



Weatherford

MICRORESISTIVITY LOG

COMPANY				CIMAREX ENERGY CO.			
WELL				HAMMER 19-5			
FIELD				LETTE SE			
PROVINCE/COUNTY				HASKELL			
COUNTRY/STATE				U.S.A. / KANSAS			
LOCATION				330' FSL & 1320' FEL S2 S2 SE			
SEC	TWP	RGE	Other Services		MA/ME		
19	30S	31W	MPD/MDN		CMI		
API Number		15-081-22026		MSS			
Permit Number				MFT			
Permanent Datum GL, Elevation 2848 feet							
Log Measured From KB							Elevations: KB 2857.00
Drilling Measured From KB							DF 2855.00
							GL 2848.00
Date	26-AUG-2013						
Run Number	ONE						
Service Order	3539920						
Depth Driller	5544.00						feet
Depth Logger	5540.00						feet
First Reading	5682.00						feet
Last Reading	4000.00						feet
Casing Driller	1860.00						feet
Casing Logger	1861.00						feet
Bit Size	7.875						inches
Hole Fluid Type	GEL						
Density / Viscosity	9.30		lb/USg		47.00		CP
PH / Fluid Loss	11.50				8.40		ml/30Min
Sample Source	FLOW LINE						
Rm @ Measured Temp	1.12 @ 62.0						ohm-m
Rmf @ Measured Temp	0.90 @ 62.0						ohm-m
Rmc @ Measured Temp	1.34 @ 62.0						ohm-m
Source Rmf / Rmc	CALC				CALC		
Rm @ BHT	0.54 @ 128.0						ohm-m
Time Since Circulation	5 HRS						
Max Recorded Temp	128.00						deg F
Equipment / Base	13244		LIB				
Recorded By	R.HOFFMAN						
Witnessed By	T. KOLODZIEJ						
IOB #	LB 13-234						

BOREHOLE RECORD

Last Edited: 26-AUG-2013 07:30

Bit Size inches	Depth From feet	Depth To feet
7.875	1860.00	5544.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	1860.00	24.00

REMARKS

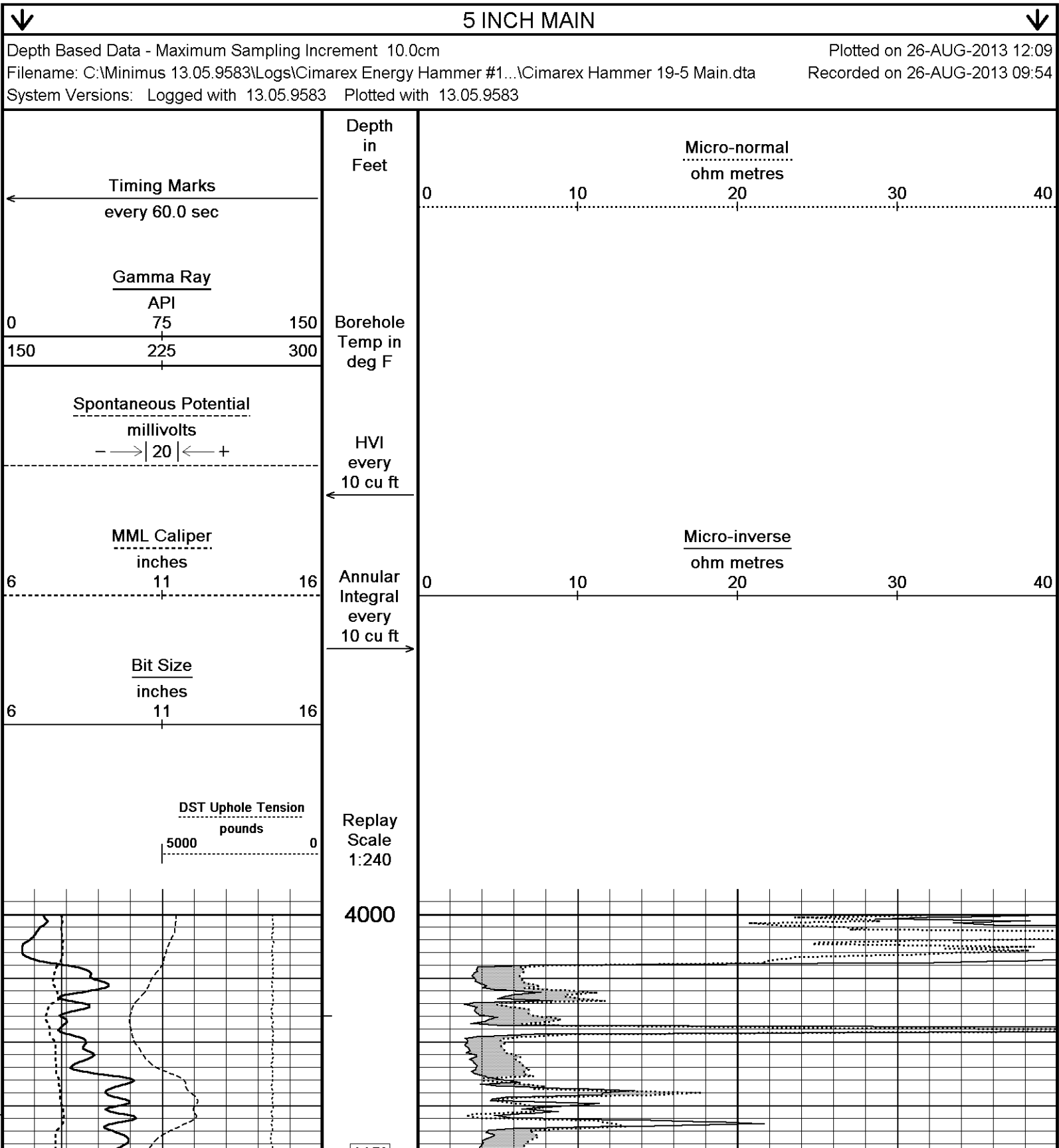
- SOFTWARE ISSUE: WLS 13.05.9583.
- RUN ONE: MCG, MML, MDN, MPD, MIE, MFE, MAI RAN IN COMBINATION.
 - HARDWARE: DUAL BOWSPRING USED ON MDN.
 - TWO 0.5 INCH STANDOFFS USED ON MSS.
 - CENTRALIZER BOWSPRING ON MIM.
 - STANDOFF USED ON MIE.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- 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: 1362 CU.FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD 4000 FEET: 275 CU.FT.

