



Weatherford

MICRO-RESISTIVITY LOG

COMPANY				O'BRIEN ENERGY RESOURCES CORP			
WELL				KEYSTONE #5-4			
FIELD				KEYSTONE			
PROVINCE/COUNTY				MEADE			
COUNTRY/STATE				U.S.A. / KANSAS			
LOCATION				S2 S2 N2 SW 1350' FSL & 1320' FWL			
SEC 4	TWP 33	RGE 29W	Other Services				
Latitude	37.202613	MAI/MFE					
Longitude	-100.484790	MDN/MPD					
API Number	15-119-21435						
Permanent Datum GL, Elevation 2634 feet				Elevations:			
Log Measured From KB, 12.00 feet above Permanent Datum				KB	2646.00		
Drilling Measured From KB				DF	2644.00		
				GL	2634.00		
Date	21-JUN-2019						
Run Number	ONE						
Service Order	17937-248222596						
Depth Driller	6250.00				feet		
Depth Logger	6250.00				feet		
First Reading	6247.00				feet		
Last Reading	1567.00				feet		
Casing Driller	1567.00				feet		
Casing Logger	1567.00				feet		
Bit Size	7.875				inches		
Hole Fluid Type	WATER-BASED						
Density / Viscosity	8.90	lb/USg	50.00	sec/qt			
PH / Fluid Loss	10.00		8.00	ml/30Min			
Sample Source	FLOWLINE						
Rm @ Measured Temp	0.88	@ 96.0	ohm-m				
Rmf @ Measured Temp	0.70	@ 96.0	ohm-m				
Rmc @ Measured Temp	1.06	@ 96.0	ohm-m				
Source Rmf / Rmc	CALC		CALC				
Rm @ BHT	0.70	@122.0	ohm-m				
Time Since Circulation	3 HOURS						
Max Recorded Temp	122.00		deg F				
Equipment / Base	13057		ELRENO				
Recorded By	M. MCGLOTHLIN						
Witnessed By	P. DEBENHAM				D. GREATHOUSE		

BOREHOLE RECORD					Last Edited: 21-JUN-2019 00:31
Bit Size inches		Depth From feet		Depth To feet	
7.875		1567.00		6250.00	
CASING RECORD					
Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft	
SURFACE	8.625	0.00	1567.00	24.00	

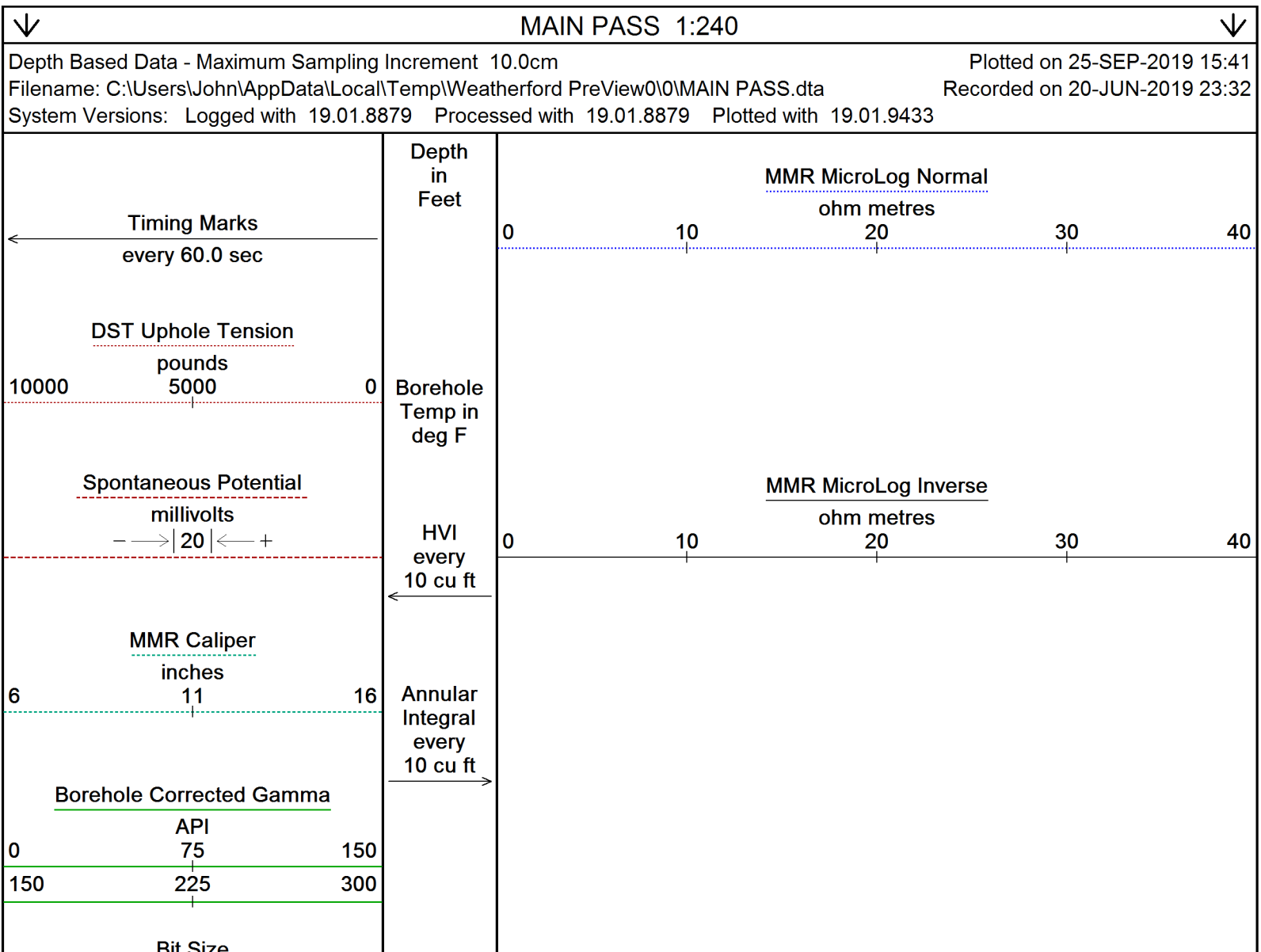
REMARKS
SOFTWARE: WLS 19.01.8879
- TOOLSTRING: RUN 1: CBH, SHA, MCG, MML, MDN, MPD, SKJ, MFE, MAI LOGGED IN COMBINATION.
- HARDWARE USED: MAI: TWO 0.5 INCH STANDOFFS WITH HOLE FINDER. MFE: ONE 0.5 INCH STANDOFF. MDN: DUAL BOWSPRING. MPD: 8 INCH PROFILE PLATE.
- DENSITY MATRICES: 2.71 G/CC DENSITY MATRIX USED TO CALCULATE LIMESTONE POROSITY. 2.65 G/CC DENSITY MATRIX USED TO CALCULATE SANDSTONE POROSITY. 2.87 G/CC DENSITY MATRIX USED TO CALCULATE DOLOMITE POROSITY.
- LOGGING INTERVAL REQUESTED:

INDUCTION / GAMMA / SP = TD - CASING SHOE.
DENSITY / NEUTRON / MICRO-RESISTIVITY / CALIPER = TD - 4000 FT.

- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING = 1400 CU.FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 630 CU.FT.
- CREW: B. TOVAR, B. COPELAND, C. BAKER.
- MUD PROPERTIES:
 - CHLORIDES: 4000 PPM.
 - LCM: 5 #/BBL.

TOOLS BRIDGED OFF AT 4742', MADE IT TO TD AFTER WIPER TRIP.

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.



Bit Size

inches

6

11

16

Replay
Scale
1:240

4000

600

106°

4050

107°

4100

107°

4150

4200

← Bit Size

← Borehole Corrected Gamma

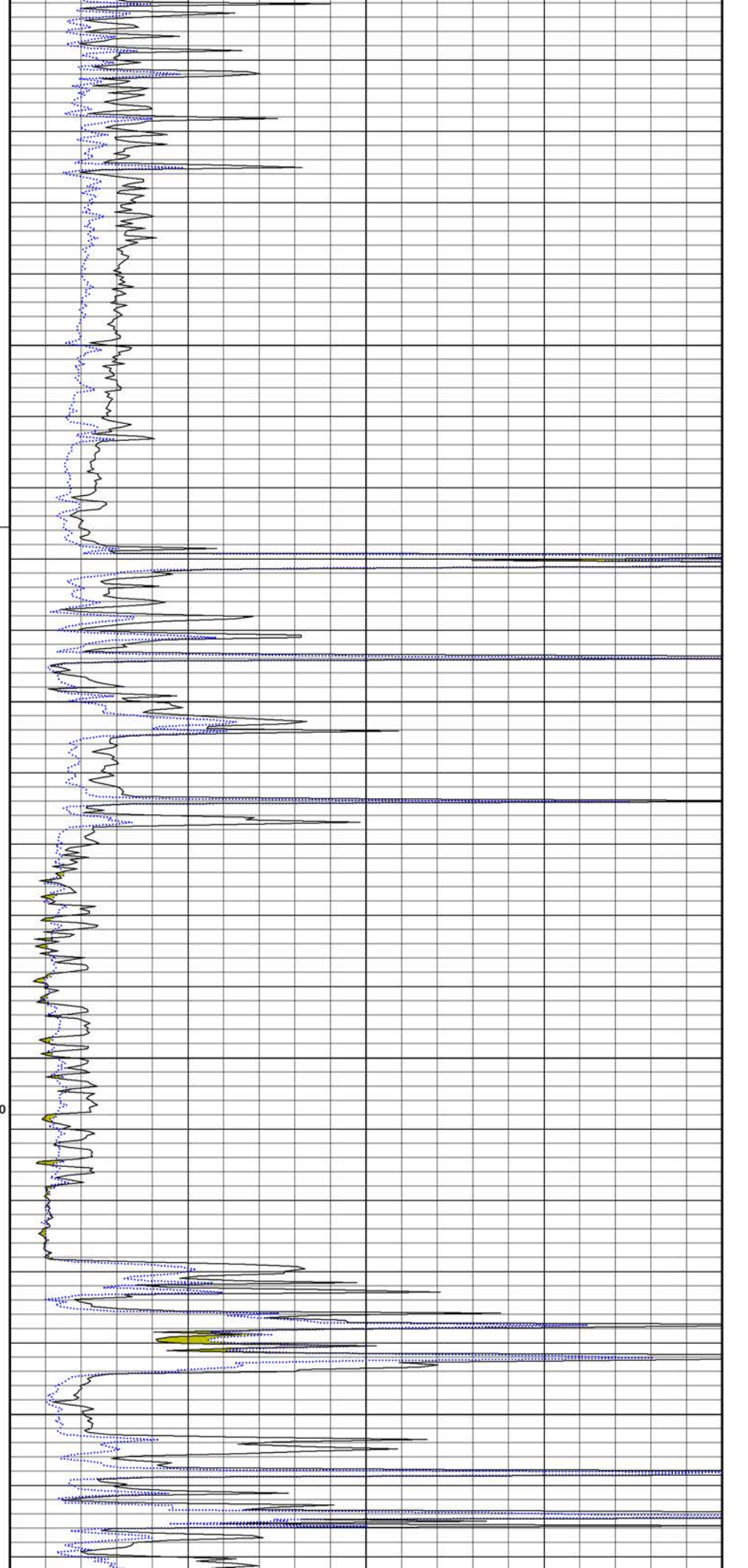
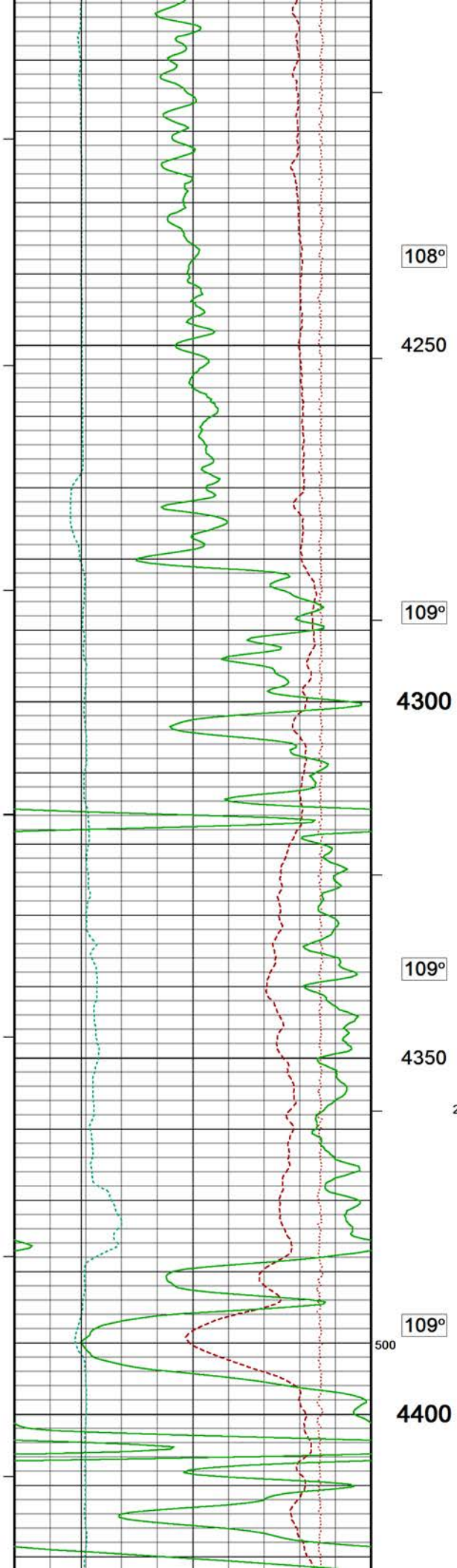
← MMR Caliper

