

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

COMPANY **EAST CHEYENNE GAS STORAGE LLC**  
WELL **ECGS No 6-17 WPD001-1**  
FIELD **PEETZ WEST**  
PROVINCE/COUNTY **LOGAN**  
COUNTRY/STATE **US/COLORADO**  
LOCATION **1899' FNL & 1634' FEL**

SEC **6** TWP **11N** RGE **52W** Other Services  
MPD/MDN

API Number **05-075-09405**  
Permit Number

Permanent Datum GL, Elevation 4549 feet  
Log Measured From KB  
Drilling Measured From KB

Elevations:  
KB 4565.00  
DF 4564.00  
GL 4549.00

Date **08-NOV-2012**

Run Number **ONE**

Depth Driller **5257.00** feet

Depth Logger **5254.00** feet

First Reading **5251.00** feet

Last Reading **1245.00** feet

Casing Driller **1241.00** feet

Casing Logger **1245.00** feet

Bit Size **8.750** inches

Hole Fluid Type **WBM**

Density / Viscosity **10.00 g/cc** **84.00 CP**

PH / Fluid Loss **8.00** **6.00 ml/30Min**

Sample Source **FLOWLINE**

Rm @ Measured Temp **3.31 @ 83.4** ohm-m

Rmf @ Measured Temp **2.65 @ 83.4** ohm-m

Rmc @ Measured Temp **3.97 @ 83.4** ohm-m

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

Rm @ BHT **1.81 @155.0** ohm-m

Time Since Circulation **4 HOURS**

Max Recorded Temp **155.00** deg F

Equipment Name **COMPACT**

Equipment / Base **13144** **RK SPR**

Recorded By **B.ROSSER**

Witnessed By **J. ASHBY**

**L. CARRASCO**

**BOREHOLE RECORD**

Last Edited: 08-NOV-2012 19:05

Bit Size inches	Depth From feet	Depth To feet
8.750	1241.00	5257.00

**CASING RECORD**

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	9.625	0.00	1241.00	36.00

**REMARKS**

SOFTWARE VERSION 13.02.6600

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

HARDWARE: MPD: 8" PROFILE PLATE USED.  
MAI: TWO 1 INCH STANDOFFS USED.  
MDN: DUAL BOWSPRING 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 NIORRABA FORMATION (4700 FT TO 4200 FT)

2.1 LOGS DERIVED FROM DATA USED TO CALCULATE LOGS IN FOOTER DATES AND MODIFICATION (4/20/11 TO 4/20/11).

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

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1753 CUBIC FEET

ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING =688 CUBIC FEET

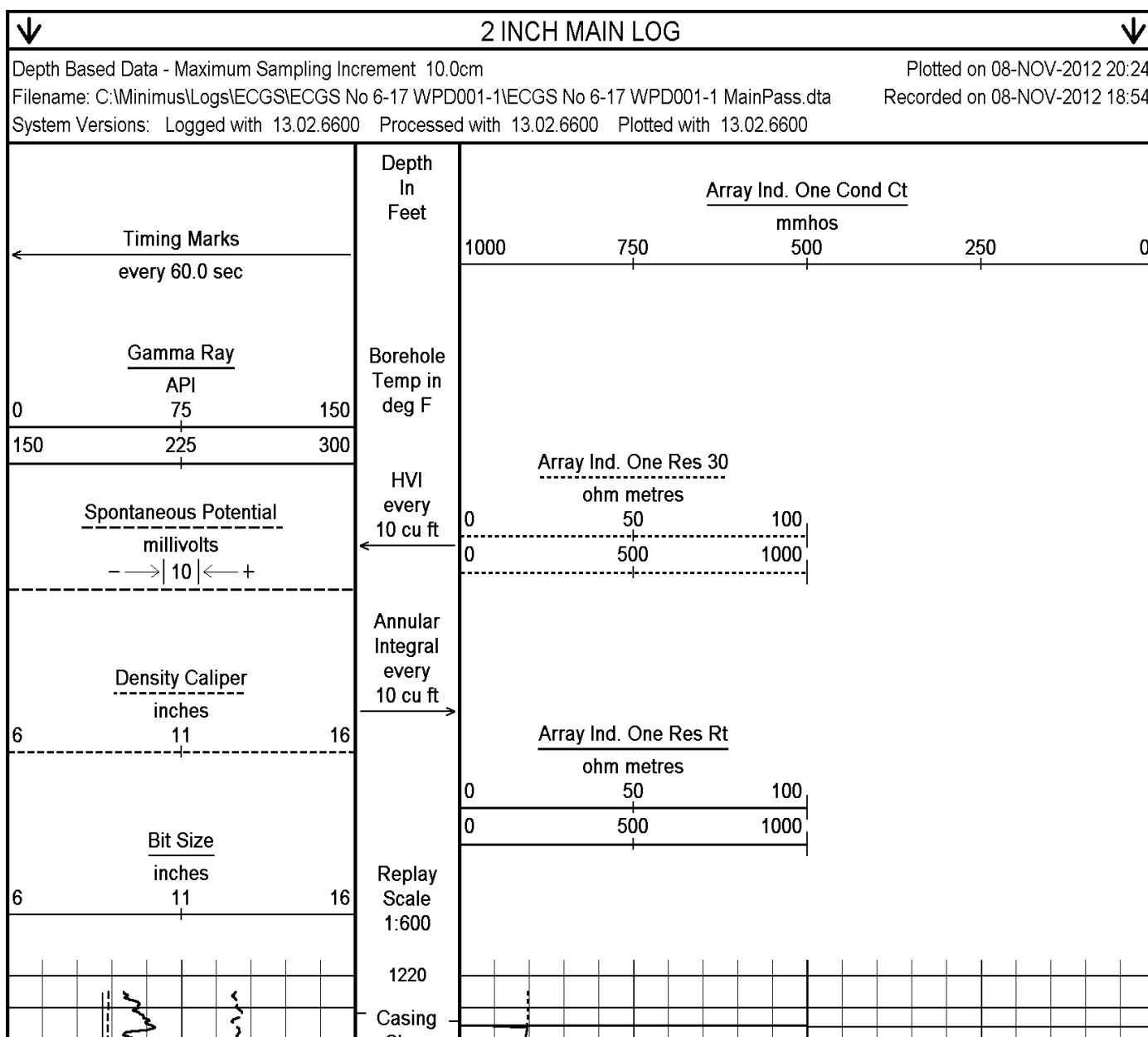
TOTAL VOLUME FROM TD TO 4200 FT =431 CUBIC FEET

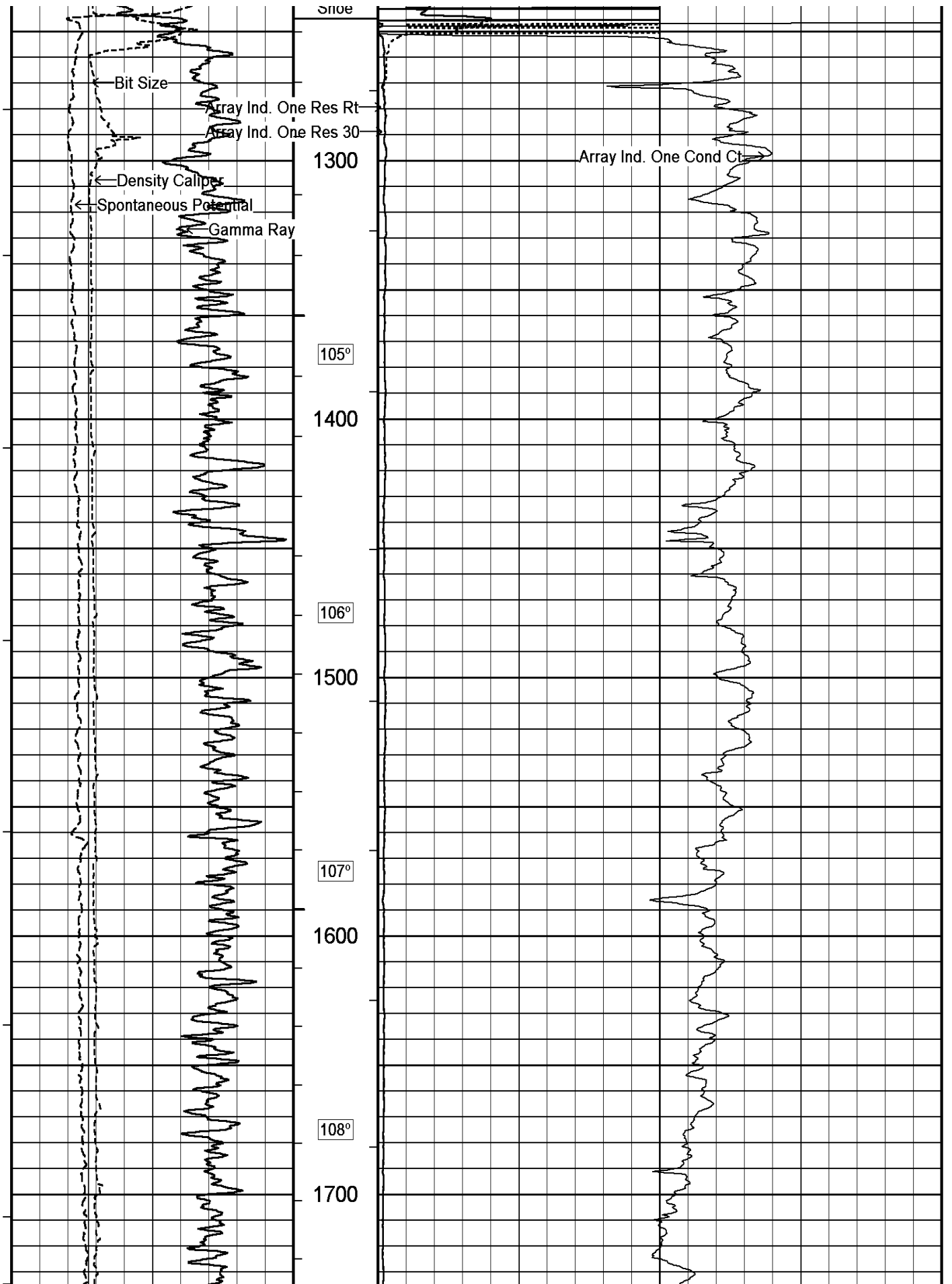
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT =155 CUBIC FEET

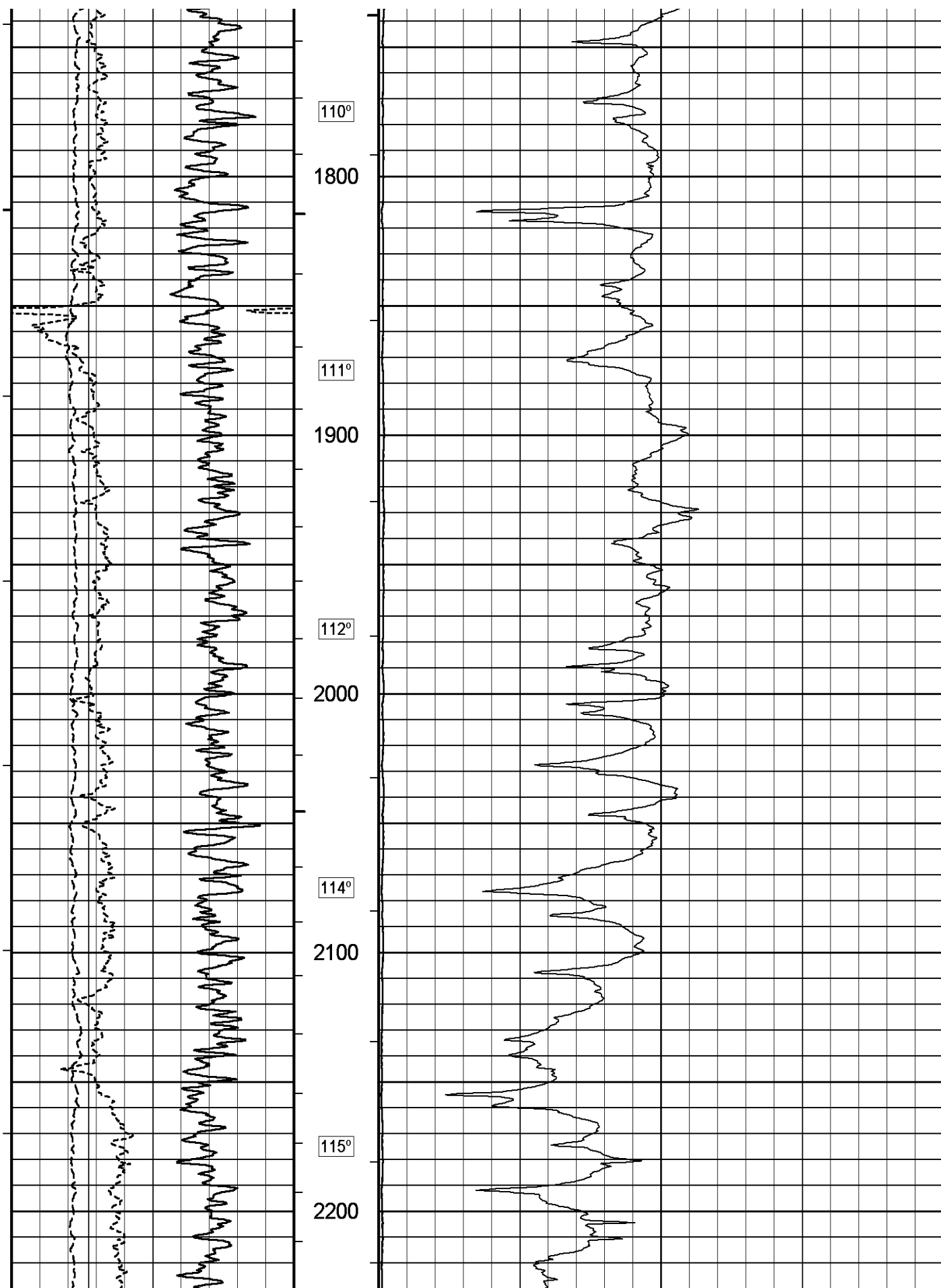
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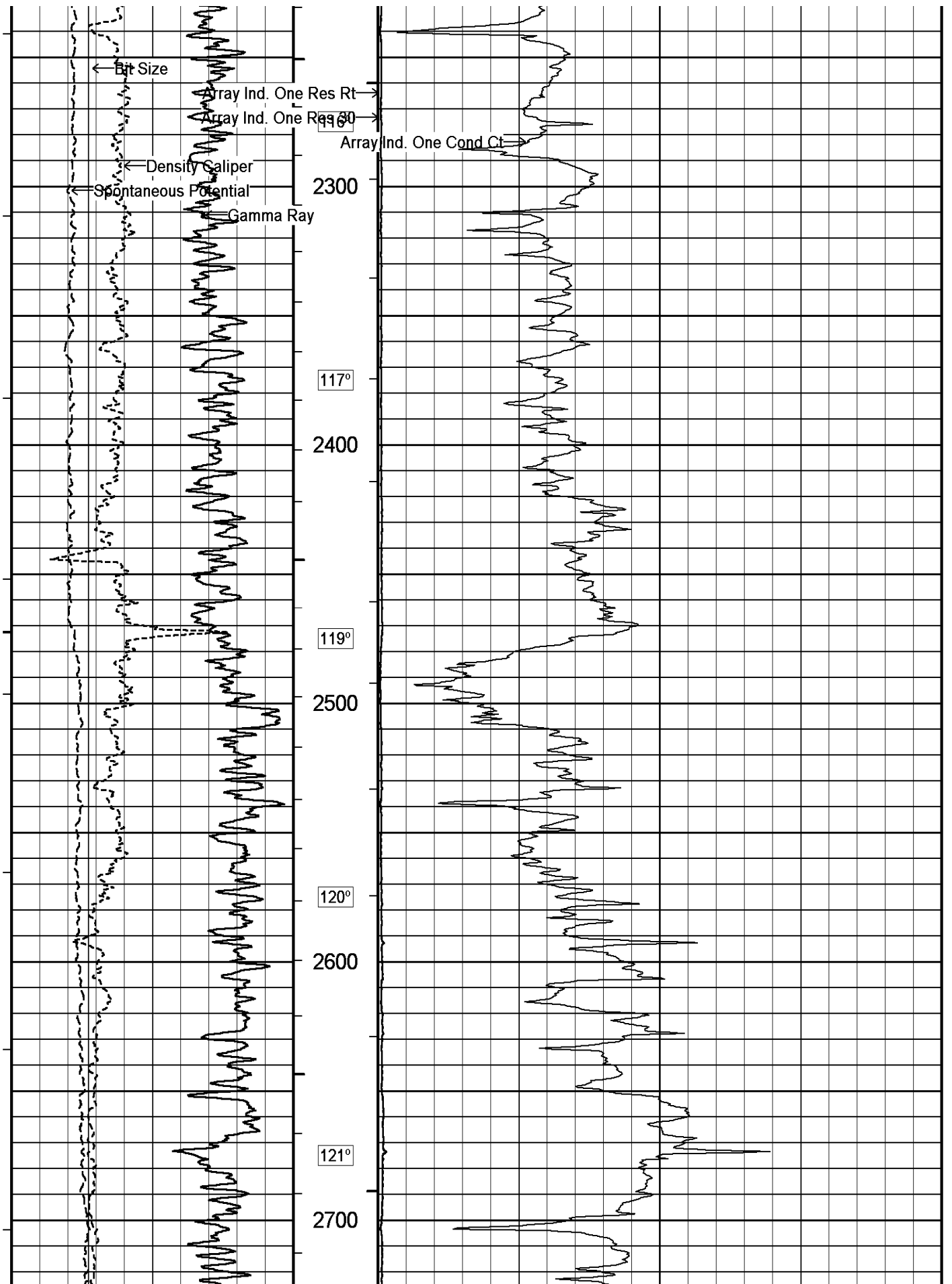
RIG: CADE 22

