



**Weatherford**<sup>®</sup>

**ARRAY INDUCTION  
SHALLOW FOCUSED  
ELECTRIC LOG**

COMPANY **SHAKESPEARE OIL CO., INC**  
WELL **TEETER #2-11**  
FIELD **STRATFORD**  
PROVINCE/COUNTY **LOGAN**  
COUNTRY/STATE **U.S.A. / KANSAS**  
LOCATION **514' FSL & 1494' FEL**

SEC **11** TWP **13S** RGE **32W** Other Services  
MPD/MDN  
MML  
API Number **15-109-21219**  
Permit Number  
Permanent Datum GL, Elevation 2993 feet  
Log Measured From KB  
Drilling Measured From KB

Date **08-DEC-2013** Elevations: **feet**  
Run Number **ONE** KB **2995.00**  
Service Order **3547626** DF **2993.00**  
Depth Driller **4700.00** feet **2983.00**  
Depth Logger **4698.00** feet  
First Reading **4694.66** feet  
Last Reading **3698.00** feet  
Casing Driller **227.00** feet  
Casing Logger **222.00** feet

Bit Size **7.875** inches  
Hole Fluid Type **CHEMICAL**  
Density / Viscosity **9.40 lb/USg** 55.00 CP  
PH / Fluid Loss **10.00** 7.20 ml/30Min  
Sample Source **FLOWLINE**  
Rm @ Measured Temp **1.73 @ 89.3** ohm-m  
Rmf @ Measured Temp **1.38 @ 89.3** ohm-m  
Rmc @ Measured Temp **2.08 @ 89.3** ohm-m  
Source Rmf / Rmc **CALC** CALC  
Rm @ BHT **1.34 @ 116.0** ohm-m  
Time Since Circulation **3 HOURS**  
Max Recorded Temp **116.00** deg F  
Equipment / Base **13096** LIB  
Recorded By **DEREK CARTER**  
Witnessed By **TIM PRIEST**

Job# **LB13-346**  
ROB HOFFMAN

**BOREHOLE RECORD**

Last Edited: 08-DEC-2013 15:52

Bit Size inches	Depth From feet	Depth To feet
7.875	227.00	4700.00

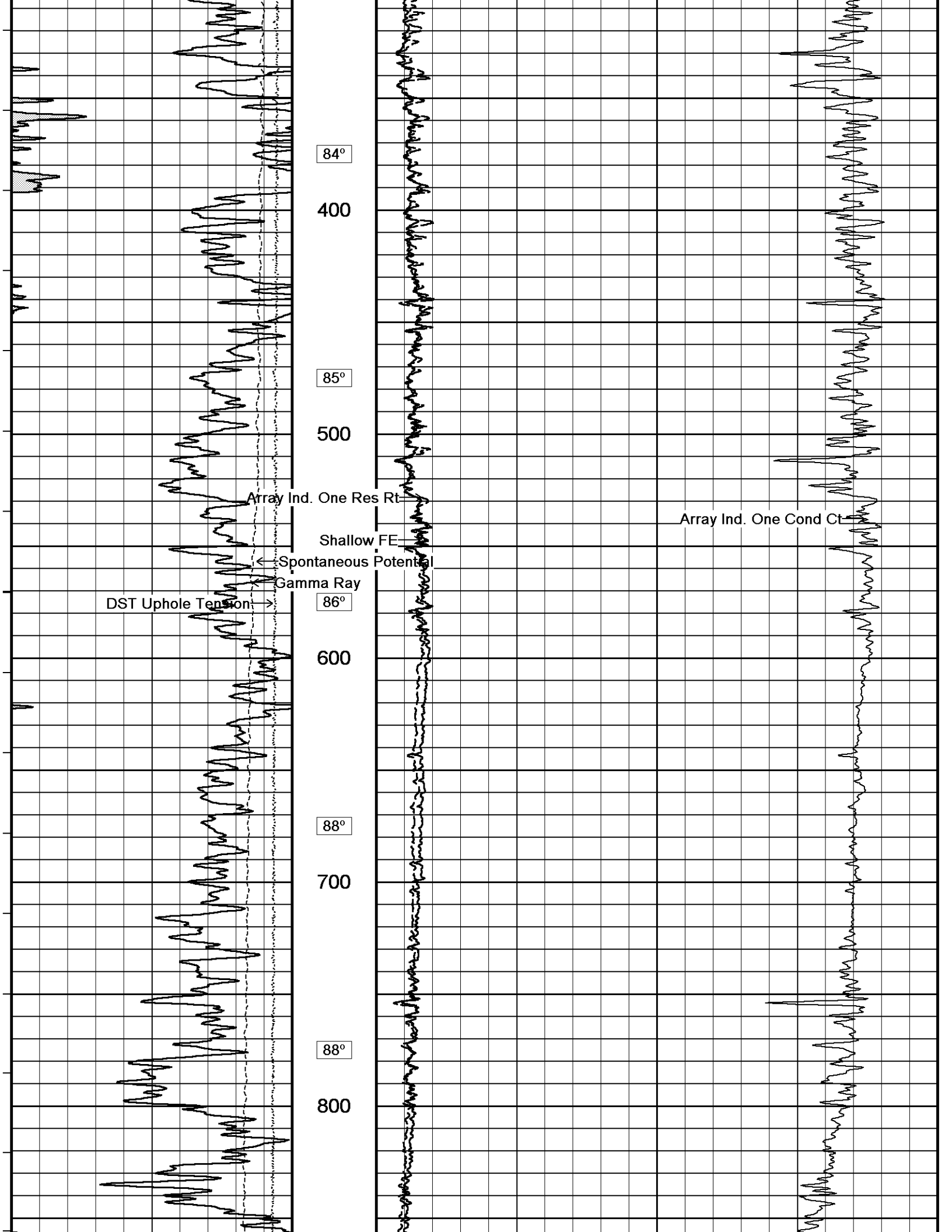
**CASING RECORD**

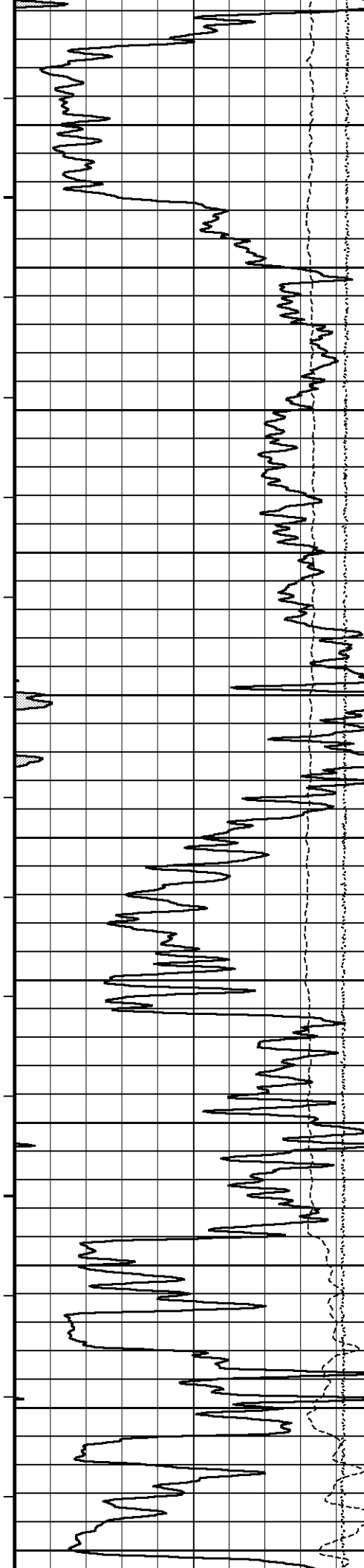
Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	227.00	24.00

**REMARKS**

- SOFTWARE ISSUE: WLS 13.05.9583
- TOOL STRING: MCG, MML, MDN, MPD, MFE, MSS, MAI RUN IN COMBINATION
- HARDWARE:  
MDN: DUAL BOWSPRING ECCENTRALIZER  
MFE: 1 X 0.5 INCH STANDOFF  
MAI: 2 X 0.5 INCH STANDOFF
- 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
- SERVICE ORDER # 3547626
- RIG: H D DRILLING #2







89°

900

90°

1000

91°

1100

92°

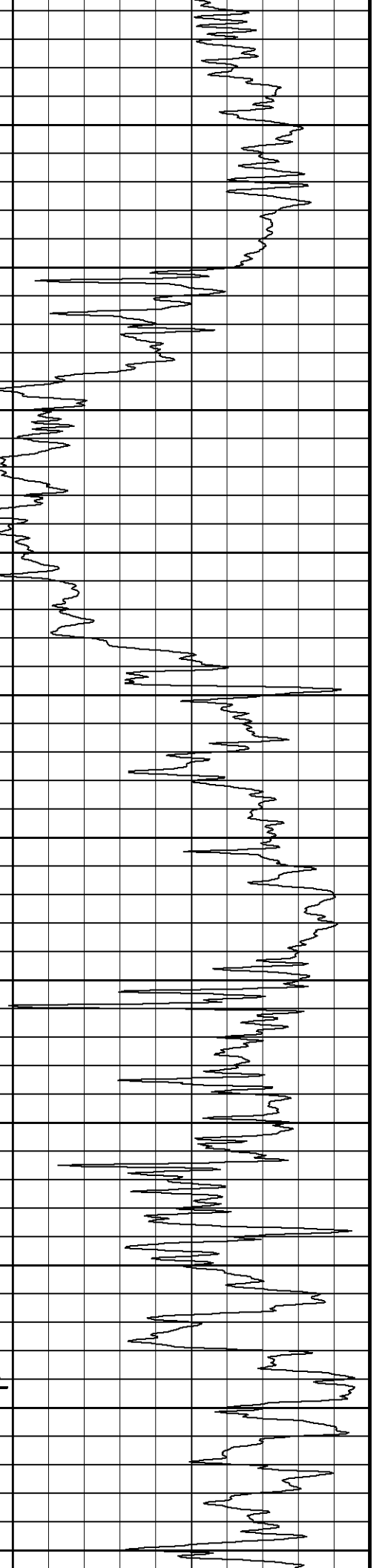
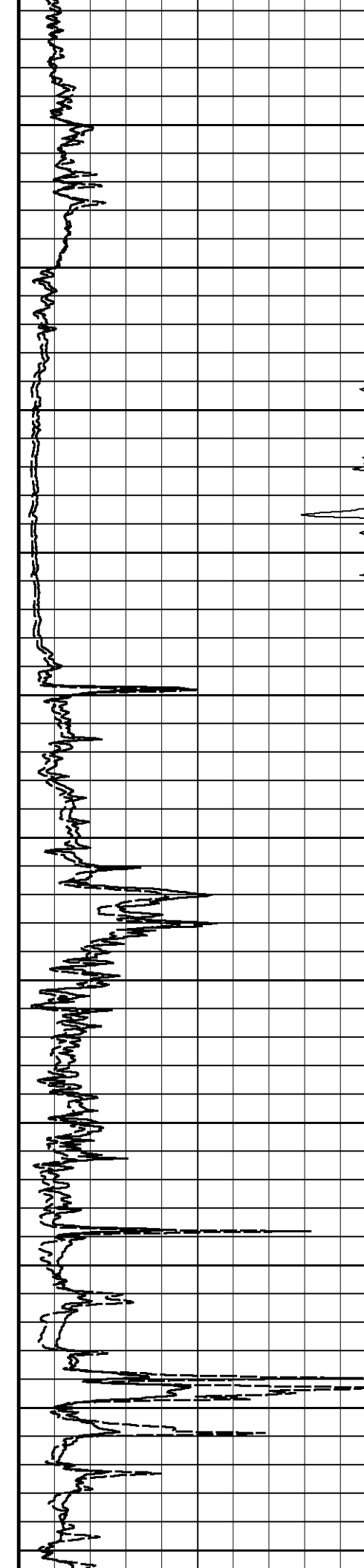
1200

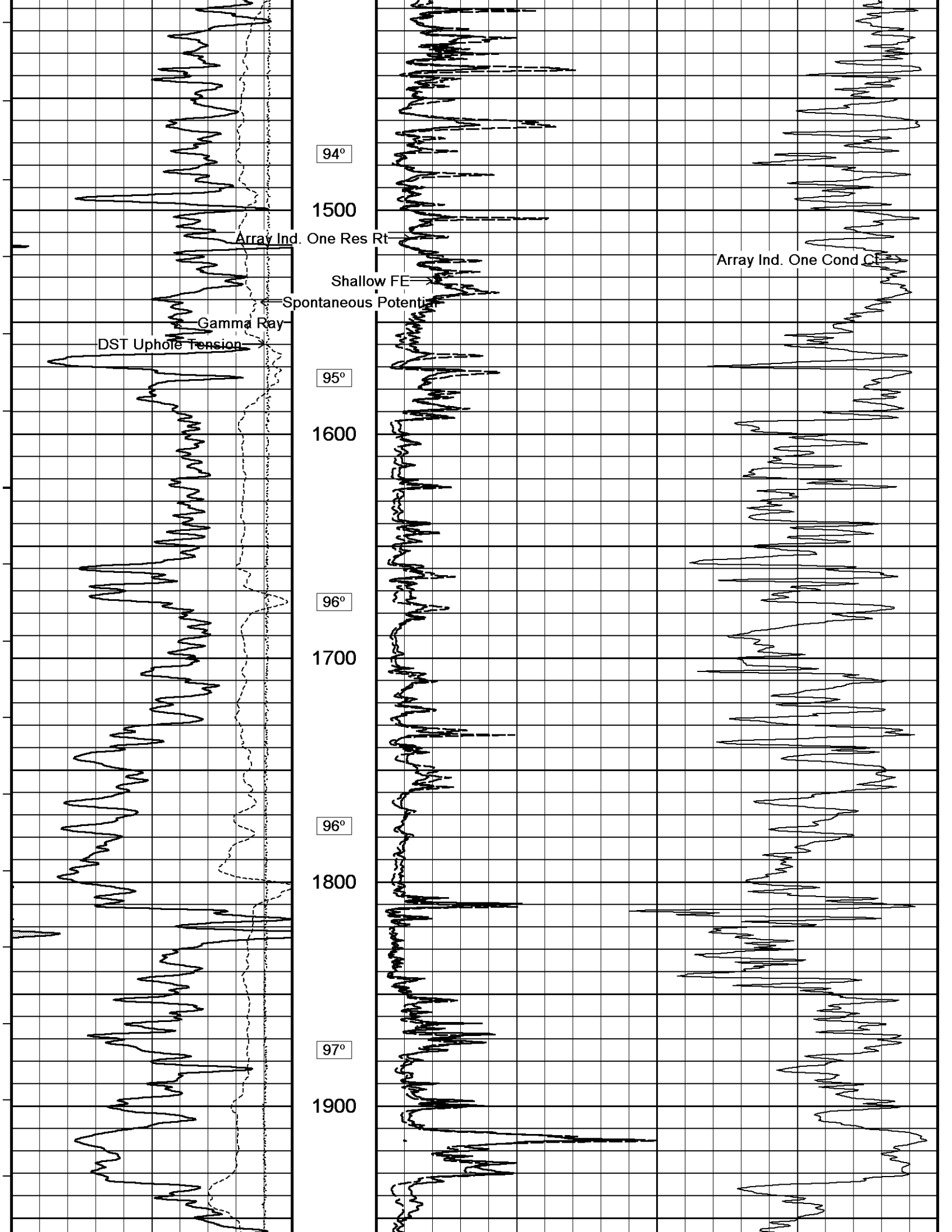
93°

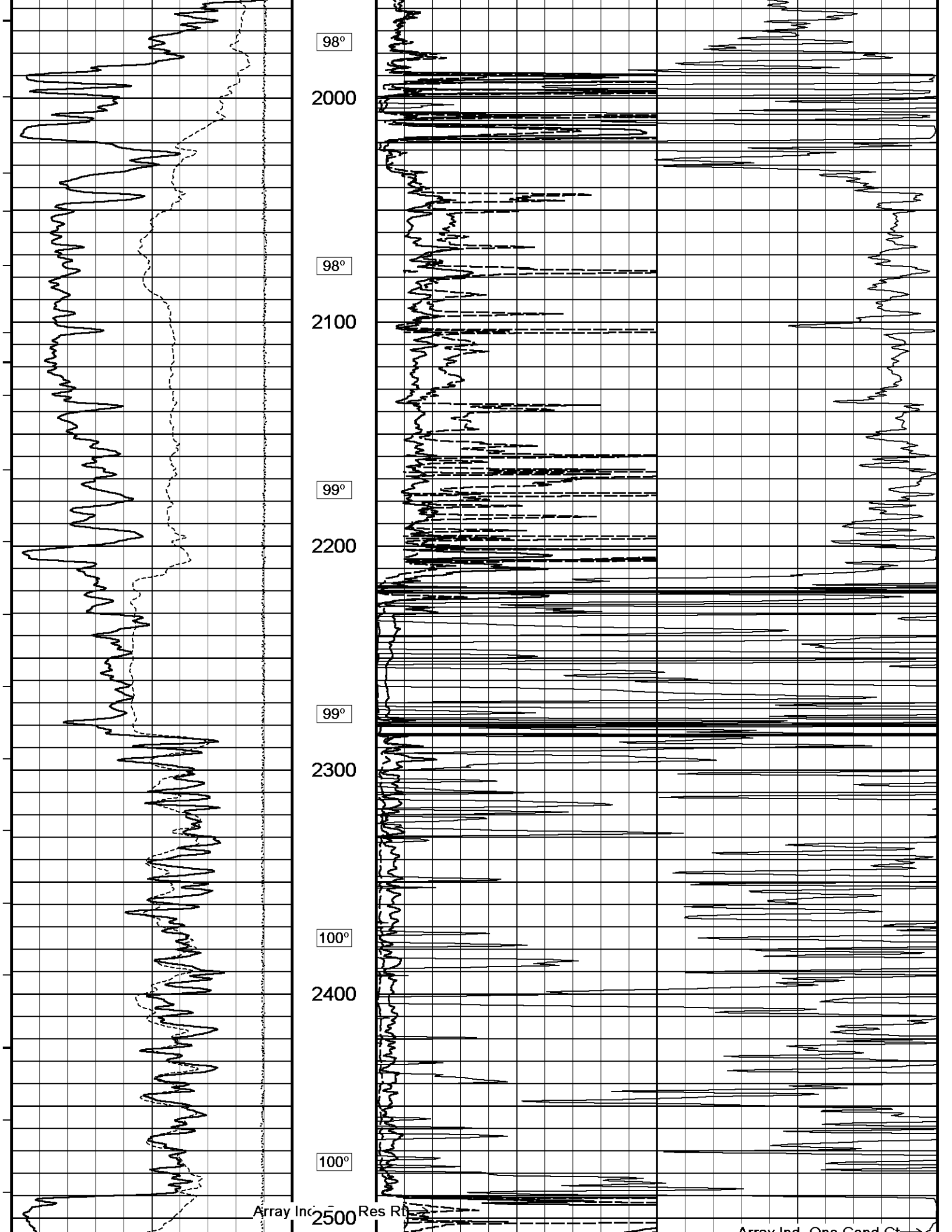
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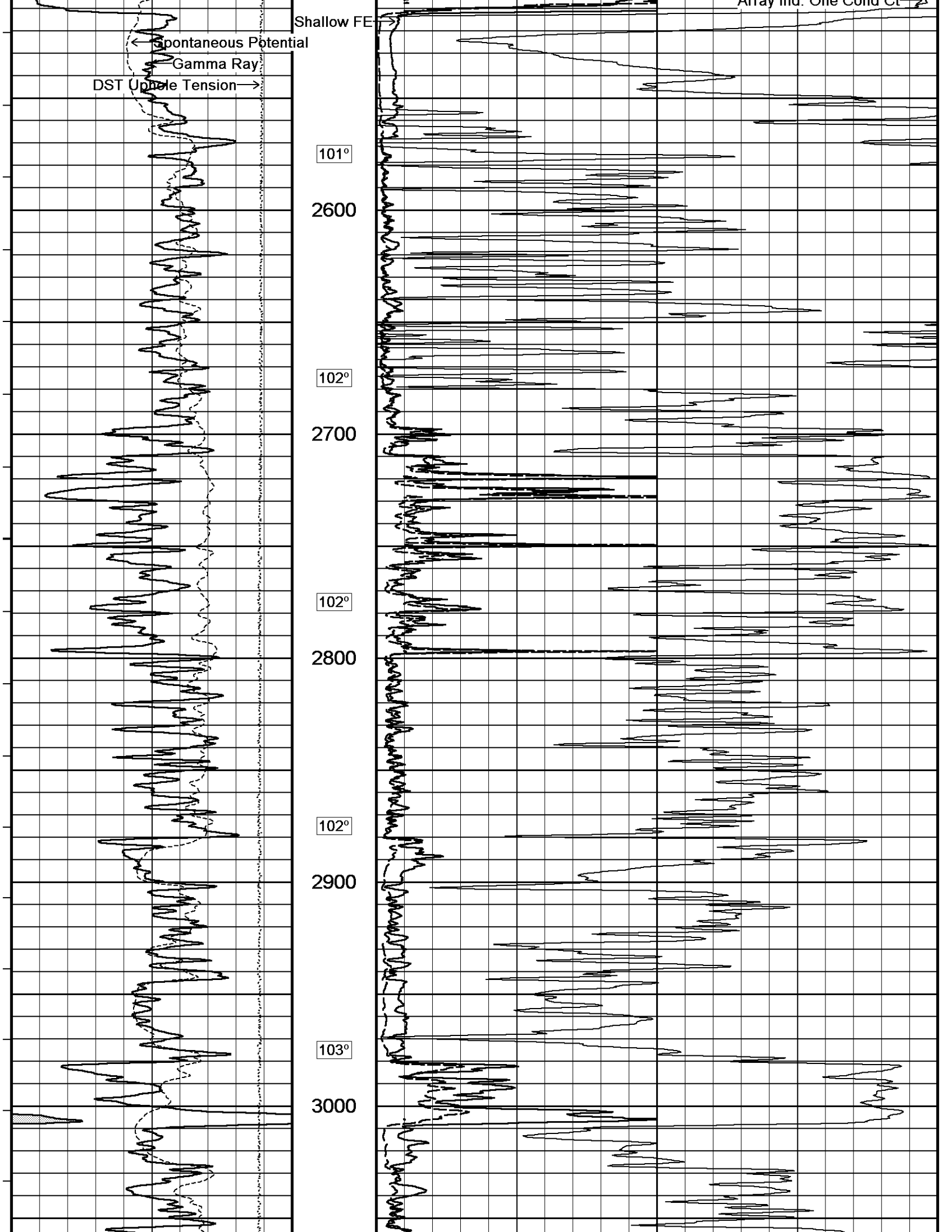
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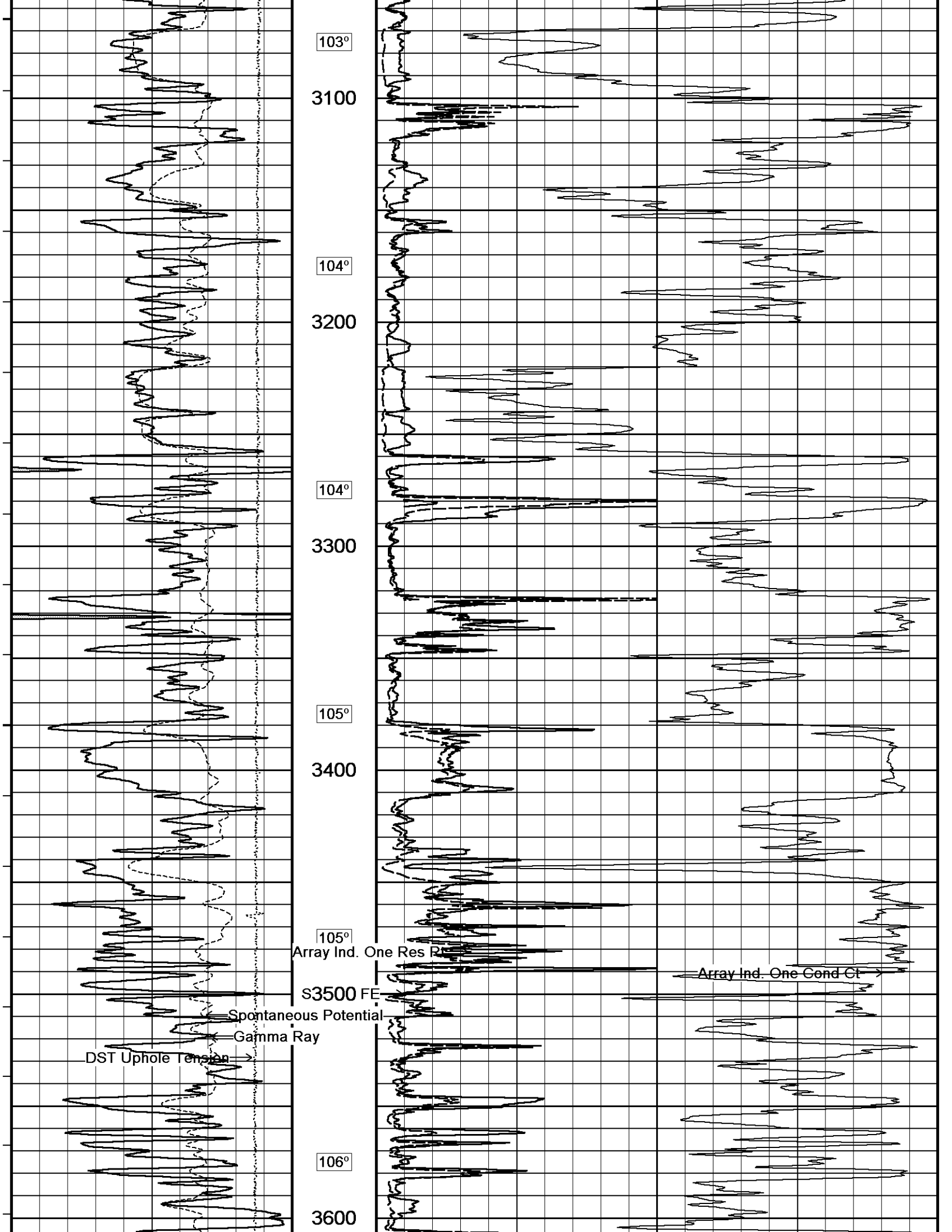
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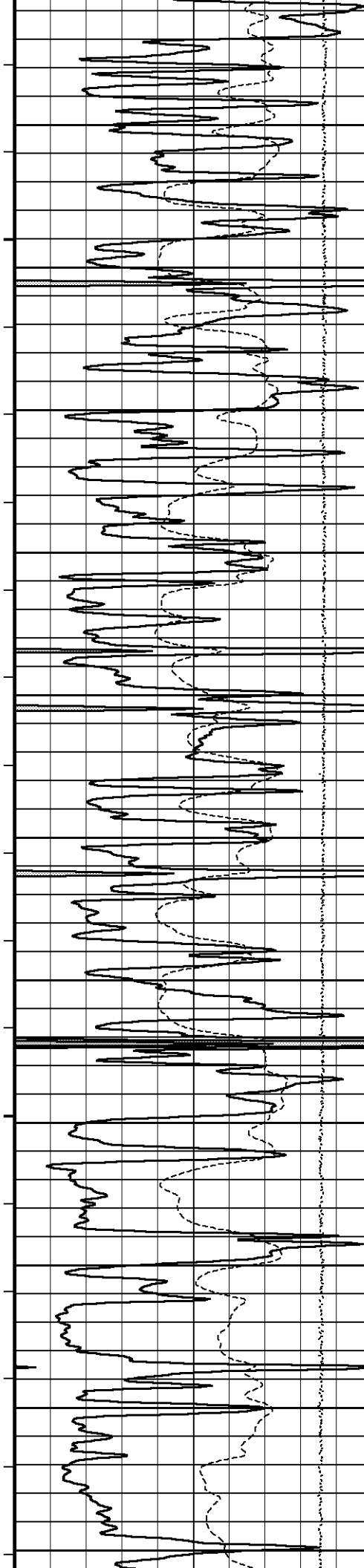












