LWD MEMORY LOG

Azimuthal Gamma Ray

Scale: **1:1200 Measured Depth**

Depth Reference: **Driller's Depth**

Status: **Final Print**

API No: 05123498170000

Job ID: 109714457

Company: Petro Operating Co

Well: Flaschenriem 2

Field: Wattenburg

County: Weld **Country:** United States

State: Colorado

Surface Location:

Latitude: 040° 20' 38.884" N

Longtitude: 104° 59' 29.550" W

SEC: 3 TWN: 4N RGE: 68W

Other Services:

Directional

Permanent Datum (P.D.): Ground Level

Elevation: 5068.00 ft

Log Measured From: Rig Floor

Above P.D. 23.00 ft

Elev. KB: N/A

Elev. DF: 5091.00 ft

Elev. GL: 5068.00 ft

Dates

Date From: 2019-03-23

Date To: 2019-04-27

Spud Date: 2019-03-23

Interval Drilled

Top: (ft) 23.00

Bottom: (ft) 15889.00

Magnetic Field Reference

Azi Reference North: True

Dip Angle: (deg) 66.69

Total Magnetic Field Strength: (nT) 52148

Mag to Reference North Correction: (deg) 8.32

Borehole Record

Hole Size (in)	From (ft)	To (ft)
13.500	23.00	1580.00
8.500	1580.00	15889.00

Casing Record

Size (in)	Weight (lb/ft)	From (ft)	To (ft)
9.625	36.00	23.00	1570.00

Mud Record

Type	From (ft)	To (ft)
Fresh Water	23.00	1580.00
Diesel-Oil Based Mud	1580.00	15899.00

Deviation Record

Hole Size (in)	Interval (ft)	Inc | Az (Start)	Inc | Az (End)
13.500	1557.00	0.39 | 213.70	20.38 | 349.79
8.500	14332.00	20.38 | 349.79	90.03 | 94.25

Acquisition System

Baker Hughes Cadence RT 5.0

Plot Studio 5.0.8260.3

Other

Rig: Ensign 140

Contractor: Ensign Drilling

District: RMD Unit: D & E

Log Run Summary

Run No	Bit Run No.	Bit Size (in)	Bit Type	Assembly Type	Bit Gauge Length (in)	Depart Wellsite	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	13.500	PDC	Steerable	6.00		0.00	0.00	23.00	1580.00	N/A	N/A	15.59
2	2	8.500	PDC	AutoTrak Curve	3.00		1567.00	15876.00	1580.00	15889.00	2019-04-24 05:00	2019-04-27 18:00	70.55

Crew

Name	Arrive Wellsite	Depart Wellsite
Shawn McCaffrey	2019-04-24	2019-04-28

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+ (%)
2019-03-23 09:00	1	95.00	Fresh Water	9.0	2	N/A	N/A	N/A	Active Pit	800	0.00
2019-04-24 12:00	2	1580.00	Diesel-Oil Based Mud	9.5	15	N/A	N/A	78.4/21.6	Active Pit	49000	0.00

2019-04-25 03:00	2	4156.00	Diesel-Oil Based Mud	9.3	19	N/A	N/A	81.1/18.9	Active Pit	45000	0.00
2019-04-26 03:00	2	9022.00	Diesel-Oil Based Mud	9.5	22	N/A	N/A	79.8/20.2	Active Pit	49000	0.00
2019-04-27 03:00	2	13550.00	Diesel-Oil Based Mud	9.6	22	N/A	N/A	79.3/20.7	Active Pit	48000	0.00

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	NaviTrak	13191955	VSS	16.55	52.64	8.000	0.000
1	NaviTrak	13191955	Directional (mag)	16.55	52.64	8.000	0.000
2	AutoTrak Curve Steering Unit	14381514	Near Bit Inclination	5.93	6.73	7.000	4.330
2	AutoTrak Curve Steering Unit	14381514	Near Bit VSS	5.93	6.73	7.000	4.330
2	AutoTrak Curve MWD	14322606	Gamma (single)	2.76	12.90	7.000	3.250
2	AutoTrak Curve MWD	14322606	Directional (mag)	12.27	22.41	7.000	3.250

Service and Tool Mnemonics

Mnemonic	Name	Description
NTK	NaviTrak	Probe Based Directional Module, NaviTrak Platform
ATC SU	AutoTrak Curve SU	Auto Trak Curve Steering Unit
ATC MWD	AutoTrak Curve MWD	Auto Trak Curve MWD
ATC LCPM	AutoTrak Curve LCPM	Auto Trak Curve LCPM

Comments

1 Depth measurements were obtained from a depth control system not supplied or operated by Baker Hughes, a GE company. Due to a lack of control by Baker Hughes, a GE company logging engineers, depth calibrations and measurements could not be independently verified and the unverified depths as supplied to Baker Hughes, a GE company are being used to present logging data.

2 Baker Hughes LWD Run 1 utilized 8 inch NaviTrak service (Directional only) behind a 13 1/2 inch bit and steerable assembly from surface to 1580 feet MD (surface to 1559 feet TVD). No logging data was acquired during this run.

3 Baker Hughes LWD Run 2 utilized 6 ¾ inch NaviGamma services (Gamma Ray and Directional) behind a 8½ inch bit and rotary steerable assembly from 1580 to 15889 feet MD (1559 to 7255 feet TVD).

4 Gamma Ray Apparent (GRAM) is presented 0 to 300 API per customer request.

Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	1580.00	8.500	2	Gamma Ray logging operations began at 1580 feet (1559 feet TVD).
2	10225.00	8.500	2	Gamma Ray Apparent (GRAUM and GRADM) began logging operations began at 10225 feet (7250 feet TVD).
3	15876.00	8.500	2	The interval from 15876 to 15889 feet MD (7255 feet TVD) was not logged due to sensor to bit offset at well TD.

Curve Mnemonics

Presented Curves	Description	Units
ROPA	Depth Averaged ROP 10 ft Average	ft/h
TVD	True Vertical Depth	ft
WOBA	Weight On Bit, Average 1 ft Average	klb
GRAM	Gamma Ray - Apparent - Memory 3 ft Average	API
GRADM	Gamma Ray - Apparent - Down Quadrant - Memory 3 ft Average	API
GRAUM	Gamma Ray - Apparent - Up Quadrant - Memory 3 ft Average	API
TCDM	Directional Real-Time Survey Temperature	degF