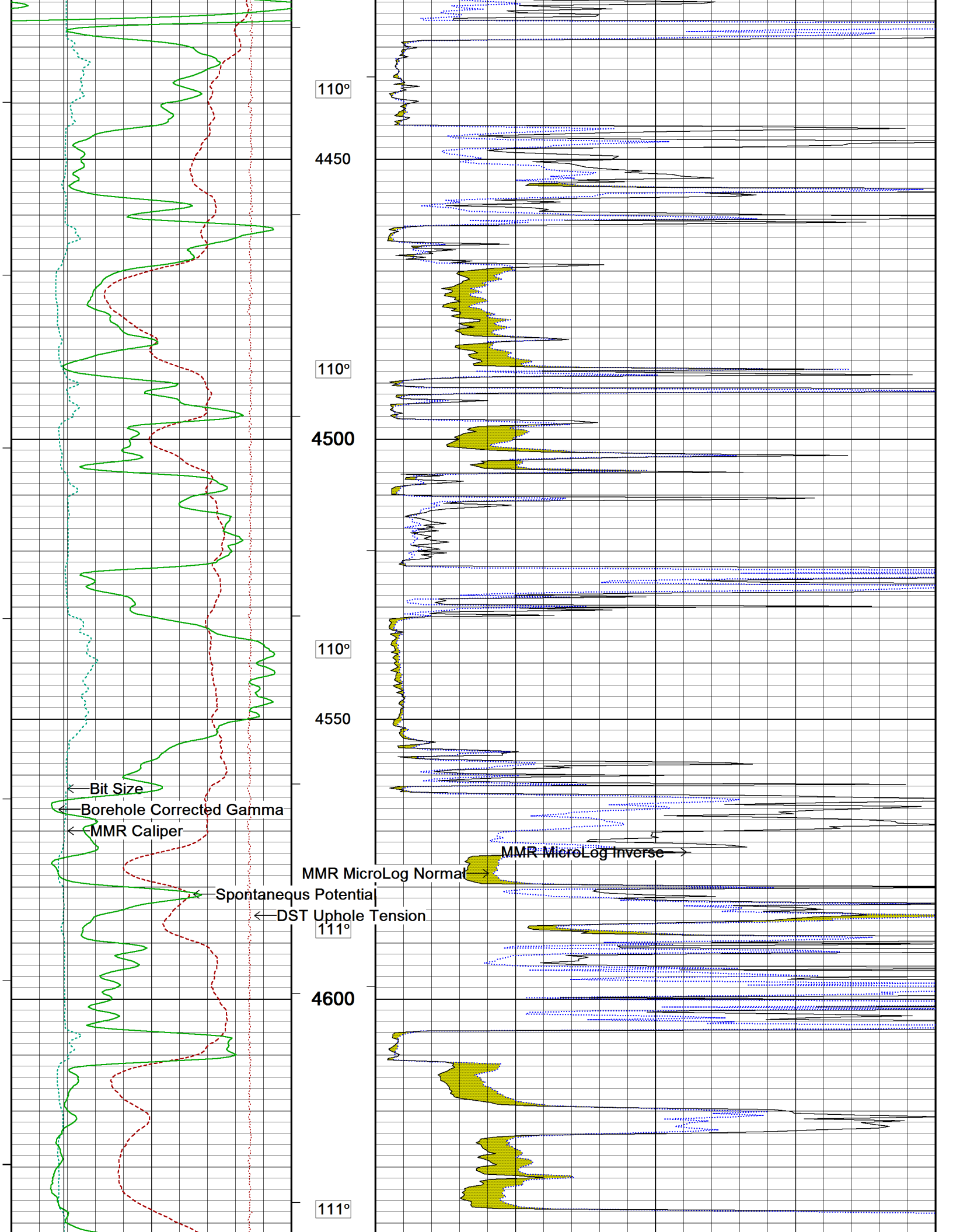
MMR MicroLog Inverse

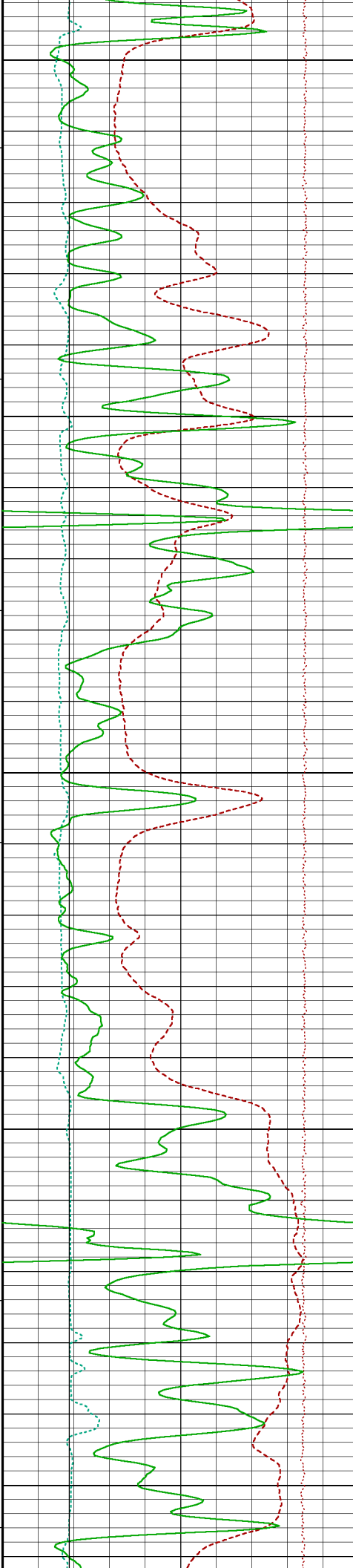
MMR MicroLog Normal →

← Spontaneous Potential

← DST Uphole Tension







4650

111°

4700

112°

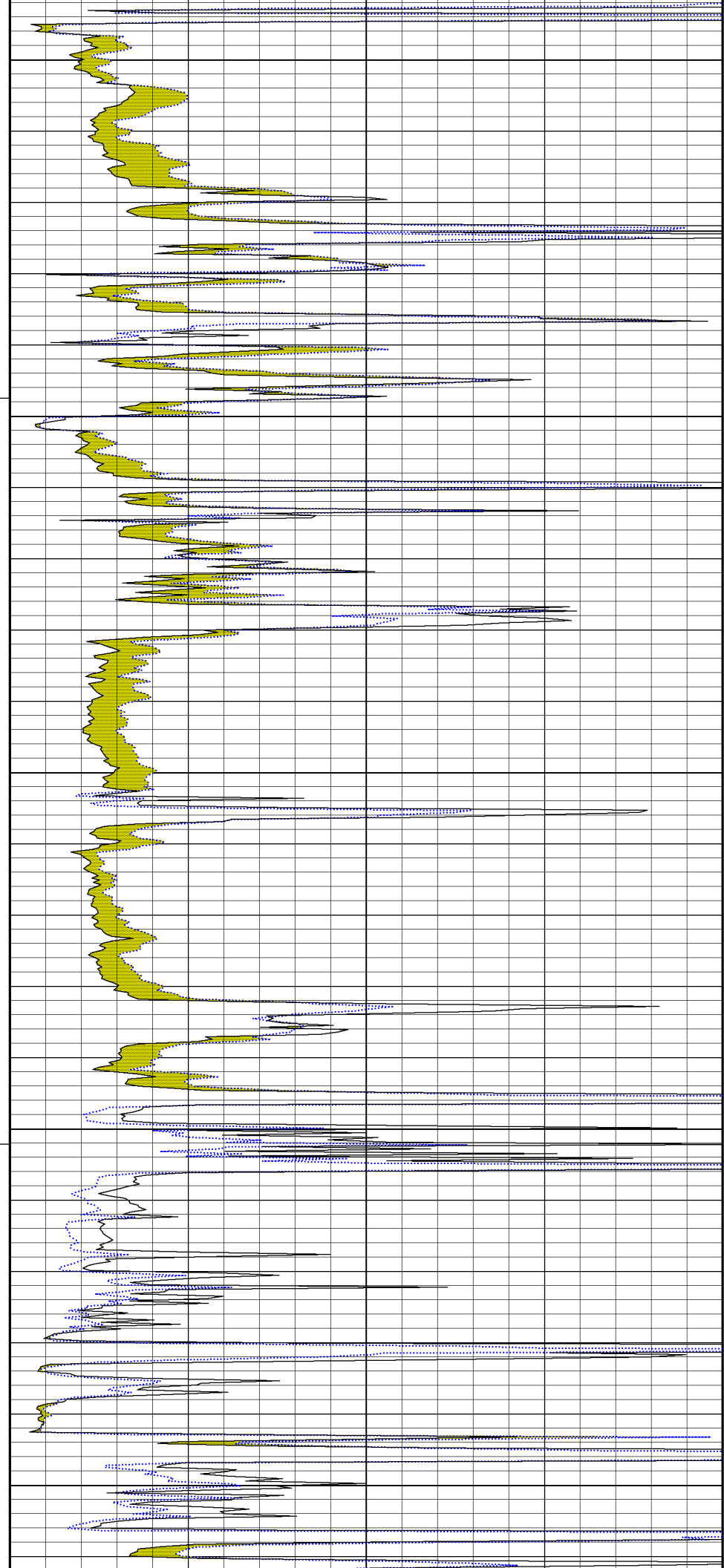
4750

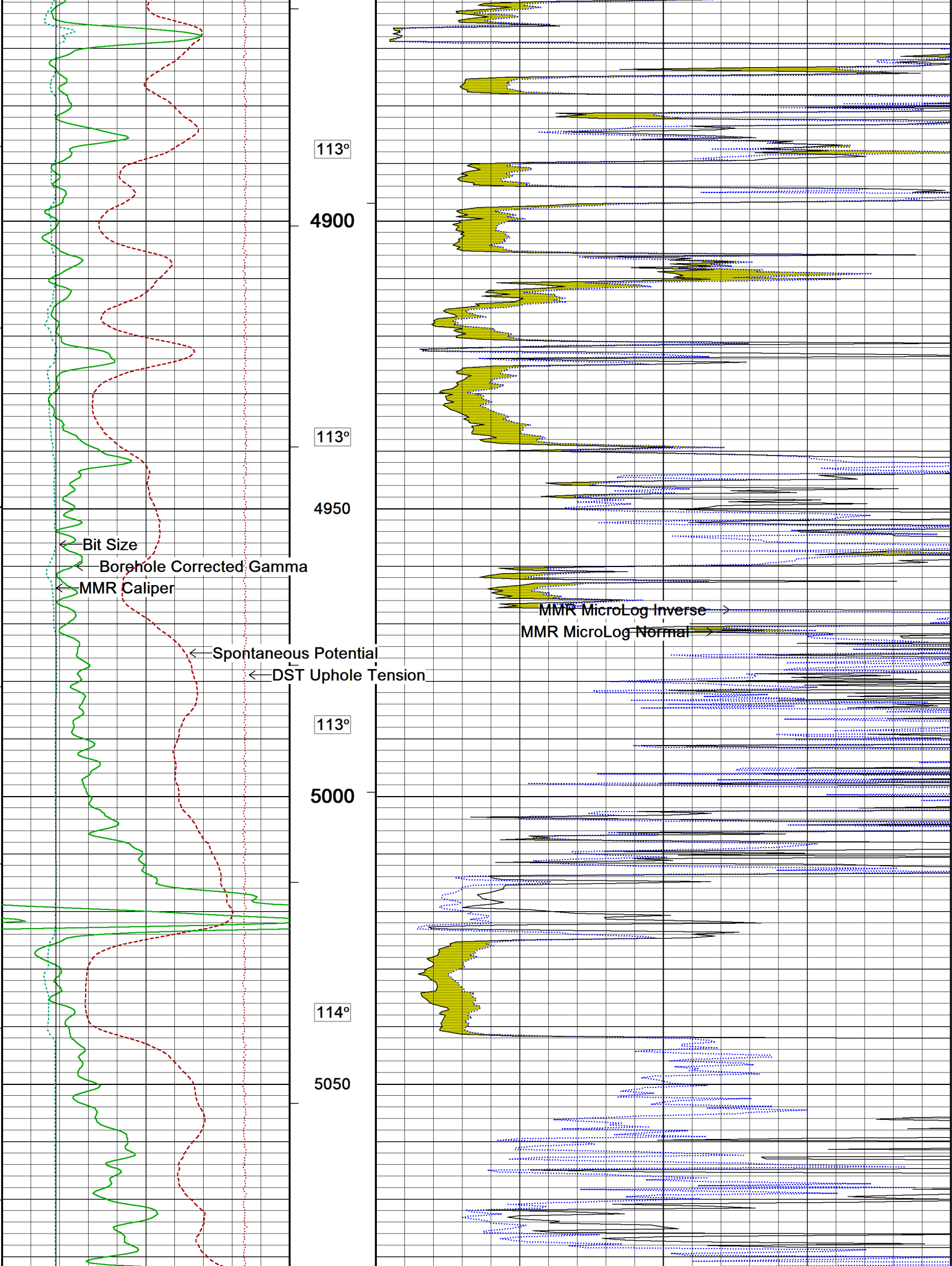
112°

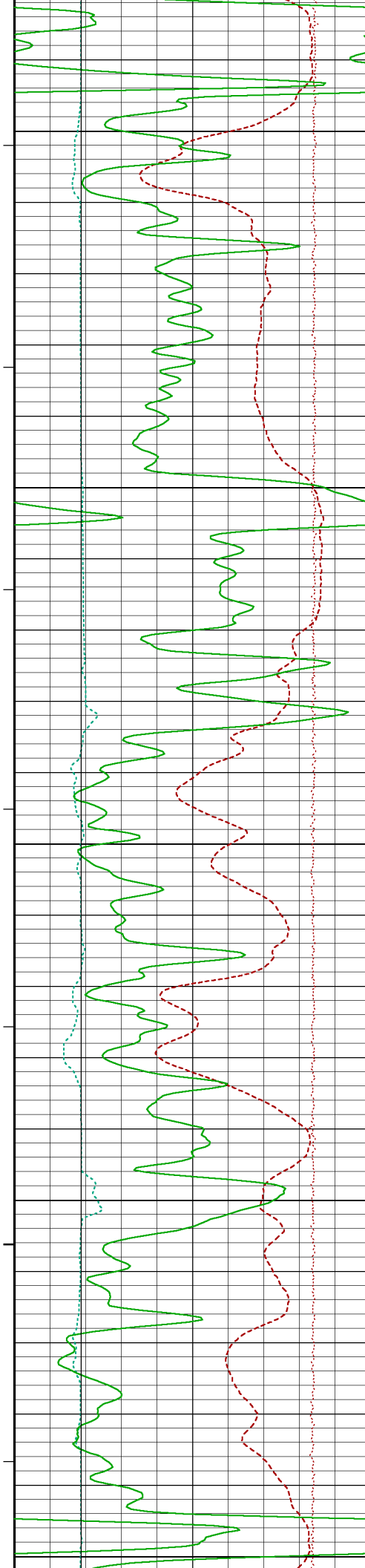
