BAKER HUGHES

Gamma Ray,Propagation Resistivity

Scale:	1:240 MD
Depth Reference:	Driller's Depth
Company:	Noble Energy
Well:	Freedom Federal LC21-630
Field:	Weld County
County:	Weld
Country:	United States
State:	Colorado
Status:	Final Print
API No:	0512342803
Job ID:	8597123

Surface Location:
Latitude: 040° 43' 59.628" N
Longtitude: 103° 58' 19.452" W
SEC: 22 TWN: 9N RGE: 59W

Other Services:
Wellbore Surveys

Permanent Datum (P.D.):	Mean Sea Level	Elevation:	4882.00 ft
Log Measured From:	Rig Floor	Above P.D.	30.00 ft
Elev. KB:	N/A		
Elev. DF:	4912.00 ft		
Elev. GL:	4882.00 ft		

Dates

Date From:	2017-07-14
Date To:	2017-07-15
Spud Date:	2017-07-13

Interval Logged

Top: (ft)	1950.00
Bottom: (ft)	5504.00

Magnetic Field Reference

Azi Reference North:	Grid
Dip Angle: (deg)	67.08
Total Magnetic Field Strength: (nT)	52610
Mag to Reference North Correction: (deg)	6.72 E

Borehole Record

Hole Size (in)	From (ft)	To (ft)
8.500	1938.00	11085.00

Casing Record

Size (in)	Weight (lb/ft)	From (ft)	To (ft)
9.625	36.00	30.00	1928.00

Mud Record

Type	From (ft)	To (ft)
Oil Based Mud	30.00	11085.00

Deviation Record

Hole Size (in)	Interval (ft)	Inc | Az (Start)	Inc | Az (End)
8.500	9147.00	0.26 | 184.19	90.18 | 267.13

Acquisition System

Baker Hughes Cadence	RT4.1
PlotStudio	4.0.7570.8

Software Version

Other

Rig:	H&P 524
Contractor:	Helmerich & Payne Drilling Co
District:	RMA
Unit:	D&E

Log Run Summary

Run No	Bit Run No.	Bit Size (in)	Bit Type	Bit Gauge Length (in)	Assembly Type	Logged Interval Top (ft)	Logged Interval Bottom (ft)	Bit Depth Interval From (ft)	Bit Depth Interval To (ft)	Date / Time Start Logging	Date / Time End Logging	Circ. Hours (h)
1	1	8.500	PDC	2.00	AutoTrak Curve	30.00	877.00	1938.00	6386.00	2017-07-13 09:28	2017-07-14 02:28	15.40
2	2	8.500	PDC	2.00	AutoTrak Curve	877.00	5510.00	6386.00	11085.00	2017-07-14 11:55	2017-07-15 10:05	21.72

Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
Steven Cano	2017-07-12	2017-07-15	Ty Jackson	2017-07-12	2017-07-15			

Mud Properties Record

Date / Time	Run No.	Measured Depth (ft)	Mud Type	Density (ppg)	Viscosity (cP)	pH	Fluid Loss (cm3)	Oil / Water	Source	Total Chlorides (ppm)	K+ (%)
2017-07-12 19:03	1	1938.00	Oil Based Mud	9.2	9	N/A	N/A	78.2/21.8	Active Pit	25000	0.00
2017-07-14 08:16	2	6385.00	Oil Based Mud	9.3	9	N/A	N/A	81.5/18.5	Active Pit	28000	0.00
2017-07-15 14:00	2	10000.00	Oil Based Mud	9.2	10	N/A	N/A	76.3/23.7	Active Pit	25000	0.00

Mud Resistivity Record

Date / Time	Run No.	Measured Depth (ft)	Surface Temp (degF)	Surface Rm (ohm.m)	Surface Rmf (ohm.m)	Surface Rmc (ohm.m)	BHCT (degF)	Downhole Rm @ BHCT (ohm.m)	Downhole Rmf @ BHCT (ohm.m)	Downhole Rmc @ BHCT (ohm.m)
2017-07-13 15:31	1	2000.00	90.0	100.000	N/A	N/A	200.0	100.000	N/A	N/A
2017-07-15 15:31	2	11085.00	90.0	100.000	N/A	N/A	212.0	100.000	N/A	N/A

Equipment and Service Data

Run No.	Tool	Serial Number	Measurement	Sensor Offset (ft)	Bit Offset (ft)	Max O.D. (in)	Min I.D. (in)
1	OnTrak	12115658	Pressure	4.37	5508.38	6.750	0.000
1	OnTrak	12115658	Gamma (double)	5.26	5509.27	6.750	0.000
1	OnTrak	12115658	Resistivity (4tx)	9.30	5513.31	6.750	0.000
1	OnTrak	12115658	Directional (mag)	15.09	5519.10	6.750	0.000
2	OnTrak	12115658	Pressure	4.37	5508.38	6.750	0.000
2	OnTrak	12115658	Gamma (double)	5.26	5509.27	6.750	0.000
2	OnTrak	12115658	Resistivity (4tx)	9.30	5513.31	6.750	0.000
2	OnTrak	12115658	Directional (mag)	15.09	5519.10	6.750	0.000

Service and Tool Mnemonics

Mnemonic	Name	Description
OTK	OnTrak	Sensor Sub (Inc, Azi, Temp, Azimuthal GR, Res, AP, VSS), OnTrak Platform
BCPM	BCPM	Bi-Directional Communication and Power Module, OnTrak Platform

Comments

1 Depth measurements obtained from a depth control system not supplied or operated by Baker Hughes. Due to lack of control by Baker Hughes logging engineers, depth calibrations and measurements could not be independently verified.

2 Baker Hughes LWD run 1 and 2 utilized a 6 3/4 inch Ontrak services (Multiple Propagation Resistivity, Gamma Ray, and Directional) behind a 8 1/2 inch bit and rotary steerable assembly to perform a MAD (Measurement After Drilling) pass from 1938 to 5485 feet MD (1938 to 5477 feet TVD). The data collected during this run was ream logged up to 16 hours after being drilled and it is presented independent of the drilling log.

Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	5485.00	8.500	2	The interval from 5485 to 11085 feet MD (5477 to 6075 feet TVD) due to sensor to bit offset at well TD.

Curve Mnemonics

Presented Curves	Description	Units
CACLM	Conductivity Attenuation - Corrected - 400kHz	mmho/m
RACHM	Resistivity Attenuation - Corrected - 2MHz	ohm.m
RACLM	Resistivity Attenuation - Corrected - 400kHz	ohm.m
RPCHM	Resistivity Phase - Corrected - 2MHz	ohm.m
RPCLM	Resistivity Phase - Corrected - 400kHz	ohm.m
RPTHM	Resistivity Time Since Drilled	min
ROPA	Depth Averaged ROP 3 ft Average	ft/h
TVD	True Vertical Depth	ft
GRAM	Gamma Ray - Apparent 0.5 ft Average	API
GRIM	Gamma Ray Data Point Indicator	unitless
GRIX	Gamma Ray - Data Point Indicator	unitless
TCDM	Downhole Temperature	degF

BAKER HUGHES

Company Noble Energy

Well Freedom Federal LC21-630

Interval

Date From: 2017-07-14 03:30:55 **Top:** 1955.00

Date To: 2017-07-15 14:32:36 **Bottom:** 5510.00

Created 2017-07-17 10:03

Gamma Ray - Apparent 0.5 ft Average [GRAM]
0 150
API

Depth Averaged ROP 3 ft Average [ROPA]
1200 0
ft/h

True Vertical Depth [TVD]