BAKER HUGHES a GE company

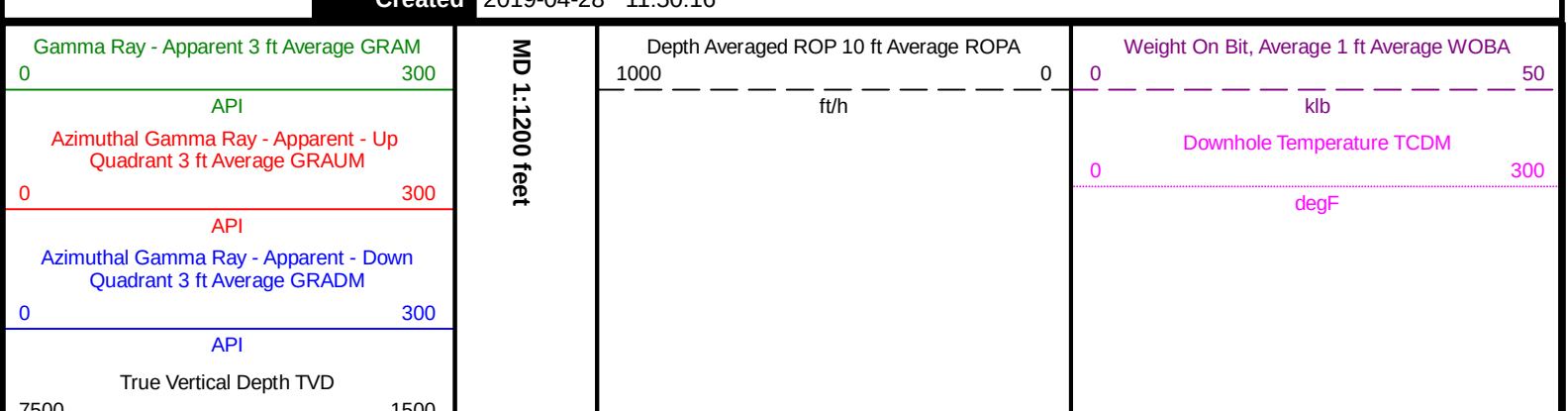
Company Petro Operating Co

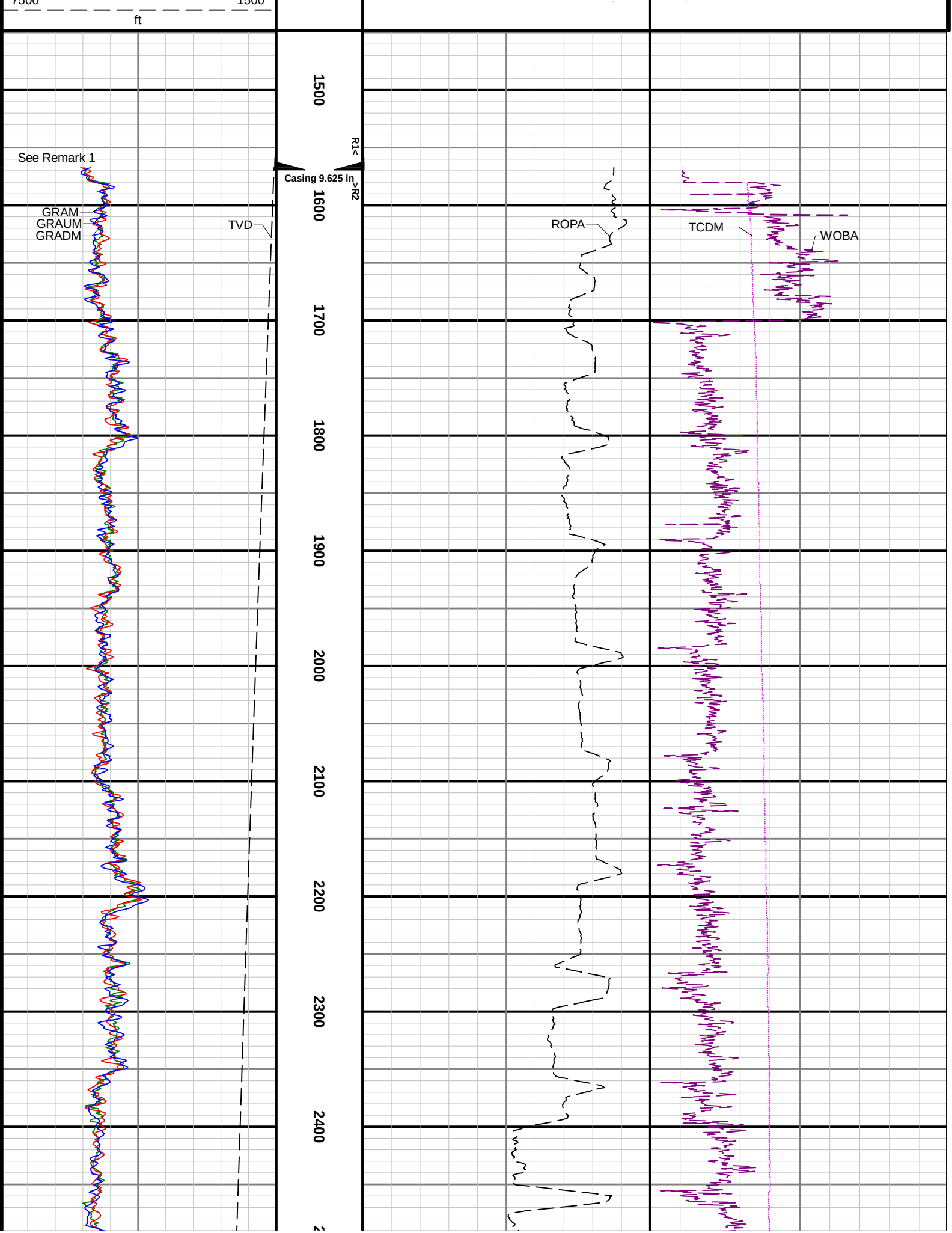
Well Flaschenriem 2

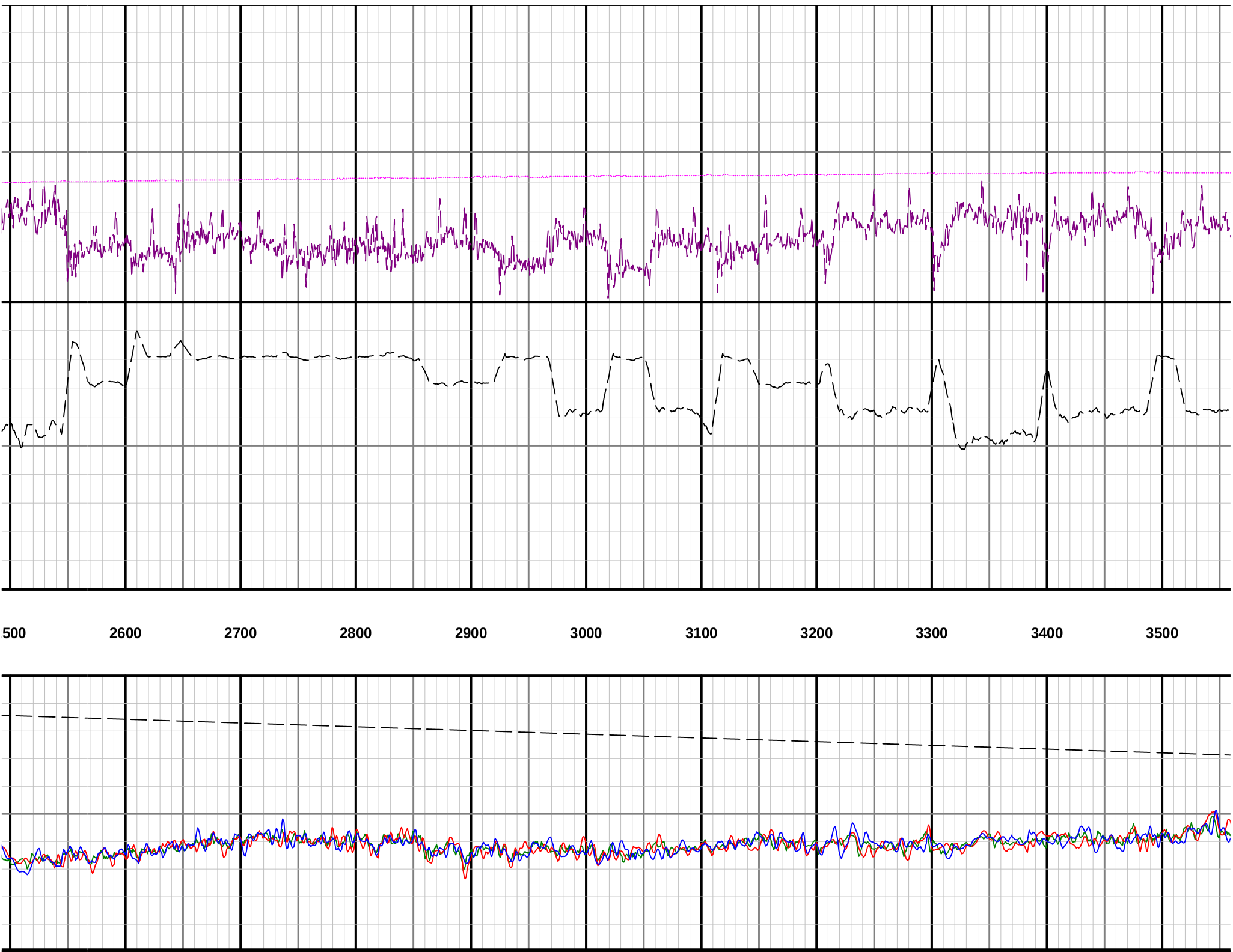
Interval **Date From:** 2019-03-23 08:03 **Top:** 23.00 ft

Date To: 2019-04-27 11:46 **Bottom:** 15889.00 ft

Created 2019-04-28 11:50:16




7500
1500
ft
See Remark 1
GRAM
GRAUM
GRADM
TVD
