



COGCC Document # 2056211
Rulison Field #75400

**Salinity Analysis of 8 Wells in Sections 21, 27,
and 28 Township 6 South, Range 94 West, 6th
P.M. Rulison Field, Piceance Basin, Colorado**

**Prepared for
COGCC**

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Tabulations

All wells:

R_w from SP Analysis (including Archie analysis where available)

Introduction

We were contacted in February 2013 by Dave Andrews of COGCC to assist in estimating water salinities in order to map the vertical distribution of fresh water in selected wells located in Sections 21, 27, and 28, Township 6 South, Range 94 West, 6th P.M. Rulison Field, Piceance Basin, Colorado. COGCC's goal is to evaluate suitable surface casing setting depths to protect useable fresh water in the Wasatch and Upper Mesa Verde Group. For the purpose of this study, "fresh water" is defined as having a salinity of less than 10,000 ppm.

It was decided that a study of no more than ten wells would be initiated to determine if comparisons between Spontaneous Potential (SP) analysis and traditional Archie analysis could be correlated to help in mapping the fresh water depths. A purchase order for this project was issued in October, 2013, when digitizing of eight wells commenced. The SP analysis was performed on all eight, but only four of these wells have porosity logs and are suitable for Archie analysis.

This report is a documentation of the results of this study.

Summary

For eight wells selected by COGCC, Digital Formation identified individual sand intervals using gamma ray (GR) logs down to about 200 feet below the top of the Mesa Verde:

05045069160000 Vassar-Heath RMV 24-27

05045069170000 Vassar-Heath RMV 21-28

05045069570000 Clough RMV 29-27

05045069580000 Clough RMV 27-28

05045069590000 Vassar-Heath RMV 34-28

05045069600000 Savage RMV 35-28

05045069760000 Clough RMV 26-21

05045069950000 Clough RMV 54-28

Calculations of salinity from the SP log were made on each of these intervals.

For the four wells with porosity logs, Archie calculations for total porosity (from a density and neutron cross plot) and saturation from formation resistivity are calculated:

05045069170000 Vassar-Heath RMV 21-28

05045069570000 Clough RMV 29-27

05045069600000 Savage RMV 35-28

05045069950000 Clough RMV 54-28

Interactive Pickett Plots were used to choose water resistivity (R_w) for each interval. Archie cementation and saturation values of $m = n = 1.8$ were used for all wells. The values were chosen based on interpretation of the sands and Digital Formation's professional experience in the Piceance Basin.

Using the calculated formation temperature – based on an average annual surface temperature of 50°F, and the log header bottom hole temperature (BHT) – an equivalent salinity is calculated from the R_w value. For many of the sands, there is a scatter of data on the Pickett Plots suggesting either:

1. Small amounts of residual hydrocarbons
2. Variable water salinity – thought to be unlikely

A critical issue is the choice of m and n , since the interpretations are a visual choice from a log-log plot, and small changes in m and n can have significant input on the choice of R_w . A sensitivity analysis was performed on one well to evaluate uncertainty related to these variables:

05045069570000 Clough RMV 29-27

Overall, the data suggests wide variation in R_w , with no consistent depth trend. Water of less than 10,000 ppm is calculated within the Mesa Verde, using $m = n = 1.8$. There is little correlation between the salinities from Archie analysis and from the SP log.

Issues

The following issues could explain why each of the SP and Archie analyses may be suspect.

SP

1. Streaming potential – if there was movement of mud filtrate into the formation as the well was logged, the SP deflection is enhanced, and cannot be used to calculate R_w , because R_w will be unrealistically low, and the resulting salinity would be unrealistically high.
2. Potentially unreliable mud filtrate resistivity (R_{mf}) from the well headers – if the logging company is not careful with the collection of mud filtrate samples, unrealistic values of R_{mf} will result. After the logging job has been completed,

there is no way to check on R_{mf} recovery. Unfortunately, the impact of this kind of error is unpredictable, as this can either increase or decrease the calculated salinities.

3. Potentially unreliable SP measurements – if the SP surface grounding electrodes did not encounter water, all SP deflections will be reduced and R_w calculations will be unrealistically high, and the resulting salinity would be unrealistically low. This is of particular concern in dry climates and low ground water levels.

Archie

1. Log/log Pickett plot – small spatial change can have large effects on the interpreted R_w
2. Potential uncertainty of Archie m and n values used – low values of m will mean higher interpreted R_w , and thus lower salinity calculations, and vice versa
3. For any one sand, the lowest R_w (highest salinity) was chosen – but many sands show residual hydrocarbons or highly variable water salinity

General Considerations

1. The analyses would infer the Archie approach is more reliable than the SP, since the calculated R_w is coming from interpretation of the log data, and is not reliant on the accuracy of the well header information.
2. May need to consider identifying the lowest level of salinity (< 10,000 ppm) regardless of the source. This approach will highlight the deepest level, in any one well where the possibility of fresh water could exist.
3. Generally very poor correlation between salinity from SP and salinity from Archie analysis
4. Issue of equivalent water resistivity (R_{weq}) -> R_w conversion – these corrections may not be reliable

Data Preparation

Log ASCII Standard (LAS) files were loaded into Digital Formation's *LESA* petrophysical software. Curves from logging service companies were renamed for consistency:

Log	Mnemonic	Description
Density	DF_RHOB	Copy of RhoB, or other service company mnemonic
Neutron	DF_NPHI_L	Copy of NPhi, or other service company mnemonic
Acoustic compressional	DF_DT	Copy of DT, or other service company mnemonic
Acoustic shear	DF_DTS	Copy of DTS, or other service company mnemonic
Caliper	DF_CALI	Copy of CALI, or other service company mnemonic
Deep Resistivity	DF_DEEP	Copy of resistivity curve identified as "deep"
Medium Resistivity	DF_MEDIUM	Copy of resistivity curve identified as medium or intermediate
Shallow Resistivity	DF_SHALLOW	Copy of resistivity curve identified as shallow
Gamma Ray	DF_GR	Copy of GR or other service company mnemonic
SP	DF_SP	Copy of SP or other service company mnemonic

Programmatic despiking of the porosity logs was performed, to eliminate obvious levels of invalid readings due to bad hole. Whenever the hole is out of gauge, the porosity logs tend to read anomalously high values. The despiking routines identify and eliminate these levels. De-spiked Curves were named adding "DS" – for example:

DF_RHOB_DS

From the data shown on the log header, environmental factors were corrected on the density and GR log curves for hole size, and application of the appropriate tornado chart was used to determine deep resistivity, total resistivity (Rt), and flushed zone resistivity (Rxo). If no match was available, it was assumed that Rt = deep, and Rxo = shallow.

Petrophysical zones equivalent to the operator-reported formation tops were correlated to major lithologic units. A depth plot of the caliper log was reviewed, to recognize appropriate hole size for each petrophysical zone.

Basic Clean Formation Analysis

Shale Volume

Shale volume (V_{SH}) was determined from the GR log, using the standard non-linear “Stieber” equation:

$$GRI = \frac{GR - GR_{clean}}{GR_{shale} - GR_{clean}}$$

$$V_{SH} = \frac{0.5 \times GRI}{1.5 - GRI}$$

GR_{clean} and GR_{shale} were chosen using interactive graphics, on a petrophysical zone basis.

Shale Responses

Shale responses of porosity logs were determined, on a zone-by-zone basis, using interactive porosity cross plots.

Porosity

Total porosity (Phi_X) was determined preferably using the density/neutron cross plot porosity. However, if that combination is not available, the LESA software offers a series of choices of cross plots or individual porosity log calculations.

Effective porosity (Phi_E) was determined using the equation:

$$Phi_E = Phi_X - (V_{SH} \times Phi_{shale})$$

Water Saturation

The Archie parameters, water resistivity (R_W) and cementation exponent (m), were determined from porosity/resistivity (Pickett) cross plots. Saturation exponent (n) was assumed equal to m , consistent with industry practice in the Piceance Basin.

Water saturation (S_W) was calculated using the Archie Model:

$$S_W^n = \sqrt{\frac{a \times R_W}{\phi^m \times R_t}}$$

Permeability

Permeability was determined using a modified Timur equation:

$$k = \frac{62500 \times Phi_E^6}{S_{Wi}^2}$$

S_{Wi} is the lower of log-calculated S_W or theoretical S_{Wi} from a Buckles equation:

$$\Phi_{iE} \times S_{Wi} = \text{Constant}$$

A constant of 0.05 was used. This value is suitable for most reservoirs in the Piceance Basin.

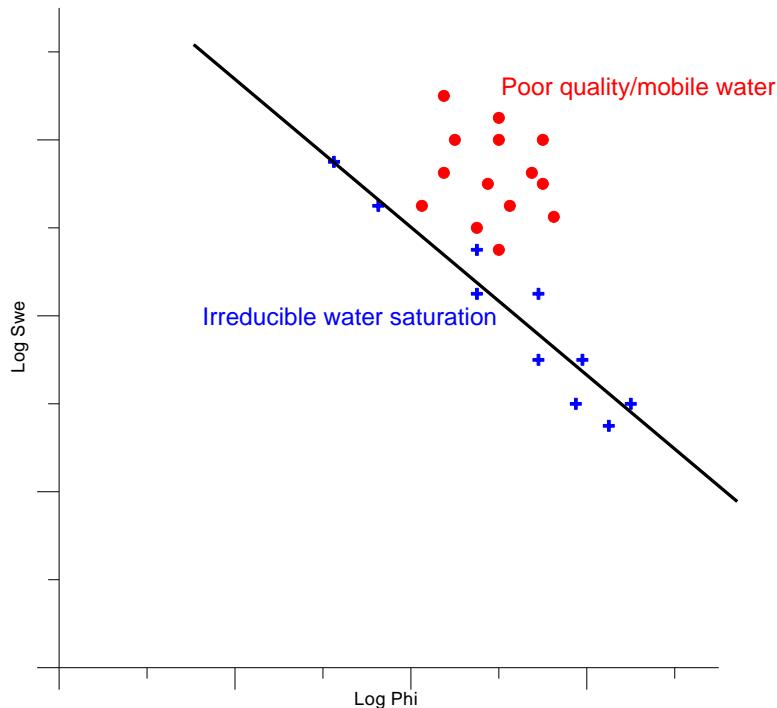
Effective Porosity and Effective Water Saturation

Effective water saturation (S_{WE}) was calculated using Dewan's equation:

$$S_{WB} = V_{SH} \times \frac{\Phi_{iSH}}{\Phi_{iX}} = \text{Bound Water Saturation}$$

$$S_{WE} = \frac{(S_W - S_{WB})}{(1 - S_{WB})}$$

From log/log cross plots of S_{WE} vs. Φ_{iE} , by petrophysical zone, levels interpreted to be at irreducible water saturation (S_{Wi}) were identified. Points with $S_{WE} > S_{Wi}$ contain potential mobile water (or belong to a poorer reservoir quality rock with higher values of S_{Wi}). Poorer reservoir qualities indicate high values of irreducible water saturation, and consequent low permeability.



Analysis of many reservoirs, including tight gas sands, suggests relations exist between porosity and irreducible water saturations.

$$\Phi^{iQ} \times S_{wi} = \text{Constant}$$

In literature, it is normally assumed that the exponent Q is equal to 1.0. Digital Formation's work, in a very extensive data base of all types of reservoirs, suggests that Q often diverges from (and is usually larger than) unity. A log/log cross plot of porosity vs. water saturation can be interpreted to distinguish rocks at irreducible saturation from others where $S_w > S_{wi}$. The inequality may be due to one of two possibilities:

1. Poorer rock quality than the choice made by the interpreter
2. Presence of mobile water

Values of Q and the constant have been selected for each sand identified, accounting for these factors.

Salinity from SP Analysis

Various chart book corrections are made during the analysis. The steps taken are:

1. The individual sand was selected looking at intervals where GR < 80 API, and the thickness was close to or greater than 5 ft.
2. An average value of the ratio of R_i/R_m was visually made for input to the Schlumberger SP-5 chart (2009), which is used to correct the SP for the effects of invasion and bed thickness. For this calculation, R_i was assumed to be equal to the deep resistivity, and mud resistivity (R_m) was read from the log header and temperature corrected to depth. From this, a corrected SP value is calculated.
3. Using a visually selected shale base line, the SP deflection is selected using the corrected SP values.
4. Using the R_{mf} from the log header, temperature corrected to depth, an R_{Weq} value is calculated using the Schlumberger transform:

$$R_{Weq} = 0.85 \times R_{mf} \times 10^{\frac{SP}{60.5 + 0.133 \times Temp}}$$

5. This R_{Weq} was then corrected using Schlumberger SP-2 (2009) to get R_w .
6. The R_w was then converted to salinity using Schlumberger Gen-9.

A plot showing the Salinity vs Depth is provided for each well. This plot also includes the salinity from Archie analysis for the four wells with porosity logs.

Sensitivity to Archie's 'm'

An analysis of the sensitivity to the selection of R_w with changing 'm' was made on one well:

05045069570000 Clough RMV 29-27

The value of 'm' was modified from the initial value of 1.8 to both 2.0 and 2.2. At each of these, the value of R_w for each identified sand interval was selected on the Pickett plot, and a separate calculation of the salinity was made.

The results for the shallowest and the deepest intervals are shown:

Interval ft.	m	R_w ohmm	Salinity ppm
507 – 516 (shallowest)	1.8	0.258	30,000
	2.0	0.158	56,000
	2.2	0.94	111,000
4084 – 4103 (deepest)	1.8	0.429	8,000
	2.0	0.254	14,000
	2.2	0.167	23,000

Obviously the selection of m and n has significant impact on the calculated salinities, but m = 1.8 results in conservatively-low salinities.

A plot with a comparison of the three iterations, m = 1.8, 2.0 and 2.2, is provided for this well.

Tabulation

Vassar-Heath RMV 24-27

Top	Bottom	Thickness	Temp	SP	R_{mf}	R_{Weq}	R_w	TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm
676	679	3	61.9	-65	1.386	0.134	0.138	62,895
776	787	11	63.7	-32	1.351	0.394	0.424	15,821
1262	1276	14	72.2	-23	1.205	0.481	0.587	9,781
1329	1341	12	73.4	-18	1.187	0.559	0.746	7,457
1468	1481	13	75.8	-44	1.152	0.233	0.236	25,747
1499	1536	37	76.6	-105	1.142	0.032	0.058	154,158
1646	1674	28	79.1	-16	1.108	0.561	0.778	6,631
1792	1799	7	81.5	-15	1.079	0.565	0.800	6,255
2033	2050	17	85.8	-15	1.028	0.541	0.767	6,223
2241	2255	14	89.4	-17	0.990	0.490	0.669	6,896

2408	2419	11	92.3	-5	0.961	0.697	1.251	3,486
2516	2526	10	94.2	-9	0.943	0.603	0.979	4,407
2723	2750	27	97.9	-10	0.909	0.565	0.896	4,650
2810	2829	19	99.4	-9	0.896	0.575	0.934	4,389
2855	2872	17	100.2	-12	0.890	0.520	0.790	5,181
2954	2959	5	101.8	-7	0.877	0.599	1.022	3,908
3165	3175	10	105.5	-11	0.847	0.513	0.799	4,871
3245	3257	12	107.0	-12	0.837	0.491	0.750	5,133
3283	3295	12	107.6	-8	0.832	0.553	0.922	4,116
3345	3357	12	108.7	-12	0.824	0.485	0.741	5,119
3367	3382	15	109.1	-16	0.821	0.427	0.604	6,311
3542	3564	22	112.2	-56	0.800	0.123	0.132	33,472
3575	3597	22	112.8	-69	0.796	0.082	0.094	50,450
3608	3613	5	113.3	-22	0.793	0.345	0.444	8,419
3730	3742	12	115.5	-42	0.779	0.185	0.200	19,834
3840	3865	25	117.5	-46	0.766	0.162	0.174	22,913
3907	3911	4	118.5	-55	0.760	0.123	0.132	31,452
3950	3975	25	119.4	-66	0.754	0.088	0.098	44,644
4100	4127	27	122.1	-18	0.739	0.366	0.507	6,794
4185	4197	12	123.4	-44	0.731	0.166	0.180	20,770
4203	4234	31	123.9	-70	0.728	0.076	0.088	49,266

Vassar-Heath RMV 21-28

Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS	Archie R _w	Archie TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm	ohmm	ppm
527	551	24	58.9	-23	1.307	0.512	0.593	11,811	0.324	23,264
658	670	12	61.0	-42	1.267	0.263	0.258	29,292	0.495	13,912
858	862	4	64.2	-27	1.209	0.418	0.459	14,360	0.464	14,190
876	889	13	64.6	-59	1.203	0.143	0.146	55,515	0.671	9,442
925	932	7	65.4	-17	1.190	0.575	0.736	8,450	0.671	9,335
1005	1011	6	66.7	-13	1.169	0.645	0.896	6,731	0.372	17,485
1186	1195	9	69.7	-55	1.123	0.155	0.157	46,290	0.683	8,605
1271	1279	8	71.1	-15	1.102	0.572	0.761	7,528	0.355	17,256
1310	1330	20	71.9	-16	1.092	0.549	0.716	7,951	0.355	17,073
1508	1517	9	75.0	-27	1.049	0.369	0.410	13,906	0.711	7,674
1550	1581	31	75.9	-48	1.038	0.184	0.186	34,236	0.679	7,968
1887	1893	6	81.3	-9	0.975	0.620	0.933	5,336	0.482	10,756
1915	1923	8	81.8	-9	0.970	0.617	0.928	5,335	0.559	9,115
2053	2059	6	84.0	-7	0.945	0.642	1.012	4,751	0.486	10,312
2072	2077	5	84.4	-7	0.942	0.640	1.008	4,751	0.425	11,883
2093	2121	28	84.9	-11	0.937	0.560	0.806	5,963	0.355	14,388
2225	2237	12	86.9	-7	0.916	0.623	0.981	4,749	0.353	14,128
2443	2448	5	90.5	-5	0.883	0.640	1.057	4,226	0.439	10,687
2513	2537	24	91.8	-10	0.871	0.539	0.795	5,609	0.390	11,978
2542	2558	16	92.2	-9	0.867	0.555	0.835	5,305	0.390	11,923
2594	2606	12	93.1	-8	0.860	0.568	0.874	5,013	0.390	11,815
2653	2658	5	94.0	-10	0.852	0.528	0.779	5,597	0.256	18,667
2944	2958	14	98.9	-7	0.813	0.555	0.875	4,721	0.222	20,804
3023	3053	30	100.3	-10	0.802	0.499	0.738	5,559	0.209	21,954
3105	3115	10	101.5	-6	0.793	0.559	0.903	4,456	0.179	25,955
3153	3169	16	102.3	-10	0.787	0.490	0.726	5,545	0.261	16,692
3173	3187	14	102.7	-17	0.785	0.393	0.514	7,957	0.334	12,660
3202	3218	16	103.2	-11	0.781	0.472	0.685	5,843	0.284	15,065
3232	3247	15	103.6	-13	0.778	0.442	0.618	6,483	0.327	12,830
3282	3296	14	104.5	-9	0.772	0.497	0.752	5,242	0.198	22,363
3343	3401	58	105.8	-58	0.762	0.108	0.117	41,232	0.425	9,451
3557	3568	11	109.0	-3	0.742	0.575	0.999	3,745	0.343	11,564
3585	3598	13	109.5	-11	0.739	0.448	0.654	5,791	0.402	9,696
3634	3679	45	110.5	-21	0.732	0.327	0.407	9,483	0.234	17,395
3721	3736	15	111.7	-36	0.724	0.205	0.223	18,131	0.249	16,041
3832	3838	6	113.5	-31	0.714	0.236	0.266	14,670	0.249	15,779
3849	3874	25	113.9	-49	0.711	0.136	0.145	29,309	0.765	4,726
3893	3898	5	114.5	-42	0.708	0.168	0.180	22,664	0.604	6,018
3940	3945	5	115.3	-35	0.703	0.207	0.227	17,200	0.264	14,545
3981	4023	42	116.3	-28	0.698	0.254	0.294	12,797	0.416	8,794
4088	4137	49	118.1	-26	0.688	0.266	0.315	11,667	0.399	9,052
4168	4185	17	119.2	-13	0.682	0.392	0.555	6,317	0.309	11,822
4193	4198	5	119.5	-25	0.680	0.272	0.326	11,120	0.348	10,363

4217	4267	50	120.2	-33	0.676	0.213	0.238	15,598	0.343	10,458
4280	4302	22	121.1	-37	0.672	0.188	0.206	18,258	0.437	8,012
4353	4477	124	123.1	-54	0.661	0.111	0.121	33,454	0.333	10,540

Clough RMV 29-27

Top	Bottom	Thickness	Tem	SP	R _{mf}	R _{Weq}	R _w	TDS	Archie R _w	Archie
FT	FT	FT	p	mv	ohmm	ohmm	ohmm	ppm	ohmm	TDS
			DEGF							ppm
507	516	9	59.2	-14	0.834	0.443	0.484	14,718	0.258	30,291
838	843	5	65.1	-35	0.766	0.203	0.200	37,186	0.410	16,077
968	972	4	67.4	-28	0.742	0.249	0.248	27,581	0.410	15,516
1411	1419	8	75.4	-57	0.670	0.089	0.102	73,920	1.197	4,429
1441	1448	7	75.9	-65	0.666	0.068	0.086	92,048	1.197	4,400
1532	1549	17	77.6	-7	0.652	0.441	0.533	10,100	0.529	10,188
1605	1612	7	78.8	-14	0.643	0.347	0.384	14,222	0.588	8,955
1733	1743	10	81.1	-14	0.626	0.338	0.376	14,155	0.507	10,203
1772	1775	3	81.8	-28	0.621	0.214	0.219	25,978	0.601	8,436
1867	1881	14	83.6	-12	0.609	0.352	0.400	12,821	0.556	8,973
2036	2056	20	86.7	-12	0.589	0.341	0.389	12,750	0.385	12,883
2144	2155	11	88.5	-8	0.577	0.380	0.456	10,496	0.478	9,968
2161	2168	7	88.8	-10	0.576	0.356	0.416	11,556	0.537	8,771
2305	2311	6	91.4	-9	0.561	0.358	0.425	10,974	0.537	8,771
2339	2358	19	92.1	-15	0.557	0.294	0.327	14,476	0.537	8,459
2436	2455	19	93.8	-14	0.547	0.299	0.336	13,787	0.381	12,020
2615	2628	13	97.0	-6	0.530	0.373	0.462	9,426	0.429	10,219
2824	2834	10	100.7	-13	0.512	0.290	0.332	13,000	0.382	11,154
2912	2923	11	102.3	-13	0.505	0.286	0.328	12,960	0.389	10,764
2940	2956	16	102.8	-10	0.502	0.313	0.370	11,300	0.378	11,044
3041	3046	5	104.5	-9	0.494	0.318	0.381	10,762	0.375	10,954
3098	3114	16	105.6	-25	0.489	0.192	0.205	21,244	0.328	12,537
3142	3159	17	106.4	-46	0.486	0.100	0.110	44,427	0.353	11,483
3179	3195	16	107.1	-38	0.483	0.127	0.136	34,059	0.331	12,240
3233	3251	18	108.1	-10	0.479	0.299	0.356	11,205	0.310	13,028
3280	3285	5	108.8	-13	0.476	0.271	0.313	12,799	0.310	12,938
3416	3428	12	111.3	-18	0.466	0.228	0.254	15,772	0.283	13,971
3464	3483	19	112.2	-30	0.462	0.157	0.167	25,177	0.361	10,617
3502	3511	9	112.8	-50	0.460	0.085	0.096	48,922	0.368	10,343
3520	3531	11	113.2	-36	0.459	0.130	0.139	31,099	0.365	10,403
3579	3583	4	114.2	-31	0.455	0.151	0.160	25,958	0.245	15,969
3742	3756	14	117.2	-29	0.444	0.157	0.168	23,905	0.245	15,537
3840	3884	44	119.2	-60	0.437	0.061	0.075	63,310	0.387	9,266
3980	4010	30	121.6	-18	0.429	0.212	0.238	15,418	0.379	9,287
4084	4103	19	123.3	-40	0.423	0.109	0.118	34,388	0.429	8,018

Clough RMV 27-28

Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm
490	497	7	58.1	-15	2.148	1.100	2.199	3,017
511	531	20	58.6	-33	2.133	0.596	0.744	9,290
672	678	6	61.1	-12	2.053	1.167	2.557	2,468
841	856	15	64.0	-34	1.970	0.539	0.660	9,694
1335	1368	33	72.3	-13	1.763	0.978	2.006	2,707
1508	1534	26	75.1	-38	1.703	0.418	0.487	11,513
1661	1669	8	77.5	-10	1.655	1.016	2.283	2,224
2143	2149	6	85.4	-6	1.513	1.061	2.711	1,705
2447	2471	24	90.6	-4	1.432	1.072	2.929	1,491
2528	2534	6	91.8	-3	1.415	1.094	3.097	1,392
2645	2649	4	93.7	-3	1.388	1.073	3.032	1,395
2789	2793	4	96.0	-3	1.356	1.049	2.955	1,398
2819	2824	5	96.6	-3	1.349	1.044	2.940	1,399
3071	3080	9	100.7	-2	1.297	1.036	3.017	1,309
3135	3146	11	101.8	-4	1.284	0.964	2.607	1,502
3162	3172	10	102.3	-3	1.279	0.990	2.777	1,403
3224	3245	21	103.4	-2	1.266	1.011	2.941	1,311
3281	3307	26	104.3	-4	1.255	0.942	2.546	1,503
3333	3344	11	105.1	-8	1.246	0.827	1.950	1,957
3367	3382	15	105.7	-5	1.240	0.903	2.355	1,607
3435	3443	8	106.7	-4	1.228	0.923	2.492	1,503
3576	3594	18	109.1	-6	1.203	0.850	2.142	1,715
3683	3702	19	110.9	-3	1.185	0.919	2.569	1,405
3824	3858	34	113.4	-2	1.160	0.928	2.691	1,313
3893	3903	10	114.3	-3	1.151	0.893	2.499	1,404
3940	3978	38	115.3	-32	1.142	0.367	0.493	7,395
4059	4105	46	117.3	-20	1.123	0.521	0.888	3,935
4133	4150	17	118.3	-6	1.114	0.790	1.997	1,705
4245	4258	13	120.1	-10	1.099	0.691	1.541	2,187
4269	4275	6	120.5	-4	1.096	0.826	2.233	1,496
4282	4303	21	120.8	-12	1.093	0.647	1.362	2,466

Vassar-Heath RMV 34-28

Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm
558	567	9	59.3	-7	2.823	1.896	7.495	0,854
679	683	4	61.3	-7	2.742	1.843	7.184	0,865
983	997	14	66.4	-19	2.550	1.153	2.642	2,214
1045	1051	6	67.3	-13	2.517	1.391	4.007	1,431
1065	1080	15	67.7	-15	2.504	1.295	3.436	1,663
1242	1252	10	70.6	-15	2.410	1.250	3.288	1,674
1297	1316	19	71.6	-60	2.380	0.281	0.288	21,743
1369	1379	10	72.7	-38	2.347	0.573	0.772	7,257
1457	1467	10	74.2	-7	2.305	1.558	5.678	0,921
1539	1576	37	75.7	-65	2.260	0.230	0.233	26,168
1647	1653	6	77.3	-6	2.219	1.552	5.854	0,860
1769	1772	3	79.3	-11	2.168	1.290	3.896	1,266
1808	1823	15	80.0	-10	2.149	1.322	4.153	1,177
1877	1882	5	81.1	-6	2.123	1.487	5.542	0,869
1913	1924	11	81.7	-10	2.108	1.298	4.062	1,180
2006	2022	16	83.3	-7	2.071	1.405	4.982	0,943
2166	2175	9	85.9	-7	2.013	1.368	4.820	0,948
2269	2282	13	87.6	-12	1.976	1.145	3.279	1,373
2450	2466	16	90.6	-7	1.915	1.304	4.555	0,954
2546	2560	14	92.2	-10	1.885	1.167	3.598	1,191
2583	2598	15	92.8	-9	1.873	1.198	3.841	1,108
2693	2698	5	94.5	-7	1.841	1.255	4.363	0,958
2825	2835	10	96.8	-5	1.801	1.309	4.943	0,826
2933	2939	6	98.5	-6	1.771	1.248	4.507	0,891
2970	2975	5	99.1	-3	1.761	1.363	5.607	0,711
3164	3172	8	102.3	-4	1.709	1.283	5.032	0,770
3185	3195	10	102.7	-11	1.704	1.029	3.036	1,277
3257	3272	15	103.9	-8	1.685	1.118	3.705	1,033
3325	3330	5	105.0	-5	1.669	1.215	4.558	0,830
3342	3360	18	105.4	-20	1.663	0.762	1.655	2,306
3369	3374	5	105.7	-9	1.658	1.067	3.400	1,108
3384	3393	9	106.0	-10	1.654	1.032	3.164	1,189
3412	3420	8	106.4	-8	1.647	1.094	3.625	1,032
3508	3523	15	108.1	-7	1.624	1.113	3.838	0,960
3556	3564	8	108.8	-6	1.613	1.141	4.097	0,893
3594	3611	17	109.5	-14	1.604	0.887	2.352	1,555
3626	3633	7	110.0	-6	1.598	1.130	4.057	0,893
3702	3714	12	111.3	-26	1.580	0.606	1.119	3,266
3745	3766	21	112.0	-27	1.570	0.585	1.053	3,452
3828	3877	49	113.7	-48	1.549	0.305	0.374	10,100

