



Weatherford

MICRORESISTIVITY LOG

COMPANY			SHAKESPEARE OIL CO., INC.		
WELL			EDWARDS #1-21		
FIELD			PENCE WEST		
PROVINCE/COUNTY			SCOTT		
COUNTRY/STATE			U.S.A. / KANSAS		
LOCATION			1428' FSL & 481' FEL		
SEC 21	TWP 16S	RGE 34W	Other Services		MAI/MFE
Latitude			MDN/MPD		
Longitude			MSS		
API Number			15-171-21174		
Permanent Datum GL, Elevation 3132 feet					
Log Measured From KB					
Drilling Measured From KB @ 8 FEET					
Date	05-AUG-2016				Elevations: KB 3140.00 DF 3138.00 GL 3132.00
Run Number	ONE				
Service Order	4558-157610049				
Depth Driller	4915.00		feet		
Depth Logger	4911.00		feet		
First Reading	4865.00		feet		
Last Reading	3800.00		feet		
Casing Driller	264.00		feet		
Casing Logger	266.00		feet		
Bit Size	7.875		inches		
Hole Fluid Type	CHEMICAL				
Density / Viscosity	9.50 lb/USg		59.00 CP		
PH / Fluid Loss	10.50		8.00 ml/30Min		
Sample Source	FLOWLINE				
Rm @ Measured Temp	0.62 @ 75.0		ohm-m		
Rmf @ Measured Temp	0.50 @ 75.0		ohm-m		
Rmc @ Measured Temp	0.74 @ 75.0		ohm-m		
Source Rmf / Rmc	CALC		CALC		
Rm @ BHT	0.40 @ 116.0		ohm-m		
Time Since Circulation	5 HOURS				
Max Recorded Temp	116.00		deg F		
Equipment / Base	13096		OKC		
Recorded By	ADAM SILL				
Witnessed By	TIM PRIEST				

BOREHOLE RECORD					Last Edited: 05-AUG-2016 17:49
Bit Size inches		Depth From feet		Depth To feet	
7.875		264.00		4915.00	
CASING RECORD					
Type	Size inches	Depth From feet	Shoe Depth feet		Weight pounds/ft
SURFACE	8.625	0.00	264.00		24.00

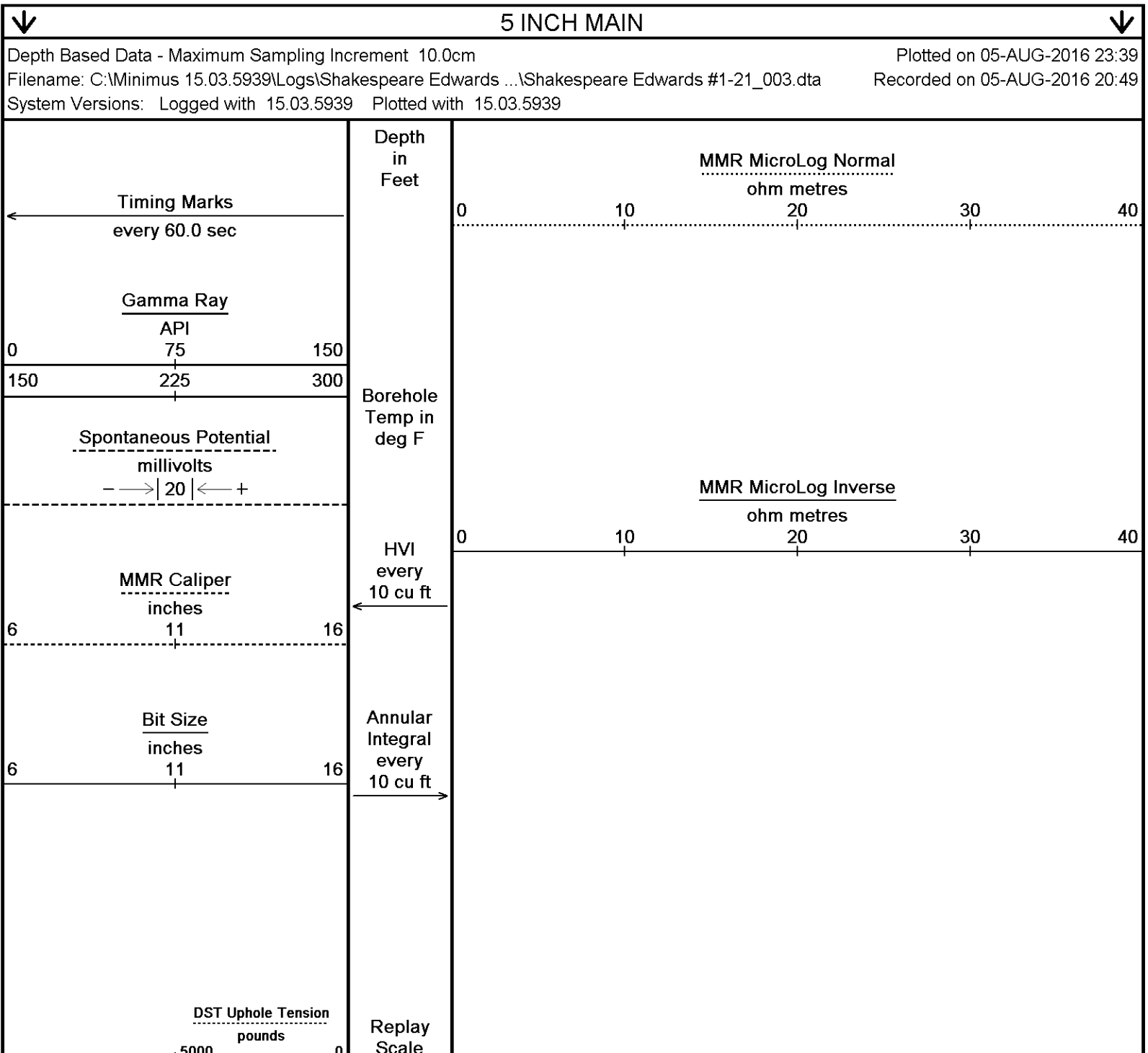
REMARKS
- SOFTWARE ISSUE: WLS 15.03.5939.
- RUN ONE: MCG, MML, MDN, MPD, MFE, MSS, MAI RUN IN COMBINATION. - HARDWARE: DUAL BOWSPRING USED ON MDN. 0.5 INCH STANDOFF USED ON MFE. TWO 0.5 INCH STANDOFFS USED ON MSS. 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 2496 CU.FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD TO 3800 FEET: 288 CU.FT.

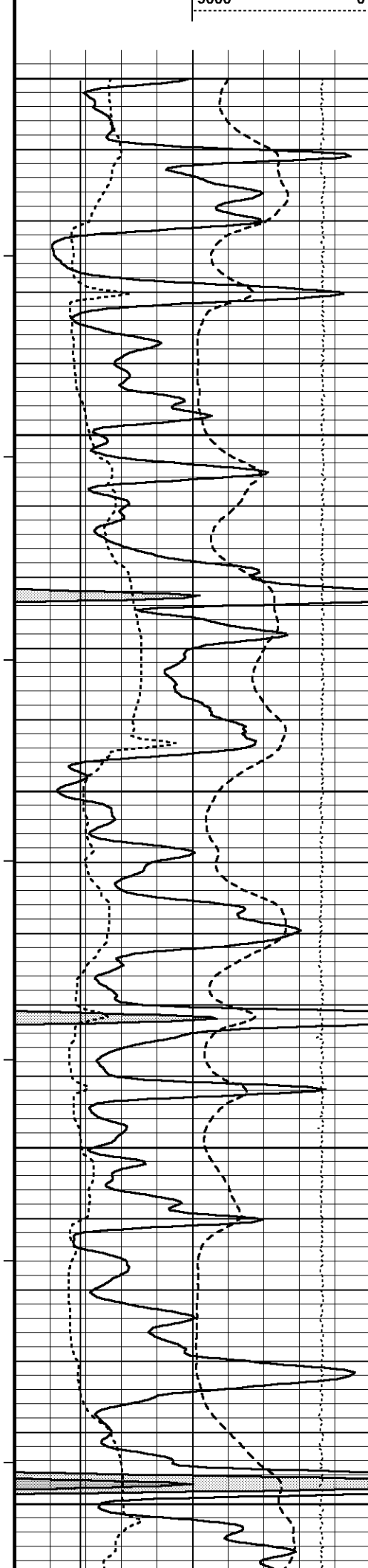
- RIG: DUKE #2.

