



# Induction Array Log

Company Pronghorn Operating, LLC.  
Well Harley #3  
Field Cheyenne Wells  
County Cheyenne State Colorado

Location: 1869 FSL & 2013 FWL  
SEC 5 TWP 14S RGE 44W  
Permanent Datum G.L. Elevation 4298 ft.  
Log Measured From K.B. , 16 ft. above perm. datum  
Drilling Measured From K.B.  
Other Services  
MAS, CNL,  
LDT, SGR  
Elevation  
K.B. 4314 ft.  
D.F. 4313 ft.  
G.L. 4298 ft.

Date 24-May-2013

Run Number	One
Depth Driller	5579'
Depth Logger	5547'
Bottom Logged Interval	5545'
Top Log Interval	200'
Casing Driller	13.375" @ 493'
Casing Logger	492'
Bit Size	12.25" & 7.875"
Type Fluid in Hole	WBM
Density / Viscosity	8.8 / 48
pH / Fluid Loss	8.5 / 9.6
Source of Sample	Mud Pit
Rm @ Meas. Temp	1.21 @ 75 °F
Rmf @ Meas. Temp	0.96 @ 75 °F
Rmc @ Meas. Temp	1.57 @ 75 °F
Source of Rmf / Rmc	Calculated
Rm @ BHT	0.7 @ 130 °F
Time Circulation Stopped	15:00
Time Logger on Bottom	25-May-2013 @ 00:00
Maximum Recorded Temperature	130 °F
Equipment Number	10002
Location	Brighton
Recorded By	B. Oetting
Witnessed By	J. Flora

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## Equipment and Log Data

Service Order: 23247

Gamma		Density		Neutron		Sonic		IAT	
Run No.	One	Run No.	One	Run No.	One	Run No.	One	Run No.	One
Serial No.	9990	Serial No.	0872	Serial No.	7939	Serial No.	10010072	Serial No.	10110
O.D.	3.375 in.	Source No.	50130B	Source No.	66010B	Centralizers	2	Standoffs	2 @ 0.5"
		O.D.	4.5 in.	O.D.	3.375 in.	O.D.	3.375 in.	O.D.	3.875 in.

## Logging Pass Data

General			Gamma		Density			Neutron			Sonic			IAT	
			Scales		Scales			Scales			Scales			Scales	
Run	Depths		Left	Right	Left	Right	Matrix	Left	Right	Matrix	Left	Right	Matrix	Left	Right
One	TD	CSG	0	150	0.3	-0.1	2.71 g/cc	0.3	-0.1	Lime	0.3	-0.1	47.6 usec/ft	0.12	2000

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 interpretation, and we shall not, except in the case of gross or willful 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 set out in our current Price Schedule.

## Comments

First run in hole  
Tools ran slick due to hole conditions  
5.5" production casing used to calculate annular hole volumes  
Chlorides reported at: 3500 ppm

YOUR CREW TODAY: A. Hughes, E. Soto

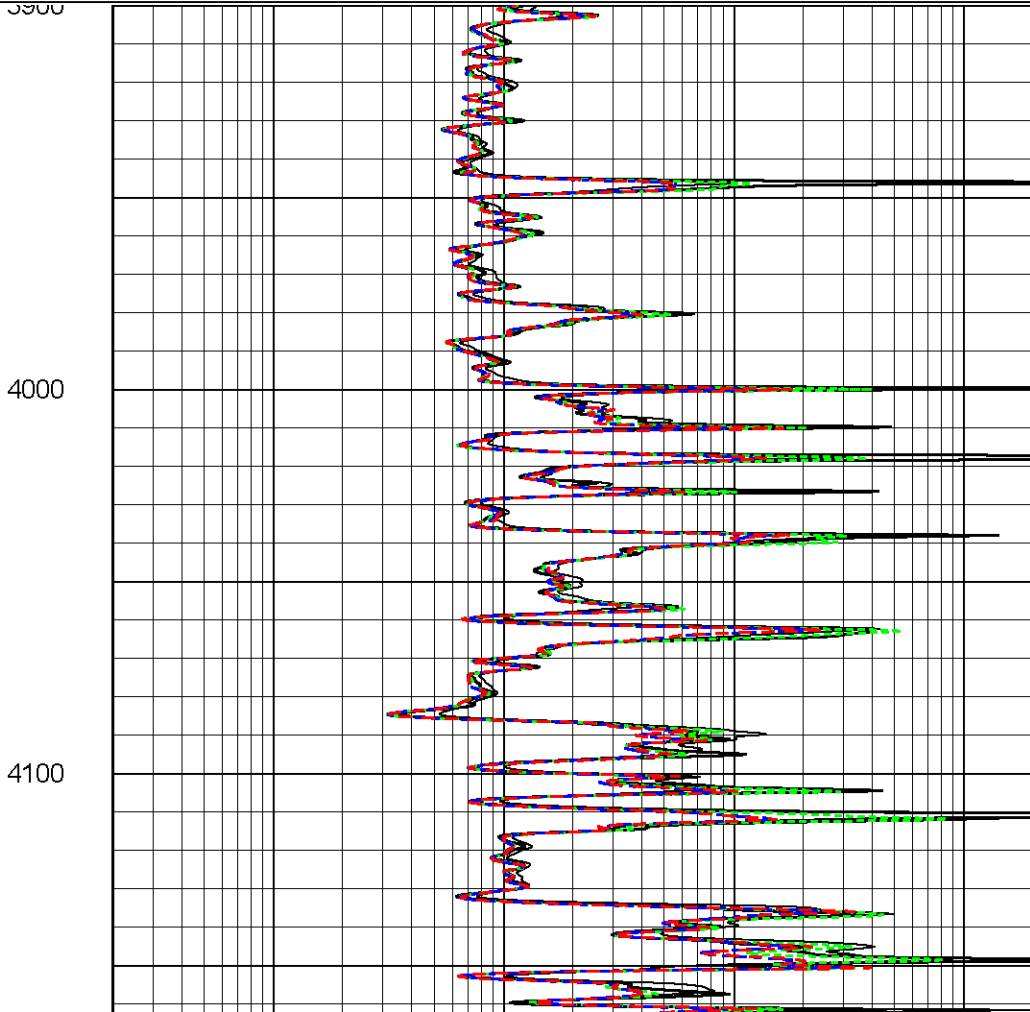
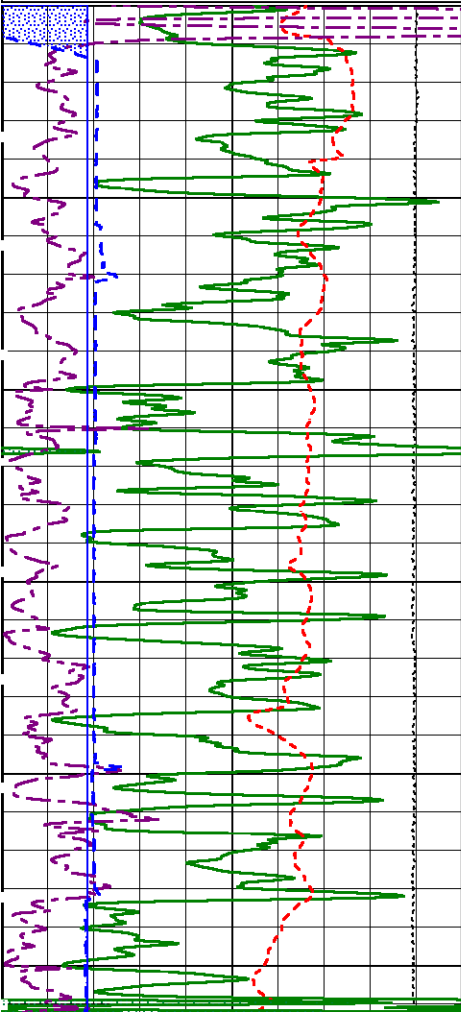


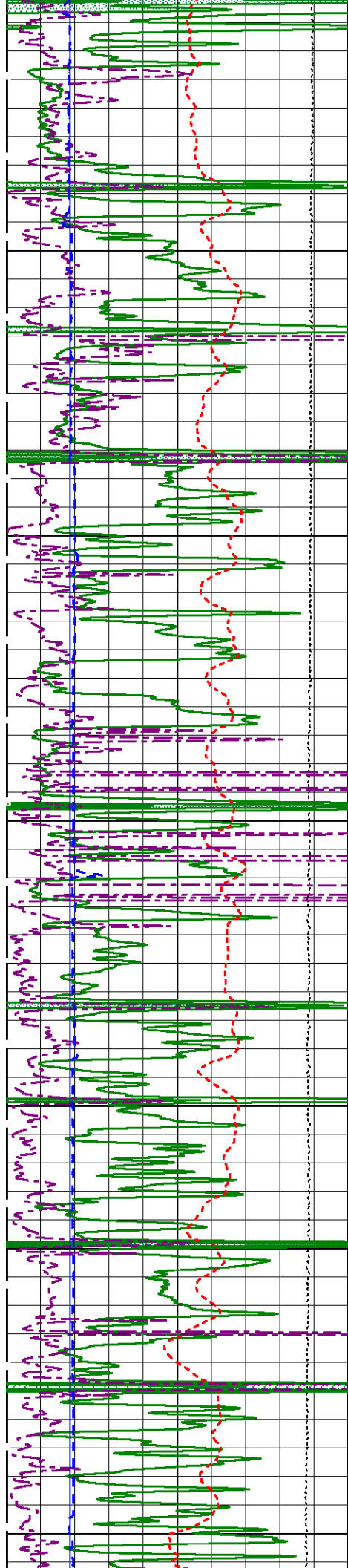
# Main Pass

Database File: pronghorn\_harley\_3.db  
Dataset Pathname: lime  
Presentation Format: iat\_ph\_2  
Dataset Creation: Sat May 25 02:32:32 2013  
Charted by: Depth in Feet scaled 1:600

0	Gamma Ray (GAPI)	150
	SP [-20mV+]	
0	Rwa (Ohm-m)	1
6	Caliper (in)	16
6	Bit Size (in)	16
	Line Tension	
	10000 (lb)	0

0.2	10 IN Resistivity (Ohm-m)	2000
0.2	20 IN Resistivity (Ohm-m)	2000
0.2	30 IN Resistivity (Ohm-m)	2000
0.2	60 IN Resistivity (Ohm-m)	2000
0.2	90 IN Resistivity (Ohm-m)	2000





4200

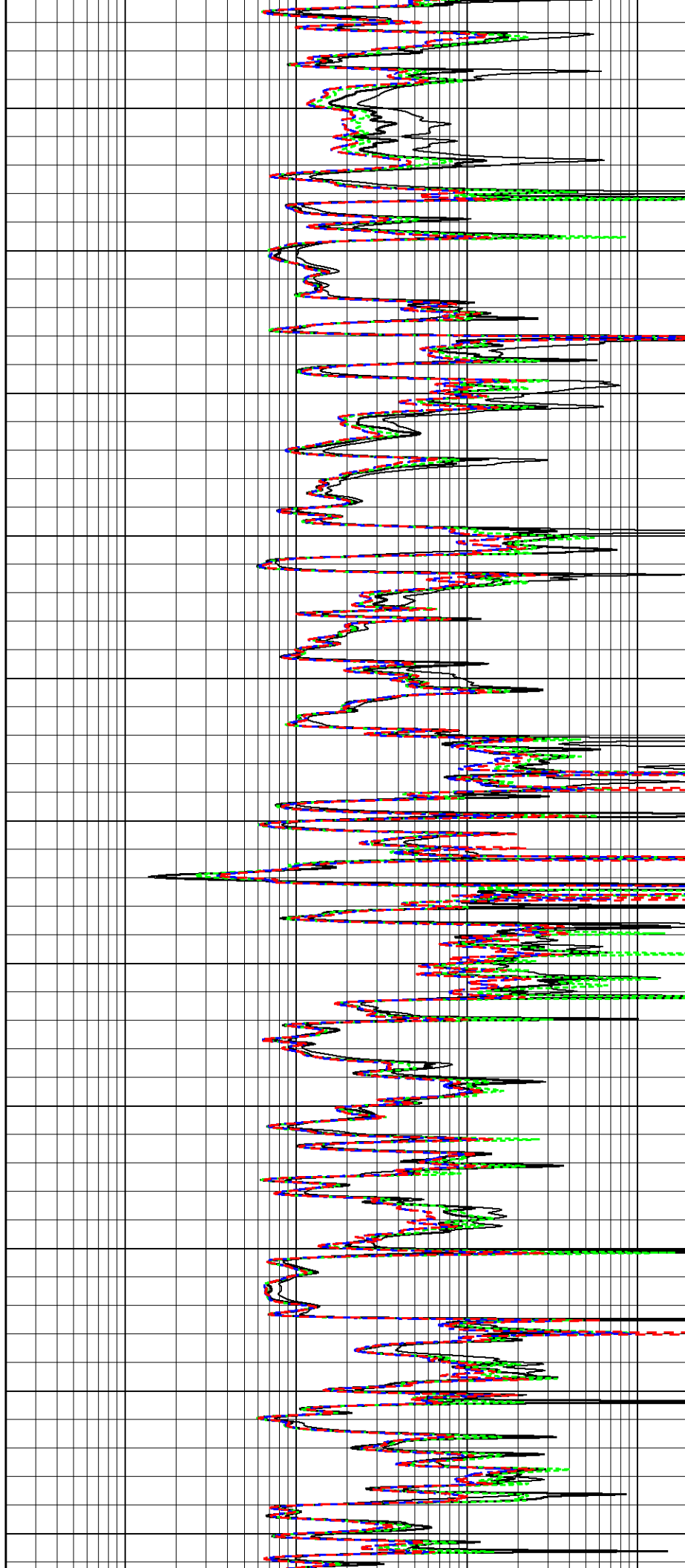
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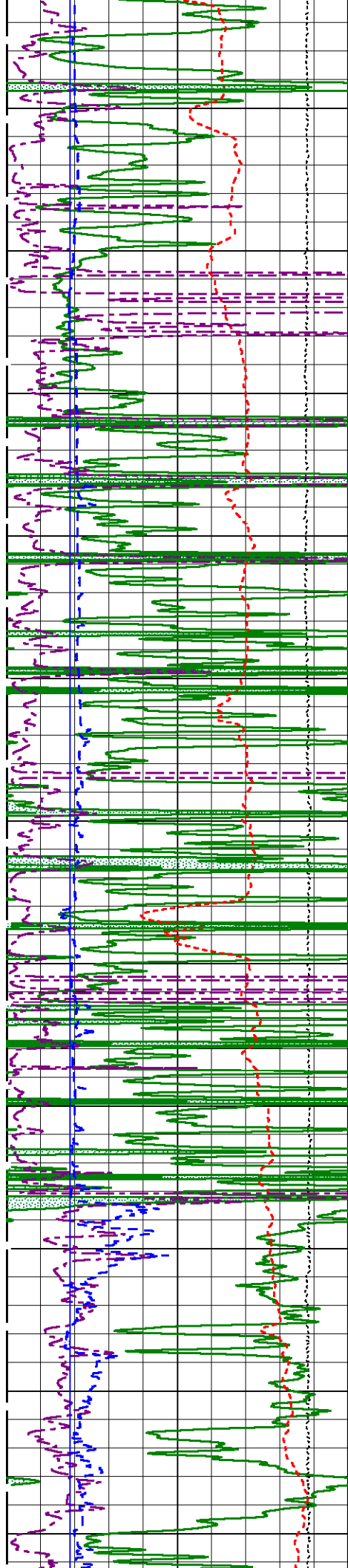
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4500