107°

3700

107°

3800

108°

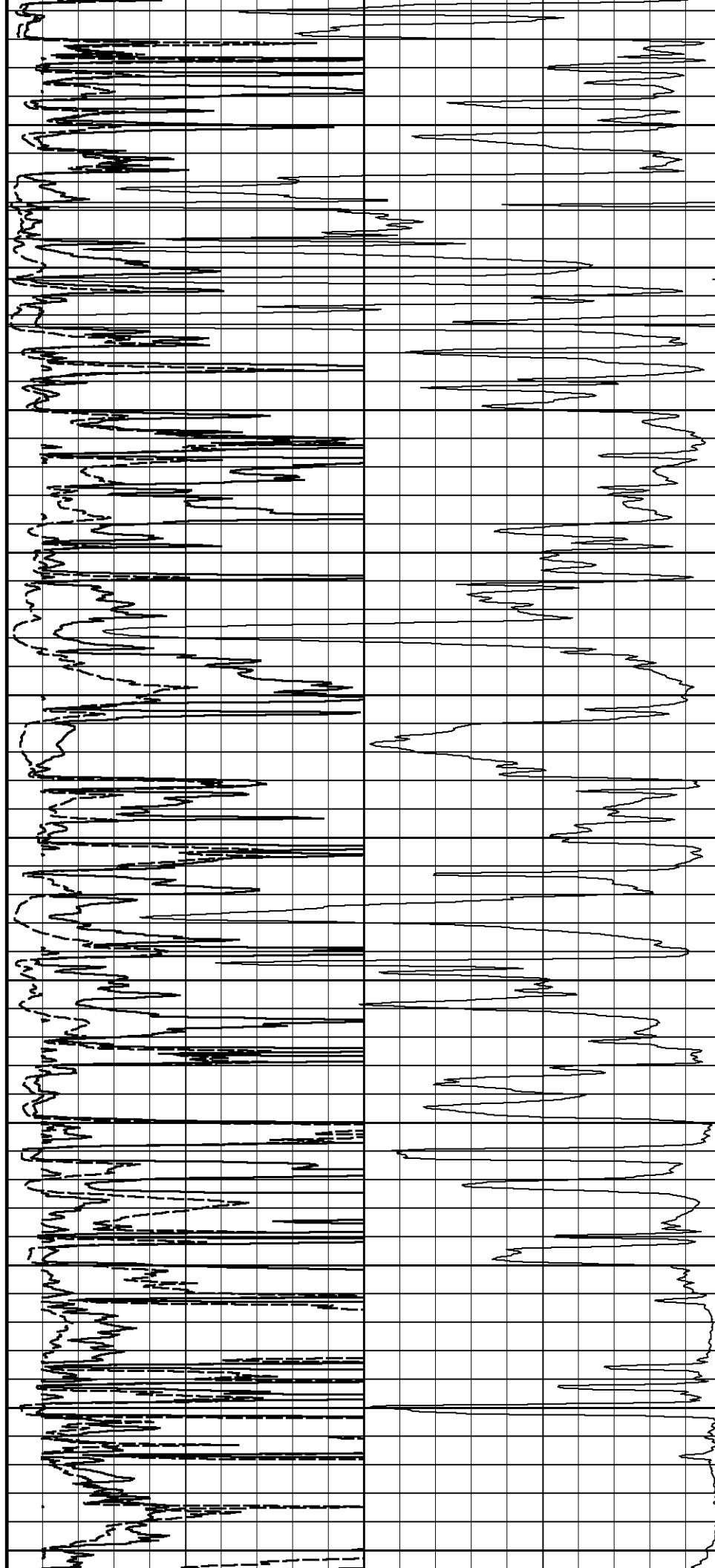
3900

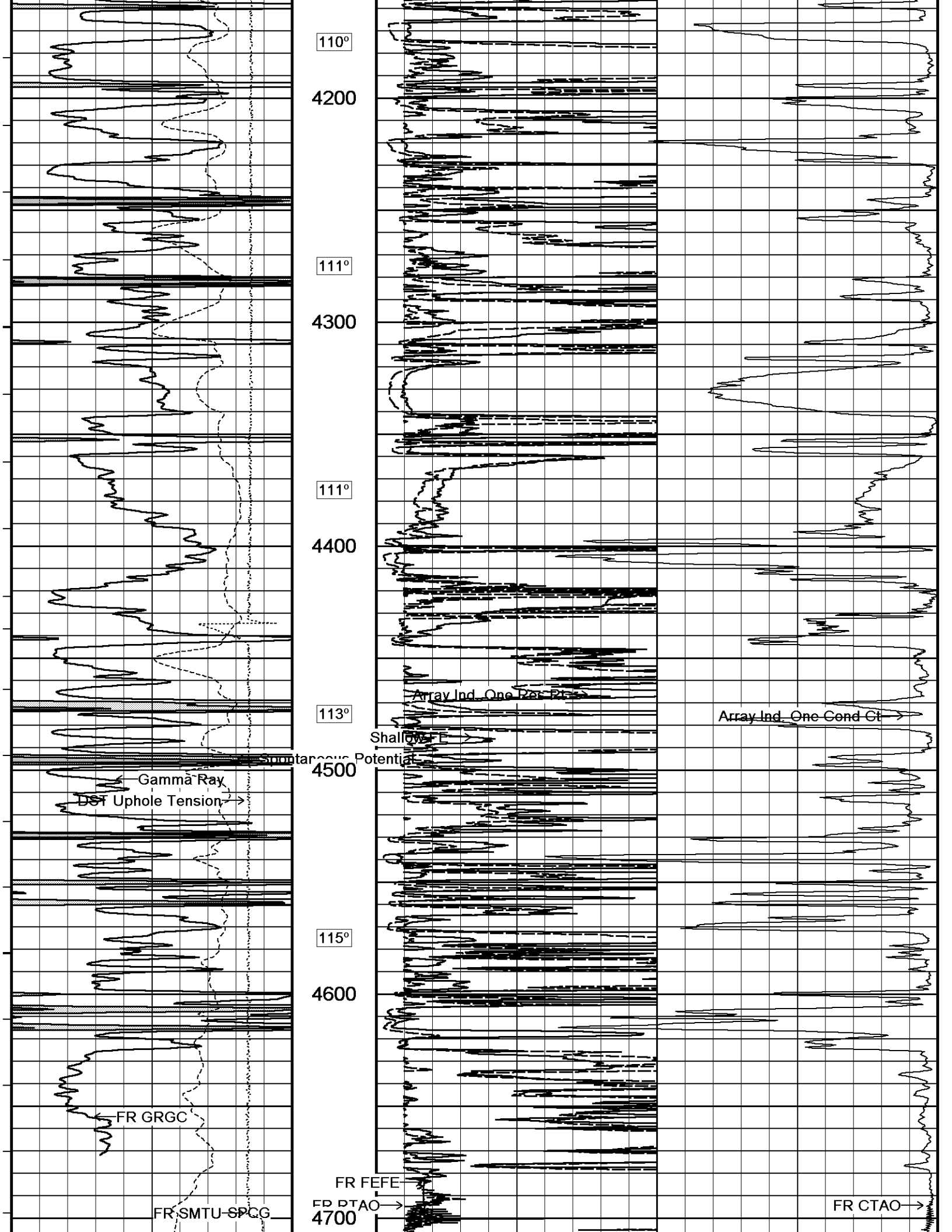
108°

4000

109°

4100



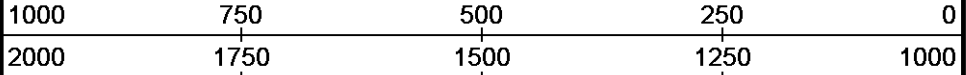


4730

Depth  
In  
Feet

Array Ind. One Cond Ct

mmhos



Timing Marks  
every 60.0 sec

Gamma Ray

API

75

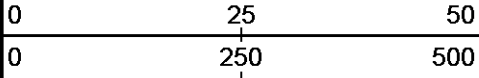
0 150

150 225 300

Borehole  
Temp in  
deg F

Shallow FE

ohm metres



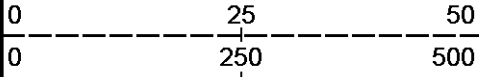
Spontaneous Potential

millivolts

- -> | 20 | <- +

Array Ind. One Res Rt

ohm metres



DST Uphole Tension

pounds

5000 0

Replay  
Scale  
1:600

Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 09-DEC-2013 00:31

Filename: E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main.dta

Recorded on 08-DEC-2013 19:59

System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583



2 INCH MAIN



5 INCH MAIN



Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 09-DEC-2013 00:31

Filename: E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main.dta

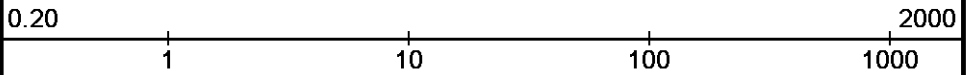
Recorded on 08-DEC-2013 19:59

System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Depth  
In  
Feet

Shallow FE

ohm metres



Timing Marks  
every 60.0 sec

Gamma Ray

API

75

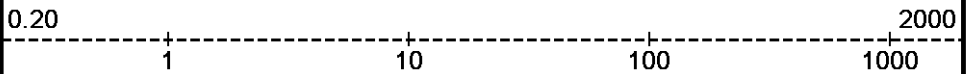
0 150

150 225 300

Borehole  
Temp in  
deg F

Array Ind. One Res 40

ohm metres



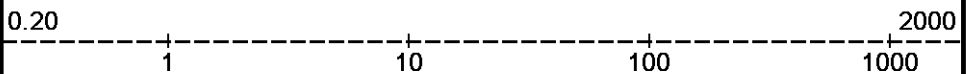
Spontaneous Potential

millivolts

- -> | 20 | <- +

Array Ind. One Res 60

ohm metres



DST Uphole Tension

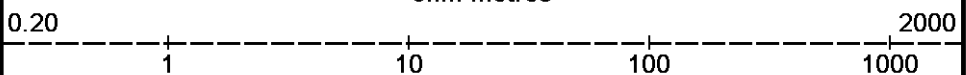
pounds

5000 0

Replay  
Scale  
1:240

Array Ind. One Res Rt

ohm metres



216  
Casing  
Shoe

250

81°

← Spontaneous Potential

300

← Gamma Ray  
DST Uphole Tension →

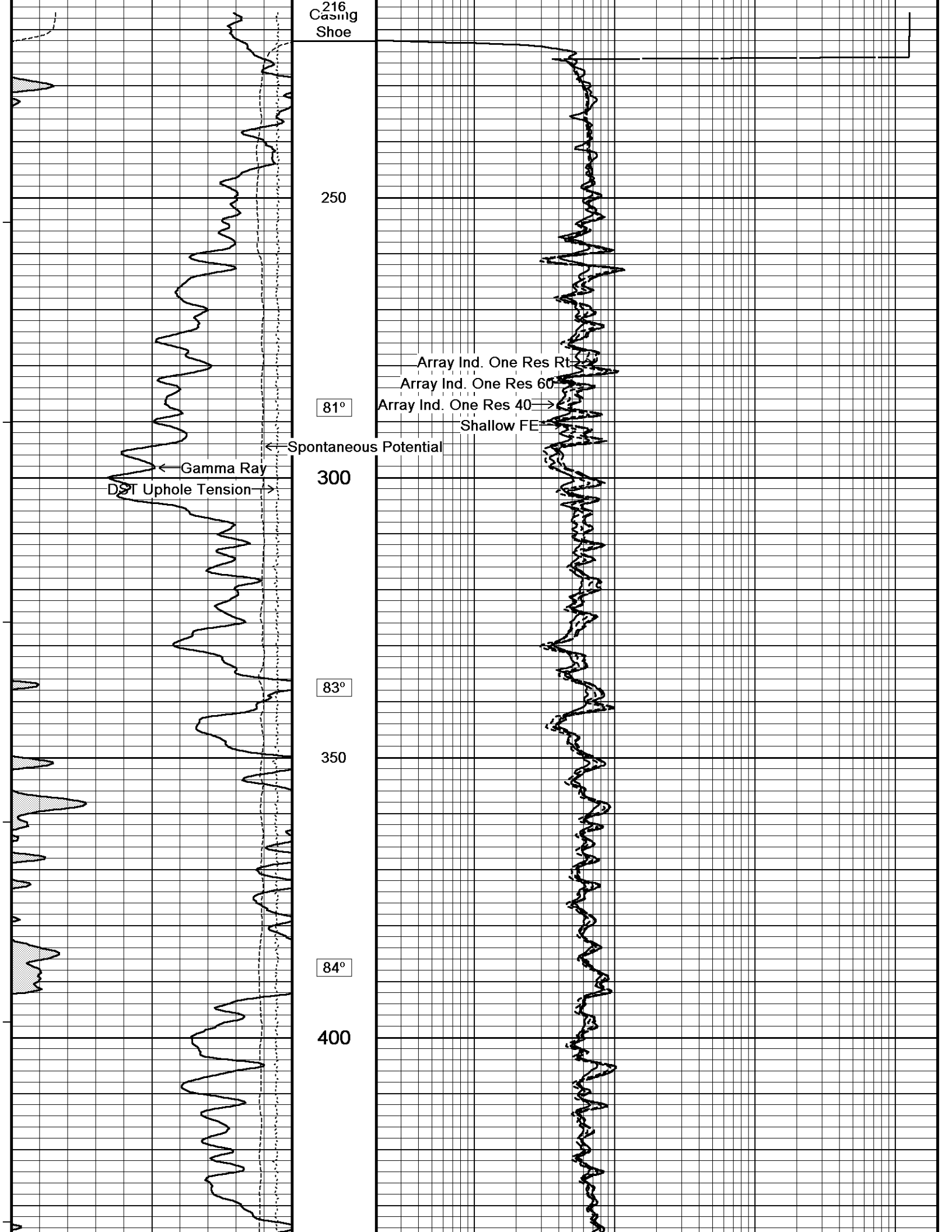
83°

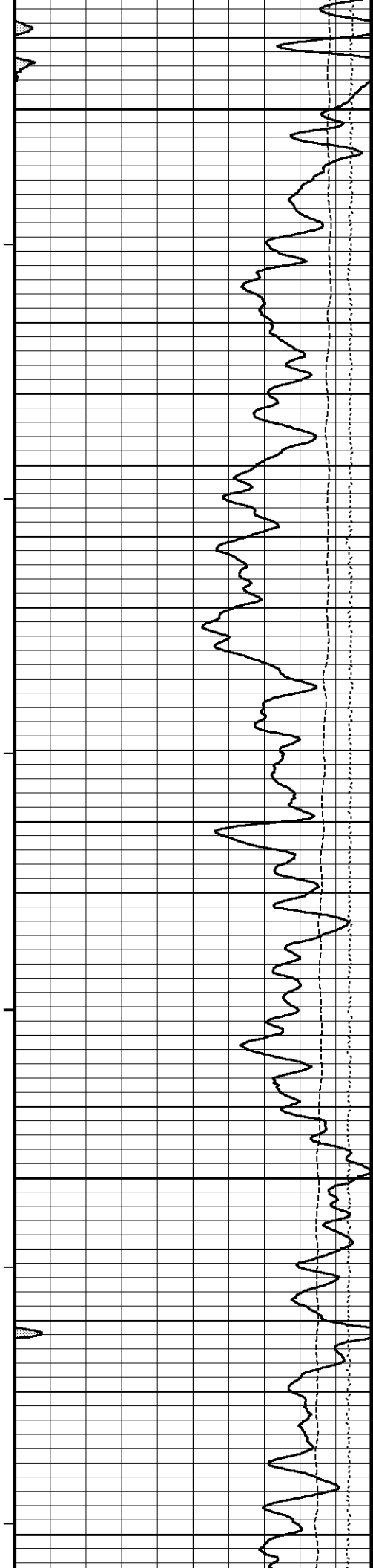
350

84°

400

Array Ind. One Res Rt  
Array Ind. One Res 60  
Array Ind. One Res 40 →  
Shallow FE





