Schlumberger

Company: Noble Energy Inc

Well: Lilli Federal LG13-02

Field: Lilli

County: Weld State: Colorado

# Platform Express

## Triple Combo Repeat Anaylsis

## PEX-AIT

County: Weld
Field: Lilli
Location: Sect. 13, Twp. 8N, Rng. 59W
Well: Lilli Federal LG13-02
Company: Noble Energy Inc

| Location: | | | | |
|---|---|---|---|---|
| Sect. 13, Twp. 8N, Rng. 59W<br>SHL: 620' FNL & 1740' FEL | Elev.: | K.B. | 4735.00 ft |
| | | G.L. | 4705.00 ft |
| | | D.F. | 4734.00 ft |

| | | | |
|---|---|---|---|
| Permanent Datum: | Ground Level | Elev.: | 4705.00 f |
| Log Measured From: | Kelly Bushing | 30.00 ft | above Perm.Datum |
| Drilling Measured From: | Kelly Bushing | | |

| API Serial No. | Section: | Township: | Range: |
|---|---|---|---|
| 05-123-39883 | 13 | 8N | 59W |

| | | | | | | |
|---|---|---|---|---|---|---|
| Logging Date | | 11-Sep-2014 | | | | |
| Run Number | | One-1 | | | | |
| Depth Driller | | 6750.00 ft | | | | |
| Schlumberger Depth | | 6751.00 ft | | | | |
| Bottom Log Interval | | 6751.00 ft | | | | |
| Top Log Interval | | 1257.00 ft | | | | |
| Casing Driller Size @ Depth | | 9.625 in @ 1260.00 ft | | | | |
| Casing Schlumberger | | 1257 ft | | | | |
| Bit Size | | 7.875 in | | | | |
| Type Fluid In Hole | | WBM | | | | |
| MUD Density | Viscosity | 9 lbm/gal | 51 s | | | |
| MUD Fluid Loss | PH | 7 cm3 | 9 | | | |
| MUD Source of Sample | | Active Tank | | | | |
| RM @ Meas Temp | | 2.04 ohm.m @ 75 degF | | | | |
| RMF @ Meas Temp | | 1.53 ohm.m @ 75 degF | | | | |
| RMC @ Meas Temp | | 2.54 ohm.m @ 75 degF | | | | |
| Source RMF | RMC | Calculated | Calculated | | | |
| RM @ BHT | RMF @ BHT | 0.87 @ 185 | 0.65 @ 185 | | | |
| Max Recorded Temperatures | | 185 degF | | | | |
| Circulation Stopped Time | | 11-Sep-2014 | 05:00:00 | | | |
| Logger on Bottom Time | | 11-Sep-2014 | 11:00:00 | | | |
| Unit Number | Location: | 2135 | Fort Morgan | | | |
| Recorded By | | Kevin Crow/Nolan Welsh | | | | |
| Witnessed By | | Andy Tipton | | | | |

## Disclaimer



## Contents

11. Tail

## Operational Run Summary

| Parameter ( unit ) | One-1 | | | | | |
|---|---|---|---|---|---|---|
| Date Log Started | 11-Sep-2014 | | | | | |
| Time Log Started | 10:13:09 | | | | | |
| Date Log Finished | 11-Sep-2014 | | | | | |
| Time Log Finished | 17:36:10 | | | | | |
| | | | | | | |
| Top Log Interval ( ft ) | 1257.00 | | | | | |
| Bottom Log Interval ( ft ) | 6751.00 | | | | | |
| | | | | | | |
| Total Depth ( ft ) | 6751.00 | | | | | |
| Max Hole Deviation ( deg ) | 0.00 | | | | | |
| Azimuth of Max Deviation ( deg ) | 0.00 | | | | | |
| Bit Size ( in ) | 7.875 | | | | | |
| | | | | | | |
| Logging Unit Number | 2135 | | | | | |
| Logging Unit Location | Fort Morgan | | | | | |
| Recorded By | Kevin Crow/Nolan Welsh | | | | | |
| Witnessed By | Andy Tipton | | | | | |
| Service Order Number | CXRX-00033 | | | | | |

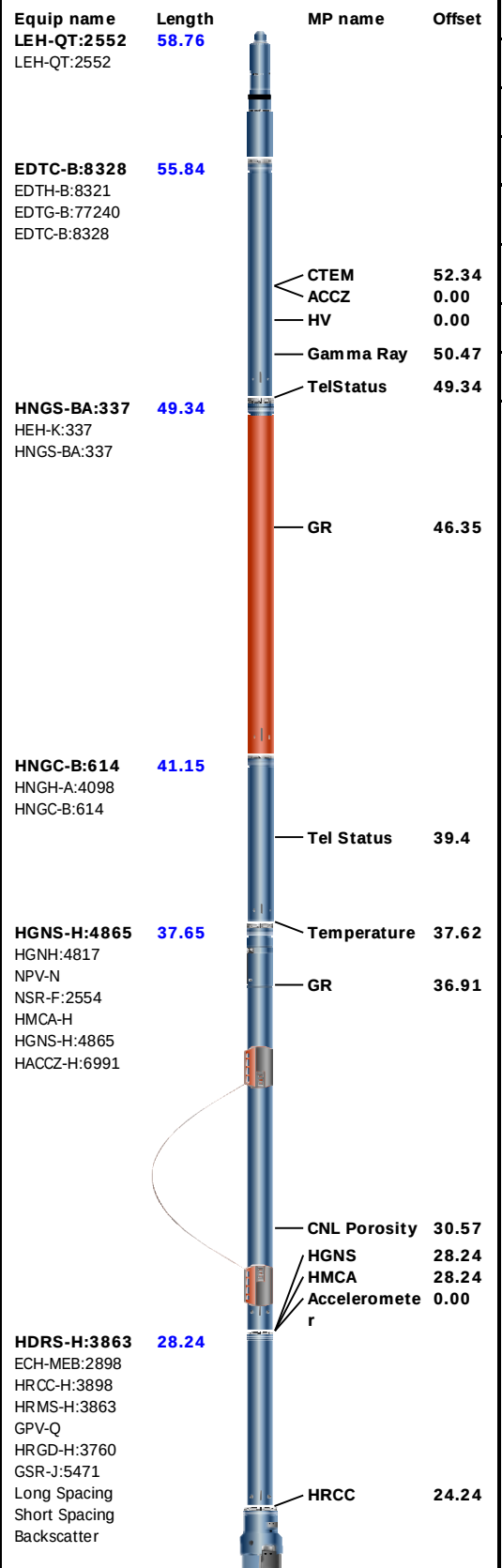
## Borehole Fluids

| Parameter( unit ) | One-1 | | | | | |
|---|---|---|---|---|---|---|
| Fluid Type | Water | | | | | |
| Fluid Name | WBM | | | | | |
| Max Recorded Temperatures ( degF ) | 185 | | | | | |
| Source of Sample | Active Tank | | | | | |
| Salinity ( ppm ) | 0 | | | | | |
| Density ( lbm/gal ) | 9 | | | | | |
| Funnel Viscosity ( s ) | 51 | | | | | |
| Fluid Loss ( cm3 ) | 7 | | | | | |
| PH | 9 | | | | | |
| Date/Time Circulation Stopped | 11-Sep-2014 05:00:00 | | | | | |
| Date Logger on Bottom | 11-Sep-2014 | | | | | |
| Time Logger on Bottom | 11:00:00 | | | | | |
| Source RMF | Calculated | | | | | |
| RMC | Calculated | | | | | |
| RM @ Meas Temp ( ohm.m@degF ) | 2.04 @ 75 | | | | | |
| RMF @ Meas Temp | 1.53 @ 75 | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| ( ohm.m@degF ) | | | | | | |
| RMC @ Meas Temp ( ohm.m@degF ) | 2.54 @ 75 | | | | | |
| RM @ BHT ( ohm.m@degF ) | 0.87 @ 185 | | | | | |
| RMF @ BHT ( ohm.m@degF ) | 0.65 @ 185 | | | | | |
| RMC @ BHT ( ohm.m@degF ) | 1.08 @ 185 | | | | | |
| Total Solid ( % ) | | | | | | |
| High Gravity Solids ( % ) | | | | | | |

# Remarks and Equipment Summary

## One-1: Toolstring




## One-1: Remarks

| |
|---|
| This is the first run in the well. |
| Toolstring run as per tool sketch. |
| Rig: H&P 330 |
| Matrix: Limestone MDEN: 2.71 g/cm3 |
| Repeat Pass from TD to 5000 ft, as per client request. |
| Very HiRes PEX data from TD to 4750 ft., as per client request. |
| Logging interval from TD to Casing shoe. |
| Crew: Aaron Weber, Jeff Schossow |


Lengths are in ft
Maximum Outer Diameter = 9.000 in
Line: Sensor Location, Value: Gating Offset
All measurements are relative to TOOL_ZERO

# Depth Summary

| | One-1 | | |
|---|---|---|---|
| **Depth Measuring Device** | | | |
| Type | IDW-JA | | |
| Serial Number | 5916 | | |
| Calibration Date | 24-Mar-2014 | | |
| Calibrator Serial Number | | | |
| Calibration Cable Type | 7-46 PXS | | |
| Wheel Correction 1 | -6 | | |
| Wheel Correction 2 | -3 | | |
| **Tension Device** | | | |
| Type | CMTD-B/A | | |
| Serial Number | 1919 | | |
| Calibration Date | 01-Sep-2014 | | |
| Calibrator Serial Number | 100513A | | |
| Number of Calibration Points | 10 | | |
| Calibration Root Mean Square Error | 15 | | |
| Calibration Peak Error | 24 | | |
| **Logging Cable** | | | |
| Type | 7-46P-XS | | |
| Serial Number | U711057 | | |

| | | | |
|---|---|---|---|
| Length | 18500.00 ft | | |
| Conveyance Type | Wireline | | |
| Rig Type | | | |

| One-1:Depth Control Parameters | | Depth Control Remarks |
|---|---|---|
| Log Sequence | First Log In the Well | All Shlumberger depth procedures followed. |
| Rig Up Length At Surface | | IDW used as primary depth control. |
| Rig Up Length At Bottom | | Z-Chart used as secondary depth control. |
| Rig Up Length Correction | | |
| Stretch Correction | | |
| Tool Zero Check At Surface | | |

# One-1

# 5" Triple Combo

## Software Version

| Acquisition System | Version |
|---|---|
| MaxWell | 4.0.9163.3000 |
| Application Patch | Patch-SP-10767_18214-4.0.9163.3001 |
| | Patch-Hotfix_Task_Tree_GDI_SP2-20806-4.0.9434.3002 |

| Computation | Description | Version |
|---|---|---|
| HENVIR | Computation Ensemble for the HGNS Neutron environmental corrections | 4.0.9360.3000 |
| DepthCorrection | DepthCorrection | 4.0.9433.3000 |

| Tool Elements | Description | Software Version | Firmware Version |
|---|---|---|---|
| HRCC-H | HILT High-Resolution Control Cartridge, 150 degC | 4.0.9385.3000 | 2.0 |
| HRGD-H | HILT Resistivity Gamma-Ray Density Device, 150 degC | 4.0.9385.3000 | 3.0 |
| HGNS-H | HILT Gamma-Ray and Neutron Sonde, 150 degC | 4.0.9385.3000 | 2.0 |
| AMIS | Array Induction Sonde - M | 4.0.9427.3000 | 1 |
| HNGS-BA | HNGS Sonde Element | 4.0.9360.3000 | 2.0 |

## Pass Summary

| Run Name | Pass Objective | Direction | Top | Bottom | Start | Stop | DSC Mode | Depth Shift | Include Parallel Data |
|---|---|---|---|---|---|---|---|---|---|
| One-1 | Main[3]:Up | Up | 11.13 ft | 6759.63 ft | 11-Sep-2014 12:36:28 PM | 11-Sep-2014 5:36:08 PM | ON | -0.45 ft | Yes |

All depths are referenced to toolstring zero

## Log

Company:Noble Energy Inc Well:Lilli Federal LG13-02

One-1: Main[3]:Up:S011

Description: HGNS standard resolution porosities for Platform Express Format: Log ( Import of KM 5in Triple Combo ) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 11-Sep-2014 18:05:31

| Channel | Source | Sampling |
|---|---|---|
| AT10 | AIT-M:AMIS:AMIS | 3in |
| AT30 | AIT-M:AMIS:AMIS | 3in |
| AT90 | AIT-M:AMIS:AMIS | 3in |
| CALI | HDRS-H:HRCC-H:HRCC-H | 1in |
| CGR | HNGS-BA:HNGS-BA:HNGS-BA | 6in |
| DPHZ | HDRS-H:HRMS-H:HRGD-H | 2in |
| GR | HGNS-H:HGNS-H:HGNS-H | 6in |
| NPOR | HGNS-H:HGNS-H:HGNS-H | 6in |
| PEFZ | HDRS-H:HRMS-H:HRGD-H | 2in |
| SP | AIT-M:AMIS:AMIS | 6in |
| STIT | DepthCorrection | 6in |
| TENS | WLWorkflow | 6in |
| TIME_1900 | WLWorkflow | 0.1in |

TIME_1900 - Time Marked every 60.00 (s)

Gamma Ray Back up

Caliper (CALI) HDRS-H

6 in 16

Gamma Ray (GR) HGNS-H

0 gAPI 150

Gamma Ray Contribution from Thorium and Potassium (CGR) HNGS-BA

0 gAPI 150

Gamma Ray Contribution from Thorium and Potassium (CGR) HNGS-BA

0 gAPI 150

Spontaneous Potential (SP) AIT-M

-80 mV 20

Stuck Tool Indicator, Total (STIT)

0 ft 50

Array Induction Two Foot Resistivity A10 (AT10) AIT-M

0.2 ohm.m 200

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2 ohm.m 200

Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2 ohm.m 200

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10

Gas Effect

NPOR Backup

Cable Tension (TENS)

