

**Weatherford****ARRAY INDUCTION
LOGS****COMPANY EAST CHEYENNE GAS STORAGE LLC****WELL ECGS No 6-19D WPD003-1****FIELD PEETZ WEST****PROVINCE/COUNTY LOGAN****COUNTRY/STATE USA/COLORADO****LOCATION SESE 653' FSL AND 716' FEL****SEC****TWP 6 11N****RGE 52W****Other Services
MPD/MDN
CMI****API Number****05-075-09409****Permit Number****Permanent Datum GL, Elevation 4553 feet****Log Measured From KB****Drilling Measured From KB****Date 28-OCT-2012****Run Number ONE****Depth Driller 5285.00 feet****Depth Logger 5288.00 feet****First Reading 5285.00 feet****Last Reading 1216.00 feet****Casing Driller 1220.00 feet****Casing Logger 1216.00 feet****Bit Size 8.750 inches****Hole Fluid Type WBM****Density / Viscosity 9.90 lb/USg 52.00 CP****PH / Fluid Loss 7.50 7.50 ml/30Min****Sample Source FLOWLINE****Rm @ Measured Temp 3.33 @ 62.7 ohm-m****Rmf @ Measured Temp 2.664 @ 62.7 ohm-m****Rmc @ Measured Temp 3.996 @ 62.7 ohm-m****Source Rmf / Rmc CALC CALC****Rm @ BHT 1.401 @153.0 ohm-m****Time Since Circulation 4 HOURS****Max Recorded Temp 153.00 deg F****Equipment Name COMPACT****Equipment / Base 13144 RK SPR****Recorded By T. BENICH J. PAULSON****Witnessed By J. ASHBY L. CARRASCO****Elevations:
KB 4566.00
DF 4565.00
GL 4553.00****BOREHOLE RECORD**

Last Edited: 28-OCT-2012 21:23

**Bit Size
inches**

8.750

**Depth From
feet**

1216.00

**Depth To
feet**

5288.00

CASING RECORD**Type**

SURFACE

**Size
inches**

9.625

**Depth From
feet**

0.00

**Shoe Depth
feet**

1216.00

**Weight
pounds/ft**

36.00

REMARKS

SOFTWARE VERSION 13.03.7779

TOOLS RUN: SHA, MCG, MDN, MPD, MIS-D, SKJ, MIS-E, SKJ, SHA, MIM, MIE, SKJ, MFE, MAI RUN IN COMBINATION.

HARDWARE:

MPD: 8" PROFILE PLATE USED.

MAI: TWO 1 INCH STANDOFFS USED.

MDN: DUAL BOWSPRING USED.

MIM: ONE NONMETALIC CENTRALIZING BASKET USED.

MIE: ONE 1 INCH STANDOFF USED

2.65 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY FROM TD TO BOTTOM OF FORT HAYES FORMATION(5288FT 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.

IMAGER PAD 3 APPEARED TO HAVE COMMS PROBLEMS FROM 5170 FT TO 4890 FT.

PAD 6 APPEARS TO HAVE BAD BUTTONS.

CALIPERS WERE CLOSED AND REOPENED AT 4795 TO TRY TO REMOVE MUDCAKE

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.

LAT/ LONG: 40.95080 N / 103.21282 W

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1800 CUBIC FEET

ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 730 CUBIC FEET

TOTAL VOLUME FROM TD TO 4200 FT =440 CUBIC FEET

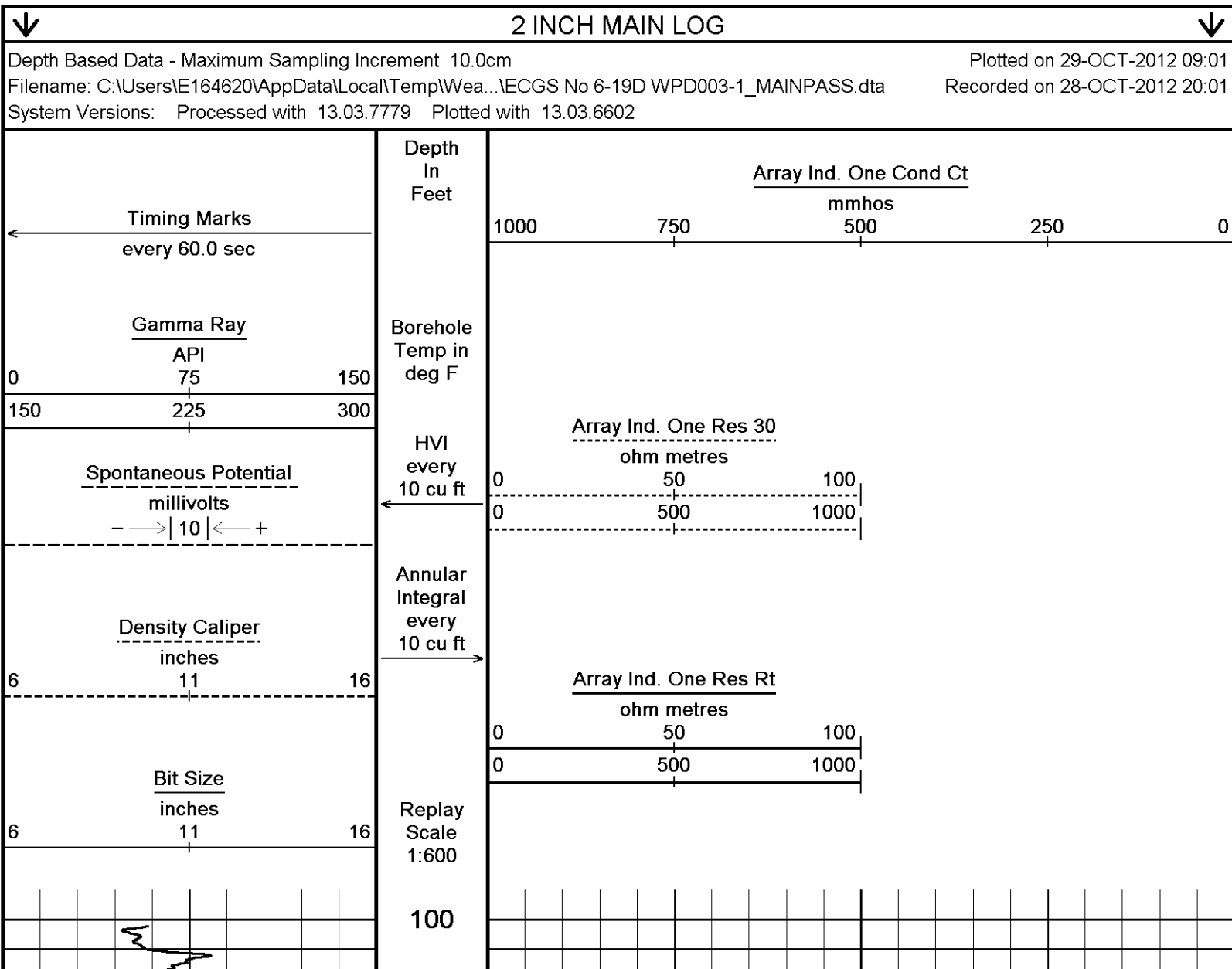
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT = 160 CUBIC FEET