3922	3930	8	114.9	-24	1.533	0.628	1.229	2,876
3961	3990	29	115.7	-36	1.523	0.434	0.644	5,573
4076	4092	16	117.5	-13	1.501	0.861	2.377	1,439
4116	4141	25	118.2	-17	1.492	0.759	1.834	1,861
4156	4190	34	118.9	-27	1.483	0.558	1.016	3,381

Savage RMV 35-28

Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS	Archie R _w	Archie TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm	ohmm	ppm
511	530	19	59.2	-12	1.940	1.101	2.225	2,931	0.409	17,737
673	691	18	62.1	-5	1.860	1.337	3.451	1,794	0.255	29,182
718	727	9	62.8	-10	1.841	1.120	2.392	2,579	0.315	22,502
773	787	14	63.8	-6	1.814	1.262	3.108	1,946	0.315	22,128
923	927	4	66.4	-16	1.750	0.875	1.527	3,881	0.270	25,395
1074	1081	7	69.0	-30	1.688	0.533	0.671	8,854	0.303	21,301
1191	1211	20	71.2	-7	1.641	1.108	2.560	2,141	0.303	20,619
1265	1279	14	72.5	-20	1.615	0.712	1.109	4,976	0.321	18,957
1406	1414	8	74.9	-38	1.567	0.385	0.433	13,112	0.694	7,886
1483	1493	10	76.3	-12	1.541	0.886	1.716	3,020	0.344	16,627
1604	1625	21	78.5	-45	1.500	0.296	0.314	17,897	1.120	4,561
1632	1663	31	79.1	-41	1.490	0.335	0.368	14,863	1.618	3,100
1800	1803	3	81.8	-7	1.444	0.980	2.213	2,180	0.179	32,946
1979	1983	4	85.0	-4	1.394	1.043	2.602	1,784	0.337	15,219
2130	2138	8	87.7	-5	1.355	0.982	2.356	1,916	0.358	13,782
2170	2185	15	88.5	-18	1.344	0.644	1.051	4,344	0.874	5,264
2228	2236	8	89.5	-5	1.330	0.964	2.310	1,919	0.454	10,426
2366	2377	11	91.9	-4	1.297	0.971	2.402	1,798	0.262	18,611
2426	2432	6	92.9	-4	1.284	0.962	2.376	1,799	0.216	22,947
2478	2486	8	93.9	-4	1.272	0.953	2.353	1,800	0.331	14,018
2590	2642	52	96.2	-5	1.243	0.903	2.150	1,926	0.276	16,722
2698	2709	11	97.8	-4	1.224	0.918	2.260	1,804	0.284	15,927
2730	2736	6	98.3	-4	1.218	0.914	2.248	1,804	0.374	11,693
2765	2778	13	99.0	-9	1.210	0.776	1.626	2,492	0.346	12,642
2810	2821	11	99.8	-4	1.201	0.901	2.217	1,805	0.315	13,904
2966	2982	16	102.6	-5	1.171	0.852	2.024	1,928	0.206	21,789
3005	3020	15	103.3	-5	1.163	0.847	2.012	1,928	0.327	12,879
3068	3095	27	104.5	-7	1.151	0.787	1.754	2,191	0.223	19,509
3108	3132	24	105.2	-5	1.144	0.833	1.978	1,927	0.228	18,891
3270	3295	25	108.0	-8	1.115	0.741	1.602	2,328	0.215	19,622
3323	3334	11	108.8	-6	1.107	0.783	1.800	2,052	0.318	12,578
3380	3467	87	110.5	-47	1.091	0.220	0.242	16,759	0.194	21,536
3486	3501	15	111.8	-7	1.080	0.741	1.654	2,181	0.194	21,278
3631	3642	11	114.3	-6	1.057	0.749	1.725	2,045	0.238	16,475
3649	3655	6	114.6	-3	1.055	0.819	2.078	1,689	0.212	18,722
3659	3675	16	114.8	-9	1.053	0.681	1.433	2,460	0.366	10,219

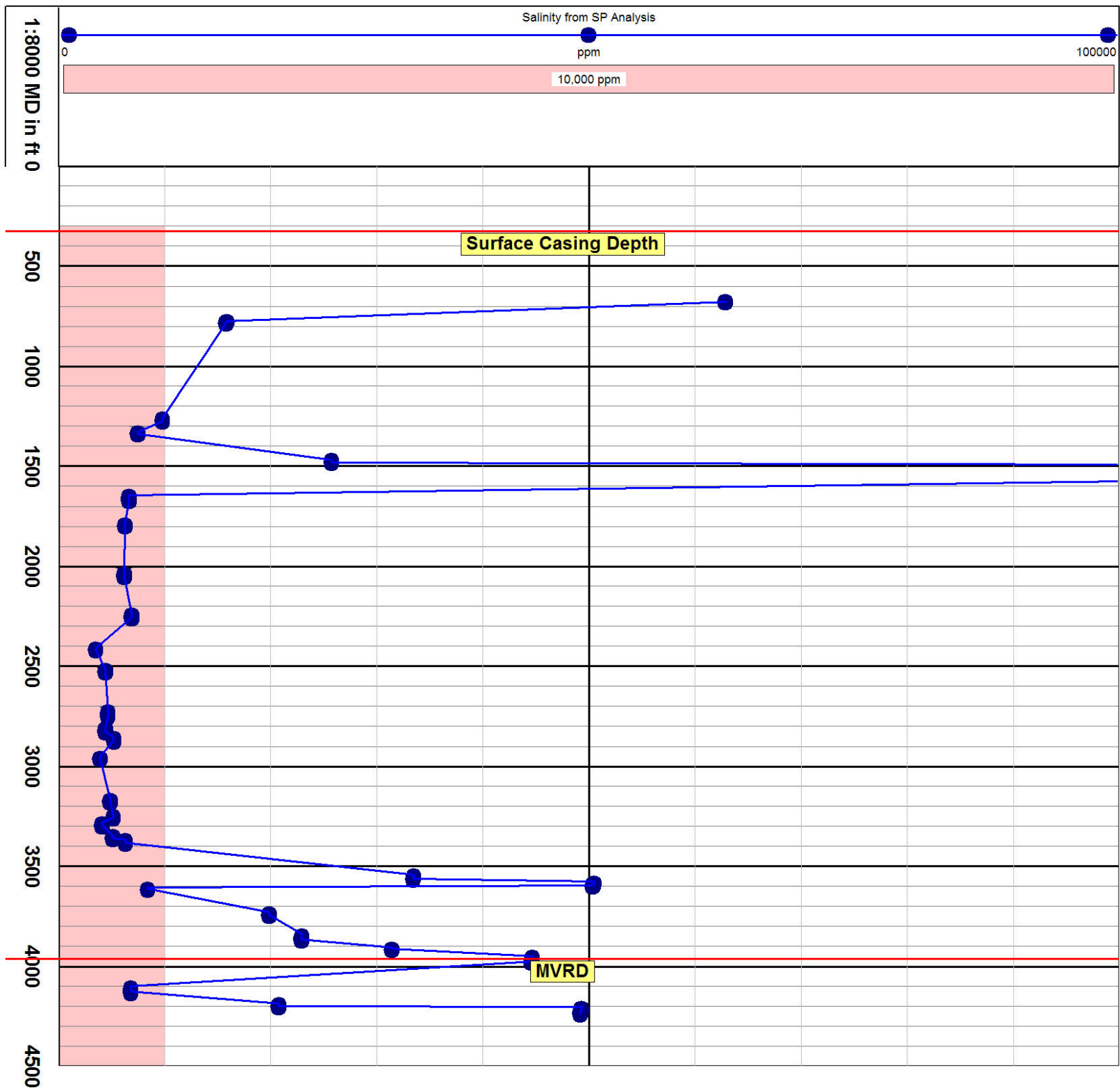
3723	3764	41	116.2	-6	1.041	0.738	1.701	2,042	0.189	21,023
3770	3815	45	117.0	-6	1.034	0.733	1.690	2,041	0.157	25,861
3830	3842	12	117.8	-6	1.027	0.728	1.681	2,039	0.201	19,301
3897	3940	43	119.3	-6	1.016	0.720	1.663	2,037	0.172	22,773
3958	3972	14	120.1	-11	1.009	0.616	1.230	2,753	0.156	25,322
4000	4045	45	121.1	-56	1.001	0.158	0.170	22,700	0.211	17,736
4097	4155	58	122.9	-20	0.987	0.461	0.742	4,530	0.215	17,089
4181	4196	15	124.1	-4	0.978	0.738	1.819	1,791	0.164	23,051
4235	4246	11	125.0	-5	0.972	0.711	1.700	1,905	0.207	17,526
4251	4281	30	125.4	-32	0.968	0.317	0.414	8,192	0.209	17,271

Clough RMV 26-21

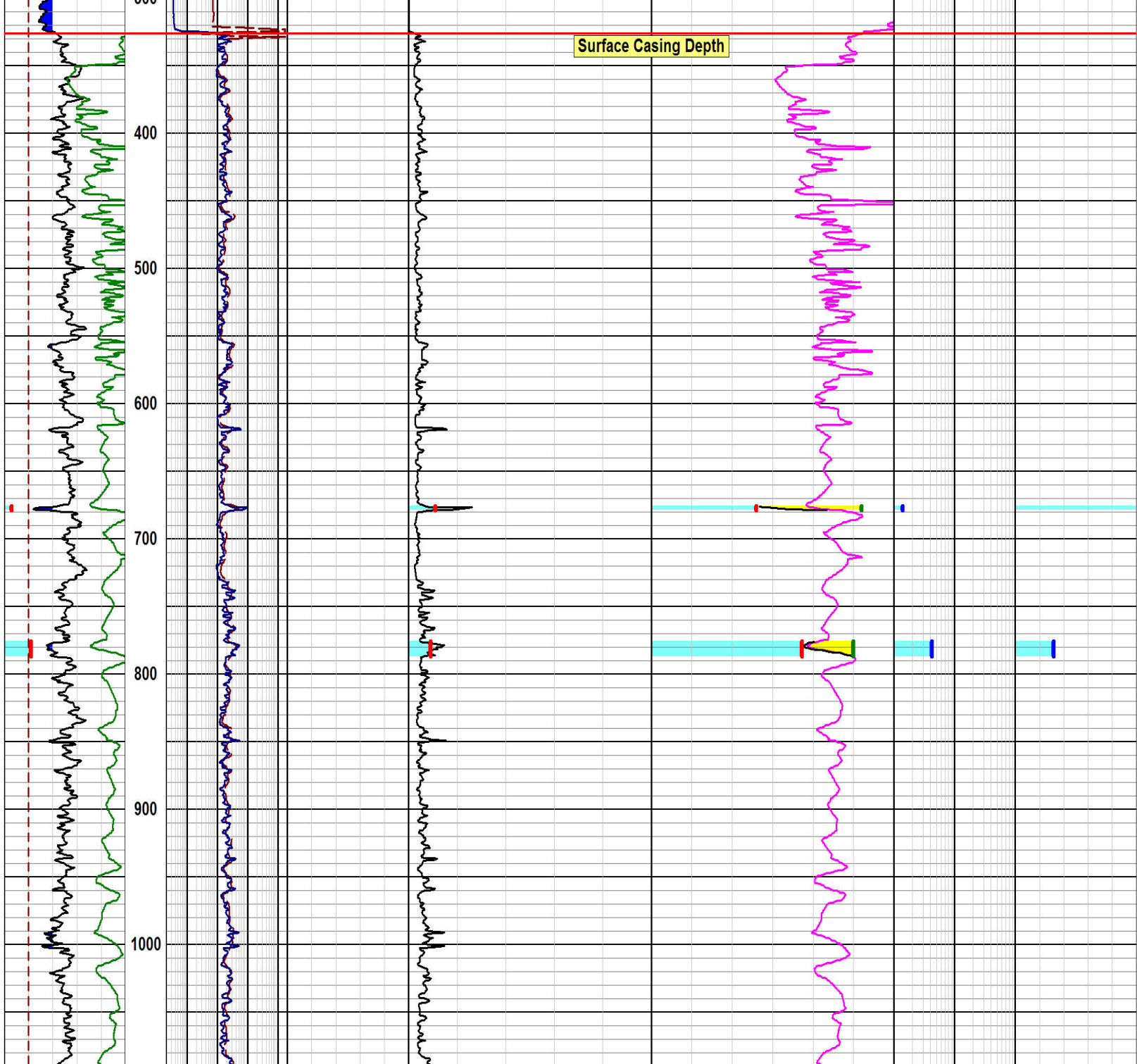
Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm
392	398	6	57.1	-19	2.190	0.979	1.731	3,923
606	631	25	61.1	-35	2.061	0.541	0.653	10,269
684	692	8	62.3	-34	2.024	0.551	0.677	9,691
700	705	5	62.6	-18	2.016	0.938	1.684	3,706
1248	1259	11	72.4	-35	1.765	0.476	0.577	9,921
1554	1588	34	78.1	-46	1.647	0.314	0.337	16,590
1723	1733	10	80.9	-11	1.594	0.950	2.059	2,371
1763	1774	11	81.7	-6	1.581	1.107	2.858	1,685
2159	2164	5	88.7	-8	1.465	0.965	2.295	1,948
2317	2322	5	91.5	-3	1.422	1.099	3.125	1,383
2474	2479	5	94.3	-3	1.383	1.069	3.029	1,387
2512	2522	10	95.1	-3	1.373	1.062	3.005	1,388
2660	2665	5	97.7	-4	1.339	1.004	2.731	1,490
2821	2833	12	100.6	-2	1.302	1.040	3.041	1,300
2920	2926	6	102.3	-3	1.282	0.992	2.792	1,394
3073	3100	27	105.3	-8	1.248	0.828	1.959	1,945
3148	3157	9	106.4	-4	1.235	0.928	2.514	1,493
3217	3223	6	107.7	-7	1.222	0.837	2.046	1,820
3305	3312	7	109.2	-3	1.205	0.934	2.623	1,396
3351	3376	25	110.2	-15	1.195	0.642	1.234	2,982
3387	3401	14	110.8	-9	1.190	0.768	1.760	2,064
3450	3463	13	111.9	-16	1.178	0.614	1.152	3,153
3540	3555	15	113.5	-2	1.162	0.930	2.705	1,305
3618	3641	23	115.0	-8	1.148	0.766	1.815	1,930
3655	3665	10	115.5	-3	1.143	0.887	2.490	1,395
3725	3732	7	116.8	-2	1.132	0.906	2.635	1,304
3893	3931	38	120.0	-17	1.103	0.562	1.035	3,288
3973	3977	4	121.2	-1	1.093	0.901	2.722	1,218
3995	4007	12	121.6	-6	1.089	0.773	1.963	1,690
4025	4044	19	122.2	-31	1.084	0.364	0.502	6,849
4137	4175	38	124.4	-14	1.066	0.596	1.194	2,742
4247	4277	30	126.3	-8	1.051	0.704	1.682	1,906
4339	4352	13	127.8	-8	1.039	0.696	1.666	1,903
4401	4446	45	129.2	-33	1.028	0.329	0.444	7,371

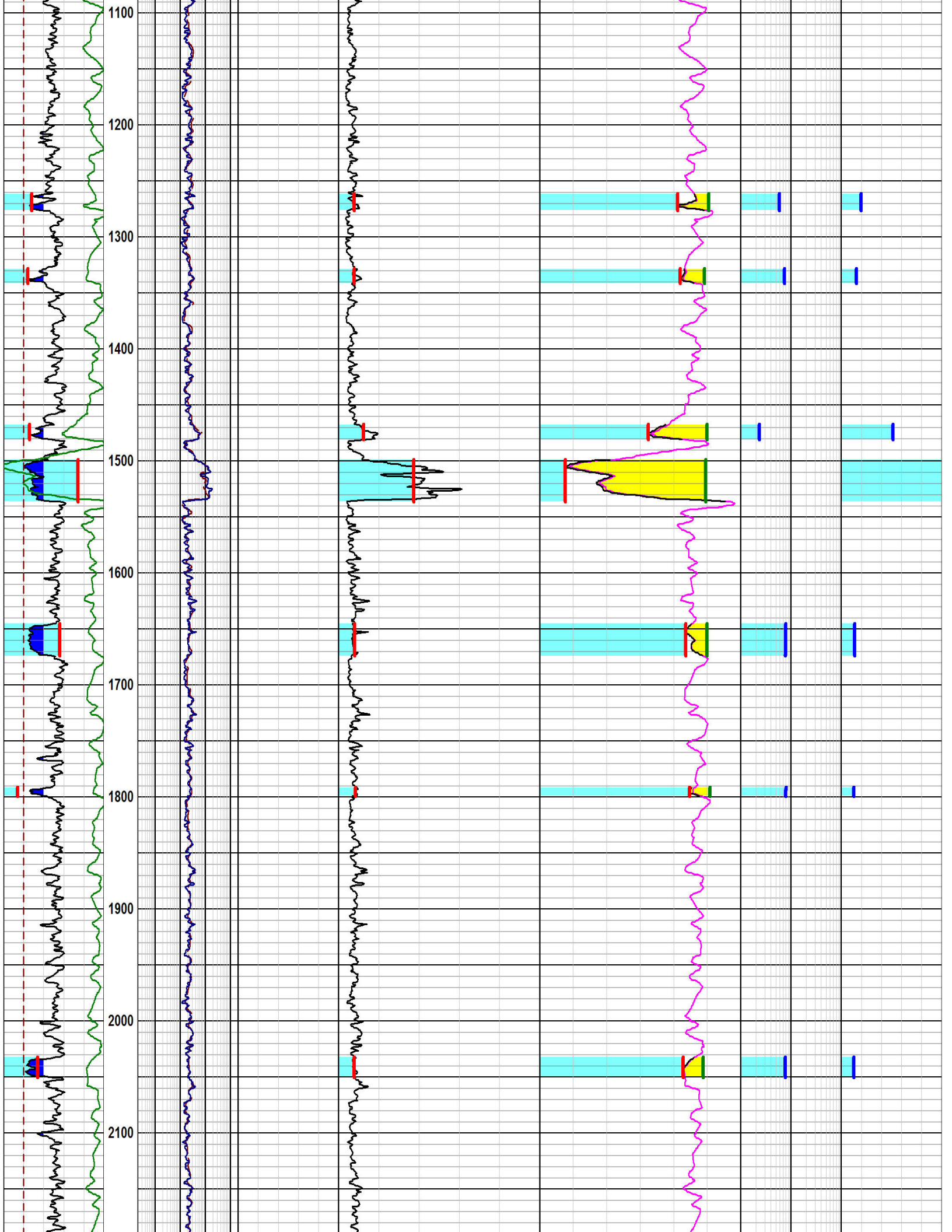
Clough RMV 54-28

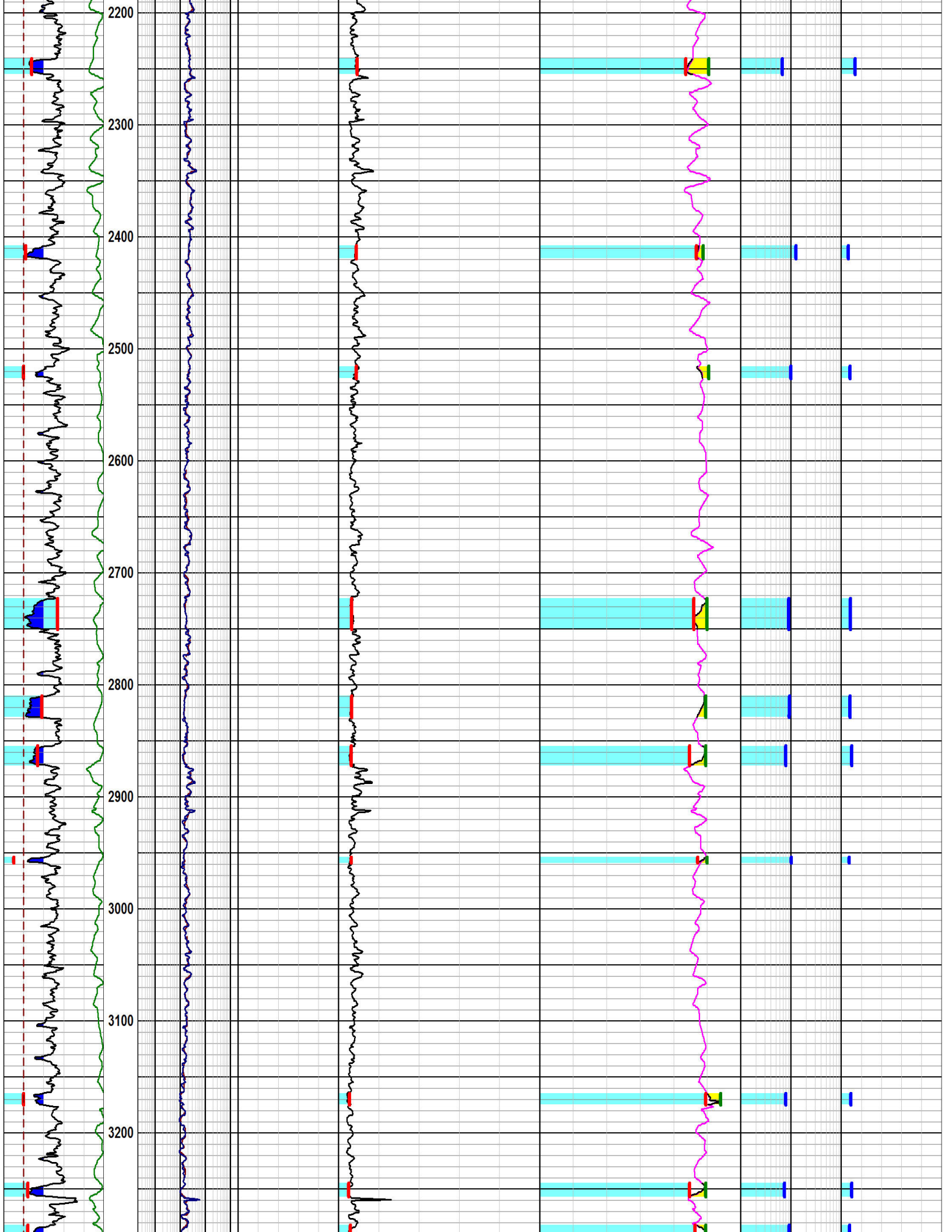
Top	Bottom	Thickness	Temp	SP	R _{mf}	R _{Weq}	R _w	TDS	Archie R _w	Archie TDS
FT	FT	FT	DEGF	mv	ohmm	ohmm	ohmm	ppm	ohmm	ppm
969	983	14	66.5	-21	1.480	0.626	0.852	7,115	0.337	19,604
994	1009	15	67.0	-52	1.471	0.223	0.220	32,025	0.632	9,725
1120	1138	18	69.1	-46	1.429	0.266	0.268	24,555	0.441	13,947
1159	1174	15	69.8	-55	1.417	0.196	0.195	35,441	0.684	8,586
1498	1542	44	75.7	-64	1.314	0.138	0.143	47,348	0.869	6,154
1555	1566	11	76.4	-57	1.304	0.173	0.175	36,583	1.632	3,175
1812	1818	6	80.7	-6	1.239	0.868	1.718	2,860	0.446	11,783
1881	1887	6	81.9	-5	1.223	0.885	1.804	2,684	0.569	8,929
2151	2161	10	86.5	-6	1.163	0.816	1.605	2,872	0.435	11,294
2355	2378	23	90.1	-10	1.120	0.693	1.216	3,676	0.445	10,580
2415	2421	6	91.0	-6	1.110	0.780	1.530	2,876	0.510	9,048
2555	2572	17	93.4	-4	1.083	0.811	1.687	2,537	0.270	17,686
2621	2632	11	94.5	-2	1.071	0.855	1.892	2,232	0.342	13,432
2658	2668	10	95.1	-10	1.065	0.661	1.159	3,665	0.215	22,506
2702	2706	4	95.8	-3	1.057	0.818	1.753	2,382	0.552	7,898
2890	2896	6	99.0	-5	1.025	0.746	1.502	2,703	0.356	12,253
3010	3052	42	101.3	-6	1.003	0.708	1.385	2,873	0.246	18,030
3145	3157	12	103.4	-17	0.985	0.494	0.740	5,382	0.476	8,572
3249	3260	11	105.1	-3	0.969	0.751	1.605	2,385	0.442	9,123
3289	3292	3	105.7	-26	0.964	0.367	0.471	8,482	0.331	12,403
3302	3340	38	106.2	-11	0.960	0.581	0.998	3,842	0.427	9,366
3349	3392	43	107.1	-45	0.953	0.202	0.218	19,521	0.206	20,801
3428	3438	10	108.1	-5	0.944	0.688	1.386	2,695	0.360	11,060
3494	3505	11	109.3	-2	0.935	0.747	1.646	2,240	0.470	8,218
3559	3574	15	110.4	-10	0.926	0.579	1.022	3,610	0.656	5,722
3578	3605	27	110.8	-15	0.922	0.495	0.779	4,765	0.311	12,650
3625	3637	12	111.5	-3	0.917	0.711	1.520	2,382	0.290	13,575
3689	3697	8	112.5	-3	0.909	0.705	1.507	2,381	0.306	12,674
3715	3735	20	113.1	-4	0.905	0.681	1.414	2,530	0.206	19,614
3821	3844	23	114.9	-4	0.891	0.671	1.394	2,528	0.255	15,167
3873	3898	25	115.8	-16	0.885	0.463	0.716	4,981	0.216	18,120
3940	3970	30	117.0	-13	0.876	0.503	0.831	4,229	0.320	11,597
4029	4073	44	118.6	-13	0.865	0.497	0.822	4,217	0.251	14,931
4124	4137	13	120.0	-13	0.856	0.492	0.815	4,208	0.475	7,401
4153	4168	15	120.5	-12	0.852	0.505	0.857	3,981	0.475	7,369
4180	4203	23	121.0	-16	0.849	0.446	0.694	4,930	0.368	9,632