8000 lbf 0

Standard Resolution Density Porosity (DPHZ) HDRS-H

0.45 ft3/ft3 -0.15

Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H

0.45 m3/m3 -0.15

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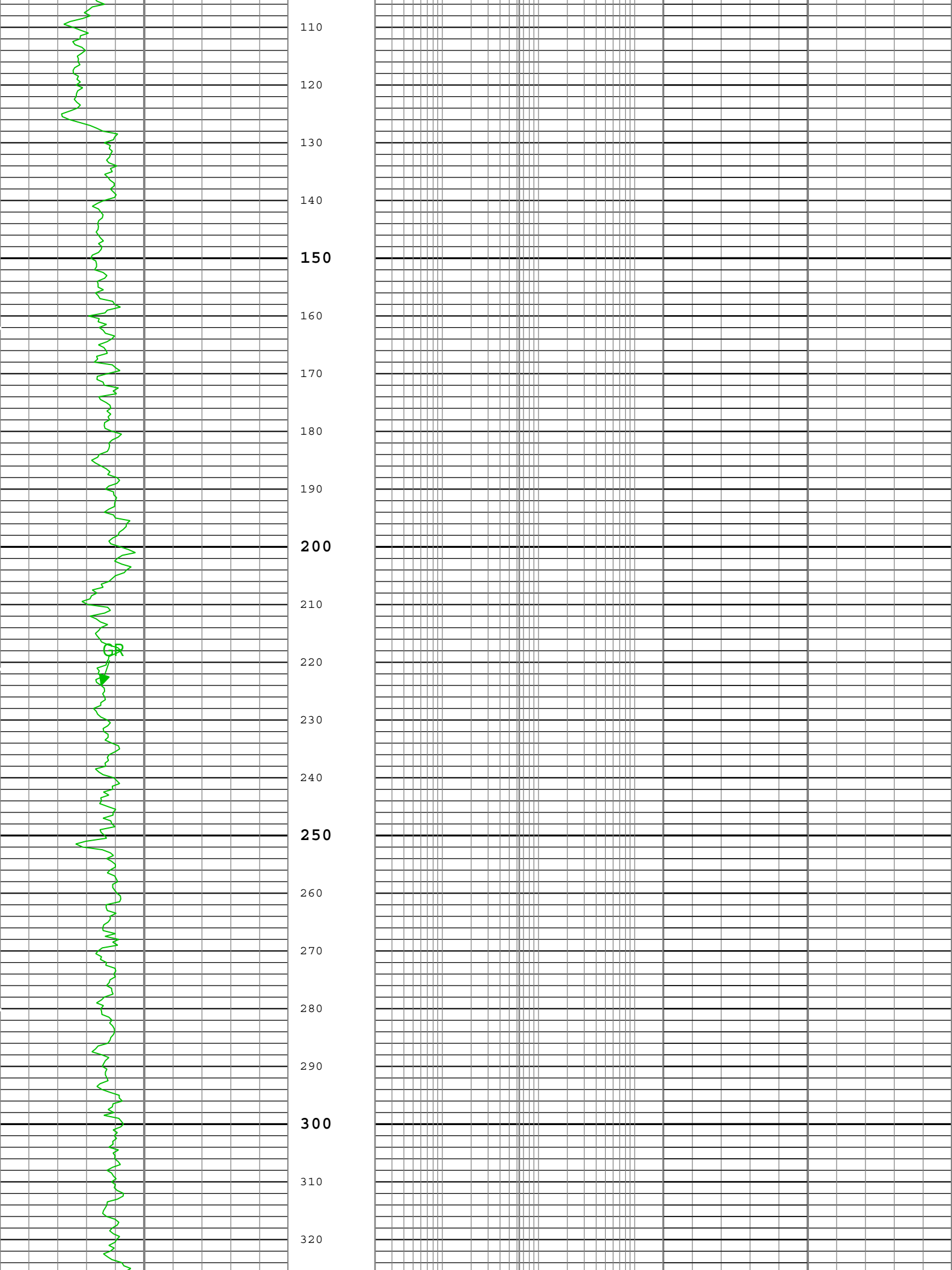
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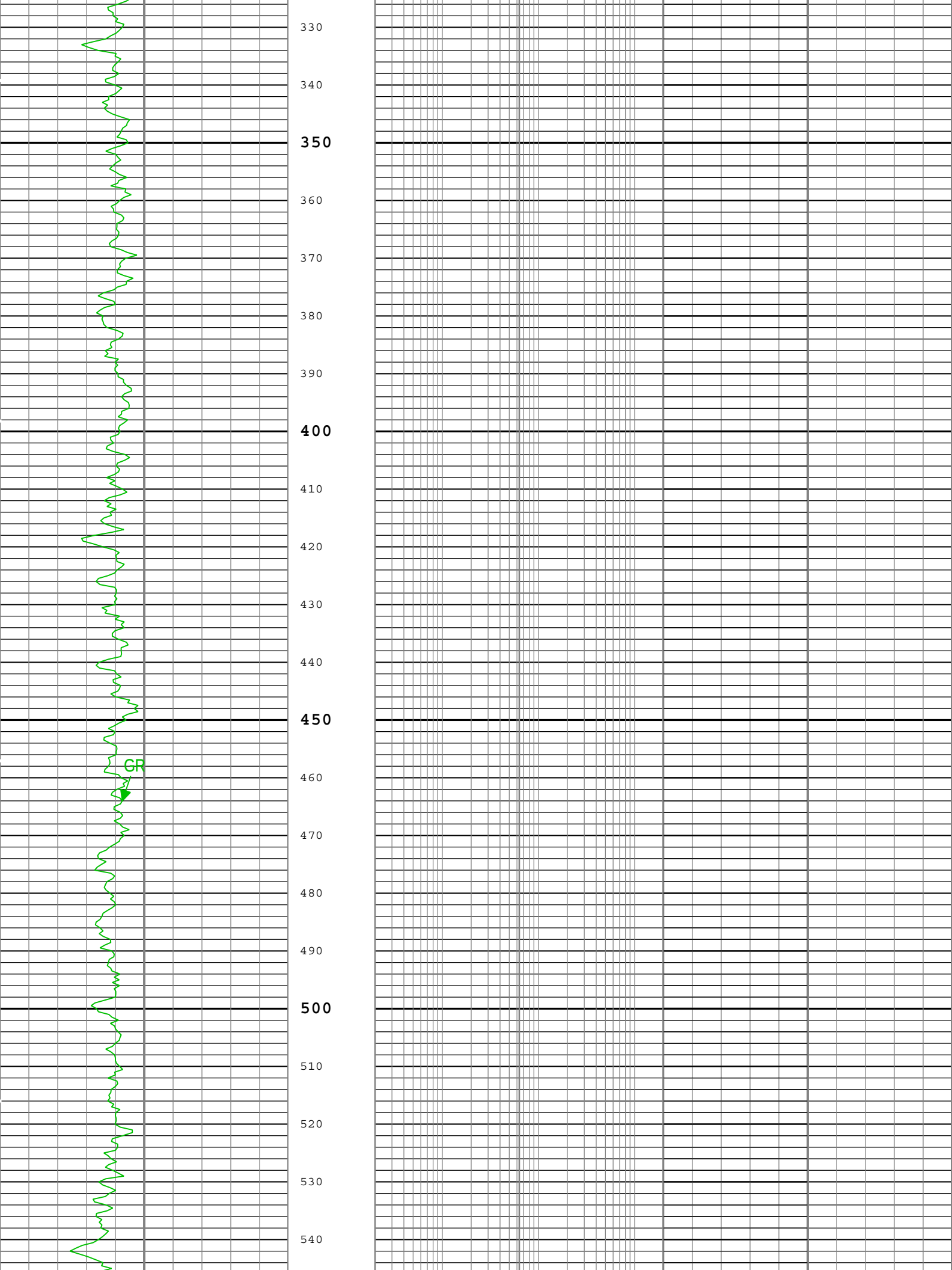
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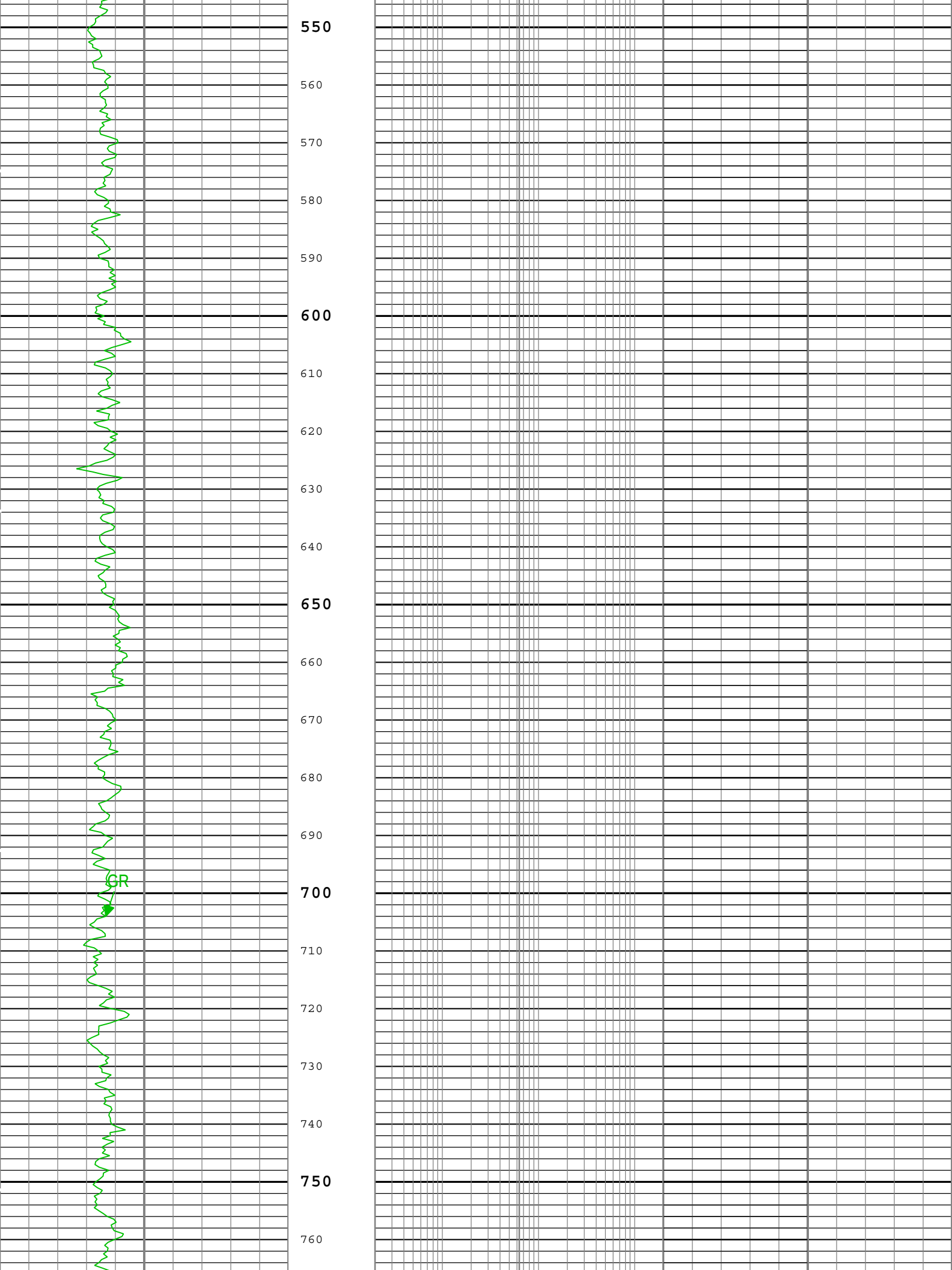
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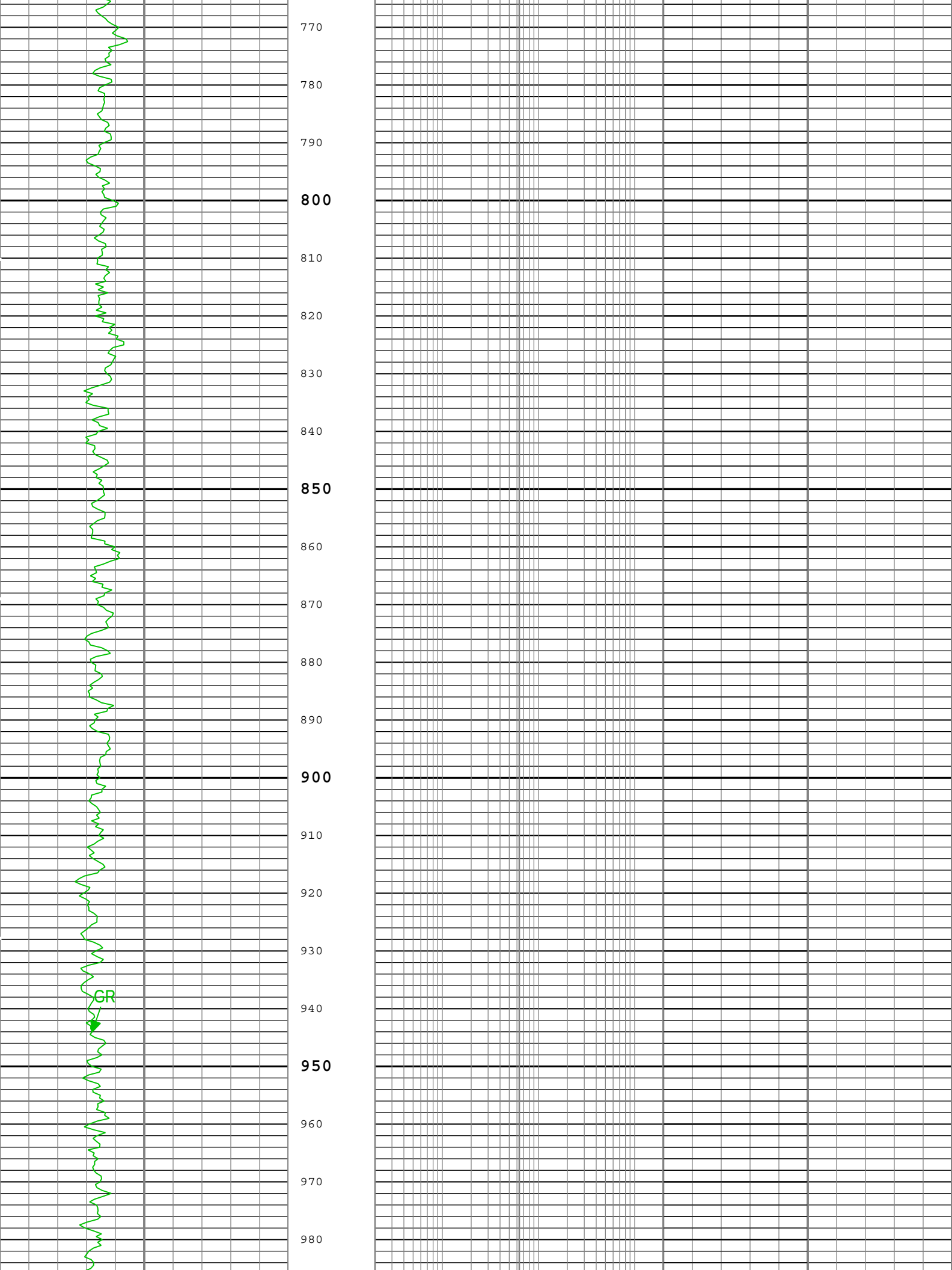
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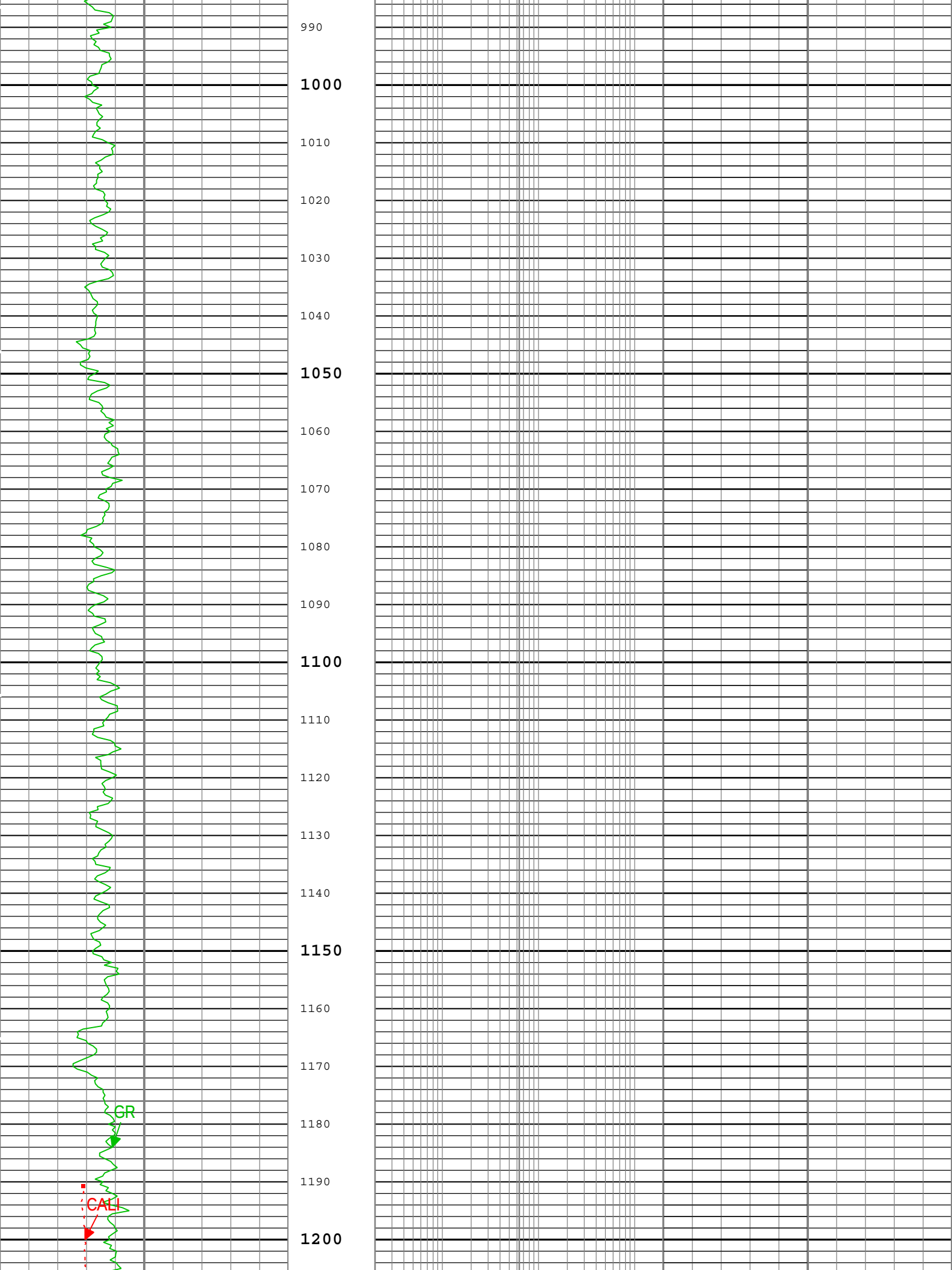
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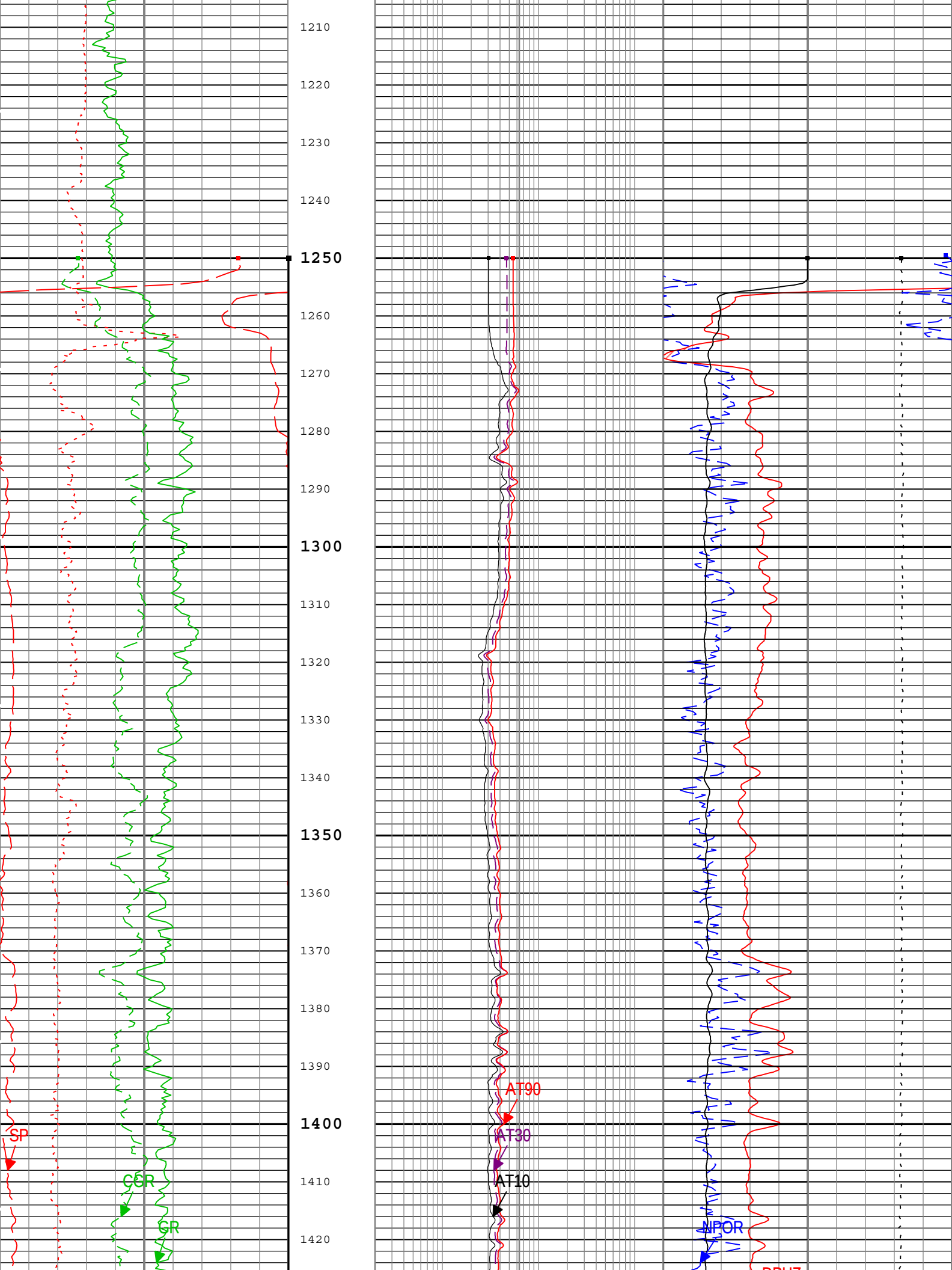
