Weatherford

MICRORESISTIVITY LOG

COMPANY	MURFIN DRILLING COMPANY, INC.
WELL	RED POLL #8-21
FIELD	WILDCAT
PROVINCE/COUNTY	LINCOLN
COUNTRY/STATE	U.S.A. / COLORADO
LOCATION	1900' FNL & 605' FEL

SEC 21	TWP 10S	RGE 56W	Other Services
Latitude			MAI/MFE MPD/MDN
Longitude			MSS
API Number	05-073-06754		

Permanent Datum GL, Elevation 5489 feet
Log Measured From KB, 13.00 feet above Permanent Datum
Drilling Measured From KB

Elevations:	feet
KB	5502.00
DF	5500.00
GL	5489.00

Date	09-DEC-2018			
Run Number	ONE			
Service Order	4558-231541832			
Depth Driller	8400.00	feet		
Depth Logger	8402.00	feet		
First Reading	8354.00	feet		
Last Reading	4200.00	feet		
Casing Driller	432.00	feet		
Casing Logger	432.00	feet		
Bit Size	7.875	inches		
Hole Fluid Type	CHEMICAL			
Density / Viscosity	9.40 lb/USg		68.00 CP	
PH / Fluid Loss	9.00		8.00 ml/30Min	
Sample Source	FLOWLINE			
Rm @ Measured Temp	1.15 @ 75.0	ohm-m		
Rmf @ Measured Temp	0.92 @ 75.0	ohm-m		
Rmc @ Measured Temp	1.38 @ 75.0	ohm-m		
Source Rmf / Rmc	CALC		CALC	
Rm @ BHT	0.47 @182.0	ohm-m		
Time Since Circulation	5 HOURS			
Max Recorded Temp	182.00	deg F		
Equipment / Base	13096		LIB	
Recorded By	ADAM SILL			
Witnessed By	GREGG SMITH			

BOREHOLE RECORD

Last Edited: 09-DEC-2018 04:36

Bit Size inches	Depth From feet	Depth To feet
7.875	432.00	8400.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	432.00	24.00

REMARKS

- SOFTWARE ISSUE: WLS 18.03.9344.

- 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: 3751 CU.FT.

- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD TO 4200 FEET: 732 CU.FT.

- RIG: MURFIN #25.

- ENGINEER: A. SILL.

- OPERATOR: B. TOVAR, B. COPELAND.

**** CALIPERS WERE CLOSED BETWEEN 5750 FEET AND 5920 FEET AS PER CUSTOMER'S REQUEST, DUE TO HOLE CONDITIONS THROUGH THAT INTERVAL. TOOL READINGS MAY NOT BE ACCURATE THOUGH THIS INTERVAL. ****

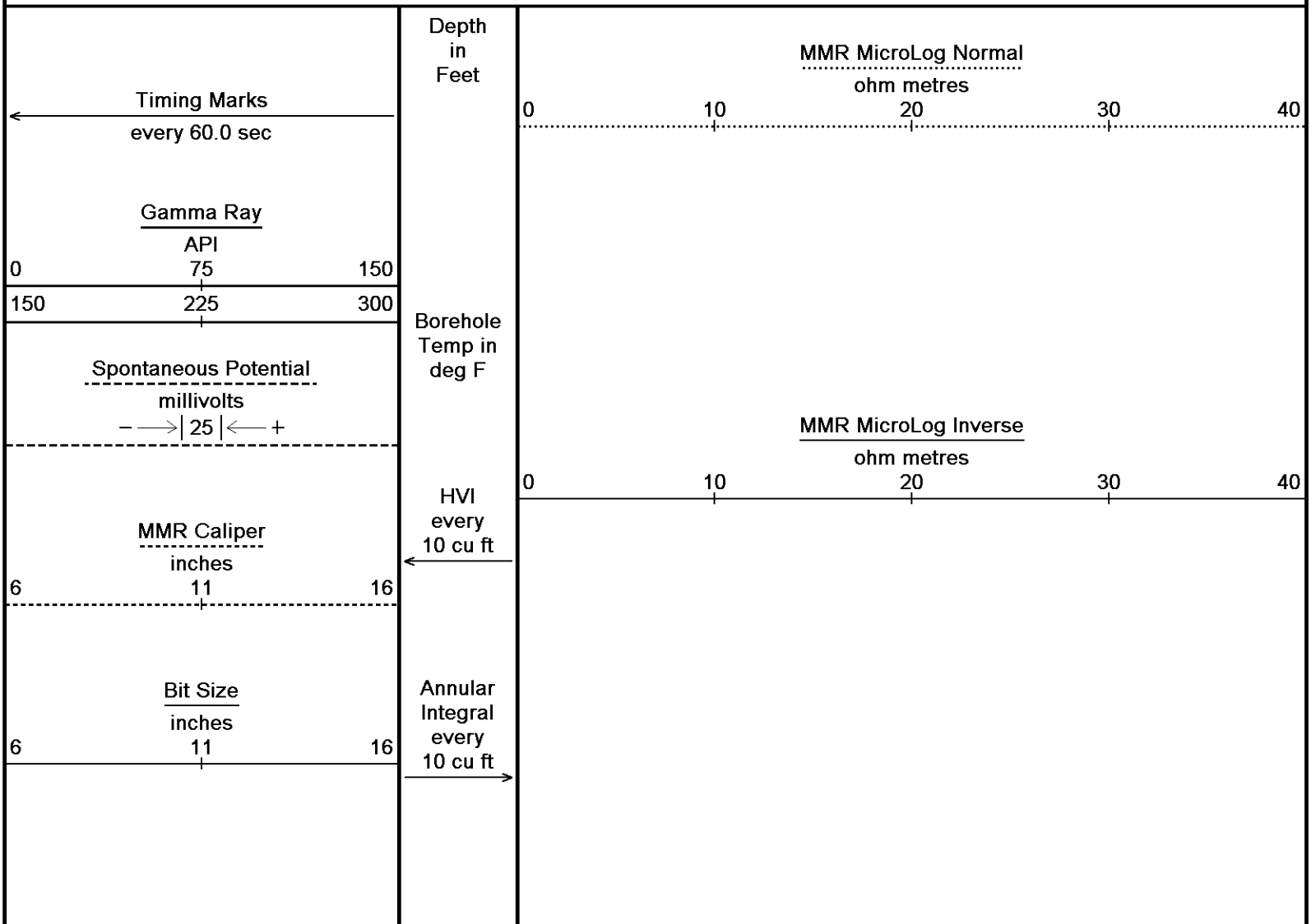
**** SP IS A LITTLE ERRATIC IN PLACES DUE TO AN UNKNOWN CAUSE. CHECKED SP PLACEMENT AND CHECKED FOR SOMETHING THAT MAY BE CAUSING STRAY VOLTAGE AND COULD NOT FIND A CAUSE. ****

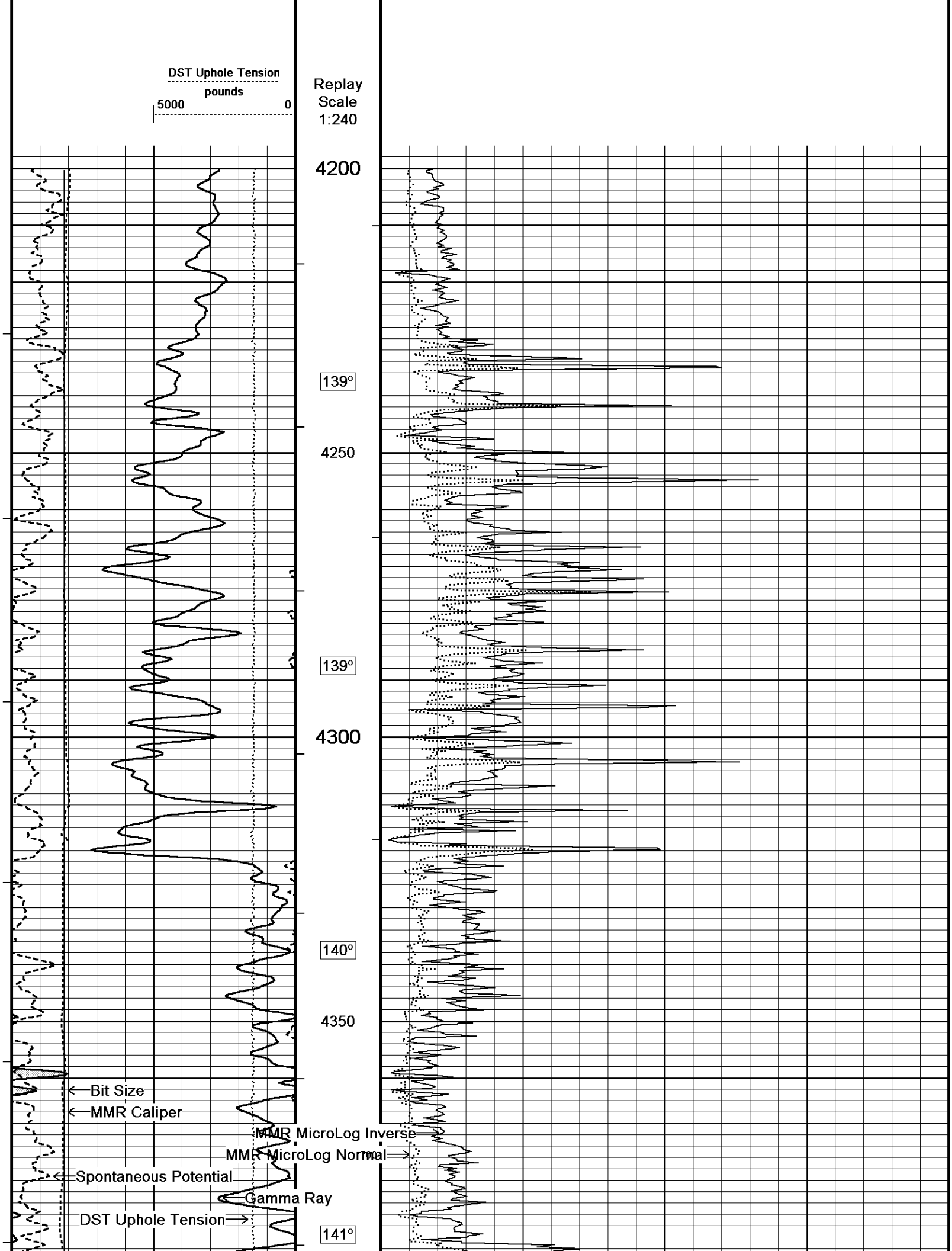
5 INCH MAIN

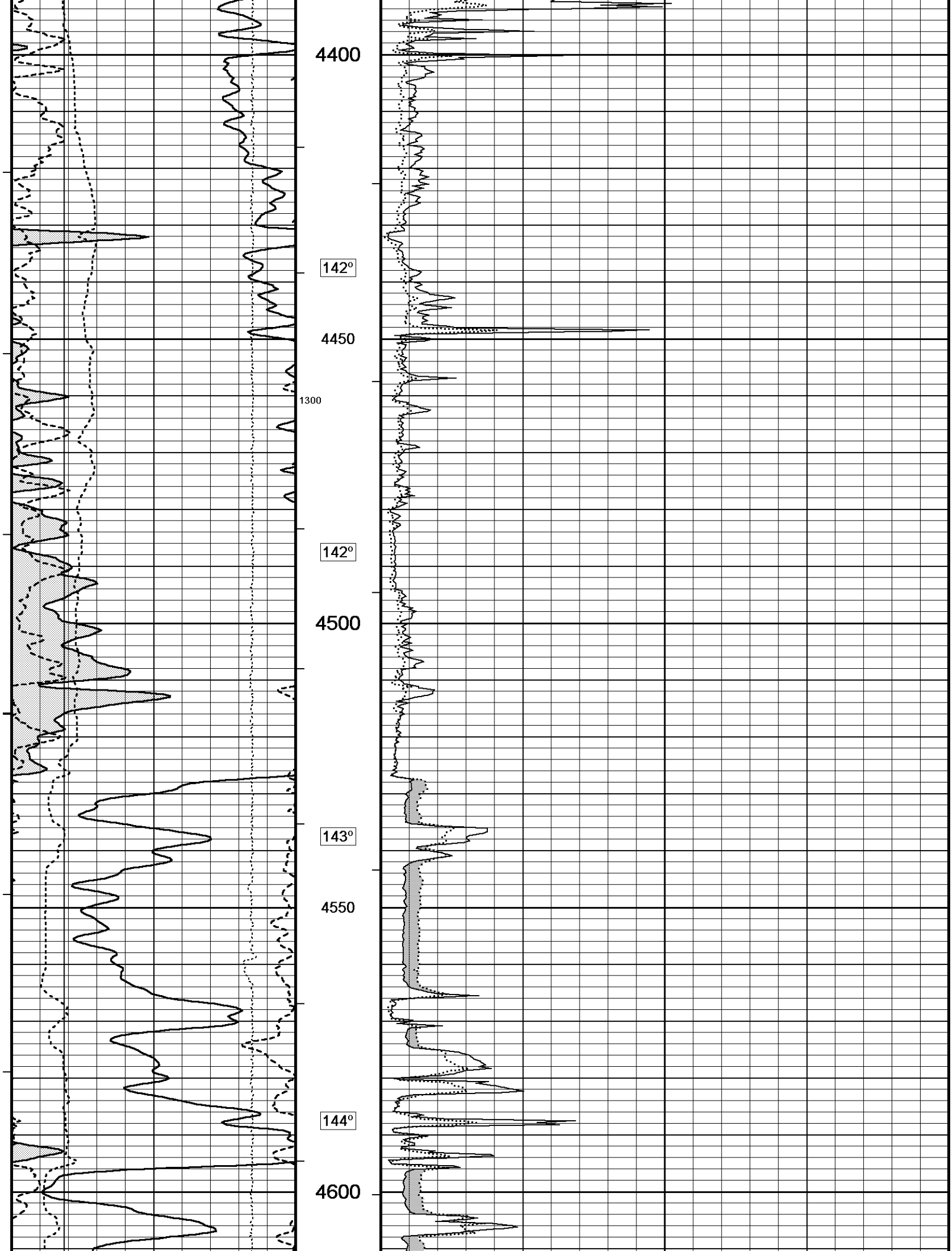
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 09-DEC-2018 13:07

