



**ThruBit**  
A Schlumberger Company

**SPECTRAL DENSITY  
DUAL SPACED NEUTRON  
GAMMA RAY  
MEMORY LOG**

Company	SANDRIDGE ENERGY	Location:	API #: 15-077-21981-01-00	Other Services THRUBIT PORTAL BIT
Well	CATHER 3507 2-4H	SHL: 250' FSL & 2150' FEL		Elevation K.B. 1304' D.F. 1304' G.L. 1286'
Field	WALDRON	SEC 4 TWP 35S RGE 7W		
County	HARPER			
State	KANSAS			
Permanent Datum	G.L.	Elevation 1286'		
Log Measured From	D.F.	18' ABOVE PERM DATUM		
Drilling Measured From	D.F.			

Date	25 NOV 2013
Run Number	ONE
Depth Driller	8122'
Depth Logger	8095'
Bottom Logged Interval	8077'
Top Log Interval	3000'
Casing Driller	7" @ 5495'
Casing Logger	7" @ 5490'
Bit Size	6.125"
Type Fluid in Hole	WBM
Density / Viscosity	8.5 / 43
pH / Fluid Loss	10.5 / 6.0
Source of Sample	MUD SENSOR
Rm @ Meas. Temp	3.24 OHM @ 56 DEGF
Rmf @ Meas. Temp	2.43 OHM @ 56 DEGF
Rmc @ Meas. Temp	4.05 OHM @ 56 DEGF
Source of Rmf / Rmc	CALCULATED
Rm @ BHT	2.02 OHM @ 105 DEGF
Time Circulation Stopped	0115 25 NOV 2013
Time Logger on Bottom	0230 25 NOV 2013
Maximum Recorded Temperature	105 DEGF
Equipment Number	T011
Location	OKLAHOMA CITY, OK
Recorded By	RICK BROOMFIELD
Witnessed By	BILL TORBETT

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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**

**SERVICE: LEVEL 4- HORIZONTAL MEMORY PUMPDOWN - BIT DEPTH 8027' LOG TO 3000'  
ALL SCALES AND PRESENTATION PER CLIENT REQUEST  
LIMESTONE POROSITY , 2.71 G/CC, USED FOR POROSITY CALCULATIONS  
LOG RAN WITH SWIVEL, SMALL DECENTRALIZER AND NO STANDOFFS  
TBHV REPRESENTS TOTAL BOREHOLE VOLUME, FT3  
ABHV REPRESENTS ANNULAR BOREHOLE VOLUME, FT3, CALCULATED FOR 4.50" CASING  
RIGMINDER LITE AND RIGSENSE USED TO CREATE DEPTH LOG  
LOG DEPTH CORRELATED TO MWD GR PROVIDED BY CUSTOMER  
TOOL WAS ROLLING OVER DURING FIRST 200' OF LOG**

**RIG: LARIAT 45  
CREW: R. BROOMFIELD, J. HIRSCHLER, E. PRICE**

Service Ticket No.	2344	API No.	15-077-21981-01-00	PGM Ver	WARRIOR 7.0
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The Well Name, Location, Borehole Description, and / or Cementing Data Furnished by Client

**EQUIPMENT DATA**

GAMMA RAY	NEUTRON	DENSITY	INDUCTION
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Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	PS24T	Serial No.	PS29N	Serial No.	PS43D	Serial No.	PS15R
Model No.	PS	Model No.	PS	Model No.	PS	Model No.	PS
Diameter	2.125"	Diameter	2.125"	Diameter	2.125"	Diameter	2.125"

LOGGING DATA

General Data

Pass	Depths		Well Head	Speed	Logging Run Comments
No.	From	To	Pressure	Ft/Min	
ONE	8095'	3000'	0	30 FPM	

	GAMMA RAY		NEUTRON		DENSITY		INDUCTION	
Pass	Scale		Scale		Scale		Scale	
No.	L	R	L	R	L	R	L	R
ONE	0 API	150 API	30 %	-10 %	30 %	-10 %	0.2 OHM-M	2000 OHM-M

DIRECTIONAL INFORMATION

Maximum Deviation	91.8	deg. @	7199'	KOP	4097'
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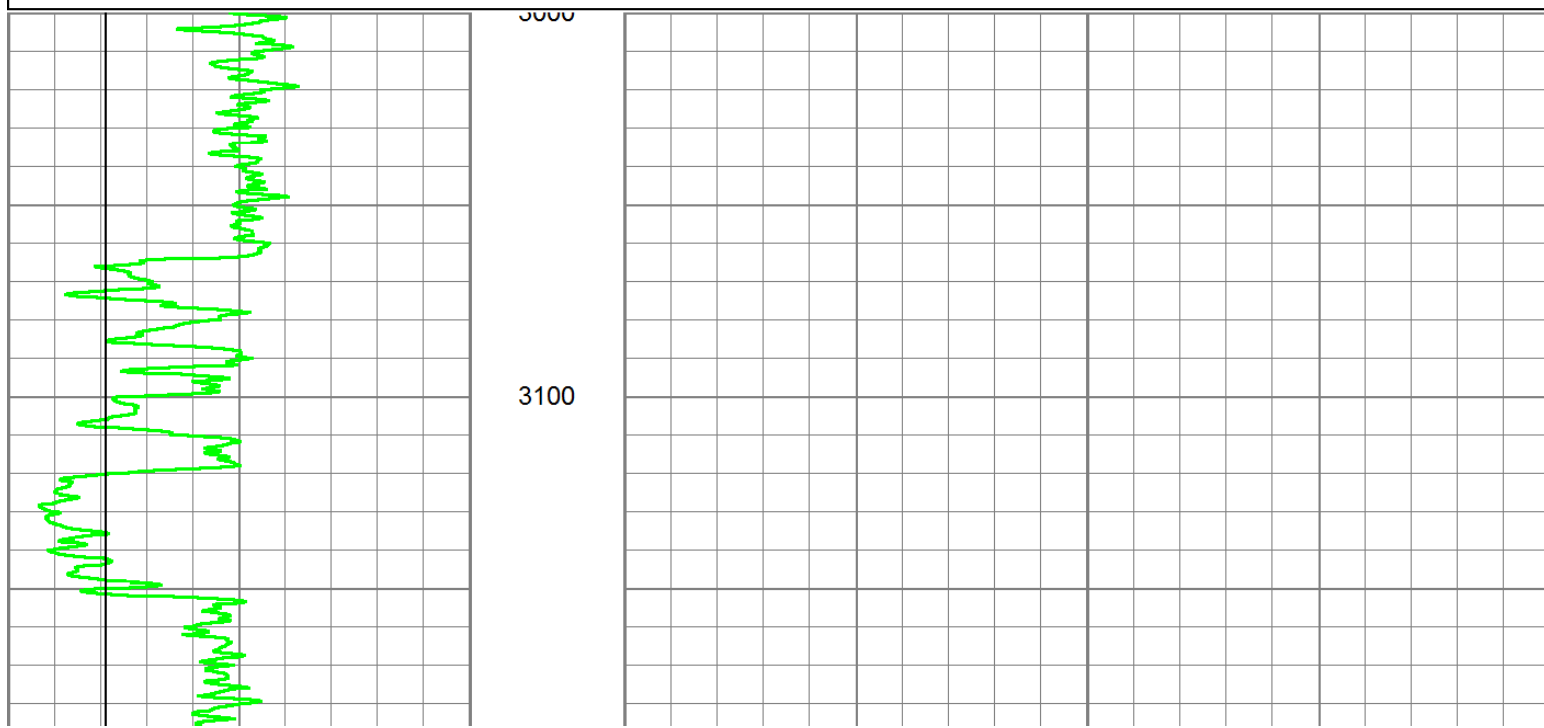


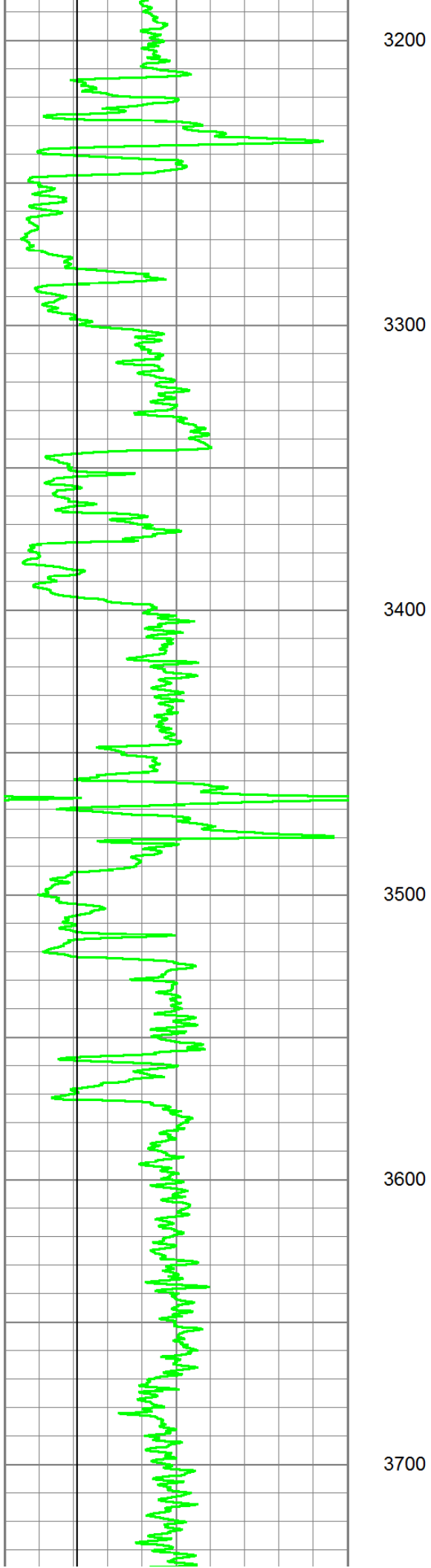
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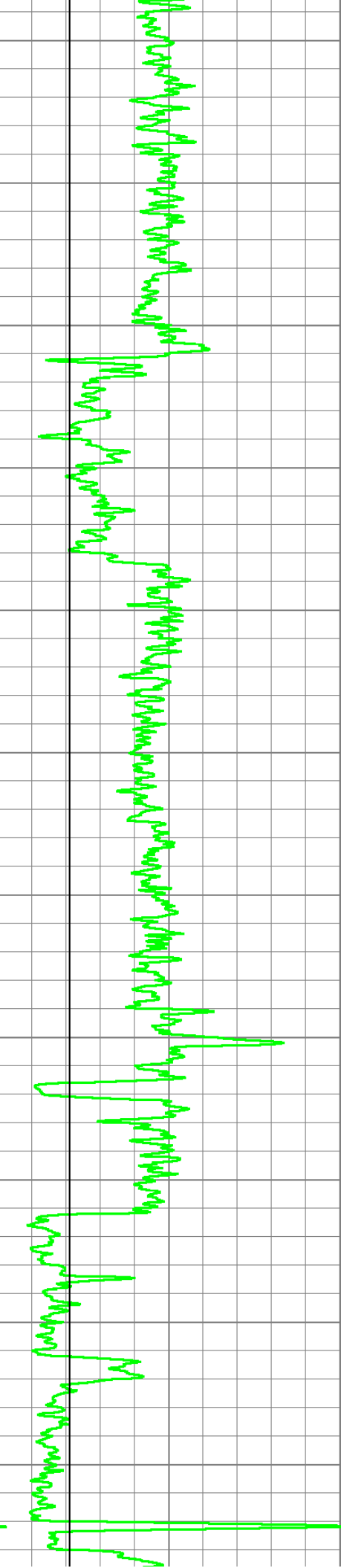
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 Charted by: Depth in Feet scaled 1:600