MD 1:240 feet

Resistivity Phase - Corrected - 2MHz [RPCHM]
0.2 200
ohm.m

Resistivity Phase - Corrected - 400kHz [RPCLM]
0.2 200
ohm.m

Resistivity Attenuation - Corrected - 2MHz

Conductivity Attenuation - Corrected - 400kHz [CACLM]
4000 0
mmho/m

Downhole Temperature [TCDM]
0 250
degF

True Vertical Depth [TVD]
0 10000
ft

Resistivity Attenuation - Corrected - 2MHz [RACHM]
0.2 200
ohm.m

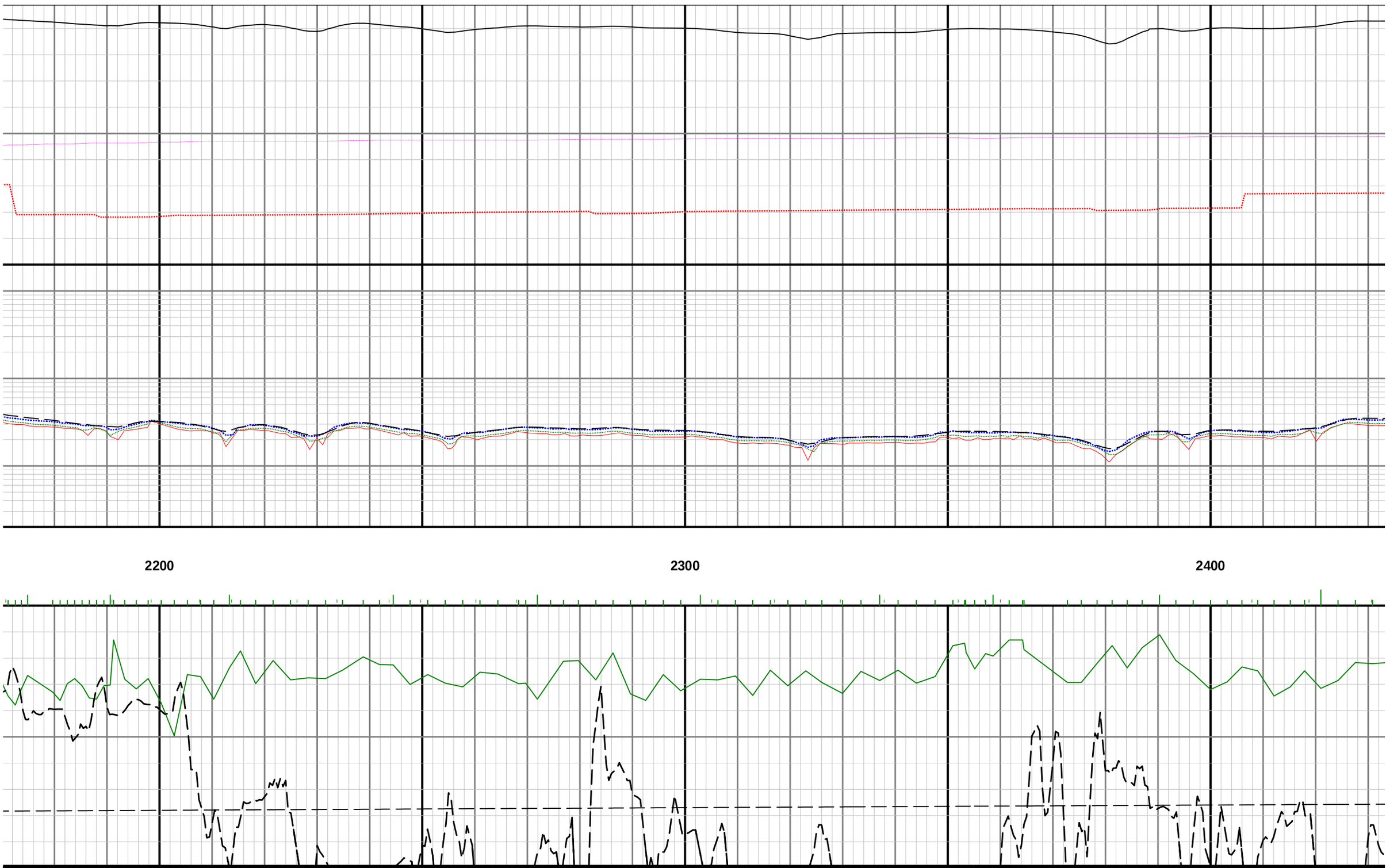
Resistivity Attenuation - Corrected - 400kHz [RACLM]
0.2 200
ohm.m

