HALLIBURTON

BOREHOLE SONIC ARRAY LOG

COMPANY **CMX, INC**

WELL **BLACK WIDOW OWWO 1-29**

FIELD/BLOCK **HARDING**

COUNTY **PRATT** STATE **KANSAS**

API No. 15-151-20320-00

Location NW NW SW
2310' FSL & 330' FWL

Other Services:
GTET
DSNT
SDLT
BSAT
ACRT

Sect. 29 Twp. 29S Rge. 11W

Permanent Datum	GL	Elev. 1861.0 ft	Elev.: K.B. 1870.0 ft
Log measured from	KB	9.0 ft above perm. Datum	D.F. 1870.0 ft
Drilling measured from	KB		G.L. 1861.0 ft

Date		19-Oct-17					
Run No.		ONE					
Depth - Driller		4748.0 ft					
Depth - Logger		4738.0 ft					
Bottom - Logged Interval		4730.0 ft					
Top - Logged Interval		353.0 ft					
Casing - Driller		8.625 in	@ 350.0 ft	@		@	
Casing - Logger		353.0 ft					
Bit Size		7.875 in		@		@	
Type Fluid in Hole		Water Based Mud					
Density	Viscosity	8.5 ppg	66.00 s/qt				
PH	Fluid Loss	9.50 pH	1.5 cptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		0.55 ohmm	@ 75.00 degF	@		@	
Rmf @ Meas. Temperature		0.63 ohmm	@ 75.00 degF	@		@	
Rmc @ Meas. Temperature		0.47 ohmm	@ 75.00 degF	@		@	
Source Rmf	Rmc	MEAS	MEAS				
Rm @ BHT		0.21 ohmm	@ 120.0 degF	@		@	
Time Since Circulation		03:37 hr					
Time on Bottom		19-Oct-17 00:37					
Max. Rec. Temperature		120.00 degF	@ 4736.0 ft	@		@	
Equipment	Location	12156883	EL RENO, OK				
Recorded By		MICHAEL RICHTER					
Witnessed By		LEAH KASTEN					

Fold here

Service Ticket No.: 904369081 API No.: 15-151-20320-00 PGM Version: WL INSITE R5.0.5 (Build 8)

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE

RESISTIVITY SCALE CHANGES

	Sample No.				Type Log	Depth	Scale Up Hole	Scale Down Hole
Date								
Depth-Driller								
Type Fluid in Hole								
Density	Viscosity							
Ph	Fluid Loss							

RESISTIVITY EQUIPMENT DATA

	Run No.	Tool Type & No.	Pad Type	Tool Pos.	Other
Source of Sample					
Rm @ Meas. Temp	@	@			
Rmf @ Meas. Temp.	@	ACRT	NONE	CENT	N/A
Rmc @ Meas. Temp.	@	I-11055059			
Source Rmf	Rmc	S-11038385			
Rm @ BHT	@				
Rmf @ BHT	@				
Rmc @ BHT	@				

EQUIPMENT DATA

GAMMA		ACOUSTIC		DENSITY		NEUTRON	
Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	11021139	Serial No.	10939049	Serial No.	10865881	Serial No.	11019641
Model No.	GTET	Model No.	BSAT	Model No.	SDLT	Model No.	DSNT
Diameter	3.625"	No. of Cent.	2	Diameter	6.0"	Diameter	3.625"
Detector Model No.	GTET	Spacing	0.5"	Log Type	GAM-GAM	Log Type	NEU-NEU
Type	SCINT			Source Type	Cs-137	Source Type	Am241Be
Length	8"	LSA [Y/N]		Serial No.	5155GW	Serial No.	DSN-436
Distance to Source	N/A	FWDA [Y/N]		Strength	1.5 Ci	Strength	15 Ci

LOGGING DATA

GENERAL				GAMMA		ACOUSTIC		DENSITY		NEUTRON	
Run No.	Depth From	Depth To	Speed ft/min	Scale L	Scale R	Scale L	Scale R	Matrix	Scale L	Scale R	Matrix
ONE	TD	CSG	RED	0	150	30	-10	47.6 us/ft	30	-10	2.71 g/cc	30	-10	LIME

DIRECTIONAL INFORMATION

Maximum Deviation @	KOP @

CLIENT REPORTED VERTICAL WELL

Remarks: GTET-DSNT-SDLT RUN IN COMBINTION

GTET-BSAT-ACRT RUN IN COMBINATION

ANNULAR HOLE VOLUME CALCULATED FOR 5.5 INCH CASING

DETAILED SECTION LOGGED UP TO 1.950 FT AS PER CLIENT REQUEST

CHLORDES REPORTED AT 8500 PPM

NO POST-CALS COMPLETED AS PER CLIENT REQUEST

RIG: DUKE DRILLING RIG #4

CREW: K. FITZPATRICK, R. BLANKENSHIP

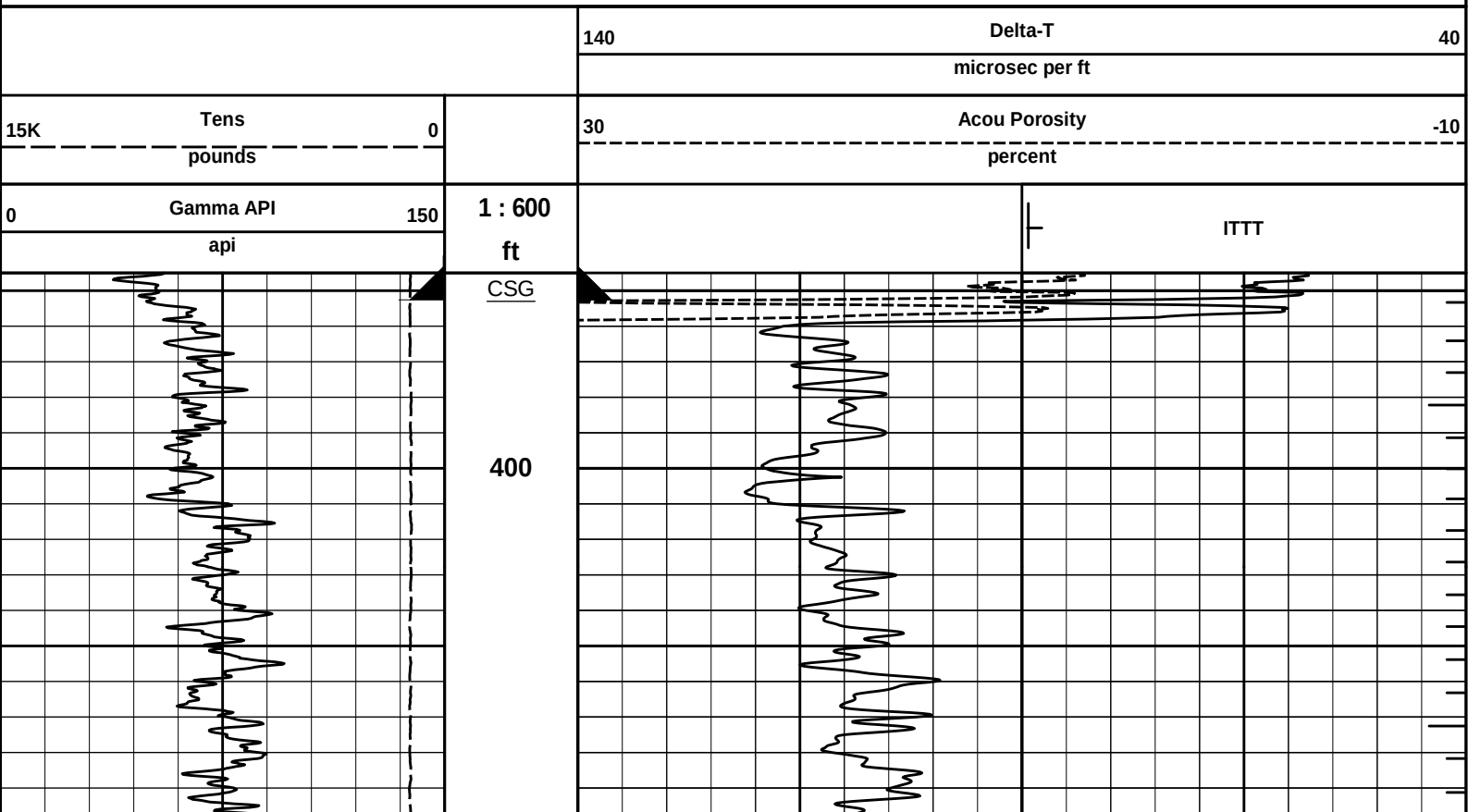
THANK YOU FOR CHOOSING HALLIBURTON ENERGY SERVICES -- EL RENO, OK -- 405.298.9685

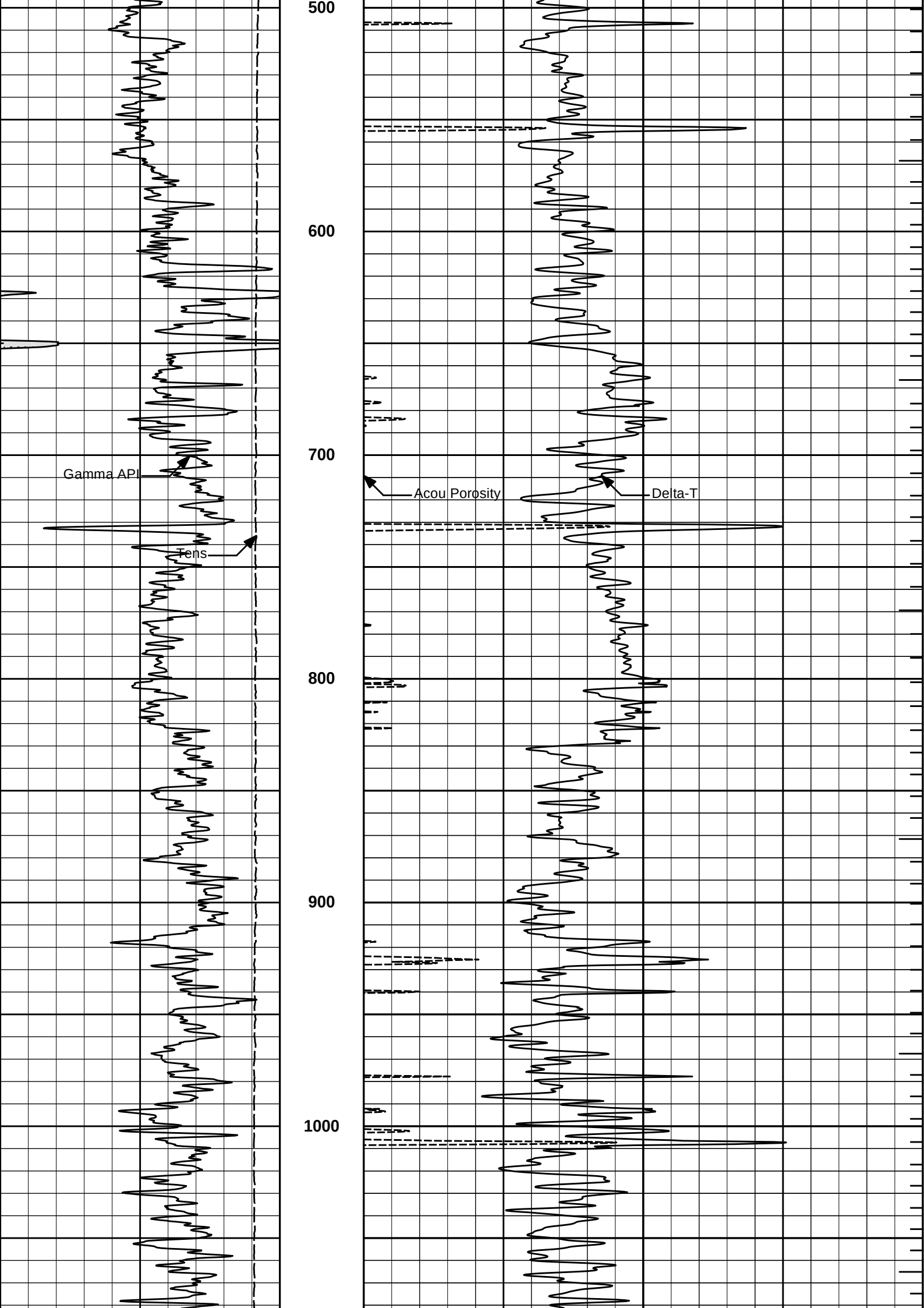
HALLIBURTON

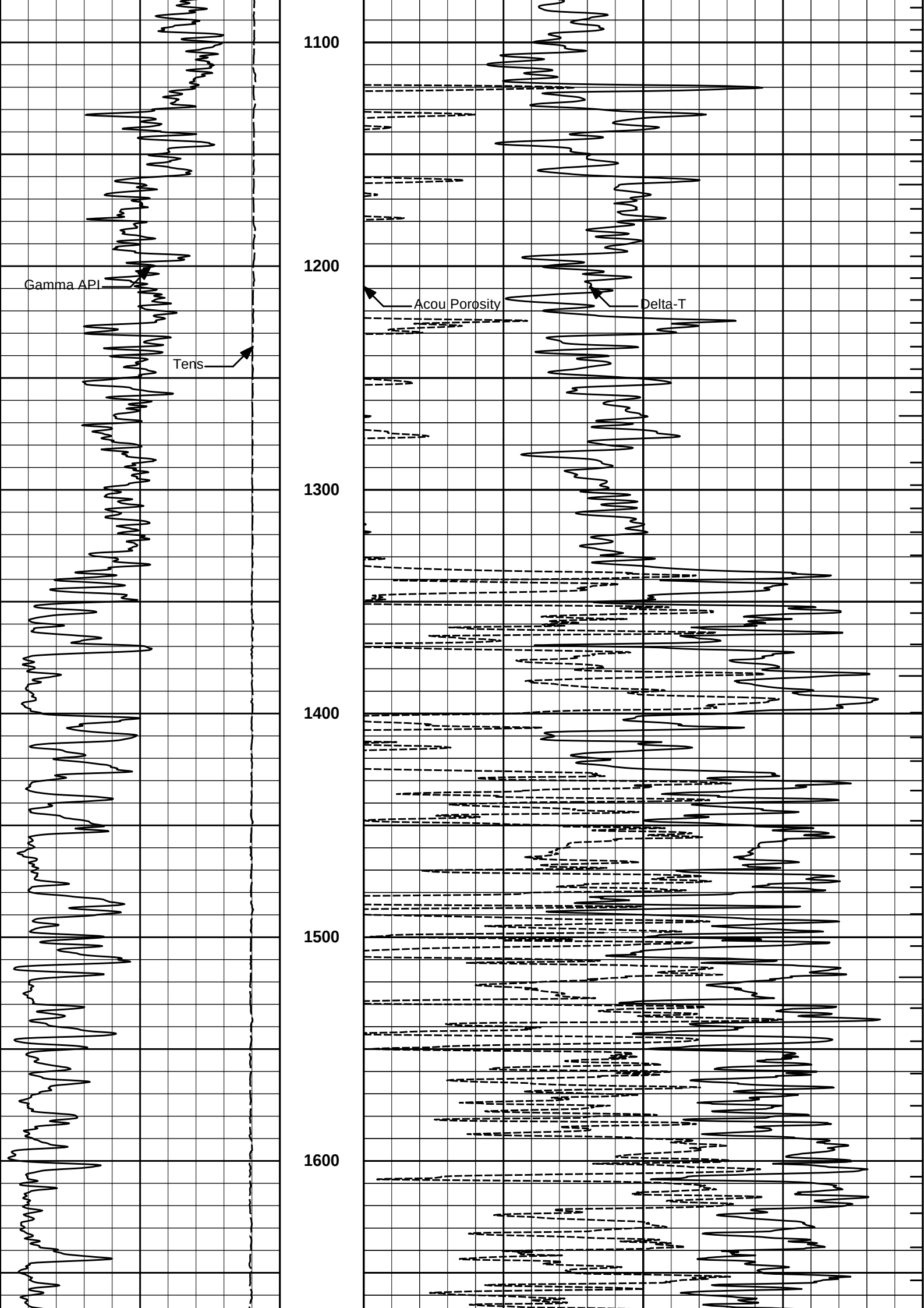
Plot Time: 19-Oct-17 07:13:16
Plot Range: 345 ft to 4739.33 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 MAIN
Plot File: \\BSAT\BSAT_2inch