4600

4700





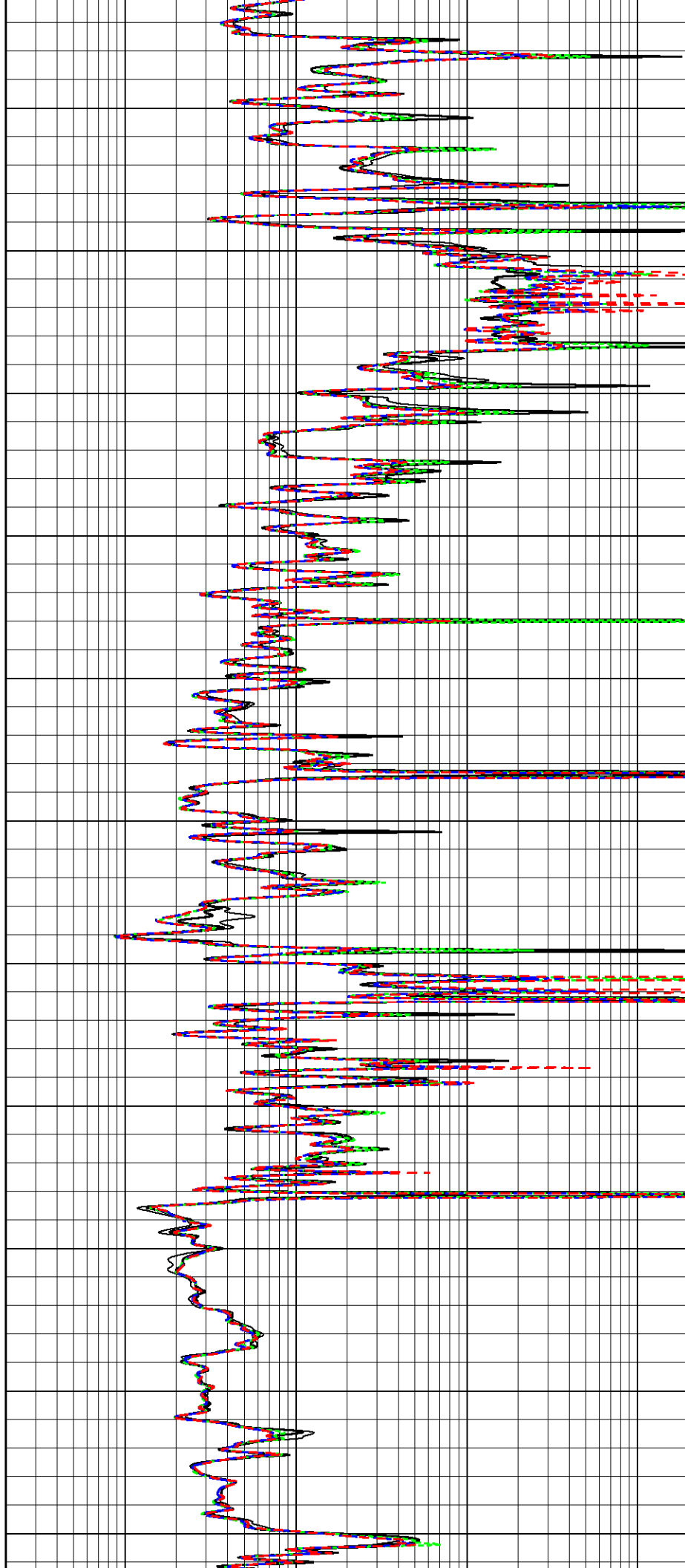
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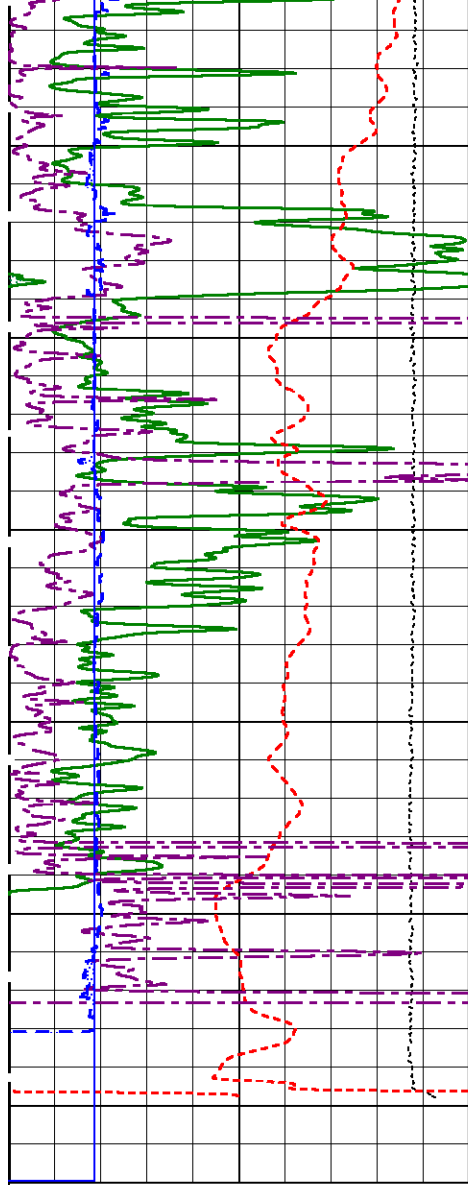
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5000

5100

5200



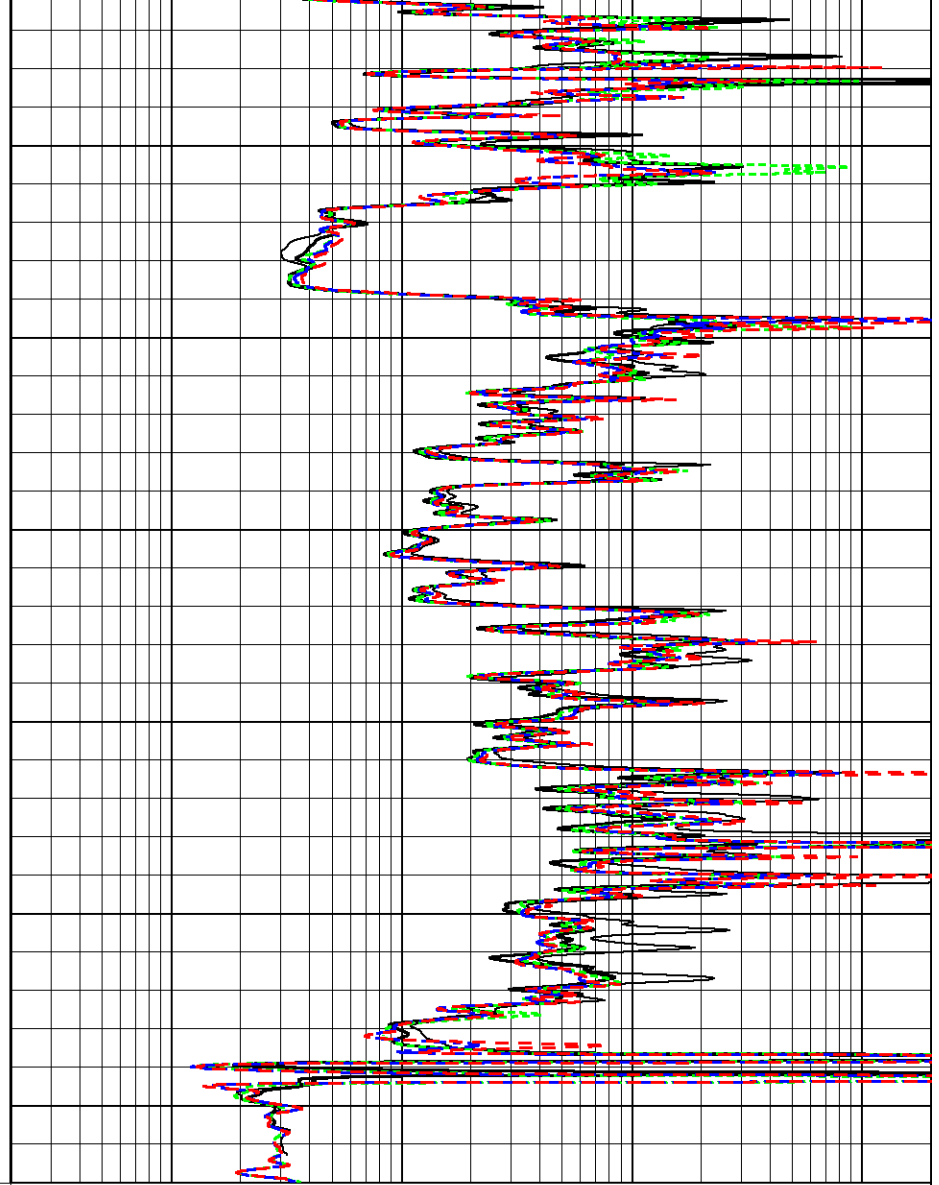


5300

5400

5500

0	Gamma Ray (GAPI)	150
	SP [-20mV+]	
0	Rwa (Ohm-m)	1
6	Caliper (in)	16
6	Bit Size (in)	16
	Line Tension	
	10000 (lb)	0



0.2	10 IN Resistivity (Ohm-m)	2000
0.2	20 IN Resistivity (Ohm-m)	2000
0.2	30 IN Resistivity (Ohm-m)	2000
0.2	60 IN Resistivity (Ohm-m)	2000
0.2	90 IN Resistivity (Ohm-m)	2000



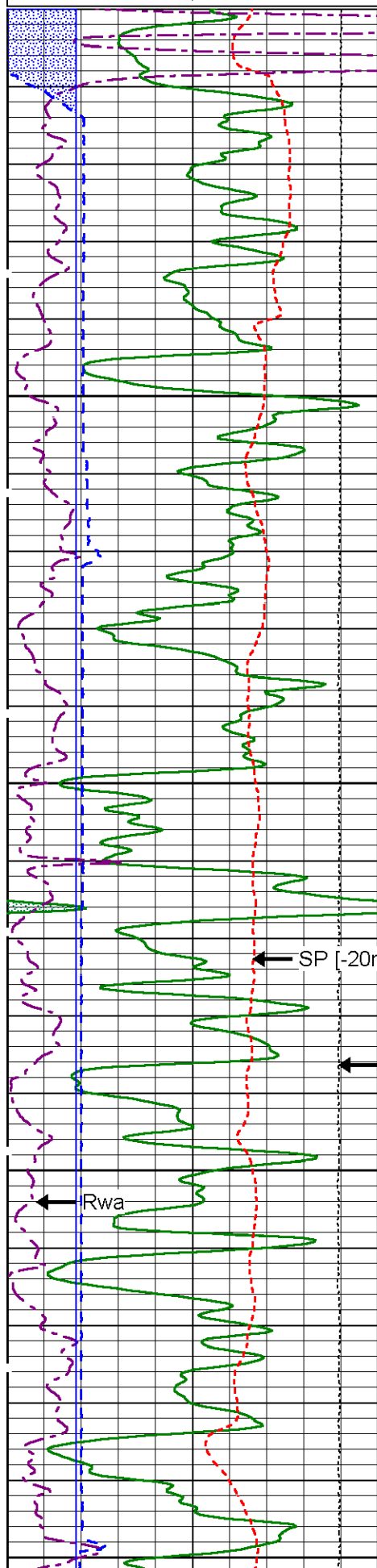
# Main Pass

Database File: pronghorn\_harley\_3.db  
 Dataset Pathname: lime  
 Presentation Format: iat\_ph\_5  
 Dataset Creation: Sat May 25 02:32:32 2013  
 Charted by: Depth in Feet scaled 1:240

