HALLIBURTON

ARRAY COMPENSATED TRUE RESISTIVITY LOG

COMPANY **CMX, INC.**

WELL **FOGHORN #1-27**

FIELD/BLOCK **CHASE-SILICA**

COUNTY **RICE** STATE **KANSAS**

COMPANY CMX, INC.
WELL FOGHORN #1-27
FIELD/BLOCK CHASE-SILICA
COUNTY RICE
STATE KANSAS

API No. 15-159-22839-00-00

Location 2310' FNL & 1110' FEL

Sect. 27 Twp. 19S Rge. 10W

Other Services:
ACRT
BSAT
DSNT/SDLT
MICRO

Permanent Datum	GL	Elev. 1753.0 ft	Elev.: K.B. 1761.0 ft
Log measured from	KB	, 8.0 ft above perm. Datum	D.F. 1761.0 ft
Drilling measured from	KB		G.L. 1753.0 ft

Date		17-Mar-17					
Run No.		ONE					
Depth - Driller		3320.0 ft					
Depth - Logger		3315.0 ft					
Bottom - Logged Interval		3311.0 ft					
Top - Logged Interval		1250.0 ft					
Casing - Driller		8.625 in	@ 256.0 ft	@		@	
Casing - Logger		258.0 ft					
Bit Size		7.875 in		@		@	
Type Fluid in Hole		Water Based Mud					
Density	Viscosity	9.1 ppg	57.00 s/qt				
PH	Fluid Loss	2.60 pH	10.0 cptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		0.49 ohmm	@ 75.00 degF	@		@	
Rmf @ Meas. Temperature		0.42 ohmm	@ 75.00 degF	@		@	
Rmc @ Meas. Temperature		0.57 ohmm	@ 75.00 degF	@		@	
Source Rmf	Rmc	CALC	CALC				
Rm @ BHT		0.38 ohmm	@ 98.0 degF	@		@	
Time Since Circulation		08:00 hr					
Time on Bottom		17-Mar-17 18:41					
Max. Rec. Temperature		98.00 degF	@ 3315.0 ft	@		@	
Equipment	Location	11072142	EL RENO, OK				
Recorded By		THOMAS HYDE					
Witnessed By		K. LEBLANC					

Fold here

PGM Version: WL INSITE R5.0.5 (Build 8)

Service Ticket No.: 903904174

API No.: 15-159-22839-00-00

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE

RESISTIVITY SCALE CHANGES

	Type Log	Depth	Scale Up Hole	Scale Down Hole

RESISTIVITY EQUIPMENT DATA

	Run No.	Tool Type & No.	Pad Type	Tool Pos.	Other
Rm @ Meas. Temp	@				
Rmf @ Meas. Temp.	@	ONE	ACRT	N/A	CENT.	N/A
Rmc @ Meas. Temp.	@		I-11026095			
Source Rmf	Rmc		S-11005908			
Rm @ BHT	@					
Rmf @ BHT	@					
Rmc @ BHT	@					

EQUIPMENT DATA

	GAMMA		ACOUSTIC			DENSITY			NEUTRON		
Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	11013114	Serial No.	10747683	Serial No.	10960494	Serial No.	10993115
Model No.	GTET	Model No.	BSAT	Model No.	SDLT	Model No.	DSNT
Diameter	3.625"	No. of Cent.	3.625"	Diameter	5.5"	Diameter	3.625"
Detector Model No.	T-102	Spacing	EVEN	Log Type	GAM-GAM	Log Type	NEU-NEU
Type	SCINT			Source Type	Cs137	Source Type	Am241Be
Length	8"	LSA [Y/N]		Serial No.	5168GW	Serial No.	DSN-424
Distance to Source	10'	FWDA [Y/N]		Strength	1.5 Ci	Strength	15 Ci

LOGGING DATA

	GENERAL				GAMMA		ACOUSTIC		DENSITY		NEUTRON	
	Run No.	Depth From	Depth To	Speed ft/min	Scale L	Scale R	Scale L	Scale R	Matrix	Scale L	Scale R	Matrix
ONE	3315	258	REC	0	150	30	10	147.6	30	10	2.71	LIME

ONE	3315	258	REC	0	150	30	-10	47.6	30	-10	2.71	30	-10	LIME

DIRECTIONAL INFORMATION

Maximum Deviation	@	KOP	@

Remarks: RUN 1: GTET-DSNT-SDLT

RUN 2: GTET-BSAT-ACRT

TOOLS RUN PER CUSTOMER REQUEST

ANNULAR HOLE VOLUME RAN FOR 5.5 INCH CASING

CHLORIDES REPORTED AT 12,200 mg/l

TODAY'S CREW: J. WOOD J. ROBERSON

THANK YOU FOR CHOOSING HALLIBURTON ENERGY SERVICES EL RENO, OK 405-278-9685

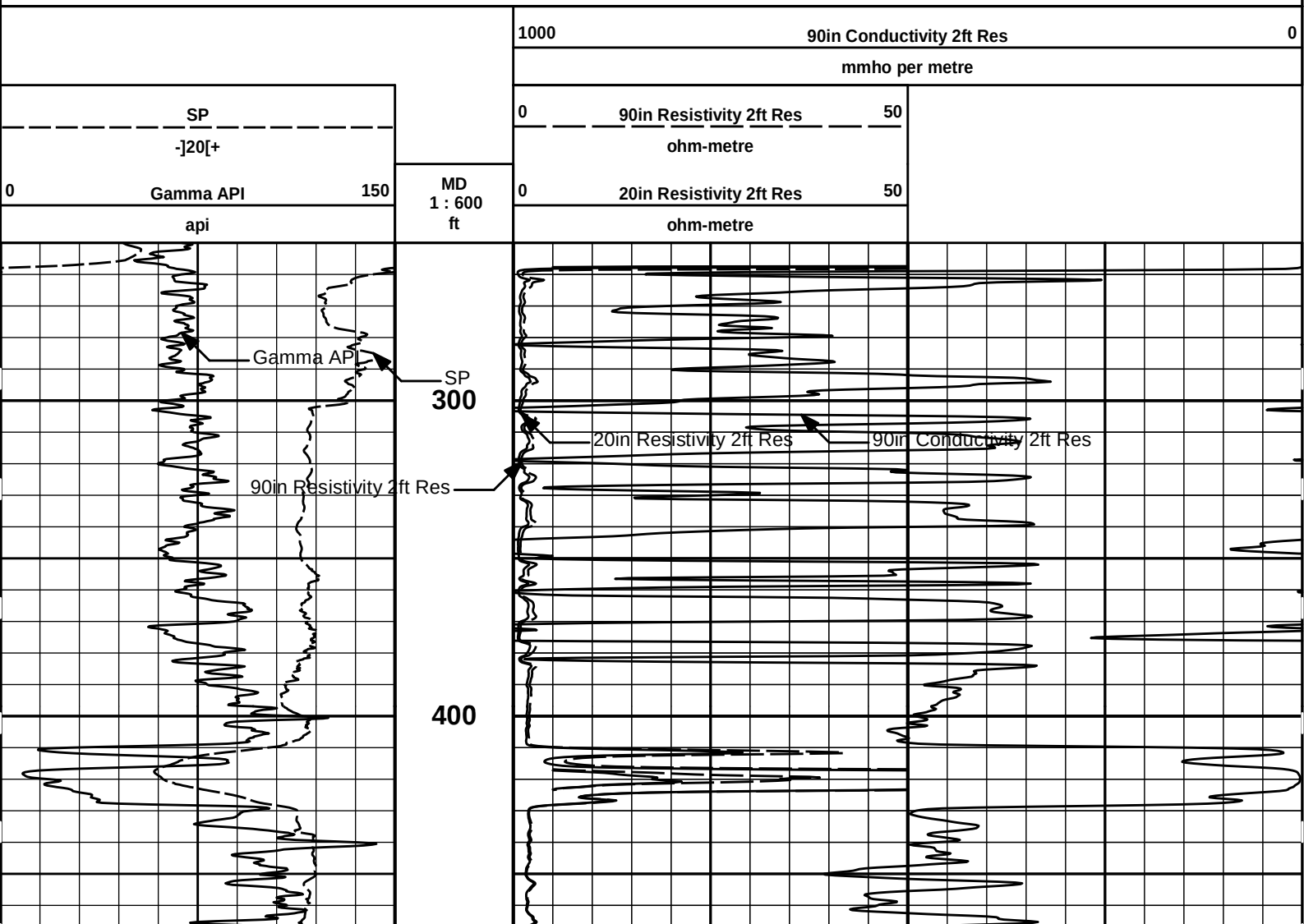
HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR 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.

