



Company: **Lamont Doherty Earth Observatory**
 Well: **Expedition 349, Site U1433B**
 Field: **South China Sea Tectonics**
 Rig: **JOIDES Resolution** Ocean: **South China Sea**

High Resolution Laterolog Array (HRLA)
 Hostile Litho Density Sonde (HLDS)
 Natural Gamma Ray

Latitude: N 12.918855*	Elev.: K.B. -4391.00 m
Longitude: E 115.0474733*	G.L. 0.00 m
	D.F. -4391.00 m
Permanent Datum: Sea Floor	Elev.: 0.00 m
Log Measured From: Sea Floor	0.00 m above Perm. Datum
Drilling Measured From: Sea Floor	

API Serial No.	N 12.918855	E 115.0474733
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Rig: JOIDES Resolution
 Field: South China Sea Tectonics
 Location: Latitude: N 12.918855*
 Well: Expedition 349, Site U1433B
 Company: Lamont Doherty Earth Observatory

Logging Date	18-Mar-2014
Run Number	1
Depth Driller	858.5 m
Schlumberger Depth	840 m
Bottom Log Interval	840 m
Top Log Interval	0 m
Casing Driller Size @ Depth	13.375 in @ 100.4 m
Casing Schlumberger	100 m
Bit Size	9.875 in
Type Fluid In Hole	Seawater-Sepiolite
MUD Density	1.029 g/cm3
MUD Viscosity	
MUD Fluid Loss	PH
MUD Source Of Sample	N/A
RM @ Measured Temperature	@ @
RMF @ Measured Temperature	@ @
RMC @ Measured Temperature	@ @
Source RMF	RMC N/A N/A
RM @ MRT	RMF @ MRT @ 22 @ 22 @ @
Maximum Recorded Temperatures	22 degC
Circulation Stopped	Time 18-Feb-2014 8:00
Logger On Bottom	Time 18-Mar-2014 18:00
Unit Number	Location 625003 Houston
Recorded By	K. Swain
Witnessed By	T. Williams

	Run 1	Run 2	Run 3
Logging Date			
Run Number			
Depth Driller			
Schlumberger Depth			
Bottom Log Interval			
Top Log Interval			
Casing Driller Size @ Depth		@	
Casing Schlumberger			
Bit Size			
Type Fluid In Hole			
MUD Density			
MUD Viscosity			
MUD Fluid Loss		PH	
MUD Source Of Sample			
RM @ Measured Temperature		@	
RMF @ Measured Temperature		@	
RMC @ Measured Temperature		@	
Source RMF		RMC	
RM @ MRT		RMF @ MRT @	@
Maximum Recorded Temperatures			
Circulation Stopped		Time	
Logger On Bottom		Time	
Unit Number		Location	
Recorded By			
Witnessed By			

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OTHER SERVICES1
 OS1: FMS/DSI
 OS2:
 OS3: HRLA/HLDS/APS/HNGS
 OS4:
 OS5:

OTHER SERVICES2
 OS1:
 OS2:
 OS3:
 OS4:
 OS5:

REMARKS: RUN NUMBER 1

REMARKS: RUN NUMBER 2

Hole drilled with RCB coring bit and bottom hole assembly (BHA). 9 7/8 " BS

Original log files recorded from drill floor depth reference and later played back to sea floor reference which are the reference for these logs.
 Borehole correction assuming bit size (BS) at client request.
 Mud weight assumes 1.03 g/cc at client request as heavy mud not evenly displaced
 2 MCD (mechanical Caliper Device) centralizers run with HRLA. 2 knuckle joints and 1 thru wired extension separates the centralized HRLA from the eccentered HLDS/APS.

The RCB bit was dropped at the bottom of the hole prior to logging.
 HNGS run at bottom of toolstring per client request. APS and ILEF eccentricizer removed per client request.
 LDEO-MSS tool not utilized due to high temperature expectation.
 HLDS calibration counts are flagged as low in summary listing due to source strength being lower than nominal. Actual density measurement is not affected.

RUN 1		
SERVICE ORDER #:		
PROGRAM VERSION:	19C0-187	
FLUID LEVEL:		
LOGGED INTERVAL	START	STOP

RUN 2		
SERVICE ORDER #:		
PROGRAM VERSION:		
FLUID LEVEL:		
LOGGED INTERVAL	START	STOP




EQUIPMENT DESCRIPTION

RUN 1

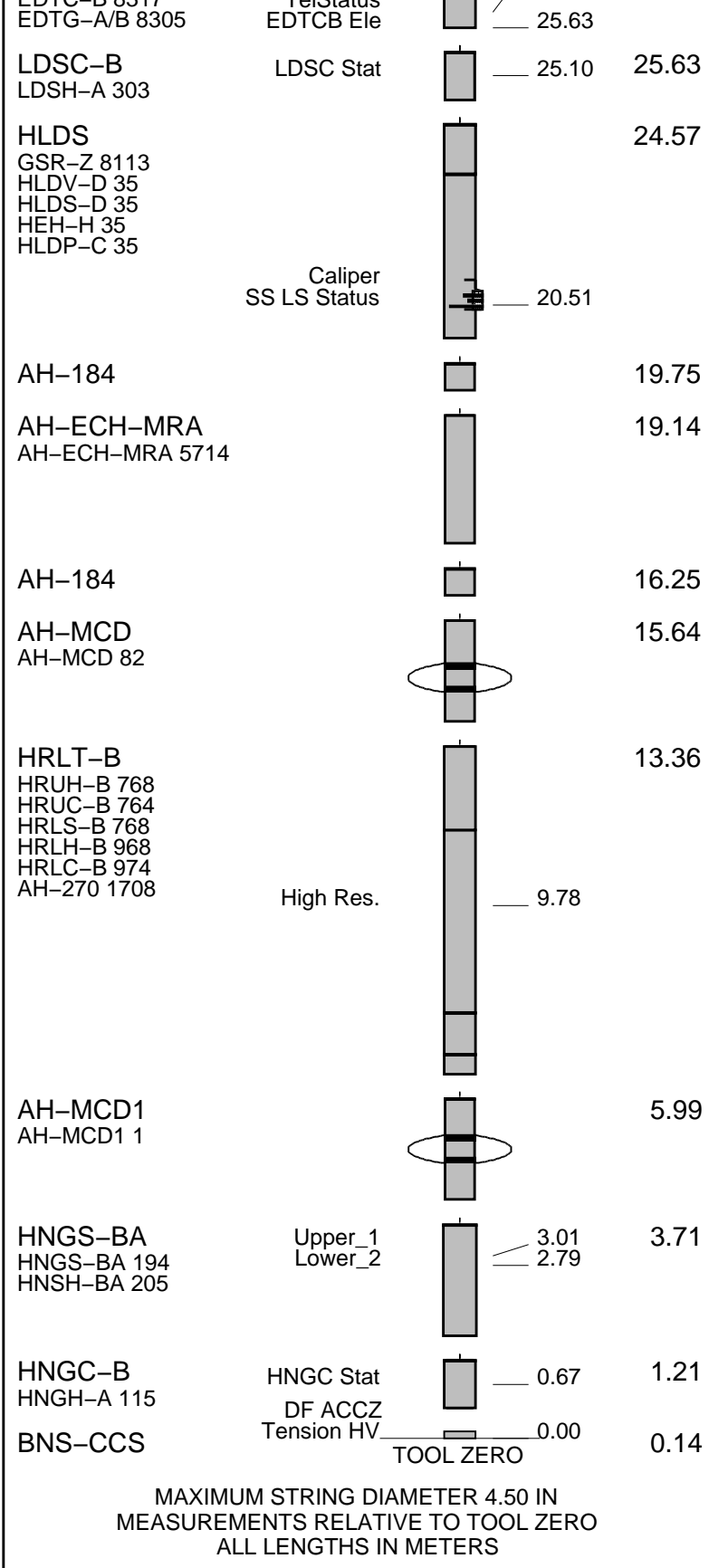
SURFACE EQUIPMENT

GSR-U 616008
 WITM (EDTS)-A 1

DOWNHOLE EQUIPMENT

LEH-MT 101		29.01	
LEH-MT 101 101			
AH-369			
MDSB_EDTC		27.62	28.05
Mud Tempe		26.55	
CTEM		25.98	27.62
Gamma Ray			
EDTC-B			
EDTH-B 8303			
EDTC-B 8317			
EFTB DIAG			
TelStatus			

RUN 2



Production String	(in)	(M)	Well Schematic	(M)	(in)	Casing String
	OD	ID		MD	MD	

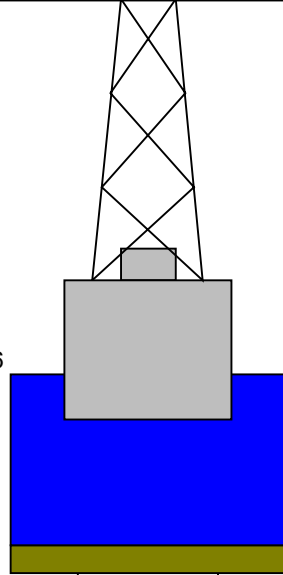
Kelly Bushing Elevation
Derrick Floor Elevation

Mean Sea Level

-4390.6

-4390.6

-4379.6



4.1



0

4.1

100.43

9.875

Sea Floor

Open Hole

858.5

Total Depth

Input DLIS Files

DEFAULT	NGS_HRLA_LDL_018PUP	FN:24	PRODUCER	18-Mar-2014 13:12	5237.2 M	4384.2 M
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Output DLIS Files

DEFAULT	NGS_HRLA_LDL_022PUP	FN:32	PRODUCER	18-Mar-2014 13:53	841.7 M	-11.3 M
BACKUP	NGS_HRLA_LDL_022PUP	FN:33	PRODUCER	18-Mar-2014 13:53	841.7 M	-11.3 M

OP System Version: 19C0-187

HNGC-B	19C0-187	HNGS-BA	19C0-187
HRLT-B	19C0-187	HLDS	19C0-187
LDSC-B	19C0-187	EDTC-B	SKK-5169-EDTCB

PIP SUMMARY

Time Mark Every 60 S

HRLT True Resistivity (RT_HRLT)		
0.2	(OHMM)	2000

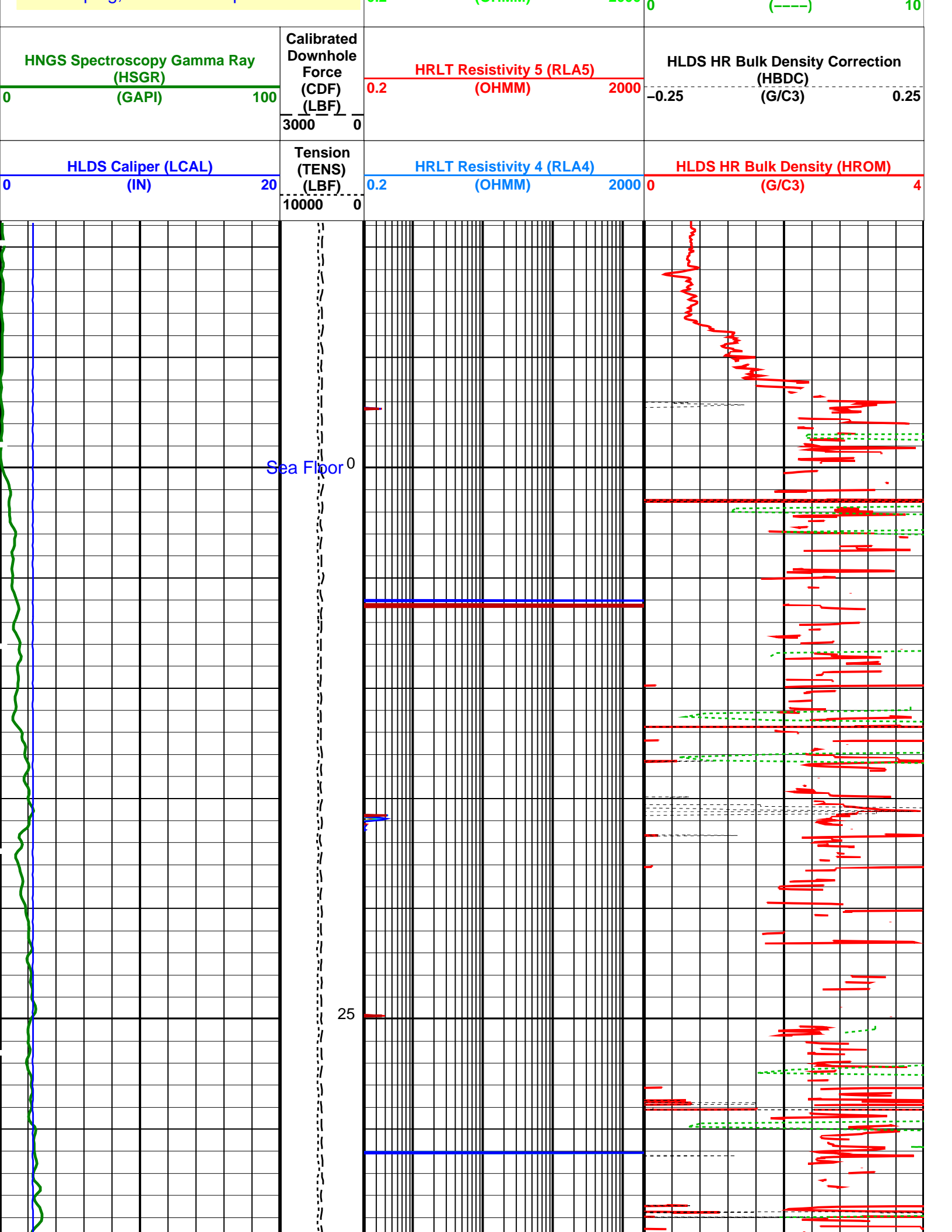
HRLT Resistivity 1 (RLA1)		
0.2	(OHMM)	2000

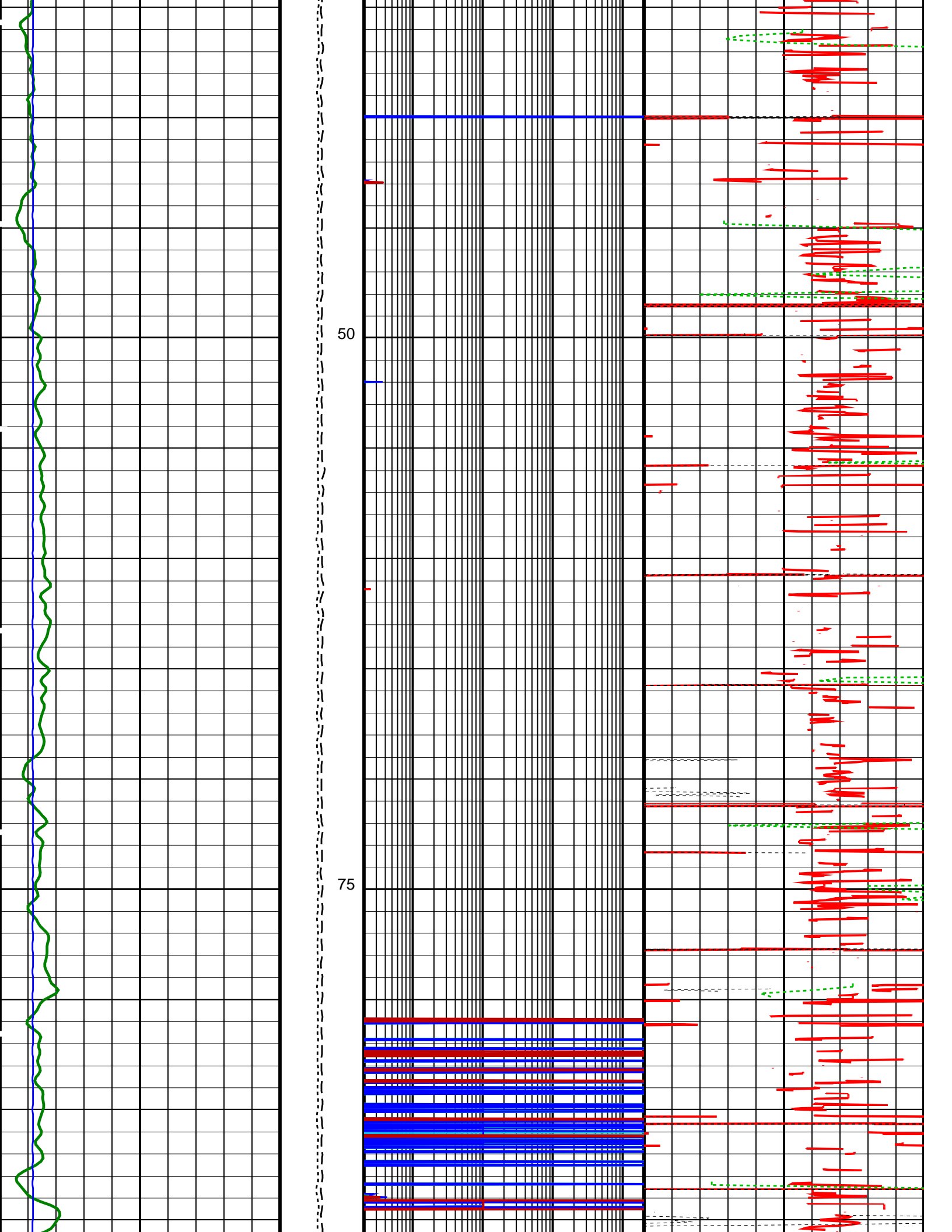
HRLT Resistivity 2 (RLA2)		
0.2	(OHMM)	2000

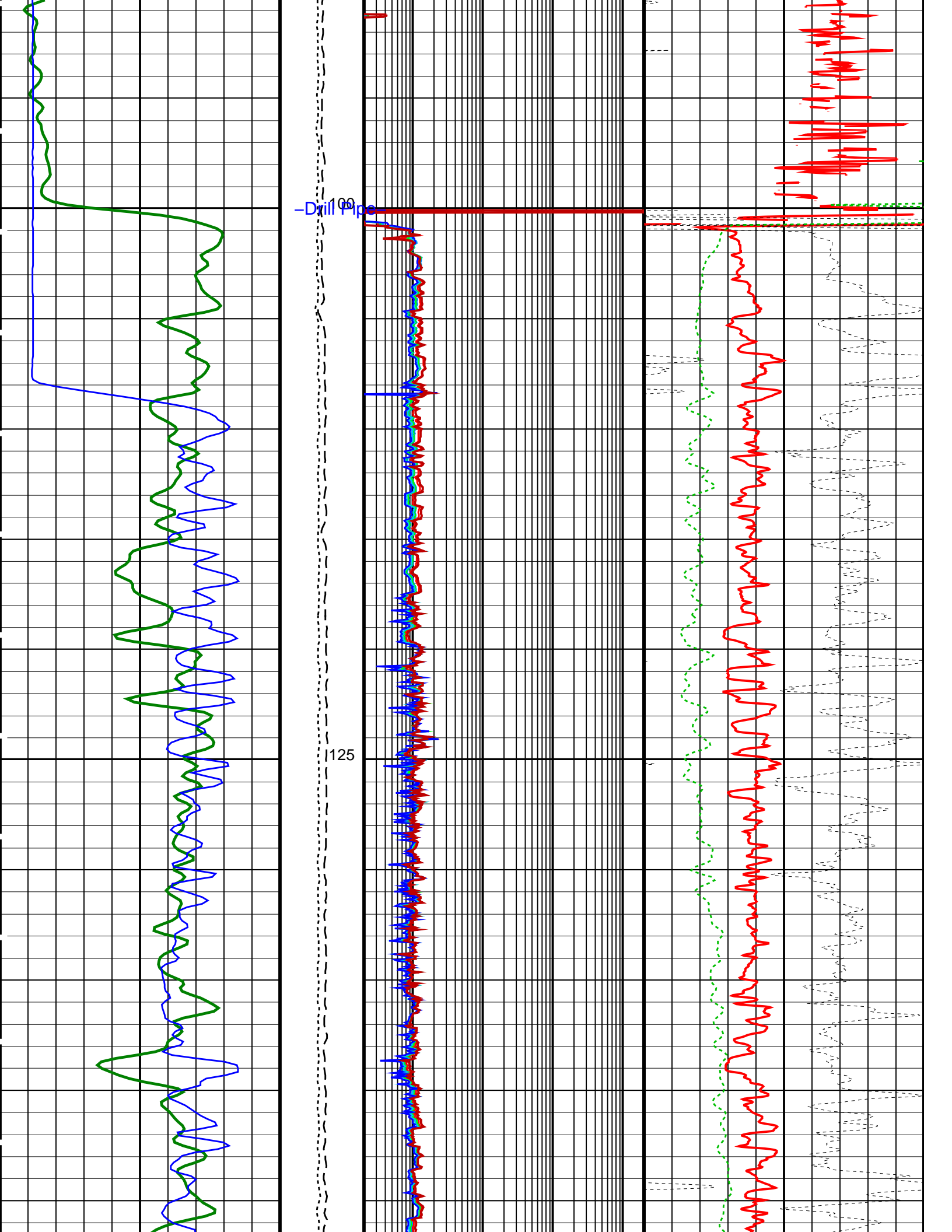
Main Uplog. Sea Floor Depth Reference

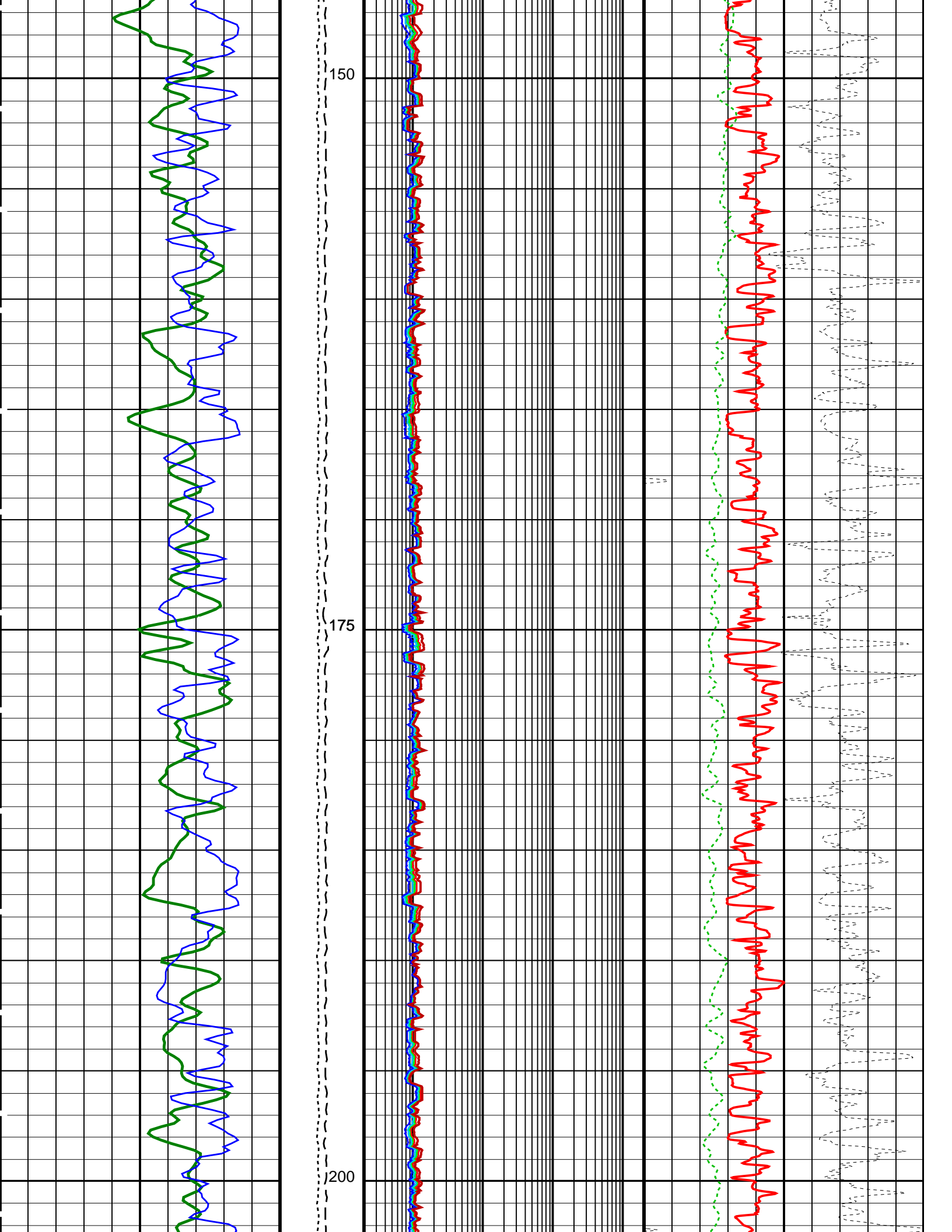
HRLT Resistivity 3 (RLA3)		
0.2	(OHMM)	2000

