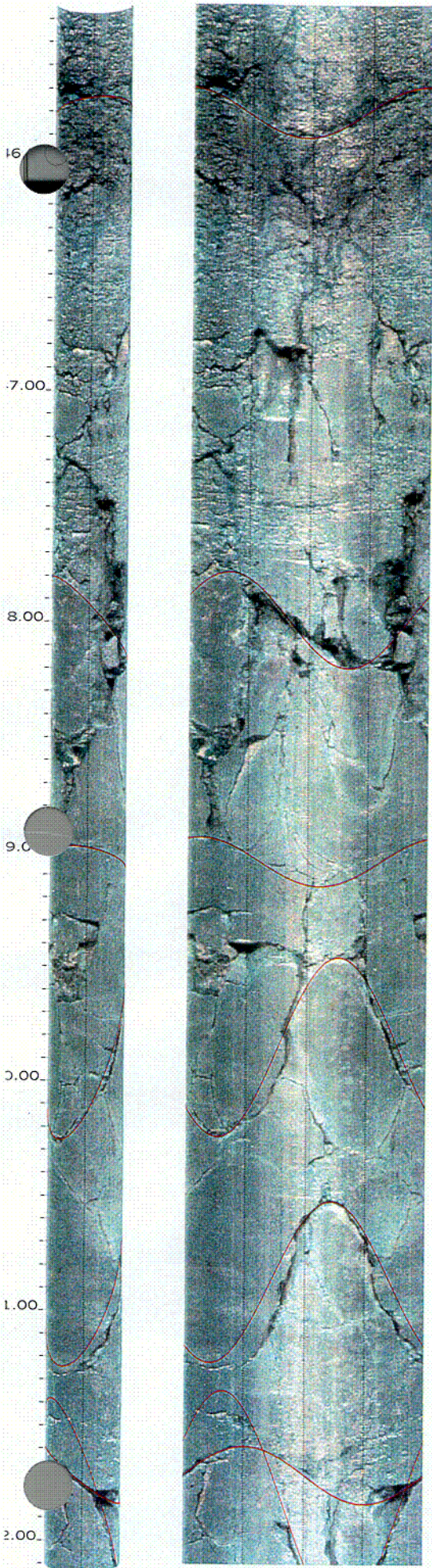
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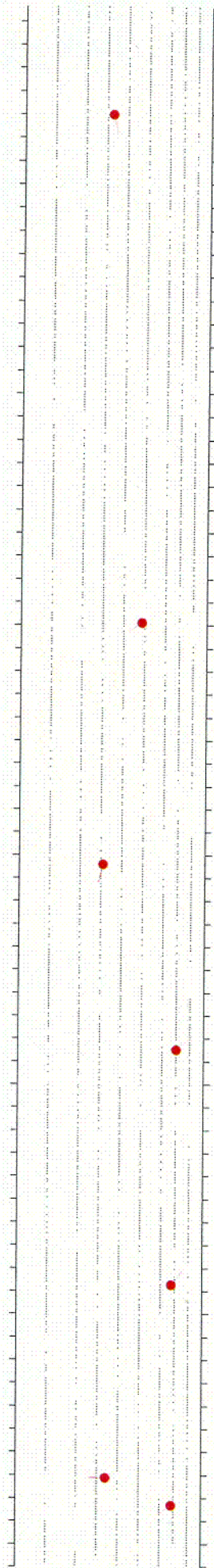
C40





01-C

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52.104 to 45.336ft

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N167 33 Fracture Irregular Fracture zone

N239 48 Fracture Irregular Fracture zone

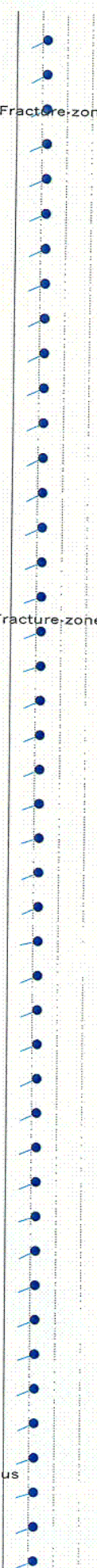
N194 31 Fracture Irregular

N047 70 Fracture Irregular

N039 67 Fracture Irregular

N271 34 Fracture Discontinuous

N237 68 Fracture Irregular



02 May 2001

C41



3.00

4.00

5.00

6.00

7.00

3.00

01-C

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58.872 to 52.104ft

E-204 of 350

02 May 2001

N251 40 Fracture contact?

