



**Weatherford**

**ARRAY INDUCTION  
SHALLOW FOCUSED  
ELECTRIC LOG**

COMPANY WESTERN OPERATING COMPANY

WELL FOX #1-8

FIELD HELFRICH

PROVINCE/COUNTY HAMILTON

COUNTRY/STATE U.S.A. / KANSAS

LOCATION 335' FNL & 495' FWL

SEC 8 TWP 25S RGE 42W Other Services MPD/MDN MML

API Number 15-075-20866

Permit Number

Permanent Datum GL, Elevation 3596 feet

Log Measured From KB

Drilling Measured From KB

Elevations: KB 3609.00 DF 3608.00 GL 3596.00

Date 16-JAN-2013

Run Number ONE

Service Order 3537806

Depth Driller 5400.00 feet

Depth Logger 5400.00 feet

First Reading 5397.00 feet

Last Reading 842.00 feet

Casing Driller 850.00 feet

Casing Logger 842.00 inches

Bit Size 7.875

Hole Fluid Type CHEMICAL lb/USg

Density / Viscosity 9.40 lb/USg 50.00 CP

PH / Fluid Loss 9.50 9.50

Sample Source FLOWLINE

Rm @ Measured Temp 0.58 @ 73.0 ohm-m

Rmf @ Measured Temp 0.46 @ 73.0 ohm-m

Rmc @ Measured Temp 0.70 @ 73.0 ohm-m

Source Rmf / Rmc CALC CALC

Rm @ BHT 0.37 @ 119.0 ohm-m

Time Since Circulation 4 HOURS

Max Recorded Temp 119.00 deg F

Equipment / Base 13096 LIB

Recorded By ADAM SILL

Witnessed By PETER DEBENHAM

JOB # LB13-012

**BOREHOLE RECORD**

Last Edited: 16-JAN-2013 12:26

Bit Size inches	Depth From feet	Depth To feet
7.875	850.00	5400.00

**CASING RECORD**

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	850.00	24.00

**REMARKS**

- SOFTWARE ISSUE: WLS 13.04.8492.
- MCG, MML, MDN, MPD, MFE, MAI RAN IN COMBINATION.
  - HARDWARE: DUAL BOWSPRING USED ON MDN.
  - 0.5 INCH STANDOFF USED ON MFE.
  - 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 2134 CU. FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH CASING FROM TD TO 2300 FT: 578 CU. FT.
- SERVICE ORDER # 3537806

- RIG: MURFIN #25.

- ENGINEER: A. SILL.

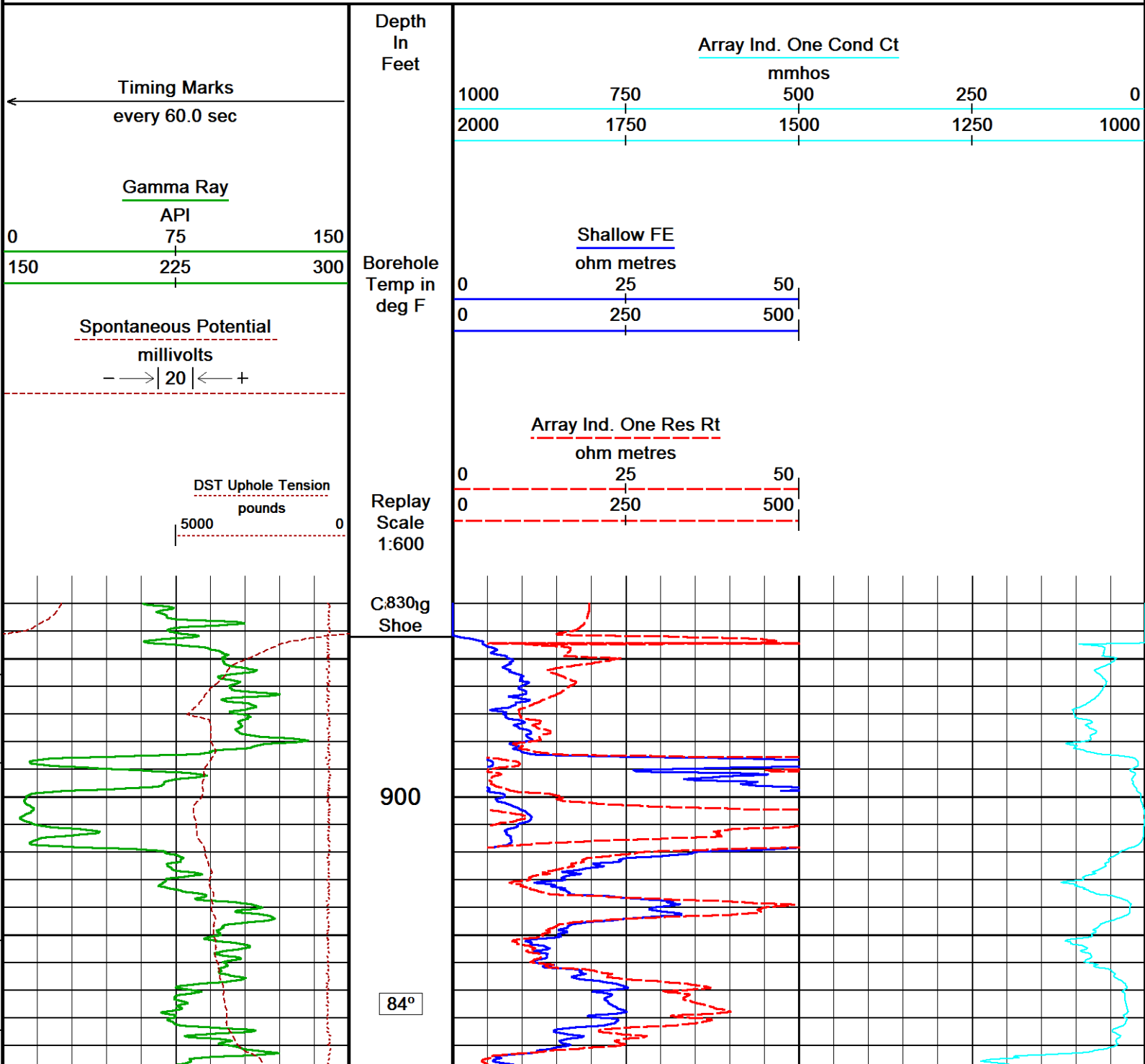
- OPERATOR(S): B. JOHNSON.

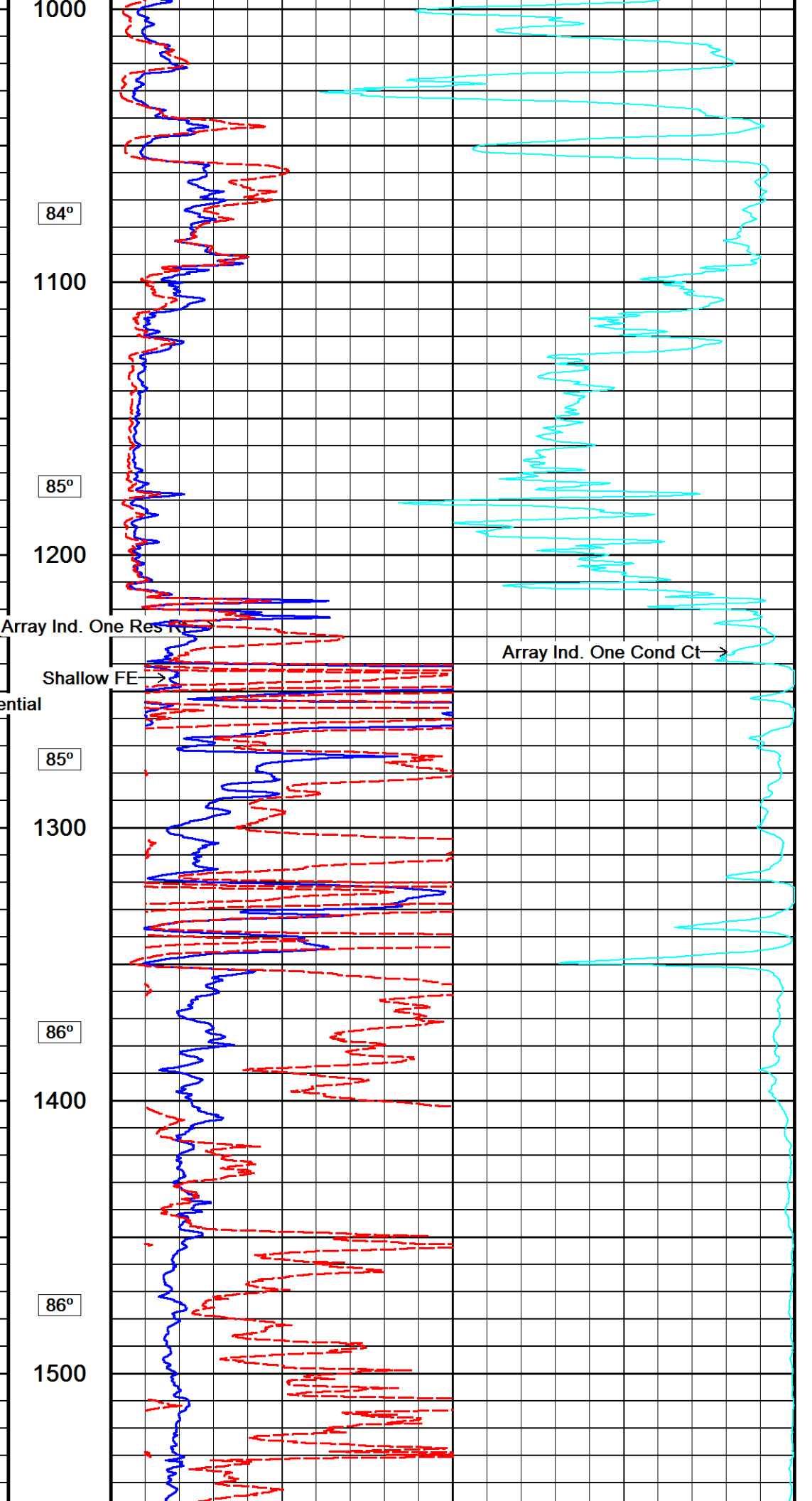
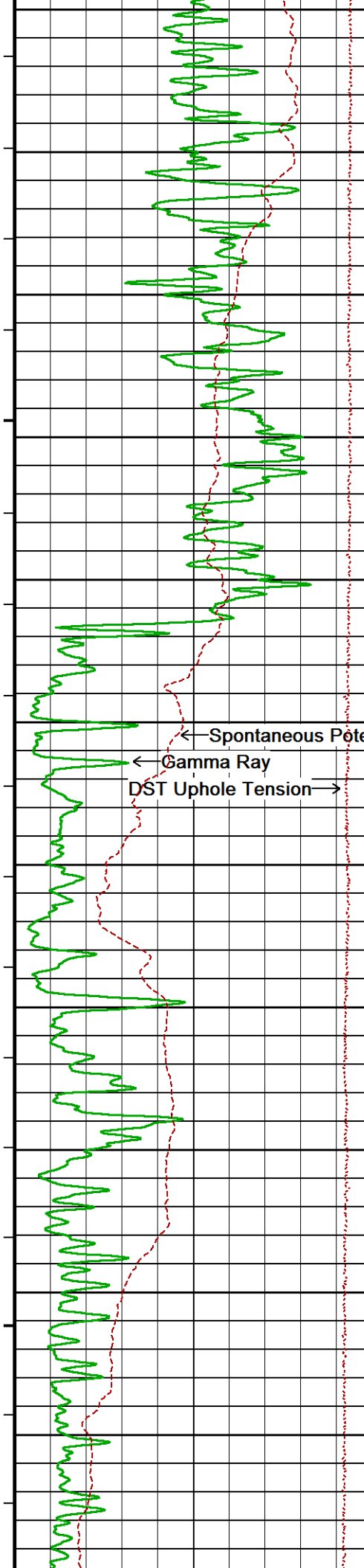
\*\*\*\* SOFTWARE ISSUE CHANGED FLUID LOSS TO MATCH THE PH, FLUID LOSS SHOULD BE 9.6 ML/30MIN. \*\*\*\*

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.

2 INCH MAIN

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 18-JAN-2013 08:57  
 Filename: C:\Users\E143235\AppData\Local\Temp\Weatherford...Western Operating Fox #1-8\_002.dta Recorded on 16-JAN-2013 14:37  
 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506



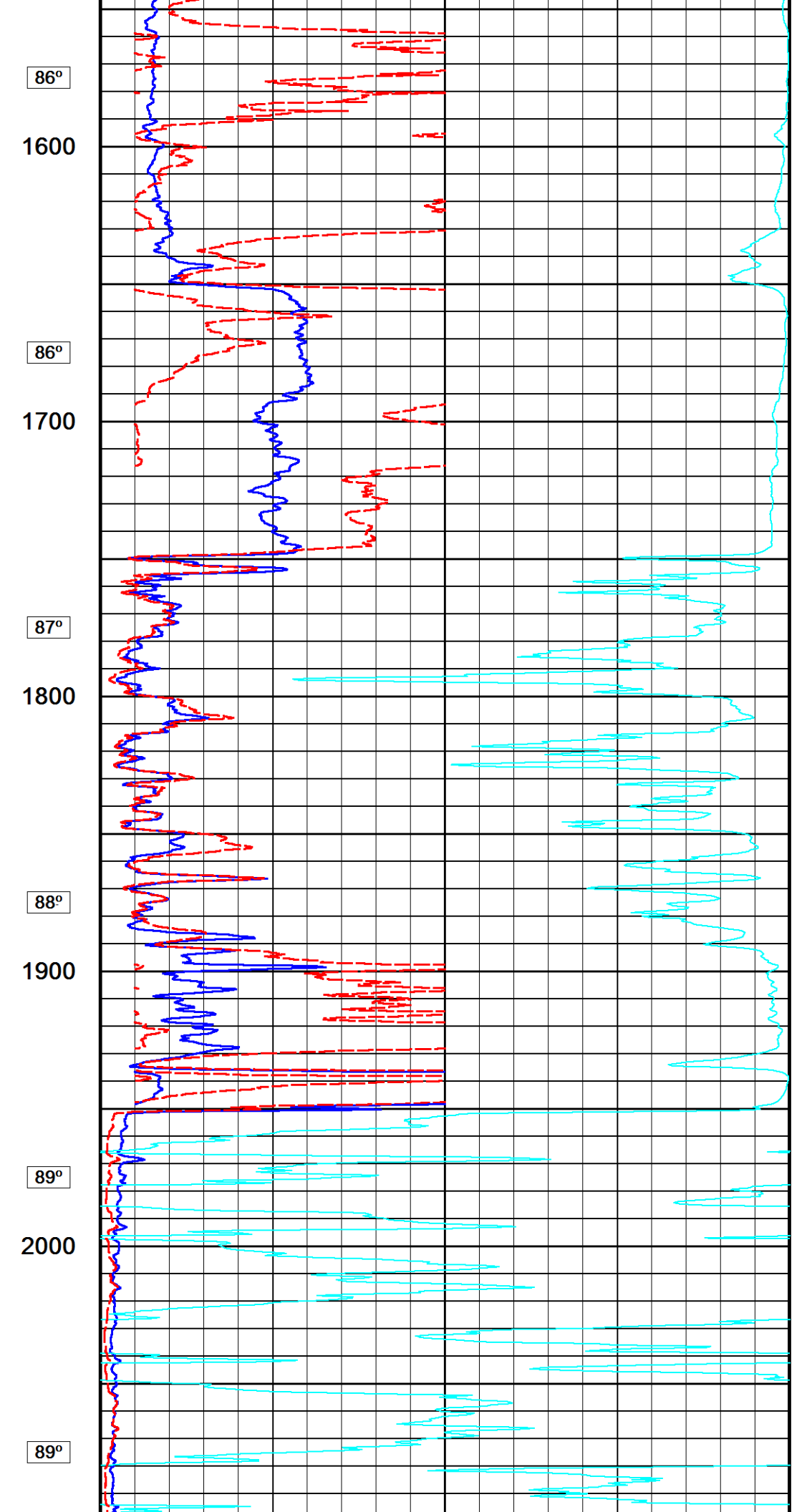
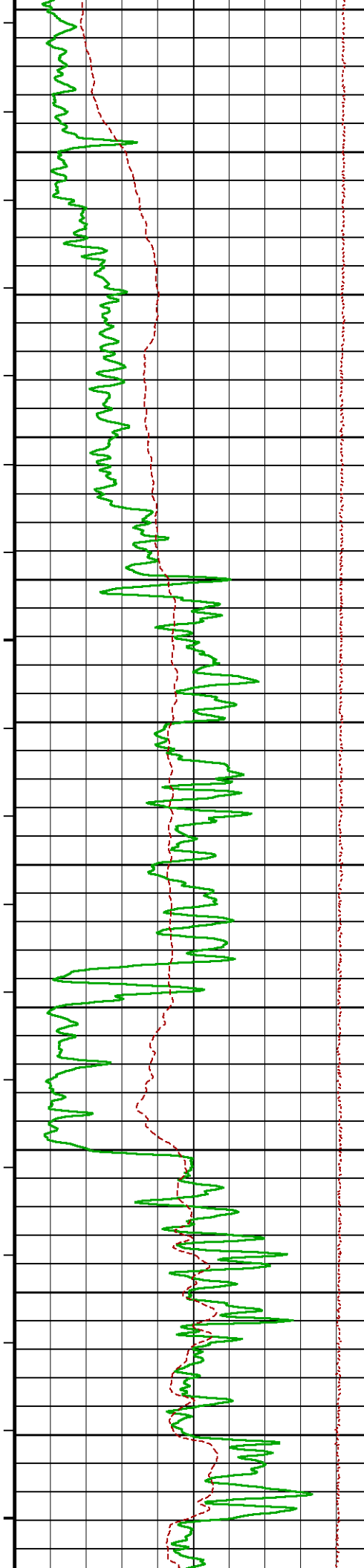


