



**Weatherford®**

## COMPACT ARRAY INDUCTION LOG

COMPANY

SANDRIDGE

WELL

MARR 0780 5-6H

FIELD

NORTH PARK

PROVINCE/COUNTY JACKSON

COUNTRY/STATE USA / COLORADO

LOCATION SHL: 345 FNL & 2382' FEL

SEC 7 TWP 7N RGE 80W Other Services  
COMPENSATED SONIC

Latitude 40.5985140000

Longitude -106.4155420000

API Number 05-057-065750000

Permanent Datum GL, Elevation 8130 feet

Log Measured From KB

Drilling Measured From KB @ 5.5

Date 19-AUG-2016

Run Number ONE

Service Order 7953-158842941

Depth Driller 2325.00 feet

Depth Logger 2320.00 feet

First Reading 2316.66 feet

Last Reading 45.00 feet

Casing Driller 45.00 feet

Casing Logger 45.00 feet

Bit Size 12.250 inches

Hole Fluid Type WBM

Density / Viscosity 9.70 lb/USg 50.00 Sec/Qt

PH / Fluid Loss 8.00 12.00 ml/30Min

Sample Source FLOWLINE

Rm @ Measured Temp 1.80 @ 69.0 ohm-m

Rmf @ Measured Temp 1.35 @ 69.0 ohm-m

Rmc @ Measured Temp 2.25 @ 69.0 ohm-m

Source Rmf / Rmc CALC CALC

Rm @ BHT 1.214 @104.0 ohm-m

Time Since Circulation 4 HRS

Max Recorded Temp 104.00 deg F

Equipment / Base 13173 CASPER

Recorded By G. SHIREMAN

Witnessed By C. MARBERRY

Elevations:  
KB 8135.50  
DF 8135.50  
GL 8130.00

### BOREHOLE RECORD

Last Edited: 19-AUG-2016 19:23

Bit Size  
inches

12.250

Depth From  
feet

45.00

Depth To  
feet

2325.00

### CASING RECORD

Type

Size  
inches

20.000

Depth From  
feet

0.00

Shoe Depth  
feet

45.00

Weight  
pounds/ft

84.00

### REMARKS

SOFTWARE VERSION 16.01.9649

TOOLS RUN: CBH, SHA, MCG, MXC, MSS, MXC, MFE, MAI

HARDWARE: MAI: BASKET

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

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST

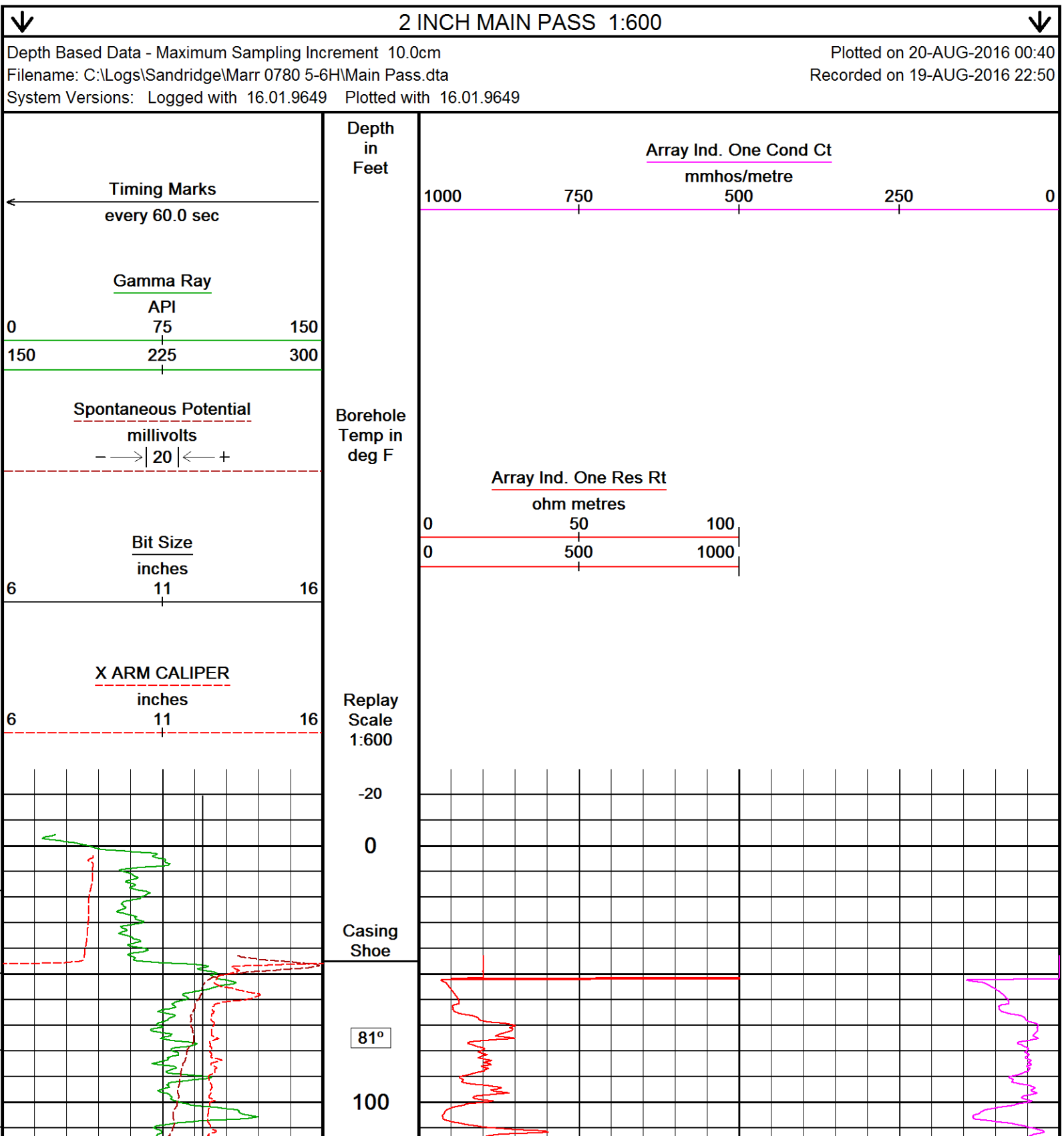
TOTAL HOLE VOLUME FROM 2000 TO SURFACE CASING = 1760 CUBIC FEET

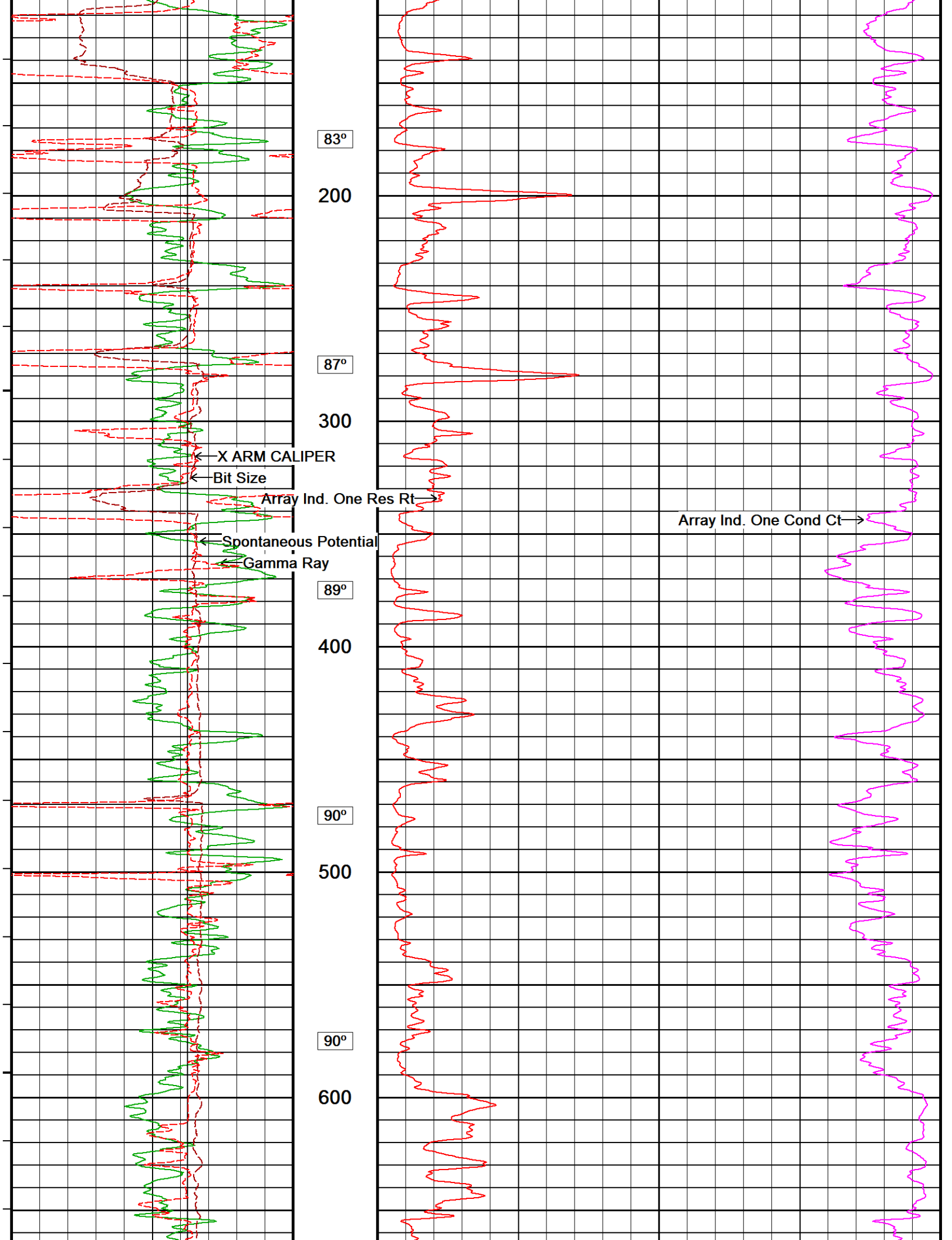
TOTAL ANNULAR VOLUME FROM 2000 TO SURFACE WITH 9.625 IN CASING= 575 CUBIC FEET

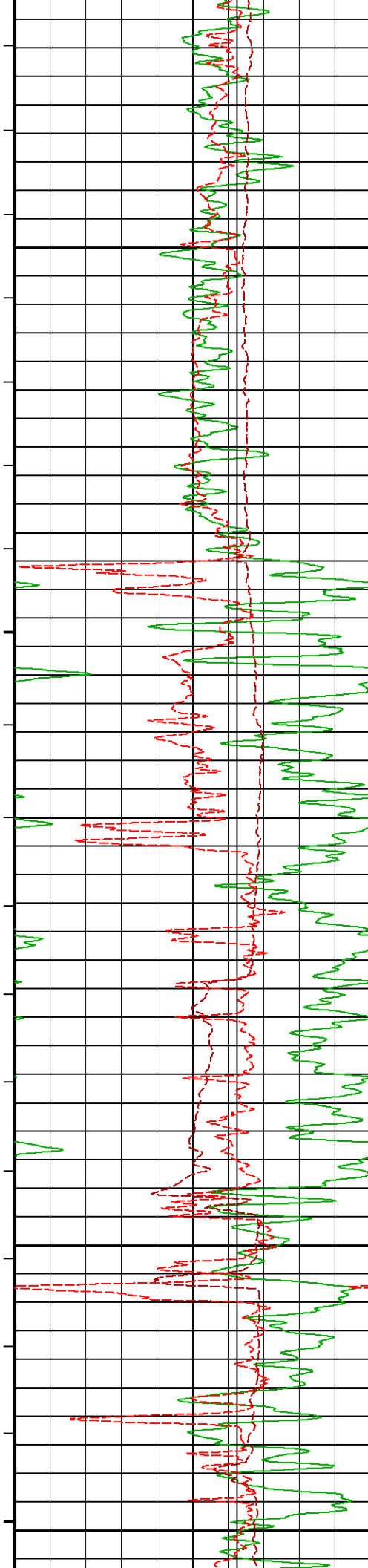
RIG: WHITE MOUNTAIN OPERATING 344

In interpreting, communicating or providing information and/or making recommendations, either written or oral, as to logs or test or other data,

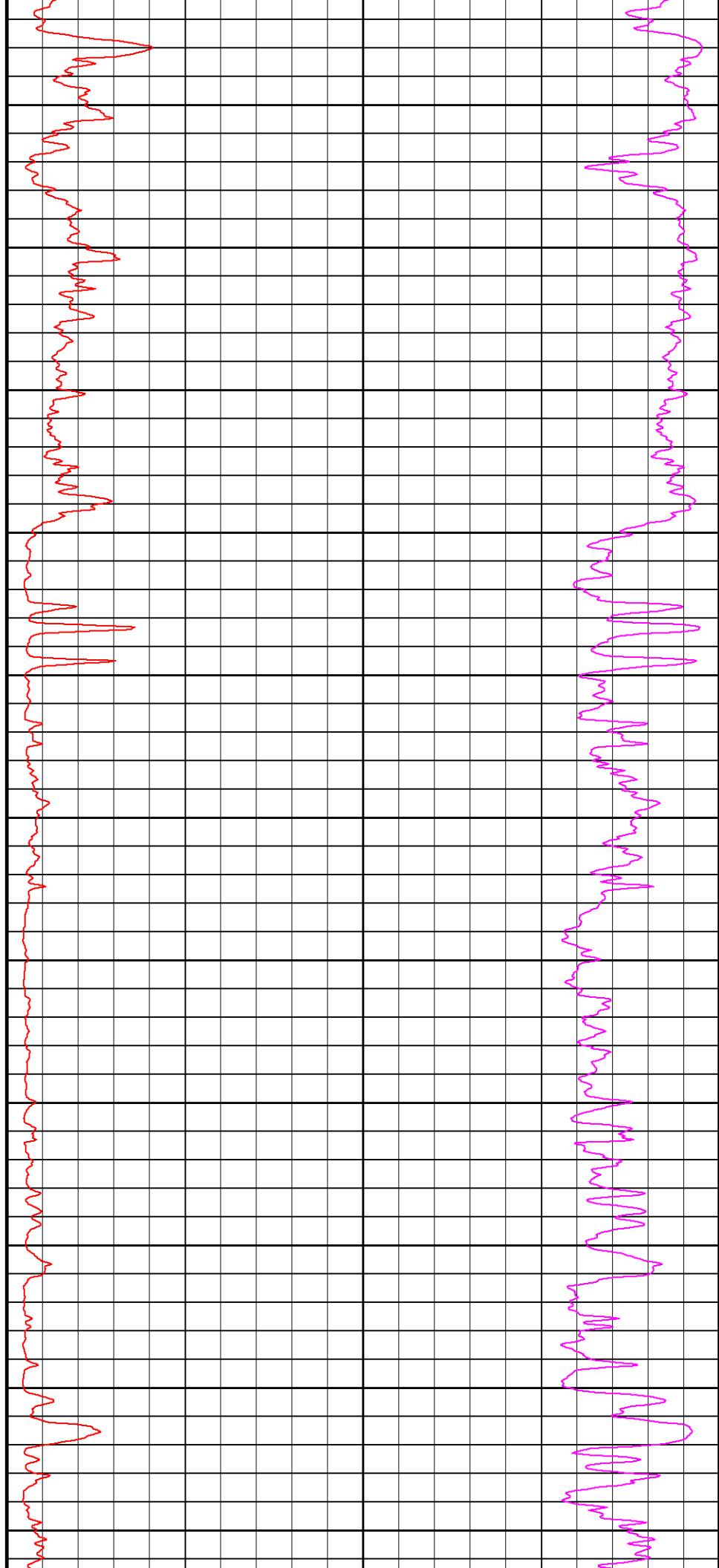
type or amount of material, or Work or other service to be furnished, or manner of performance, or in predicting results to be obtained, the Contractor will give the Company the benefit of the Contractor's best judgment based on its experience and will perform all such Work in a good and workmanlike manner. Any interpretation of test or other data, and any recommendation or reservoir description based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions, which inferences and assumptions are not infallible, and with respect to which professional engineers and analysts may differ. ACCORDINGLY ANY INTERPRETATION OR RECOMMENDATION RESULTING FROM THE SERVICES WILL BE AT THE SOLE RISK OF THE COMPANY, AND THE CONTRACTOR CANNOT AND DOES NOT WARRANT THE ACCURACY, CORRECTNESS OR COMPLETENESS OF ANY SUCH INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.

