



**Weatherford**

**COMPACT PHOTO DENSITY  
COMPENSATED NEUTRON  
MICRORESISTIVITY LOG**

COMPANY

SHAKESPEARE OIL CO., INC.

WELL

SCHOWALTER #1-7

FIELD

WILDCAT

PROVINCE/COUNTY

SCOTT

COUNTRY/STATE

U.S.A. / KANSAS

LOCATION

480' FNL & 2220' FWL

SEC 7

TWP 16S RGE 32W

Other Services  
MAI/MFE

Latitude

Longitude

MSS

API Number

15-171-21205

Permanent Datum GL, Elevation 3009 feet

Log Measured From KB, 11.00 feet above Permanent Datum

Drilling Measured From KB

Date

09-JUL-2017

Run Number

ONE

Service Order

4558-186803695

Depth Driller

4750.00 feet

Depth Logger

4757.00 feet

First Reading

4725.00 feet

Last Reading

3800.00 feet

Casing Driller

265.00 feet

Casing Logger

267.00 feet

Bit Size

7.875 inches

Hole Fluid Type

CHEMICAL

Density / Viscosity

9.30 lb/USg 54.00 CP

PH / Fluid Loss

10.50 8.80 ml/30Min

Sample Source

FLOWLINE

Rm @ Measured Temp

0.95 @ 75.0 ohm-m

Rmf @ Measured Temp

0.76 @ 75.0 ohm-m

Rmc @ Measured Temp

1.14 @ 75.0 ohm-m

Source Rmf / Rmc

CALC CALC

Rm @ BHT

0.59 @120.0 ohm-m

Time Since Circulation

5 HOURS

Max Recorded Temp

120.00 deg F

Equipment / Base

14249 LIB

Recorded By

ADAM SILL

Witnessed By

TIM PRIEST

Elevations:  
KB 3020.00 feet  
DF 3018.00 feet  
GL 3009.00 feet

**BOREHOLE RECORD**

Last Edited: 09-JUL-2017 16:19

Bit Size inches	Depth From feet	Depth To feet
7.875	253.00	4750.00

**CASING RECORD**

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	253.00	24.00

**REMARKS**

- SOFTWARE ISSUE: 17.01.7206.
- RUN ONE: MCG, MML, MDN, MPD, MFE, MSS, MAI RUN IN COMBINATION.
  - HARDWARE: DUAL BOWSPRING USED ON MDN.
  - 0.5 INCH STANDOFF USED ON MFE.
  - TWO 0.5 INCH STANDOFFS USED ON MSS.
  - 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 1703 CU.FT.
- ANNULAR HOLE VOLUME WITH 4.5 INCH PRODUCTION CASING FROM TD TO 3800 FEET: 219 CU.FT.

- RIG: DUKE #5.

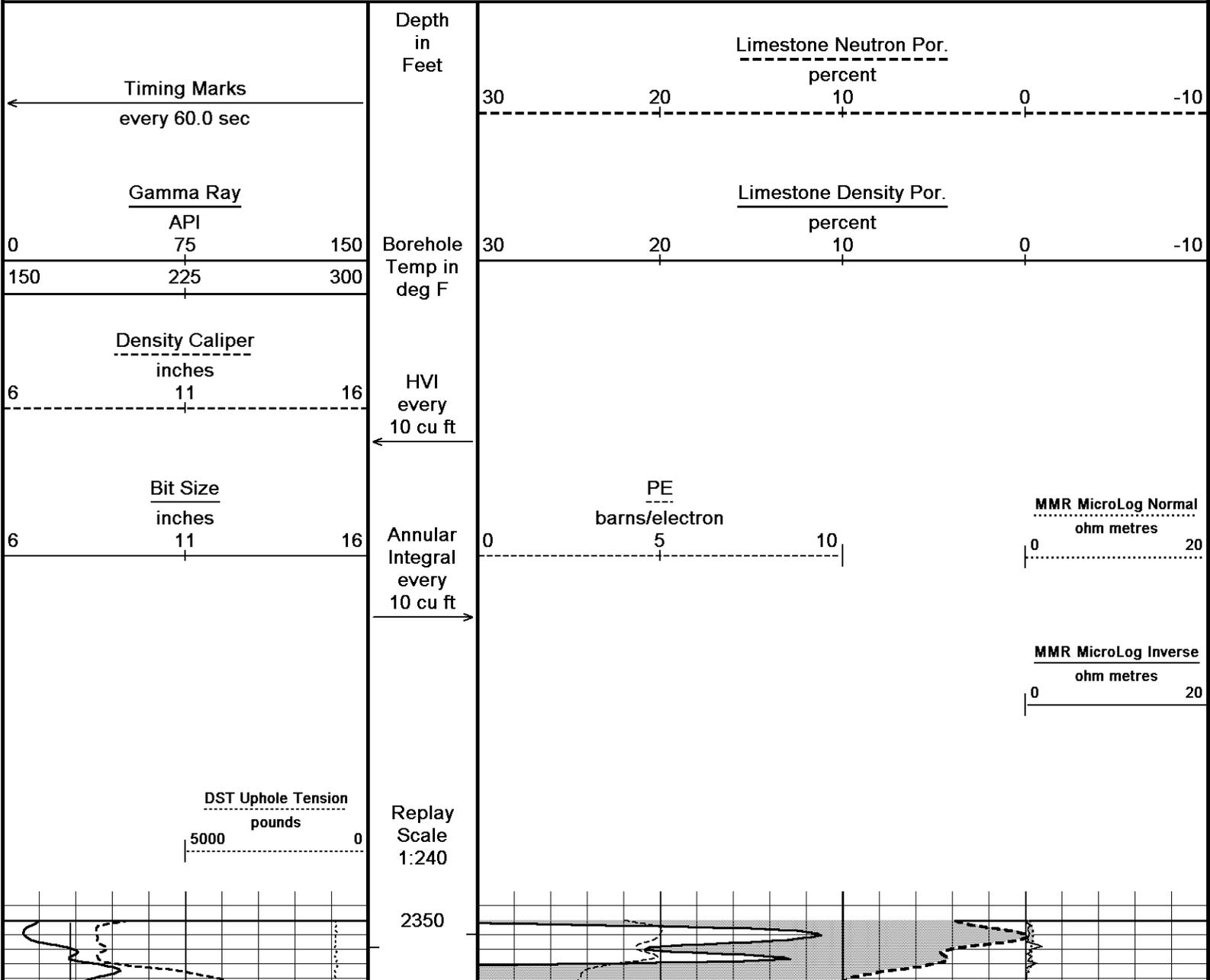
- ENGINEER: A. SILL.

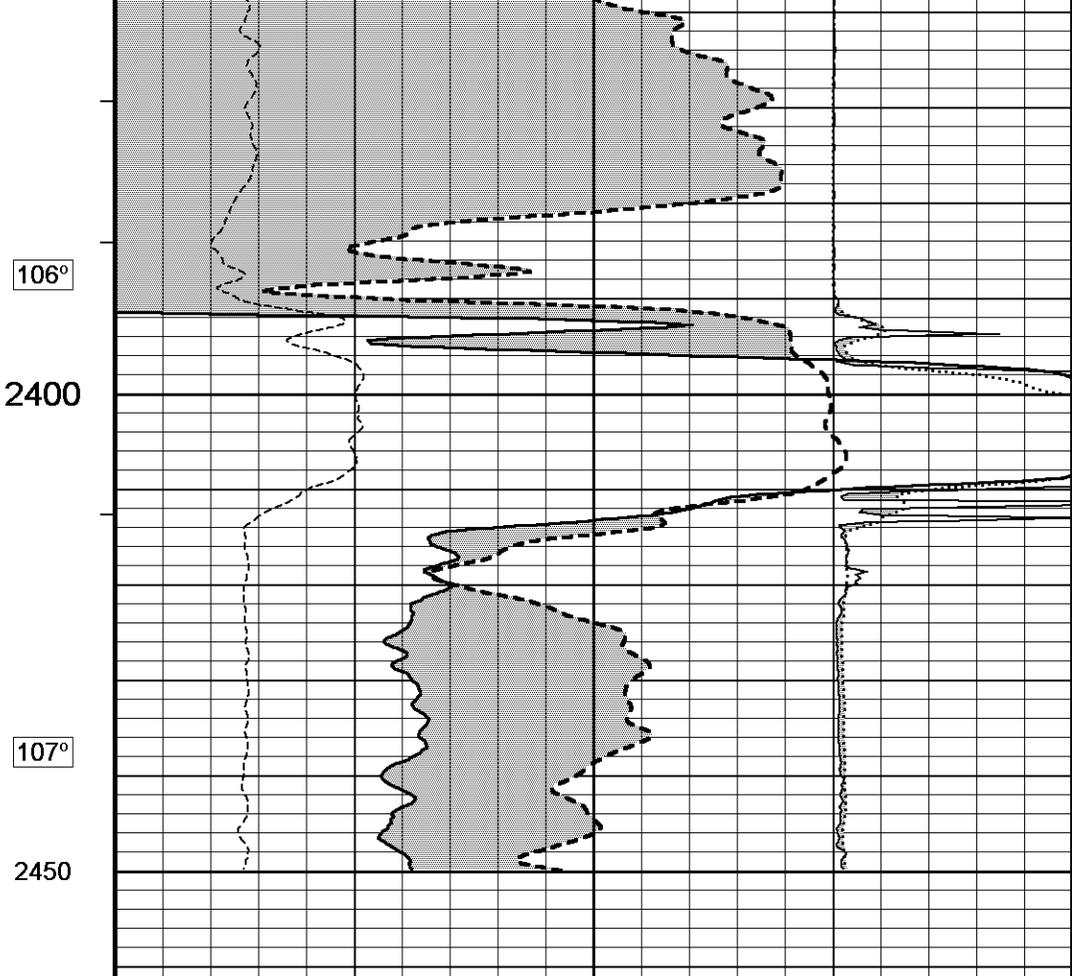
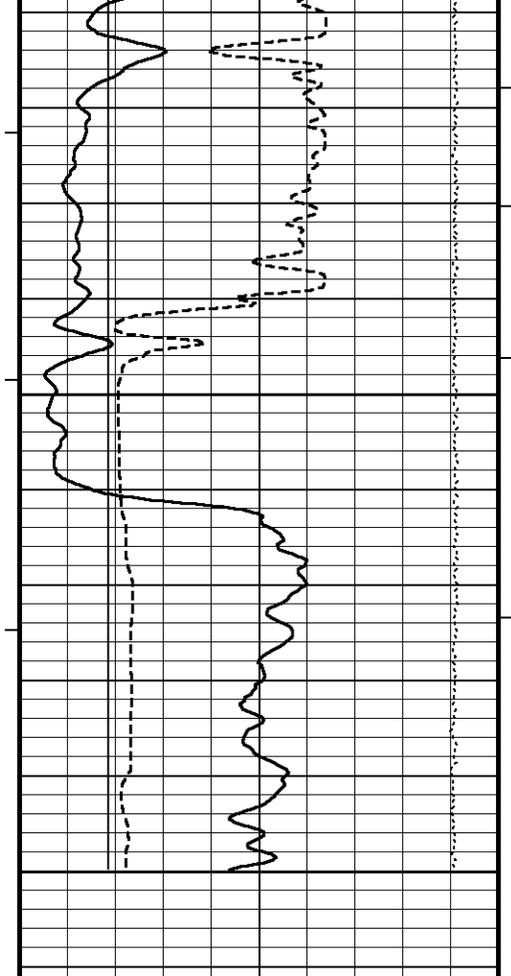
- OPERATOR: B. TOVAR.

In interpreting, communicating or providing information and/or making recommendations, either written or oral, as to logs or test or other data, type or amount of material, or Work or other service to be furnished, or manner of performance, or in predicting results to be obtained, the Contractor will give the Company the benefit of the Contractor's best judgment based on its experience and will perform all such Work in a good and workmanlike manner. Any interpretation of test or other data, and any recommendation or reservoir description based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions, which inferences and assumptions are not infallible, and with respect to which professional engineers and analysts may differ. ACCORDINGLY ANY INTERPRETATION OR RECOMMENDATION RESULTING FROM THE SERVICES WILL BE AT THE SOLE RISK OF THE COMPANY, AND THE CONTRACTOR CANNOT AND DOES NOT WARRANT THE ACCURACY, CORRECTNESS OR COMPLETENESS OF ANY SUCH INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.

**5 INCH MAIN - ANHYDRITE**

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_002.dta Recorded on 09-JUL-2017 18:52  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206





Depth  
in  
Feet

Timing Marks  
every 60.0 sec

Gamma Ray  
API  
0 75 150  
150 225 300

Density Caliper  
inches  
6 11 16

Bit Size  
inches  
6 11 16

Borehole  
Temp in  
deg F

HVI  
every  
10 cu ft

Annular  
Integral  
every  
10 cu ft

DST Uphole Tension  
pounds  
5000 0

Replay  
Scale  
1:240

Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 09-JUL-2017 21:58

Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_002.dta

Recorded on 09-JUL-2017 18:52

System Versions: Logged with 17.01.7206 Plotted with 17.01.7206



### 5 INCH MAIN - ANHYDRITE



### 5 INCH MAIN - LIMESTONE



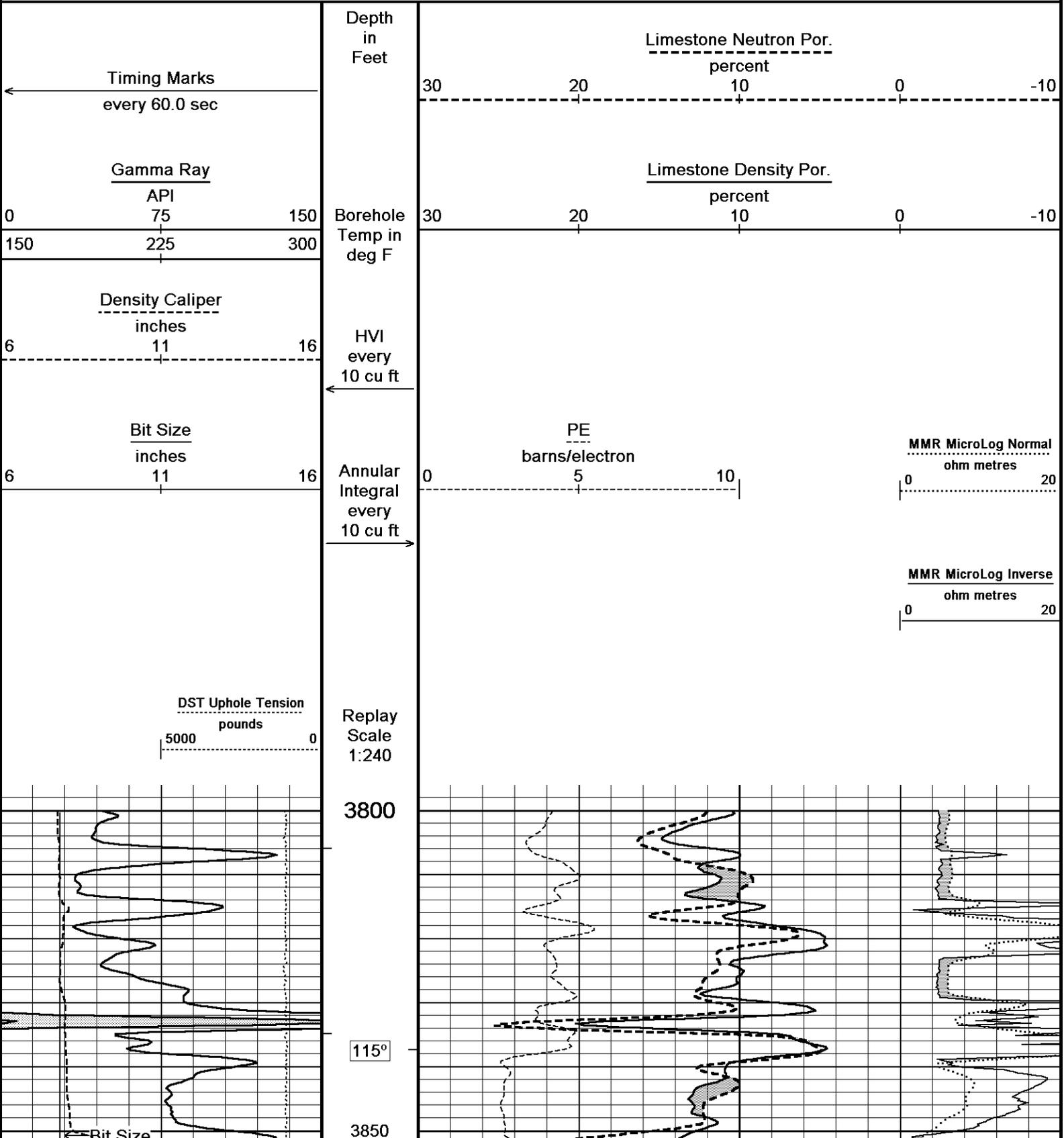
Depth Based Data - Maximum Sampling Increment 10.0cm