85°

450

85°

500

86°

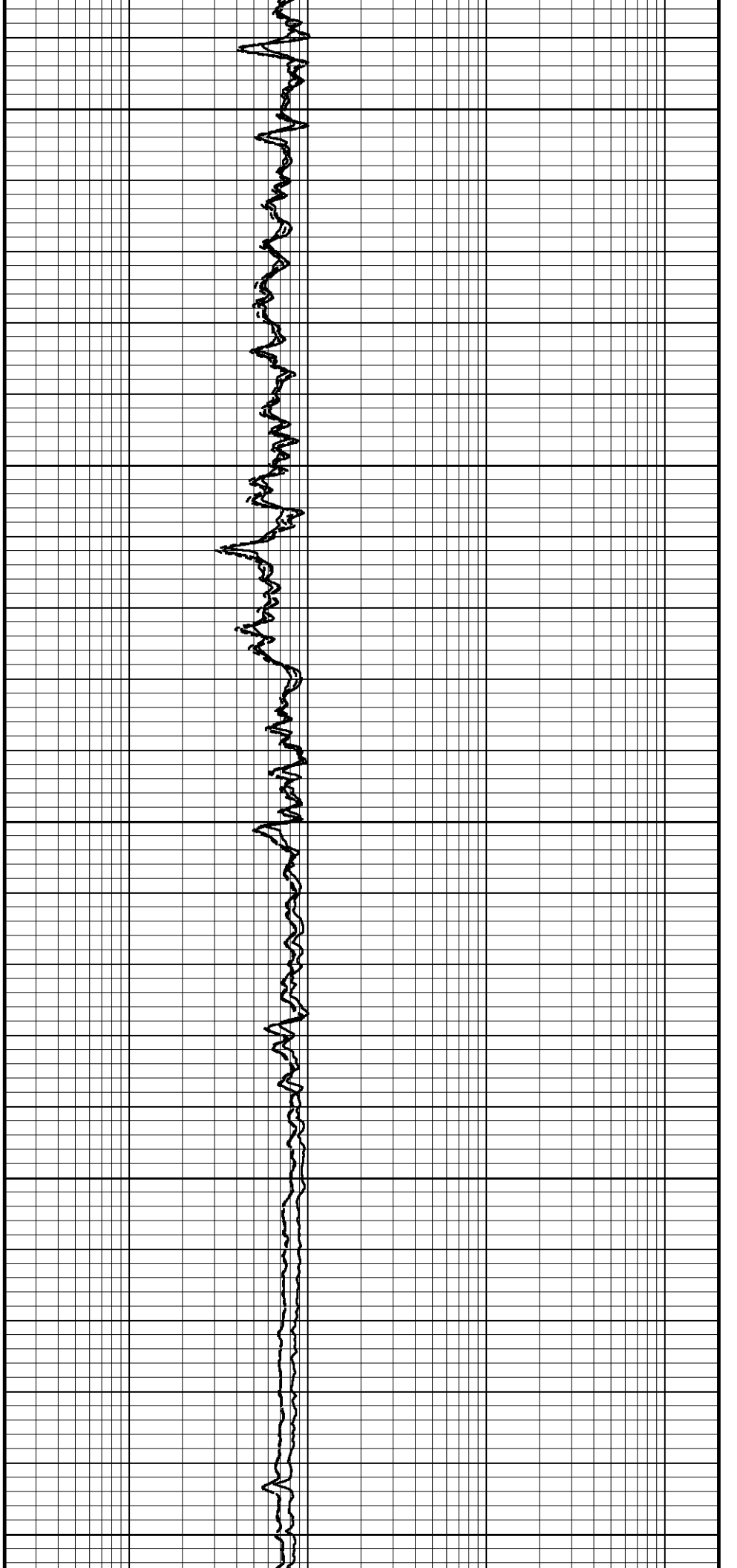
550

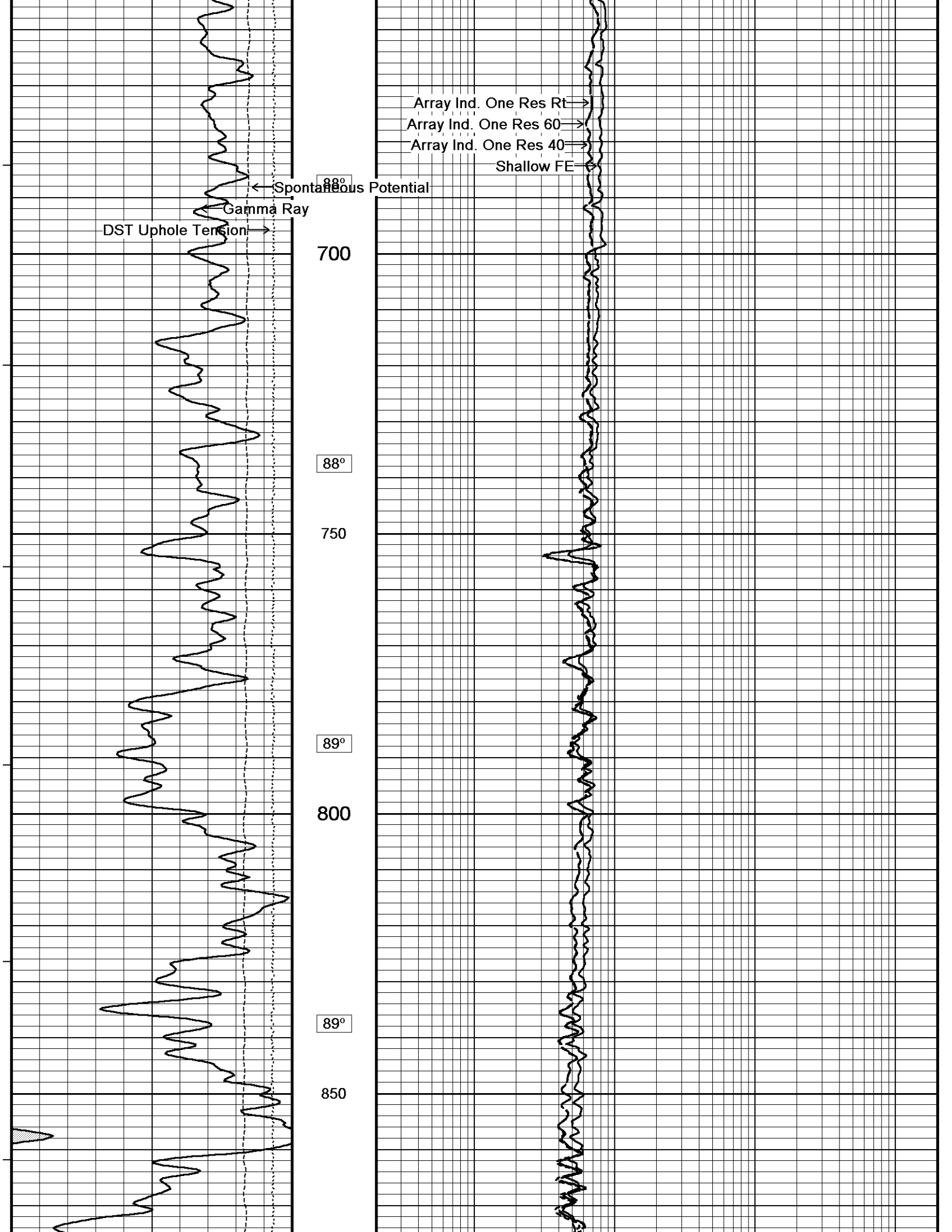
87°

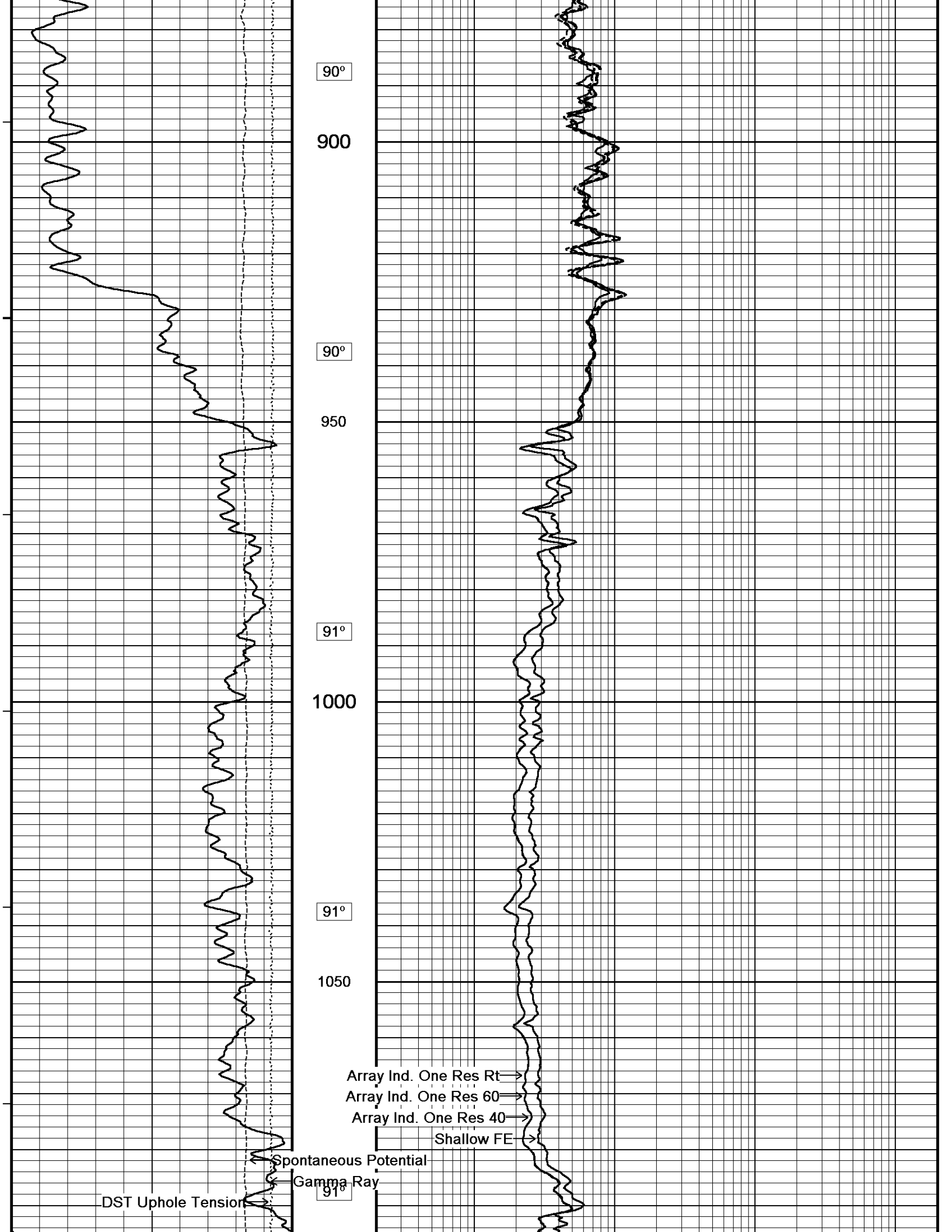
600

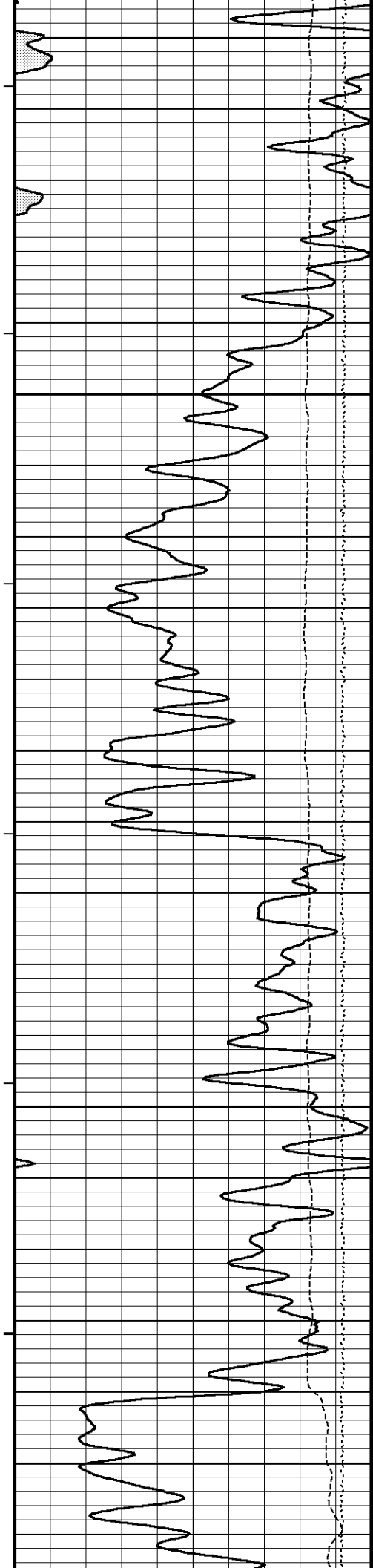
87°

650









1100

92°

1150

92°

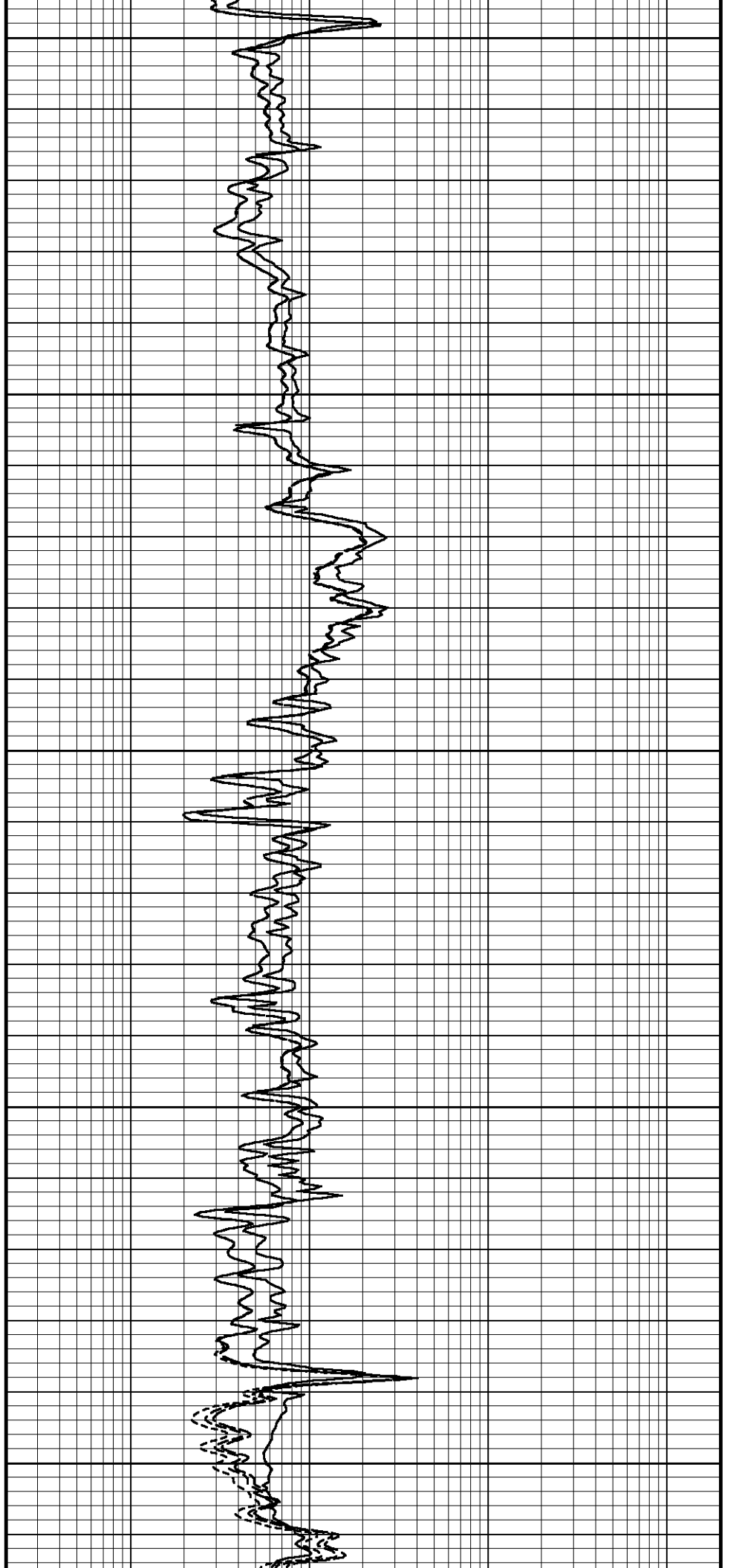
1200

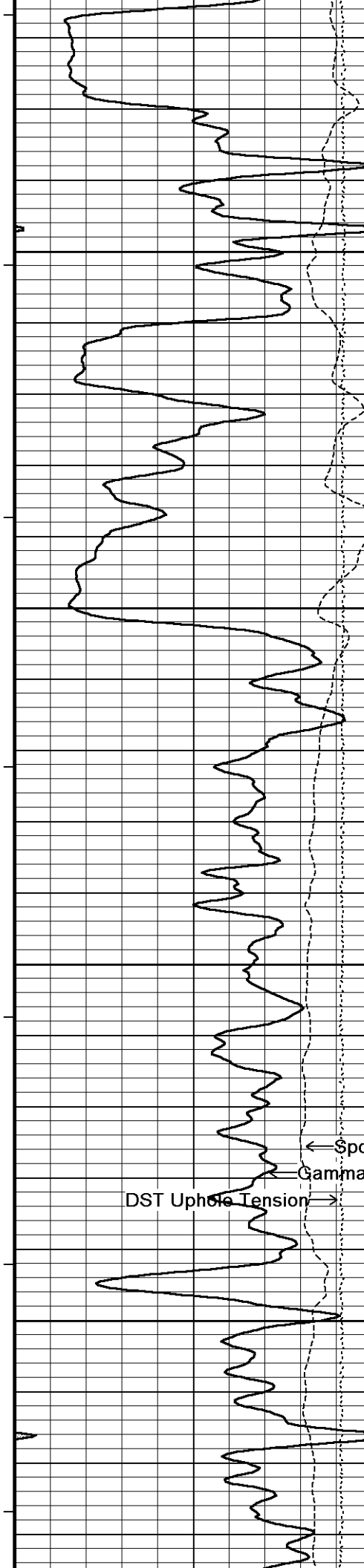
92°

1250

93°

1300





93°

1350

94°

1400

94°

1450

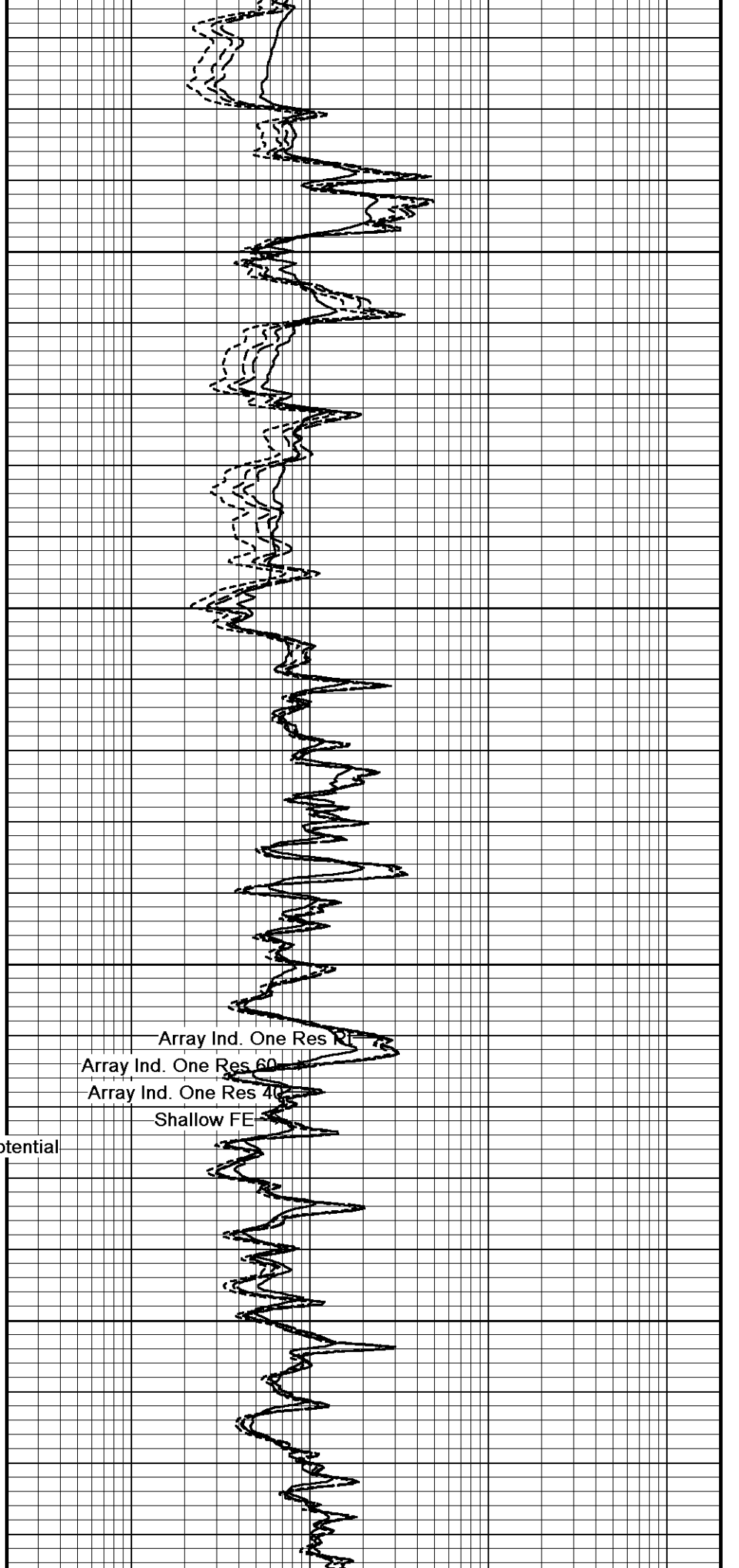
94°

1500

← Spontaneous Potential

Gamma Ray

DST Uphole Tension →

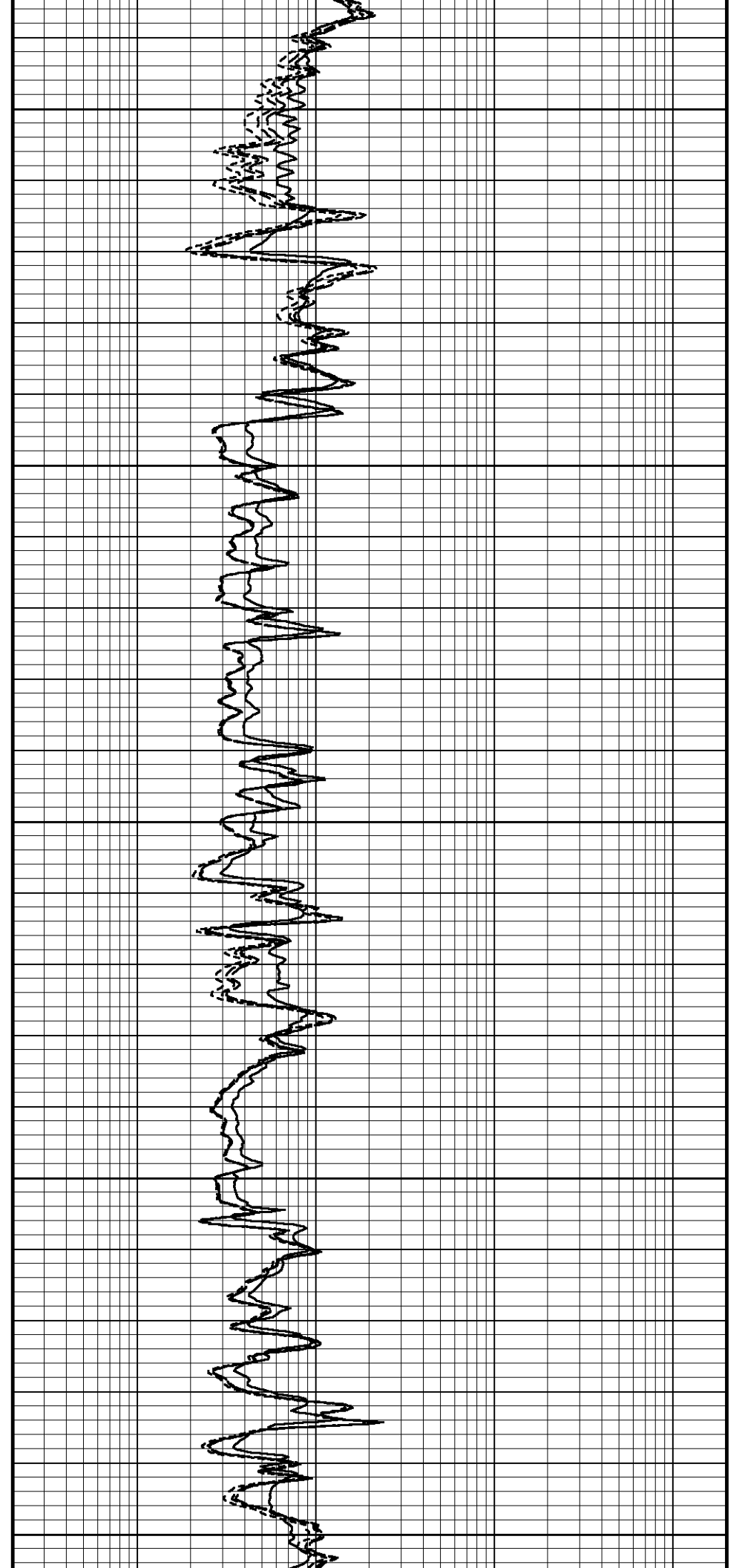
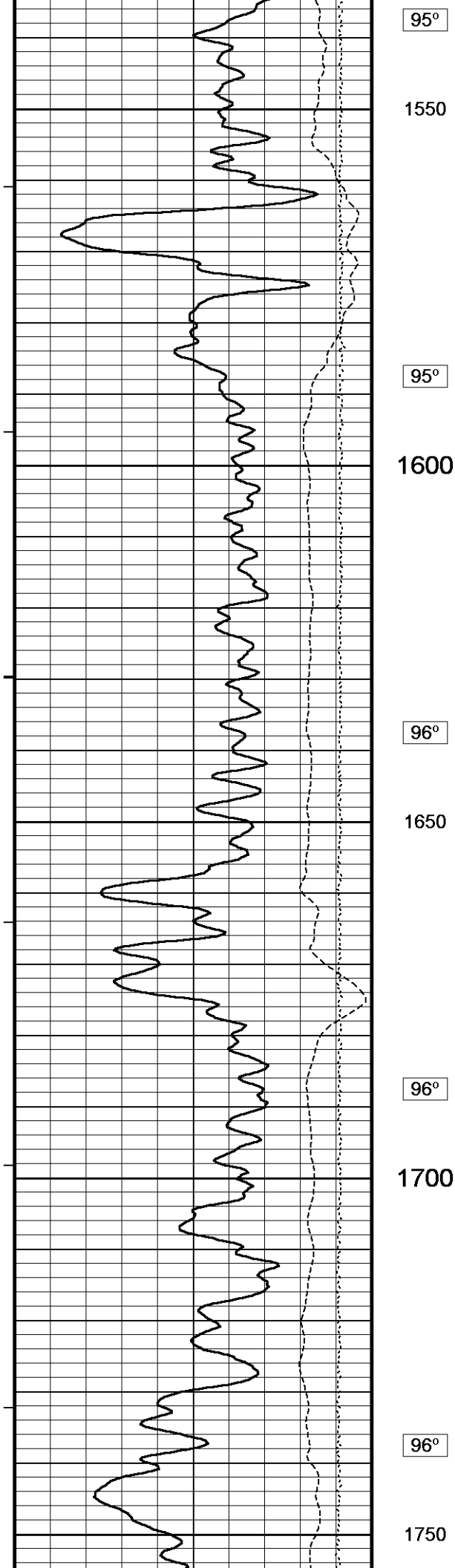