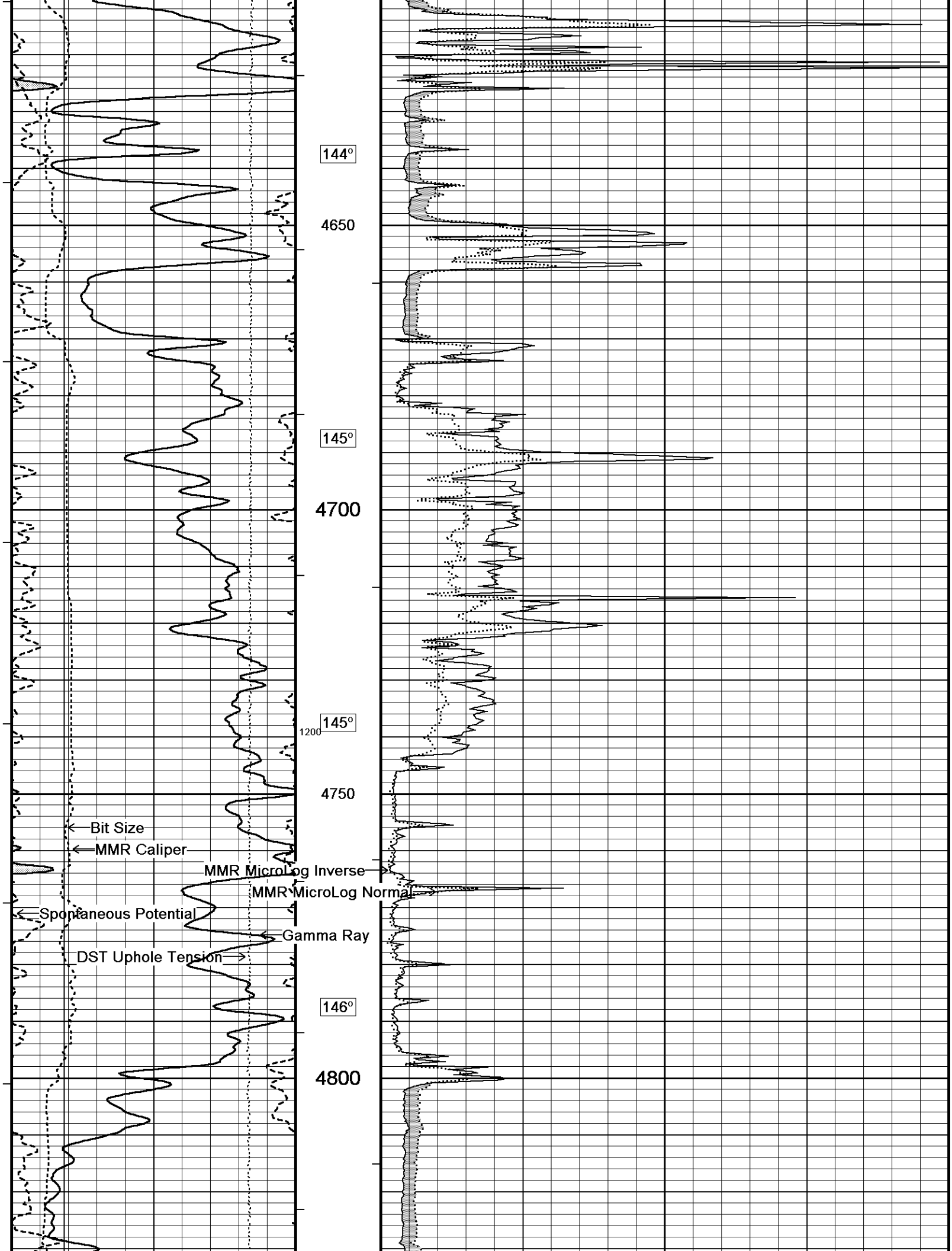
Filename: C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_003.dta — Recorded on 09-DEC-2018 07:52

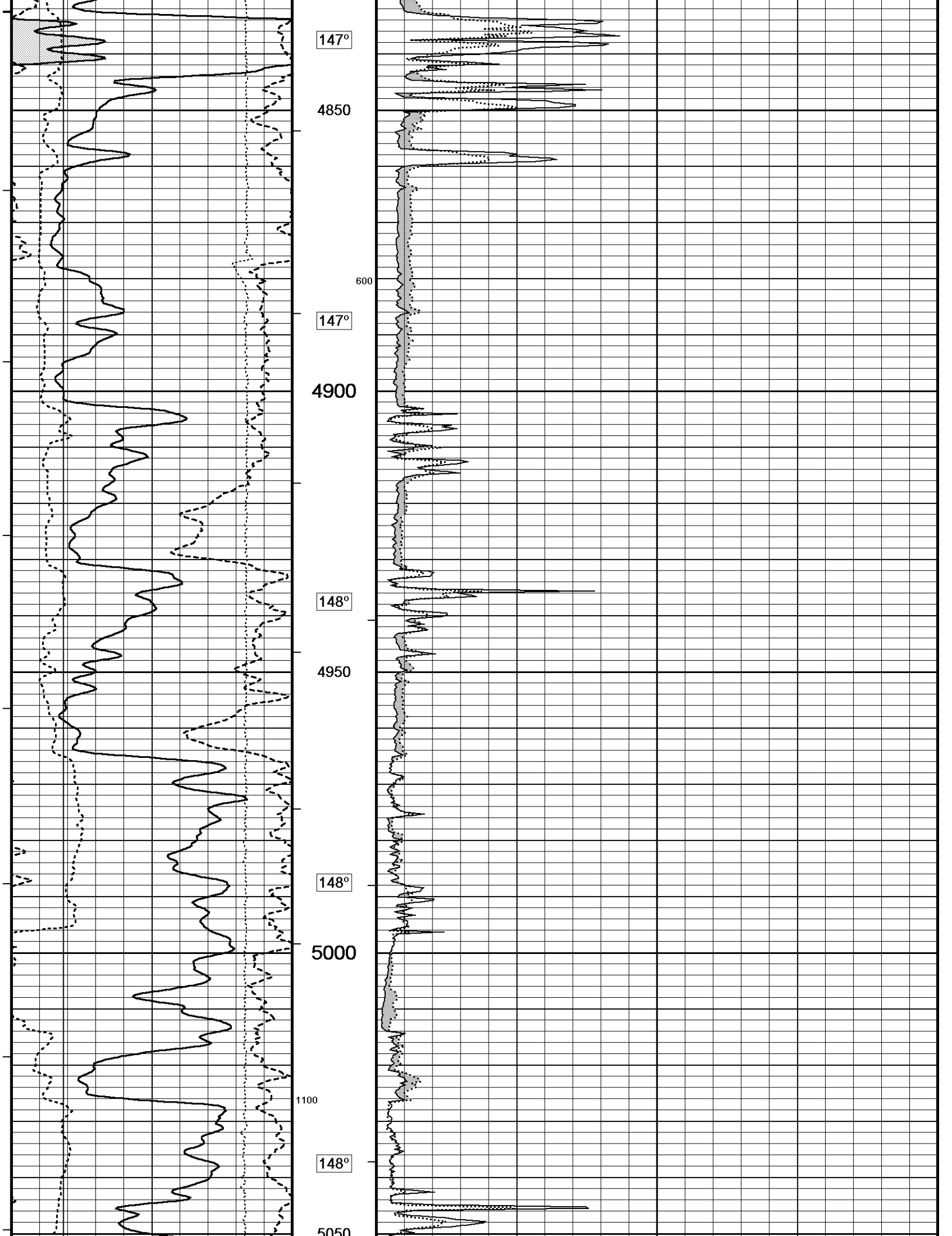
System Versions: Logged with 18.03.9344 Plotted with 18.03.9344




DST Uphole Tension
pounds
5000
0
Replay
Scale
1:240
4200
139°
4250
139°
4300
140°
4350
141°
Bit Size
MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension


4400
142°
4450
1300
142°
4500
143°
4550
144°
4600


144°
4650
145°
4700
145°
1200
4750
146°
4800
Bit Size
MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension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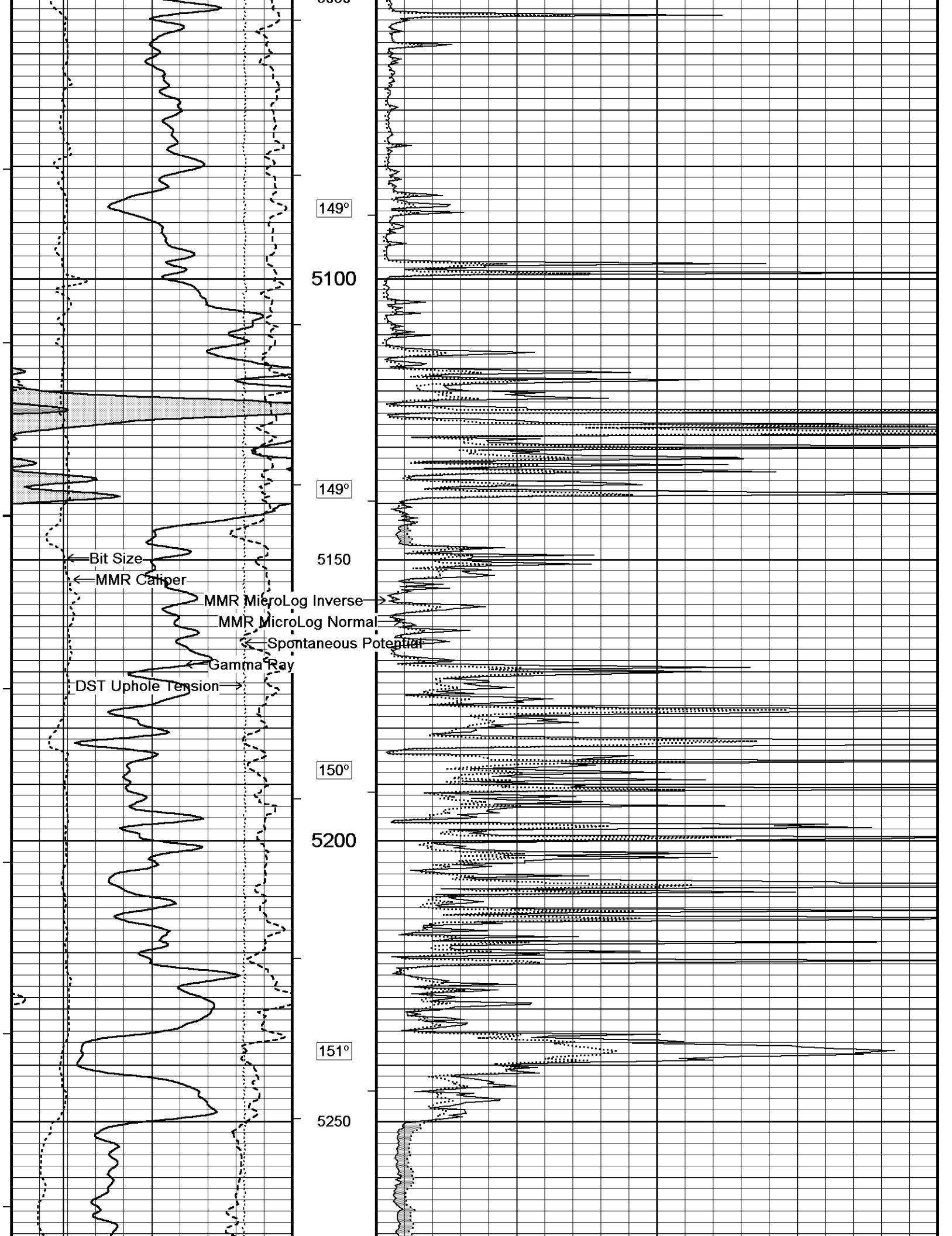
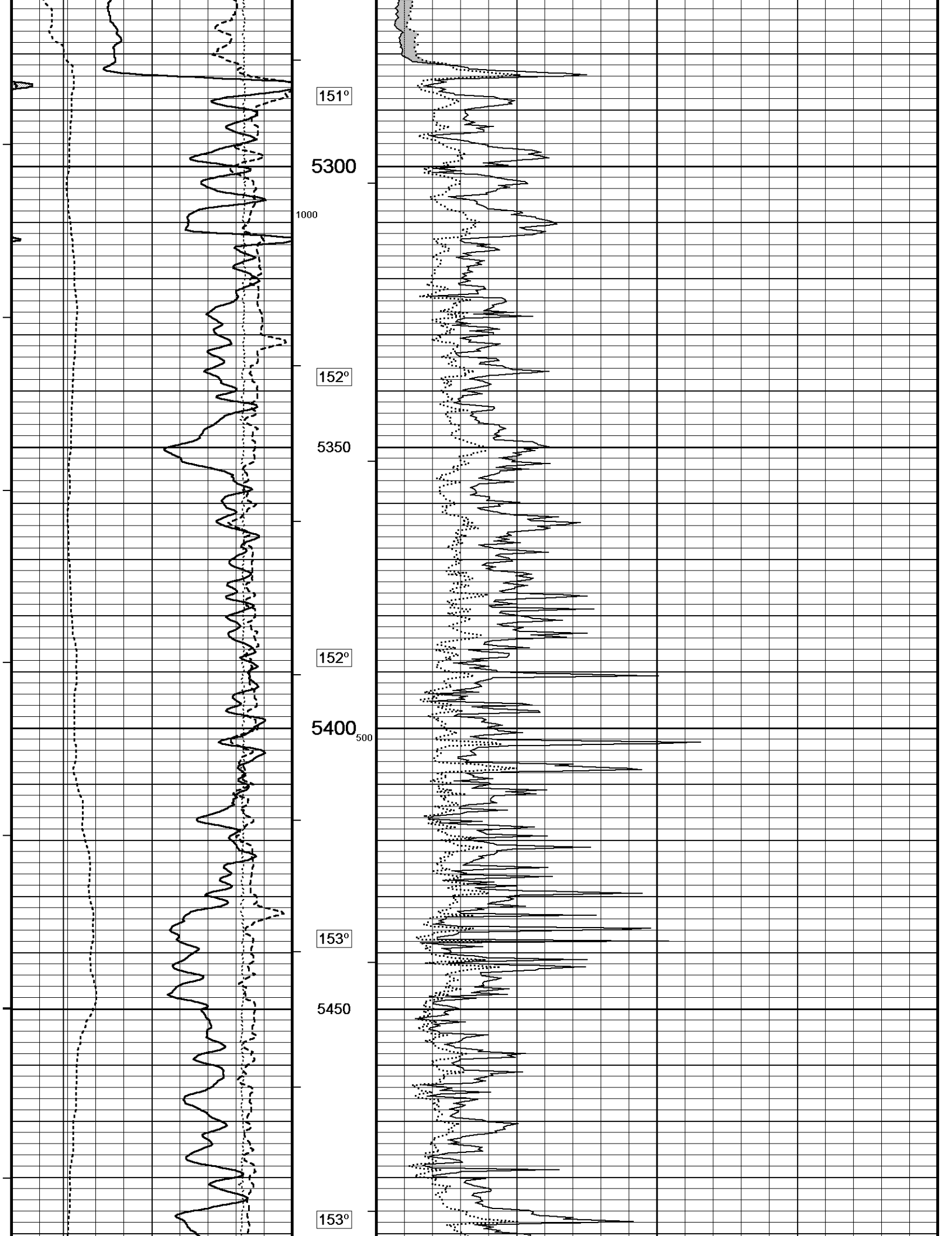
4850
600
147°
4900
148°
4950
148°
5000
1100
148°
5050