Resistivity Time Since Drilled [RPTHM]
0 600
min

>R1

TVD
GRAM
ROPA
GRIM
RPCHM
RPCLM
RACHM
RACLM
TCDM
RPTHM
CACLM

2000
2100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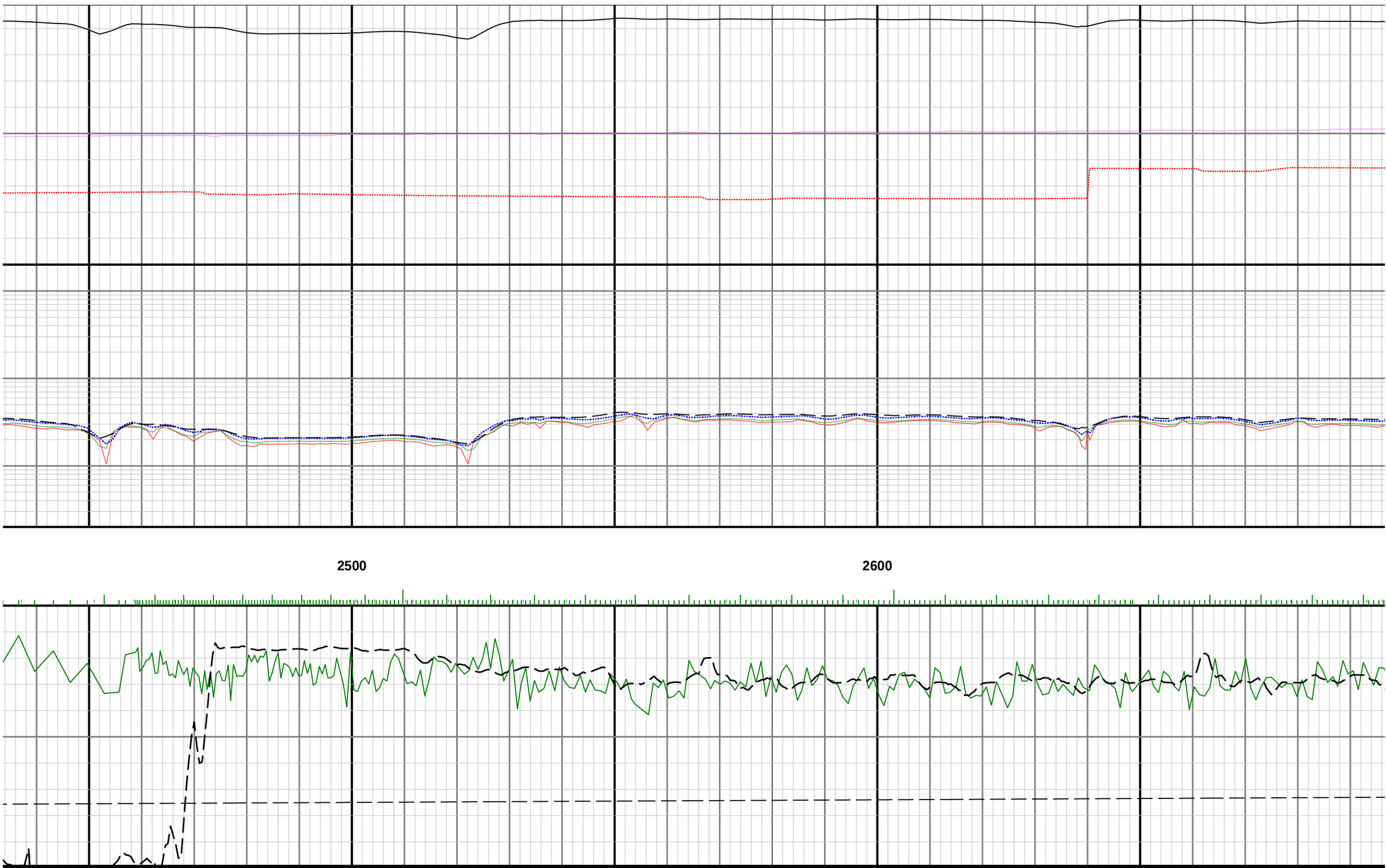
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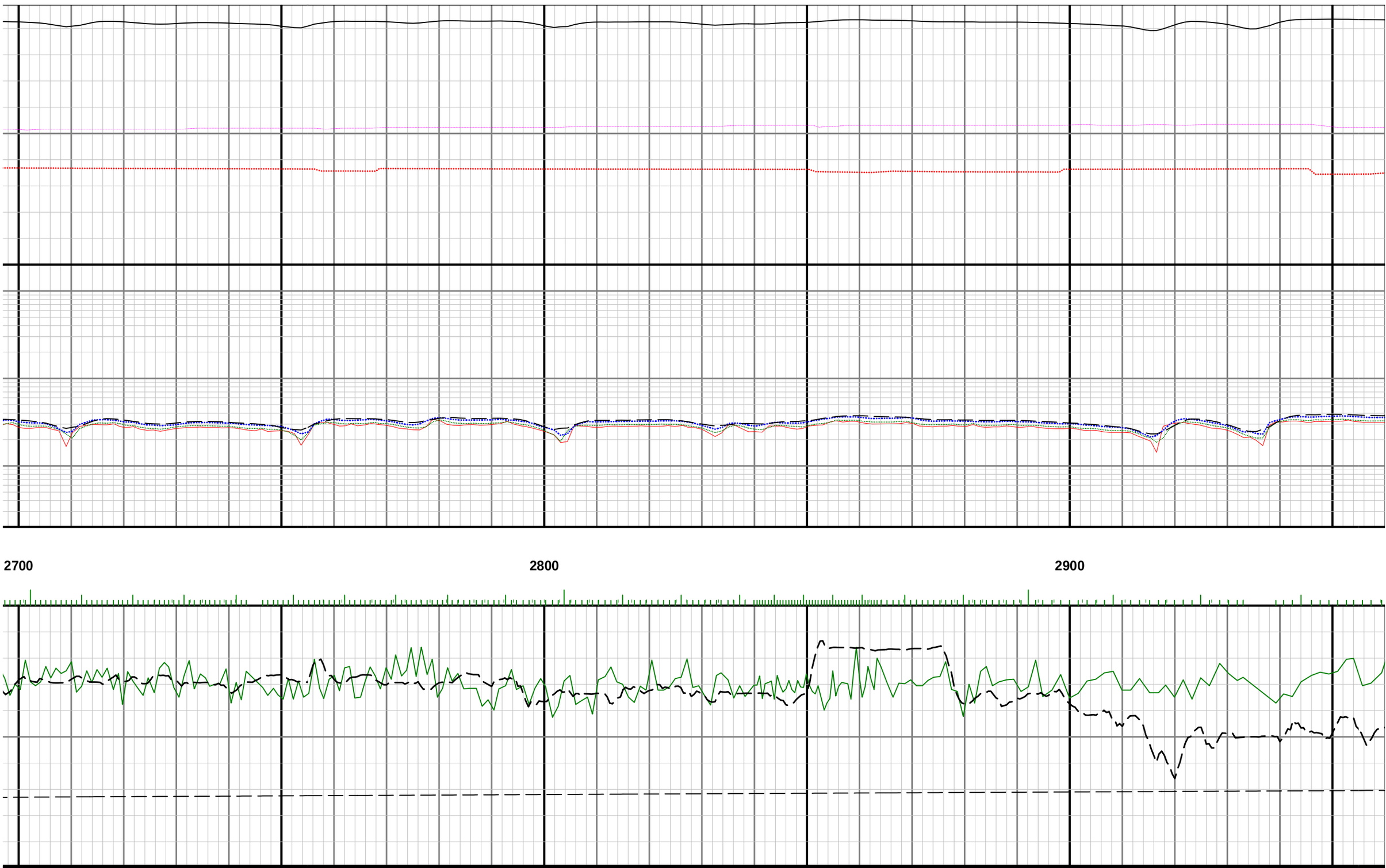