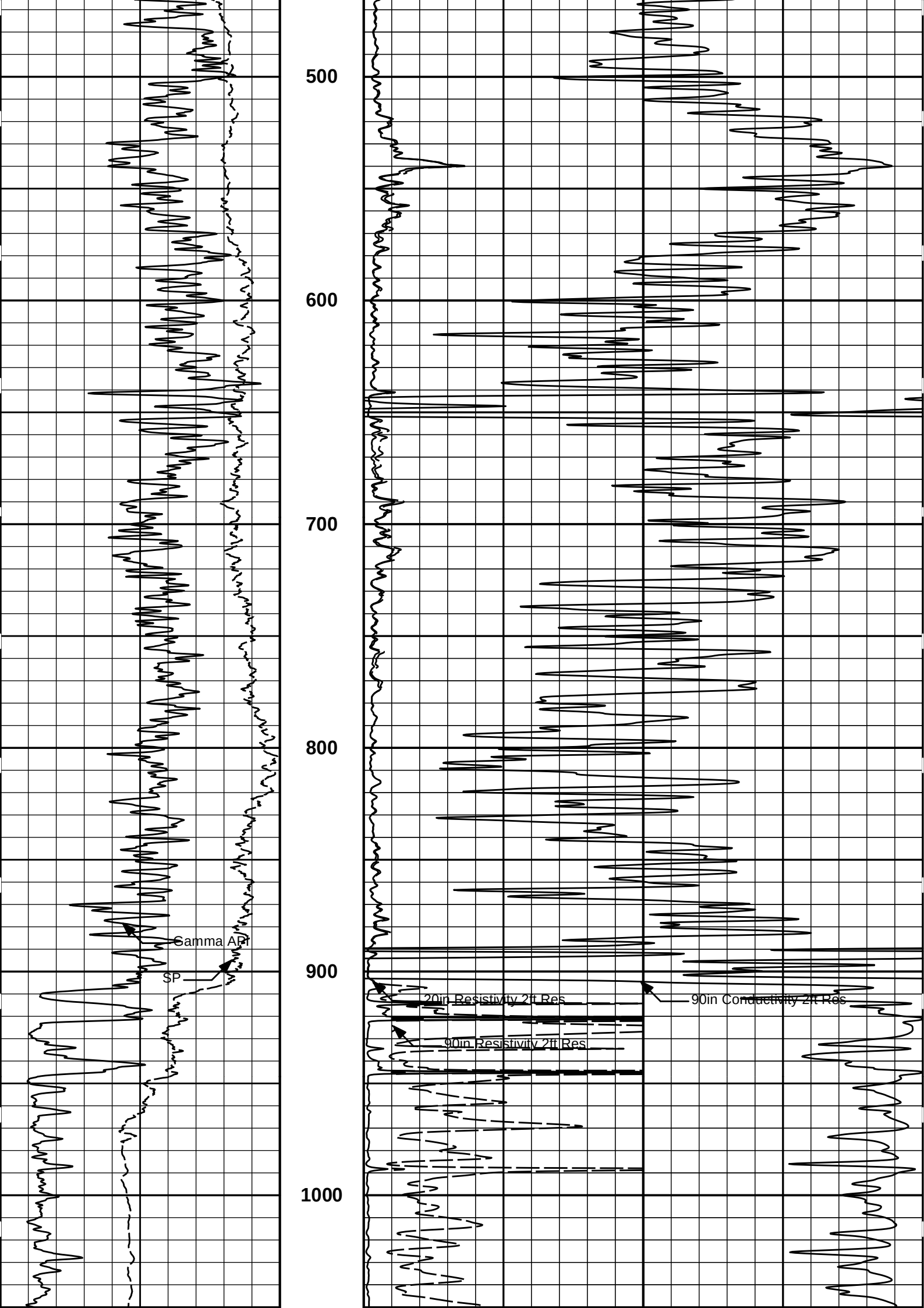
HALLIBURTON

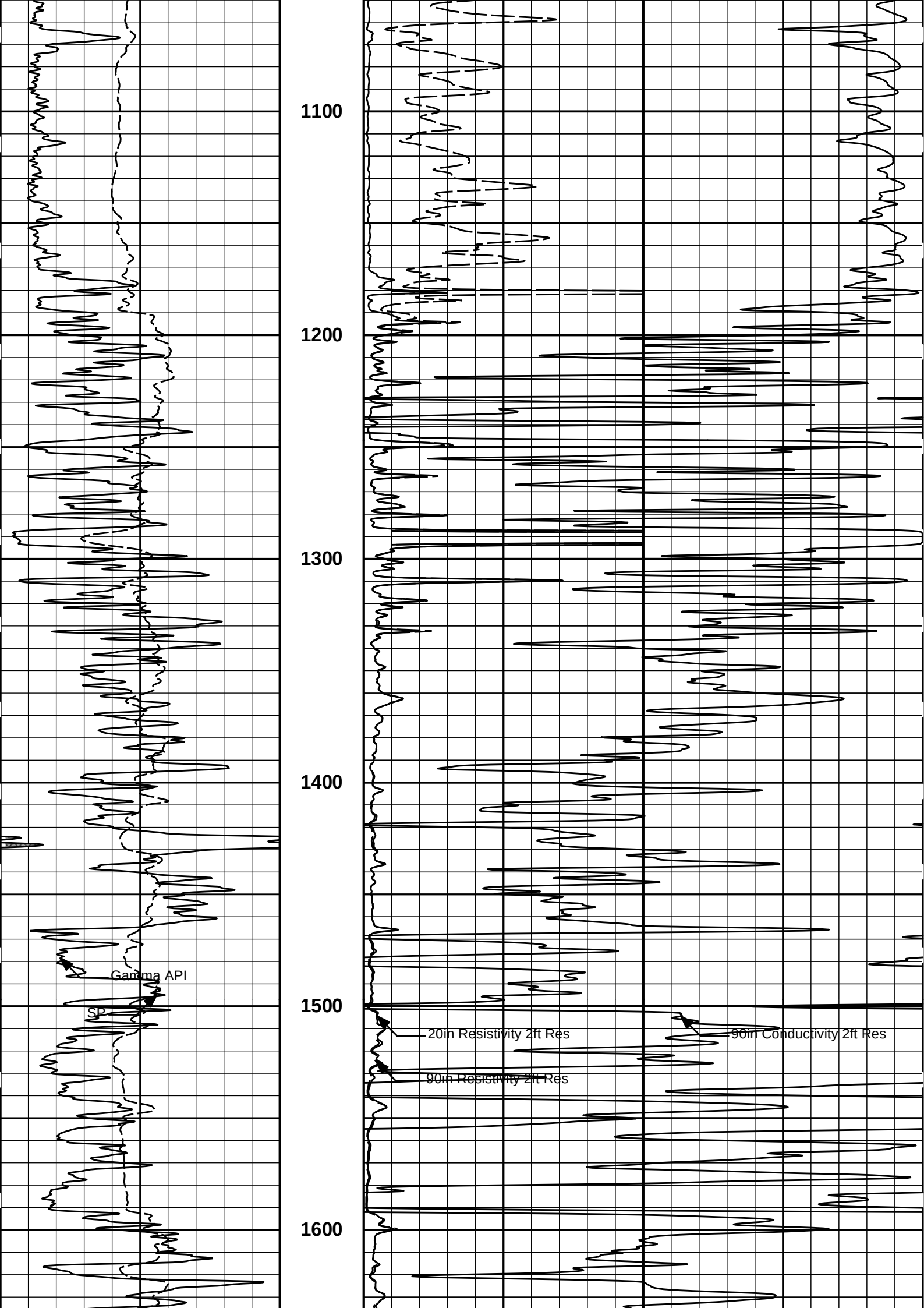
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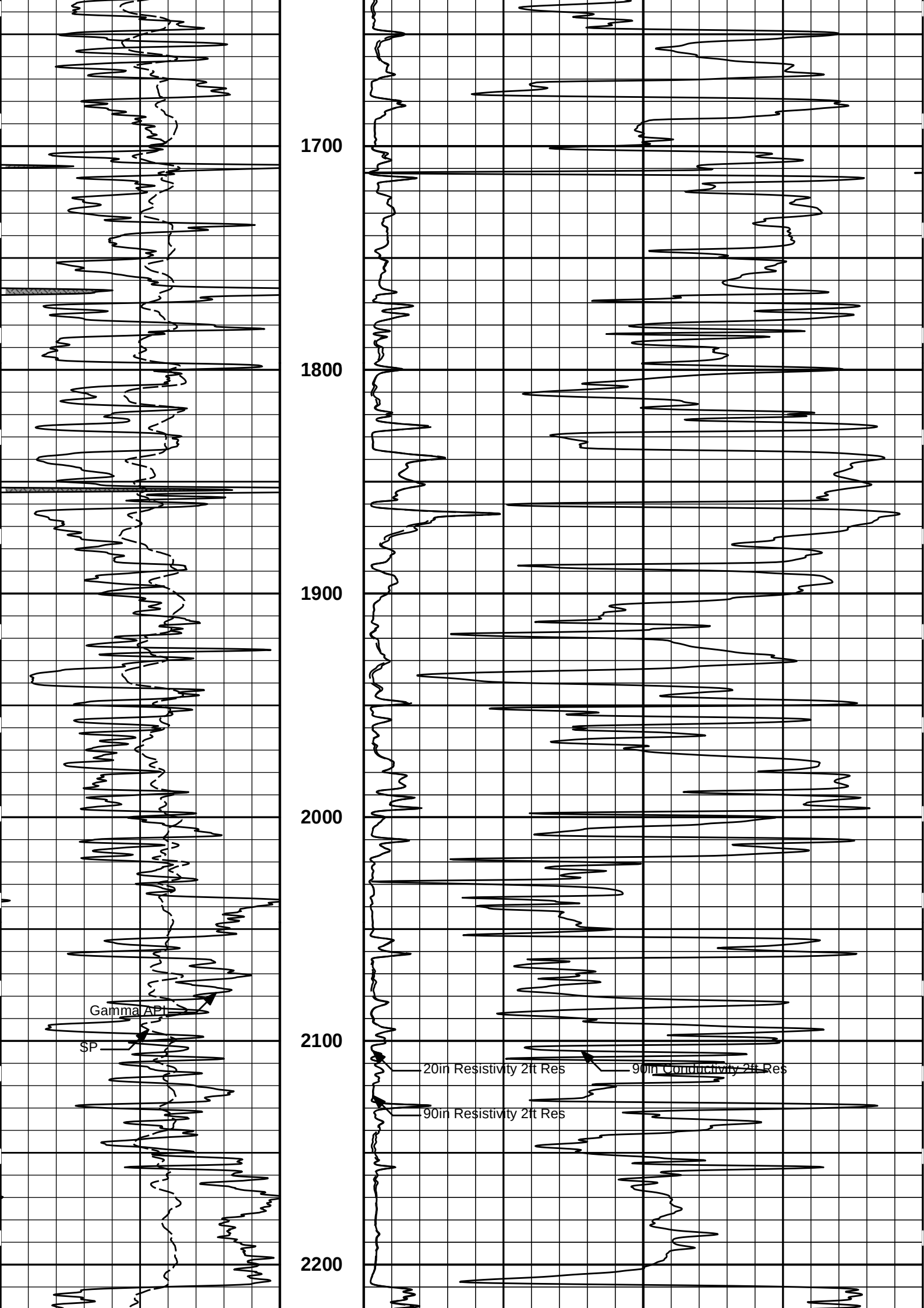
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Plot Range: 250 ft to 3317.17 ft
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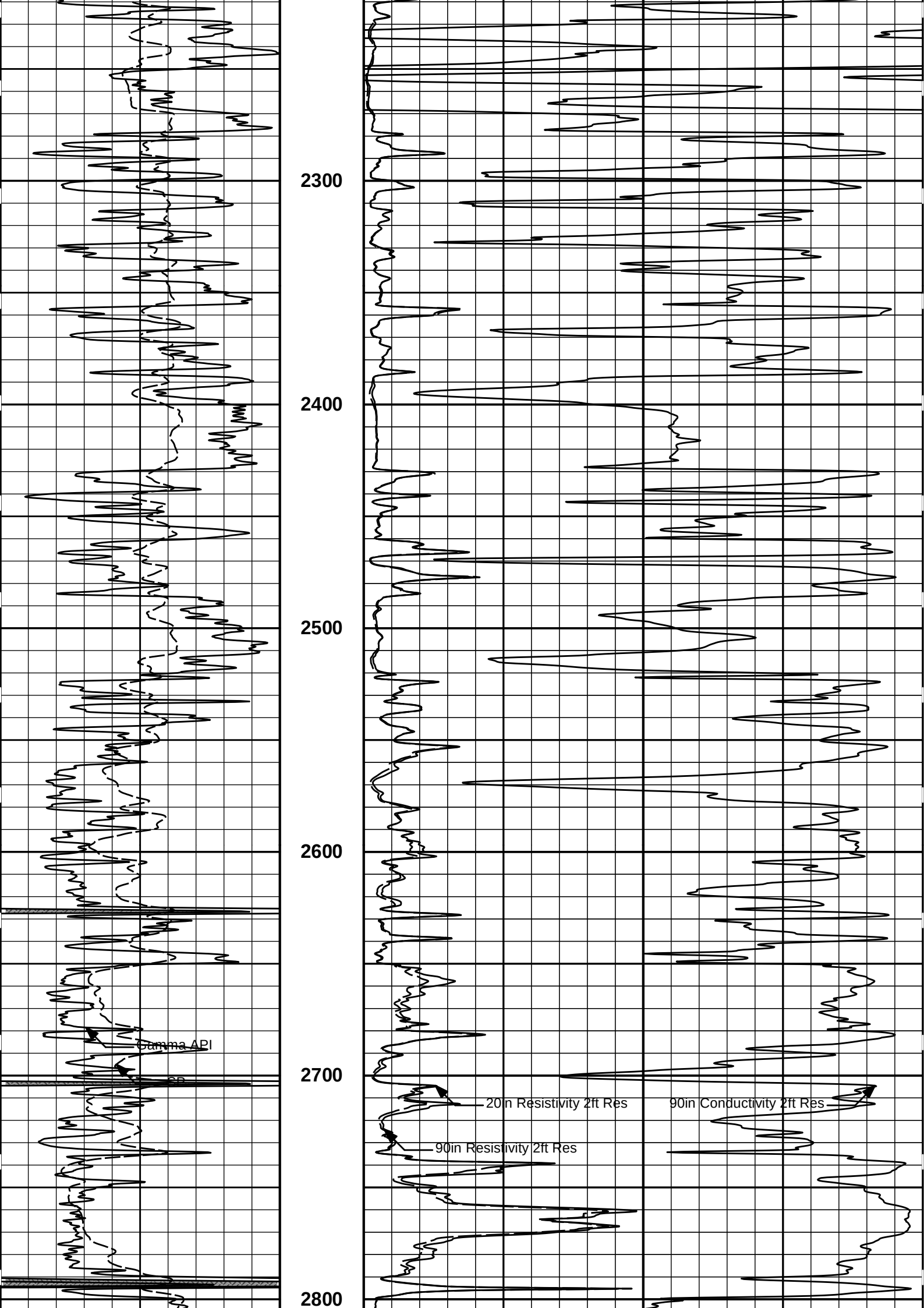
2 INCH MAIN LOG

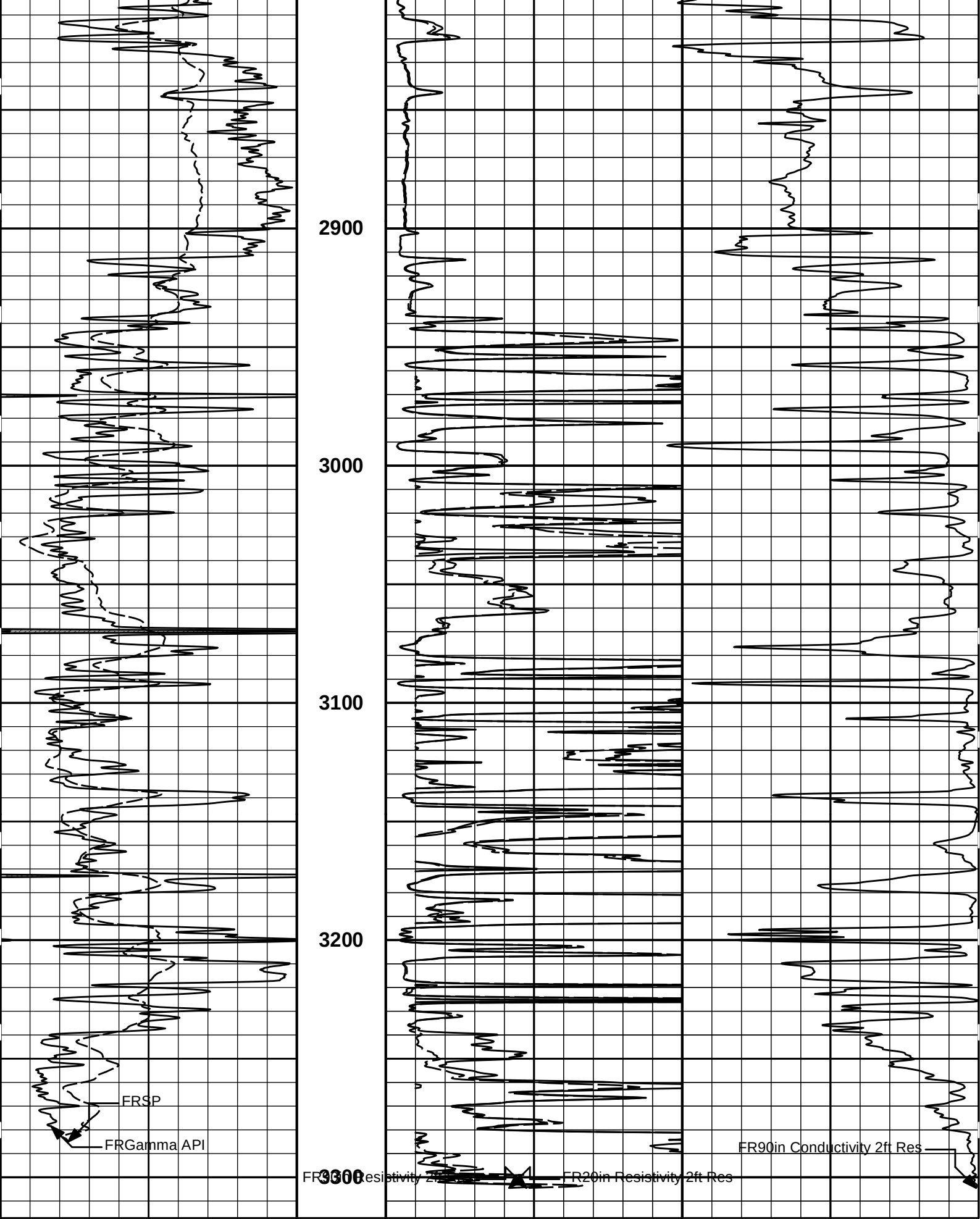



500
600
700
800
900
1000
Gamma API
SP
20in Resistivity 2ft Res
90in Resistivity 2ft Res
90in Conductivity 2ft Res


1100
1200
1300
1400
1500
1600
Gamma API
SP
20in Resistivity 2ft Res
90in Conductivity 2ft Res
90in Resistivity 2ft Res


1700
1800
1900
2000
2100
2200
Gamma API
SP
20in Resistivity 2ft Res
90in Conductivity 2ft Res
90in Resistivity 2ft Res


2300
2400
2500
2600
2700
2800
Gamma API
SP
20in Resistivity 2ft Res
90in Resistivity 2ft Res
90in Conductivity 2ft Res



