



Interpretation Results

Company: EOG Resources, Inc.

Well: Critter Creek 02-03H

Field: Hereford Ranch

County: Weld, CO

API: 05-123-31047

Log Date: 17-Jun-2010

SO: B14I-00037

Analyst: Casey R. Chadwick

Job: B4MA-00259



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Well Bore Information:

Intermediate Casing: 7" 23# HCP-110 LTC @ 7582' MD (Shoe)
 Production Liner: 4 1/2" 11.6# HCP-110 LTC @ 6812' MD (TOL) to 11917' MD (TD) **(No Tbg)**
 KOP @ 6863' MD / 6860.53' TVD / 0.93 deg EOB @ 7680' MD / 7339.17' TVD / 89.32 deg
 Packers: 18 Swell Packers (see Wellbore Diagram) - **Bridge Plug @ 10334' MD**
 Perforations: 20 Stages / 101 Perforations (see Wellbore Diagram)
 Correlation: PerfoLog CCL dated 14-Apr-2010 (reported by Field Engineer)
 Logging Tool: Standard Flow Scanner Assembly (diagram below)

General Logging Procedure:

RU & RIH w/ Dummy prior to Flow Scanner (FSI). Find Tag Depth. Confirm production.

RU & RIH w/ Flow Scanner (FSI). Confirm "stable flow" and log Initial Down Pass @ 60 fpm from Correlation Depth (in the vertical) to just short of Tag Depth (in the horizontal). Actual Bottom Log Interval (BLI) at FE's discretion. Monitor and report surface rates.

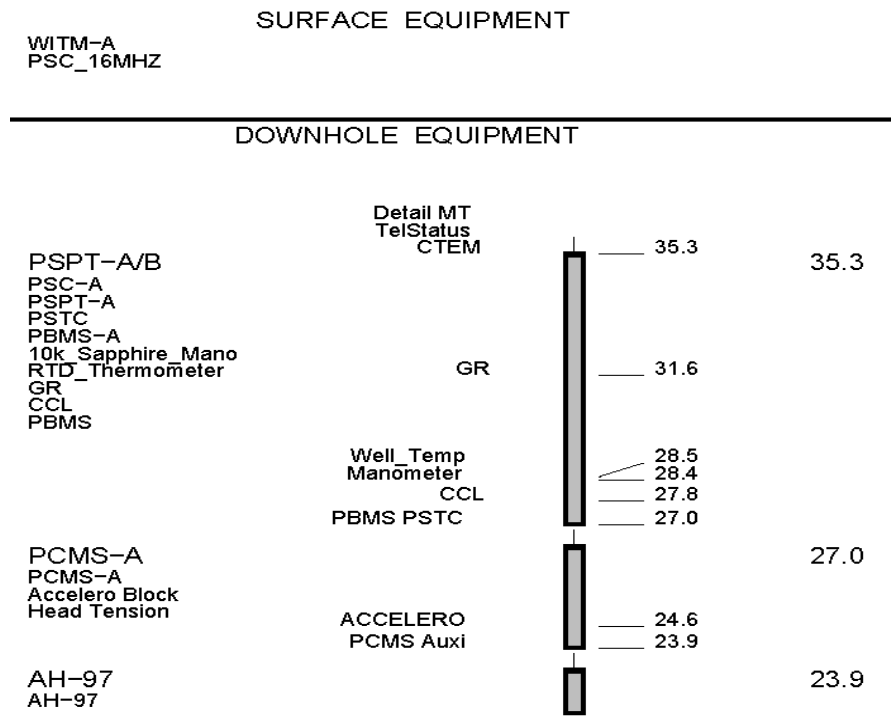
Record Station (2 min) @ BLI, then Log Up and Stop for Stations (2 min) between stages and/or major changes in trajectory with the final station at Top Log Interval (TLI). Actual TLI is at FE's discretion, based well conditions.

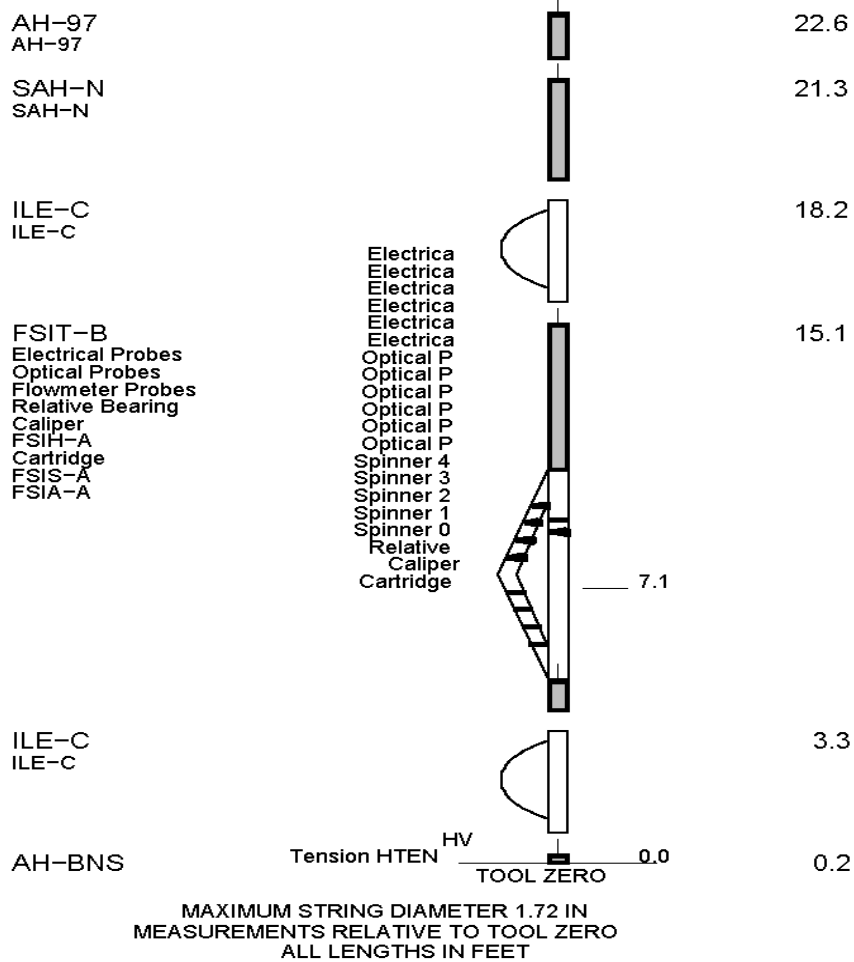
Record Main Logging Passes (3 Down / 3 Up) from TLI to BLU at the following recommended logging speeds: 80, 100 & 120 fpm. Pull final up pass back to correlation depth. Monitor and report surface rates during each pass.

Additional passes and/or stations at client, field engineer or interpreter request.

Confirm data quality with interpreter, then ROH.

Flow Scanner Tool Sketch:





Interpretation Results: (Stage)

% Oil	% Water	Perforations	Q oil Surf Cond. (BOPD)	Q water Surf Cond. (BWPD)	Interp Remark
trace	--	Stg 20-19-18 7612 - 8172	trace	--	
8.3%	--	Stg 17 8230 - 8384	35	--	
4.8%	--	Stg 16 8442 - 8598	20	--	
3.6%	--	Stg 15-14-13-12 8656 - 9457	15	--	
3.6%	--	Stg 11 9511 - 9673	15	--	
79.8%	--	Stg 10-9-8 9727 - 10317	335	--	
100.0%	--	Total	420	--	

Interpretation Discussion:

Completions with swell packers and multiple perforations (within each stage) create a unique scenario for production logging. Experience tells us that fluid movement behind pipe is very probable within each stage, or in other words, between swell packers. In turn, production has to be grouped by stage with the location of the swell packers providing the only confident area for "stable production intervals" which are critical for a quantitative production log interpretation.

Lower flow rates (oil) add to the interpretation challenge especially when deviation is below 90 deg and oil production is forced to stream on the high side of the wellbore. In

this case (<90 deg), the amount of oil production governs the percent area that it occupies, (also know as oil holdup). For a quantitative FSI interpretation, this oil holdup must result in enough "height" for the oil to dominate the top most spinner. This is not the case in this particular wellbore, and confident oil production can only be quantified in area where deviation is above 90 deg, and oil dominates the wellbore.

Putting the two together, "stable production intervals" are chosen at the swell packers, and in areas where oil dominates the wellbore. As a result, calculated production rates are confident but have to be presented by stage and grouped in some areas of the wellbore.

Interpretation Remarks:

This interpretation is based on Flow Scanner dated recorded on 17-Jun-2010.

Correlation by Schlumberger Field Engineer (FE) to PerfoLog CCL dated 14-Apr-2010 and reported PBR @ 6804' MD. Swell packers are clearly observed on the FSI CCL.

Bottom Log Interval (BLI) is stopped short @ 10120' MD on the main logging passes to ensure a safe distance from the BP reported @ 10334' MD and the clean out depth reported @ 10300' MD. After the main logging passes were successfully recorded, a final pass was made in order to extend BLI to 11250' MD. Effective BLI for Well View Images is 11245' MD. Effective BLI for confident rate calculation is 9720' MD. Please see the interpretation discussion (above).

Top Log Interval (TLI) is consistent @ 7500' MD on main logging passes.

Caliper (CALI_FSI) is relatively smooth except for subtle compressions for 7690' MD to 7730' MD. A nominal ID of 4.00" is used for interpretation calculations.

Downhole pressure (WPRE) is relatively stable during logging operations. Down three (D3) and down four (D4) have the most consistent pressures and are used preferentially.

Downhole temperature (WTEP) trends are repeatable, but not overly anomalous. Caution is advised when using temperature in a perforation-packer completion as movement behind pipe is expected within each stage.

All DEFT (electrical) probes (DFHF0-DFHF5) are of high quality and the basis of the Well View Image which relates water and oil holdup to wellbore trajectory (deviation). The image shown is from down pass four (D4), and down pass five (D5) near the toe.