0	GR (GAPI)	150
4	DCAL (in)	14
4	BOREID (in)	14
-5	ACCY	5

0	PEF (barn)	10	-0.5	DRHO (g/cc)	0.5
2	RHOB (g/cc)				3







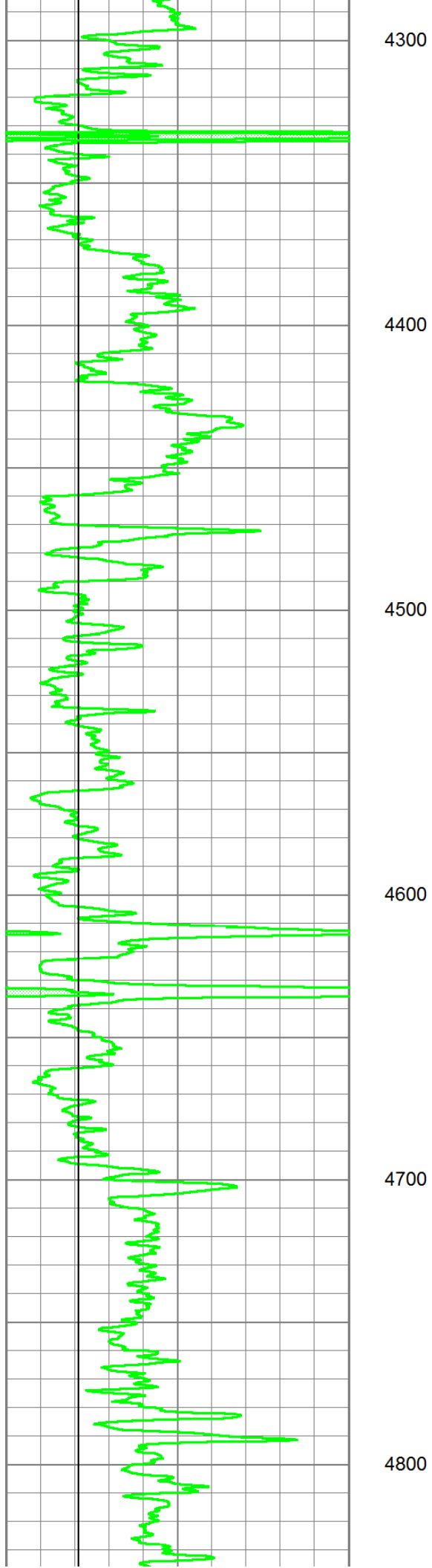
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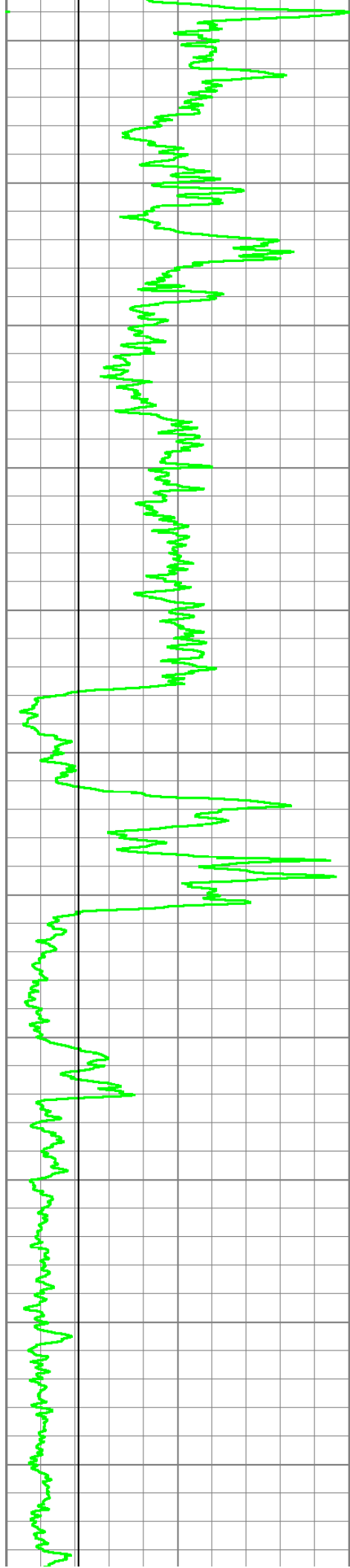
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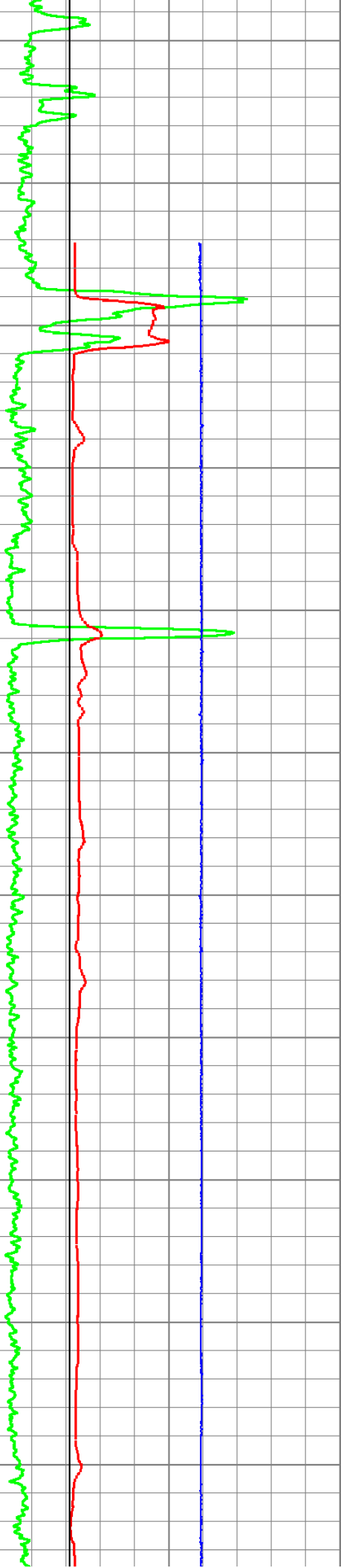
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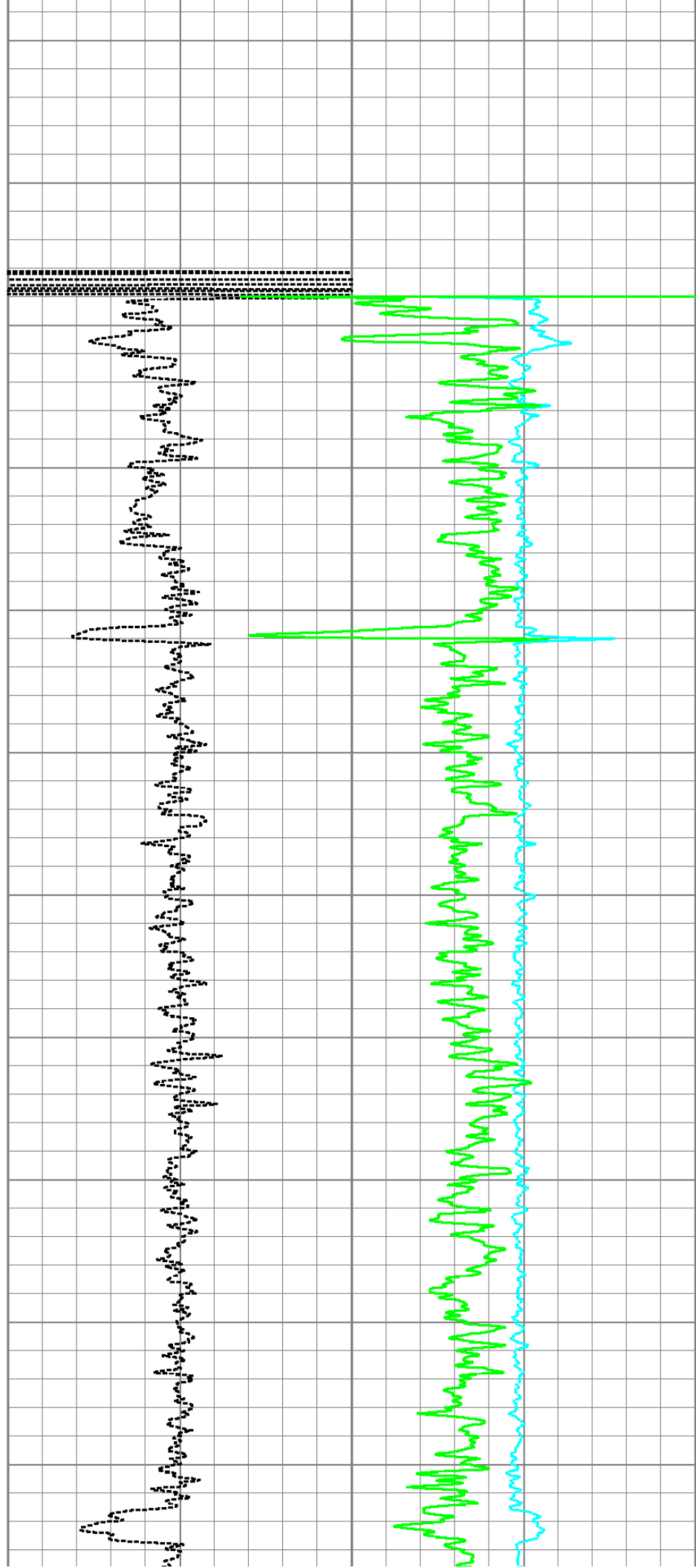
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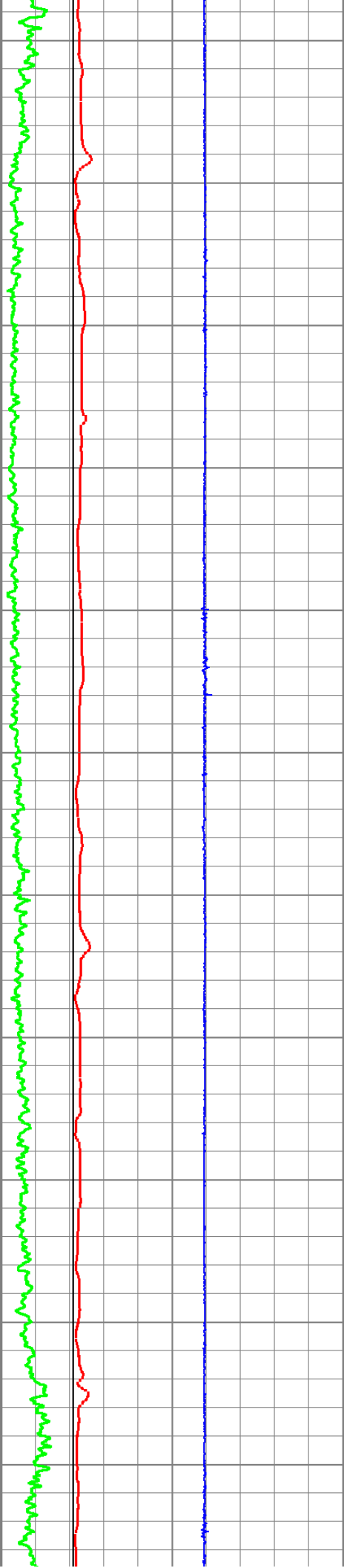
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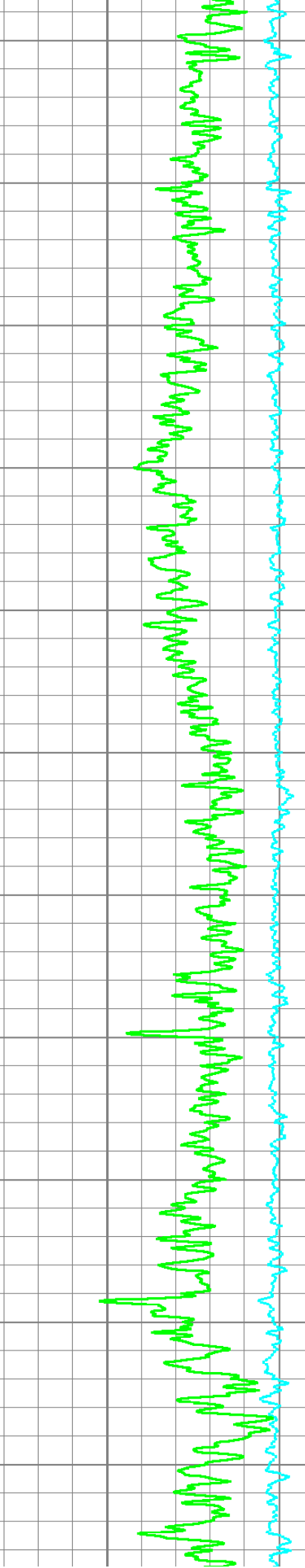
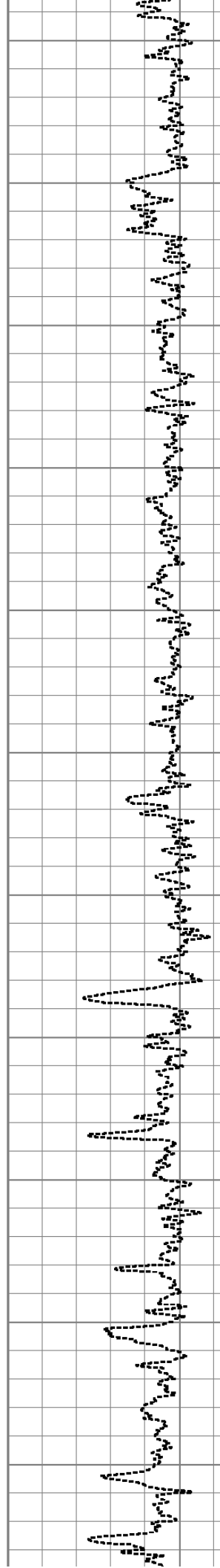
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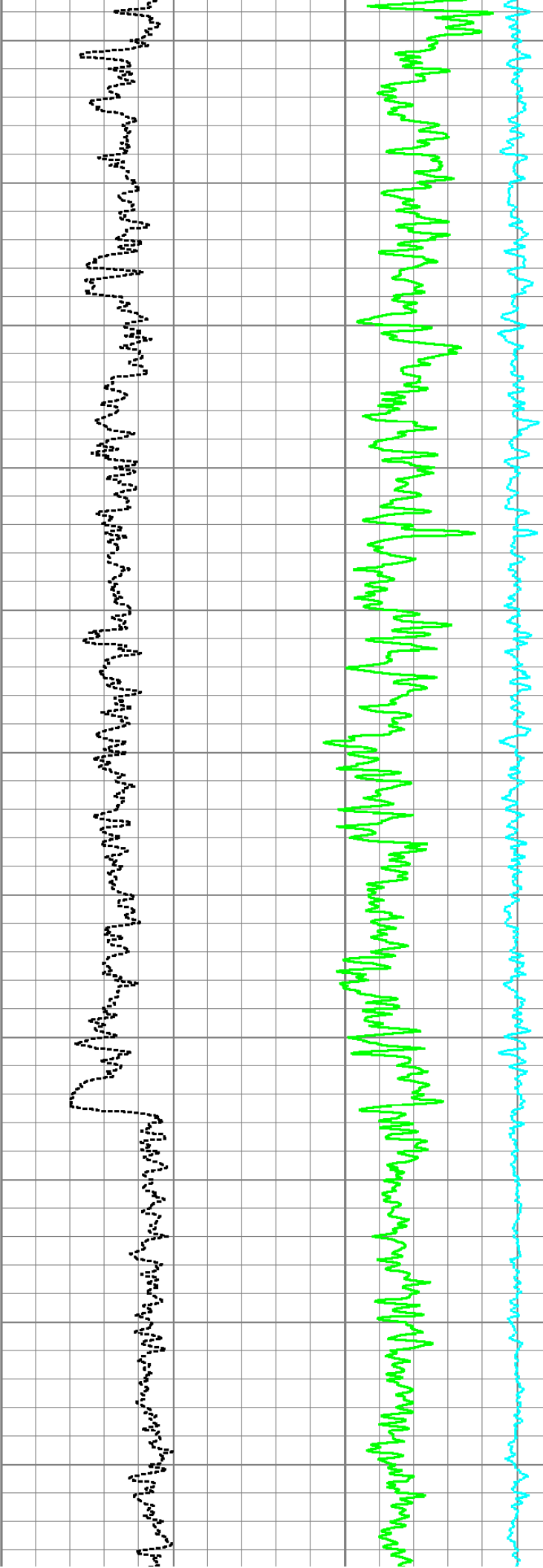
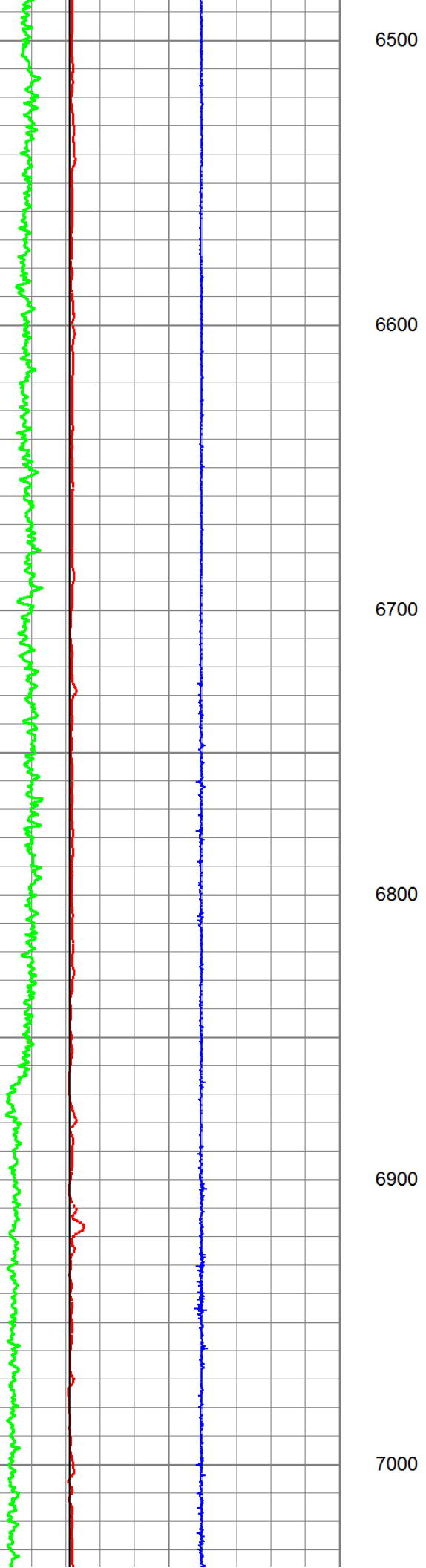
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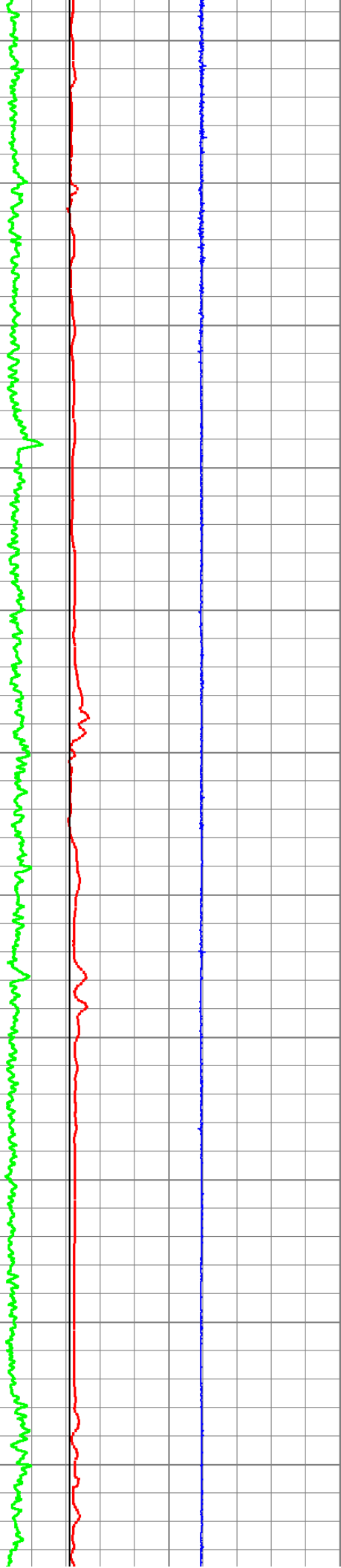
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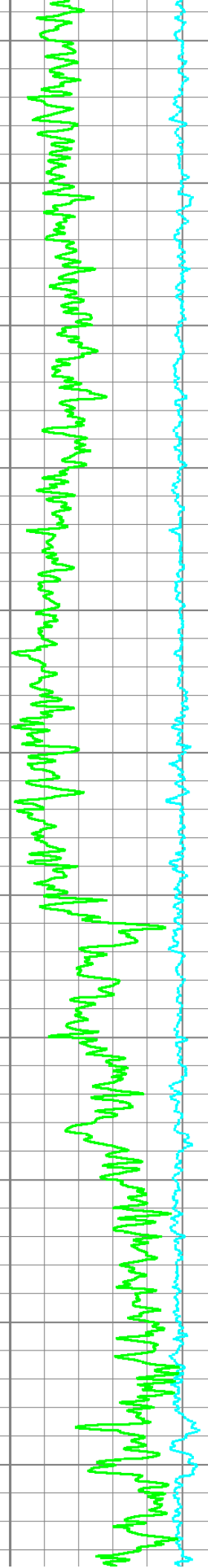
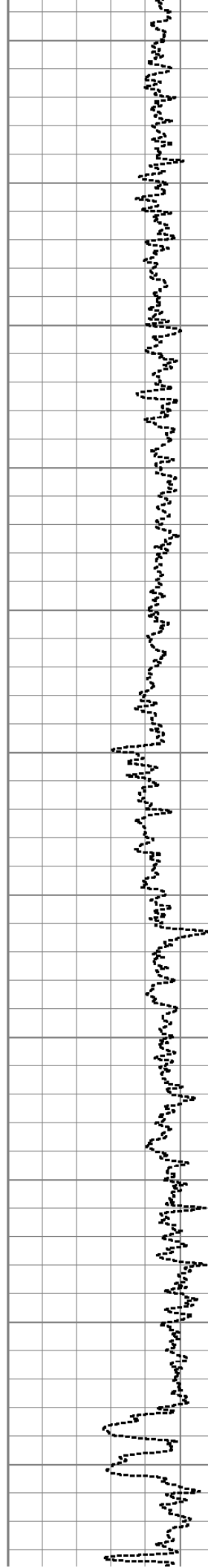
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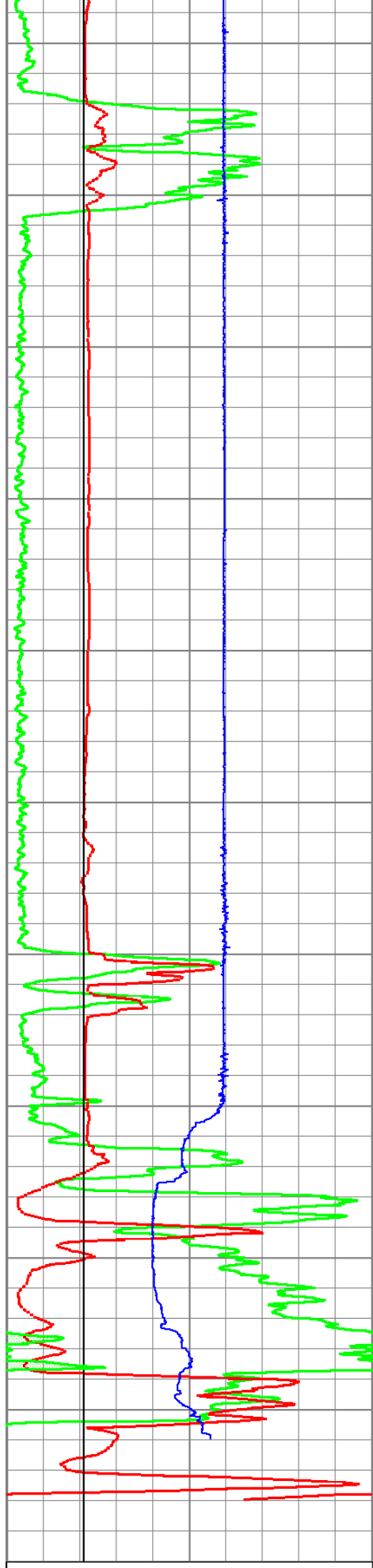
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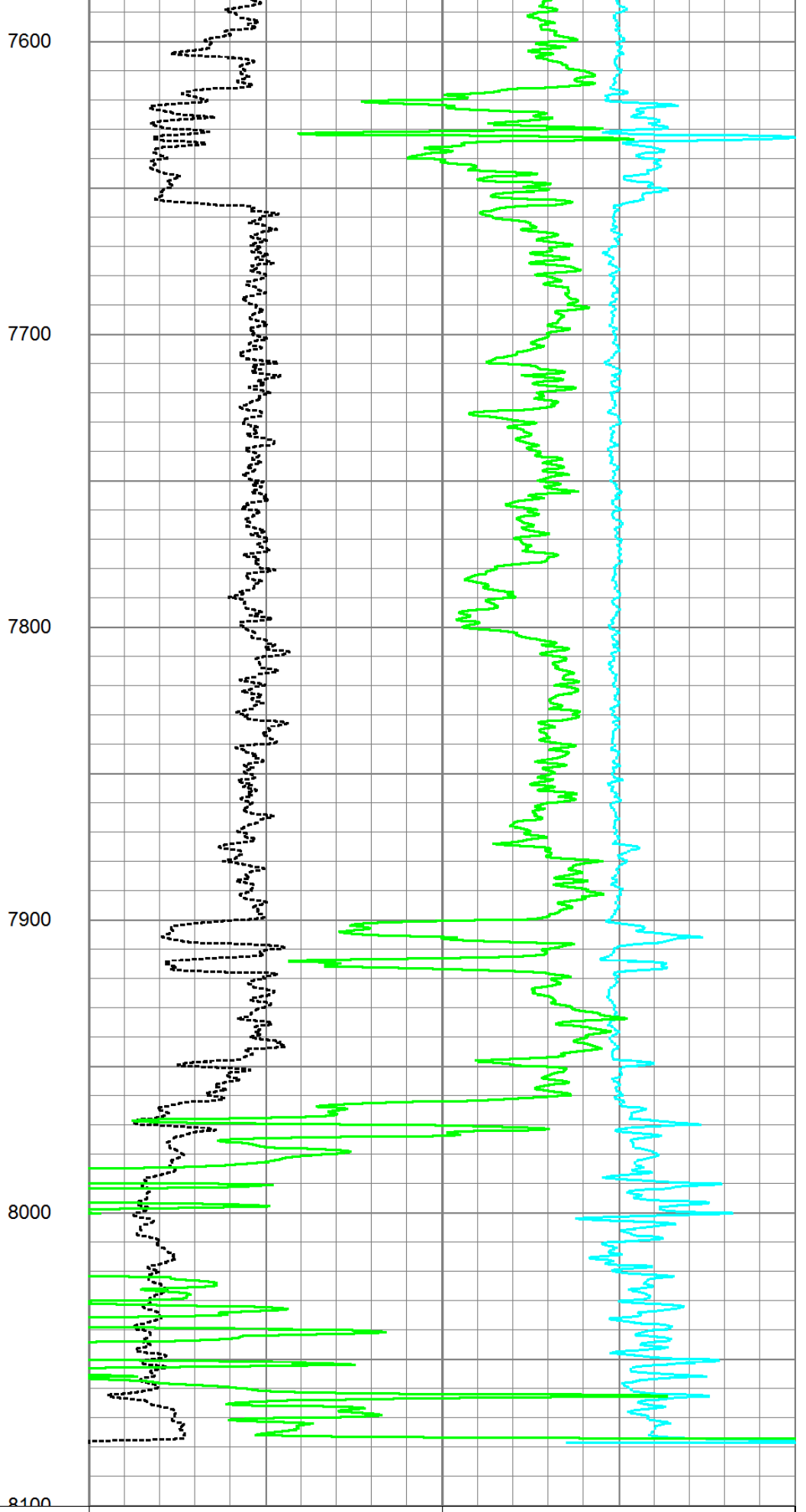
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0	GR (GAPI)	150
4	DCAL (in)	14
4	BOREID (in)	14



0	PEF (barn)	10	-0.5	DRHO (g/cc)	0.5
2	RHOB (g/cc)		3		

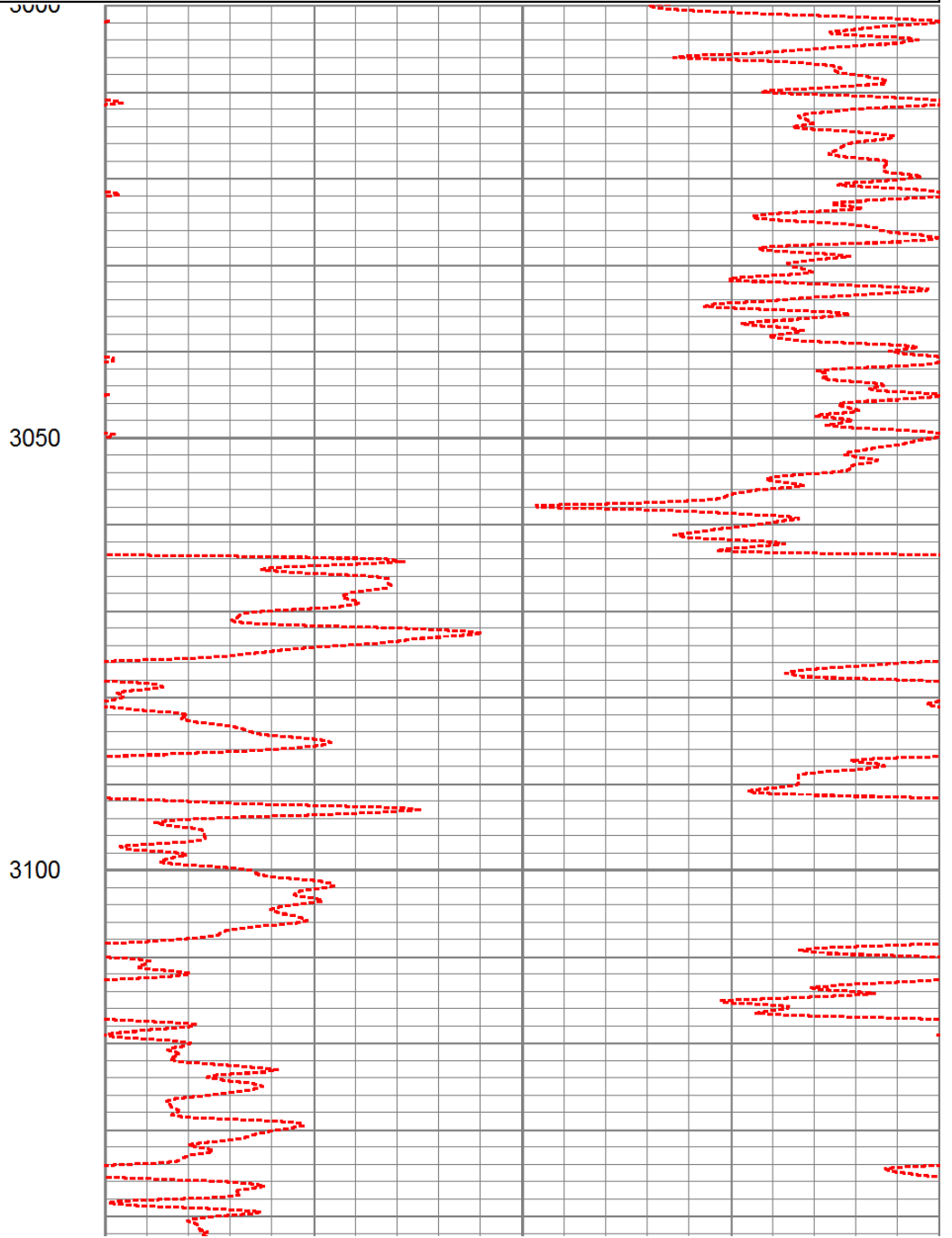
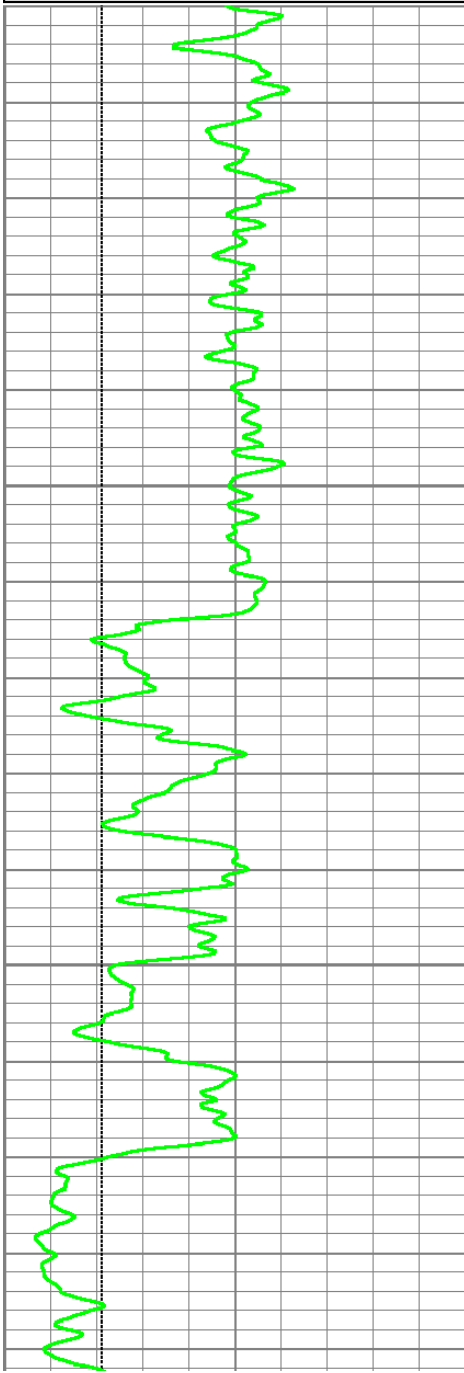