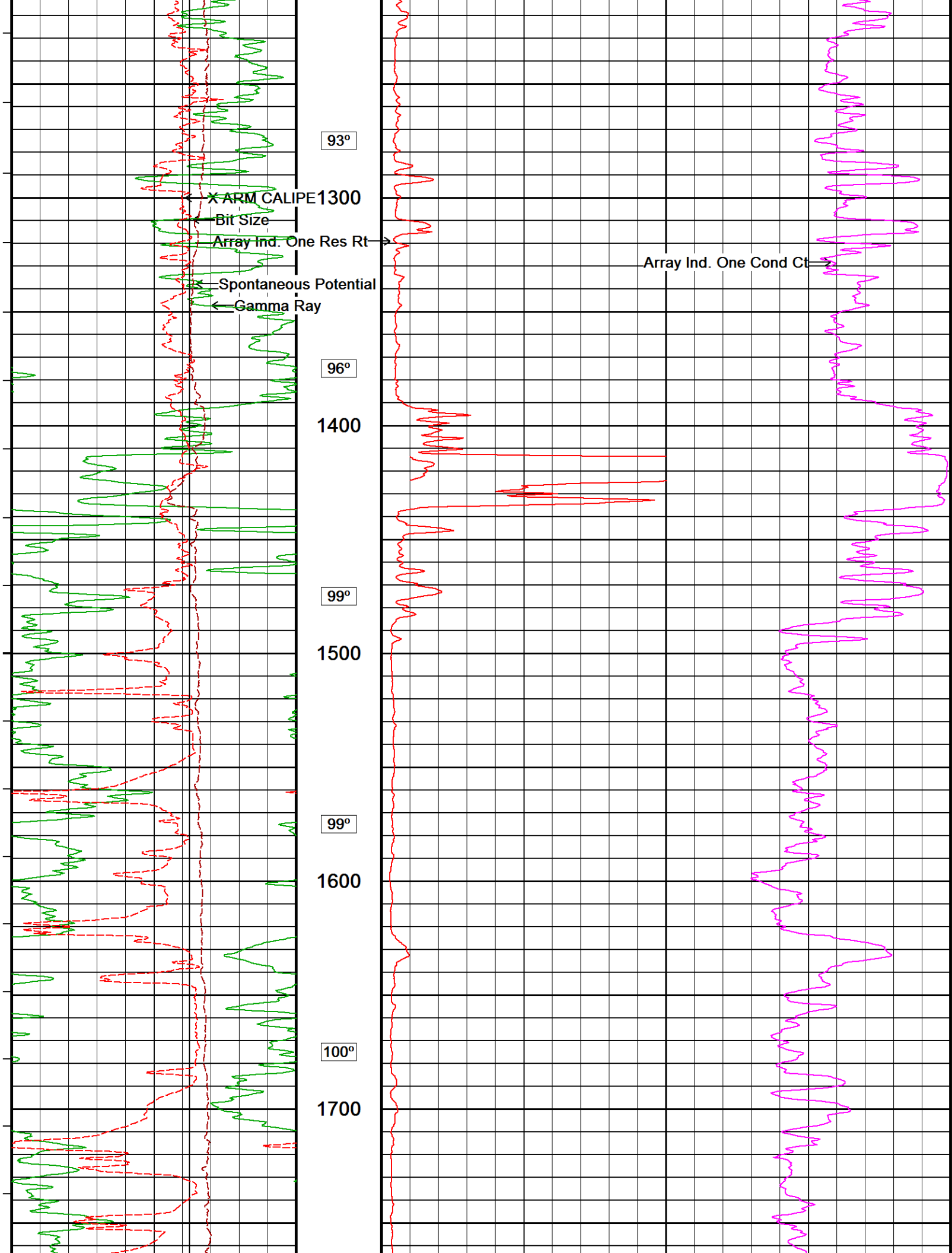


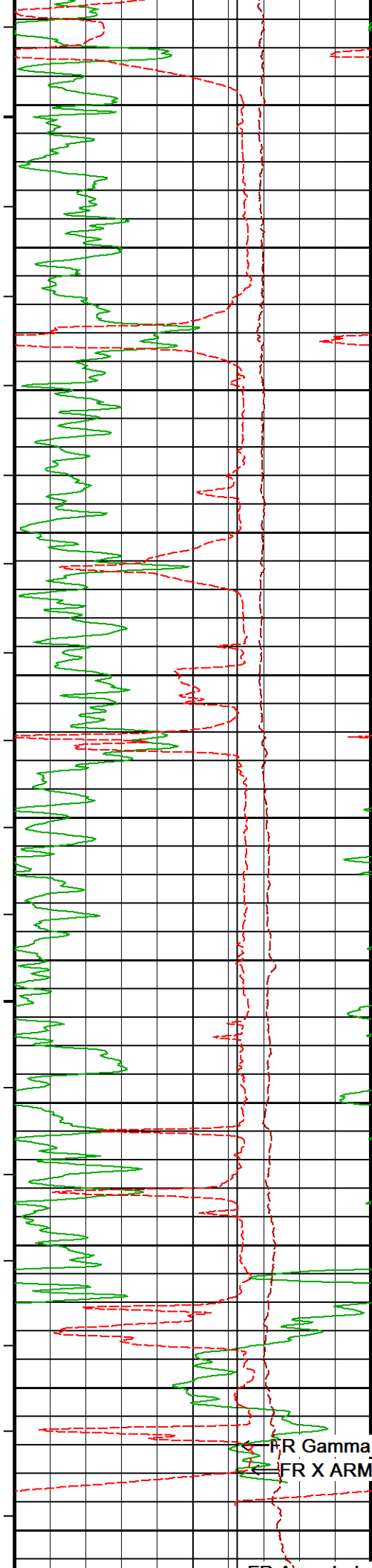




90°  
700  
89°  
800  
92°  
900  
94°  
1000  
94°  
1100  
95°  
1200







101°

1800

102°

1900

103°

2000

103°

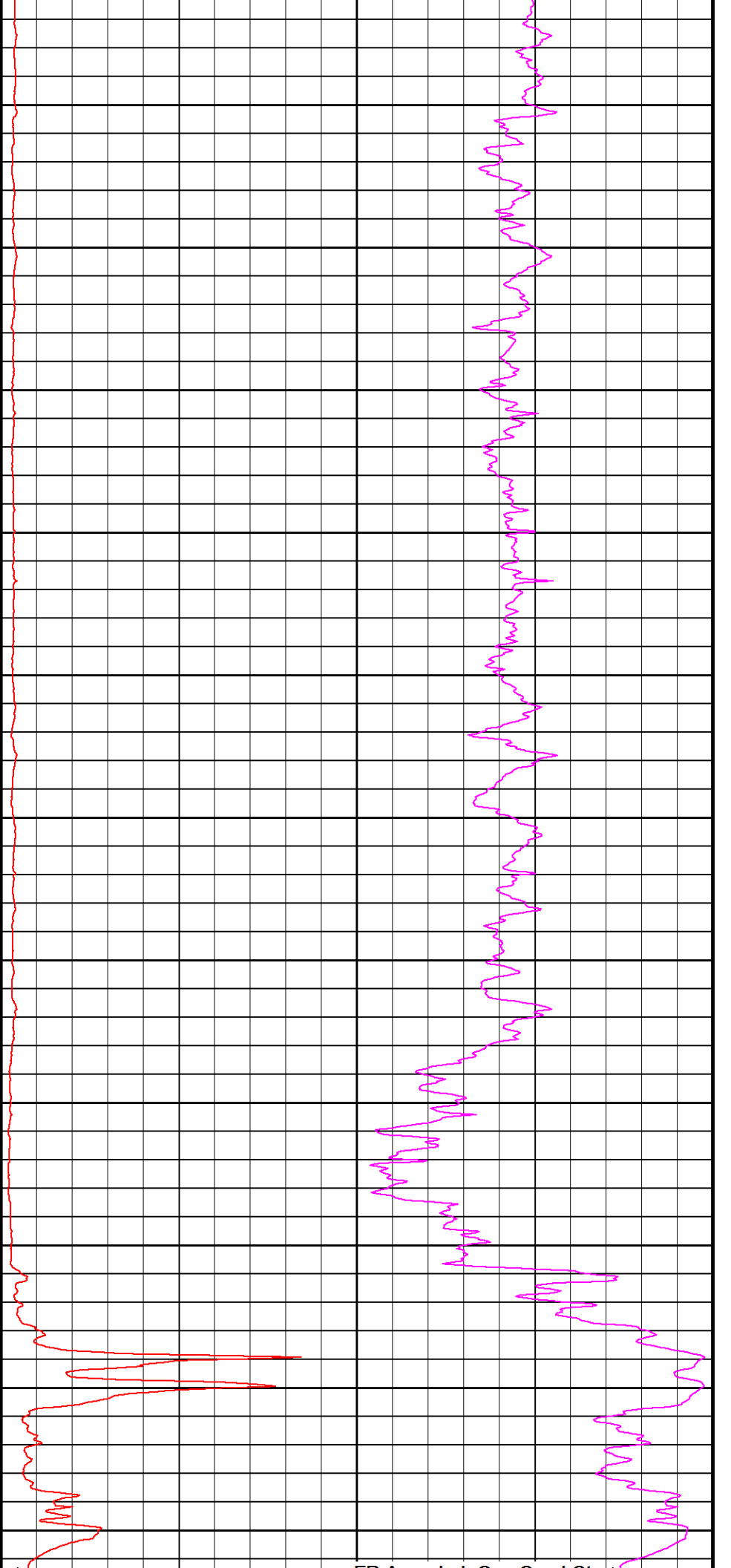
2100

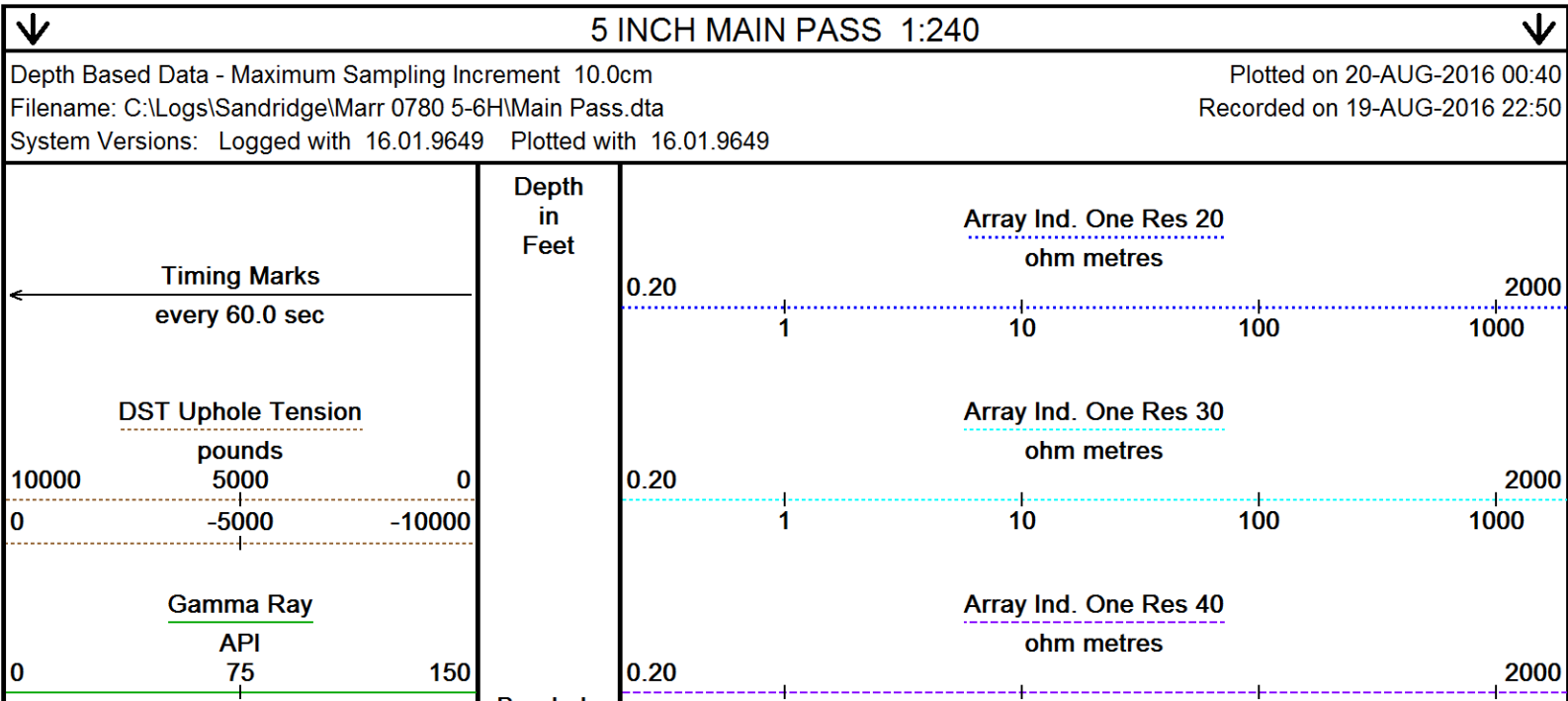
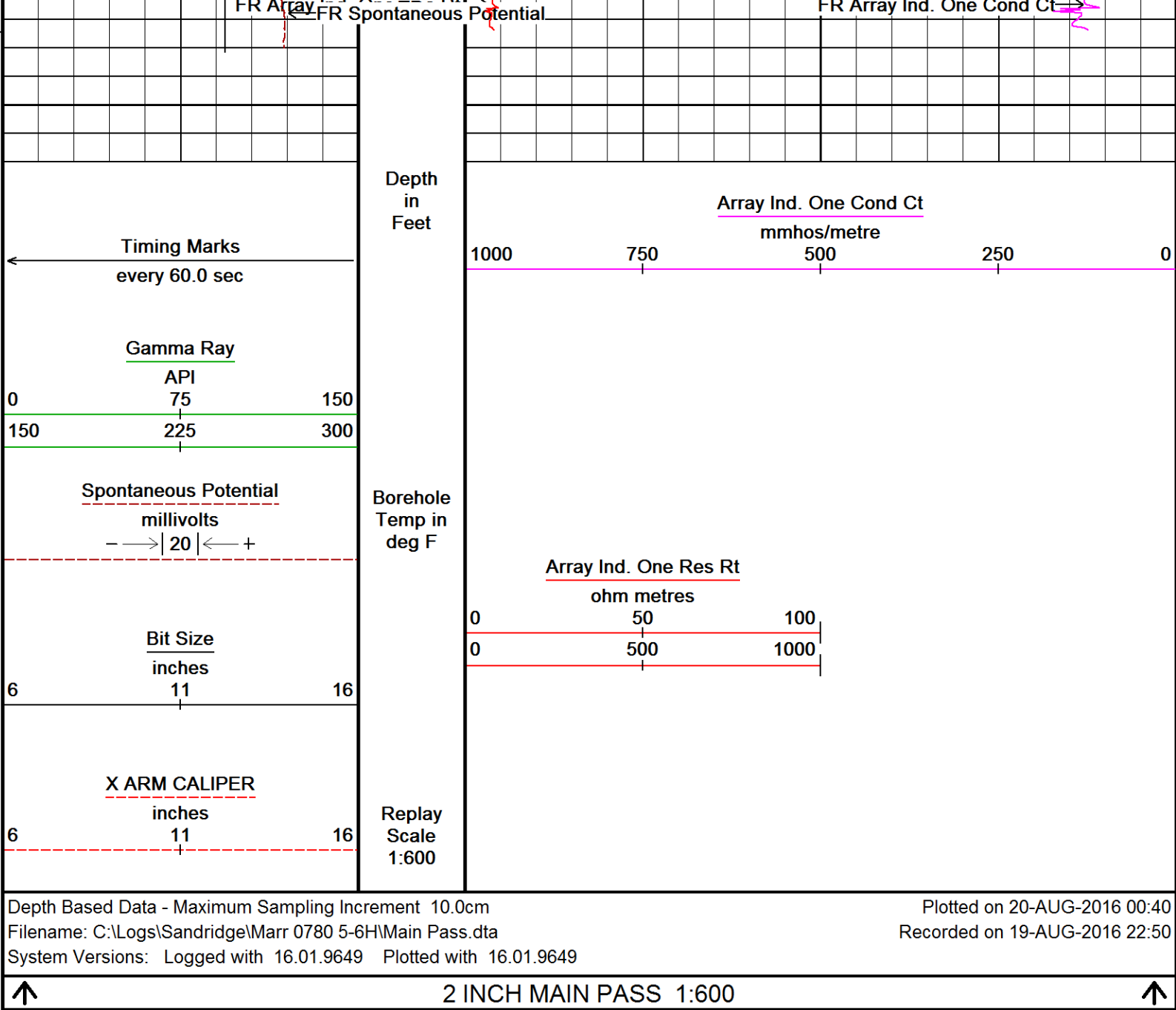
104°