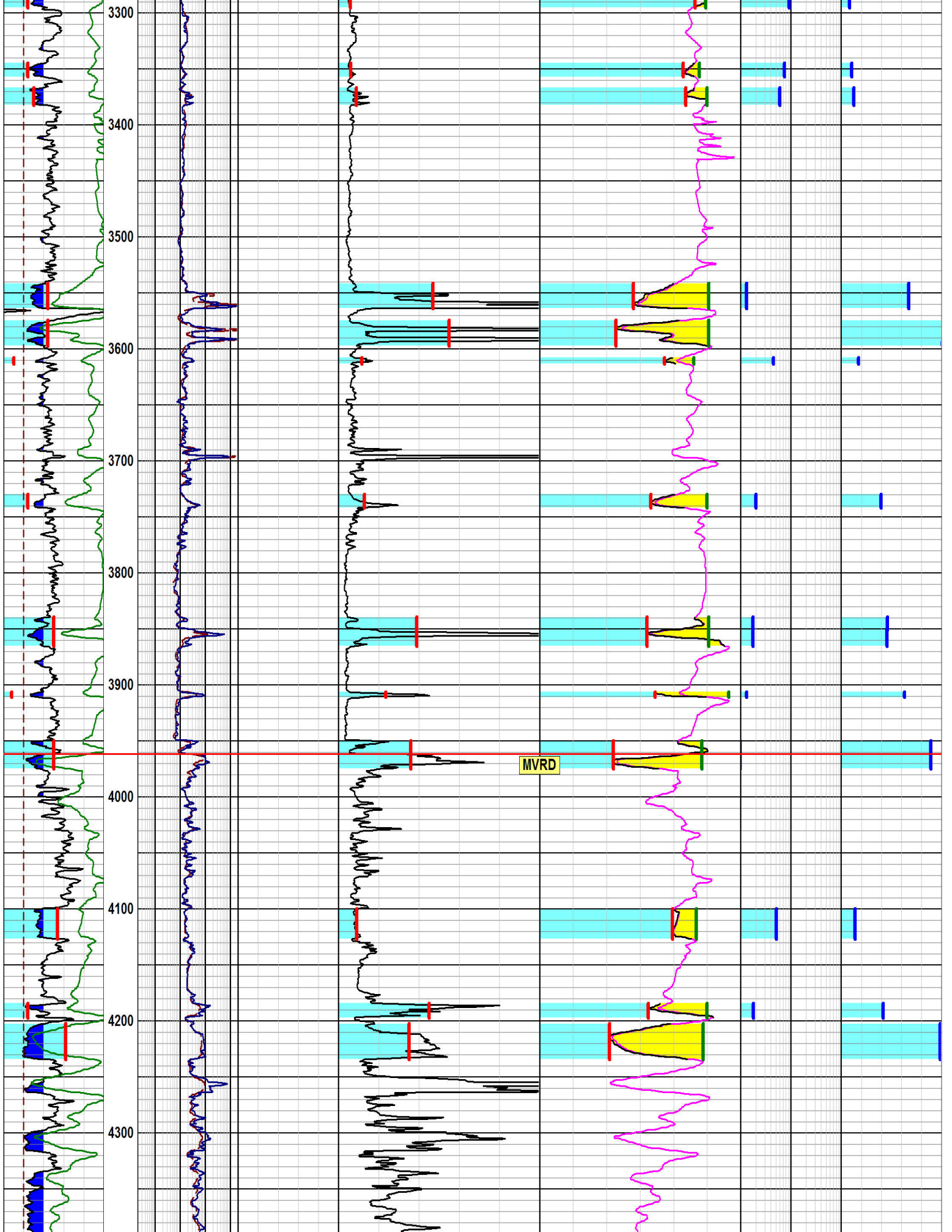


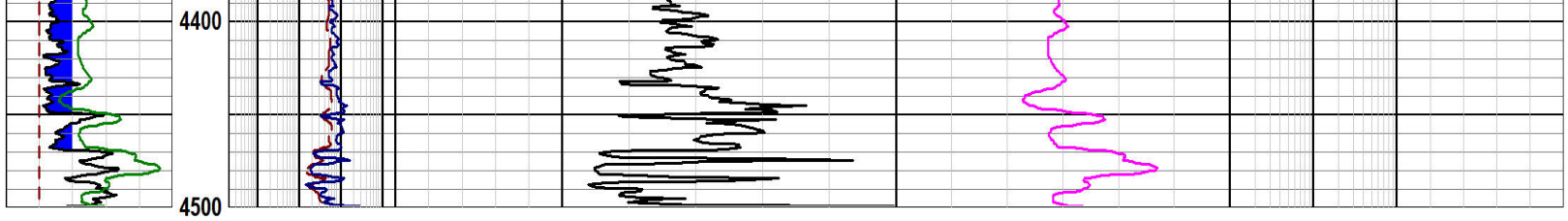
GR 0 GAPI 200 200 400 SP -100 mV 0 Sand h 0 F 50 H Bit Size	Resistivities Deep 0.2 OHMM 2000 Shallow 0.2 OHMM 2000	Implied Gas Effect	Ri/Rm 0 V/V 200 Average Ri/Rm 0 V/V 200 Ave Ri/Rm	SP -125 mV 25 SP-5 Corrected SP -125 mV 25 SP Clean -125 mV 25 SP Shale -125 mV 25 Deflection	Rw from SP 0.1 ohmm 100	Salinity from SP ppm 50000
	1 : 1200 MD in ft					
	300					
	400					

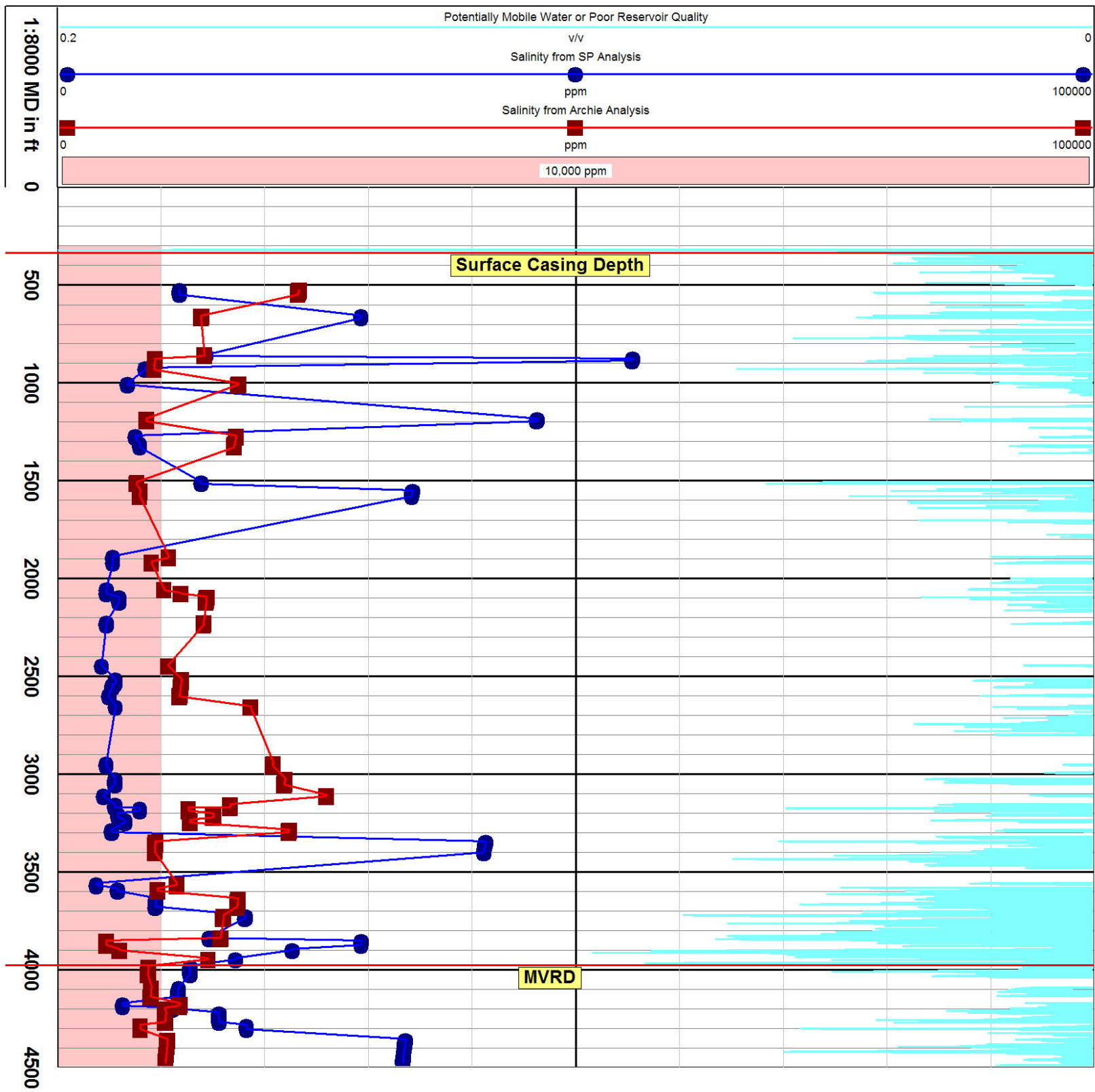








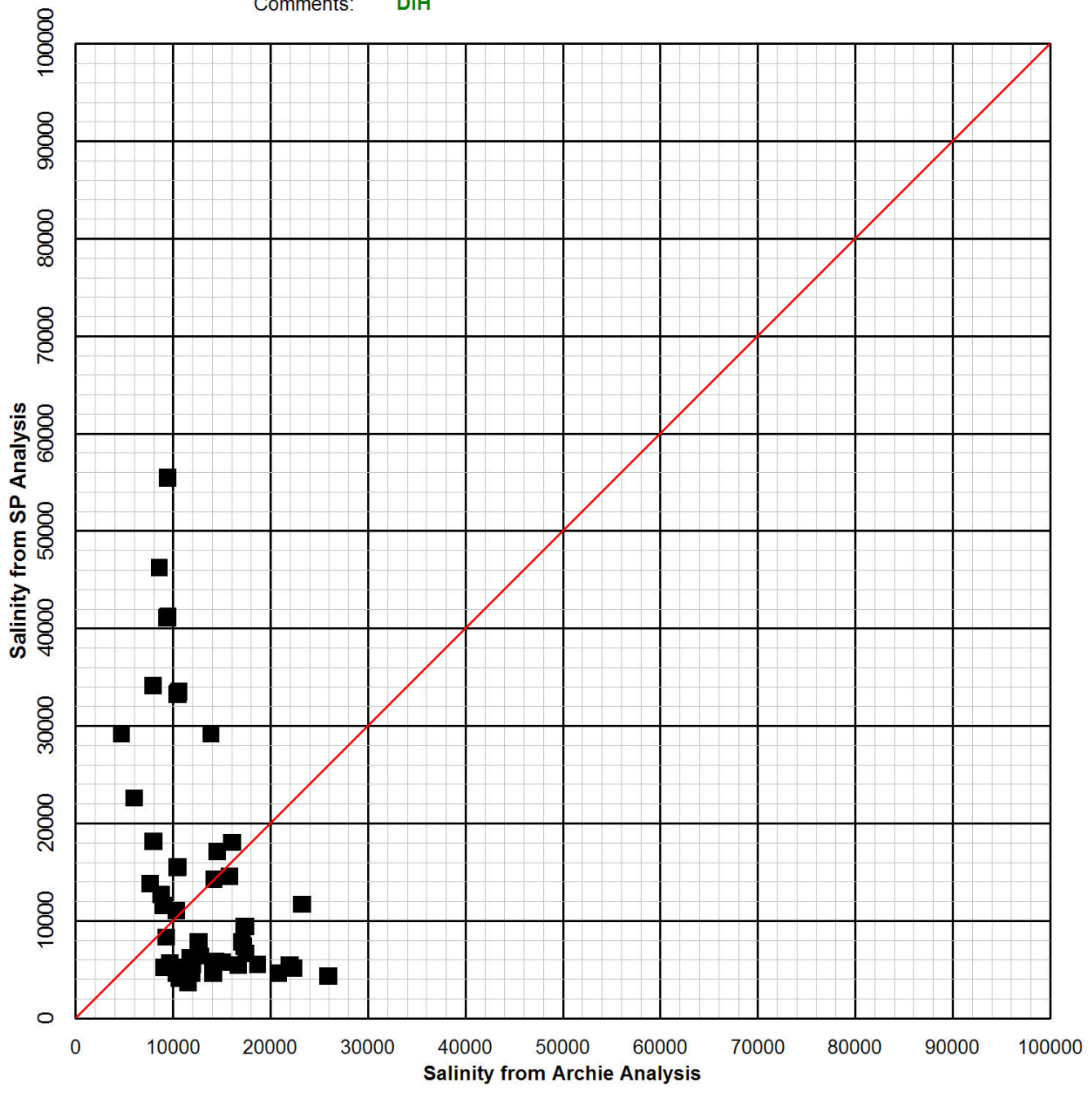






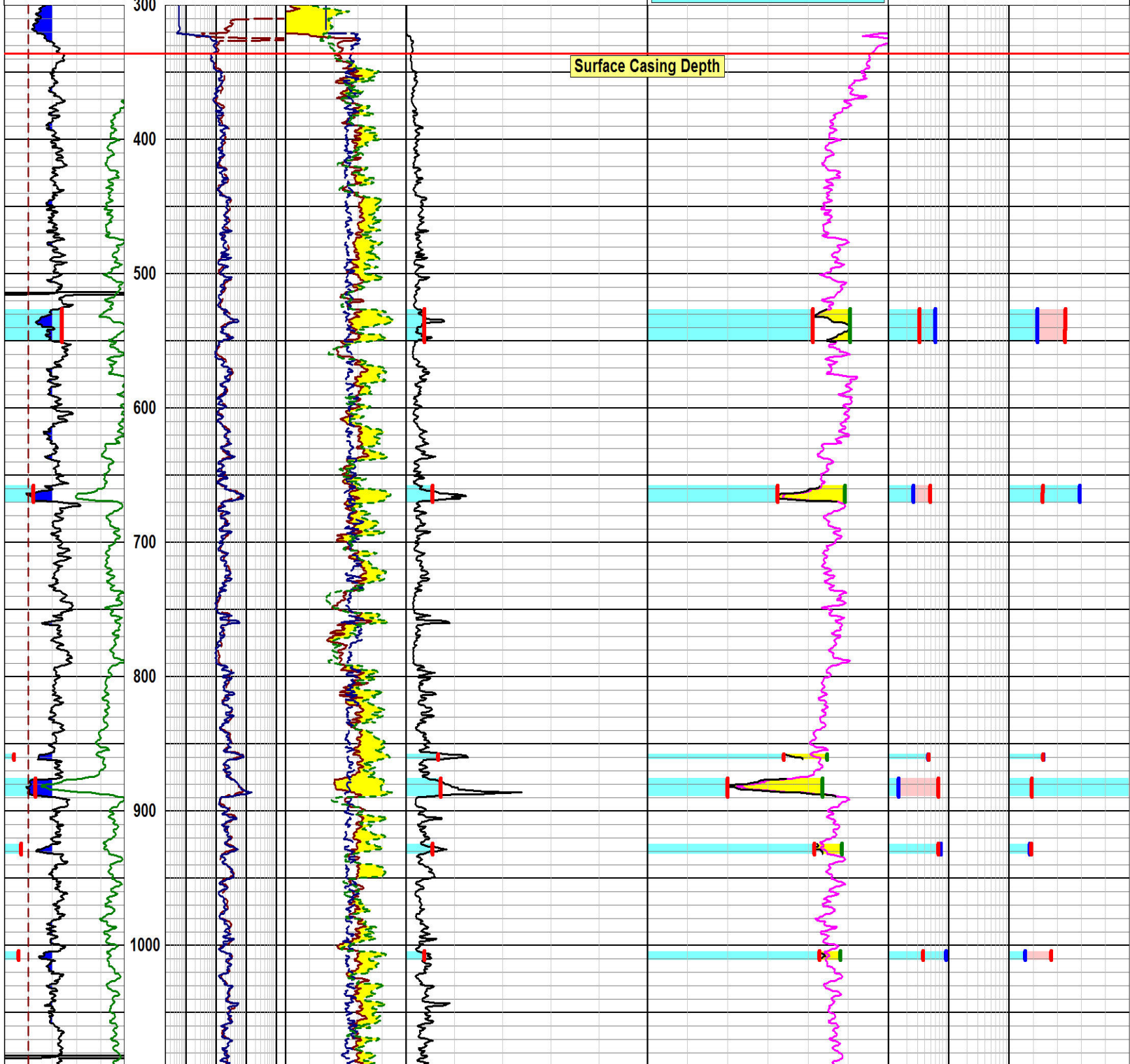
LESAs 9.7.1, © 1992-2014 Digital Formation, Inc.
File: 0504506917000 Vassar Heath RMV 21-28.lb
Plot: C-Salinity from Archie vs. Salinity from SP
Gross Interval: 300 to 7200 by 0.5 F
Ranges: User Ranges
300-4500
Time: 01:39 PM
Section: SECTION
Location: LOCATION
Comments: DIH

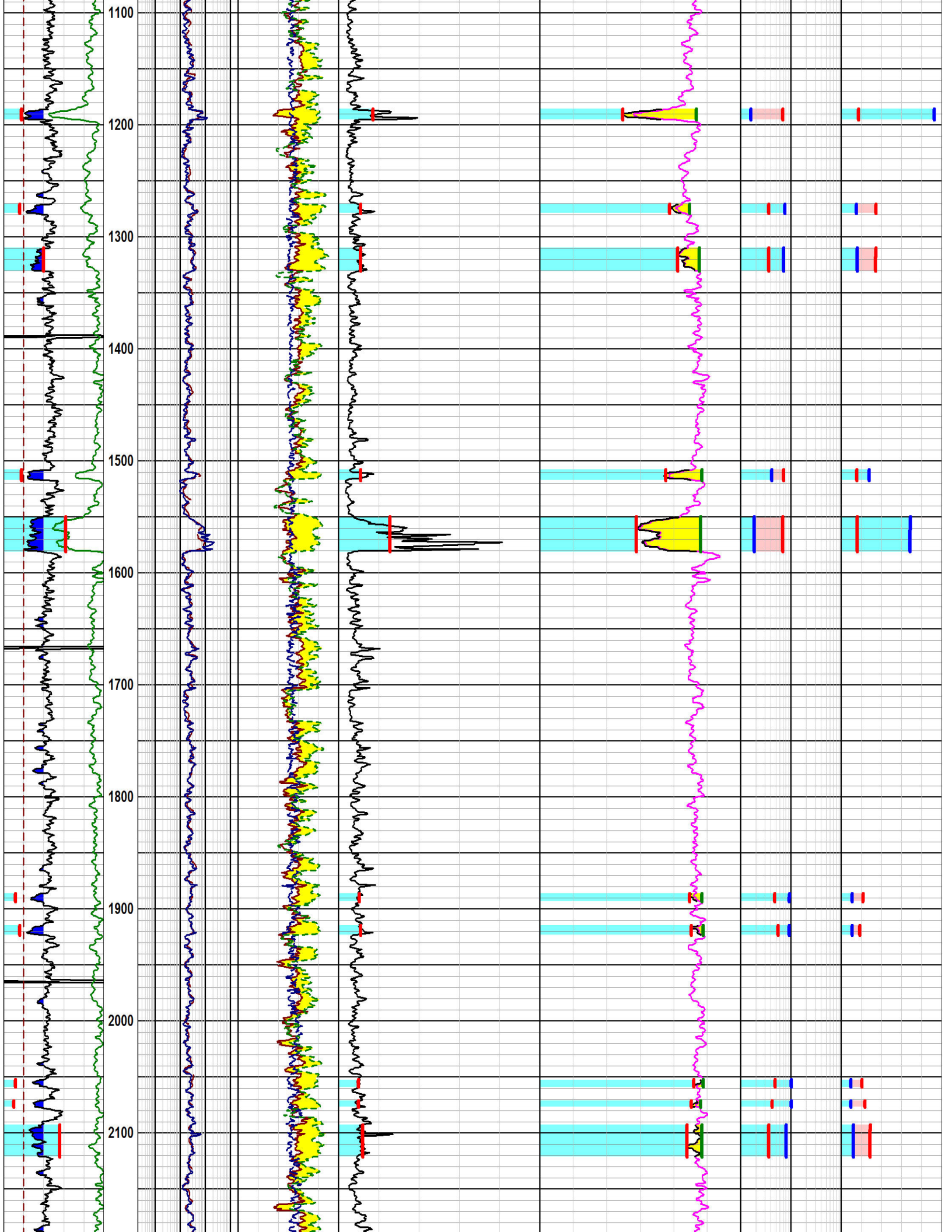
Well Name: VASSAR-HEATH RMV 21-28
Date: Tue, Jul 01, 2014
Township: TOWNSHIP API #: 0504506917000
Range: RANGE UWI: 0504506917000

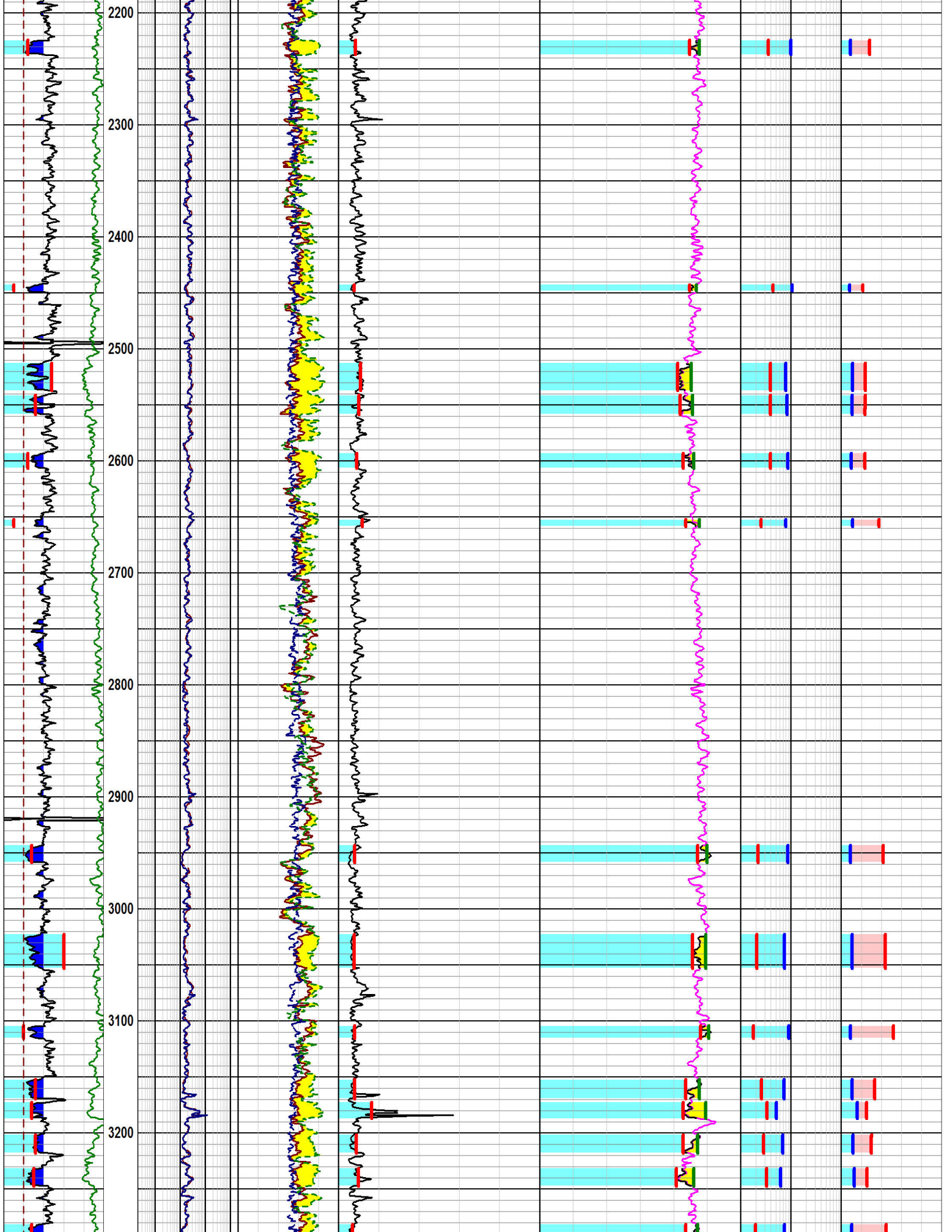


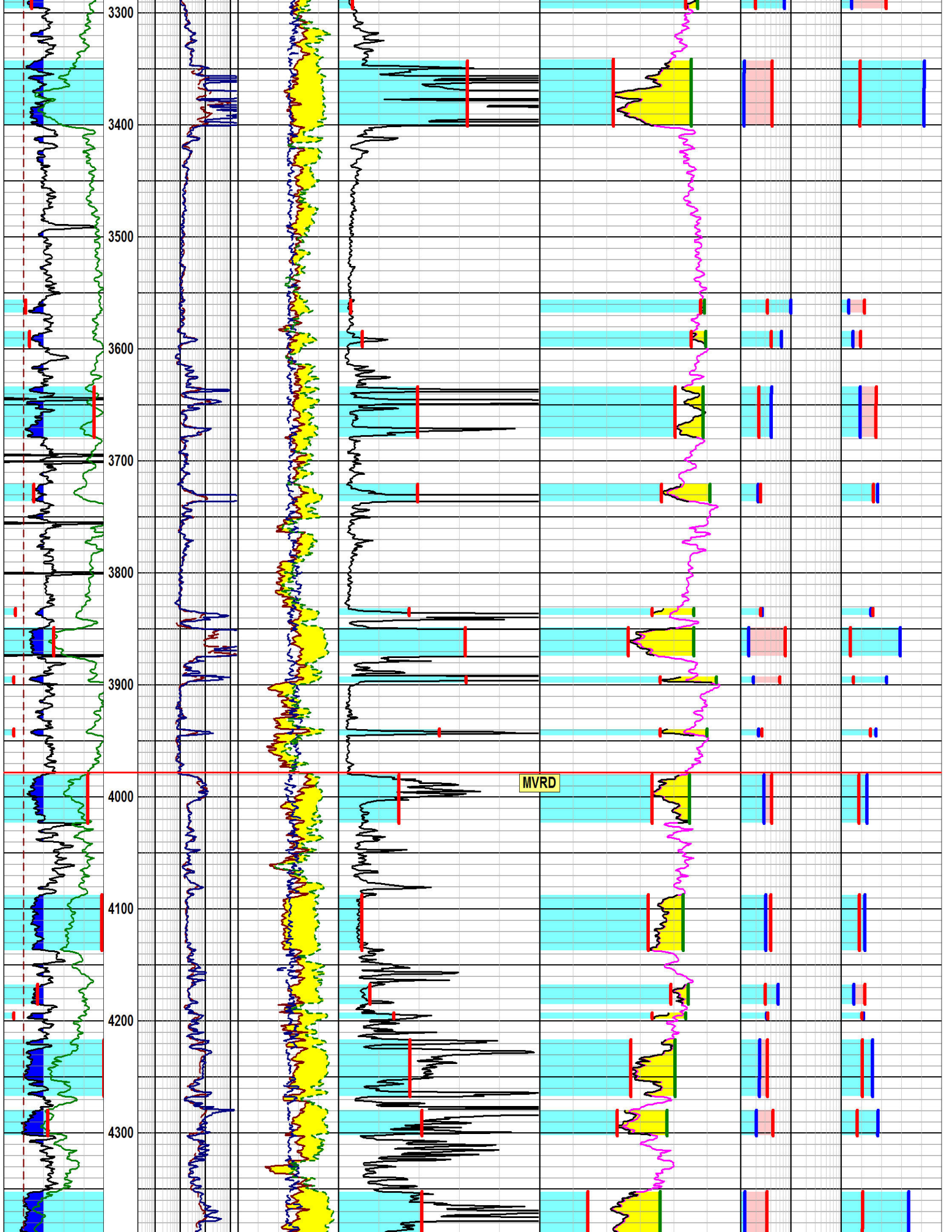
GR	Resistivities	RhoB	Ri/Rm	SP	Rw from SP	Salinity from SP
0 GAPI 200	Deep	2 G/CC 3	V/V	-125 mV 25	0.1 ohmm 100	ppm 50000
200 400	OHMM 2000	DRho	Average Ri/Rm	SP-5 Corrected SP	Archie Rw	Salinity from Archie
SP	Shallow	-0.75 G/CC 0.75	V/V	-125 mV 25	0.1 ohmm 100	ppm 50000
-100 mV 0	OHMM 2000	Neutron	Ave Ri/Rm	SP Clean		
Sand h		0.6 V/V 0		-125 mV 25		
0 F 50		Implied Gas Effect		SP Shale		
H				-125 mV 25		
Bit Size				Deflection		

