

**Weatherford****ARRAY INDUCTION
LOGS**

COMPANY **EAST CHEYENNE GAS STORAGE LLC**
WELL **ECGS No 6-15 WPD002-1**
FIELD **PEETZ WEST**
PROVINCE/COUNTY **LOGAN**
COUNTRY/STATE **US/COLORADO**
LOCATION **1611' FNL & 999' FWL**

SEC **6** TWP **11N** RGE **52W** Other Services
API Number **05-075-09401** MPD/MDN
Permit Number **CMI**

Permanent Datum GL, Elevation 4556 feet
Log Measured From KB
Drilling Measured From KB

Elevations:
KB 4570.00
DF 4569.00
GL 4556.00

Date **13-NOV-2012**

Run Number **ONE**

Depth Driller **5270.00** feet

Depth Logger **5265.00** feet

First Reading **5262.00** feet

Last Reading **1226.00** feet

Casing Driller **1228.00** feet

Casing Logger **1226.00** feet

Bit Size **8.750** inches

Hole Fluid Type **WBM**

Density / Viscosity **9.90 g/cc** **53.00 CP**

PH / Fluid Loss **9.00** **7.20 ml/30Min**

Sample Source **FLOWLINE**

Rm @ Measured Temp **3.10 @ 85.7** ohm-m

Rmf @ Measured Temp **2.48 @ 85.7** ohm-m

Rmc @ Measured Temp **3.72 @ 85.7** ohm-m

Source Rmf / Rmc **CALC** **CALC**

Rm @ BHT **1.70 @159.0** ohm-m

Time Since Circulation **4 HOURS**

Max Recorded Temp **159.00** deg F

Equipment Name **COMPACT**

Equipment / Base **13037** **RK SPR**

Recorded By **B.ROSSER**

Witnessed By **A. ASHBY**

L. CARRASCO

BOREHOLE RECORD

Last Edited: 13-NOV-2012 08:43

Bit Size inches	Depth From feet	Depth To feet
8.750	1226.00	5270.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	9.625	0.00	1226.00	36.00

REMARKS

SOFTWARE VERSION 13.02.6600
TOOLS RUN: MCG, MDN, MPD, MIM, MIE, MFE, MAI RUN IN COMBINATION.

HARDWARE: MPD: 8" PROFILE PLATE USED.
MAI: TWO 1 INCH STANDOFFS USED.
MDN: DUAL BOWSPRING USED.
MIM: CENTRALIZER BOWSPRING USED.

2.65 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY FROM TD TO BOTTOM OF FORT HAYES FORMATION(TD TO 4700FT).
2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY IN FORT HAYES AND NIOBRARA FORMATION (4700 FT TO 4200 FT).

TIGHT PULLS, BOREHOLE SIZE AND RUGOSITY WILL AFFECT REPEATABILITY AND DATA QUALITY.

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.

IMAGE LOG RAN OVER BOTTOM 500 FT.

LATITUDE: 40.95937
LONGITUDE: -103.22532

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1720 CUBIC FEET

ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING =652 CUBIC FEET

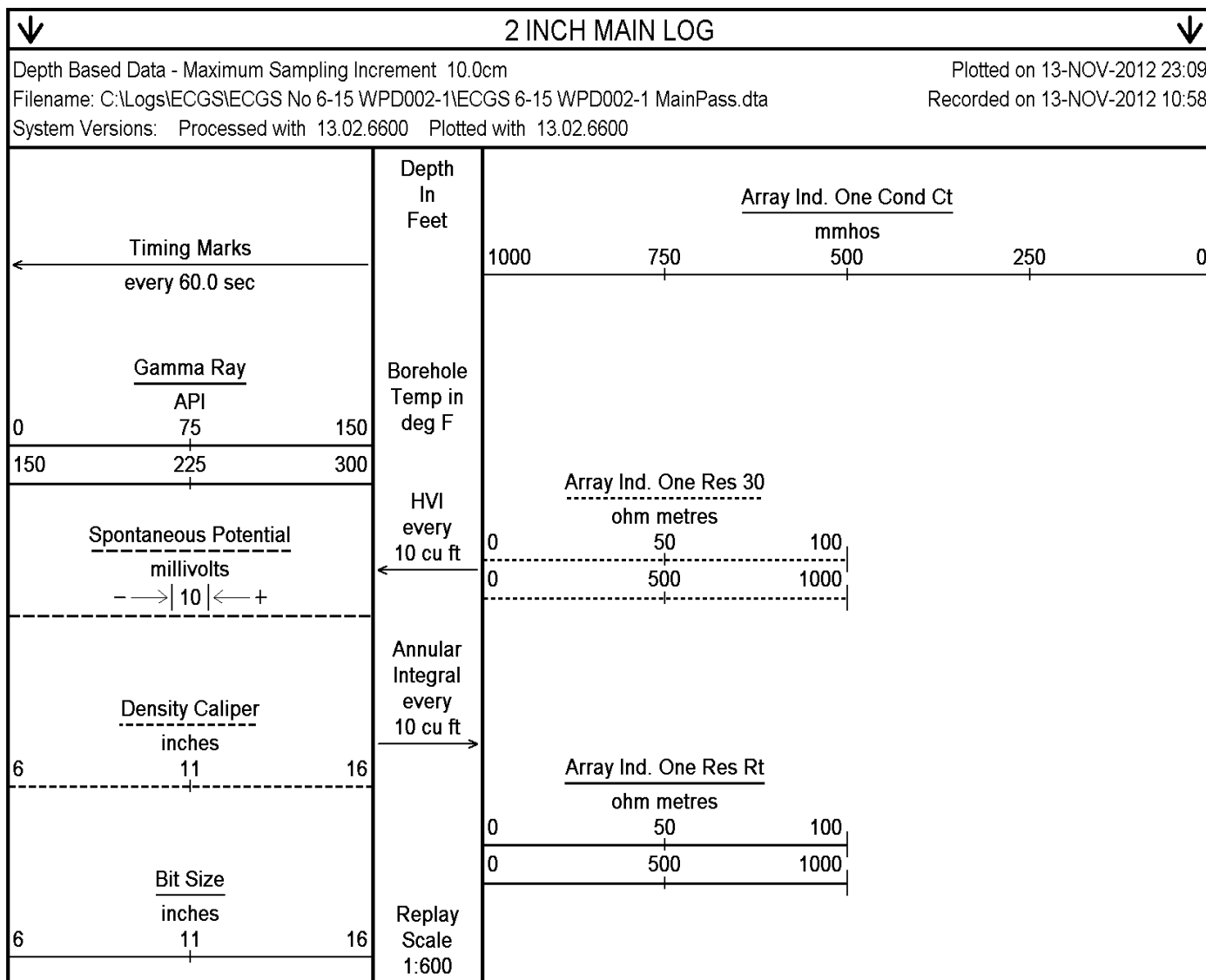
TOTAL VOLUME FROM TD TO 4200 FT =415 CUBIC FEET

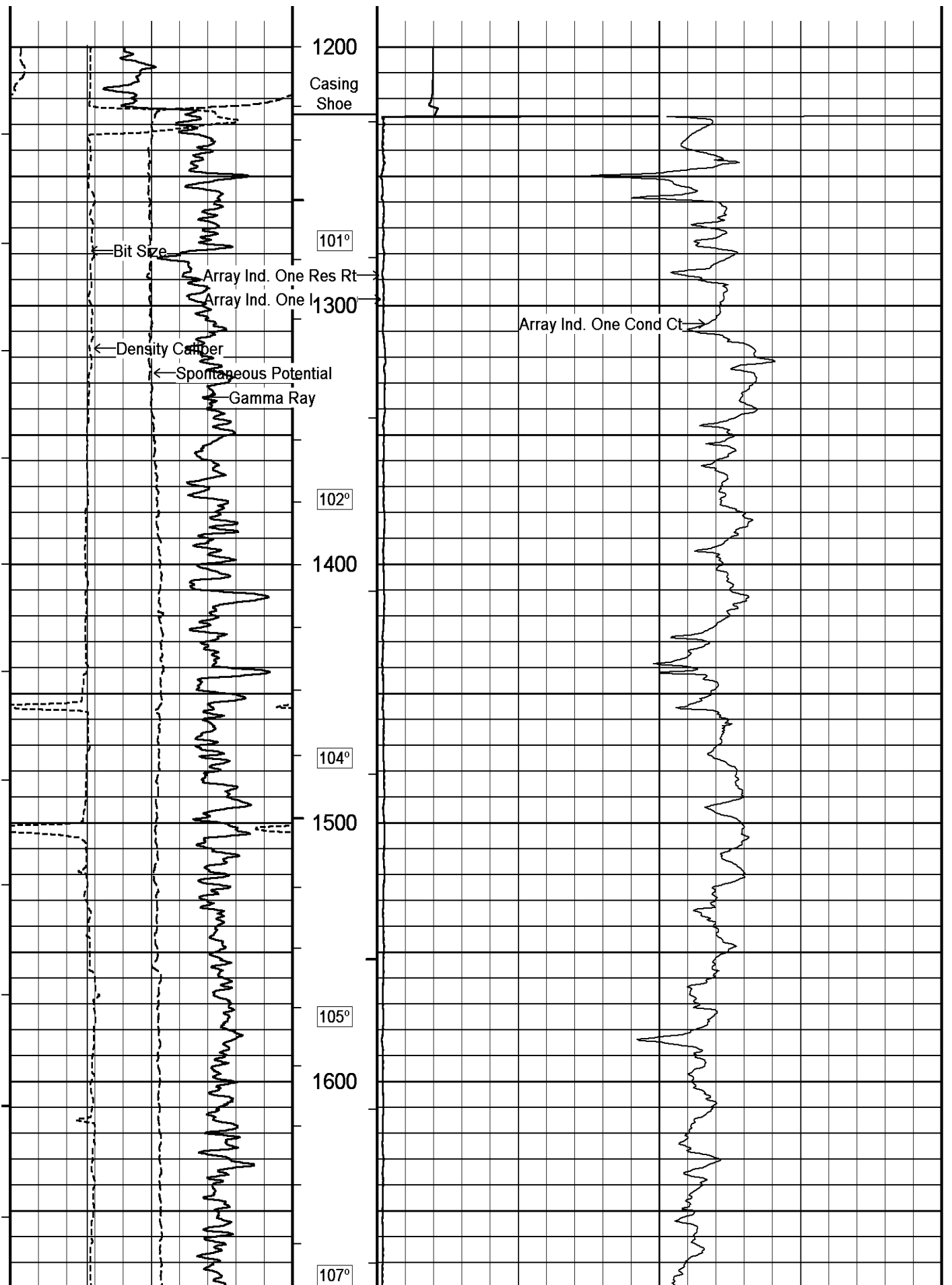
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT =145 CUBIC FEET

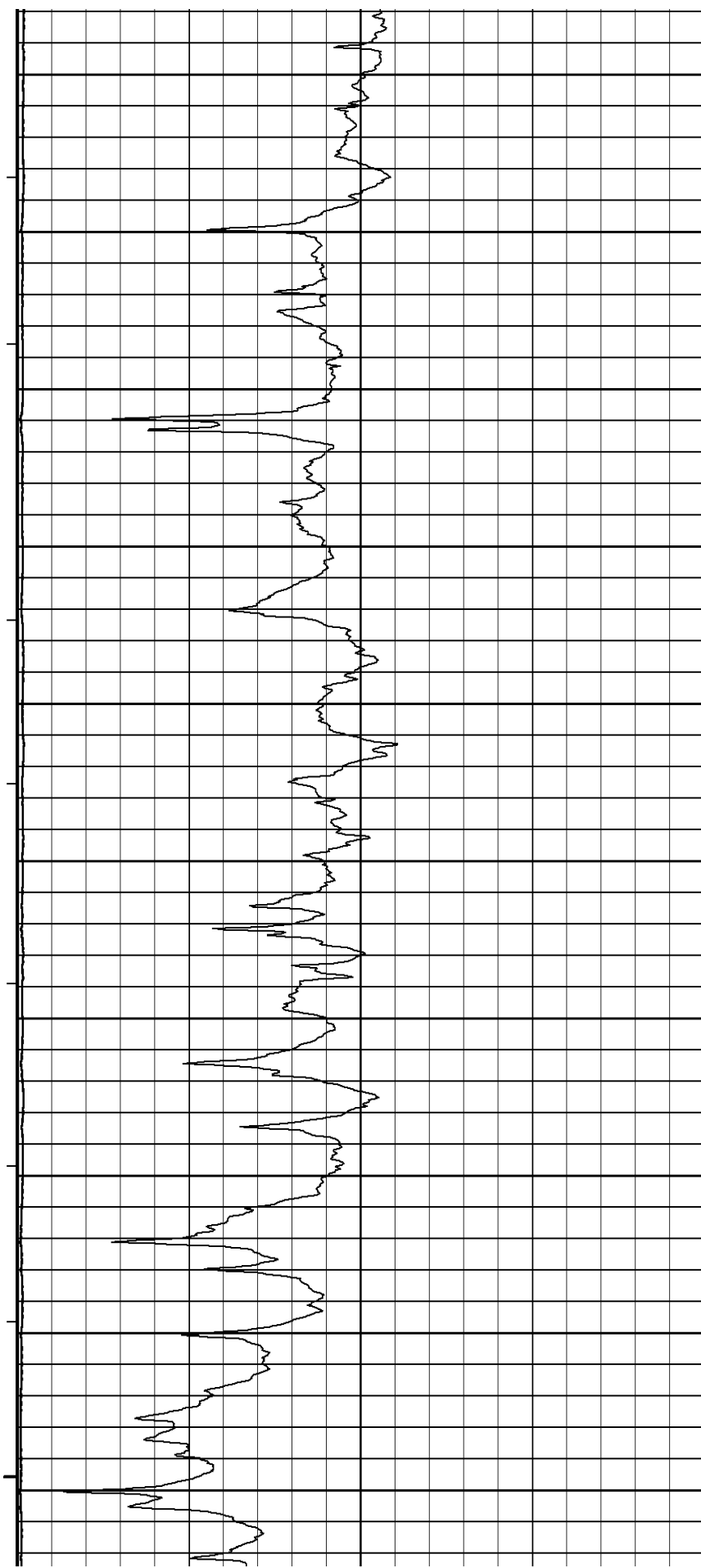
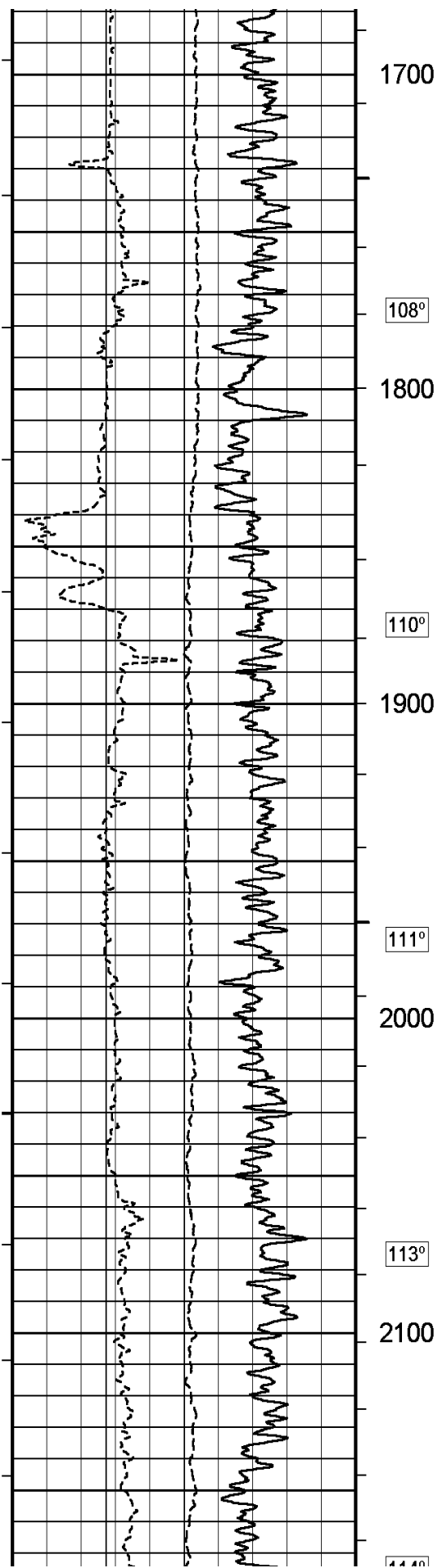
SERVICE ORDER: 3535305