← Spontaneous Potential  
← Gamma Ray  
DST Uphole Tension →

Array Ind. One Res IV  
Shallow FE →

Array Ind. One Cond Ct →

1000  
84°  
1100  
85°  
1200  
85°  
1300  
86°  
1400  
86°  
1500



86°

1600

86°

1700

87°

1800

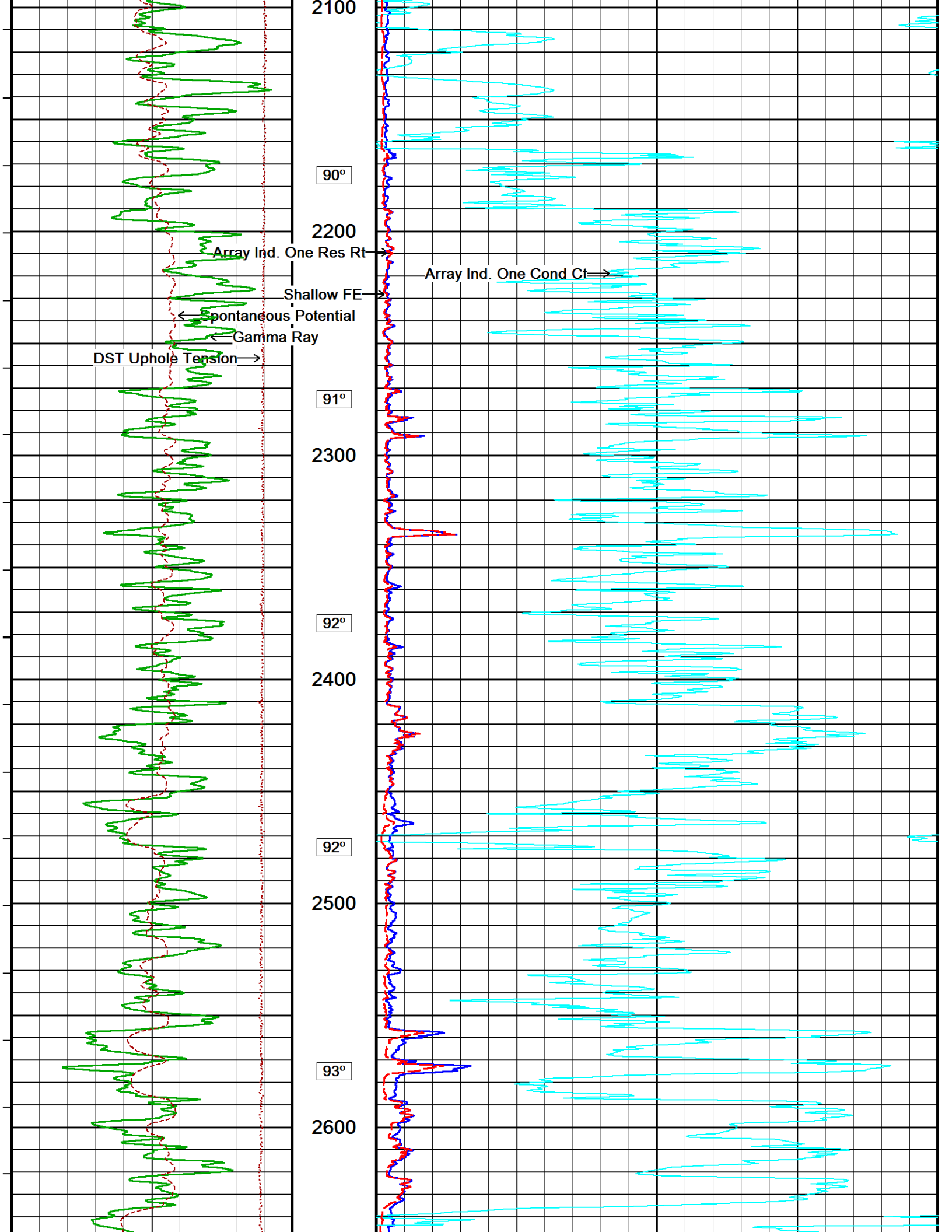
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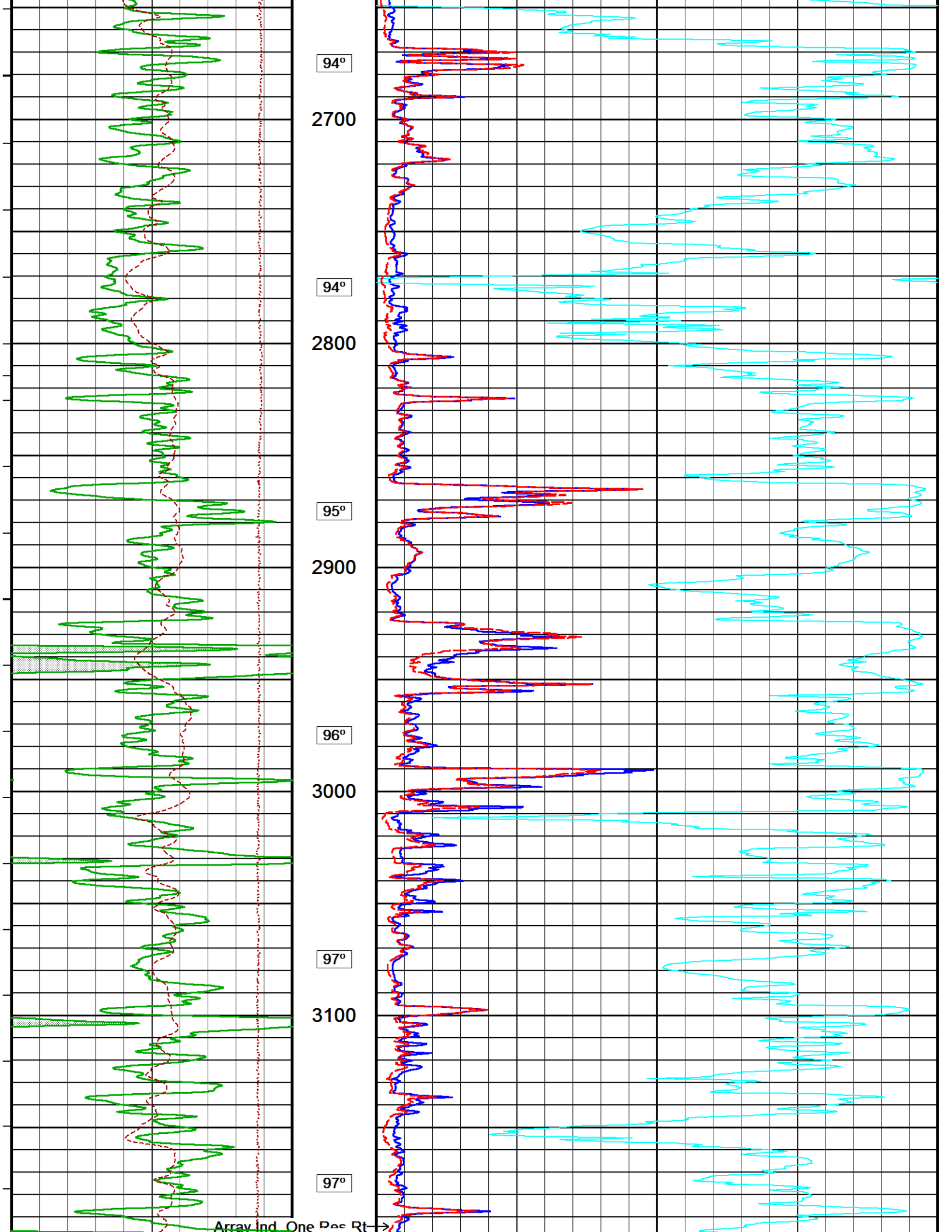
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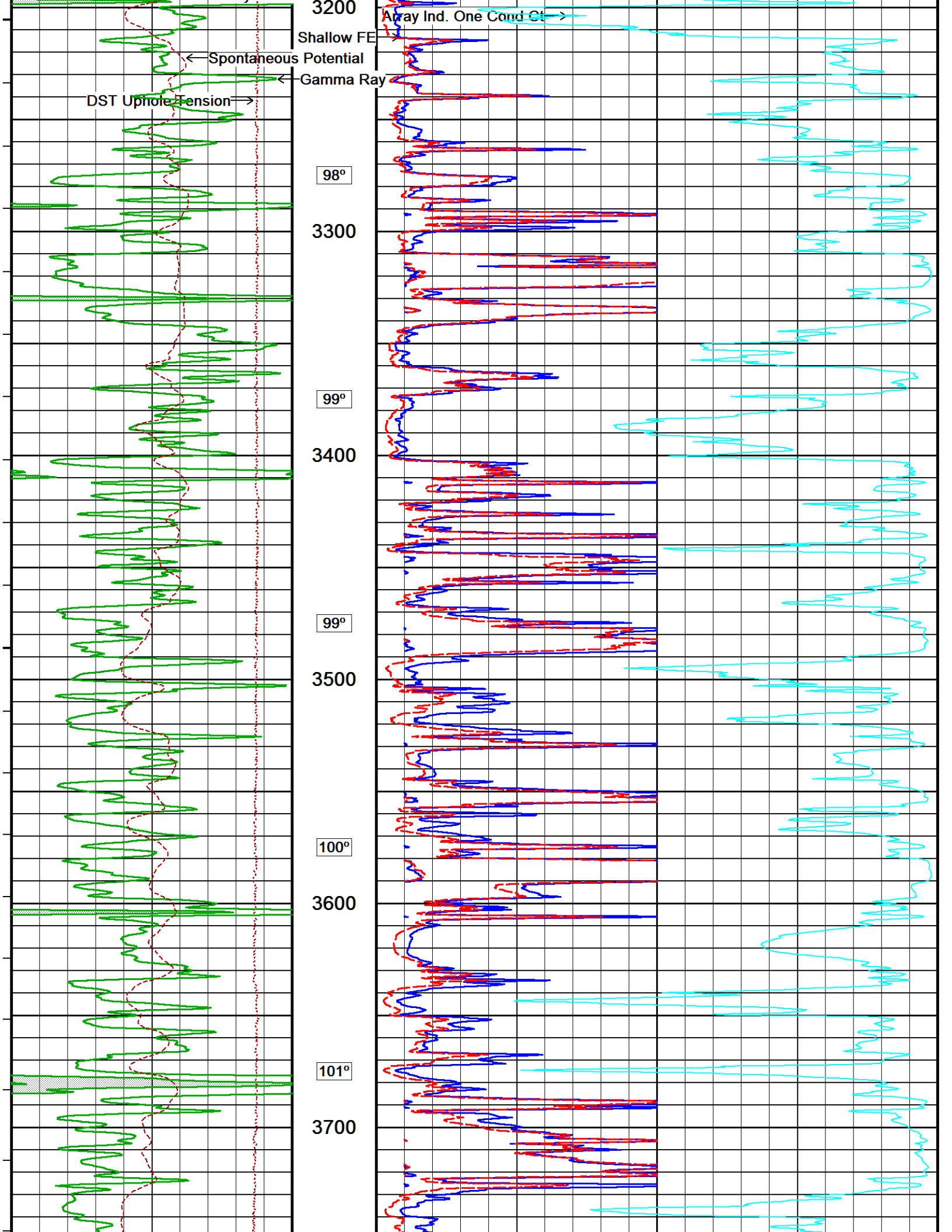
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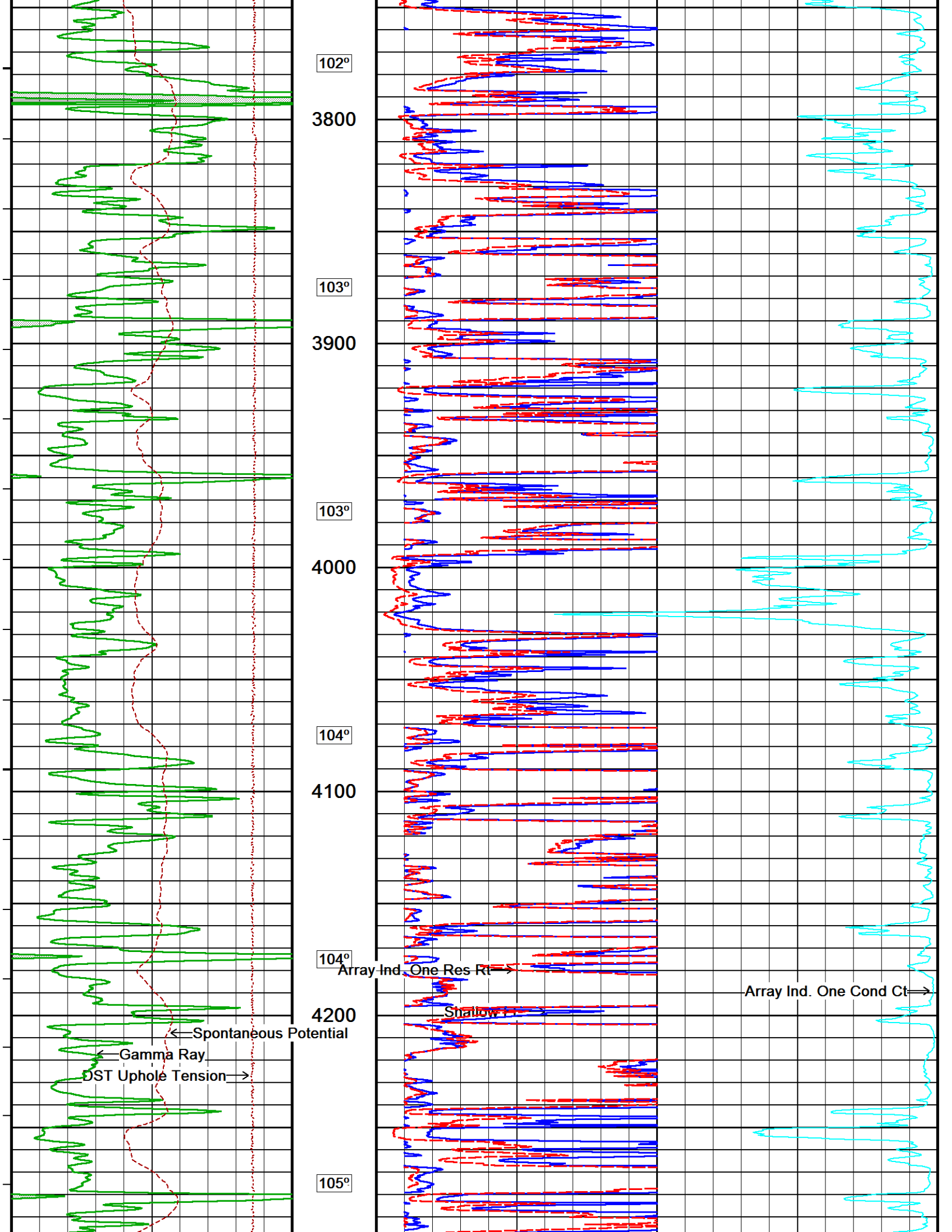
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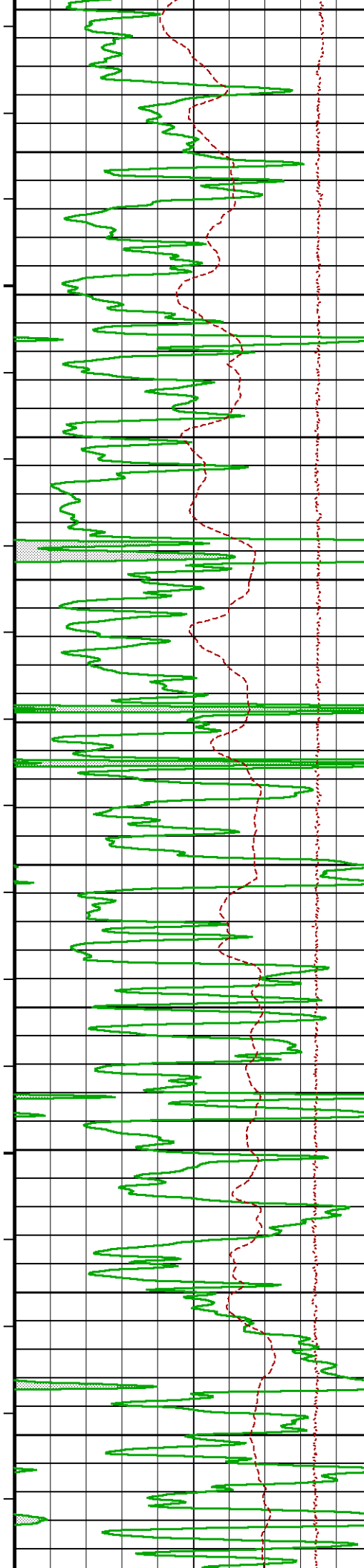
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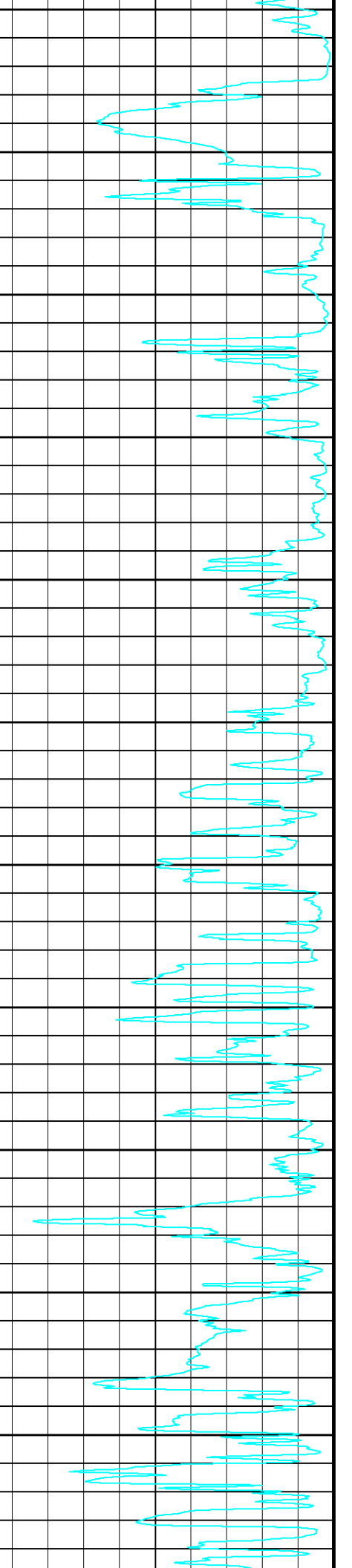
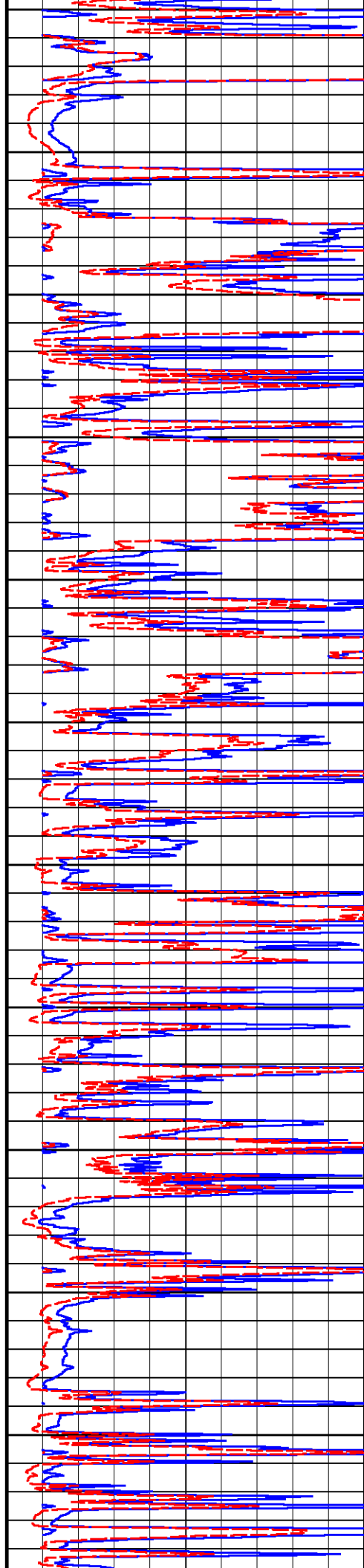


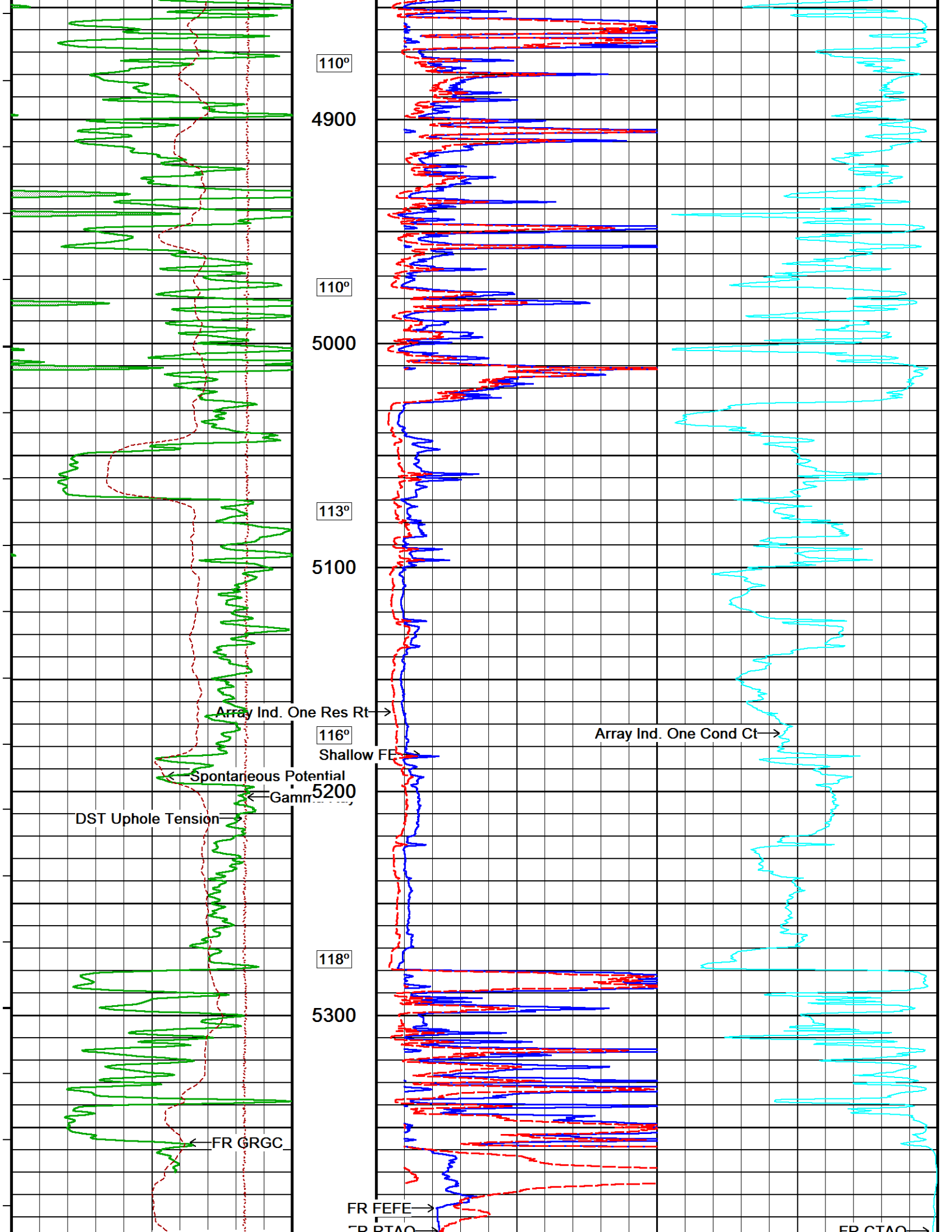






4300  
106°  
4400  
107°  
4500  
108°  
4600  
108°  
4700  
109°  
4800



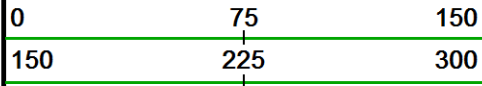


Depth  
In  
Feet

Timing Marks  
every 60.0 sec

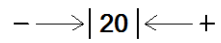
Gamma Ray

API



Spontaneous Potential

millivolts



DST Uphole Tension

pounds

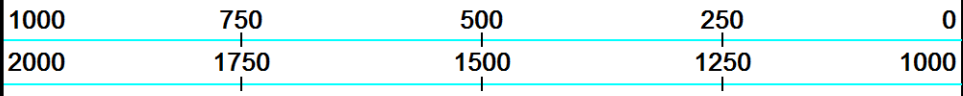


Borehole  
Temp in  
deg F

Replay  
Scale  
1:600

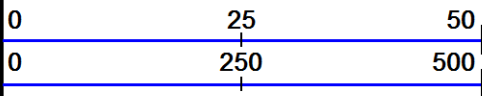
Array Ind. One Cond Ct

mmhos



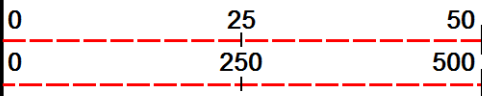
Shallow FE

ohm metres



Array Ind. One Res Rt

ohm metres



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2 INCH MAIN



5 INCH MAIN



Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 18-JAN-2013 08:57

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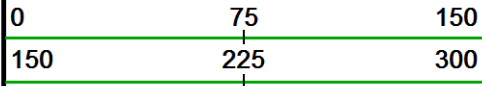
Recorded on 16-JAN-2013 14:37

