



Weatherford

**ARRAY INDUCTION
LOG**

COMPANY			HIGHPOINT RESOURCES CORPORATION		
WELL			LION CREEK 23-0164B		
FIELD			WATTENBERG		
PROVINCE/COUNTY WELD					
COUNTRY/STATE			USA /COLORADO		
UWI			SHL: 300' FNL & 1320' FWL		
SEC 23	TWP 11N	RGE 64W	Other Services		
Latitude		40.912576	CROSS-DIPOLE SONIC		
Longitude		-104.517319			
API Number					
Permanent Datum GL, Elevation 5391 feet					
Log Measured From KB, 20.00 feet above Permanent Datum					
Drilling Measured From KB					
Date	05-SEP-2018				Elevations: KB 5411.00 DF 5411.00 GL 5391.00
Run Number	1				
Service Order	2938-220066519				
Depth Driller	8237.00		feet		
Depth Logger	8237.00		feet		
First Reading	8213.00		feet		
Last Reading	1555.00		feet		
Casing Driller	1541.00		feet		
Casing Logger	1555.00		feet		
Bit Size	8.750		inches		
Hole Fluid Type	WBM				
Density / Viscosity	9.80 lb/USg		42.00 sec/qt		
PH / Fluid Loss	7.00		8.00 ml/30Min		
Sample Source	MUDTANK				
Rm @ Measured Temp	2.65 @ 55.0		ohm-m		
Rmf @ Measured Temp	1.99 @ 55.0		ohm-m		
Rmc @ Measured Temp	3.31 @ 55.0		ohm-m		
Source Rmf / Rmc	CALC		CALC		
Rm @ BHT	0.79 @192.0		ohm-m		
Time Since Circulation	0.25 HRS				
Max Recorded Temp	192.00		deg F		
Equipment / Base	3504		CASPER		
Recorded By	ARBER ÇUKU		BLAKE CAROLL		
Witnessed By	---				

BOREHOLE RECORD					Last Edited: 06-SEP-2018 08:54
Bit Size inches		Depth From feet		Depth To feet	
8.750		1541.00		8237.00	
CASING RECORD					
Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft	
SURFACE	9.625	0.00	1541.00	36.00	

REMARKS
WLS SOFTWARE VERSION: 18.03.9328
TOOLSTRING RAN AS PER THE STRING DIAGRAM.
PRIMARY DEPTH REFERENCE WAS PIPE STRAP.
LOG NORMALIZED WITH MWD GAMMA RAY PROVIDED BY THE CLIENT.
LOGGED USING MESSENGER SHUTTLE METHOD OF DEPLOYMENT.
HARDWARE USED: OVERBODY BASKET CENTRALIZER ON CXD TRANSMITTER (TOP AND BOTTOM). 1 STANDOFF ON CXD TRANSMITTER 3 STANDOFFS ON CXD RECEIVER CXD TOOL HAS BEEN CONFIGURED TO BE STOOD OFF IN THE HORIZONTAL/DEVIATED SECTION AND TO BE RAN CENTERED ON THE VERTICAL SECTION BY THE OVERBODY CENTRALIZERS IN THE TRANSMITTER AND THE MIS D ABOVE THE CXD. INLINE CENTRALIZER ASSEMBLY ON MAI BOTTOM.

HOLE VOLUME FROM TD TO CASING SHOE = 2730 CU.FT

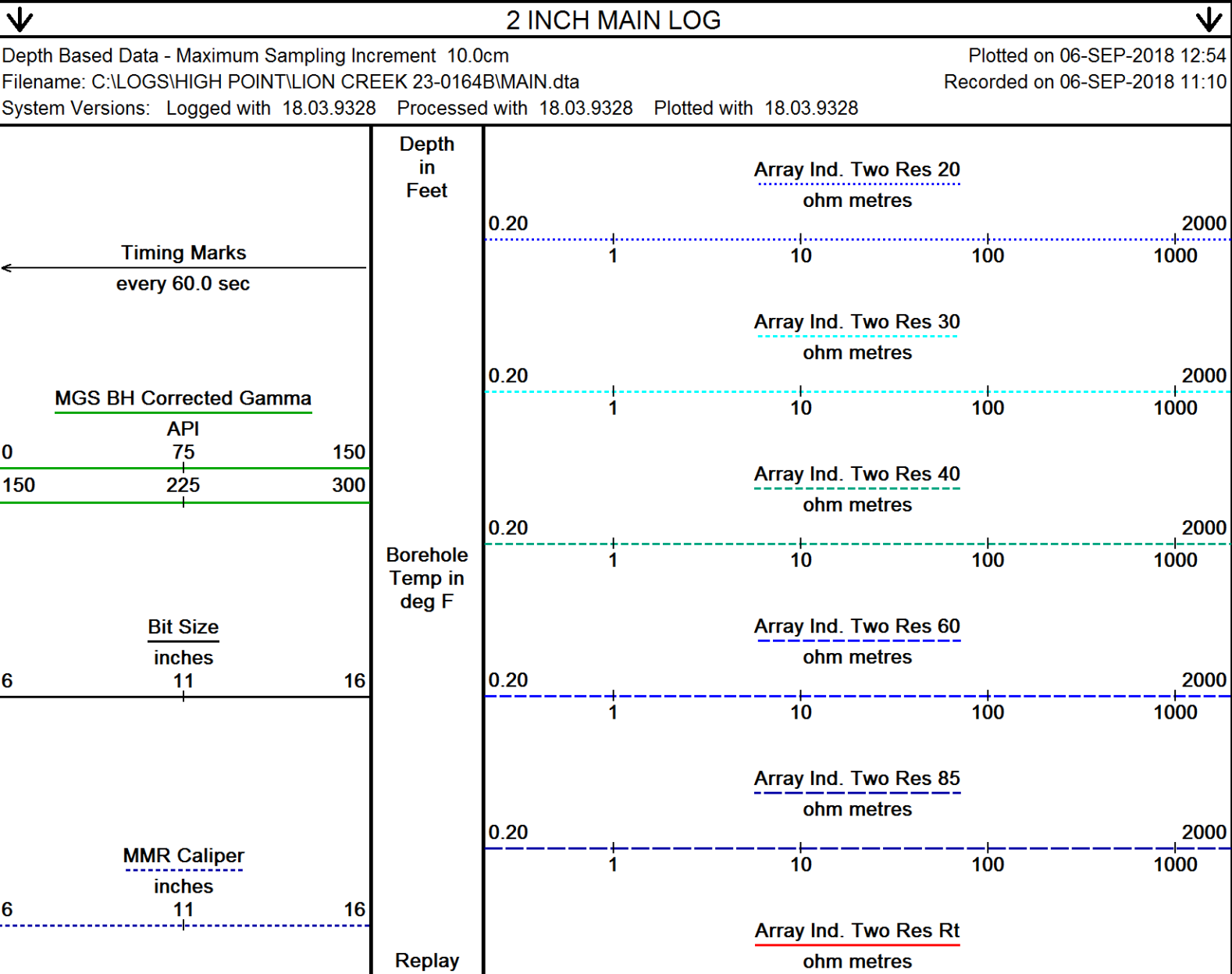
ANNULAR VOLUME FROM FROM TD TO CASING SHOE BASED ON 7 INCH CASING = 950 CU.FT

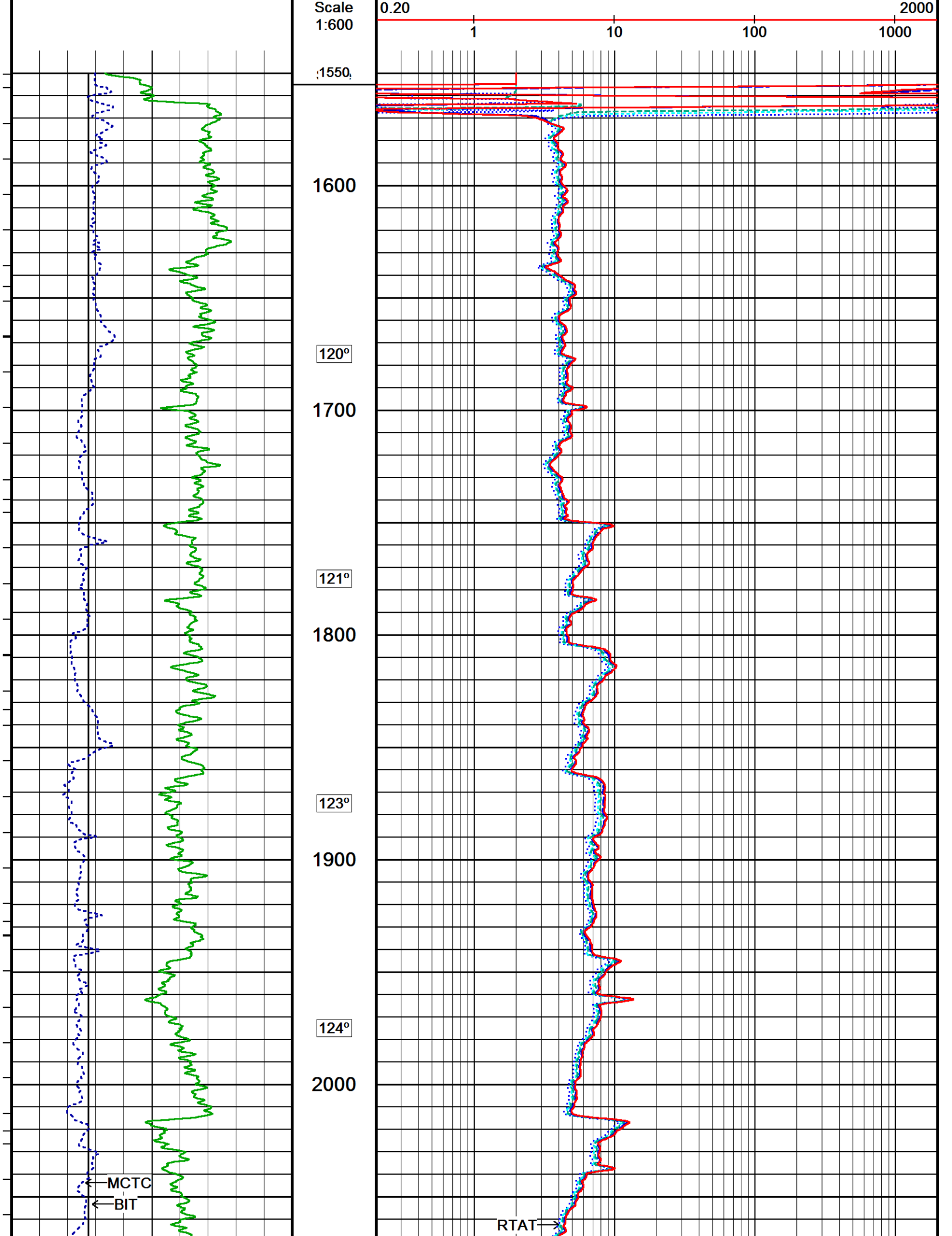
HOLE AND ANNULAR VOLUMES CALCULATED FROM MMR CALIPER MEASUREMENTS

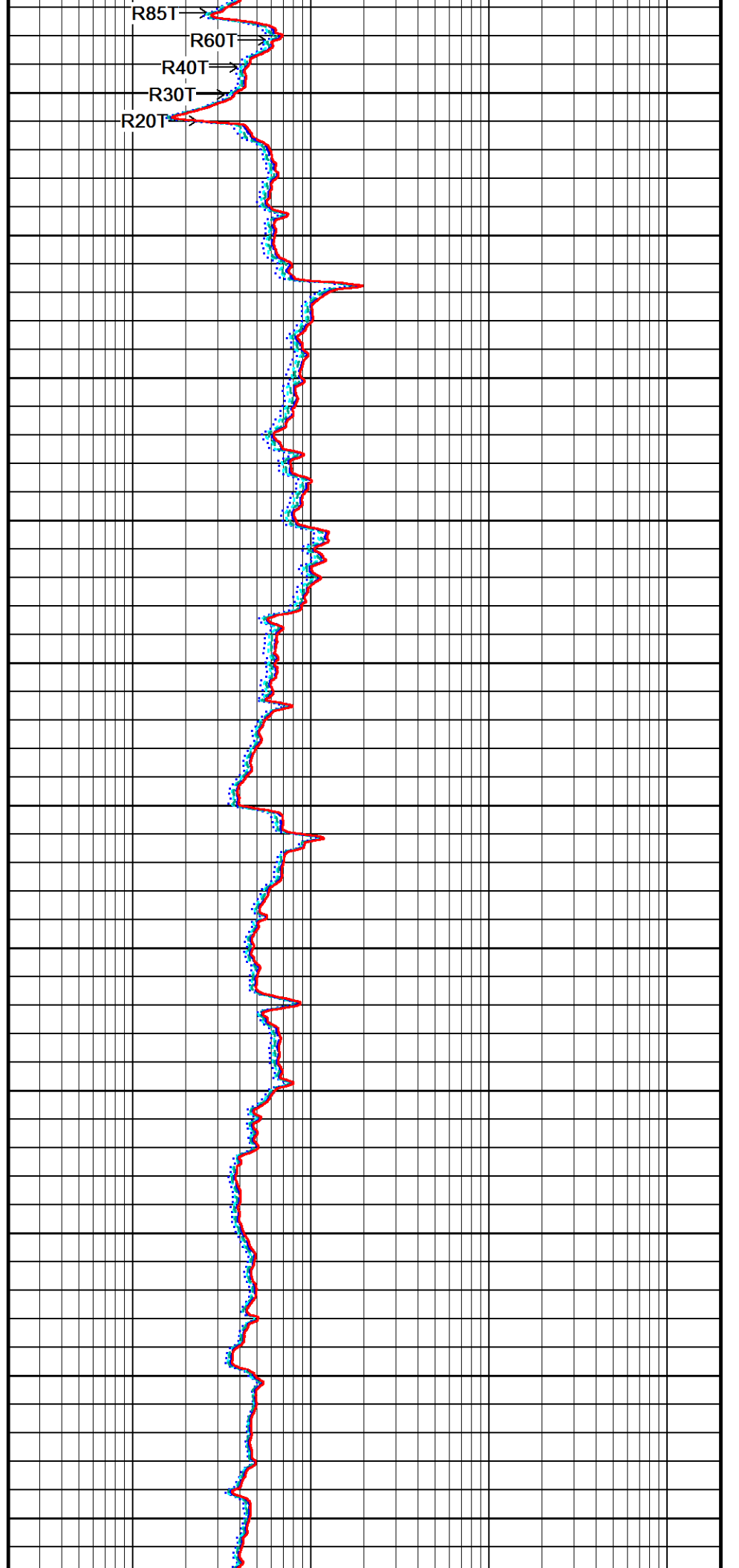
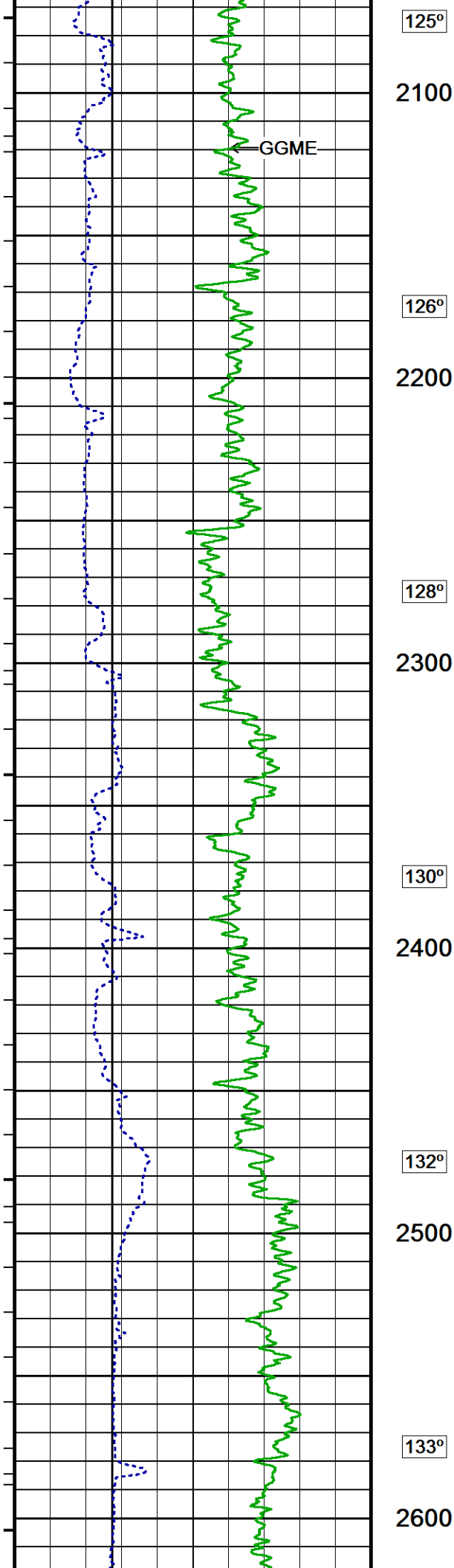
MAGNETIC DECLINATION USED 8.35 DEG EAST, AS PER DIRECTIONAL SURVEYS OF LION CREEK 23-0164B DATE 03-SEP-2018 FROM SCIENTIFIC DRILLING.

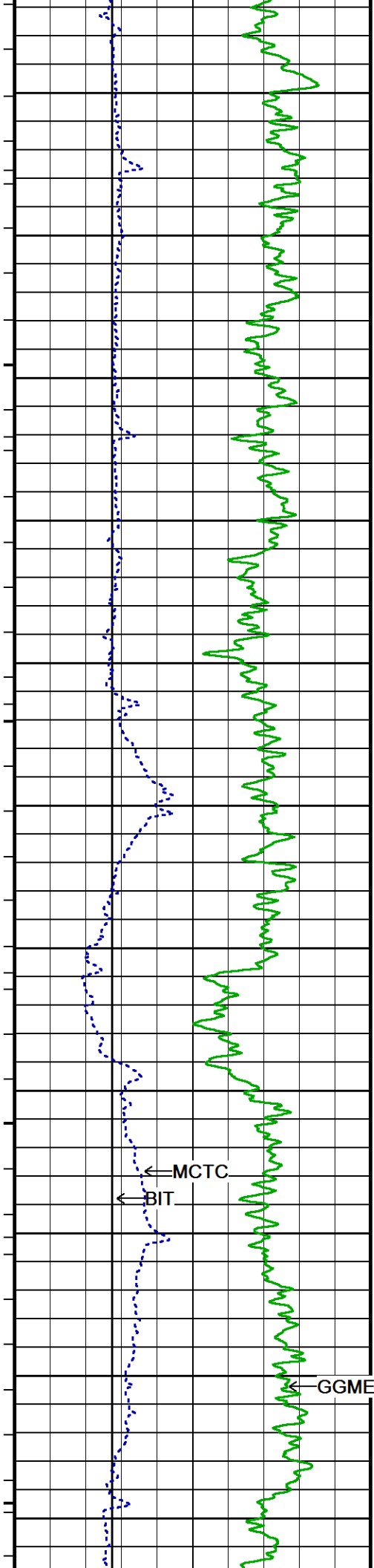
RIG: SAVANNA 802.

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









134°

2700

136°

2800

137°

2900

139°

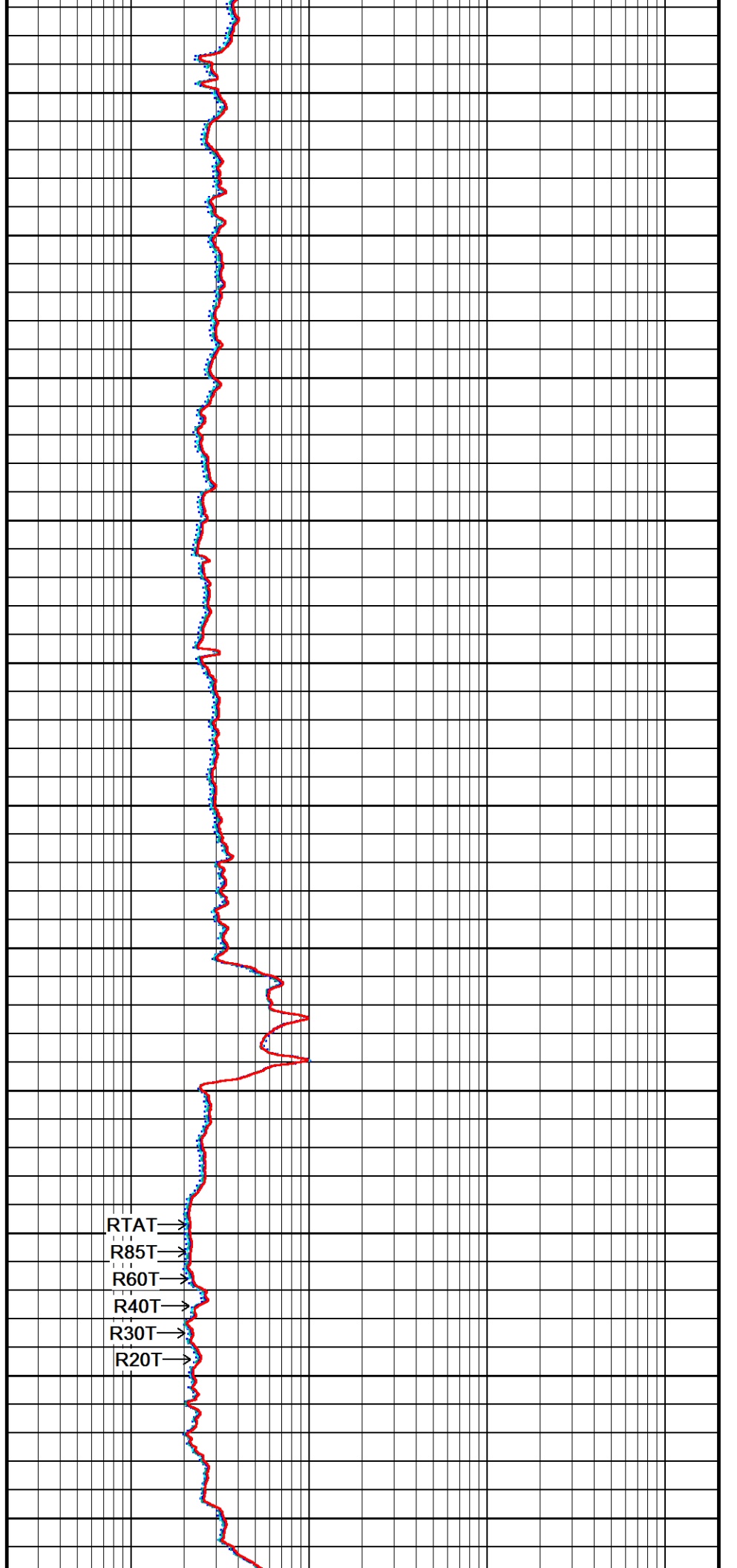
3000

141°

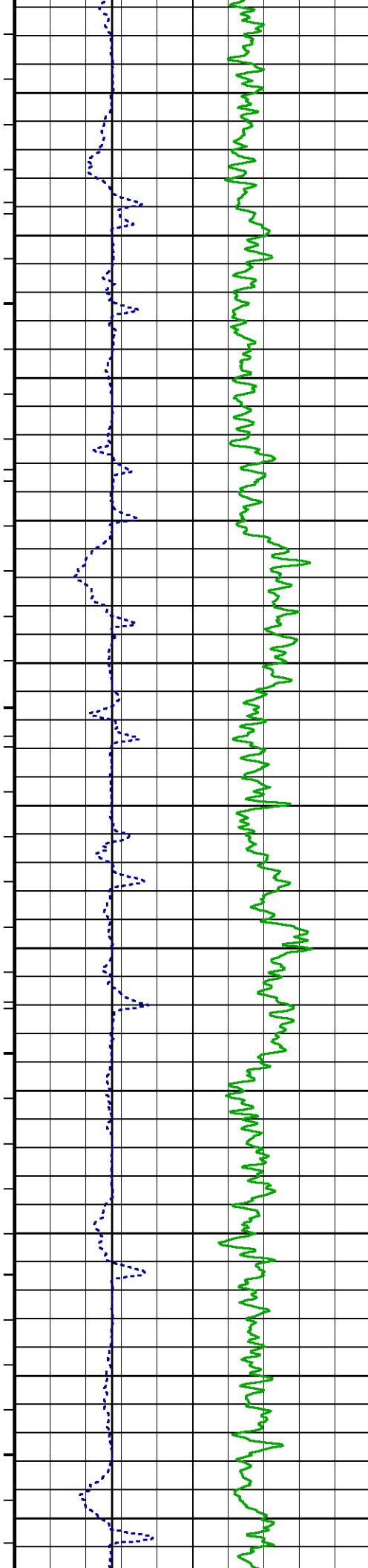
3100

← MCTC
← BIT

GGME



RTAT →
R85T →
R60T →
R40T →
R30T →
R20T →



142°

3200

143°

3300

144°

3400

145°

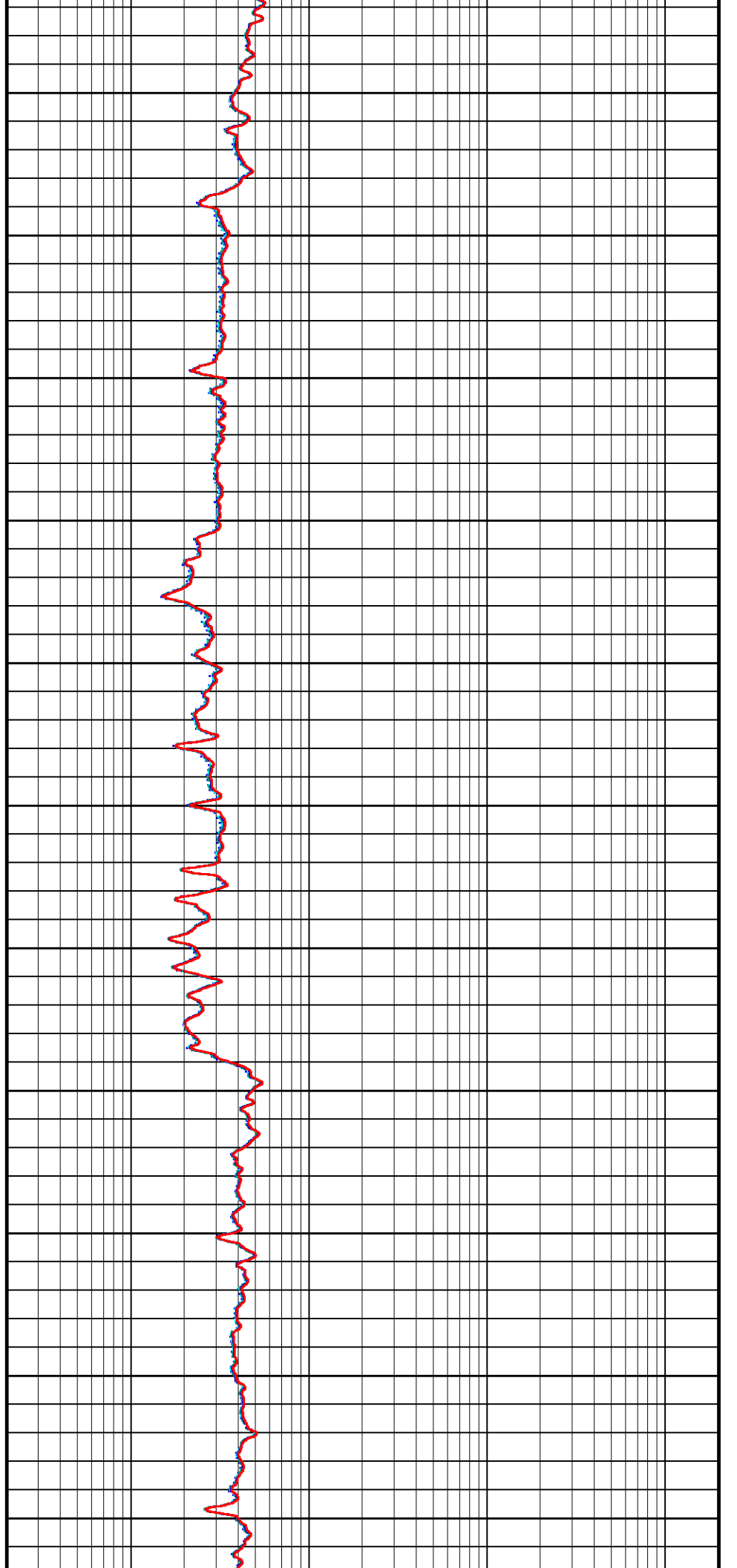
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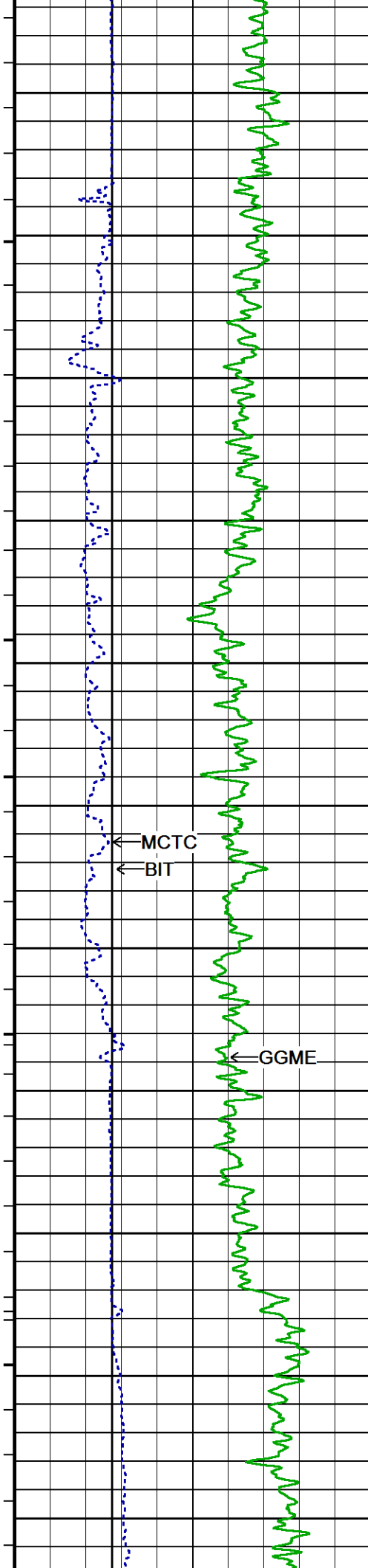
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3600

148°

3700





149°

3800

150°

3900

151°

4000

← MCTC
← BIT

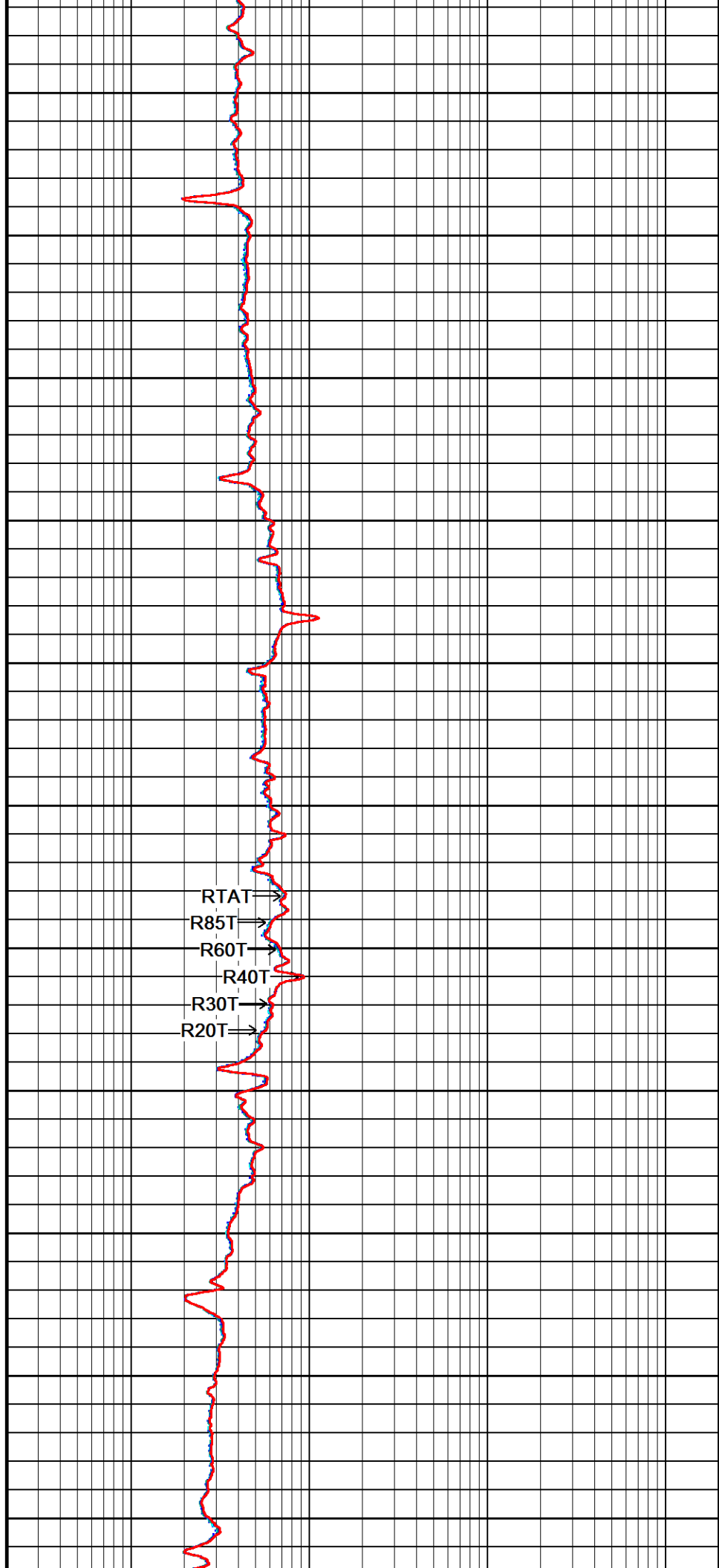
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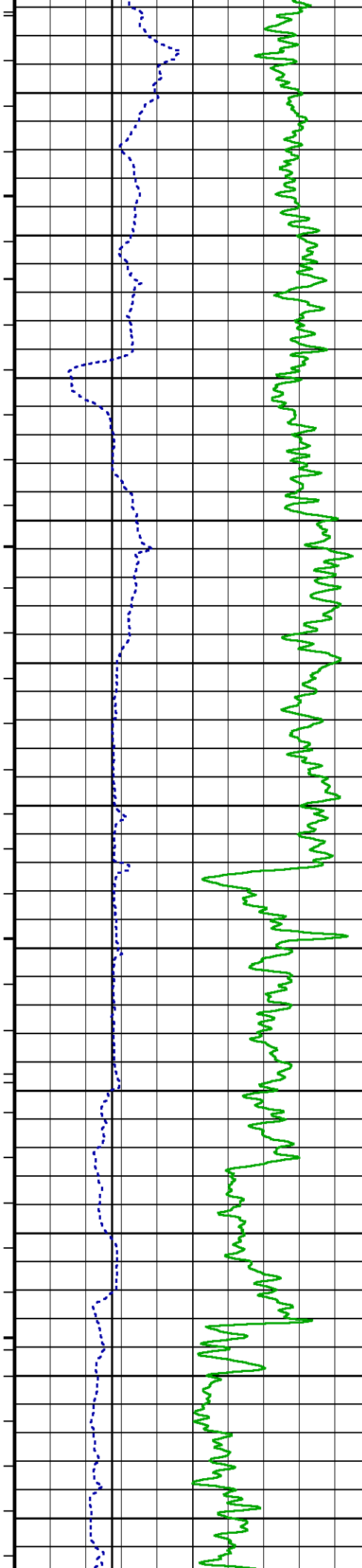
← GGME