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

millimo per metre

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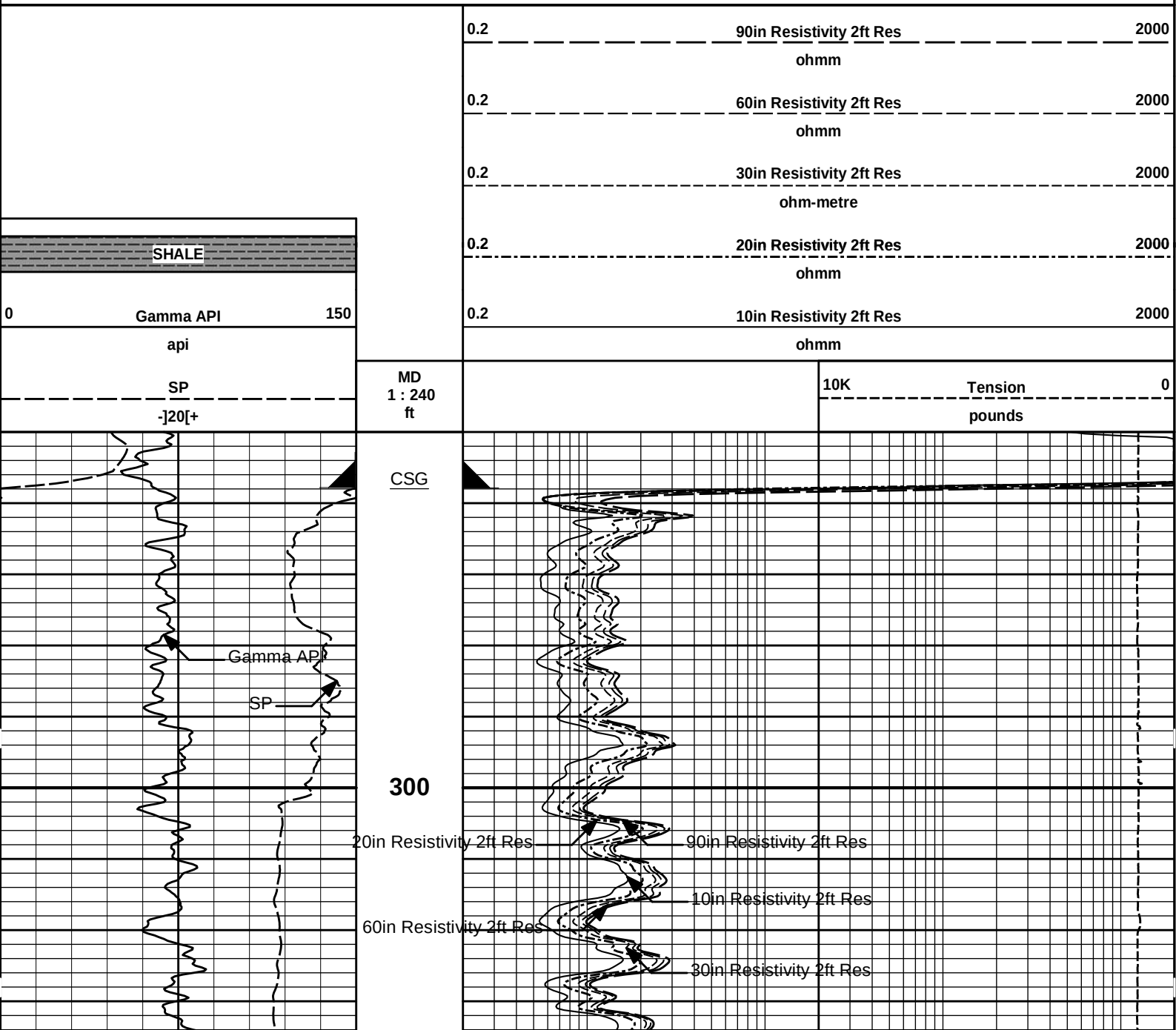
2 INCH MAIN LOG

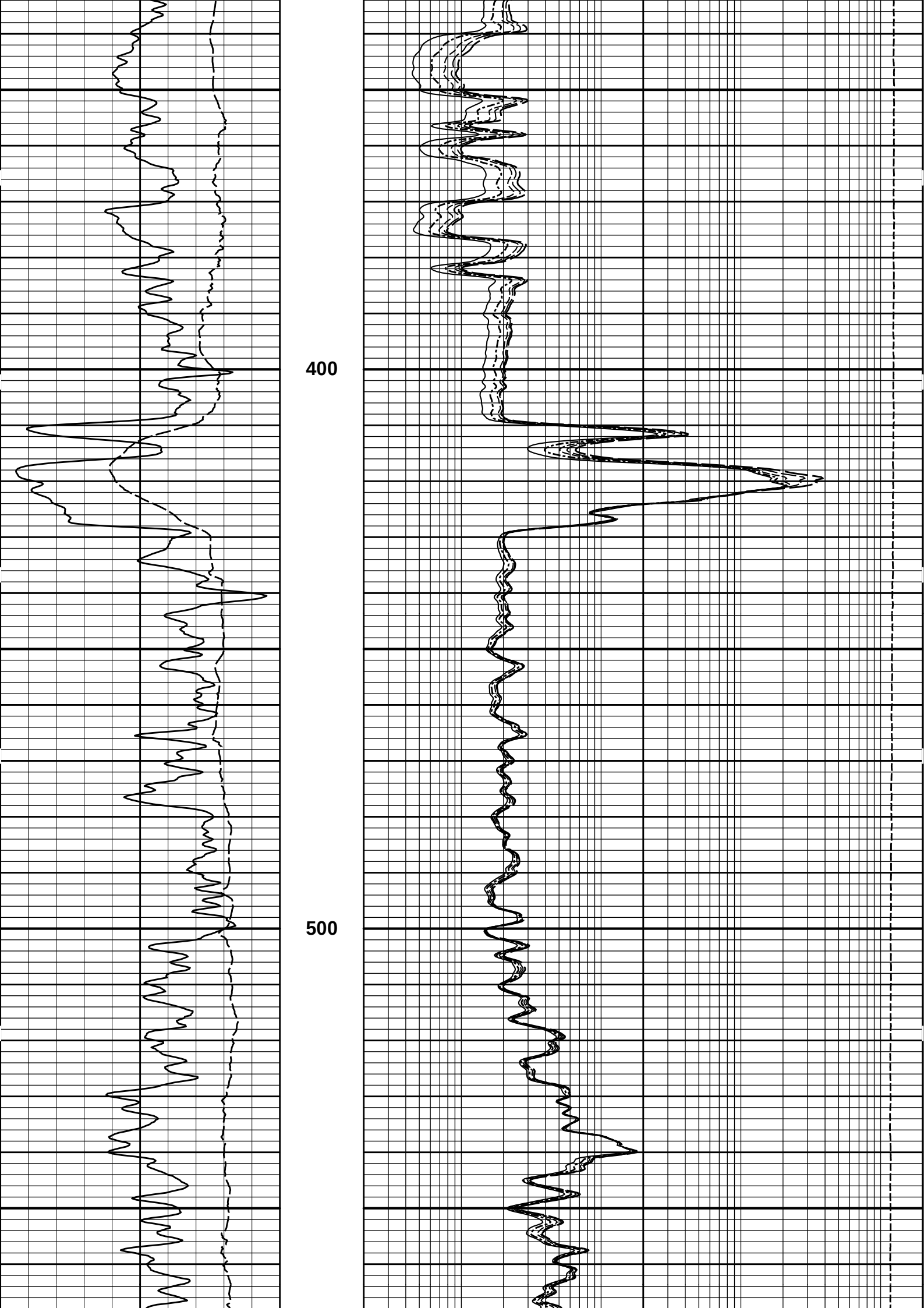
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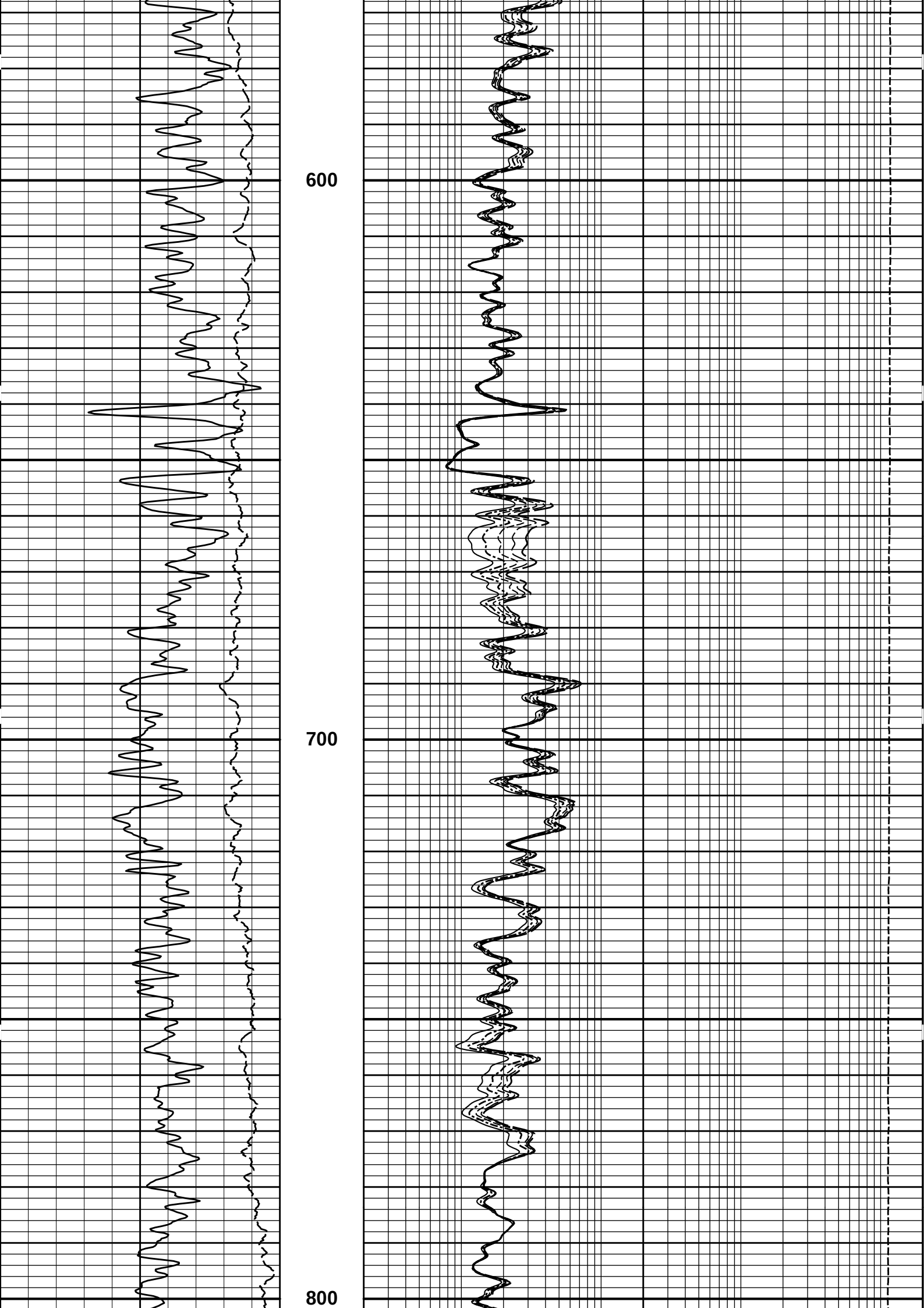
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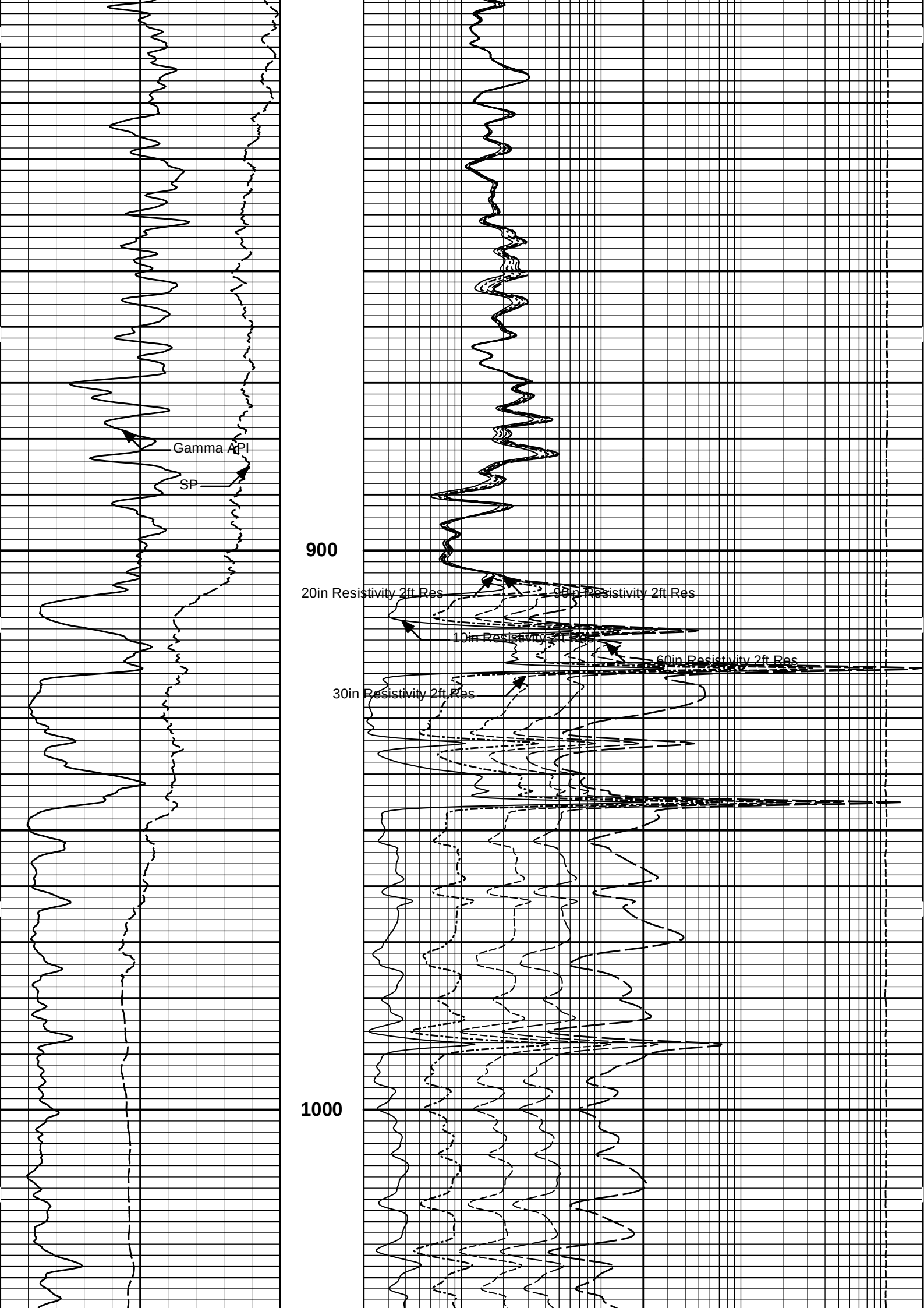
5 INCH MAIN LOG