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 Charted by: Depth in Feet scaled 1:240

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4	BOREID (in)	14
0	GR (GAPI)	150
-5	ACCY	5
	TBHV (ft3)	

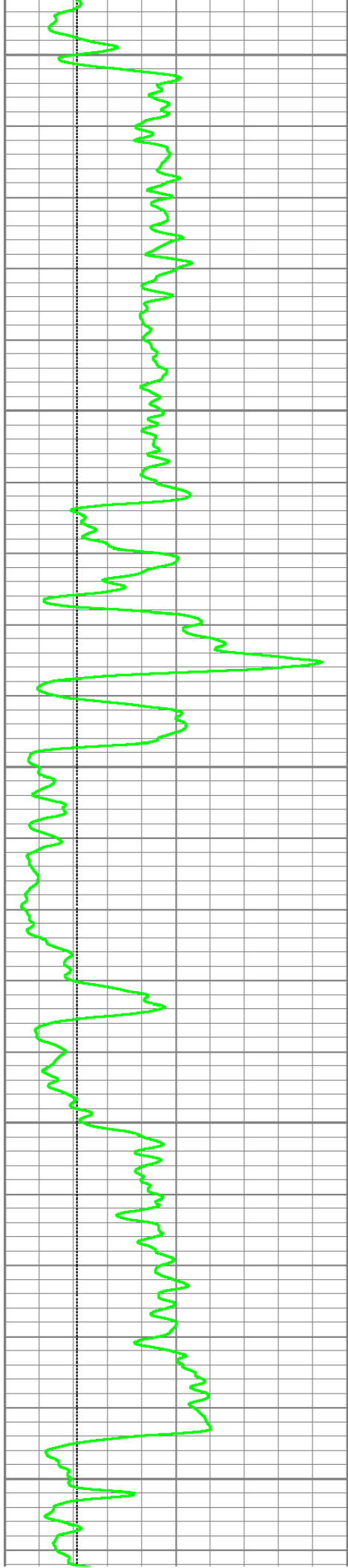
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30	DPHI (pu)		-10
0	PEF (barn)	10	-0.5
	DRHO (g/cc)		0.5
ABHV (ft3)			



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3050

3100



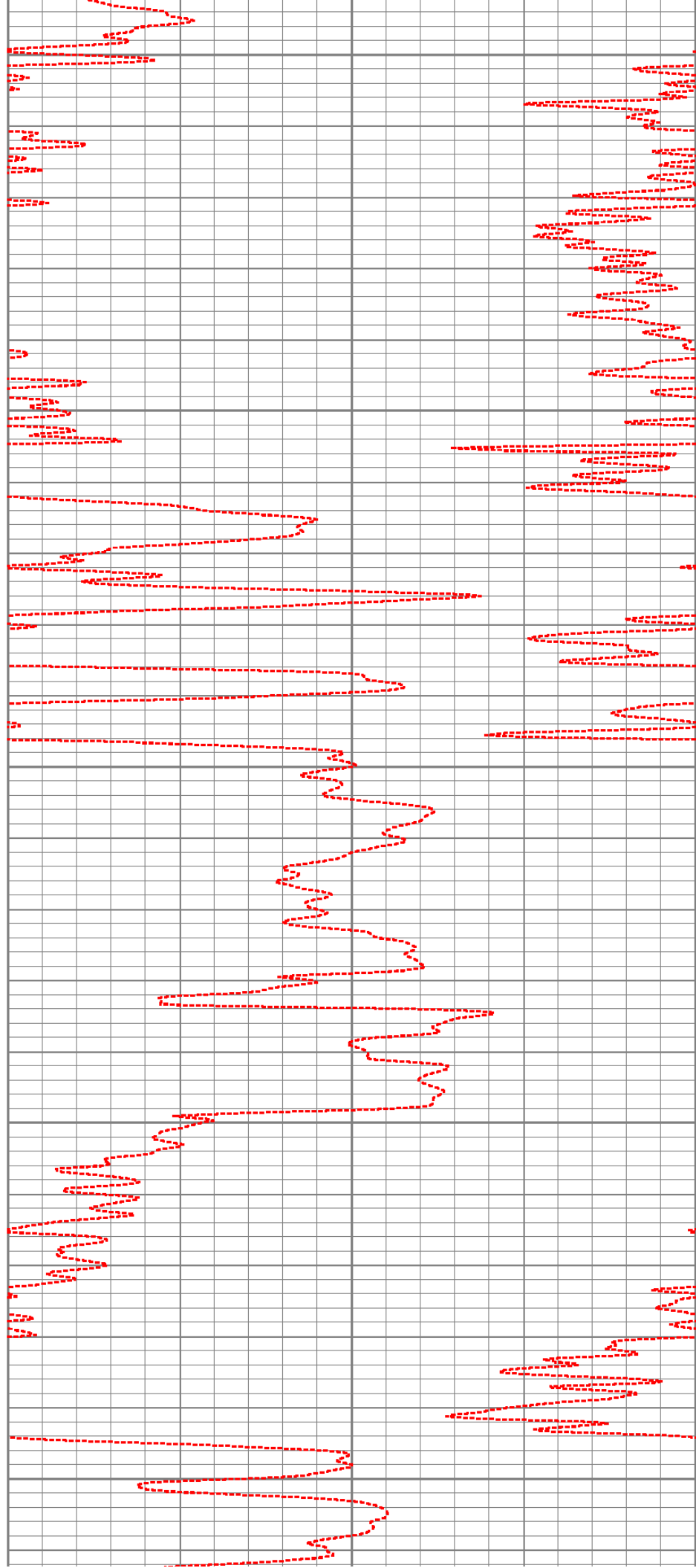
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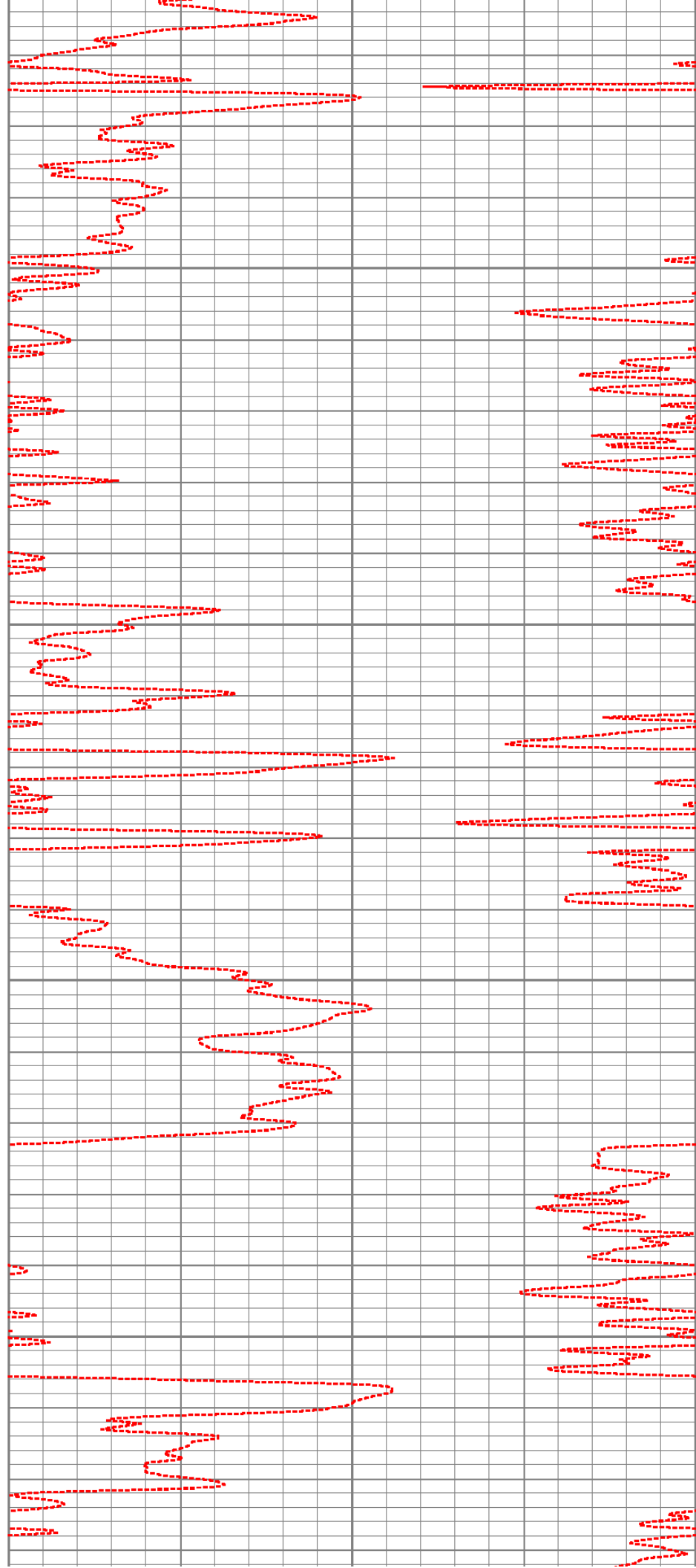


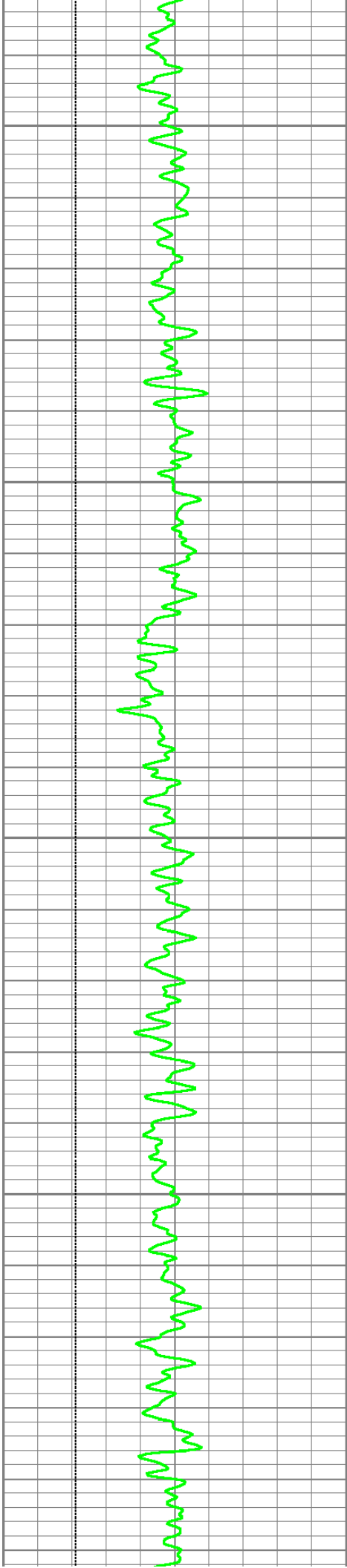
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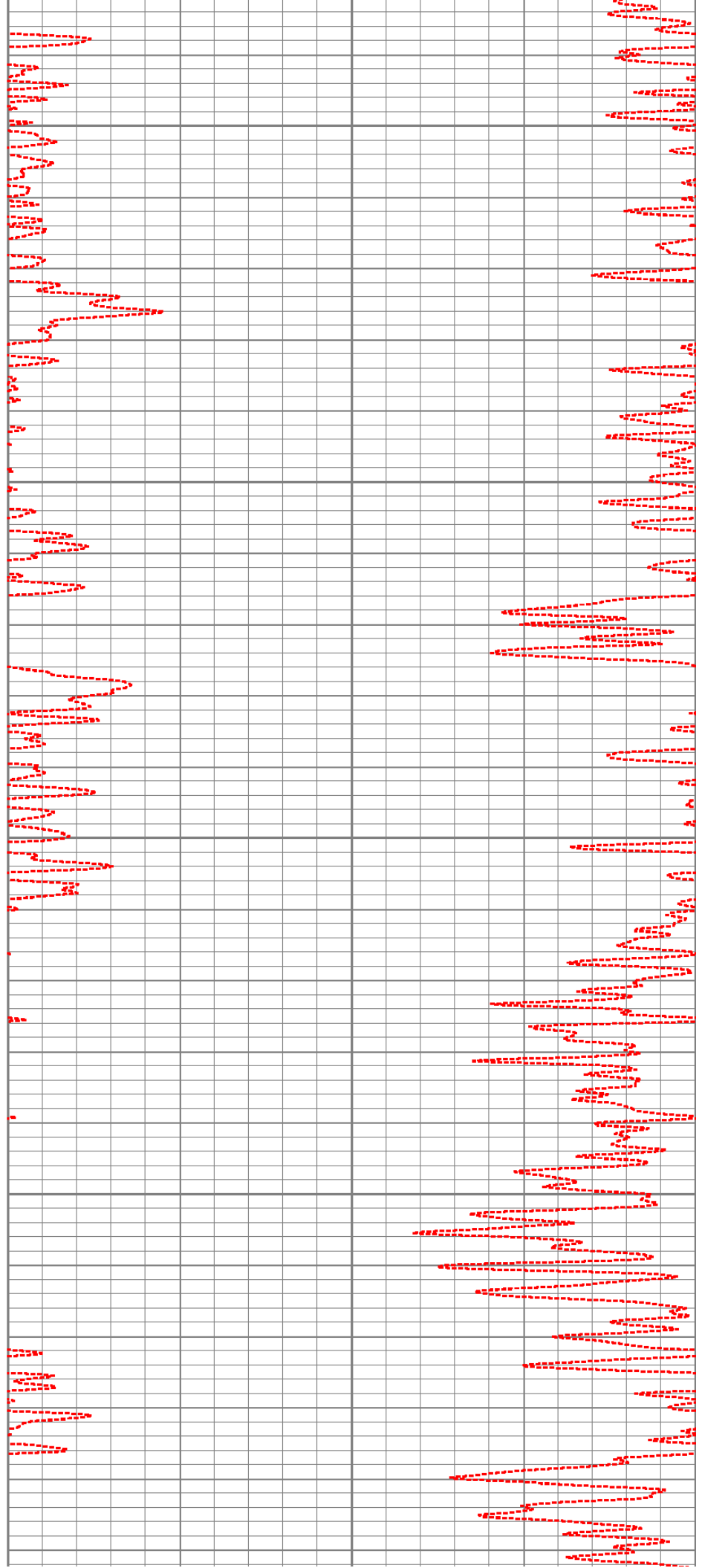
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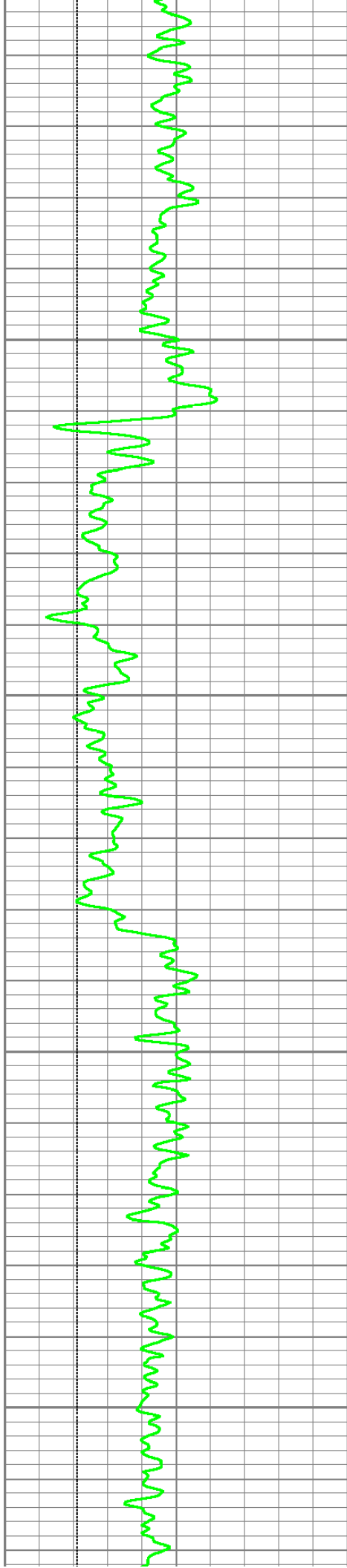
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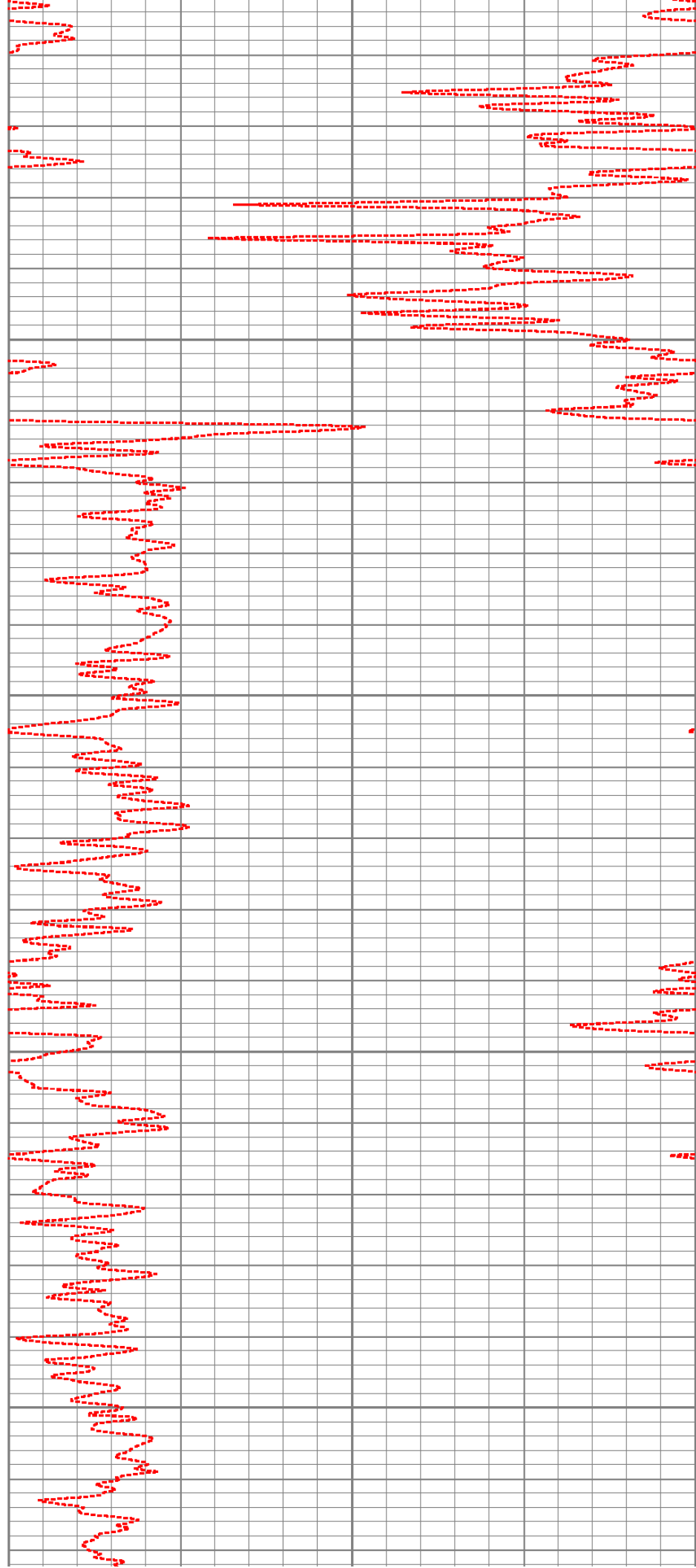