All GHOST (optical) probes (GHHF0-GHHF5) are of high quality and show no indication of downhole gas in the lateral section. During RIH and ROH, bubble count from the GHOST probes are used to identify the "bubble point". Please see snapshot below.

All micro-spinners (SPIF0-SPIF4) are spinning nicely except for a few regions where the lower most spinner (SPIF0) goes to zero, possibly the result of minor debris. All spinners are calibrated downhole and used in phase velocity calculations.

Oil rates are calculated downhole on a "level by level" basis using proprietary software (FSI-IP) and presented in downhole barrels on the snapshots and log presentations below. Calculated rate are converted to surface rates (standard conditions) and presented in the above table.

Overall, calculated oil rates are confident and compare nicely to reported surface rates during logging operations. As noted in the interpretation discussion above, oil rates are presented by stage and must be grouped as downhole condition require. Water rates are below a level where quantification is confident.

"Trace" denotes a qualitative indication of minor production.

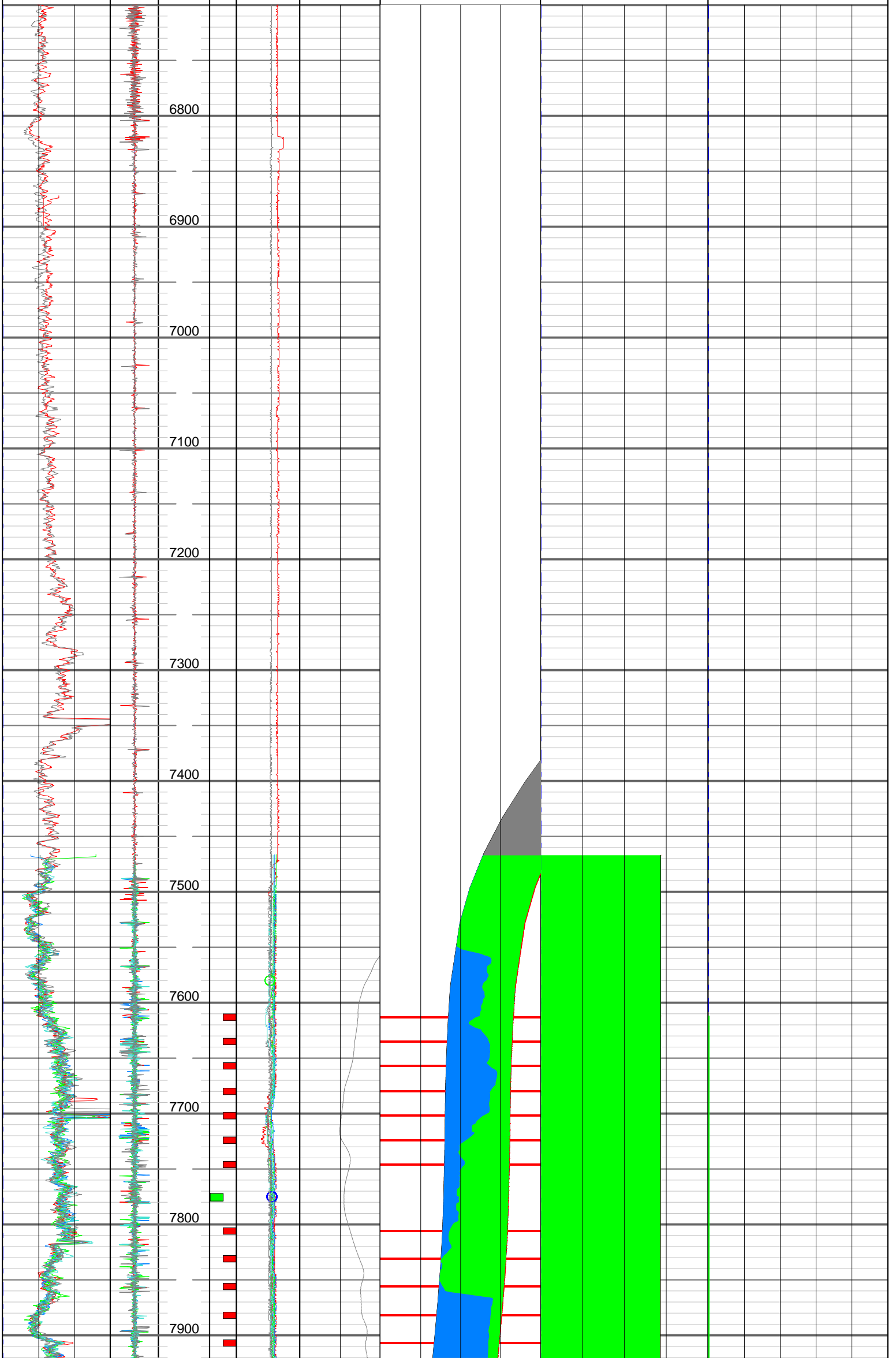
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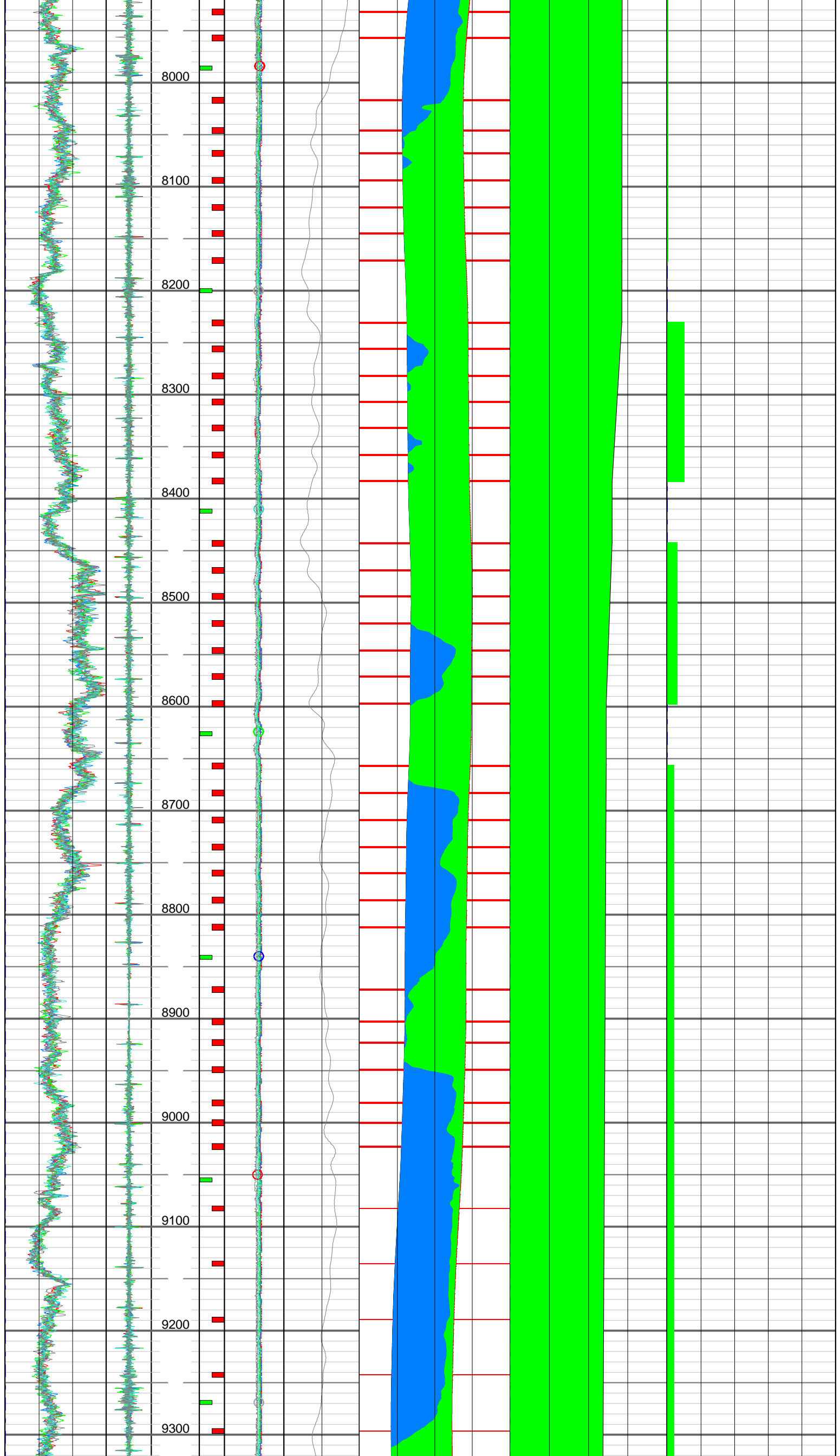