- ENGINEER: A. SILL.

- OPERATOR: J. LaPOINT.

In interpreting, communicating or providing information and/or making recommendations, either written or oral, as to logs or test or other data, type or amount of material, or Work or other service to be furnished, or manner of performance, or in predicting results to be obtained, the Contractor will give the Company the benefit of the Contractor's best judgment based on its experience and will perform all such Work in a good and workmanlike manner. Any interpretation of test or other data, and any recommendation or reservoir description based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions, which inferences and assumptions are not infallible, and with respect to which professional engineers and analysts may differ. ACCORDINGLY ANY INTERPRETATION OR RECOMMENDATION RESULTING FROM THE SERVICES WILL BE AT THE SOLE RISK OF THE COMPANY, AND THE CONTRACTOR CANNOT AND DOES NOT WARRANT THE ACCURACY, CORRECTNESS OR COMPLETENESS OF ANY SUCH INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.





1:240

3800

110°

3850

110°

3900

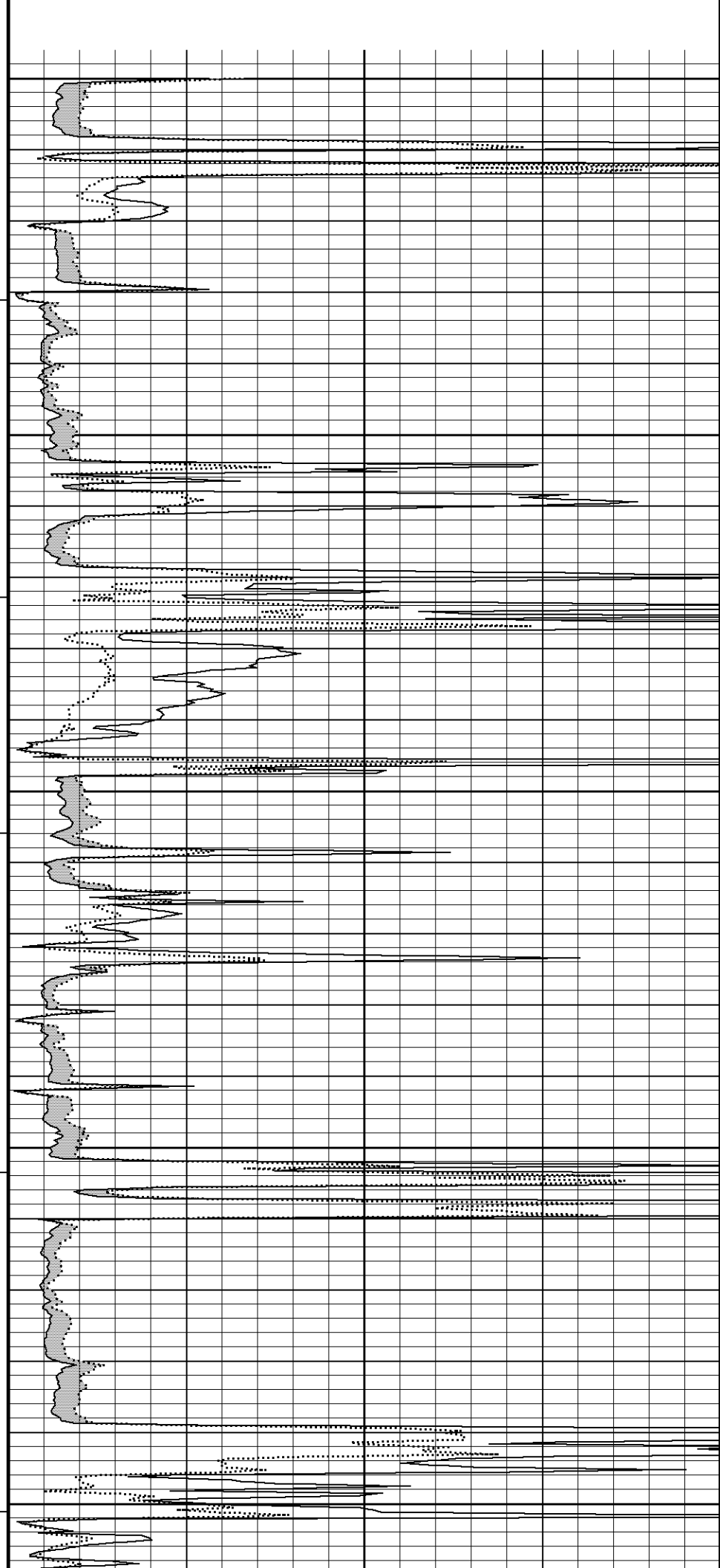
110°

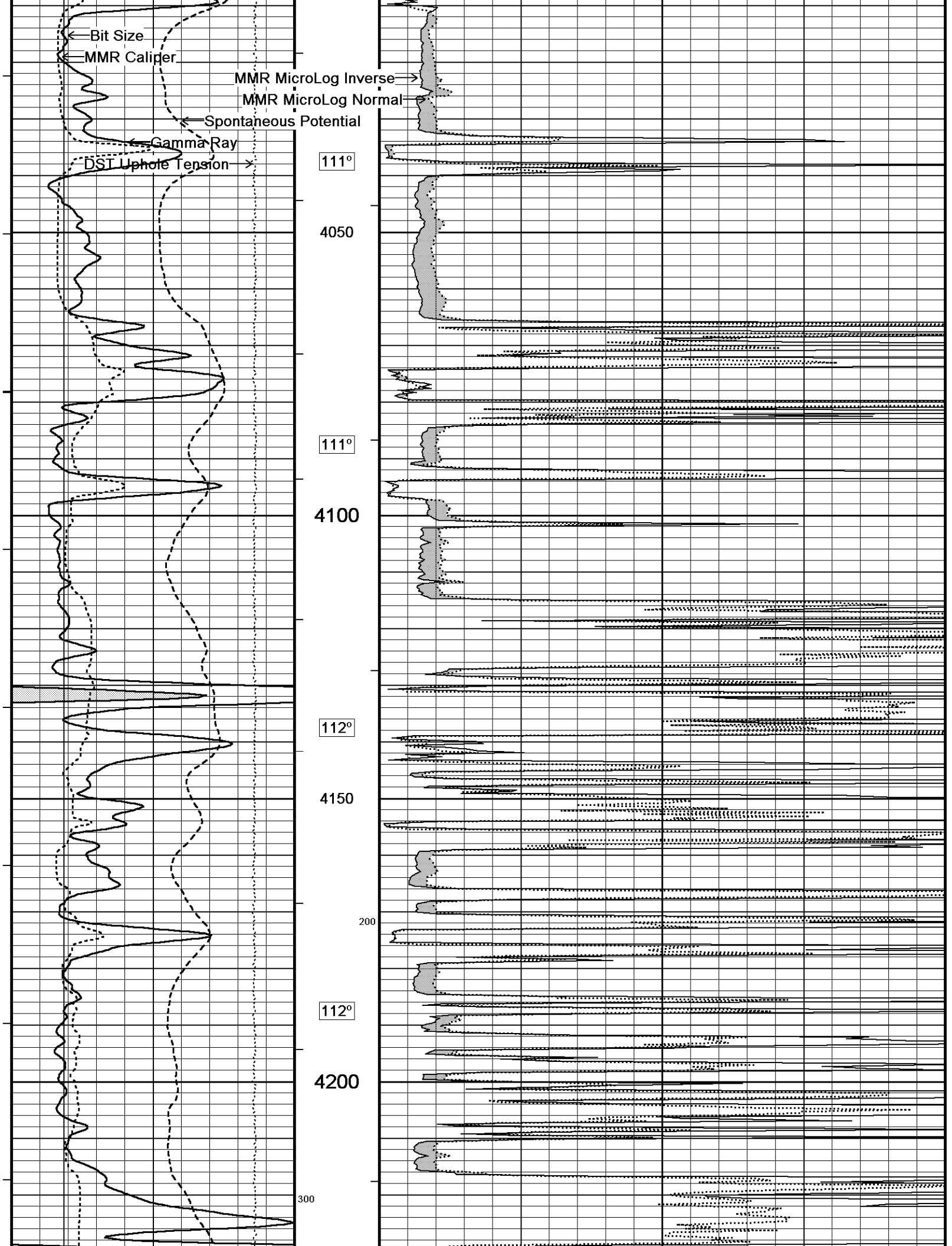
3950

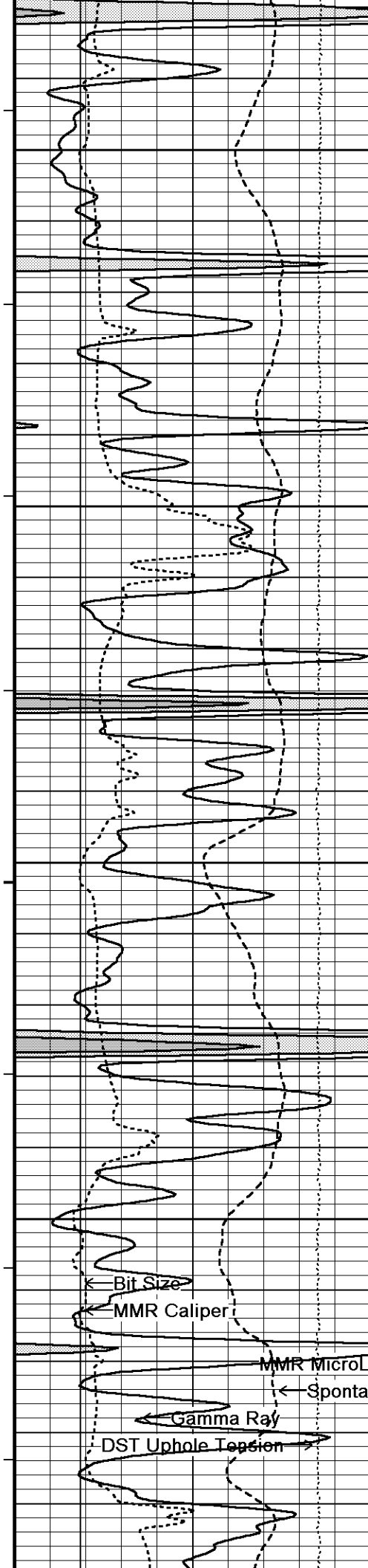
400

111°

4000







112°

4250

112°

4300

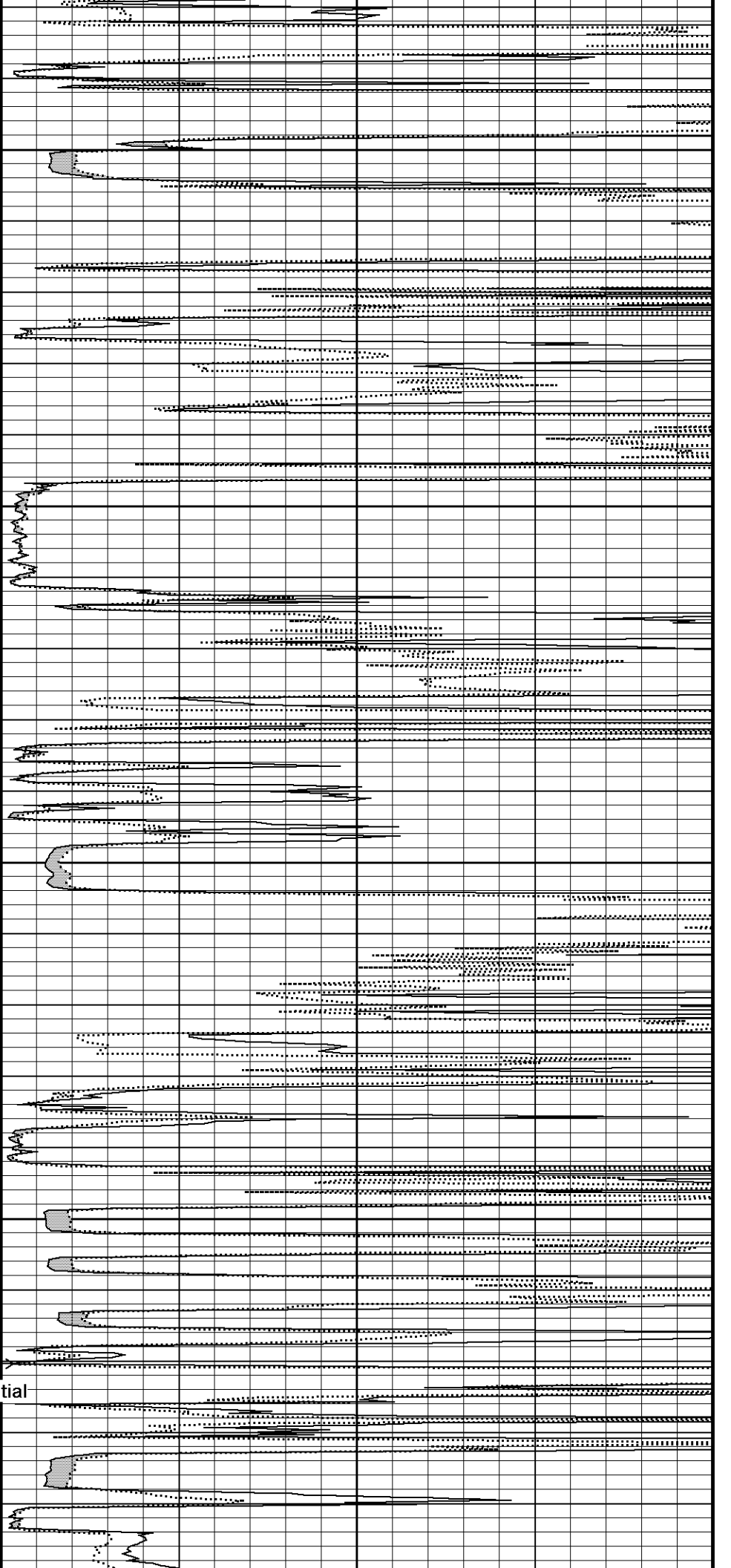
112°

4350

113°

4400

113°

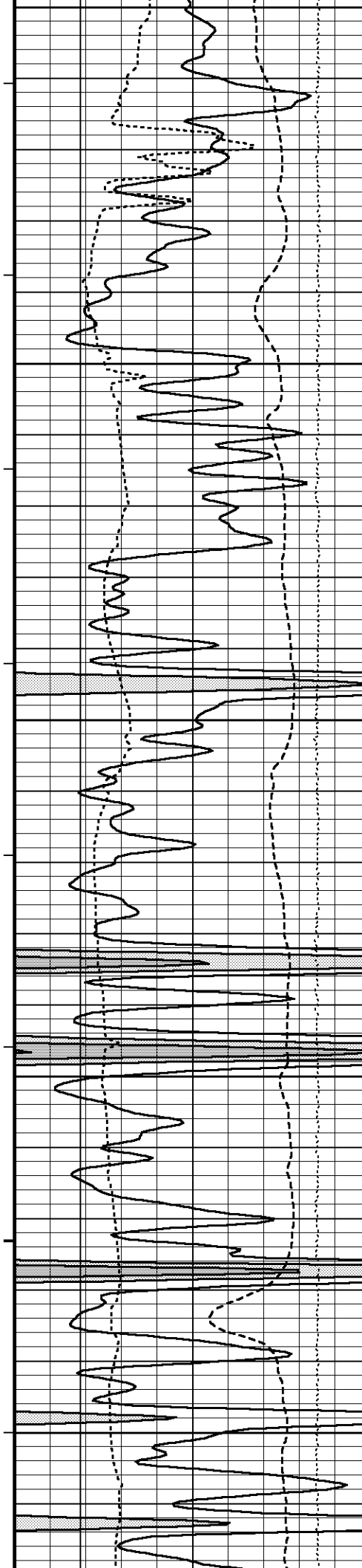


MMR MicroLog Normal

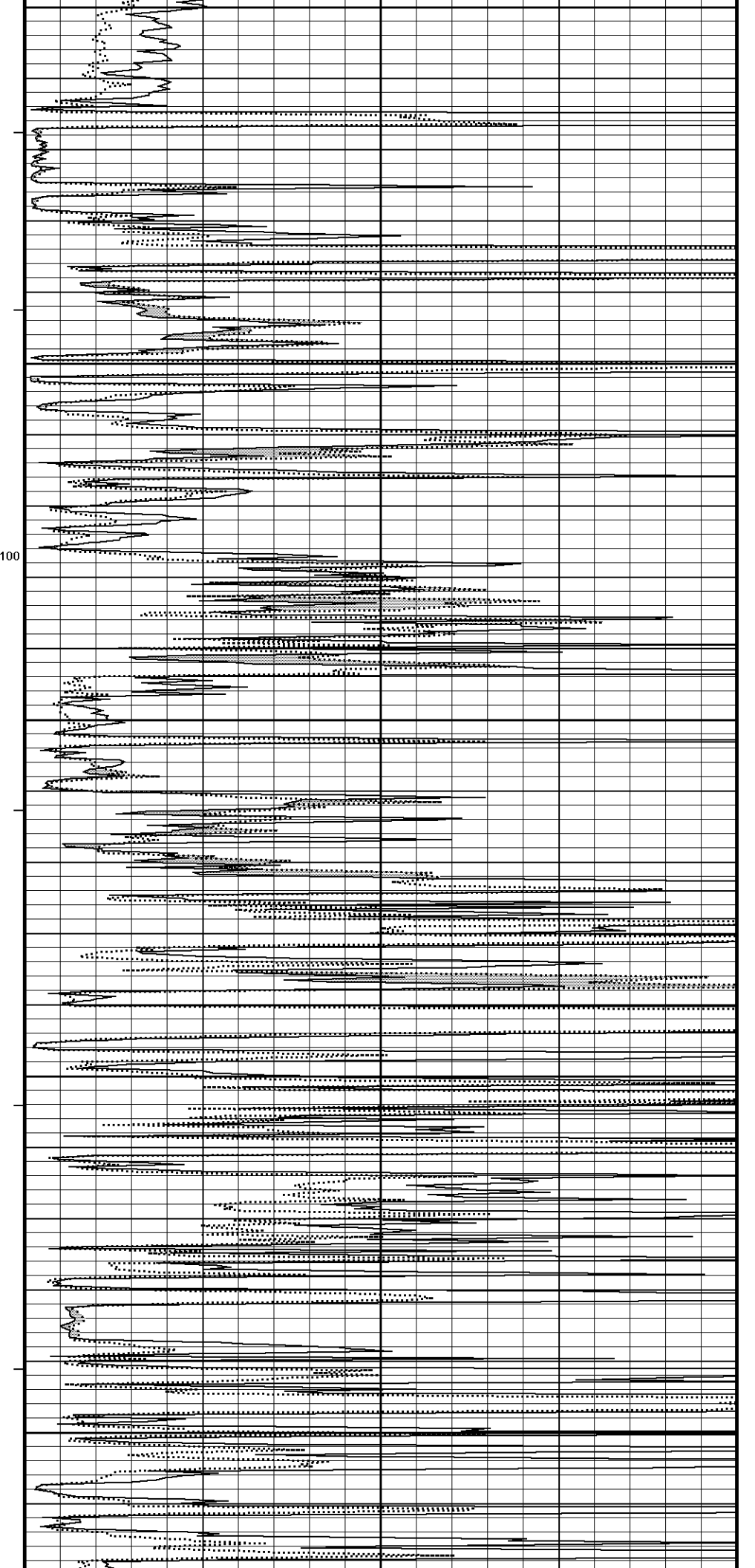
Spontaneous Potential

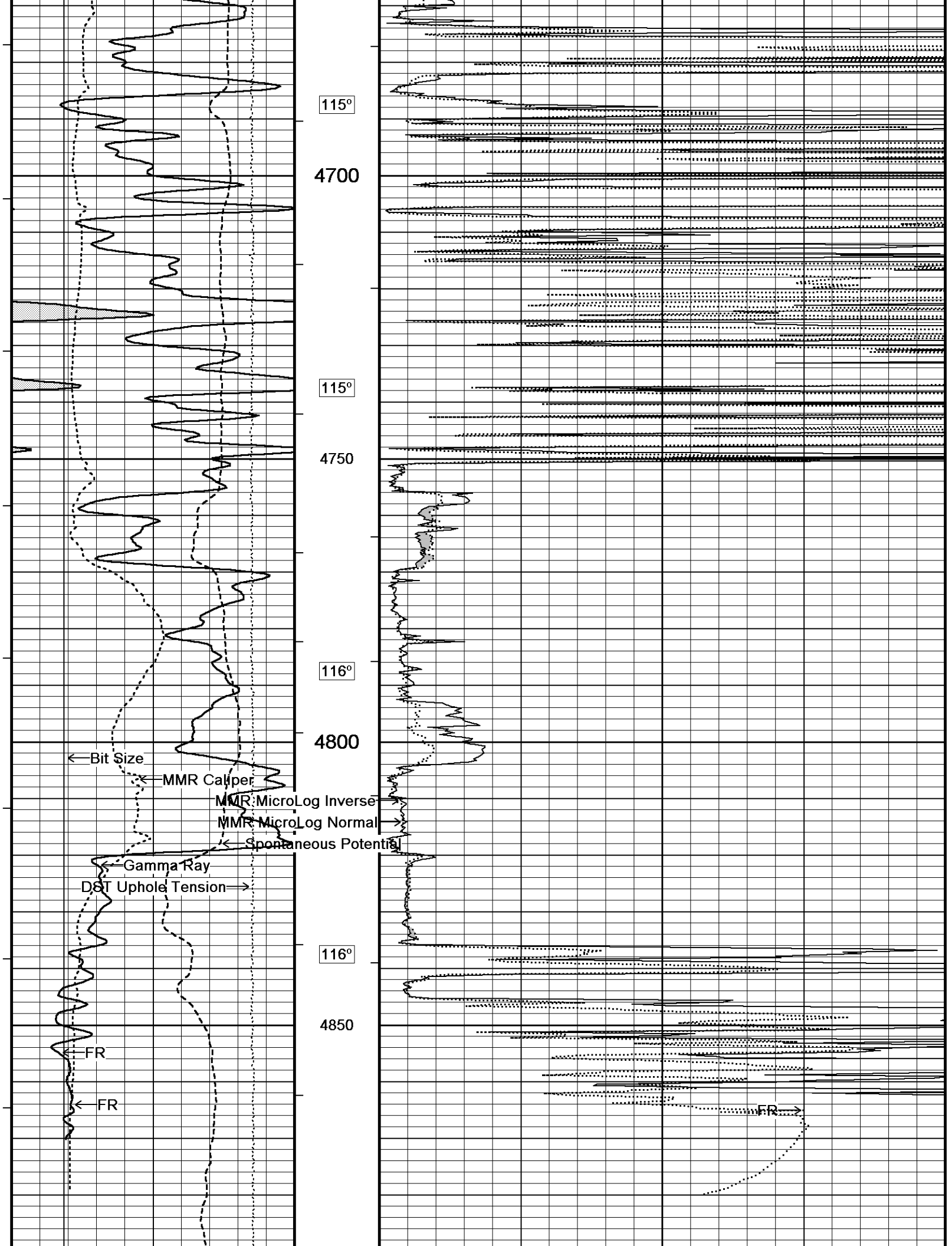
Gamma Ray

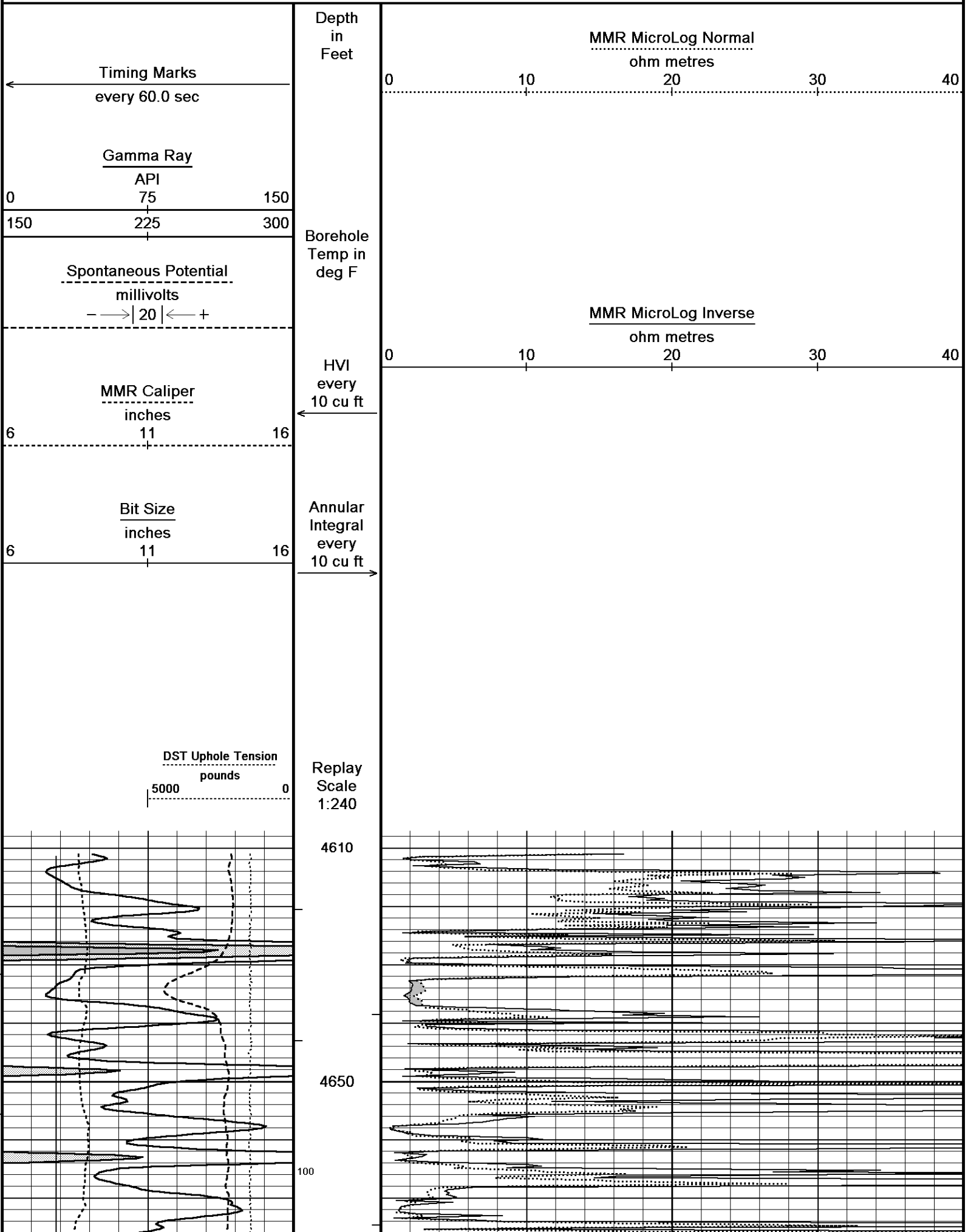
DST Uphole Tension

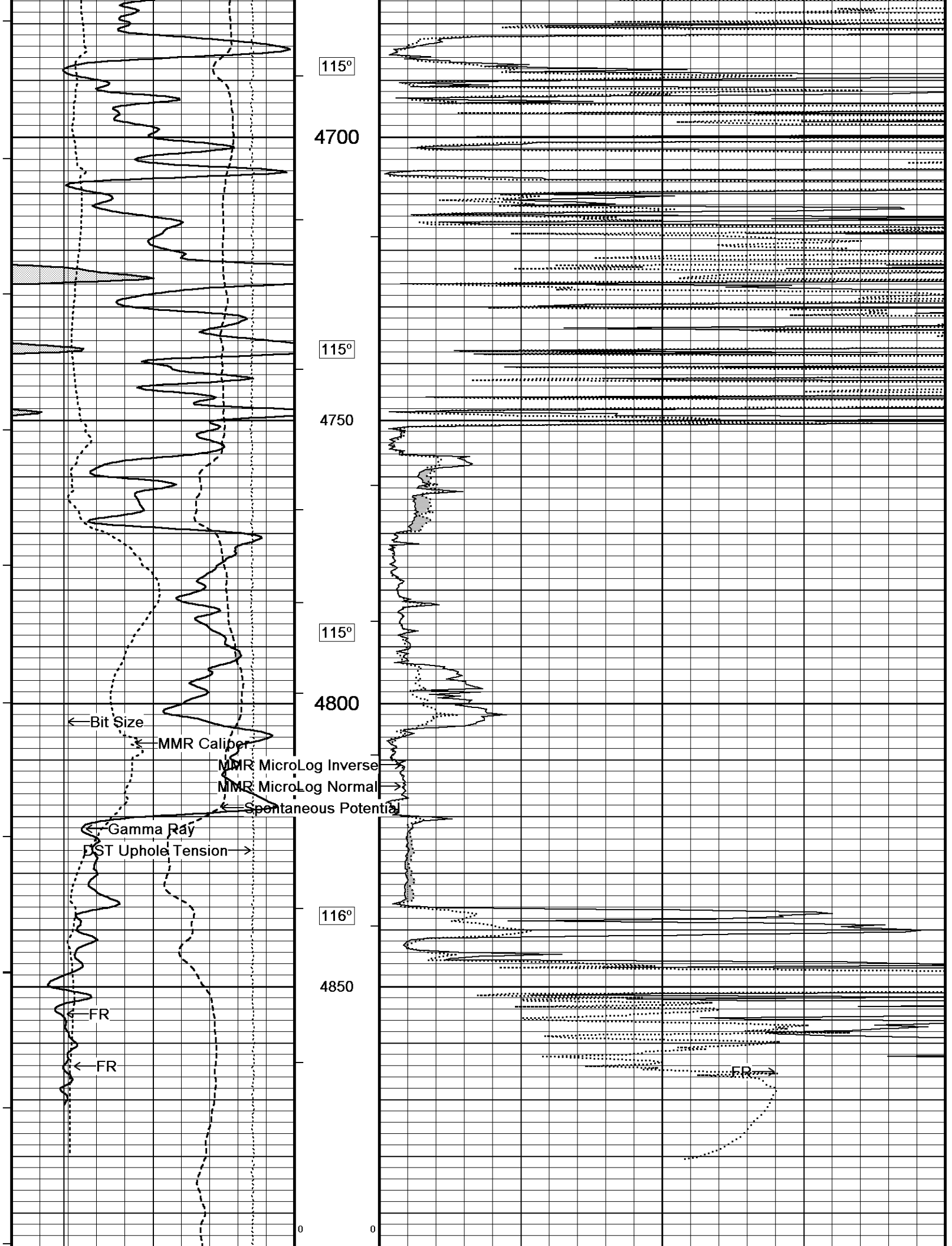


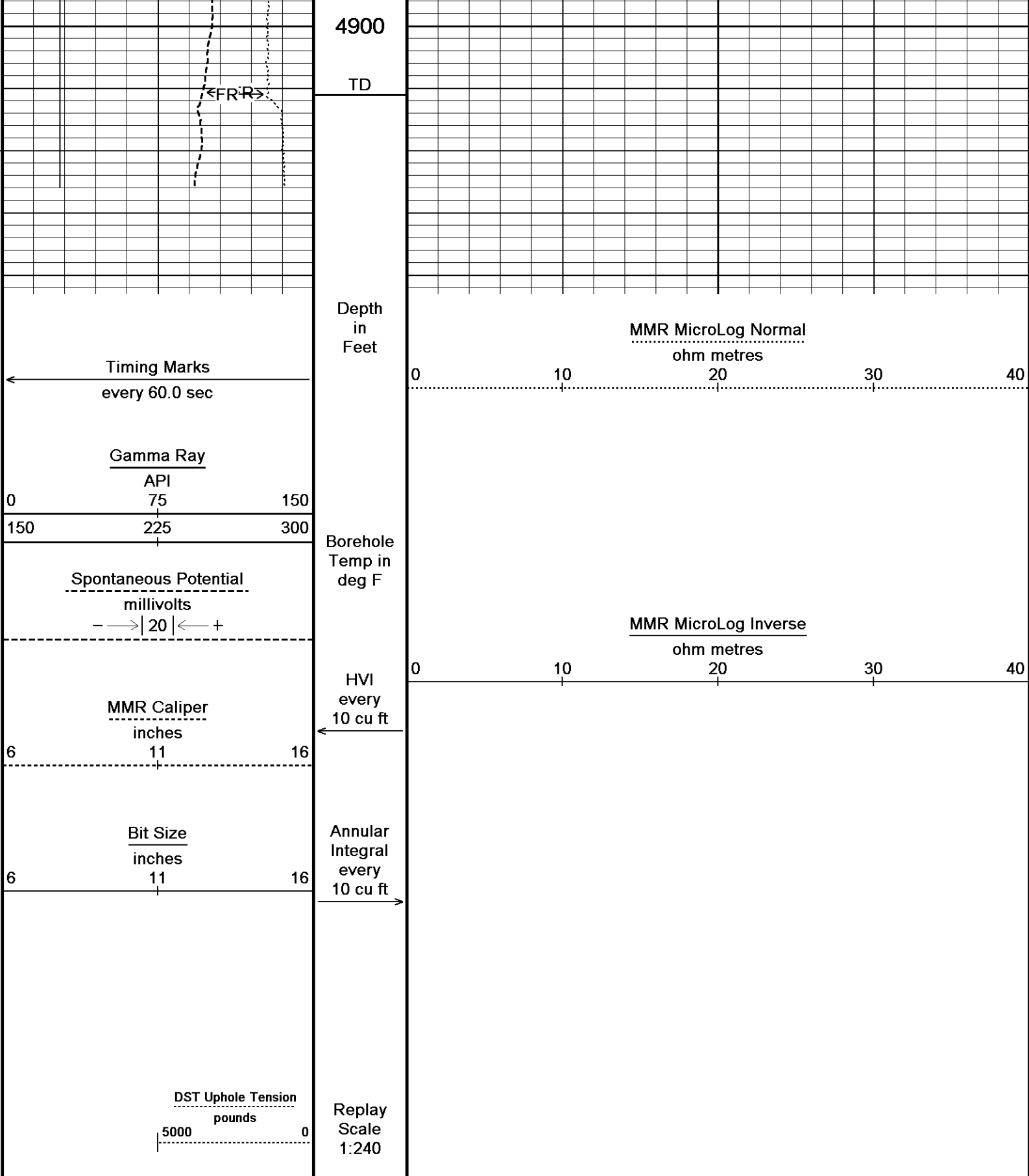
4450
114°
4500
100
114°
4550
115°
4600
115°
4650
100