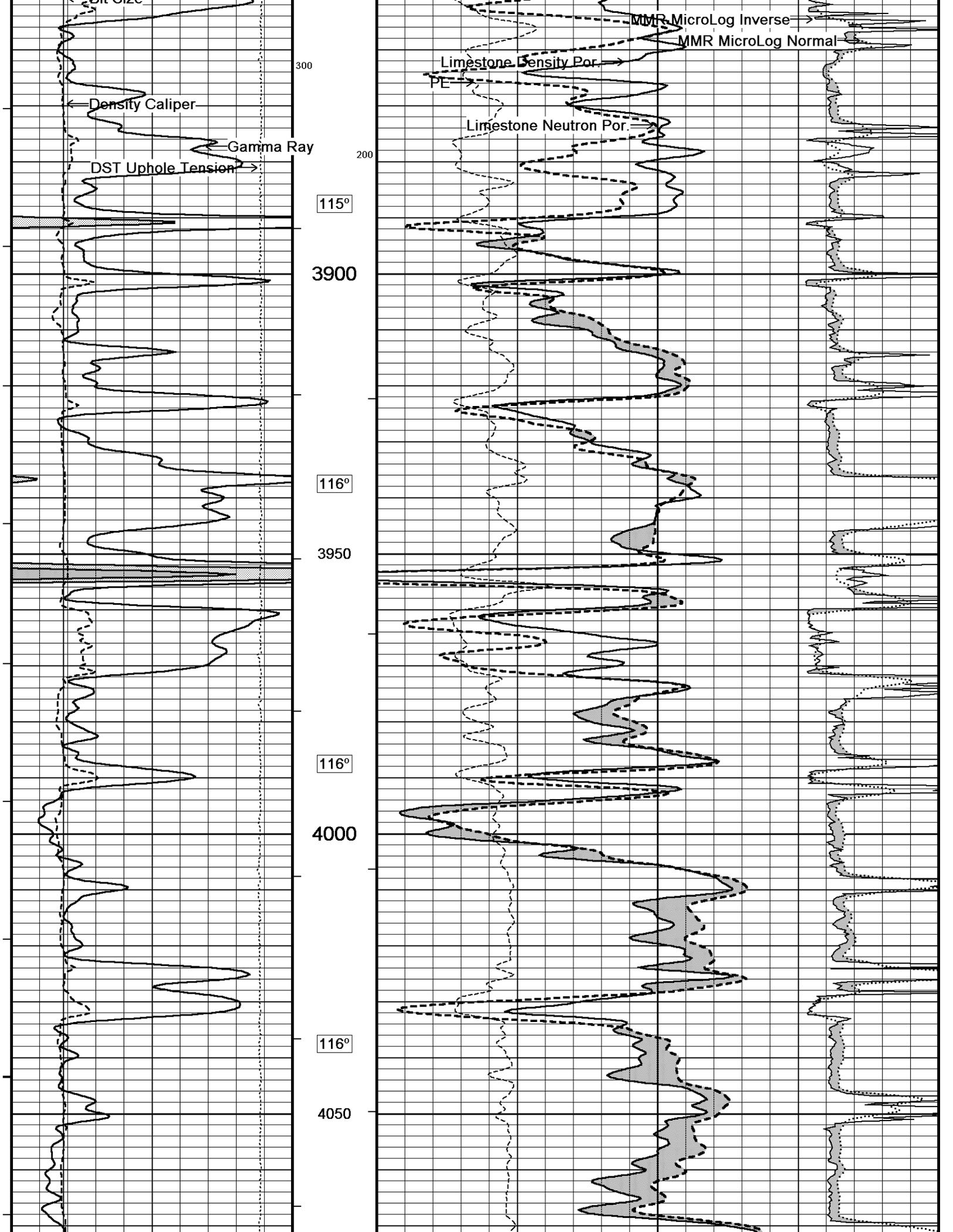
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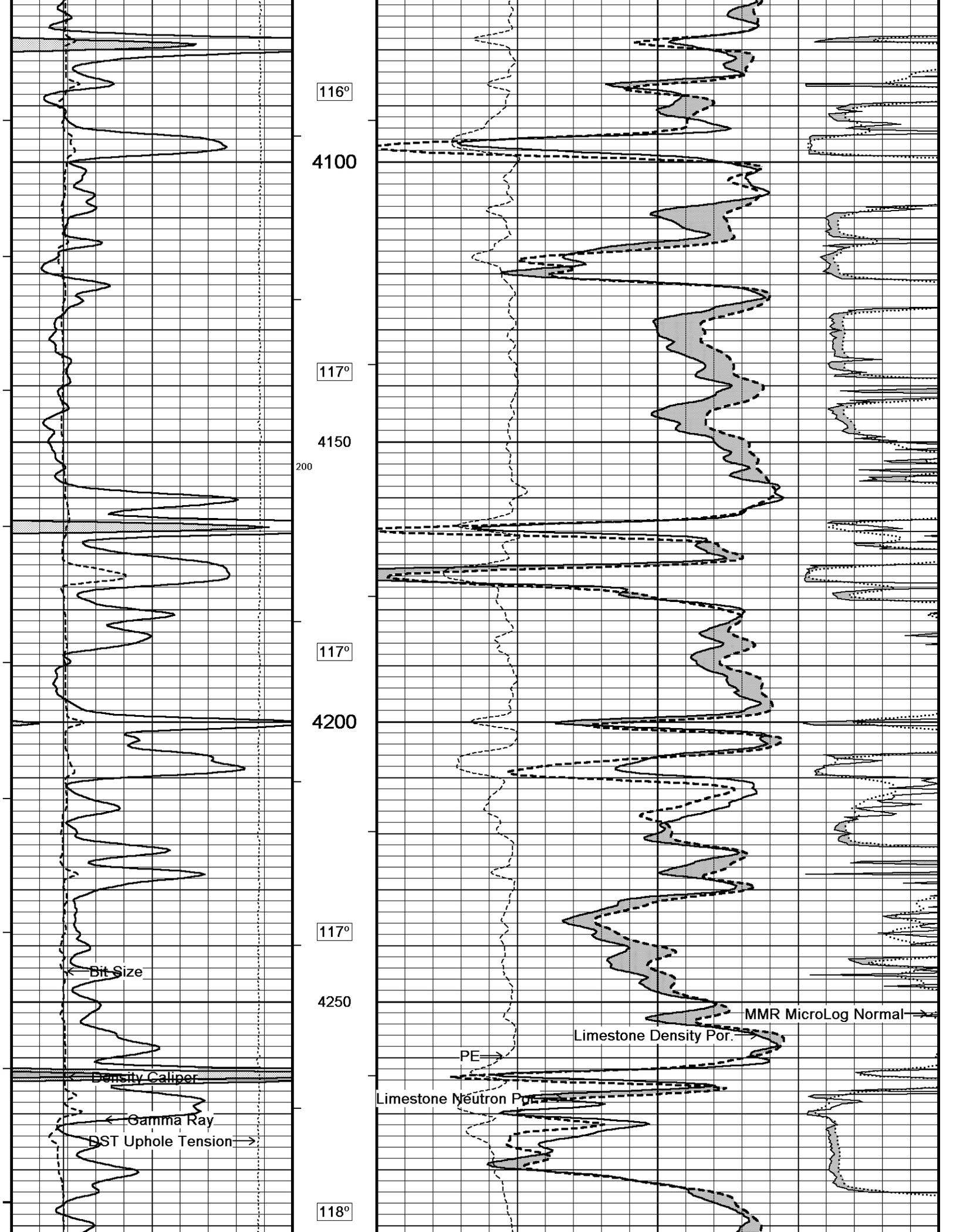
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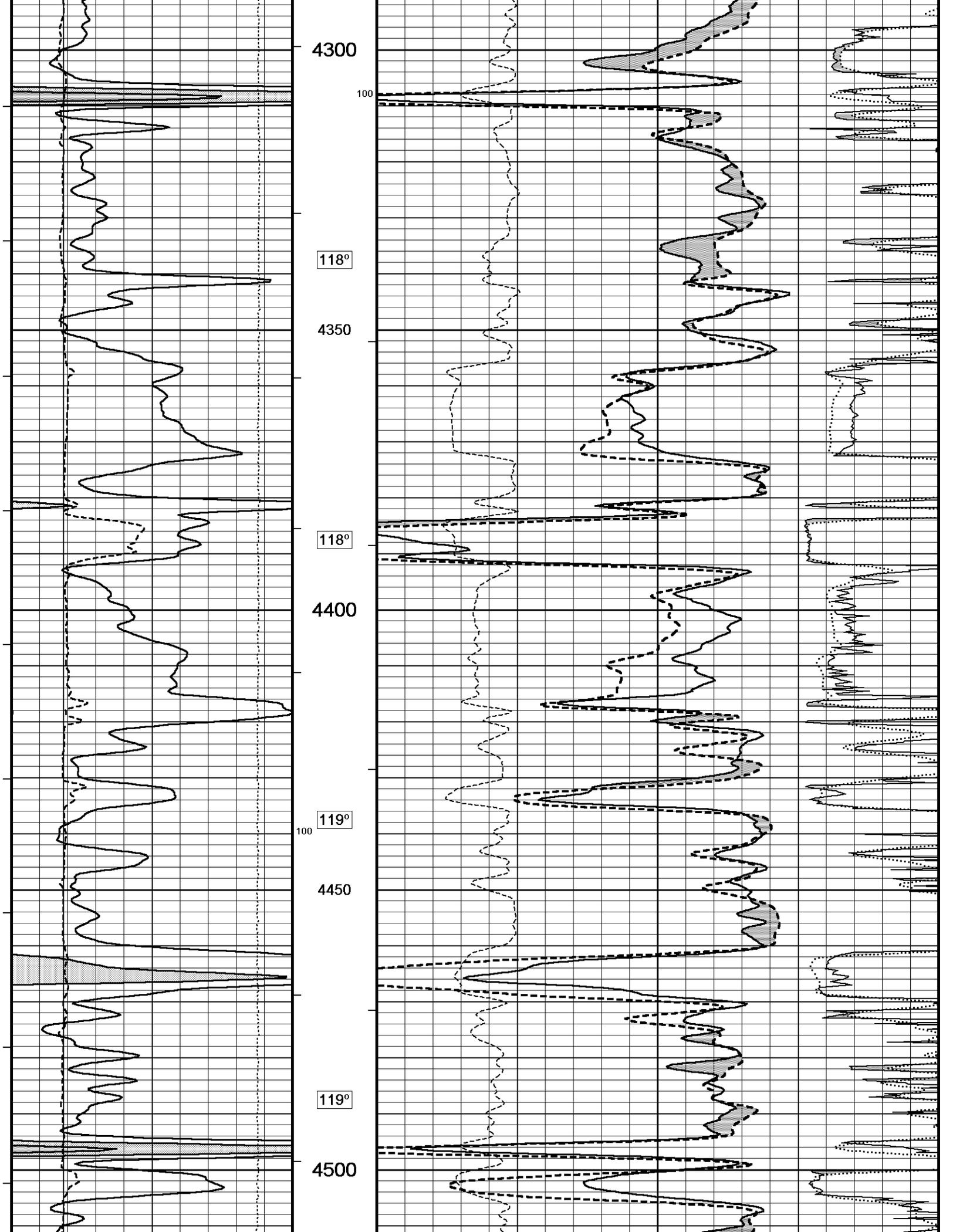
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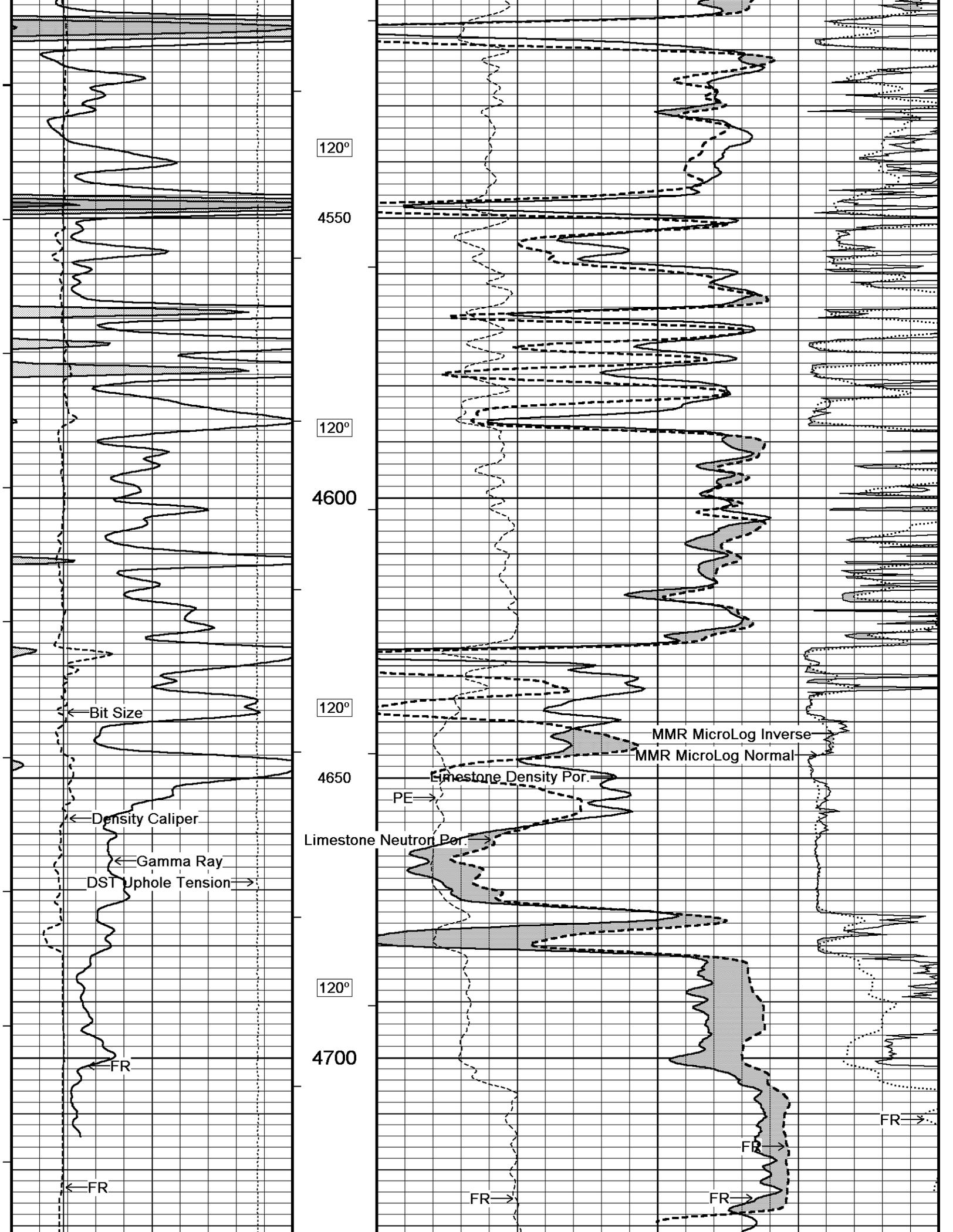
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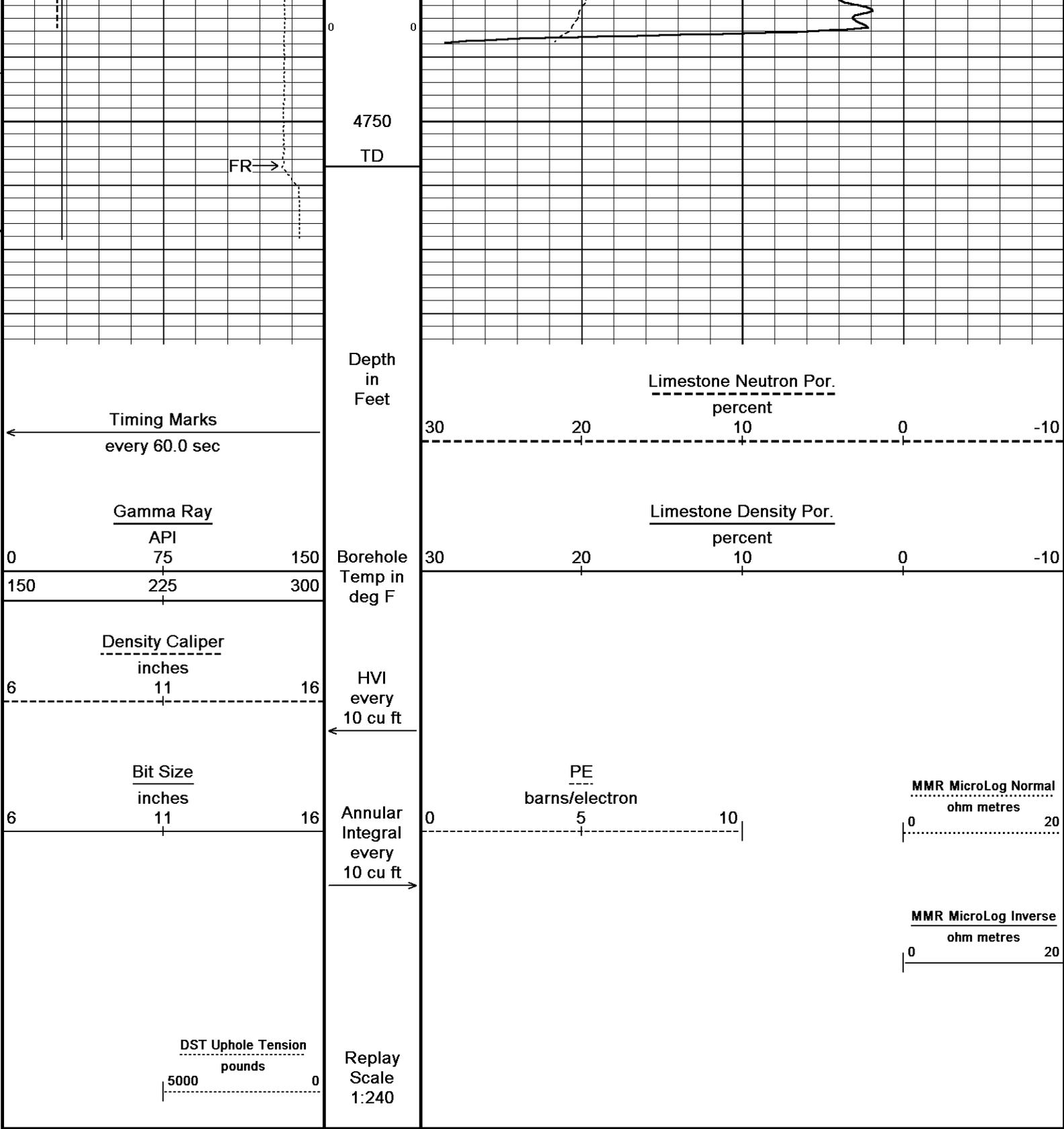