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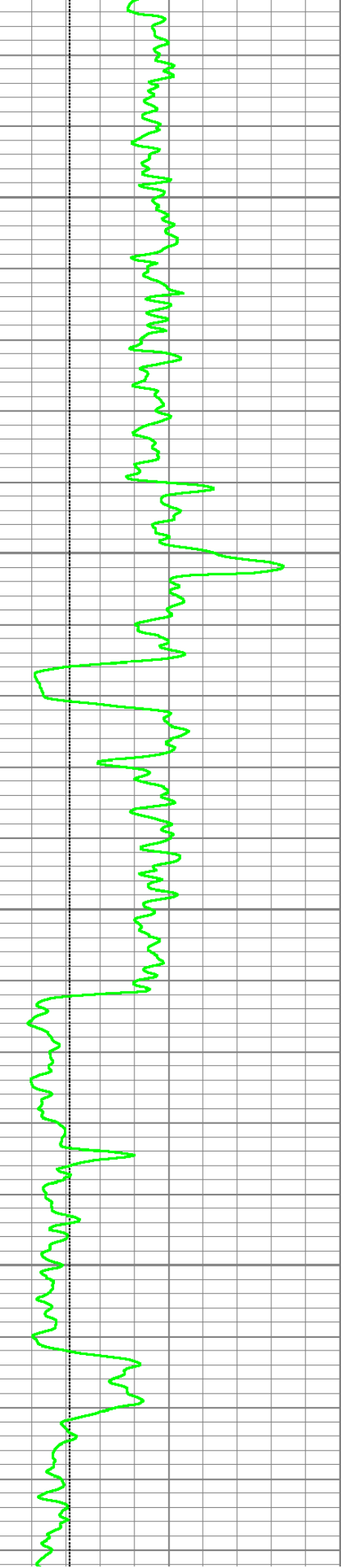
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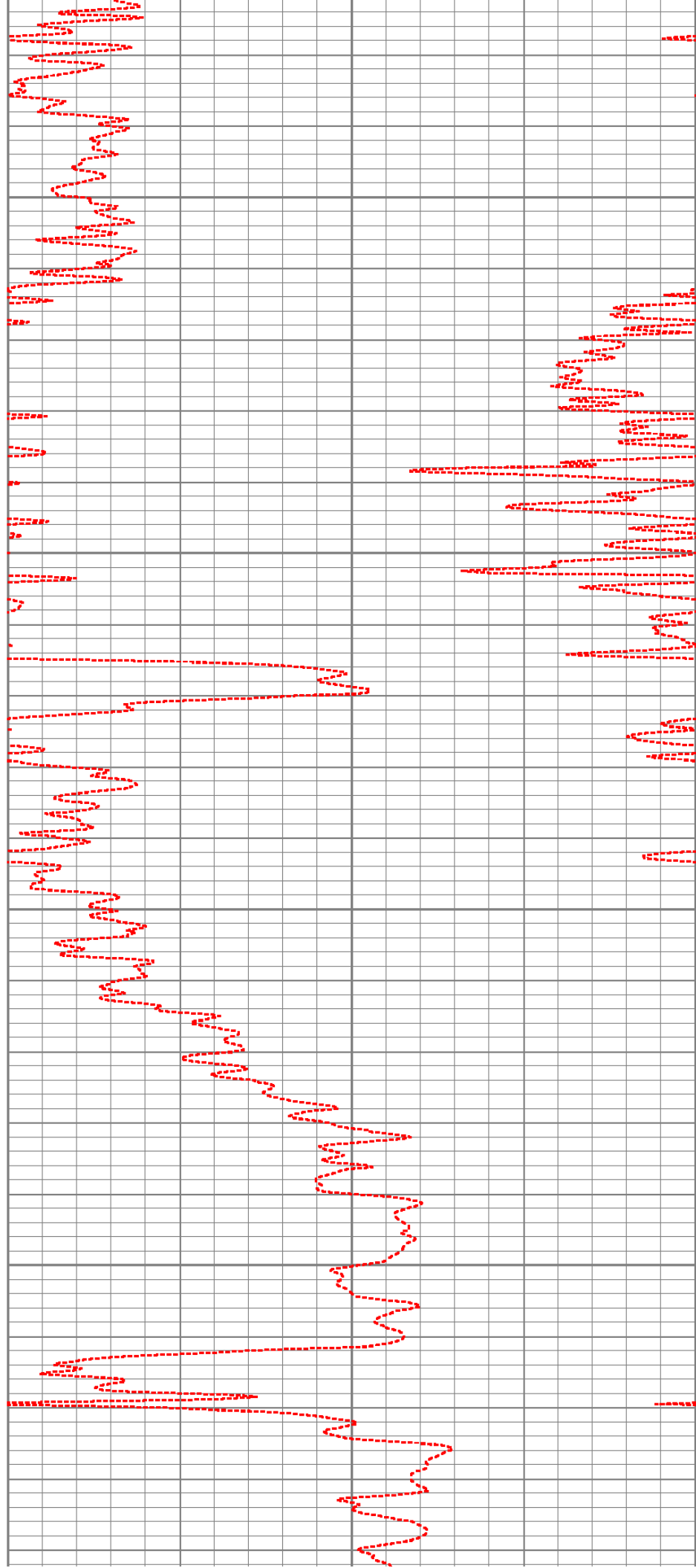


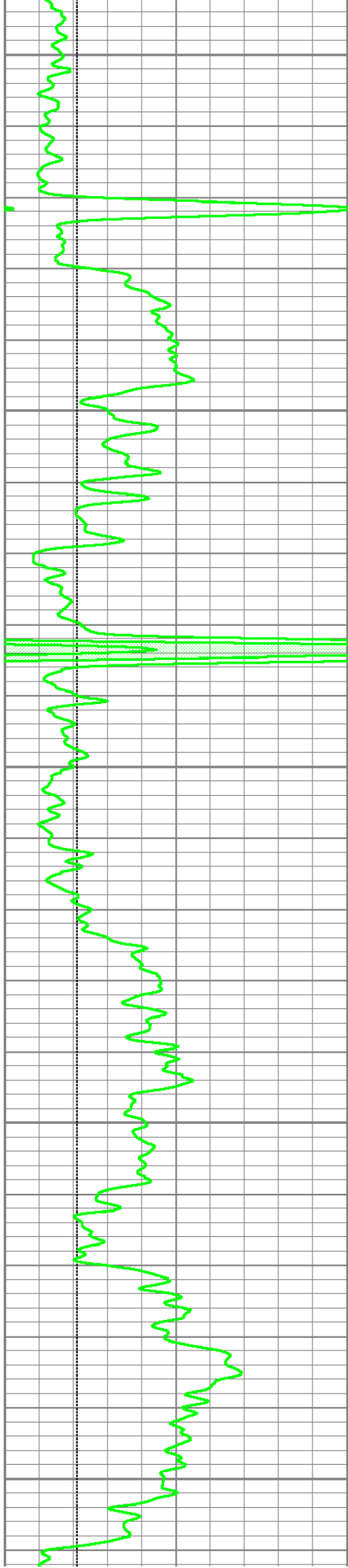
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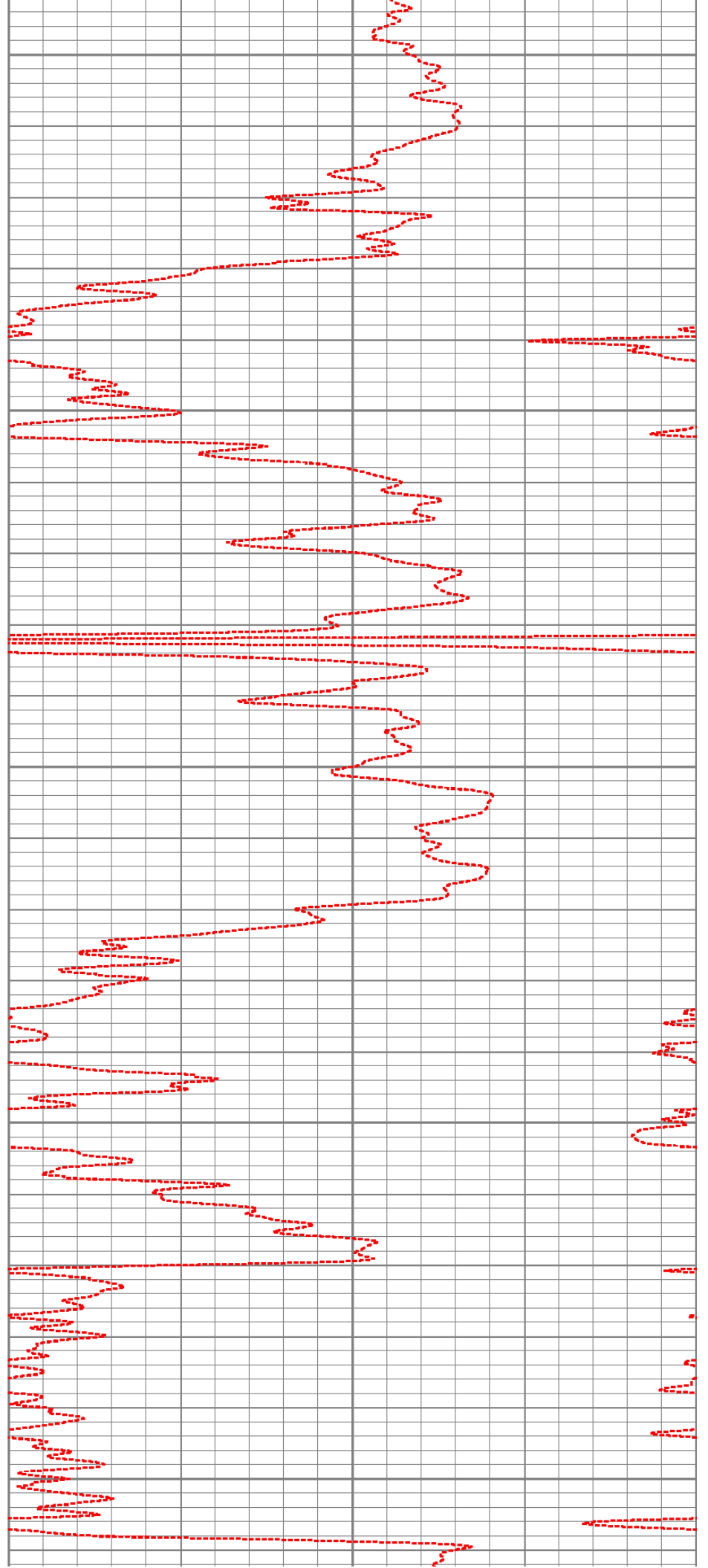
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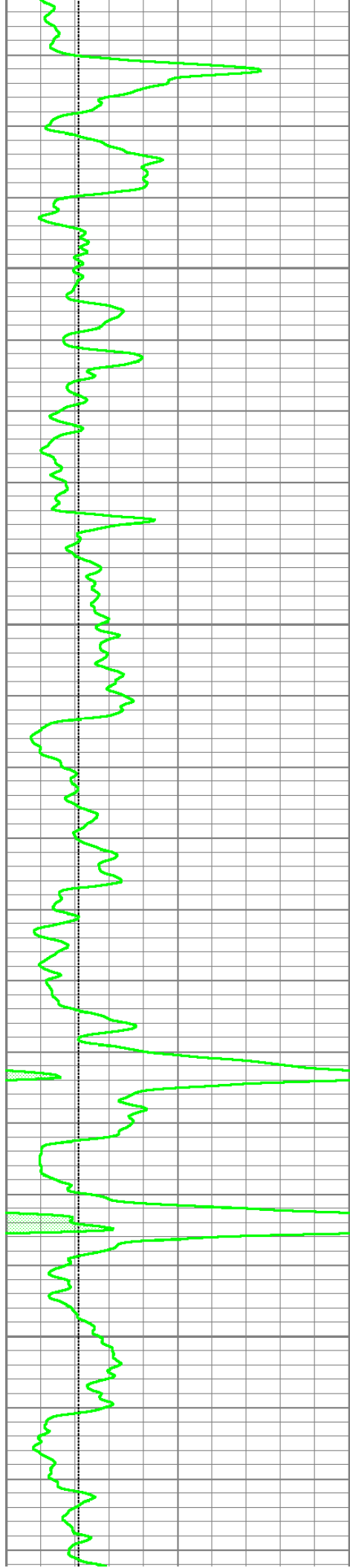
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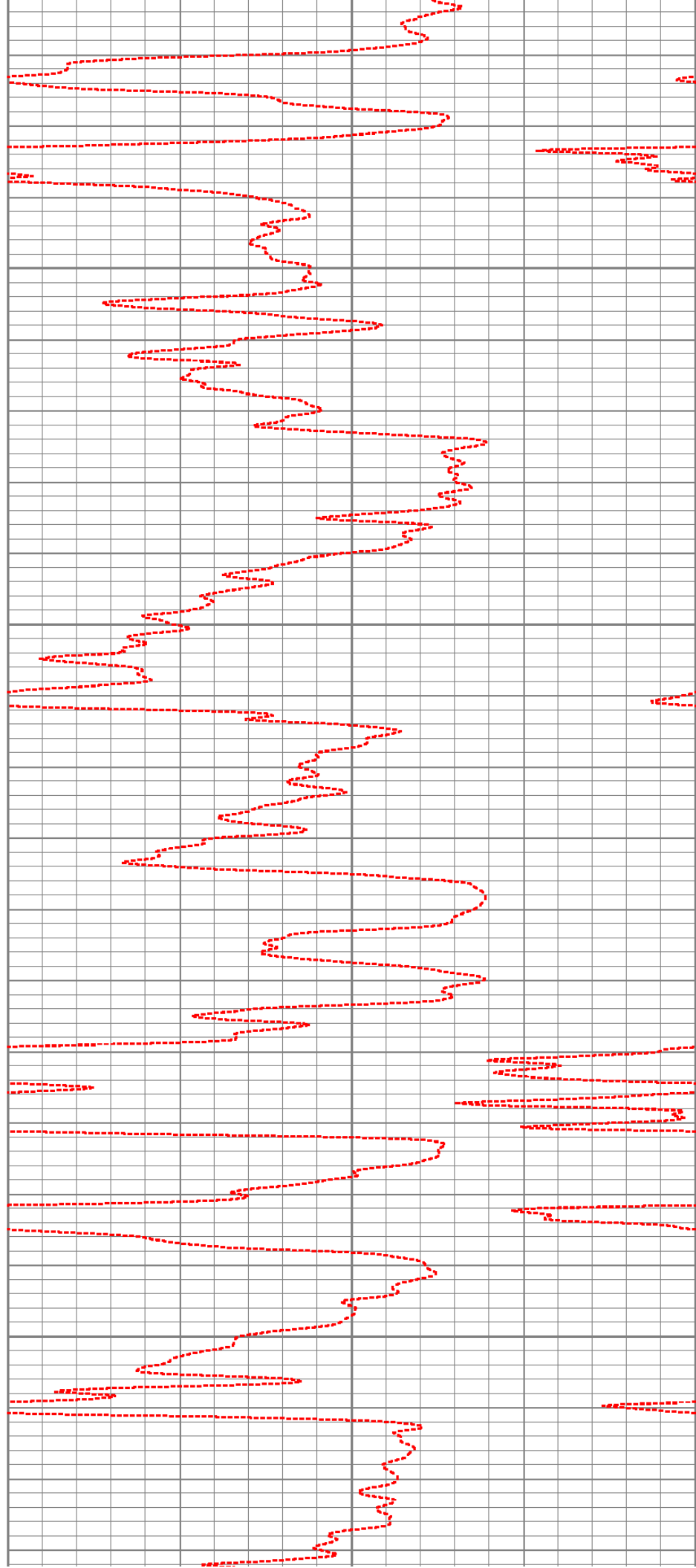


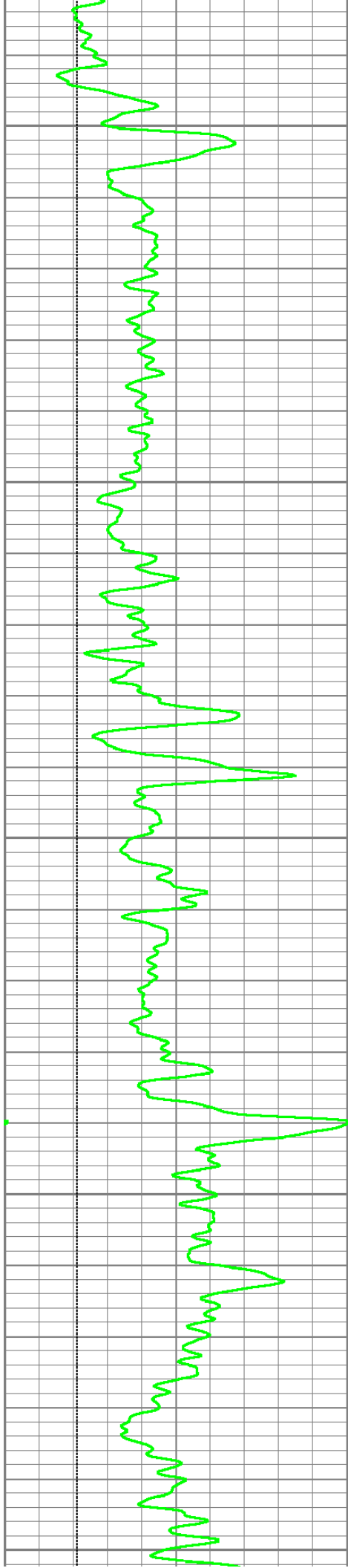
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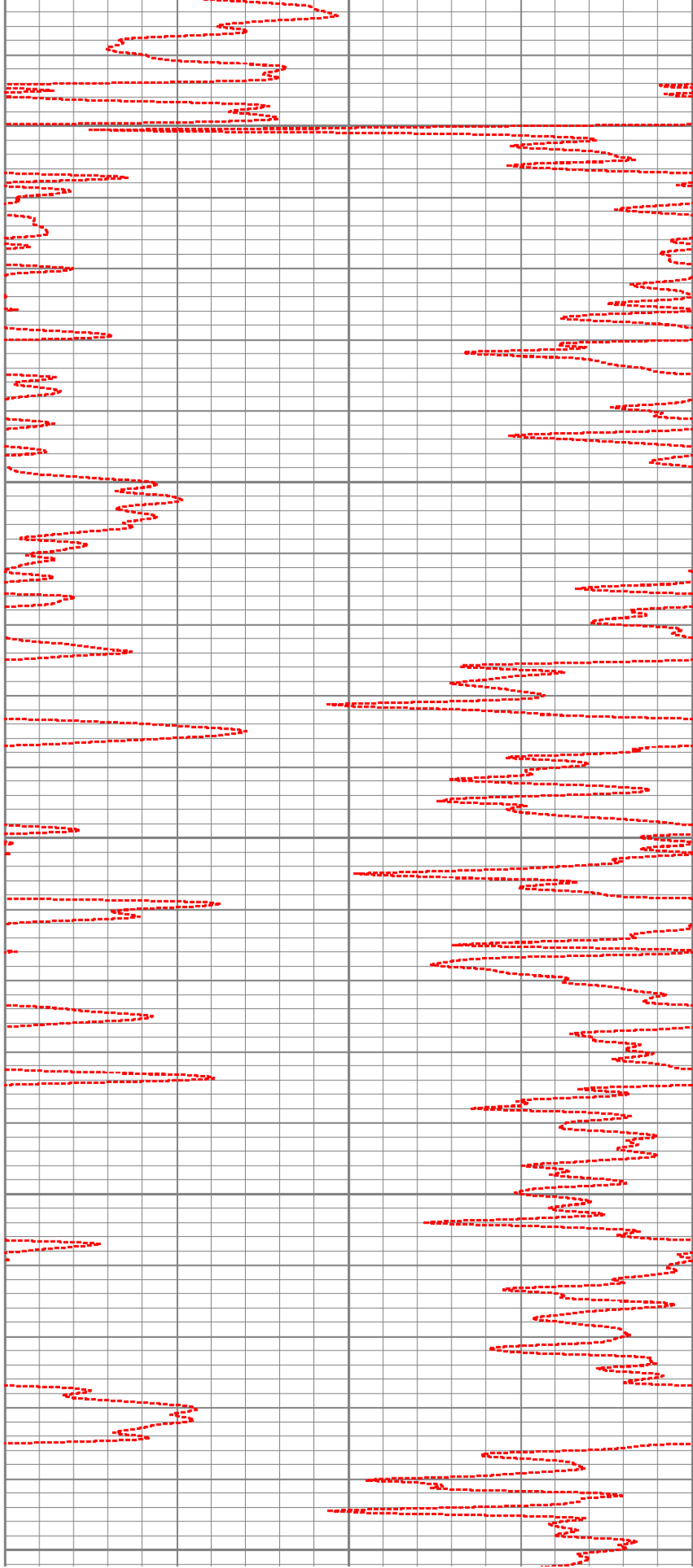
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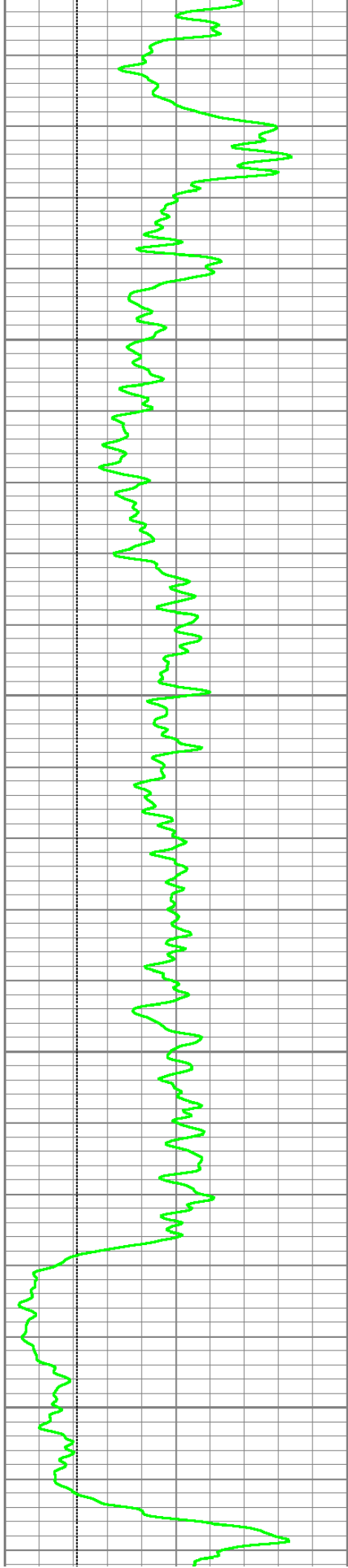
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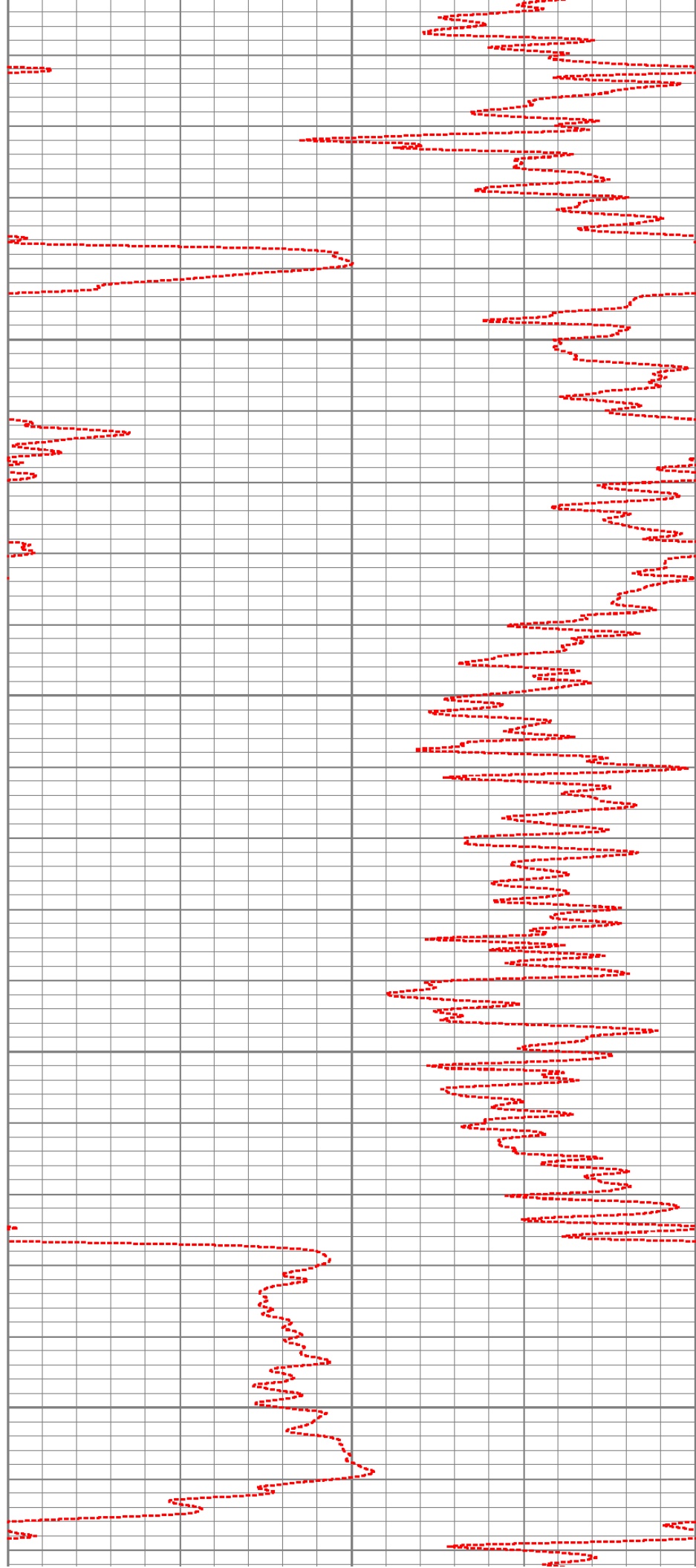