System Versions: Logged with 13.04.8492 Plotted with 13.05.8506

Timing Marks  
every 60.0 sec

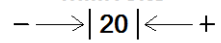
Gamma Ray

API



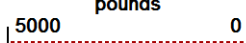
Spontaneous Potential

millivolts



DST Uphole Tension

pounds



Depth  
in  
Feet

Borehole  
Temp in  
deg F

Replay  
Scale

Shallow FE

ohm metres



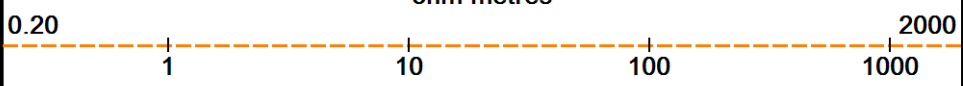
Array Ind. One Res 40

ohm metres



Array Ind. One Res 60

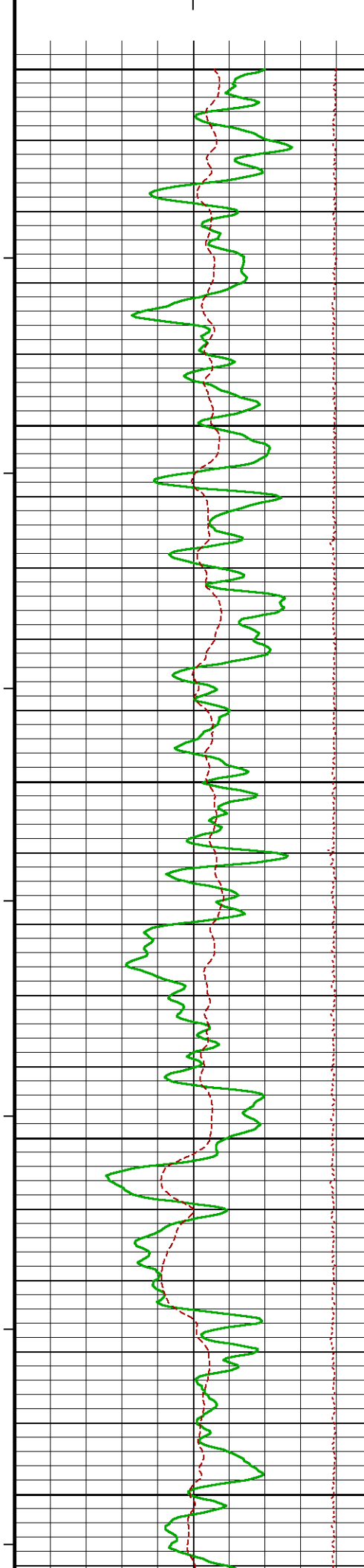
ohm metres



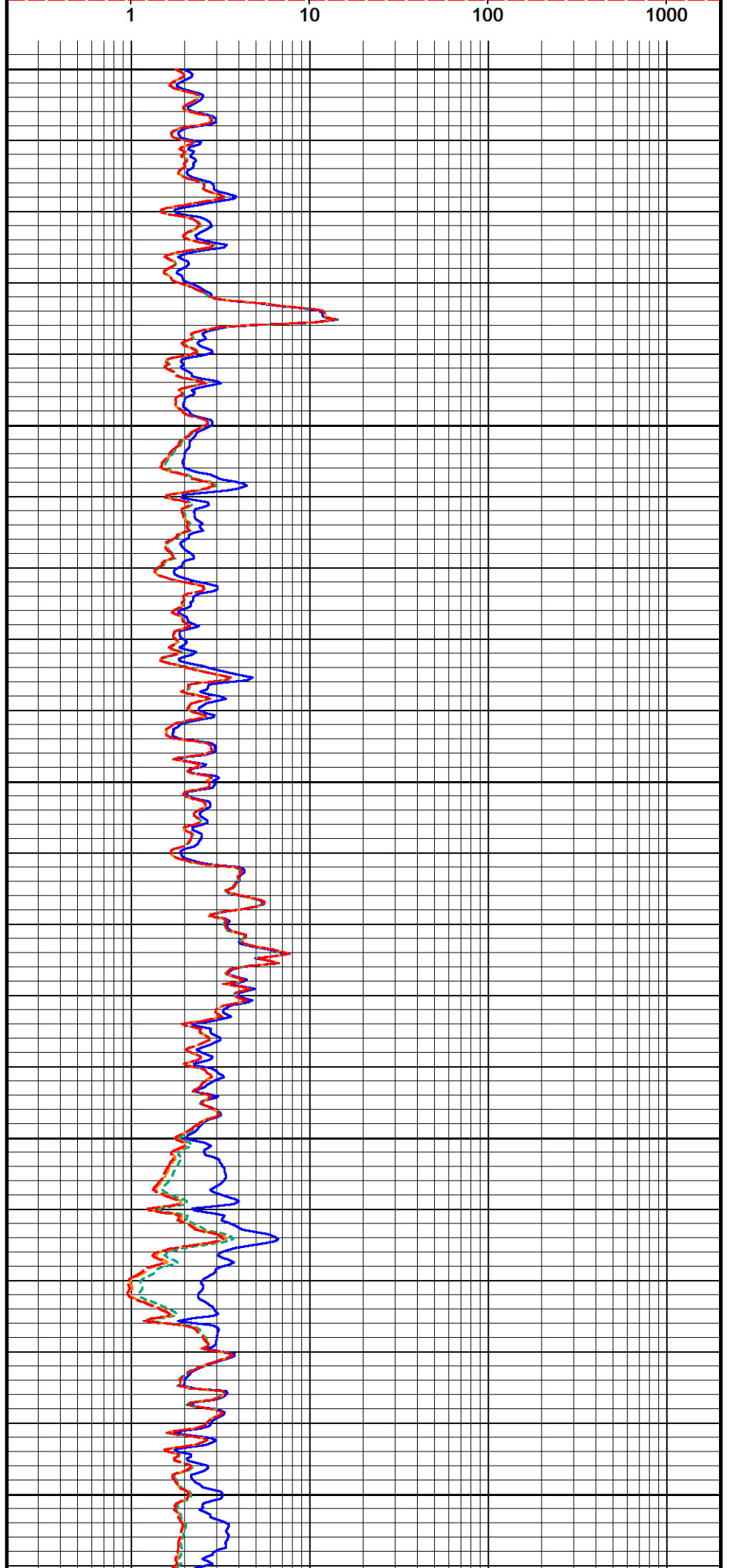
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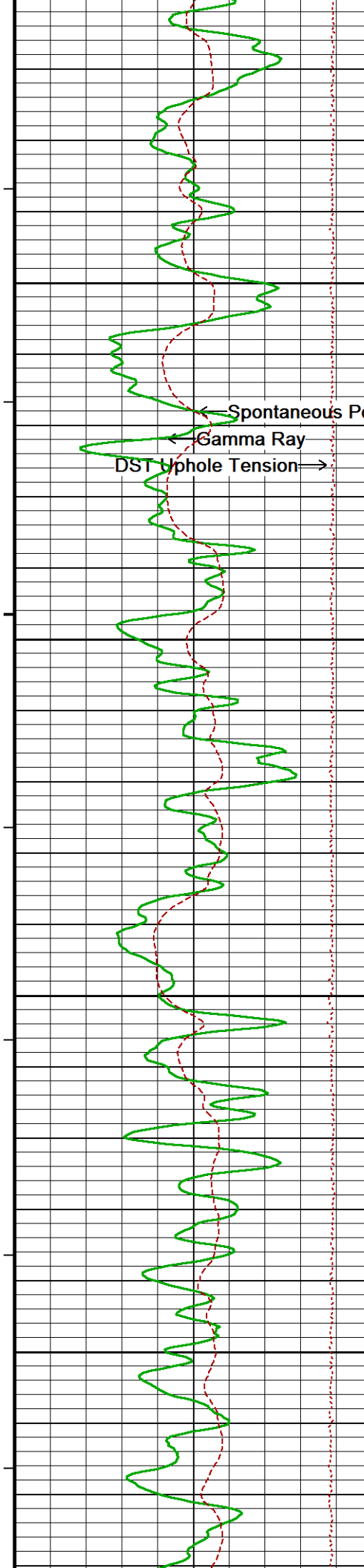
ohm metres





1:240  
2300  
91°  
2350  
92°  
2400  
92°  
2450  
92°  
2500





93°

2550

Array Ind. One Res Rt

Array Ind. One Res 60

Array Ind. One Res 40

Shallow SE

← Spontaneous Potential

← Gamma Ray

DST Uphole Tension →

93°

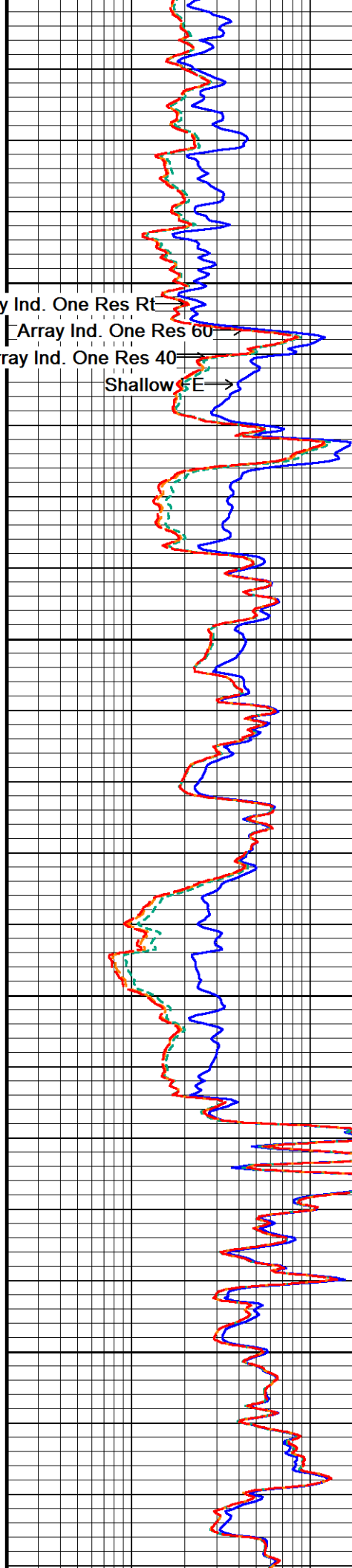
2600

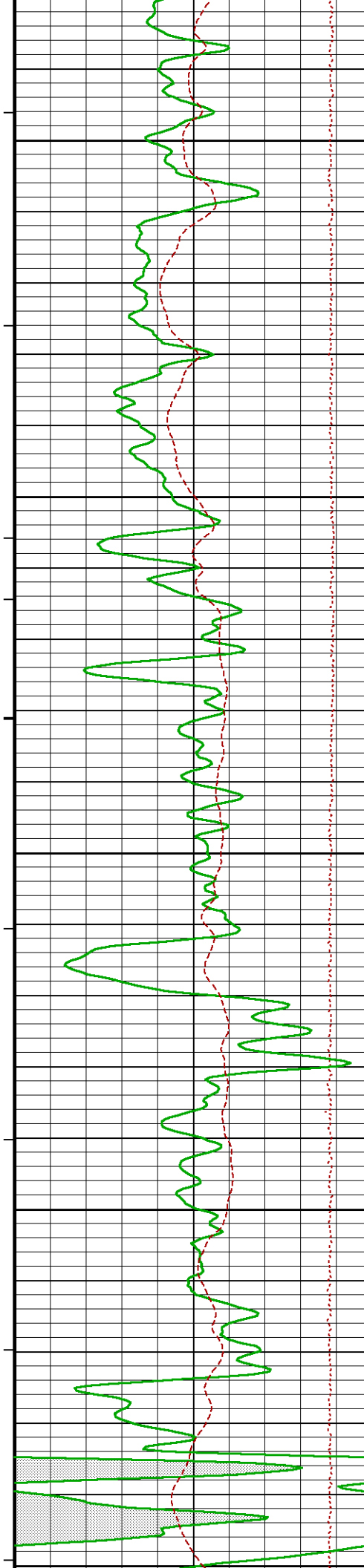
93°

2650

94°

2700





94°

2750

95°

2800

95°

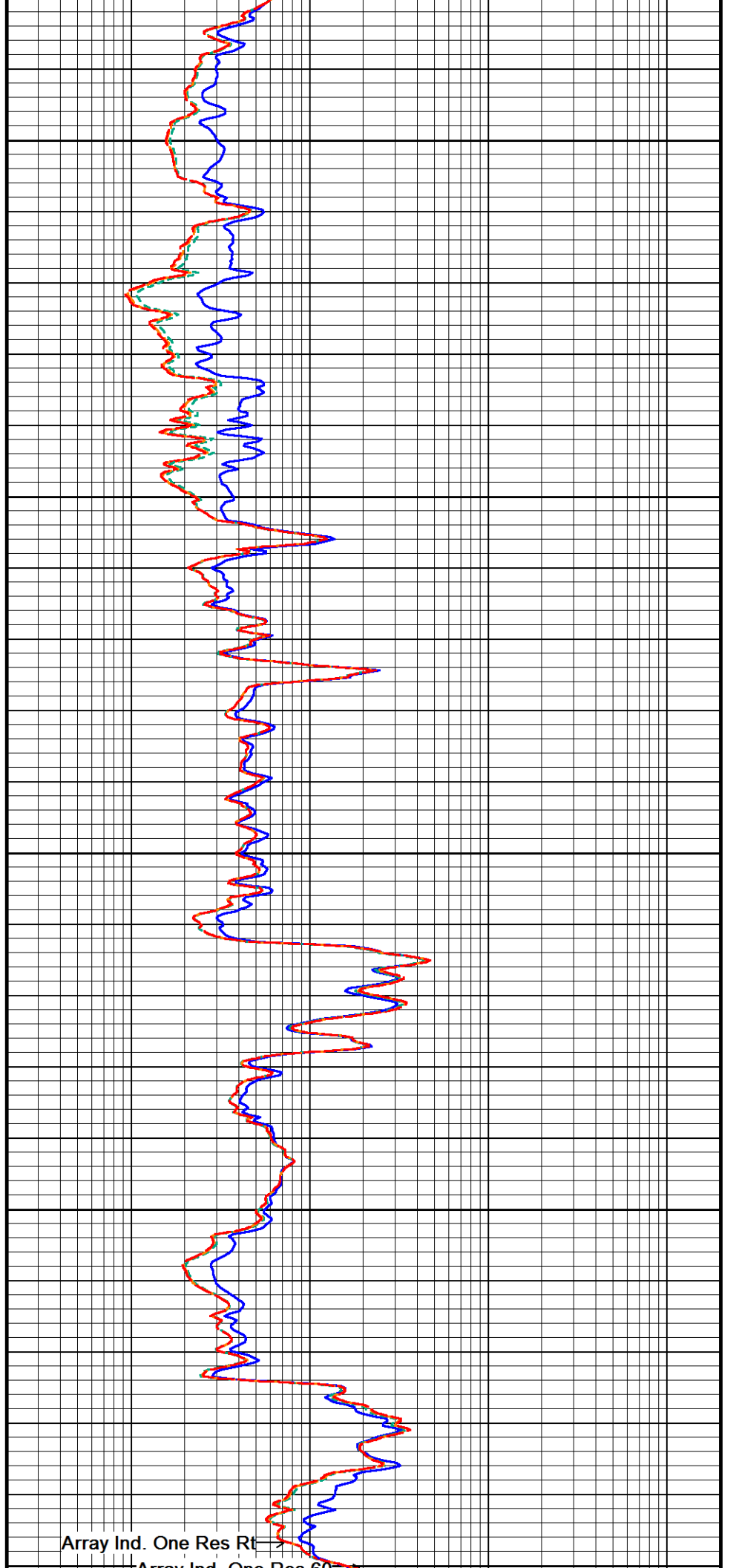
2850

95°

2900

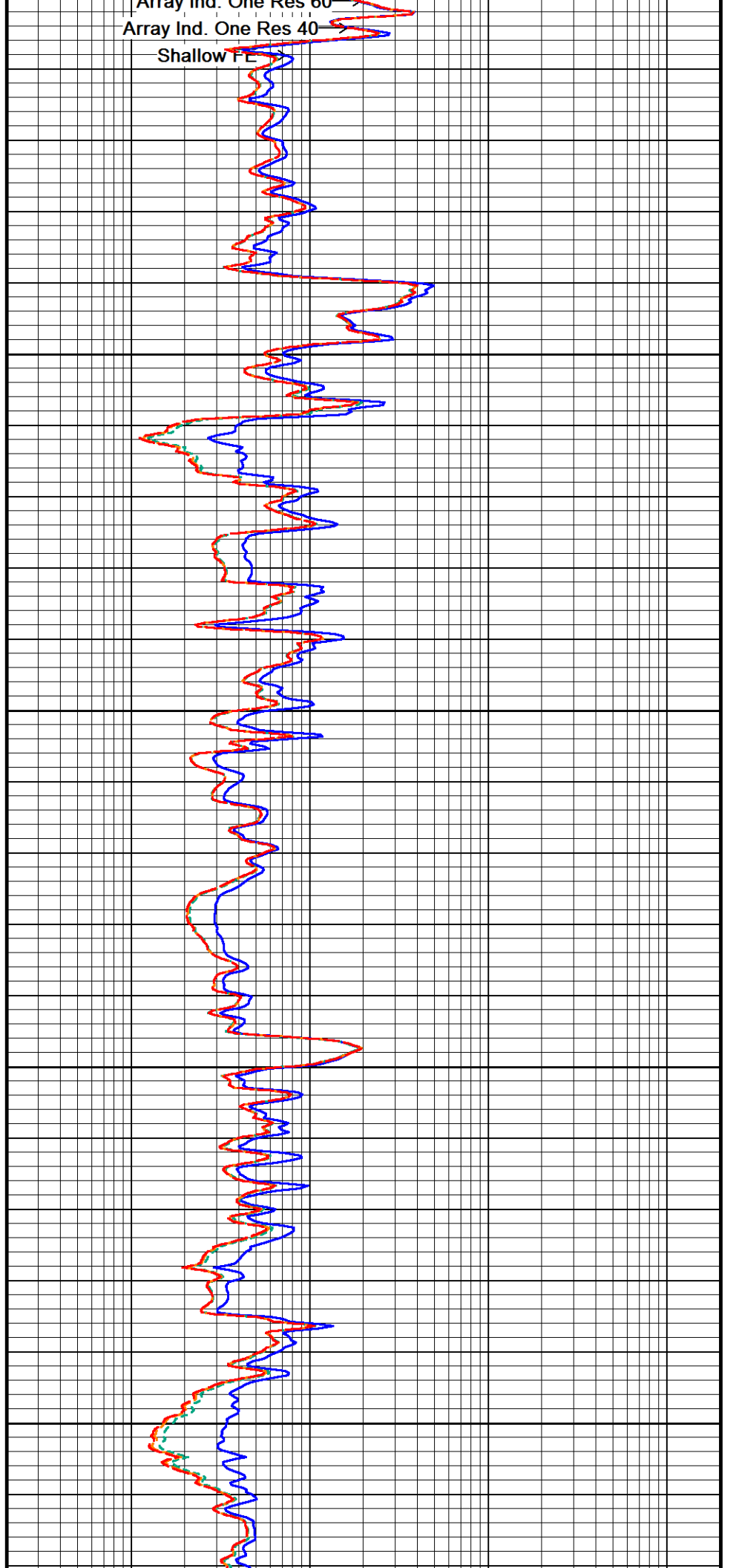
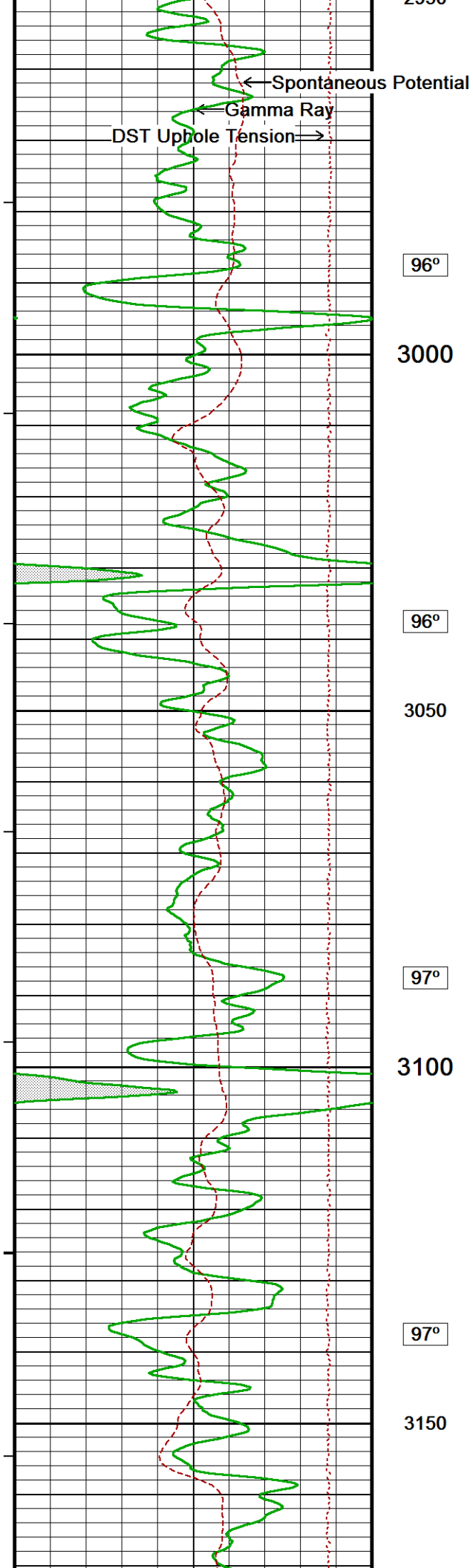
96°