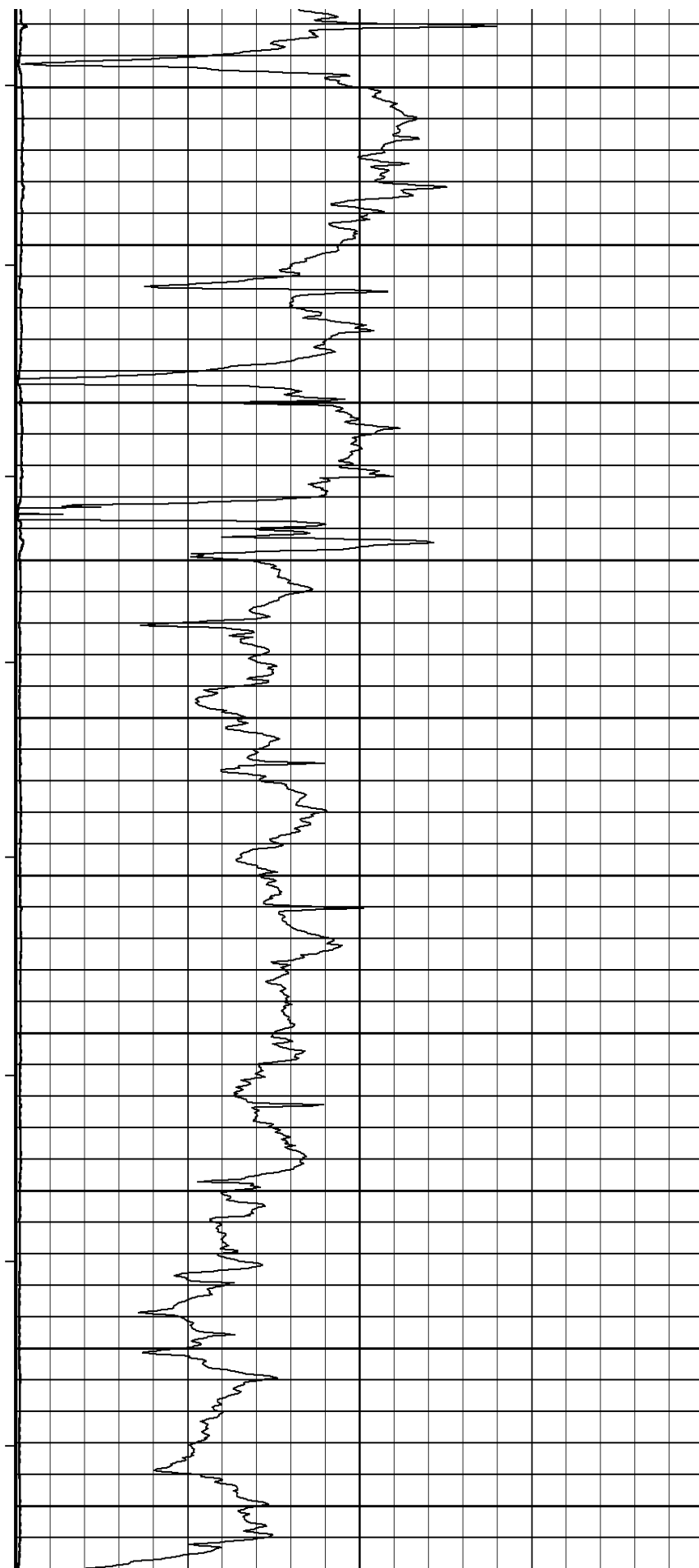
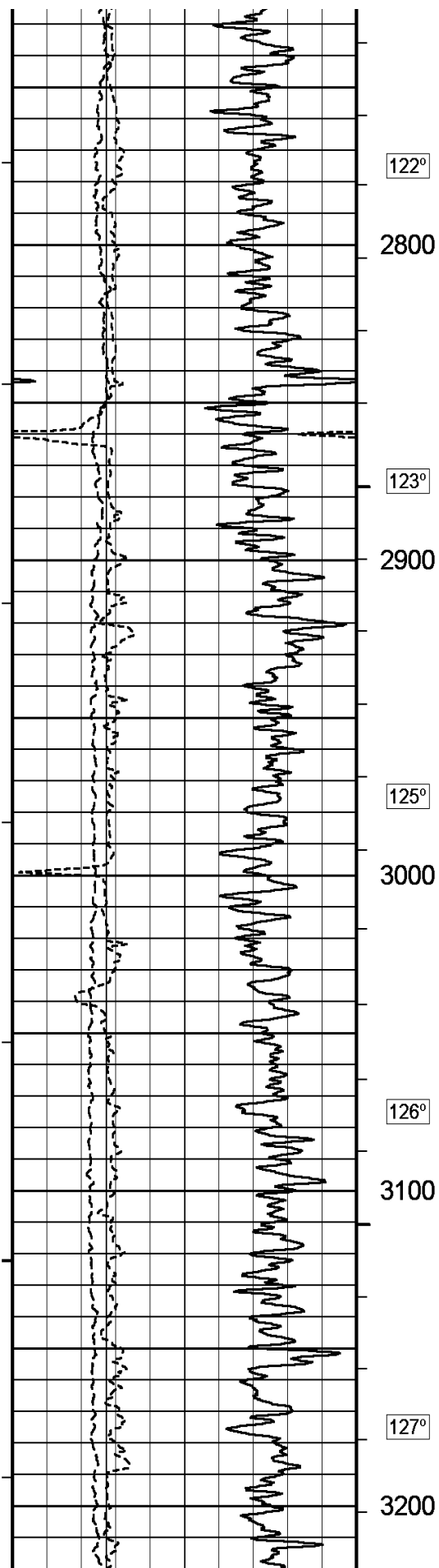
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs,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