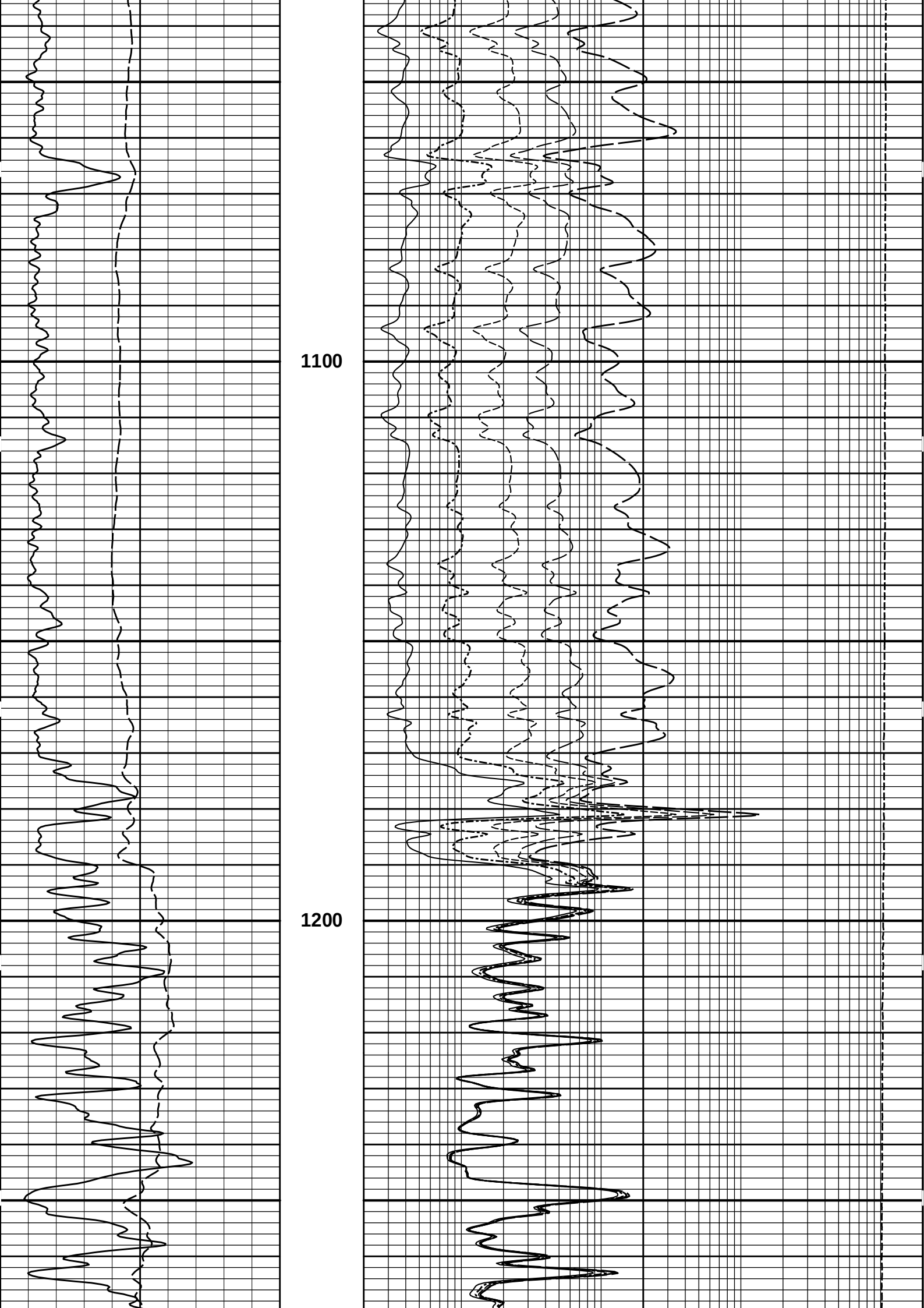
MEASURED DEPTH
MAIN SECTION 5" PER 100'

