

# HALLIBURTON

## ARRAY COMPENSATED TRUE RESISTIVITY LOG

COMPANY		HARTMAN OIL COMPANY, INC	
WELL		WARD #4 TWIN	
FIELD/BLOCK		DAMME	
COUNTY		FINNEY	
STATE		KANSAS	
Permanent Datum	GL	Sect. 16	Twp. 22S
Log measured from	KB		Rge. 33W
Drilling measured from	KB		Elev. 2889.0 ft
Date	21-Mar-18		8.0 ft above perm. Datum
Run No.	ONE		Elev.: K.B. 2897.0 ft
Depth - Driller	4800.0 ft		D.F. 2897.0 ft
Depth - Logger	4803.0 ft		G.L. 2889.0 ft
Bottom - Logged Interval	4784.00 ft		
Top - Logged Interval	342.00 ft		
Casing - Driller	8.625 in		@
Casing - Logger	342.0 ft		@
Bit Size	7.875 in		@
Type Fluid in Hole	Water Based Mud		@
Density	9.1 ppg		51.00 sl/qt
PH	9.00 pH		8.0 cpm
Source of Sample	MUD PIT		
Rm @ Meas. Temperature	0.86 ohmm		@ 75.00 degF
Rmf @ Meas. Temperature	0.86 ohmm		@ 75.00 degF
Rmc @ Meas. Temperature	1.02 ohmm		@ 75.00 degF
Source Rmf	MEAS		MEAS
Rm @ BHT	0.56 ohmm		@ 118.0 degF
Time Since Circulation	5.0 hr		
Time on Bottom	21-Mar-18 12:25		
Max. Rec. Temperature	118.00 degF		@ 4803.0 ft
Equipment	12147634		EL RENO
Recorded By	JORGE ORLANDO PEREZ		
Witnessed By	KITT NOAH		

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Service Ticket No.: 904699315		API No.: 15-055-22481-00-00		PGM Version: WL INSITE R5.0.5 (Build 8)	
CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE			RESISTIVITY SCALE CHANGES		
Date	Sample No.		Type Log	Depth	Scale Up Hole
Depth-Driller					Scale Down Hole
Type Fluid in Hole					
Density	Viscosity				
Ph	Fluid Loss				
Source of Sample			RESISTIVITY EQUIPMENT DATA		
Rm @ Meas. Temp	@	@	Run No.	Tool Type & No.	Pad Type
Rmf @ Meas. Temp.	@	@	ONE	ACRT	N/A
Rmc @ Meas. Temp.	@	@		I-11026095	
Source Rmf	Rmc			S-11005908	
Rm @ BHT	@	@			
Rmf @ BHT	@	@			
Rmc @ BHT	@	@			
EQUIPMENT DATA					
GAMMA		ACOUSTIC		DENSITY	
Run No.	ONE	Run No.		Run No.	ONE
Serial No.	11958947	Serial No.		Serial No.	10951315
Model No.	GTET	Model No.		Model No.	SDLT
Diameter	3.625"	No. of Cent.		Diameter	5.5"
Detector Model No.	T-102	Spacing		Log Type	GAM-GAM
Type	SCINT			Source Type	CS137
Length	8"	LSA [Y/N]		Serial No.	5168GW
Distance to Source	N/A	FWDA [Y/N ]		Strength	1.5 Ci
LOGGING DATA					
GENERAL		GAMMA		ACOUSTIC	
Run	Depth	Speed	Scale	Scale	DENSITY
No.	From	To	L	R	Scale
ONE	TD	CSC	0	150	30

Scale		Matrix		NEUTRON	
L	R	L	R	L	R
30	10	2.71 gr/cc	30	10	LIME

ONE	TD	CSG	REC	0	150			30	-10	2.77 g/cc	30	-10	LIME
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DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks: ANNULAR HOLE VOLUME CALCULATED FOR 5.5 INCH CASING

CHLORIDES REPORTED AT 2250 ppm

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

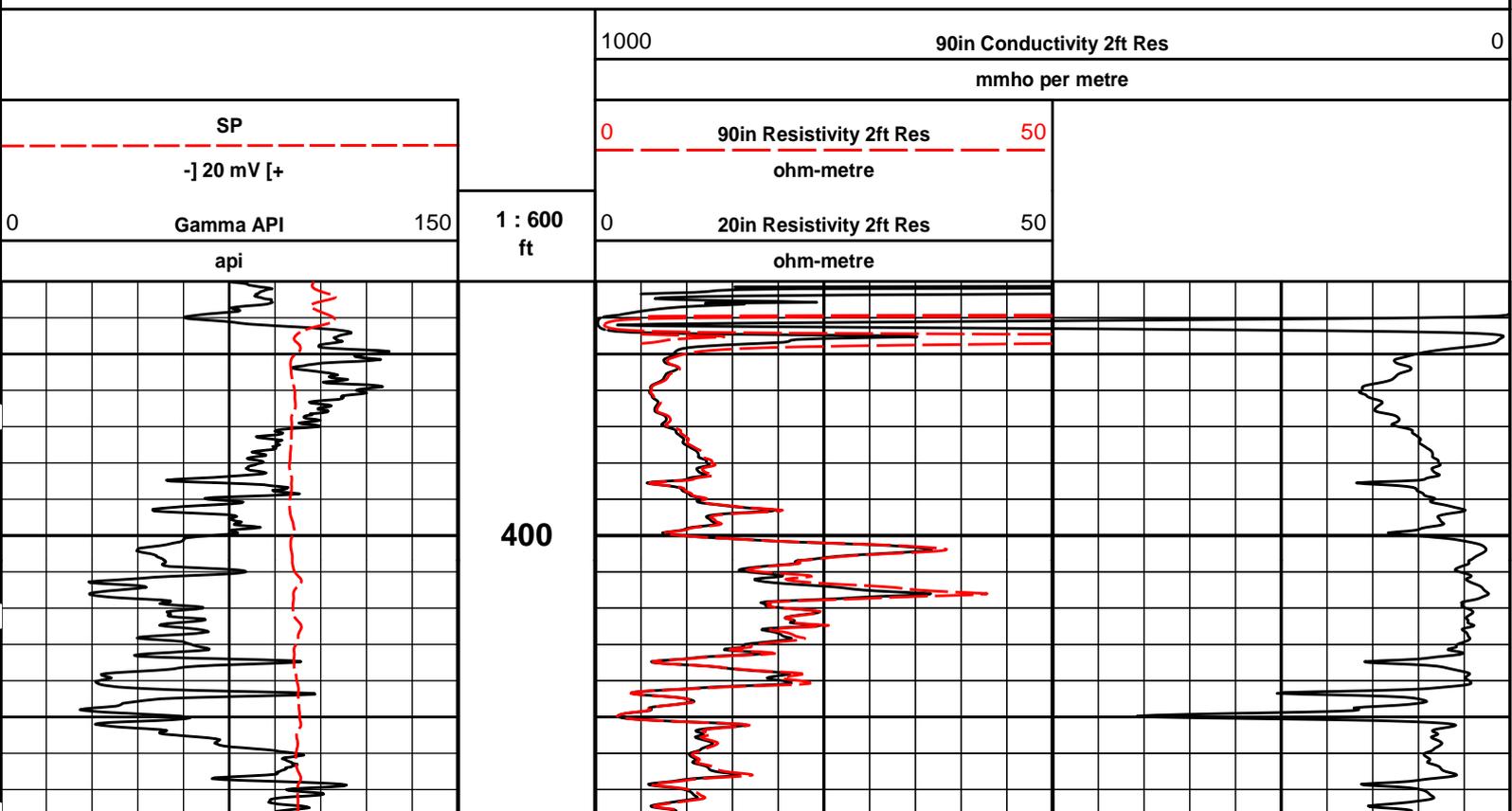
HALLIBURTON

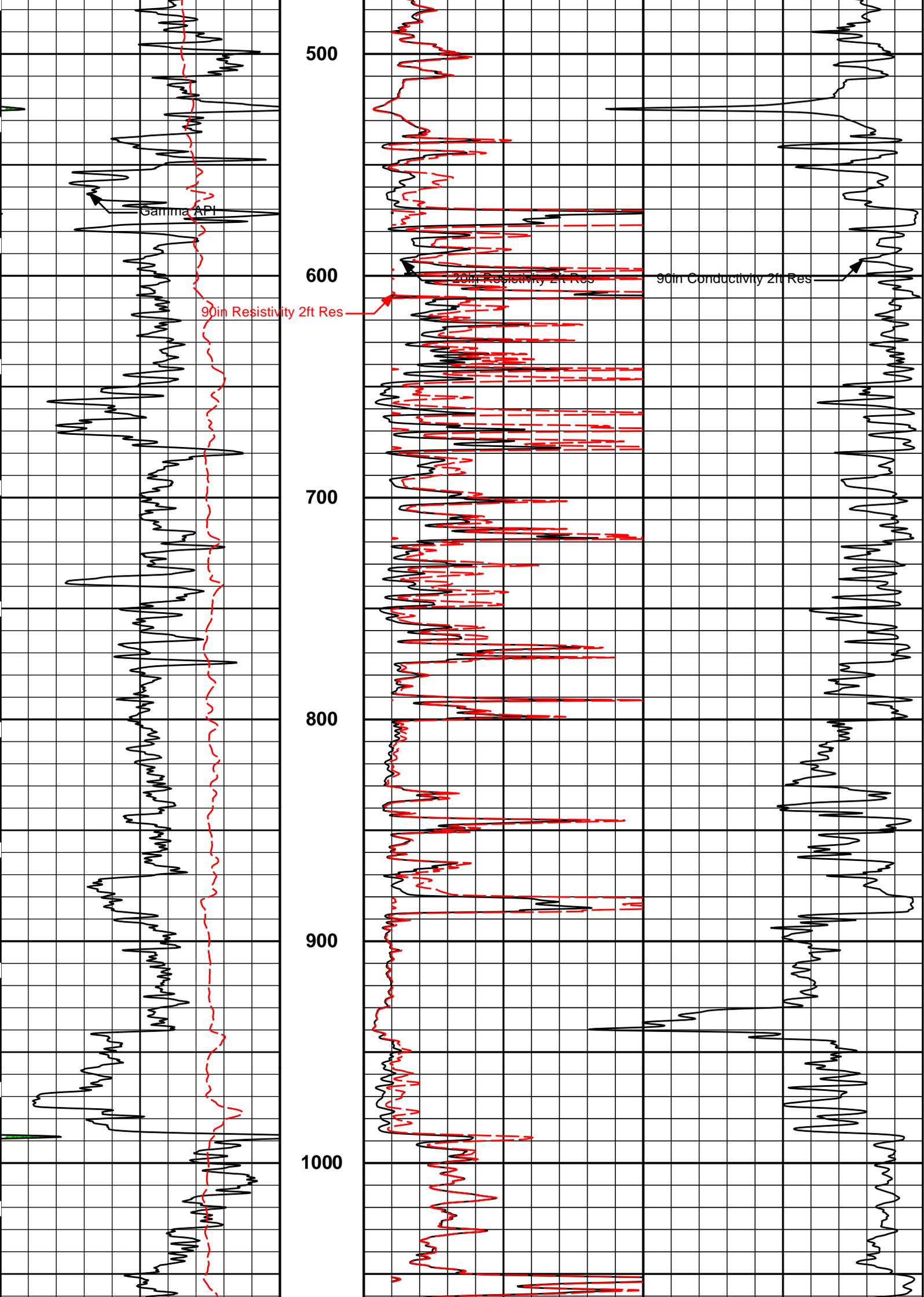


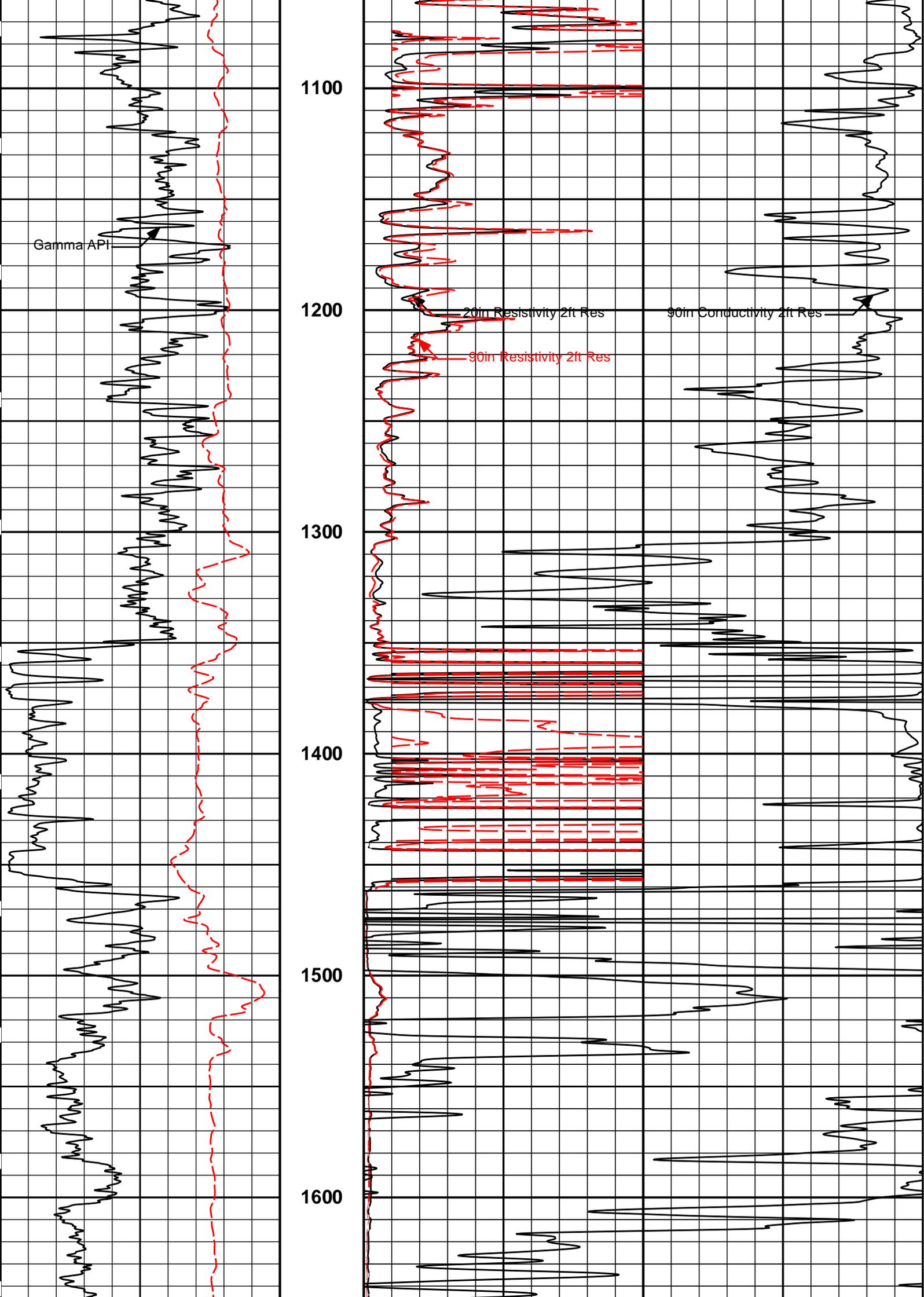
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 Data: WARD\_4-TWINWell Based\MAIN\  
 Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_2\_main

