Schlumberger

Company: Noble Energy, Inc.

Well: Wells Ranch AF05-625

Field: Wattenberg

County: Weld State: CO

Ultrasonic Imager

Cement Evaluation

Gamma Ray - CCL

County: Weld
Field: Wattenberg
Location: SWSW Sec. 5, T5N, R62W
Well: Wells Ranch AF05-625
Company: Noble Energy, Inc.

Location:				
SWSW Sec. 5, T5N, R62W		Elev.:	K.B.	4691.00 ft
SHL: 784' FSL & 545' FWL			G.L.	4667.00 ft
Lat/Long: 40.42344/-10435472			D.F.	4691.00 ft
Permanent Datum:	Ground Level	Elev.:	4667.00 f	
Log Measured From:	Kelly Bushing	24.00 ft	above Perm.Datum	
Drilling Measured From:	Kelly Bushing			

API Serial No.	Section:	Township:	Range:
05-123-42136	5	5N	62W

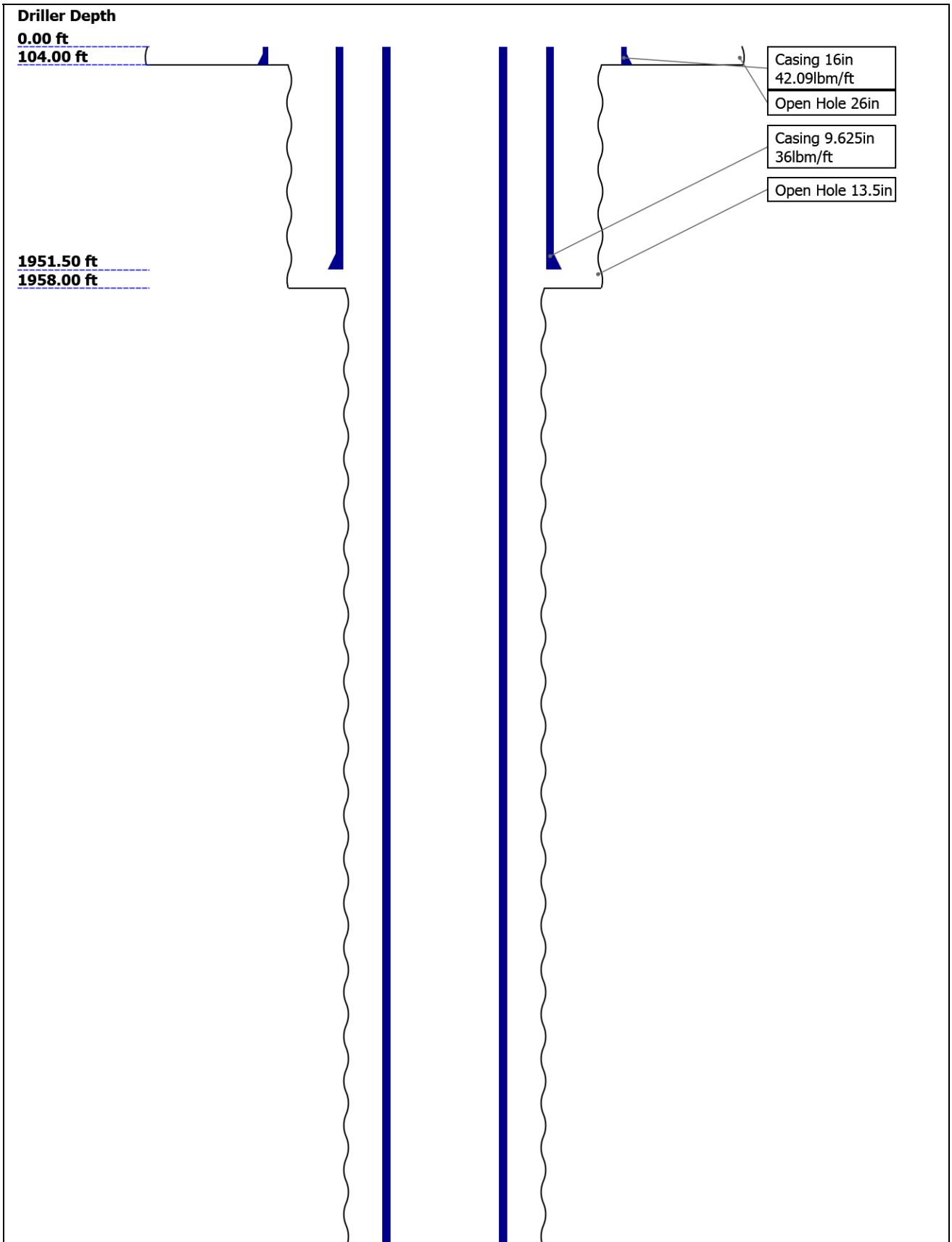
Logging Date	14-Apr-2016		
Run Number	ONE		
Depth Driller	16040.00 ft		
Schlumberger Depth	16040.00 ft		
Bottom Log Interval	6817.00 ft		
Top Log Interval	56.00 ft		
Casing Fluid Type	Water		
Salinity			
Density	8.4 lbm/gal		
Fluid Level	8.00 ft		
BIT/CASING/TUBING STRING			
Bit Size	8.50 in		
From	1958.00 ft		
To	16040.00 ft		
Casing/Tubing Size	5.5 in		
Weight	20 lbm/ft		
Grade	N/A		
From	0.00 ft		
To	16030.40 ft		
Max Recorded Temperatures	201 degF		
Logger on Bottom Time			
Unit Number Location:	2161	Fort Morgan, CO	
Recorded By	Evan Meadows		
Witnessed By			

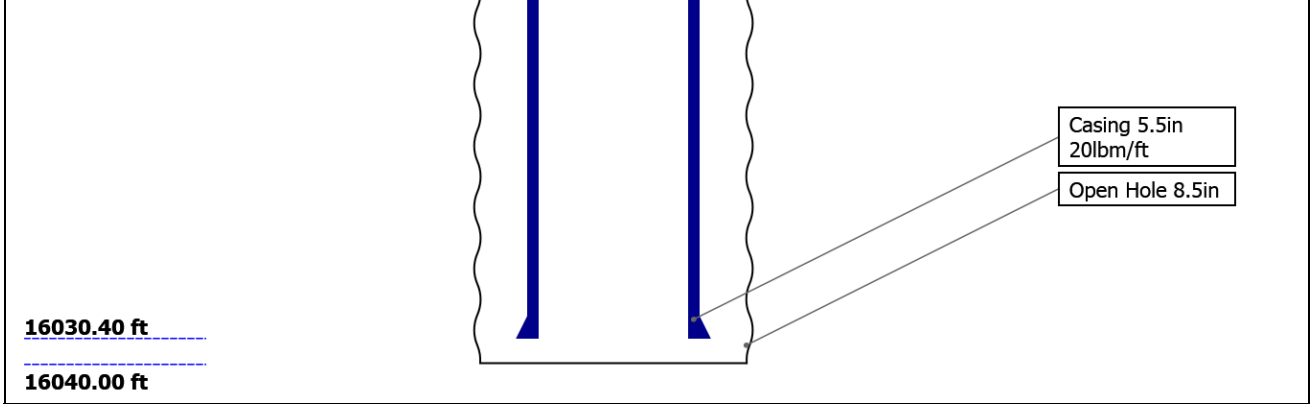
Disclaimer

Contents

in)
12. XYZ (USI Fluid Acoustic Slowness vs Depth 3.0 in)
13. Calibration Report
14. Tail

Well Sketch



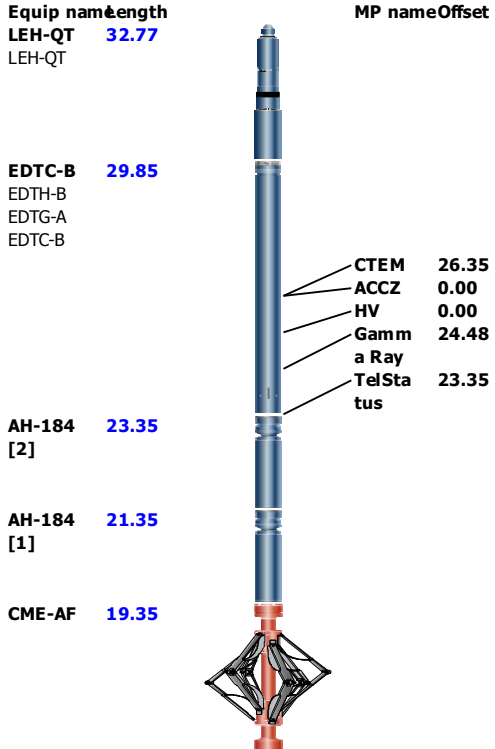


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	26	13.5	8.5			
Top Driller (ft)	0	104	1958			
Top Logger (ft)	0	104	1958			
Bottom Driller (ft)	104	1958	16040			
Bottom Logger (ft)	104	1958	16040			
Casing						
Size (in)	16	9.625	5.5			
Weight (lbm/ft)	42.09	36	20			
Inner Diameter (in)	15.511	8.921	4.778			
Grade	N/A	N/A	N/A			
Top Driller (ft)	0	0	0			
Top Logger (ft)	0	0	0			
Bottom Driller (ft)	104	1951.5	16030.4			
Bottom Logger (ft)	104	1951.5	16030.4			

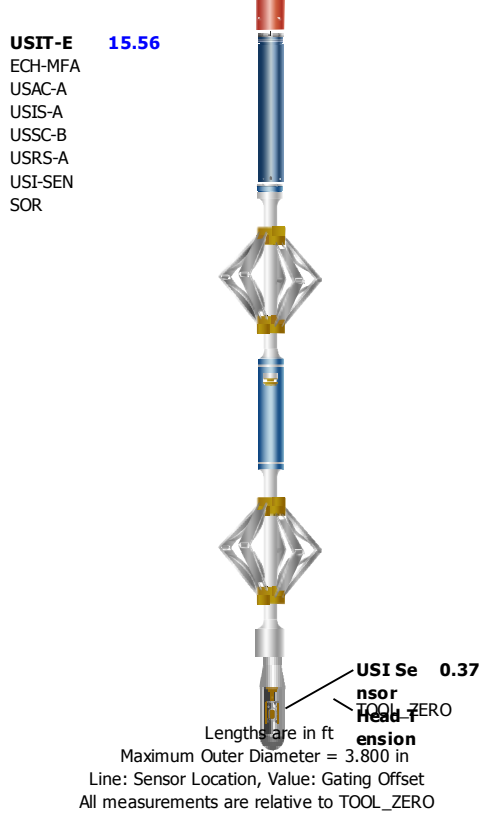
Remarks and Equipment Summary

ONE: Toolstring



ONE: Remarks

1. THIS IS THE FIRST RUN IN THE WELL
2. TOOL RAN AS PER TOOL SKETCH.
3. CSG: 5.5" 20 LB/FT
4. WELL FLUID: 8.4 PPG FRESH WATER
5. SPACER/LEAD/TAIL: 11.2 PPG MUDPUSH / 12 PPG / 13 PPG
4. REPEAT PASS RECORDED AT 0 PSI. MAIN PASS RECORDED AT 2500 PSI
6. BHT: 201 F



Depth Summary

	ONE		
Depth Measuring Device			
Type	IDW-B		
Serial Number			
Calibration Date			
Calibrator Serial Number			
Calibration Cable Type			
Wheel Correction 1	0		
Wheel Correction 2	0		
Tension Device			
Type	CMTD-B/A		
Serial Number			
Calibration Date			
Calibrator Serial Number			
Number of Calibration Points	0		
Logging Cable			
Type	7-46NT-XS		
Serial Number			
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Mast		

ONE:Depth Control Parameters		Depth Control Remarks
Log Sequence	First Log In the Well	1. ALL SCHLUMBERGER DEPTH CONTROL PROCEDURES WERE FOLLOWED DURING LOGGING OPERATIONS
Rig Up Length At Surface		2. IDW WAS USED AS PRIMARY DEPTH CONTROL MEASURE
Rig Up Length At Bottom		3. Z CHART WAS USED AS SECONDARY DEPTH CONTROL MEASURE

Rig Up Length Correction	4. LOG STARTED AT 6817' (LOST MOMENTUM IN CURVE)
Stretch Correction	
Tool Zero Check At Surface	

Copy of USI Composite

USIT - Fluid Properties Measurement

Run Name	Pass Name	Start Depth(ft)	Stop Depth(ft)
Run 1	Log[4]:Up	6820.98	55.52

Fluid Velocity = "Automatic".
CFVL equals DFSL channel

Start Depth(ft)	Stop Depth(ft)	Start Value(us/ft)	End Value(us/ft)

Mud Impedance = "Manual".
CZMD uses ZMUD parameter zoned table below

Start Depth(ft)	Stop Depth(ft)	Start Value(Mrayl)	End Value(Mrayl)
0	200	1.48	1.48
200	400	1.65	1.65
400	700	1.66	1.66
700	1000	1.68	1.68
1000	1500	1.7	1.7
1500	2000	1.72	1.72
2000	2500	1.74	1.74
2500	3000	1.76	1.76
3000	4000	1.77	1.77
4000		1.78	1.78

Log

Company:Noble Energy, Inc. Well:Wells Ranch AF05-625 ONE: Log[4]:Up:S008

Description: USI Composite Format: USI Composite Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:24

USIT Processing Flags (UFLG[0]) USIT-E

1 - UFLG 1 Value within [0.0 - 1.5] - :	UTIM Error
2 - UFLG 2 Value within [1.5 - 2.5] - :	Pulse Origin Not Detected
3 - UFLG 3 Value within [2.5 - 3.5] - :	WINLEN Error
4 - UFLG 4 UFLG 5 UFLG 6 Value within [3.5 - 6.5] - :	Casing Thickness Error
5 - UFLG 7 UFLG 8 UFLG 9 Value within [6.5 - 10] - :	Loop Processing Error

TIME_1900 - Time Marked every 60.00 (s)

CableDrag

Azimuth of Eccentering (AZEC) USIT-E

0 deg 360

Casing Collar Locator Ultrasonic (CCLU) USIT-E

-20 in 20

Amplitude of Eccentering for Unflagged Waves (ECCE_RF) USIT-E

0 in 0.5

Absent -5.200 -3.600 -2.000 -0.400

Explicit Normalization

USIT - Amplitude of Unflagged Wave (AWBK_RF) USIT-E (dB)

IRAV

ERAV

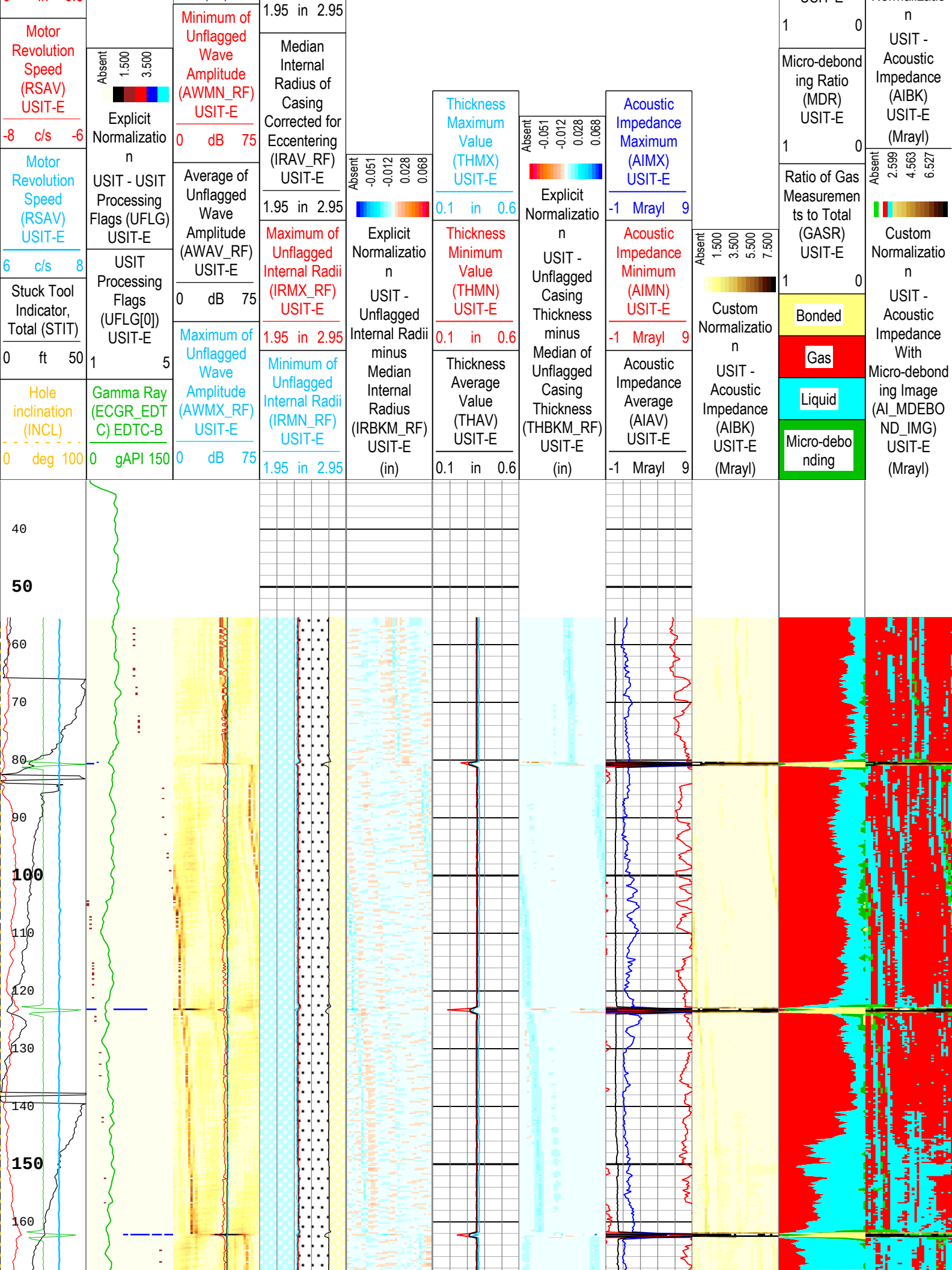
IRAV-ERAV

Median of Unflagged External Radii (ERAV_RF) USIT-E

Ratio of Cement Measurements to Total (CEMR) USIT-E

Absent 3.090 5.054 7.018

Custom Normalizatio


Motor Revolution Speed (RSAV) USIT-E
-8 c/s -6
Motor Revolution Speed (RSAV) USIT-E
6 c/s 8
Stuck Tool Indicator, Total (STIT)
0 ft 50
Hole inclination (INCL)
0 deg 100
Absent 1.500 3.500
Explicit Normalization
USIT - USIT Processing Flags (UFLG) USIT-E
USIT Processing Flags (UFLG[0]) USIT-E
1 5
Gamma Ray (ECGR_EDTC) EDTC-B
0 gAPI 150
Minimum of Unflagged Wave Amplitude (AWMN_RF) USIT-E
0 dB 75
Average of Unflagged Wave Amplitude (AWAV_RF) USIT-E
0 dB 75
Maximum of Unflagged Wave Amplitude (AWMX_RF) USIT-E
0 dB 75
1.95 in 2.95
Median Internal Radius of Casing Corrected for Eccentering (IRAV_RF) USIT-E
1.95 in 2.95
Maximum of Unflagged Internal Radii (IRMX_RF) USIT-E
1.95 in 2.95
Minimum of Unflagged Internal Radii (IRMN_RF) USIT-E
1.95 in 2.95
Absent -0.051 -0.012 0.028 0.068
Explicit Normalization
USIT - Unflagged Internal Radii minus Median Internal Radius (IRBKM_RF) USIT-E
(in)
Thickness Maximum Value (THMX) USIT-E
0.1 in 0.6
Thickness Minimum Value (THMN) USIT-E
0.1 in 0.6
Thickness Average Value (THAV) USIT-E
0.1 in 0.6
Absent -0.051 -0.012 0.028 0.068
Explicit Normalization
USIT - Unflagged Casing Thickness minus Median of Unflagged Casing Thickness (THBKM_RF) USIT-E
(in)
Acoustic Impedance Maximum (AIMX) USIT-E
-1 Mrayl 9
Acoustic Impedance Minimum (AIMN) USIT-E
-1 Mrayl 9
Acoustic Impedance Average (AIAV) USIT-E
-1 Mrayl 9
Absent 1.500 3.500 5.500 7.500
Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E
(Mrayl)
1 0
Micro-debonding Ratio (MDR) USIT-E
1 0
Ratio of Gas Measurements to Total (GASR) USIT-E
1 0
Bonded
Gas
Liquid
Micro-debonding
USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)
Absent 2.599 4.563 6.527
Custom Normalization
USIT - Acoustic Impedance With Micro-debonding Image (AI_MDEBOND_IMG) USIT-E
(Mrayl)
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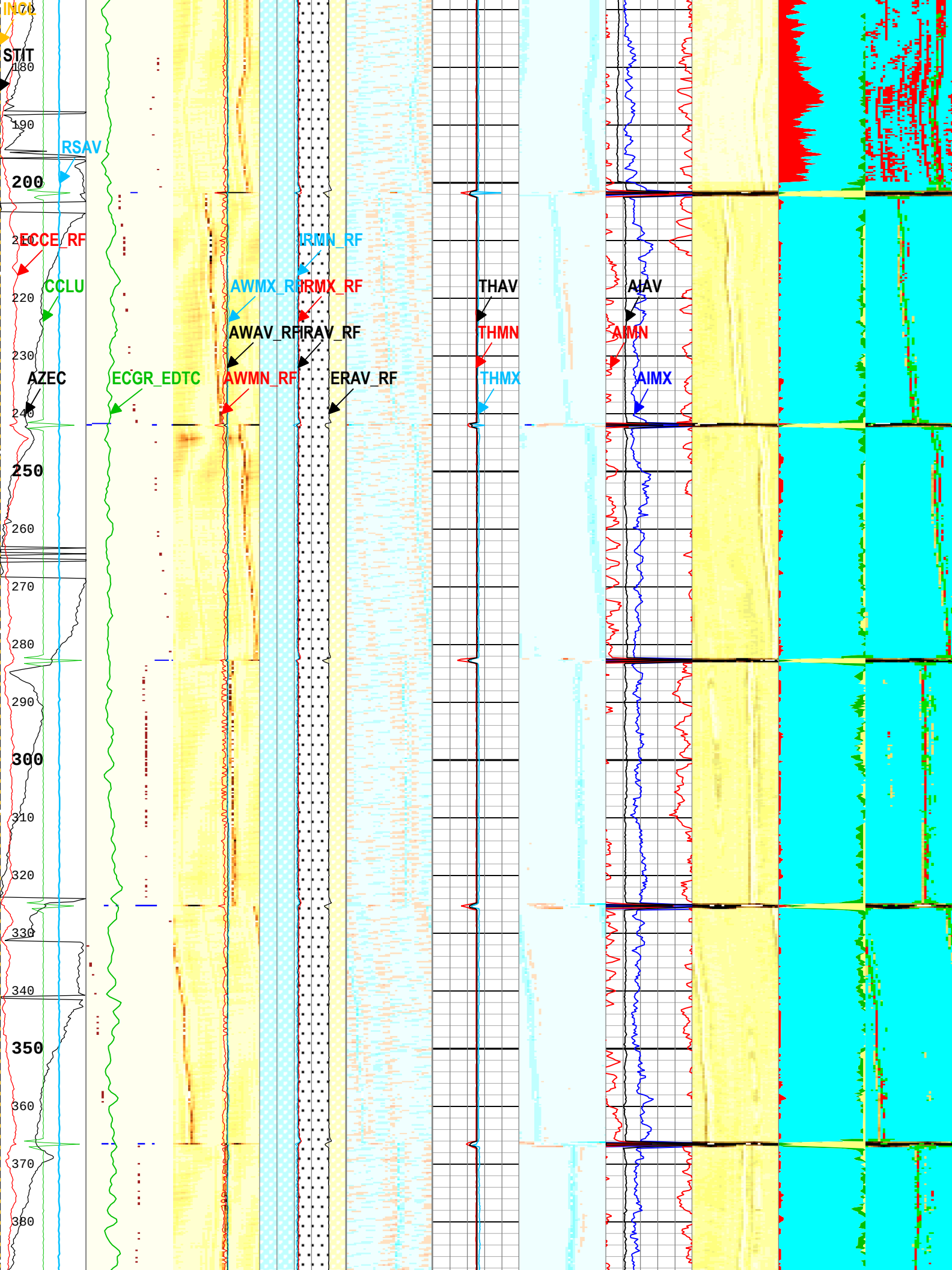
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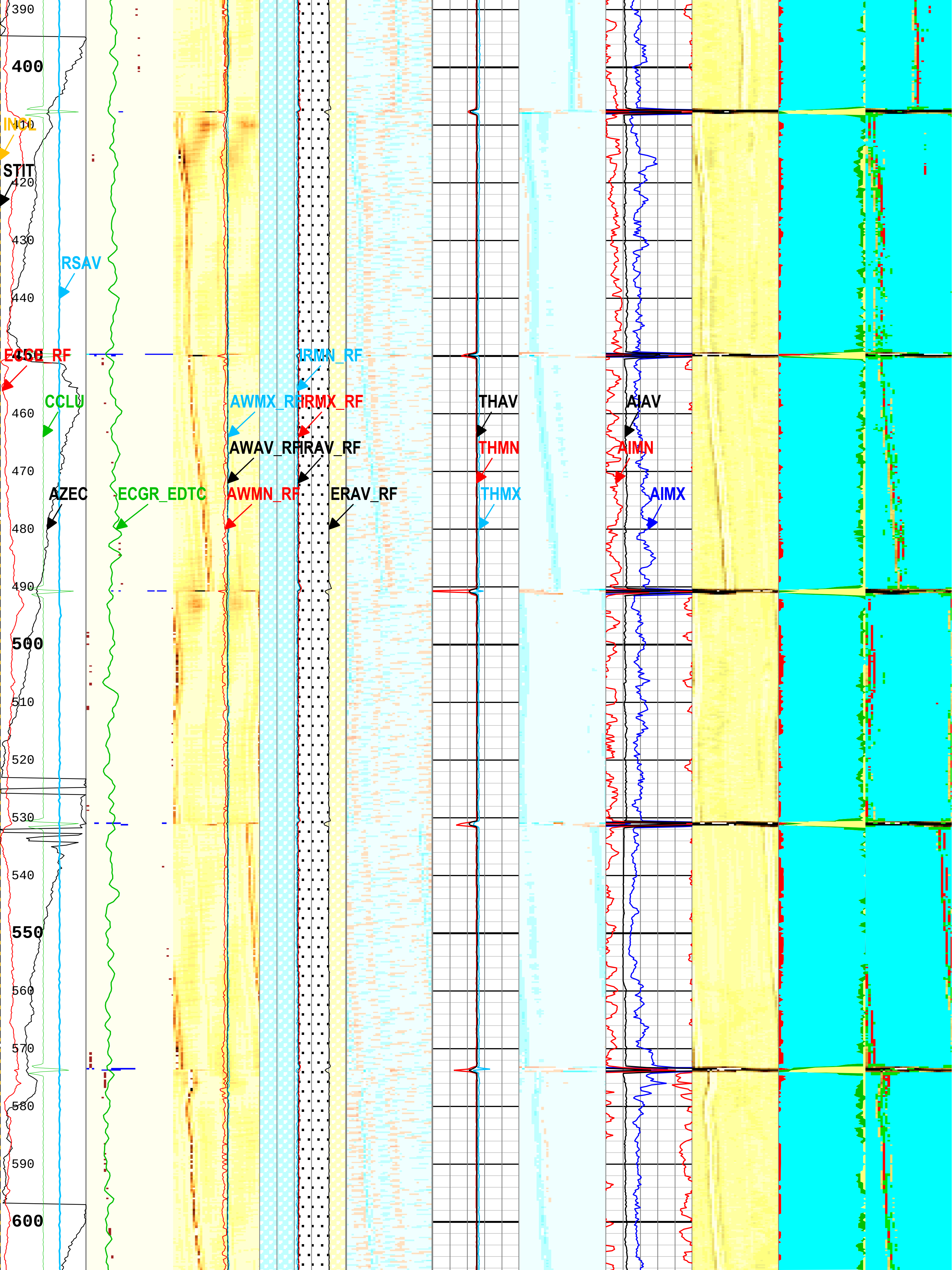