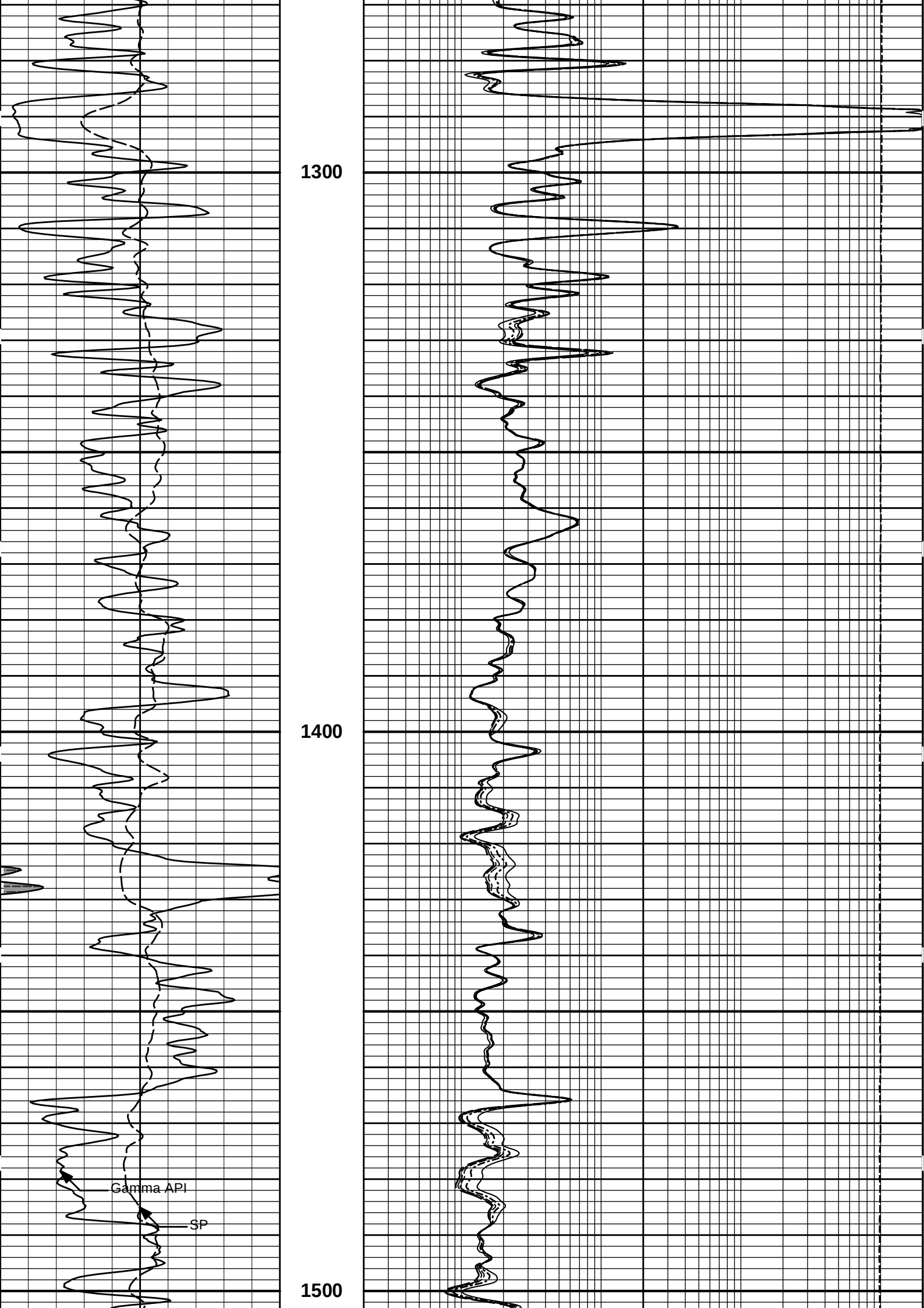


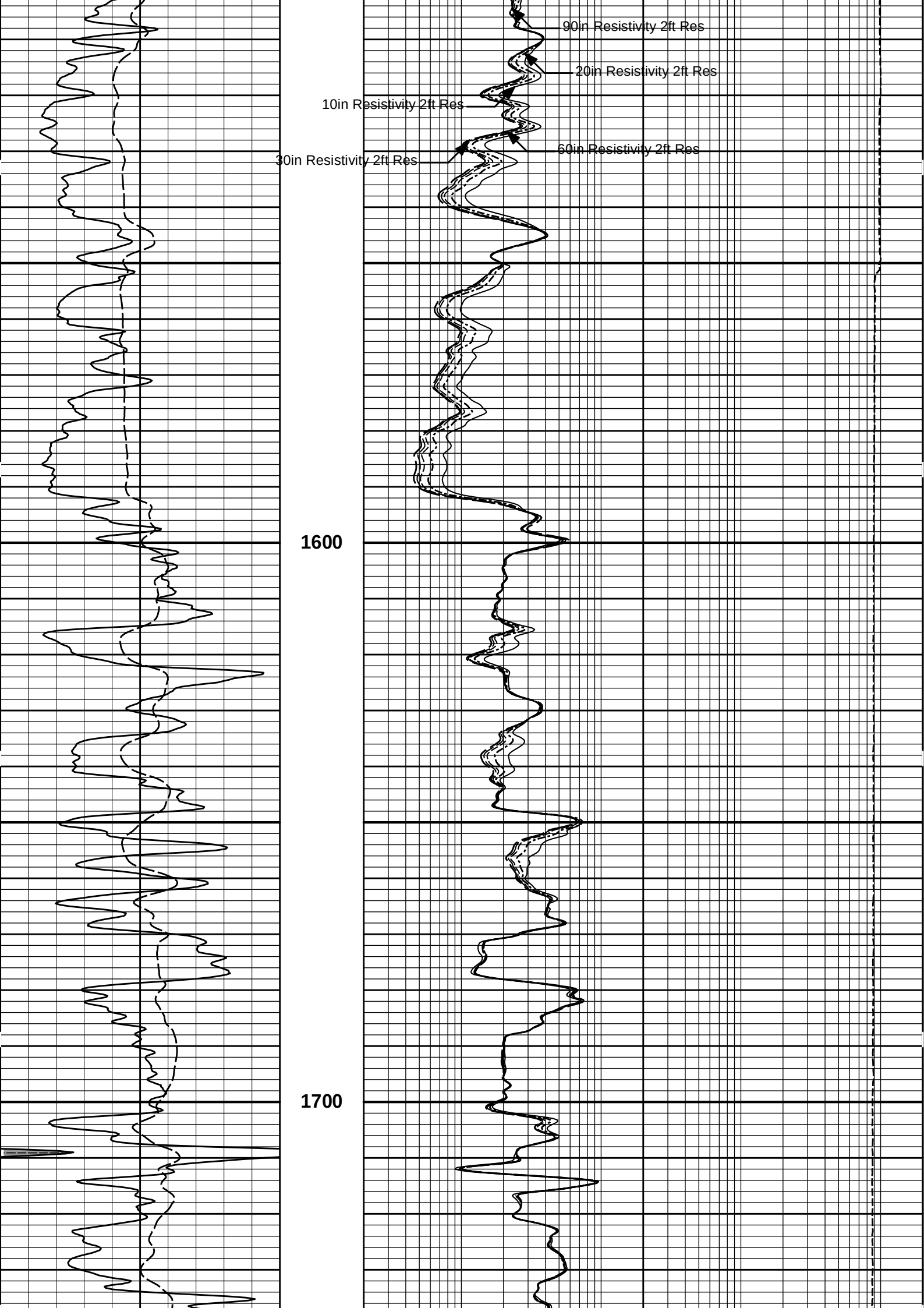

400
500

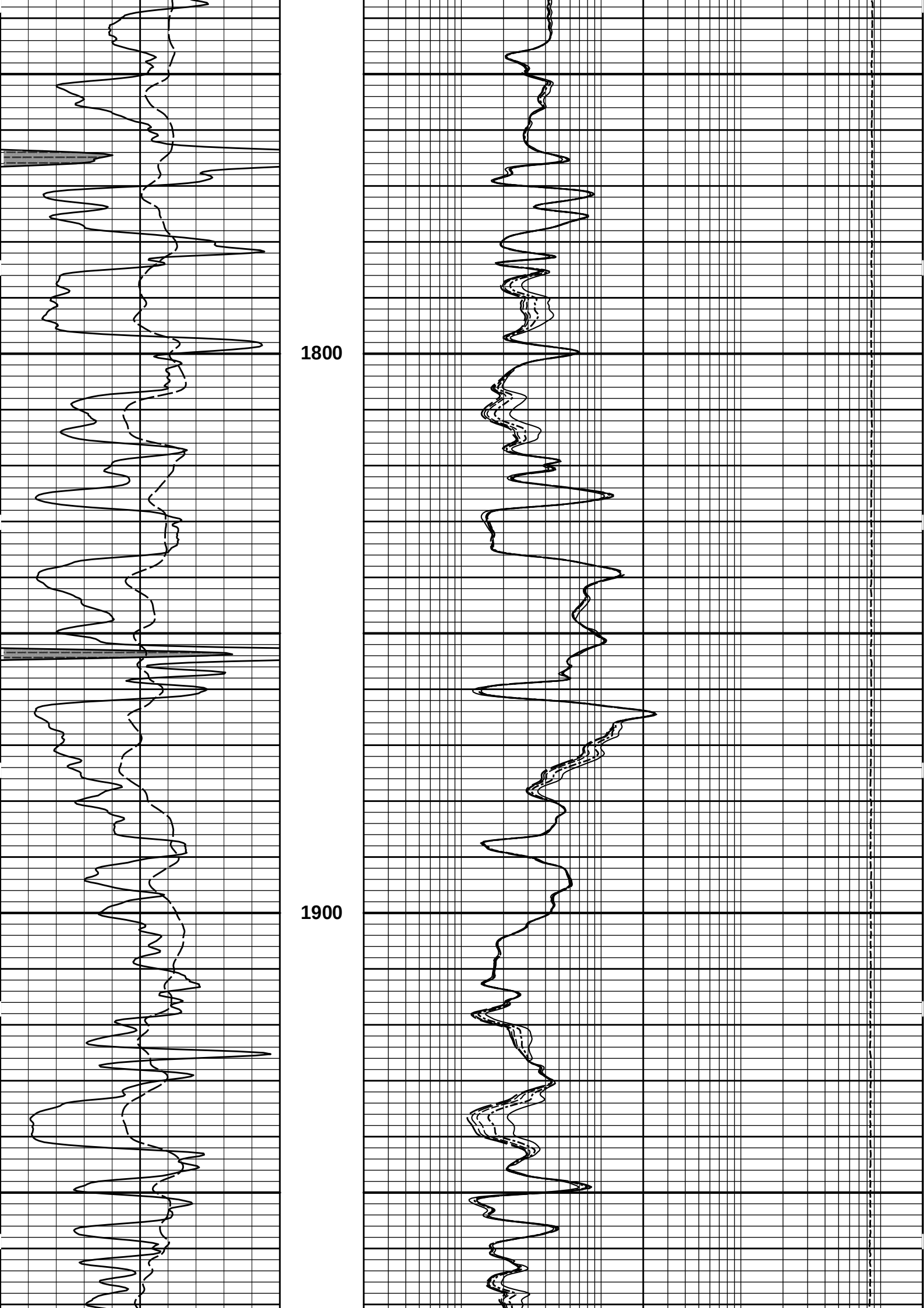

600
700
800

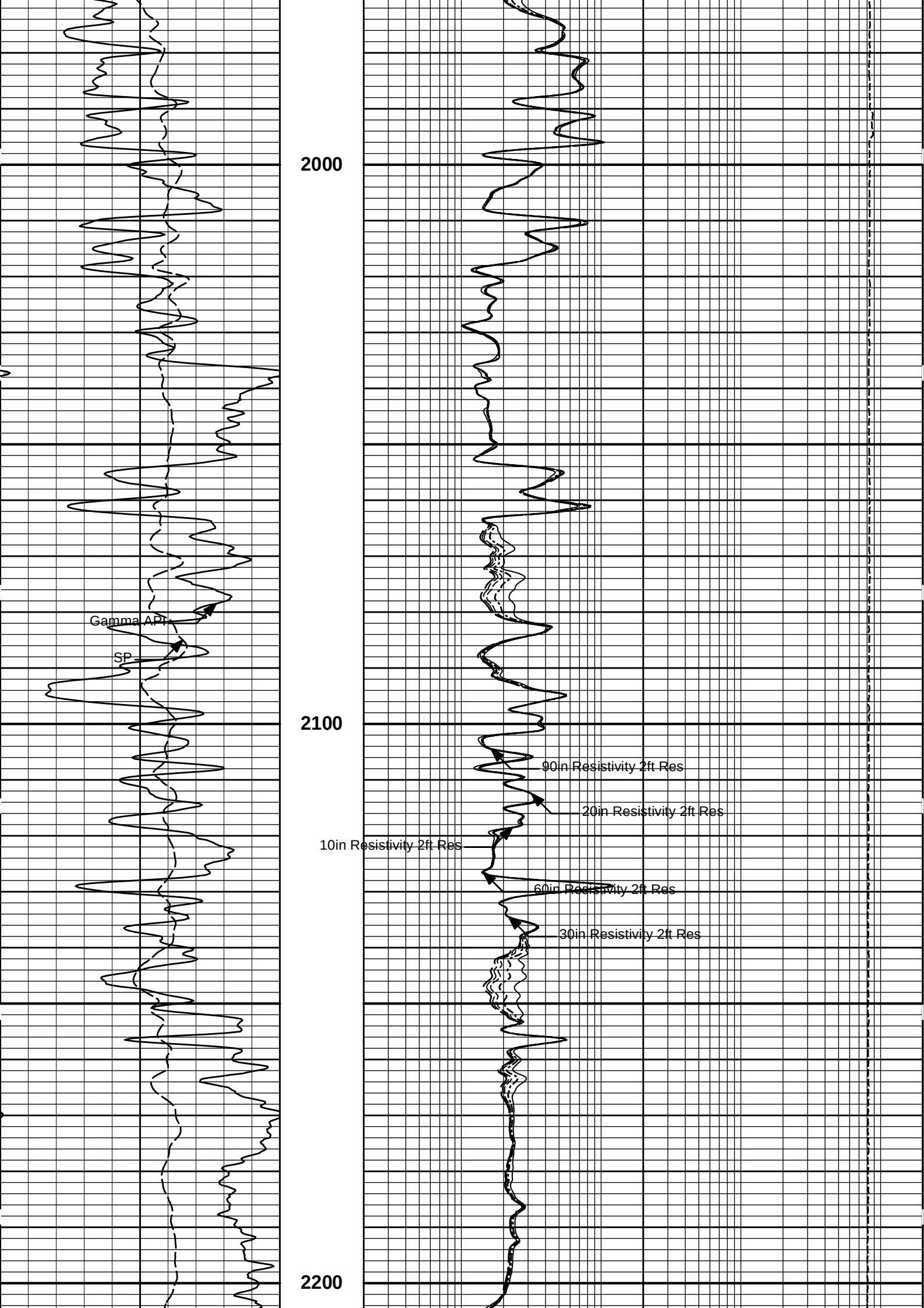

Gamma API
SP
900
20in Resistivity 2ft Res
90in Resistivity 2ft Res
10in Resistivity 2ft Res
60in Resistivity 2ft Res
30in Resistivity 2ft Res
1000

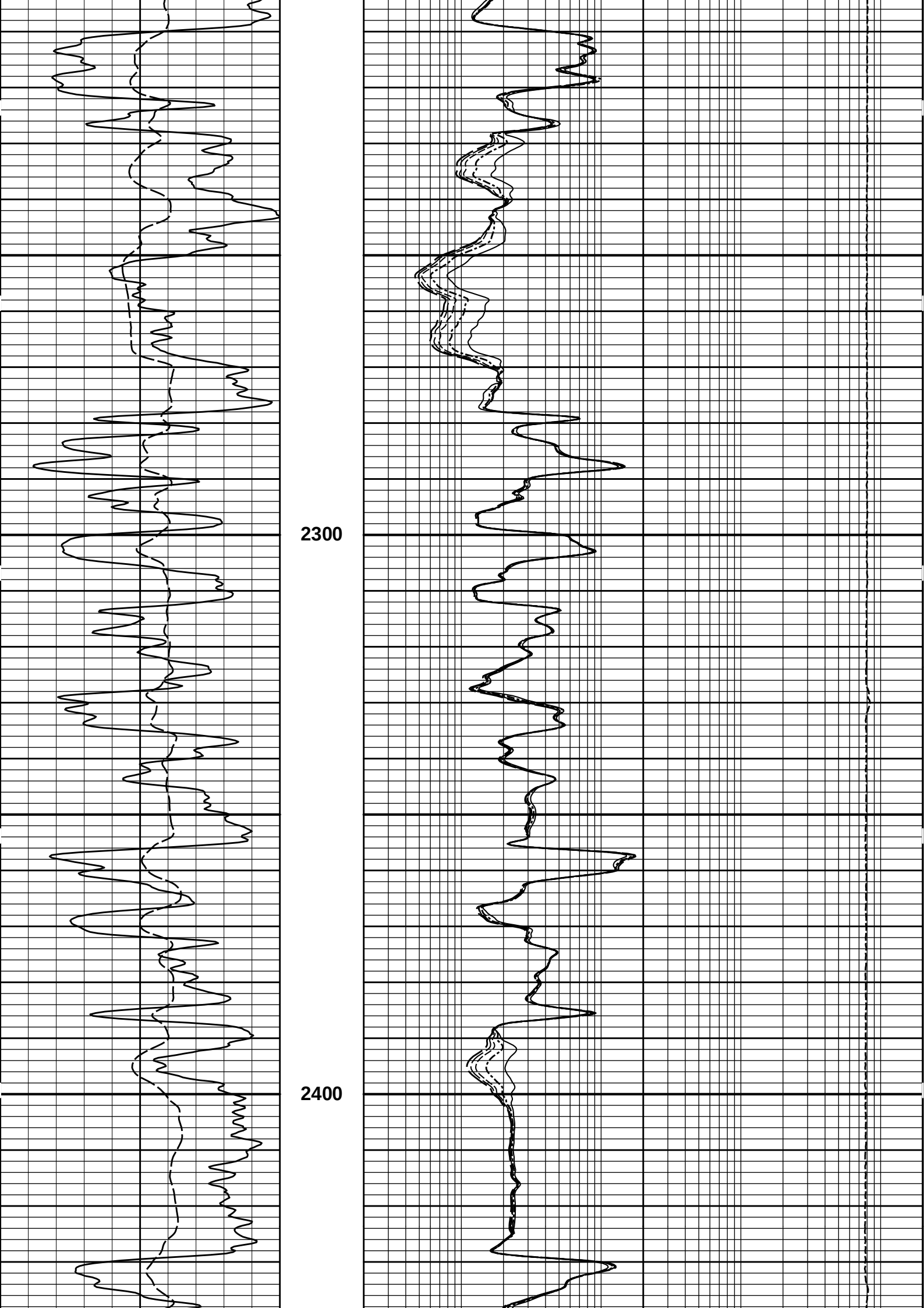

1100
1200

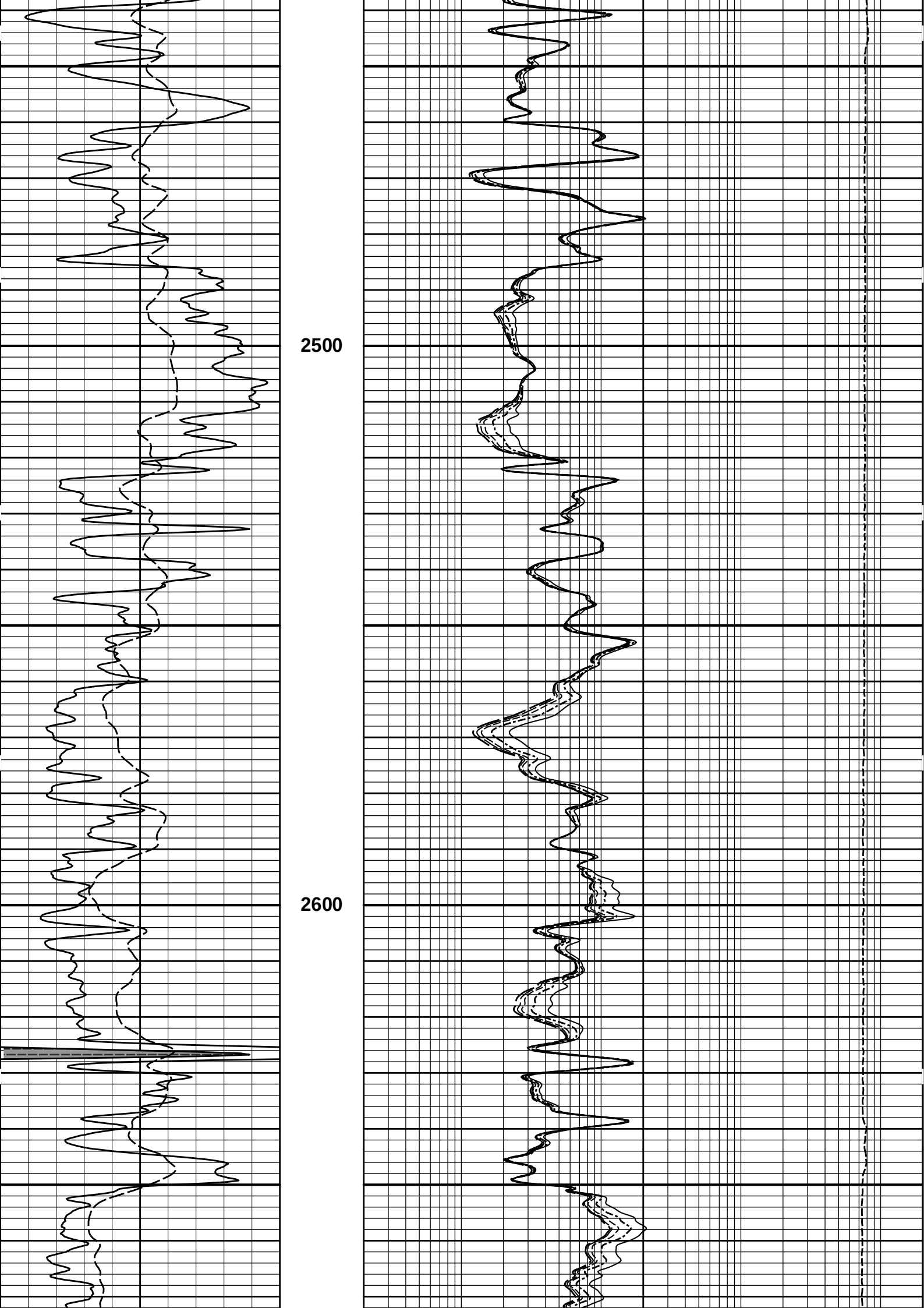

1300
1400
1500
Gamma API
SP

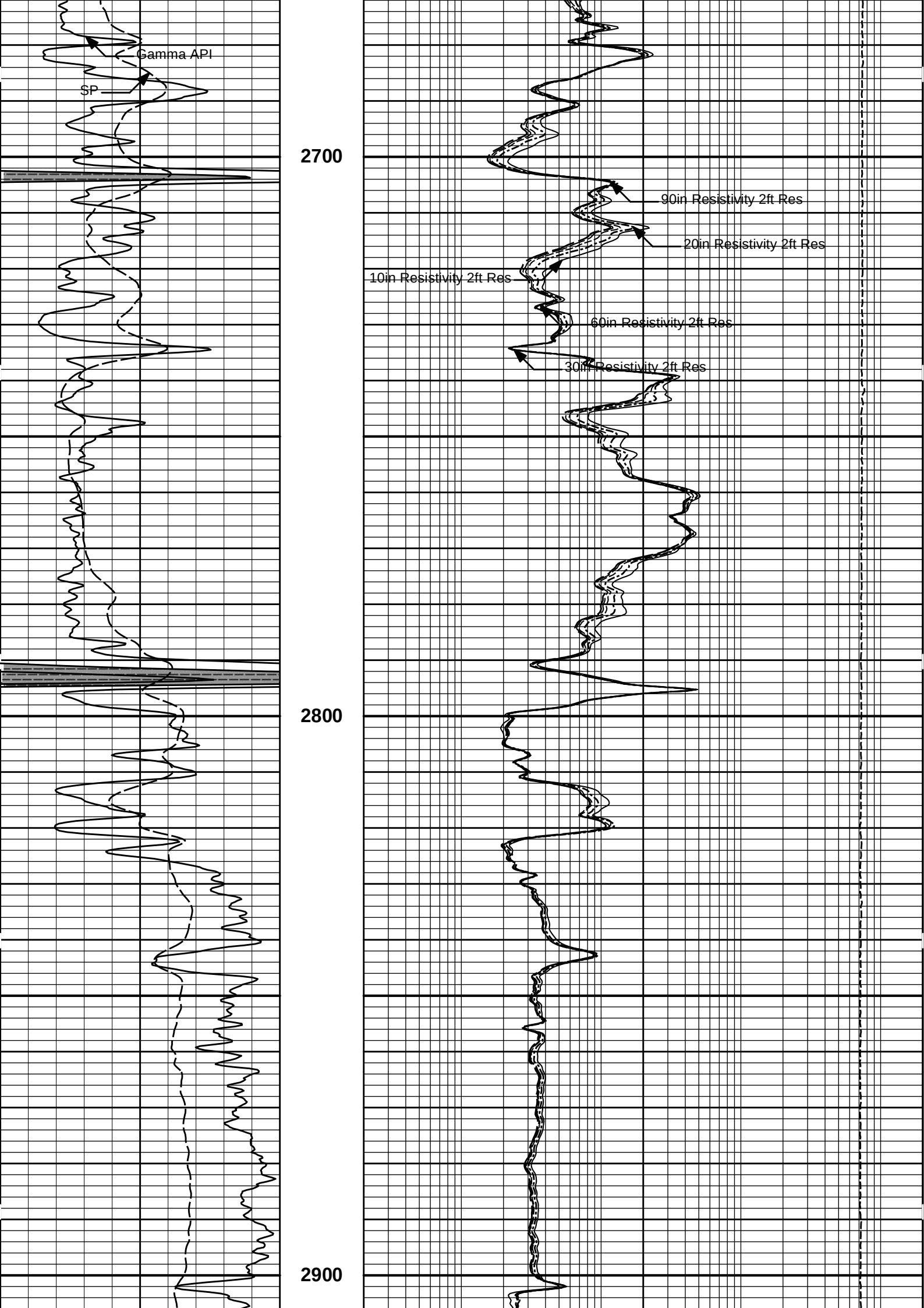

90in Resistivity 2ft Res
20in Resistivity 2ft Res
10in Resistivity 2ft Res
60in Resistivity 2ft Res
30in Resistivity 2ft Res
1600
1700