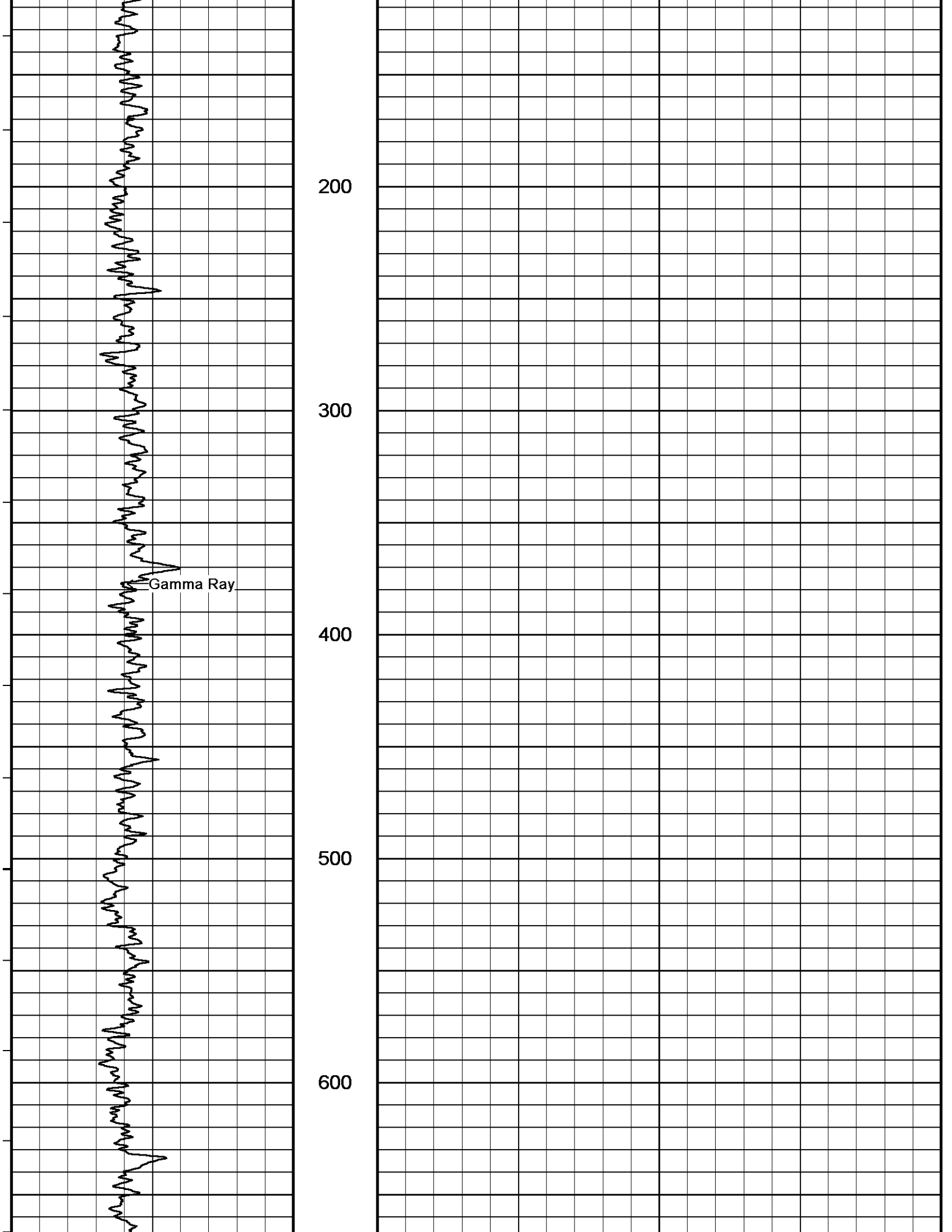
SERVICE ORDER: 3531933

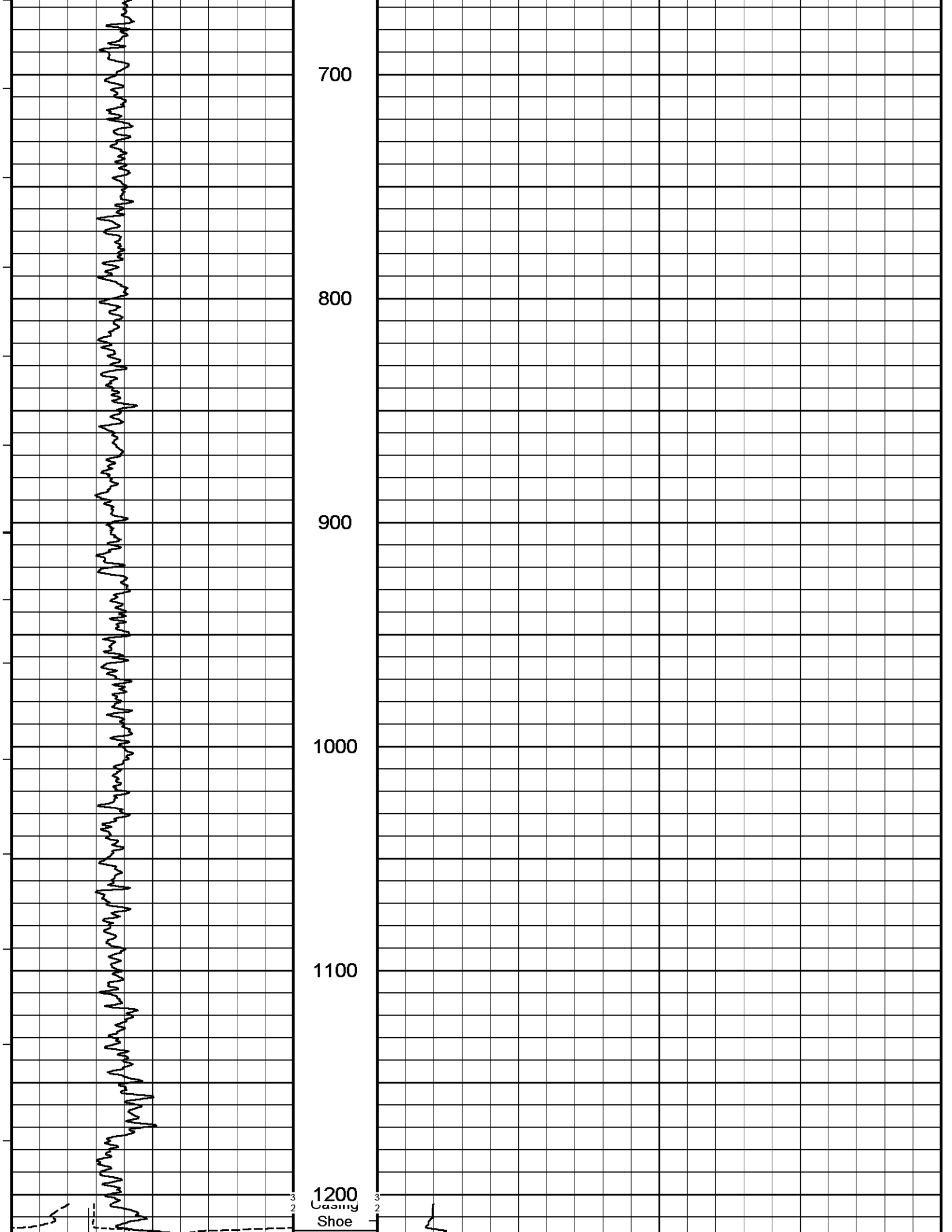
OPERATOR: B. PECK

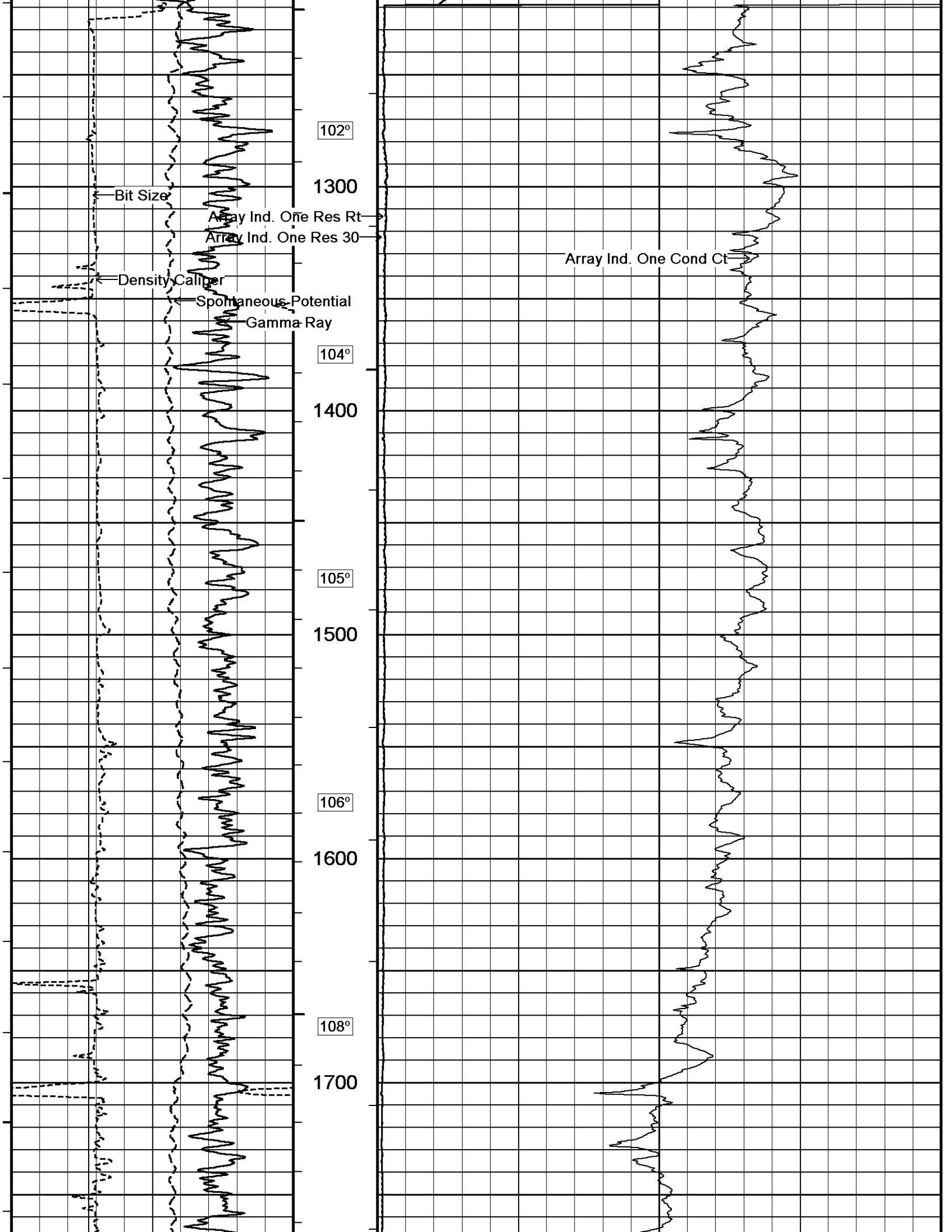
RIG: CADE 22

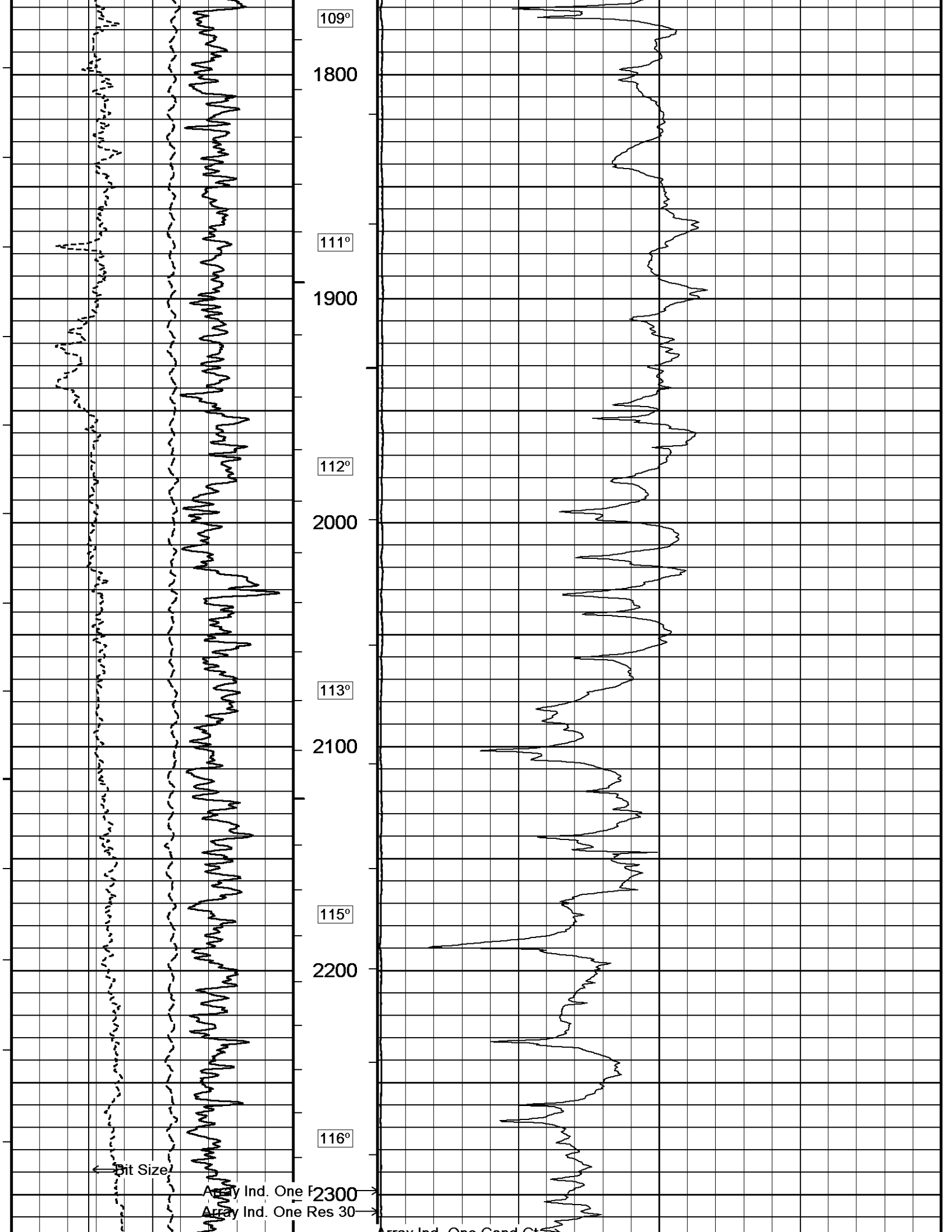
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, 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.

