

**Weatherford****COMPACT PHOTO DENSITY
COMPENSATED NEUTRON**

COMPANY

SOUTHERN STAR CENTRAL GAS PIPELINE, INC.

WELL

ALDEN GAS STORAGE #O-27

FIELD

ALDEN

PROVINCE/COUNTY

RICE

COUNTRY/STATE

U.S.A. / KANSAS

LOCATION

330' FNL & 1474' FEL

SEC

TWP
15 21SRGE
9WOther Services
MAI/MFE
MML

MSS

API Number

15-159-22730

Permit Number

Permanent Datum GL, Elevation 1672 feet

Log Measured From KB

Drilling Measured From KB

Date

05-MAY-2013

Elevations:
KB 1685.00
DF 1684.00
GL 1672.00

Run Number

ONE

Service Order

3539046

Depth Driller

3520.00 feet

Depth Logger

3516.00 feet

First Reading

3516.00 feet

Last Reading

578.00 feet

Casing Driller

580.00 feet

Casing Logger

578.00 feet

Bit Size

9.625 inches

Hole Fluid Type

CHEMICAL

Density / Viscosity

9.45 lb/USg 49.00 CP

PH / Fluid Loss

10.50 7.20 ml/30Min

Sample Source

FLOWLINE

Rm @ Measured Temp

1.08 @ 89.0 ohm-m

Rmf @ Measured Temp

0.86 @ 89.0 ohm-m

Rmc @ Measured Temp

1.30 @ 89.0 ohm-m

Source Rmf / Rmc

CALC CALC

Rm @ BHT

0.99 @ 97.0 ohm-m

Time Since Circulation

4 HOURS

Max Recorded Temp

97.00 deg F

Equipment / Base

13057 LIB

Recorded By

ADAM SILL

Witnessed By

MARK ROUSE

JOB #

LB13-124

BOREHOLE RECORD

Last Edited: 05-MAY-2013 15:48

Bit Size
inches

9.625

Depth From
feet

585.00

Depth To
feet

3520.00

CASING RECORD

Type

Size
inches

11.750

Depth From
feet

0.00

Shoe Depth
feet

585.00

Weight
pounds/ft

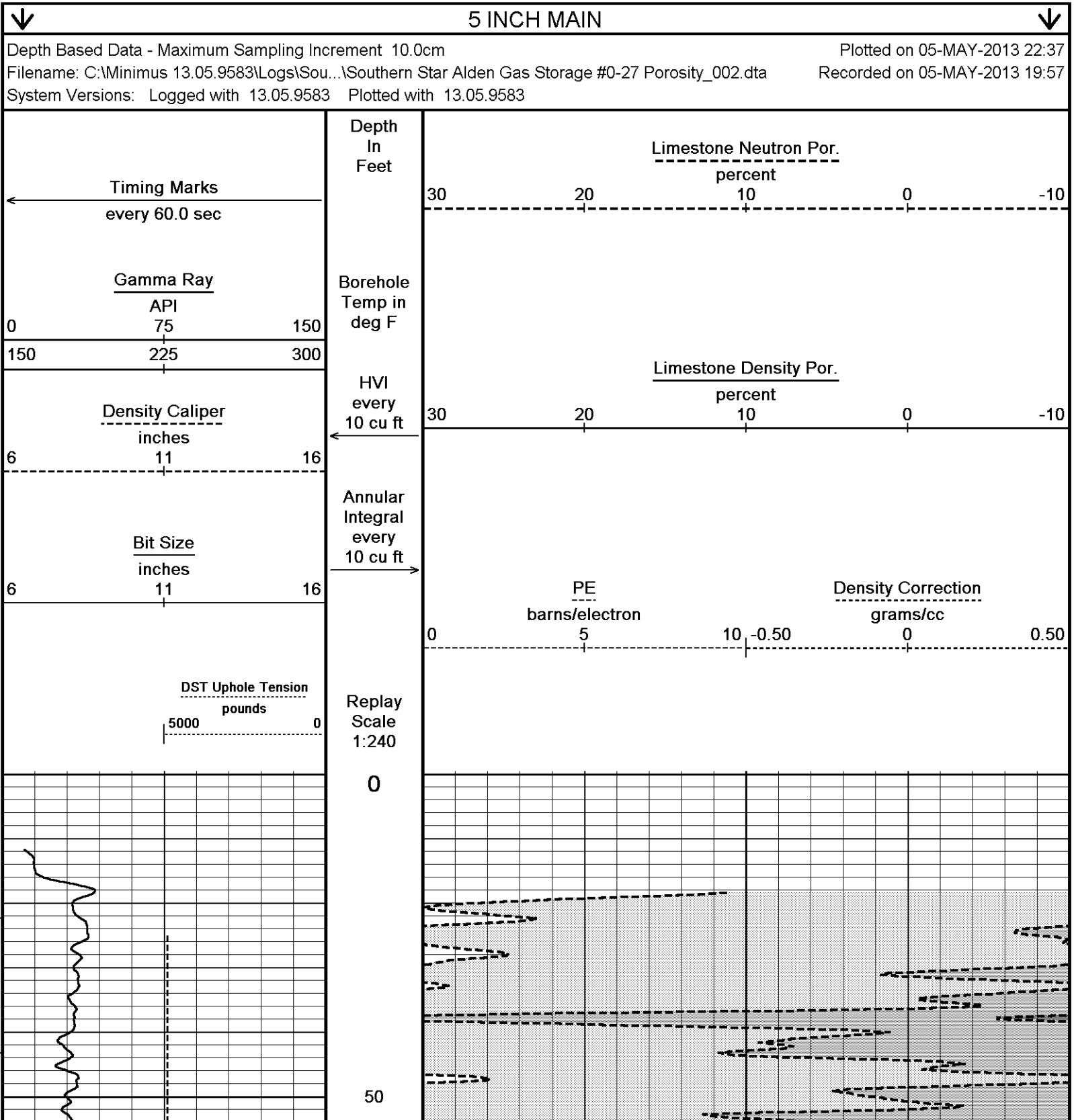
38.00

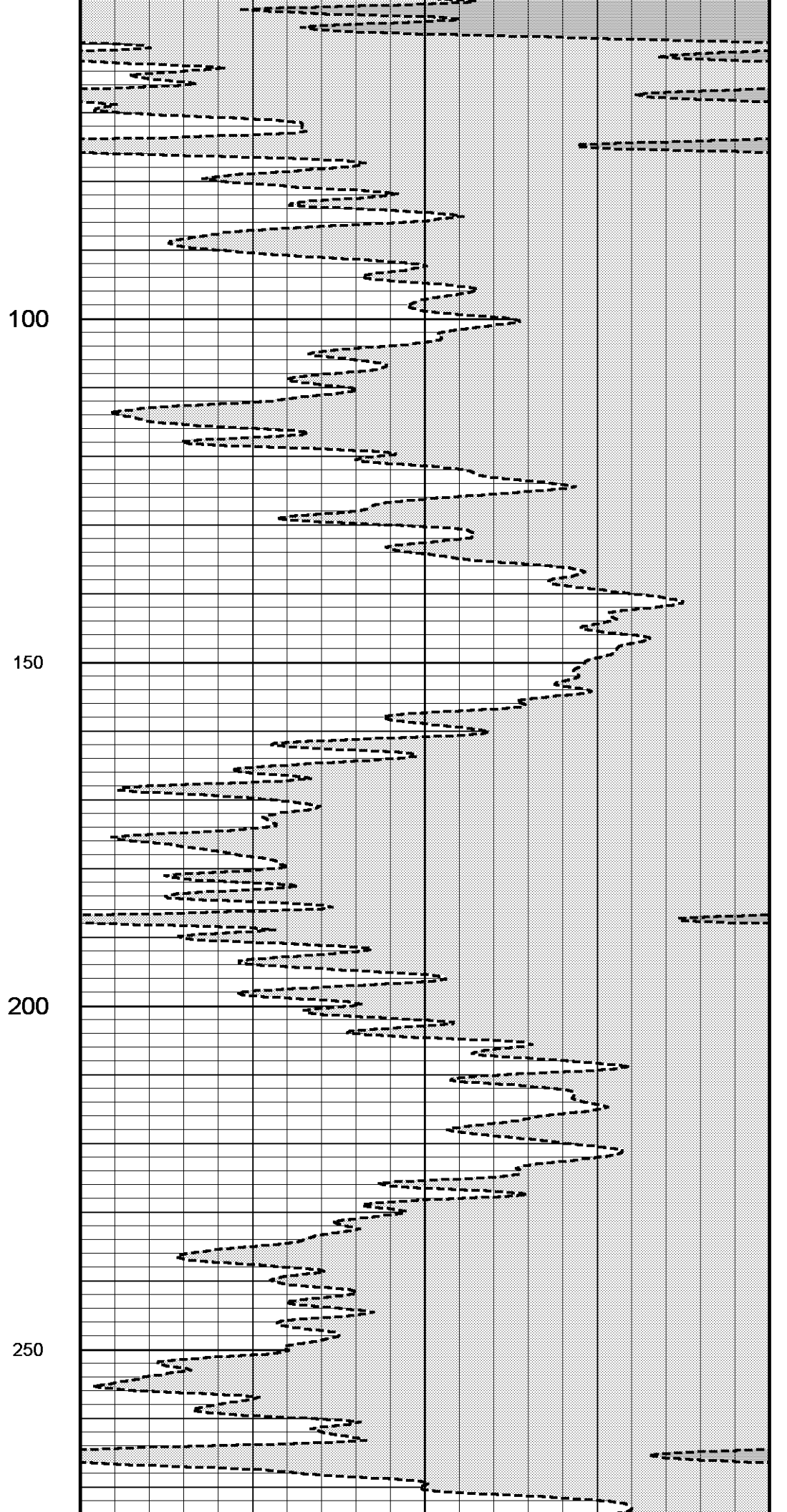
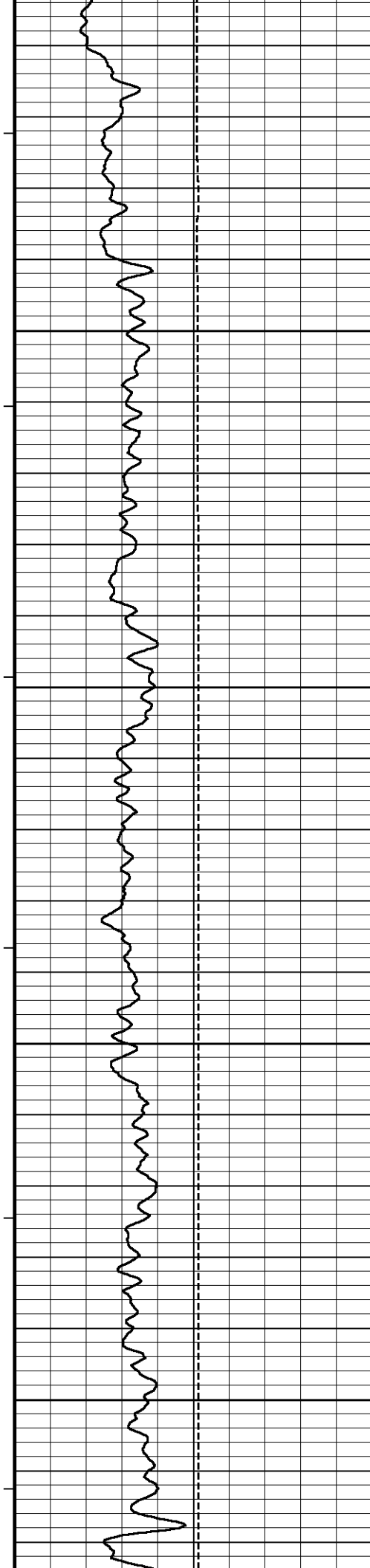
REMARKS

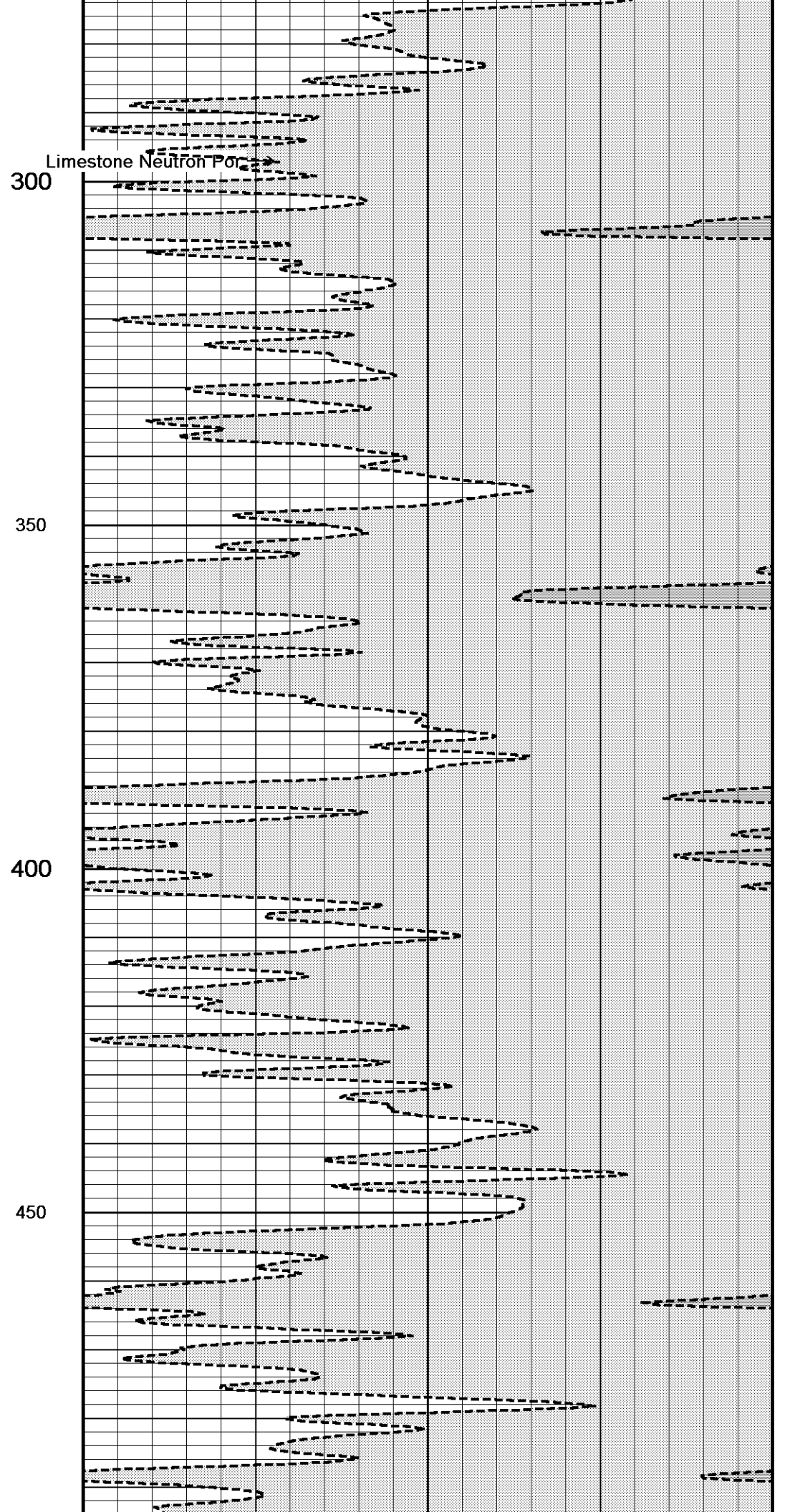
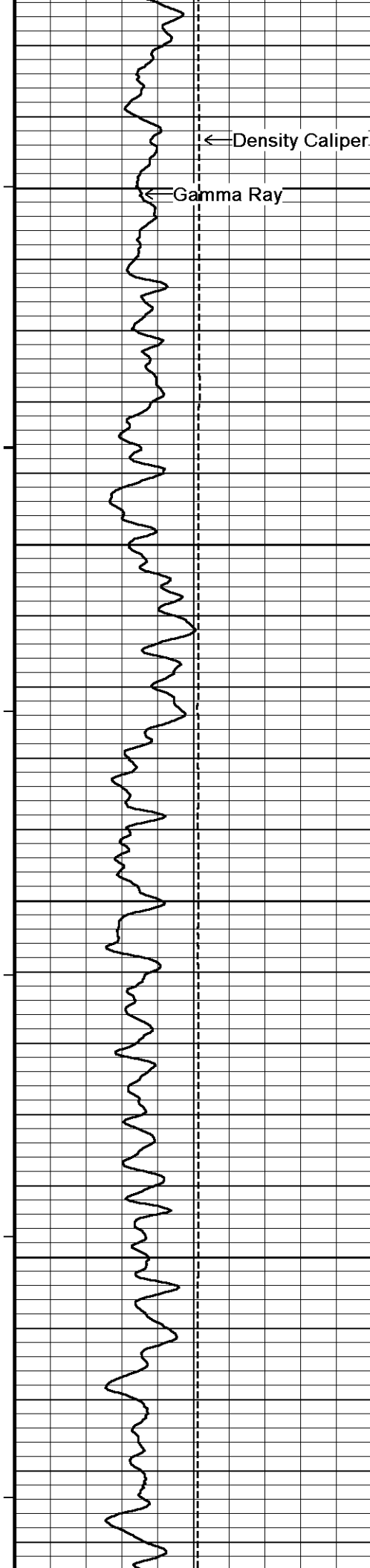
- SOFTWARE ISSUE: WLS 13.05.9583.
- RUN 1: MCG, MML, MFE, MSS, MAI RAN IN COMBINATION.
 - HARDWARE: 0.5 INCH STANDOFF USED ON MFE.
 - TWO 0.5 INCH STANDOFFS USED ON MSS.
 - 0.5 INCH STANDOFF USED ON MAI.
- RUN 2: MCG, MDN, MPD RAN IN COMBINATION.
 - HARDWARE: DUAL BOWSPRING USED ON MDN.
- 2.71 G/CC LIMESTONE 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 GROUND LEVEL: 2290 CU. FT.

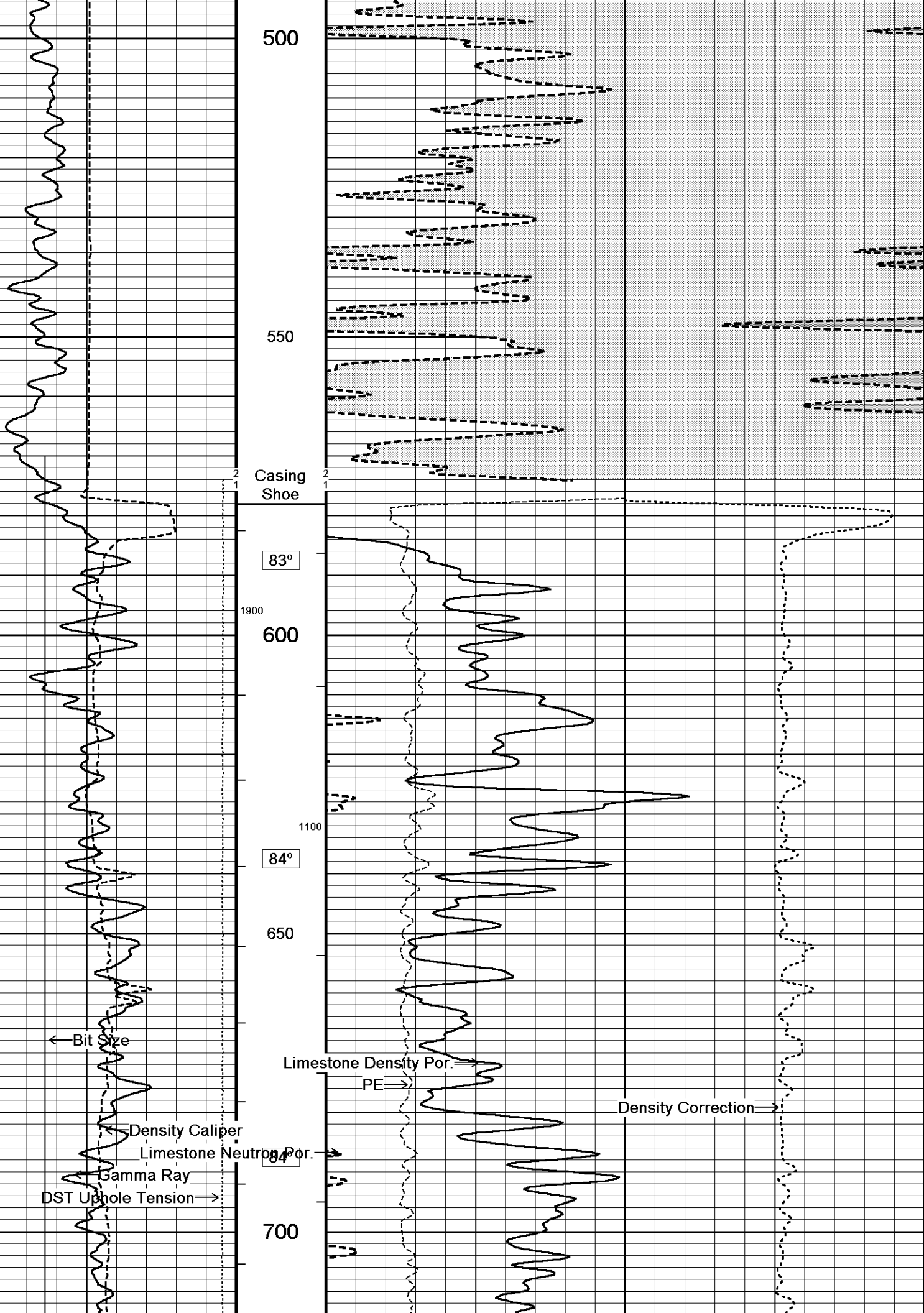
- ANNULAR HOLE VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 2200 FEET: 390 CU. FT.
- RIG: STERLING #4.
- ENGINEER: A. SILL.
- OPERATOR(S): N. ADAME.