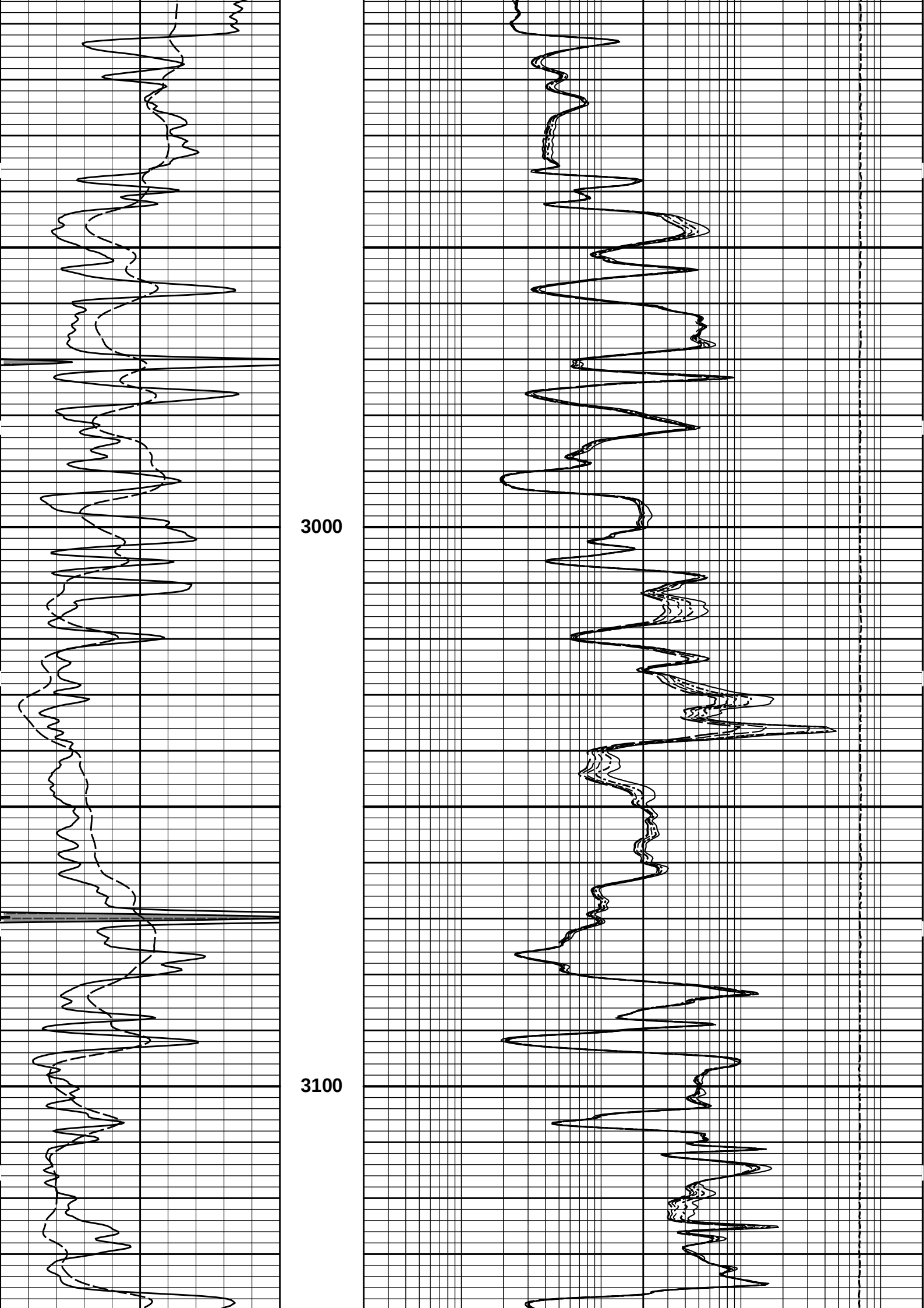

1800
1900

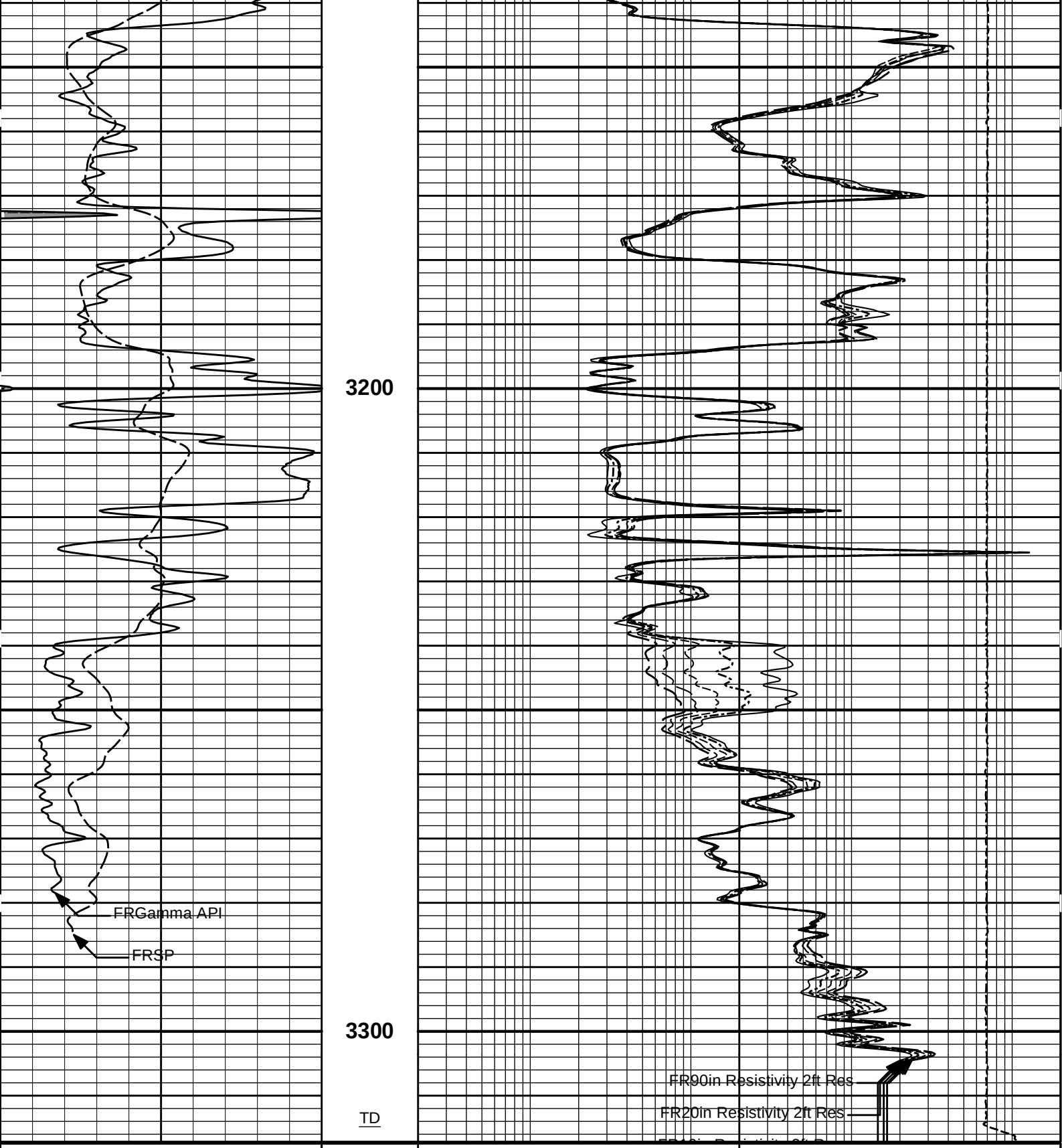

2000
Gamma API
SP
2100
90in Resistivity 2ft Res
20in Resistivity 2ft Res
10in Resistivity 2ft Res
60in Resistivity 2ft Res
30in Resistivity 2ft Res
2200


2300
2400


2500
2600


Gamma API
SP
2700
90in Resistivity 2ft Res
20in Resistivity 2ft Res
10in Resistivity 2ft Res
60in Resistivity 2ft Res
30in Resistivity 2ft Res
2800
2900


3000
3100



SP -]20[+	MD 1 : 240 ft	10K Tension 0 pounds
0 Gamma API 150 api		0.2 10in Resistivity 2ft Res 2000 ohmm
SHALE		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 2000

ohmm

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Plot Time: 17-Mar-17 20:19:52
Plot Range: 250 ft to 3317.17 ft
Data: FOG_1-27\Well Based*\
Plot File: \\-LOCAL-\FOG_1-27\0004 GTET-BSAT-ACRT\ACRT\ACRT_5_main_lib