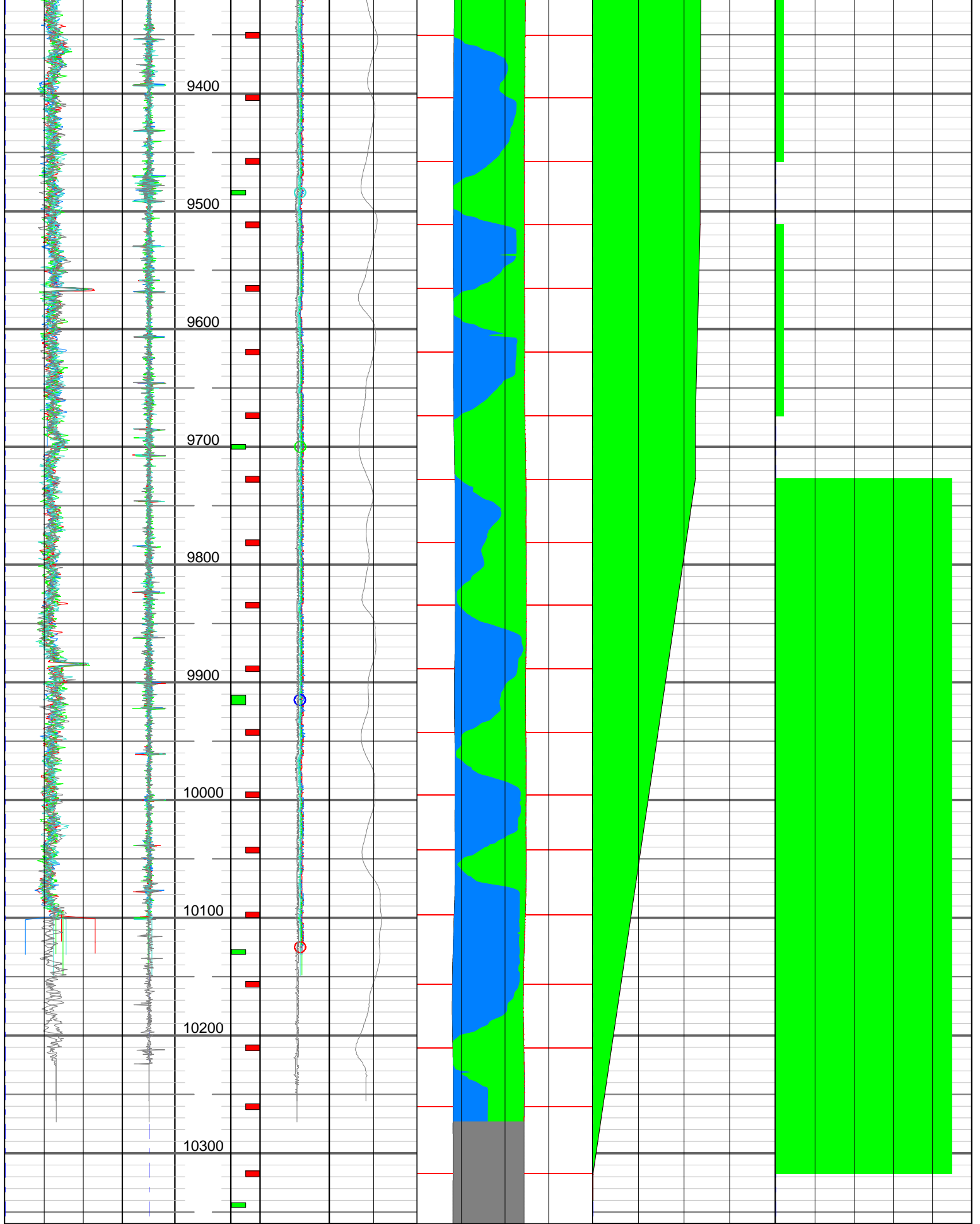
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Field: Hereford Ranch
Well: Critter Creek 02-03H

Test: Flow Scanner
Date: 17-Jun-2010
Survey: Flowing

GR	CCLC	Depth	Z	CALI_FSI	Deviation	Well View	QZT	QZI
0	-8	1/1200		3. in 4.5	95 ° 85	(ft -> Top)	B/D	B/D
GAPI	8				DEVI S1,U5	7400	800	500
150						7300	0	