4800

113°

4850







114°

5100

300

115°

5150

115°

5200

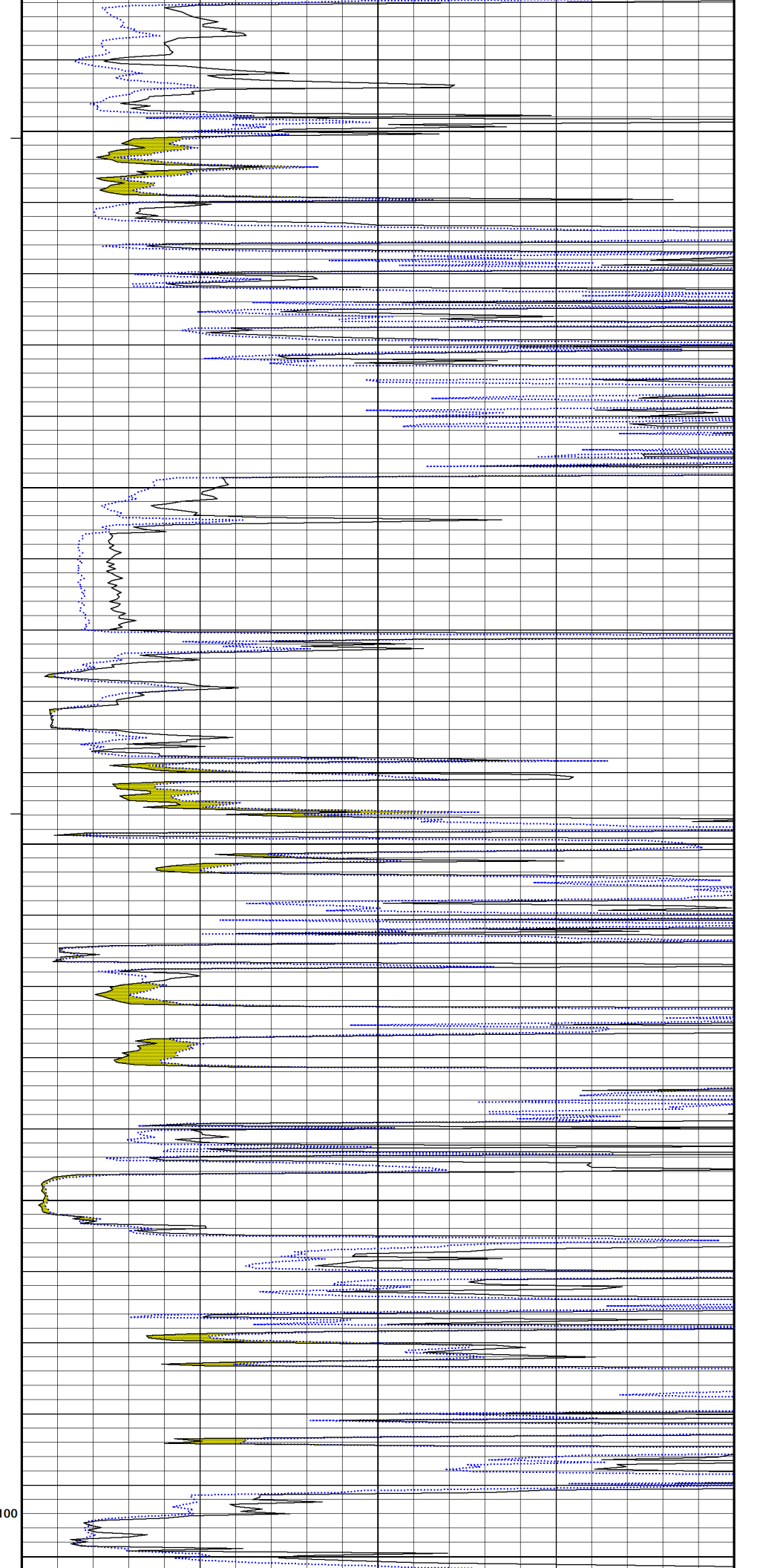
115°

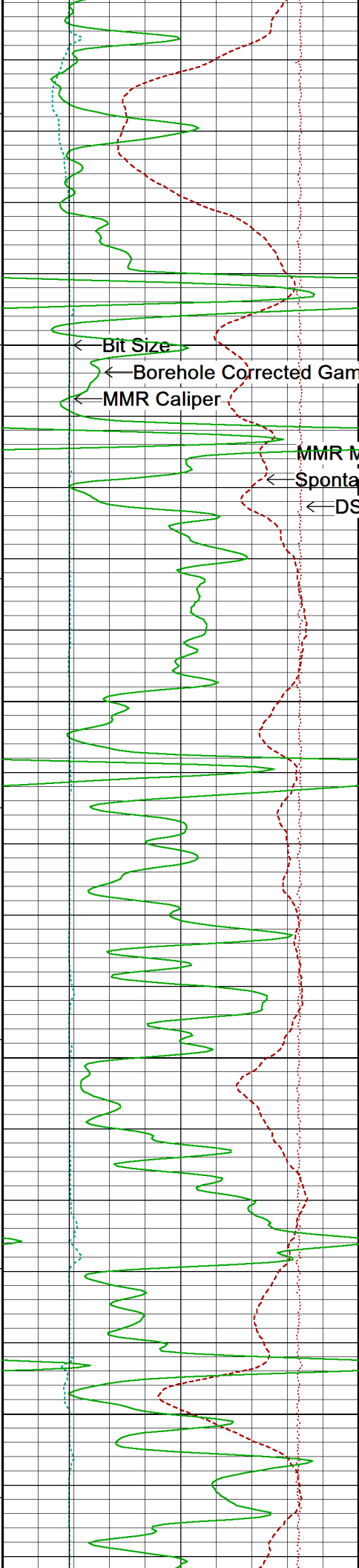
5250

115°

100

5300





116°

5350

116°

5400

117°

5450

117°

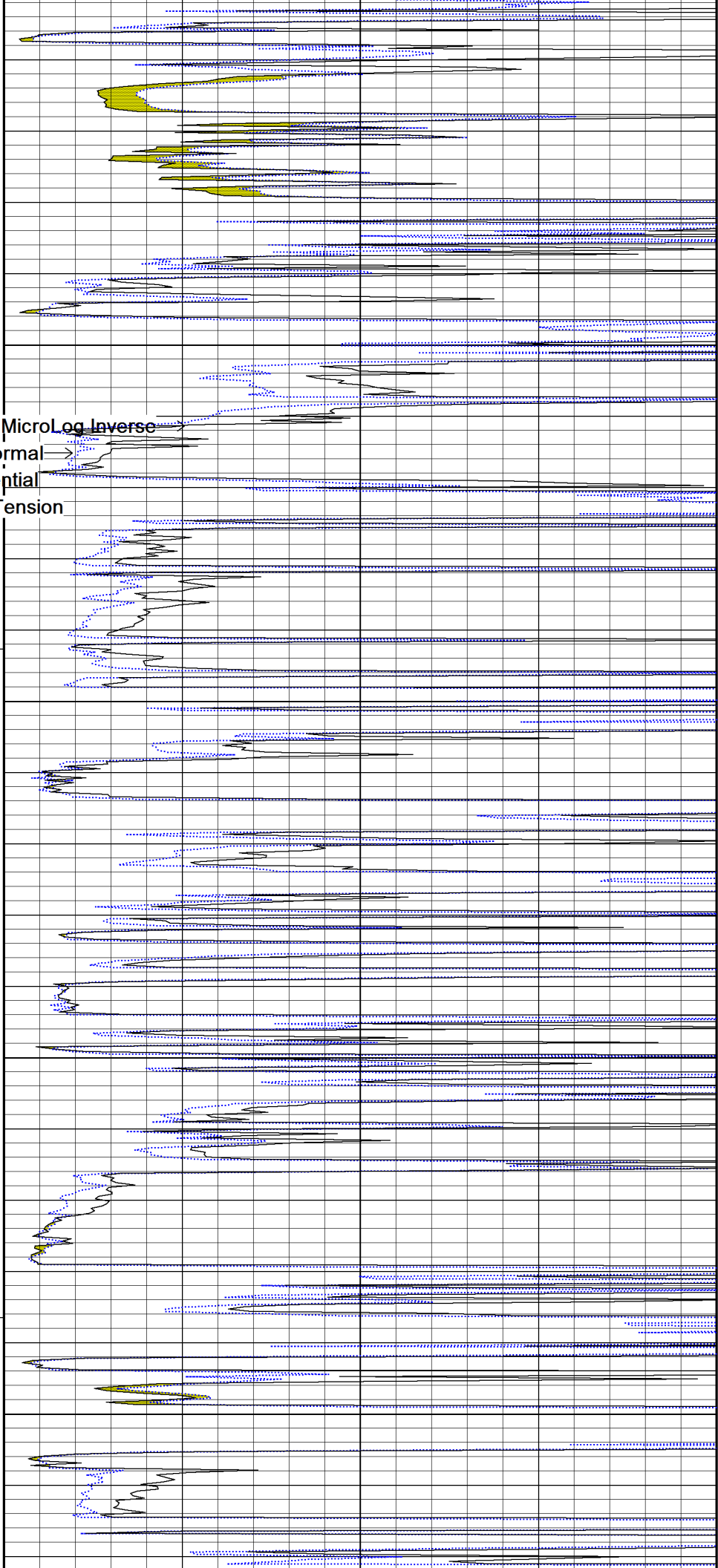
200 5500

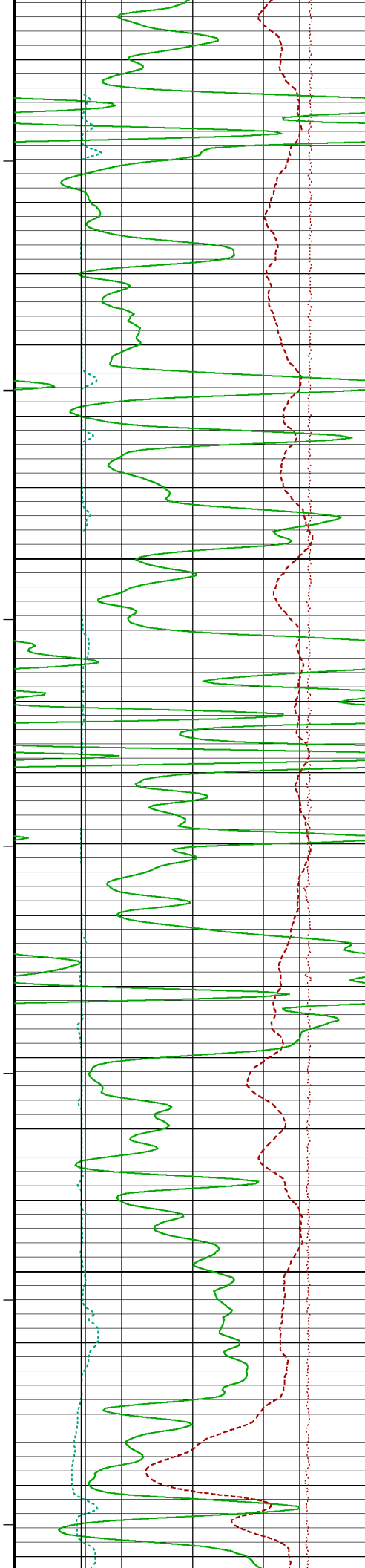
MMR MicroLog Inverse