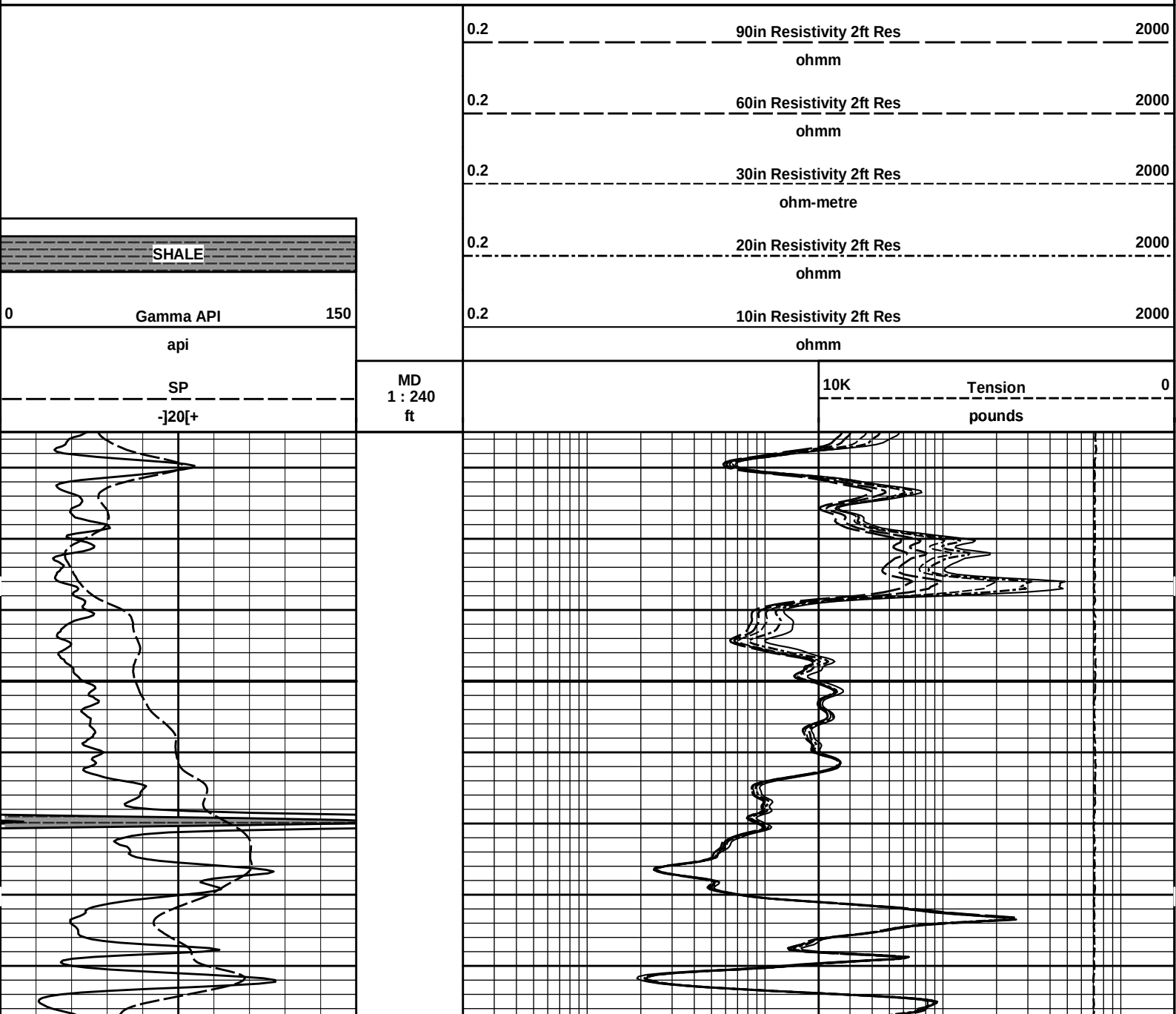
5 INCH MAIN LOG

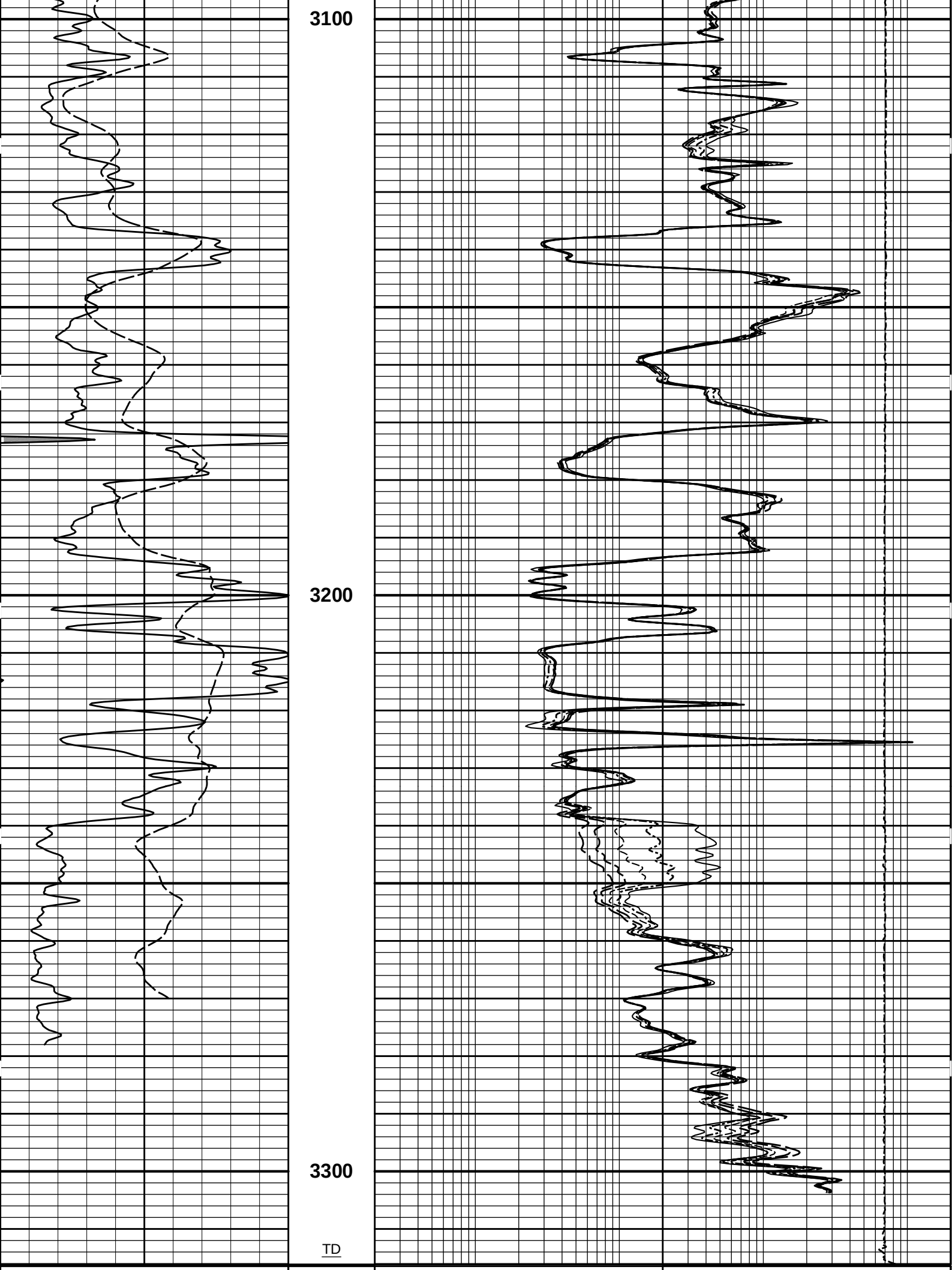
MEASURED DEPTH
MAIN SECTION 5" PER 100'

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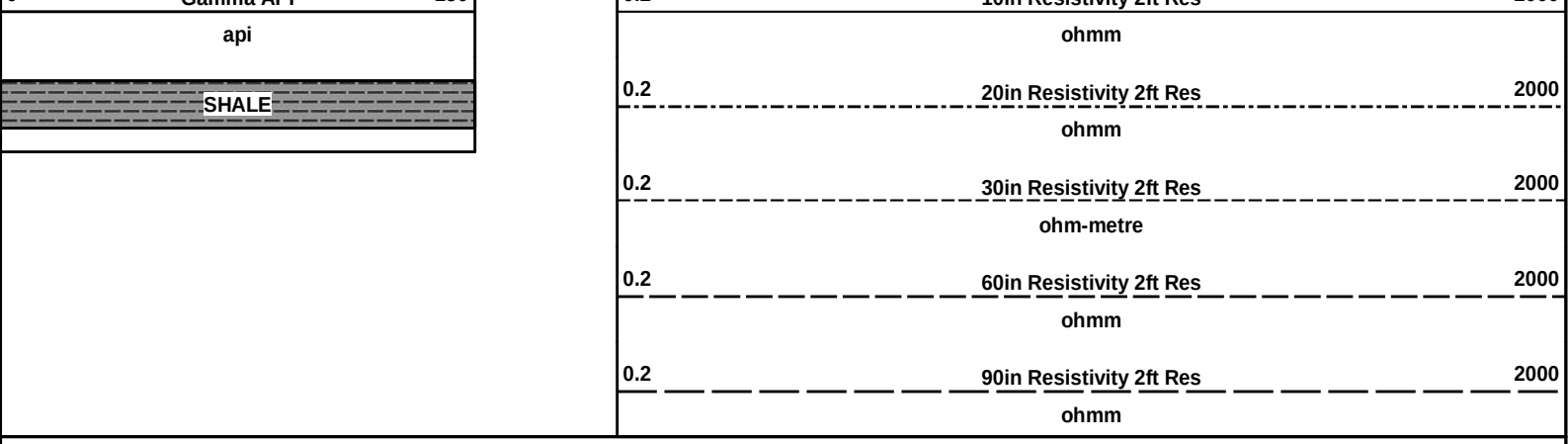
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Data: FOG_1-27\Well Based\ACRT_BSAT_RPT\
Plot File: \\-LOCAL-\FOG_1-27\0004 GTET-BSAT-ACRT\ACRT\ACRT_5_repeat_lib

REPEAT SECTION





SP	MD		10K Tension 0
-]20[+	1 : 240 ft		pounds
0 Gamma API 150		0.2 10in Resistivity 2ft Res	2000



HALLIBURTON

Plot Time: 17-Mar-17 20:19:54
Plot Range: 3015 ft to 3316.17 ft
Data: FOG_1-27\Well Based\ACRT_BSAT_RPT
Plot File: \\-LOCAL-\FOG_1-27\0004 GTET-BSAT-ACRT\ACRT\ACRT_5_repeat_lib

REPEAT SECTION

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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	0.490	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	3315.00	ft
	SHARED	BHT	Bottom Hole Temperature	98.0	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	0.10	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	Bit Size	

CrossPlot				
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	Bit Size	
BSAT	MBOK	Compute BCAS Results?	Yes	
BSAT	FLLO	Frequency Filter Low Pass Value?	5000	Hz
BSAT	FLHI	Frequency Filter High Pass Value?	27000	Hz
BSAT	DTFL	Delta -T Pore Fluid	189.00	uspf
BSAT	DTMT	Delta -T Matrix Type	User define	
BSAT	DTMA	Delta -T Matrix	47.60	uspf
BSAT	DTSH	Delta -T Shale	100.00	uspf
BSAT	SPEQ	Acoustic Porosity Equation	Wylie	
ACRt Sonde	RTOK	Process ACRt?	Yes	
ACRt Sonde	MNSO	Minimum Tool Standoff	1.19	in
ACRt Sonde	TCS1	Temperature Correction Source	FP Lwr & FP Upr	
ACRt Sonde	TPOS	Tool Position	Centered	
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	Bit Size	
ACRt Sonde	MBFL	Apply Corkscrew Effect?	No	

BOTTOM

Data: FOG_1-27\0004 GTET-BSAT-ACRT\IDLE **Date: 17-Mar-17 19:12:57**

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CALIBRATION REPORT

NATURAL GAMMA RAY TOOL SHOP CALIBRATION

Tool Name: **GTET - 11013114** **Reference Calibration Date:** **03-Jan-17 10:45:31**

Engineer: **THOMAS HYDE** **Calibration Date:** **15-Feb-17 11:45:58**

Software Version: **WL INSITE R5.0.5 (Build 8)** **Calibration Version:** **1**

Calibrator Source S/N: TB-146

Calibrator API Reference:265.00 api

Equivalent Calibrator API Reference:269.6 api

Measurement	Measured	Calibrated	Units
Background	34.7	35.1	api
Background + Calibrator	301.7	304.7	api
Calibrator	266.9	269.6	api

NATURAL GAMMA RAY TOOL FIELD CALIBRATION

Tool Name: **GTET - 11013114** **Reference Calibration Date:** **15-Feb-17 11:45:58**

Engineer: **THOMAS HYDE** **Calibration Date:** **06-Mar-17 09:20:23**

Software Version: **WL INSITE R5.0.5 (Build 8)** **Calibration Version:** **1**

Calibrator Source S/N: TB-146

Calibrator API Reference:265.00 api

Equivalent Calibrator API Reference:269.6 api

Field Verification	Shop	Field	Units
Background	35.1	42.9	api
Background + Calibrator	304.7	314.5	api
Calibrator	269.6	271.6	api

Shop	Field	Difference	Tolerance
269.6	271.6	-2.0	+/- 9.00

ARRAY COMPENSATED TRUE RESISTIVITY SHOP CALIBRATION

Tool Name: ACRt Sonde - 11005908
Reference Calibration Date: 17-Jan-17 17:45:25
Engineer: JORGE ORLANDO PEREZ
Calibration Date: 10-Mar-17 14:51:20
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	1.0474	1.05	0.95	1.0220	1.05	0.95	1.0129	1.05
A2 (50")	0.95	1.0451	1.05	0.95	1.0219	1.05	0.95	1.0143	1.05
A3 (29")	0.95	1.0425	1.05	0.95	1.0182	1.05	0.95	1.0082	1.05
A4 (17")	0.95	1.0425	1.05	0.95	1.0162	1.05	0.95	1.0086	1.05
A5 (10")	N/A	N/A	N/A	0.95	1.0073	1.05	0.95	0.9992	1.05
A6 (6")	N/A	N/A	N/A	0.95	0.9995	1.05	0.95	0.9916	1.05

SONDE OFFSET

Subarray	R12KHz	R36KHz	R72KHz
	(mmho/m)	(mmho/m)	(mmho/m)
A1 (80")	2.374	-3.926	-6.312
A2 (50")	-0.107	-3.995	-5.520
A3 (29")	-14.070	-4.584	-4.123
A4 (17")	-96.348	-29.562	-24.891
A5 (10")	N/A	-111.844	-48.791
A6 (6")	N/A	351.437	181.261

TRANSMITTER CURRENT GAIN

Signal	Lower	R	Upper
12K	0.6	0.91	1.3
36K	1.0	1.95	2.0
72K	1.0	1.24	2.0

R-MUD VERIFICATION

Signal	Lower (ohm-m)	Measured (ohm-m)	Upper (ohm-m)
Mud Cell	0.95	1.00	1.05

PASS/FAIL SUMMARY

GAIN RANGE CHK	PASS
SONDE OFFSET CHK	PASS

TOOL OK TO LOG

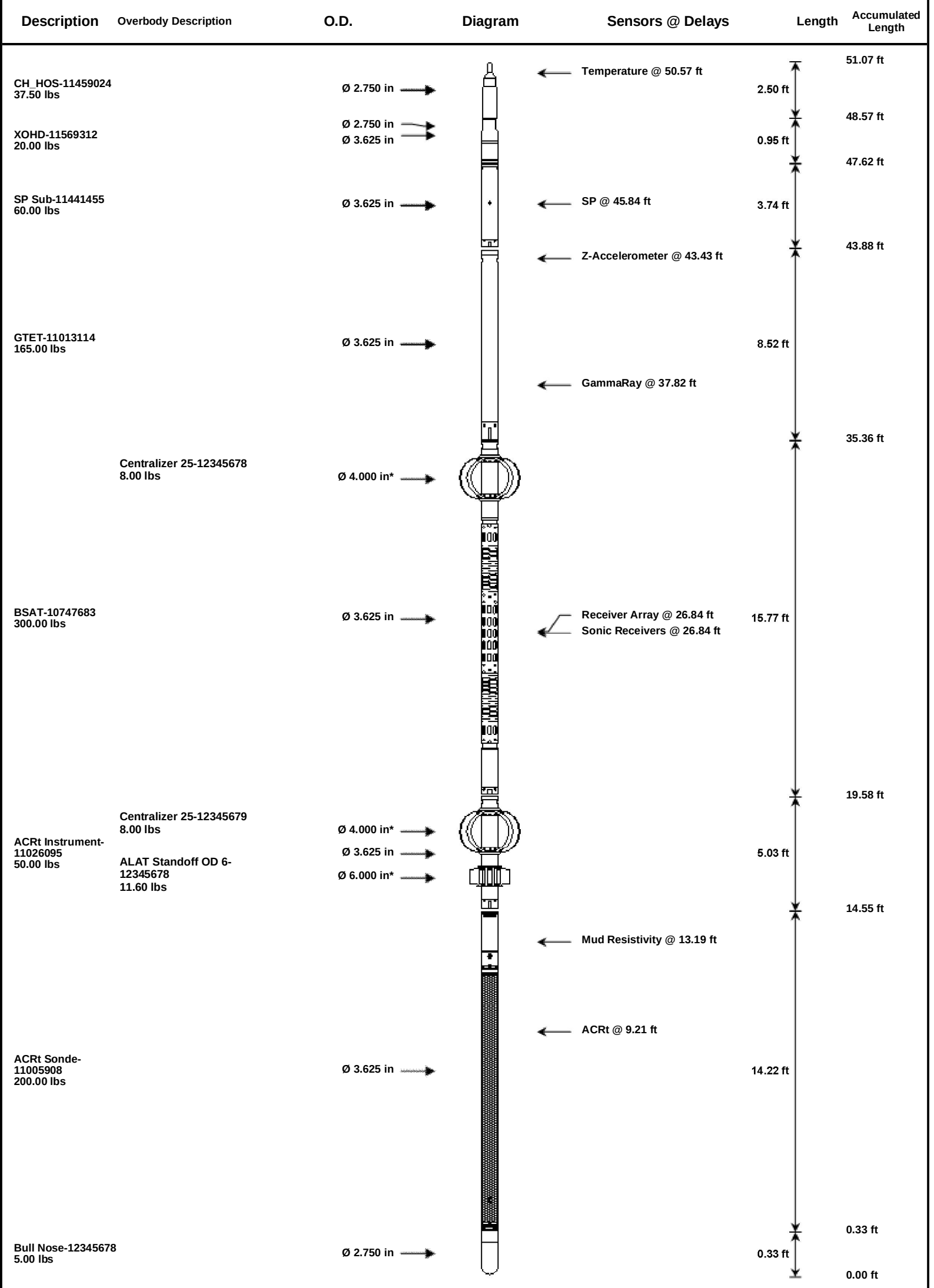
CALIBRATION SUMMARY

Sensor	Shop	Field	Post	Difference	Tolerance	Units
GTET-11013114						
Gamma Ray Calibrator	269.6	271.6	----------	-2.0	+/- 9.00	api
ACRt Sonde-11005908						
Mud Cell	1.00	----------	----------	0	----------	ohm-m