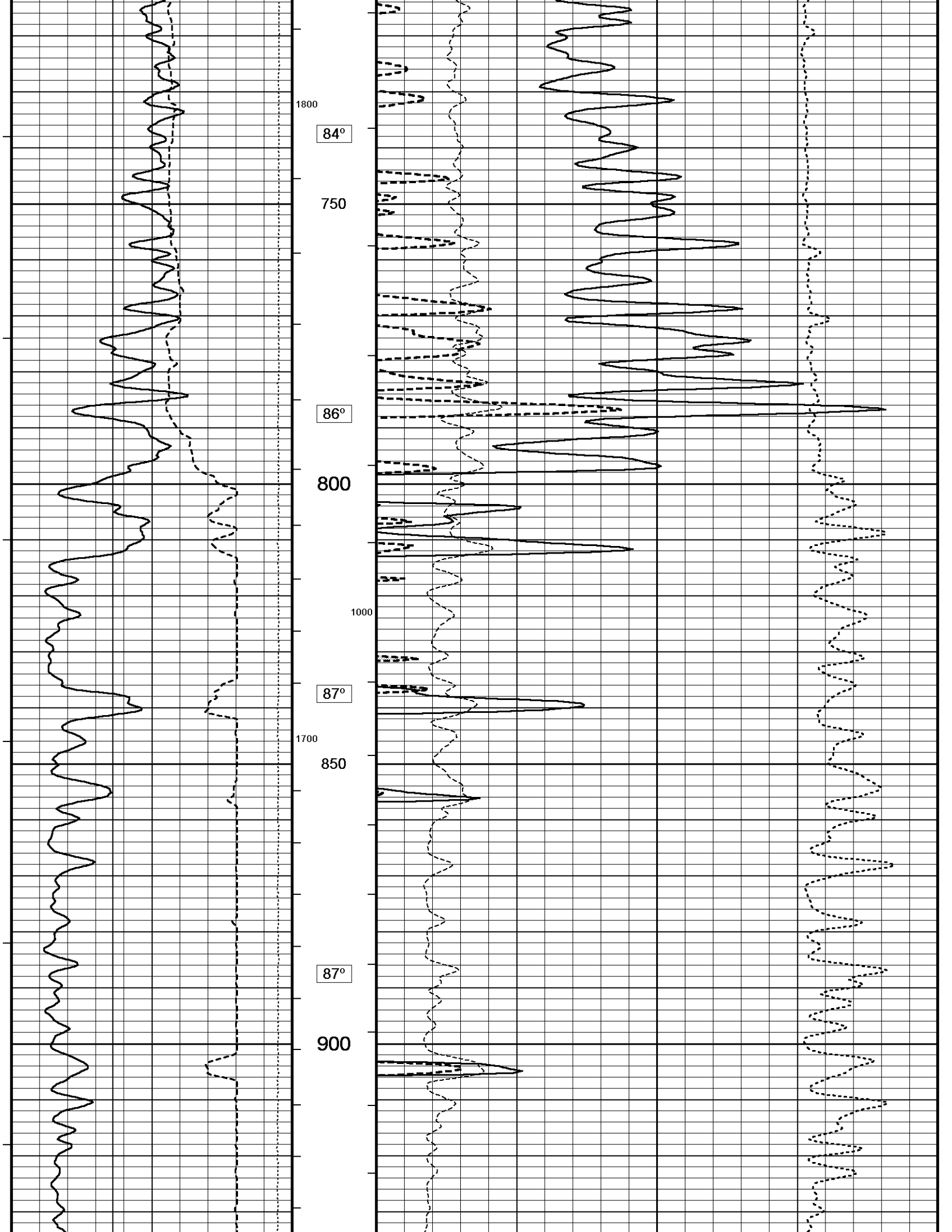
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions in our price schedule.

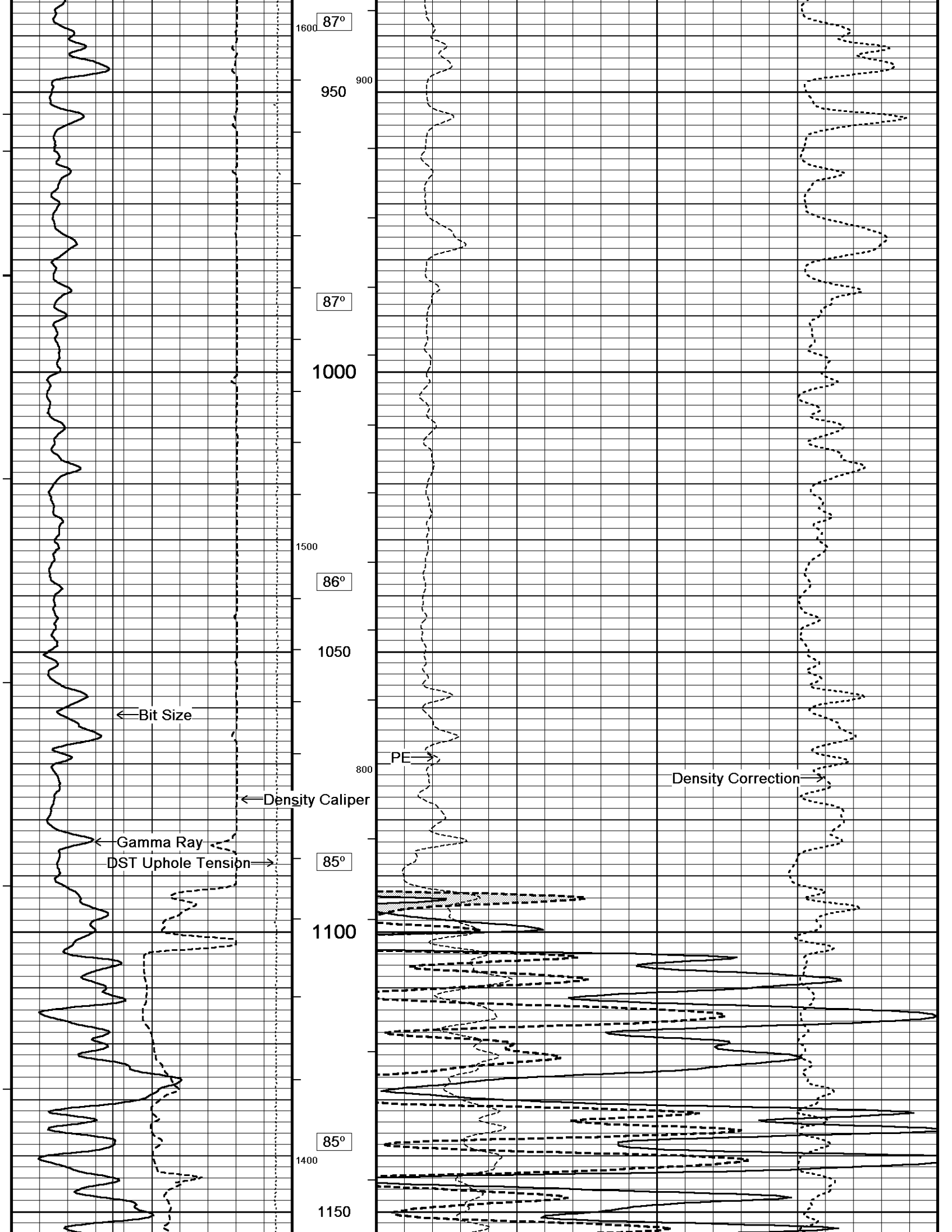


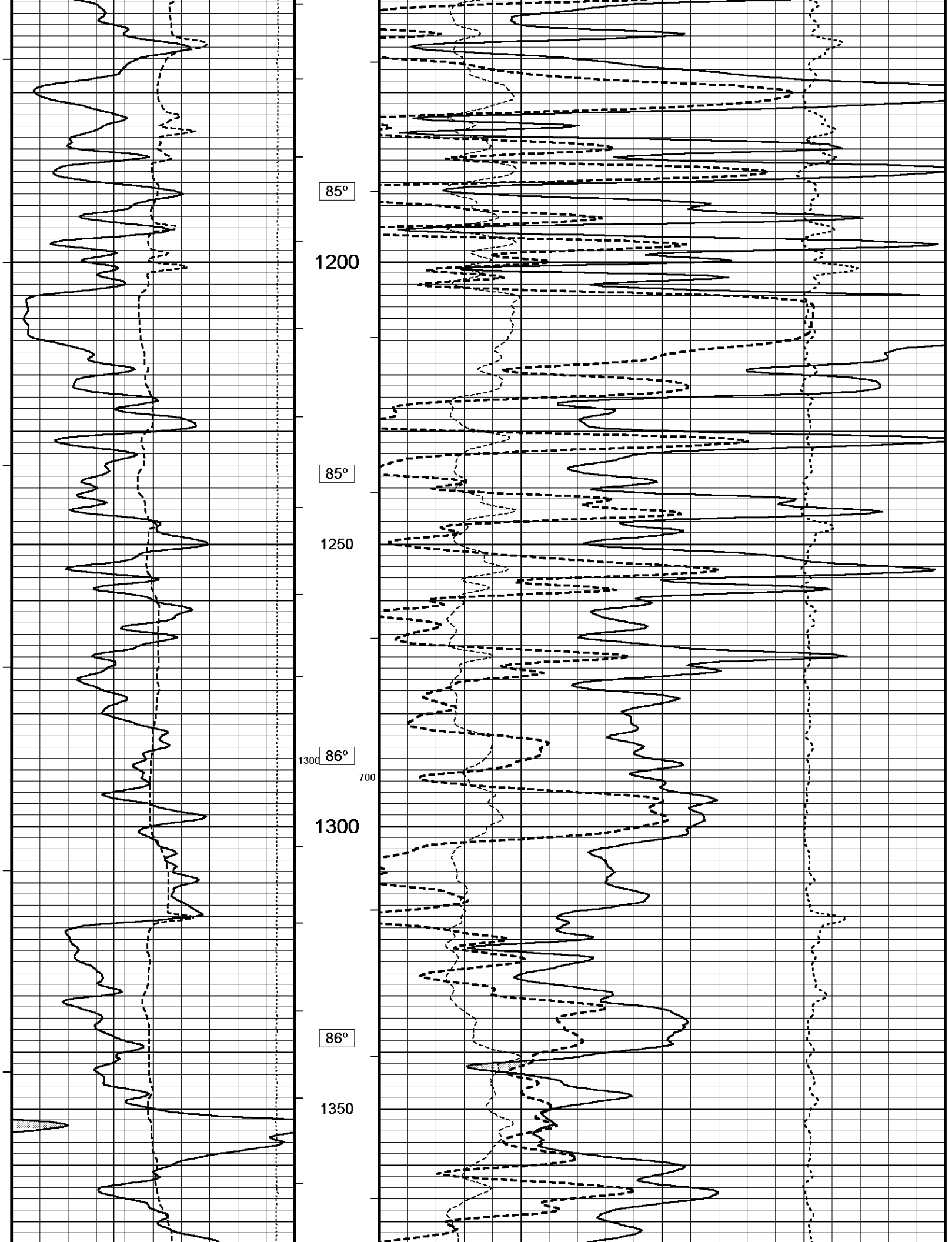


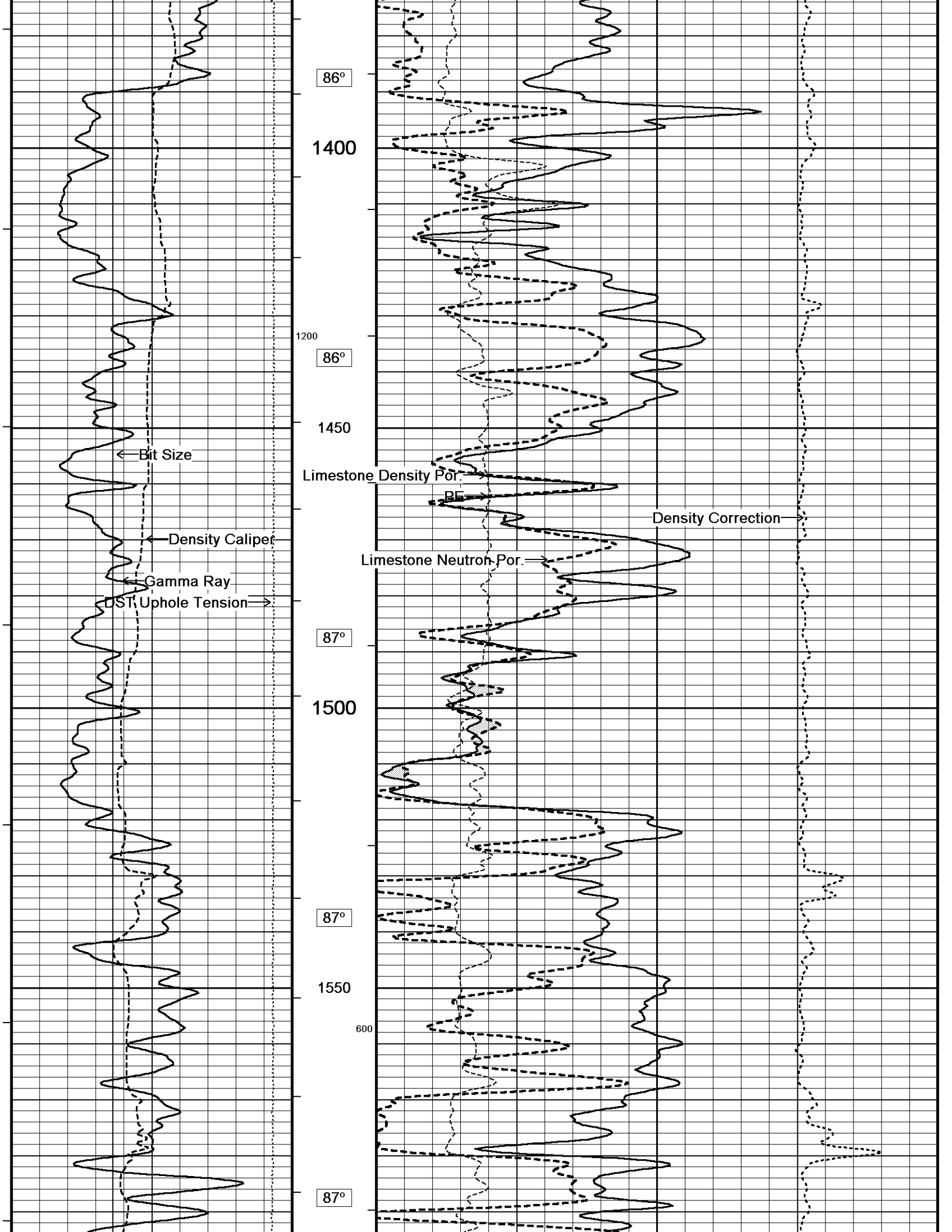


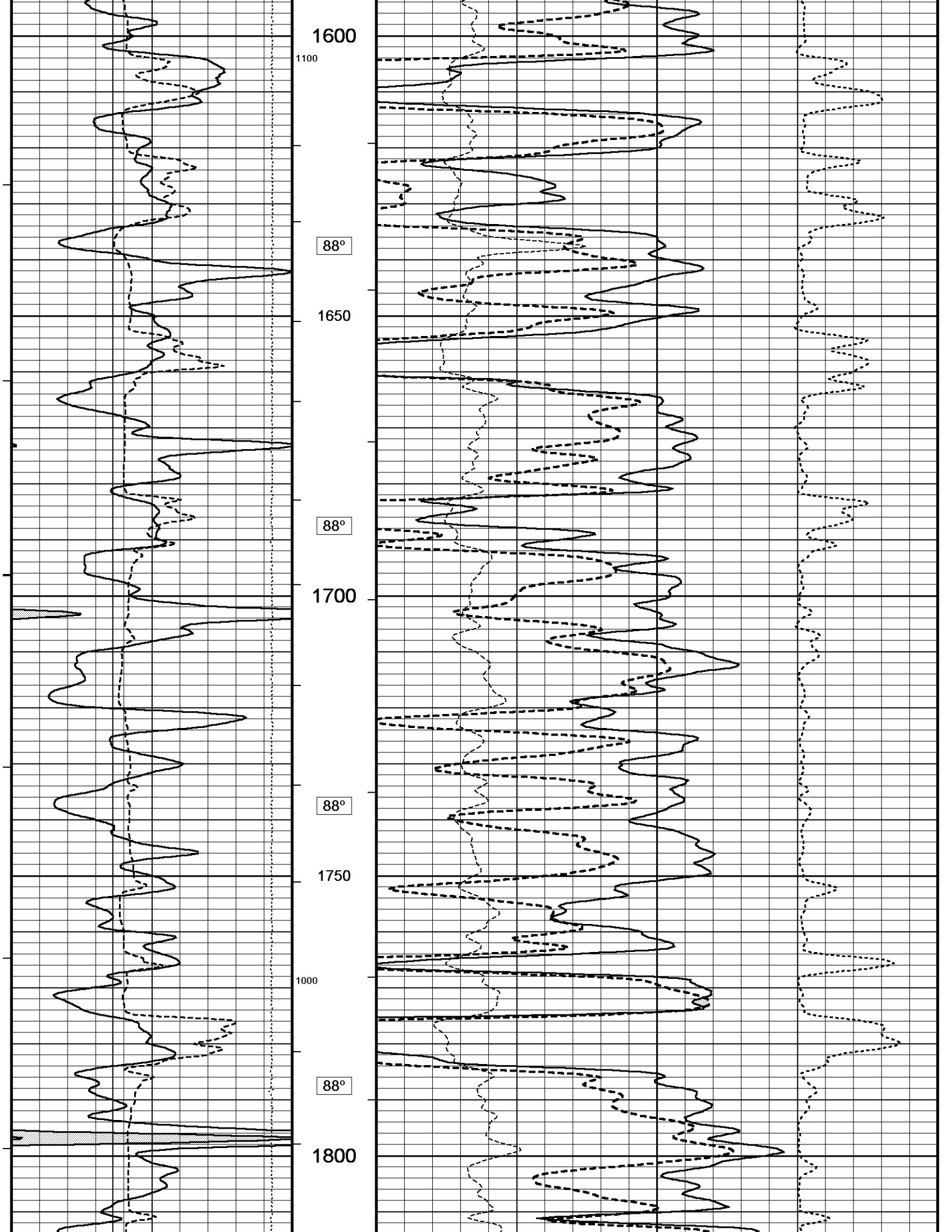


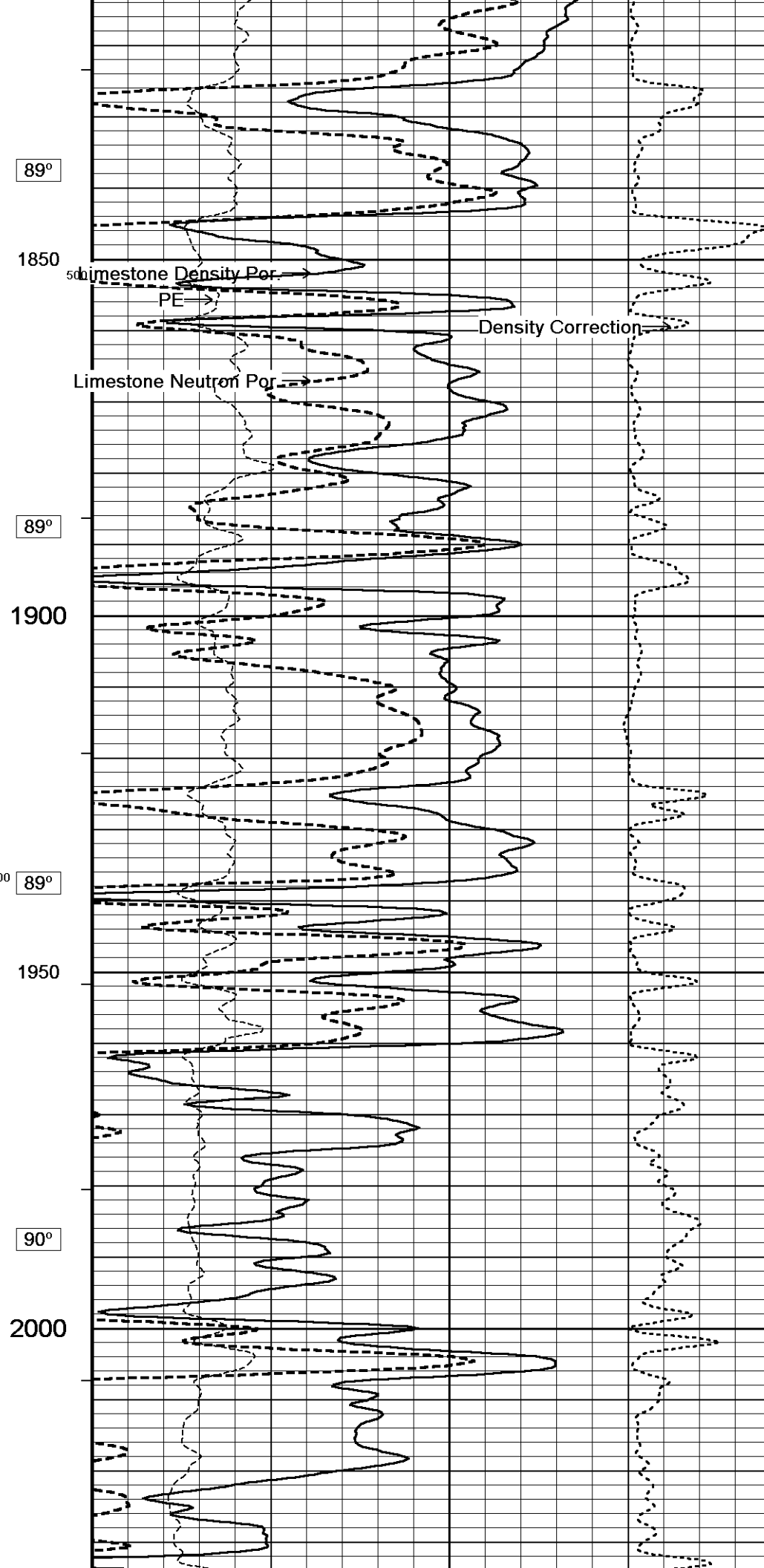
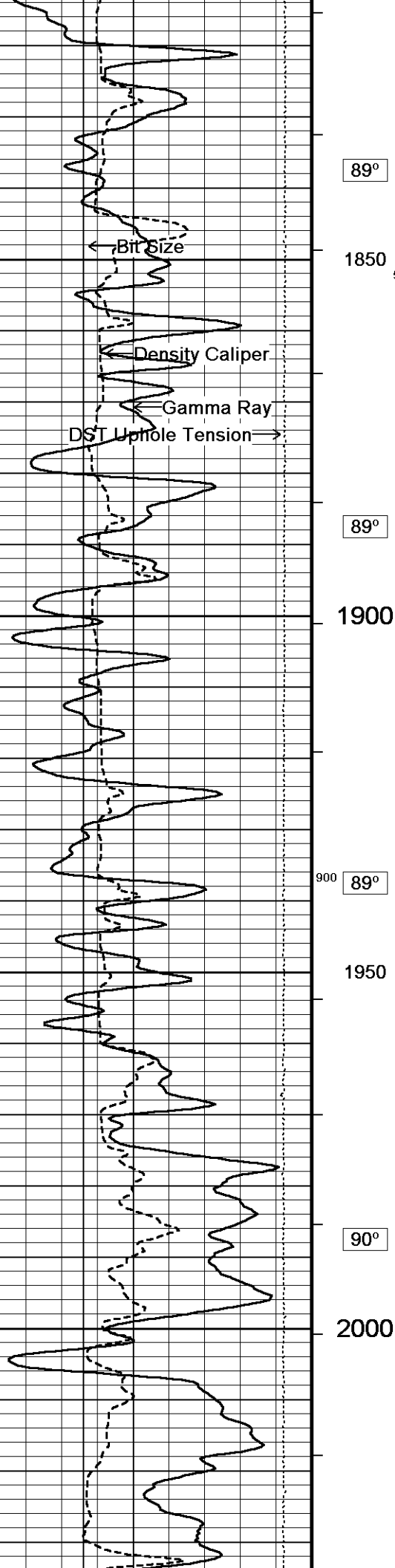