Casing 9.625 in
R1<
>R2
ROPA
TCDM
WOBA
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400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2700
2800
2900
3000
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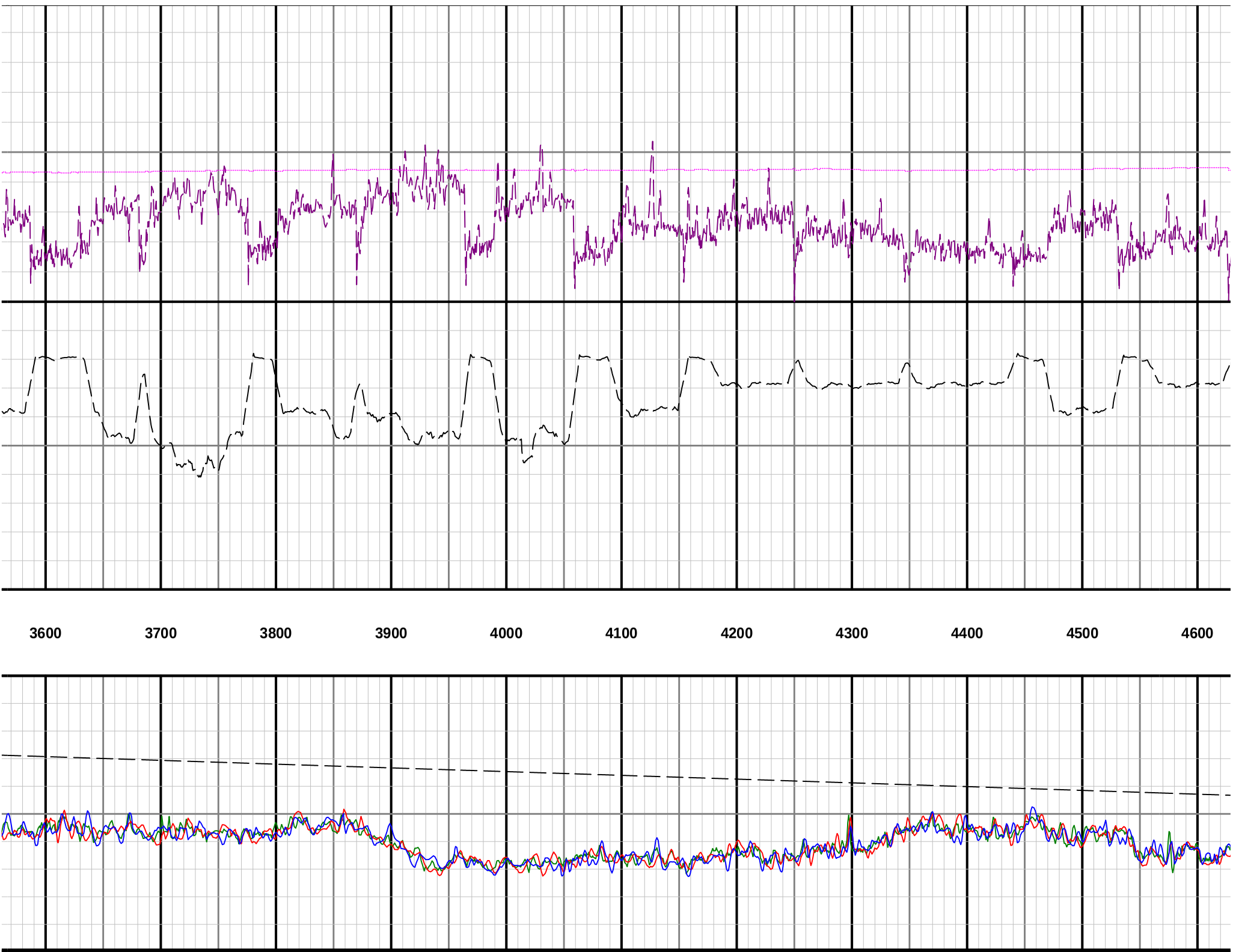
3200
3300
3400
3500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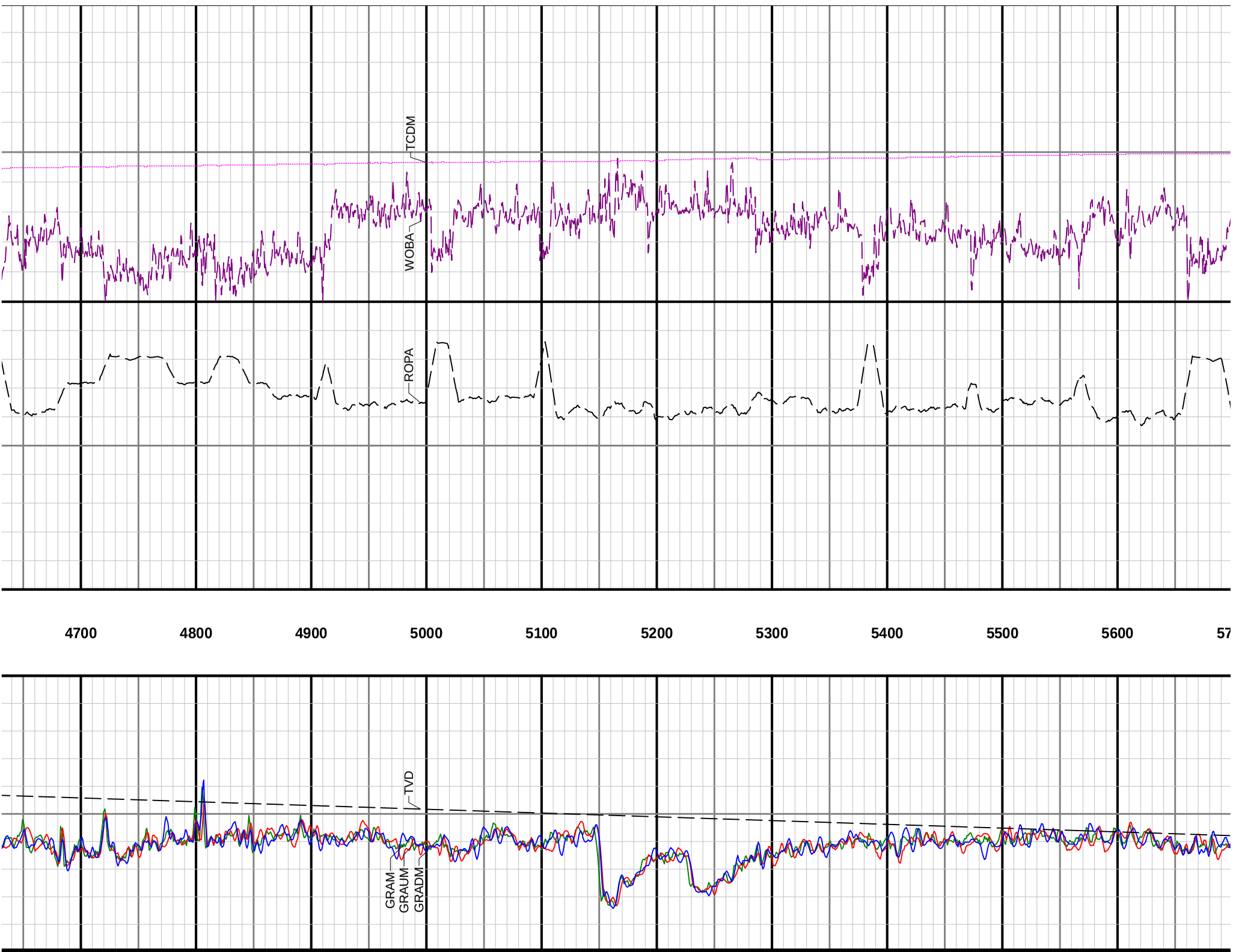
4400
4500
4600