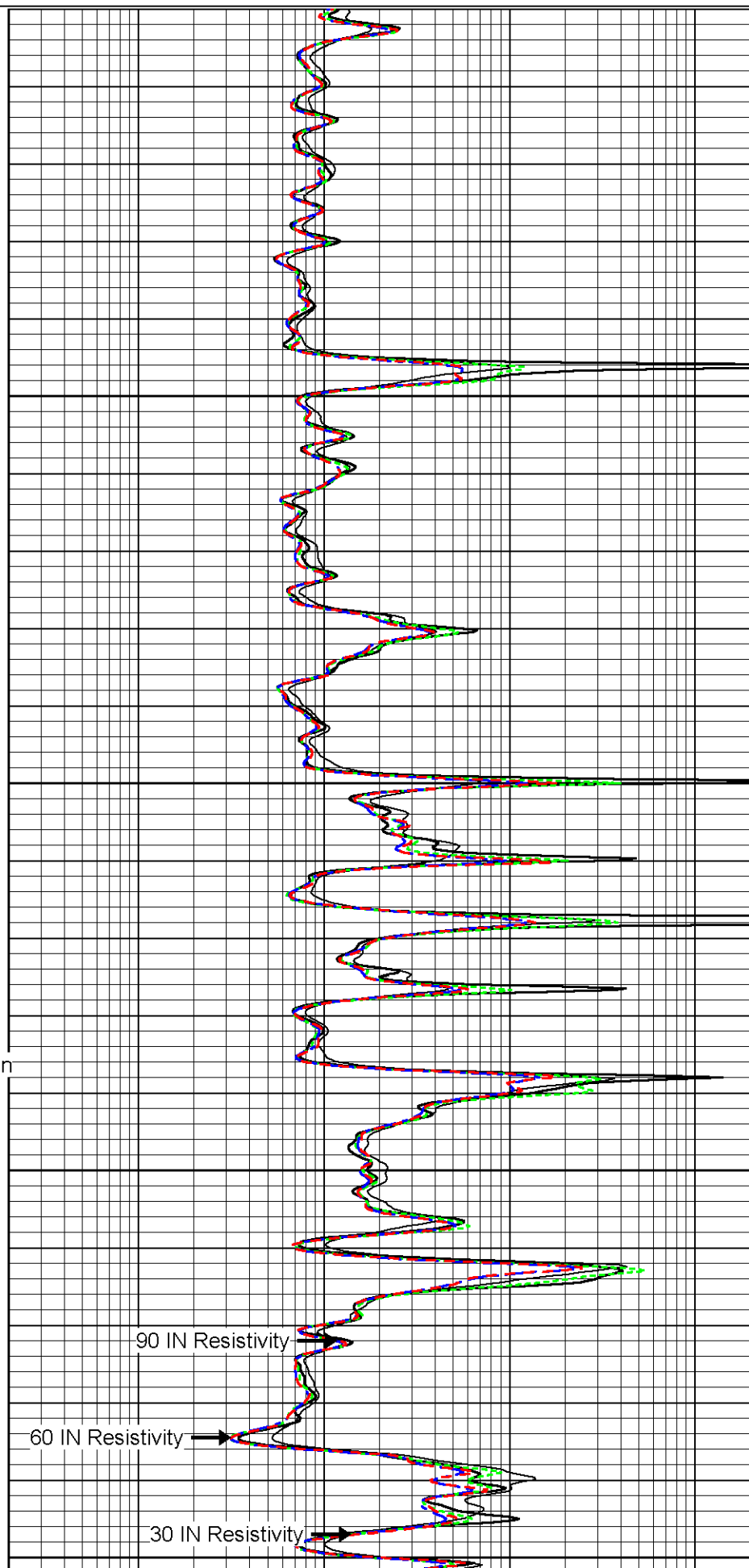
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	SP [-20mV+]	
0	Rwa (Ohm-m)	1
6	Caliper (in)	16

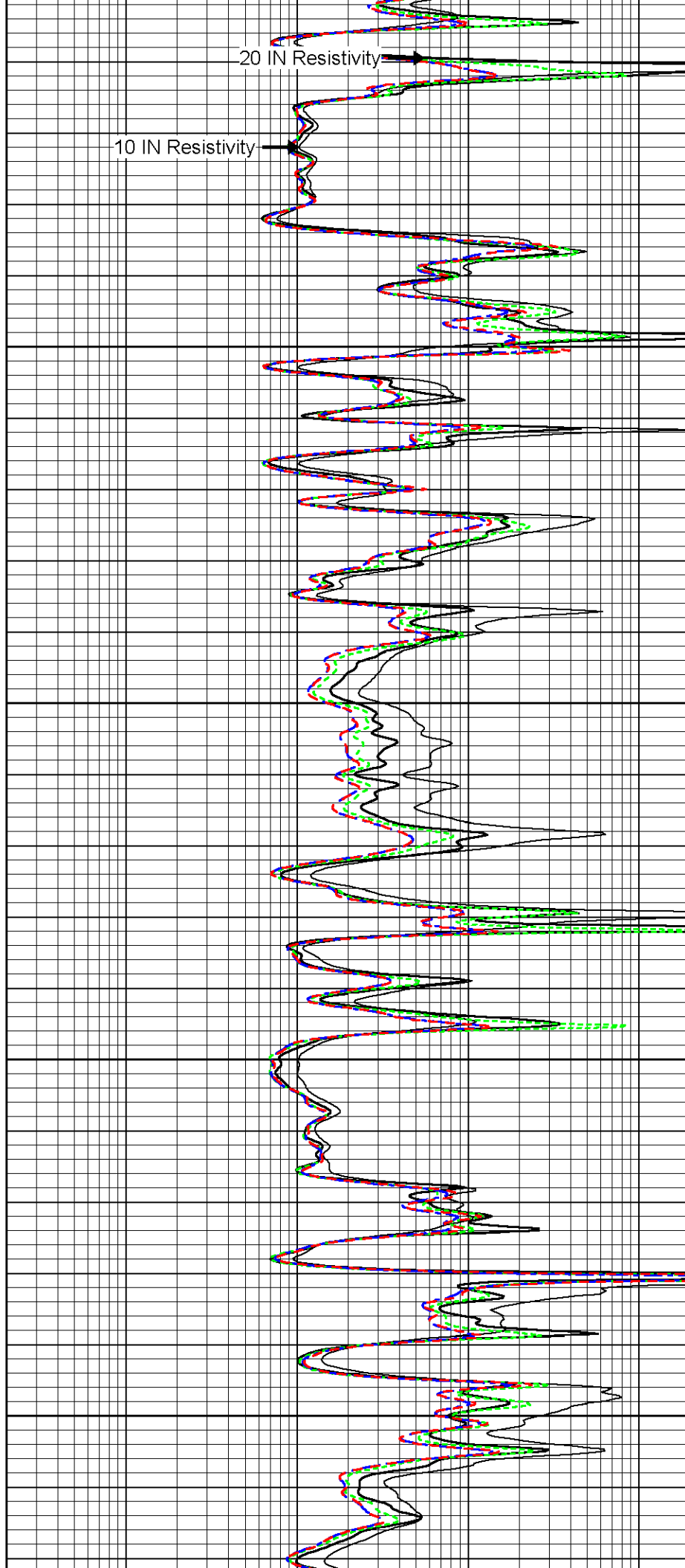
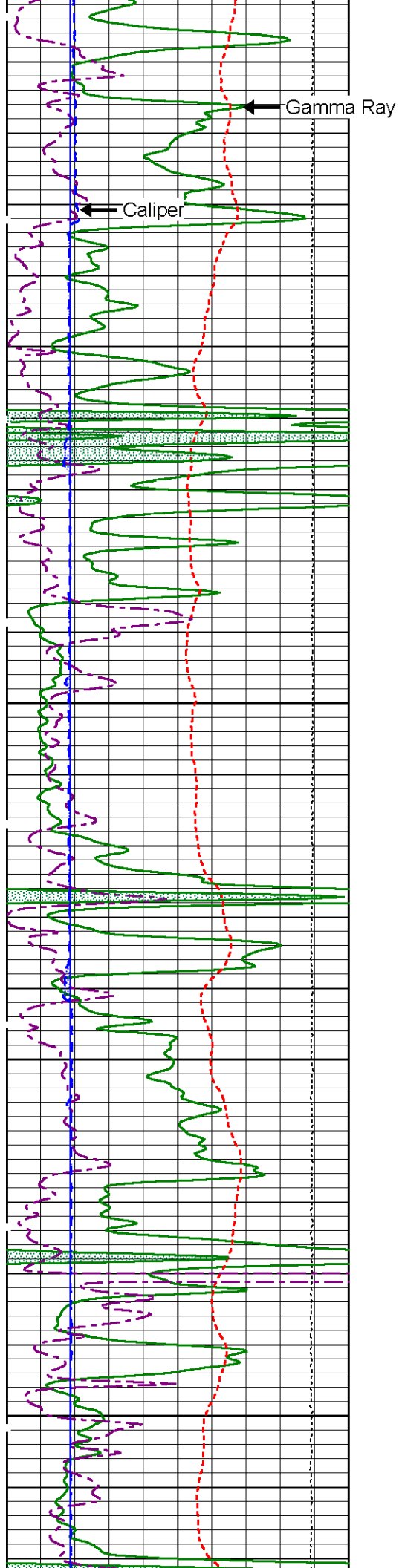
0.2	10 IN Resistivity (Ohm-m)	2000
0.2	20 IN Resistivity (Ohm-m)	2000
0.2	30 IN Resistivity (Ohm-m)	2000
0.2	60 IN Resistivity (Ohm-m)	2000