2 INCH MAIN LOG

2" MAIN LOG SECTION




500
600
700
800
900
1000
Gamma API
Tens
Acou Porosity
Delta-T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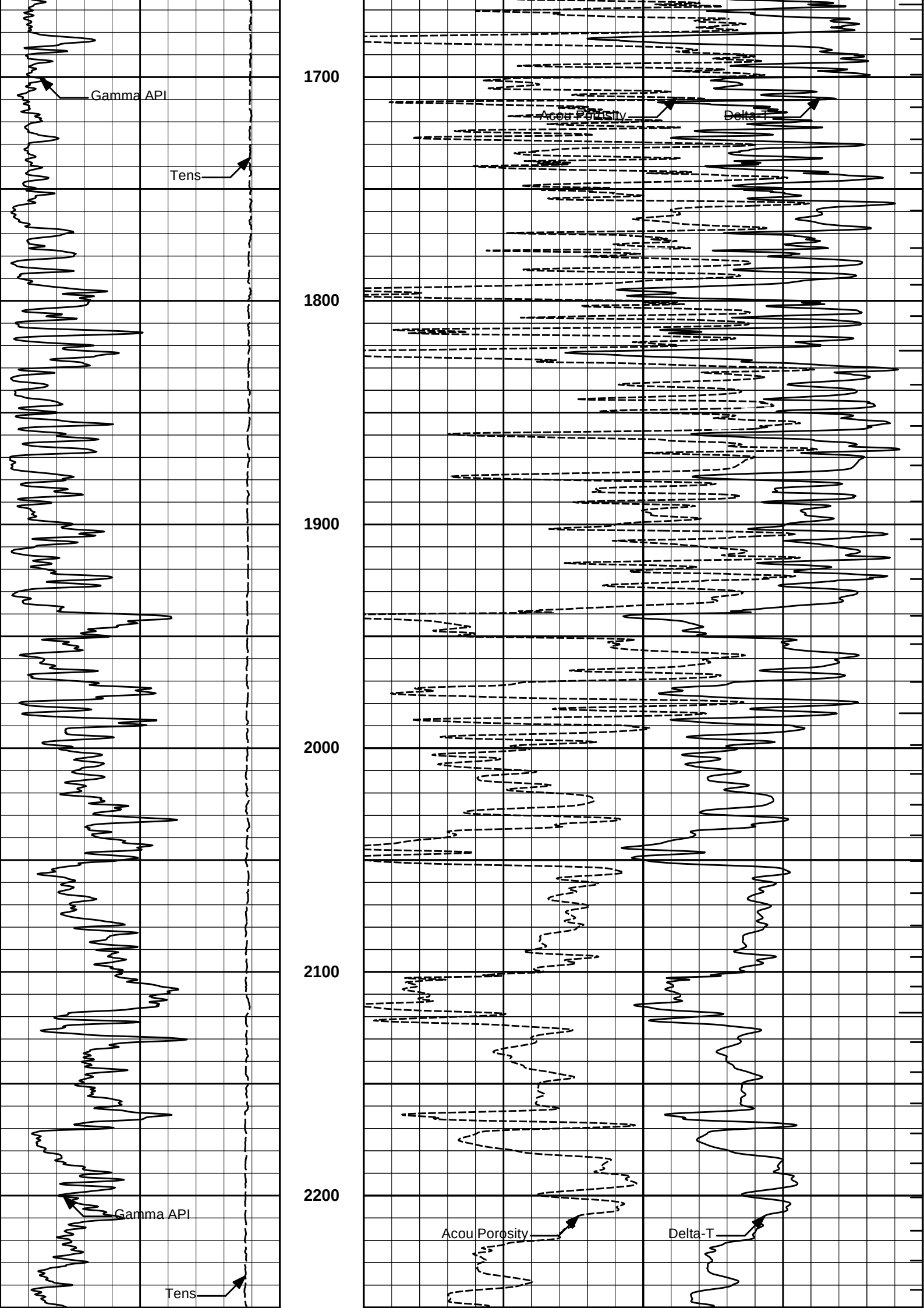
Tens
Acou Porosity
Delta-T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Delta-T
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1900
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2100
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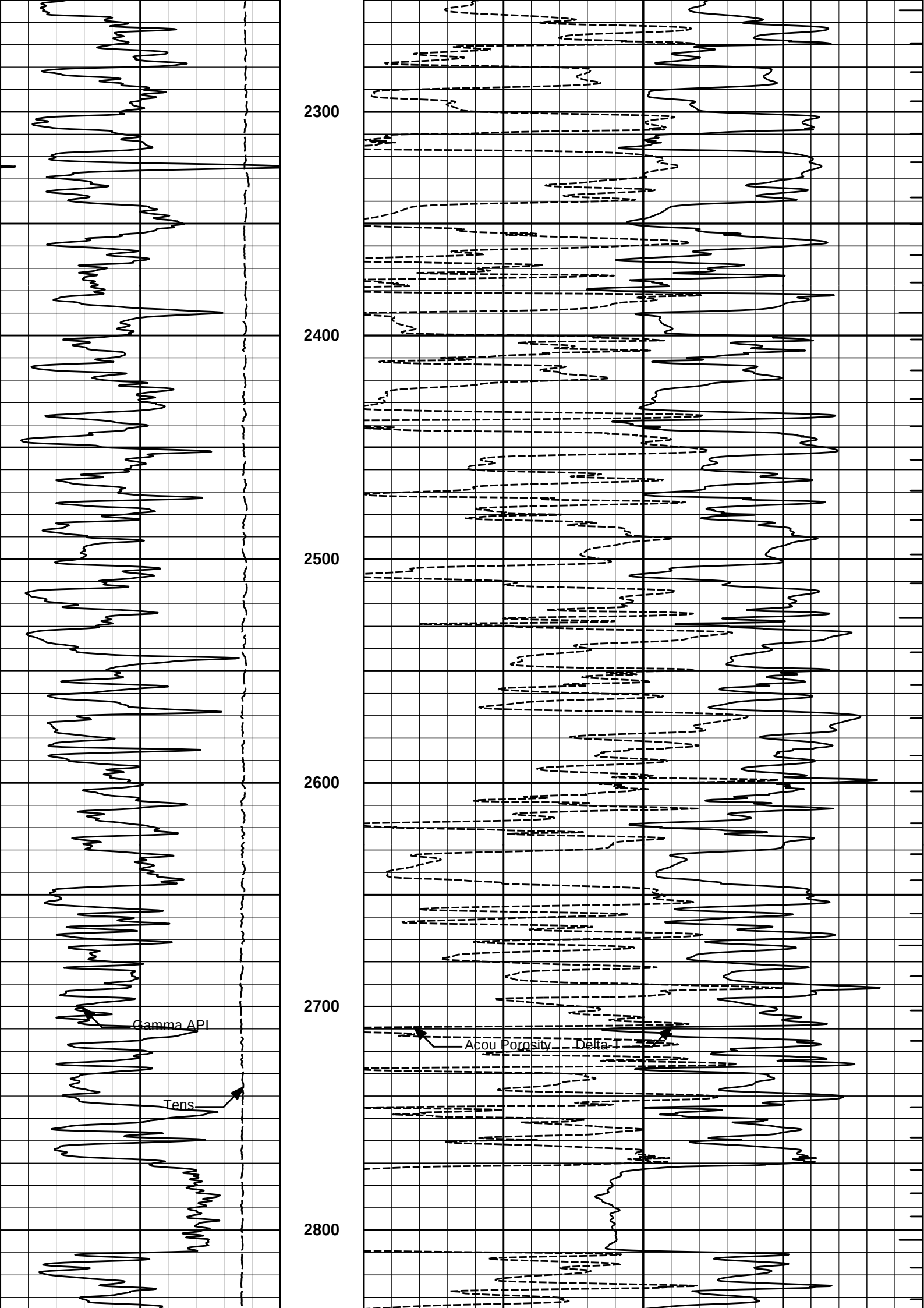
Tens
Acou Porosity
Delta-T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2400
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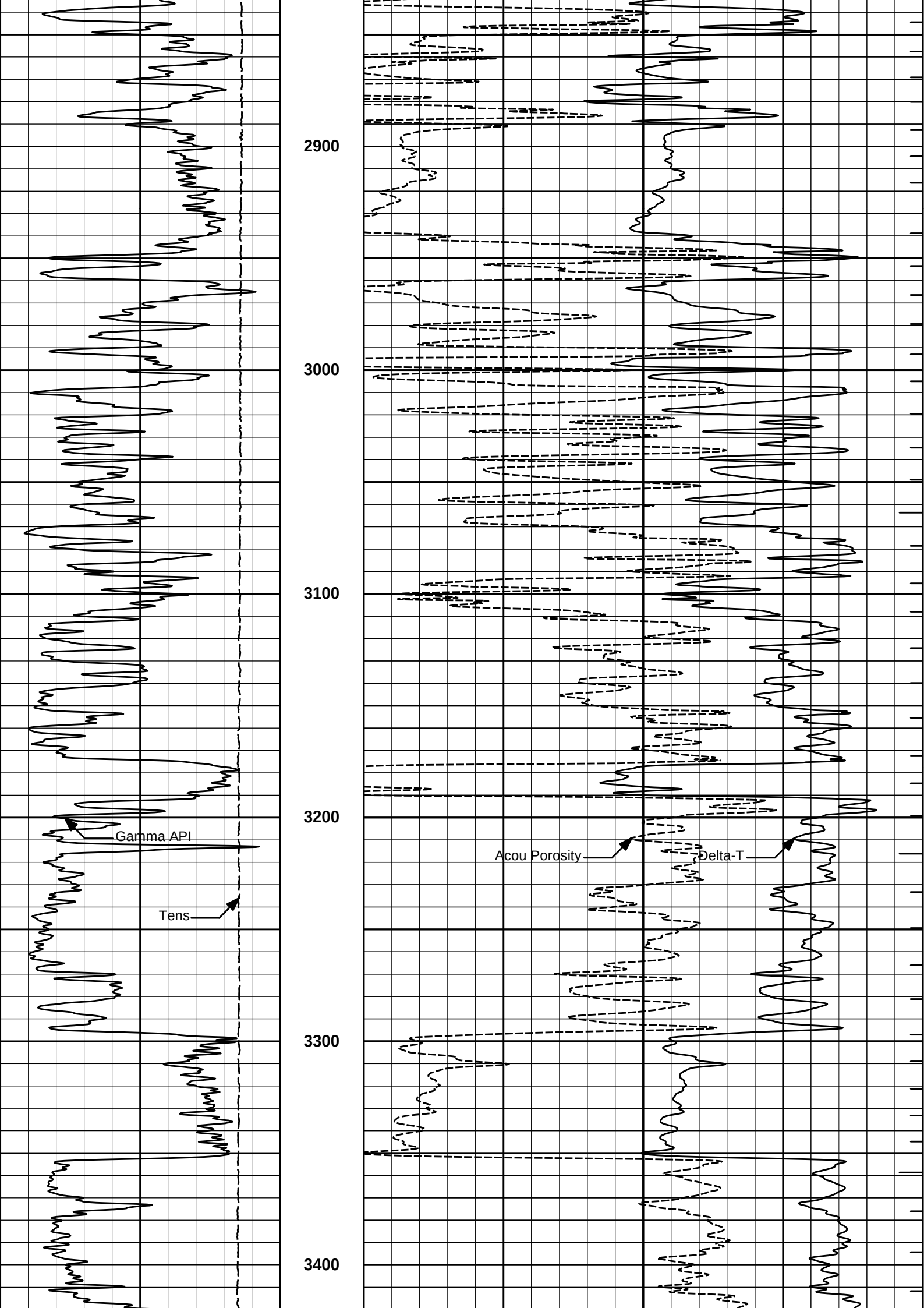
2600
2700
2800
Gamma API
Tens
Acou Porosity
Delta T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3000
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3200
3300
3400
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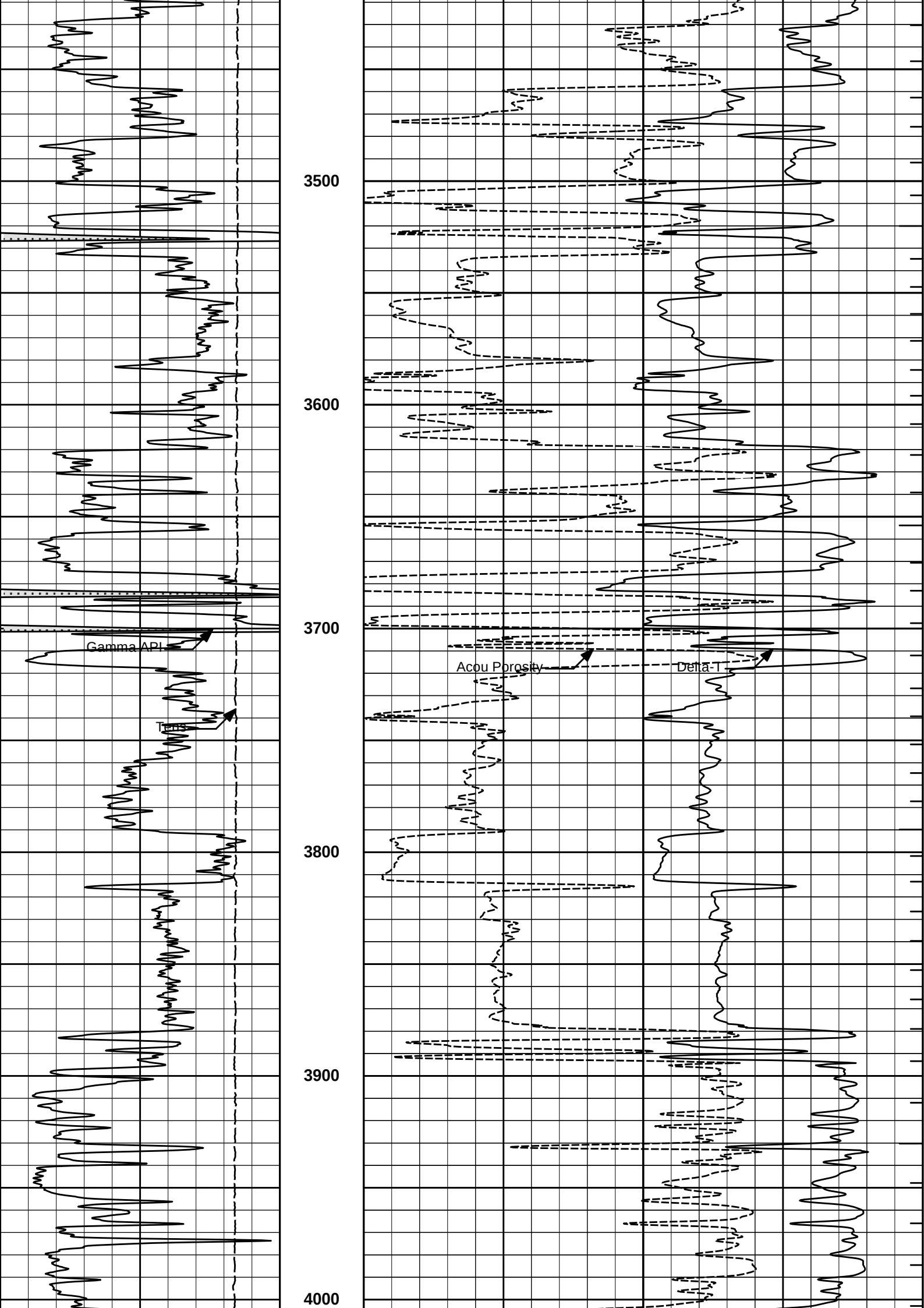
Tens
Acou Porosity
Delta-T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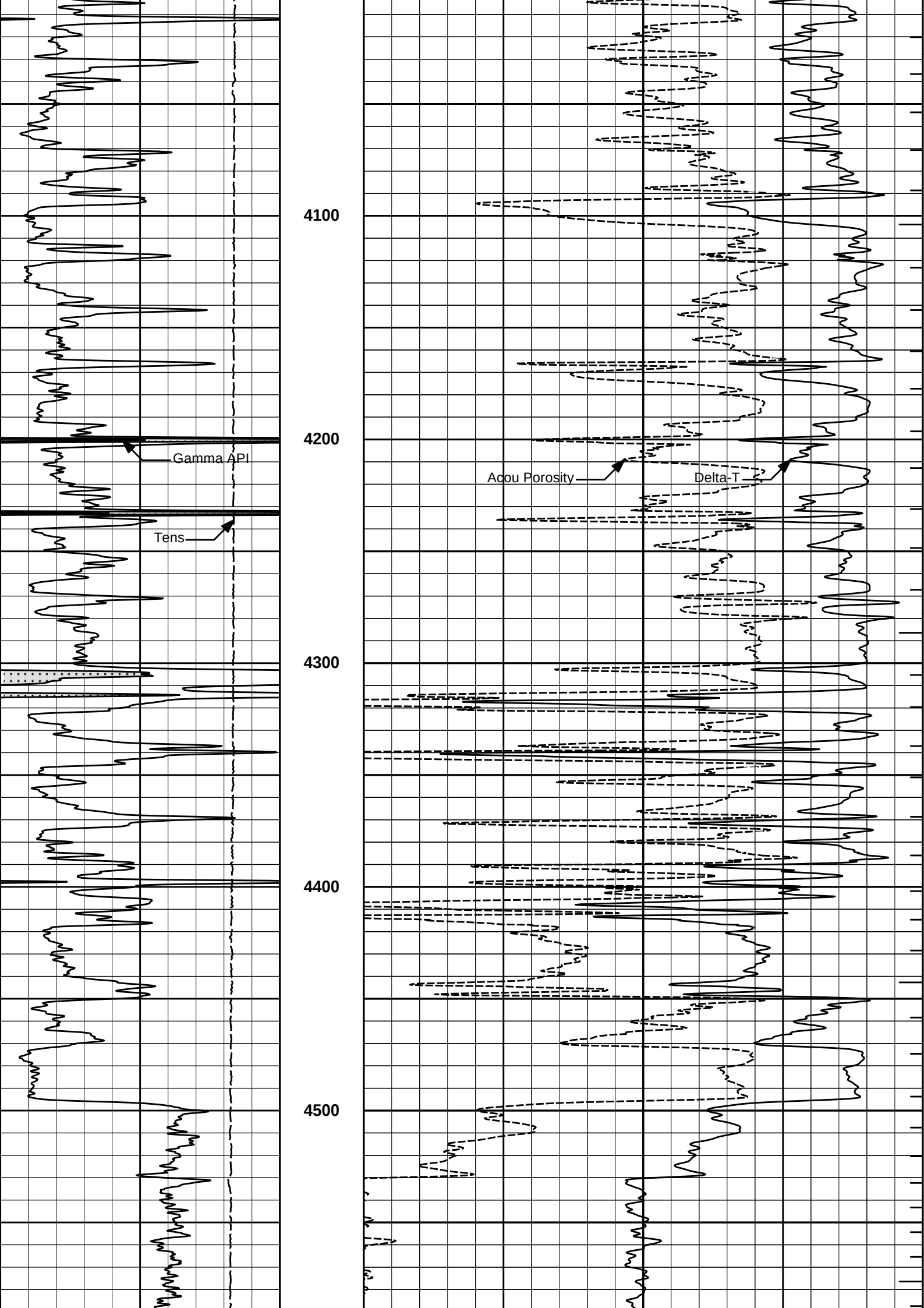
Trans
Acou Porosity
Delta-T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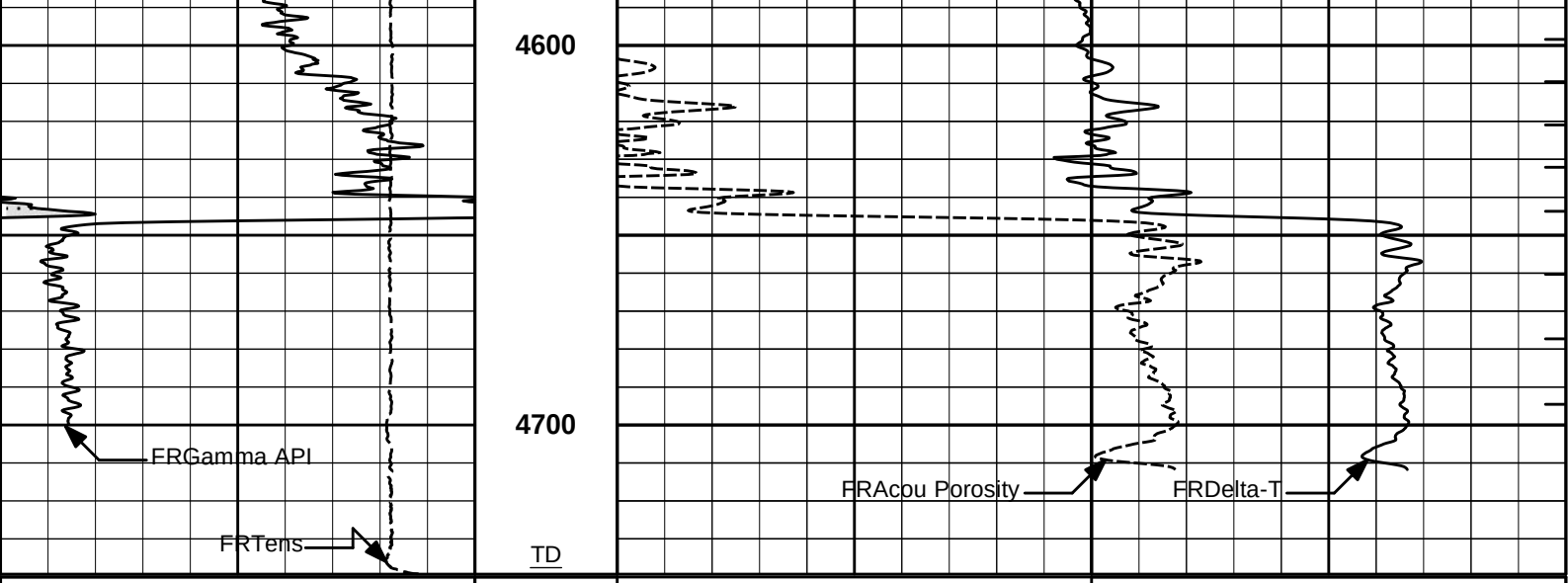
Tens
Acou Porosity
Delta-T