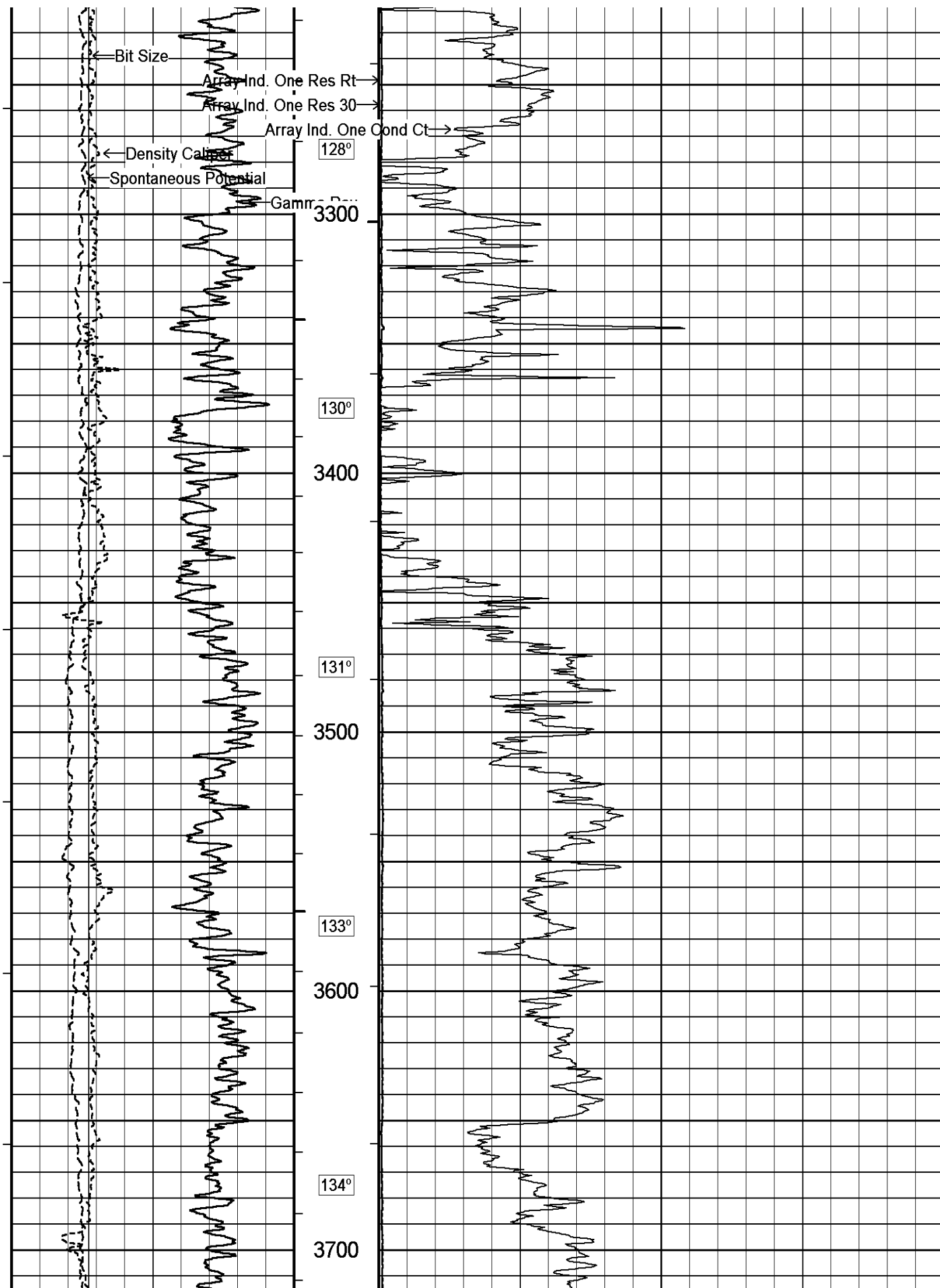


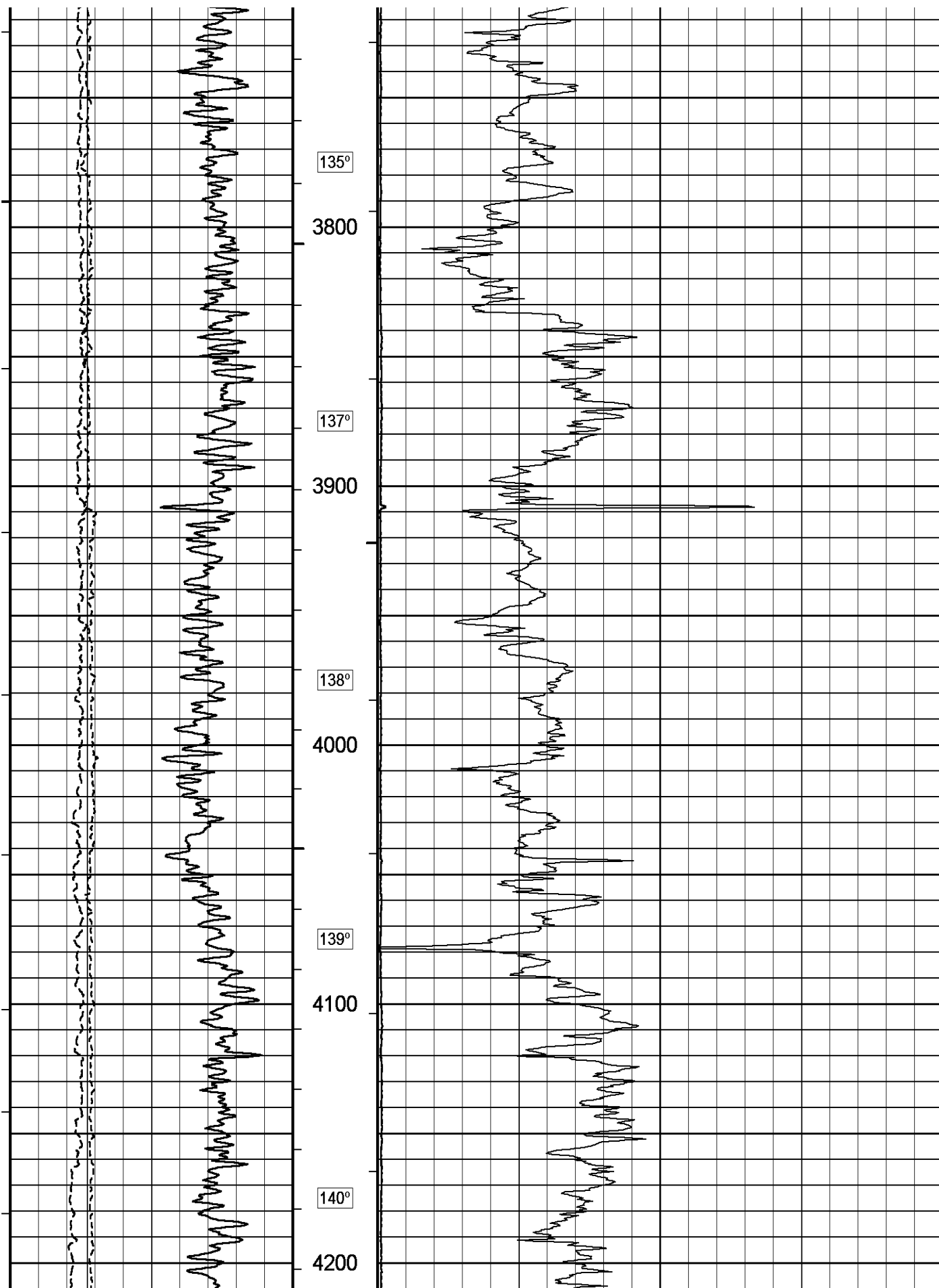




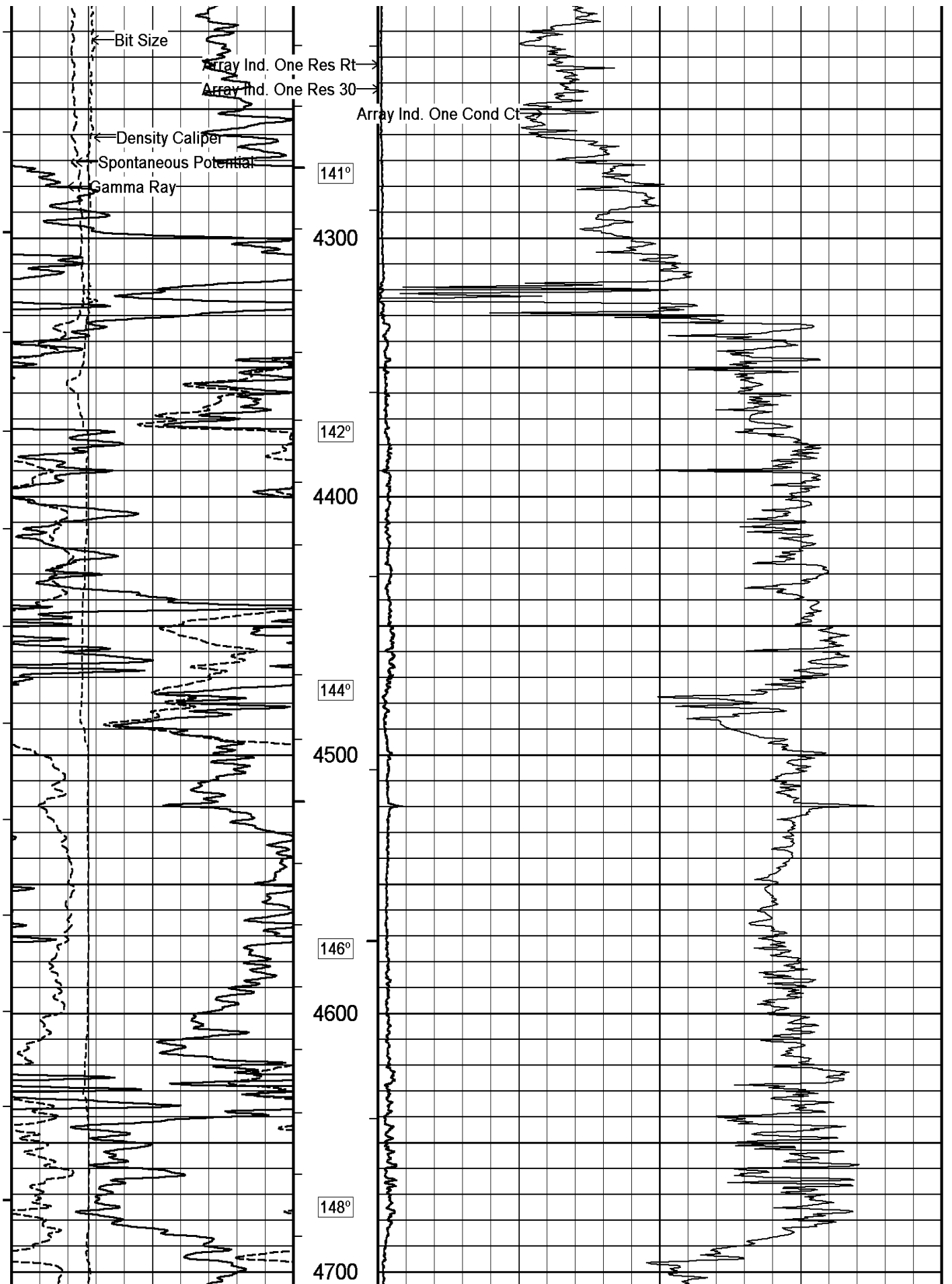


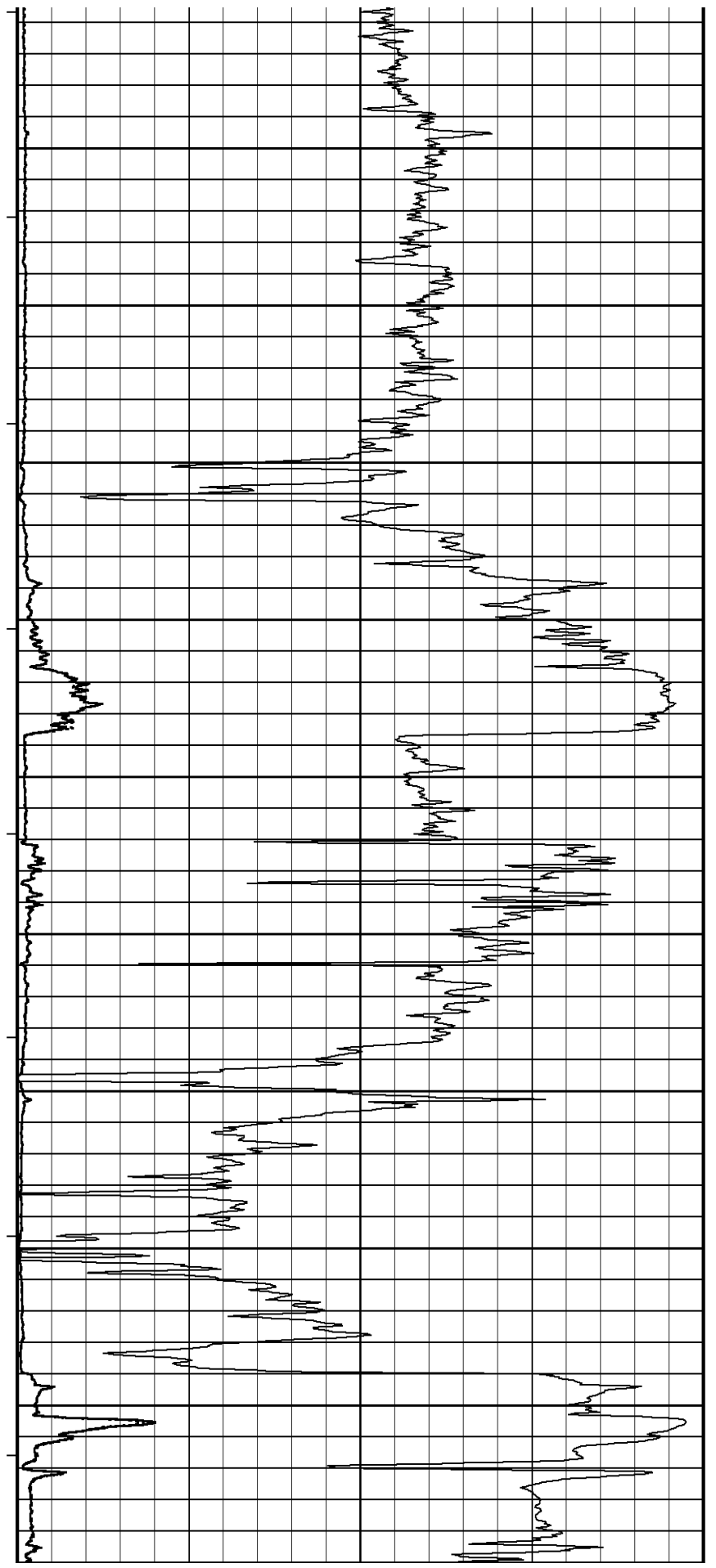
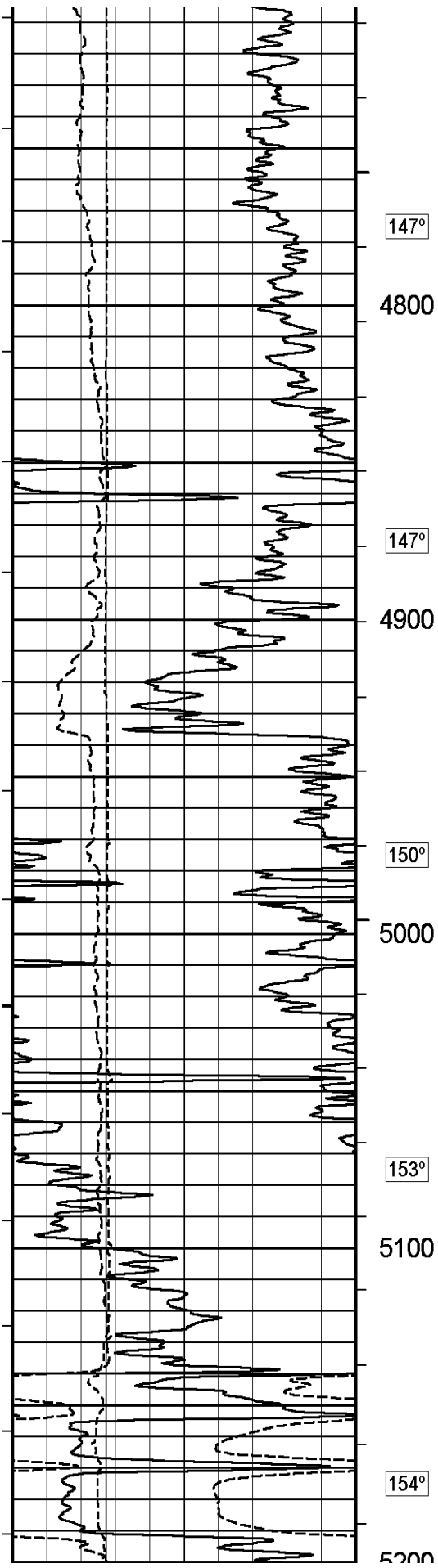


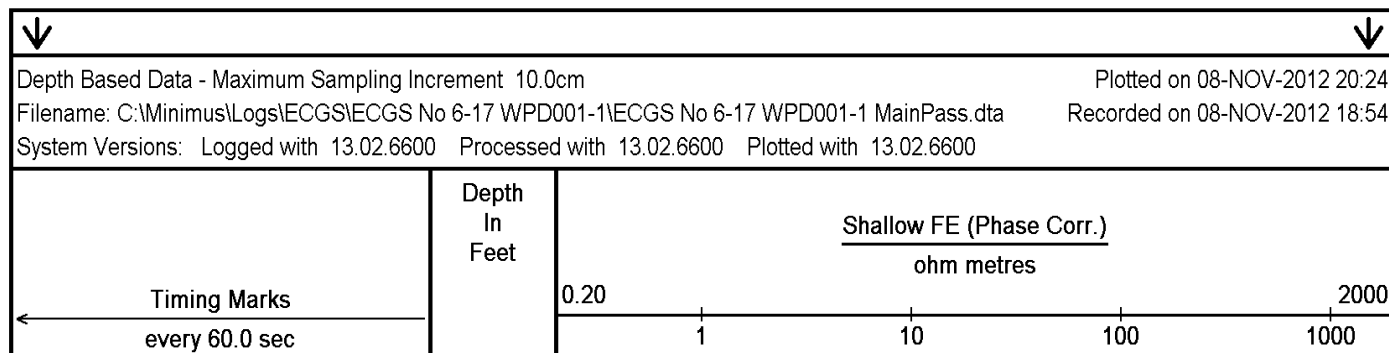
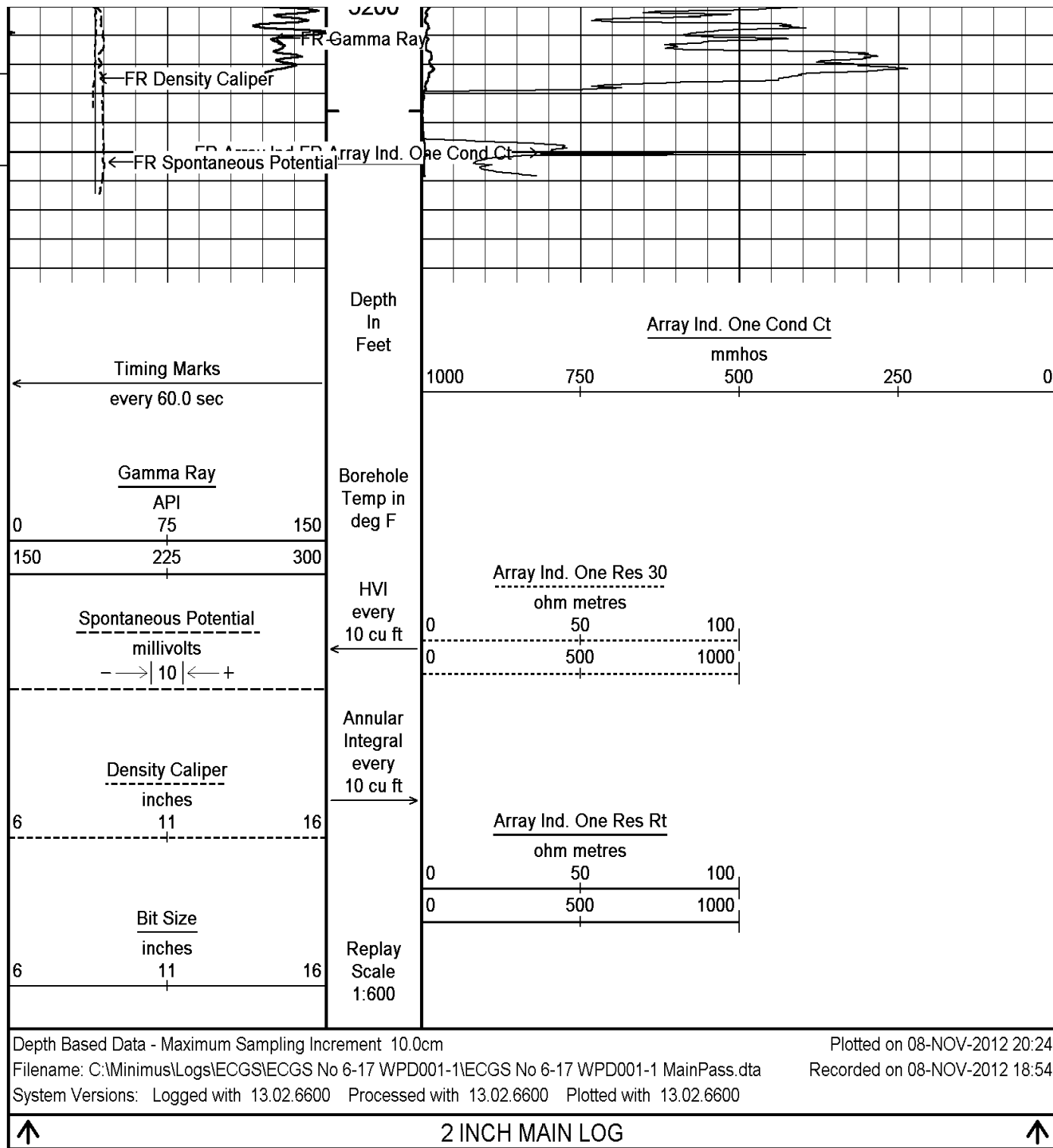