TCDM
WOBA
ROPA
4700
4800
4900
5000
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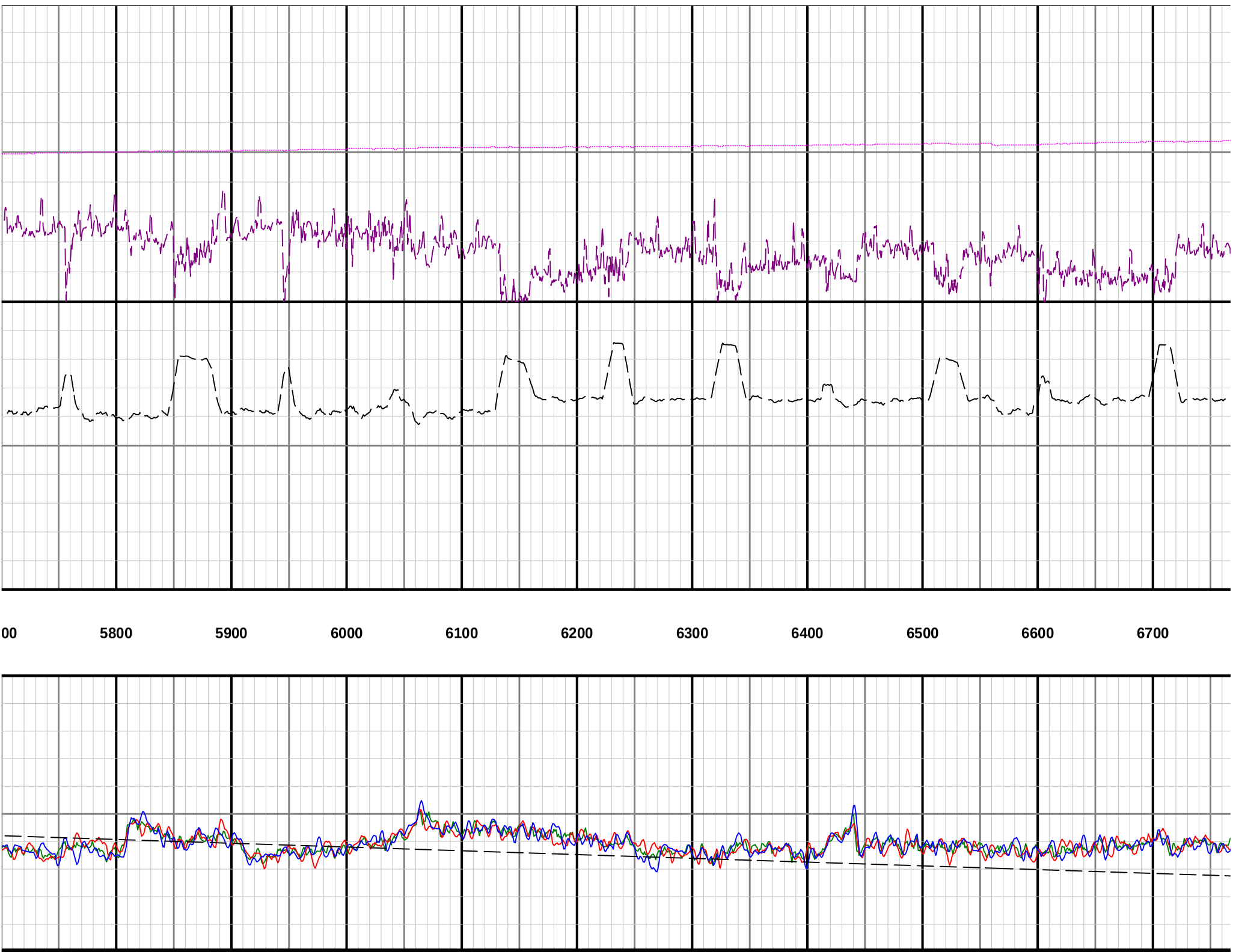
5200
5300
5400
5500
5600
TVD
GRAM
GRAUM
GRADM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