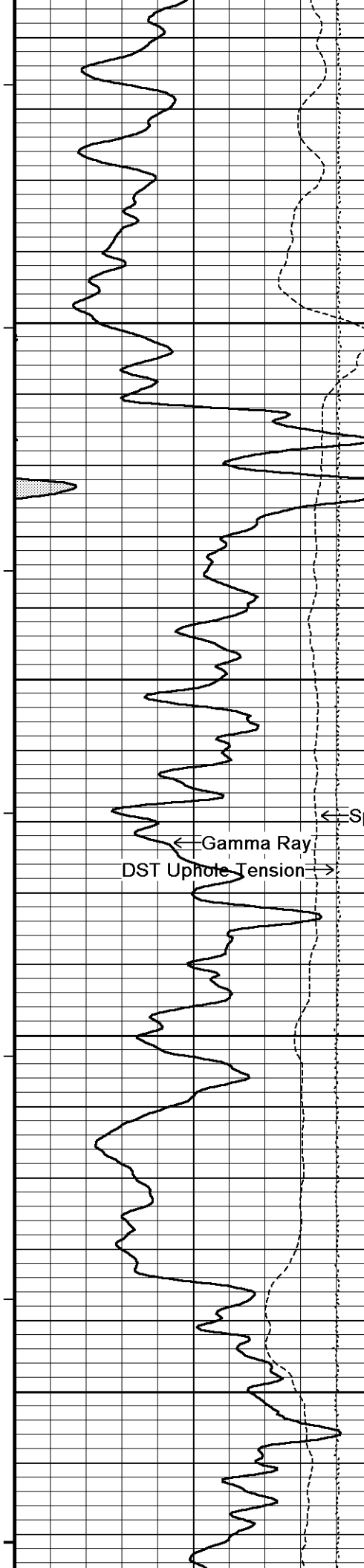
Array Ind. One Res RI

Array Ind. One Res 60

Array Ind. One Res 40

Shallow FE





96°

1800

97°

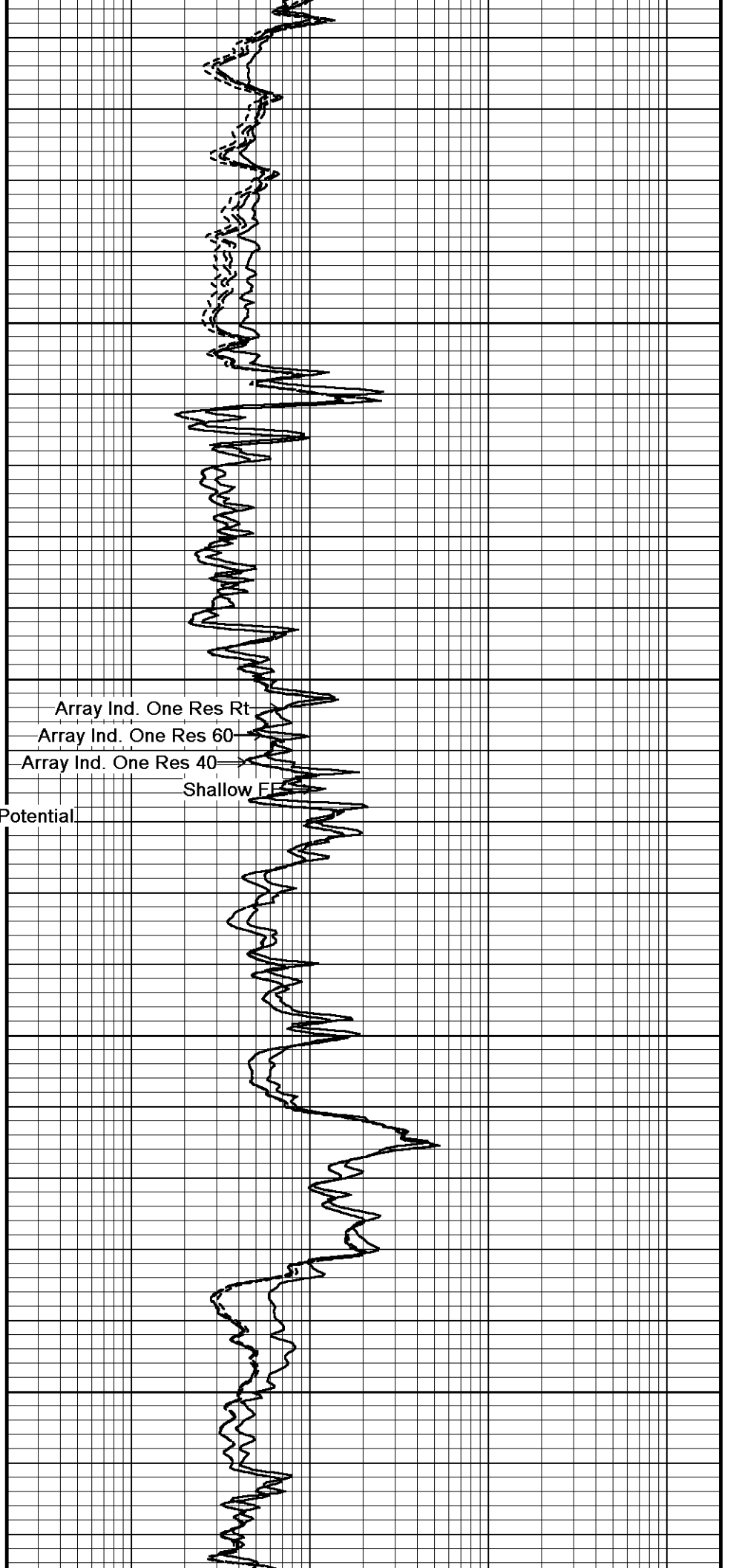
1850

97°

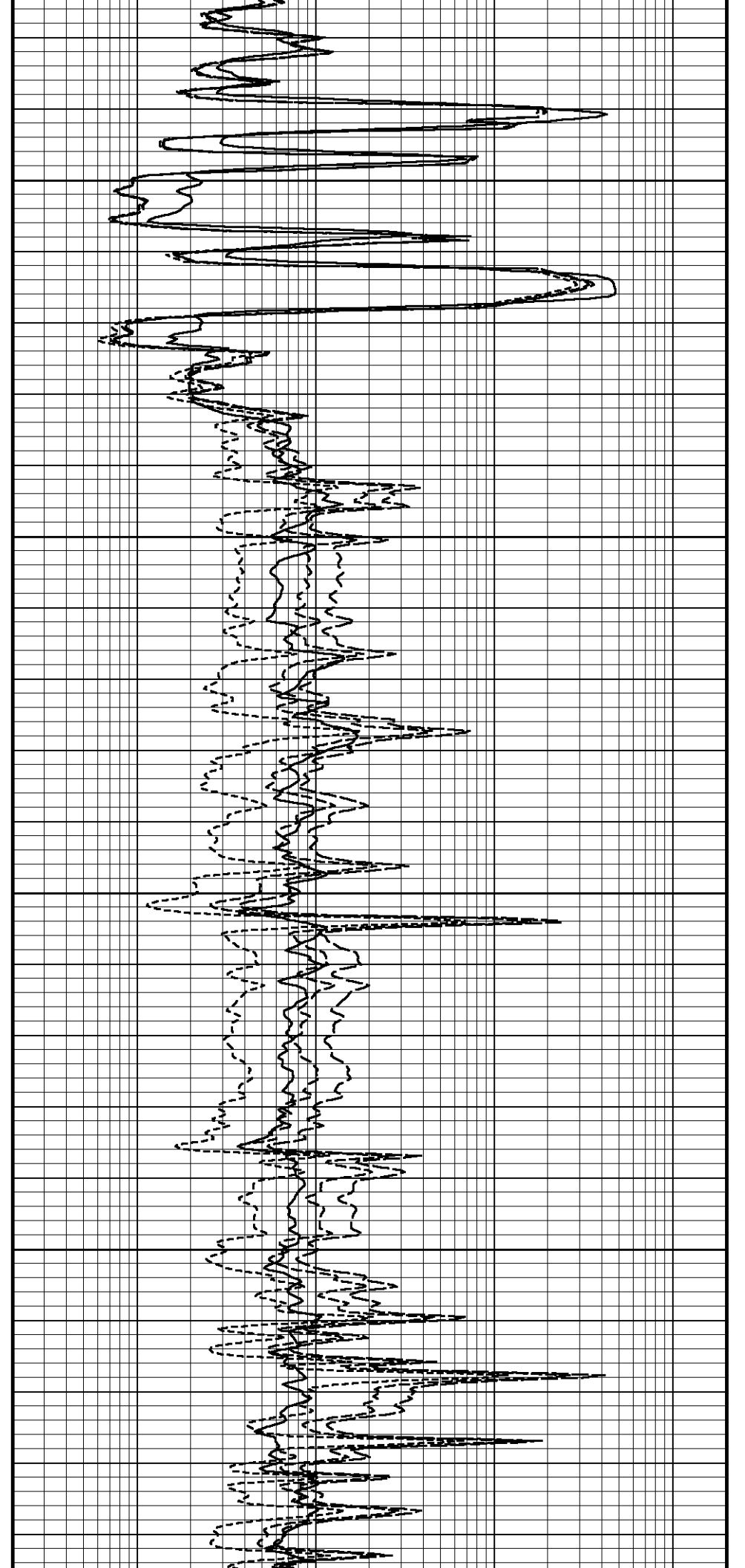
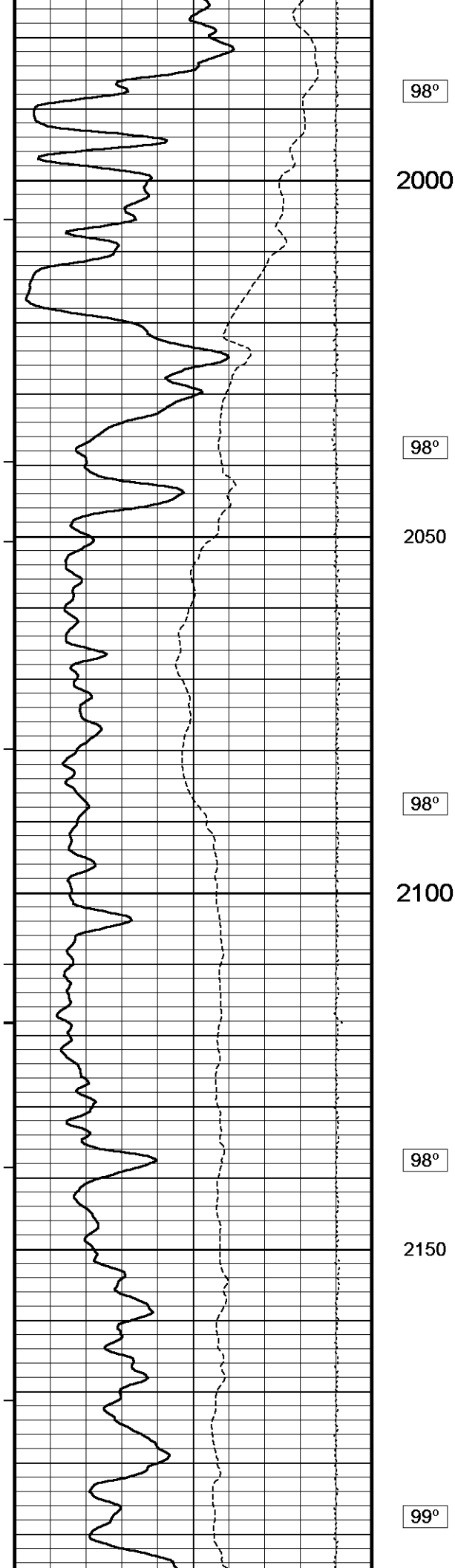
1900

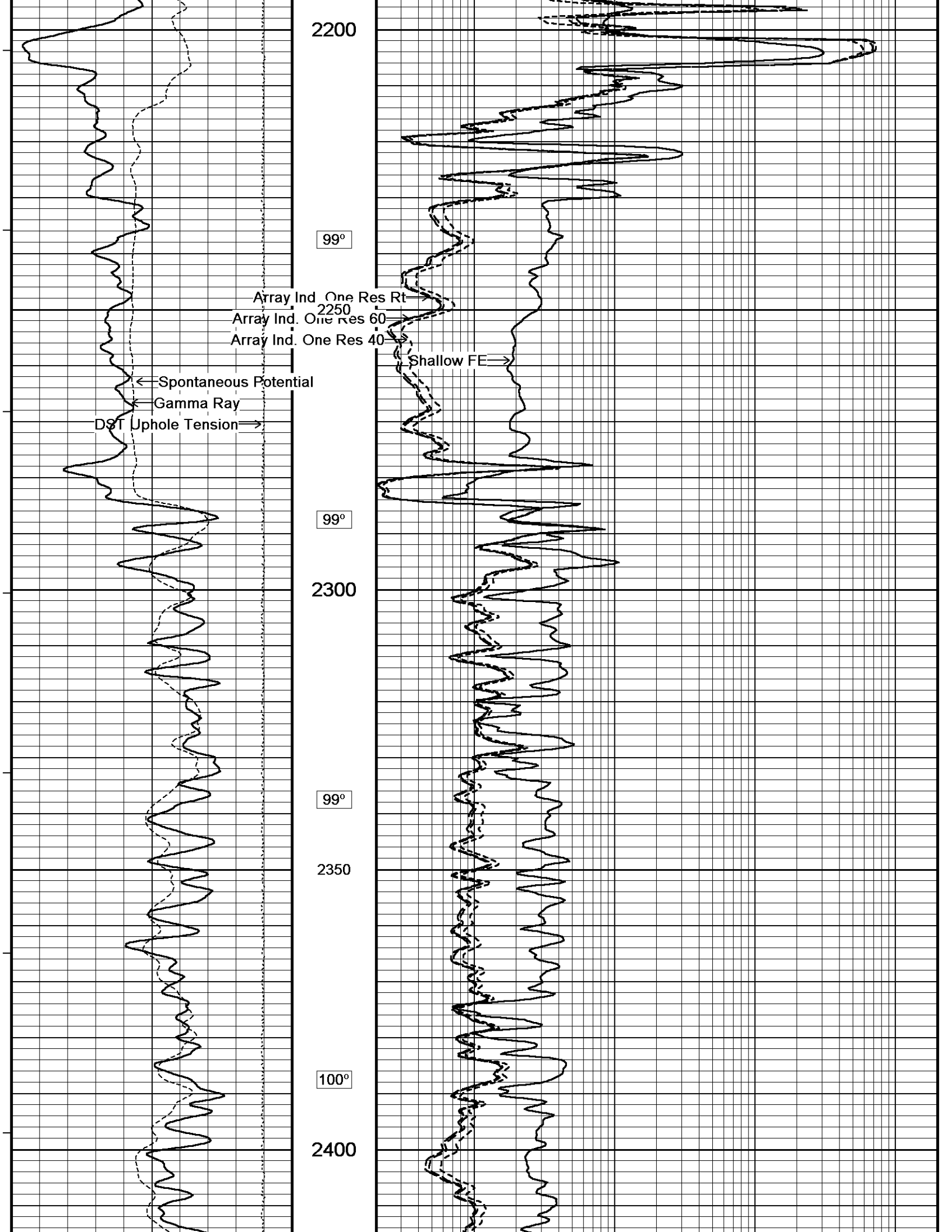
98°

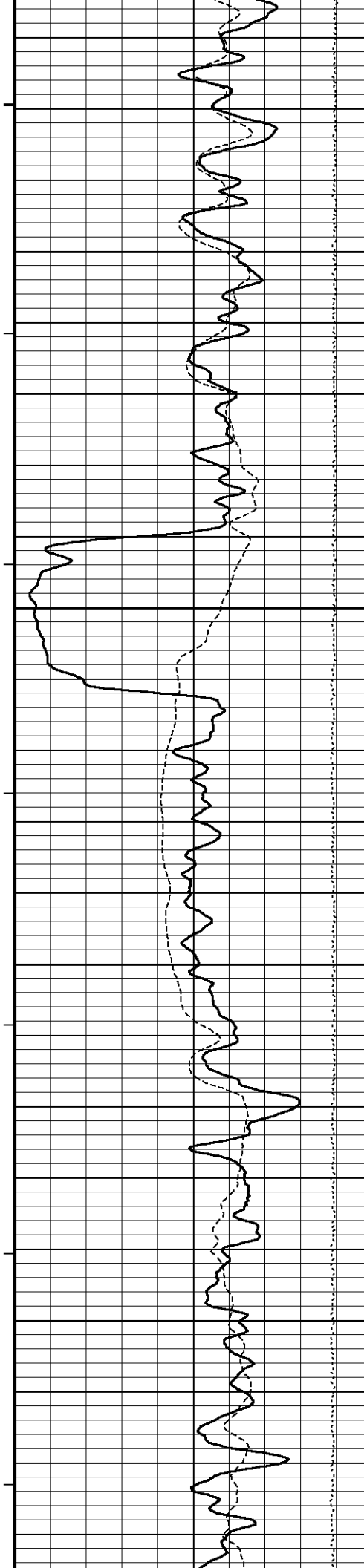
1950



Array Ind. One Res Rt  
Array Ind. One Res 60  
Array Ind. One Res 40  
Shallow F