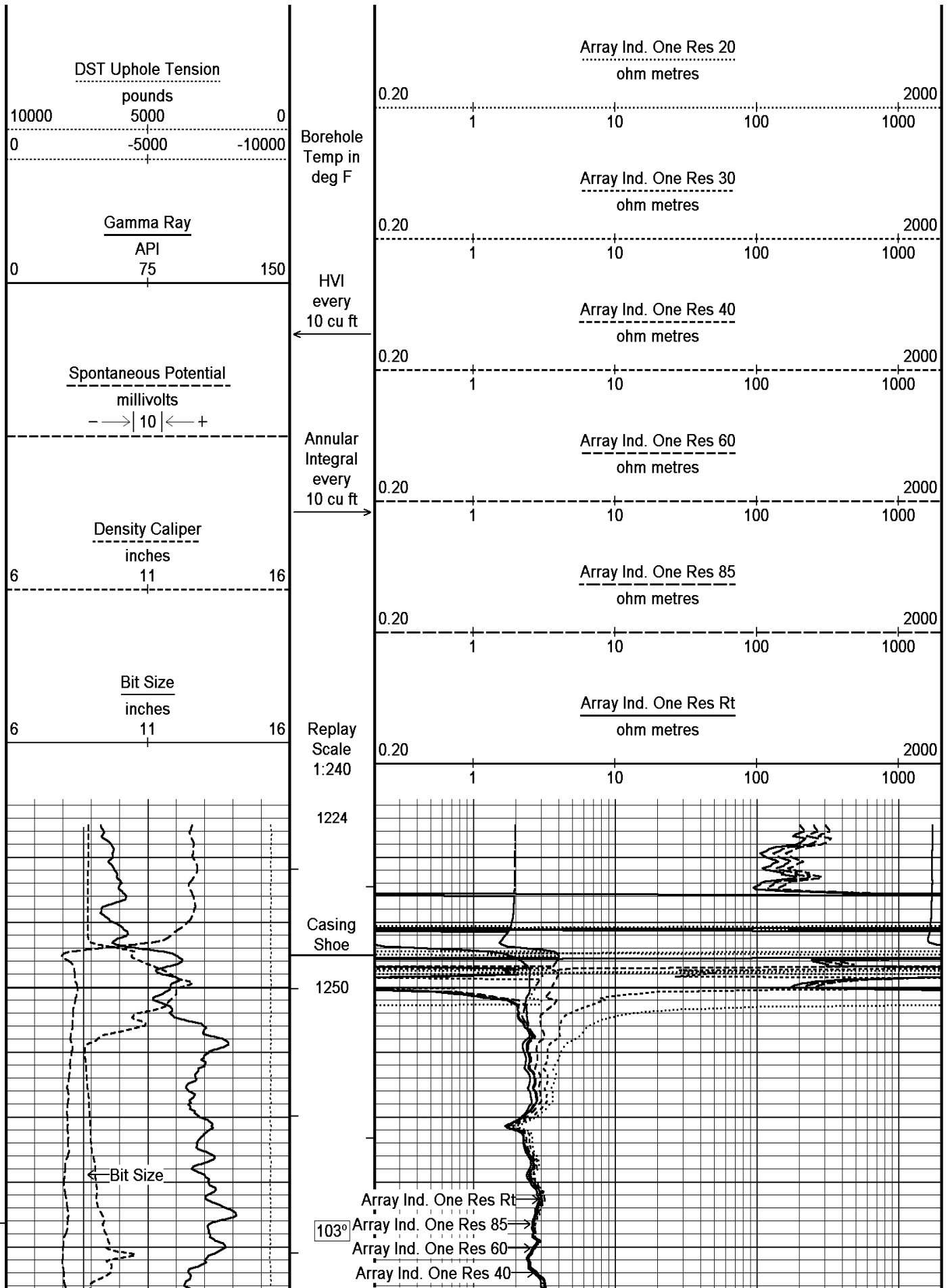


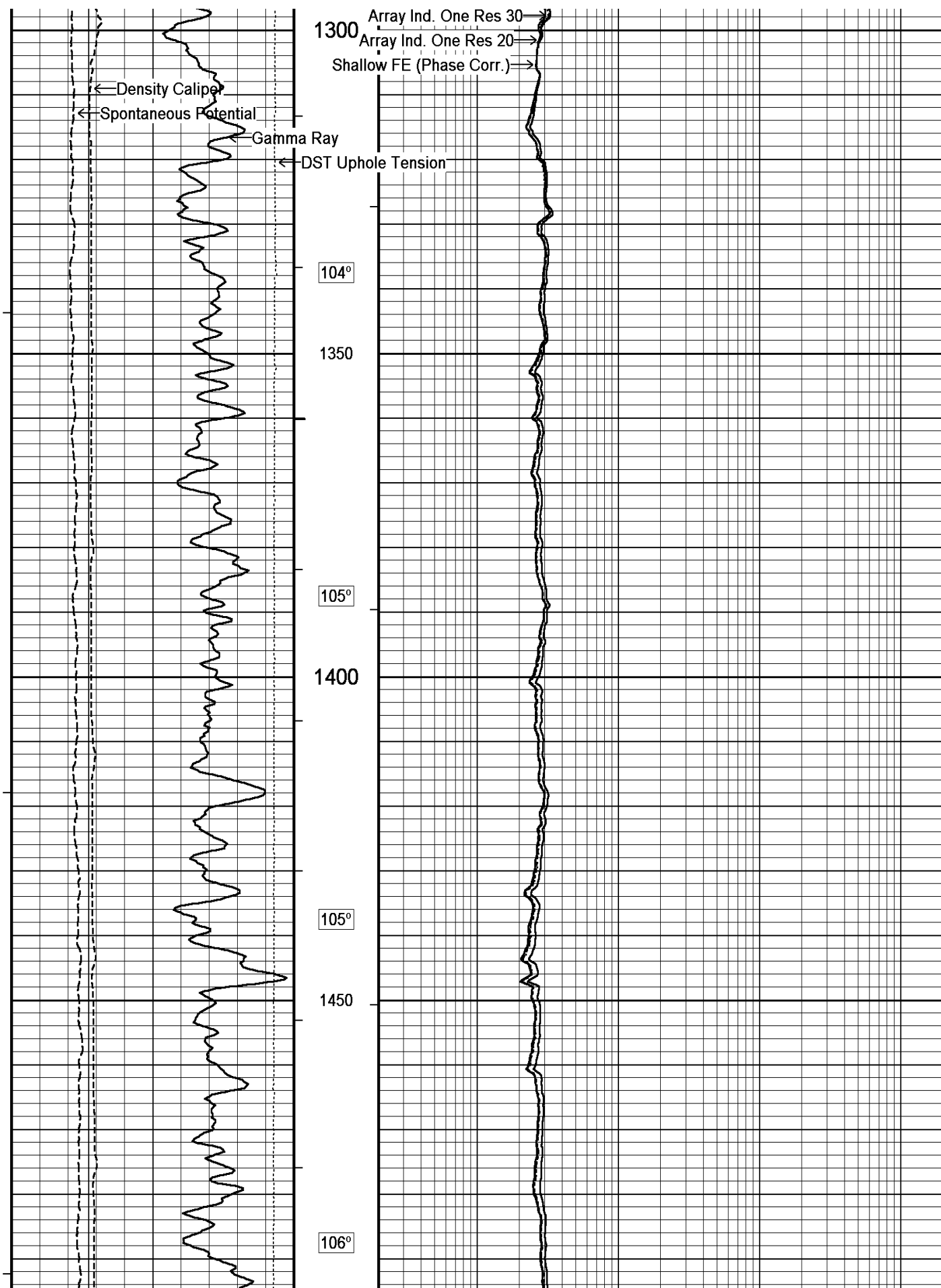


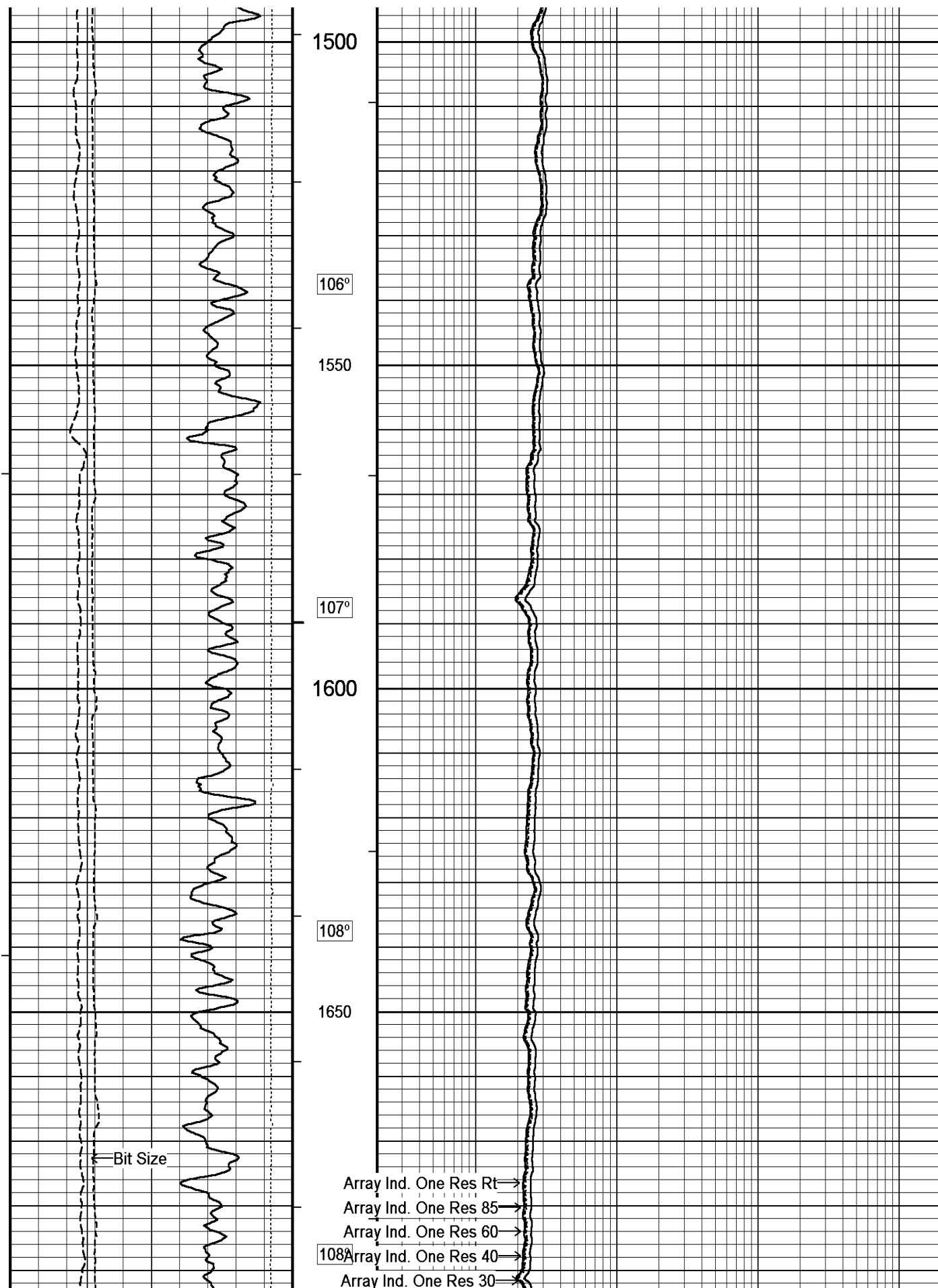


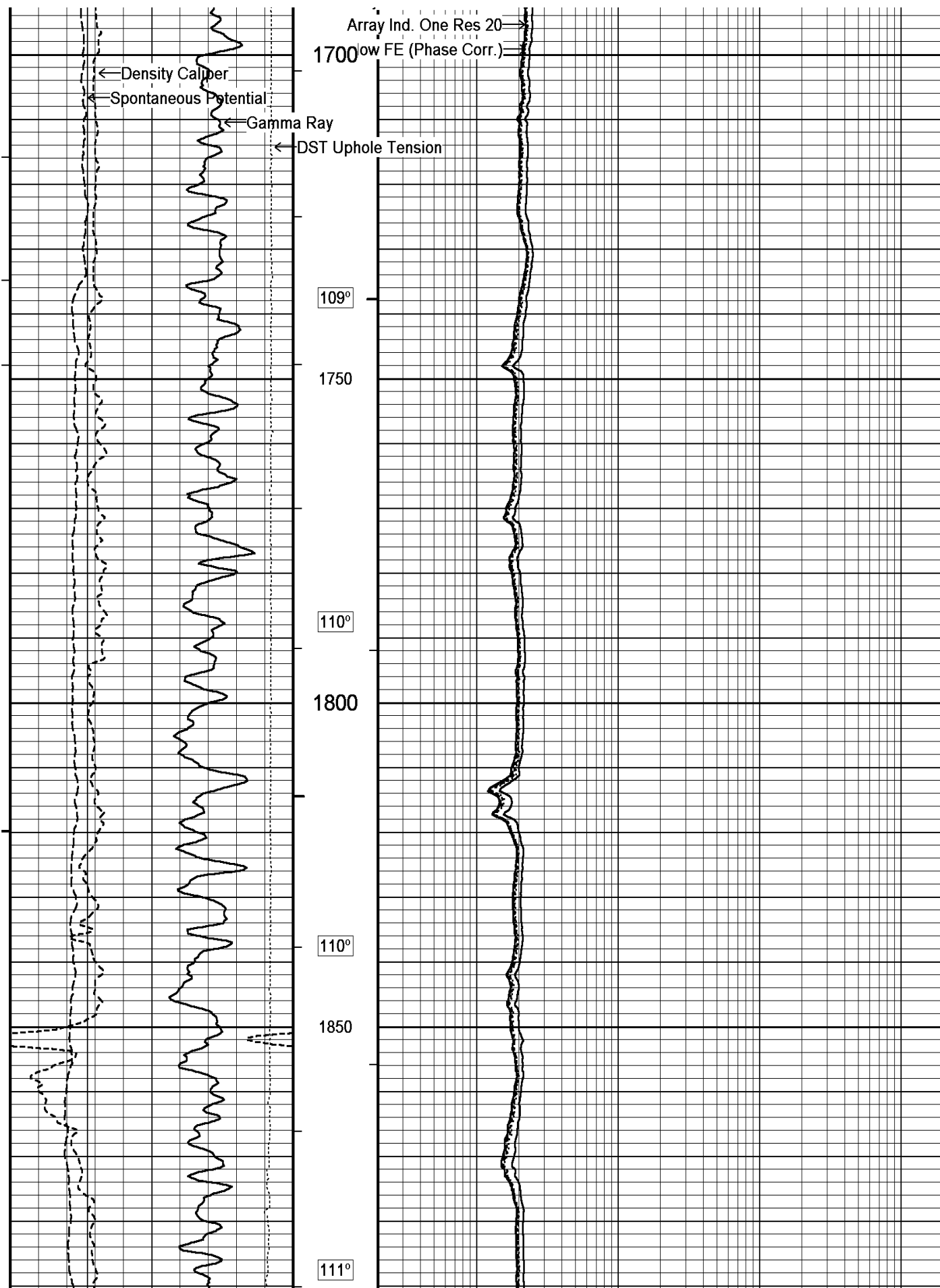


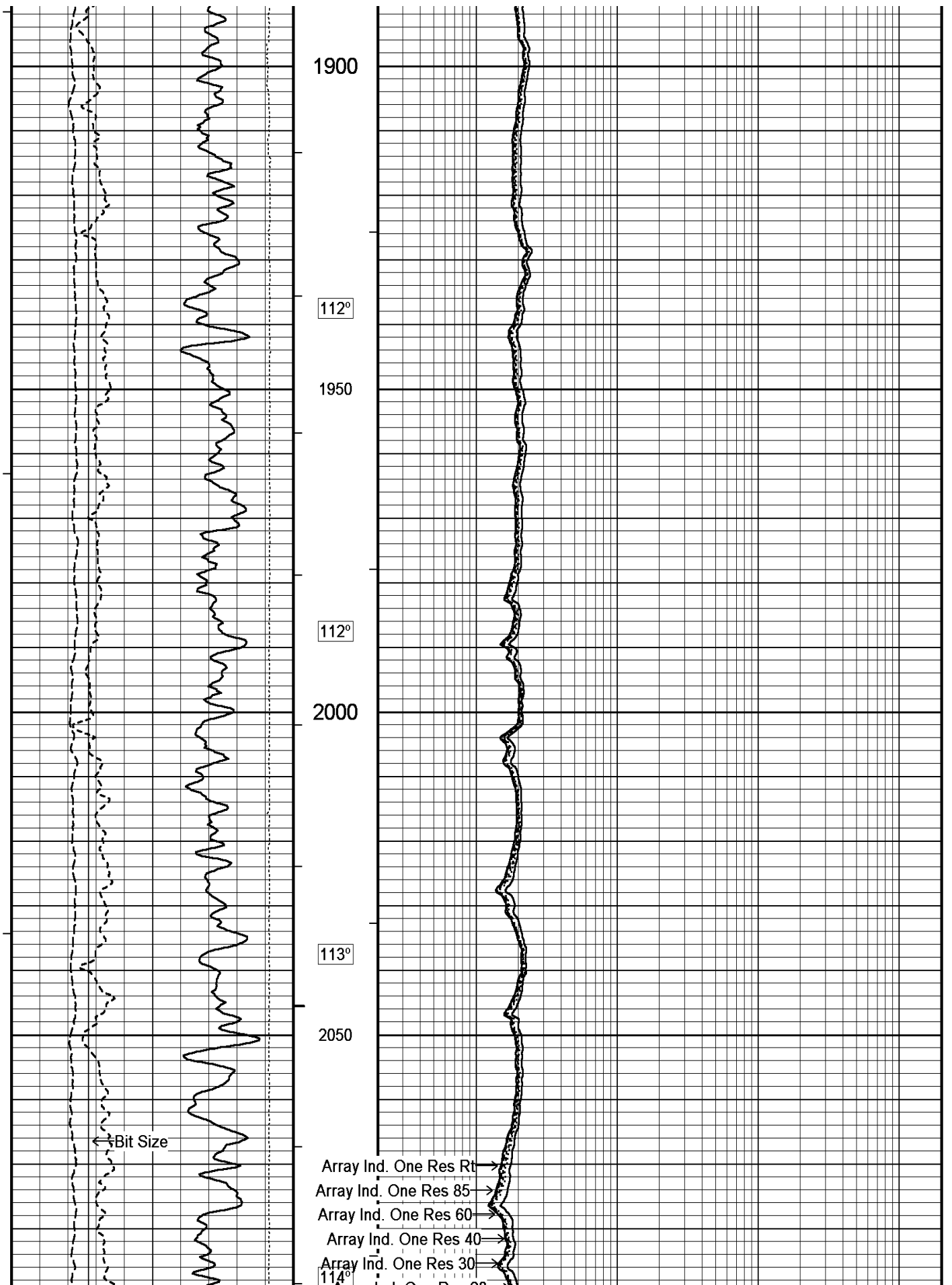