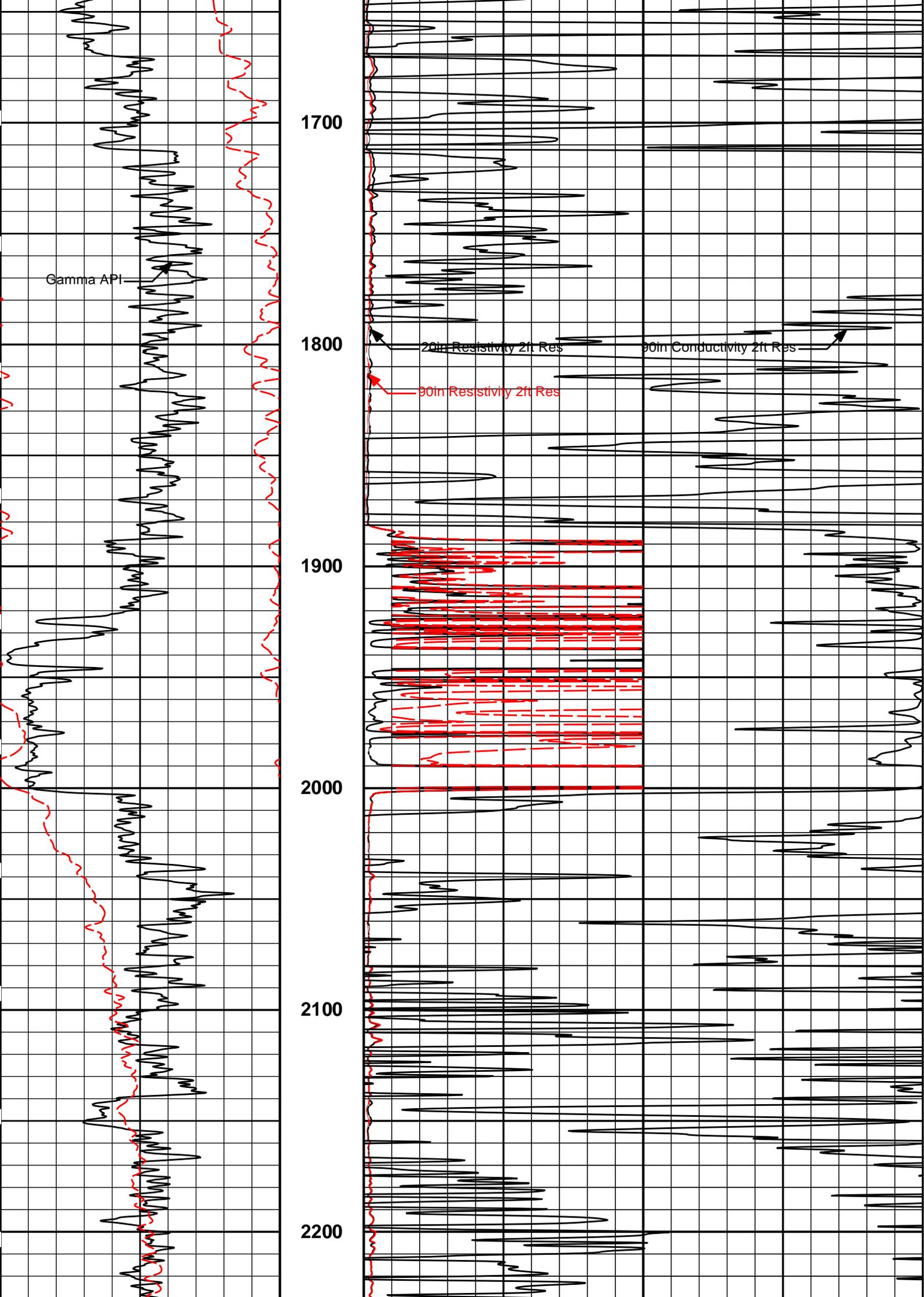
## 2 INCH MAIN LOG

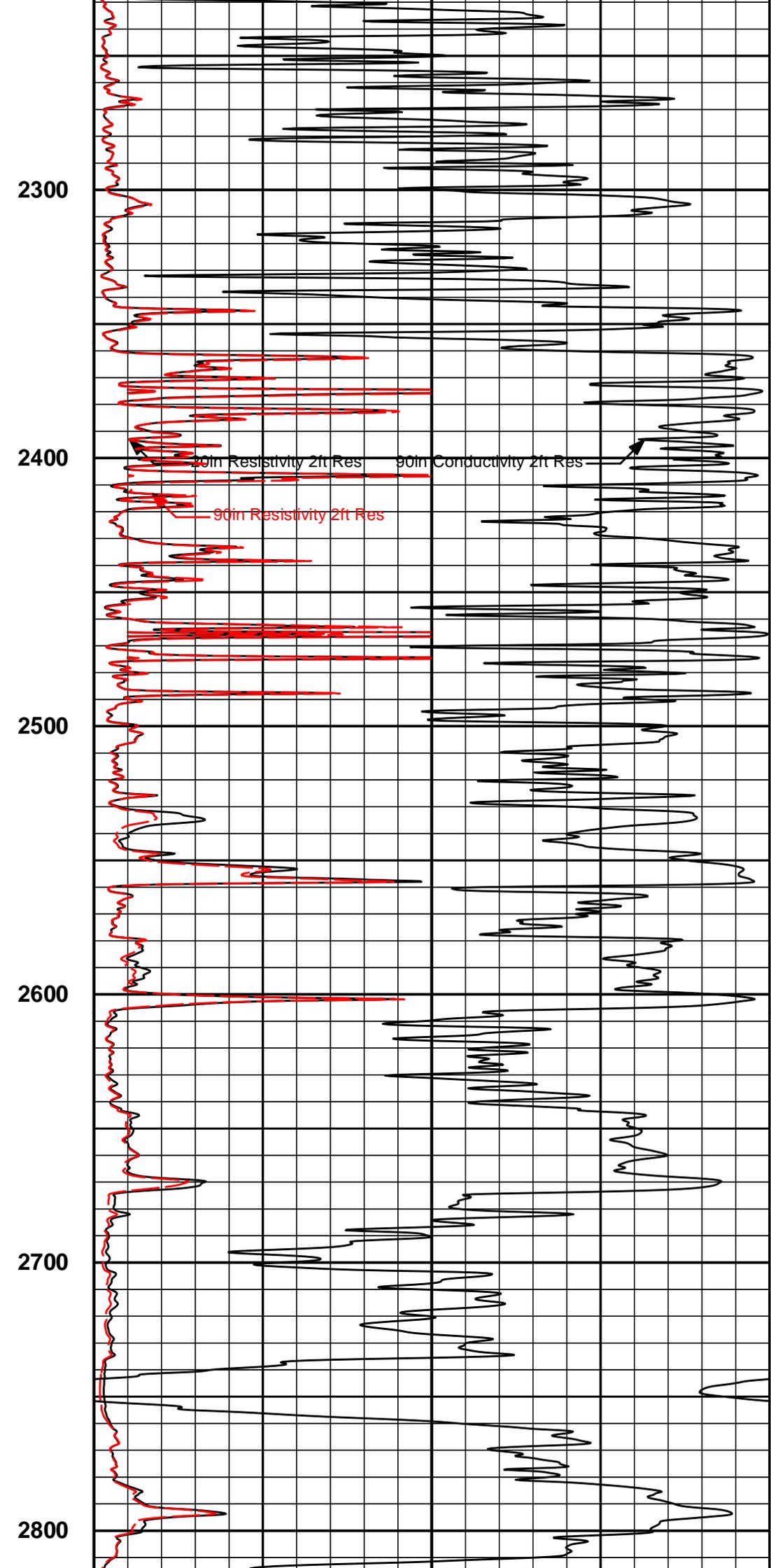
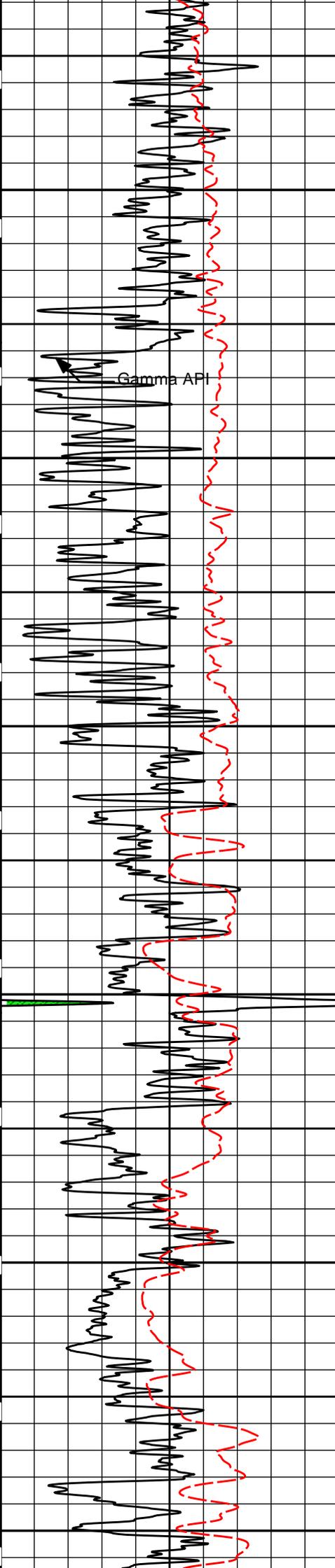
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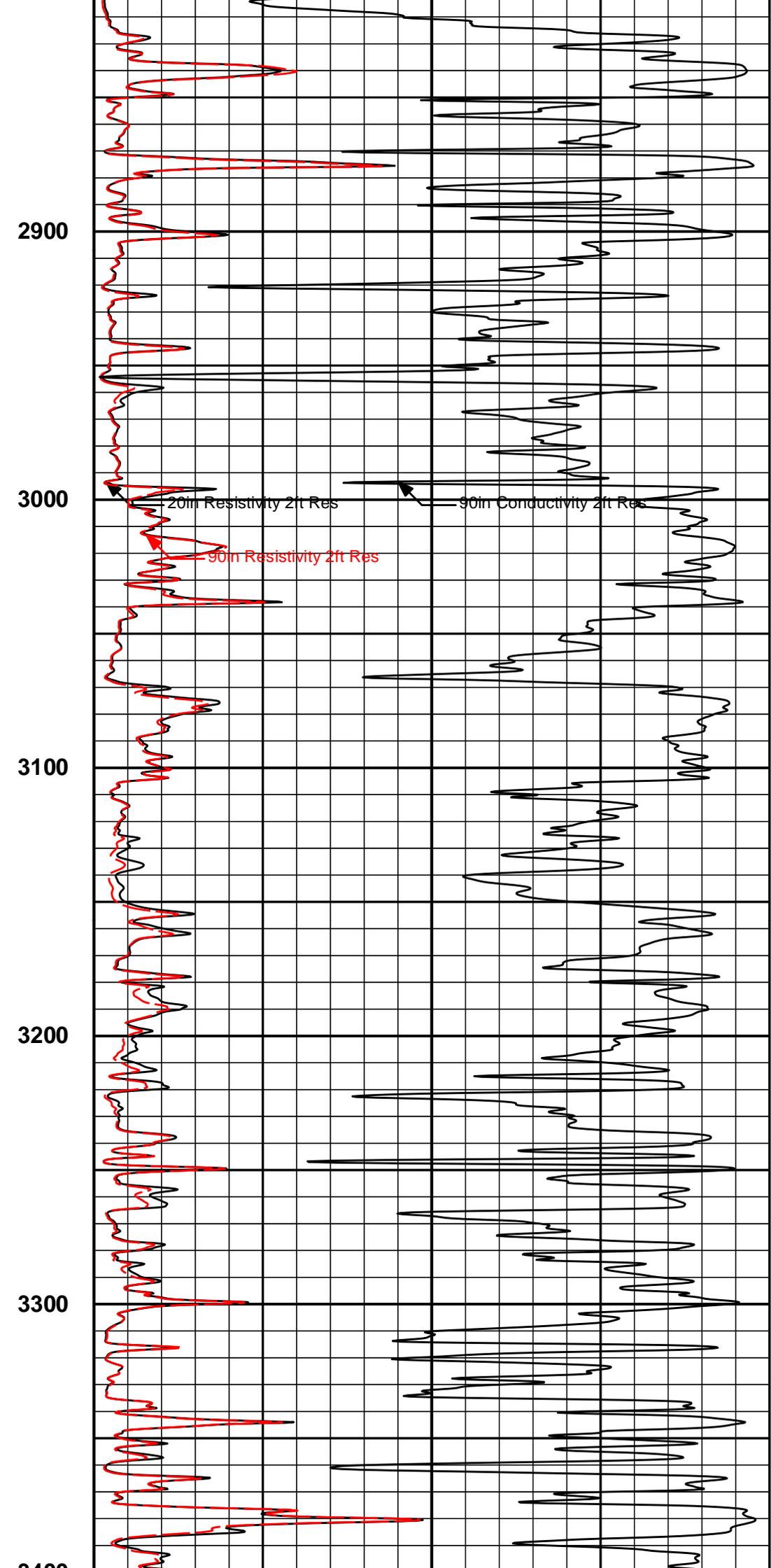
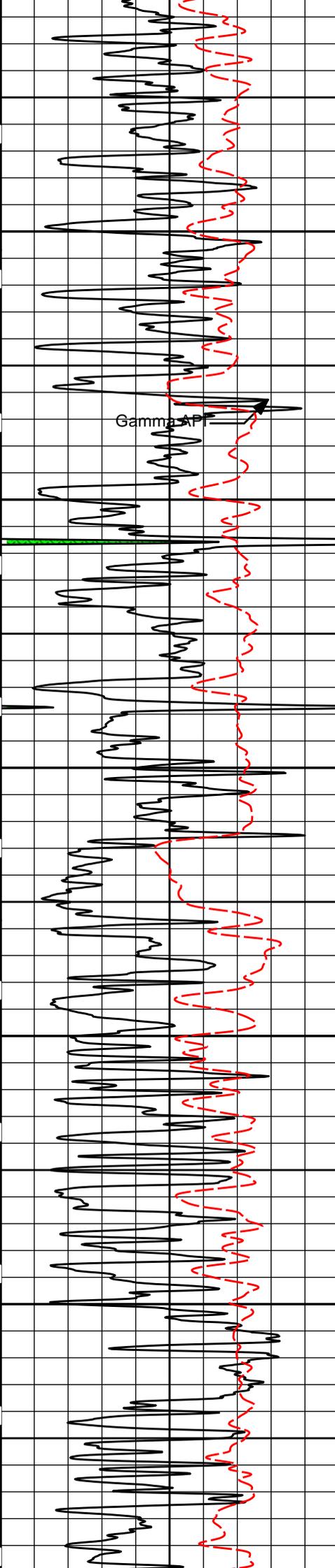


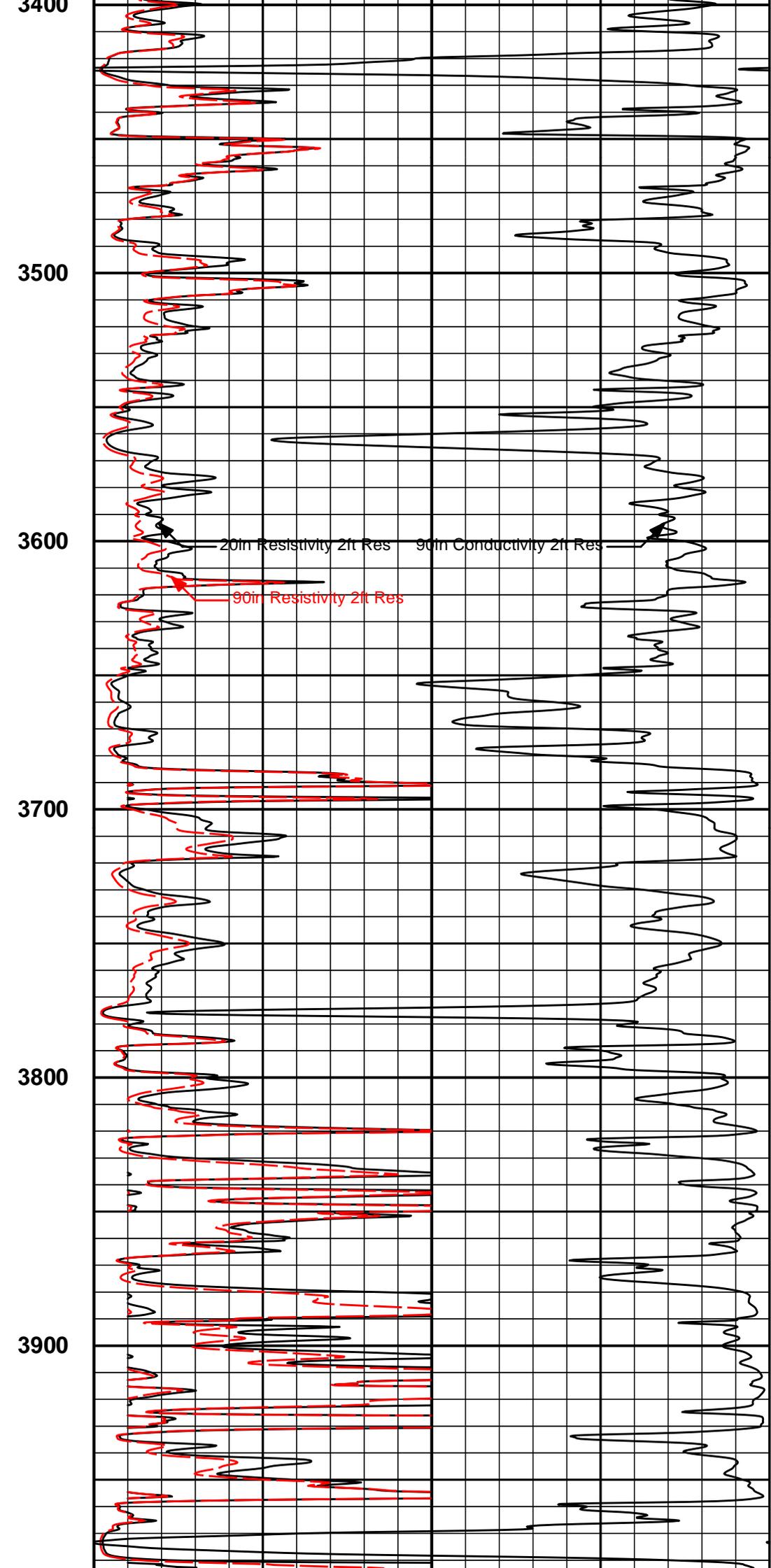
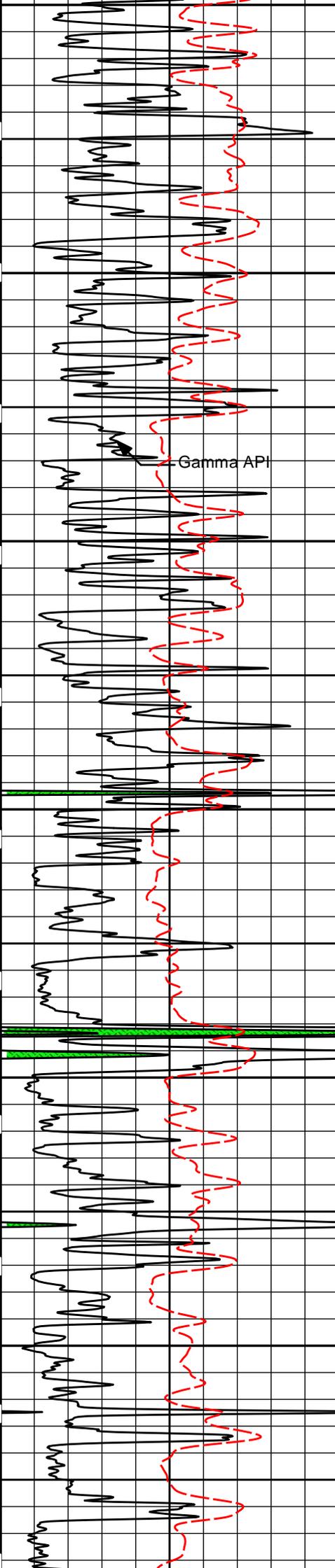


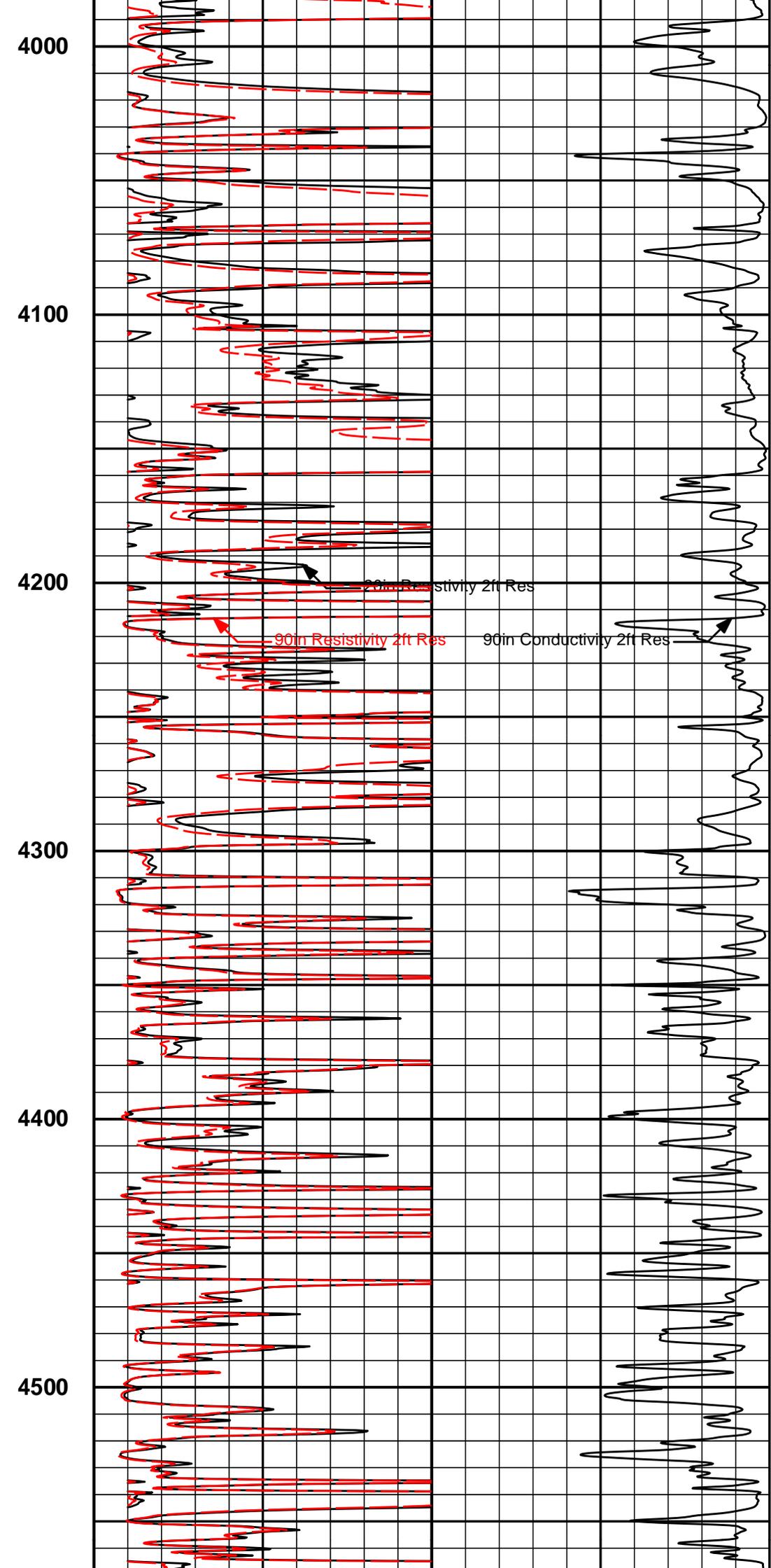
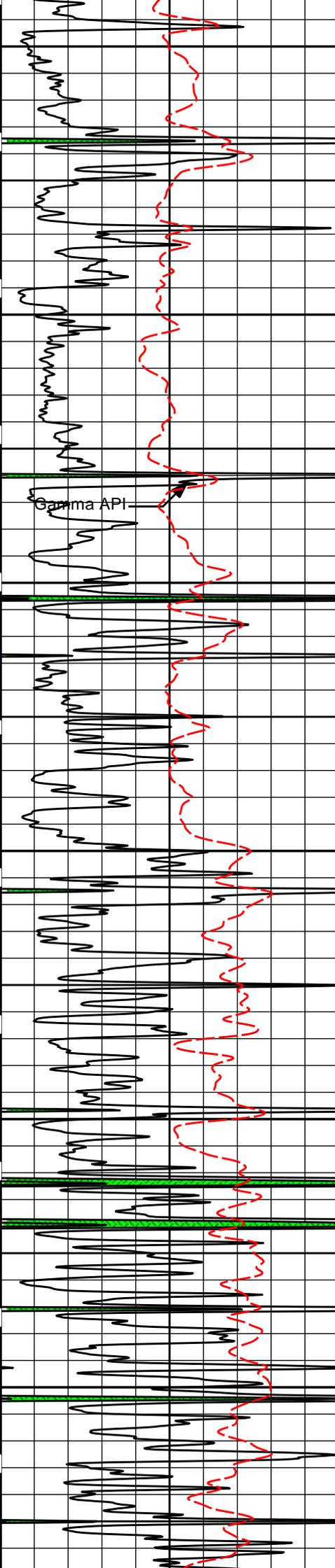


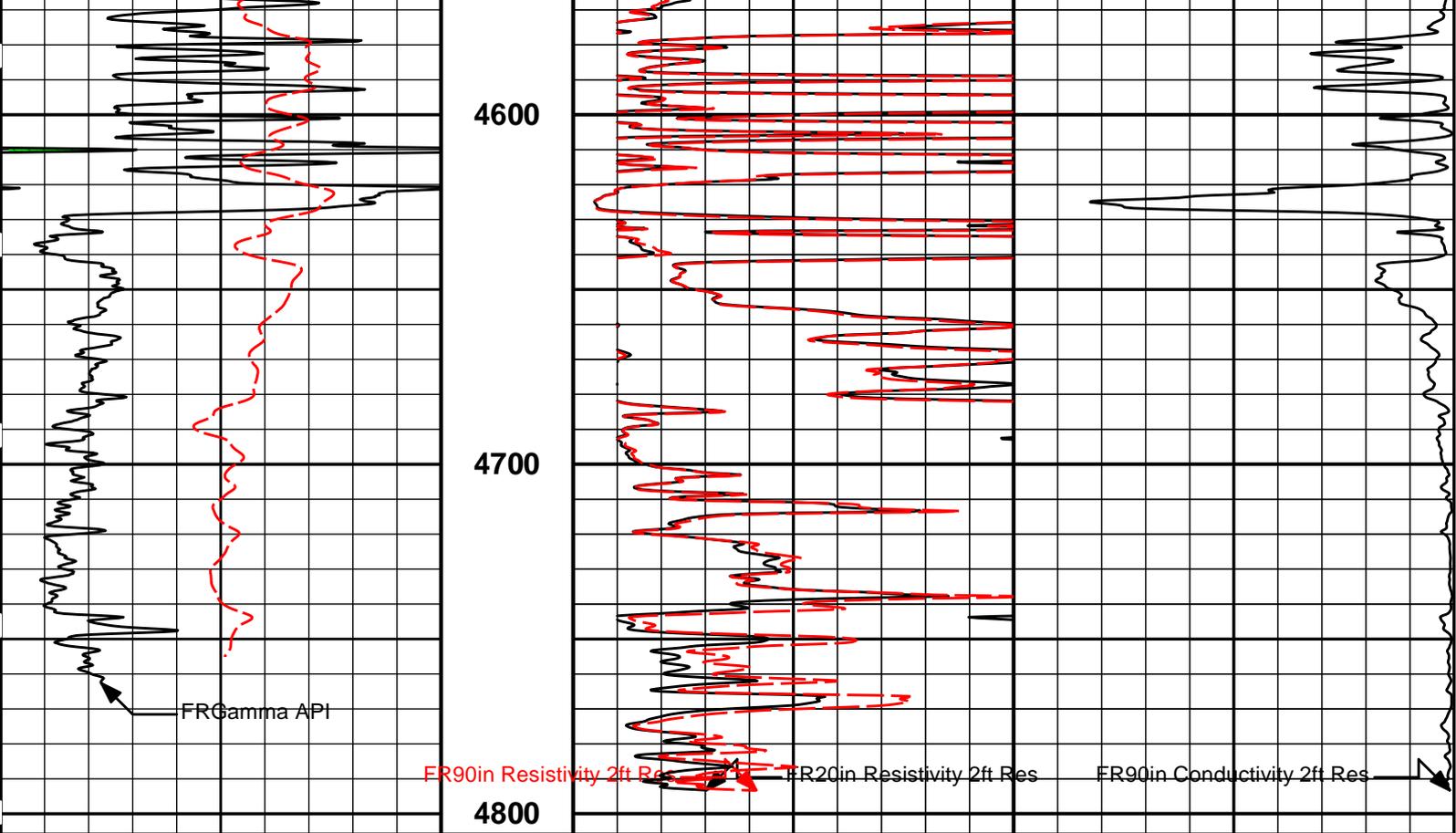












0	Gamma API	150	1 : 600 ft	0	20in Resistivity 2ft Res	50
	api			0	90in Resistivity 2ft Res	50
	SP					
	-] 20 mV [+]					
				1000	90in Conductivity 2ft Res	0
					mmho per metre	

**HALLIBURTON**

Plot Time: 21-Mar-18 15:42:41  
 Plot Range: 330 ft to 4805.75 ft  
 Data: WARD\_4-TWINWell Based\MAIN  
 Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_2\_main

**2 INCH MAIN LOG**

**2 INCH MAIN LOG**

**HALLIBURTON**

Plot Time: 21-Mar-18 15:42:41  
 Plot Range: 330 ft to 4805.75 ft  
 Data: WARD\_4-TWINWell Based\MAIN  
 Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_5inch\_main

**5 INCH MAIN LOG**

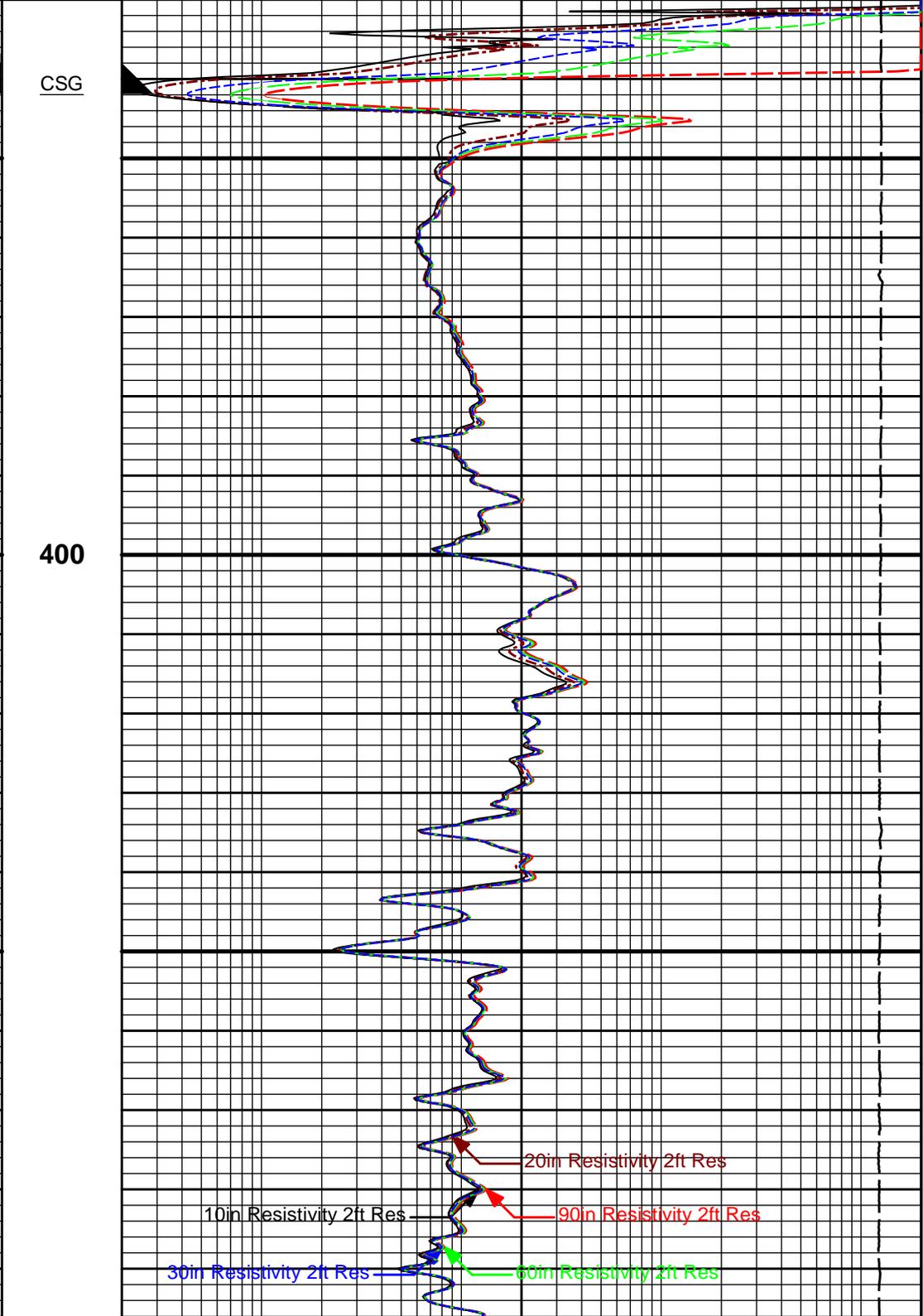
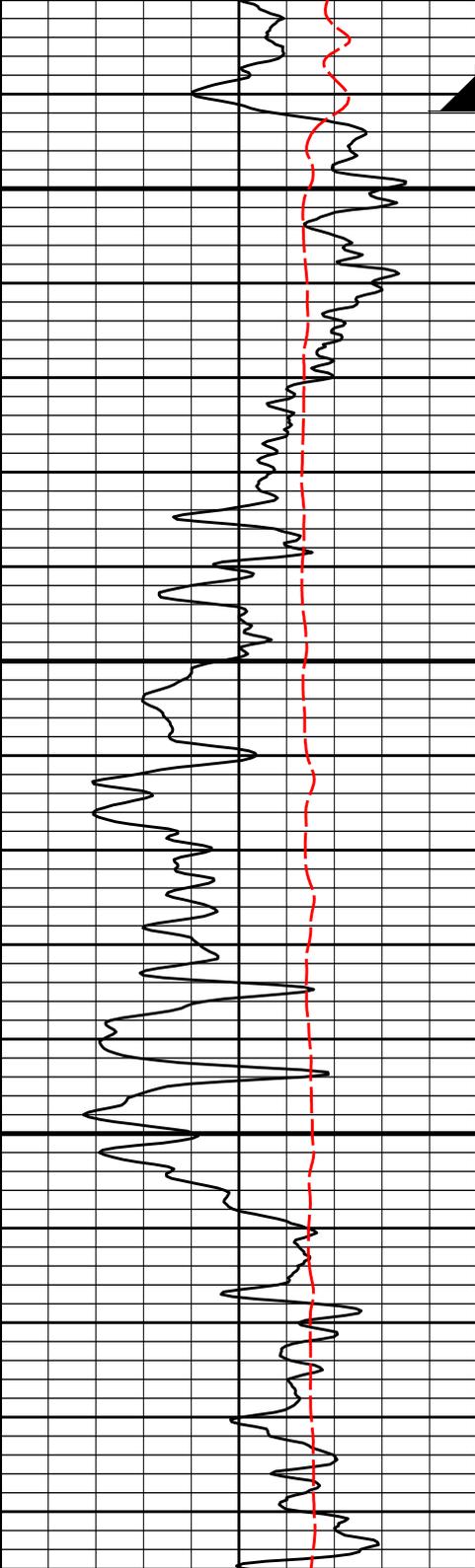
**5 INCH MAIN LOG**