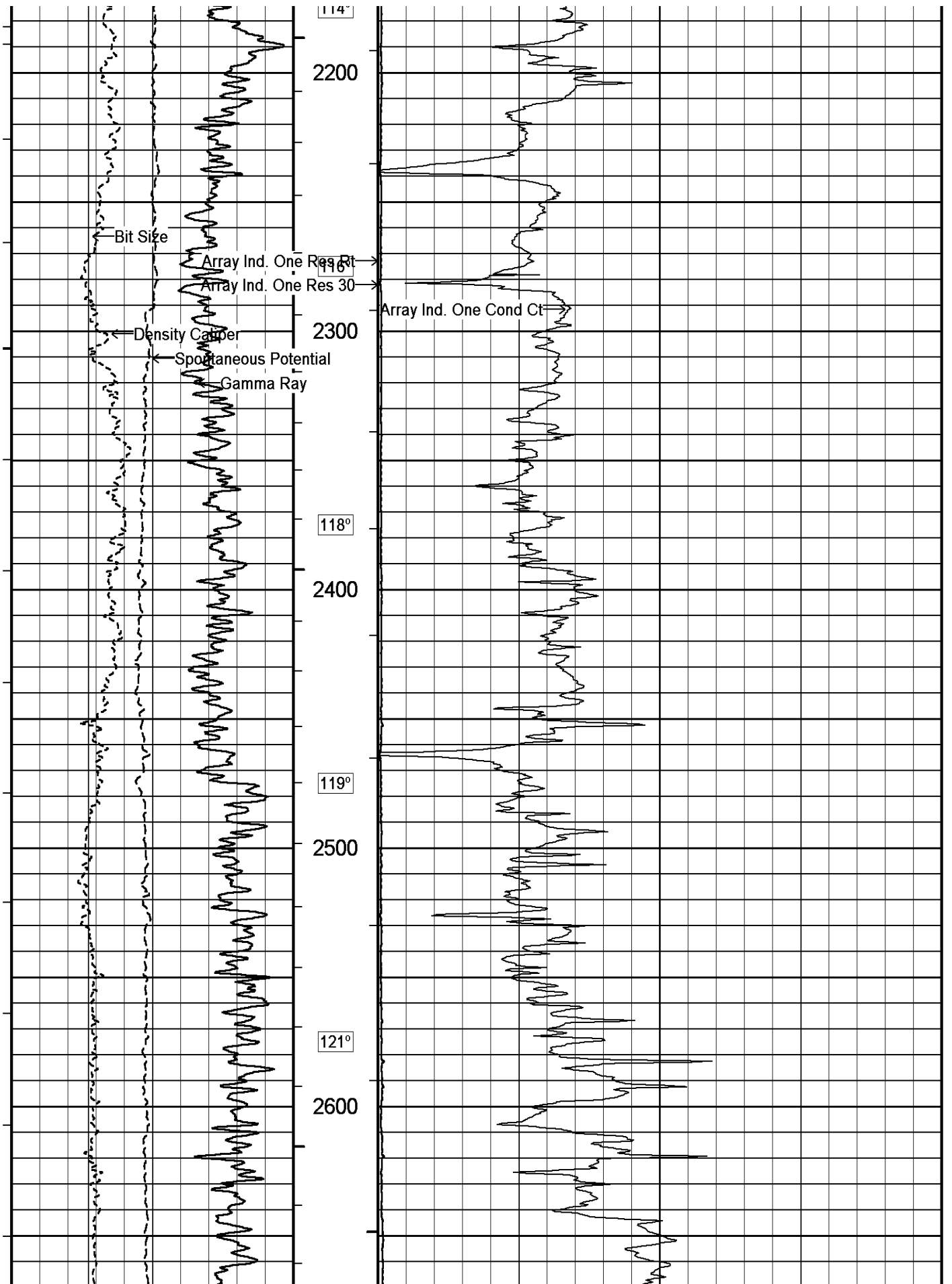
RIG: CADE 22

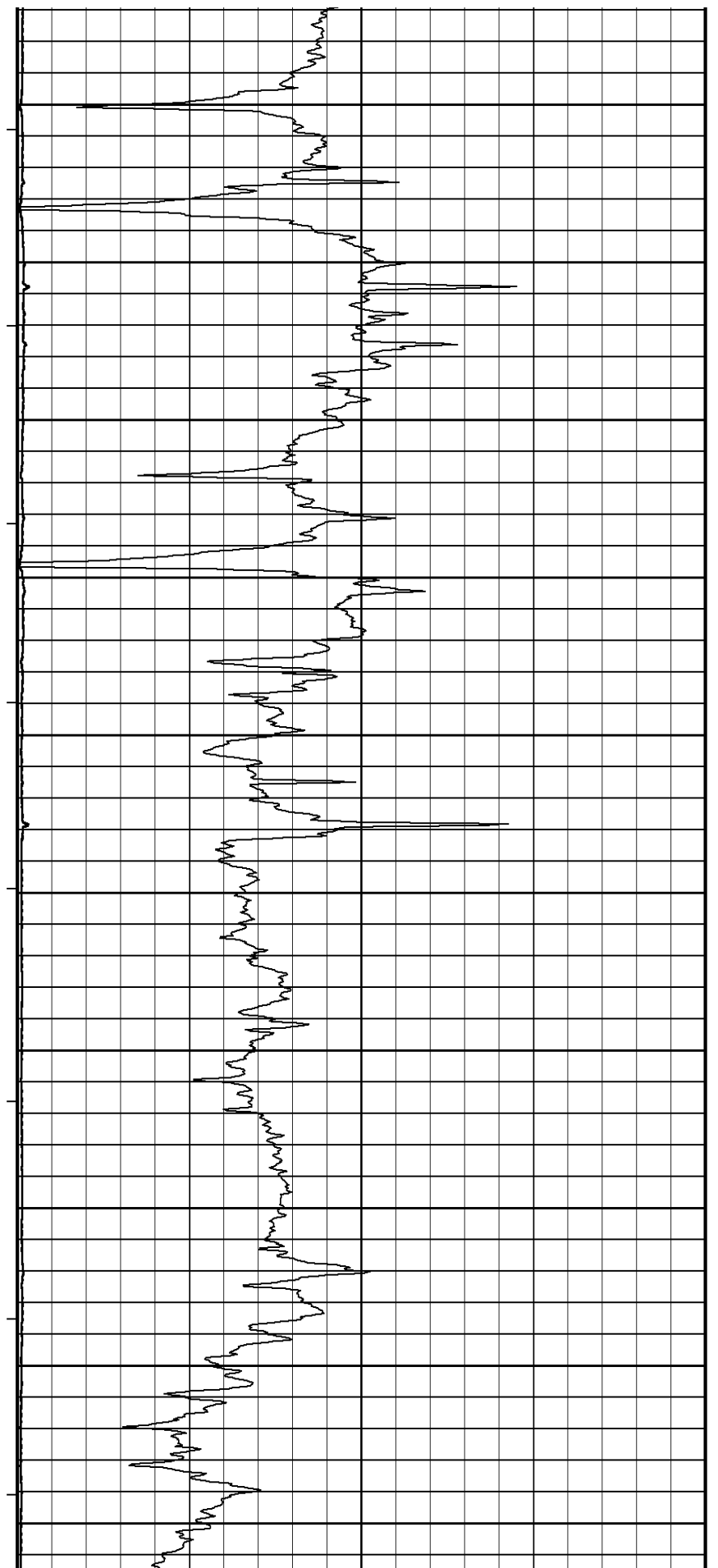
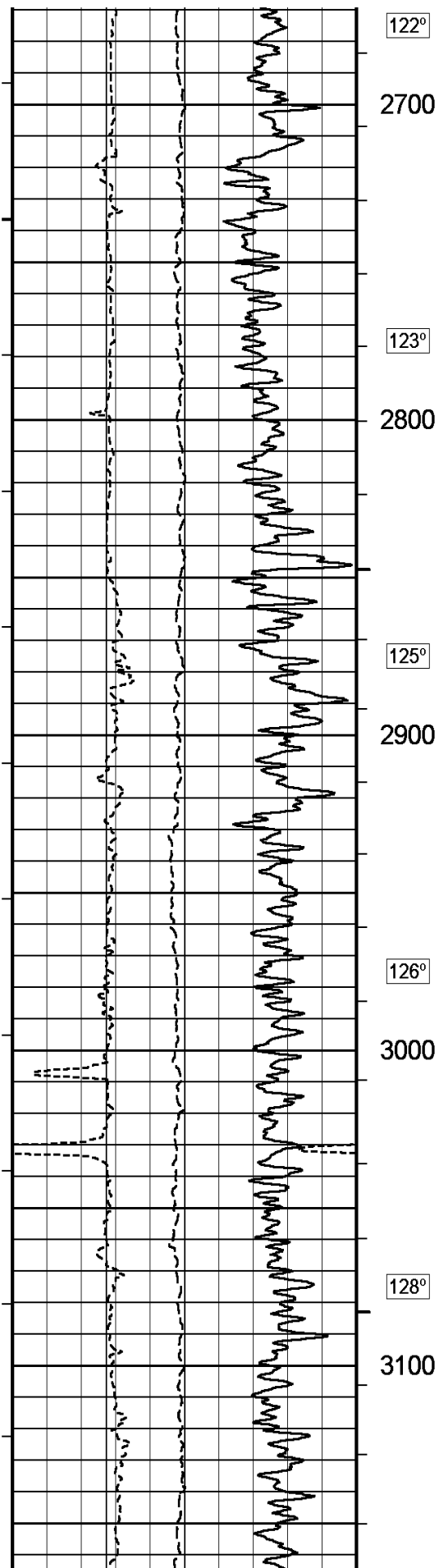
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions in our price schedule.

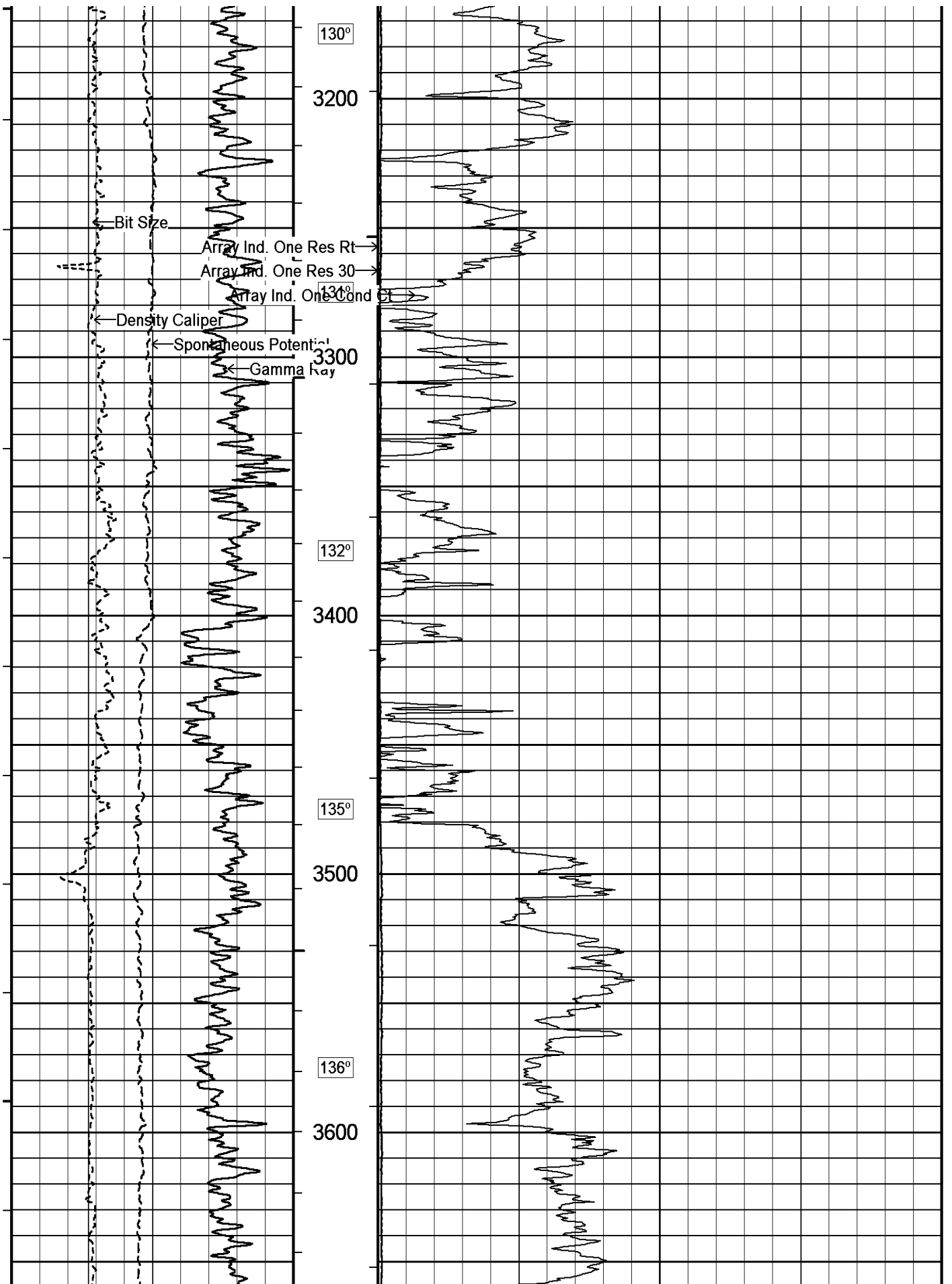


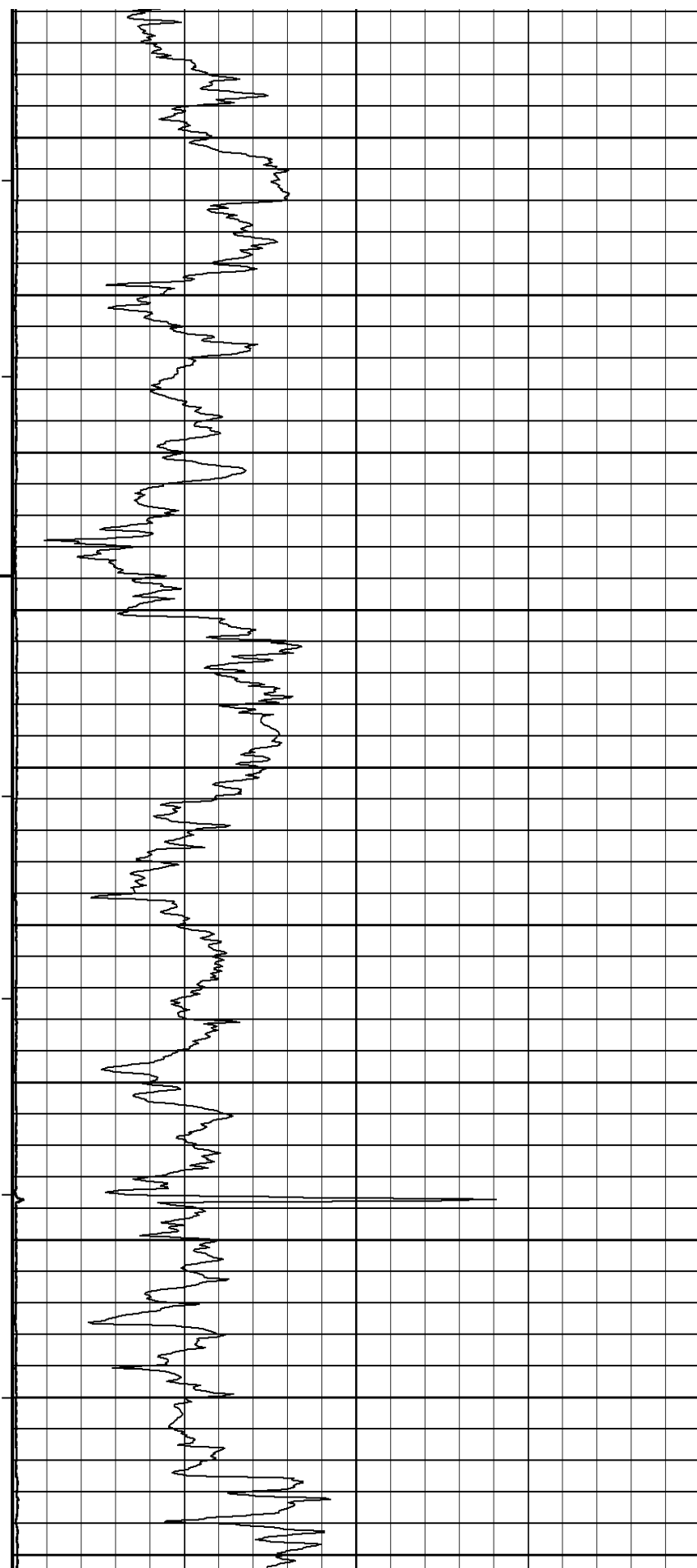
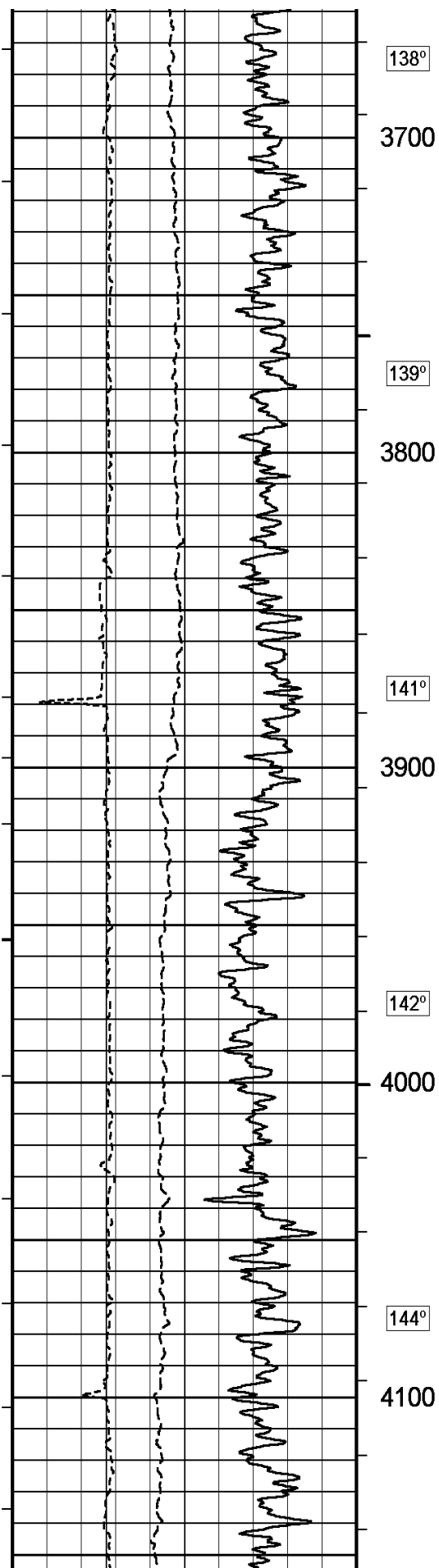


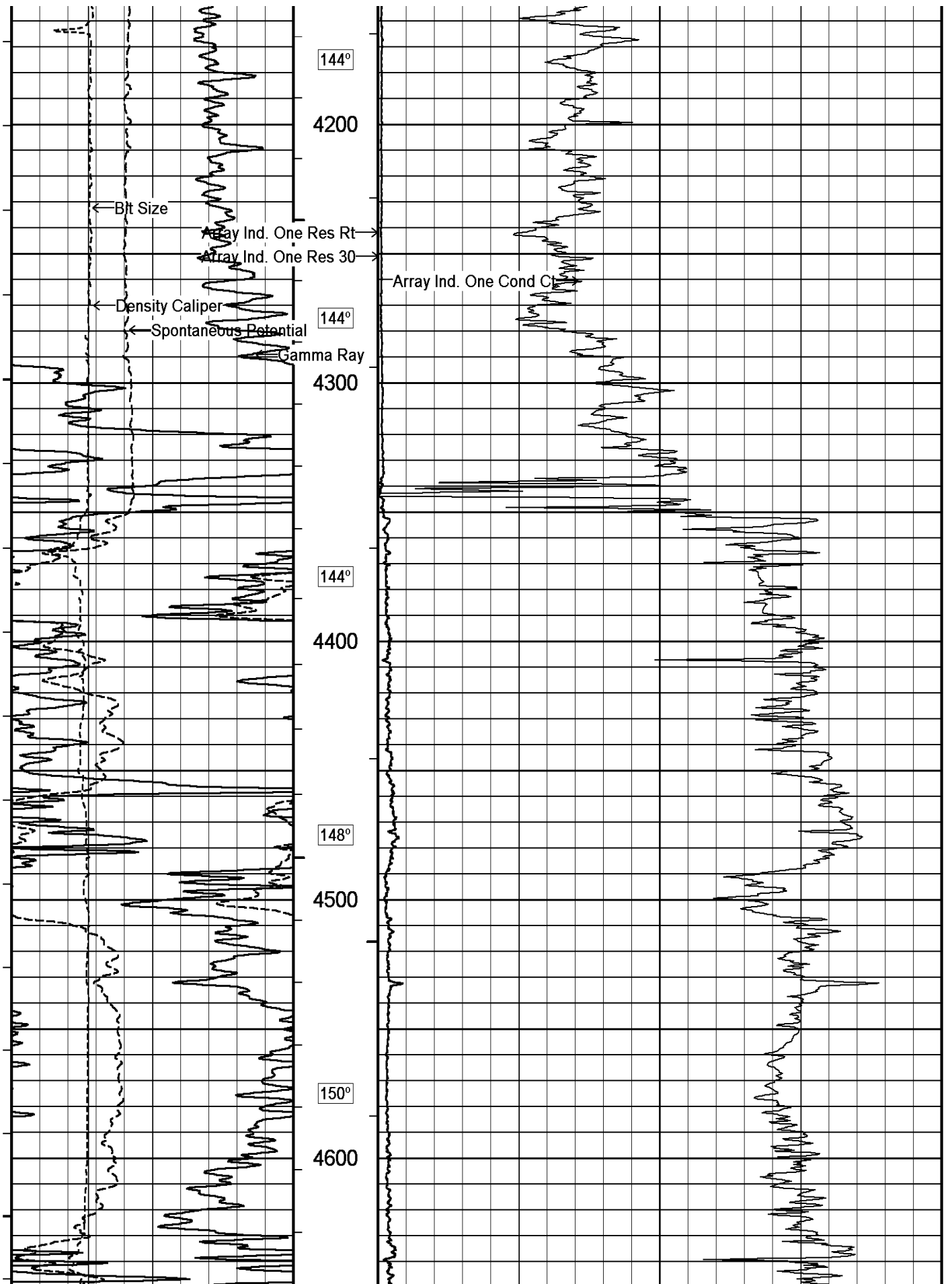


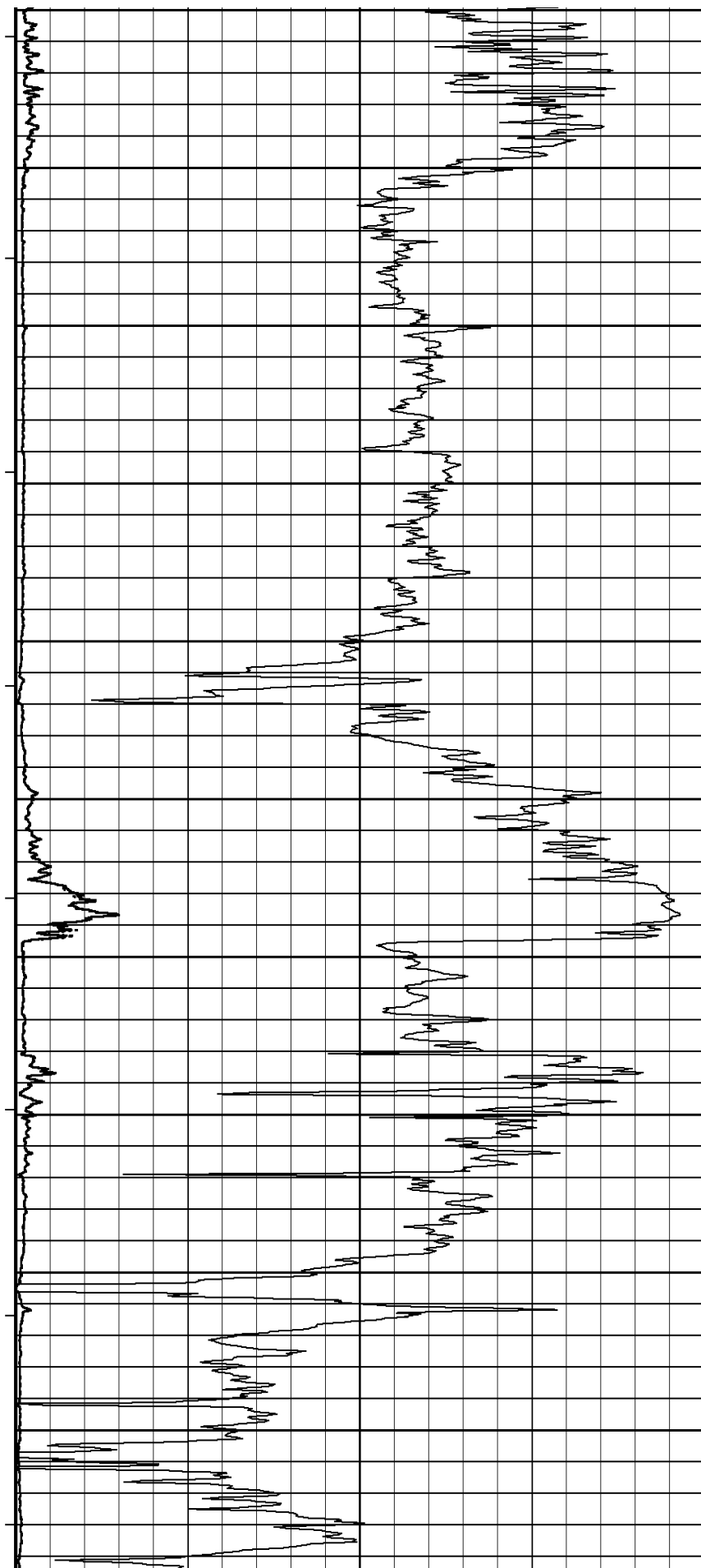
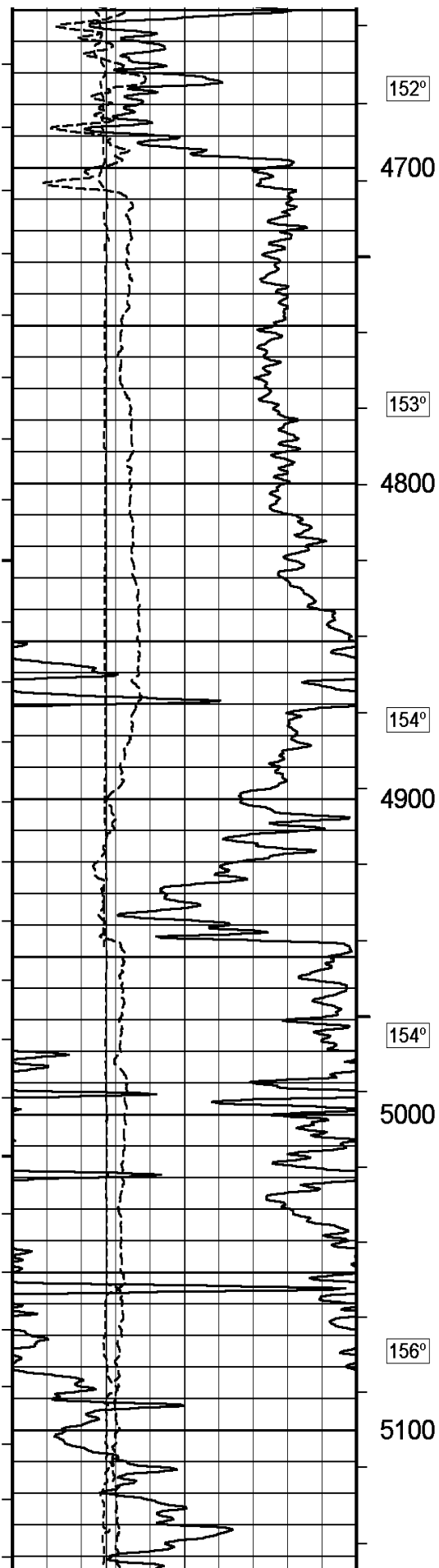