149°
5100
149°
Bit Size
MMR Caliper
5150
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension
150°
5200
151°
5250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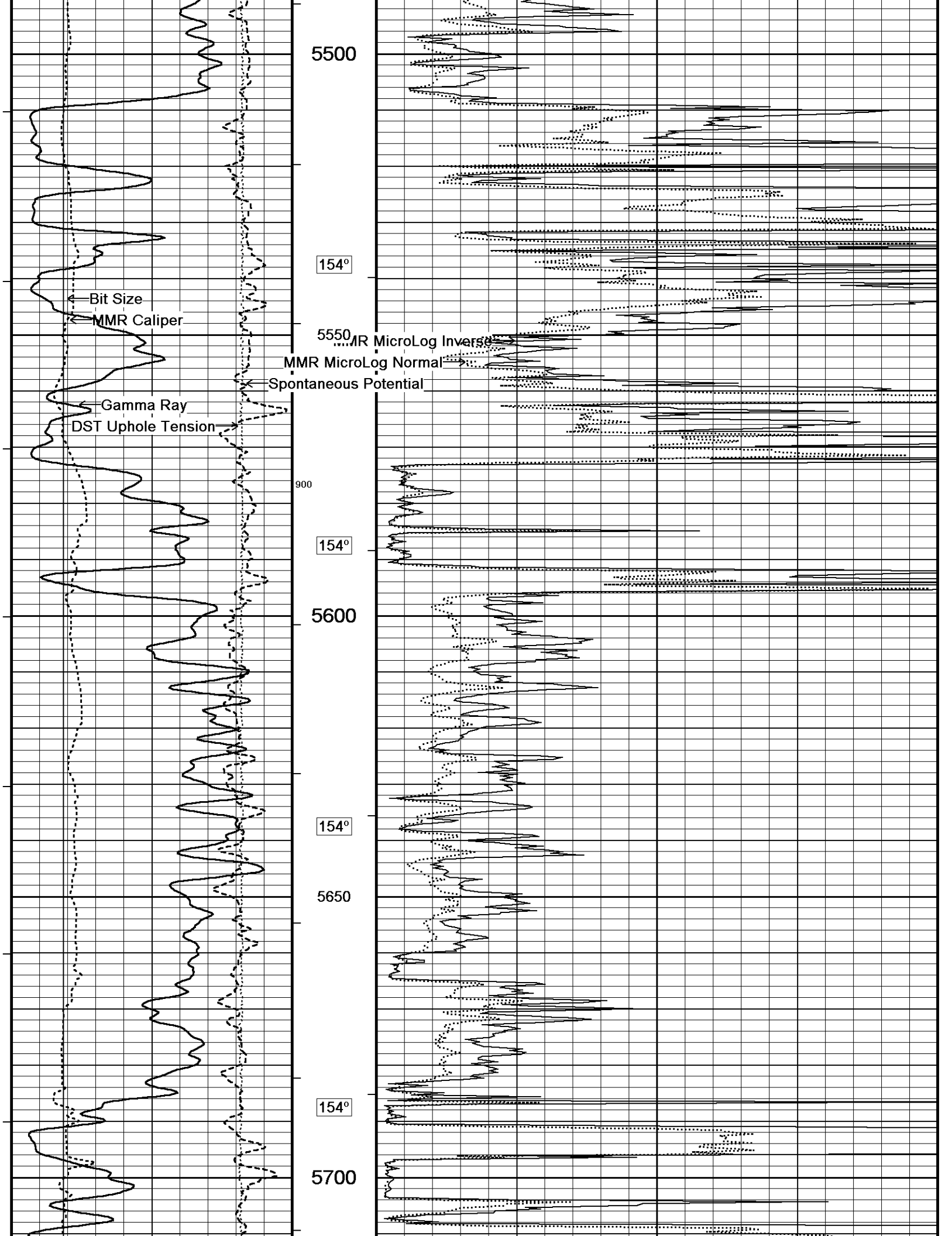
5300
1000
152°
5350
152°
5400
500
153°
5450
153°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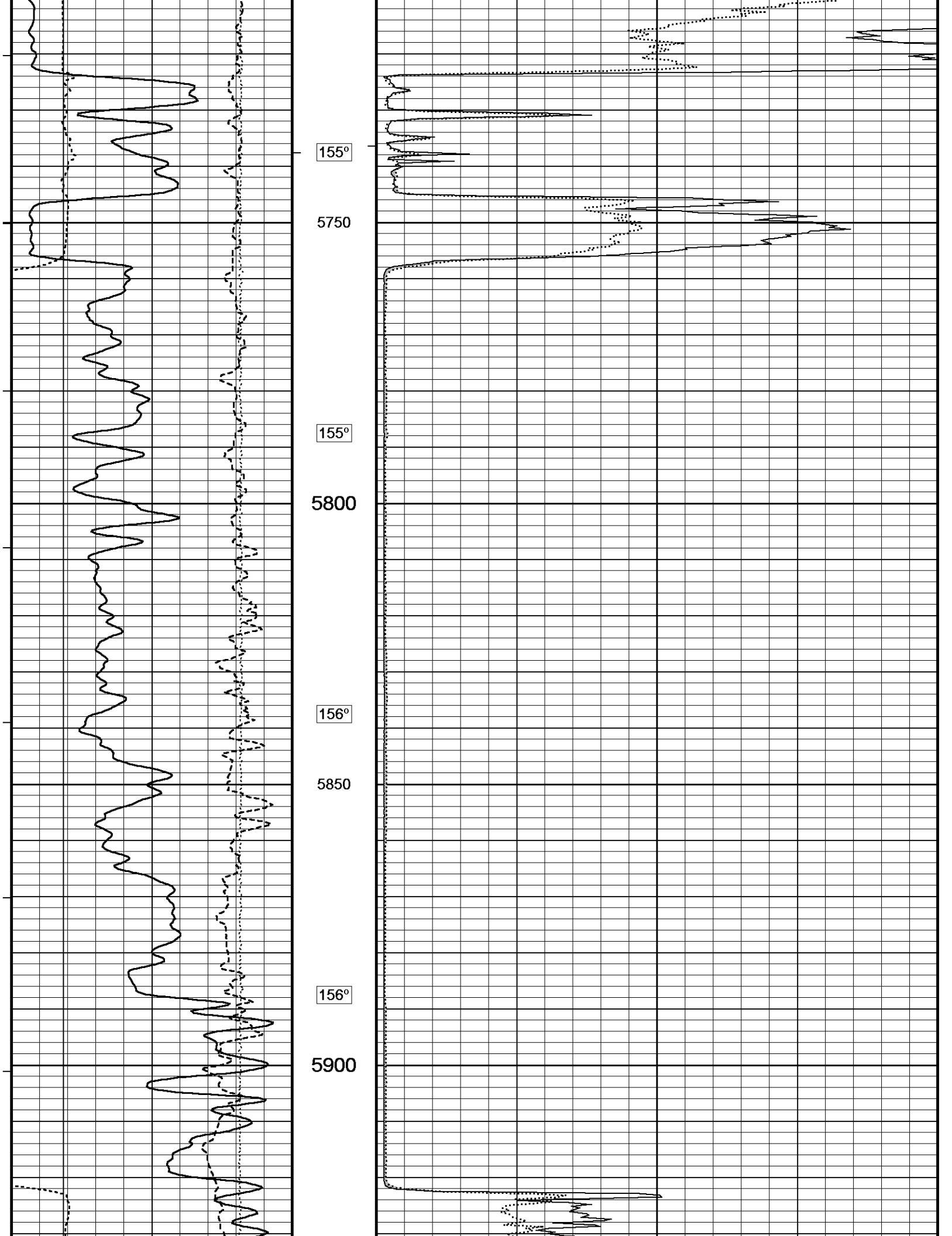
154°
Bit Size
MMR Caliper
5550
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension
900
154°
5600
154°
5650
154°
5700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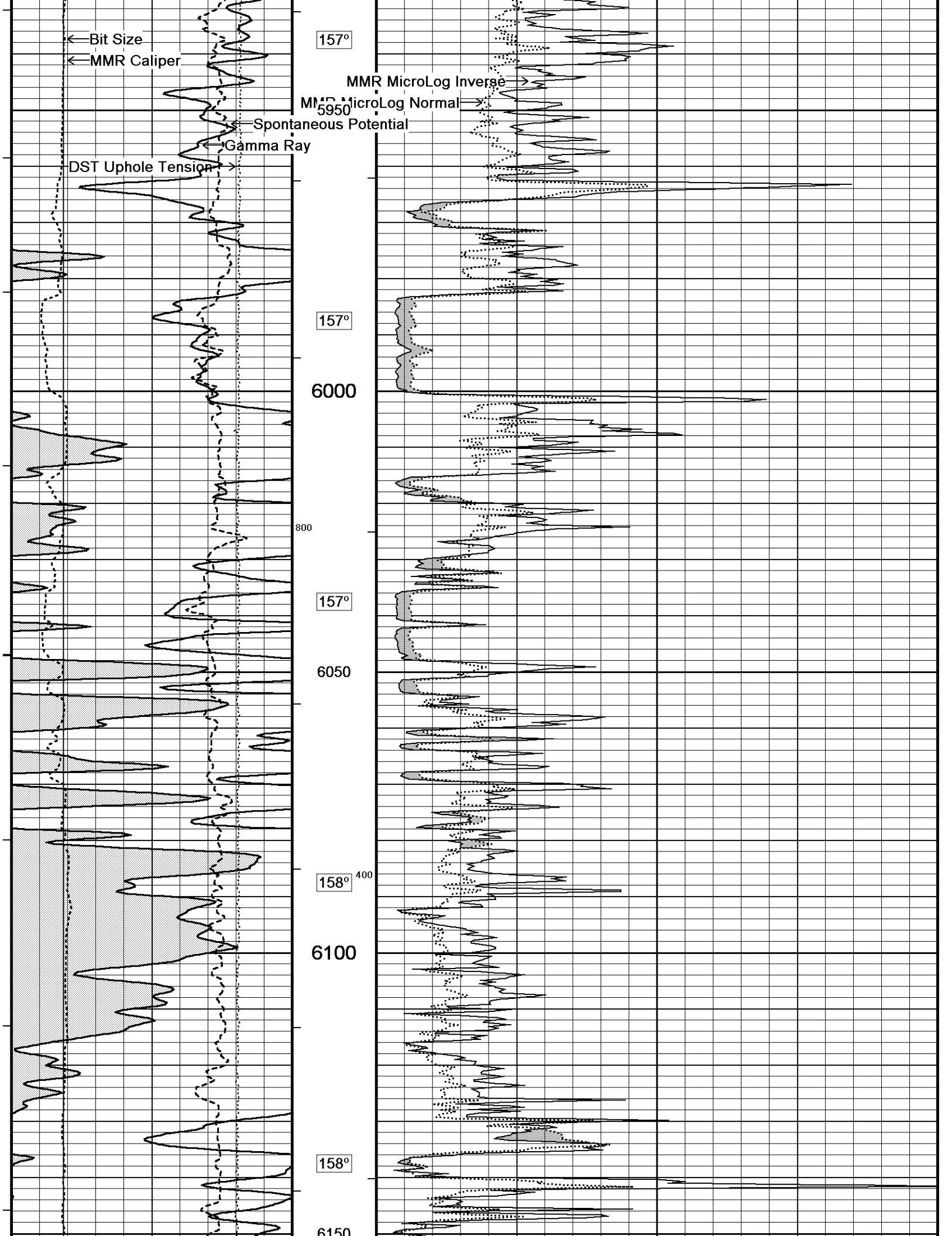
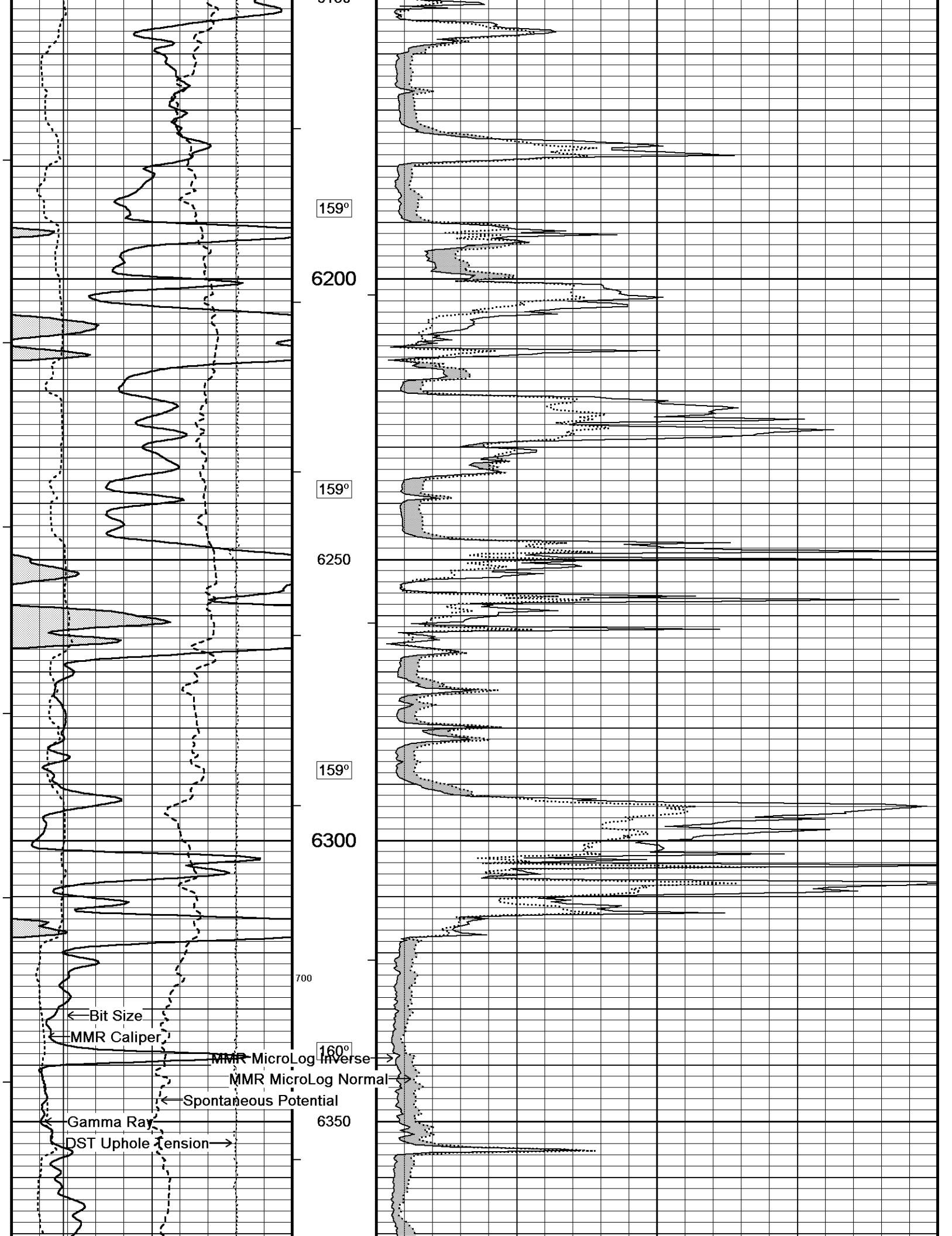
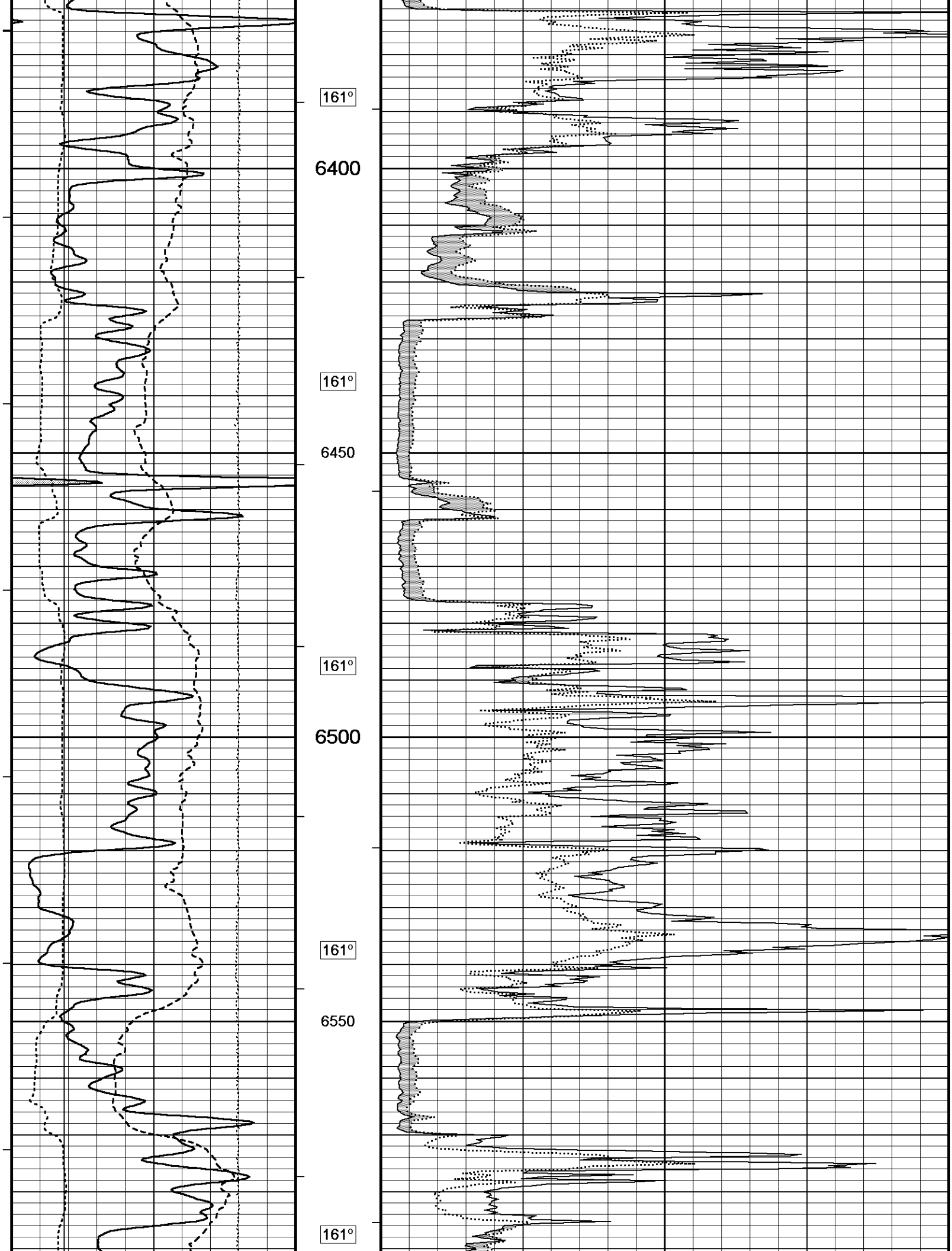
5750
155°
5800
156°
5850
156°
5900