0 Gamma API 150 api	1 : 600 ft	ITTT
15K Tens 0 pounds		30 Acou Porosity -10 percent
		140 Delta-T 40 microsec per ft

HALLIBURTON

Plot Time: 19-Oct-17 07:13:19
Plot Range: 345 ft to 4739.33 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 MAIN\
Plot File: \\BSAT\BSAT_2inch

2 INCH MAIN LOG

2" MAIN LOG SECTION

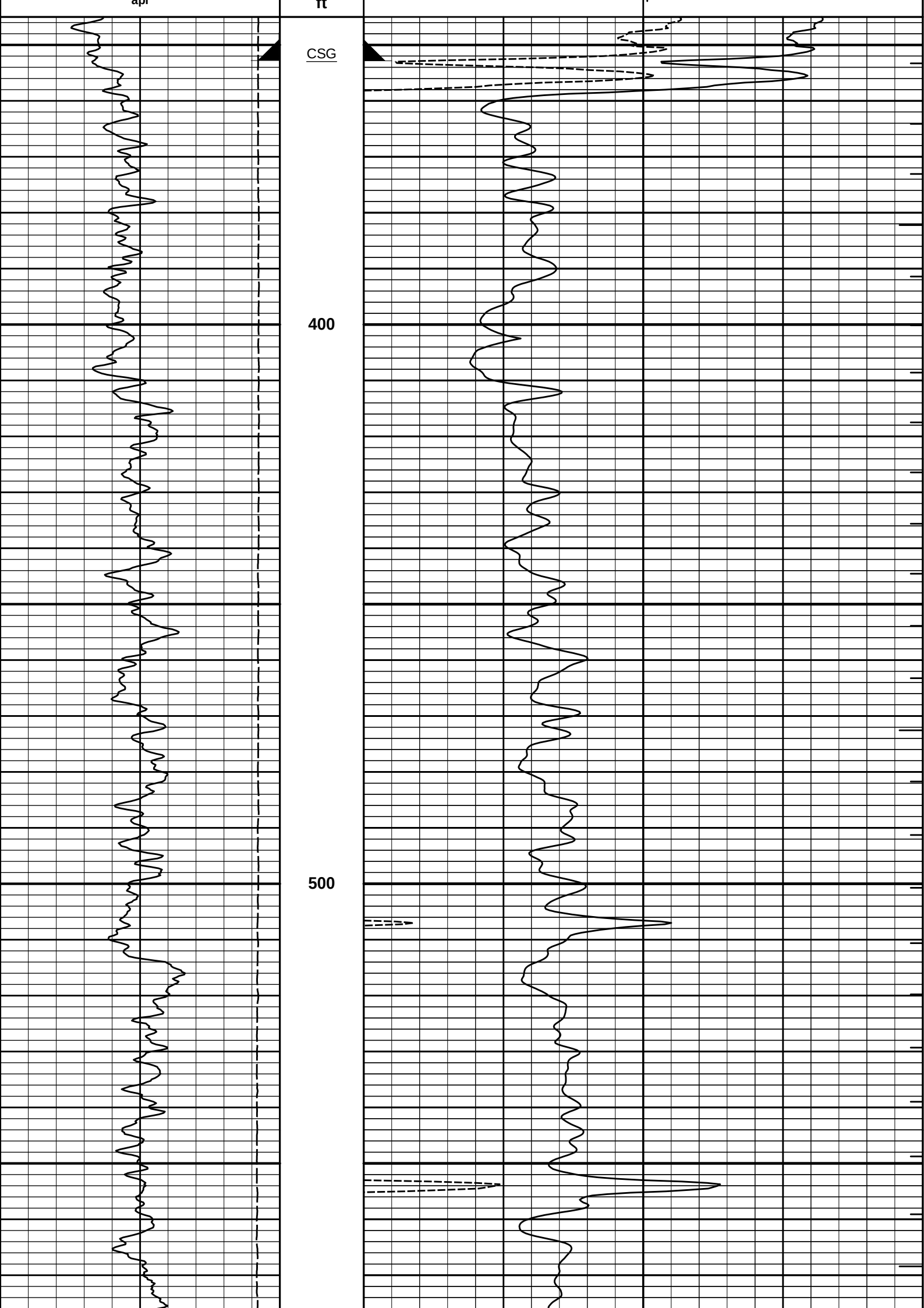
HALLIBURTON

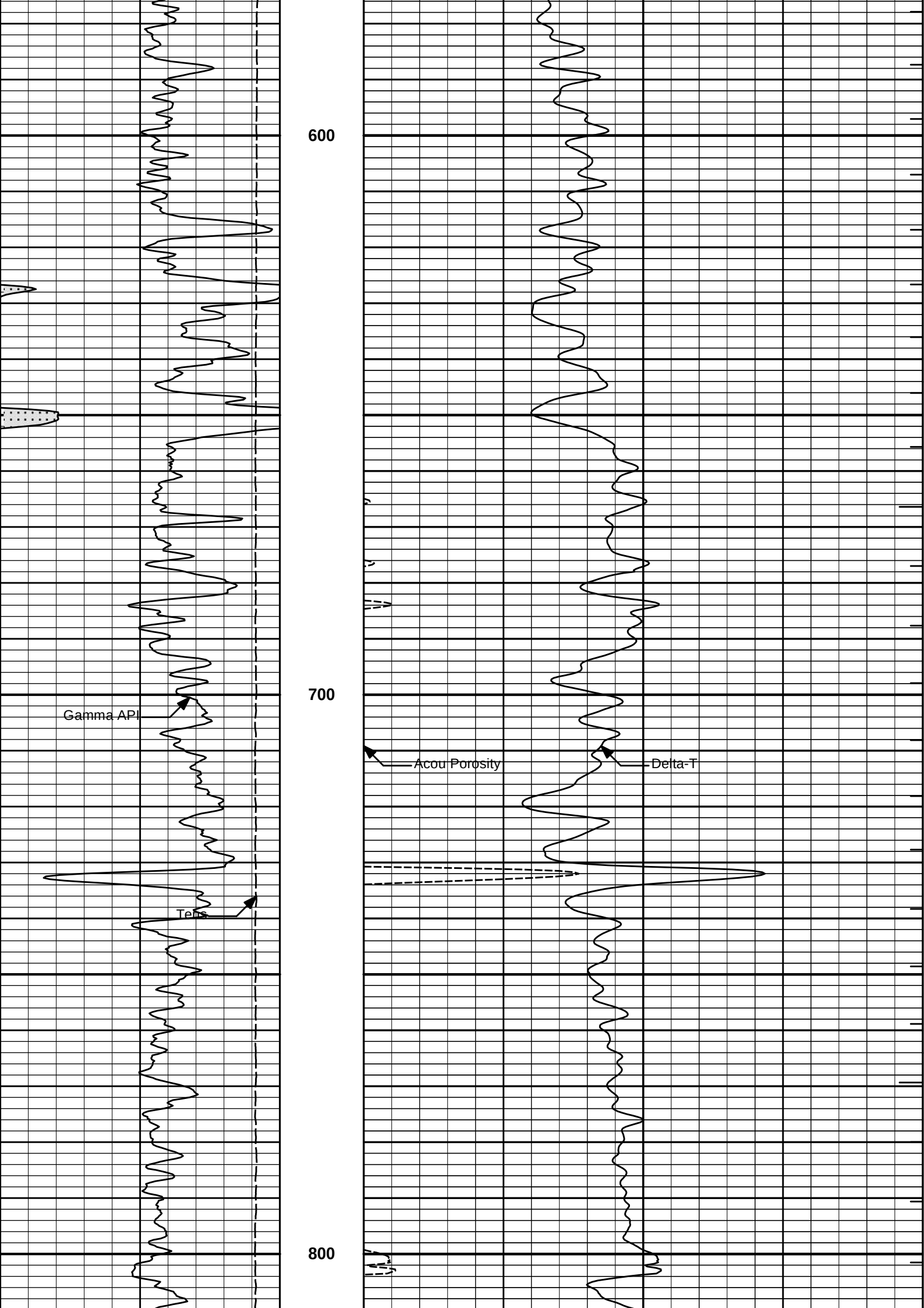
Plot Time: 19-Oct-17 07:13:20
Plot Range: 345 ft to 4739.33 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 MAIN\
Plot File: \\BSAT\BSAT_5inch