MMR MicroLog Normal

Spontaneous Potential

DST Uphole Tension





117°

5550

118°

5600

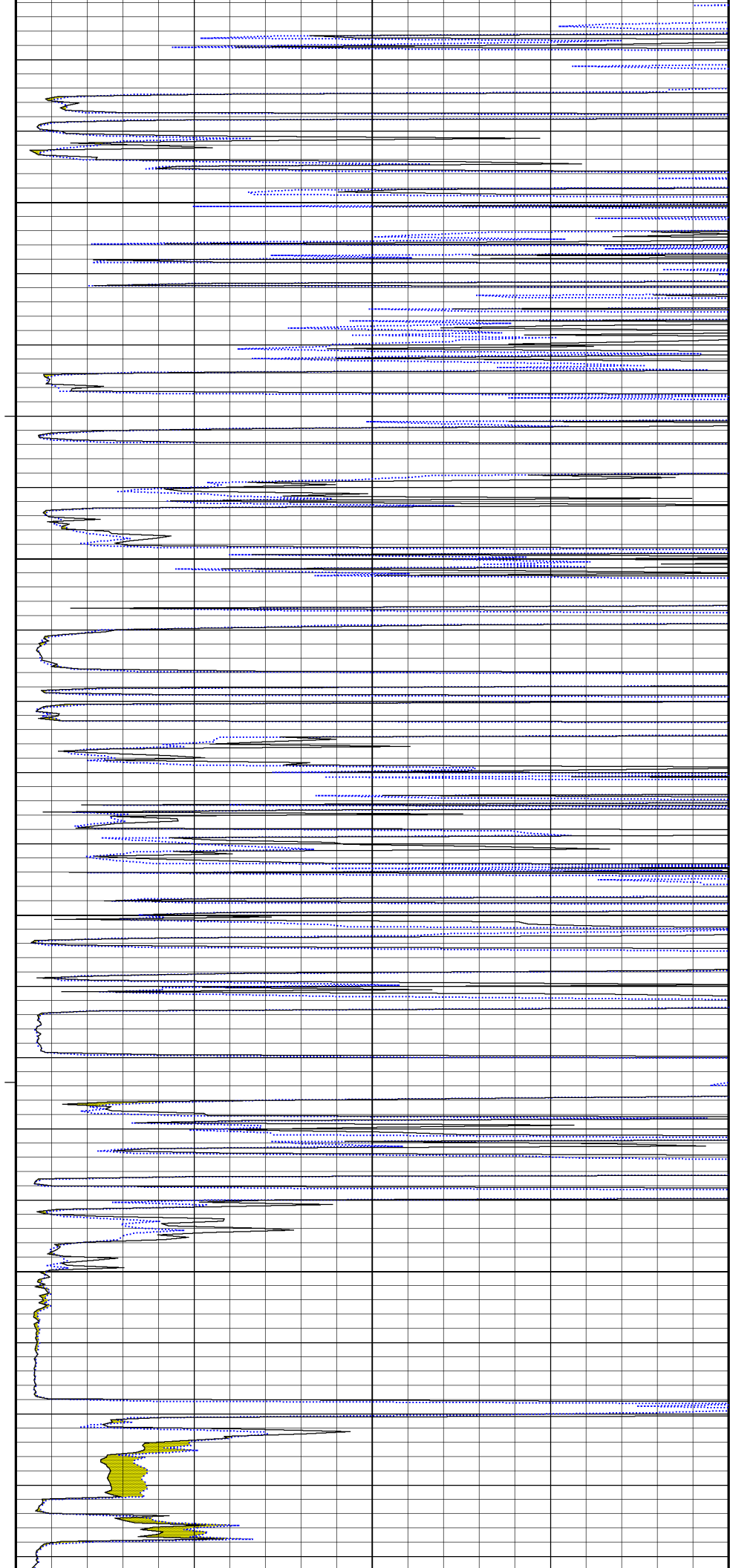
118°

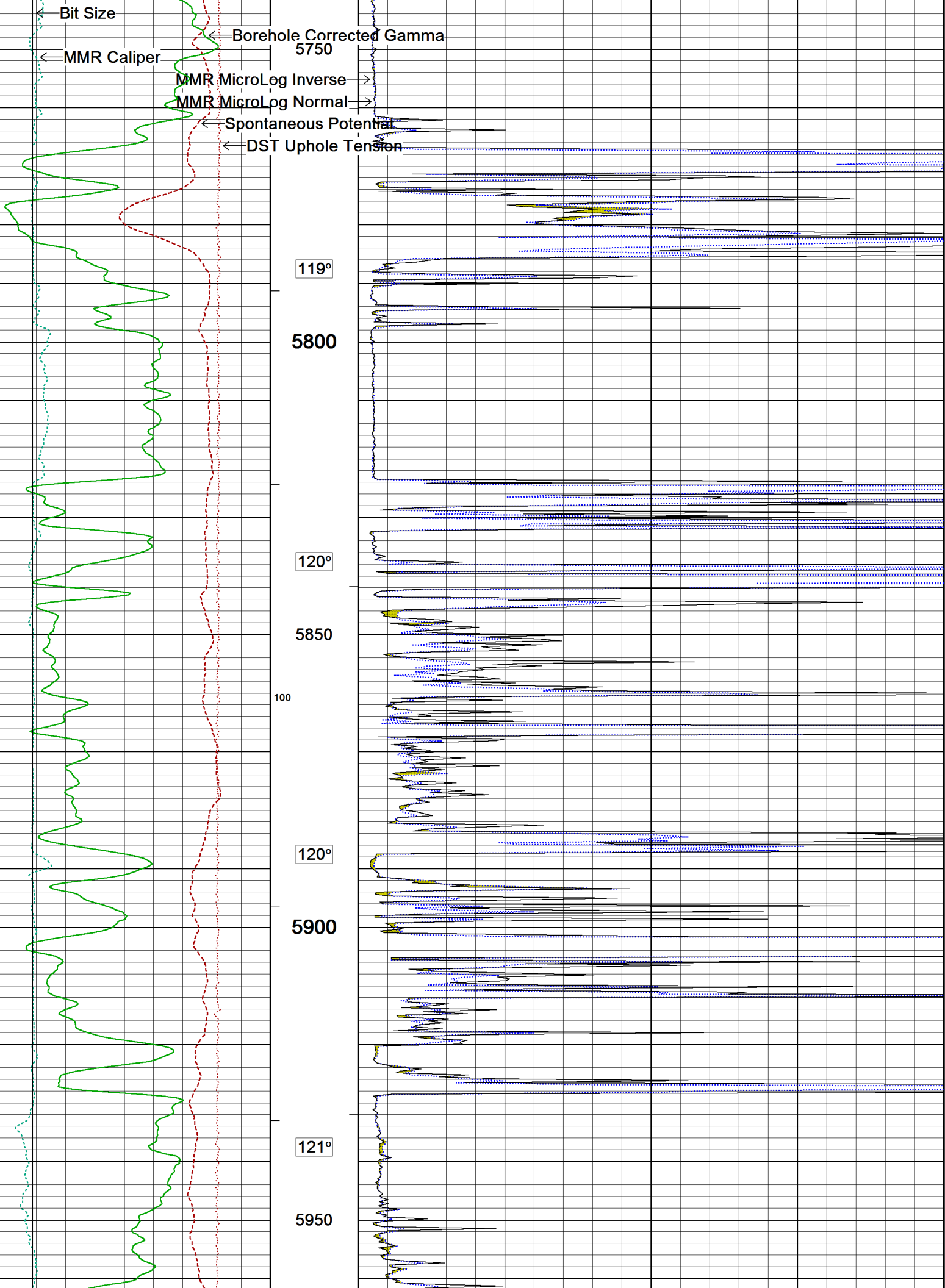
5650

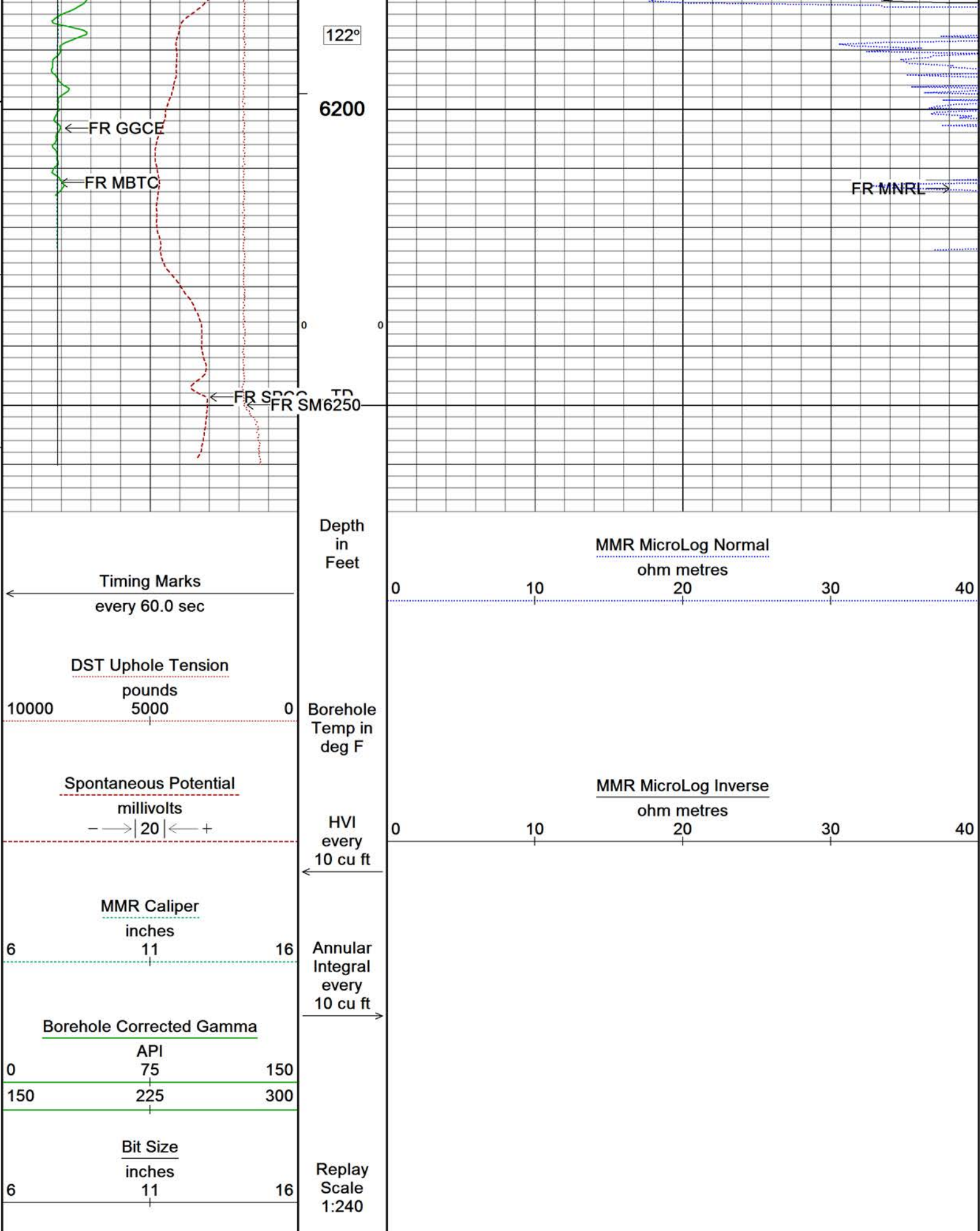
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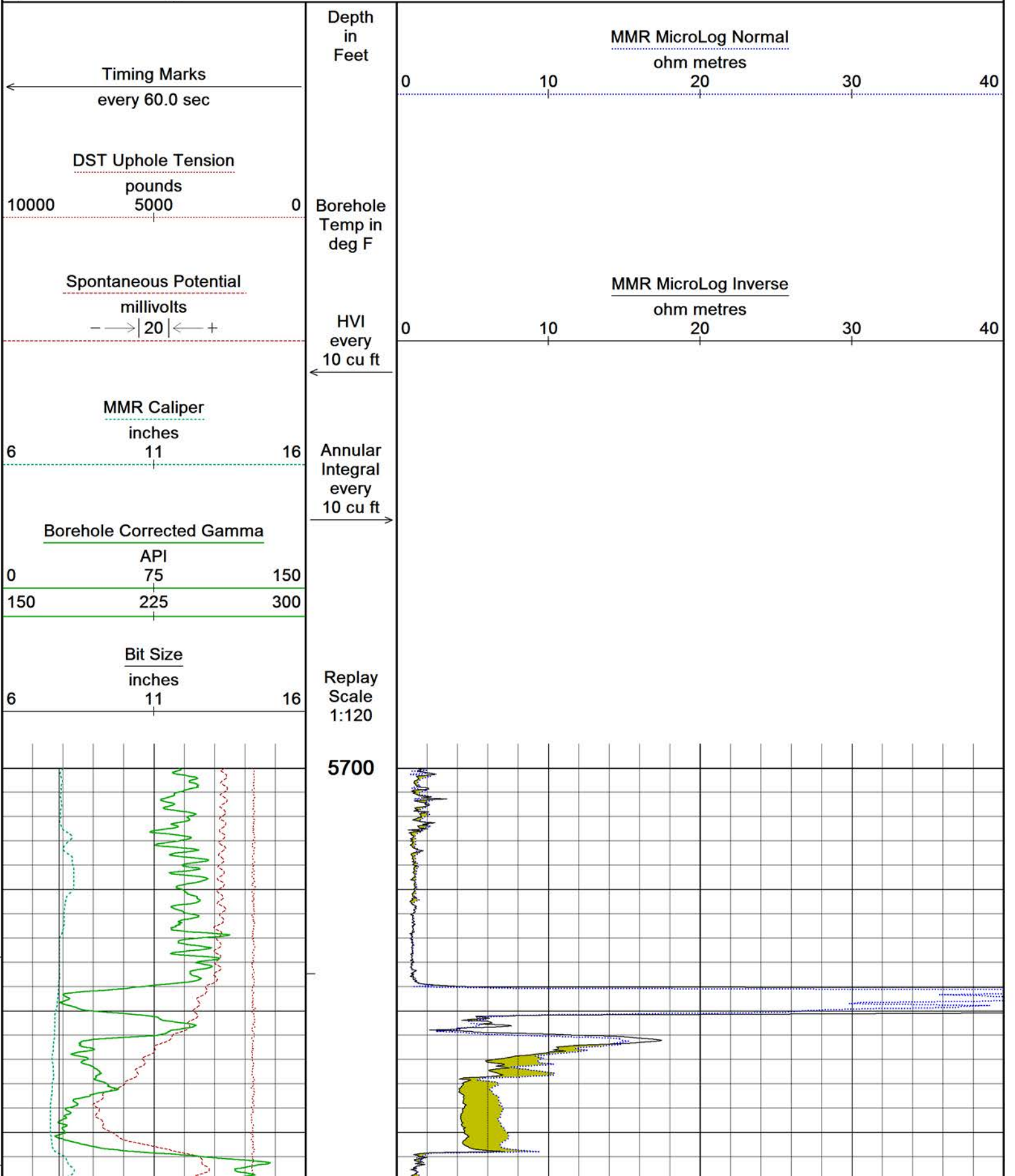
5700