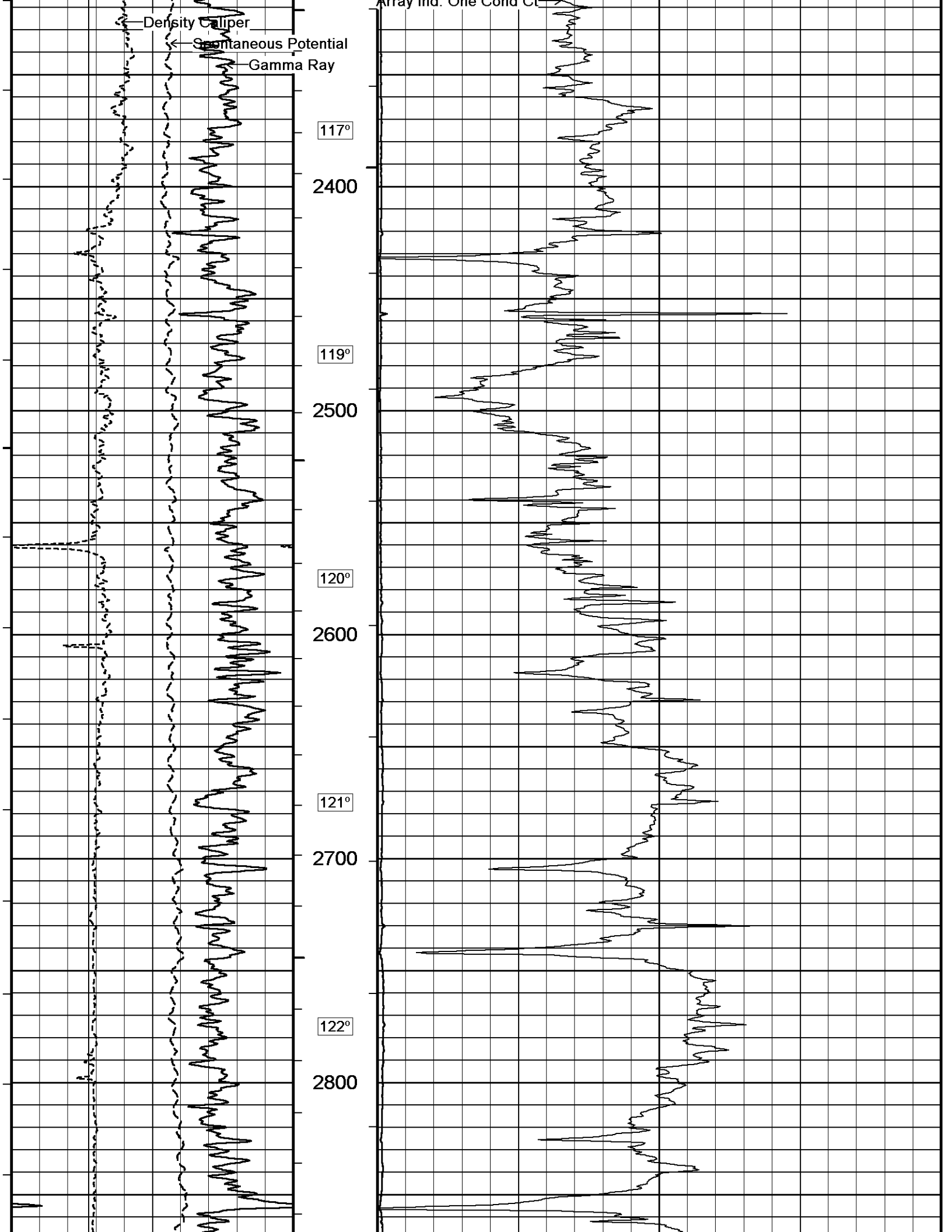


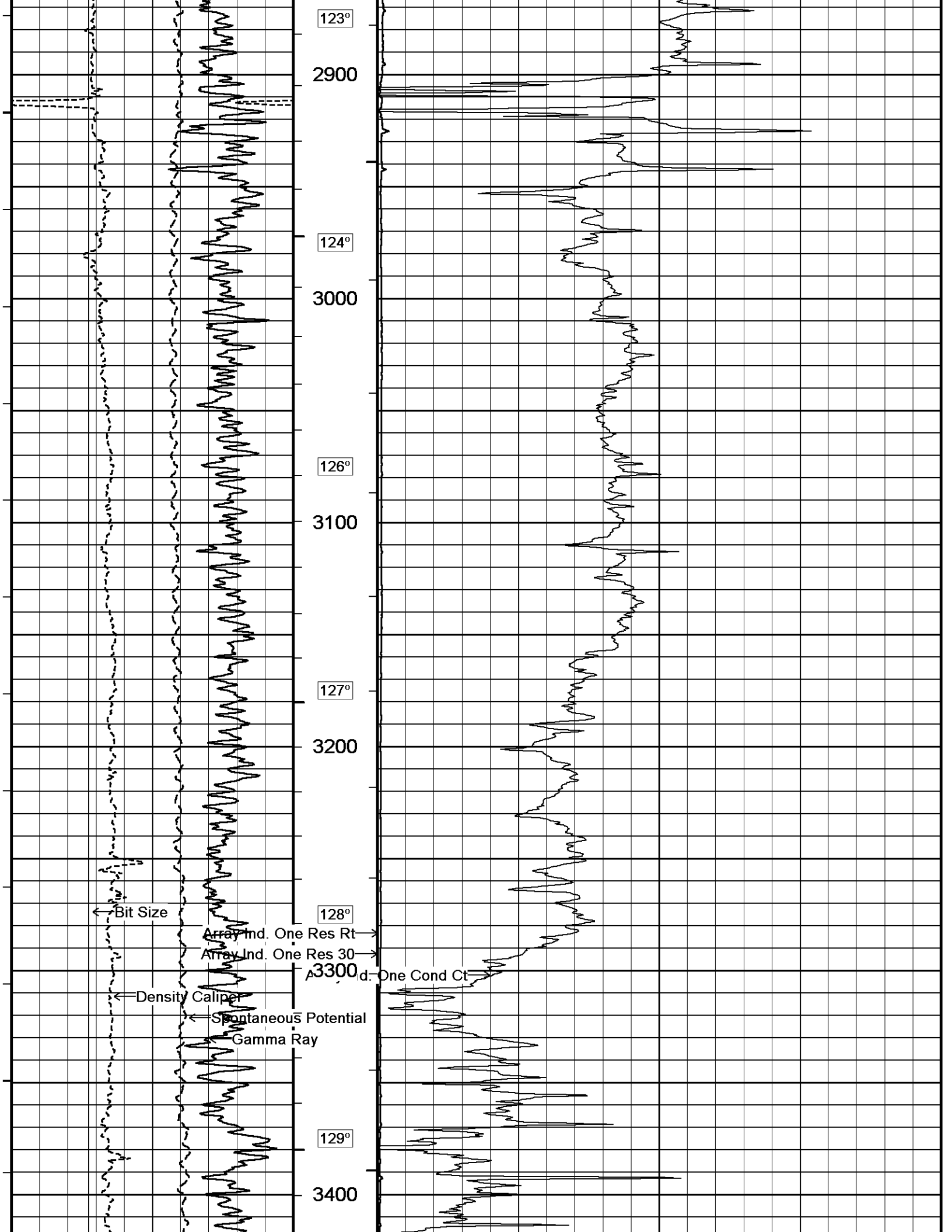


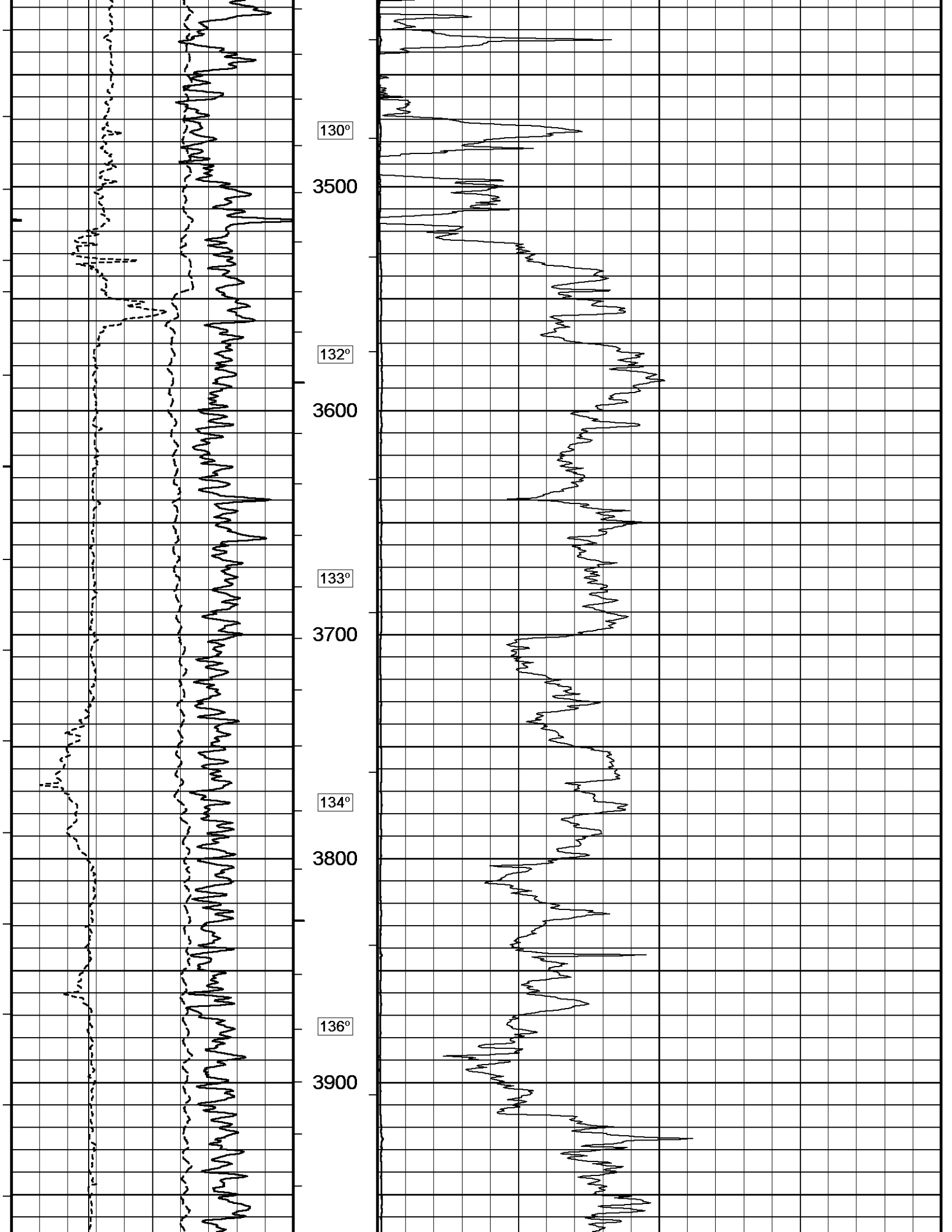


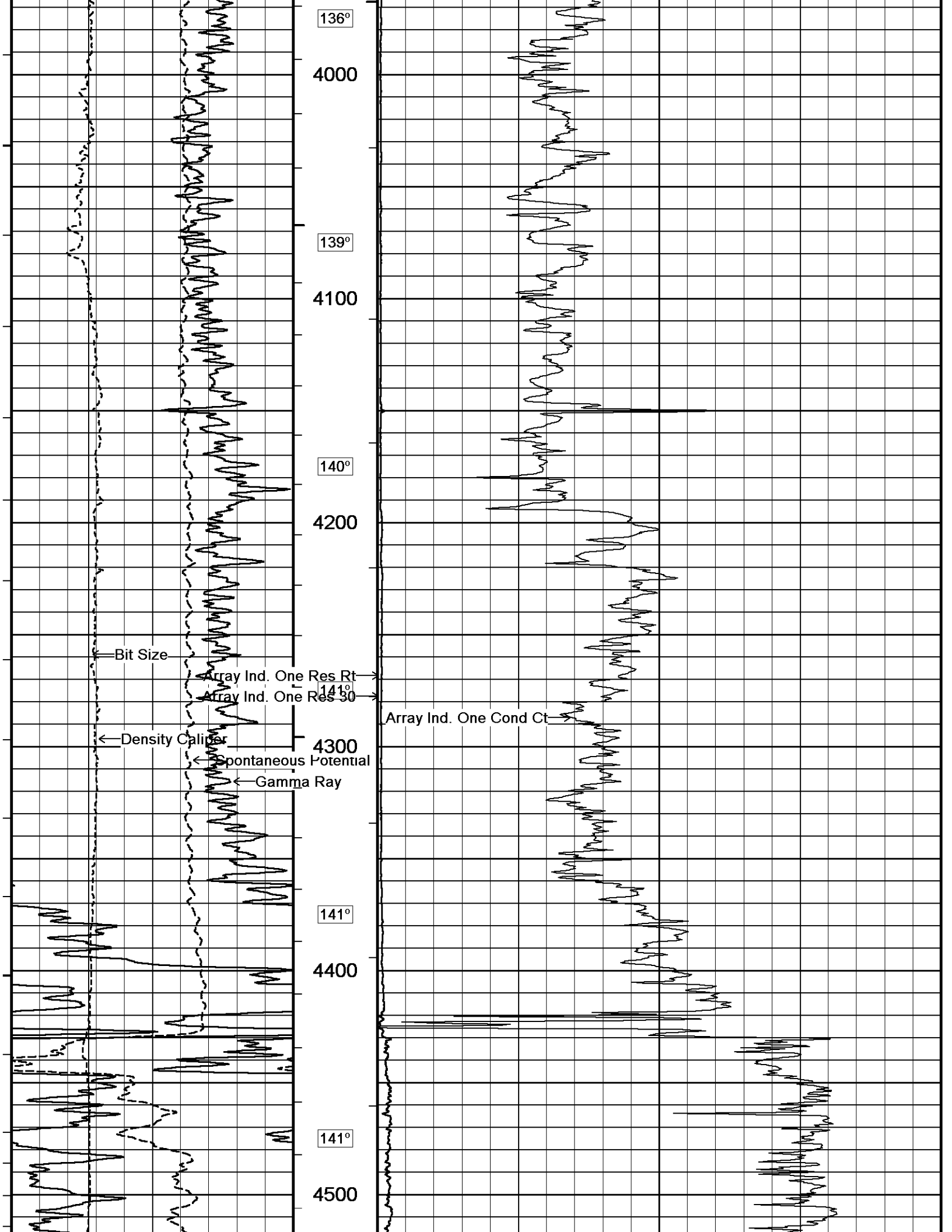


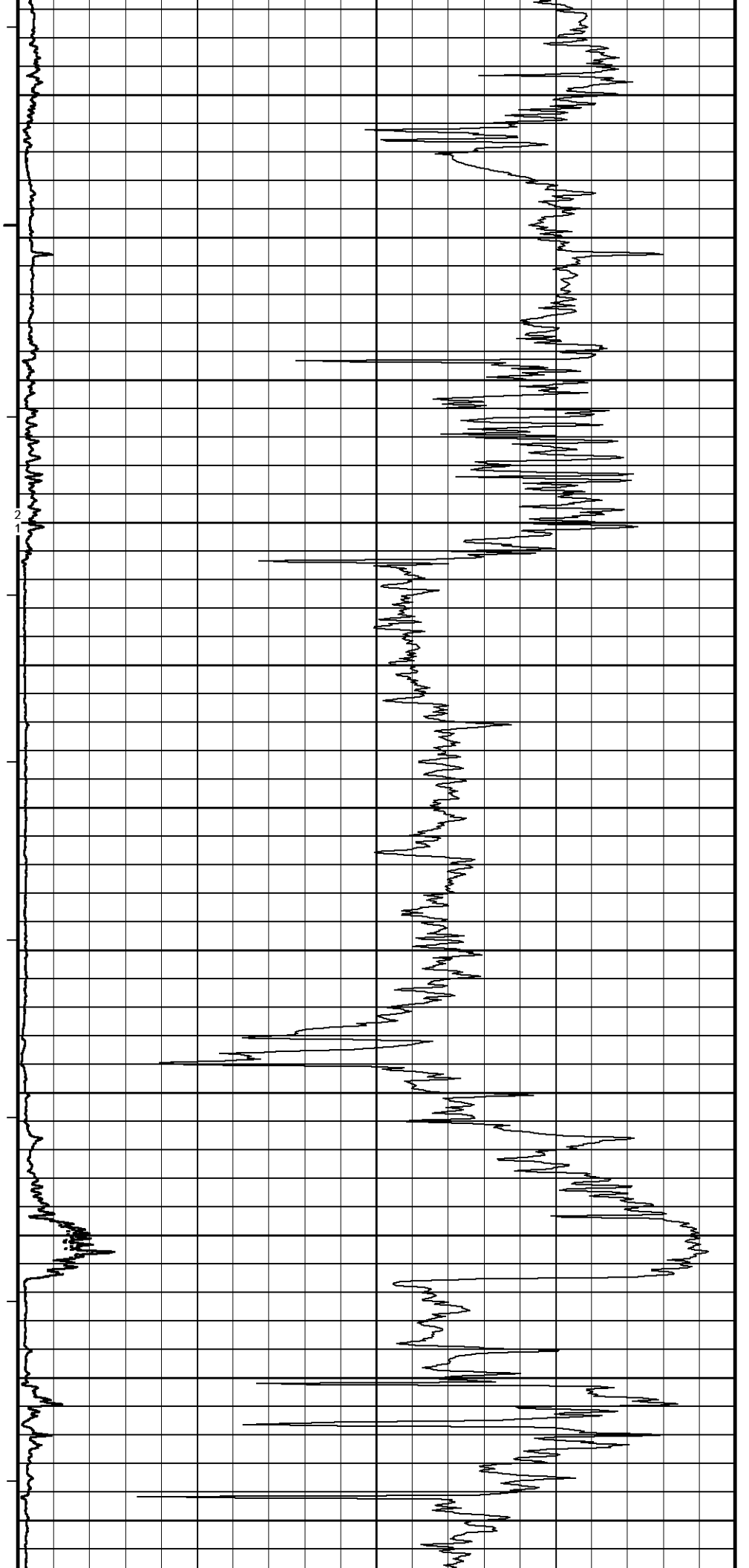
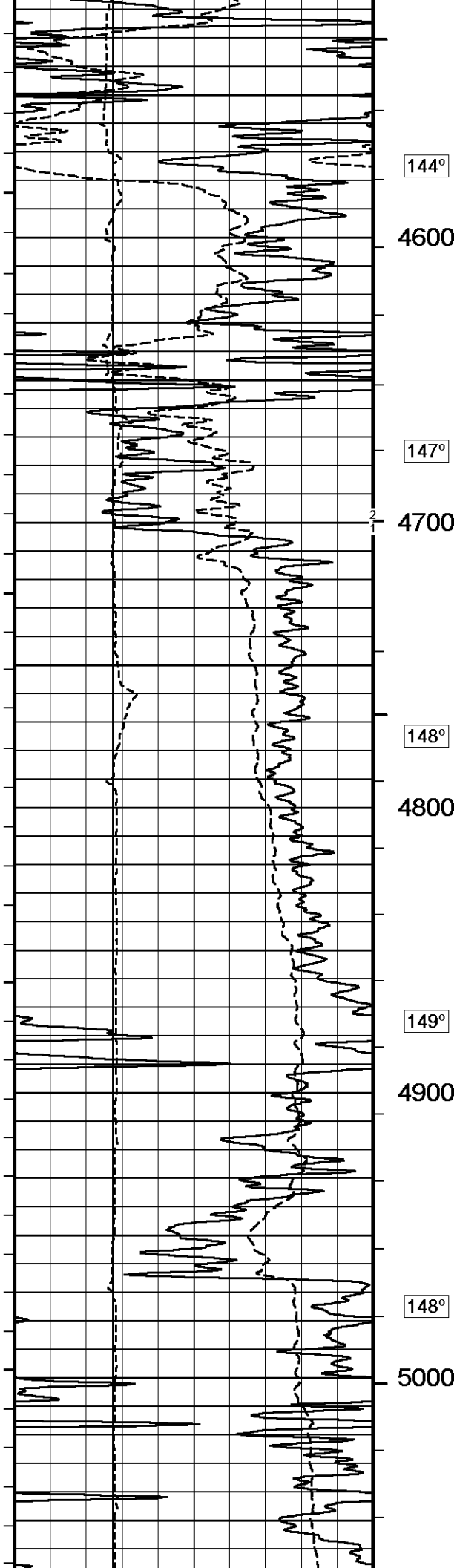


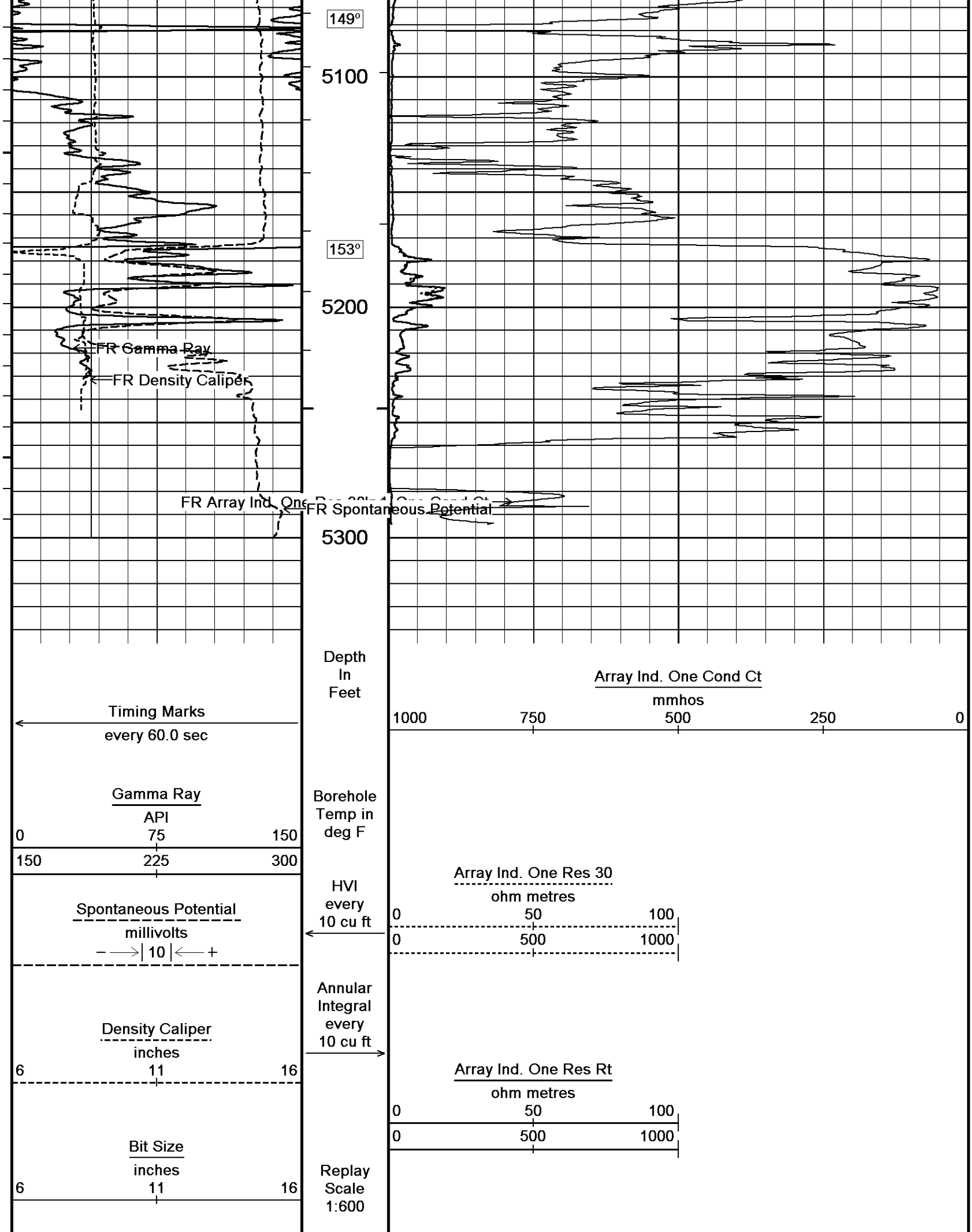












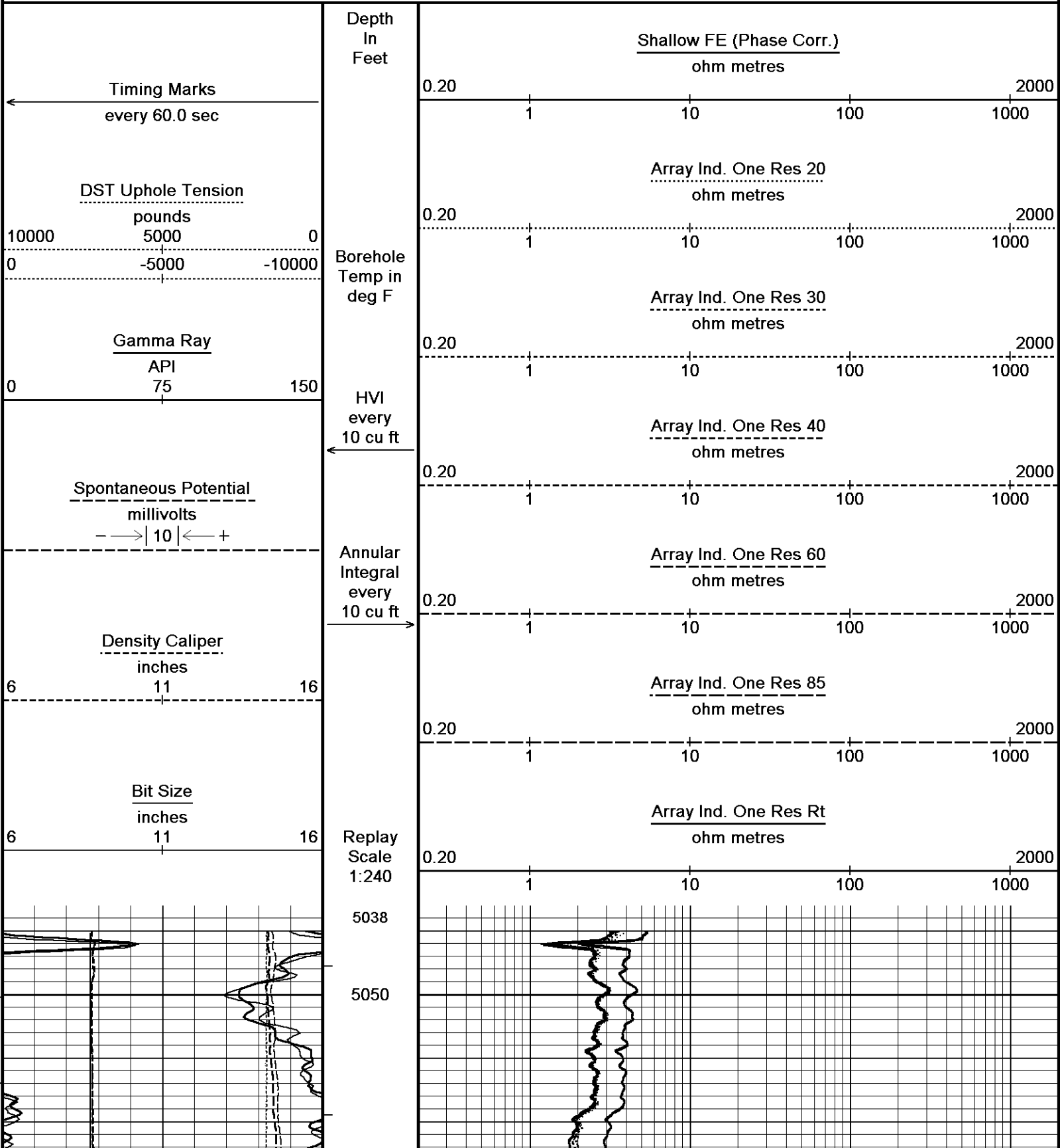
↓

MAIN PASS
REPEAT

↓

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\E164620\AppData\Local\Temp\Wea... \ECGS No 6-19D WPD003-1_MAINPASS.dta
Filename: C:\Users\E164620\AppData\Local\Temp\Weath... \ECGS No 6-19D WPD003-1_REPEAT.dta
System Versions: Processed with 13.03.7779 Plotted with 13.03.6602

Plotted on 29-OCT-2012 09:01
Recorded on 28-OCT-2012 20:01
Recorded on 28-OCT-2012 19:43