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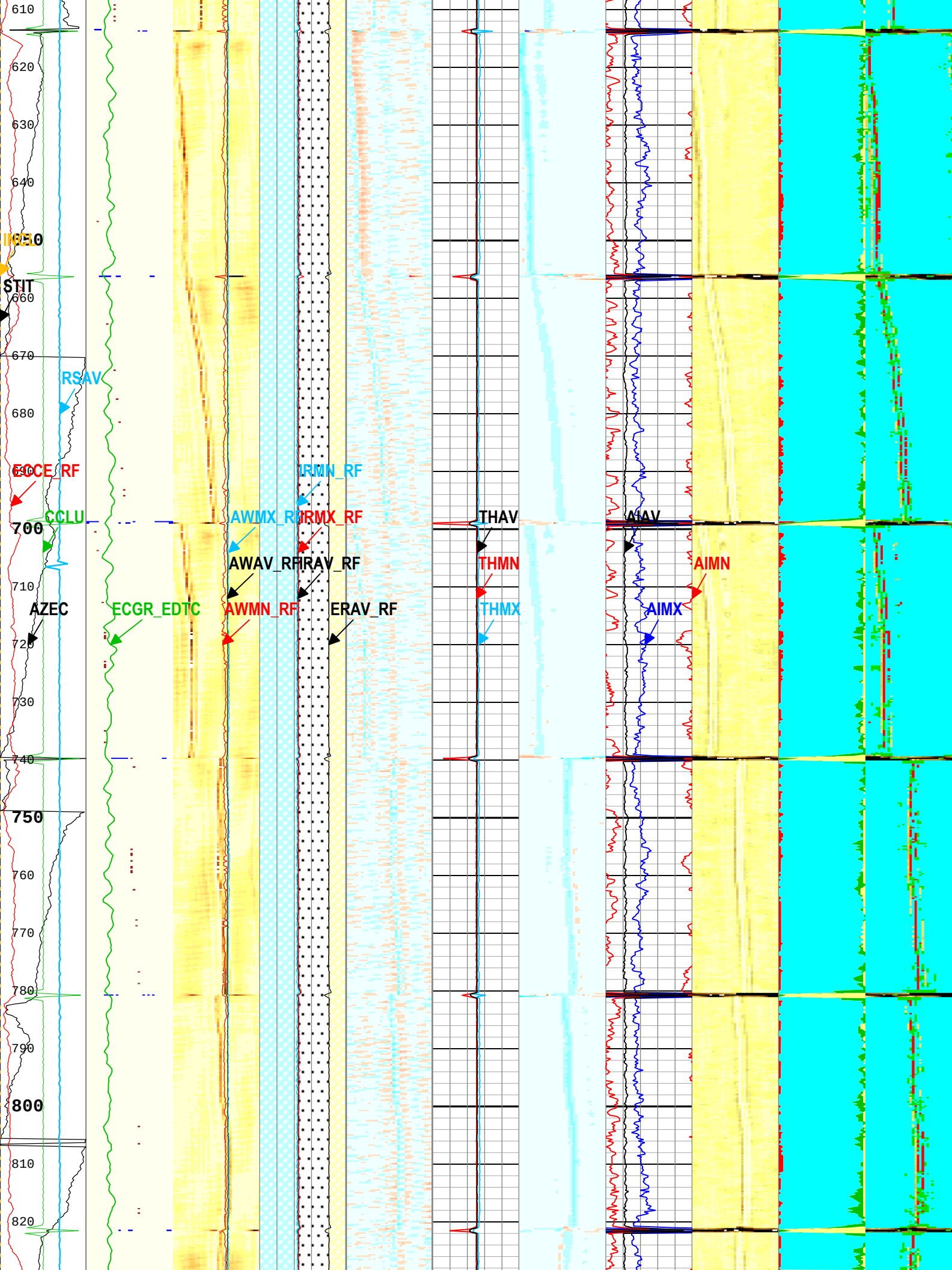
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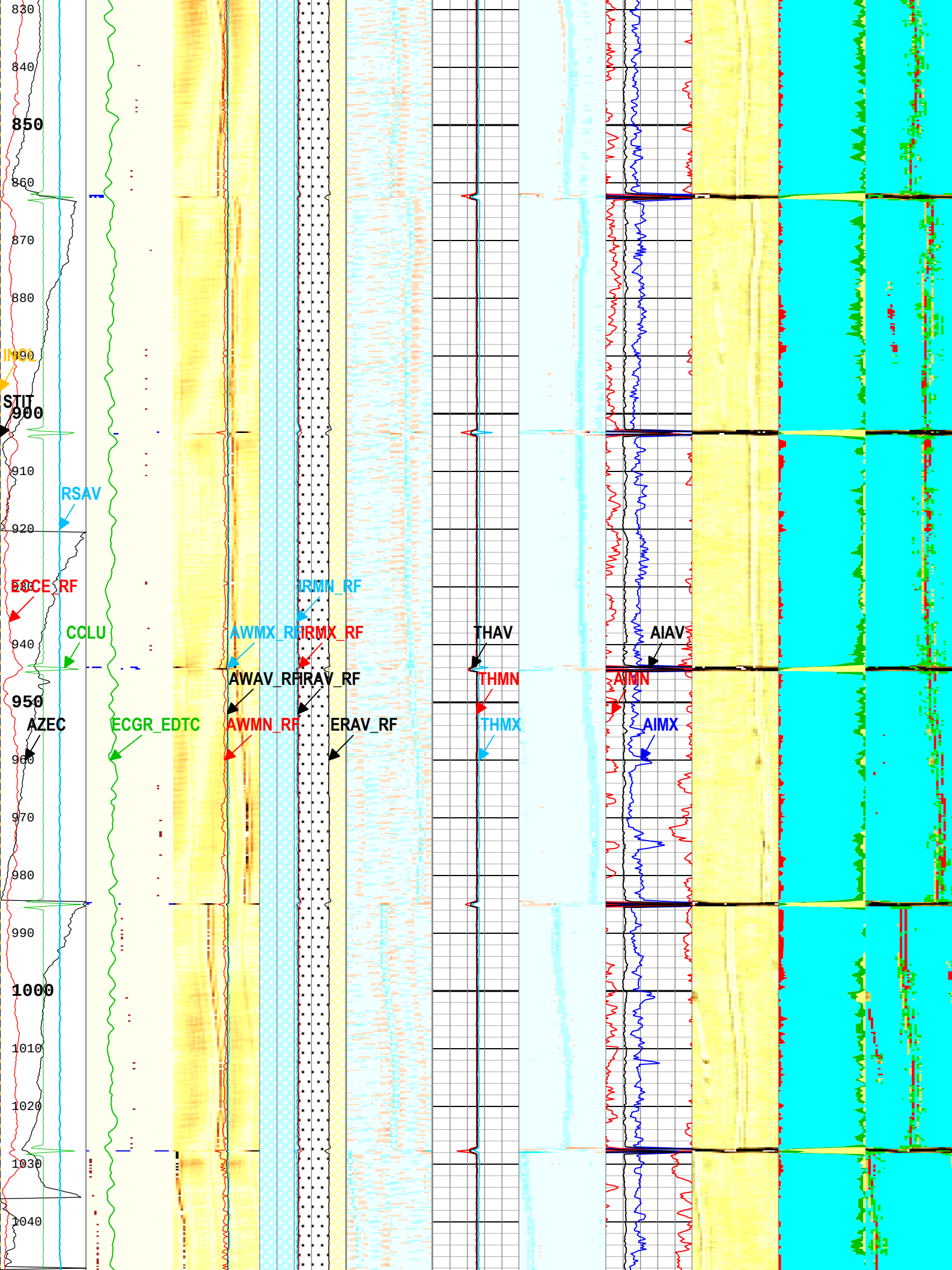
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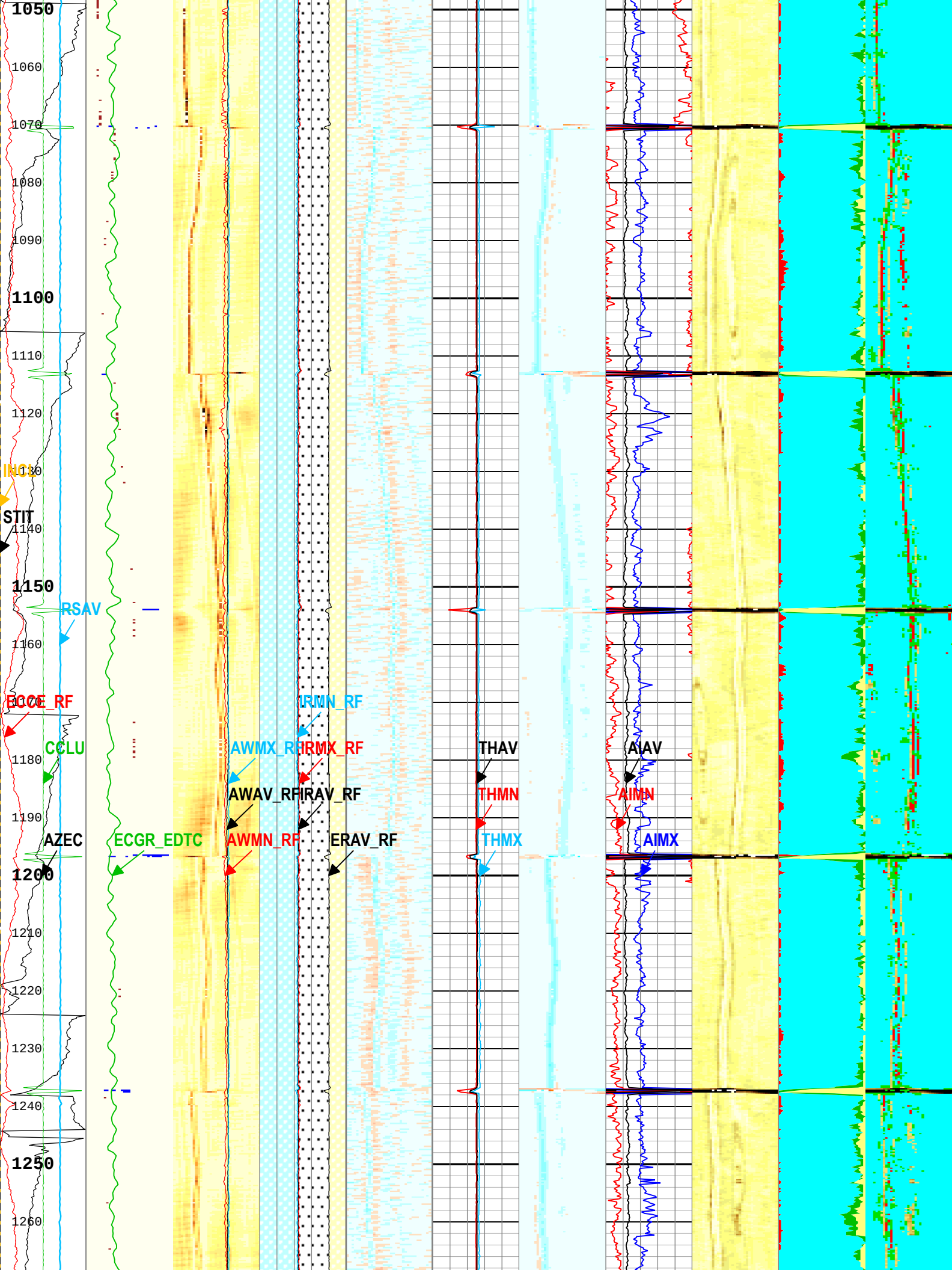
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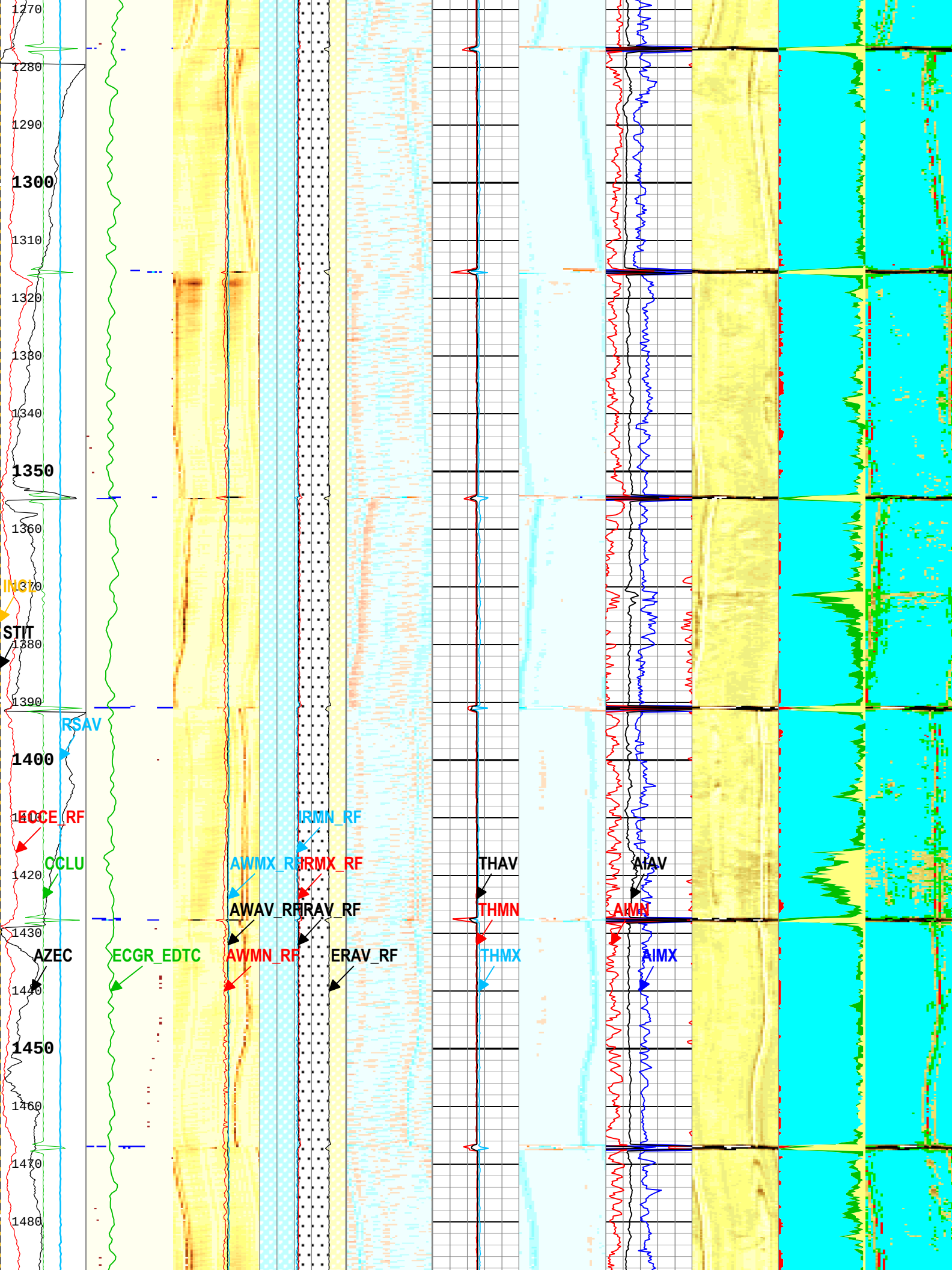
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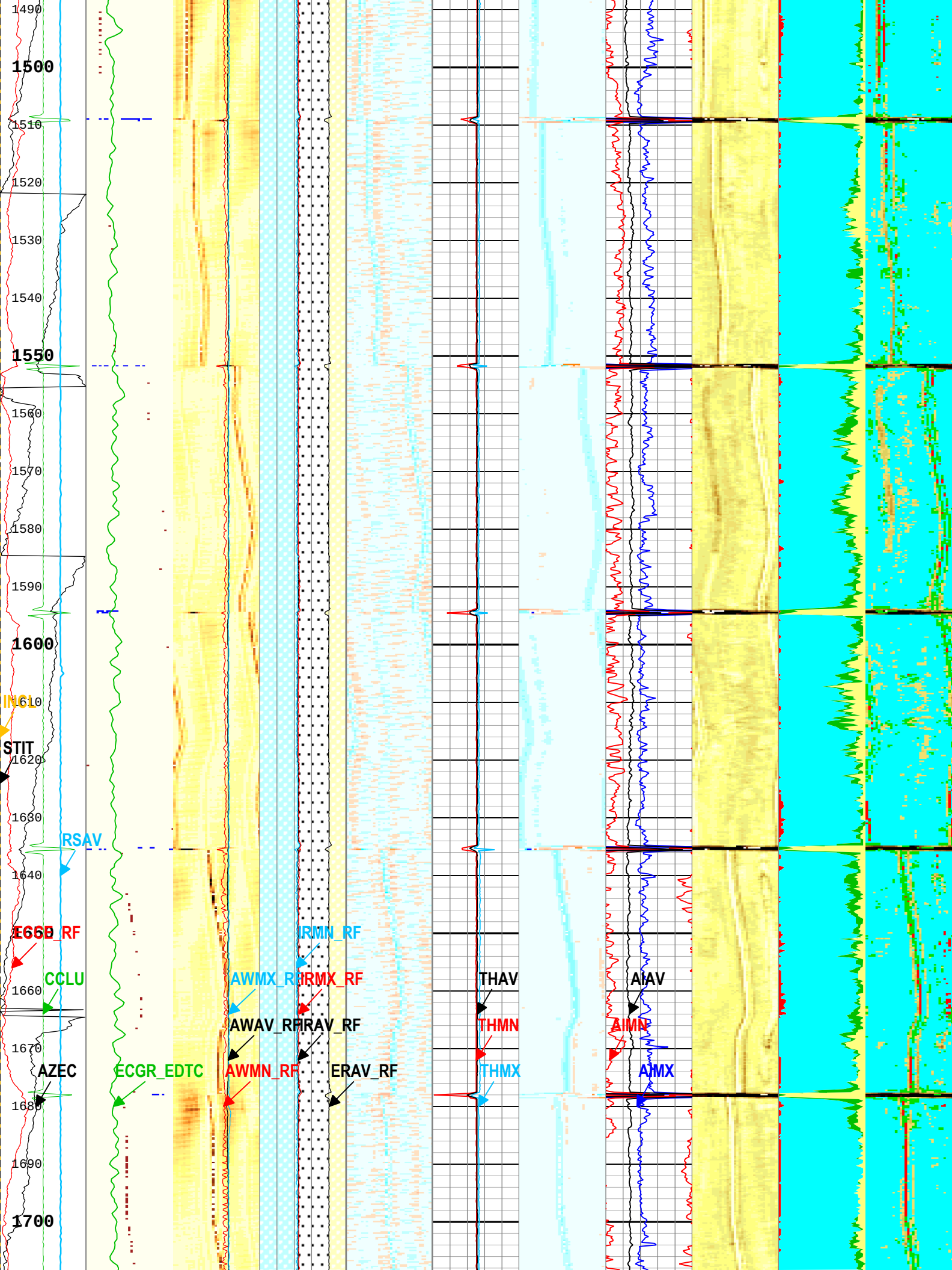
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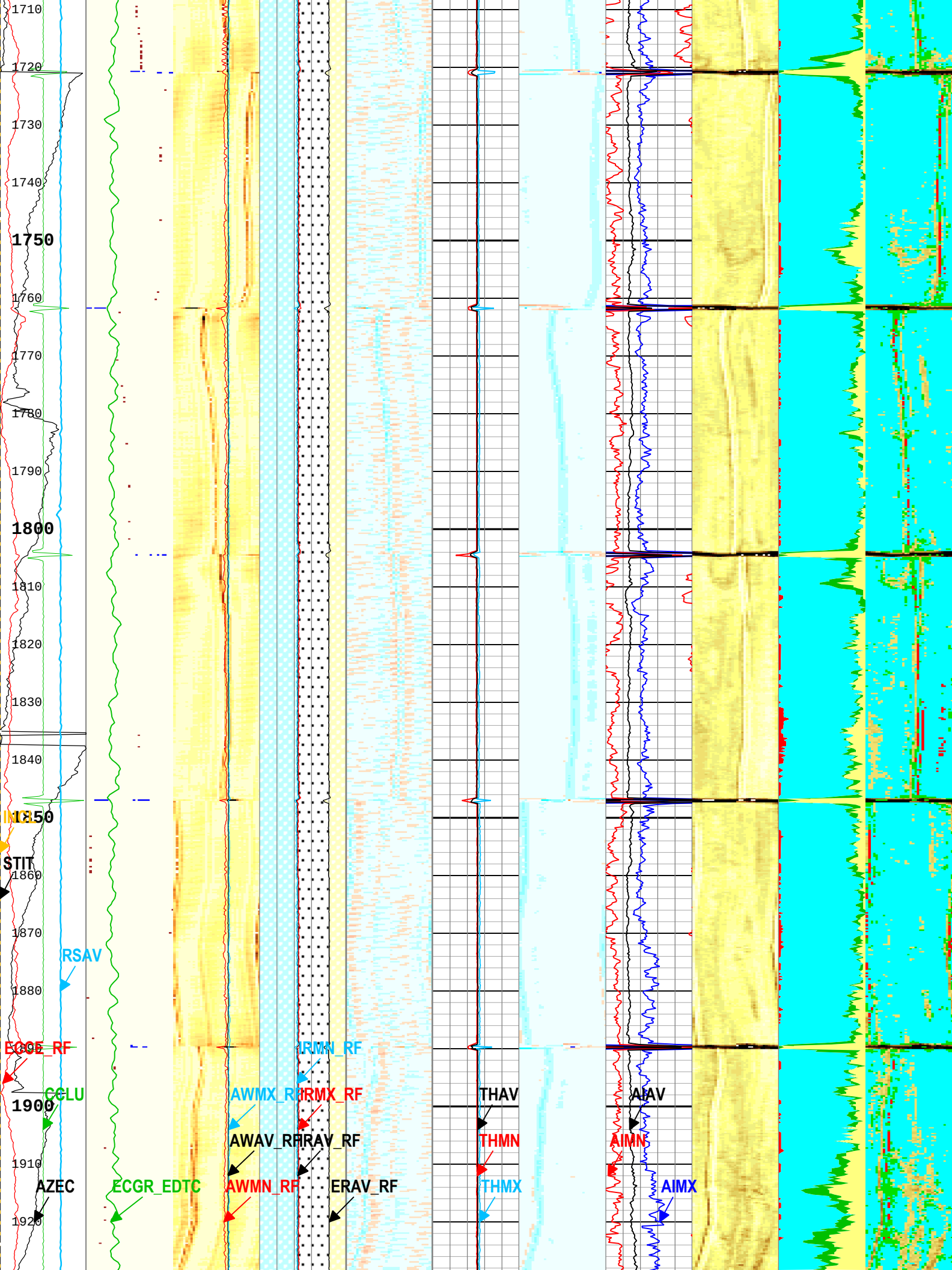
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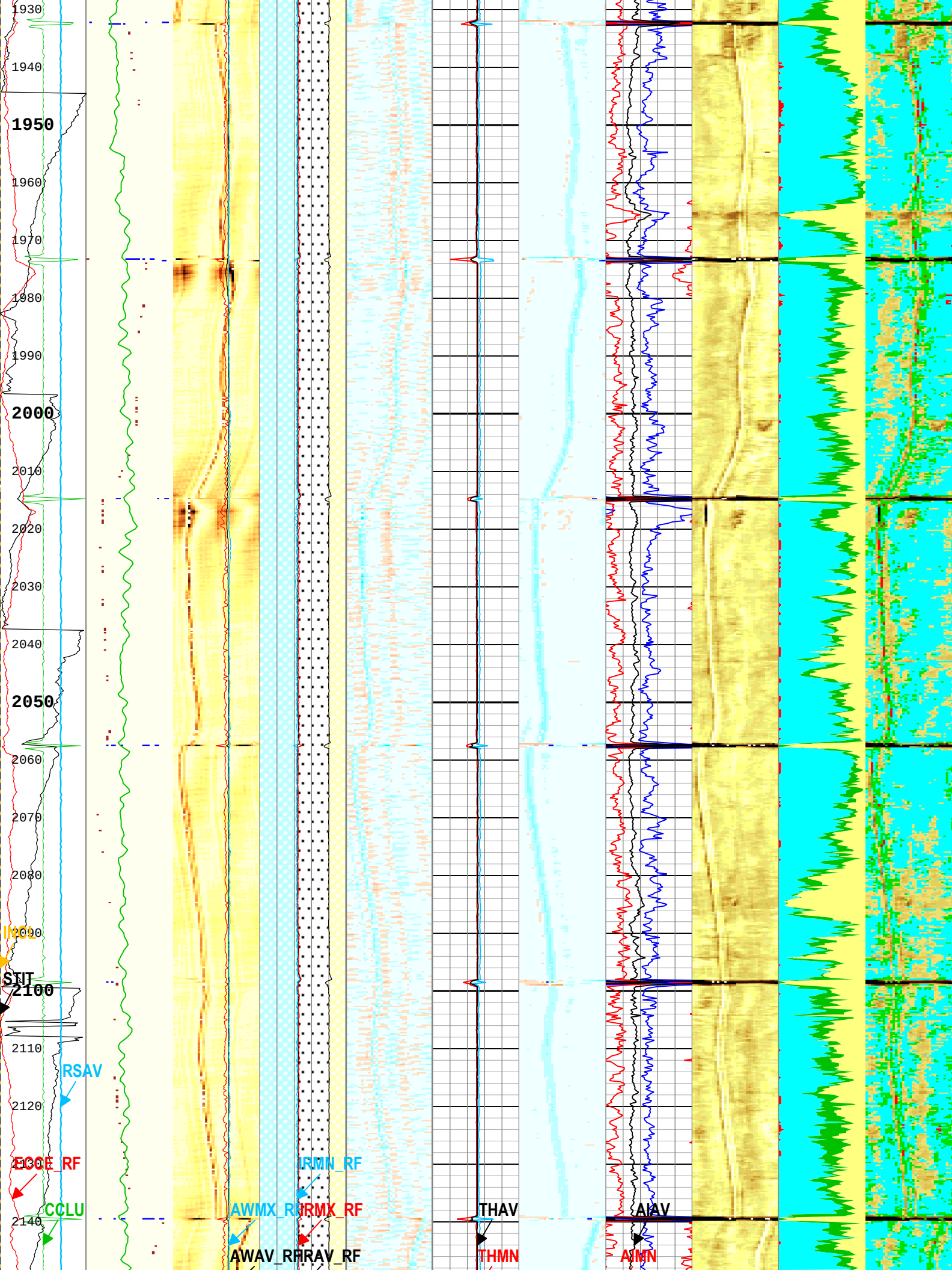