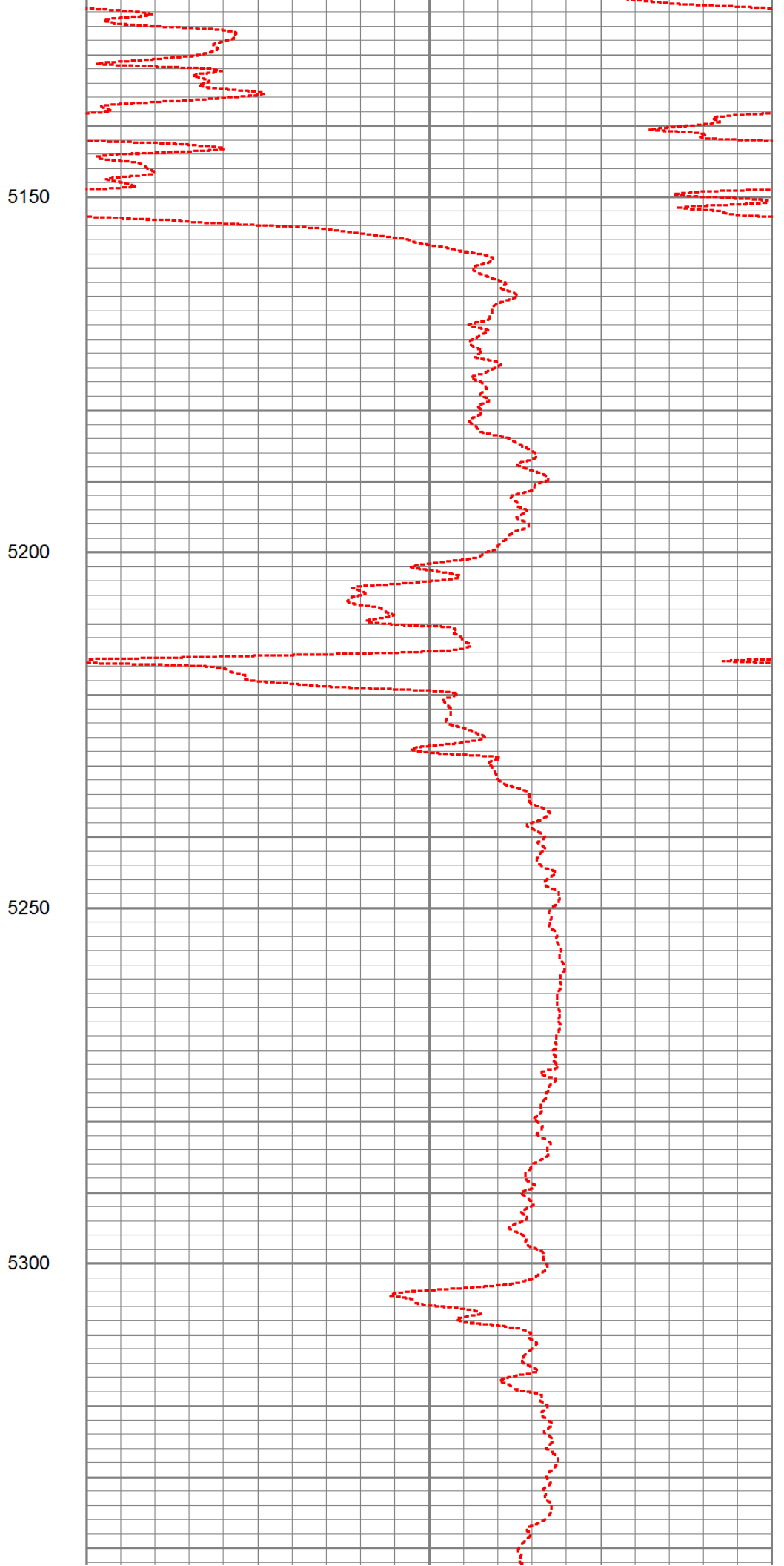
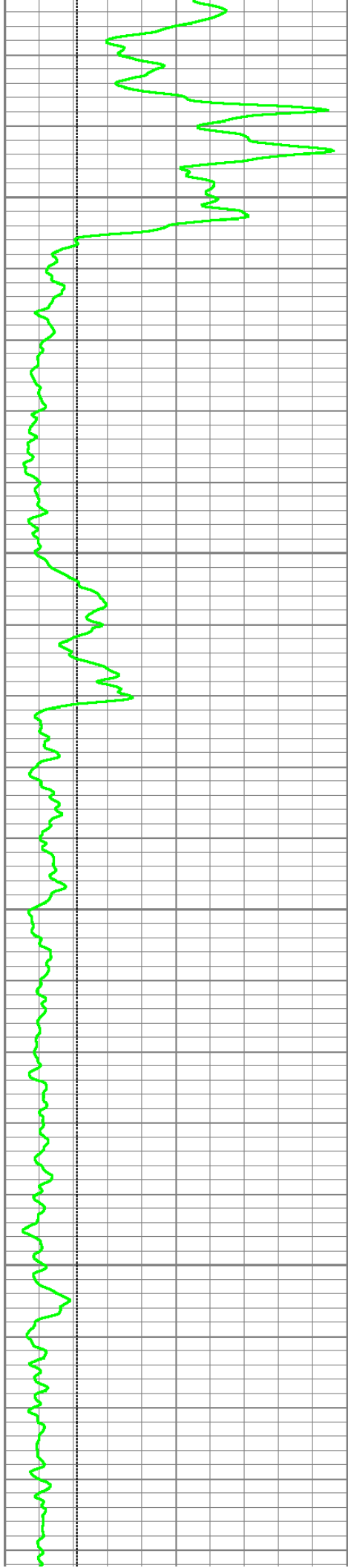
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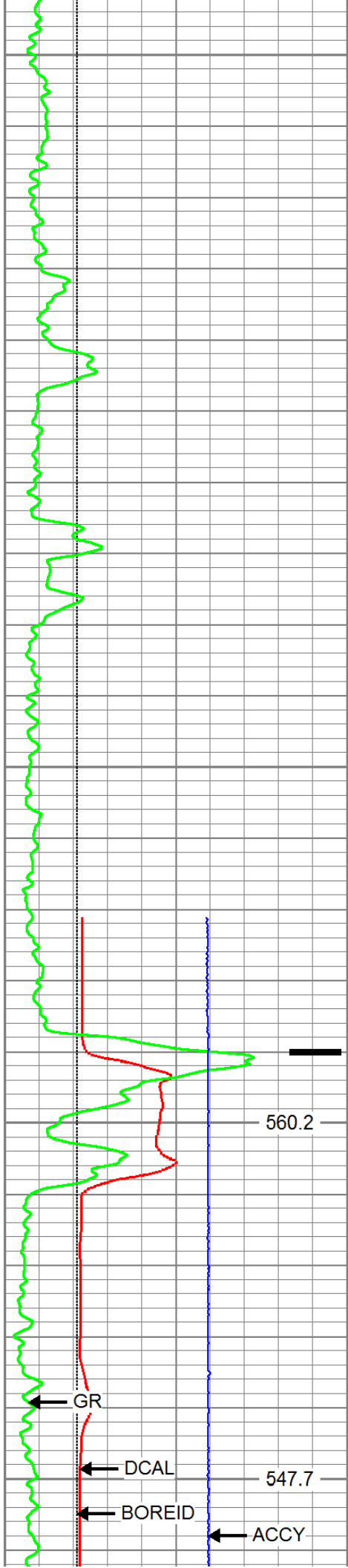
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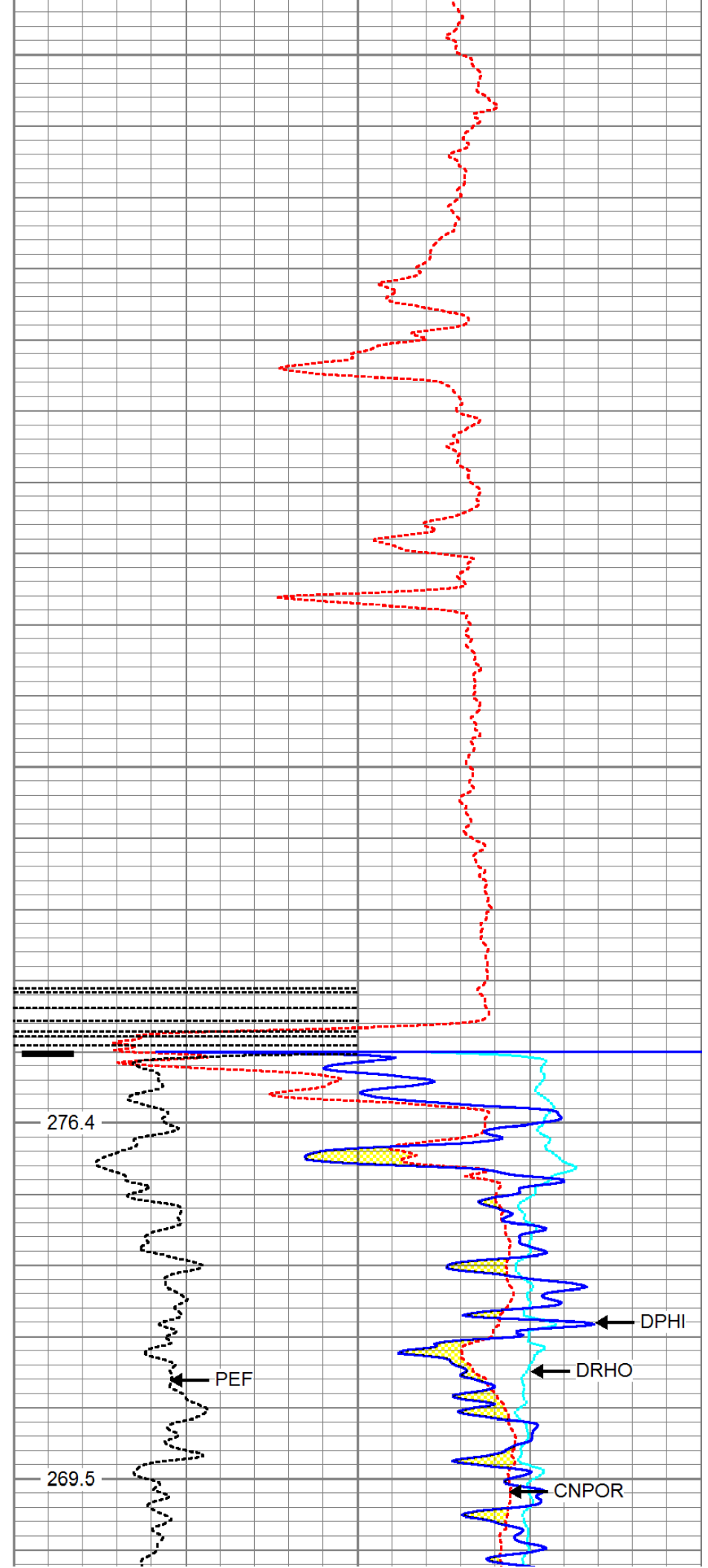
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GR

DCAL

BOREID

ACCY



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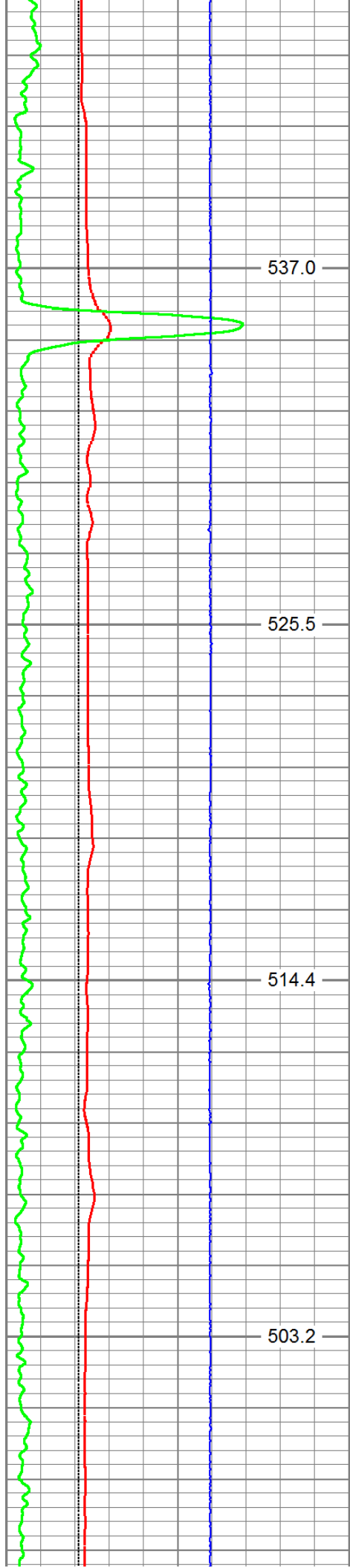
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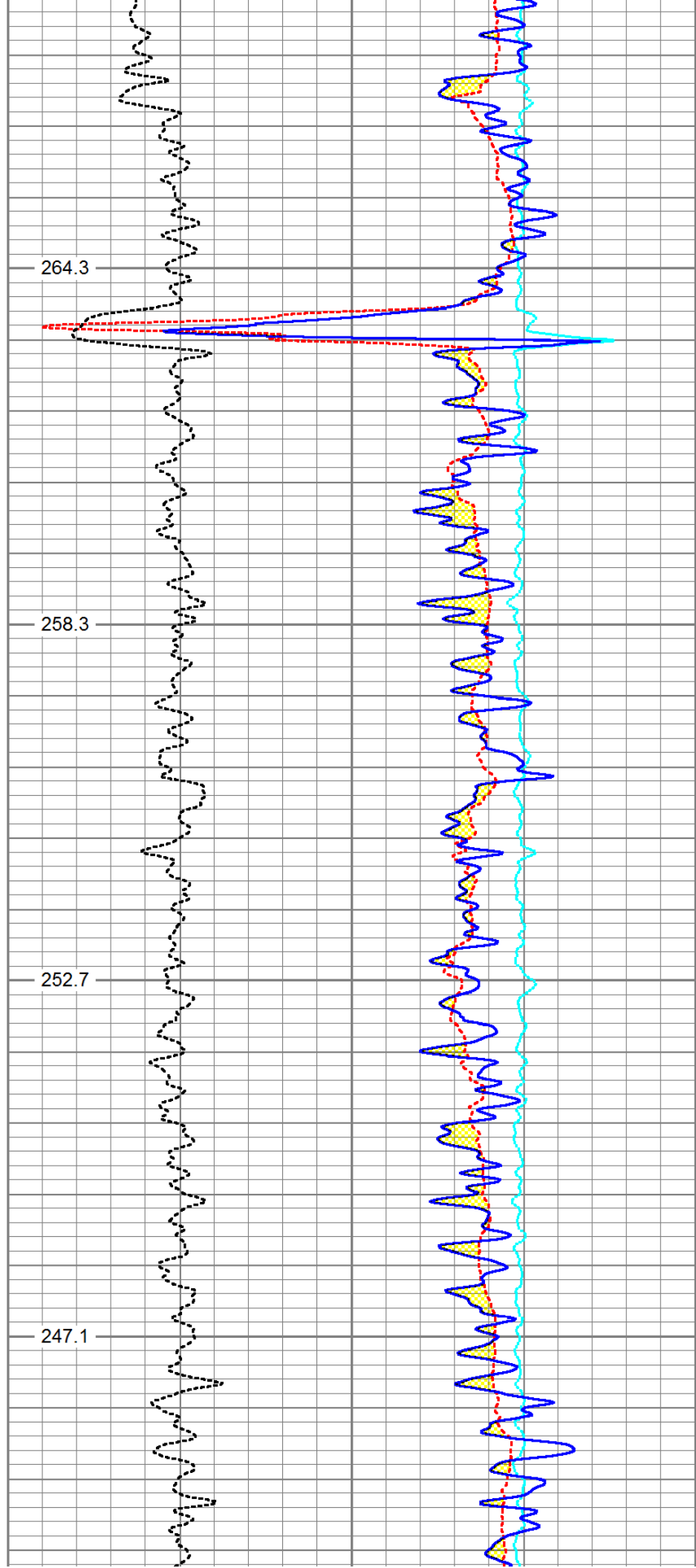