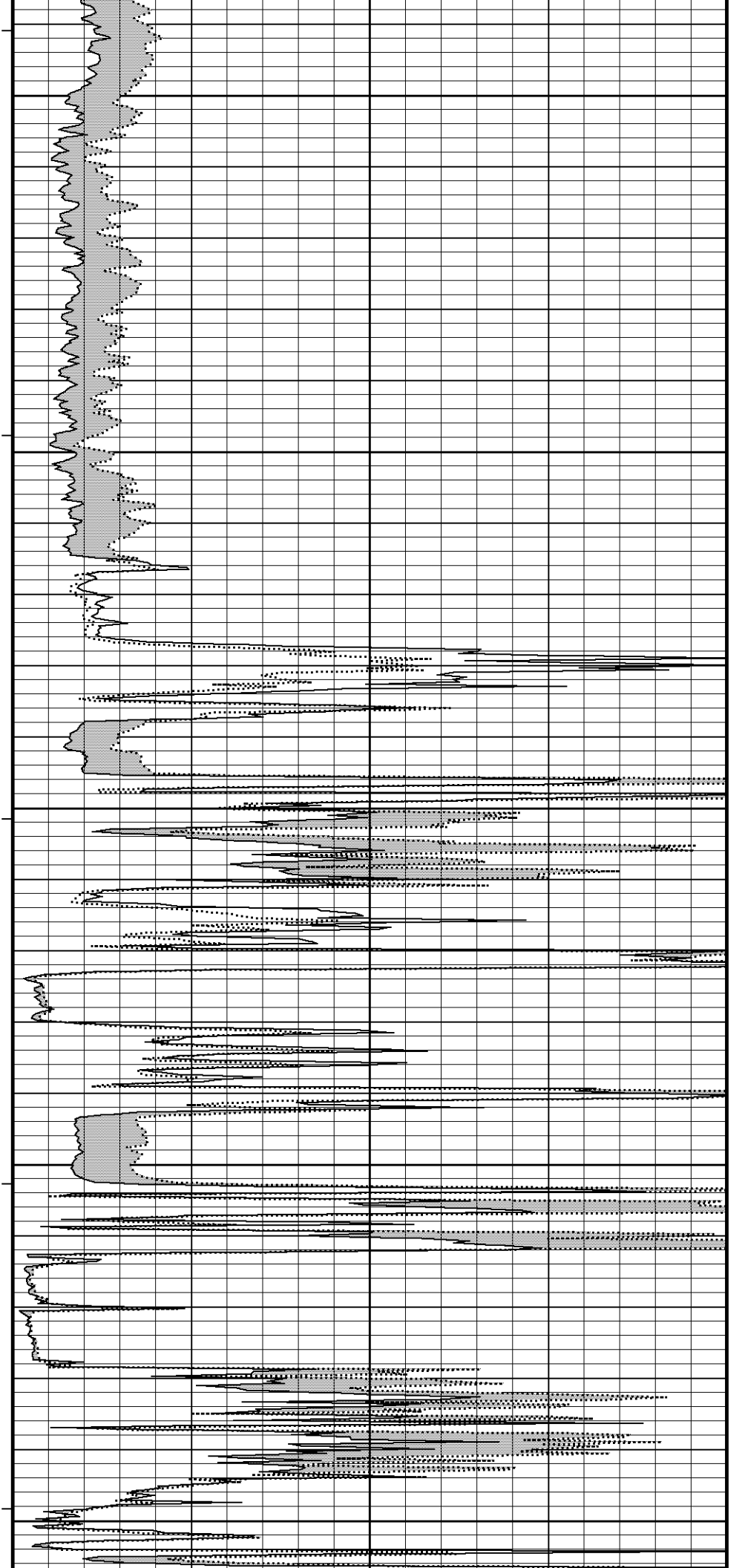
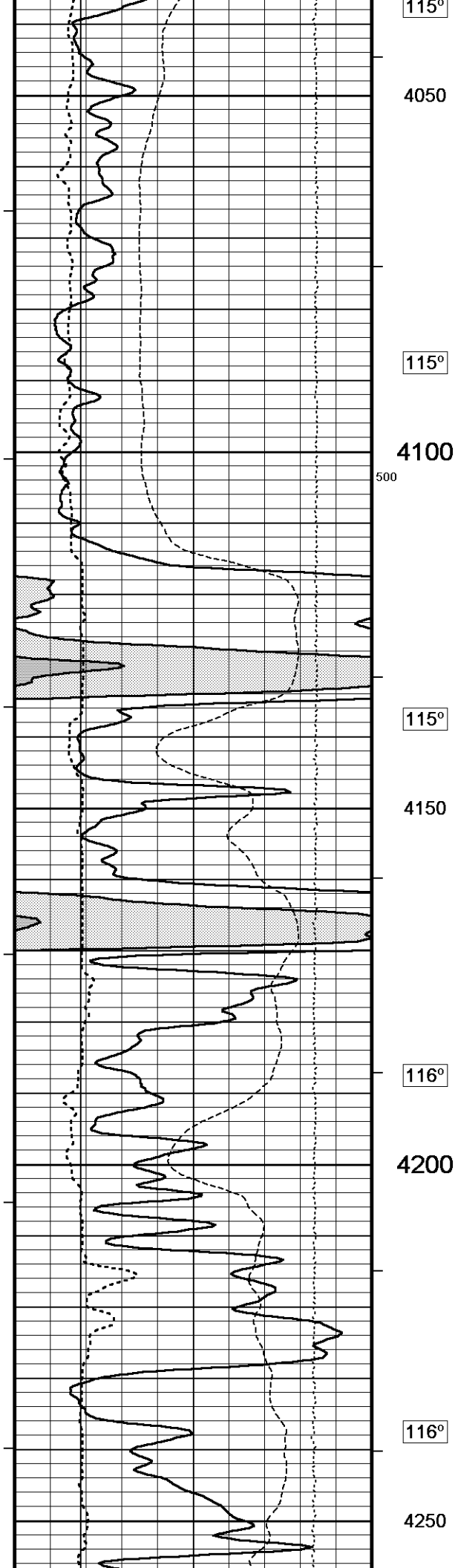
- RIG: TOM CAT DRILLING RIG #4

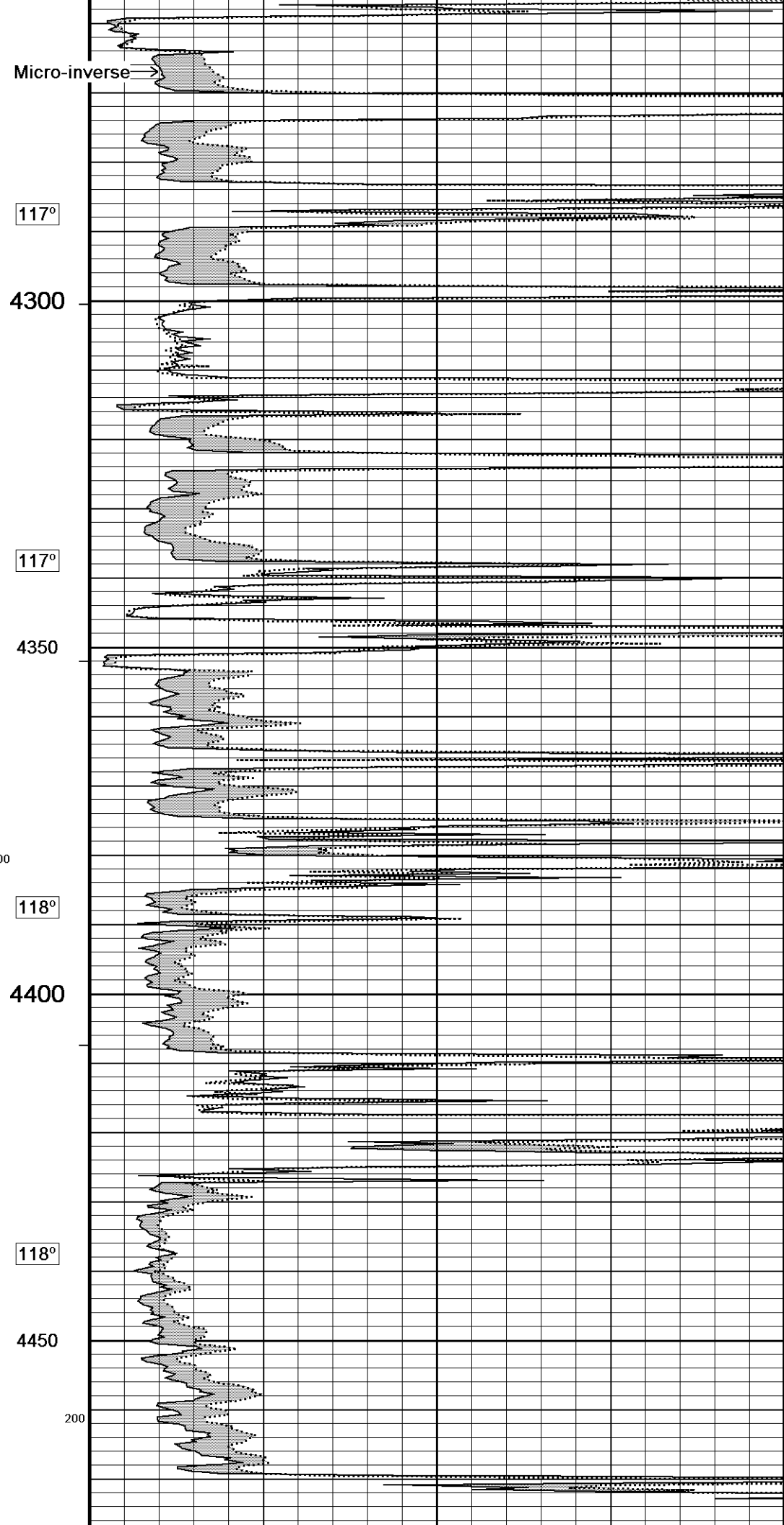
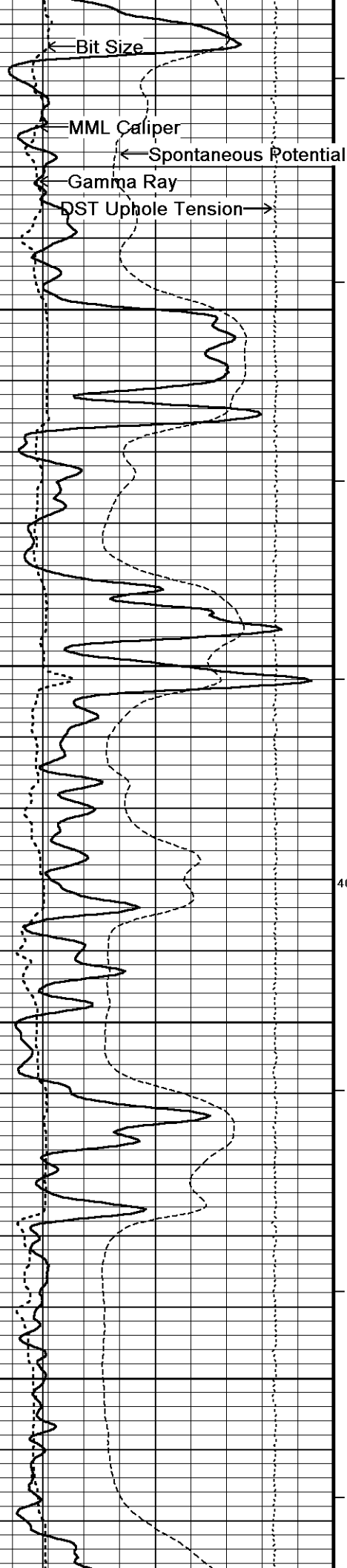
- ENGINEER: R. HOFFMAN