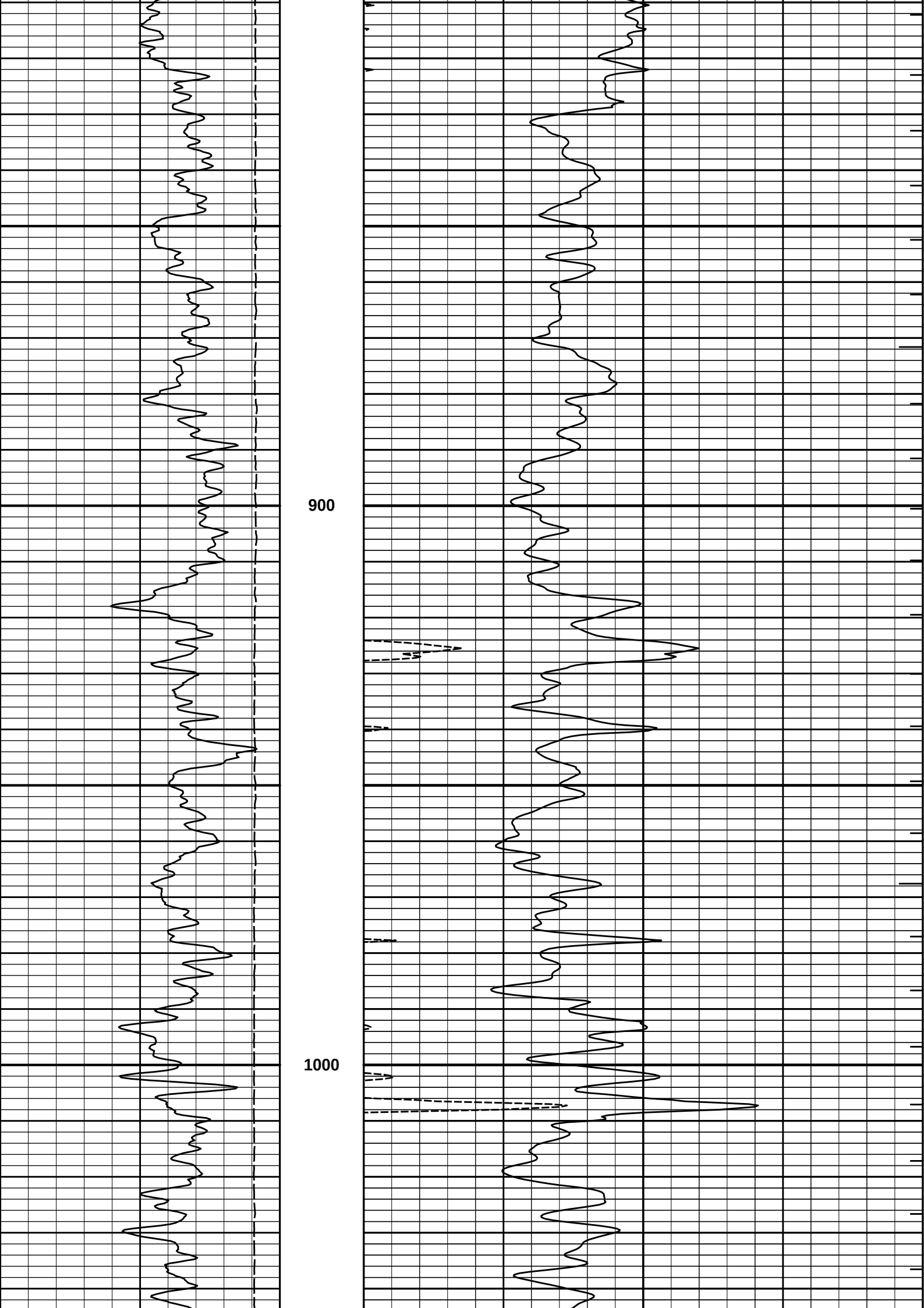
5 INCH MAIN LOG

MAIN LOG SECTION

		30 Acou Porosity -10 percent
15K Tens 0 pounds		140 Delta-T 40 microsec per ft
0 Gamma API 150 api	1 : 240 ft	ITTT


api
ft
CSG
400
500


600
700
800
Gamma API
Acou Porosity
Delta-T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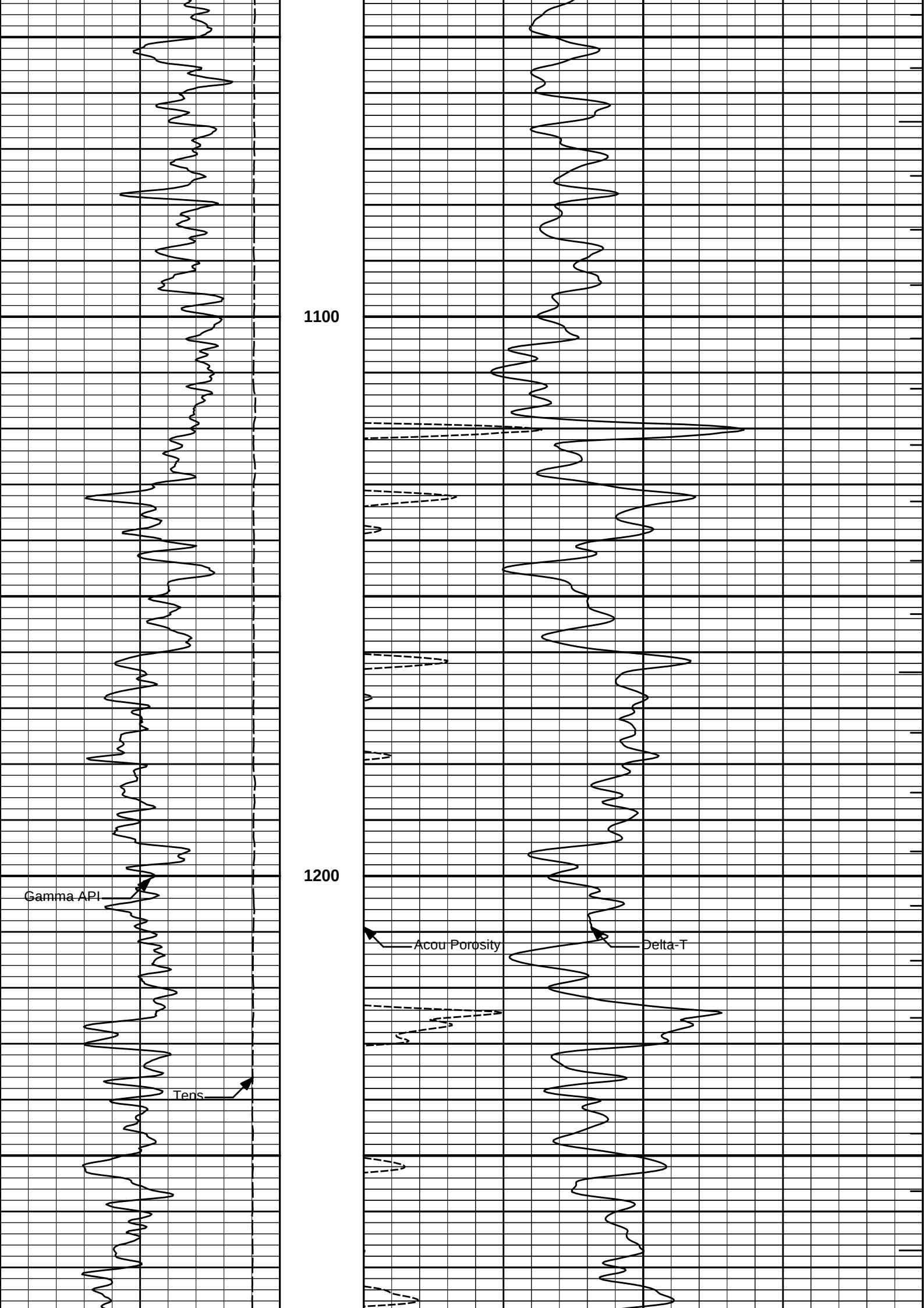
1100
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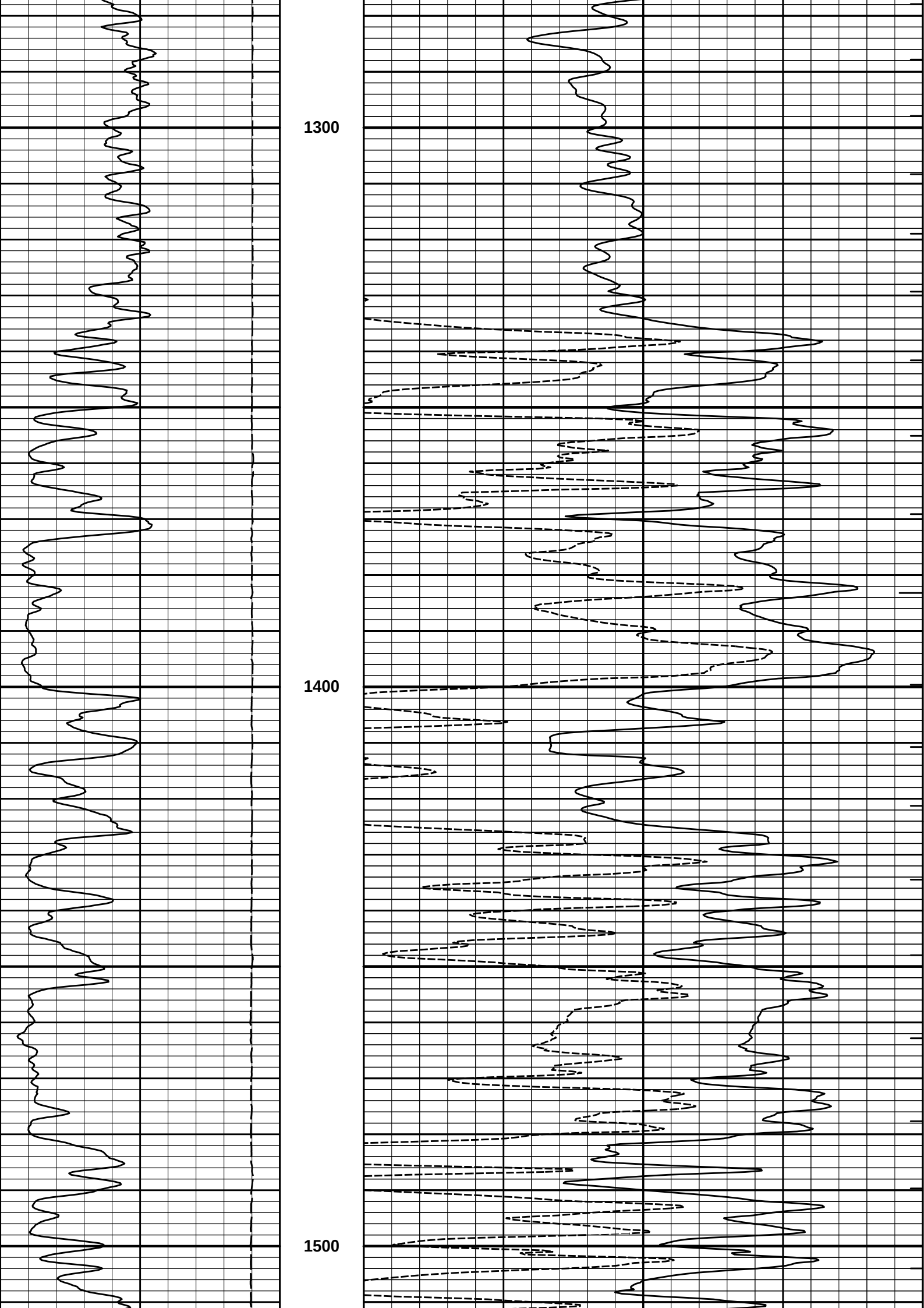