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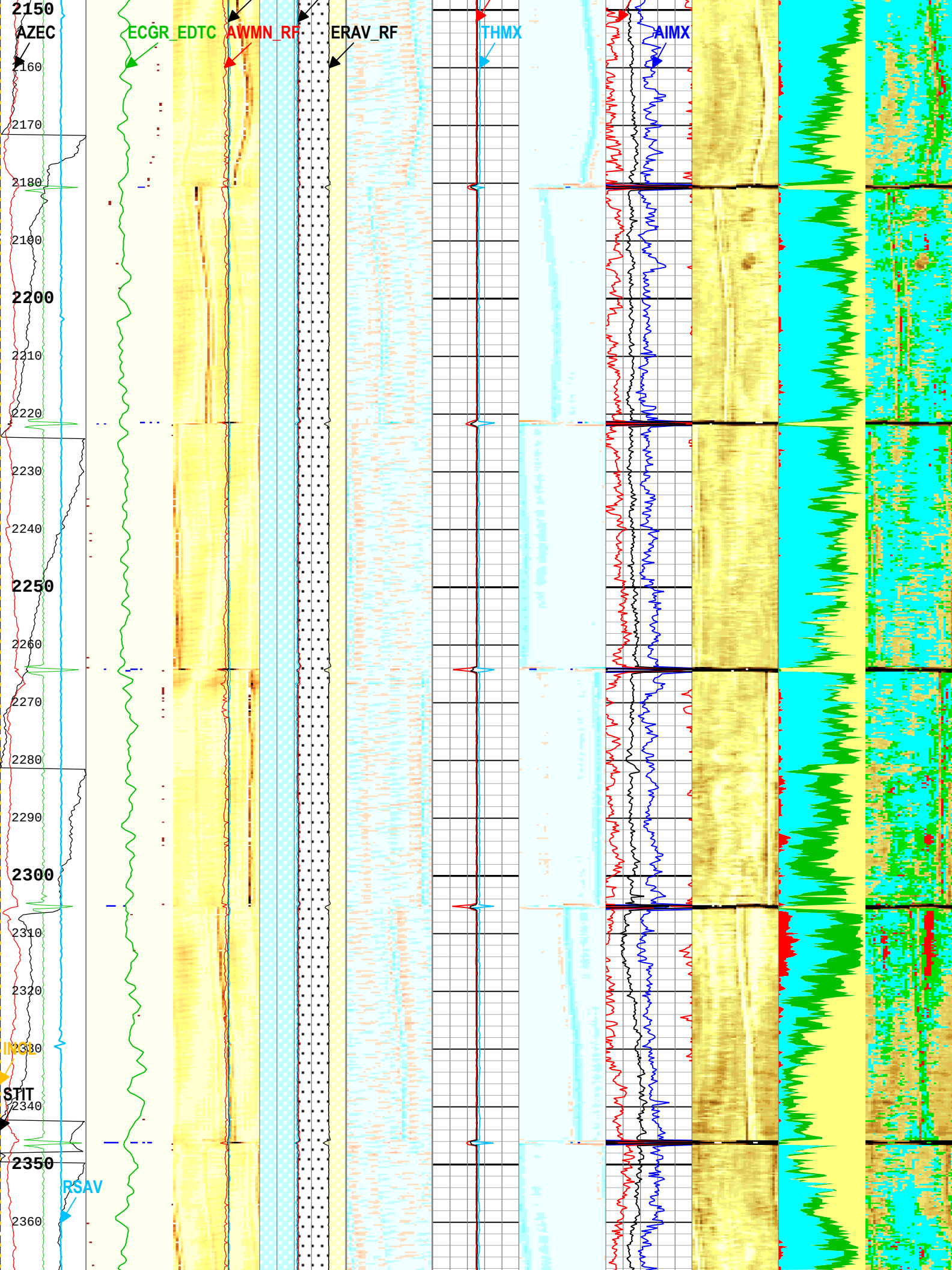
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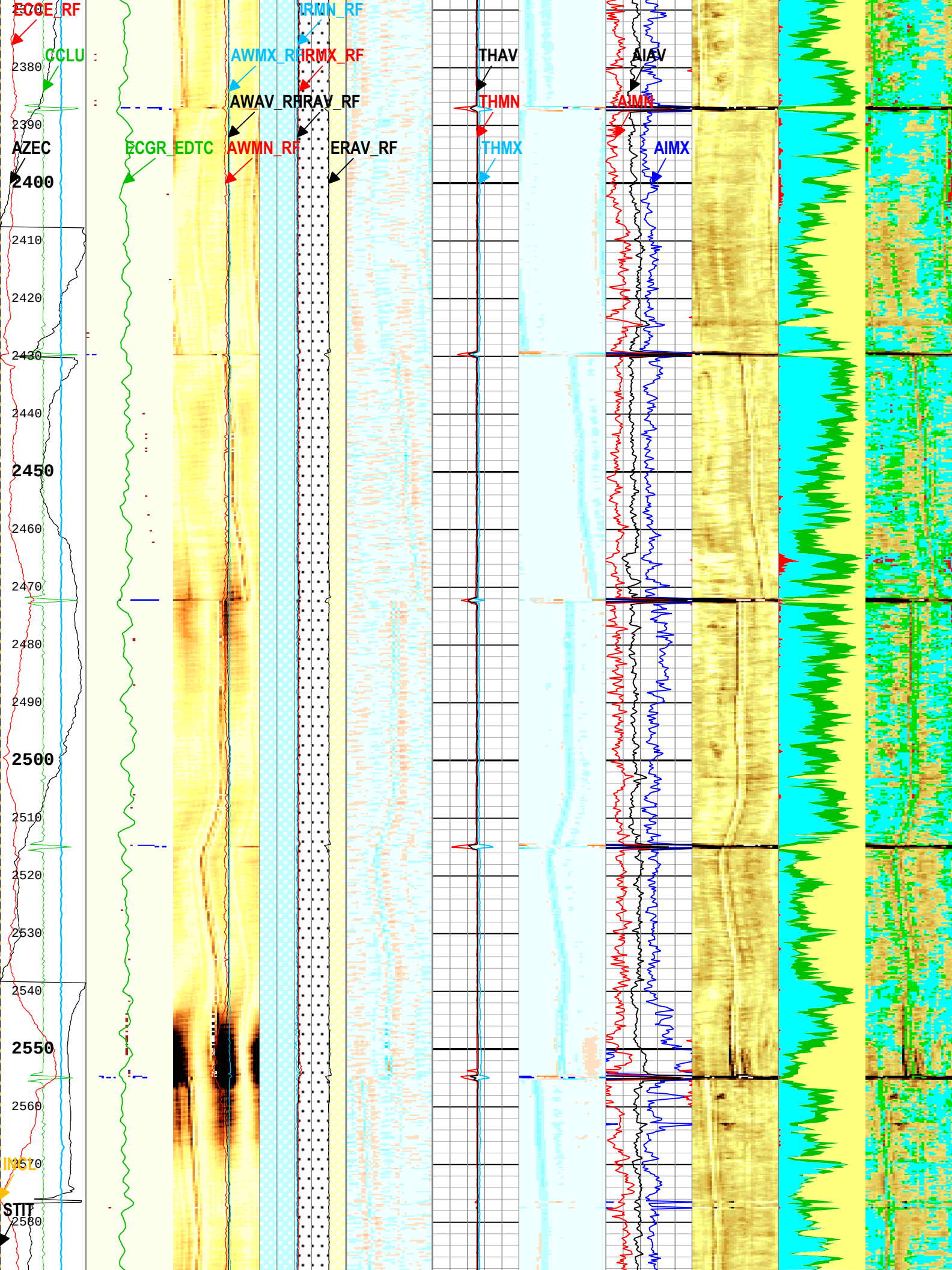
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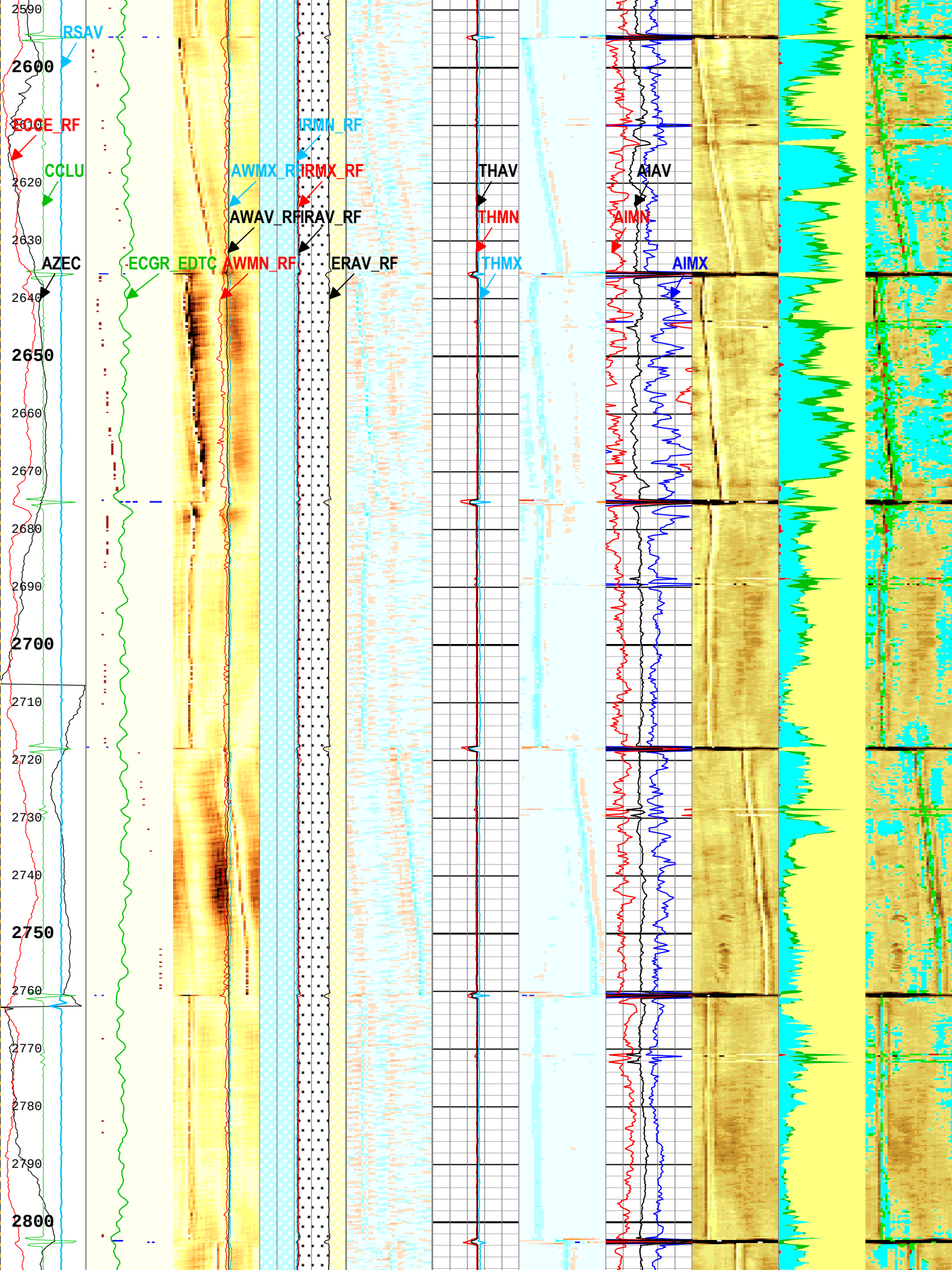
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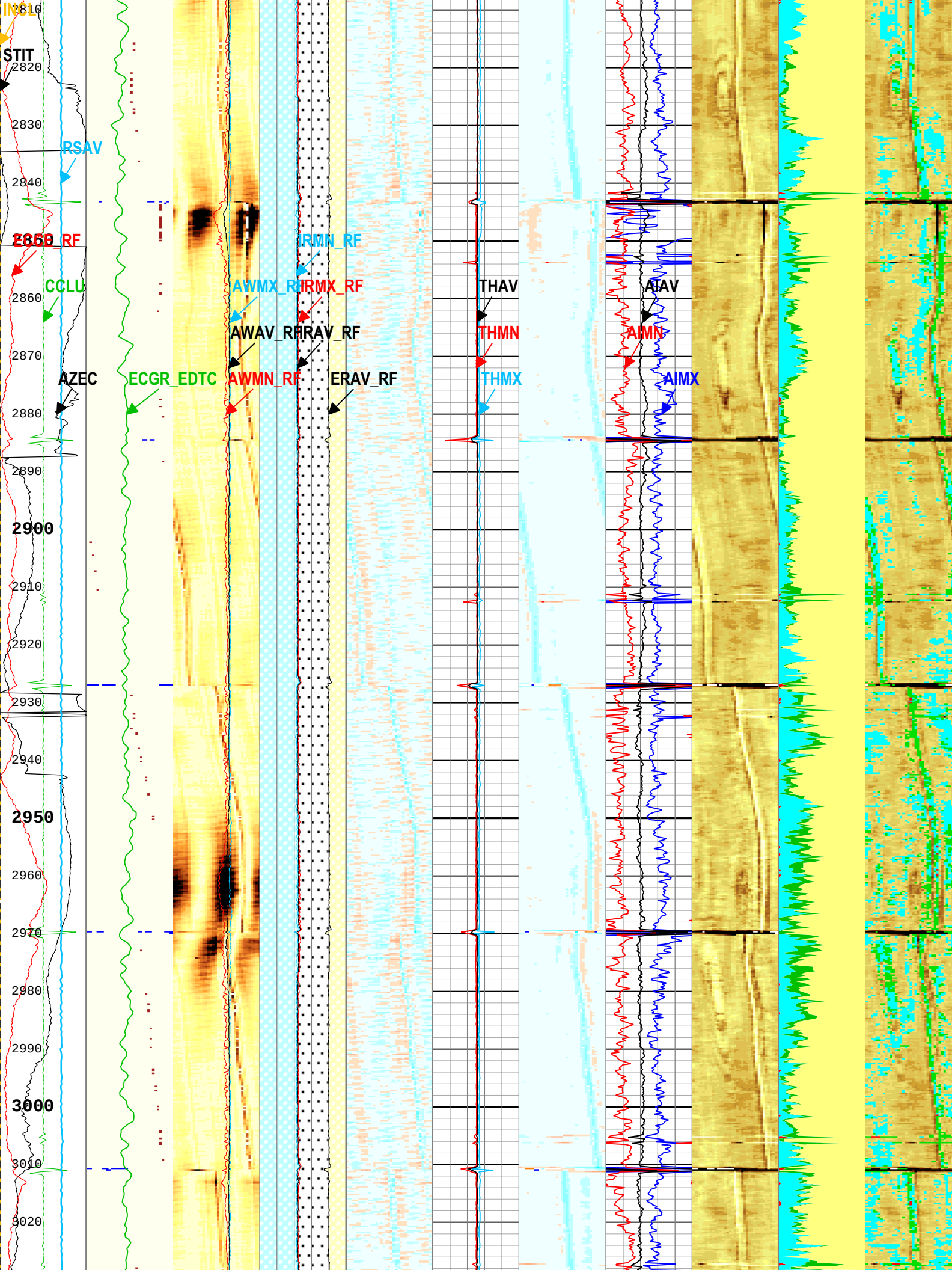
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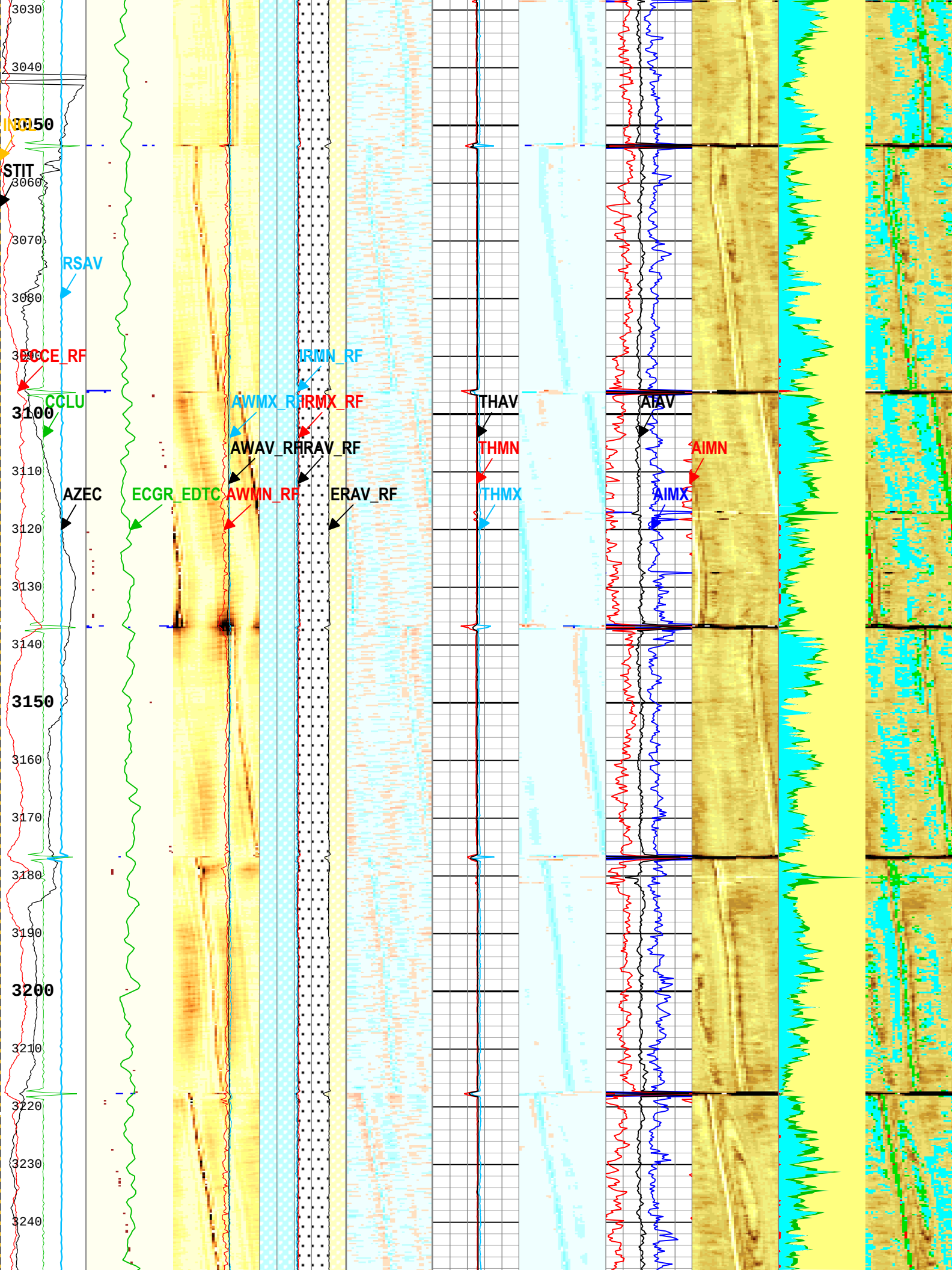
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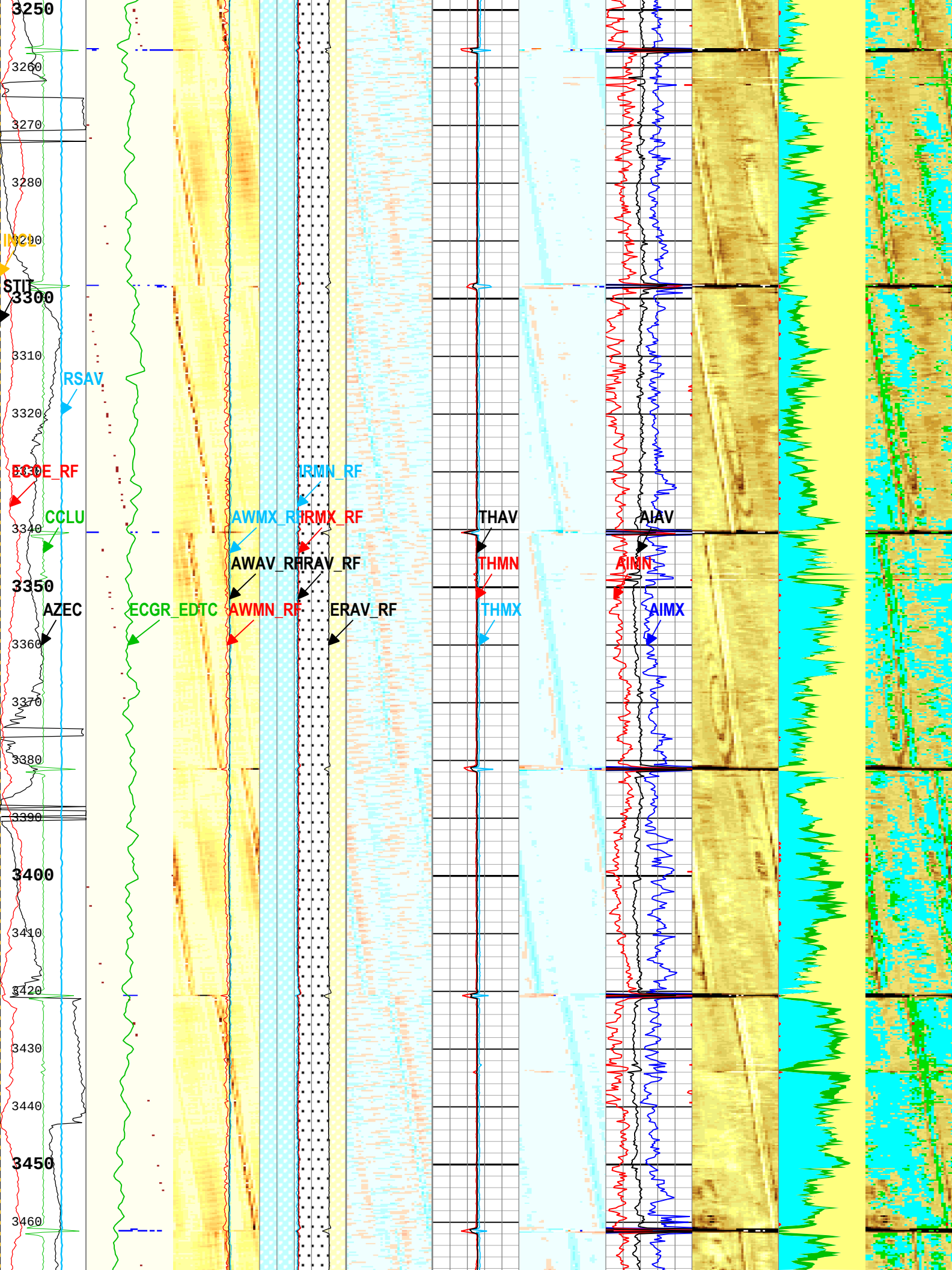
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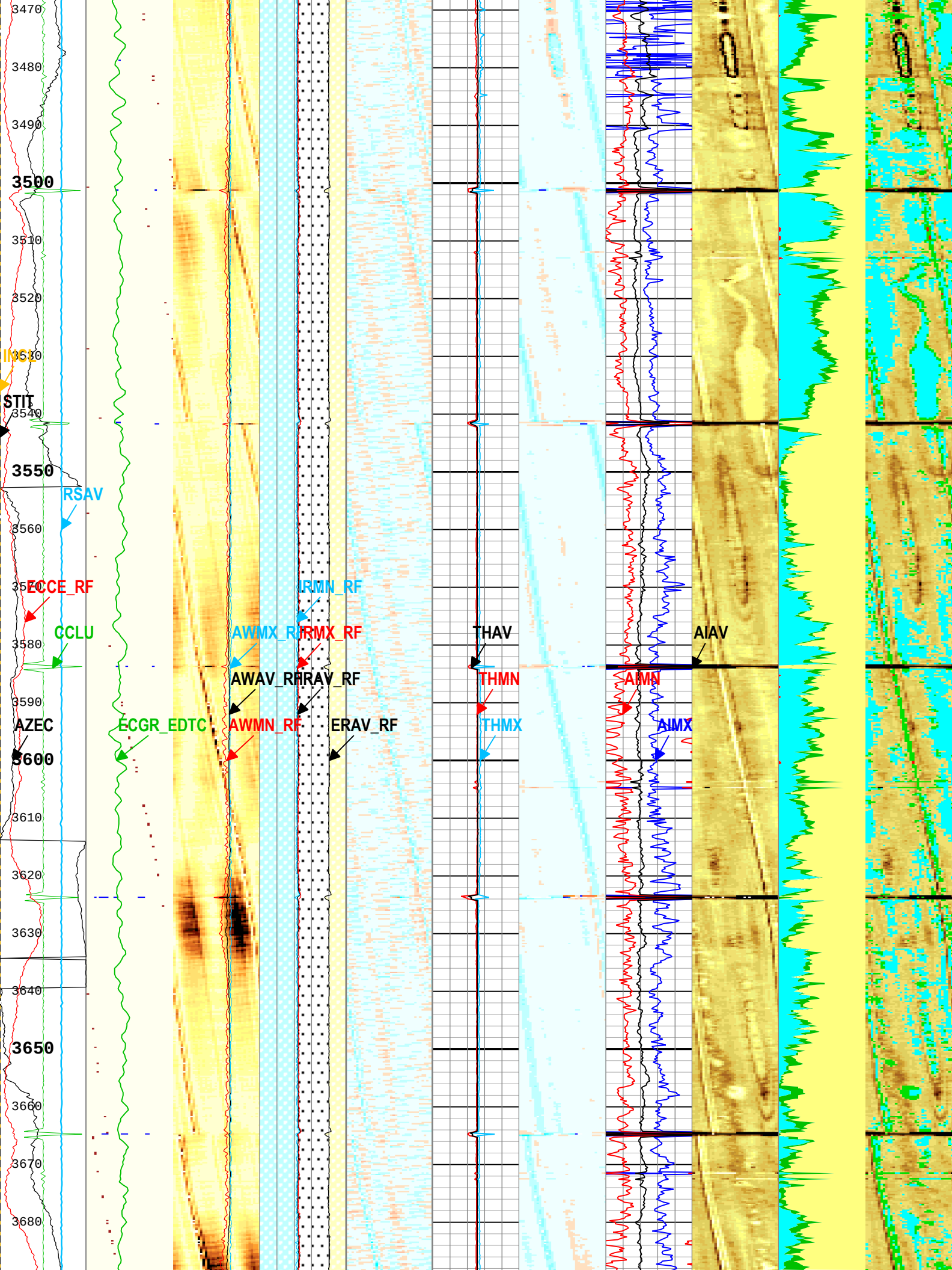
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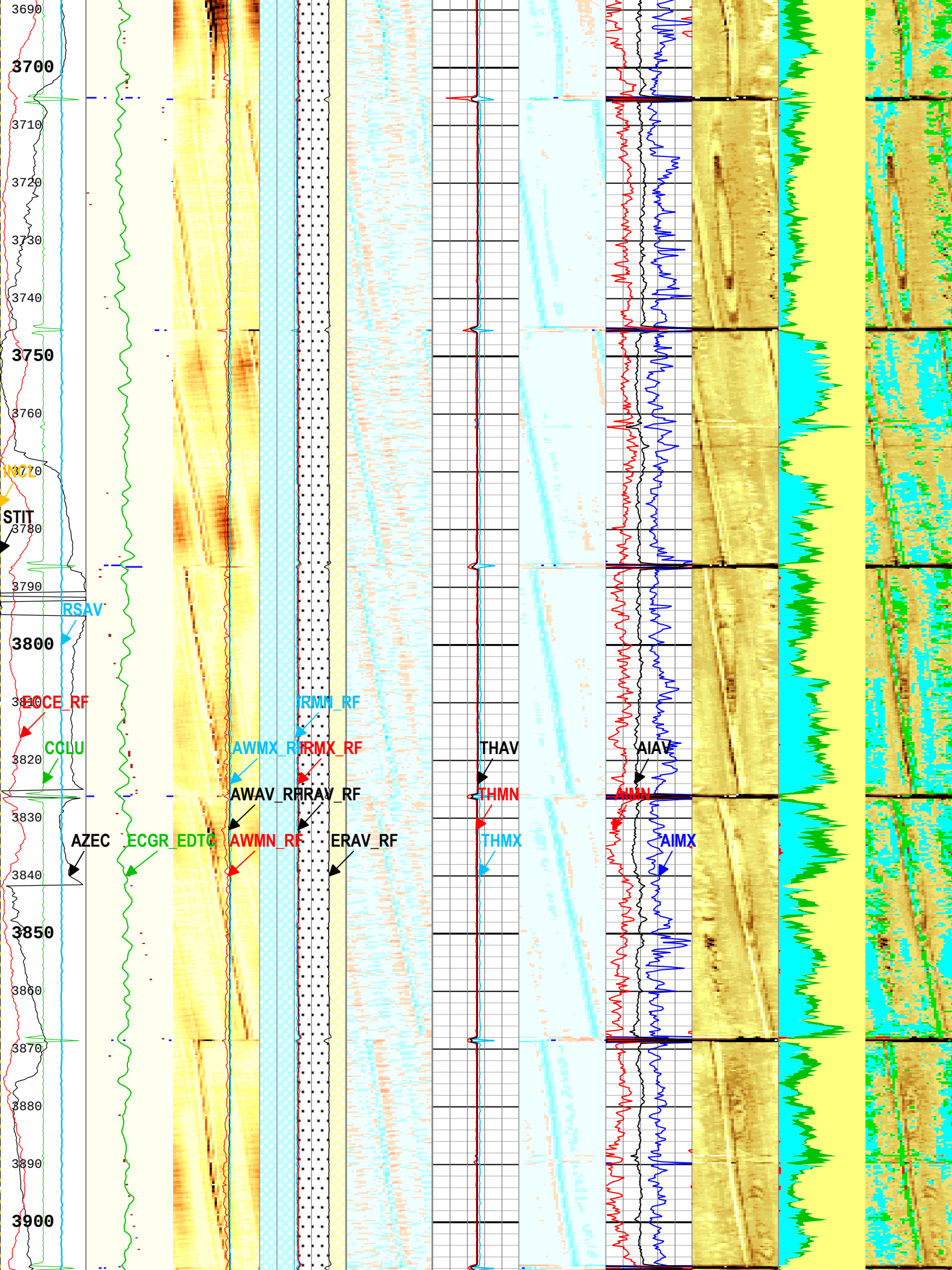