6	Caliper (in)	16
6	Bit Size (in)	16
Line Tension		
10000 (lb)		0

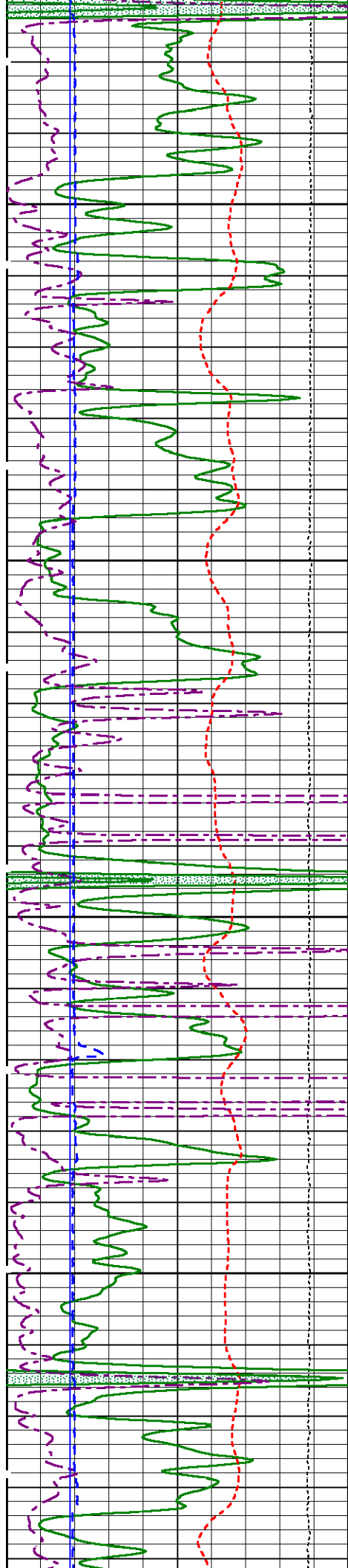


0.2	60 IN Resistivity (Ohm-m)	2000
0.2	90 IN Resistivity (Ohm-m)	2000

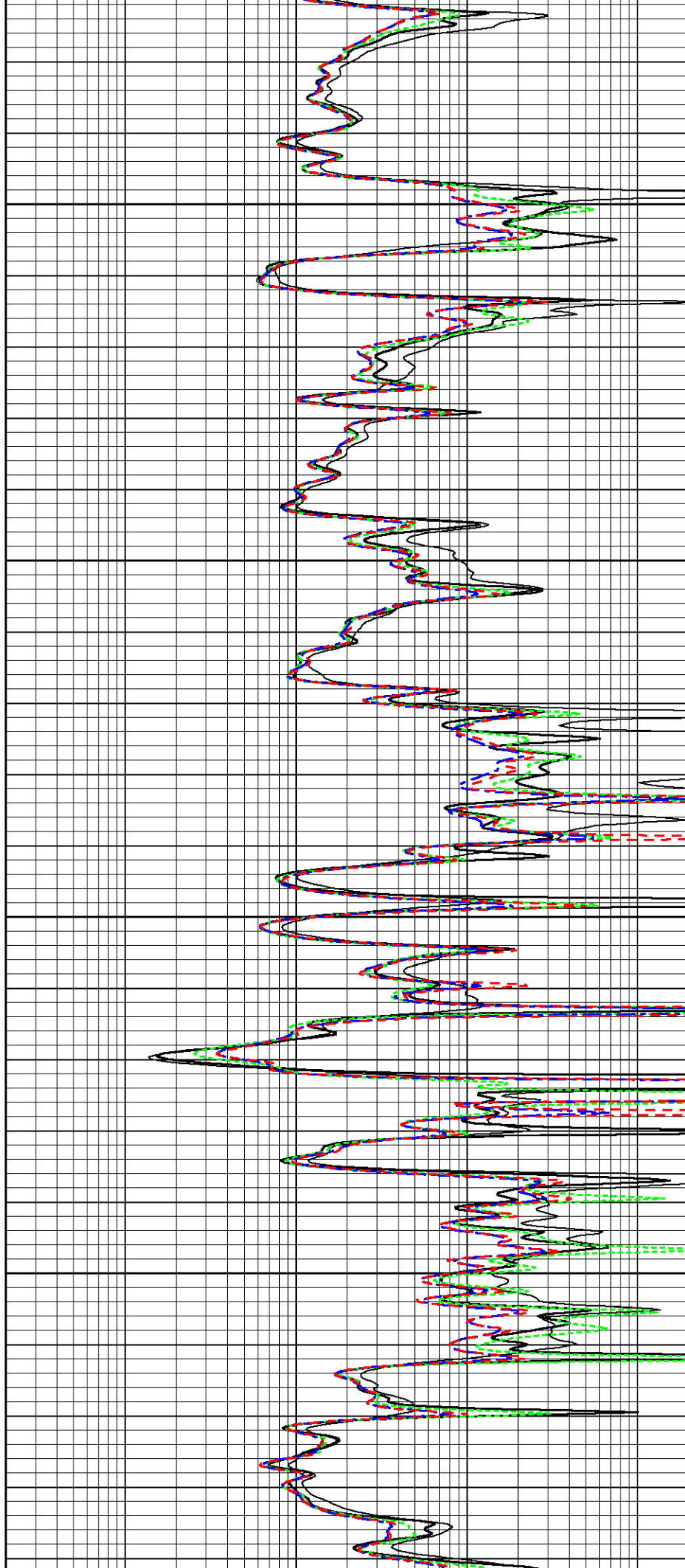




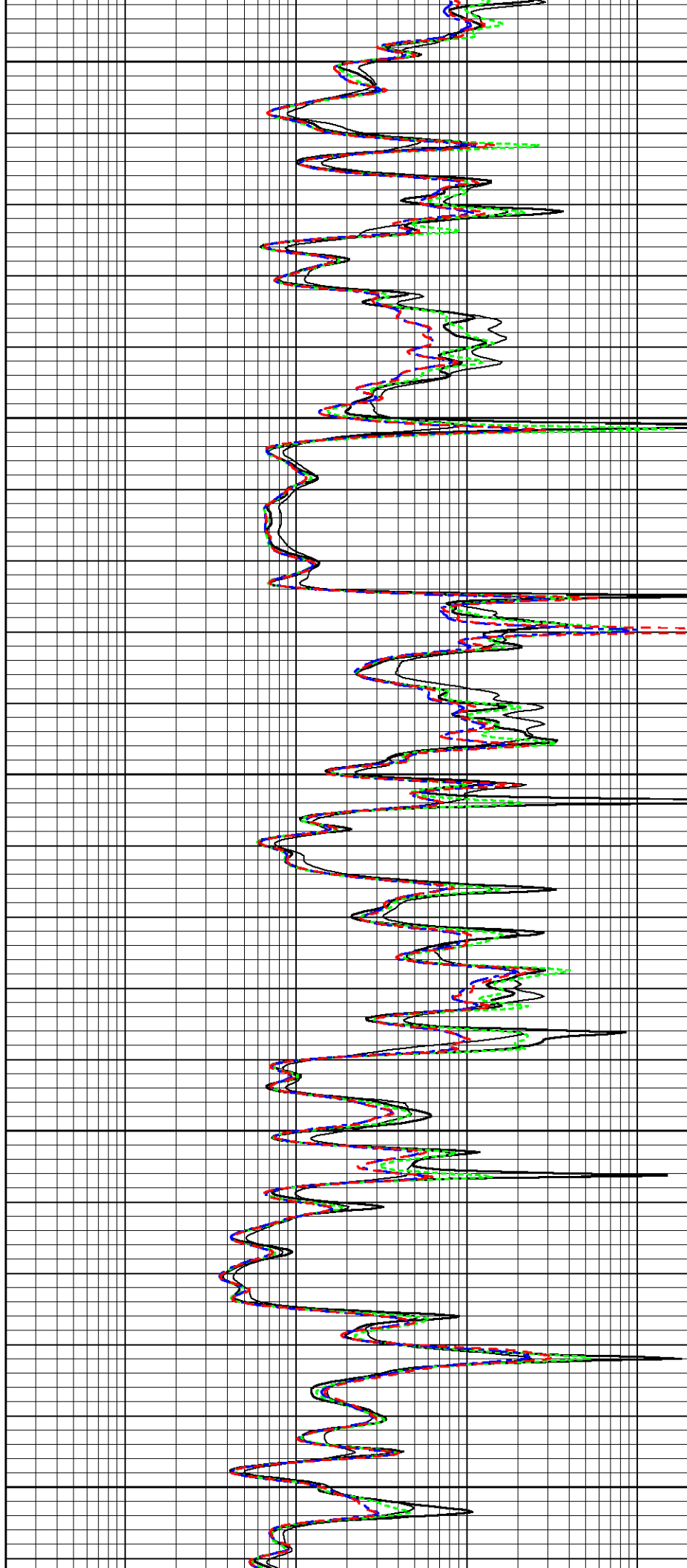
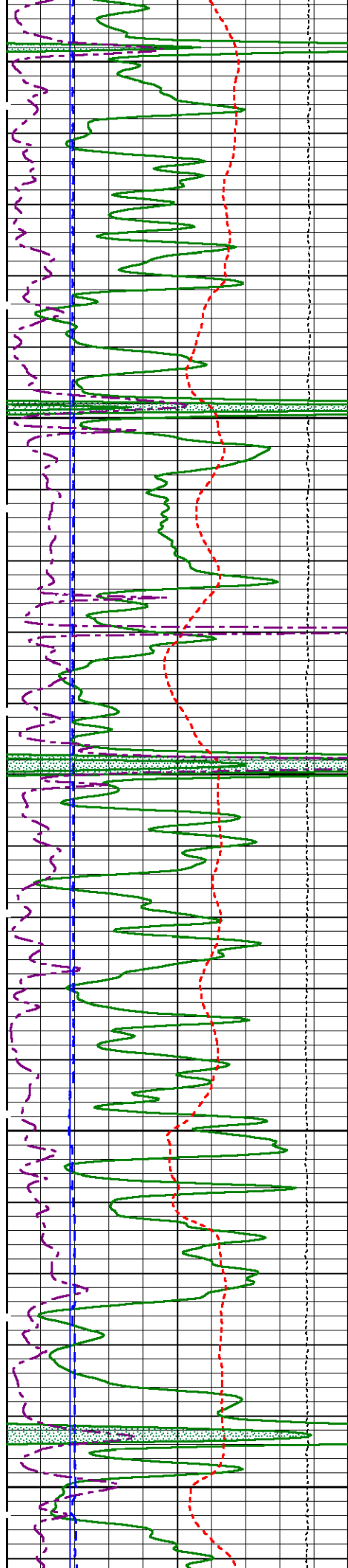


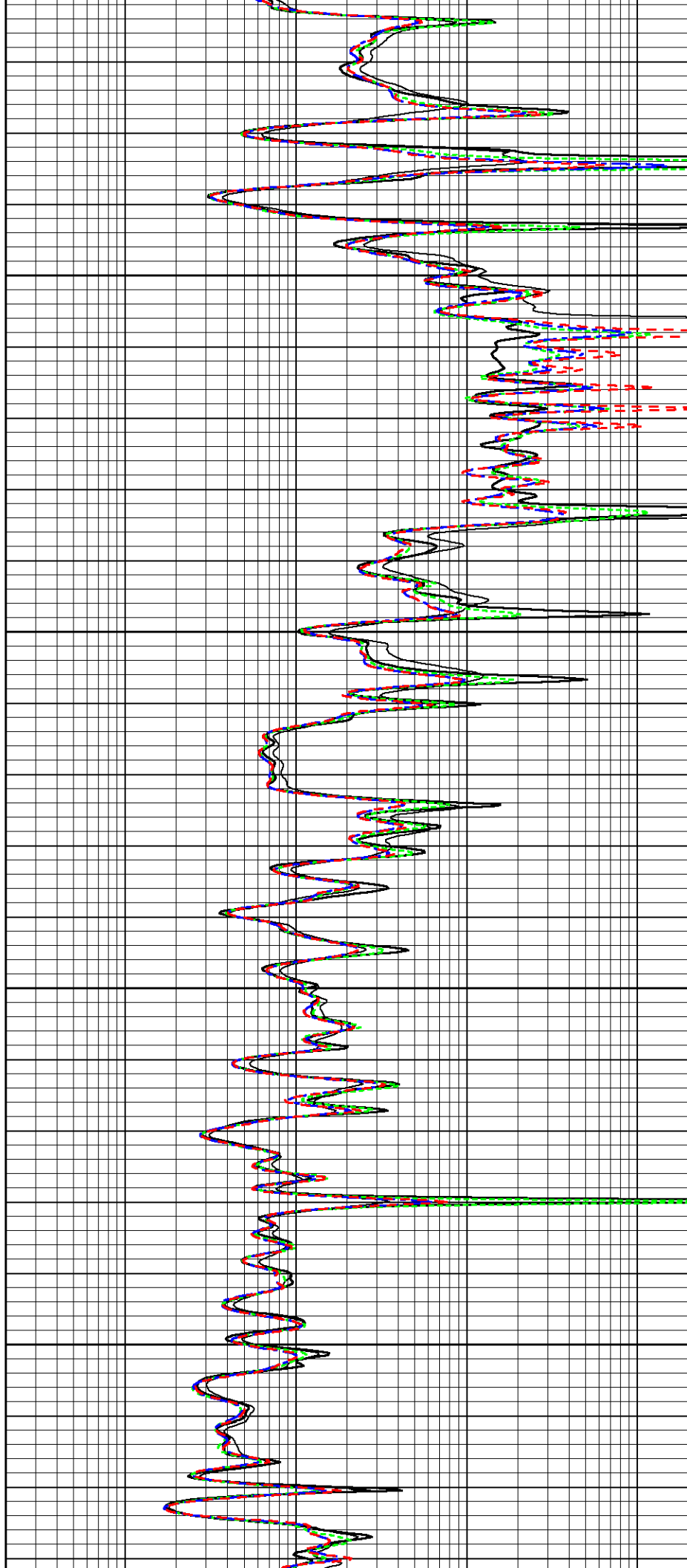
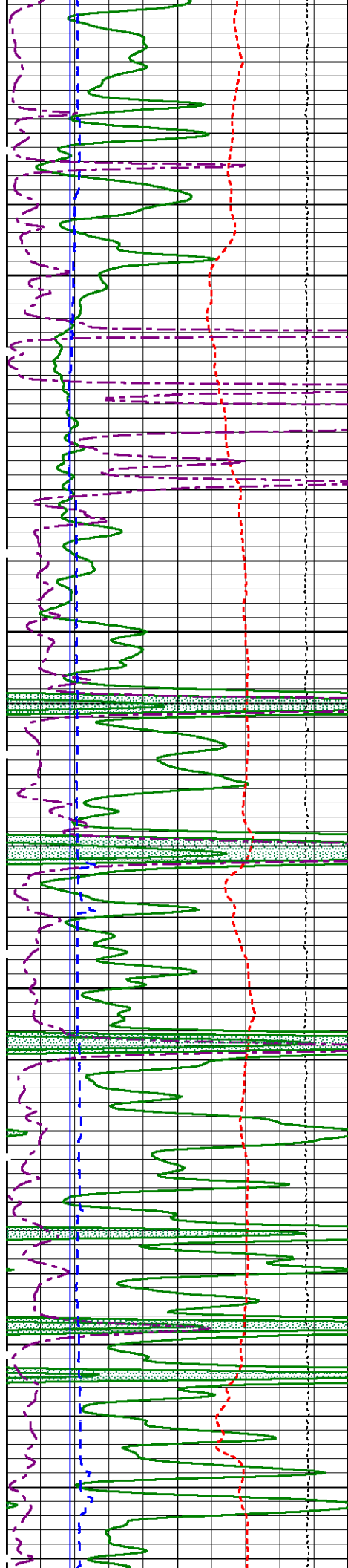