N354 52 Fracture Discontinuous

N003 56 Fracture

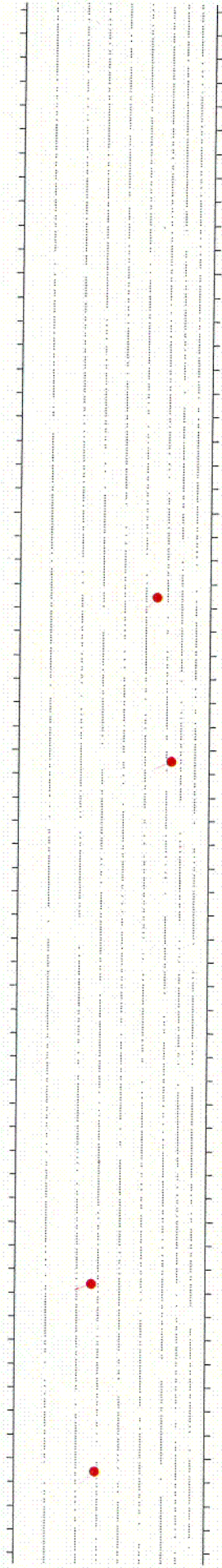
N076 64 Fracture

N285 49 Fracture Irregular

N195 43 Fracture Irregular Fracture zone

C42



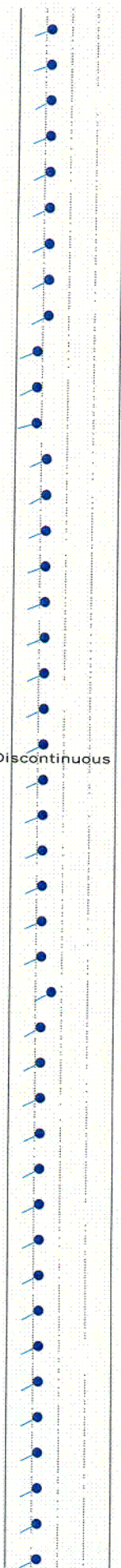


N222 55 Fracture Irregular

N246 63 Fracture Irregular Discontinuous

N251 27 Fracture Irregular

N229 29 Fracture Planar





LETTIS AND PG&e

Borehole: 01-C REPEAT

DCPP ISFSI

top of borehole.....

East:

North:

Al823

North ref. is true

Depth units are feet

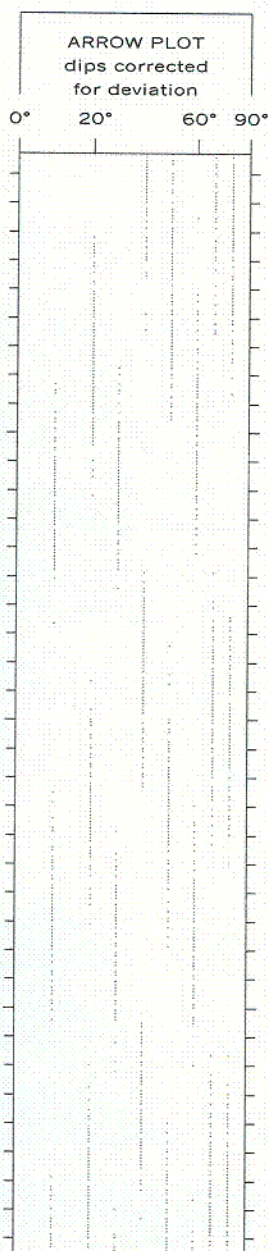
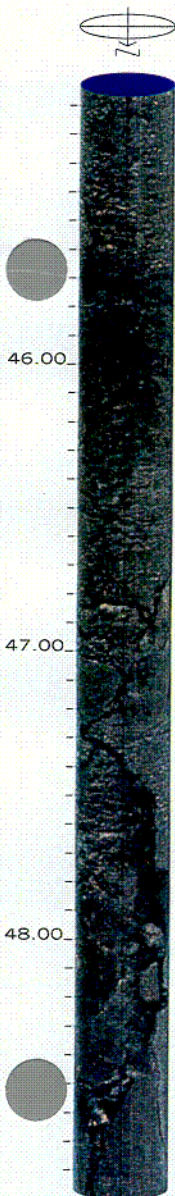
Vertical scale: 1/8