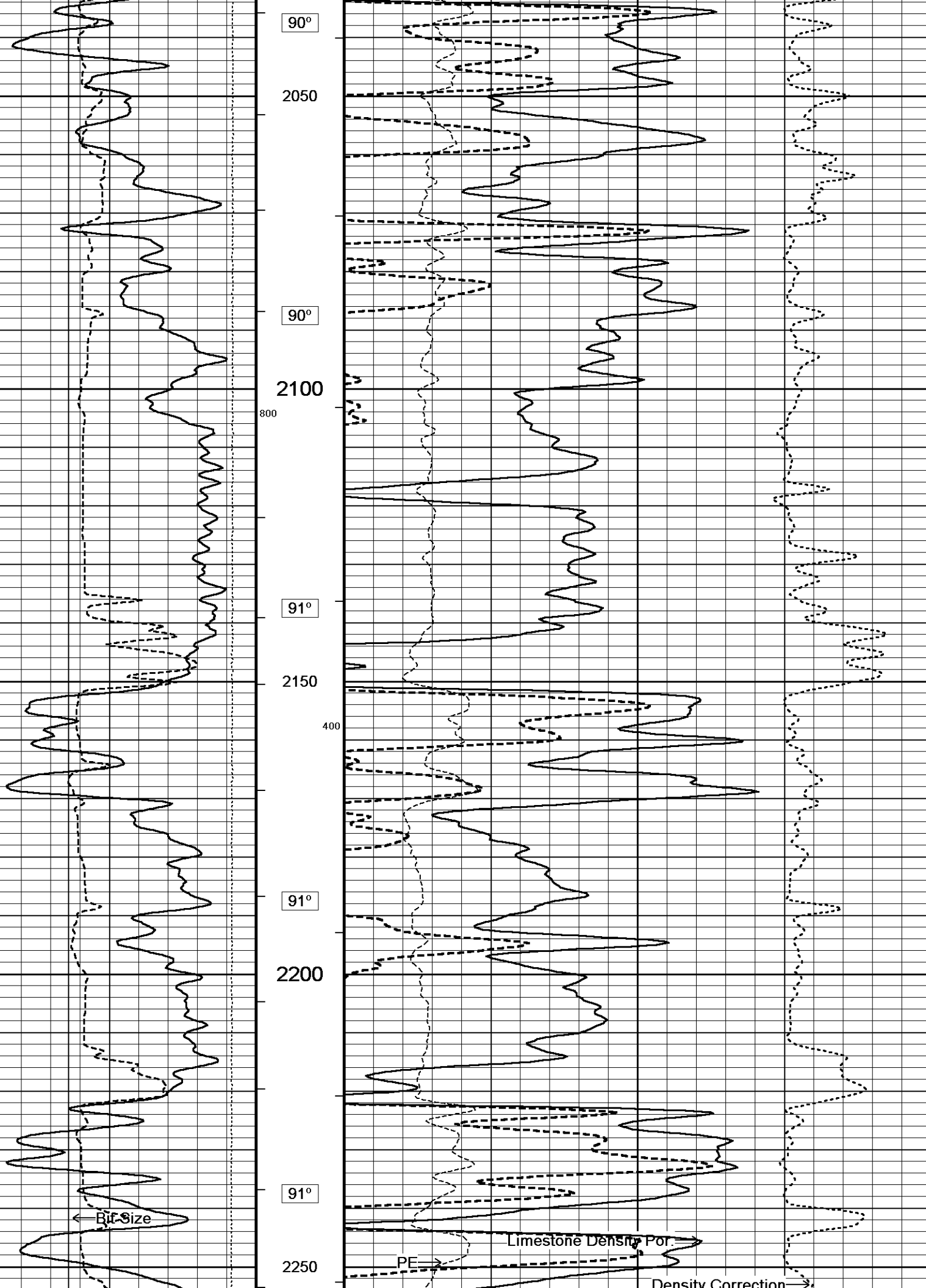


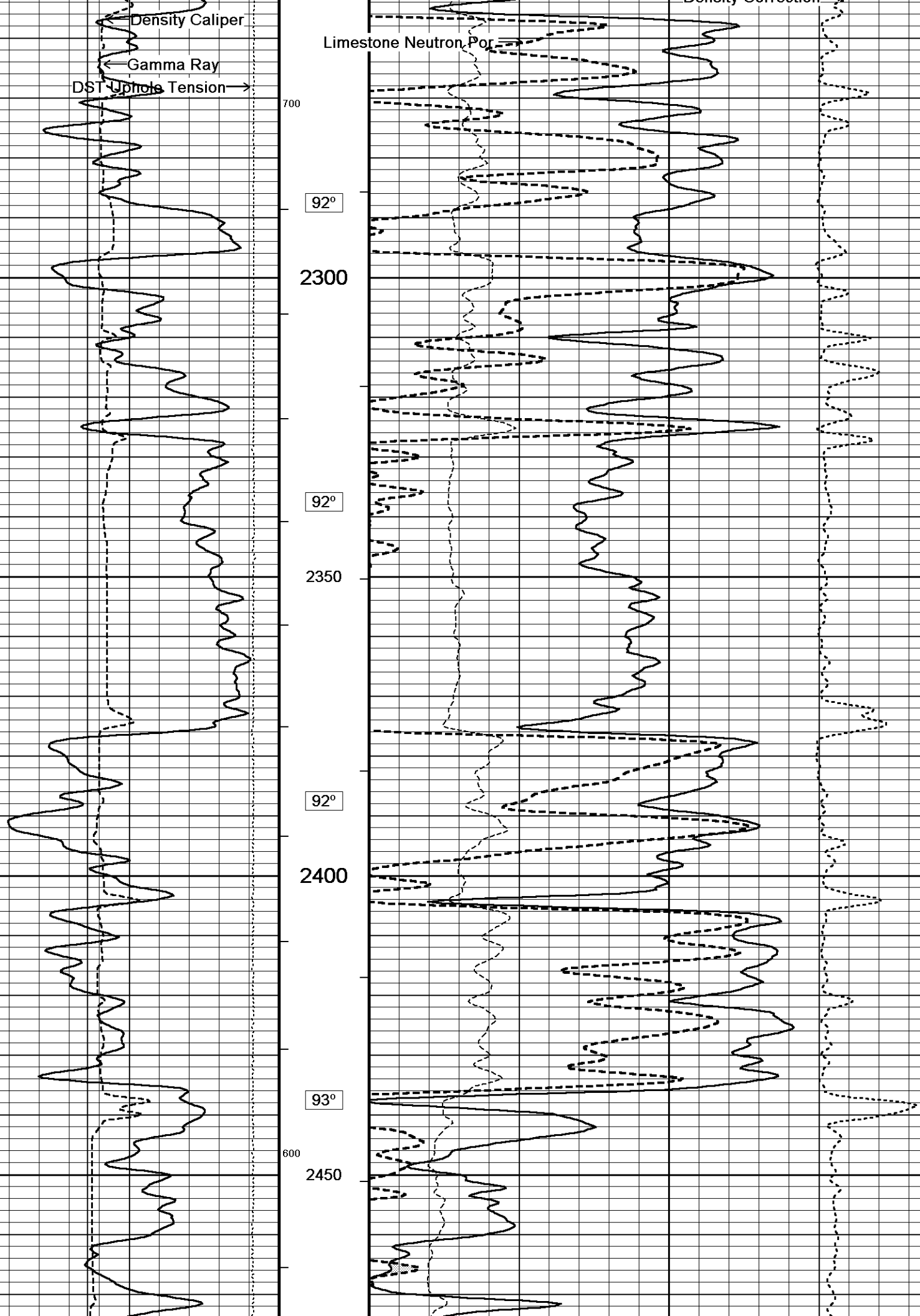


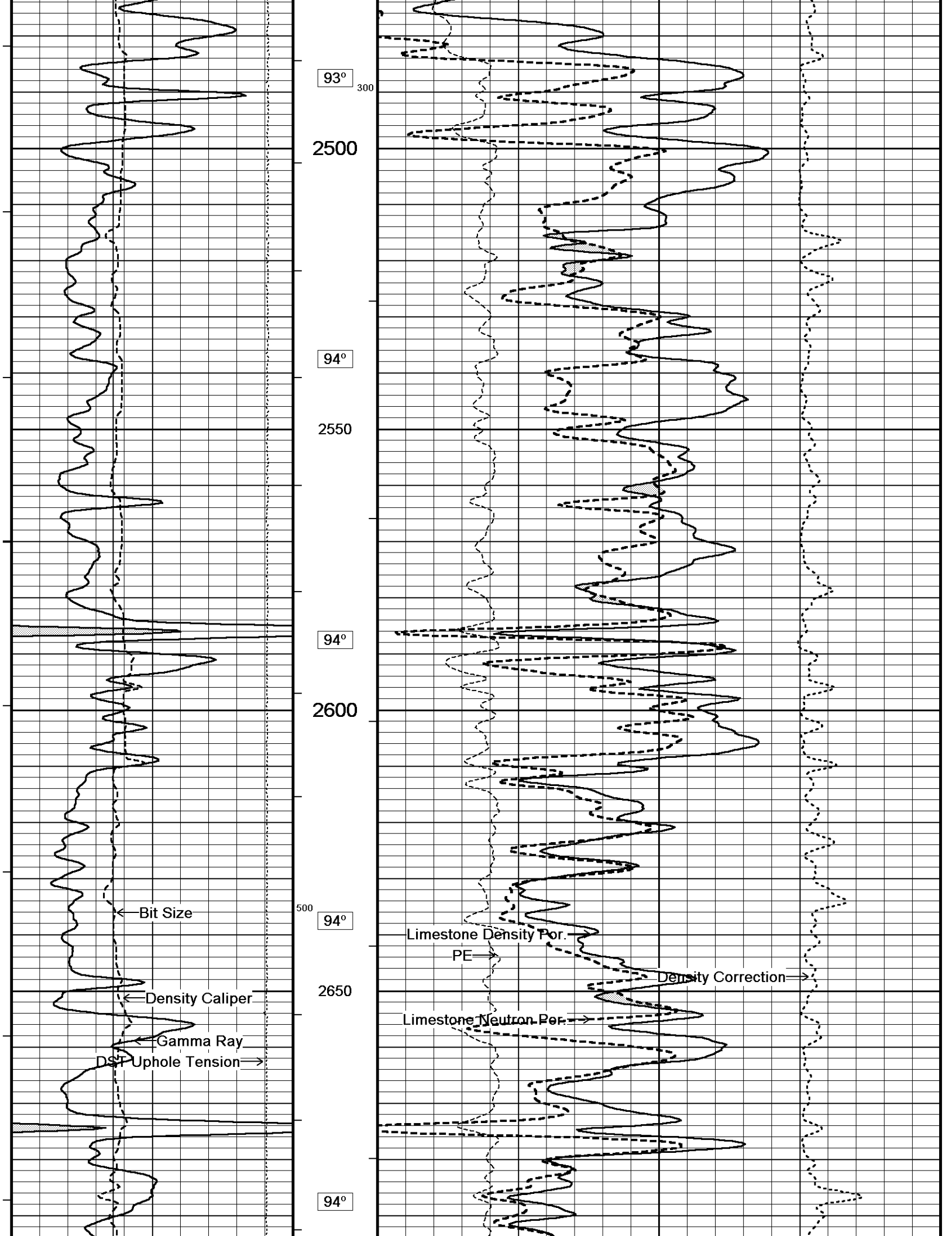


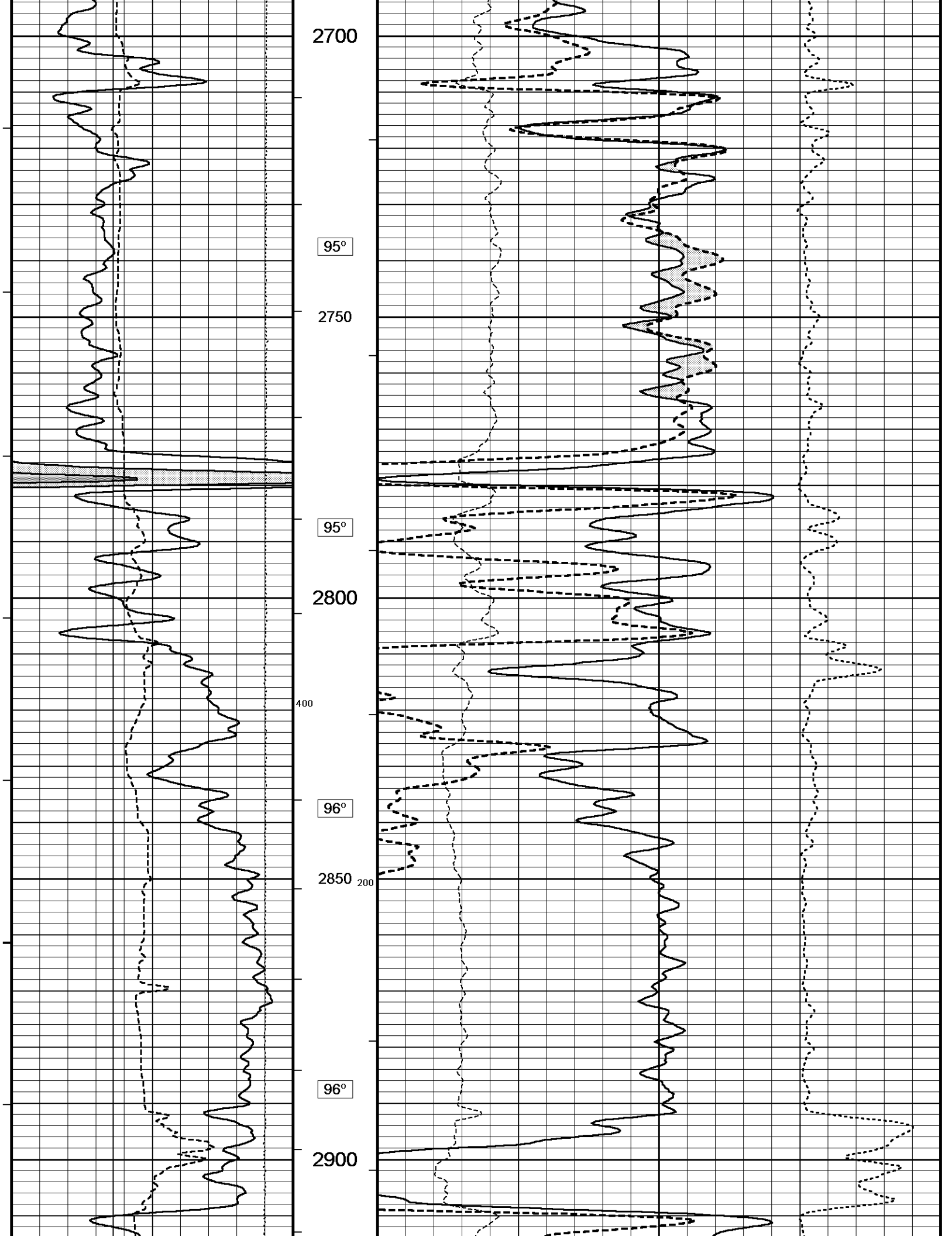


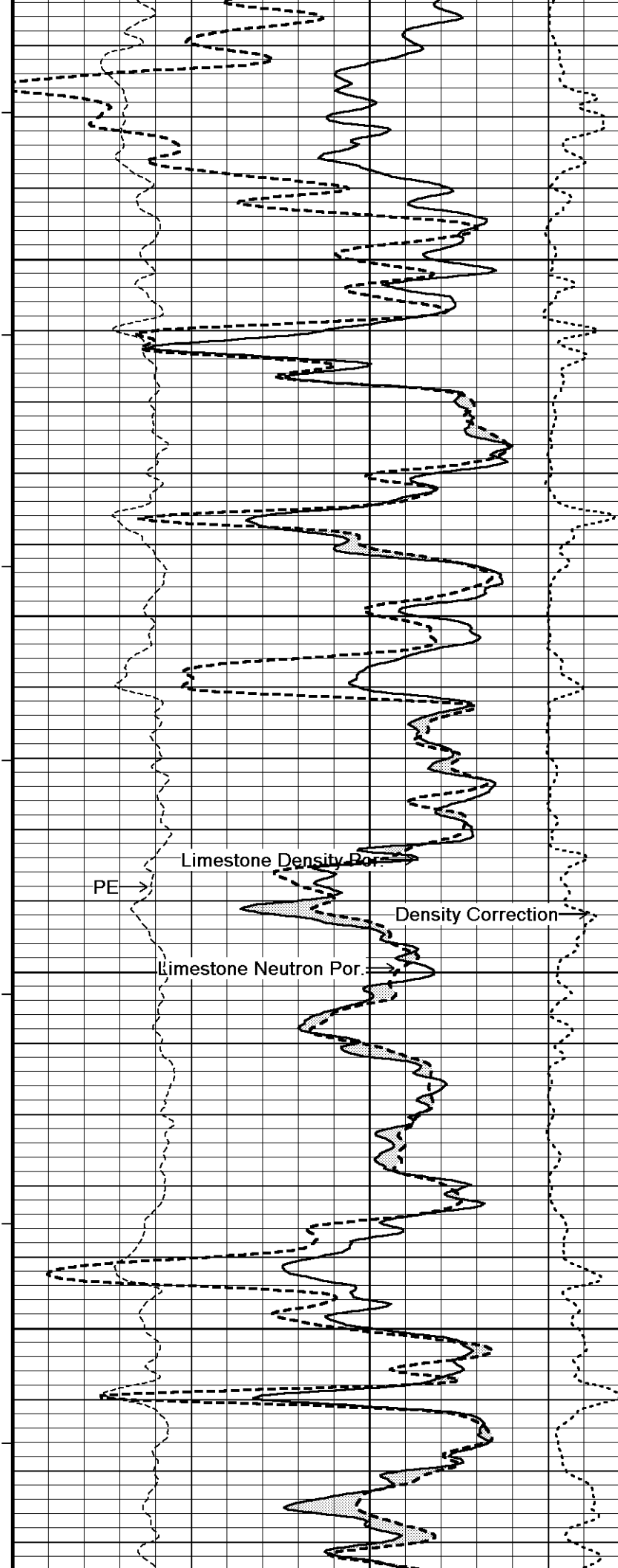
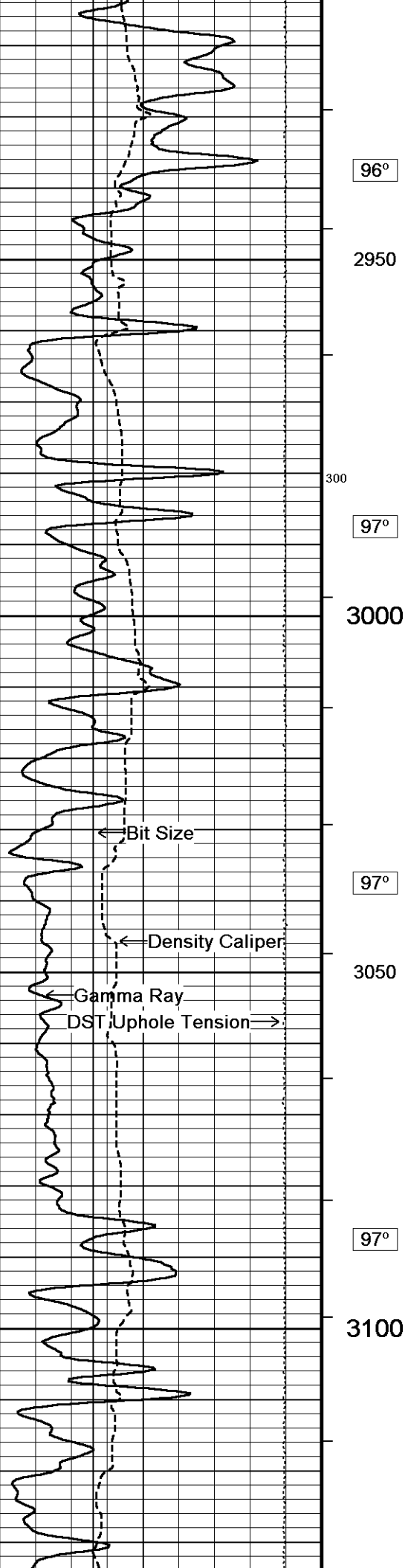