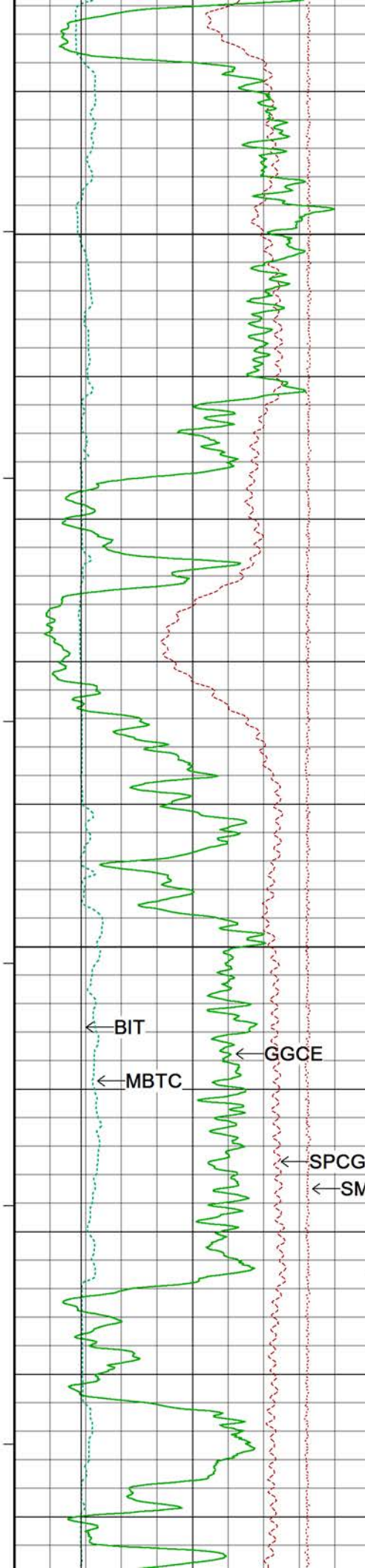
119°











118°

5750

119°

5800

119°

← BIT

← MBTC

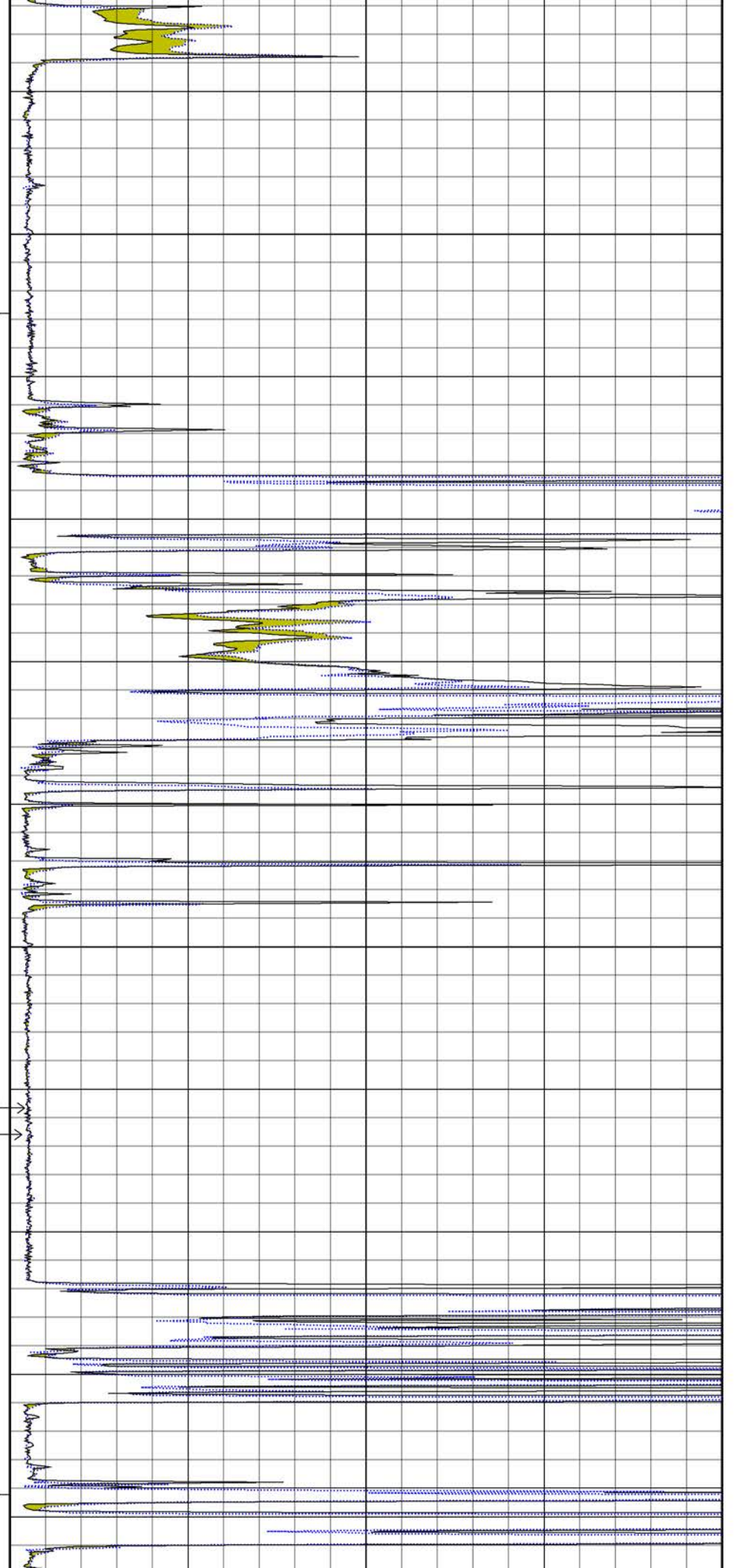
← GGCE

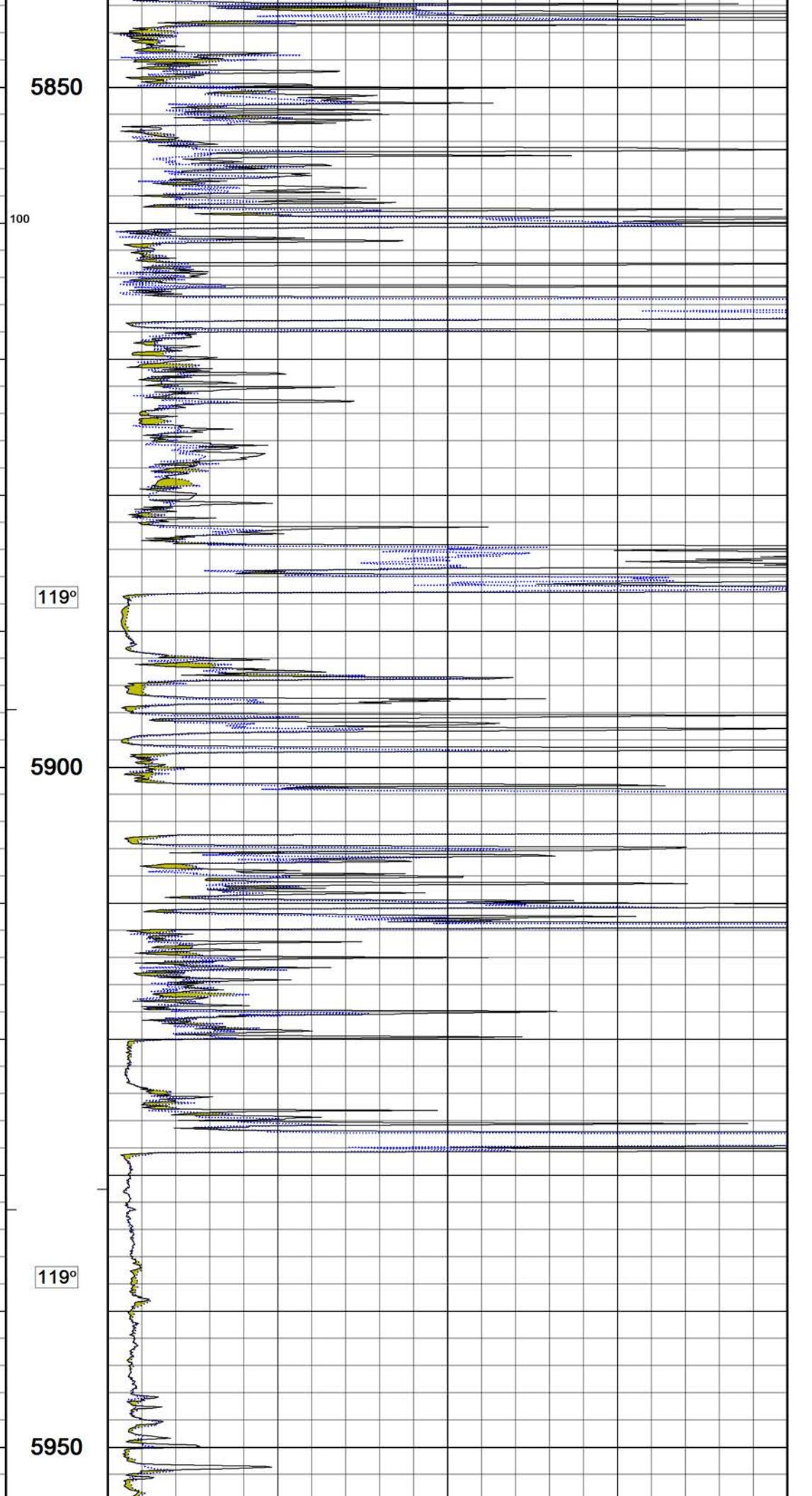
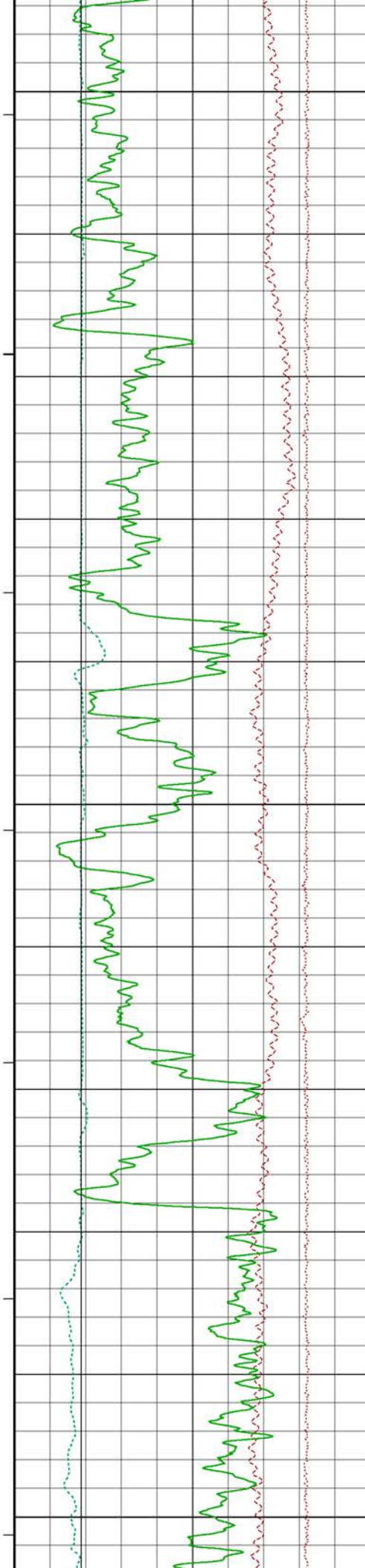
← SPCG

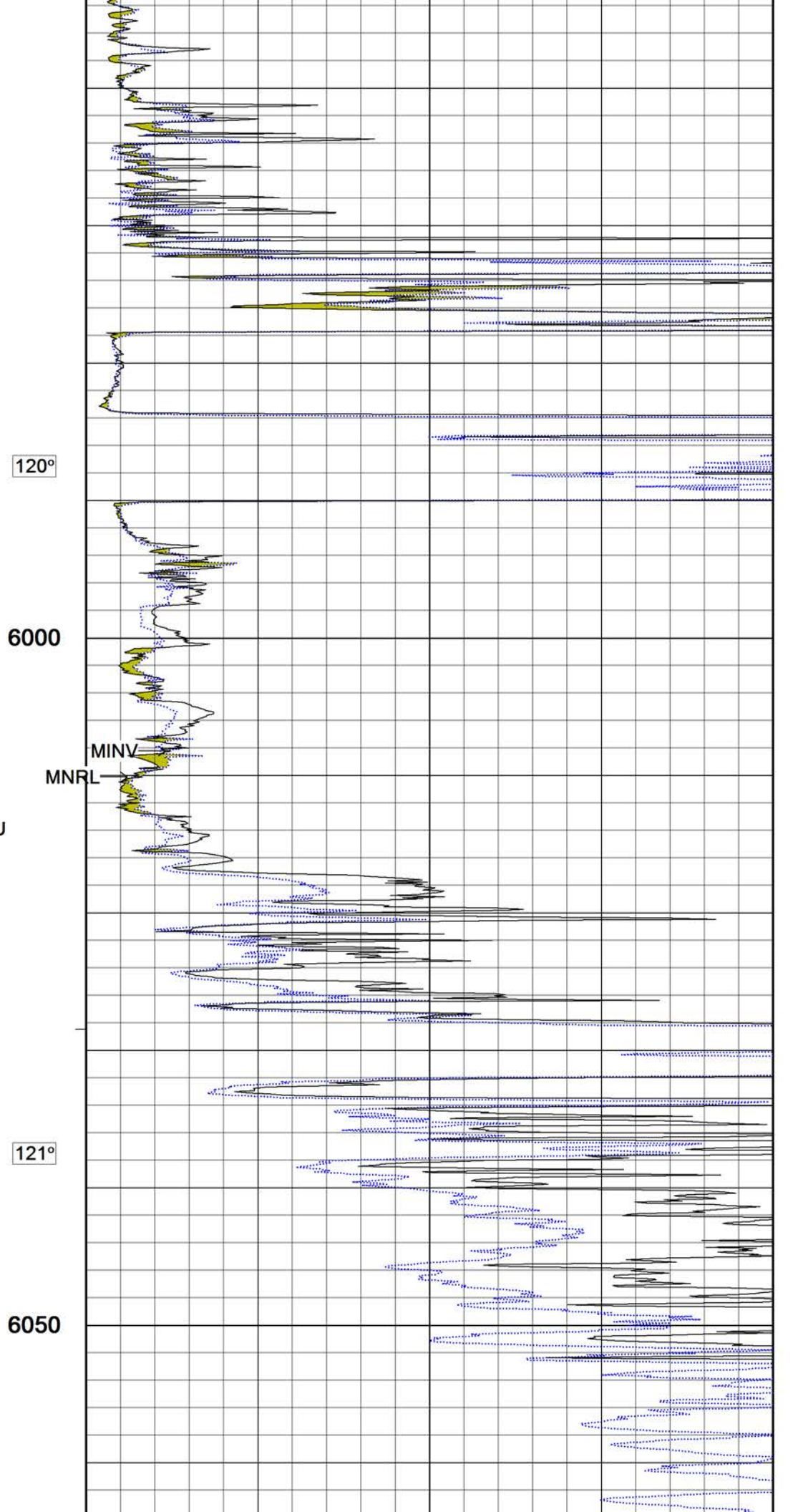
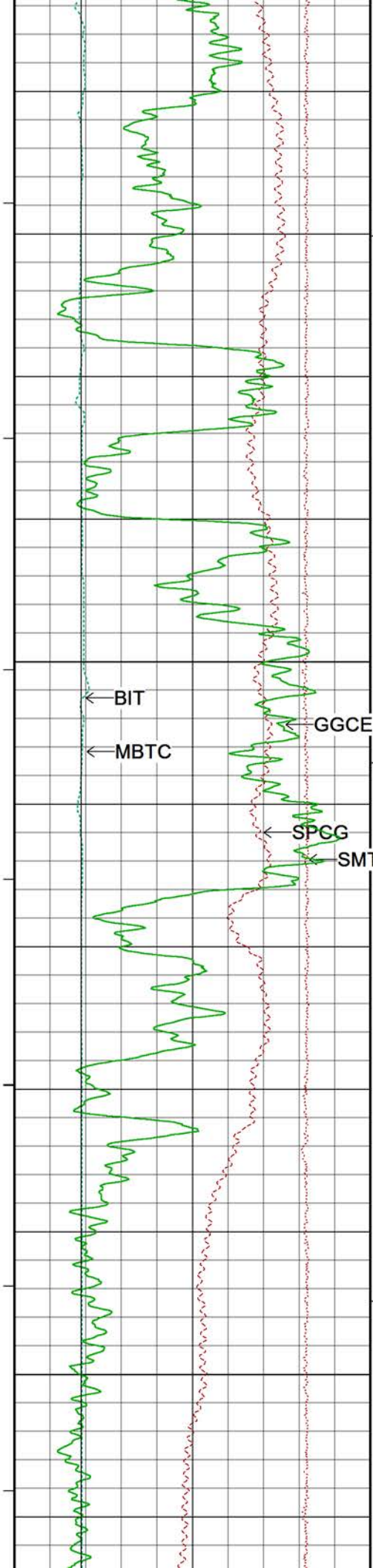
← SMTU