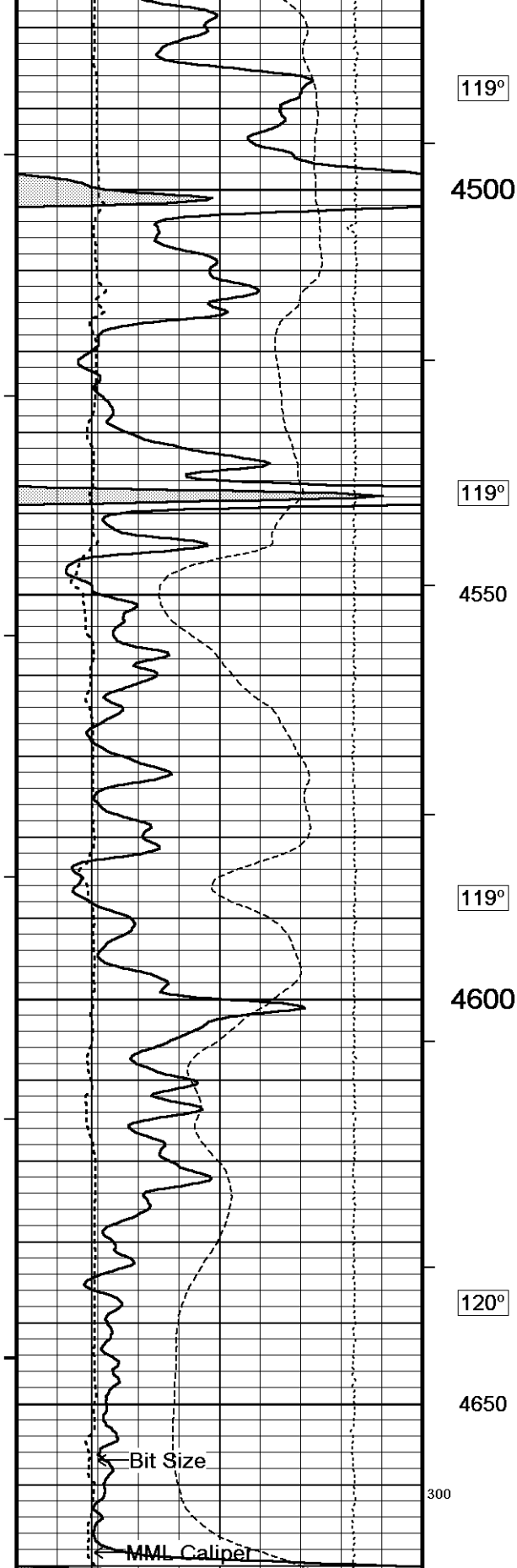
- OPERATOR: C. RAMIREZ.