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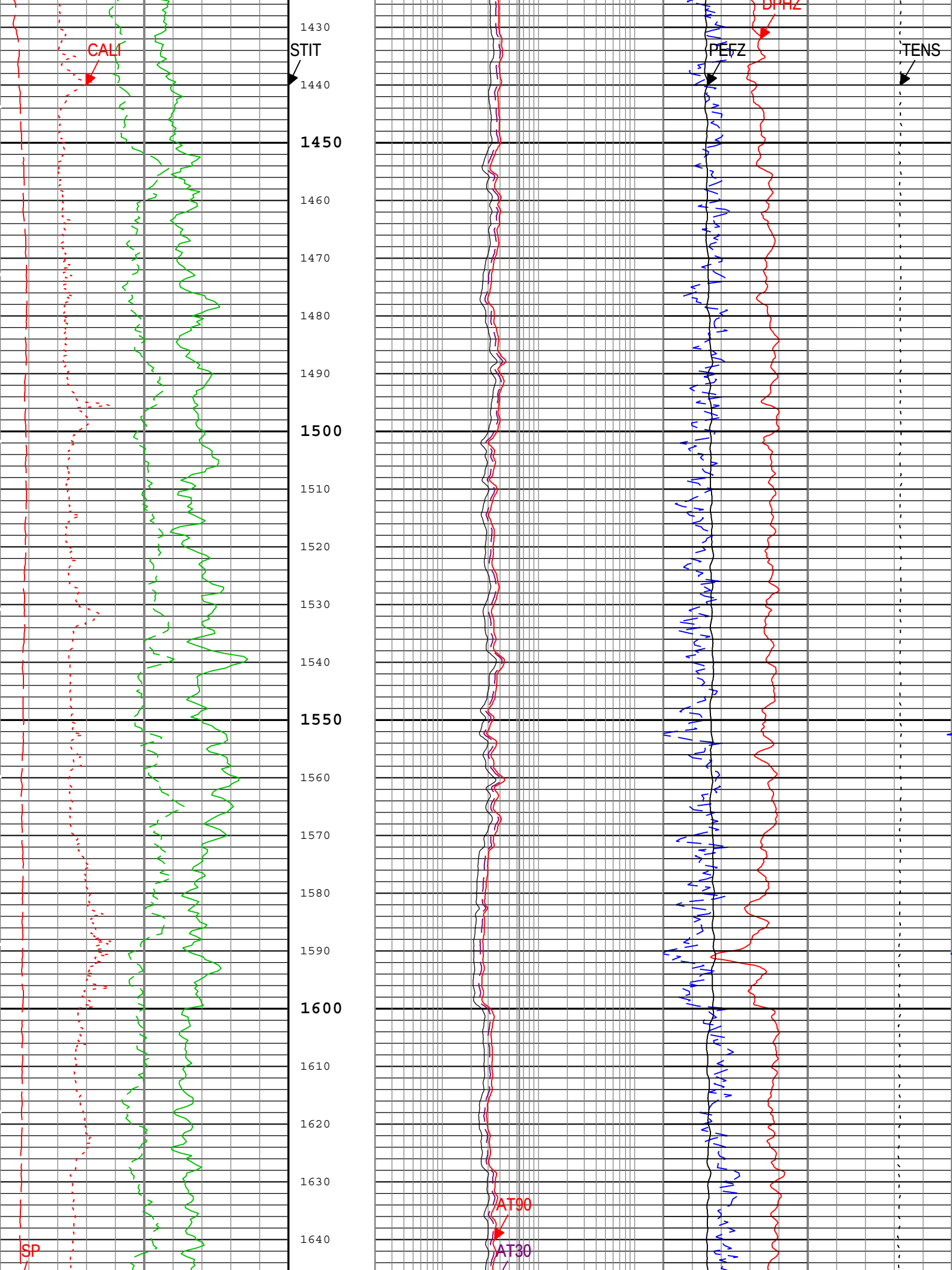
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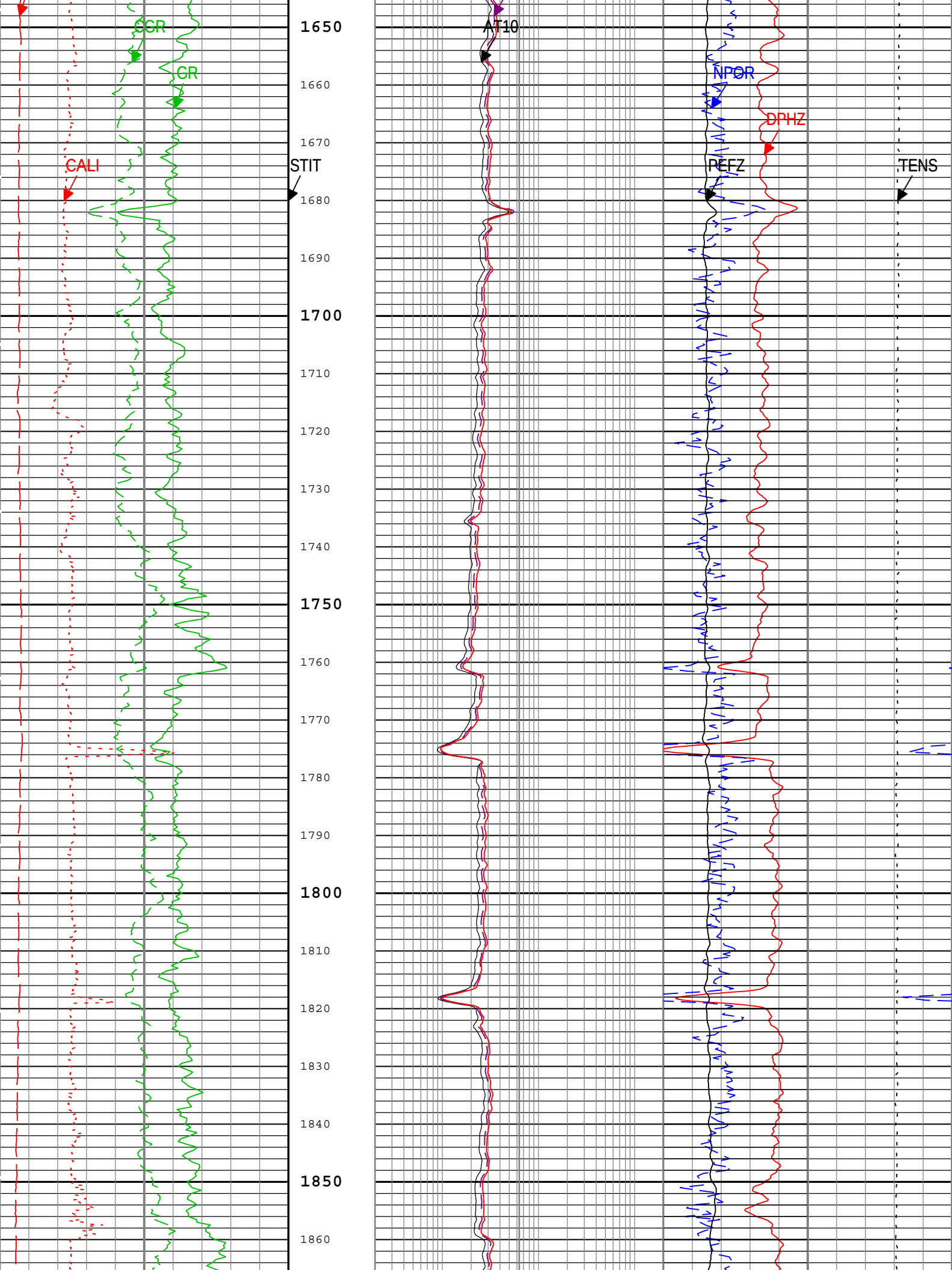
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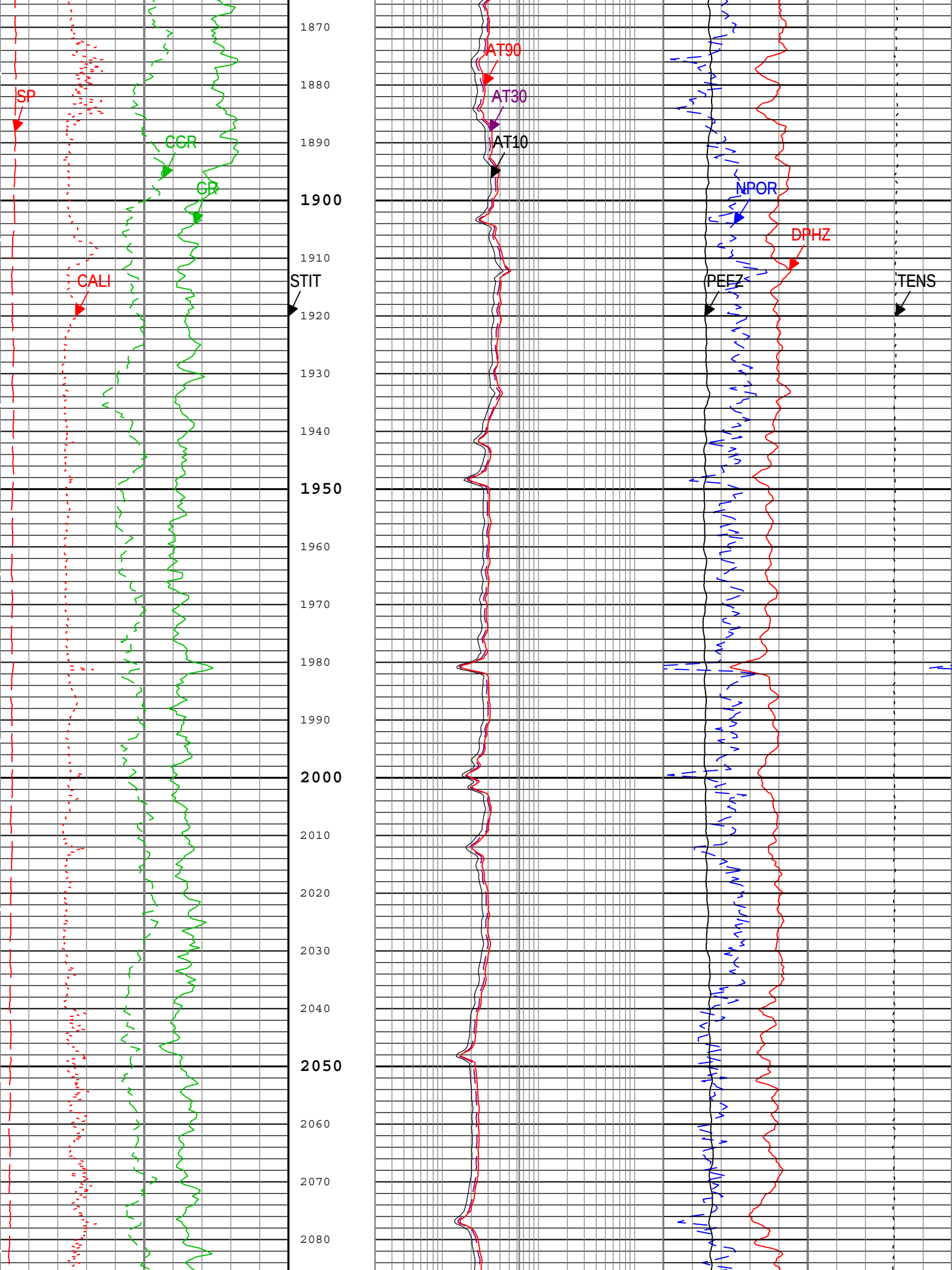
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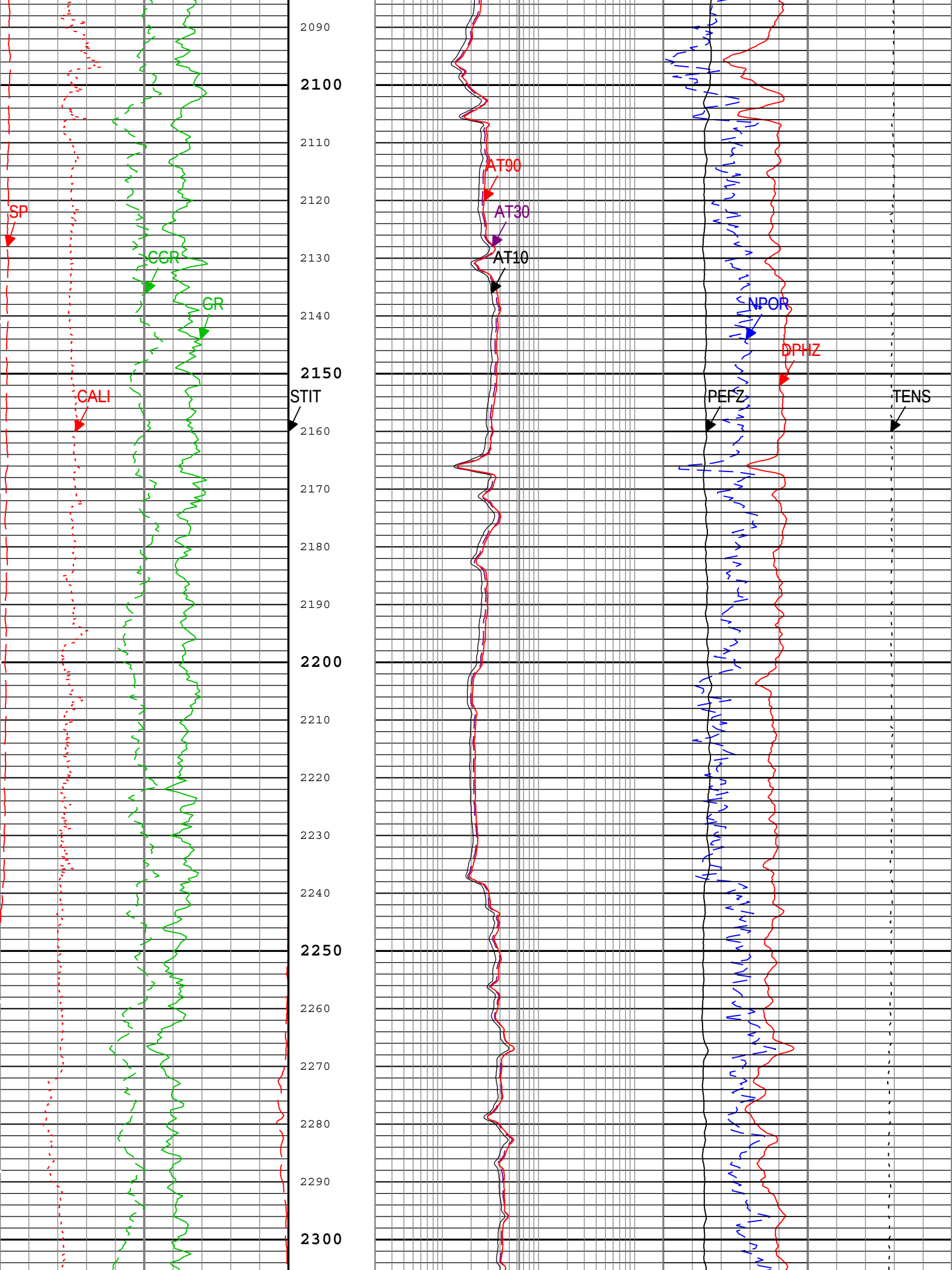
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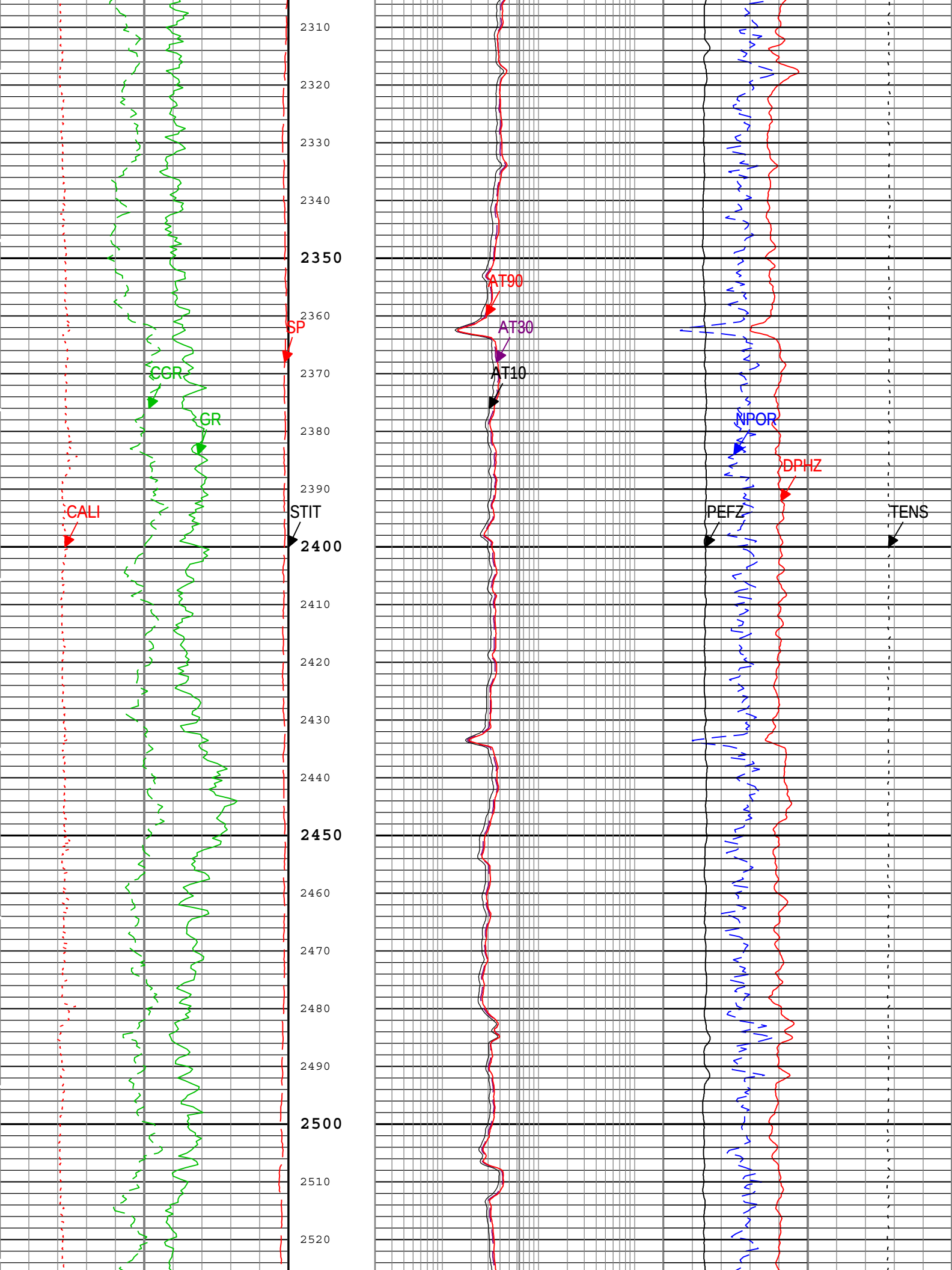
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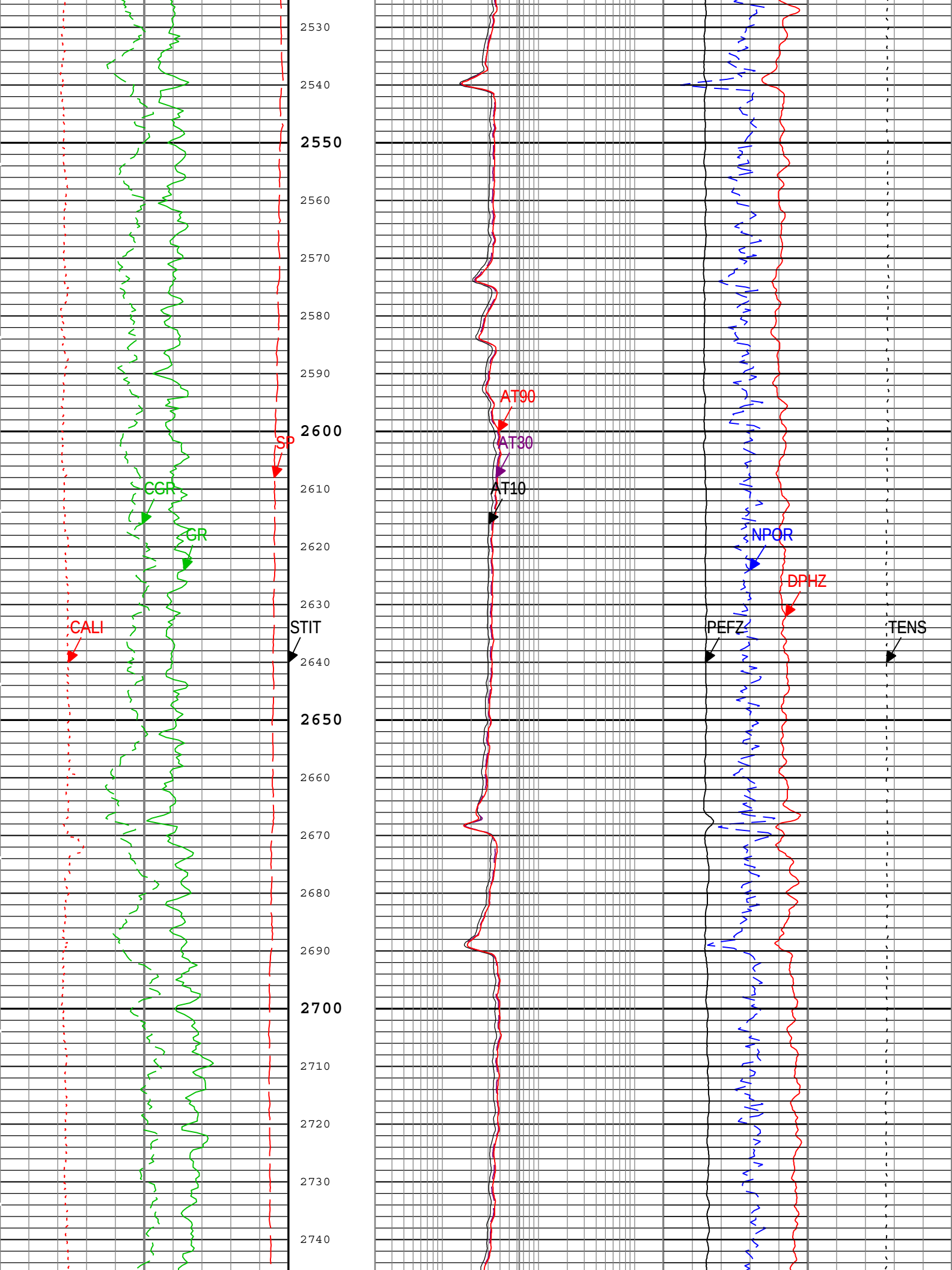
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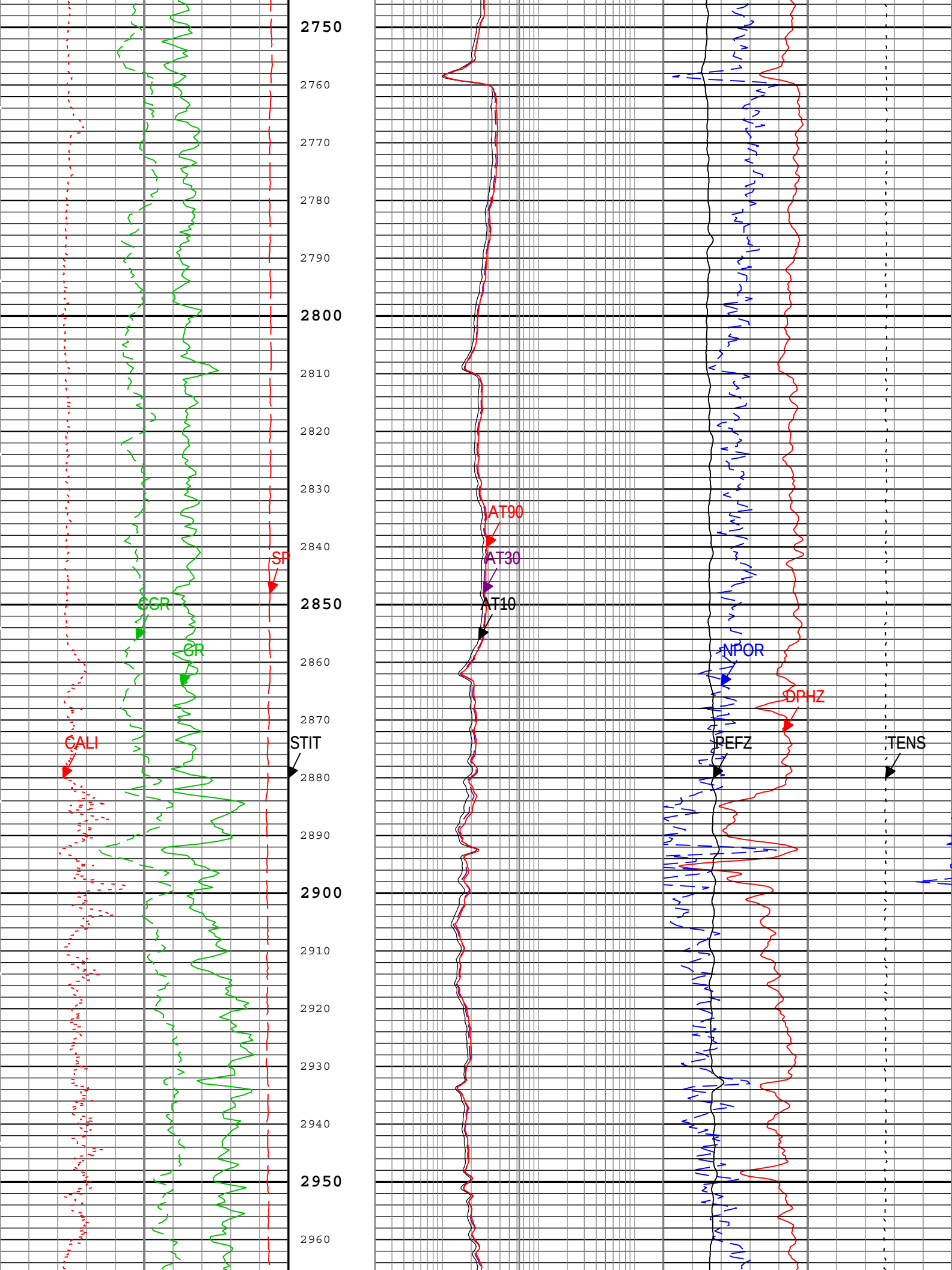
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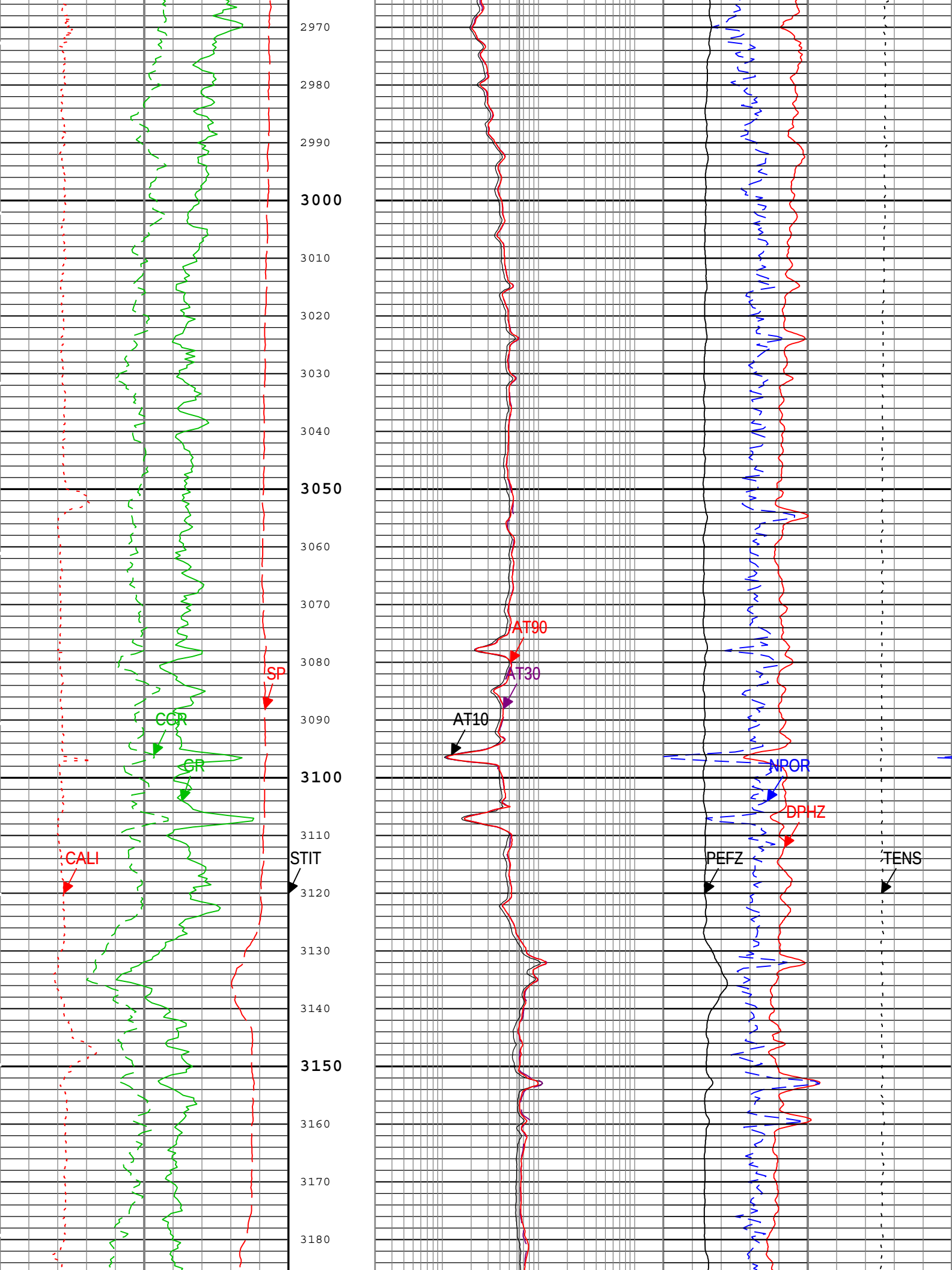