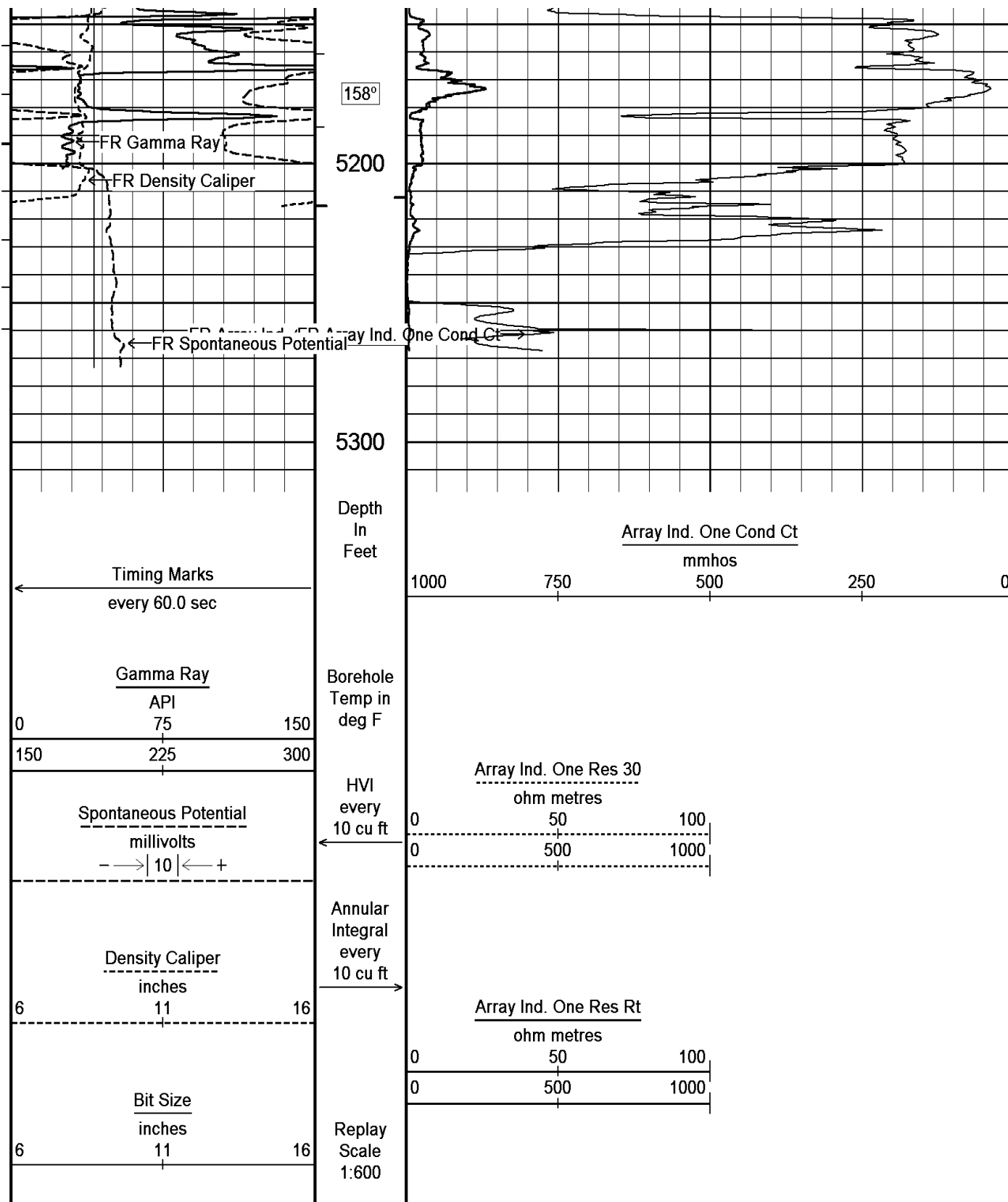












Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 13-NOV-2012 23:09

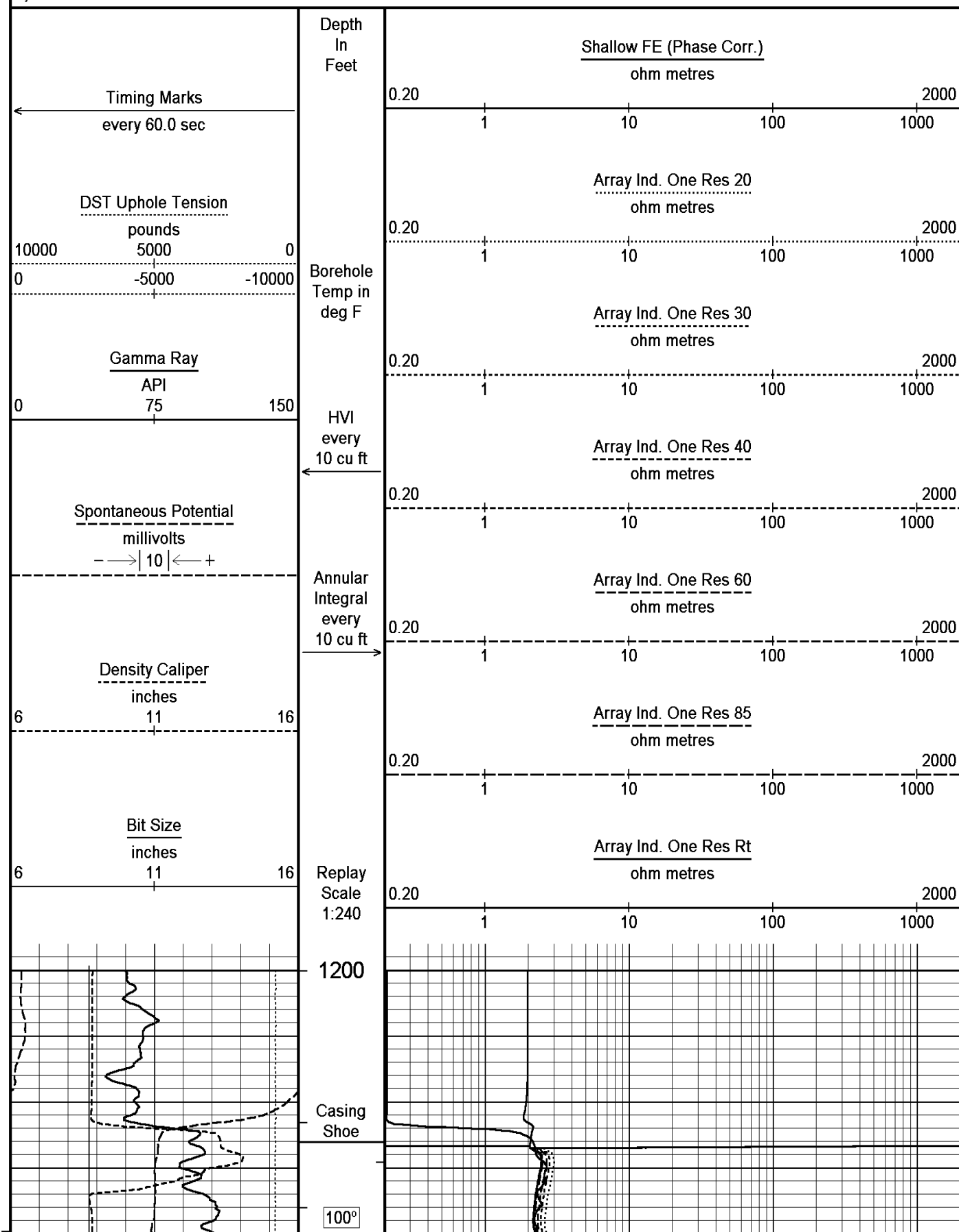
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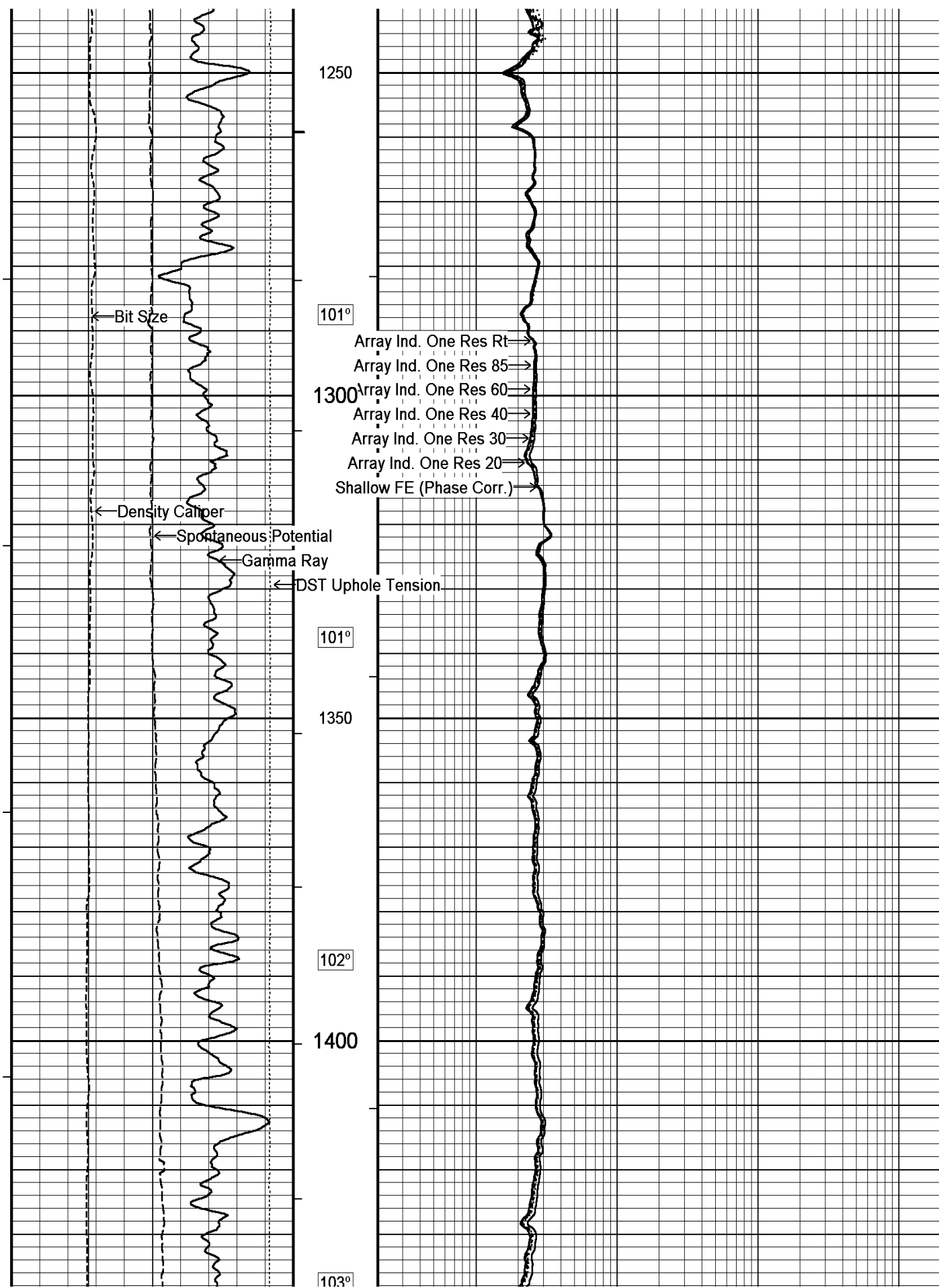
Recorded on 13-NOV-2012 10:58

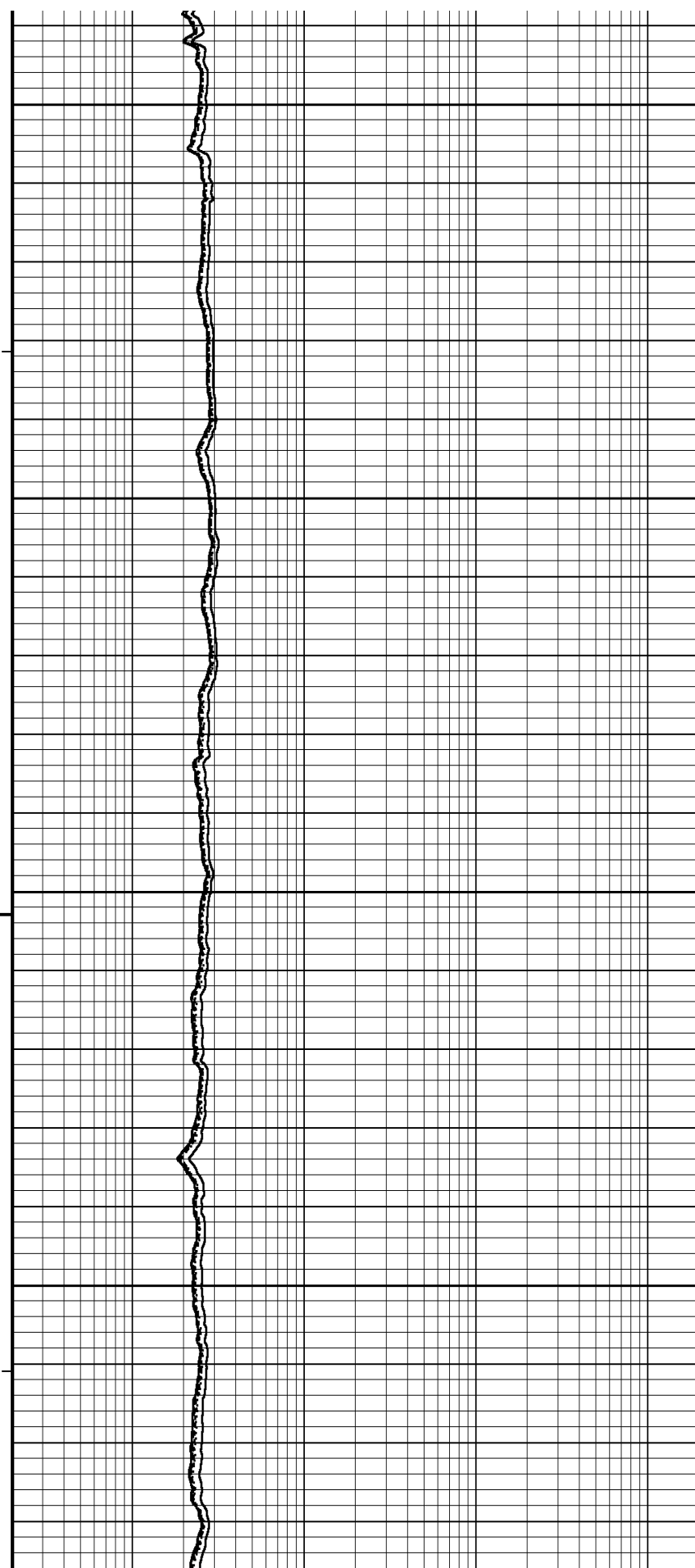
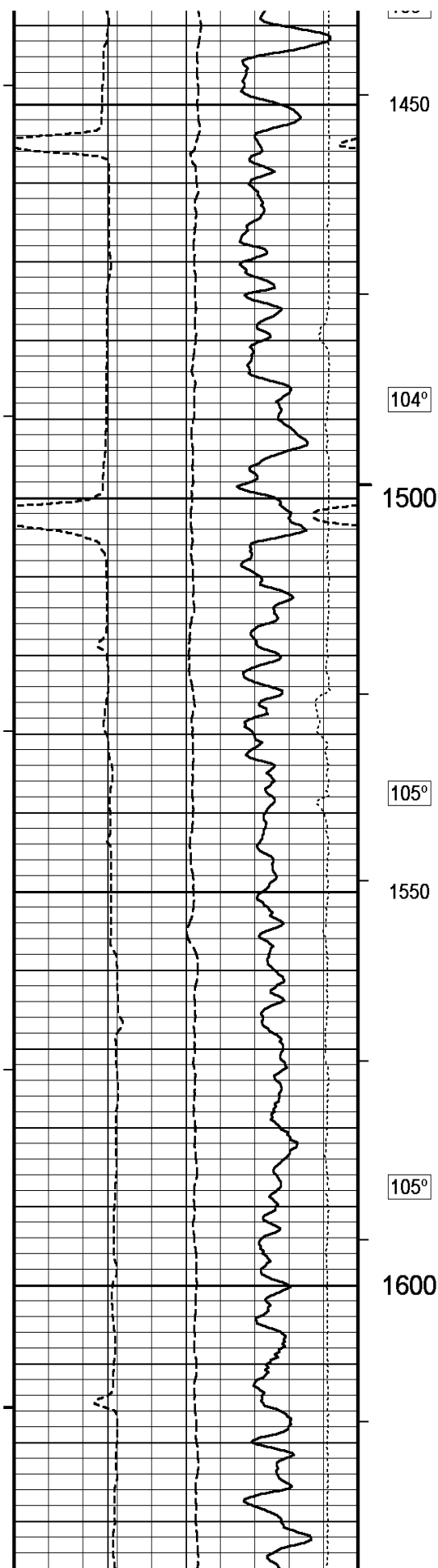
System Versions: Processed with 13.02.6600 Plotted with 13.02.6600