153°

4200



RTAT →
R85T →
R60T →
R40T →
R30T →
R20T →



154°

4300

156°

4400

157°

4500

158°

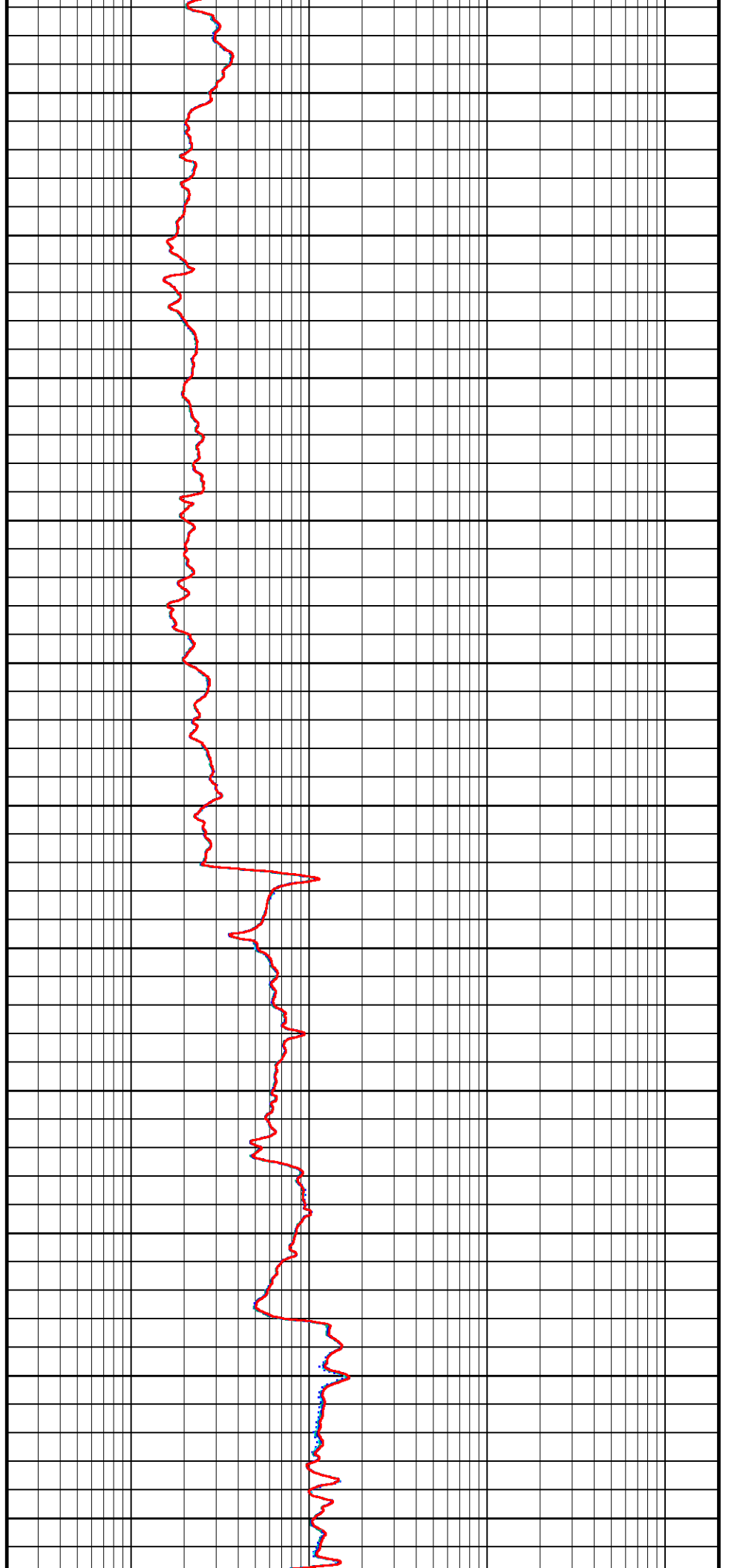
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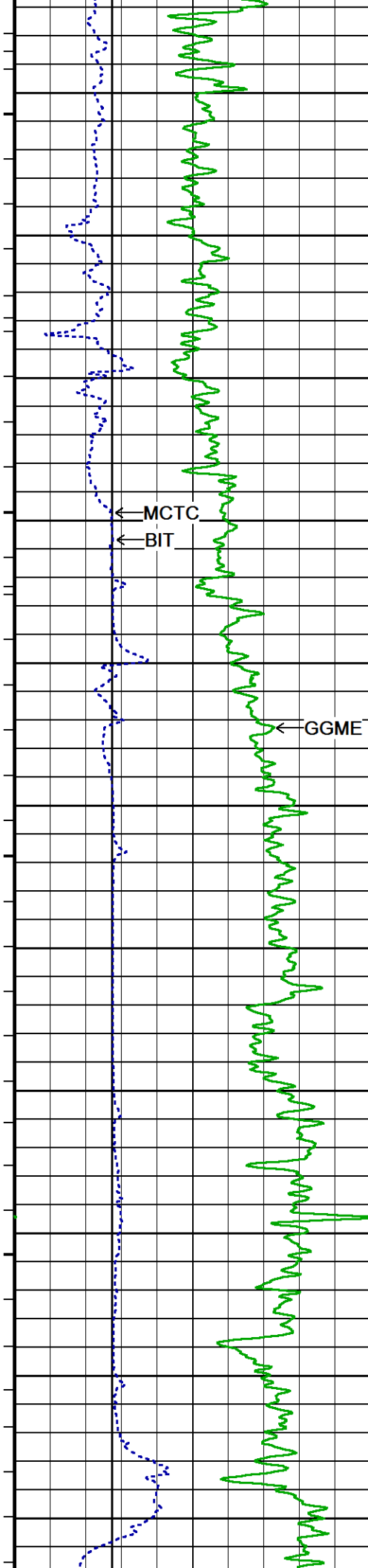
159°

4700

160°

4800





160°

4900

161°

5000

162°

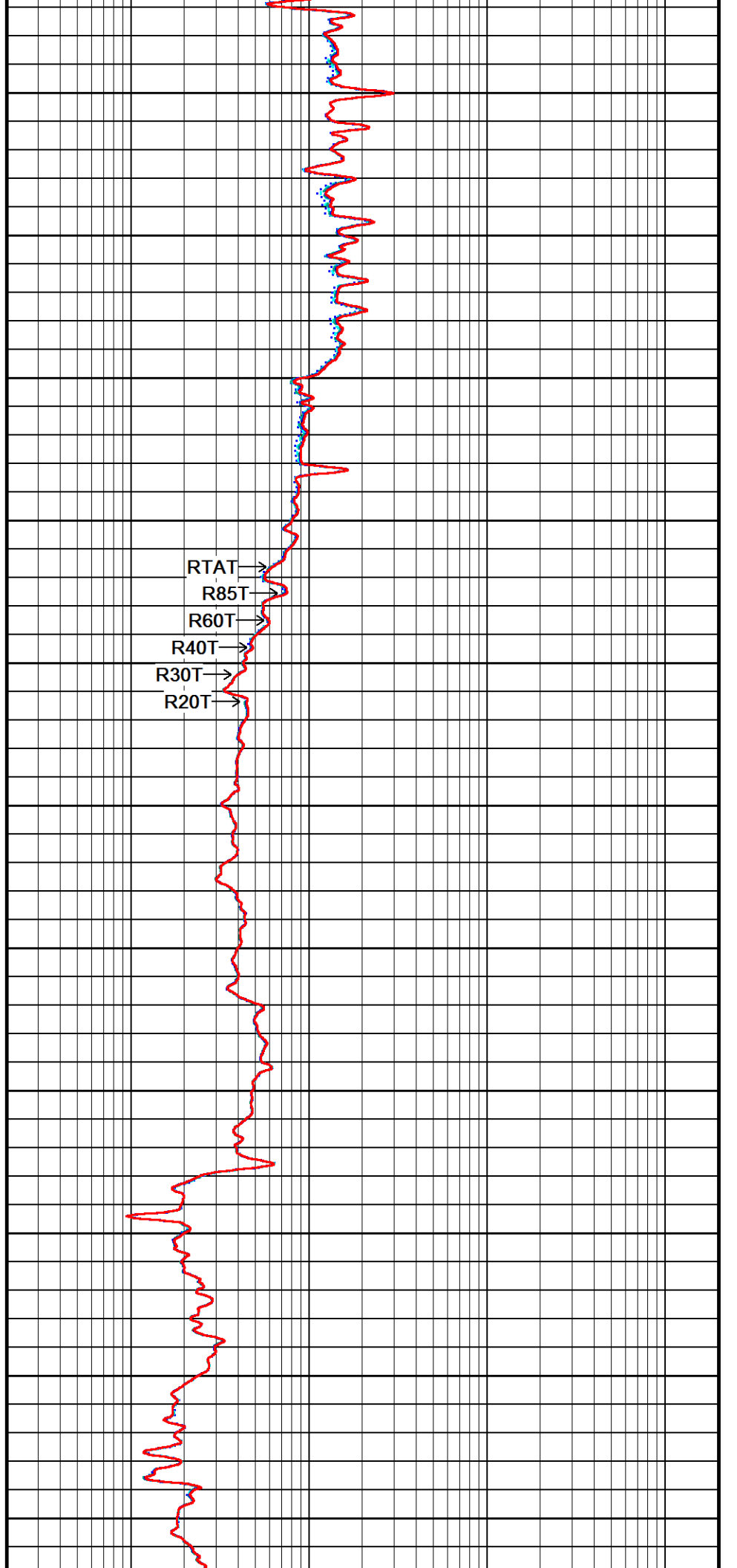
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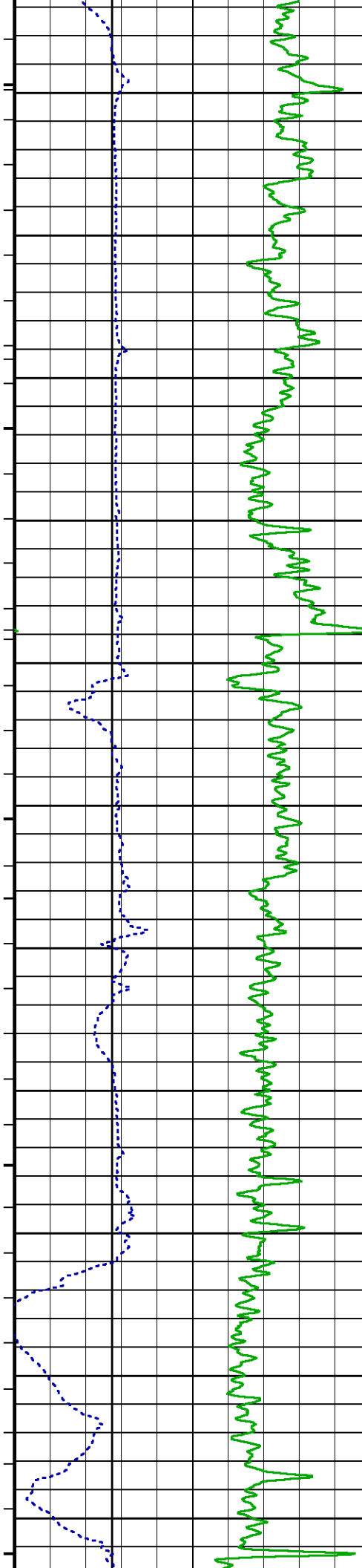
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5200

163°

5300





163°

5400

164°

5500

164°

5600

164°

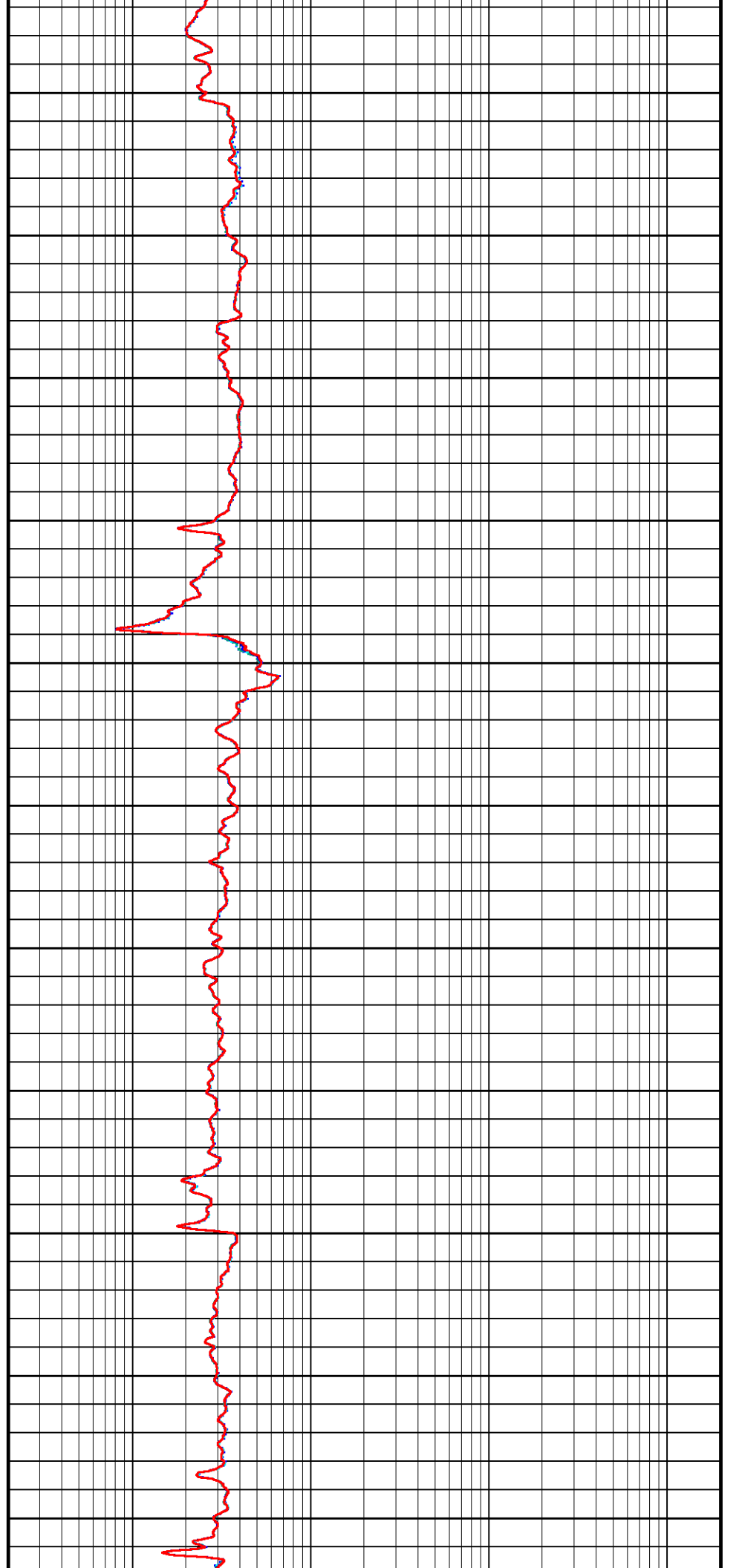
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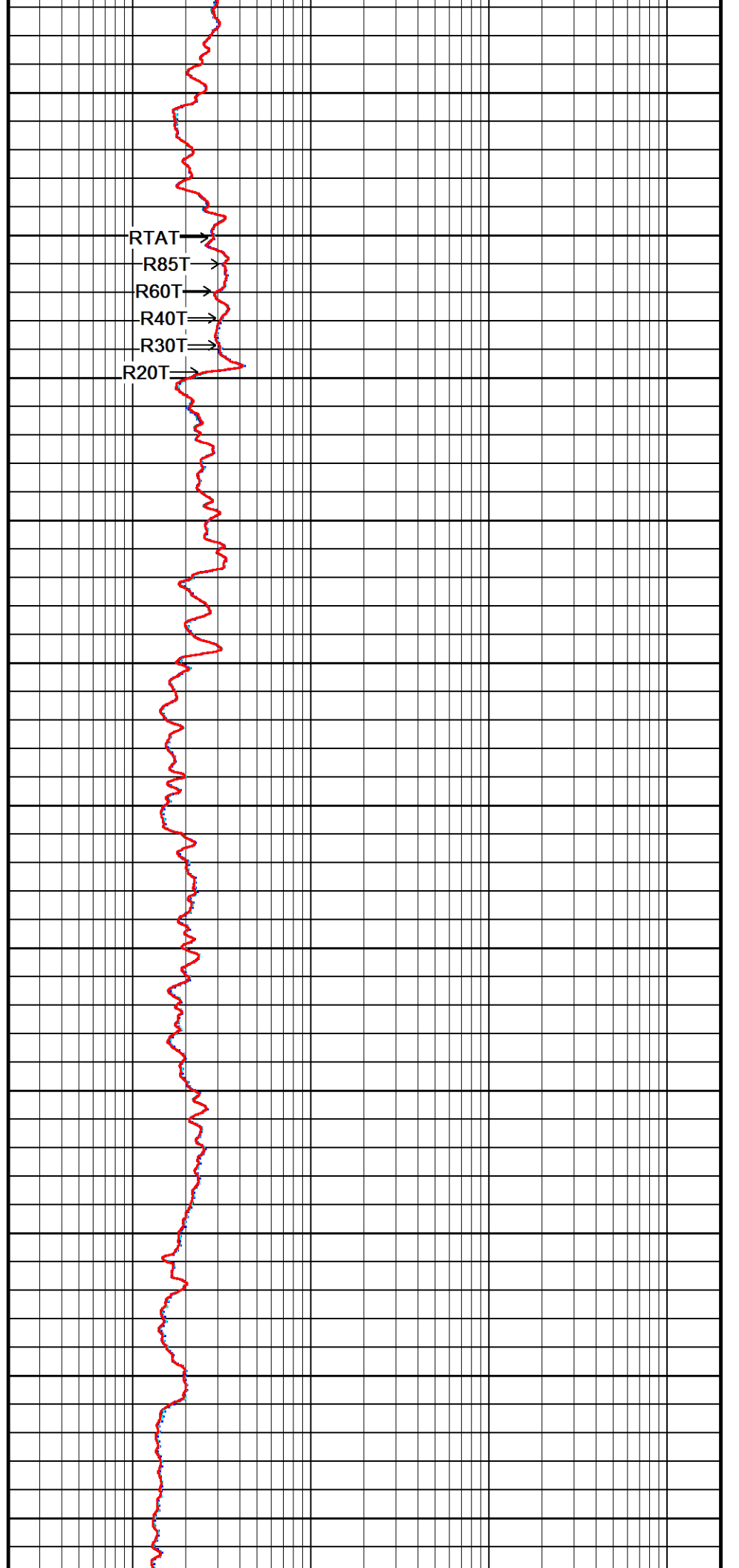
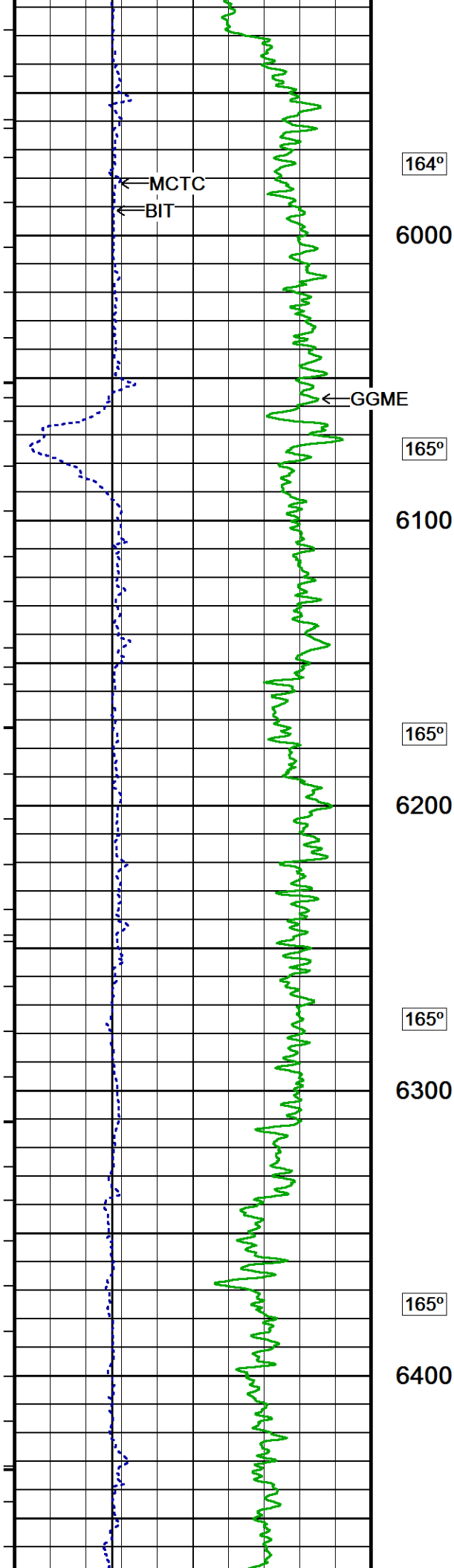
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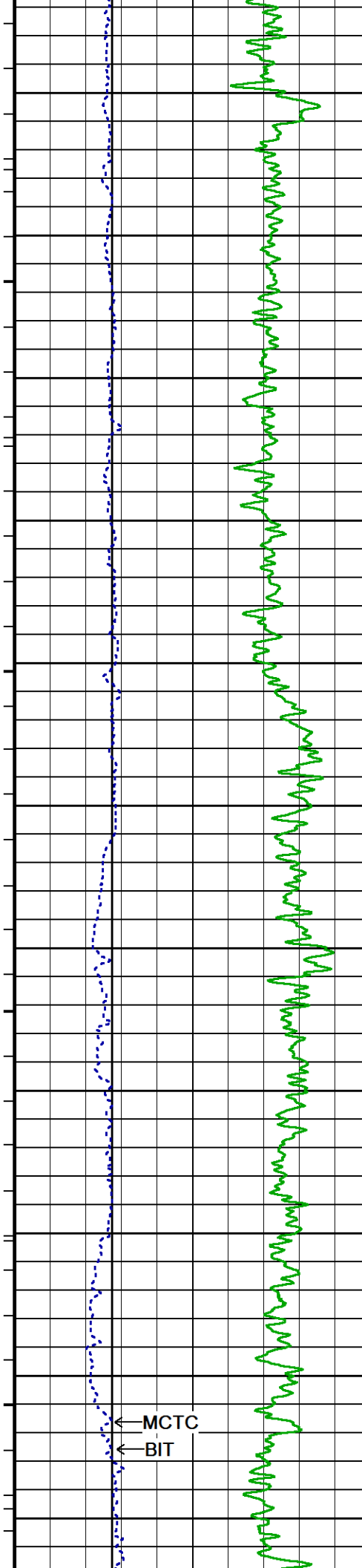
5800