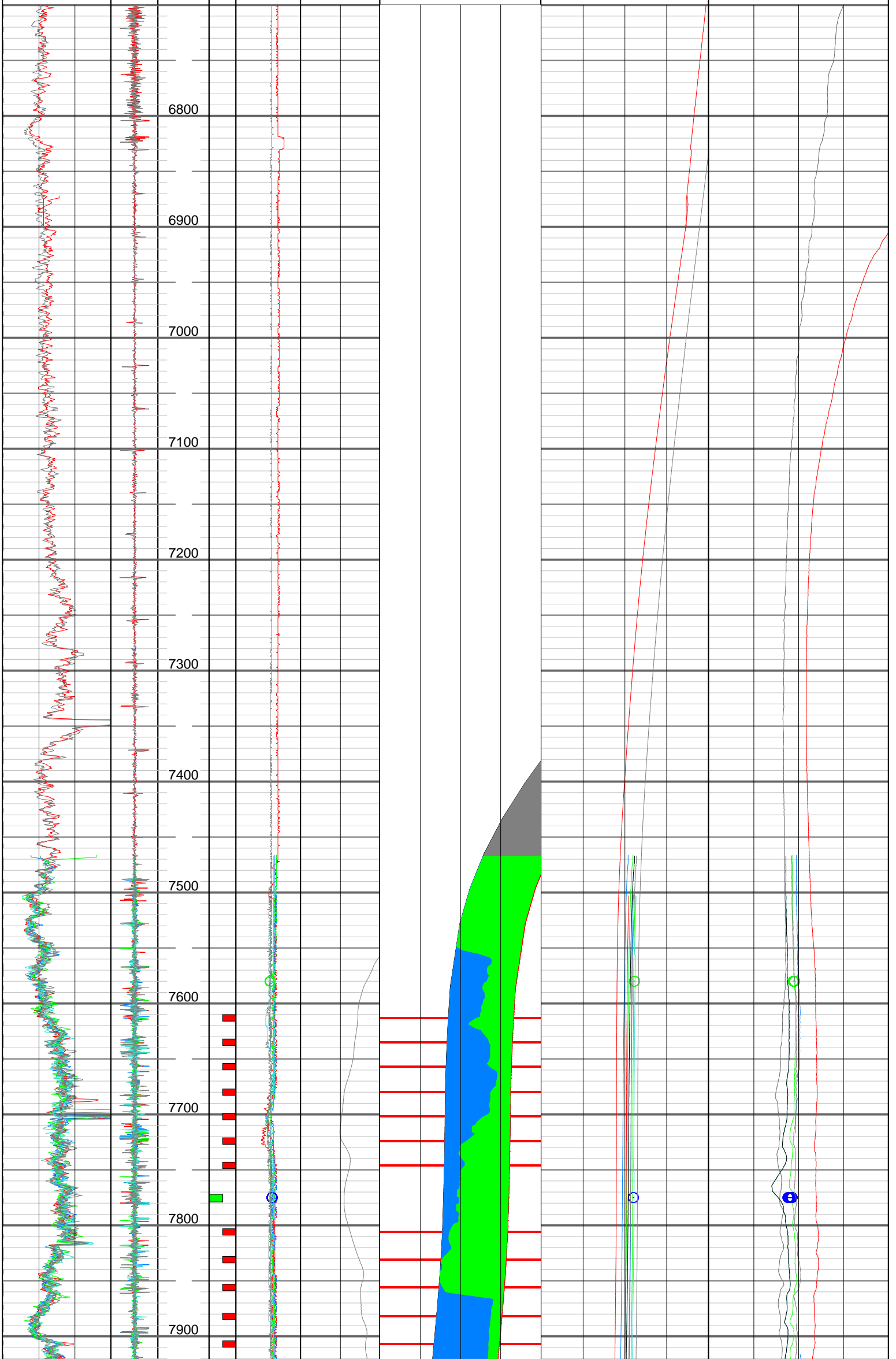


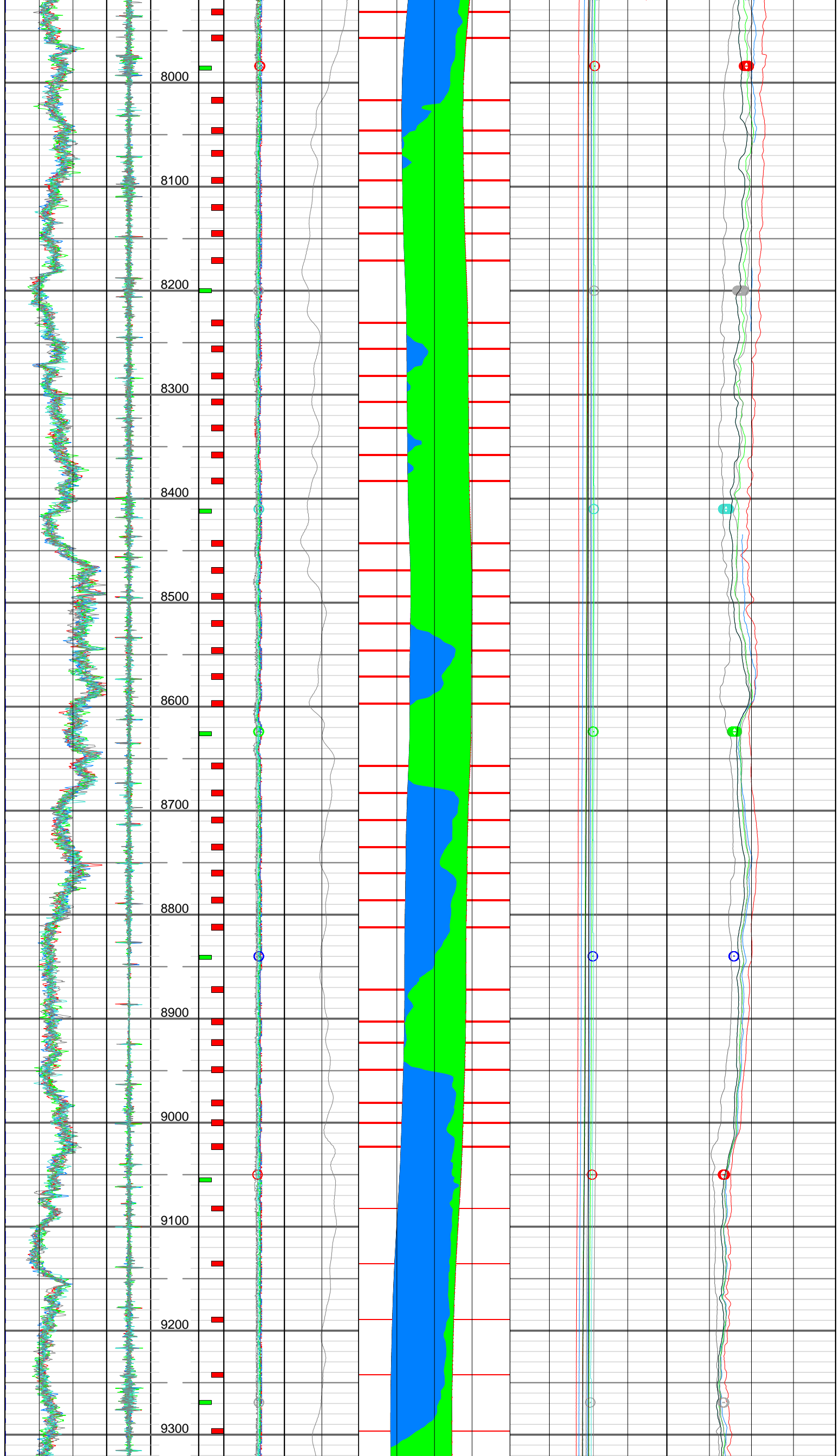


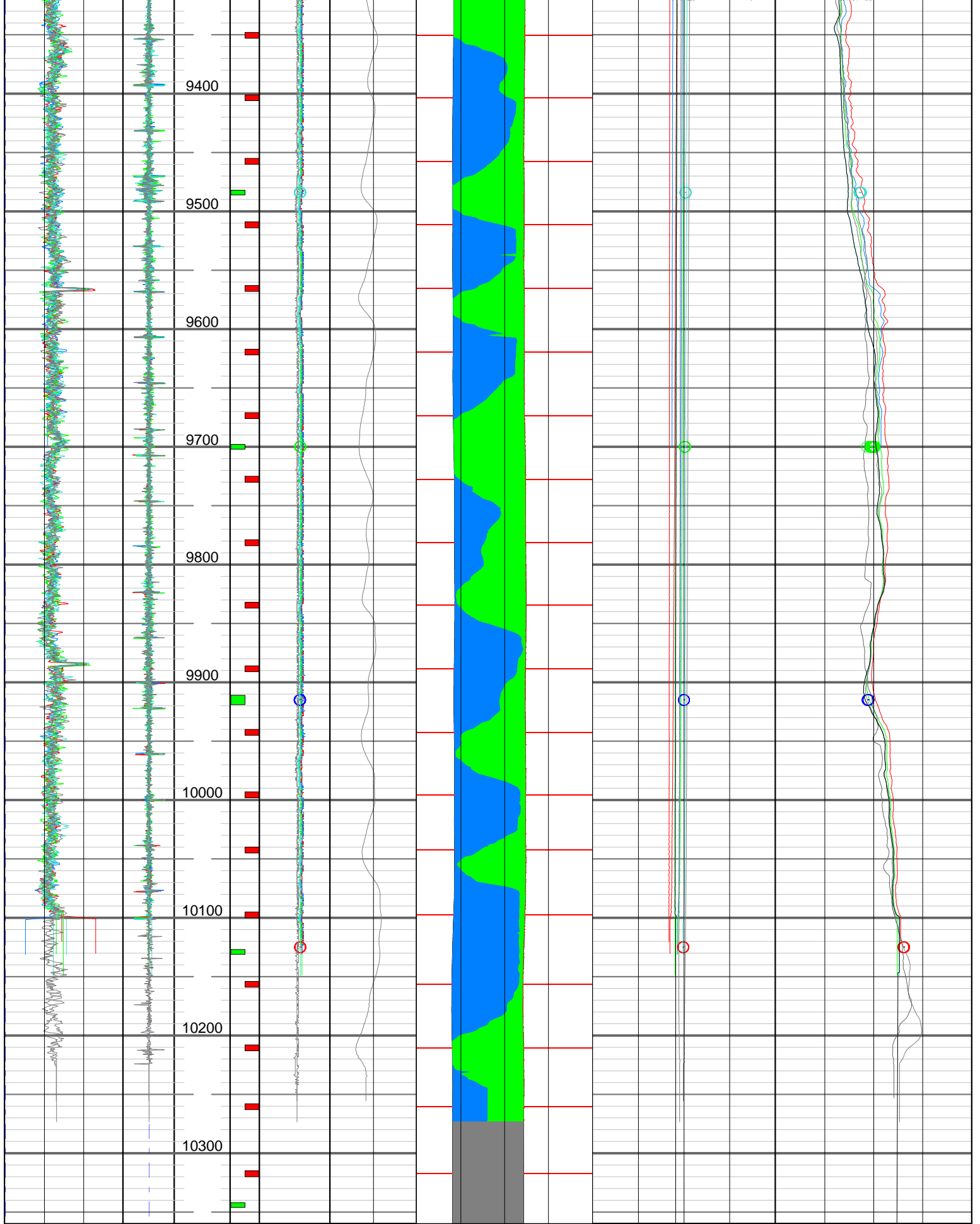
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0	GAPI 150	-8 8	1/1200	3. in 4.5	95 ° 85	(ft -> Top)	psia	°F
					DEVI S1,U5	7400 7300	3400 3000	221 217