100°

2450

100°

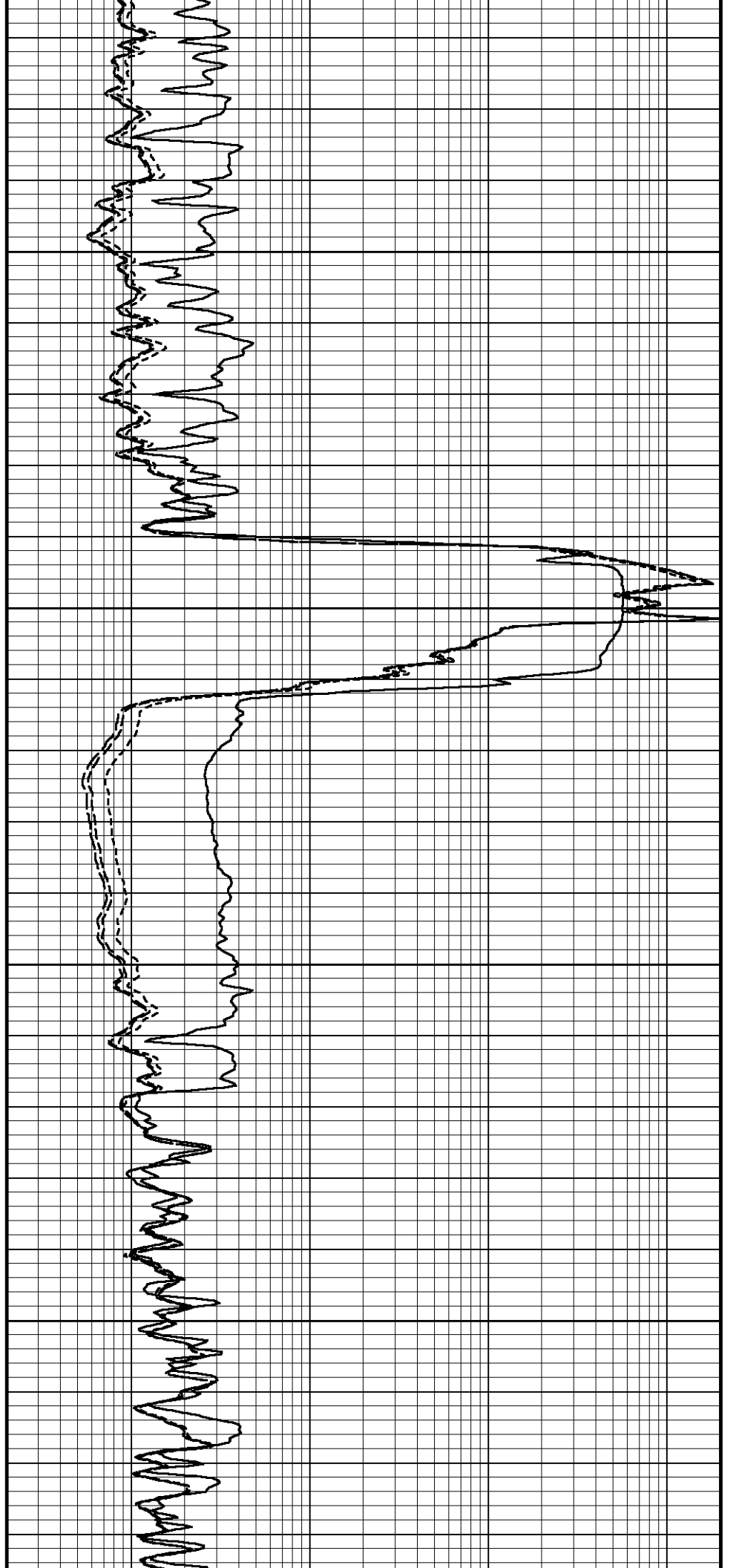
2500

101°

2550

101°

2600



101°

Array Ind. One Res Rt

Array Ind. One Res 60

f2650 Ind. One Res 40

Shallow

Spontaneous Potential

Gamma Ray

DST Uphole Tension

102°

2700

102°

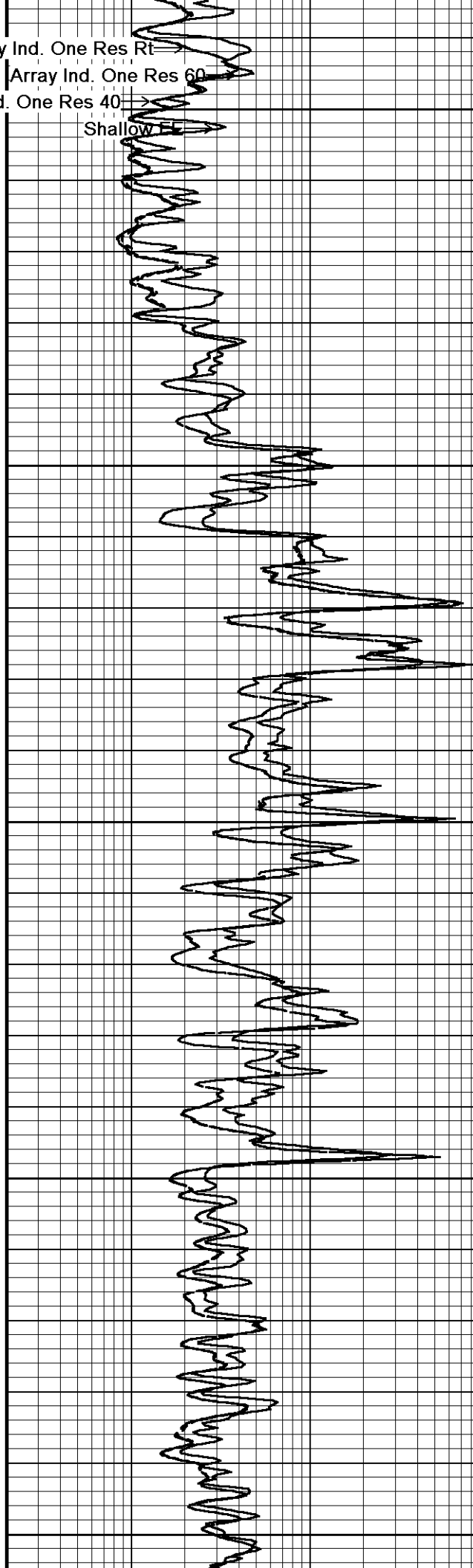
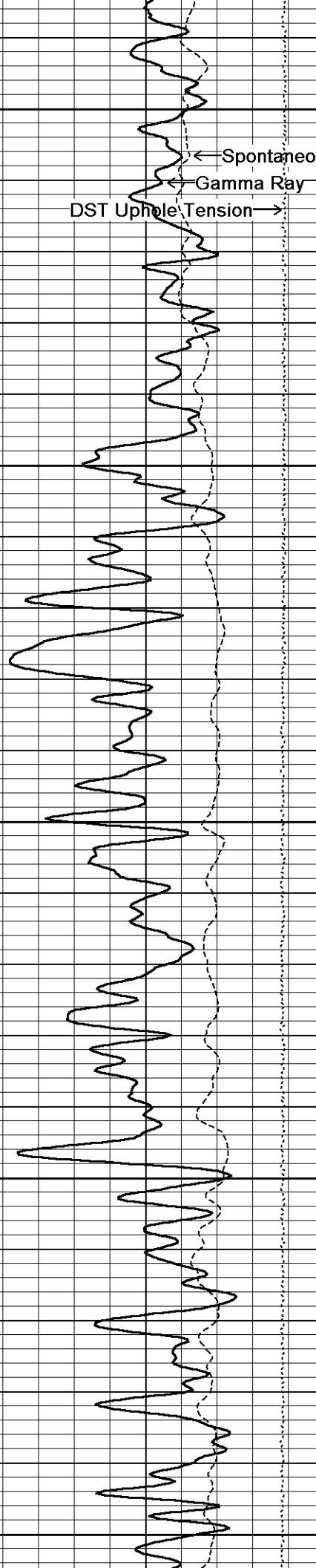
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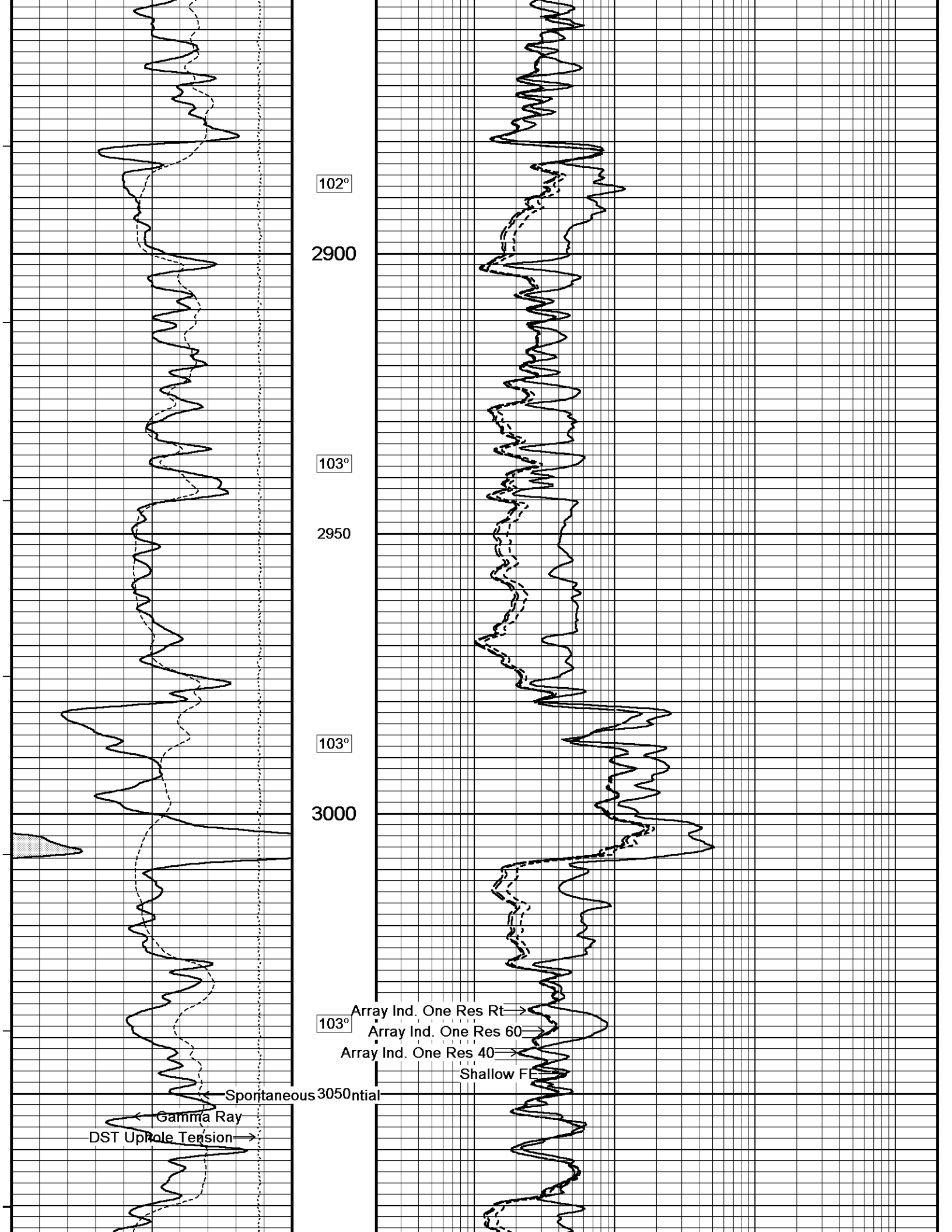
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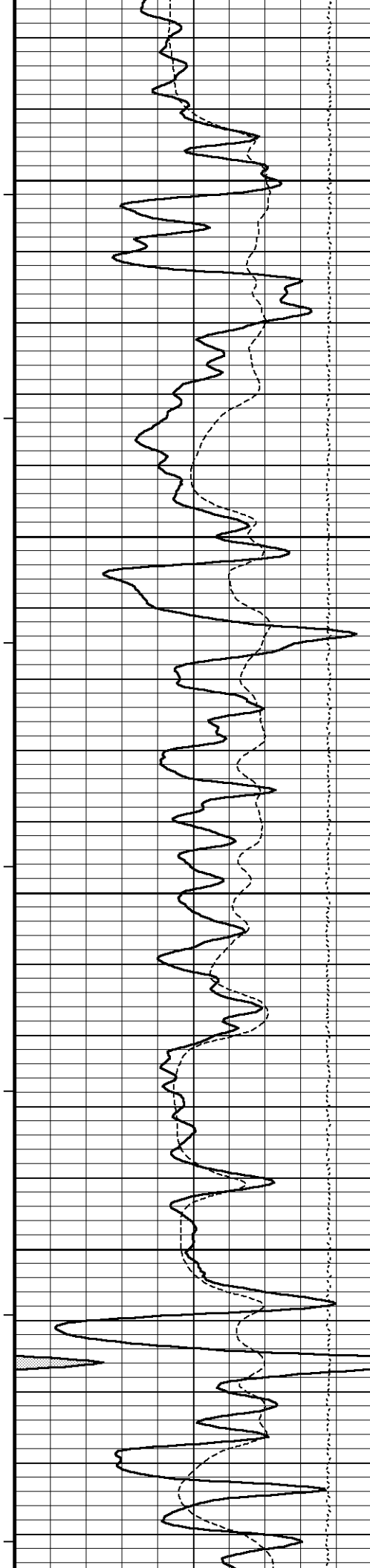
2800

102°

2850







104°

3100

104°

3150

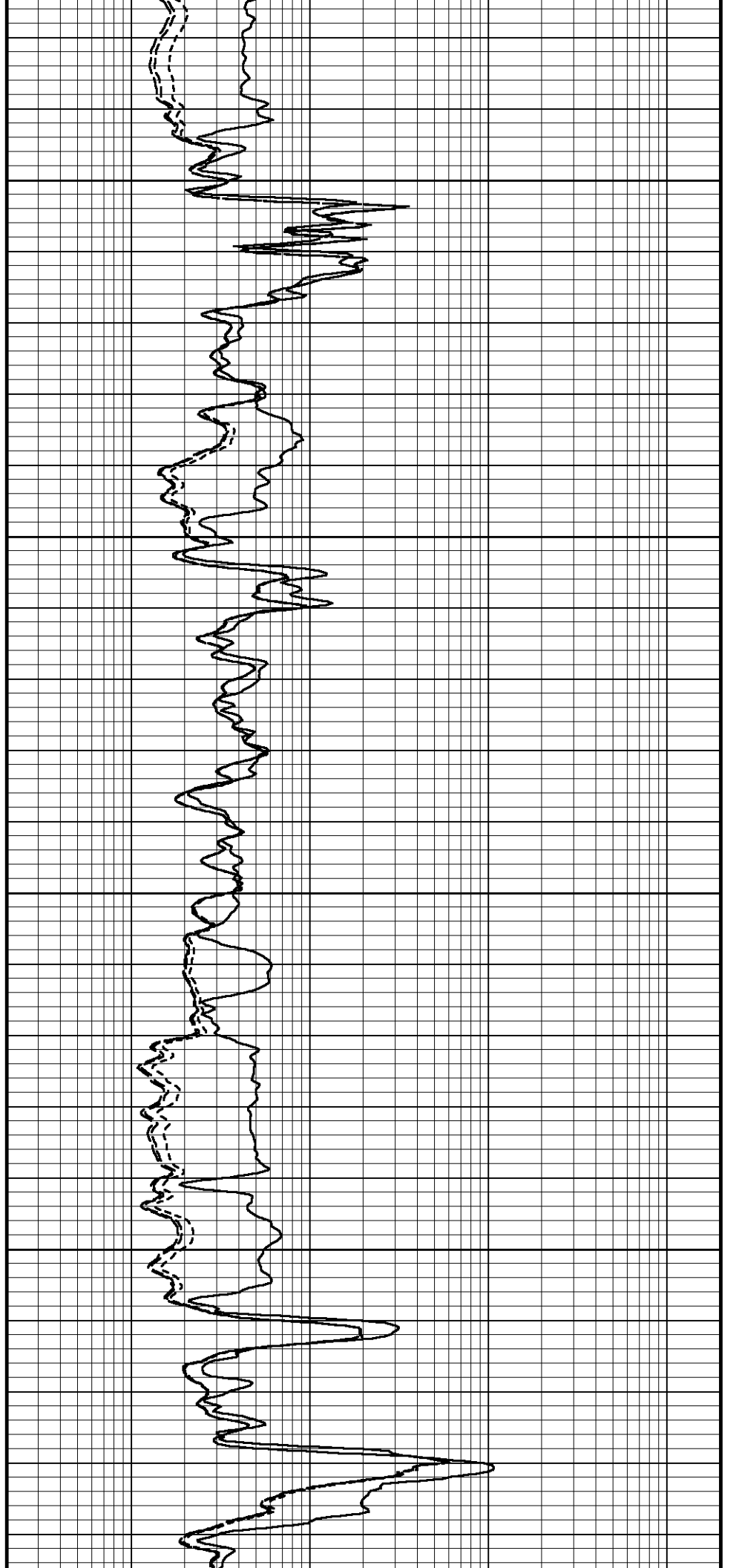
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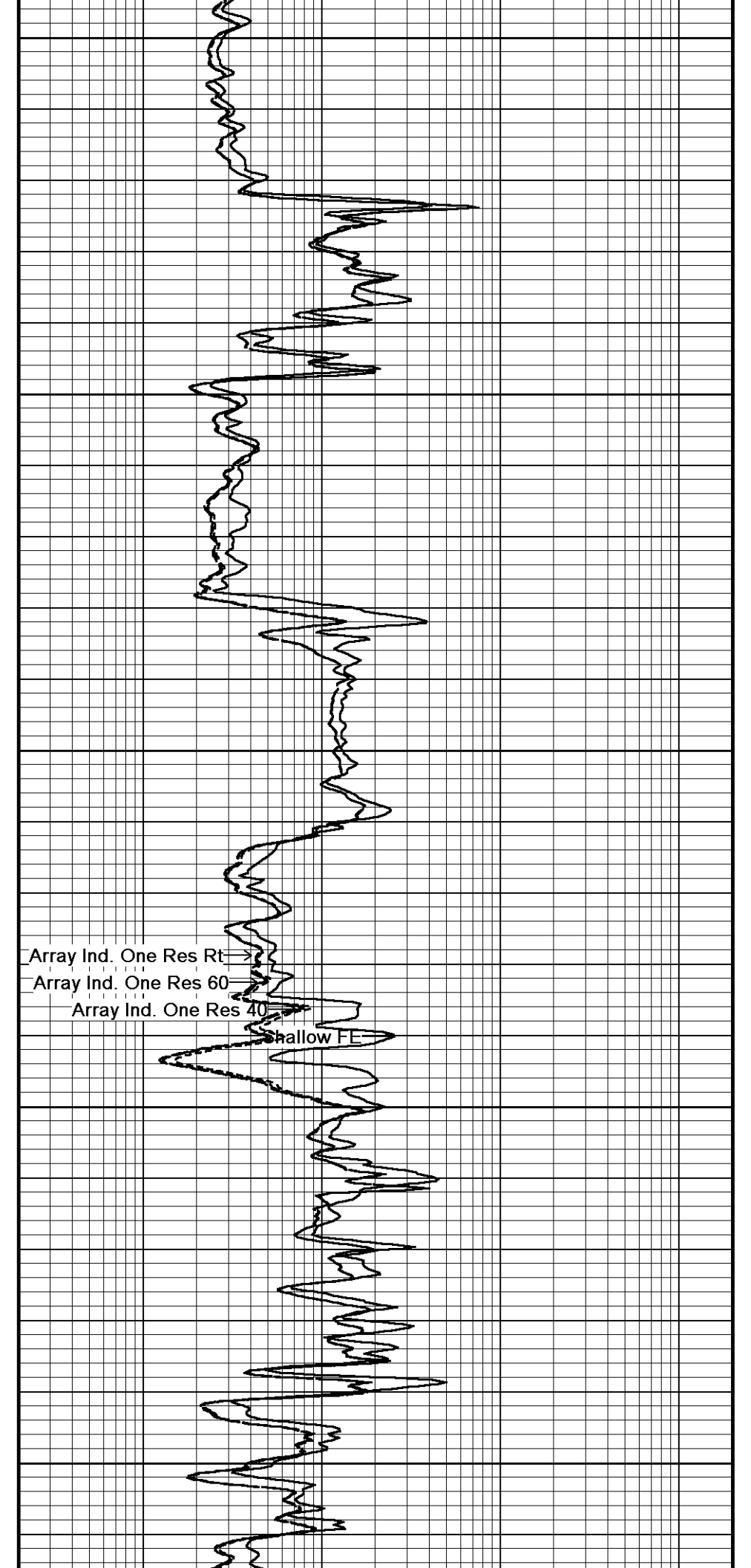
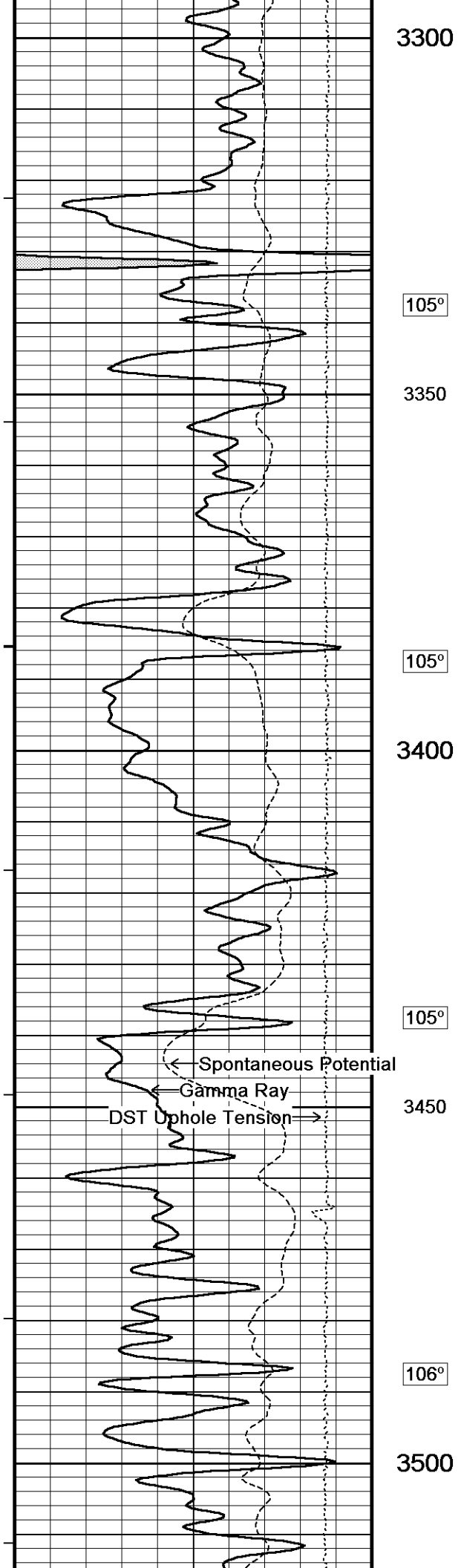
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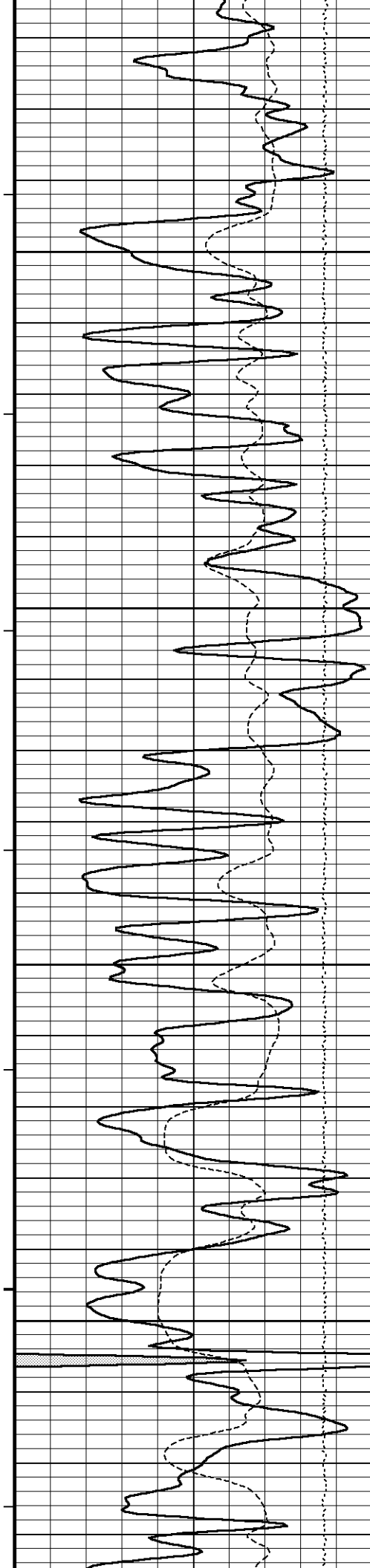
104°