164°

5900







165°

6500

165°

6600

165°

6700

165°

6800

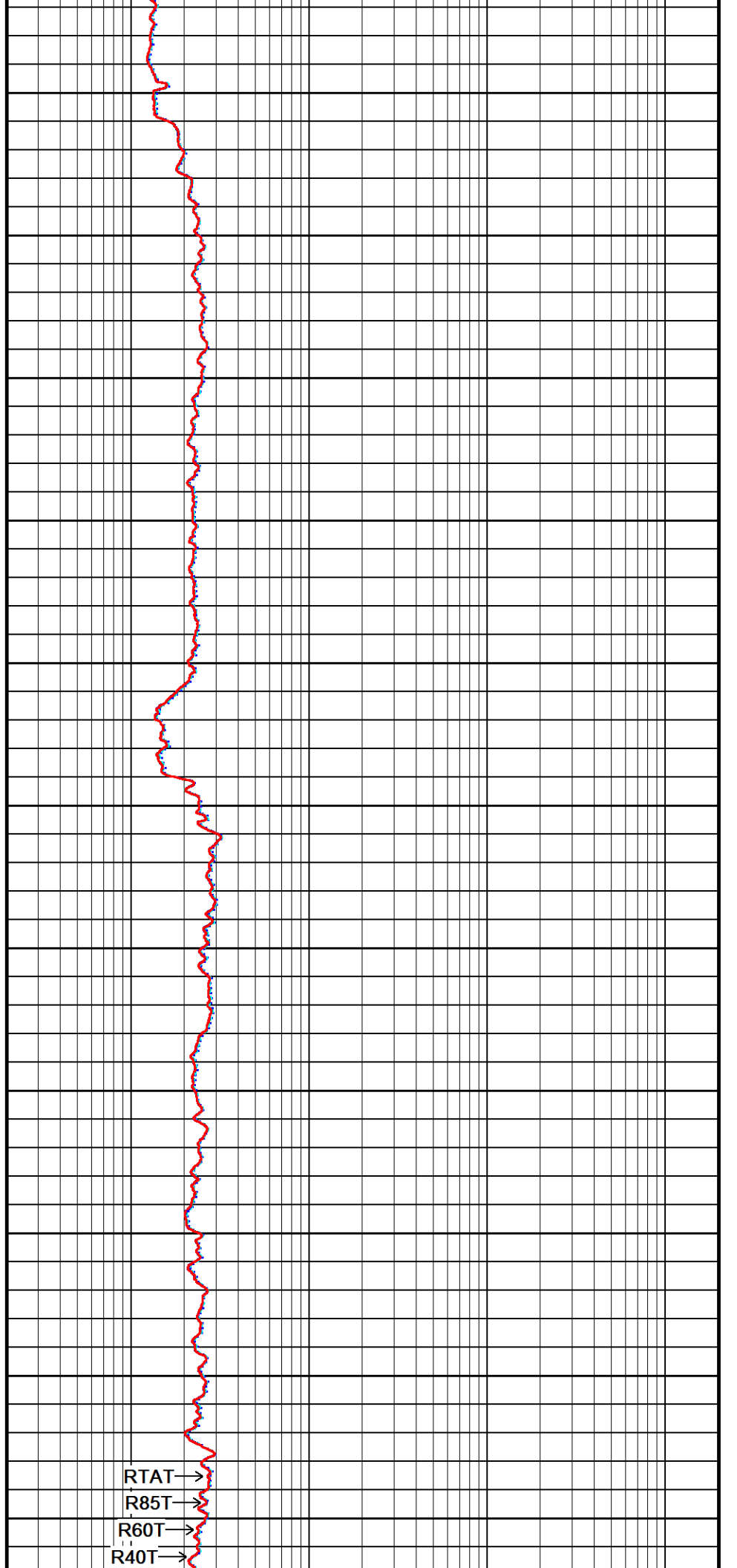
164°

6900

164°

7000

← MCTC
← BIT

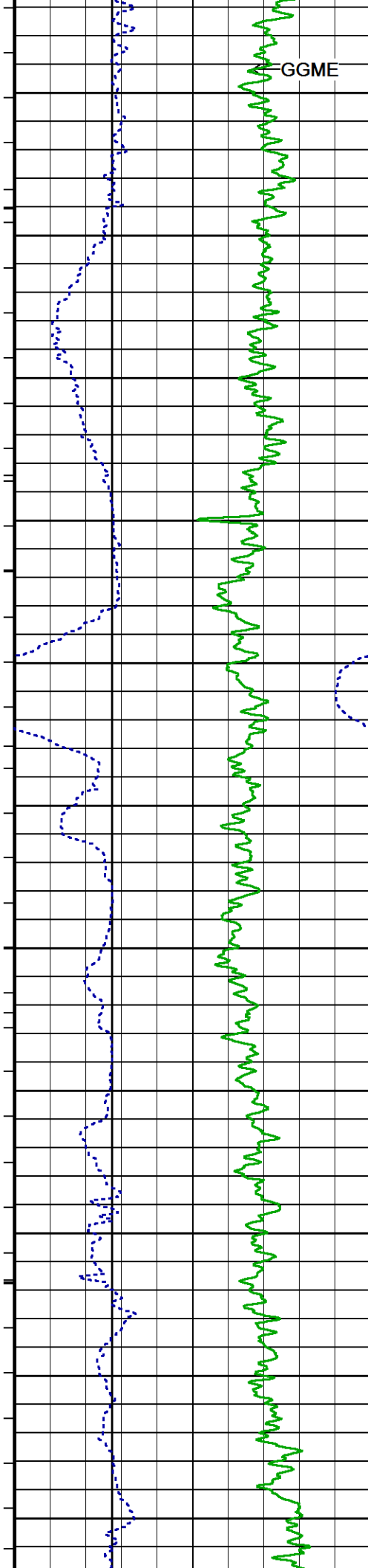


RTAT→

R85T→

R60T→

R40T→



162°

7100

163°

7200

163°

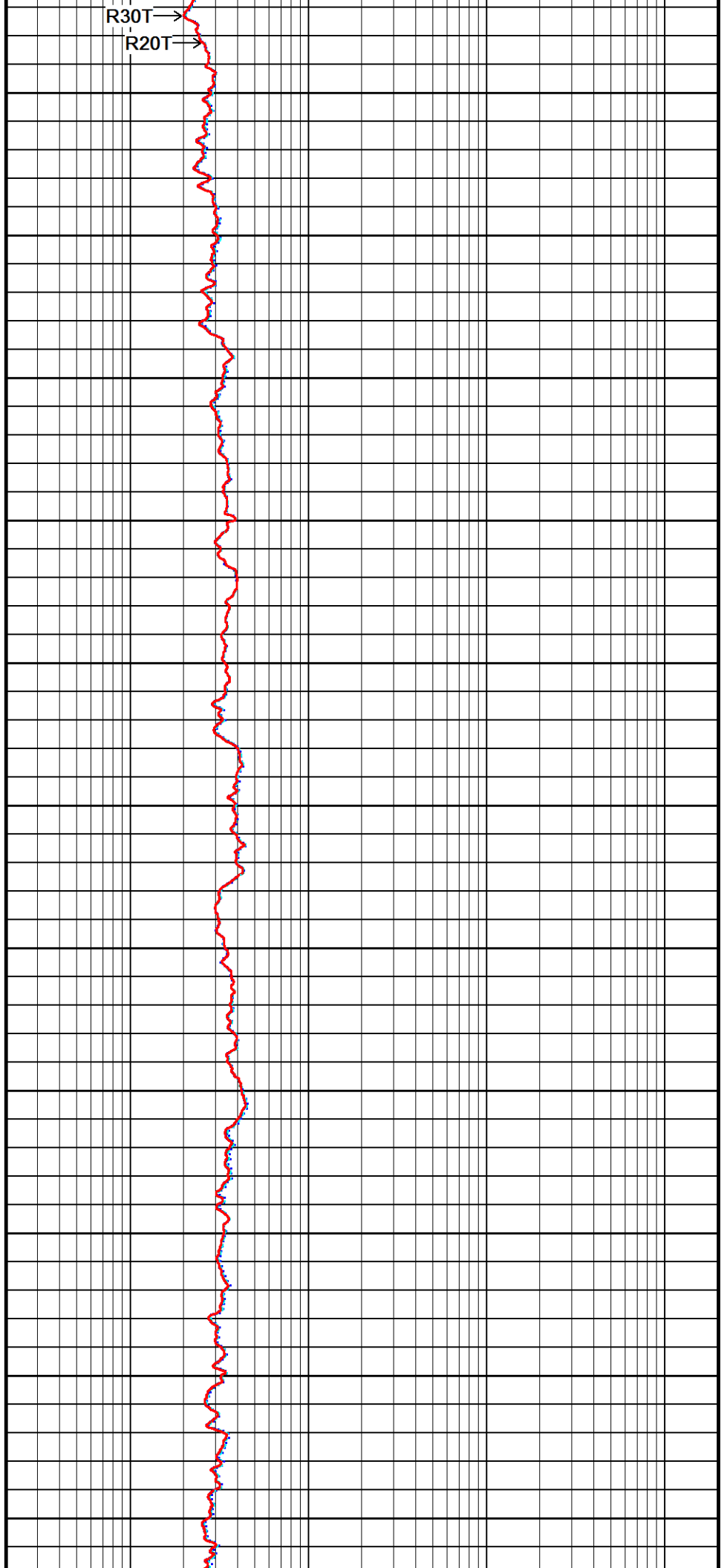
7300

164°

7400

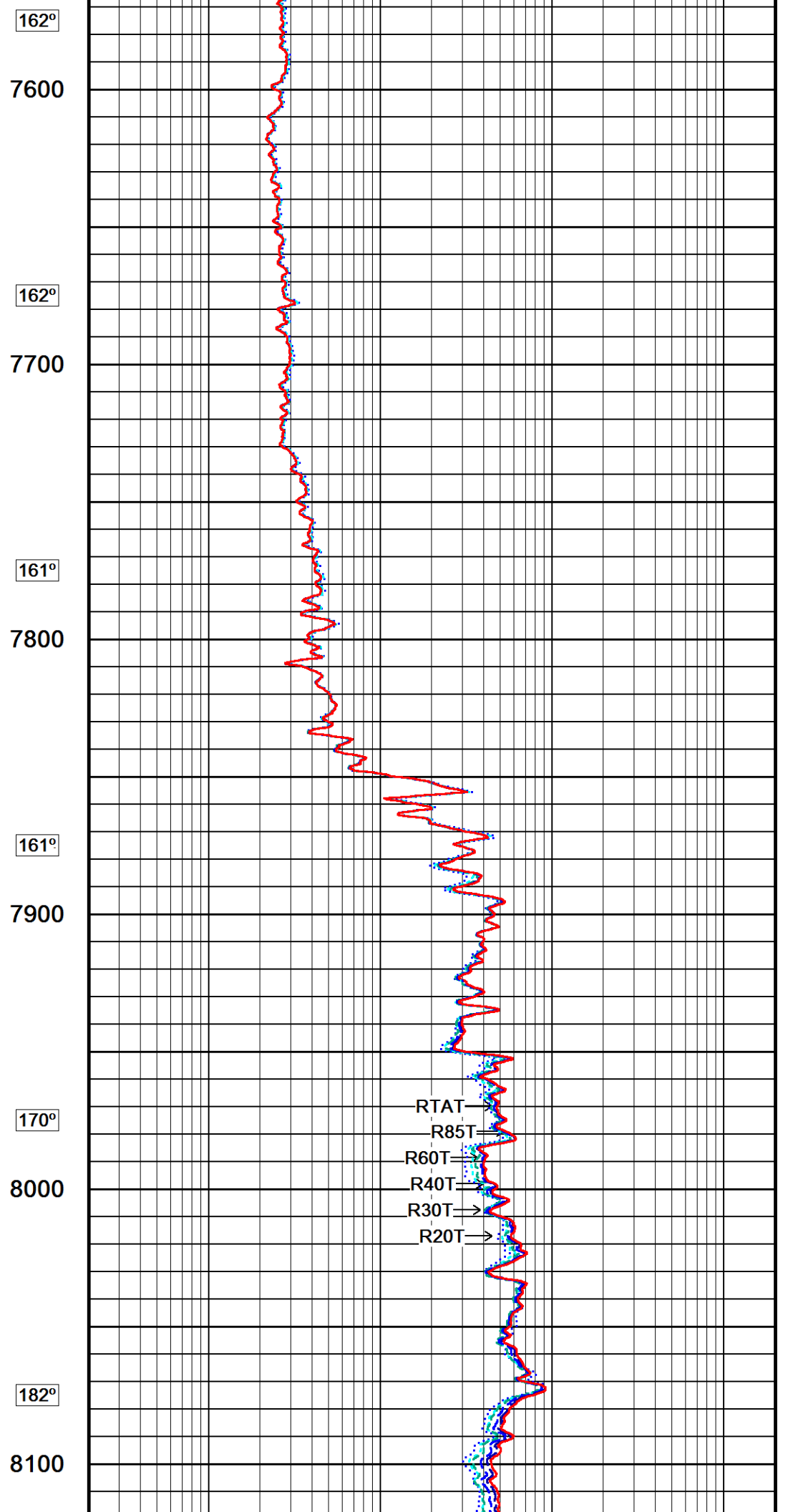
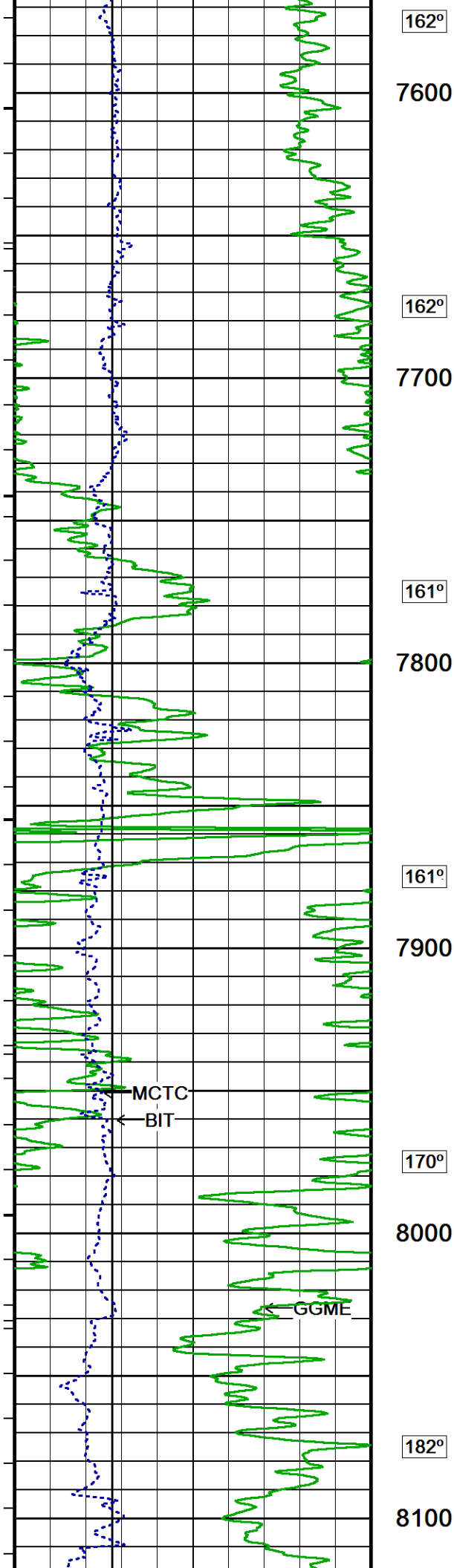
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7500

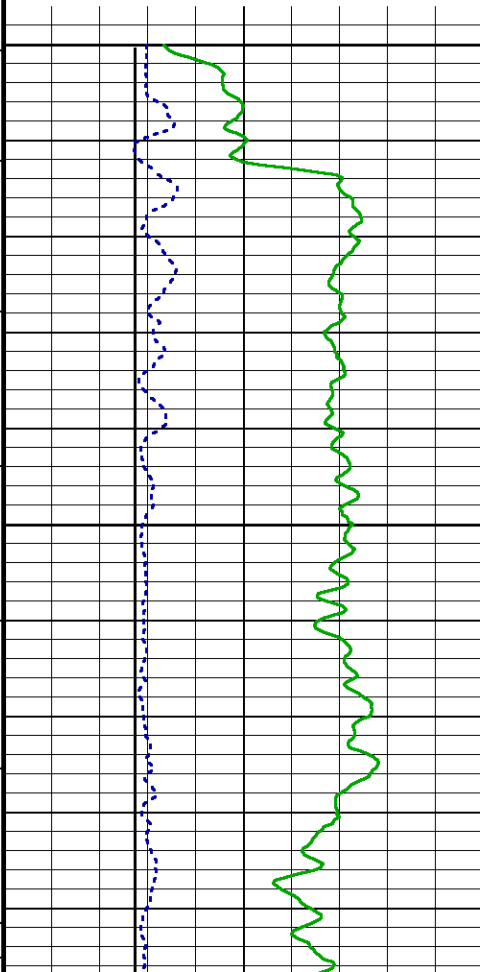
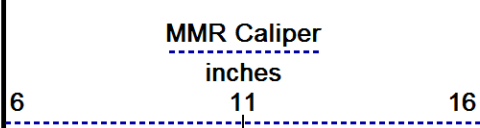
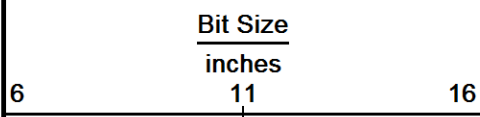
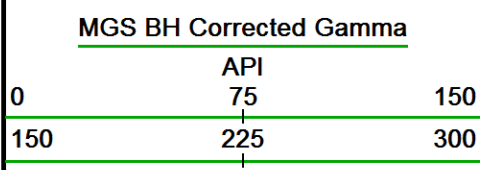


R30T→

R20T→



← Timing Marks
every 60.0 sec



Depth
in
Feet

Borehole
Temp in
deg F

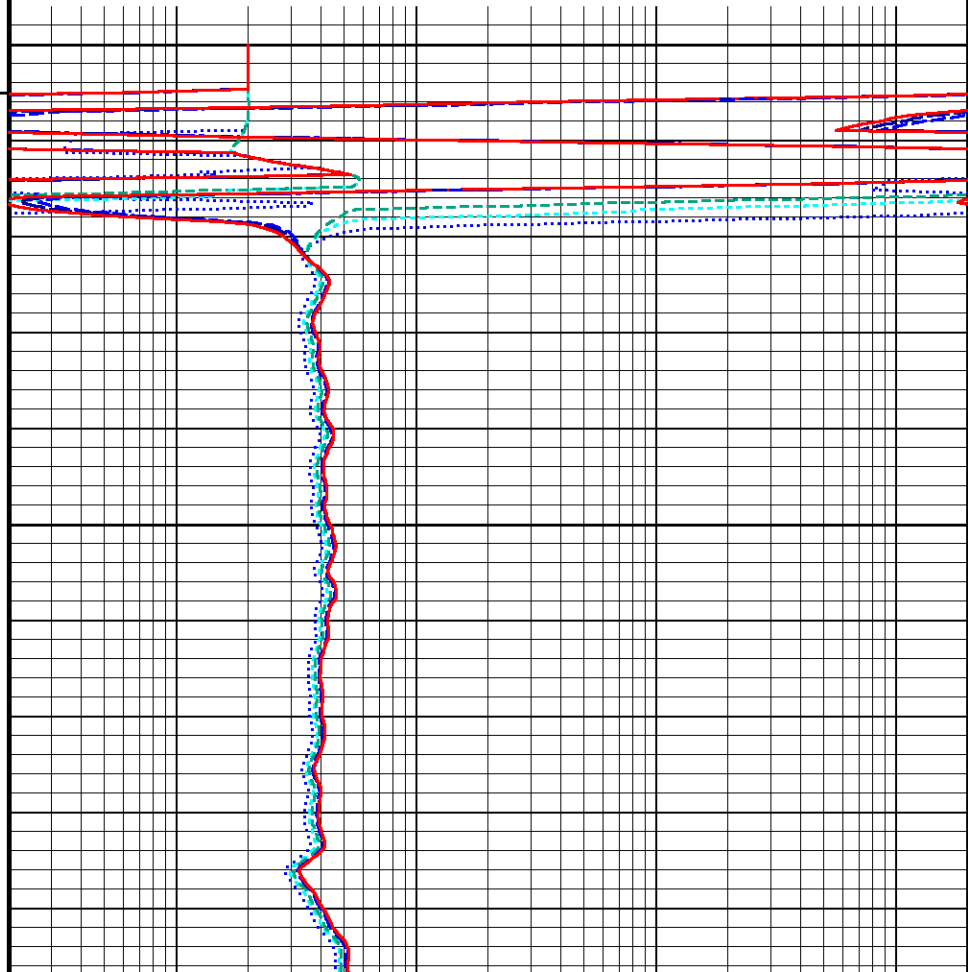
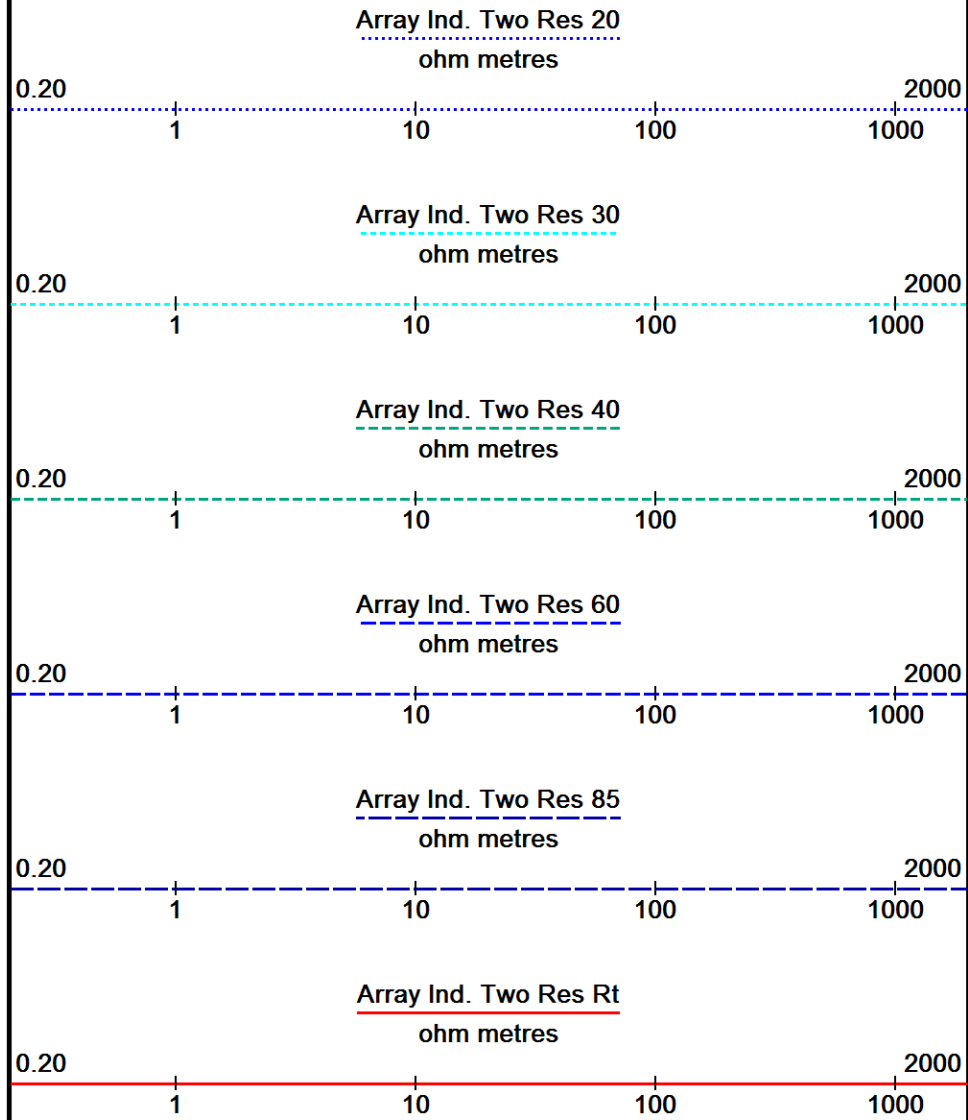
Replay
Scale
1:240

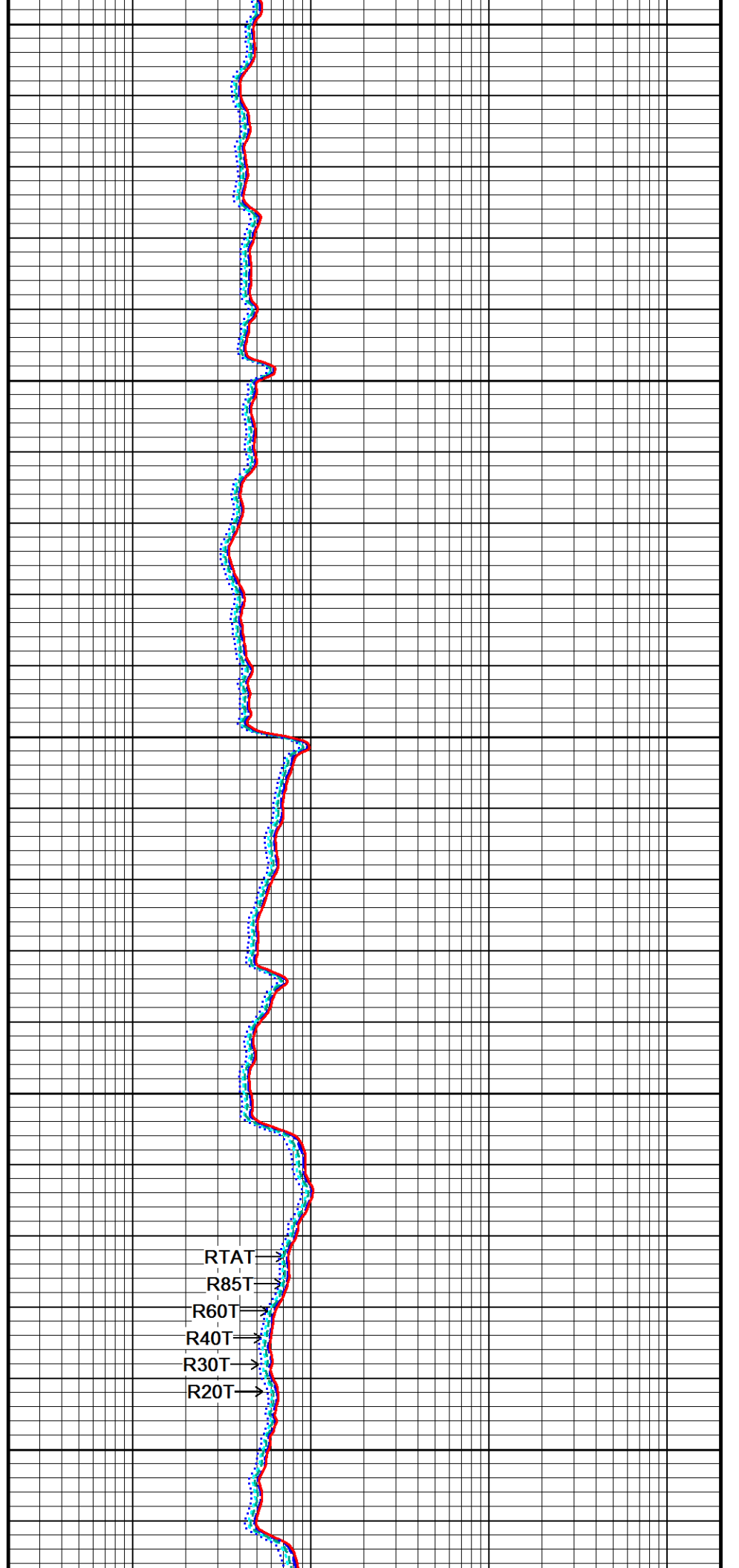
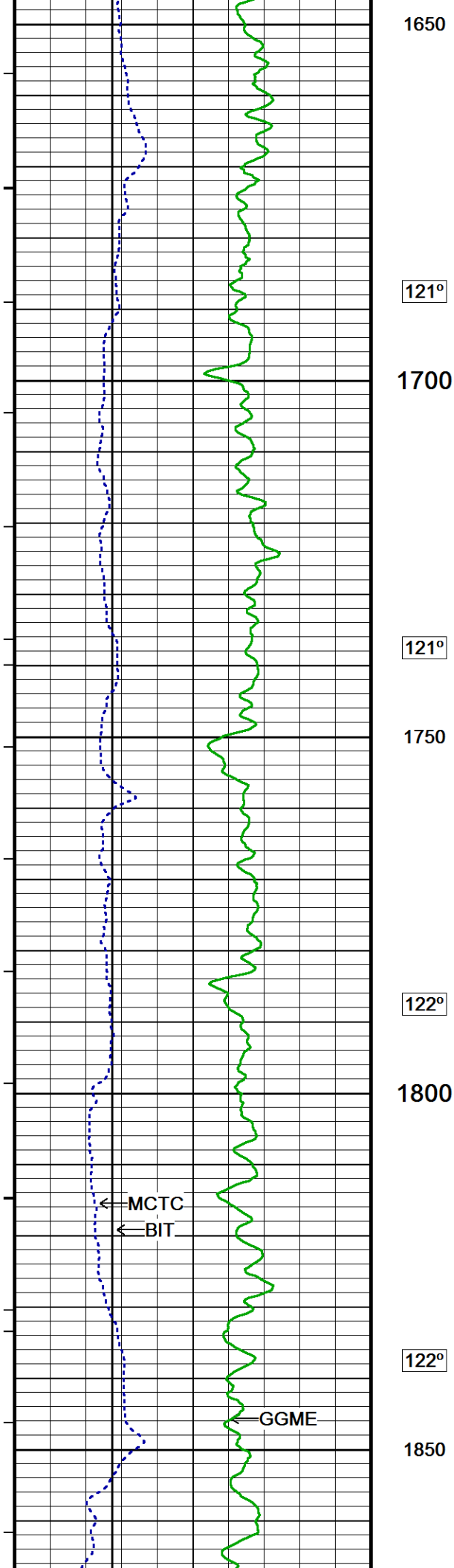
C1550g
Shoe

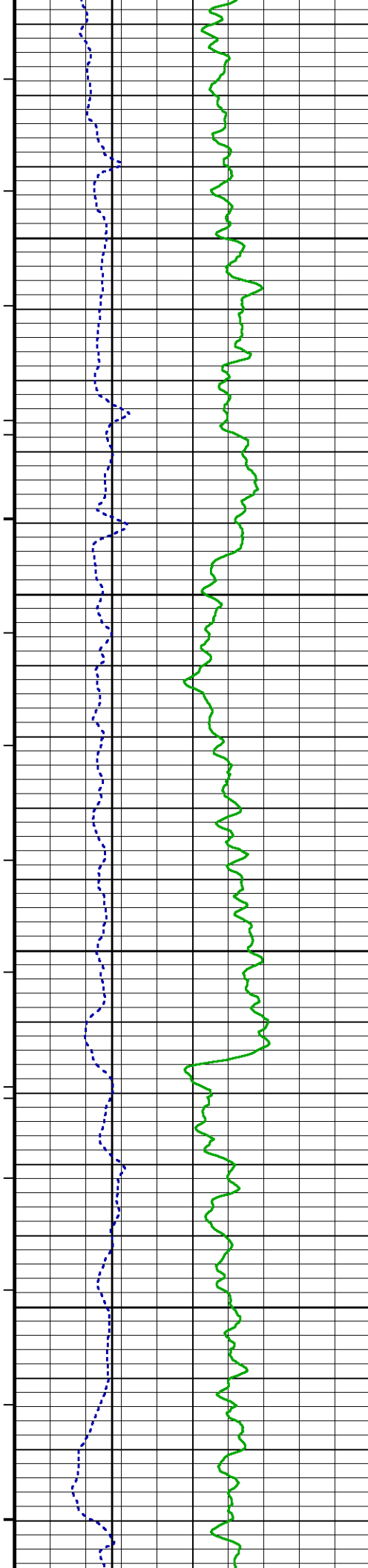
119°

1600

120°







123°

1900

123°

1950

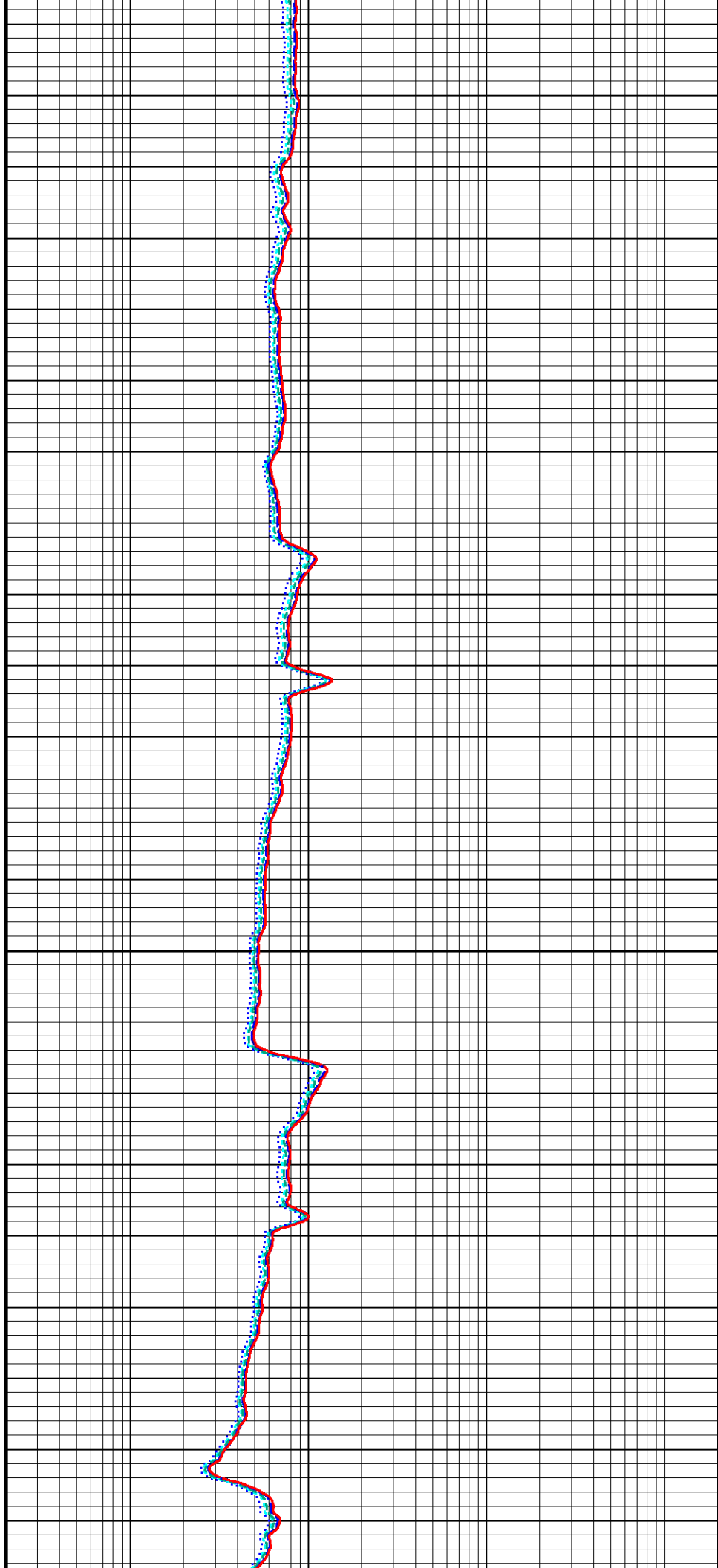
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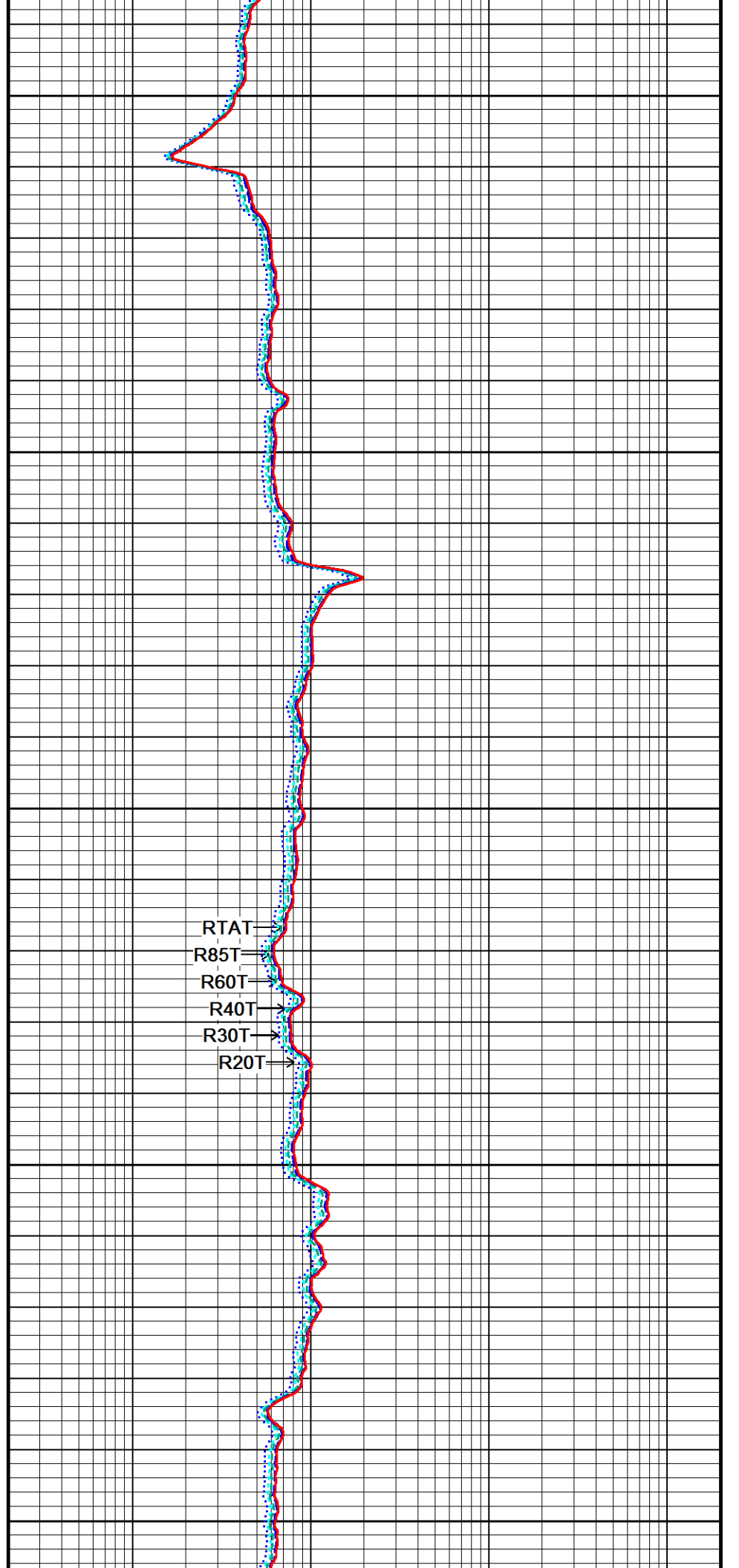
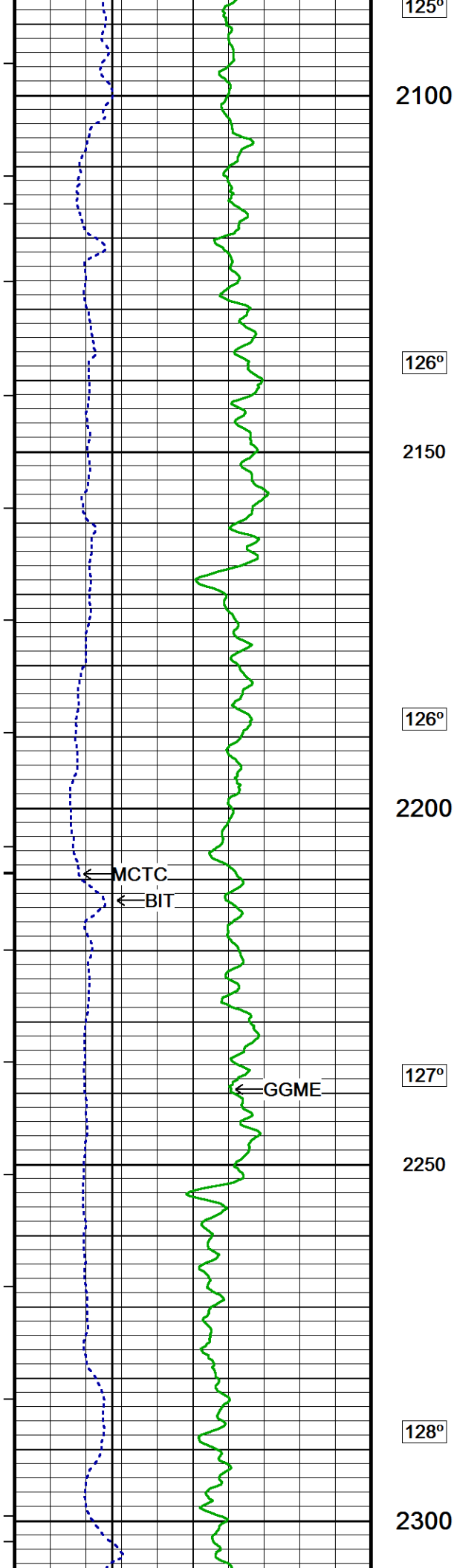
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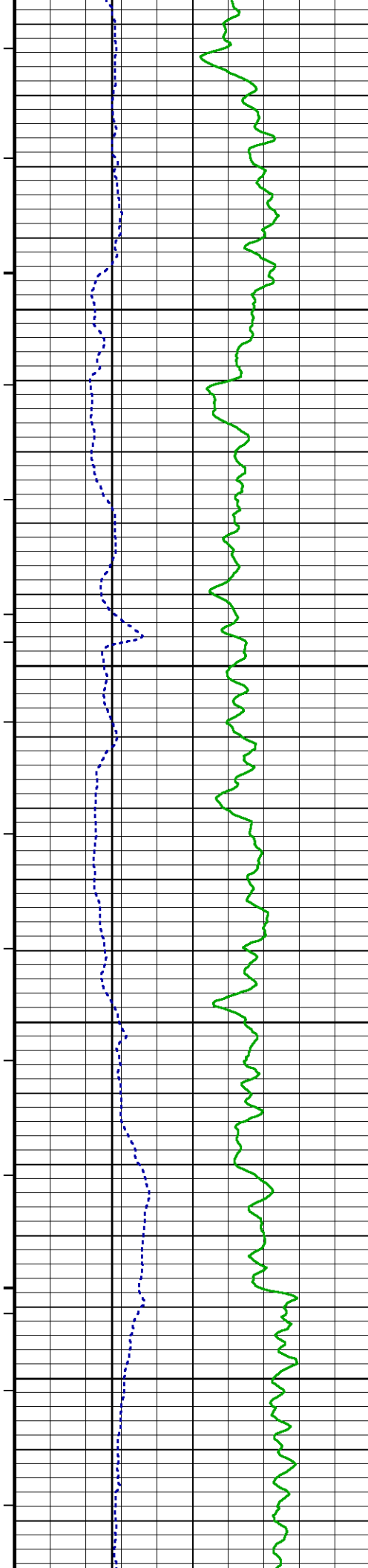
124°