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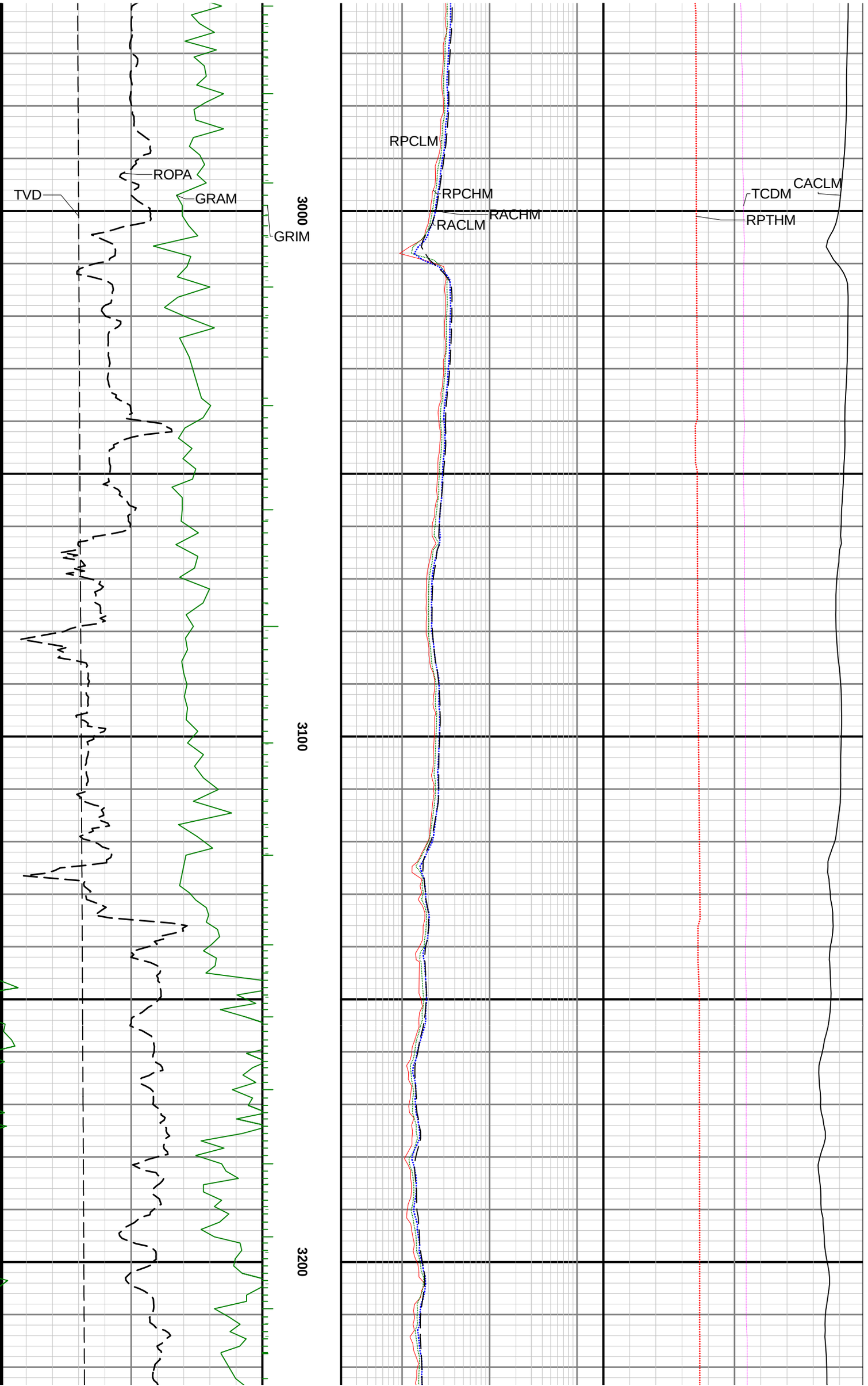
TVD
ROPA
GRAM
GRIM
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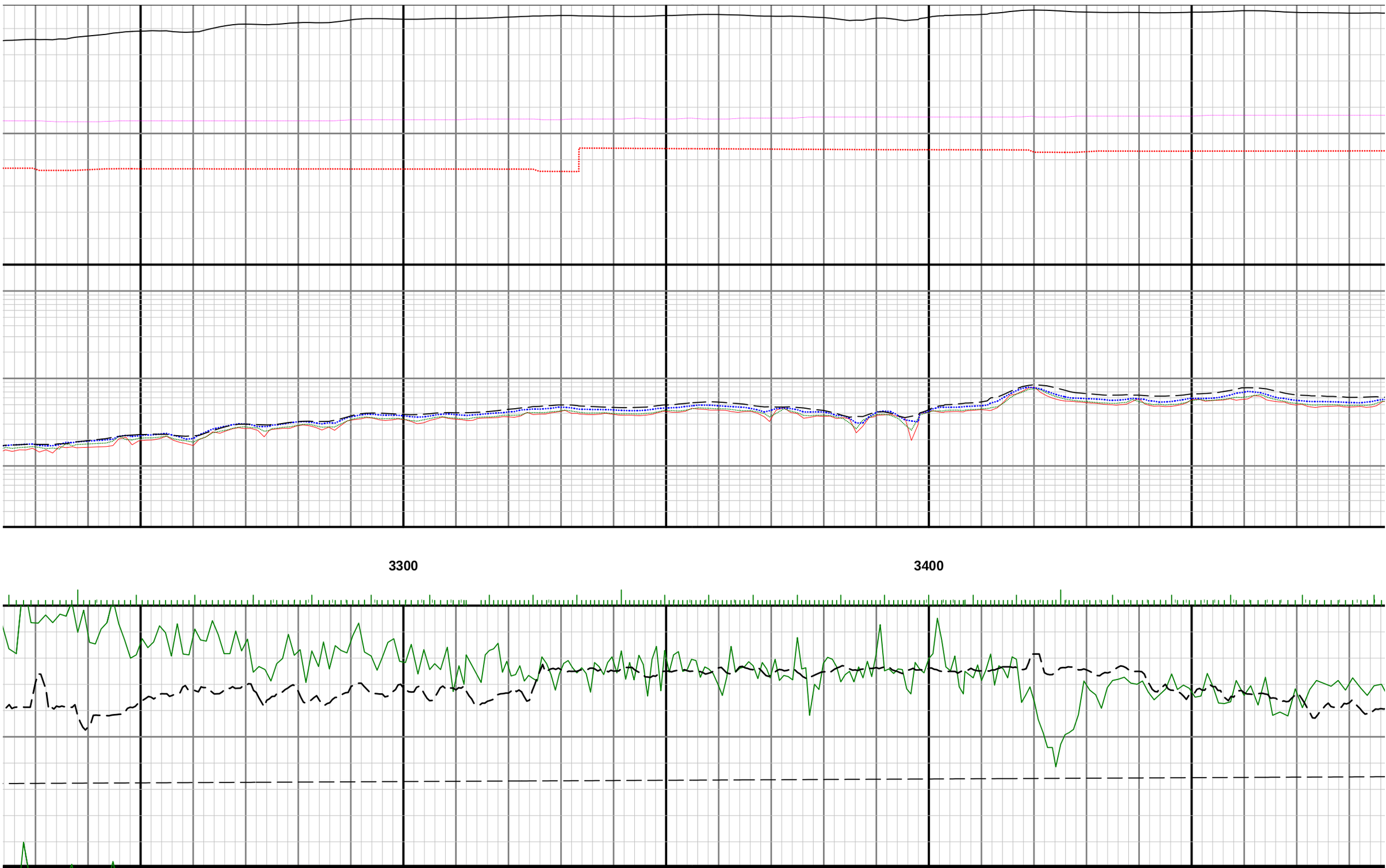
TCDM
CACLM
RPTHM
3000
3100
3200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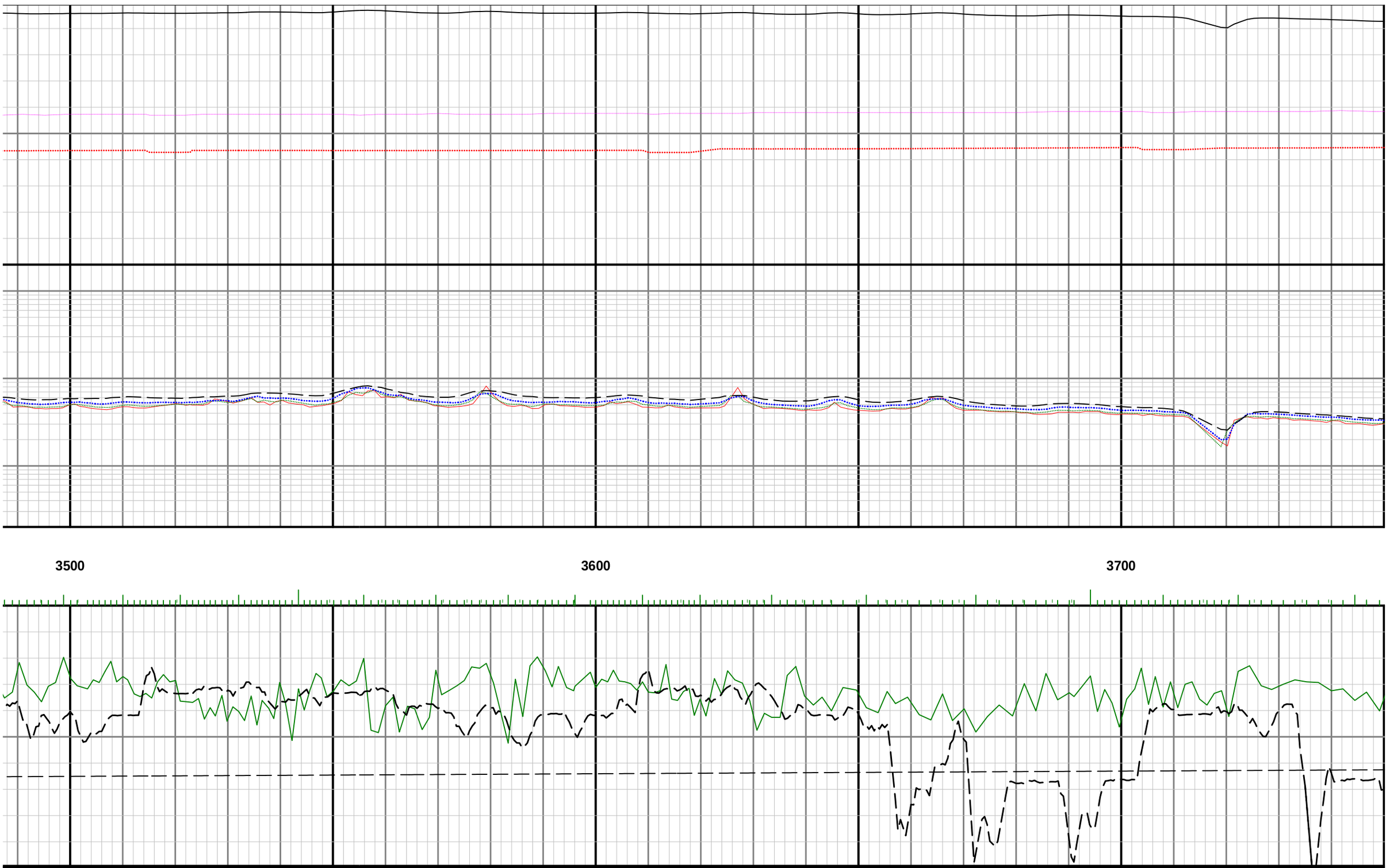