1:1200 MD in ft

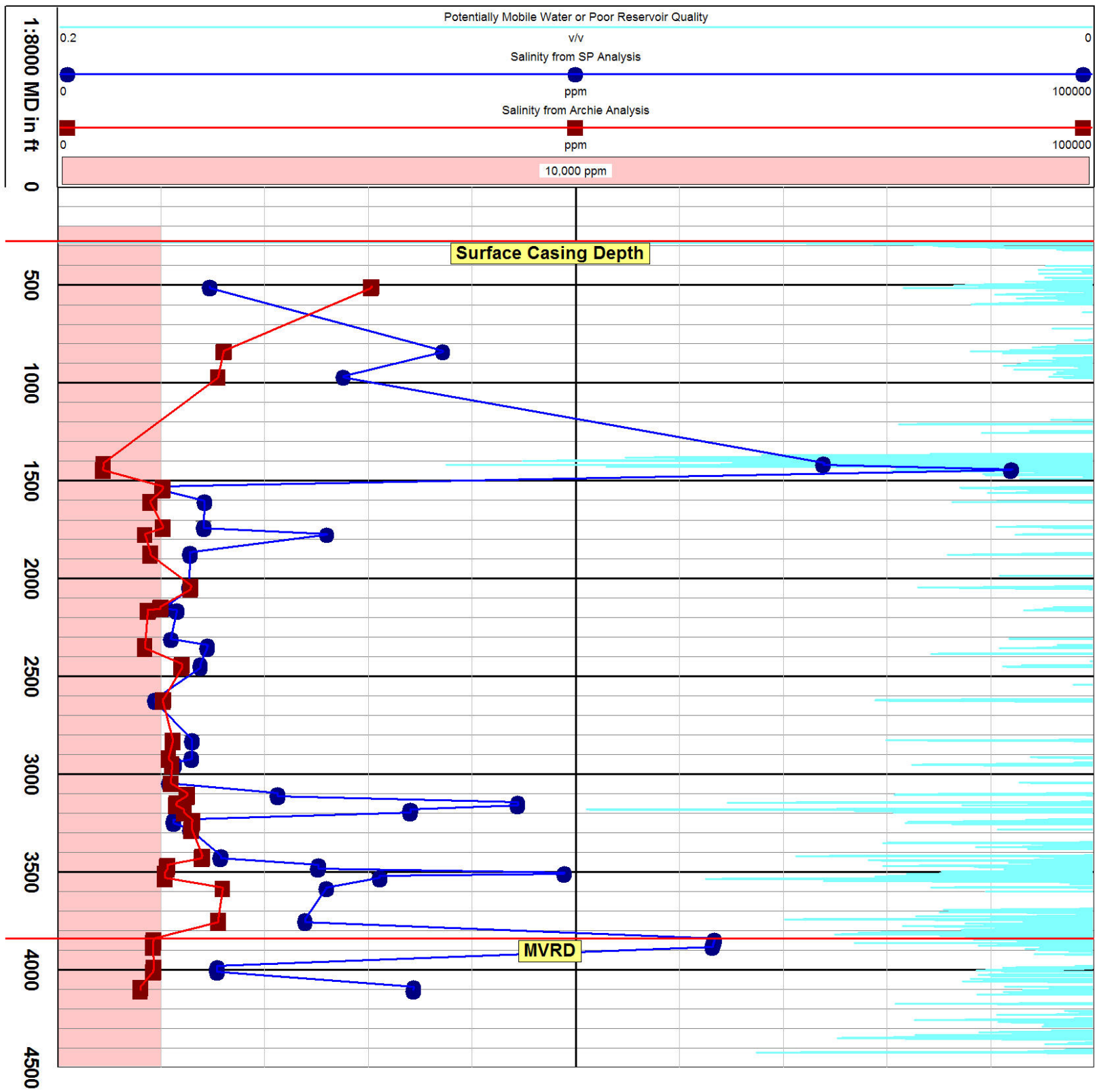














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File: 0504506957000 Clough RMV 29-27.lbs