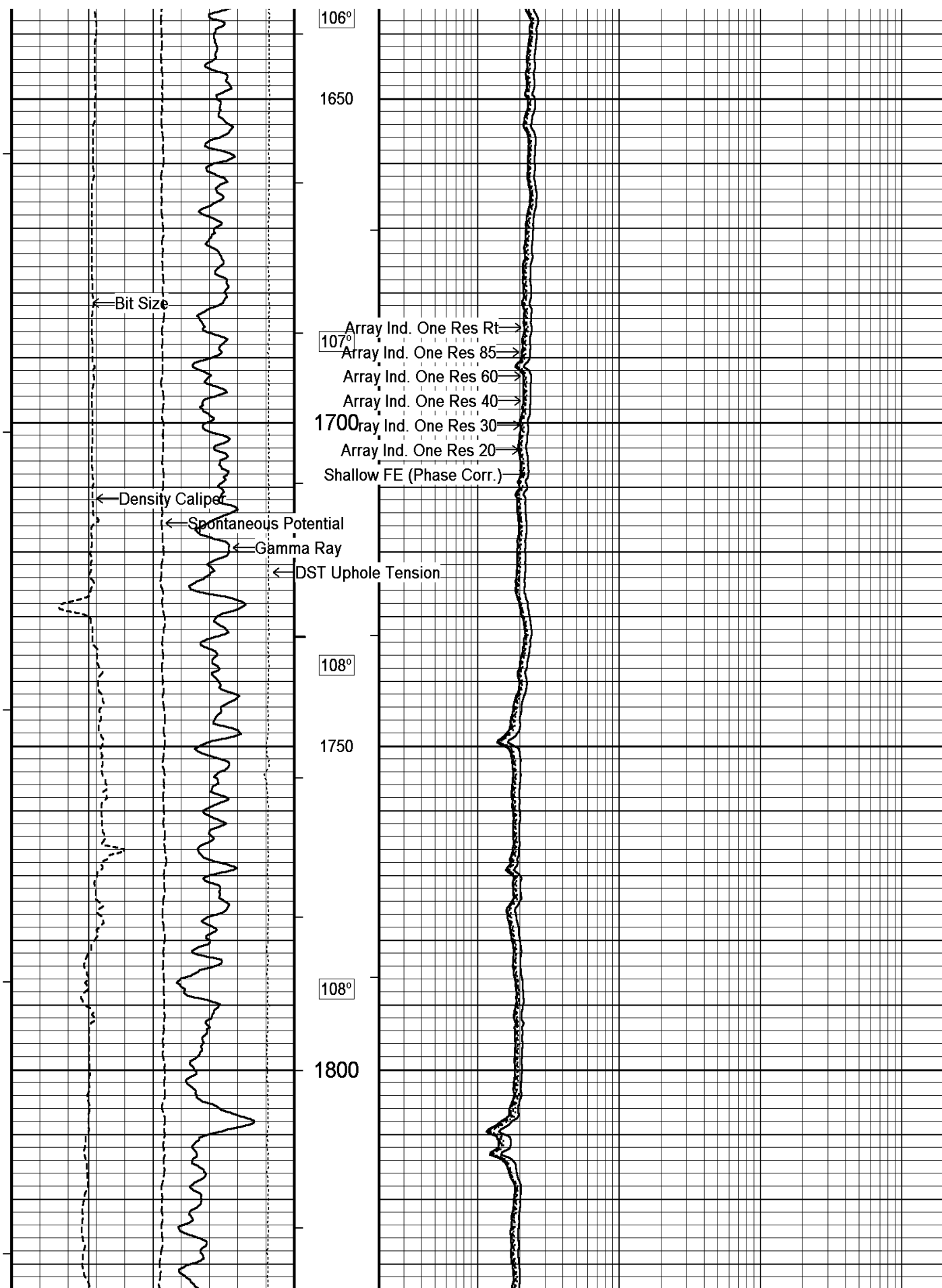
↑ 2 INCH MAIN LOG ↑

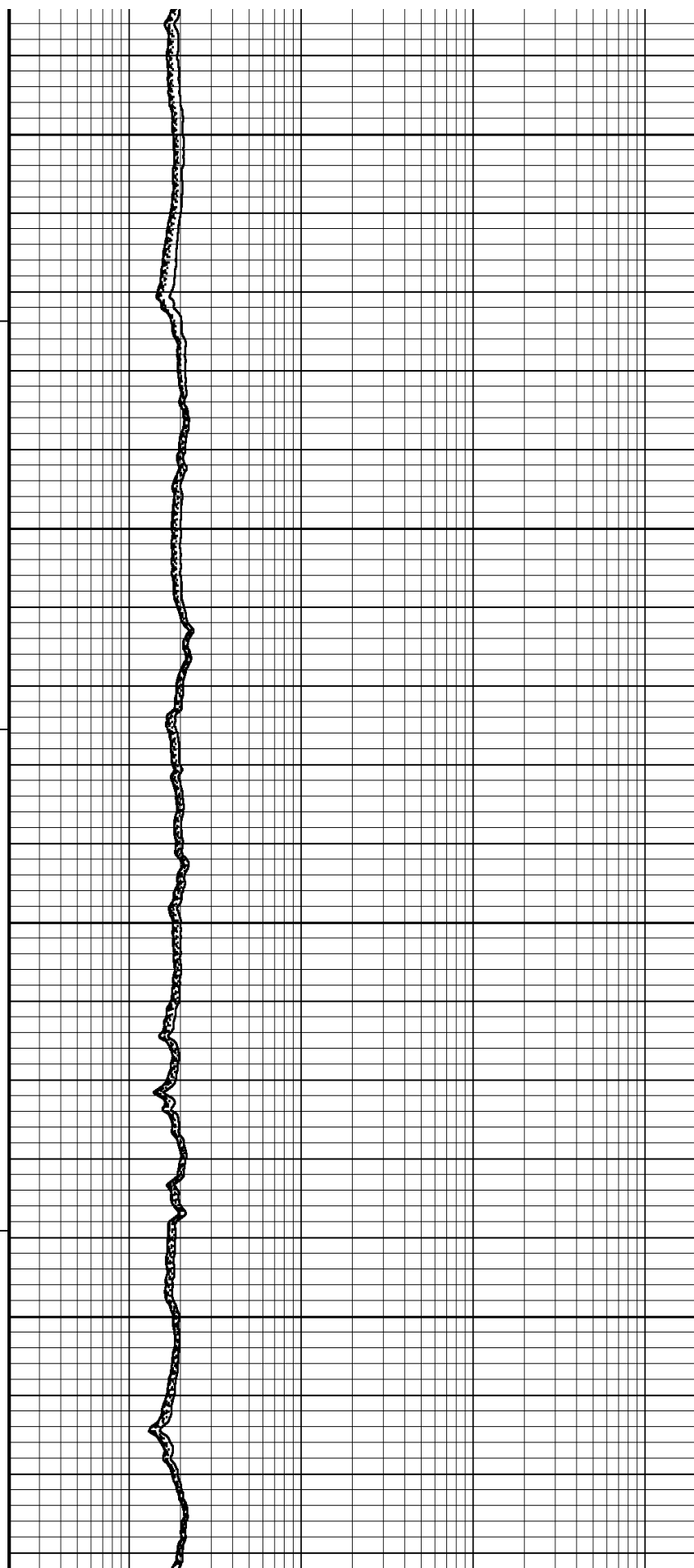
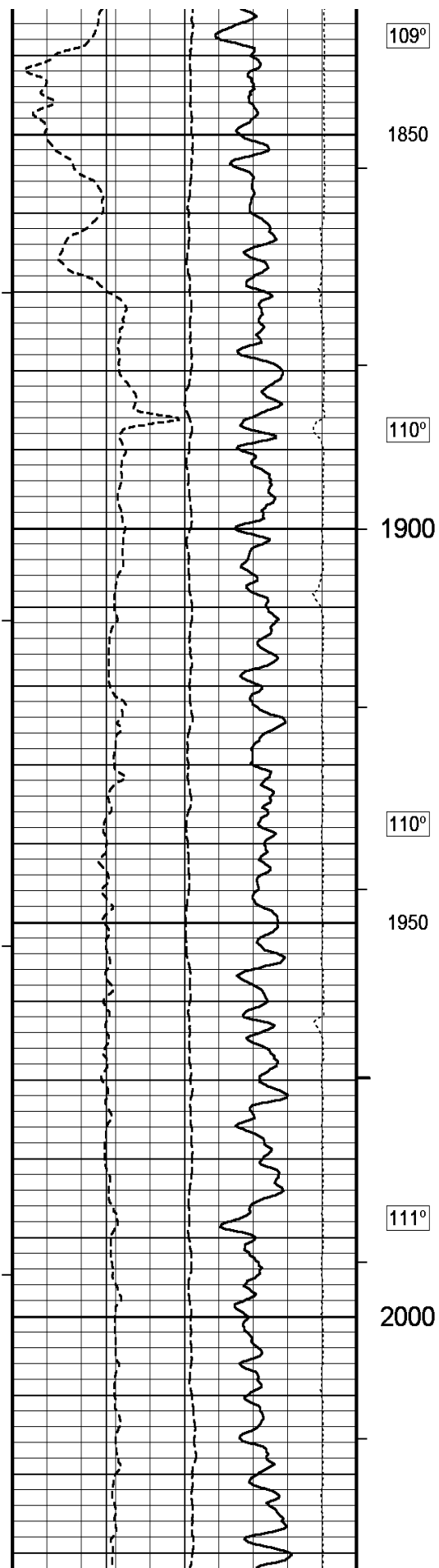
↓ 5 INCH MAIN LOG ↓

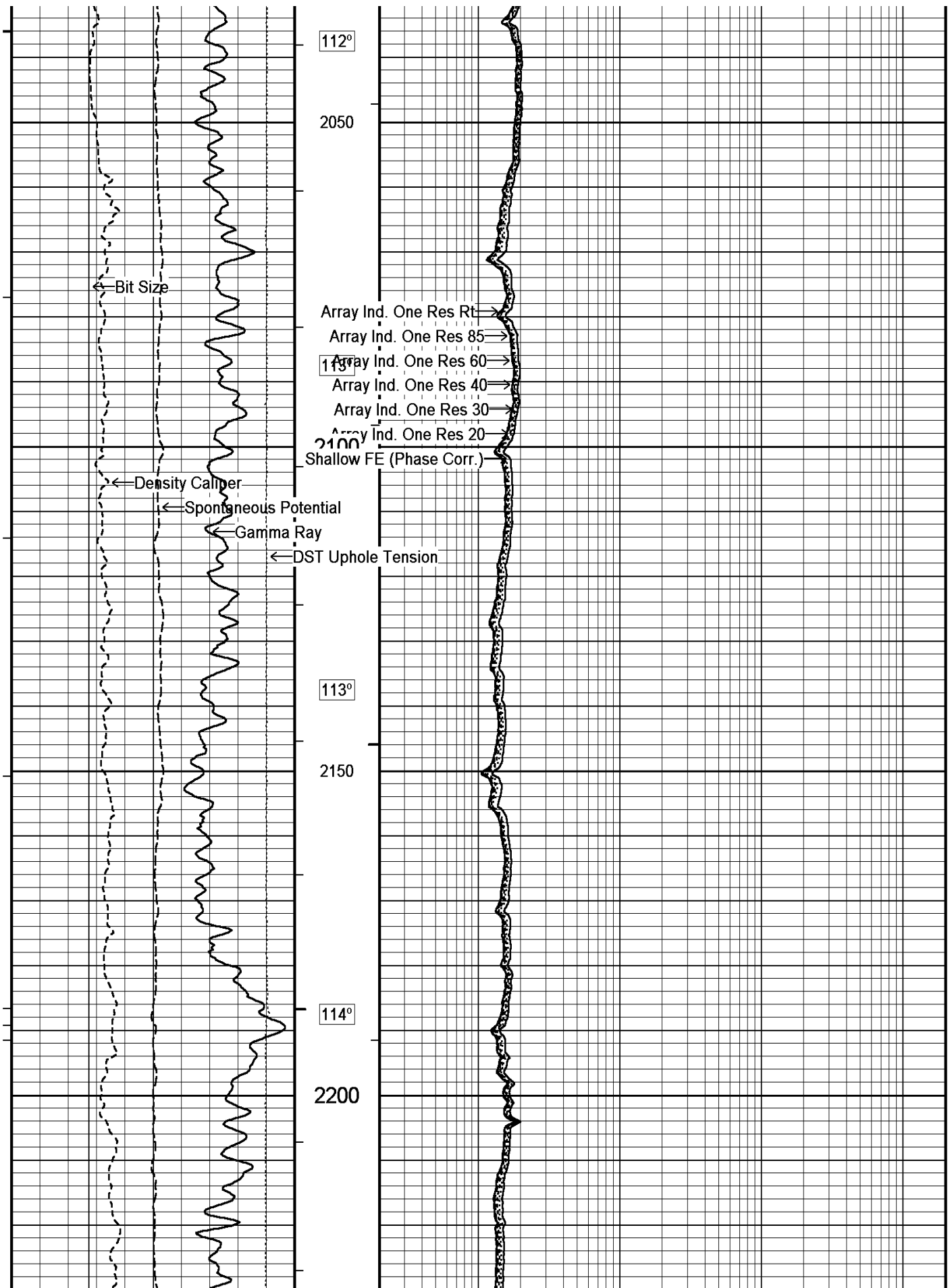


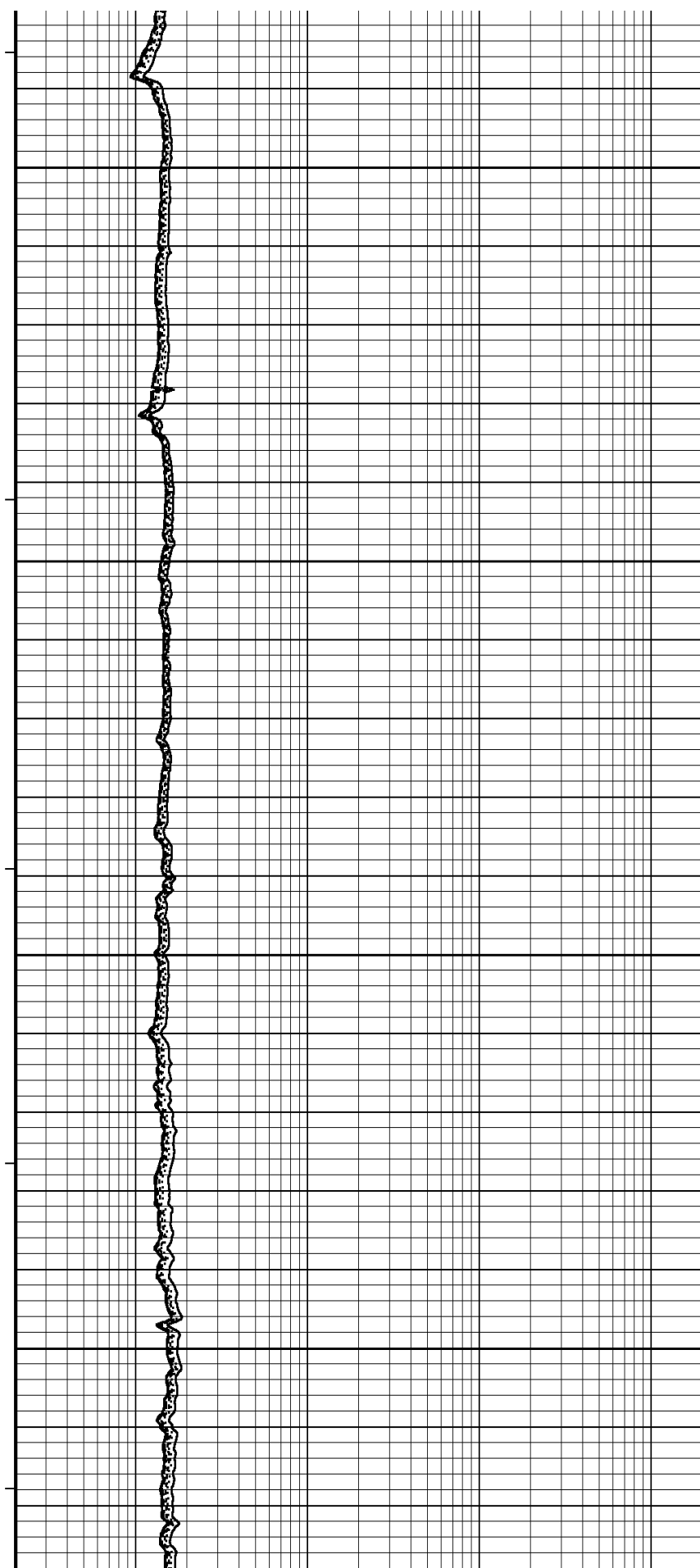
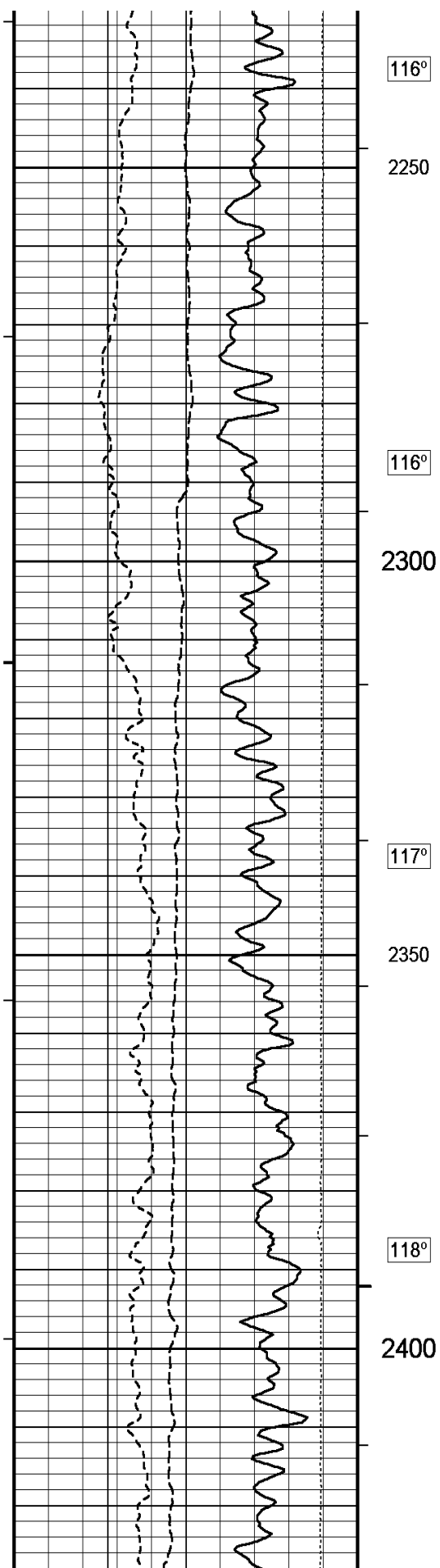