Data: FOG_1-27\0004 GTET-BSAT-ACRT\IDLE **Date: 17-Mar-17 18:44:32**

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TOOL STRING DIAGRAM REPORT



Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)	Accumulated Length	Max.Log. Speed
CH_HOS	Cable Head Overshot	11459024	37.50	2.50	51.07 ft	3600 ft/hr
XOHD	Crossover Head	11569312	20.00	0.95	48.57 ft	3600 ft/hr
SP Sub	SP Sub	11441455	60.00	3.74	47.62 ft	3600 ft/hr
GTET	Gamma Tension Extended Tool	11013114	165.00	8.52	43.88 ft	3600 ft/hr
Centralizer 25-12345678	Centralizer 25	12345678	8.00		35.36 ft	3600 ft/hr
BSAT	Borehole Sonic Array Tool	10747683	300.00	15.77	35.36 ft	3600 ft/hr
Centralizer 25-12345679	Centralizer 25	12345679	8.00		19.58 ft	3600 ft/hr
ACRt Instrument	ACRt Instrument	11026095	50.00	5.03	19.58 ft	3600 ft/hr
ALAT Standoff OD 6-12345678	ALAT Standoff OD 6	12345678	11.60		14.55 ft	3600 ft/hr
ACRt Sonde	ACRt Sonde	11005908	200.00	14.22	14.55 ft	3600 ft/hr
Bull Nose-12345678	Bull Nose	12345678	5.00	0.33	0.33 ft	3600 ft/hr

Mnemonic	Tool Name	Number	Weight (lbs)	Length (ft)		Speed (fpm)
CH_HOS	Hostile Cable Head with Load Cell	11459024	37.50	2.50		48.57	300.00
XOHD	Hostile to Dits Cross Over	11569312	20.00	0.95		47.62	300.00
SP	SP Sub	11441455	60.00	3.74		43.88	300.00
GTET	Gamma Telemetry Tool	11013114	165.00	8.52		35.36	60.00
BSAT	Borehole Sonic Array Tool	10747683	300.00	15.77		19.58	60.00
OBCEN	Centralizer - 25 in. Overbody	12345678	8.00	2.08	*	32.63	300.00
ACRt	Array Compensated True Resistivity Instrument Section	11026095	50.00	5.03		14.55	120.00
ALATS	Array Laterolog Tool OD 6 Standoff	12345678	11.60	1.00	*	15.53	60.00
OBCEN	Centralizer - 25 in. Overbody	12345679	8.00	2.08	*	17.01	300.00
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
Total			**865.10**	**51.07**			

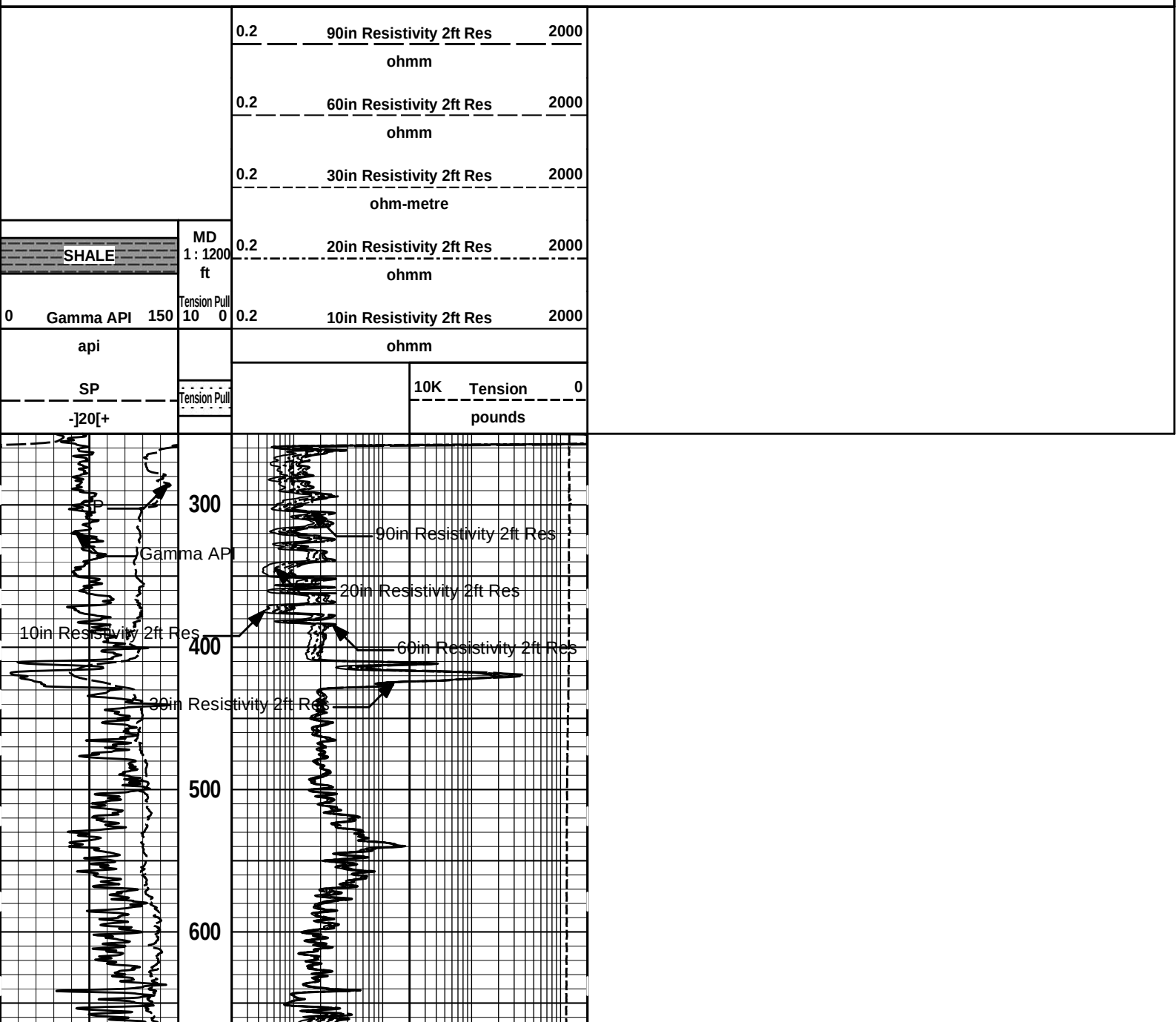
* Not included in Total Length and Length Accumulation.

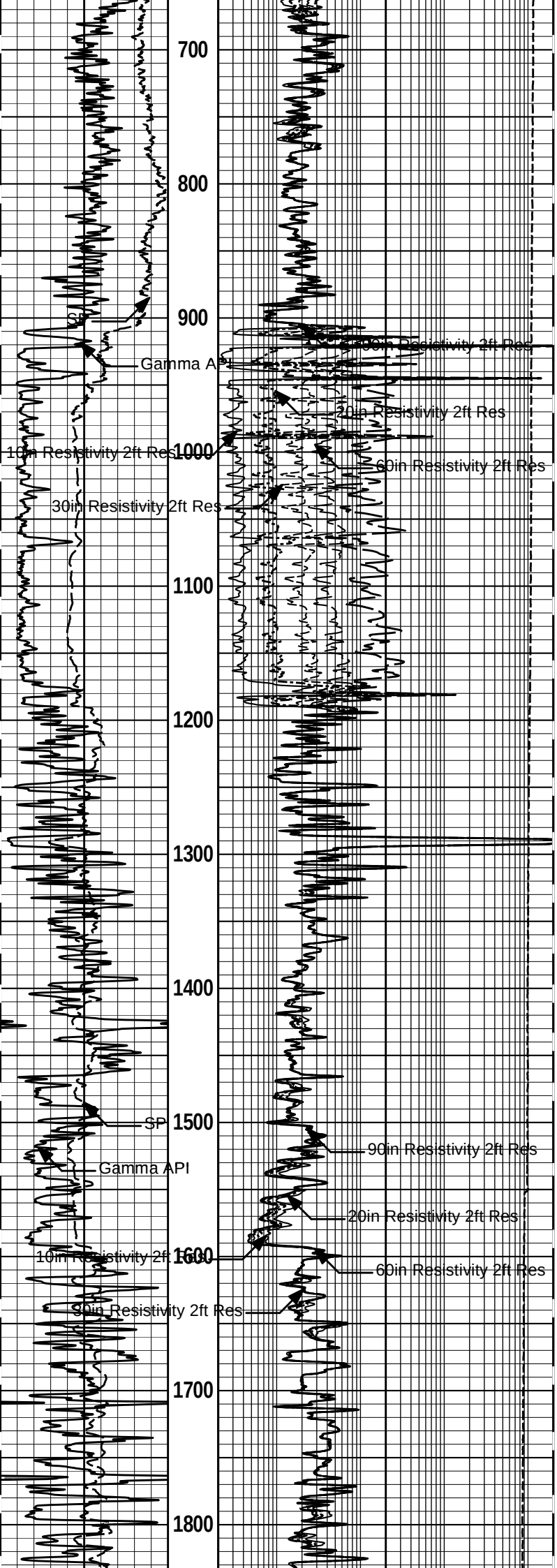
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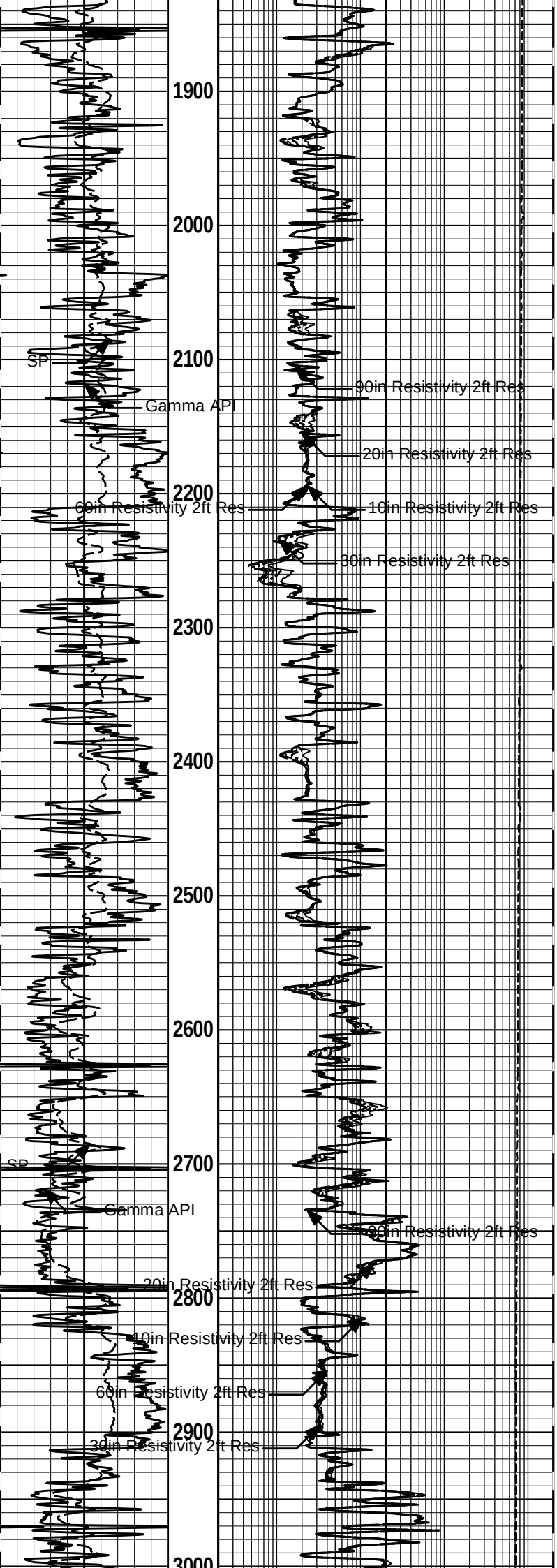
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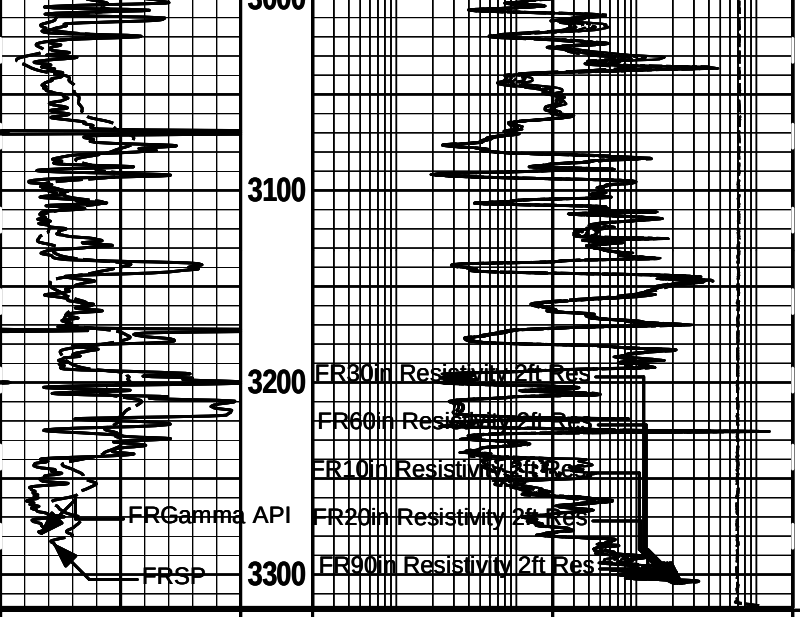
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Plot Range: 250 ft to 3317.17 ft
Data: FOG_1-27\Well Based*
Plot File: \\-LOCAL-\FOG_1-27\0004 GTET-BSAT-ACRT\ACRT\ACRT_1_main_lib

5 INCH MAIN LOG




700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
SP
Gamma API
10in Resistivity 2ft Res
30in Resistivity 2ft Res
60in Resistivity 2ft Res
SP
Gamma API
90in Resistivity 2ft Res
20in Resistivity 2ft Res
60in Resistivity 2ft Res


1900
2000
2100
SP
90in Resistivity 2ft Res
Gamma API
20in Resistivity 2ft Res
2200
60in Resistivity 2ft Res
10in Resistivity 2ft Res
30in Resistivity 2ft Res
2300
2400
2500
2600
2700
SP
Gamma API
90in Resistivity 2ft Res
20in Resistivity 2ft Res
2800
10in Resistivity 2ft Res
60in Resistivity 2ft Res
2900
30in Resistivity 2ft Res
3000



SP	Tension Pull		10K Tension 0
-]20[+			pounds
0 Gamma API 150	Tension Pull 10 0	0.2 10in Resistivity 2ft Res 2000	
api	MD 1 : 1200 ft	ohmm	
SHALE		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 2000	
		ohmm	

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Plot Time: 17-Mar-17 20:19:58
Plot Range: 250 ft to 3317.17 ft
Data: FOG_1-27\Well Based*
Plot File: \\-LOCAL-\FOG_1-27\0004 GTET-BSAT-ACRT\ACRT\ACRT_1_main_lib

5 INCH MAIN LOG

COMPANY	**CMX, INC.**
WELL	**FOGHORN #1-27**
FIELD	**CHASE-SILICA**
COUNTY	**RICE**
STATE	**KANSAS**

HALLIBURTON

ARRAY COMPENSATED TRUE RESISTIVITY LOG