2050

125°







129°

2350

130°

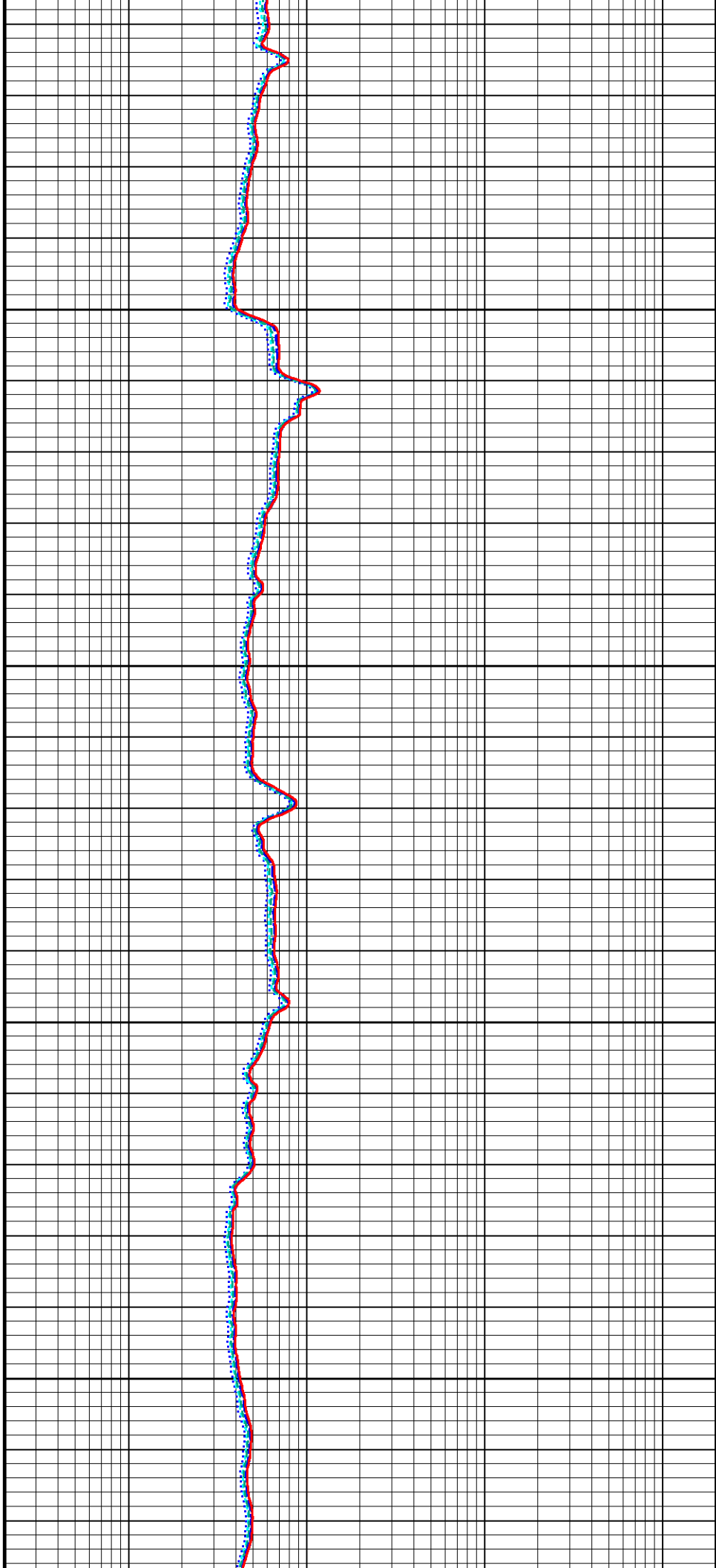
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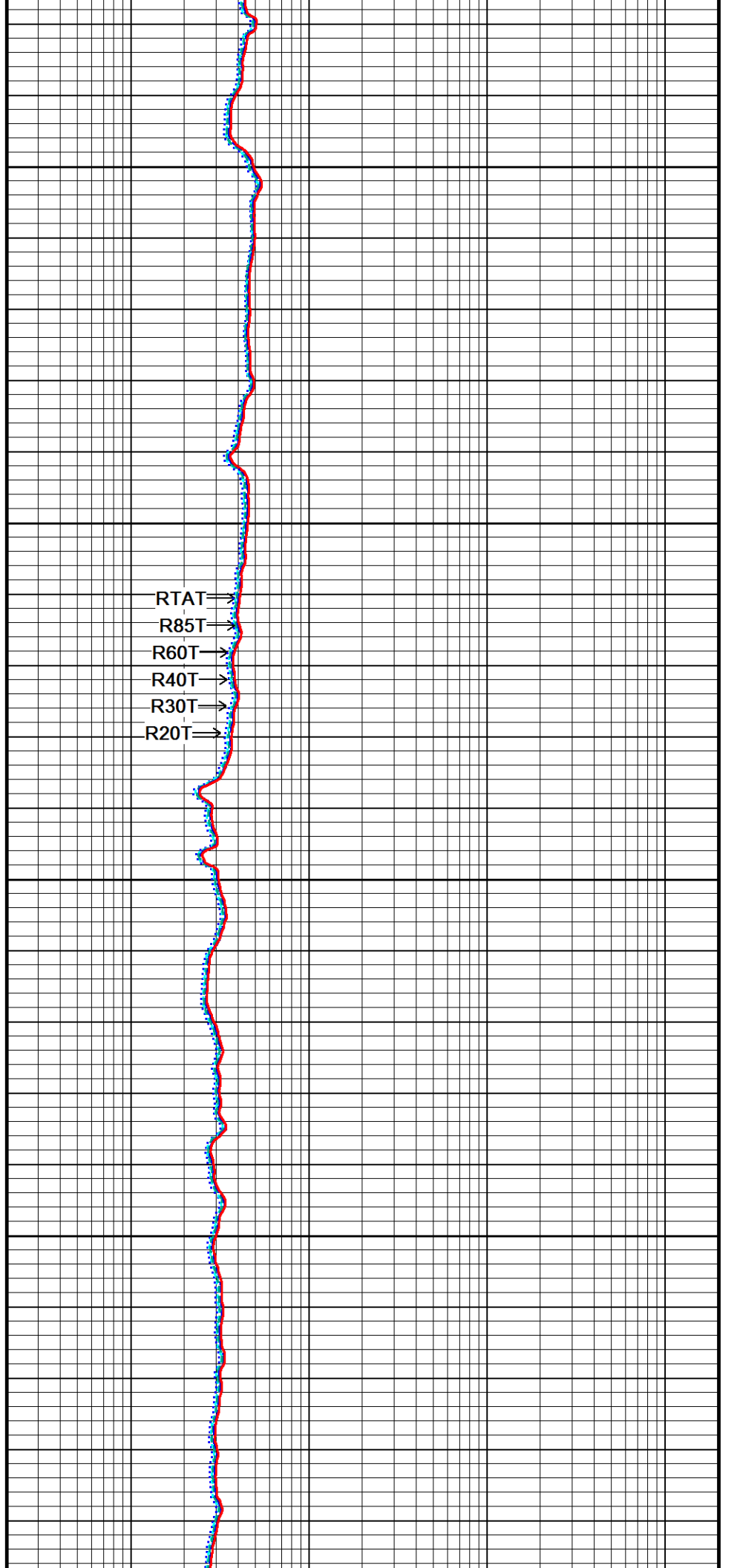
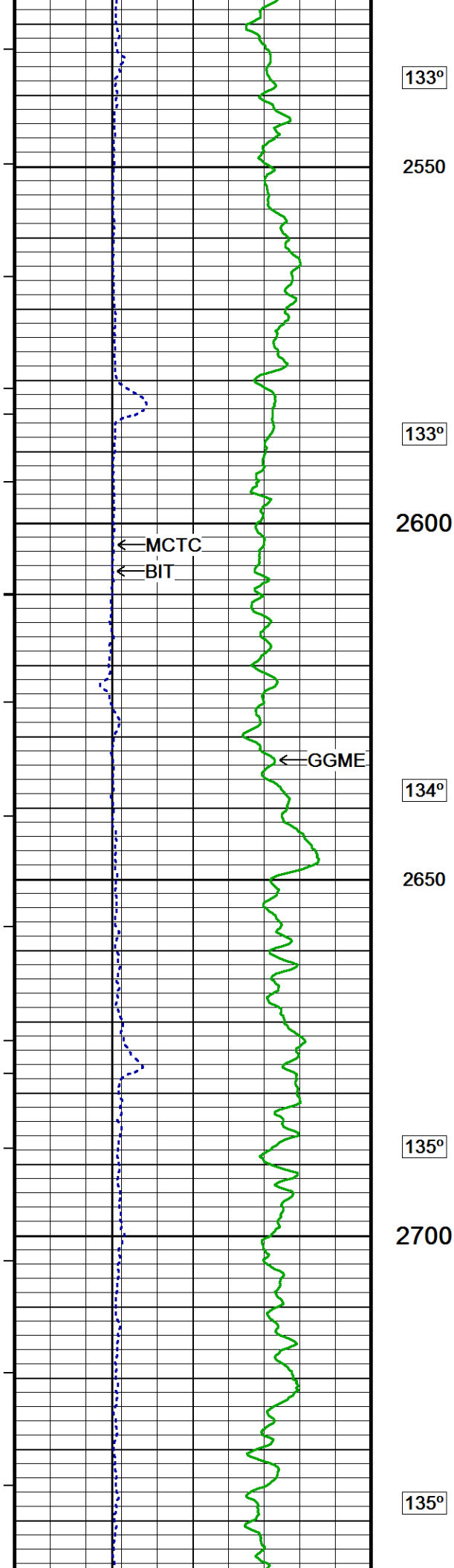
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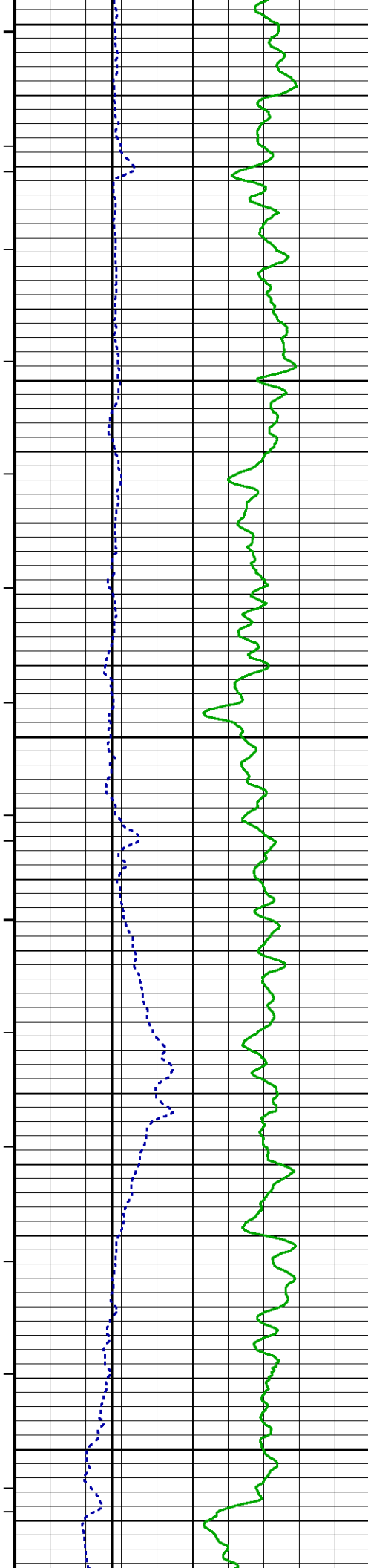
2450

132°

2500







2750

136°

2800

137°

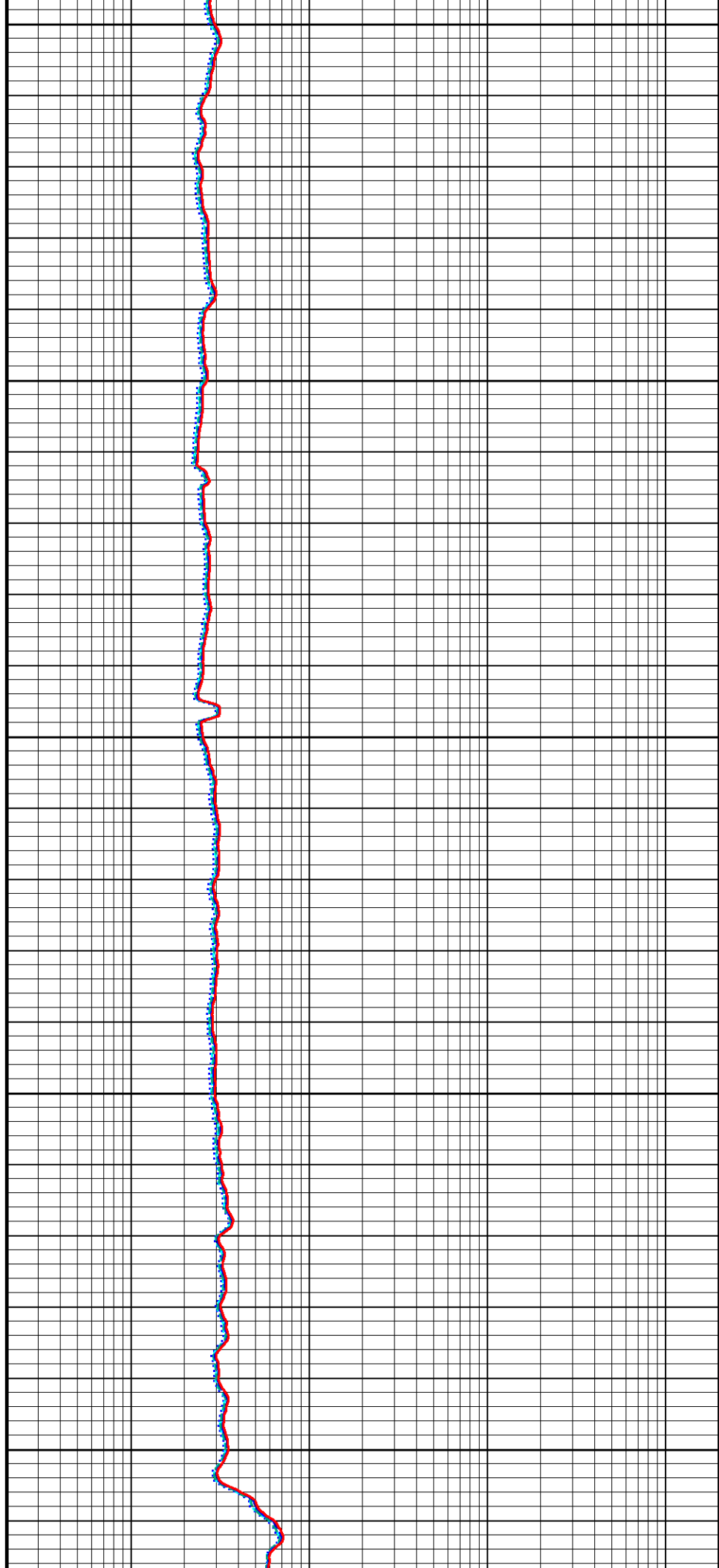
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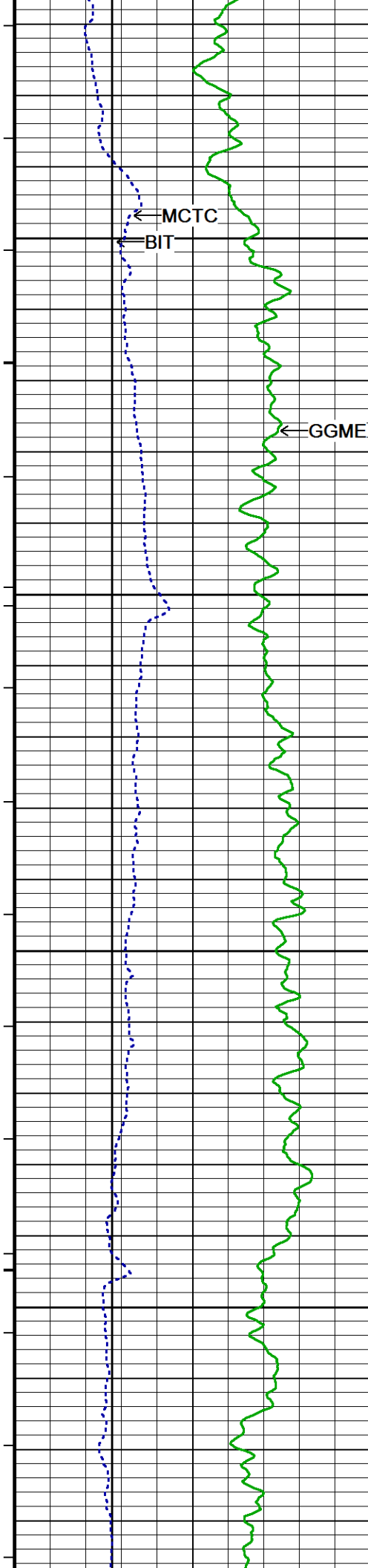
138°

2900

138°

2950





139°

3000

140°

3050

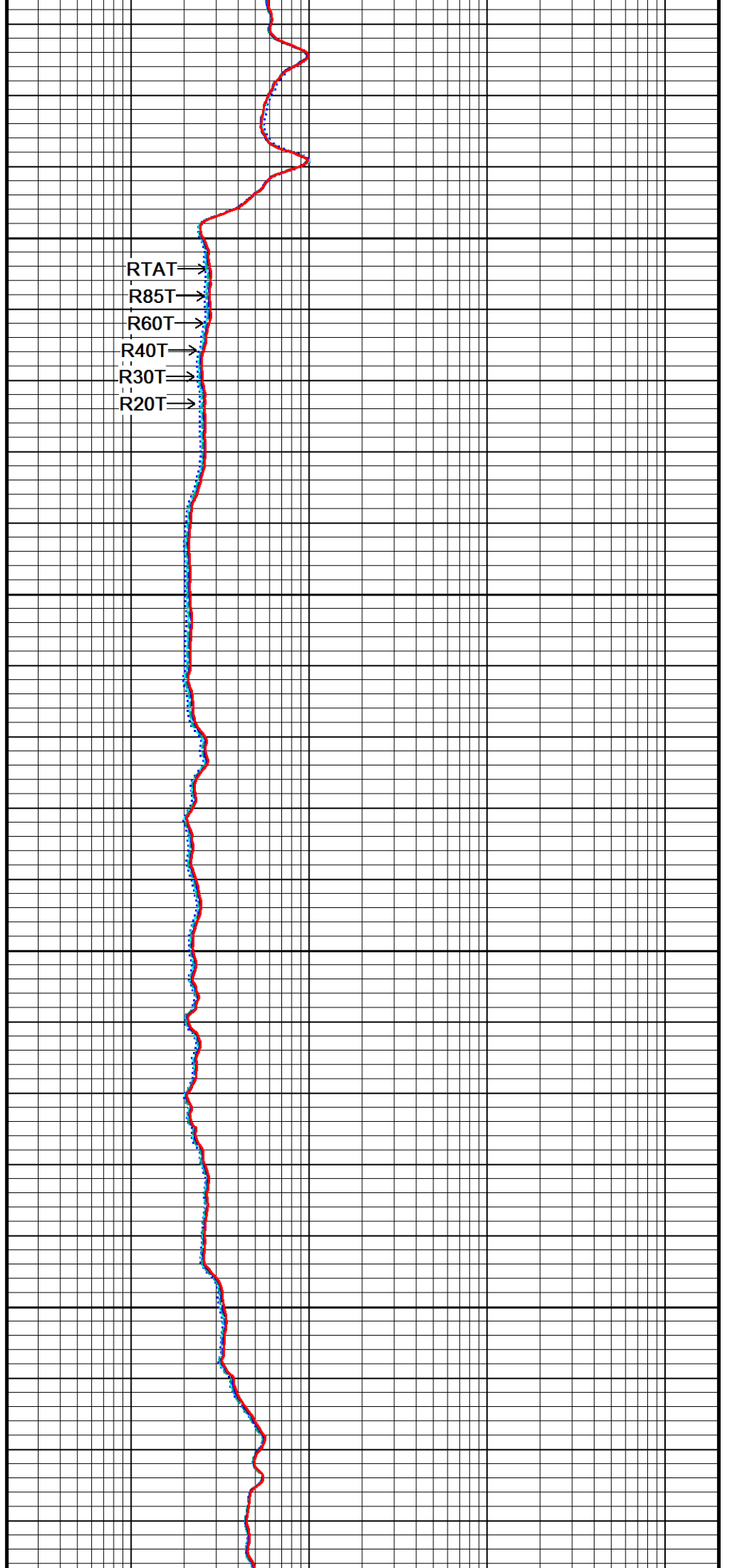
141°

3100

141°

3150

3200



RTAT⇒

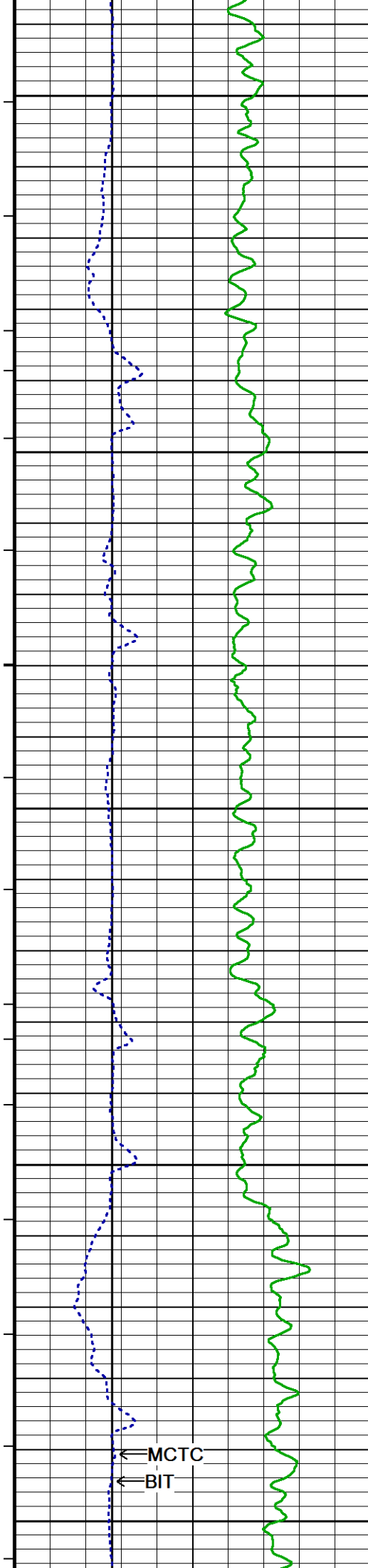
R85T⇒

R60T⇒

R40T⇒

R30T⇒

R20T⇒



142°

3200

142°

3250

143°

3300

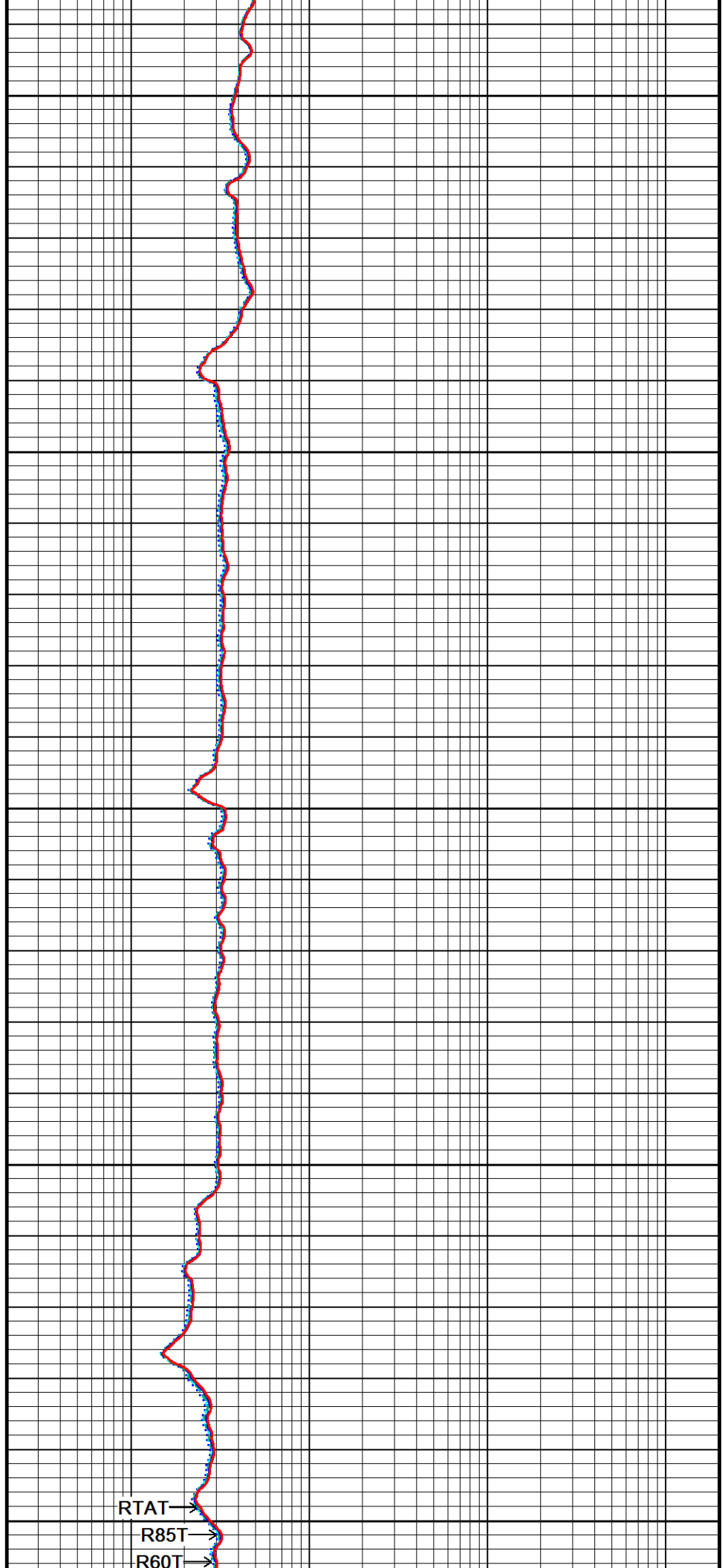
144°

3350

144°

3400

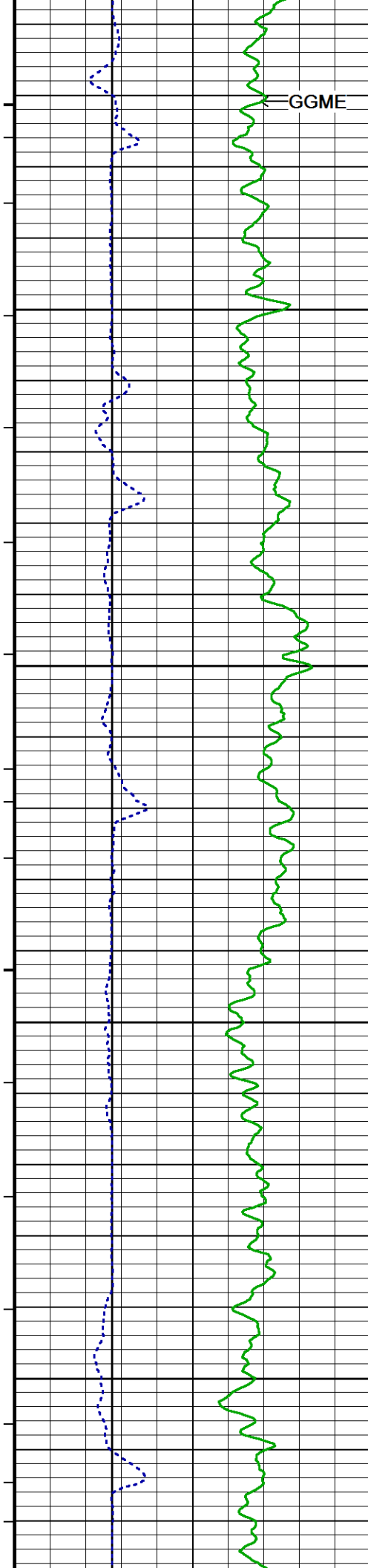
←MCTC
←BIT



RTAT→

R85T→

R60T→



145°

3450

145°

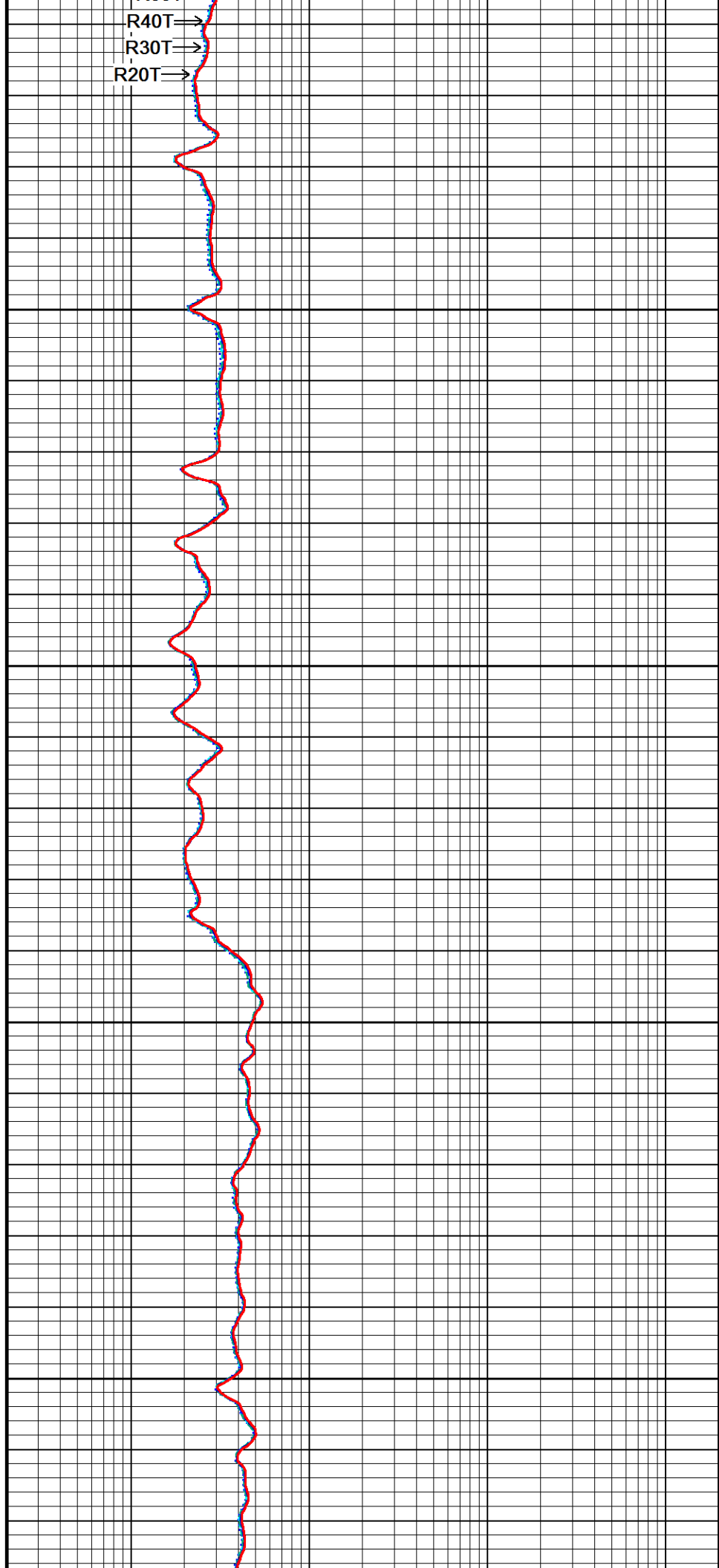
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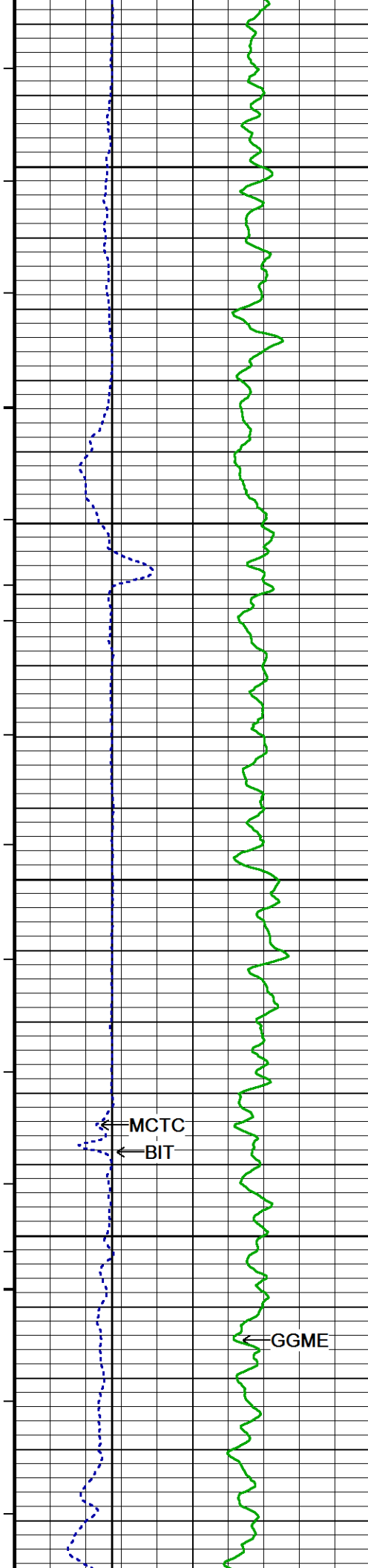
146°