Bit Size
MMR Caliper
DST Uphole Tension
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
157°
157°
158°
158°
5950
6000
6050
6100
6150
800
400


159°
6200
159°
6250
159°
6300
700
160°
6350
Bit Size
MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension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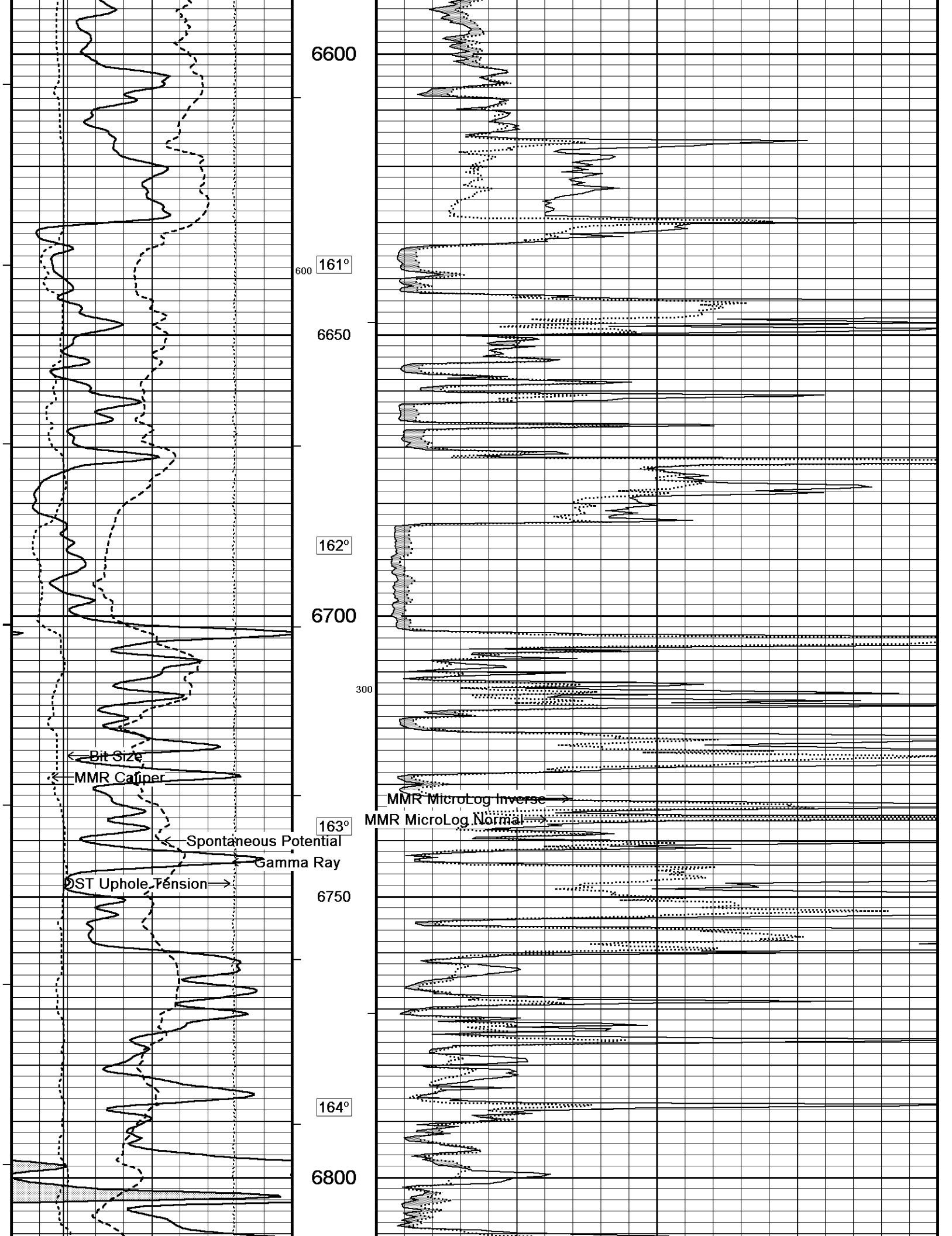
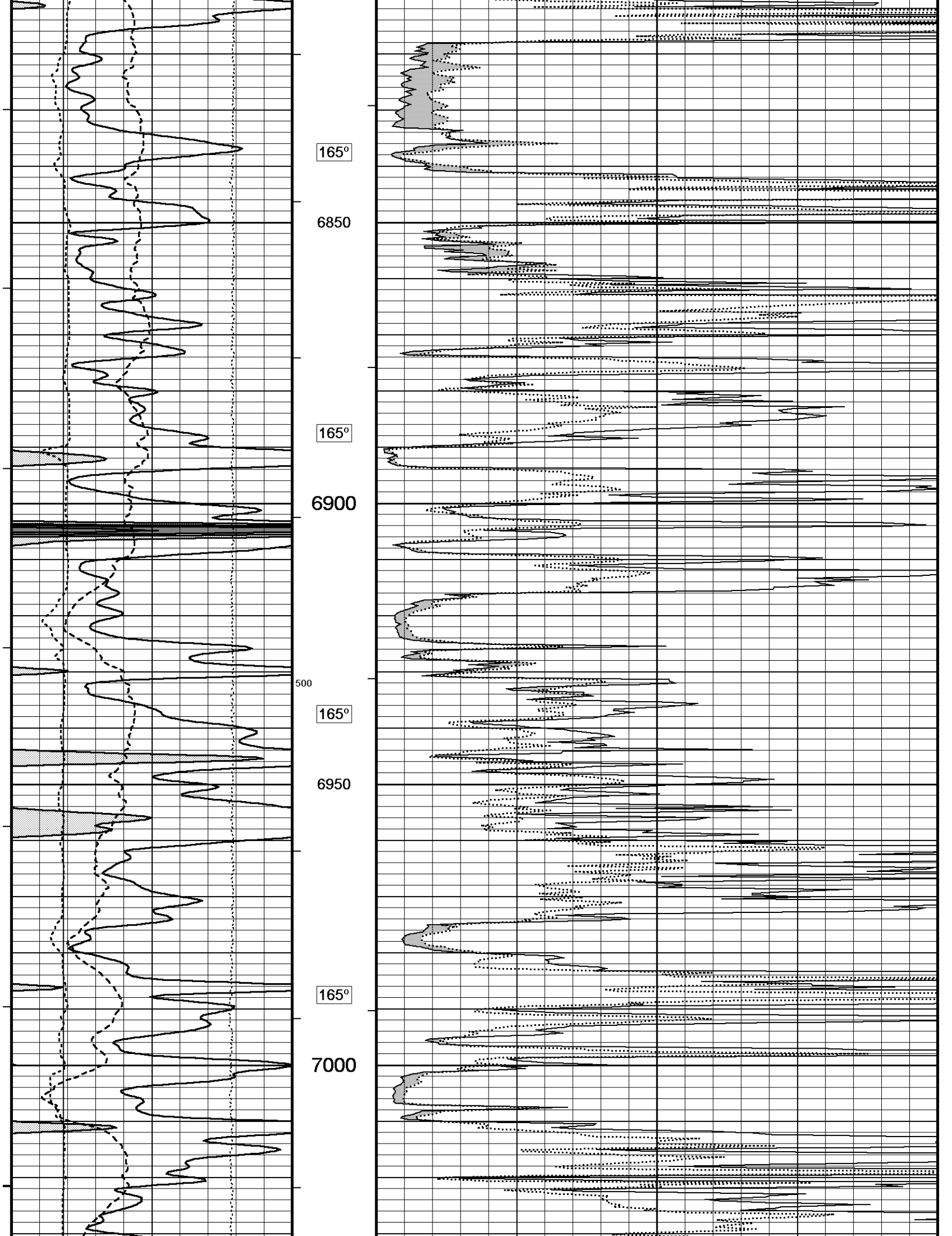
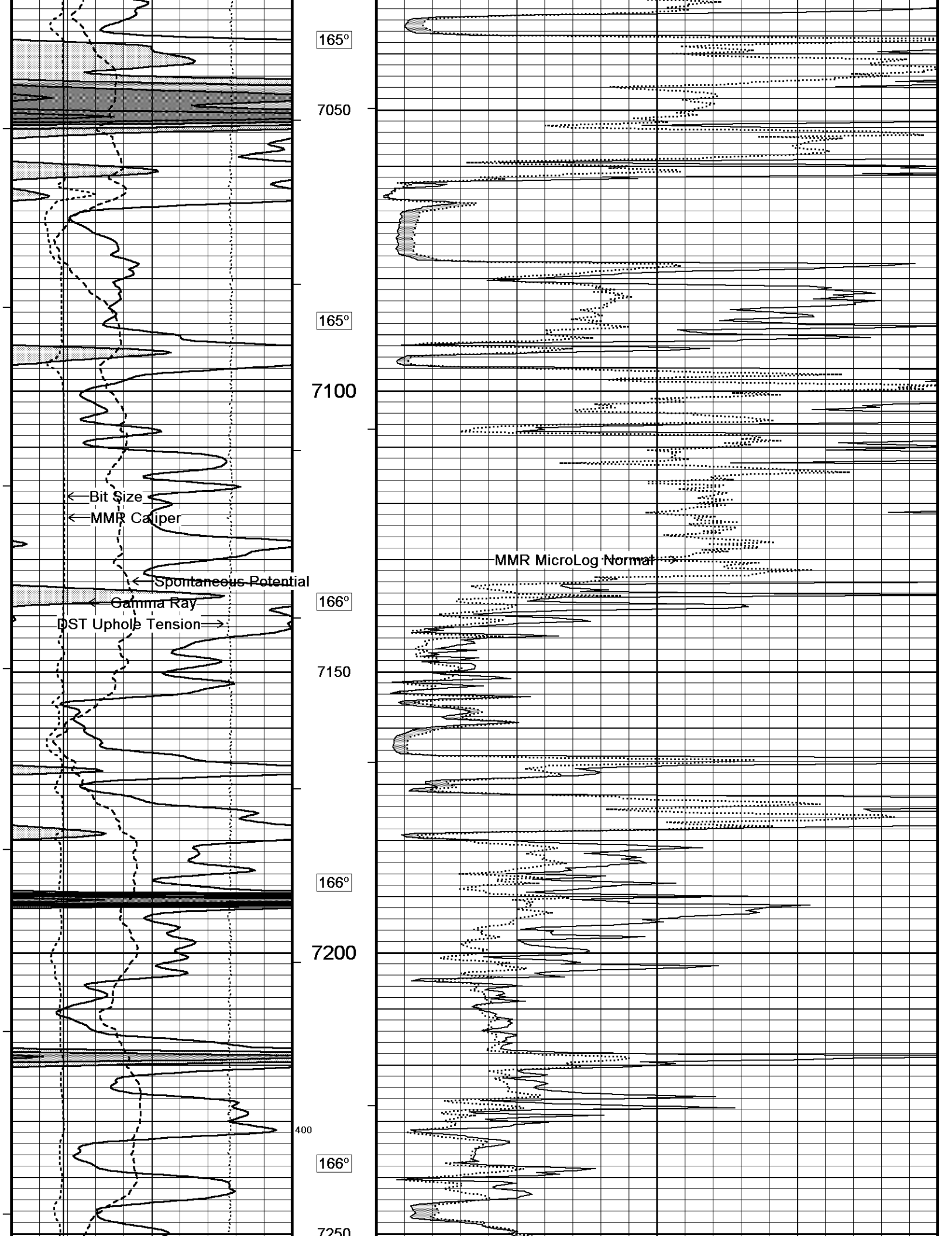
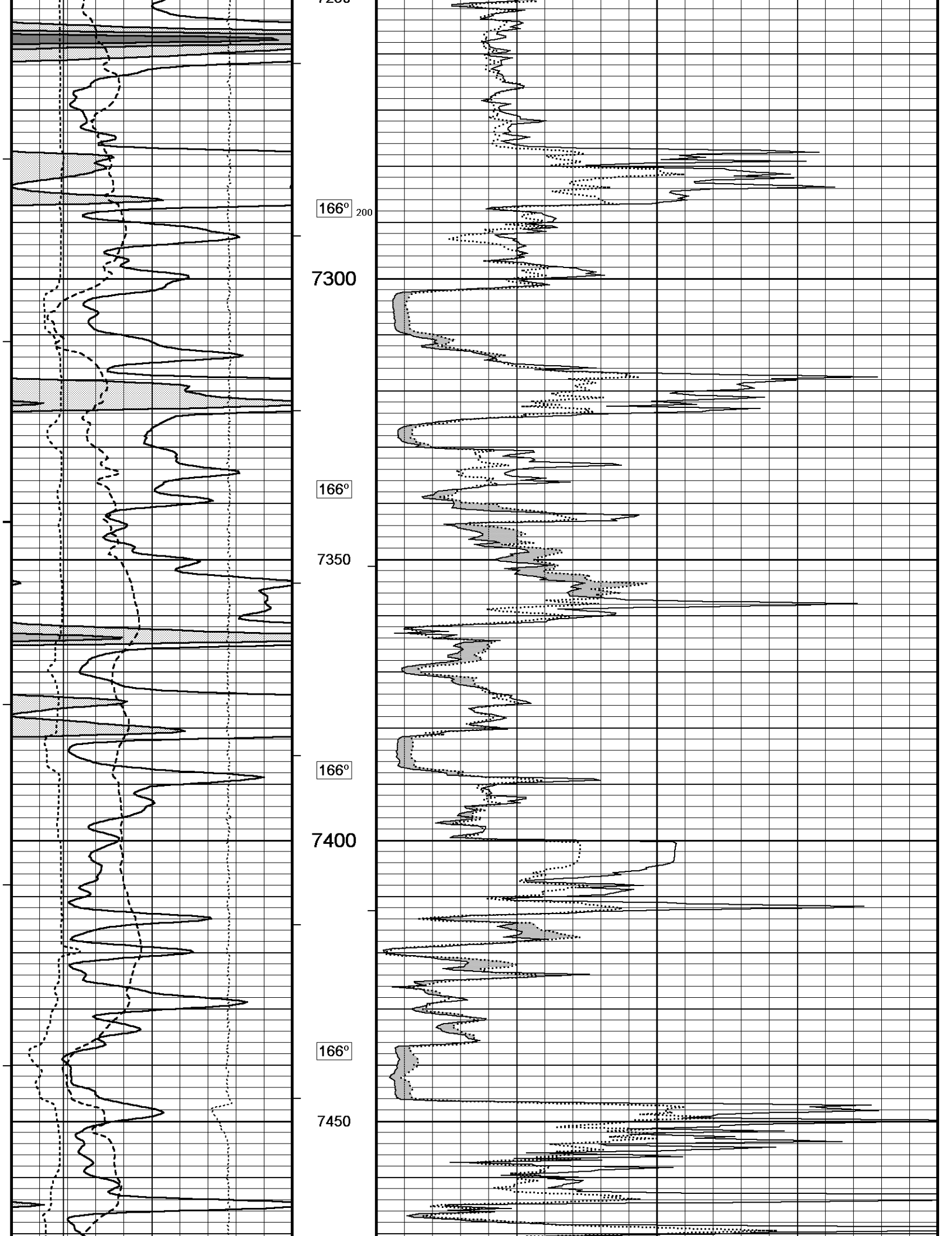
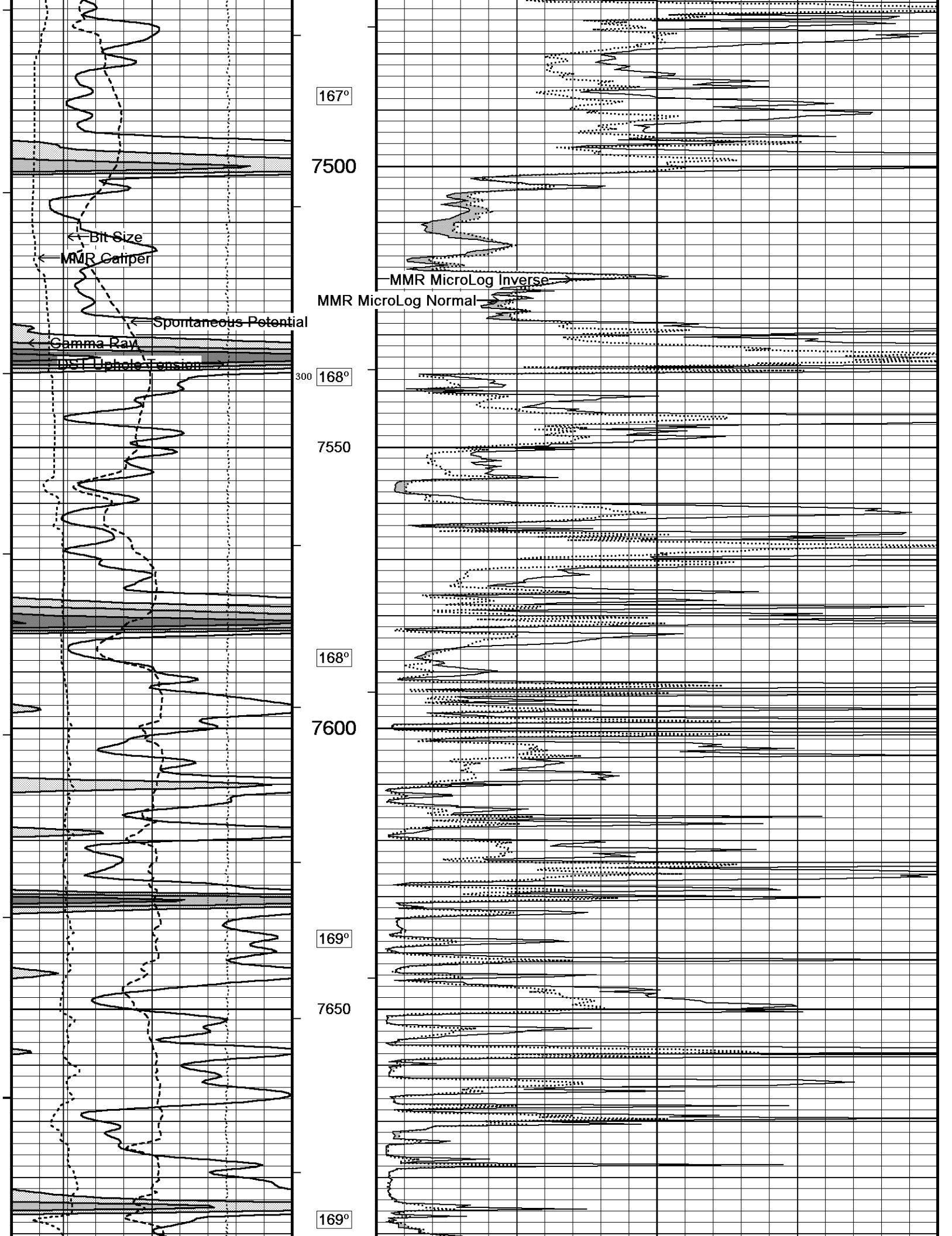
6400
161°
6450
161°
6500
161°
6550
161°