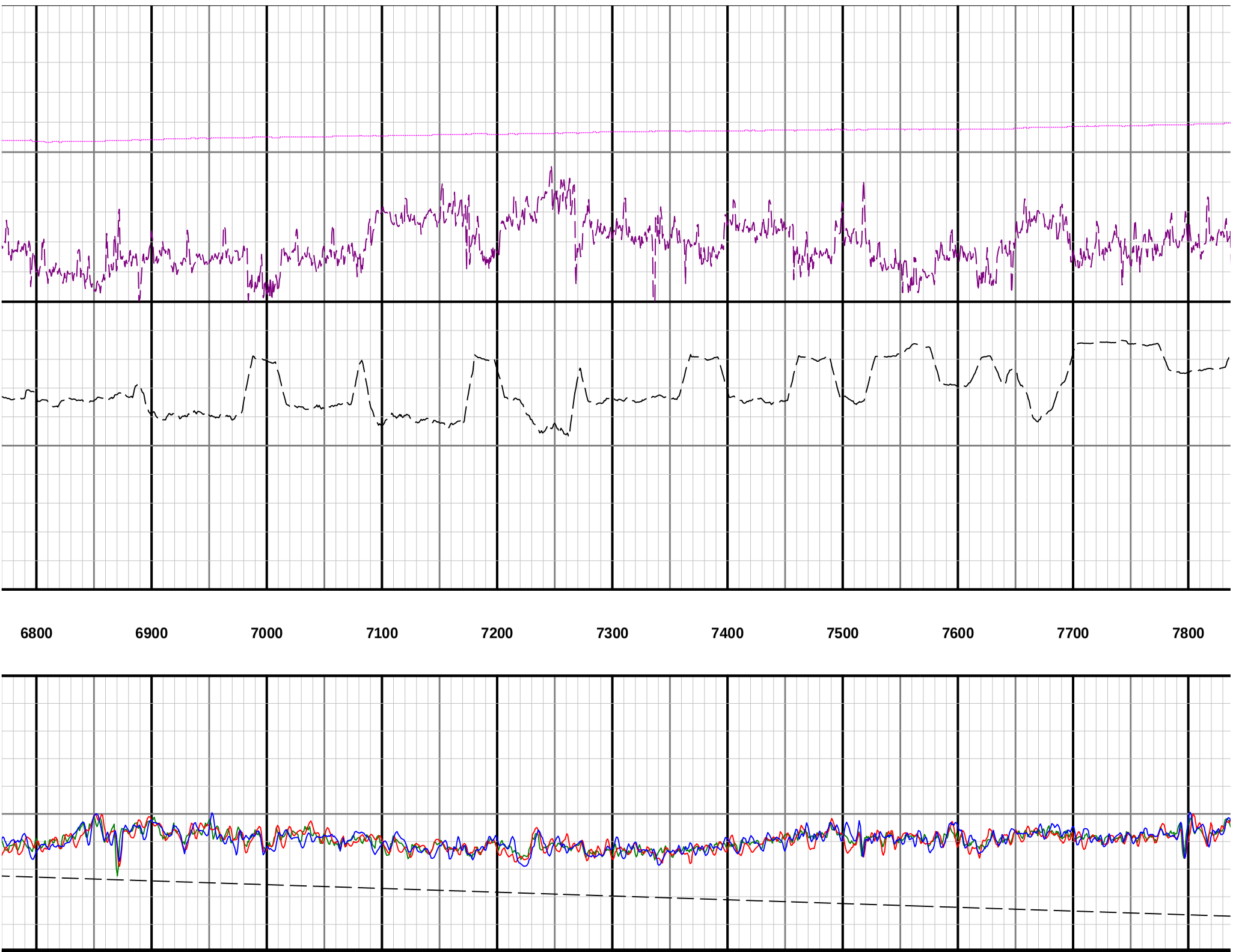
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8400
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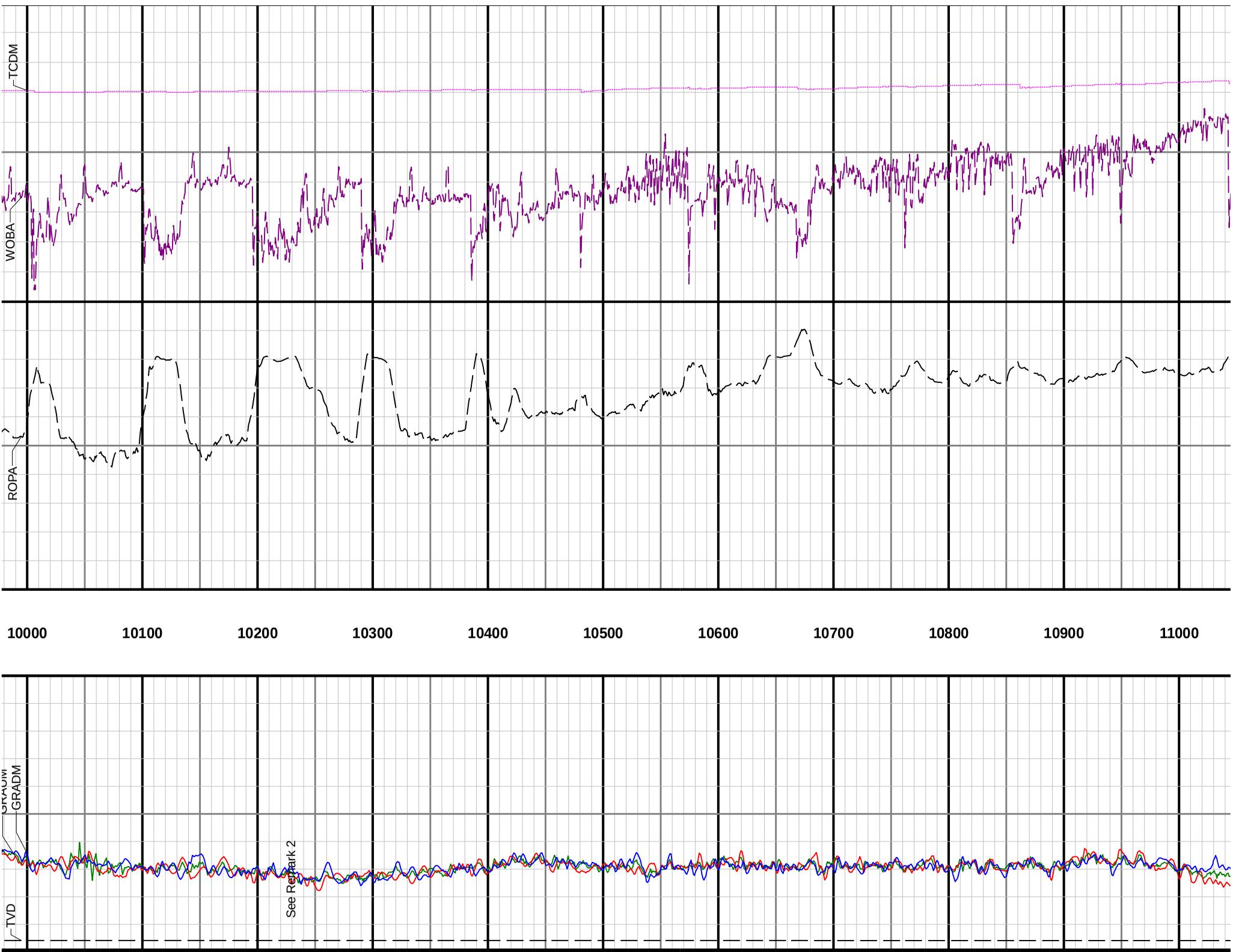
9900
GRAM