3550

147°

3600





147°

3650

148°

3700

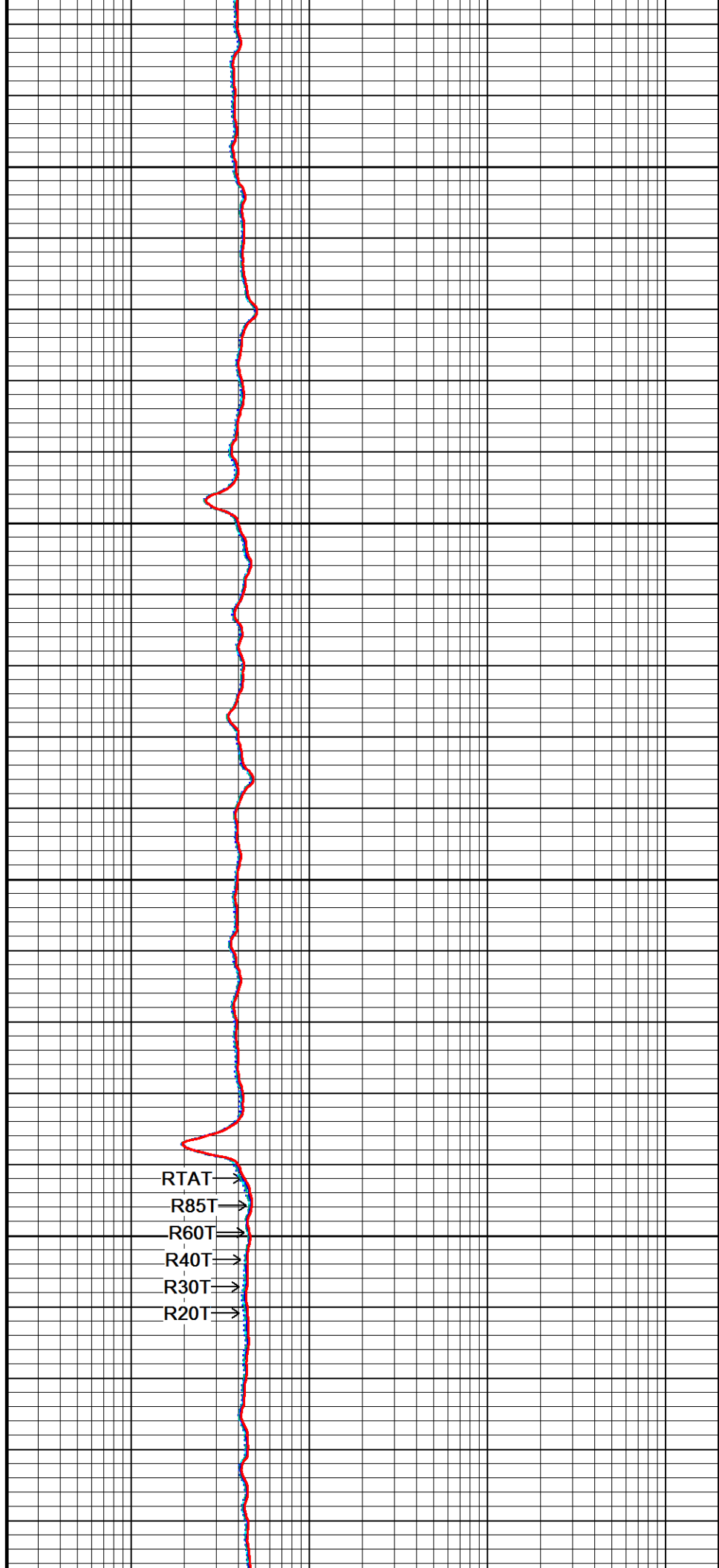
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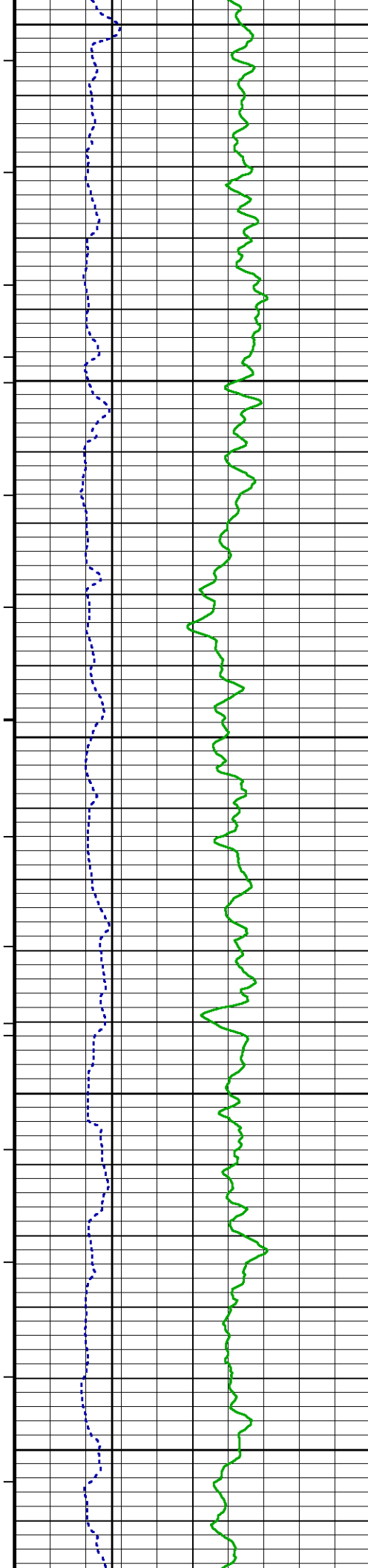
3750

149°

3800

149°





3850

150°

3900

151°

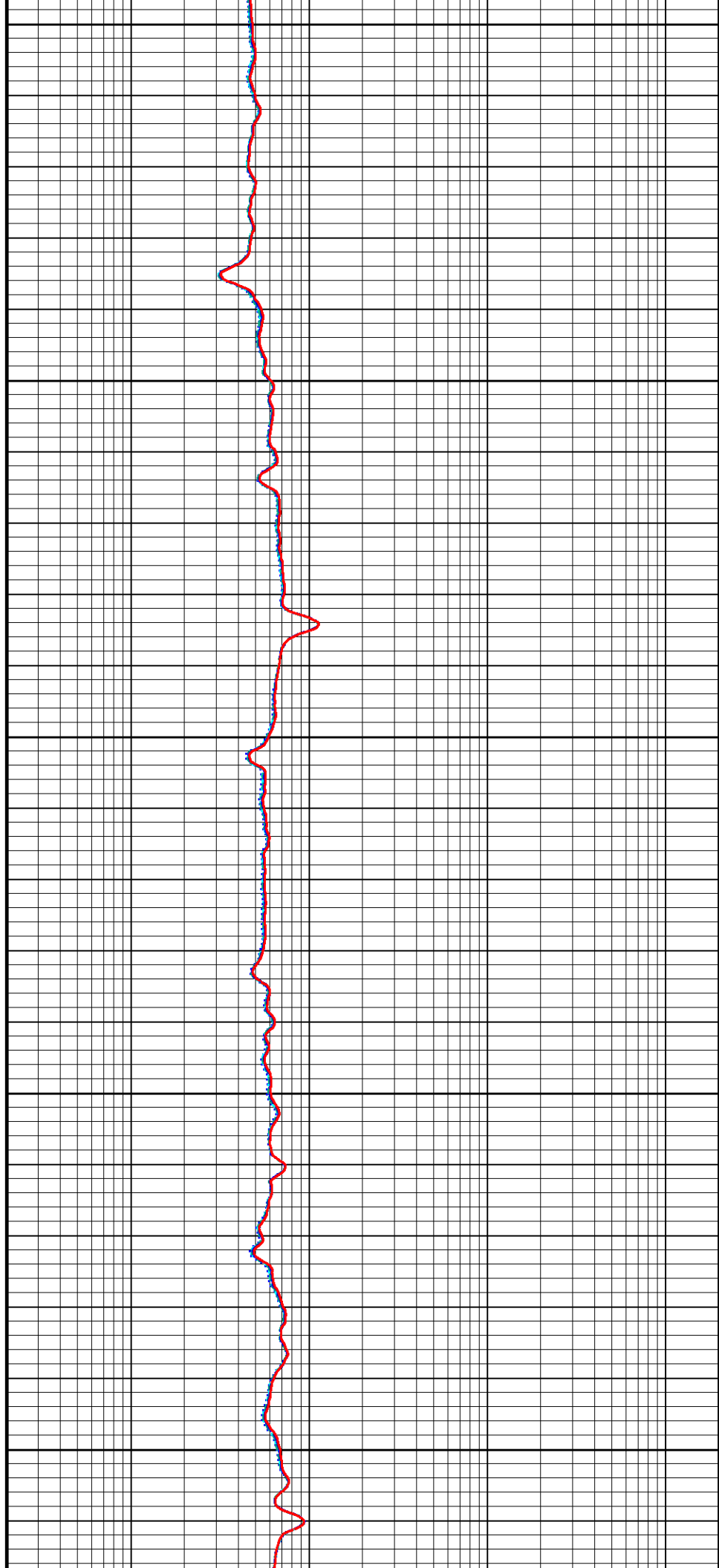
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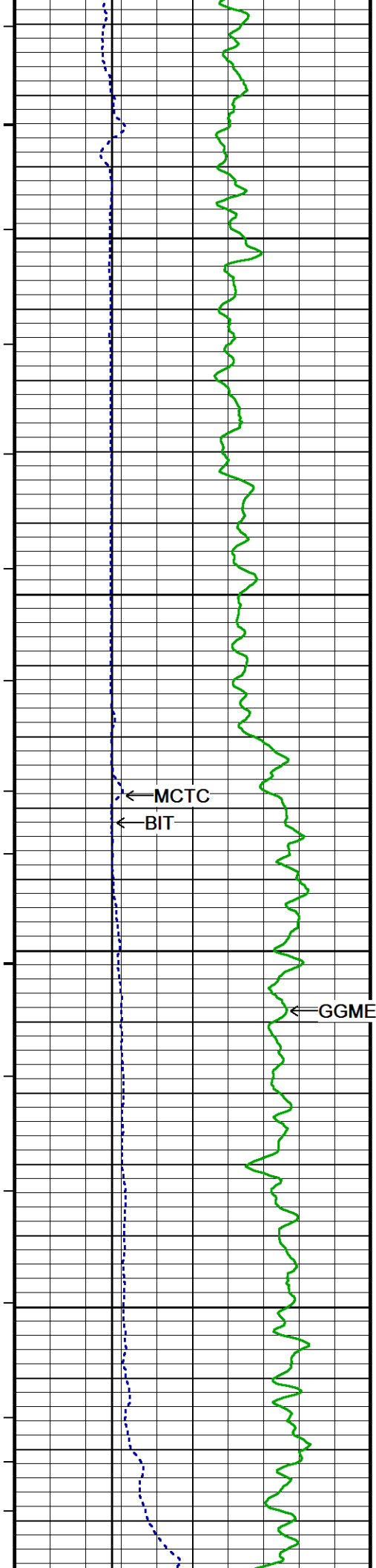
151°

4000

152°

4050





152°

4100

153°

4150

154°

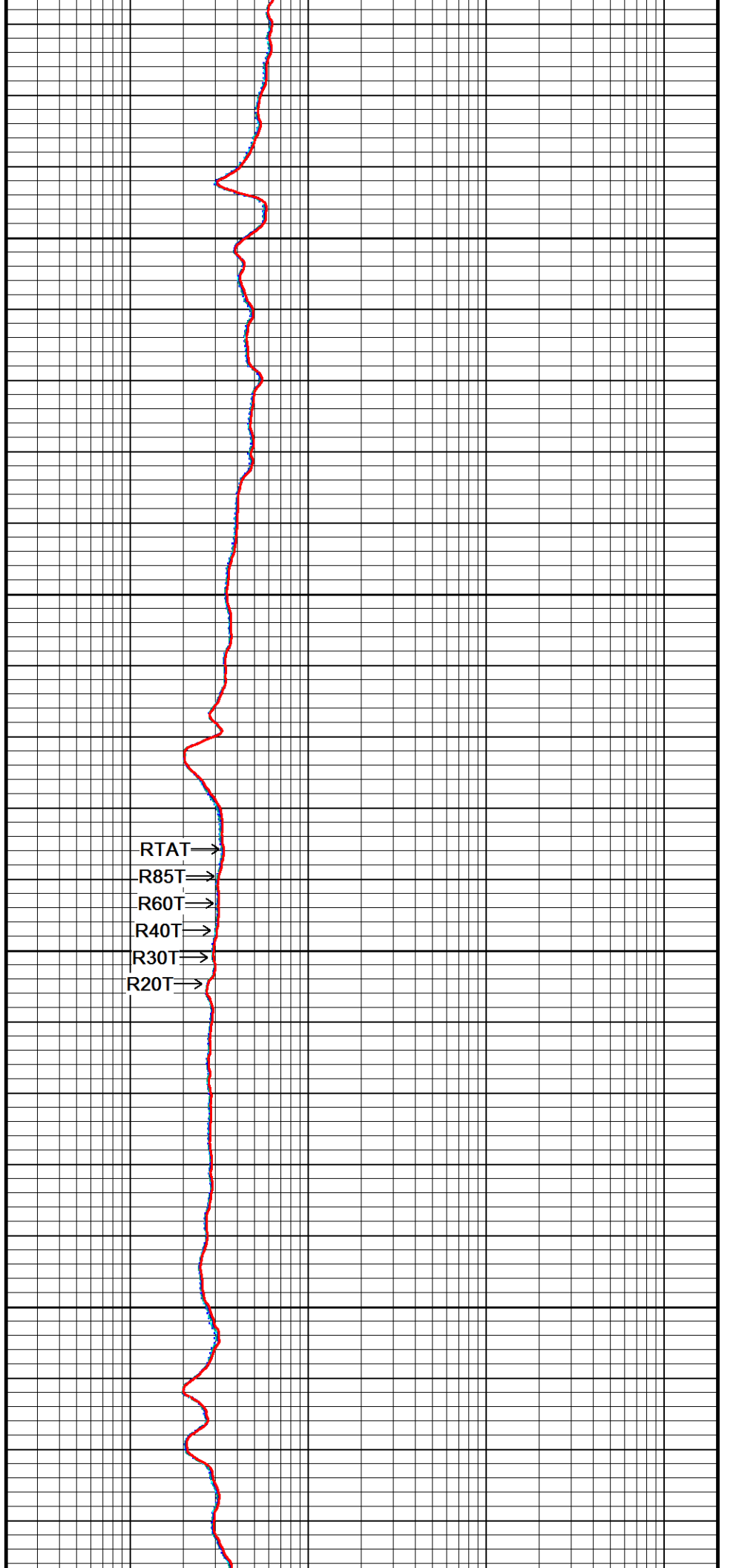
4200

← GGME

154°

4250

4300



RTAT →

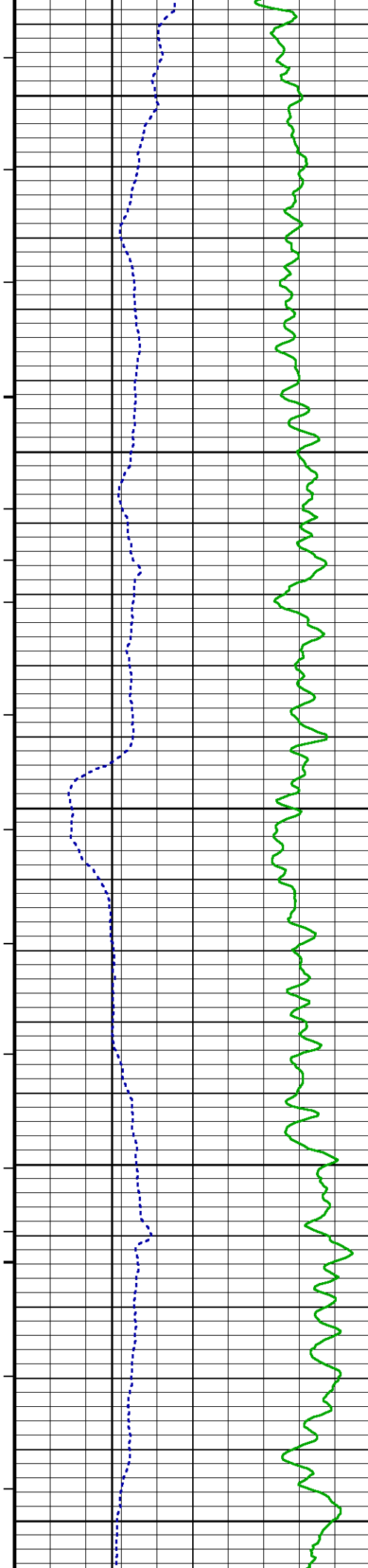
R85T →

R60T →

R40T →

R30T →

R20T →



155°

4300

155°

4350

156°

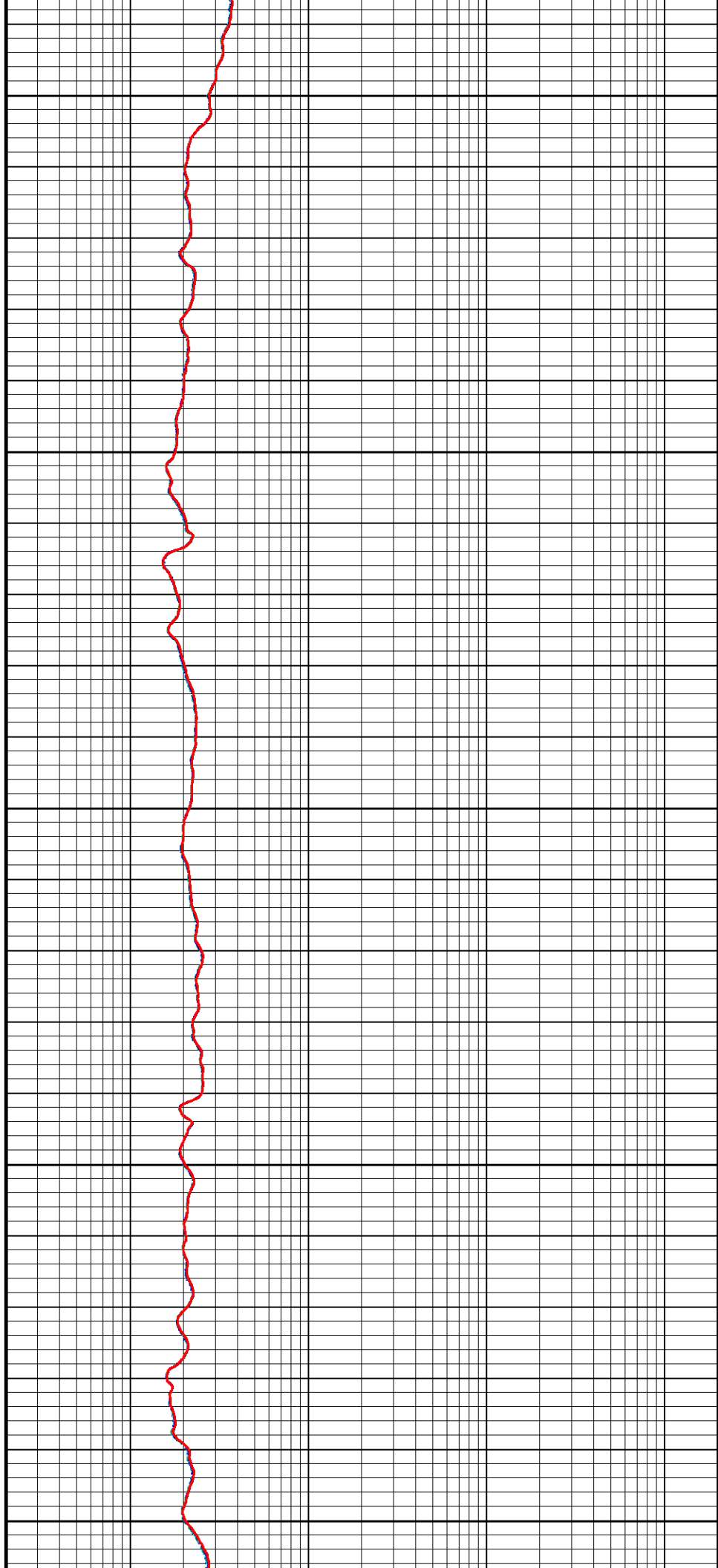
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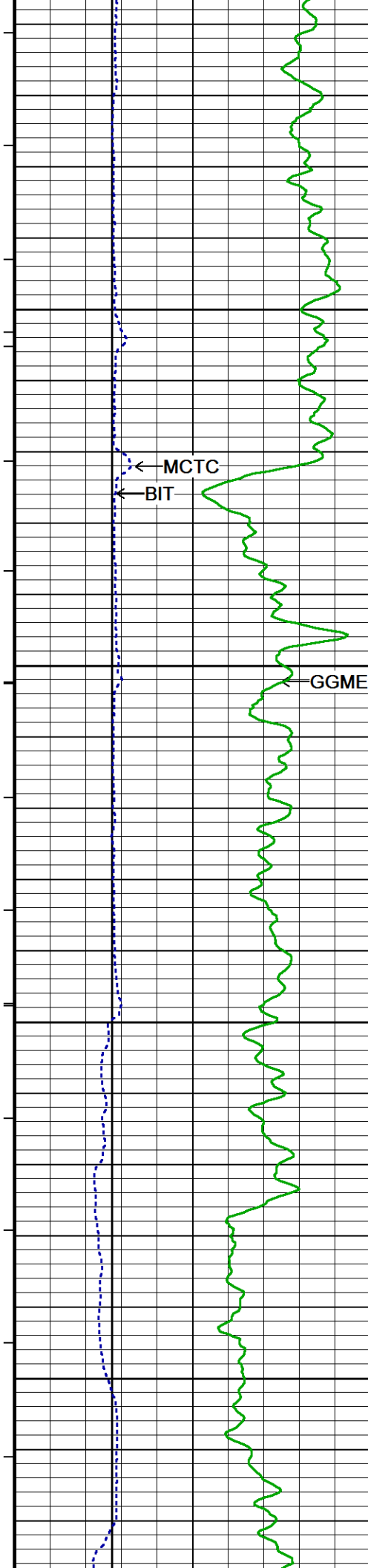
157°

4450

157°

4500





158°

4550

← MCTC
← BIT

158°

4600

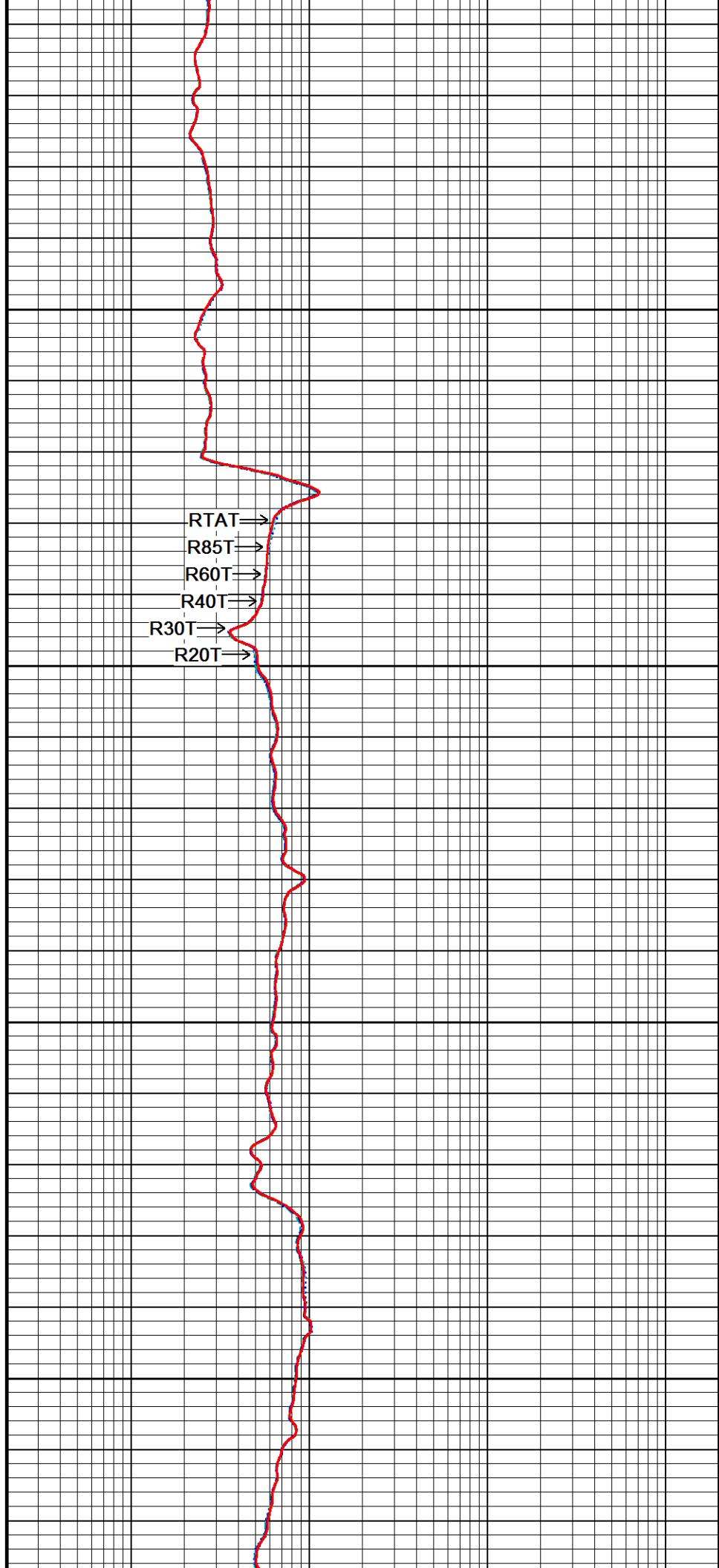
← GGME

159°

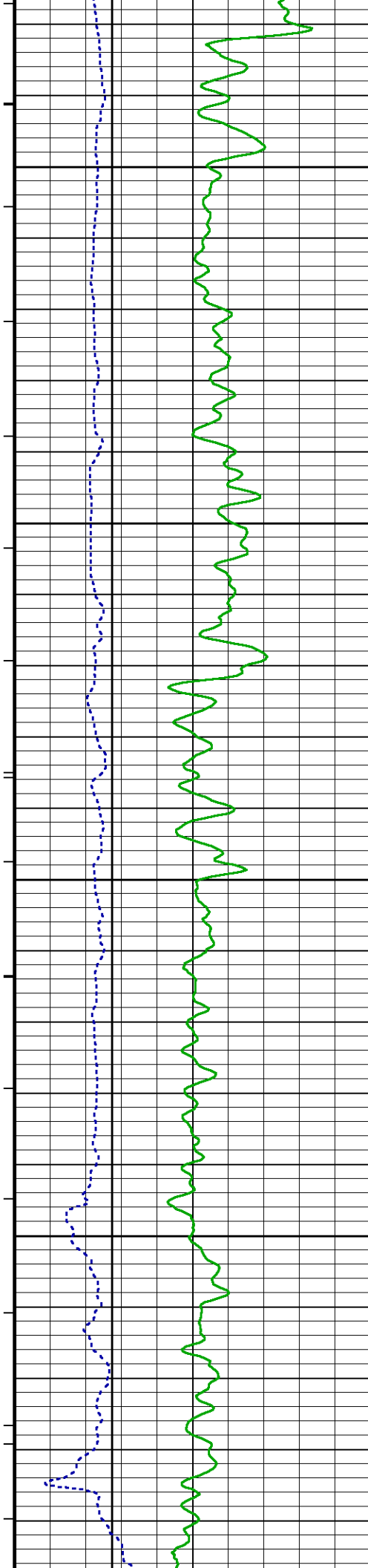
4650

159°

4700



RTAT →
R85T →
R60T →
R40T →
R30T →
R20T →



159°

4750

160°

4800

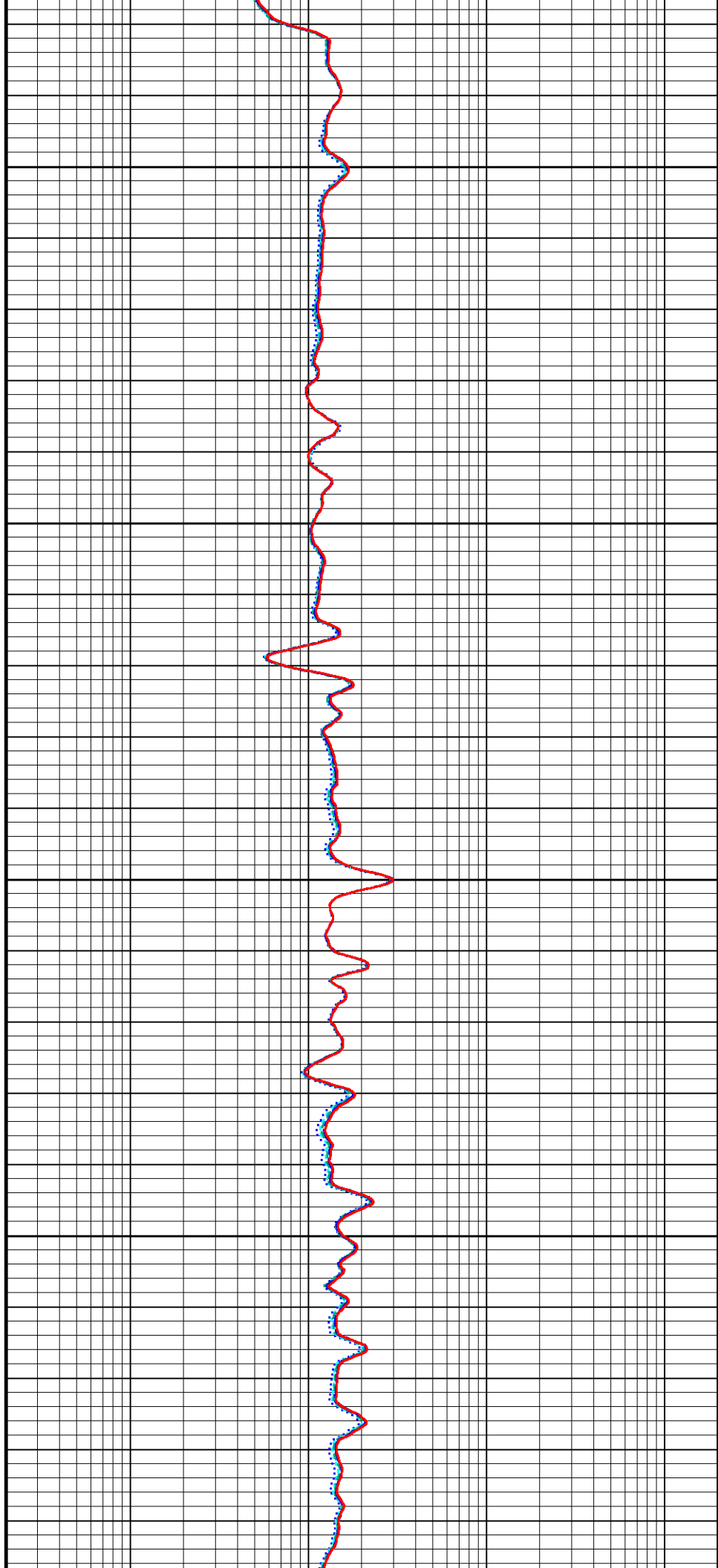
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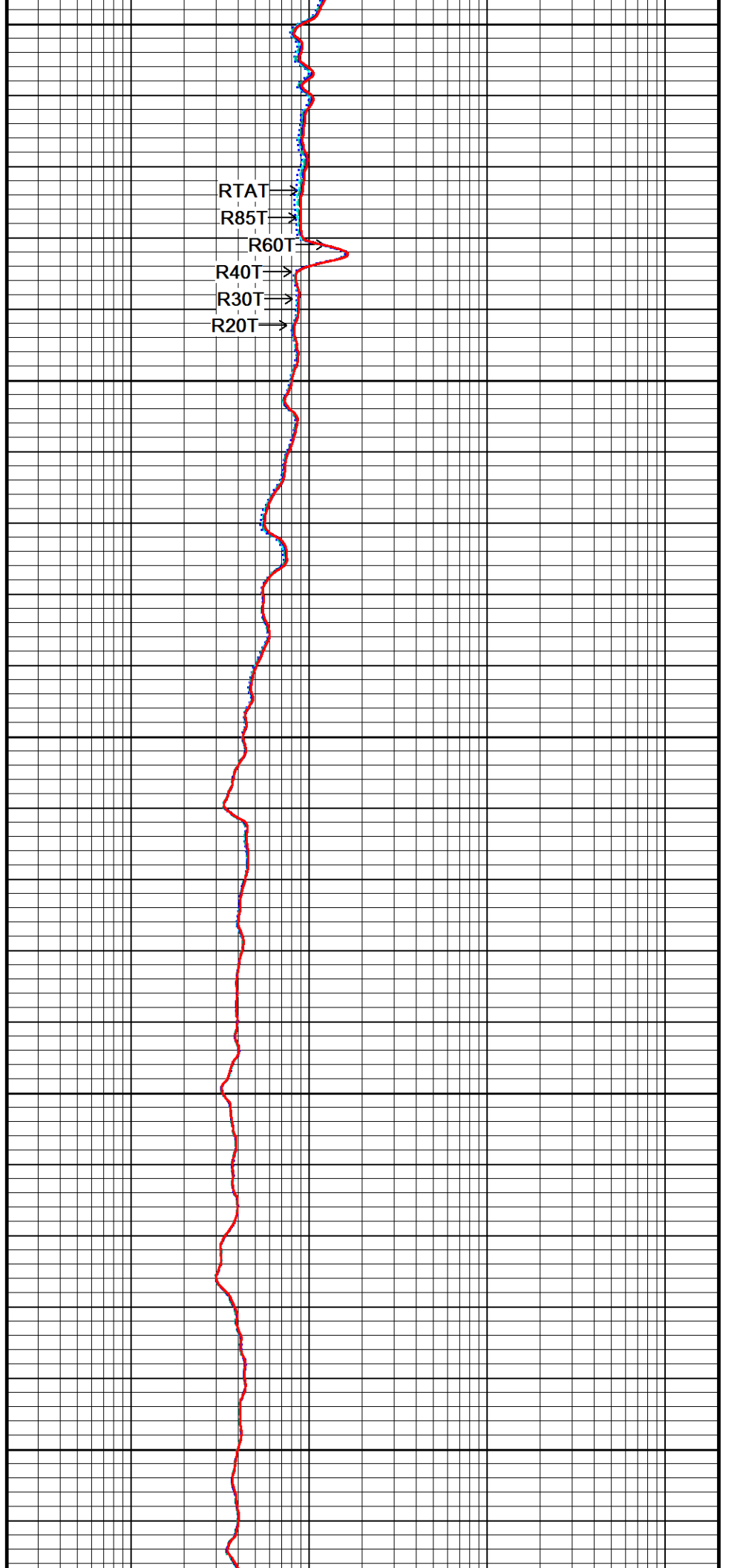
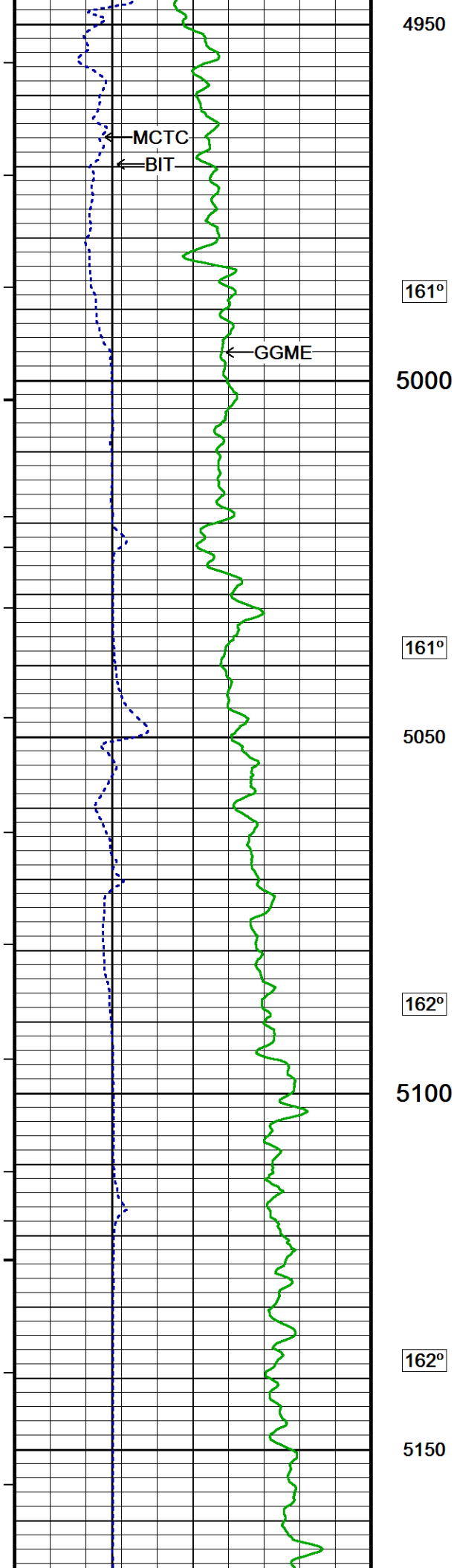
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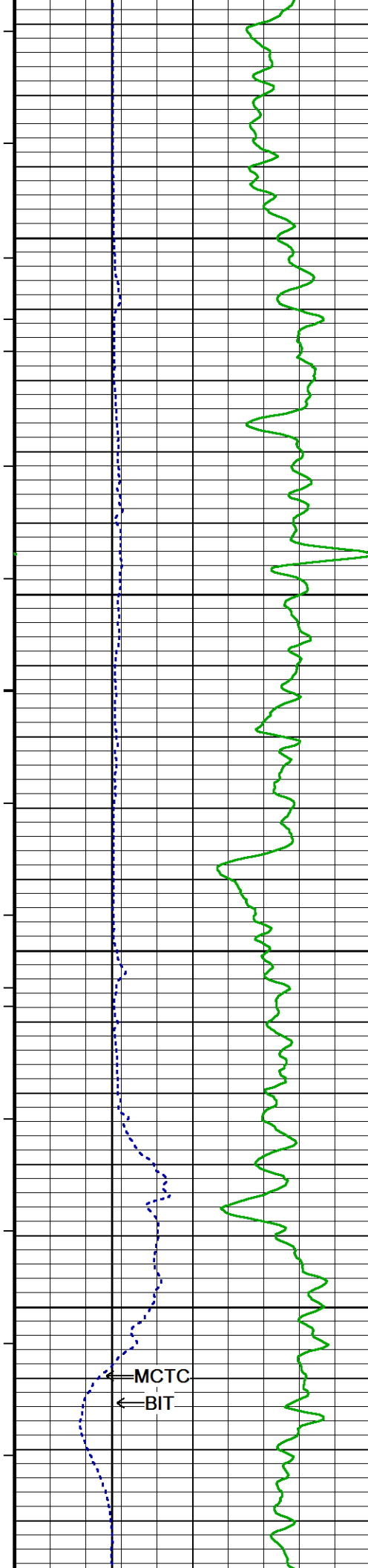
160°