149°

5100

151°

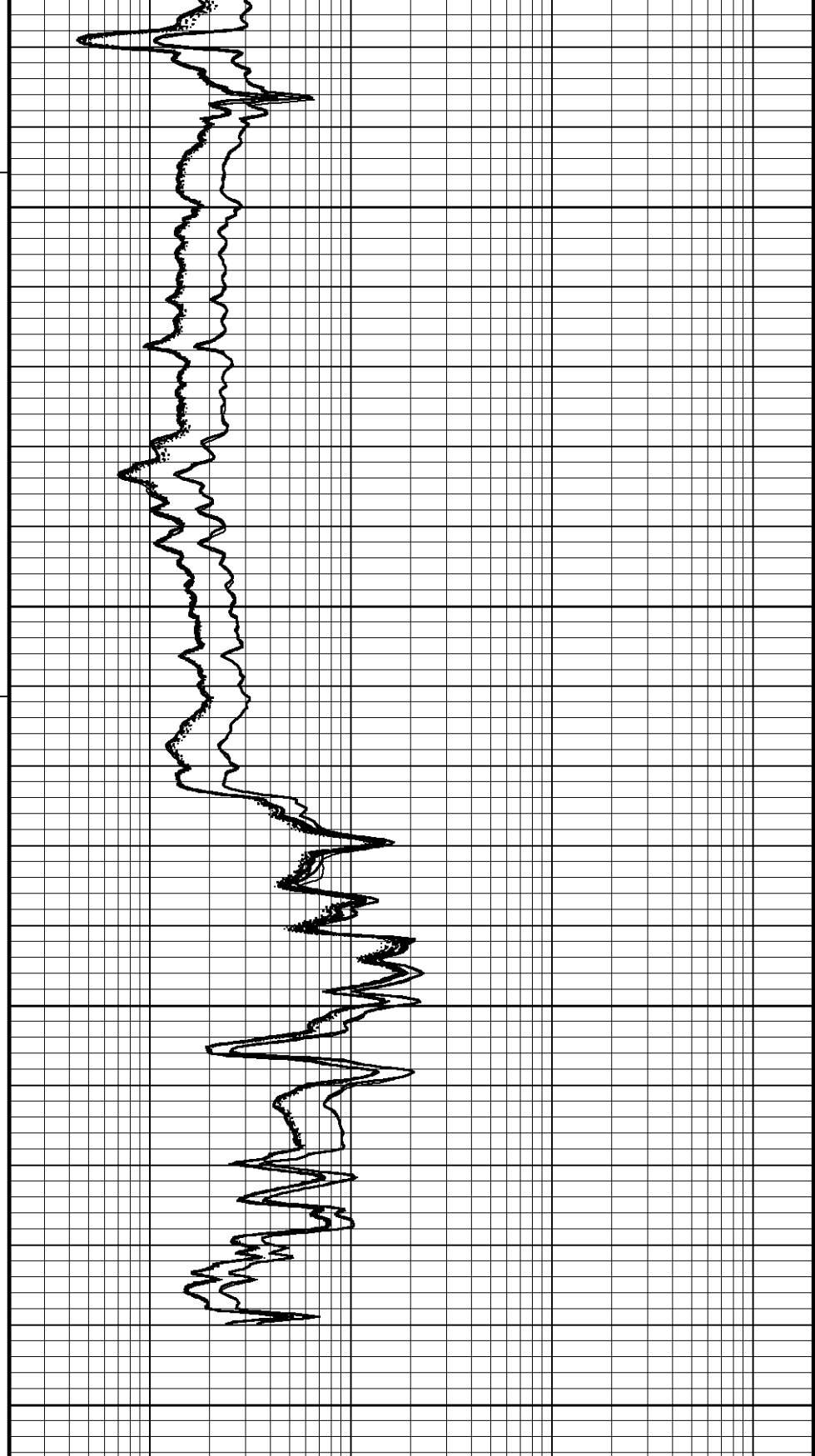
5150

153°

5200

5250

Depth
In
Feet

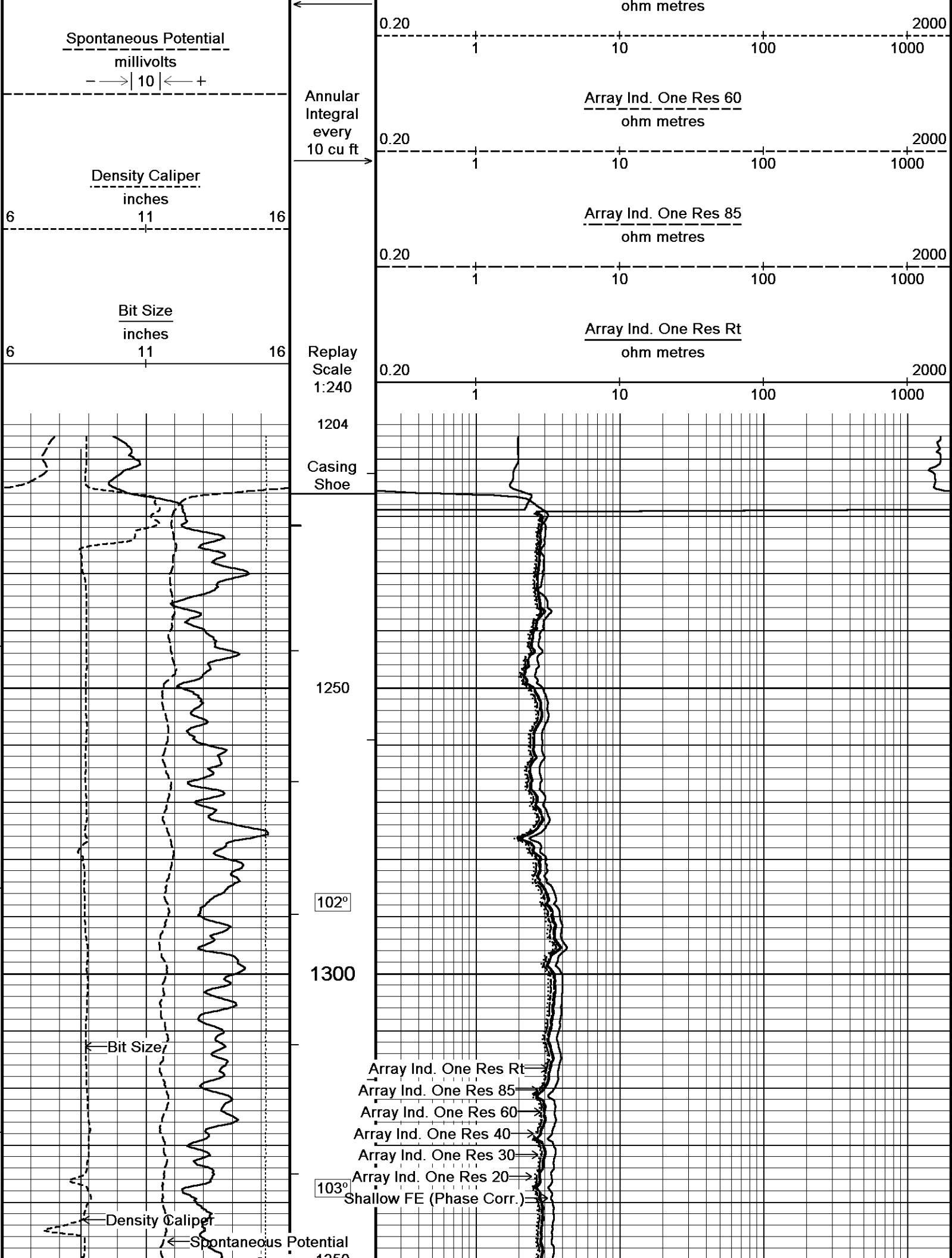


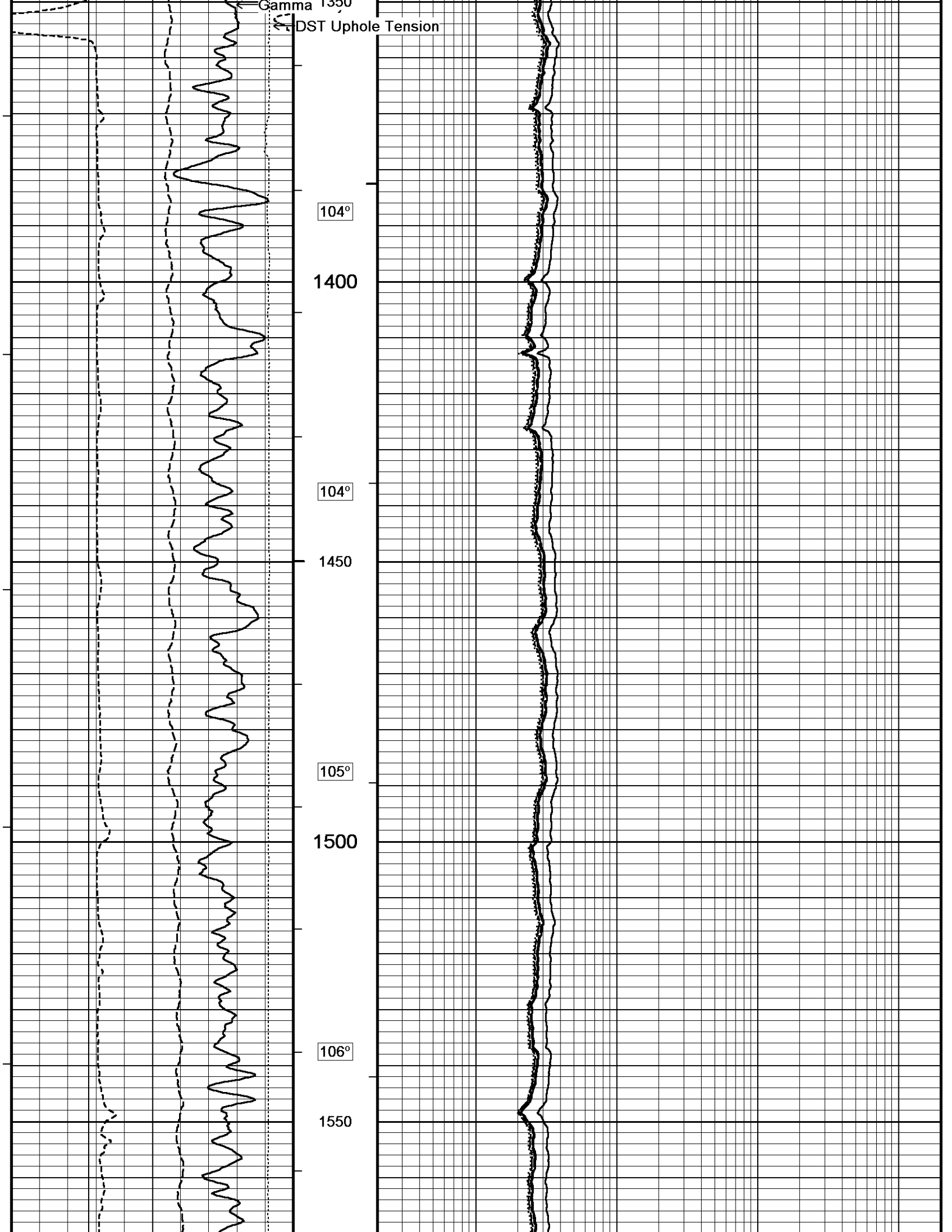
Shallow FE (Phase Corr.)
ohm metres

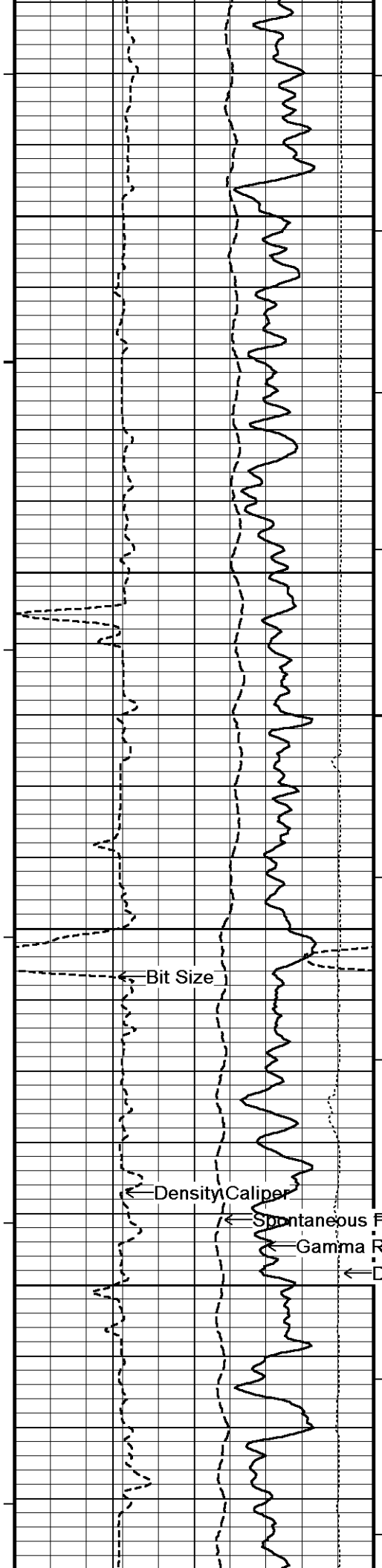
0.20 1 10 100 1000 2000

Array Ind. One Res 20
ohm metres

0.20 1 10 100 1000 2000







106°

1600

107°

1650

108°

1700

109°

1750

110°

- Array Ind. One Res Rt
- Array Ind. One Res 85
- Array Ind. One Res 60
- Array Ind. One Res 40
- Array Ind. One Res 30
- Array Ind. One Res 20
- Shallow FE (Phase Corr.)