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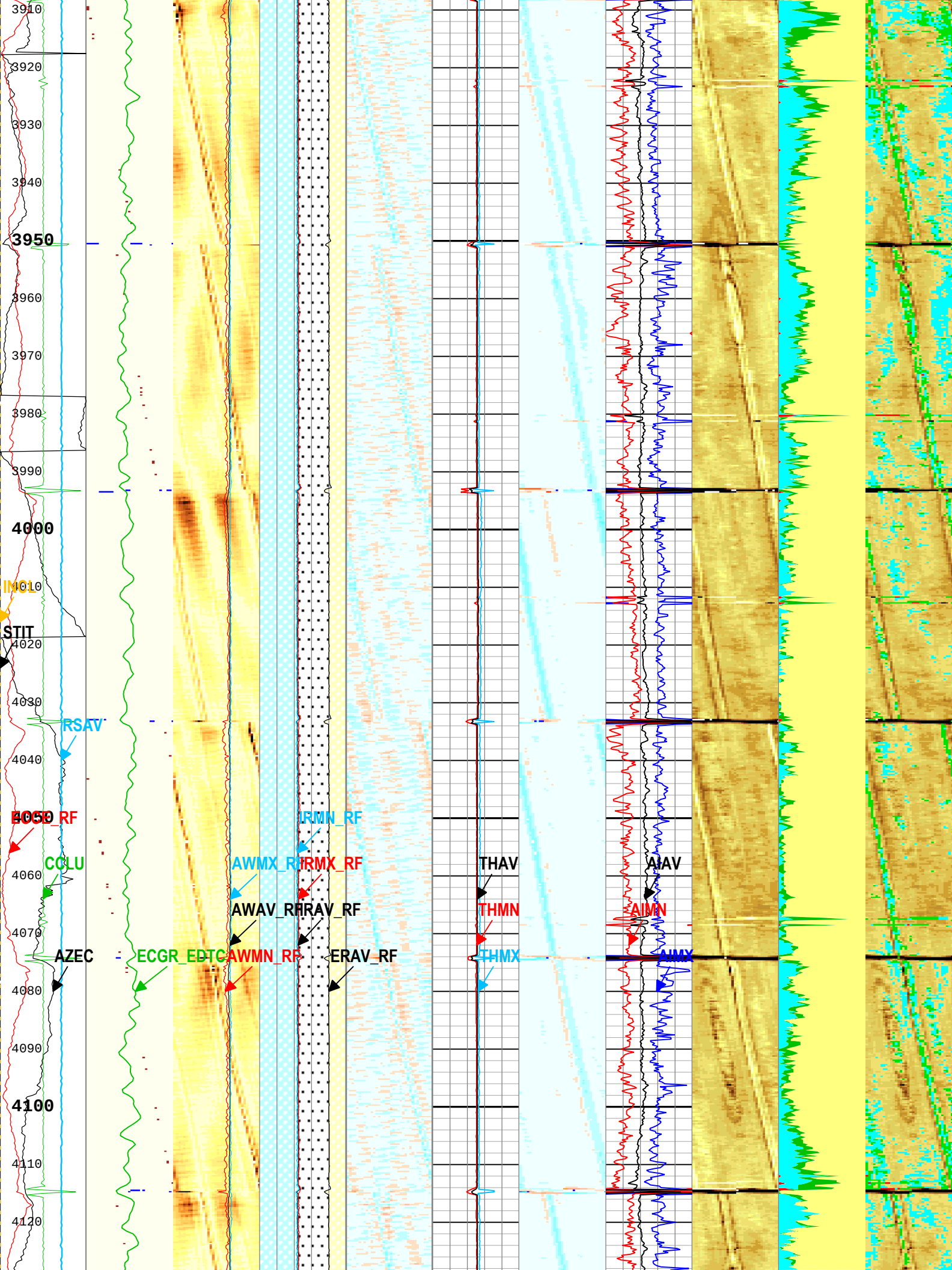
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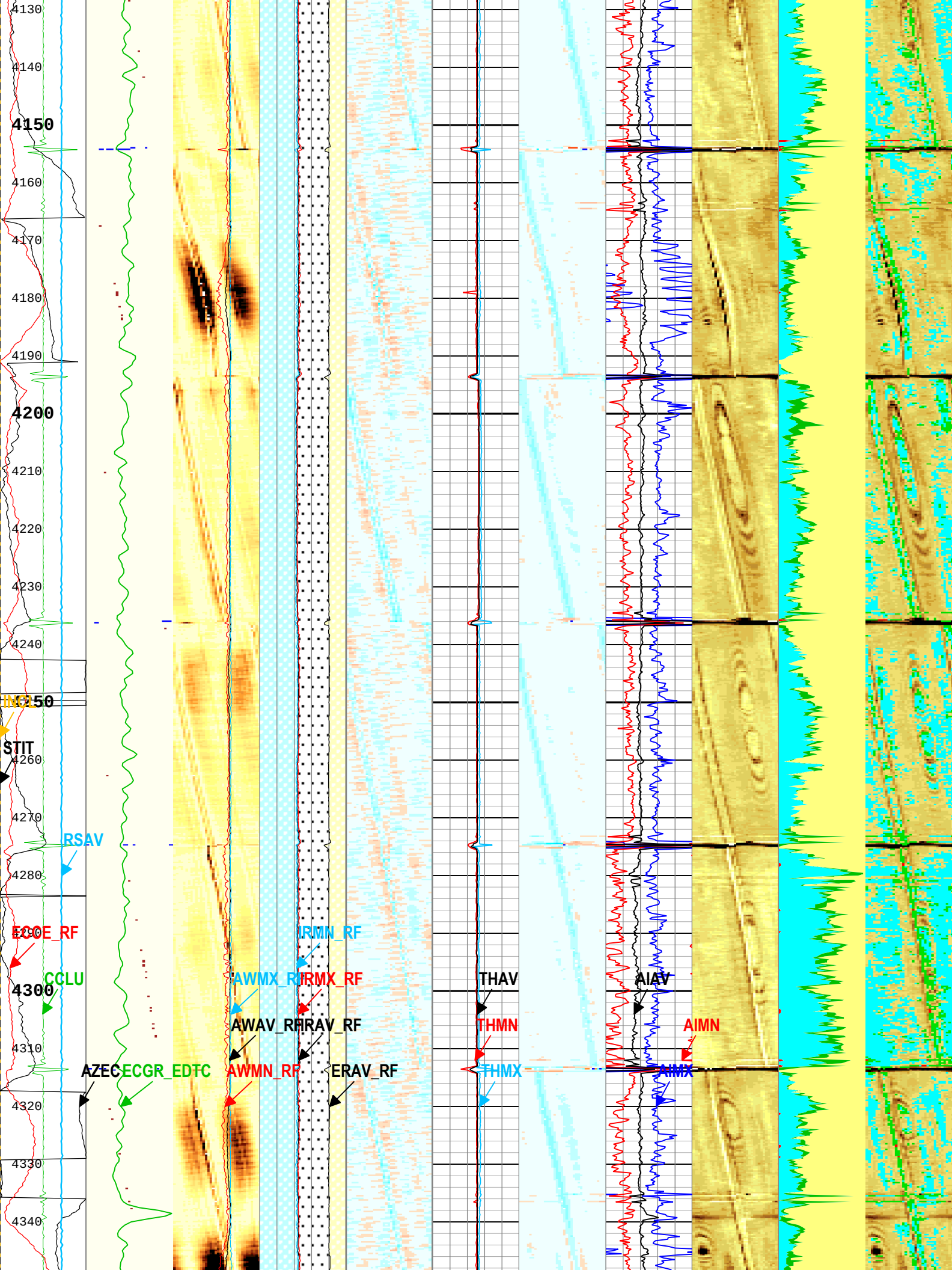
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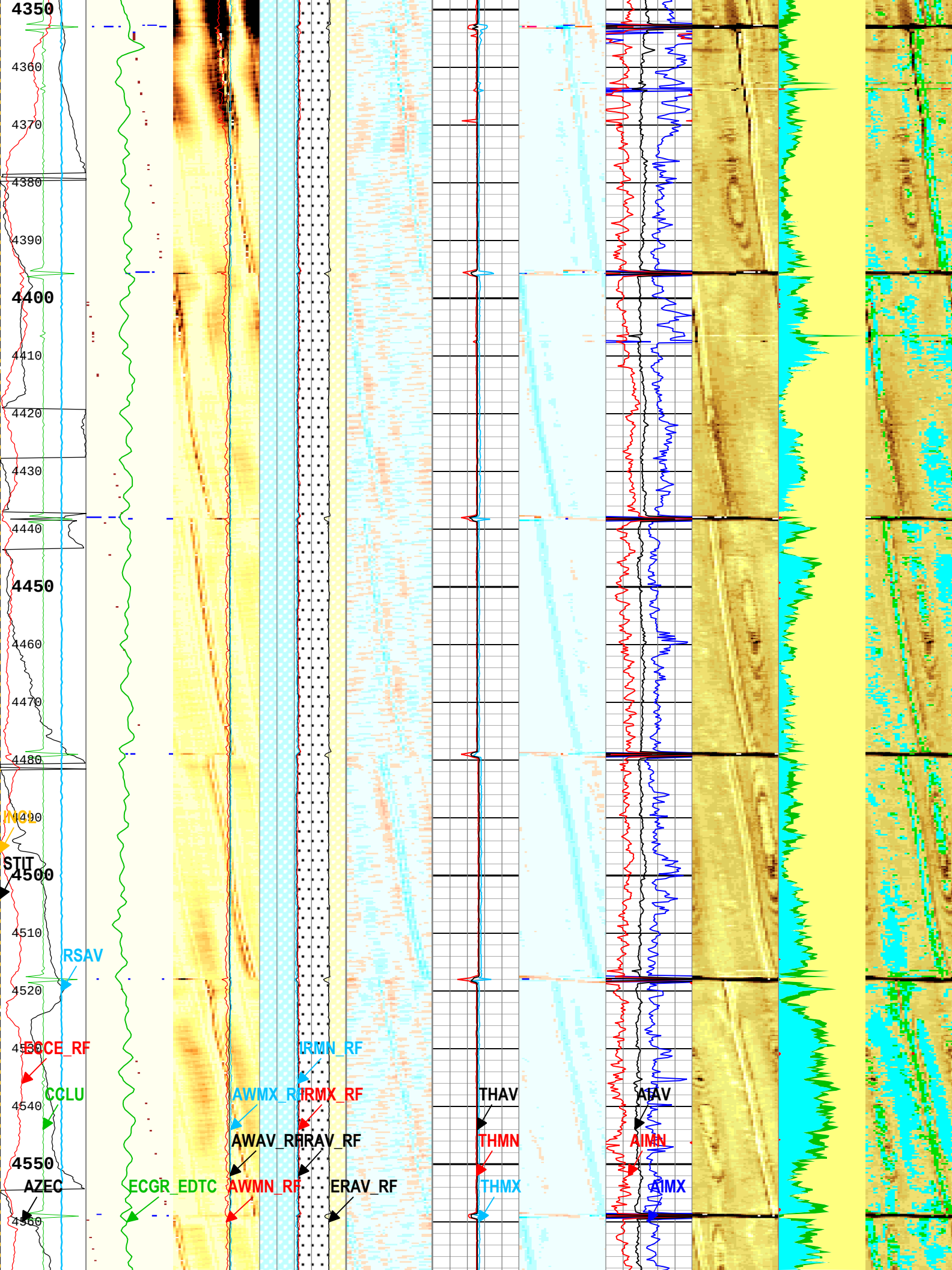
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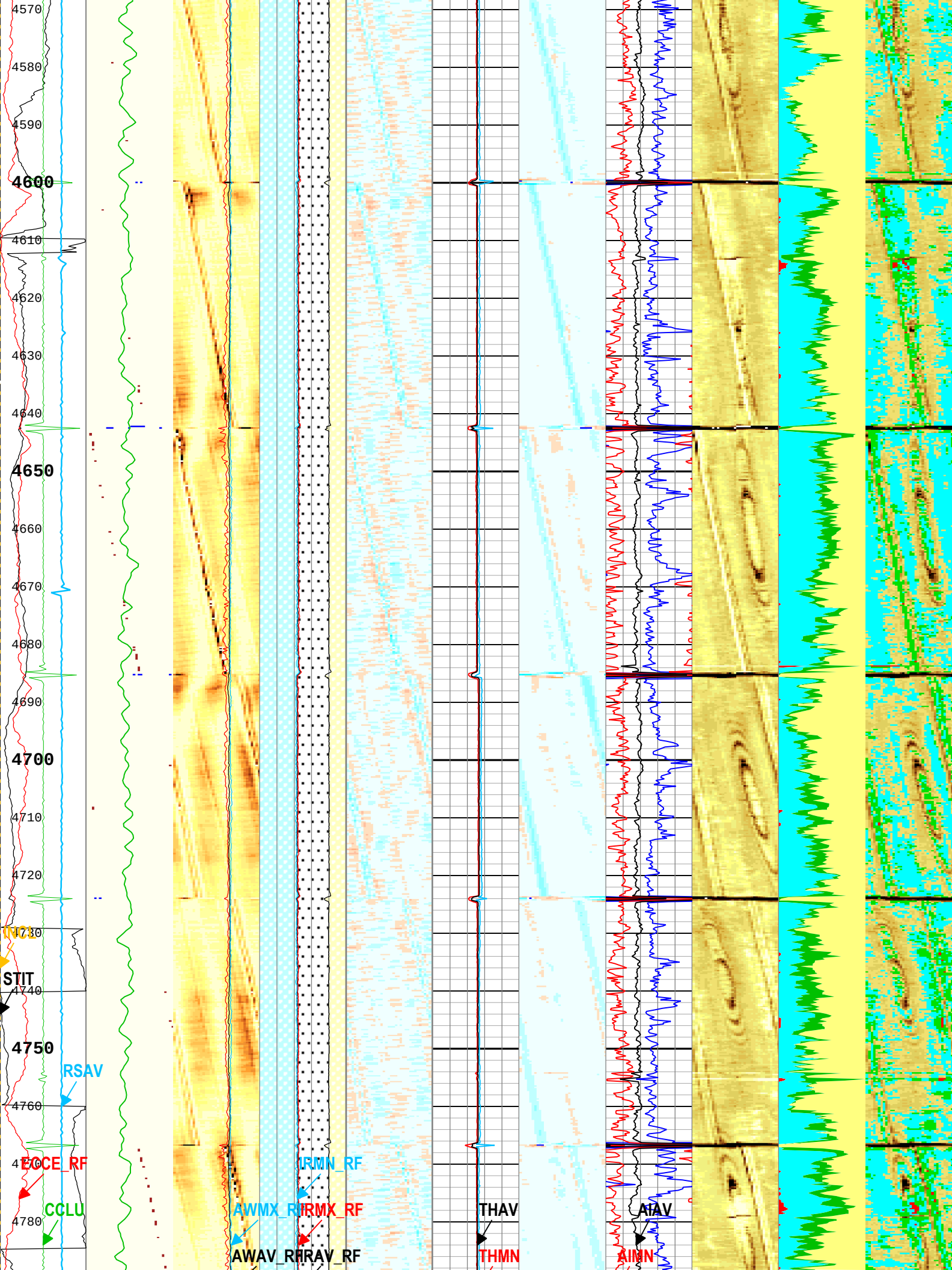
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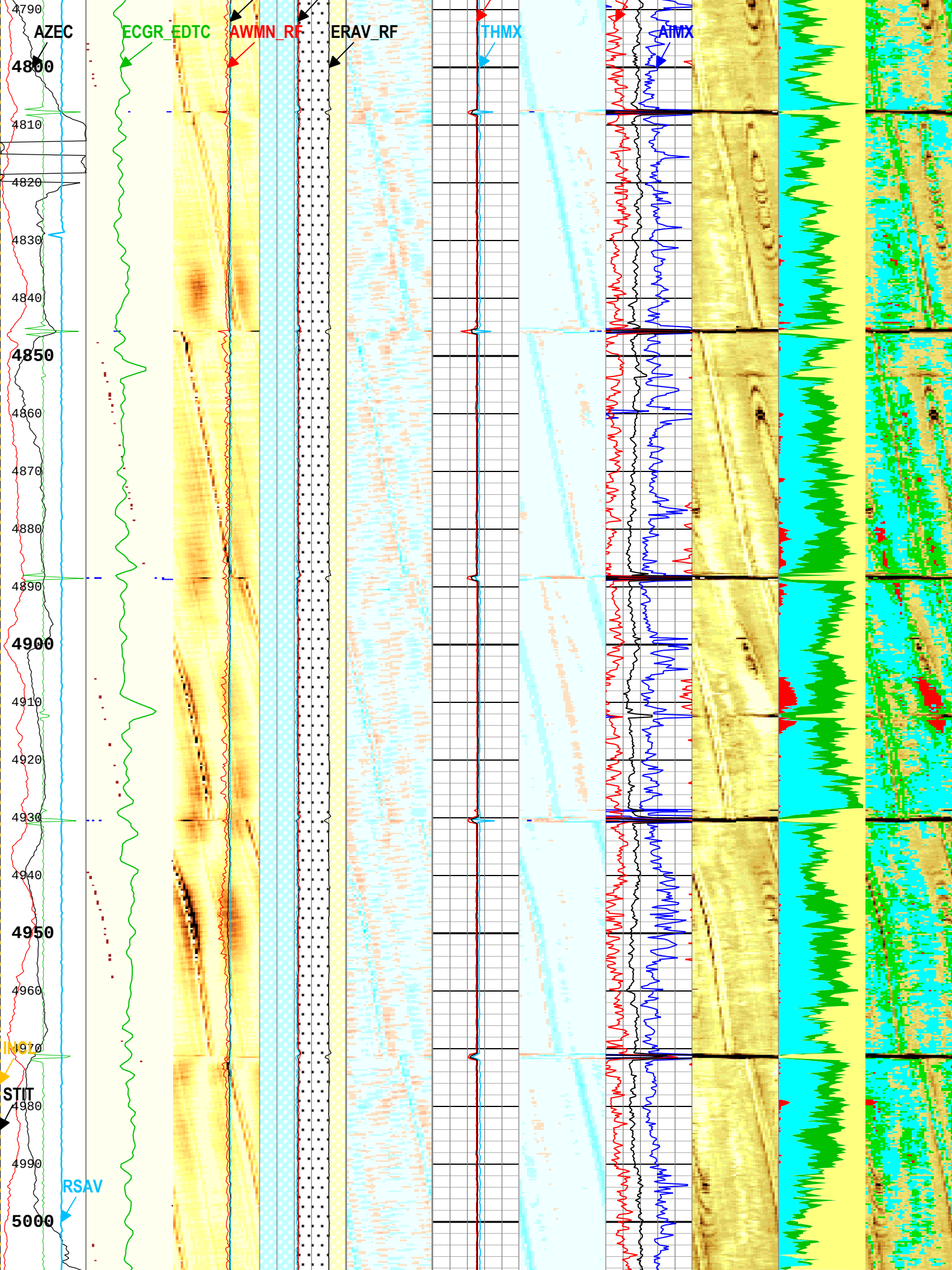
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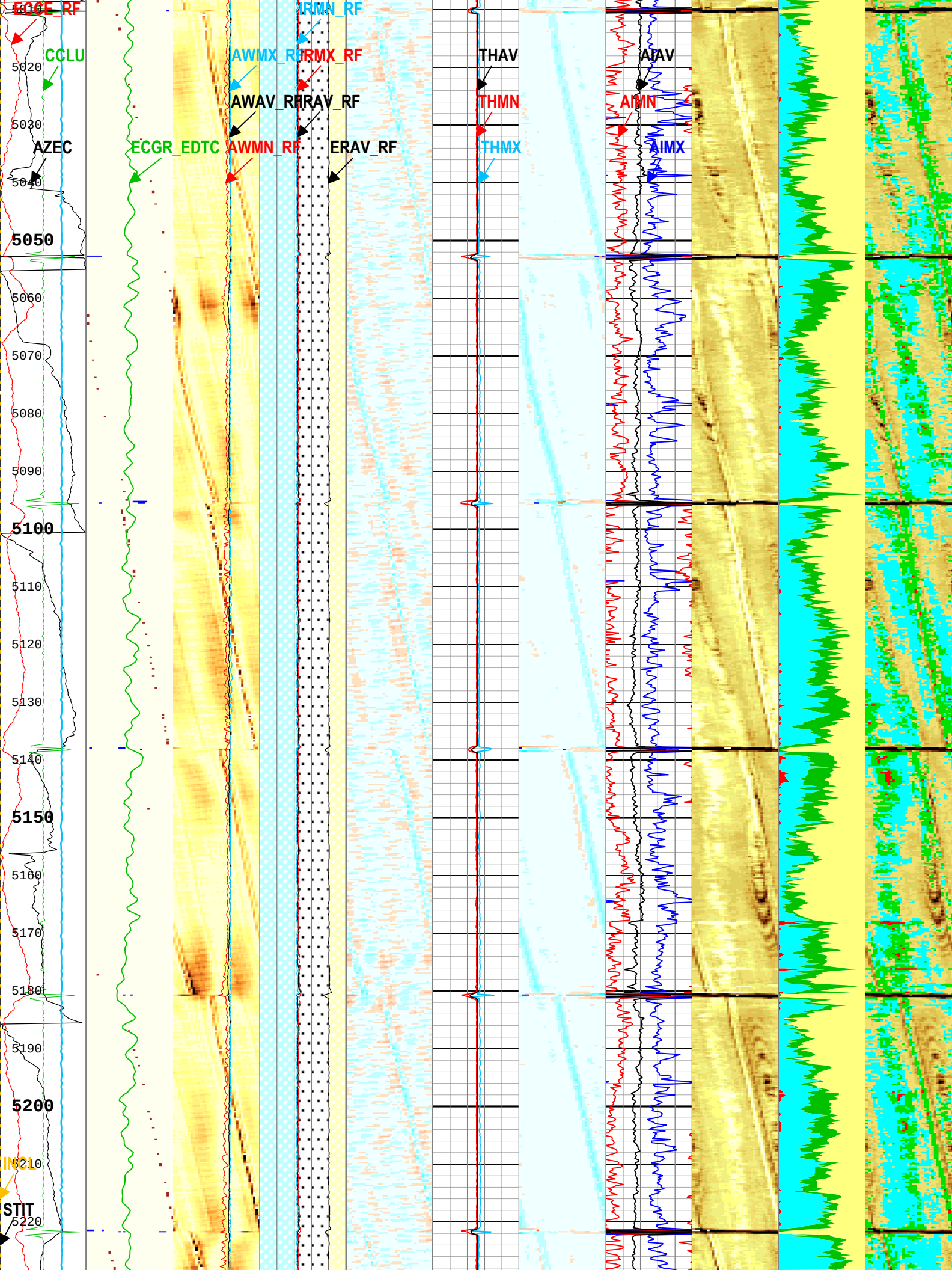
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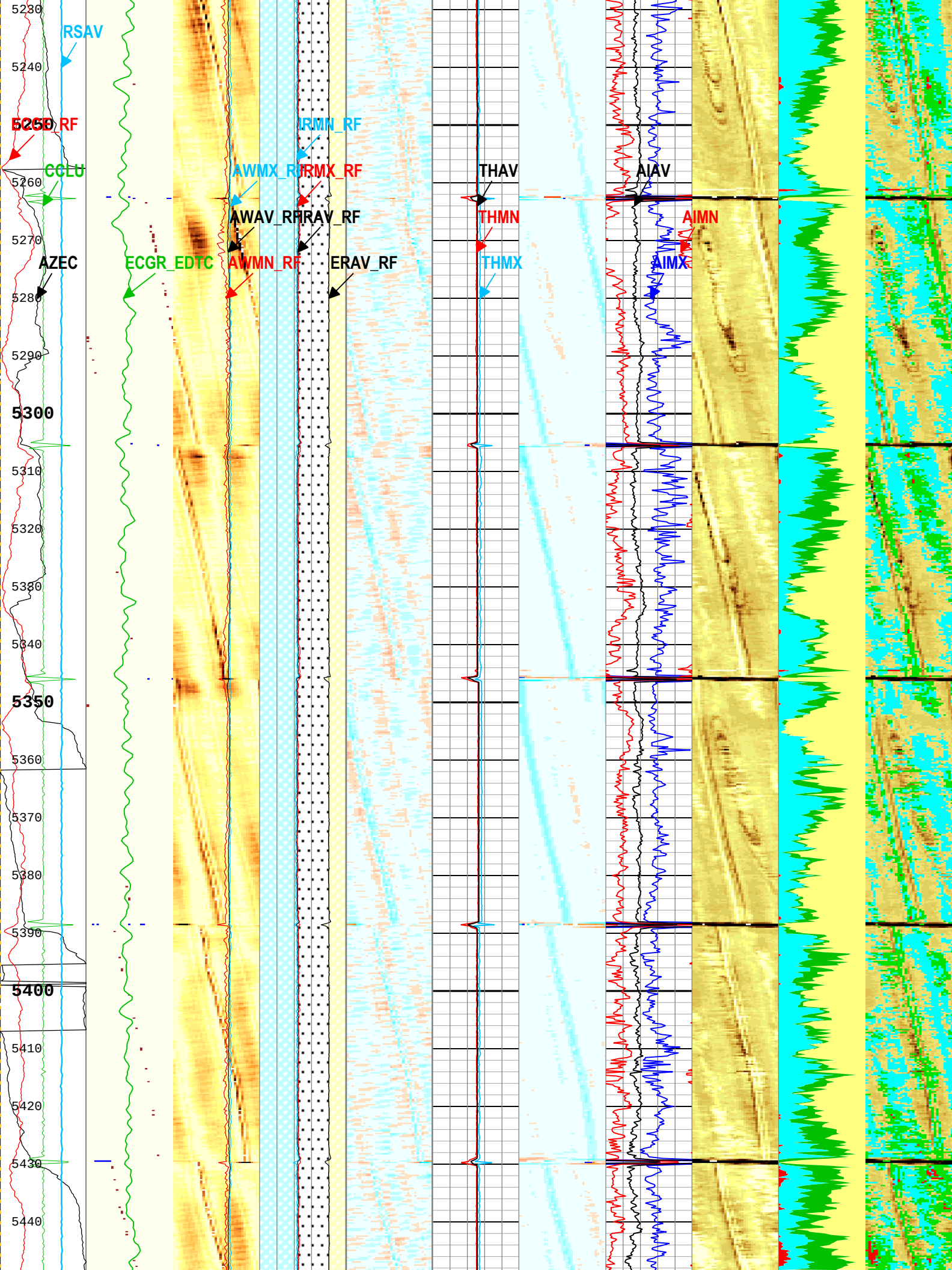