Plot: C-Salinity from Archie vs. Salinity from SP

Gross Interval: 200 to 7160 by 0.5 F

Ranges: User Ranges

200-4500

Time: 01:40 PM

Section: SECTION

Location: LOCATION

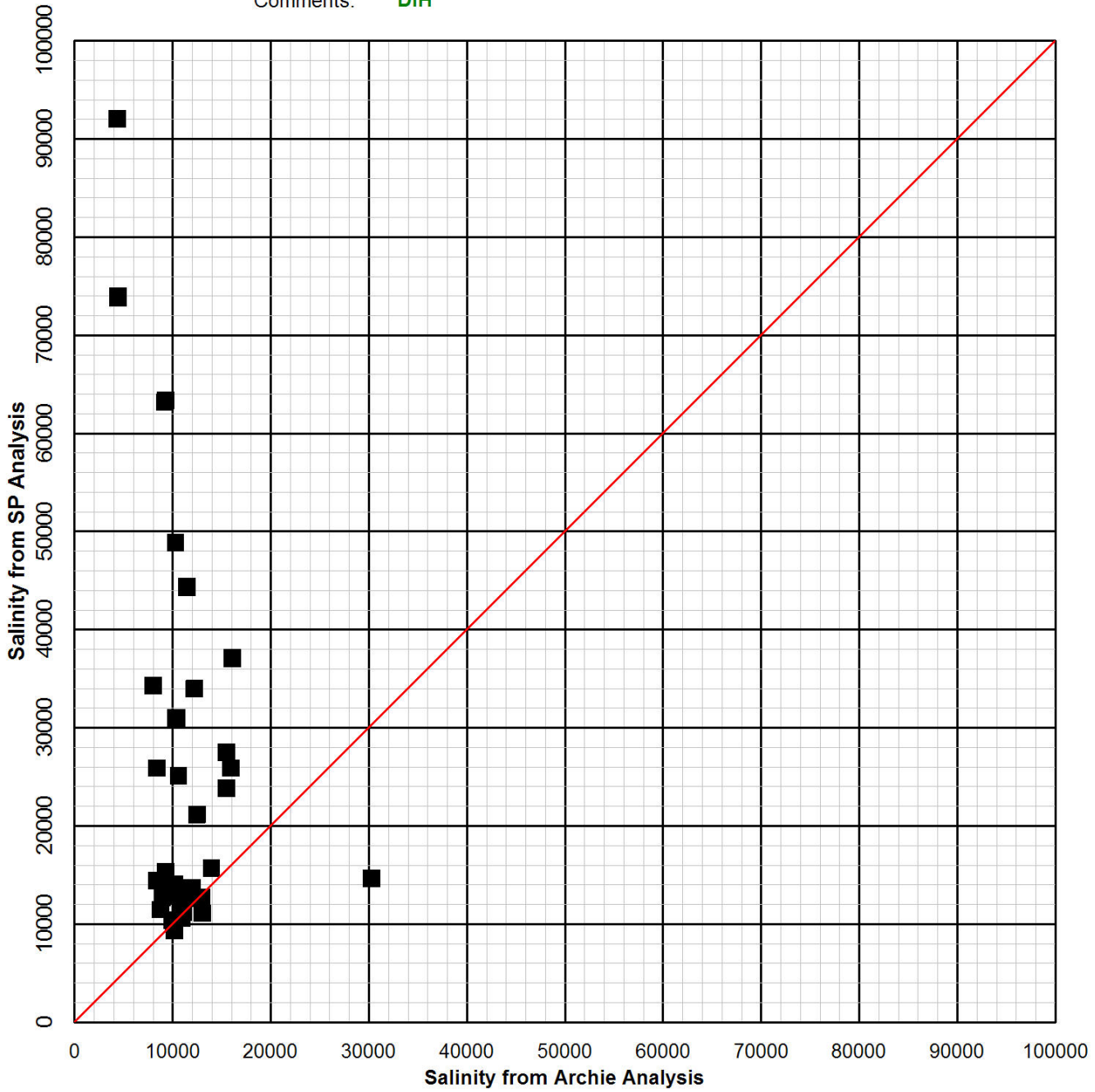
Comments: DIH

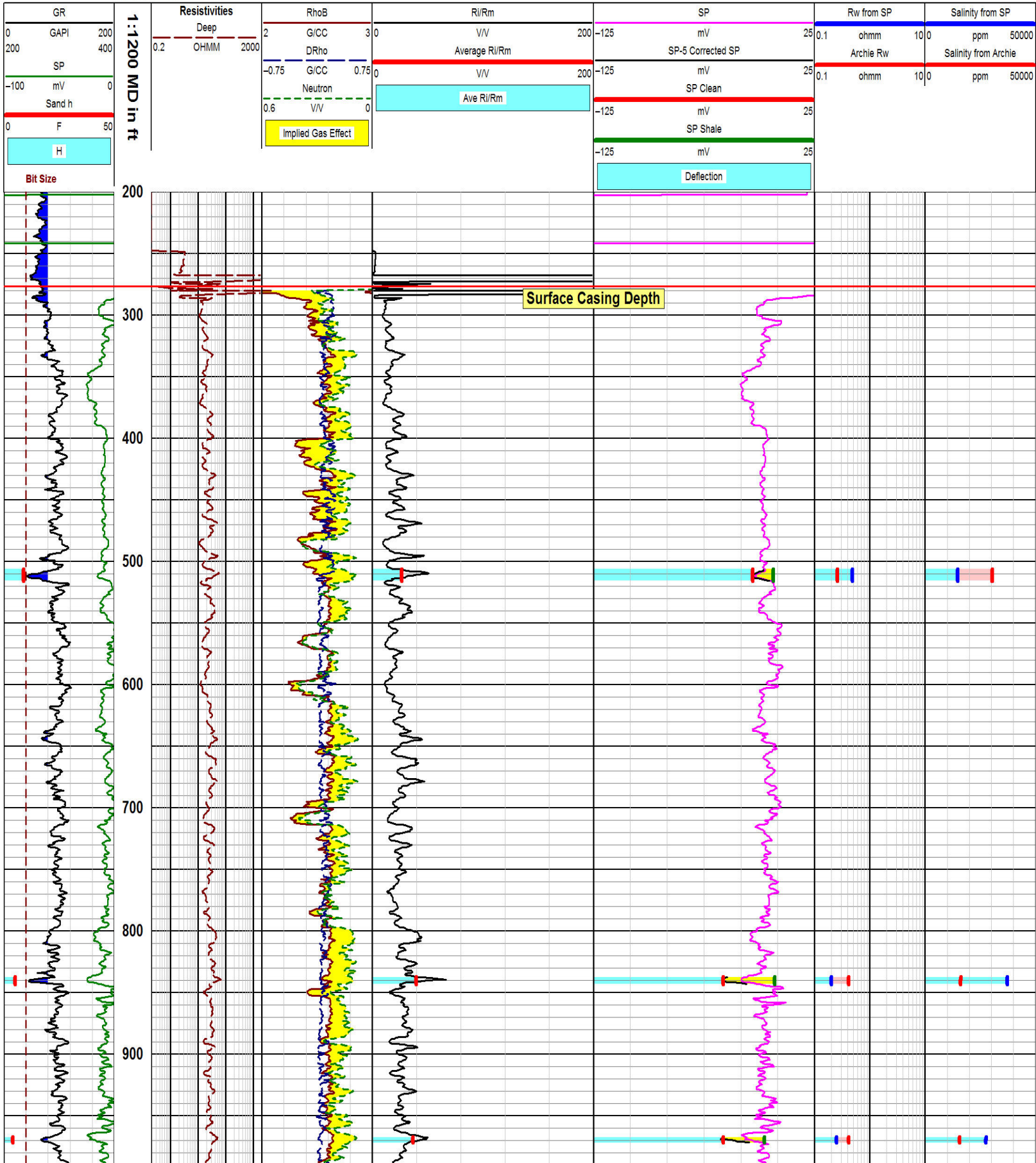
Well Name: CLOUGH RMV 29-27

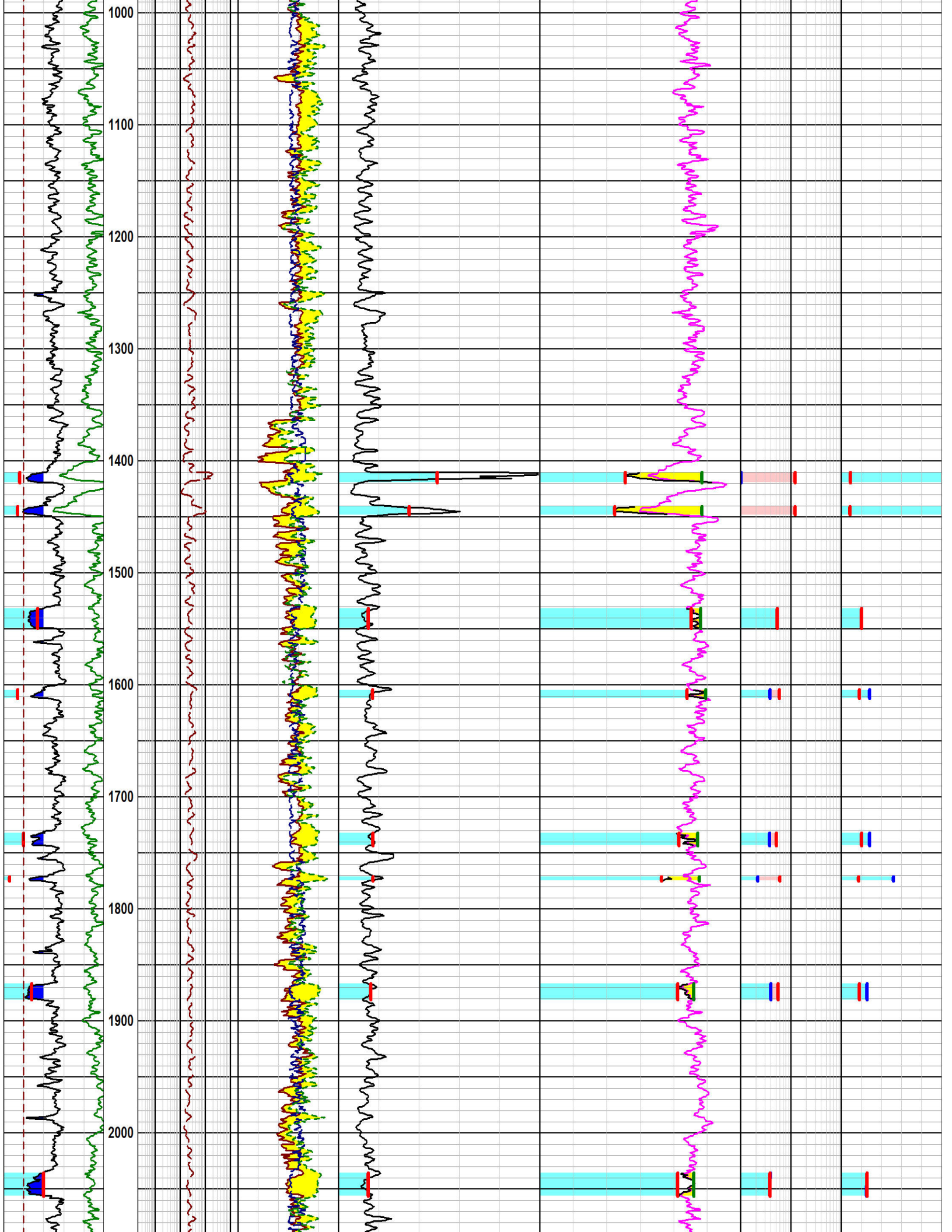
Date: Tue, Jul 01, 2014

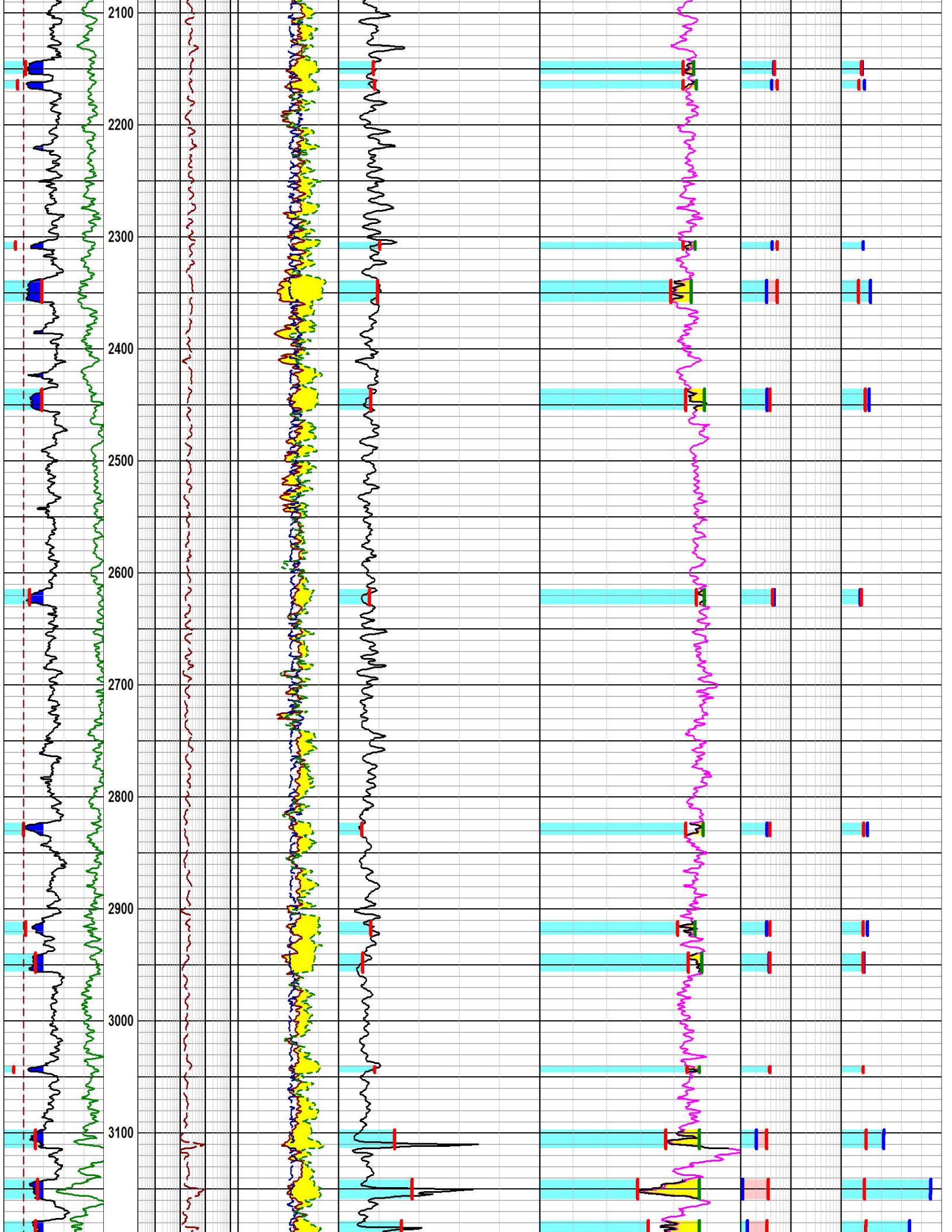
Township: TOWNSHIP API #: 0504506957000

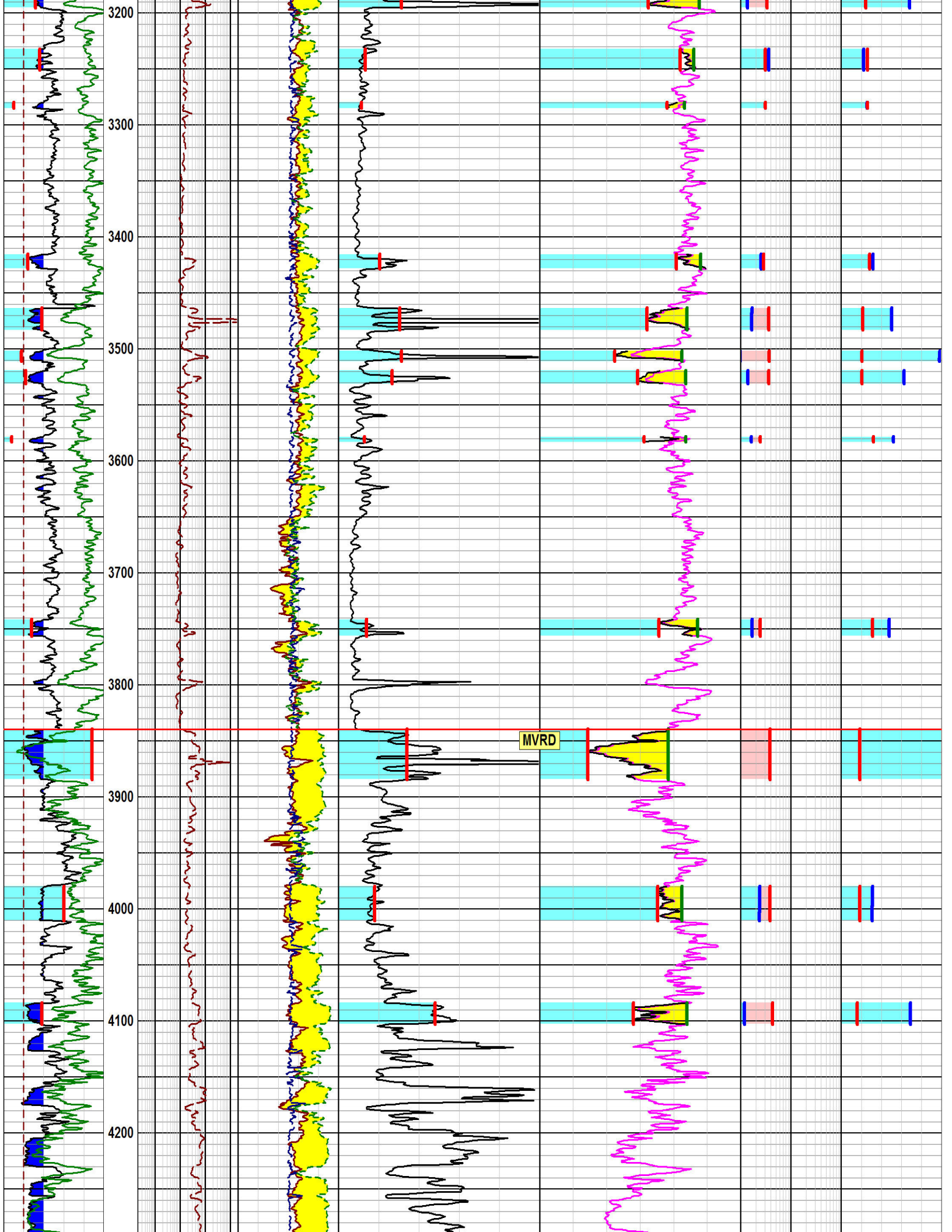
Range: RANGE UWI: 0504506957000









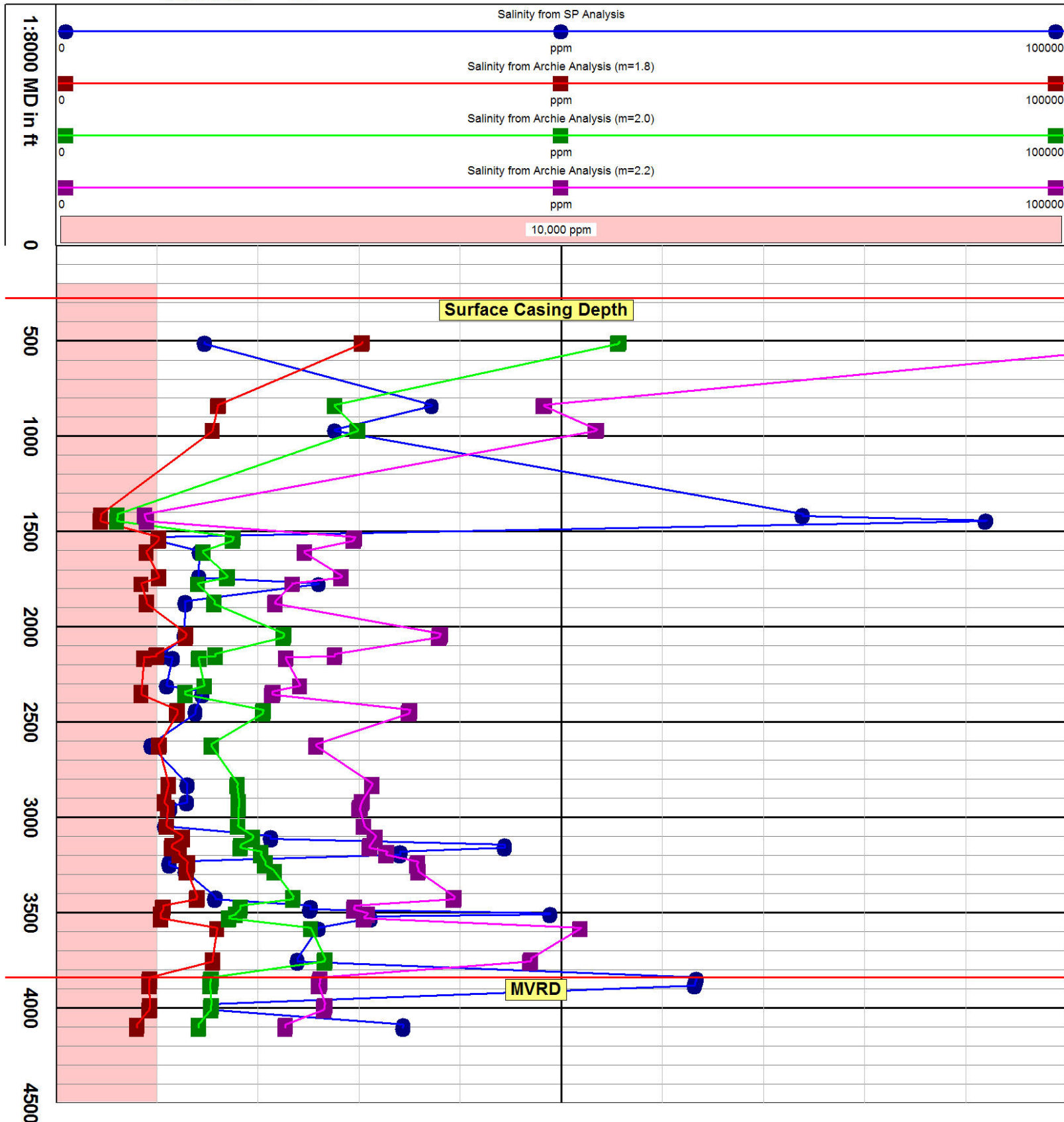


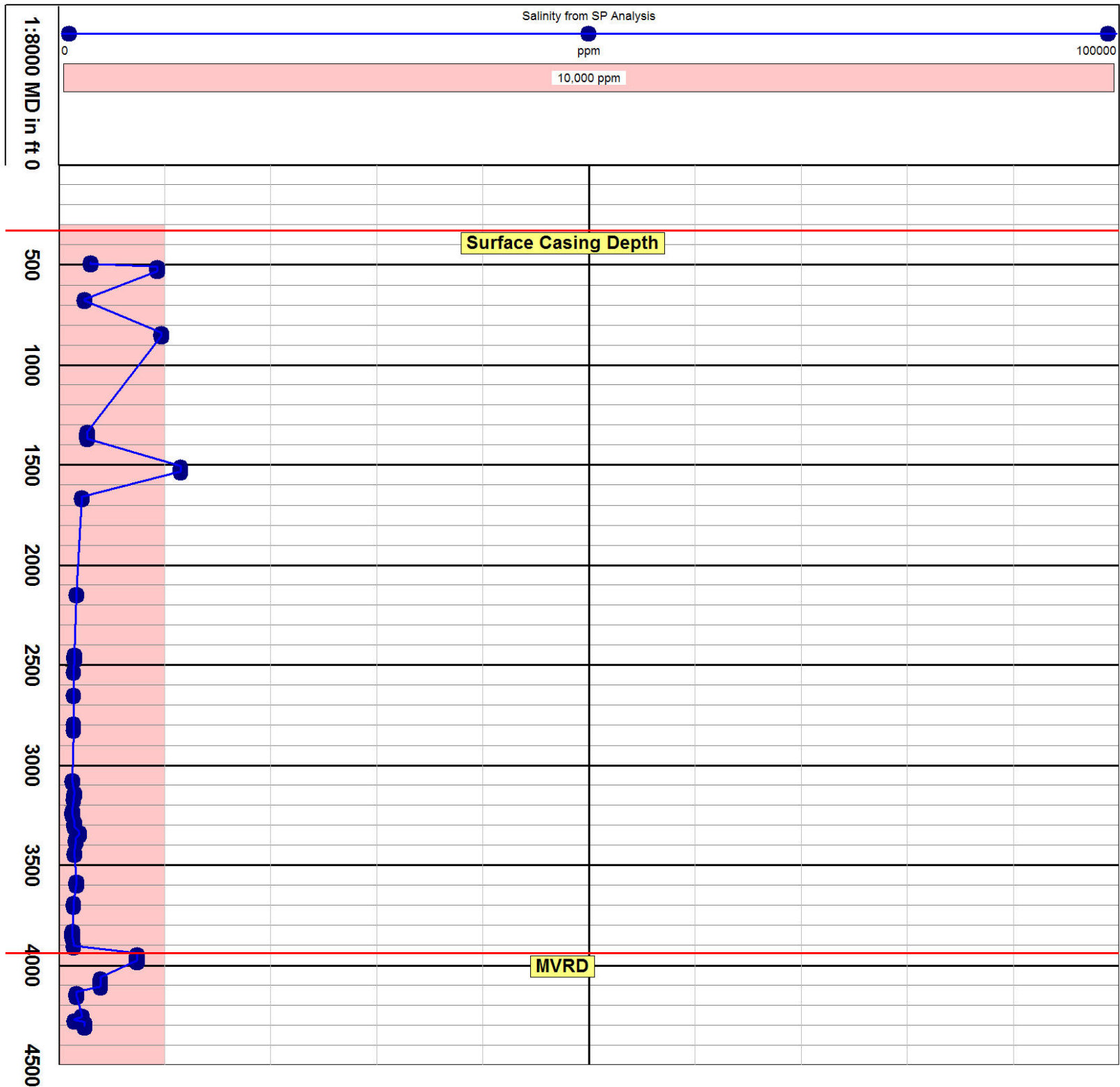


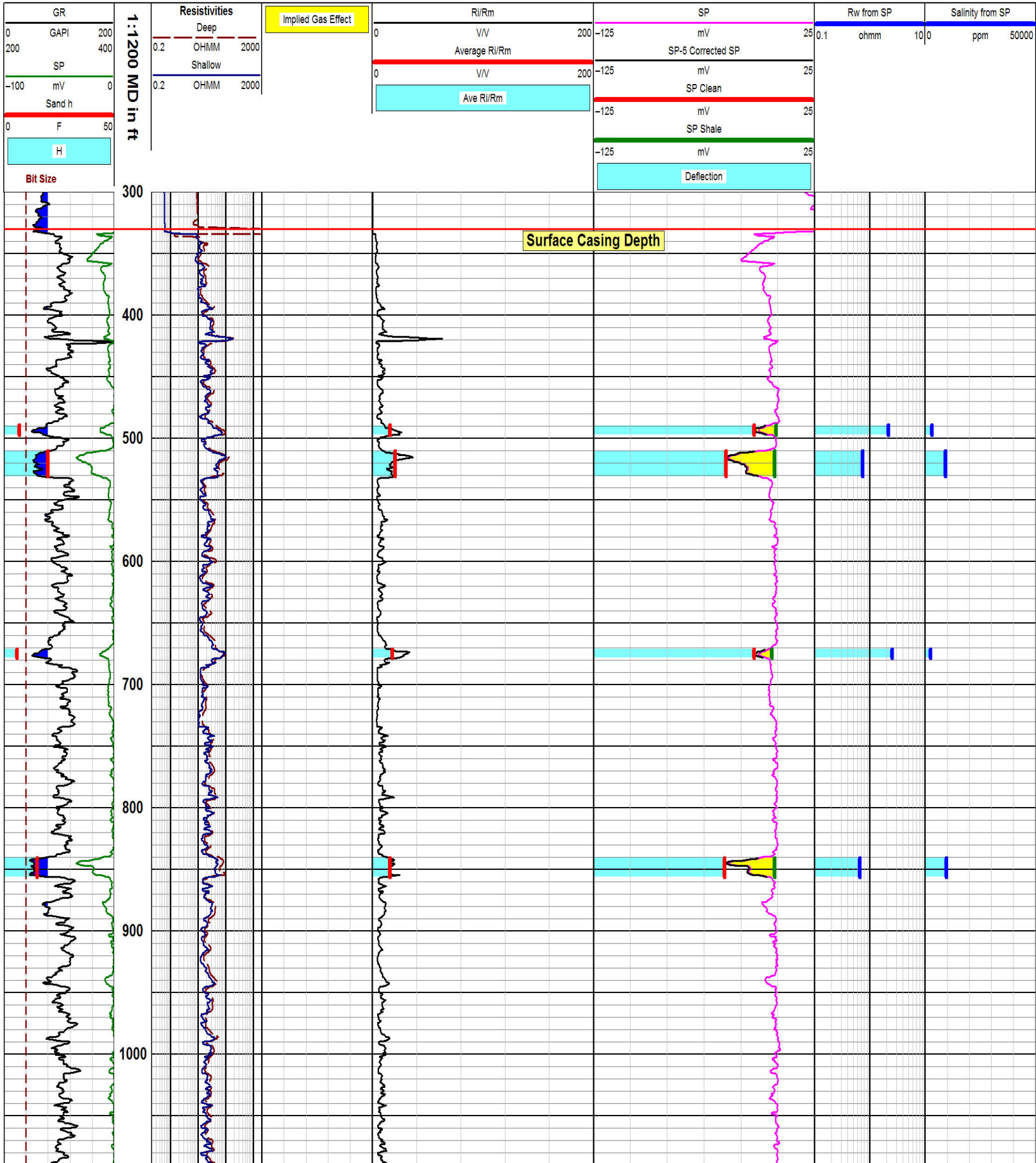
Gross Interval: 200 to 7160 by 0.5 F
Ranges: User Ranges

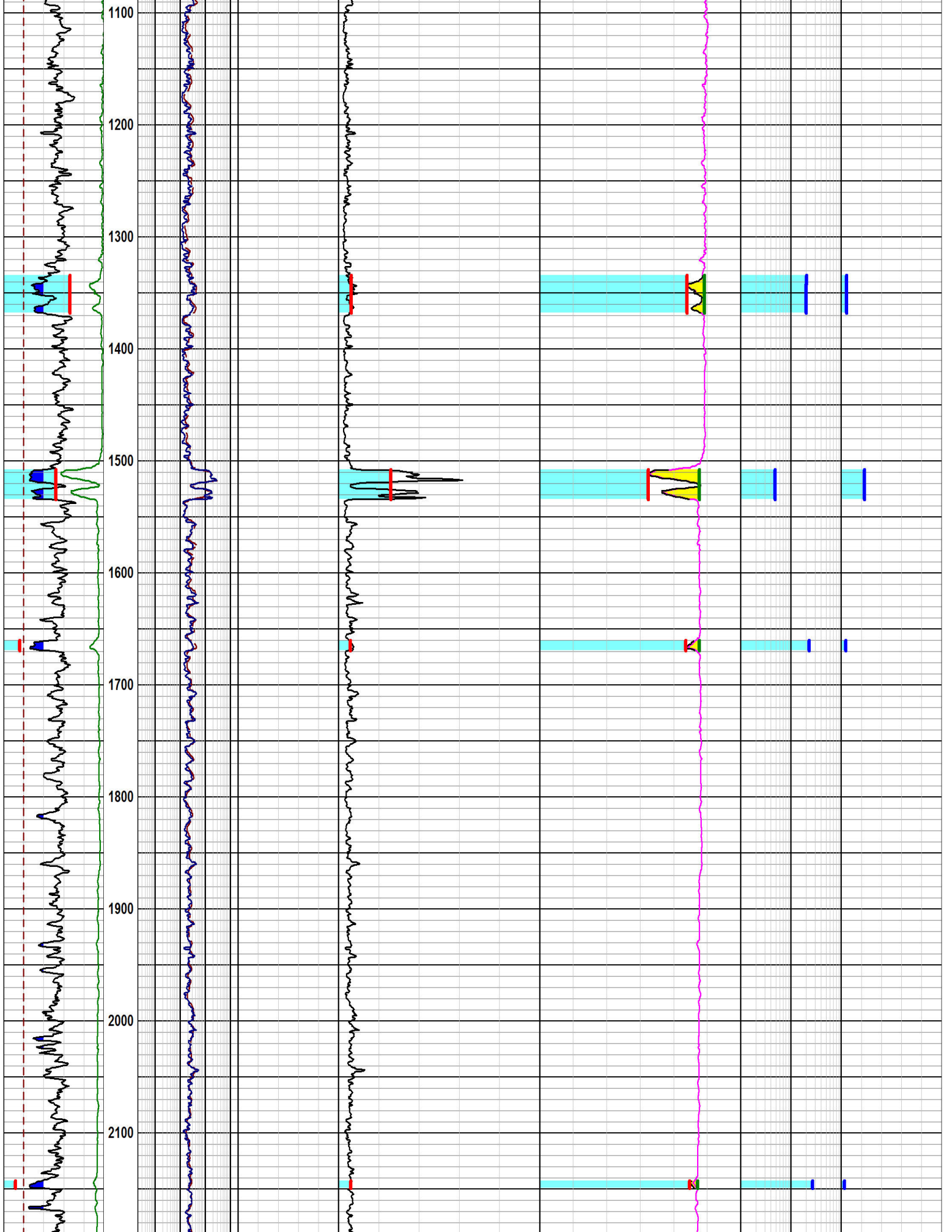
200-4500
Time: 01:16 PM
Section: SECTION
Location: LOCATION
Comments: DIH

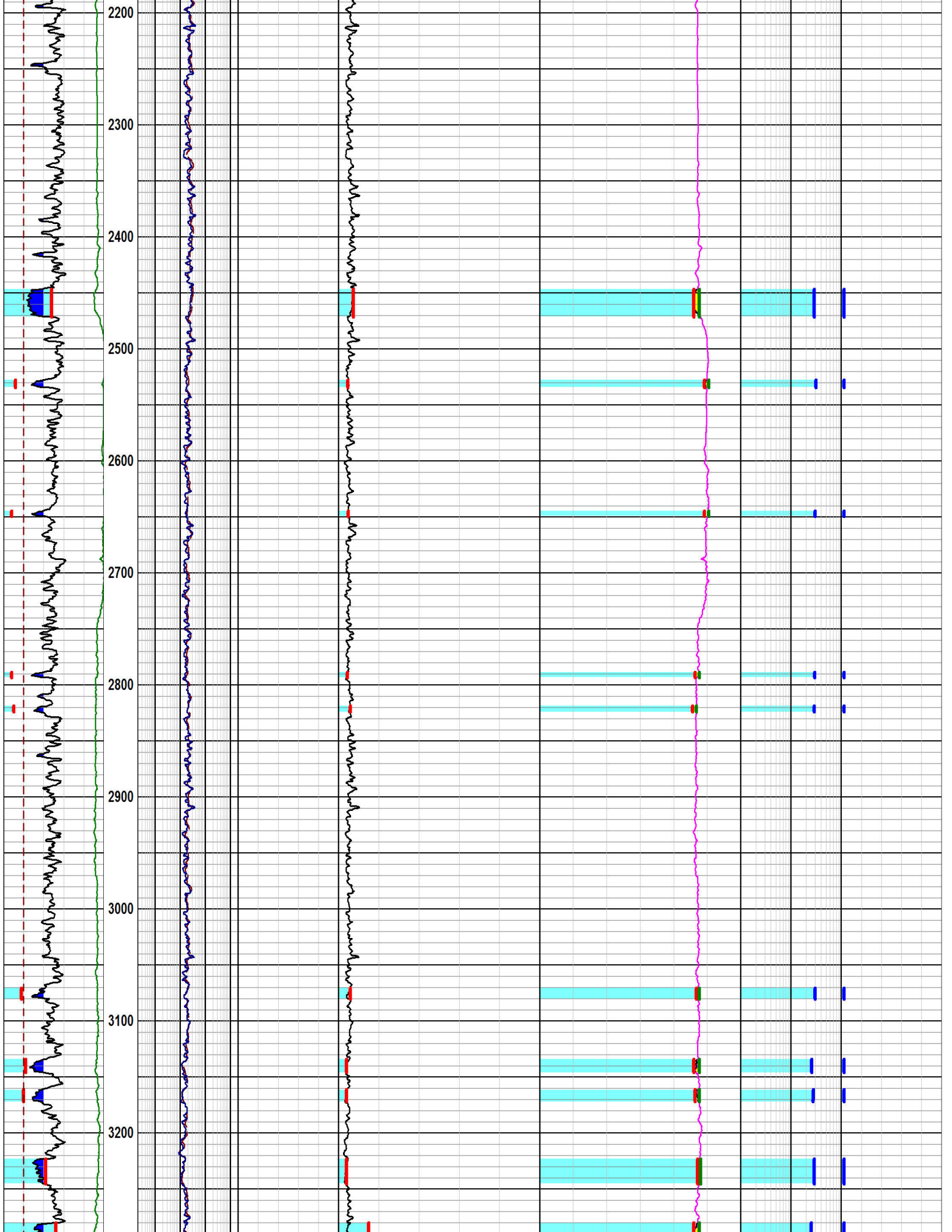
Date: Tue, Jul 01, 2014
Township: TOWNSHIP API #: 05045069570000
Range: RANGE UWI: 05045069570000