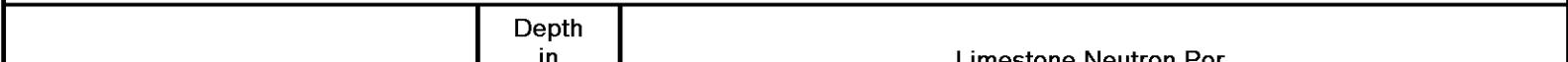


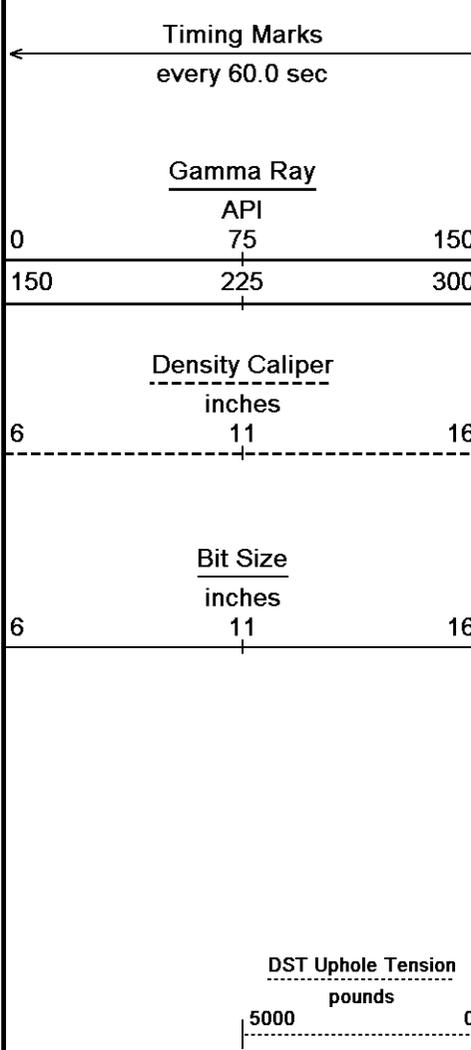
Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_002.dta Recorded on 09-JUL-2017 18:52  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206

↑ 5 INCH MAIN - LIMESTONE ↑

↓ REPEAT SECTION ↓

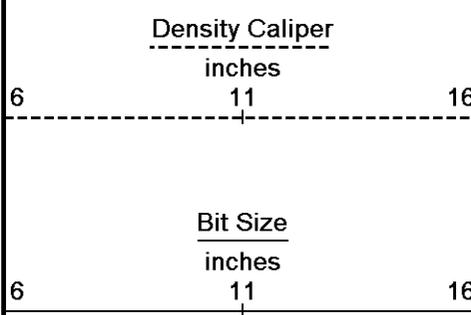
Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_001.dta Recorded on 09-JUL-2017 18:18  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206





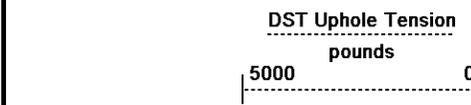
Feet

Borehole  
Temp in  
deg F

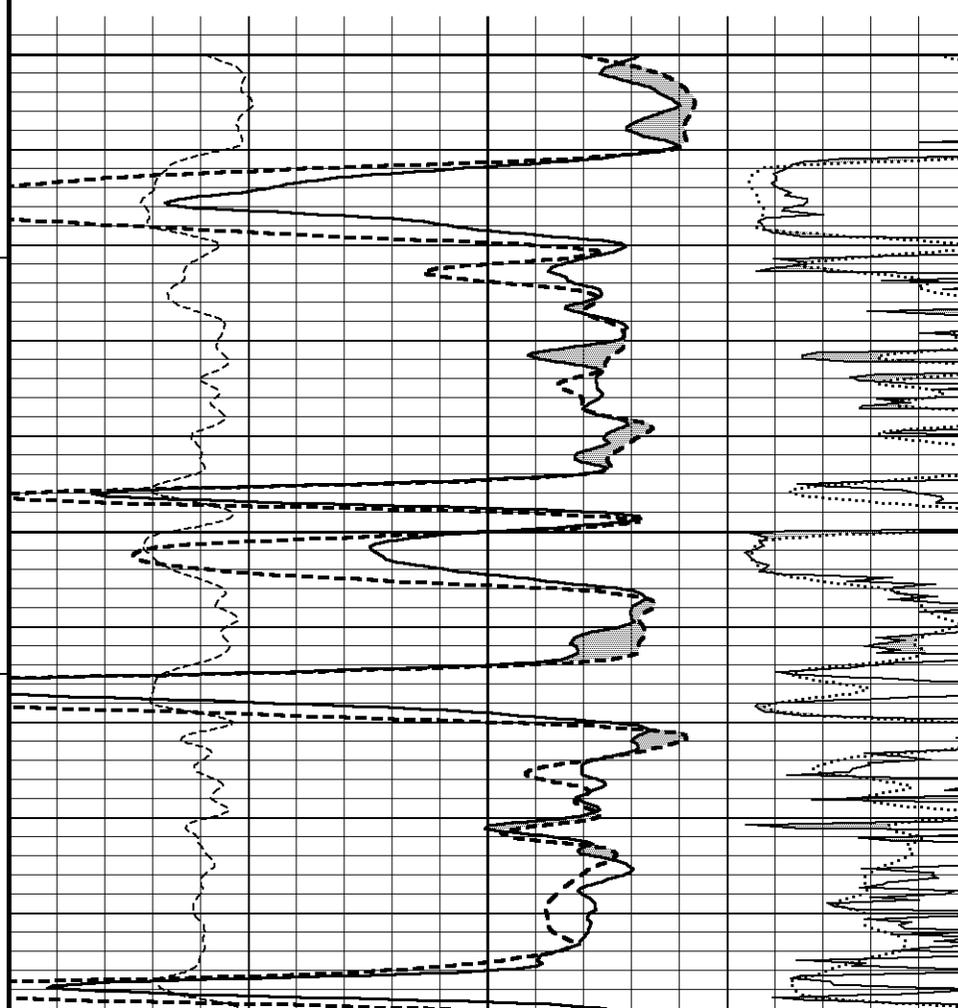
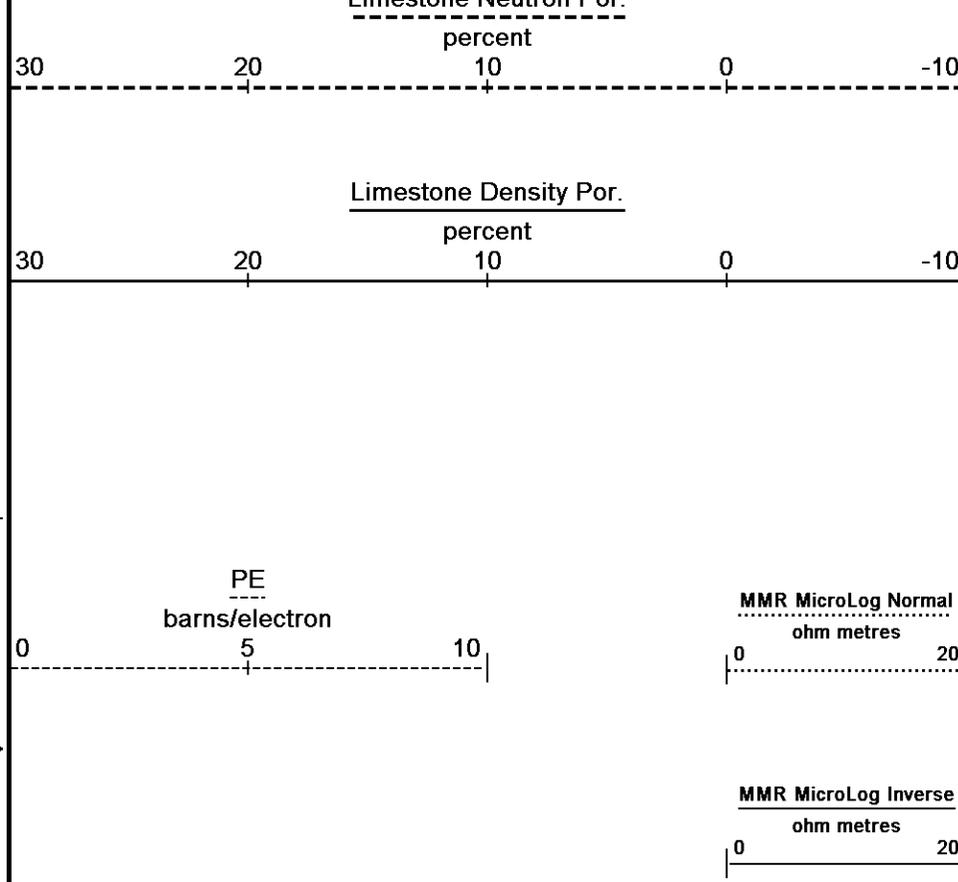
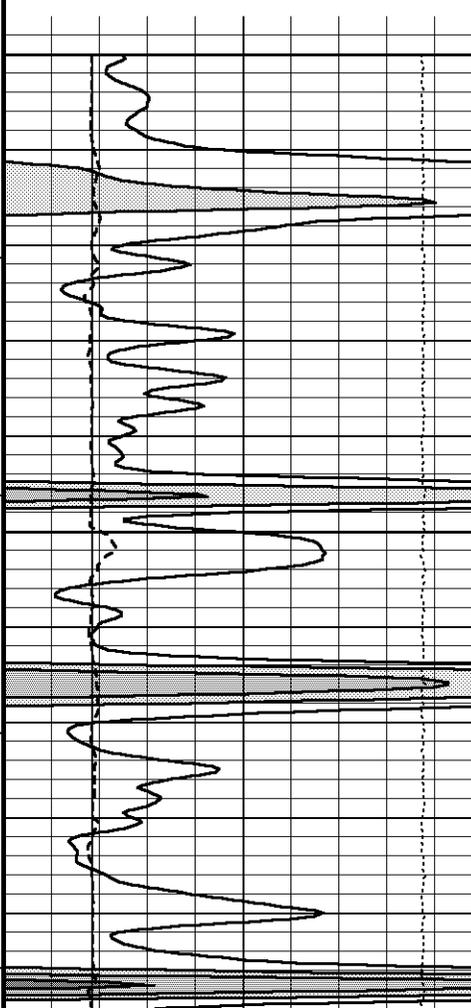