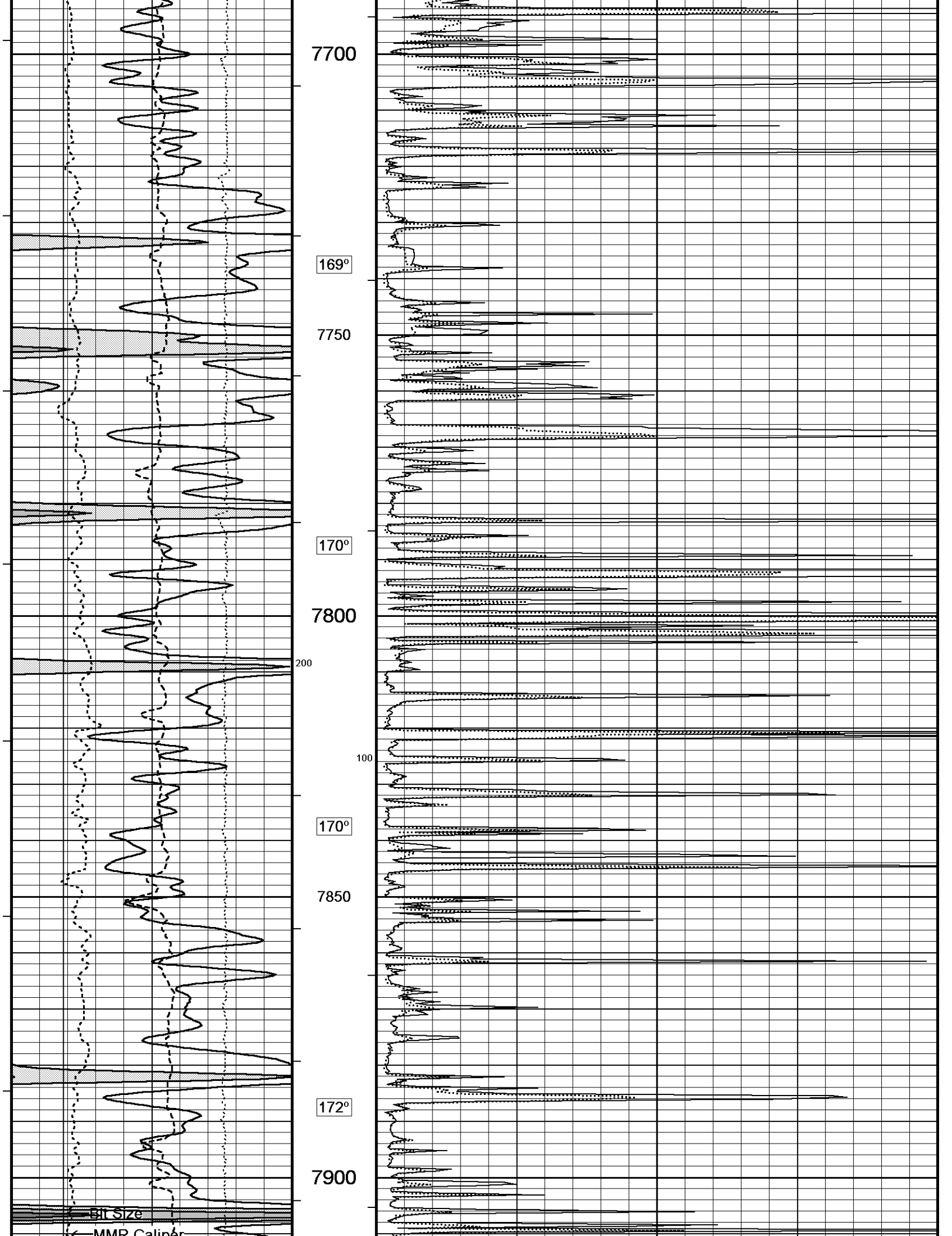

6600
600
161°
6650
162°
6700
300
Bit Size
MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
163°
Spontaneous Potential
Gamma Ray
DST Uphole Tension
6750
164°
6800

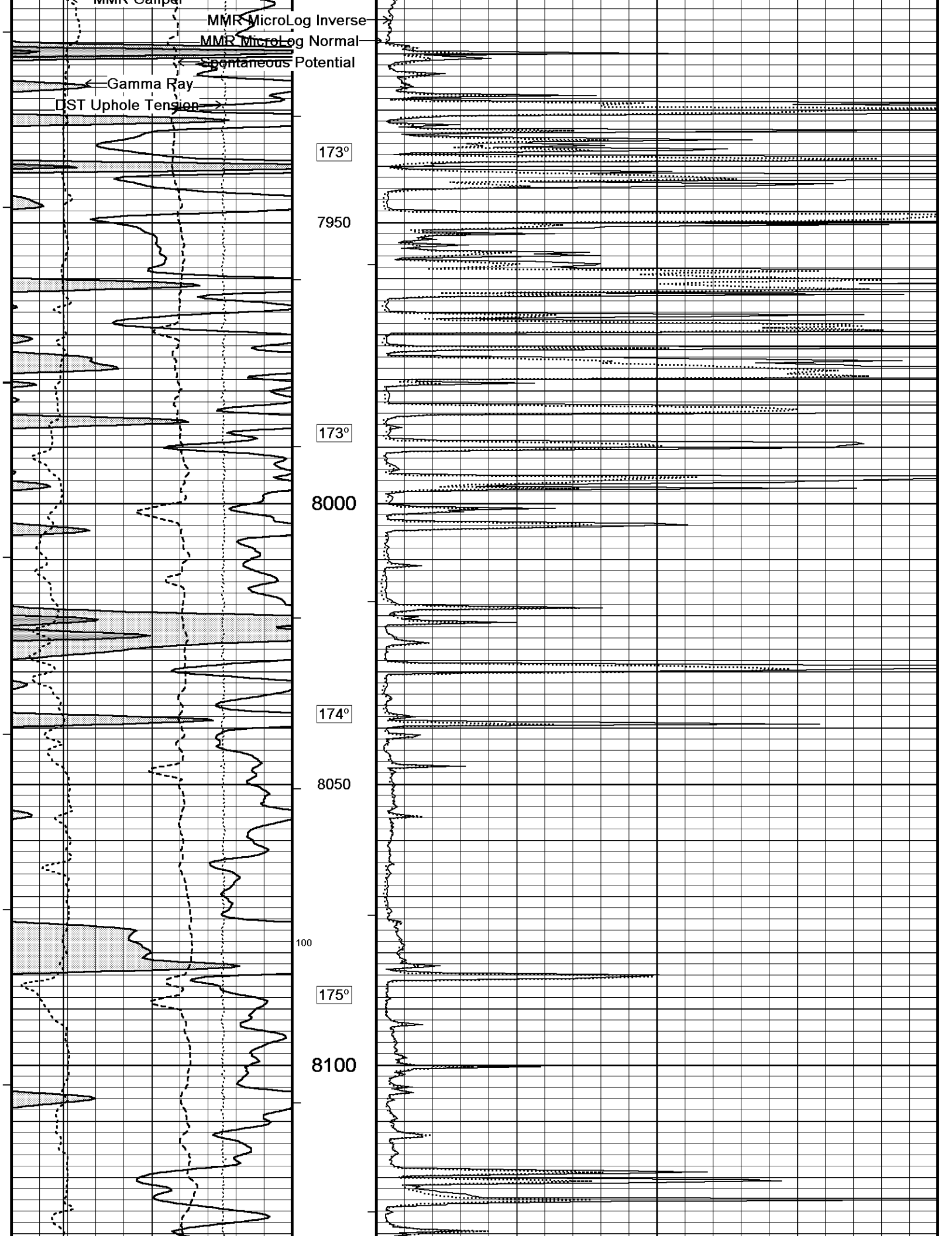

165°
6850
165°
6900
500
165°
6950
165°
7000

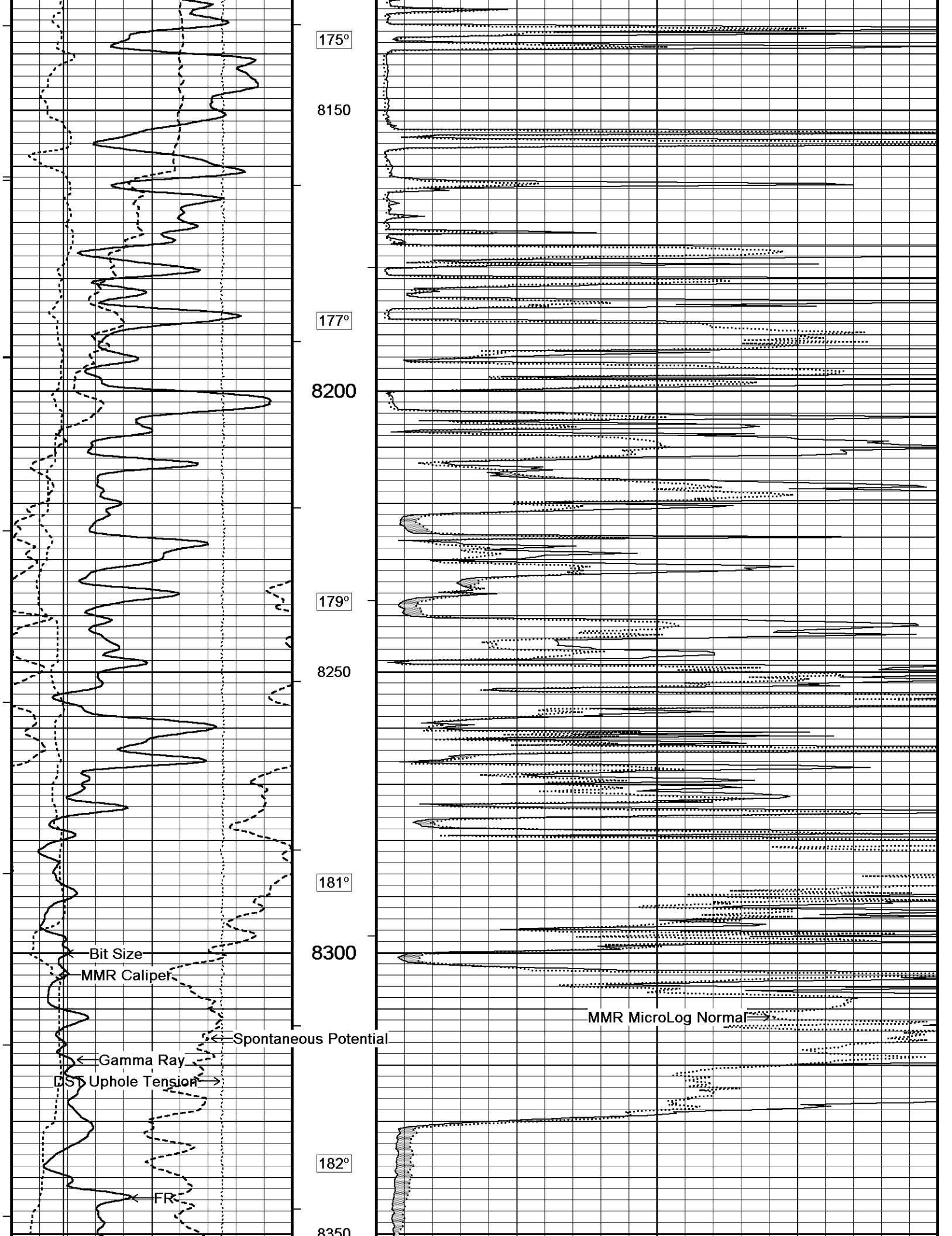

165°
7050
165°
7100
Bit Size
MMR Caliper
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension
166°
7150
166°
7200
400
166°
7250