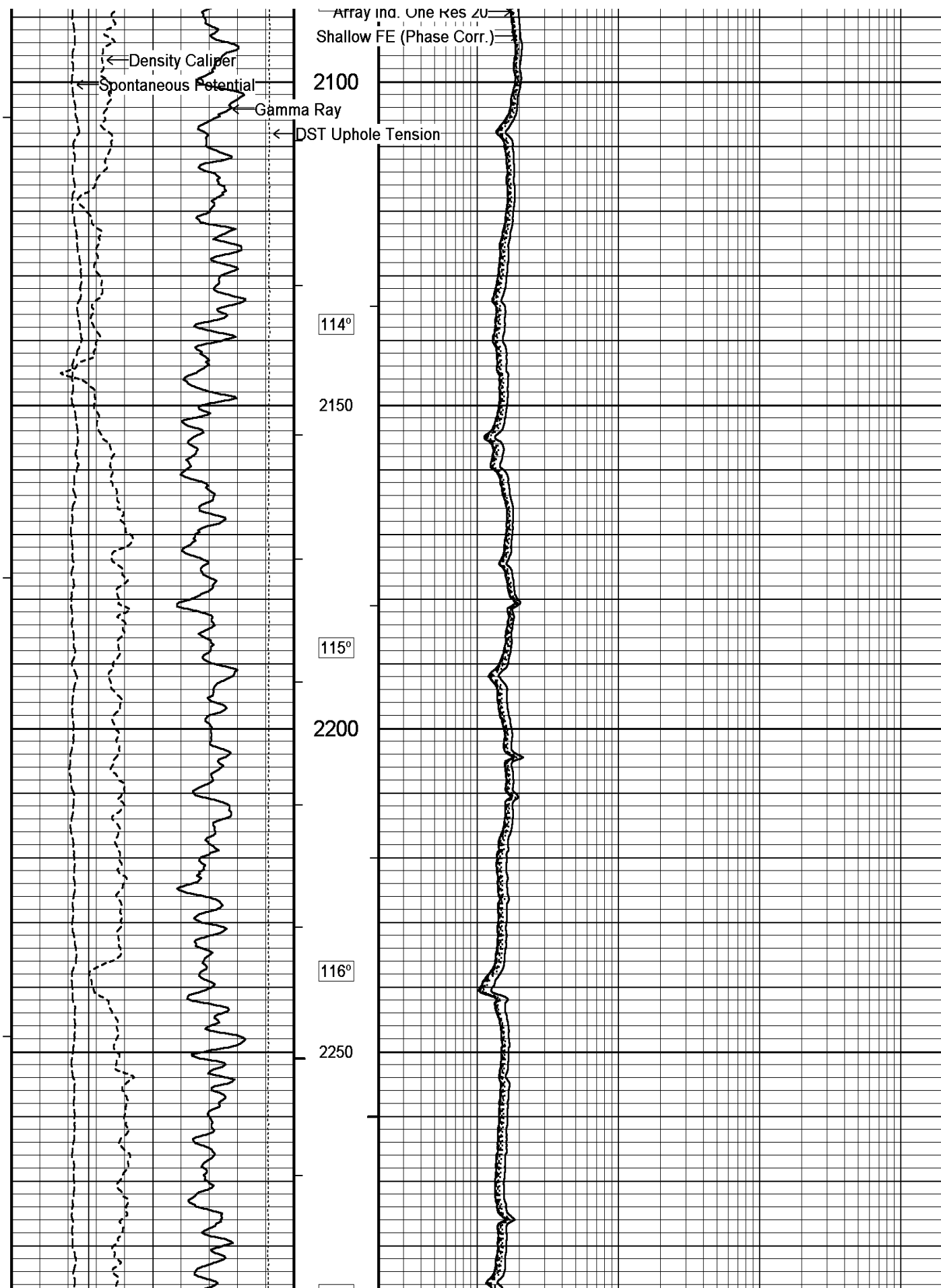


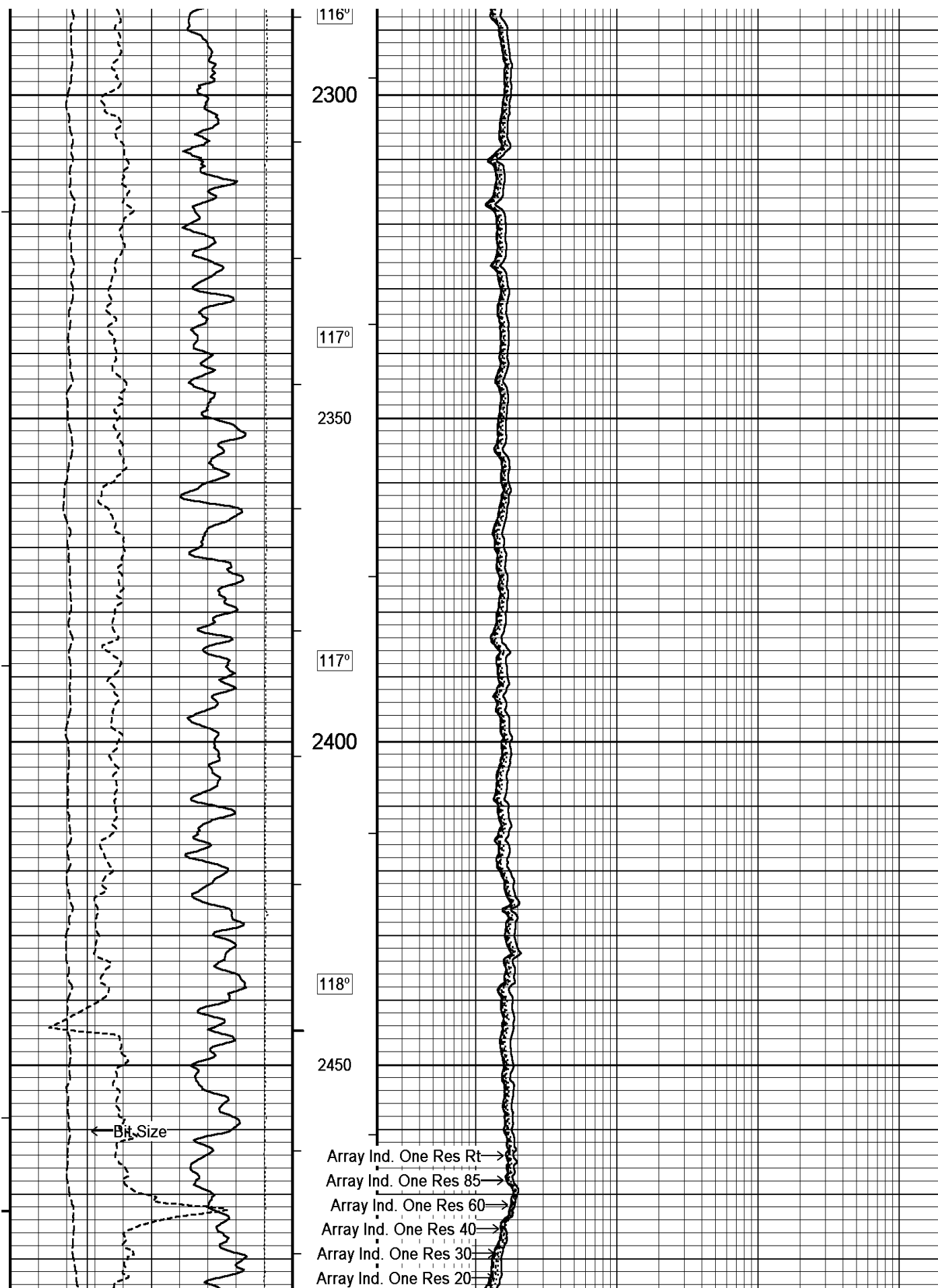


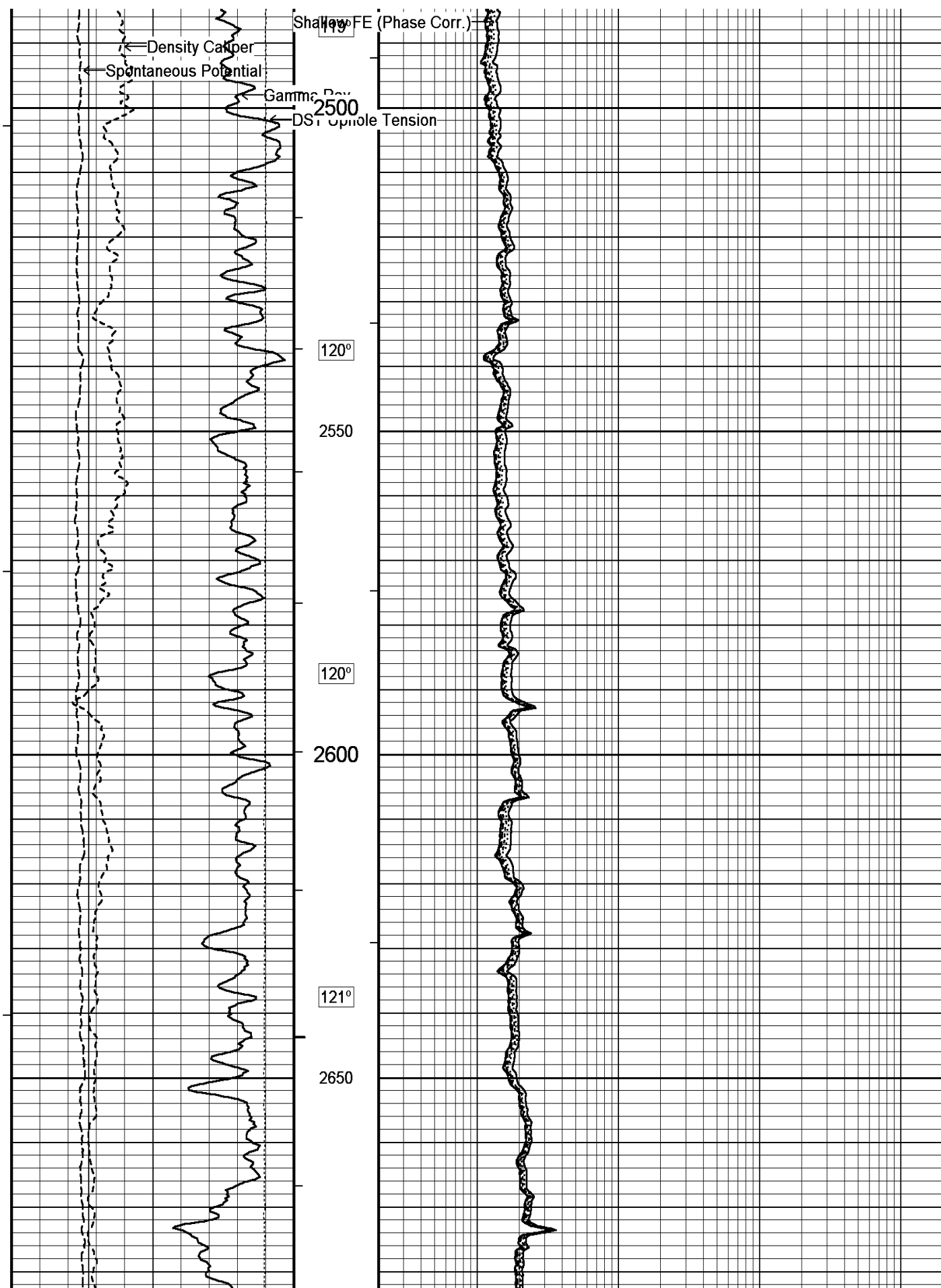


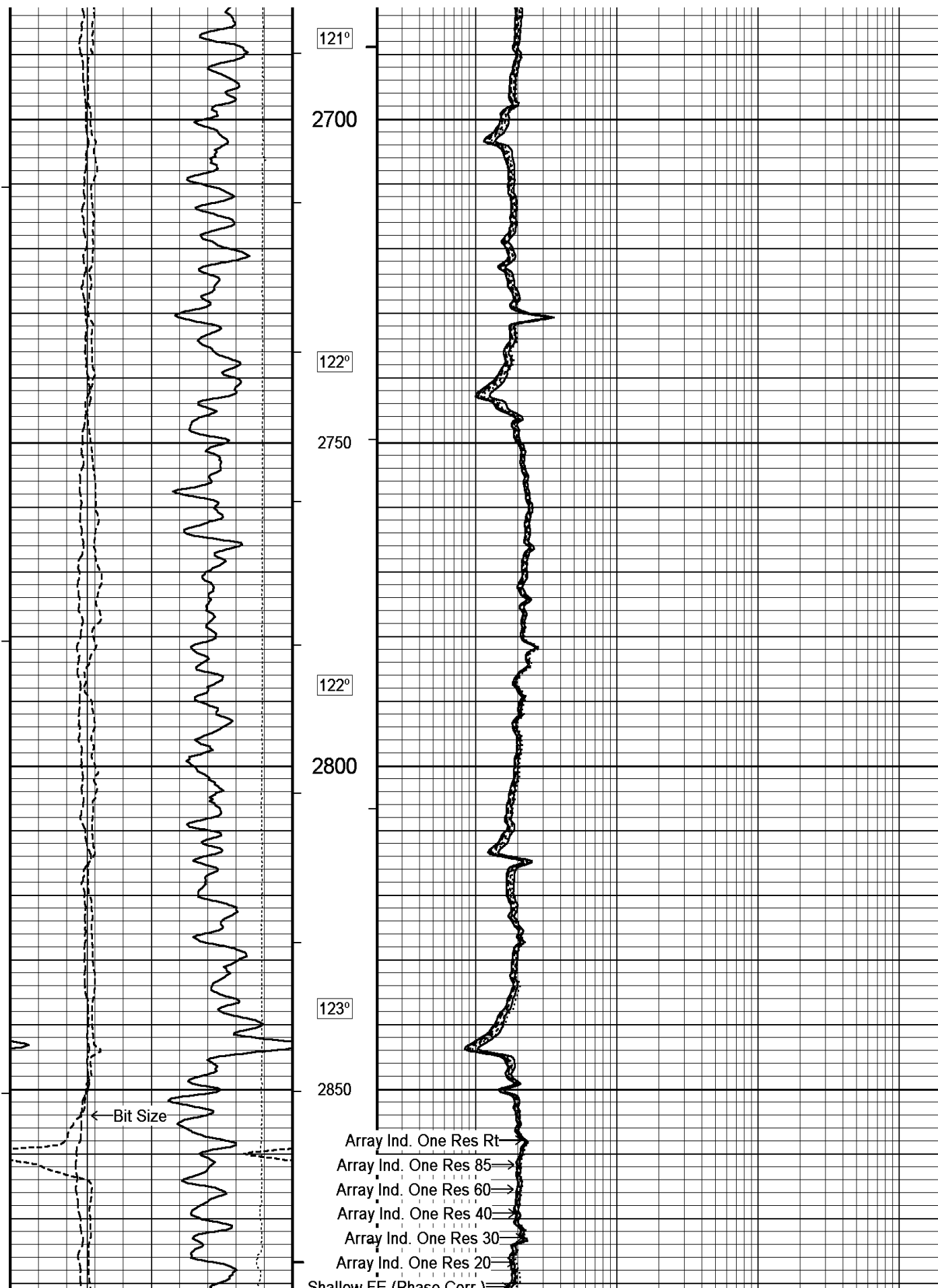


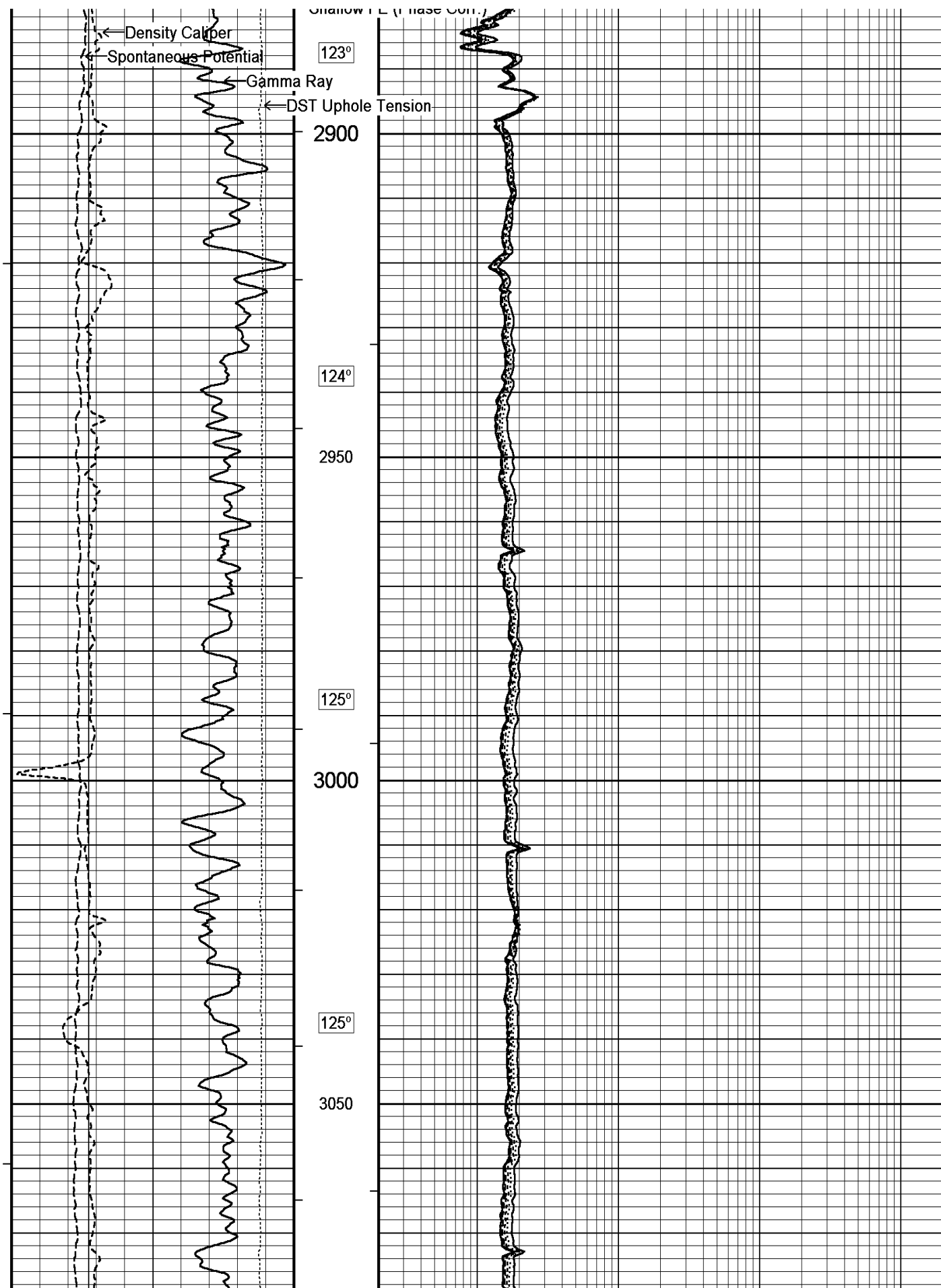