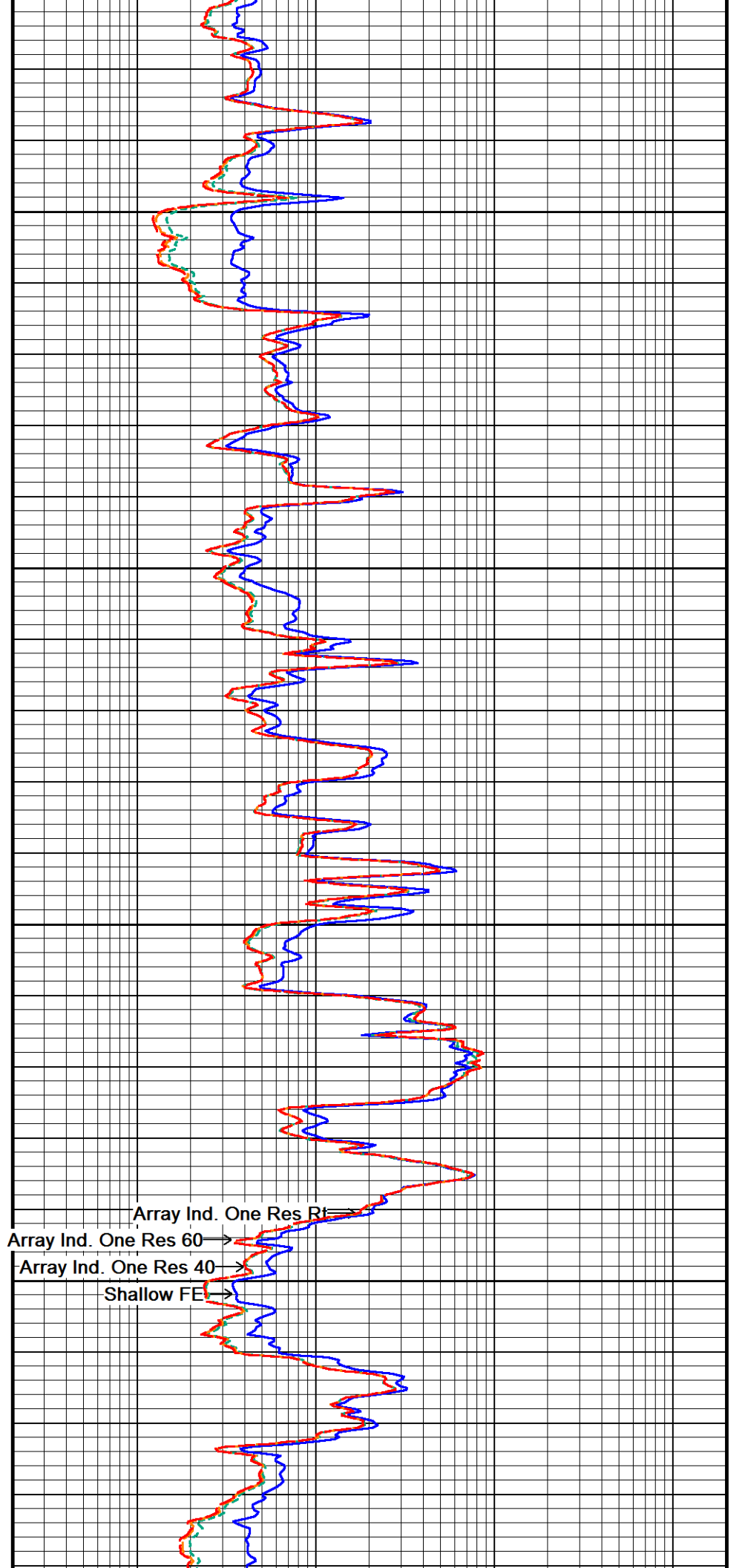
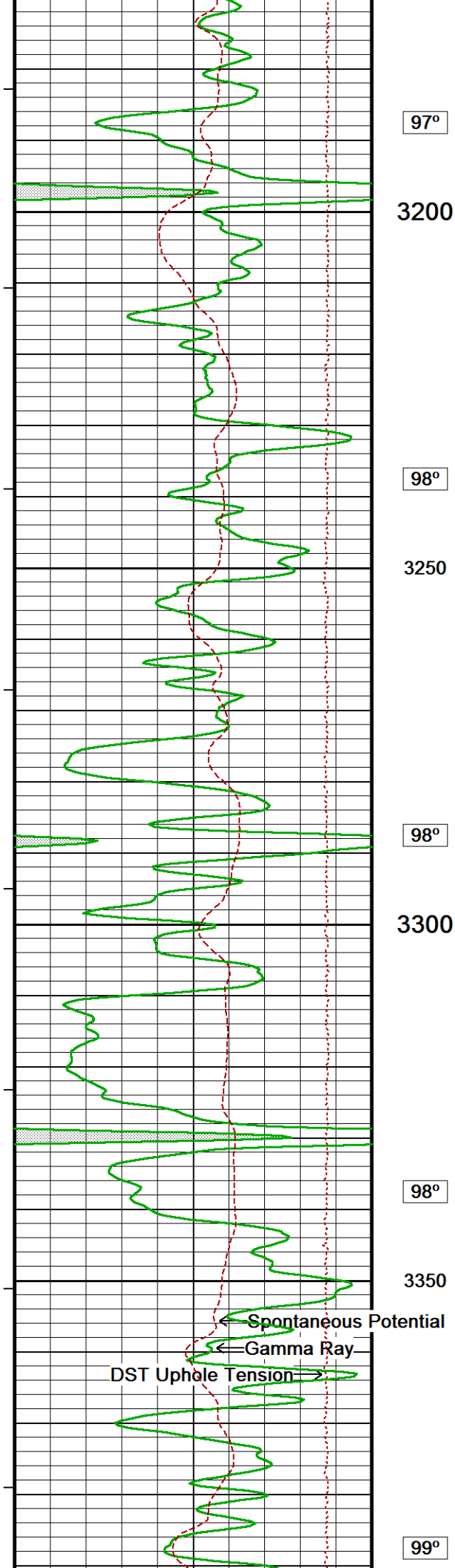
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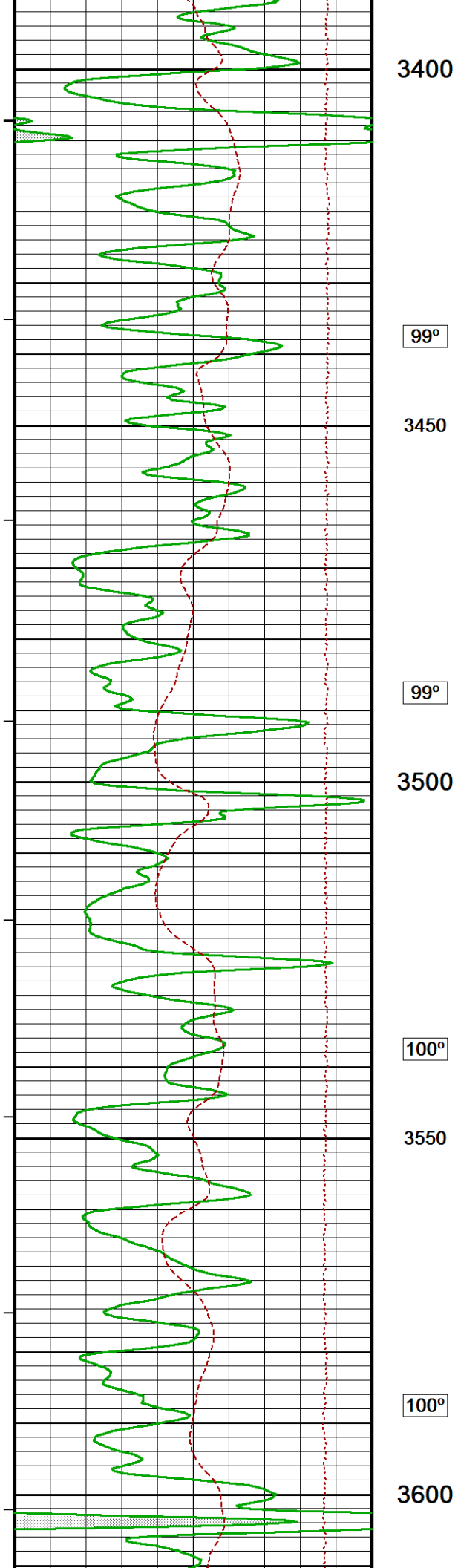


Array Ind. One Res Rt

Array Ind. One Res 60







3400

99°

3450

99°

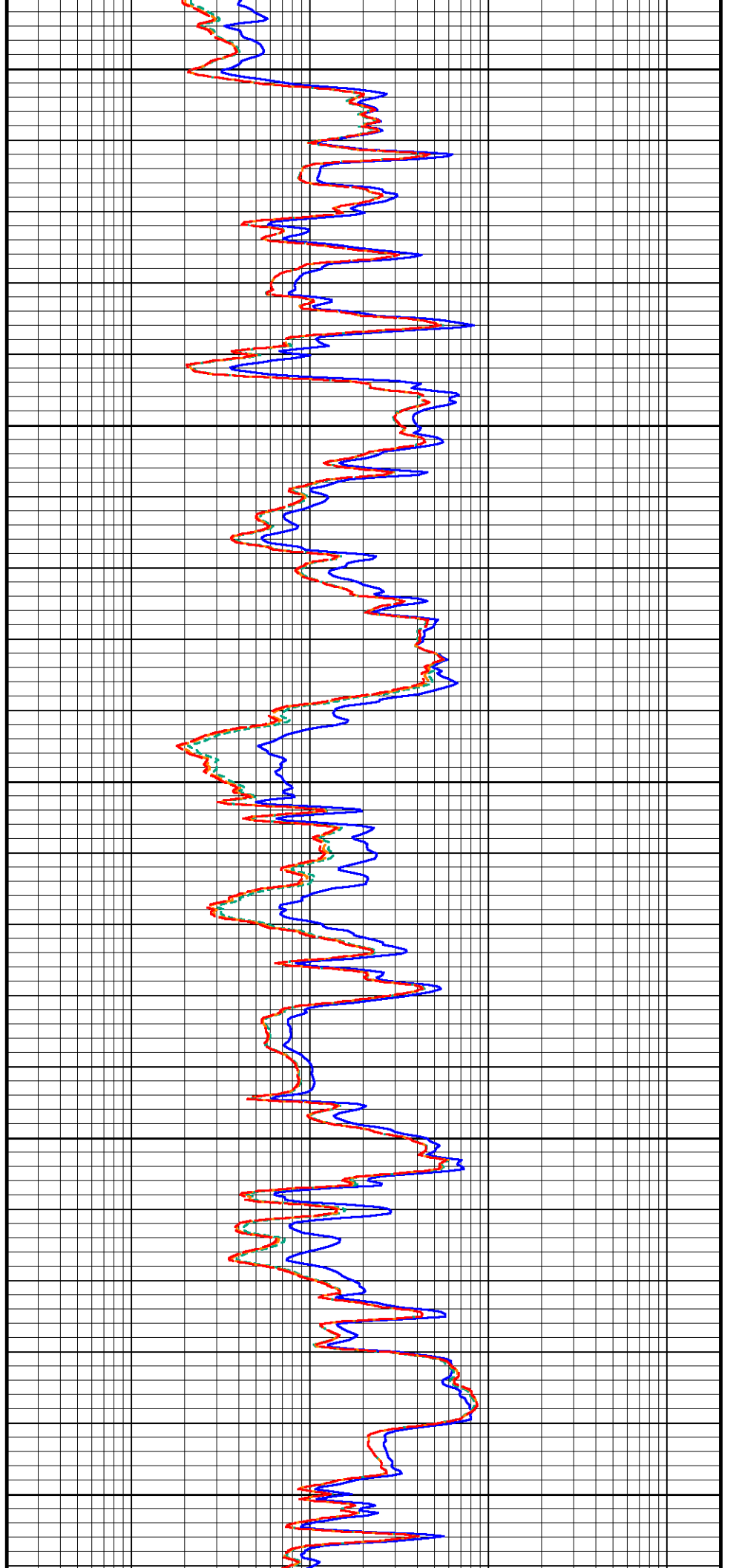
3500

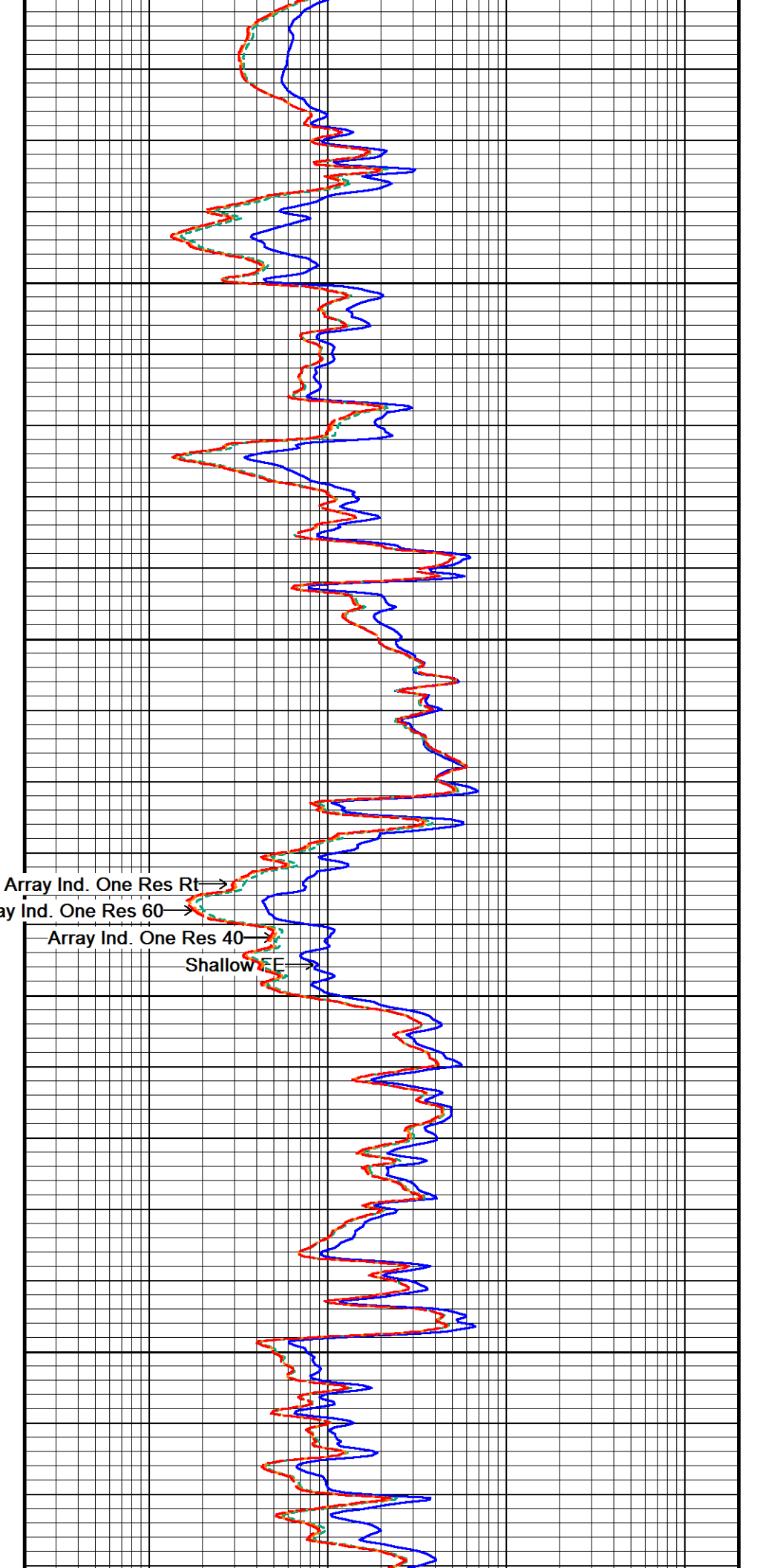
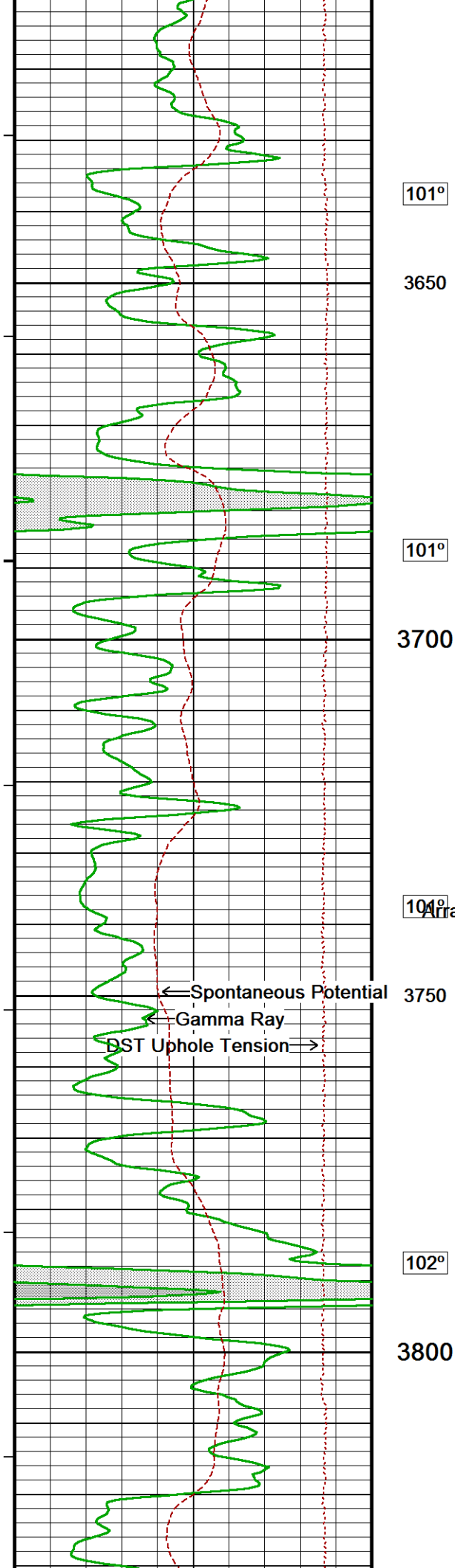
100°