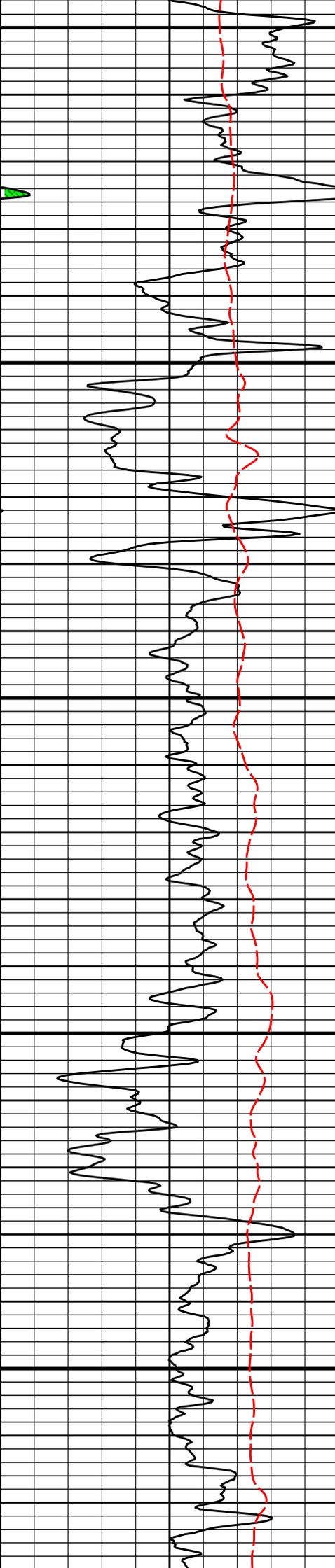
0.2	10in Resistivity 2ft Res	2K
	ohmm	
0.2	20in Resistivity 2ft Res	2000
	ohmm	
0.2	30in Resistivity 2ft Res	2000
	ohm-metre	
0.2	60in Resistivity 2ft Res	2000
	ohmm	
0.2	90in Resistivity 2ft Res	2K
	ohmm	

SP  
-] 20 mV [+]

0 Gamma API 150  
api

15K Tension 0  
pounds

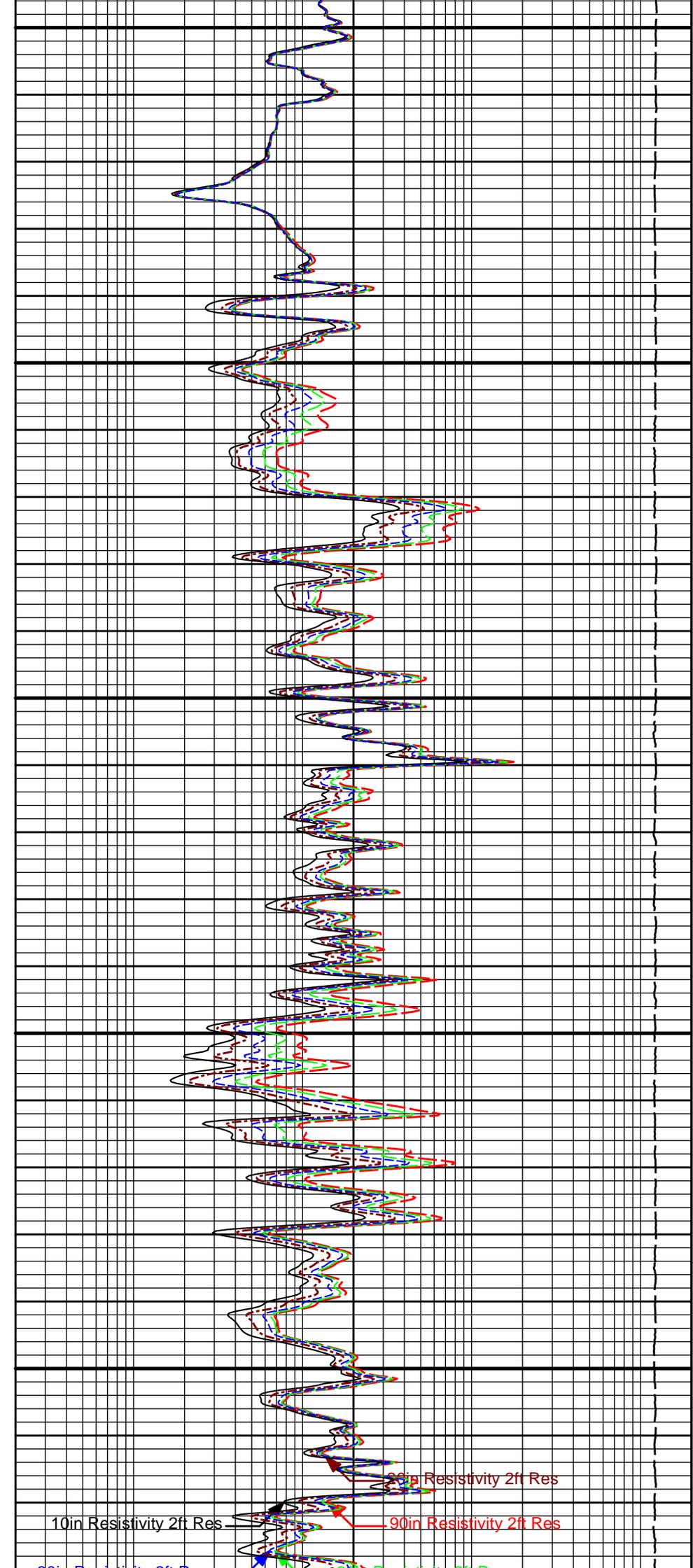




500

600

700



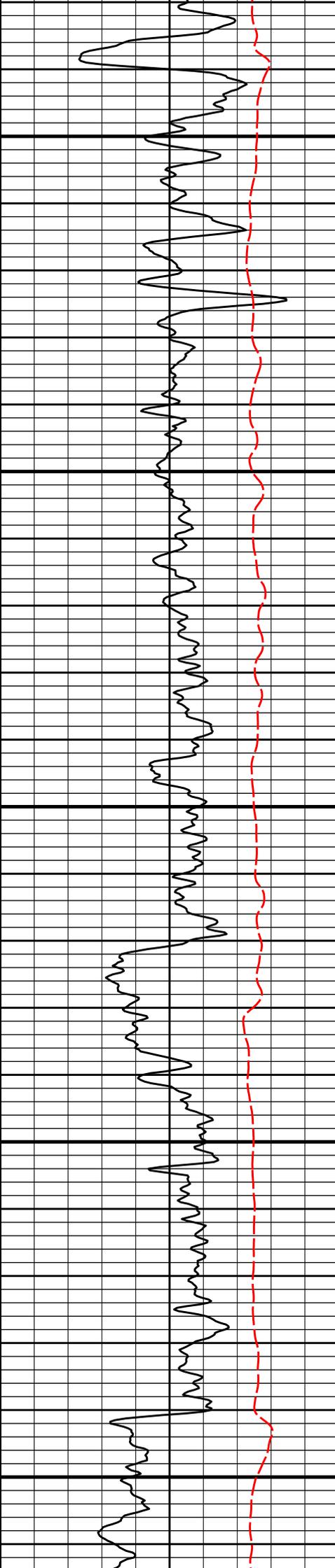
10in Resistivity 2ft Res

20in Resistivity 2ft Res

90in Resistivity 2ft Res

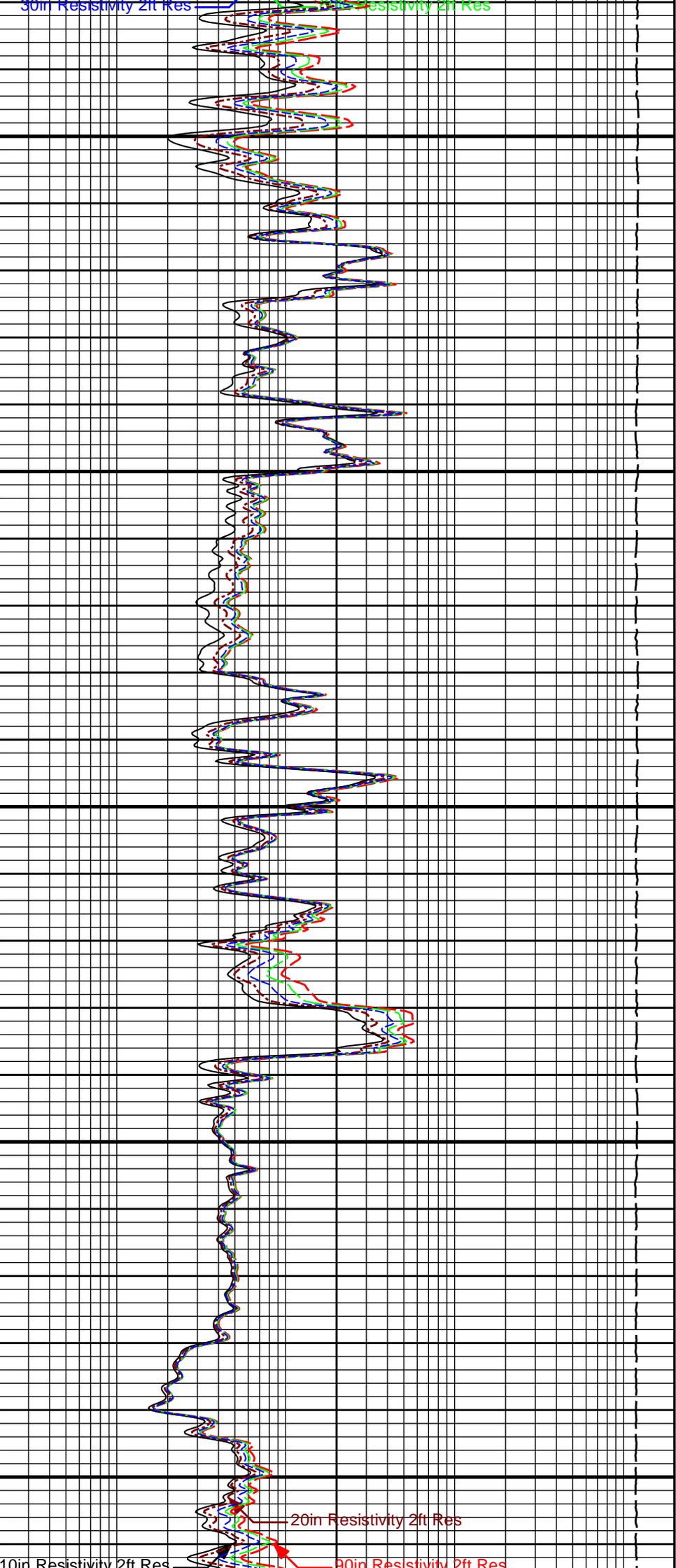
30in Resistivity 2ft Res

60in Resistivity 2ft Res



800

900



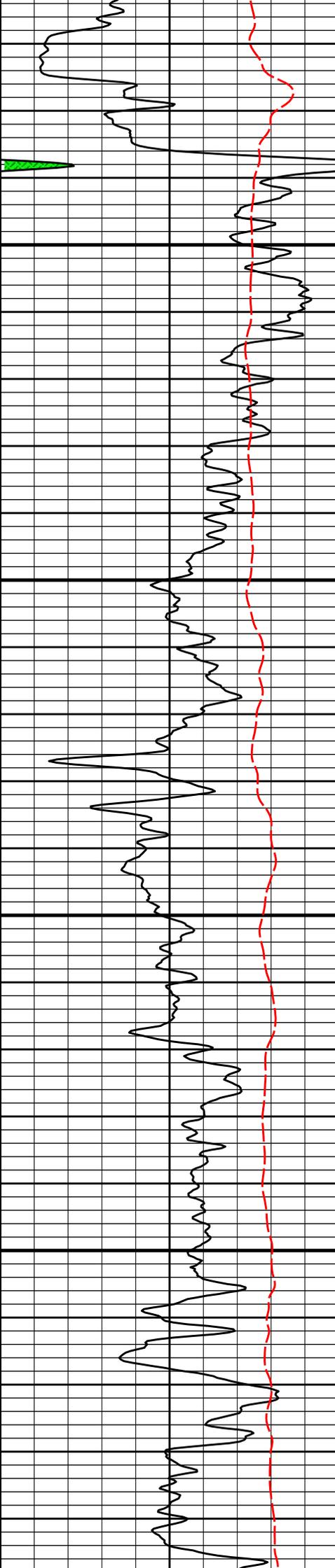
30in Resistivity 2ft Res

15in Resistivity 2ft Res

20in Resistivity 2ft Res

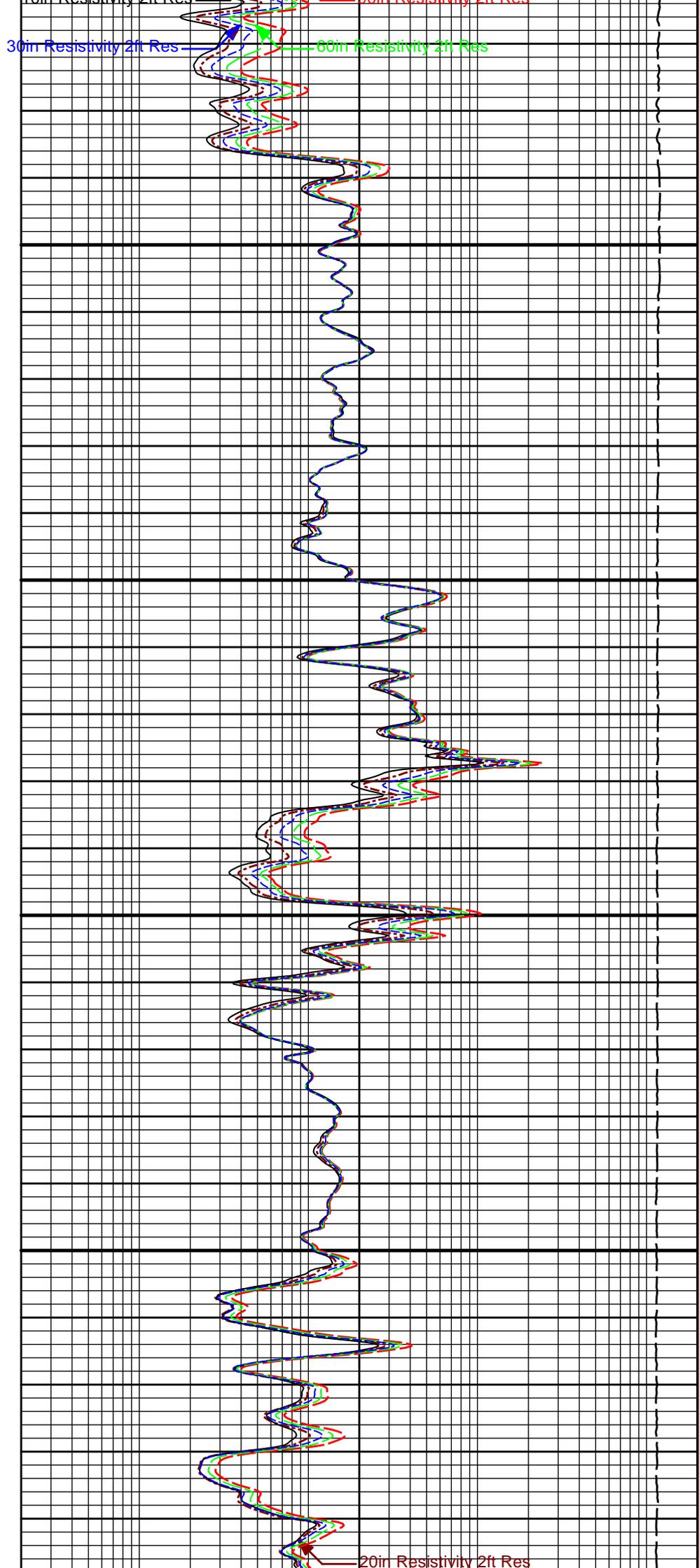
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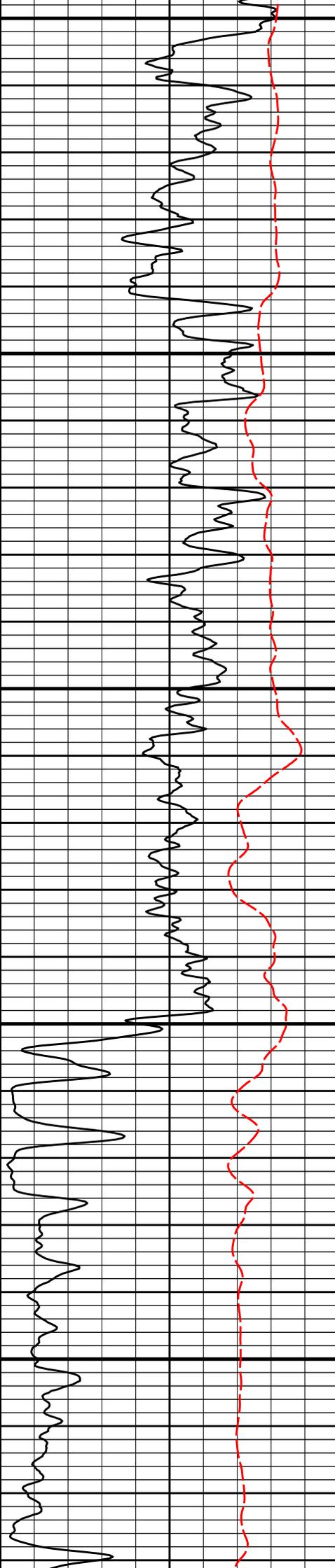
90in Resistivity 2ft Res