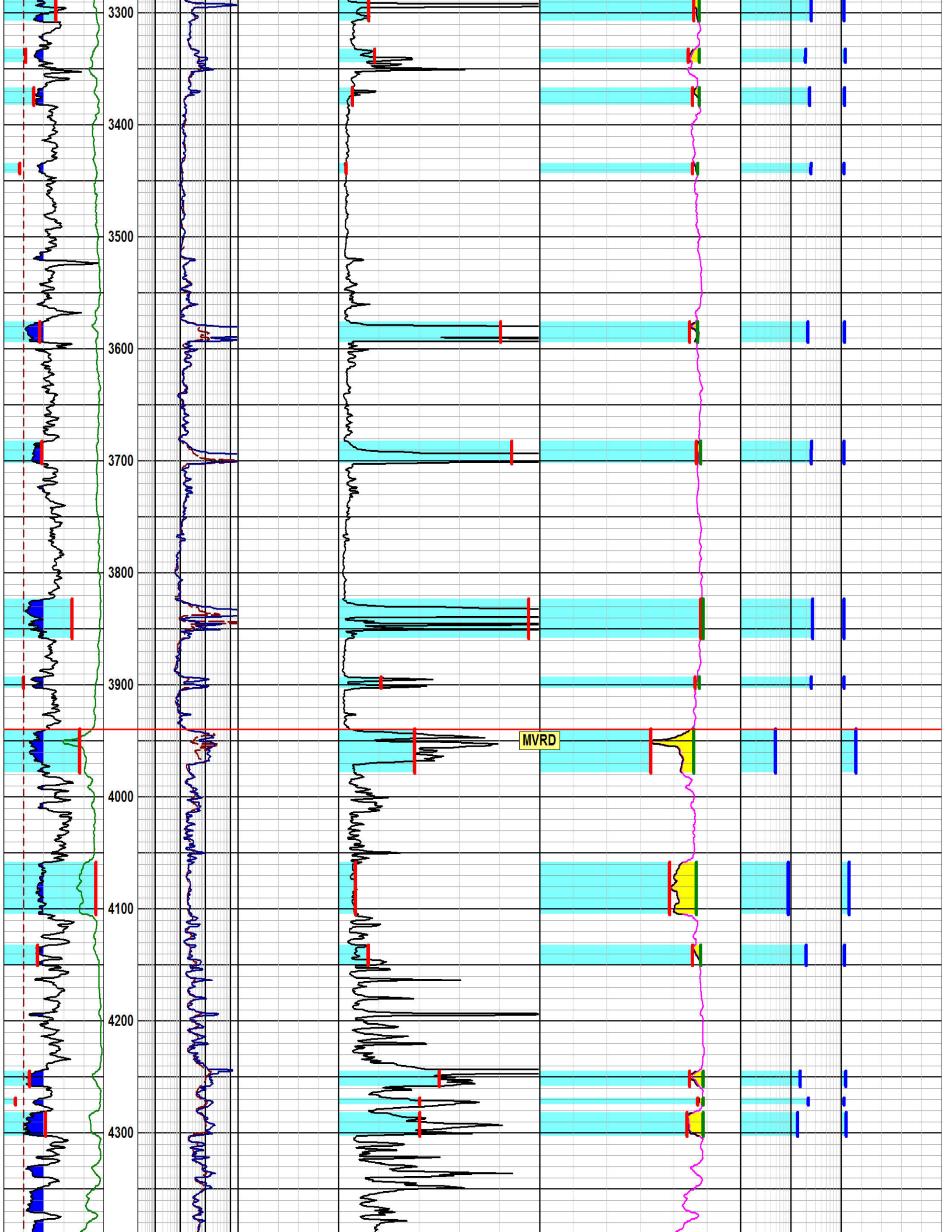


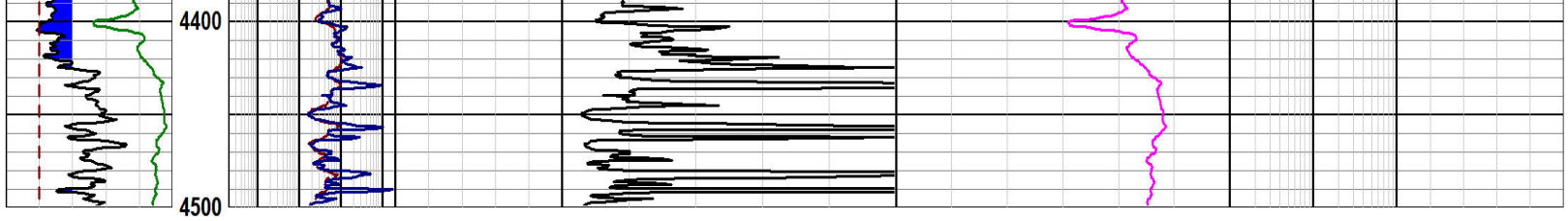


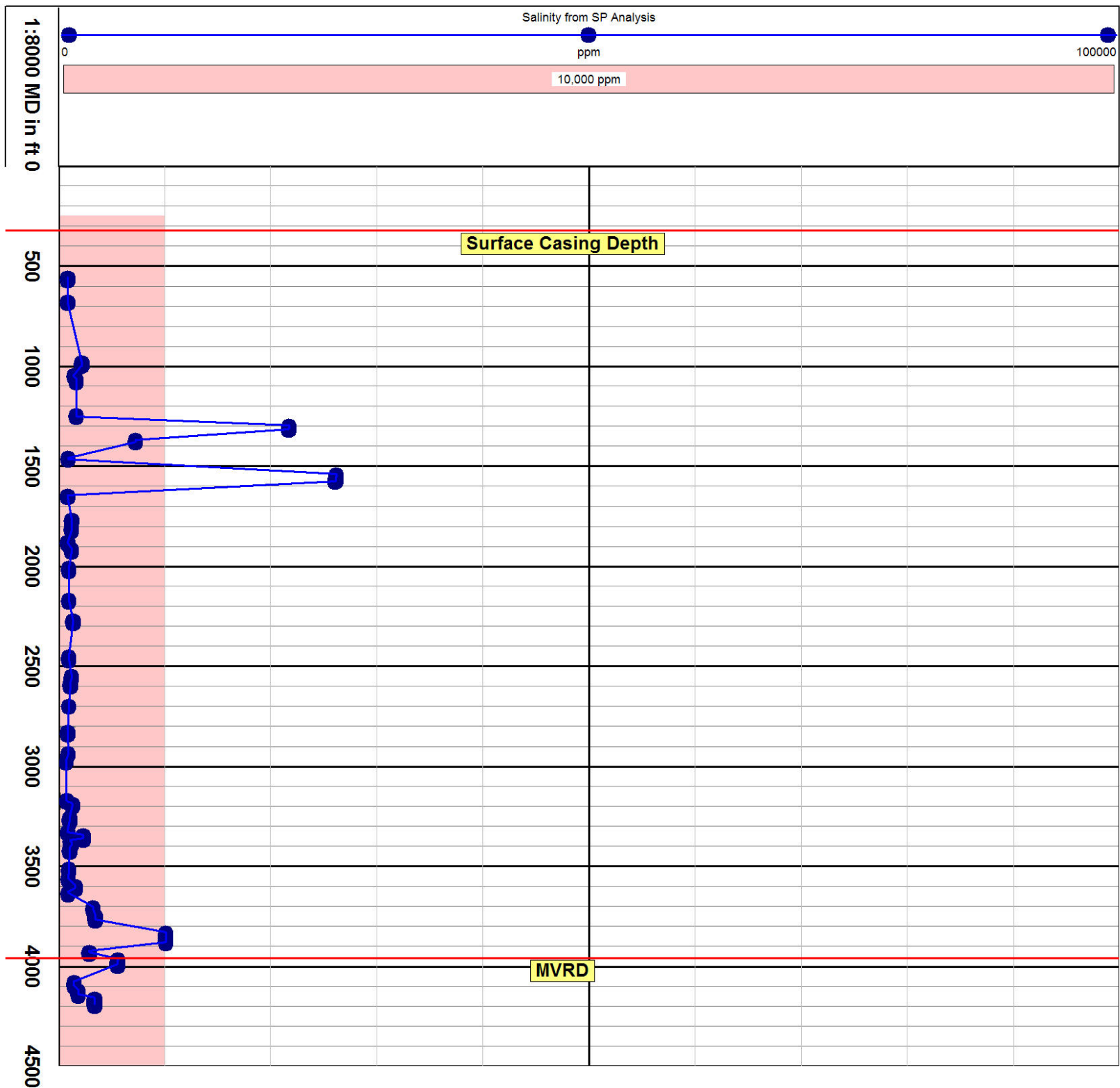




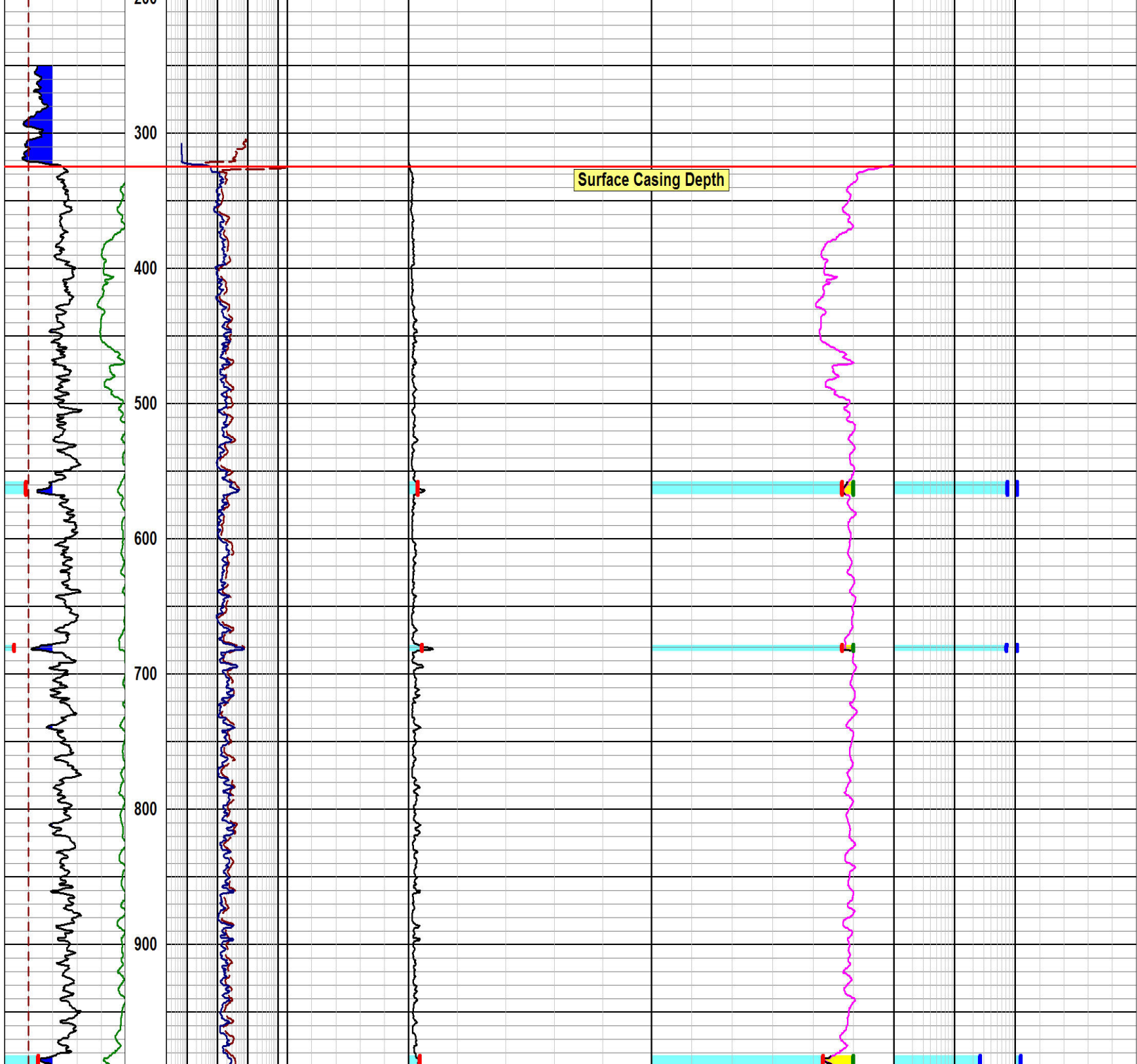


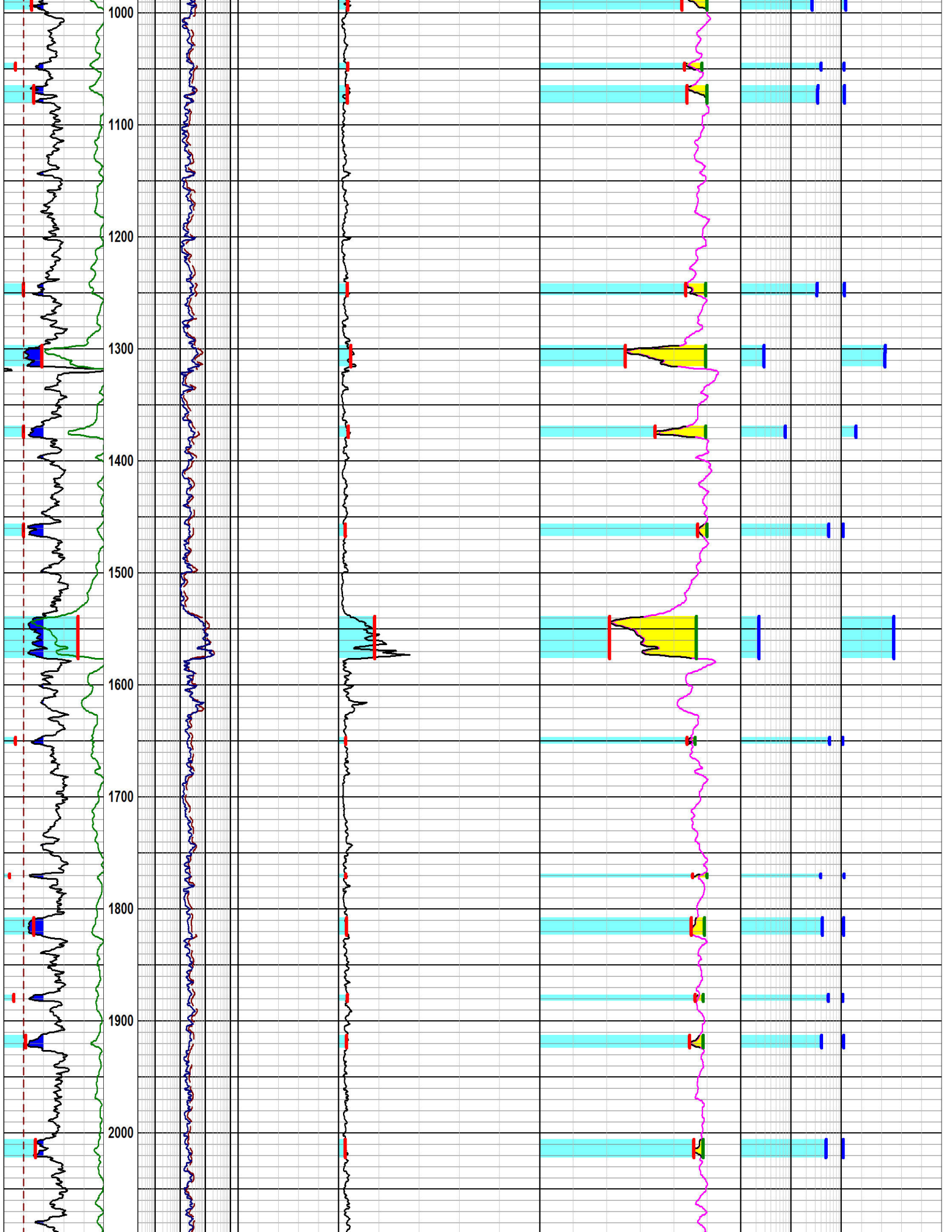


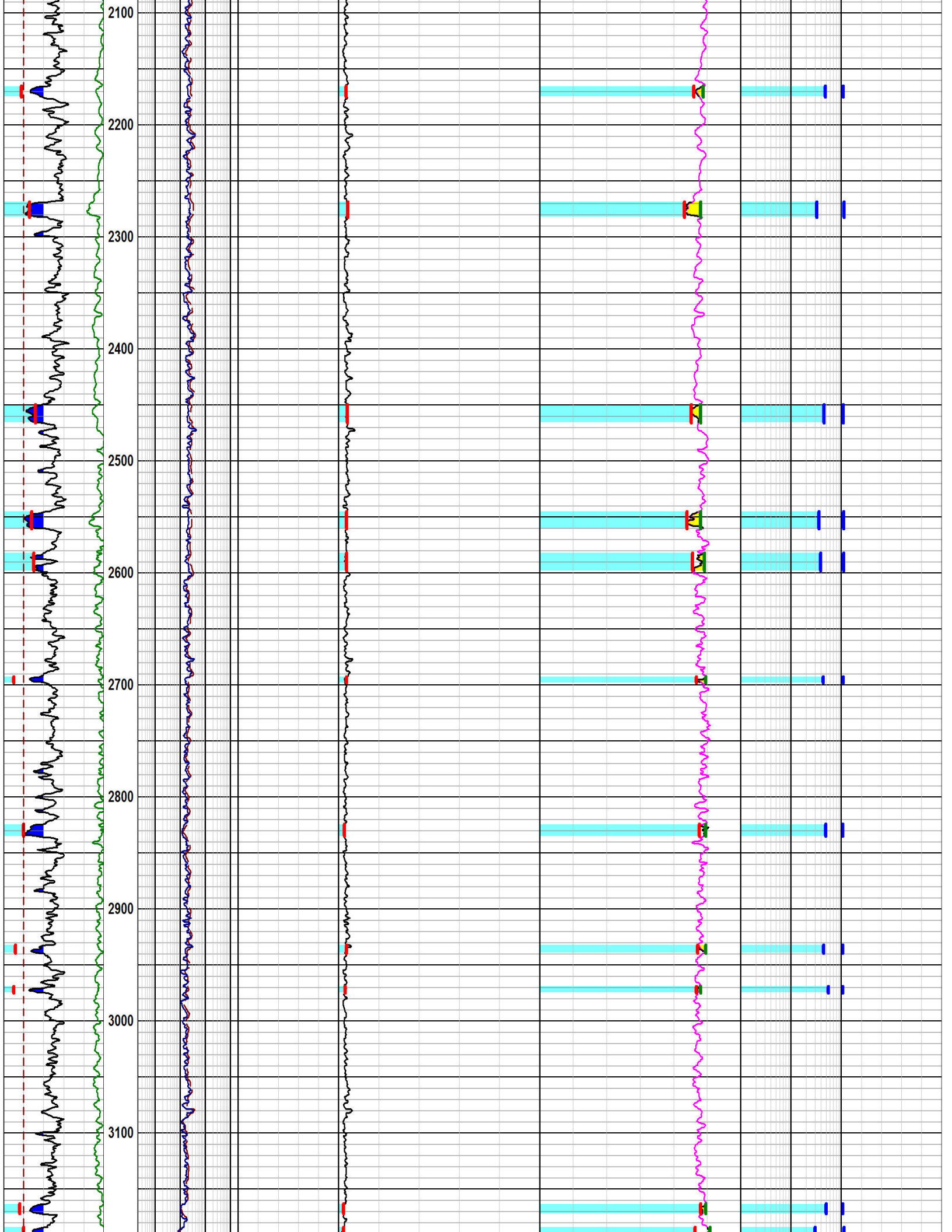


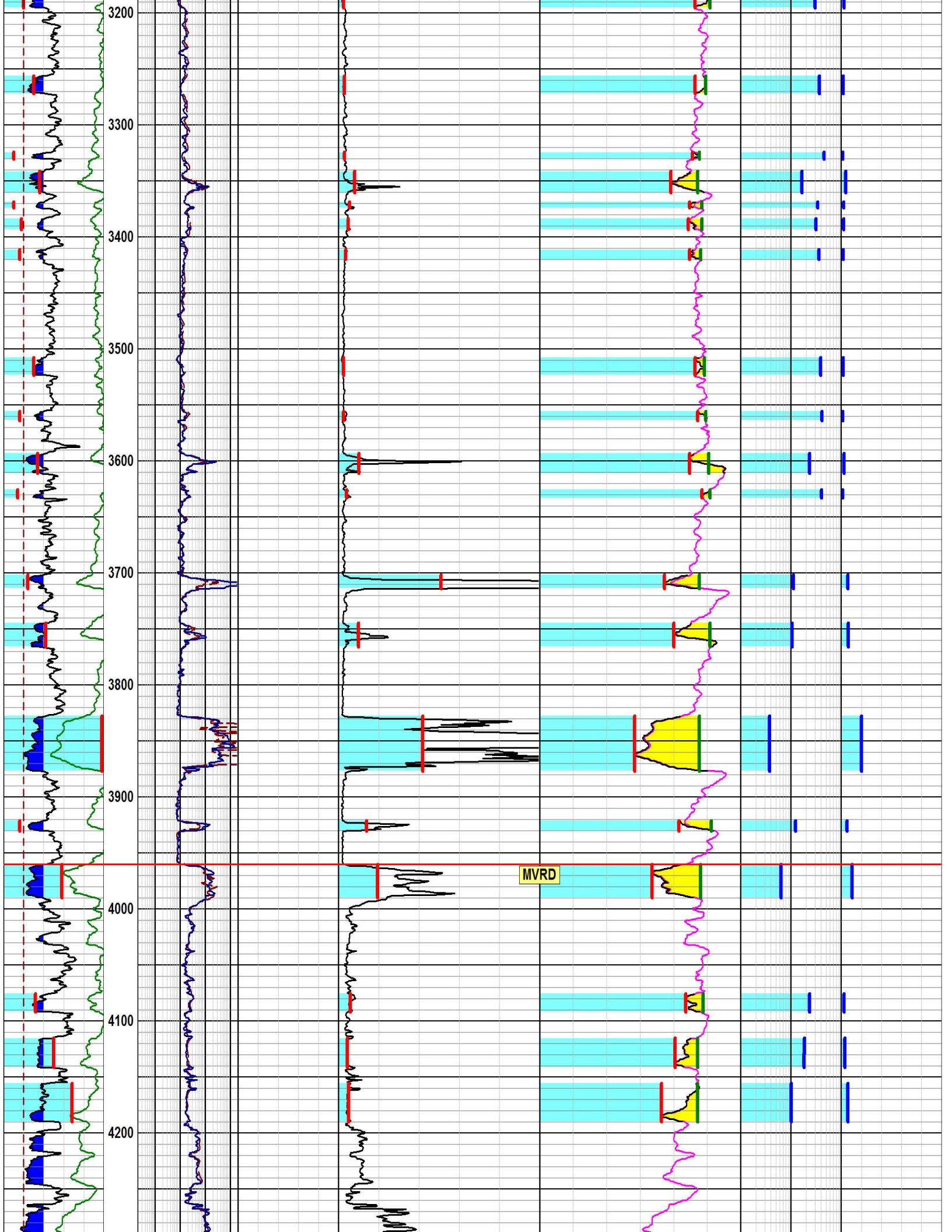


GR	Resistivities	RhoB	Ri/Rm	SP	Rw from SP	Salinity from SP
0 GAPI 200	Deep	2 G/C3 3	V/V	-125 mV	0.1 ohmm 100	ppm 50000
200	0.2 OHMM 2000	DRho	Average Ri/Rm	SP-5 Corrected SP		
SP	Shallow	-0.75 G/C3 0.75	V/V	-125 mV		
-100 mV 0	0.2 OHMM 2000	Implied Gas Effect	Ave Ri/Rm	SP Clean		
Sand h				-125 mV		
0 F 50				SP Shale		
H				-125 mV		
Bit Size				Deflection		

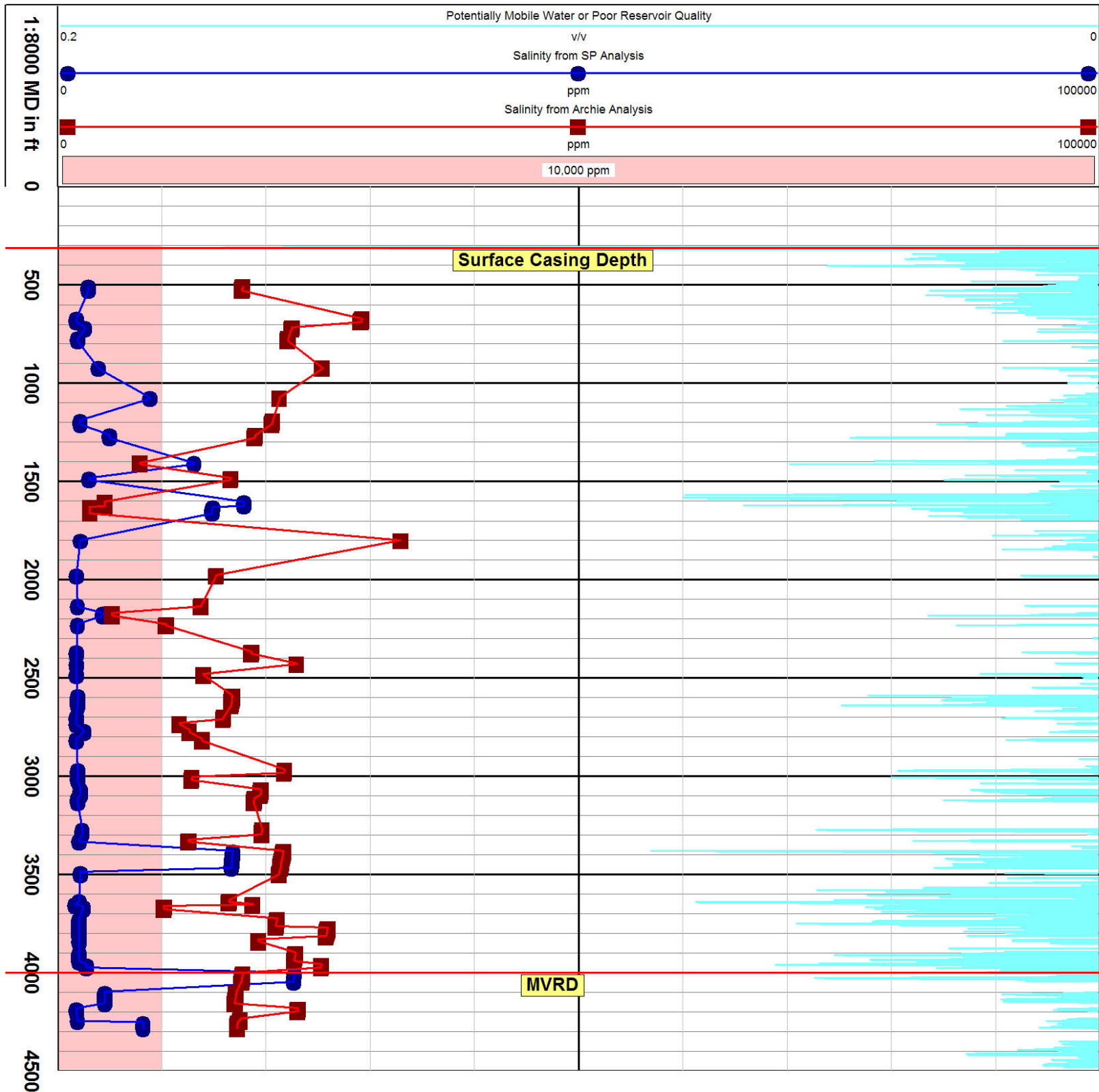














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File: 0504506960000 Savage RMV 35-28.lbs