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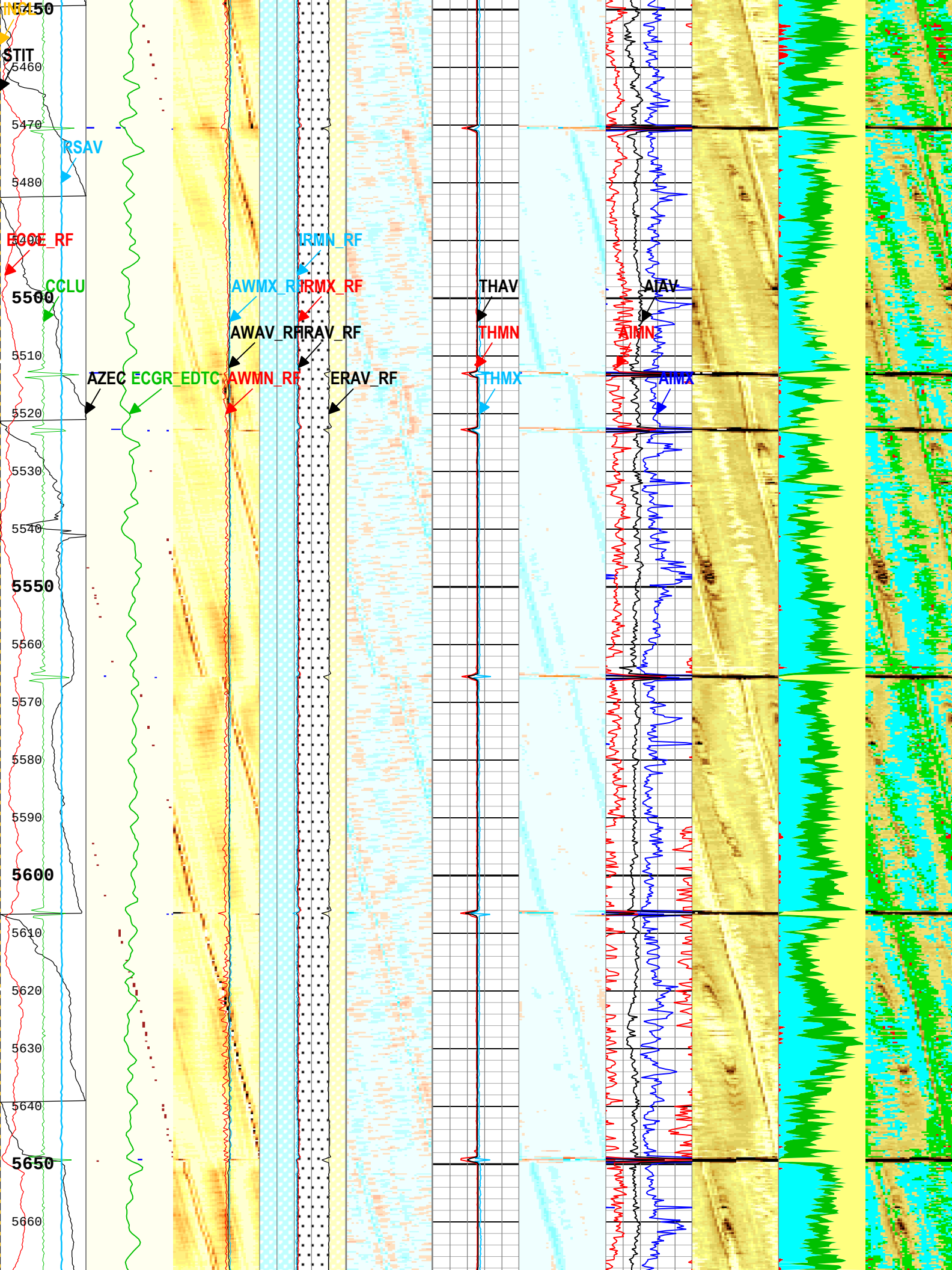
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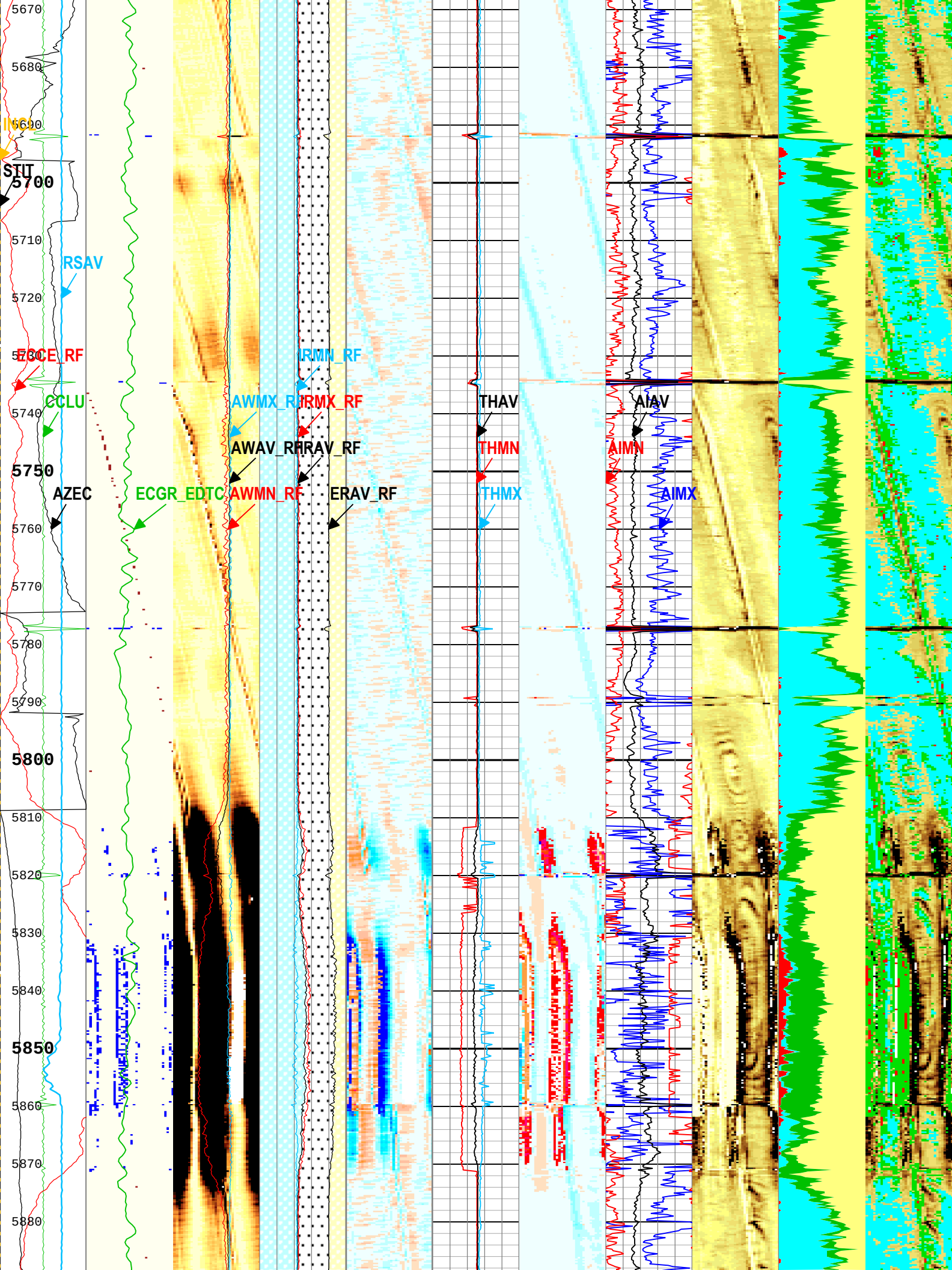
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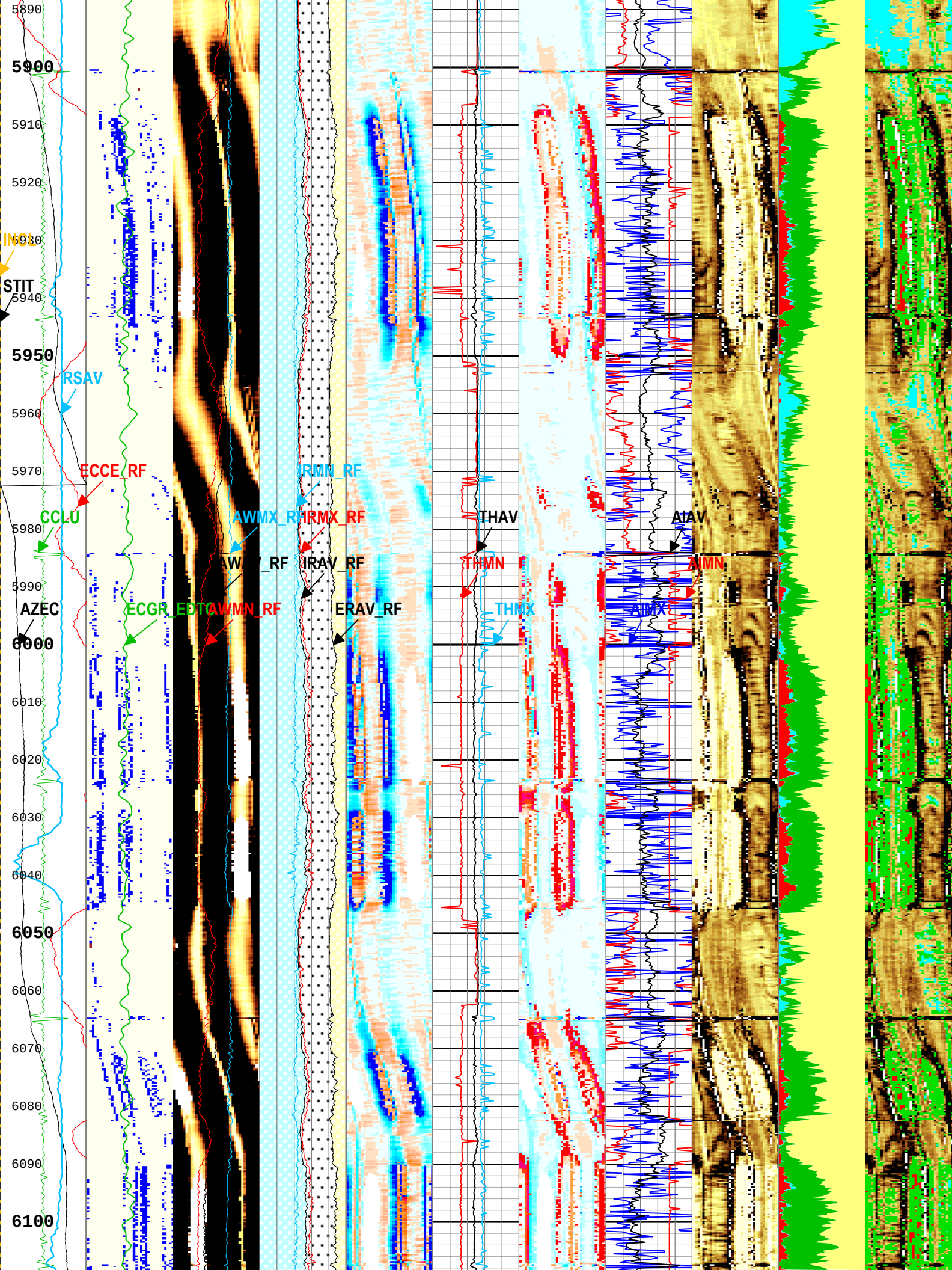
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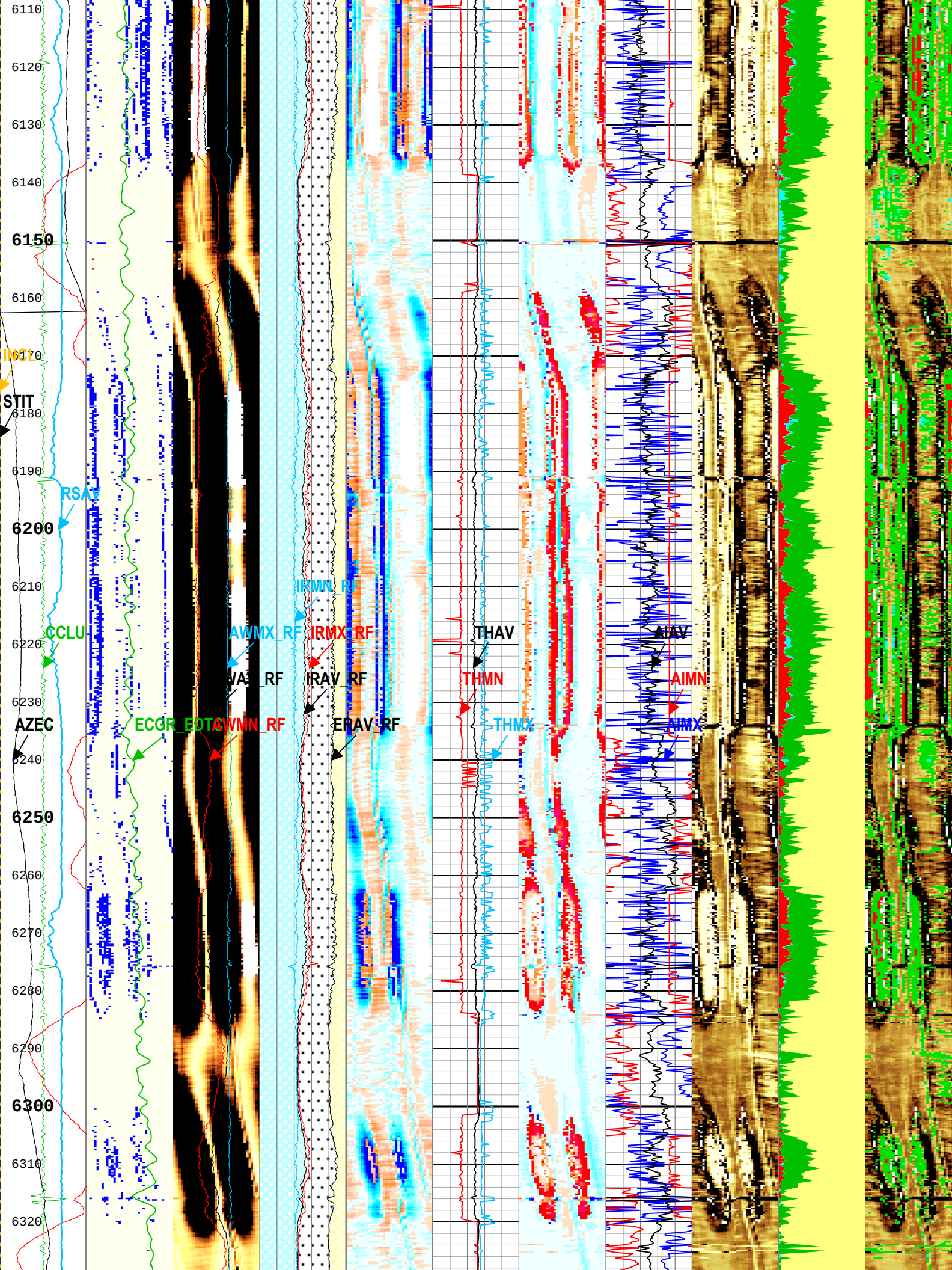
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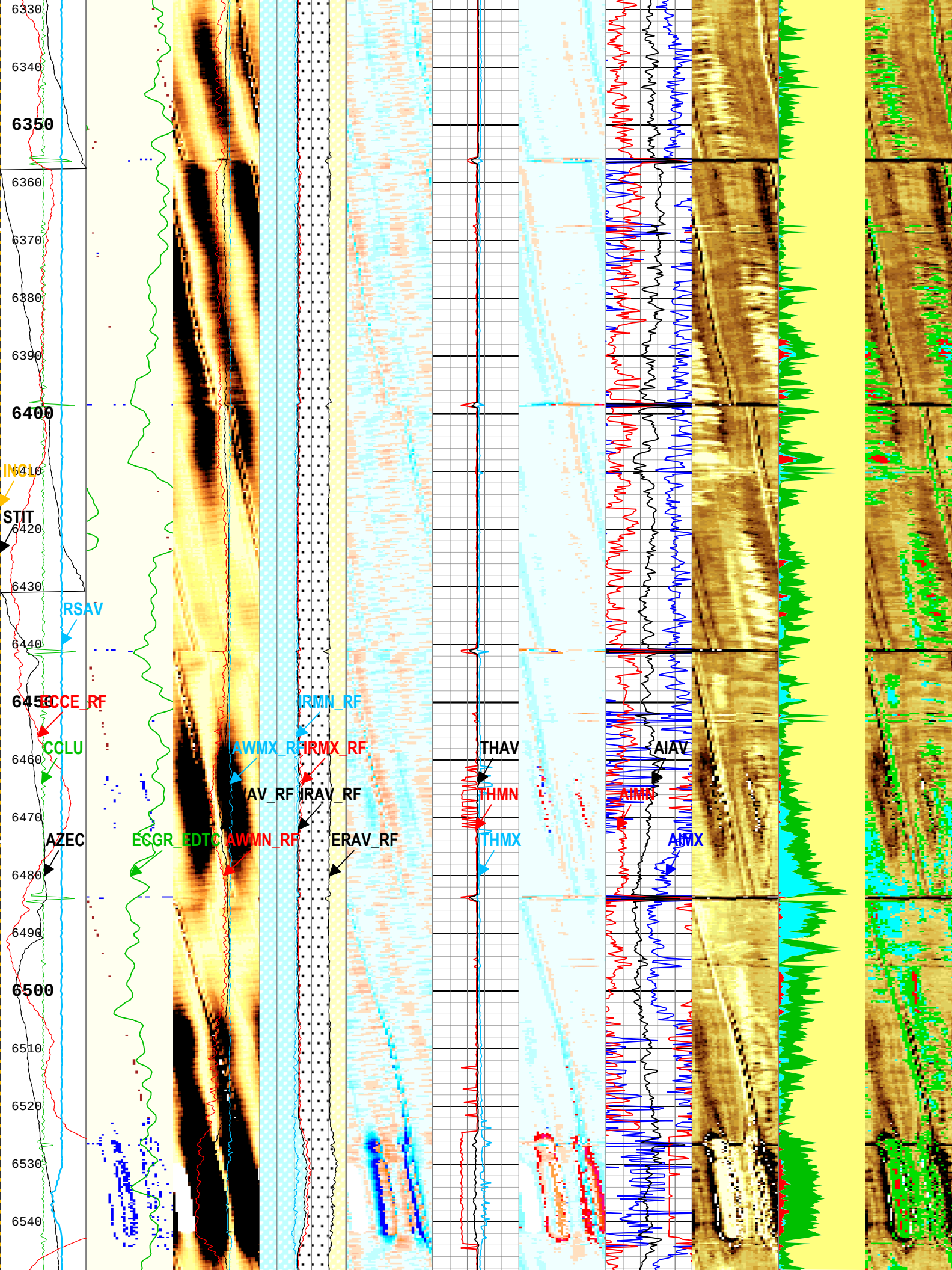
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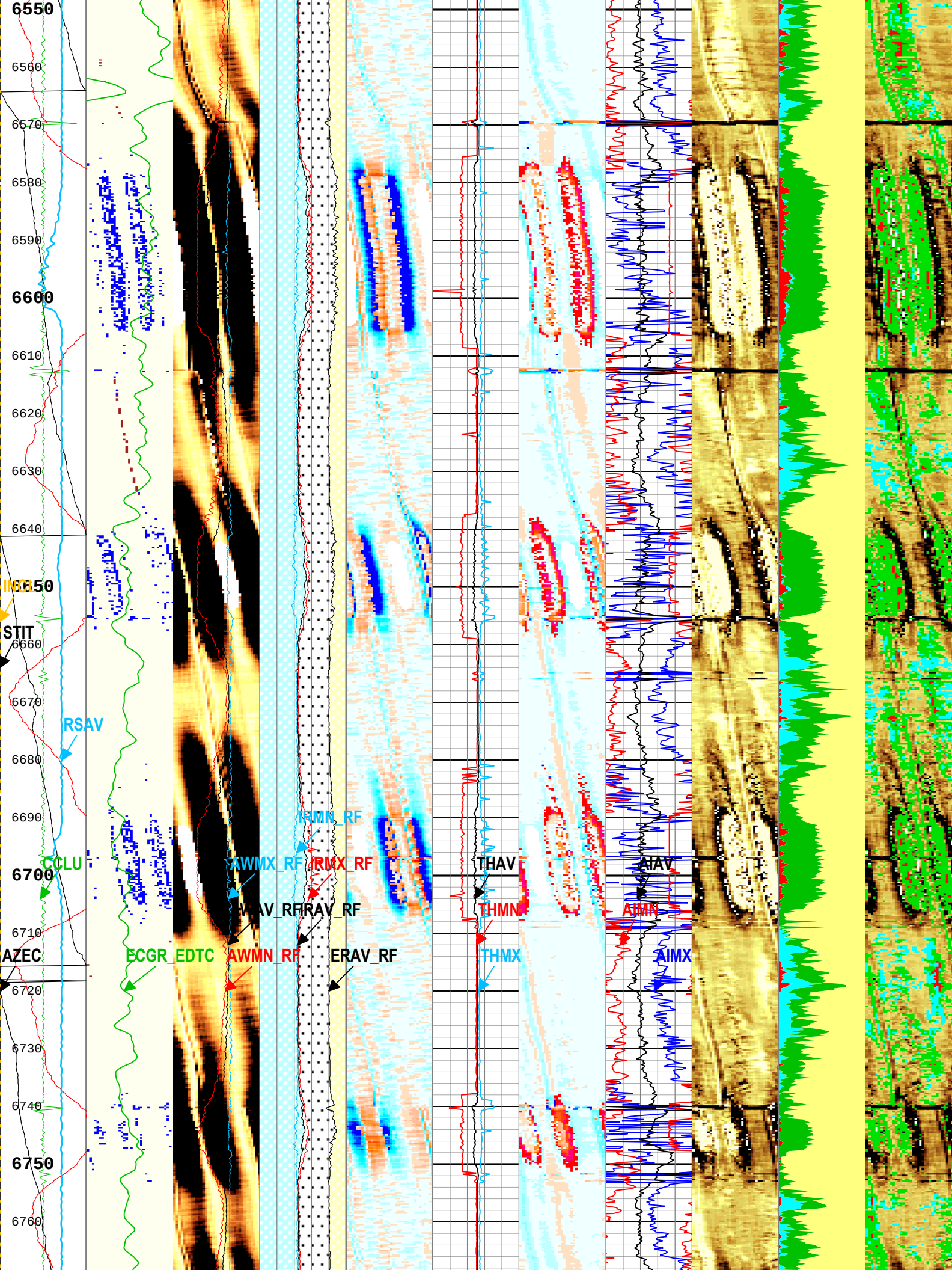
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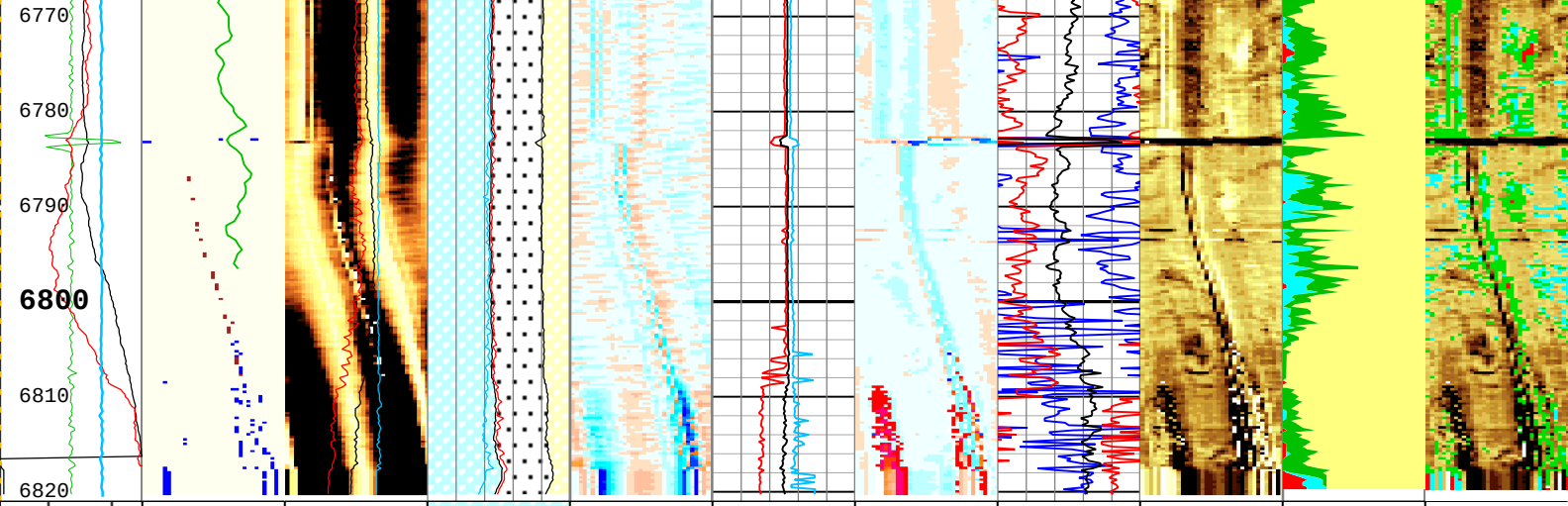