1000

1100





1200

10in Resistivity 2ft Res

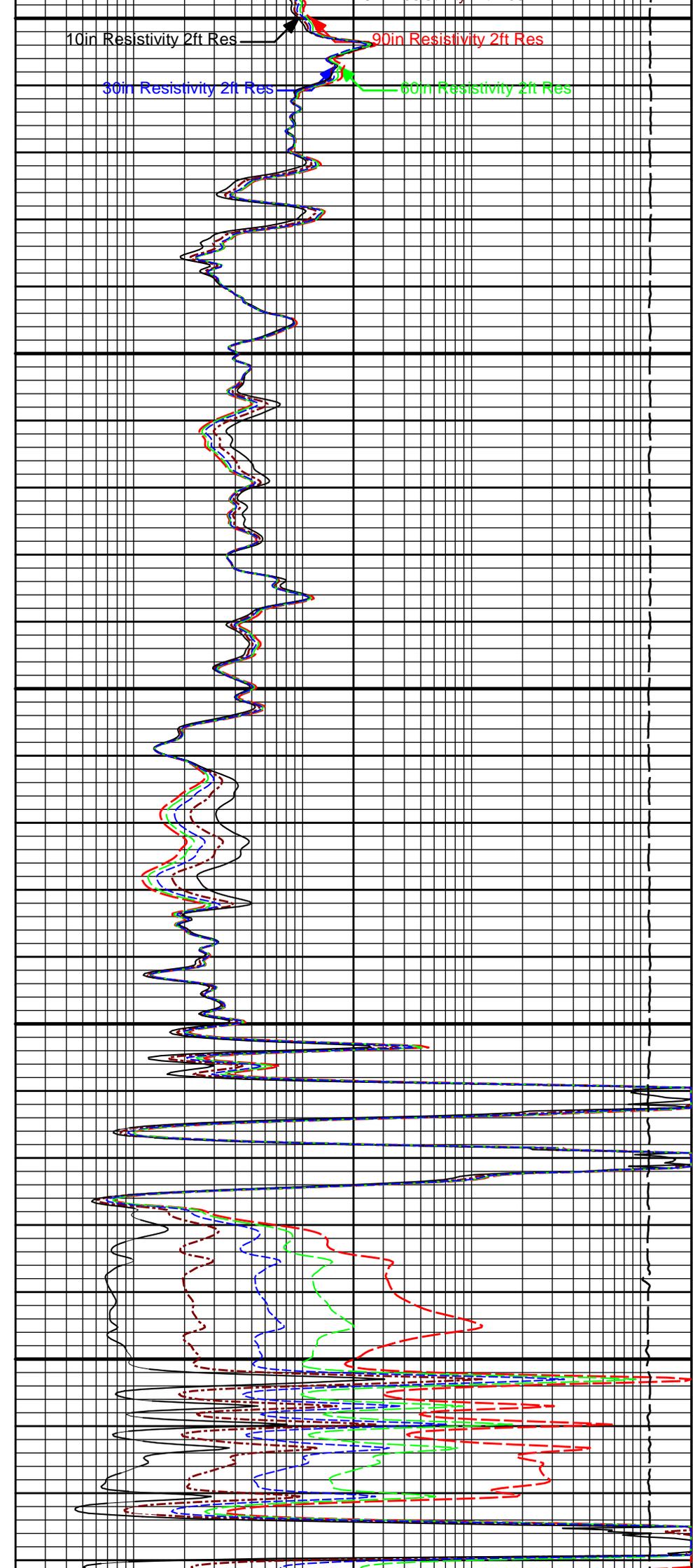
90in Resistivity 2ft Res

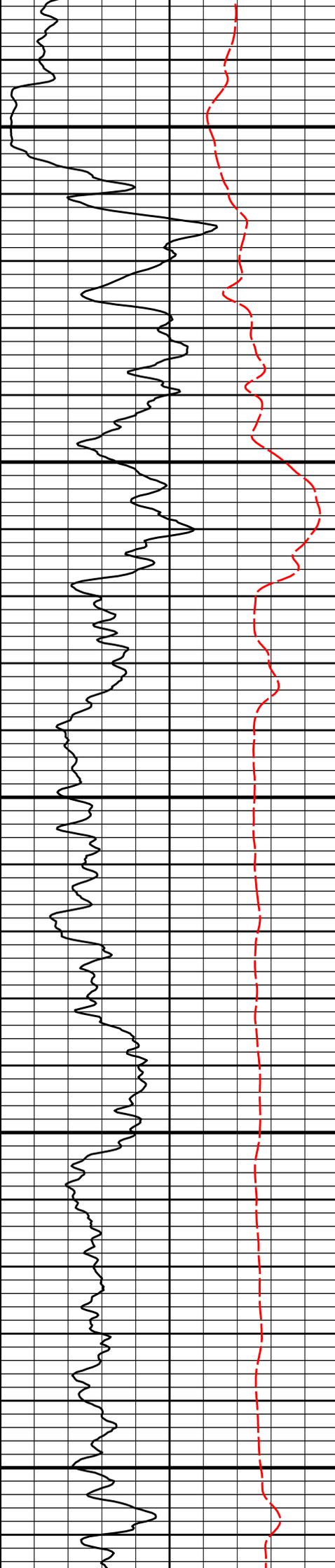
30in Resistivity 2ft Res

60in Resistivity 2ft Res

1300

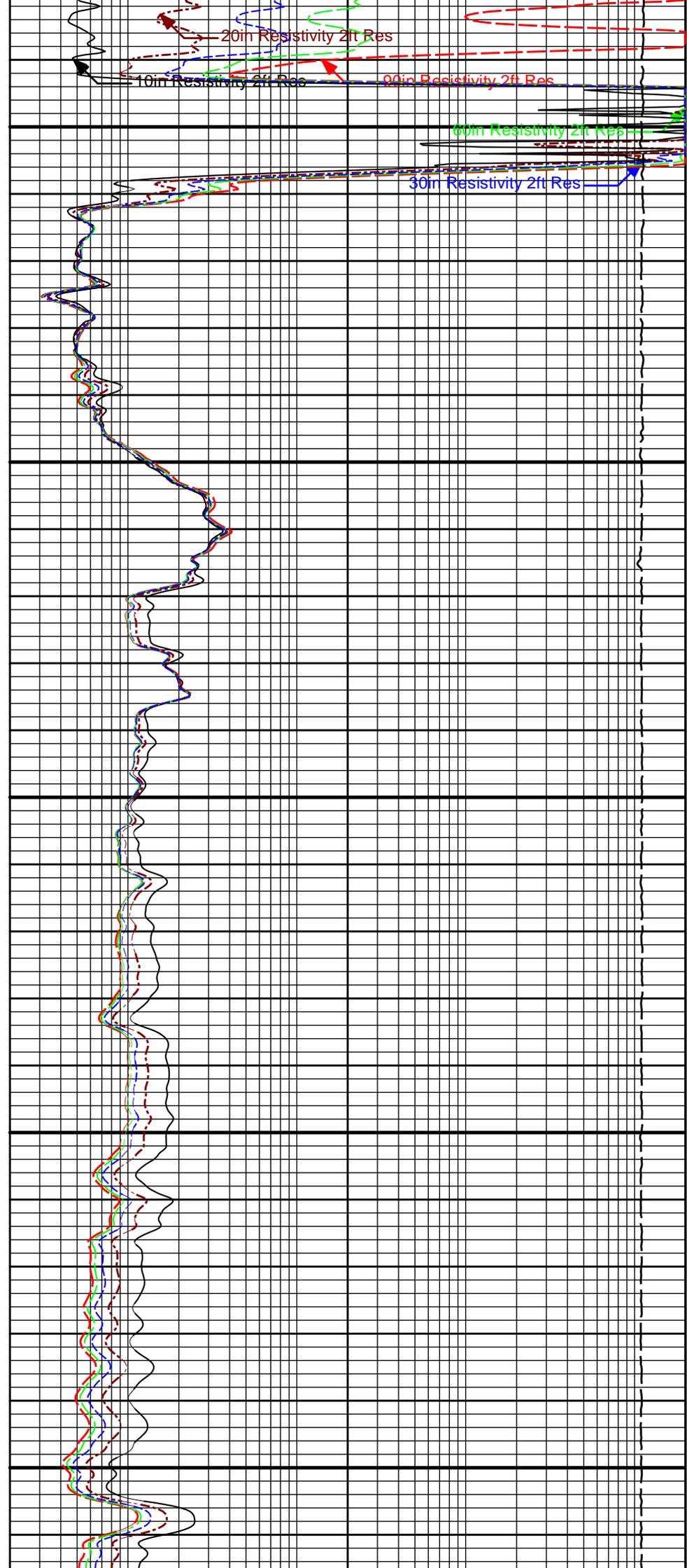
1400





1500

1600



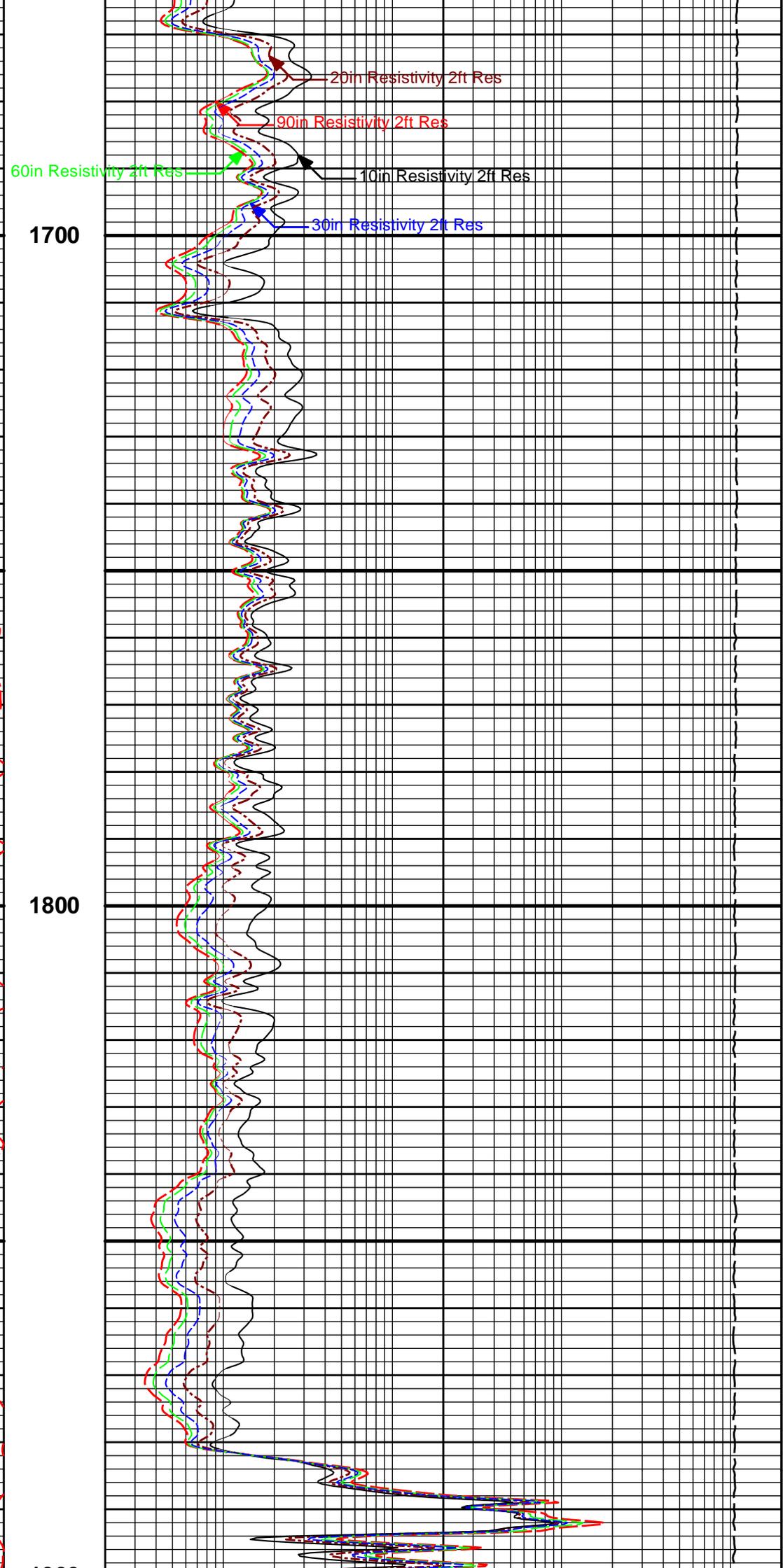
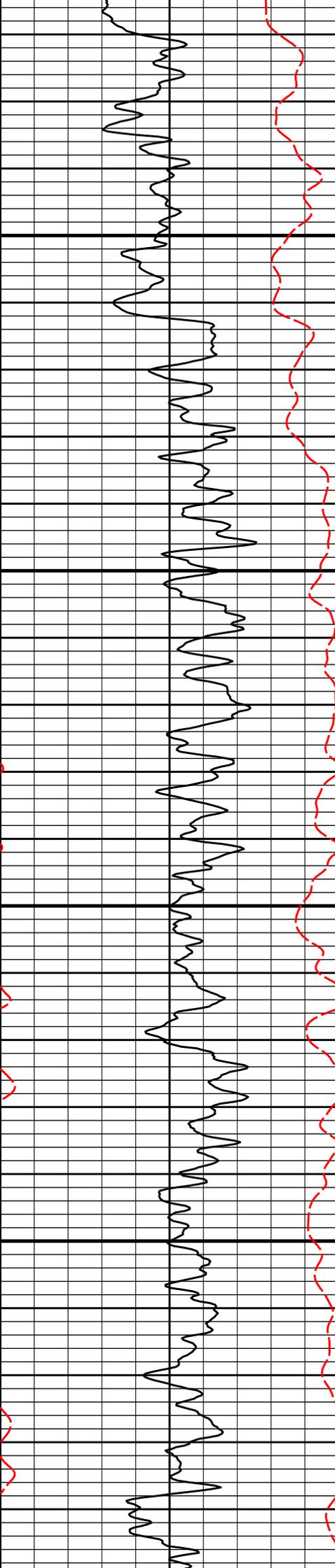
20in Resistivity 2ft Res

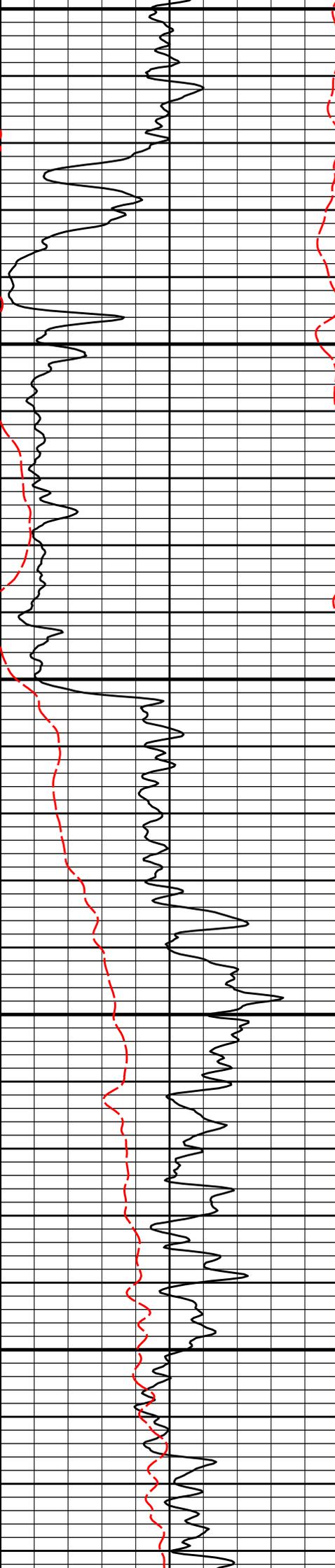
10in Resistivity 2ft Res

40in Resistivity 2ft Res

60in Resistivity 2ft Res

30in Resistivity 2ft Res

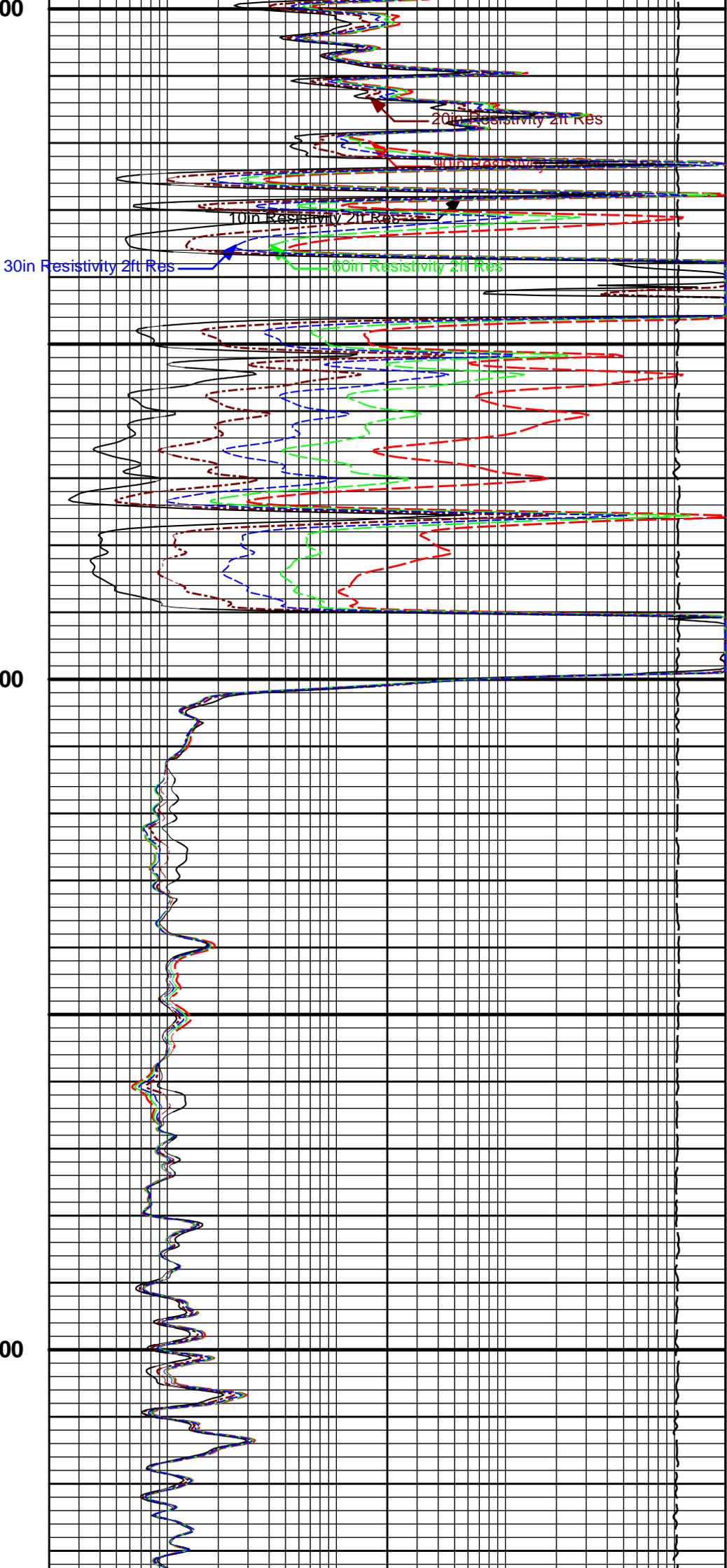


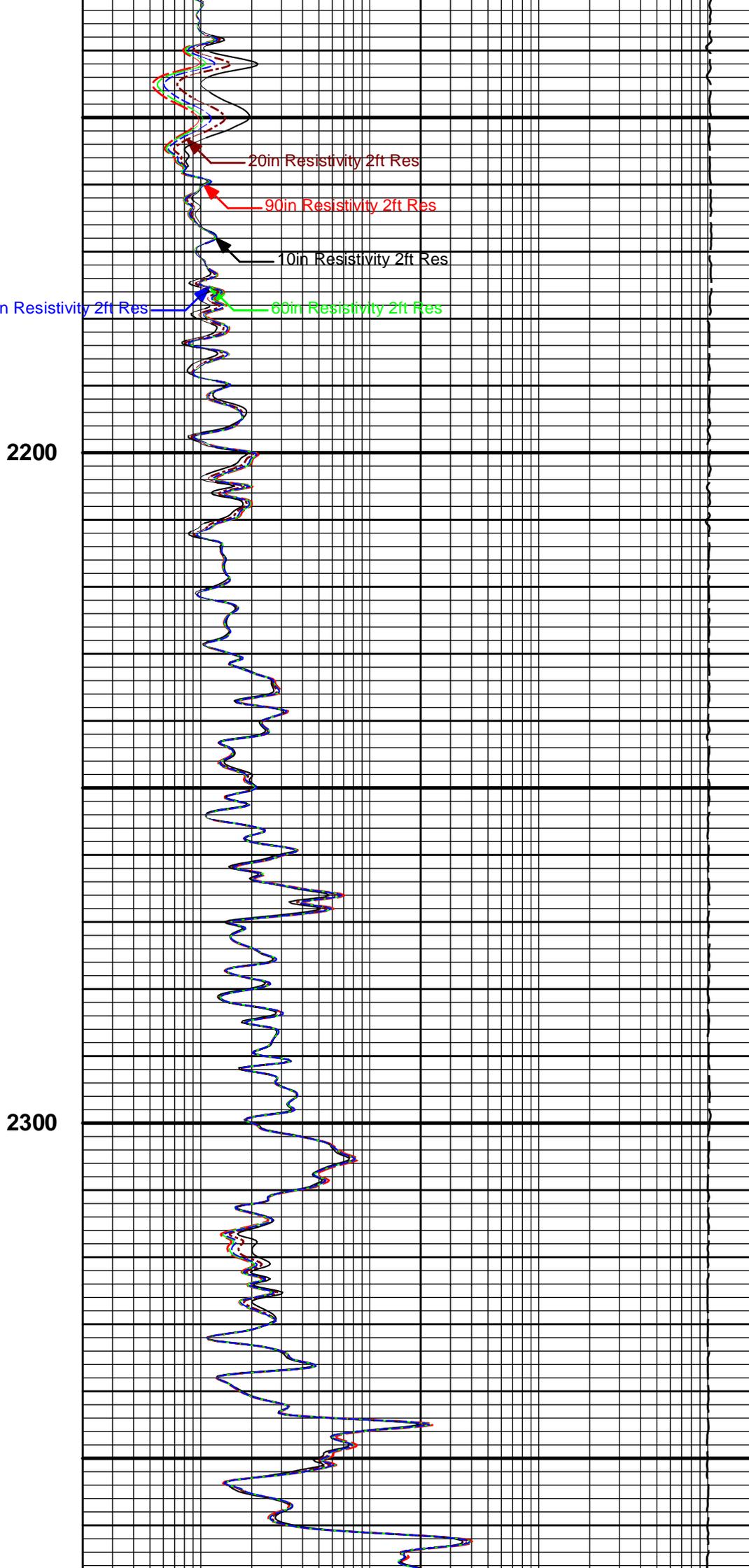
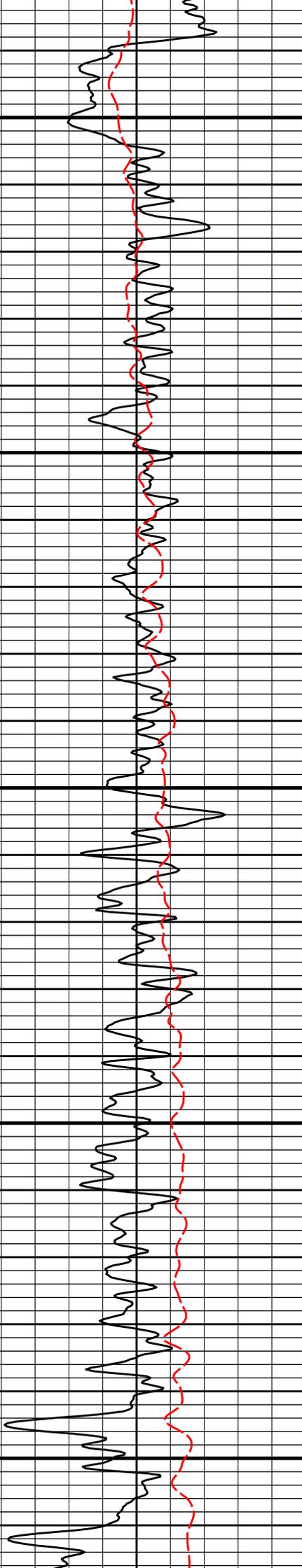