3250

104°







106°

3550

106°

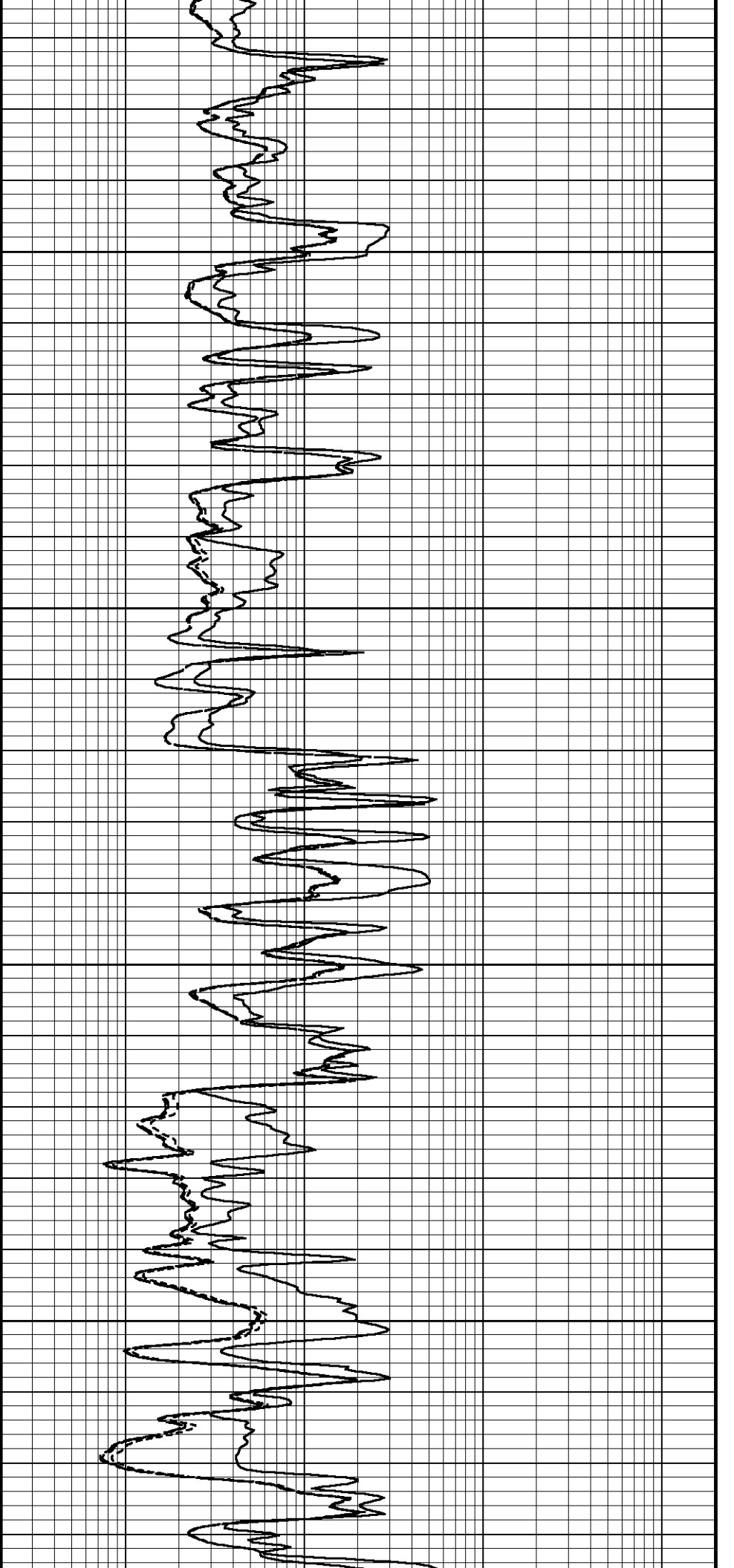
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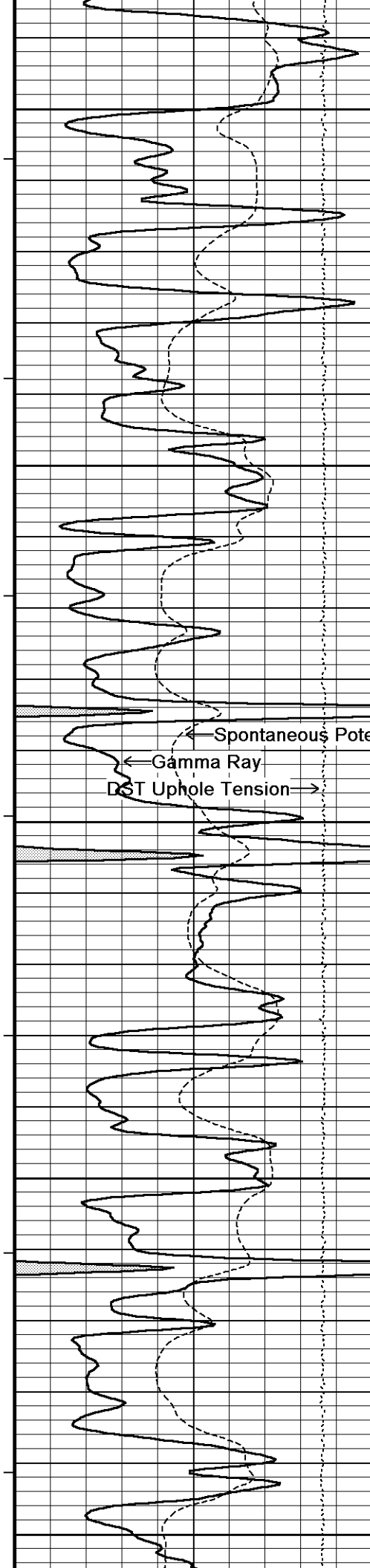
107°

3650

107°

3700





107°

3750

108°

3800

Array Ind. One Res Rt

Array Ind. One Res 60

Array Ind. One Res 40

Shallow FE

108°

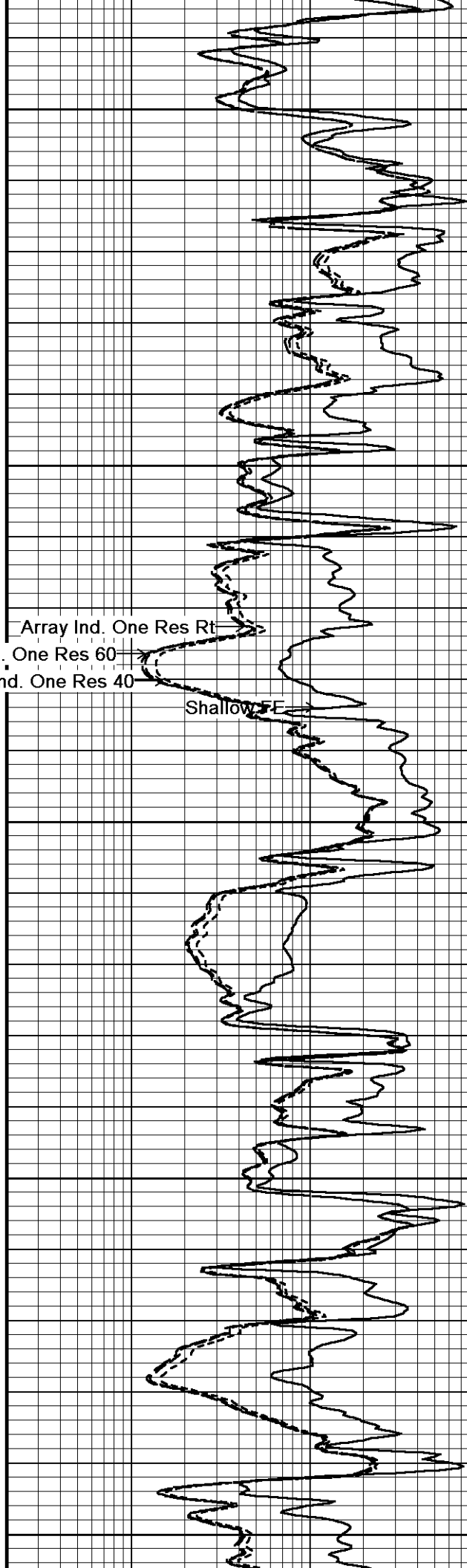
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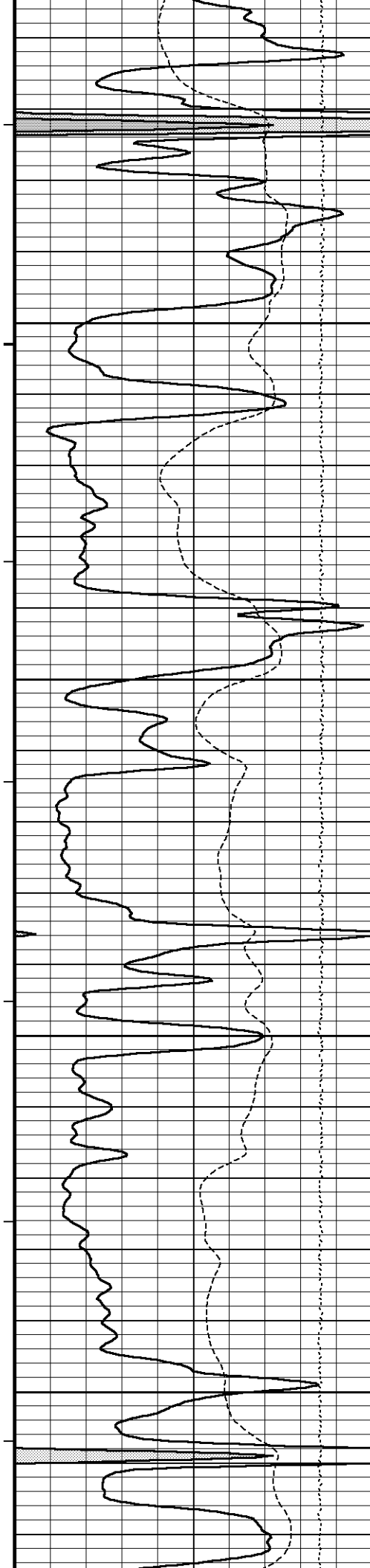
108°

3900

108°

3950





109°

4000

109°

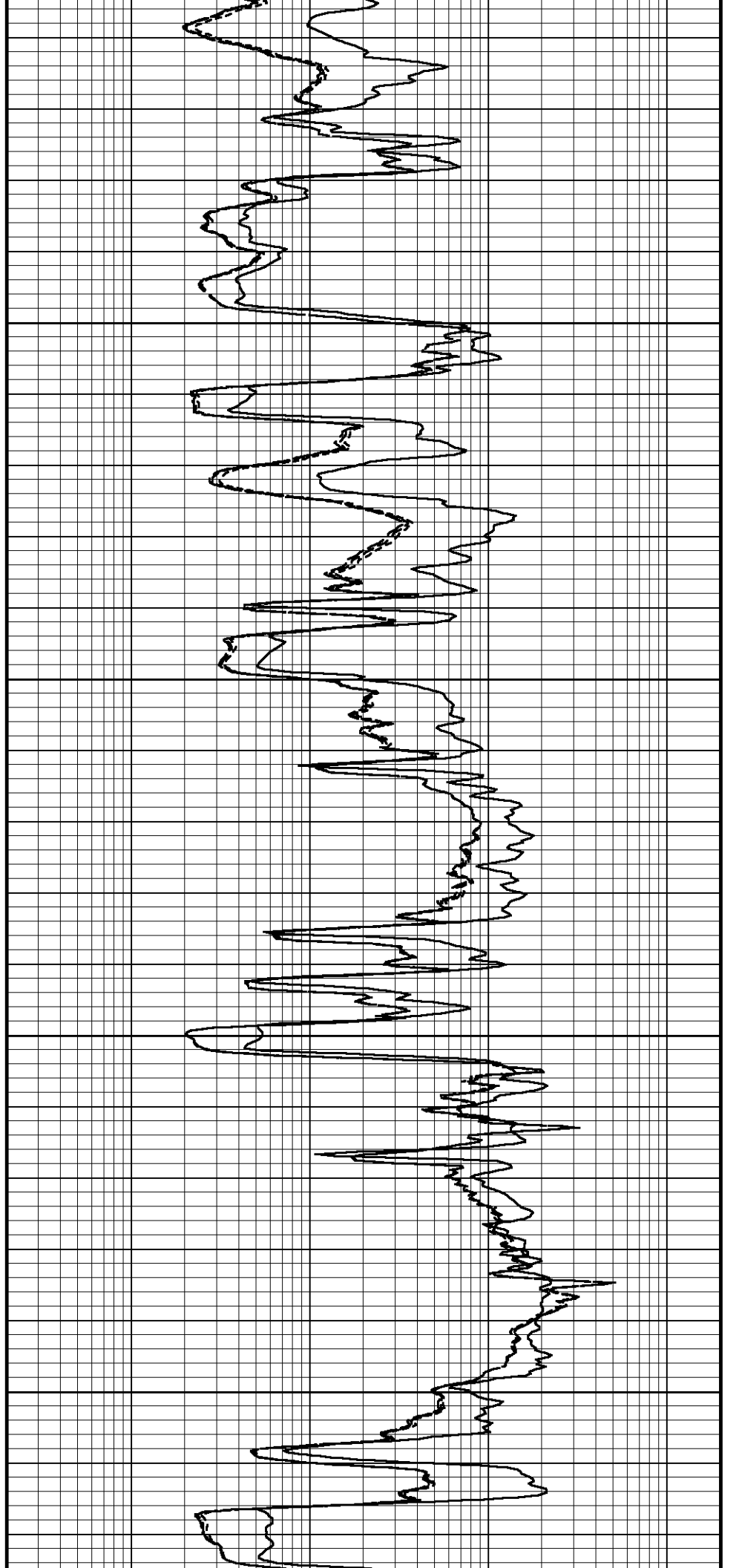
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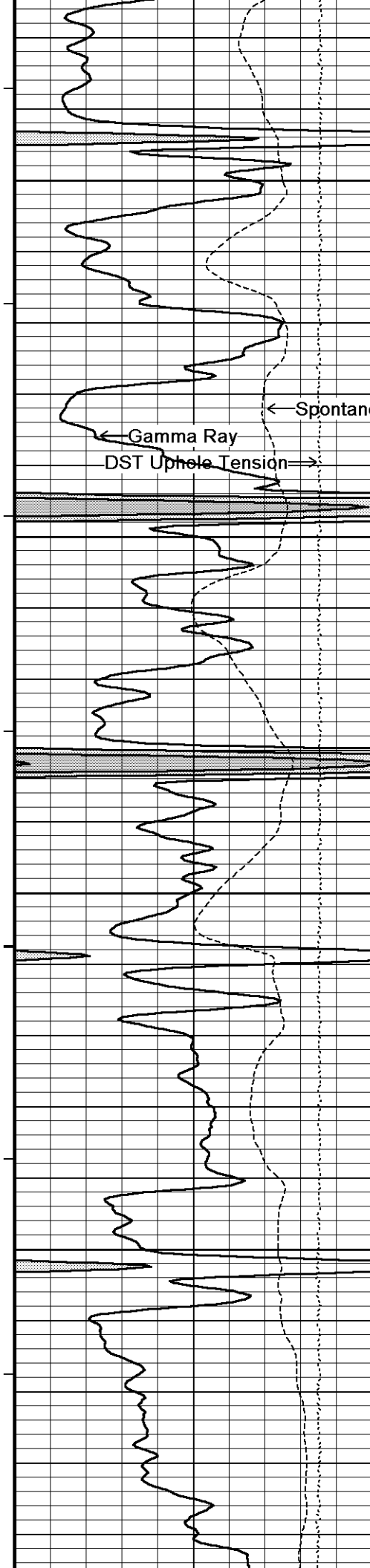
109°

4100

110°

4150





110°

4200

Array Ind. One Res Rt  
Array Ind. One Res 60  
Array Ind. One Res 40  
Shallow

111°

4250

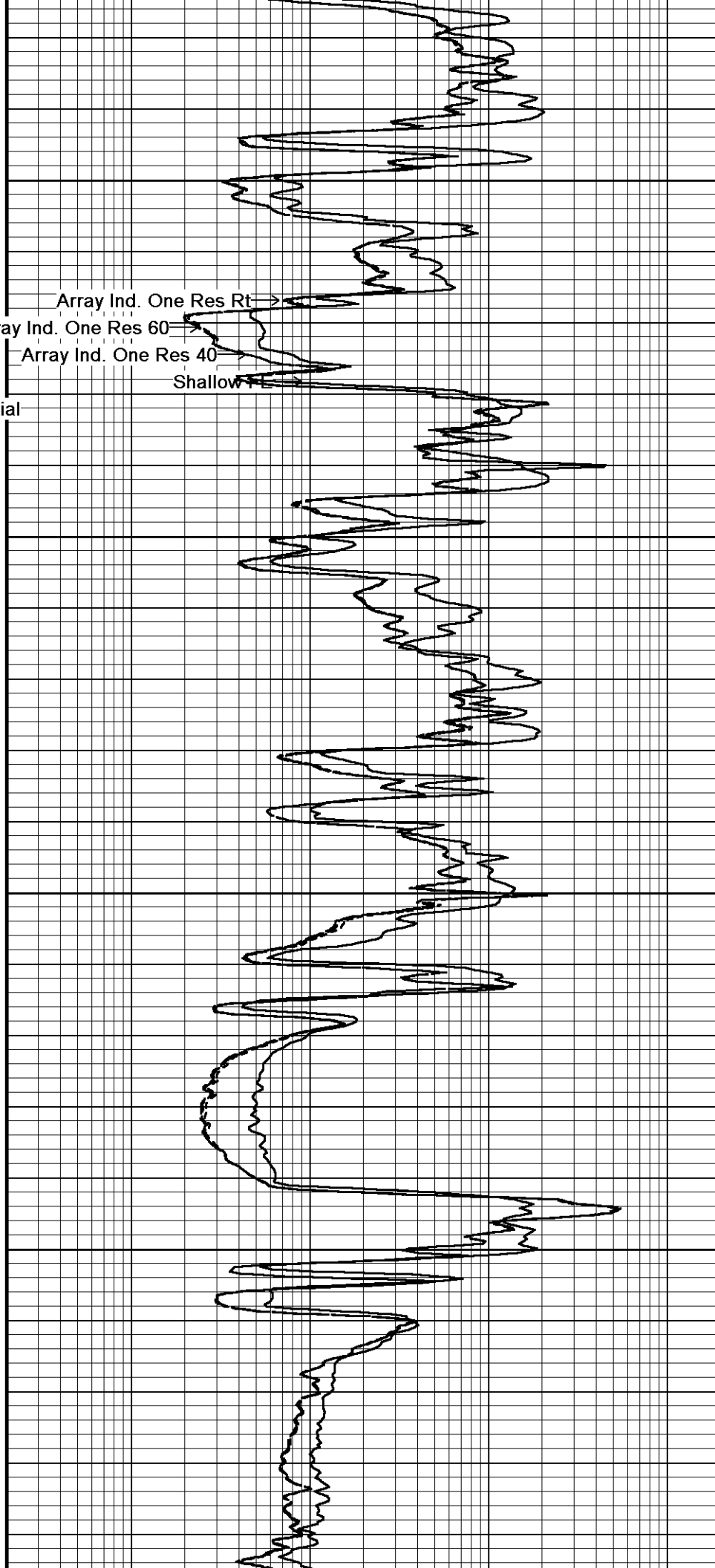
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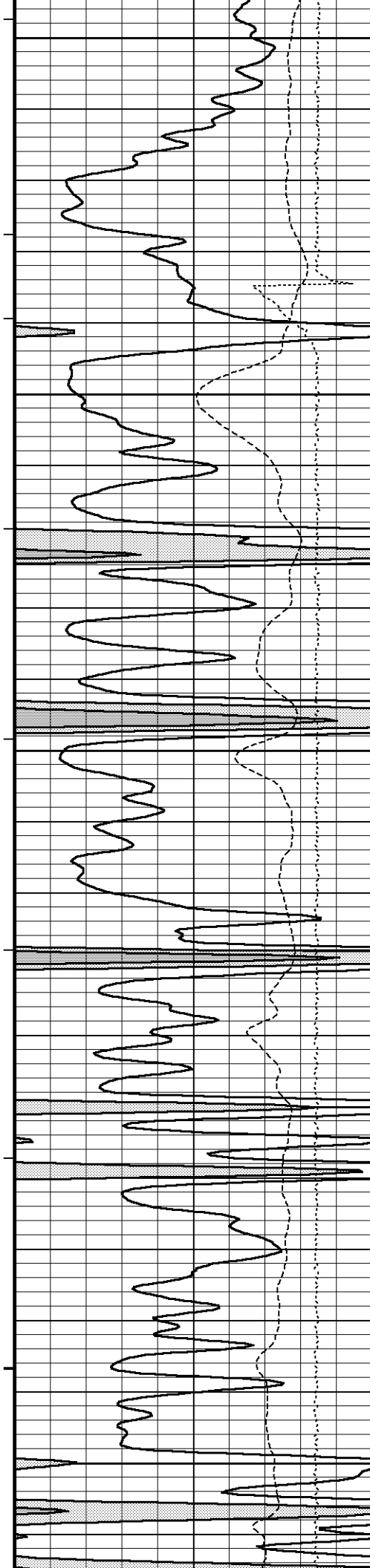
4300