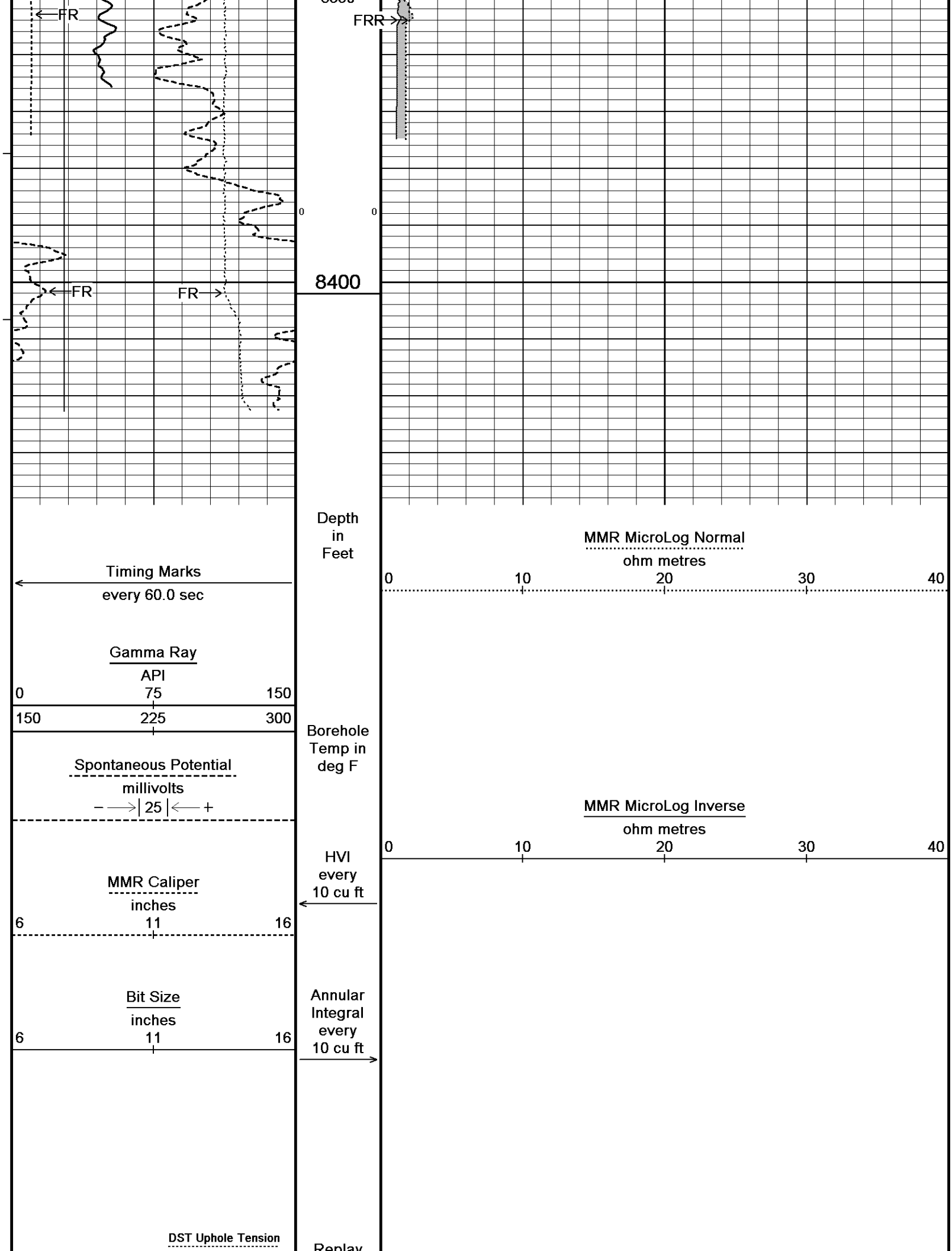

166°
200
7300
166°
7350
166°
7400
166°
7450


167°
7500
Bit Size
MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
WST Uphole Tension
300
168°
7550
168°
7600
169°
7650
169°


7700
169°
7750
170°
7800
200
100
170°
7850
172°
7900
Bit Size
MMR Caliper


MMR Caliper
MMR MicroLog Inverse
MMR MicroLog Normal
Spontaneous Potential
Gamma Ray
DST Uphole Tension
173°
7950
173°
8000
174°
8050
100
175°
8100


175°
8150
177°
8200
179°
8250
181°
8300
182°
8350
Bit Size
MMR Caliper
Spontaneous Potential
Gamma Ray
DST Uphole Tension
FR
MMR MicroLog Normal


FR
FRR
0
0
8400
FR
FR
Depth
in
Feet
MMR MicroLog Normal
ohm metres
0
10
20
30
40
Timing Marks
every 60.0 sec
Gamma Ray
API
0
75
150
150
225
300
Borehole
Temp in
deg F
Spontaneous Potential
millivolts
– 25 +
MMR MicroLog Inverse
ohm metres
0
10
20
30
40
HVI
every
10 cu ft
MMR Caliper
inches
6
11
16
Bit Size
inches
6
11
16
Annular
Integral
every
10 cu ft
DST Uphole Tension
Replay

DST Uphole Tension
pounds
5000 0

Replay Scale 1:240

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_003.dta
System Versions: Logged with 18.03.9344 Plotted with 18.03.9344

Plotted on 09-DEC-2018 13:07
Recorded on 09-DEC-2018 07:52

5 INCH MAIN

REPEAT SECTION

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_002.dta
System Versions: Logged with 18.03.9344 Plotted with 18.03.9344

Plotted on 09-DEC-2018 13:07
Recorded on 09-DEC-2018 07:23

Timing Marks
every 60.0 sec

Gamma Ray
API
0 75 150
150 225 300

Spontaneous Potential
millivolts
– → | 25 | ← +

MMR Caliper
inches
6 11 16

Bit Size
inches
6 11 16

Depth in Feet

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

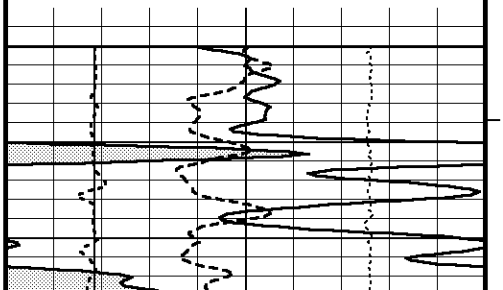
MMR MicroLog Normal
ohm metres
0 10 20 30 40

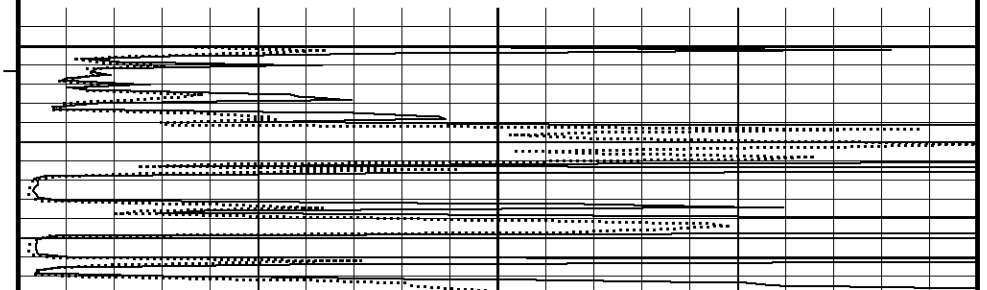
MMR MicroLog Inverse
ohm metres
0 10 20 30 40