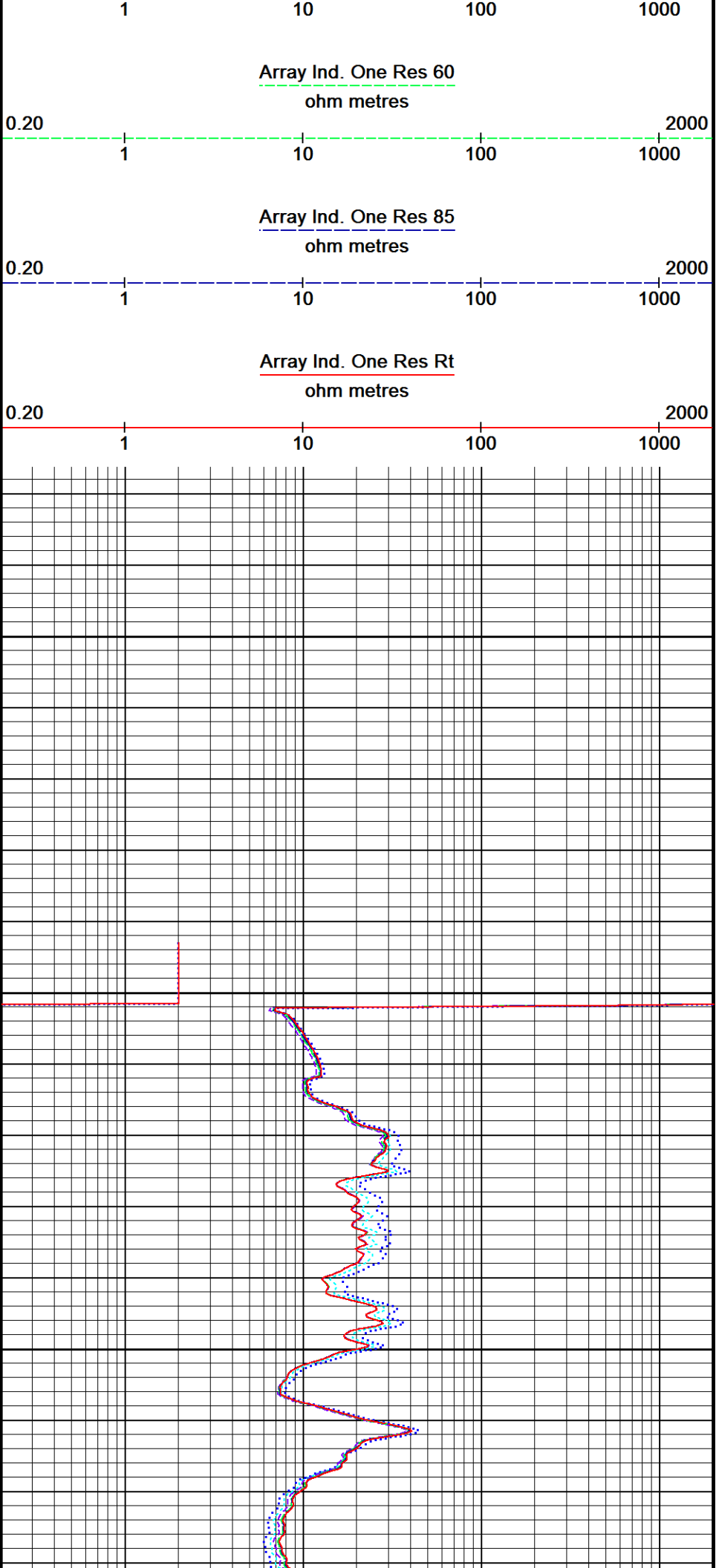
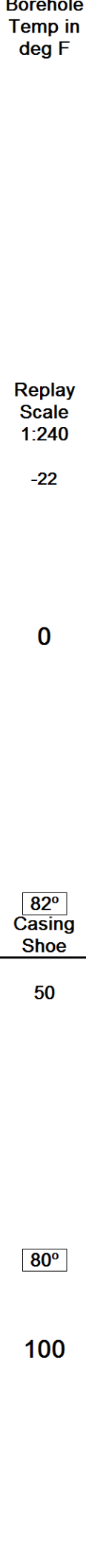
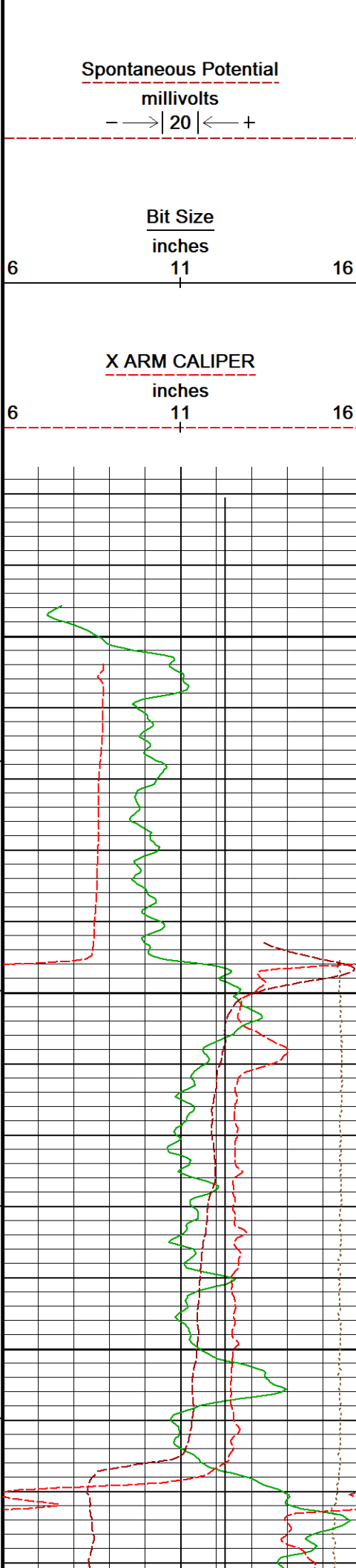
2200

2300

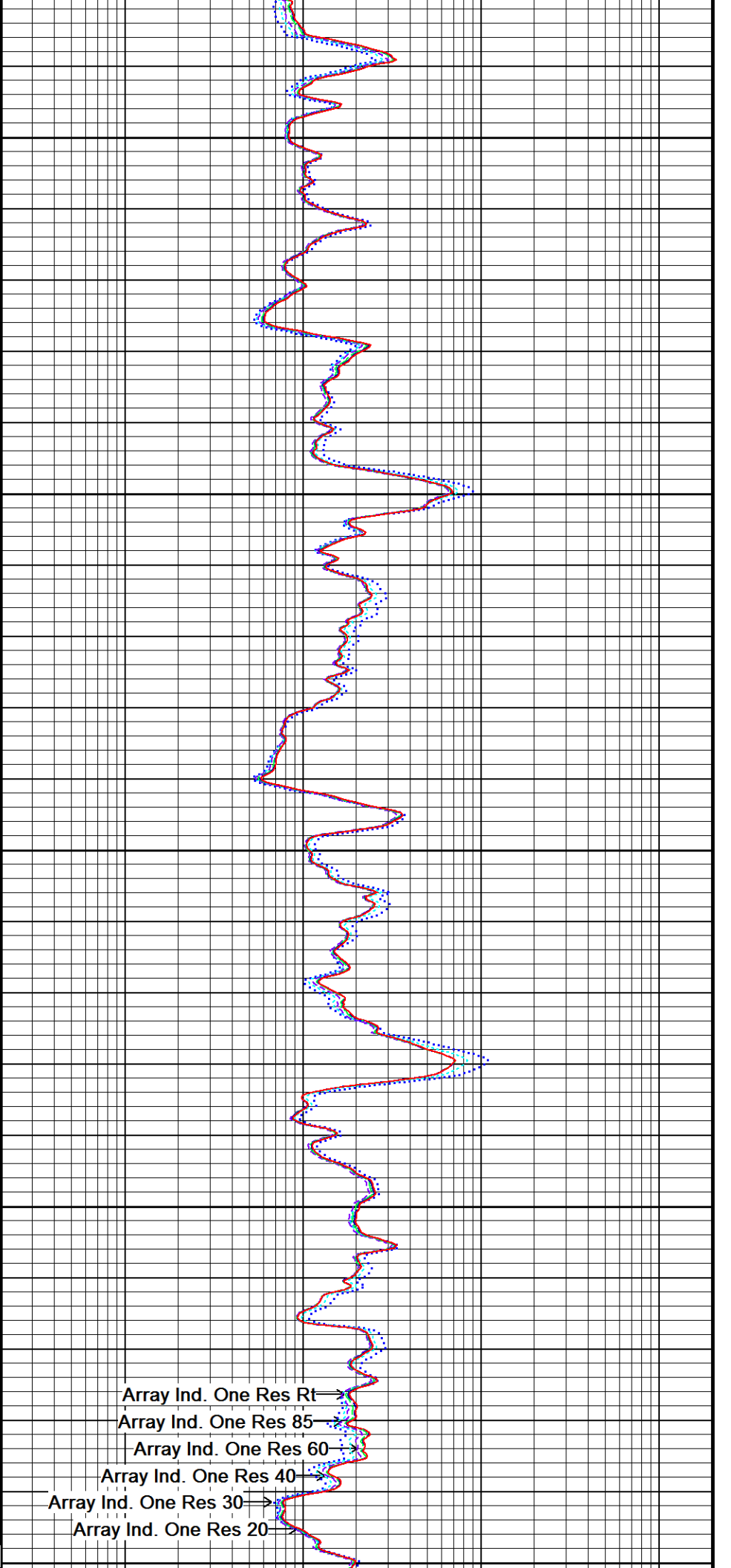
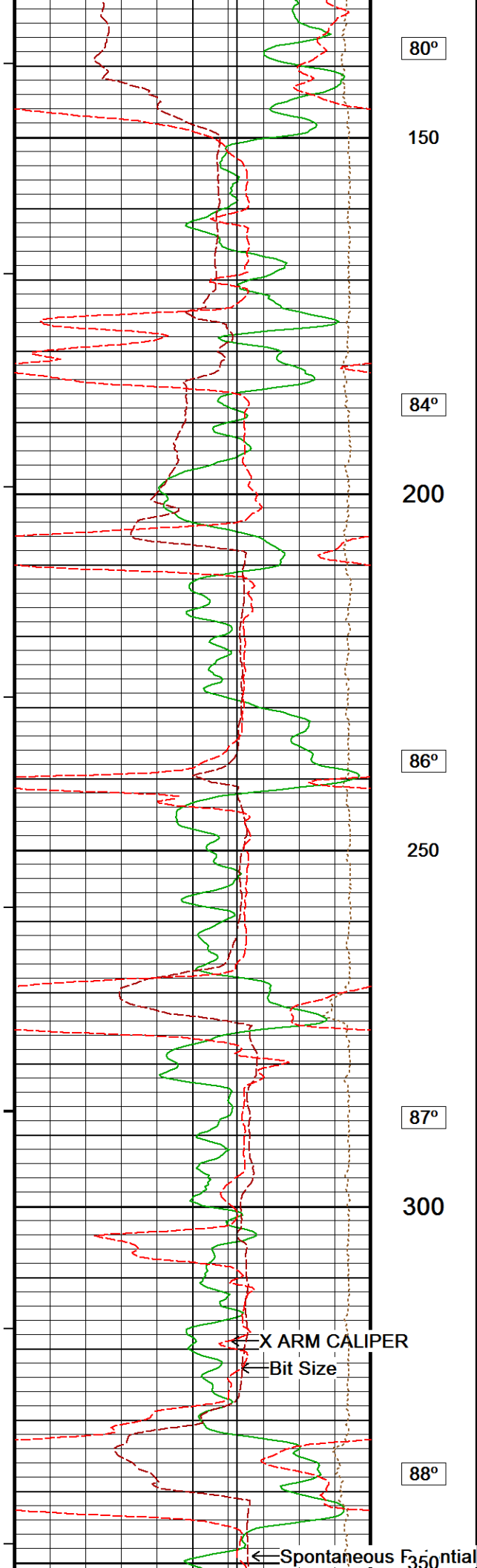
FR Gamma Ray  
FR X ARM CALIPER