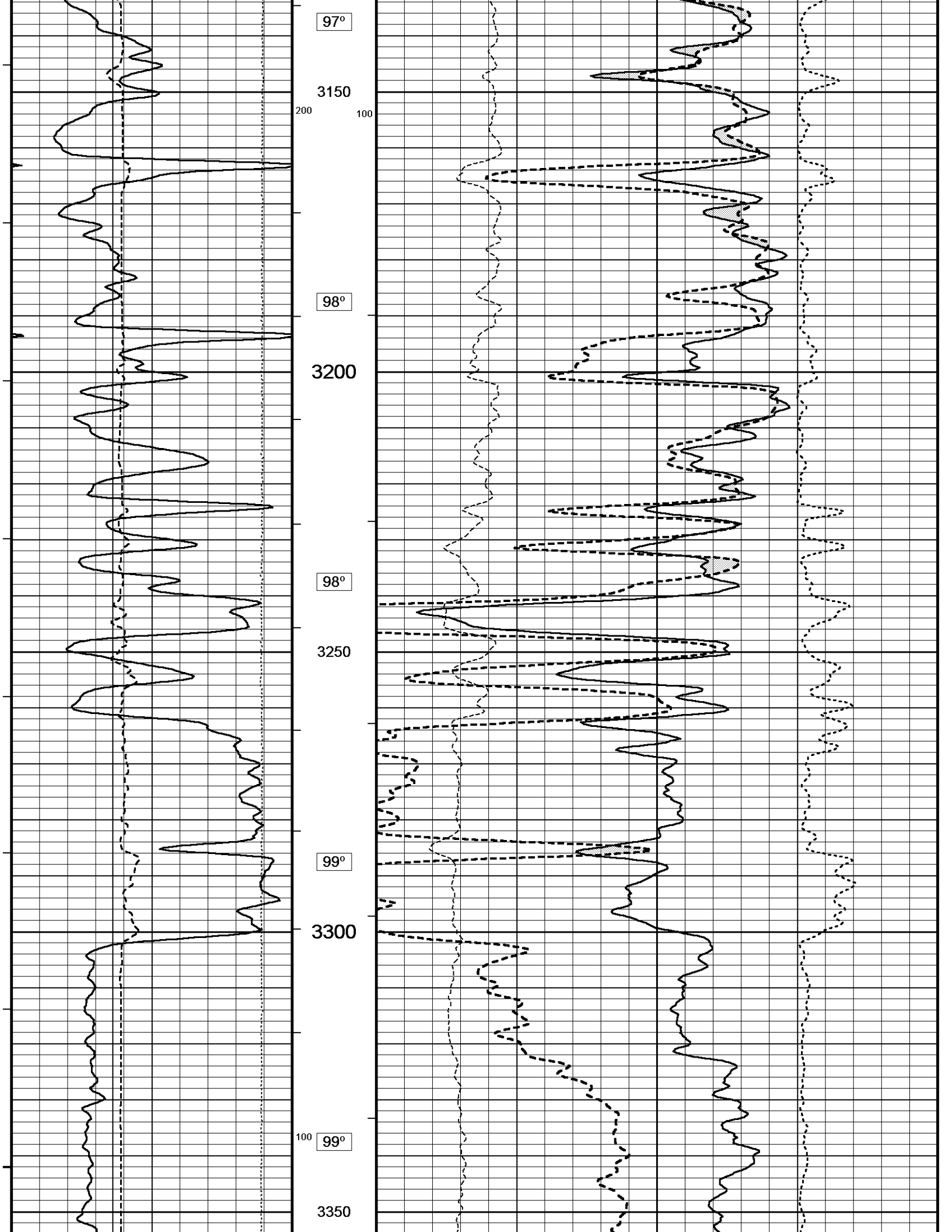


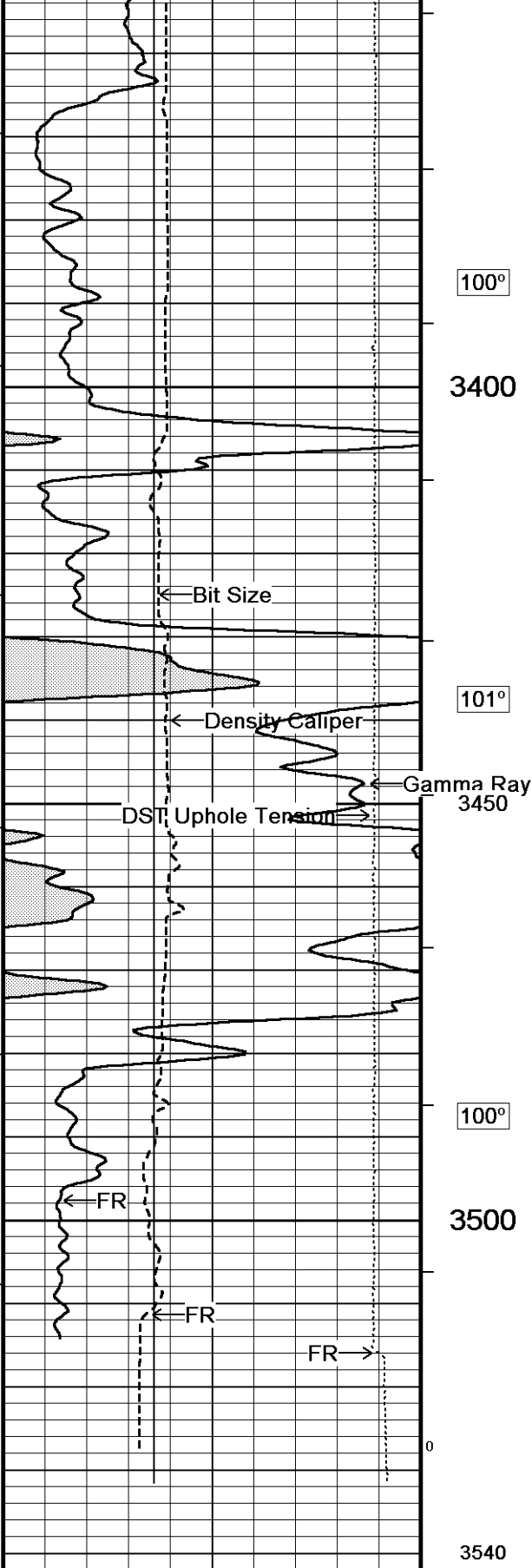








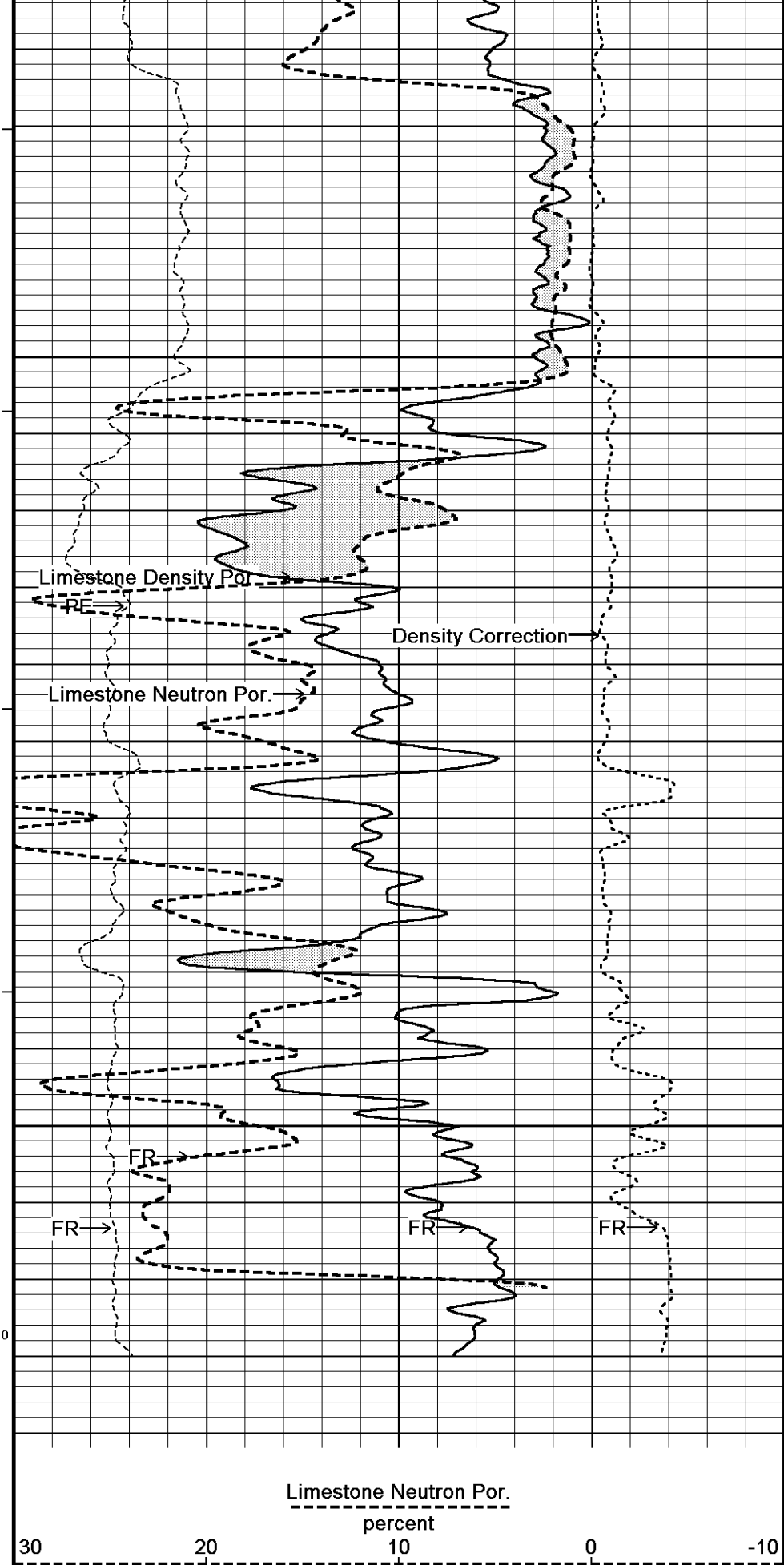


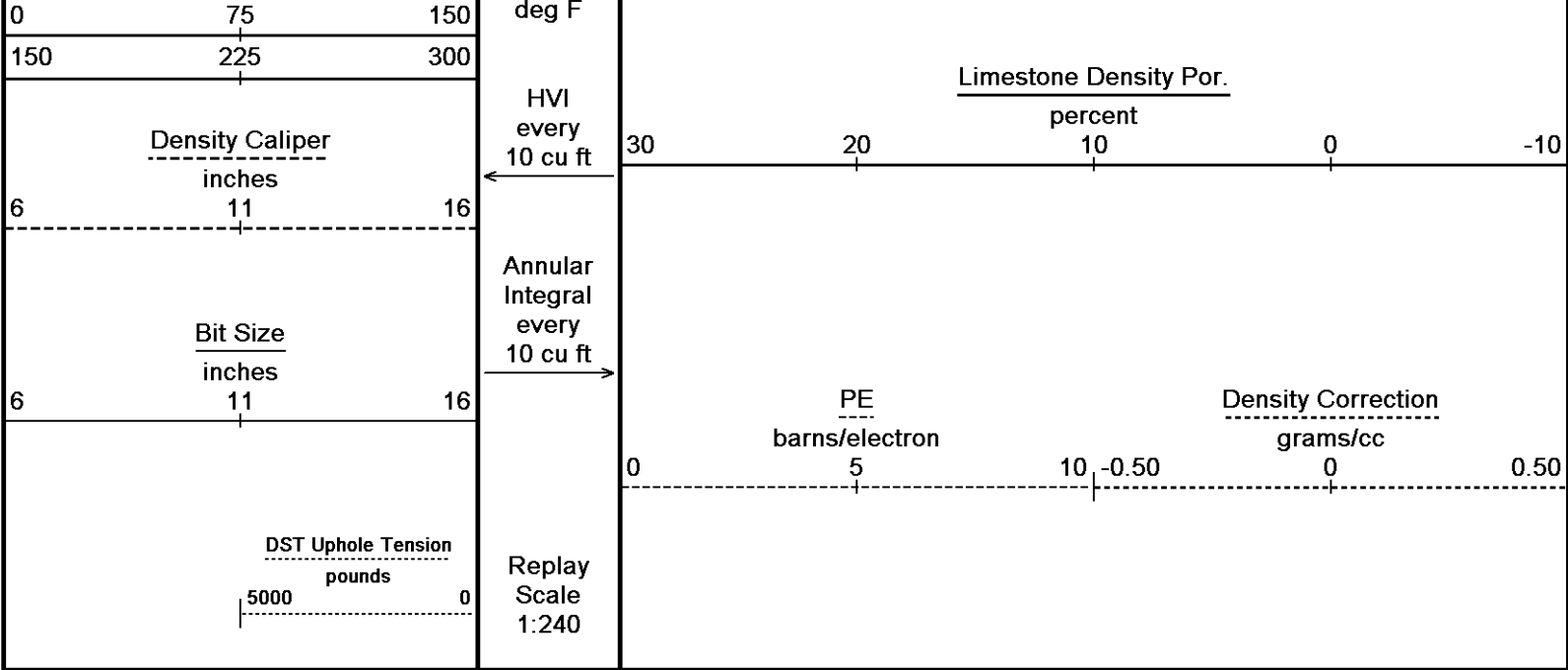


Timing Marks
every 60.0 sec

Gamma Ray
API

Borehole
Temp in





Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 05-MAY-2013 22:37

Filename: C:\Minimus 13.05.9583\Logs\Sou...\Southern Star Alden Gas Storage #0-27 Porosity_002.dta

Recorded on 05-MAY-2013 19:57

System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

↑

5 INCH MAIN

↑

↓

5 INCH MAIN SANDSTONE

↓

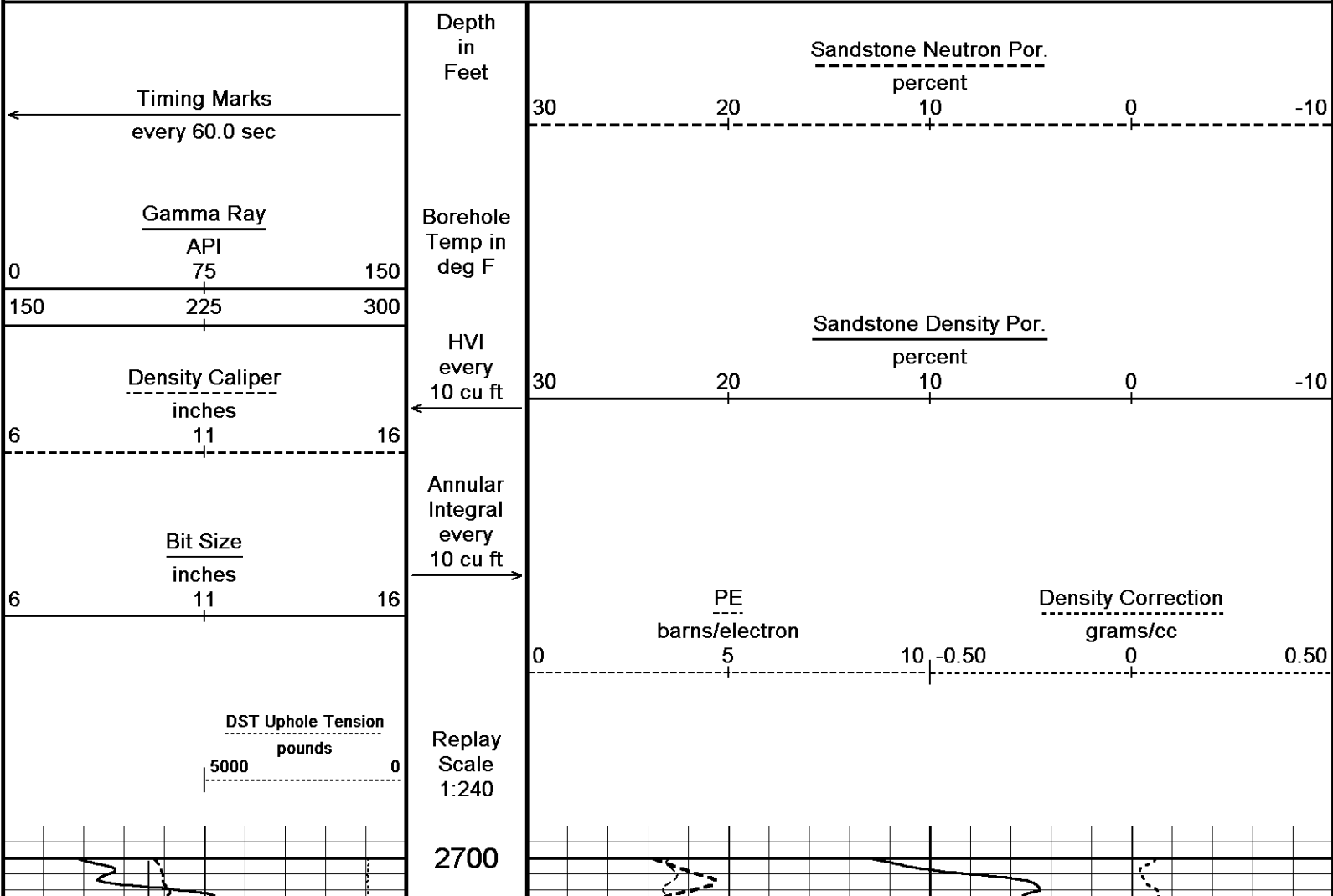
Depth Based Data - Maximum Sampling Increment 10.0cm