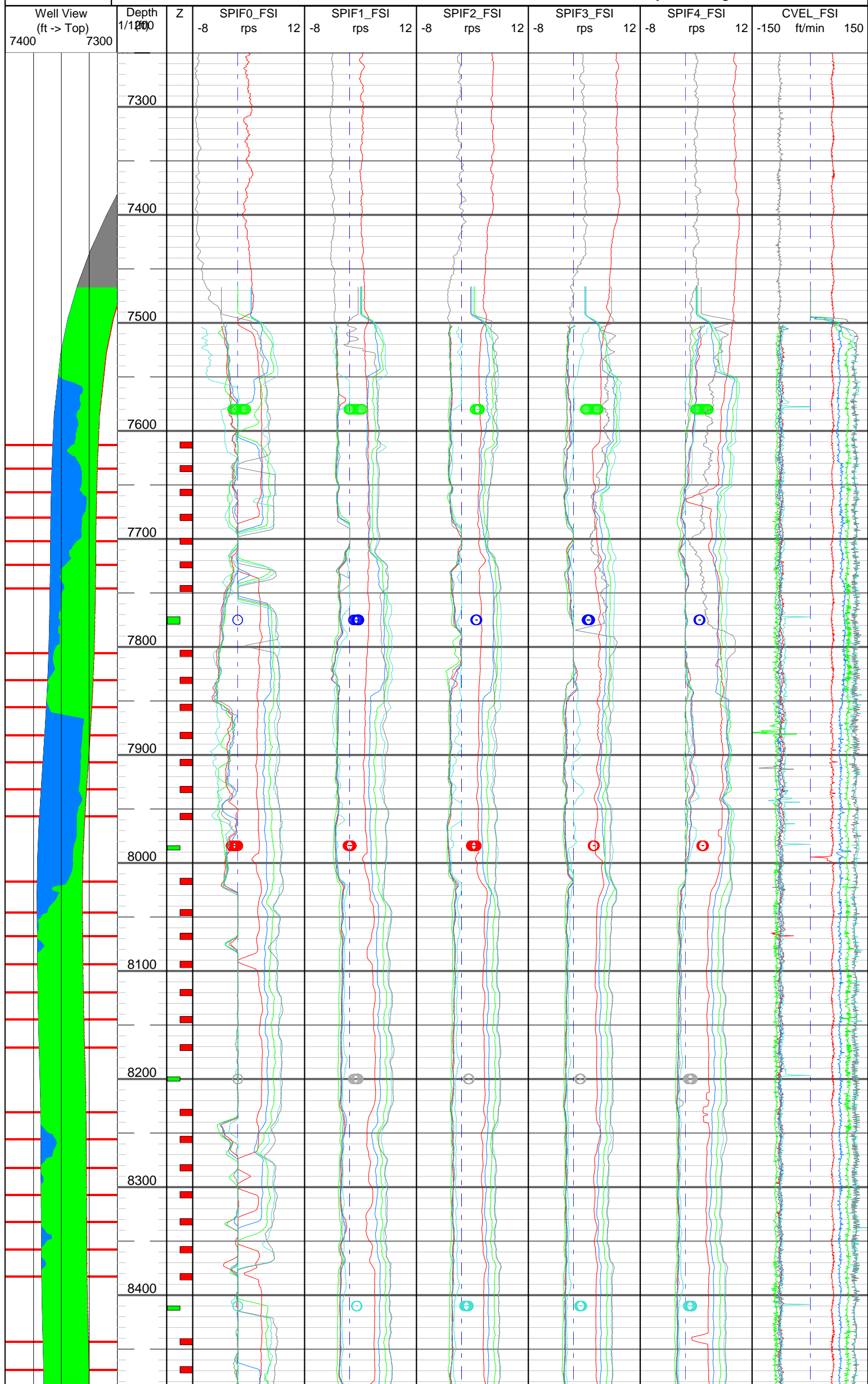


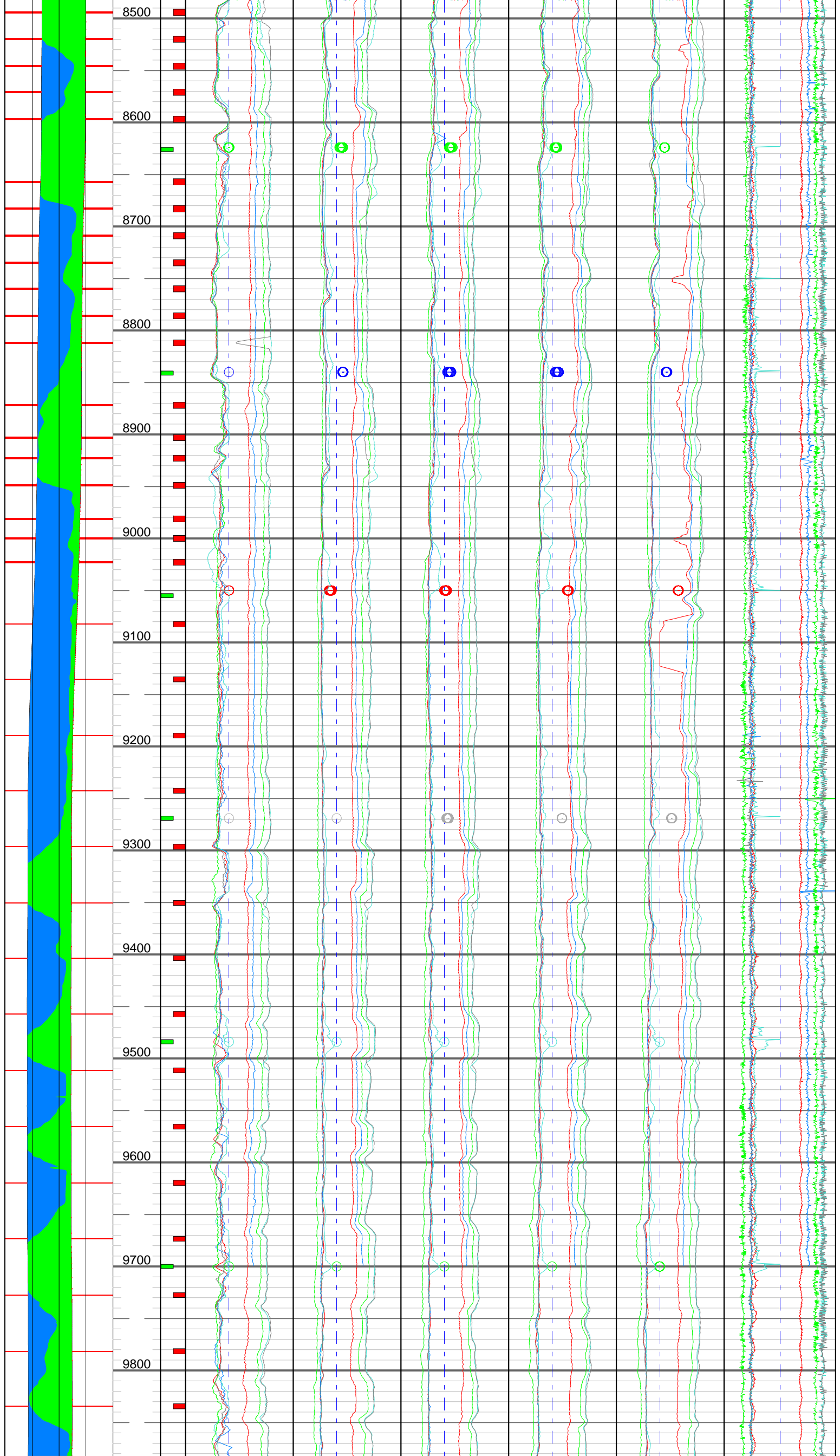


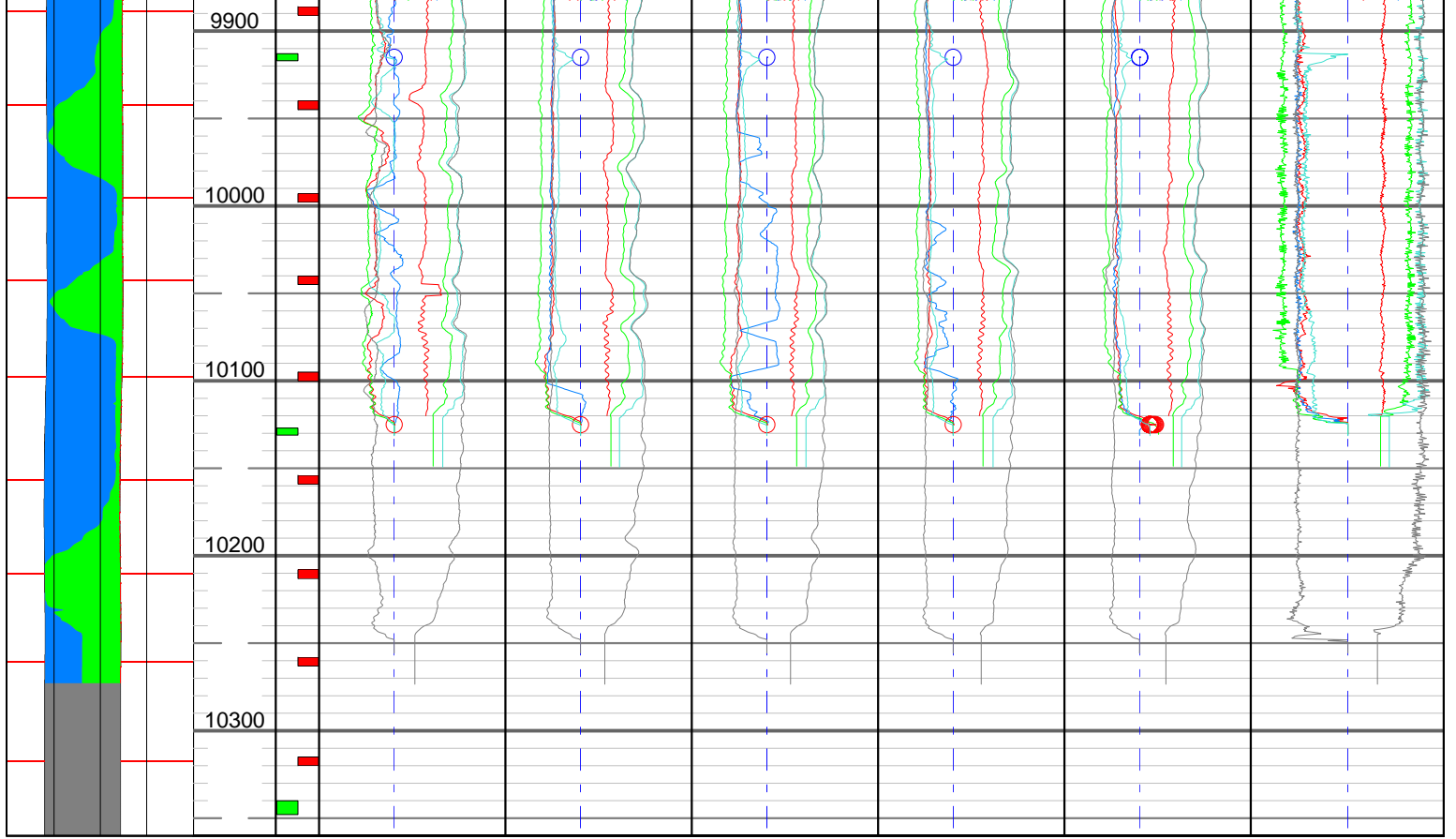


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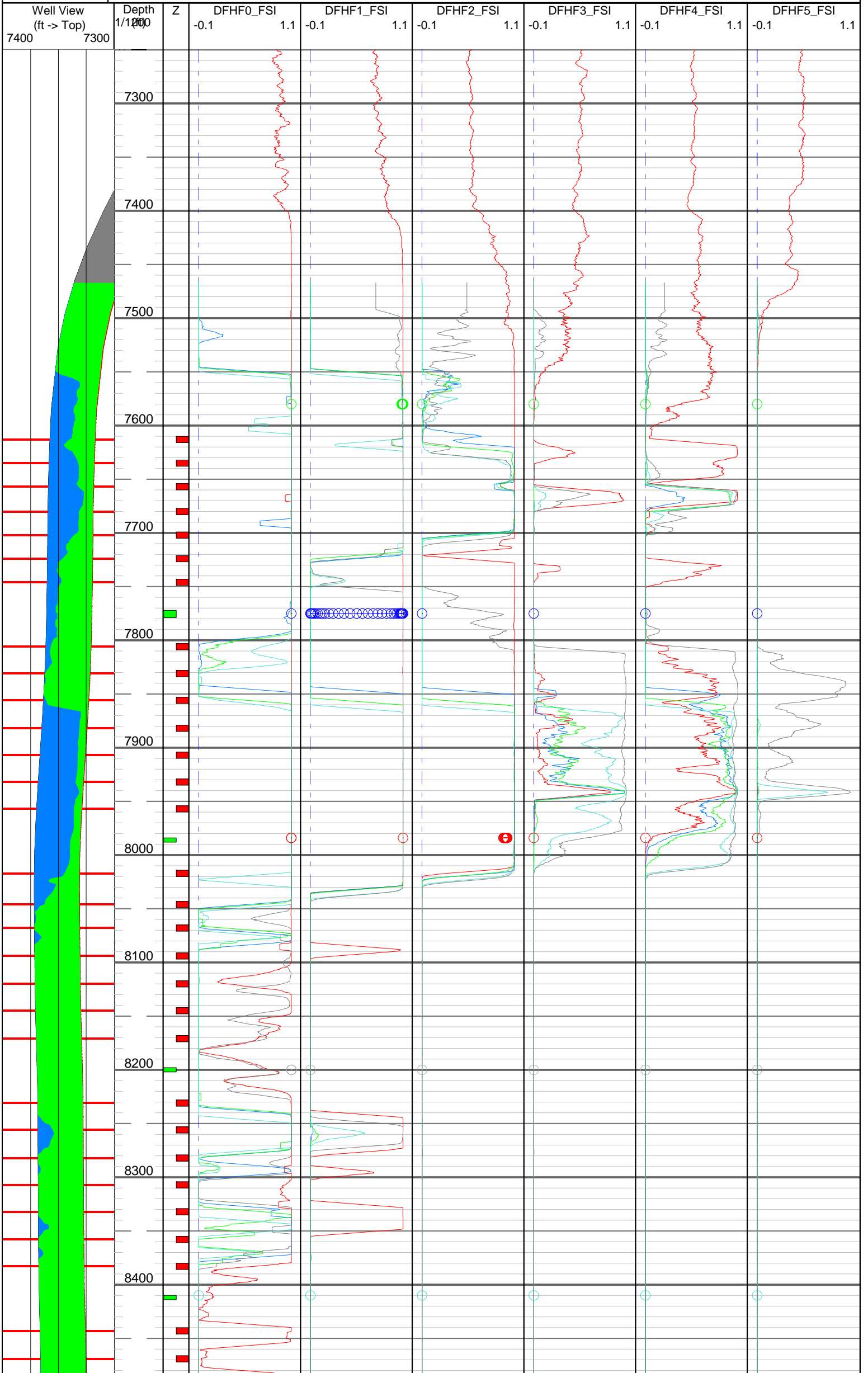