111°

4350

111°





4400

113°

4450

113°

4500

114°

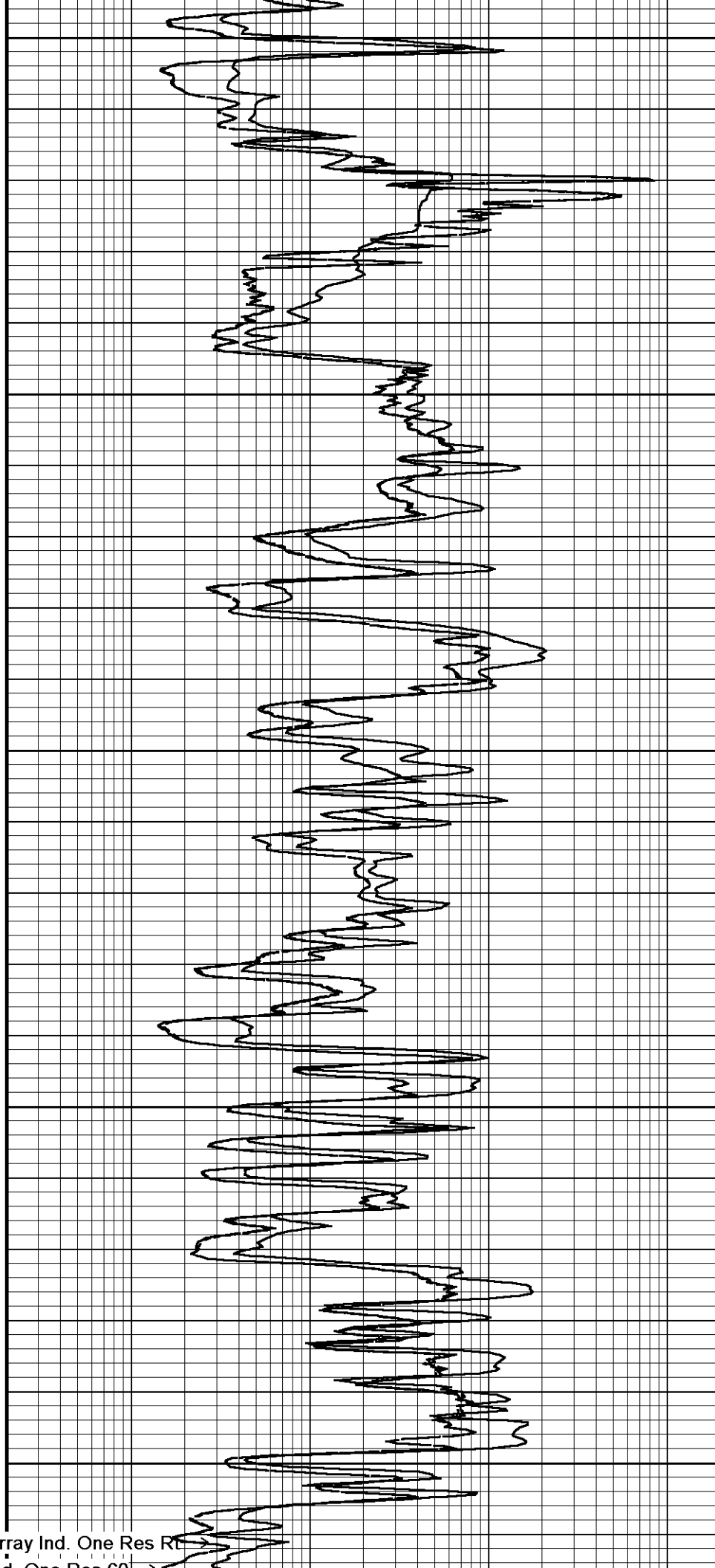
4550

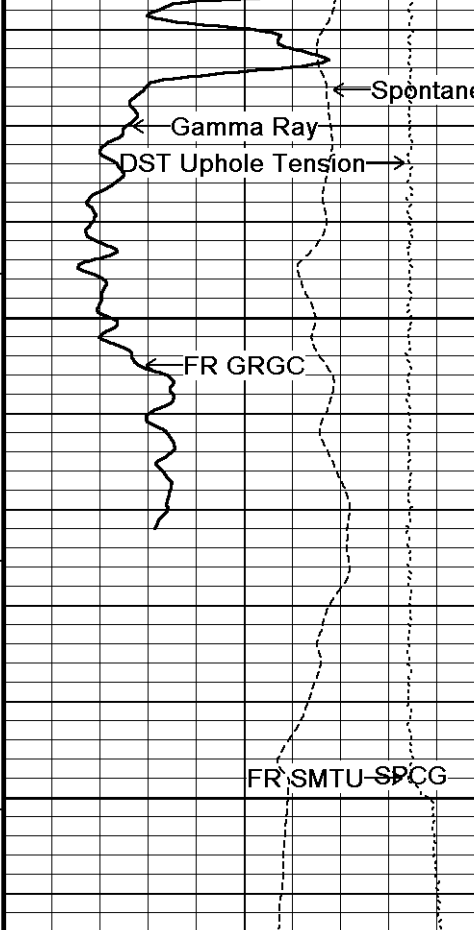
115°

4600

Array Ind. One Res Rt

Array Ind. One Res Co





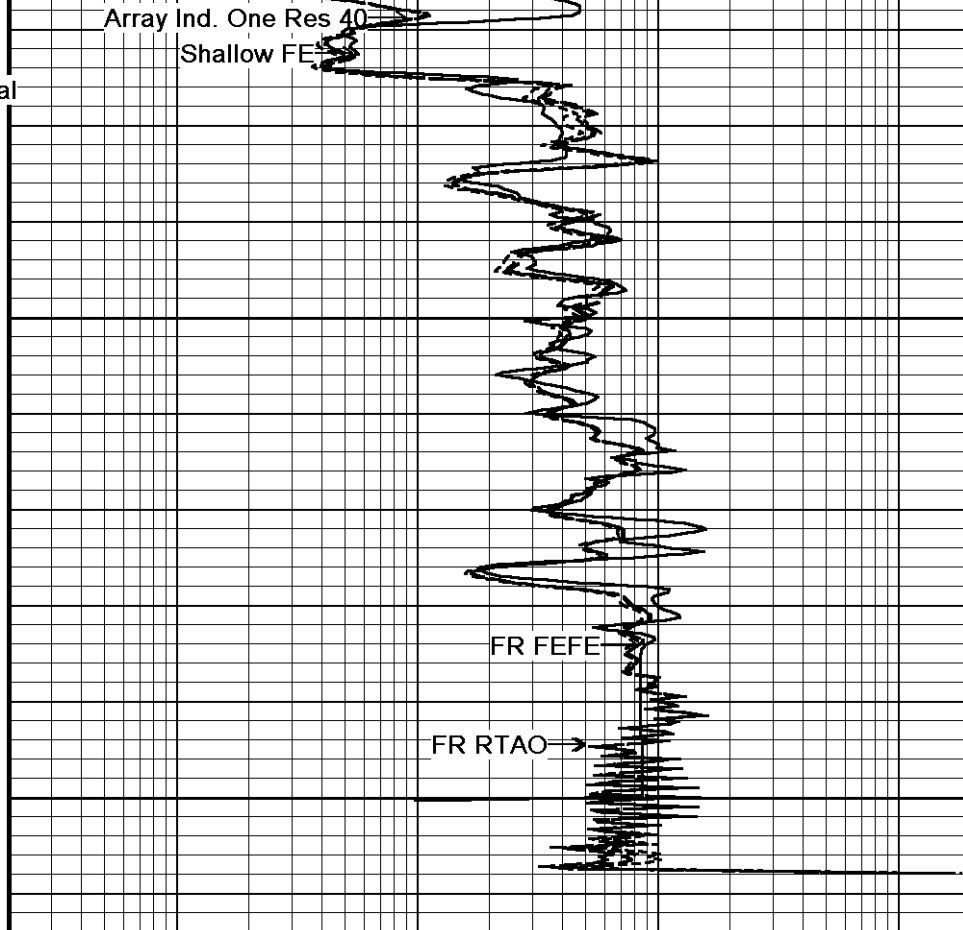
116°

4650

4700

4722

Depth In Feet



Timing Marks every 60.0 sec

Gamma Ray API

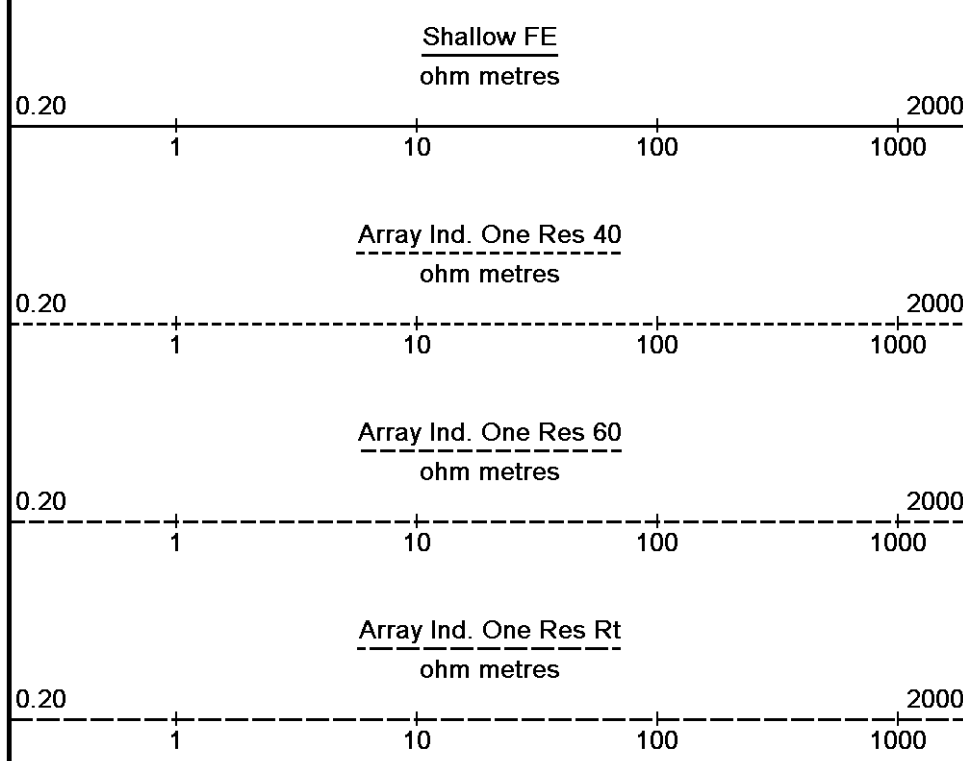
0	75	150
150	225	300

Spontaneous Potential millivolts

- - - - -> | 20 | <- - - - - +

DST Uphole Tension pounds

5000 0



Borehole Temp in deg F

Replay Scale 1:240

Depth Based Data - Maximum Sampling Increment 10.0cm

Filename: E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main.dta

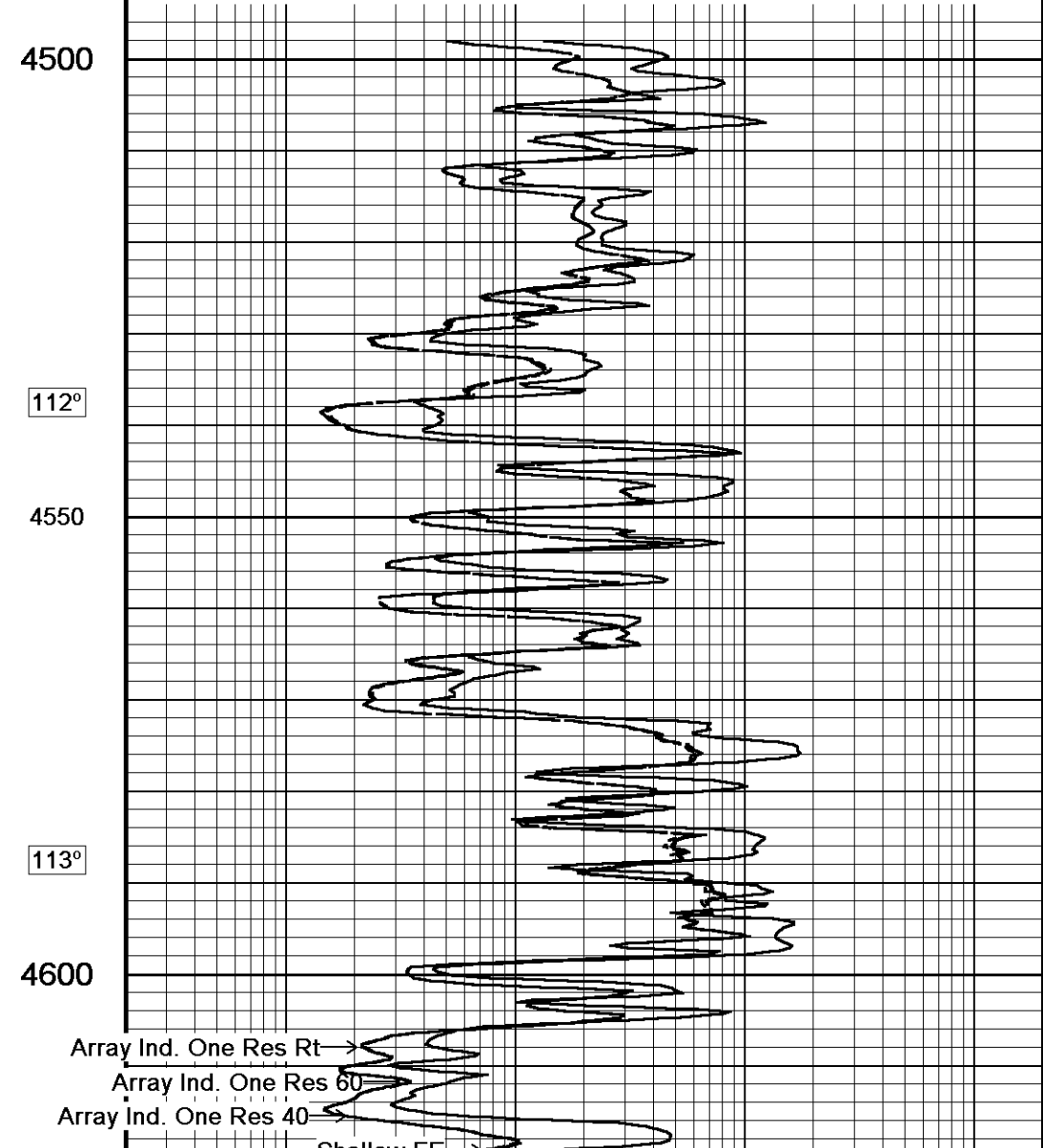
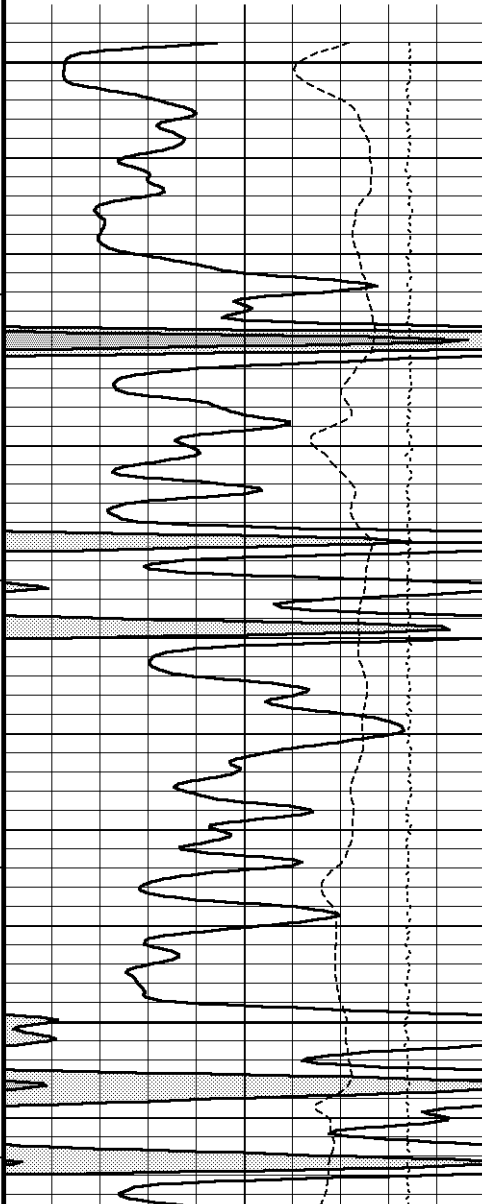
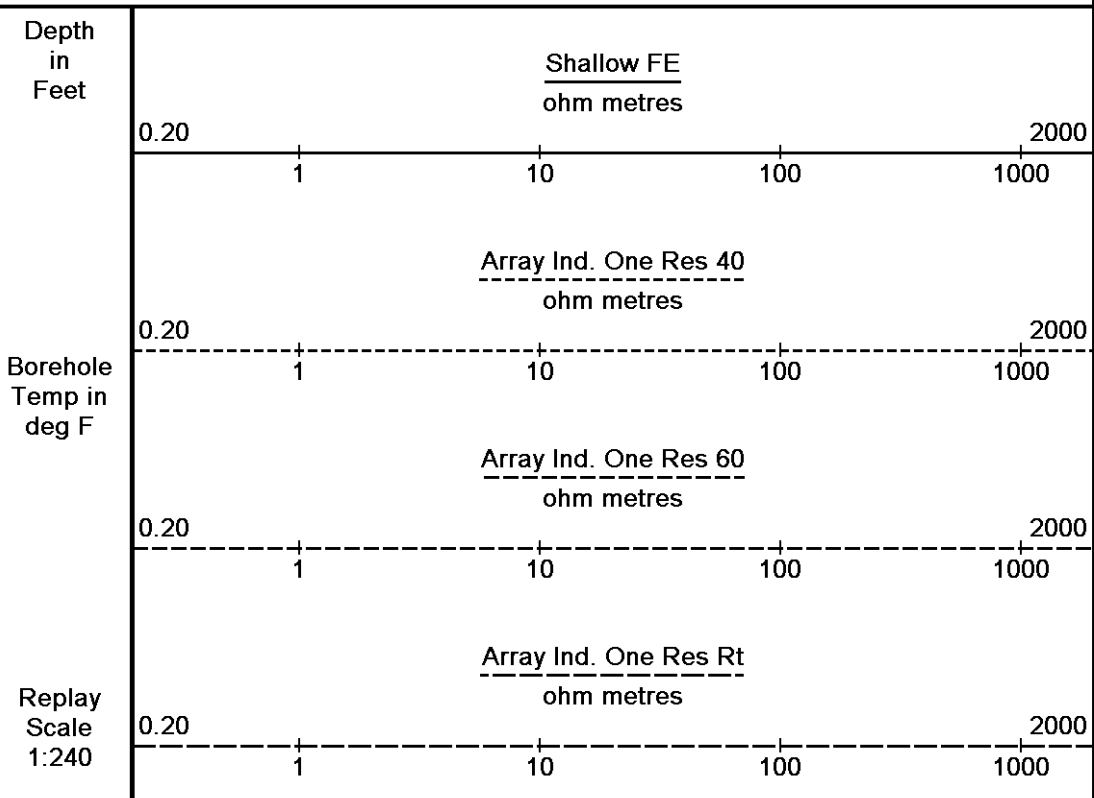
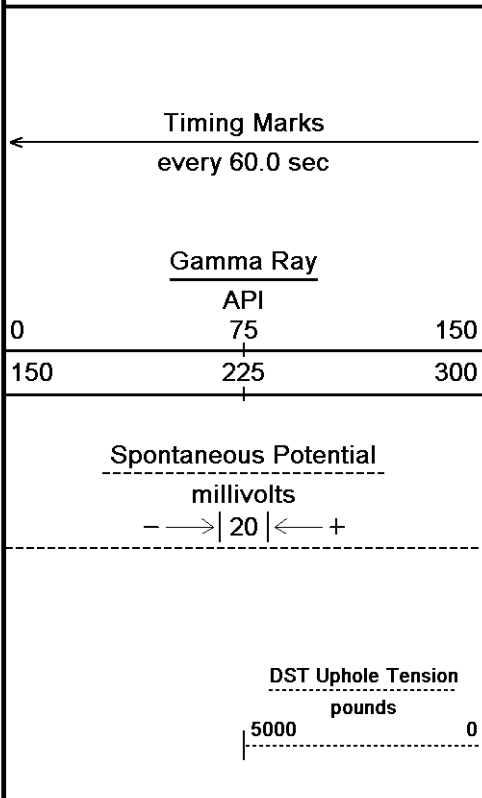
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

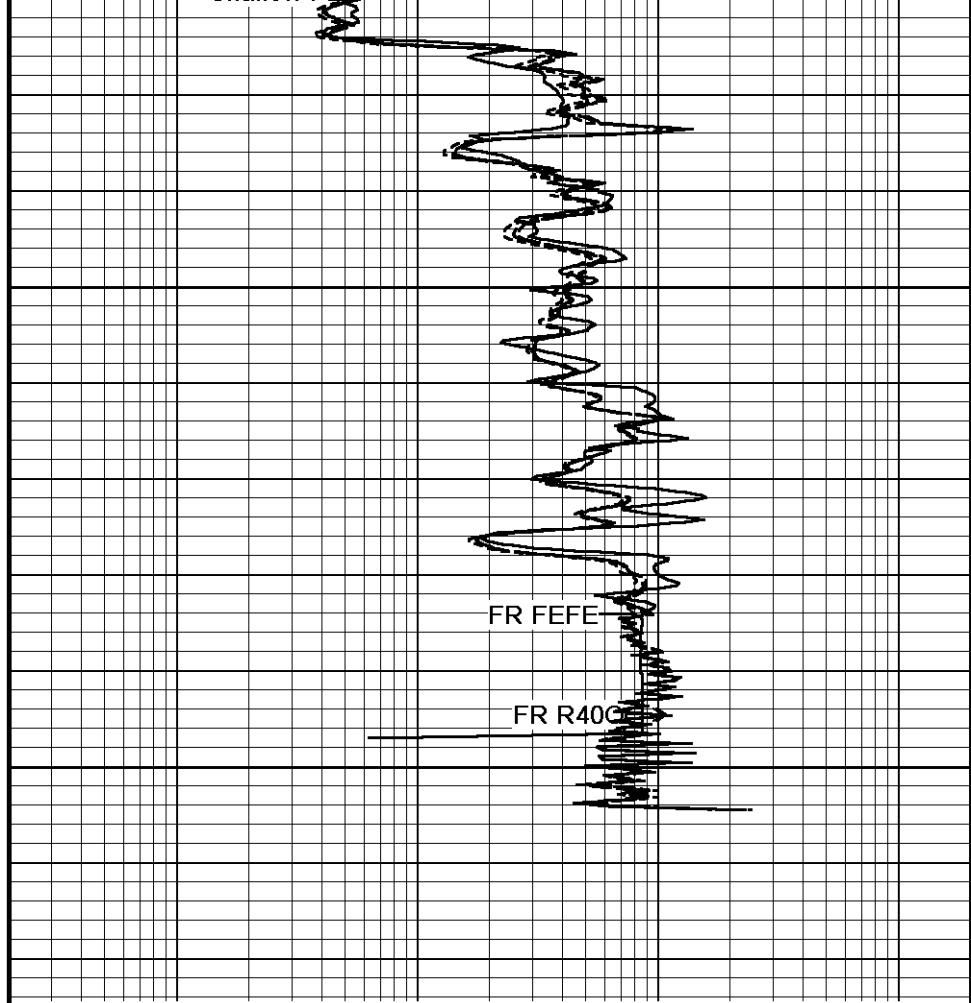
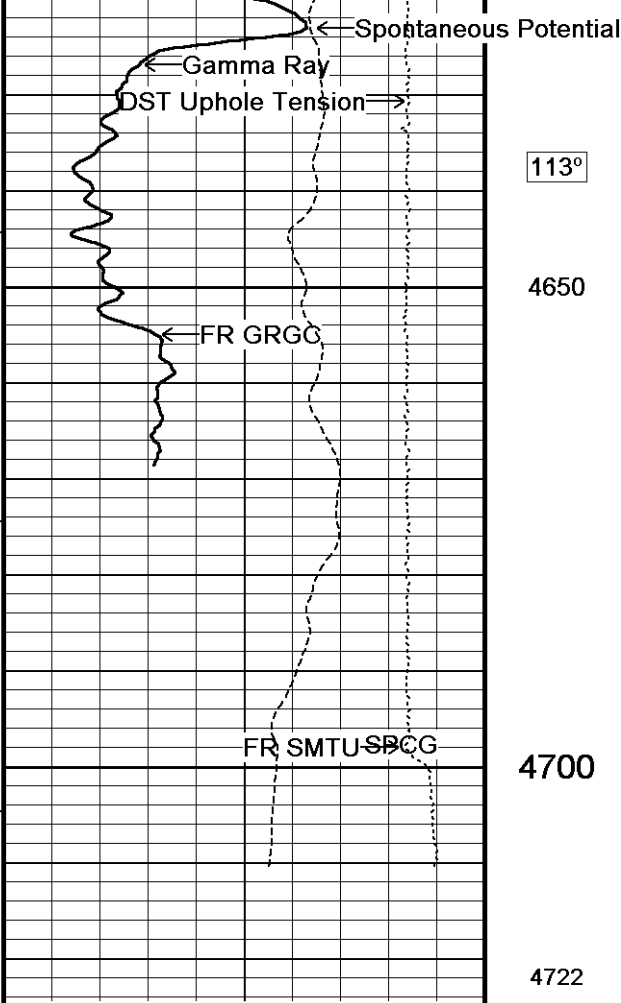
Plotted on 09-DEC-2013 00:32

Recorded on 08-DEC-2013 19:59

↑ 5 INCH MAIN ↑

↓ REPEAT SECTION ↓





113°

4650

4700

4722

Depth in Feet

Timing Marks every 60.0 sec

Gamma Ray  
API  
0 75 150  
150 225 300

Spontaneous Potential  
millivolts  
- - -> | 20 | <- - +

DST Uphole Tension  
pounds  
5000 0

Borehole Temp in deg F

Replay Scale 1:240

Shallow FE  
ohm metres

0.20 1 10 100 1000 2000

Array Ind. One Res 40  
ohm metres

0.20 1 10 100 1000 2000

Array Ind. One Res 60  
ohm metres

0.20 1 10 100 1000 2000

Array Ind. One Res Rt  
ohm metres

0.20 1 10 100 1000 2000

Depth Based Data - Maximum Sampling Increment 10.0cm  
 Plotted on 09-DEC-2013 00:32  
 Filename: E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Repeat.dta  
 Recorded on 08-DEC-2013 19:18  
 System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

↑ REPEAT SECTION ↑

BEFORE SURVEY CALIBRATION  
 E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main Detail.dta

## General Parameters

Mud Resistivity	1.730	ohm-metres
Mud Resistivity Temperature	89.300	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	None	

## Rwa Parameters

Porosity used	Crossplot Porosity	
Resistivity used	Array Ind. One Res Rt	
RWA Constant A	1.000	
RWA Constant M	2.000	
SW/APOR Tool Source	0.000	

## Gamma Calibration MCG-B 39

Field Calibration on 08-DEC-2013 11:44

	Measured	Calibrated (API)
Background	60	40
Calibrator (Gross)	1135	765
Calibrator (Net)	1075	725

## Gamma Constants MCG-B 39

Last Edited on 08-DEC-2013,15:55

Gamma Calibrator Number	GRC38	
Mud Density	1.13	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

## High Resolution Temperature Calibration MCG-B 39

Field Calibration on 08-DEC-2013,11:39

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

## High Resolution Temperature Constants MCG-B 39

Last Edited on 08-DEC-2013,11:39

Pre-filter Length	11
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## FE Calibration MFE-B.J 353

Base Calibration on 07-OCT-2013 09:02

Field Check on 08-DEC-2013 11:10

## Base Calibration

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	964.2	126.8
Base Check		281.0
Field Check		281.2