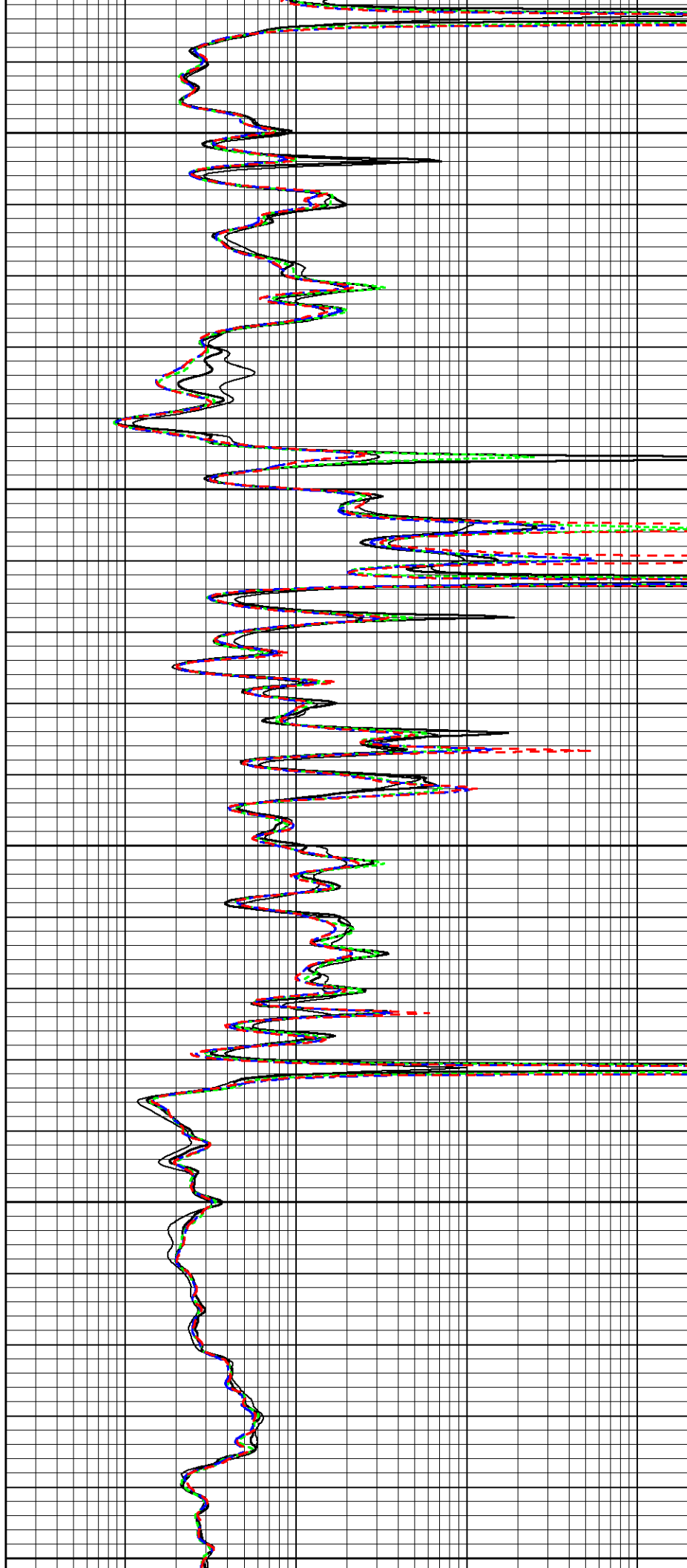
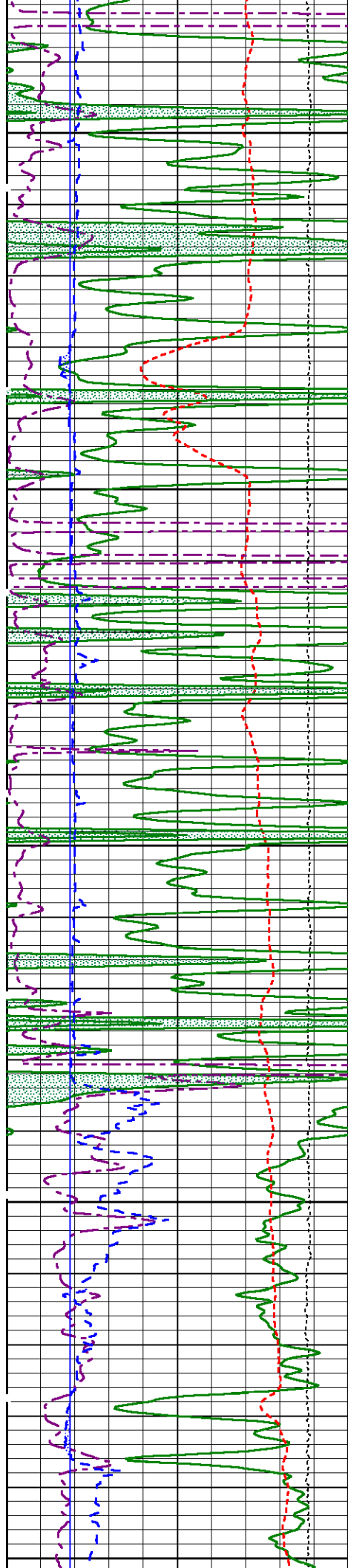
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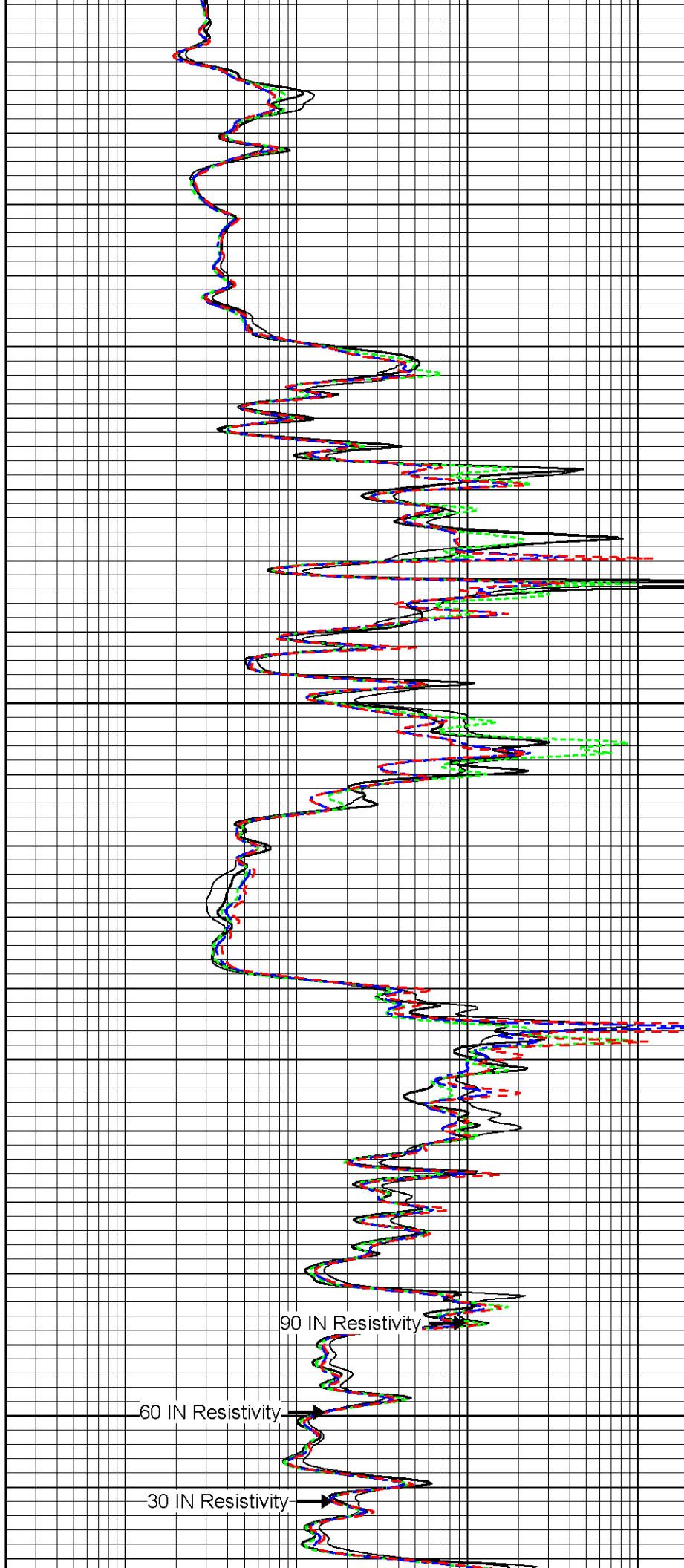
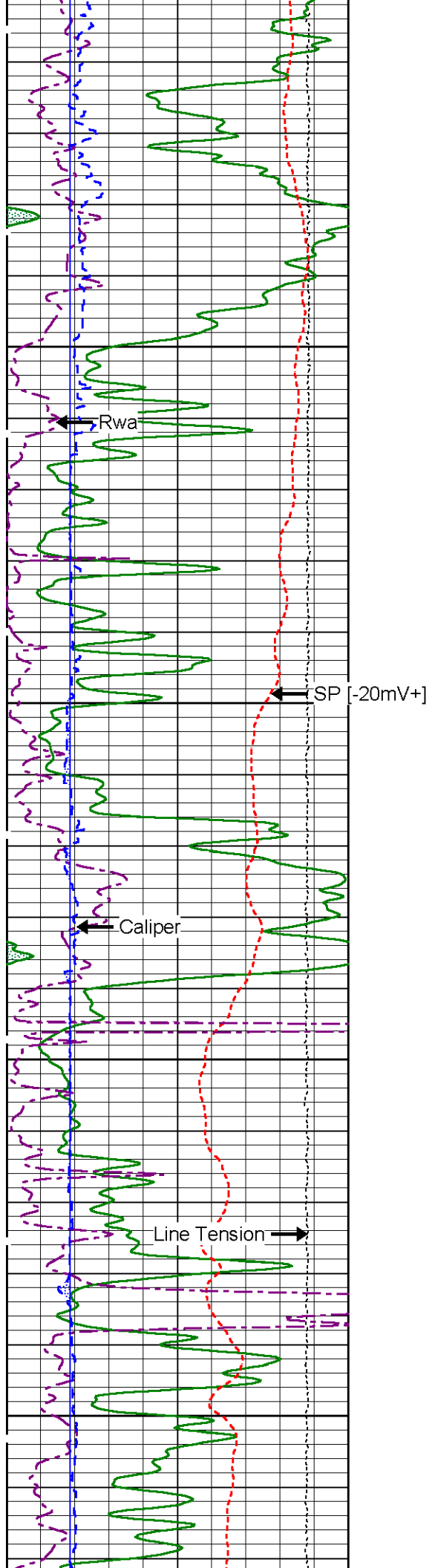