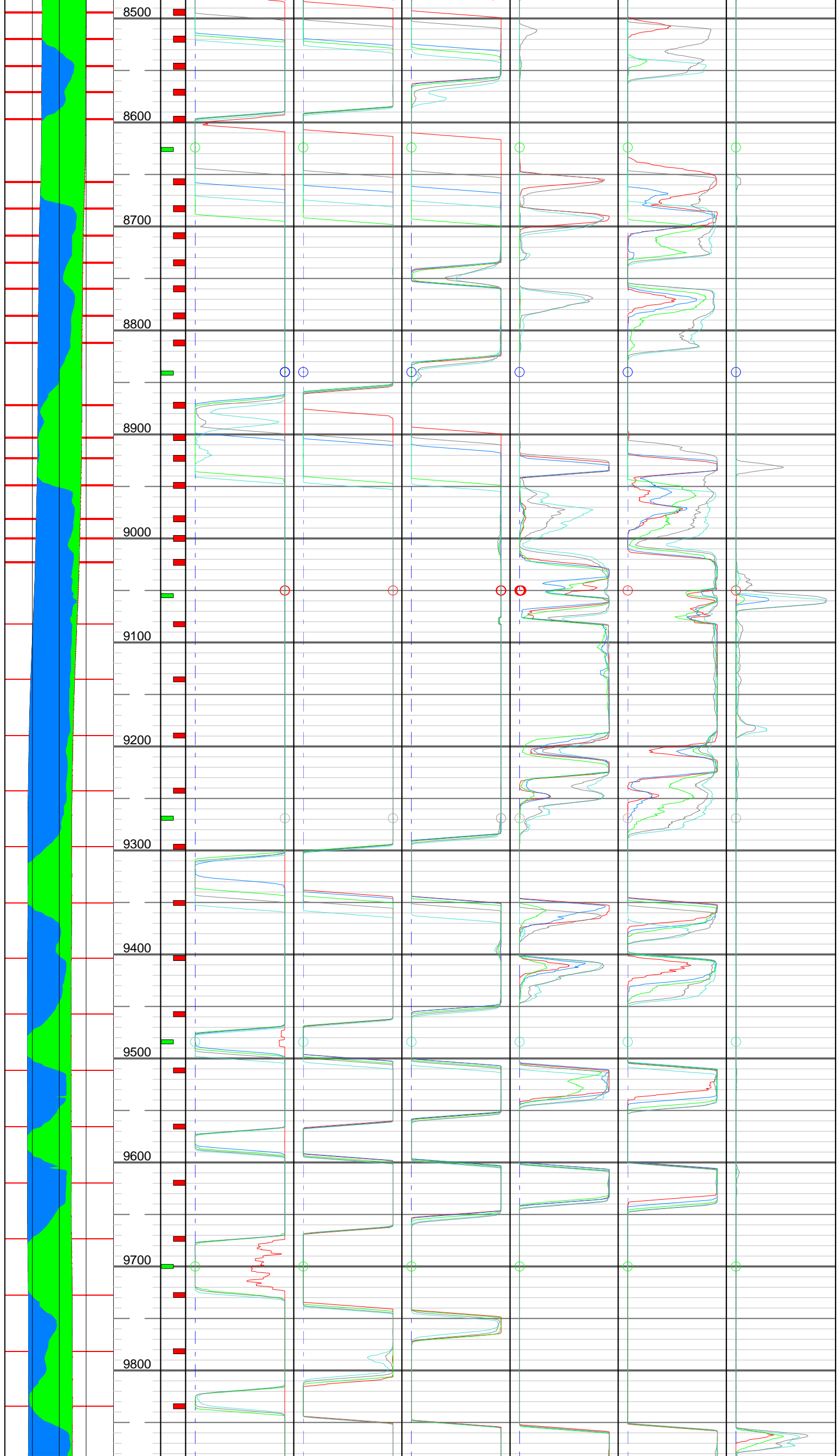


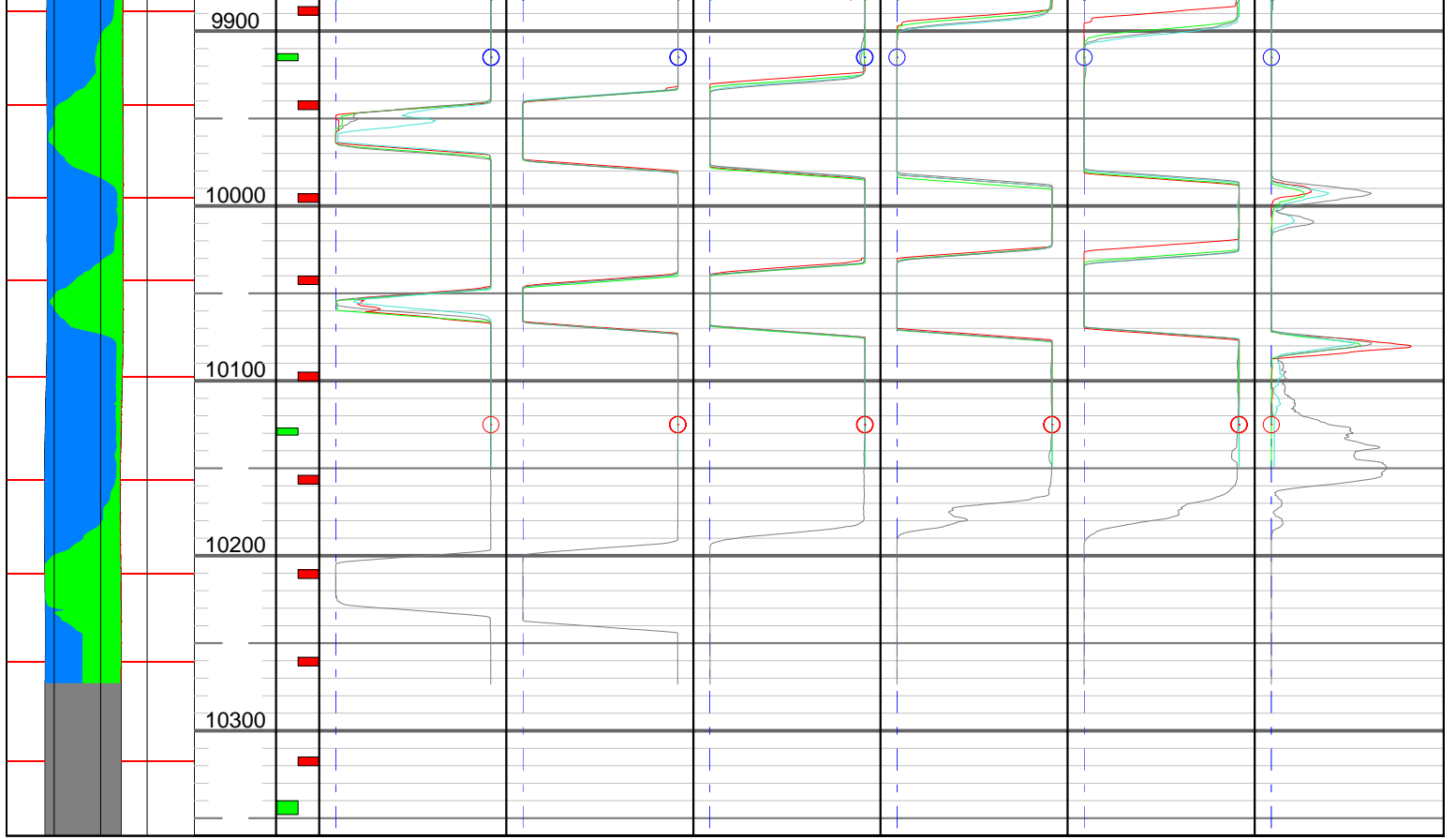


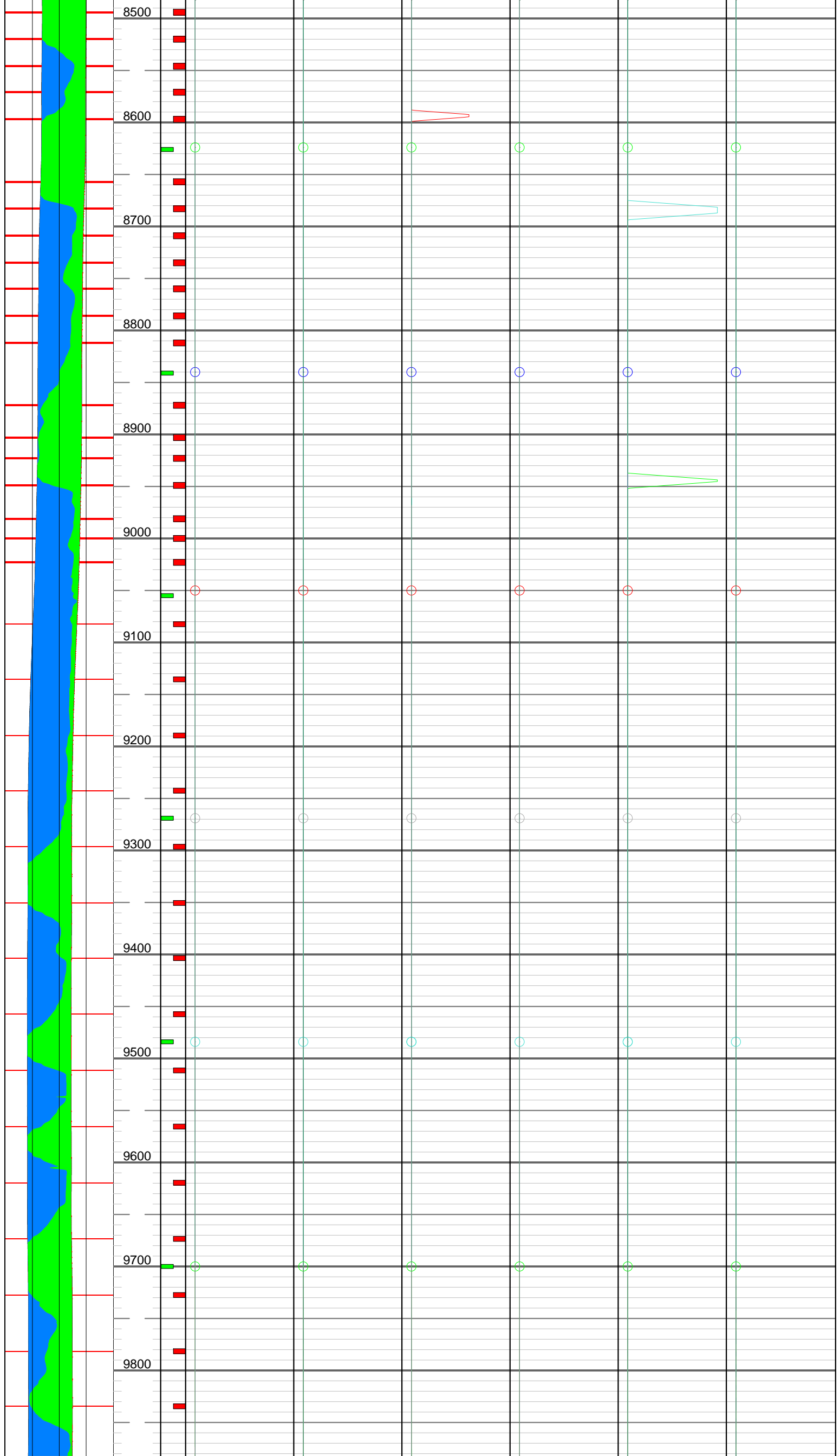
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