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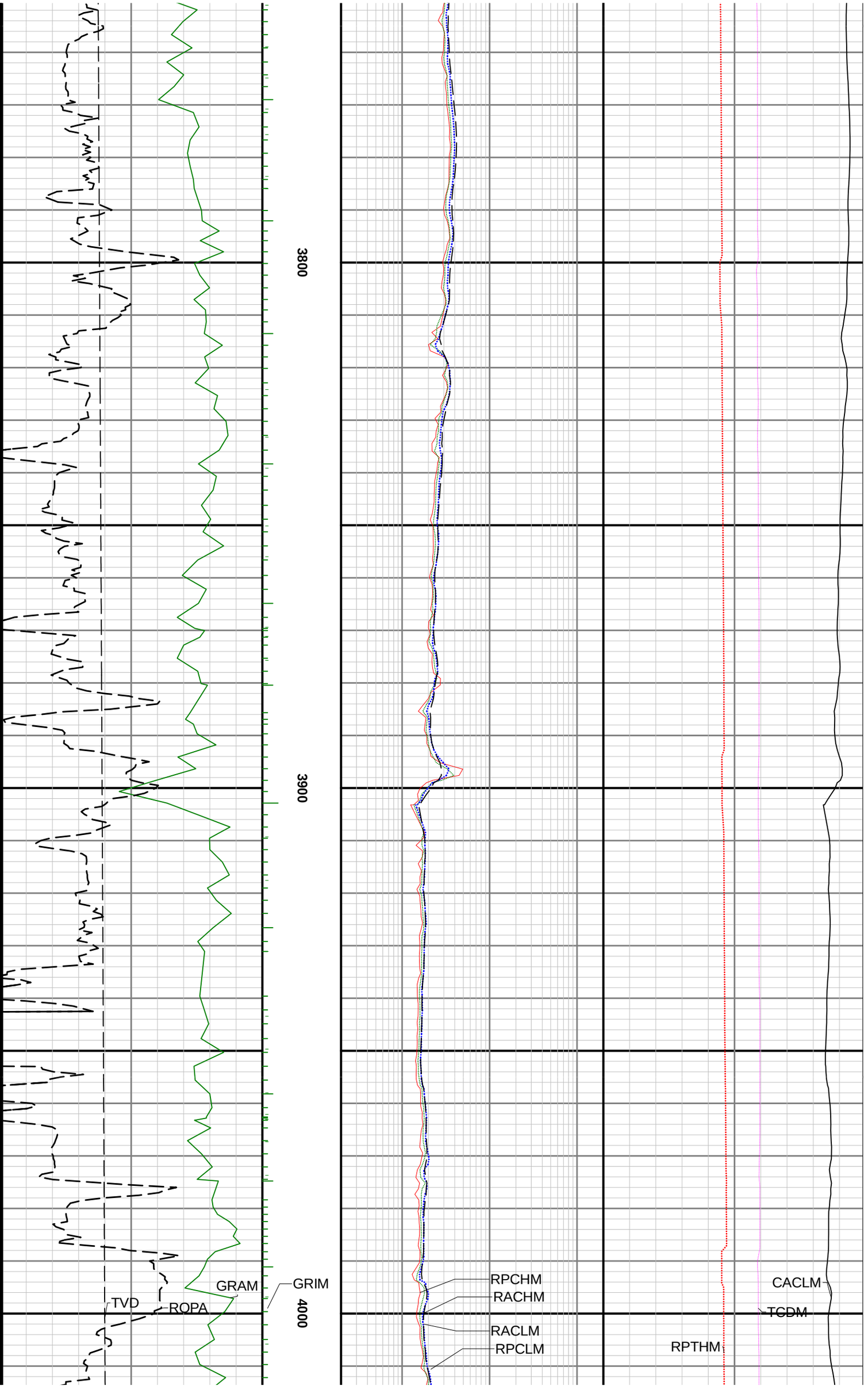
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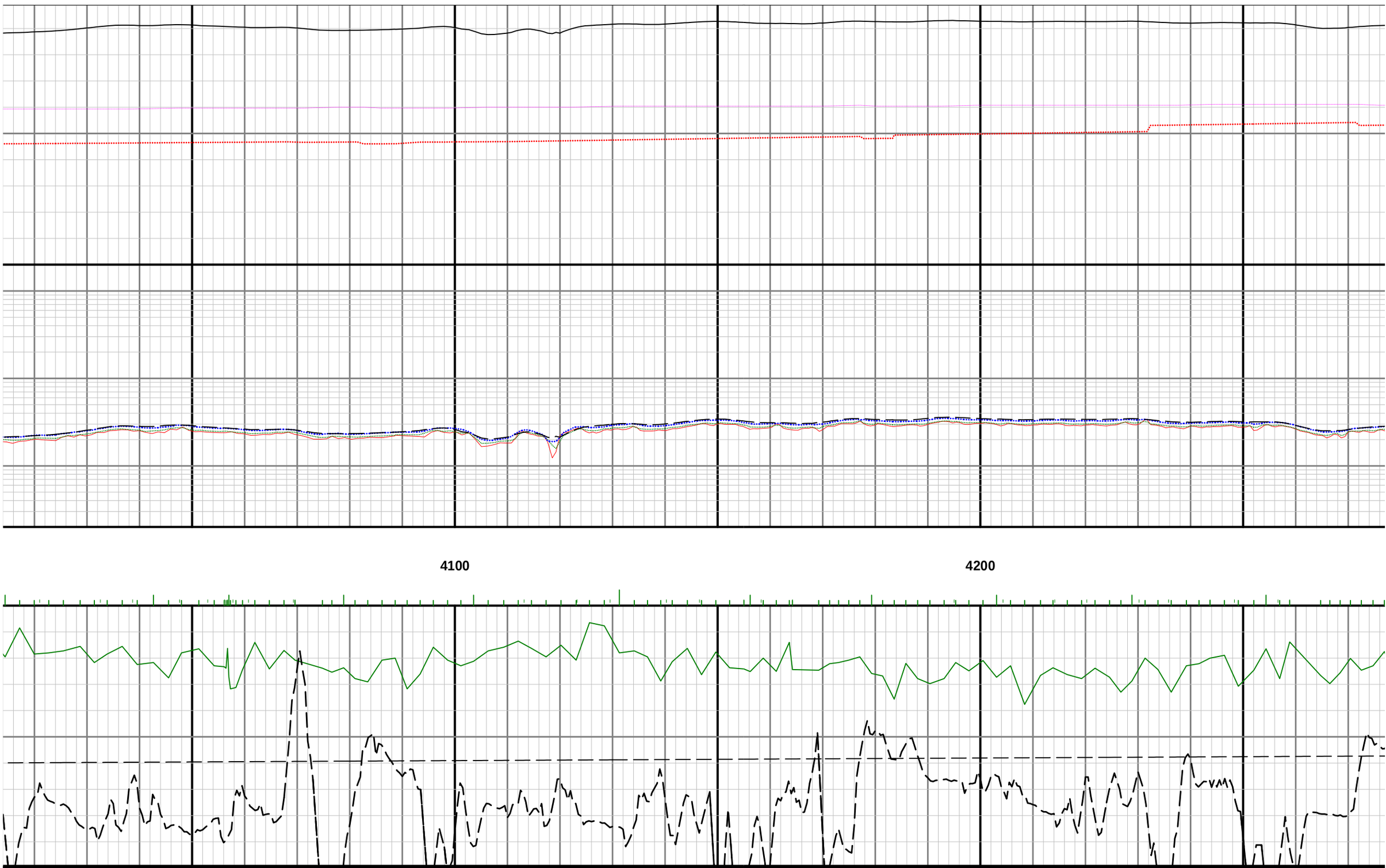
RPCLM
RPTHM
CACLM
TCDM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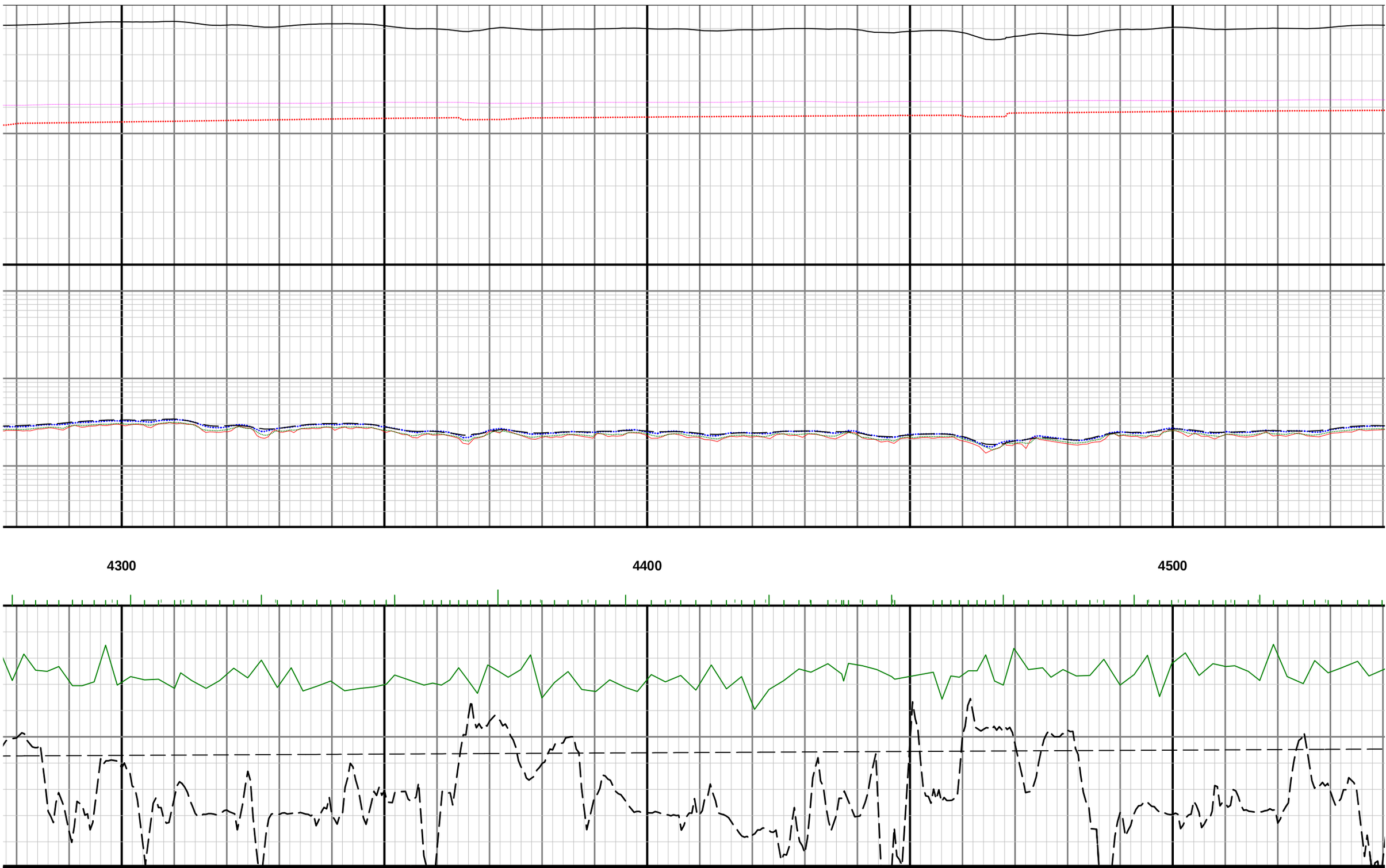
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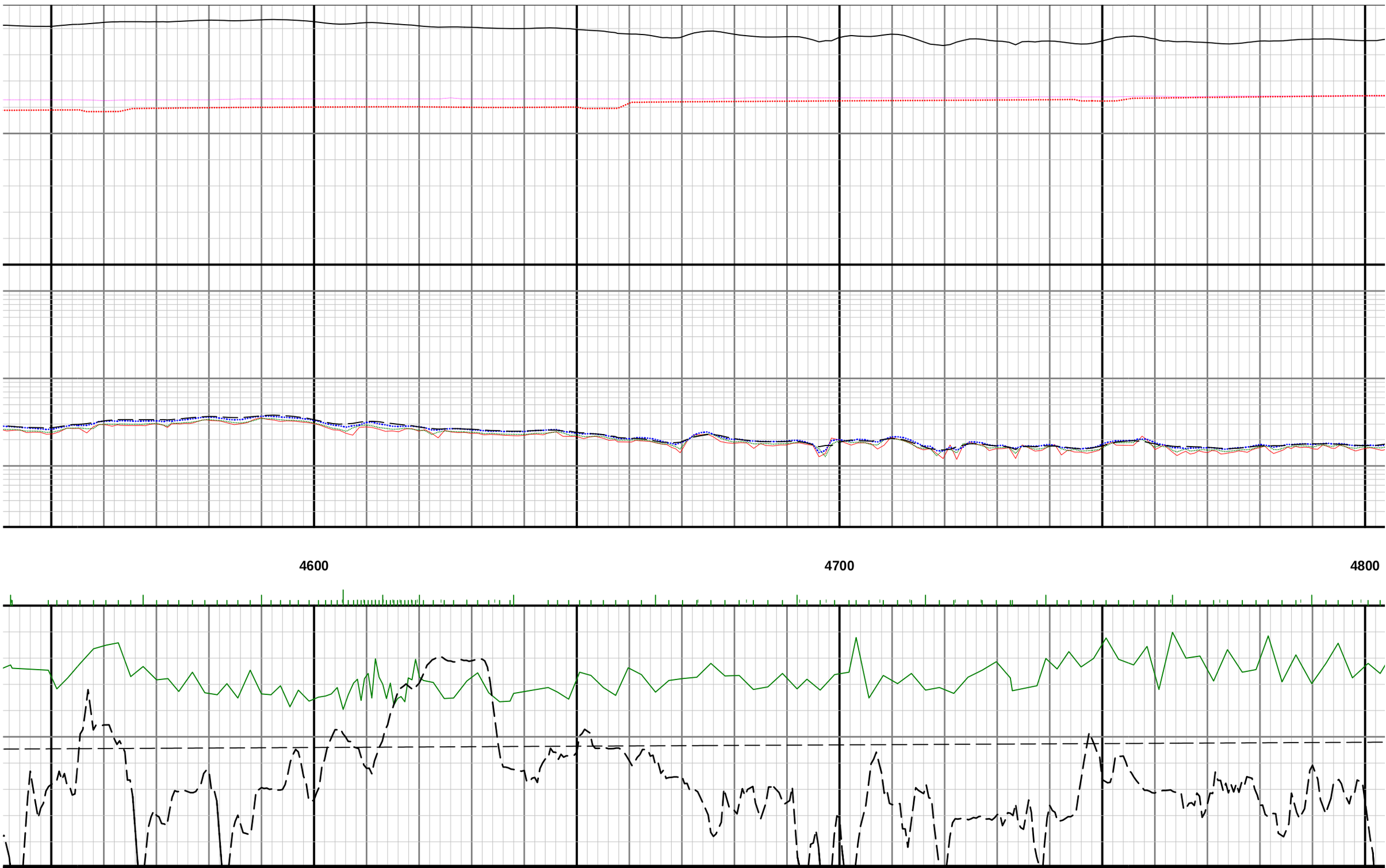