TCDM
WOBA
ROPA
10000
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10200
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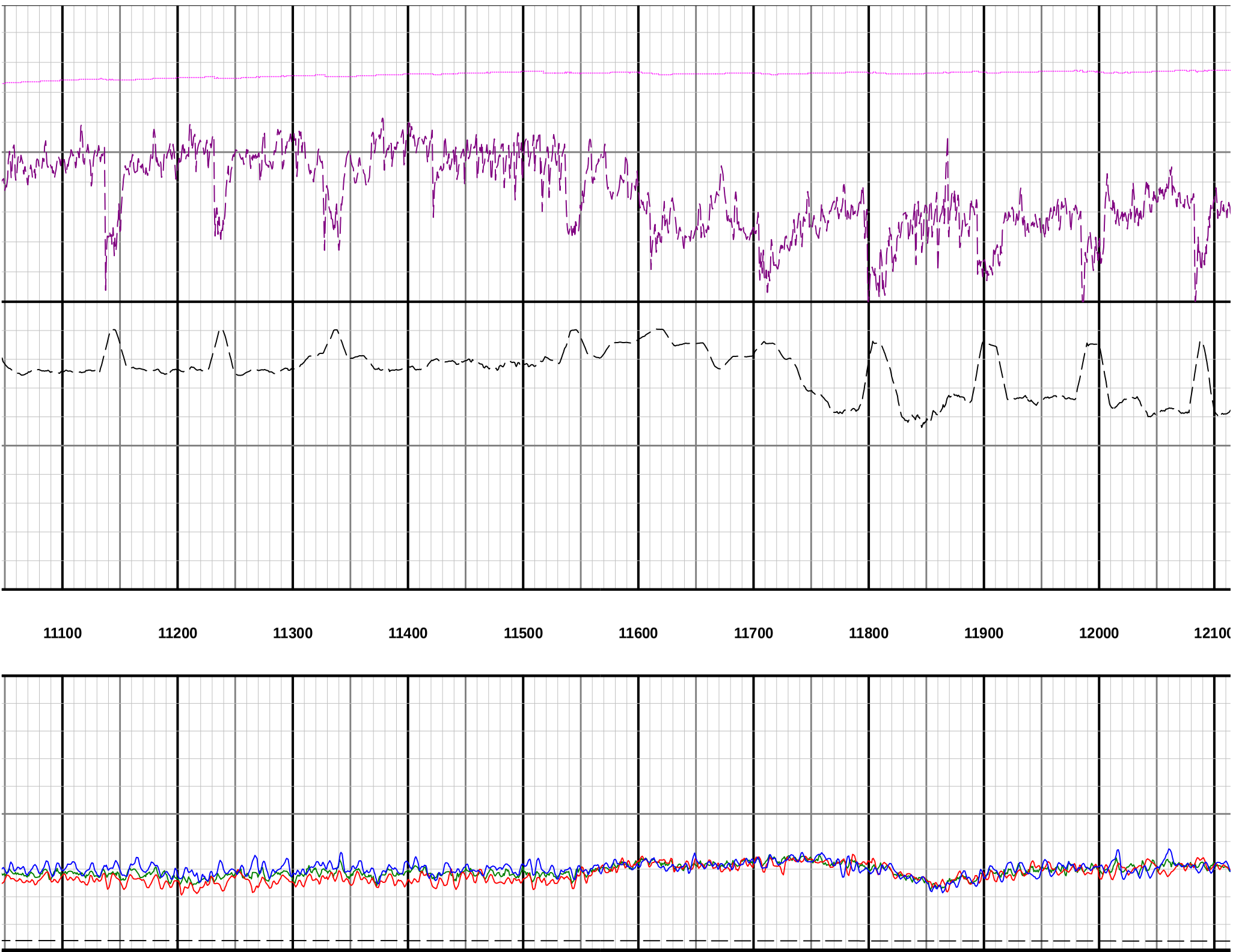
10800
10900
11000
GRADM
TVD
See Remark 2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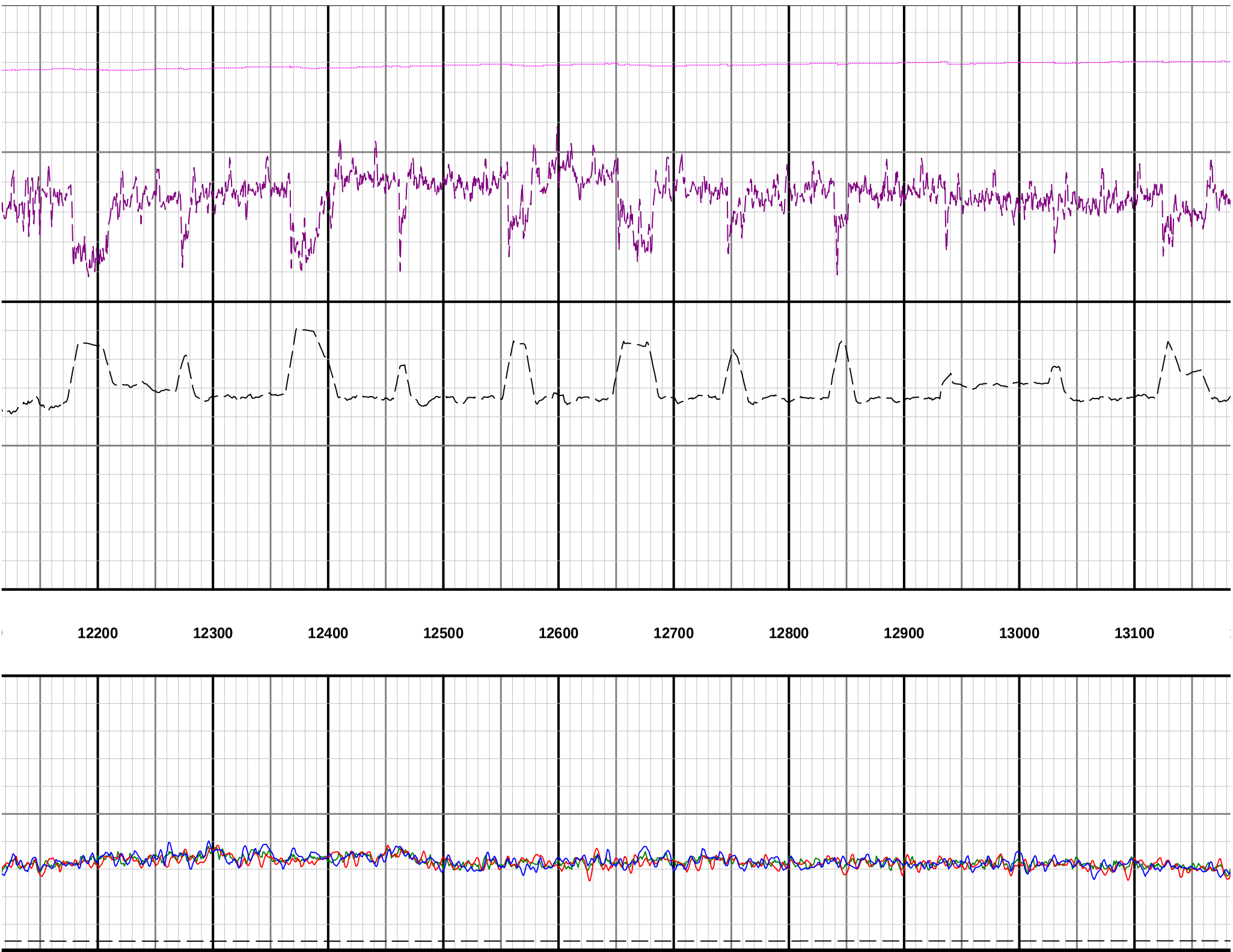
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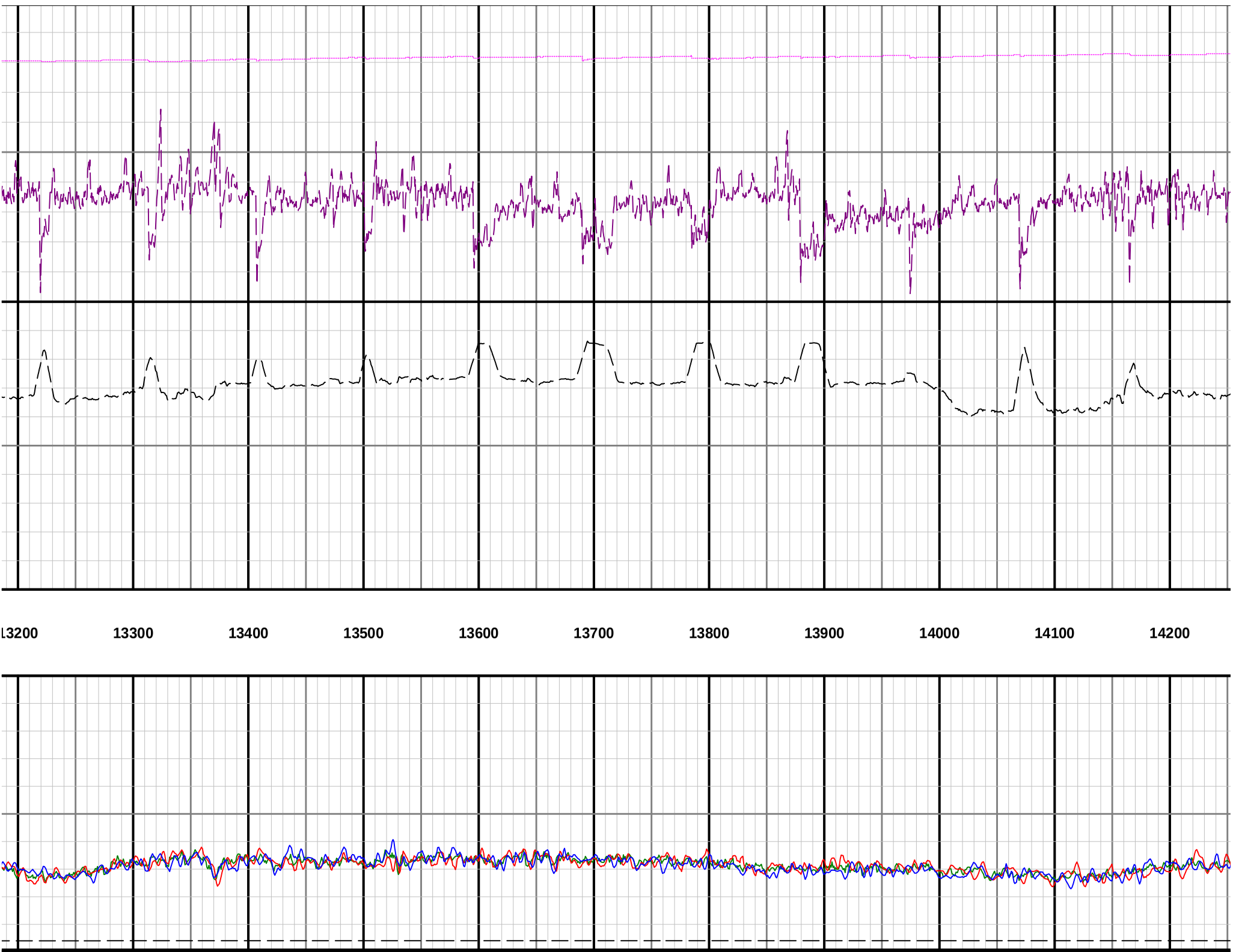