Horiz scale = vert scale

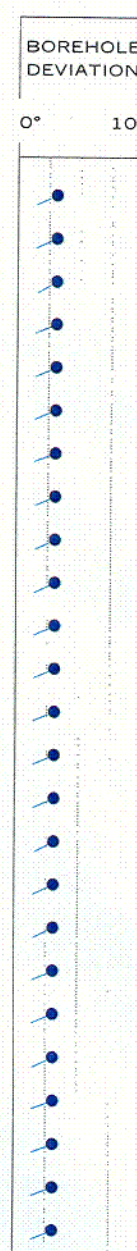
Zone from 65.409 to 45.029ft  
Vertical = borehole-axis

Borehole diam: 4.000inch

— BEDDING  
— FRACTURE  
Identified units



COMMENTS



01-C REPEAT

48.866 to 45.029ft

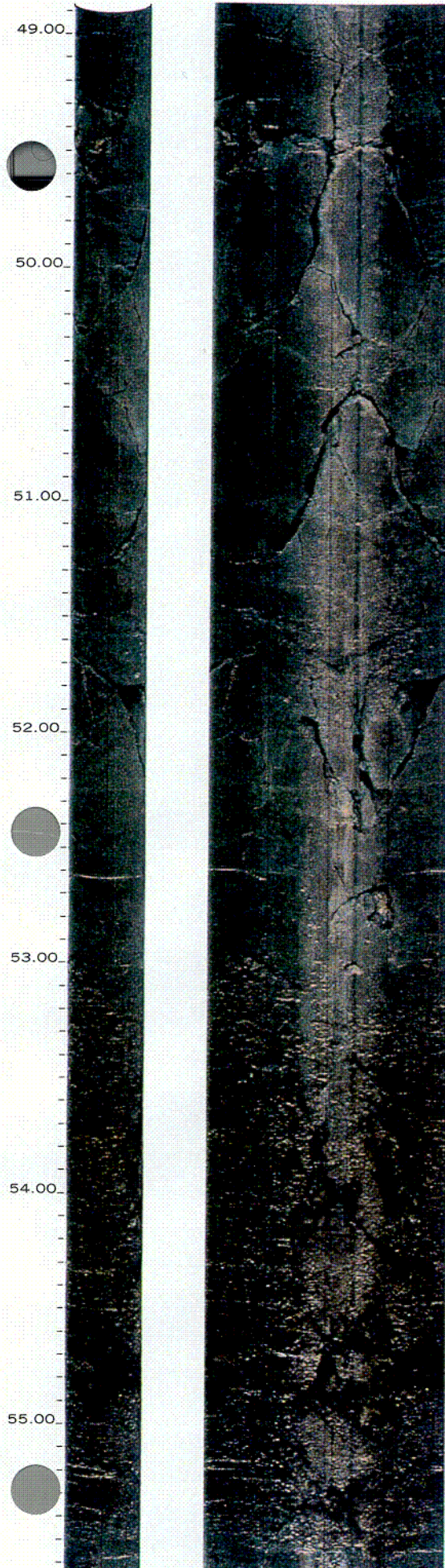
20 May 2001

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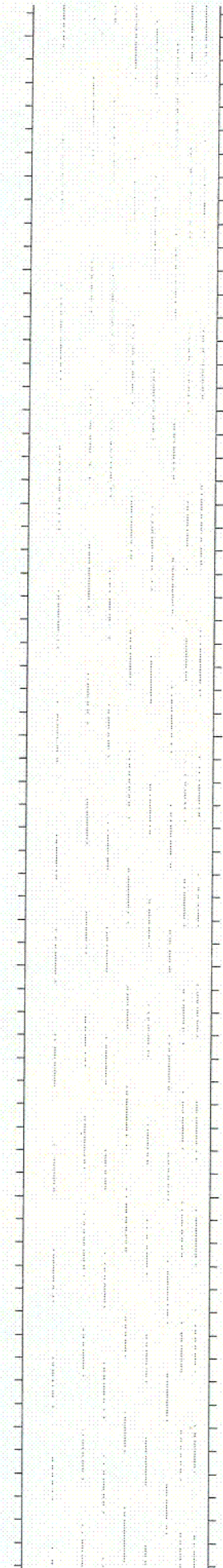
C44