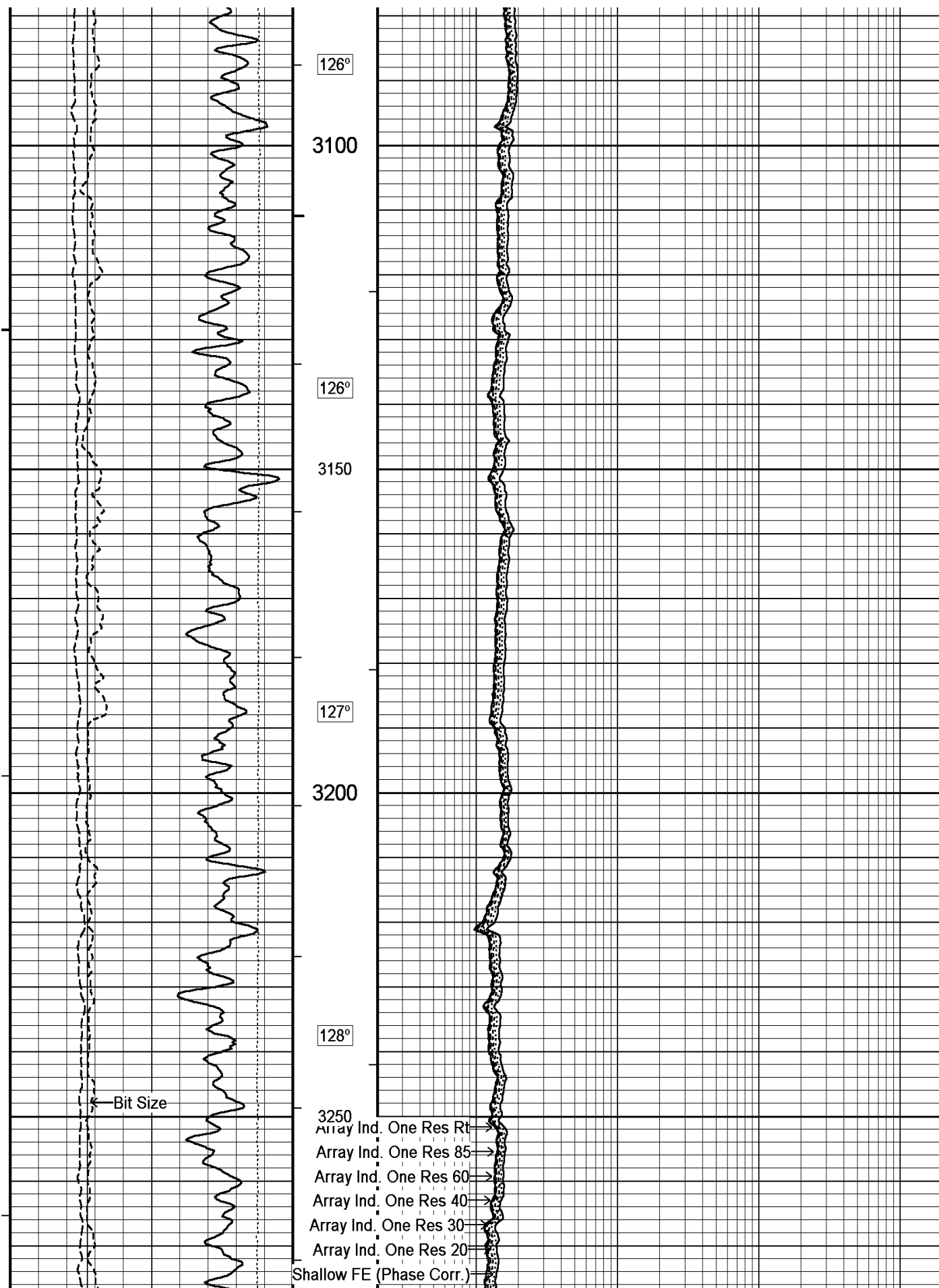


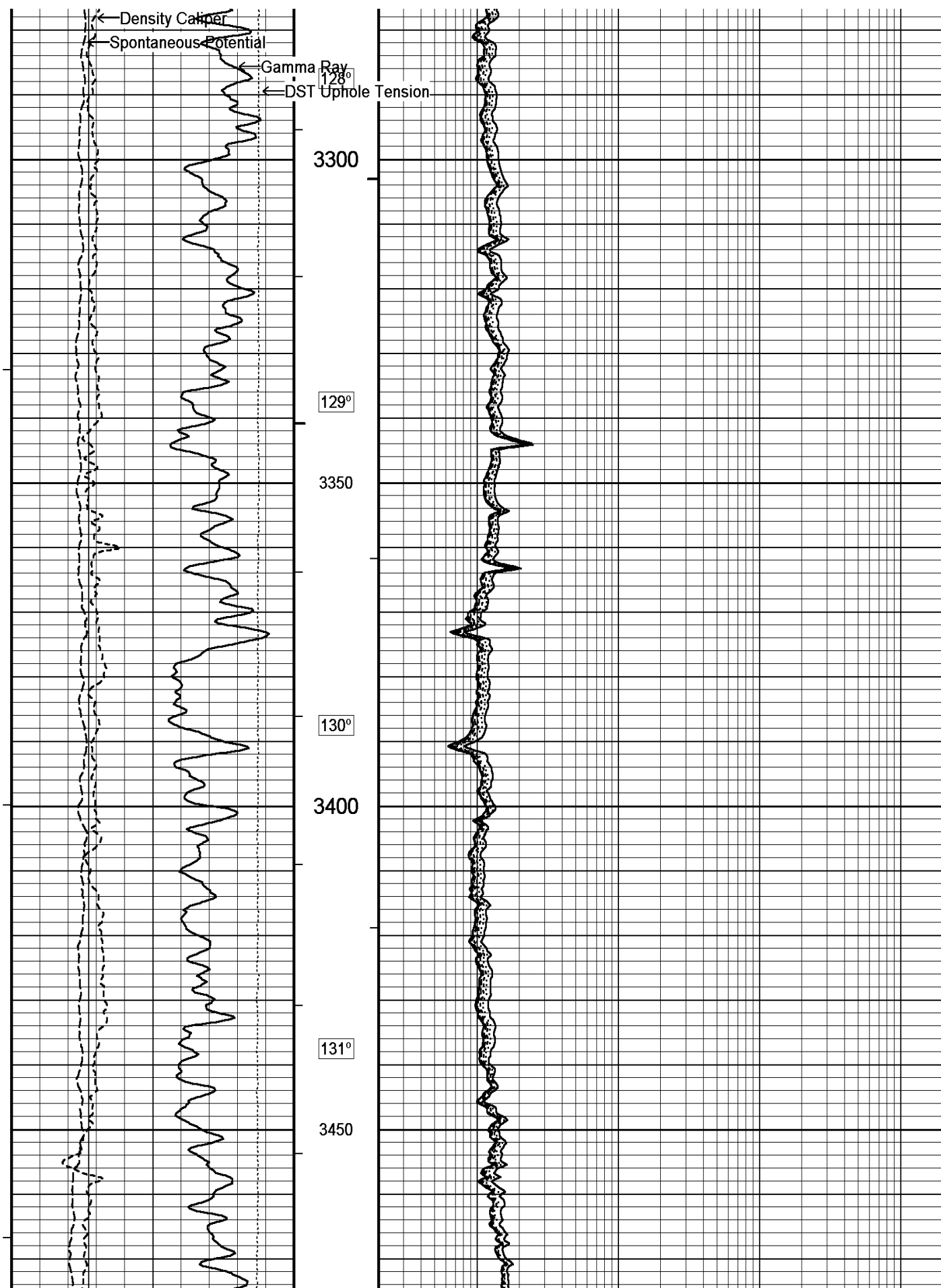


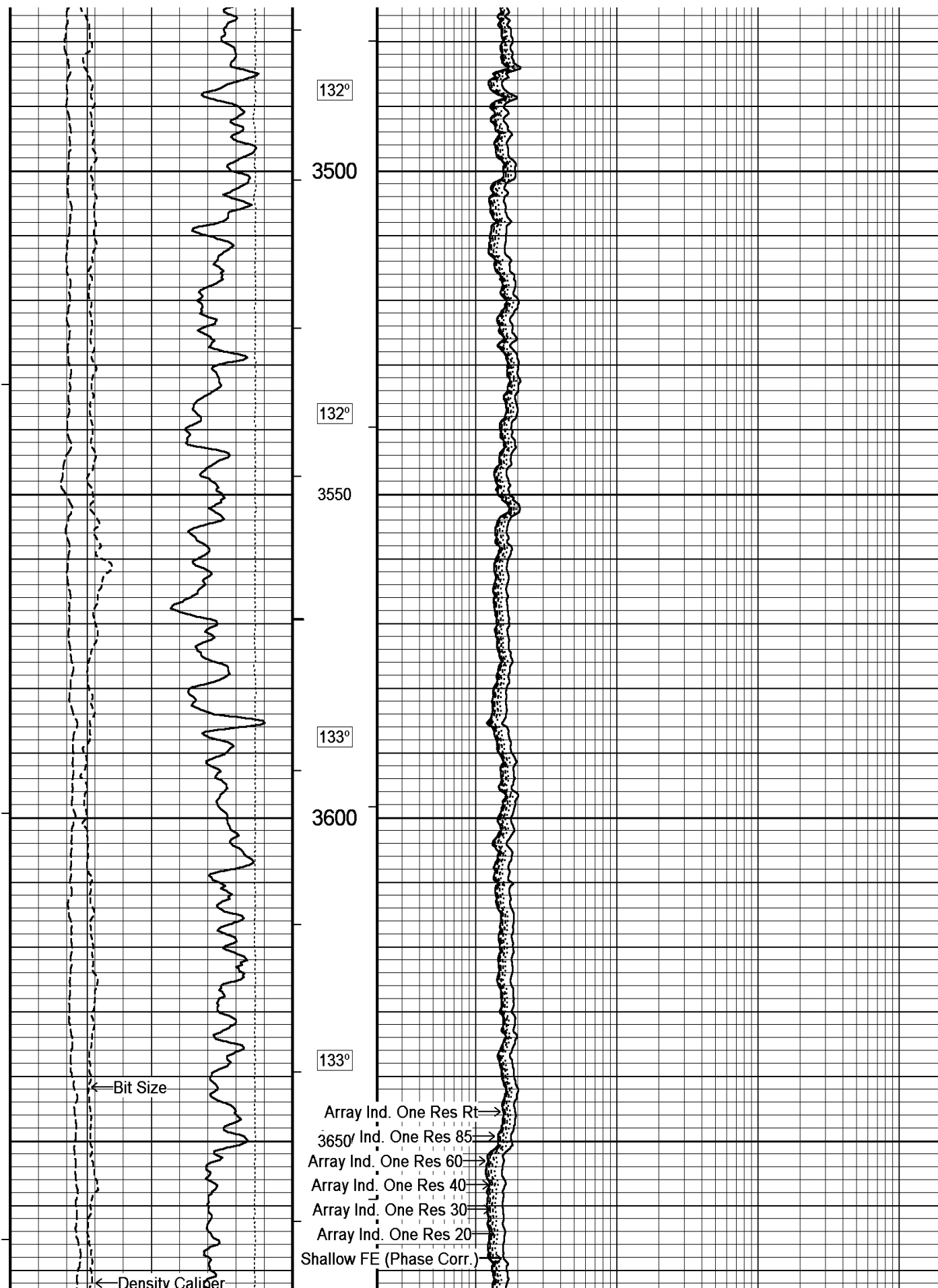




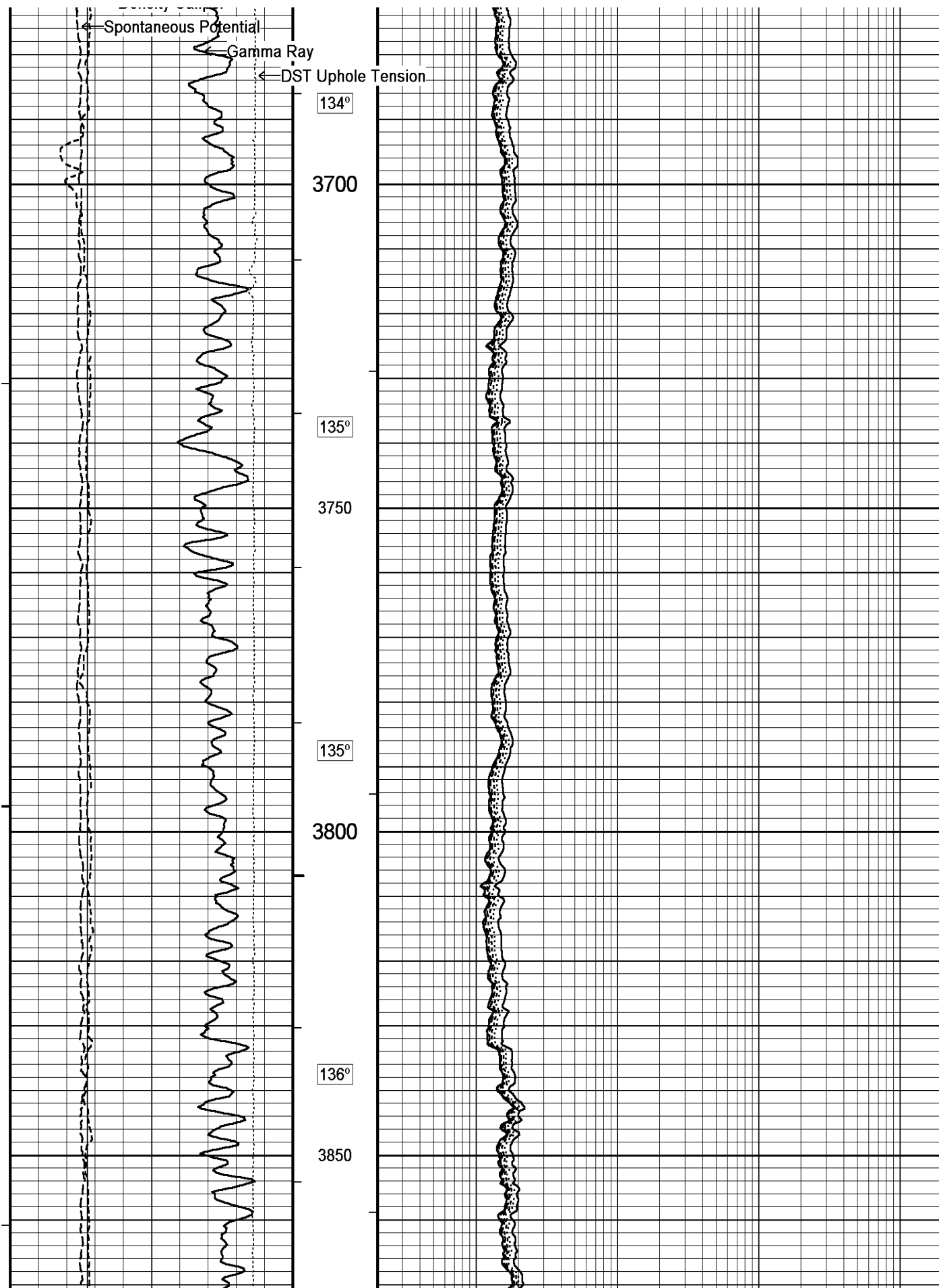


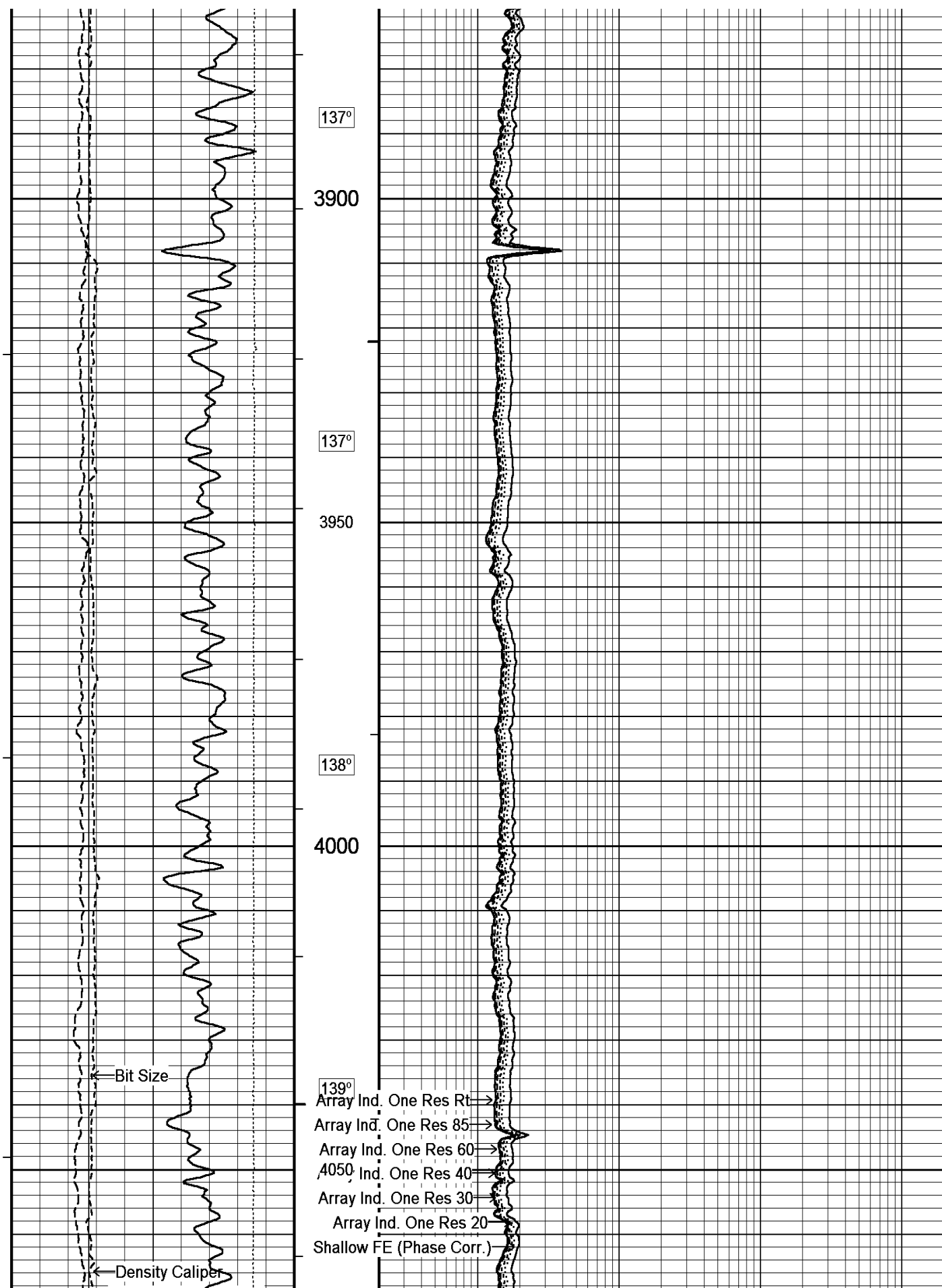