Depth Based Data - Maximum Sampling Increment 10.0cm		Plotted on 05-AUG-2016 23:39
Filename: C:\Minimus 15.03.5939\Logs\Shakespeare Edwards ...\Shakespeare Edwards #1-21_002.dta		Recorded on 05-AUG-2016 20:25
System Versions: Logged with 15.03.5939 Plotted with 15.03.5939		

↑	REPEAT SECTION	↑
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General Parameters

Mud Resistivity	0.620	ohm-metres
Mud Resistivity Temperature	75.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	

Hole/Annular Volume and Differential Caliper Parameters

HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	5.500	inches
Caliper for Differential Caliper	None	

Rwa Parameters

Porosity used	Base Density Porosity
Resistivity used	Array Ind. One Res Rt
RWA Constant A	0.610
RWA Constant M	2.150
SW/APOR Tool Source	0.000

Down-hole Tension Calibration SMS 0

Field Calibration on 24-JUL-2016 15:20

Reading No	Measured	Calibrated (lbs)
1	15235.81	0.00
2	16026.61	481.00

Gamma Calibration MCG-C 123

Field Calibration on 04-AUG-2016 08:11

	Measured	Calibrated (API)
Background	71	49
Calibrator (Gross)	731	505
Calibrator (Net)	660	456

Gamma Calibration Tolerances MCG-C 123

Ratio	1.448	1.40 1.475 1.55	Counts/API
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Gamma Constants MCG-C 123

Last Edited on 05-AUG-2016,17:51

Gamma Calibrator Number	MCGGRCC141	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.14	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-C 123

Field Calibration on 31-OCT-2015,17:05

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	100.00	100.00

High Resolution Temperature Constants MCG-C 123

Last Edited on 22-SEP-2015,11:43

Pre-filter Length	11
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SP Calibration MCG-C 123

Field Calibration on 14-JUL-2016 12:06

	Measured	Calibrated (mV)
Reference 1	101.2	100.6
Reference 2	-99.1	-99.9

Micro Normal and Micro Inverse Calibration MMR-C.A 247

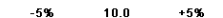
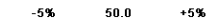
Base Calibration on 22-MAY-2016 16:59

Field Check on 04-AUG-2016 07:56

Base Calibration

Channel	Resistor 1	Measured Resistor 2	Calibrated (ohm-m) Resistor 1	Resistor 2
Micro Normal	10.2	49.9	5.1	25.6
Micro Inverse	10.0	49.5	3.4	16.9

Micro Normal & Micro Inverse Calibration Tolerance MMR-C.A 247

Micro Normal Res. 1	10.2		ohm	Micro Normal Res. 2	49.9		ohm
Micro Inverse Res. 1	10.0		ohm	Micro Inverse Res. 2	49.5		ohm
Micro Normal Base Check	93.6		ohm-m				
Micro Inverse Base Check	62.2		ohm-m				
Micro Normal Field Check	93.6		ohm-m				
Micro Inverse Field Check	62.2		ohm-m				