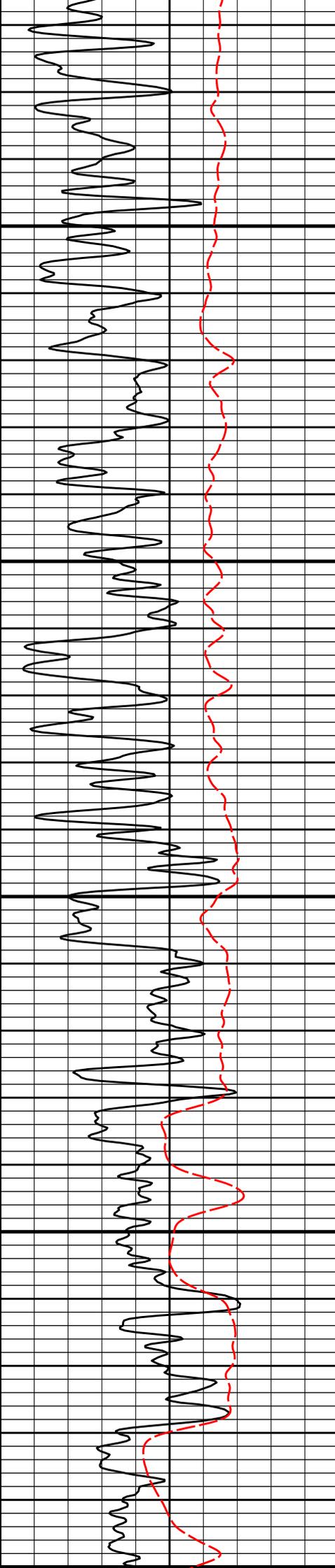
1900

2000

2100



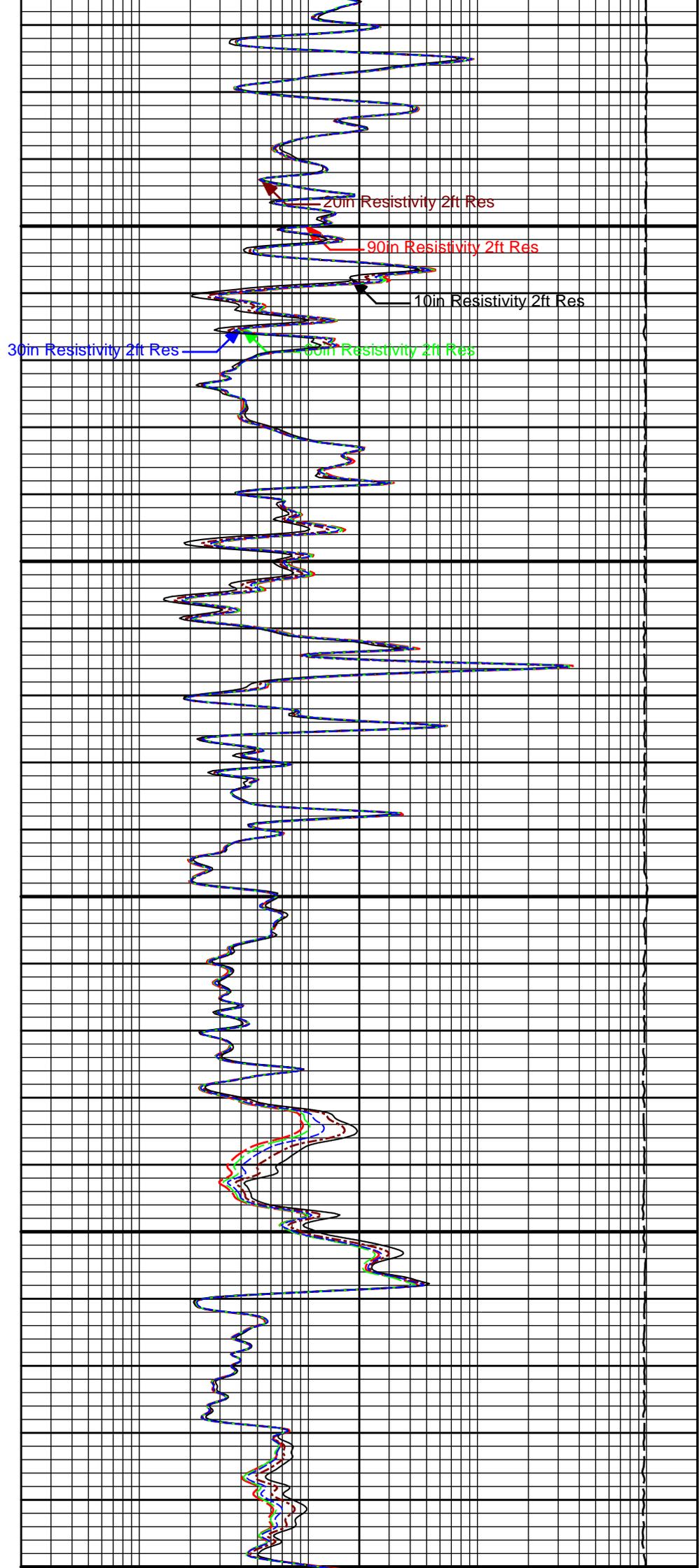


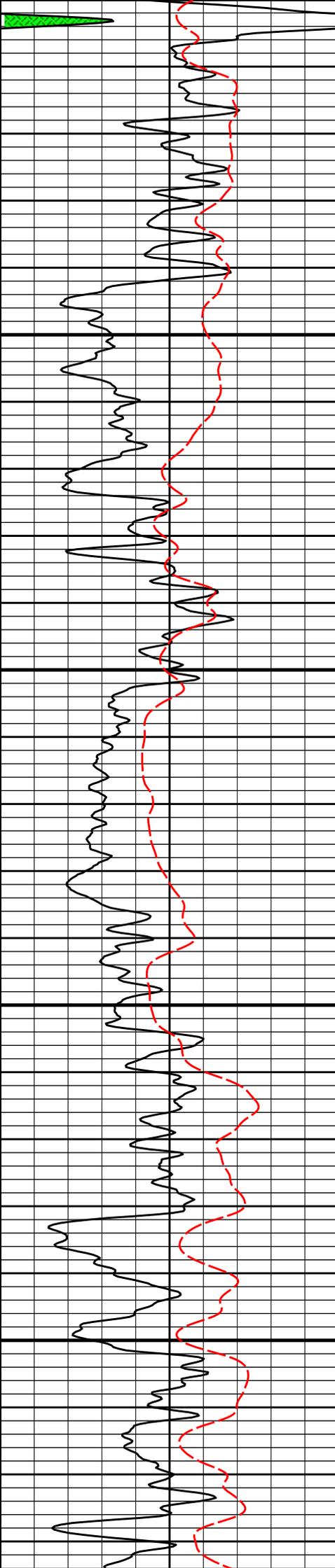


2400

2500

2600

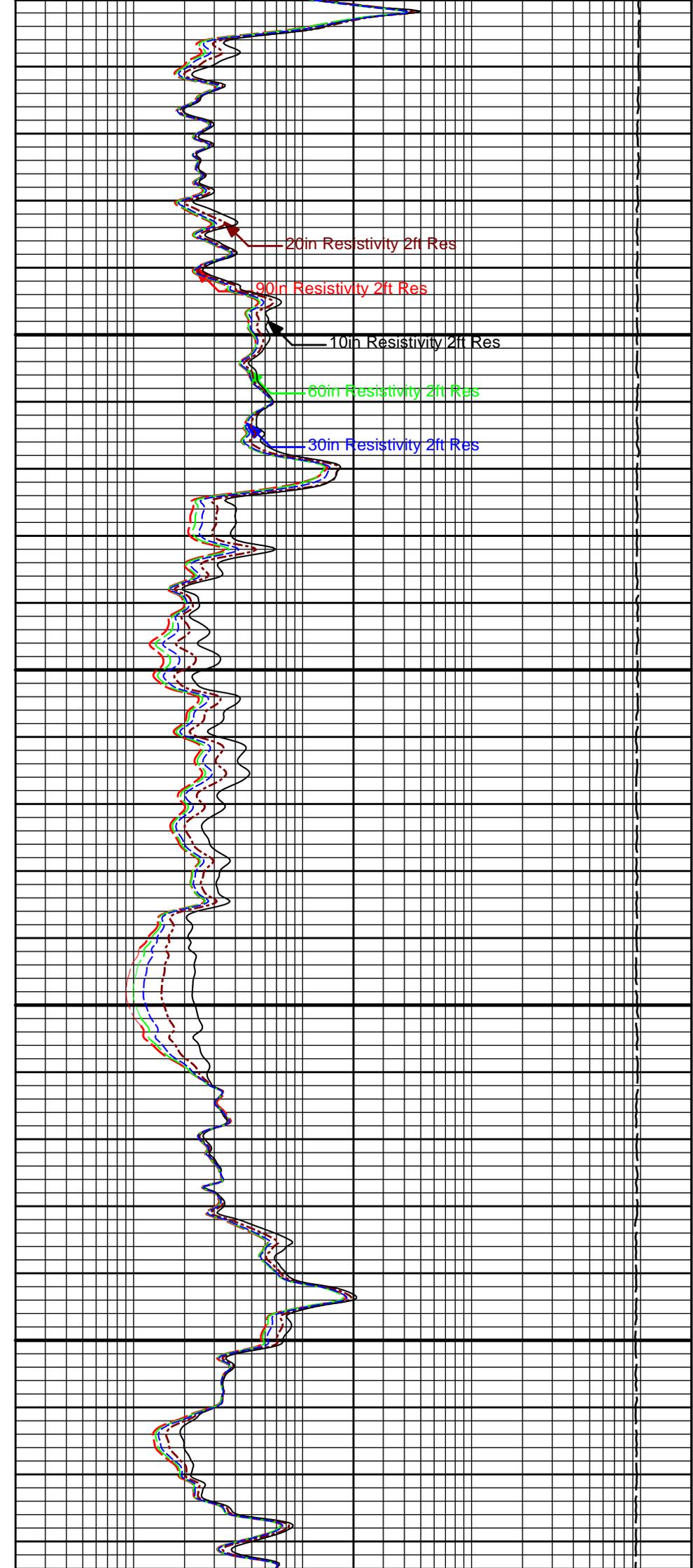


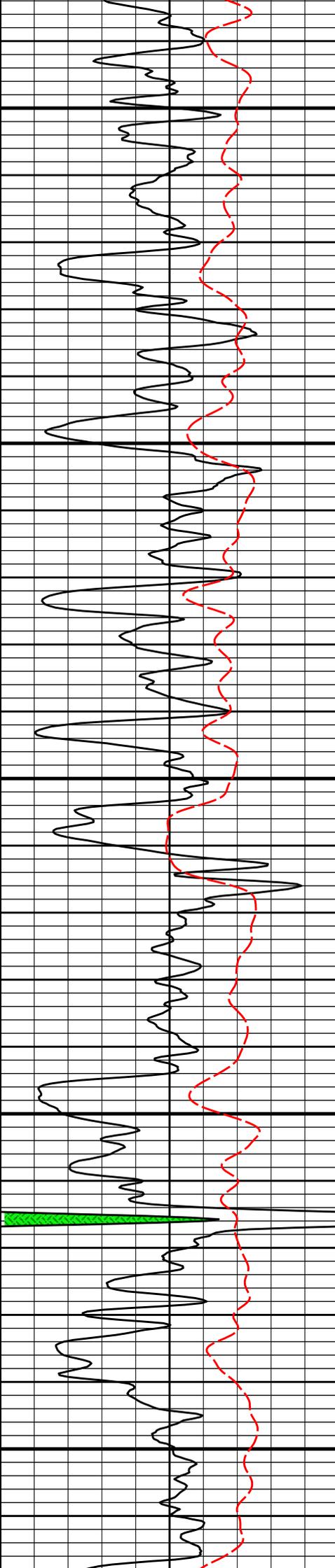


2600

2700

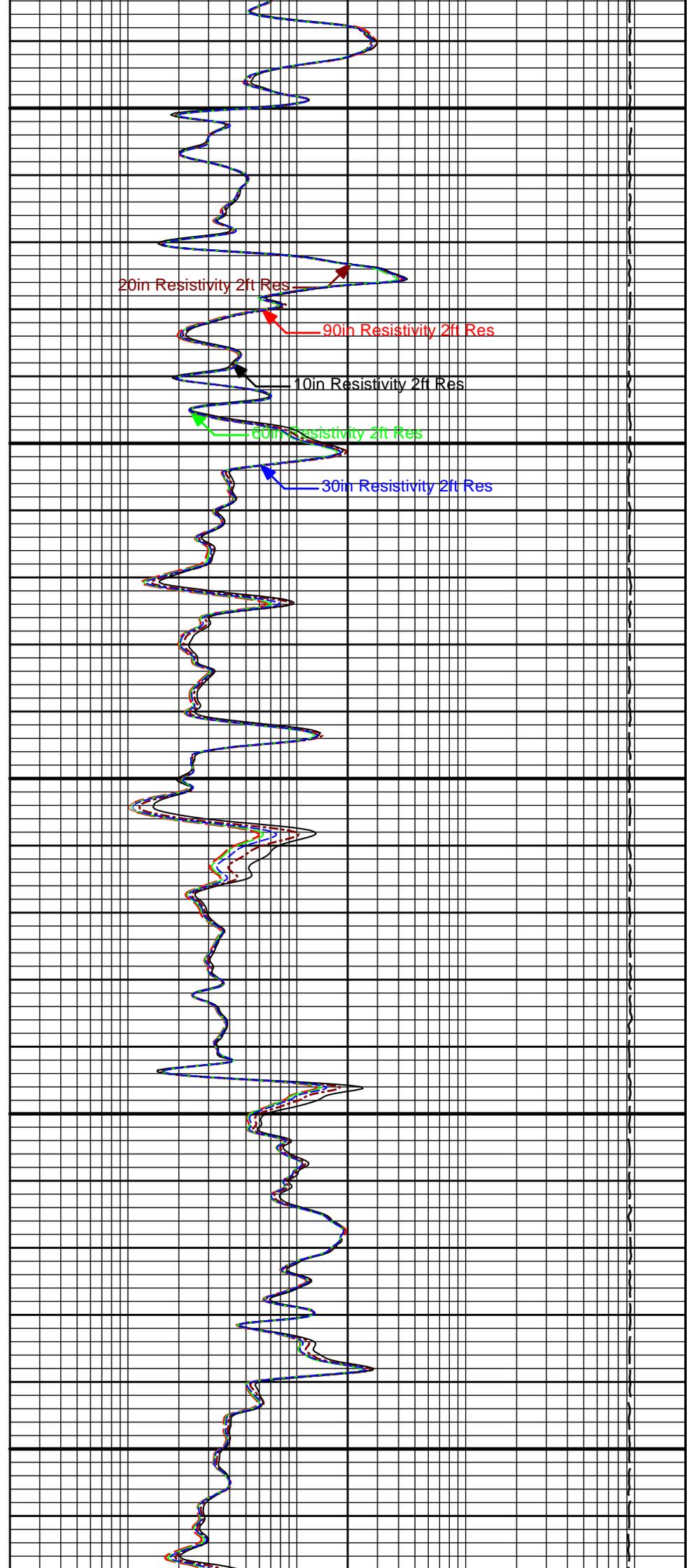
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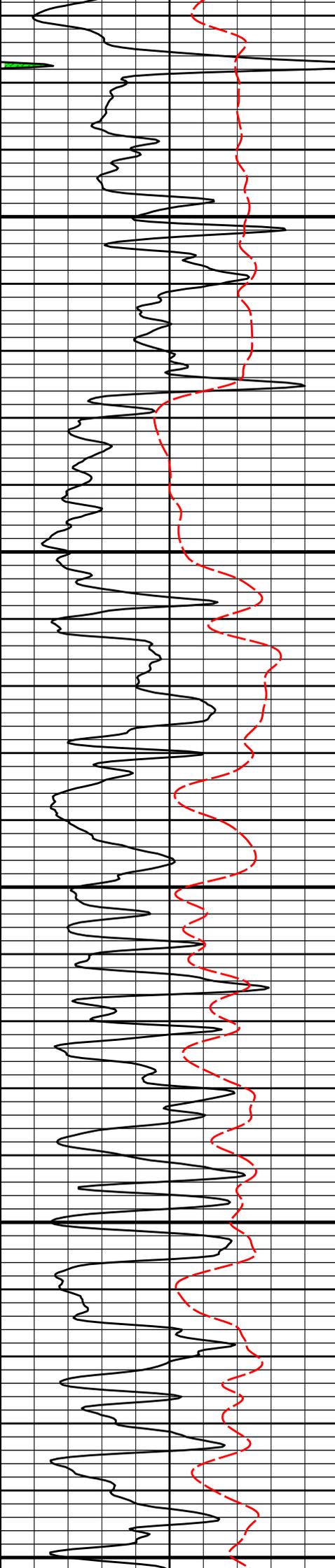




2900

3000

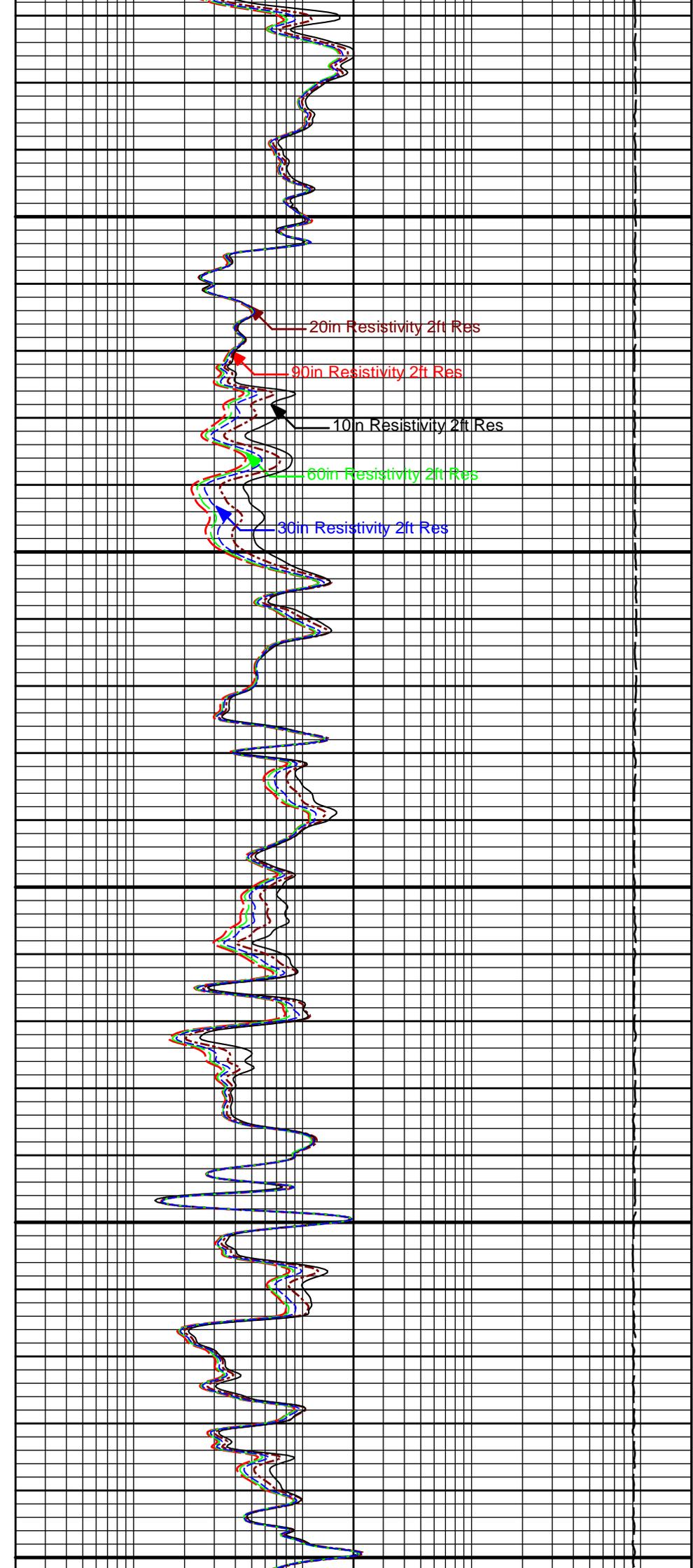


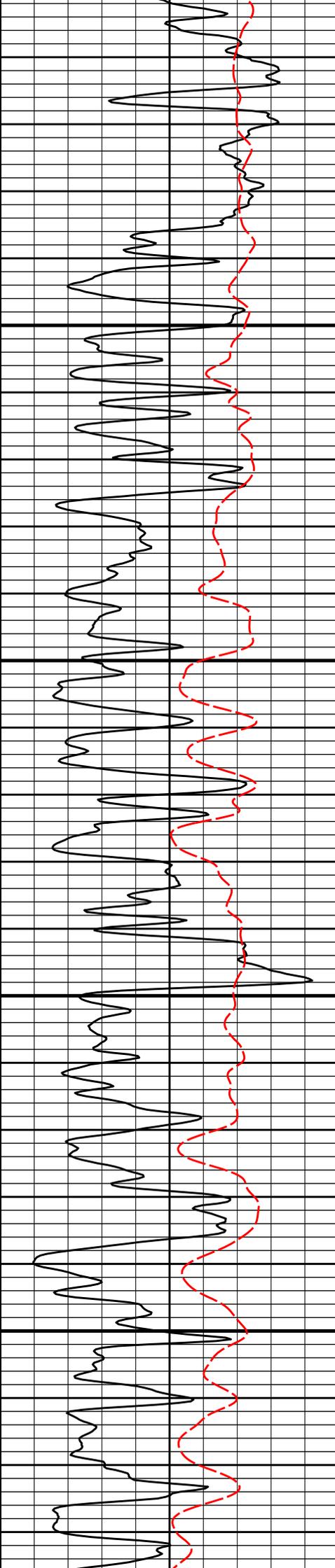


3100

3200

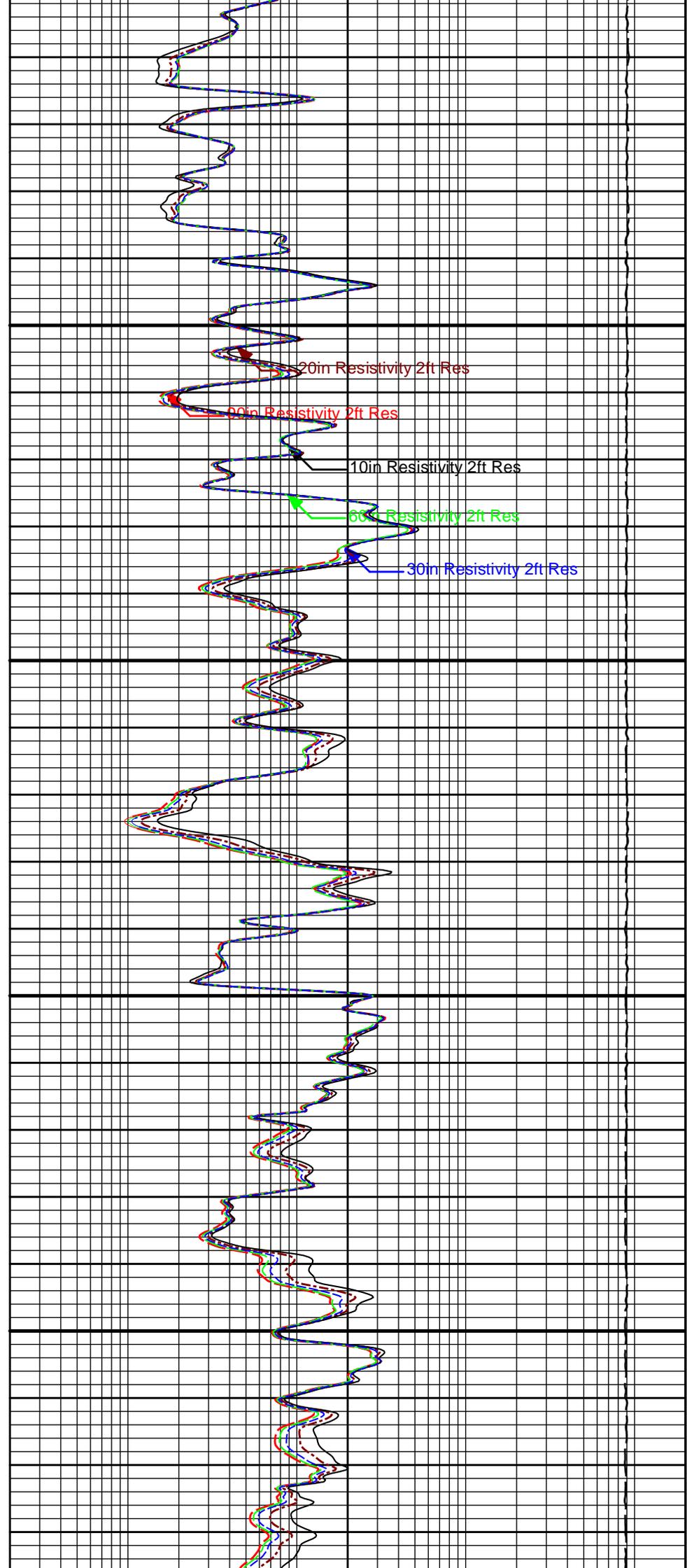
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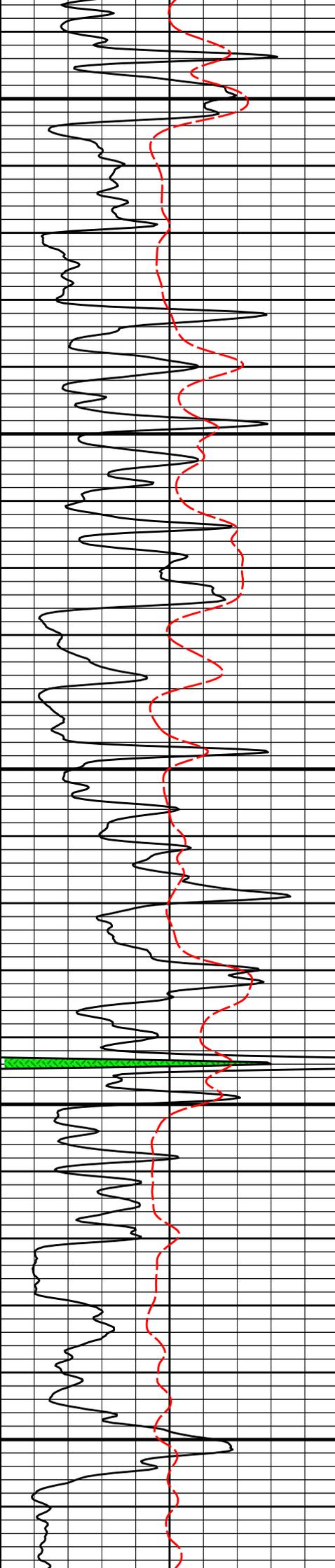