Gamma API
Tens
Acou Porosity
Delta-T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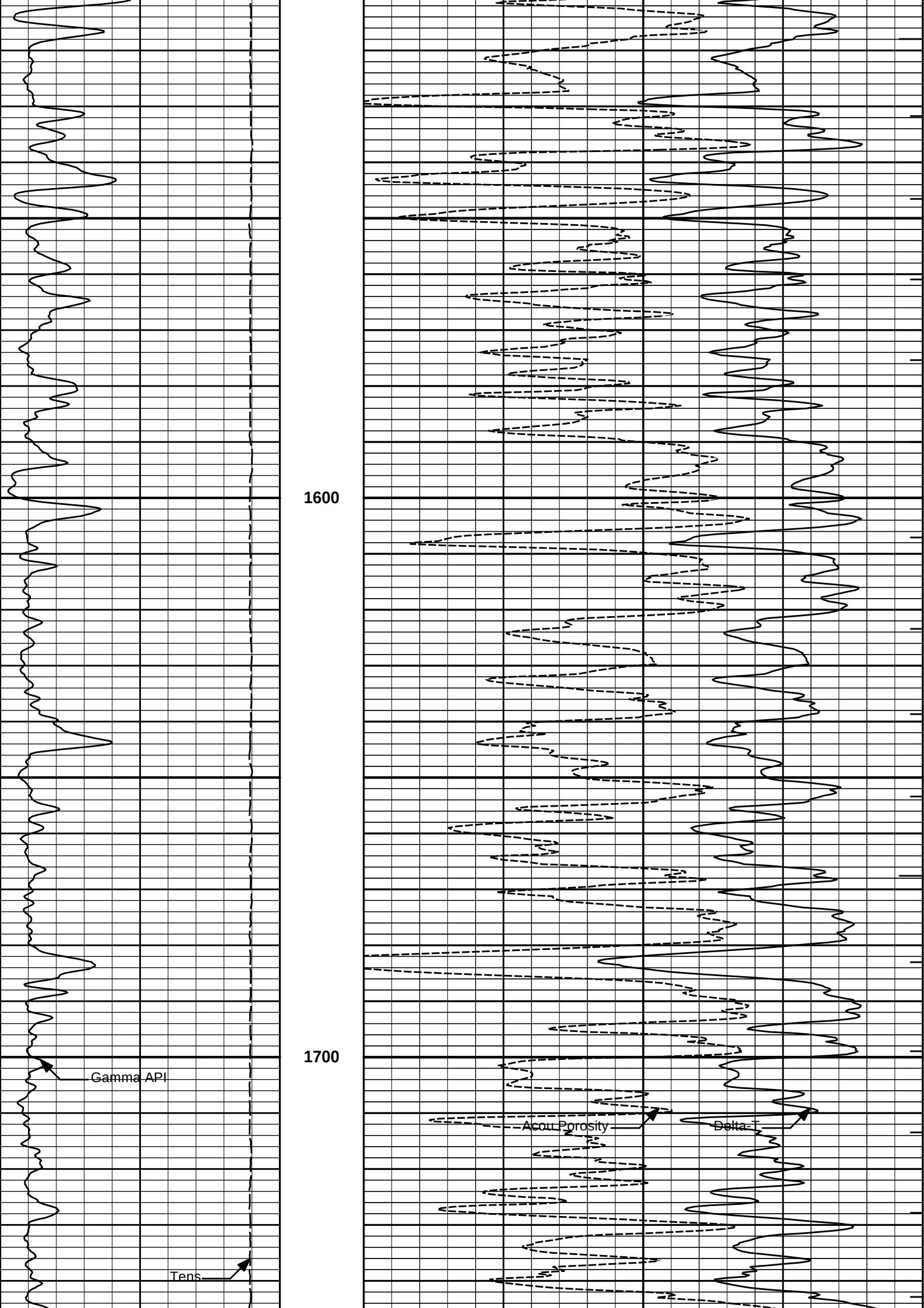
1600
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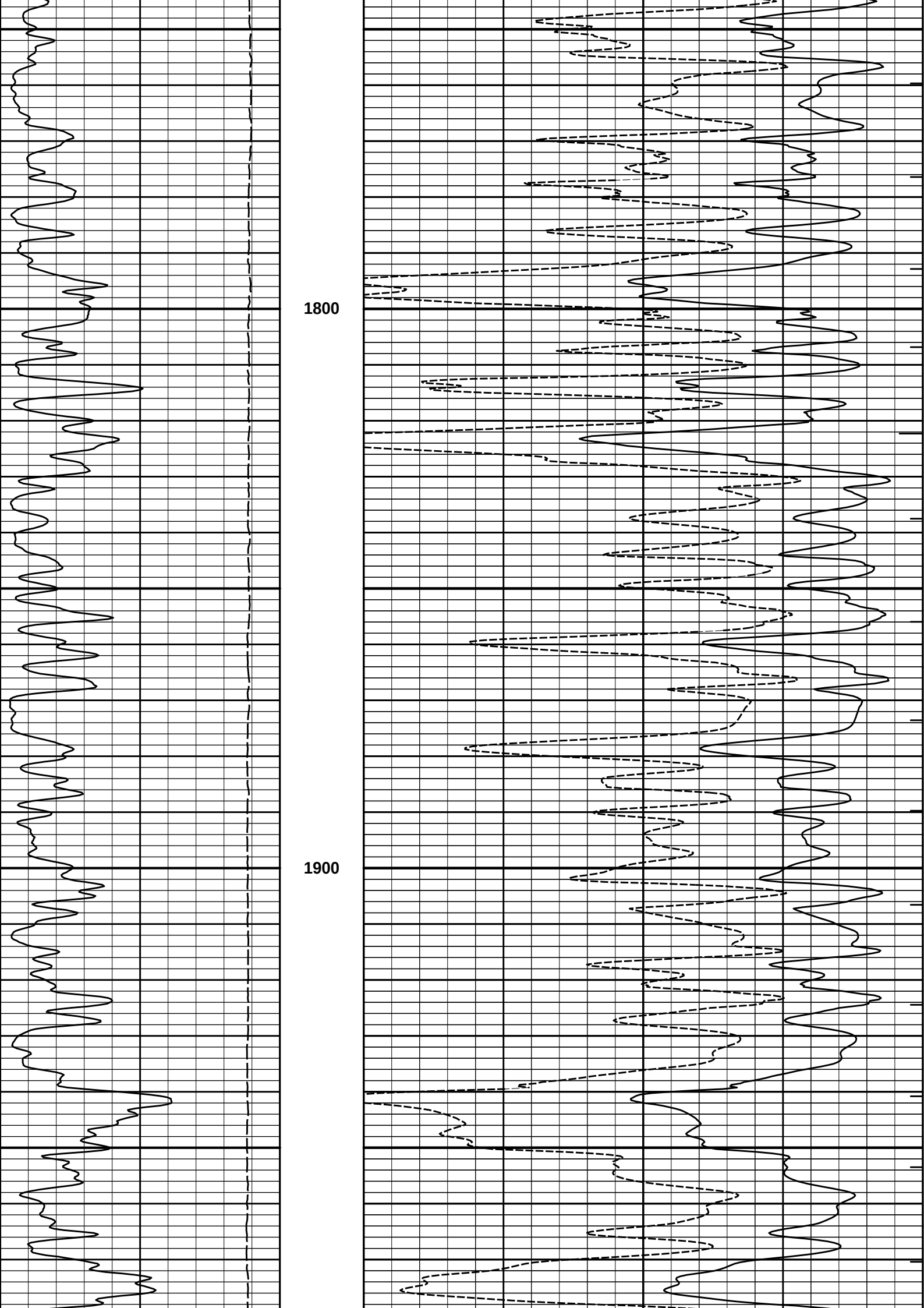
Gamma API
Tens
Acou Porosity
Delta-T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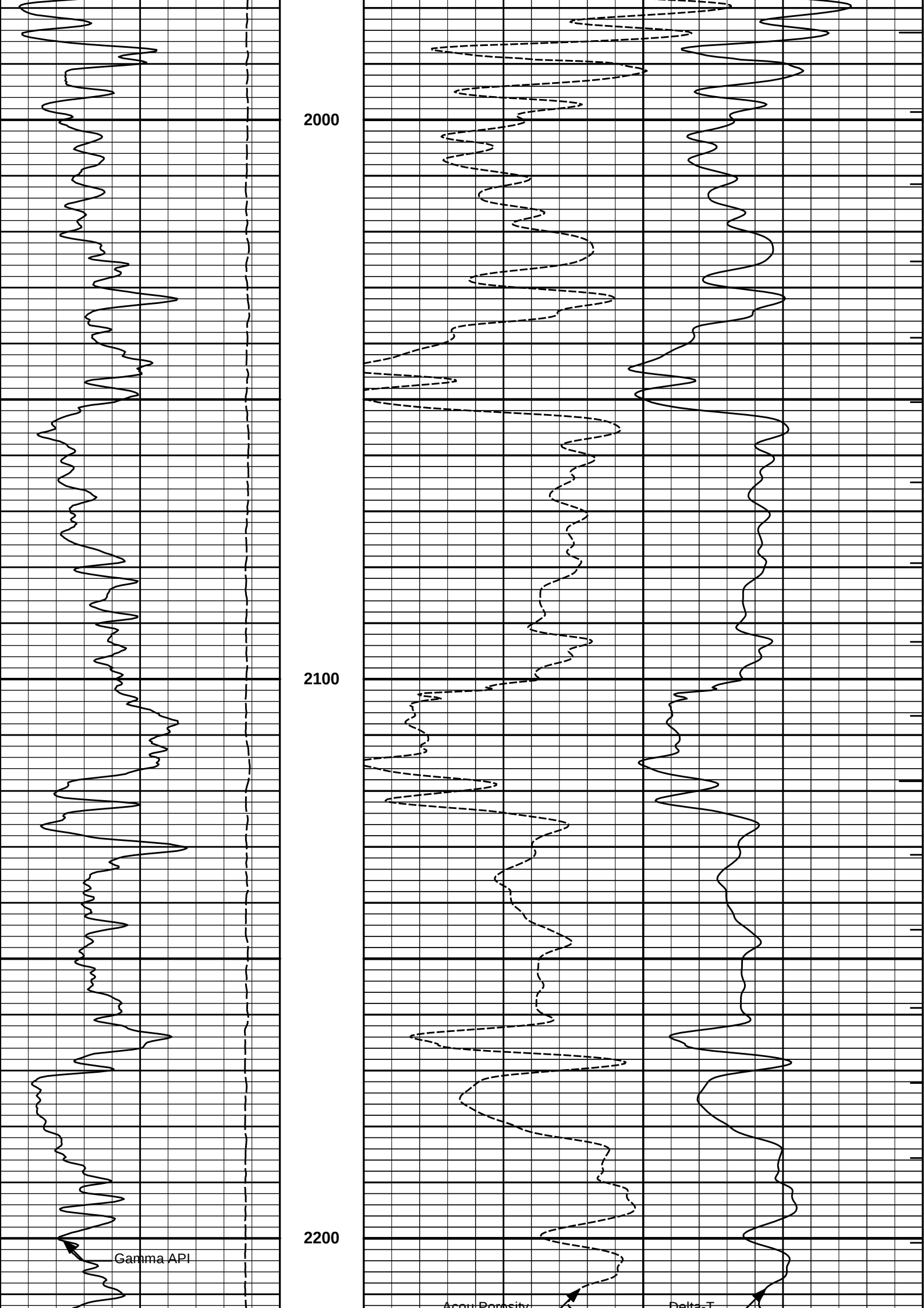
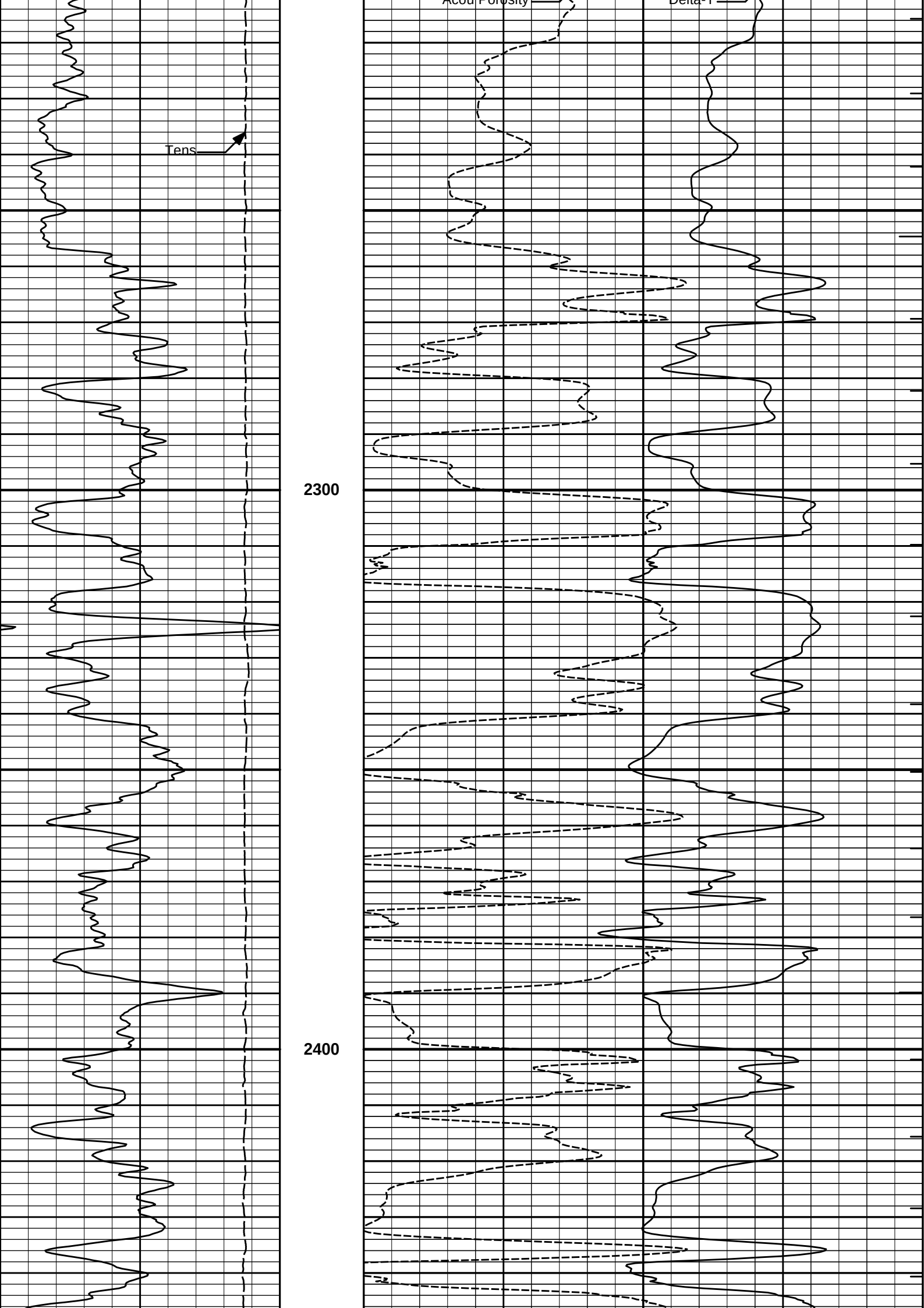
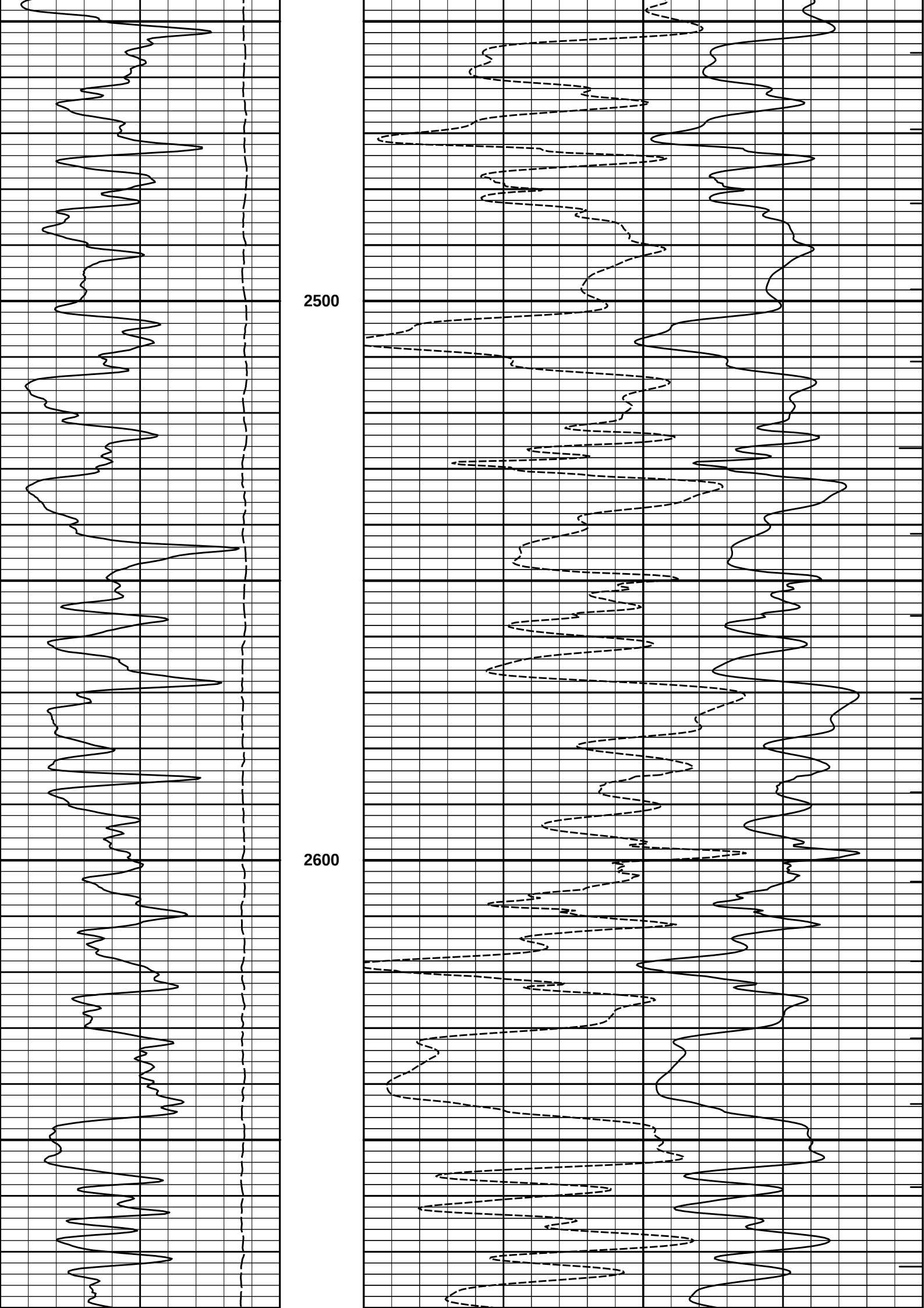