CableDrag

Azimuth of Eccentering (AZEC) USIT-E
0 deg 360

Casing Collar Locator Ultrasonic (CCLU) USIT-E
-20 in 20

Amplitude of Eccentering for Unflagged Waves (ECCE_RF) USIT-E
0 in 0.5

Motor Revolution Speed (RSAV) USIT-E
-8 c/s -6

Motor Revolution Speed (RSAV) USIT-E
6 c/s 8

Stuck Tool Indicator, Total (STIT)
0 ft 50

Hole inclination (INCL)
0 deg 100

Absent 1.500 3.500

Explicit Normalization
USIT - USIT Processing Flags (UFLG) USIT-E

USIT Processing Flags (UFLG[0]) USIT-E
1 5

Gamma Ray (ECGR_EDTC) EDTC-B
0 gAPI 150

Absent -5.200 -3.600 -2.000 -0.400

Explicit Normalization
USIT - Amplitude of Unflagged Wave (AWBK_RF) USIT-E
(dB)

Minimum of Unflagged Wave Amplitude (AWMN_RF) USIT-E
0 dB 75

Average of Unflagged Wave Amplitude (AWAV_RF) USIT-E
0 dB 75

Maximum of Unflagged Wave Amplitude (AWMX_RF) USIT-E
0 dB 75

IRAV

ERAV

IRAV-ERAV

Median of Unflagged External Radii (ERAV_RF) USIT-E
1.95 in 2.95

Median Internal Radius of Casing Corrected for Eccentering (IRAV_RF) USIT-E
1.95 in 2.95

Maximum of Unflagged Internal Radii (IRMX_RF) USIT-E
1.95 in 2.95

Minimum of Unflagged Internal Radii (IRMN_RF) USIT-E
1.95 in 2.95

Absent -0.051 -0.012 0.028 0.068

Explicit Normalization
USIT - Unflagged Internal Radii minus Median Internal Radius (IRBKM_RF) USIT-E
(in)

Thickness Maximum Value (THMX) USIT-E
0.1 in 0.6

Thickness Minimum Value (THMN) USIT-E
0.1 in 0.6

Thickness Average Value (THAV) USIT-E
0.1 in 0.6

Absent -0.051 -0.012 0.028 0.068

Explicit Normalization
USIT - Unflagged Casing Thickness minus Median of Unflagged Casing Thickness (THBKM_RF) USIT-E
(in)

Acoustic Impedance Maximum (AIMX) USIT-E
-1 Mrayl 9

Acoustic Impedance Minimum (AIMN) USIT-E
-1 Mrayl 9

Acoustic Impedance Average (AIAV) USIT-E
-1 Mrayl 9

Absent 1.500 3.500 5.500 7.500

Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E
(Mrayl)

Ratio of Cement Measurements to Total (CEMR) USIT-E
1 0

Micro-debonding Ratio (MDR) USIT-E
1 0

Ratio of Gas Measurements to Total (GASR) USIT-E
1 0

Bonded

Gas

Liquid

Micro-debonding

Absent 3.090 5.054 7.018

Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E
(Mrayl)

Absent 2.599 4.563 6.527

Custom Normalization
USIT - Acoustic Impedance With Micro-debonding Image (AI_MDEBOND_IMG) USIT-E
(Mrayl)

TIME_1900 - Time Marked every 60.00 (s)

USIT Processing Flags (UFLG[0]) USIT-E

1 - UFLG 1 Value within [0.0 - 1.5] - :
2 - UFLG 2 Value within [1.5 - 2.5] - :
3 - UFLG 3 Value within [2.5 - 3.5] - :
4 - UFLG 4 UFLG 5 UFLG 6 Value within [3.5 - 6.5] - :
5 - UFLG 7 UFLG 8 UFLG 9 Value within [6.5 - 10] - :

UTIM Error
Pulse Origin Not Detected
WINLEN Error
Casing Thickness Error
Loop Processing Error

Description: USI Composite Format: USI Composite Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:24