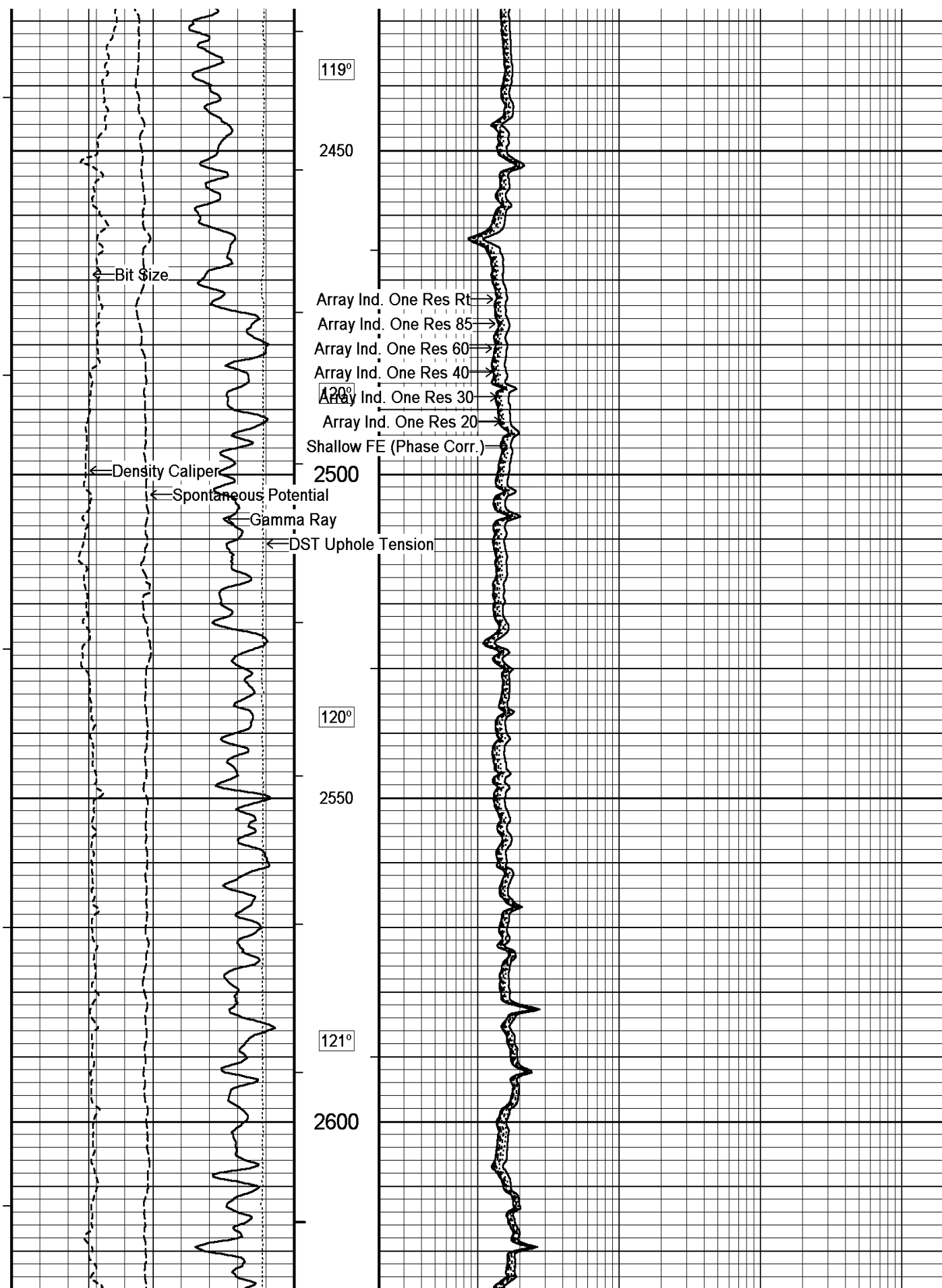


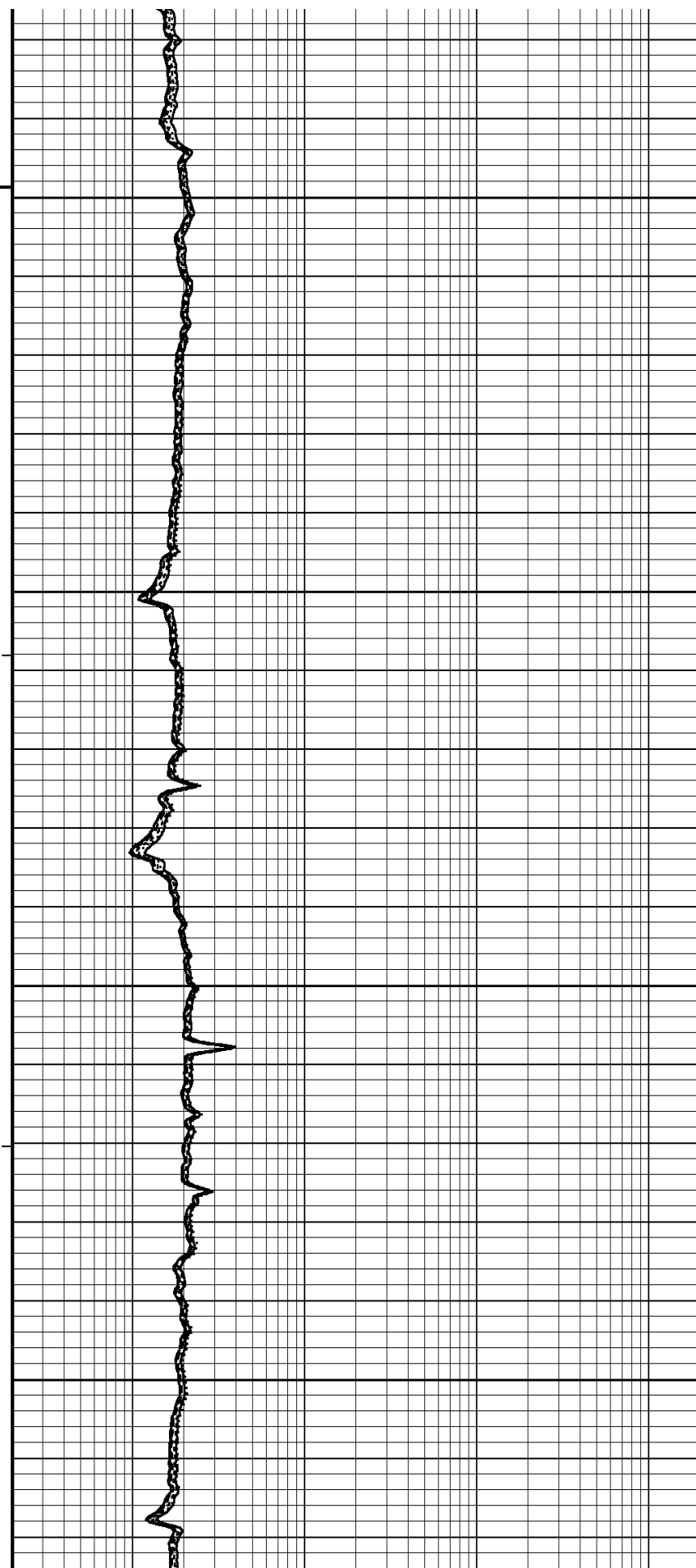
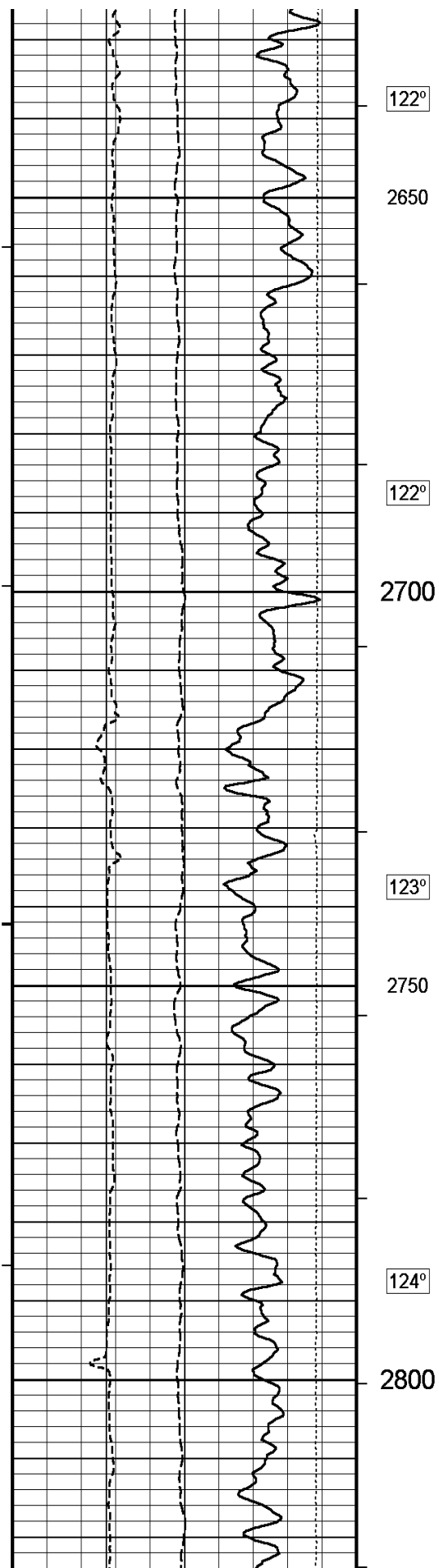


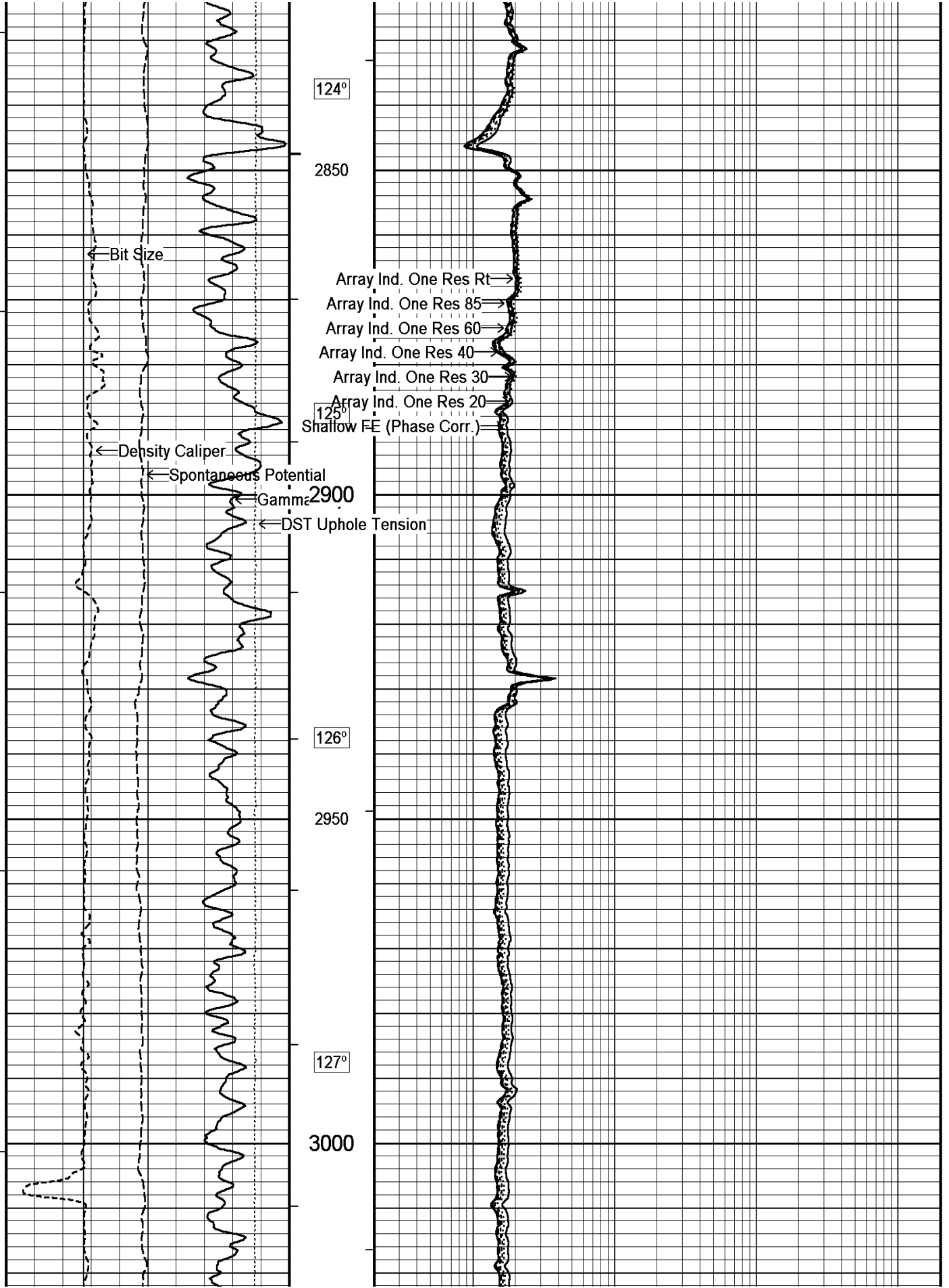


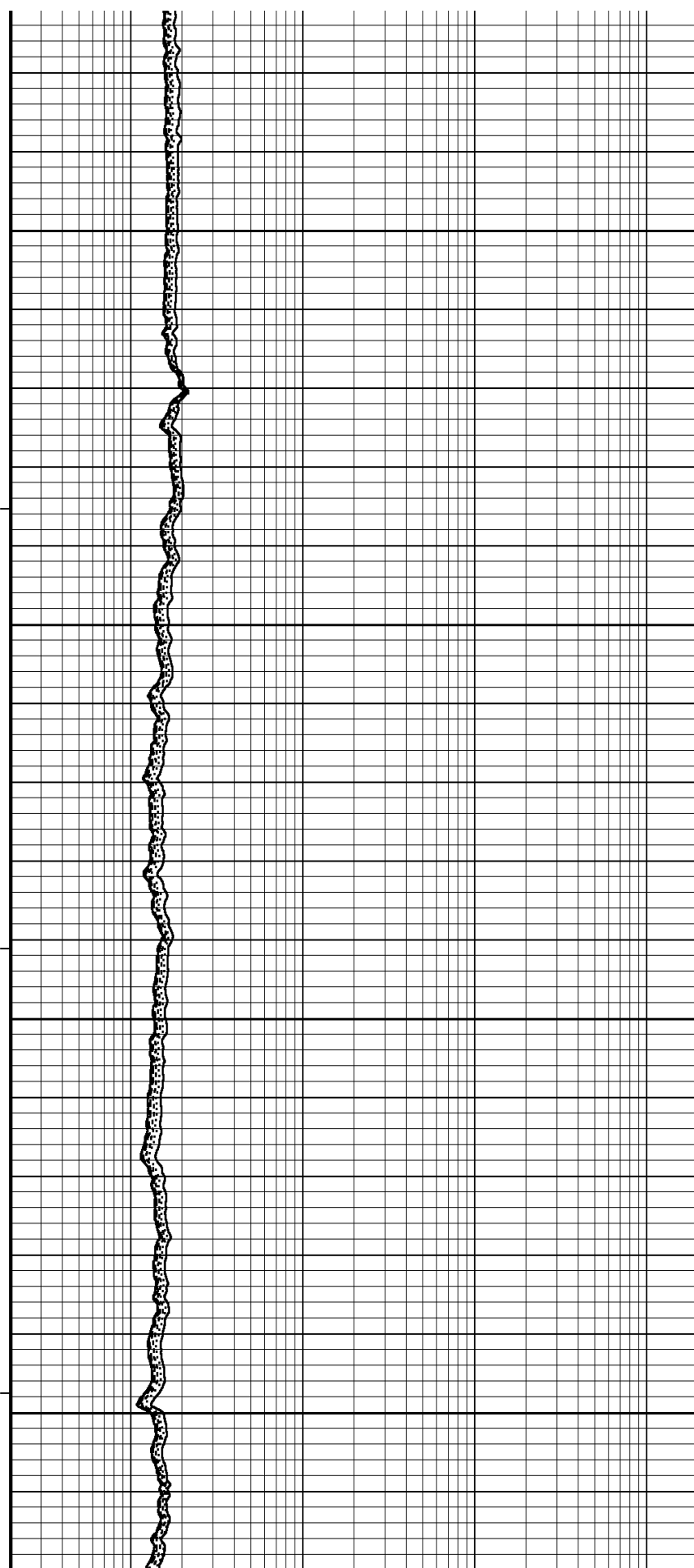
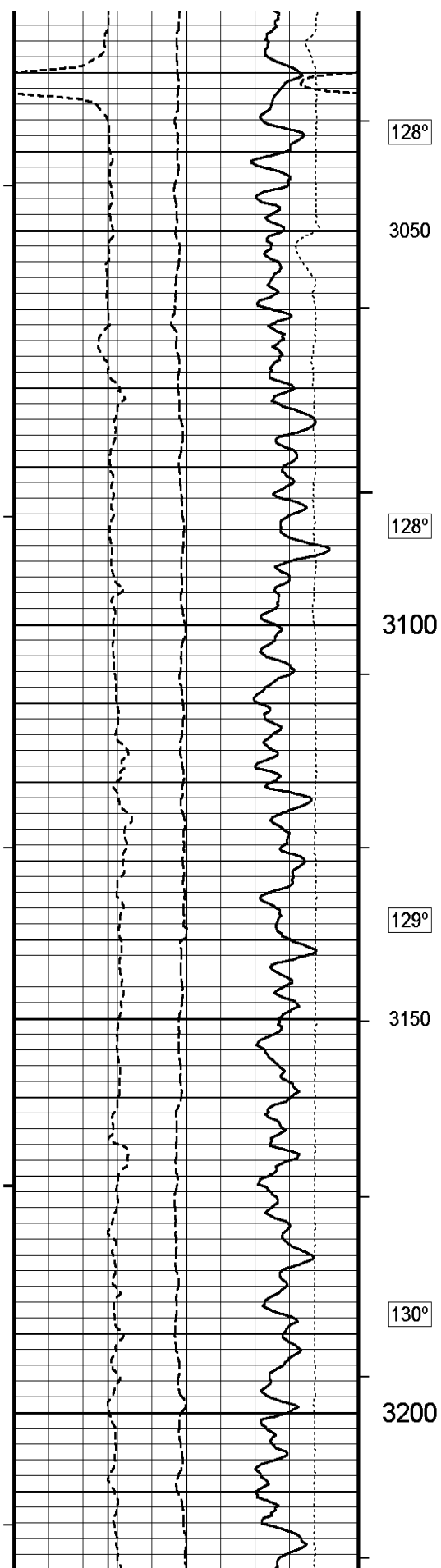


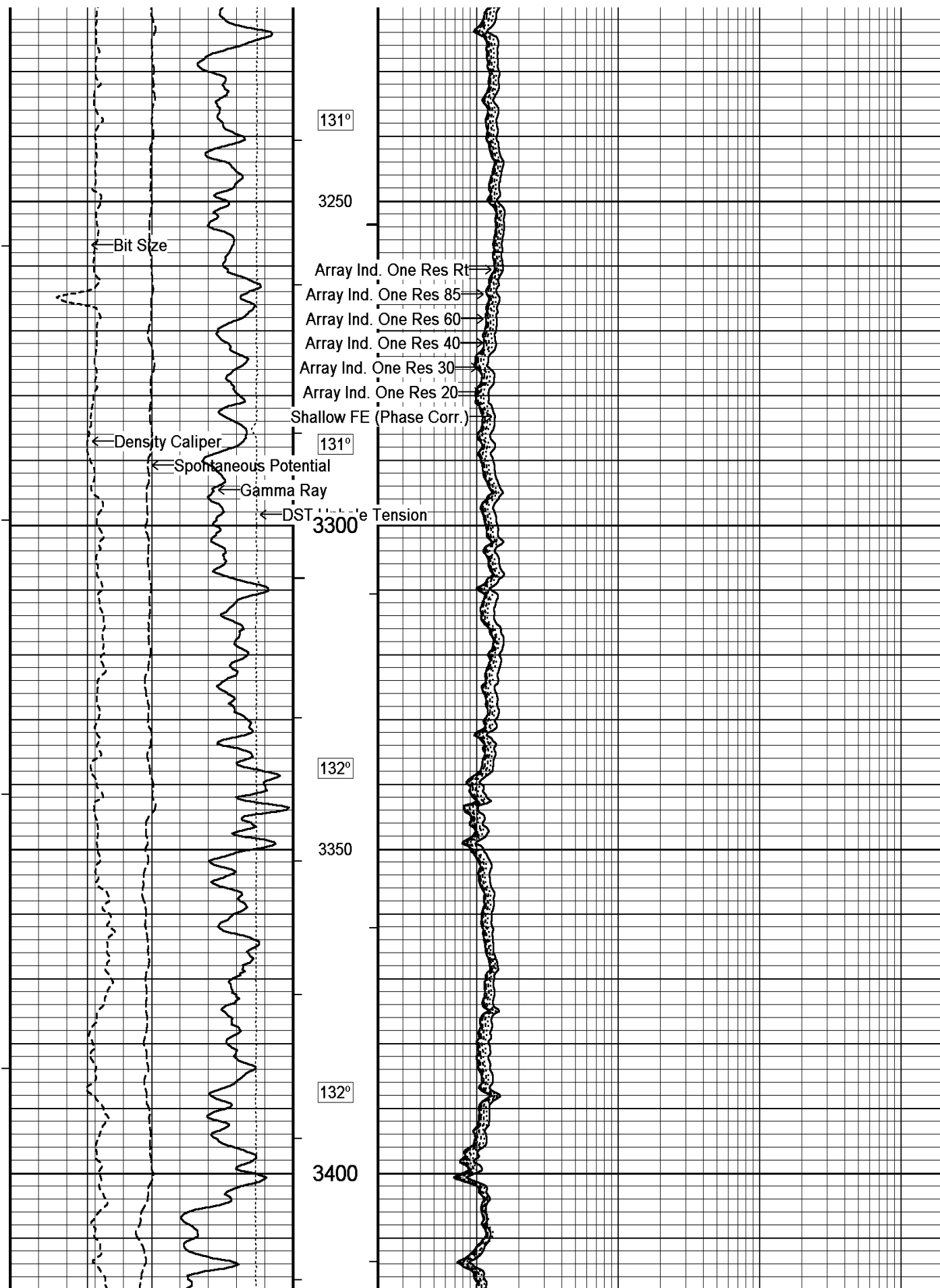


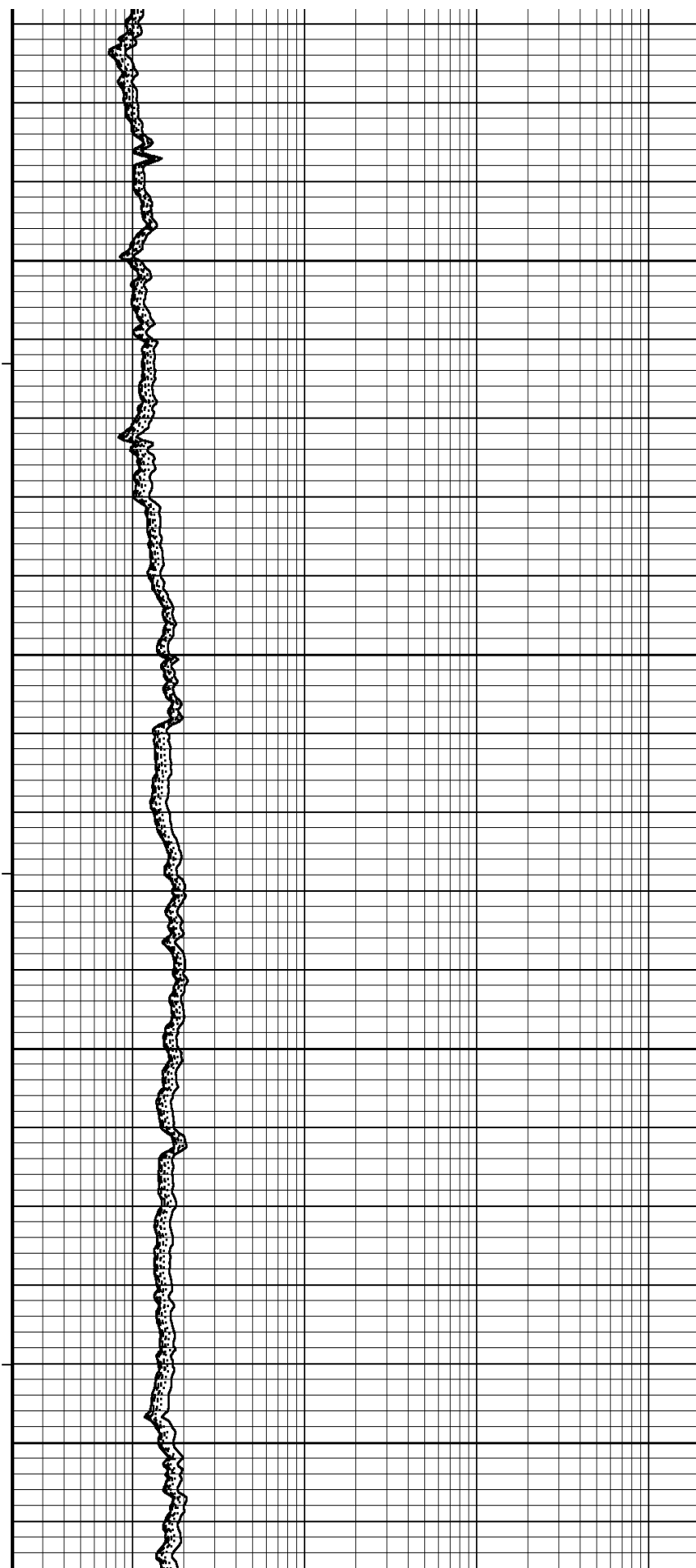
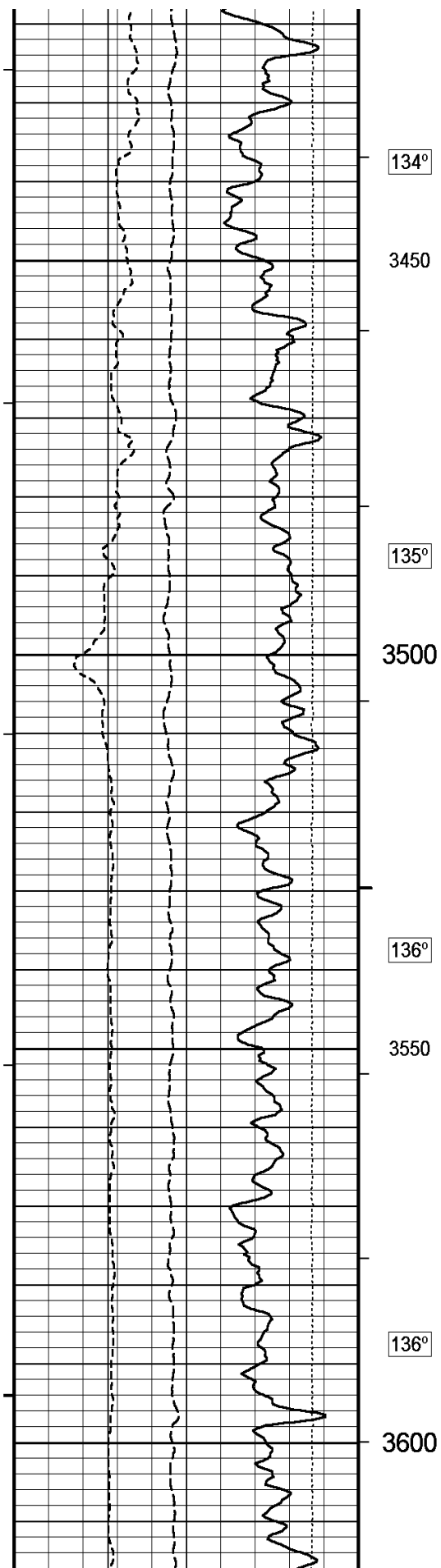