Bit Size

Density

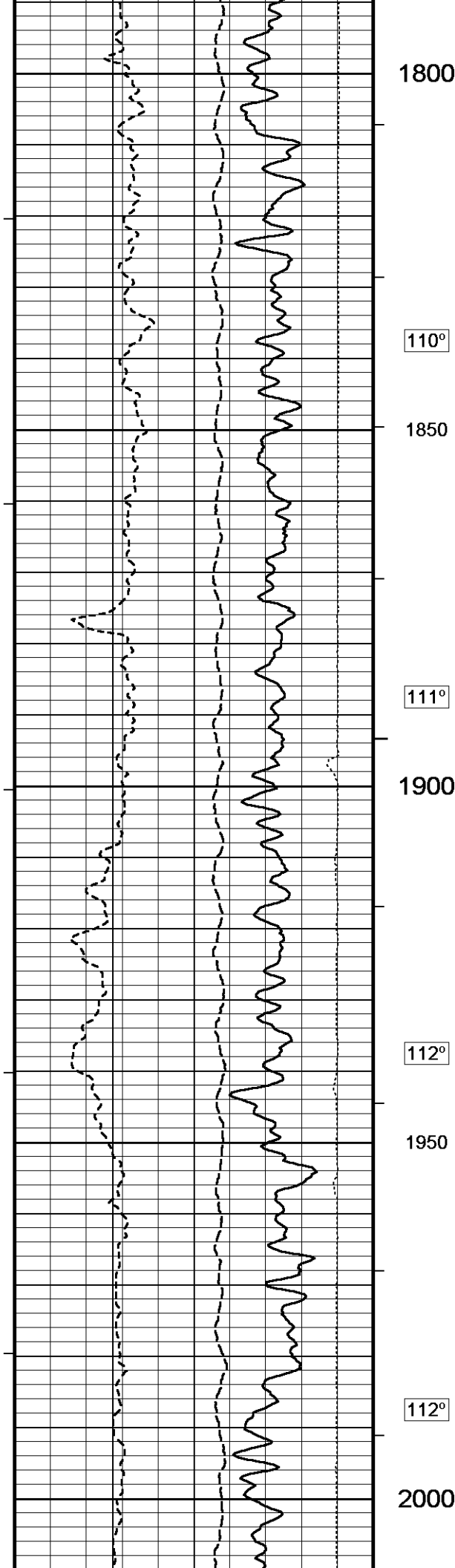
Caliper

Spontaneous Potential

Gamma Ray

DST

Wellbore Tension



1800

110°

1850

111°

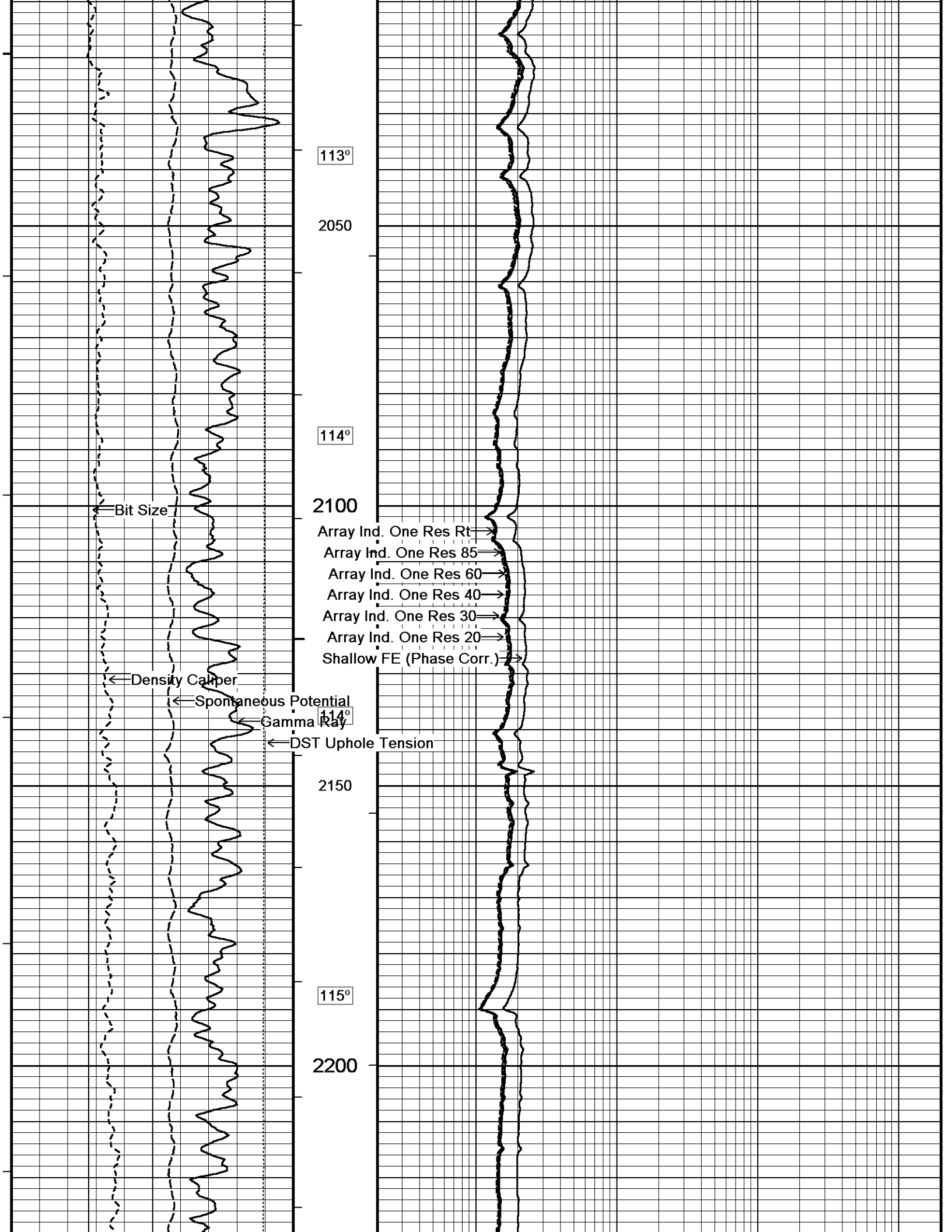
1900

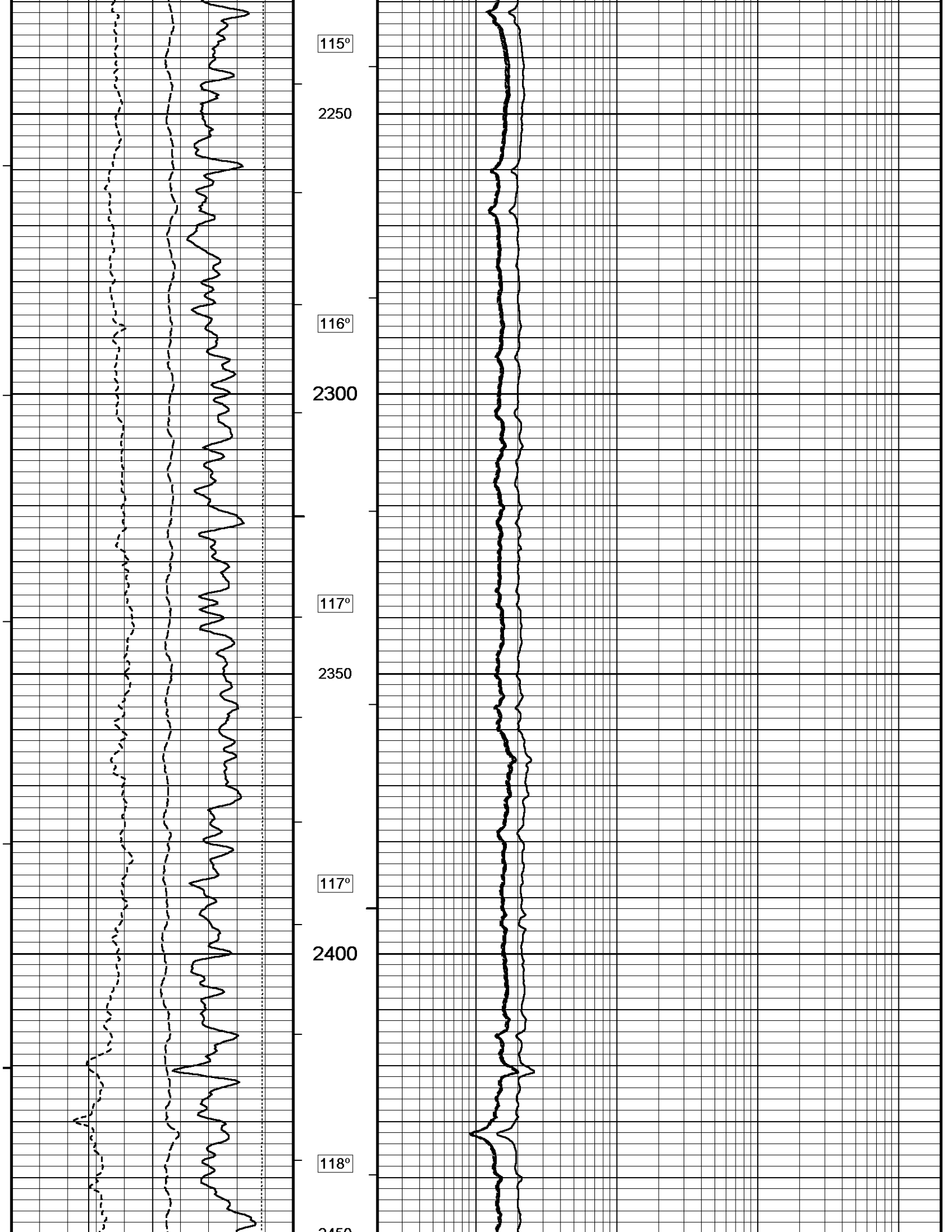
112°

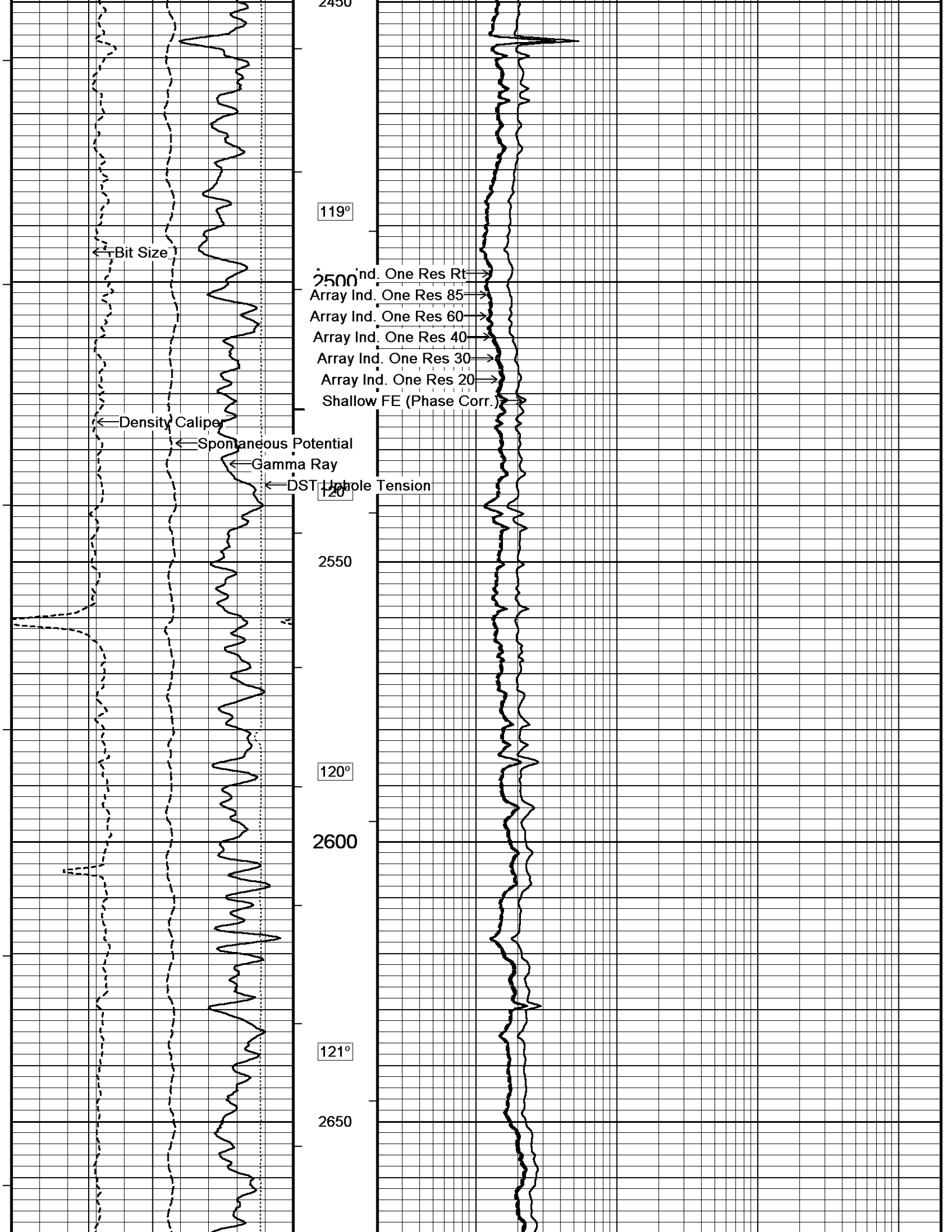
1950