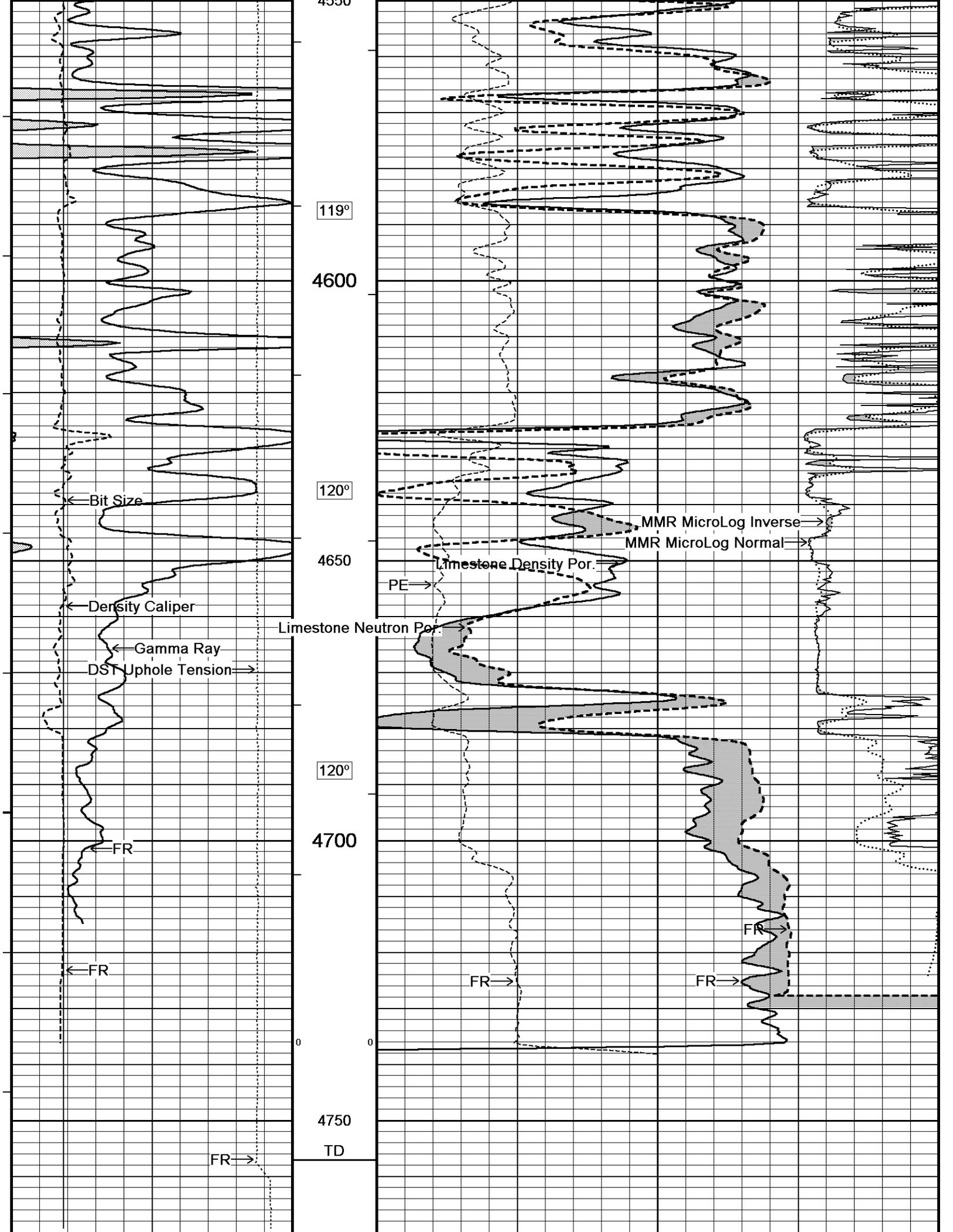
HVI  
every  
10 cu ft

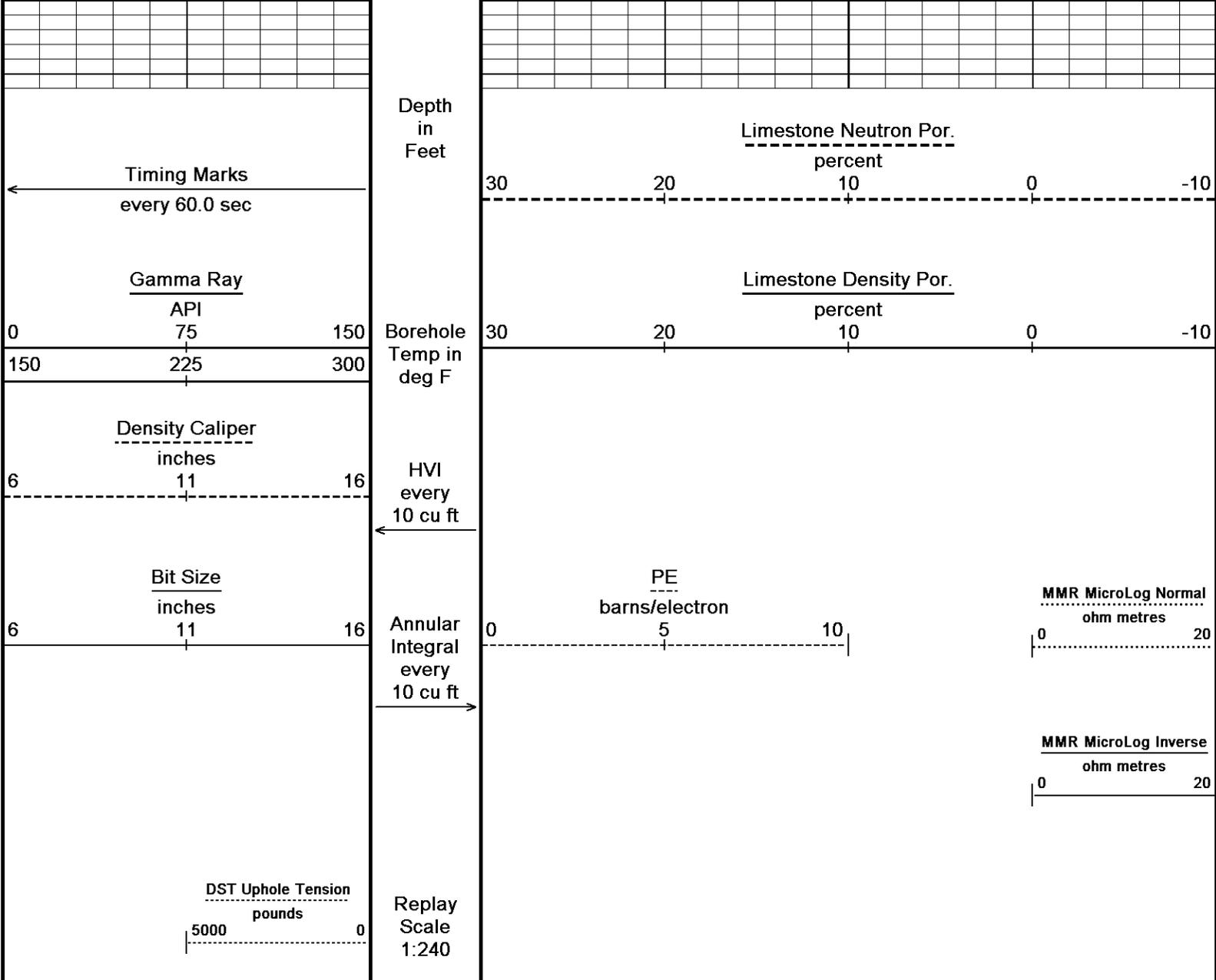
Annular  
Integral  
every  
10 cu ft



Replay  
Scale  
1:240





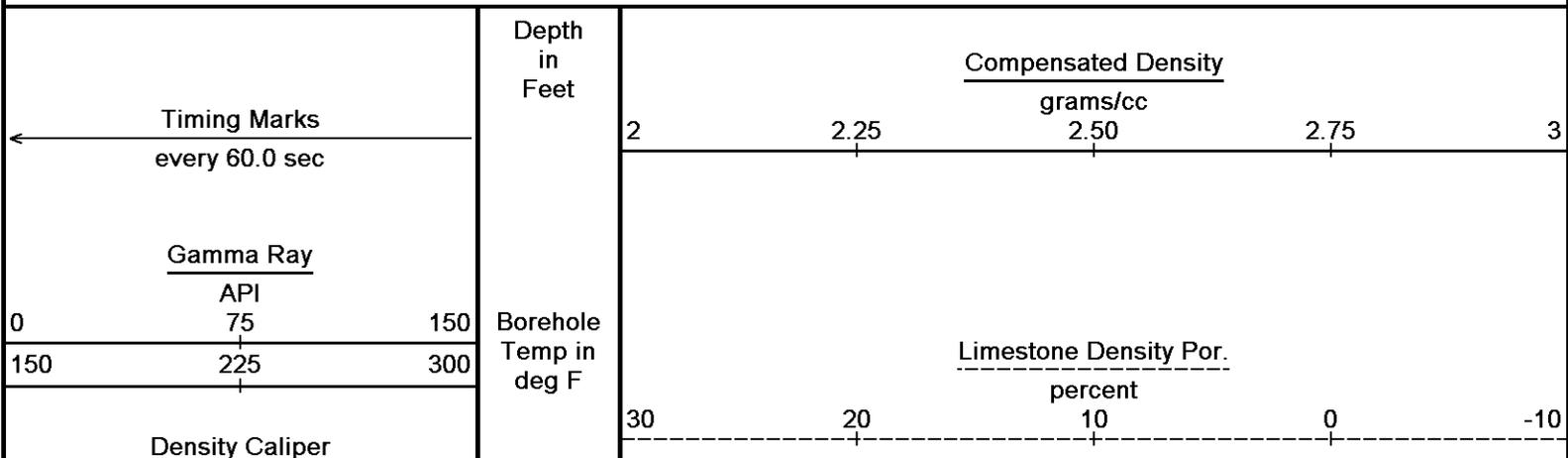


Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_001.dta Recorded on 09-JUL-2017 18:18  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206

↑ REPEAT SECTION ↑

↓ 5 INCH MAIN - BULK DENSITY ↓

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_002.dta Recorded on 09-JUL-2017 18:52  
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inches  
6 11 16