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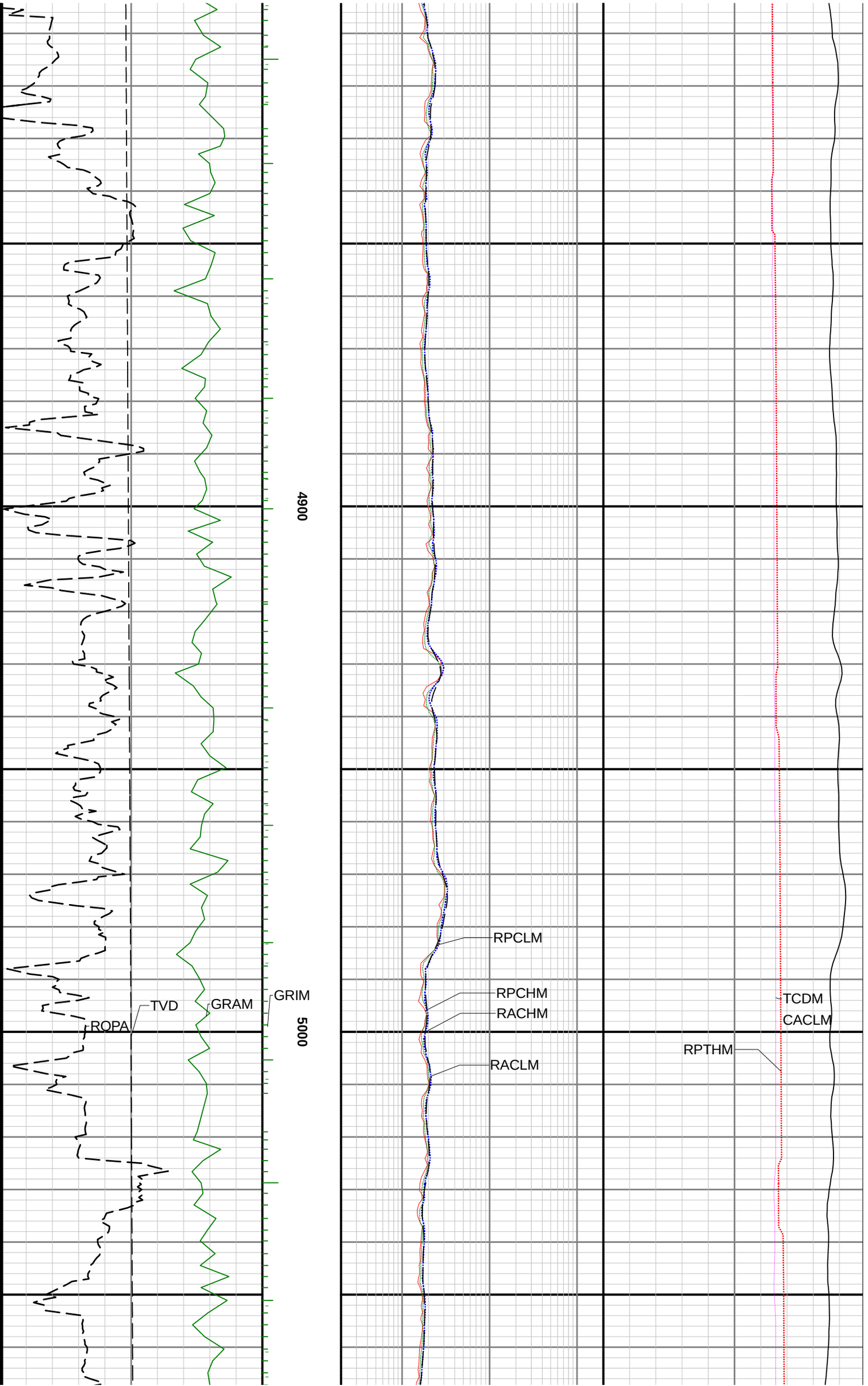
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TVD
GRAM
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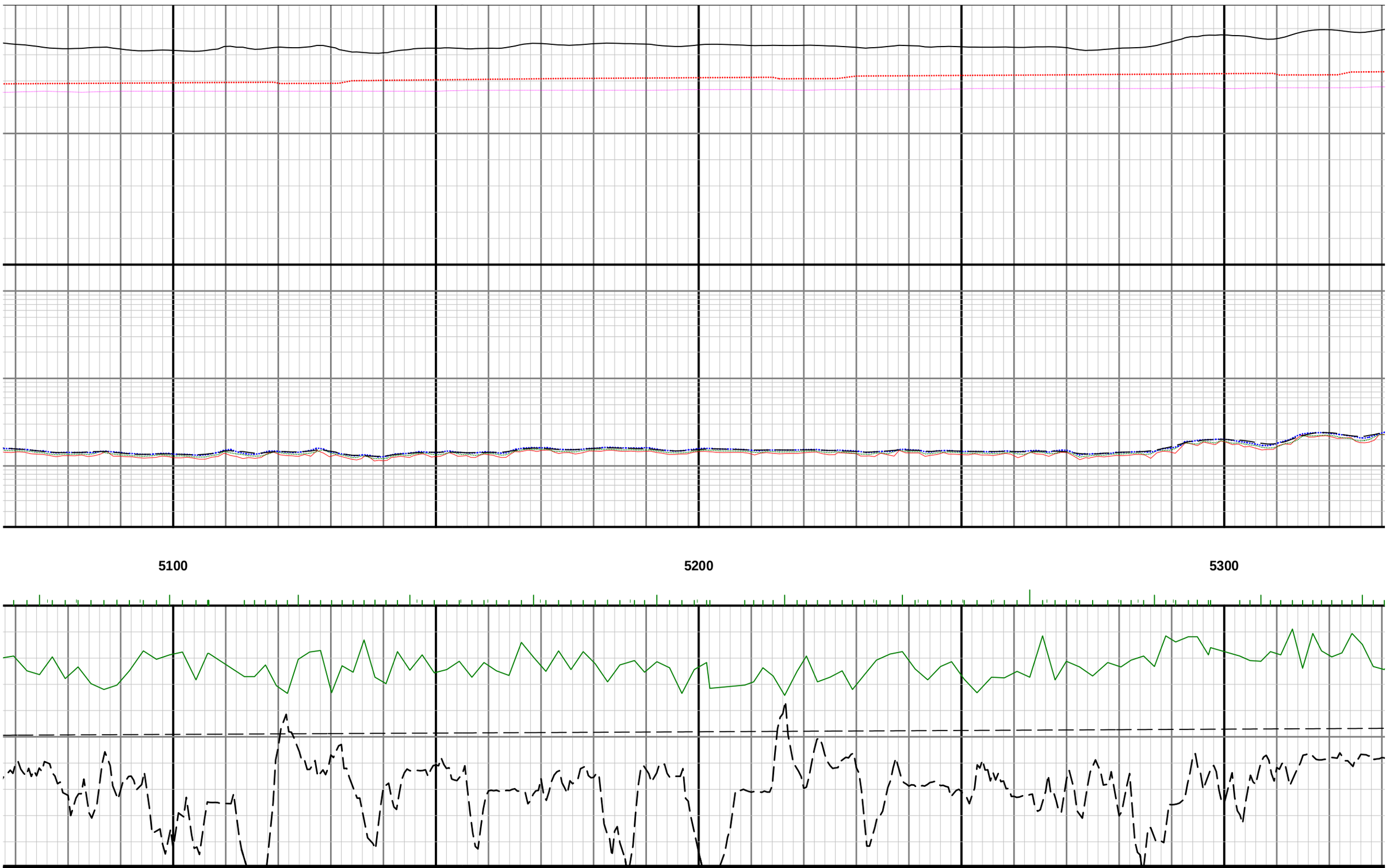
RPCLM
RPCHM
RACHM
RACLM
RPTHM
TCDM