2000
2100
2200
Gamma API
Accu Porosity
Delta-T


Tens
Acou Porosity
Delta-T
2300
2400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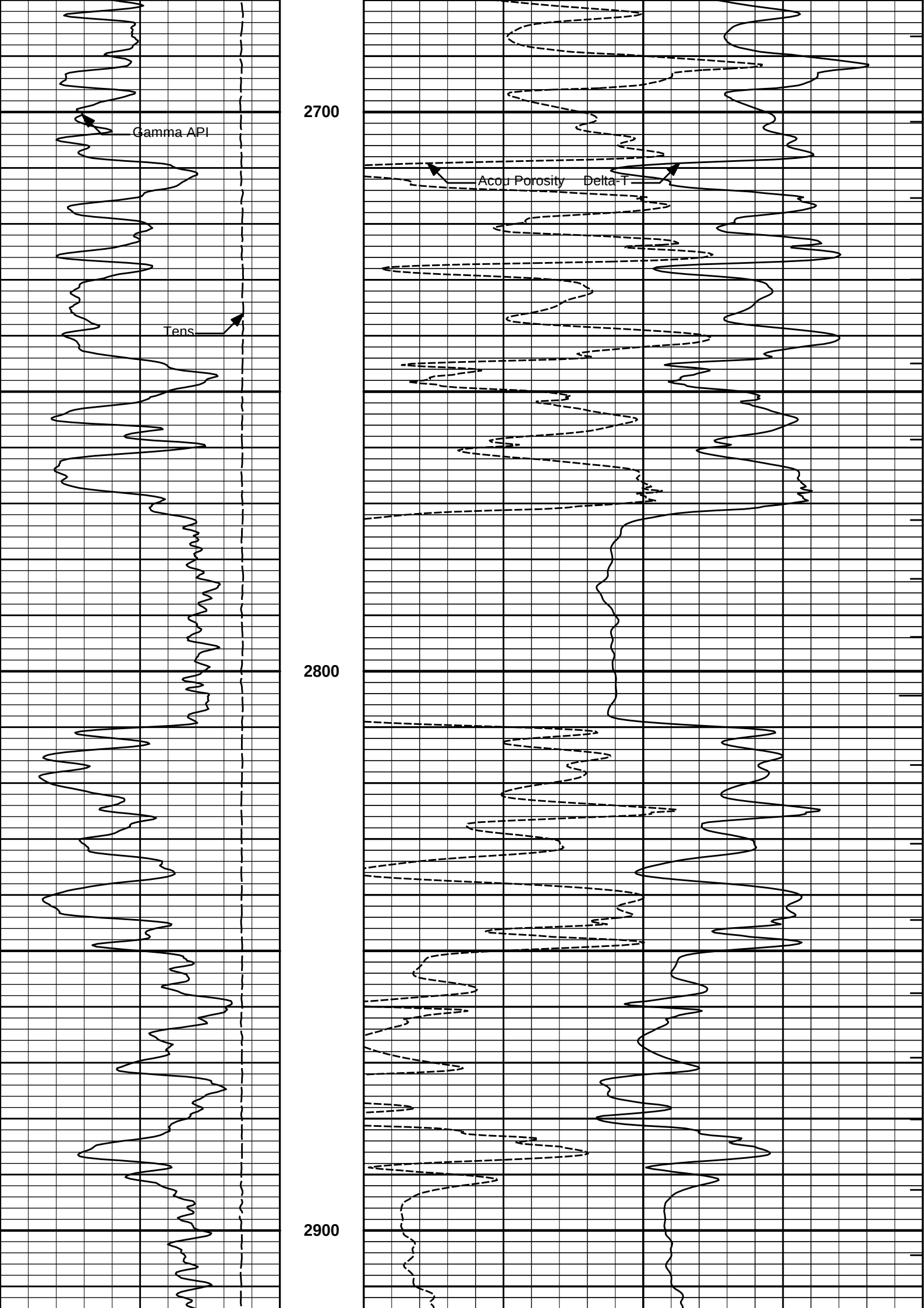
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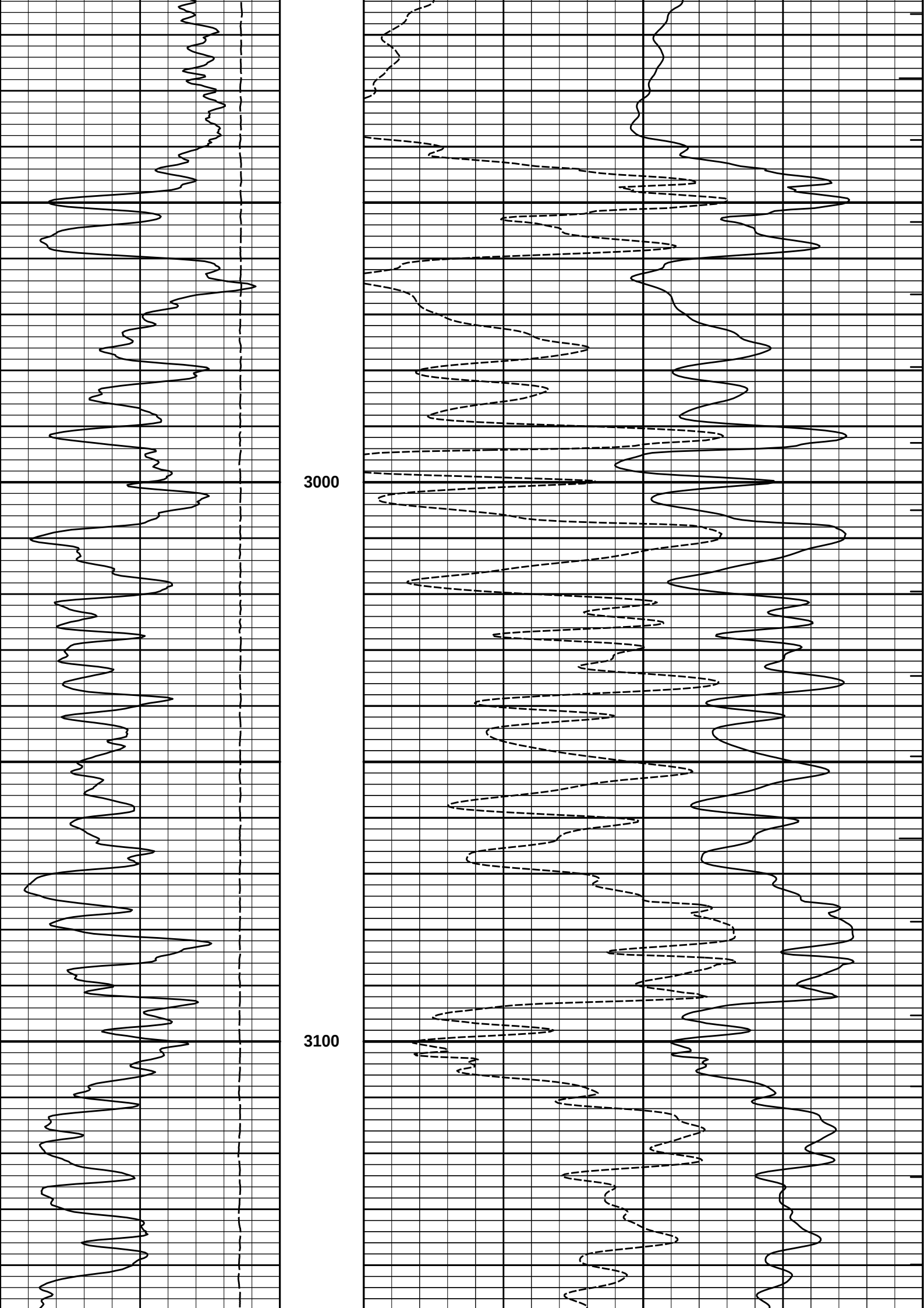
Gamma API
Acou Porosity
Delta-T
Tens
2800
2900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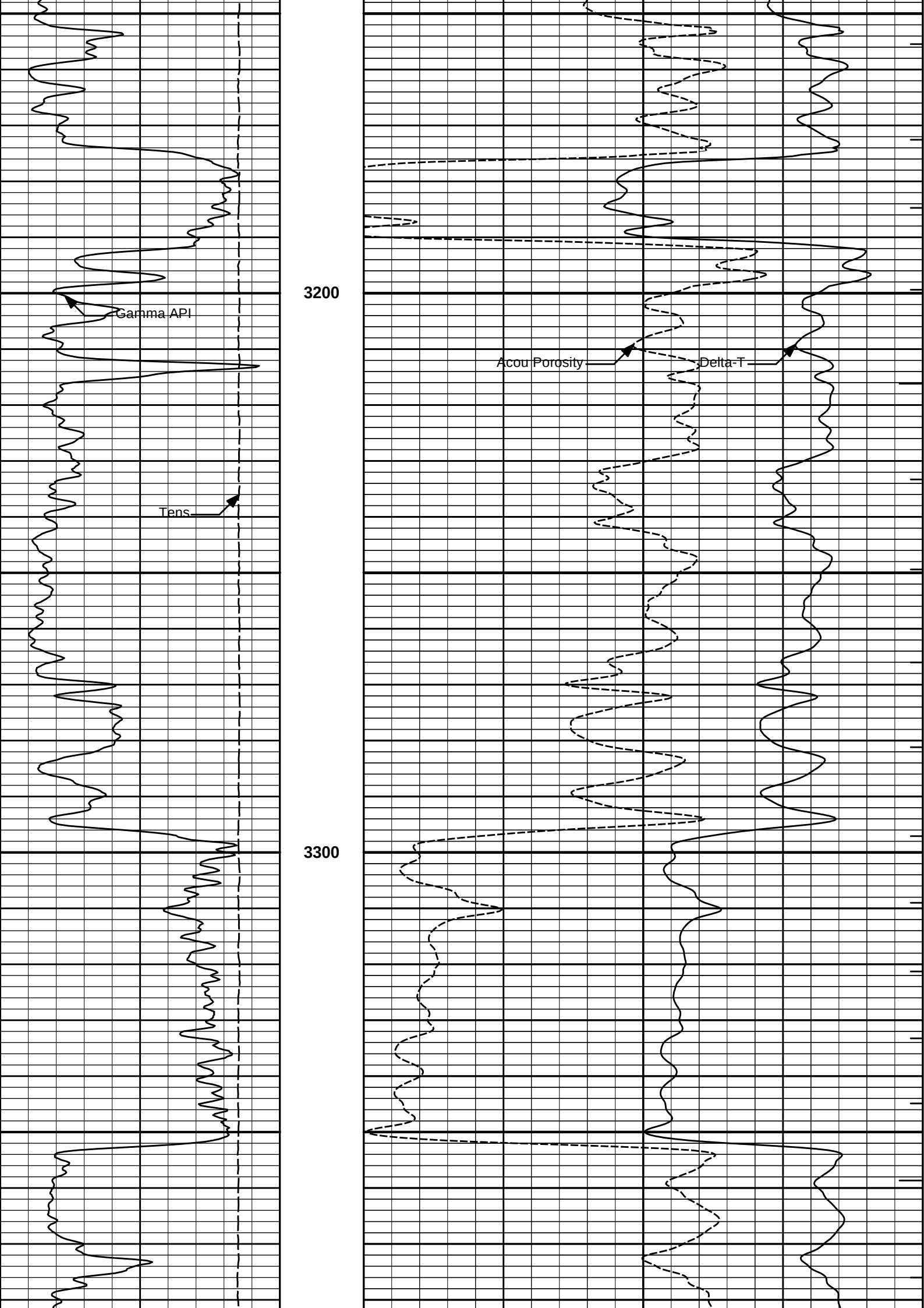
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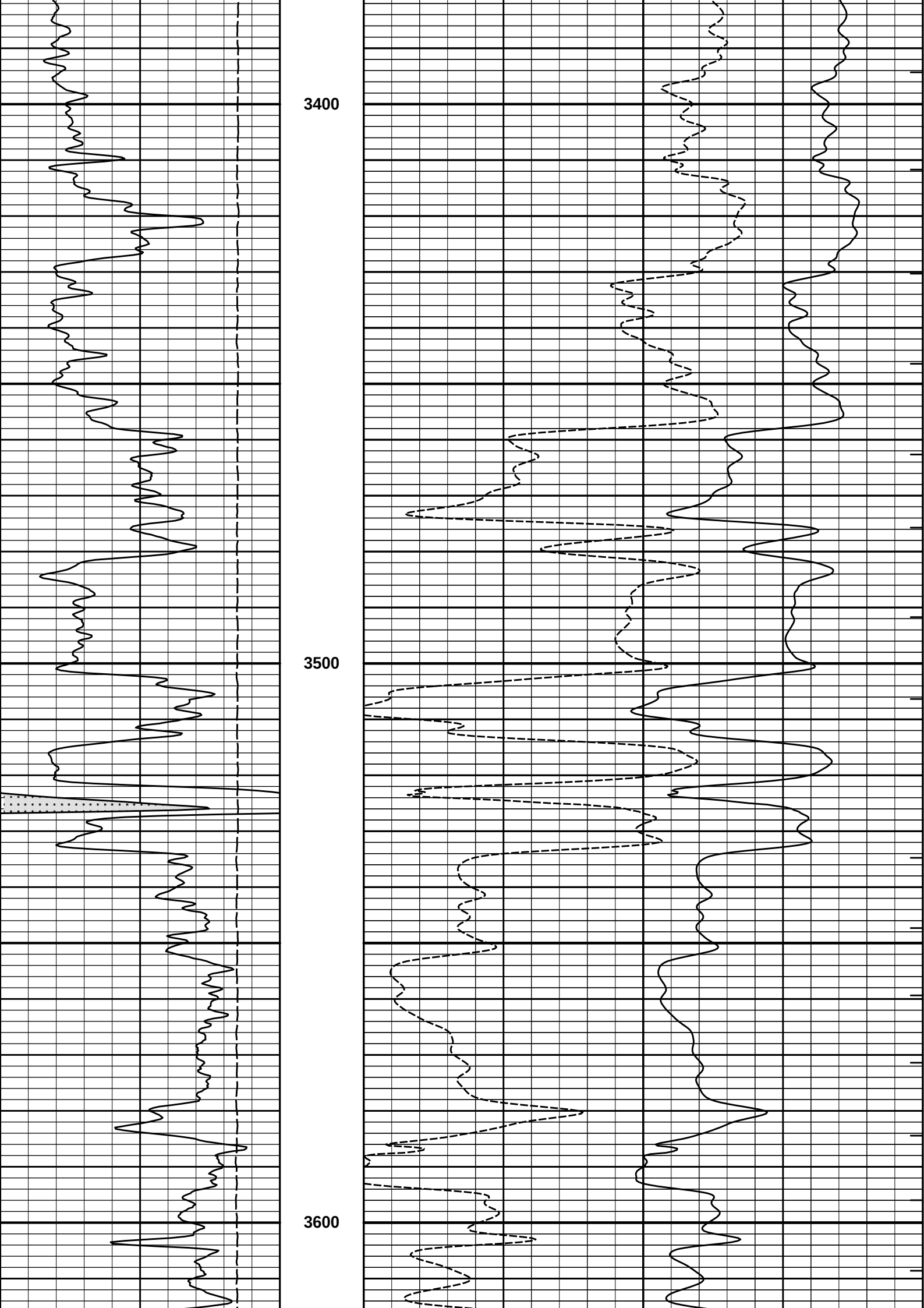
Gamma API
Acou Porosity
Delta-T
Tens
3300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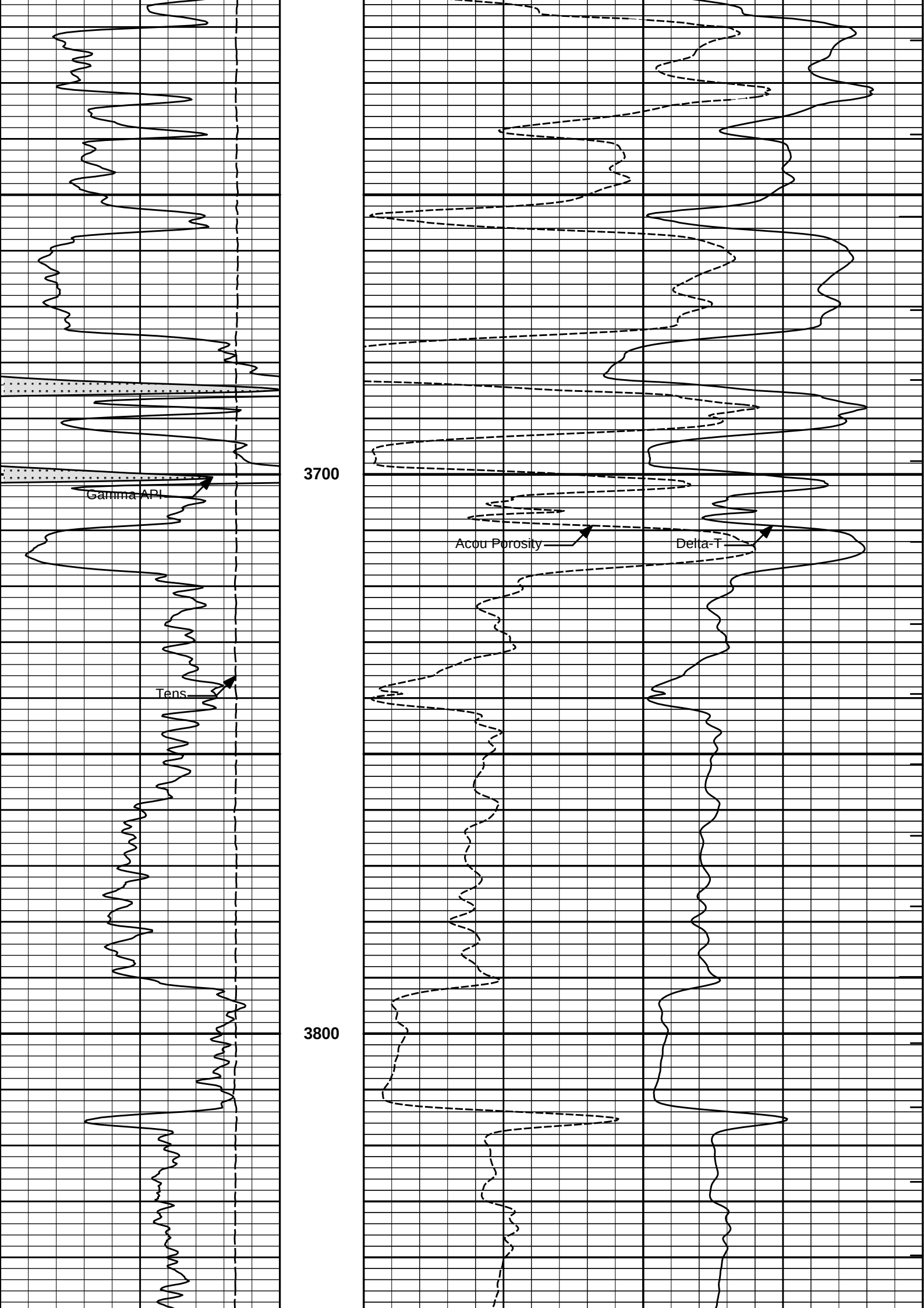
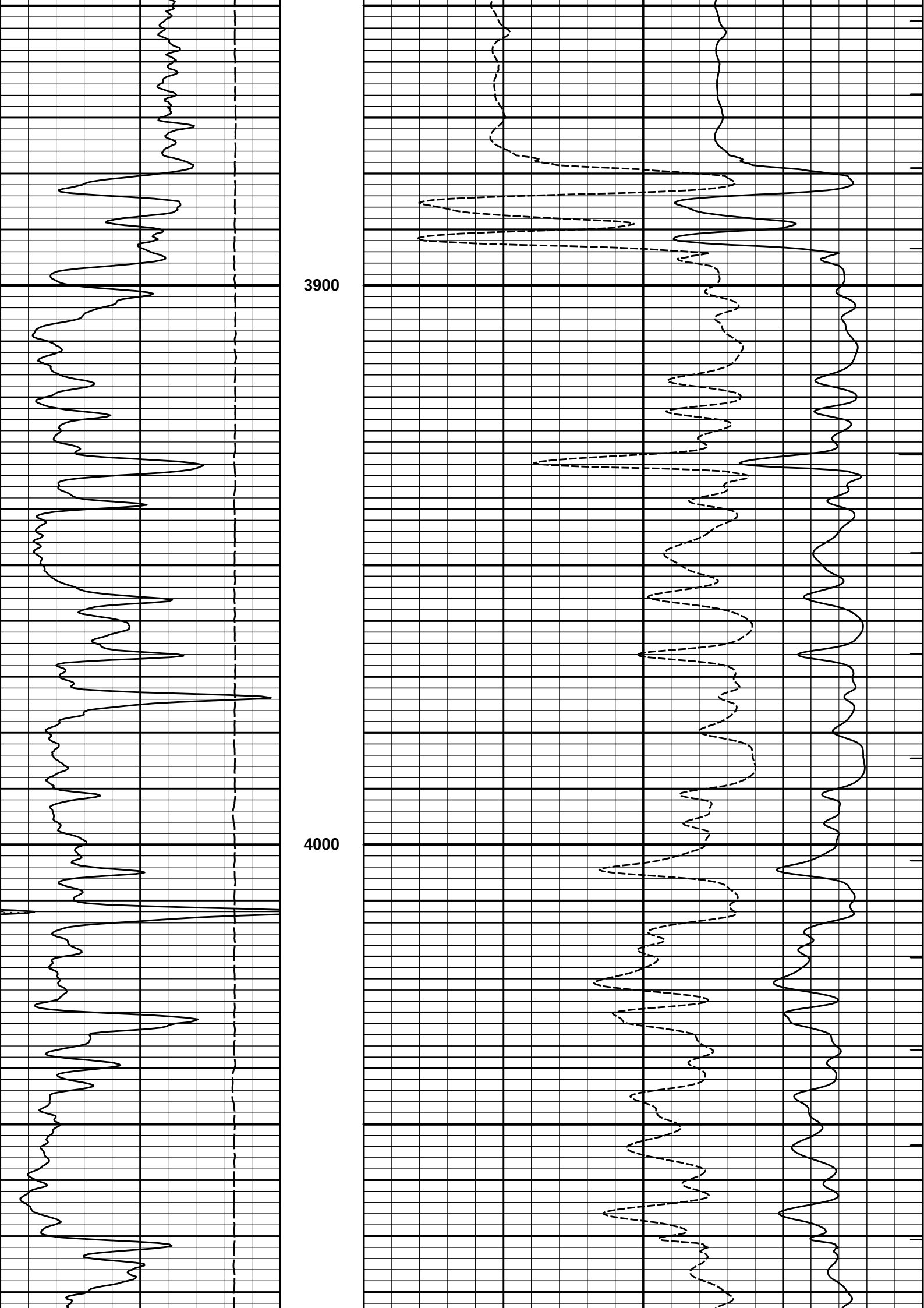