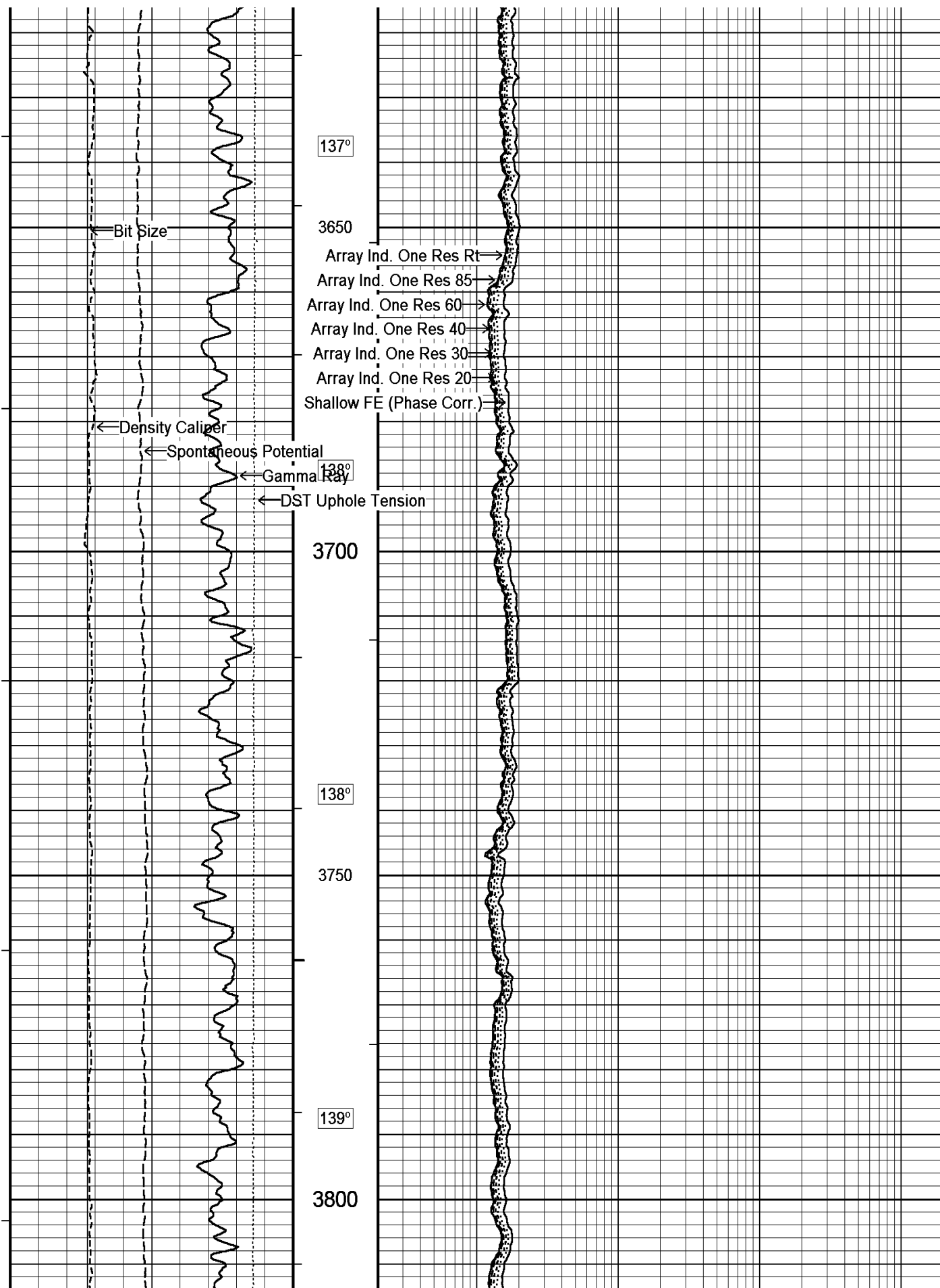


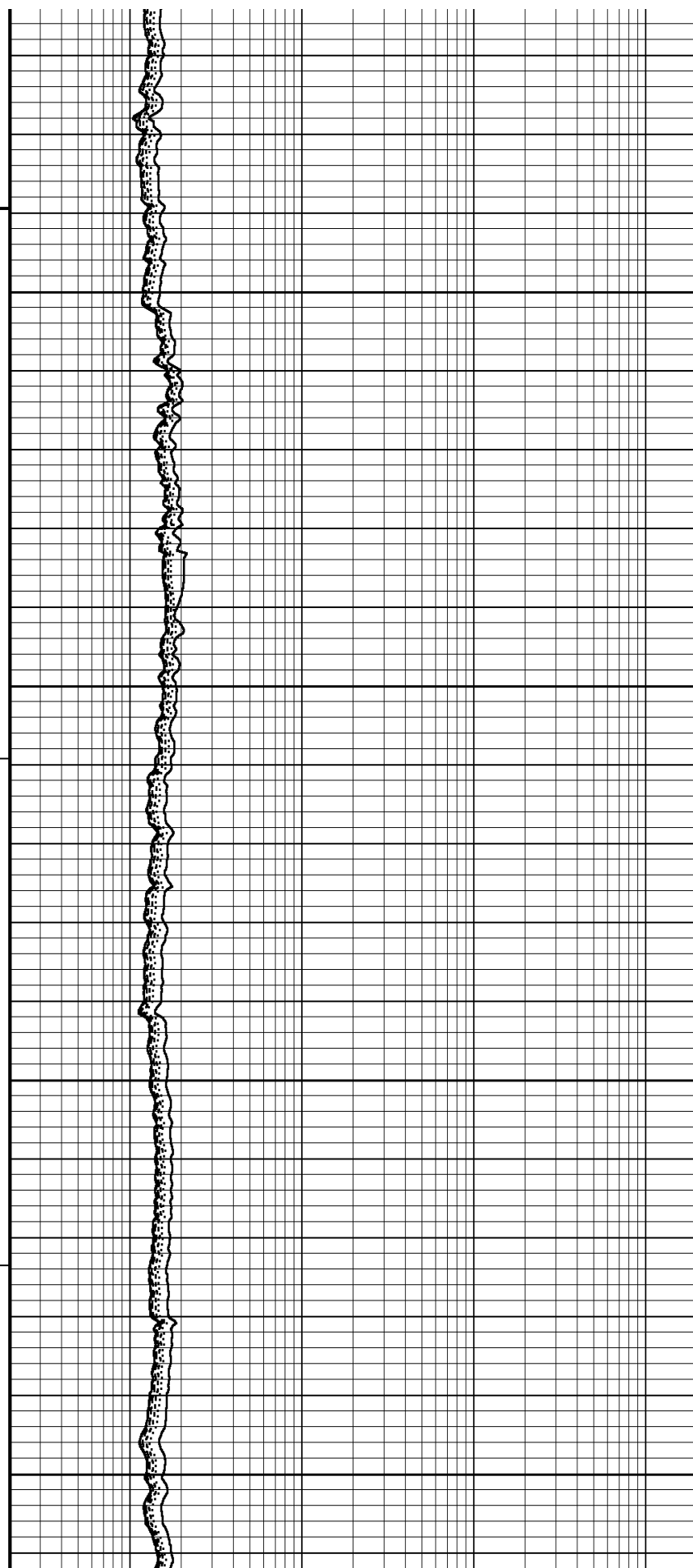
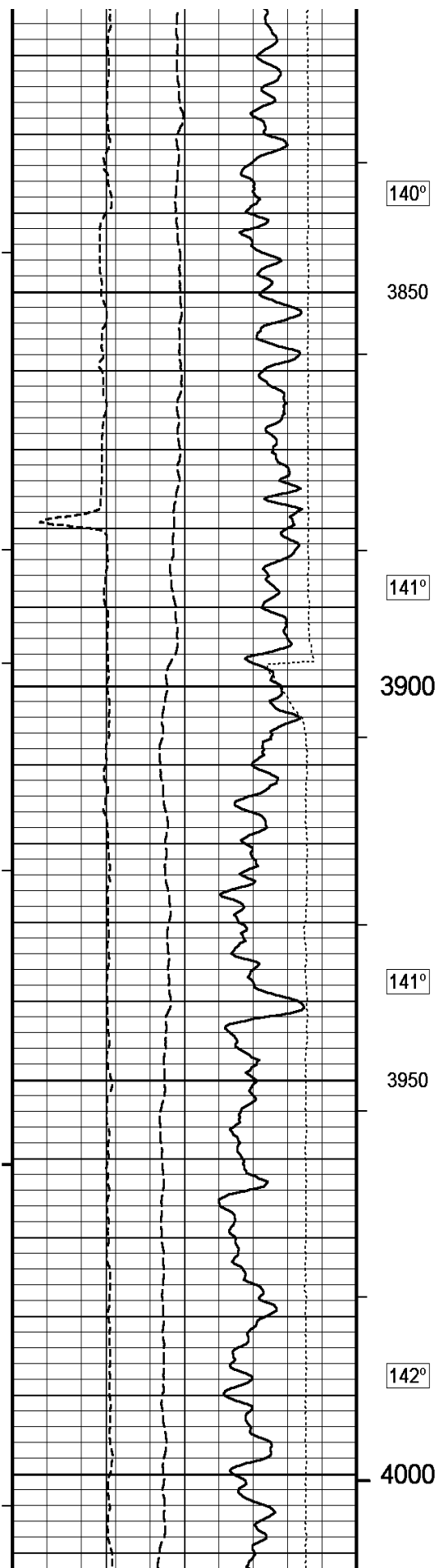


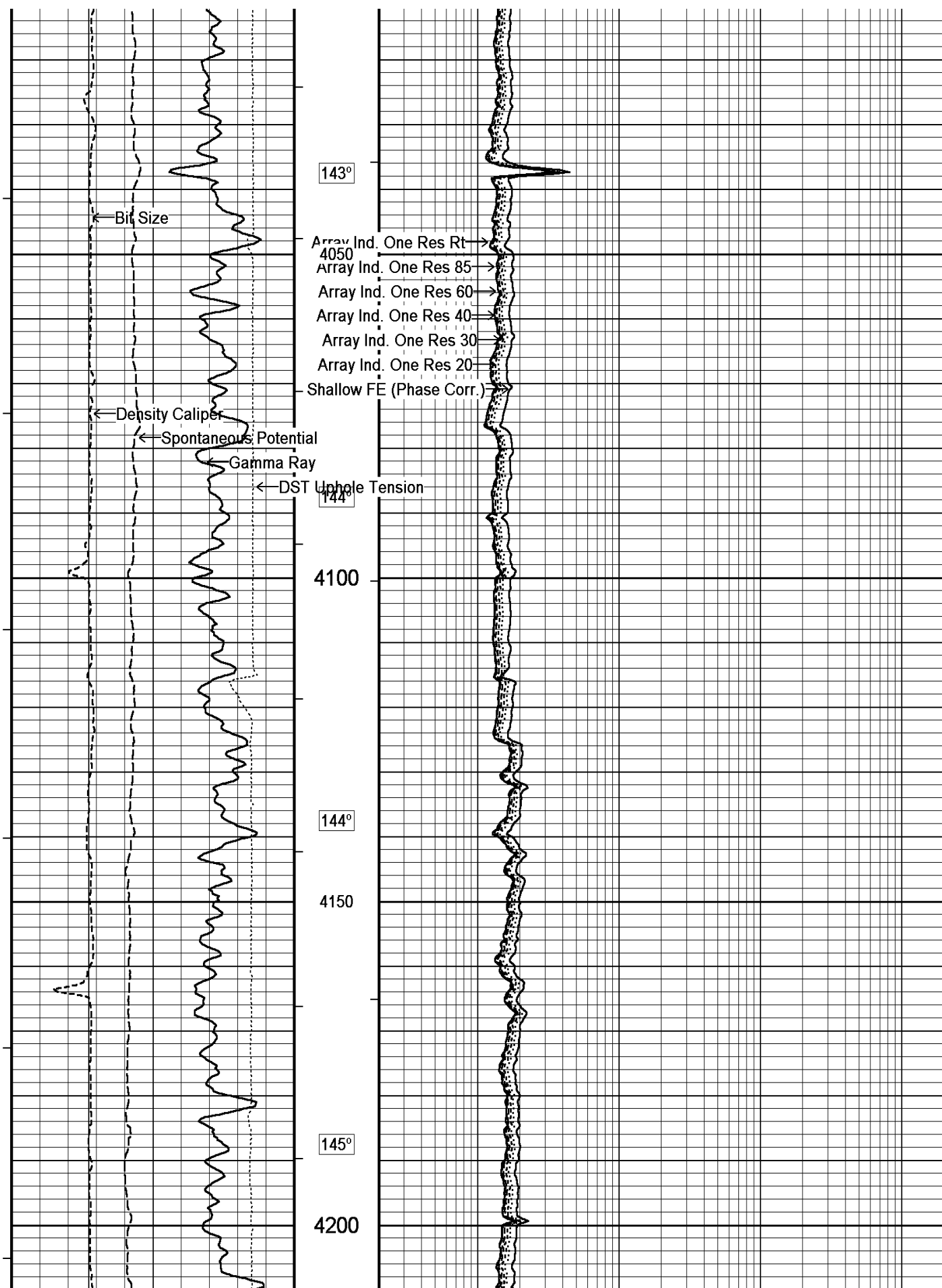


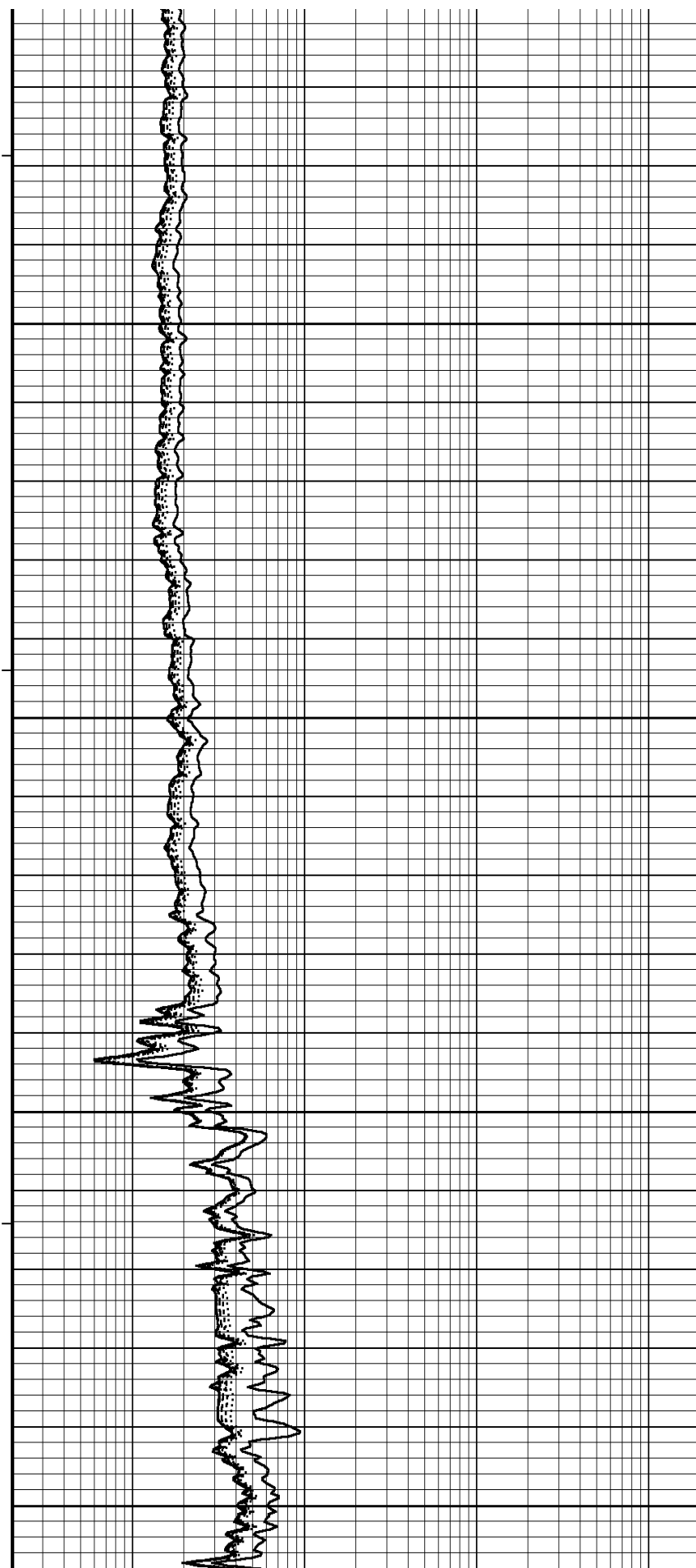
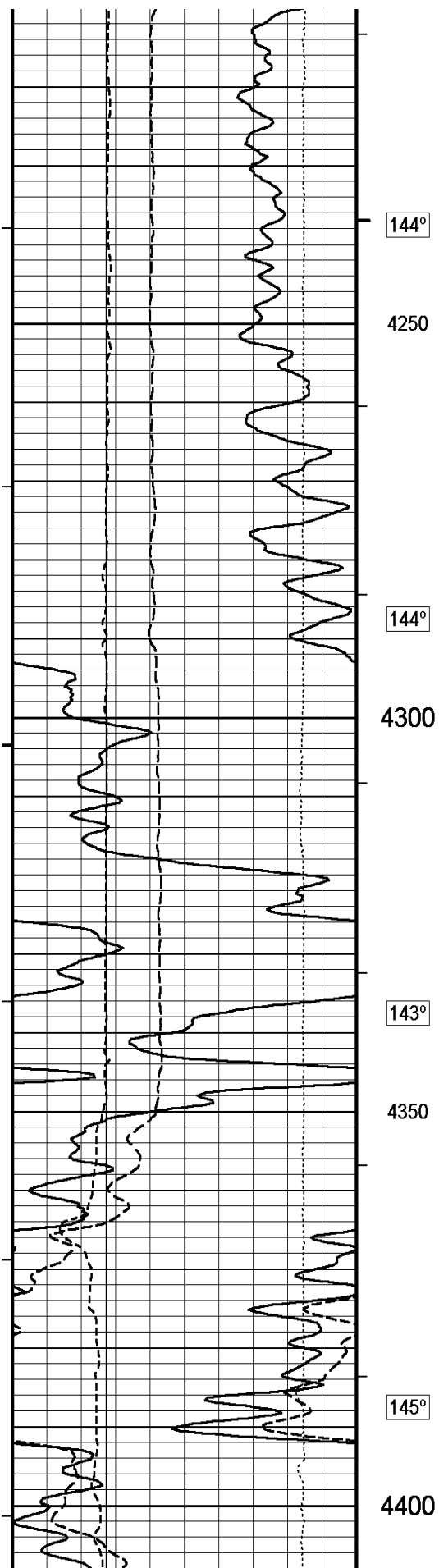