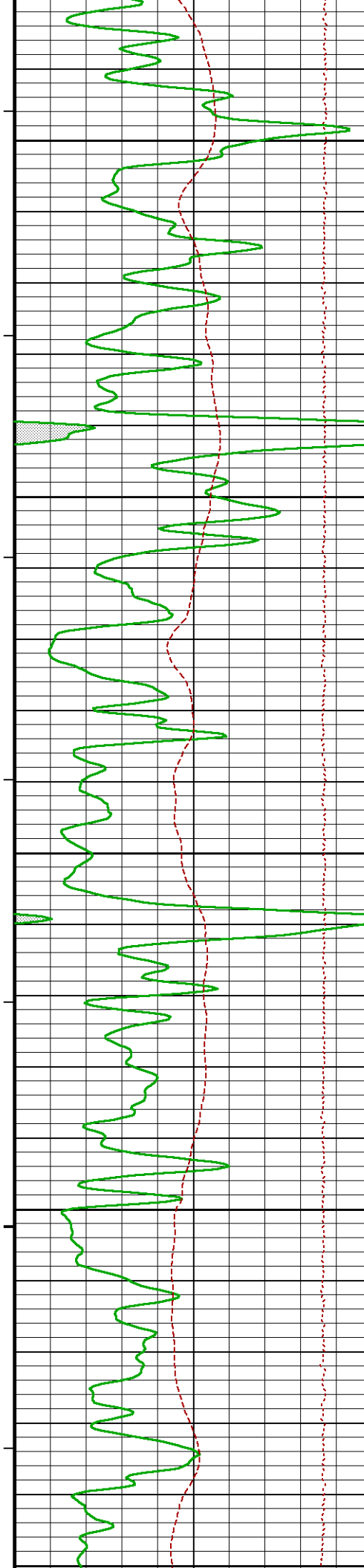
3550

100°

3600







102°

3850

103°

3900

103°

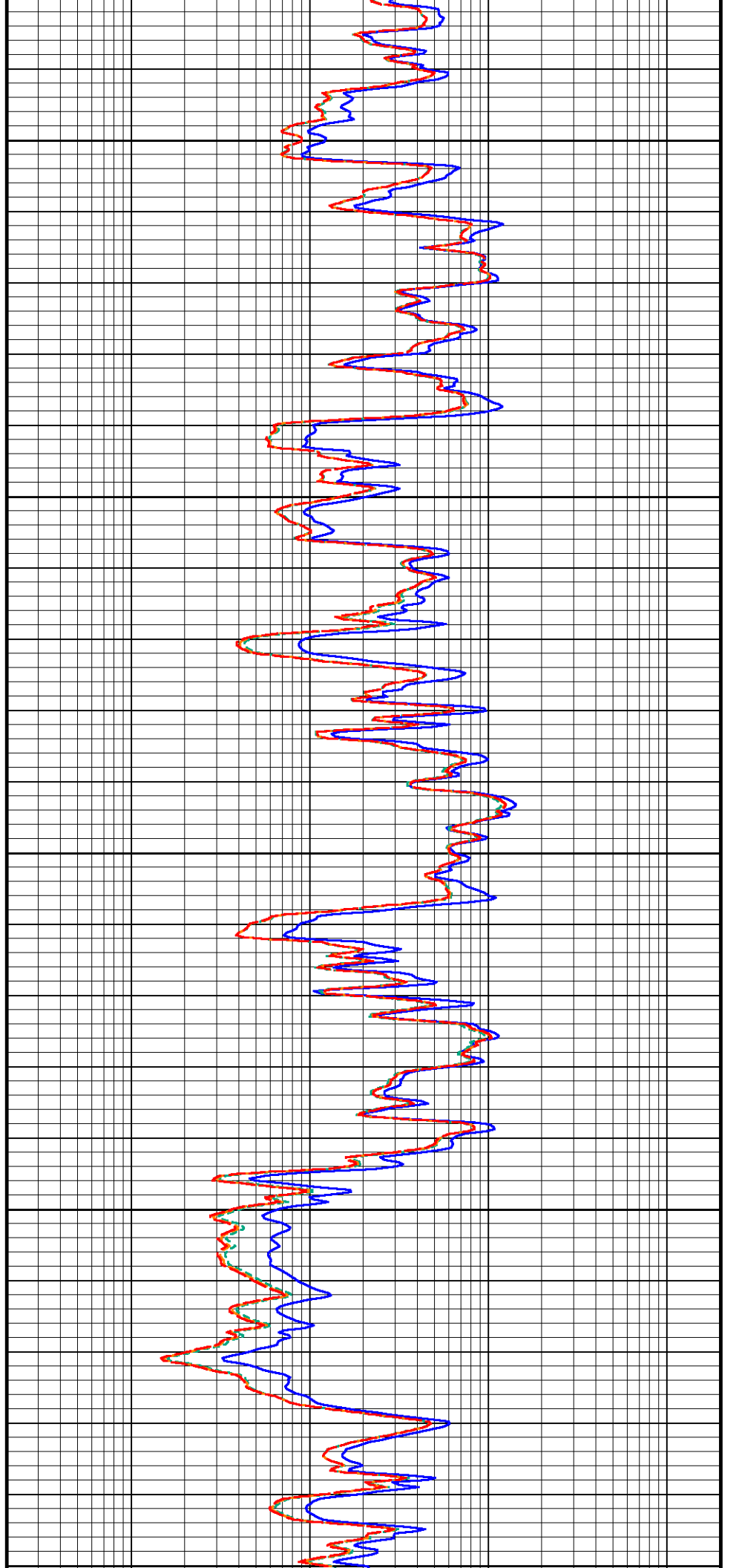
3950

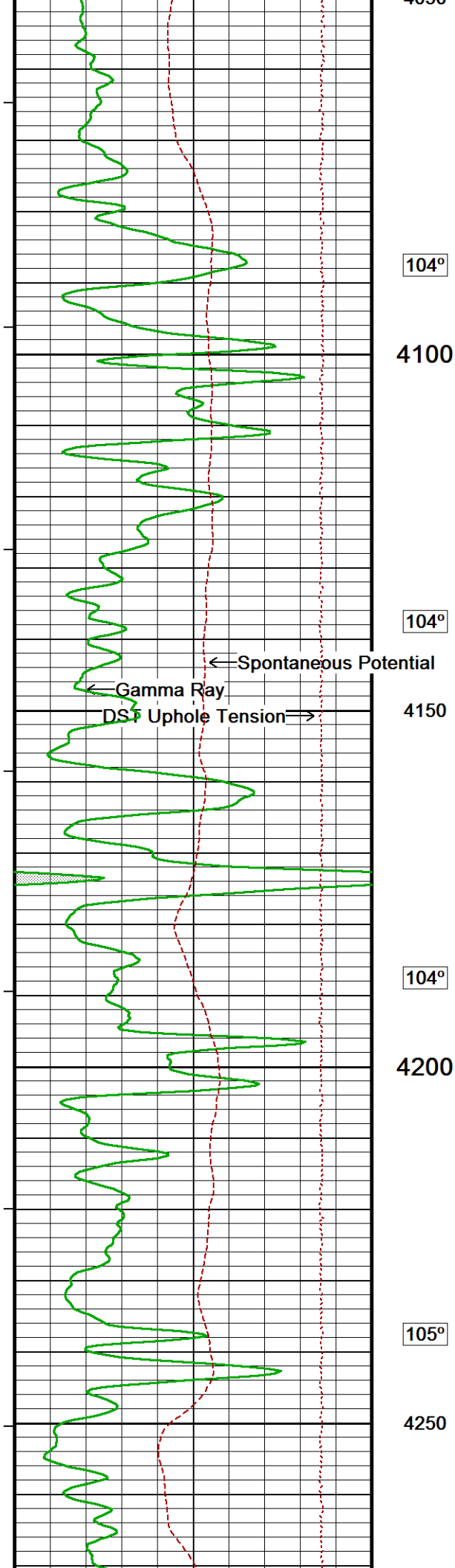
103°

4000

104°

4050





104°

4100

104°

4150

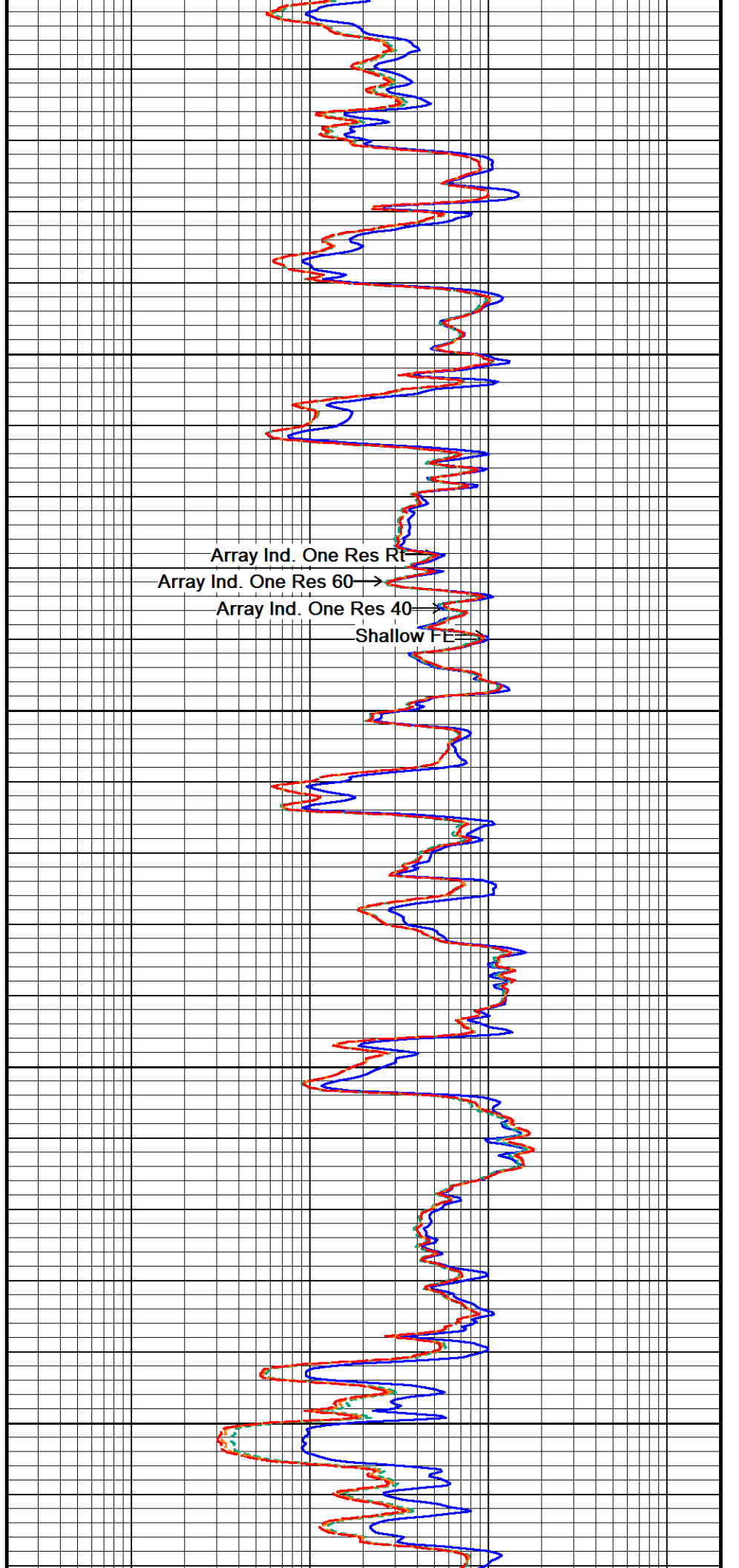
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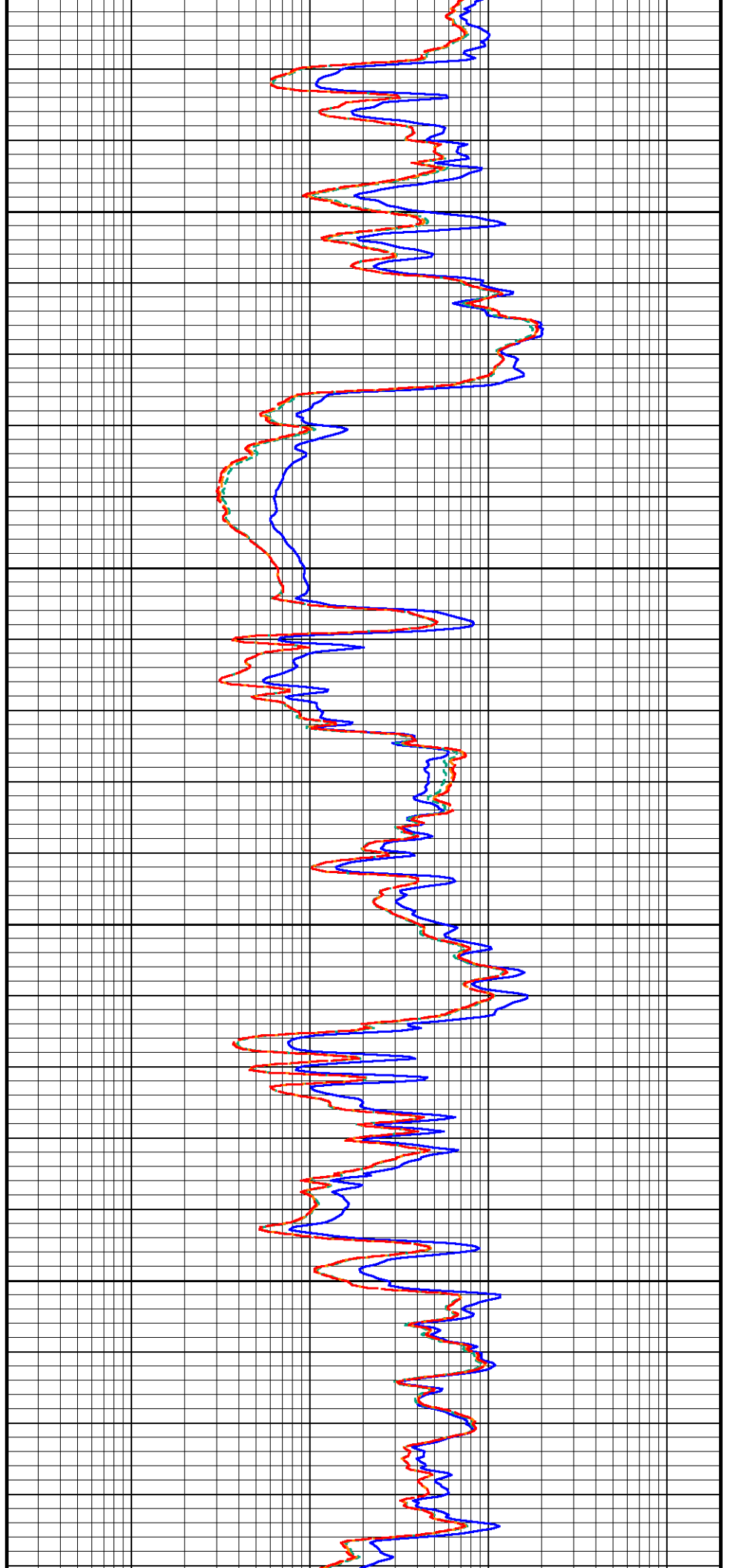
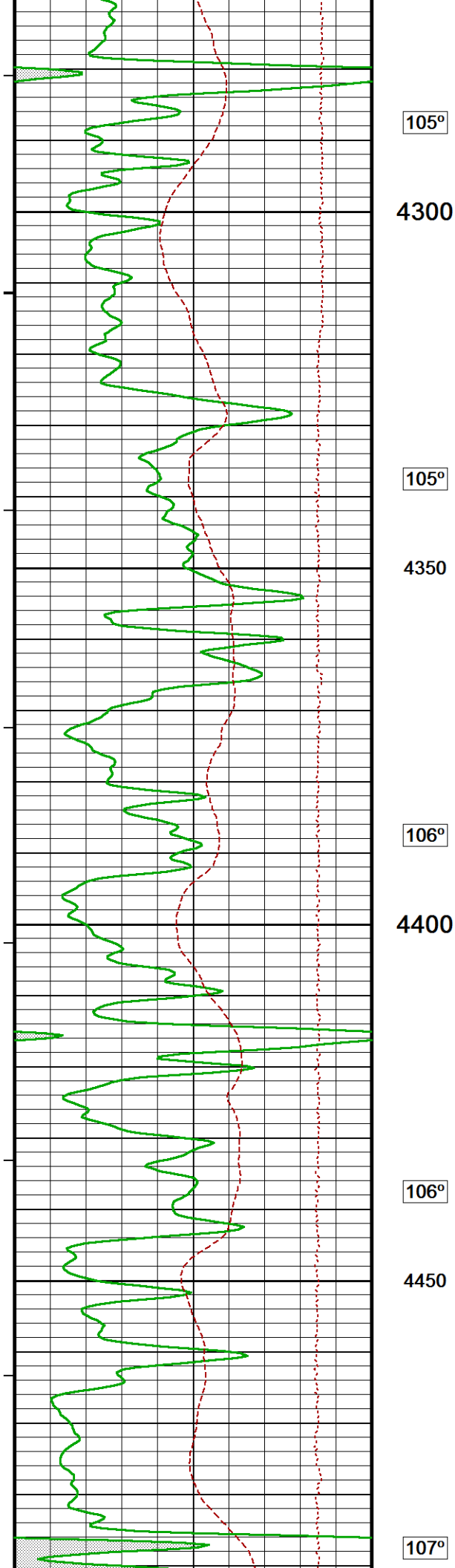
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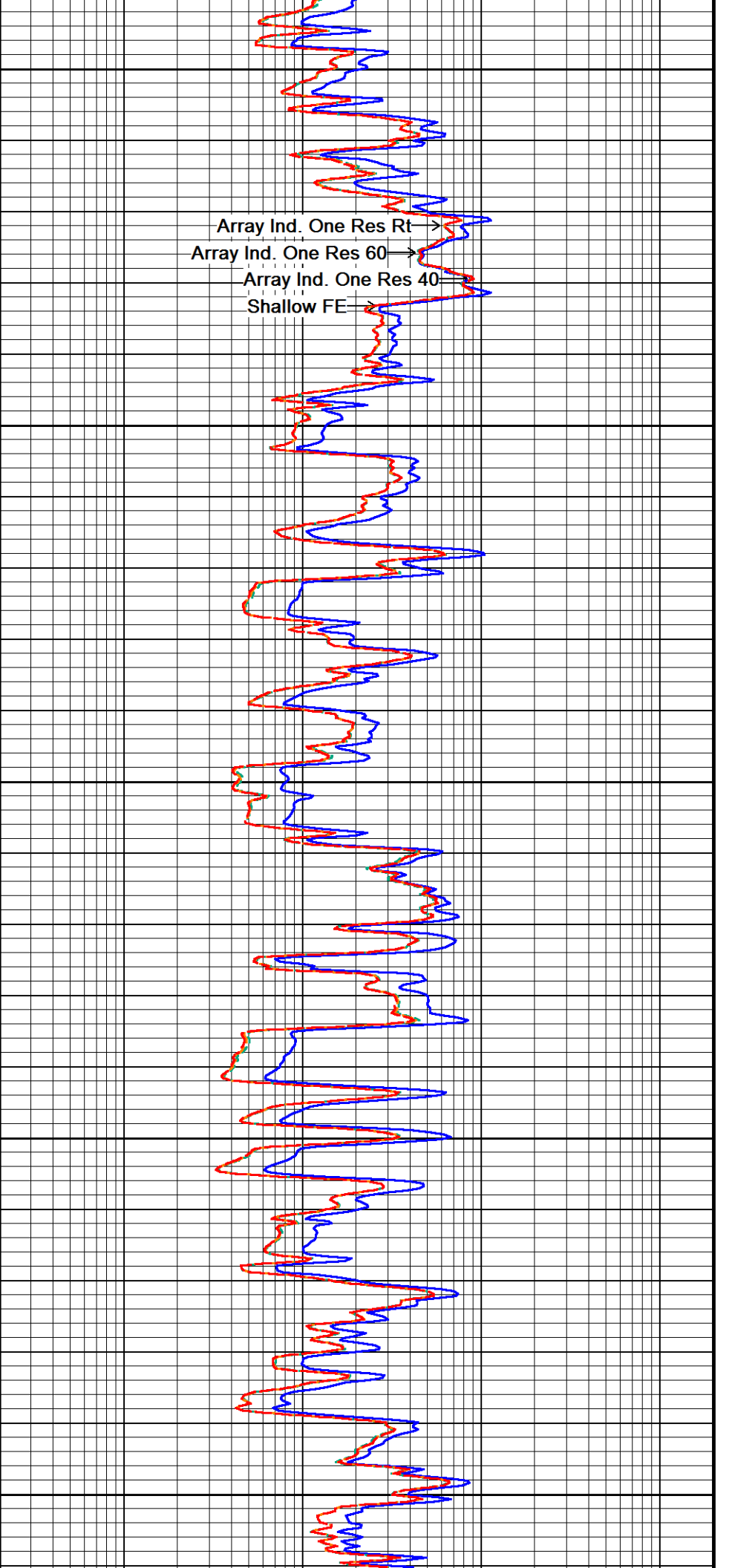
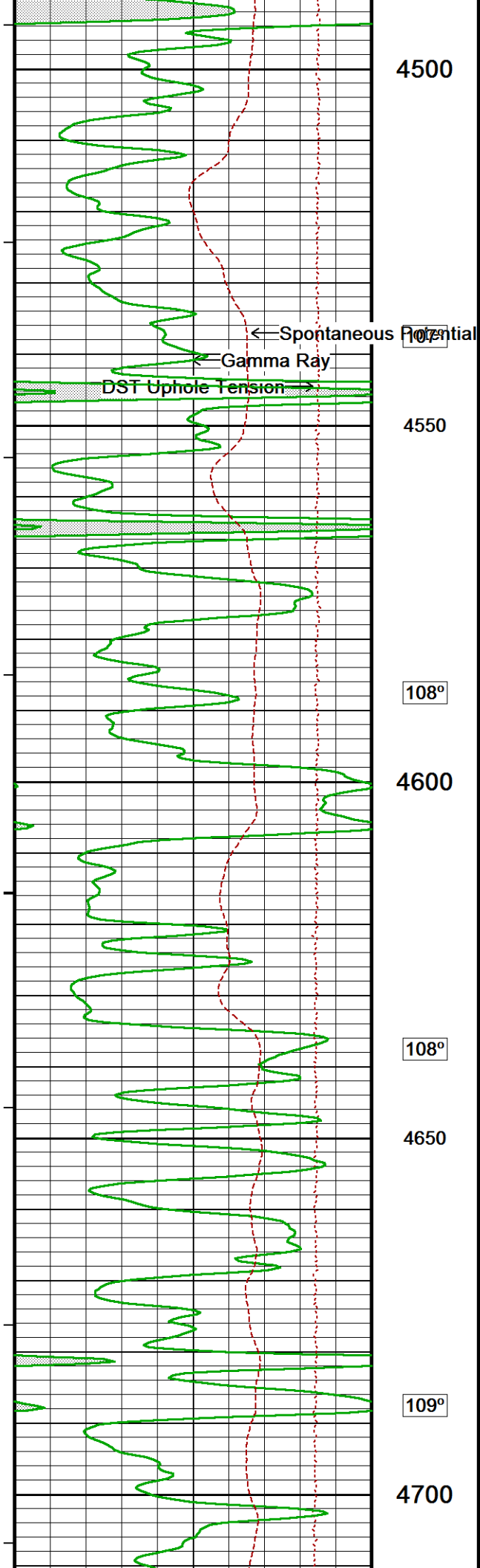
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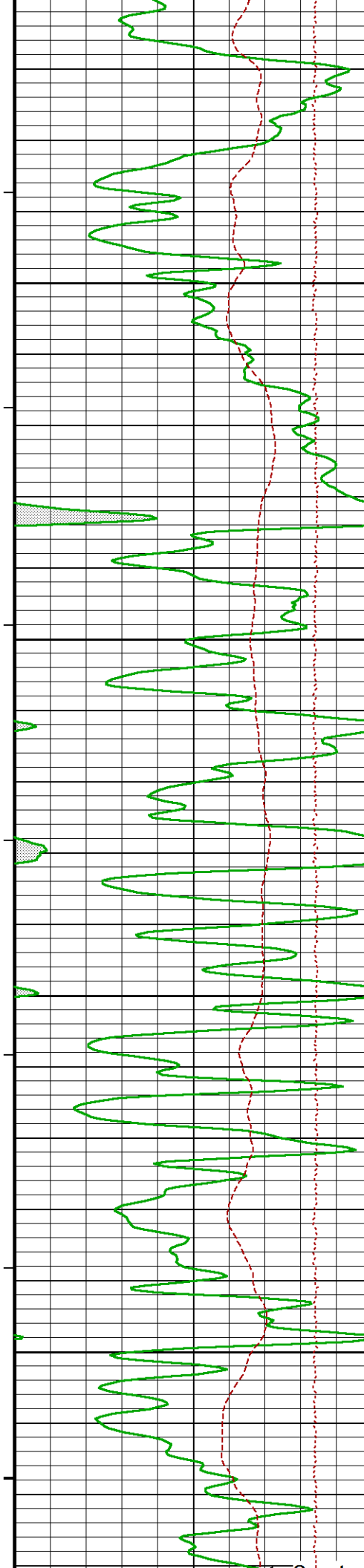
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Array Ind. One Res RT  
Array Ind. One Res 60  
Array Ind. One Res 40  
Shallow FE