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119°

4500

119°

4550

119°

4600

120°

4650

300

Bit Size

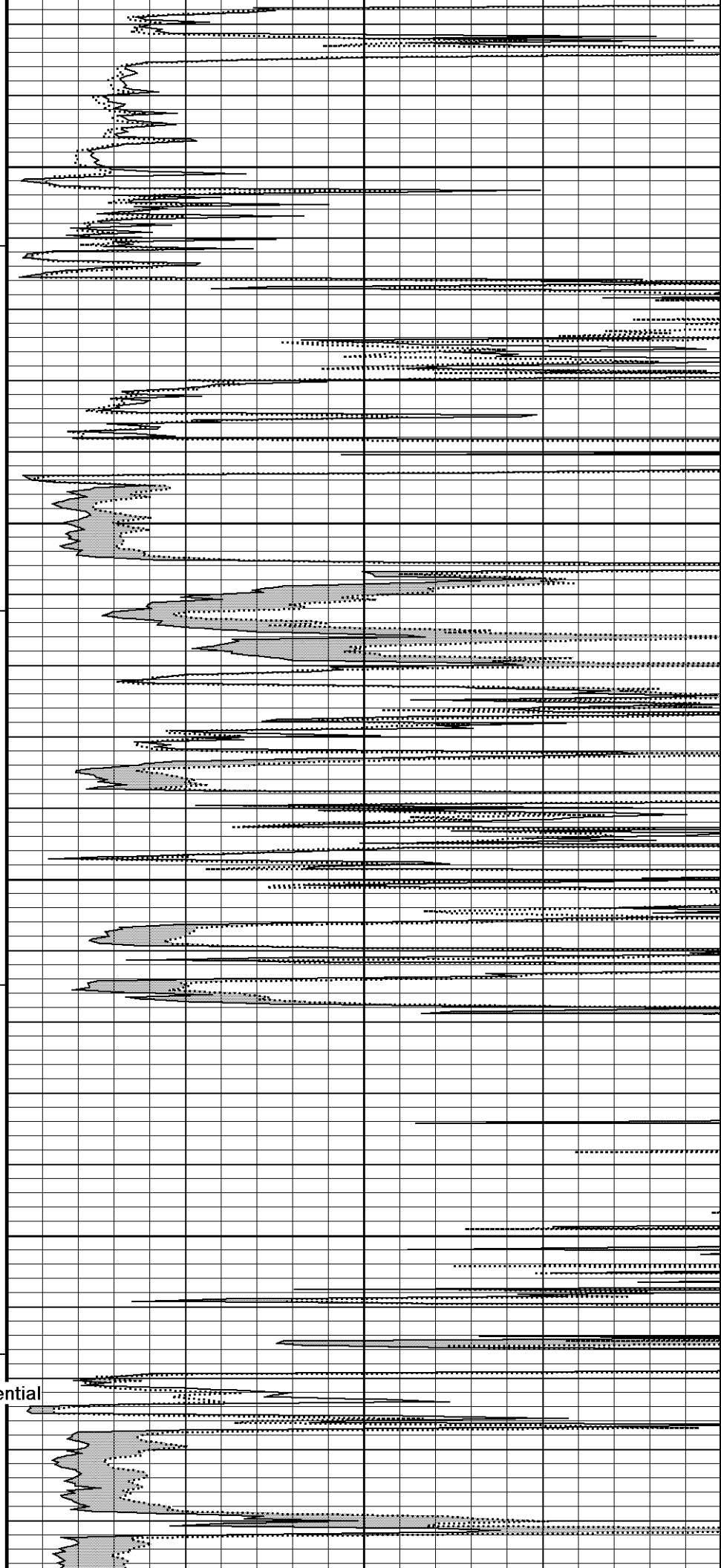
MML Caliper

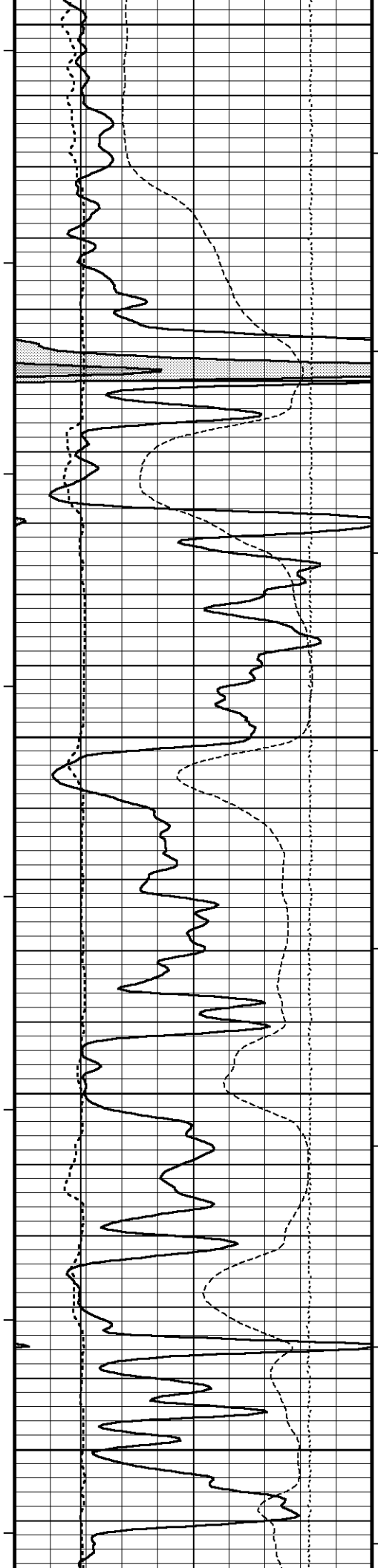
Spontaneous Potential

Gamma-Ray

DST Uphole Tension

120°





4700

121°

4750

121°

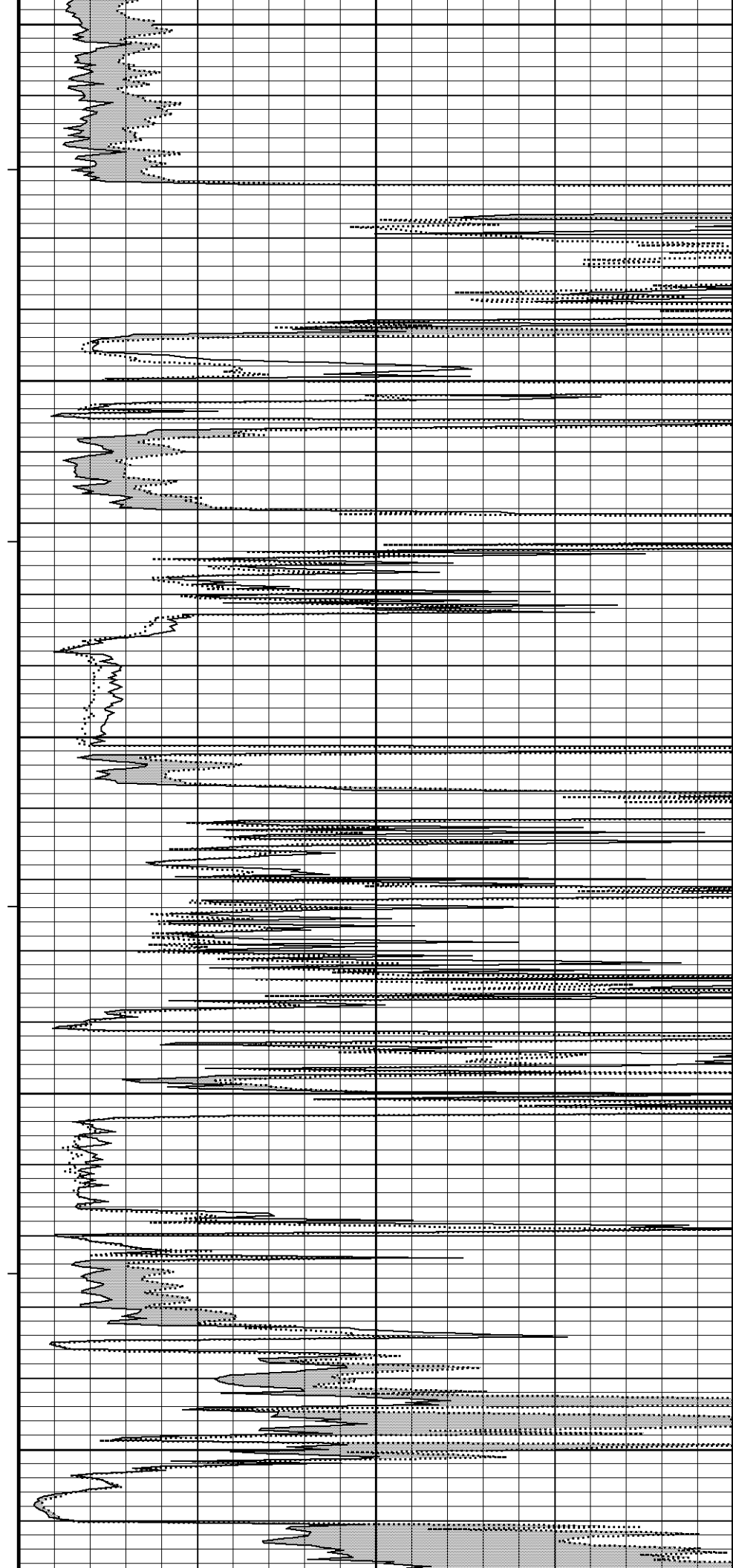
4800

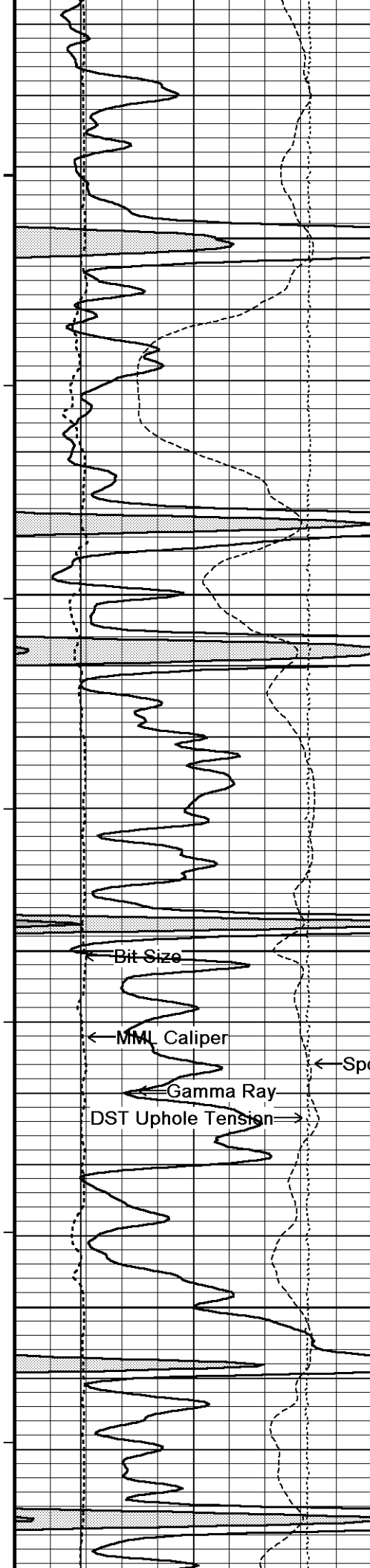
122°

4850

122°

4900





123°

200

4950

100

123°

5000

124°

5050

Micro-normal

Micro-inverse

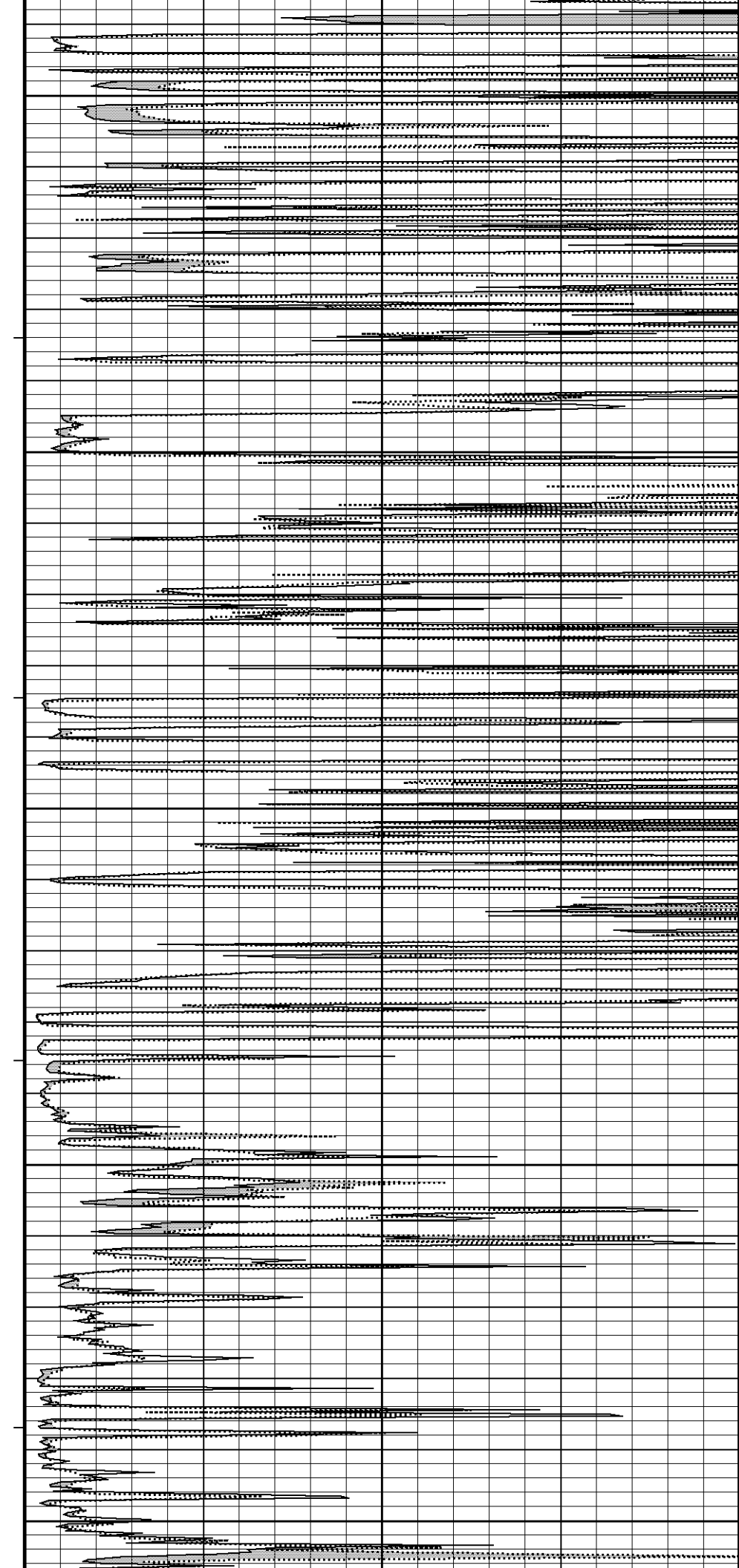
Spontaneous Potential

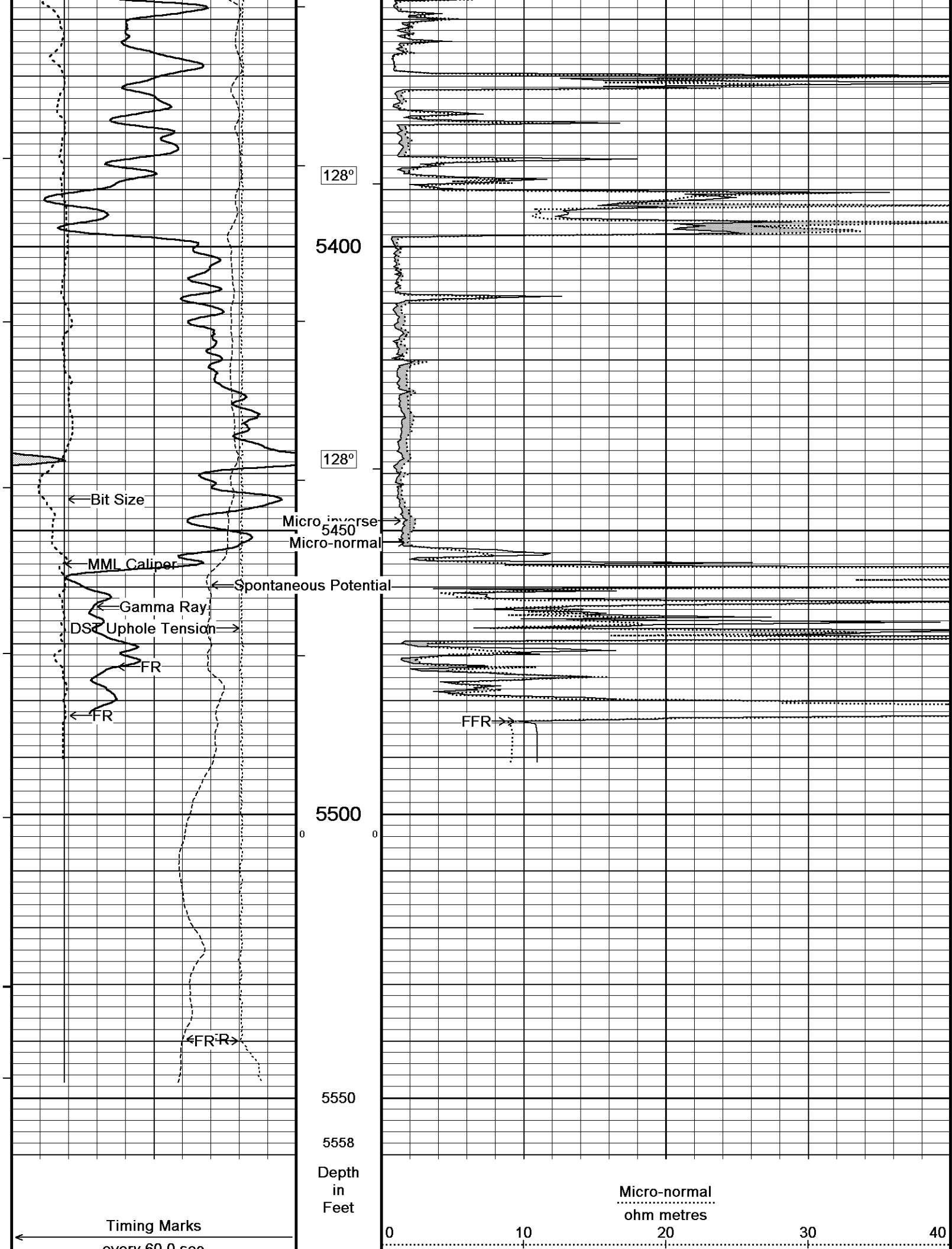
124°

5100



125°
5150
125°
5200
100
126°
5250
127°
5300
127°
5350

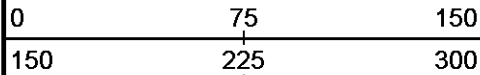




every 60.0 sec

Gamma Ray

API



Borehole
Temp in
deg F

Spontaneous Potential

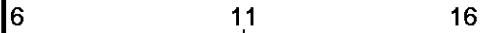
millivolts

- -> | 20 | <- +

HVI
every
10 cu ft

MML Caliper

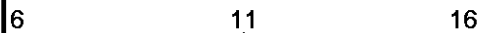
inches



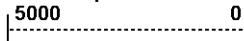
Annular
Integral
every
10 cu ft

Bit Size

inches



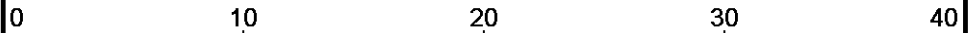
DST Uphole Tension
pounds



Replay
Scale
1:240

Micro-inverse

ohm metres



Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 26-AUG-2013 12:09

Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #1...\Cimarex Hammer 19-5 Main.dta

Recorded on 26-AUG-2013 09:54

System Versions: Logged with 13.05.9583 Plotted with 13.05.9583



5 INCH MAIN



REPEAT SECTION



Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 26-AUG-2013 12:09

Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer ...\Cimarex Hammer 19-5 Repeat.dta