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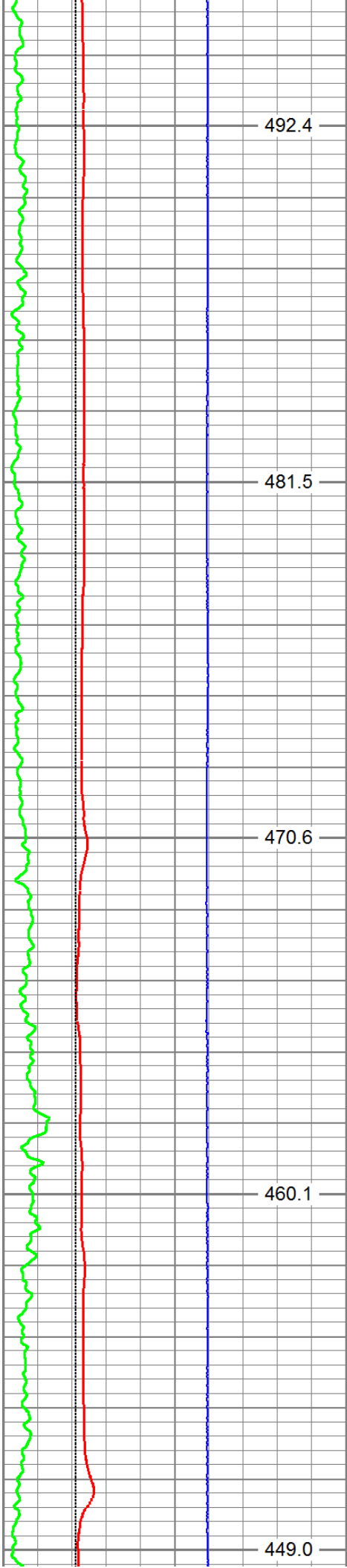
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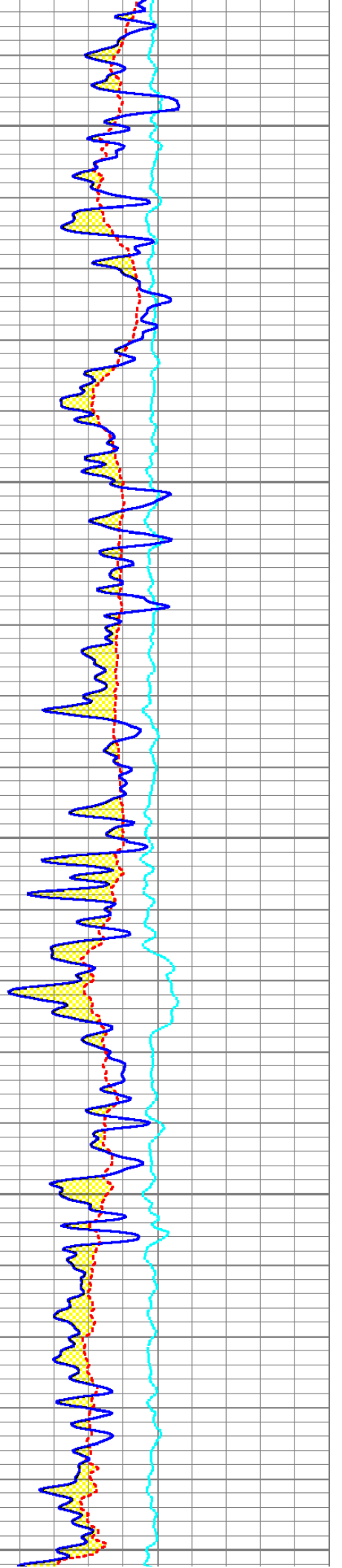
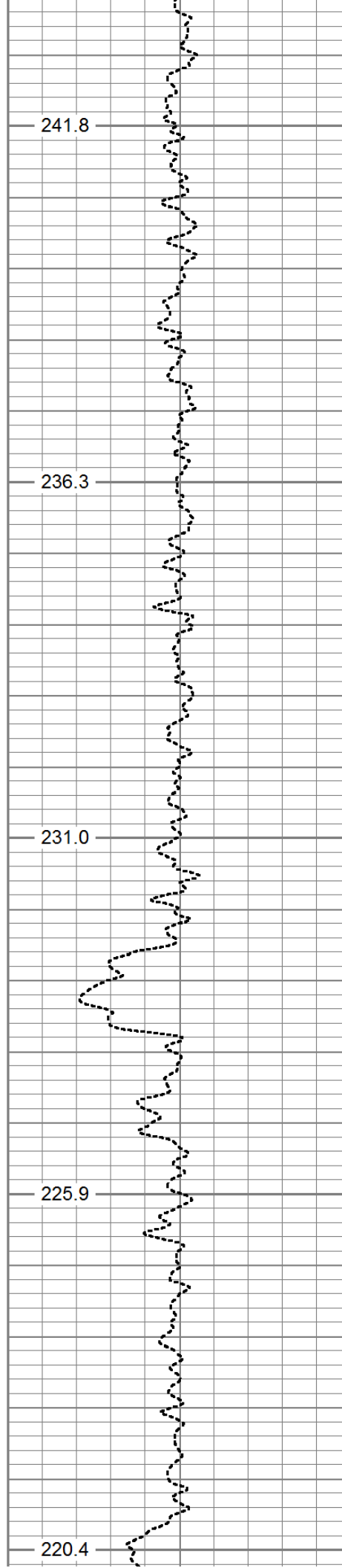
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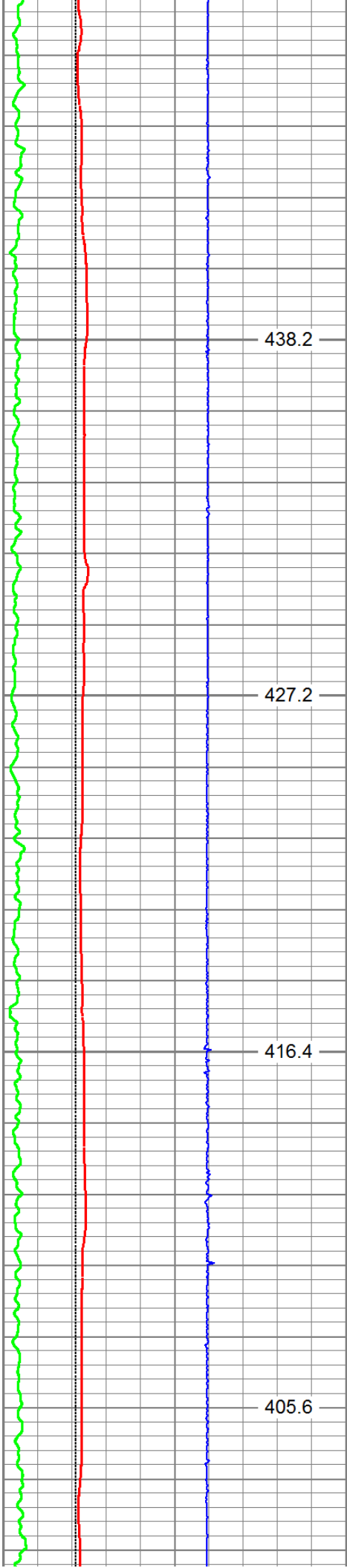
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6000





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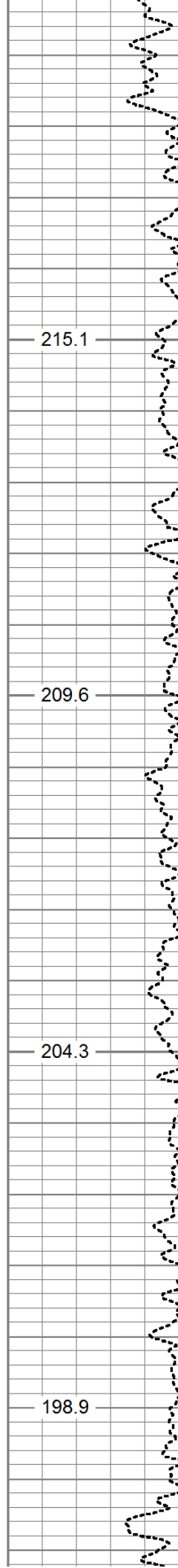
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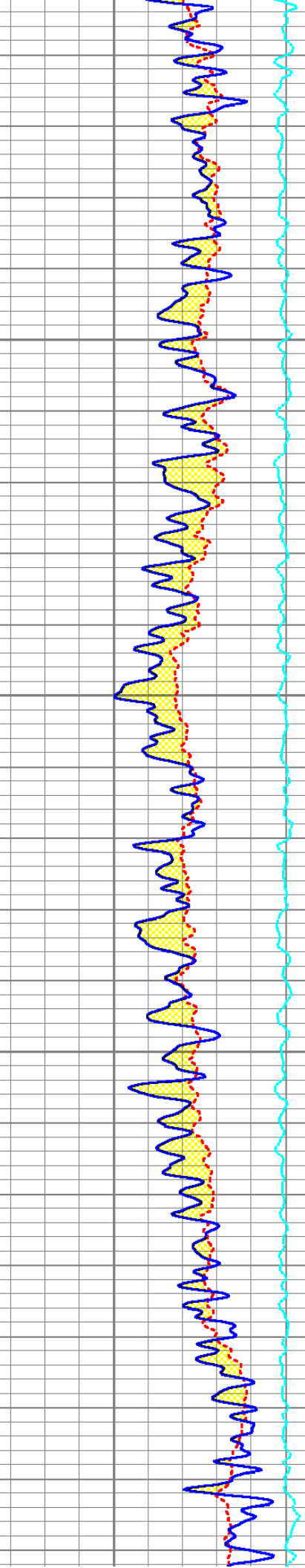


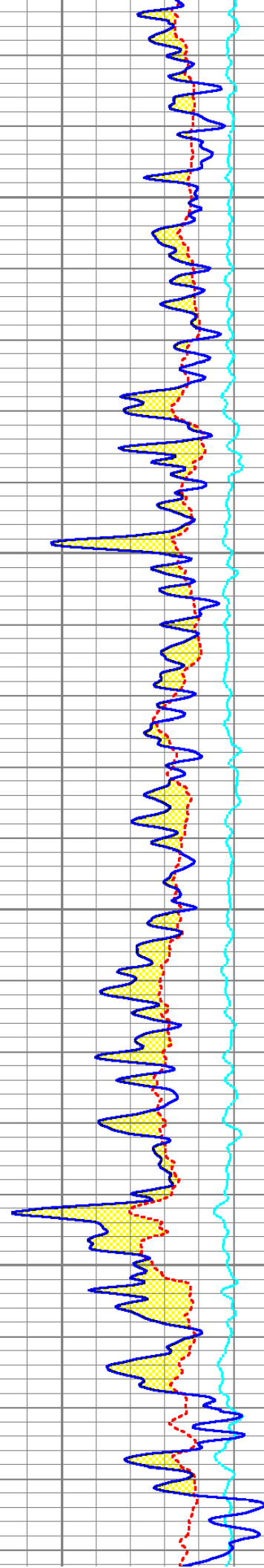
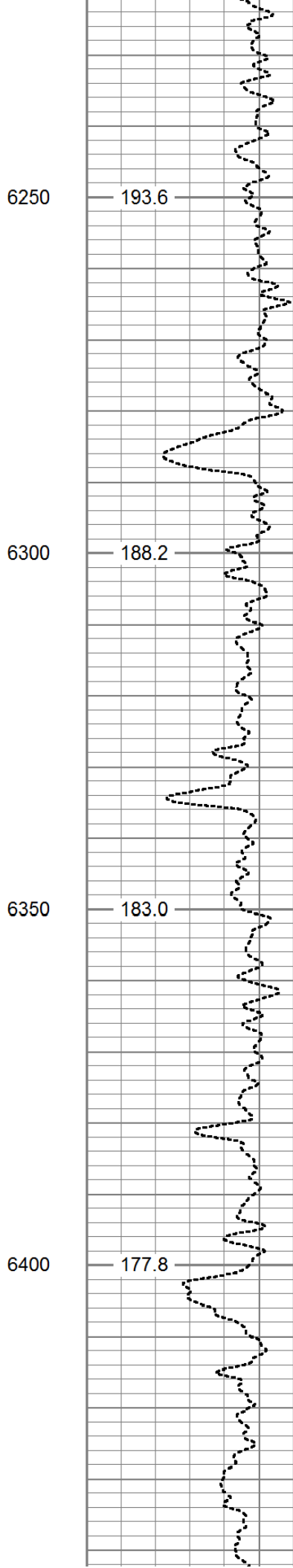
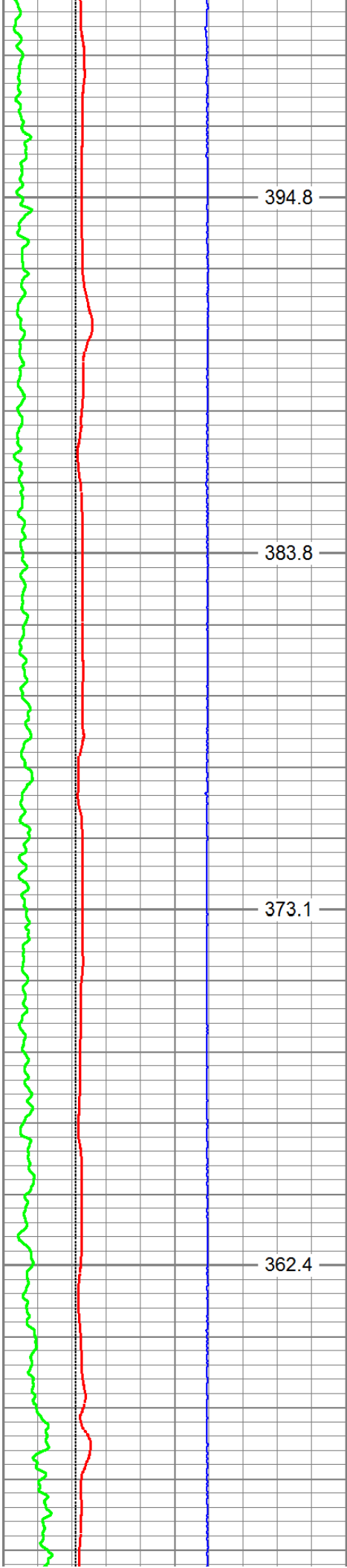
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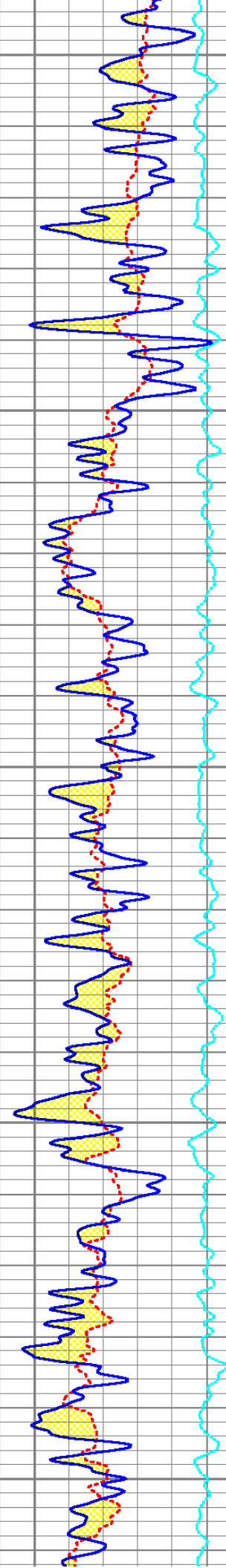
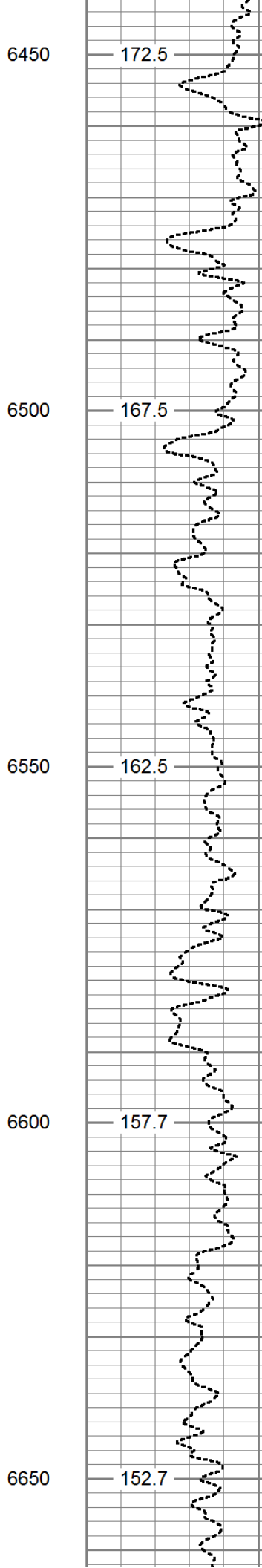
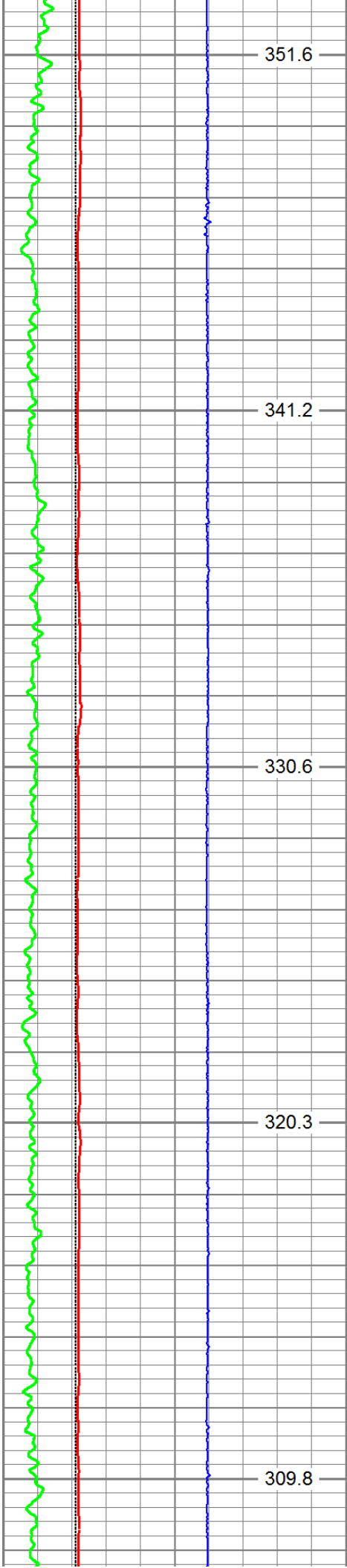
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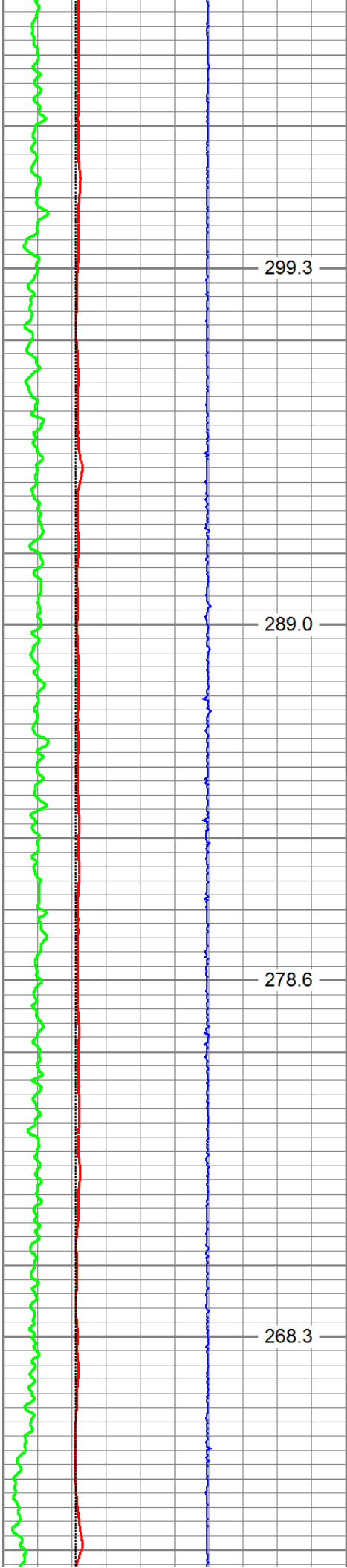
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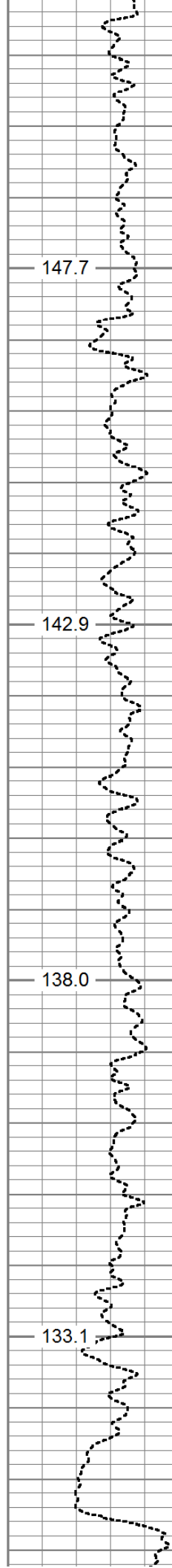
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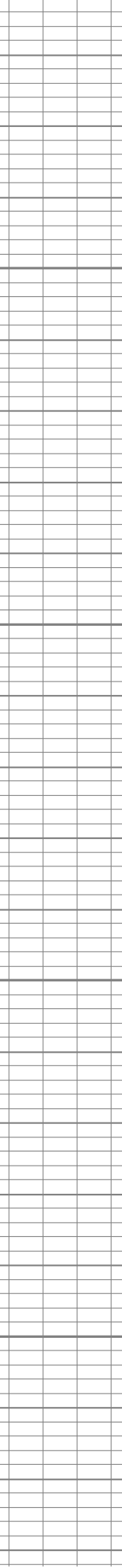
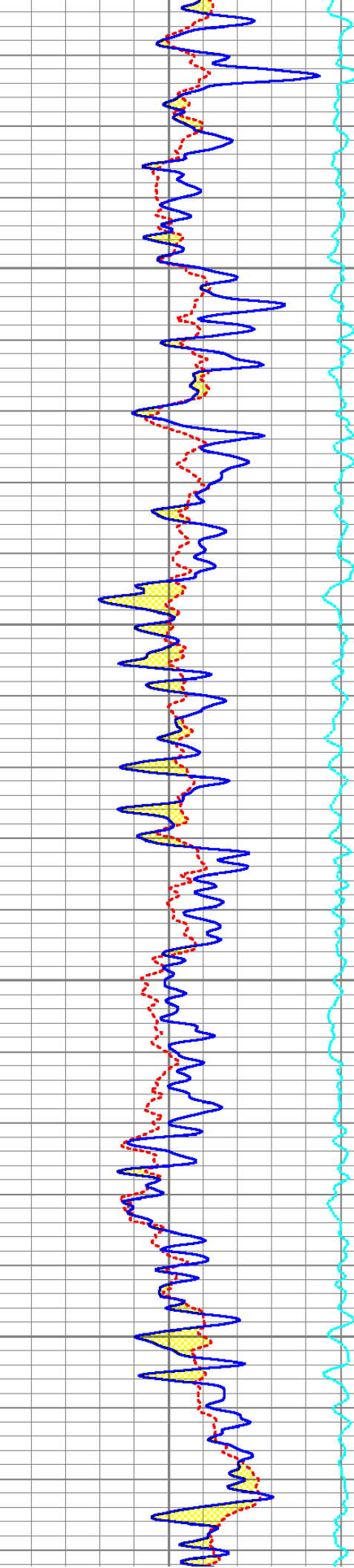