108°

4750

109°

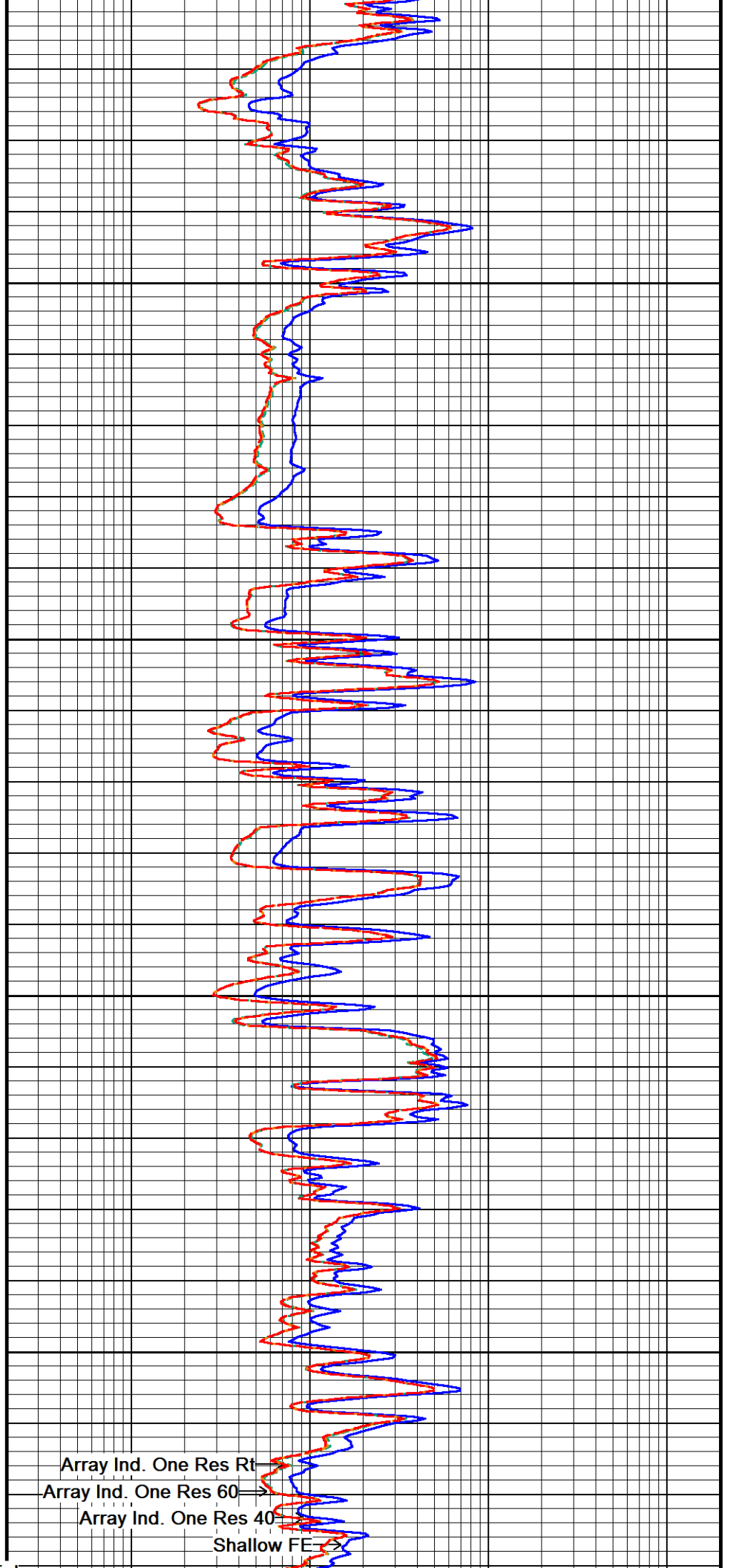
4800

109°

4850

110°

4900

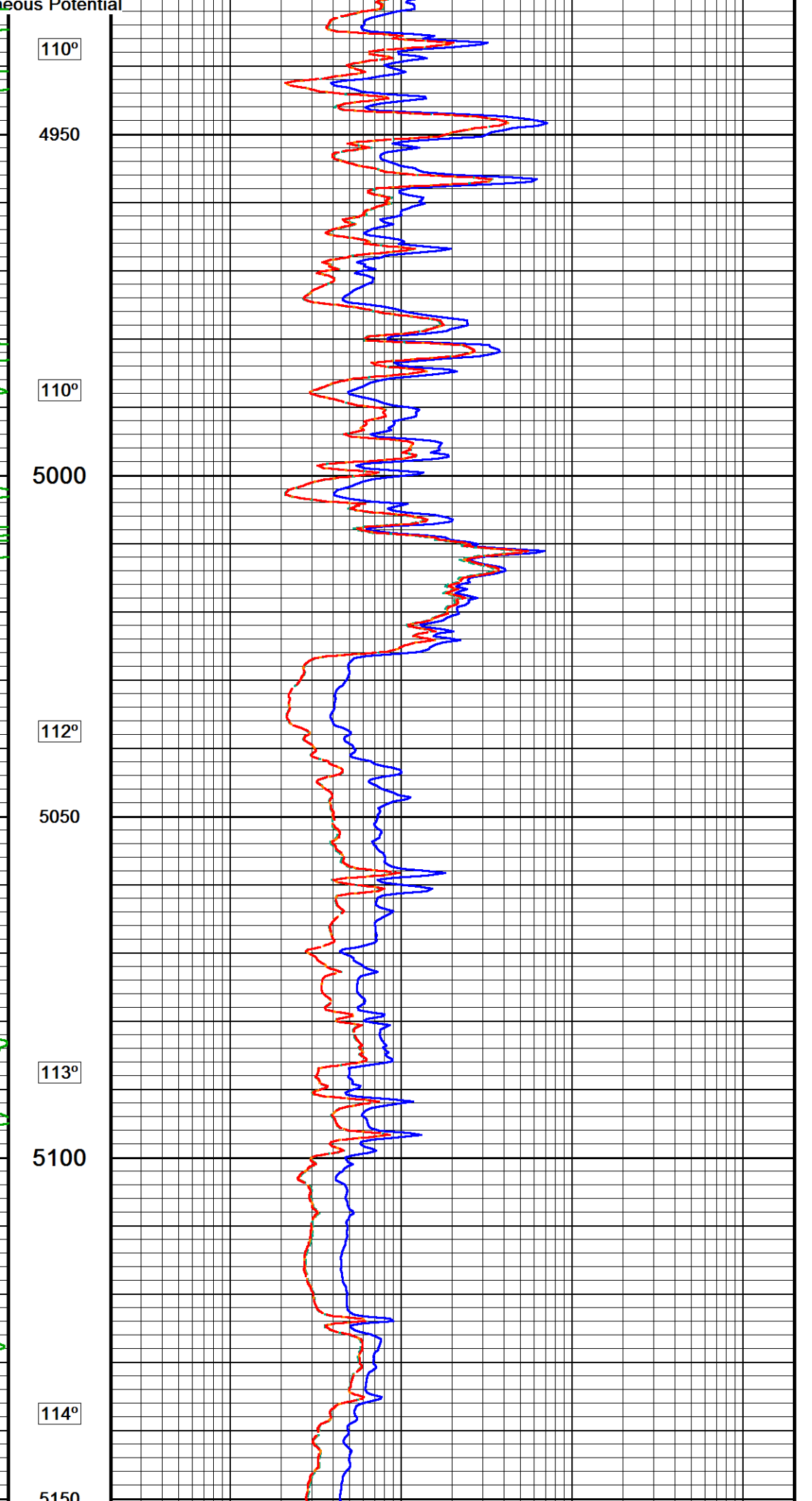
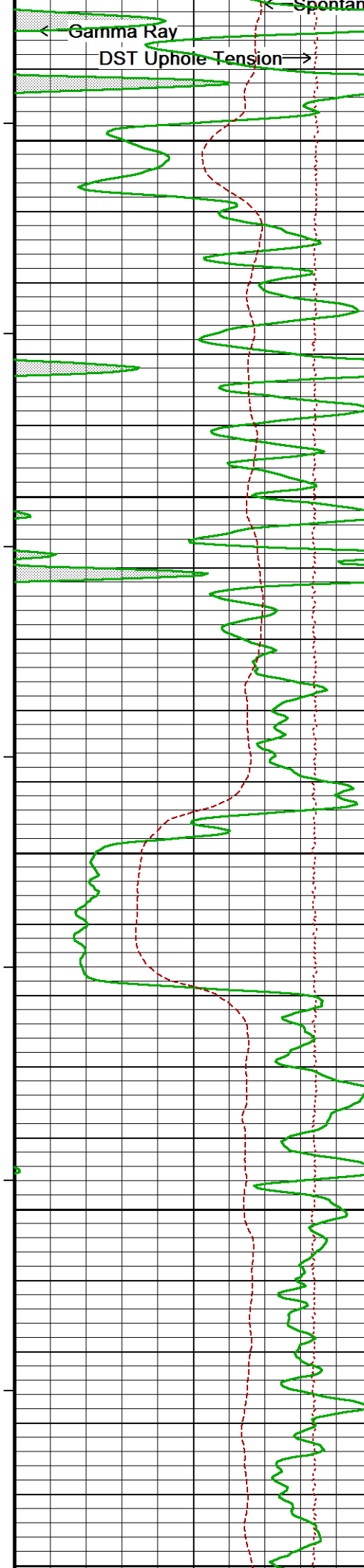


Array Ind. One Res Rt

Array Ind. One Res 60

Array Ind. One Res 40

Shallow FE



110°

110°

112°

113°

114°

Gamma Ray

DST Uphole Tension

Spontaneous Potential

110°

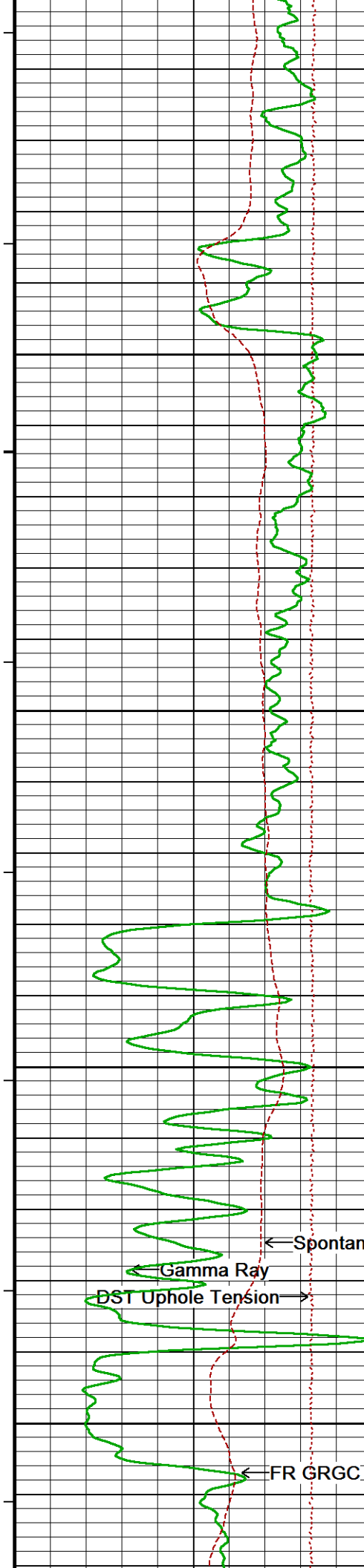
4950

5000

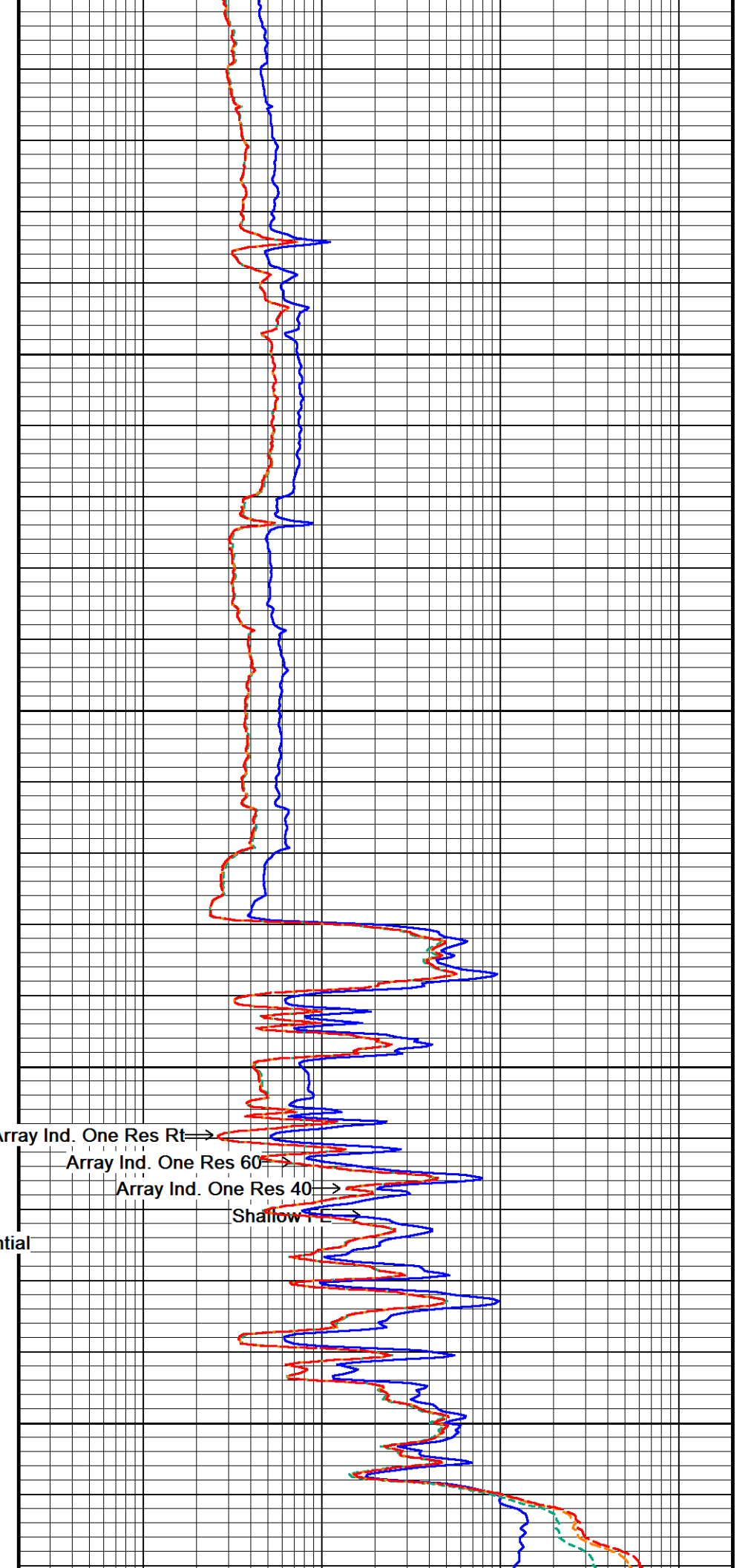
5050

5100

5150

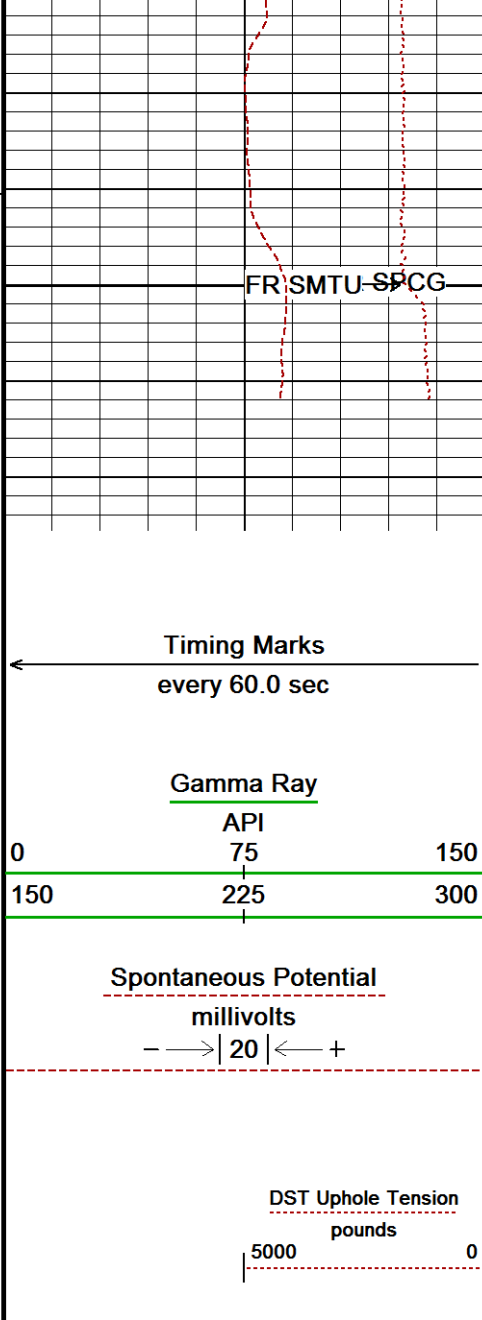


5150  
116°  
5200  
117°  
5250  
118°  
5300  
119°  
5350



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

← Spontaneous Potential  
← Gamma Ray  
DST Uphole Tension →  
← FR GRGC

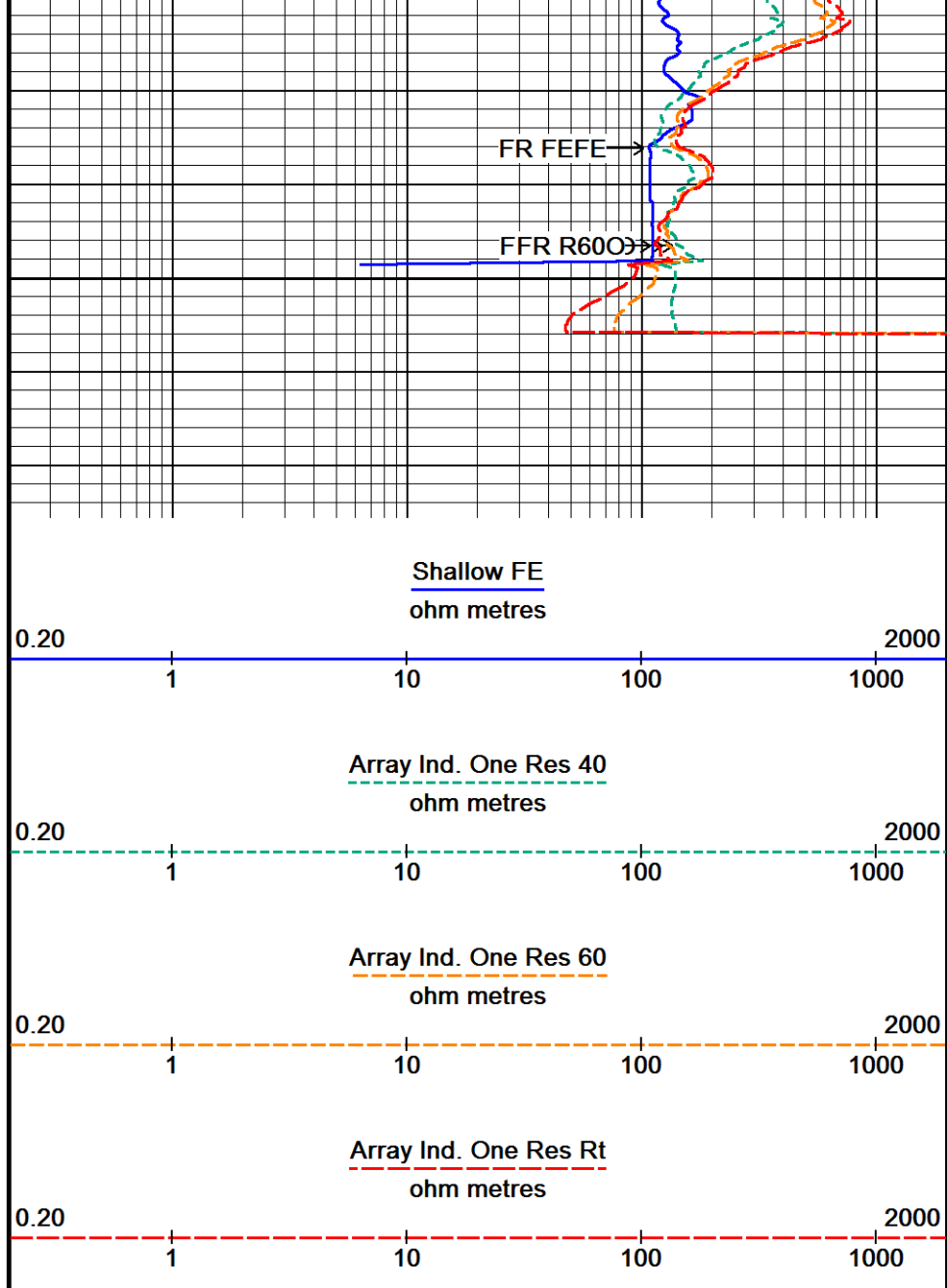


5400

5424  
Depth  
in  
Feet

Borehole  
Temp in  
deg F

Replay  
Scale  
1:240

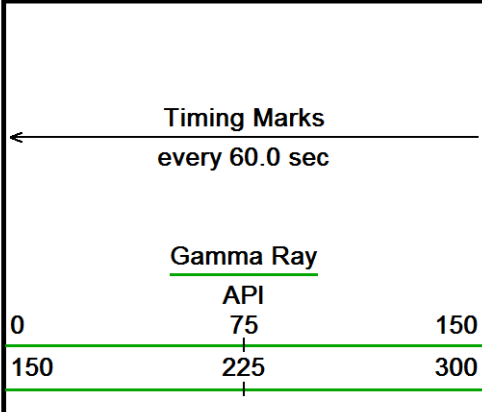


Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 18-JAN-2013 08:57  
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↑ 5 INCH MAIN ↑