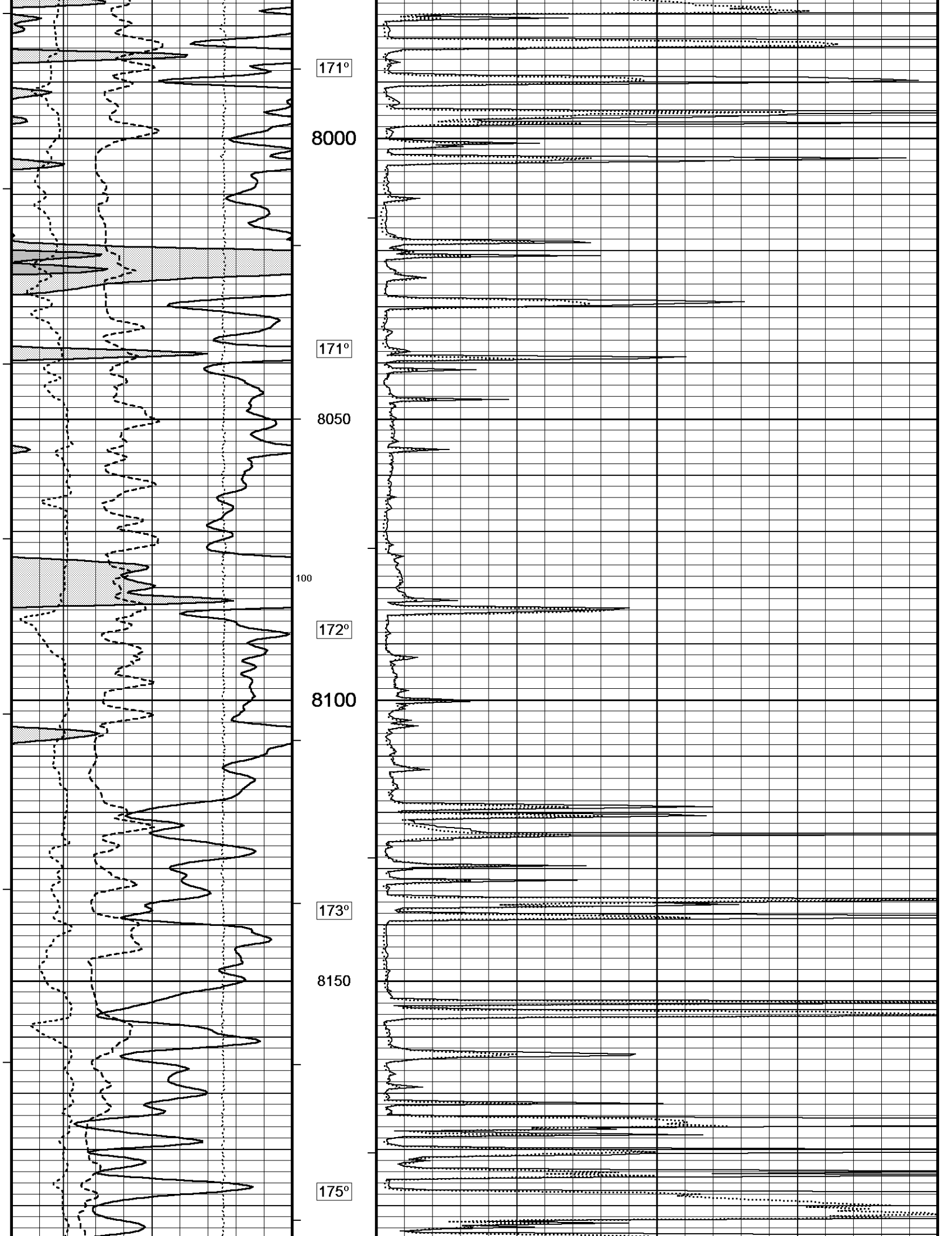
DST Uphole Tension
pounds
5000 0

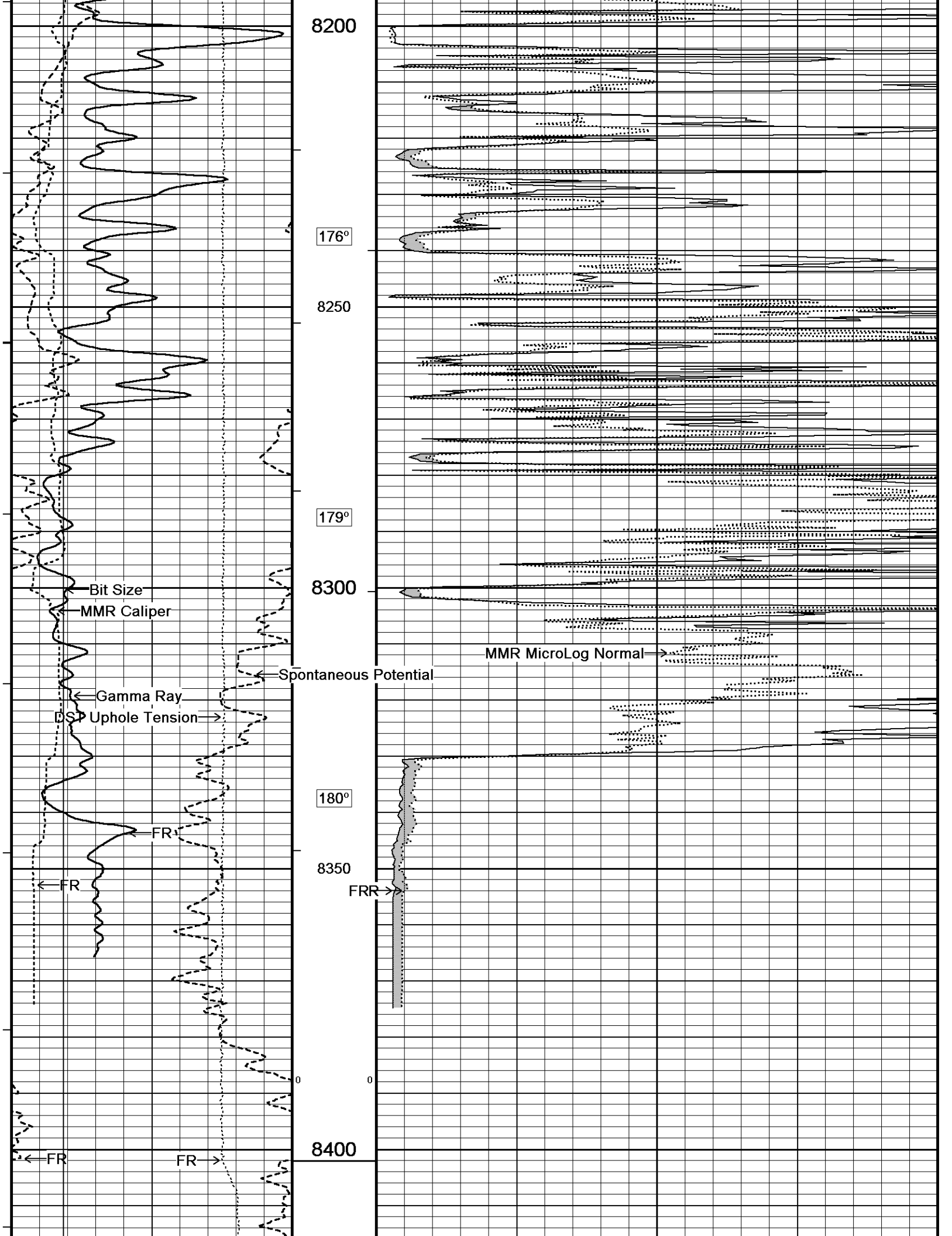
Replay Scale 1:240

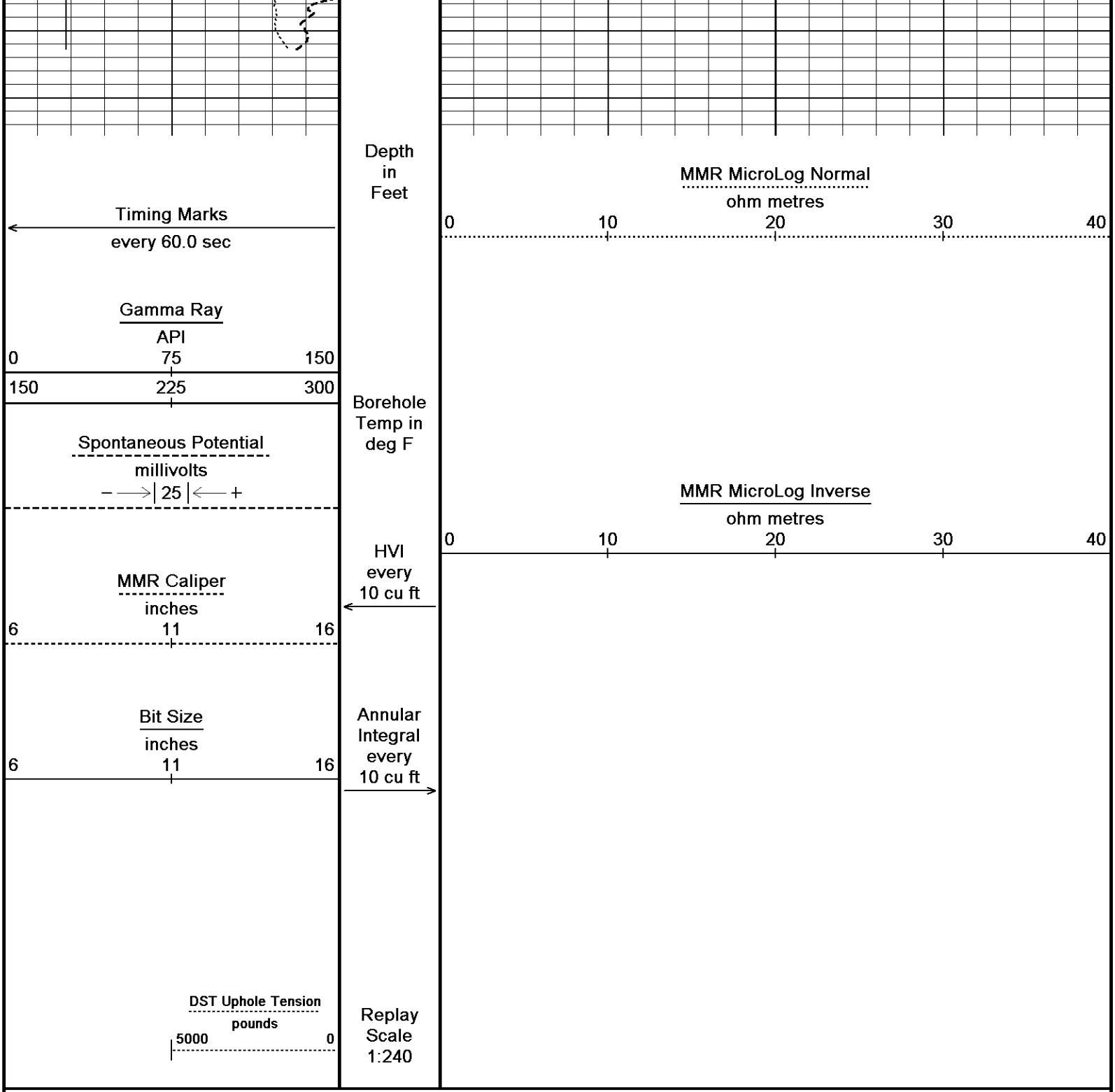
7950






171°
8000
171°
8050
100
172°
8100
173°
8150
175°


8200
176°
8250
179°
8300
180°
8350
8400
Bit Size
MMR Caliper
Gamma Ray
DSP Uphole Tension
FR
FR
FR
FR
MMR MicroLog Normal
Spontaneous Potential
FRR
0
0



Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 09-DEC-2018 13:07

Filename: C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_002.dta — Recorded on 09-DEC-2018 07:23

System Versions: Logged with 18.03.9344 Plotted with 18.03.9344

REPEAT SECTION

BEFORE SURVEY CALIBRATION

C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_002.dta

General Constants All 000 — Last Edited on 09-DEC-2018,06:28

General Parameters

Mud Resistivity	1.150	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	Density Caliper	

Rwa Parameters	
Porosity used	Crossplot Porosity
Resistivity used	Array Ind. Two Res Rt
RWA Constant A	0.620
RWA Constant M	2.150
SW/APOR Tool Source	0.000

High Resolution Temperature Calibration MCG-D.K 443

Field Calibration on 12-OCT-2018,05:20

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	212.00	212.00

High Resolution Temperature Constants MCG-D.K 443

Last Edited on 12-OCT-2018,05:20

Pre-filter Length	11

Gamma Calibration MCG-D.K 443

Field Calibration on 07-DEC-2018,13:43

	Measured	Calibrated (API)
Background	106	74
Calibrator (Gross)	758	530
Calibrator (Net)	652	456

Gamma Calibration Tolerances MCG-D.K 443

Ratio	1.430	1.40 1.475 1.55	Counts/API

Gamma Constants MCG-D.K 443

Last Edited on 08-DEC-2018,00:26

Gamma Calibrator Number	MCGGRCC141	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.13	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

Micro Normal and Micro Inverse Calibration MMR-B.A 91

Base Calibration on 04-DEC-2018 12:12
Field Check on 07-DEC-2018 13:08

	Resistor 1 (ohm)		Resistor 2 (ohm)	
	10.0		50.0	
Base Calibration				
	Measured		Calibrated (ohm-m)	
Micro Normal	10.4	49.9	5.1	25.6
Micro Inverse	9.9	49.4	3.4	16.9

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Micro Normal	93.9	93.9
Micro Inverse	62.3	62.3

Micro Normal & Micro Inverse Calibration Tolerance MMR-B.A 91

Micro Normal Res. 1	10.4	-5% 10.0 +5%	ohm	Micro Normal Res. 2	49.9	-5% 50.0 +5% ohm
Micro Inverse Res. 1	9.9	-5% 10.0 +5%	ohm	Micro Inverse Res. 2	49.4	-5% 50.0 +5% ohm

Micro Normal Base Check	93.9	-2% 93.18 +2%	ohm-m
Micro Inverse Base Check	62.3	-2% 62.25 +2%	ohm-m
Micro Normal Field Check	93.9	-2% 93.9 +2%	ohm-m
Micro Inverse Field Check	62.3	-2% 62.3 +2%	ohm-m

Micro Normal and Micro Inverse Constants MMR-B.A 91

Last Edited on 13-APR-2018,05:04

Micro Normal and Micro Inverse Constants MMR-B.A 91 — Last Edited on 13-APR-2018,05:04

Pad Type	8-12 in Soft Rubber Inflatable 006-9011-159	
Micro Normal K Factor	0.5110	
Micro Inverse K Factor	0.3380	
Standoff Offset	0.0000	inches

Caliper Calibration MMR-B.A 91