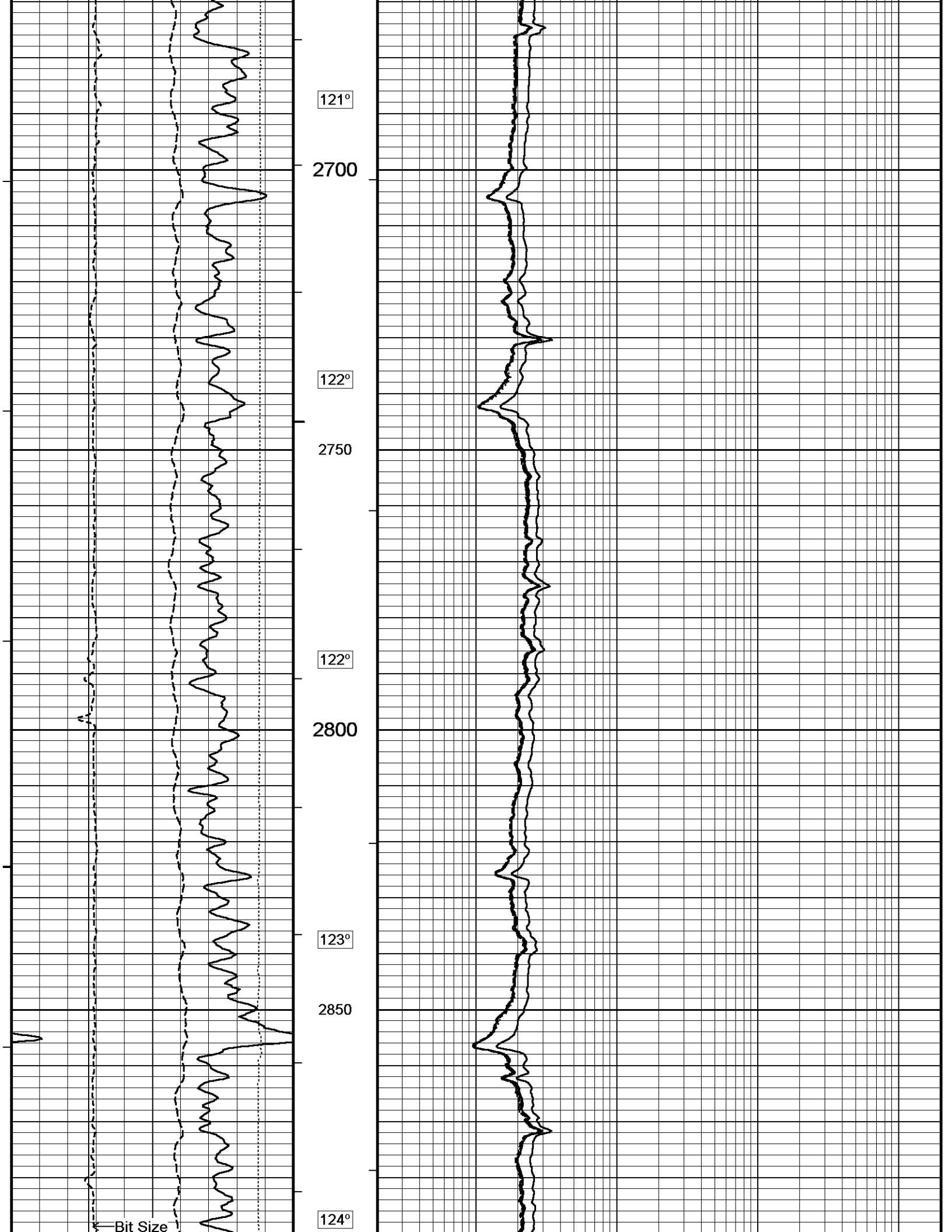
112°

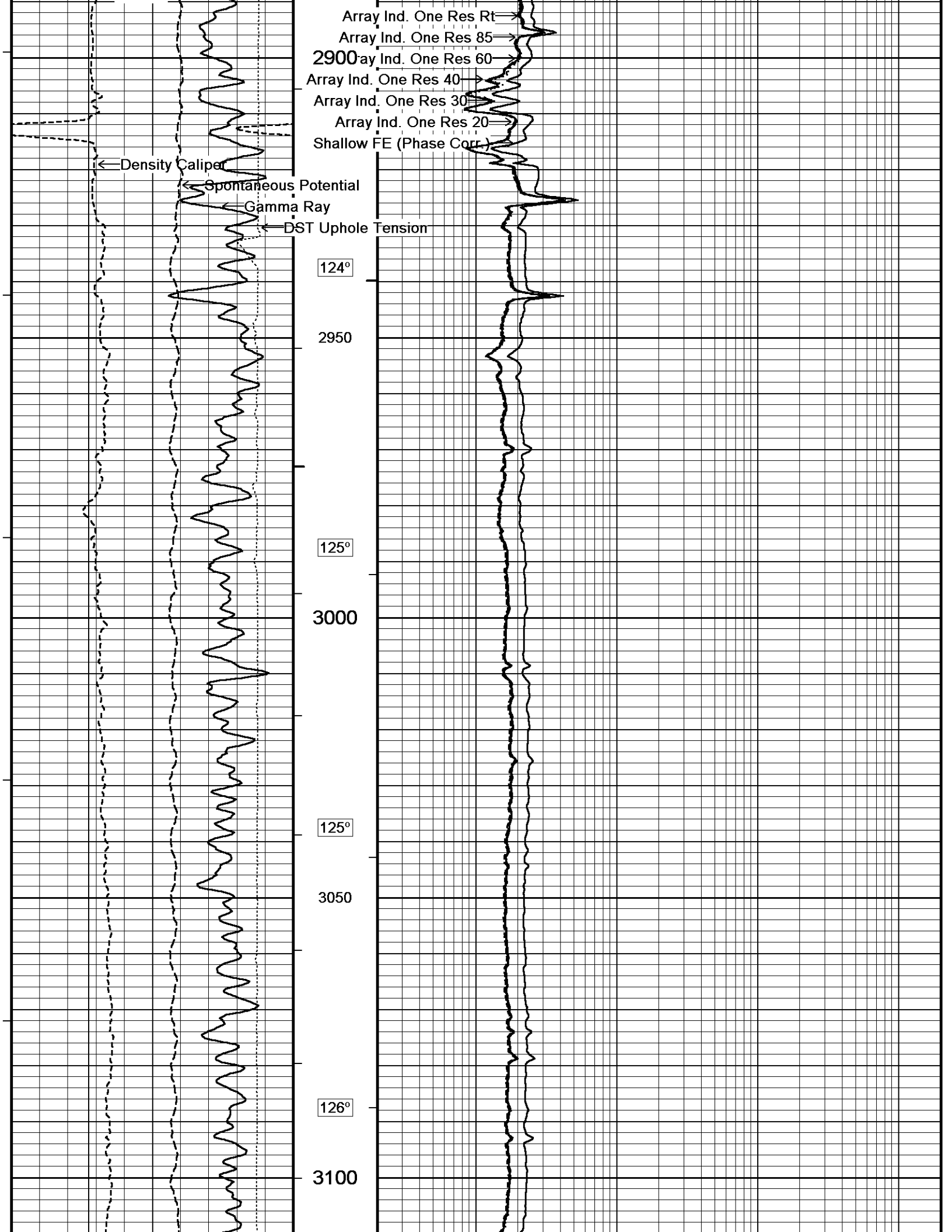
2000

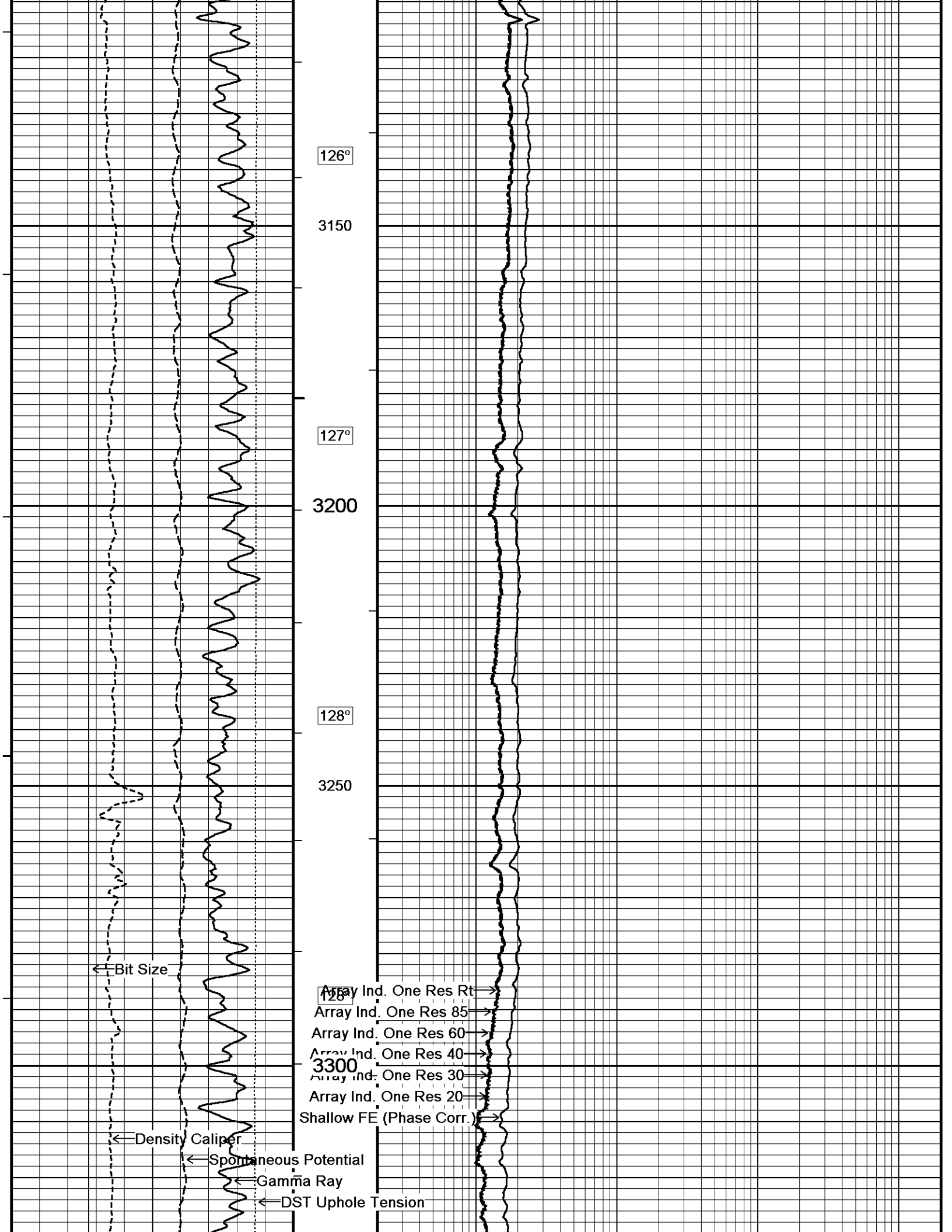


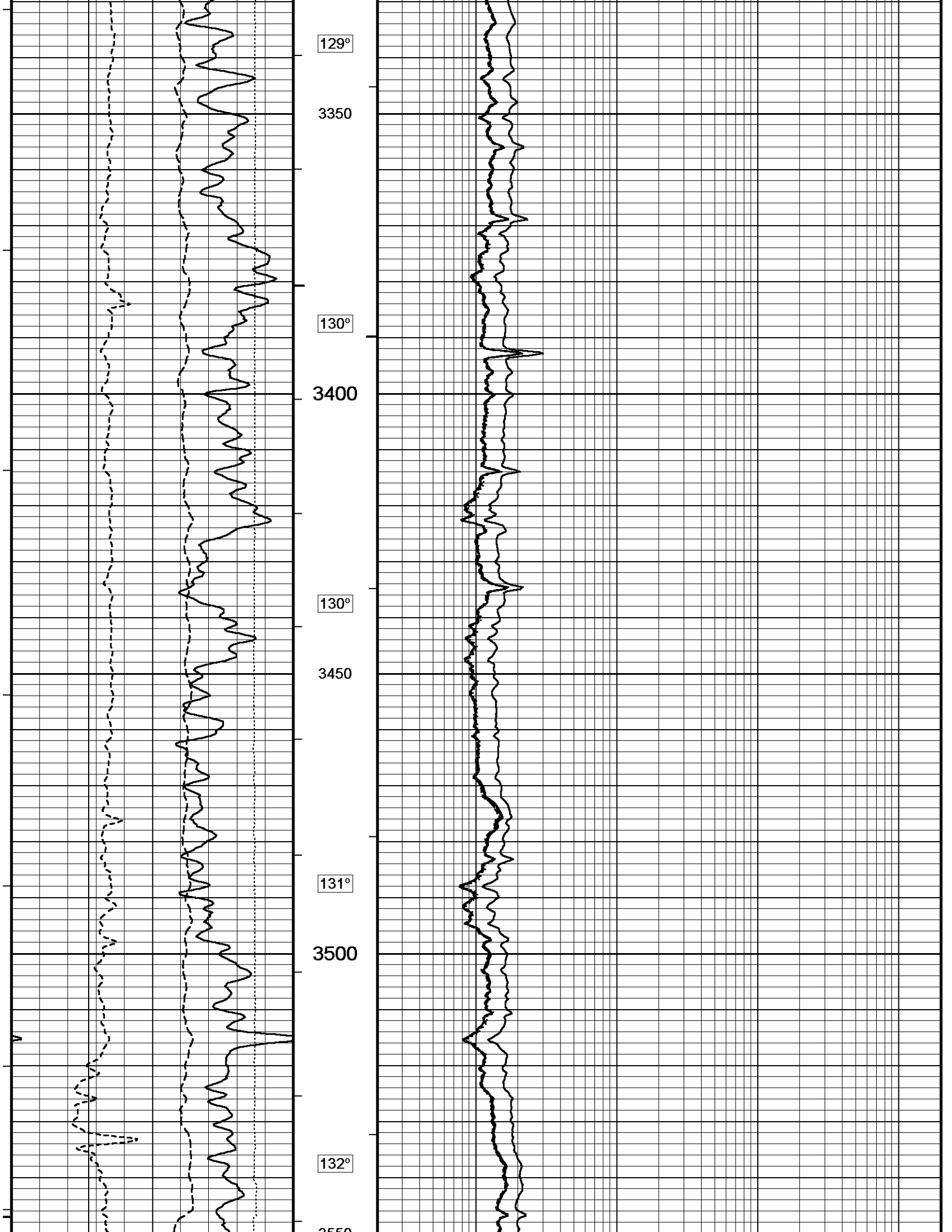


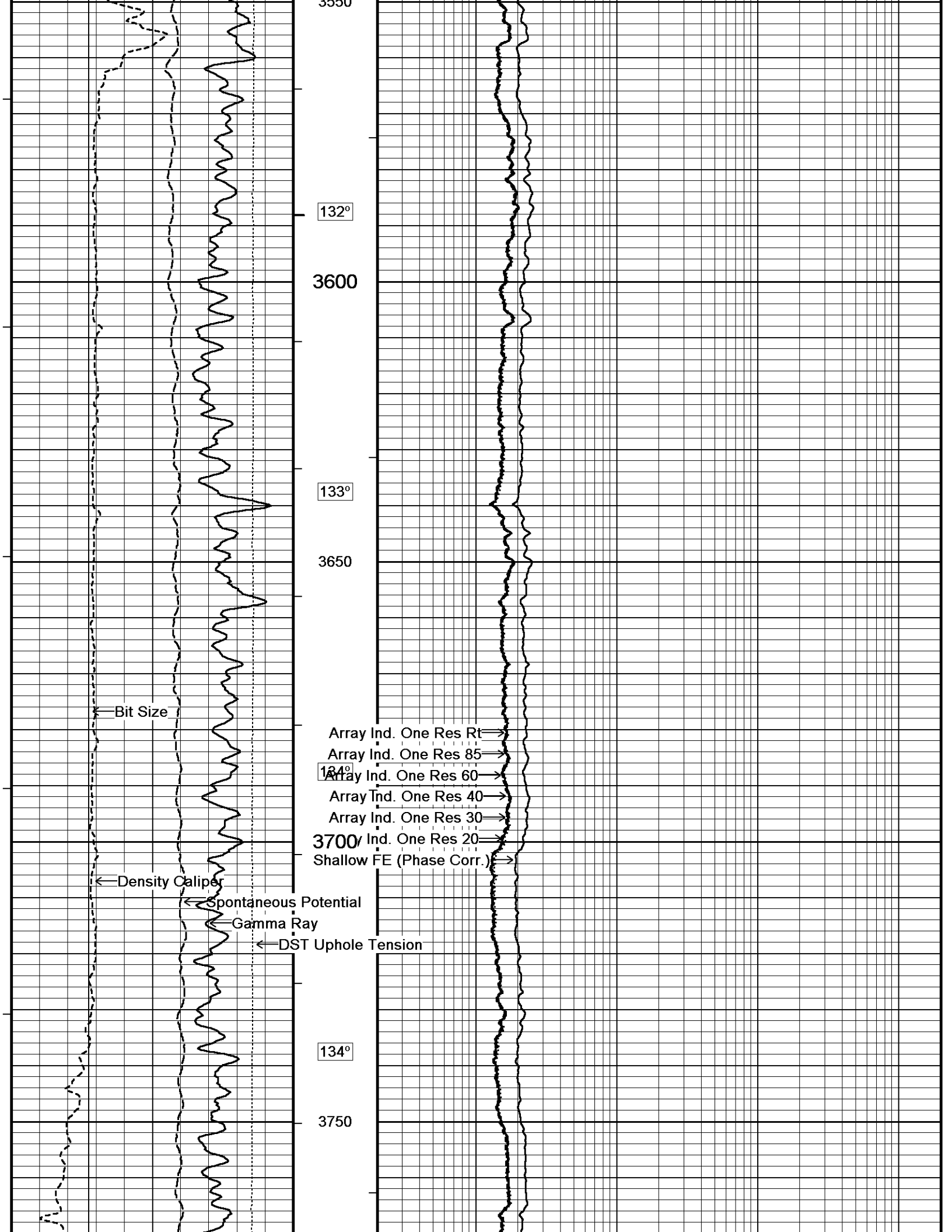


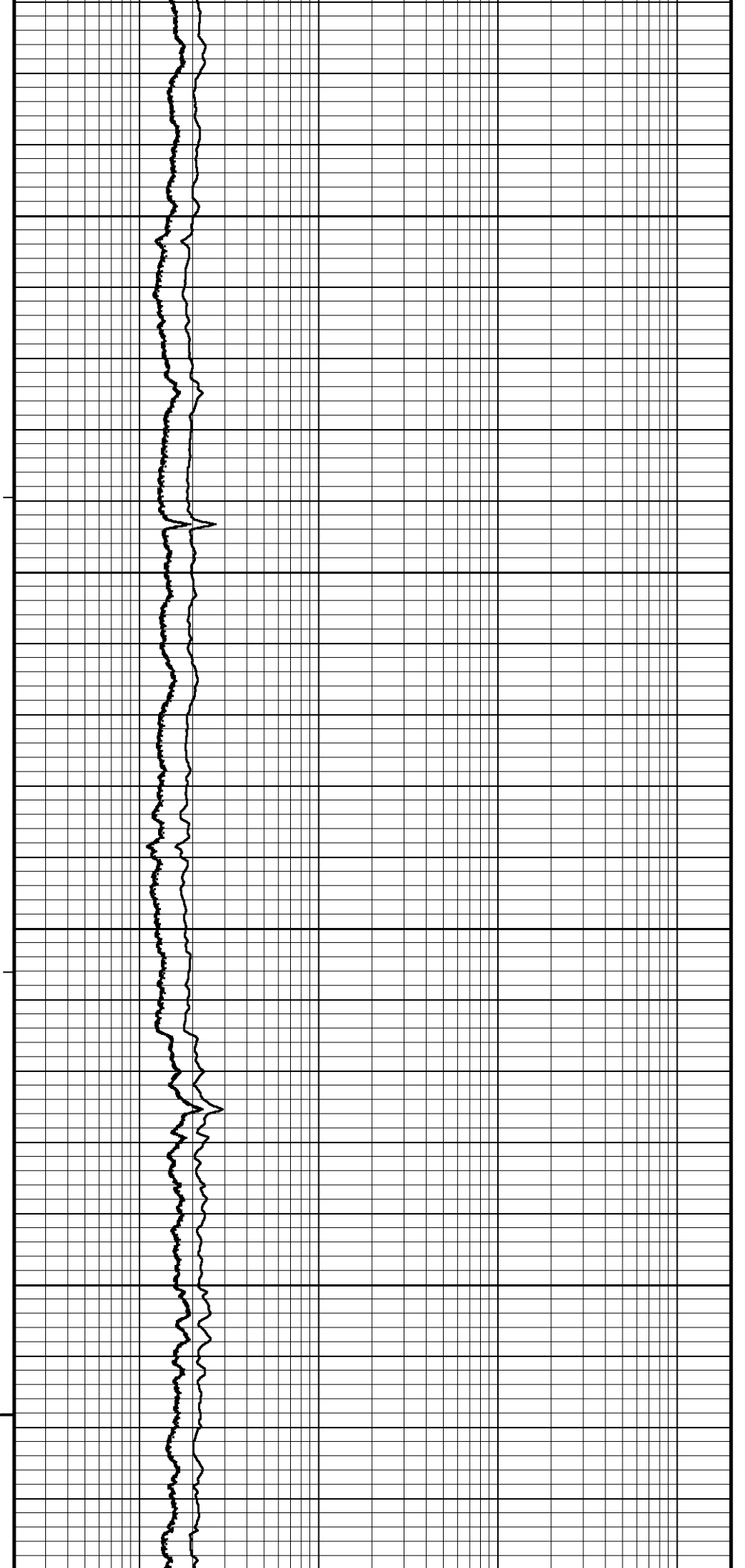
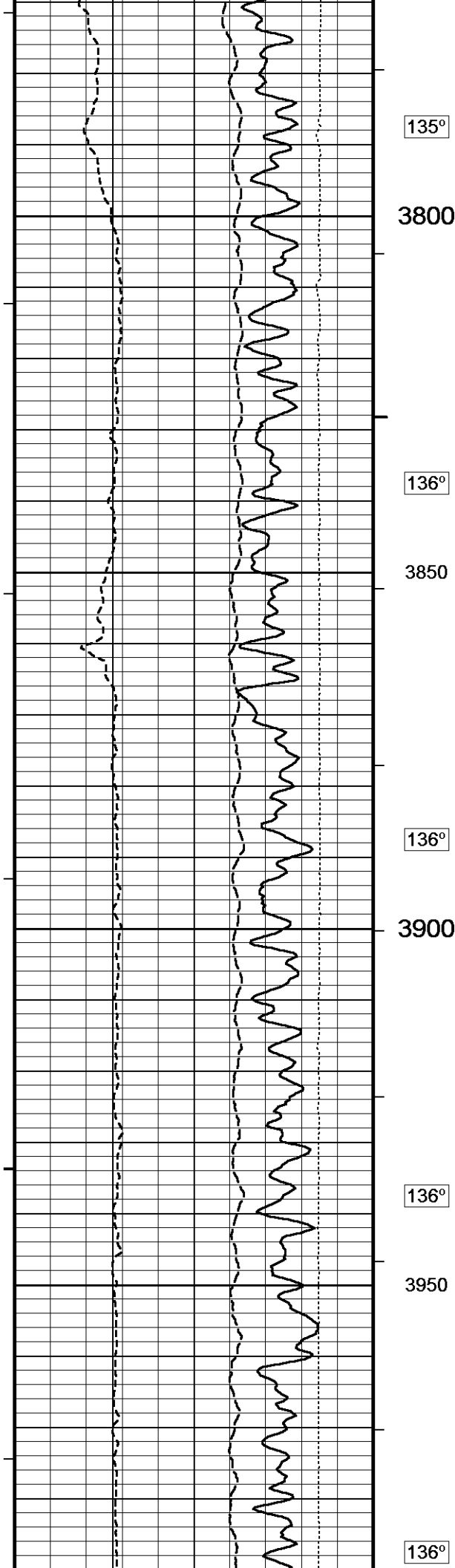