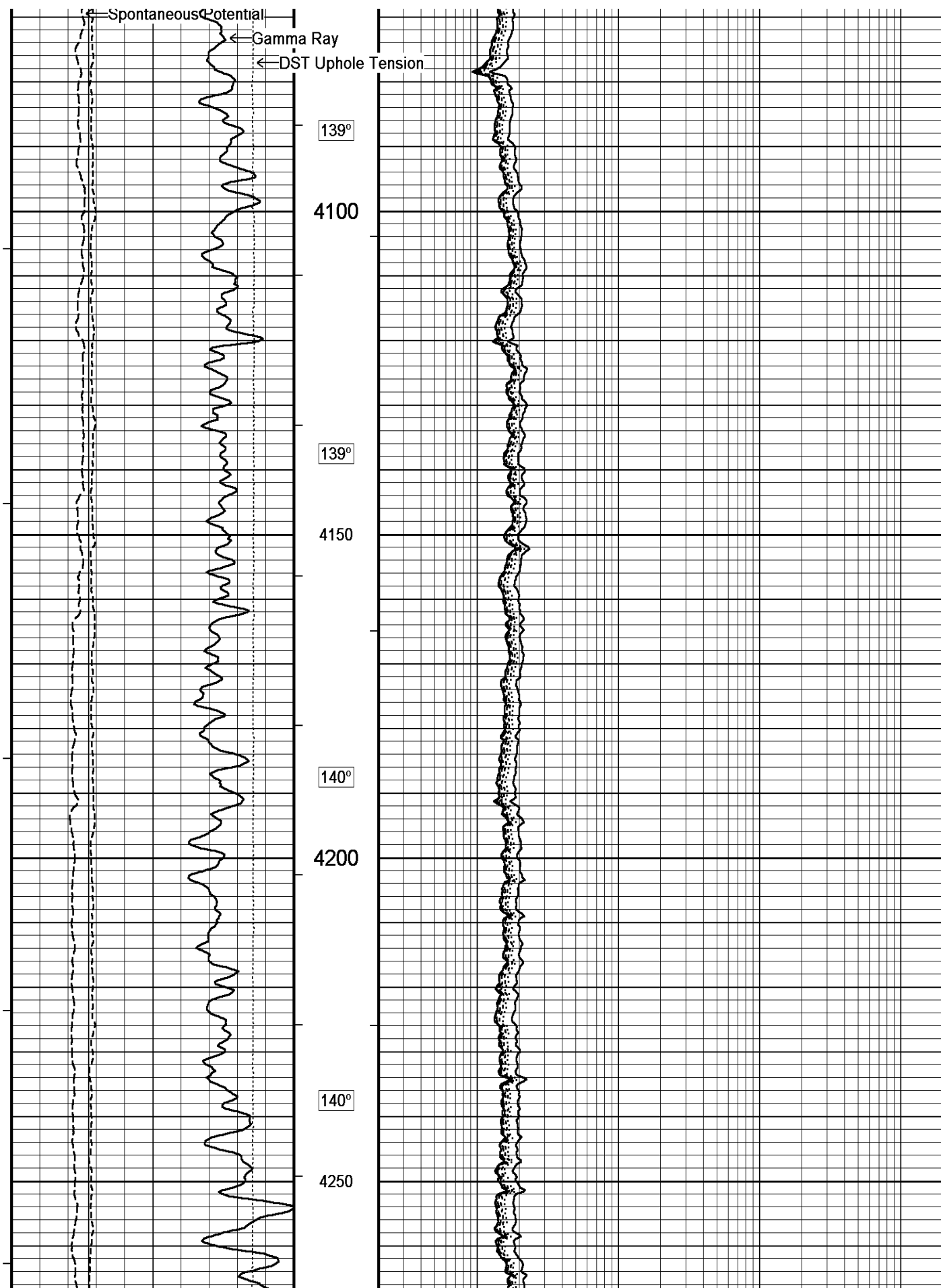


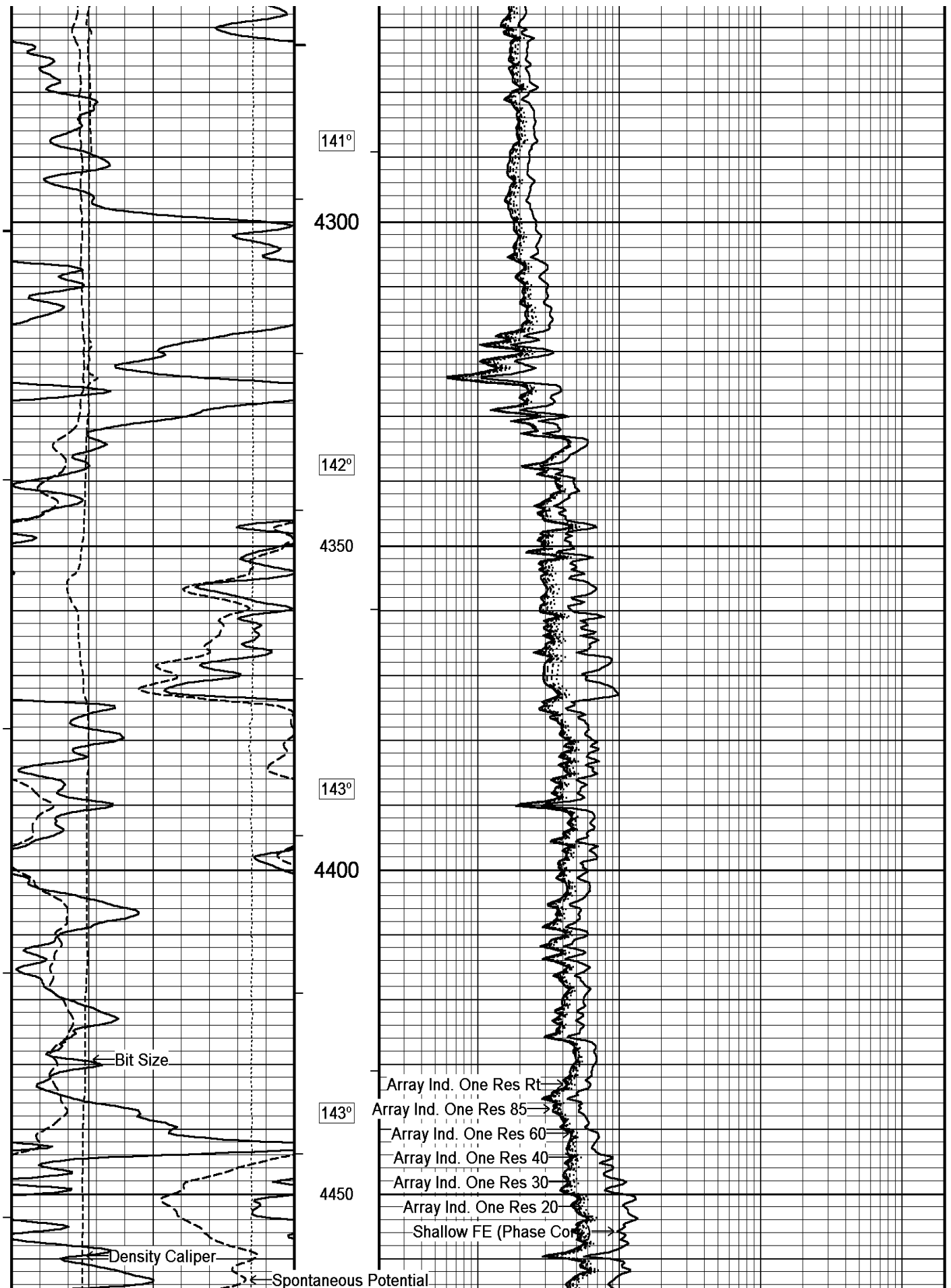


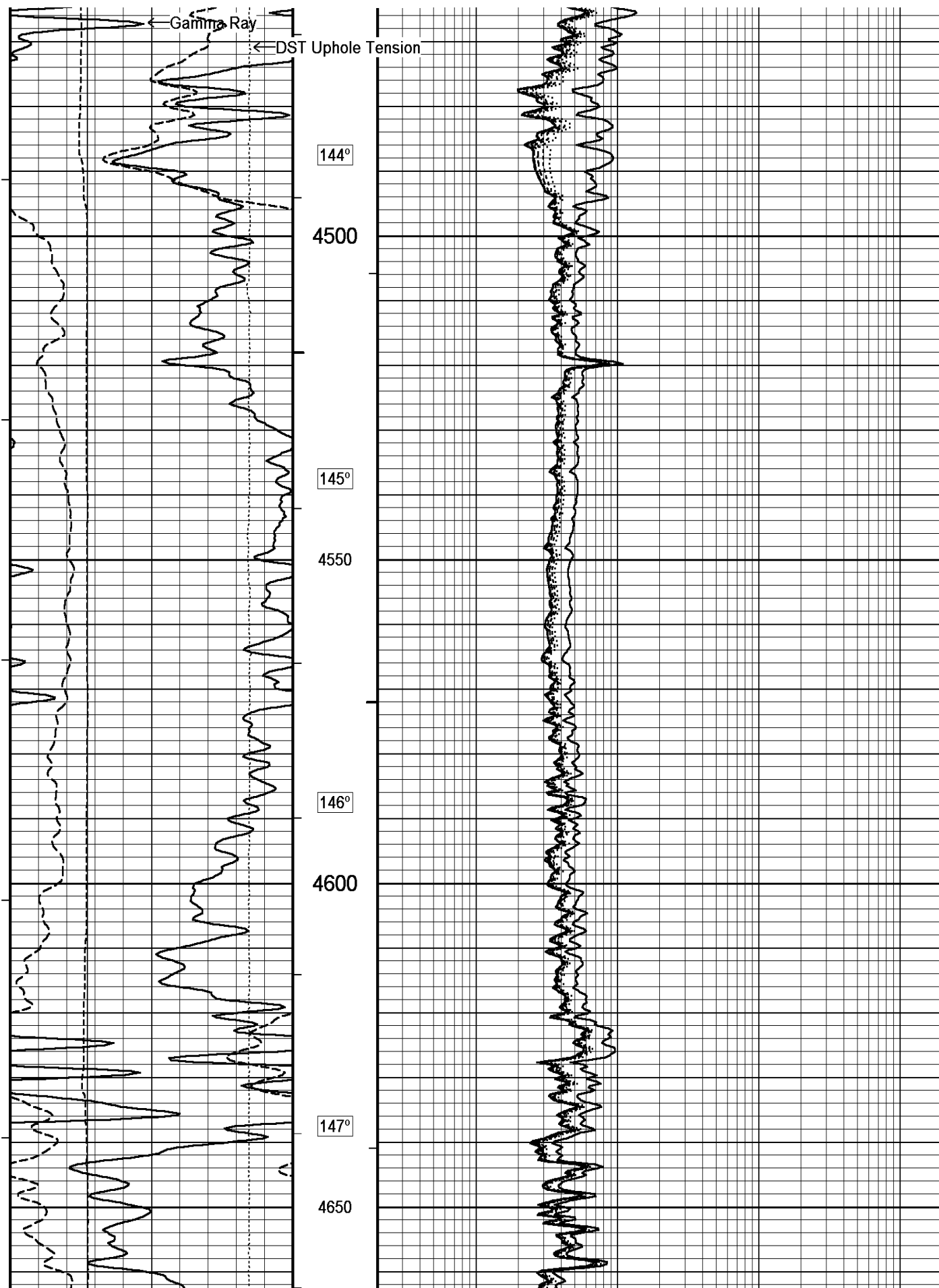


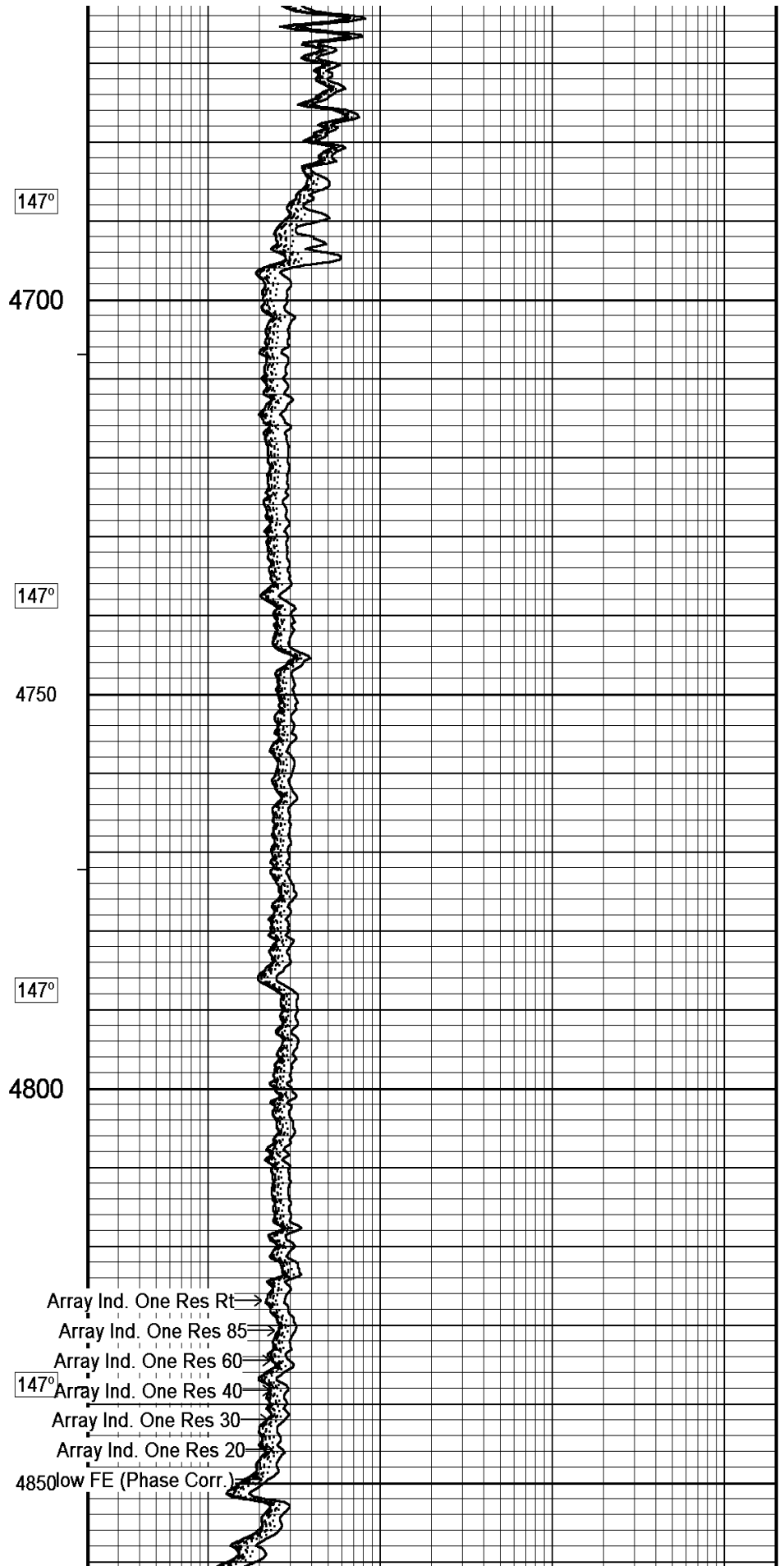
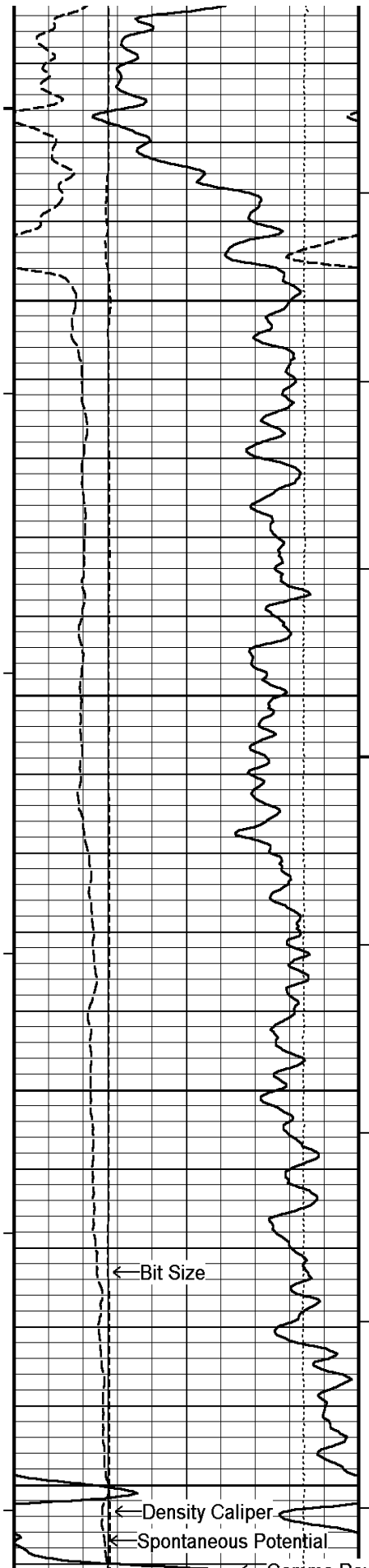