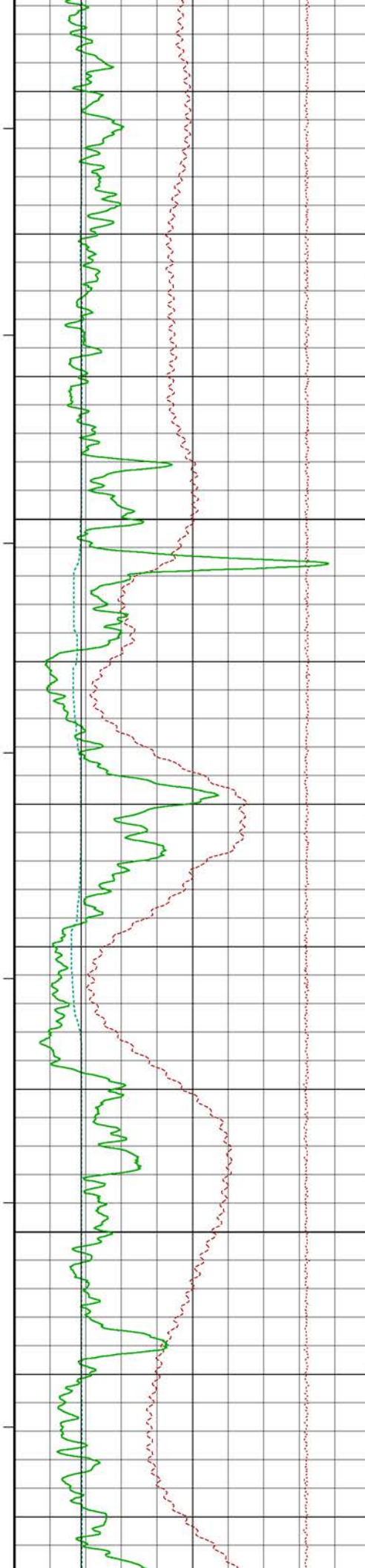
MINV →

MNRL →







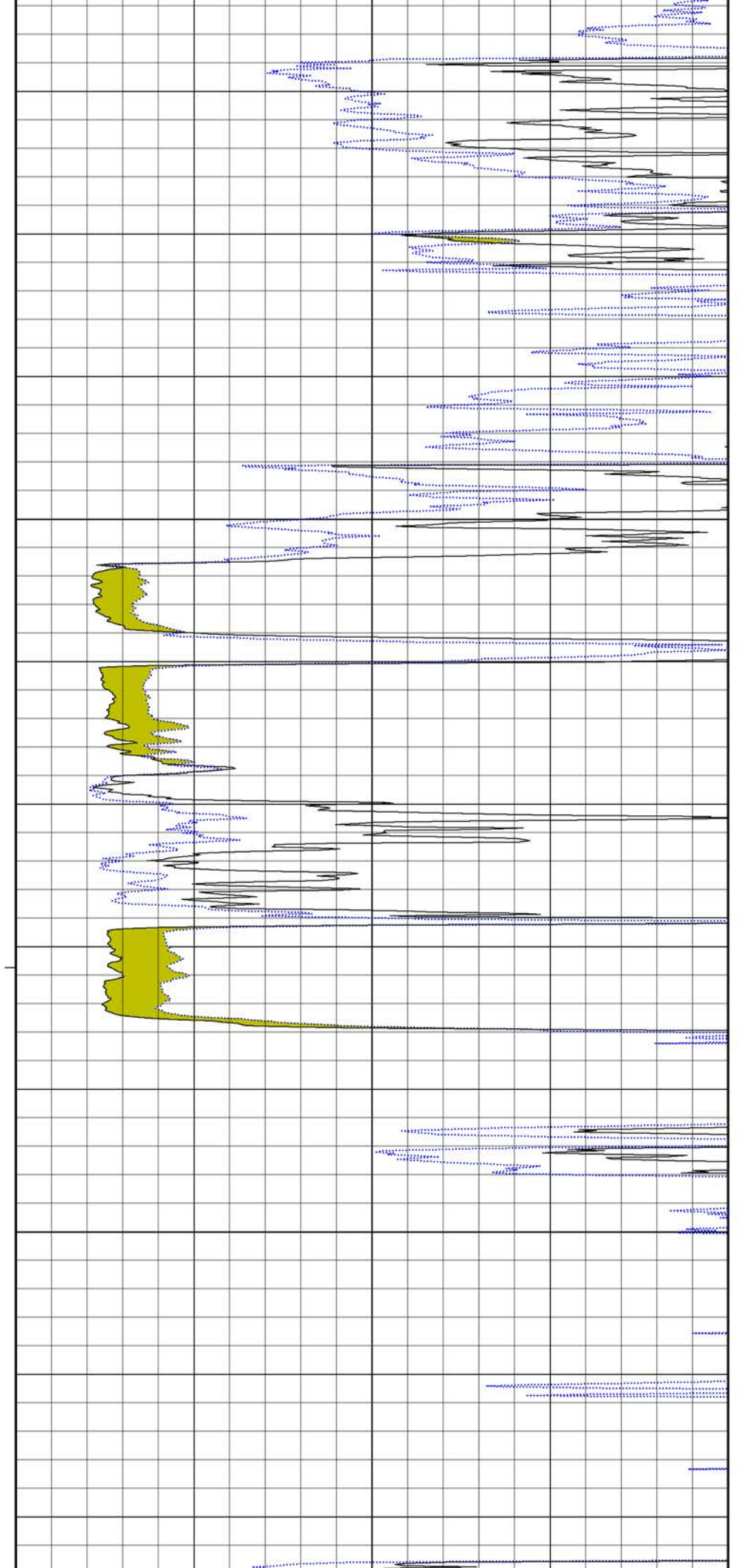


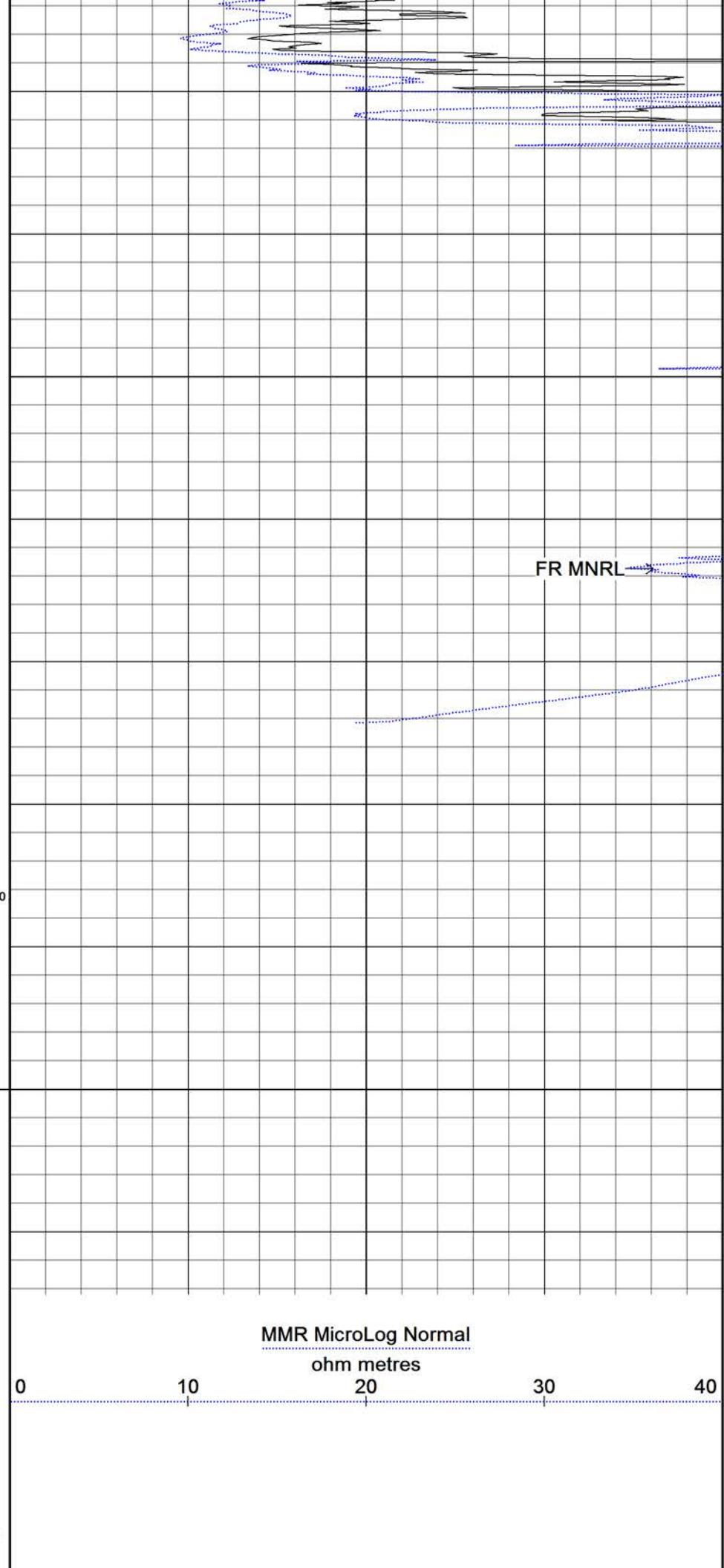
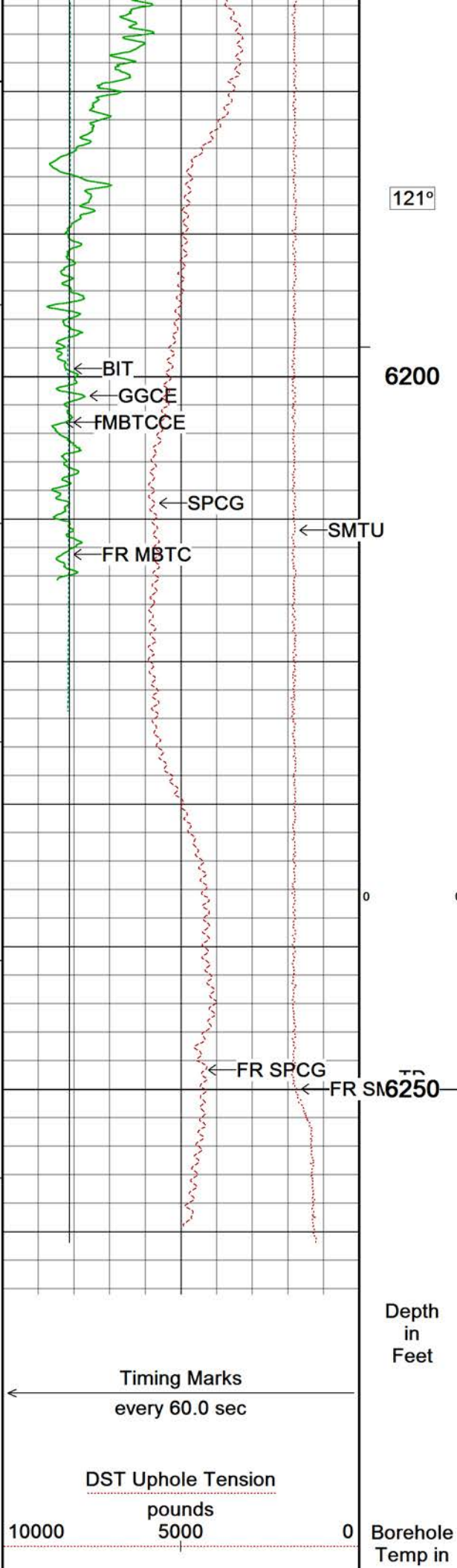
121°