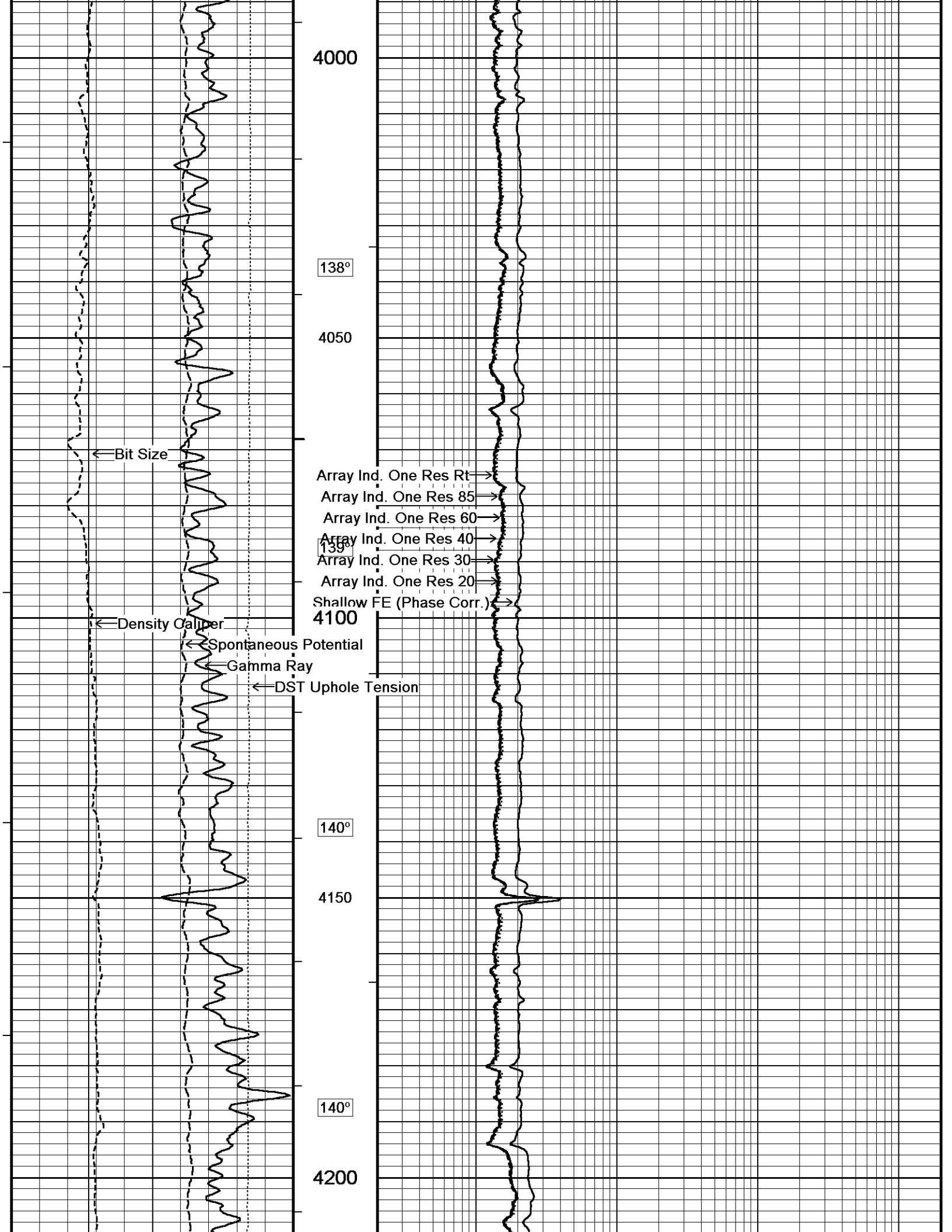


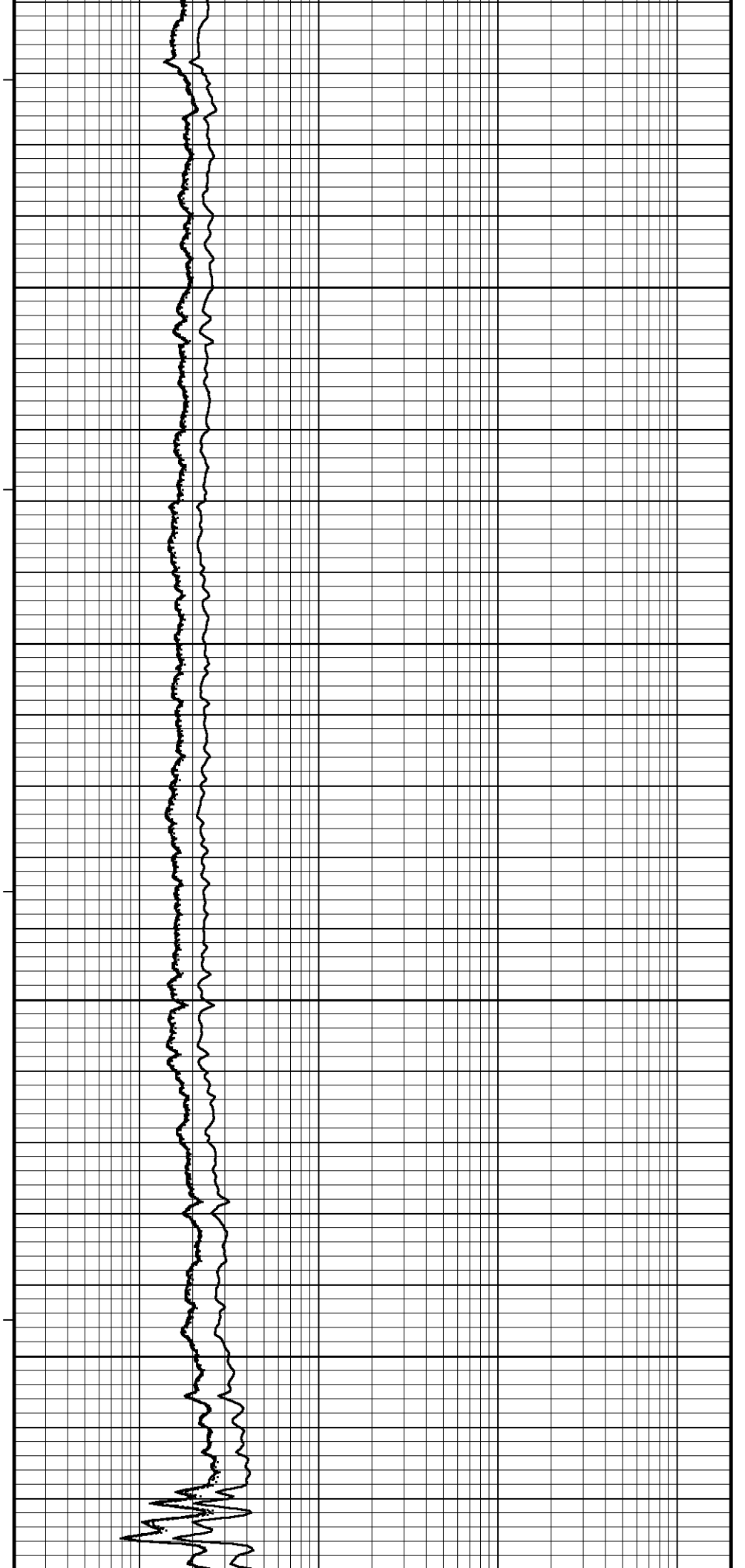
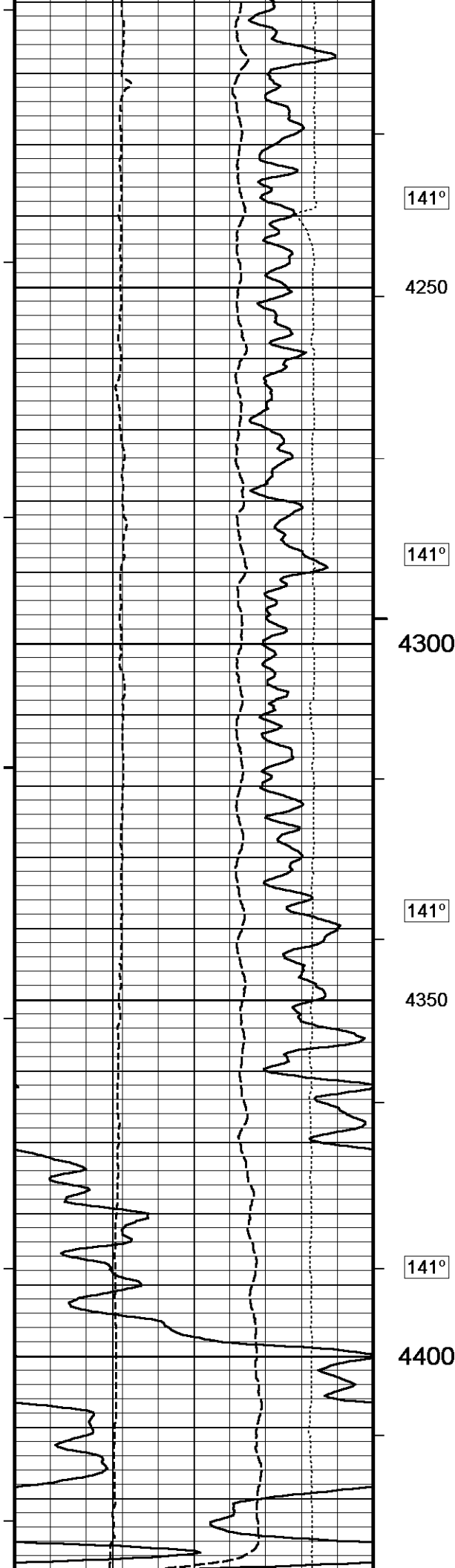


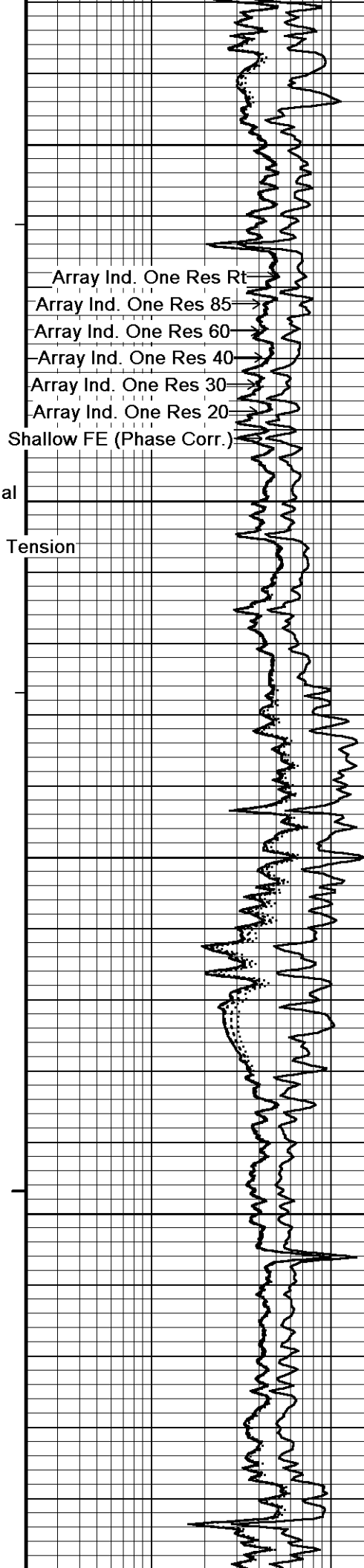
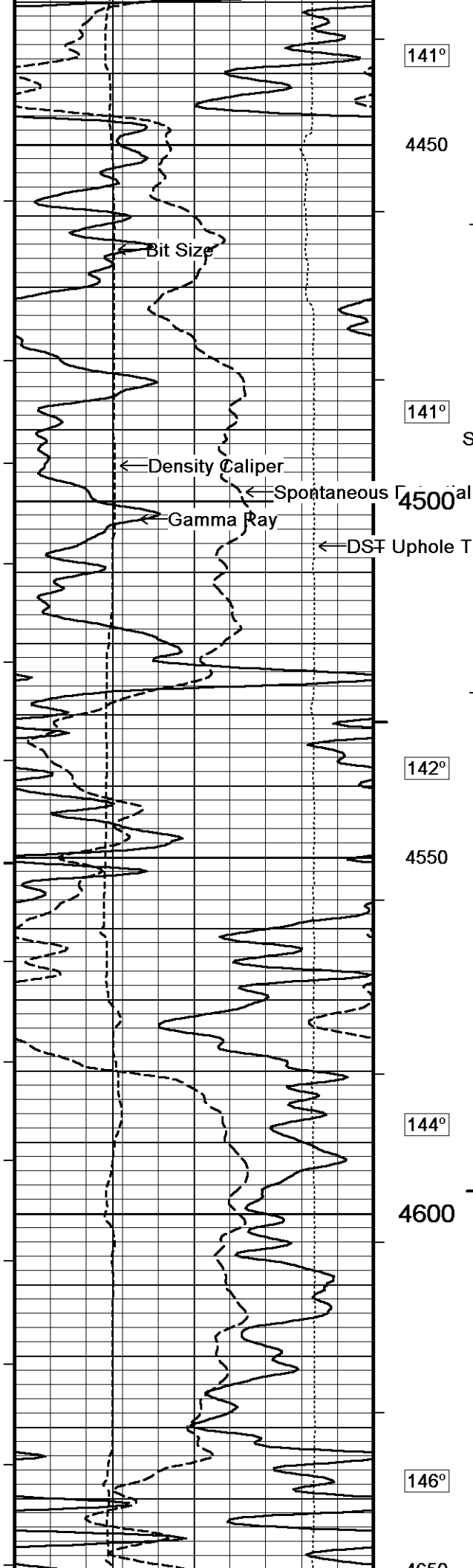