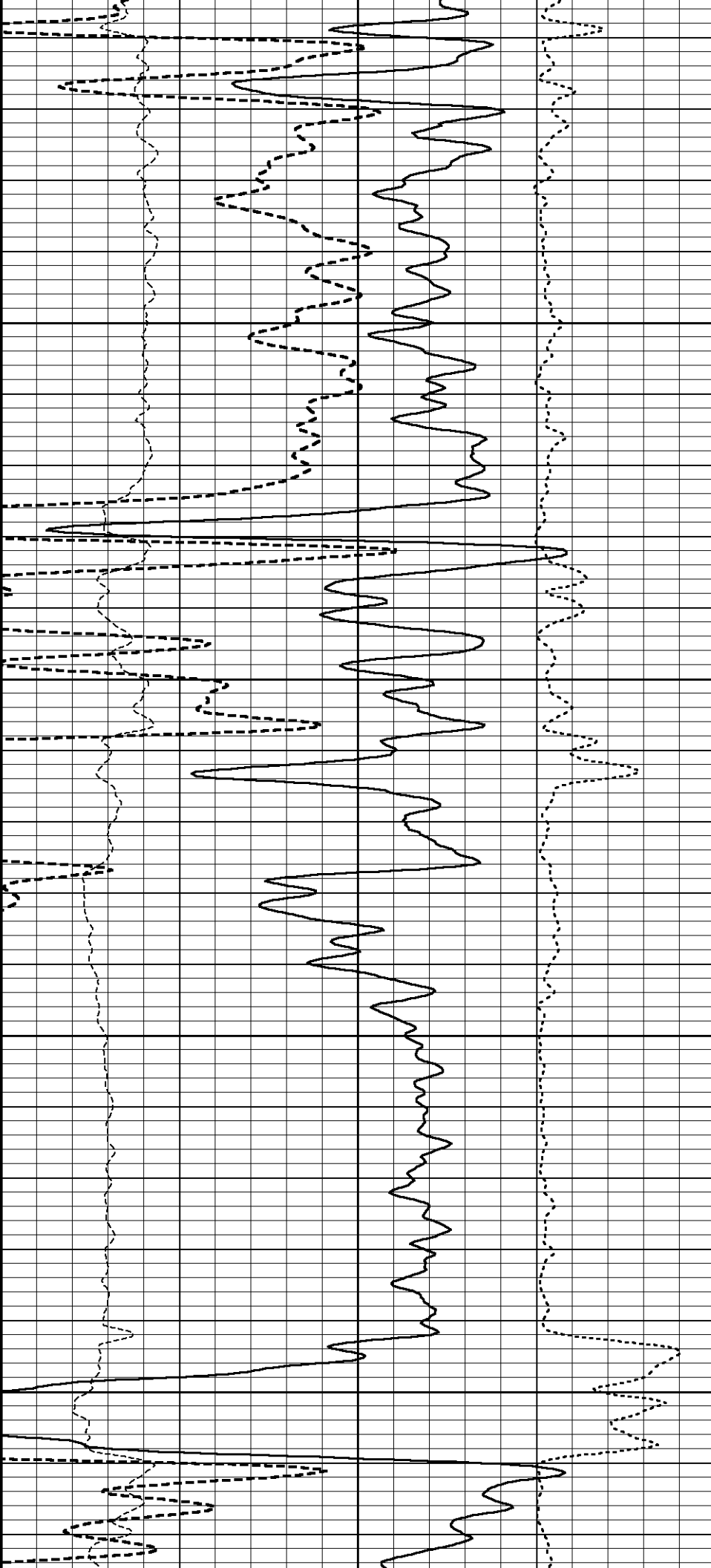
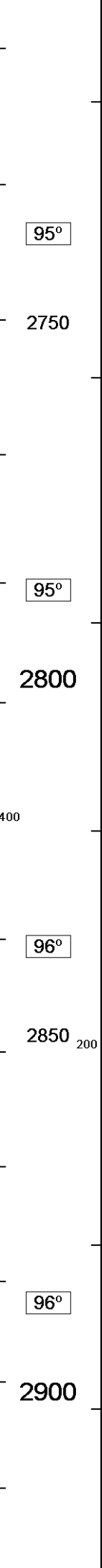
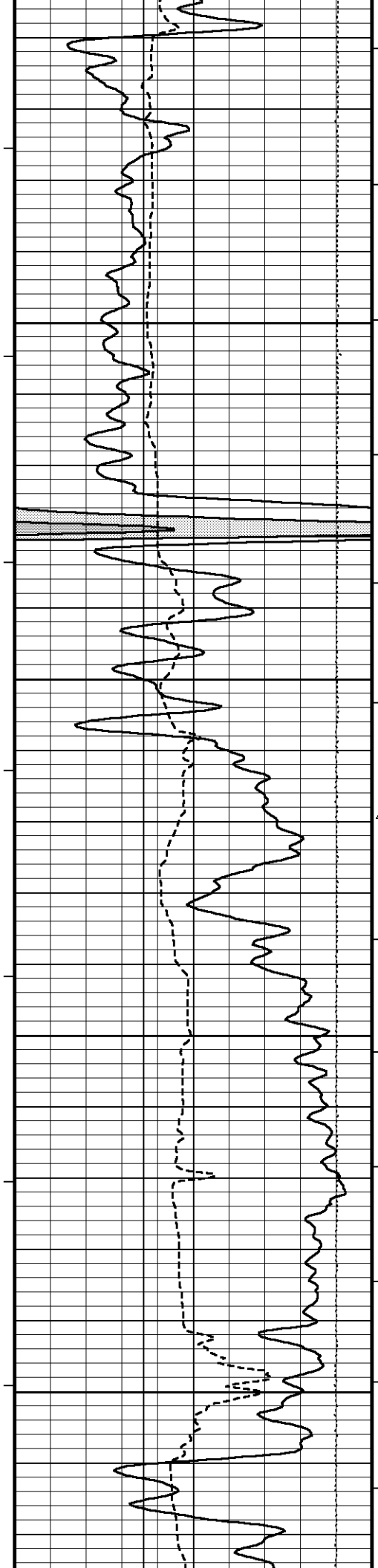
Plotted on 05-MAY-2013 22:37

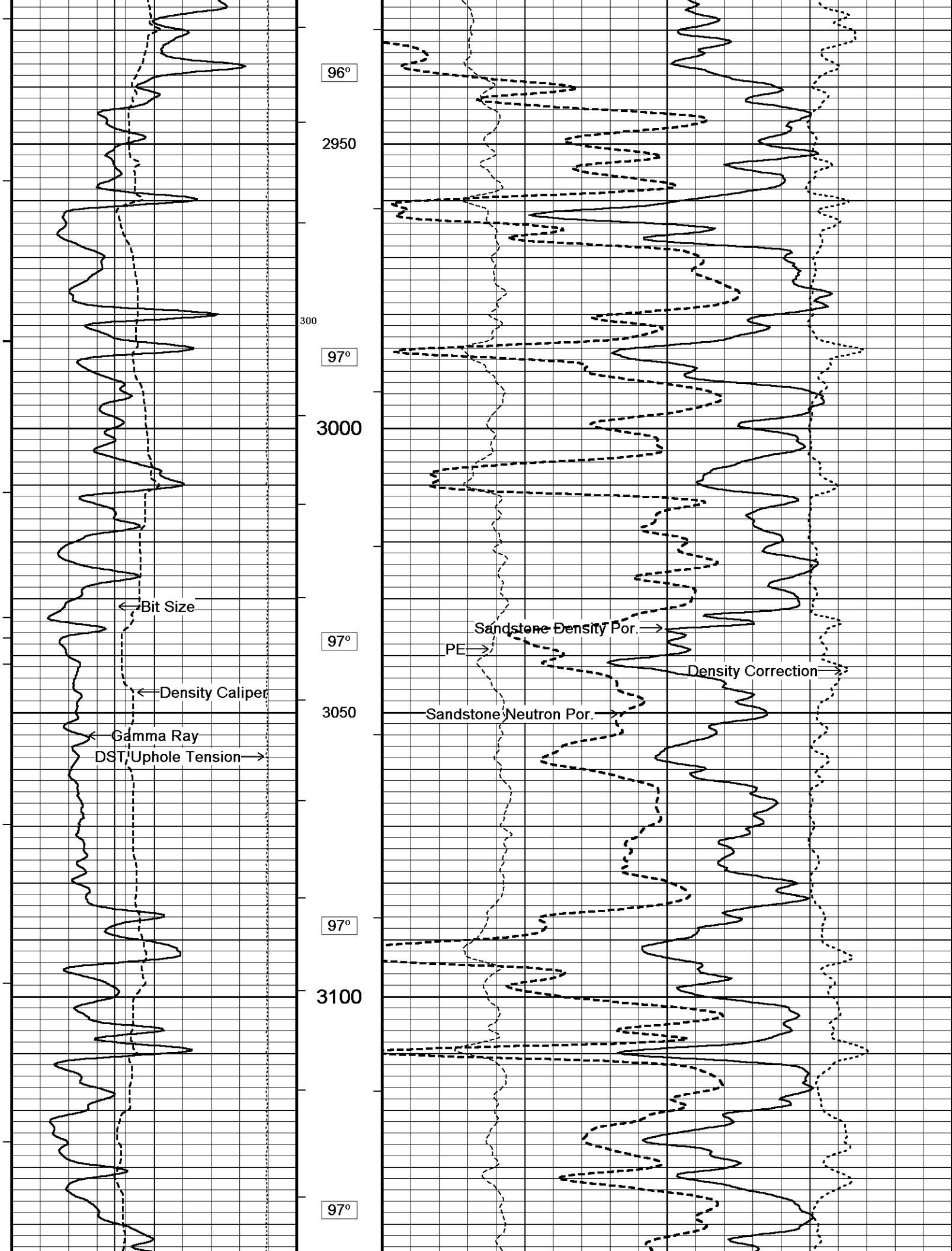
Filename: C:\Minimus 13.05.9583\Logs\Sou...\Southern Star Alden Gas Storage #0-27 Porosity_002.dta

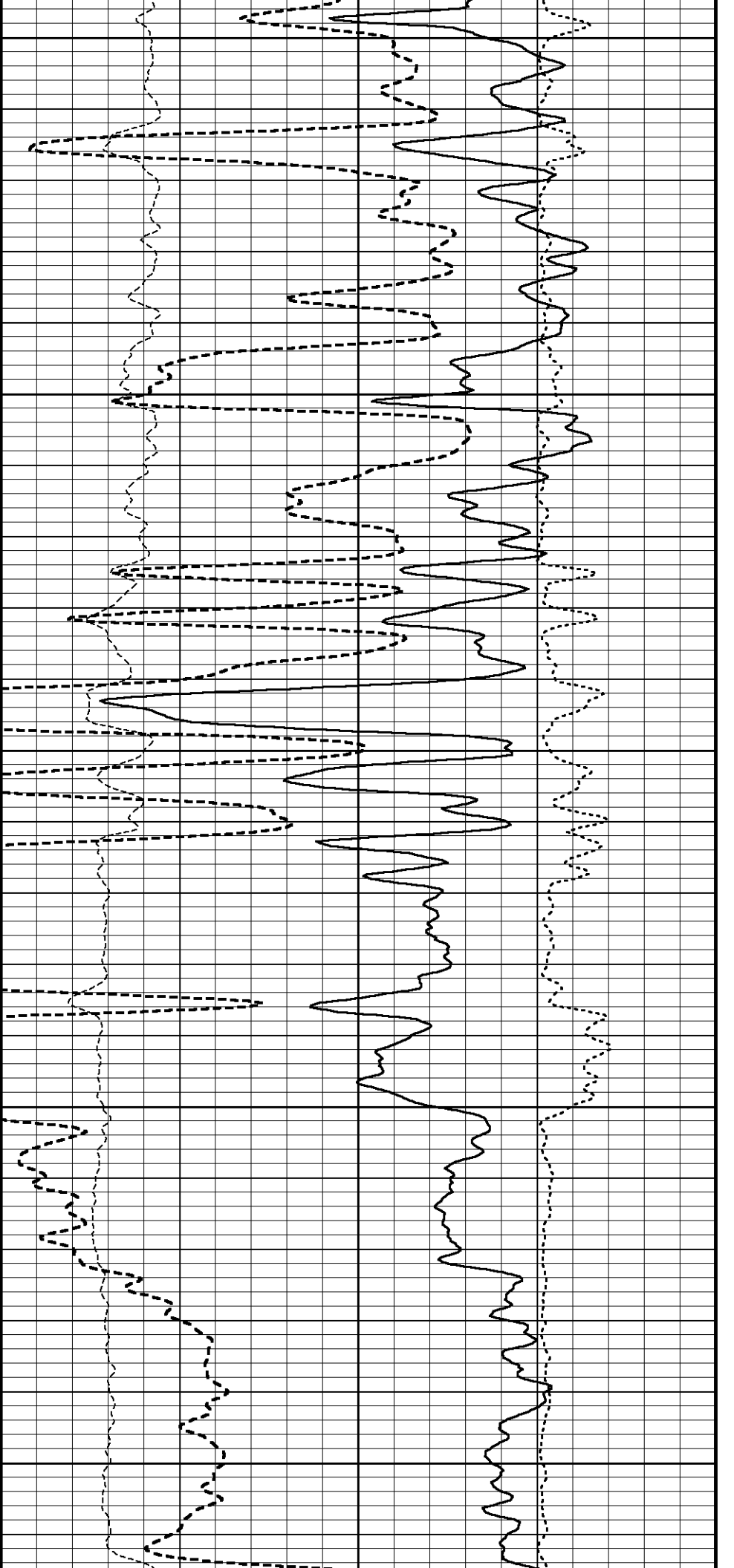
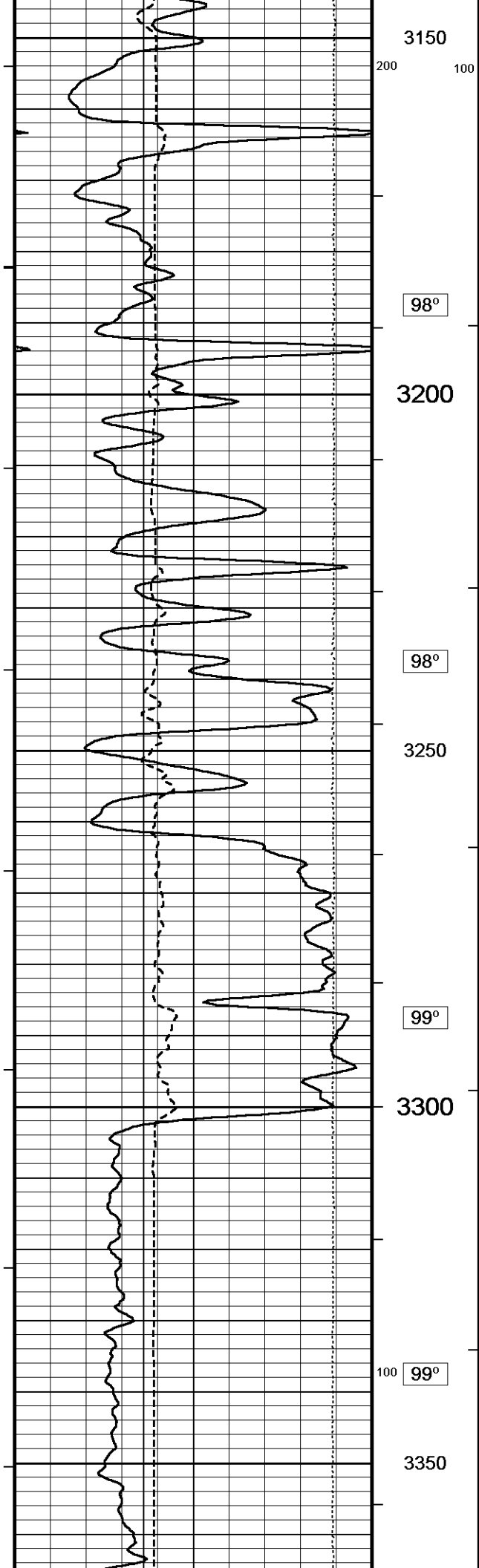
Recorded on 05-MAY-2013 19:57

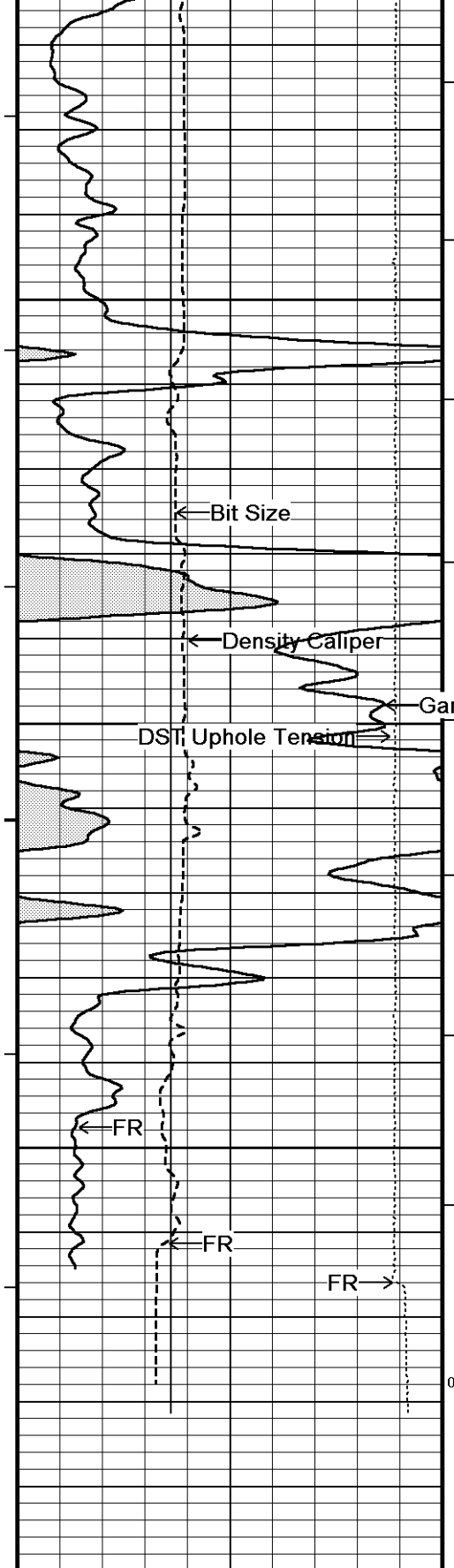
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583