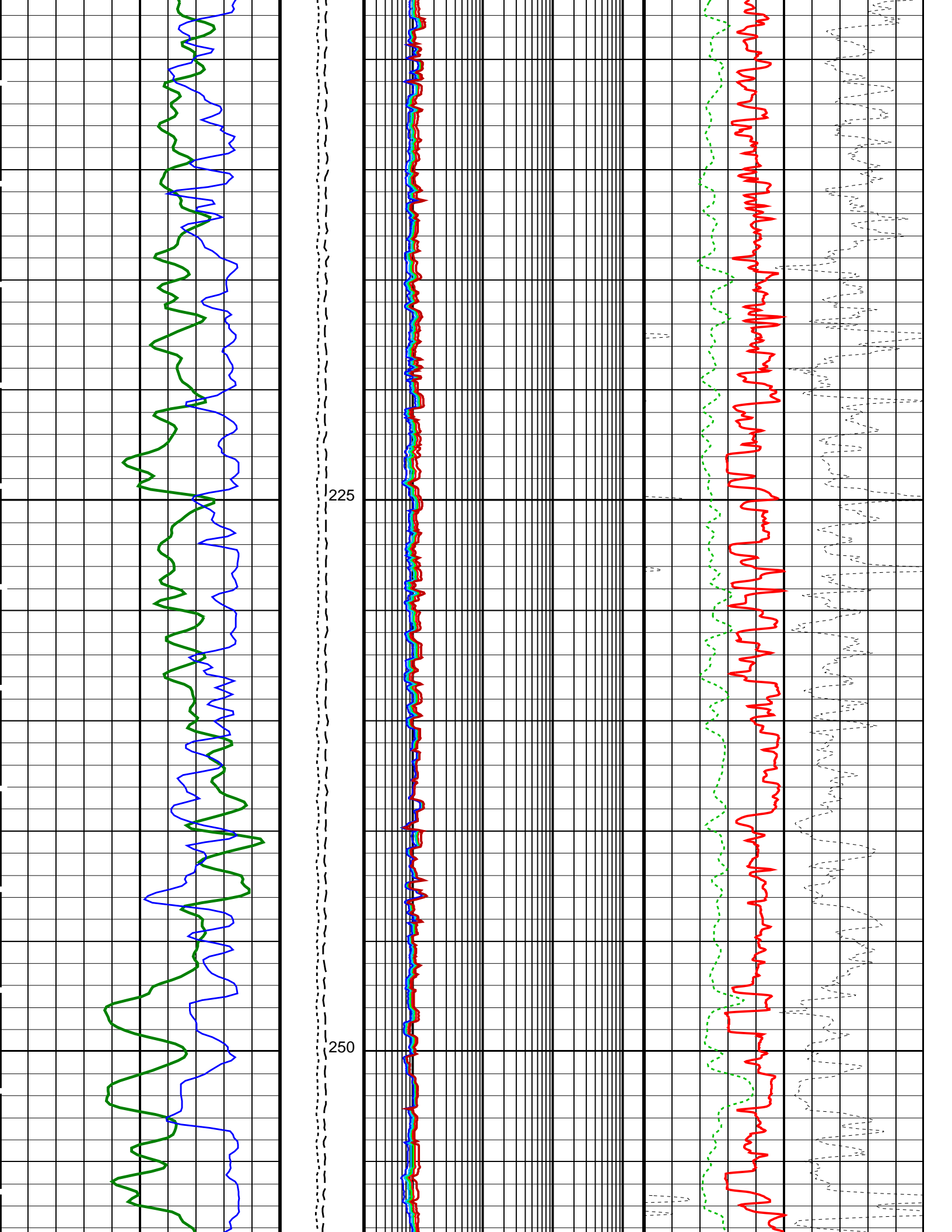
HLDS Long Spaced Photoelectric Effect (PEFL)