4900

160°







162°

5200

162°

5250

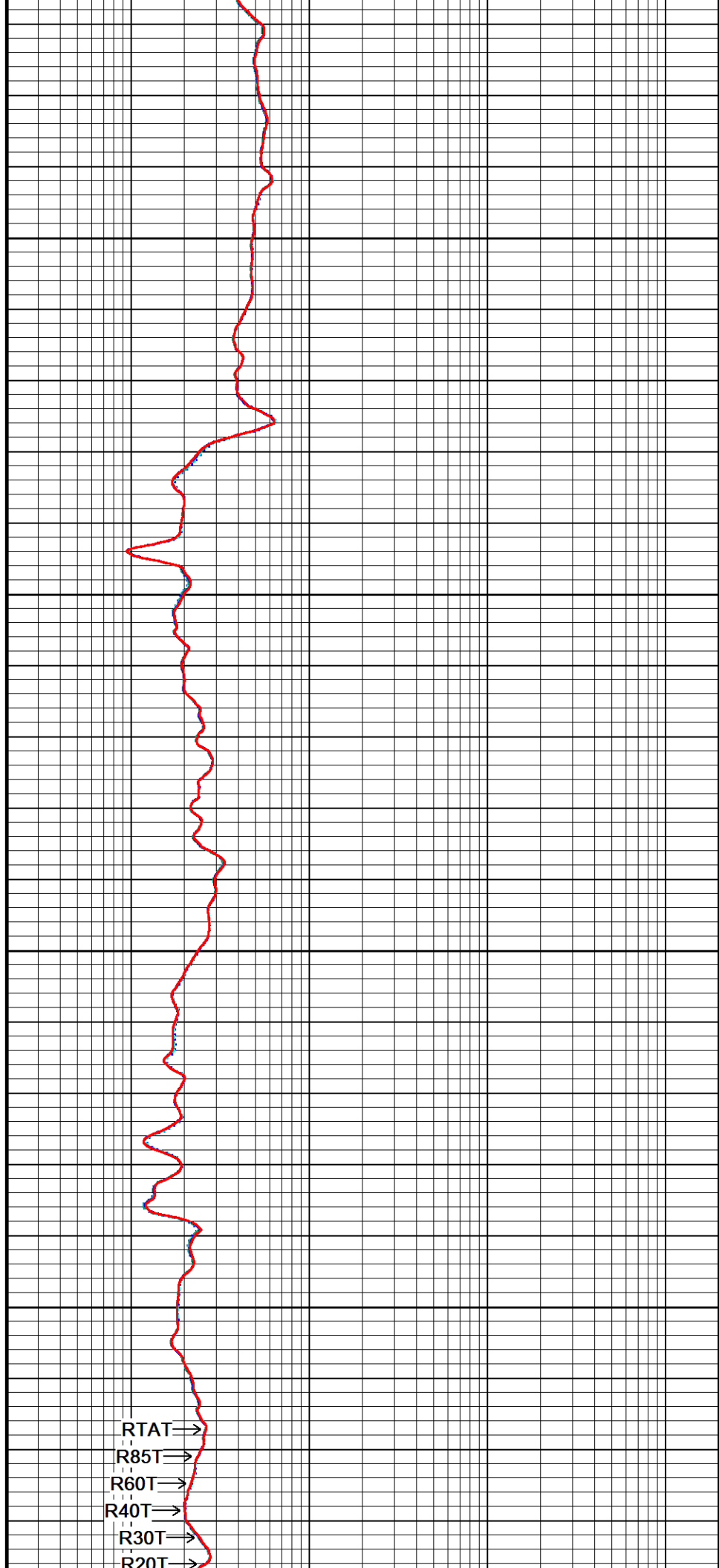
163°

5300

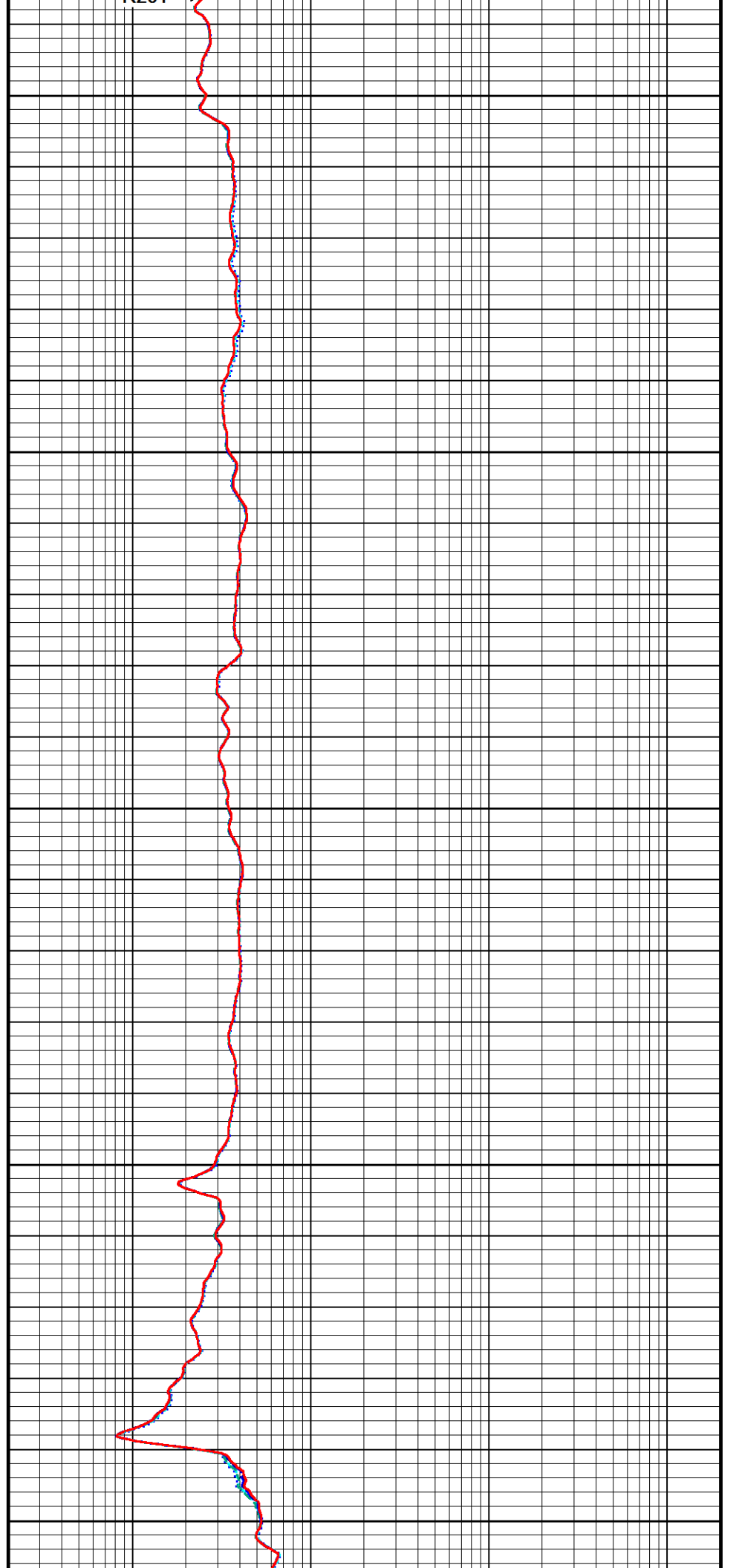
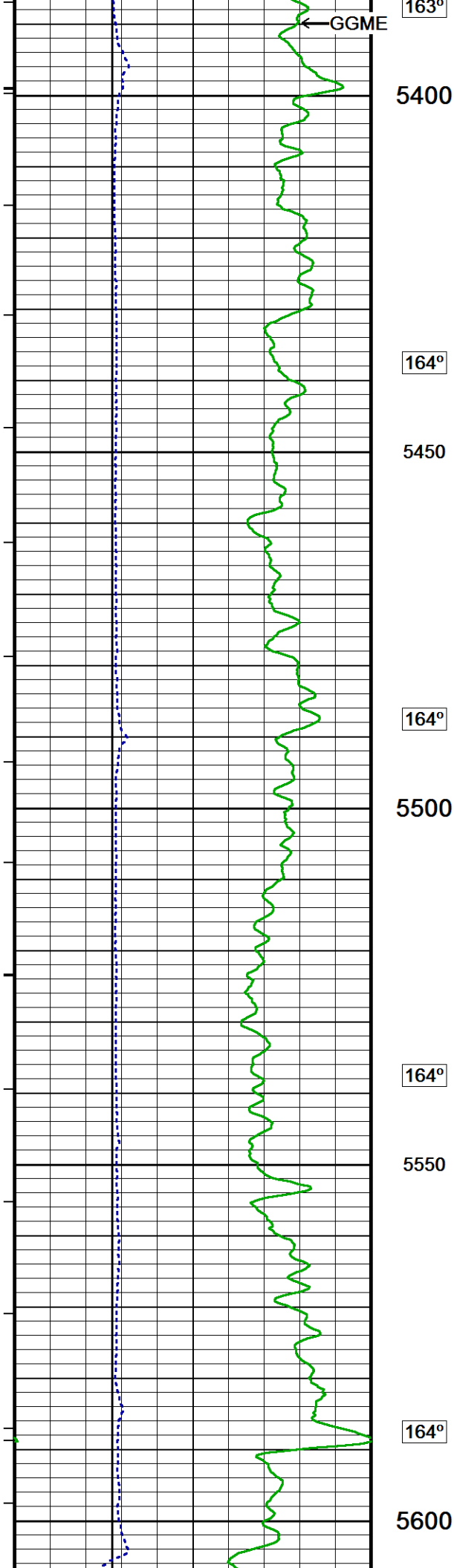
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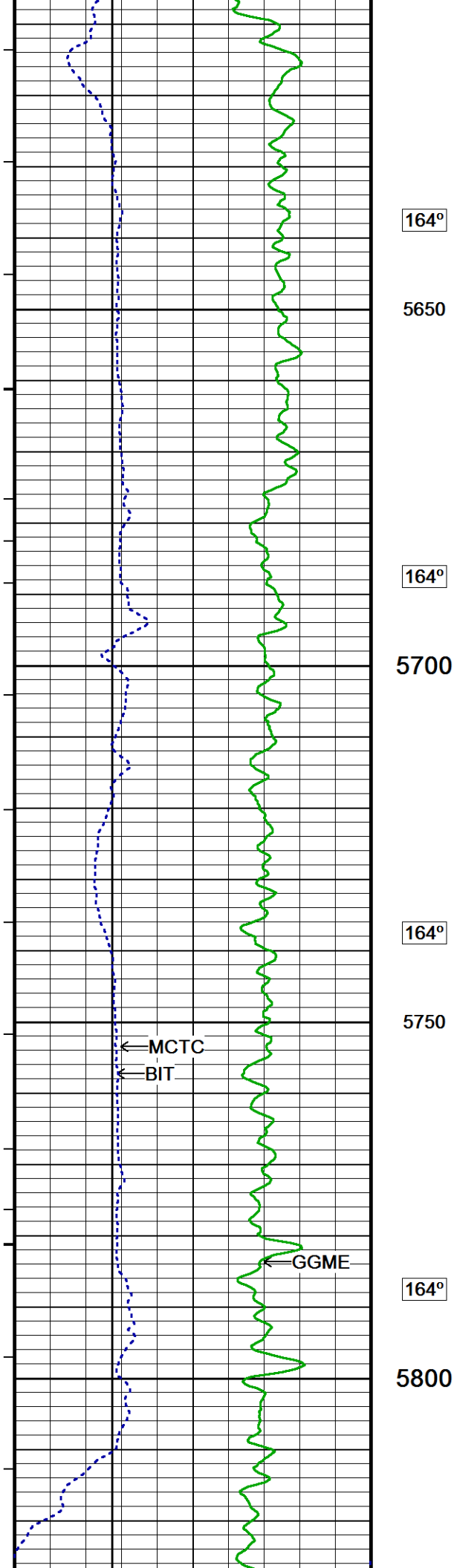
5350

← MCTC
← BIT



RTAT→
R85T→
R60T→
R40T→
R30T→
R20T→





164°

5650

164°

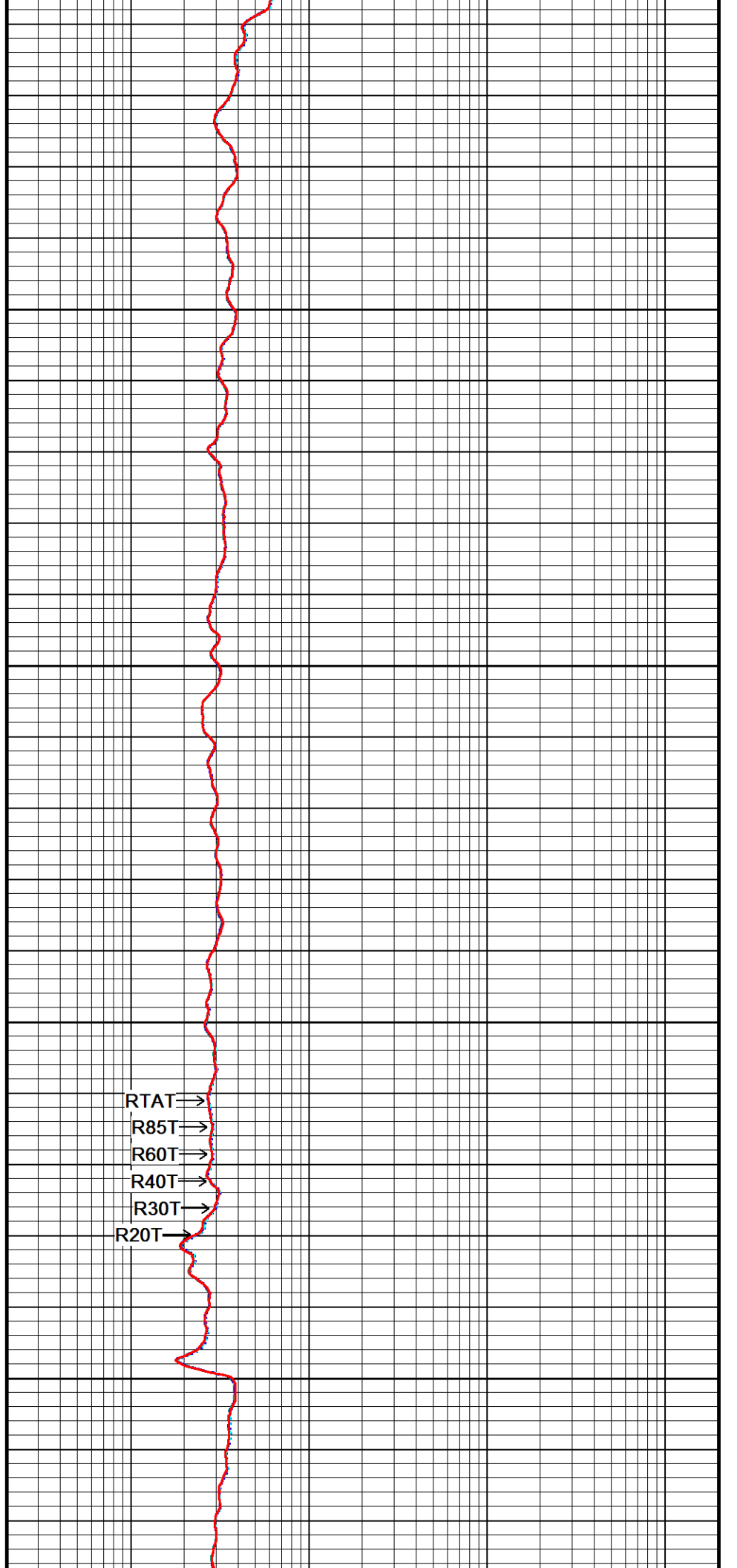
5700

164°

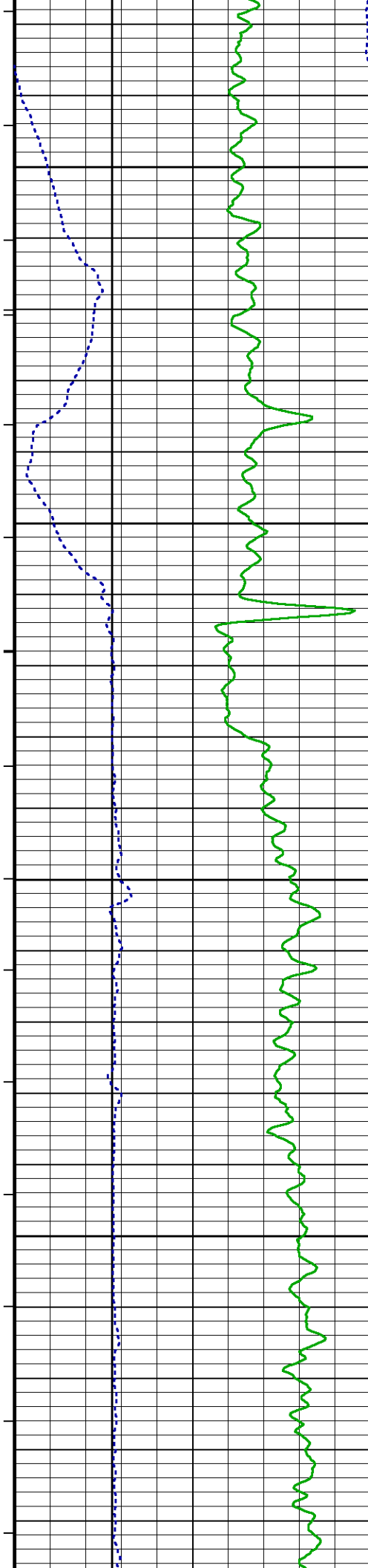
5750

164°

5800



RTAT→
R85T→
R60T→
R40T→
R30T→
R20T→



164°

5850

164°

5900

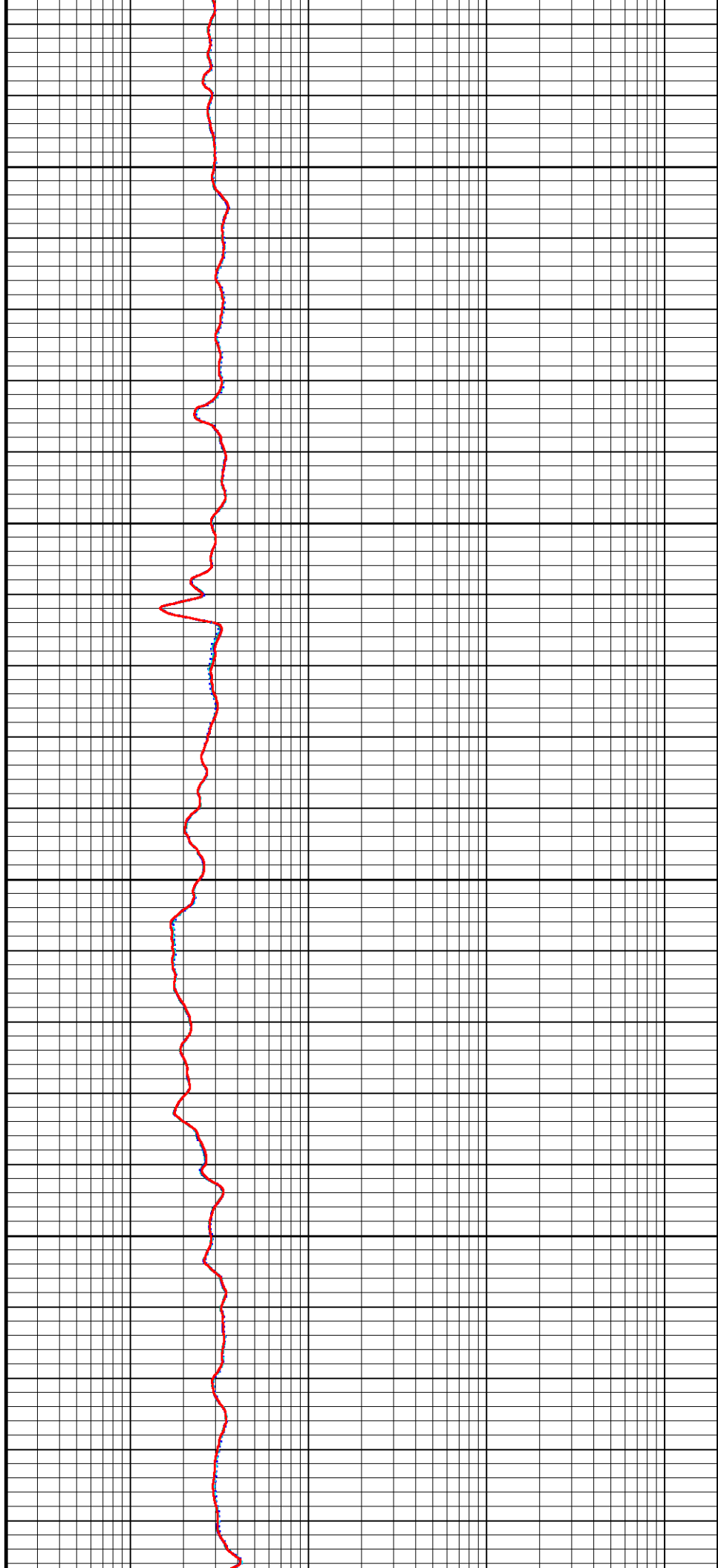
165°

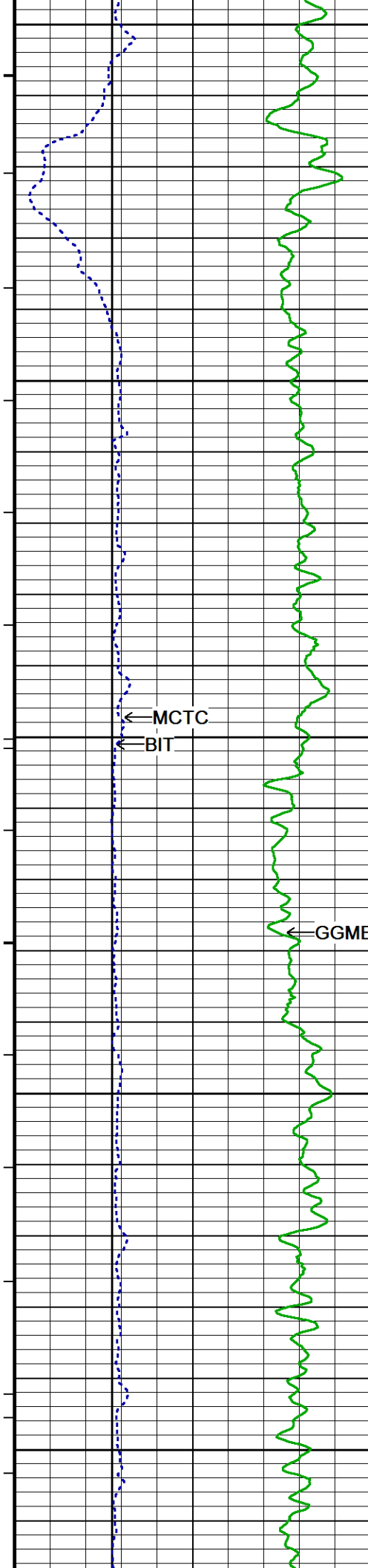
5950

164°

6000

165°





6050

165°

6100

165°

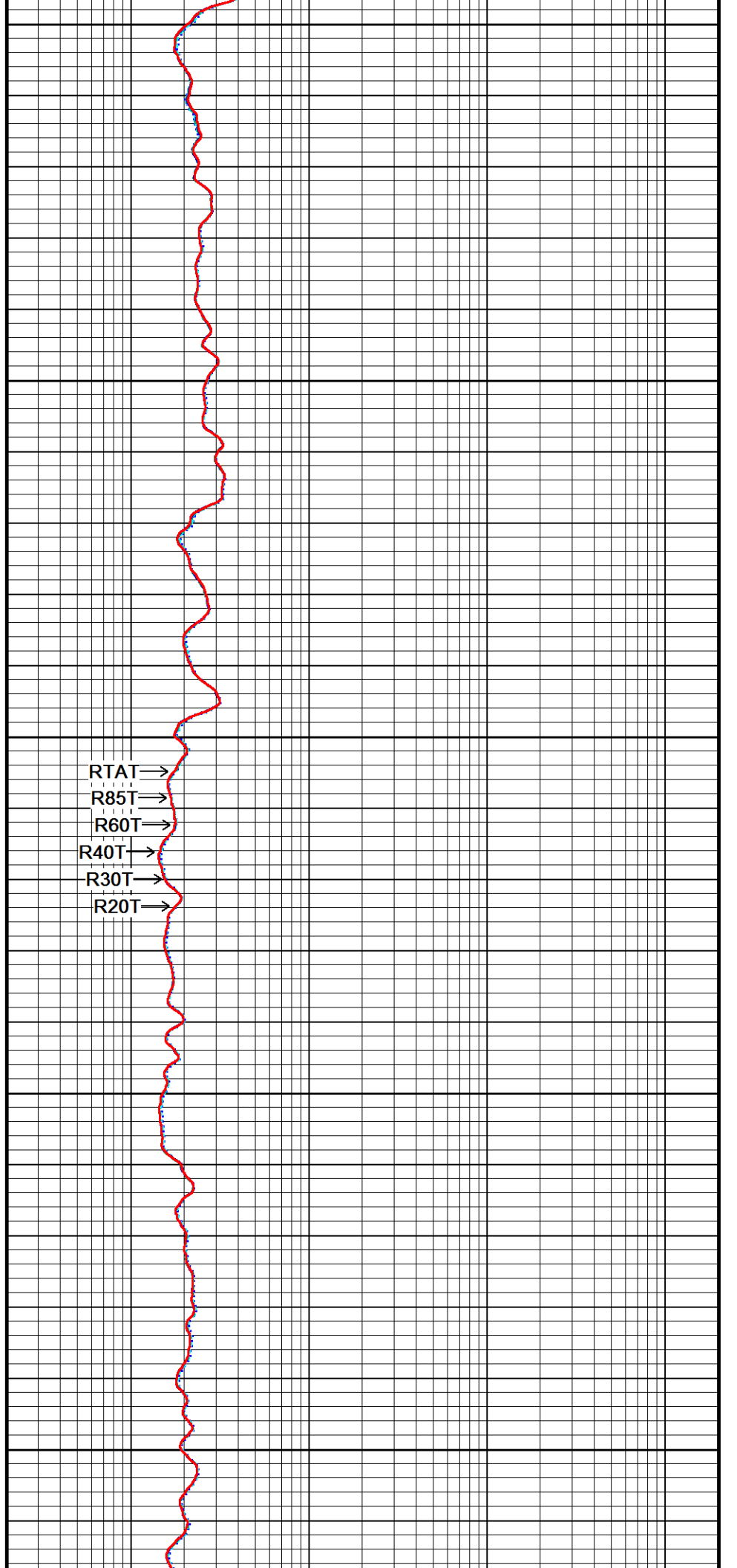
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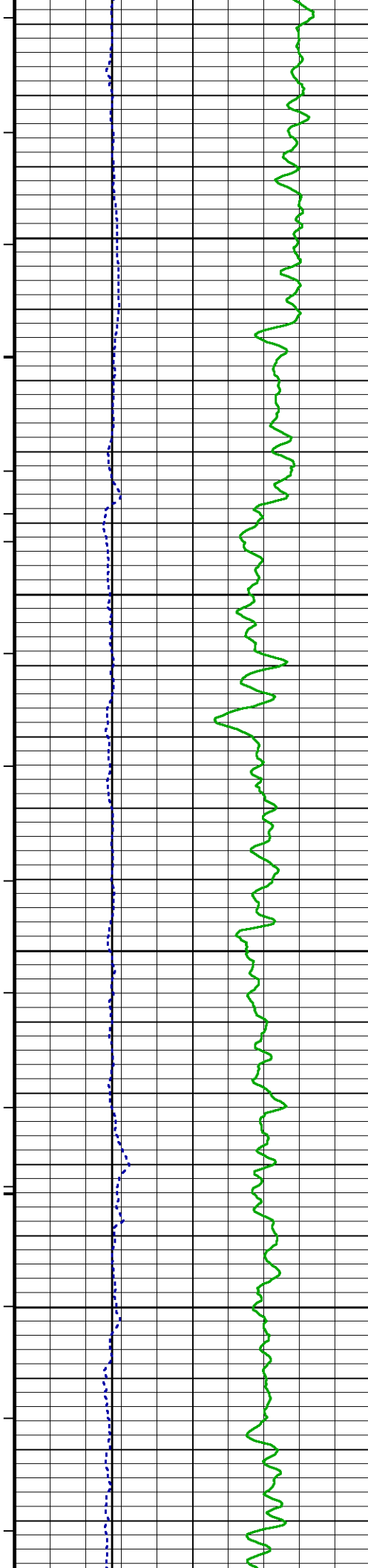
165°