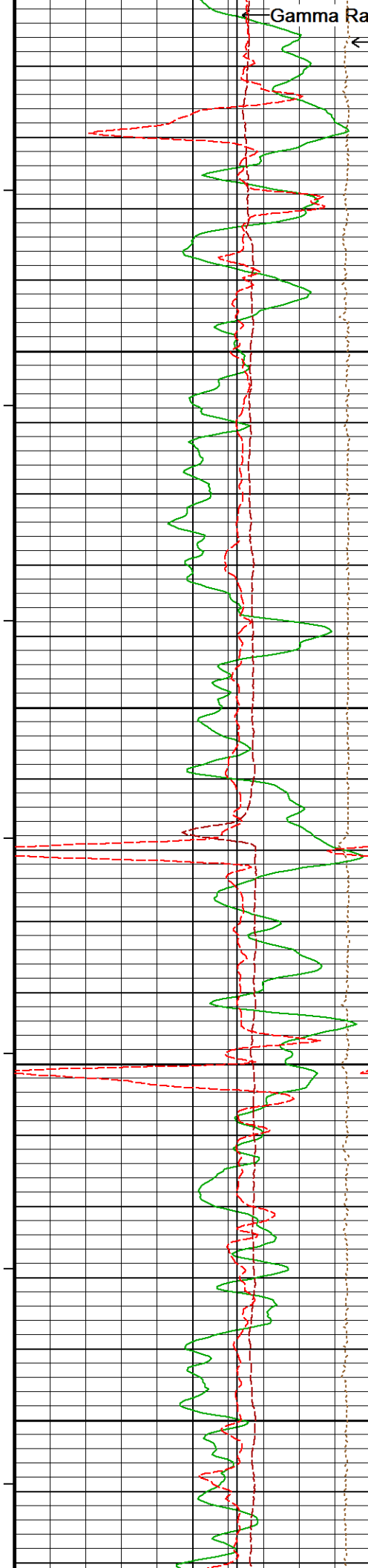












← DST Uphole Tension

89°

400

90°

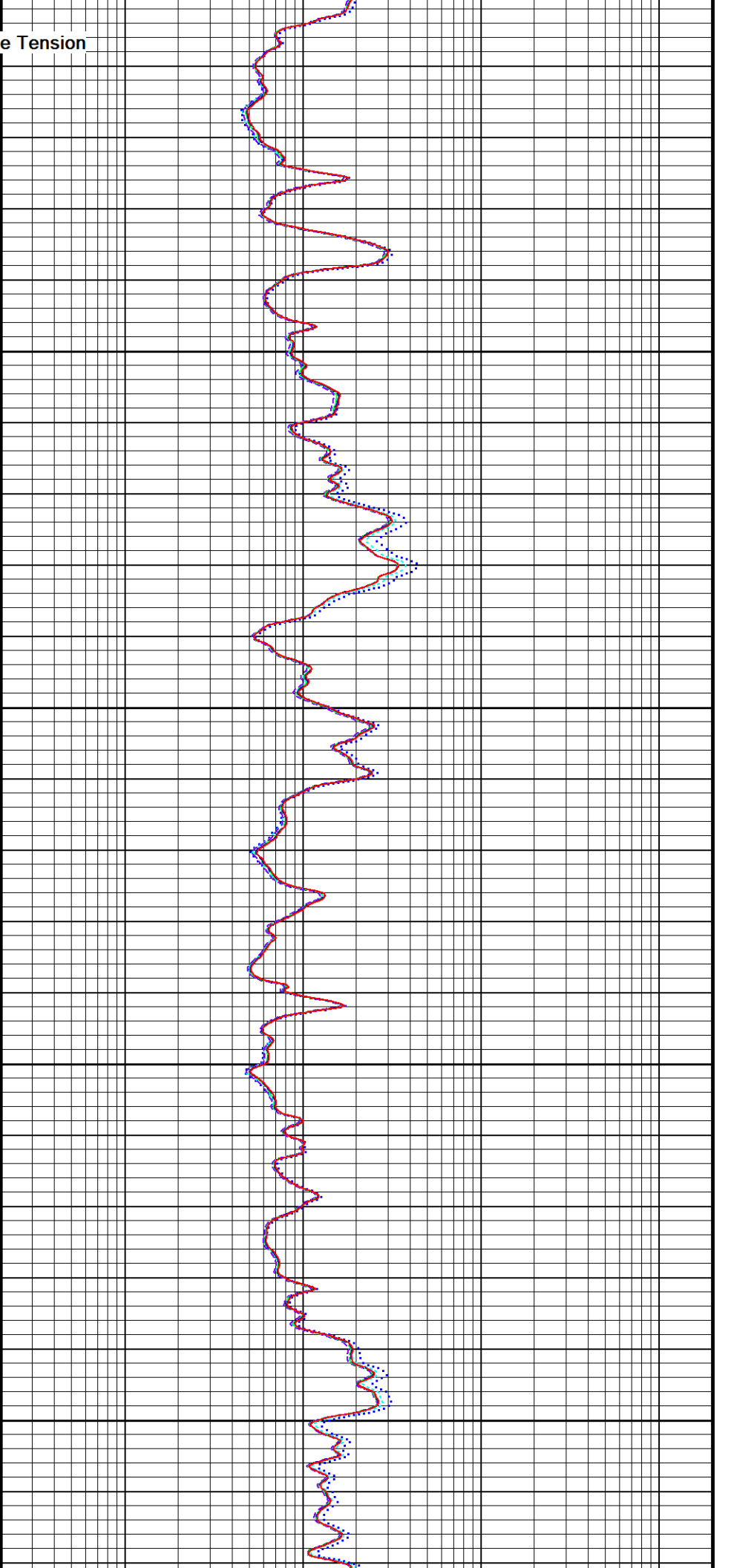
450

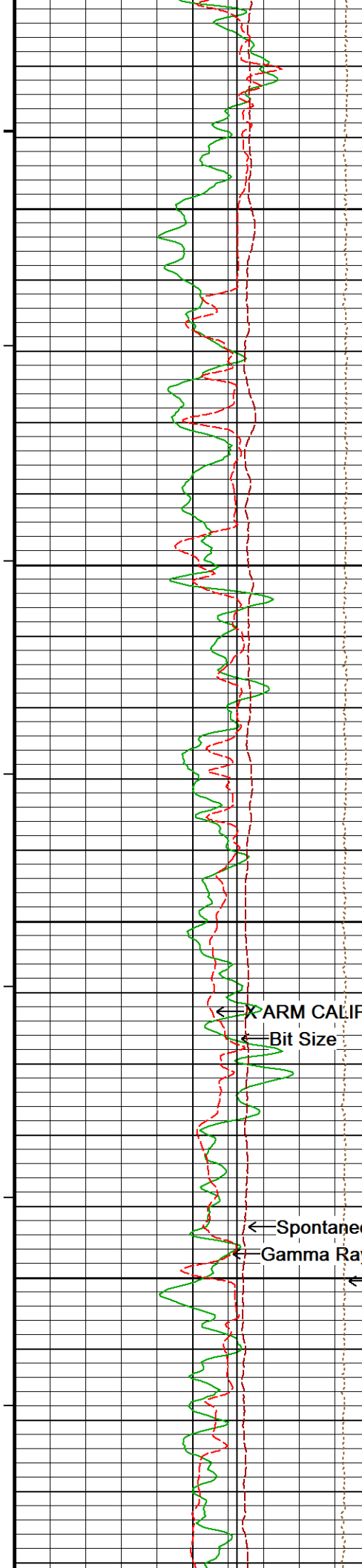
90°

500

91°

550





90°

600

90°

650

90°

700

← ARM CALIPER

← Bit Size

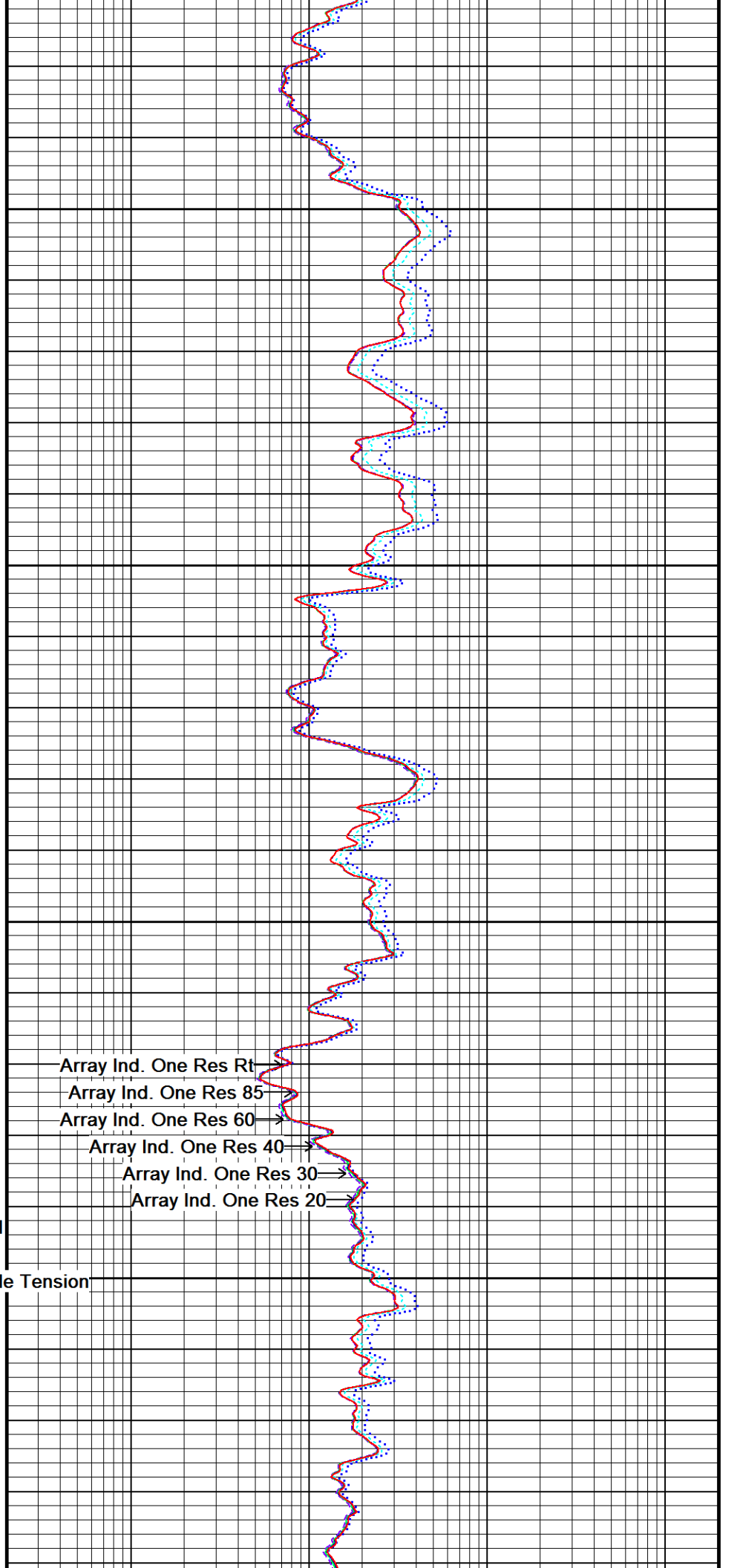
← Spontaneous Potential

← Gamma Ray

← DS750<sub>ph</sub> Tension

89°

89°



Array Ind. One Res Rt

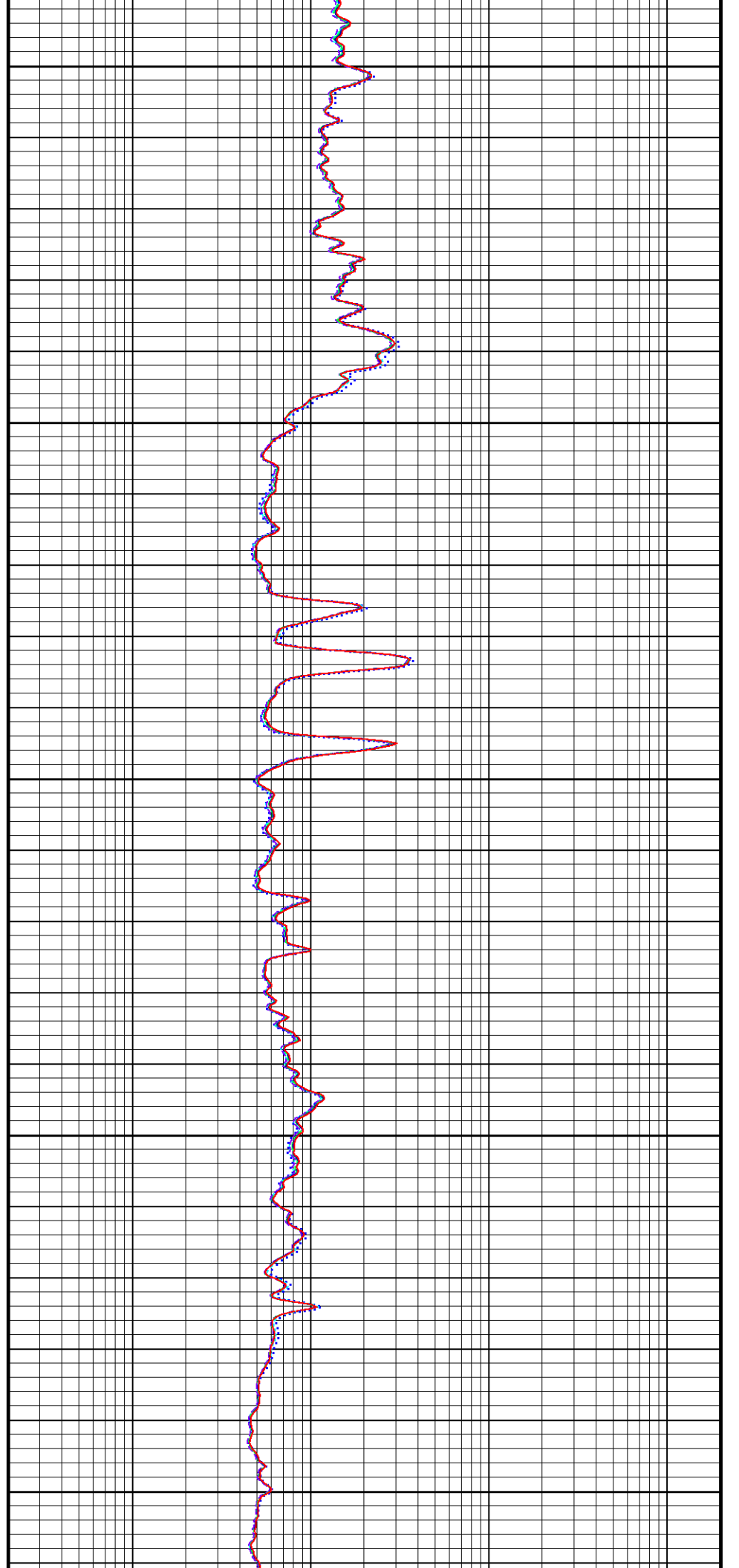
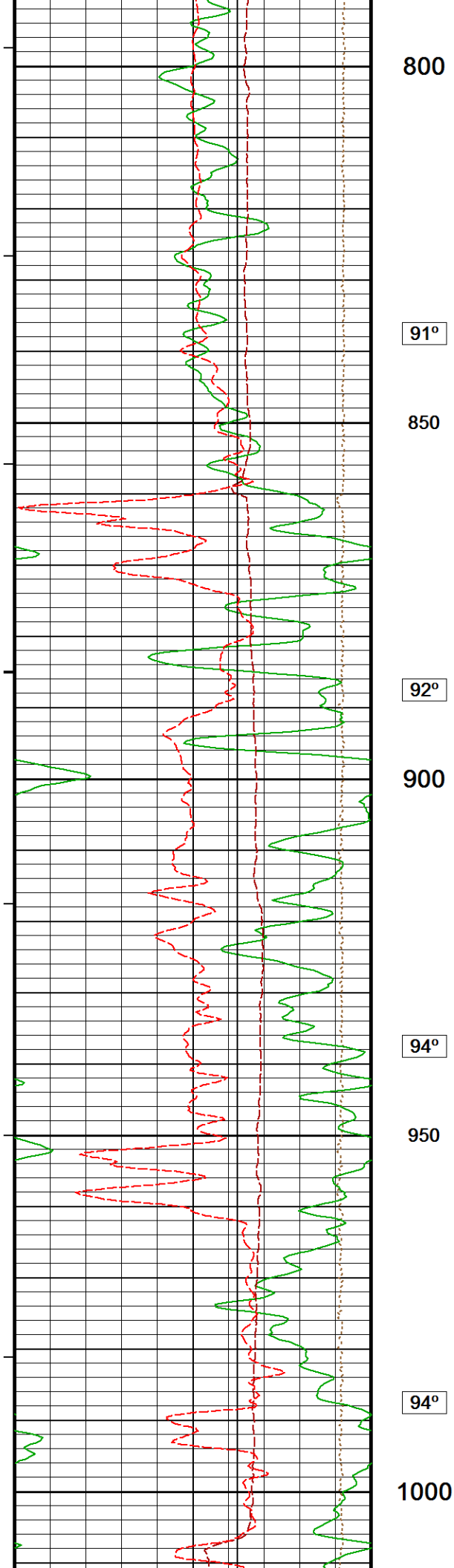
Array Ind. One Res 85