Bit Size  
inches  
6 11 16

HVI  
every  
10 cu ft

Annular  
Integral  
every  
10 cu ft

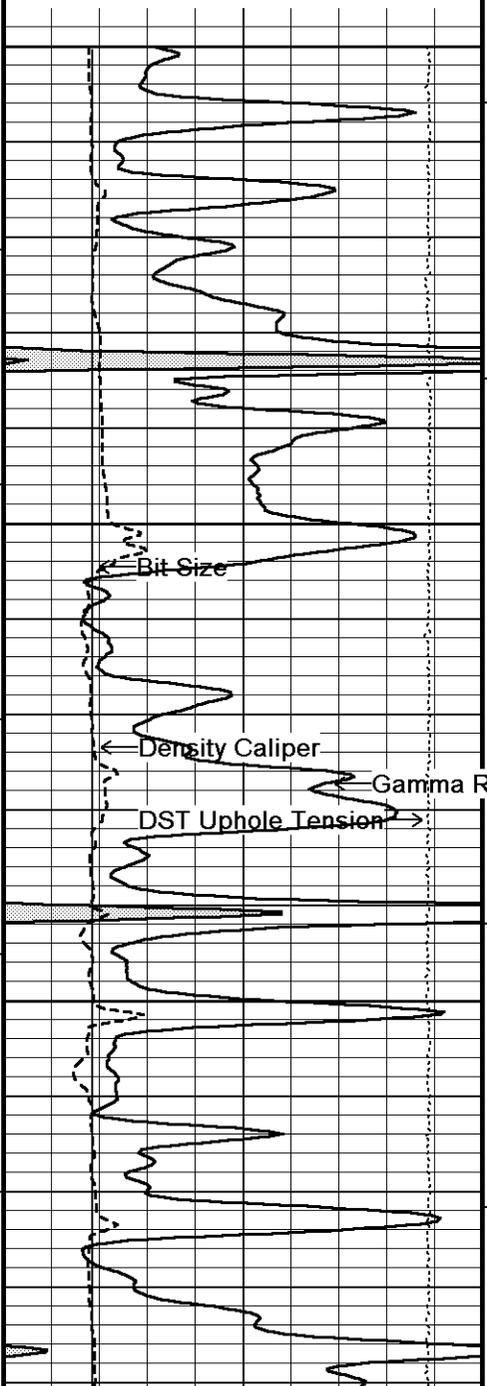
DST Uphole Tension  
pounds  
5000 0

Replay  
Scale  
1:240

PE  
barns/electron

Density Correction  
grams/cc

0 5 10 -0.50 0 0.50



3800

115°

3850

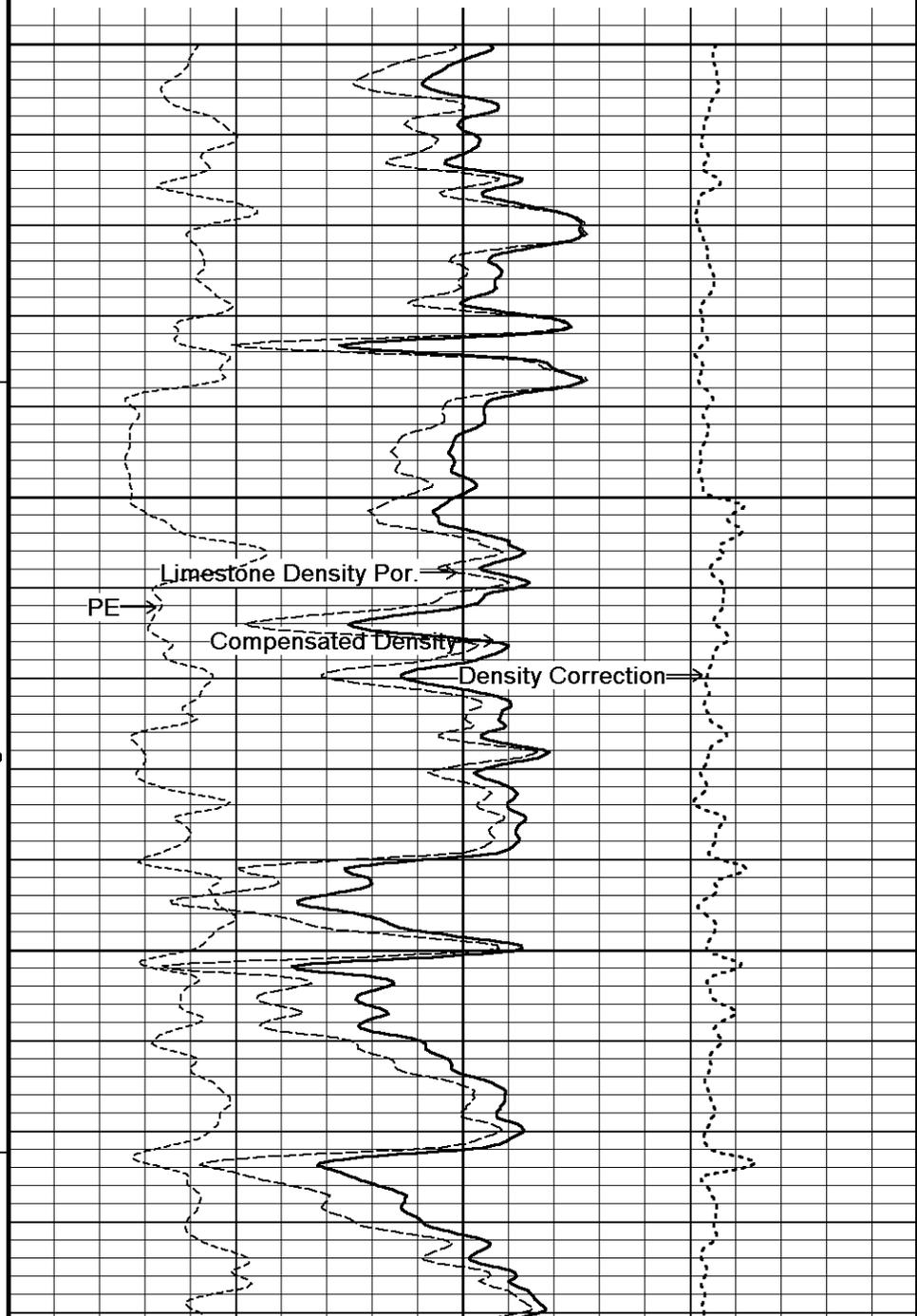
300

200

115°

3900

116°



Bit Size

Density Caliper

Gamma Ray

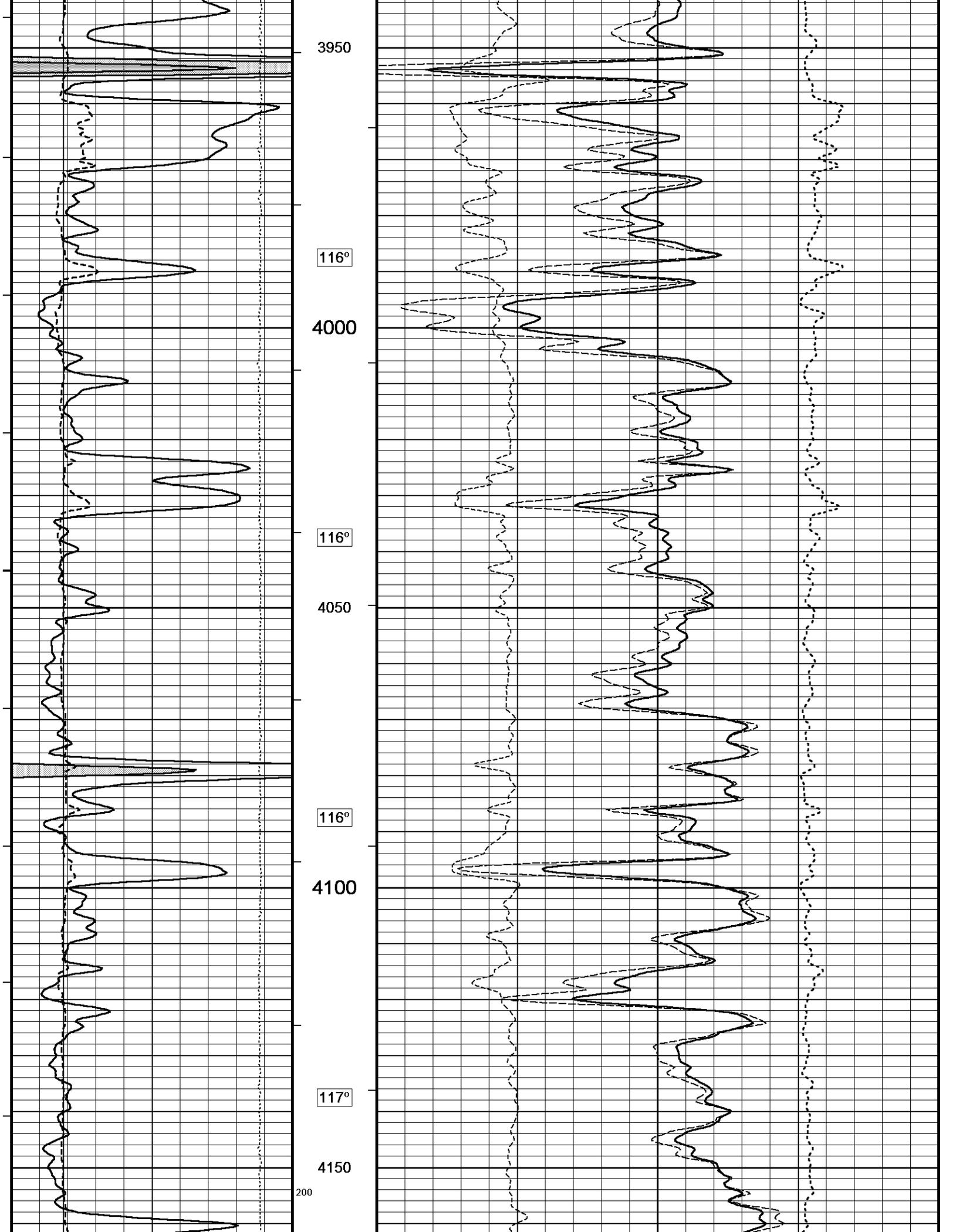
DST Uphole Tension

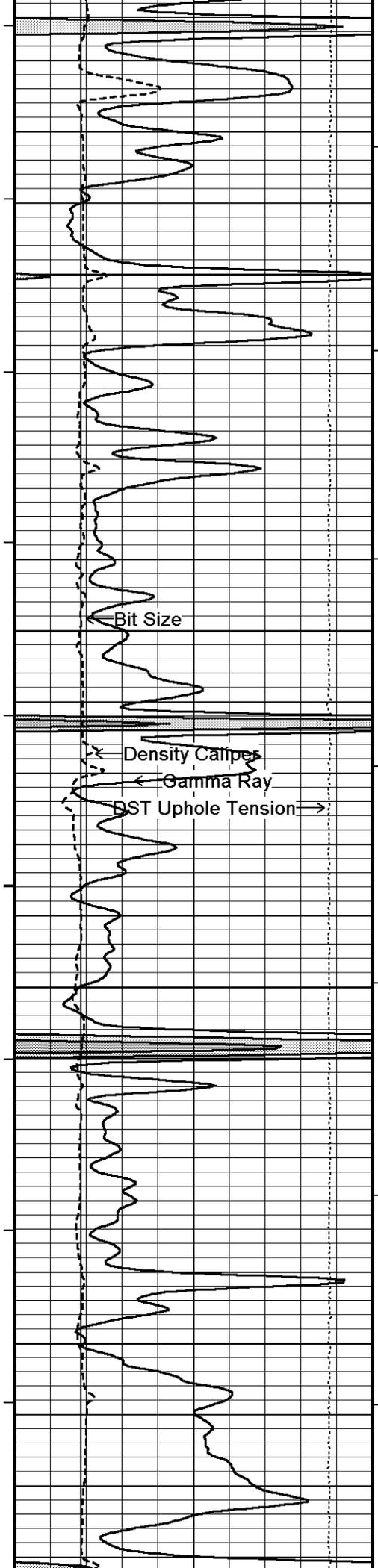
PE

Limestone Density Por.