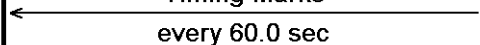
Recorded on 26-AUG-2013 08:21

System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

Depth
in
Feet

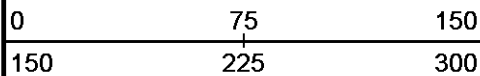
Timing Marks

every 60.0 sec



Gamma Ray

API



Borehole
Temp in
deg F

Spontaneous Potential

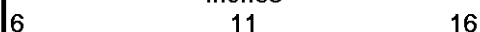
millivolts

- -> | 20 | <- +

HVI
every
10 cu ft

MML Caliper

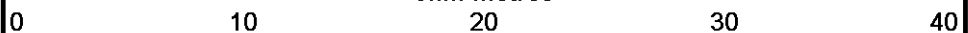
inches



Annular

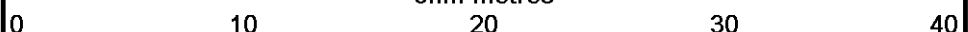
Micro-normal

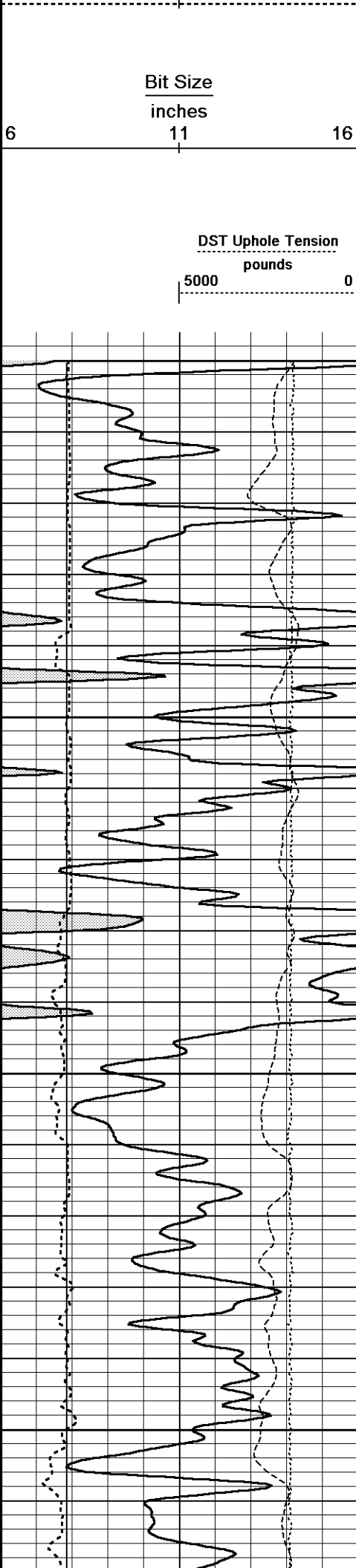
ohm metres



Micro-inverse

ohm metres





Integral
every
10 cu ft

Replay
Scale
1:240

5200

100

125°

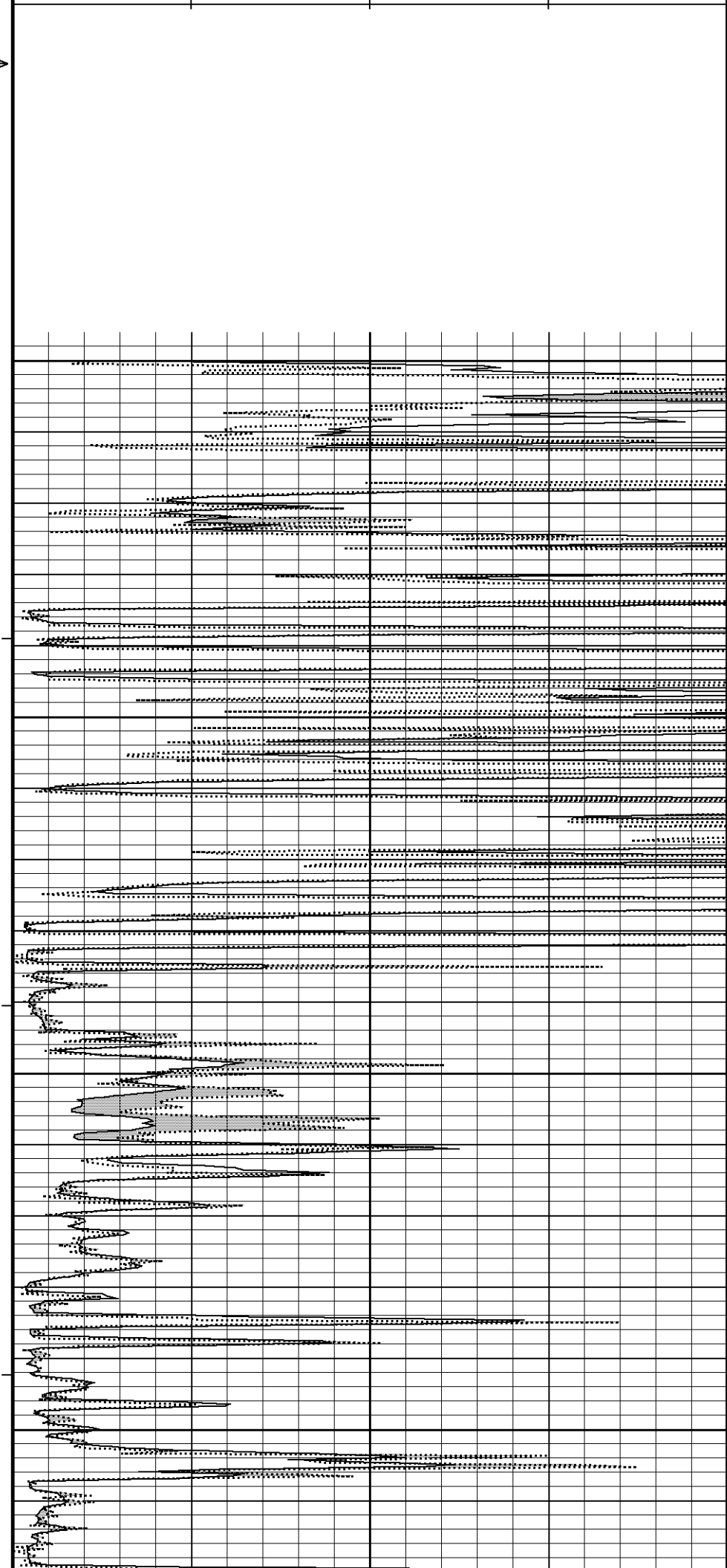
5250

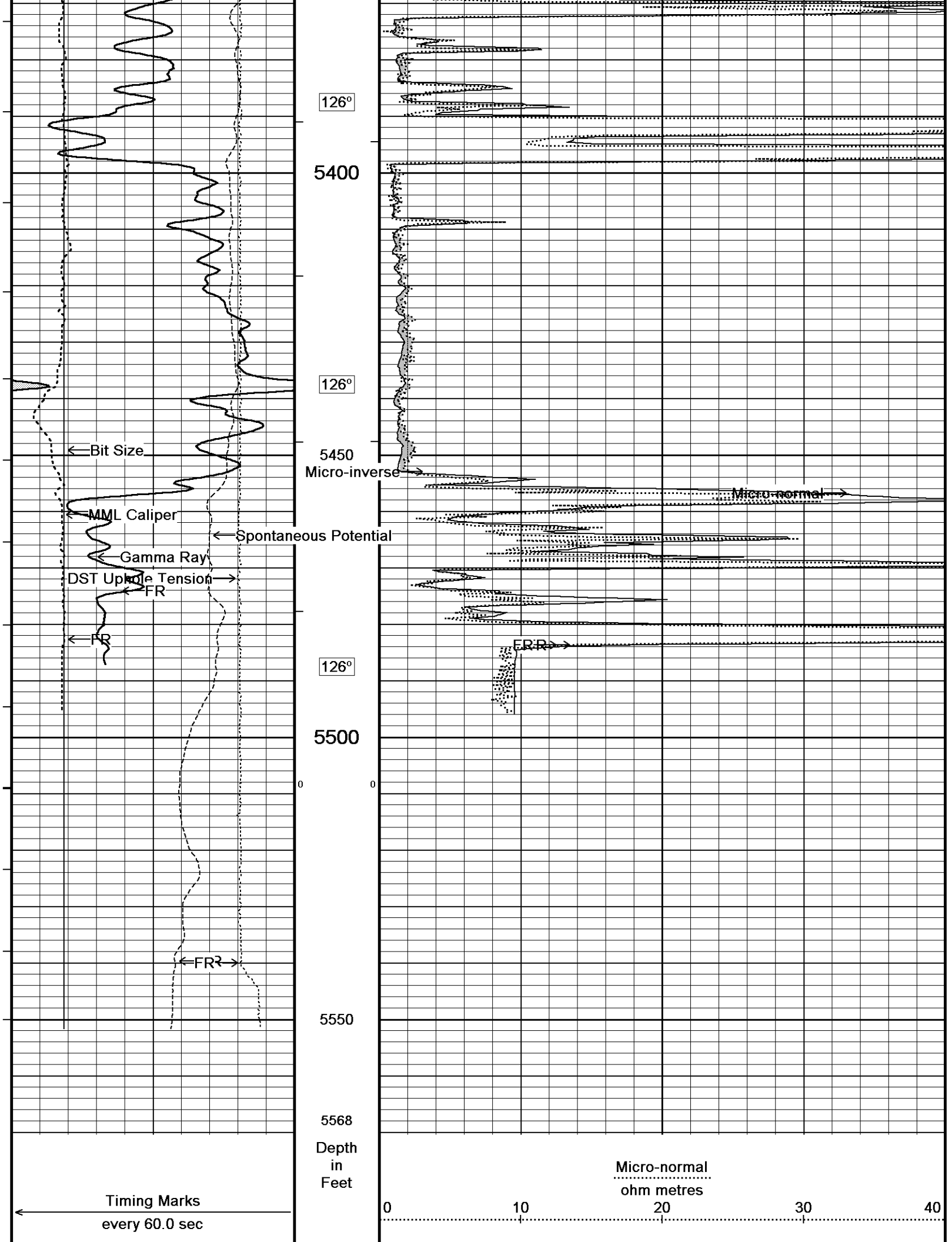
125°

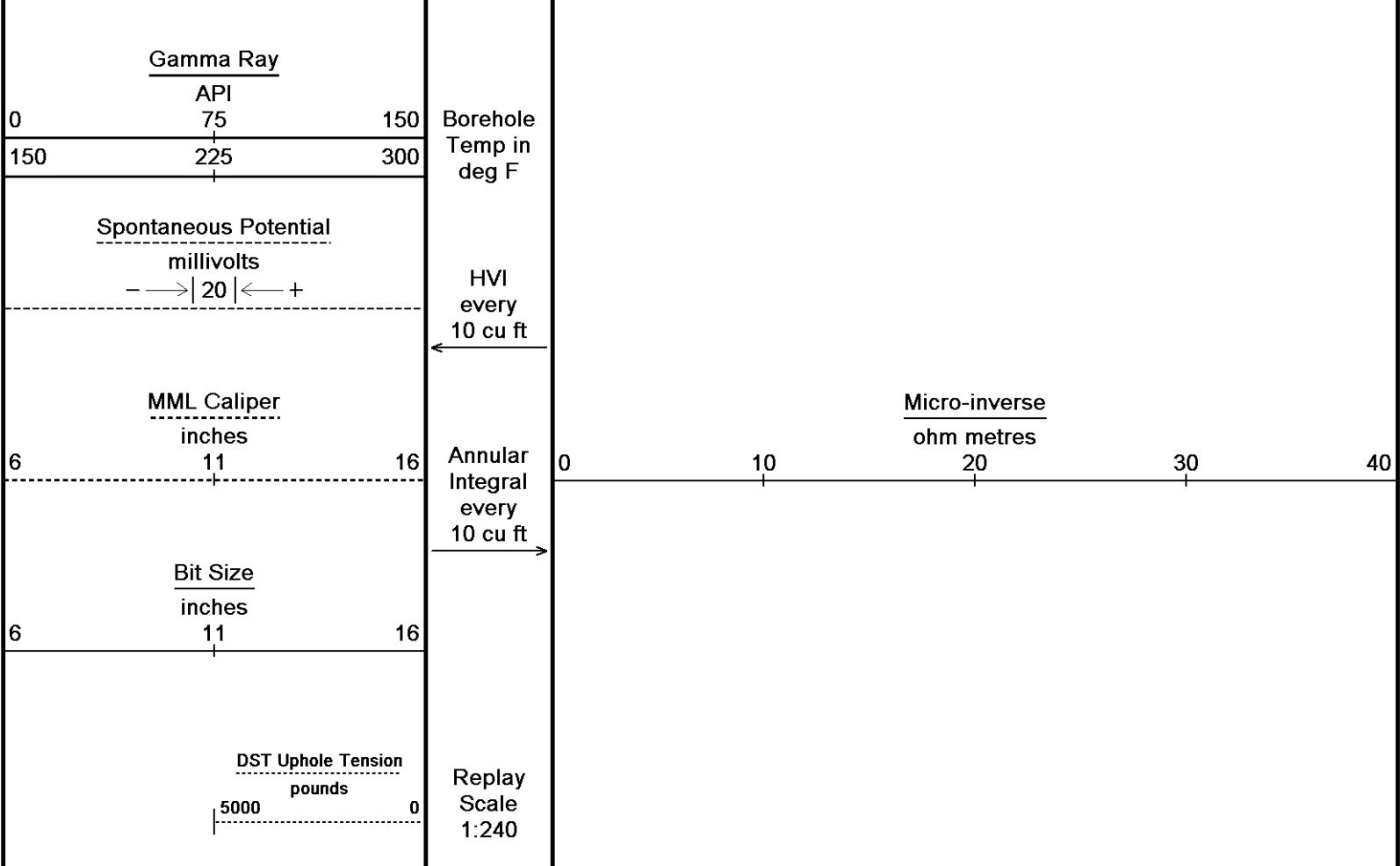
5300

126°

5350







Depth Based Data - Maximum Sampling Increment 10.0cm
 Plotted on 26-AUG-2013 12:09
 Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer ...\Cimarex Hammer 19-5 Repeat.dta
 Recorded on 26-AUG-2013 08:21
 System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

↑ REPEAT SECTION ↑

BEFORE SURVEY CALIBRATION		
C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #19-5\Cimarex Hammer 19-5 Main.dta		
General Constants All 000		Last Edited on 26-AUG-2013,06:03
General Parameters		
Mud Resistivity	1.120	ohm-metres
Mud Resistivity Temperature	62.000	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	Base Density Porosity	
Resistivity used	Array Ind. Four Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-D.K 443		Field Calibration on 25-AUG-2013 20:40
	Measured	Calibrated (API)
Background	67	46
Calibrator (Gross)	1131	771
Calibrator (Net)	1221	725

Gamma Constants MCG-D.K 443

Last Edited on 26-AUG-2013,06:03

Gamma Calibrator Number	GRC38	
Mud Density	1.12	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

SP Calibration MCG-D.K 443

Field Calibration on 23-AUG-2013,11:54

	Measured	Calibrated (mV)
Reference 1	100.1	100.0
Reference 2	-100.5	-100.0

High Resolution Temperature Calibration MCG-D.K 443

Field Calibration on 23-AUG-2013,11:53

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MCG-D.K 443

Last Edited on 23-AUG-2013,11:59

Pre-filter Length	11
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Caliper Calibration MML-A 16

Base Calibration on 16-AUG-2013 09:13

Field Calibration on 25-AUG-2013 20:46

Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	13832	5.98
2	16950	7.97
3	20199	9.86
4	24116	11.92
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
5.96	5.98

Micro Normal and Micro Inverse Calibration MML-A 16

Base Calibration on 16-AUG-2013 09:25

Field Check on 25-AUG-2013 20:45

Base Calibration				
		Measured	Calibrated (ohm-m)	
Channel	Resistor 1	Resistor 2	Resistor 1	Resistor 2
Micro Normal	12.2	60.2	5.0	25.0
Micro Inverse	15.6	78.3	5.0	25.0
Channel	Base Check (ohm-m)		Field Check (ohm-m)	
Micro Normal	62.9		62.9	
Micro Inverse	48.3		48.3	

Micro Normal and Micro Inverse Constants MML-A 16

Last Edited on 25-AUG-2013,20:40

Pad Type	8-12 in Soft Rubber Inflatable 006-9011-159
Micro Normal K Factor	1.0000
Micro Inverse K Factor	1.0000
Standoff Offset	N/A inches