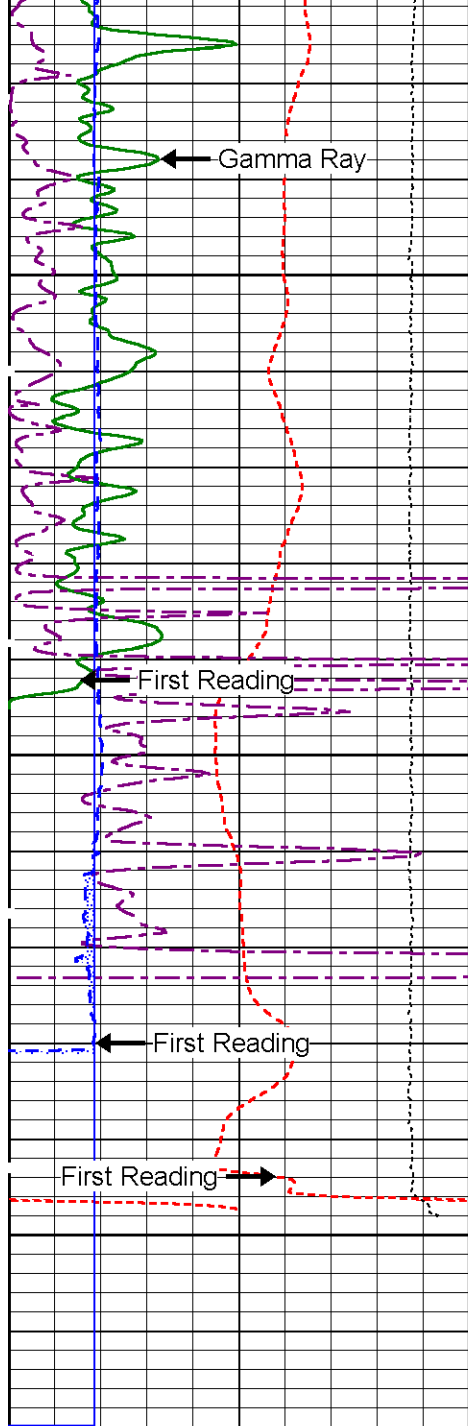








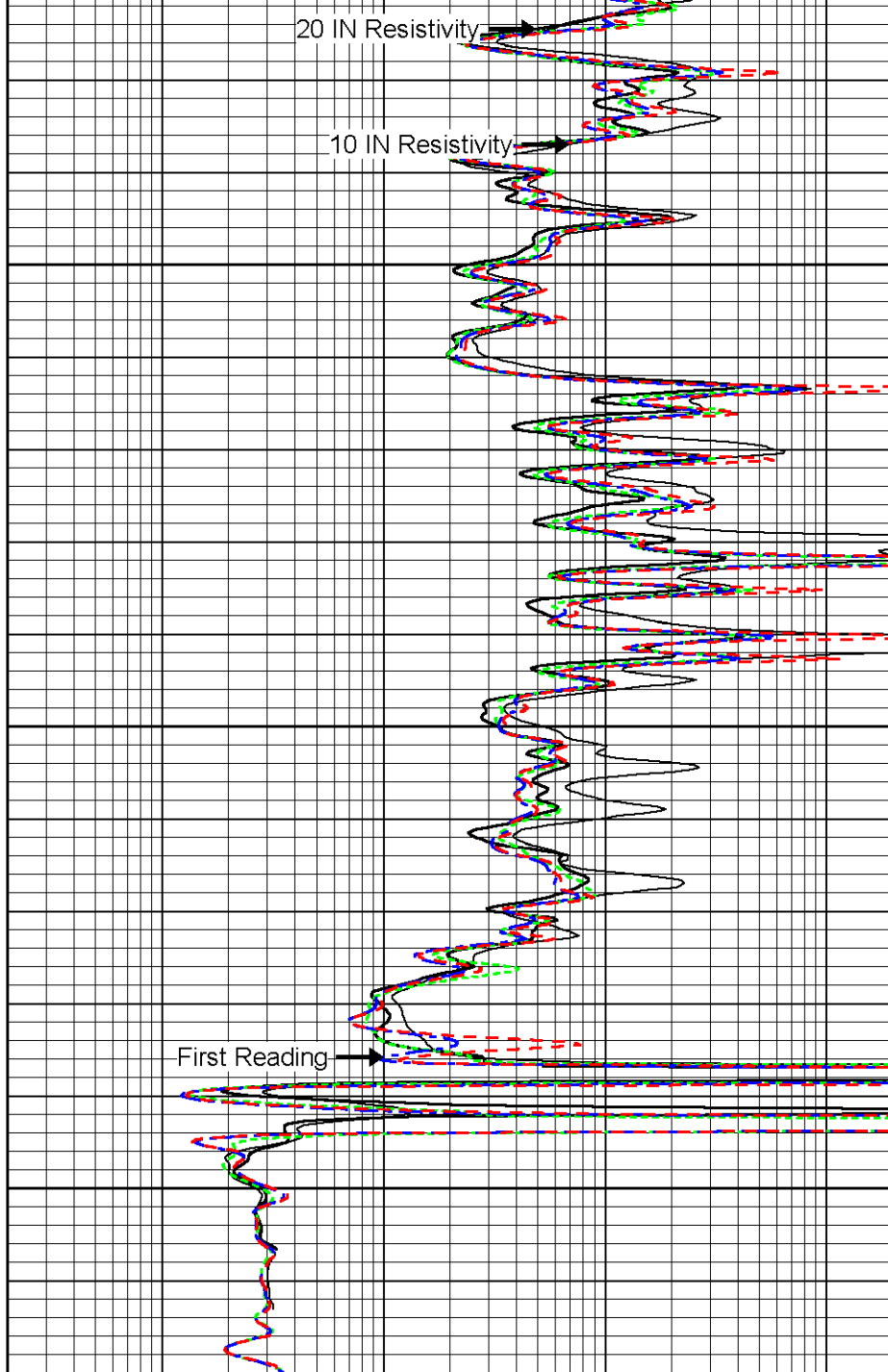




5500

Total Depth

0	Gamma Ray (GAPI)	150
	SP [-20mV+]	
0	Rwa (Ohm-m)	1
6	Caliper (in)	16
6	Bit Size (in)	16
Line Tension		
10000	(lb)	0



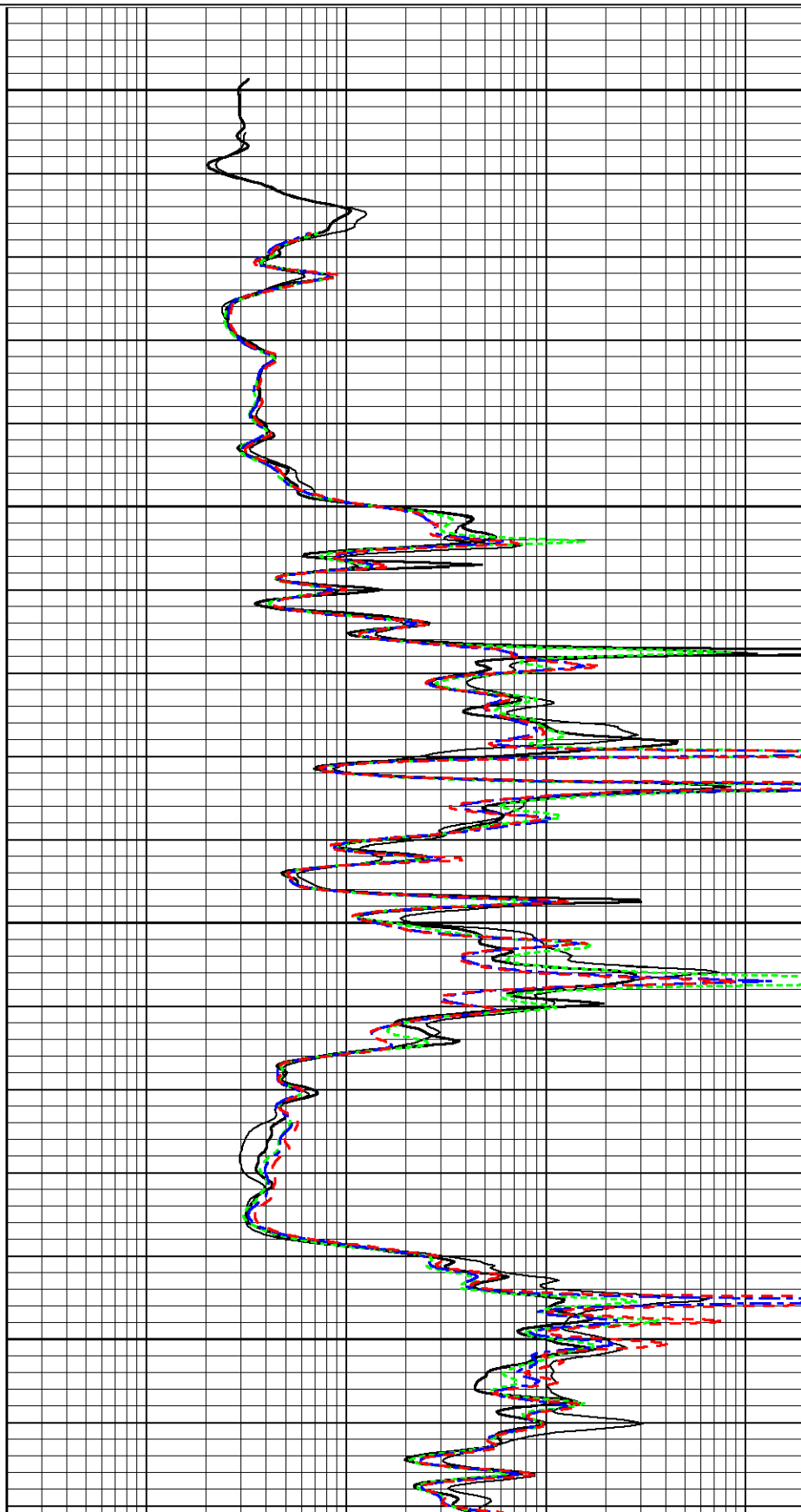
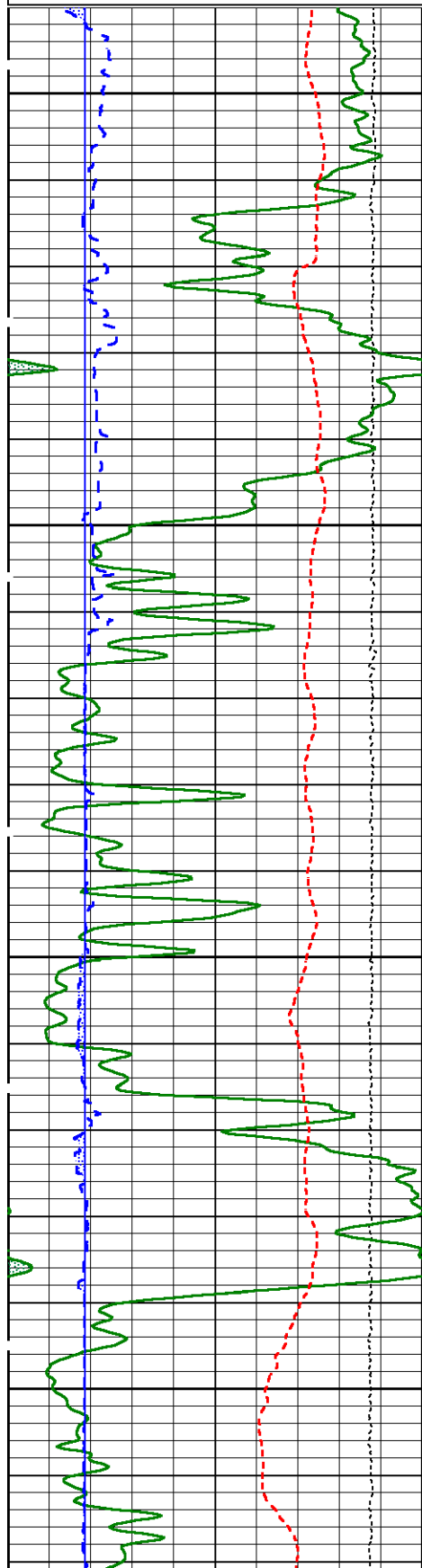
0.2	10 IN Resistivity (Ohm-m)	2000
0.2	20 IN Resistivity (Ohm-m)	2000
0.2	30 IN Resistivity (Ohm-m)	2000
0.2	60 IN Resistivity (Ohm-m)	2000
0.2	90 IN Resistivity (Ohm-m)	2000

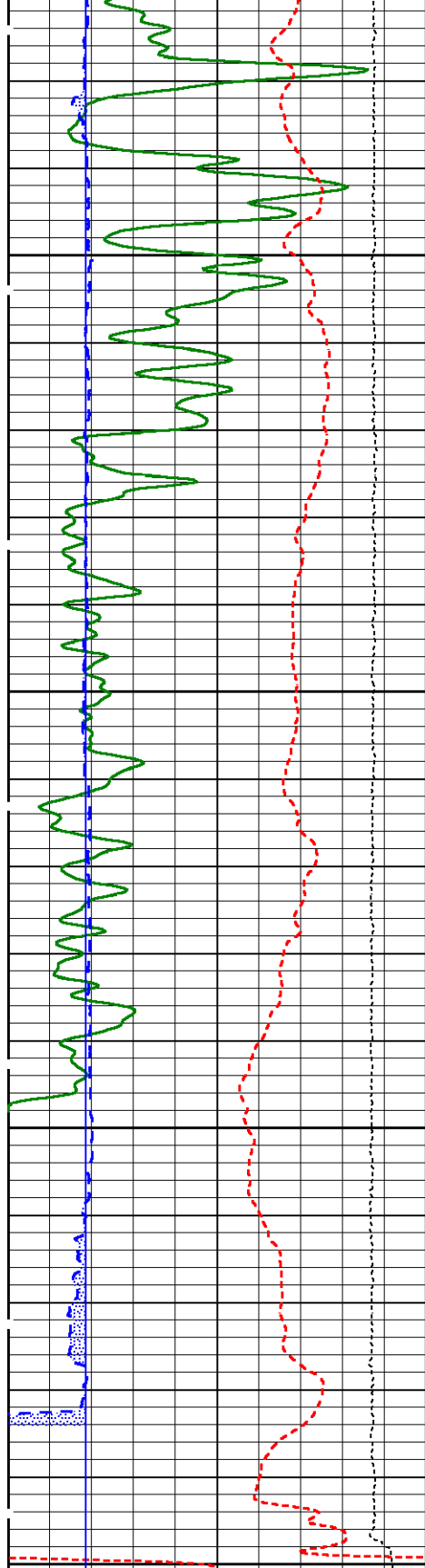


# Repeat Pass

Database File: pronghorn\_harley\_3.db  
 Dataset Pathname: pass5  
 Presentation Format: iat\_ph\_5

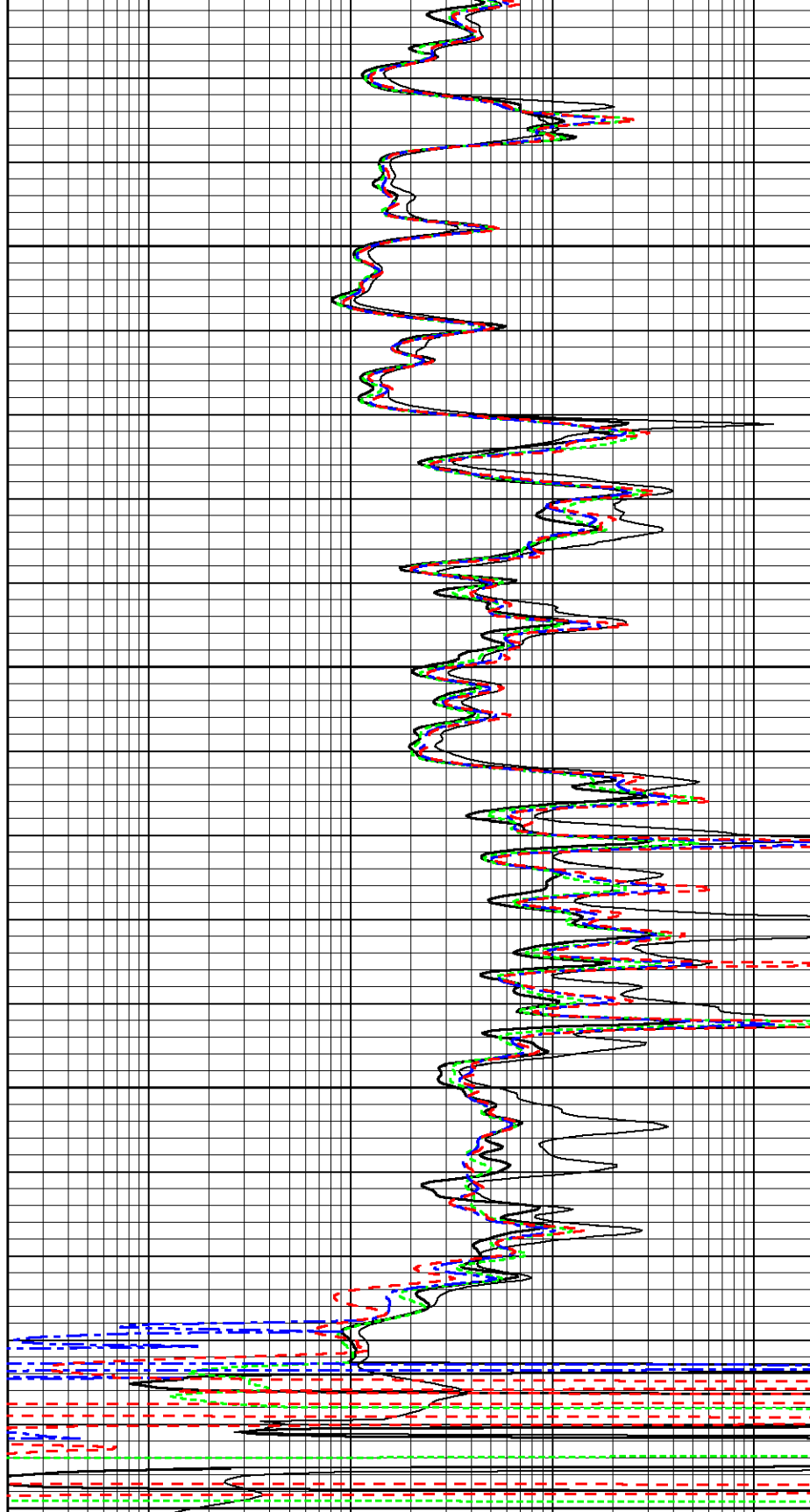
0	Gamma Ray (GAPI)	150	0.2	10 IN Resistivity (Ohm-m)	2000
	SP [-20mV+]		0.2	20 IN Resistivity (Ohm-m)	2000
6	Caliper (in)	16	0.2	30 IN Resistivity (Ohm-m)	2000
6	Bit Size (in)	16	0.2	60 IN Resistivity (Ohm-m)	2000
	Line Tension		0.2	90 IN Resistivity (Ohm-m)	2000
	10000 (lb)	0			





0	Gamma Ray (GAPI)	150
	SP [-20mV+]	
6	Caliper (in)	16
6	Bit Size (in)	16
	Line Tension	
	10000 (lb)	0

5500



0.2	10 IN Resistivity (Ohm-m)	2000
0.2	20 IN Resistivity (Ohm-m)	2000
0.2	30 IN Resistivity (Ohm-m)	2000
0.2	60 IN Resistivity (Ohm-m)	2000
0.2	90 IN Resistivity (Ohm-m)	2000



## Top - 493.00 ft

MAXAMPL mV 0	MINAMPL mV 1	MINATTN db/ft 0.8	COMPACT  1	SVFLUID usec/ft 189	SVMATRIX usec/ft 47.6	FRMSALIN kppm 0	MUDSALIN kppm 0
DEVI ° 0	SRFTEMP degF 68	SO in 1.5	DE-CENT  Yes	<b>CASED?</b>  <b>Yes</b>	<b>CASEWGHT</b> lb/ft <b>54</b>	NPORSEL  Limestone	AIR_HOLE?  No
MudWgt lb/gal 8.8	FLUIDDEN g/cc 1	MATRXDEN g/cc 2.71	SPSHIFT mV 0	<b>CASEOD</b> in <b>13.375</b>	PERFS  0	TDEPTH ft 5579	BOTTEMP degF 130
<b>BOREID</b> in <b>15</b>							