Compensated Density

Density Correction





117°

4200

117°

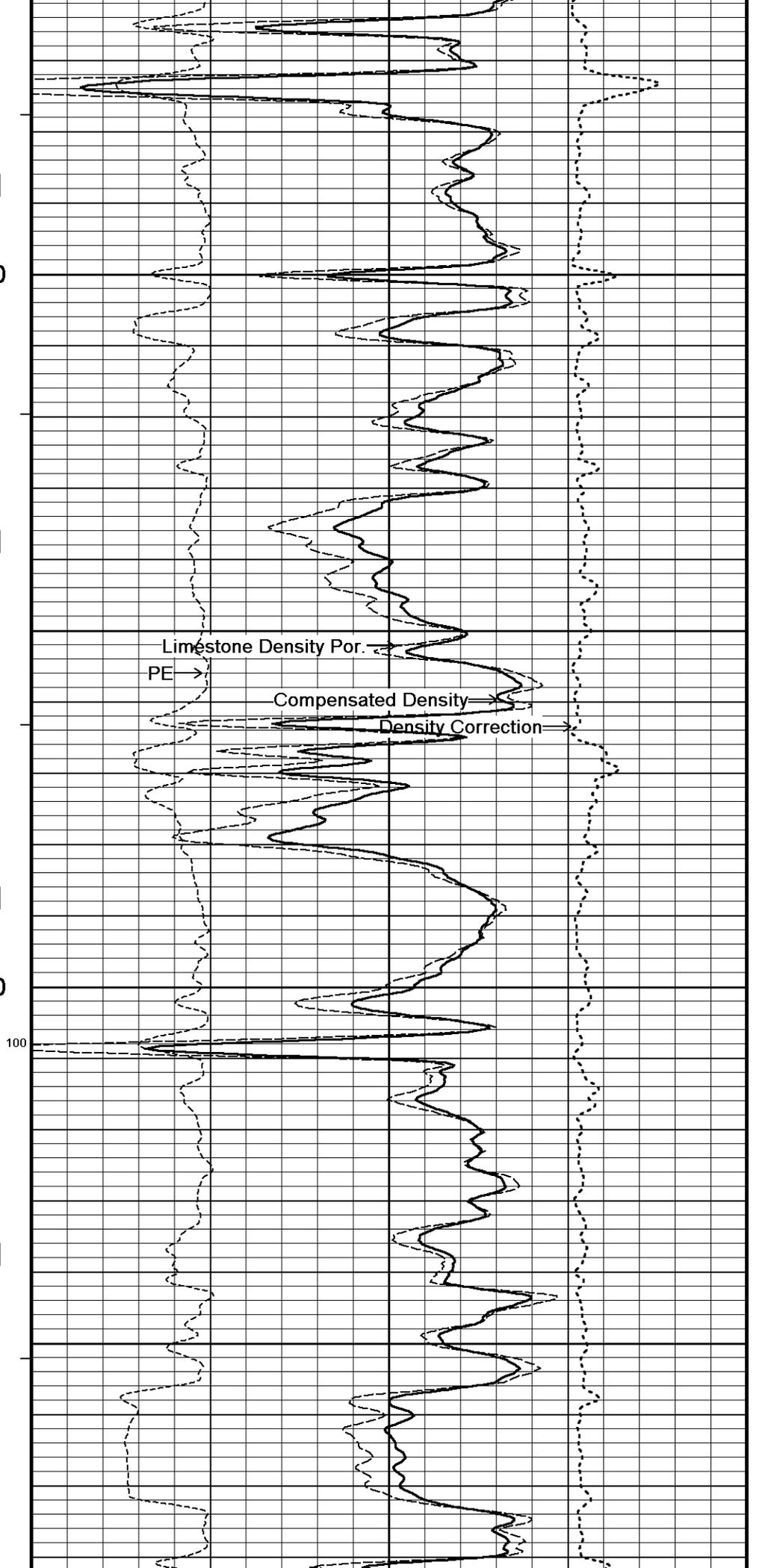
4250

118°

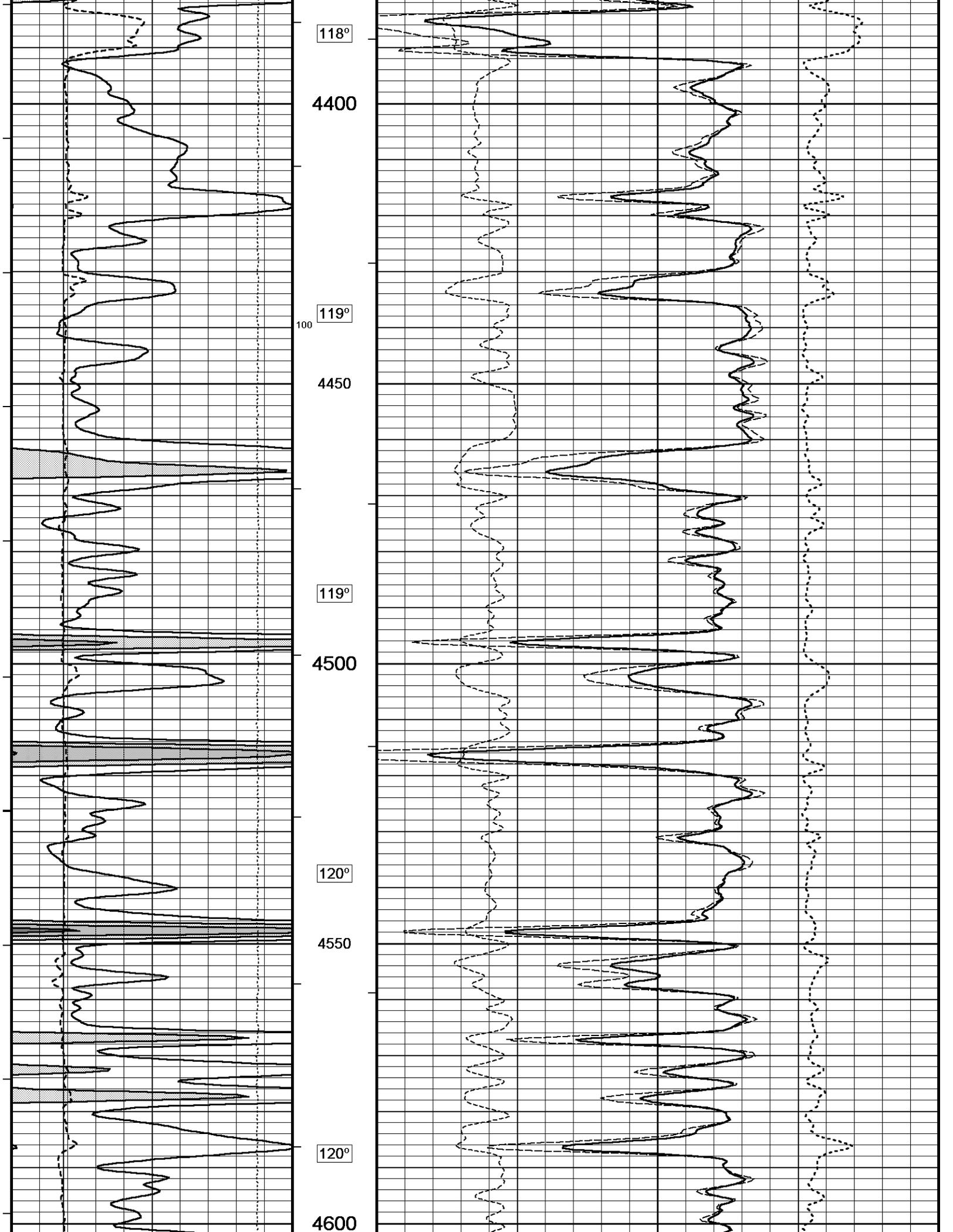
4300

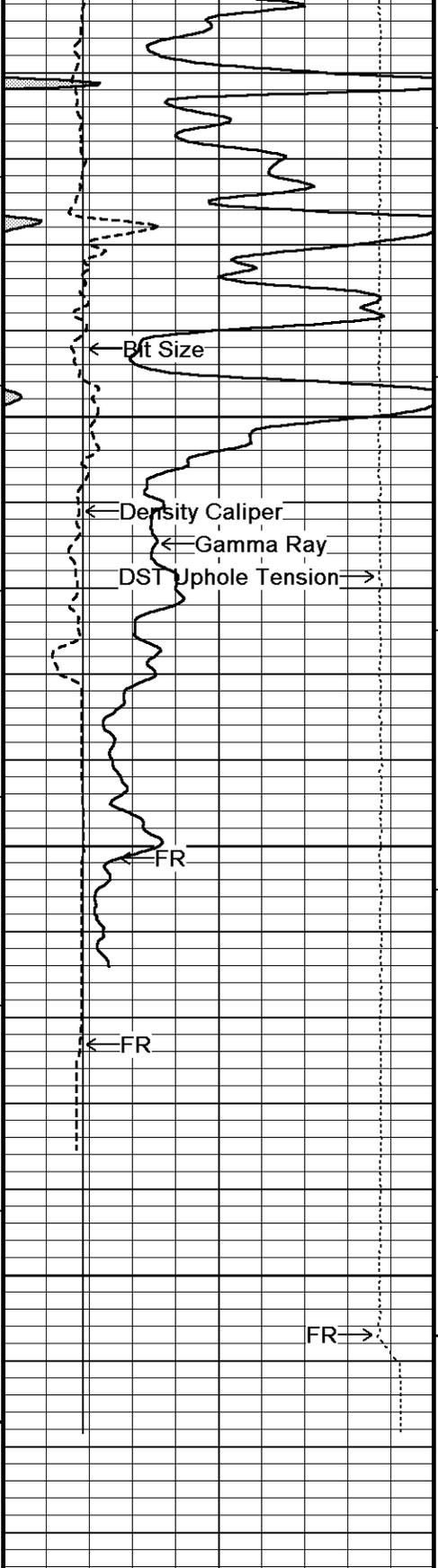
118°

4350



Limestone Density Por. →  
PE →  
Compensated Density →  
Density Correction →





120°

4650

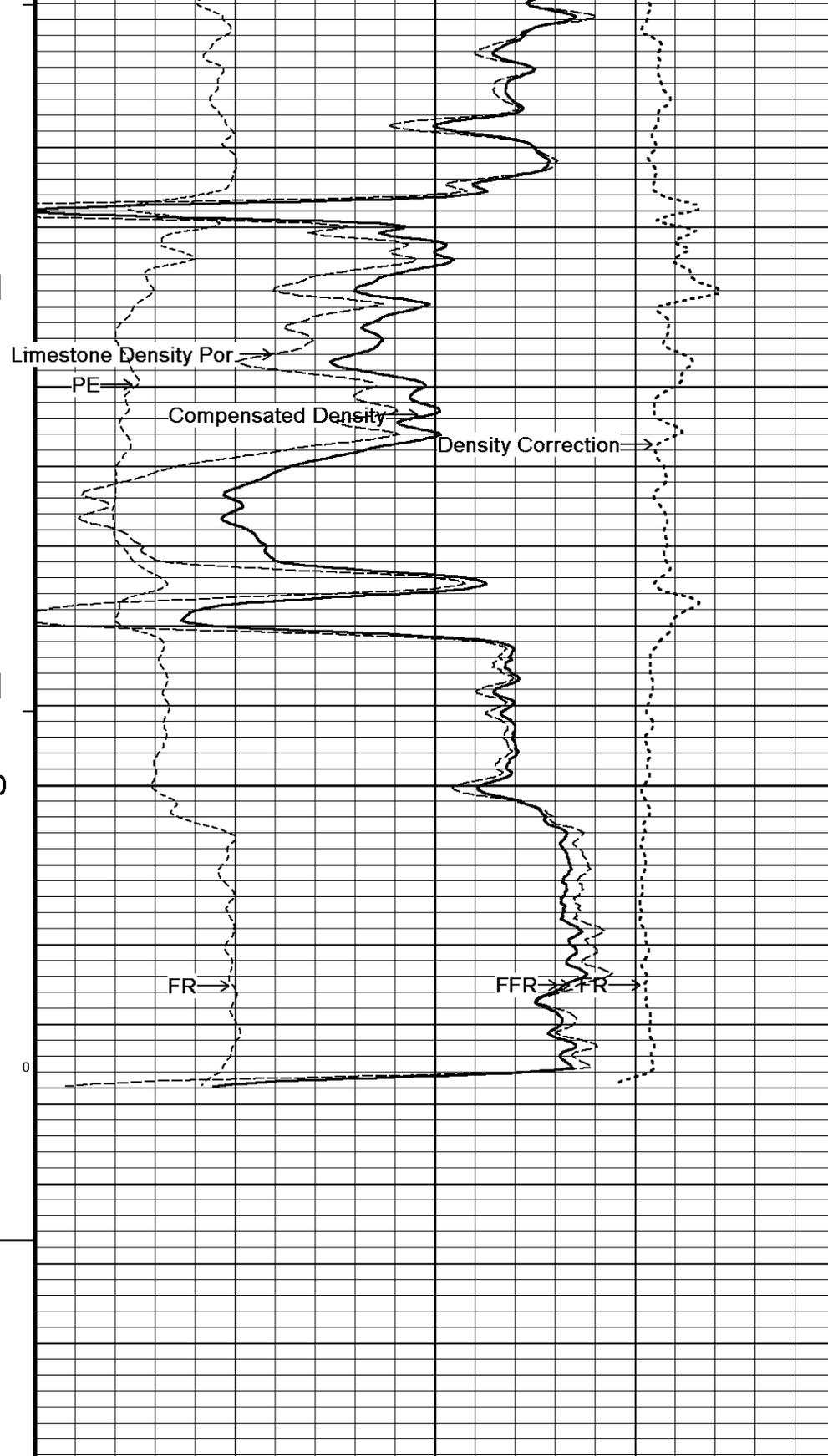
120°

4700

0

4750

TD



Timing Marks every 60.0 sec

Gamma Ray

API

0 75 150

Depth in Feet

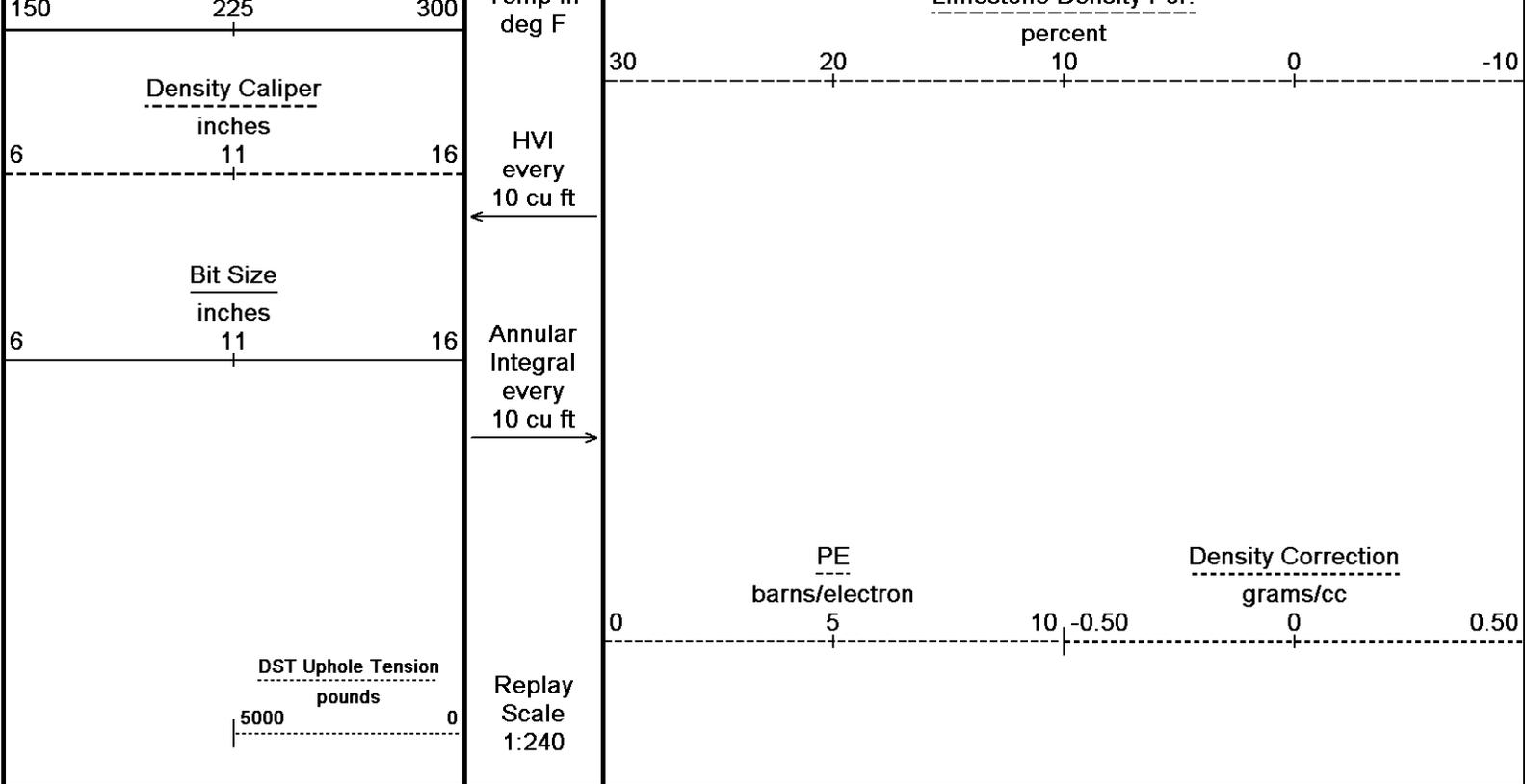
Compensated Density

grams/cc

2 2.25 2.50 2.75 3

Borehole Temp in

Limestone Density Por

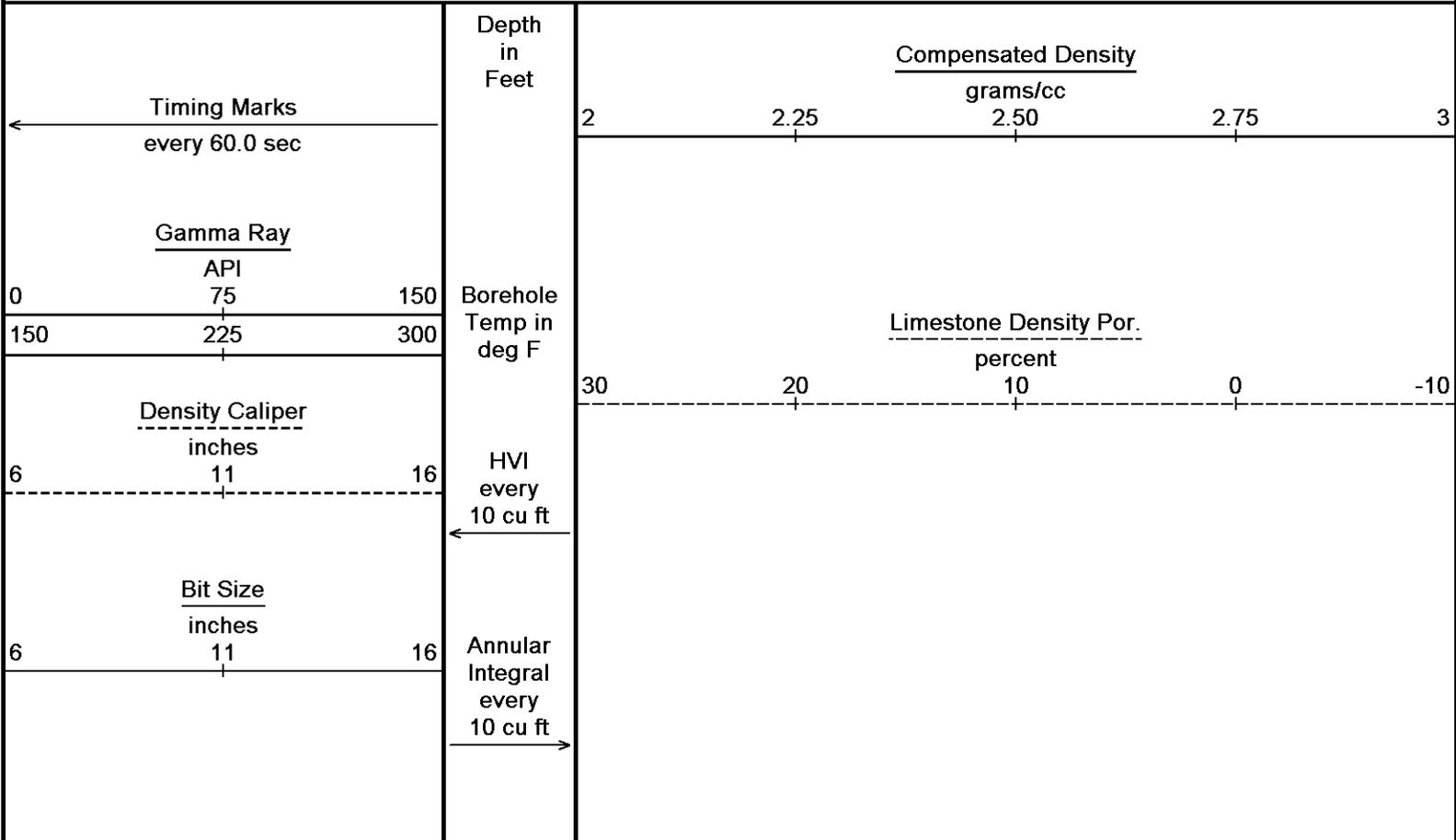


Depth Based Data - Maximum Sampling Increment 10.0cm  
 Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_002.dta  
 Recorded on 09-JUL-2017 18:52  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206

↑ 5 INCH MAIN - BULK DENSITY ↑

↓ REPEAT SECTION ↓

Depth Based Data - Maximum Sampling Increment 10.0cm  
 Plotted on 09-JUL-2017 21:58  
 Filename: C:\Minimus 17.01.7206\Logs\Shakespeare Schowal...\Shakespeare Schowalter #1-7\_001.dta  
 Recorded on 09-JUL-2017 18:18  
 System Versions: Logged with 17.01.7206 Plotted with 17.01.7206