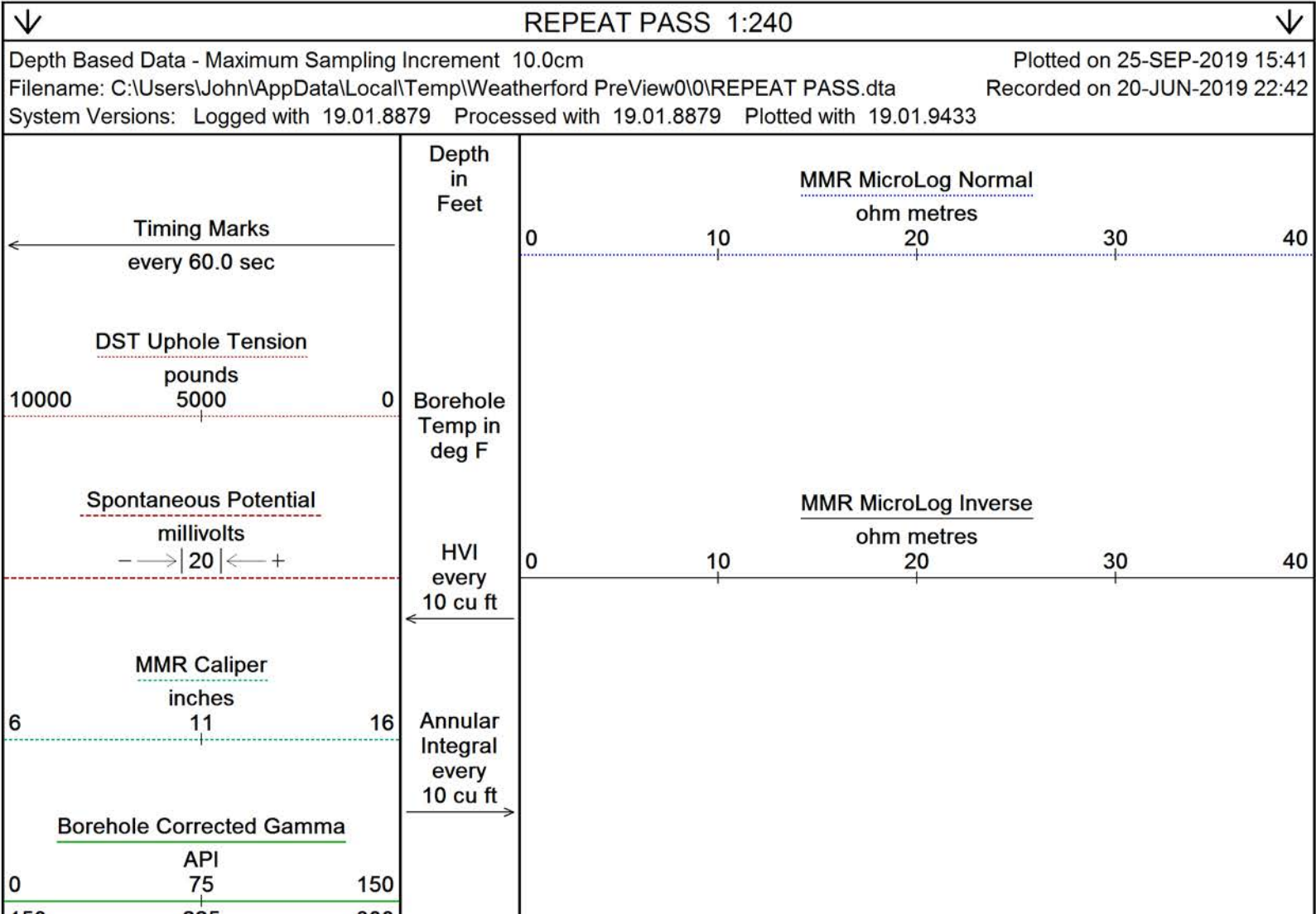
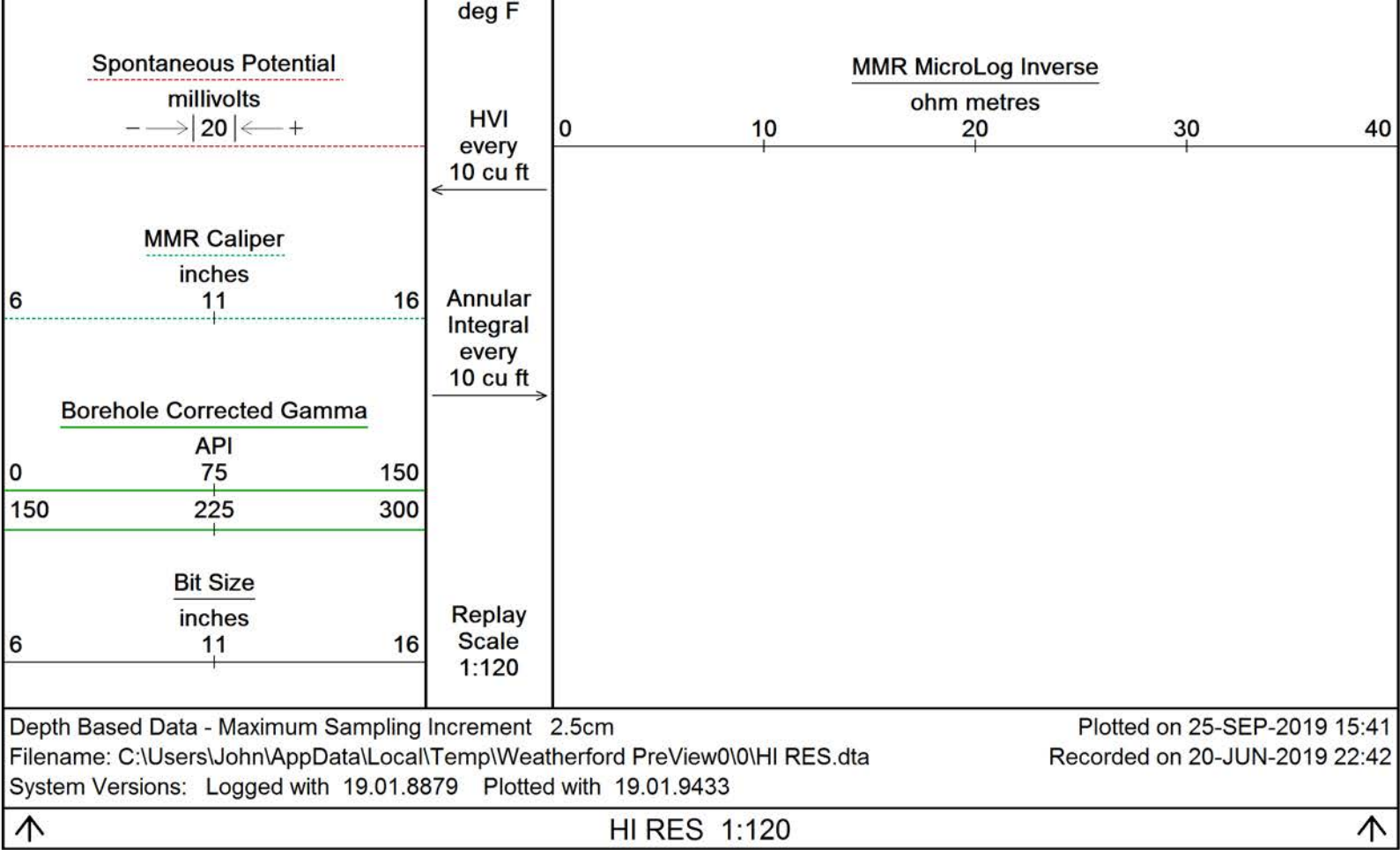
6100