100°

3400

101°

3450

100°

3500

3550
Depth
in
Feet

← Bit Size

← Density Caliper

DST, Uphole Tension →

Gamma Ray

← FR

← FR

FR →

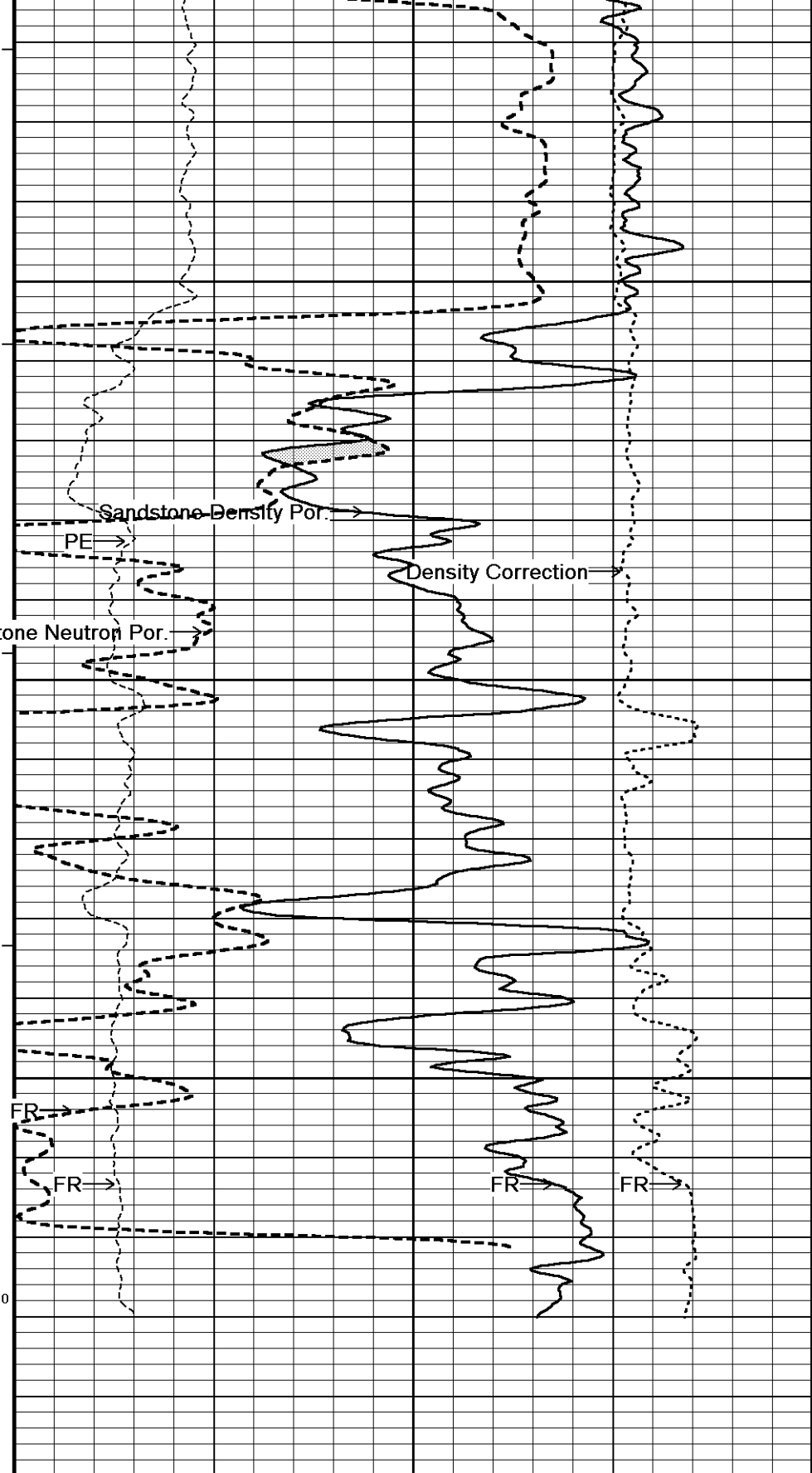
Timing Marks
every 60.0 sec

Gamma Ray

API

0 75 150

Borehole
Temp in
deg F



Sandstone Density Por. →

PE →

Density Correction →

Sandstone Neutron Por. →

FR →

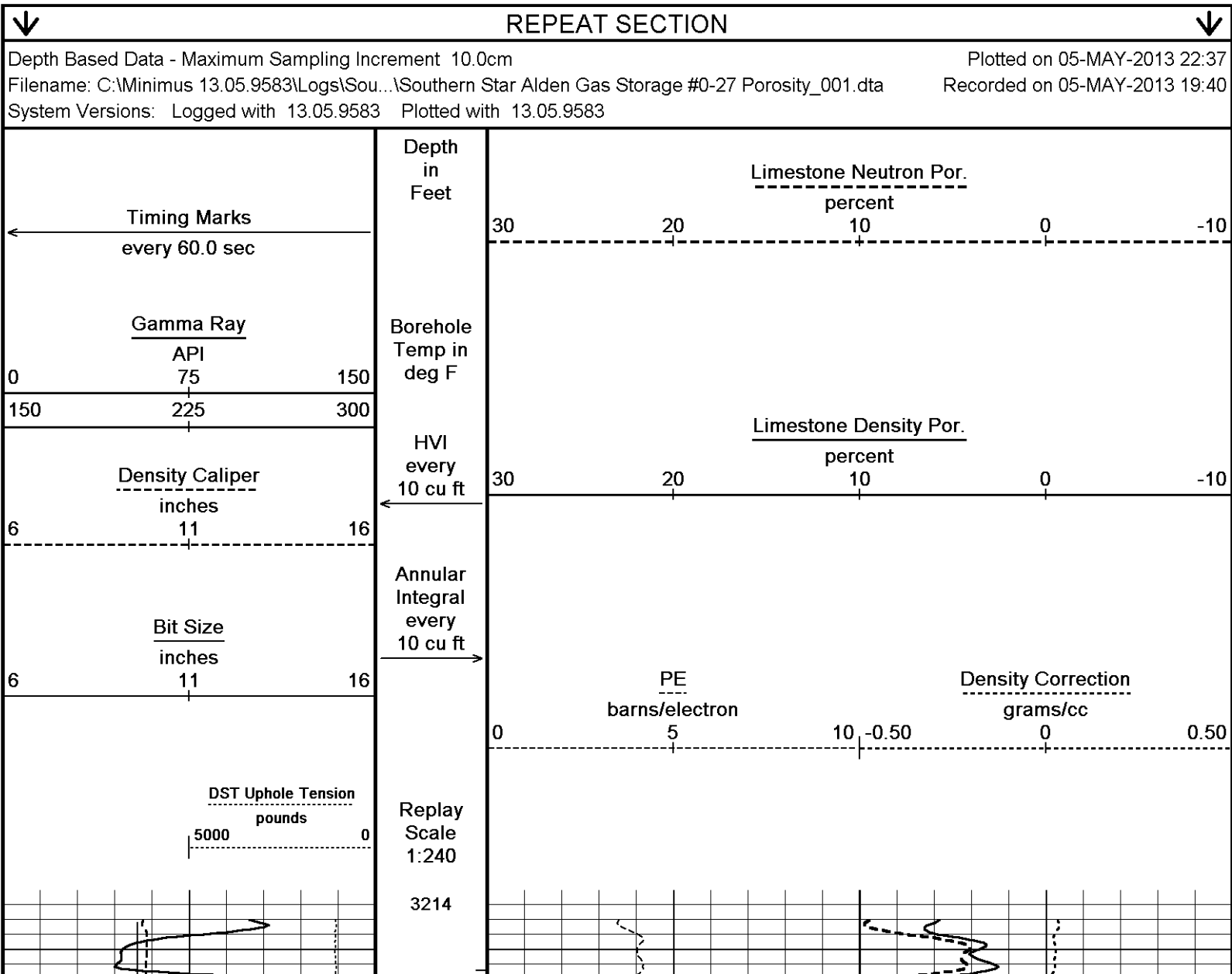
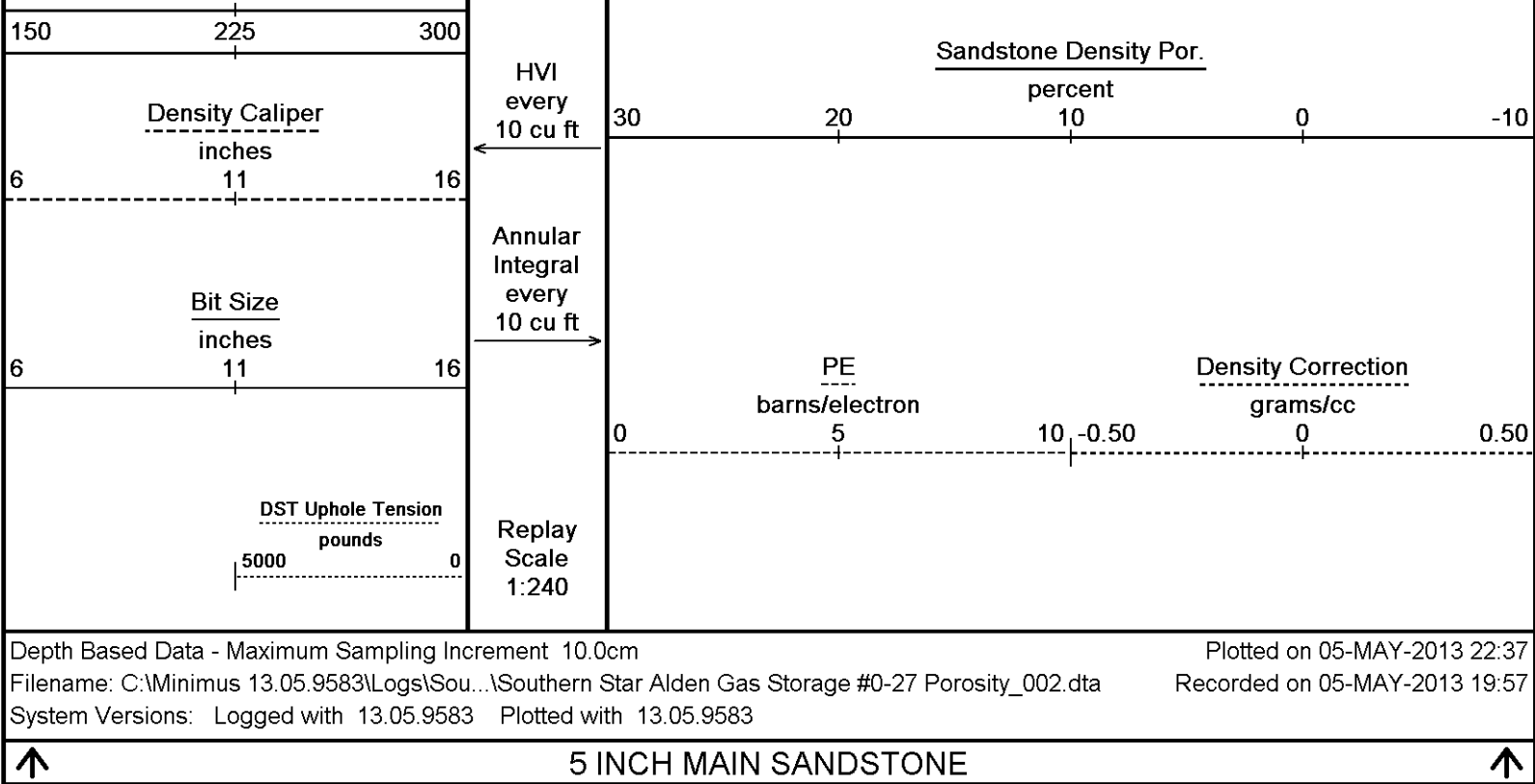
FR →

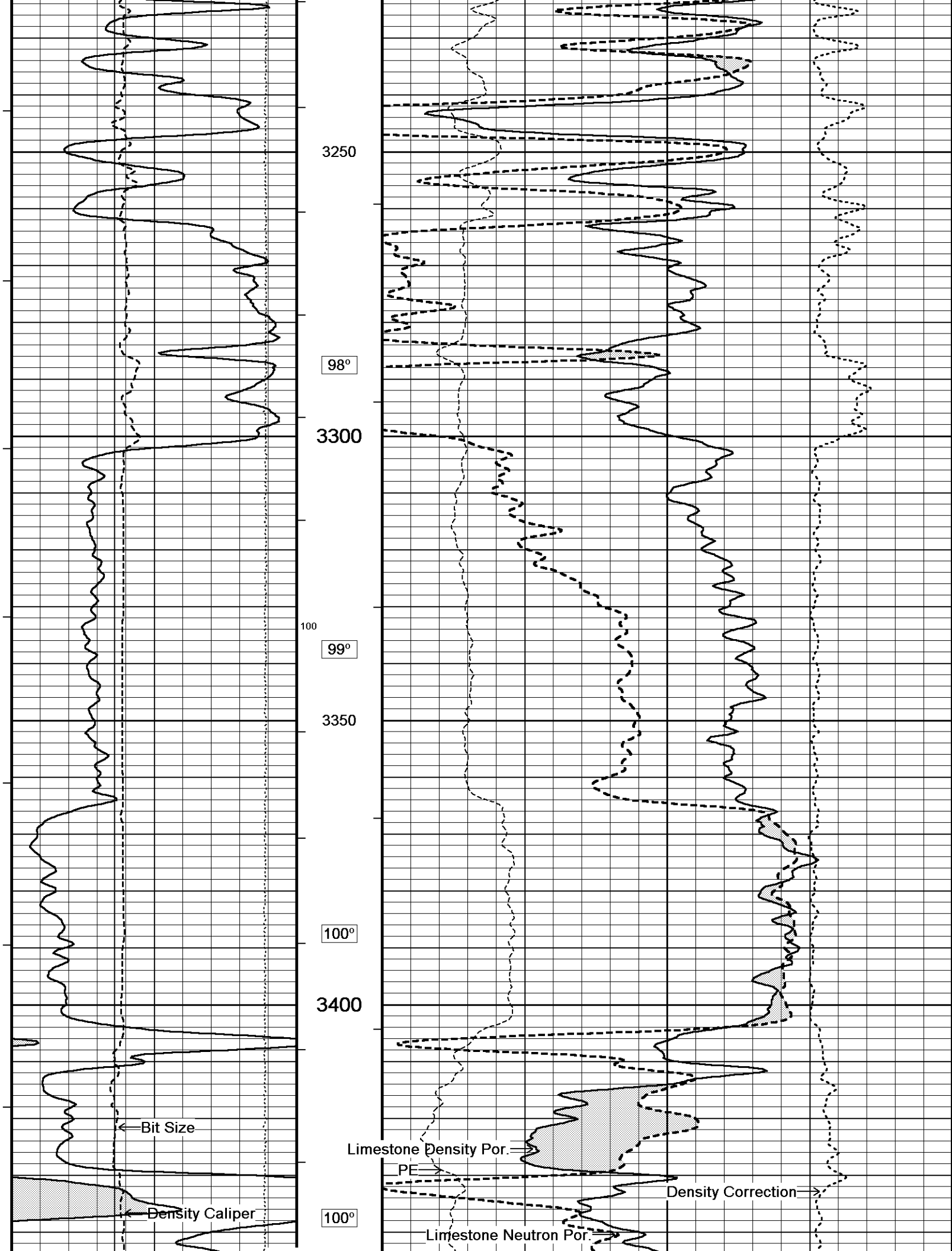
FR →

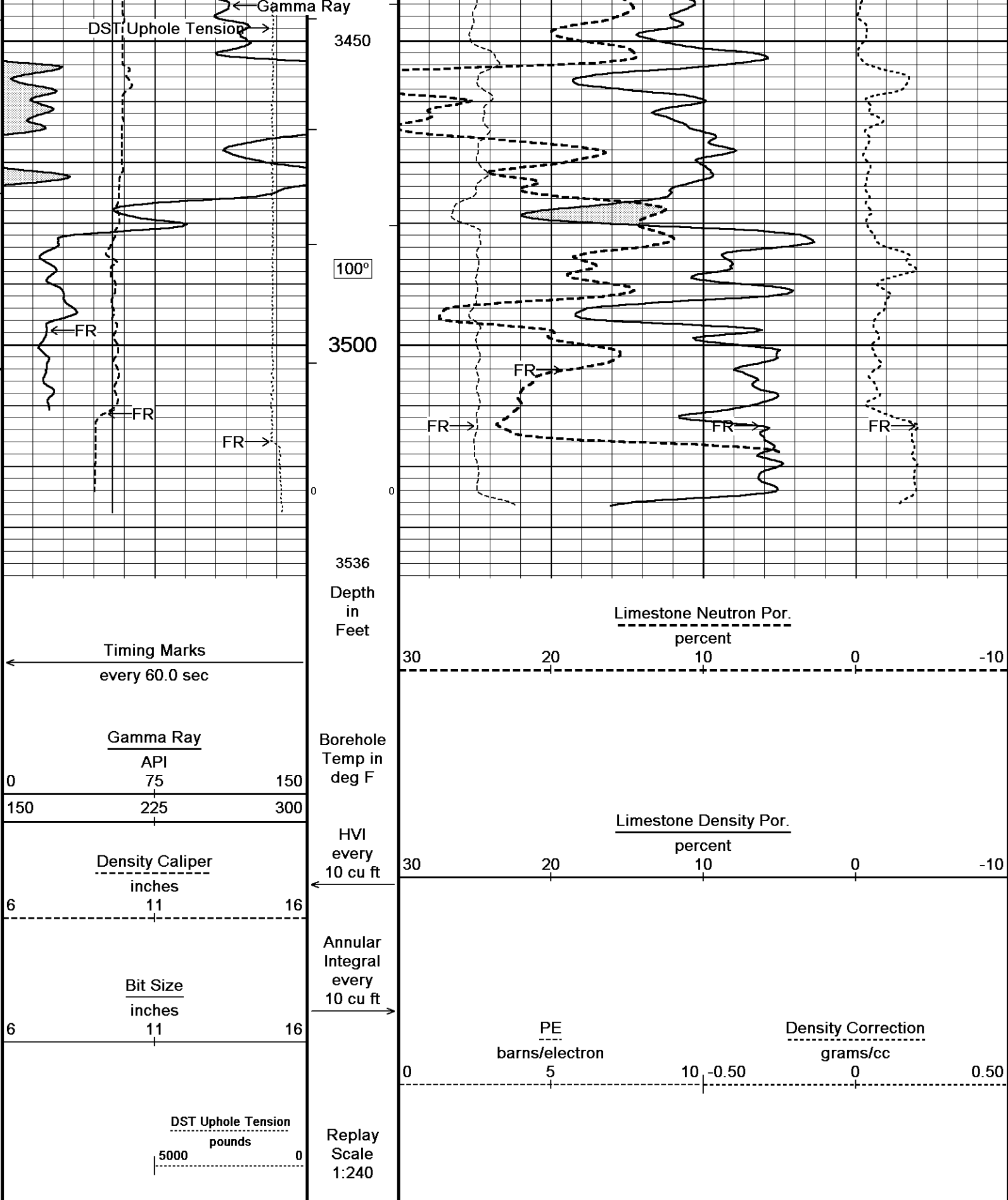
FR →

Sandstone Neutron Por.
percent

30 20 10 0 -10







5 INCH MAIN

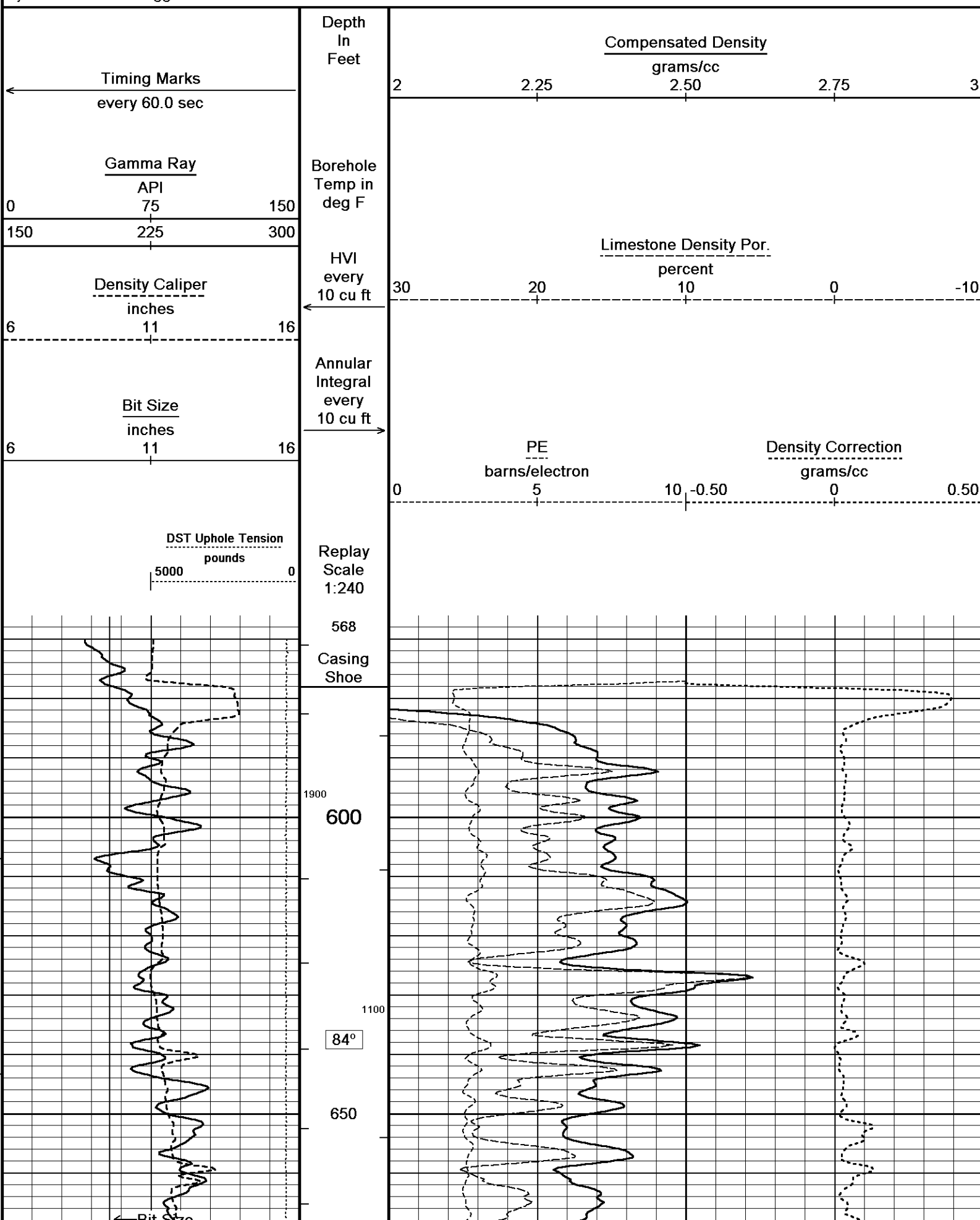
Depth Based Data - Maximum Sampling Increment 10.0cm