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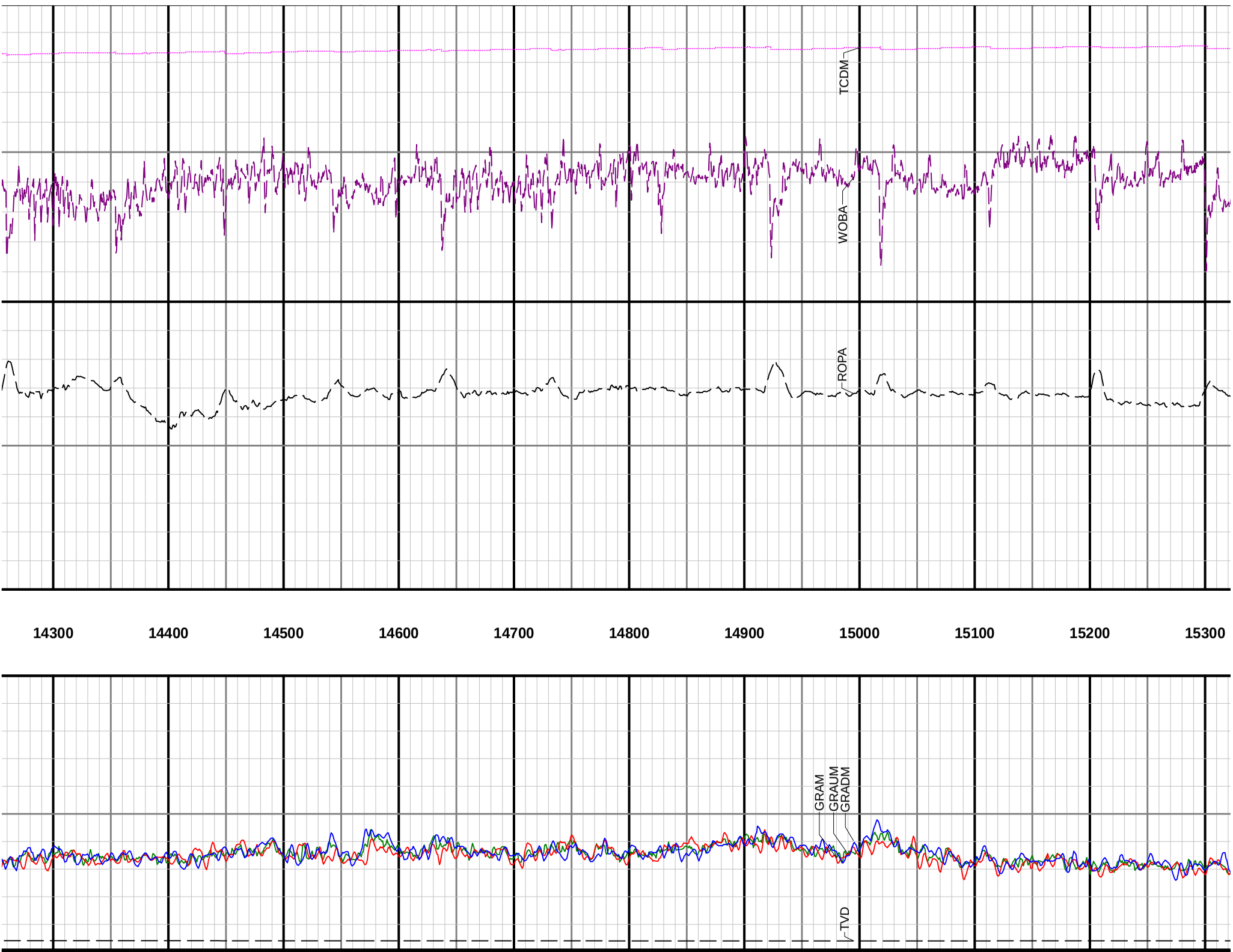
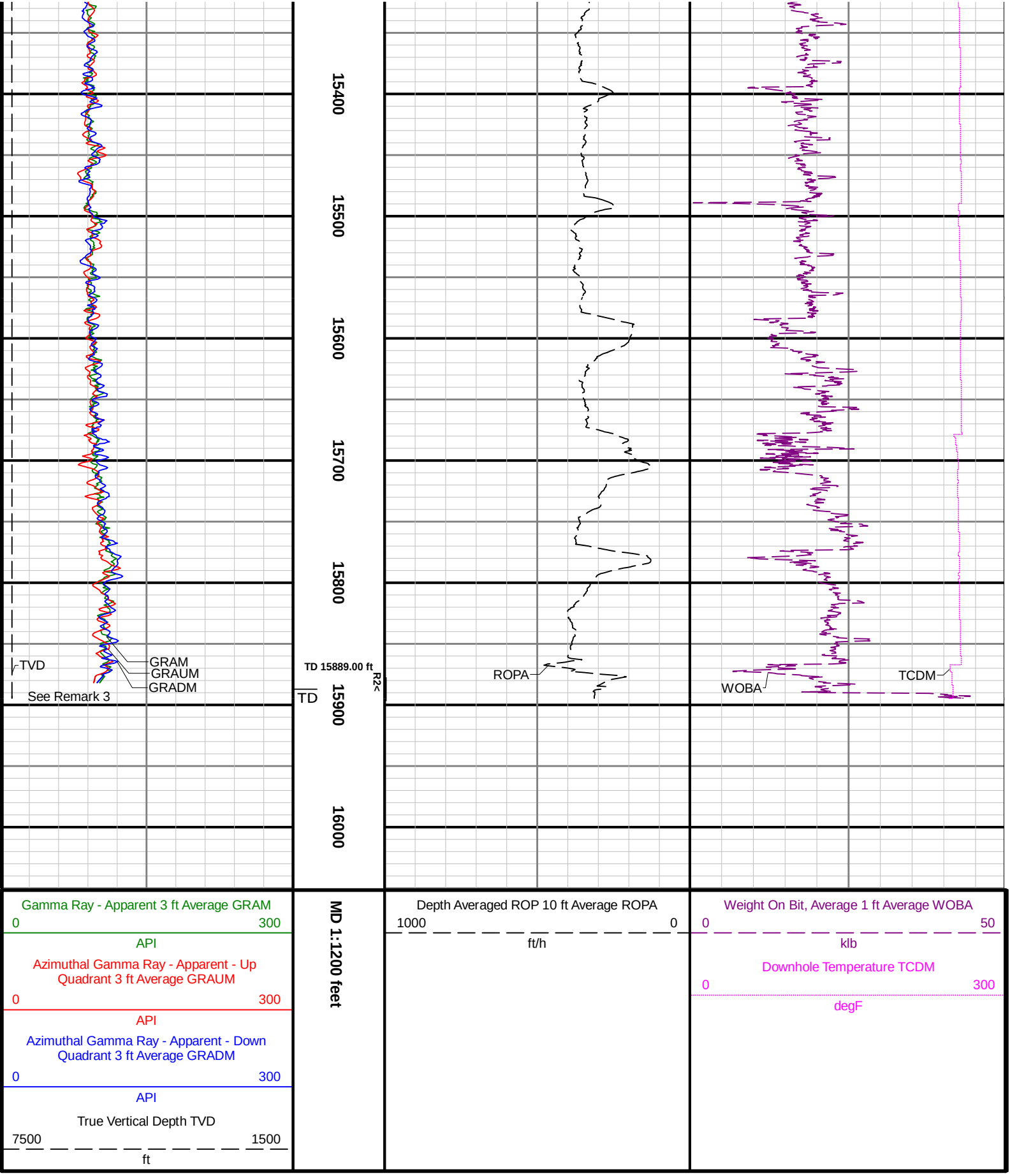

TCDM
WOBA
ROPA
14300
14400
14500
14600
14700
14800
14900
15000
15100
15200
15300
GRAM
GRAUM
GRADM
TVD


15400
15500
15600
15700
15800
15900
16000
TVD
See Remark 3
GRAM
GRAUM
GRADM
TD 15889.00 ft
TD
ROPA
WOBA
TCDM
Gamma Ray - Apparent 3 ft Average GRAM
0
300
API
Azimuthal Gamma Ray - Apparent - Up Quadrant 3 ft Average GRAUM
0
300
API
Azimuthal Gamma Ray - Apparent - Down Quadrant 3 ft Average GRADM
0
300
API
True Vertical Depth TVD
7500
1500
ft
MD 1:1200 feet
Depth Averaged ROP 10 ft Average ROPA
1000
0
ft/h
Weight On Bit, Average 1 ft Average WOBA
0
50
klb
Downhole Temperature TCDM
0
300
degF