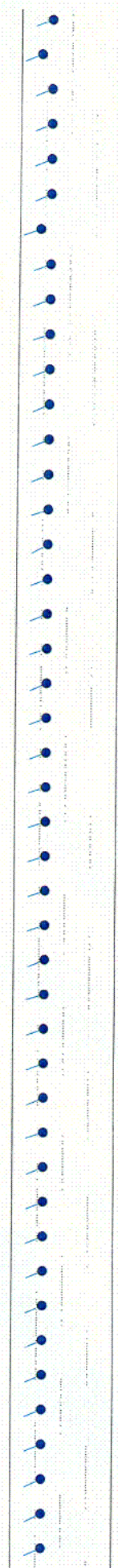
01-C REPEAT

Diablo Canyon ISFSI  
Data Report E, Rev. 0



55.634 to 48.866ft

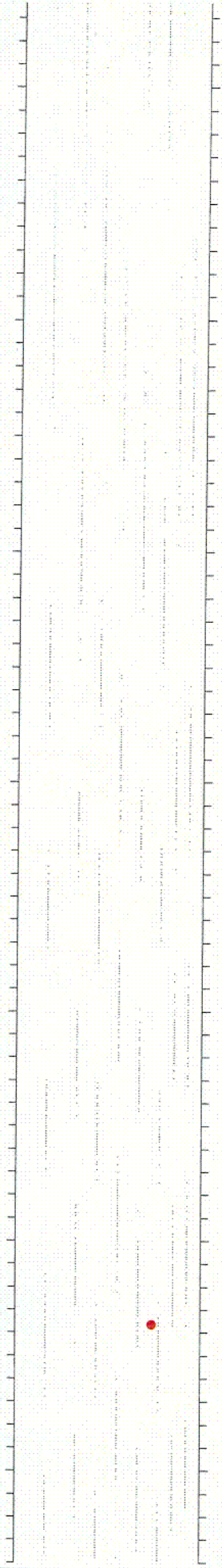
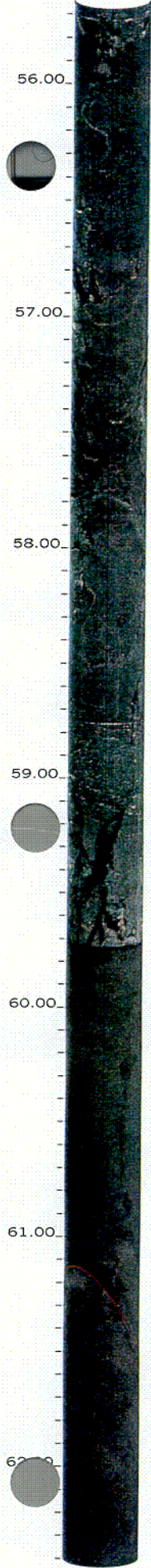
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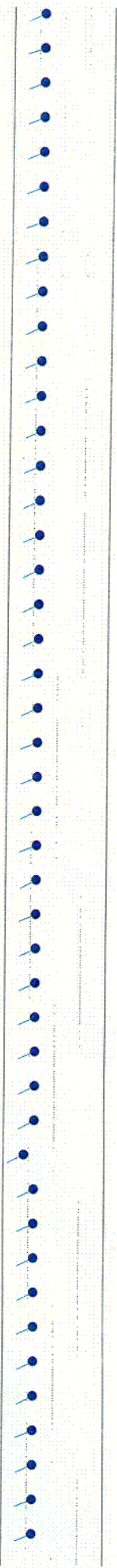
20 May 2001

045





N224 56 Fracture Planar



01-C REPEAT

62.402 to 55.634ft

20 May 2001

Diablo Canyon ISFSI  
Data Report E, Rev. 0

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C46



63.00

64.00

65.00

01-C REPEAT

Diablo Canyon ISFSI  
Data Report E, Rev. 0

65.409 to 62.402ft

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20 May 2001

C47