3400

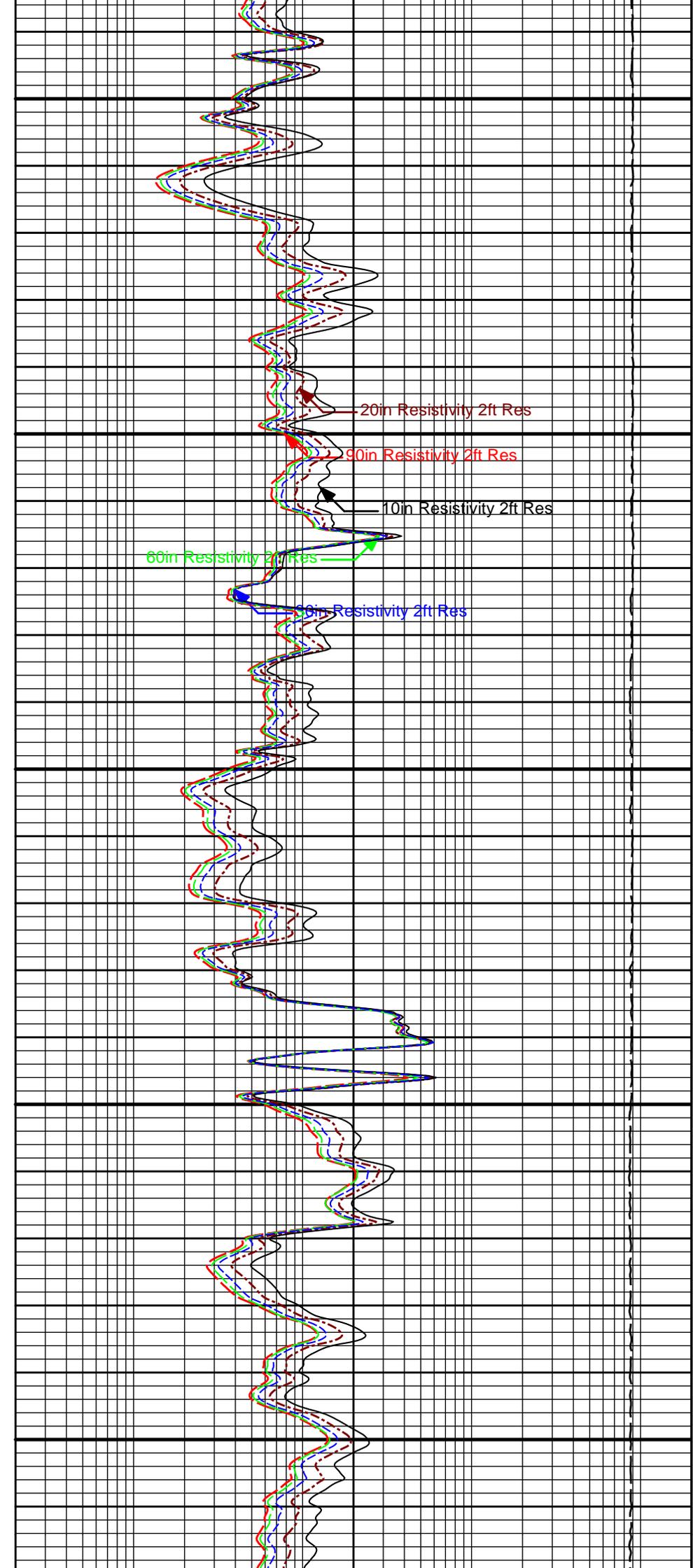
3500





3600

3700



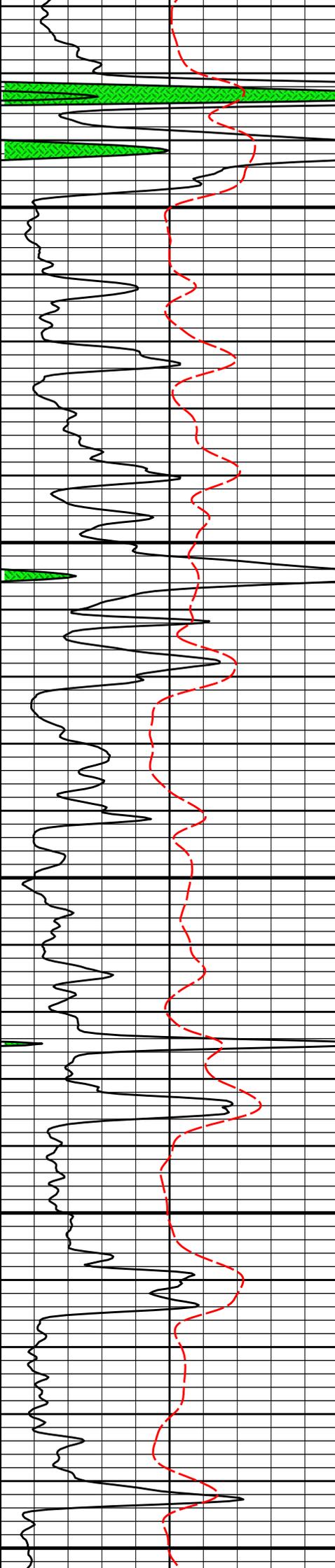
20in Resistivity 2ft Res

90in Resistivity 2ft Res

10in Resistivity 2ft Res

60in Resistivity 2ft Res

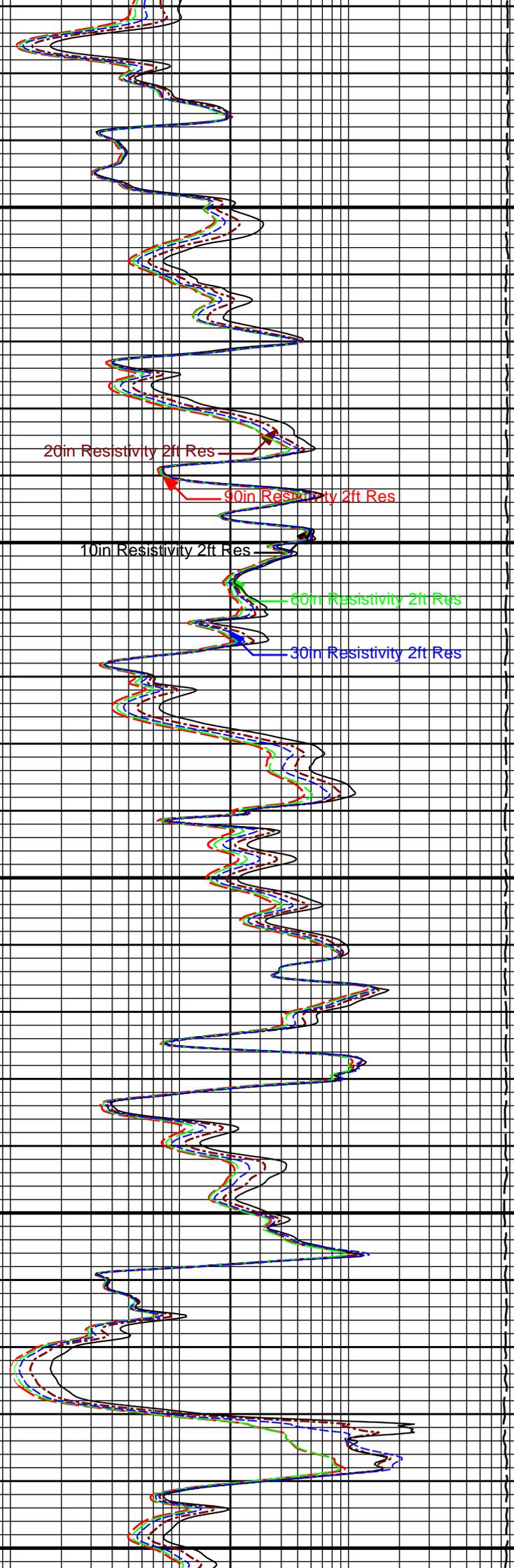
30in Resistivity 2ft Res



3800

3900

4000



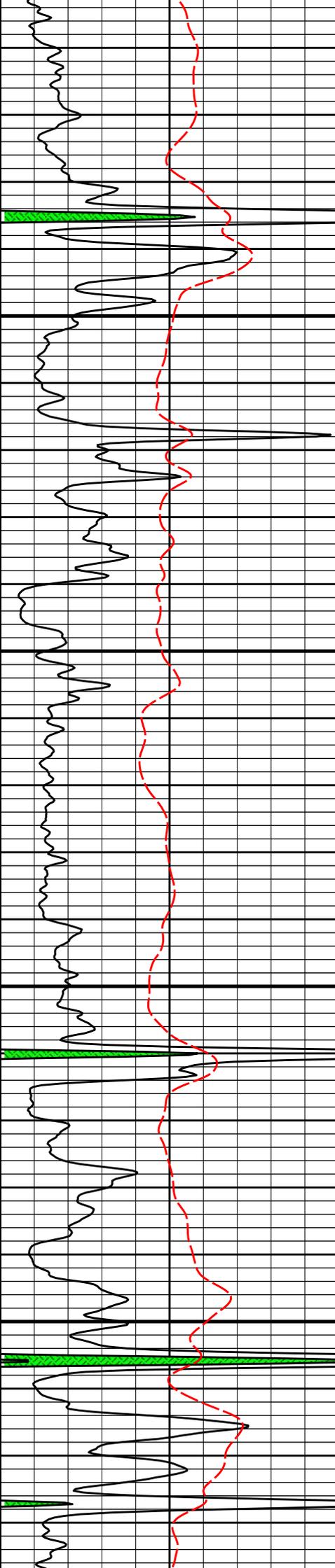
20in Resistivity 2ft Res

90in Resistivity 2ft Res

10in Resistivity 2ft Res

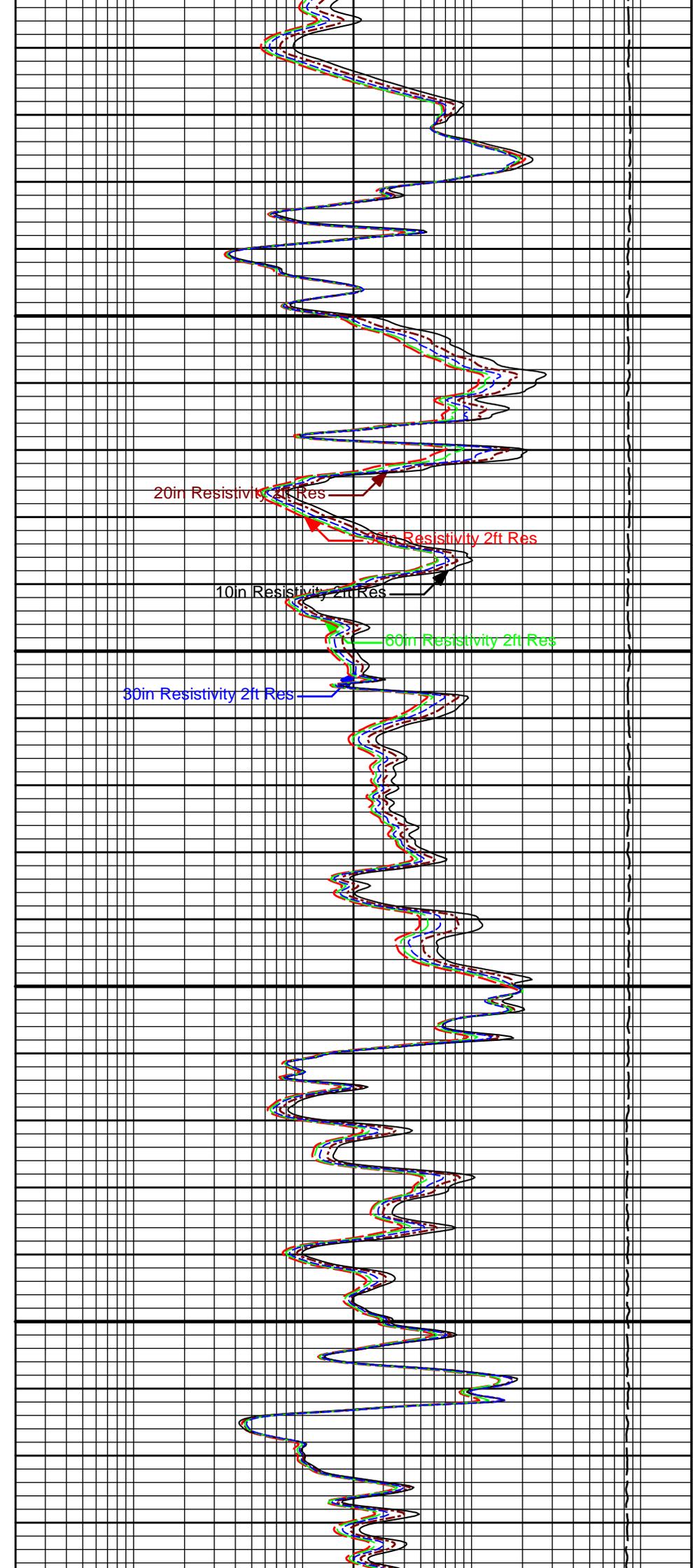
60in Resistivity 2ft Res

30in Resistivity 2ft Res



4100

4200

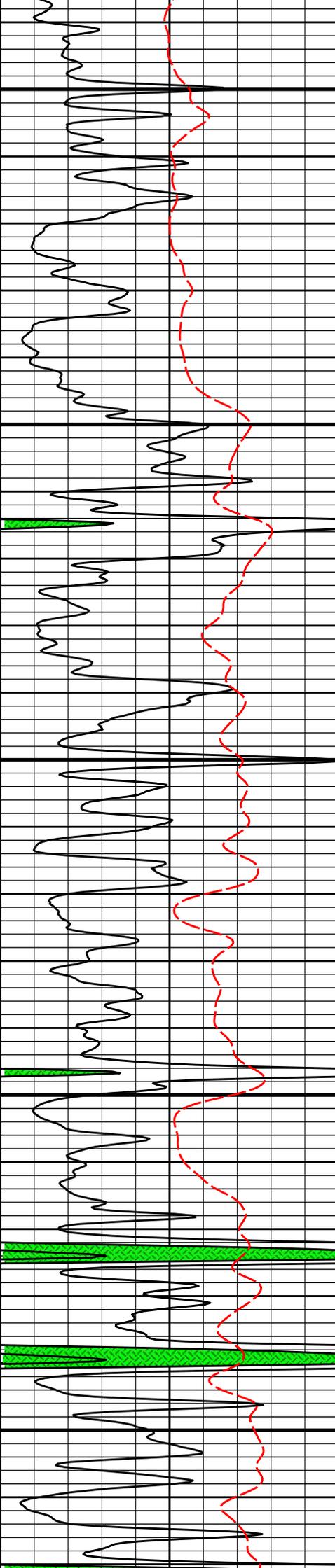


20in Resistivity 2ft Res

10in Resistivity 2ft Res

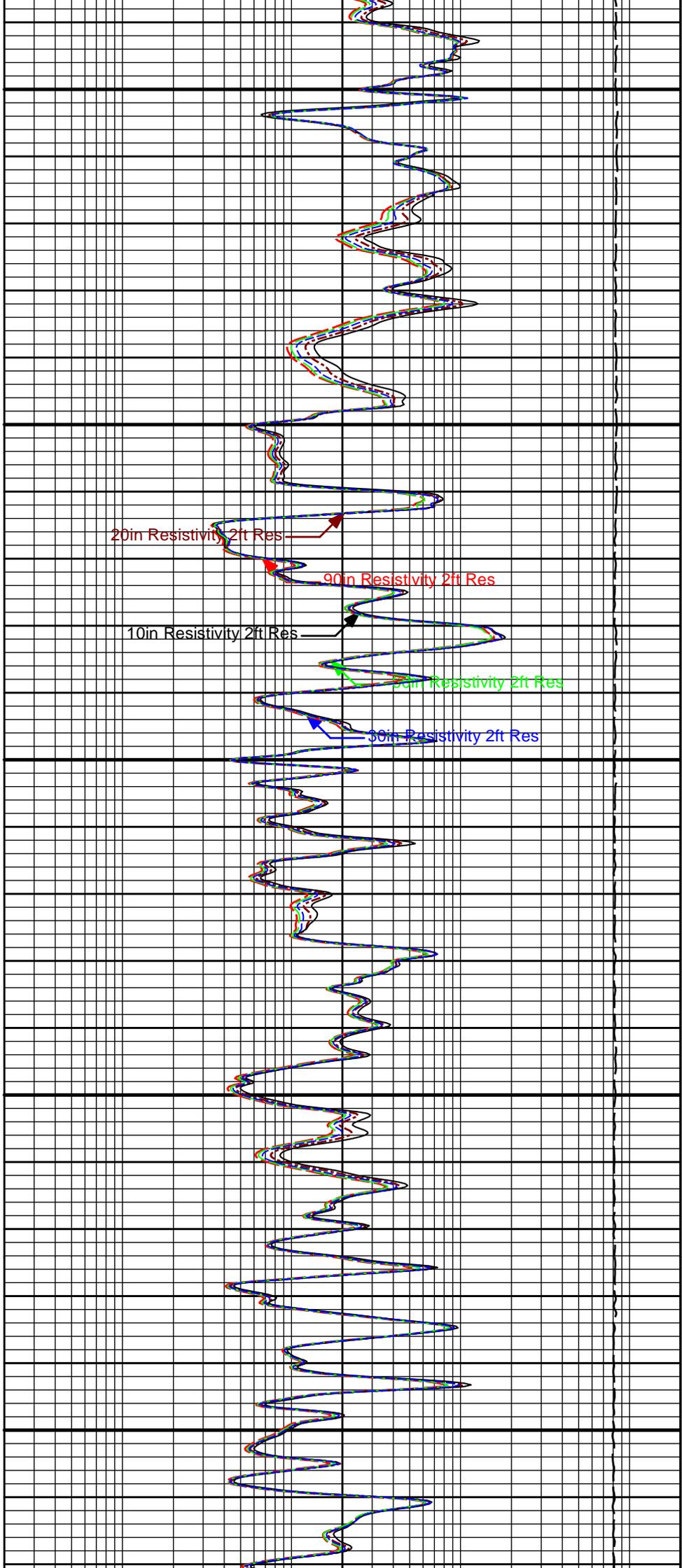
30in Resistivity 2ft Res

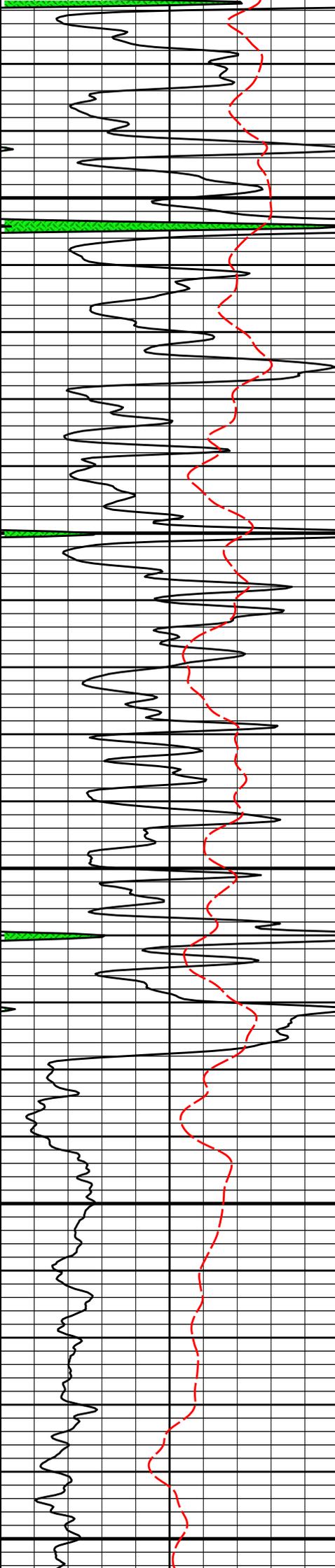
60in Resistivity 2ft Res



4300

4400

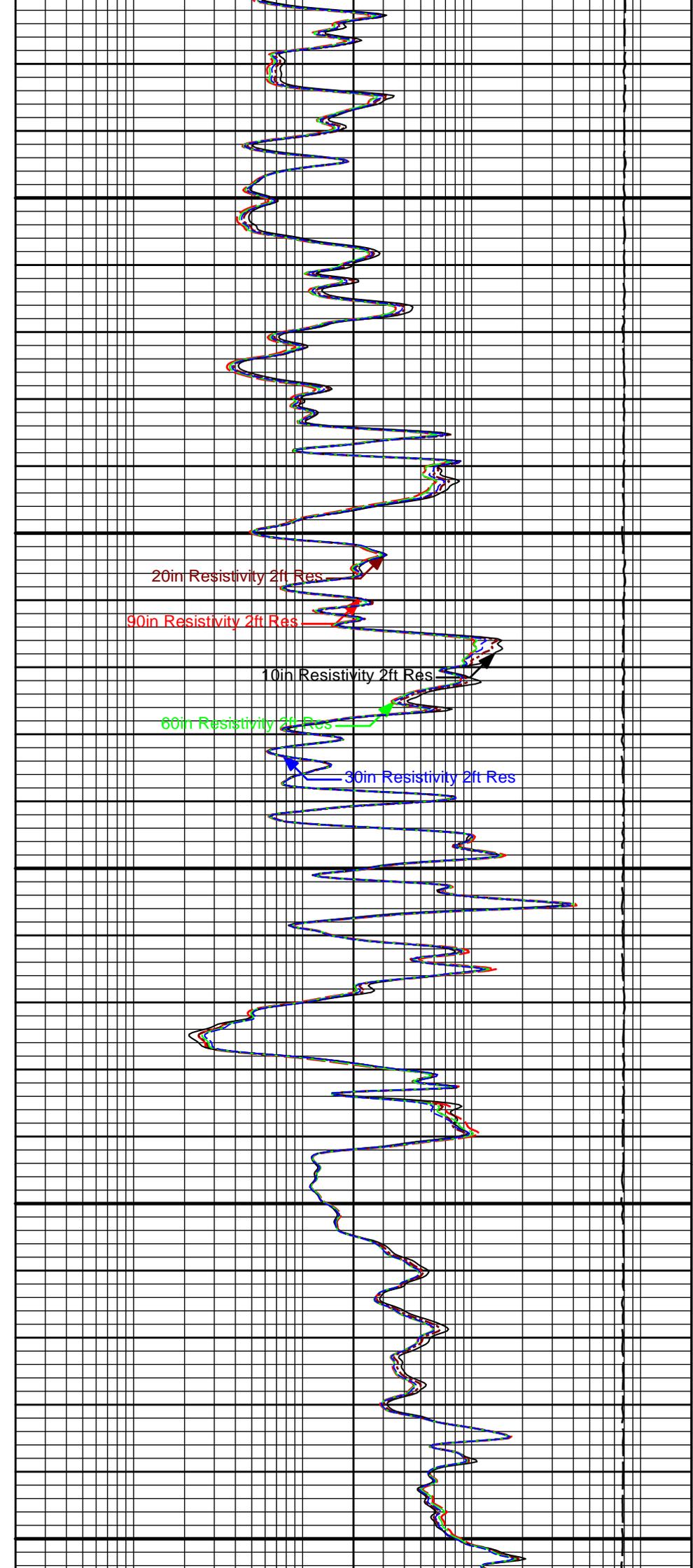




4500

4600

4700



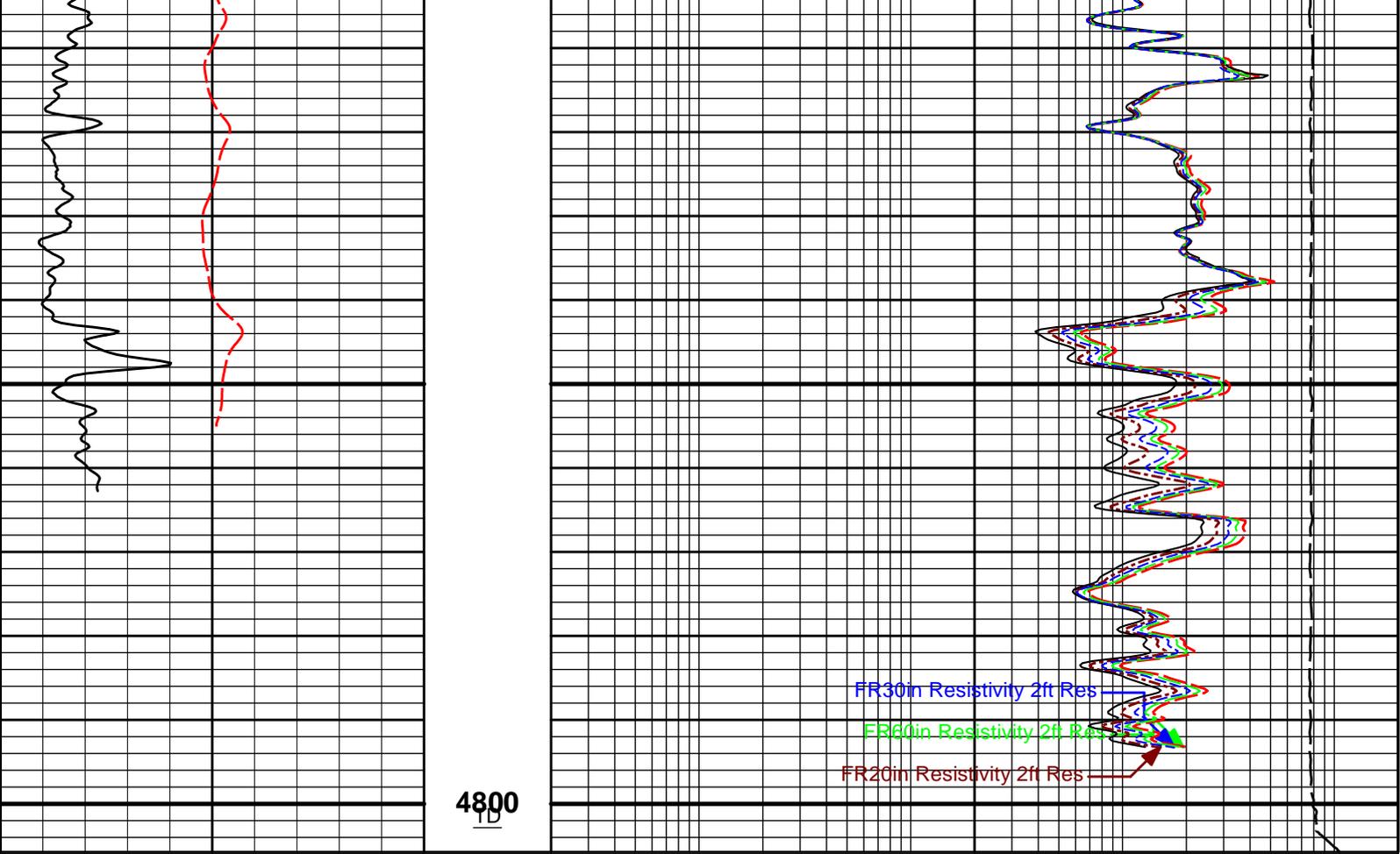
20in Resistivity 2ft Res

90in Resistivity 2ft Res

10in Resistivity 2ft Res

60in Resistivity 2ft Res

30in Resistivity 2ft Res



0	Gamma API	150		15K	Tension	0
	api				pounds	
	SP					
	-] 20 mV [+]		0.2	90in Resistivity 2ft Res		2K
				ohmm		
			0.2	60in Resistivity 2ft Res		2000
				ohmm		
			0.2	30in Resistivity 2ft Res		2000
				ohm-metre		
			0.2	20in Resistivity 2ft Res		2000
				ohmm		
			0.2	10in Resistivity 2ft Res		2K
				ohmm		