Caliper Calibration MMR-C.A 247		Base Calibration on 22-MAY-2016 16:40 Field Calibration on 04-AUG-2016 07:55	
Base Calibration			
Reading No	Measured	Calibrator Size (in)	
1	14762	5.98	
2	18067	7.97	
3	21325	9.86	
4	25277	11.92	
5	0	0.00	
6	N/A	N/A	
Field Calibration			
	Measured Caliper (in)	Actual Caliper (in)	
	7.95	7.97	

Micro-Resistivity Caliper Constants MMR-C.A 247		Last Edited on
Sonde Configuration	Resistivity Mode	

Neutron Calibration Tolerances MDN-A.B 66

Ratio 32.277

-5% 33 +5%

Base Check 0.681

0.65 0.7 0.75

0.661 0.681 0.701

Neutron Constants MDN-A.B 66

Last Edited on 05-AUG-2016,17:51

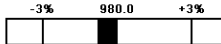
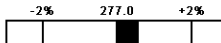
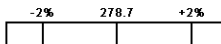
Neutron Source Id	P0204NN	
Neutron Jig Number	NJ5736	
Air Hole Processing	Legacy	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	N/A	kppm
Barite Mud Correction	Not Applied	

FE Calibration MFE-B.J 352

Base Calibration on 22-MAY-2016 16:12
Field Check on 04-AUG-2016 07:46

Base Calibration	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	972.3	126.8
Base Check		278.7
Field Check		278.8

FE Calibration Tolerances MFE-B.J 352

Reference 2	972.3		ohm
Base Check	278.7		ohm-m
Field Check	278.8		ohm-m

FE Constants MFE-B.J 352

Last Edited on 05-AUG-2016,17:50

Running Mode	No Sleeve	
MFE K Factor	0.1268	
Borehole Correction Constants		
Sonde Position	0.5	inches
Hole Size Source	Density Caliper	
Hole Size Constant Value	N/A	inches
Rm Source	Global Value: Temperature Corrected	
Temp. for Rm Corr.	MCG External Temperature	

Sonic Constants MSS-A.A 55

Last Edited on 05-AUG-2016,17:50

Maximum Boundary Contrast	100.00	micro-sec/ft
Fluid Transit Time	189.00	micro-sec/ft
Limestone Transit Time	47.50	micro-sec/ft
Sandstone Transit Time	55.50	micro-sec/ft
Dolomite Transit Time	43.50	micro-sec/ft
Sonic used for Porosities	3-5' Compensated Sonic	
Correction for Sonde Skew	Applied	
Cycle Stretch Algorithm	Applied	
MN3FT	N/A	micro-sec
MX3FT	N/A	micro-sec
Hunt-Raymer Constant	83.13	micro-sec/ft
Sonde Mode	Compensated	
Hole Type	Open Hole	

Sonde Parameters

	Measured	Calibrated
Offset	N/A	0.0000
Free Pipe	N/A	N/A
Peak Amplitude Source		N/A

Waveform	Start Time (micro-sec)	Width (micro-sec)	Pre Gain	Start Gain	Discriminator (mV)
3'	N/A	N/A	N/A	N/A	N/A
4'	N/A	N/A	N/A	N/A	N/A
5'	N/A	N/A	N/A	N/A	N/A
6'	N/A	N/A	N/A	N/A	N/A

Processed Fixed Gate Parameters

Waveform Used For Processing	N/A			
Start Time (micro-sec)	End Time (micro-sec)	Discriminator (mV)	N/A	
N/A	N/A	N/A		N/A
N/A	N/A	N/A		N/A
N/A	N/A	N/A		N/A
N/A	N/A	N/A		N/A
N/A	N/A	N/A		N/A

Full Waveform Parameters

Use 3' Waveform to derive TR	N/A	
Use 4' Waveform to derive TR	N/A	
Use 5' Waveform to derive TR	N/A	
Use 6' Waveform to derive TR	N/A	
3' Waveform Discriminator Level	N/A	mV
4' Waveform Discriminator Level	N/A	mV
5' Waveform Discriminator Level	N/A	mV
6' Waveform Discriminator Level	N/A	mV
3' Waveform Filter	N/A	
4' Waveform Filter	N/A	
5' Waveform Filter	N/A	
6' Waveform Filter	N/A	
Semblance Level	N/A	
Semblance Window Width	N/A	micro-sec
Sonic 1 Despiker	N/A	N/A
Sonic 2 Despiker	N/A	N/A

Induction Calibration MAI-A.A 111

Base Calibration on 05-AUG-2014,09:34
Field Check on 04-AUG-2016 07:45

Base Calibration

Test Loop Calibration	Measured		Calibrated (mmho/m)	
Channel	Low	High	Low	High
1	17.6	473.6	9.3	966.2
2	6.4	385.9	7.6	821.4
3	3.2	264.0	5.2	566.0
4	2.1	135.5	2.6	279.2

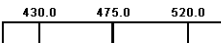
Array Temperature 23.0 Deg F

Test Loop Calibration Verified 22-MAY-2016,17:59

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	12.1	3873.0	10.5	3867.1
2	29.8	3528.1	27.6	3522.2
3	29.1	3021.3	27.1	3016.2
4	19.1	2058.5	17.8	2054.6
Deep	17.7	1962.1	16.5	1958.5
Medium	43.1	3976.4	40.4	3970.0
Shallow	44.4	5232.7	41.2	5224.4

Array Temperature 65.8 83.0 Deg F

Induction Calibration Tolerances MAI-A.A 111

Low Conductivity 1 17.6  mmho/m High Conductivity 1 473.6  mmho/m

Low Conductivity 2	6.4		mmho/m	High Conductivity 2	385.9		mmho/m
Low Conductivity 3	3.2		mmho/m	High Conductivity 3	264.0		mmho/m
Low Conductivity 4	2.1		mmho/m	High Conductivity 4	135.5		mmho/m
Background Vx 1	0.0		mmho/m	Phase Check Loop 1	0.0		%
Background Vx 2	0.0		mmho/m	Phase Check Loop 2	0.0		%
Background Vx 3	0.0		mmho/m	Phase Check Loop 3	0.0		%
Background Vx 4	0.0		mmho/m	Phase Check Loop 4	0.0		%

Induction Constants MAI-A.A 111

Last Edited on 05-AUG-2016,17:50

Induction Model	RtAP-WBM		
Borehole Correction Constants			
Tool Centred	No		
Hole Size Source	Density Caliper		
Hole Size Constant Value	N/A		
Stand-off Type	Fins		
Stand-off	0.50		
Number of Fins on Stand-off	8.0000		
Stand-off Fin Angle	45.00		
Stand-off Fin Width	0.5000		
Rm Source	Global Value: Temperature Corrected		
Temp. for Rm Corr.	MCG External Temperature		
Squasher Start	0.0020	mhos/metre	
Squasher Offset	N/A	mhos/metre	
Borehole Normalisation			
DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000
Calibration Site Corrections			
Channel 1	0.00	mmhos/metre	
Channel 2	0.00	mmhos/metre	
Channel 3	0.00	mmhos/metre	
Channel 4	0.00	mmhos/metre	
Symmetrised Receiver Gains			
Receiver 1	1.00		
Receiver 2	1.00		
Receiver 3	1.00		
Receiver 4	1.00		
Apparent Porosity and Water Saturation Constants			
Archie Constant (A)	1.00		
Cementation Exponent (M)	2.00		
Saturation Exponent (N)	2.00		
Saturation of Water for Apor	100.00	percent	
Resistivity of Water for Apor and Sw	0.05	ohm-m	
Resistivity of Mud Filtrate for Sw	0.00	ohm-m	
Source for Rt	0.00		
Source for Rxo	0.00		