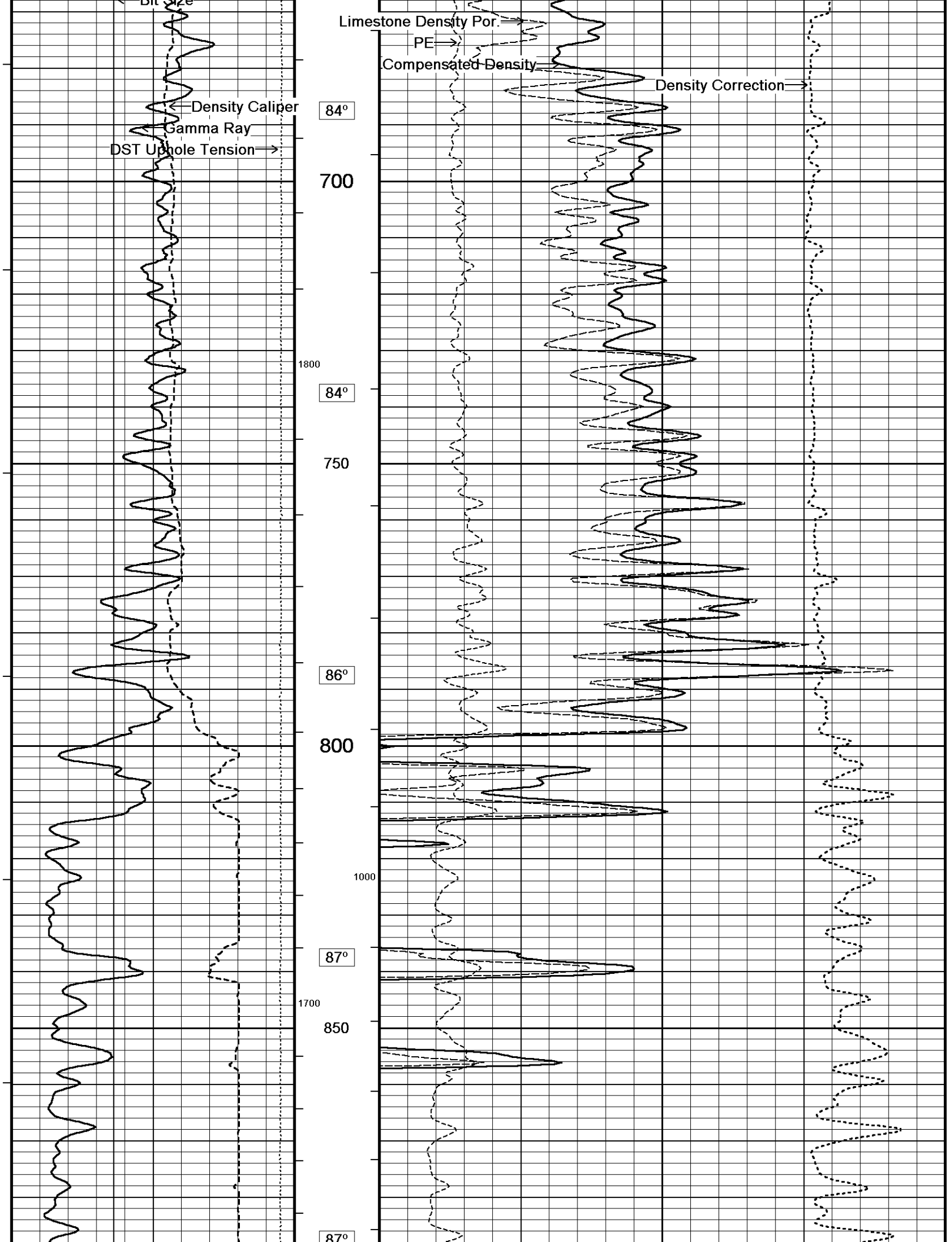
Plotted on 05-MAY-2013 22:37

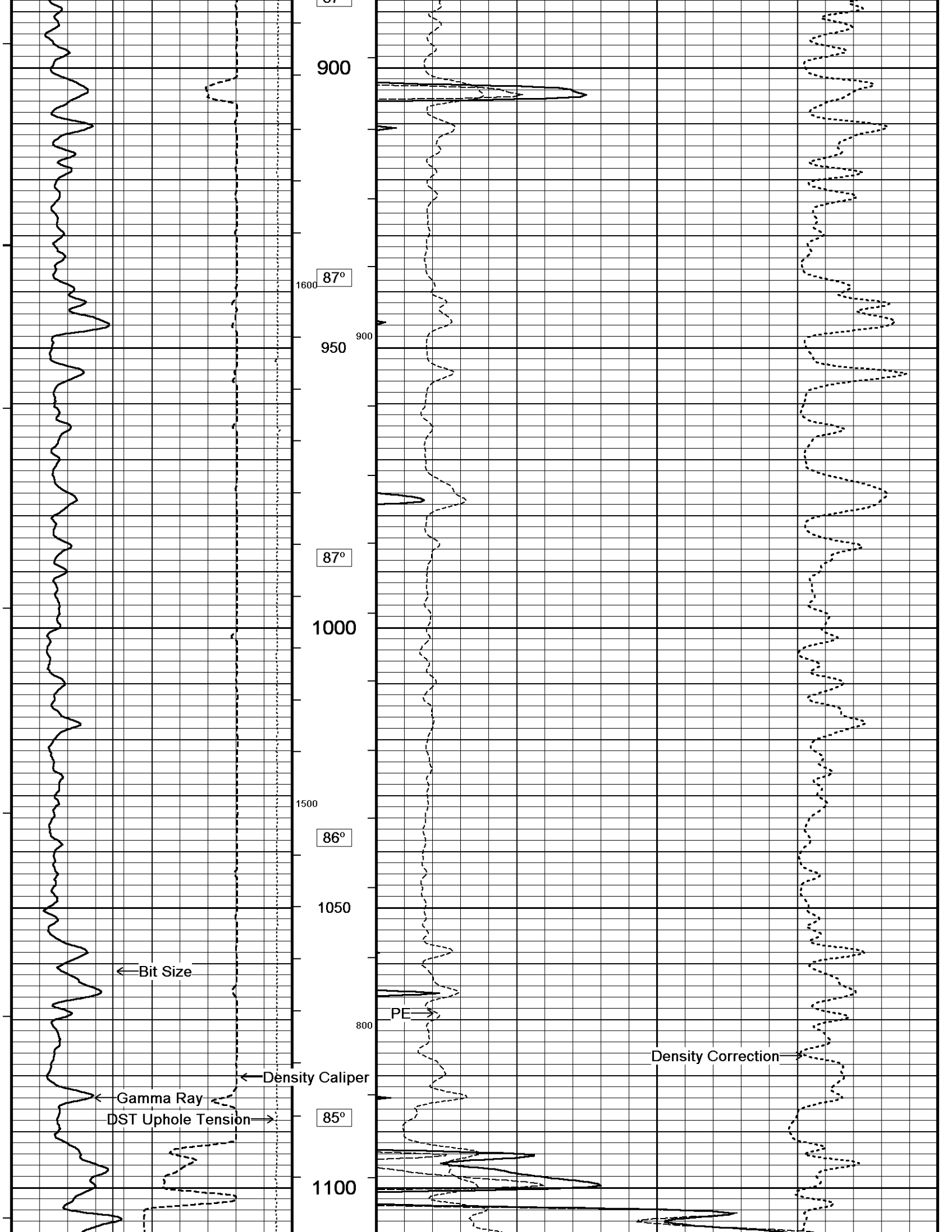
Filename: C:\Minimus 13.05.9583\Logs\Sou...\Southern Star Alden Gas Storage #0-27 Porosity_002.dta

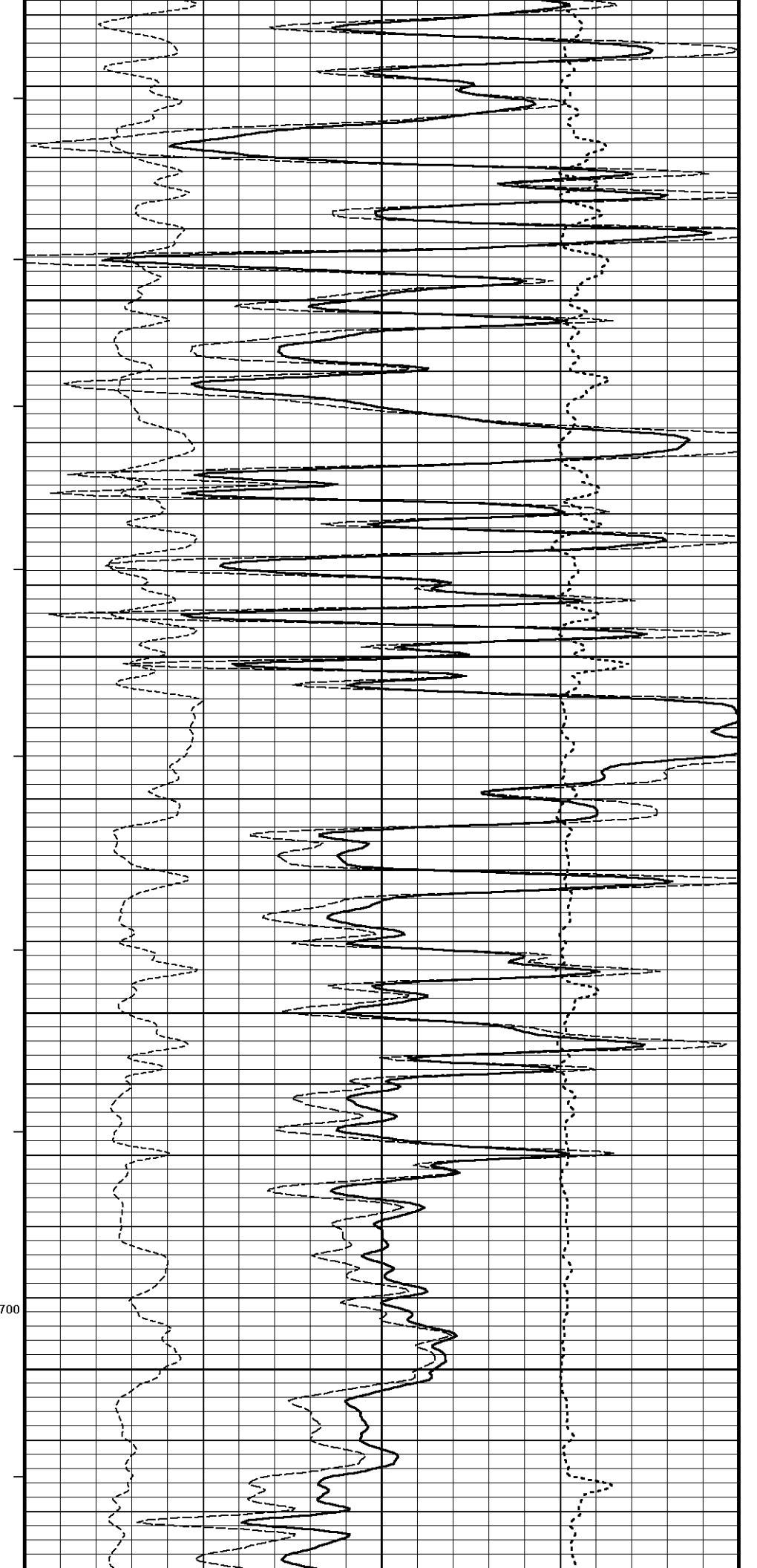
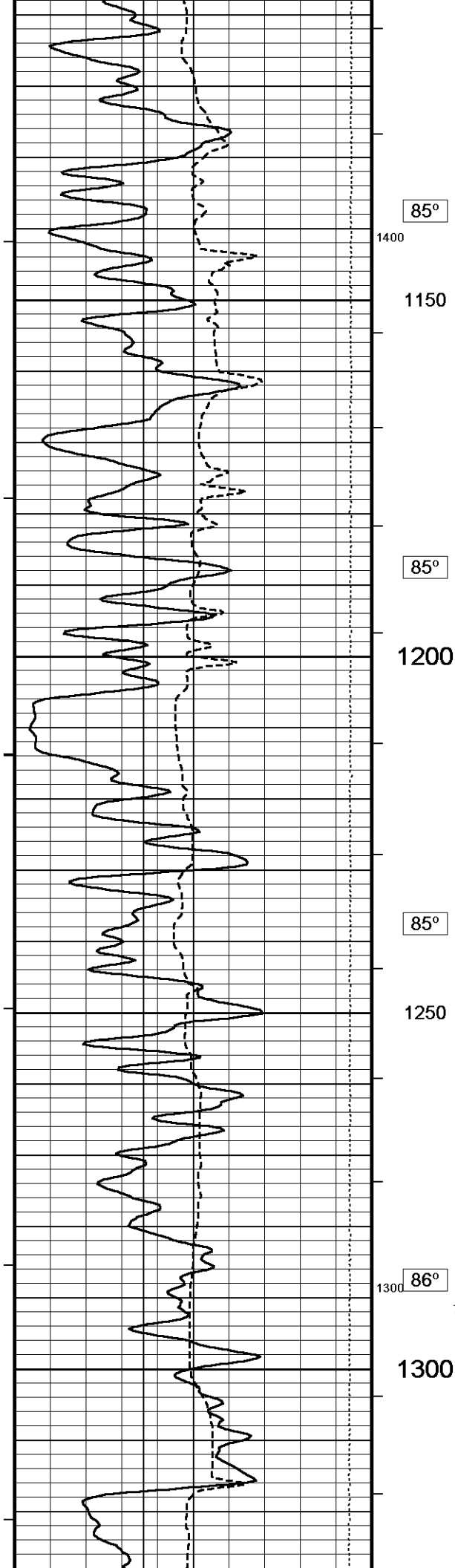
Recorded on 05-MAY-2013 19:57

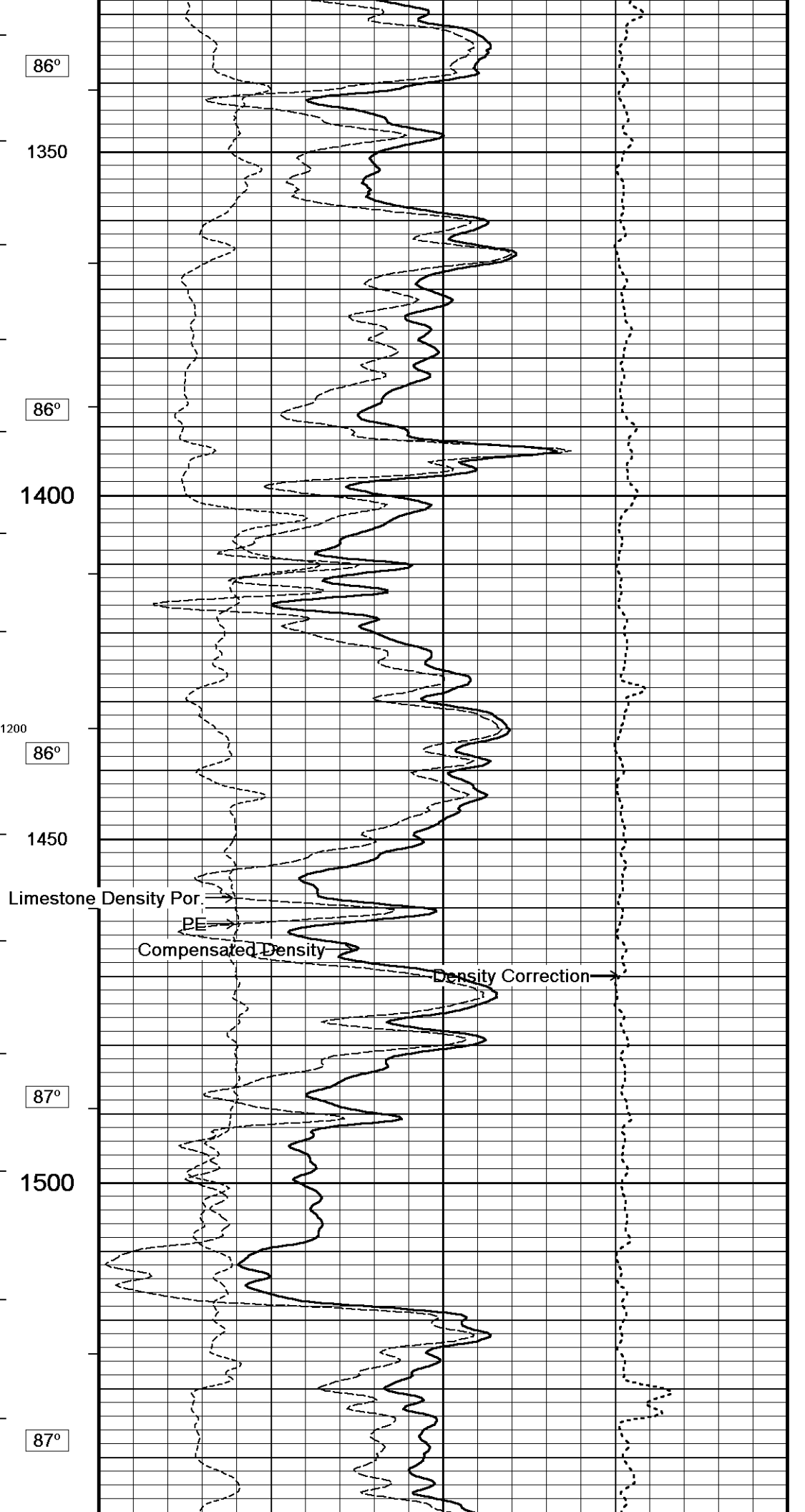
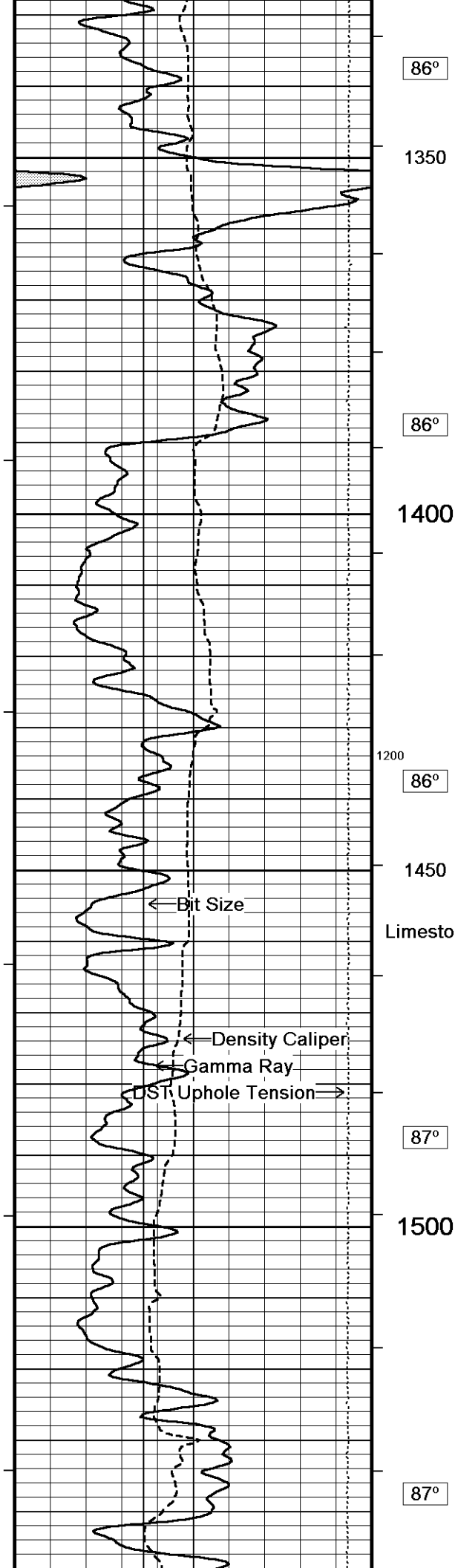
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