**HALLIBURTON**

Plot Time: 21-Mar-18 15:42:51  
 Plot Range: 330 ft to 4805.75 ft  
 Data: WARD\_4-TWINWell Based\MAIN\  
 Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_5inch\_main

## 5 INCH MAIN LOG

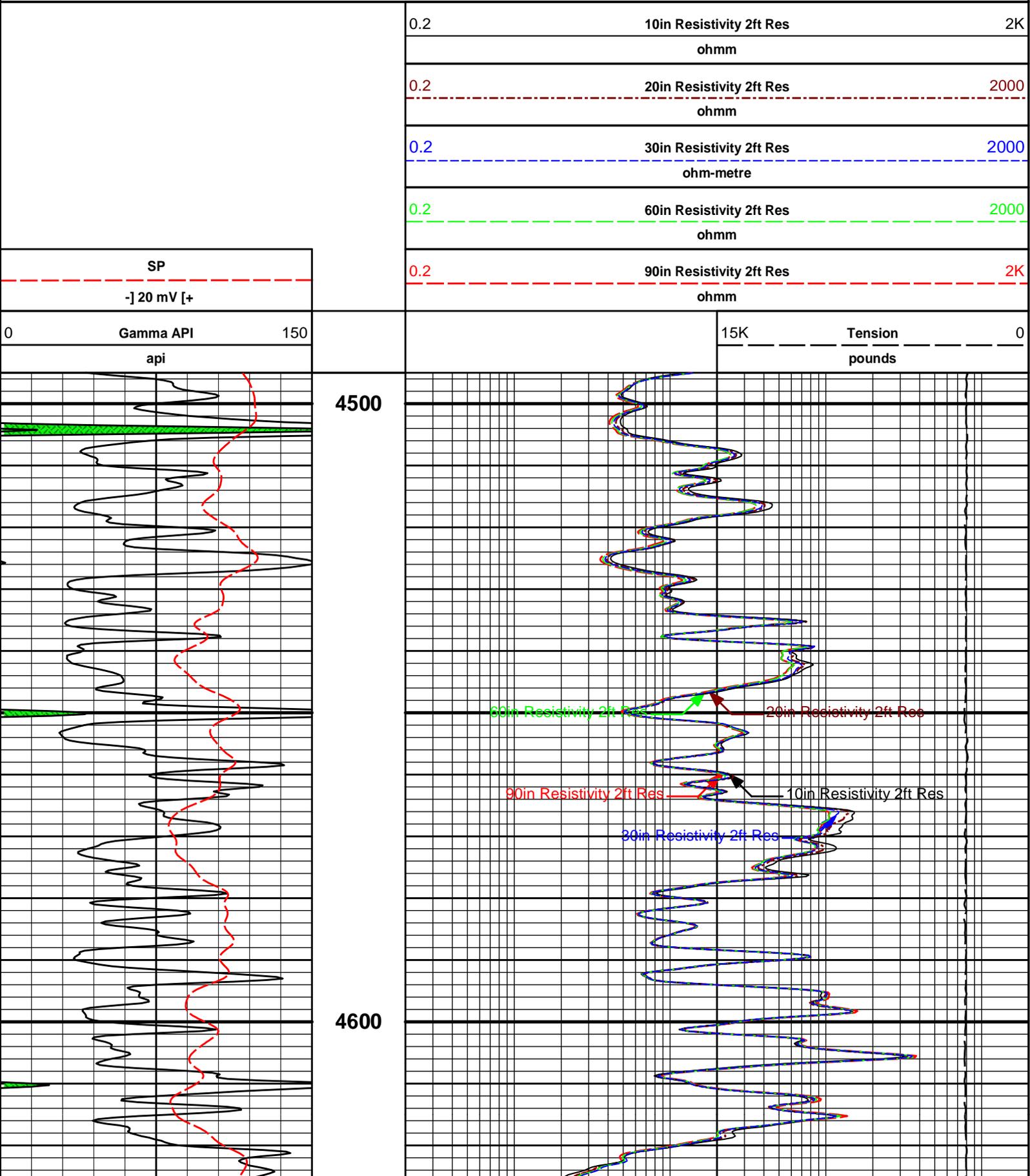
## 5 INCH MAIN LOG

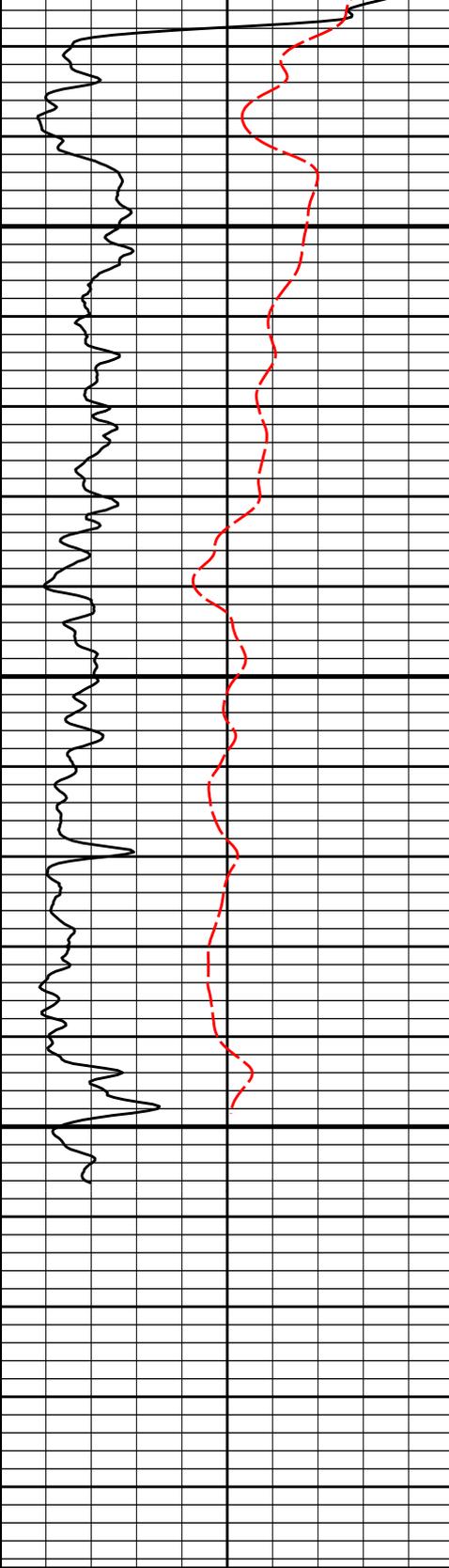
**HALLIBURTON**

Plot Time: 21-Mar-18 15:42:51  
 Plot Range: 4495 ft to 4799 ft  
 Data: WARD\_4-TWINWell Based\REPEAT\  
 Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_5inch\_repeat

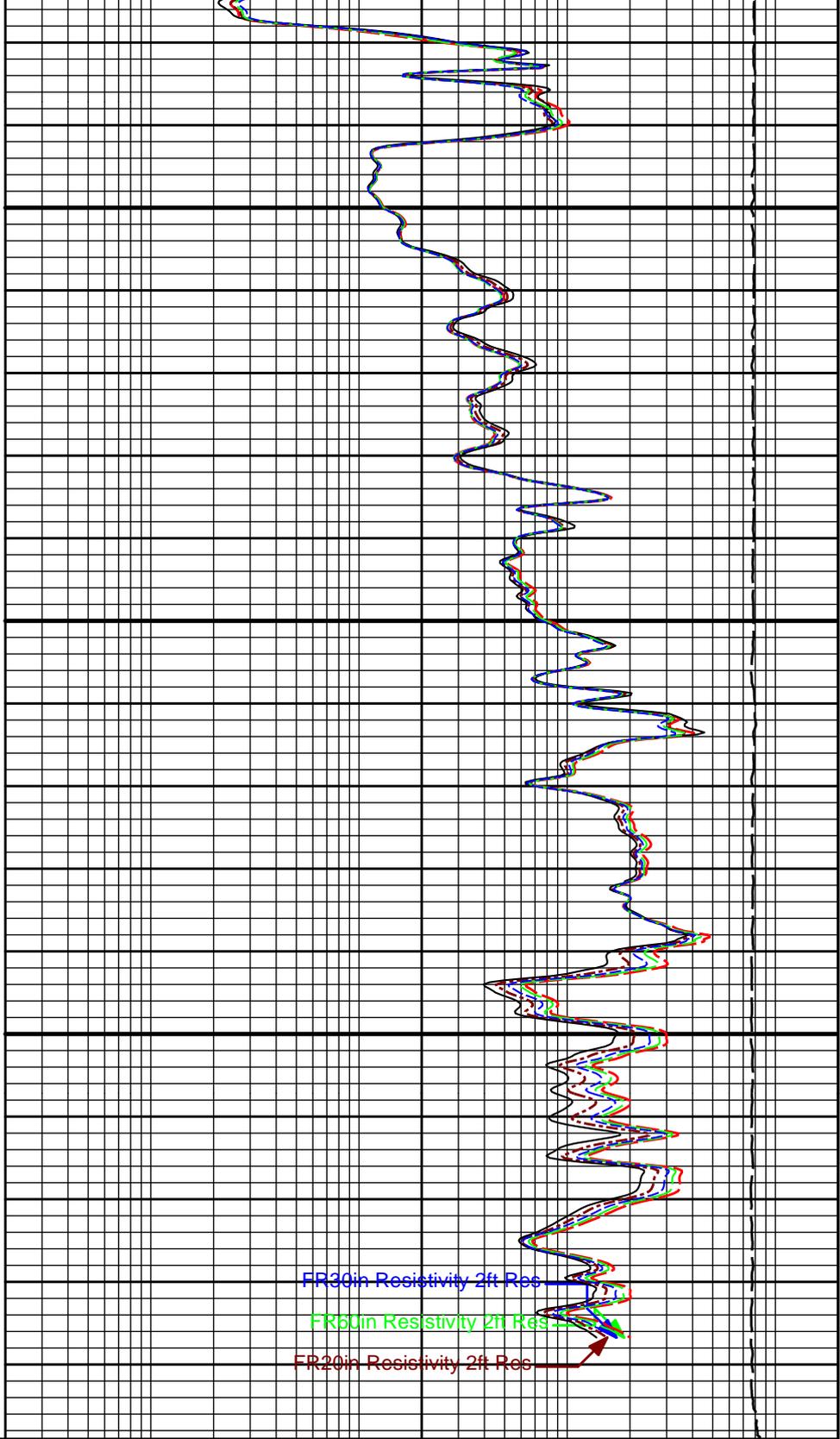
# 5 INCH MAIN LOG

## 5 INCH REPEAT LOG





4700



FR30in Resistivity 2ft Res  
 FR60in Resistivity 2ft Res  
 FR20in Resistivity 2ft Res

0	Gamma API	150
	api	
	SP	
	-] 20 mV [+	

	15K	Tension	0
		pounds	

0.2	90in Resistivity 2ft Res	2K
	ohmm	
0.2	60in Resistivity 2ft Res	2000
	ohmm	
0.2	30in Resistivity 2ft Res	2000
	ohm-metre	
0.2	20in Resistivity 2ft Res	2000
	ohmm	
0.2	10in Resistivity 2ft Res	2K
	ohmm	

# 5 INCH MAIN LOG

# 5 INCH REPEAT LOG

## TOOL STRING DIAGRAM REPORT

Description	Overbody Description	O.D.	Diagram	Sensors @ Delays	Length	Accumulated Length	
CH_HOS-11459024 37.50 lbs	Weak Point 7000 lbs- 00000025 0.01 lbs	Ø 2.750 in Ø 0.010 in*		Temperature @ 55.29 ft	2.50 ft	55.79 ft	
XOHD-11569312 20.00 lbs		Ø 2.750 in Ø 3.625 in				0.95 ft	53.29 ft
SP Sub-11153357 60.00 lbs		Ø 3.625 in			SP @ 50.56 ft	3.74 ft	52.34 ft
					Z-Accelerometer @ 48.15 ft		48.60 ft
GTET-11958947 165.00 lbs		Ø 3.625 in				8.52 ft	
					GammaRay @ 42.54 ft		40.08 ft
DSNT-11055304 174.00 lbs	DSN Decentralizer- 11055304 6.60 lbs	Ø 5.000 in* Ø 3.625 in			DSN Far @ 33.15 ft DSN Near @ 32.40 ft	9.69 ft	30.40 ft
SDLT-10951315 360.00 lbs	SDLT Pad-10865873 65.00 lbs Microlog Pad-10951315 8.00 lbs RAM-Cs137-00005168 1.00 lbs	Ø 4.500 in Ø 4.500 in* Ø 4.750 in* Ø 0.800 in*			Microlog @ 22.58 ft SDL Caliper @ 22.40 ft SDL @ 22.39 ft	10.81 ft	

ACRt Instrument-  
11026095  
50.00 lbs

Ø 3.625 in →

5.03 ft

19.58 ft

14.55 ft

← Mud Resistivity @ 13.19 ft

← ACRt @ 9.21 ft

ACRt Sonde-  
11005908  
200.00 lbs

Ø 3.625 in →

14.22 ft

Bull Nose-12345678  
5.00 lbs

Ø 2.750 in →

0.33 ft

0.33 ft

0.00 ft



Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)	Accumulated Length (ft)	Max.Log. Speed (fpm)
CH_HOS	Hostile Cable Head with Load Cell	11459024	37.50	2.50	53.29	300.00
WP7K	Weak Point 7000 lbs	00000025	0.01	0.01	* 54.09	300.00
XOHD	Hostile to Dits Cross Over	11569312	20.00	0.95	52.34	300.00
SP	SP Sub	11153357	60.00	3.74	48.60	300.00
GTET	Gamma Telemetry Tool	11958947	165.00	8.52	40.08	60.00
DSNT	Dual Spaced Neutron	11055304	174.00	9.69	30.40	60.00
DCNT	DSN Decentralizer	11055304	6.60	5.13	* 33.73	300.00
SDLT	Spectral Density Tool	10951315	360.00	10.81	19.58	60.00
SDLP	Density Insite Pad	10865873	65.00	2.55	* 21.79	60.00
Cs137	Logging Source, SDLT-I, 1.78 Ci - Cs137	00005168	1.00	0.80	* 22.02	300.00
MICP	Microlog Pad	10951315	8.00	1.00	* 22.08	60.00
ACRt	Array Compensated True Resistivity Instrument Section	11026095	50.00	5.03	14.55	120.00
ACRt	Array Compensated True Resistivity Sonde Section	11005908	200.00	14.22	0.33	120.00
BLNS	Bull Nose	12345678	5.00	0.33	0.00	300.00
<b>Total</b>			<b>1,152.11</b>	<b>55.79</b>		

\* Not included in Total Length and Length Accumulation.

Data: WARD\_4-TWIN\0001 GTET-DSNT-SDLT-ACRT-634-DRIVERS\LDLE

Date: 21-Mar-18 13:31:38

**HALLIBURTON**

## PARAMETERS REPORT

Depth (ft)	Tool Name	Mnemonic	Description	Value	Units
TOP					
	SHARED	BS	Bit Size	7.875	in
	SHARED	UBS	Use Bit Size instead of Caliper for all applications.	No	
	SHARED	MDBS	Mud Base	Water	
	SHARED	MDWT	Borehole Fluid Weight	9.100	ppg
	SHARED	WAGT	Weighting Agent	Natural	
	SHARED	BSAL	Borehole salinity	0.00	ppm
	SHARED	FSAL	Formation Salinity NaCl	0.00	ppm
	SHARED	KPCT	Percent K in Mud by Weight?	0.00	%
	SHARED	RMUD	Mud Resistivity	0.865	ohmm
	SHARED	TRM	Temperature of Mud	75.0	degF

SHARED	CSD	Logging Interval is Cased?	No	
SHARED	ICOD	AHV Casing OD	5.500	in
SHARED	CSTR	Compressive Strength	1000.00	psia
SHARED	ST	Surface Temperature	75.0	degF
SHARED	TD	Total Well Depth	4800.00	ft
SHARED	BHT	Bottom Hole Temperature	118.0	degF
SHARED	SVTM	Navigation and Survey Master Tool	NONE	
SHARED	AZTM	High Res Z Accelerometer Master Tool	GTET	
SHARED	TEMM	CBM Temperature Master Tool	GTET	
Rwa / CrossPlot	XPOK	Process Crossplot?	Yes	
Rwa / CrossPlot	FCHO	Select Source of F	Automatic	
Rwa / CrossPlot	AFAC	Archie A factor	0.6200	
Rwa / CrossPlot	MFAC	Archie M factor	2.1500	
Rwa / CrossPlot	RMFR	Rmf Reference	0.71	ohmm
Rwa / CrossPlot	TMFR	Rmf Ref Temp	75.00	degF
Rwa / CrossPlot	RWA	Resistivity of Formation Water	0.05	ohmm
Rwa / CrossPlot	ADP	Use Air Porosity to calculate CrossplotPhi	No	
Rwa / CrossPlot	BHSM	Borehole Size Source Tool	SDLT	
Rwa / CrossPlot	ROIN	Input for RO Calculation	Rwa	
GTET	GROK	Process Gamma Ray?	Yes	
GTET	GEOK	Process Gamma Ray EVR?	No	
GTET	TPOS	Tool Position for Gamma Ray Tools.	Eccentered	
GTET	BHSM	Borehole Size Source Tool	SDLT	
DSNT	DNOK	Process DSN?	Yes	
DSNT	DEOK	Process DSN EVR?	No	
DSNT	NLIT	Neutron Lithology	Limestone	
DSNT	DNSO	DSN Standoff - 0.25 in (6.35 mm) Recommended	0.250	in
DSNT	DNTT	Temperature Correction Type	None	
DSNT	DPRS	DSN Pressure Correction Type	None	
DSNT	SHCO	View More Correction Options	No	
DSNT	UTVD	Use TVD for Gradient Corrections?	No	
DSNT	LHWT	Logging Horizontal Water Tank?	No	
DSNT	BHSM	Borehole Size Source Tool	SDLT	
SDLT	CLOK	Process Caliper Outputs?	Yes	
Microlog Pad	MLOK	Process MicroLog Outputs?	Yes	
SDLT Pad	DNOK	Process Density?	Yes	
SDLT Pad	DNOK	Process Density EVR?	No	
SDLT Pad	CB	Logging Calibration Blocks?	No	
SDLT Pad	SPVT	SDLT Pad Temperature Valid?	Yes	
SDLT Pad	DTWN	Disable temperature warning	No	
SDLT Pad	DMA	Formation Density Matrix	2.710	g/cc
SDLT Pad	DFL	Formation Density Fluid	1.000	g/cc
SDLT Pad	BHSM	Borehole Size Source Tool	SDLT	
ACRt Sonde	RTOK	Process ACRT?	Yes	
ACRt Sonde	MNSO	Minimum Tool Standoff	1.50	in
ACRt Sonde	TCS1	Temperature Correction Source	FP Lwr & FP Upr	
ACRt Sonde	TPOS	Tool Position	Free Hanging	
ACRt Sonde	RMOP	Rmud Source	Mud Cell	
ACRt Sonde	RMIN	Minimum Resistivity for MAP	0.20	ohmm
ACRt Sonde	RMAX	Maximum Resistivity for MAP	200.00	ohmm
ACRt Sonde	THQY	Threshold Quality	0.50	
ACRt Sonde	MRFX	Fixed mud resistivity	2000	ohmm
ACRt Sonde	BHSM	Borehole Size Source Tool	SDLT	

BOTTOM

Data: WARD\_4-TWIN0001 GTET-DSNT-SDLT-ACRT-634-DRIVERSIDLE

Date: 21-Mar-18 14:52:19

**HALLIBURTON****CALIBRATION REPORT****NATURAL GAMMA RAY TOOL SHOP CALIBRATION****Tool Name:** GTET - 11958947**Reference Calibration Date:** 20-Feb-18 09:19:12**Engineer:** JORGE ORLANDO PEREZ**Calibration Date:** 20-Feb-18 09:23:22**Software Version:** WL INSITE R5.0.5 (Build 8)**Calibration Version:** 1

Calibrator Source S/N: TB-146

Calibrator API Reference:225.00 api

Equivalent Calibrator API Reference:228.9 api

Measurement	Measured	Calibrated	Units
Background	29.2	29.5	api
Background + Calibrator	256.0	258.4	api
Calibrator	226.8	228.9	api

**NATURAL GAMMA RAY TOOL FIELD CALIBRATION****Tool Name:** GTET - 11958947**Reference Calibration Date:** 20-Feb-18 09:23:22**Engineer:** JORGE ORLANDO PEREZ**Calibration Date:** 07-Mar-18 09:29:45**Software Version:** WL INSITE R5.0.5 (Build 8)**Calibration Version:** 1

Calibrator Source S/N: TB-146

Calibrator API Reference:225.00 api

Equivalent Calibrator API Reference:228.9 api

Field Verification	Shop	Field	Units
Background	29.5	23.3	api
Background + Calibrator	258.4	253.5	api
Calibrator	228.9	230.1	api

Shop	Field	Difference	Tolerance
228.9	230.1	-1.2	+/- 9.00

**ARRAY COMPENSATED TRUE RESISTIVITY SHOP CALIBRATION****Tool Name:** ACRt Sonde - 11005908**Reference Calibration Date:** 24-Jan-18 11:50:13**Engineer:** JORGE ORLANDO PEREZ**Calibration Date:** 16-Mar-18 10:34:00**Software Version:** WL INSITE R5.0.5 (Build 8)**Calibration Version:** 1**Host Tool Name:** ACRt Instrument - 11026095**TYPICAL GAIN RANGE**