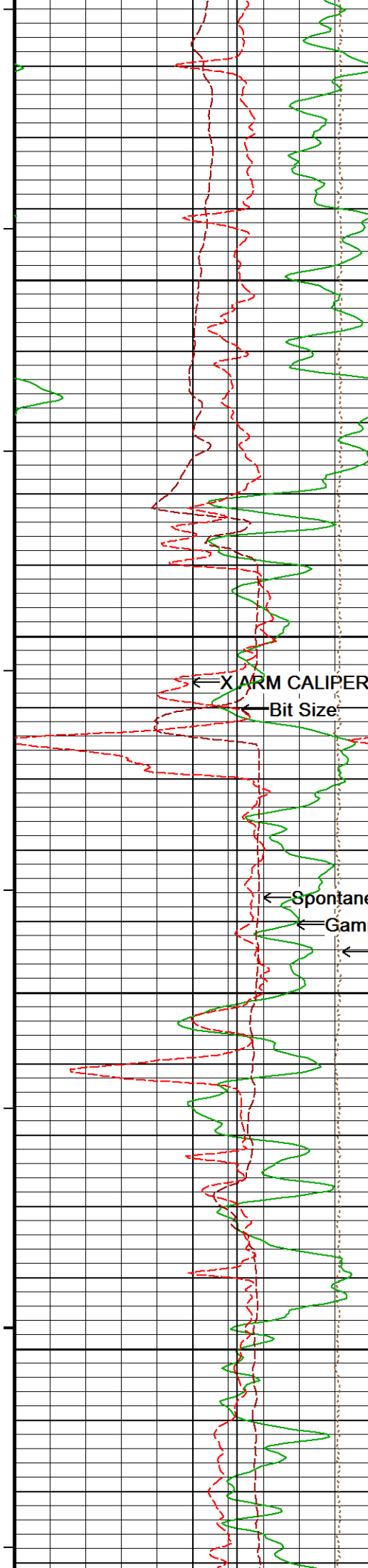
Array Ind. One Res 60

Array Ind. One Res 40

Array Ind. One Res 30

Array Ind. One Res 20





94°

1050

95°

1100

XARM CALIPER

Bit Size

Spontaneous Potential

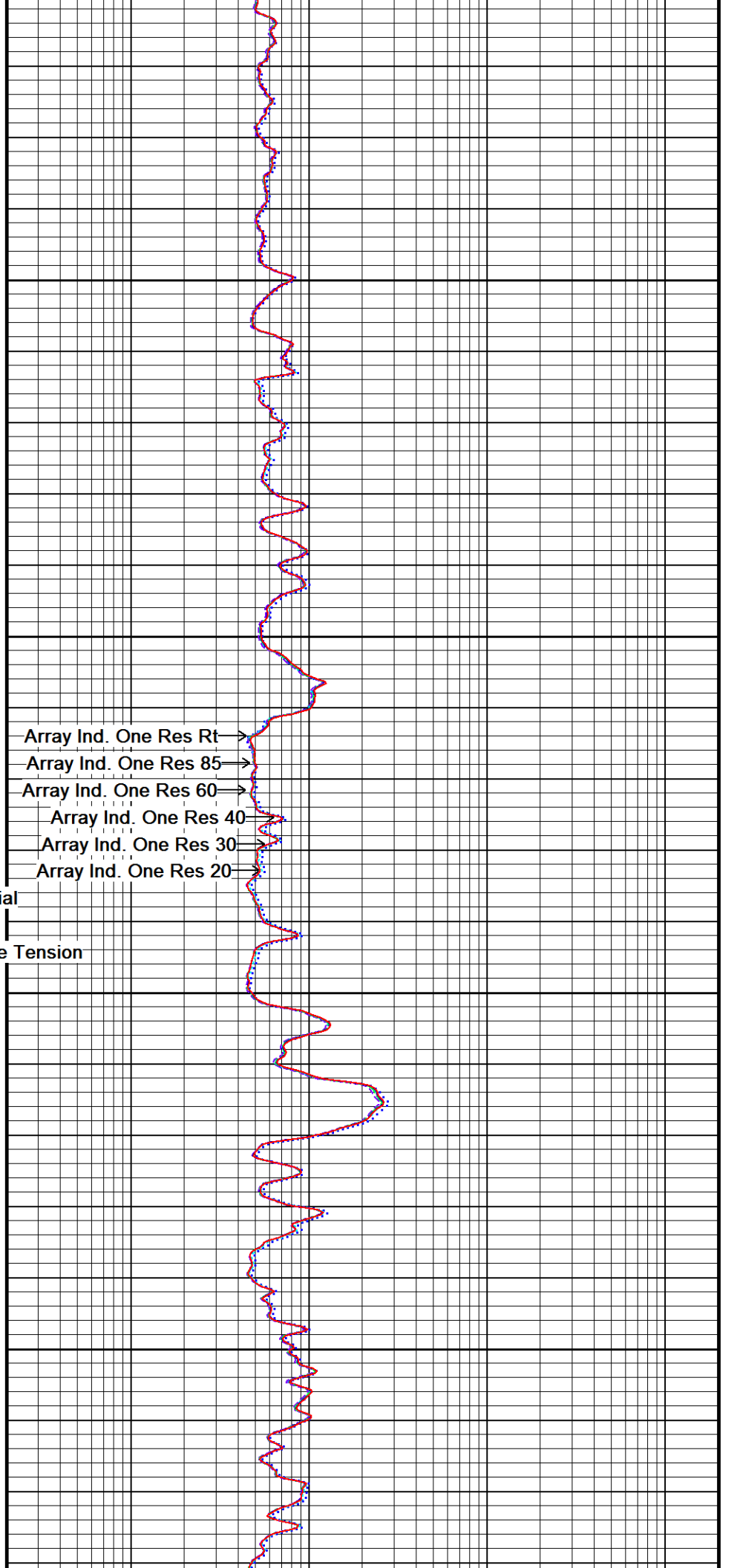
Gamma Ray

DST Uphole Tension

1150

94°

1200



Array Ind. One Res Rt

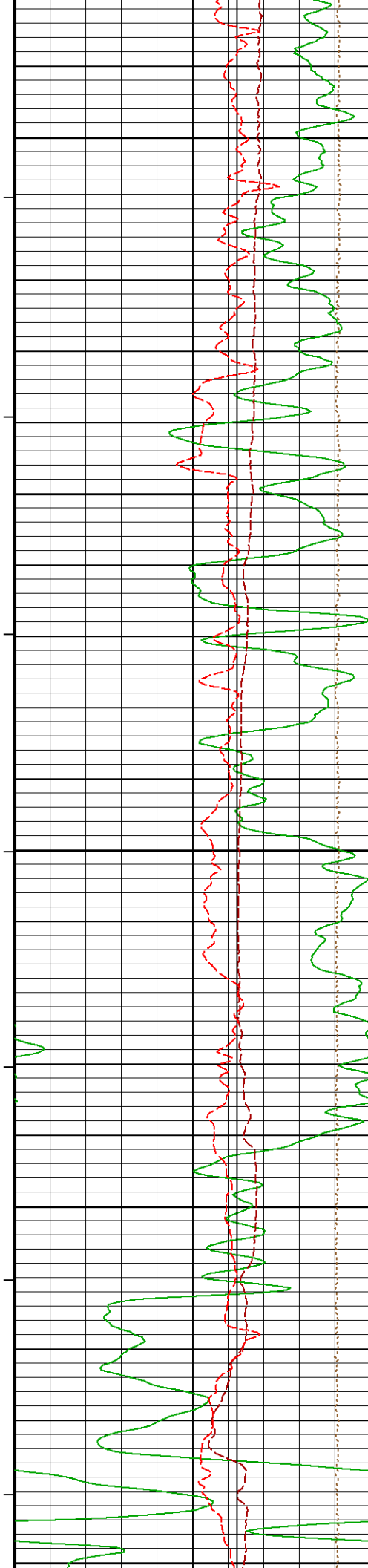
Array Ind. One Res 85

Array Ind. One Res 60

Array Ind. One Res 40

Array Ind. One Res 30

Array Ind. One Res 20



94°

1250

94°

1300

95°

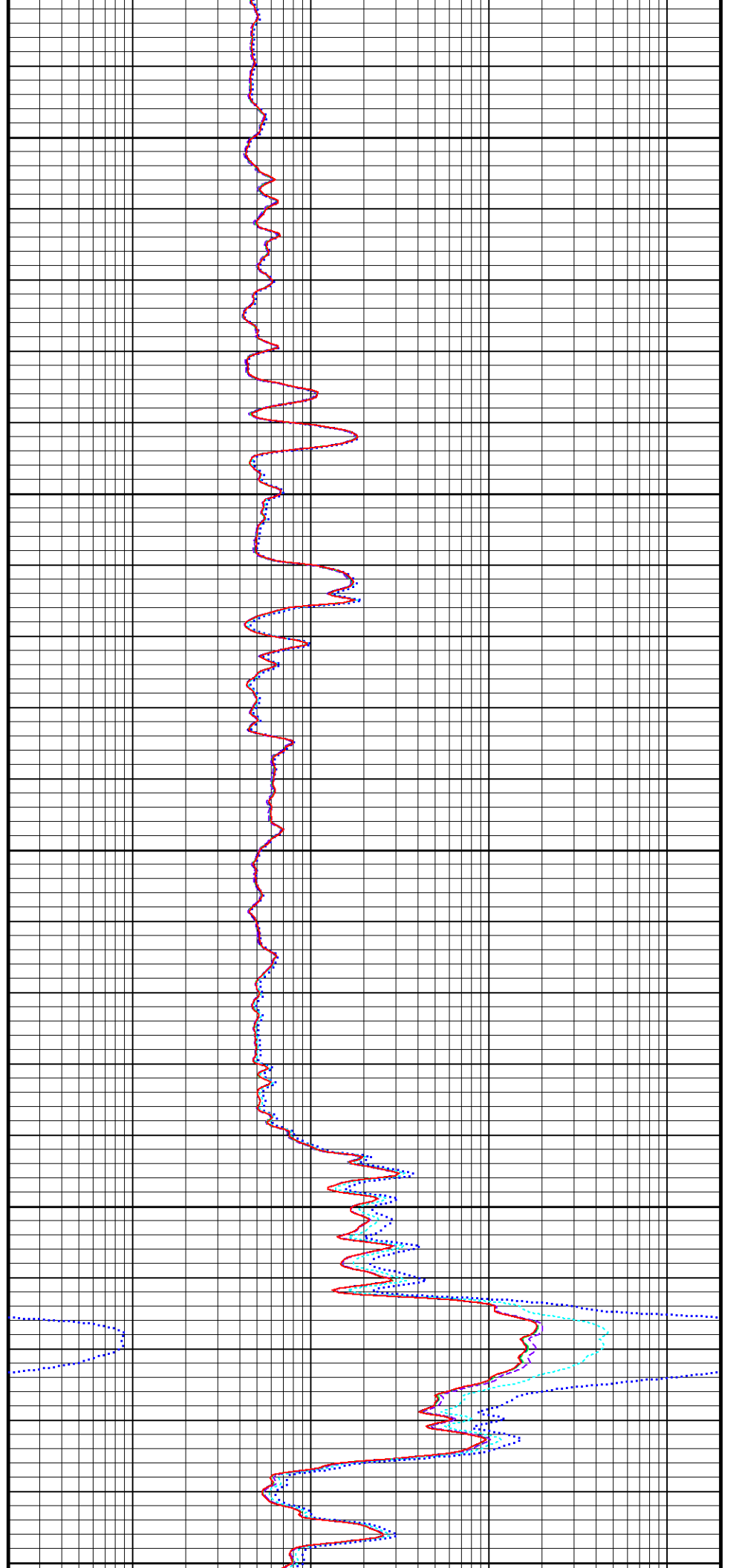
1350

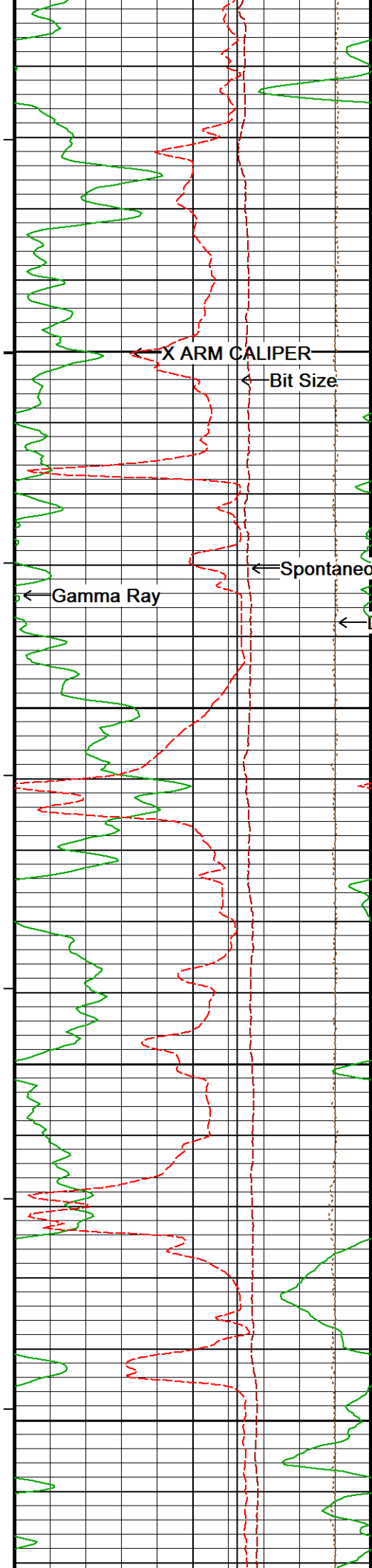
97°

1400

98°

1450





99°

1500

X ARM CALIPER  
Bit Size

Spontaneous Potential

Gamma Ray

DST 2° Hole Tension

99°

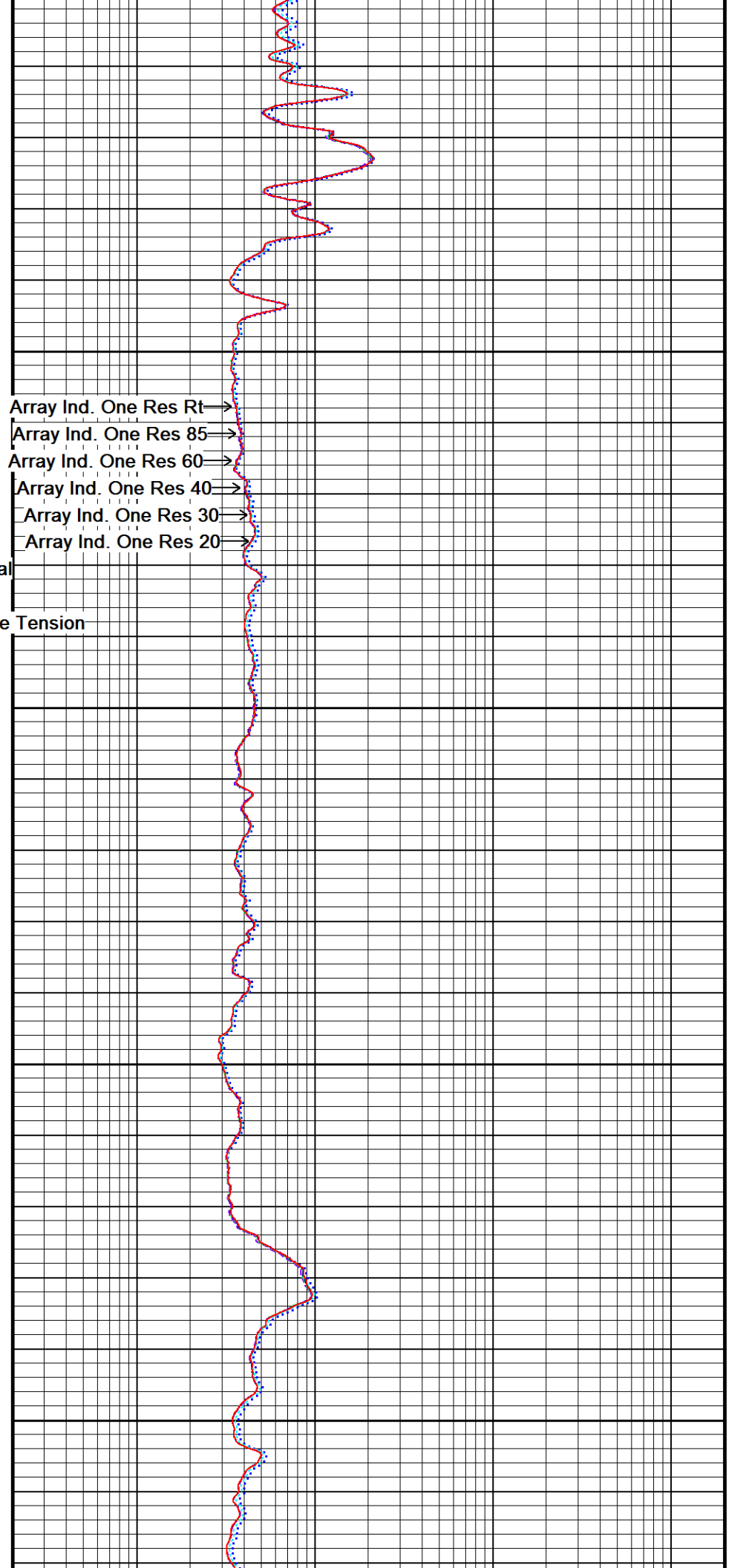