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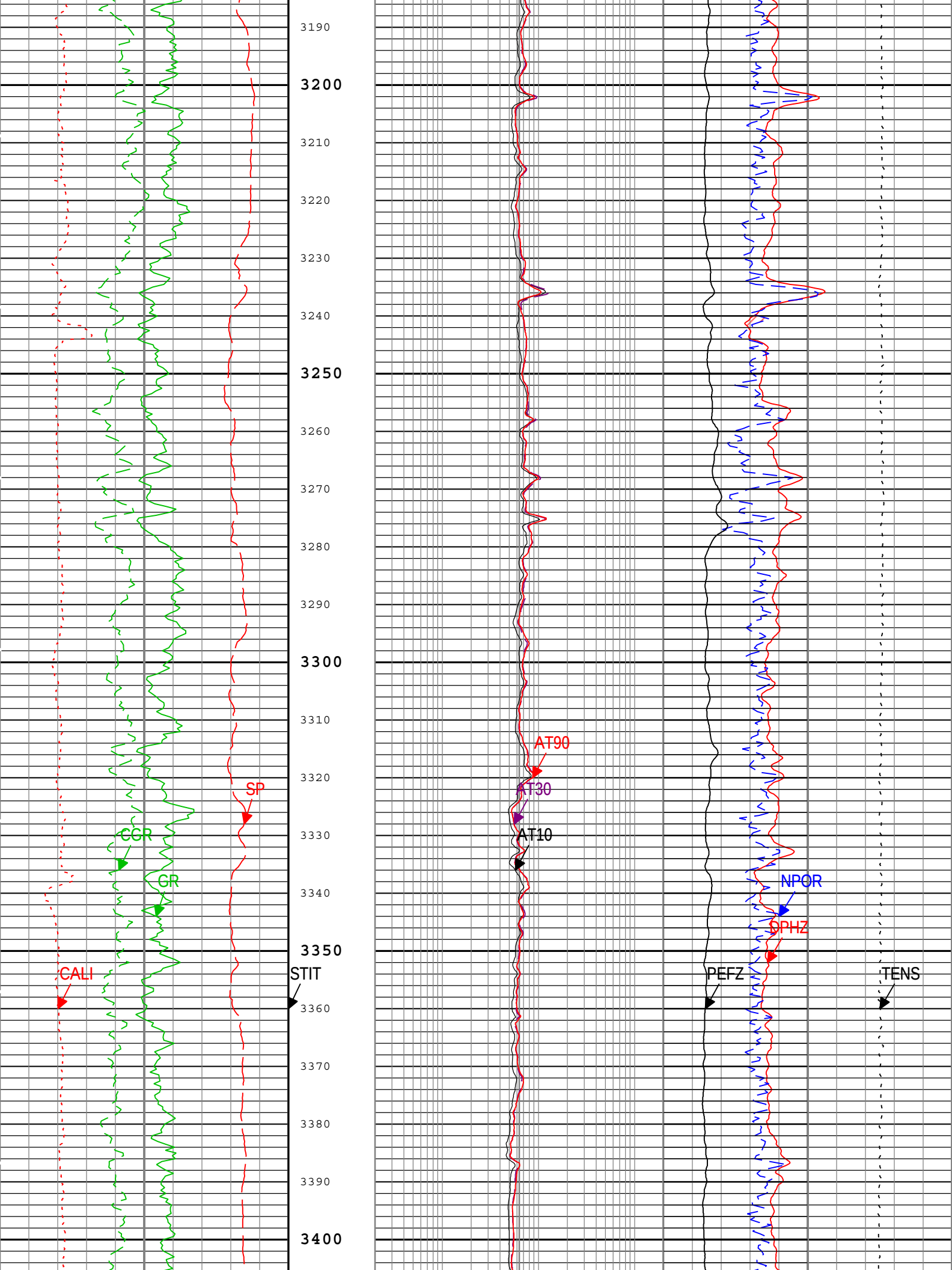
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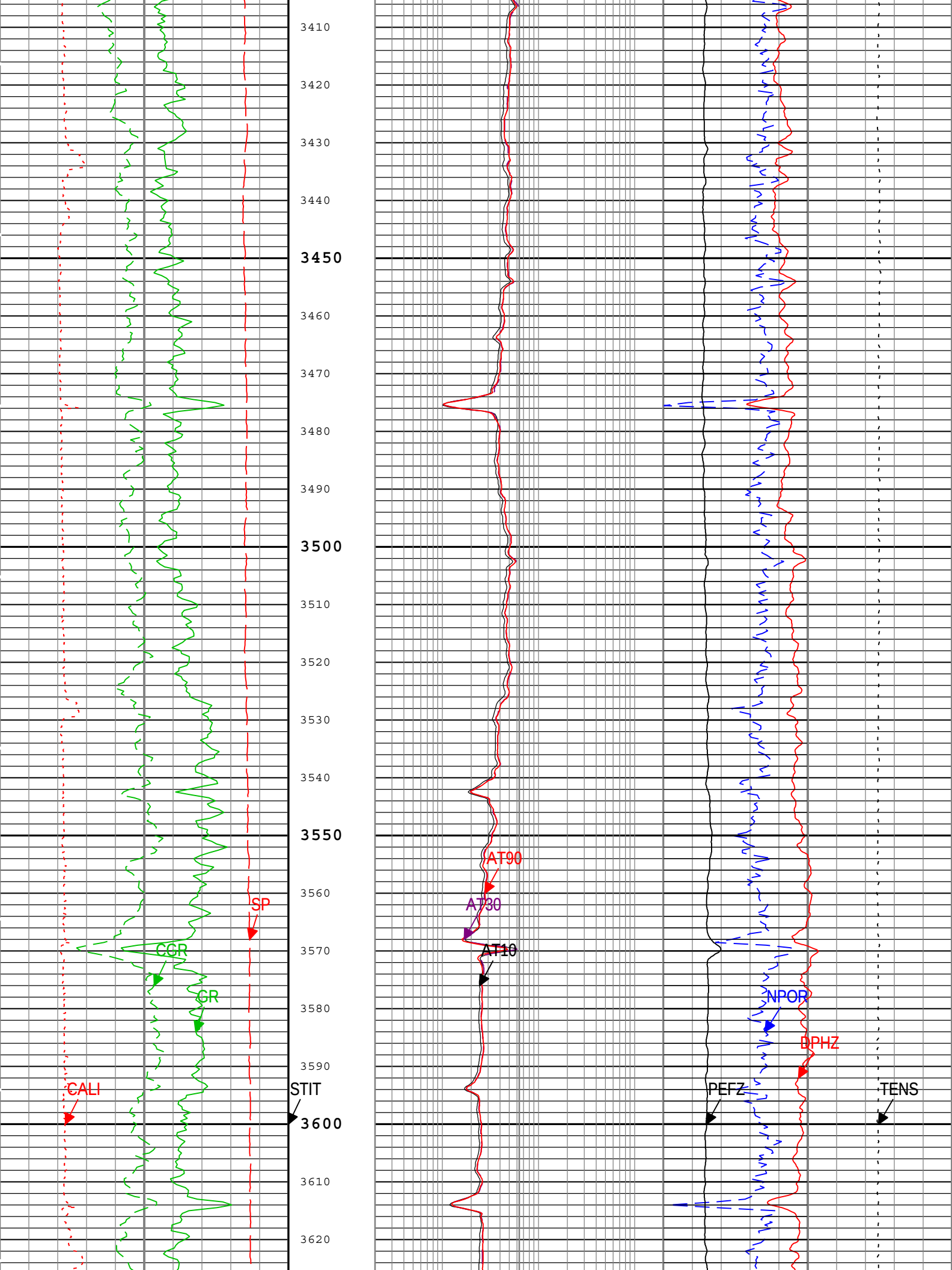
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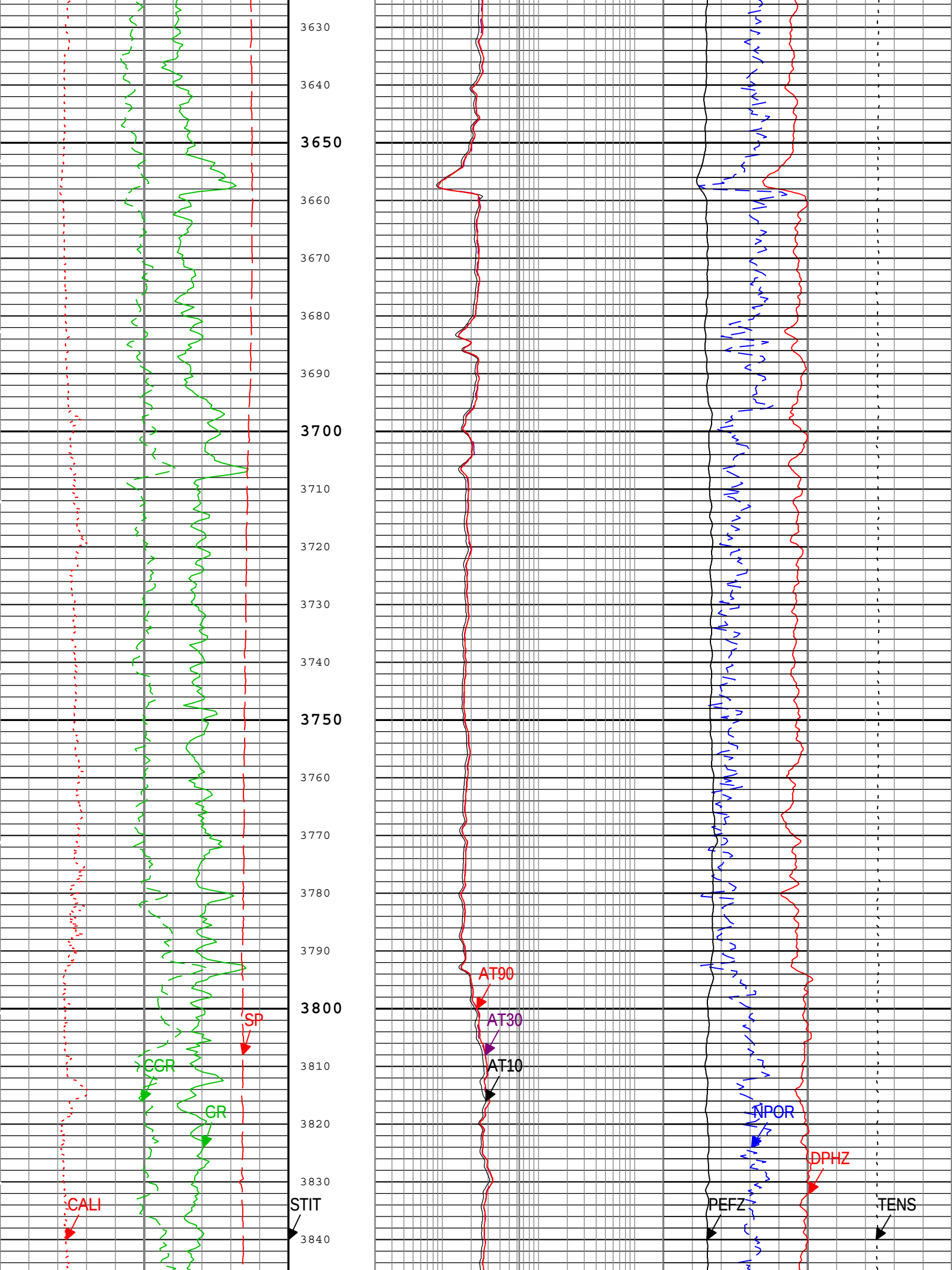
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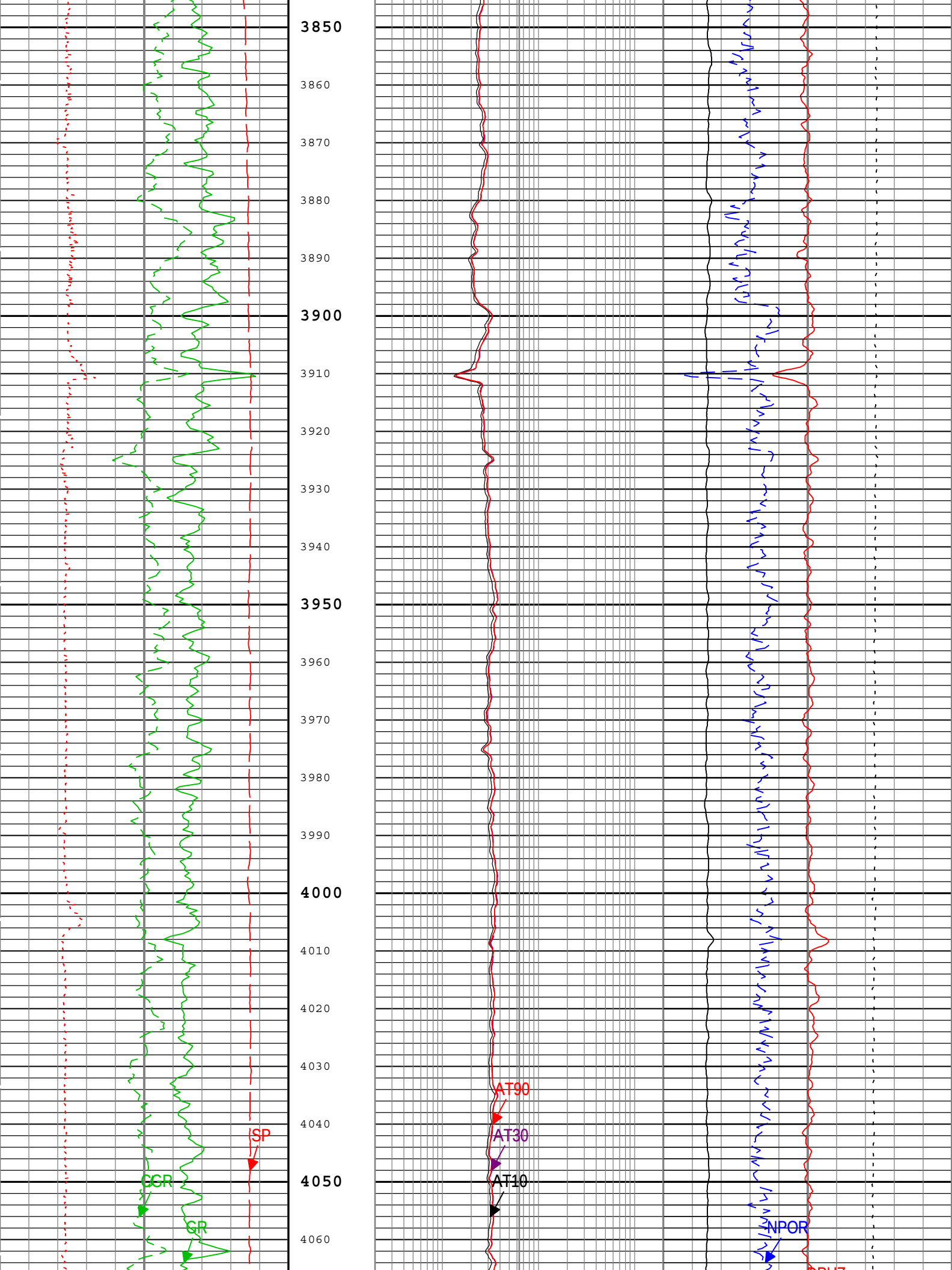
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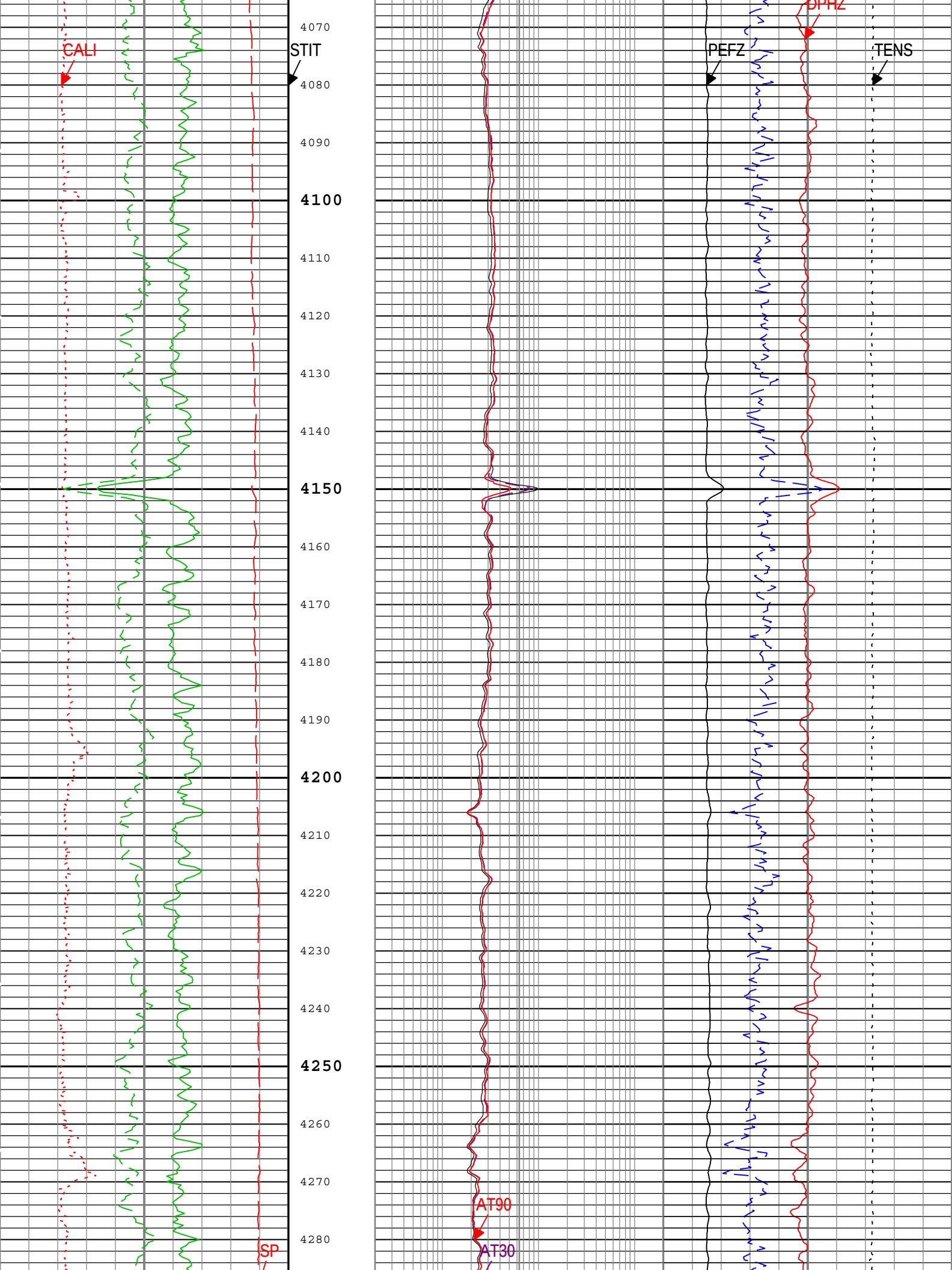
CALI
STIT
DPHZ
PEFZ
TENS
AT90
AT30
SP
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4080
4090
4100
4110
4120
4130
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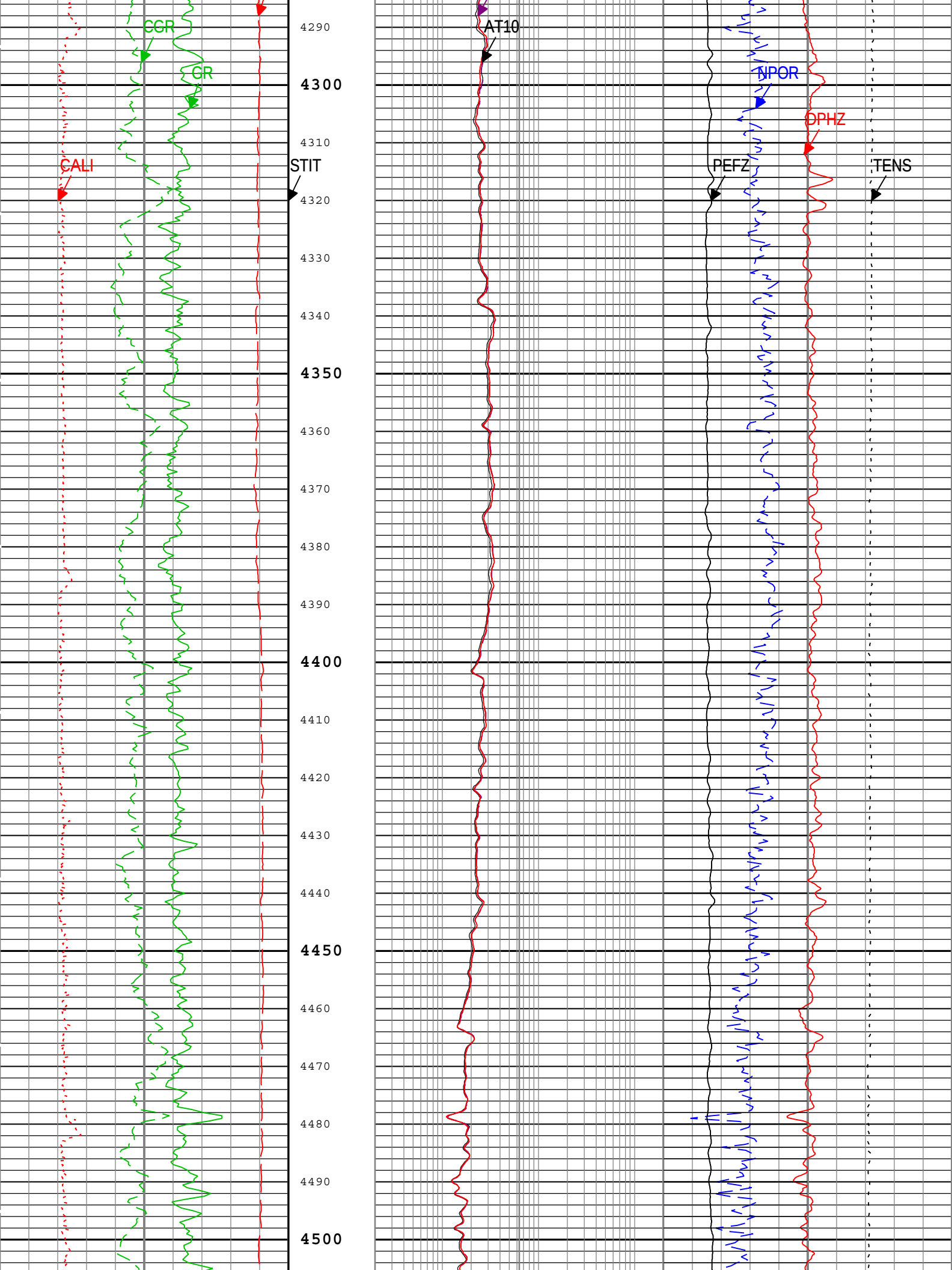
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DPHZ