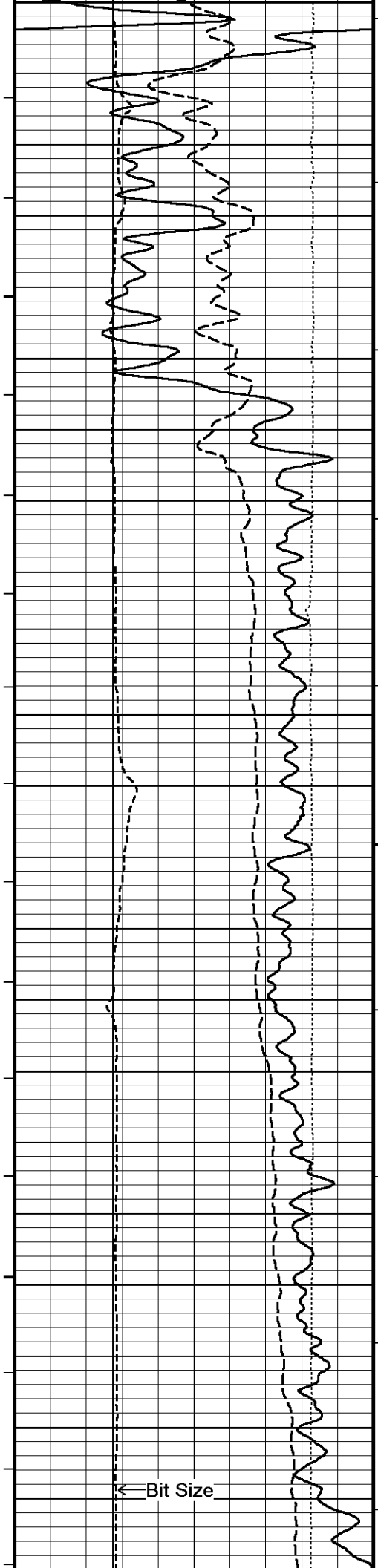






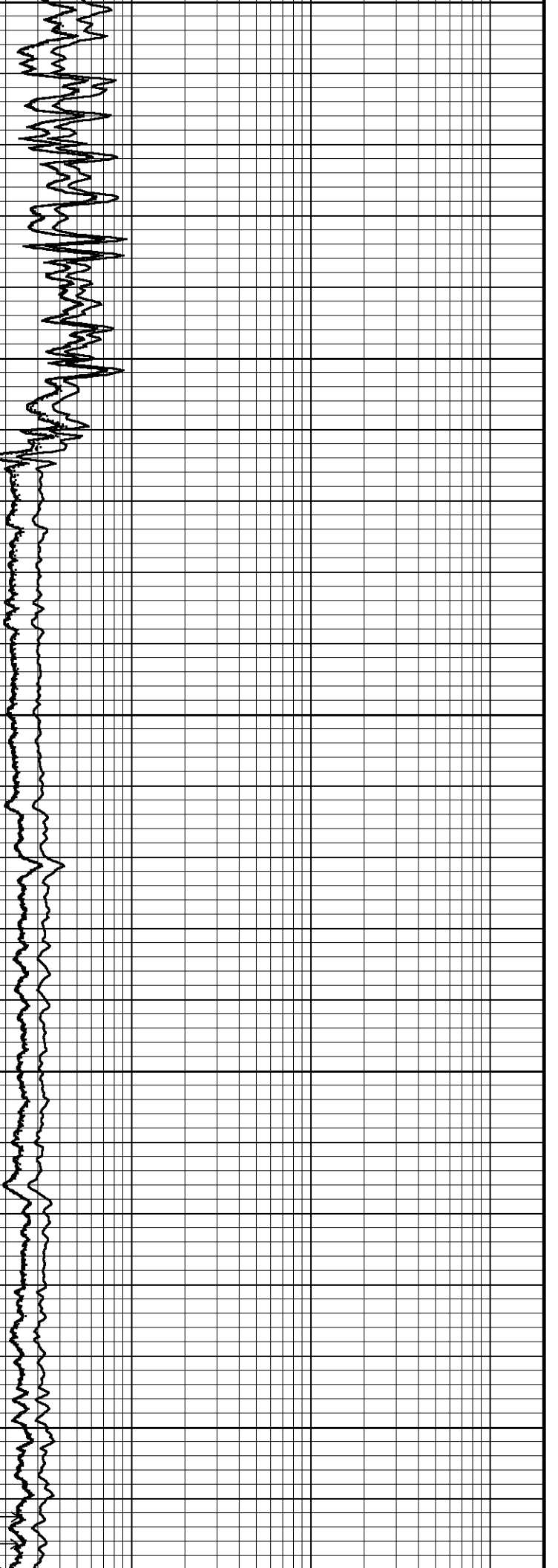


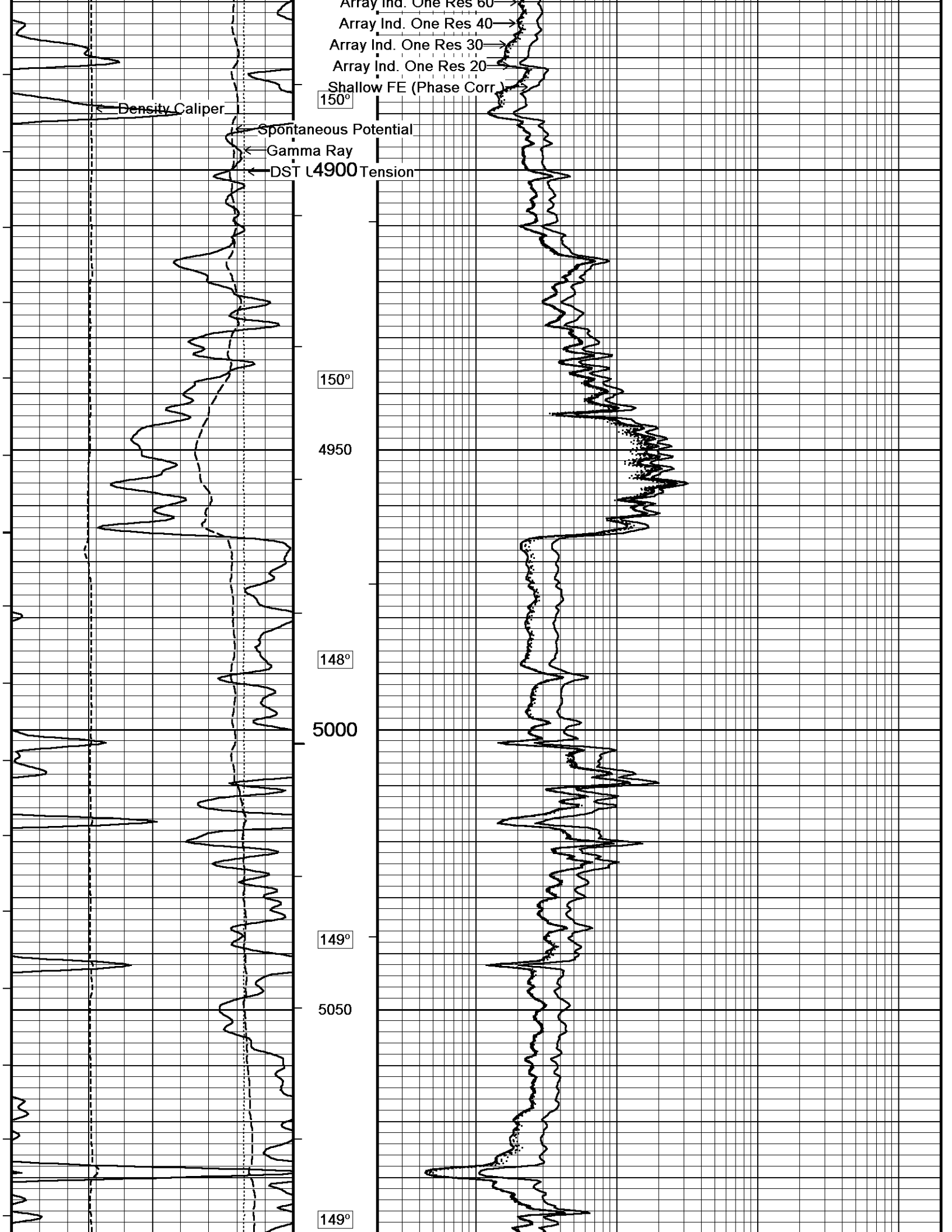


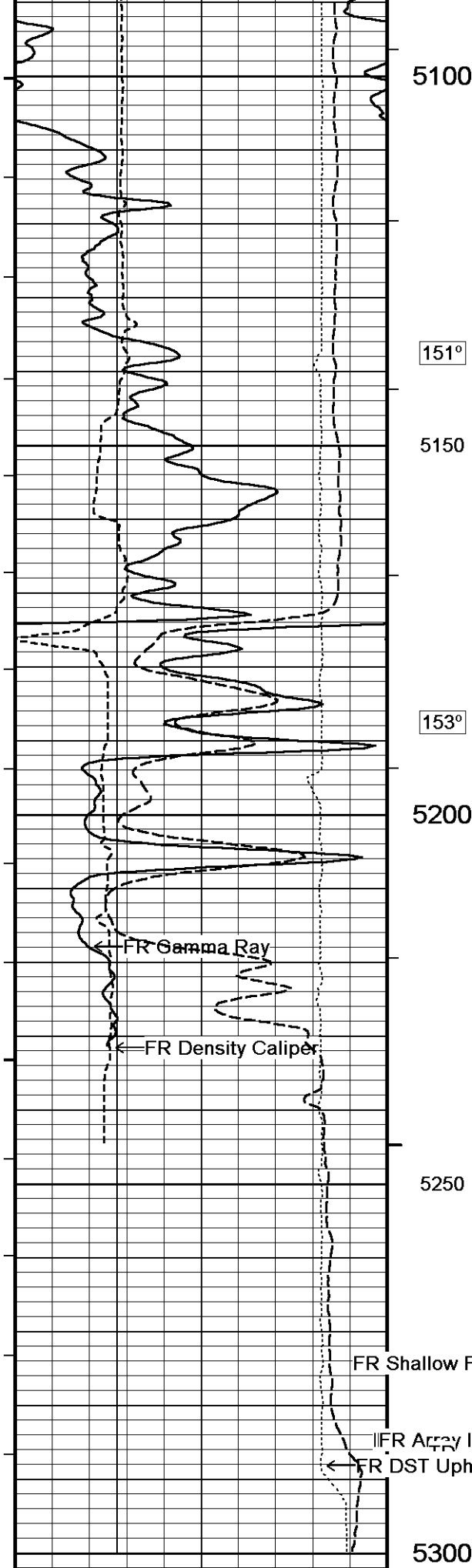


4650
148°
4700
148°
4750
148°
4800
148°
4850

Array Ind. One Res Rt
Array Ind. One Res 85
Array Ind. One Res 60







5100

151°

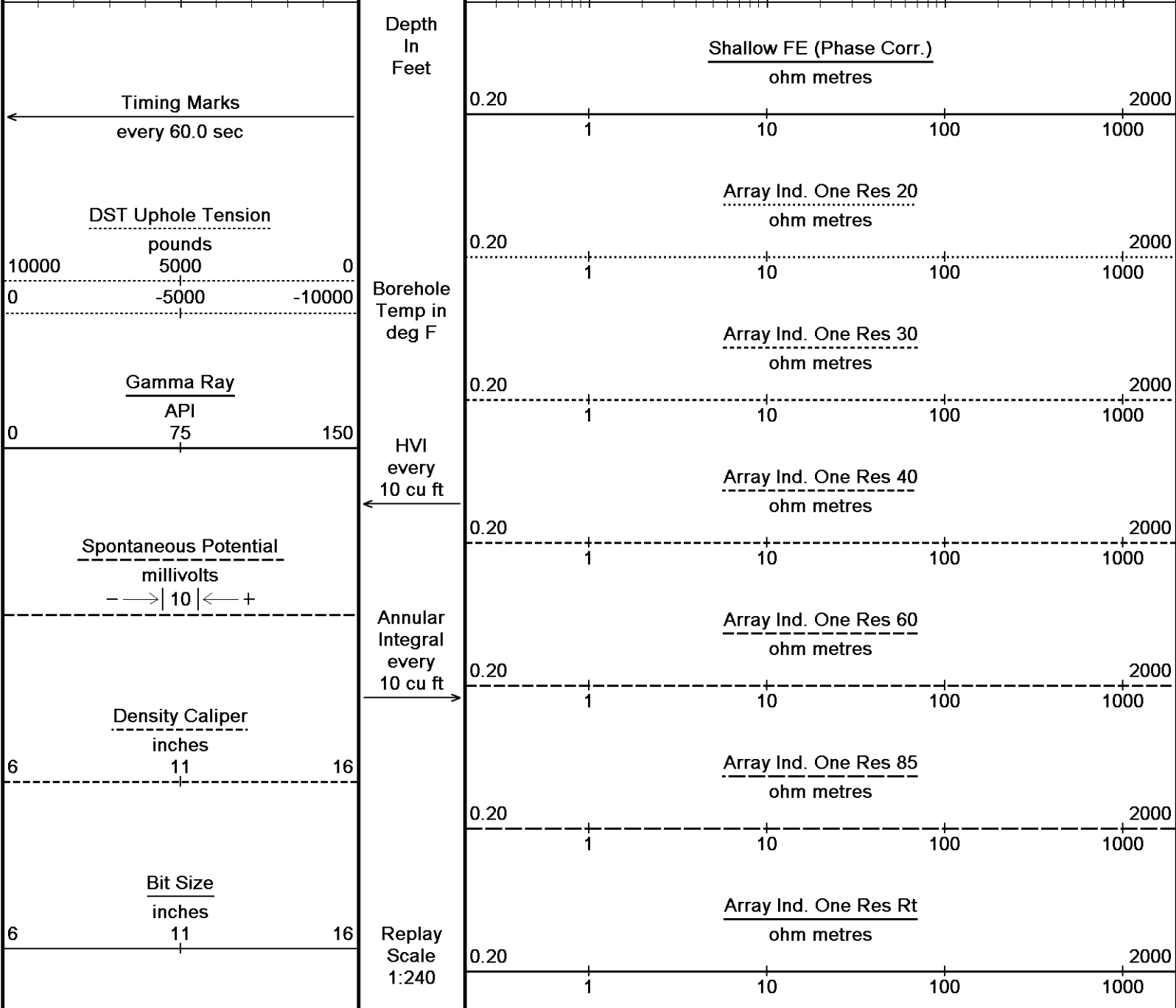
5150

153°

5200

5250

5300



Depth Based Data - Maximum Sampling Increment 10.0cm
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 System Versions: Processed with 13.03.7779 Plotted with 13.03.6602
 Plotted on 29-OCT-2012 09:01
 Recorded on 28-OCT-2012 20:01

OVERLAY SECTION

BEFORE SURVEY CALIBRATION
 C:\Users\E164620\AppData\Local\Temp\Weatherford PreView\5\ECGS No 6-19D WPD003-1_MAINPASS.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 28-OCT-2012,19:11

General Parameters

Mud Resistivity	3.330	ohm-metres
Mud Resistivity Temperature	62.700	degrees F
Water Level	0.000	feet
Density/Neutron Processing	Wet Hole	

Hole/Annular Volume and Differential Caliper Parameters

HVOL Method HVOL Caliper 1 HVOL Caliper 2 Annular Volume Diameter Caliper for Differential Caliper Rwa Parameters Porosity used Resistivity used RWA Constant A RWA Constant M	Single Caliper Density Caliper N/A 7.000 Density Caliper Base Density Porosity Array Ind. One Res Rt 0.610 2.150	inches	
Down-hole Tension Calibration SMS 0			
Reading No	Measured	Calibrated (lbs)	Field Calibration on 28-OCT-2012 18:35
1	15363.35	0.00	
2	16651.73	510.00	
Gamma Calibration MCG-D.K 483			
	Measured	Calibrated (API)	Field Calibration on 28-OCT-2012 08:43
Background	74	50	
Calibrator (Gross)	832	569	
Calibrator (Net)	758	519	
Gamma Constants MCG-D.K 483			
			Last Edited on 05-OCT-2012,14:10
Gamma Calibrator Number	GRCC119		
Mud Density	1.00	gm/cc	
Caliper Source for Processing	Density Caliper		
Tool Position	Eccentred		
Concentration of KCl	0.00	kppm	
SP Calibration MCG-D.K 483			
	Measured	Calibrated (mV)	Field Calibration on 23-SEP-2012,10:15
Reference 1	100.0	100.0	
Reference 2	-100.0	-100.0	
High Resolution Temperature Calibration MCG-D.K 483			
	Measured	Calibrated(Deg F)	Field Calibration on 30-SEP-2012,04:09
Lower	50.00	50.00	
Upper	75.00	75.00	
High Resolution Temperature Constants MCG-D.K 483			
			Last Edited on 02-OCT-2012,09:19
Pre-filter Length	11		
Neutron Calibration MDN-B.J 372			
Base Calibration			Base Calibration on 09-OCT-2012 10:28 Field Check on 28-OCT-2012 09:04
	Measured	Calibrated (cps)	
	Near Far	Near Far	
	2898 88	3714 110	
Ratio	32.889	33.764	
Field Calibrator at Base		Calibrated (cps)	
		2351 3475	
Ratio		0.677	
Field Check		Calibrated (cps)	
		0 0	
Ratio		0.000	
Neutron Constants MDN-B.J 372			
			Last Edited on 28-OCT-2012,16:55
Neutron Source Id	P31115B		
Neutron Jig Number	NJ5299		
Epithermal Neutron	No		
Caliper Source for Processing	Density Caliper		
Stand-off	0.00	inches	
Mud Density	1.00	gm/cc	
Limestone Sigma	7.10		

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 207			Last Edited on 28-OCT-2012,16:53
Magnetic Declination	7.96	degrees	East

Magnetometer Parameters MIE-A.A 207			
Date Of Last Magnetometer Calibration	3-OCT-2012,17:23		
	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.000965	-0.989937
Offset	0.014422	-0.012785	0.011064

Magnetometer Constants MIE-A.A 207			Last Edited on
Magnetometer Calibrator Number	000		

Accelerometer Parameters MIE-A.A 207			
Date Of Last Accelerometer Calibration	28-OCT-2012,16:53		
	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.112364	-1.102657	-1.101773
Offset	0.011564	0.008310	0.010144

Accelerometer Constants MIE-A.A 207			Last Edited on 17-AUG-2011,09:33	
Accelerometer Calibrator Number		000		
Accelerometer Temperature Characterisation				
X Accelerometer				
Serial Number	818			
Calibration Date	10-Mar-2009			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-9.54720e-006	-3.37284e-009	2.77661e-012
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.89756e-004	3.97830e-007	3.83291e-010
Y Accelerometer				
Serial Number	808			
Calibration Date	25-Feb-2009			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-2.75932e-006	-2.07753e-008	1.48470e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.72438e-004	2.93457e-007	8.36055e-010
Z Accelerometer				
Serial Number	835			
Calibration Date	19-Mar-2009			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-9.62639e-006	-1.21867e-008	9.07240e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.81882e-004	3.88354e-007	7.48706e-010

Caliper Calibration MIE-A.A 207			Base Calibration on 28-OCT-2012 09:19
			Field Calibration on 28-OCT-2012 09:22
Base Calibration			
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)
1	26888	26971	5.97
2	37117	37129	7.96
3	47211	46396	9.87
4	58796	57746	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	24831	25507	24808	25761	5.97
2	33668	34186	33550	34279	7.96
3	41838	42174	42148	42696	9.87
4	51734	51950	51983	52871	11.92
5	0	0	0	0	0.00
Field Calibration					
	Measured Pads 1-5 Caliper(in) 7.96	Measured Pads 3-7 Caliper(in) 7.91		Actual Caliper(in) 7.96	
	Measured Pad 2 Caliper(in) 3.96	Measured Pad 4 Caliper(in) 3.96	Measured Pad 6 Caliper(in) 4.00	Measured Pad 8 Caliper(in) 4.00	Actual Caliper(in) 7.96
Caliper Constants MIE-A.A 207				Last Edited on 12-OCT-2011,10:05	
Caliper Difference for BRKT		0.120	inches		
Imager Pad Check MIE-A.A 207					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 207				Last Edited on 28-OCT-2012,09:23	
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	0.0500				
Image Processing	Enabled				
FE Calibration MFE-A.A 76				Base Calibration on 08-OCT-2012 10:03 Field Check on 28-OCT-2012 05:48	
Base Calibration		Measured	Calibrated (ohm-m)		
Reference 1		0.0	0.0		
Reference 2		965.4	126.8		
Base Check			279.7		
Field Check			279.8		
FE Constants MFE-A.A 76				Last Edited on 28-OCT-2012,16:57	
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		
High Resolution Temperature Calibration MAI-B.A 219				Field Calibration on 10-AUG-2011,00:10	
	Measured	Calibrated(Deg F)			
Lower	50.00	50.00			
Upper	75.00	75.00			
High Resolution Temperature Constants MAI-B.A 219				Last Edited on 30-SEP-2012,04:08	
Pre-filter Length		11			
Induction Calibration MAI-B.A 219				Base Calibration on 08-MAY-2012,15:56	

Base Calibration

Test Loop Calibration

Channel	Measured		Calibrated (mmho/m)	
	Low	High	Low	High
1	17.4	478.1	9.3	966.2
2	5.8	380.3	7.6	821.4
3	3.5	258.5	5.2	566.0
4	1.9	136.0	2.6	279.2

Array Temperature 77.2 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	0.0	0.0	12.4	3793.5
2	0.0	0.0	30.9	3537.3
3	0.0	0.0	28.6	3056.1
4	0.0	0.0	19.3	2028.4
Deep	0.0	0.0	16.5	1948.6
Medium	0.0	0.0	42.7	4088.7
Shallow	0.0	0.0	47.6	5283.8

Array Temperature 0.0 68.4 Deg F

Induction Constants MAI-B.A 219

Last Edited on 28-OCT-2012, 16:58

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	0.5000	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	

Caliper Calibration MPD-B 183

Base Calibration on 18-OCT-2012 14:40

Field Calibration on 28-OCT-2012 06:03

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	17392	3.99
2	25904	5.97
3	34387	7.96
4	42672	9.87
5	52112	11.92

6	0.2112	N/A	11.02	N/A
Field Calibration	Measured Caliper (in)	Actual Caliper (in)		
	7.86	7.96		
Photo Density Calibration MPD-B 183			Base Calibration on 18-OCT-2012 14:23 Field Check on 28-OCT-2012 06:00	
Density Calibration				
Base Calibration	Measured	Calibrated (sdu)		
	Near	Far	Near	Far
Reference 1	39817	13046	52994	19123
Reference 2	18730	1788	25185	2558
Field Check at Base				
	639.0	756.5		
Field Check				
	640.8	751.3		
PE Calibration				
Base Calibration	Measured	Calibrated		
	WS	WH	Ratio	Ratio
Background	118	573		
Reference 1	13710	39721	0.347	0.309
Reference 2	5433	18657	0.294	0.274
Field Check at Base				
	117.9	572.8		
Field Check				
	117.6	578.7		
Density Constants MPD-B 183			Last Edited on 28-OCT-2012,16:56	
Density Source Id	P15771B			
Nylon Calibrator Number	527			
Aluminium Calibrator Number	527			
Density Shoe Profile	8 inch			
Caliper Source for Processing	Density Caliper			
PE Correction to Density	Not Applied			
Mud Density	1.19	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)			
2.68	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			

DOWNHOLE EQUIPMENT	
C:\Users\E164620\AppData\Local\Temp\Weatherford PreView\5\ECGS No 6-19D WPD003-1_MAINPASS.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	
SHA-H Compact Swivel Head Adaptor	
SHA-H 142 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.J 372 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-B 183 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

MIS-D.B Compact Inline Bowspring sub
MIS-D.B 660 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

Compact MMI Memory Section
MIM-A.A 207 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

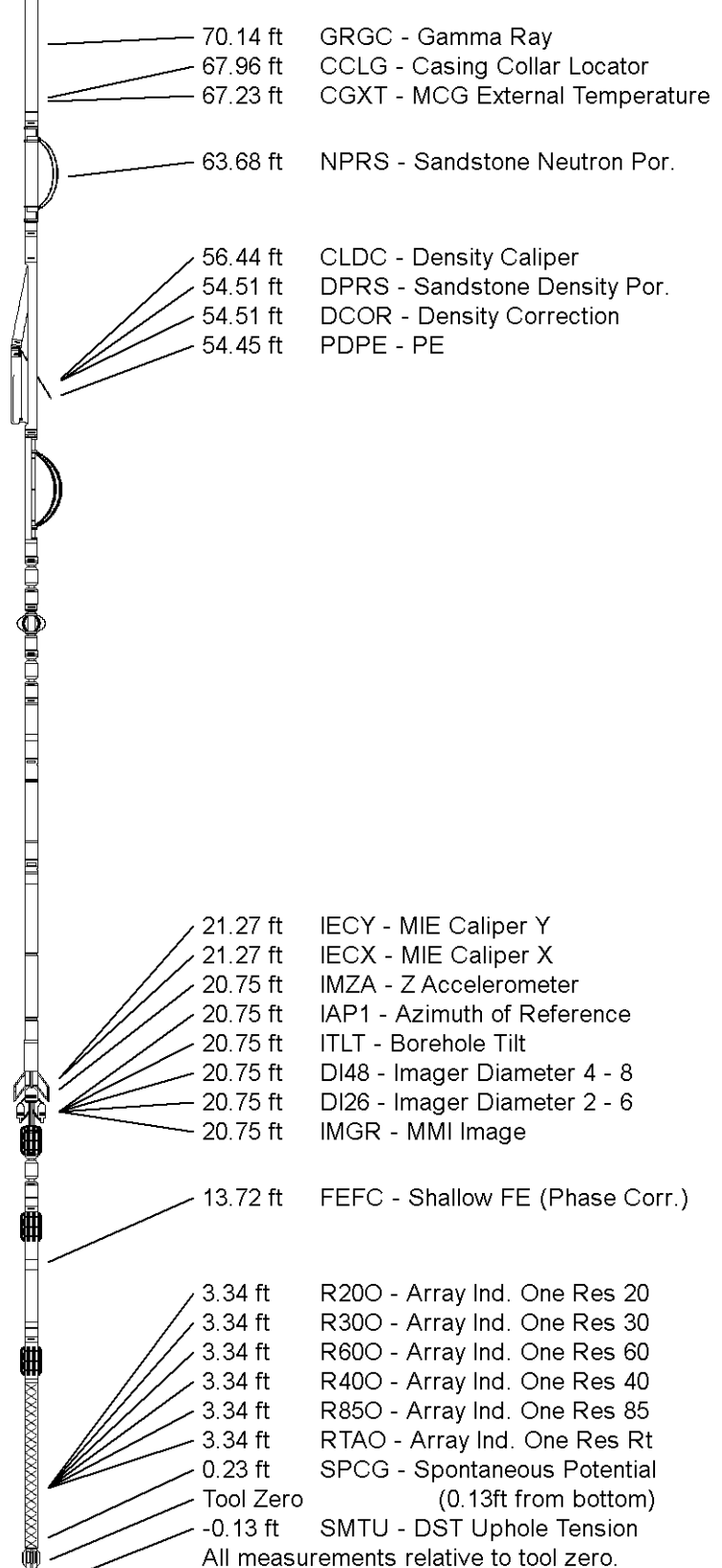
Compact MMI Electrode Section
MIE-A.A 207 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

SKJ-E.B Compact Knuckle Joint
SKJ-E.B 583 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact Focussed Electric
MFE-A.A 76 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-B.A 219 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 79.30 ft Weight: 608.5 lb



COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 6-19D WPD003-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4566.00	feet	First Reading	5285.00	feet
Elevation Drill Floor	4565.00	feet	Depth Driller	5285.00	feet
Elevation Ground Level	4553.00	feet	Depth Logger	5288.00	feet



Weatherford®

ARRAY INDUCTION

LOGS