1550

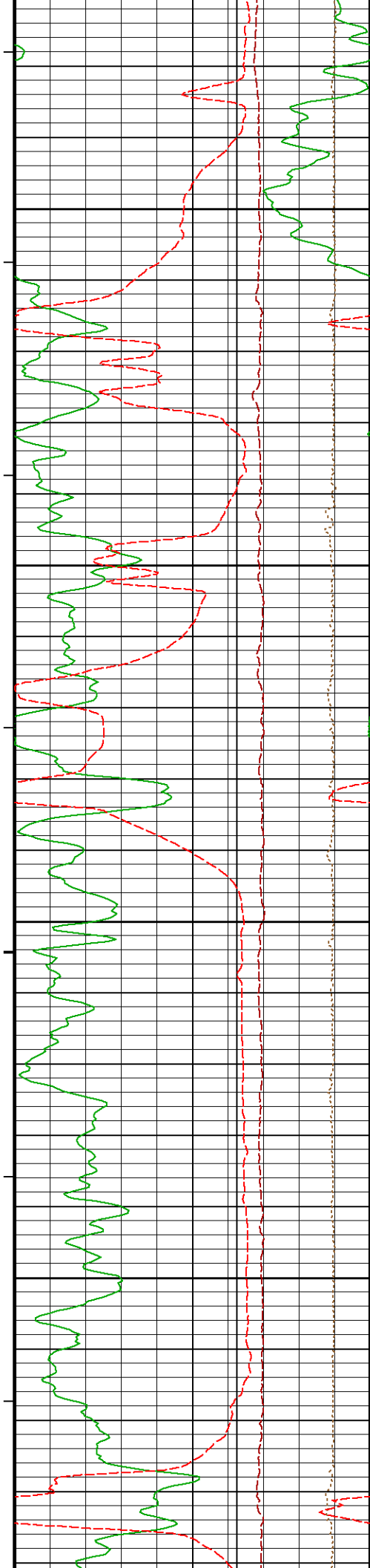
99°

1600

100°

1650





100°

1700

100°

1750

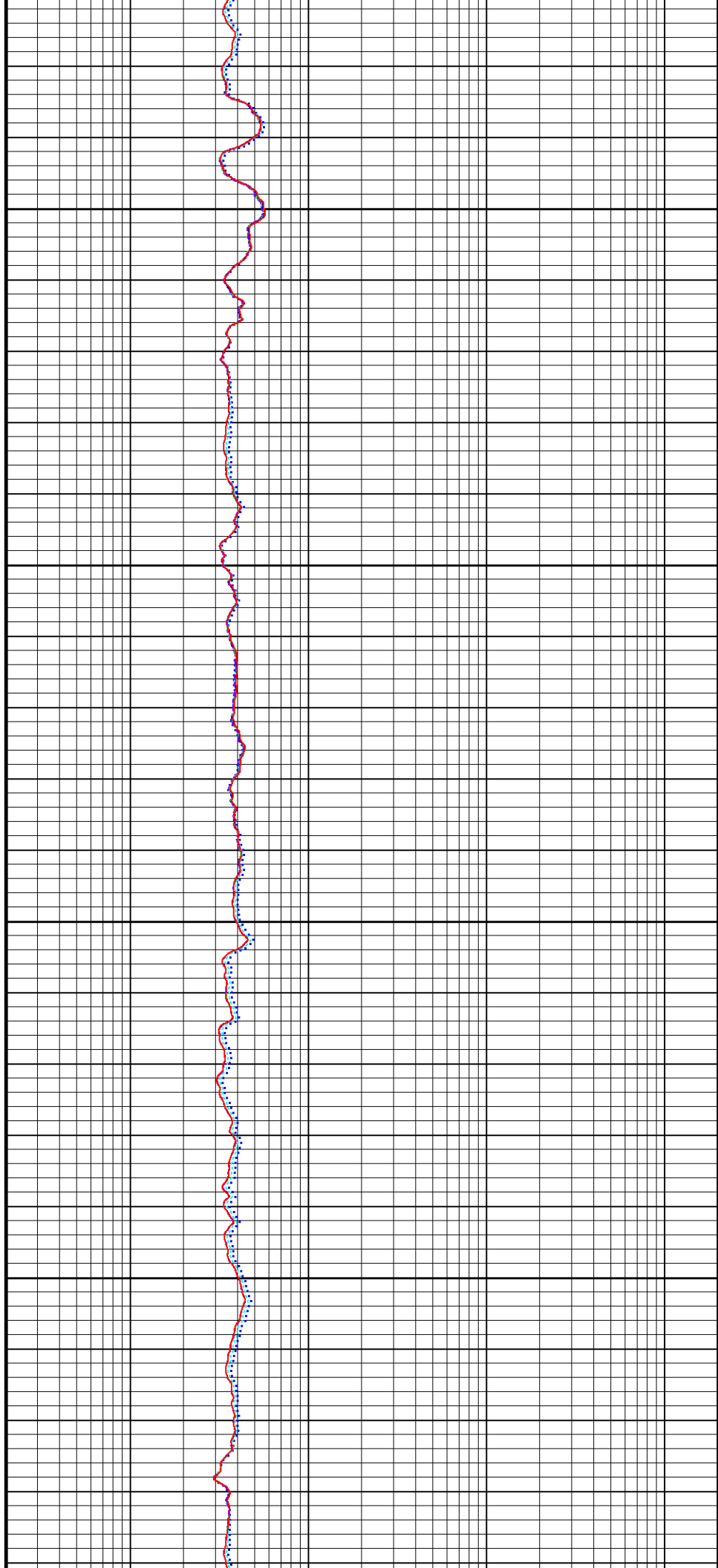
101°

1800

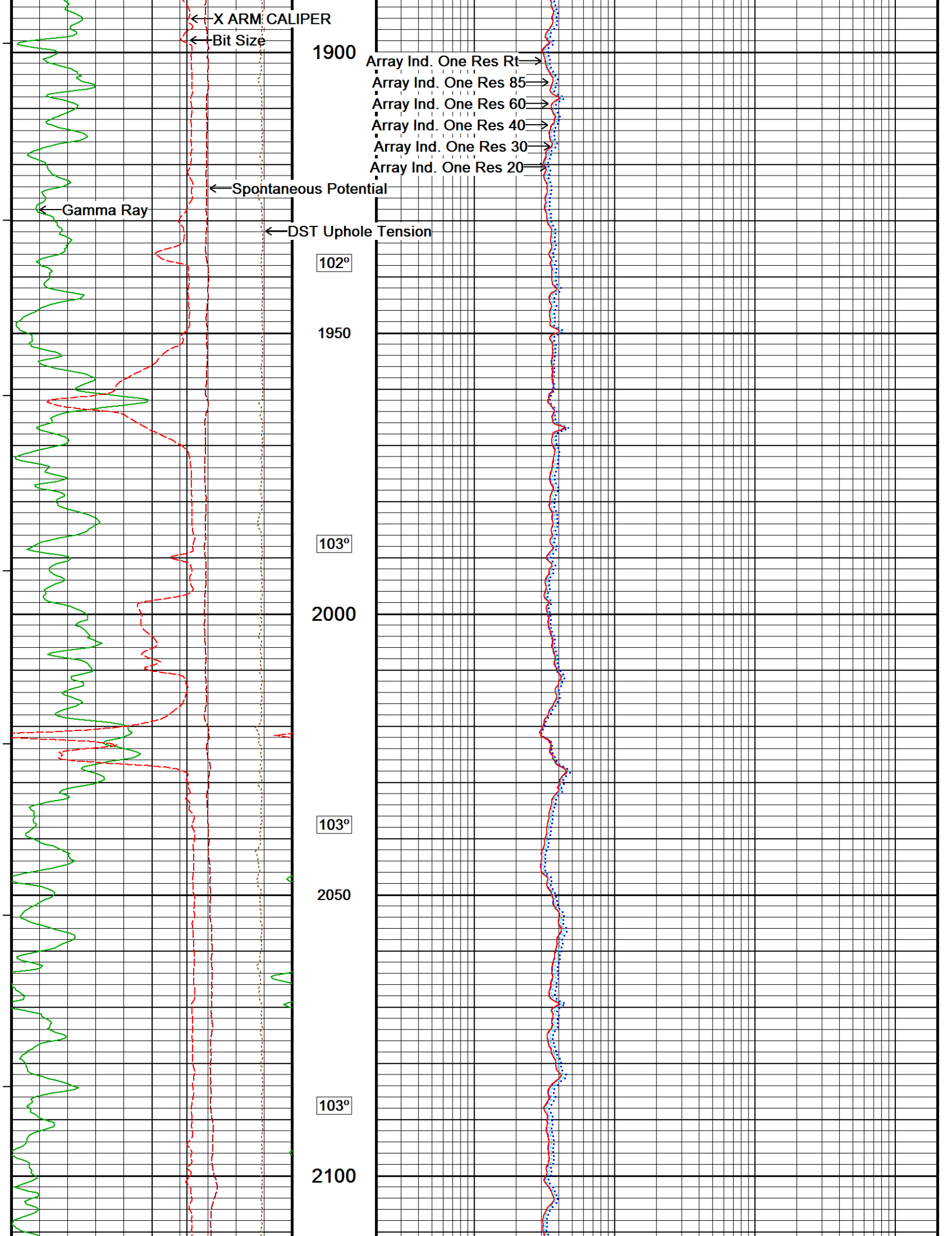
101°

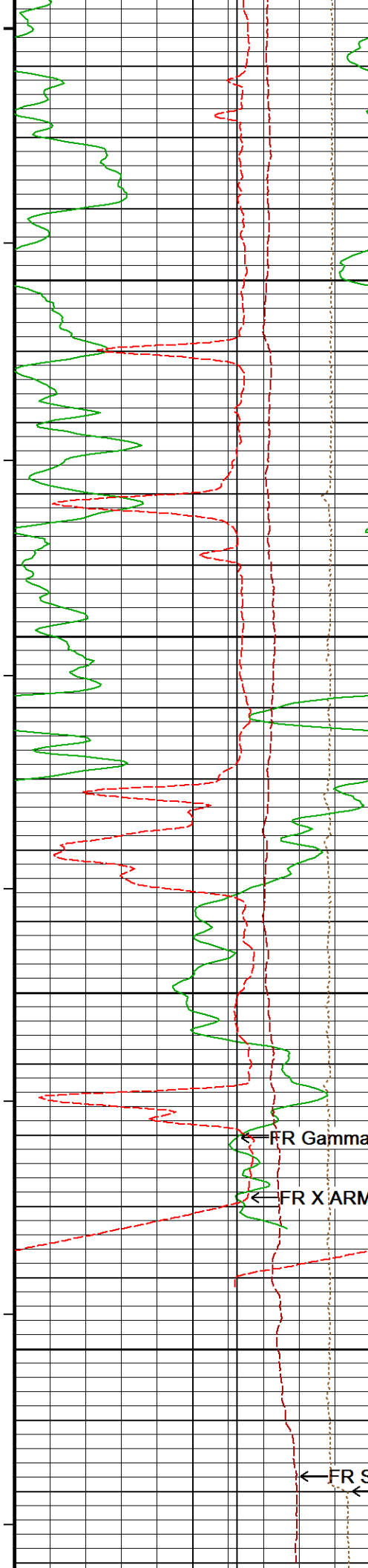
1850

102°









104°

2150

104°

2200

104°

2250

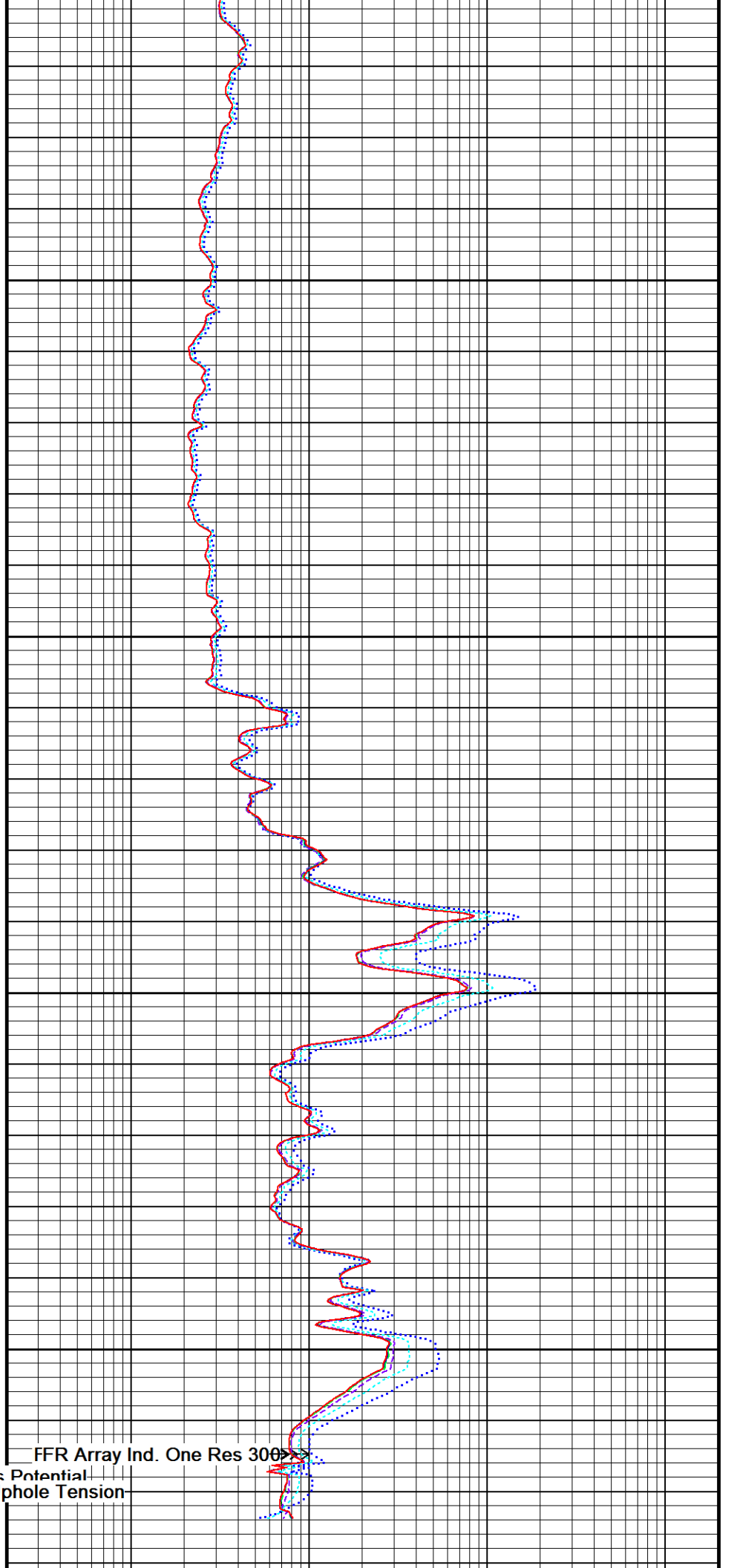
2300

← FR Gamma Ray

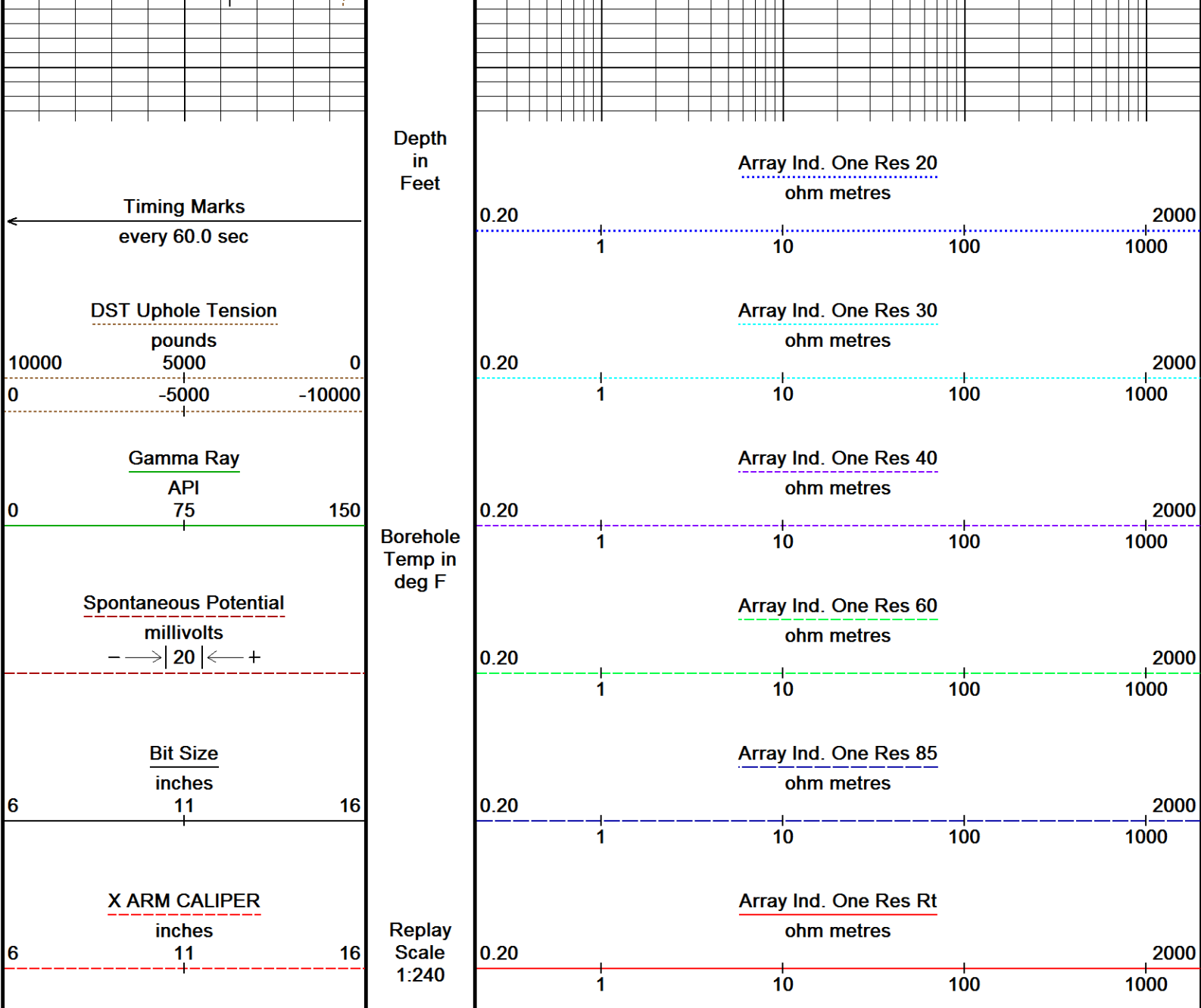
← FR X ARM CALIPER

← FR Spontaneous Potential

← FR DST Uphole Tension



FFR Array Ind. One Res 300

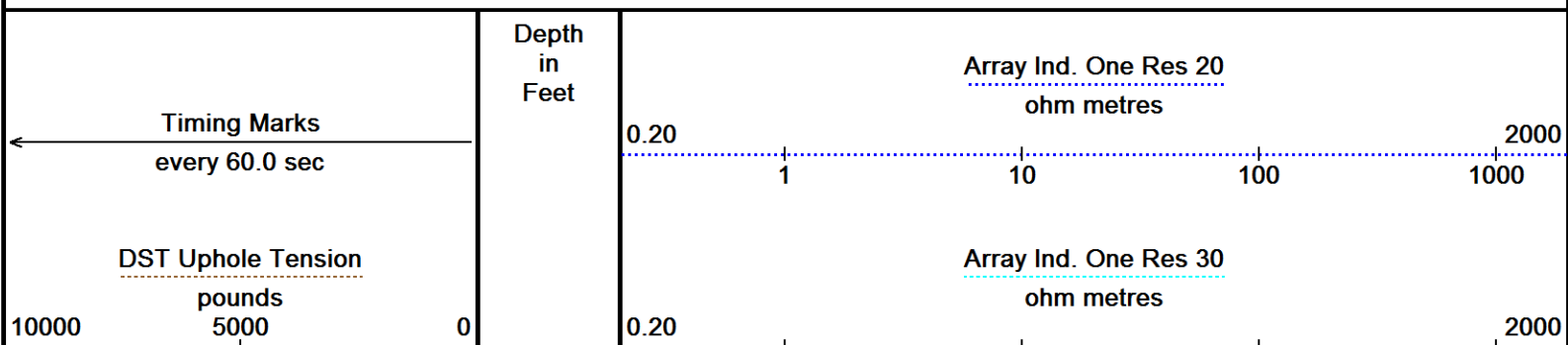


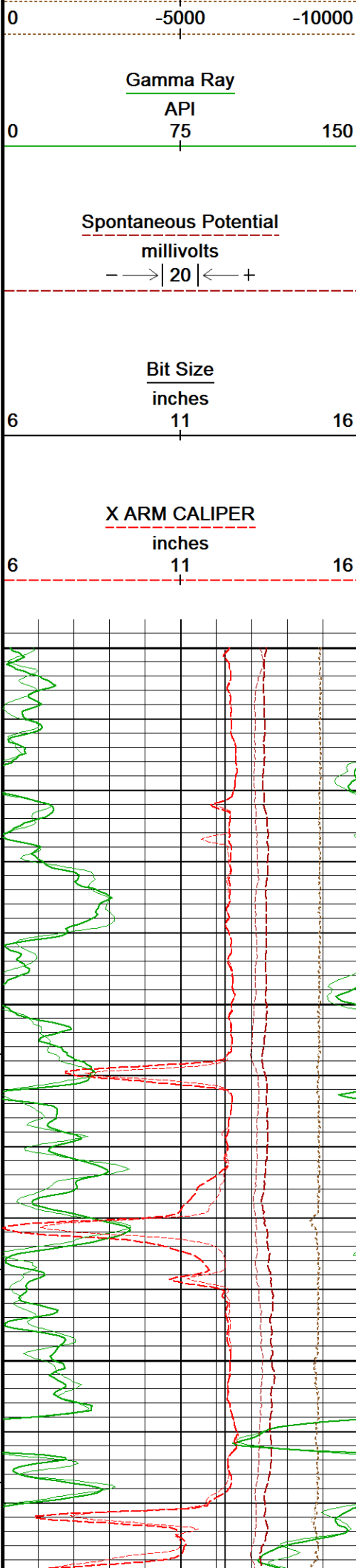
Depth Based Data - Maximum Sampling Increment 10.0cm Filename: C:\Logs\Sandridge\Marr 0780 5-6H\Main Pass.dta System Versions: Logged with 16.01.9649 Plotted with 16.01.9649	Plotted on 20-AUG-2016 00:40 Recorded on 19-AUG-2016 22:50
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↑	5 INCH MAIN PASS 1:240	↑
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↓	5 INCH REPEAT PASS 1:240 5 INCH MAIN PASS 1:240	↓
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Depth Based Data - Maximum Sampling Increment 10.0cm Filename: C:\Logs\Sandridge\Marr 0780 5-6H\Repeat Pass.dta Filename: C:\Logs\Sandridge\Marr 0780 5-6H\Main Pass.dta System Versions: Logged with 16.01.9649 Plotted with 16.01.9649	Plotted on 20-AUG-2016 00:40 Recorded on 19-AUG-2016 22:35 Recorded on 19-AUG-2016 22:50
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Borehole  
Temp in  
deg F