3700
Gamma API
Acou Porosity
Delta-T
Tens
3800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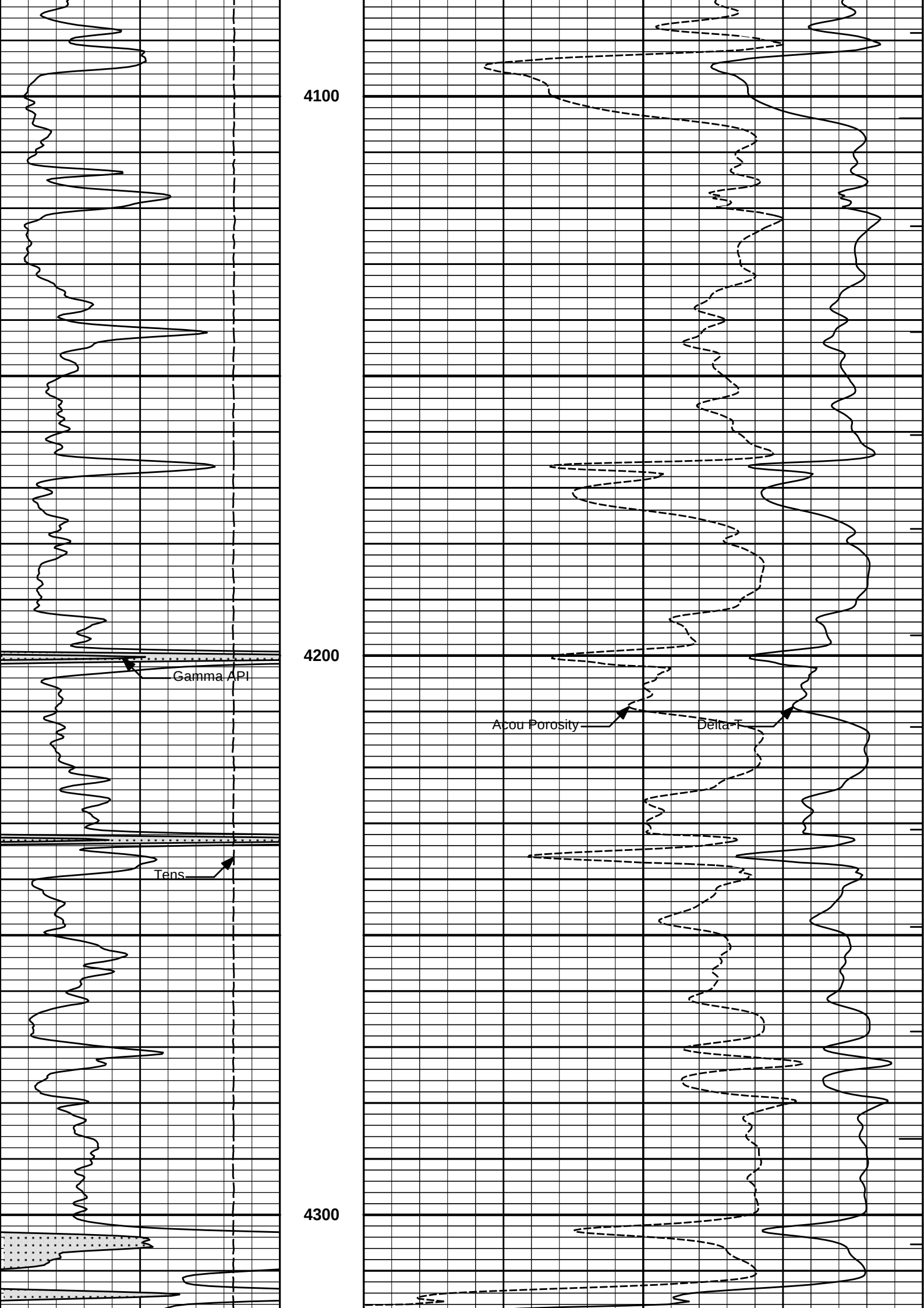
4100
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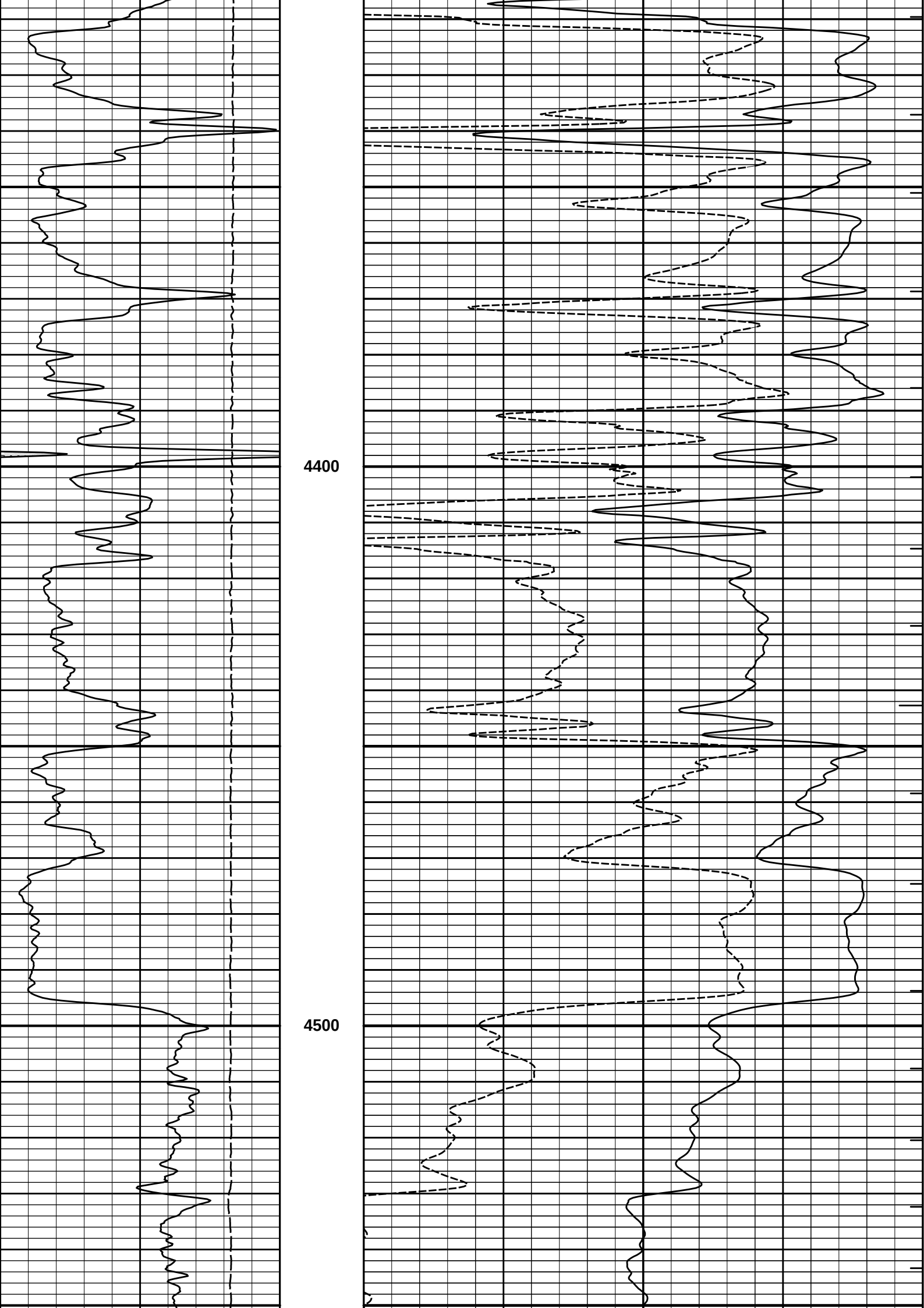
Gamma API
Tens
Acou Porosity
Delta-T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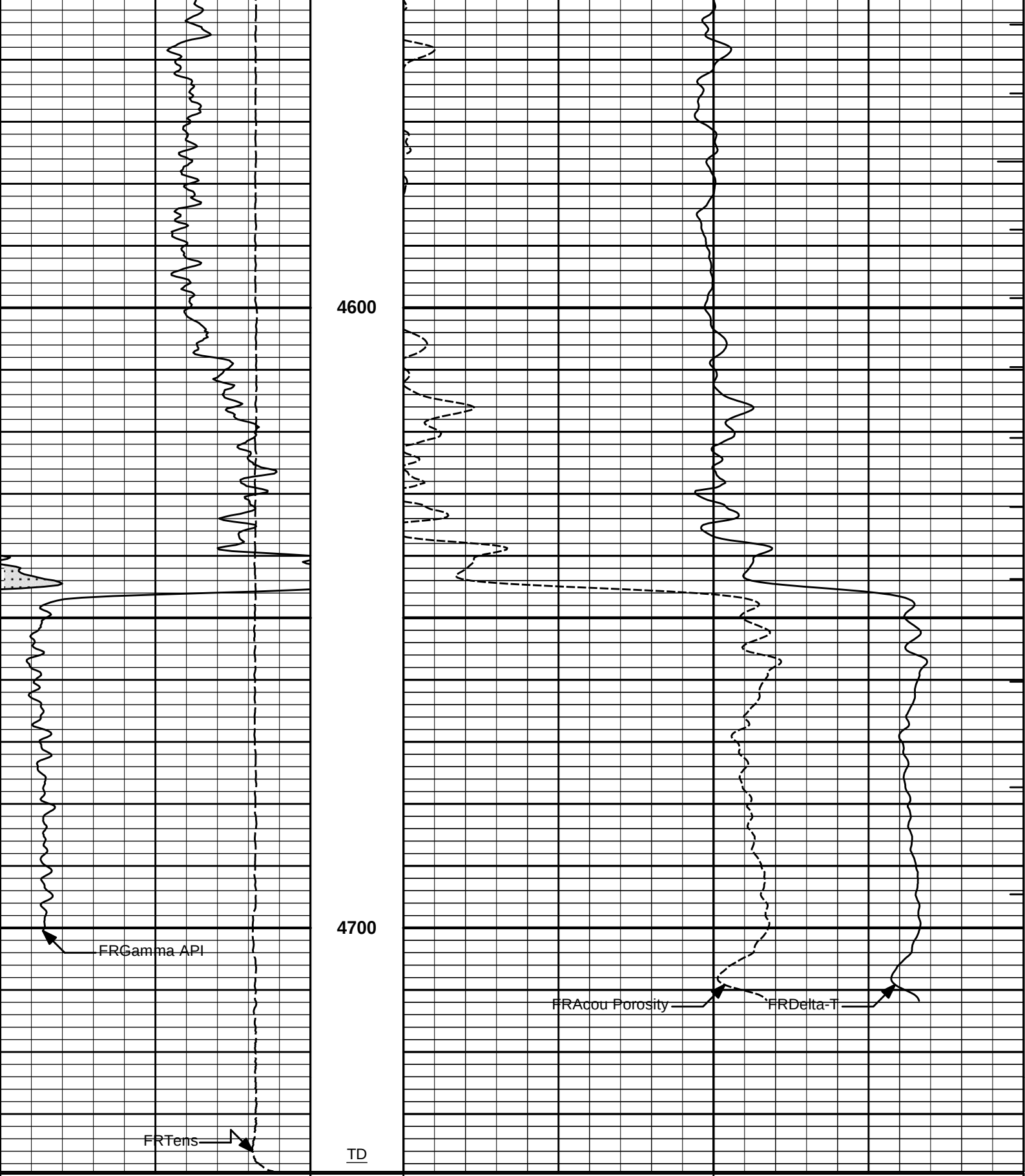


Gamma API		1 : 240	ITTT
0	150	ft	
api			
Tens			Delta-T
15K	0		140 40
pounds			microsec per ft
			Acou Porosity
			30 -10
			percent

HALLIBURTON

Plot Time: 19-Oct-17 07:13:24
Plot Range: 345 ft to 4739.33 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 MAIN\
Plot File: \\BSAT\BSAT_5inch

5 INCH MAIN LOG

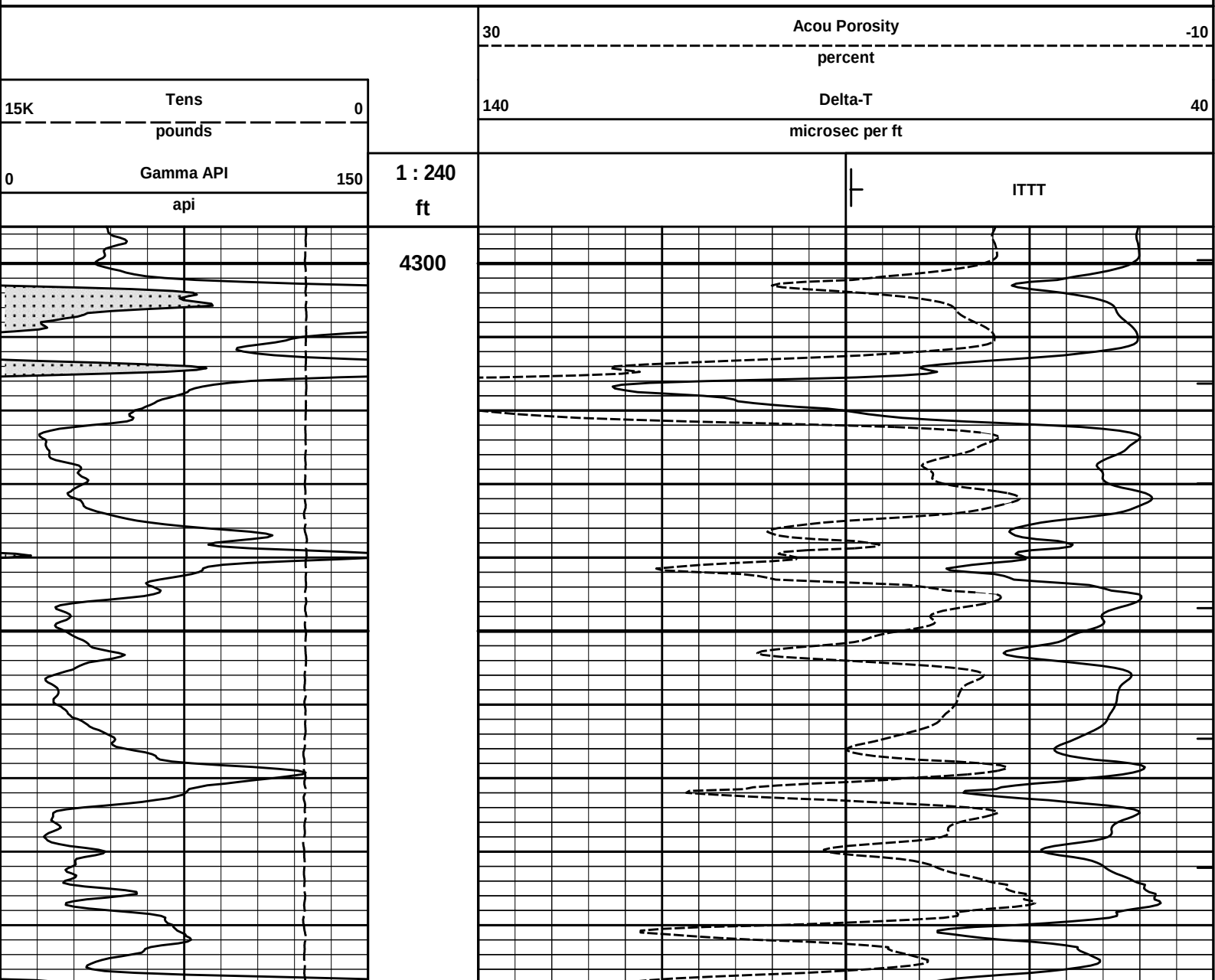
MAIN LOG SECTION

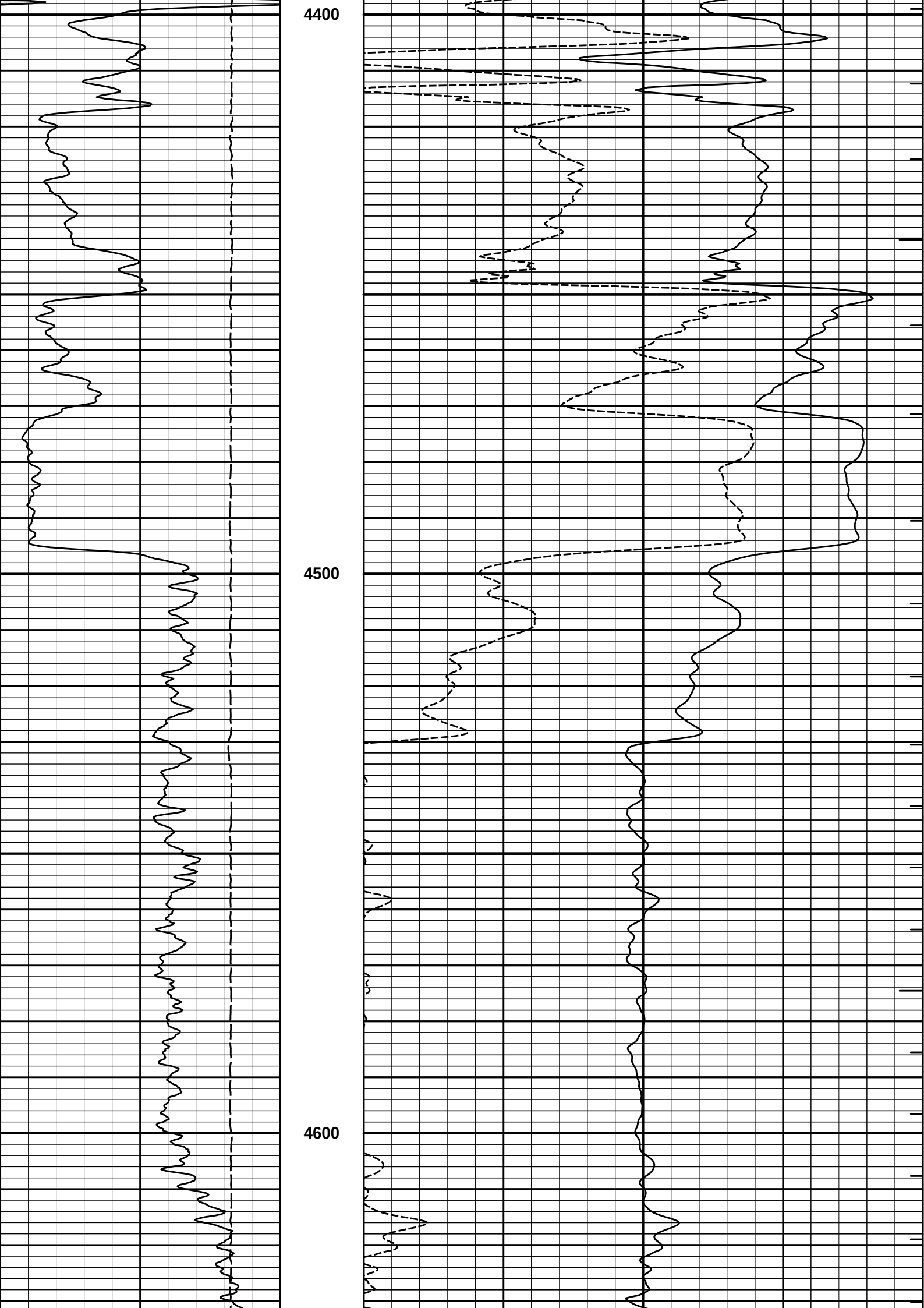
HALLIBURTON

Plot Time: 19-Oct-17 07:13:25
Plot Range: 4295 ft to 4736.25 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 REPEAT\
Plot File: \\BSAT\BSAT_5inch