Plot: Salinity from Archie vs. Salinity from SP

Gross Interval: 300 to 7240 by 0.5 F

Ranges: User Ranges
300-4500

Time: 01:40 PM

Section: SECTION

Location: LOCATION

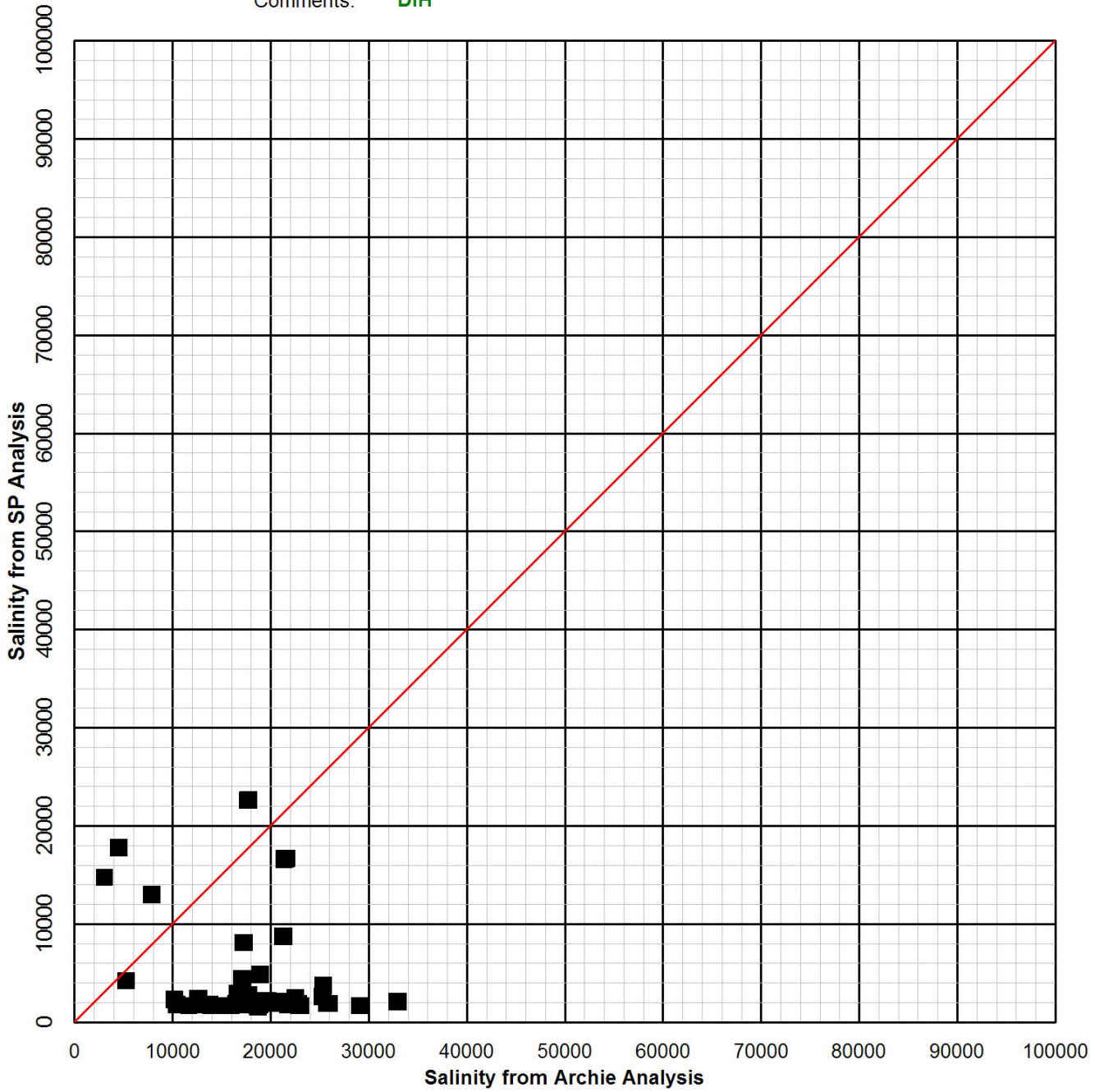
Comments: DIH

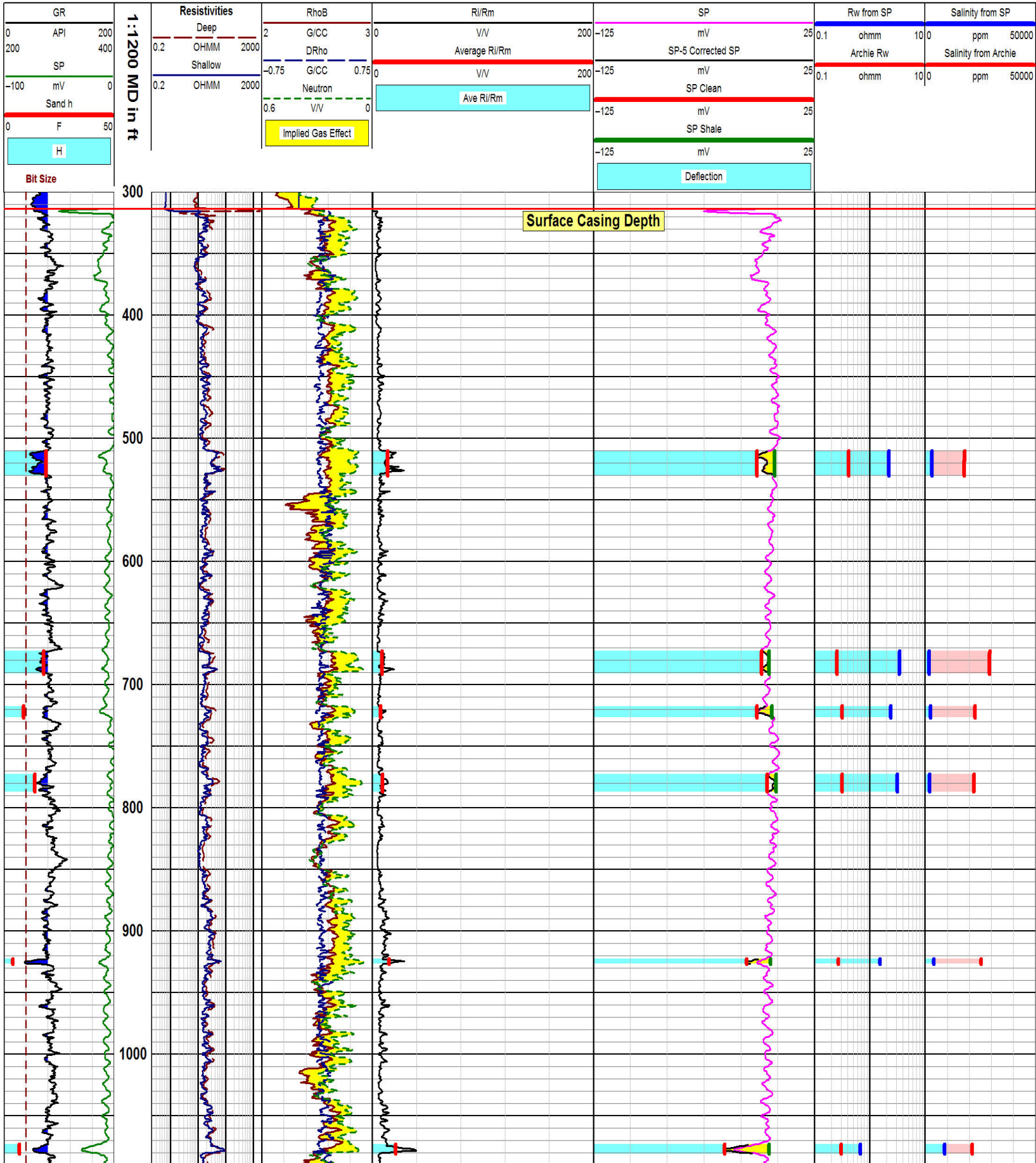
Well Name: SAVAGE RMV 35-28

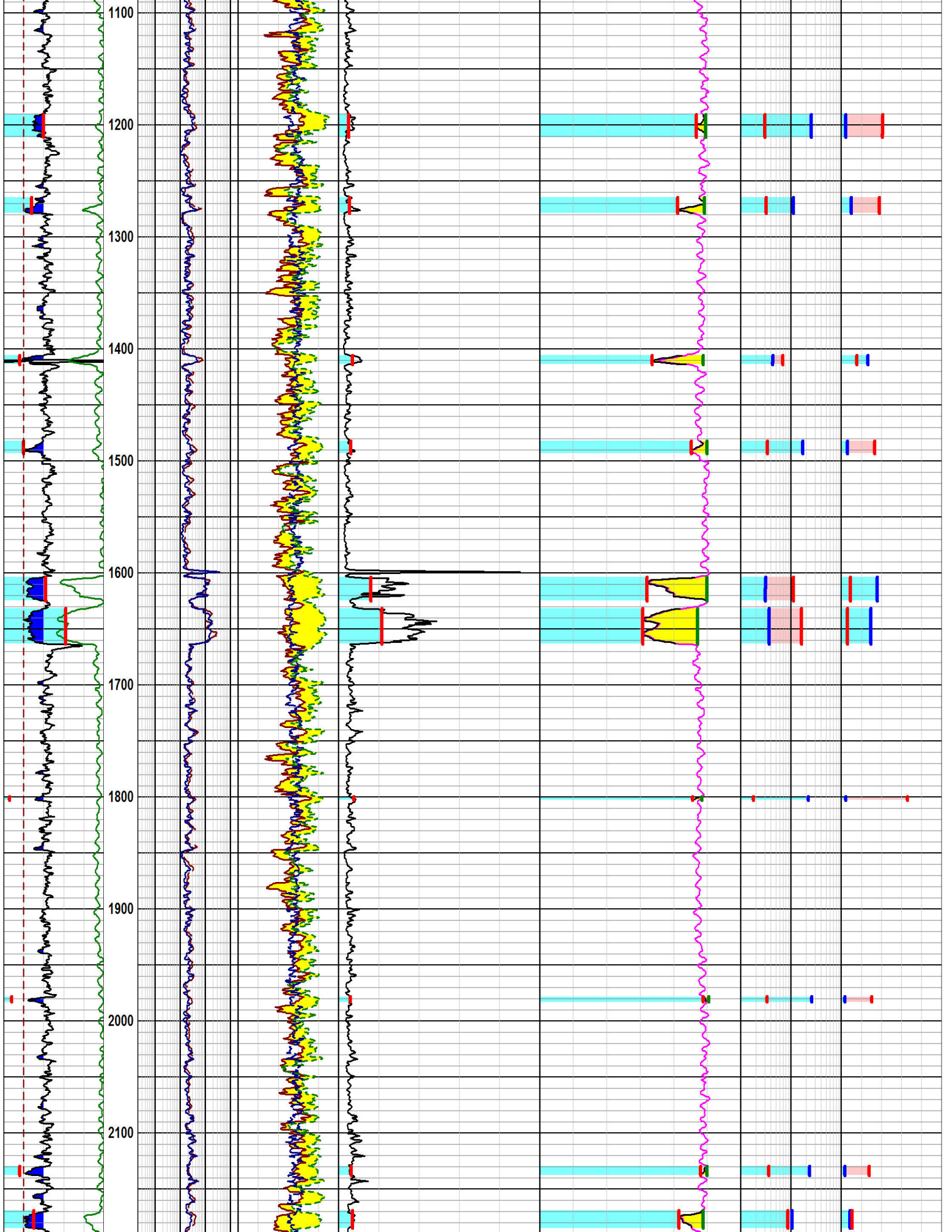
Date: Tue, Jul 01, 2014

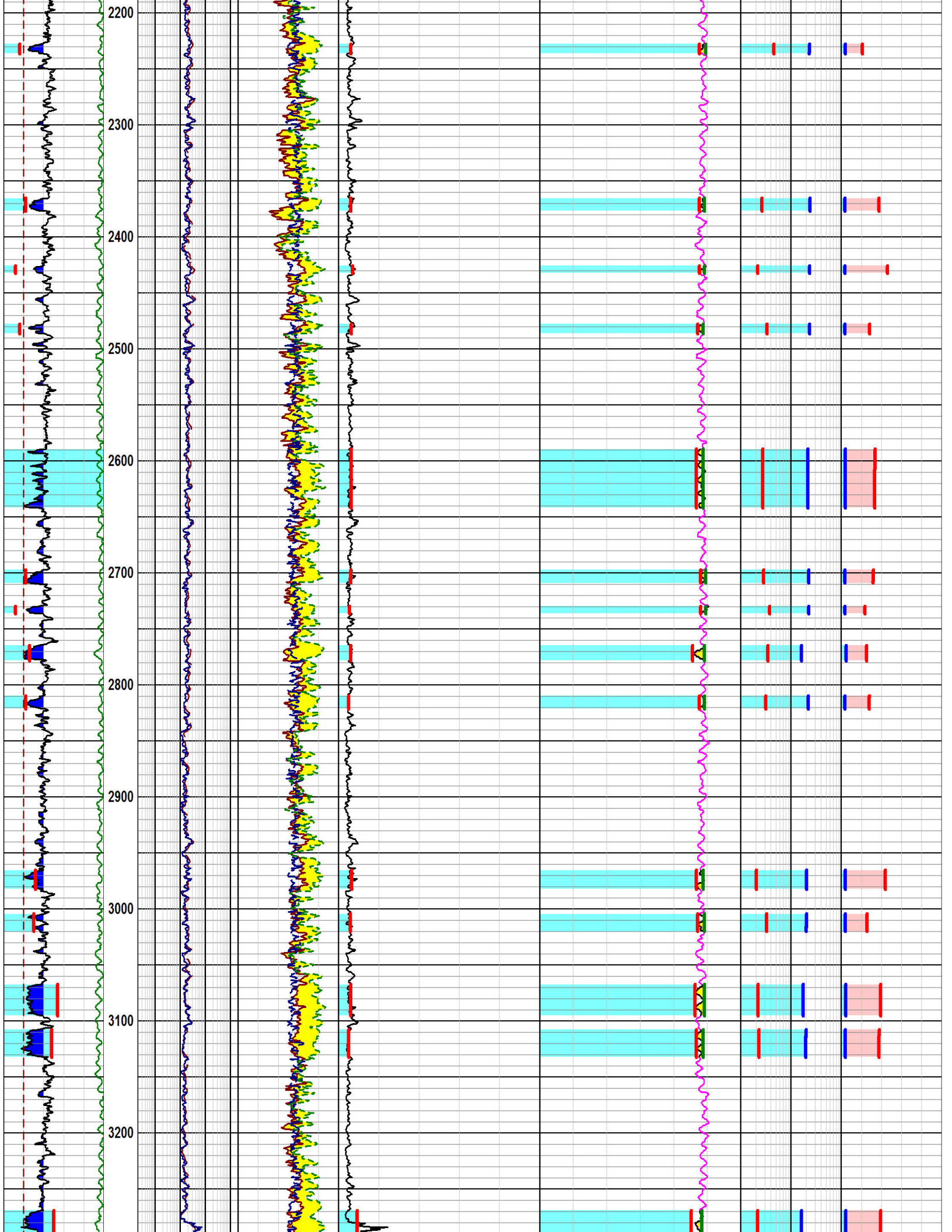
Township: TOWNSHIP API #: 0504506960000

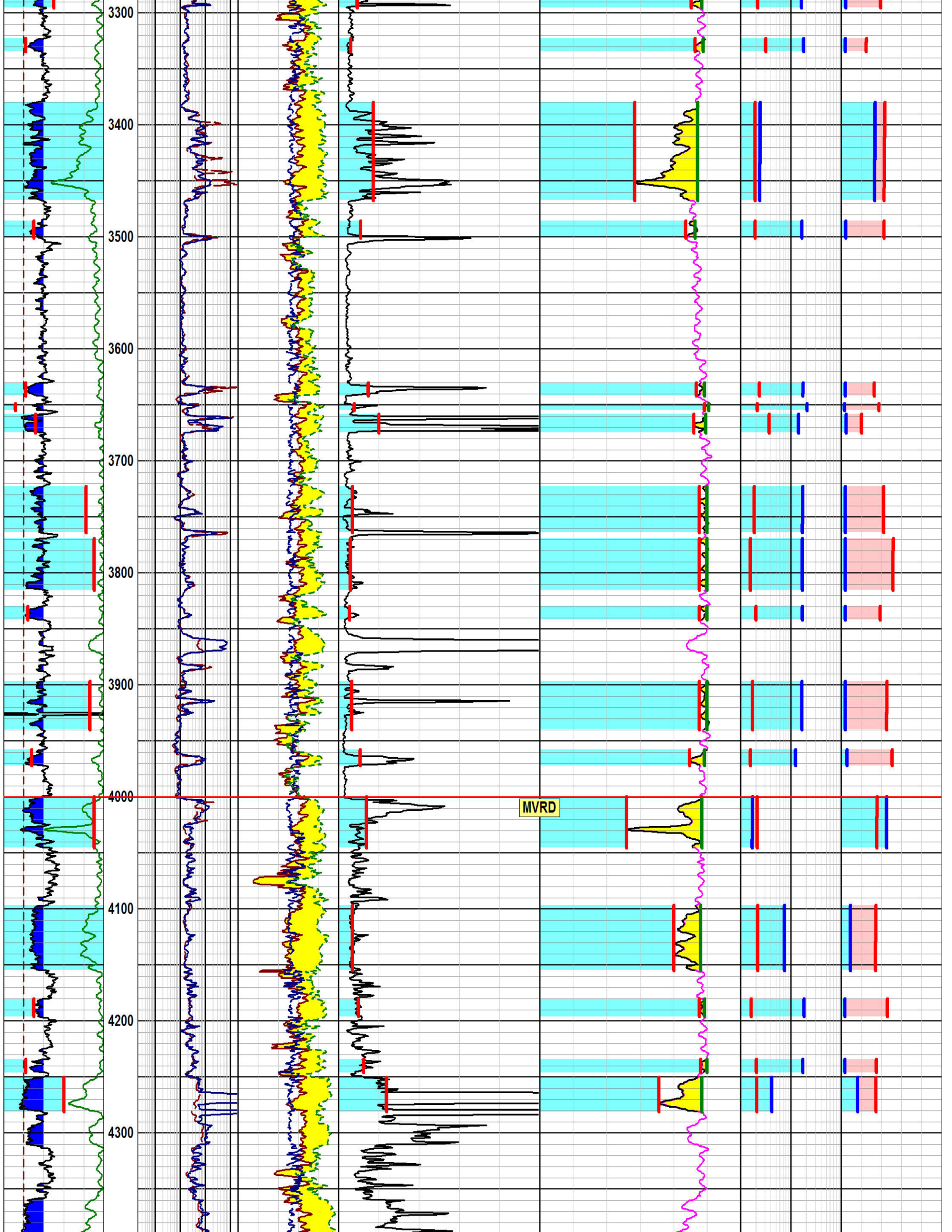
Range: RANGE UWI: 0504506960000

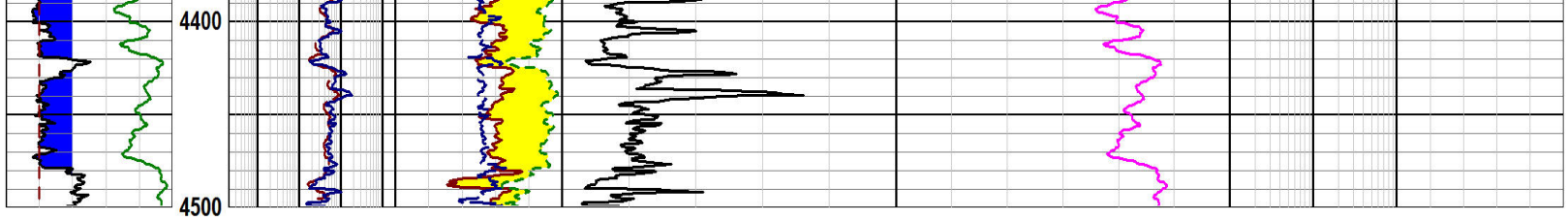


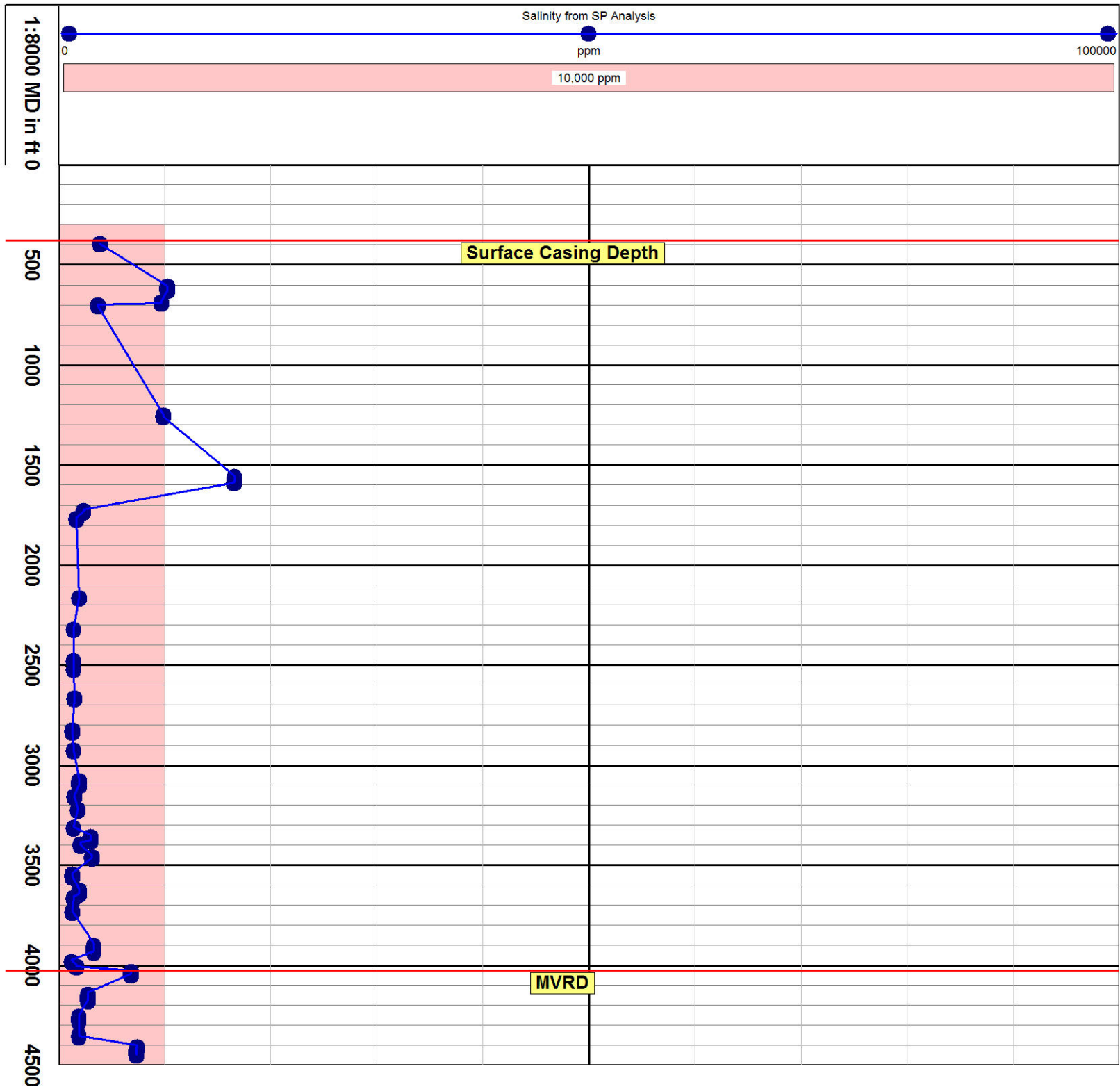


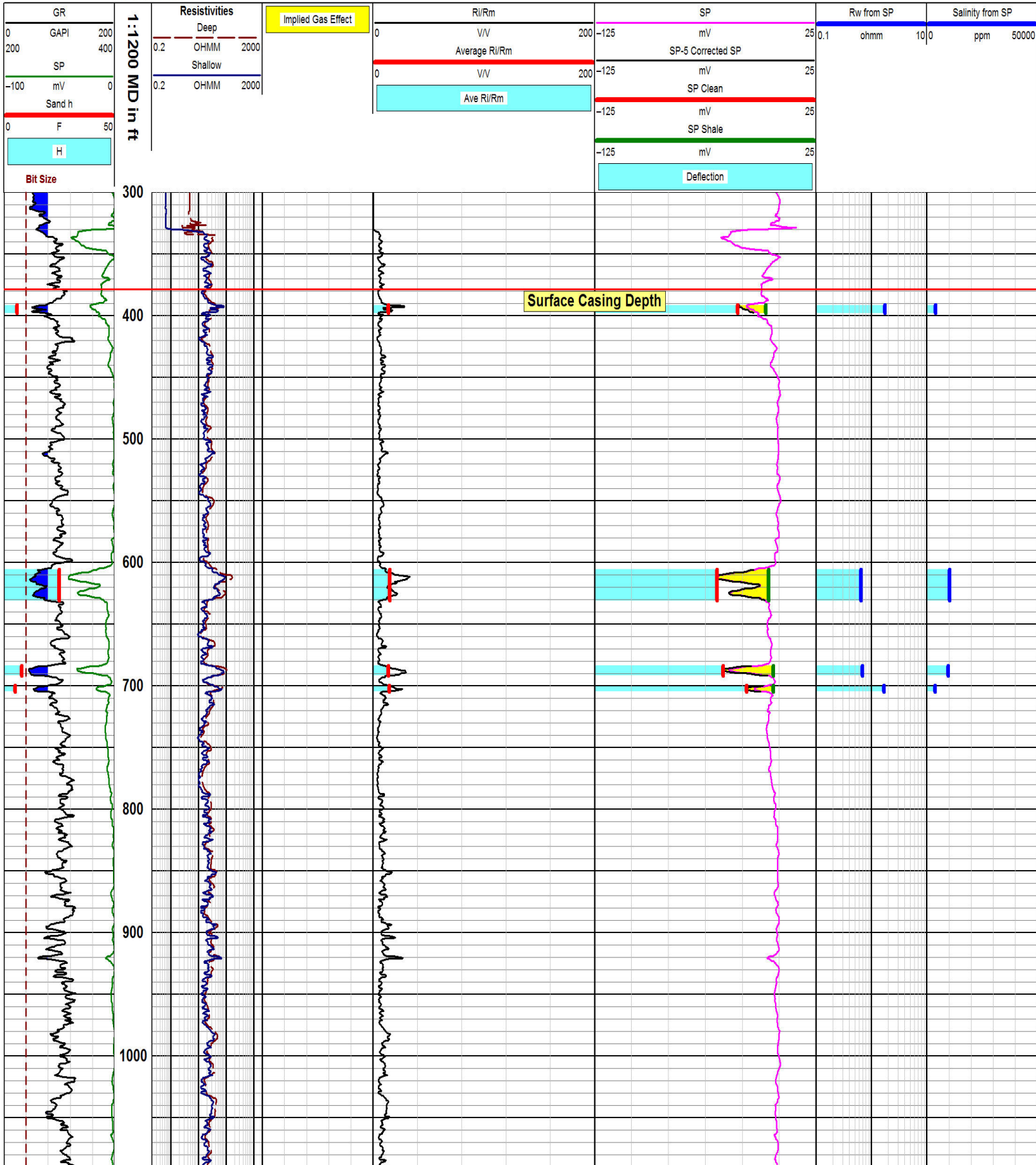


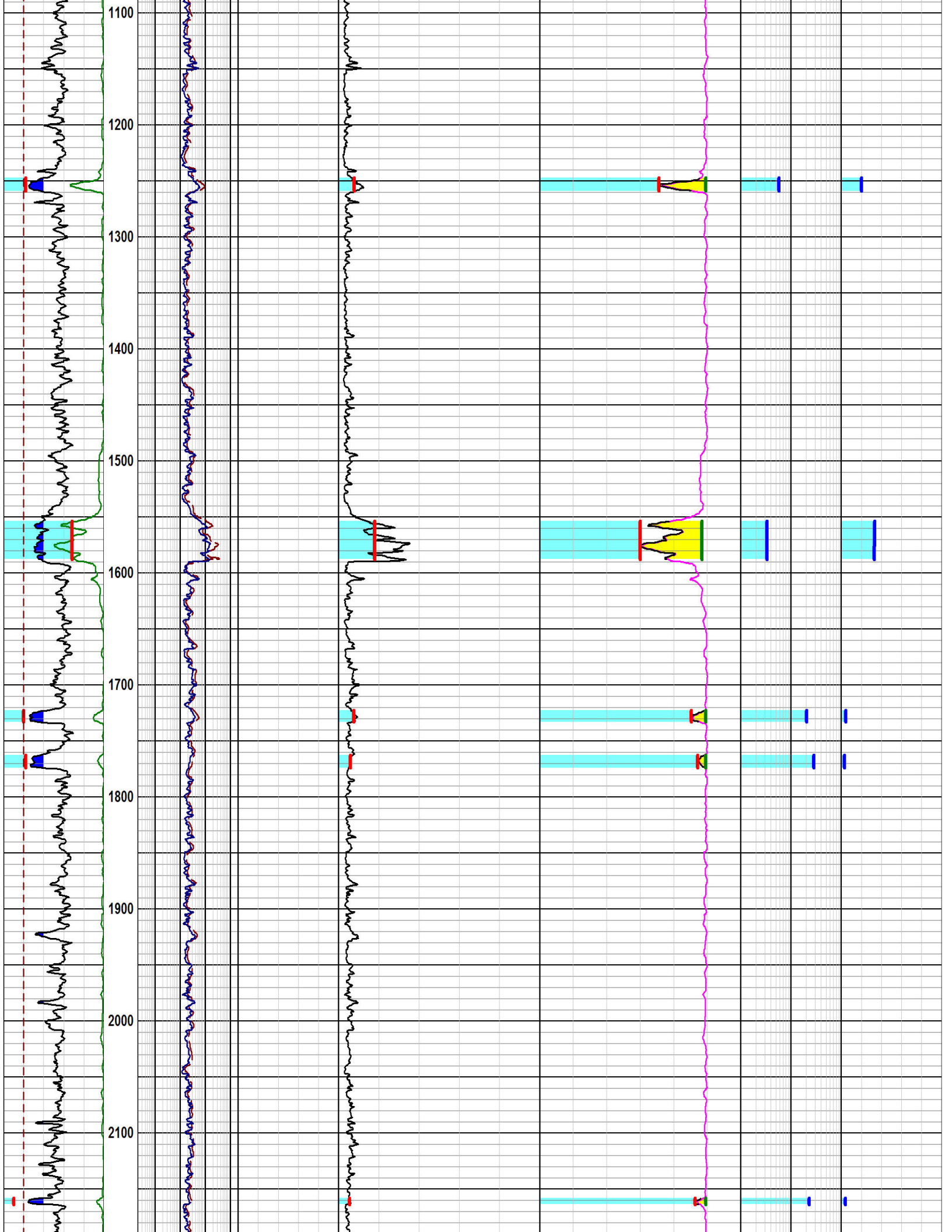


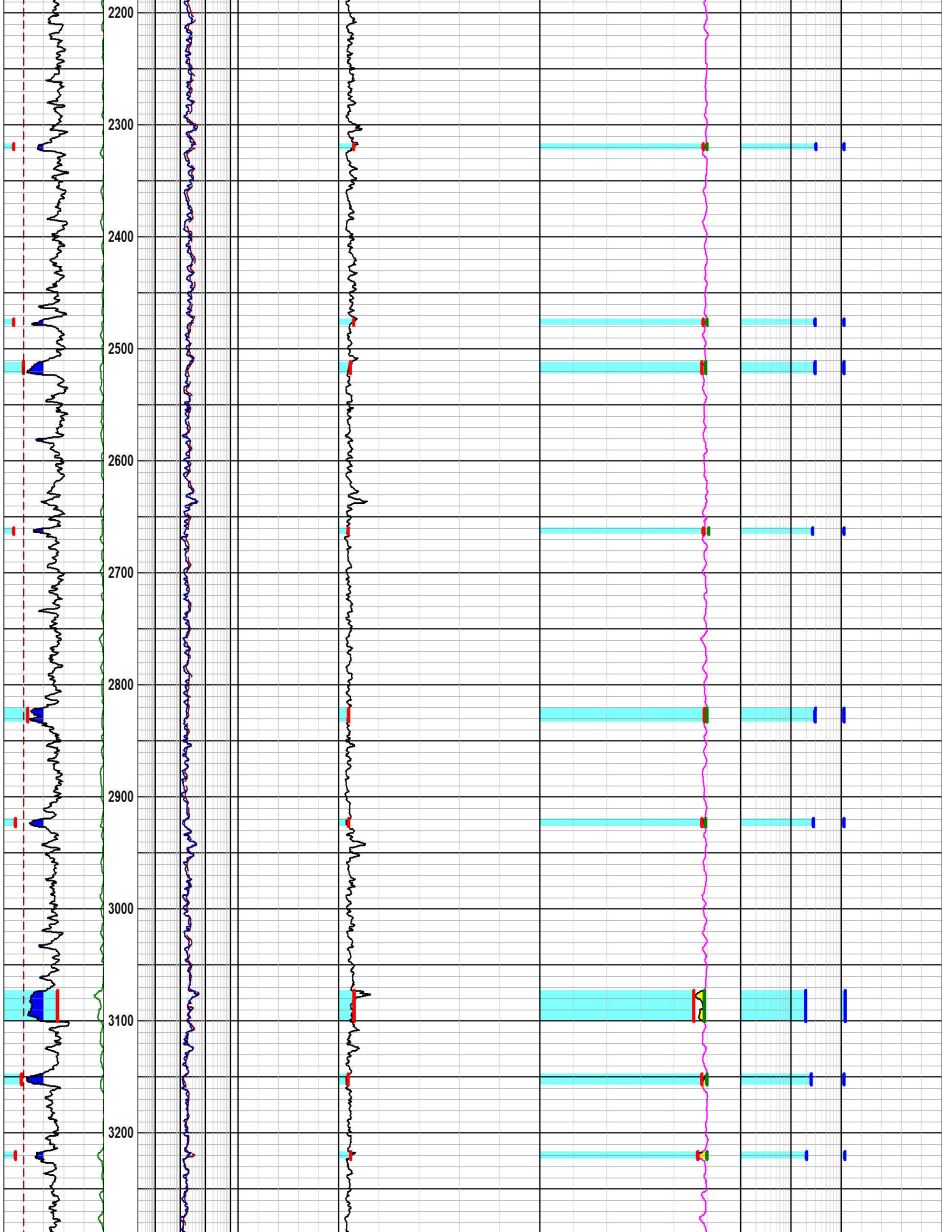


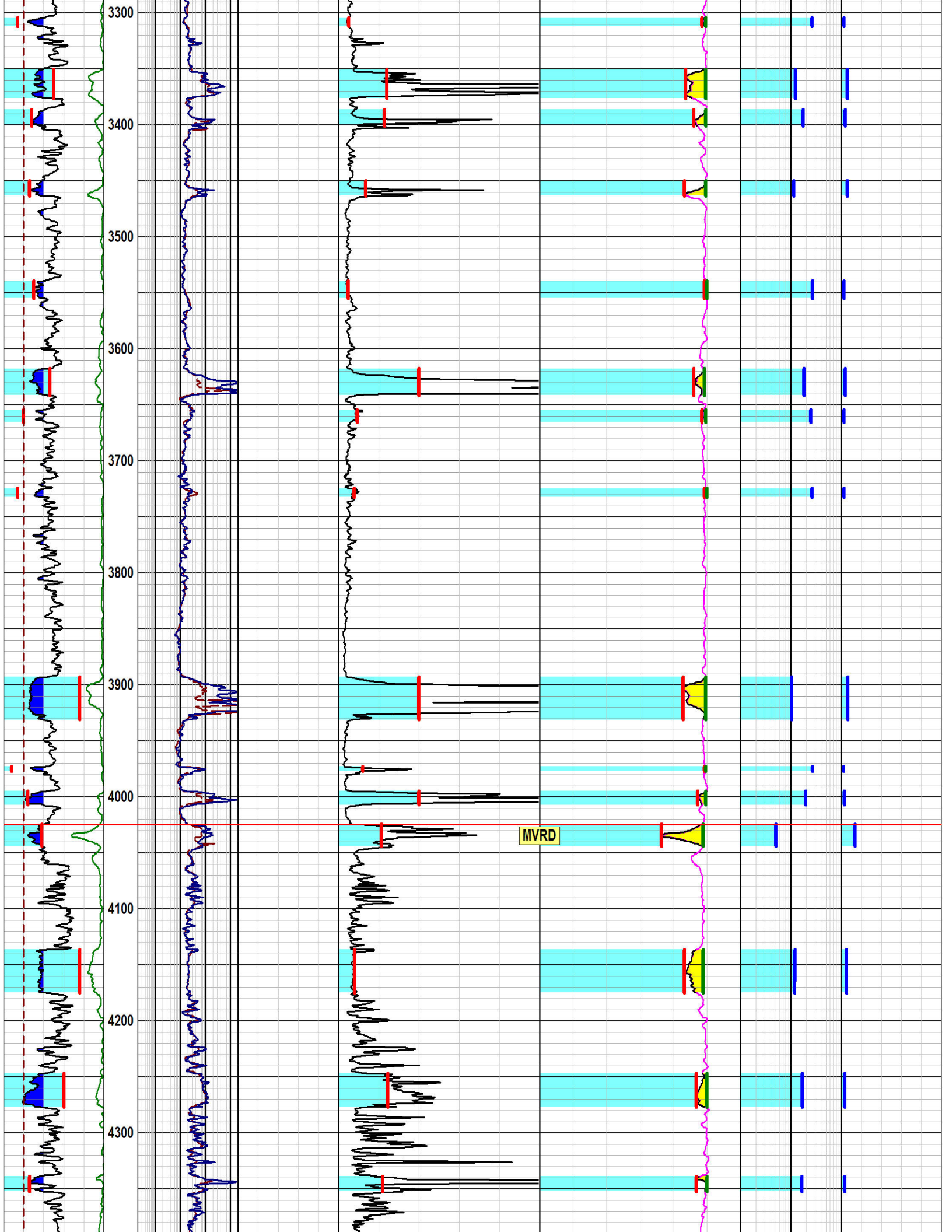


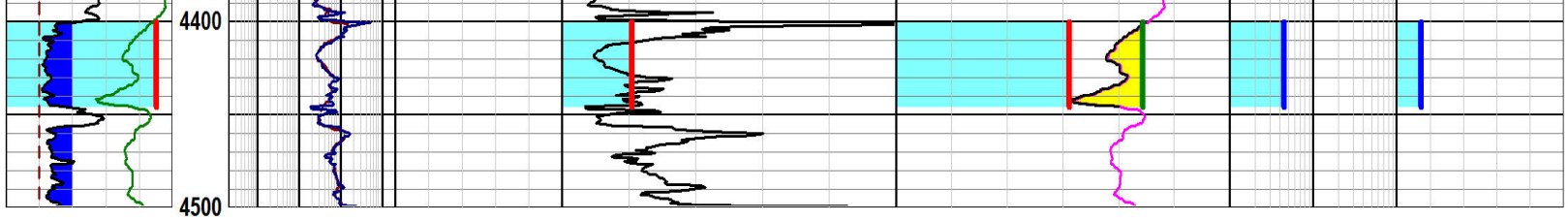


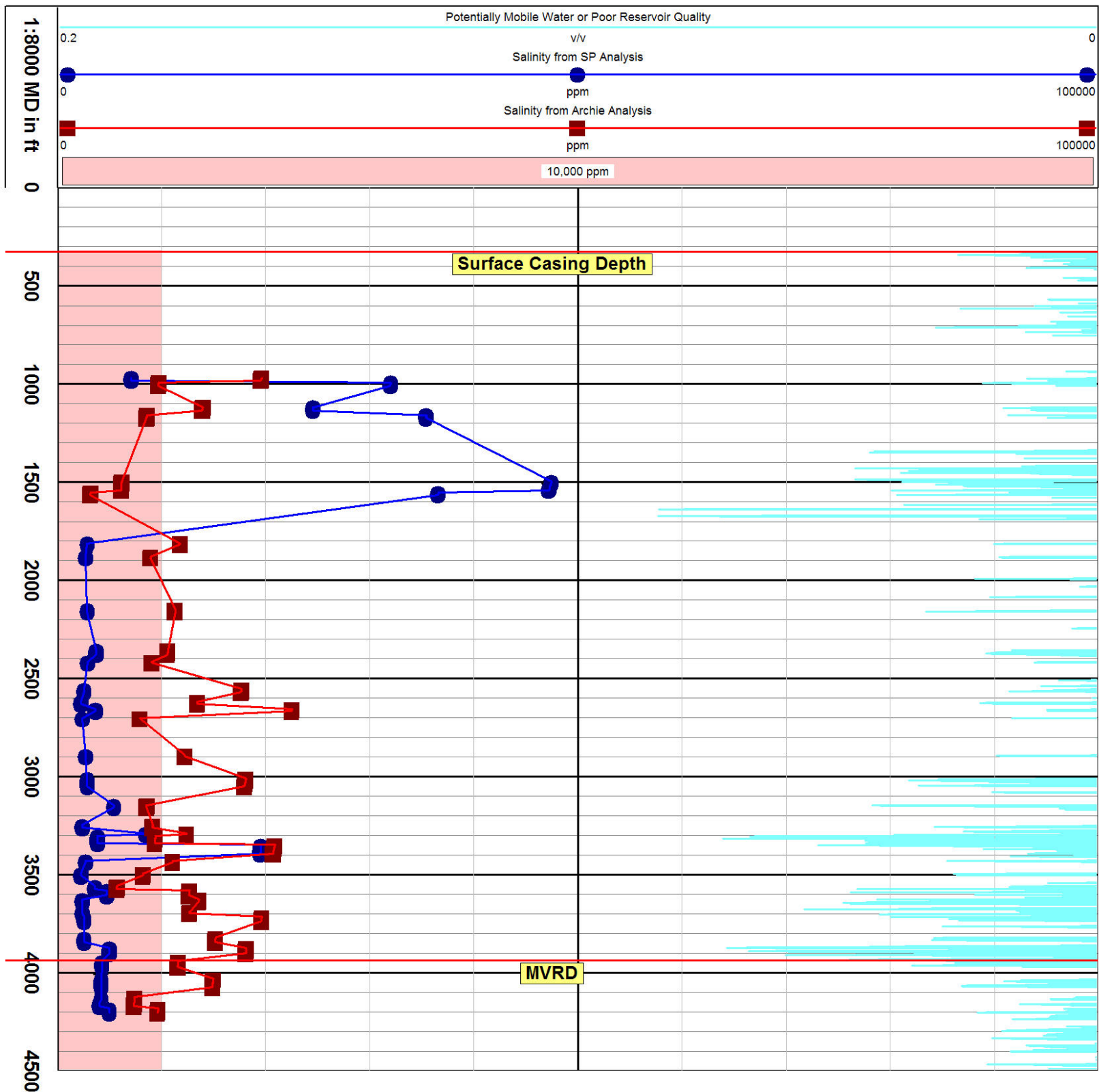














LESA 9.7.1, © 1992-2014 Digital Formation, Inc.