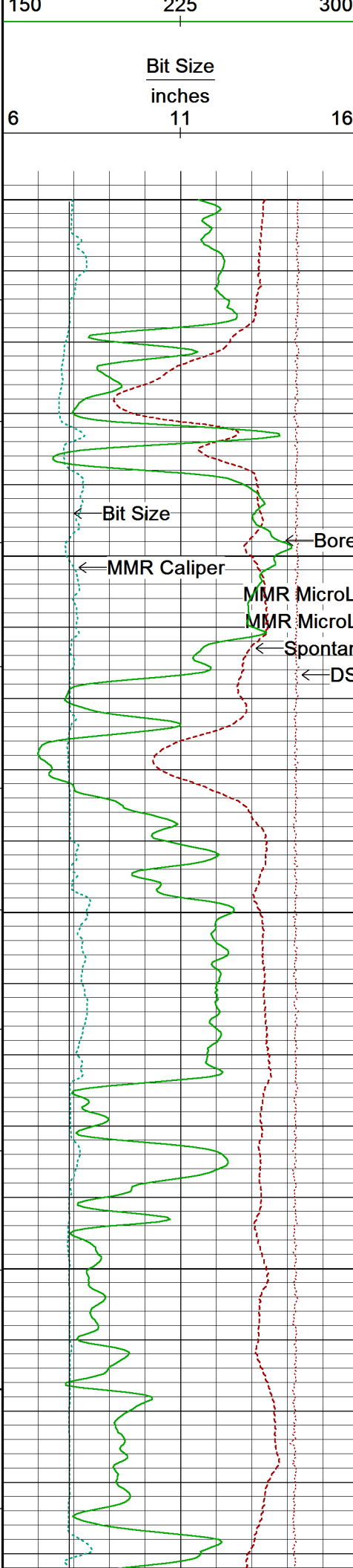
121°

6150









Replay
Scale
1:240

5700

118°

Borehole Corrected Gamma

5750

MMR MicroLog Inverse

MMR MicroLog Normal

Spontaneous Potential

DST Uphole Tension

118°

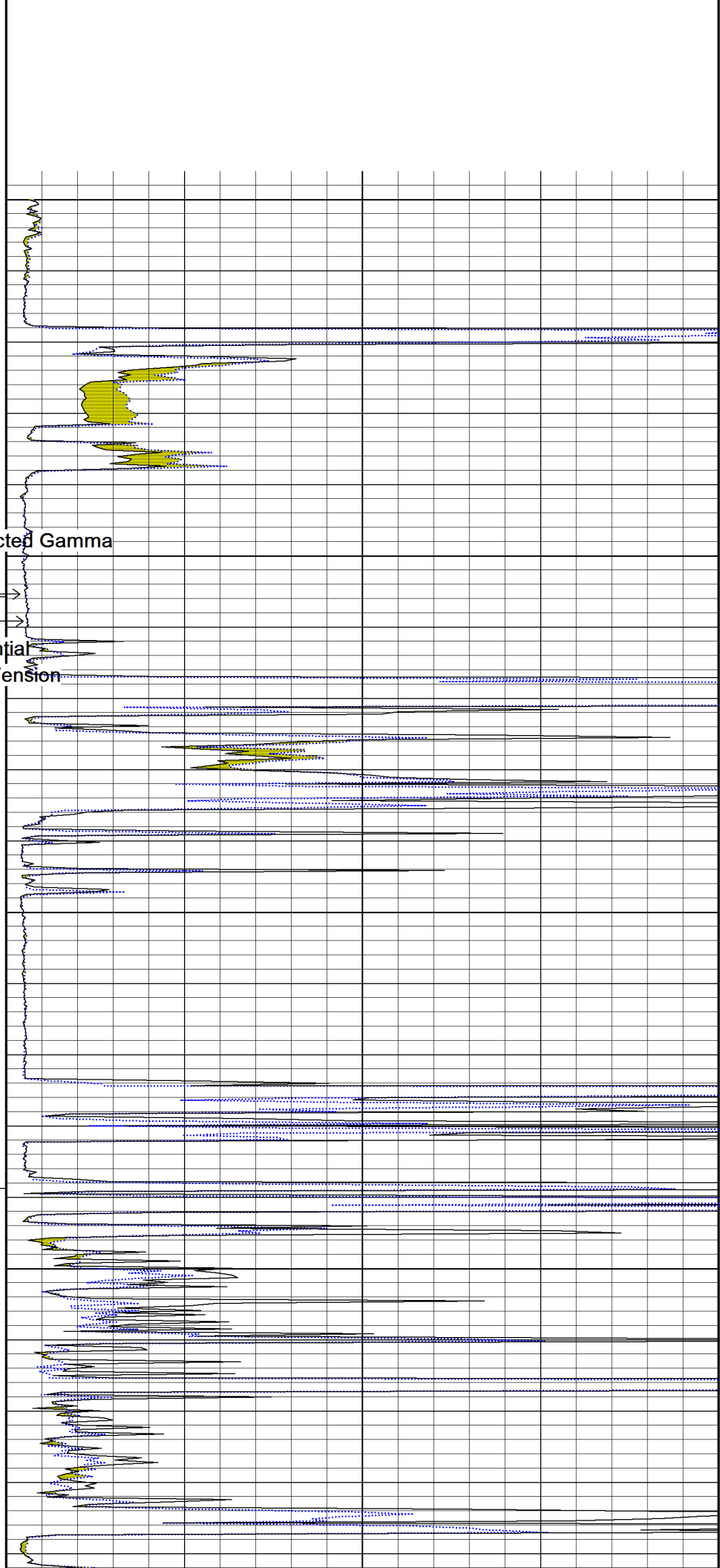
5800

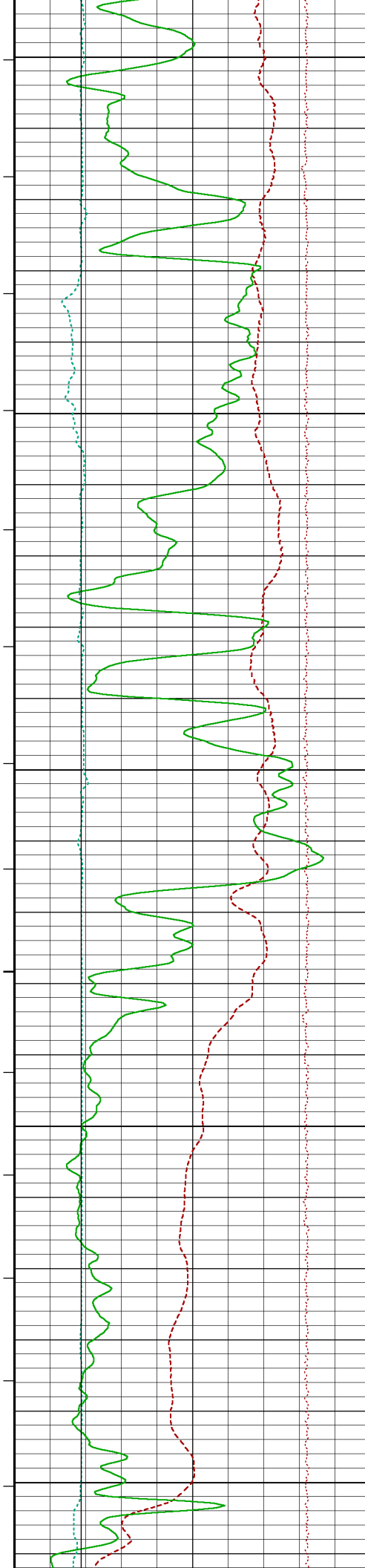
119°

5850

100

119°





5900

119°

5950

120°

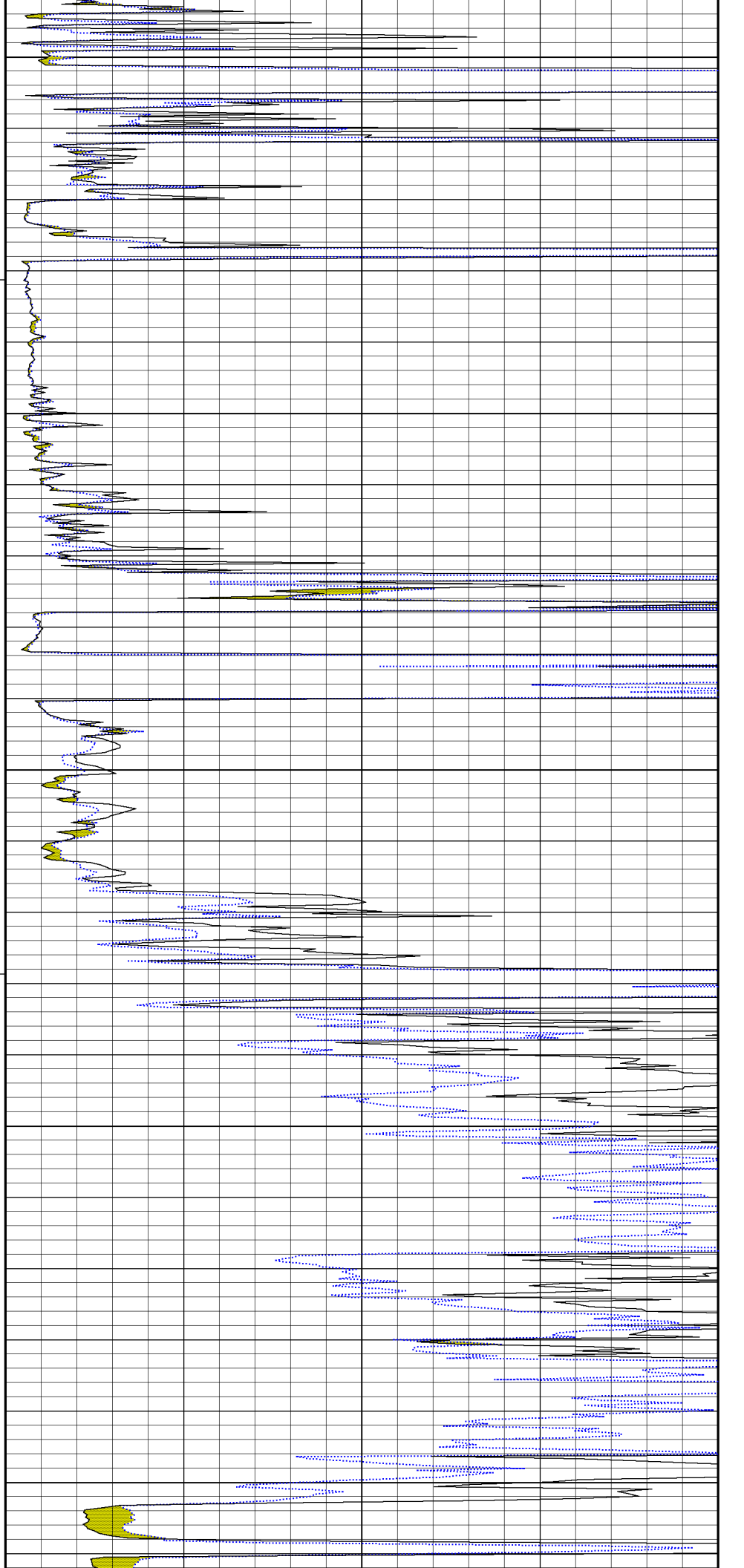
6000

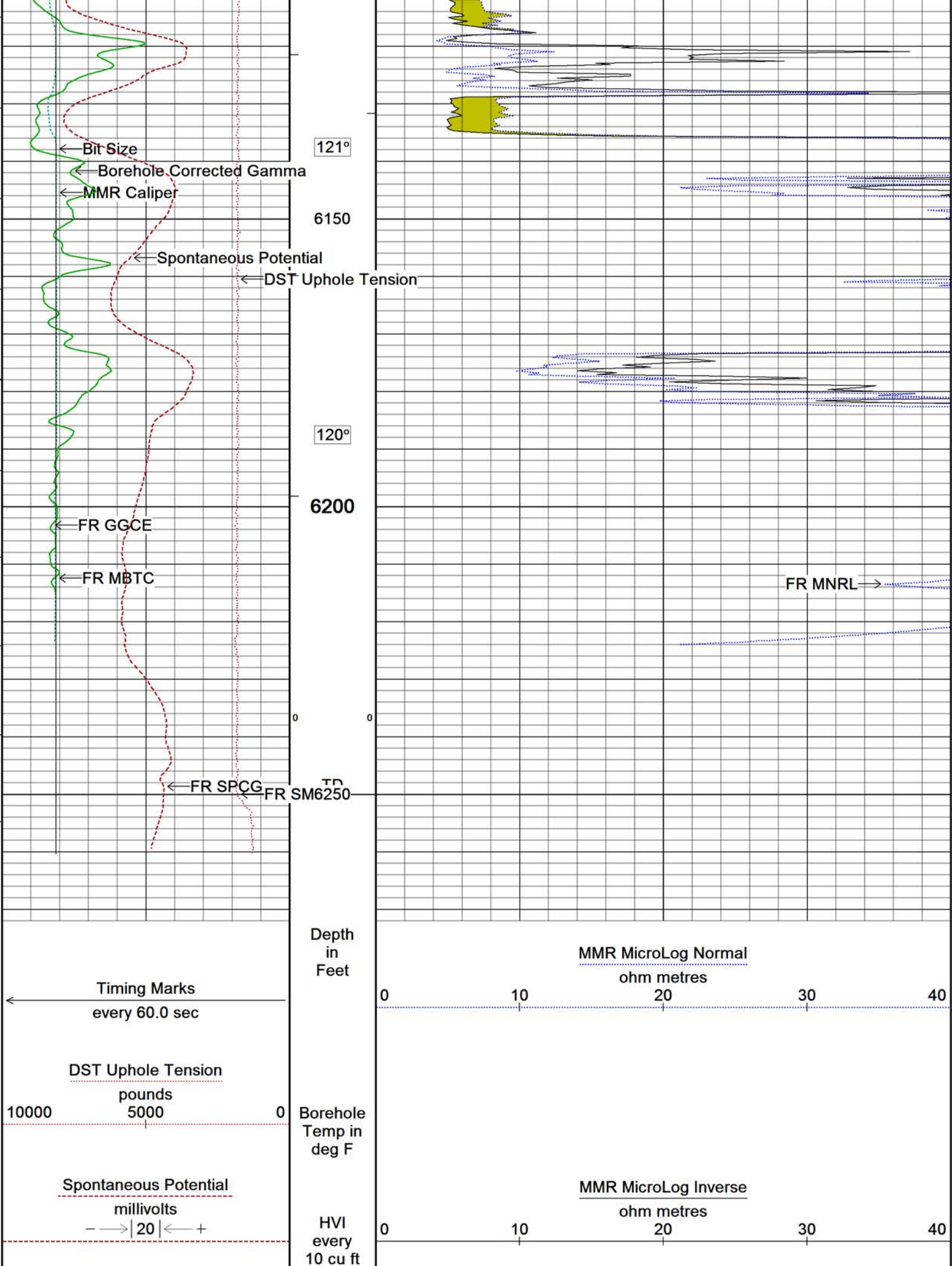
121°

6050

121°

6100





<u>MMR Caliper</u> inches 6 11 16	Annular Integral every 10 cu ft →	
<u>Borehole Corrected Gamma</u> API 0 75 150 150 225 300		
<u>Bit Size</u> inches 6 11 16		
Replay Scale 1:240		

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 25-SEP-2019 15:41
 Filename: C:\Users\John\AppData\Local\Temp\Weatherford PreView0\0\REPEAT PASS.dta Recorded on 20-JUN-2019 22:42
 System Versions: Logged with 19.01.8879 Processed with 19.01.8879 Plotted with 19.01.9433

↑ REPEAT PASS 1:240 ↑

BEFORE SURVEY CALIBRATION

C:\Users\John\AppData\Local\Temp\Weatherford PreView0\0\MAIN PASS.dta

General Constants All 000
Last Edited on 20-JUN-2019,20:27

General Parameters		
Mud Resistivity	0.880	ohm-metres
Mud Resistivity Temperature	96.000	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	Limestone Density Por.	
Resistivity used	Array Ind. Two Res Rt	
RWA Constant A	0.620	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-D.K 443
Field Calibration on 13-JUN-2019 10:16

	Measured	Calibrated (API)
Background	82	58
Calibrator (Gross)	791	555
Calibrator (Net)	709	497

Gamma Calibration Tolerances MCG-D.K 443

Ratio

1.426Counts/API

Gamma Constants MCG-D.K 443
Last Edited on 20-JUN-2019,10:19

Gamma Calibrator Number	GRCC175	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.07	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	

Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%
High Resolution Temperature Calibration MCG-D.K 443		Field Calibration on 13-JUN-2019,10:18
	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 13-JUN-2019,10:18
Pre-filter Length	11	
Caliper Calibration MMR-B.A 91		Base Calibration on 13-JUN-2019 11:47 Field Calibration on 13-JUN-2019 11:48
Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	13869	5.98
2	17522	7.96
3	20731	9.86
4	24837	11.93
5	0	0.00
6	N/A	N/A
Field Calibration		
	Measured Caliper (in)	Actual Caliper (in)
	7.98	7.96
Caliper Calibration Tolerances MMR-B.A 91		
Short Arm Field Cal.	7.98	7.76 7.96 8.16 in
Micro Normal and Micro Inverse Calibration MMR-B.A 91		Base Calibration on 13-JUN-2019 11:37 Field Check on 13-JUN-2019 11:39
	Resistor 1 (ohm)	Resistor 2 (ohm)
	10.0	50.0
Base Calibration		
	Measured	Calibrated (ohm-m)
Micro Normal	9.9 49.3	5.1100 25.5500
Micro Inverse	9.9 49.2	3.3800 16.9000
Channel	Base Check (ohm-m)	Field Check (ohm-m)
Micro Normal	94.5	94.5
Micro Inverse	62.6	62.6
Micro Normal & Micro Inverse Calibration Tolerance MMR-B.A 91		
Micro Normal Res. 1	9.9	-5% 10.0 +5% ohm
Micro Inverse Res. 1	9.9	-5% 10.0 +5% ohm
Micro Normal Res. 2	49.3	-5% 50.0 +5% ohm
Micro Inverse Res. 2	49.2	-5% 50.0 +5% ohm
Micro Normal Base Check	94.5	-2% 94.39 +2% ohm-m
Micro Inverse Base Check	62.6	-2% 62.54 +2% ohm-m
Micro Normal Field Check	94.5	-2% 94.5 +2% ohm-m
Micro Inverse Field Check	62.6	-2% 62.6 +2% ohm-m
Micro Normal and Micro Inverse Constants MMR-B.A 91		Last Edited on 13-JUN-2019,11:29
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 MPD-D.A 479		Base Calibration on 13-JUN-2019 17:42 Field Calibration on 13-JUN-2019 17:44
Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	16436	4.01
2	25093	5.98
3	33645	7.87

4	41925	9.87
5	51125	11.88
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.87	7.87

Caliper Calibration Tolerances MPD-D.A 479

Long Arm Field Cal. 7.87

7.46	7.87	8.27
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 in

DOWNHOLE EQUIPMENT

C:\Users\John\AppData\Local\Temp\Weatherford PreView0\0\MAIN PASS.dta

Cablehead, 11 pin
CBH-CA 177 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in

Compact Swivel Head Adaptor
SHA-J.B 719 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

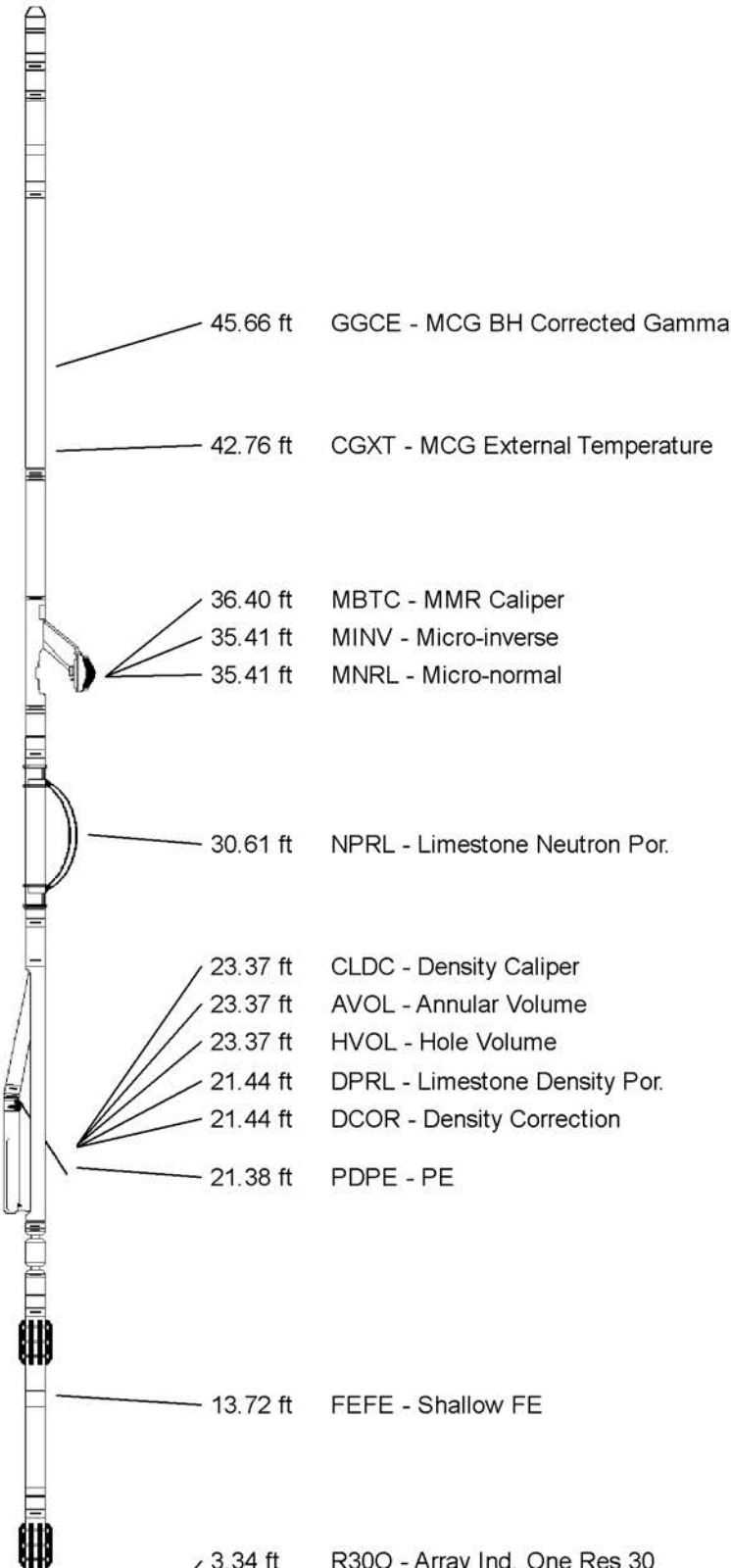
Compact Neutron
MDN-B.A 295 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

Compact Density/Caliper
MPD-D.A 479 LG: 9.59 ft WT: 90.4 lb OD: 2.449 in

Compact Knuckle Joint
SKJ-E.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

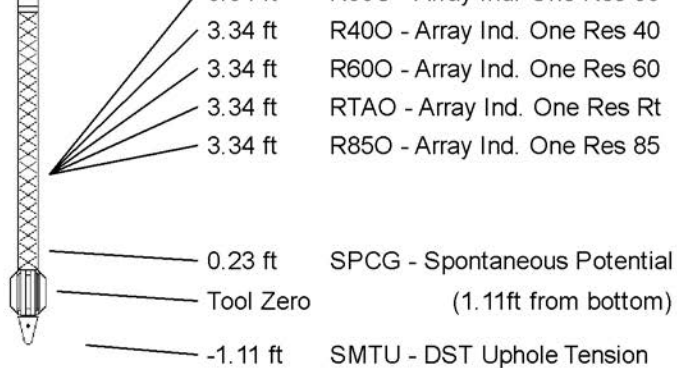
Compact Induction
MAI-B.A 299 LG: 11.00 ft WT: 48.5 lb OD: 2.244 in



Compact Hole Finder

HFS 1 LG: 0.78 ft WT: 2.2 lb OD: 2.244 in

Total Length: 56.62 ft Weight: 456.4 lb



All measurements relative to tool zero.

COMPANY	O'BRIEN ENERGY RESOURCES CORP
WELL	KEYSTONE #5-4
FIELD	KEYSTONE
PROVINCE/COUNTY	MEADE
COUNTRY/STATE	U.S.A. / KANSAS

Elevation Kelly Bushing	2646	feet	First Reading	6247.00	feet
Elevation Drill Floor	2644	feet	Depth Driller	6250.00	feet
Elevation Ground Level	2634	feet	Depth Logger	6250.00	feet



Weatherford®

MICRO-RESISTIVITY LOG