5 INCH REPEAT LOG

REPEAT LOG SECTION

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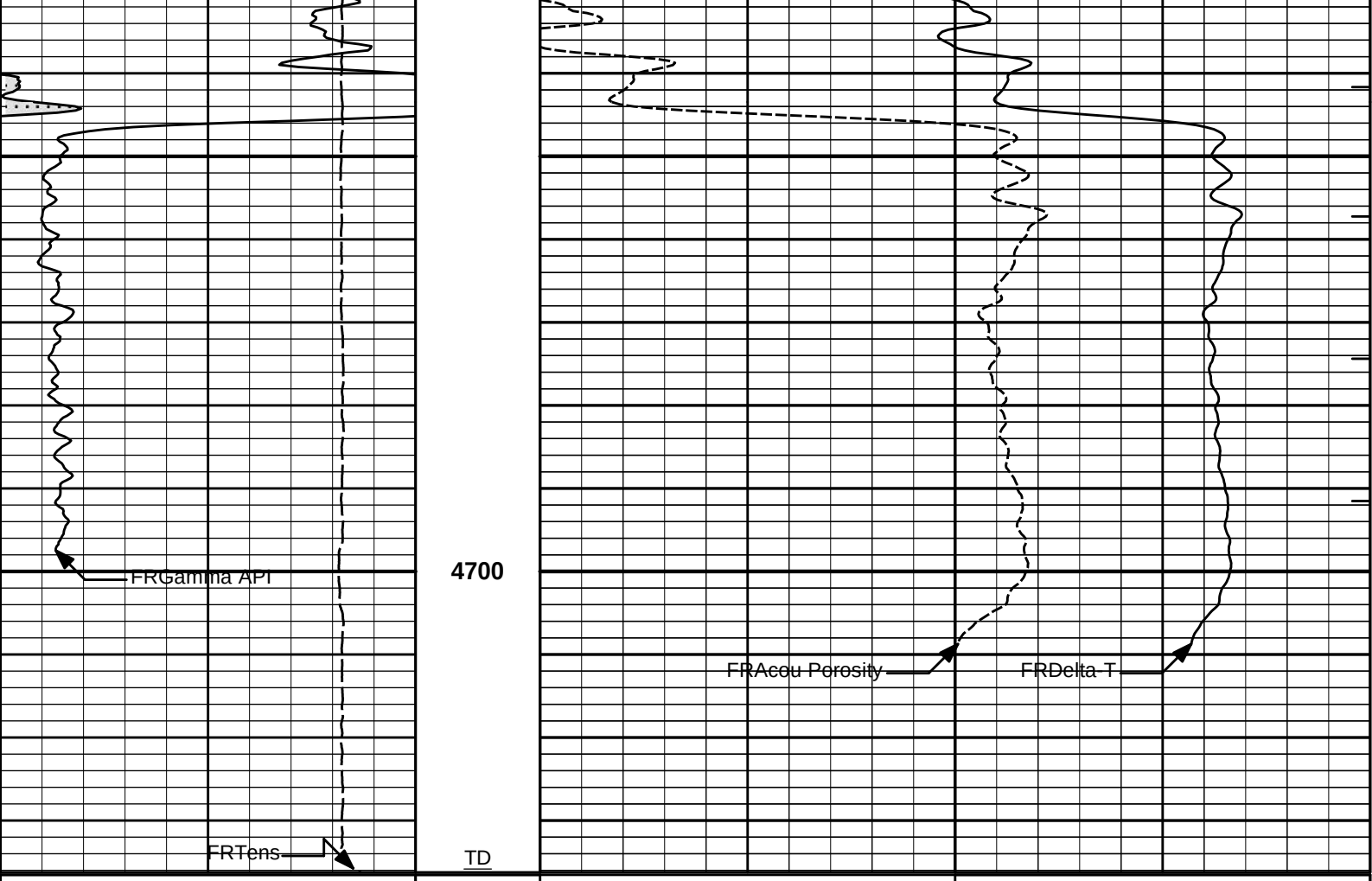


HALLIBURTON

Plot Time: 19-Oct-17 07:13:26
Plot Range: 4295 ft to 4736.25 ft
Data: CMX_BLACK WIDOW\Well Based\RUN 2 REPEAT
Plot File: \\BSAT\BSAT_5inch

5 INCH REPEAT LOG

REPEAT LOG SECTION

HALLIBURTON

PARAMETERS REPORT

Depth (ft)	Tool Name	Mnemonic	Description	Value	Units
TOP					
	SHARED	BS	Bit Size	7.875	in
	SHARED	UBS	Use Bit Size instead of Caliper for all applications.	No	
	SHARED	MDBS	Mud Base	Water	

SHARED	MDWT	Borehole Fluid Weight	8.500	ppg
SHARED	WAGT	Weighting Agent	Natural	
SHARED	BSAL	Borehole salinity	0.00	ppm
SHARED	FSAL	Formation Salinity NaCl	0.00	ppm
SHARED	KPCT	Percent K in Mud by Weight?	0.00	%
SHARED	RMUD	Mud Resistivity	0.800	ohmm
SHARED	TRM	Temperature of Mud	75.0	degF
SHARED	CSD	Logging Interval is Cased?	No	
SHARED	ICOD	AHV Casing OD	5.500	in
SHARED	CSTR	Compressive Strength	1000.00	psia
SHARED	ST	Surface Temperature	75.0	degF
SHARED	TD	Total Well Depth	4745.00	ft
SHARED	BHT	Bottom Hole Temperature	130.0	degF
SHARED	SVTM	Navigation and Survey Master Tool	NONE	
SHARED	AZTM	High Res Z Accelerometer Master Tool	GTET	
SHARED	TEMM	CBM Temperature Master Tool	GTET	
Rwa / CrossPlot	XPOK	Process Crossplot?	Yes	
Rwa / CrossPlot	FCHO	Select Source of F	Density	
Rwa / CrossPlot	AFAC	Archie A factor	0.6200	
Rwa / CrossPlot	MFAC	Archie M factor	2.1500	
Rwa / CrossPlot	RMFR	Rmf Reference	0.10	ohmm
Rwa / CrossPlot	TMFR	Rmf Ref Temp	75.00	degF
Rwa / CrossPlot	RWA	Resistivity of Formation Water	0.05	ohmm
Rwa / CrossPlot	ADP	Use Air Porosity to calculate CrossplotPhi	No	
Rwa / CrossPlot	BHSM	Borehole Size Source Tool	Bit Size	
Rwa / CrossPlot	ROIN	Input for RO Calculation	Rwa	
GTET	GROK	Process Gamma Ray?	Yes	
GTET	GEOK	Process Gamma Ray EVR?	No	
GTET	TPOS	Tool Position for Gamma Ray Tools.	Centered	
GTET	BHSM	Borehole Size Source Tool	Bit Size	
BSAT	MBOK	Compute BCAS Results?	Yes	
BSAT	FLLO	Frequency Filter Low Pass Value?	5000	Hz
BSAT	FLHI	Frequency Filter High Pass Value?	27000	Hz
BSAT	DTFL	Delta -T Pore Fluid	189.00	uspf
BSAT	DTMT	Delta -T Matrix Type	User define	
BSAT	DTMA	Delta -T Matrix	47.60	uspf
BSAT	DTSH	Delta -T Shale	100.00	uspf
BSAT	SPEQ	Acoustic Porosity Equation	Wylie	
ACRt Sonde	RTOK	Process ACRt?	Yes	
ACRt Sonde	MNSO	Minimum Tool Standoff	1.19	in
ACRt Sonde	TCS1	Temperature Correction Source	FP Lwr & FP Upr	
ACRt Sonde	TPOS	Tool Position	Centered	
ACRt Sonde	RMOP	Rmud Source	Mud Cell	
ACRt Sonde	RMIN	Minimum Resistivity for MAP	0.20	ohmm
ACRt Sonde	RMAX	Maximum Resistivity for MAP	200.00	ohmm
ACRt Sonde	THQY	Threshold Quality	0.50	
ACRt Sonde	MRFX	Fixed mud resistivity	2000	ohmm
ACRt Sonde	BHSM	Borehole Size Source Tool	Bit Size	
ACRt Sonde	MBFL	Apply Corkscrew Effect?	No	

BOTTOM

HALLIBURTON

CALIBRATION REPORT

NATURAL GAMMA RAY TOOL SHOP CALIBRATION

Tool Name:	**GTET - 11021139**	**Reference Calibration Date:**	**23-Sep-17 12:22:06**
Engineer:	**WHITLOCK**	**Calibration Date:**	**06-Oct-17 11:06:34**
Software Version:	**WL INSITE R5.0.5 (Build 8)**	**Calibration Version:**	**1**

Calibrator Source S/N: TB79

Calibrator API Reference:222.00 api

Equivalent Calibrator API Reference:225.9 api

Measurement	Measured	Calibrated	Units
Background	25.7	25.8	api
Background + Calibrator	250.7	251.7	api
Calibrator	225.0	225.9	api

NATURAL GAMMA RAY TOOL FIELD CALIBRATION

Tool Name:	**GTET - 11021139**	**Reference Calibration Date:**	**06-Oct-17 11:06:34**
Engineer:	**WHITLOCK**	**Calibration Date:**	**06-Oct-17 11:10:24**
Software Version:	**WL INSITE R5.0.5 (Build 8)**	**Calibration Version:**	**1**

Calibrator Source S/N: TB79

Calibrator API Reference:222.00 api

Equivalent Calibrator API Reference:225.9 api

Field Verification	Shop	Field	Units
Background	25.8	24.9	api
Background + Calibrator	251.7	254.1	api
Calibrator	225.9	229.3	api

Shop	Field	Difference	Tolerance
225.9	229.3	-3.4	+/- 9.00

ARRAY COMPENSATED TRUE RESISTIVITY SHOP CALIBRATION

Tool Name:	**ACRt Sonde - 11038385**	**Reference Calibration Date:**	**12-Sep-17 13:48:00**
Engineer:	**JORGE ORLANDO PEREZ**	**Calibration Date:**	**12-Sep-17 13:58:19**
Software Version:	**WL INSITE R5.0.5 (Build 8)**	**Calibration Version:**	**1**
Host Tool Name:	**ACRt Instrument - 11055059**		

TYPICAL GAIN RANGE

Subarray	R12KHz			R36KHz			R72KHz		
	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper
A1 (80")	0.95	1.0395	1.05	0.95	1.0229	1.05	0.95	1.0146	1.05
A2 (50")	0.95	1.0409	1.05	0.95	1.0225	1.05	0.95	1.0165	1.05
A3 (29")	0.95	1.0384	1.05	0.95	1.0194	1.05	0.95	1.0115	1.05
A4 (17")	0.95	1.0343	1.05	0.95	1.0133	1.05	0.95	1.0069	1.05
A5 (10")	N/A	N/A	N/A	0.95	1.0083	1.05	0.95	0.9989	1.05
A6 (6")	N/A	N/A	N/A	0.95	1.0000	1.05	0.95	0.9929	1.05

SONDE OFFSET

Subarray	R12KHz	R36KHz	R72KHz
	(mmho/m)	(mmho/m)	(mmho/m)
A1 (80")	0.702	-4.637	-5.501
A2 (50")	-0.771	-4.034	-5.172
A3 (29")	-13.230	-3.699	-3.350
A4 (17")	-110.240	-33.969	-26.356

A5 (10")	N/A	-83.665	-41.621
A6 (6")	N/A	333.771	173.557

TRANSMITTER CURRENT GAIN

Signal	Lower	R	Upper
12K	0.6	0.90	1.3
36K	1.0	1.36	2.0
72K	1.0	1.62	2.0

R-MUD VERIFICATION

Signal	Lower (ohm-m)	Measured (ohm-m)	Upper (ohm-m)
Mud Cell	0.95	1.00	1.05

PASS/FAIL SUMMARY

GAIN RANGE CHK	PASS
SONDE OFFSET CHK	PASS

TOOL OK TO LOG

CALIBRATION SUMMARY

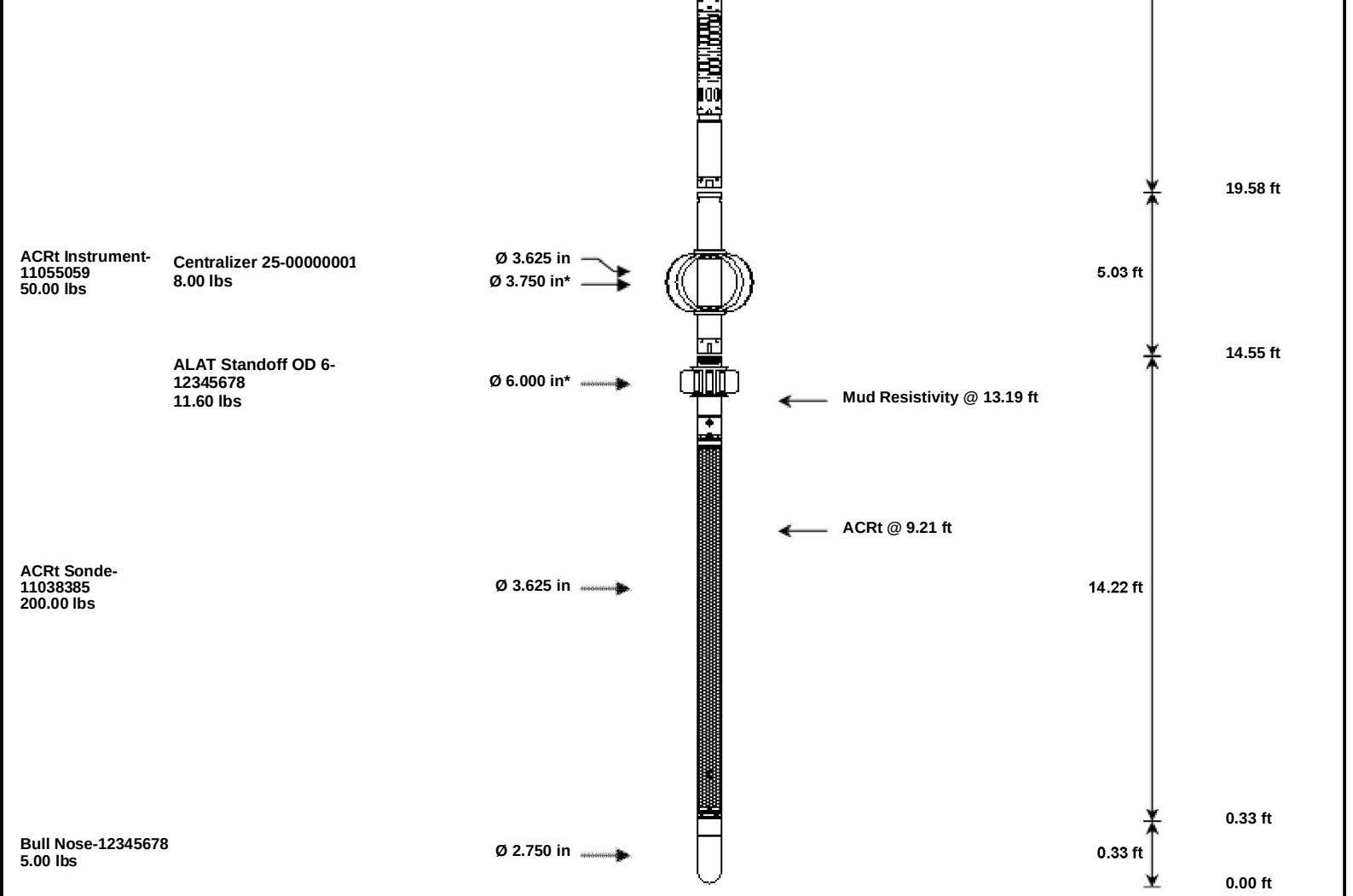
Sensor	Shop	Field	Post	Difference	Tolerance	Units
GTET-11021139						
Gamma Ray Calibrator	225.9	229.3	----------	-3.4	+/- 9.00	api
ACRt Sonde-11038385						
Mud Cell	1.00	----------	----------	0	----------	ohm-m

Data: CMX_BLACK WIDOW\0002 GTET-BSAT-ACRT\IDLE **Date: 19-Oct-17 04:39:26**

HALLIBURTON

TOOL STRING DIAGRAM REPORT

Description	Overbody Description	O.D.	Diagram	Sensors @ Delays	Length	Accumulated Length
				Temperature @ 50.57 ft		50.82 ft
CH_HOS_I 37.50 lbs		Ø 2.750 in			2.25 ft	
		Ø 2.750 in				48.57 ft
XOHD-11021555 20.00 lbs		Ø 3.625 in			0.95 ft	
						47.62 ft
SP Sub-10904995 60.00 lbs		Ø 3.625 in		SP @ 45.84 ft	3.74 ft	
				Z-Accelerometer @ 43.43 ft		43.88 ft
GTET-11021139 165.00 lbs		Ø 3.625 in			8.52 ft	
				GammaRay @ 37.82 ft		
						35.36 ft
	Centralizer 25-00000002 8.00 lbs	Ø 3.750 in*				
BSAT-10939049 300.00 lbs		Ø 3.625 in		Receiver Array @ 26.84 ft Sonic Receivers @ 26.84 ft	15.77 ft	



Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)		Accumulated Length (ft)	Max.Log. Speed (fpm)
CH_HOS	Hostile Cable Head with Load Cell	CH_HOS_I	37.50	2.25		48.57	300.00
XOHD	Hostile to Dits Cross Over	11021555	20.00	0.95		47.62	300.00
SP	SP Sub	10904995	60.00	3.74		43.88	300.00
GTET	Gamma Telemetry Tool	11021139	165.00	8.52		35.36	60.00
BSAT	Borehole Sonic Array Tool	10939049	300.00	15.77		19.58	60.00
OBCEN	Centralizer - 25 in. Overbody	00000002	8.00	2.08	*	32.44	300.00
ACRt	Array Compensated True Resistivity Instrument Section	11055059	50.00	5.03		14.55	120.00
OBCEN	Centralizer - 25 in. Overbody	00000001	8.00	2.08	*	15.70	300.00
ACRt	Array Compensated True Resistivity Sonde Section	11038385	200.00	14.22		0.33	120.00
ALATS	Array Laterolog Tool OD 6 Standoff	12345678	11.60	1.00	*	13.19	60.00
BLNS	Bull Nose	12345678	5.00	0.33		0.00	300.00
Total			**865.10**	**50.82**			

* Not included in Total Length and Length Accumulation.

Data: CMX_BLACK WIDOW\0002 GTET-BSAT-ACRT\IDLE **Date: 19-Oct-17 03:48:35**

COMPANY	**CMX, INC**		
WELL	**BLACK WIDOW OWWO 1-29**		
FIELD	**HARDING**		
COUNTY	**PRATT**	STATE	**KANSAS**

HALLIBURTON

BOREHOLE SONIC ARRAY LOG