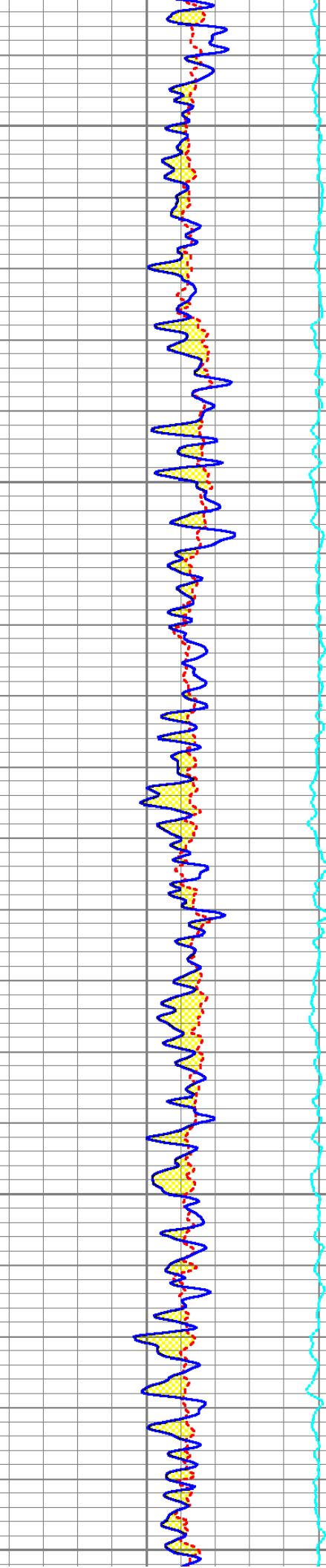
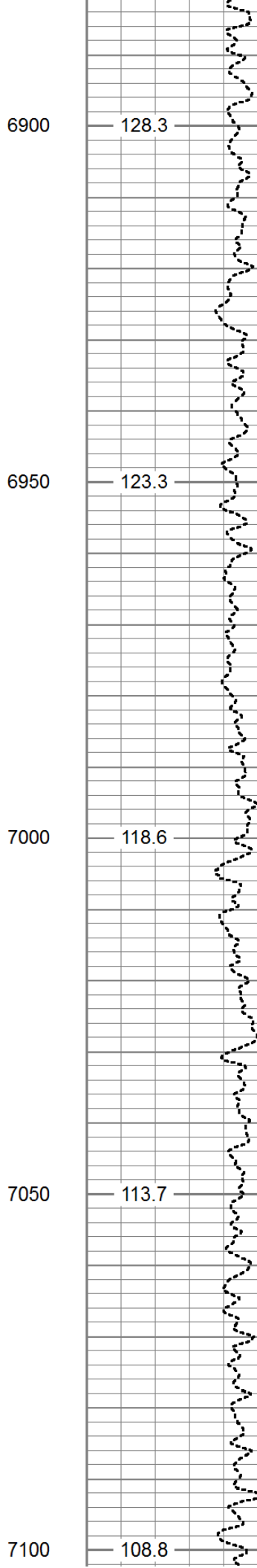
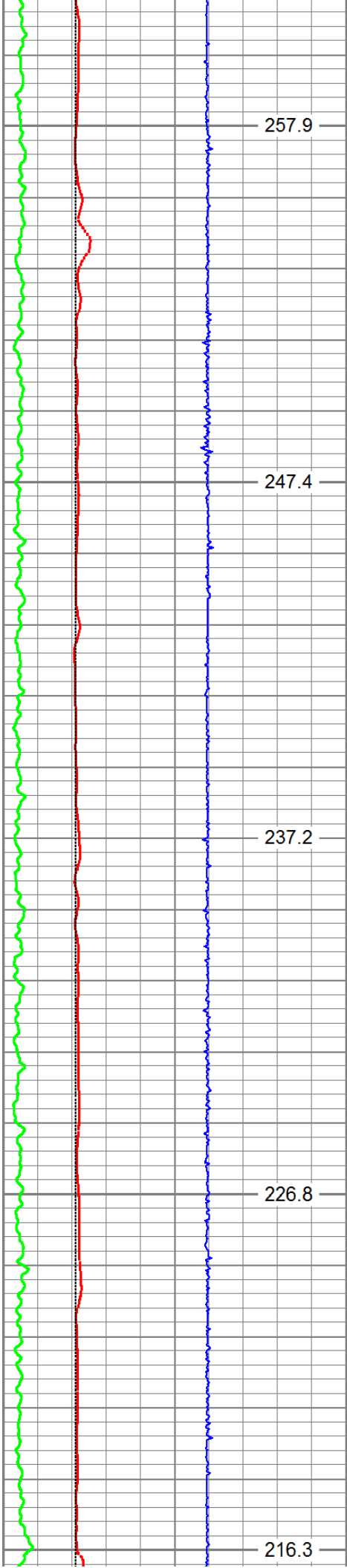
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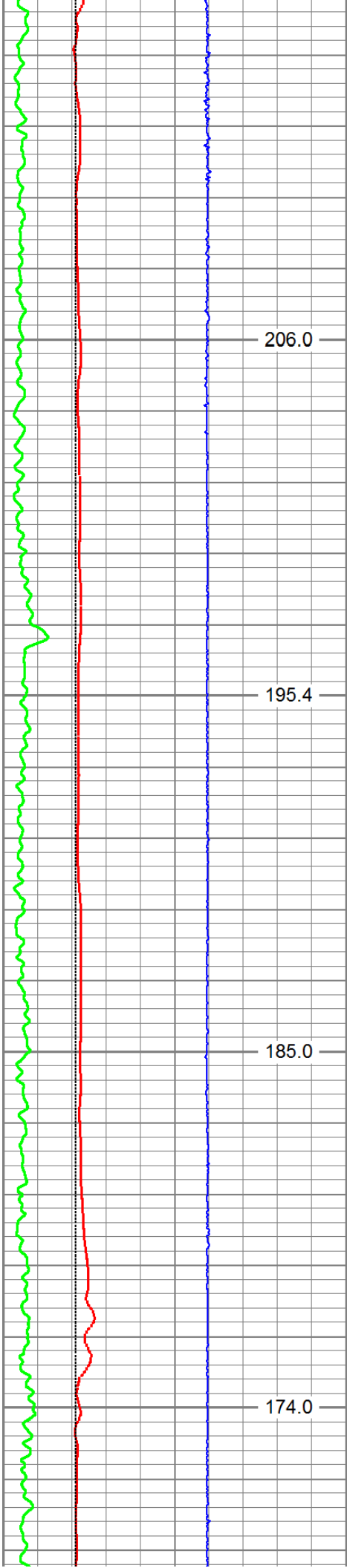
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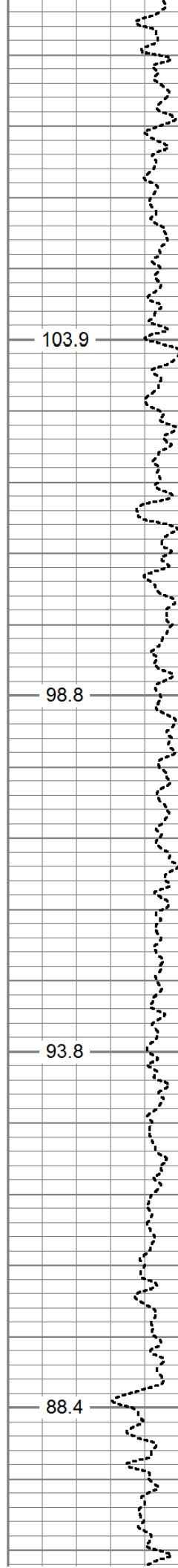
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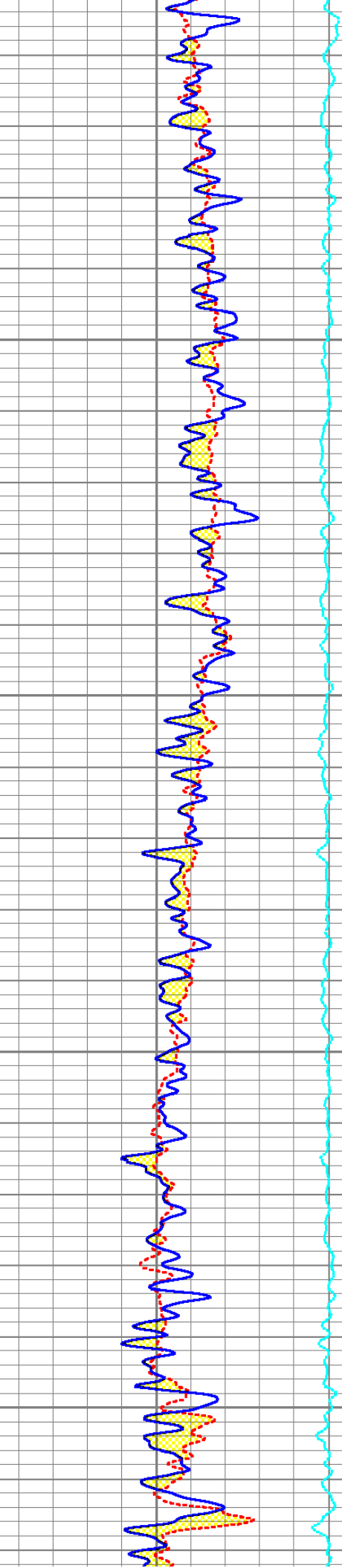


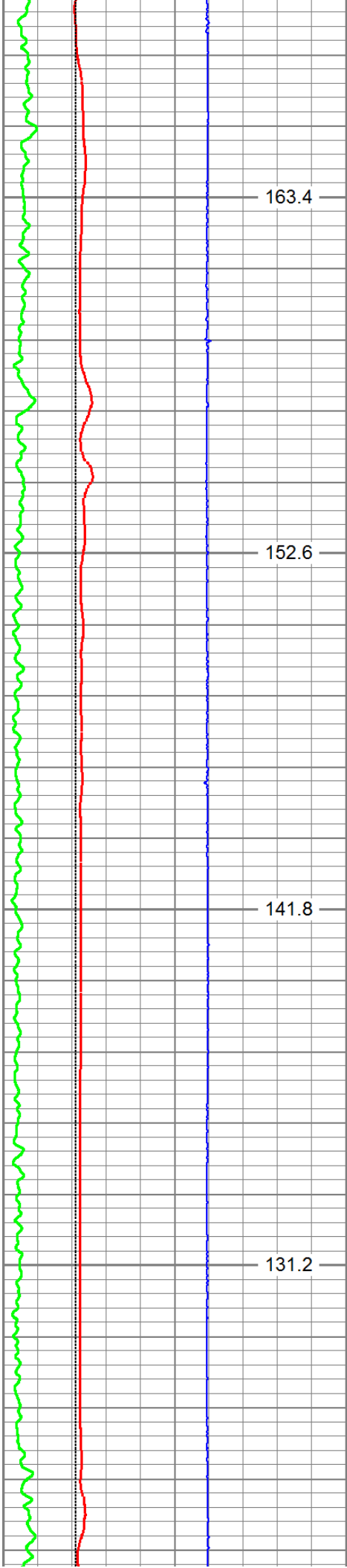
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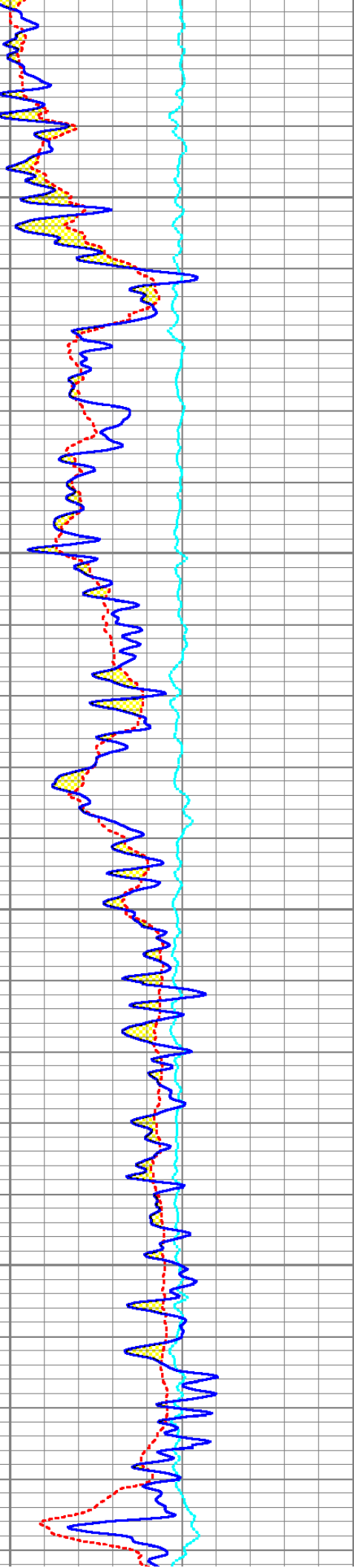
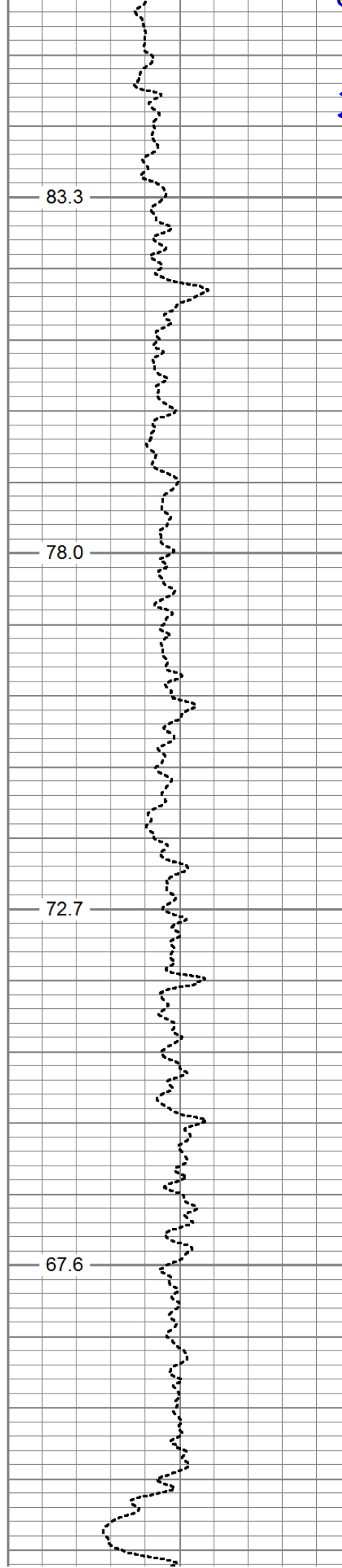


7350

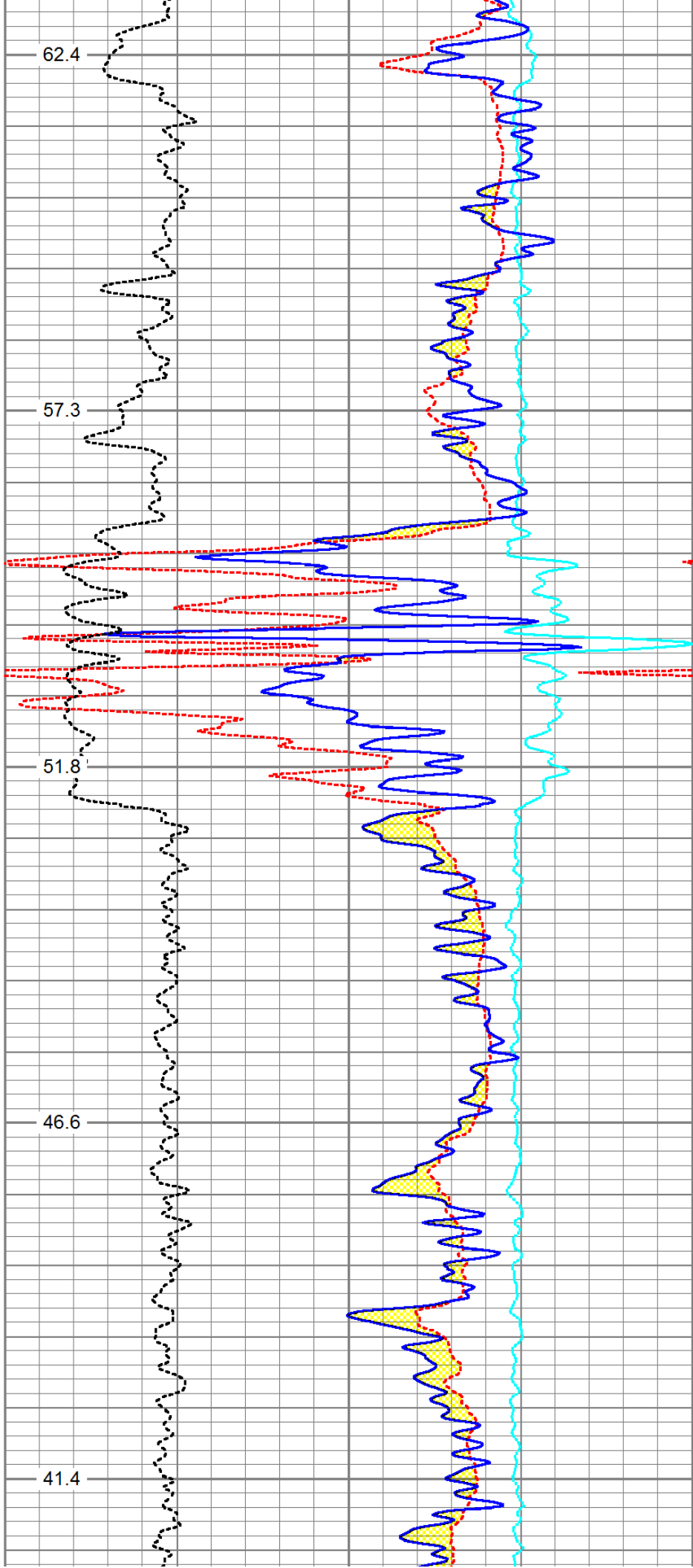
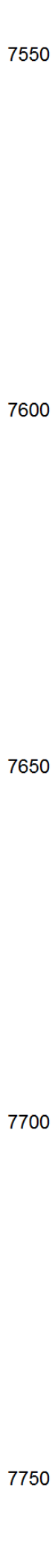
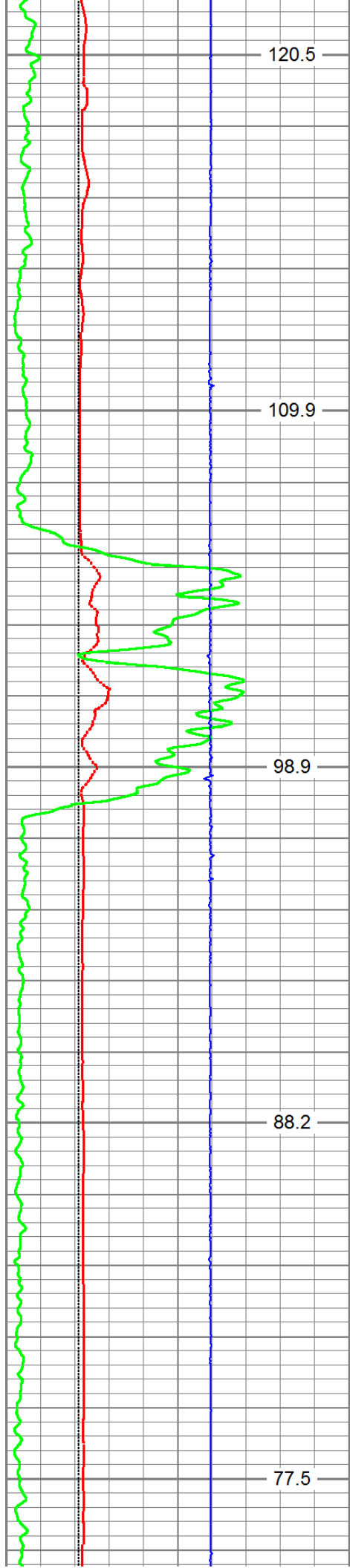
7400