DST Uphole Tension  
pounds

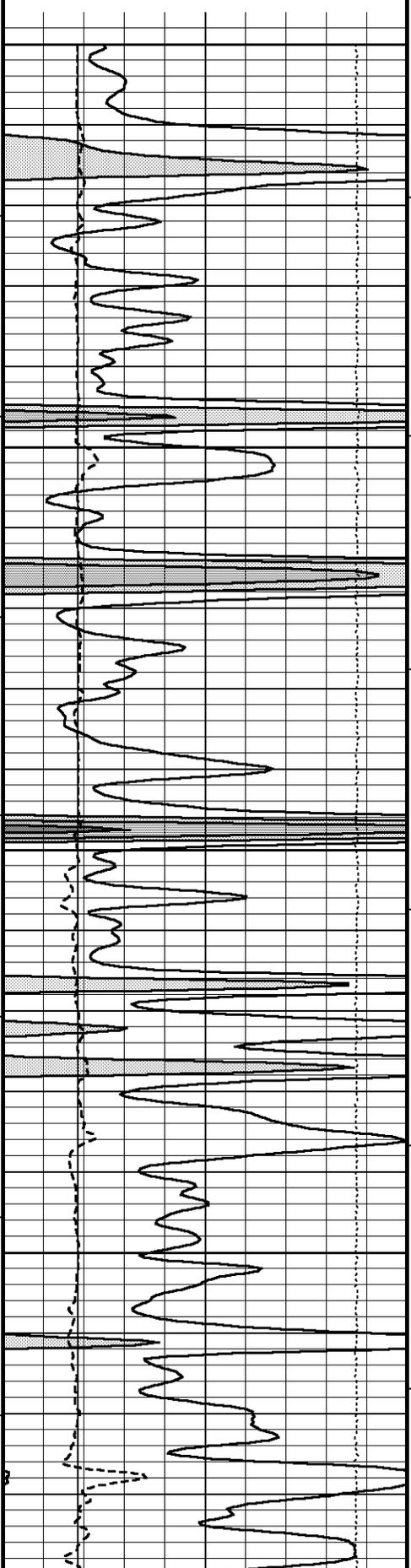
5000 0

Replay  
Scale  
1:240

PE  
barns/electron

Density Correction  
grams/cc

0 5 10 -0.50 0 0.50



4450

118°

4500

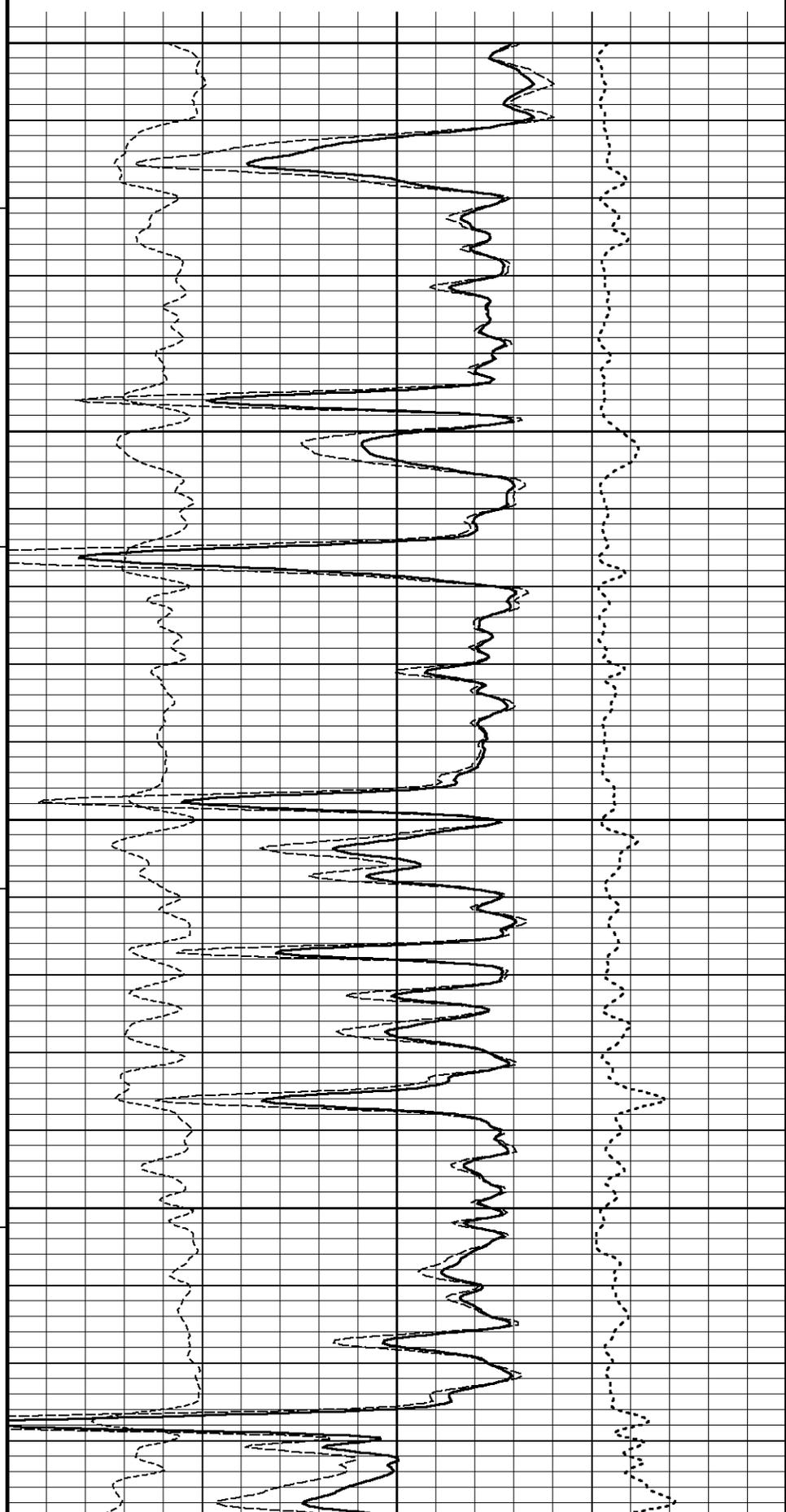
119°

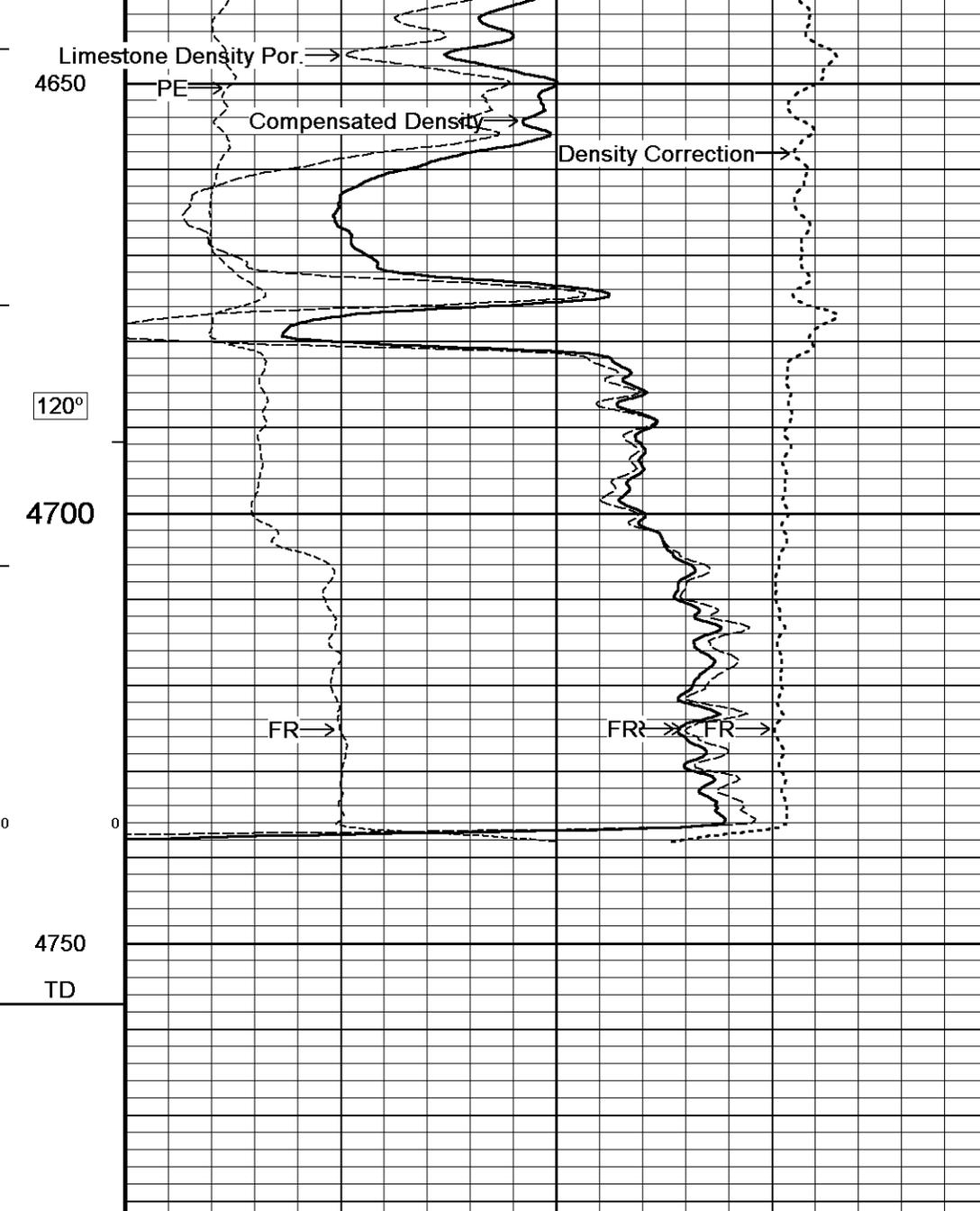
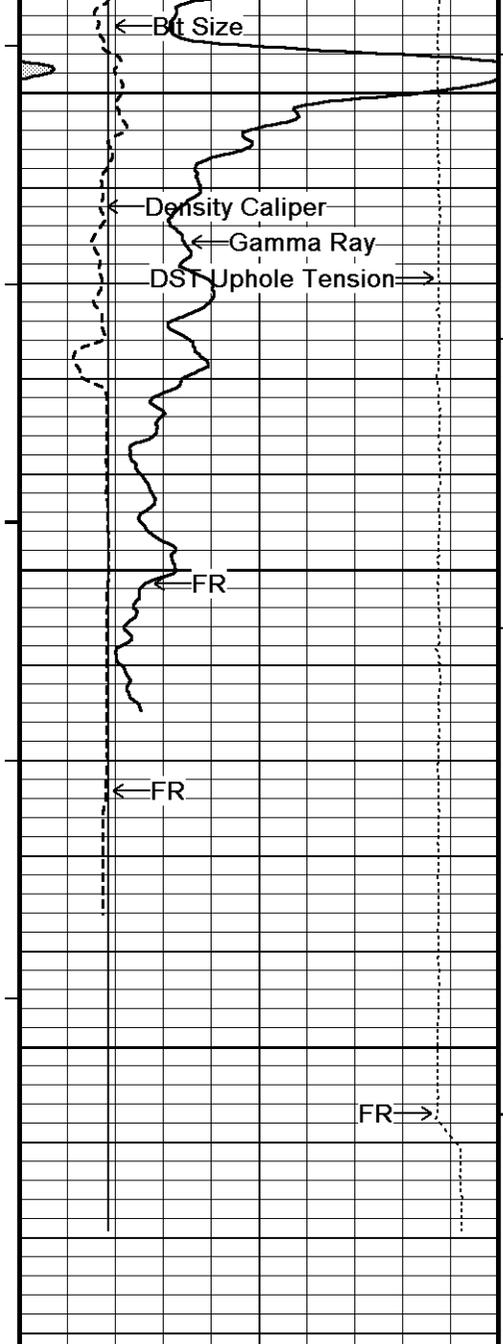
4550

119°

4600

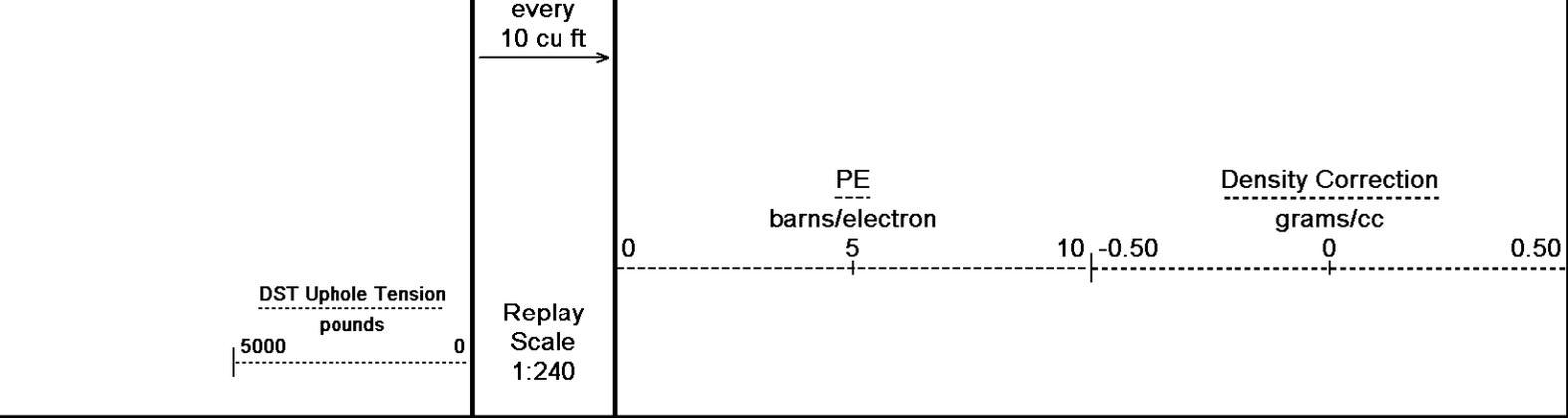
120°





Timing Marks every 60.0 sec		
Gamma Ray		
API		
0	75	150
150	225	300
Density Caliper		
inches		
6	11	16
Bit Size		
inches		
6	11	16

Depth in Feet	Compensated Density				
	grams/cc				
	2	2.25	2.50	2.75	3
Borehole Temp in deg F	Limestone Density Por.				
	percent				
	30	20	10	0	-10
HVI every 10 cu ft					
Annular Integral					



Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 09-JUL-2017 21:58  
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↑ REPEAT SECTION ↑

**BEFORE SURVEY CALIBRATION**  
 C:\Minimus 17.01.7206\Logs\Shakespeare Schowalter #1-7\Shakespeare Schowalter #1-7\_001.dta

General Constants All 000 Last Edited on 09-JUL-2017,17:48

<b>General Parameters</b>		
Mud Resistivity	0.950	ohm-metres
Mud Resistivity Temperature	75.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	
<b>Hole/Annular Volume and Differential Caliper Parameters</b>		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	4.500	inches
Caliper for Differential Caliper	Density Caliper	
<b>Rwa Parameters</b>		
Porosity used	Base Density Porosity	
Resistivity used	Array Ind. Four Res Rt	
RWA Constant A	0.620	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-C 84 Field Calibration on 09-JUL-2017 11:34