Subarray	R12KHz			R36KHz			R72KHz		
	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper
A1 (80")	0.95	1.0415	1.05	0.95	1.0202	1.05	0.95	1.0109	1.05
A2 (50")	0.95	1.0485	1.05	0.95	1.0233	1.05	0.95	1.0144	1.05
A3 (29")	0.95	1.0353	1.05	0.95	1.0139	1.05	0.95	1.0048	1.05
A4 (17")	0.95	1.0423	1.05	0.95	1.0194	1.05	0.95	1.0121	1.05
A5 (10")	N/A	N/A	N/A	0.95	1.0134	1.05	0.95	1.0048	1.05
A6 (6")	N/A	N/A	N/A	0.95	1.0044	1.05	0.95	0.9956	1.05

**SONDE OFFSET**

Subarray	R12KHz			R36KHz			R72KHz		
	(mmho/m)			(mmho/m)			(mmho/m)		

	(mmho/m)	(mmho/m)	(mmho/m)
A1 (80")	1.428	-4.149	-5.990
A2 (50")	-0.217	-4.118	-5.417
A3 (29")	-14.051	-4.501	-3.906
A4 (17")	-92.668	-28.984	-24.290
A5 (10")	N/A	-111.115	-48.871
A6 (6")	N/A	354.229	183.875

TRANSMITTER CURRENT GAIN				R-MUD VERIFICATION			
Signal	Lower	R	Upper	Signal	Lower (ohm-m)	Measured (ohm-m)	Upper (ohm-m)
12K	0.6	0.92	1.3	Mud Cell	0.95	1.00	1.05
36K	1.0	1.93	2.0				
72K	1.0	1.27	2.0				

PASS/FAIL SUMMARY	
GAIN RANGE CHK	PASS
SONDE OFFSET CHK	PASS
TOOL OK TO LOG	

### CALIBRATION SUMMARY

Sensor	Shop	Field	Post	Difference	Tolerance	Units
GTET-11958947						
Gamma Ray Calibrator	228.9	230.1	-----	-1.2	+/- 9.00	api
ACRt Sonde-11005908						
Mud Cell	1.00	-----	-----	0	-----	ohm-m

Data: WARD\_4-TWIN0001 GTET-DSNT-SDLT-ACRT-634-DRIVERSIDLE Date: 21-Mar-18 14:53:31

## HALLIBURTON

### INPUTS, DELAYS AND FILTERS TABLE

Mnemonic	Input Description	Delay (ft)	Filter Type	Filter Length (ft)
<b>Depth Panel</b>				
TENS	Tension	0.00	NO	
<b>Rwa / CrossPlot</b>				
TPUL	Tension Pull	55.79	NO	
BS	Bit Size	55.79	NO	
HDIA	Measured Hole Diameter	0.00	NO	
<b>CH_HOS</b>				
DHTN	DownholeTension	0.00	BLK	0.000
<b>SP Sub</b>				
PLTC	Plot Control Mask	50.56	NO	
SP	Spontaneous Potential	50.56	BLK	1.250
SPR	Raw Spontaneous Potential	50.56	NO	
SPO	Spontaneous Potential Offset	50.56	NO	
<b>GTET</b>				
TPUL	Tension Pull	42.54	NO	
GR	Natural Gamma Ray API	42.54	TRI	1.750
GRU	Unfiltered Natural Gamma Ray API	42.54	NO	
EGR	Natural Gamma Ray API with Enhanced Vertical Resolution	42.54	W	1.416 , 0.750
HDIA	Measured Hole Diameter	0.00	NO	
ACCZ	Accelerometer Z	0.00	BLK	0.083

DEVI	Inclination	0.00	NO	
<b>DSNT</b>				
TPUL	Tension Pull	32.30	NO	
RNDS	Near Detector Telemetry Counts	32.40	BLK	1.417
RFDS	Far Detector Telemetry Counts	33.15	TRI	0.583
DNTT	DSN Tool Temperature	32.40	NO	
DSNS	DSN Tool Status	32.30	NO	
ERND	Near Detector Telemetry Counts EVR	32.40	BLK	0.000
ERFD	Far Detector Telemetry Counts EVR	33.15	BLK	0.000
ENTM	DSN Tool Temperature EVR	32.40	NO	
HDIA	Measured Hole Diameter	0.00	NO	
<b>SDLT</b>				
TPUL	Tension Pull	22.40	NO	
PCAL	Pad Caliper	22.40	TRI	0.250
ACAL	Arm Caliper	22.40	TRI	0.250
<b>ACRt Sonde</b>				
TPUL	Tension Pull	2.73	NO	
F1R1	ACRT 12KHz - 80in R value	8.98	BLK	0.000
F1X1	ACRT 12KHz - 80in X value	8.98	BLK	0.000
F1R2	ACRT 12KHz - 50in R value	6.48	BLK	0.000
F1X2	ACRT 12KHz - 50in X value	6.48	BLK	0.000
F1R3	ACRT 12KHz - 29in R value	4.98	BLK	0.000
F1X3	ACRT 12KHz - 29in X value	4.98	BLK	0.000
F1R4	ACRT 12KHz - 17in R value	3.98	BLK	0.000
F1X4	ACRT 12KHz - 17in X value	3.98	BLK	0.000
F1R5	ACRT 12KHz - 10in R value	3.48	BLK	0.000
F1X5	ACRT 12KHz - 10in X value	3.48	BLK	0.000
F1R6	ACRT 12KHz - 6in R value	3.23	BLK	0.000
F1X6	ACRT 12KHz - 6in X value	3.23	BLK	0.000
F2R1	ACRT 36KHz - 80in R value	8.98	BLK	0.000
F2X1	ACRT 36KHz - 80in X value	8.98	BLK	0.000
F2R2	ACRT 36KHz - 50in R value	6.48	BLK	0.000
F2X2	ACRT 36KHz - 50in X value	6.48	BLK	0.000
F2R3	ACRT 36KHz - 29in R value	4.98	BLK	0.000
F2X3	ACRT 36KHz - 29in X value	4.98	BLK	0.000
F2R4	ACRT 36KHz - 17in R value	3.98	BLK	0.000
F2X4	ACRT 36KHz - 17in X value	3.98	BLK	0.000
F2R5	ACRT 36KHz - 10in R value	3.48	BLK	0.000
F2X5	ACRT 36KHz - 10in X value	3.48	BLK	0.000
F2R6	ACRT 36KHz - 6in R value	3.23	BLK	0.000
F2X6	ACRT 36KHz - 6in X value	3.23	BLK	0.000
F3R1	ACRT 72KHz - 80in R value	8.98	BLK	0.000
F3X1	ACRT 72KHz - 80in X value	8.98	BLK	0.000
F3R2	ACRT 72KHz - 50in R value	6.48	BLK	0.000
F3X2	ACRT 72KHz - 50in X value	6.48	BLK	0.000
F3R3	ACRT 72KHz - 29in R value	4.98	BLK	0.000
F3X3	ACRT 72KHz - 29in X value	4.98	BLK	0.000
F3R4	ACRT 72KHz - 17in R value	3.98	BLK	0.000
F3X4	ACRT 72KHz - 17in X value	3.98	BLK	0.000
F3R5	ACRT 72KHz - 10in R value	3.48	BLK	0.000
F3X5	ACRT 72KHz - 10in X value	3.48	BLK	0.000
F3R6	ACRT 72KHz - 6in R value	3.23	BLK	0.000
F3X6	ACRT 72KHz - 6in X value	3.23	BLK	0.000
RMUD	Mud Resistivity	12.52	BLK	0.000
F1RT	Transmitter Reference 12 KHz Real Signal	2.73	BLK	0.000
F1XT	Transmitter Reference 12 KHz Imaginary Signal	2.73	BLK	0.000

F2RT	Transmitter Reference 36 KHz Real Signal	2.73	BLK	0.000
F2XT	Transmitter Reference 36 KHz Imaginary Signal	2.73	BLK	0.000
F3RT	Transmitter Reference 72 KHz Real Signal	2.73	BLK	0.000
F3XT	Transmitter Reference 72 KHz Imaginary Signal	2.73	BLK	0.000
TFPU	Upper Feedpipe Temperature Calculated	2.73	BLK	0.000
TFPL	Lower Feedpipe Temperature Calculated	2.73	BLK	0.000
ITMP	Instrument Temperature	2.73	BLK	0.000
TCVA	Temperature Correction Values Loop Off	2.73	NO	
TIDV	Instrument Temperature Derivative	2.73	NO	
TUDV	Upper Temperature Derivative	2.73	NO	
TLDV	Lower Temperature Derivative	2.73	NO	
TRBD	Receiver Board Temperature	2.73	NO	
HDIA	Measured Hole Diameter	0.00	NO	

#### Microlog Pad

TPUL	Tension Pull	22.58	NO	
MINV	Microlog Lateral	22.58	BLK	0.750
MNOR	Microlog Normal	22.58	BLK	0.750

#### SDLT Pad

TPUL	Tension Pull	22.39	NO	
NAB	Near Above	22.21	BLK	0.920
NHI	Near Cesium High	22.21	BLK	0.920
NLO	Near Cesium Low	22.21	BLK	0.920
NVA	Near Valley	22.21	BLK	0.920
NBA	Near Barite	22.21	BLK	0.920
NDE	Near Density	22.21	BLK	0.920
NPK	Near Peak	22.21	BLK	0.920
NLI	Near Lithology	22.21	BLK	0.920
NBAU	Near Barite Unfiltered	22.21	BLK	0.250
NLIU	Near Lithology Unfiltered	22.21	BLK	0.250
FAB	Far Above	22.56	BLK	0.250
FHI	Far Cesium High	22.56	BLK	0.250
FLO	Far Cesium Low	22.56	BLK	0.250
FVA	Far Valley	22.56	BLK	0.250
FBA	Far Barite	22.56	BLK	0.250
FDE	Far Density	22.56	BLK	0.250
FPK	Far Peak	22.56	BLK	0.250
FLI	Far Lithology	22.56	BLK	0.250
PTMP	Pad Temperature	22.40	BLK	0.920
NHV	Near Detector High Voltage	21.79	NO	
FHV	Far Detector High Voltage	21.79	NO	
ITMP	Instrument Temperature	21.79	NO	
DDHV	Detector High Voltage	21.79	NO	
HDIA	Measured Hole Diameter	0.00	NO	

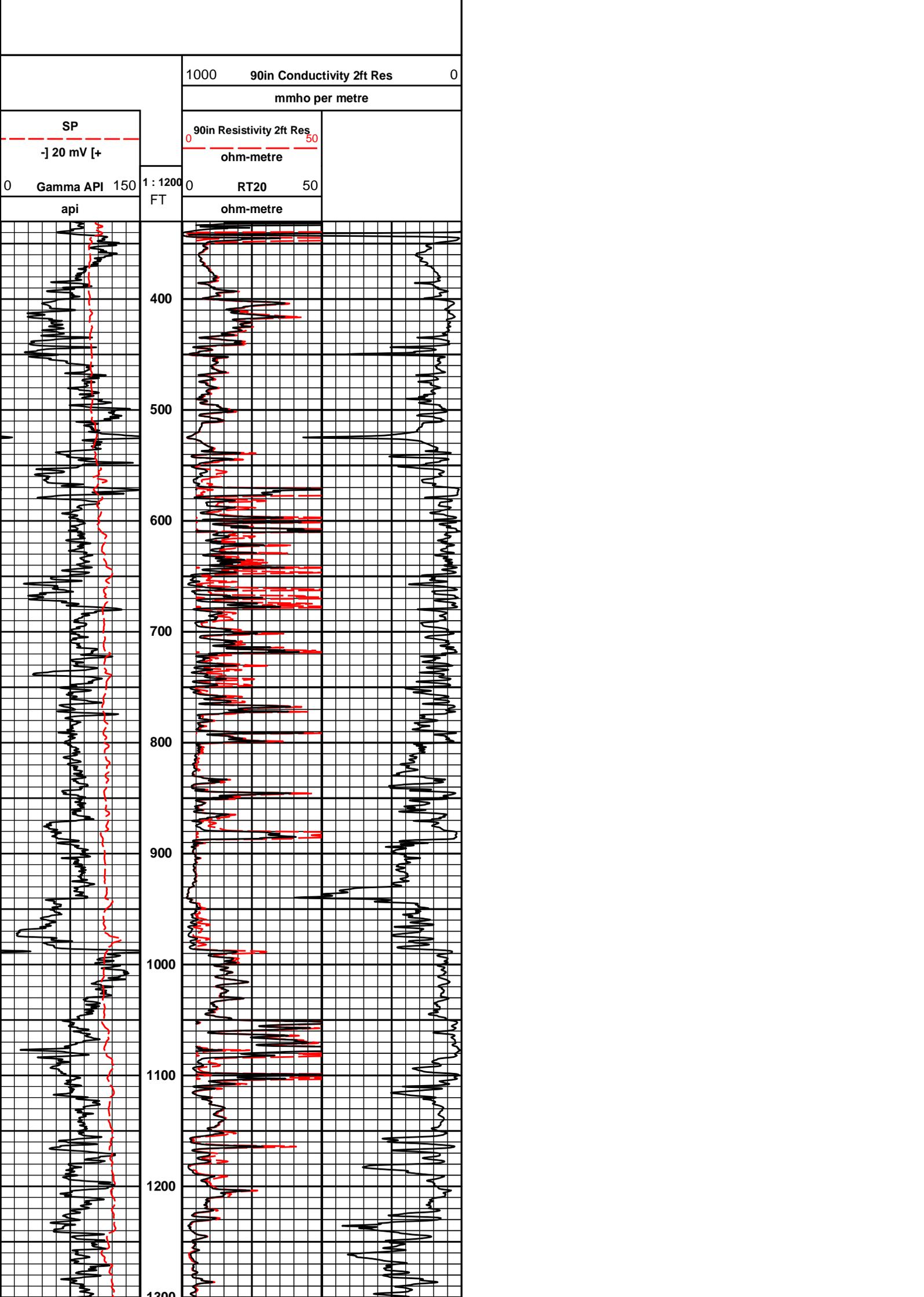
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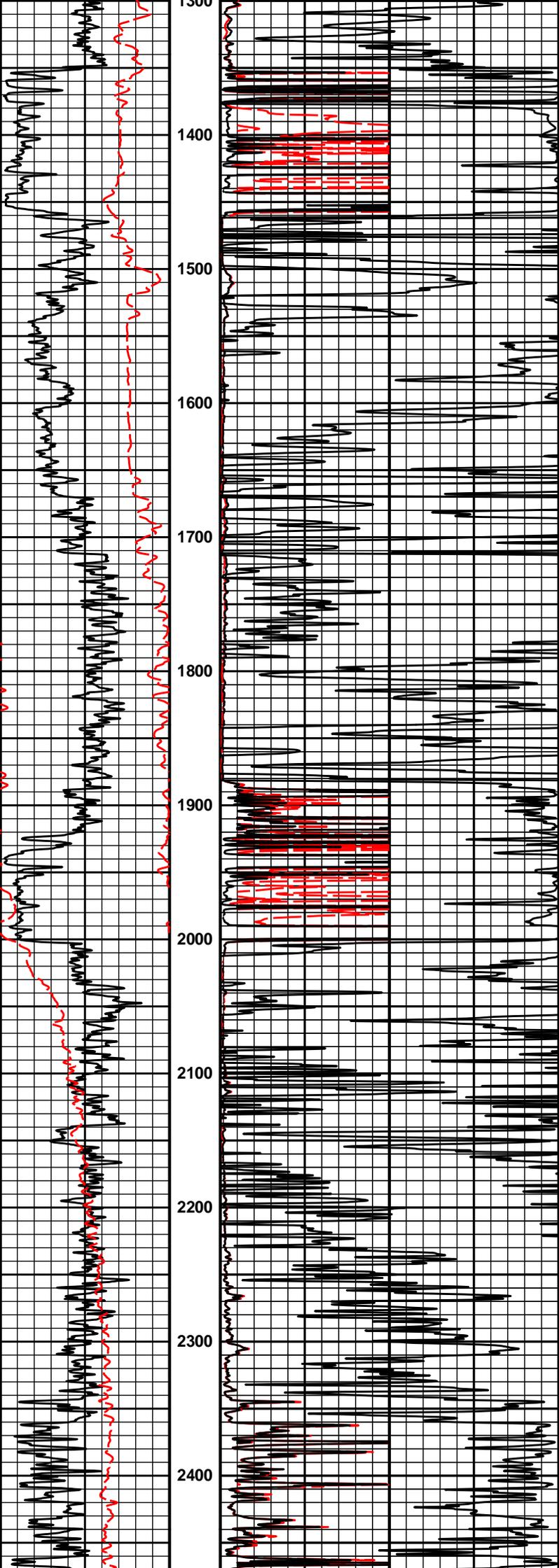
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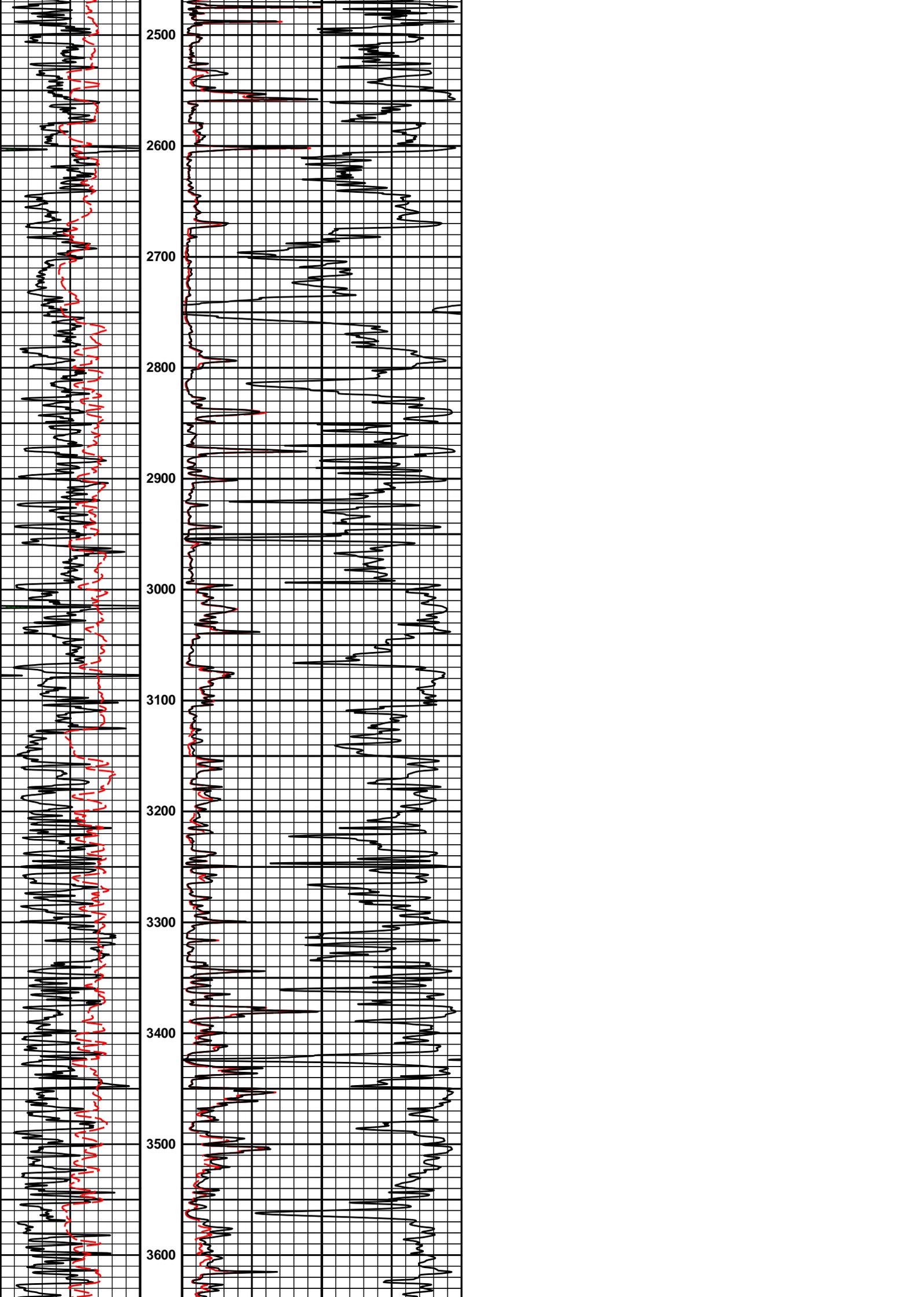
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Plot Time: 21-Mar-18 15:42:58  
Plot Range: 330 ft to 4793.25 ft  
Data: WARD\_4-TWINWell Based\MAIN\  
Plot File: \\-LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_1\_main

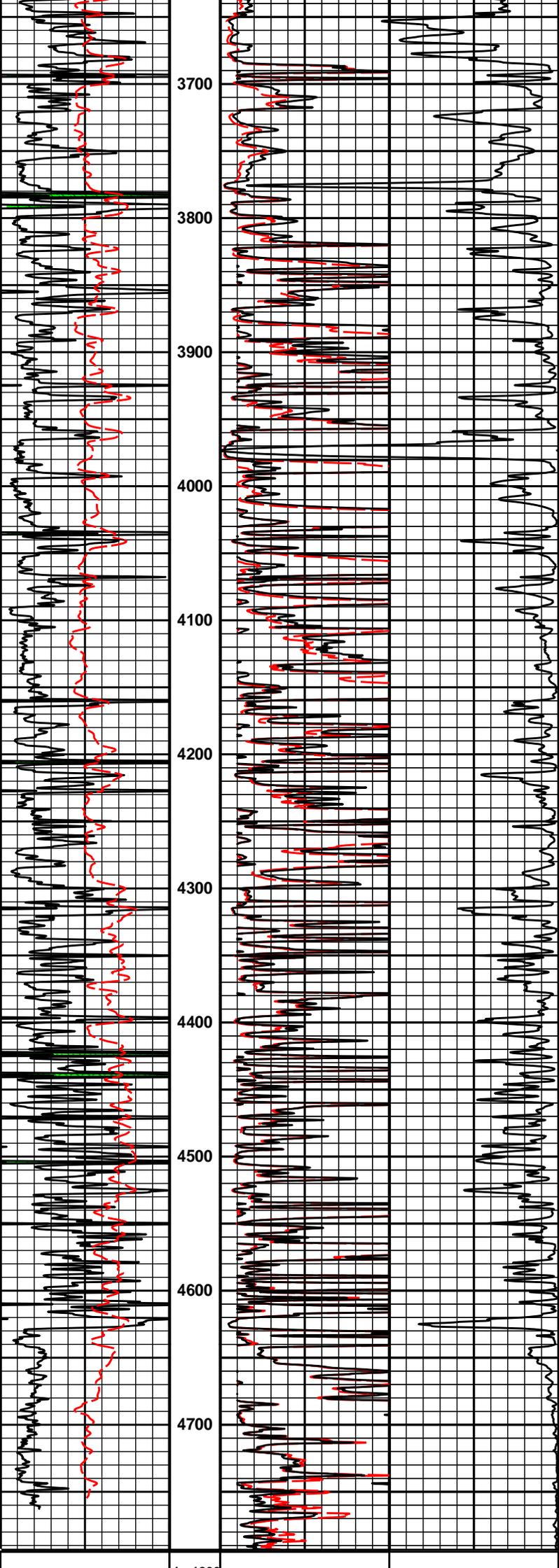
# 1 INCH MAIN LOG

1 INCH CORRELATION LOG









Gamma API	150	1:1200	0	RT20	50
api		FT		ohm-metre	
SP				90in Resistivity 2ft Res	
-] 20 mV [+]				ohm-metre	
			1000	90in Conductivity 2ft Res	0
				mmho per metre	

**HALLIBURTON**  
 Plot Time: 21-Mar-18 15:43:02  
 Plot Range: 330 ft to 4793.25 ft  
 Data: WARD\_4-TWINWell Based\MAIN\  
 Plot File: \\LOCAL-WARD\_4-TWINWell Based\ACRT\ACRT\_1\_main

**1 INCH MAIN LOG**

1 INCH CORRELATION LOG

COMPANY	HARTMAN OIL COMPANY, INC		
WELL	WARD #4 TWIN		
FIELD	DAMME		
COUNTY	FINNEY	STATE	KANSAS

**HALLIBURTON**

ARRAY COMPENSATED  
 TRUE RESISTIVITY  
 LOG