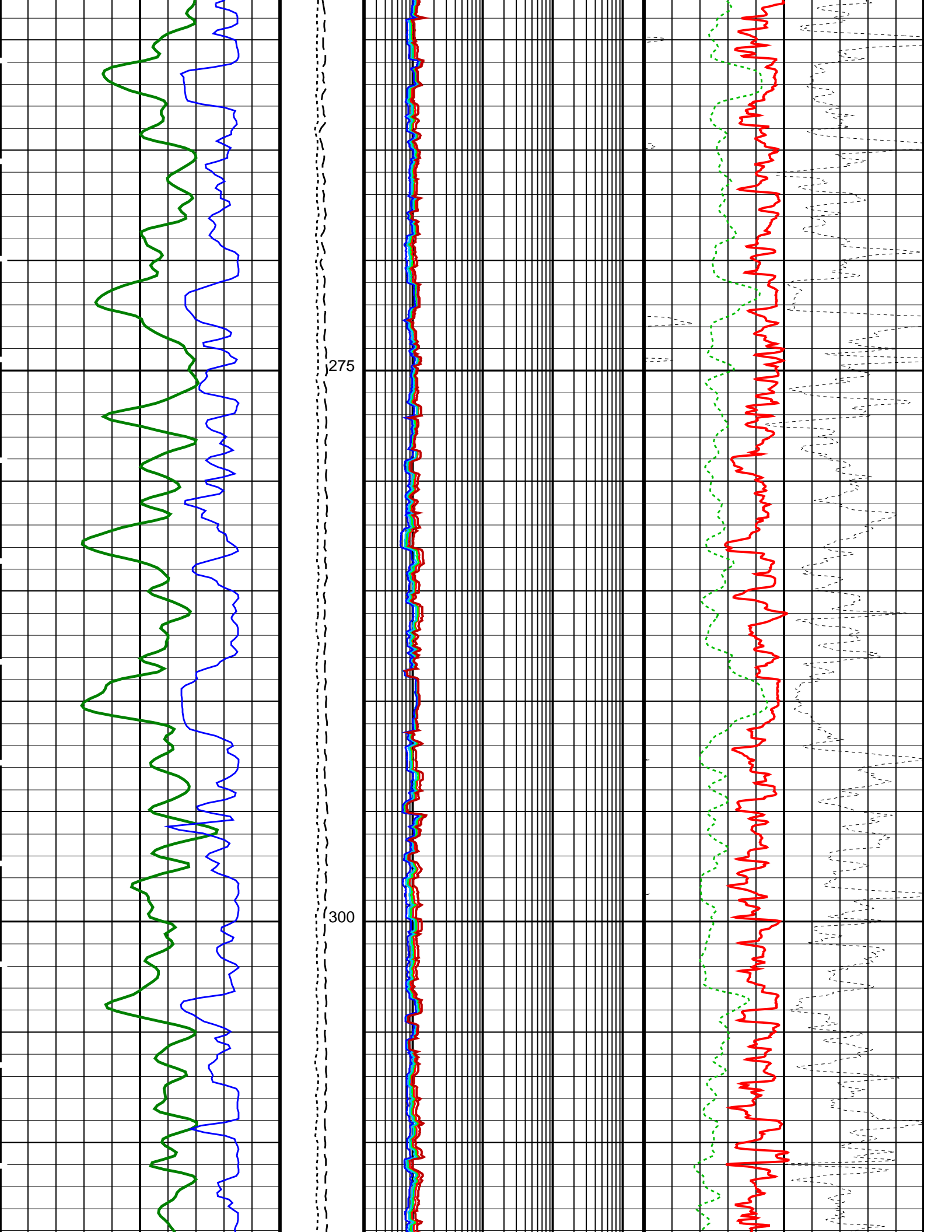


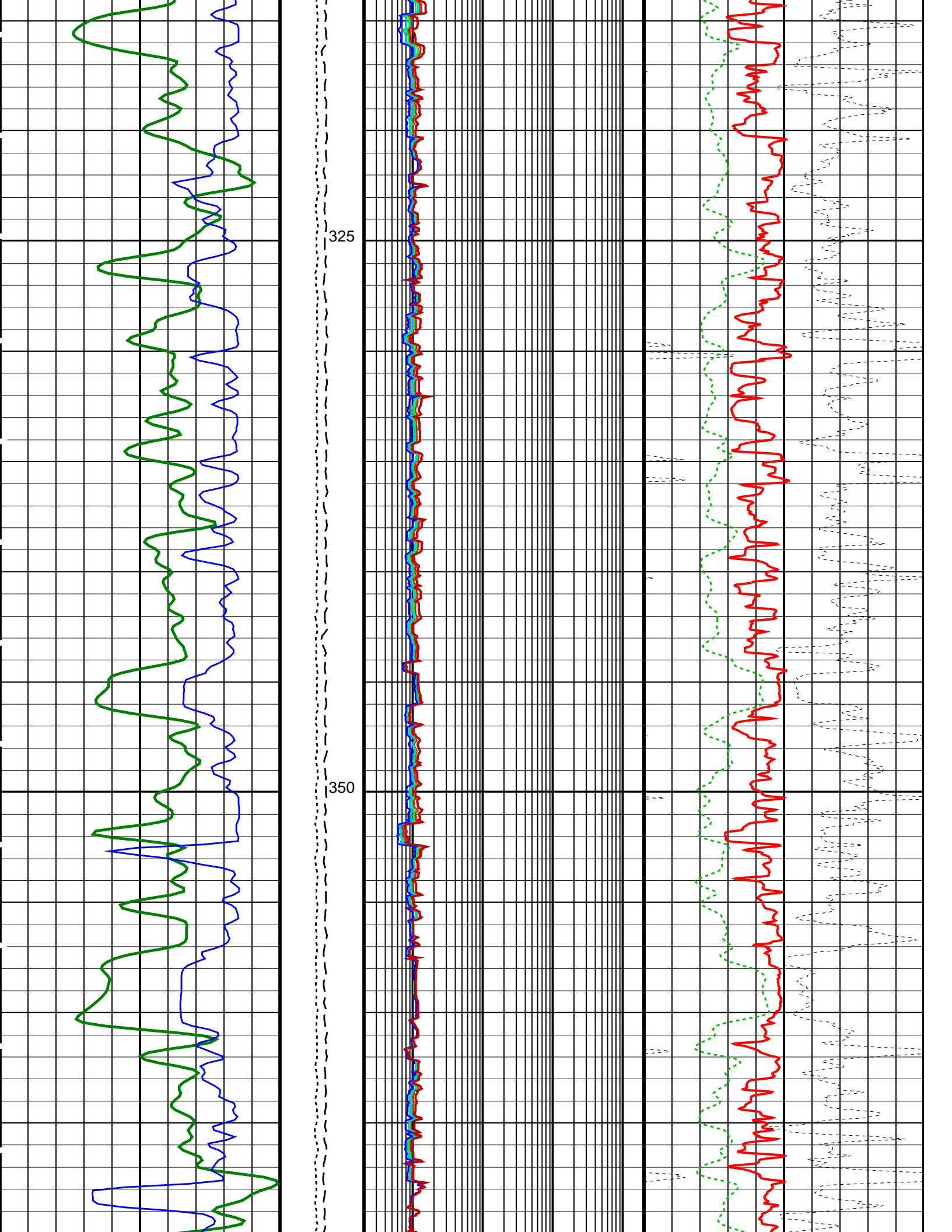


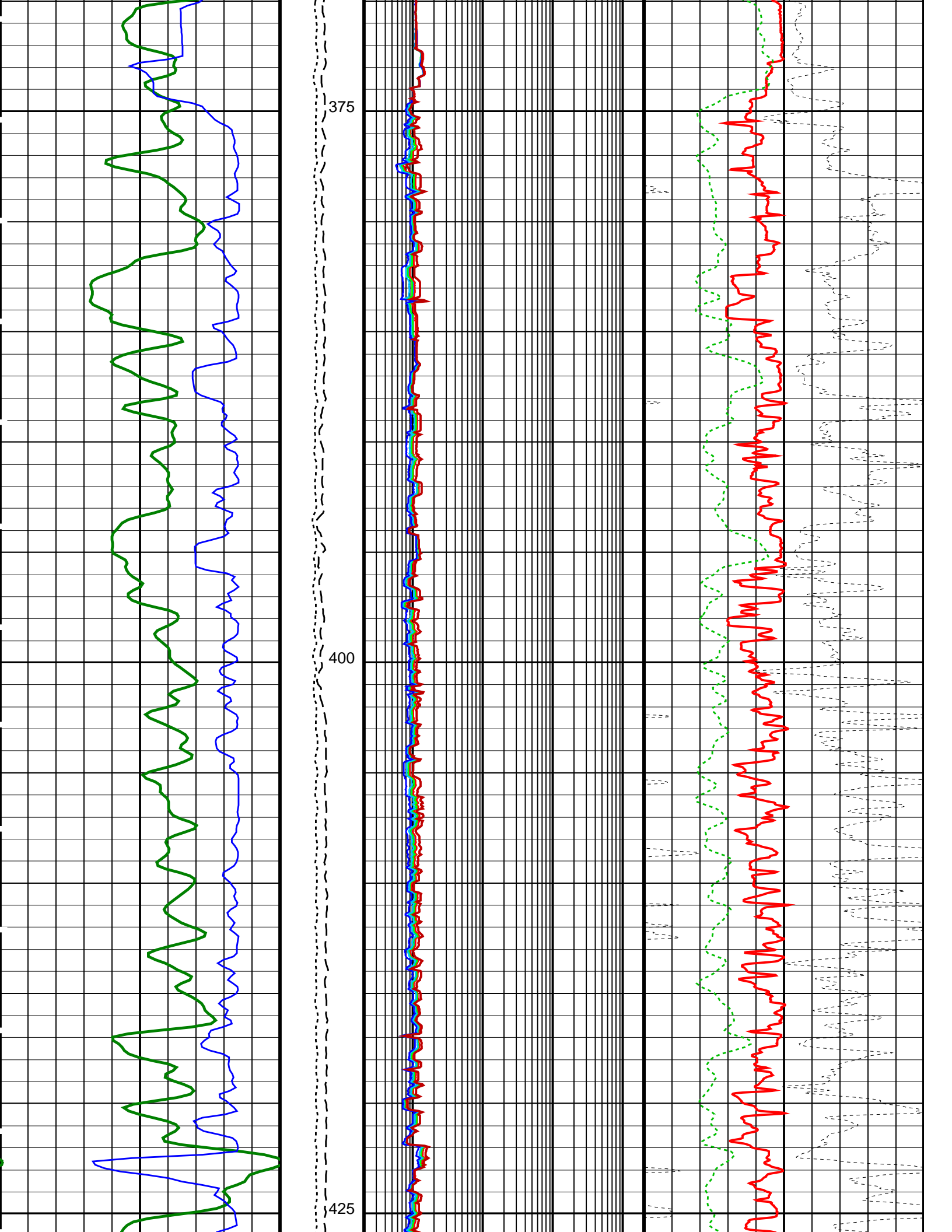


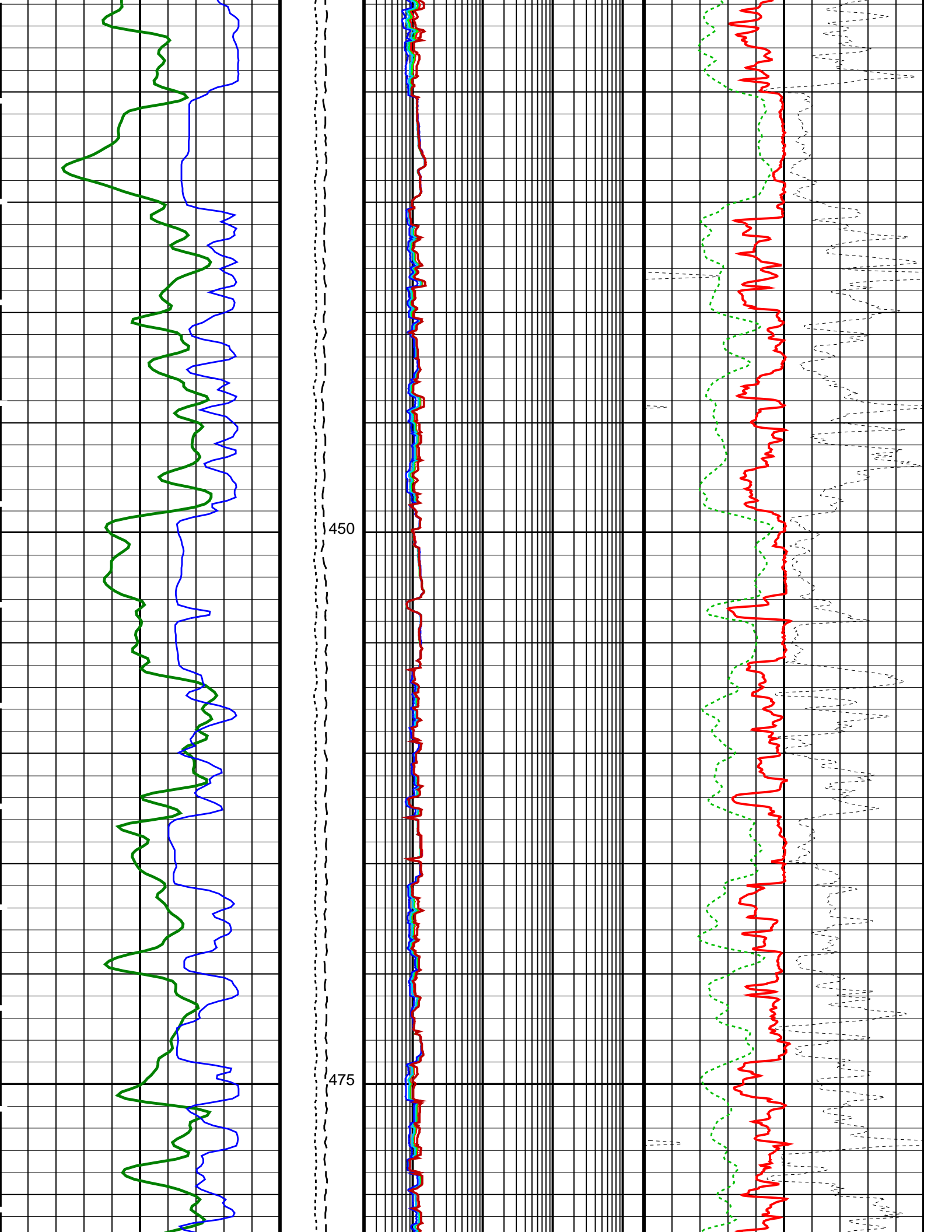


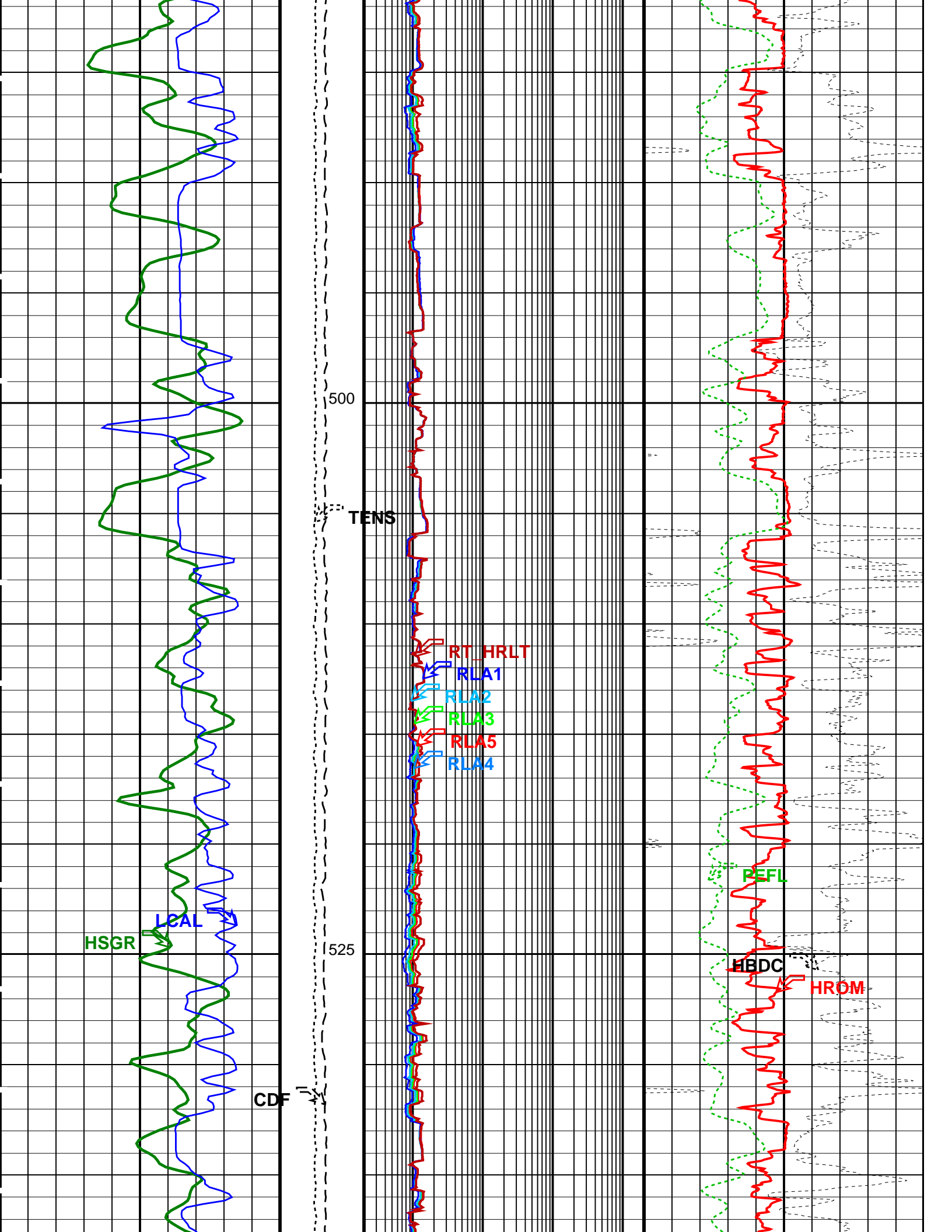


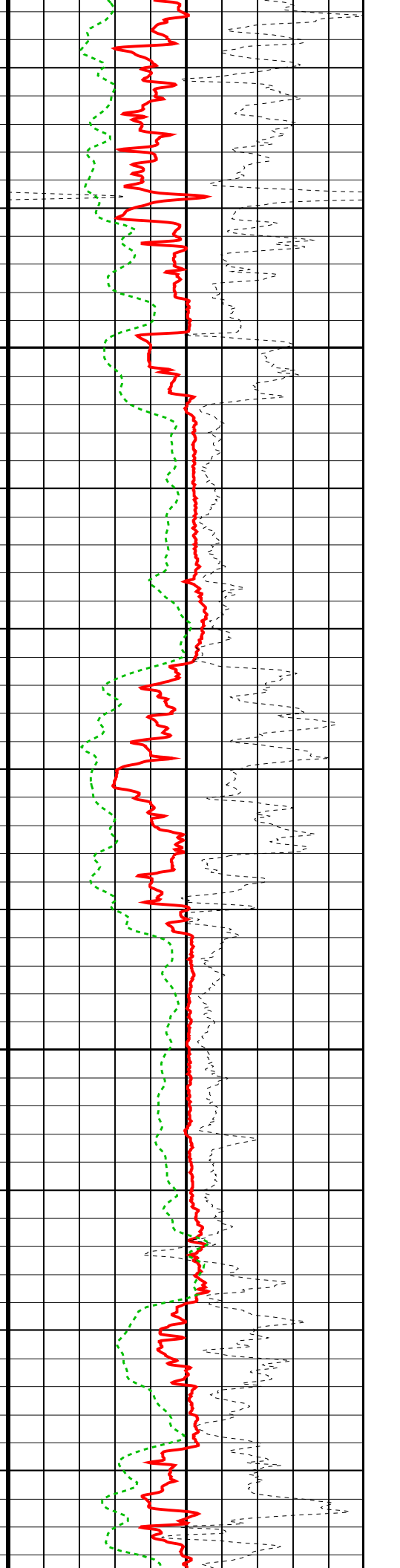
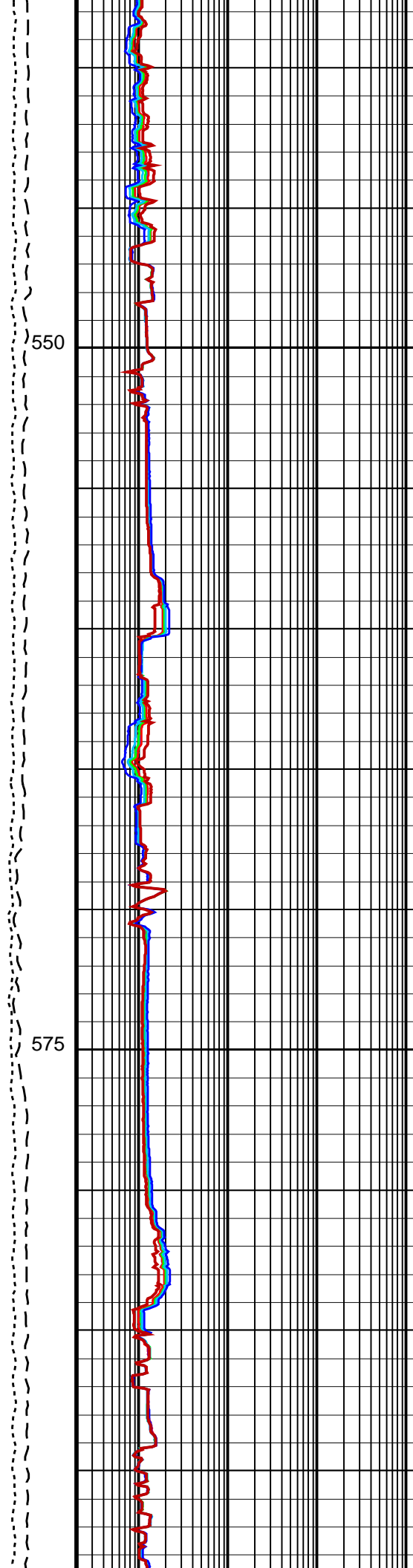
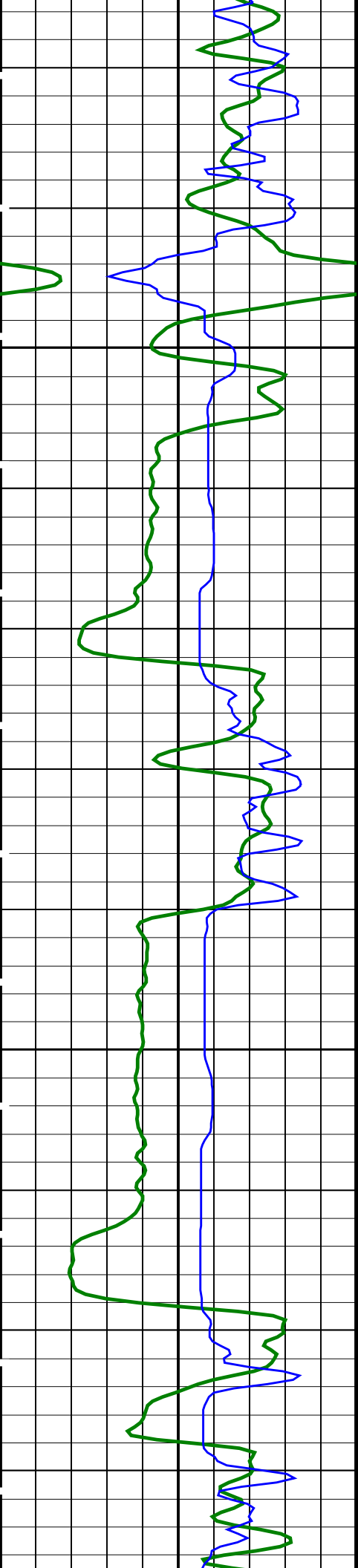


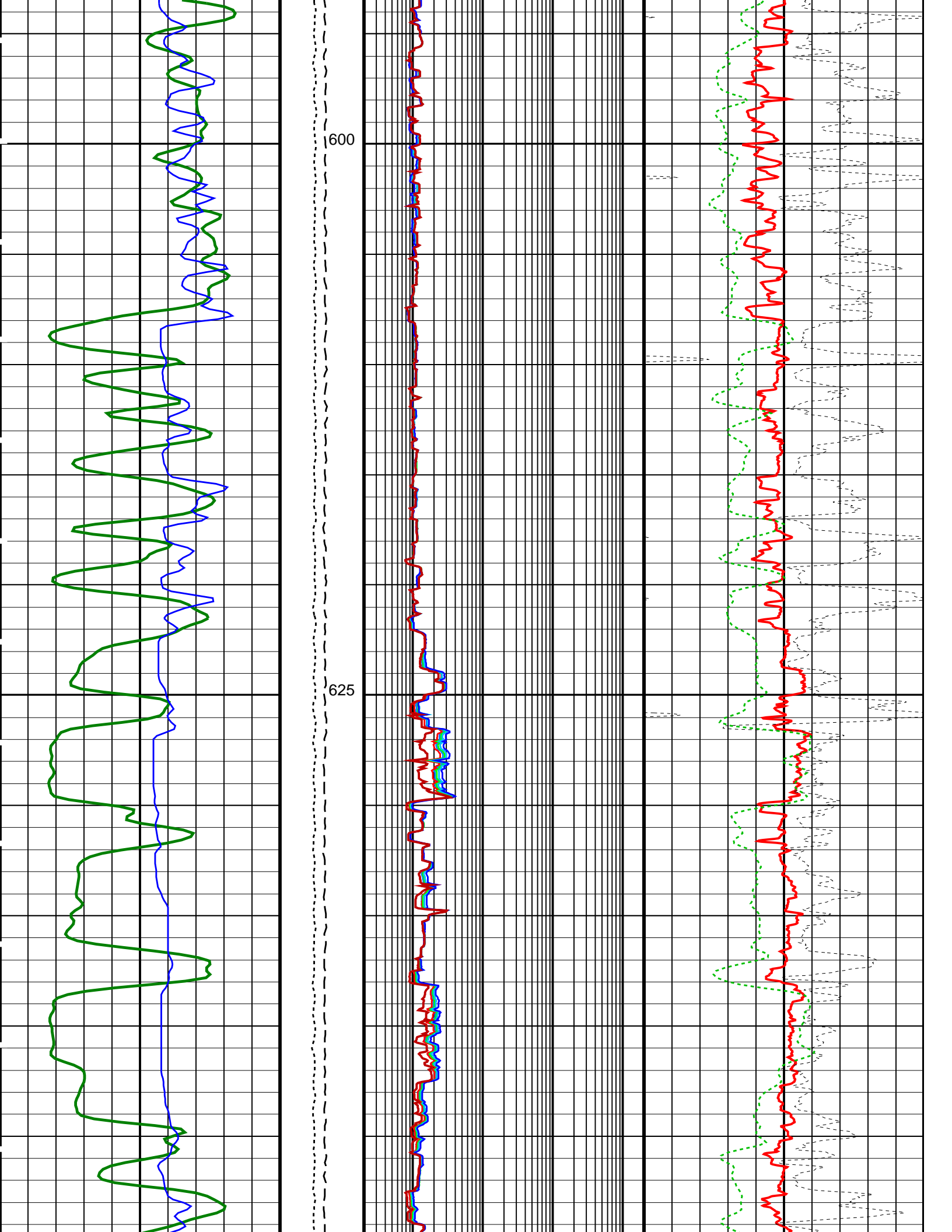


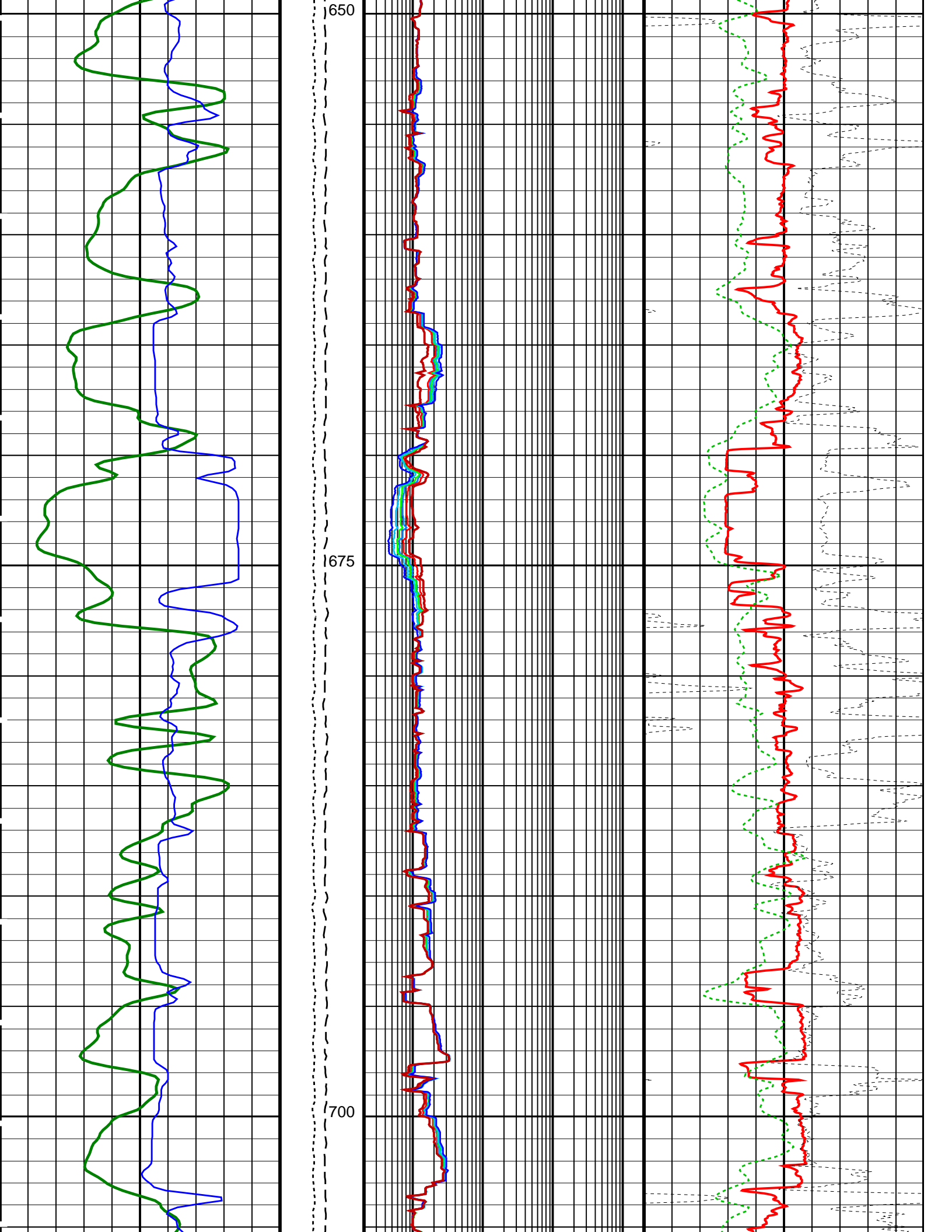


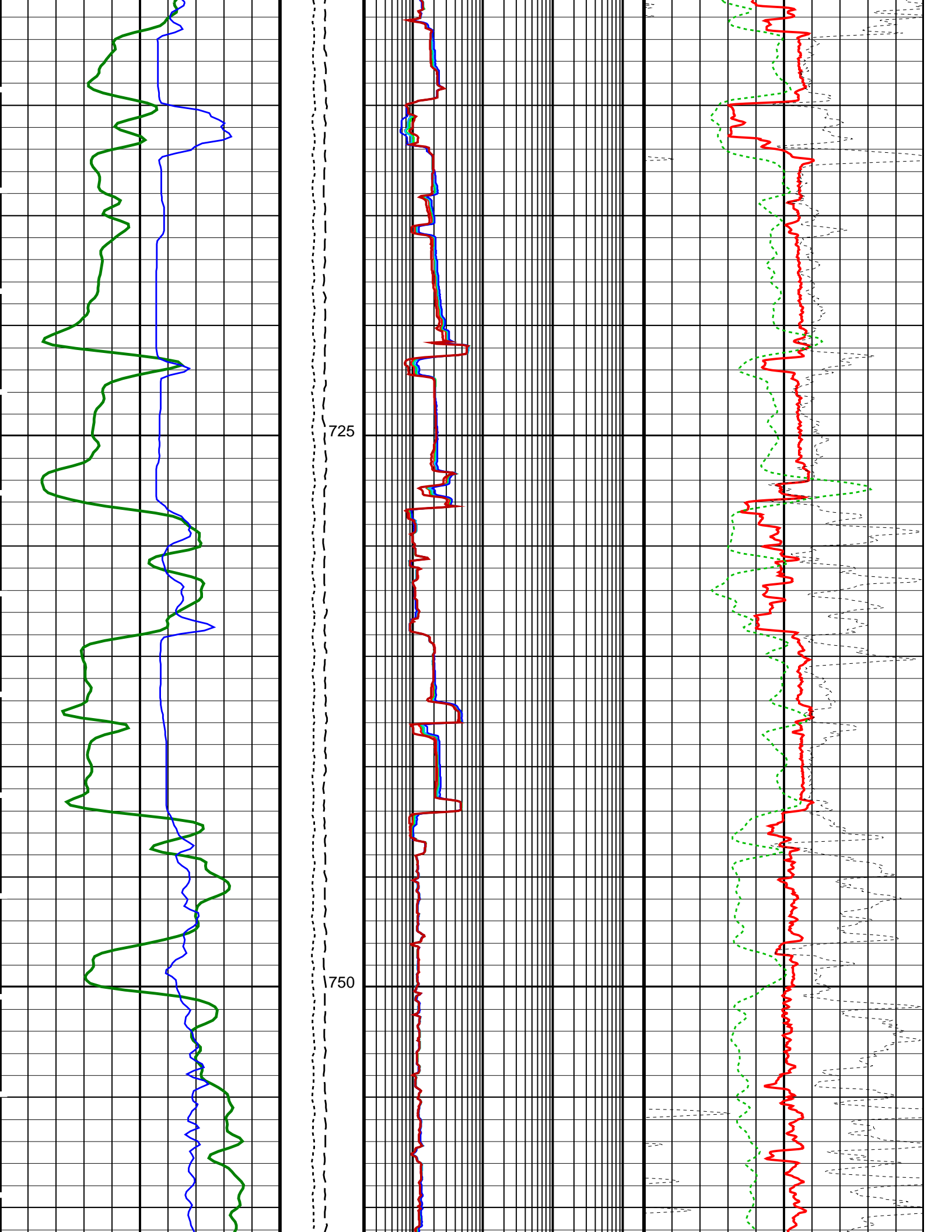


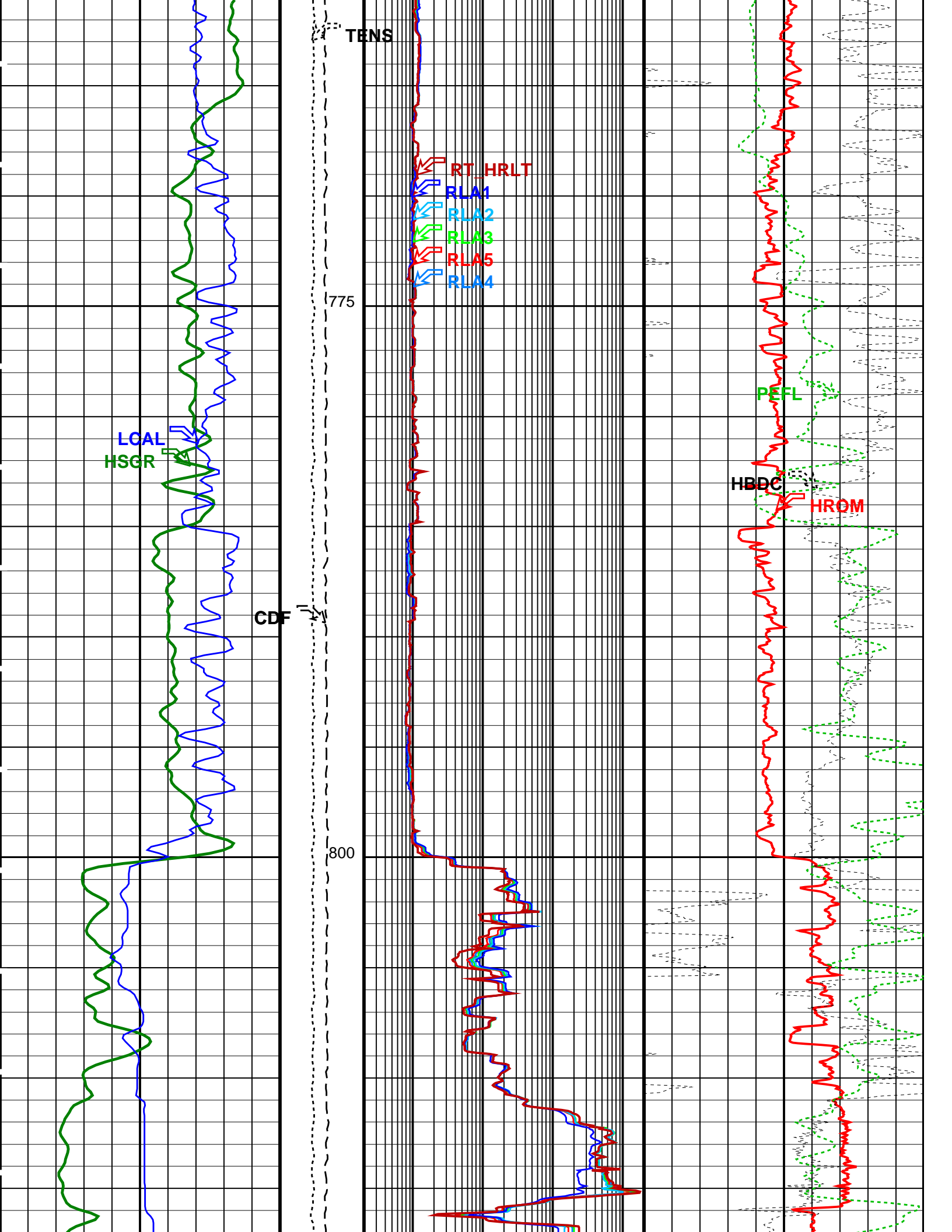


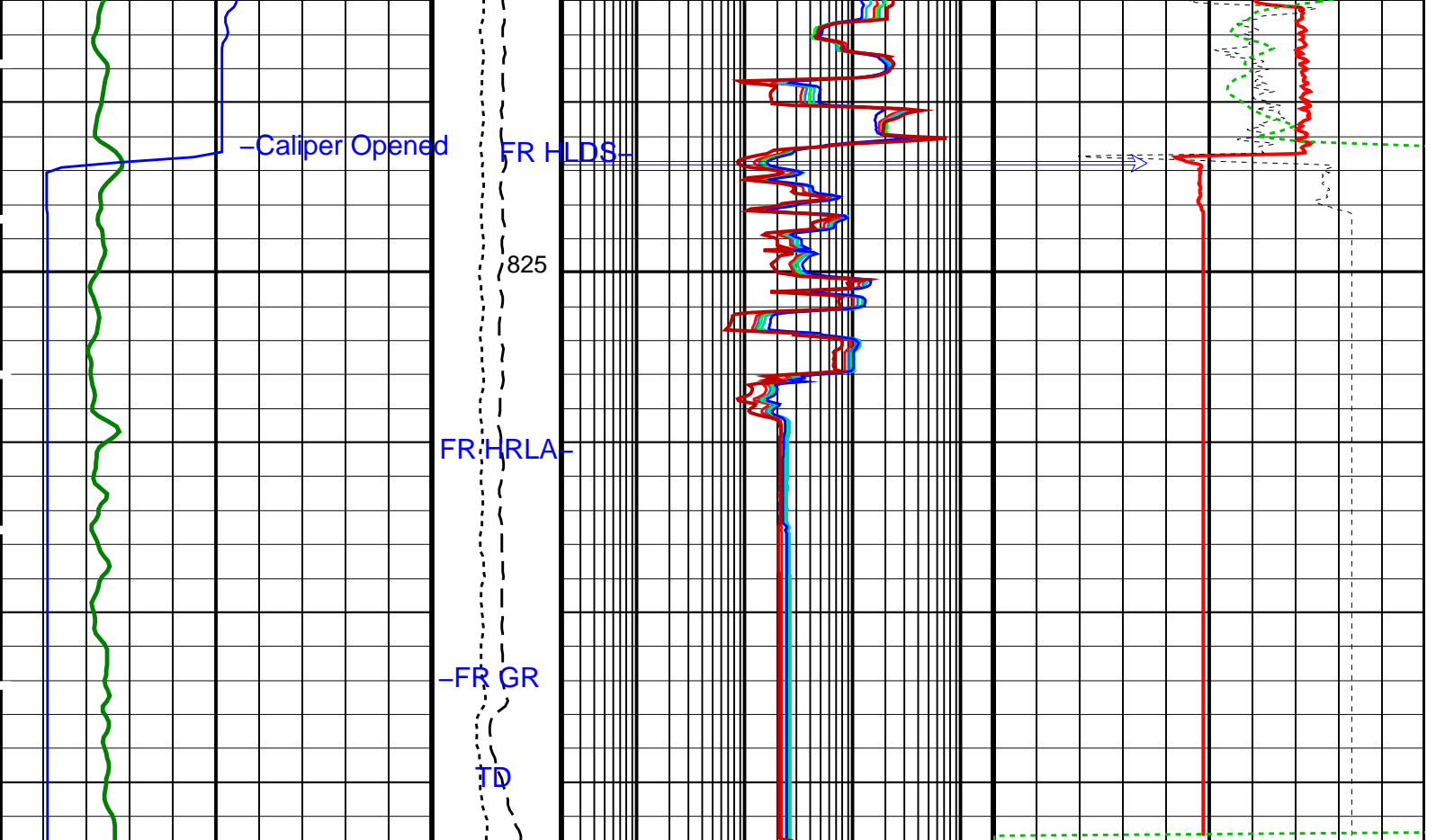












HLDS Caliper (LCAL) (IN)	Tension (TENS) (LBF)	HRLT Resistivity 4 (RLA4) (OHMM)	HLDS HR Bulk Density (HROM) (G/C3)
0 20	10000 0	0.2 2000	0 4
HNGS Spectroscopy Gamma Ray (HSGR) (GAPI)	Calibrated Downhole Force (CDF) (LBF)	HRLT Resistivity 5 (RLA5) (OHMM)	HLDS HR Bulk Density Correction (HBDC) (G/C3)
0 100	3000 0	0.2 2000	-0.25 0.25
Main Uplog, Sea Floor Depth Reference	HRLT Resistivity 3 (RLA3) (OHMM)	HLDS Long Spaced Photoelectric Effect (PEFL) (----)	0 10
	HRLT Resistivity 2 (RLA2) (OHMM)		
	HRLT Resistivity 1 (RLA1) (OHMM)		
	HRLT True Resistivity (RT_HRLT) (OHMM)		

PIP SUMMARY

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value
HNGS-BA: Hostile Natural Gamma Ray Sonde		
BAR1	HNGS Detector 1 Barite Constant	1
BAR2	HNGS Detector 2 Barite Constant	1
BHK	HNGS Borehole Potassium Correction Concentration	0
BHS	Borehole Status	OPEN
BHT	Bottom Hole Temperature (used in calculations)	68 DEGC
CSD1	Inner Casing Outer Diameter	0 IN
CSD2	Outer Casing Outer Diameter	0 IN
CSW1	Inner Casing Weight	0 LB/F
CSW2	Outer Casing Weight	0 LB/F