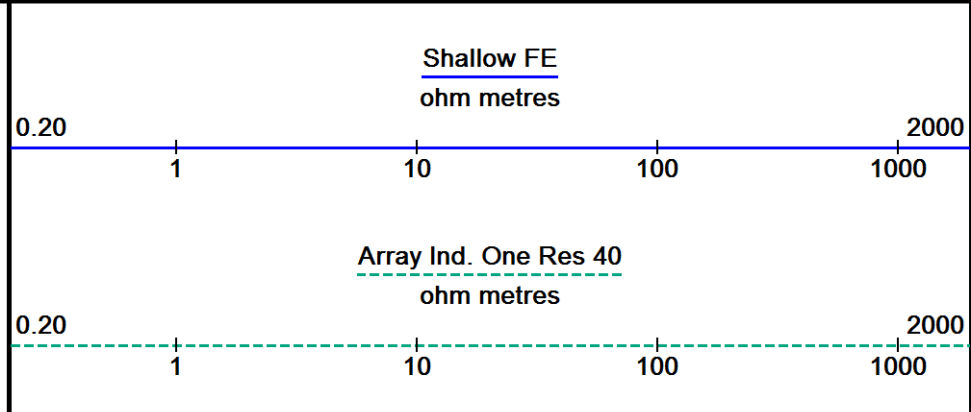
↓ REPEAT SECTION ↓

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 18-JAN-2013 08:57  
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 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506



Depth  
in  
Feet

Borehole  
Temp in  
deg F



Spontaneous Potential

millivolts

- -> | 20 | <- - +

DST Uphole Tension

pounds

5000 0

deg T

Replay  
Scale  
1:240

5000

110°

5050

111°

5100

113°

5150

Array Ind. One Res 60

ohm metres

0.20

1

10

100

1000

2000

Array Ind. One Res Rt

ohm metres

0.20

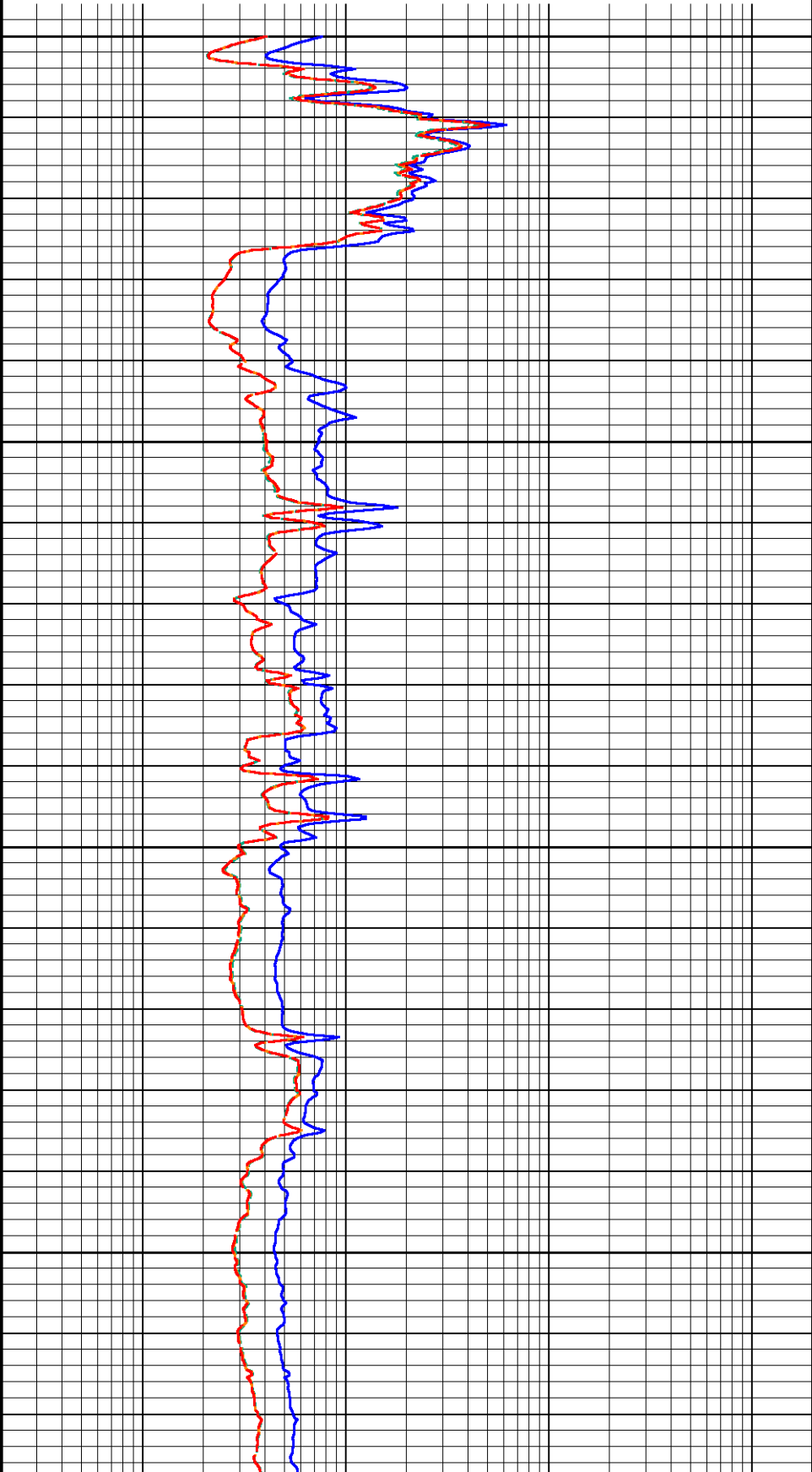
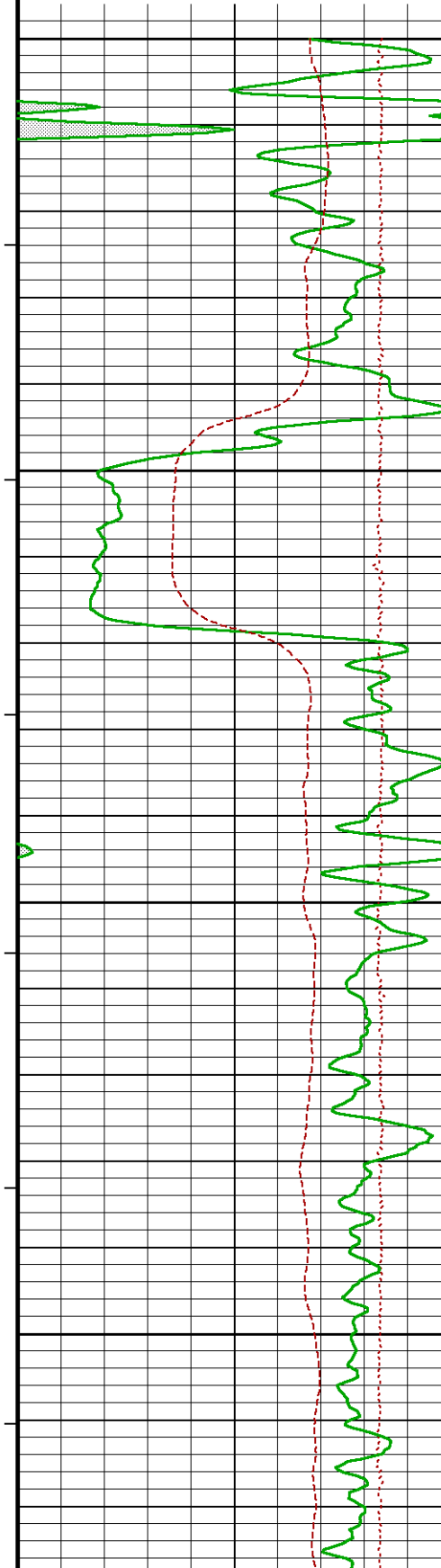
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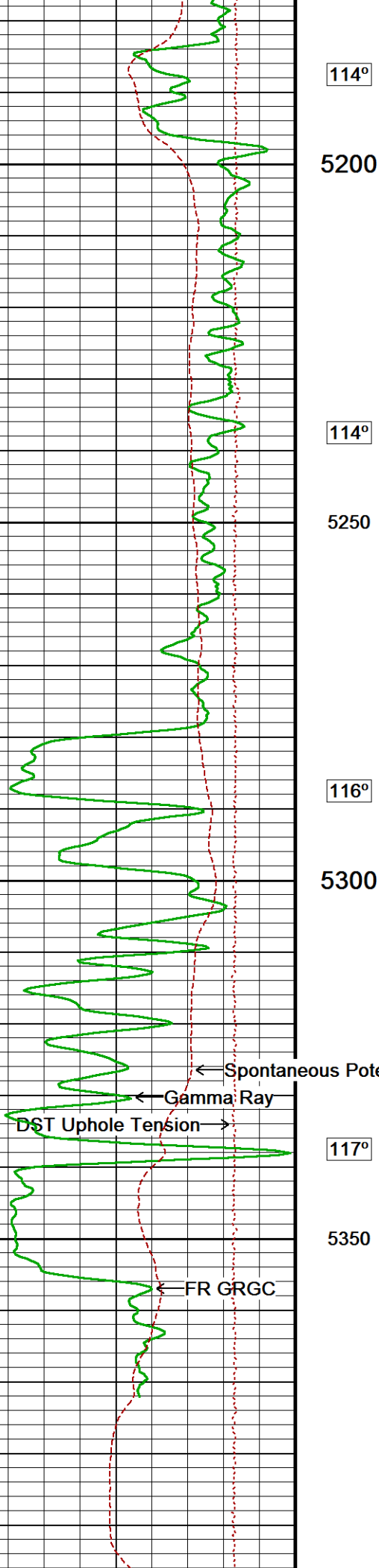
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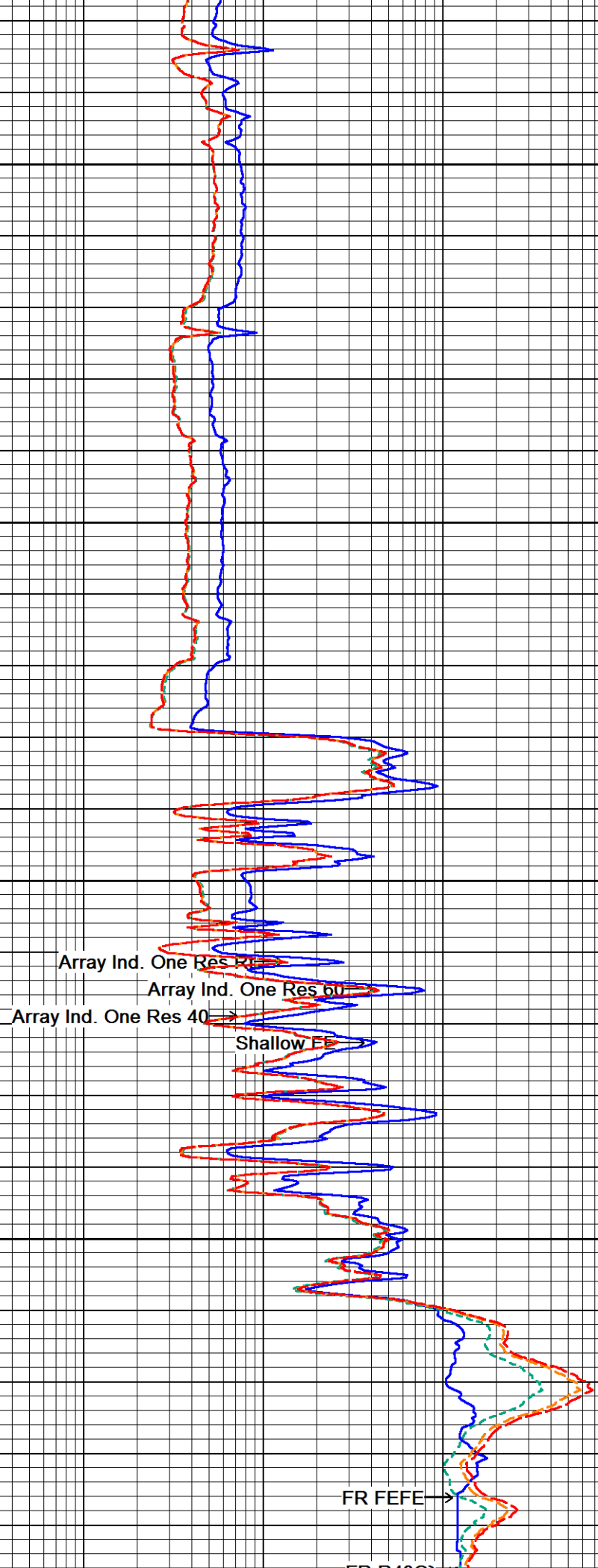
1000

2000

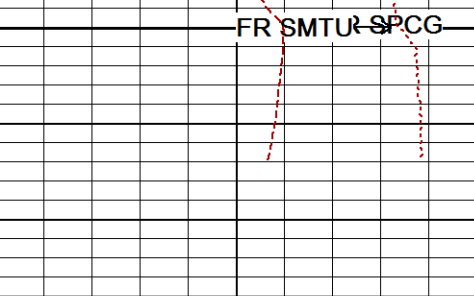




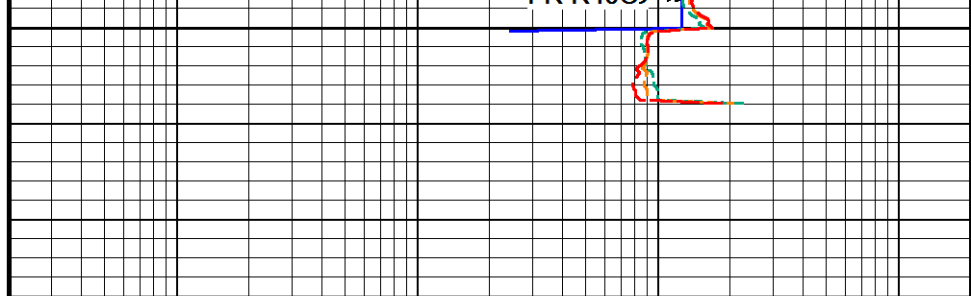
114°  
5200  
114°  
5250  
116°  
5300  
117°  
5350



Array Ind. One Res FE  
Array Ind. One Res 60  
Array Ind. One Res 40  
Shallow FE  
FR FEFE  
FR R400



5400



5426

Depth in Feet

Timing Marks every 60.0 sec

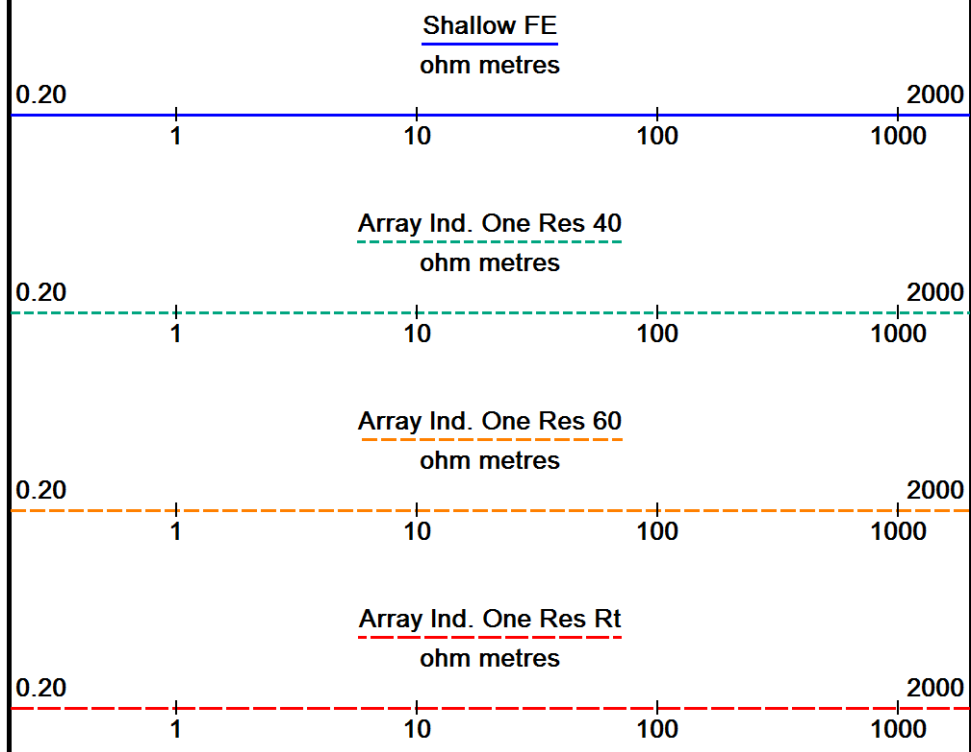
Gamma Ray API  
0 75 150  
150 225 300

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 Plotted on 18-JAN-2013 08:57  
 Filename: C:\Users\E143235\AppData\Local\Temp\Weatherford...Western Operating Fox #1-8\_001.dta Recorded on 16-JAN-2013 14:09  
 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506

↑ REPEAT SECTION ↑

BEFORE SURVEY CALIBRATION

C:\Users\E143235\AppData\Local\Temp\Weatherford PreView3\3\Western Operating Fox #1-8\_001.dta

General Constants All 000 Last Edited on 16-JAN-2013,12:29

General Parameters  
 Mud Resistivity 0.580 ohm-metres  
 Mud Resistivity Temperature 73.000 degrees F  
 Water Level 0.000 feet  
 Borehole Fluid Processing Wet Hole

Hole/Annular Volume and Differential Caliper Parameters  
 HVOL Method Single Caliper  
 HVOL Caliper 1 Density Caliper  
 HVOL Caliper 2 N/A  
 Annular Volume Diameter 5.500 inches  
 Caliper for Differential Caliper Density Caliper

Rwa Parameters  
 Porosity used Base Density Porosity  
 Resistivity used Array Ind. Four Res Rt  
 RWA Constant A 0.610  
 RWA Constant M 2.150  
 SW/APOR Tool Source

High Resolution Temperature Calibration MCG-B 34

Field Calibration on 08-NOV-2012,10:05

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	100.00	100.00

High Resolution Temperature Constants MCG-B 34 Last Edited on 08-NOV-2012,10:04

Pre-filter Length	11	
Gamma Calibration MCG-B 34 <span style="float: right;">Field Calibration on 16-JAN-2013 08:24</span>		
	Measured	Calibrated (API)
Background	70	47
Calibrator (Gross)	1141	772
Calibrator (Net)	1071	725

Gamma Constants MCG-B 34 <span style="float: right;">Last Edited on 16-JAN-2013,12:29</span>		
Gamma Calibrator Number	GRC38	
Mud Density	1.13	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl	0.00	kppm
K Mud Type		
K Mud Concentration	%	

FE Calibration MFE-B.J 353 <span style="float: right;">Base Calibration on 13-DEC-2012 09:28 Field Check on 13-JAN-2013 17:02</span>		
Base Calibration		
	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	964.3	126.8
Base Check	281.1	
Field Check	281.1	

FE Constants MFE-B.J 353 <span style="float: right;">Last Edited on 16-JAN-2013,12:28</span>		
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 <span style="float: right;">Base Calibration on 14-NOV-2012,09:21 Field Check on 13-JAN-2013 17:00</span>				
Base Calibration				
Test Loop Calibration				
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			11.7	3841.8
2			29.1	3480.3
3			28.7	3056.3
4			19.6	2083.9
Deep			18.3	2051.2
Medium			41.9	3995.7
Shallow			42.2	5058.8
Array Temperature			56.6	Deg F