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TENS
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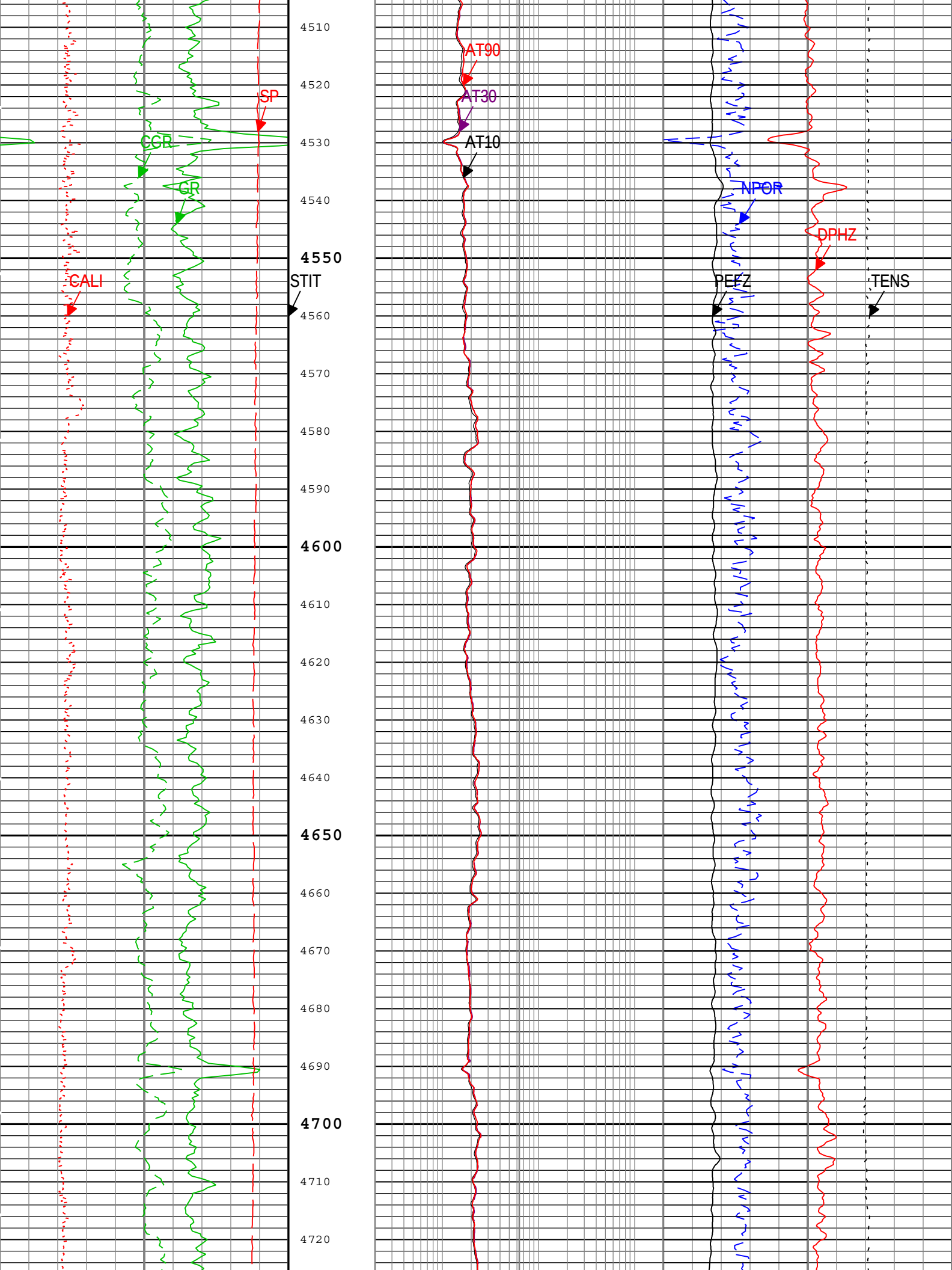
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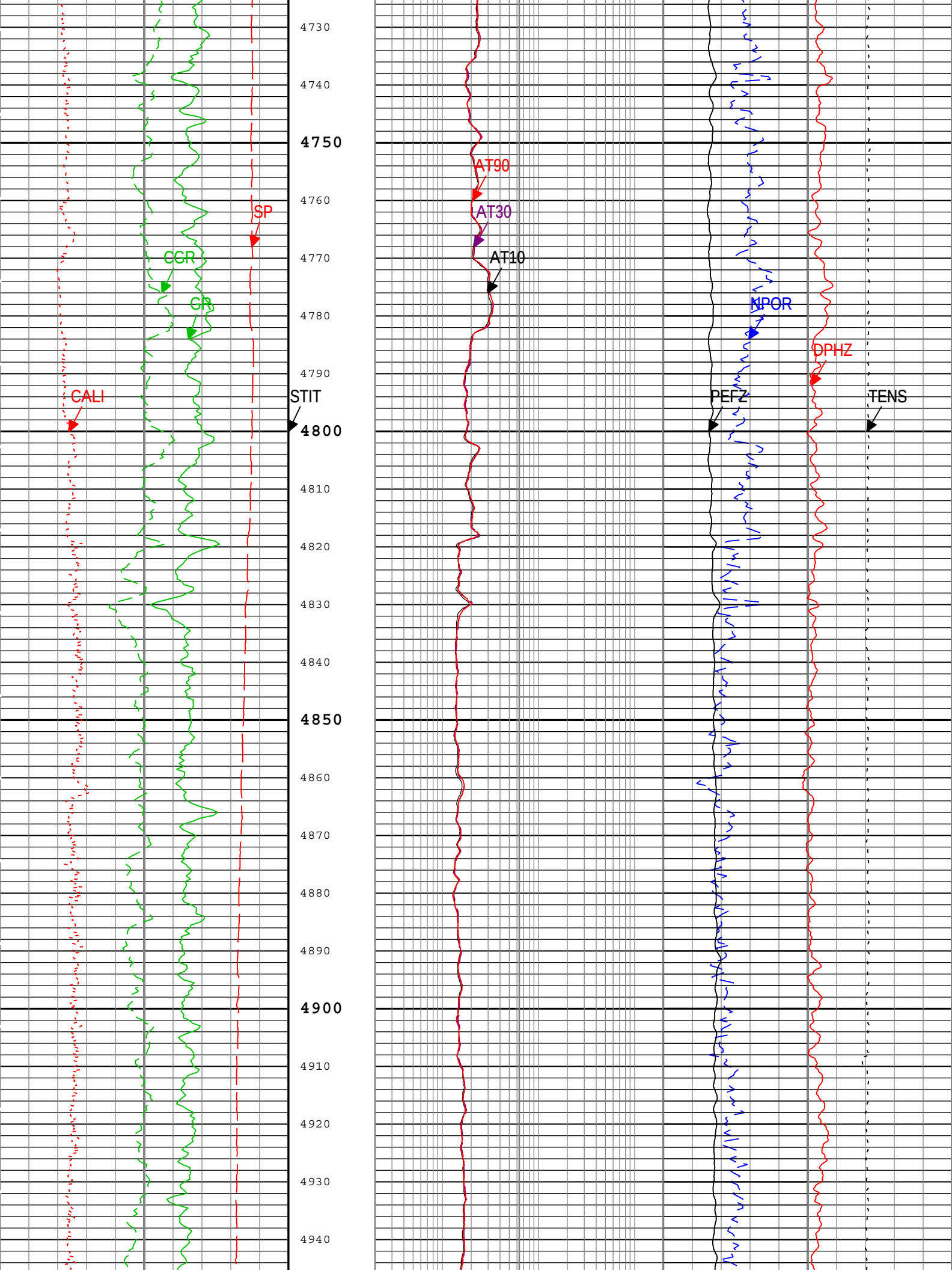
DPHZ
PEFZ
TENS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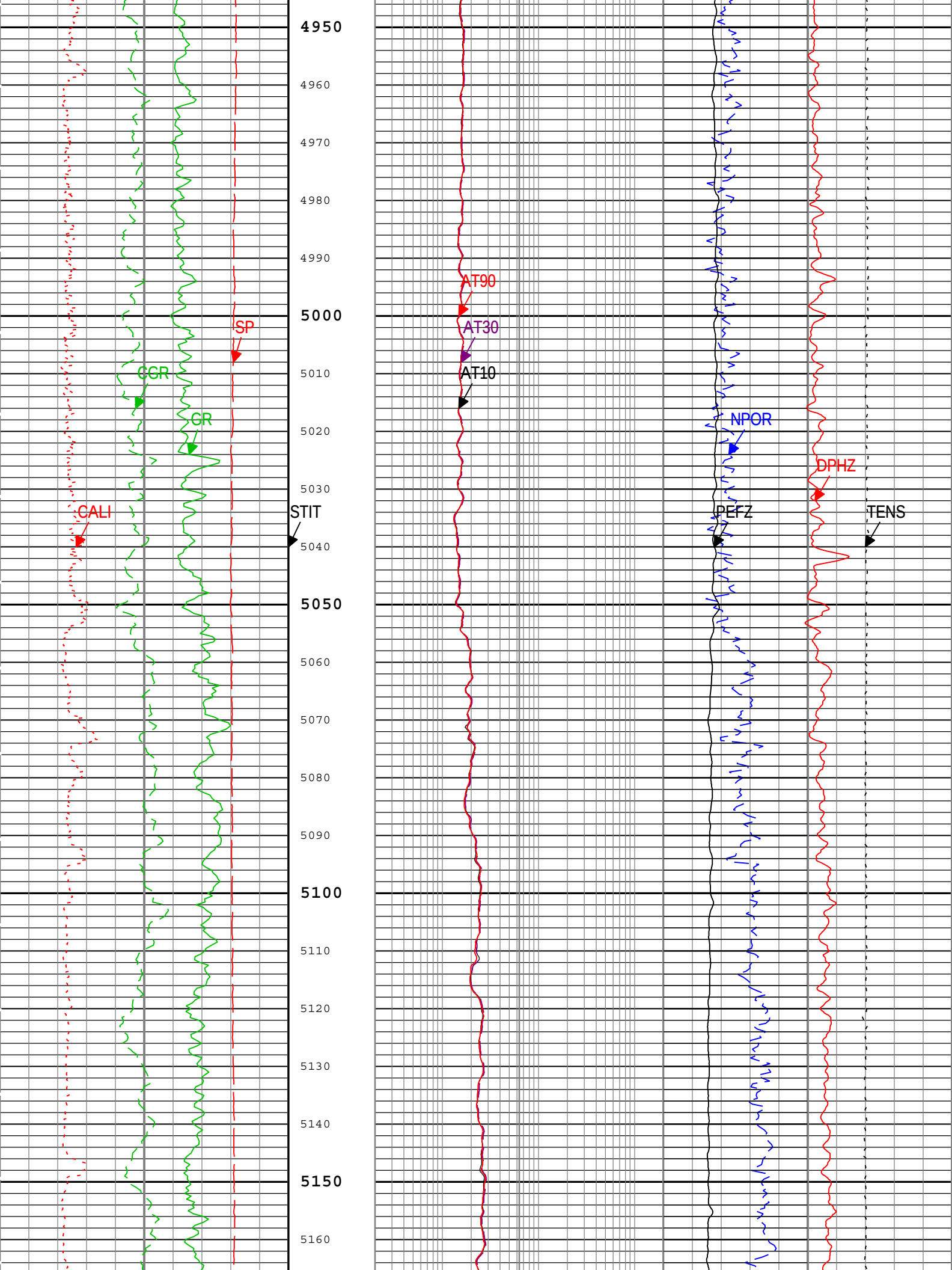
NPOR
DPHZ
PEFZ
TENS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5110
5120
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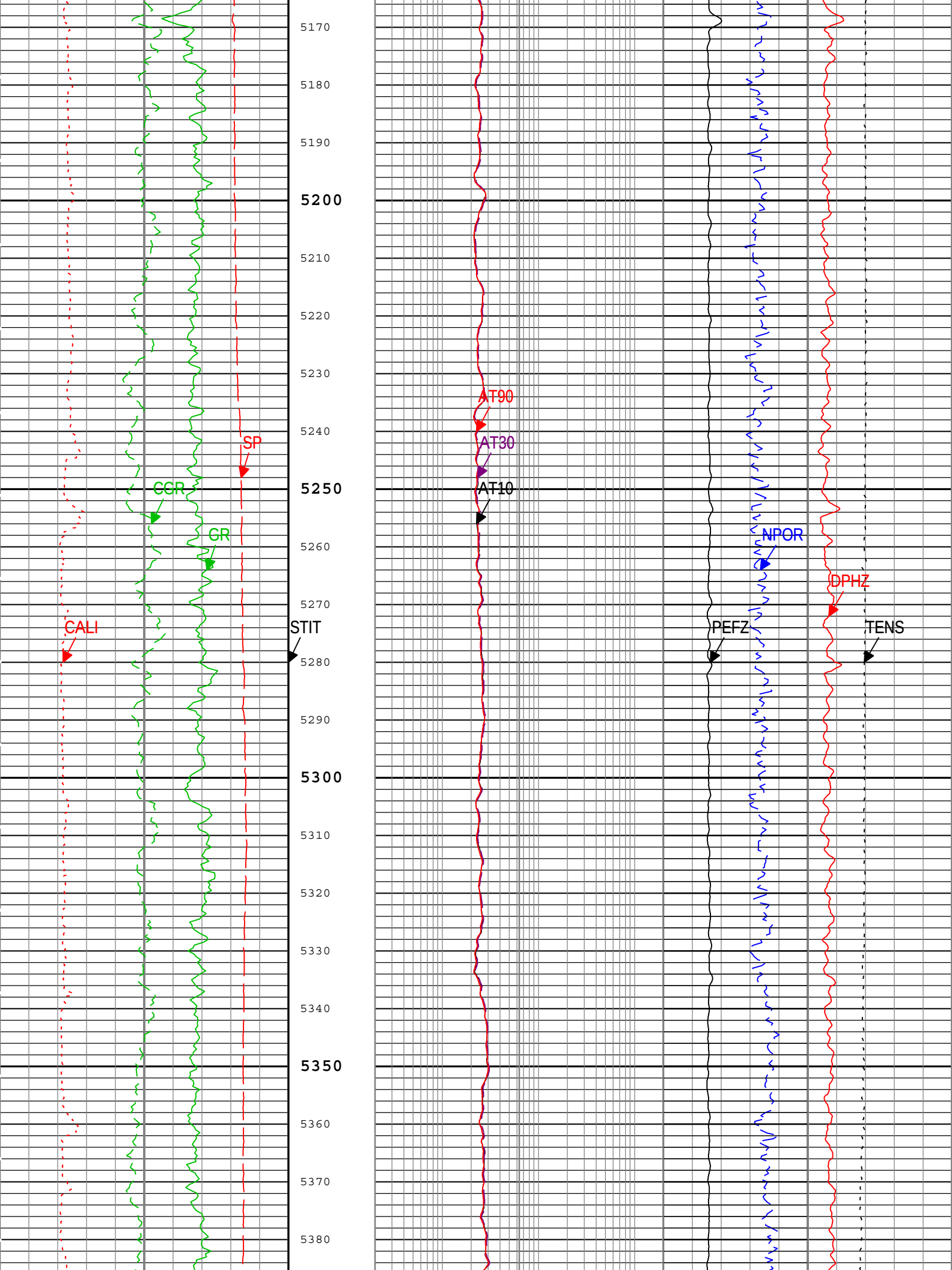
NPOR
DPHZ
PEFZ
TENS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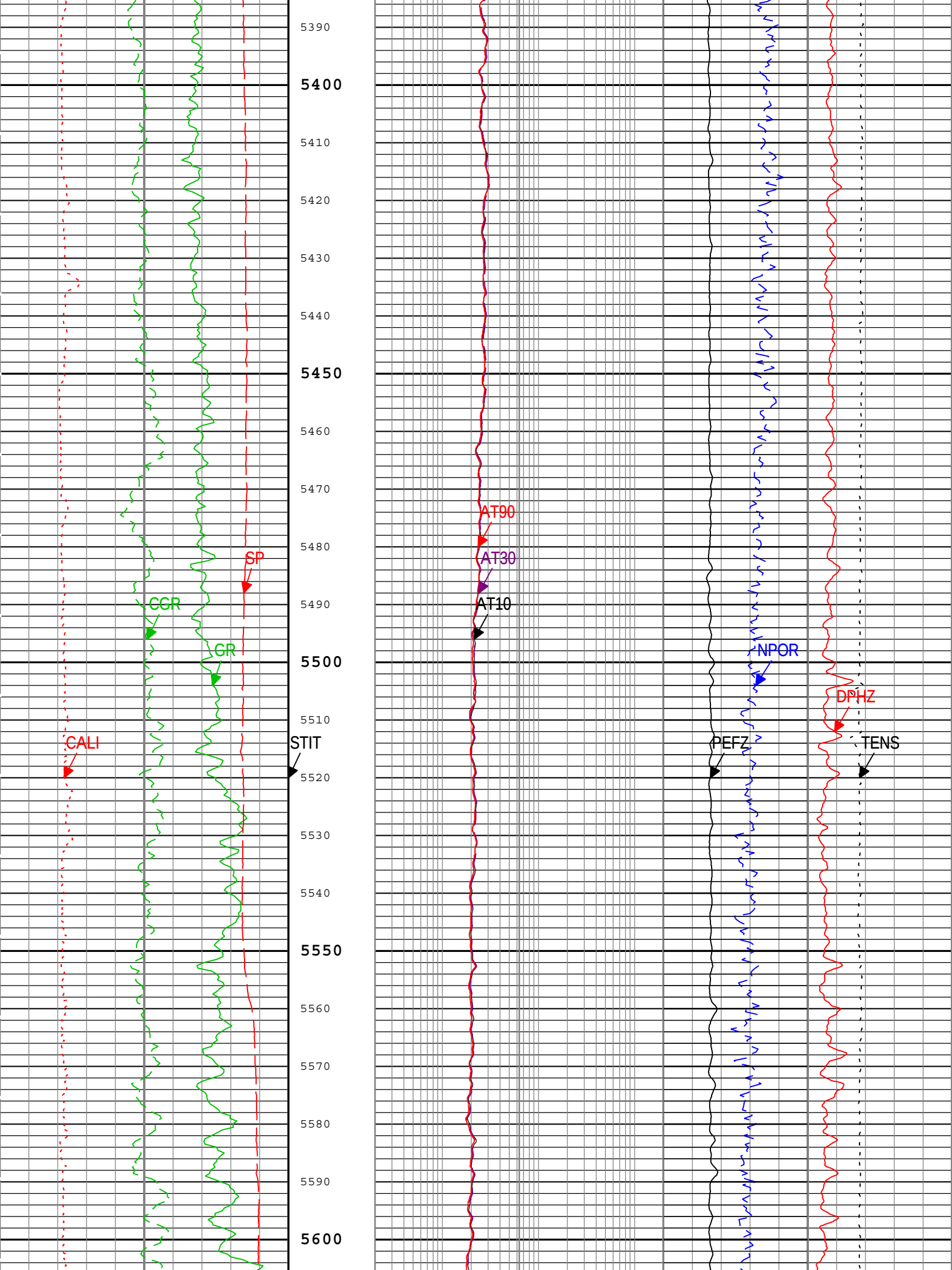
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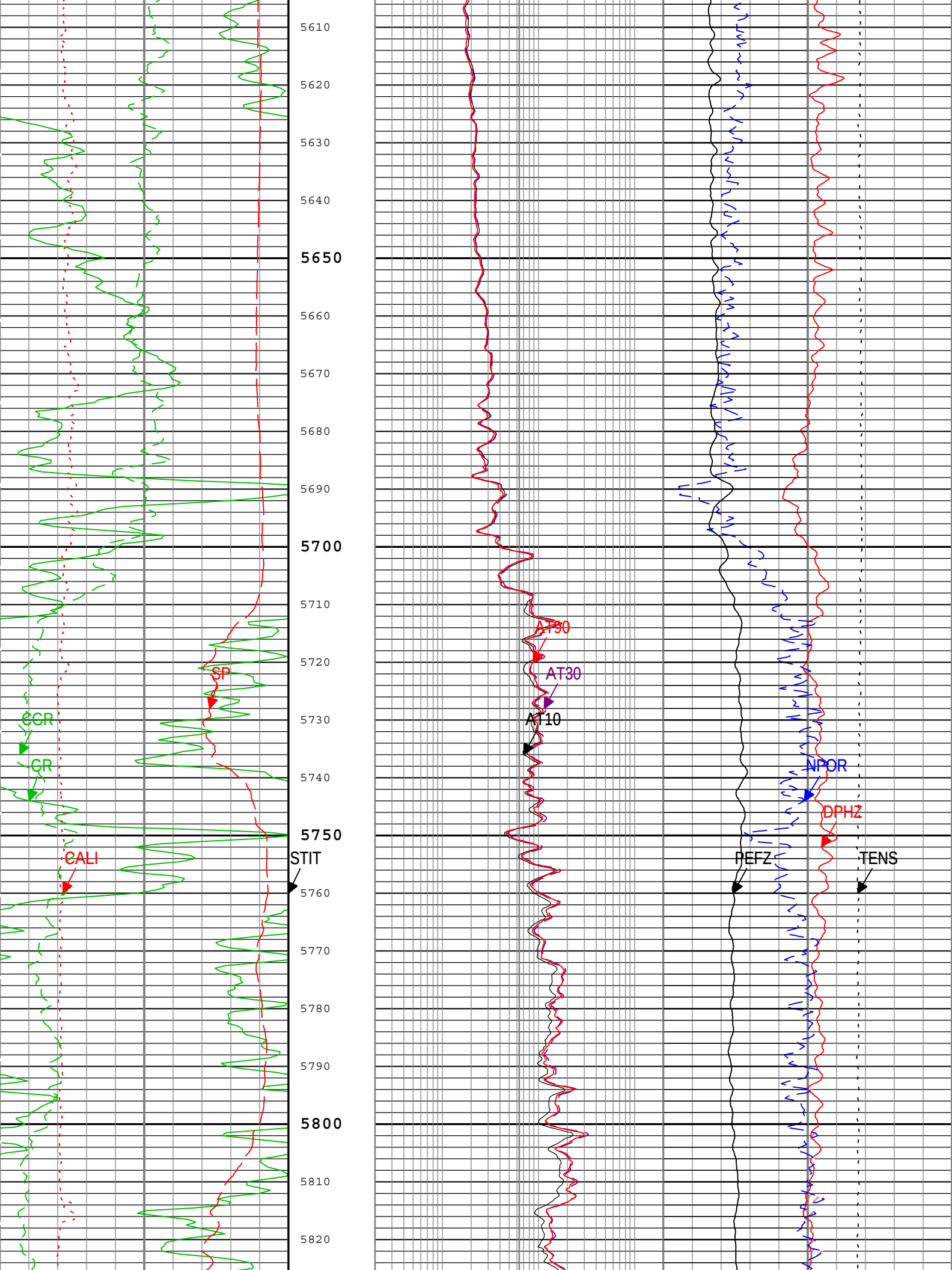
NPOR
DPHZ
PEFZ