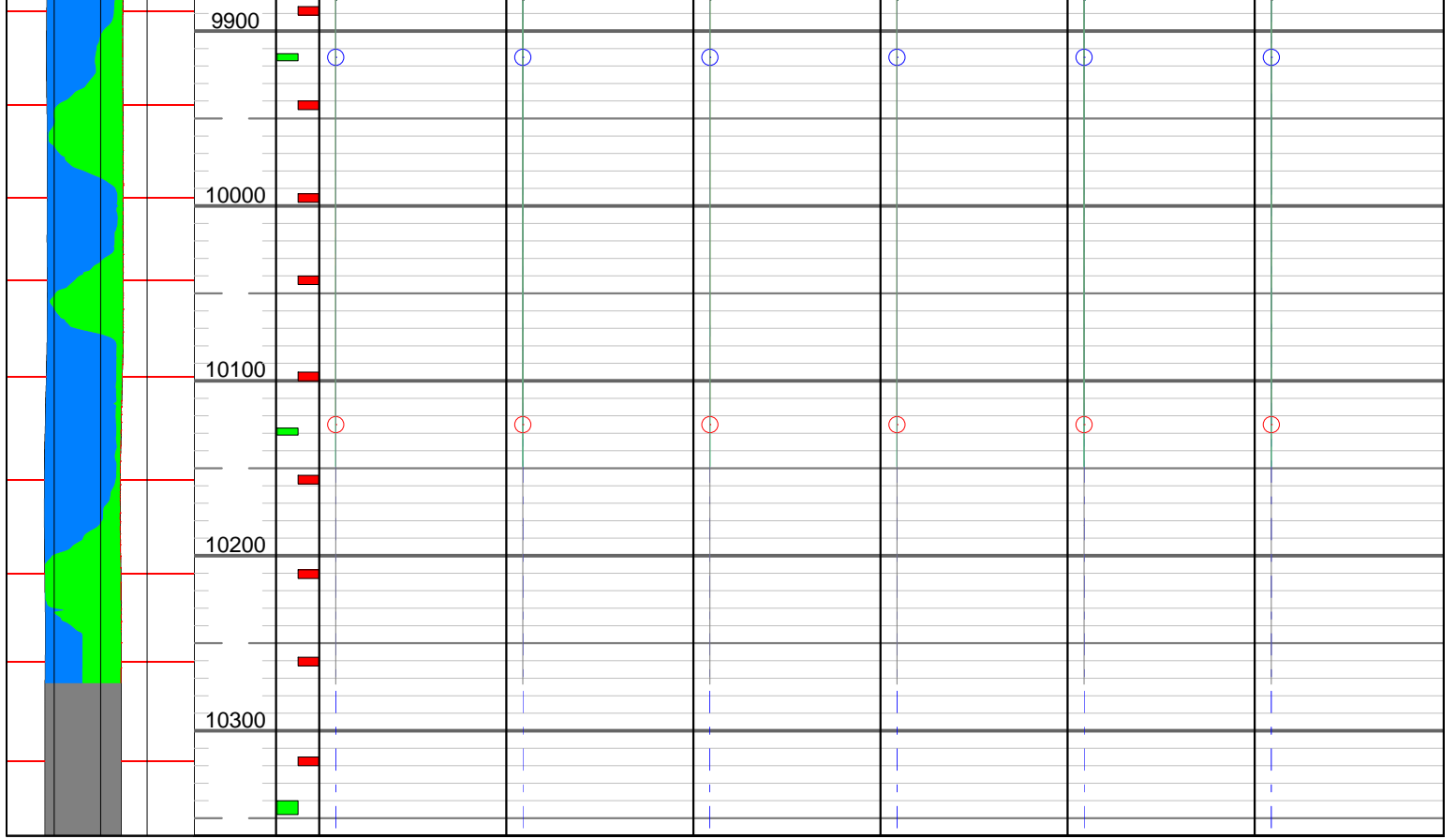
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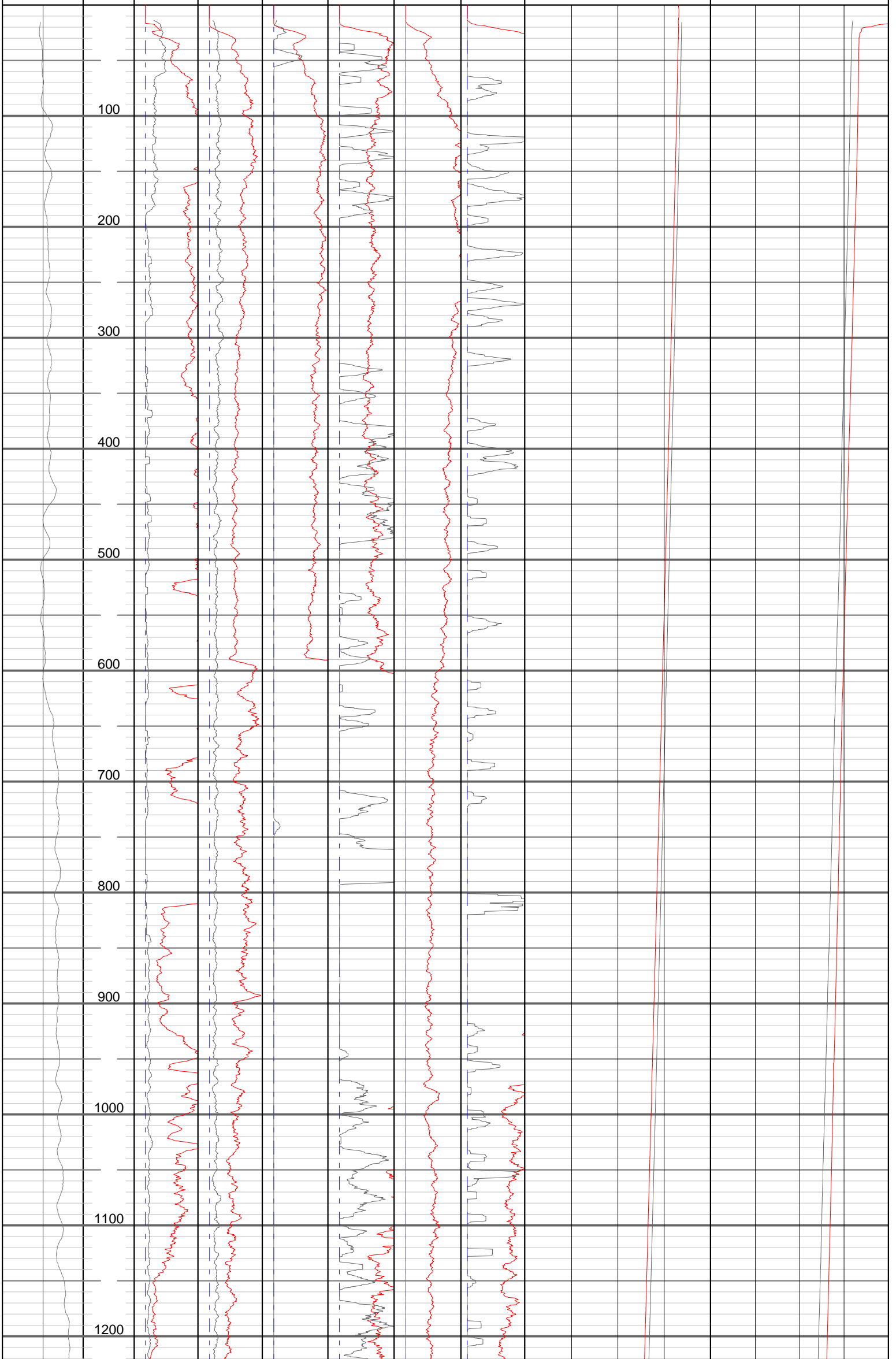