Neutron Calibration MDN-B.J 387

Base Calibration on 16-AUG-2013 14:44

Field Check on 23-AUG-2013 10:33

Base Calibration				
		Measured	Calibrated (cps)	
	Near	Far	Near	Far
	3010	92	3714	110
Ratio	32.584		33.764	
Field Calibrator at Base			Calibrated (cps)	
			1653	2429
Ratio			0.681	

Field Check	Calibrated (cps)	
	1653	2452
Ratio	0.674	

Neutron Constants MDN-B.J 387			Last Edited on 23-AUG-2013,10:30
Neutron Source Id	P58125B		
Neutron Jig Number	5824NE		
Epithermal Neutron	No		
Caliper Source for Processing	Bit Size		
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-A.A 55			Base Calibration on 16-AUG-2013 08:59
			Field Check on 23-AUG-2013 10:20
Base Calibration			
	Measured	Calibrated (ohm-m)	
Reference 1	0.0	0.0	
Reference 2	950.9	126.8	
Base Check		281.6	
Field Check		281.8	

FE Constants MFE-A.A 55			Last Edited on 26-AUG-2013,06:02
Running Mode	No Sleeve		
MFE K Factor	0.1268		
Caliper Source for FE correction	Density Caliper		
Caliper Value for FE correction	N/A	inches	
Rm Source for FE correction	Constant Value		
Temp. for Rm Corr.	N/A		
Stand-off	Centred	inches	

Induction Calibration MAI-A.A 178			Base Calibration on 29-APR-2013,09:40
			Field Check on 23-AUG-2013 10:19
Base Calibration			
Test Loop Calibration	Measured	Calibrated (mmho/m)	
Channel	Low High	Low High	
1	17.6 484.7	9.3 966.2	
2	6.2 391.4	7.6 821.4	
3	4.0 264.5	5.2 566.0	
4	2.3 135.1	2.6 279.2	
Array Temperature	77.0	Deg F	
Channel	Base Check (mmho/m)	Field Check (mmho/m)	
	Low High	Low High	
1	0.0 0.0	12.8 3763.3	
2	0.0 0.0	29.8 3467.3	
3	0.0 0.0	27.3 3014.2	
4	0.0 0.0	18.8 2065.0	
Deep		15.9 1995.4	
Medium		40.3 3955.4	
Shallow		45.7 5082.3	
Array Temperature	0.0	79.8	Deg F

Induction Constants MAI-A.A 178			Last Edited on 26-AUG-2013,06:02
Induction Model	RtAP-WBM		

Caliper for Borehole Corr.	MML Caliper		
Hole Size for Borehole Correction	N/A	inches	
Tool Centred	No		
Stand-off Type	Fins		
Stand-off	0.50	inches	
Number of Fins on Stand-off	8.0000		
Stand-off Fin Angle	45.00	degrees	
Stand-off Fin Width	0.5000	inches	
Borehole Corr. Rm Source	Temperature Corr		
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	
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 178			
		Field Calibration on 30-APR-2013,11:24	
	Measured	Calibrated(Deg F)	
Lower	50.00	50.00	
Upper	75.00	75.00	
High Resolution Temperature Constants MAI-A.A 178			
		Last Edited on 30-MAY-2013,19:58	
Pre-filter Length	11		
Accelerometer Parameters MIE-B.A 254			
Date Of Last Accelerometer Calibration	28-JUN-2012,12:18		
	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.098933	-1.108676	-1.107830
Offset	0.004383	0.002543	0.005594
Accelerometer Constants MIE-B.A 254			
		Last Edited on 07-MAY-2013,13:52	
Accelerometer Calibrator Number	000		
Accelerometer Temperature Characterisation			
X Accelerometer			
Serial Number	1135		
Calibration Date	10-May-2012		
	B0	B1	B2
Bias(g)	0.00000e+000	3.80136e-005	-1.44052e-008
	SF0	SF1	SF2
Scale Factor(mA/g)	3.00000e+000	2.76201e-004	2.79882e-007
			1.31941e-009
Y Accelerometer			
Serial Number	1137		
Calibration Date	10-May-2012		
	B0	B1	B2
Bias(g)	0.00000e+000	5.58386e-005	9.83739e-009
			1.99670e-011