CSWZ	Outer Casing Weight	0	LB/FT
DBCC	HNGS Barite Constant Correction Flag	NONE	
GCSE	Generalized Caliper Selection	BS	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN_9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
H1P	HNGS Detector 1 Allow/Disallow In Processing	ALLOW	
H2P	HNGS Detector 2 Allow/Disallow In Processing	ALLOW	
HABK	HNGS Borehole Potassium Running Average	-0.00292136	
HALF	HNGS Alpha Filter Length	60	IN
HCRB	HNGS Apply Borehole Potassium Correction	NONE	
HMWM	Mud Weighting Material	NATU	
HNPE	HNGS Processing Enable	YES	
ISSBAR	Barite Mud Switch	NOBARITE	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
S1BI	HNGS Detector 1 Calibration Bismuth Count Rate	1.3	CPS
S2BI	HNGS Detector 2 Calibration Bismuth Count Rate	1.3	CPS
SGRC	HNGS Standard Gamma-Ray Correction Flag	YES	
SHT	Surface Hole Temperature	20	DEGC
TPOS	Tool Position	CENT	
VBA1	HNGS Detector 1 Variable Barite Factor Running Average	1.00477	
VBA2	HNGS Detector 2 Variable Barite Factor Running Average	1.0061	
HRLT-B: High Resolution Laterolog Array - B			
BHS	Borehole Status	OPEN	
BHT	Bottom Hole Temperature (used in calculations)	68	DEGC
CALSTAT	HRLTB Calibration Status	SHALLOW_DONE	
CALTEMP	HRLTB Calibration Temperature	9.71505	DEGC
FREQ0	HRLT Frequency Index for Mode 0	32	
FREQ1	HRLT Frequency Index for Mode 1	128	
FREQ2	HRLT Frequency Index for Mode 2	104	
FREQ3	HRLT Frequency Index for Mode 3	86	
FREQ4	HRLT Frequency Index for Mode 4	56	
FREQ5	HRLT Frequency Index for Mode 5	44	
FREQ6	HRLT Frequency Index for Mode 6	116	
GCSE	Generalized Caliper Selection	BS	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN_9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
ISSBAR	Barite Mud Switch	NOBARITE	
KFAC_HRLT	HRLT K Factor Option	SONDE	
LOOPCOEF_S	HRLT Loop Coefficient for Shallow Modes	LOW	
LOOPMOD0	HRLT Mode 0 Loop Mode	OFF	
LOOPMOD1	HRLT Mode 1 Loop Mode	OFF	
LOOPMOD2	HRLT Mode 2 Loop Mode	OFF	
LOOPMOD3	HRLT Mode 3 Loop Mode	OFF	
LOOPMOD4	HRLT Mode 4 Loop Mode	OFF	
LOOPMOD5	HRLT Mode 5 Loop Mode	OFF	
LOOPMOD6	HRLT Mode 6 Loop Mode	OFF	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
PROCI NV	Inversion Selection	ON	
PROCMFL	Inversion Micro-Resistivity Selection	NO_EXTERNAL_RXO	
PROCM SO	Mechanical Standoff Fin Size	0	IN
PROCRM	Processing Mud Resistivity Select	HRLT_Compute	
PROCSPO	Sonde Position	Centered	
SHT	Surface Hole Temperature	20	DEGC
HLDS: Hostile Litho-Density Sonde			
CLCL	HLDS LS Control Loop Controller Mode	AUTO_DEFAULT	
CLCS	HLDS SS Control Loop Controller Mode	AUTO_DEFAULT	
CLLS	HLDS Mode Loop Long Spacing	AUTO	
CLSS	HLDS Mode Loop Short Spacing	AUTO	
DHC	Density Hole Correction	BS	
DPPM	Density Porosity Processing Mode	HIRS	
FD	Fluid Density	1	G/C3
LATC	HLDS Activation Correction	OFF	
LLDL	HLDS LS Low Level Discriminator DAC	14000	
LLDS	HLDS SS Low Level Discriminator DAC	14000	
LLML	HLDS LS Low Level Discriminator Mode	AUTO	
LLMS	HLDS SS Low Level Discriminator Mode	AUTO	
MDEN	Matrix Density	2.71	G/C3
PHVL	HLDS Long Spacing High Voltage Setting	1000	V
PHVS	HLDS Short Spacing High Voltage Setting	1000	V
PSDL	HLDS LS Pulse Shape Compensation DAC	30000	
PSDS	HLDS SS Pulse Shape Compensation DAC	30000	
PSML	HLDS LS Pulse Shape Compensation Mode	AUTO	
PSMS	HLDS SS Pulse Shape Compensation Mode	AUTO	
EDTC-B: Enhanced DTS Cartridge			
BHFL	Borehole Fluid Type	WATER	
BHS	Borehole Status	OPEN	
BHT	Bottom Hole Temperature (used in calculations)	68	DEGC
BSCO	Borehole Salinity Correction Option	NO	
CCCO	Casing & Cement Thickness Correction Option	NO	
DPPM	Density Porosity Processing Mode	HIRS	
FSAL	Formation Salinity	-50000	PPM

FSCO	Formation Salinity Correction Option	NO	
GCSE	Generalized Caliper Selection	BS	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN 9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
HSCO	Hole Size Correction Option	YES	
ISSBAR	Barite Mud Switch	NOBARITE	
ISSBAR_EDTC	Nuclear Mud Type	NOBARITE	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
MCCO	Mud Cake Correction Option	NO	
MCOR	Mud Correction	NATU	
MWCO	Mud Weight Correction Option	YES	
PTCO	Pressure/Temperature Correction Option	NO	
SDAT	Standoff Data Source	SOCN	
SHT	Surface Hole Temperature	20	DEGC
SOCN	Standoff Distance	0.5	IN
SOCO	Standoff Correction Option	NO	
TPOS_EDTC	EDTC Tool Centered/Eccentered	Eccentered	
U-ETELM_EDTS	Telemetry Mode for eWAFE	Standard_EDTS	
U-TELM_EDTS	Telemetry Mode for WAFE	Standard_EDTS	
System and Miscellaneous			
ALTDPCHAN	Name of alternate depth channel	SpeedCorrectedDepth	
BS	Bit Size	9.875	IN
BSAL	Borehole Salinity	-50000.00	PPM
CSIZ	Current Casing Size	13.375	IN
CWEI	Casing Weight	168.00	LB/F
DFD	Drilling Fluid Density	1.03	G/C3
DO	Depth Offset for Playback	-4395.5	M
FLEV	Fluid Level	-50000.00	M
MST	Mud Sample Temperature	-50000.00	DEGC
PBVSADP	Use alternate depth channel for playback	NO	
PP	Playback Processing	NORMAL	
RMFS	Resistivity of Mud Filtrate Sample	-50000.0000	OHMM
RW	Resistivity of Connate Water	1.0000	OHMM
TD	Total Depth	5270	M
TDD	Total Depth - Driller	5270.00	M
TDL	Total Depth - Logger	5270.00	M
TWS	Temperature of Connate Water Sample	37.78	DEGC

Format: TripleCombo Vertical Scale: 1:200 Graphics File Created: 18-Mar-2014 13:53

OP System Version: 19C0-187

HNGC-B	19C0-187	HNGS-BA	19C0-187
HRLT-B	19C0-187	HLDS	19C0-187
LDSC-B	19C0-187	EDTC-B	SKK-5169-EDTCB

Input DLIS Files

DEFAULT	NGS_HRLA_LDL_018PUP	FN:24	PRODUCER	18-Mar-2014 13:12	5237.2 M	4384.2 M
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Output DLIS Files

DEFAULT	NGS_HRLA_LDL_022PUP	FN:32	PRODUCER	18-Mar-2014 13:53		
BACKUP	NGS_HRLA_LDL_022PUP	FN:33	PRODUCER	18-Mar-2014 13:53		

Input DLIS Files

DEFAULT	NGS_HRLA_LDL_017PUP	FN:22	PRODUCER	18-Mar-2014 13:10	5226.4 M	4329.7 M
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Output DLIS Files

DEFAULT	NGS_HRLA_LDL_021PUP	FN:30	PRODUCER	18-Mar-2014 13:50	839.7 M	-57.3 M
BACKUP	NGS_HRLA_LDL_021PUP	FN:31	PRODUCER	18-Mar-2014 13:50	839.7 M	-57.3 M

OP System Version: 19C0-187

HNGC-B	19C0-187	HNGS-BA	19C0-187
HRLT-B	19C0-187	HLDS	19C0-187
LDSC-B	19C0-187	EDTC-B	SKK-5169-EDTCB

	HRLT True Resistivity (RT_HRLT) 0.2 (OHMM) 2000	
	HRLT Resistivity 1 (RLA1) 0.2 (OHMM) 2000	
	HRLT Resistivity 2 (RLA2) 0.2 (OHMM) 2000	

FLipped Downlog, Sea Floor Depth Reference

HRLT Resistivity 3 (RLA3) 0.2 (OHMM) 2000	HLDS Long Spaced Photoelectric Effect (PEFL) 0 (----) 10
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HNGS Spectroscopy Gamma Ray (HSGR) 0 (GAPI) 100

Calibrated Downhole Force (CDF) (LBF) 3000 0
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HRLT Resistivity 5 (RLA5) 0.2 (OHMM) 2000

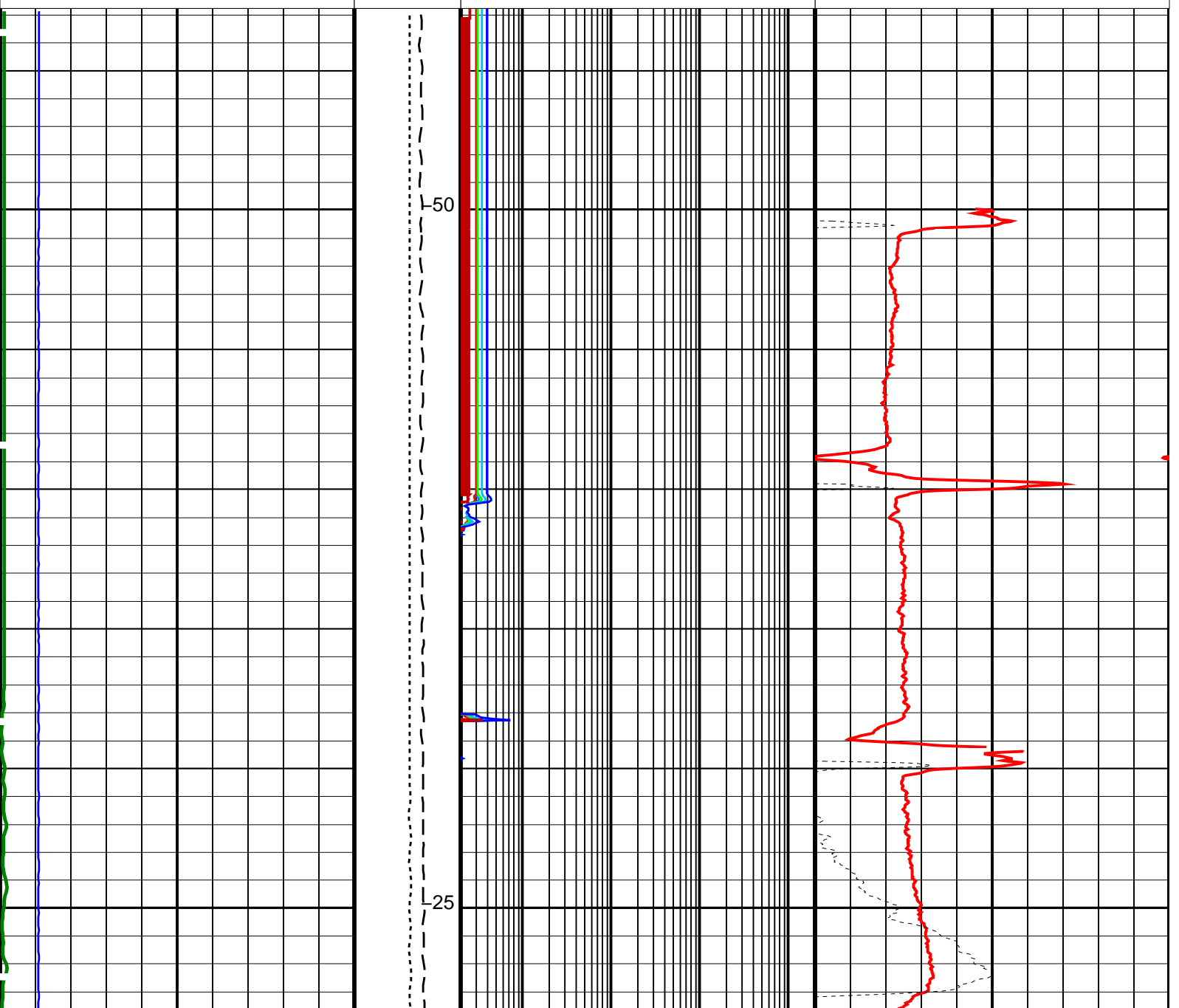
HLDS HR Bulk Density Correction (HBDC) -0.25 (G/C3) 0.25
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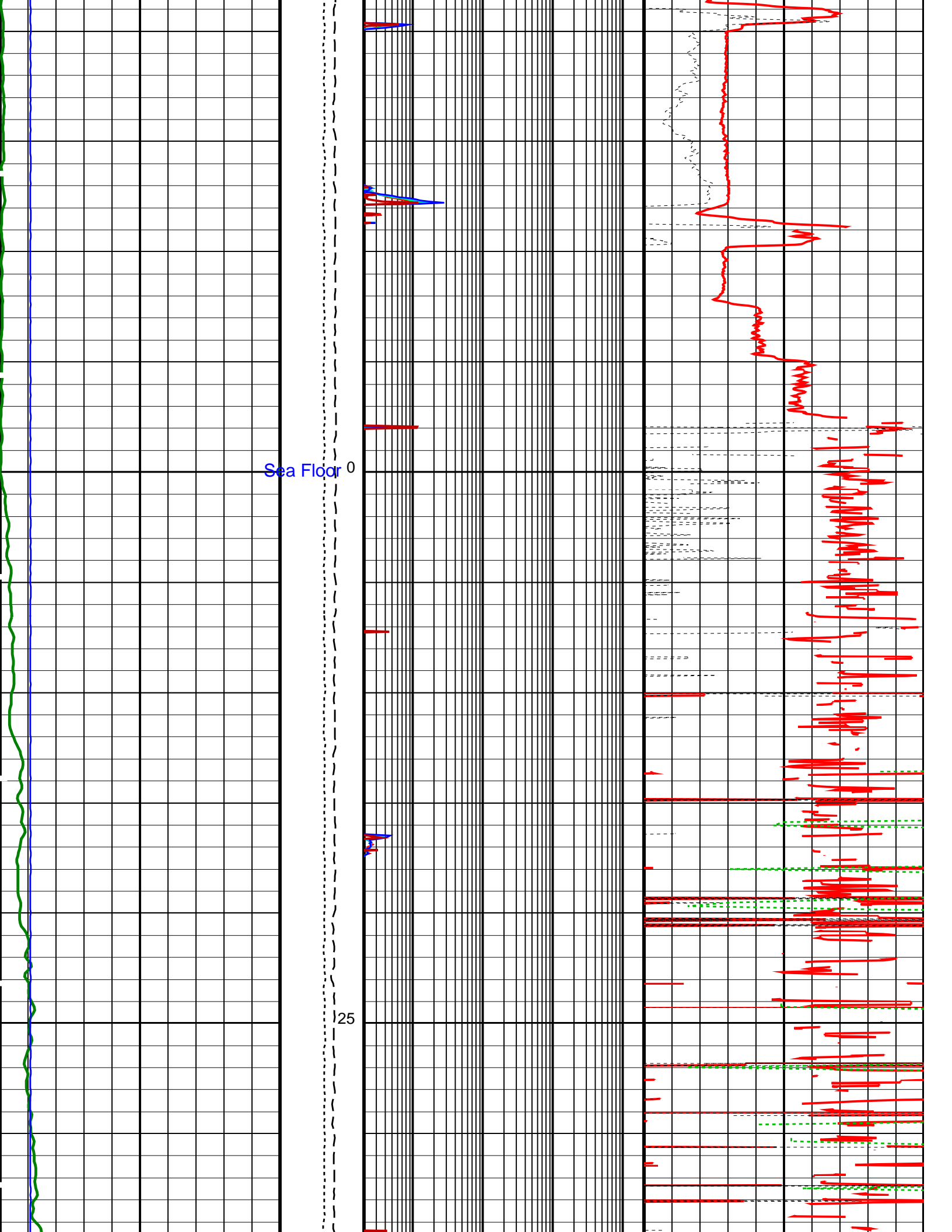
HLDS Caliper (LCAL) 0 (IN) 20

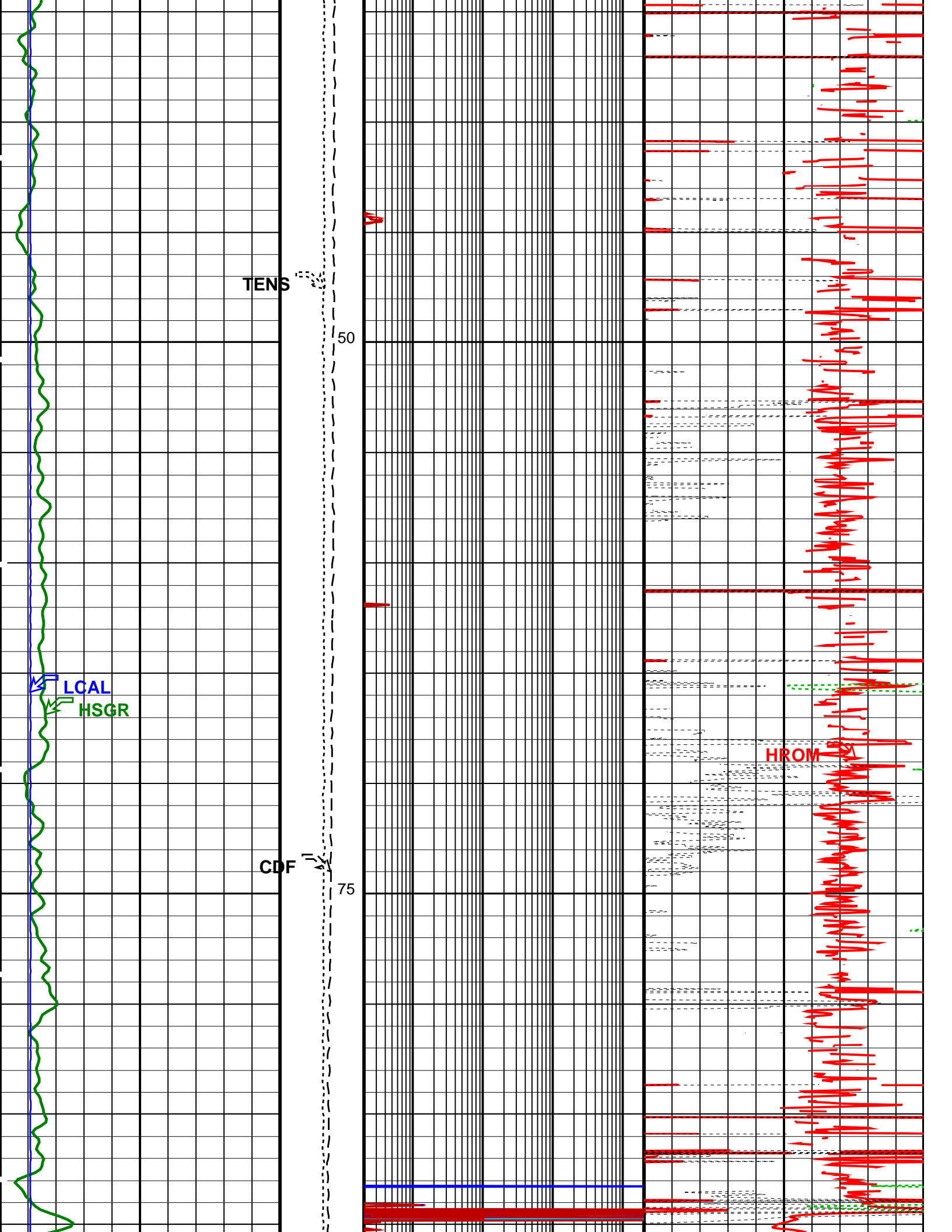
Tension (TENS) (LBF) 10000 0
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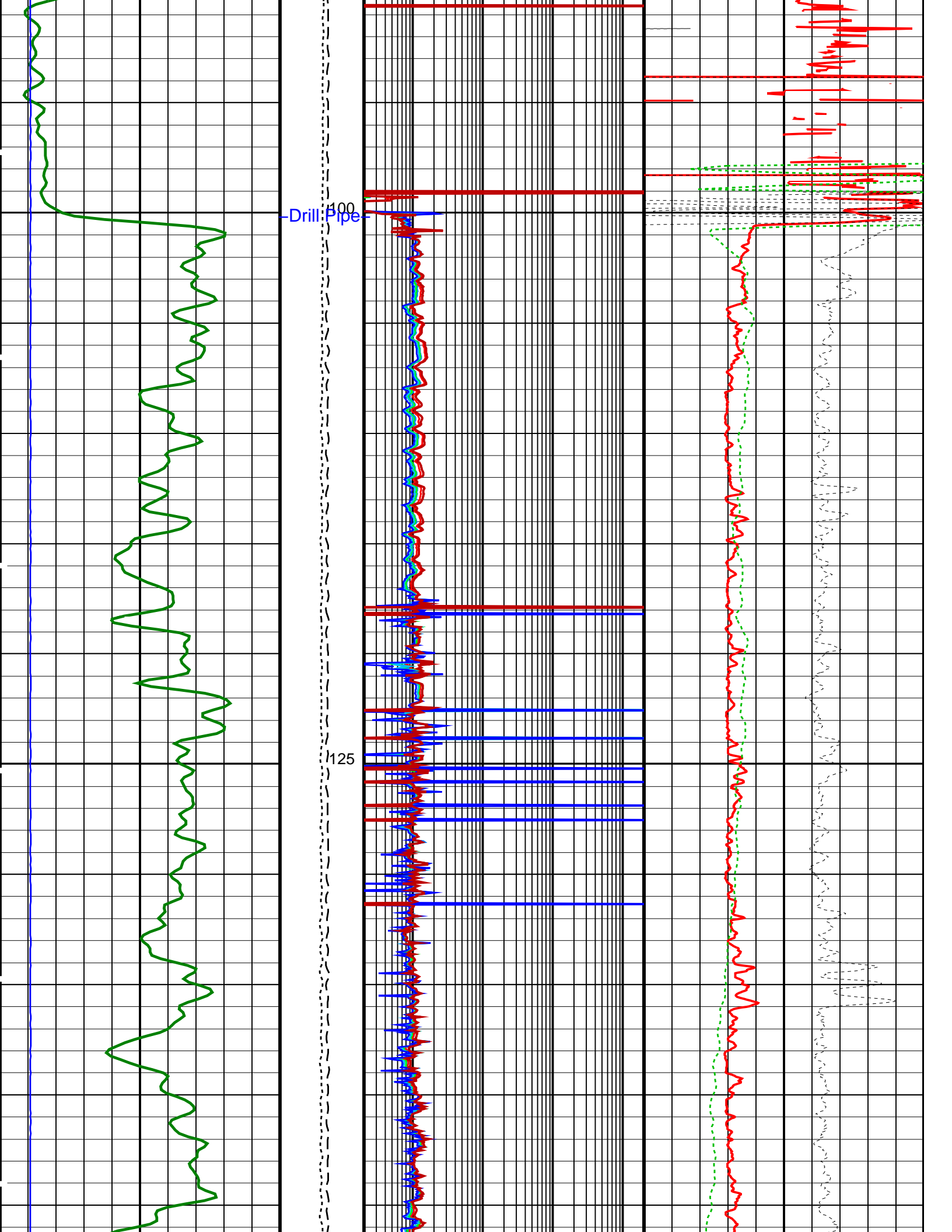
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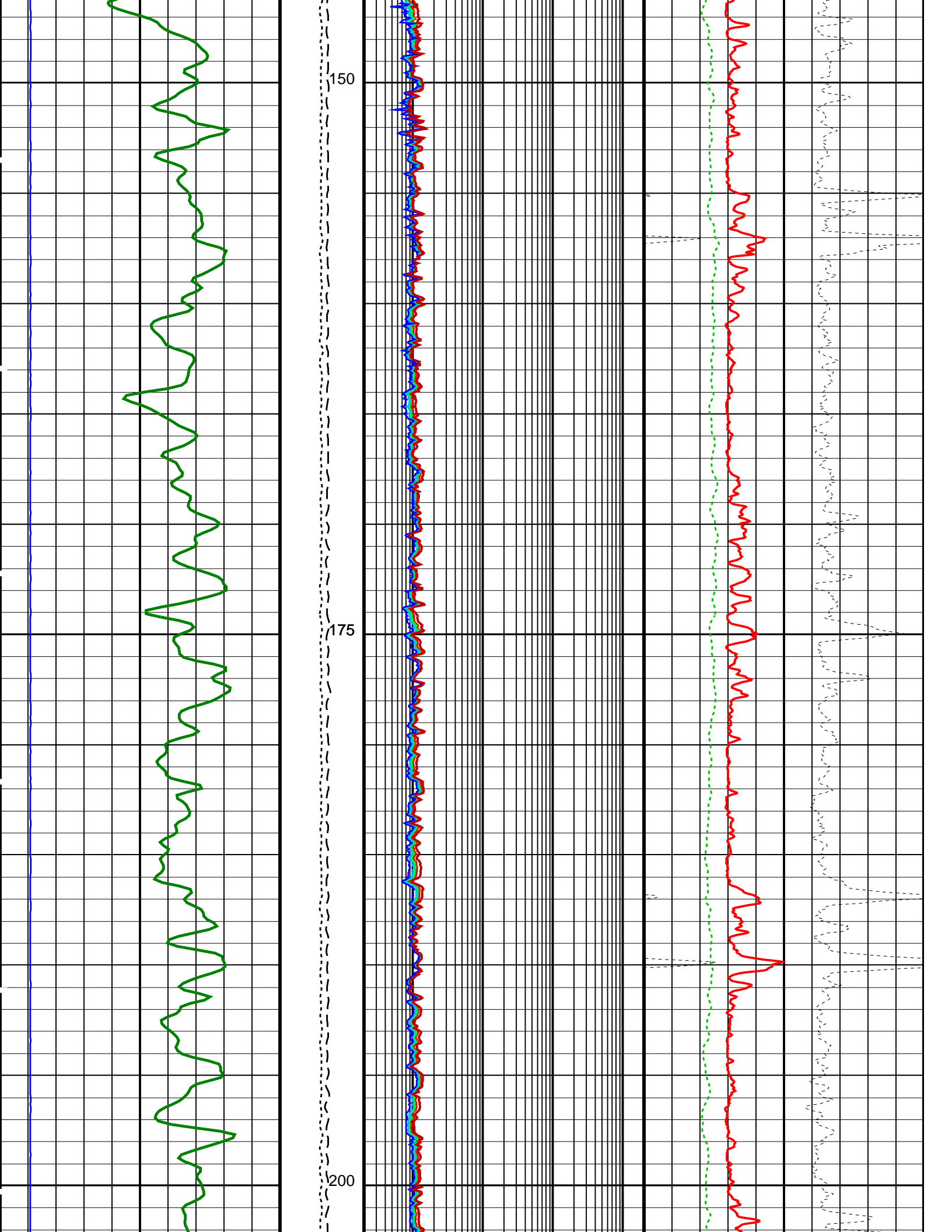
HLDS HR Bulk Density (HROM) 0 (G/C3) 4
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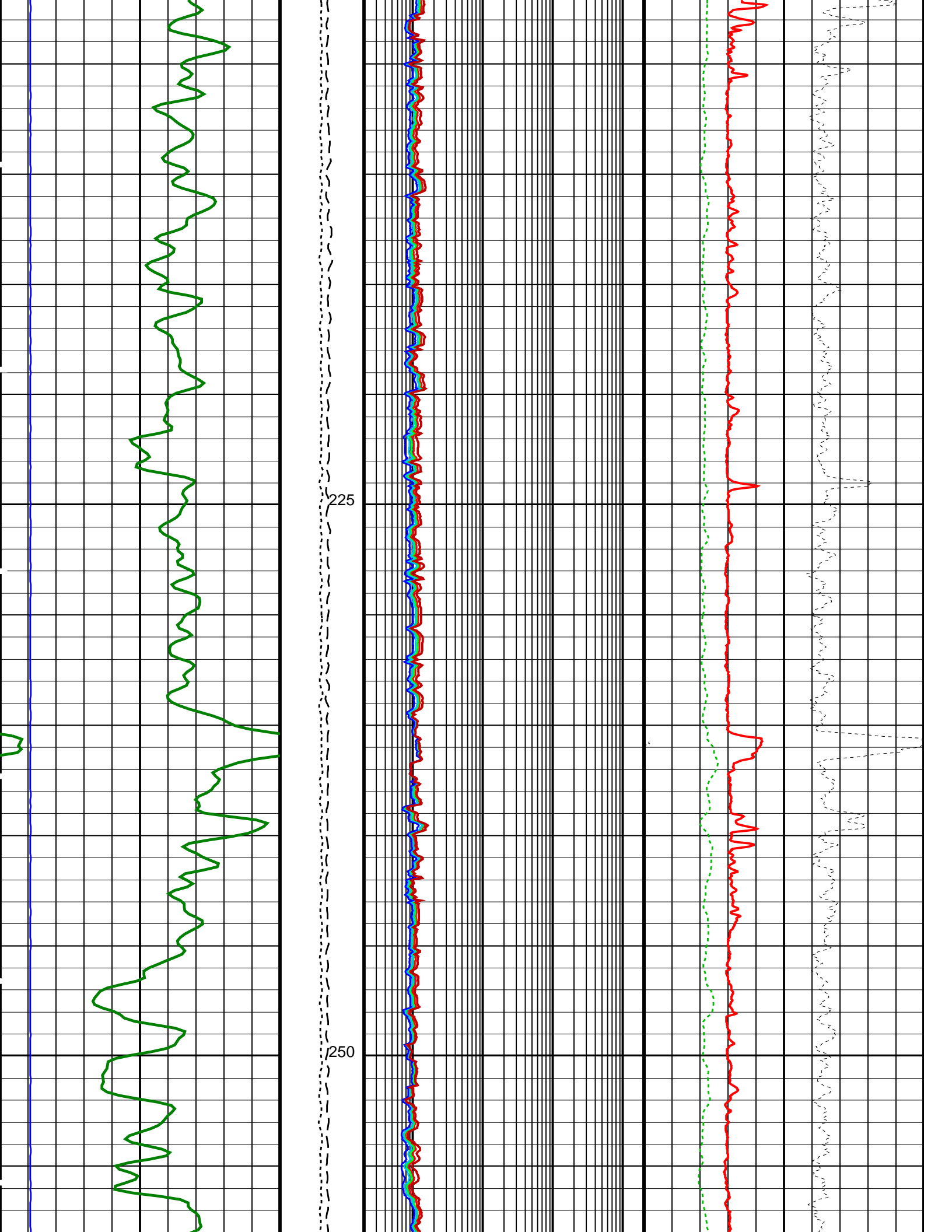