Channel Processing Parameters

ONE: Parameters

Parameter	Description	Tool	Value	Unit
ISSBAR	Barite Mud Presence Flag	Borehole	No	
BERJ	Bad Echo Rejection	USIT-E	On	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CASING_PRATIO	Casing Poisson Ratio	USIT-E	Standard Poisson Ratio	
CBLO	Casing Bottom (Logger)	WLSESSION	16030.4	ft
CDEN	Cement Density	EDTC-B	16.69	lbm/gal
CMTY(U-USIT_CEMT)	Cement Type	USIT-E	Regular Cement	
THNO	Nominal Casing Thickness - Zoned along logger depths	WLSESSION	0.361	in
DC_MODE	Depth Correction Mode	DepthCorrection	Real-time	
DFD	Drilling Fluid Density	Borehole	8.4	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DTMD	Borehole Fluid Slowness	Borehole	190	us/ft
ETIP	Elevation of the TIP above MSL	WLSESSION	4691	ft
FDII	FPM Data Interpolation Interval	USIT-E	0	ft
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	BS	
GR_MULTIPLIER	Gamma Ray Multiplier	EDTC-B	1	
HEMA	Hematite Presence Flag	Borehole	No	
ICE_PROCESS	ICE Processing	USIT-E	Yes	
IMAR	Image Rotation	USIT-E	Off	
MEAS_WLEN	Tcube Processing Window Length in Measurement Mode	USIT-E	22.44	us
MUD_N_FRP	Free Pipe Mud Normalization Factor	USIT-E	0.97	
MUD_N_THE	Theoretical Mud Normalization Factor	USIT-E	1	
OPLEV	USIT Remove Flagged Data Level	USIT-E	OPT2	
RCOD	Reference Calibrator Outer Diameter	USIT-E	4.5	in
RCSO	Reference Calibrator Standoff	USIT-E	0.842	in
RCTH	Reference Calibrator Thickness	USIT-E	0.216	in
SDNV	Number of Vertical Samples used for Micro-debonding Computation	USIT-E	5	
SDTHOR	Acoustic Impedance STD Horizontal Threshold for Micro-debonding	USIT-E	0.5	Mrayl
SDTVER	Acoustic Impedance STD Vertical Threshold for Micro-debonding	USIT-E	0.3	Mrayl
SOCN	Standoff Distance	EDTC-B	0.125	in
SOCO	Standoff Correction Option	EDTC-B	No	
TCUB	T^3 Processing Level	USIT-E	Loop	
THDH	Maximum Search Thickness (percentage of nominal)	USIT-E	130	%
THDL	Minimum Search Thickness (percentage of nominal)	USIT-E	70	%
TPOS_EDTC	Tool Position: Centered or Eccentered	EDTC-B	Eccentered	
U-USIT_DFSZ	Drilling Fluid Specific Acoustic Impedance	USIT-E	0	Mrayl
UFGDE	Fiberglass Density	USIT-E	16.27	lbm/gal

UFGPS	Fiberglass Processing Selection	USIT-E	No	
UFGVL	Fiberglass Velocity	USIT-E	9678.48	ft/s
USI_FSOD	USIT USI Fluid Slowness Fits Casing Outer Diameter	USIT-E	0_OFF	
USI_FVEL_SEL	USI Fluid Velocity Selection	USIT-E	Automatic	
USI_ZMUD_SEL	USI Mud Impedance Selection	USIT-E	Manual	
THDP	Thickness Detection Policy	USIT-E	Fundamental	
VCAS	Ultrasonic Transversal Velocity in Casing	USIT-E	51.4	us/ft
ZCAS	Acoustic Impedance of Casing	USIT-E	46.25	Mrayl
ZINI	Initial Estimate of Cement Impedance	USIT-E	-1	Mrayl
ZMUD	Acoustic Impedance of Mud	Borehole	Depth Zoned	Mrayl
ZTCM	Acoustic Impedance Threshold for Cement	USIT-E	2.6	Mrayl
ZTGS	Acoustic Impedance Threshold for Gas	USIT-E	0.3	Mrayl

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	26	31.5	104
BS	13.5	104	1958
BS	8.5	1958	6821
ZMUD	1.48	31.5	200
ZMUD	1.65	200	400
ZMUD	1.66	400	700
ZMUD	1.68	700	1000
ZMUD	1.7	1000	1500
ZMUD	1.72	1500	2000
ZMUD	1.74	2000	2500
ZMUD	1.76	2500	3000
ZMUD	1.77	3000	4000
ZMUD	1.78	4000	6821

All depth are actual.

Tool Control Parameters

ONE: Parameters

Parameter	Description	Tool	Value	Unit
AGMN	Minimum Gain of Cartridge	USIT-E	-12	dB
AGMX	Maximum Gain of Cartridge	USIT-E	36	dB
U-USIT_DDT5	USIC Downhole Decimation for T5 only	USIT-E	0_NONE	
DOT(DOS)	Distance between Opposite Transducer Faces	USIT-E	1.756	in
EMXV	EMEX Voltage	USIT-E	50	V
HRES	Horizontal Resolution	USIT-E	10 deg	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	6750	ft/h
MOTOR_PROTECT	Motor Protection	USIT-E	On	
TMUC	Type of Mud	USIT-E	BRI	
UACLV_PERM	Ultrasonic ACLV Permanent	USIT-E	No	
ULOG	Logging Objective	USIT-E	MEASUREMENT	
UMFR	Modulation Frequency	USIT-E	333333	Hz
USFR	Ultrasonic Sampling Frequency	USIT-E	500000	Hz
UPAT	USIT Emission Pattern	USIT-E	Pattern 375 KHz	
UWKM	USIT Working Mode	USIT-E	Uncompressed 10 deg at 3.0 in LF	
USIT_DEPTHLOG	Starting Depth Log for Ultrasonics	USIT-E	6800	ft
USSP	Ultrasonic Service	USIT-E	USI	

VRES	Vertical Resolution	USIT-E	3.0 in	
WINB	Window Begin Time	USIT-E	25.99	us
WINE	Window End Time	USIT-E	73.89	us

USI Goodwin

ONE

USI Goodwin Compressed

Log

Company:Noble Energy, Inc. Well:Wells Ranch AF05-625

ONE: Log[4]:Up:S008

Description: USI Goodwin Format: USI Goodwin Index Scale: 0.1 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:35

TIME_1900 - Time Marked every 60.00 (s)

Minimum Acoustic Impedance 1 (MIN_AI1) USIT-E	Minimum Acoustic Impedance 3 (MIN_AI3) USIT-E	Minimum Acoustic Impedance 5 (MIN_AI5) USIT-E	Minimum Acoustic Impedance 7 (MIN_AI7) USIT-E
0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15
Maximum Acoustic Impedance 1 (MAX_AI1) USIT-E	Maximum Acoustic Impedance 3 (MAX_AI3) USIT-E	Maximum Acoustic Impedance 5 (MAX_AI5) USIT-E	Maximum Acoustic Impedance 7 (MAX_AI7) USIT-E
0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15
Average Acoustic Impedance 1 (AV_AI1) USIT-E	Average Acoustic Impedance 3 (AV_AI3) USIT-E	Average Acoustic Impedance 5 (AV_AI5) USIT-E	Average Acoustic Impedance 7 (AV_AI7) USIT-E
0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15
Minimum Acoustic Impedance 2 (MIN_AI2) USIT-E	Minimum Acoustic Impedance 4 (MIN_AI4) USIT-E	Minimum Acoustic Impedance 6 (MIN_AI6) USIT-E	Minimum Acoustic Impedance 8 (MIN_AI8) USIT-E
-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5
Maximum Acoustic Impedance 2 (MAX_AI2) USIT-E	Maximum Acoustic Impedance 4 (MAX_AI4) USIT-E	Maximum Acoustic Impedance 6 (MAX_AI6) USIT-E	Maximum Acoustic Impedance 8 (MAX_AI8) USIT-E
-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5
Average Acoustic Impedance 2 (AV_AI2) USIT-E	Average Acoustic Impedance 4 (AV_AI4) USIT-E	Average Acoustic Impedance 6 (AV_AI6) USIT-E	Average Acoustic Impedance 8 (AV_AI8) USIT-E
-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5

Minimum Acoustic Impedance 9 (MIN_AI9) USIT-E	Acoustic Impedance Minimum (AIMN) USIT-E
0 Mrayl 15	0 Mrayl 7.5
Maximum Acoustic Impedance 9 (MAX_AI9) USIT-E	Acoustic Impedance Maximum (AIMX) USIT-E
0 Mrayl 15	0 Mrayl 7.5
Average Acoustic Impedance 9 (AV_AI9) USIT-E	Acoustic Impedance Average (AIAV) USIT-E
0 Mrayl 15	0 Mrayl 7.5

Amplitude of Eccentering (ECCE) USIT-E

0 in 0.5

Absent 1.500 3.500 5.500 7.500

Custom Normalization

USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)

Absent 2.599 4.563 6.527

Custom Normalization

USIT - Acoustic Impedance With Micro-debonding Image (AI_MDEBOND_IMG) USIT-E (Mrayl)

GR<75

Gamma Ray (ECGR_EDTC) EDTC-B

0 gAPI 150

Micro-Debonded

Gas

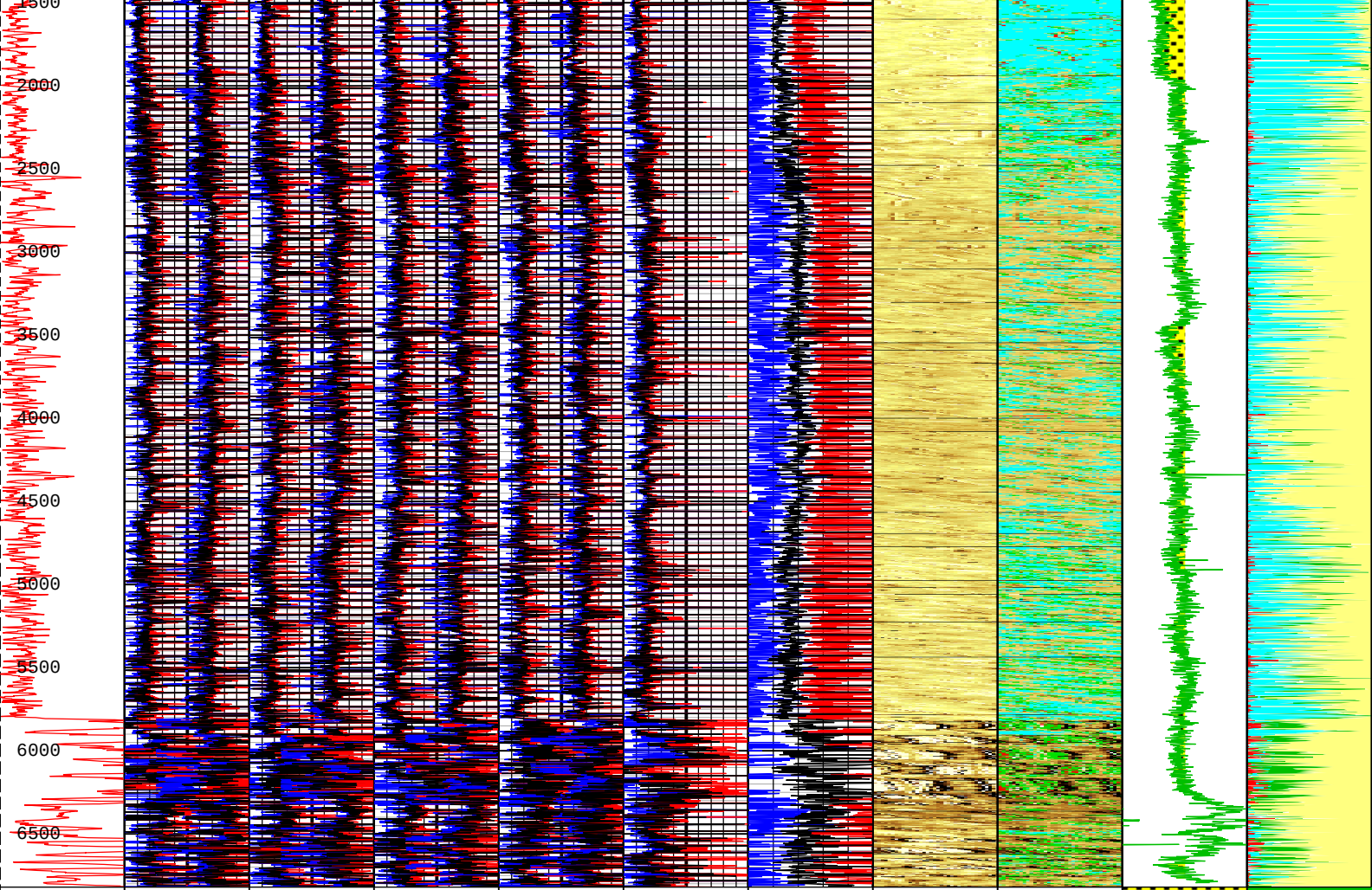
Liquid

Bonded

500

1000

1500



Amplitude of Eccentering (ECCE) USIT-E	Minimum Acoustic Impedance 1 (MIN_AI1) USIT-E	Minimum Acoustic Impedance 3 (MIN_AI3) USIT-E	Minimum Acoustic Impedance 5 (MIN_AI5) USIT-E	Minimum Acoustic Impedance 7 (MIN_AI7) USIT-E	Minimum Acoustic Impedance 9 (MIN_AI9) USIT-E	Acoustic Impedance Minimum (AIMN) USIT-E	Absent 1.500 3.500 5.500 7.500	Absent 2.599 4.563 6.527	GR<75	Micro-Debonded
0 in 0.5	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 7.5	Custom Normalization USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)	Custom Normalization USIT - Acoustic Impedance With Micro-debonding Image (AI_MDEBOND_IMG) USIT-E (Mrayl)	Gamma Ray (ECGR_EDTC) EDTC-B 0 gAPI 150	Gas Liquid Bonded
	Maximum Acoustic Impedance 1 (MAX_AI1) USIT-E	Maximum Acoustic Impedance 3 (MAX_AI3) USIT-E	Maximum Acoustic Impedance 5 (MAX_AI5) USIT-E	Maximum Acoustic Impedance 7 (MAX_AI7) USIT-E	Maximum Acoustic Impedance 9 (MAX_AI9) USIT-E	Acoustic Impedance Maximum (AIMX) USIT-E				
	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 7.5				
	Average Acoustic Impedance 1 (AV_AI1) USIT-E	Average Acoustic Impedance 3 (AV_AI3) USIT-E	Average Acoustic Impedance 5 (AV_AI5) USIT-E	Average Acoustic Impedance 7 (AV_AI7) USIT-E	Average Acoustic Impedance 9 (AV_AI9) USIT-E	Acoustic Impedance Average (AIAV) USIT-E				
	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 15	0 Mrayl 7.5				
	Minimum Acoustic Impedance 2 (MIN_AI2) USIT-E	Minimum Acoustic Impedance 4 (MIN_AI4) USIT-E	Minimum Acoustic Impedance 6 (MIN_AI6) USIT-E	Minimum Acoustic Impedance 8 (MIN_AI8) USIT-E						
	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5						
	Maximum Acoustic Impedance 2 (MAX_AI2) USIT-E	Maximum Acoustic Impedance 4 (MAX_AI4) USIT-E	Maximum Acoustic Impedance 6 (MAX_AI6) USIT-E	Maximum Acoustic Impedance 8 (MAX_AI8) USIT-E						
	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5						

Average Acoustic Impedance 2 (AV_AI2) USIT-E	Average Acoustic Impedance 4 (AV_AI4) USIT-E	Average Acoustic Impedance 6 (AV_AI6) USIT-E	Average Acoustic Impedance 8 (AV_AI8) USIT-E
-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5	-7.5 Mrayl 7.5

TIME_1900 - Time Marked every 60.00 (s)

Description: USI Goodwin Format: USI Goodwin Index Scale: 0.1 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:35

Copy of USI Composite

Log

Company:Noble Energy, Inc. Well:Wells Ranch AF05-625 ONE: Log[3]:Up:S008

Description: USI Composite Format: USI Composite Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:40

TIME_1900 - Time Marked every 60.00 (s)

USIT Processing Flags (UFLG[0]) USIT-E

1 - UFLG 1 Value within [0.0 - 1.5] - :
2 - UFLG 2 Value within [1.5 - 2.5] - :
3 - UFLG 3 Value within [2.5 - 3.5] - :
4 - UFLG 4 UFLG 5 UFLG 6 Value within [3.5 - 6.5] - :
5 - UFLG 7 UFLG 8 UFLG 9 Value within [6.5 - 10] - :

UTIM Error
Pulse Origin Not Detected
WINLEN Error
Casing Thickness Error
Loop Processing Error

CableDrag

Azimuth of Eccentering (AZEC) USIT-E
0 deg 360

Casing Collar Locator Ultrasonic (CCLU) USIT-E
-20 in 20

Amplitude of Eccentering for Unflagged Waves (ECCE_RF) USIT-E
0 in 0.5

Motor Revolution Speed (RSAV) USIT-E
-8 c/s -6

Motor Revolution Speed (RSAV) USIT-E
6 c/s 8

Stuck Tool Indicator, Total (STIT)

Absent 1.500 3.500
Explicit Normalization
USIT - USIT Processing Flags (UFLG) USIT-E

USIT Processing Flags (UFLG[0])

Absent -5.200 -3.600 -2.000 -0.400
Explicit Normalization
USIT - Amplitude of Unflagged Wave (AWBK_RF) USIT-E (dB)

Minimum of Unflagged Wave Amplitude (AWMN_RF) USIT-E
0 dB 75

Average of Unflagged Wave Amplitude (AWAV_RF) USIT-E
0 dB 75

IRAV
ERAV
IRAV-ERAV

Median of Unflagged External Radii (ERAV_RF) USIT-E
1.95 in 2.95

Median Internal Radius of Casing Corrected for Eccentering (IRAV_RF) USIT-E
1.95 in 2.95

Maximum of Unflagged Internal Radii (IRMX_RF) USIT-E

Absent -0.051 -0.012 0.028 0.068
Explicit Normalization
USIT - Unflagged

Thickness Maximum Value (THMX) USIT-E
0.1 in 0.6

Thickness Minimum Value (THMN) USIT-E

Absent -0.051 -0.012 0.028 0.068
Explicit Normalization
USIT - Unflagged Casing Thickness

Acoustic Impedance Maximum (AIMX) USIT-E
-1 Mrayl 9

Acoustic Impedance Minimum (AIMN) USIT-E

Absent 1.500 3.500 5.500 7.500
Custom Normalization

Ratio of Cement Measurements to Total (CEMR) USIT-E
1 0

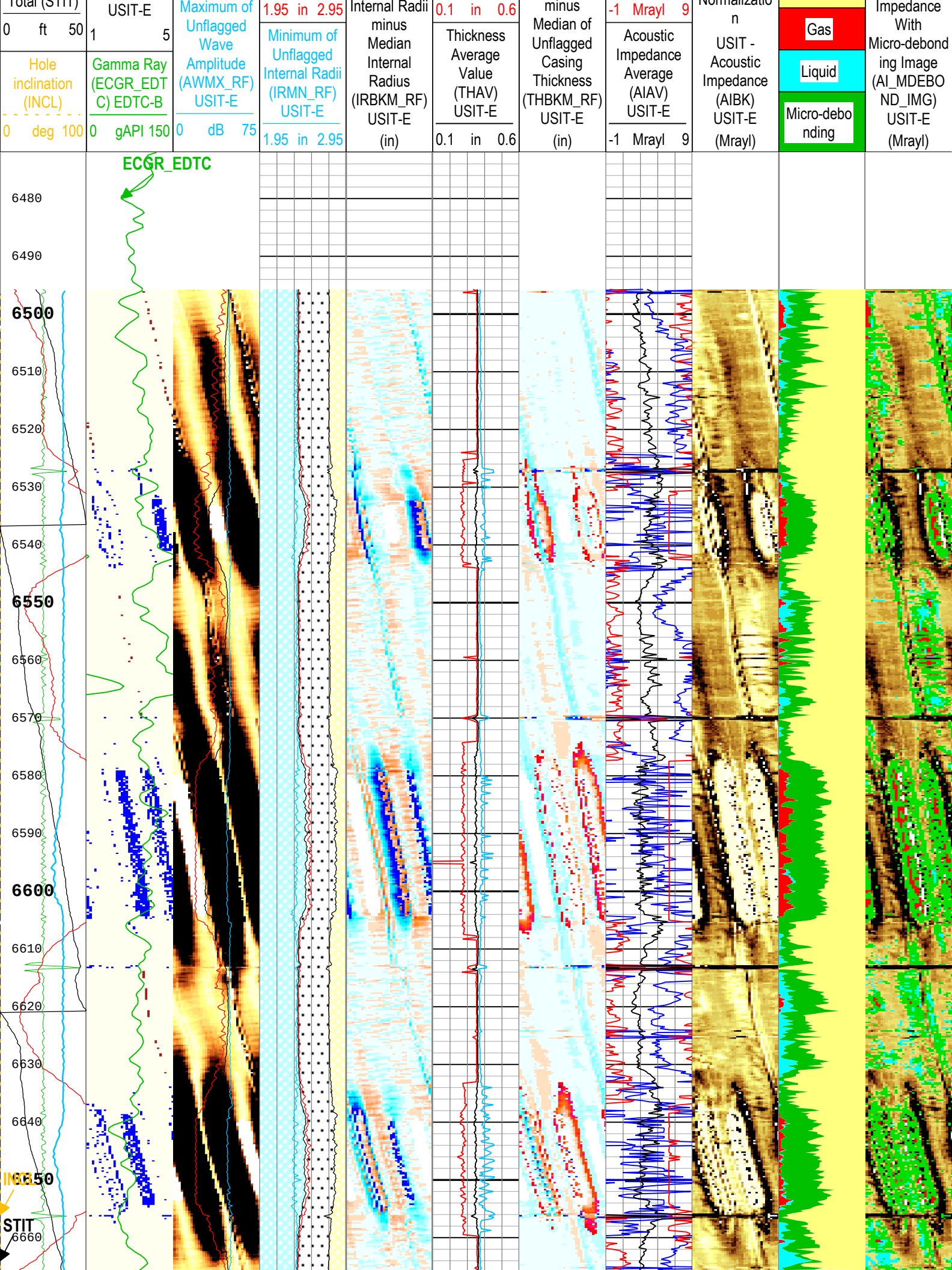
Micro-debonding Ratio (MDR) USIT-E
1 0

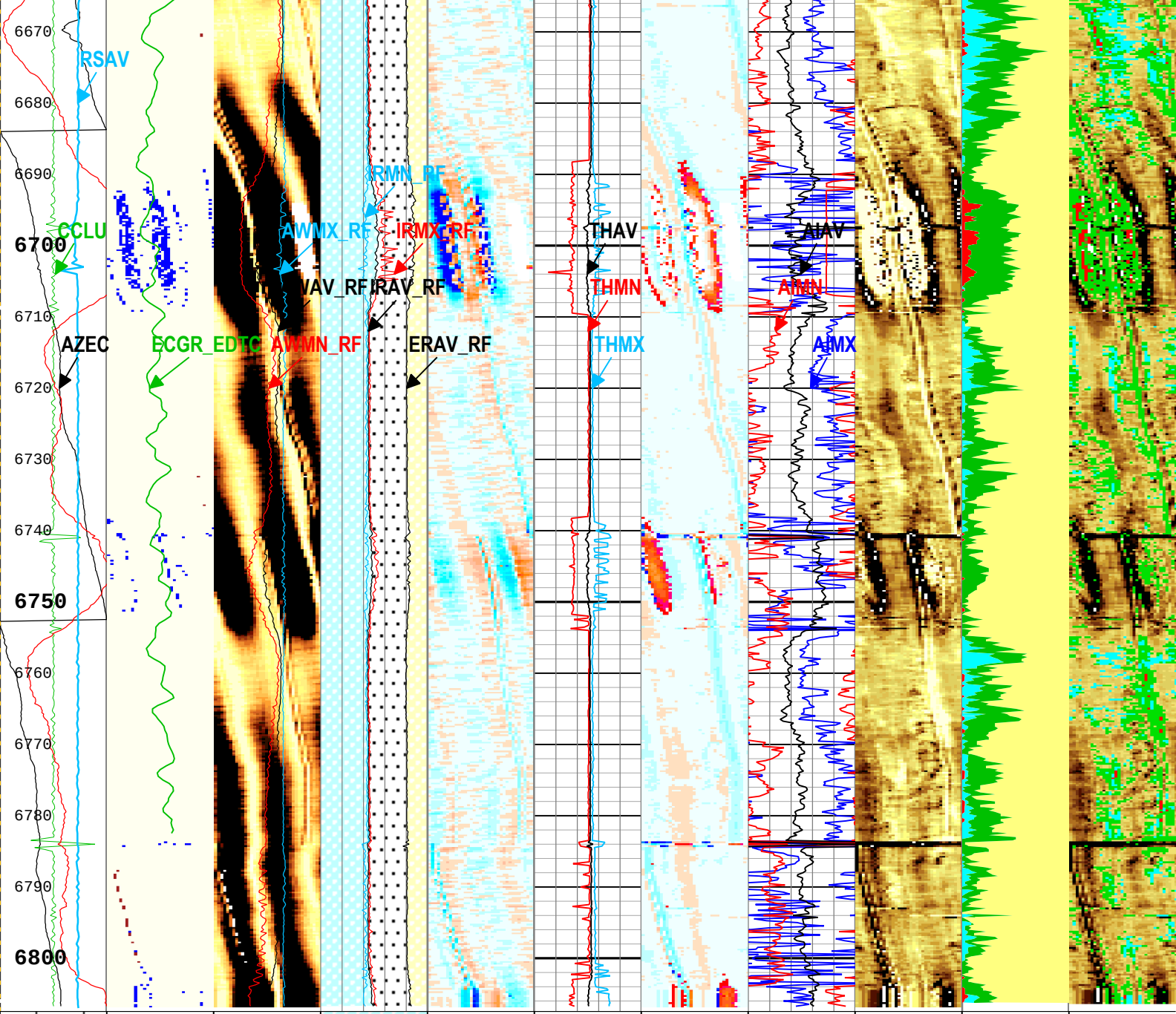
Ratio of Gas Measurements to Total (GASR) USIT-E
1 0