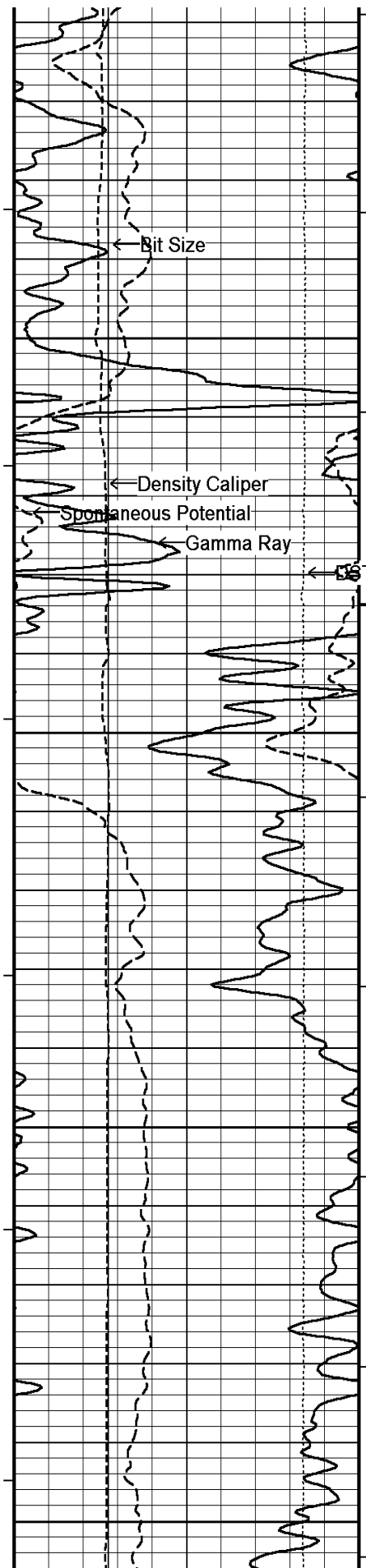












147°

4450

148°

4500

149°

4550

150°

4600

Array Ind. One Res Rt →

Array Ind. One Res 85 →

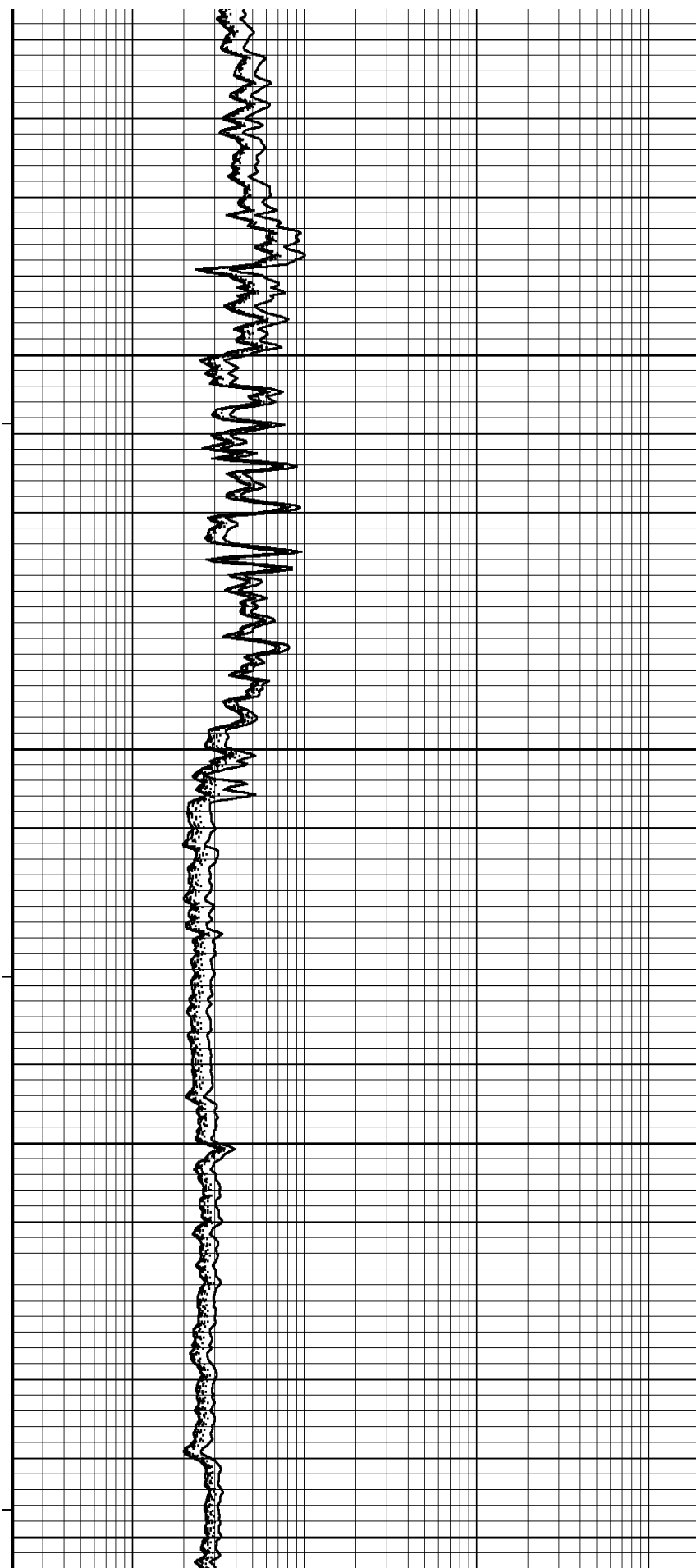
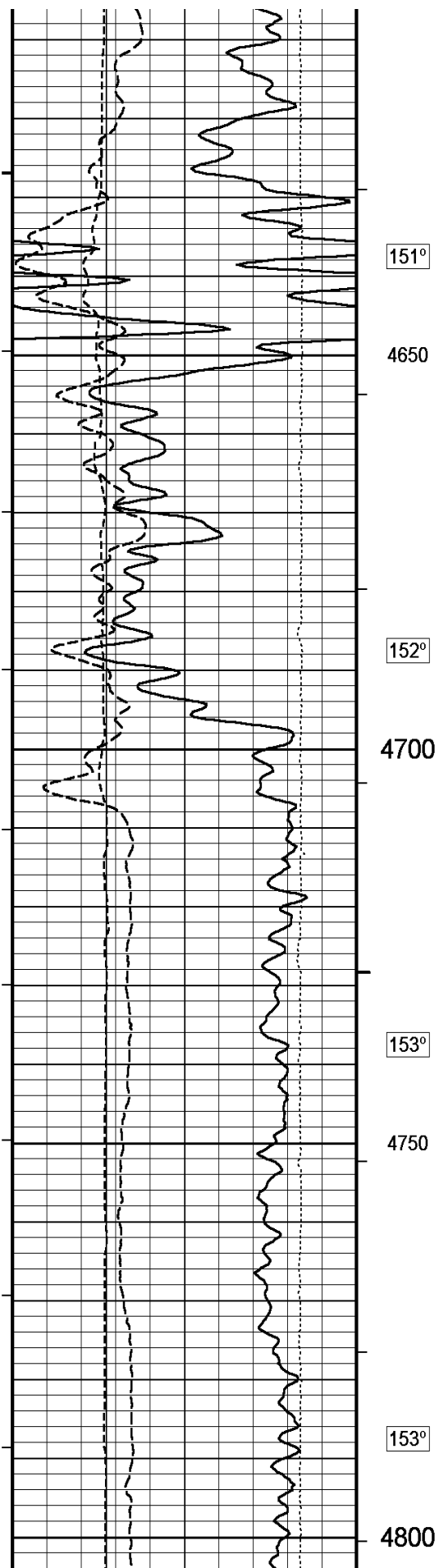
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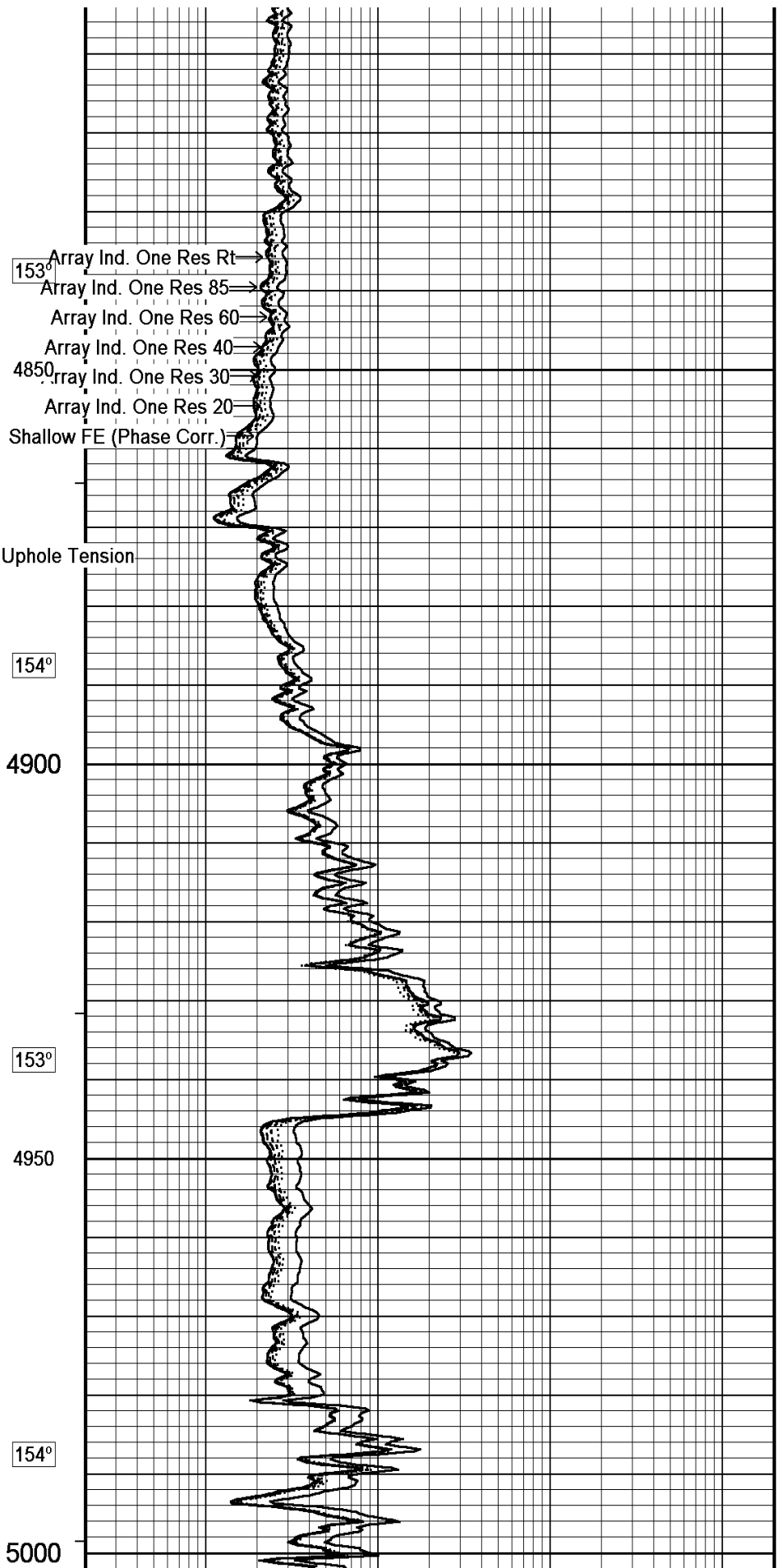
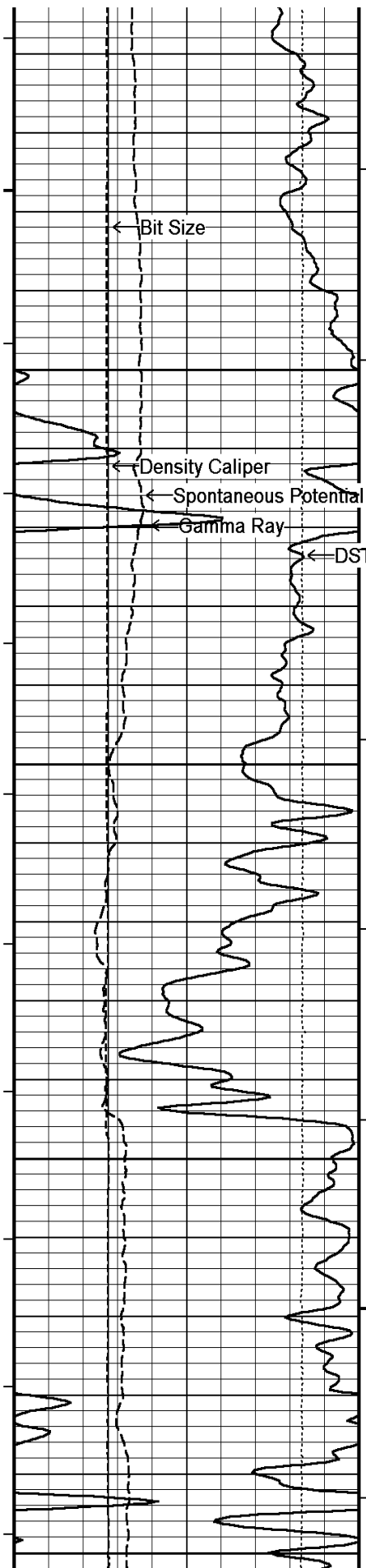
Array Ind. One Res 40 →

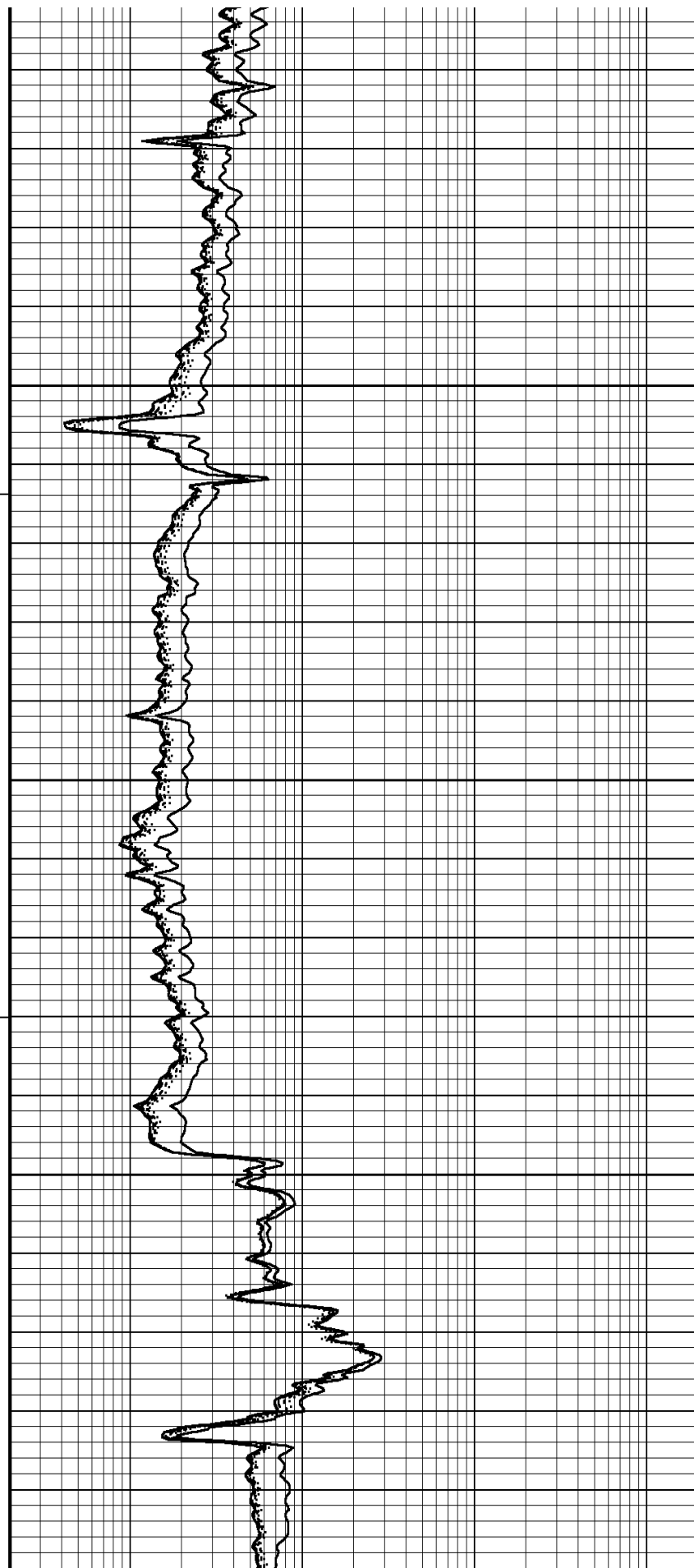
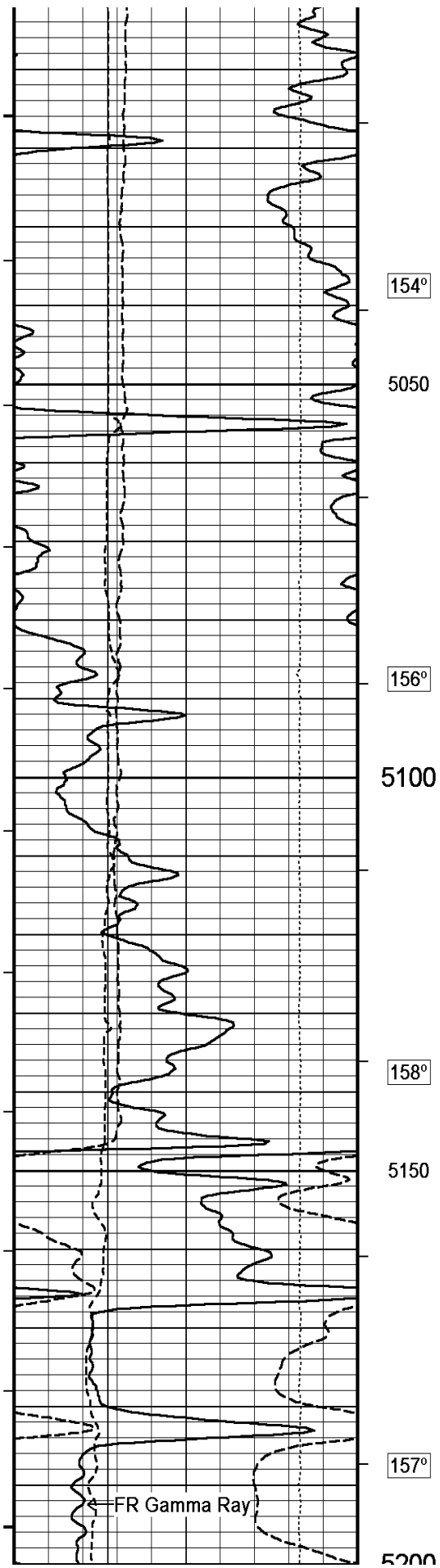
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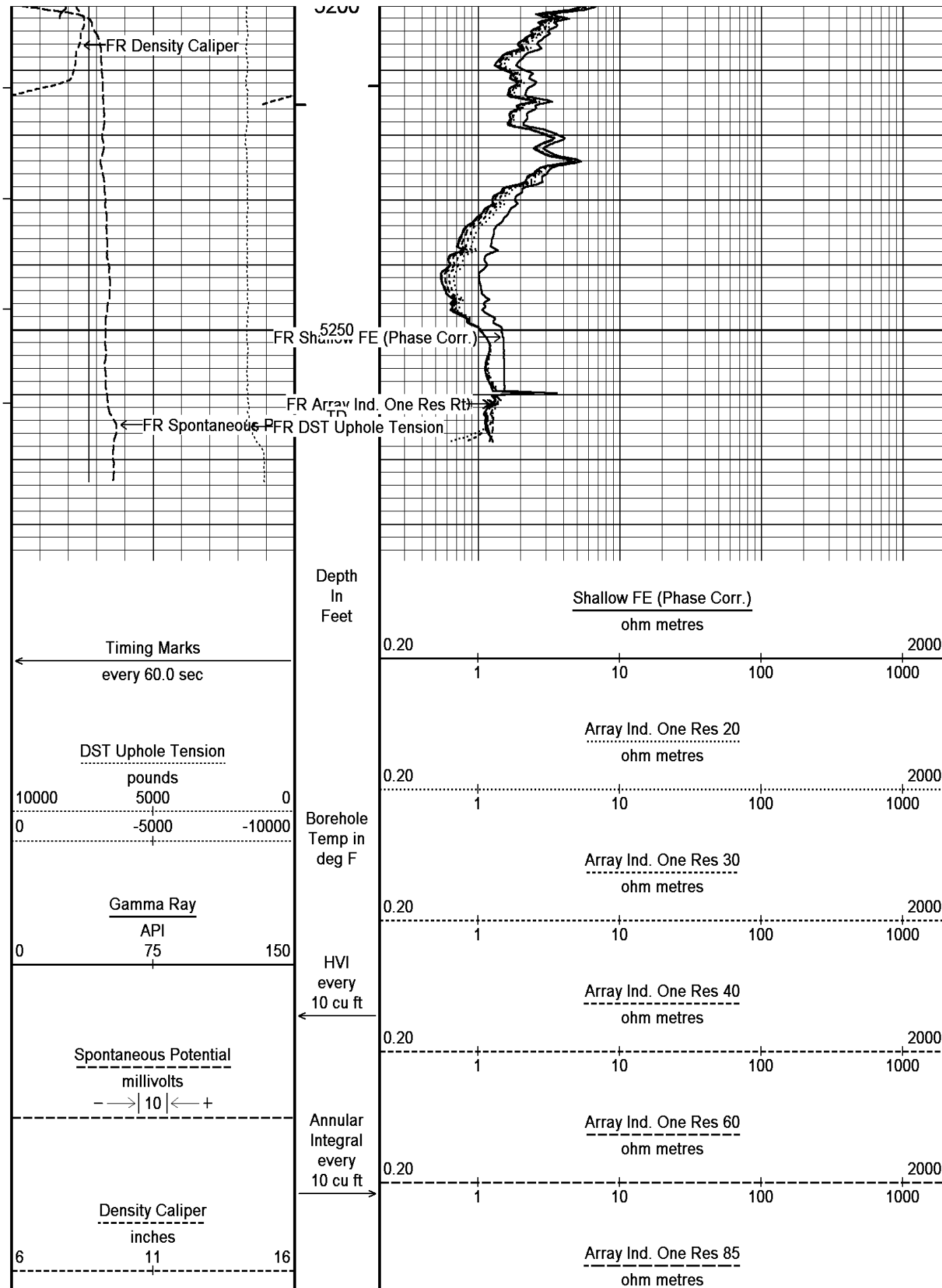
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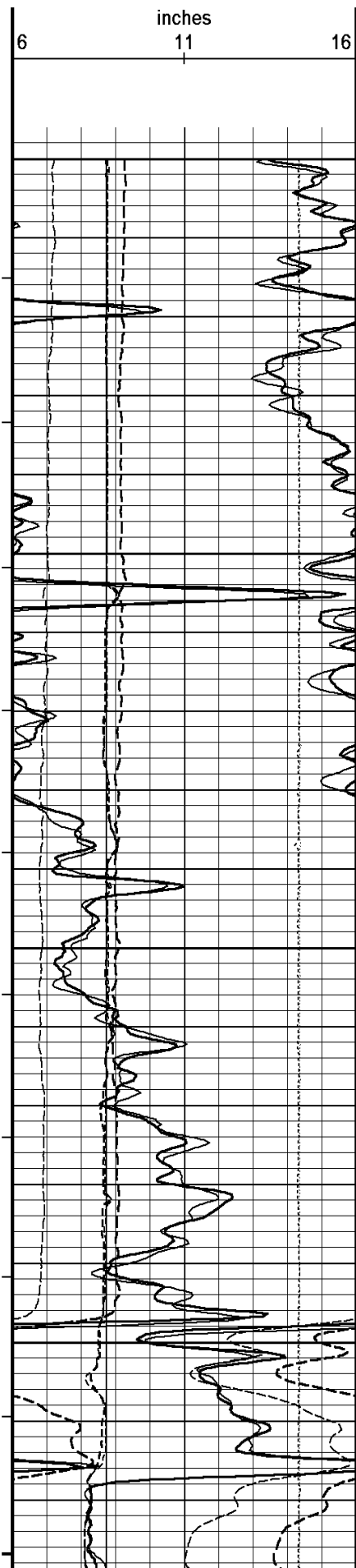
Shallow FE (Phase Cor)