Induction Constants MAI-A.A 167 <span style="float: right;">Last Edited on 16-JAN-2013,12:28</span>		
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	0.50	inches
Number of Fins on Stand-off	8.0000	
Stand-off Fin Angle	45.00	degrees
Stand-off Fin Width	0.5000	inches
Borehole Corr. Rm Source	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Squasher Start	0.0020	mhos/metre
Squasher Offset	N/A	mhos/metre

**Borehole Normalisation**

DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

**Calibration Site Corrections**

Channel 1	0.00	mmhos/metre
Channel 2	0.00	mmhos/metre
Channel 3	0.00	mmhos/metre
Channel 4	0.00	mmhos/metre

**Apparent Porosity and Water Saturation Constants**

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

**DOWNHOLE EQUIPMENT**

C:\Users\E143235\AppData\Local\Temp\Weatherford PreView3\3\Western Operating Fox #1-8\_001.dta

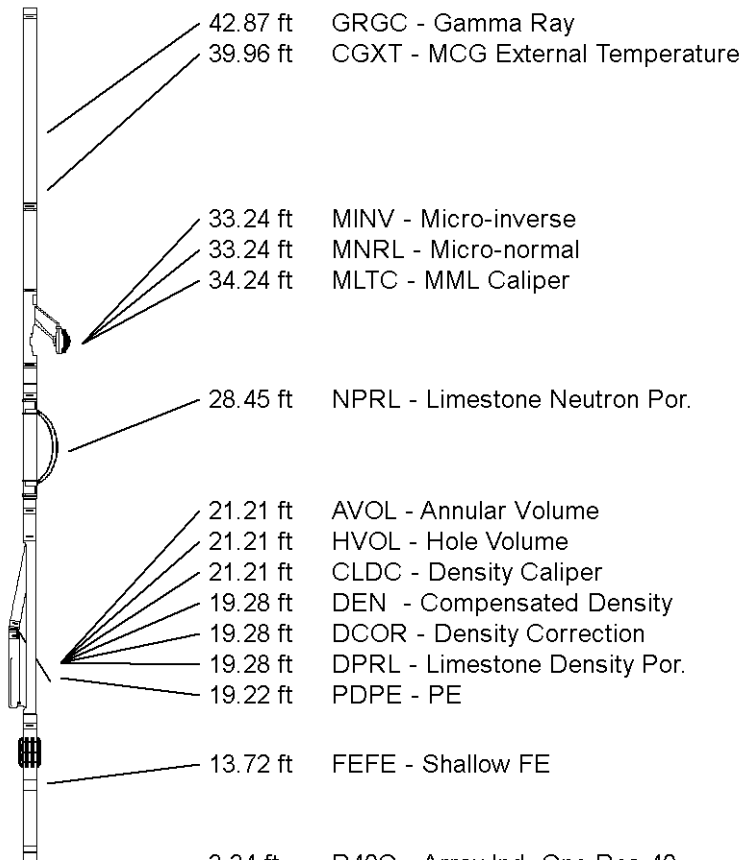
Compact Comms Gamma  
MCG-B 34 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

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

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

Compact Density/Caliper  
MPD-B 64 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

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



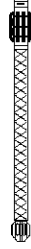
Compact Induction

2.24 ft

IRAG - Apparent Log Res. 40

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

Total Length: 48.16 ft Weight: 383.6 lb



3.34 ft R400 - Array Ind. One Res 40  
 3.34 ft RTAO - Array Ind. One Res Rt  
 3.34 ft R600 - Array Ind. One Res 60  
 0.23 ft SPCG - Spontaneous Potential  
 -0.13 ft SMTU - DST Uphole Tension  
 Tool Zero (0.13ft from bottom)  
 All measurements relative to tool zero.

COMPANY WESTERN OPERATING COMPANY  
 WELL FOX #1-8  
 FIELD HELFRICH  
 PROVINCE/COUNTY HAMILTON  
 COUNTRY/STATE U.S.A. / KANSAS

Elevation Kelly Bushing	3609.00	feet	First Reading	5397.00	feet
Elevation Drill Floor	3608.00	feet	Depth Driller	5400.00	feet
Elevation Ground Level	3596.00	feet	Depth Logger	5400.00	feet

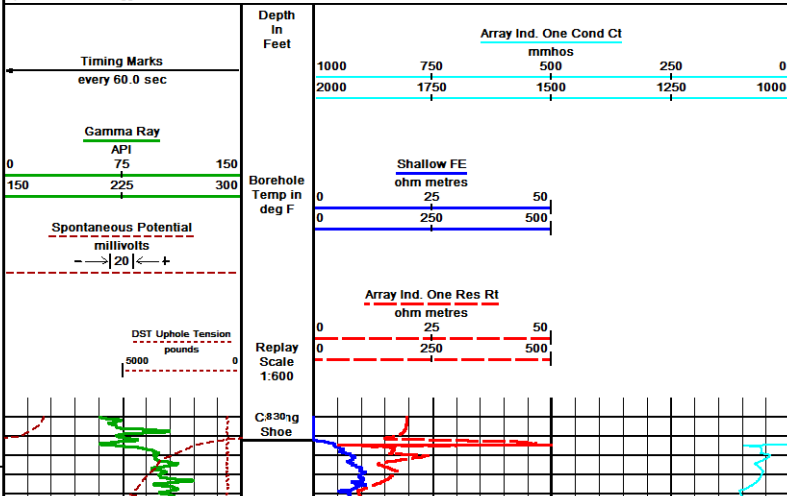


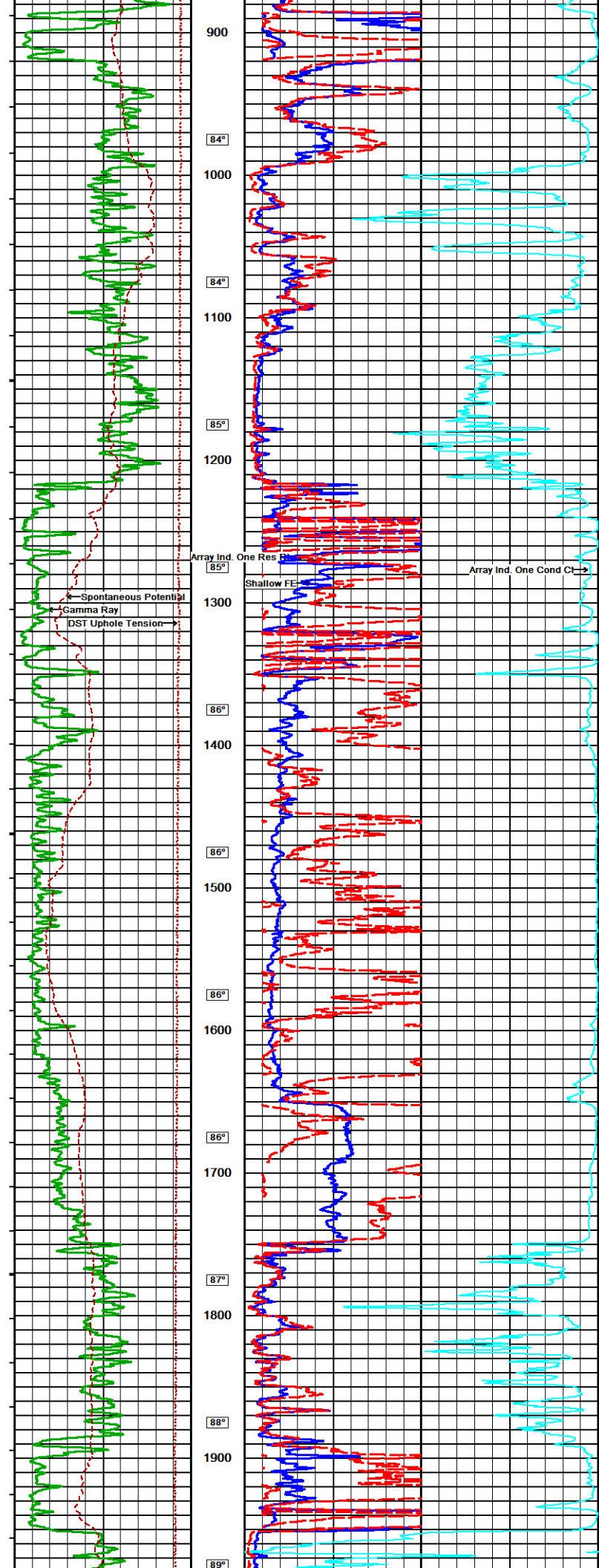
**Weatherford**<sup>®</sup>

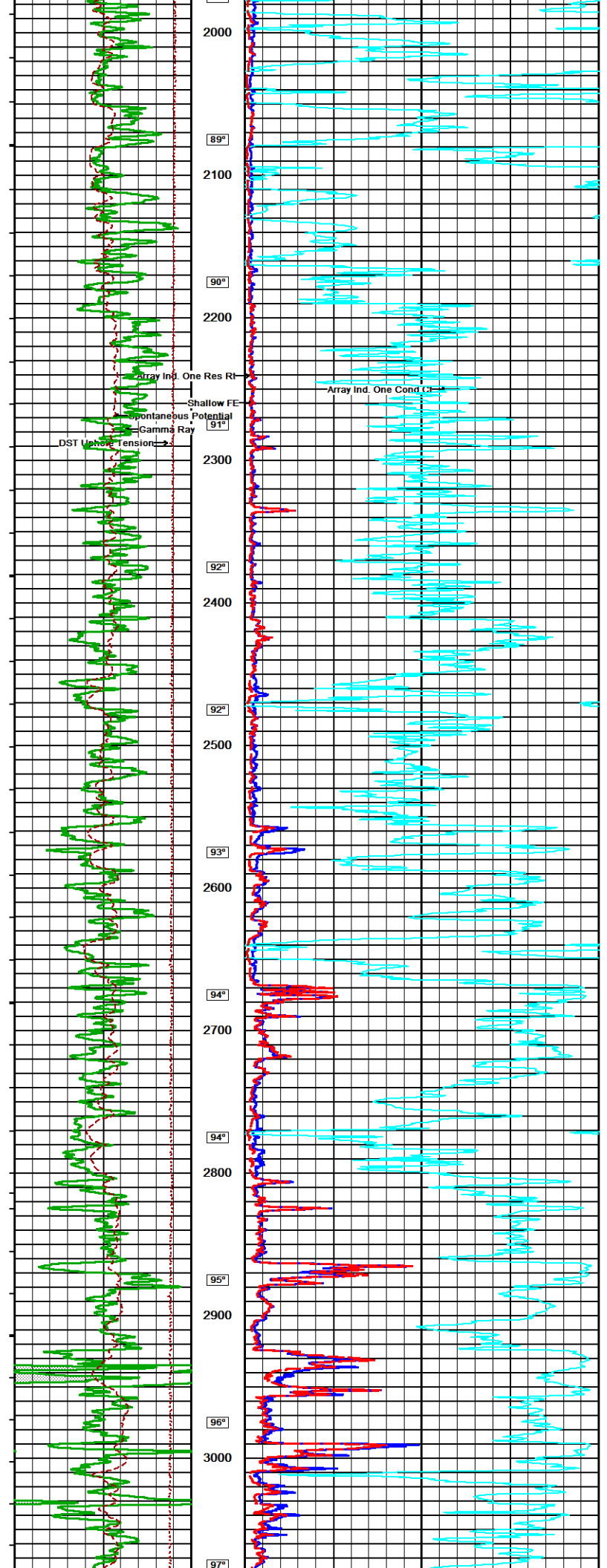
ARRAY INDUCTION  
 SHALLOW FOCUSED  
 ELECTRIC LOG

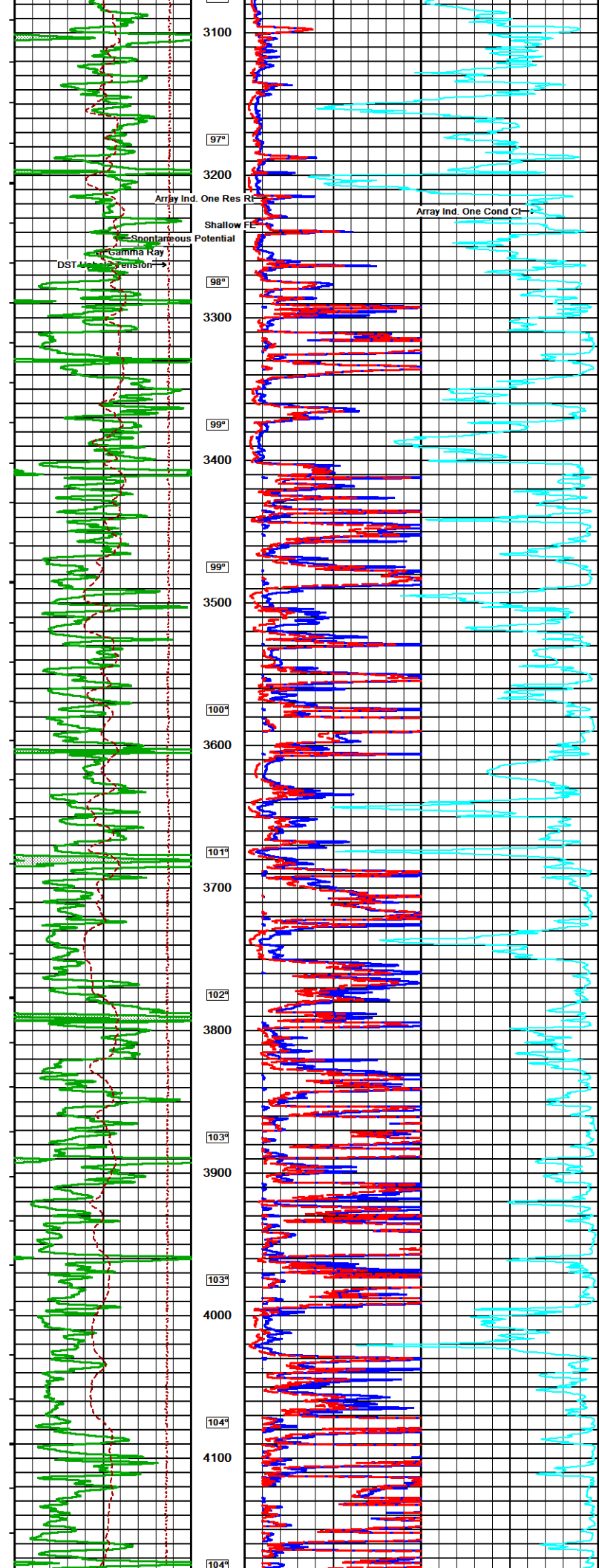
<b>Weatherford</b> <sup>®</sup>		ARRAY INDUCTION SHALLOW FOCUSED ELECTRIC LOG	
COMPANY	WESTERN OPERATING COMPANY	WELL	FOX #1-8
FIELD	HELFRICH	PROVINCE/COUNTY	HAMILTON
COUNTRY/STATE	U.S.A. / KANSAS	LOCATION	335' FMI & 495' FMI
SEC	TYPE	DATE	18-JAN-2013
8	25S	15:07:42088	
9	42VI		
10	10P/INDV		
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99			
100			

1 INCH MAIN  
 Depth Based Data - Maximum Sampling Increment 10.0cm  
 Plotted on 18-JAN-2013 08:57  
 Filename: C:\Users\E143235\AppData\LocalTemp\Weatherford Pre.\Western Operating Fox #1-8\_002.dat  
 Recorded on 16-JAN-2013 14:37  
 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506









3100

97°

3200

98°

99°

3400

99°

3500

100°

3600

101°

3700

102°

3800

103°

3900

103°

4000

104°

4100

104°

Array Ind. One Res Rt

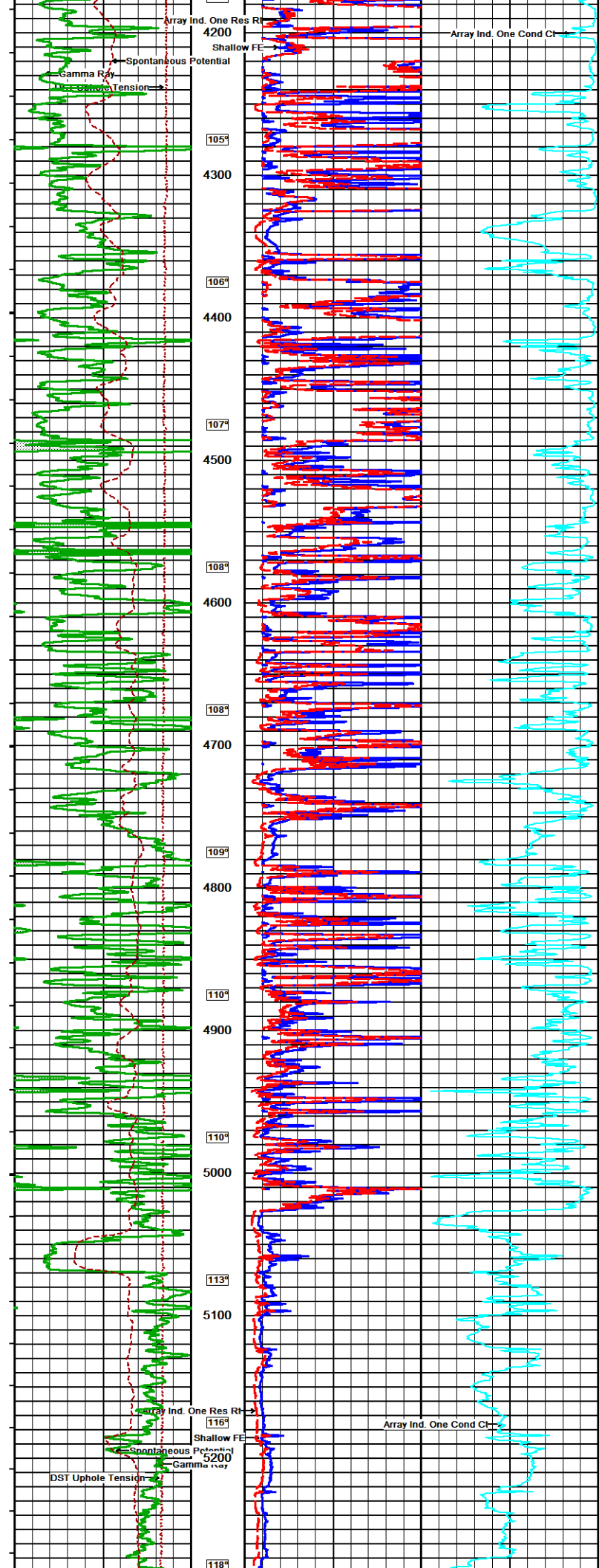
Array Ind. One Cond Ct

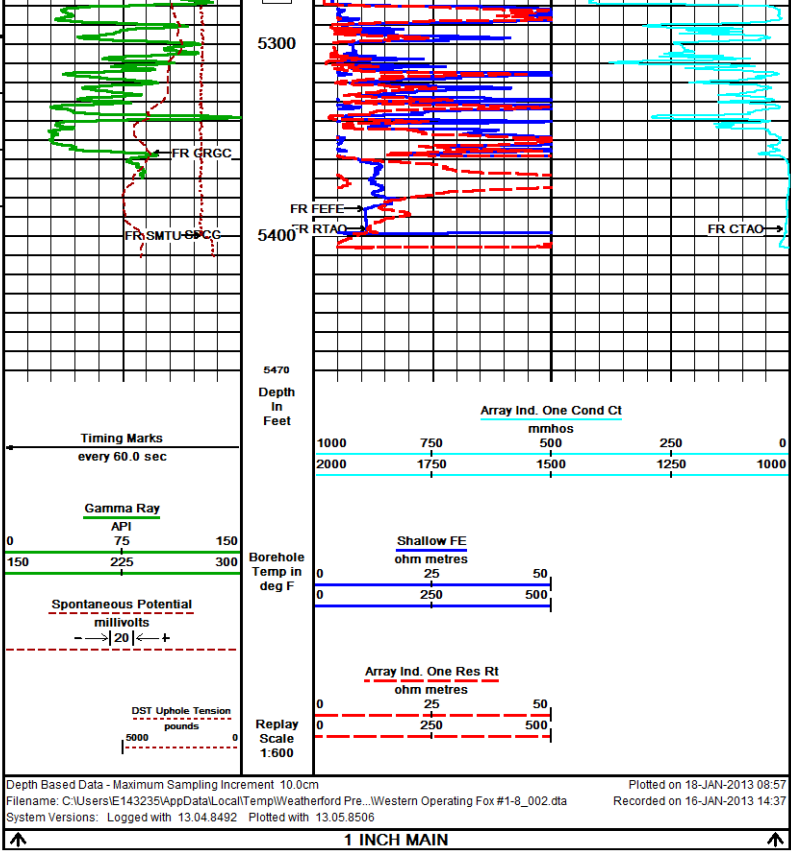
Shallow F


Spontaneous Potential

Gamma Ray

DST (Differential Self-Potential)





COMPANY	WESTERN OPERATING COMPANY				
WELL	FOX #1-8				
FIELD	HELFRICH				
PROVINCE/COUNTY	HAMILTON				
COUNTRY/STATE	U.S.A. / KANSAS				
Elevation Kelly Bushing	3609.00	feet	First Reading	5397.00	feet
Elevation Drill Floor	3608.00	feet	Depth Driller	5400.00	feet
Elevation Ground Level	3596.00	feet	Depth Logger	5400.00	feet
		ARRAY INDUCTION SHALLOW FOCUSED ELECTRIC LOG			