Bonded

Absent 3.090 5.054 7.018
Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)

Absent 2.599 4.563 6.527
Custom Normalization
USIT - Acoustic


Total (STIT)
0 ft 50
Hole inclination (INCL)
0 deg 100
USIT-E
1 5
Gamma Ray (ECGR_EDTC) EDTC-B
0 gAPI 150
Maximum of Unflagged Wave Amplitude (AWMX_RF) USIT-E
0 dB 75
1.95 in 2.95
Minimum of Unflagged Internal Radii (IRMN_RF) USIT-E
1.95 in 2.95
Internal Radii minus Median Internal Radius (IRBKM_RF) USIT-E
(in)
0.1 in 0.6
Thickness Average Value (THAV) USIT-E
0.1 in 0.6
minus Median of Unflagged Casing Thickness (THBKM_RF) USIT-E
(in)
-1 Mrayl 9
Acoustic Impedance Average (AIAV) USIT-E
-1 Mrayl 9
Normalizatio n
USIT - Acoustic Impedance (AIBK) USIT-E
(Mrayl)
Gas
Liquid
Micro-debo nding
Impedance With Micro-debond ing Image (AI_MDEBOND_IMG) USIT-E
(Mrayl)
ECGR_EDTC
6480
6490
6500
6510
6520
6530
6540
6550
6560
6570
6580
6590
6600
6610
6620
6630
6640
6650
6660
INCL
STIT



CableDrag

Azimuth of Eccentering (AZEC) USIT-E
0 deg 360

Casing Collar Locator Ultrasonic (CCLU) USIT-E
-20 in 20

Amplitude of Eccentering for Unflagged Waves (ECCE_RF) USIT-E
0 in 0.5

Absent 1.500 3.500

Explicit Normalization
USIT - USIT Processing Flags (UFLG) USIT-E

USIT Processing Flags (UFLG[0]) USIT-E
1 5

Gamma Ray (ECGR_EDTC) EDTC-B
0 gAPI 150

Absent -5.200 -3.600 -2.000 -0.400

Explicit Normalization
USIT - Amplitude of Unflagged Wave (AWBK_RF) USIT-E (dB)

Minimum of Unflagged Wave Amplitude (AWMN_RF) USIT-E
0 dB 75

Average of

IRAV

ERAV

IRAV-ERAV

Median of Unflagged External Radii (ERAV_RF) USIT-E
1.95 in 2.95

Median Internal Radius of Casing Corrected for Eccentering (IRAV_RF) USIT-E

Absent -0.051 -0.012 0.028 0.068

Explicit Normalization
USIT - Unflagged Internal Radii minus Median Internal Radius (IRBKM_RF) USIT-E (in)

Thickness Maximum Value (THMX) USIT-E
0.1 in 0.6

Thickness Minimum Value (THMN) USIT-E
0.1 in 0.6

Thickness Average Value (THAV) USIT-E
0.1 in 0.6

Absent -0.051 -0.012 0.028 0.068

Explicit Normalization
USIT - Unflagged Casing Thickness minus Median of Unflagged Casing Thickness (THBKM_RF) USIT-E (in)

Acoustic Impedance Maximum (AIMX) USIT-E
-1 Mrayl 9

Acoustic Impedance Minimum (AIMN) USIT-E
-1 Mrayl 9

Acoustic Impedance Average (AIAV) USIT-E
-1 Mrayl 9

Absent 1.500 3.500 5.500 7.500

Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)

Ratio of Cement Measurements to Total (CEMR) USIT-E
1 0

Micro-debonding Ratio (MDR) USIT-E
1 0

Ratio of Gas Measurements to Total (GASR) USIT-E
1 0

Bonded

Absent 3.090 5.054 7.018

Custom Normalization
USIT - Acoustic Impedance (AIBK) USIT-E (Mrayl)

Absent 2.599 4.563 6.527

Custom Normalization
USIT - Acoustic Impedance

Motor Revolution Speed (RSAV) USIT-E

-8 c/s -6

Motor Revolution Speed (RSAV) USIT-E

6 c/s 8

Stuck Tool Indicator, Total (STIT)

0 ft 50

Hole inclination (INCL)

0 deg 100

Unflagged Wave Amplitude (AWAV_RF) USIT-E

0 dB 75

Maximum of Unflagged Wave Amplitude (AWMX_RF) USIT-E

0 dB 75

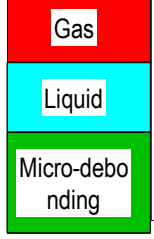
1.95 in 2.95

Maximum of Unflagged Internal Radii (IRMX_RF) USIT-E

1.95 in 2.95

Minimum of Unflagged Internal Radii (IRMN_RF) USIT-E

1.95 in 2.95



With Micro-debond ing Image (AI_MDEBOND_IMG) USIT-E (Mrayl)

USIT Processing Flags (UFLG[0]) USIT-E

1 - UFLG 1 Value within [0.0 - 1.5] - :

2 - UFLG 2 Value within [1.5 - 2.5] - :

3 - UFLG 3 Value within [2.5 - 3.5] - :

4 - UFLG 4 UFLG 5 UFLG 6 Value within [3.5 - 6.5] - :

5 - UFLG 7 UFLG 8 UFLG 9 Value within [6.5 - 10] - :

UTIM Error

Pulse Origin Not Detected

WINLEN Error

Casing Thickness Error

Loop Processing Error

TIME_1900 - Time Marked every 60.00 (s)

Description: USI Composite Format: USI Composite Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 19-Apr-2016 18:49:40

Channel Processing Parameters

ONE: Parameters

Parameter	Description	Tool	Value	Unit
ISSBAR	Barite Mud Presence Flag	Borehole	No	
BERJ	Bad Echo Rejection	USIT-E	On	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	8.5	in
CASING_PRATIO	Casing Poisson Ratio	USIT-E	Standard Poisson Ratio	
CBLO	Casing Bottom (Logger)	WLSESSION	16030.4	ft
CDEN	Cement Density	EDTC-B	16.69	lbm/gal
CMTY(U-USIT_CEMT)	Cement Type	USIT-E	Regular Cement	
THNO	Nominal Casing Thickness - Zoned along logger depths	WLSESSION	0.361	in
DC_MODE	Depth Correction Mode	DepthCorrection	Real-time	
DFD	Drilling Fluid Density	Borehole	8.4	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DTMD	Borehole Fluid Slowness	Borehole	190	us/ft
ETIP	Elevation of the TIP above MSL	WLSESSION	4691	ft
FDII	FPM Data Interpolation Interval	USIT-E	0	ft
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	BS	
GR_MULTIPLIER	Gamma Ray Multiplier	EDTC-B	1	
HEMA	Hematite Presence Flag	Borehole	No	

ICE_PROCESS	ICE Processing	USIT-E	Yes	
IMAR	Image Rotation	USIT-E	Off	
MEAS_WLEN	Tcube Processing Window Length in Measurement Mode	USIT-E	22.44	us
MUD_N_FRP	Free Pipe Mud Normalization Factor	USIT-E	0.97	
MUD_N_THE	Theoretical Mud Normalization Factor	USIT-E	1	
OPLEV	USIT Remove Flagged Data Level	USIT-E	OPT2	
RCOD	Reference Calibrator Outer Diameter	USIT-E	4.5	in
RCSO	Reference Calibrator Standoff	USIT-E	0.842	in
RCTH	Reference Calibrator Thickness	USIT-E	0.216	in
SDNV	Number of Vertical Samples used for Micro-debonding Computation	USIT-E	5	
SDTHOR	Acoustic Impedance STD Horizontal Threshold for Micro-debonding	USIT-E	0.5	Mrayl
SDTVER	Acoustic Impedance STD Vertical Threshold for Micro-debonding	USIT-E	0.3	Mrayl
SOCN	Standoff Distance	EDTC-B	0.125	in
SOCO	Standoff Correction Option	EDTC-B	No	
TCUB	T^3 Processing Level	USIT-E	Loop	
THDH	Maximum Search Thickness (percentage of nominal)	USIT-E	130	%
THDL	Minimum Search Thickness (percentage of nominal)	USIT-E	70	%
TPOS_EDTC	Tool Position: Centered or Eccentered	EDTC-B	Eccentered	
U-USIT_DFSZ	Drilling Fluid Specific Acoustic Impedance	USIT-E	0	Mrayl
UFGDE	Fiberglass Density	USIT-E	16.27	lbm/gal
UFGPS	Fiberglass Processing Selection	USIT-E	No	
UFGVL	Fiberglass Velocity	USIT-E	9678.48	ft/s
USI_FSOD	USIT USI Fluid Slowness Fits Casing Outer Diameter	USIT-E	0_OFF	
USI_FVEL_SEL	USI Fluid Velocity Selection	USIT-E	Automatic	
USI_ZMUD_SEL	USI Mud Impedance Selection	USIT-E	Manual	
THDP	Thickness Detection Policy	USIT-E	Fundamental	
VCAS	Ultrasonic Transversal Velocity in Casing	USIT-E	51.4	us/ft
ZCAS	Acoustic Impedance of Casing	USIT-E	46.25	Mrayl
ZINI	Initial Estimate of Cement Impedance	USIT-E	-1	Mrayl
ZMUD	Acoustic Impedance of Mud	Borehole	1.78	Mrayl
ZTCM	Acoustic Impedance Threshold for Cement	USIT-E	2.6	Mrayl
ZTGS	Acoustic Impedance Threshold for Gas	USIT-E	0.3	Mrayl

Tool Control Parameters

ONE: Parameters

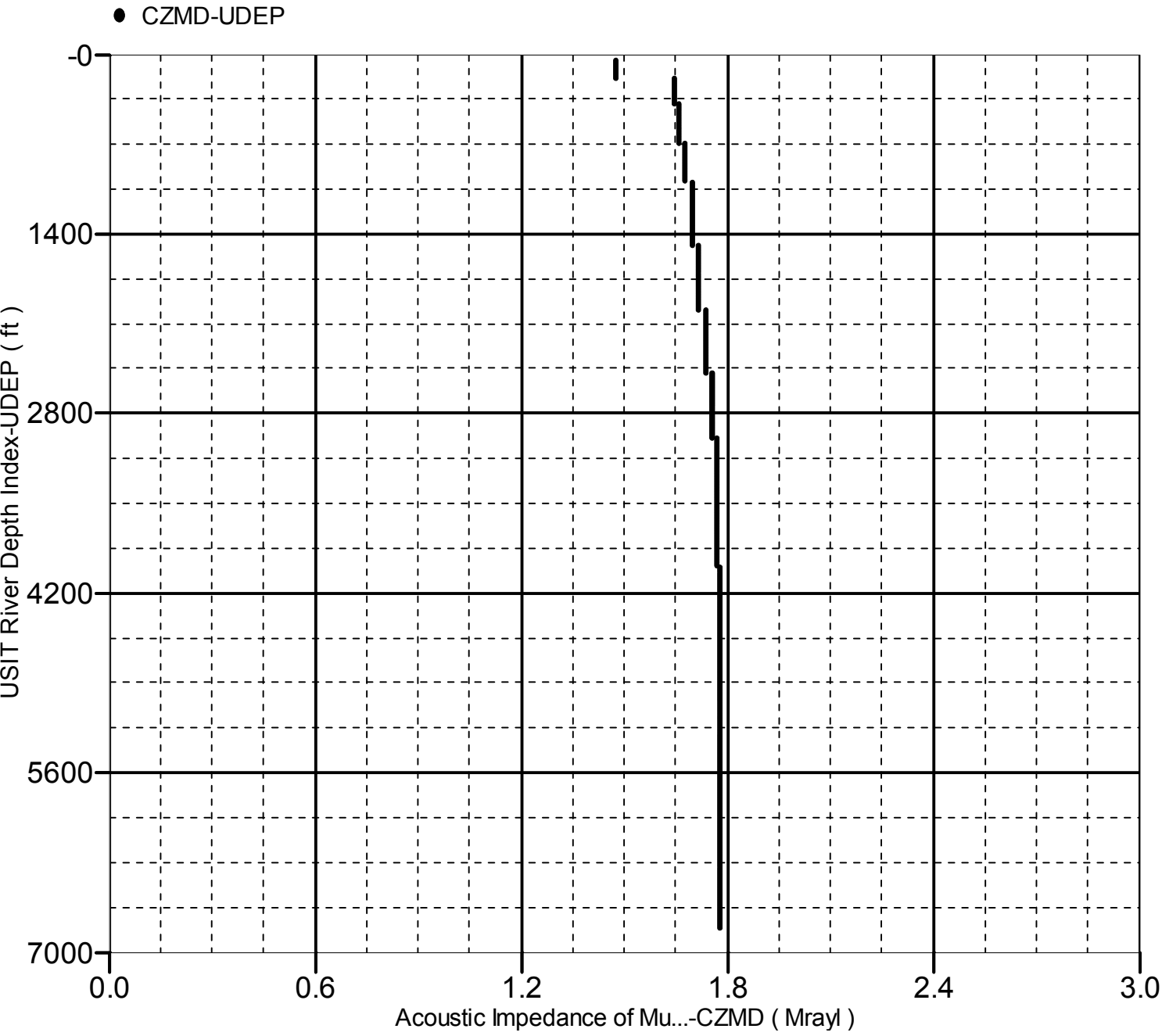
Parameter	Description	Tool	Value	Unit
AGMN	Minimum Gain of Cartridge	USIT-E	-12	dB
AGMX	Maximum Gain of Cartridge	USIT-E	36	dB
U-USIT_DDT5	USIC Downhole Decimation for T5 only	USIT-E	0_NONE	
DOT(DOS)	Distance between Opposite Transducer Faces	USIT-E	1.756	in
EMXV	EMEX Voltage	USIT-E	50	V
HRES	Horizontal Resolution	USIT-E	10 deg	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	6750	ft/h
MOTOR_PROTECT	Motor Protection	USIT-E	On	
TMUC	Type of Mud	USIT-E	BRI	
UACLV_PERM	Ultrasonic ACLV Permanent	USIT-E	No	
ULOG	Logging Objective	USIT-E	MEASUREMENT	
UMFR	Modulation Frequency	USIT-E	333333	Hz
USFR	Ultrasonic Sampling Frequency	USIT-E	500000	Hz
UPAT	USIT Emission Pattern	USIT-E	Pattern 375 KHz	

UWKM	USIT Working Mode	USIT-E	Uncompressed 10 deg at 3.0 in LF	
USIT_DEPTHLOG	Starting Depth Log for Ultrasonics	USIT-E	6800	ft
USSP	Ultrasonic Service	USIT-E	USI	
VRES	Vertical Resolution	USIT-E	3.0 in	
WINB	Window Begin Time	USIT-E	25.99	us
WINE	Window End Time	USIT-E	73.89	us

Acoustic Impedance of Mud vs Depth

2D Cross Plot

Index Range: From 6820.50 to 55.25 ft

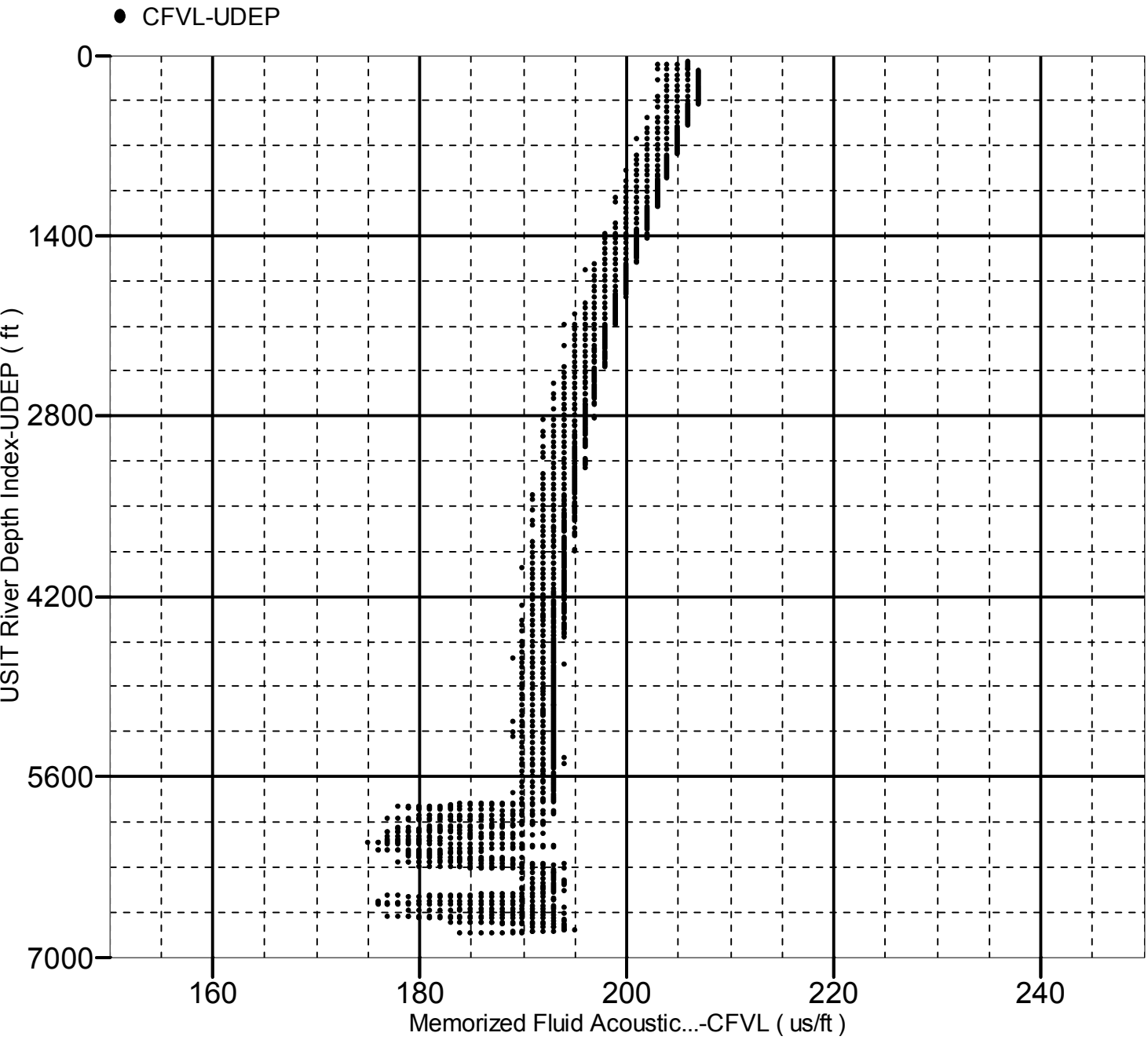


Fluid Acoustic Slowness vs Depth

Fluid Acoustic Slowness vs Depth

2D Cross Plot

Index Range: From 6820.50 to 55.25 ft



Calibration Report

EDTC-B (Enhanced Digital Telemetry Cartridge - Version B) Calibration - Run ONE

Primary Equipment :

EDTC-B EDTC-B

Calibration Parameter :

Plus Reference

EDTC-B Accelerometer Calibration - EDTC-B Accelerometer Calibration

Before:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
AZ Vertical Measurement - 0	ft/s2	Before	-----	-----	-----	-----	

EDTC-B Memory Data - EDTC-B Memory Data

Master (EEPROM): 13:22:03 14-Apr-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Initial PMT HV	V	Master			1482.000		

Accelerometer Serial Number		Master			696		
Accelerometer Coefficients - 0		Master	-----	-----	2.987	-----	
Accelerometer Coefficients - 1		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 2		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 4		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 7		Master	-----	-----	-0.007	-----	
Accelerometer Coefficients - 8		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 9		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 10		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 11		Master	-----	-----	0.000	-----	
Gamma-Ray Detector Serial Number		Master			7792		

EDTC-B Gamma-Ray Calibration - Gamma Ray Coefficients

Before: After:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Gamma Ray Gain		Before	1.000	0.900	NOT DONE	1.100	
		After	-----	-----	-----	-----	
		After-Before	-----	-----	-----	-----	

EDTC-B Gamma-Ray Calibration - Gamma Ray Accumulations

Before: After:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RGR Zero Measurement - 0	gAPI	Before	-----	-----	-----	-----	
		After	-----	-----	-----	-----	
		After-Before	-----	-----	-----	-----	
RGR Plus Measurement	gAPI	Before			NOT DONE		
		After			NOT DONE		
		After-Before	-----	-----	-----	-----	

LEH-QT (Logging Equipment Head - QT, 3-3/8 inch 31 pin HPHT with Tension Sensor) Calibration - Run ONE

Primary Equipment :

Logging Equipment Head - QT, 3-3/8 inch 31 pin HPHT with Tension Sensor LEH-QT

HTEN Master Calibration - HTEN Master Calibration

Master:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
HTEN Shop Gain		Master	1.000	0.800	NOT DONE	4.500	
HTEN Shop Offset	lbf	Master	0	-1000.000	NOT DONE	1000.000	

HTEN Before Calibration - HTEN Before Calibration

Before:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RHTE Zero Measurement - 0	lbf	Before	-----	-----	-----	-----	
RHTE Plus Measurement - 0	lbf	Before	-----	-----	-----	-----	
HTEN Gain - 0		Before	-----	-----	-----	-----	
HTEN Offset - 0	lbf	Before	-----	-----	-----	-----	

Company:	Noble Energy, Inc.
Well:	Wells Ranch AF05-625
Field:	Wattenberg
County:	Weld
State:	CO

Schlumberger

Ultrasonic Imager
Cement Evaluation
Gamma Ray - CCL