Replay
Scale
1:240

5000

154°

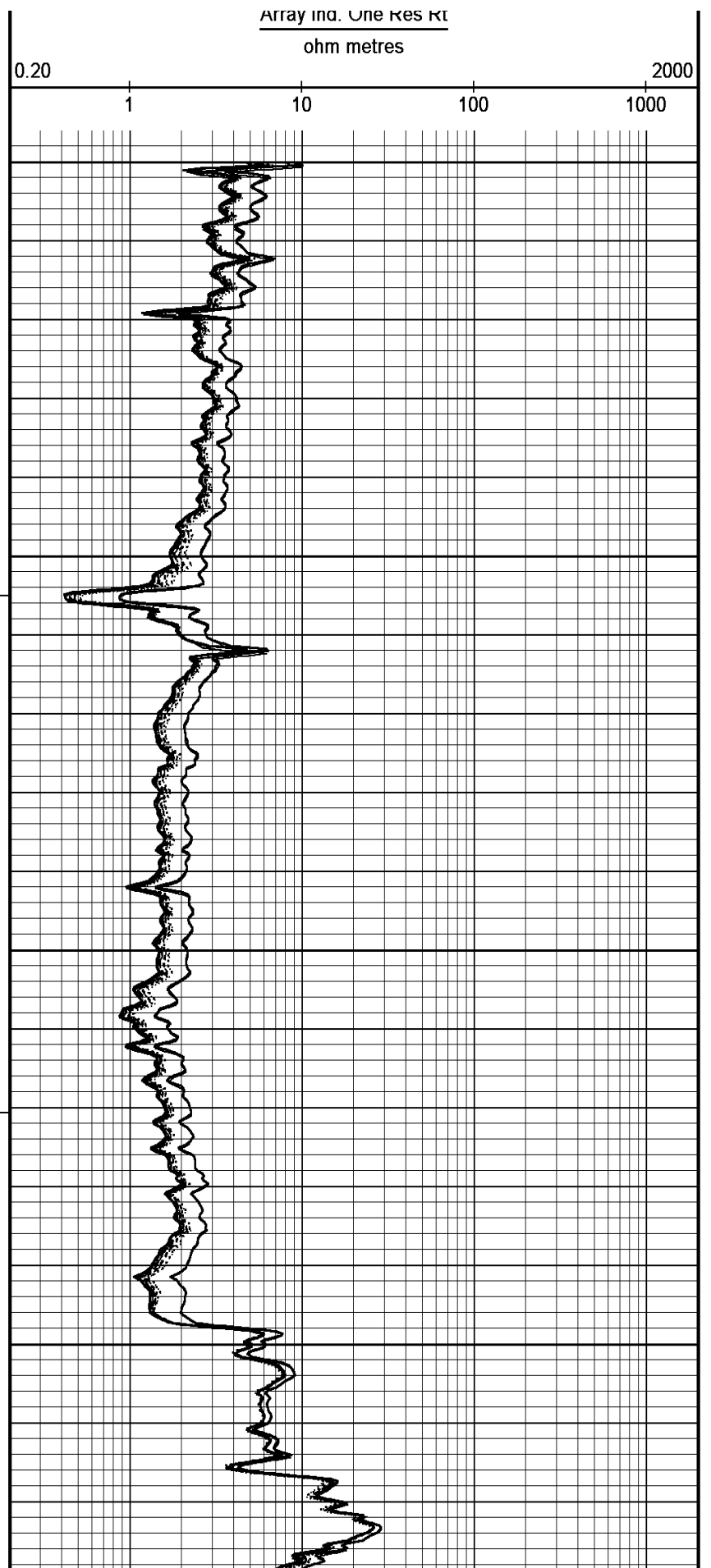
5050

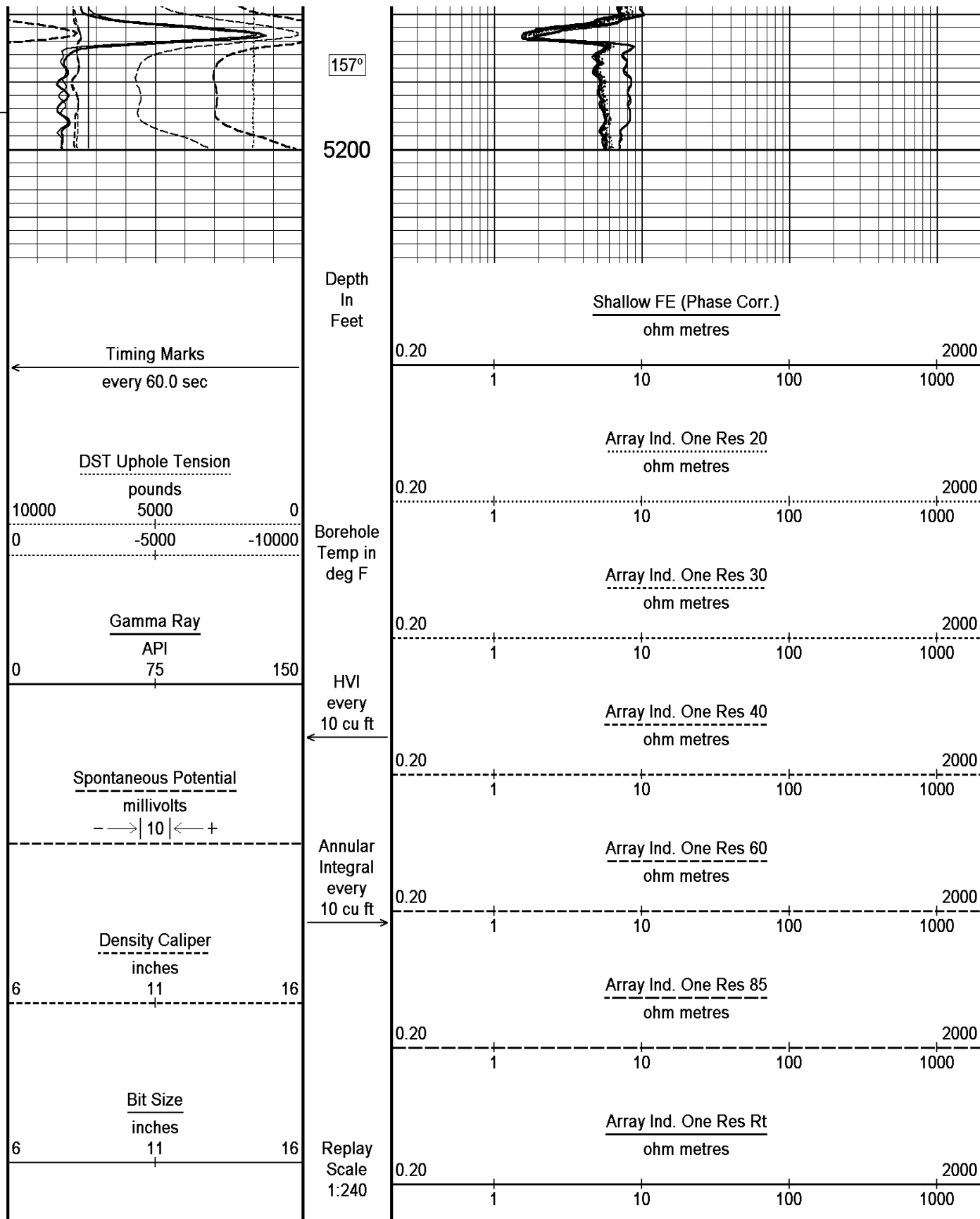
156°

5100

158°

5150





Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 13-NOV-2012 23:09

Filename: C:\Logs\ECGS\ECGS No 6-15 WPD002-1\ECGS 6-15 WPD002-1 MainPass.dta

Recorded on 13-NOV-2012 10:58

Filename: C:\Logs\ECGS\ECGS No 6-15 WPD002-1\ECGS 6-15 WPD002-1 Repeat.dta

Recorded on 13-NOV-2012 09:05

System Versions: Processed with 13.02.6600 Plotted with 13.02.6600

OVERLAY SECTION

BEFORE SURVEY CALIBRATION

C:\Logs\IEGS\IEGS No 6-15 WPD002-1\IEGS 6-15 WPD002-1 Repeat.dta

Down-hole Tension Calibration All 000

Field Calibration on 24-OCT-2010 03:34

Reading No	Measured	0
1	15659.85	0.00
2	15734.68	370.00

General Constants All 000

Last Edited on 13-NOV-2012,08:47

General Parameters		
Mud Resistivity	3.100	ohm-metres
Mud Resistivity Temperature	85.700	degrees F
Water Level	0.000	feet
Density/Neutron 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	7.000	inches
Caliper for Differential Caliper	Density Caliper	

Rwa Parameters	
Porosity used	Base Density Porosity
Resistivity used	Array Ind. One Res Rt
RWA Constant A	0.610
RWA Constant M	2.150

Down-hole Tension Calibration SMS 0

Field Calibration on 13-NOV-2012 08:18

Reading No	Measured	Calibrated (lbs)
1	15164.23	0.00
2	16641.18	500.00

High Resolution Temperature Calibration MCG-D.K 483

Field Calibration on 06-JUL-2012 14:06

	Measured	Calibrated(Deg F)
Lower	0.00	0.00
Upper	0.00	0.00

High Resolution Temperature Constants MCG-D.K 483

Last Edited on

Pre-filter Length	11
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SP Calibration MCG-D.K 483

Field Calibration on 06-JUL-2012 14:06

	Measured	Calibrated (mV)
Reference 1	100.6	100.1
Reference 2	-98.9	-100.1

Gamma Calibration MCG-D.K 483

Field Calibration on 12-NOV-2012 13:13

	Measured	Calibrated (API)
Background	74	50
Calibrator (Gross)	786	530
Calibrator (Net)	712	480

Gamma Constants MCG-D.K 483

Last Edited on 13-NOV-2012,04:36

Gamma Calibrator Number	GRCC-112	
Mud Density	1.00	gm/cc
Caliper Source for Processing	Density Caliper	

Caliper Source for Processing	Density Caliper			
Tool Position	Eccentred			
Concentration of KCl	0.00	kppm		
Neutron Calibration MDN-B.A 227			Base Calibration on 15-OCT-2012 15:48 Field Check on 12-NOV-2012 13:22	
Base Calibration				
		Measured	Calibrated (cps)	
	Near	Far	Near	Far
	2896	90	3714	110
Ratio	32.069		33.764	
Field Calibrator at Base			Calibrated (cps)	
			1658	2365
Ratio	0.701			
Field Check			Calibrated (cps)	
			1633	2356
Ratio	0.693			
Neutron Constants MDN-B.A 227			Last Edited on 13-NOV-2012,04:35	
Neutron Source Id	P44382B			
Neutron Jig Number	NEC43			
Epithermal Neutron	No			
Caliper Source for Processing	Density Caliper			
Stand-off	0.00	inches		
Mud Density	1.00	gm/cc		
Limestone Sigma	7.10	cu		
Sandstone Sigma	7.00	cu		
Dolomite Sigma	4.70	cu		
Formation Pressure Source	None			
Formation Pressure	N/A	kpsi		
Temperature Source	None			
Temperature	N/A	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			
Navigation Constants MIE-A.A 174			Last Edited on 29-MAR-2010,02:58	
Magnetic Declination	0.00	degrees	East	
Magnetometer Parameters MIE-A.A 174				
Date Of Last Magnetometer Calibration	01-JAN-1998			
	X Magnetometer	Y Magnetometer	Z Magnetometer	
Slope	-1.000000	-1.010750	-0.999300	
Offset	0.009287	-0.020140	0.013025	
Magnetometer Constants MIE-A.A 174			Last Edited on	
Magnetometer Calibrator Number	000			
Accelerometer Parameters MIE-A.A 174				
Date Of Last Accelerometer Calibration	01-JAN-1998			
	X Accelerometer	Y Accelerometer	Z Accelerometer	
Slope	-1.108610	-1.104030	-1.096720	
Offset	0.005796	-0.001009	0.012654	
Accelerometer Constants MIE-A.A 174			Last Edited on 23-APR-2009,07:34	
Accelerometer Calibrator Number	000			

Accelerometer Temperature Characterisation

X Accelerometer

Serial Number	644			
Calibration Date	19-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	8.97681e-006	-1.88894e-008	1.27694e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.72633e-004	2.24457e-007	1.11567e-009

Y Accelerometer

Serial Number	679			
Calibration Date	24-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	2.76667e-005	-1.48113e-008	9.65949e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.60693e-004	5.14448e-007	-1.83309e-010

Z Accelerometer

Serial Number	687			
Calibration Date	30-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-2.68884e-005	4.88649e-009	-1.07028e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.65798e-004	2.86695e-007	9.16986e-010

Caliper Calibration MIE-A.A 174

Base Calibration on 13-NOV-2012 03:57

Field Calibration on 13-NOV-2012 03:58

Base Calibration

Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)
1	26539	26547	5.96
2	36989	37140	7.99
3	46454	46711	9.86
4	55567	58265	11.93
5	0	0	0.00

Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	26424	25773	25566	25741	5.96
2	35767	34710	33739	34118	7.99
3	43766	42899	41717	42151	9.86
4	51706	54174	52590	50282	11.93
5	0	0	0	0	0.00

Field Calibration

Measured	Measured	Actual		
Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)	Caliper(in)		
8.02	7.97	7.99		
Measured	Measured	Measured	Measured	Actual
Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
4.00	3.96	3.99	4.05	7.99

Caliper Constants MIE-A.A 174

Last Edited on 13-NOV-2012,03:53

Caliper Difference for BRKT 0.120 inches

Imager Pad Check MIE-A.A 174

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-A.A 174

Last Edited on 13-NOV-2012,04:35

Sonde Configuration Imager Mode degrees

Arm-Pad Kit	Normal Pads (12.25 in)		
Centre Pad 1 Rotational Offset	0.00		
Image/Borehole Ovality Reference	Azimuth of Pad 1	degrees	
Non Active Buttons	Omit	feet	
Search Angle	0.00	feet	
Correlation Interval	3.28	mAmp	
Correlation Step	1.64	mAmp	
Current Offset	0.0000		
Squasher Start	N/A		
Image Processing	Enabled		
FE Calibration MFE-A.A 66		Base Calibration on 15-OCT-2012 13:42 Field Check on 12-NOV-2012 13:15	
Base Calibration			
	Measured	Calibrated (ohm-m)	
Reference 1	0.0	0.0	
Reference 2	997.0	126.8	
Base Check		272.6	
Field Check		272.7	
FE Constants MFE-A.A 66		Last Edited on 13-NOV-2012,04:34	
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	Temperature Corr		
Temp. for Rm Corr.	MCG External Temperature		
Stand-off	1.0	inches	
FE Calibration MAI-A.A 165		Base Calibration on 12-FEB-2009 10:30 Field Check on 04-APR-2009 14:52	
Base Calibration			
	Measured	Calibrated (ohm-m)	
Reference 1	0.0	0.0	
Reference 2	976.9	126.8	
Base Check		277.9	
Field Check		278.3	
FE Constants MAI-A.A 165		Last Edited on 04-APR-2009,15:12	
Running Mode	0		
MFE K Factor	0.0000		
Caliper Source for FE correction	Density Caliper		
Caliper Value for FE correction	N/A	inches	
Rm Source for FE correction	Temperature Corr		
Temp. for Rm Corr.	MCG External Temperature		
Stand-off	1.0	inches	
High Resolution Temperature Calibration MAI-A.A 165		Field Calibration on 10-OCT-2011,15:43	
	Measured	Calibrated(Deg F)	
Lower	50.00	50.00	
Upper	75.00	75.00	
High Resolution Temperature Constants MAI-A.A 165		Last Edited on 15-OCT-2012,13:33	
Pre-filter Length	11		
Induction Calibration MAI-A.A 165		Base Calibration on 15-OCT-2012,13:08 Field Check on 12-NOV-2012 13:09	
Base Calibration			

Test Loop Calibration		Measured		Calibrated (mmho/m)	
Channel		Low	High	Low	High
1		17.2	469.6	9.3	966.2
2		6.7	392.8	7.6	821.4
3		4.2	262.3	5.2	566.0
4		1.6	136.6	2.6	279.2
Array Temperature		75.0		Deg F	
		Base Check (mmho/m)		Field Check (mmho/m)	
Channel		Low	High	Low	High
1		12.9	3869.0	11.7	3869.6
2		28.4	3433.8	28.0	3434.9
3		26.7	3021.4	26.5	3022.8
4		19.7	2016.0	19.6	2017.1
Deep		17.3	2011.3	17.2	2012.6
Medium		37.6	3970.8	37.4	3972.6
Shallow		41.2	5011.9	40.6	5012.9
Array Temperature		69.2		53.8	Deg F

Induction Constants MAI-A.A 165

Last Edited on 13-NOV-2012,04:34

Induction Model		RtAP-WBM	
Caliper for Borehole Corr.		Density Caliper	
Hole Size for Borehole Correction		N/A	inches
Tool Centred		No	
Stand-off Type		Fins	
Stand-off		1.00	inches
Number of Fins on Stand-off		6.0000	
Stand-off Fin Angle		60.00	degrees
Stand-off Fin Width		0.0500	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	

Caliper Calibration MPD-C.A 195

Base Calibration on 15-OCT-2012 13:53

Field Calibration on 12-NOV-2012 13:26

Base Calibration		
Reading No.	Measured	Calibrator Size (in)

DOWNHOLE EQUIPMENT

C:\Logs\IECGS\IECGS No 6-15 WPD002-1\IECGS 6-15 WPD002-1 Repeat.dta

SHA-J.B Compact Swivel Head Adaptor
SHA-J.B 511 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-D.K 483 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron
MDN-B.A 227 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-C.A 195 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

MIS-D.B Compact Inline Bowspring sub
MIS-D.B 696 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint
SKJ-D.A 112 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

MIS-E.A Compact Inline Standoff sub
MIS-E.A 334 LG: 2.14 ft WT: 15.4 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint
SKJ-D.A 143 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SHA-J.B Compact Swivel Head Adaptor
SHA-J.B 574 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

SHA-J.B Compact Swivel Head Adaptor
SHA-J.B 510 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact MMI Memory Section
MIM-A.A 174 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

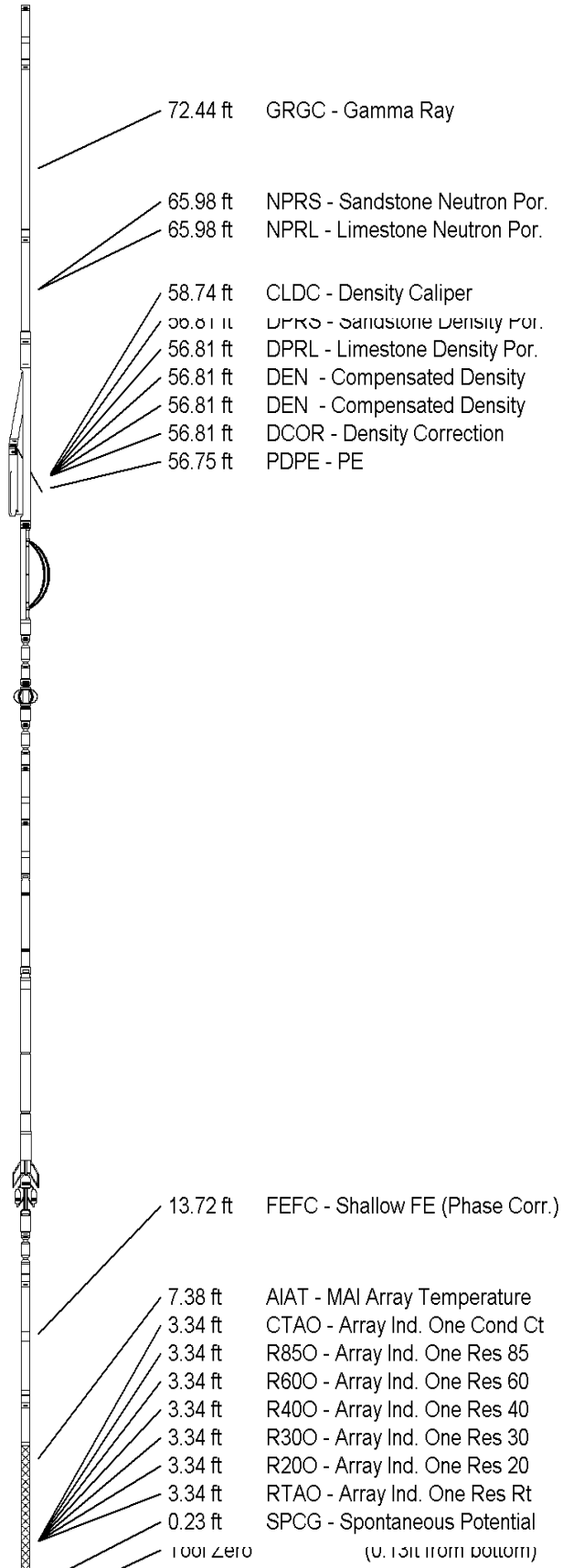
Compact MMI Electrode Section
MIE-A.A 174 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

SKJ-D.A Compact Knuckle Joint
SKJ-D.A 66 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact Focussed Electric
MFE-A.A 66 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 165 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 80.03 ft Weight: 615.1 lb





-0.13 ft SMIU - DSI Uphole Tension
All measurements relative to tool zero.

COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 6-15 WPD002-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4570.00	feet	First Reading	5262.00	feet
Elevation Drill Floor	4569.00	feet	Depth Driller	5270.00	feet
Elevation Ground Level	4556.00	feet	Depth Logger	5265.00	feet



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