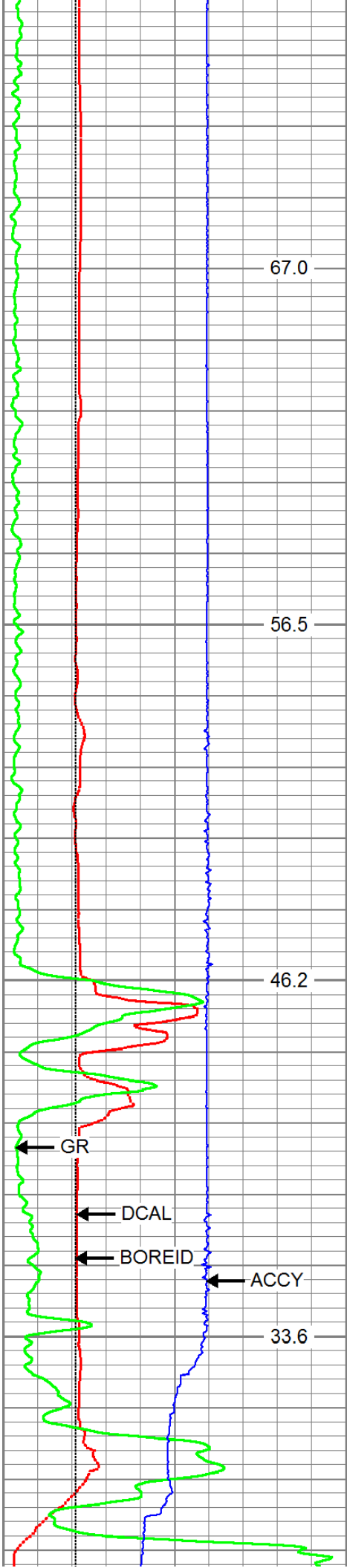
7450

7500









7800

7850

7900

7950

67.0

56.5

46.2

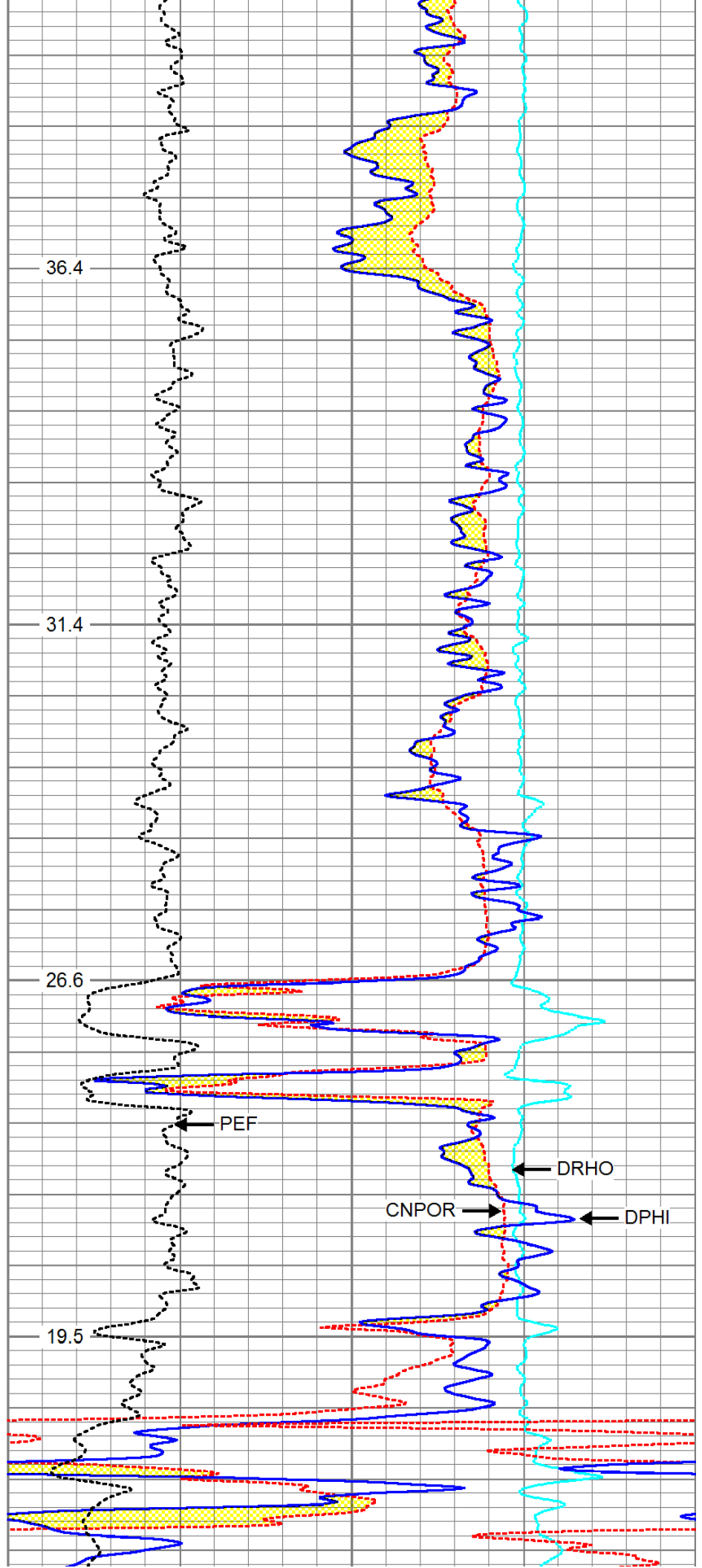
33.6

← GR

← DCAL

← BOREID

← ACCY



36.4

31.4

26.6

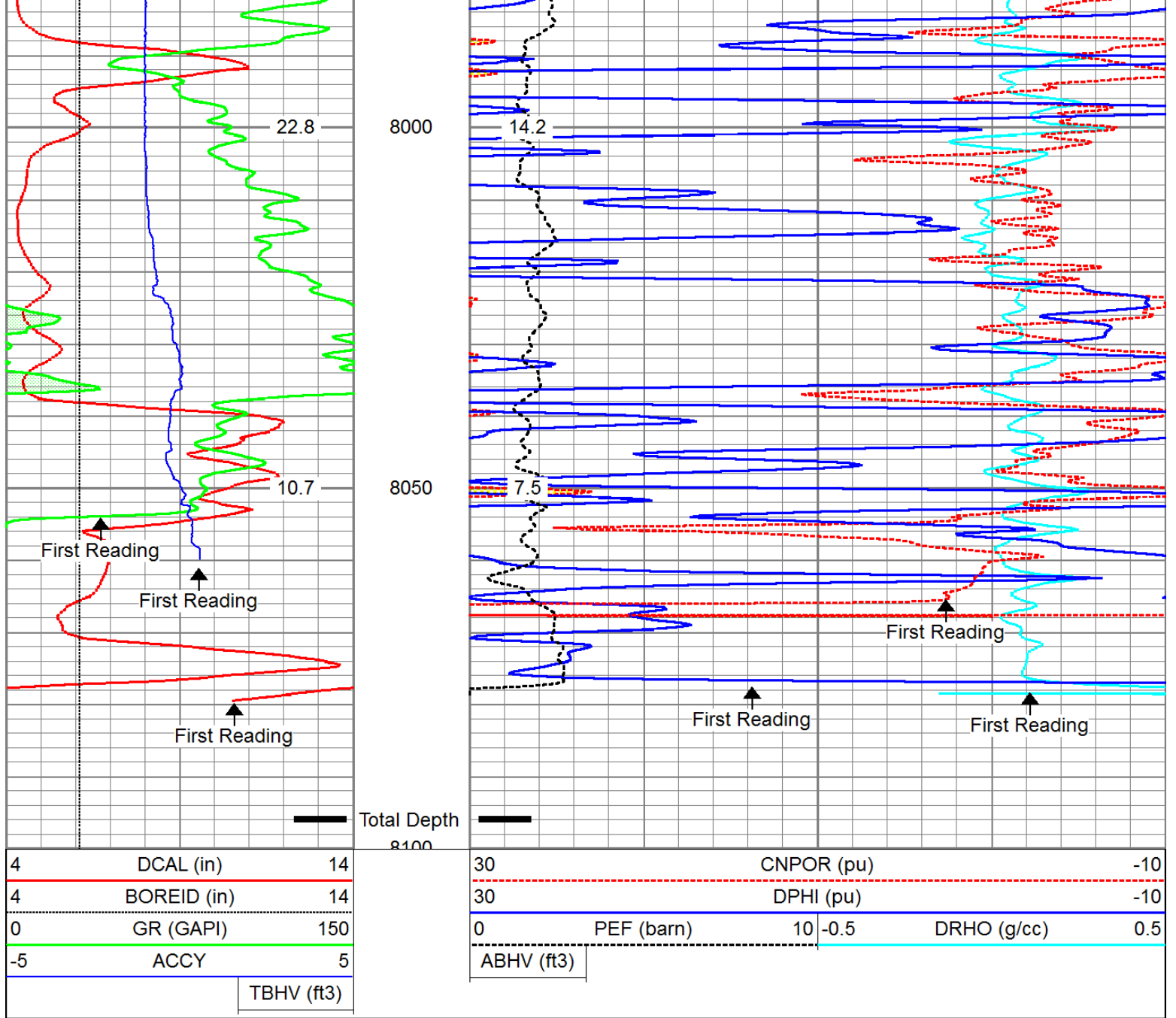
19.5

← PEF

← DRHO

← CNPOR

← DPHI



## Log Variables

Database: c:\users\t010\desktop\cather 3507 2-4h\sdrg\_cather\_mem.db  
 Dataset: field/well/proc1/pass1.3

### Top - Bottom

A	BHCOR	BHFL_TYPE	BHFLRES Ohm-m	BHFLRESSRC	BHIDSRC	BOREID in
1	On	WBM	1	MUDCELL	CURVE	6.125
BOTTEMP degF	CASED?	CASEOD in	CASETHCK in	CEMWATERSA kppm	CMNTHCK in	DNBHC?
105	No	4.5	0	0	0	NO
DPORSEL	FLUIDDEN g/cc	FRMSALIN kppm	LATNOR	M	MATRXDEN g/cc	MUDSALIN kppm
RHOB	1	0	Off	2	2.71	0.8
MudWgt lb/gal	NPORSEL	PEBHC?	PERFS	RESTMP SRC	SO in	SRFTEMP degF
8.5	Limestone	YES	0	INTERNAL	0.5	65
SZCOR	TDEPTH	TMPCOR	TOOL POS			

On	ft 8122	On	Free
----	------------	----	------

**Calibration Report**

Database File: c:\users\t010\desktop\cather 3507 2-4h\sdrp\_cather\_mem.db  
 Dataset Pathname: proc1/pass1.3  
 Dataset Creation: Mon Nov 25 12:18:53 2013

**ThruBit Induction Calibration Report**

Tool Model-Serial Number: PS-PS15R  
 Shop Calibration Performed: Tue Sep 24 08:36:59 2013

**BASELINE**

	R	Expected	X	Expected
<b>Freq 1</b>				
A1	-446.0340	[-500.00, -400.00]	156.3040	[-500.00, 500.00]
A2	-152.0180	[-180.00, -100.00]	16.5327	[-500.00, 500.00]
A3	-35.7402	[-50.00, -10.00]	-141.3930	[-500.00, 500.00]
A4	-15.8976	[-30.00, -10.00]	209.5470	[-500.00, 500.00]
A5	-13.3007	[-30.00, -10.00]	132.7320	[-500.00, 500.00]
<b>Freq 2</b>				
A1	-231.8750	[-280.00, -180.00]	68.0321	[-500.00, 500.00]
A2	-97.8308	[-130.00, -50.00]	-19.0236	[-500.00, 500.00]
A3	-25.2110	[-50.00, -10.00]	-146.3820	[-500.00, 500.00]
A4	-19.1524	[-30.00, -10.00]	53.1096	[-500.00, 500.00]
A5	-18.1899	[-30.00, -10.00]	-6.1345	[-500.00, 500.00]
<b>Freq 3</b>				
A1	-145.5070	[-180.00, -80.00]	-20.2509	[-500.00, 500.00]
A2	-72.8319	[-130.00, -30.00]	-57.3178	[-500.00, 500.00]
A3	-19.6761	[-50.00, -10.00]	-168.2330	[-500.00, 500.00]
A4	-19.9772	[-30.00, -10.00]	-52.1516	[-500.00, 500.00]
A5	-20.0964	[-30.00, -10.00]	-106.2330	[-500.00, 500.00]
<b>Freq 4</b>				
A1	-77.7044	[-120.00, -40.00]	-172.1640	[-500.00, 500.00]
A2	-51.8524	[-110.00, -10.00]	-125.2290	[-500.00, 500.00]
A3	-15.1353	[-50.00, -10.00]	-222.2020	[-500.00, 500.00]
A4	-22.7003	[-30.00, -10.00]	-209.4270	[-500.00, 500.00]
A5	-24.8546	[-30.00, -10.00]	-272.1340	[-500.00, 500.00]

**CALIBRATION COEFFICIENTS**

	R	Expected	X	Expected
<b>Freq 1</b>				
A1	0.9910	[0.95, 1.05]	0.0027	[-0.05, 0.05]
A2	0.9893	[0.95, 1.05]	0.0026	[-0.05, 0.05]
A3	0.9969	[0.95, 1.05]	-0.0044	[-0.05, 0.05]
A4	0.9865	[0.95, 1.05]	0.0044	[-0.05, 0.05]
A5	0.9908	[0.95, 1.05]	0.0039	[-0.05, 0.05]
<b>Freq 2</b>				
A1	0.9854	[0.95, 1.05]	-0.0073	[-0.05, 0.05]
A2	0.9833	[0.95, 1.05]	-0.0071	[-0.05, 0.05]
A3	0.9853	[0.95, 1.05]	-0.0068	[-0.05, 0.05]
A4	0.9804	[0.95, 1.05]	-0.0053	[-0.05, 0.05]
A5	0.9881	[0.95, 1.05]	-0.0049	[-0.05, 0.05]

Freq 3				
A1	0.9918	[0.95, 1.05]	-0.0076	[-0.05, 0.05]
A2	0.9899	[0.95, 1.05]	-0.0072	[-0.05, 0.05]
A3	0.9918	[0.95, 1.05]	-0.0075	[-0.05, 0.05]
A4	0.9836	[0.95, 1.05]	-0.0054	[-0.05, 0.05]
A5	0.9957	[0.95, 1.05]	-0.0040	[-0.05, 0.05]
Freq 4				
A1	0.9866	[0.95, 1.05]	-0.0110	[-0.05, 0.05]
A2	0.9856	[0.95, 1.05]	-0.0101	[-0.05, 0.05]
A3	0.9895	[0.95, 1.05]	-0.0119	[-0.05, 0.05]
A4	0.9745	[0.95, 1.05]	-0.0083	[-0.05, 0.05]
A5	1.0034	[0.95, 1.05]	-0.0075	[-0.05, 0.05]
Temperature	27.7897 degC			

**ThruBit Density Calibration Report**

Tool Model-Serial Number: PS-PS43D  
Source Number:  
Shop Calibration Performed: Fri Nov 08 10:57:42 2013

**REFERENCE**

	Density	Units
Aluminium	2.607	g/cc
Magnesium	1.752	g/cc

**READINGS**

Outputs	Counts	Units	Expected
SS1 Background	135.84	cps	[130.00, 170.00]
LS1 Background	146.41	cps	[130.00, 170.00]
LS4 Background	29.84	cps	[27.00, 35.00]
SS1 Aluminium	4478.32	cps	[4500.00, 5500.00]
LS1 Aluminium	898.25	cps	[750.00, 950.00]
LS4 Aluminium	948.42	cps	[843.00, 1068.00]
SS1 Magnesium	7466.94	cps	[7000.00, 9000.00]
LS1 Magnesium	5867.16	cps	[5250.00, 6250.00]
LS1 Al + Fe	808.16	cps	[650.00, 800.00]
LS4 Al + Fe	454.68	cps	[382.00, 471.00]

**RESULTS**

SS Slope	1.63	[1.52, 1.77]
LS Slope	0.42	[0.38, 0.45]
PEF K Factor	4.655	[3.510, 6.170]
PEF B Factor	-0.534	[-0.700, -0.410]

Caliper Shop Calibration performed: Fri Nov 08 10:57:42 2013

**RESULTS**

Reference	Reading	Units
12.00	1883.87	in
9.00	2044.17	in
6.00	2204.76	in

DENSITY PRE-SURVEY CHECK Performed: Sat Nov 23 12:42:10 2013

Outputs	Counts	Units	Expected
SS1 Background	137.54	cps	[131.76, 139.91]
LS1 Background	147.19	cps	[142.01, 150.80]
LS4 Background	29.23	cps	[28.05, 31.63]
CALIPER PRE-SURVEY CHECK Performed:		Sat Nov 23 12:39:43 2013	
Reference	Readings	Units	Expected
6.00	6.05	in	[5.80, 6.20]
Compensated Neutron Calibration Report			
Tool Model-Serial Number:		PS-PS29N	
Source Number:			
Calibration Tank Temperature:		60.0 degF	
Shop Calibration Performed:		Fri Nov 08 09:52:11 2013	
BACKGROUND MEASUREMENT			
Outputs	Measured	Units	Expected
SS Counts	0.0	cps	<10
LS Counts	0.1	cps	<4
WATER TANK REFERENCE			
Outputs	Measured	Units	Expected
SS Counts	2314.2	cps	
LS Counts	79.4	cps	
Tank Ratio Ref	30.9580	SS/LS	
Tank Ratio	29.1513	SS/LS	
Tank Ratio Gain	1.0620		[0.85, 1.15]
ALUMINUM SLEEVE REFERENCE			
Outputs	Measured	Units	Expected
SS Counts	27460.9	cps	
LS Counts	2600.3	cps	
Al Ratio Ref	10.797	SS/LS	
Al Ratio	11.215	SS/LS	
Al Ratio Gain	0.96		[0.90, 1.10]
Sleeve Porosity	14.46	pu	
PRE-SURVEY BACKGROUND CHECK Performed:		Sat Nov 23 12:47:09 2013	
Outputs	Measured	Units	Expected
SS Counts	0.0	cps	<10
LS Counts	0.1	cps	<4

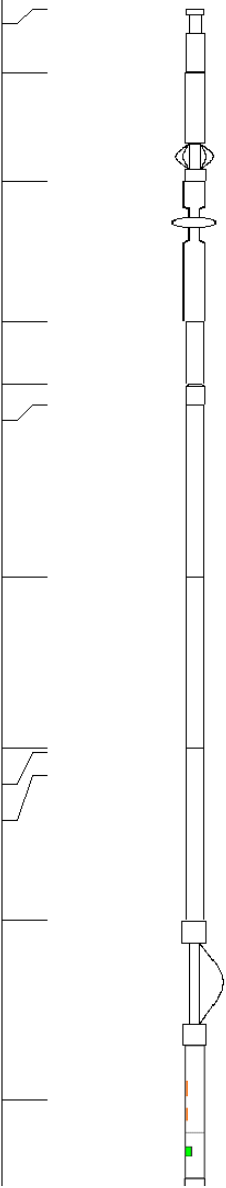
Gamma Ray Calibration Report

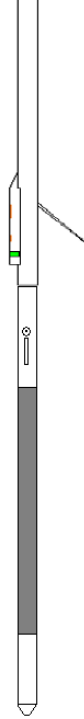
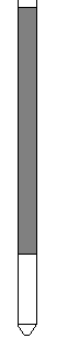
Tool Model-Serial Number: PS-PS24T  
 Performed: Fri Nov 08 12:35:25 2013  
 Calibrator Value: 162.7 GAPI  
 Background Reading: 65.6 cps  
 Calibrator Reading: 462.9 cps  
 Sensitivity: 0.3750 GAPI/cps


Inclinometer Calibration Report

Performed: Sun Jun 13 14:33:21 1993

	Low Read.	High Read.	Low Ref.	High Ref.	
X Accelerometer	0.00	1.00	0.00	1.00	gee
Y Accelerometer	0.00	1.00	0.00	1.00	gee
Z Accelerometer	0.00	1.00	0.00	1.00	gee

Sensor	Offset (ft)	Schematic	Description	Len (ft)	OD (in)	Wt (lb)
ThruBit	67.59		Cablehead-S	2.31	2.13	5.00
ThruBit	65.28		Solid Weakpoint			
			PSBDOT	3.87	2.25	35.00
ThruBit	61.41		HangOff_Tool	5.00	2.38	60.00
ThruBit	56.41		Swivel	2.25	2.06	25.00
ThruBit	54.16		10-1	0.75	2.13	3.95
TBBAT	53.41		TBBAT-A (PS30B) ThruBit Battery	6.13	2.13	38.20
TBBAT2	47.29		TBBAT2-A (PS29B) ThruBit Battery	6.13	2.13	40.00
TMG	41.16		TMG-PS (PS24T) ThruBit Telemetry Gamma Ray			
GR	41.04					
GRTEMP	40.20					
ThruBit	35.04		Decentralizer Decentralizer (Small)	4.50	2.13	70.00
CNLSC	28.60		TBN-PS (PS29N) ThruBit Neutron	4.77	2.13	63.00

LSW1	18.04		TBD-PS (PS43D) ThruBit Density	10.48	2.13	91.00
DCAL	17.13					
A1_P	10.60		TBI-PS (PS15R) ThruBit Induction	15.29	2.13	94.00
A2_P	10.10					
A3_P	9.35					
A4_P	8.35					
A5_P	6.60					
Dataset:		sdrg_cather_mem.db: field/well/proc1/pass1.3				
Total Length:		67.59 ft				
Total Weight:		570.15 lb				
O.D.:		2.38 in				

	Company	SANDRIDGE ENERGY
	Well	CATHER 3507 2-4H
	Field	WALDRON
	County	HARPER
	State	KANSAS