## 493.00 ft - 1700.00 ft

MAXAMPL mV 0	MINAMPL mV 1	MINATTN db/ft 0.8	COMPACT  1	SVFLUID usec/ft 189	SVMATRIX usec/ft 47.6	FRMSALIN kppm 0	MUDSALIN kppm 0
DEVI ° 0	SRFTEMP degF 68	SO in 1.5	DE-CENT  Yes	CASED?  No	CASEWGHT lb/ft 17	NPORSEL  Limestone	AIR_HOLE?  No
MudWgt lb/gal 8.8	FLUIDDEN g/cc 1	MATRXDEN g/cc 2.71	SPSHIFT mV 0	CASEOD in 5.5	PERFS  0	TDEPTH ft 5579	BOTTEMP degF 130
<b>BOREID</b> in <b>12.25</b>							

## 1700.00 ft - 5125.00 ft

MAXAMPL mV 0	MINAMPL mV 1	MINATTN db/ft 0.8	COMPACT  1	SVFLUID usec/ft 189	SVMATRIX usec/ft 47.6	FRMSALIN kppm 0	MUDSALIN kppm 0
DEVI ° 0	SRFTEMP degF 68	SO in 1.5	DE-CENT  Yes	CASED?  No	CASEWGHT lb/ft 17	<b>NPORSEL</b>  <b>Limestone</b>	AIR_HOLE?  No
MudWgt lb/gal 8.8	FLUIDDEN g/cc 1	<b>MATRXDEN</b> g/cc <b>2.71</b>	SPSHIFT mV 0	CASEOD in 5.5	PERFS  0	TDEPTH ft 5579	BOTTEMP degF 130
BOREID in 7.875							

## 5125.00 ft - 5240.00 ft

MAXAMPL mV 0	MINAMPL mV 1	MINATTN db/ft 0.8	COMPACT  1	SVFLUID usec/ft 189	SVMATRIX usec/ft 47.6	FRMSALIN kppm 0	MUDSALIN kppm 0
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DEVI ° 0	SRFTEMP degF 68	SO in 1.5	DE-CENT  Yes	CASED?  No	CASEWGHT lb/ft 17	<b>NPORSEL</b>  <b>Sandstone</b>	AIR_HOLE?  No
MudWgt lb/gal 8.8	FLUIDDEN g/cc 1	<b>MATRXDEN</b> <b>g/cc</b> <b>2.65</b>	SPSHIFT mV 0	CASEOD in 5.5	PERFS  0	TDEPTH ft 5579	BOTTEMP degF 130

BOREID  
in  
7.875

#### 5240.00 ft - Bottom

MAXAMPL mV 0	MINAMPL mV 1	MINATTN db/ft 0.8	COMPACT  1	SVFLUID usec/ft 189	SVMATRIX usec/ft 47.6	FRMSALIN kppm 0	MUDSALIN kppm 0
DEVI ° 0	SRFTEMP degF 68	SO in 1.5	DE-CENT  Yes	CASED?  No	CASEWGHT lb/ft 17	NPORSEL  Limestone	AIR_HOLE?  No
MudWgt lb/gal 8.8	FLUIDDEN g/cc 1	MATRXDEN g/cc 2.71	SPSHIFT mV 0	CASEOD in 5.5	PERFS  0	TDEPTH ft 5579	BOTTEMP degF 130

BOREID  
in  
7.875

#### Calibration Report

Database File: pronghorn\_harley\_3.db  
Dataset Pathname: pass6  
Dataset Creation: Sat May 25 00:21:05 2013 by Log Sondex V7.03

#### Induction Array Tool Calibration Report

Serial Number: B10110  
Tool Model: 002

Master Calibration Performed: Wed Aug 24 08:34:17 2011  
Temperature: 74.0 degF

#### Sonde Error:

Array	1	2	3	4	5	6	7	
Real	191.9	-13.8	-40.9	-15.9	-3.1	0.7	3.4	mmho/m
Imaginary	33.1	-17.8	-19.8	-16.7	-24.3	-1.9	5.8	mmho/m

#### Loop Gain:

Array	1	2	3	4	5	6	7	
Loop (real)	537.7	678.5	1295.3	1394.1	1144.8	712.8	404.8	mmho/m
Loop (imaginary)	73.3	92.5	389.8	419.5	344.5	214.5	121.8	mmho/m
Real	762.6	736.2	1247.9	1380.3	1164.3	741.8	425.4	mmho/m
Imaginary	109.3	84.7	369.6	408.4	328.0	221.5	135.1	mmho/m
Gain (real)	0.942	0.905	1.005	0.999	0.981	0.962	0.959	
Gain (imaginary)	0.961	0.902	1.001	0.987	0.978	0.960	0.942	

Before Survey Verification Performed: Thu Oct 04 13:29:32 2012  
Sonde 1 Temperature: 83.1 degF  
Sonde 2 Temperature: 86.7 degF  
Array 1 Temperature: 83.1 degF

Array	1	2	3	4	5	6	7
TxIR	-0.0	-0.0	0.1	0.1	0.1	0.1	0.1
TxIX	-0.0	-0.0	-0.2	-0.2	-0.2	-0.2	-0.2
Tx Magnitude	0.0	0.0	0.2	0.2	0.2	0.2	0.2
Gain	121.5	180.0	190.0	190.0	190.0	190.0	190.0
RxCR	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
RxCX	0.2	0.2	0.2	0.2	0.2	0.2	0.2
RxC Magnitude	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Tool Module Parameters							
Software Version:				1.9.1.0			
Borehole Size Source:				CALI			
Mud Resistivity Source:				Hilchie			
Mud Resistivity At Surface:				1.40 Ohm-m			
Mud Resistivity Surface Temperature:				65.0 degF			
Borehole Corrections:				Automatic			
Minimum Standoff:				0.4 in			

Litho Density Tool Calibration Report							
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Serial Number:				B0872S50130B			
Tool Model:				002			

Caliper Calibration Performed:				Fri May 24 20:21:14 2013			
		Diameter		Reading			
Small Ring:	3.800	in		978.200	cps		
Large Ring:	8.100	in		1440.000	cps		
Gain:	0.0093						
Offset:	-6.2084						

Master Calibration Performed:			Wed Mar 06 10:52:06 2013	
Source Number:			50103	
Medium:			Air	
Al Block Density:			2.6013 g/cc	
	Background	Al Block	Al Block + Fe	
SS1	824.5	4450.0	3821.3	cps
SS2	2318.8	30000.0	25767.6	cps
SSTOTAL	5436.6	47889.7	40834.0	cps
LITH	94.3	481.5	292.5	cps
LL	186.3	809.1	716.4	cps
LU	531.7	1063.6	991.7	cps
LS	718.0	1872.6	1708.1	cps
LSTOTAL	1360.4	4538.8	3713.8	cps
SSHV	1476.1	1480.8	1480.9	V
LSHV	1409.7	1412.0	1413.2	V
SSFF	0.005	0.008	0.004	
LSFF	0.009	0.008	-0.009	

Before Survey Verification Performed:							
After Survey Verification Performed:							
		Master Background	Before Survey Background	After Survey Background			
SS1	824.5			cps			
SS2	2318.8			cps			
SSTOTAL	5436.6			cps			
LITH	94.3			cps			

LL	186.3	cps
LU	531.7	cps
LS	718.0	cps
LSTOTAL	1360.4	cps
SSHV	1476.1	V
LSHV	1409.7	V
SSFF	0.005	
LSFF	0.009	

Tool Module Parameters		
Software Version:	2.5.1.0	
Borehole Size Source:	CALI	
Pad Type:	2	

Compensated Neutron Tool Calibration Report
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Serial Number:	C7939S66010B
Tool Model:	009

Master Calibration Performed:	Thu May 23 13:53:23 2013	
Source Number:	66010B	
Short Spacing Counts:	6649.41	cps
Long Spacing Counts:	260.18	cps
High Voltage:	1335.88	V
Target Ratio:	23.9200	
Ratio:	25.5572	
K-Factor:	0.9359	

Before Survey Verification Performed:			
After Survey Verification Performed:			
Verifier Number:		6494	
Verifier Values	Master Cal	Before Survey	After Survey
Short Spacing Counts:	251.77		cps
Long Spacing Counts:	262.36		cps
High Voltage:	1335.93		V
Ratio:	0.9596		

Tool Module Parameters		
Software Version:	1.5.0.0	
Borehole Size Source:	CALI	
Clip Crossplot Porosity:	YES	

Spectral Gamma Ray Tool Calibration Report
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Serial Number:	220344
Tool Model:	002

Performed:	Wed Mar 27 10:17:59 2013	
Source Number:	Th Blanket #14	
Calibrator Value:	217.0	API
Background Reading:	476.3	cps
Calibrator Reading:	2122.6	cps
Sensitivity:	0.132	API / cps

Performed:	
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Performed:

Verifier Number:

Concentrations

K %

U ppm

T ppm

K Peak:

U Peak:

T Peak:

Before Survey Verification Performed:

After Survey Verification Performed:

Before Survey

After Survey

Background Reading:

cps

Verifier Reading:

cps

K Peak:

U Peak:

T Peak:

### Tool Module Parameters

Software Version:

1.8.9.1

### Gamma Ray Calibration Report

Serial Number:

10009990

Tool Model:

001

Performed:

Wed Mar 27 09:56:46 2013

Calibrator Value:

236.0

GAPI

Background Reading:

205.7

cps

Calibrator Reading:

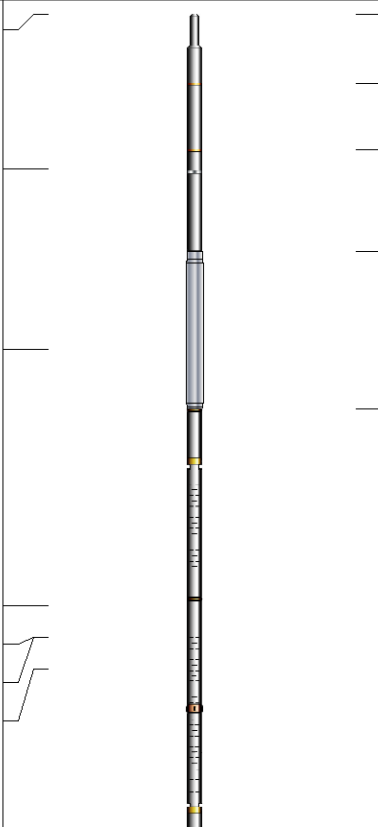
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cps


Sensitivity:

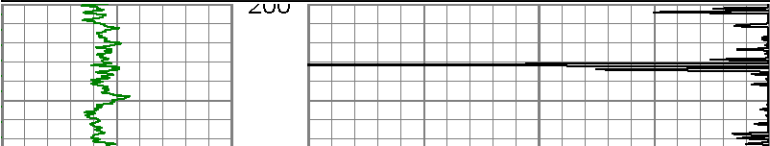
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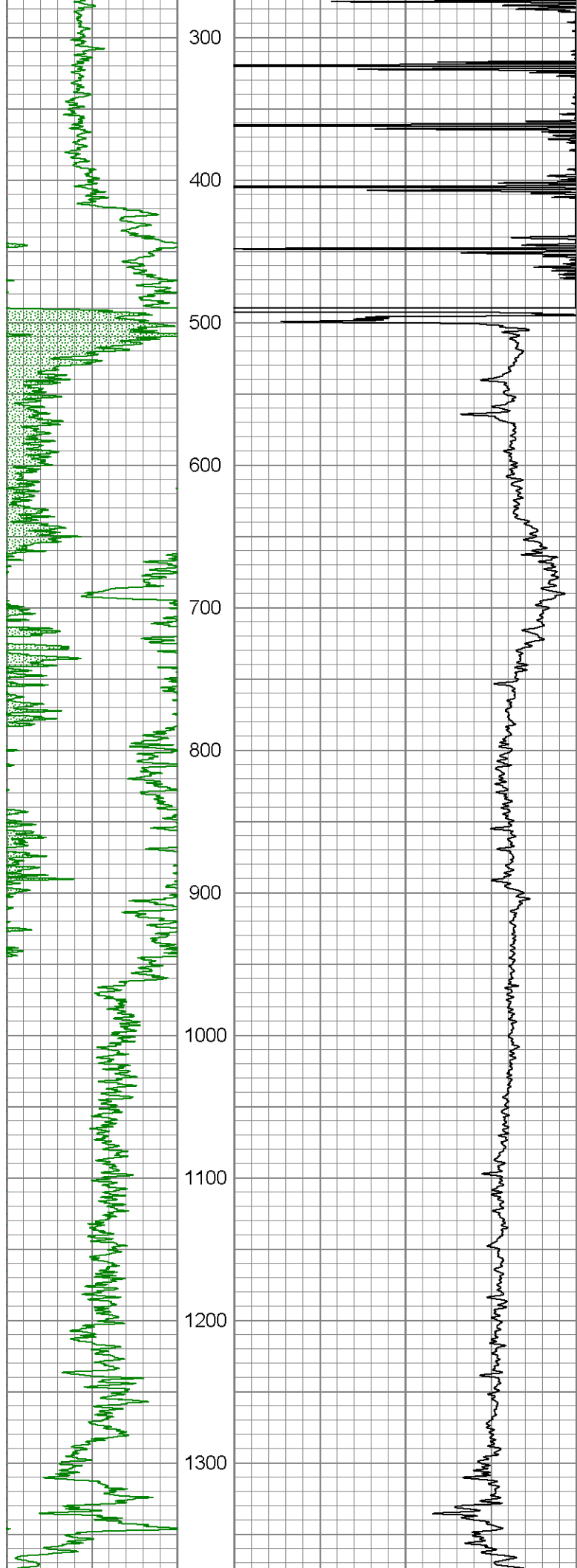
GAPI/cps

Sensor	Offset (ft)	Schematic	Description	Len (ft)	OD (in)	Wt (lb)
CHD	59.35		CHD-001 (000004) Cable Head	2.19	3.38	35.00
GR	54.47		XTU-008 (10007730) Crossover Ultrawire Toolbus to Ultralink	2.08	3.38	47.00
			GRT-001 (10009990) Gamma Ray Tool	3.22	3.38	69.00
SGR	48.79		SGR-002 (220344) Spectral Gamma Ray Tool	4.94	3.88	120.00
WVFUTRF	40.72		MAS-001SS (10010072SS) Multi Array Sonic Tool (SS)	14.28	3.38	242.00
WVFUTRN	39.72					
WVFLTRF	39.72					
WVFLTRN	38.72					