File: 05045069950000 Clough RMV 54-28.lbs

Plot: Salinity from Archie vs. Salinity from SP

Gross Interval: 320 to 7090 by 0.5 F

Ranges: User Ranges
320-4500

Time: 01:40 PM

Section: SECTION

Location: LOCATION

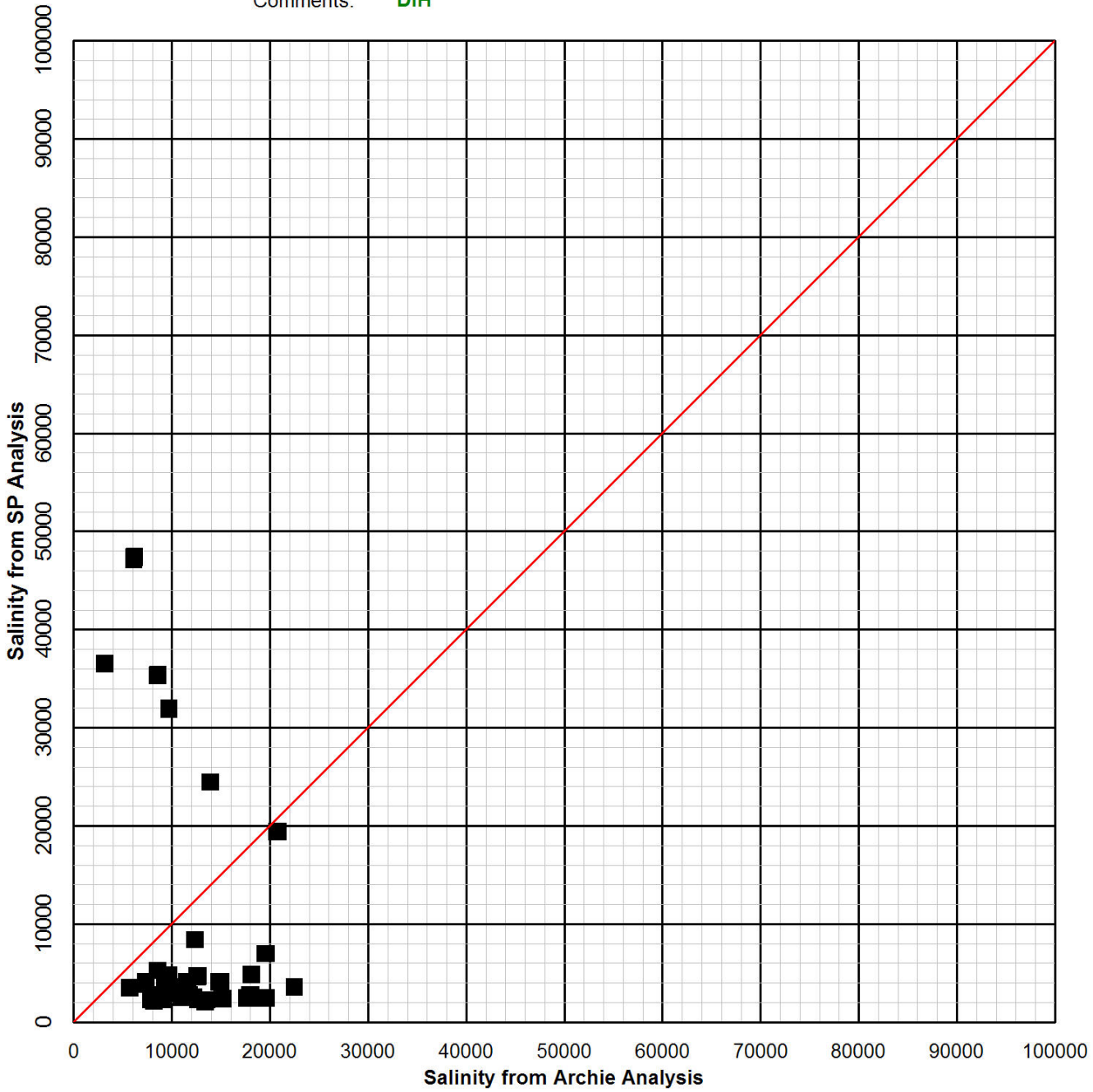
Comments: DIH

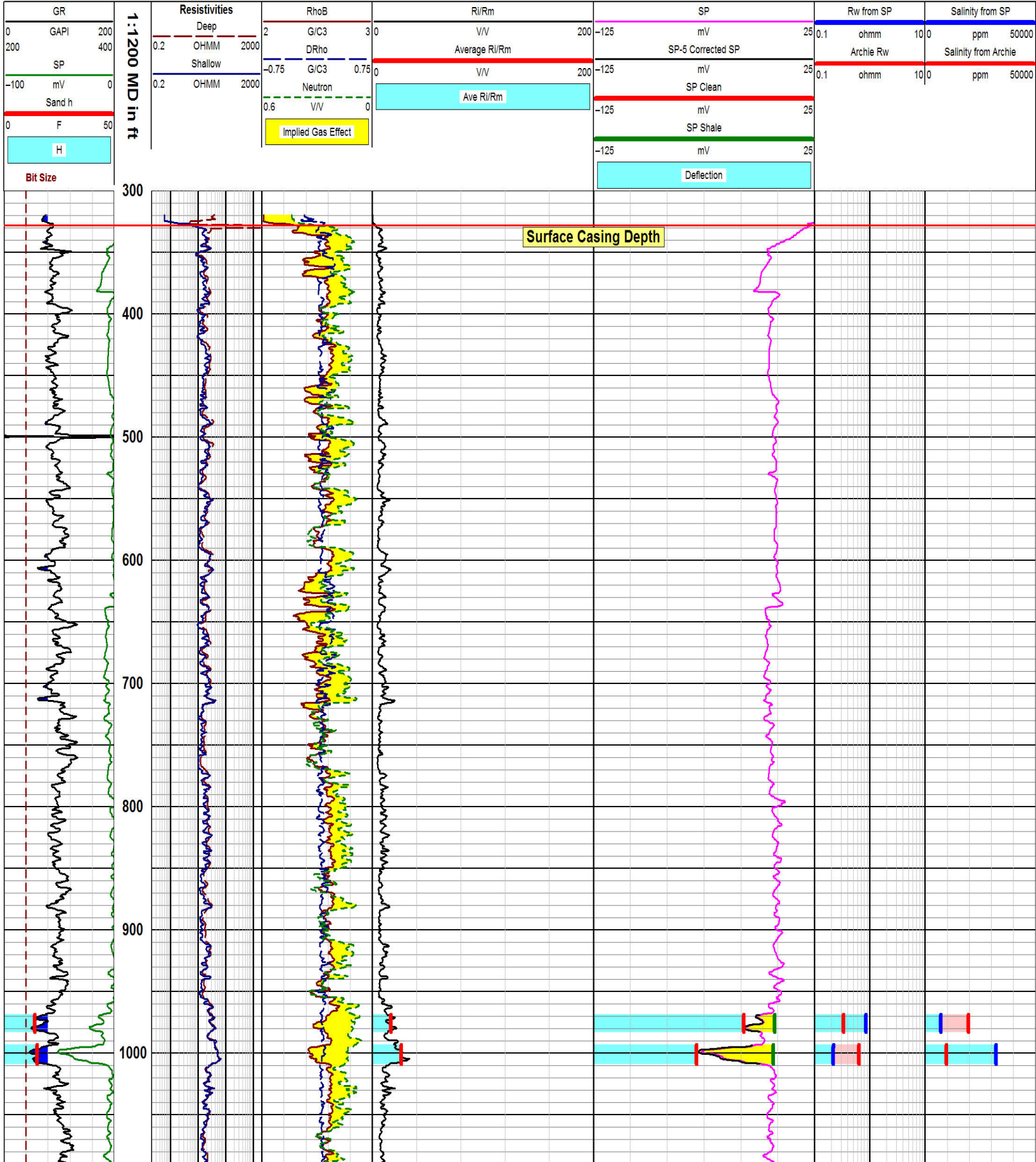
Well Name: RMV 54-28

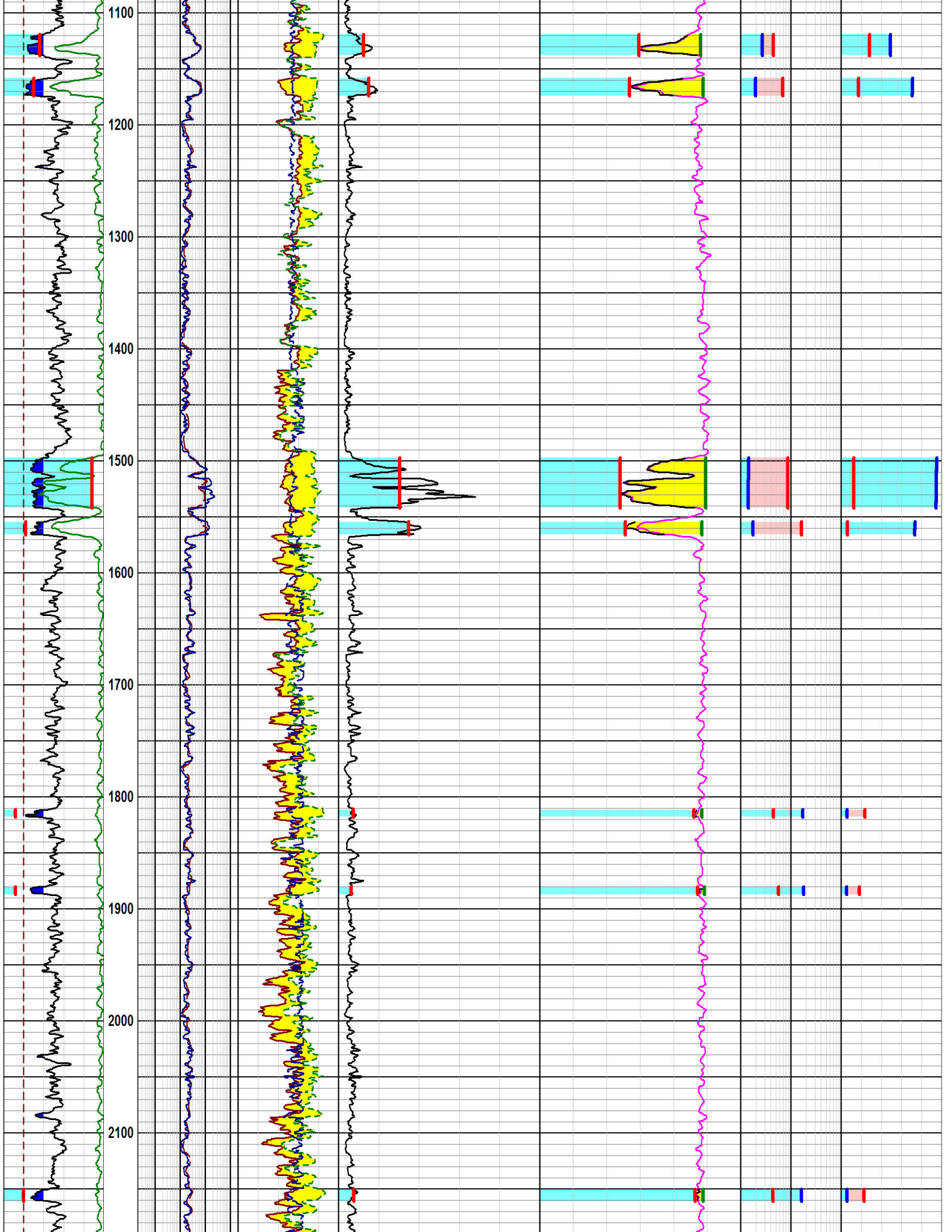
Date: Tue, Jul 01, 2014

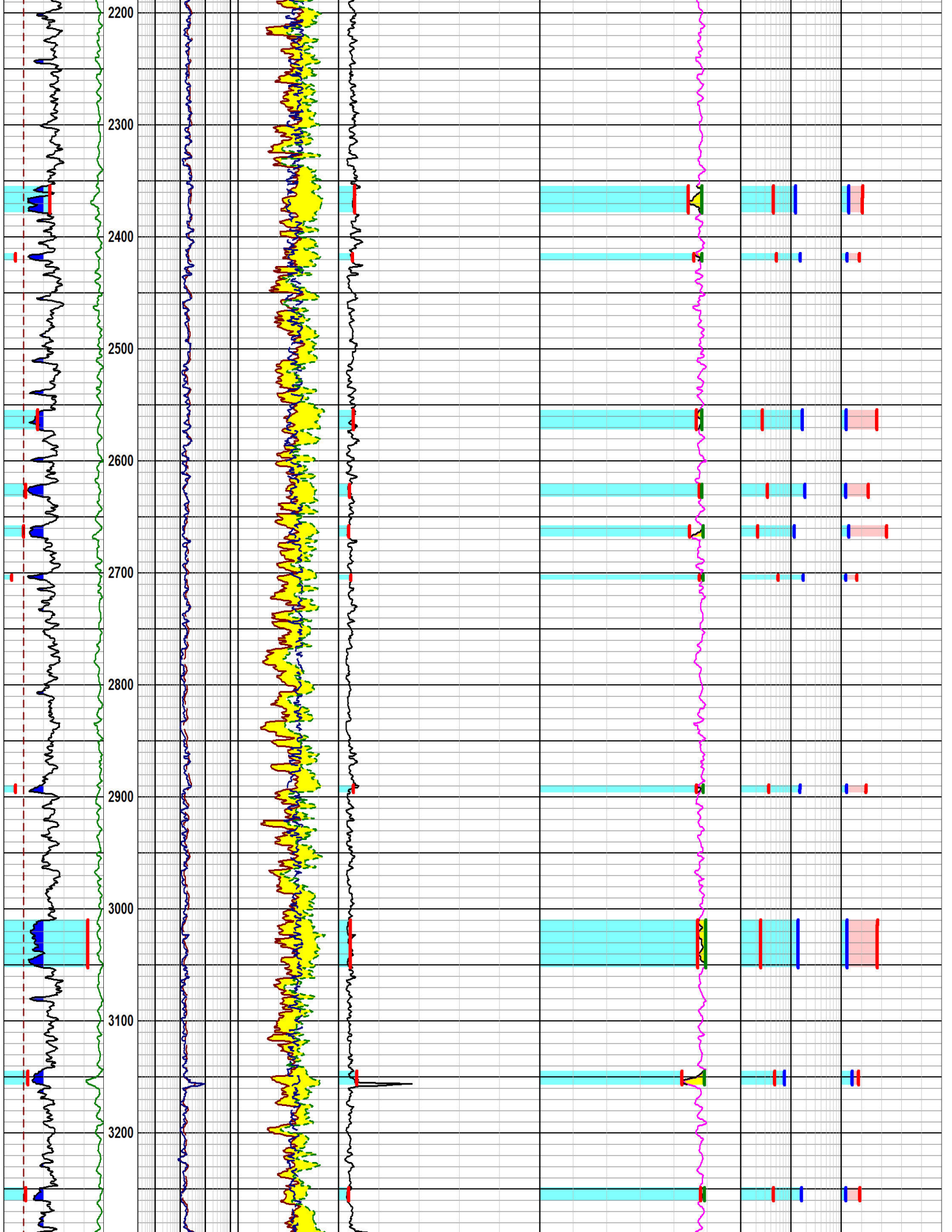
Township: TOWNSHIP API #: 05045069950000

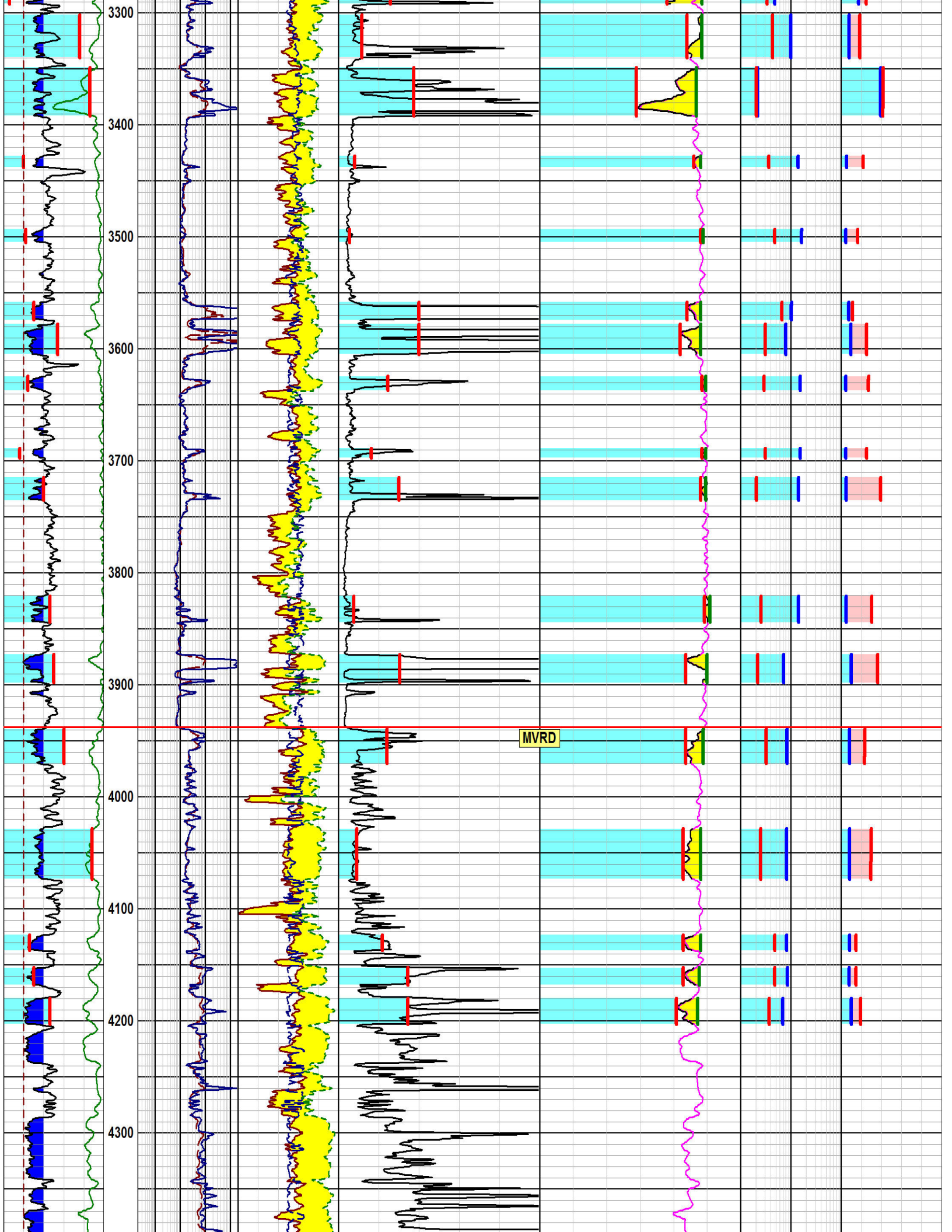
Range: RANGE UWI: 05045069950000

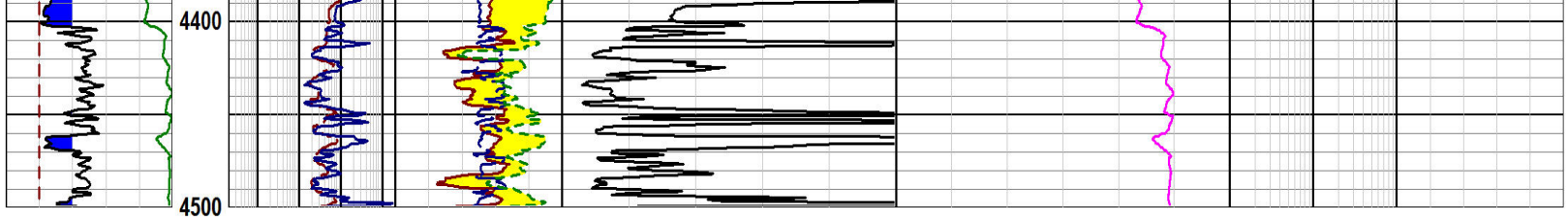




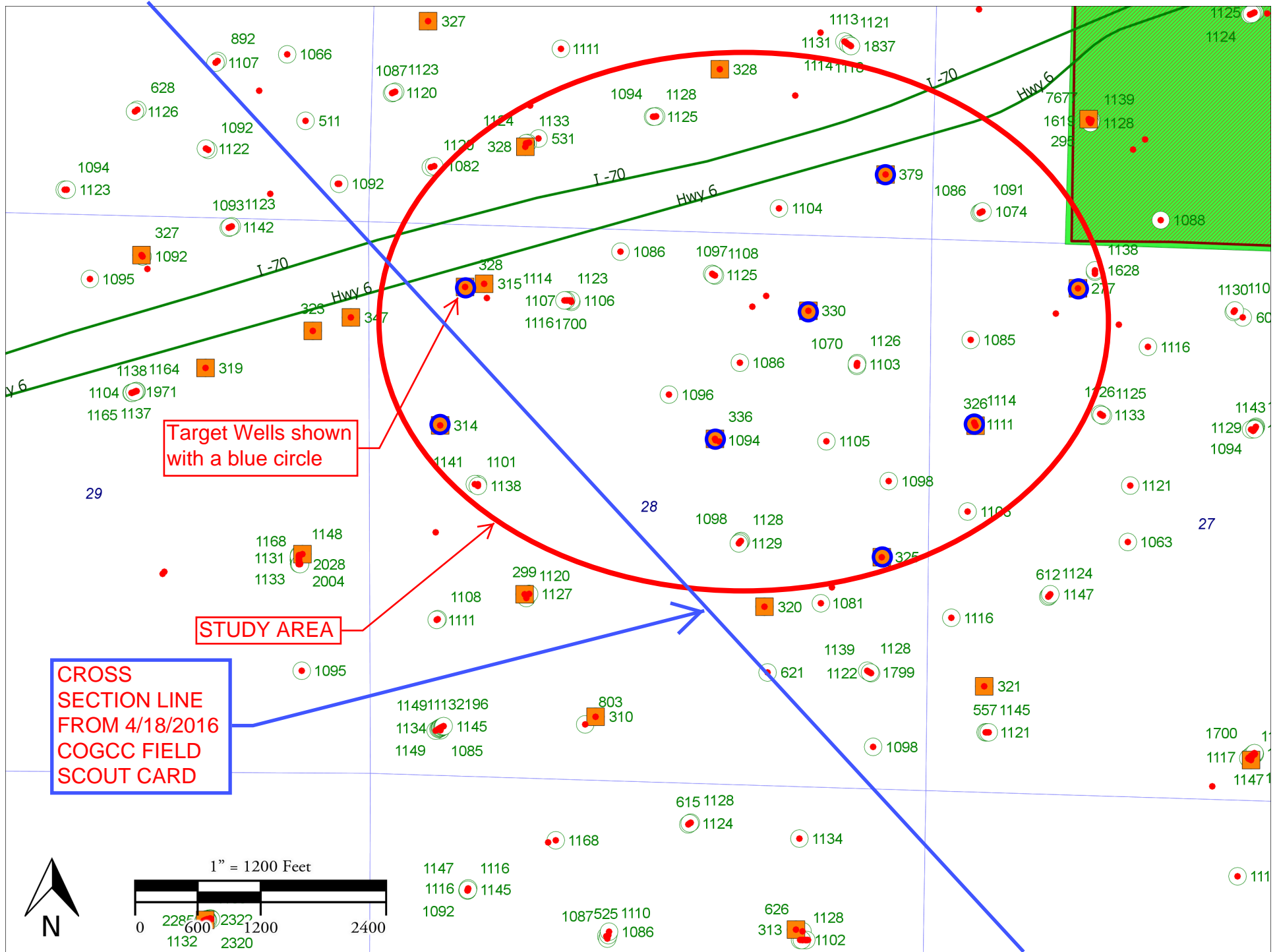








28-6S-94W Short Surface Casing Wells



PICEANCE BASIN PETROPHYSICAL ANALYSIS WELLS
DETERMINATION OF WASATCH WATER SAND TDS
PHASE 1 PILOT PROJECT
TARGET INVESTIGATION AREA: NORTHERN PORTION OF 28-6S-94W AND PORTIONS OF ADJACENT SECTIONS

Well Index	Well Name and Number	API	Legal QQ	Surface Casing Depth	MVRD Reported Top	Log Tops (COGCC revised 5/18/2016)	Log Type	Log Date	Log Document No.
1	Clough RMV 5-21	045-06858	NWSE Section 21	328	4014		Corrupt Image - Requested Re-Scan	N/A	967668
2	Clough RMV 26-21	045-06976	SESE Section 21	379	4025	1467 UWSTCG 1630 LWSTCG 2017 FTUN 3302 LWSTC 3616 OHCRC 4025 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	02/17/1995	967671
3	Vassar-Heath RMV 24-27	045-06916	SWNW Section 27	326	3962	1376 UWSTCG 1554 LWSTCG 1984 FTUN 3540 LWSTC 3820 OHCRC 3962 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	01/24/1995	967682
4	Clough RMV 29-27	045-06957	NENW Section 27	277	3840	1370 UWSTCG 1504 LWSTCG 1896 FTUN 3097 LWSTC 3403 OHCRC 3840 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	12/27/1994	967685
5	Clough RMV 54-28	045-06995	NWNW Section 28	328	3938	1426 UWSTCG 1600 LWSTCG 1971 FTUN 3270 LWSTC 3556 OHCRC 3938 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	06/26/1995	1042113
6	Savage RMV 35-28	045-06960	SWNW Section 28	314	4000	1513 UWSTCG 1692 LWSTCG 2047 FTUN 3385 LWSTC 3752 OHCRC 4000 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	06/12/1996	1042105
7	Vassar-Heath RMV 21-28	045-06917	SWNE Section 28	336	3978	1428 UWSTCG 1617 LWSTCG 1964 FTUN 3290 LWSTC 3610 OHCRC 3978 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	04/18/1995	967692
8	Clough RMV 27-28	045-06958	NENE Section 28	330	3940	1410 UWSTCG 1554 LWSTCG 1960 FTUN 3280 LWSTC 3576 OHCRC 3940 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	03/07/1995	967693
9	Vassar-Heath RMV 34-28	045-06959	NESE Section 28	325	3960	1416 UWSTCG 1610 LWSTCG 2003 FTUN 3340 LWSTC 3700 OHCRC 3960 MVRD (Opr)	Dual Induction Focused Log - SP - Gamma Ray	03/27/1995	697695
10	Vassar-Heath RMV 2-28	045-06611	NWSE Section 28	320	Not Reported (1693' Logger TD)		Dual Induction Laterolog - GR	10/23/1989	1002428
11	Cook RW 4-28	045-06880	NESW Section 28	299	Not Reported (1918' MTD)		Corrupt Image - Requested Re-Scan	N/A	967689
12	Cook RW 5-29	045-06884	NESE Section 29	294	Not Reported (1857' Logger TD)		Dual Induction Focused Log - Gamma Ray	12/07/1994	967697

LOGS FOR WELL INDEX NOS. 2 THROUGH 9 WILL BE EVALUATED BY DIGITAL FORMATION, INC.