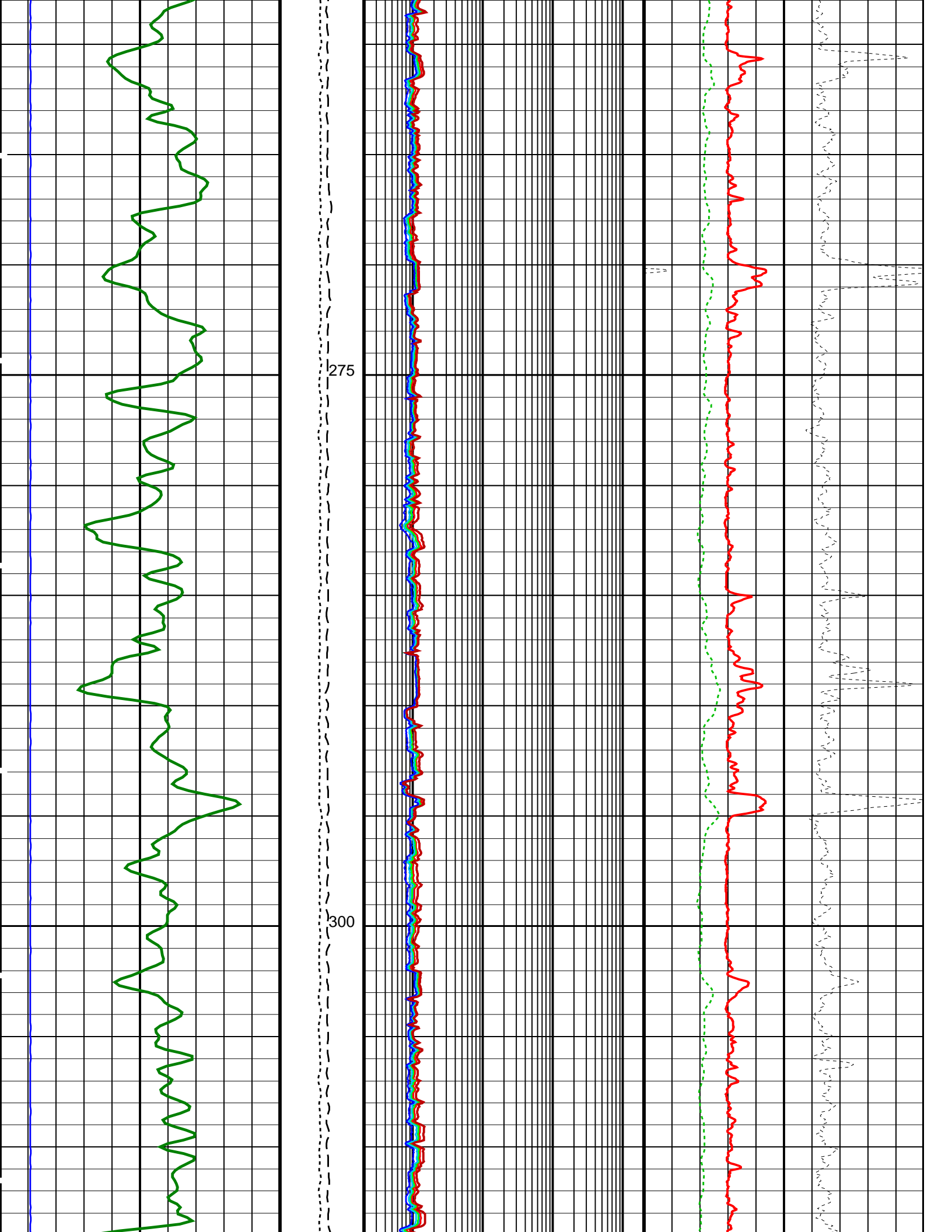


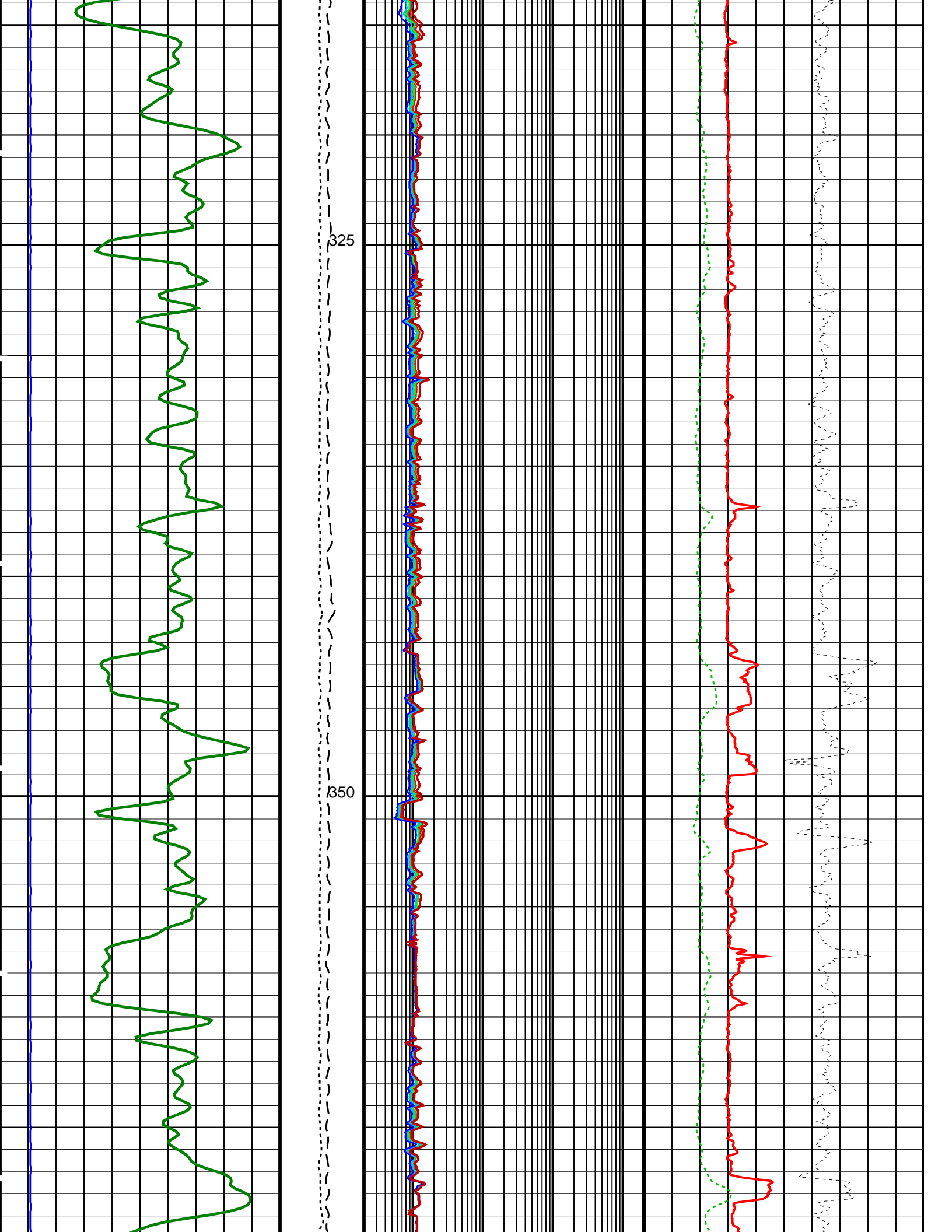


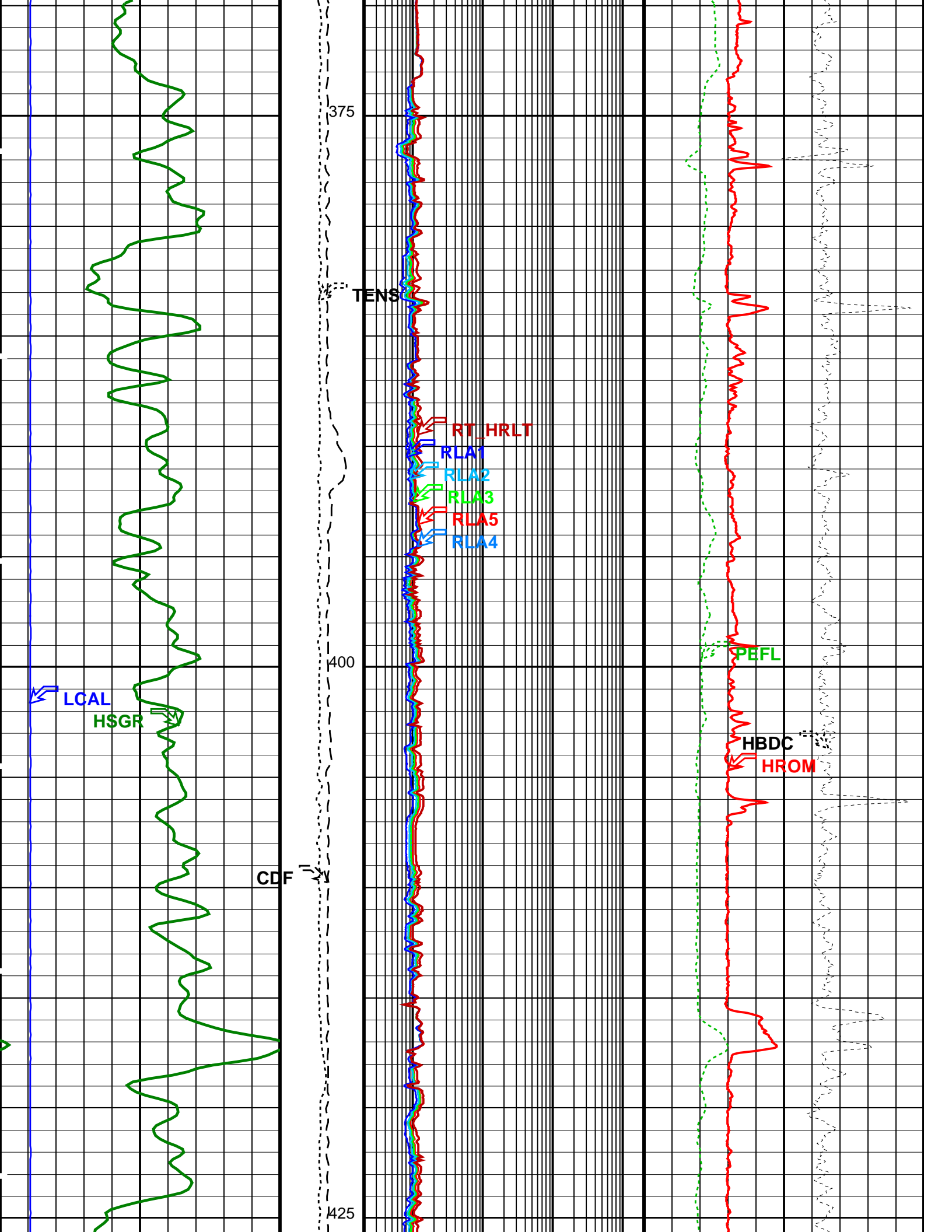


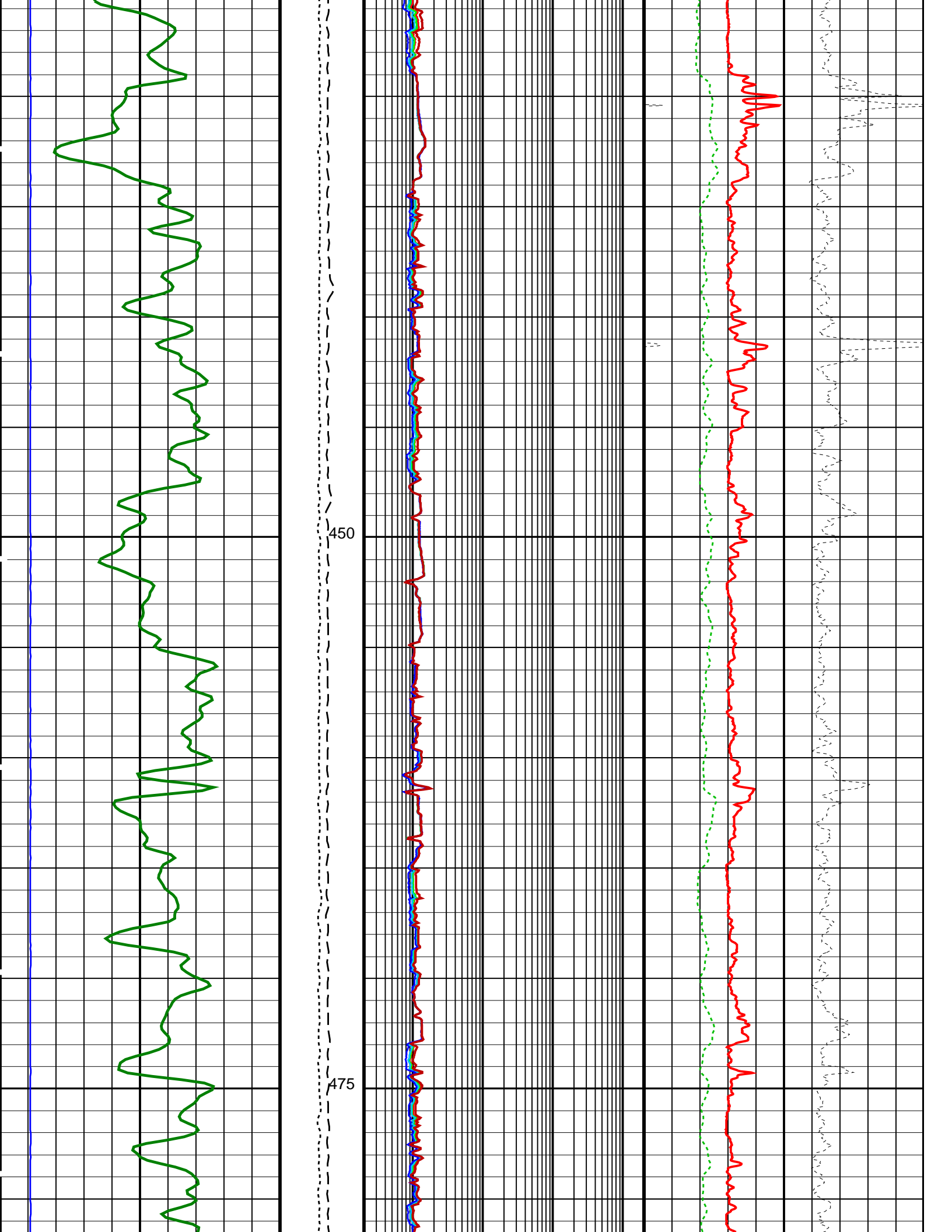


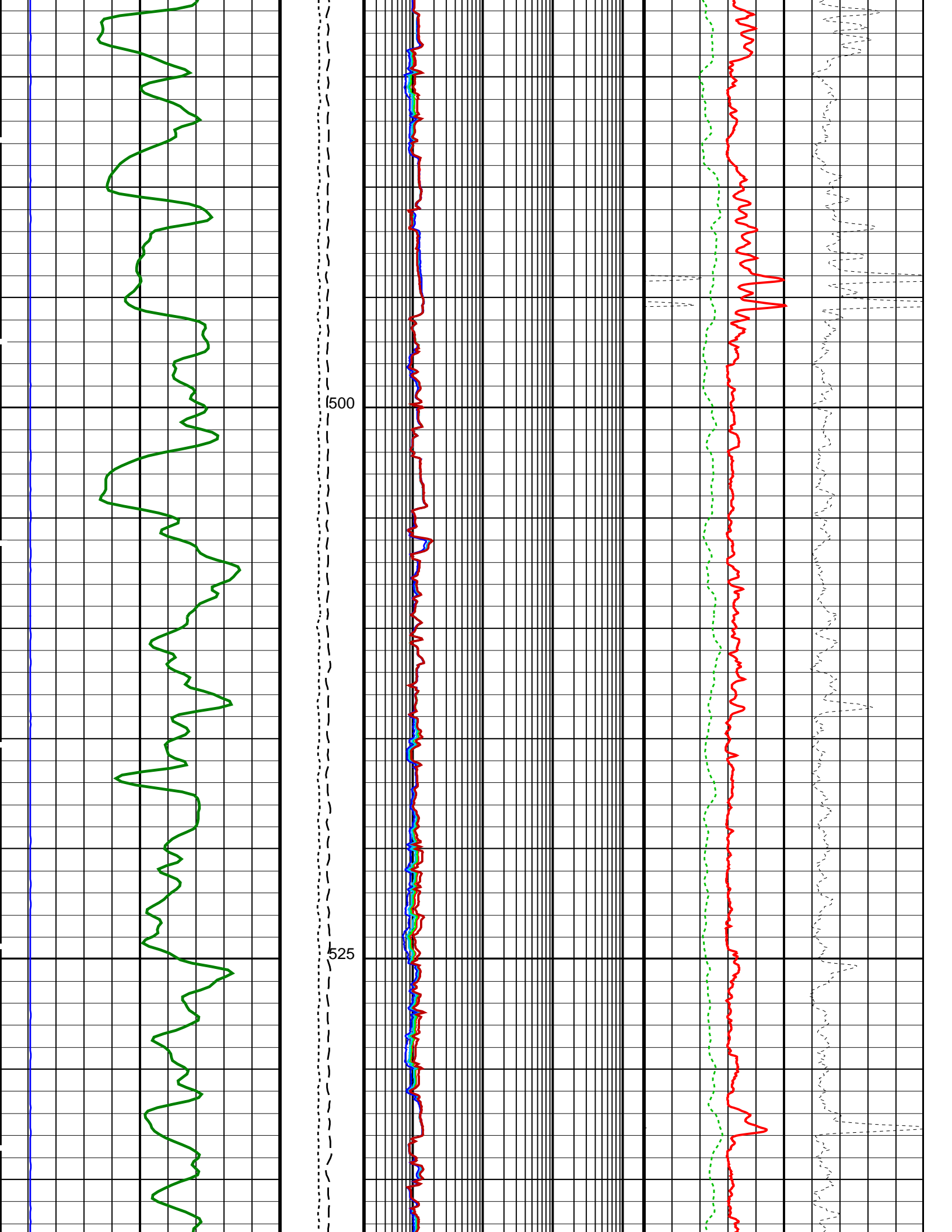


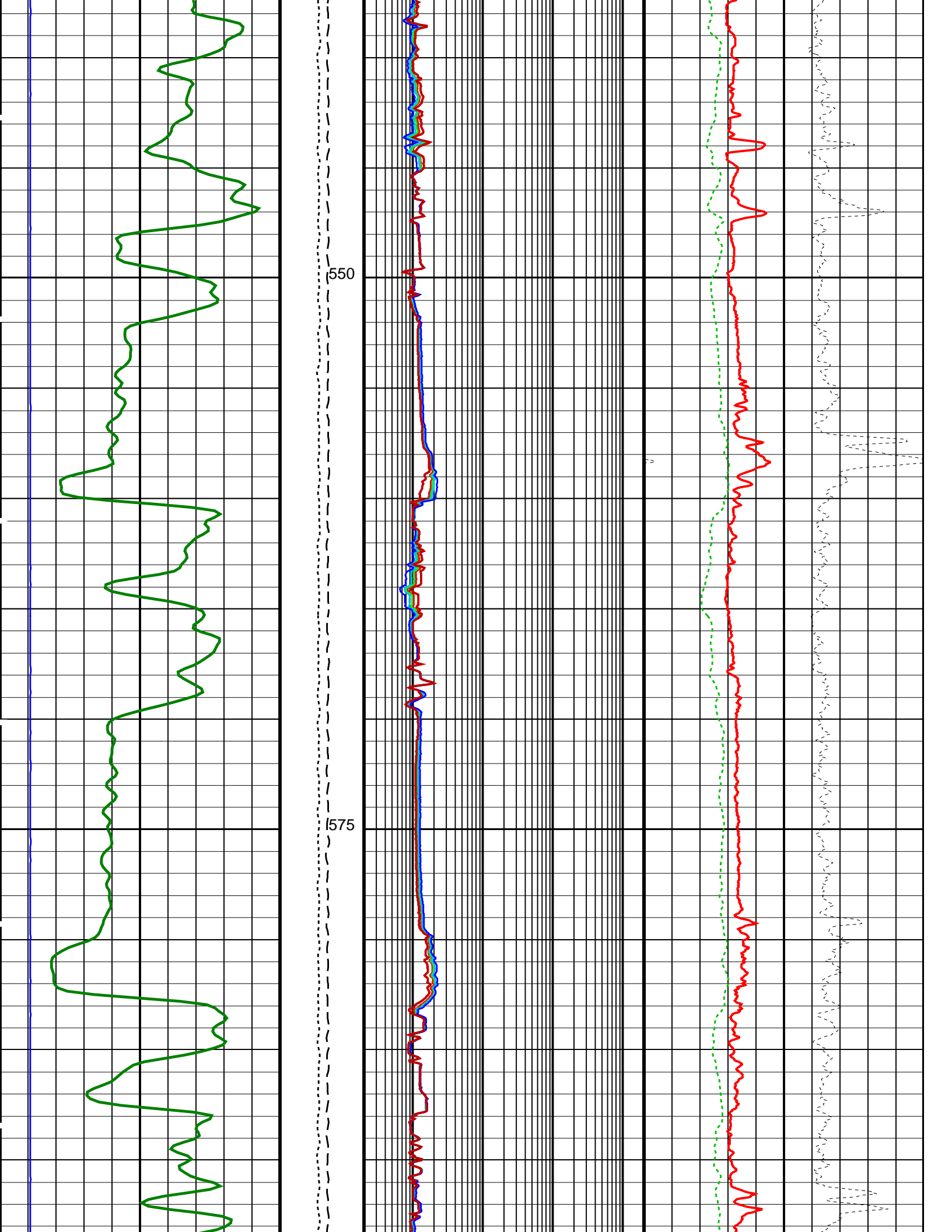


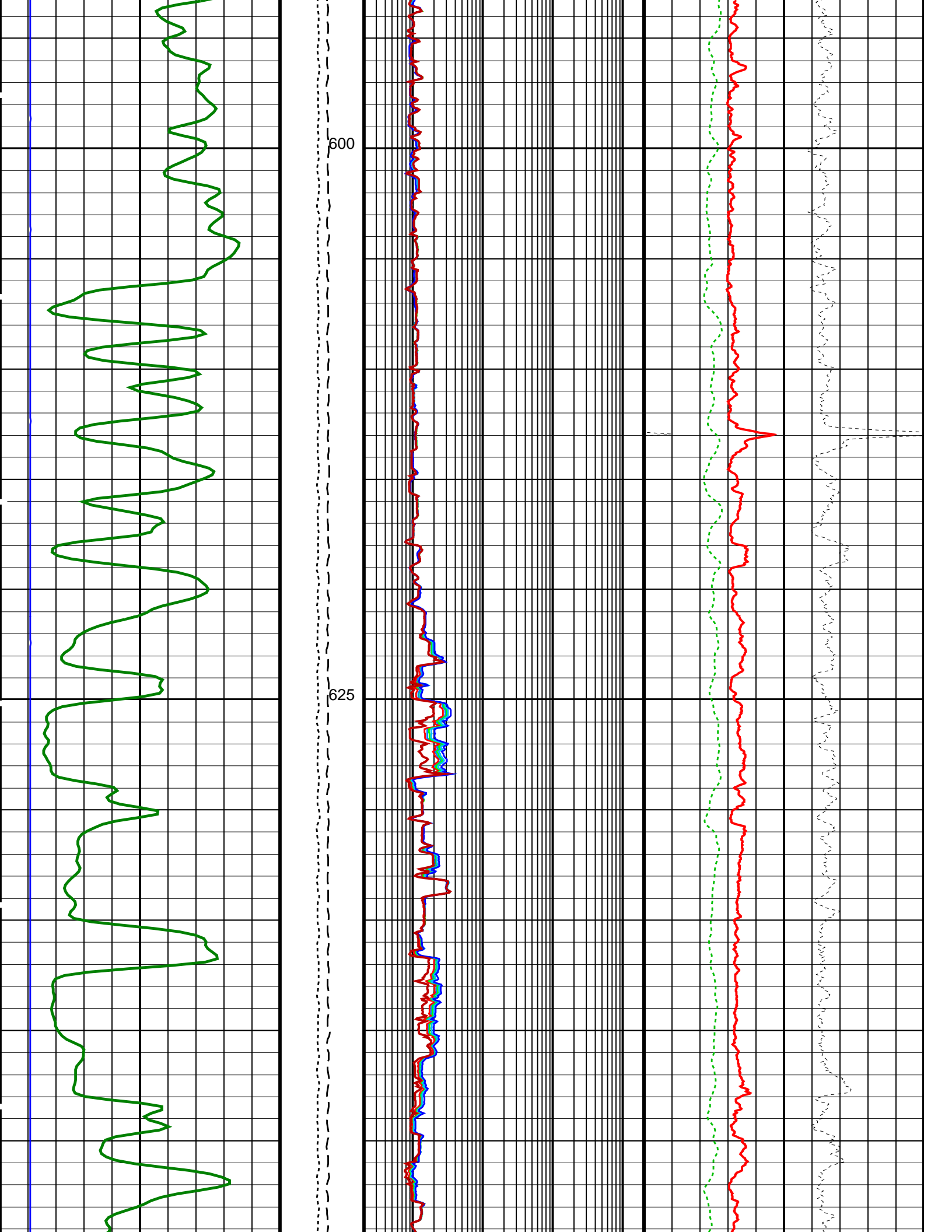


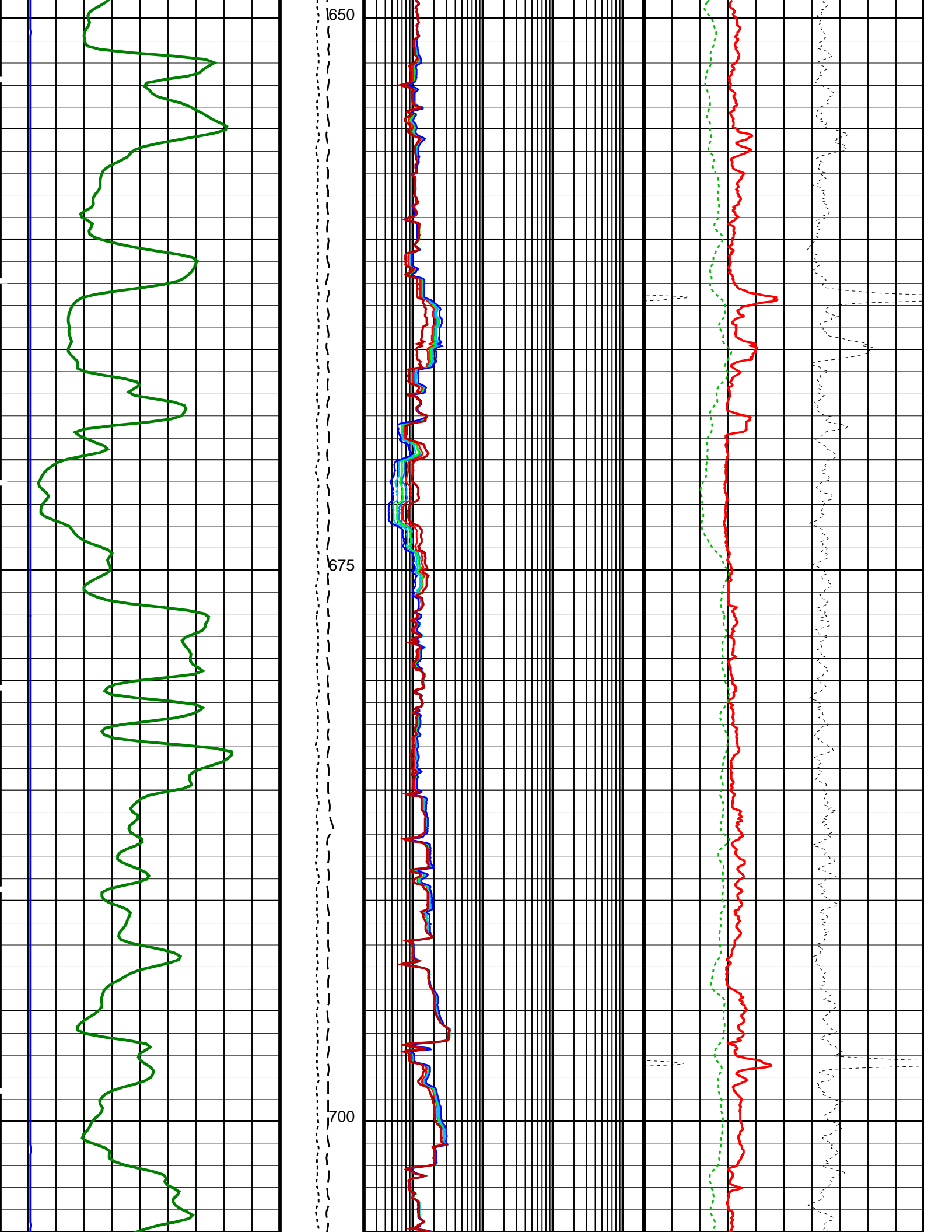


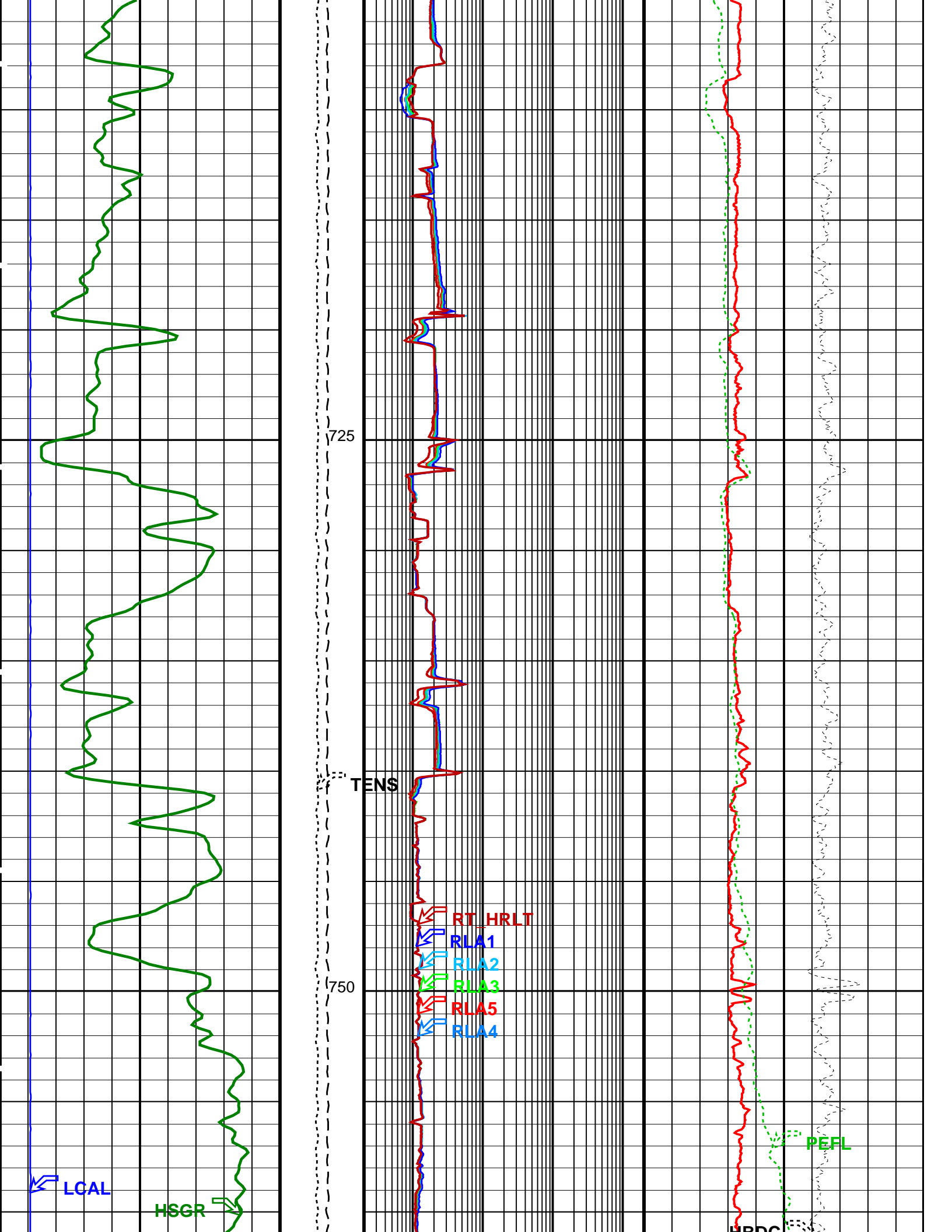


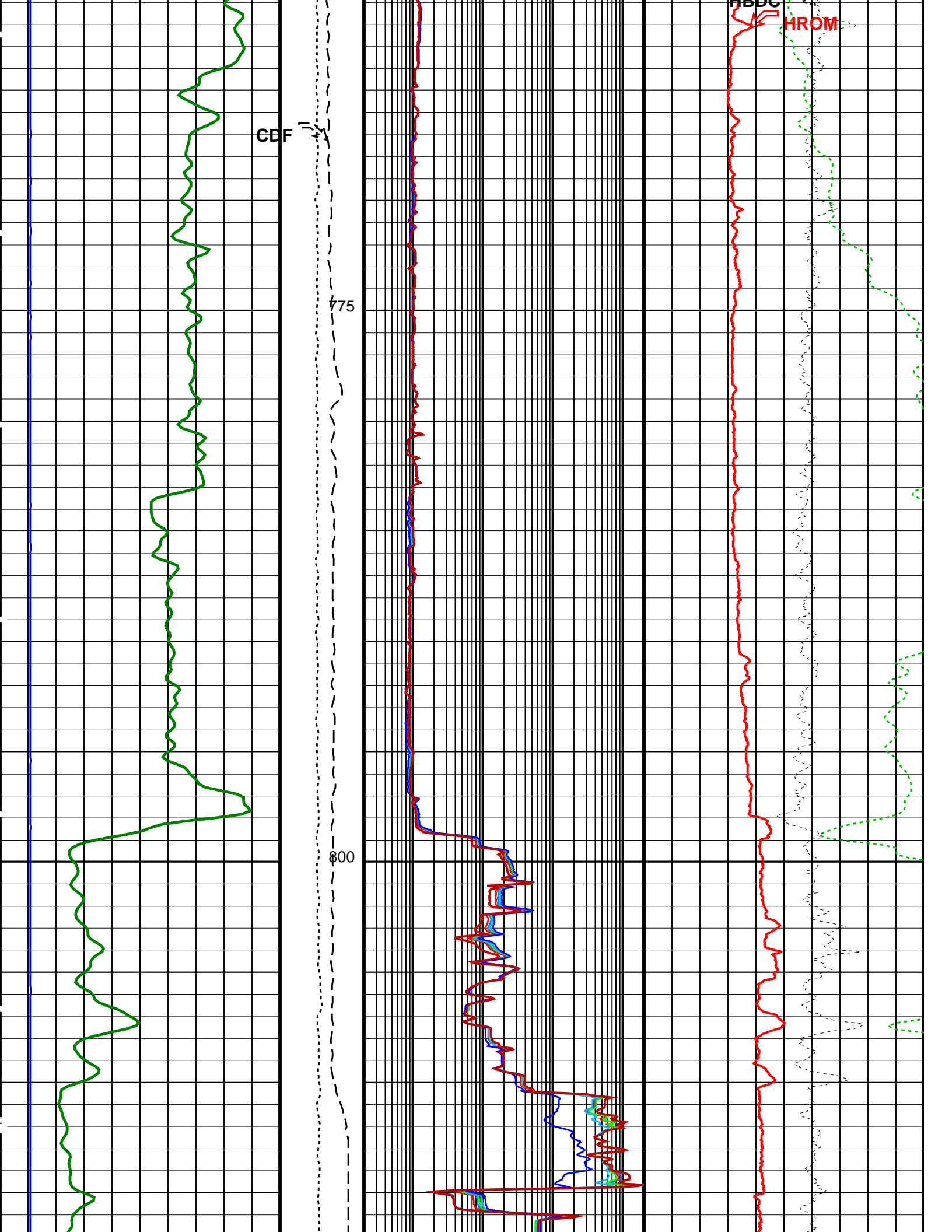


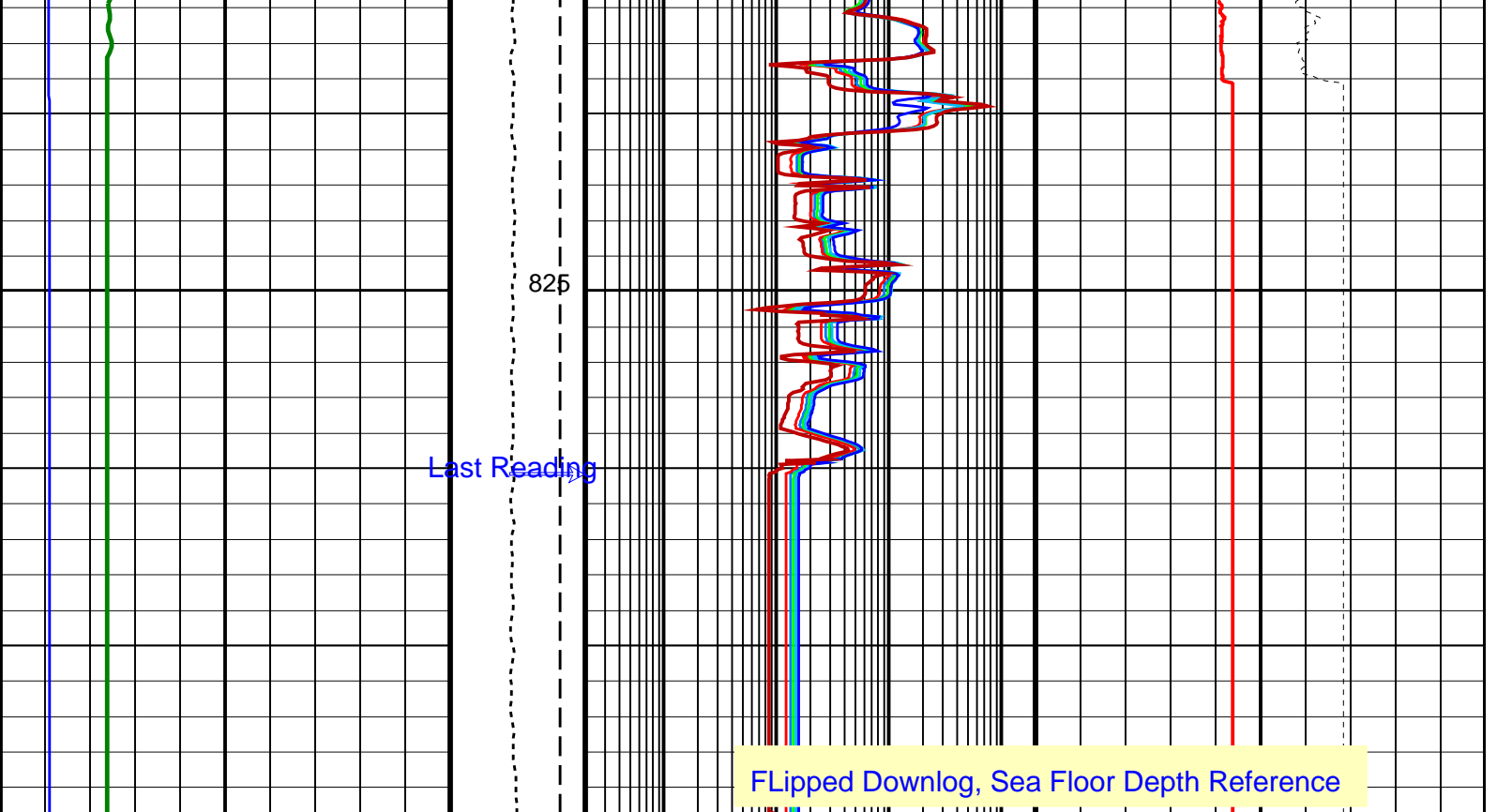












HLDS Caliper (LCAL) (IN)	Tension (TENS) (LBF)	HRLT Resistivity 4 (RLA4) (OHMM)	HLDS HR Bulk Density (HROM) (G/C3)
HNGS Spectroscopy Gamma Ray (HSGR) (GAPI)	Calibrated Downhole Force (CDF) (LBF)	HRLT Resistivity 5 (RLA5) (OHMM)	HLDS HR Bulk Density Correction (HBDC) (G/C3)
		HRLT Resistivity 3 (RLA3) (OHMM)	HLDS Long Spaced Photoelectric Effect (PEFL) (----)
		HRLT Resistivity 2 (RLA2) (OHMM)	
		HRLT Resistivity 1 (RLA1) (OHMM)	
		HRLT True Resistivity (RT_HRLT) (OHMM)	

PIP SUMMARY

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value
	HNGS-BA: Hostile Natural Gamma Ray Sonde	
BAR1	HNGS Detector 1 Barite Constant	1
BAR2	HNGS Detector 2 Barite Constant	1
BHK	HNGS Borehole Potassium Correction Concentration	0
BHS	Borehole Status	OPEN
BHT	Bottom Hole Temperature (used in calculations)	68 DEGC
CSD1	Inner Casing Outer Diameter	0 IN
CSD2	Outer Casing Outer Diameter	0 IN
CSW1	Inner Casing Weight	0 LB/F
CSW2	Outer Casing Weight	0 LB/F
DBCC	HNGS Barite Constant Correction Flag	NONE
GCSE	Generalized Caliper Selection	BS

GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN_9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
H1P	HNGS Detector 1 Allow/Disallow In Processing	ALLOW	
H2P	HNGS Detector 2 Allow/Disallow In Processing	ALLOW	
HABK	HNGS Borehole Potassium Running Average	-0.00292136	
HALF	HNGS Alpha Filter Length	60	IN
HCRB	HNGS Apply Borehole Potassium Correction	NONE	
HMWM	Mud Weighting Material	NATU	
HNPE	HNGS Processing Enable	YES	
ISSBAR	Barite Mud Switch	NOBARITE	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
S1BI	HNGS Detector 1 Calibration Bismuth Count Rate	1.3	CPS
S2BI	HNGS Detector 2 Calibration Bismuth Count Rate	1.3	CPS
SGRC	HNGS Standard Gamma-Ray Correction Flag	YES	
SHT	Surface Hole Temperature	20	DEGC
TPOS	Tool Position	CENT	
VBA1	HNGS Detector 1 Variable Barite Factor Running Average	1.00477	
VBA2	HNGS Detector 2 Variable Barite Factor Running Average	1.0061	
HRLT-B: High Resolution Laterolog Array - B			
BHS	Borehole Status	OPEN	
BHT	Bottom Hole Temperature (used in calculations)	68	DEGC
CALSTAT	HRLTB Calibration Status	SHALLOW_DONE	
CALTEMP	HRLTB Calibration Temperature	9.71505	DEGC
FREQ0	HRLT Frequency Index for Mode 0	32	
FREQ1	HRLT Frequency Index for Mode 1	128	
FREQ2	HRLT Frequency Index for Mode 2	104	
FREQ3	HRLT Frequency Index for Mode 3	86	
FREQ4	HRLT Frequency Index for Mode 4	56	
FREQ5	HRLT Frequency Index for Mode 5	44	
FREQ6	HRLT Frequency Index for Mode 6	116	
GCSE	Generalized Caliper Selection	BS	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN_9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
ISSBAR	Barite Mud Switch	NOBARITE	
KFAC_HRLT	HRLT K Factor Option	SONDE	
LOOPCOEF_S	HRLT Loop Coefficient for Shallow Modes	LOW	
LOOPMOD0	HRLT Mode 0 Loop Mode	OFF	
LOOPMOD1	HRLT Mode 1 Loop Mode	OFF	
LOOPMOD2	HRLT Mode 2 Loop Mode	OFF	
LOOPMOD3	HRLT Mode 3 Loop Mode	OFF	
LOOPMOD4	HRLT Mode 4 Loop Mode	OFF	
LOOPMOD5	HRLT Mode 5 Loop Mode	OFF	
LOOPMOD6	HRLT Mode 6 Loop Mode	OFF	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
PROCVN	Inversion Selection	ON	
PROCMFL	Inversion Micro-Resistivity Selection	NO_EXTERNAL_RXO	
PROCMO	Mechanical Standoff Fin Size	0	IN
PROCRM	Processing Mud Resistivity Select	HRLT_Compute	
PROCSPO	Sonde Position	Centered	
SHT	Surface Hole Temperature	20	DEGC
HLDS: Hostile Litho-Density Sonde			
CLCL	HLDS LS Control Loop Controller Mode	AUTO_DEFAULT	
CLCS	HLDS SS Control Loop Controller Mode	AUTO_DEFAULT	
CLLS	HLDS Mode Loop Long Spacing	AUTO	
CLSS	HLDS Mode Loop Short Spacing	AUTO	
DHC	Density Hole Correction	BS	
DPPM	Density Porosity Processing Mode	HIRS	
FD	Fluid Density	1	G/C3
LATC	HLDS Activation Correction	OFF	
LLDL	HLDS LS Low Level Discriminator DAC	14000	
LLDS	HLDS SS Low Level Discriminator DAC	14000	
LLML	HLDS LS Low Level Discriminator Mode	AUTO	
LLMS	HLDS SS Low Level Discriminator Mode	AUTO	
MDEN	Matrix Density	2.71	G/C3
PHVL	HLDS Long Spacing High Voltage Setting	1000	V
PHVS	HLDS Short Spacing High Voltage Setting	1000	V
PSDL	HLDS LS Pulse Shape Compensation DAC	30000	
PSDS	HLDS SS Pulse Shape Compensation DAC	30000	
PSML	HLDS LS Pulse Shape Compensation Mode	AUTO	
PSMS	HLDS SS Pulse Shape Compensation Mode	AUTO	
EDTC-B: Enhanced DTS Cartridge			
BHFL	Borehole Fluid Type	WATER	
BHS	Borehole Status	OPEN	
BHT	Bottom Hole Temperature (used in calculations)	68	DEGC
BSCO	Borehole Salinity Correction Option	NO	
CCCO	Casing & Cement Thickness Correction Option	NO	
DPPM	Density Porosity Processing Mode	HIRS	
FSAL	Formation Salinity	-50000	PPM
FSCO	Formation Salinity Correction Option	NO	
GCSE	Generalized Caliper Selection	BS	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG

GGRD	Geothermal GRAD	0.018227	DC/M
GRSE	Generalized Mud Resistivity Selection	CHART_GEN 9	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
HSCO	Hole Size Correction Option	YES	
ISSBAR	Barite Mud Switch	NOBARITE	
ISSBAR_EDTC	Nuclear Mud Type	NOBARITE	
MATR	Rock Matrix for Neutron Porosity Corrections	LIMESTONE	
MCCO	Mud Cake Correction Option	NO	
MCOR	Mud Correction	NATU	
MWCO	Mud Weight Correction Option	YES	
PTCO	Pressure/Temperature Correction Option	NO	
SDAT	Standoff Data Source	SOCN	
SHT	Surface Hole Temperature	20	DEGC
SOCN	Standoff Distance	0.5	IN
SOCO	Standoff Correction Option	NO	
TPOS_EDTC	EDTC Tool Centered/Eccentered	Eccentered	
U-ETELM_EDTS	Telemetry Mode for eWAFE	Standard_EDTS	
U-TELM_EDTS	Telemetry Mode for WAFE	Standard_EDTS	
System and Miscellaneous			
ALTDPCHAN	Name of alternate depth channel	SpeedCorrectedDepth	
BS	Bit Size	9.875	IN
BSAL	Borehole Salinity	-50000.00	PPM
CSIZ	Current Casing Size	13.375	IN
CWEI	Casing Weight	168.00	LB/F
DFD	Drilling Fluid Density	1.03	G/C3
DO	Depth Offset for Playback	-4387.0	M
FLEV	Fluid Level	-50000.00	M
MST	Mud Sample Temperature	-50000.00	DEGC
PBVSADP	Use alternate depth channel for playback	NO	
PP	Playback Processing	NORMAL	
RMFS	Resistivity of Mud Filtrate Sample	-50000.0000	OHMM
RW	Resistivity of Connate Water	1.0000	OHMM
TD	Total Depth	5270	M
TDD	Total Depth - Driller	5270.00	M
TDL	Total Depth - Logger	5270.00	M
TWS	Temperature of Connate Water Sample	37.78	DEGC

Format: TripleCombo Vertical Scale: 1:200 Graphics File Created: 18-Mar-2014 13:50

OP System Version: 19C0-187

HNGC-B	19C0-187	HNGS-BA	19C0-187
HRLT-B	19C0-187	HLDS	19C0-187
LDSC-B	19C0-187	EDTC-B	SKK-5169-EDTCB

Input DLIS Files

DEFAULT	NGS_HRLA_LDL_017PUP	FN:22	PRODUCER	18-Mar-2014 13:10	5226.4 M	4329.7 M
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Output DLIS Files

DEFAULT	NGS_HRLA_LDL_021PUP	FN:30	PRODUCER	18-Mar-2014 13:50
BACKUP	NGS_HRLA_LDL_021PUP	FN:31	PRODUCER	18-Mar-2014 13:50

Calibration and Check Summary

Measurement	Nominal	Master	Before	After	Change	Limit	Units
Hostile Natural Gamma Ray Sonde Wellsite Calibration - Detector 1 Check							
Master: 4-Feb-2014 23:51 Before: 5-Feb-2014 0:02 After: 14-Feb-2014 22:49							
Na 511 Peak Loc	40.00	39.52	39.48	39.40	-0.08661	1.000	
Na 511 Peak Res	15.50	15.96	16.77	17.49	0.7250	2.000	%
High Voltage	1150	1194	1193	1178	-14.73	N/A	V
Na 1785 Peak Loc	142.6	142.1	141.8	143.3	1.589	7.000	
Na 1785 Peak Res	8.500	9.703	8.709	9.053	0.3436	2.000	%
Temperature	15.50	35.74	35.71	29.22	-6.490	N/A	DEGC
Na Count Rate	45.00	11.77	12.16	12.00	-0.1618	8.000	CPS

Hostile Natural Gamma Ray Sonde Wellsite Calibration - Detector 2 Check							
Master: 4-Feb-2014 23:51 Before: 5-Feb-2014 0:02 After: 14-Feb-2014 22:49							
Na 511 Peak Loc	40.00	39.56	39.51	39.31	-0.1972	1.000	
Na 511 Peak Res	15.50	16.07	16.56	18.46	1.905	2.000	%
High Voltage	1150	1126	1128	1111	-16.18	N/A	V
Na 1785 Peak Loc	142.6	142.3	143.1	141.7	-1.305	7.000	

Na 1785 Peak Res	8.500	8.953	9.953	9.256	-0.6973	2.000	%
Temperature	15.50	36.60	36.88	30.79	-6.093	N/A	DEGC
Na Count Rate	45.00	12.28	12.68	12.14	-0.5404	8.000	CPS

Hostile Natural Gamma Ray Sonde Wellsite Calibration – Ratio Of Detector 1 To Detector 2

Master: 4-Feb-2014 23:51 Before: 5-Feb-2014 0:02 After: 14-Feb-2014 22:49

Coincidence Count Rate Ratio	1.000	0.9624	0.9606	0.9838	0.02323	0.05000	
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Hostile Natural Gamma Ray Sonde Master Calibration – Detector 1 Calibration

Master: 4-Feb-2014 20:09

Na 511 Peak Set Point	40.00	41.00	--	--	--	--	
Th Peak Loc	209.6	210.4	--	--	--	--	
Th Peak Res	7.000	7.207	--	--	--	--	%
Background Count Rate	142.5	16.20	--	--	--	--	CPS
Gain Ratio	1.000	1.012	--	--	--	--	

Hostile Natural Gamma Ray Sonde Master Calibration – Detector 2 Calibration

Master: 4-Feb-2014 20:09

Na 511 Peak Set Point	40.00	41.00	--	--	--	--	
Th Peak Loc	209.6	208.9	--	--	--	--	
Th Peak Res	7.000	7.337	--	--	--	--	%
Background Count Rate	142.5	16.52	--	--	--	--	CPS
Gain Ratio	1.000	1.004	--	--	--	--	

High Resolution Laterolog Array – B Wellsite Calibration – HRLT M01

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT M0-M1 Voltage Plus – 0	0	N/A	-319.0	-319.3	-0.3503	9.681	UV
HRLT M0-M1 Voltage Plus – 1	0	N/A	-331.8	-335.6	-3.834	9.681	UV
HRLT M0-M1 Voltage Plus – 2	0	N/A	-333.5	-336.0	-2.552	9.681	UV
HRLT M0-M1 Voltage Plus – 3	0	N/A	-337.1	-339.4	-2.229	9.681	UV
HRLT M0-M1 Voltage Plus – 4	0	N/A	-325.8	-327.0	-1.148	9.681	UV
HRLT M0-M1 Voltage Plus – 5	0	N/A	-322.0	-323.0	-0.9915	9.681	UV
HRLT M0-M1 Voltage Plus – 6	0	N/A	321.9	326.3	4.420	9.681	UV
HRLT M0-M1 Voltage Plus – 7	0	N/A	-322.7	-322.7	0	9.681	UV

High Resolution Laterolog Array – B Wellsite Calibration – HRLT M12

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT M1-M2 Voltage Plus – 0	0	N/A	1754	1755	1.182	53.42	UV
HRLT M1-M2 Voltage Plus – 1	0	N/A	1826	1847	21.22	53.42	UV
HRLT M1-M2 Voltage Plus – 2	0	N/A	1829	1843	13.83	53.42	UV
HRLT M1-M2 Voltage Plus – 3	0	N/A	1848	1860	11.55	53.42	UV
HRLT M1-M2 Voltage Plus – 4	0	N/A	1786	1791	5.250	53.42	UV
HRLT M1-M2 Voltage Plus – 5	0	N/A	1766	1770	3.955	53.42	UV
HRLT M1-M2 Voltage Plus – 6	0	N/A	-1779	-1805	-25.27	53.42	UV
HRLT M1-M2 Voltage Plus – 7	0	N/A	1781	1781	0	53.42	UV

High Resolution Laterolog Array – B Wellsite Calibration – HRLT M23

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT M2-M3 Voltage Plus – 0	0	N/A	1739	1741	1.428	53.42	UV
HRLT M2-M3 Voltage Plus – 1	0	N/A	1823	1844	21.04	53.42	UV
HRLT M2-M3 Voltage Plus – 2	0	N/A	1828	1841	13.37	53.42	UV
HRLT M2-M3 Voltage Plus – 3	0	N/A	1851	1862	11.76	53.42	UV
HRLT M2-M3 Voltage Plus – 4	0	N/A	1782	1787	5.438	53.42	UV
HRLT M2-M3 Voltage Plus – 5	0	N/A	1763	1767	4.339	53.42	UV
HRLT M2-M3 Voltage Plus – 6	0	N/A	-1766	-1791	-24.53	53.42	UV
HRLT M2-M3 Voltage Plus – 7	0	N/A	1781	1781	0	53.42	UV

High Resolution Laterolog Array – B Wellsite Calibration – HRLT V34

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT A3-A4 Voltage Plus – 0	0	N/A	68400	68480	77.78	2100	UV
HRLT A3-A4 Voltage Plus – 1	0	N/A	71470	72330	854.0	2100	UV
HRLT A3-A4 Voltage Plus – 2	0	N/A	71970	72500	531.6	2100	UV
HRLT A3-A4 Voltage Plus – 3	0	N/A	73100	73600	501.7	2100	UV
HRLT A3-A4 Voltage Plus – 4	0	N/A	70390	70610	223.9	2100	UV
HRLT A3-A4 Voltage Plus – 5	0	N/A	69620	69810	183.2	2100	UV
HRLT A3-A4 Voltage Plus – 6	0	N/A	-68260	-69230	-969.1	2100	UV
HRLT A3-A4 Voltage Plus – 7	0	N/A	70000	70000	0	2100	UV

High Resolution Laterolog Array – B Wellsite Calibration – HRLT V45

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT A4-A5 Voltage Plus – 0	0	N/A	68680	68760	84.69	2100	UV
HRLT A4-A5 Voltage Plus – 1	0	N/A	71880	72710	833.9	2100	UV
HRLT A4-A5 Voltage Plus – 2	0	N/A	72320	72870	548.8	2100	UV
HRLT A4-A5 Voltage Plus – 3	0	N/A	73440	73950	504.8	2100	UV
HRLT A4-A5 Voltage Plus – 4	0	N/A	70670	70900	225.3	2100	UV
HRLT A4-A5 Voltage Plus – 5	0	N/A	69900	70100	195.5	2100	UV
HRLT A4-A5 Voltage Plus – 6	0	N/A	-68620	-69610	-989.0	2100	UV
HRLT A4-A5 Voltage Plus – 7	0	N/A	70000	70000	0	2100	UV

High Resolution Laterolog Array – B Wellsite Calibration – HRLT V56

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT A5-A6 Voltage Plus – 0	0	N/A	68500	68500	0.000	2100	UV
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HRLT A5-A6 Voltage Plus - 0	0	N/A	68580	68660	86.56	2100	UV
HRLT A5-A6 Voltage Plus - 1	0	N/A	71600	72430	839.4	2100	UV
HRLT A5-A6 Voltage Plus - 2	0	N/A	72090	72630	537.3	2100	UV
HRLT A5-A6 Voltage Plus - 3	0	N/A	73260	73720	461.5	2100	UV
HRLT A5-A6 Voltage Plus - 4	0	N/A	70540	70780	239.3	2100	UV
HRLT A5-A6 Voltage Plus - 5	0	N/A	69780	69980	190.3	2100	UV
HRLT A5-A6 Voltage Plus - 6	0	N/A	-68350	-69310	-958.7	2100	UV
HRLT A5-A6 Voltage Plus - 7	0	N/A	70000	70000	0	2100	UV

High Resolution Laterolog Array - B Wellsite Calibration - HRLT VTP

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT Torpedo-M0 Voltage - 0	0	N/A	-68250	-68330	-79.06	2100	UV
HRLT Torpedo-M0 Voltage - 1	0	N/A	-71920	-72780	-861.5	2100	UV
HRLT Torpedo-M0 Voltage - 2	0	N/A	-72380	-72940	-554.5	2100	UV
HRLT Torpedo-M0 Voltage - 3	0	N/A	-73560	-74040	-484.6	2100	UV
HRLT Torpedo-M0 Voltage - 4	0	N/A	-70740	-70970	-229.8	2100	UV
HRLT Torpedo-M0 Voltage - 5	0	N/A	-69950	-70130	-178.7	2100	UV
HRLT Torpedo-M0 Voltage - 6	0	N/A	68620	69610	982.9	2100	UV
HRLT Torpedo-M0 Voltage - 7	0	N/A	-70000	-70000	0	2100	UV

High Resolution Laterolog Array - B Wellsite Calibration - HRLT VBD

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT Bridle#9-M0 Voltage - 0	0	N/A	-68240	-68320	-79.68	2100	UV
HRLT Bridle#9-M0 Voltage - 1	0	N/A	-71890	-72770	-876.3	2100	UV
HRLT Bridle#9-M0 Voltage - 2	0	N/A	-72350	-72910	-560.8	2100	UV
HRLT Bridle#9-M0 Voltage - 3	0	N/A	-73520	-74020	-492.6	2100	UV
HRLT Bridle#9-M0 Voltage - 4	0	N/A	-70720	-70970	-246.4	2100	UV
HRLT Bridle#9-M0 Voltage - 5	0	N/A	-69950	-70130	-180.5	2100	UV
HRLT Bridle#9-M0 Voltage - 6	0	N/A	68600	69580	985.4	2100	UV
HRLT Bridle#9-M0 Voltage - 7	0	N/A	-70000	-70000	0	2100	UV

High Resolution Laterolog Array - B Wellsite Calibration - HRLT ISO

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT Source Current Plus - 0	0	N/A	284.6	284.9	0.3229	8.520	UA
HRLT Source Current Plus - 1	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 2	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 3	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 4	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 5	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 6	0	N/A	281.1	281.1	0	8.520	UA
HRLT Source Current Plus - 7	0	N/A	281.1	281.1	0	8.520	UA

High Resolution Laterolog Array - B Wellsite Calibration - HRLT MV

Before: 18-Mar-2014 10:09 After: 18-Mar-2014 13:41

HRLT Vertical Voltage PI - 0	0	N/A	-321.6	-321.6	0.01349	9.681	UV
HRLT Vertical Voltage PI - 1	0	N/A	-326.7	-330.2	-3.518	9.681	UV
HRLT Vertical Voltage PI - 2	0	N/A	-327.2	-329.7	-2.427	9.681	UV
HRLT Vertical Voltage PI - 3	0	N/A	-329.1	-331.0	-1.846	9.681	UV
HRLT Vertical Voltage PI - 4	0	N/A	-315.2	-316.0	-0.7322	9.681	UV
HRLT Vertical Voltage PI - 5	0	N/A	-326.5	-327.0	-0.5164	9.681	UV
HRLT Vertical Voltage PI - 6	0	N/A	329.7	334.2	4.464	9.681	UV
HRLT Vertical Voltage PI - 7	0	N/A	-322.7	-322.7	0	9.681	UV

Hostile Litho-Density Sonde Wellsite Calibration - Background Measurement

Master: 18-Jan-2014 7:12 Before: 7-Feb-2014 4:38 After: 18-Mar-2014 15:19

SS Cs Resolution Bkg	9.000	7.743	7.765	7.793	0.02817	1.800	%
LS Cs Resolution Bkg	9.000	8.077	8.064	7.995	-0.06902	1.800	%
LSW1 Background	100.0	83.87	83.87	83.26	-0.6111	3.000	CPS
LSW2 Background	100.0	76.15	75.58	75.50	-0.07910	3.000	CPS
LSW3 Background	200.0	173.7	172.8	169.3	-3.520	6.000	CPS
LSW4 Background	250.0	211.2	209.8	210.5	0.6411	7.500	CPS
LSW5 Background	600.0	497.9	497.1	497.6	0.5074	18.00	CPS
SSW1 Background	100.0	80.53	80.61	81.46	0.8484	3.000	CPS
SSW2 Background	200.0	138.8	140.3	140.2	-0.08379	6.000	CPS
SSW3 Background	500.0	394.3	393.6	390.4	-3.245	15.00	CPS
SSW4 Background	270.0	209.8	210.8	208.7	-2.124	8.100	CPS
SSW5 Background	200.0	149.8	150.6	151.1	0.4661	6.000	CPS

Hostile Litho-Density Sonde Wellsite Calibration - Aluminum Measurement

Master: 18-Jan-2014 8:04

LSW1 Aluminum	600.0	441.7	N/A	N/A	N/A	N/A	CPS
LSW2 Aluminum	900.0	643.8	N/A	N/A	N/A	N/A	CPS
LSW3 Aluminum	1100	765.2	N/A	N/A	N/A	N/A	CPS
LSW4 Aluminum	580.0	389.9	N/A	N/A	N/A	N/A	CPS
LSW5 Aluminum	570.0	349.1	N/A	N/A	N/A	N/A	CPS
SSW1 Aluminum	2800	2085	N/A	N/A	N/A	N/A	CPS
SSW2 Aluminum	8000	5782	N/A	N/A	N/A	N/A	CPS
SSW3 Aluminum	11600	8168	N/A	N/A	N/A	N/A	CPS
SSW4 Aluminum	5000	3220	N/A	N/A	N/A	N/A	CPS
SSW5 Aluminum	660.0	353.1	N/A	N/A	N/A	N/A	CPS

Hostile Litho-Density Sonde Wellsite Calibration - Lithology Measurement

Master: 18-Jan-2014 7:59

LSW1 Iron	400.0	327.2	N/A	N/A	N/A	N/A	CPS
LSW2 Iron	730.0	553.4	N/A	N/A	N/A	N/A	CPS
LSW3 Iron	1000	724.2	N/A	N/A	N/A	N/A	CPS
LSW4 Iron	520.0	374.0	N/A	N/A	N/A	N/A	CPS
LSW5 Iron	470.0	335.9	N/A	N/A	N/A	N/A	CPS
SSW1 Iron	2100	1575	N/A	N/A	N/A	N/A	CPS
SSW2 Iron	6800	4944	N/A	N/A	N/A	N/A	CPS
SSW3 Iron	10800	7631	N/A	N/A	N/A	N/A	CPS
SSW4 Iron	4600	3018	N/A	N/A	N/A	N/A	CPS
SSW5 Iron	580.0	325.4	N/A	N/A	N/A	N/A	CPS

Hostile Litho-Density Sonde Wellsite Calibration – Caliper Calibration

Before: 7-Feb-2014 4:54

HLDS Caliper Small Ring	12.00	N/A	14.61	N/A	N/A	N/A	IN
HLDS Caliper Large Ring	15.19	N/A	18.22	N/A	N/A	N/A	IN

Enhanced DTS Cartridge Wellsite Calibration – EDTC Accelerometer Calibration

Before: 18-Mar-2014 5:14

EDTC Z-Axis Acceleration	9.810	N/A	9.739	N/A	N/A	N/A	M/S2
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Enhanced DTS Cartridge Wellsite Calibration – Detector Calibration

Before: Calibration out of date 4-Feb-2014 5:11

Gamma Ray (Jig – Bkg)	158.1	N/A	158.1	N/A	N/A	14.38	GAPI
Gamma Ray (Calibrated)	164.0	N/A	164.0	N/A	N/A	15.00	GAPI

Hostile Natural Gamma Ray Cartridge – B / Equipment Identification

Primary Equipment:

HNGC Cartridge HNGC – B 300

Auxiliary Equipment:

HNGC Housing HNGH – A 115

Hostile Natural Gamma Ray Sonde / Equipment Identification

Primary Equipment:

HNGS Sonde HNGS – BA 194

Auxiliary Equipment:

HNGS Sonde Housing HNSH – BA 205
Gamma Source Radioactive GSR – U 616008

Hostile Natural Gamma Ray Sonde Wellsite Calibration

Detector 1 Check

Phase	Na 511 Peak Loc	Value	Phase	Na 511 Peak Res %	Value	Phase	High Voltage V	Value
Master		39.52	Master		15.96	Master		1194
Before		39.48	Before		16.77	Before		1193
After		39.40	After		17.49	After		1178
	37.50 (Minimum) 40.00 (Nominal) 43.50 (Maximum)			12.00 (Minimum) 15.50 (Nominal) 19.00 (Maximum)			900.0 (Minimum) 1150 (Nominal) 1600 (Maximum)	
Phase	Na 1785 Peak Loc	Value	Phase	Na 1785 Peak Res %	Value	Phase	Temperature DEGC	Value
Master		142.1	Master		9.703	Master		35.74
Before		141.8	Before		8.709	Before		35.71
After		143.3	After		9.053	After		29.22
	135.0 (Minimum) 142.6 (Nominal) 150.3 (Maximum)			7.000 (Minimum) 8.500 (Nominal) 11.00 (Maximum)			-28.89 (Minimum) 15.50 (Nominal) 60.00 (Maximum)	
Phase	Na Count Rate CPS	Value						
Master		11.77						
Before		12.16						
After		12.00						
	10.00 (Minimum) 45.00 (Nominal) 100.0 (Maximum)							

Master: 4-Feb-2014 23:51

Before: 5-Feb-2014 0:02

After: 14-Feb-2014 22:49

Hostile Natural Gamma Ray Sonde Wellsite Calibration									
Detector 2 Check									
Phase	Na 511 Peak Loc	Value	Phase	Na 511 Peak Res %	Value	Phase	High Voltage V	Value	
Master		39.56	Master		16.07	Master		1126	
Before		39.51	Before		16.56	Before		1128	
After		39.31	After		18.46	After		1111	
	37.50 (Minimum)	40.00 (Nominal)	43.50 (Maximum)	12.00 (Minimum)	15.50 (Nominal)	19.00 (Maximum)	900.0 (Minimum)	1150 (Nominal)	1600 (Maximum)
Phase	Na 1785 Peak Loc	Value	Phase	Na 1785 Peak Res %	Value	Phase	Temperature DEGC	Value	
Master		142.3	Master		8.959	Master		36.60	
Before		143.1	Before		9.953	Before		36.88	
After		141.7	After		9.256	After		30.79	
	135.0 (Minimum)	142.6 (Nominal)	150.3 (Maximum)	7.000 (Minimum)	8.500 (Nominal)	11.00 (Maximum)	-28.89 (Minimum)	15.50 (Nominal)	60.00 (Maximum)
Phase	Na Count Rate CPS	Value							
Master		12.28							
Before		12.68							
After		12.14							
	10.00 (Minimum)	45.00 (Nominal)	100.0 (Maximum)						
Master: 4-Feb-2014 23:51			Before: 5-Feb-2014 0:02			After: 14-Feb-2014 22:49			

Hostile Natural Gamma Ray Sonde Wellsite Calibration			
Ratio Of Detector 1 To Detector 2			
Phase	Coincidence Count Rate Ratio	Value	
Master		0.9624	
Before		0.9606	
After		0.9838	
	0.9500 (Minimum)	1.000 (Nominal)	1.050 (Maximum)
Master: 4-Feb-2014 23:51			
Before: 5-Feb-2014 0:02			
After: 14-Feb-2014 22:49			

Hostile Natural Gamma Ray Sonde Master Calibration									
Detector 1 Calibration									
Phase	Na 511 Peak Set Point	Value	Phase	Th Peak Loc	Value	Phase	Th Peak Res %	Value	
Master		41.00	Master		210.4	Master		7.207	
	38.00 (Minimum)	40.00 (Nominal)	43.00 (Maximum)	201.0 (Minimum)	209.6 (Nominal)	218.3 (Maximum)	5.000 (Minimum)	7.000 (Nominal)	9.000 (Maximum)
Phase	Background Count Rate CPS	Value	Phase	Gain Ratio	Value				
Master		16.20	Master		1.012				
	10.00 (Minimum)	142.5 (Nominal)	265.0 (Maximum)	0.9400 (Minimum)	1.000 (Nominal)	1.060 (Maximum)			
Master: 4-Feb-2014 20:09									

Hostile Natural Gamma Ray Sonde Master Calibration									
Detector 2 Calibration									
Phase	Na 511 Peak Set Point	Value	Phase	Th Peak Loc	Value	Phase	Th Peak Res %	Value	
Master		41.00	Master		208.9	Master		7.337	
	38.00 (Minimum)	40.00 (Nominal)	43.00 (Maximum)	201.0 (Minimum)	209.6 (Nominal)	218.3 (Maximum)	5.000 (Minimum)	7.000 (Nominal)	9.000 (Maximum)
Phase	Background Count Rate CPS	Value	Phase	Gain Ratio	Value				
Master		16.52	Master		1.004				
	10.00 (Minimum)	142.5 (Nominal)	265.0 (Maximum)	0.9400 (Minimum)	1.000 (Nominal)	1.060 (Maximum)			
Master: 4-Feb-2014 20:09									

Primary Equipment:
HRLT Sonde

HRLS - B 768

Auxiliary Equipment:
HRLT lower Housing
HRLT Lower Cartridge
HRLT upper Housing
HRLT Upper Cartridge

HRLH - B 968
HRLC - B 974
HRUH - B 768
HRUC - B 764

High Resolution Laterolog Array - B Wellsite Calibration							
HRLT M01							
Idx	Phase	HRLT M0-M1 Voltage Plus UV	Value	Nominal	Maximum	Minimum	
0	Before		-319.0	-322.7	-280.7	-379.7	
	After		-319.3				
1	Before		-331.8	-322.7	-280.7	-379.7	
	After		-335.6				
2	Before		-333.5	-322.7	-280.7	-379.7	
	After		-336.0				
3	Before		-337.1	-322.7	-280.7	-379.7	
	After		-339.4				
4	Before		-325.8	-322.7	-280.7	-379.7	
	After		-327.0				
5	Before		-322.0	-322.7	-280.7	-379.7	
	After		-323.0				
6	Before		321.9	322.7	379.7	280.7	
	After		326.3				
7	Before		-322.7	-322.7	-280.7	-379.7	
	After		-322.7				
		(Minimum) (Nominal) (Maximum)					
Before: 18-Mar-2014 10:09							
After: 18-Mar-2014 13:41							

High Resolution Laterolog Array - B Wellsite Calibration							
HRLT M12							
Idx	Phase	HRLT M1-M2 Voltage Plus UV	Value	Nominal	Maximum	Minimum	
0	Before		1754	1781	2095	1549	
	After		1755				
1	Before		1826	1781	2095	1549	
	After		1847				
2	Before		1829	1781	2095	1549	
	After		1843				
3	Before		1848	1781	2095	1549	
	After		1860				
4	Before		1786	1781	2095	1549	
	After		1791				
5	Before		1766	1781	2095	1549	
	After		1770				
6	Before		-1779	-1781	-1549	-2095	
	After		-1805				
7	Before		1781	1781	2095	1549	
	After		1781				

















After		1781	1781	2095	1549
	(Minimum) (Nominal) (Maximum)				
Before: 18-Mar-2014 10:09					
After: 18-Mar-2014 13:41					

High Resolution Laterolog Array – B Wellsite Calibration						
HRLT M23						
Idx	Phase	HRLT M2–M3 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		1739	1781	2095	1549
	After		1741			
1	Before		1823	1781	2095	1549
	After		1844			
2	Before		1828	1781	2095	1549
	After		1841			
3	Before		1851	1781	2095	1549
	After		1862			
4	Before		1782	1781	2095	1549
	After		1787			
5	Before		1763	1781	2095	1549
	After		1767			
6	Before		-1766	-1781	-1549	-2095
	After		-1791			
7	Before		1781	1781	2095	1549
	After		1781			
		(Minimum) (Nominal) (Maximum)				
Before: 18-Mar-2014 10:09						
After: 18-Mar-2014 13:41						

High Resolution Laterolog Array – B Wellsite Calibration						
HRLT V34						
Idx	Phase	HRLT A3–A4 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		68400	70000	82360	60900
	After		68480			
1	Before		71470	70000	82360	60900
	After		72330			
2	Before		71970	70000	82360	60900
	After		72500			
3	Before		73100	70000	82360	60900
	After		73600			
4	Before		70390	70000	82360	60900
	After		70610			
5	Before		69620	70000	82360	60900
	After		69810			
6	Before		-68260	-70000	-60900	-82360
	After		-69230			
7	Before		70000	70000	82360	60900
	After		70000			
		(Minimum) (Nominal) (Maximum)				

















Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration						
HRLT V45						
Idx	Phase	HRLT A4–A5 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		68680	70000	82360	60900
	After		68760			
1	Before		71880	70000	82360	60900
	After		72710			
2	Before		72320	70000	82360	60900
	After		72870			
3	Before		73440	70000	82360	60900
	After		73950			
4	Before		70670	70000	82360	60900
	After		70900			
5	Before		69900	70000	82360	60900
	After		70100			
6	Before		-68620	-70000	-60900	-82360
	After		-69610			
7	Before		70000	70000	82360	60900
	After		70000			
		(Minimum) (Nominal) (Maximum)				

Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration						
HRLT V56						
Idx	Phase	HRLT A5–A6 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		68580	70000	82360	60900
	After		68660			
1	Before		71600	70000	82360	60900
	After		72430			
2	Before		72090	70000	82360	60900
	After		72630			
3	Before		73260	70000	82360	60900
	After		73720			
4	Before		70540	70000	82360	60900
	After		70780			
5	Before		69780	70000	82360	60900
	After		69980			
6	Before		-68350	-70000	-60900	-82360
	After		-69310			
7	Before		70000	70000	82360	60900
	After		70000			
		(Minimum) (Nominal) (Maximum)				

Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration

HRLT VTP

Idx	Phase	HRLT Torpedo-M0 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		-68250	-70000	-60900	-82360
	After		-68330			
1	Before		-71920	-70000	-60900	-82360
	After		-72780			
2	Before		-72380	-70000	-60900	-82360
	After		-72940			
3	Before		-73560	-70000	-60900	-82360
	After		-74040			
4	Before		-70740	-70000	-60900	-82360
	After		-70970			
5	Before		-69950	-70000	-60900	-82360
	After		-70130			
6	Before		68620	70000	82360	60900
	After		69610			
7	Before		-70000	-70000	-60900	-82360
	After		-70000			
			(Minimum)	(Nominal)	(Maximum)	

Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration

HRLT VBD

Idx	Phase	HRLT Bridle#9-M0 Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		-68240	-70000	-60900	-82360
	After		-68320			
1	Before		-71890	-70000	-60900	-82360
	After		-72770			
2	Before		-72350	-70000	-60900	-82360
	After		-72910			
3	Before		-73520	-70000	-60900	-82360
	After		-74020			
4	Before		-70720	-70000	-60900	-82360
	After		-70970			
5	Before		-69950	-70000	-60900	-82360
	After		-70130			
6	Before		68600	70000	82360	60900
	After		69580			
7	Before		-70000	-70000	-60900	-82360
	After		-70000			
			(Minimum)	(Nominal)	(Maximum)	

















Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration

















HRLT ISO

Idx	Phase	HRLT Source Current Plus UA	Value	Nominal	Maximum	Minimum
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0	Before		284.6	284.0	334.1	247.0
	After		284.9			
1	Before		281.1	281.1	330.7	244.4
	After		281.1			
2	Before		281.1	281.1	330.7	244.4
	After		281.1			
3	Before		281.1	281.1	330.7	244.4
	After		281.1			
4	Before		281.1	281.1	330.7	244.4
	After		281.1			
5	Before		281.1	281.1	330.7	244.4
	After		281.1			
6	Before		281.1	281.1	330.7	244.4
	After		281.1			
7	Before		281.1	281.1	330.7	244.4
	After		281.1			
			(Minimum)	(Nominal)	(Maximum)	

Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

High Resolution Laterolog Array – B Wellsite Calibration						
HRLT MV						
Idx	Phase	HRLT Vertical Voltage Plus UV	Value	Nominal	Maximum	Minimum
0	Before		-321.6	-322.7	-280.7	-379.7
	After		-321.6			
1	Before		-326.7	-322.7	-280.7	-379.7
	After		-330.2			
2	Before		-327.2	-322.7	-280.7	-379.7
	After		-329.7			
3	Before		-329.1	-322.7	-280.7	-379.7
	After		-331.0			
4	Before		-315.2	-322.7	-280.7	-379.7
	After		-316.0			
5	Before		-326.5	-322.7	-280.7	-379.7
	After		-327.0			
6	Before		329.7	322.7	379.7	280.7
	After		334.2			
7	Before		-322.7	-322.7	-280.7	-379.7
	After		-322.7			
			(Minimum)	(Nominal)	(Maximum)	

Before: 18-Mar-2014 10:09

After: 18-Mar-2014 13:41

Hostile Litho-Density Sonde / Equipment Identification

Primary Equipment:

Hostile Litho Density Sonde
 Hostile Litho Density High Voltage
 Gamma Source Radioactive

HLDS – D 35
 HLDV – D 35
 GSR – 7 8442

Auxiliary Equipment:

Hostile Litho Density Pad
Hostile Litho Density High Voltage Housi

HLDP - C
HEH - H

35
35

Hostile Litho-Density Sonde Wellsite Calibration								
Background Measurement								
Phase	SS Cs Resolution Bkg %	Value	Phase	LS Cs Resolution Bkg %	Value	Phase	LSW1 Background CPS	Value
Master		7.743	Master		8.077	Master		83.87
Before		7.765	Before		8.064	Before		83.87
After		7.793	After		7.995	After		83.26
	7.000 (Minimum) 9.000 (Nominal) 11.000 (Maximum)			7.000 (Minimum) 9.000 (Nominal) 11.000 (Maximum)			55.00 (Minimum) 100.0 (Nominal) 150.0 (Maximum)	
Phase	LSW2 Background CPS	Value	Phase	LSW3 Background CPS	Value	Phase	LSW4 Background CPS	Value
Master		76.15	Master		173.7	Master		211.2
Before		75.58	Before		172.8	Before		209.8
After		75.50	After		169.3	After		210.5
	50.00 (Minimum) 100.0 (Nominal) 140.0 (Maximum)			110.0 (Minimum) 200.0 (Nominal) 290.0 (Maximum)			140.0 (Minimum) 250.0 (Nominal) 360.0 (Maximum)	
Phase	LSW5 Background CPS	Value	Phase	SSW1 Background CPS	Value	Phase	SSW2 Background CPS	Value
Master		497.9	Master		80.53	Master		138.8
Before		497.1	Before		80.61	Before		140.3
After		497.6	After		81.46	After		140.2
	330.0 (Minimum) 600.0 (Nominal) 830.0 (Maximum)			55.00 (Minimum) 100.0 (Nominal) 150.0 (Maximum)			100.0 (Minimum) 200.0 (Nominal) 260.0 (Maximum)	
Phase	SSW3 Background CPS	Value	Phase	SSW4 Background CPS	Value	Phase	SSW5 Background CPS	Value
Master		394.3	Master		209.8	Master		149.8
Before		393.6	Before		210.8	Before		150.6
After		390.4	After		208.7	After		151.1
	280.0 (Minimum) 500.0 (Nominal) 700.0 (Maximum)			150.0 (Minimum) 270.0 (Nominal) 380.0 (Maximum)			110.0 (Minimum) 200.0 (Nominal) 270.0 (Maximum)	
Master: 18-Jan-2014 7:12			Before: 7-Feb-2014 4:38			After: 18-Mar-2014 15:19		

Hostile Litho-Density Sonde Master Calibration								
Detector Background Measurement								
Phase	LSW1 Background CPS	Value	Phase	LSW2 Background CPS	Value	Phase	LSW3 Background CPS	Value
Master		83.87	Master		76.15	Master		173.7
	55.00 (Minimum) 100.0 (Nominal) 150.0 (Maximum)			50.00 (Minimum) 100.0 (Nominal) 140.0 (Maximum)			110.0 (Minimum) 200.0 (Nominal) 290.0 (Maximum)	
Phase	LSW4 Background CPS	Value	Phase	LSW5 Background CPS	Value	Phase	LS Cs Resolution Bkg %	Value
Master		211.2	Master		497.9	Master		8.077
	140.0 (Minimum) 250.0 (Nominal) 360.0 (Maximum)			330.0 (Minimum) 600.0 (Nominal) 830.0 (Maximum)			7.000 (Minimum) 9.000 (Nominal) 11.000 (Maximum)	
Phase	SSW1 Background CPS	Value	Phase	SSW2 Background CPS	Value	Phase	SSW3 Background CPS	Value
Master		80.53	Master		138.8	Master		394.3
	55.00 (Minimum) 100.0 (Nominal) 150.0 (Maximum)			100.0 (Minimum) 200.0 (Nominal) 260.0 (Maximum)			280.0 (Minimum) 500.0 (Nominal) 700.0 (Maximum)	
Phase	SSW4 Background CPS	Value	Phase	SSW5 Background CPS	Value	Phase	SS Cs Resolution Bkg %	Value
Master		209.8	Master		149.8	Master		7.743
	150.0 (Minimum) 270.0 (Nominal) 380.0 (Maximum)			110.0 (Minimum) 200.0 (Nominal) 270.0 (Maximum)			7.000 (Minimum) 9.000 (Nominal) 11.000 (Maximum)	
Master: 18-Jan-2014 7:12								

Hostile Litho-Density Sonde Master Calibration								
Detector Aluminum Measurement (bkgd-subtracted)								
Phase	LSW1 Aluminum CPS	Value	Phase	LSW2 Aluminum CPS	Value	Phase	LSW3 Aluminum CPS	Value
Master		441.7	Master	EXCEEDS LIMIT	643.8	Master	EXCEEDS LIMIT	765.2
	420.0 (Minimum) 600.0 (Nominal) 770.0 (Maximum)			650.0 (Minimum) 900.0 (Nominal) 1150 (Maximum)			800.0 (Minimum) 1100 (Nominal) 1450 (Maximum)	
Phase	LSW4 Aluminum CPS	Value	Phase	LSW5 Aluminum CPS	Value	Phase	SSW1 Aluminum CPS	Value
Master		441.7	Master		441.7	Master		441.7

Master	EXCEEDS LIMIT	389.9	Master	EXCEEDS LIMIT	349.1	Master	EXCEEDS LIMIT	2085			
	410.0 (Minimum)	580.0 (Nominal)	740.0 (Maximum)	410.0 (Minimum)	570.0 (Nominal)	740.0 (Maximum)	2000 (Minimum)	2800 (Nominal)	3200 (Maximum)		
Phase	SSW2 Aluminum CPS		Value	Phase	SSW3 Aluminum CPS		Value	Phase	SSW4 Aluminum CPS		Value
Master	EXCEEDS LIMIT	5782	Master	EXCEEDS LIMIT	8168	Master	EXCEEDS LIMIT	3220			
	5800 (Minimum)	8000 (Nominal)	9300 (Maximum)	8300 (Minimum)	11600 (Nominal)	13500 (Maximum)	3500 (Minimum)	5000 (Nominal)	5800 (Maximum)		
Phase	SSW5 Aluminum CPS		Value								
Master	EXCEEDS LIMIT	353.1									
	430.0 (Minimum)	660.0 (Nominal)	770.0 (Maximum)								

Master: 18-Jan-2014 8:04

Hostile Litho-Density Sonde Master Calibration											
Detector Litholog Measurement (bkgd-subtracted)											
Phase	LSW1 Iron CPS		Value	Phase	LSW2 Iron CPS		Value	Phase	LSW3 Iron CPS		Value
Master			327.2	Master			553.4	Master			724.2
	290.0 (Minimum)	400.0 (Nominal)	560.0 (Maximum)	520.0 (Minimum)	730.0 (Nominal)	950.0 (Maximum)	720.0 (Minimum)	1000 (Nominal)	1350 (Maximum)		
Phase	LSW4 Iron CPS		Value	Phase	LSW5 Iron CPS		Value	Phase	SSW1 Iron CPS		Value
Master			374.0	Master	EXCEEDS LIMIT	335.9	Master			1575	
	370.0 (Minimum)	520.0 (Nominal)	700.0 (Maximum)	340.0 (Minimum)	470.0 (Nominal)	750.0 (Maximum)	1500 (Minimum)	2100 (Nominal)	2400 (Maximum)		
Phase	SSW2 Iron CPS		Value	Phase	SSW3 Iron CPS		Value	Phase	SSW4 Iron CPS		Value
Master			4944	Master	EXCEEDS LIMIT	7631	Master	EXCEEDS LIMIT	3018		
	4900 (Minimum)	6800 (Nominal)	7900 (Maximum)	7800 (Minimum)	10800 (Nominal)	12600 (Maximum)	3300 (Minimum)	4600 (Nominal)	5400 (Maximum)		
Phase	SSW5 Iron CPS		Value								
Master	EXCEEDS LIMIT	325.4									
	420.0 (Minimum)	580.0 (Nominal)	680.0 (Maximum)								

Master: 18-Jan-2014 7:59

Hostile Litho-Density Sonde Master Calibration											
Quality Ratios											
Phase	AL CALIBRATION RATIO 1		Value	Phase	AL CALIBRATION RATIO 2		Value	Phase	AL CALIBRATION RATIO 3		Value
Master			1.035	Master			2.286	Master			0.5977
	0.9000 (Minimum)	1.000 (Nominal)	1.100 (Maximum)	1.900 (Minimum)	2.100 (Nominal)	2.300 (Maximum)	0.4500 (Minimum)	0.5500 (Nominal)	0.6500 (Maximum)		
Phase	AL CALIBRATION RATIO 4		Value	Phase	Pad-Wear SS Ratio		Value	Phase	Pad-Wear LS Ratio		Value
Master			0.5836	Master			0.9943	Master			0.9832
	0.4000 (Minimum)	0.5500 (Nominal)	0.6500 (Maximum)	0.9800 (Minimum)	0.9880 (Nominal)	0.9960 (Maximum)	0.9800 (Minimum)	0.9880 (Nominal)	0.9960 (Maximum)		
Phase	Pad-Position SS Ratio		Value	Phase	Pad-Position LS Ratio		Value				
Master			1.005	Master			0.9911				
	0.9900 (Minimum)	0.9940 (Nominal)	1.015 (Maximum)	0.9850 (Minimum)	0.9940 (Nominal)	1.010 (Maximum)					


Master: 18-Jan-2014 7:54

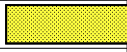


Litho-Density Spectroscopy Cartridge - B / Equipment Identification

Primary Equipment:		
LDSC Cartridge	LDSC - B	326
Auxiliary Equipment:		
LDSC Housing	LDSC - A	303

Enhanced DTS Cartridge / Equipment Identification

Primary Equipment:		
EDTC Gamma Ray Detector	EDTG - A/B	8305
Enhanced DTS Cartridge	EDTC - B	8317
Auxiliary Equipment:		
EDTC Housing	EDTH - B	8303

Enhanced DTS Cartridge Wellsite Calibration		
EDTC Accelerometer Calibration		
Phase	EDTC Z-Axis Acceleration M/S2	Value
Before		9.739
	9.610 (Minimum) 9.810 (Nominal) 10.01 (Maximum)	
Before: 18-Mar-2014 5:14		

Enhanced DTS Cartridge Wellsite Calibration									
Detector Calibration									
Phase	Gamma Ray Background GAPI	Value	Phase	Gamma Ray (Jig - Bkg) GAPI	Value	Phase	Gamma Ray (Calibrated) GAPI	Value	
Before		6.615	Before		158.1	Before		164.0	
	0 (Minimum) 30.00 (Nominal) 120.0 (Maximum)			143.8 (Minimum) 158.1 (Nominal) 172.5 (Maximum)			149.0 (Minimum) 164.0 (Nominal) 179.0 (Maximum)		
Before: Calibration out of date 4-Feb-2014 5:11									

Company: **Lamont Doherty Earth Observatory**

Schlumberger

Well: **Expedition 349, Site U1433B**

Field: **South China Sea Tectonics**

Rig: **JOIDES Resolution**

Ocean: **South China Sea**

High Resolution Laterolog Array (HRLA)

Hostile Litho Density Sonde (HLDS)

Natural Gamma Ray