6200

165°

6250





165°

6300

166°

6350

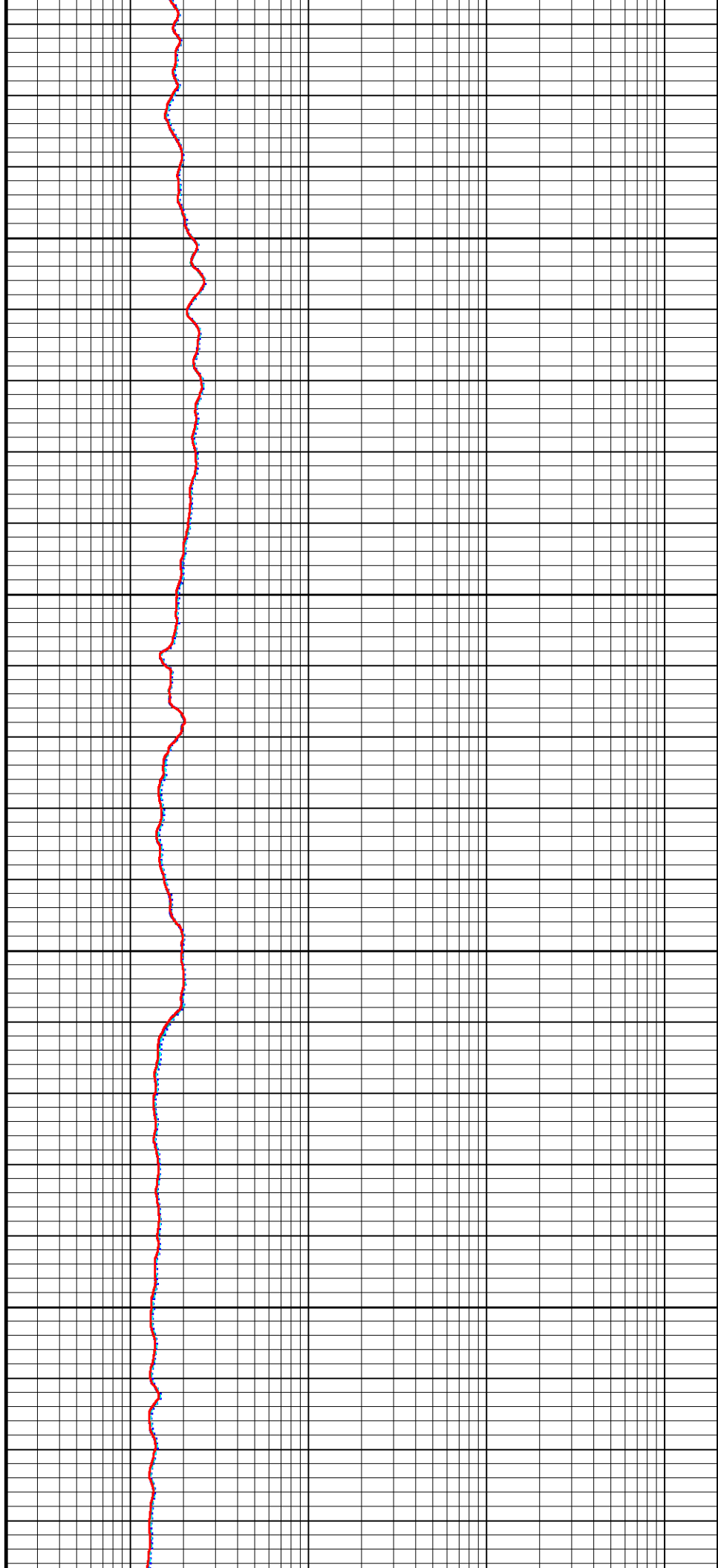
165°

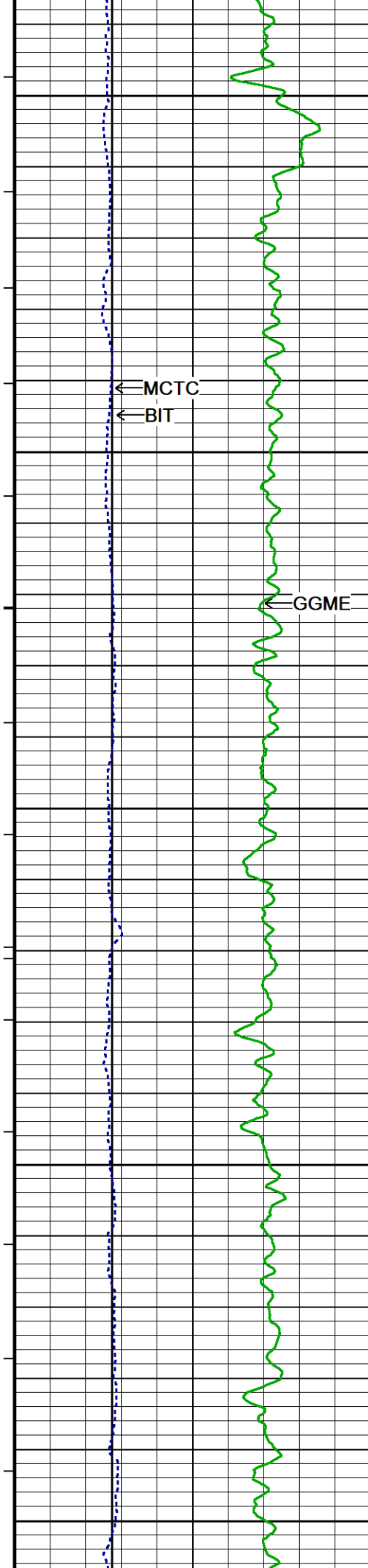
6400

165°

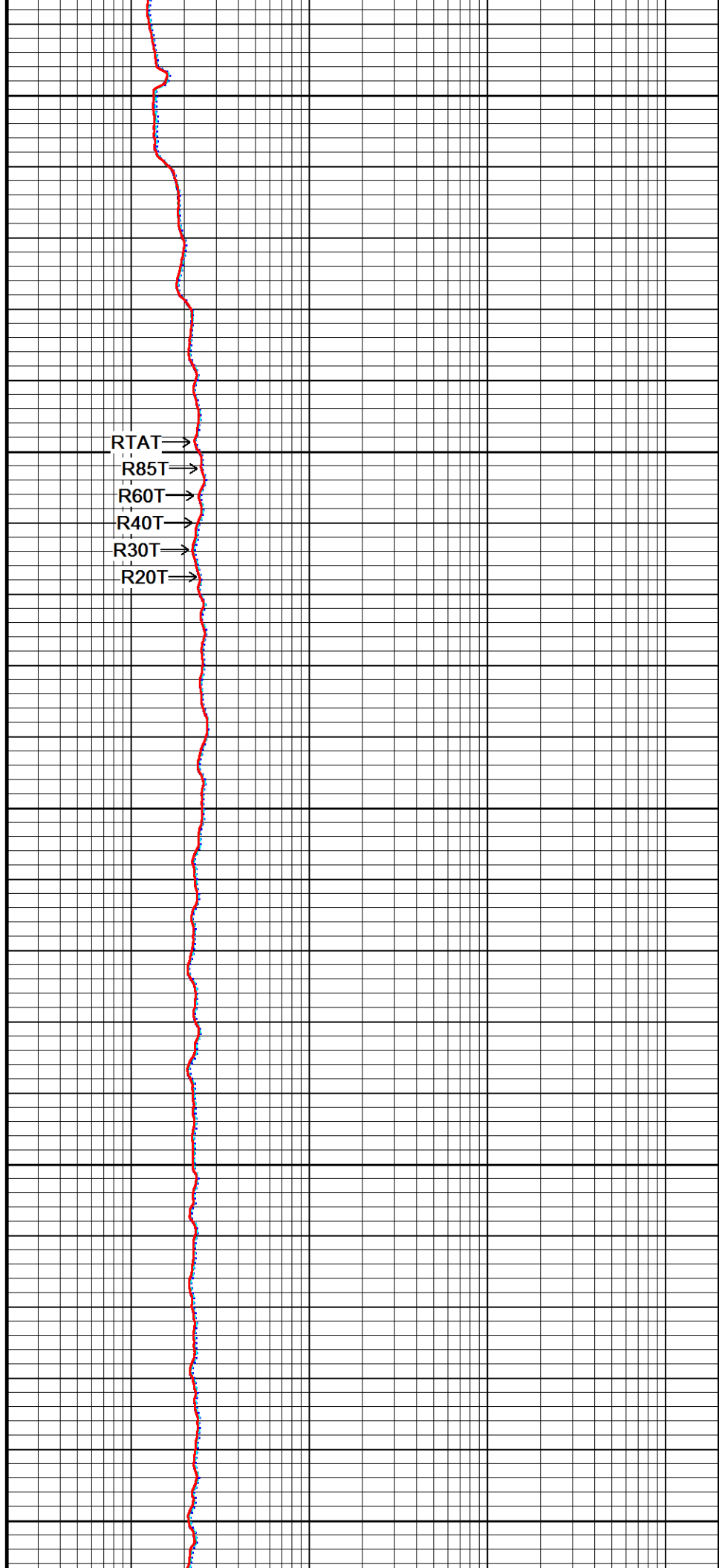
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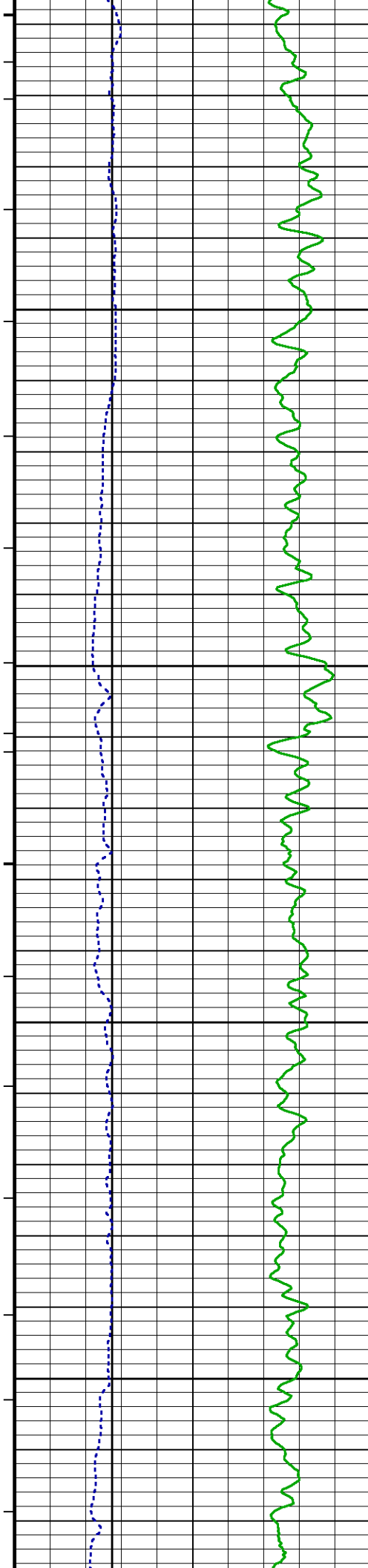
165°





165°
6500
166°
6550
165°
6600
166°
6650
165°
6700





164°

6750

165°

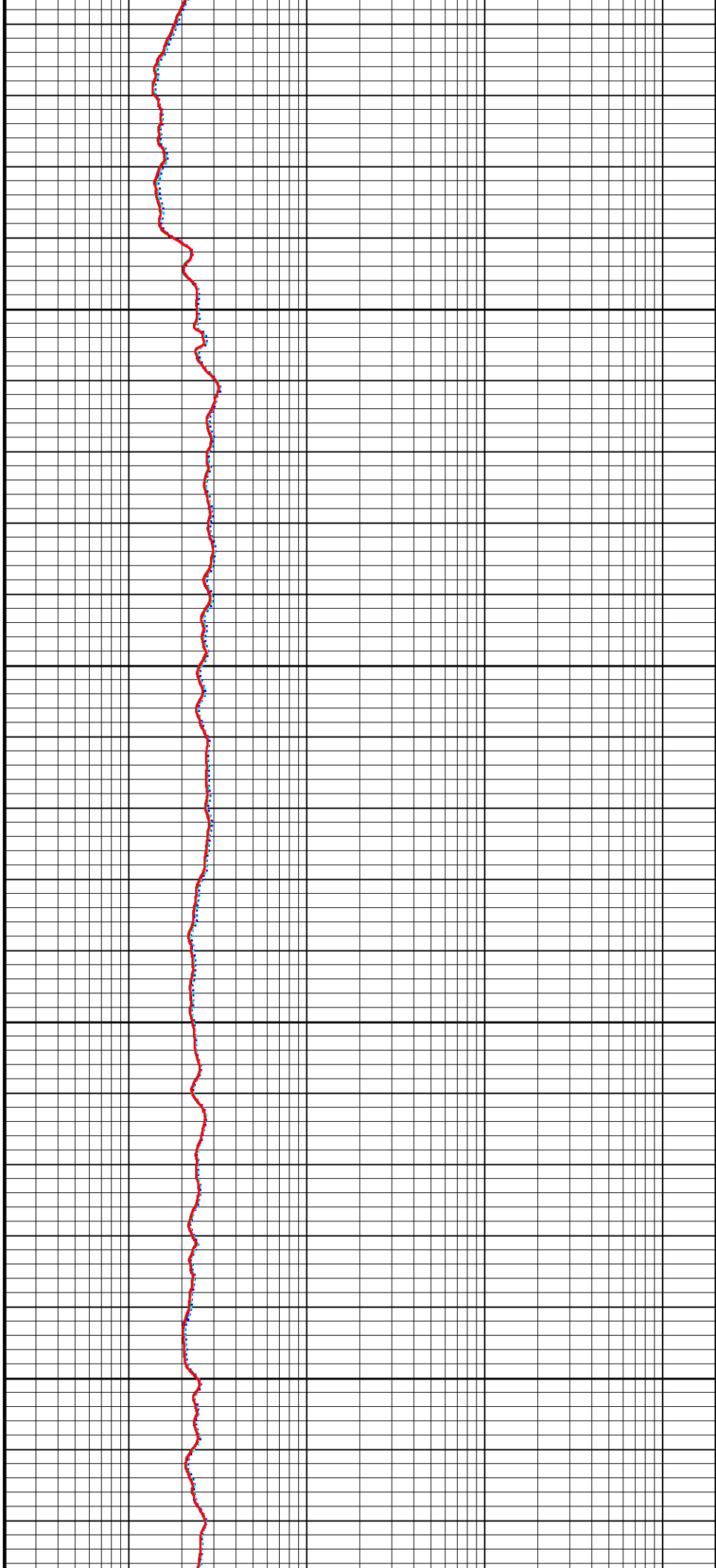
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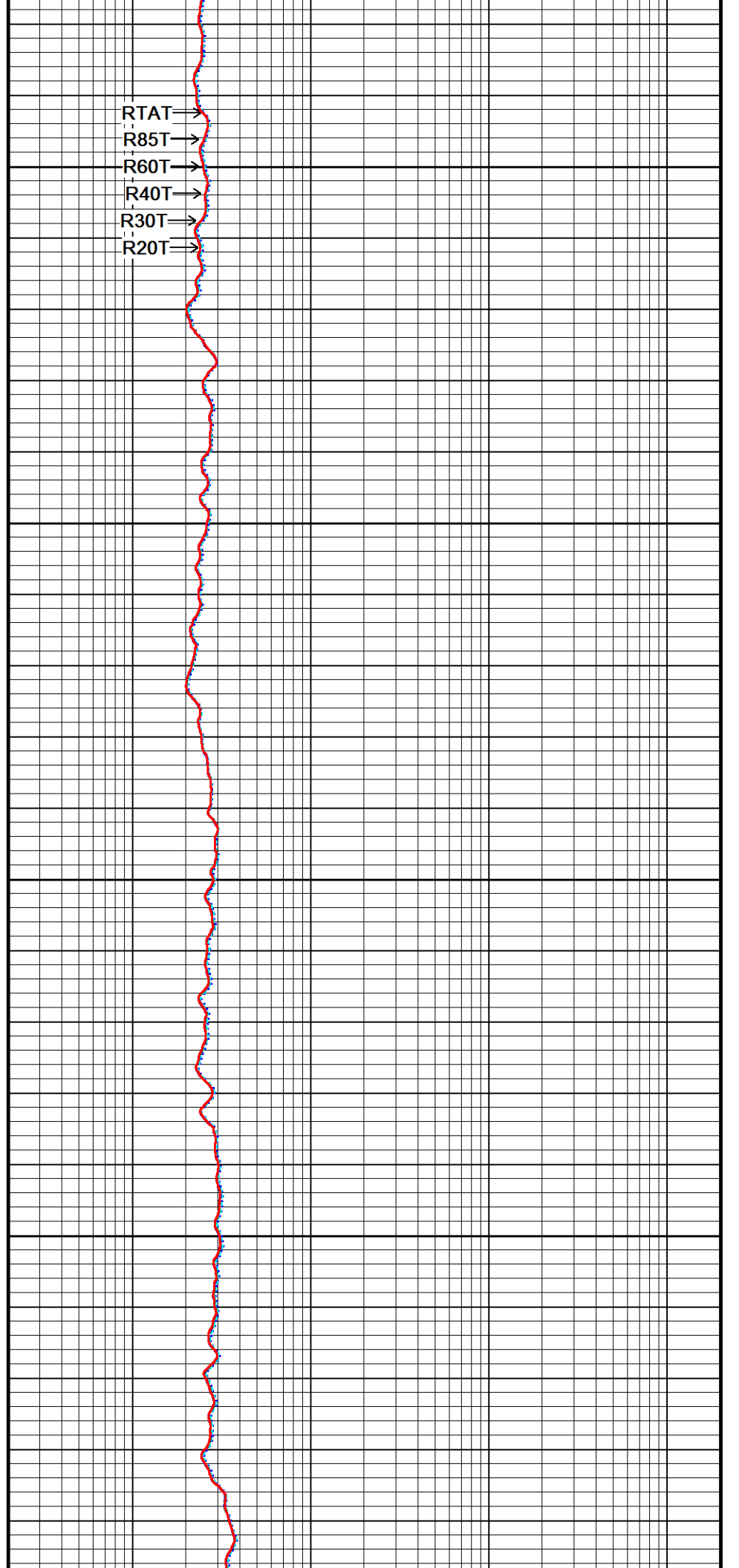
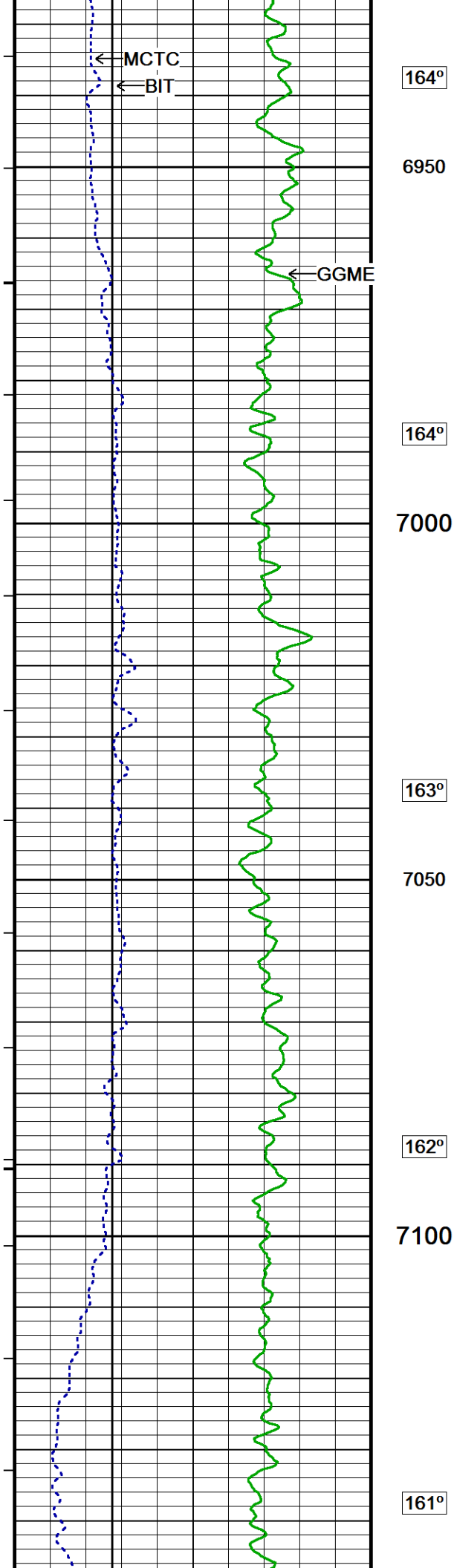
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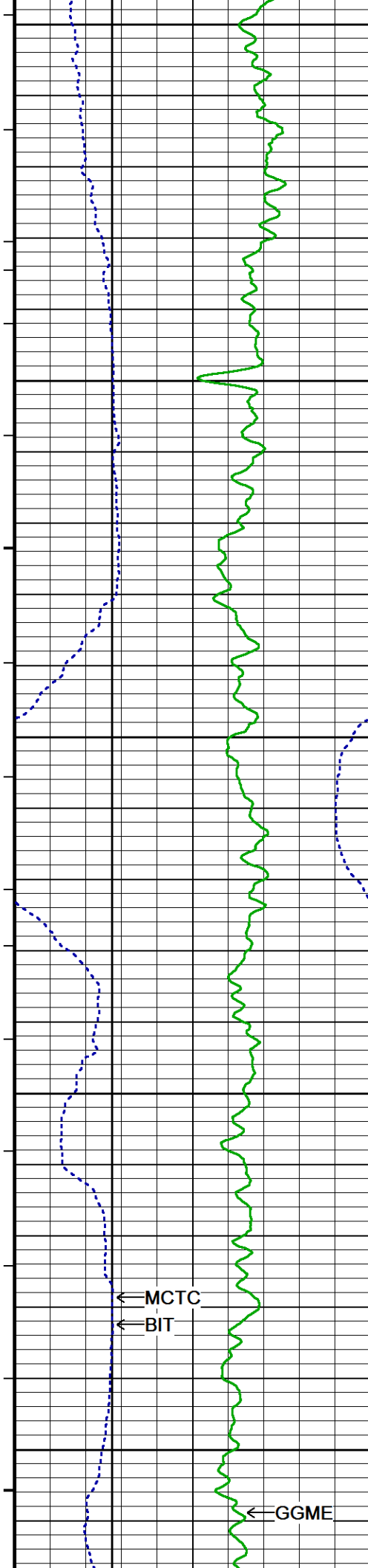
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164°

6900







7150

163°

7200

163°

7250

163°

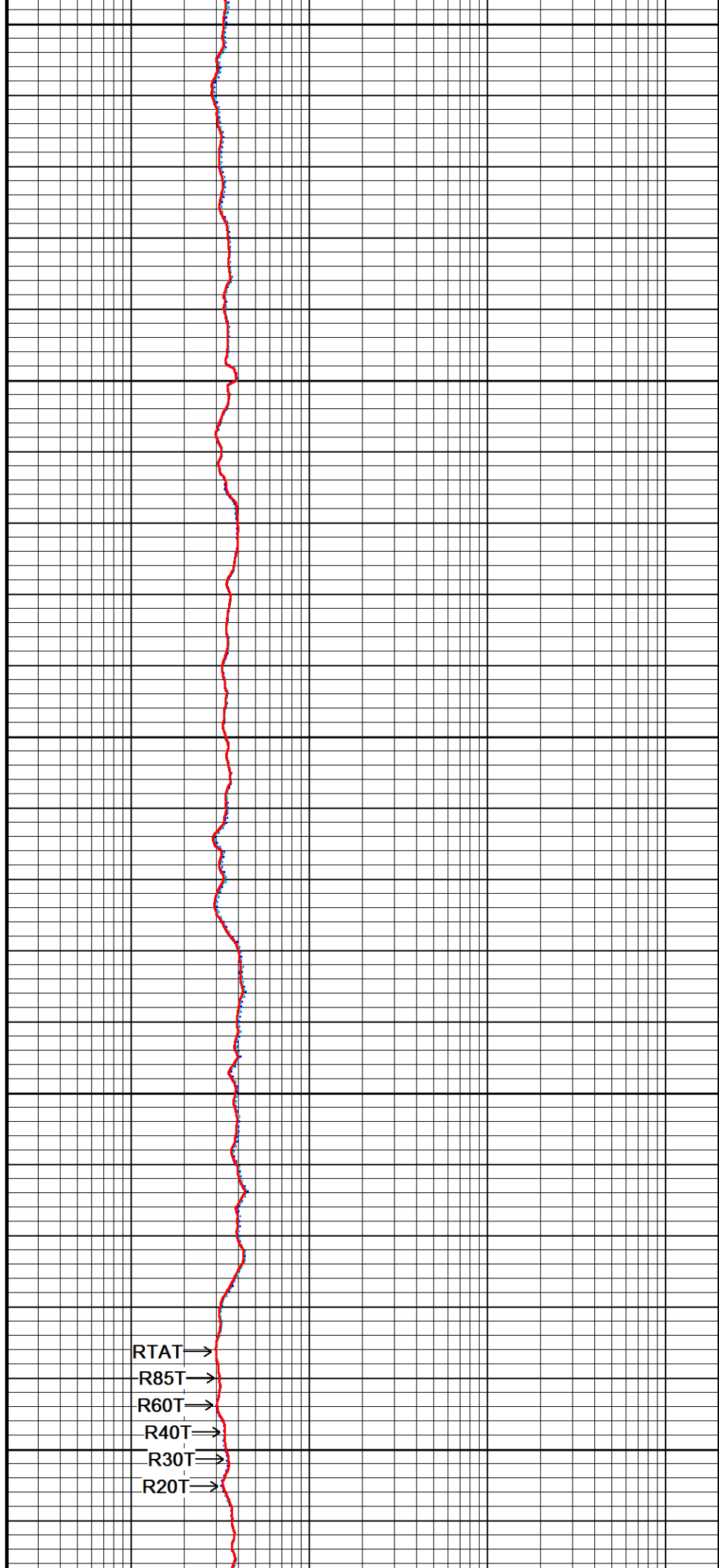
7300

← MCTC
← BIT

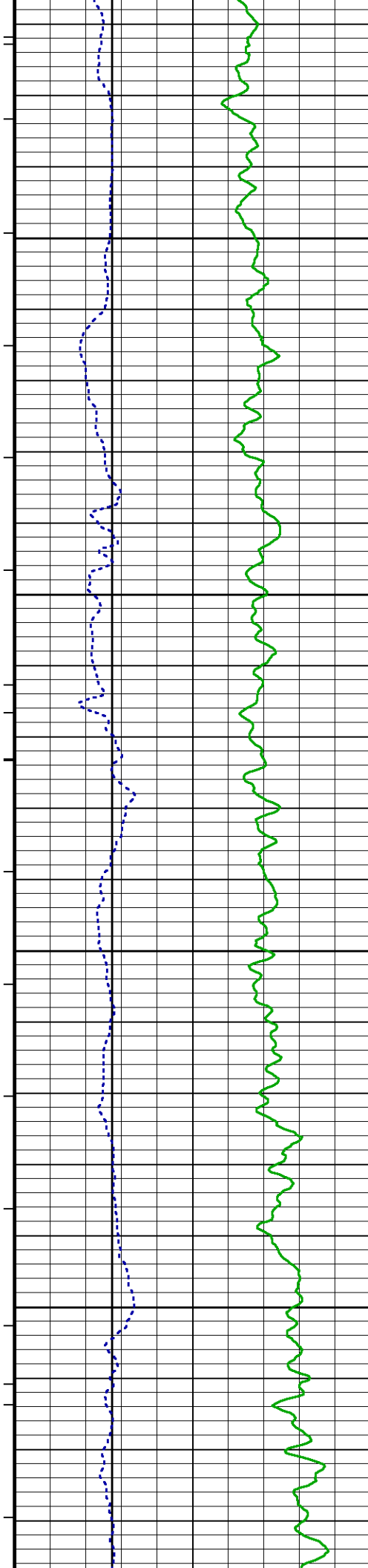
164°

7350

← GGME



RTAT →
R85T →
R60T →
R40T →
R30T →
R20T →



164°

7400

163°

7450

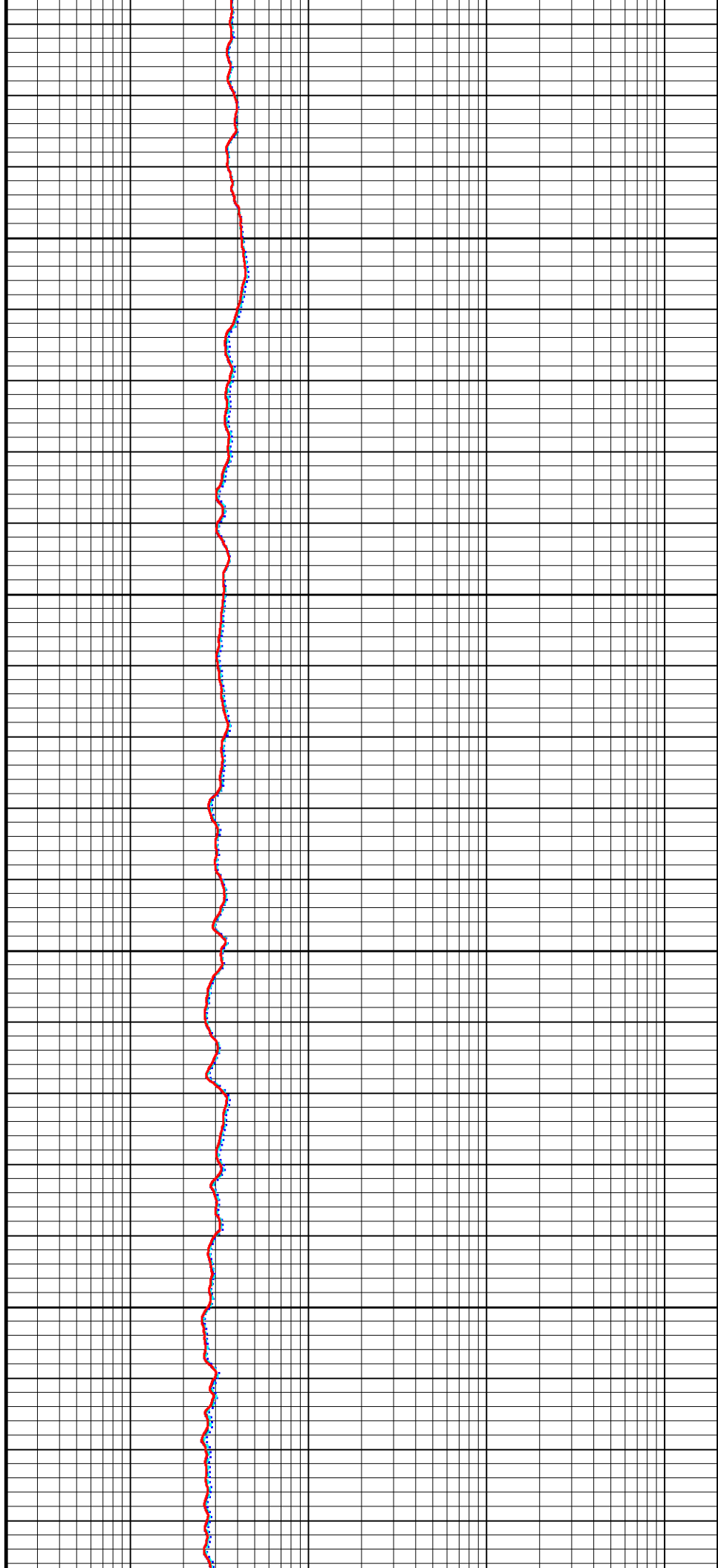
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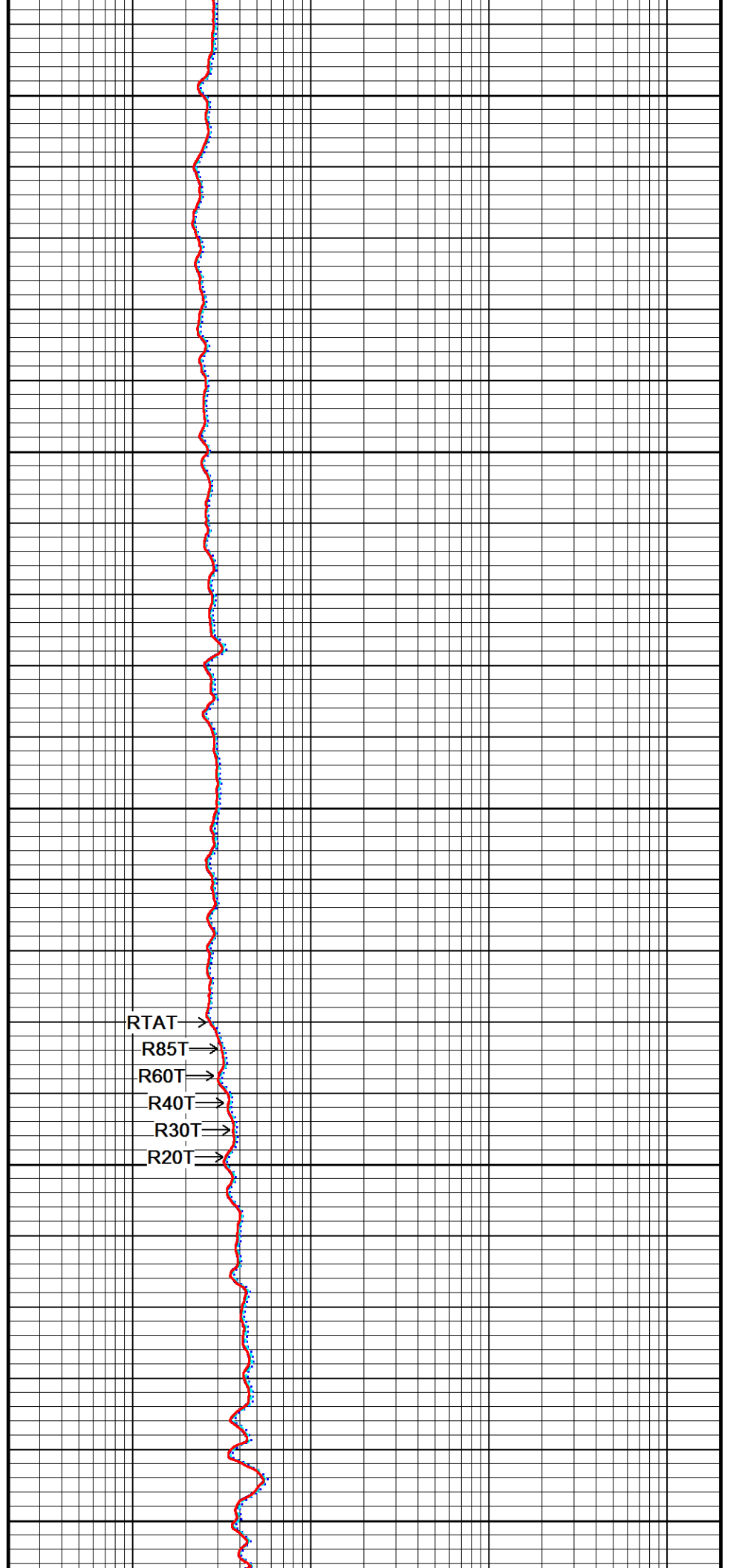
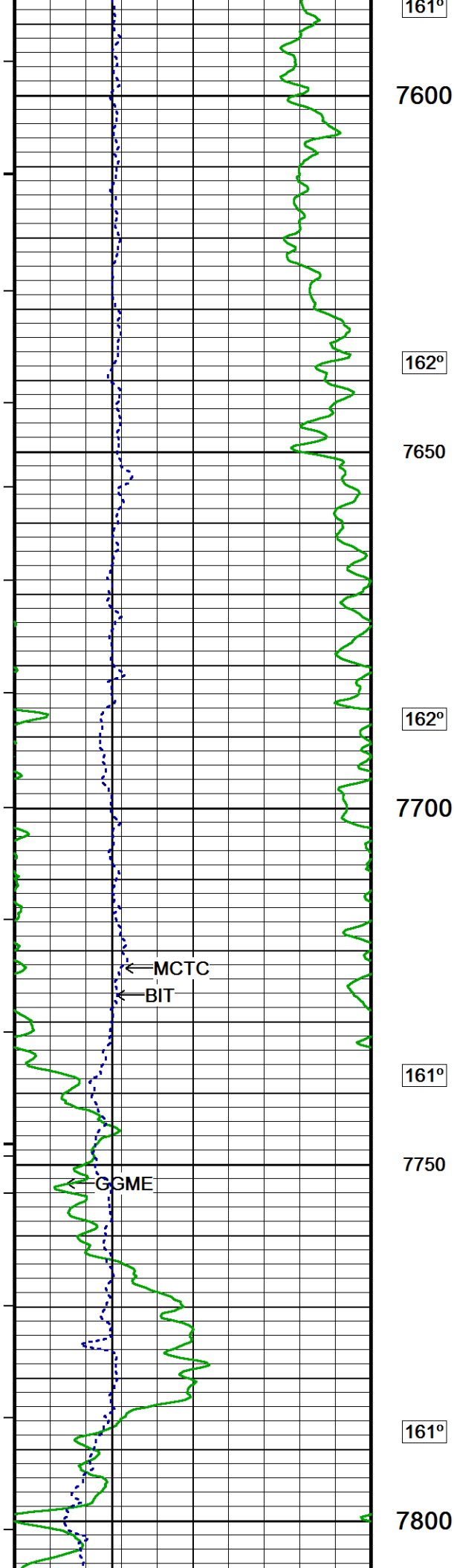
7500