TENS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SP
CCR
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CALI
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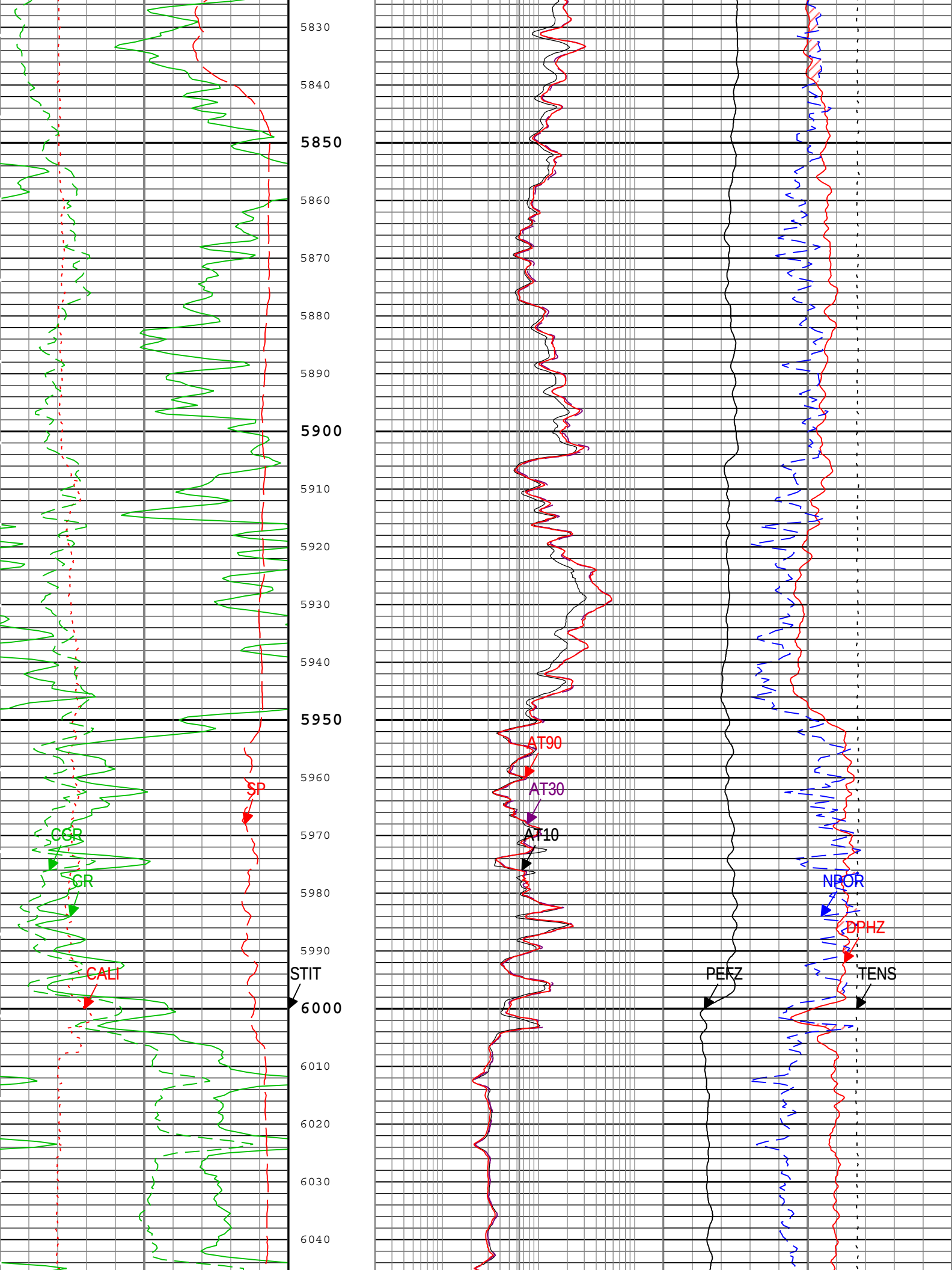
AT90
AT30
AT10
NPOR
DPHZ
PEFZ
TENS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NPOR
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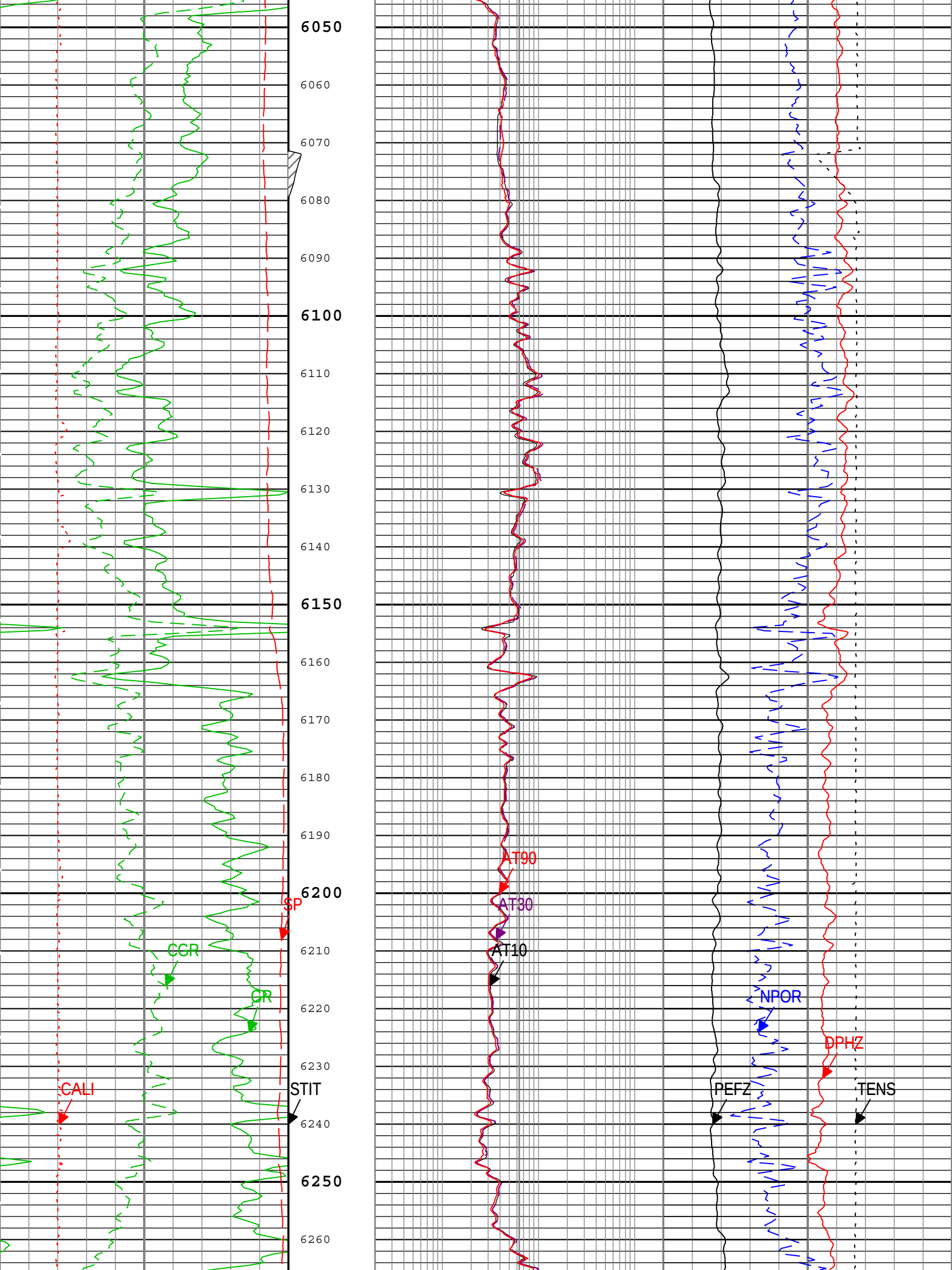
TENS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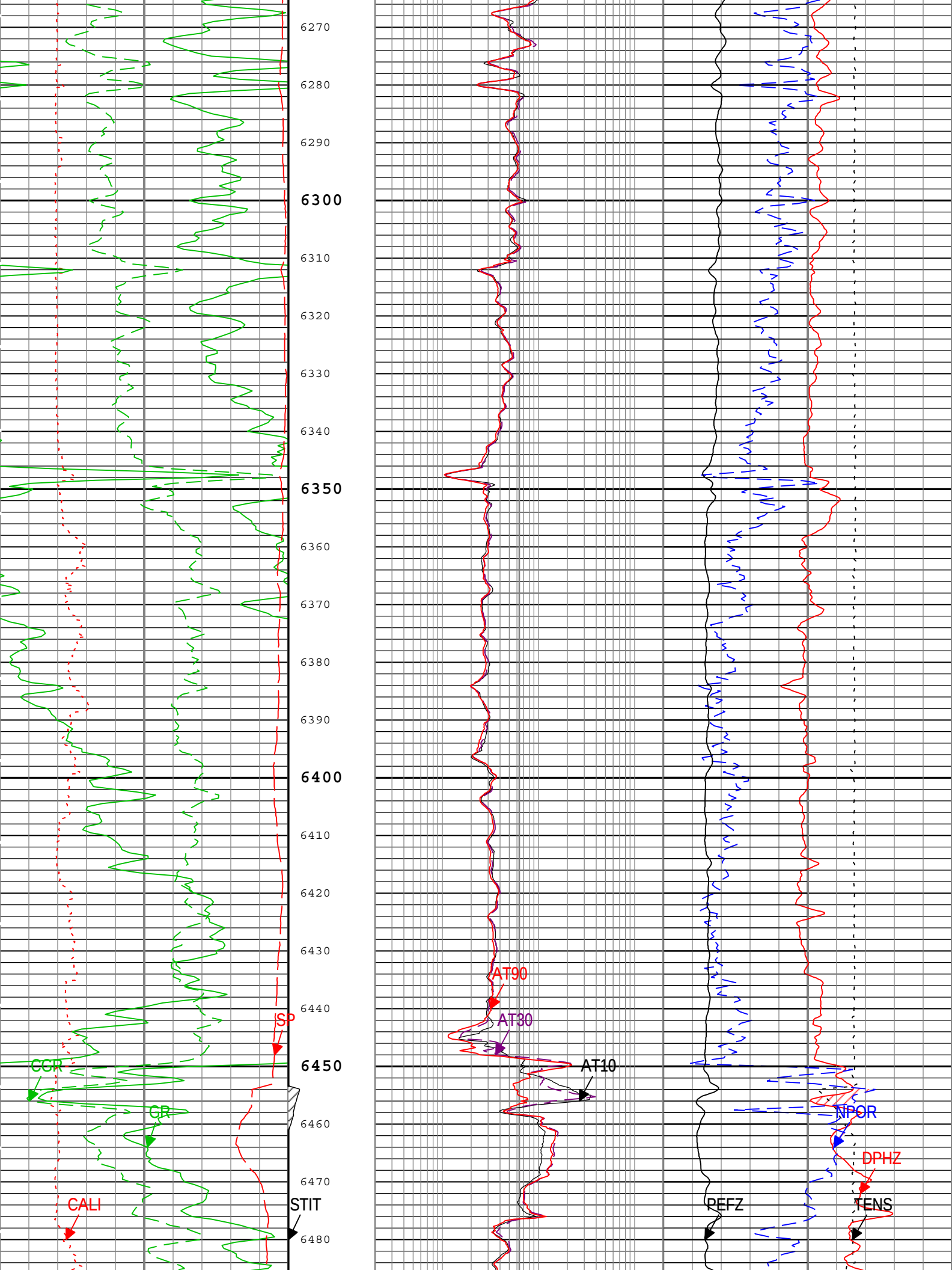
PEFZ
TENS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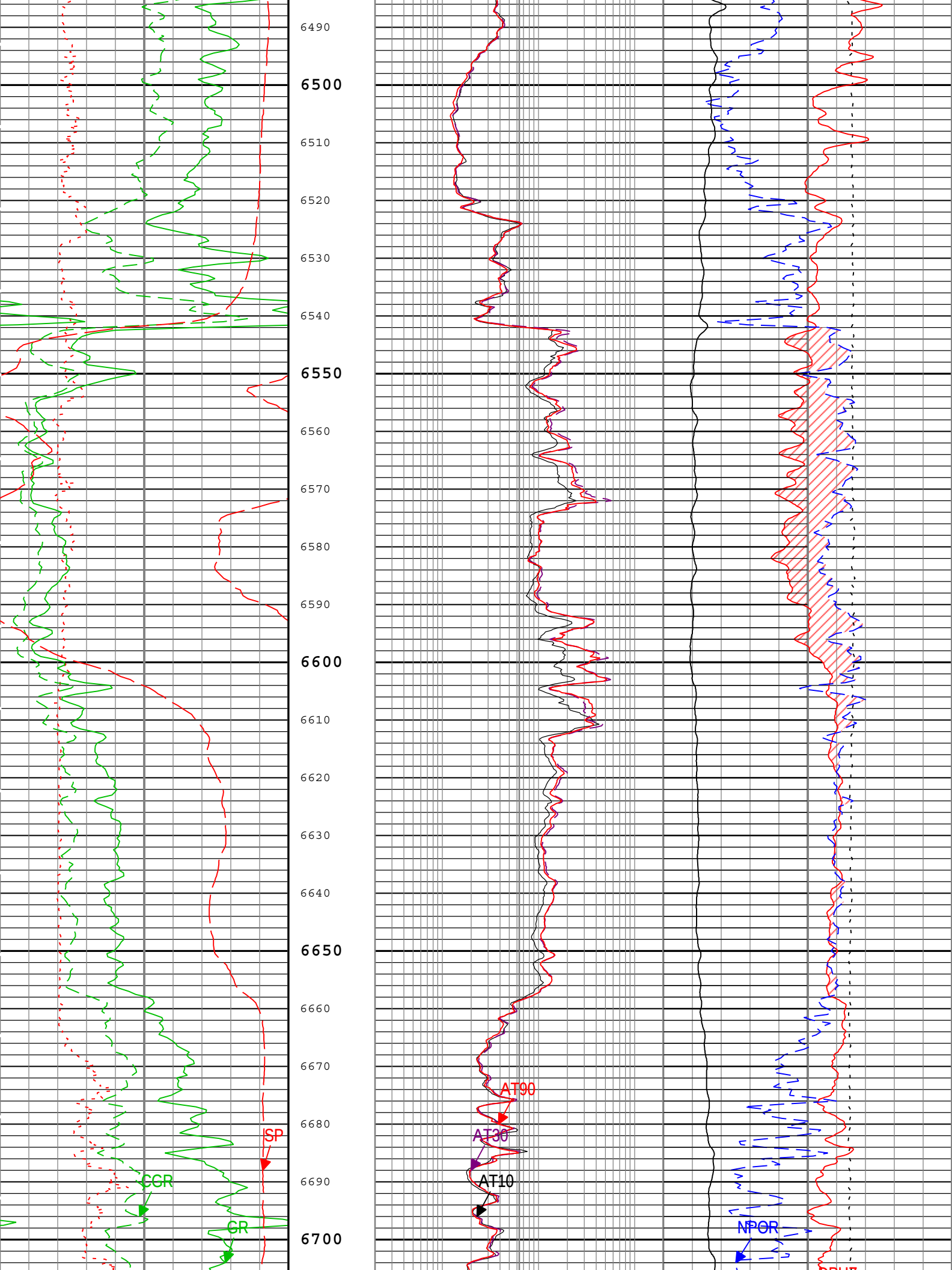
DPHZ
PEFZ
TENS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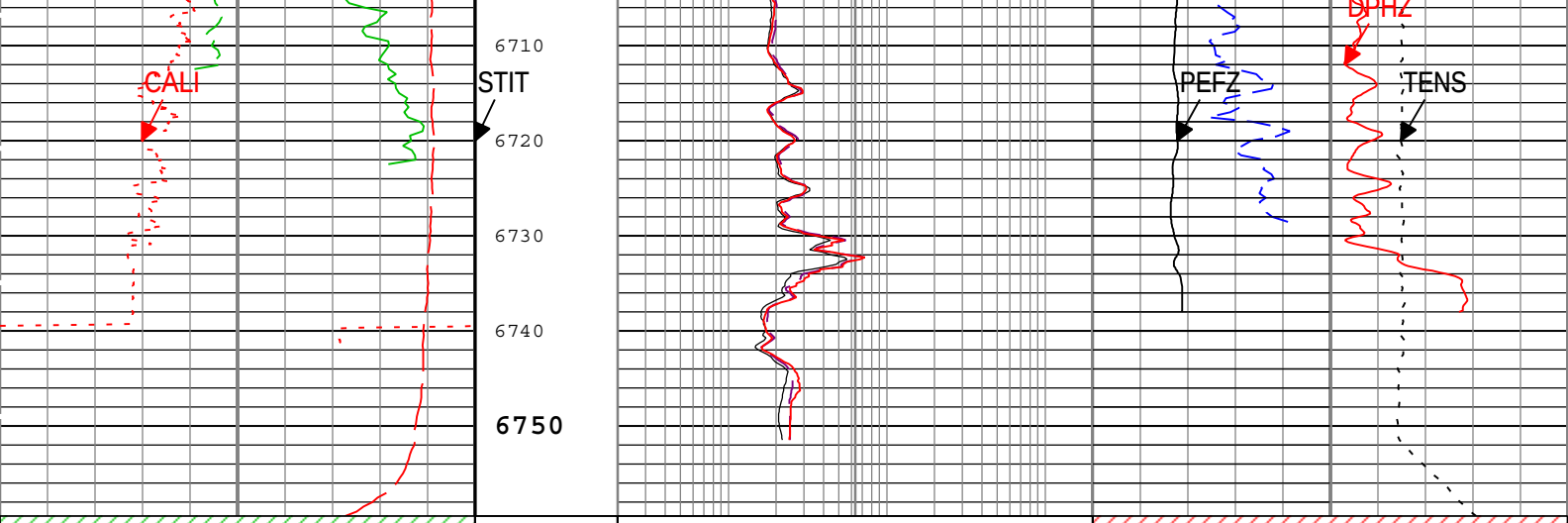
SP
CGR
GR
AT90
AT30
AT10
NPOR