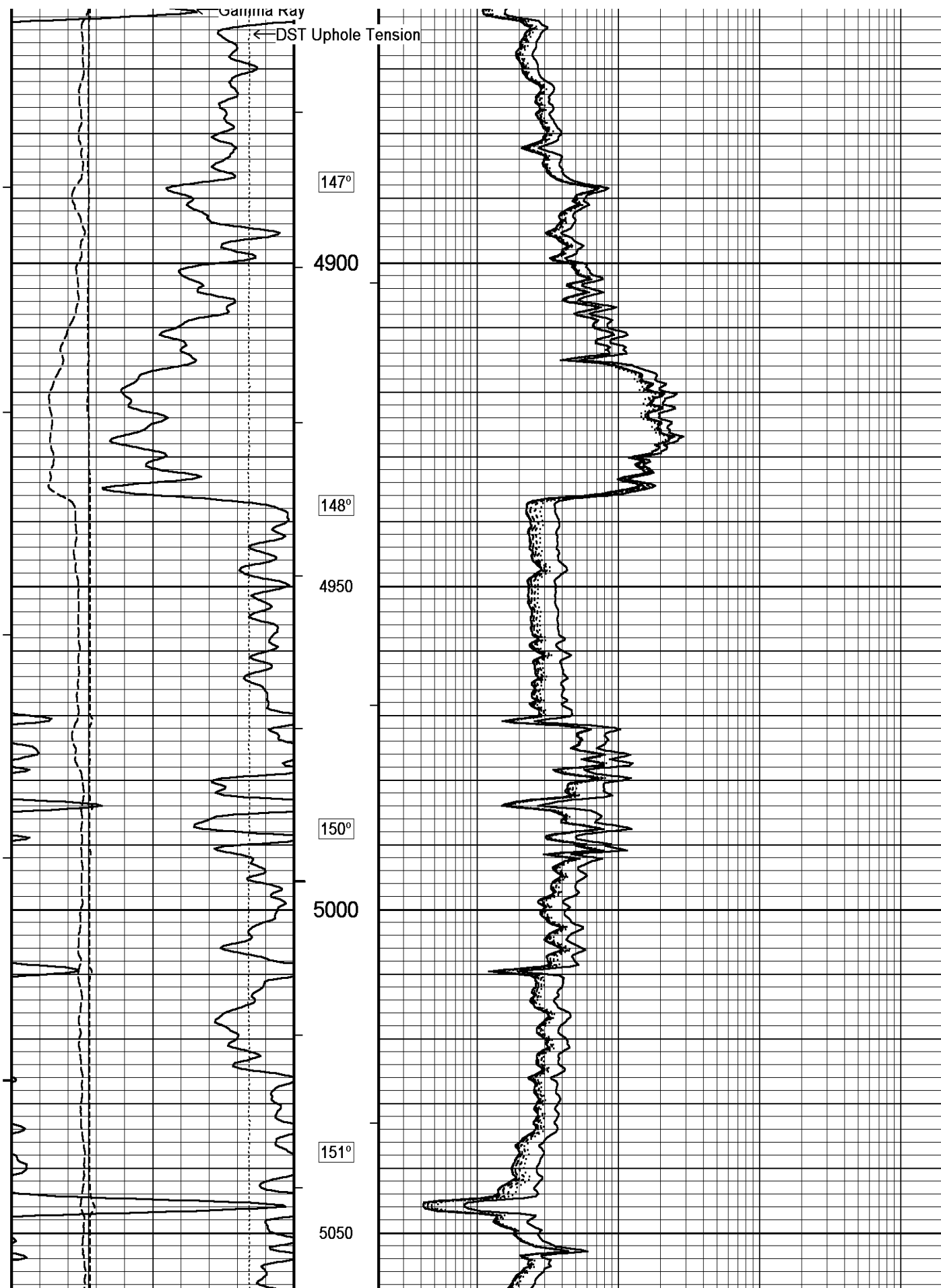


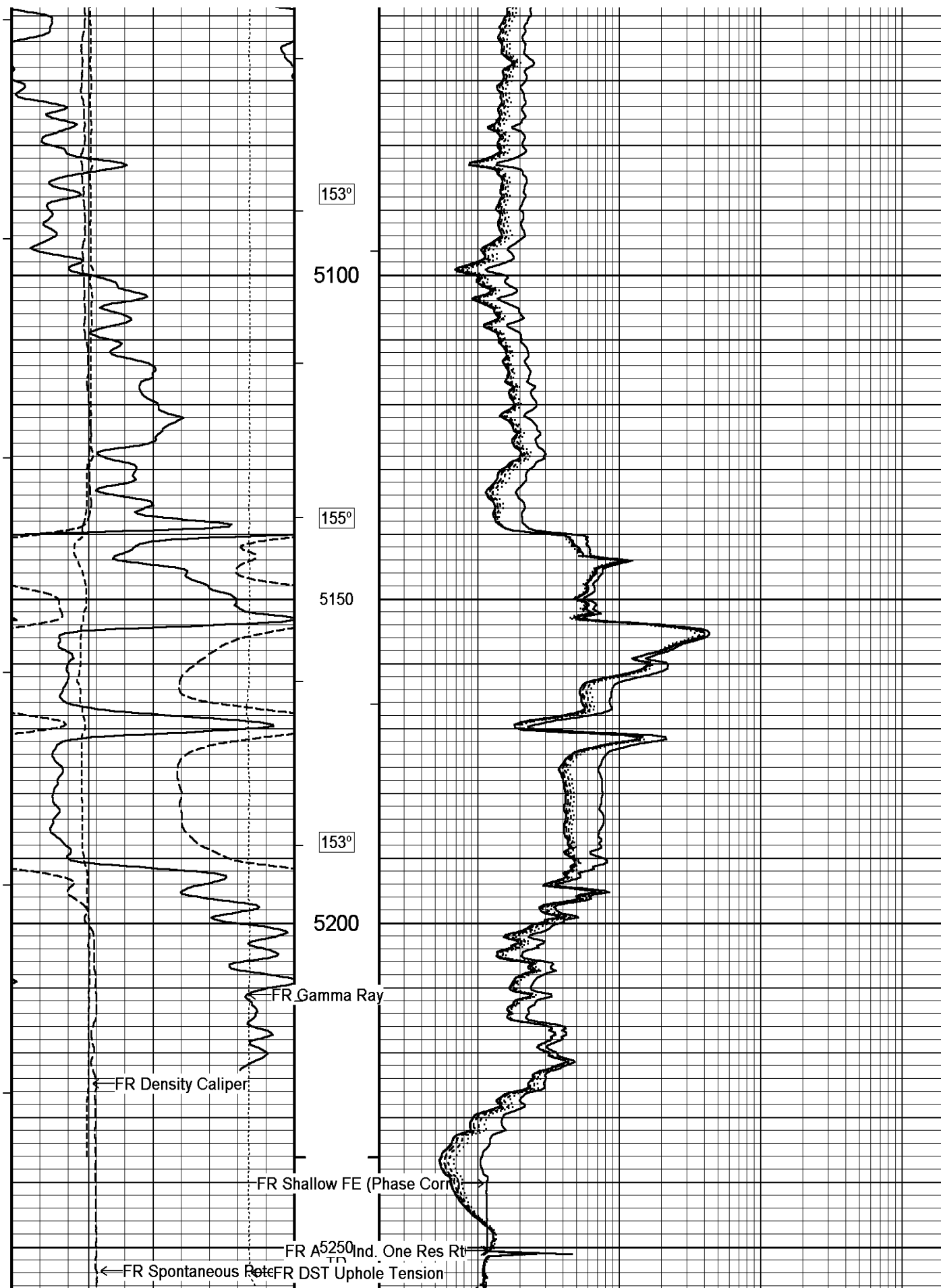




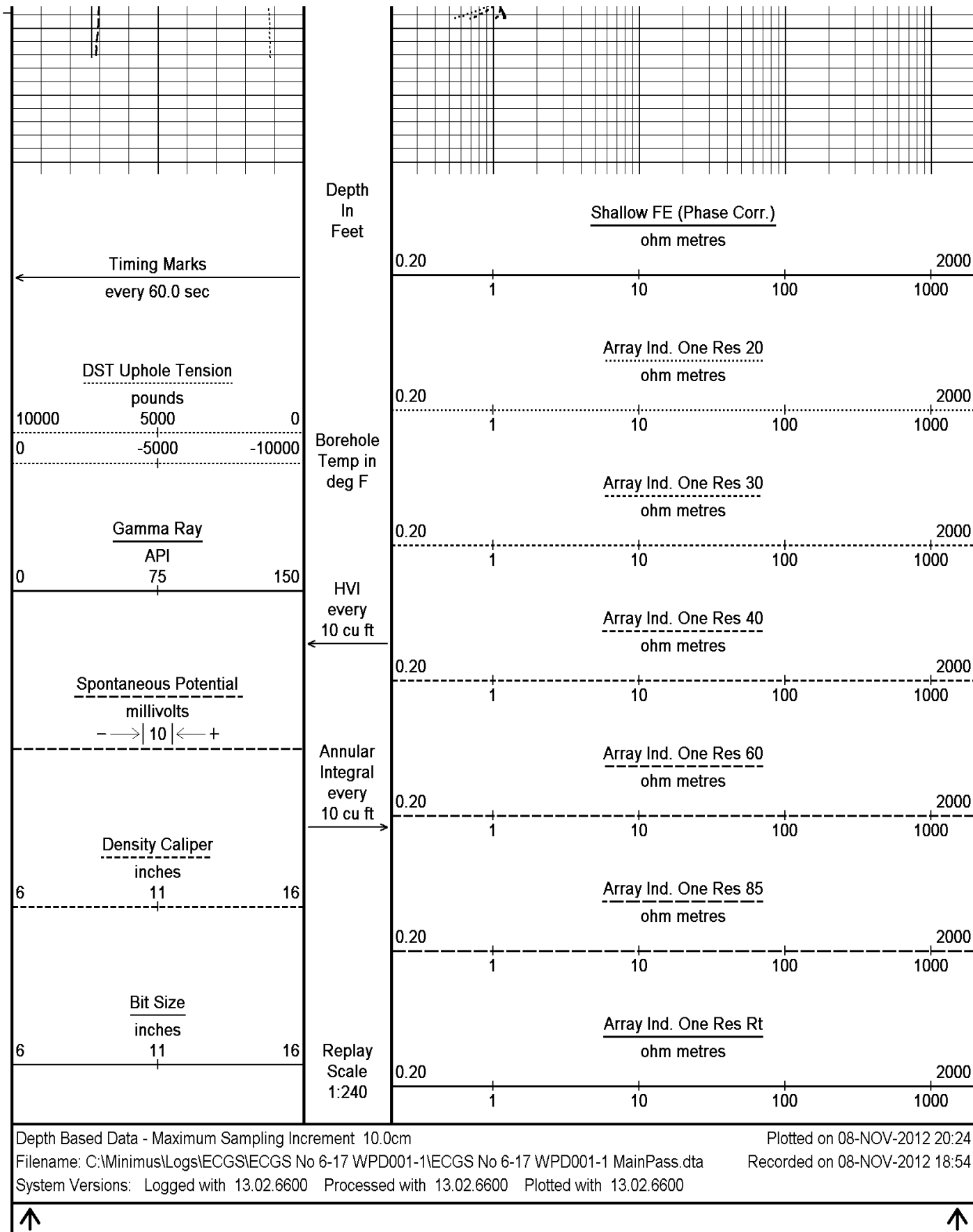


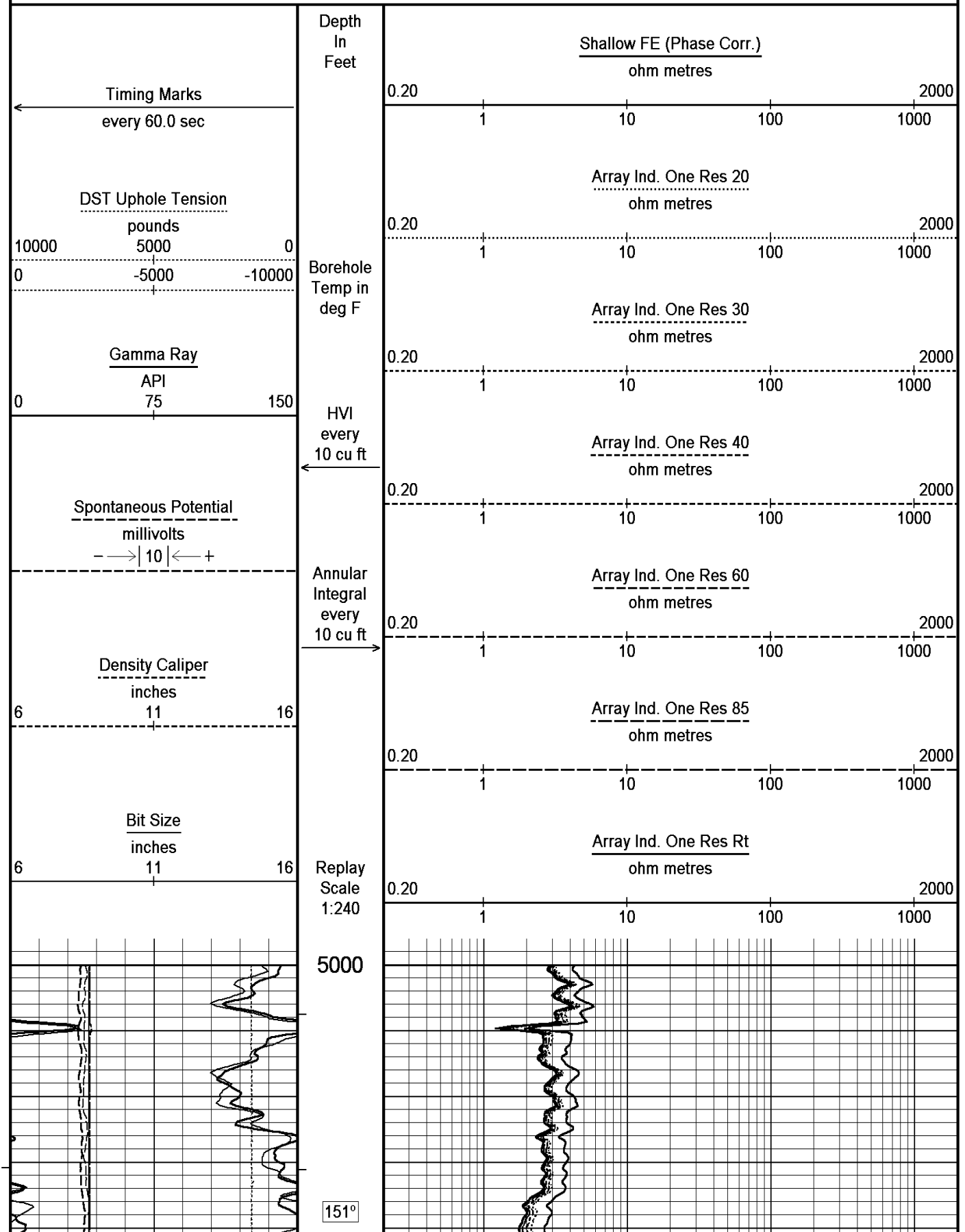


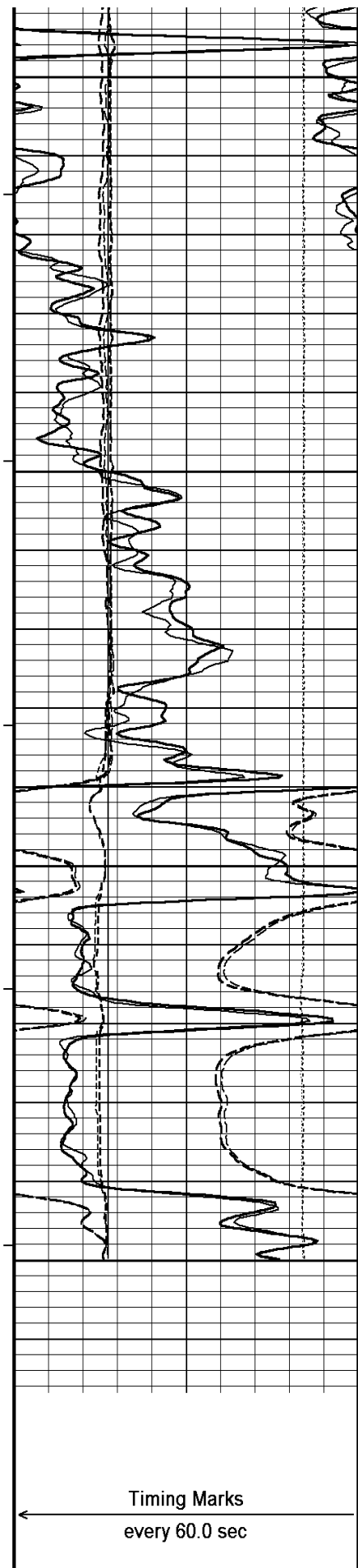












5050

153°

5100

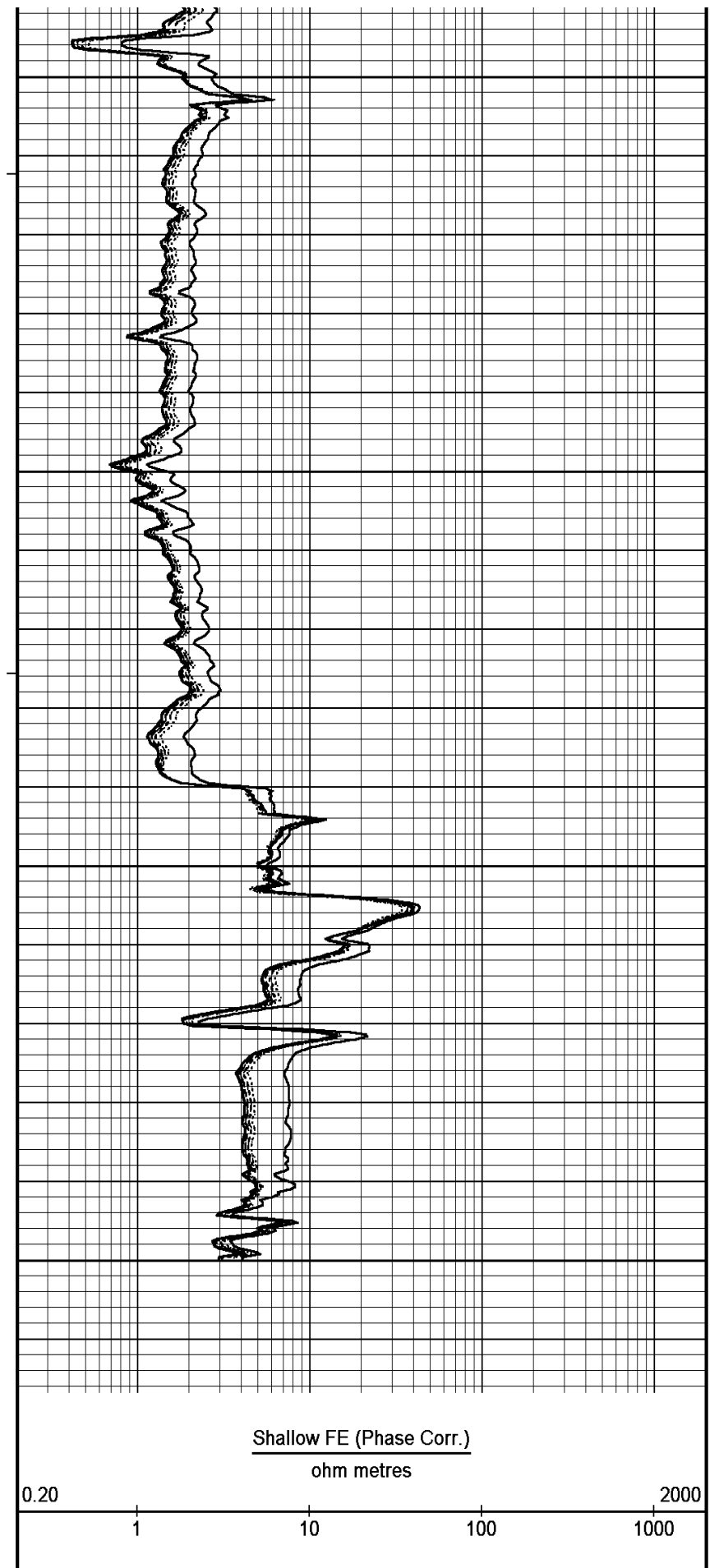
155°

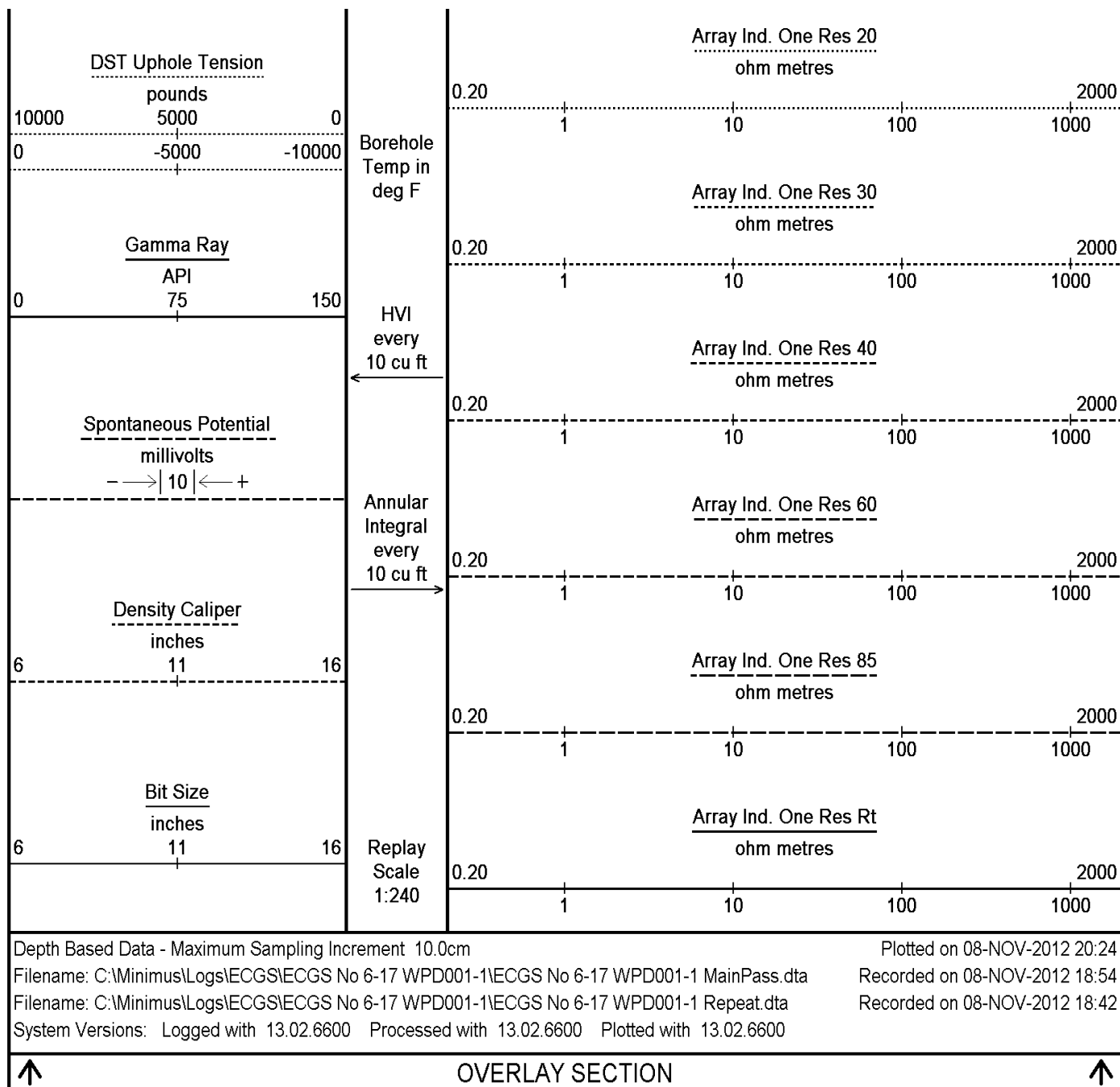
5150

153°

5200

Depth  
In  
Feet





BEFORE SURVEY CALIBRATION		
C:\Minimus\Logs\ECGS\ECGS No 6-17 WPD001-1\ECGS No 6-17 WPD001-1 Repeat.dta		
Down-hole Tension Calibration All 000 <span style="float: right;">Field Calibration on 24-OCT-2010 03:34</span>		
Reading No	Measured	0
1	15659.85	0.00
2	15734.68	370.00
General Constants All 000 <span style="float: right;">Last Edited on 08-NOV-2012,18:22</span>		
General Parameters		
Mud Resistivity	3.310	ohm-metres
Mud Resistivity Temperature	83.400	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 08-NOV-2012 18:00				
Reading No	Measured	Calibrated (lbs)		
1	15010.86	0.00		
2	16059.69	360.00		
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			
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 07-NOV-2012 16:13				
	Measured	Calibrated (API)		
Background	75	51		
Calibrator (Gross)	788	531		
Calibrator (Net)	713	480		
Gamma Constants MCG-D.K 483				
Last Edited on 08-NOV-2012,17:29				
Gamma Calibrator Number	GRCC-112			
Mud Density	1.00	gm/cc		
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 07-NOV-2012 16:21				
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)	
			1656	2376
Ratio			0.697	
Neutron Constants MDN-B.A 227				
Last Edited on 08-NOV-2012 17:29				

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	

## FE Calibration MFE-A.A 66

 Base Calibration on 15-OCT-2012 13:42  
 Field Check on 07-NOV-2012 16:14

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	997.0	126.8
Base Check		272.6
Field Check		272.8

## FE Constants MFE-A.A 66

Last Edited on 08-NOV-2012, 17:28

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

	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)
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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 07-NOV-2012 15:57
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
Channel	Base Check (mmho/m)	Field Check (mmho/m)
	Low High	Low High
1	12.9 3869.0	12.3 3869.9
2	28.4 3433.8	28.2 3434.8
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	37.5 3972.4
Shallow	41.2 5011.9	40.9 5012.7
Array Temperature	69.2	61.4 Deg F
Induction Constants MAI-A.A 165		Last Edited on 08-NOV-2012,17:28
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 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 07-NOV-2012 16:25	
Base Calibration				
Reading No	Measured	Calibrator Size (in)		
1	15007	4.00		
2	23645	5.96		
3	32400	7.99		
4	40464	9.86		
5	49760	11.93		
6	N/A	N/A		
Field Calibration				
	Measured Caliper (in)	Actual Caliper (in)		
	7.95	7.99		

Photo Density Calibration MPD-C.A 195					Base Calibration on 15-OCT-2012 14:12 Field Check on 07-NOV-2012 16:29	
Density Calibration						
Base Calibration		Measured		Calibrated (sdu)		
		Near	Far	Near	Far	
Reference 1	38135	13267		52994	19128	
Reference 2	18092	1824		25188	2558	
Field Check at Base						
	670.1	775.1				
Field Check						
	669.6	776.7				
PE Calibration						
Base Calibration		Measured		Calibrated		
	WS	WH	Ratio	Ratio		
Background	122	602				
Reference 1	13157	38045	0.348	0.309		
Reference 2	5216	18018	0.292	0.274		
Field Check at Base						
	122.4	602.2				
Field Check						
	121.2	601.8				

Density Constants MPD-C.A 195			Last Edited on 08-NOV-2012,17:29	
Density Source Id	2859GW			
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)			



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:\Minimus\Logs\ECGS\ECGS No 6-17 WPD001-1\ECGS No 6-17 WPD001-1 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 66 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

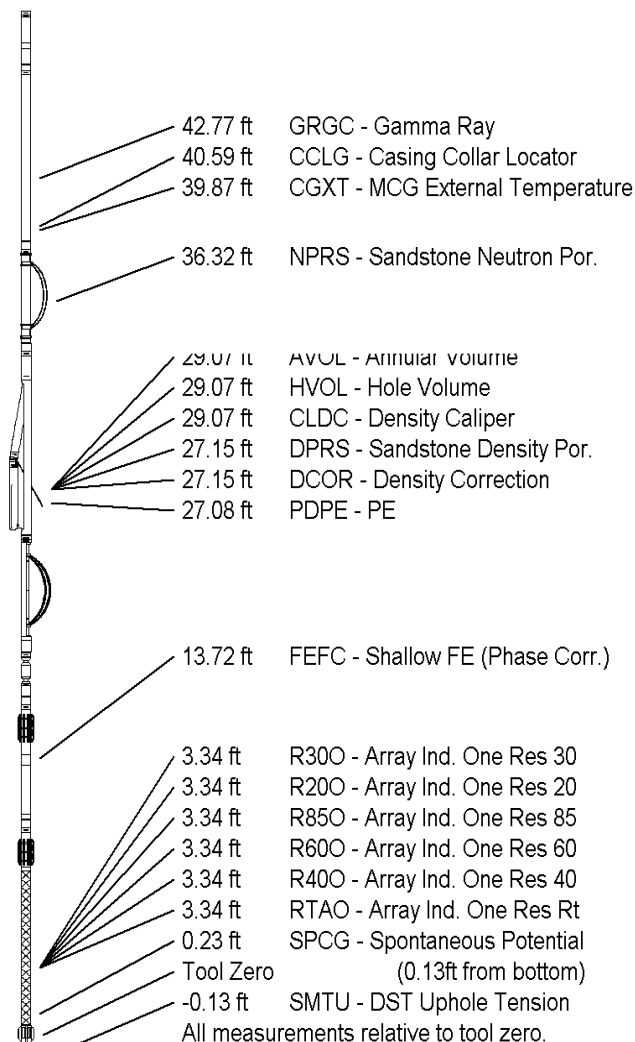
Compact Focussed Electric

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: 50.36 ft Weight: 381.4 lb



COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 6-17 WPD001-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4565.00	feet	First Reading	5251.00	feet
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Elevation Drill Floor	4564.00	feet	Depth Driller	5257.00	feet
Elevation Ground Level	4549.00	feet	Depth Logger	5254.00	feet



**Weatherford®**

ARRAY INDUCTION  
LOGS