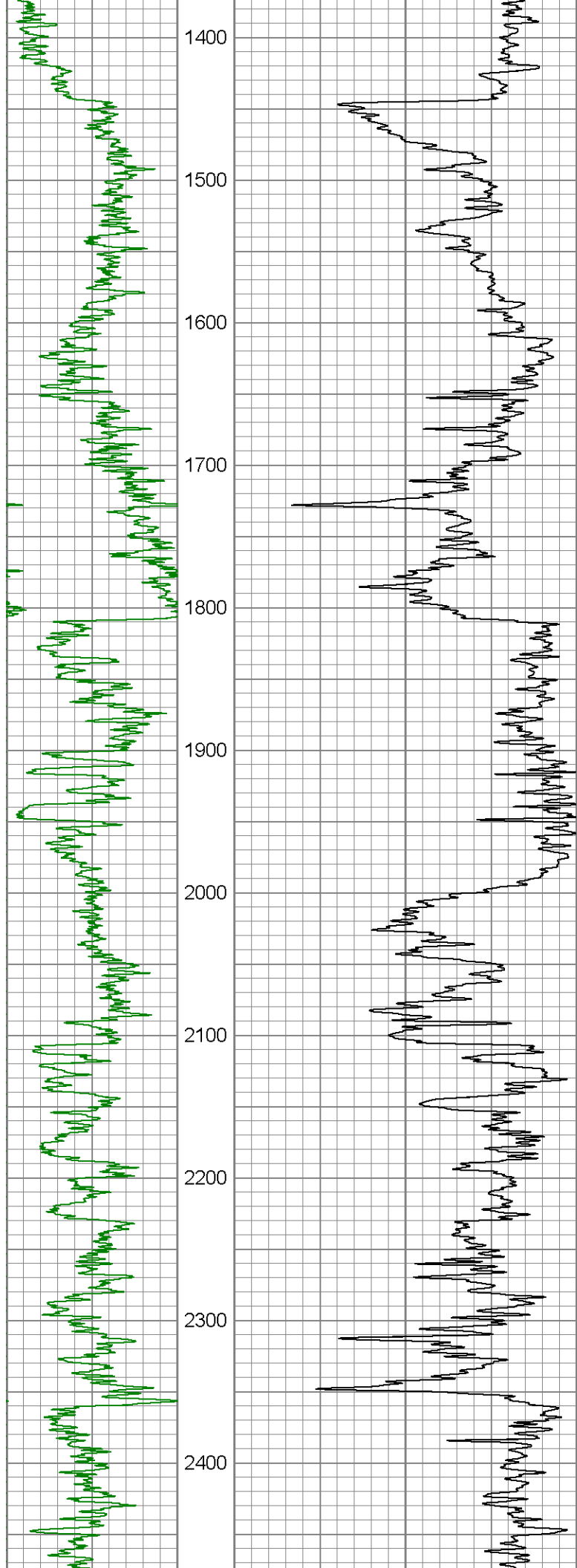
OJT	32.64		OJT-001 (000002) OH Offset Joint	2.46	3.38	56.00
CNLSC	27.16		CNL-009 (C7939S66010B) Compensated Neutron Logging Tool	5.27	3.38	125.00
CNSSC	26.66					
			LDT-002 (B0872S50130B) Litho Density Tool	9.75	4.50	310.00
LDT	17.00					
			IAT-002 (B10110) Induction Array Tool	13.22	3.88	196.00
IAT	10.00					
			BN-HF (000003) Holefinder	1.94	3.88	8.00
SP	1.99					
BN	1.94					
Dataset: pronghorn_harley_3.db: field/well/run1/pass6 Total Length: 59.35 ft Total Weight: 1208.00 lb O.D. 4.50 in						

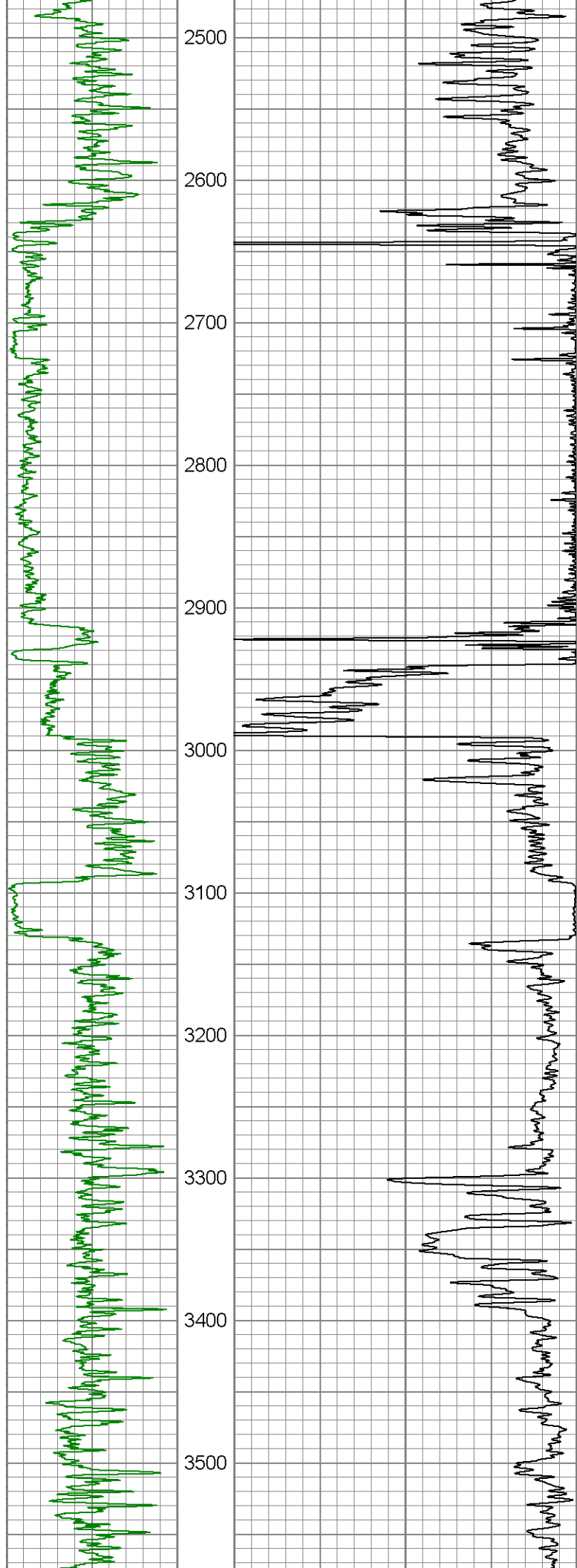
		Main Pass			
Database File: pronghorn_harley_3.db Dataset Pathname: lime Presentation Format: cond_ph1 Dataset Creation: Sat May 25 02:32:32 2013 Charted by: Depth in Feet scaled 1:1200					
Gamma Ray	Deep Resistivity				
0 (GAPI) 150	0 (Ohm-m) 50				
SP (-20mV+)	Shallow Resistivity				
0 (mV) 200	0 (Ohm-m) 50				
6 Caliper (in) 16	100CDeep Conductivity (mmho/m) 0				

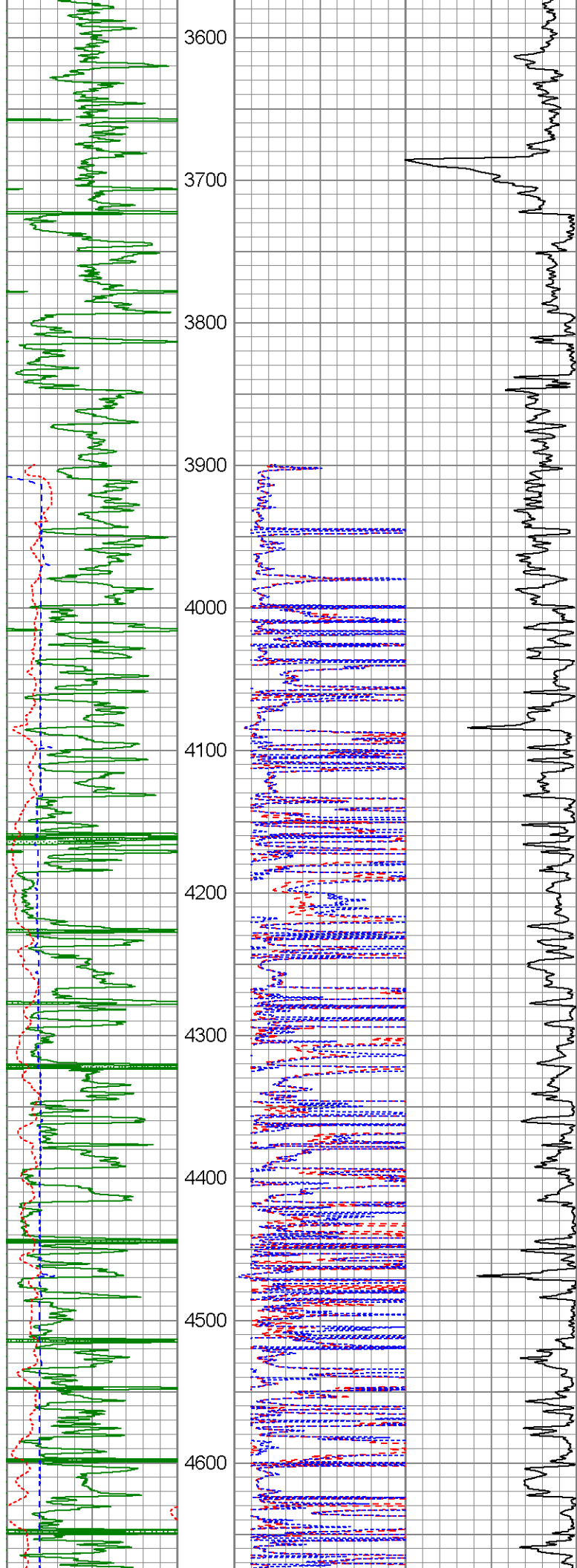


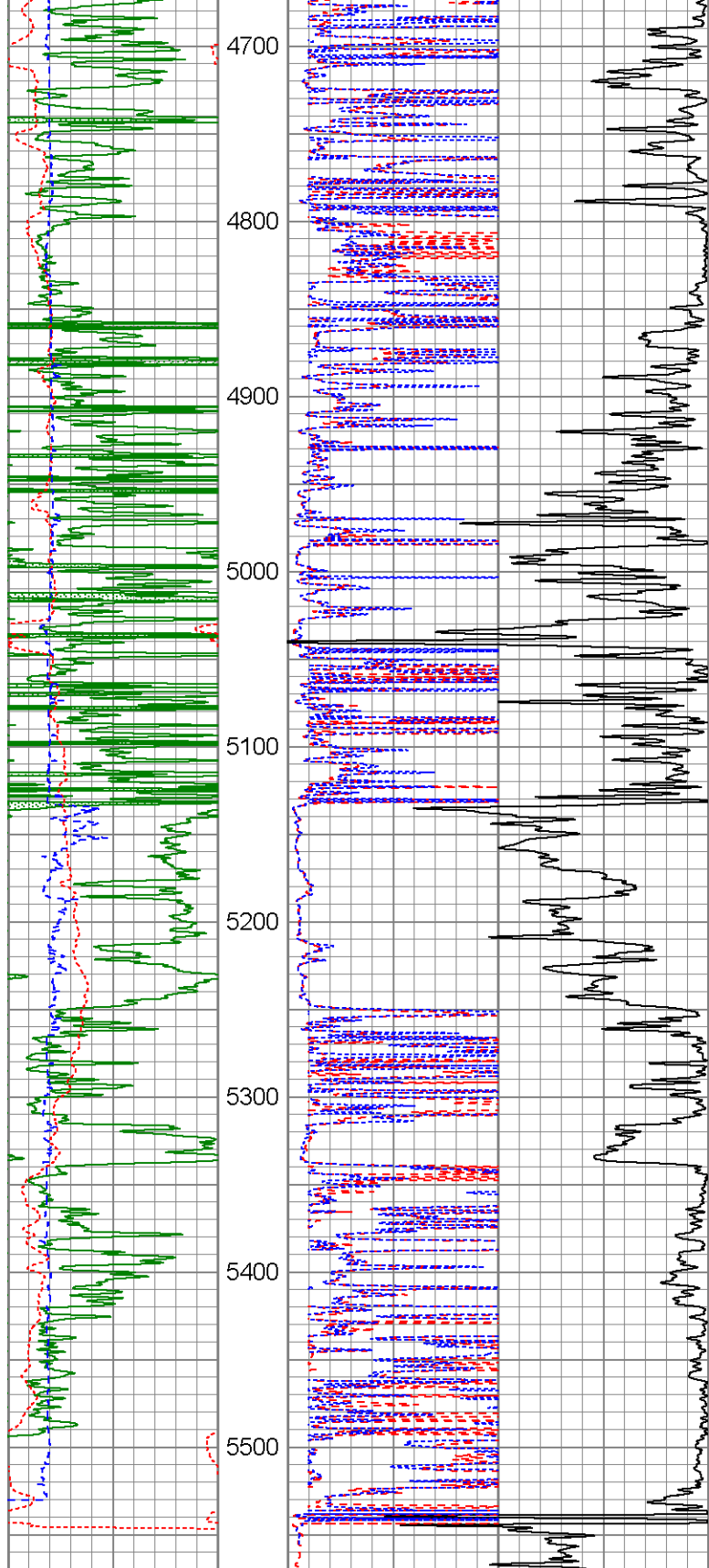












Gamma Ray	Deep Resistivity
0 (GAPI) 150	0 (Ohm-m) 50
SP (-20mV+)	Shallow Resistivity
0 (mV) 200	0 (Ohm-m) 50
6 Caliper (in) 16	1000 Deep Conductivity (mmho/m) 0