Gamma Ray Back up

Caliper (CALI) HDRS-H
6 in 16

Gamma Ray (GR) HGNS-H
0 gAPI 150

Gamma Ray Contribution from Thorium and Potassium (CGR) HNGS-BA
0 gAPI 150

Gamma Ray Contribution from Thorium and Potassium (CGR) HNGS-BA
0 gAPI 150

Spontaneous Potential (SP) AIT-M
-80 mV 20

Stuck Tool Indicator, Total (STIT)
0 ft 50

Array Induction Two Foot Resistivity A10 (AT10) AIT-M
0.2 ohm.m 200

Array Induction Two Foot Resistivity A30 (AT30) AIT-M
0.2 ohm.m 200

Array Induction Two Foot Resistivity A90 (AT90) AIT-M
0.2 ohm.m 200

Gas Effect

NPOR Backup

Cable Tension (TENS)
8000 lbf 0

Standard Resolution Density Porosity (DPHZ) HDRS-H
0.45 ft3/ft3 -0.15

Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H
0.45 m3/m3 -0.15

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H
0 10

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log ( Import of KM 5in Triple Combo ) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 11-Sep-2014 18:05:31

## Channel Processing Parameters

| Parameter | Description | Tool | Value | Unit |
|---|---|---|---|---|
| ABHM | Array Induction Borehole Correction Mode | AIT-M | Compute Standoff | |
| ACDE | Array Induction Casing Detection Enable | AIT-M | Yes | |
| ASTA | Array Induction Tool Standoff | AIT-M | 1 | in |
| BARI | Barite Mud Presence Flag | Borehole | No | |
| BHK | Drilling Fluid Potassium Concentration | Borehole | 0 | % |
| BHS | Borehole Status (Open or Cased Hole) | Borehole | Open | |
| BHT | Bottom Hole Temperature | Borehole | 185 | degF |
| BS | Bit Size | WLSESSION | 7.875 | in |
| BSAL | Borehole Salinity | Borehole | 0 | ppm |
| CALI_SHIFT | CALI Supplementary Offset | HDRS-H | 0.244 | in |
| CBLO | Casing Bottom (Logger) | WLSESSION | 1257 | ft |
| CDEN | Cement Density | HGNS-H | 2 | g/cm3 |
| DBCC | Barite Constant Correction Flag | HNGS-BA | None | |
| DC_MODE | Depth Correction Mode | DepthCorrection | Real-time | |
| DFD | Drilling Fluid Density | Borehole | 9 | lbm/gal |
| DFT | Drilling Fluid Type | Borehole | Water | |

| | | | | |
|---|---|---|---|---|
| DFT_WATER | Drilling Fluid Water Type | Borehole | WBM | |
| DHC | Density Hole Correction | HDRS-H | Bit Size | |
| FD | Fluid Density | Borehole | 1 | g/cm3 |
| FSAL | Formation Salinity | Borehole | 0 | ppm |
| GCSE_DOWN_PASS | Generalized Caliper Selection for WL Log Down Passes | Borehole | BS | |
| GCSE_UP_PASS | Generalized Caliper Selection for WL Log Up Passes | Borehole | CALI | |
| GRSE | Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity | Borehole | AMF | |
| GTSE | Generalized Temperature Selection, from Measured or Computed Temperature | Borehole | CTEM | |
| HCRB | Apply Borehole Potassium Correction | HNGS-BA | None | |
| HEMA | Hematite Presence Flag | Borehole | No | |
| HSCO | Hole Size Correction Option | HGNS-H | Yes | |
| MATR | Rock Matrix for Neutron Porosity Corrections | Borehole | LIMESTONE | |
| MDEN | Matrix Density for Density Porosity | Borehole | 2.71 | g/cm3 |
| MFST | Mud Filtrate Sample Temperature | Borehole | 75 | degF |
| NPRM | HRDD Nuclear Processing Mode | HDRS-H | Very High Resolution | |
| RMFS | Resistivity of Mud Filtrate Sample | Borehole | 1.53 | ohm.m |
| SGRC | Standard Gamma Ray Correction Flag | HNGS-BA | Yes | |
| SOCO | Standoff Correction Option | HGNS-H | Yes | |
| SPDR | SP Drift Per Foot | AIT-M | 0 | mV/ft |
| TD | Total Measured Depth | Borehole | 6751 | ft |

## Tool Control Parameters

| Parameter | Description | Tool | Value | Unit |
|---|---|---|---|---|
| HMCA_BRD_TYPE | HMCA Board Type | HGNS-H | 1 | |
| HRGD_BRD_TYPE | HRGD Board Type | HDRS-H | WITH_HET | |
| MAX_LOG_SPEED | Toolstring Maximum Logging Speed | WLSESSION | 900 | ft/h |

# One-1

# 5" Triple Combo

## Pass Summary

| Run Name | Pass Objective | Direction | Top | Bottom | Start | Stop | DSC Mode | Depth Shift | Include Parallel Data |
|---|---|---|---|---|---|---|---|---|---|
| One-1 | Log[2]:Up | Up | 4949.82 ft | 6757.17 ft | 11-Sep-2014 11:16:42 AM | 11-Sep-2014 12:23:38 PM | ON | 2.69 ft | No |
| One-1 | Main[3]:Up | Up | 11.13 ft | 6759.63 ft | 11-Sep-2014 12:36:28 PM | 11-Sep-2014 5:36:08 PM | ON | -0.45 ft | Yes |

All depths are referenced to toolstring zero

## Log

Company:Noble Energy Inc Well:Lilli Federal LG13-02

One-1: Main[3]:Up:S011

Description: HGNS standard resolution porosities for Platform Express Format: Import of KM 5in Triple Combo RA Index Scale: 5 in per 100 ft Index Unit: ft
Index Type: Measured Depth Creation Date: 11-Sep-2014 18:05:33

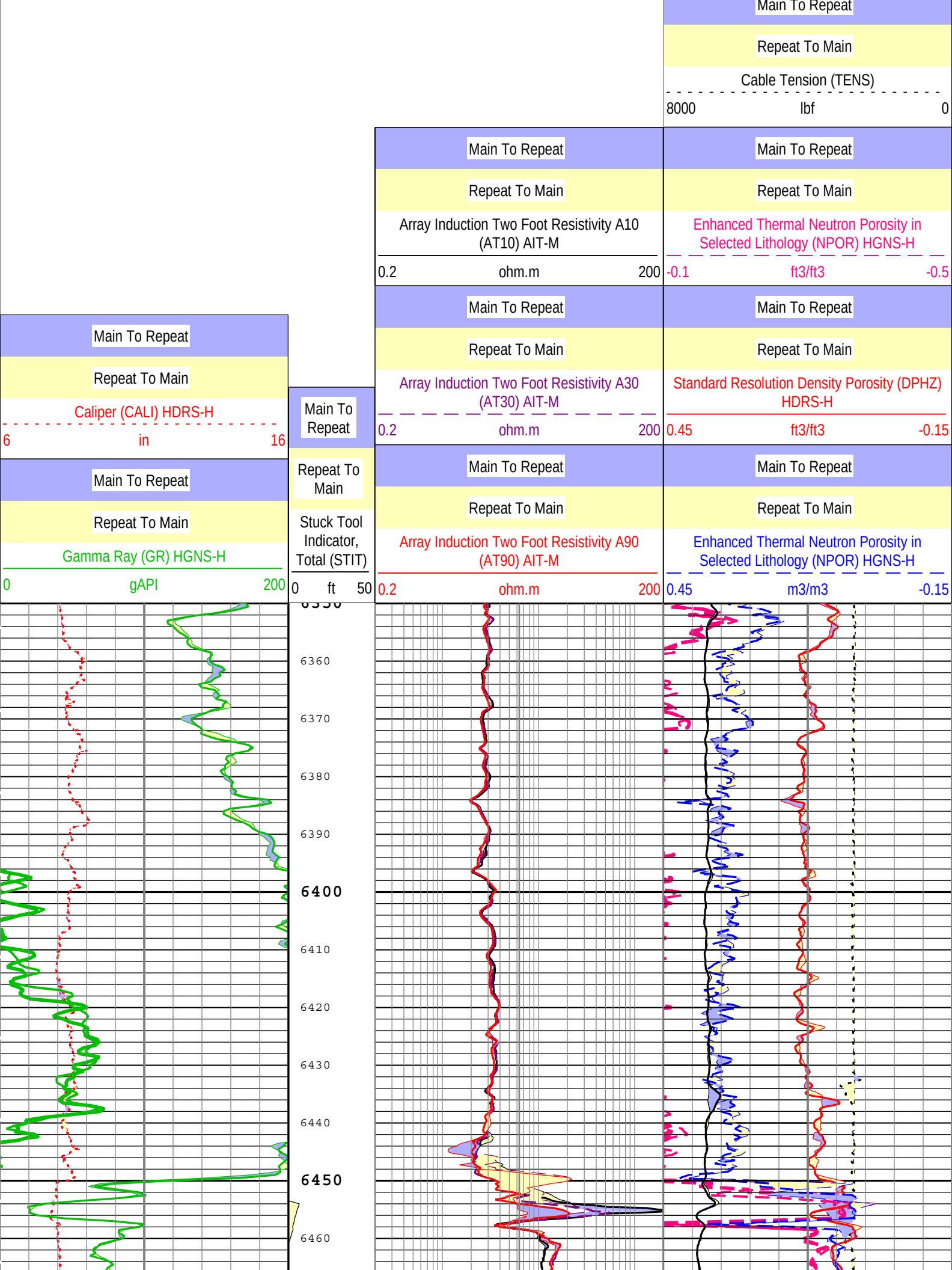
TIME_1900 - Time Marked every 60.00 (s)

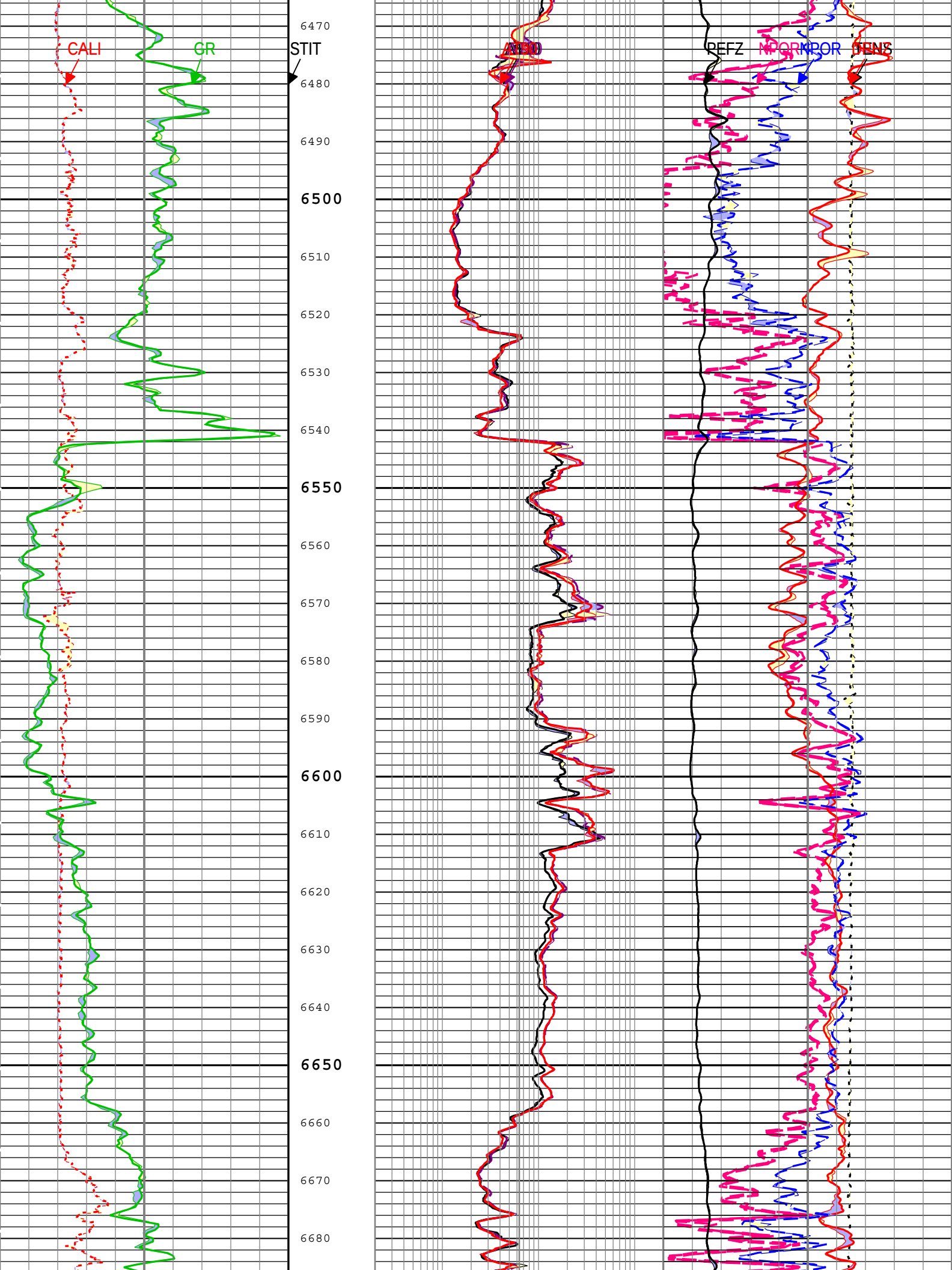
Main To Repeat

Repeat To Main

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10


Main To Repeat
Repeat To Main
Cable Tension (TENS)
8000 lbf 0
Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A10 (AT10) AIT-M
0.2 ohm.m 200
Main To Repeat
Repeat To Main
Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H
-0.1 ft3/ft3 -0.5
Main To Repeat
Repeat To Main
Caliper (CALI) HDRS-H
6 in 16
Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A30 (AT30) AIT-M
0.2 ohm.m 200
Main To Repeat
Repeat To Main
Standard Resolution Density Porosity (DPHZ) HDRS-H
0.45 ft3/ft3 -0.15
Main To Repeat
Repeat To Main
Gamma Ray (GR) HGNS-H
0 gAPI 200
Main To Repeat
Repeat To Main
Stuck Tool Indicator, Total (STIT)
0 ft 50
Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A90 (AT90) AIT-M
0.2 ohm.m 200
Main To Repeat
Repeat To Main
Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H
0.45 m3/m3 -0.15
6350
6360
6370
6380
6390
6400
6410
6420
6430
6440
6450
6460


CALI
GR
STIT
6470
6480
6490
6500
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6520
6530
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6570
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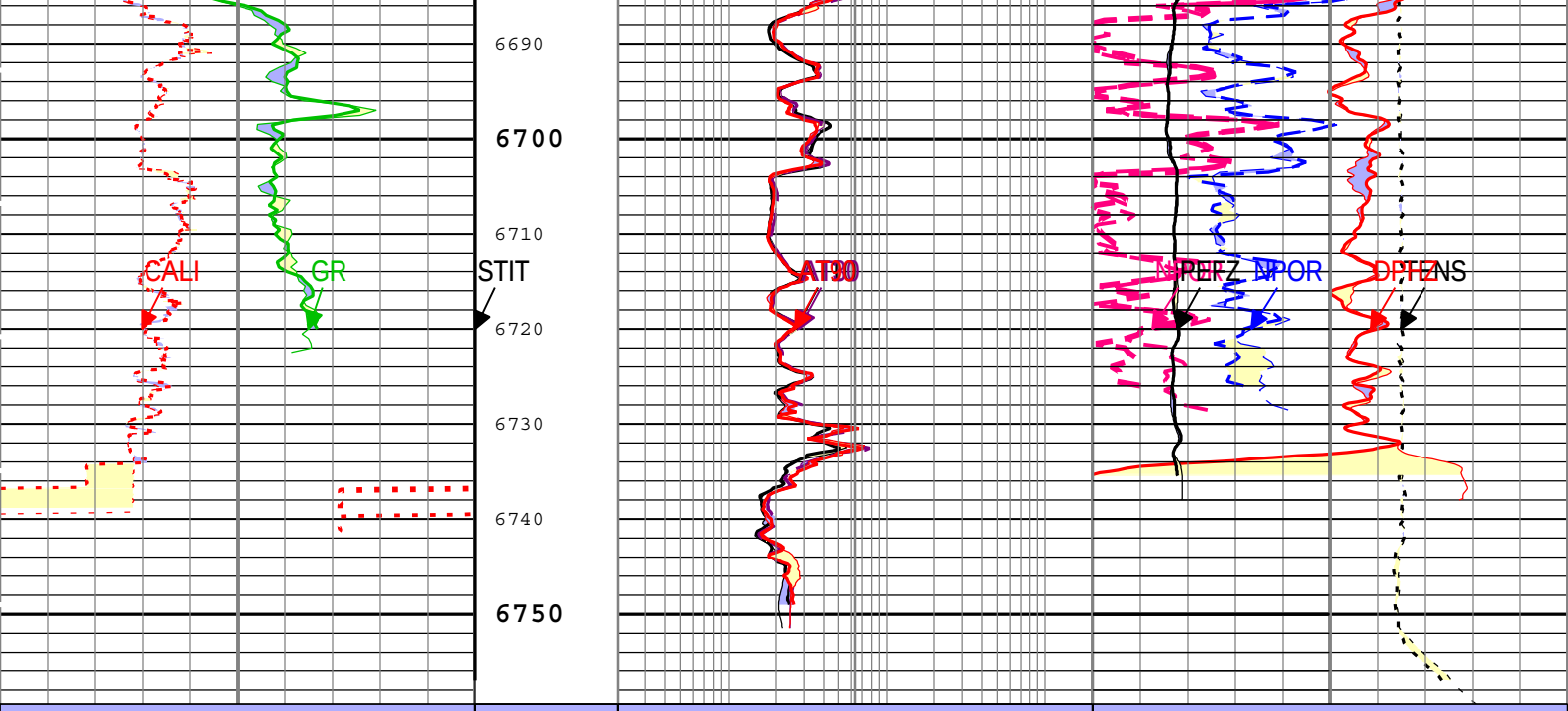
6640
6650
6660
6670
6680
PEFZ
NPOR
KPOR
TENS