	Measured	Calibrated (API)
Background	82	57
Calibrator (Gross)	732	513
Calibrator (Net)	650	456

Gamma Calibration Tolerances MCG-C 84



Gamma Constants MCG-C 84 Last Edited on 09-JUL-2017,16:21

Gamma Calibrator Number	MCGGRCC141	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.12	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

SP Calibration MCG-C 84 Field Calibration on 07-JUL-2017,19:38

	Measured	Calibrated (mV)
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Reference 1	104.4	100.1
Reference 2	-95.8	-100.1

### High Resolution Temperature Calibration MCG-C 84

Field Calibration on 24-JUN-2017,20:21

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

### High Resolution Temperature Constants MCG-C 84

Last Edited on 09-SEP-2014,02:23

Pre-filter Length 11

### Micro Normal and Micro Inverse Calibration MML-A 7

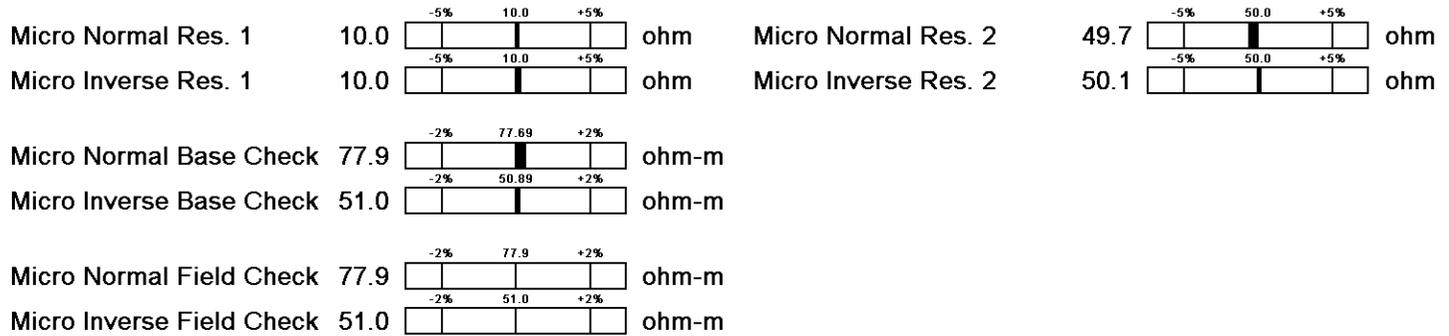
Base Calibration on 22-JUN-2017 09:29  
Field Check on 09-JUL-2017 17:32

#### Base Calibration

Channel	Measured		Calibrated (ohm-m)	
	Resistor 1	Resistor 2	Resistor 1	Resistor 2
Micro Normal	10.0	49.7	5.1	25.6
Micro Inverse	10.0	50.1	3.4	16.9

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Micro Normal	77.9	77.9
Micro Inverse	51.0	51.0

### Micro Normal & Micro Inverse Calibration Tolerance MML-A 7



### Micro Normal and Micro Inverse Constants MML-A 7

Last Edited on 09-JUL-2017,17:31

Pad Type	8-12 in Soft Rubber Inflatable 006-9011-159
Micro Normal K Factor	0.5110
Micro Inverse K Factor	0.3380
Standoff Offset	N/A inches

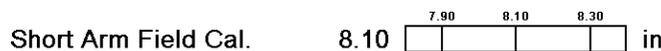
### Caliper Calibration MML-A 7

Base Calibration on 22-JUN-2017 09:39  
Field Calibration on 09-JUL-2017 17:31

Reading No	Measured	Calibrator Size (in)
1	13752	5.98
2	16863	7.97
3	19899	9.86
4	23808	11.92
5	0	0.00
6	N/A	N/A

Field Calibration	Measured Caliper (in)	Actual Caliper (in)
	8.10	8.10

### Caliper Calibration Tolerances MML-A 7



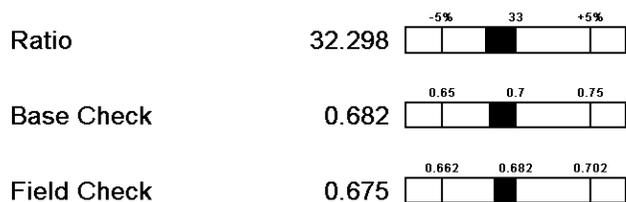
### Neutron Calibration MDN-A.B 114

Base Calibration on 22-JUN-2017 14:55  
Field Check on 09-JUL-2017 11:38

Ratio	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	3156	98	3714	110
	32.298		33.764	

Field Calibrator at Base	Calibrated (cps)	2073	3042
Ratio			0.682
Field Check	Calibrated (cps)	2053	3040
Ratio			0.675

### Neutron Calibration Tolerances MDN-A.B 114



### Neutron Constants MDN-A.B 114

Last Edited on 09-JUL-2017,16:21

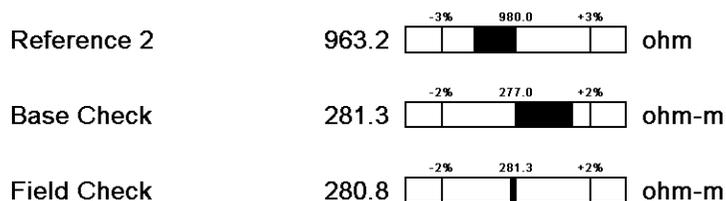
Neutron Source Id	P0204NN	
Neutron Jig Number	NJ5736	
Air Hole Processing	Modified Ratio	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	N/A	kppm
Barite Mud Correction	Not Applied	

### FE Calibration MFE-A.A 135

Base Calibration on 22-JUN-2017 11:49  
Field Check on 09-JUL-2017 17:10

Base Calibration	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	963.2	126.8
Base Check		281.3
Field Check		280.8

### FE Calibration Tolerances MFE-A.A 135



### FE Constants MFE-A.A 135

Last Edited on 09-JUL-2017,17:09

Running Mode	No Sleeve	
MFE K Factor	0.1268	
Borehole Correction Constants		
Sonde Position	0.5	inches
Hole Size Source	Density Caliper	
Hole Size Constant Value	N/A	inches
Rm Source	Global Value: Temperature Corrected	
Temp. for Rm Corr.	MCG External Temperature	

### Sonic Constants MSS-A.A 55

Last Edited on 09-JUL-2017,16:20



4	19.2	2035.4	20.5	2036.0
Deep	17.8	1959.3	19.2	1959.9
Medium	43.1	3970.5	45.7	3971.4
Shallow	44.9	5225.2	48.4	5227.1
Array Temperature	95.2		104.7 Deg F	

Induction Calibration Tolerances MAI-A.A 111

Low Conductivity 1	17.6		mmho/m	High Conductivity 1	473.6		mmho/m
Low Conductivity 2	6.4		mmho/m	High Conductivity 2	385.9		mmho/m
Low Conductivity 3	3.2		mmho/m	High Conductivity 3	264.0		mmho/m
Low Conductivity 4	2.1		mmho/m	High Conductivity 4	135.5		mmho/m
Background Vx 1	0.0		mmho/m	Phase Check Loop 1	0.0		%
Background Vx 2	0.0		mmho/m	Phase Check Loop 2	0.0		%
Background Vx 3	0.0		mmho/m	Phase Check Loop 3	0.0		%
Background Vx 4	0.0		mmho/m	Phase Check Loop 4	0.0		%

Induction Constants MAI-A.A 111

Last Edited on 09-JUL-2017,17:27

Induction Model	RtAP-WBM		
Borehole Correction Constants			
Tool Centred	No		
Hole Size Source	Density Caliper		
Hole Size Constant Value	N/A	inches	
Stand-off Type	Fins		
Stand-off	0.50	inches	
Number of Fins on Stand-off	8.0000		
Stand-off Fin Angle	45.00	degrees	
Stand-off Fin Width	0.5000	inches	
Rm Source	Global Value: Temperature Corrected		
Temp. for Rm Corr.	MCG External Temperature		
Squasher Start	0.0020	mhos/metre	
Squasher Offset	N/A	mhos/metre	
Borehole Normalisation			
DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000
Calibration Site Corrections			
Channel 1	0.00	mmhos/metre	
Channel 2	0.00	mmhos/metre	
Channel 3	0.00	mmhos/metre	
Channel 4	0.00	mmhos/metre	
Symmetrised Receiver Gains			
Receiver 1	1.00		
Receiver 2	1.00		
Receiver 3	1.00		
Receiver 4	1.00		
Apparent Porosity and Water Saturation Constants			
Archie Constant (A)	1.00		
Cementation Exponent (M)	2.00		
Saturation Exponent (N)	2.00		
Saturation of Water for Apor	100.00	percent	
Resistivity of Water for Apor and Sw	0.05	ohm-m	
Resistivity of Mud Filtrate for Sw	0.00	ohm-m	
Source for Rt	0.00		
Source for Rxo	0.00		



## Caliper Calibration MPD-C.A 216

Base Calibration on 22-JUN-2017 11:00

Field Calibration on 09-JUL-2017 17:26

## Base Calibration

Reading No	Measured	Calibrator Size (in)
1	18416	3.99
2	28544	5.98
3	38624	7.97
4	48448	9.86
5	59555	11.92
6	N/A	N/A

## Field Calibration

Measured Caliper (in)	Actual Caliper (in)
8.06	8.10

## Caliper Calibration Tolerances MPD-C.A 216

Short Arm Field Cal. 8.06  in

## DOWNHOLE EQUIPMENT

C:\Minimus 17.01.7206\Logs\Shakespeare Schowalter #1-7\Shakespeare Schowalter #1-7\_001.dta

## Mono-Cablehead

MCH-AA 0 LG: 1.02 ft WT: 2.2 lb OD: 1.417 in

## 11C-SLB 10-way Compact Tool Adaptor

MTA-B 1 LG: 0.78 ft WT: 19.8 lb OD: 3.540 in

## Compact Comms Gamma

MCG-C 84 LG: 8.70 ft WT: 63.9 lb OD: 2.240 in

## Compact Micro-log

MML-A 7 LG: 7.97 ft WT: 81.6 lb OD: 2.244 in

## Compact Neutron

MDN-A.B 114 LG: 5.04 ft WT: 50.7 lb OD: 2.240 in

## Compact Density/Caliper

MPD-C.A 216 LG: 9.59 ft WT: 90.4 lb OD: 2.449 in

## Compact Focussed Electric

MFE-A.A 135 LG: 6.05 ft WT: 48.5 lb OD: 2.240 in

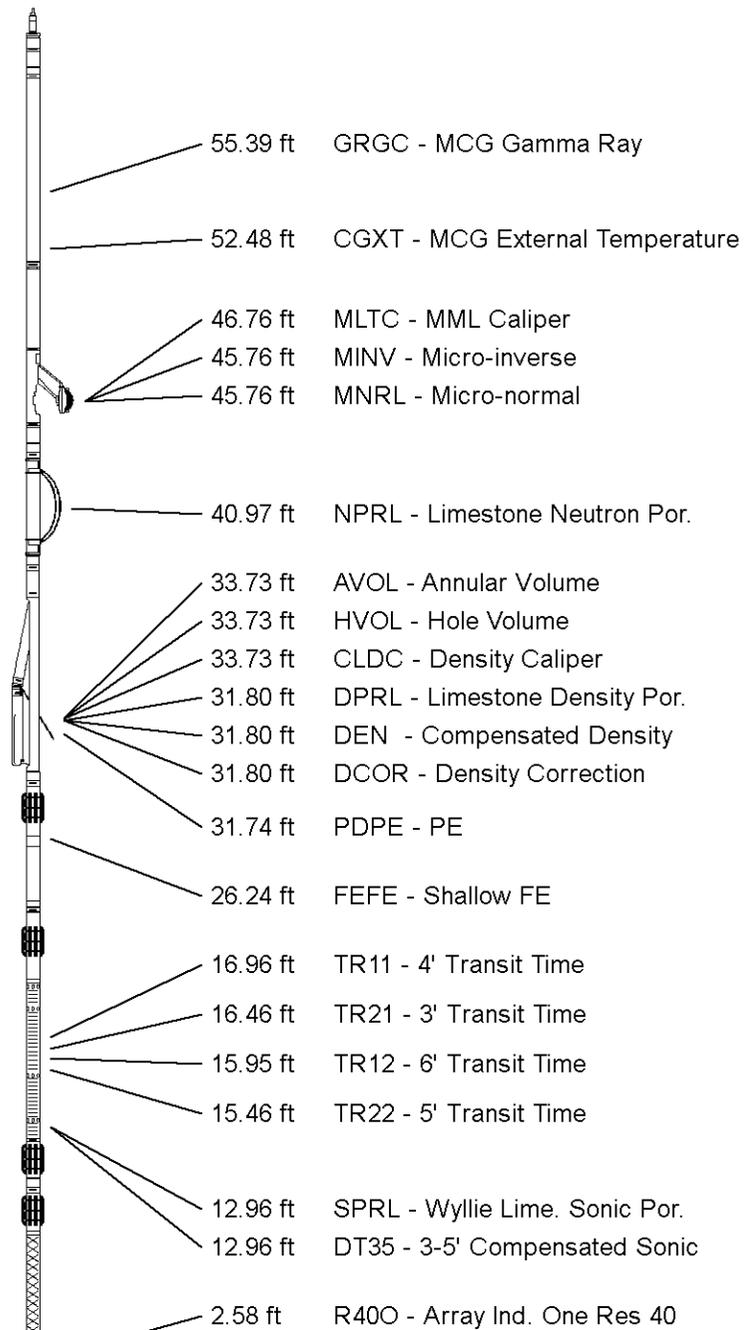
## Compact Sonic

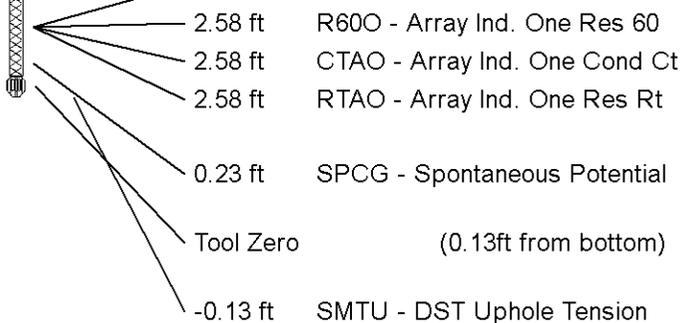
MSS-A.A 55 LG: 12.52 ft WT: 72.8 lb OD: 2.244 in

## Compact Induction

MAI-A.A 111 LG: 10.81 ft WT: 48.5 lb OD: 2.244 in

Total Length: 62.47 ft Weight: 478.4 lb





All measurements relative to tool zero.

COMPANY SHAKESPEARE OIL CO., INC.  
 WELL SCHOWALTER #1-7  
 FIELD WILDCAT  
 PROVINCE/COUNTY SCOTT  
 COUNTRY/STATE U.S.A. / KANSAS

Elevation Kelly Bushing	3020	feet	First Reading	4725.00	feet
Elevation Drill Floor	3018	feet	Depth Driller	4750.00	feet
Elevation Ground Level	3009	feet	Depth Logger	4757.00	feet



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 COMPENSATED NEUTRON  
 MICRORESISTIVITY LOG