CACLM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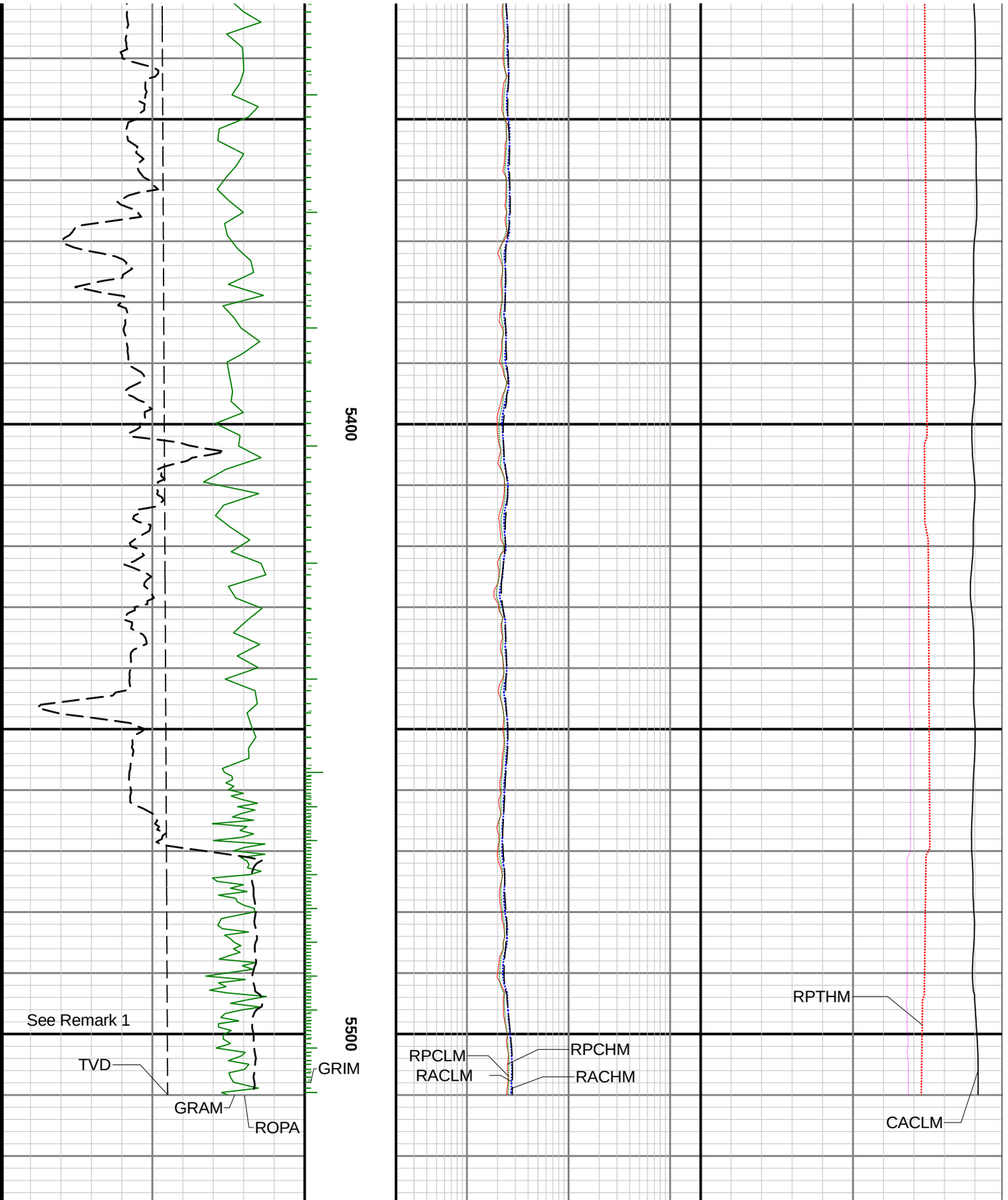

Gamma Ray - Apparent 0.5 ft Average [GRAM]
0 150
API
Depth Averaged ROP 3 ft Average [ROPA]
1200 0
ft/h
True Vertical Depth [TVD]
0 10000
ft

MD 1:240 feet

Resistivity Phase - Corrected - 2MHz [RPCHM]
0.2 200
ohm.m
Resistivity Phase - Corrected - 400kHz [RPCLM]
0.2 200
ohm.m
Resistivity Attenuation - Corrected - 2MHz [RACHM]
0.2 200
ohm.m
Resistivity Attenuation - Corrected - 400kHz [RACLM]
0.2 200
ohm.m

Conductivity Attenuation - Corrected - 400kHz [CACLM]
4000 0
mmho/m
Downhole Temperature [TCDM]
0 250
degF
Resistivity Time Since Drilled [RPTHM]
0 600
min