Main To Repeat

Repeat To Main

Caliper (CALI) HDRS-H

6 in 16

Main To Repeat

Repeat To Main

Gamma Ray (GR) HGNS-H

0 gAPI 200

Main To Repeat

Repeat To Main

Stuck Tool Indicator, Total (STIT)

0 ft 50

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A10 (AT10) AIT-M

0.2 ohm.m 200

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2 ohm.m 200

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2 ohm.m 200

Main To Repeat

Repeat To Main

Cable Tension (TENS)

8000 lbf 0

Main To Repeat

Repeat To Main

Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H

-0.1 ft3/ft3 -0.5

Main To Repeat

Repeat To Main

Standard Resolution Density Porosity (DPHZ) HDRS-H

0.45 ft3/ft3 -0.15

Main To Repeat

Repeat To Main

Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H

0.45 m3/m3 -0.15

Main To Repeat

Repeat To Main

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10

TIME 1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Import of KM 5in Triple Combo RA Index Scale: 5 in per 100 ft Index Unit: ft
Index Type: Measured Depth Creation Date: 11-Sep-2014 18:05:33

# Calibration Report

## AIT-M (Array Induction Tool - M) Calibration - Run One-1

Primary Equipment :

| | | |
|---|---|---|
| File code for AIT-MA Sonde Tool Element | AMIS | 181 |

Auxiliary Equipment :

| | | |
|---|---|---|
| AITM Rm/SP Bottom Nose | AMRM | 181 |

## AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 15:52:07 18-Jun-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Test Loop Gain - 0 | | Master | 1.000 | 0.950 | 1.016 | 1.050 |
| Test Loop Phase - 0 | deg | Master | 0 | -3.000 | -0.873 | 3.000 |
| Test Loop Gain - 1 | | Master | 1.000 | 0.950 | 1.016 | 1.050 |
| Test Loop Phase - 1 | deg | Master | 0 | -3.000 | -0.523 | 3.000 |
| Test Loop Gain - 2 | | Master | 1.000 | 0.950 | 1.020 | 1.050 |
| Test Loop Phase - 2 | deg | Master | 0 | -3.000 | -0.285 | 3.000 |
| Test Loop Gain - 3 | | Master | 1.000 | 0.950 | 1.017 | 1.050 |
| Test Loop Phase - 3 | deg | Master | 0 | -3.000 | -0.364 | 3.000 |
| Test Loop Gain - 4 | | Master | 1.000 | 0.950 | 0.996 | 1.050 |
| Test Loop Phase - 4 | deg | Master | 0 | -3.000 | 0.047 | 3.000 |
| Test Loop Gain - 5 | | Master | 1.000 | 0.950 | 0.992 | 1.050 |
| Test Loop Phase - 5 | deg | Master | 0 | -3.000 | -0.306 | 3.000 |
| Test Loop Gain - 6 | | Master | 1.000 | 0.950 | 0.998 | 1.050 |
| Test Loop Phase - 6 | deg | Master | 0 | -3.000 | -0.014 | 3.000 |
| Test Loop Gain - 7 | | Master | 1.000 | 0.950 | 1.012 | 1.050 |
| Test Loop Phase - 7 | deg | Master | 0 | -3.000 | -0.171 | 3.000 |

## AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM): 15:52:07 18-Jun-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Sonde Error Correction Real - 0 | mS/m | Master | ----- | -231.000 | -105.375 | 119.000 |
| Sonde Error Correction Quad - 0 | | Master | ----- | -2250.000 | 128.249 | 2250.000 |
| Sonde Error Correction Real - 1 | mS/m | Master | ----- | 114.000 | 154.526 | 204.000 |
| Sonde Error Correction Quad - 1 | | Master | ----- | -625.000 | -120.438 | 625.000 |
| Sonde Error Correction Real - 2 | mS/m | Master | ----- | 66.000 | 113.010 | 156.000 |
| Sonde Error Correction Quad - 2 | | Master | ----- | -350.000 | -106.668 | 350.000 |
| Sonde Error Correction Real - 3 | mS/m | Master | ----- | 39.000 | 49.722 | 89.000 |
| Sonde Error Correction Quad - 3 | | Master | ----- | -250.000 | -9.512 | 250.000 |
| Sonde Error Correction Real - 4 | mS/m | Master | ----- | 15.000 | 25.368 | 35.000 |
| Sonde Error Correction Quad - 4 | | Master | ----- | -63.000 | -11.301 | 63.000 |
| Sonde Error Correction Real - 5 | mS/m | Master | ----- | 4.000 | 10.767 | 24.000 |
| Sonde Error Correction Quad - 5 | | Master | ----- | -50.000 | 19.041 | 50.000 |
| Sonde Error Correction Real - 6 | mS/m | Master | ----- | 5.000 | 9.775 | 15.000 |
| Sonde Error Correction Quad - 6 | | Master | ----- | -30.000 | 0.982 | 30.000 |
| Sonde Error Correction Real - 7 | mS/m | Master | ----- | -5.000 | -1.211 | 5.000 |
| Sonde Error Correction Quad - 7 | | Master | ----- | -30.000 | 1.407 | 30.000 |

## AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM): 15:52:07 18-Jun-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Coarse Gain | | Master | 1.000 | 0.800 | 0.903 | 1.200 |
| Fine Gain | | Master | 1.000 | 0.800 | 0.900 | 1.200 |

## AIT Electronics Check - Thru Calibration Check

Master (EEPROM): 15:52:07 18-Jun-2014 Before (Measured): 15:45:45 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Thru Cal Mag - 0 | V | Master | ----- | 0.366 | 0.576 | 0.854 |
| | | Before | ----- | 0.366 | 0.575 | 0.854 |
| | | Before-Master | ----- | ----- | -0.001 | ----- |
| Thru Cal Phase - 0 | deg | Master | ----- | 137.000 | -169.574 | -103.000 |
| | | Before | ----- | 137.000 | -169.262 | -103.000 |
| | | Before-Master | ----- | ----- | 0.312 | ----- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Thru Cal Mag - 1 | V | Master | ----- | 0.762 | 1.179 | 1.778 | |
| | | Before | ----- | 0.762 | 1.178 | 1.778 | |
| | | Before-Master | ----- | ----- | -0.001 | ----- | |
| Thru Cal Phase - 1 | deg | Master | ----- | 136.000 | -170.676 | -104.000 | |
| | | Before | ----- | 136.000 | -170.363 | -104.000 | |
| | | Before-Master | ----- | ----- | 0.313 | ----- | |
| Thru Cal Mag - 2 | V | Master | ----- | 0.372 | 0.585 | 0.868 | |
| | | Before | ----- | 0.372 | 0.585 | 0.868 | |
| | | Before-Master | ----- | ----- | 0.000 | ----- | |
| Thru Cal Phase - 2 | deg | Master | ----- | 132.000 | -174.320 | -108.000 | |
| | | Before | ----- | 132.000 | -174.005 | -108.000 | |
| | | Before-Master | ----- | ----- | 0.315 | ----- | |
| Thru Cal Mag - 3 | V | Master | ----- | 0.420 | 0.661 | 0.980 | |
| | | Before | ----- | 0.420 | 0.660 | 0.980 | |
| | | Before-Master | ----- | ----- | -0.001 | ----- | |
| Thru Cal Phase - 3 | deg | Master | ----- | 131.000 | -175.098 | -109.000 | |
| | | Before | ----- | 131.000 | -174.783 | -109.000 | |
| | | Before-Master | ----- | ----- | 0.315 | ----- | |
| Thru Cal Mag - 4 | V | Master | ----- | 0.804 | 1.234 | 1.876 | |
| | | Before | ----- | 0.804 | 1.234 | 1.876 | |
| | | Before-Master | ----- | ----- | 0.000 | ----- | |
| Thru Cal Phase - 4 | deg | Master | ----- | 125.000 | 178.625 | -115.000 | |
| | | Before | ----- | 125.000 | 178.942 | -115.000 | |
| | | Before-Master | ----- | ----- | 0.317 | ----- | |
| Thru Cal Mag - 5 | V | Master | ----- | 1.176 | 1.797 | 2.744 | |
| | | Before | ----- | 1.176 | 1.795 | 2.744 | |
| | | Before-Master | ----- | ----- | -0.002 | ----- | |
| Thru Cal Phase - 5 | deg | Master | ----- | 122.000 | 176.963 | -118.000 | |
| | | Before | ----- | 122.000 | 177.284 | -118.000 | |
| | | Before-Master | ----- | ----- | 0.321 | ----- | |
| Thru Cal Mag - 6 | V | Master | ----- | 1.176 | 1.796 | 2.744 | |
| | | Before | ----- | 1.176 | 1.795 | 2.744 | |
| | | Before-Master | ----- | ----- | -0.001 | ----- | |
| Thru Cal Phase - 6 | deg | Master | ----- | 121.000 | 176.970 | -119.000 | |
| | | Before | ----- | 121.000 | 177.292 | -119.000 | |
| | | Before-Master | ----- | ----- | 0.322 | ----- | |
| Thru Cal Mag - 7 | V | Master | ----- | 0.846 | 1.295 | 1.974 | |
| | | Before | ----- | 0.846 | 1.294 | 1.974 | |
| | | Before-Master | ----- | ----- | -0.001 | ----- | |
| Thru Cal Phase - 7 | deg | Master | ----- | 115.000 | 176.186 | -125.000 | |
| | | Before | ----- | 115.000 | 176.544 | -125.000 | |
| | | Before-Master | ----- | ----- | 0.358 | ----- | |
| SPA Zero | mV | Master | | -50.000 | 0.159 | 50.000 | |
| | | Before | | -50.000 | 0.146 | 50.000 | |
| | | Before-Master | ----- | ----- | -0.013 | ----- | |
| SPA Plus | mV | Master | | 941.000 | 992.540 | 1040.000 | |
| | | Before | | 941.000 | 992.449 | 1040.000 | |
| | | Before-Master | ----- | ----- | -0.091 | ----- | |
| Temperature Zero | V | Master | | -0.050 | 0.000 | 0.050 | |
| | | Before | | -0.050 | 0.000 | 0.050 | |
| | | Before-Master | ----- | ----- | 0.000 | ----- | |
| Temperature Plus | V | Master | | 0.870 | 0.919 | 0.960 | |
| | | Before | | 0.870 | 0.919 | 0.960 | |
| | | Before-Master | ----- | ----- | 0.000 | ----- | |

## HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One-1

**Primary Equipment :**

| | | |
|---|---|---|
| HILT High-Resolution Control Cartridge, 150 degC | HRCC-H | 3898 |
| HILT Resistivity Gamma-Ray Density Device, 150 degC | HRGD-H | 3760 |

**Auxiliary Equipment :**

| | | |
|---|---|---|
| HRDD Backscatter Detector | Backscatter | |
| HRDD Long Spacing Detector | Long Spacing | |
| HRDD Short Spacing Detector | Short Spacing | |
| Cesium 137 Gamma-Ray Logging Source | GSR-J | 5471 |

| | | |
|---|---|---|
| HILT High-Resolution Control Cartridge, 150 degC | HRCC-H | 3898 |
| HILT High-Resolution Mechanical Sonde, 150 degC | HRMS-H | 3863 |

Calibration Parameter :

| | |
|---|---|
| Small Ring Size (Caliper Calibration Small Ring) | 8.00 |
| Large Ring Size (Caliper Calibration Large Ring) | 12.00 |

## HDRS Caliper Calibration - Caliper Accumulations

Before (Measured): 15:50:50 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Small Ring | in | Before | 8.00 | 6.00 | 8.21 | 10.00 |
| Large Ring | in | Before | 12.00 | 9.00 | 12.55 | 15.00 |

## HDRS Density Calibration - Inversion Results

Master (EEPROM): 14:43:16 09-Sep-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Rho Aluminum | g/cm3 | Master | 2.596 | 2.586 | 2.596 | 2.606 |
| Rho Magnesium | g/cm3 | Master | 1.686 | 1.676 | 1.686 | 1.696 |
| Pe Aluminum | | Master | 2.570 | 2.470 | 2.547 | 2.670 |
| Pe Magnesium | | Master | 2.650 | 2.550 | 2.629 | 2.750 |

## HDRS Density Calibration - Deviation Summary

Master (EEPROM): 14:43:16 09-Sep-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Average Deviation | % | Master | 0 | -0.6000 | 0.4032 | 0.6000 |
| BS Max Deviation | % | Master | 0 | -1.6000 | 0.7988 | 1.6000 |
| SS Average Deviation | % | Master | 0 | -1.0000 | 0.2371 | 1.0000 |
| SS Max Deviation | % | Master | 0 | -2.5000 | 0.6653 | 2.5000 |
| LS Average Deviation | % | Master | 0 | -1.5000 | 0.8556 | 1.5000 |
| LS Max Deviation | % | Master | 0 | -3.5000 | 2.7786 | 3.5000 |

## HDRS Density Calibration - Background Summary

Master (EEPROM): 14:43:16 09-Sep-2014 Before (Measured): 15:52:59 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Window Ratio | | Master | 1.0000 | | 0.7339 | |
| | | Before | 0.7339 | 0.6972 | 0.7360 | 0.7706 |
| | | Before-Master | ----- | ----- | 0.0021 | ----- |
| BS Window Sum | 1/s | Master | 1 | | 23846 | |
| | | Before | 23846 | 22654 | 23858 | 25038 |
| | | Before-Master | ----- | ----- | 12 | ----- |
| SS Window Ratio | | Master | 1.0000 | | 0.4846 | |
| | | Before | 0.4846 | 0.4604 | 0.4856 | 0.5088 |
| | | Before-Master | ----- | ----- | 0.0010 | ----- |
| SS Window Sum | 1/s | Master | 1 | | 9752 | |
| | | Before | 9752 | 9264 | 9748 | 10239 |
| | | Before-Master | ----- | ----- | -4 | ----- |
| LS Window Ratio | | Master | 1.0000 | | 0.2981 | |
| | | Before | 0.2981 | 0.2832 | 0.3004 | 0.3130 |
| | | Before-Master | ----- | ----- | 0.0023 | ----- |
| LS Window Sum | 1/s | Master | 1 | | 1179 | |
| | | Before | 1179 | 1121 | 1173 | 1238 |
| | | Before-Master | ----- | ----- | -6 | ----- |

## HDRS Density Calibration - Photo-multiplier High Voltages

Master (EEPROM): 14:43:16 09-Sep-2014 Before (Measured): 15:52:59 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS PM High Voltage | V | Master | | 1000 | 1380 | 2400 |
| | | Before | | 1000 | 1391 | 2400 |
| | | Before-Master | ----- | -100 | 11 | 100 |
| SS PM High Voltage | V | Master | | 1000 | 1645 | 2400 |
| | | Before | | 1000 | 1659 | 2400 |
| | | Before-Master | ----- | -100 | 14 | 100 |
| LS PM High Voltage | V | Master | | 1000 | 1190 | 2400 |
| | | Before | | 1000 | 1196 | 2400 |
| | | Before-Master | ----- | -100 | 6 | 100 |

## HDRS Density Calibration - Crystal Quality Resolutions

Master (EEPROM): 14:43:16 09-Sep-2014 Before (Measured): 15:52:59 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Crystal Resolution | % | Master | | 5.00 | 10.65 | 25.00 |
| | | Before | | 5.00 | 10.66 | 25.00 |
| | | Before-Master | ----- | -1.00 | 0.01 | 1.00 |
| SS Crystal Resolution | % | Master | | 5.00 | 9.39 | 20.00 |
| | | Before | | 5.00 | 9.38 | 20.00 |
| | | Before-Master | ----- | -1.00 | -0.01 | 1.00 |
| LS Crystal Resolution | % | Master | | 5.00 | 8.43 | 20.00 |
| | | Before | | 5.00 | 8.52 | 20.00 |
| | | Before-Master | ----- | -1.00 | 0.09 | 1.00 |

## HDRS MCFL Calibration - MCFL Accumulations

Before (Measured): 10:28:52 11-Sep-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Main Resistivity | ohm.m | Before | 3875 | 3565 | 3860 | 4185 |
| Deep Resistivity | ohm.m | Before | 3830 | 3524 | 3799 | 4136 |
| Shallow Resistivity | ohm.m | Before | 3830 | 3524 | 3818 | 4136 |

## HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One-1

Primary Equipment :

| | | |
|---|---|---|
| HILT Gamma-Ray and Neutron Sonde, 150 degC | HGNS-H | 4865 |

Auxiliary Equipment :

| | | |
|---|---|---|
| HGNS Accelerometer, 150 degC | HACCZ-H | 6991 |
| AmBe Neutron Logging Source | NSR-F | 2554 |

Calibration Parameter :

| | |
|---|---|
| Water Temperature | |
| Housing Size | |
| JIG-BKG (Jig minus background reference) | 165 |

## HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured): 10:27:55 11-Sep-2014

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| AZ Vertical Measurement | ft/s2 | Before | 32.2 | 31.5 | 32.1 | 32.8 |

## HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM): 00:00:00 15-May-2007

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Accelerometer Manufacturer | | Master | | | QAT_160 | |
| Accelerometer Reference Temperature | degF | Master | | 30.2 | 77.0 | 122.0 |
| Accelerometer Coefficients - 0 | | Master | ----- | ----- | -4298.000 | ----- |
| Accelerometer Coefficients - 1 | | Master | ----- | ----- | 50.180 | ----- |
| Accelerometer Coefficients - 2 | | Master | ----- | ----- | -0.002 | ----- |
| Accelerometer Coefficients - 3 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 4 | | Master | ----- | ----- | 2.754 | ----- |
| Accelerometer Coefficients - 5 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 6 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 7 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 8 | | Master | ----- | ----- | 300.500 | ----- |
| Accelerometer Coefficients - 9 | | Master | ----- | ----- | 0.994 | ----- |

## HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM): 14:29:32 23-Jul-2014 Before (Measured): 15:54:36 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Near Zero Measurement | 1/s | Master | 0 | 5.0 | 27.5 | 40.0 |
| | | Before | 0 | 5.0 | 27.3 | 40.0 |
| | | Before-Master | ----- | -4.1 | -0.2 | 4.1 |
| Far Zero Measurement | 1/s | Master | 0 | 5.0 | 28.9 | 40.0 |
| | | Before | 0 | 5.0 | 28.4 | 40.0 |
| | | Before-Master | ----- | -4.3 | -0.5 | 4.3 |
| Near Plus Measurement | 1/s | Master | 6031.0 | 4700.0 | 5764.0 | 6900.0 |
| | | Before | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Far Plus Measurement | 1/s | Master | 2793.0 | 1900.0 | 2396.0 | 2900.0 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| Near Corrected Plus Measurement | 1/s | Master | | 4700.0 | 5720.0 | 6900.0 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| Far Corrected Plus Measurement | 1/s | Master | | 1900.0 | 2356.0 | 2900.0 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |

## HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured): 15:50:39 09-Sep-2014 Expired by 1 days

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit | |
|---|---|---|---|---|---|---|---|
| RGR Zero Measurement | gAPI | Before | 30.0 | 0 | 82.7 | 120.0 | |
| RGR Plus Measurement | gAPI | Before | 185.4 | 157.1 | 181.7 | 206.3 | |
| GR Calibration Gain | | Before | 0.89 | 0.80 | 0.91 | 1.05 | |

| | |
|---|---|
| Company: | Noble Energy Inc |
| Well: | Lilli Federal LG13-02 |
| Field: | Lilli |
| County: | Weld |
| State: | Colorado |

Schlumberger

# Platform Express
# Triple Combo Repeat Anaylsis
# PEX-AIT