## FE Constants MFE-B.J 353

Last Edited on 08-DEC-2013,15:54

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	0.5	inches

## Induction Calibration MAI-A.A 167

Base Calibration on 02-OCT-2013,14:21

Field Check on 08-DEC-2013 11:07

## Base Calibration

Test Loop Calibration	Measured	Calibrated (mD-ft/m)
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Test Loop Calibration	measured	Calibrated (mmho/m)		
Channel	Low	High	Low	High
1	17.3	474.2	9.3	966.2
2	6.3	388.4	7.6	821.4
3	3.3	259.4	5.2	566.0
4	1.9	133.0	2.6	279.2

Array Temperature 76.8 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	0.0	0.0	12.0	3841.9
2	0.0	0.0	29.3	3479.0
3	0.0	0.0	29.0	3054.6
4	0.0	0.0	19.7	2083.0
Deep			18.5	2050.1
Medium			42.2	3993.0
Shallow			42.5	5057.0
Array Temperature	0.0		57.7	Deg F

Induction Constants MAI-A.A 167

Last Edited on 08-DEC-2013,15:54

Induction Model	RtAP-NC		
Caliper for Borehole Corr.	Density 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		
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	

DOWNHOLE EQUIPMENT

E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main Detail.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



42.87 ft GRGC - Gamma Ray

MCG-B 39 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Micro-log  
MML-A 3 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

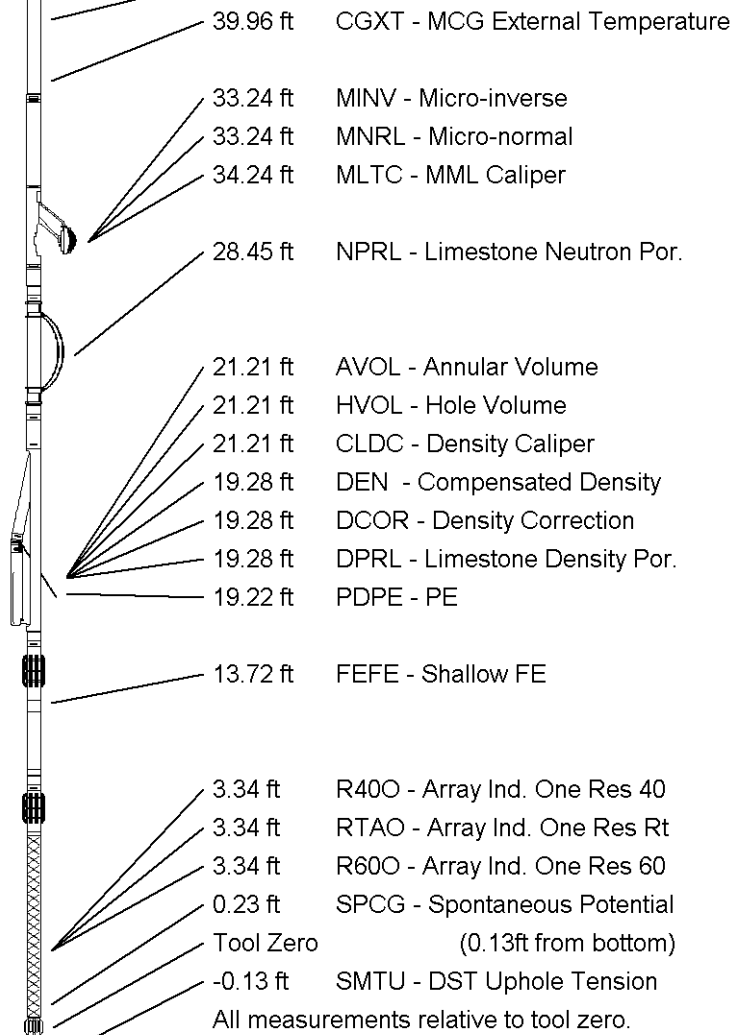
Compact Neutron  
MDN-A.B 66 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper  
MPD-C.A 216 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

Compact Focused Electric  
MFE-B.J 353 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction  
MAI-A.A 167 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 49.73 ft Weight: 399.0 lb



**COMPANY** SHAKESPEARE OIL CO., INC  
**WELL** TEETER #2-11  
**FIELD** STRATFORD  
**PROVINCE/COUNTY** LOGAN  
**COUNTRY/STATE** U.S.A. / KANSAS

Elevation Kelly Bushing	2995.00	feet	First Reading	4694.66	feet
Elevation Drill Floor	2993.00	feet	Depth Driller	4700.00	feet
Elevation Ground Level	2983.00	feet	Depth Logger	4698.00	feet



**ARRAY INDUCTION  
SHALLOW FOCUSED  
ELECTRIC LOG**

**Weatherford**<sup>®</sup>

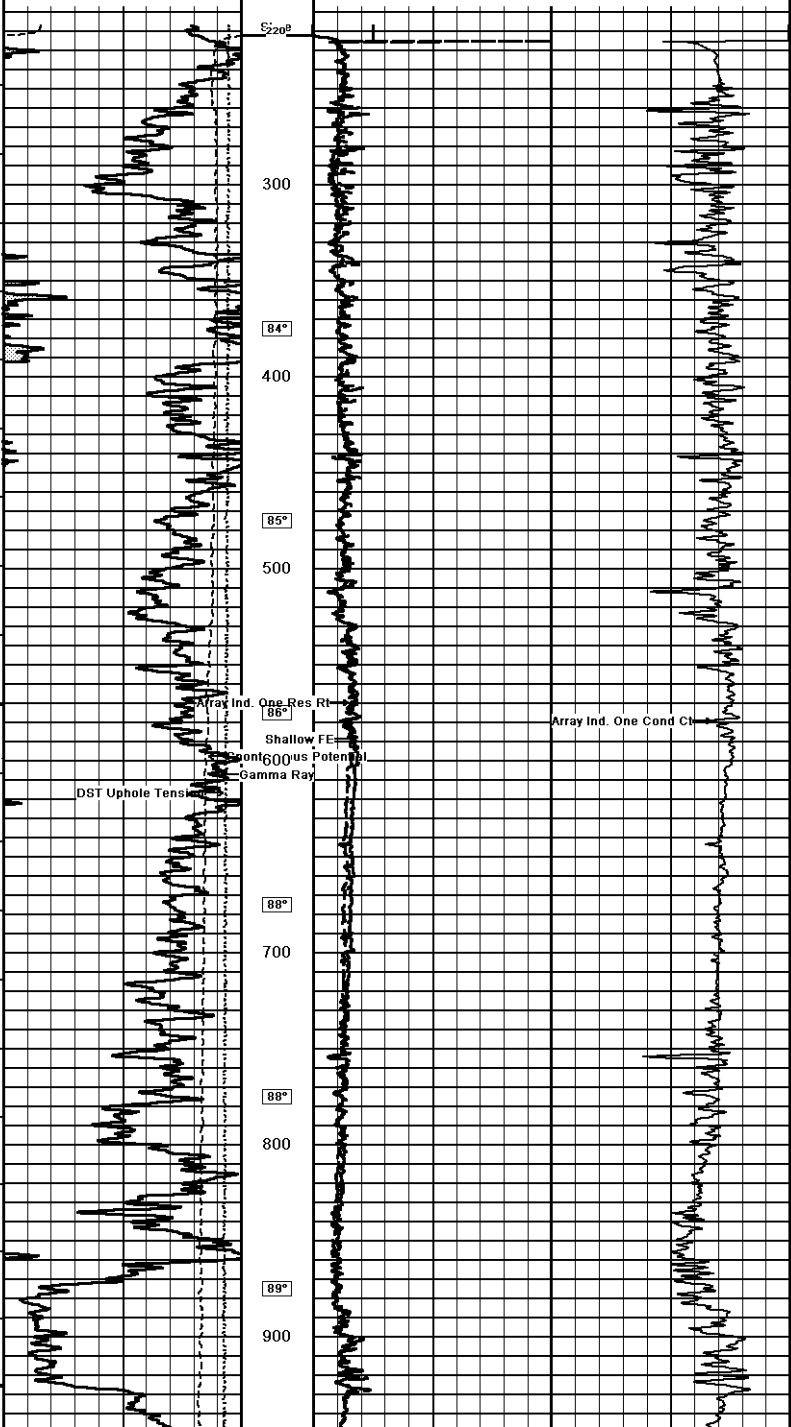
<b>Weatherford</b>		<b>ARRAY SHALLOW ELEC</b>	
COMPANY SHAKESPEARE OIL CO., INC		WELL TEETER #2-11	
FIELD STRATFORD		PROVINCE/COUNTY LOGAN	
COUNTRY/STATE U.S.A. / KANSAS		LOCATION 5141 FSL & 14941 FEL	
SEC T1	TIME 1:35	DATE 08-DEC-2013	LOG MEASURED FROM KB
SRV NUMBER 15-109-21219	MPD/MDN MML	PERMANENT DATUM OL ELEVATION 2893 feet	DRIING MEASURED FROM KB
Run Number	ONE	Service Order	3547626
Depth Driller	4700.00 feet	Depth Logger	4698.00 feet
First Reading	4694.66 feet	Last Reading	2698.00 feet
Casing Driller	227.00 feet	Casing Logger	7.875 inches
Bit Size	CHEMICAL	Hole Fluid Type	9.40 in/USG
Density/Viscosity	10.00	PH/Fluid Loss	7.20 ml/30min
Sample Source	FLOWLINE	Run @ Measured Temp	1.73 @ 89.3
Run @ Measured Temp	1.38 @ 89.3	Run @ Measured Temp	2.08 @ 89.3
Source Rmt/Rmc	CALC	Source Rmt/Rmc	CALC
Run @ BHT	1.34 @ 116.0	Time Since Circulation	3 HOURS
Max Recorded Temp	116.00 deg F	Equipment/Base	113066 LIB
Recorded By	DEREK CARTER	Witnessed By	TIM PREST
Tool#	LET-3-46		

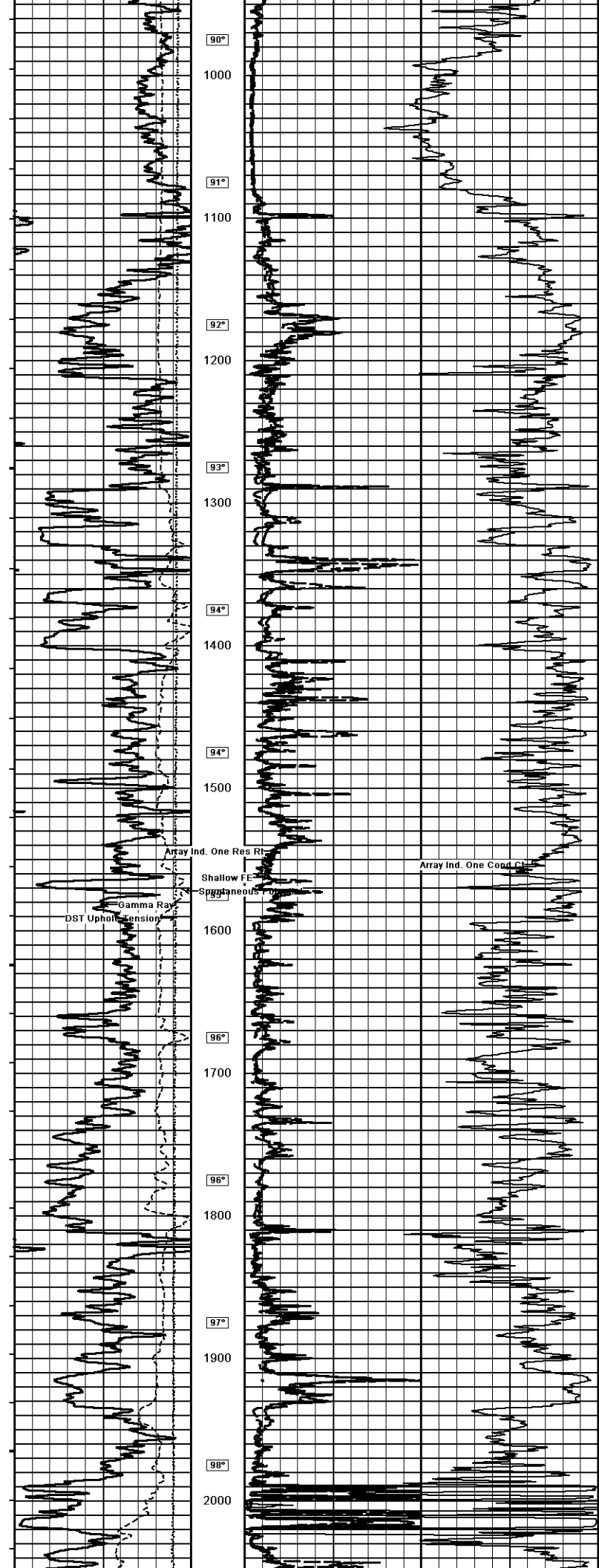
Estimate: 2985.00  
KID 2985.00  
DF 2983.00  
OL 2983.00

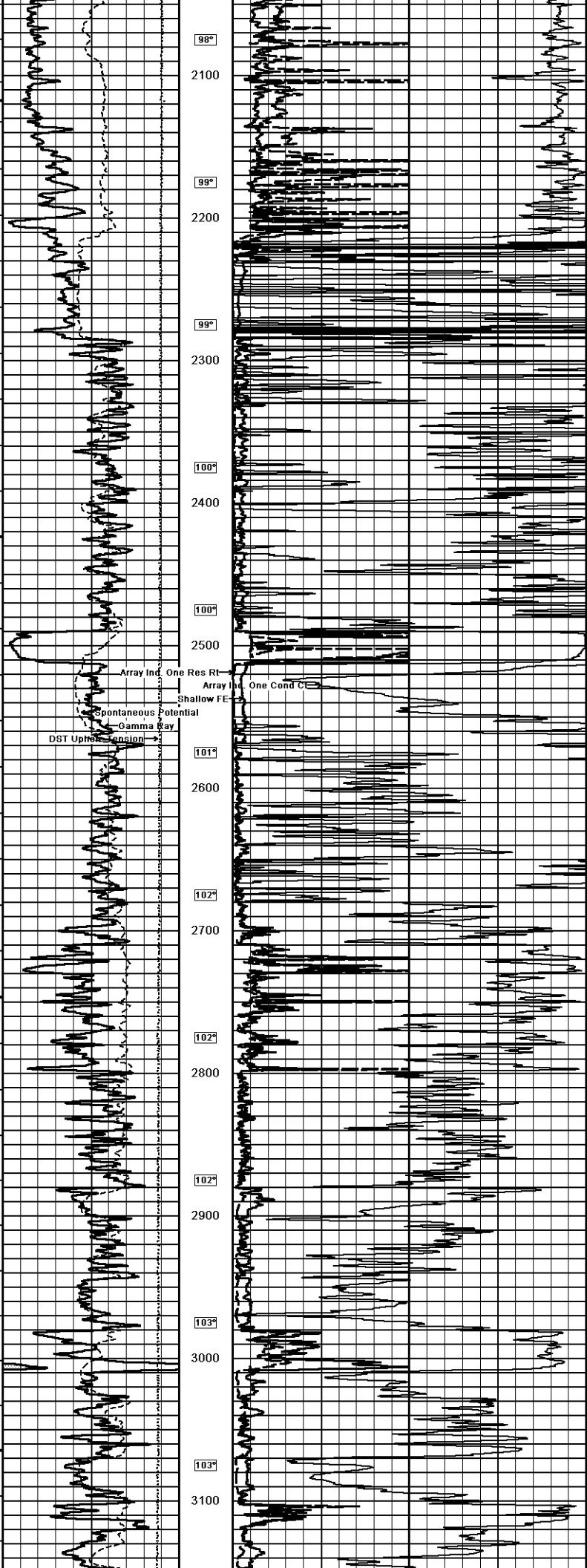
1 INCH MAIN

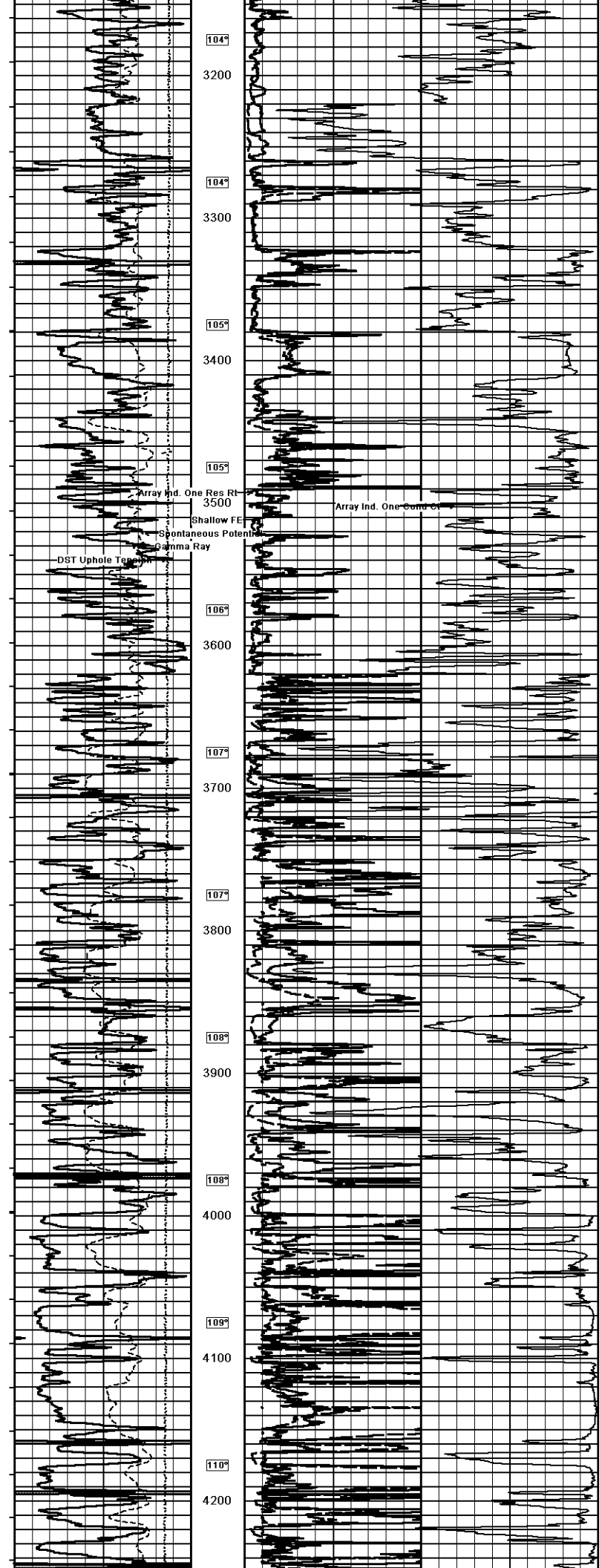
Depth Based Data - Maximum Sampling Increment 10.0cm  
Plotted on 09-DEC-2013 00:32  
Filename: E:\Shakespeare Teeter #2-11\Shakespeare Teeter #2-11 Main.dta  
Recorded on 09-DEC-2013 19:59  
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

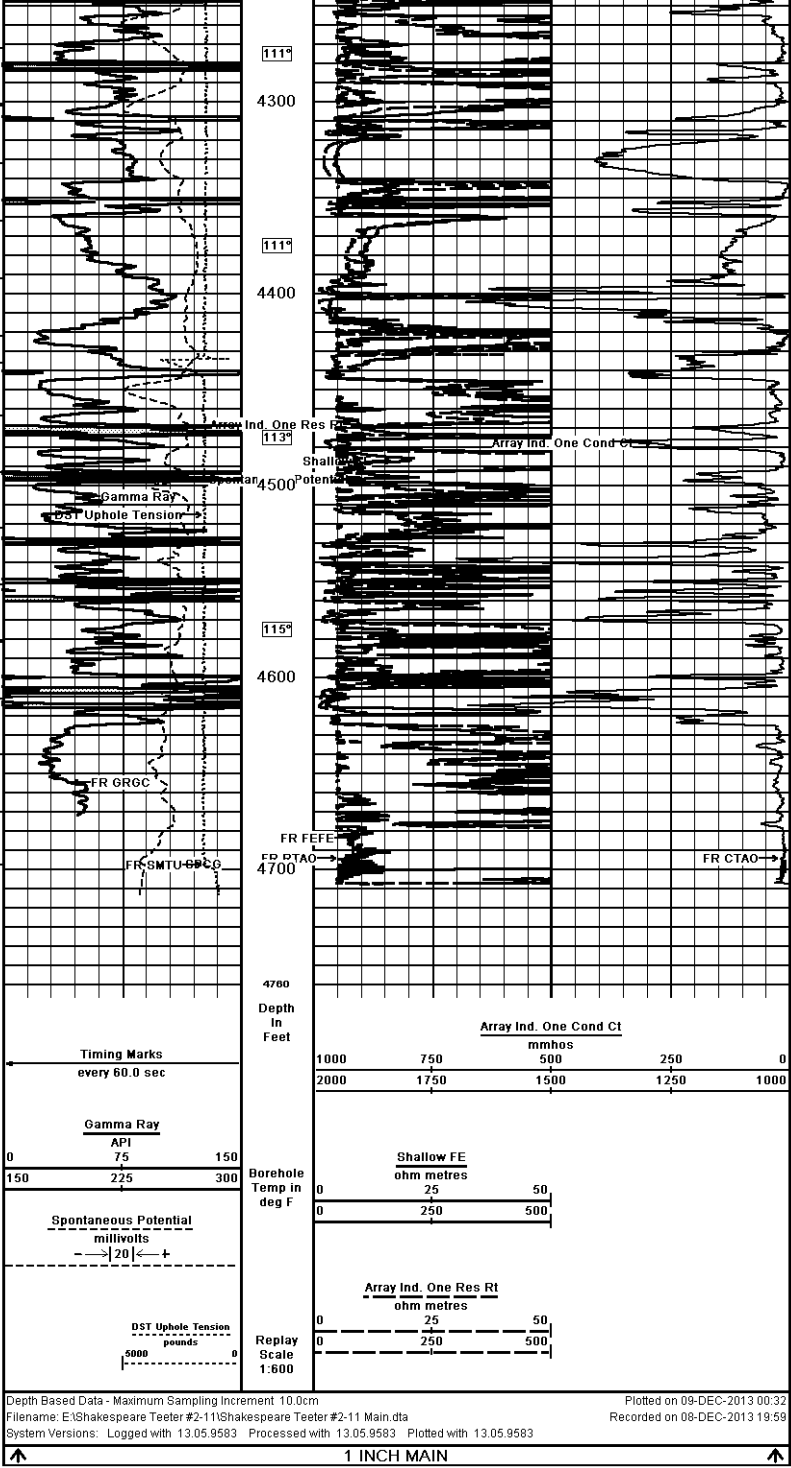
Timing Marks every 60.0 sec	Array Ind. One Cond Ct mmhos			
	1000	750	500	250
Gamma Ray API	Shallow FE ohm metres			
	0	75	150	300
Spontaneous Potential millivolts	Array Ind. One Res Rt ohm metres			
	0	25	50	100
DST Uphole Tension pounds	Borehole Temp in deg F			
	0	25	50	100
Replay Scale 1:600	Array Ind. One Res Rt ohm metres			
	0	25	50	100












COMPANY SHAKESPEARE OIL CO., INC  
 WELL TEETER #2-11  
 FIELD STRATFORD  
 PROVINCE/COUNTY LOGAN  
 COUNTRY/STATE U.S.A. / KANSAS

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