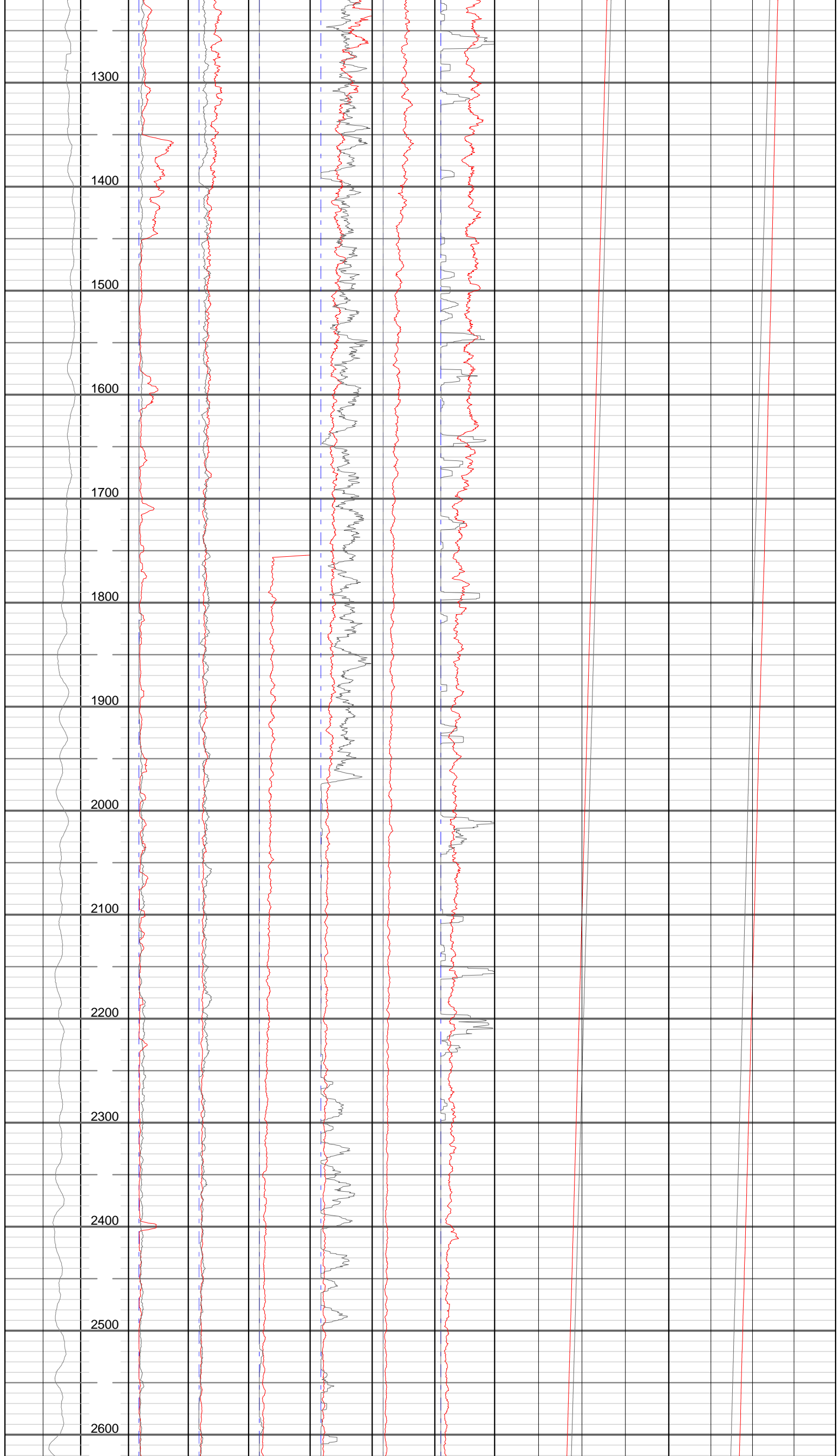


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Deviation 2 ° 0	Depth 1/1200	GHBF0_FS -20 Hz100	GHBF1_FS -20 Hz100	GHBF2_FS -20 Hz100	GHBF3_FS ...	GHBF4_FS -20 Hz100	GHBF5_FS -10 Hz100	2500	WPRE psia	500	200	WTEP °F	80
DEVI S1,U5													



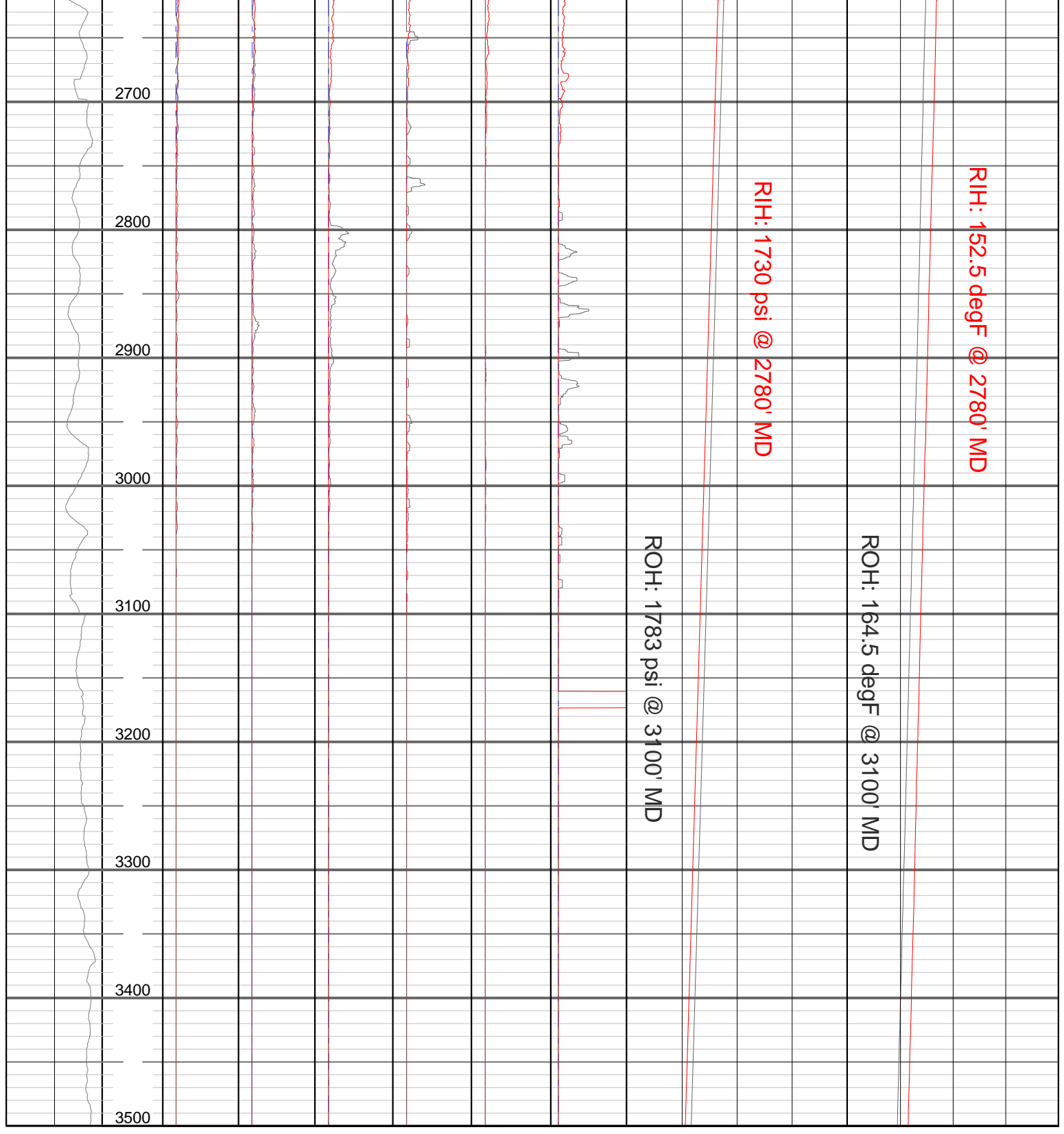


RIH: 152.5 degF @ 2780' MD

RIH: 1730 psi @ 2780' MD

ROH: 164.5 degF @ 3100' MD

ROH: 1783 psi @ 3100' MD



2700
2800
2900
3000
3100
3200
3300
3400
3500

PSP & FSI Interpretation Mnemonics

CALI_FSI	Flow Scanner Caliper
CCLC/CCLD	Casing Collar Locator
CVEL/SCVL	Cable Velocity
D1RB	DEFT Relative Bearing Probe 1
DFBFx_FSI (0-5)	FSI Vertical DEFT Bubble Count Array (0-Bot, 5-Top)
DFBM	PSP Mean DEFT Bubble Count
DFBx (1-4)	PSP Individual Probe DEFT Bubble Count
DFHFx_FSI (0-5)	FSI Vertical DEFT Water Holdup Array (0-Bot, 5-Top)
DFHM	PSP Mean DEFT Water Holdup
DFHx (1-4)	PSP Individual Probe DEFT Water Holdup
GHBfx_FSI (0-5)	FSI Vertical GHOST Bubble Count Array (0-Bot, 5-Top)
GHBM2	PSP Mean GHOST Bubble Count
GHBx (5-8)	PSP Individual Probe GHOST Bubble Count
GHHfx_FSI (0-5)	FSI Vertical GHOST Gas Holdup Array (0-Bot,5-Top)
GHHM2	PSP Mean GHOST Gas Holdup
GHHx (5-8)	PSP Individual Probe GHOST Gas Holdup
GR	Gamma Ray
HTEN	Head Tension/Compression
MWFD	Pressure Derived Density
PFC1	PSP Caliper 1 (X)
PFC2	PSP Caliper 2 (Y)
RB_FSI	FSI Relative Bearing
SPIN/SPI1	Full Bore Spinner / Inline Spinner
SPIFx_FSI (0-4)	FSI Vertical Micro-Spinner Array (0-Bot, 4-Top)
WFDE	Gradio Well Fluid Density
WPRE	Well Pressure
WTEP	Well Temperature

Color Coding is typically the same for all the curves that belong to the same pass
 RED – Pass One / Dk Blue – Pass Two / Green – Pass Three / Lt Blue – Pass Four

VAFV/VAPP	Apparent fluid velocity (gas, water & oil)
QGI, QOI, QWI	Interval Gas, Oil, Water Rates (down hole unless stated otherwise)
QGT, QOT, QWT	Cumulative Gas, Oil, Water Rates (down hole unless stated otherwise)

Tool Mnemonics List

DEFT	Digital Fluid Entry Tool (Resistivity Probes)
GHOST	Gas Holdup Optical Sensor Tool (Optical Probes)
FSI	Flow Scanner Imager
PSP	Production Services Platform
PBMS	Production Basic Measurement Sonde (Temperature, Pressure, CCL, GR)
PCMS	Production Compression Measurement Sonde
PGMC	Production GradioManometer Carrier (Density)
PFCs	Production Flowmeter Caliper Sonde (Holdup, Caliper, Full Bore Spinner)
PILS	Production In-Line Spinner