Bias(g)	0.00000e+000	0.00000e+000	0.00000e+000	0.00000e+000
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.77779e-004	1.92151e-007	1.16282e-009
Z Accelerometer				
Serial Number	1096			
Calibration Date	29-Jun-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	1.18445e-005	-1.40013e-009	1.45484e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.85296e-004	2.19938e-007	1.07369e-009

Caliper Calibration MIE-B.A 254					Base Calibration on 28-JUN-2013 11:46
					Field Calibration on 25-AUG-2013 20:33
Base Calibration					
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)		
1	25947	25206	5.98		
2	35996	35798	7.97		
3	45695	45741	9.86		
4	57194	57363	11.92		
5	0	0	0.00		
Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	25173	25605	25407	25834	5.98
2	33891	34086	34350	34577	7.97
3	42019	42297	42807	42696	9.86
4	51555	52094	52685	52573	11.92
5	0	0	0	0	0.00
Field Calibration					
	Measured	Measured	Actual		
	Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)	Caliper(in)		
	5.92	6.04	5.98		
	Measured	Measured	Measured	Measured	Actual
	Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
	3.06	2.99	2.95	2.99	5.98

Caliper Constants MIE-B.A 254	Last Edited on 01-MAY-2013,17:06		
Caliper Difference for BRKT	0.120	inches	

Magnetometer Parameters MIE-B.A 254			
Date Of Last Magnetometer Calibration	20-FEB-2013,16:25		
	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.000126	-0.998001
Offset	-0.000662	-0.013917	0.004180

Magnetometer Constants MIE-B.A 254	Last Edited on		
Magnetometer Calibrator Number	000		

Navigation Constants MIE-B.A 254	Last Edited on 26-AUG-2013,06:20		
Magnetic Declination	6.12	degrees	East

Imager Pad Check MIE-B.A 254				Field Check on
Pad 1	Pad Not Tested	Pad 5	Pad Not Tested	
Pad 2	Pad Not Tested	Pad 6	Pad Not Tested	
Pad 3	Pad Not Tested	Pad 7	Pad Not Tested	
Pad 4	Pad Not Tested	Pad 8	Pad Not Tested	

Compact Micro Imager Constants MIE-B.A 254				Last Edited on 25-AUG-2013,20:32
Sonde Configuration	Imager Mode			
Arm-Pad Kit	Normal Pads (12.25 in)			
Arm-Pad Kit Serial Number	N/A			
Centre Pad 1 Rotational Offset	0.00 degrees			
Image/Borehole Ovality Reference	Azimuth of Pad 1			
Non Active Buttons	Omit			
Search Angle	0.00 degrees			
Correlation Interval	3.28 feet			

Correlation Step	1.64	feet
Current Offset	0.0000	mAmp
Squasher Start	0.0500	mAmp
Image Processing	Enabled	

Photo Density Calibration MPD-B 59

Base Calibration on 23-AUG-2013 11:44

Field Check on 23-AUG-2013 11:53

Density Calibration		Measured		Calibrated (sdu)	
Base Calibration		Near	Far	Near	Far
Reference 1	58612	28481	59556	30836	
Reference 2	23605	2511	24941	2541	

Field Check at Base

1186.0 1254.6

Field Check

1184.3 1253.5

PE Calibration

Base Calibration		Measured		Calibrated
	WS	WH	Ratio	Ratio
Background	217	1063		
Reference 1	21648	58418	0.374	0.371
Reference 2	6282	23469	0.271	0.272

Field Check at Base

216.6 1062.7

Field Check

213.2 1058.6

Density Constants MPD-B 59

Last Edited on 26-AUG-2013,06:03

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	1.12 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 (m)
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 59

Base Calibration on 23-AUG-2013 11:17

Field Calibration on 23-AUG-2013 11:19

Base Calibration		Calibrator Size (in)
Reading No	Measured	
1	16284	3.99
2	23984	5.98
3	31584	7.97
4	39888	9.86
5	49152	11.92
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
5.91	5.98

Reading No	Measured	Calibrated (lbs)
1	15380.34	0.00
2	16307.40	570.00

DOWNHOLE EQUIPMENT

C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #19-5\Cimarex Hammer 19-5 Main.dta

3/8" Triple Cone Cable Head (MCB C A)

MCB-C.A 5 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Comms Gamma

MCG-D.K 443 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Micro-log

MML-A 16 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

Compact Neutron

MDN-B.J 387 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper

MPD-B 59 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

SKJ-D.A Compact Knuckle Joint

SKJ-D.A 36 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint

SKJ-D.A 37 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact MMI Memory Section

MIM-A.A 119 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section

MIE-B.A 254 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

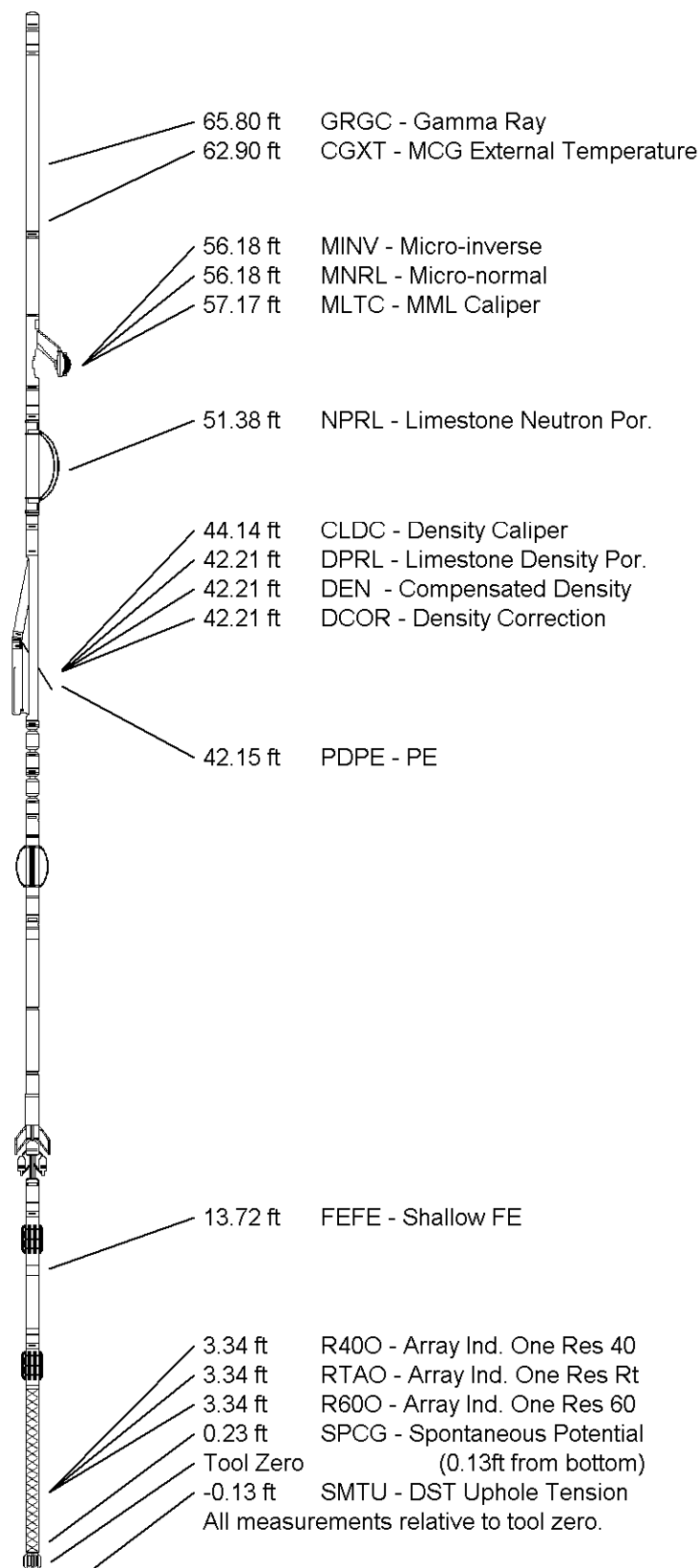
Compact Focussed Electric

MFE-A.A 55 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction

MAI-A.A 178 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 72.67 ft Weight: 573.2 lb



COMPANY	CIMAREX ENERGY CO.		
WELL	HAMMER 19-5		
FIELD	LETTE SE		
PROVINCE/COUNTY	HASKELL		
COUNTRY/STATE	U.S.A. / KANSAS		

Elevation Kelly Bushing	2857.00	feet	First Reading	5682.00	feet
Elevation Drill Floor	2855.00	feet	Depth Driller	5544.00	feet
Elevation Ground Level	2848.00	feet	Depth Logger	5540.00	feet



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