Base Calibration on 04-DEC-2018 12:06
Field Calibration on 07-DEC-2018 13:04

Base Calibration

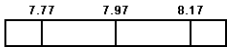
Reading No	Measured	Calibrator Size (in)
1	14099	5.98
2	17485	7.97
3	20790	9.86
4	24525	11.92
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.97	7.97

Caliper Calibration Tolerances MMR-B.A 91

Short Arm Field Cal. 7.97 in



Caliper Calibration MPD-C.A 216

Base Calibration on 04-DEC-2018 12:24
Field Calibration on 07-DEC-2018 12:57

Base Calibration

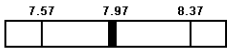
Reading No	Measured	Calibrator Size (in)
1	15599	3.99
2	24289	5.98
3	32989	7.97
4	41250	9.86
5	50464	11.92
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.92	7.97

Caliper Calibration Tolerances MPD-C.A 216

Long Arm Field Cal. 7.92 in



DOWNHOLE EQUIPMENT

C:\Minimus 18.03.9344\Data\Murfin Red Poll #8-21\Murfin Red Poll #8-21_002.dta

Cablehead, 11 pin
CBH-CB 264 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in

Compact Swivel Head Adaptor
SHA-J.B 595 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in

Compact Comms Gamma
MCG-D.K 443 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Micro-Resistivity
MMR-B.A 91 LG: 8.59 ft WT: 81.6 lb OD: 4.882 in

Compact Neutron
MDN-B.A 292 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

Compact Density/Caliper

58.18 ft GRGC - MCG Gamma Ray
55.28 ft CGXT - MCG External Temperature
48.92 ft MBTC - MMR Caliper
47.93 ft MINV - Micro-inverse
47.93 ft MNRL - Micro-normal
43.13 ft NPRL - Limestone Neutron Por.
35.89 ft AVOL - Annular Volume

MPD-C.A 216 LG: 9.59 ft WT: 90.4 lb OD: 2.913 in

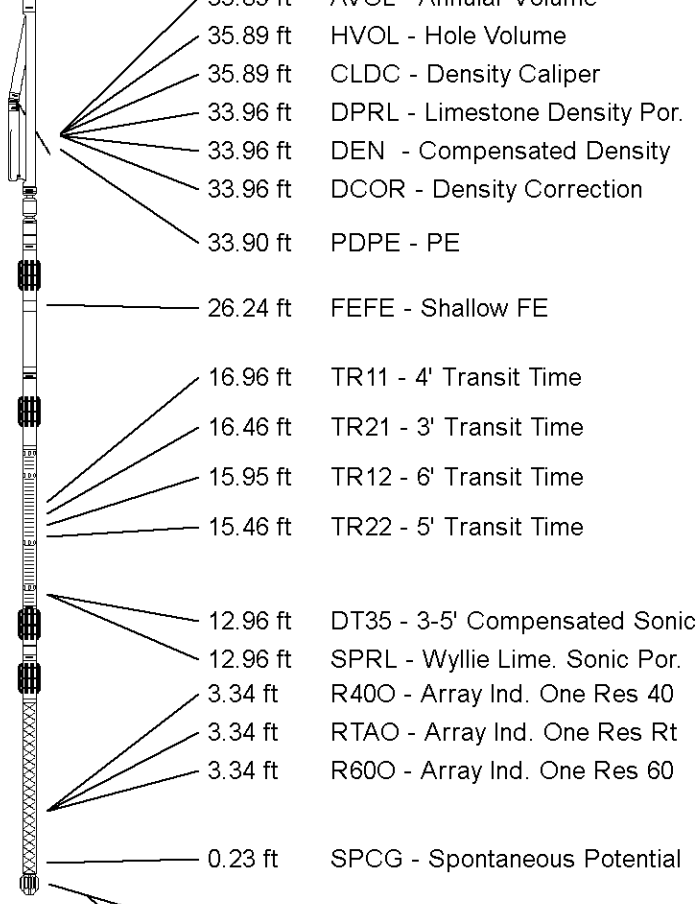
Compact Knuckle Joint
SKJ-D.A 167 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

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

Compact Sonic
MSS-C.K 319 LG: 12.52 ft WT: 72.8 lb OD: 2.244 in

Compact Induction
MAI-B.J 390 LG: 10.81 ft WT: 48.5 lb OD: 2.244 in

Total Length: 68.16 ft Weight: 526.9 lb



35.89 ft	HVOL - Hole Volume
35.89 ft	CLDC - Density Caliper
33.96 ft	DPRL - Limestone Density Por.
33.96 ft	DEN - Compensated Density
33.96 ft	DCOR - Density Correction
33.90 ft	PDPE - PE
26.24 ft	FEFE - Shallow FE
16.96 ft	TR11 - 4' Transit Time
16.46 ft	TR21 - 3' Transit Time
15.95 ft	TR12 - 6' Transit Time
15.46 ft	TR22 - 5' Transit Time
12.96 ft	DT35 - 3-5' Compensated Sonic
12.96 ft	SPRL - Wyllie Lime. Sonic Por.
3.34 ft	R40O - Array Ind. One Res 40
3.34 ft	RTAO - Array Ind. One Res Rt
3.34 ft	R60O - Array Ind. One Res 60
0.23 ft	SPCG - Spontaneous Potential
Tool Zero	(0.13ft from bottom)
-0.13 ft	SMTU - DST Uphole Tension

All measurements relative to tool zero.

COMPANY	MURFIN DRILLING COMPANY, INC.
WELL	RED POLL #8-21
FIELD	WILDCAT
PROVINCE/COUNTY	LINCOLN
COUNTRY/STATE	U.S.A. / COLORADO

Elevation Kelly Bushing	5502	feet	First Reading	8354.00	feet
Elevation Drill Floor	5500	feet	Depth Driller	8400.00	feet
Elevation Ground Level	5489	feet	Depth Logger	8402.00	feet

Weatherford®

MICRORESISTIVITY LOG