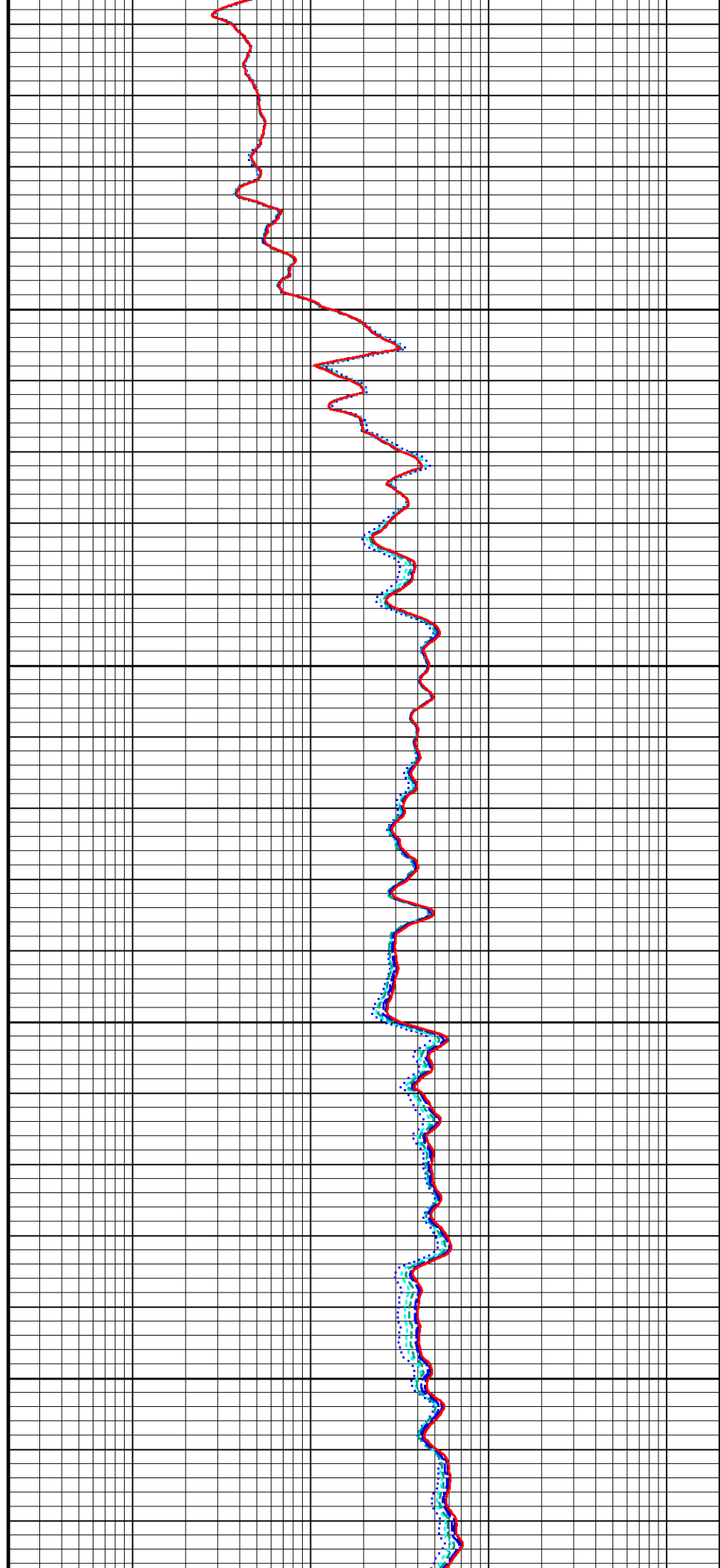
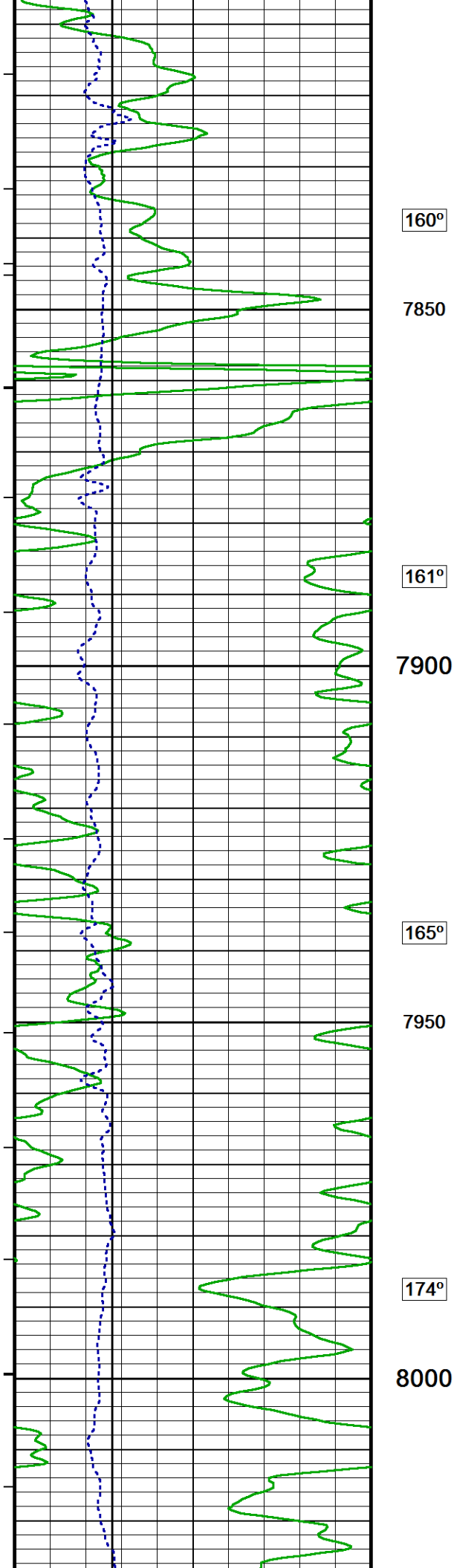
162°

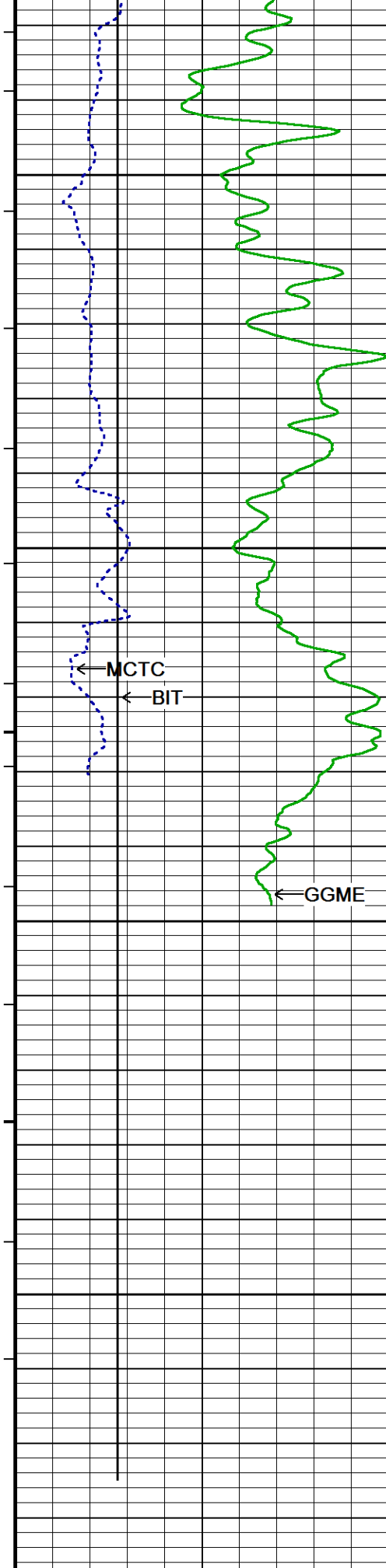
7550

7600









191°

8050

184°

8100

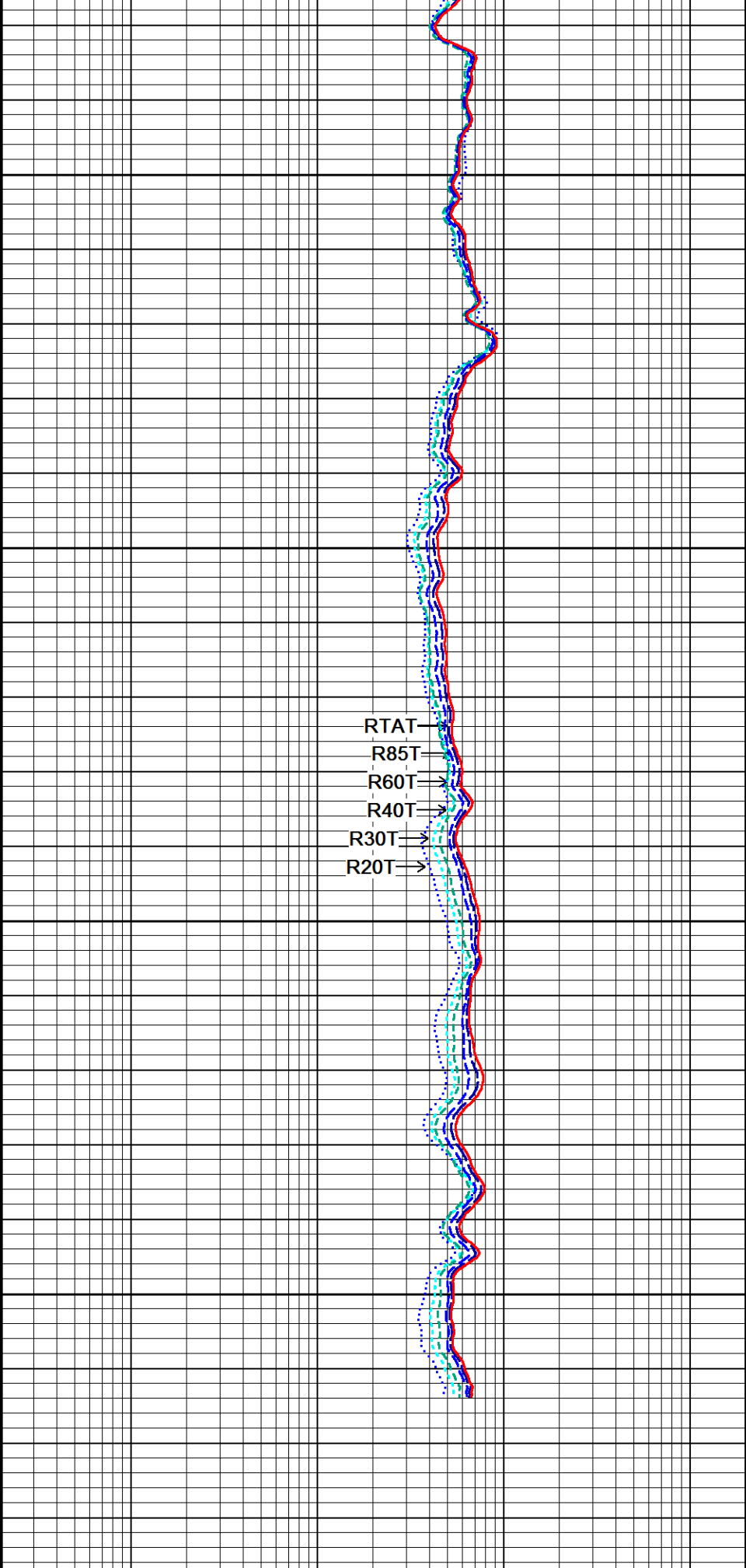
192°

8150

8200

8234

Depth
in
Feet



RTAT

R85T

R60T

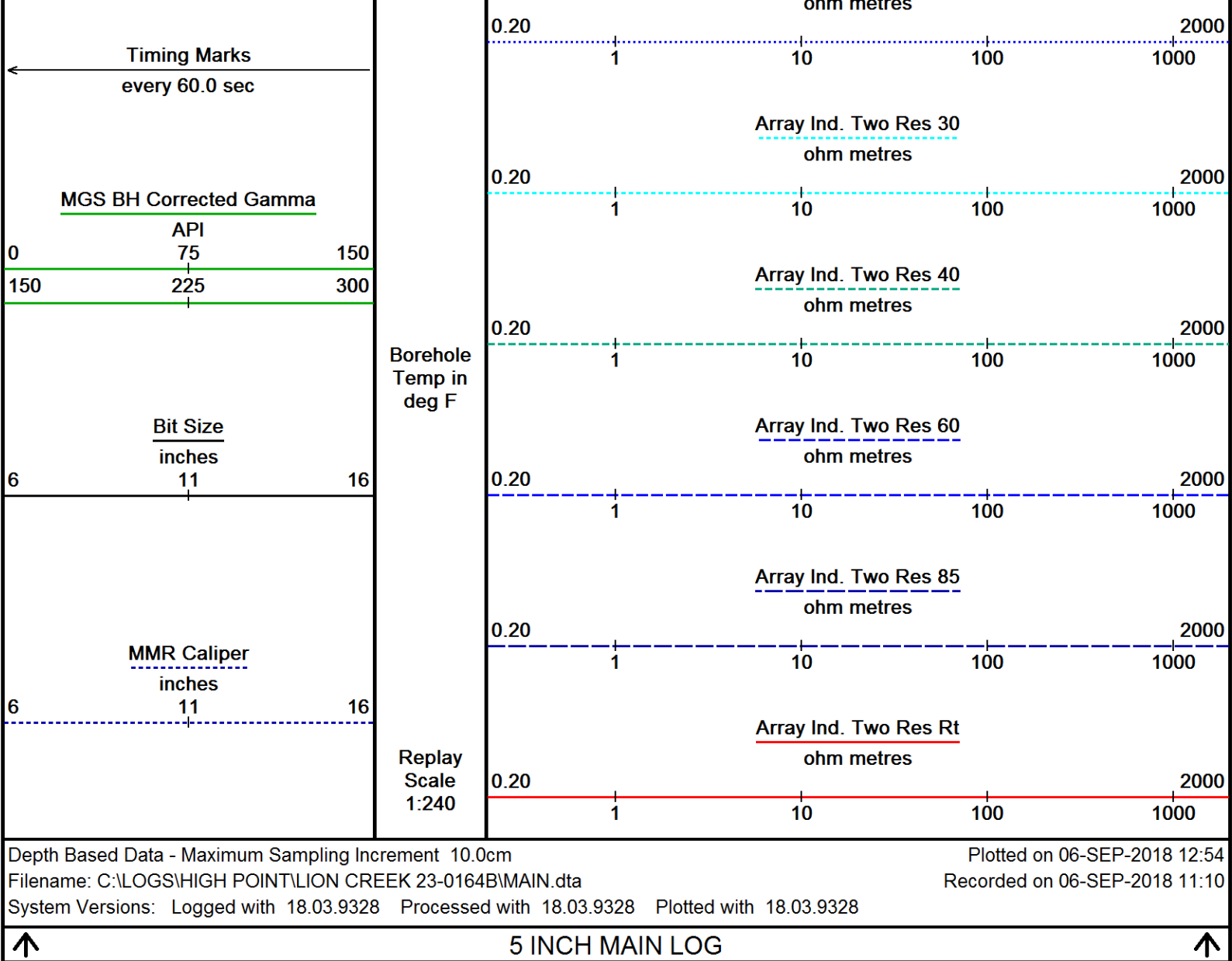
R40T

R30T

R20T

Array Ind. Two Res 20

ohm-meters



BEFORE SURVEY CALIBRATION		
C:\LOGS\HIGH POINT\LION CREEK 23-0164B\MAIN.dta		
General Constants All 000		Last Edited on 06-SEP-2018,08:44
General Parameters		
Mud Resistivity	2.650	ohm-metres
Mud Resistivity Temperature	55.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	MMR Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	7.000	inches
Caliper for Differential Caliper	MMR Caliper	
Rwa Parameters		
Porosity used	Limestone H-R Sonic Por.	
Resistivity used	Array Ind. Two Res Rt	
RWA Constant A	0.620	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	
Caliper Calibration MMR-B.A 85		Base Calibration on 03-SEP-2018 14:55
		Field Calibration on 03-SEP-2018 14:56

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	13218	4.00
2	15018	5.96
3	17027	7.98
4	19033	9.86
5	21347	11.88
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.99	7.98

Caliper Calibration Tolerances MMR-B.A 85

Long Arm Field Cal.	7.99	<div><div></div><div></div><div></div><div></div></div>	in
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Gamma Calibration MGS-D.A 219

Field Calibration on 05-SEP-2018 09:11

	Measured	Calibrated (API)
Background	117	76
Calibrator (Gross)	938	610
Calibrator (Net)	821	534

Gamma Calibration Tolerances MGS-D.A 219

Ratio	1.537	<div><div></div><div></div><div></div><div></div></div>	Counts/API
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Gamma Constants MGS-D.A 219

Last Edited on 06-SEP-2018,08:46

Gamma Calibrator Number	GRCC 225	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.17	gm/cc
Caliper Source for Processing	MMR Caliper	
Tool Position	Eccentred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MGS-D.A 219

Field Calibration on 04-SEP-2018,15:30

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	300.00	300.00

High Resolution Temperature Constants MGS-D.A 219

Last Edited on 27-DEC-2017 16:56

Pre-filter Length	11
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Accelerometer Parameters MBN-C.J 146

Date Of Last Accelerometer Calibration	19-JAN-2018,15:13		
	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.111434	-1.101306	-1.097142
Offset	-0.004715	0.003509	-0.005130

Accelerometer Constants MBN-C.J 146

Last Edited on 25-JAN-2018,09:17

Accelerometer Calibrator Number	000			
Accelerometer Temperature Characterisation				
X Accelerometer				
Serial Number	1013			
Calibration Date	12-Feb-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+00	-9.33042e-06	-5.43613e-09	3.26808e-10
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+00	2.57435e-04	3.69697e-07	7.37279e-10
Y Accelerometer				
Serial Number	1109			
Calibration Date	04-Jul-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+00	1.07574e-05	7.04500e-09	0.00070e-10
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+00	2.57435e-04	3.69697e-07	7.37279e-10

Bias(g)	0.00000e+00	1.07571e-05	-7.01503e-09	9.36978e-11
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+00	2.76402e-04	2.92956e-07	6.97968e-10
Z Accelerometer				
Serial Number	1087			
Calibration Date	07-May-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+00	7.29157e-06	2.12028e-08	9.77407e-11
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+00	2.71055e-04	2.46581e-07	1.04581e-09

Navigation Constants MBN-C.J 146	Last Edited on 05-SEP-2018,12:42			
Magnetic Declination	8.35	degrees	East	

Magnetometer Parameters MBN-C.J 146				
Date Of Last Magnetometer Calibration	1-AUG-2018,10:57			
	X Magnetometer	Y Magnetometer	Z Magnetometer	
Slope	-1.000000	1.001008	1.001635	
Offset	0.010621	0.017955	-0.009824	

Magnetometer Constants MBN-C.J 146				
Magnetometer Calibrator Number	000			

Induction Calibration MAI-C.A 516	Factory Loop Calibration 08-AUG-2018 10:50 Field Check on 05-SEP-2018 09:16			
Factory Loop Calibration				
High Conductivity Reference Resistor	3.3	ohm		
Low Conductivity Reference Resistor	333.3	ohm		
	Measured Signal (unitless)		Reference Conductivity (mmho/m)	
Array	Low	High	Low	High
1 (near)	16.0	461.3	9.3	966.2
2	6.3	374.6	7.6	821.4
3	4.2	254.3	5.2	566.0
4 (far)	1.9	131.3	2.6	279.2
Array Temperature	76.1	Deg F		
Calibration	Gain	Offset		
	0.000	0.0		
	0.000	0.0		
	0.000	0.0		
	0.000	0.0		
Tool Checks				
	Factory Reference (mmho/m)		Before Survey (mmho/m)	
Array	Low	High	Low	High
1 (near)	-3.7	2086.8	-3.7	2086.9
2	13.2	1917.9	13.2	1917.9
3	12.7	1662.1	12.7	1662.2
4 (far)	9.8	1122.4	9.8	1122.5
Array Temperature	49.0	Deg F	65.9	Deg F

Induction Check Tolerances MAI-C.A 516									
Low Array 1	-3.7	<div><div>-5.2</div><div>-3.7</div><div>-2.2</div></div>	mmho/m	High Array 1	2086.9	<div><div>-0.5%</div><div>2086.8</div><div>+0.5%</div></div>	mmho/m		
Low Array 2	13.2	<div><div>11.7</div><div>13.2</div><div>14.7</div></div>	mmho/m	High Array 2	1917.9	<div><div>-0.5%</div><div>1917.9</div><div>+0.5%</div></div>	mmho/m		
Low Array 3	12.7	<div><div>11.2</div><div>12.7</div><div>14.2</div></div>	mmho/m	High Array 3	1662.2	<div><div>-0.5%</div><div>1662.1</div><div>+0.5%</div></div>	mmho/m		
Low Array 4	9.8	<div><div>8.3</div><div>9.8</div><div>11.3</div></div>	mmho/m	High Array 4	1122.5	<div><div>-0.5%</div><div>1122.4</div><div>+0.5%</div></div>	mmho/m		

Induction Constants MAI-C.A 516	Last Edited on 06-SEP-2018,08:46			
Induction Model	RtAP-WBM			
Borehole Correction Constants				
Tool Centred	Yes			
Hole Size Source	MMR Caliper			
Hole Size Constant Value	N/A	inches		
Stand-off Type	N/A			
Stand-off	N/A	inches		
Number of Fins on Stand-off	N/A			
Stand-off Fin Angle	N/A	degrees		
Stand-off Fin Width	N/A	inches		

Rm Source	Global Value: Temperature Corrected	N/A	mhos
Temp. for Rm Corr.	MGS External Temperature		
Borehole Correction Method	Default		
Squasher Start	0.0020	mhos/metre	
Squasher Offset	N/A	mhos/metre	
Borehole Normalisation			
DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

Calibration Site Corrections			
Channel 1	0.00	mmhos/metre	
Channel 2	0.00	mmhos/metre	
Channel 3	0.00	mmhos/metre	
Channel 4	0.00	mmhos/metre	

Symmetrised Receiver Gains	
Receiver 1	1.00
Receiver 2	1.00
Receiver 3	1.00
Receiver 4	1.00

Apparent Porosity and Water Saturation Constants		
Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	1.00	v/v
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

DOWNHOLE EQUIPMENT

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Shuttle Running Tool 3.5"
SRT-A.A 35 LG: 5.90 ft WT: 37.5 lb OD: 2.520 in

Compact Linker (SHA-J.B)
MLK-A 3 LG: 2.30 ft WT: 22.0 lb OD: 2.240 in

Compact Linker
MLK-E.A 101 LG: 14.23 ft WT: 99.2 lb OD: 2.240 in

Compact Linker
MLK-C.A 26 LG: 8.53 ft WT: 30.9 lb OD: 2.240 in

Compact Linker (SKJ-E.B)
MLK-A 2 LG: 2.17 ft WT: 24.3 lb OD: 2.240 in



Compact Linker (MIS-E.A)
MLK-C.A 27 LG: 2.14 ft WT: 15.4 lb OD: 2.240 in

200v Compact Battery Sub
MBS-F.A 119 LG: 17.06 ft WT: 123.5 lb OD: 2.240 in

Compact Memory Sub F.A
MMS-F.A 256 LG: 5.20 ft WT: 37.5 lb OD: 2.244 in

Compact Tool Isolator sub.
MTI-C.A 136 LG: 1.54 ft WT: 13.2 lb OD: 2.244 in

Compact Micro-Resistivity
MMR-B.A 85 LG: 8.59 ft WT: 81.6 lb OD: 3.819 in

Compact Focussed Electric
MFE-C.A 430 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

Compact Short Gamma
MGS-D.A 219 LG: 3.41 ft WT: 24.3 lb OD: 2.244 in

Compact Knuckle Joint
SKJ-E.B 588 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

Compact Swivel Head Adaptor
SHA-J.B 682 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in

Compact Knuckle Joint
SKJ-E.B 537 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

Compact Inline Bowspring sub
MIS-D.B 735 LG: 5.70 ft WT: 33.1 lb OD: 2.240 in

Compact Linker (MCL-C.A)
MLK-C.A 28 LG: 3.17 ft WT: 26.5 lb OD: 2.240 in

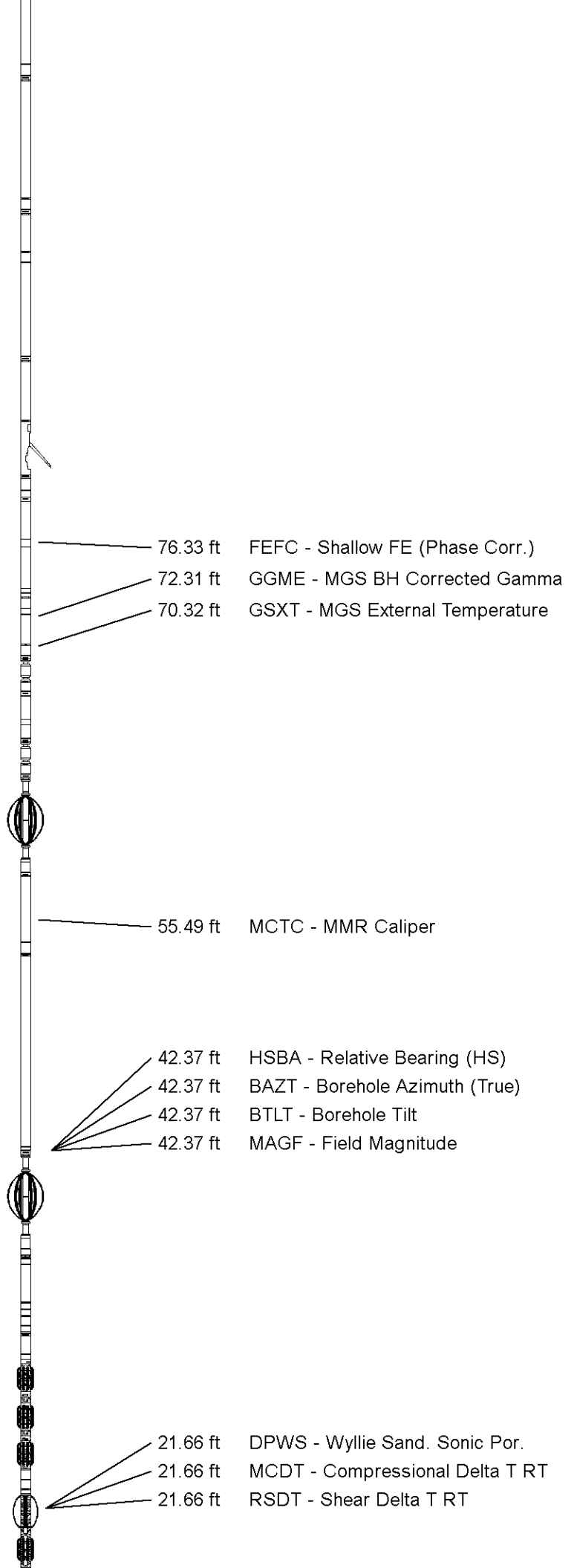
Compact Navigation
MBN-C.J 146 LG: 11.81 ft WT: 70.5 lb OD: 2.244 in

Compact Inline Bowspring sub
MIS-D.B 810 LG: 5.70 ft WT: 33.1 lb OD: 2.240 in

Compact Dipole Memory
MDM-B.A 177 LG: 4.48 ft WT: 39.7 lb OD: 2.244 in

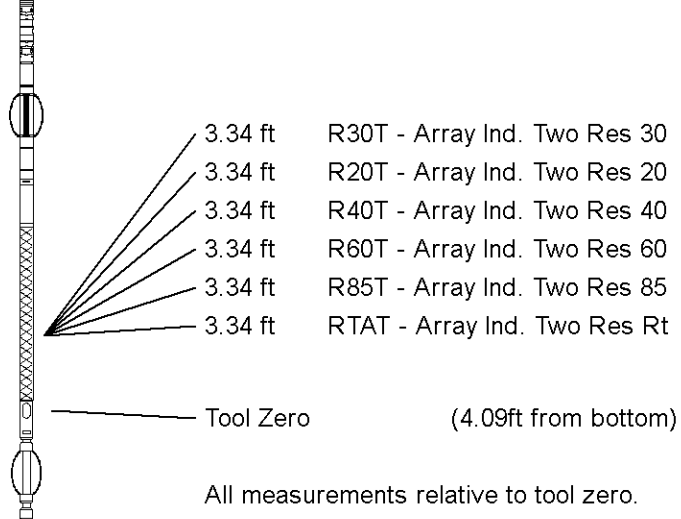
Compact Dipole Receiver
MRD-B.A 177 LG: 8.89 ft WT: 88.2 lb OD: 2.244 in

Compact Dipole Transmitter
MTD-B.A 177 LG: 12.63 ft WT: 110.2 lb OD: 2.244 in



Compact Induction
MAI-C.A 516 LG: 14.76 ft WT: 48.5 lb OD: 2.240 in

Total Length: 150.89 ft Weight: 1078.1 lb



COMPANY	HIGHPOINT RESOURCES CORPORATION
WELL	LION CREEK 23-0164B
FIELD	WATTENBERG
PROVINCE/COUNTY	WELD
COUNTRY/STATE	USA /COLORADO

Elevation Kelly Bushing	5411	feet	First Reading	8213.00	feet
Elevation Drill Floor	5411	feet	Depth Driller	8237.00	feet
Elevation Ground Level	5391	feet	Depth Logger	8237.00	feet



Weatherford®

ARRAY INDUCTION
LOG