Replay  
Scale  
1:240

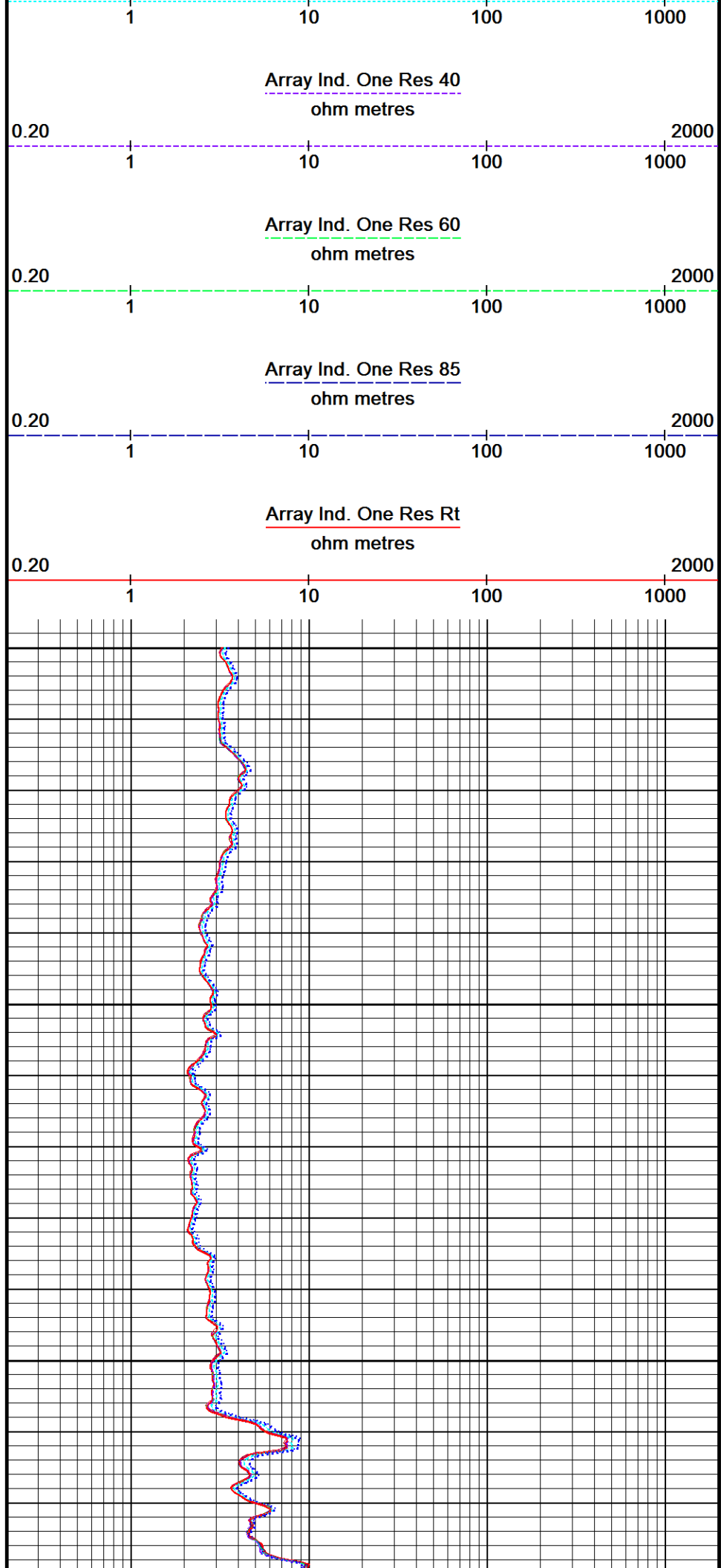
2100

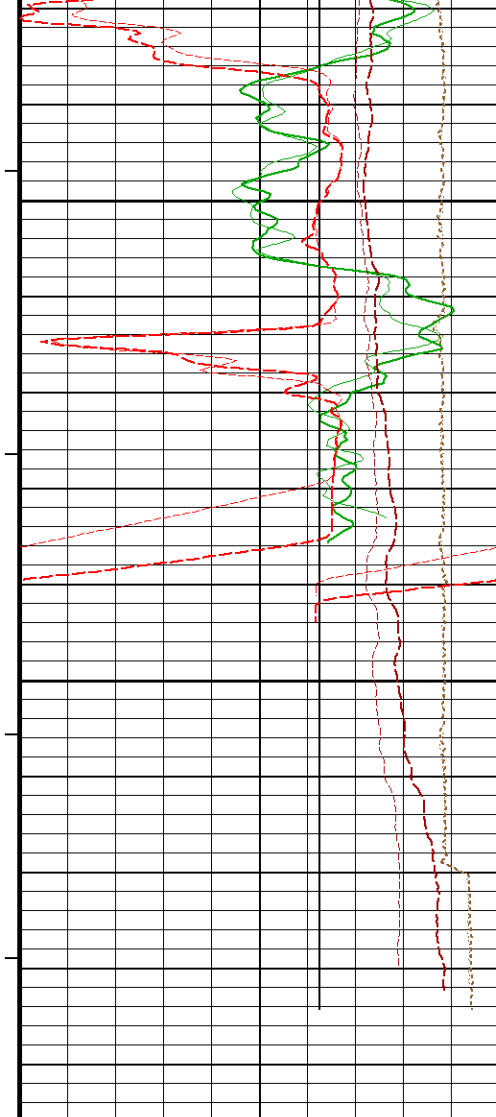
103°

2150

104°

2200





104°

2250

104°

2300

TD

Depth  
in  
Feet

Timing Marks  
every 60.0 sec

DST Uphole Tension  
pounds

10000 5000 0  
0 -5000 -10000

Gamma Ray

API  
75

0 150

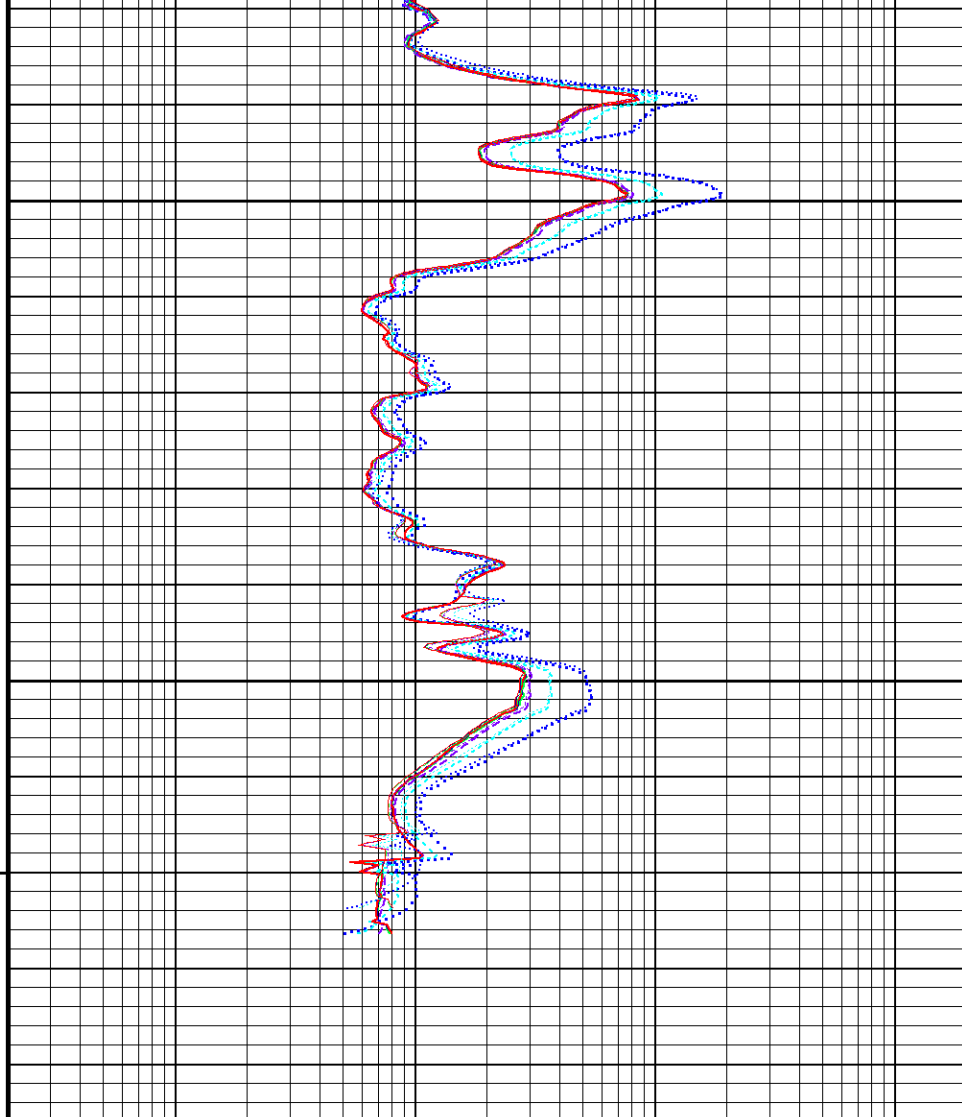
Spontaneous Potential  
millivolts

- —> | 20 | <— +

Bit Size  
inches

6 11 16

Borehole  
Temp in  
deg F



Array Ind. One Res 20  
ohm metres

0.20 1 10 100 1000 2000

Array Ind. One Res 30  
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 85  
ohm metres

0.20 1 10 100 1000 2000

<b>X ARM CALIPER</b> inches 6                      11                      16	Replay Scale 1:240	<b>Array Ind. One Res Rt</b> ohm metres 0.20                      1                      10                      100                      2000
Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 20-AUG-2016 00:40 Filename: C:\Logs\Sandridge\Marr 0780 5-6H\Repeat Pass.dta Recorded on 19-AUG-2016 22:35 Filename: C:\Logs\Sandridge\Marr 0780 5-6H>Main Pass.dta Recorded on 19-AUG-2016 22:50 System Versions: Logged with 16.01.9649 Plotted with 16.01.9649		
5 INCH REPEAT PASS 1:240 5 INCH MAIN PASS 1:240		

## BEFORE SURVEY CALIBRATION

C:\Logs\Sandridge\Marr 0780 5-6H>Main Pass.dta

General Constants All 000		Last Edited on 19-AUG-2016,19:20
General Parameters		
Mud Resistivity	1.800	ohm-metres
Mud Resistivity Temperature	69.000	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	Quad Arm Caliper X	
HVOL Caliper 2	N/A	
Annular Volume Diameter	9.625	inches
Caliper for Differential Caliper	None	
Rwa Parameters		
Porosity used	Wyllie Lime. Sonic Por.	
Resistivity used	Array Ind. Two Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-E.A 514		Field Calibration on 03-AUG-2016 04:47
	Measured	Calibrated (API)
Background	91	60
Calibrator (Gross)	1460	972
Calibrator (Net)	1369	912

Gamma Calibration Tolerances MCG-E.A 514	
Ratio	1.501
<div style="display: flex; align-items: center; justify-content: center;"> <div style="width: 100px; height: 15px; border: 1px solid black; position: relative;"> <div style="position: absolute; top: -5px; left: 10px;">1.40</div> <div style="position: absolute; top: -5px; left: 30px;">1.475</div> <div style="position: absolute; top: -5px; left: 50px;">1.55</div> <div style="background-color: green; width: 20px; height: 100%;"></div> </div> <div style="margin-left: 10px;">Counts/API</div> </div>	

Gamma Constants MCG-E.A 514		Last Edited on 19-AUG-2016,19:21
Gamma Calibrator Number GRC 072		
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.16	gm/cc
Caliper Source for Processing	Bit Size	
Tool Position	Centred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-E.A 514		Field Calibration on 18-OCT-2014,09:50
	Measured	Calibrated(Deg F)
Lower	32.00	32.00
Upper	100.00	100.00

High Resolution Temperature Constants MCG-E.A 514		Last Edited on 18-OCT-2014,09:50
Pre-filter Length	11	

## Base Calibration

Reading No	Measured	Calibrator Size (in)
1	12877	3.98
2	17957	5.96
3	23046	7.97
4	28075	9.84
5	33795	11.91
6	N/A	N/A

## Field Calibration

Measured Caliper (in)	Actual Caliper (in)
11.92	11.91

## Induction Calibration MAI-C.A 456

Base Calibration on 21-JUL-2016,14:56  
Field Check on 03-AUG-2016 04:19

## Base Calibration

Test Loop Calibration		Measured		Calibrated (mmho/m)	
Channel		Low	High	Low	High
1		16.2	452.6	9.3	966.2
2		5.6	366.0	7.6	821.4
3		2.9	251.0	5.2	566.0
4		1.3	130.8	2.6	279.2

Array Temperature 73.2 Deg F

Test Loop Calibration Verified 29-JUL-2016 17:55

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	-2.4	2136.4	-4.0	2134.5
2	15.6	1966.2	14.9	1965.3
3	16.2	1682.5	15.7	1681.7
4	11.6	1126.9	11.3	1126.4
Deep	9.9	1072.4	9.5	1071.8
Medium	25.0	2238.7	24.4	2237.9
Shallow	22.9	2941.9	21.9	2940.5

Array Temperature 82.6 65.2 Deg F

## Induction Calibration Tolerances MAI-C.A 456

Low Conductivity 1	16.2		mmho/m	High Conductivity 1	452.6		mmho/m
Low Conductivity 2	5.6		mmho/m	High Conductivity 2	366.0		mmho/m
Low Conductivity 3	2.9		mmho/m	High Conductivity 3	251.0		mmho/m
Low Conductivity 4	1.3		mmho/m	High Conductivity 4	130.8		mmho/m
Background Vx 1	0.0		mmho/m	Phase Check Loop 1	0.0		%
Background Vx 2	0.0		mmho/m	Phase Check Loop 2	0.0		%
Background Vx 3	0.0		mmho/m	Phase Check Loop 3	0.0		%
Background Vx 4	0.0		mmho/m	Phase Check Loop 4	0.0		%

## Induction Constants MAI-C.A 456

Last Edited on 19-AUG-2016,19:21

## Induction Model

RtAP-WBM

## Borehole Correction Constants

Tool Centred	Yes
Hole Size Source	Quad Arm Caliper X
Hole Size Constant Value	N/A inches
Stand-off Type	N/A
Stand-off	N/A inches
Number of Fins on Stand-off	N/A
Stand-off Fin Angle	N/A degrees
Stand-off Fin Width	N/A inches
Rm Source	Global Value: Temperature Corrected
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
Symmetrised Receiver Gains			
Receiver 1		1.00	
Receiver 2		1.00	
Receiver 3		1.00	
Receiver 4		1.00	
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:\Logs\Sandridge\Marr 0780 5-6H\Main Pass.dta

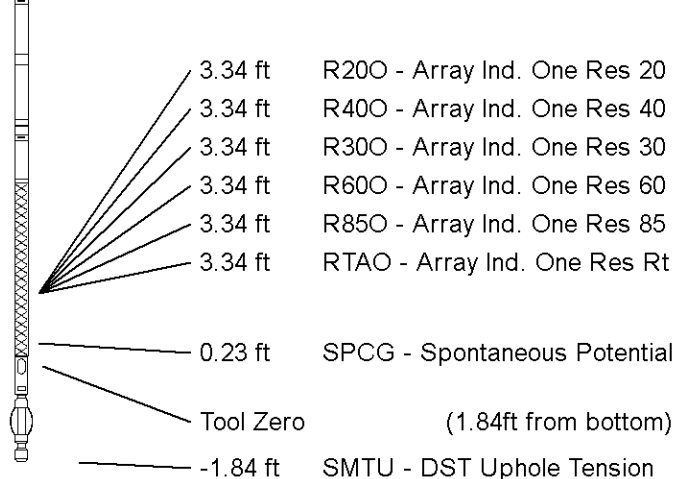
Cablehead, 11 pin CBH-C 0 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in		
Compact Swivel Head Adaptor SHA-J.B 588 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in		
Compact Comms Gamma MCG-E.A 514 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in	47.78 ft	GRGC - MCG Gamma Ray
Compact Quad Arm Caliper MXC-B.A 110 LG: 7.49 ft WT: 77.2 lb OD: 2.240 in	44.87 ft	CGXT - MCG External Temperature
Compact Sonic MSS-D.A 401 LG: 12.52 ft WT: 72.8 lb OD: 2.244 in	39.36 ft	XCXD - Quad Arm Caliper X
	30.50 ft	TR11 - 4' Transit Time
	30.00 ft	TR21 - 3' Transit Time
	29.00 ft	TR22 - 5' Transit Time
Compact Quad Arm Caliper MXC-B.A 109 LG: 7.49 ft WT: 77.2 lb OD: 2.240 in	26.50 ft	DT35 - 3-5' Compensated Sonic
	26.50 ft	SPRS - Wyllie Sand. Sonic Por.
	19.35 ft	AVOL - Annular Volume
	19.35 ft	HVOL - Hole Volume



Compact Focussed Electric  
MFE-C.A 417 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

Compact Induction  
MAI-C.A 456 LG: 12.52 ft WT: 48.5 lb OD: 2.240 in

Total Length: 59.47 ft Weight: 434.3 lb



All measurements relative to tool zero.

COMPANY	SANDRIDGE
WELL	MARR 0780 5-6H
FIELD	NORTH PARK
PROVINCE/COUNTY	JACKSON
COUNTRY/STATE	USA / COLORADO

Elevation Kelly Bushing	8135.50	feet	First Reading	2316.66	feet
Elevation Drill Floor	8135.50	feet	Depth Driller	2325.00	feet
Elevation Ground Level	8130.00	feet	Depth Logger	2320.00	feet



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COMPACT ARRAY INDUCTION  
LOG