High Resolution Temperature Calibration MAI-A.A 111

Field Calibration on 24-NOV-2014,10:23

	Measured	Calibrated(Deg F)
Lower	10.00	10.00
Upper	100.00	100.00

High Resolution Temperature Constants MAI-A.A 111

Last Edited on 26-JUN-2014,15:06

Pre-filter Length	11
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Photo Density Calibration MPD-B 104

Base Calibration on 22-MAY-2016 17:45

Density Calibration
Base Calibration

	Measured		Calibrated (sdu)	
	Near	Far	Near	Far
Background	1148	1338		
Reference 1	49789	23977	59556	30836
Reference 2	20127	2423	24941	2541

Field Check at Base

1148.2	1337.6
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Field Check

1145.5	1333.5
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PE Calibration

Base Calibration		Measured		Calibrated
	WS	WH	Ratio	Ratio
Background	211	1025		
Reference 1	20854	49612	0.425	0.371
Reference 2	5819	19993	0.296	0.272

Field Check at Base

211.2	1025.1
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Field Check

211.0	1024.0
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Photo Density Calibration Tolerances MPD-B 104

Near Density Ratio	2.56	-5% 2.52 +5%
PE Calibration	0.121	0.089 0.110 0.131

Far Density Ratio	20.85	-5% 21.00 +5%
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Near Den. Field Check	1145.5	-3% 1148.2 +3%
PE WS Field Check	211.0	-6% 211.2 +6%

Far Den. Field Check	1333.5	-3% 1337.6 +3%
PE WH Field Check	1024.0	-6% 1025.1 +6%

Density Constants MPD-B 104

Last Edited on 05-AUG-2016,17:50

Density Source Id	P50557B
Nylon Calibrator Number	DNCE695
Aluminium Calibrator Number	DACD698
Density Shoe Profile	8 inch
Caliper Source for Processing	Density Caliper
PE Correction to Density	Not Applied
Mud Density	1.14 gm/cc
Mud Density Z/A Multiplier	1.11
Mud Filtrate Density	1.00 gm/cc
Dry Hole Mud Filtrate Density	1.00 gm/cc
DNCT	0.00 gm/cc
CRCT	0.00 gm/cc
Density Z/A Correction	Hybrid
Matrix Density (gm/cc)	Depth (ft)
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

Caliper Calibration MPD-B 104

Base Calibration on 22-MAY-2016 17:26
Field Calibration on 04-AUG-2016 07:48

Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	13598	3.99
2	22432	5.98
3	31029	7.97
4	39246	9.86
5	48339	11.92

Field Calibration

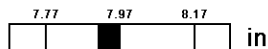
Measured Caliper (in)
7.91

Actual Caliper (in)
7.97

Caliper Calibration Tolerances MPD-B 104

Short Arm Field Cal.

7.91



DOWNHOLE EQUIPMENT

C:\Minimus 15.03.5939\Logs\Shakespeare Edwards #1-21\Shakespeare Edwards #1-21_002.dta

Cablehead, 11 pin

CBH-CA 176 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in

Compact Comms Gamma

MCG-C 123 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Micro-Resistivity

MMR-C.A 247 LG: 8.59 ft WT: 81.6 lb OD: 4.882 in

Compact Neutron

MDN-A.B 66 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

Compact Density/Caliper

MPD-B 104 LG: 9.59 ft WT: 90.4 lb OD: 2.449 in

Compact Focussed Electric

MFE-B.J 352 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

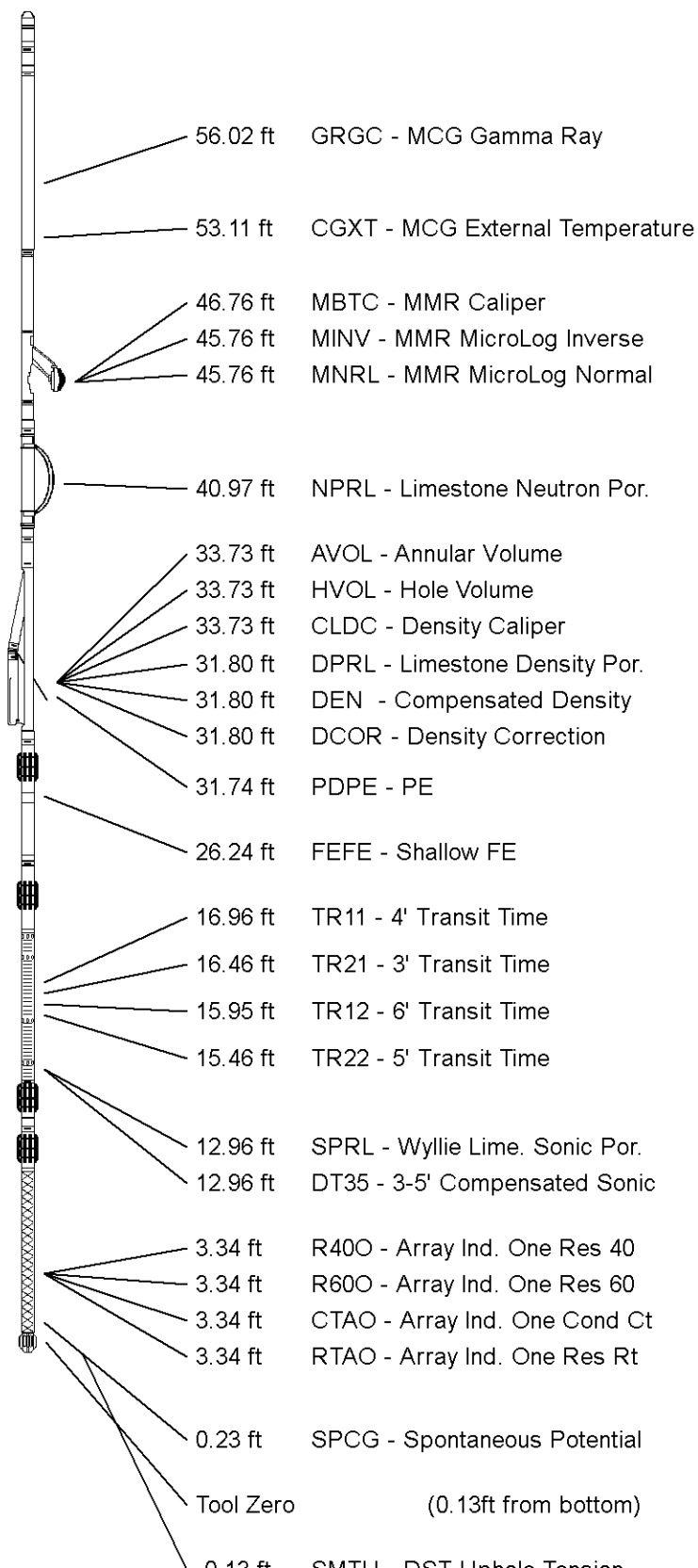
Compact Sonic

MSS-A.A 55 LG: 12.52 ft WT: 72.8 lb OD: 2.244 in

Compact Induction

MAI-A.A 111 LG: 10.81 ft WT: 48.5 lb OD: 2.244 in

Total Length: 63.70 ft Weight: 480.6 lb



COMPANY	SHAKESPEARE OIL CO., INC.
WELL	EDWARDS #1-21
FIELD	PENCE WEST
PROVINCE/COUNTY	SCOTT
COUNTRY/STATE	U.S.A. / KANSAS

Elevation Kelly Bushing	3140.00	feet	First Reading	4865.00	feet
Elevation Drill Floor	3138.00	feet	Depth Driller	4915.00	feet
Elevation Ground Level	3132.00	feet	Depth Logger	4911.00	feet



MICRORESISTIVITY LOG

Weatherford®