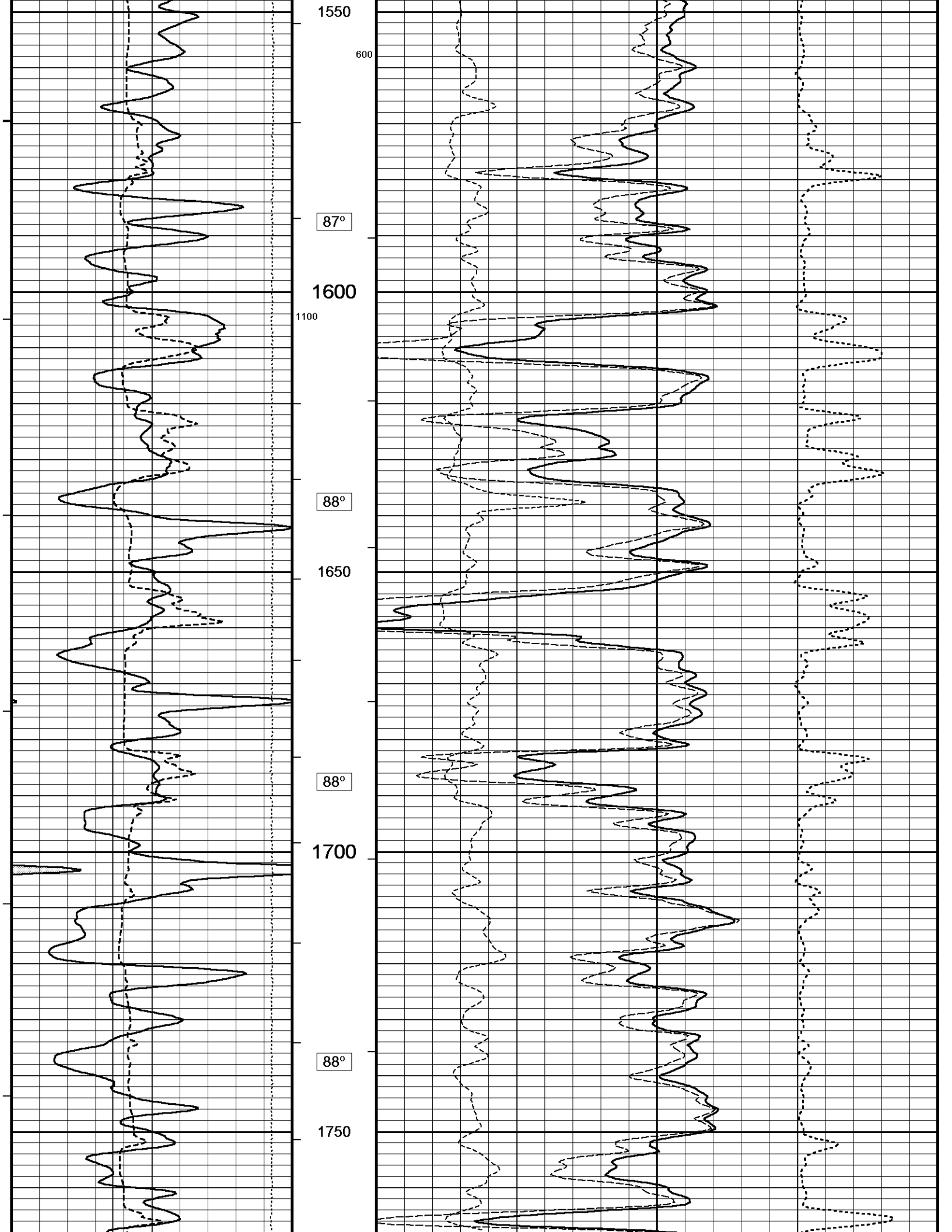


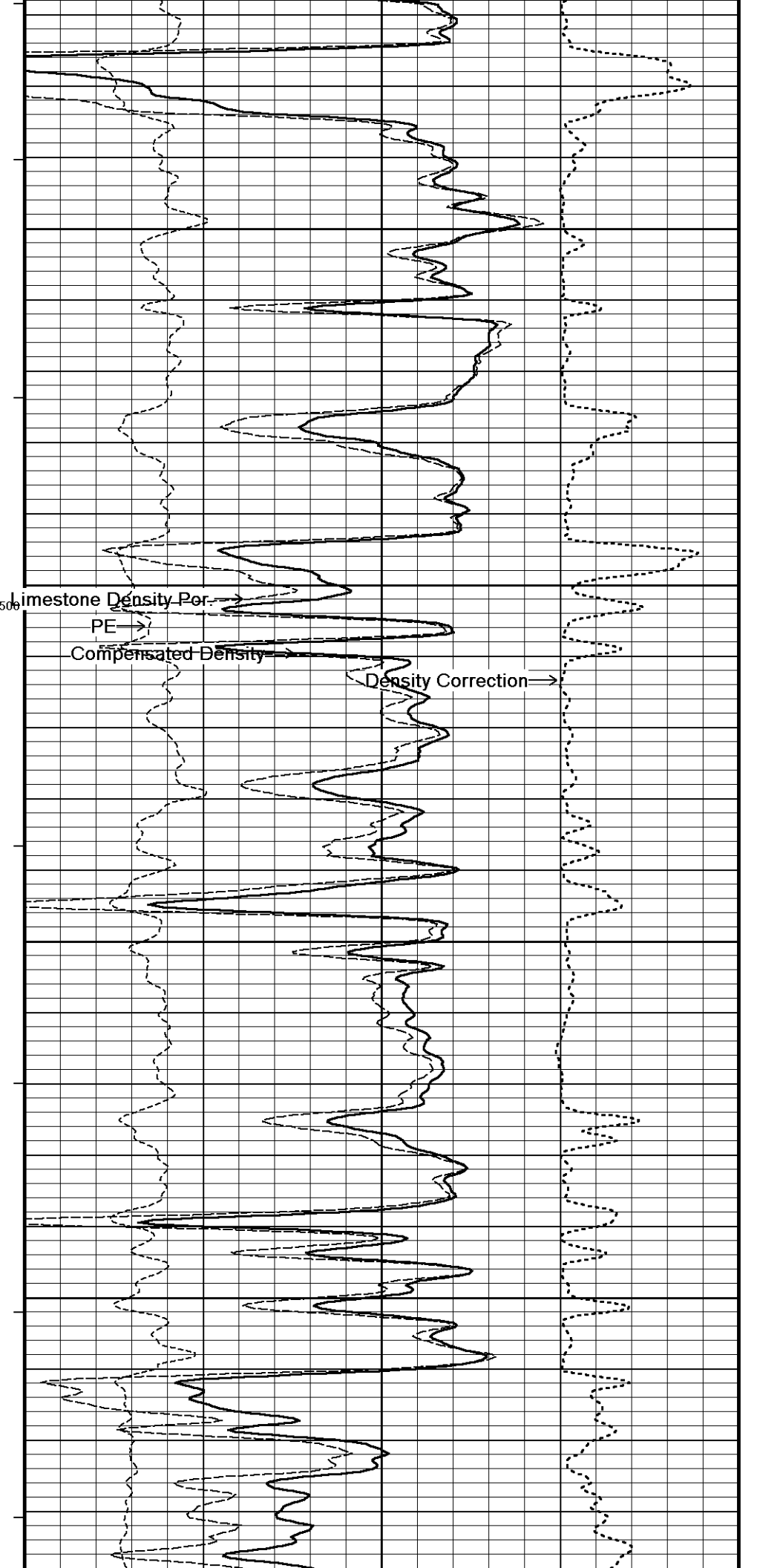
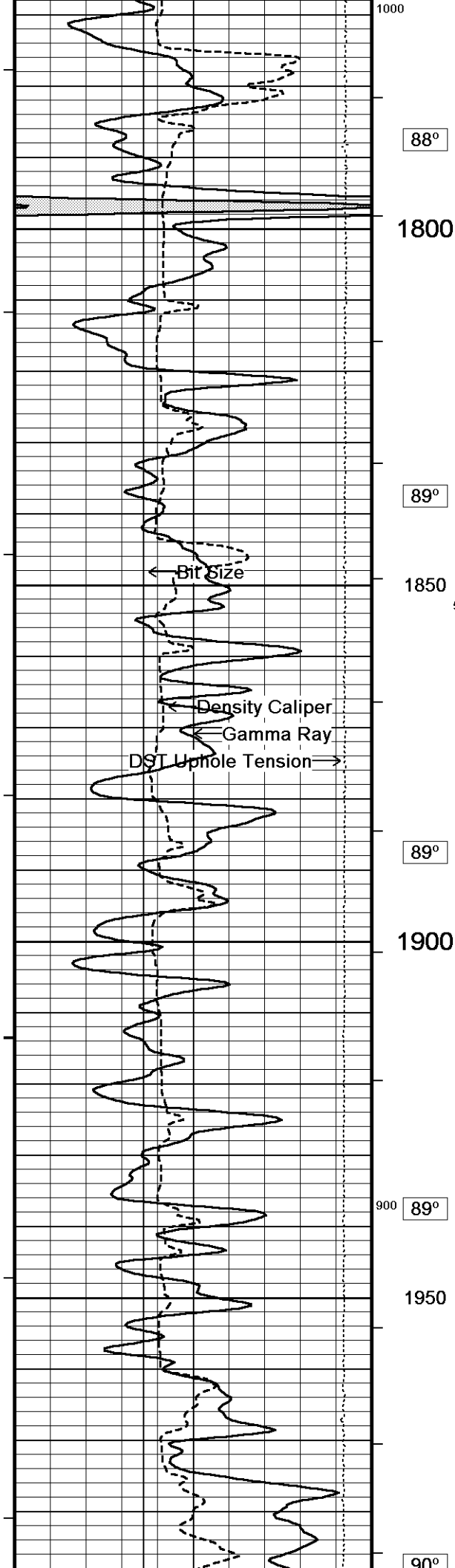


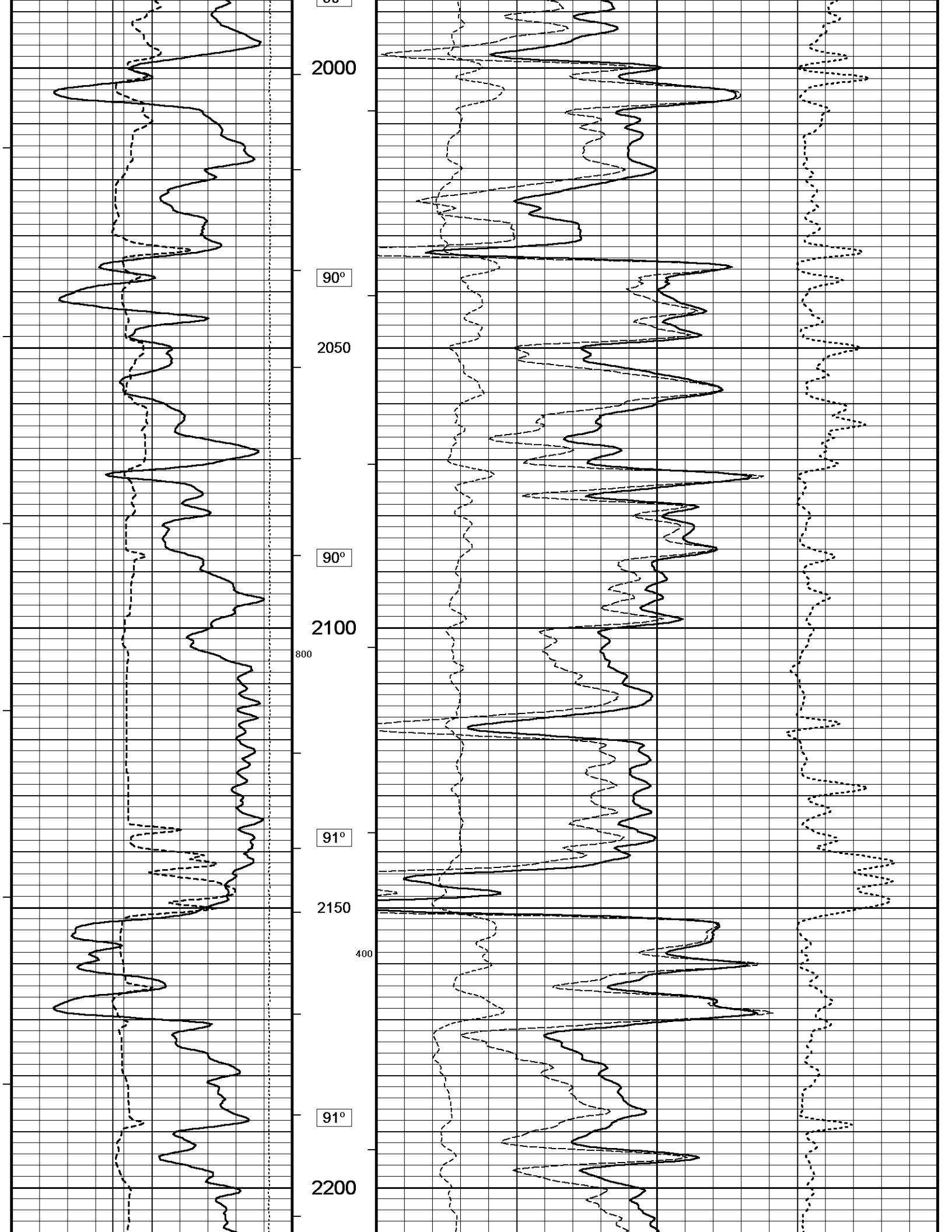


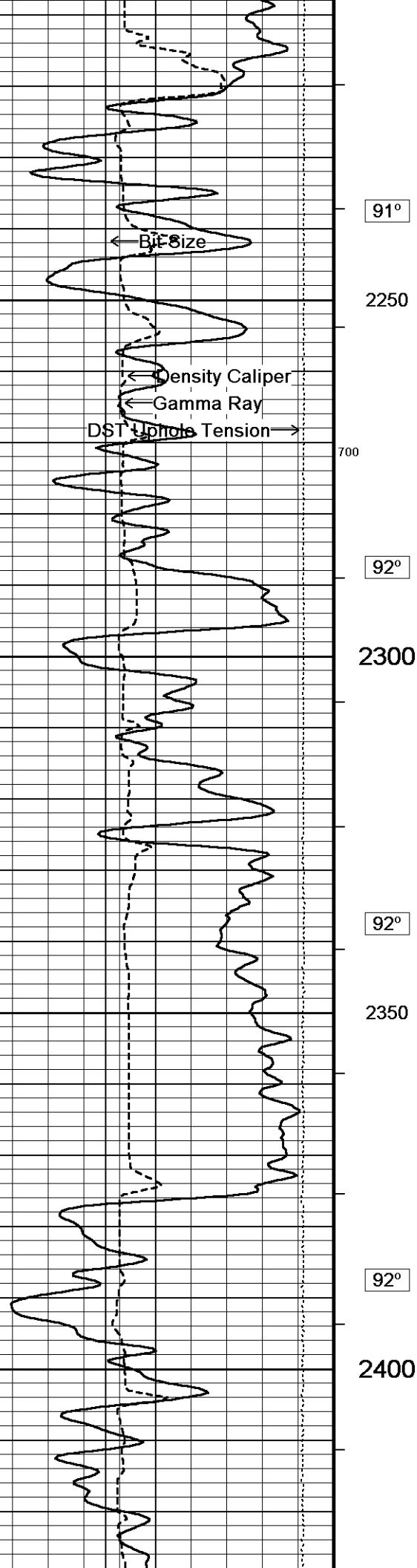












91°

2250

700

92°

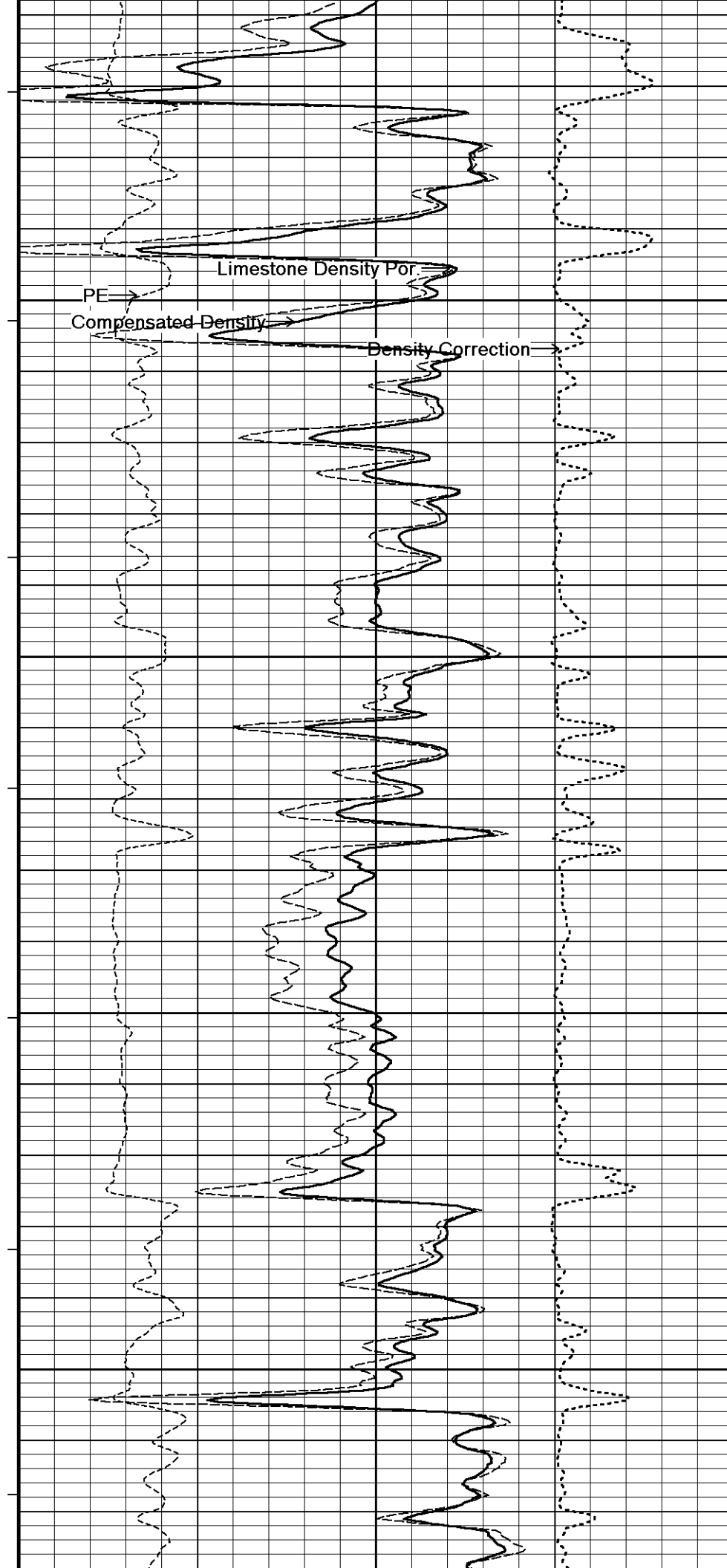
2300

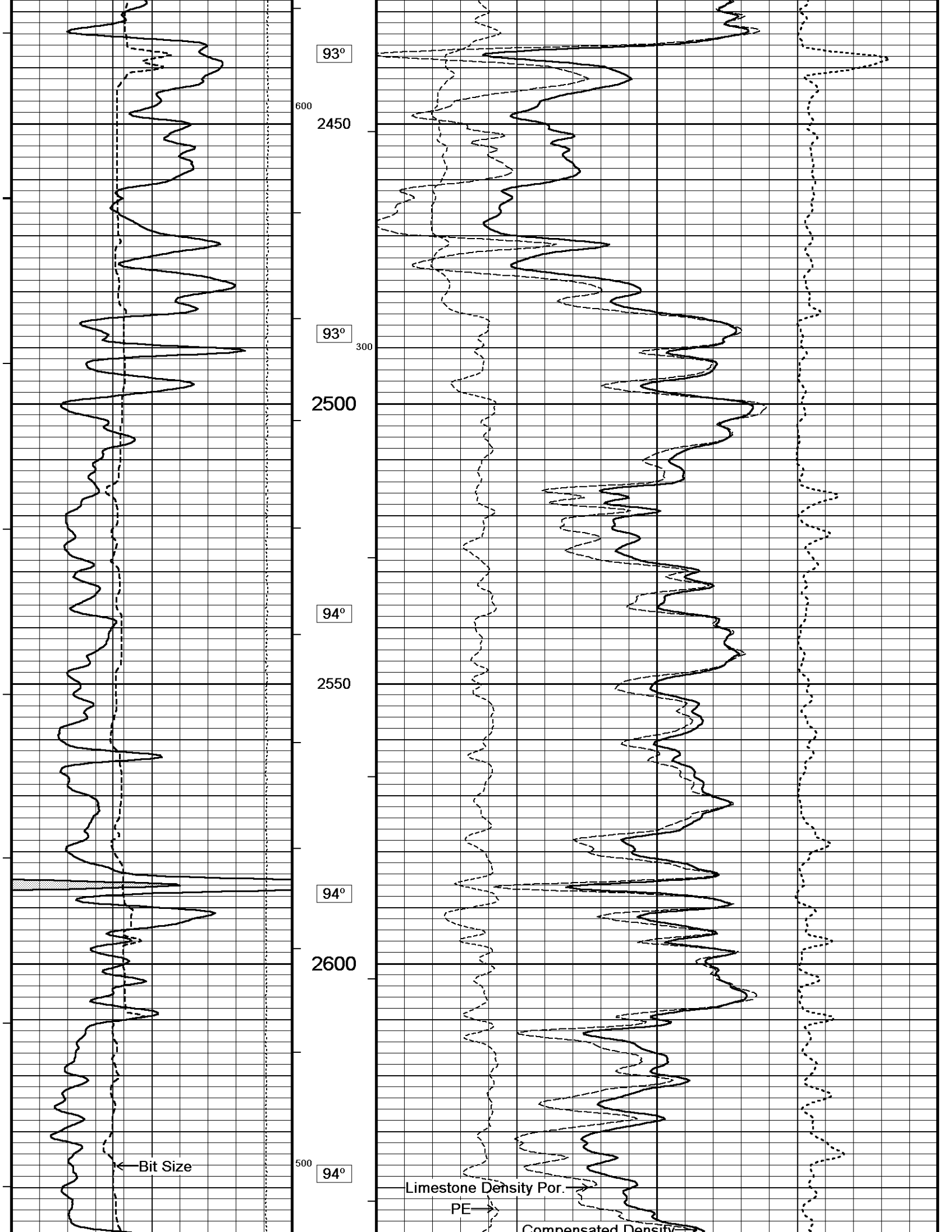
92°

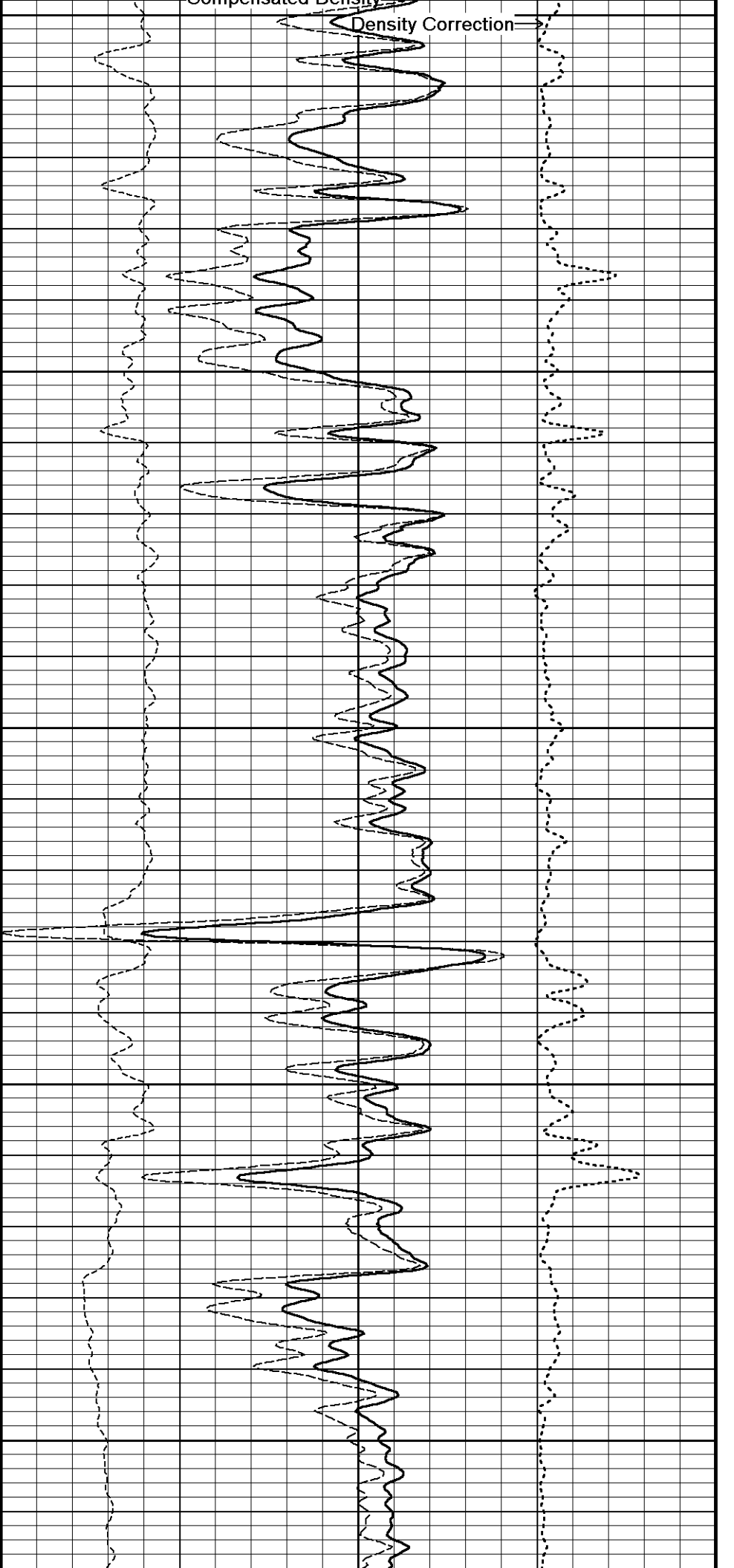
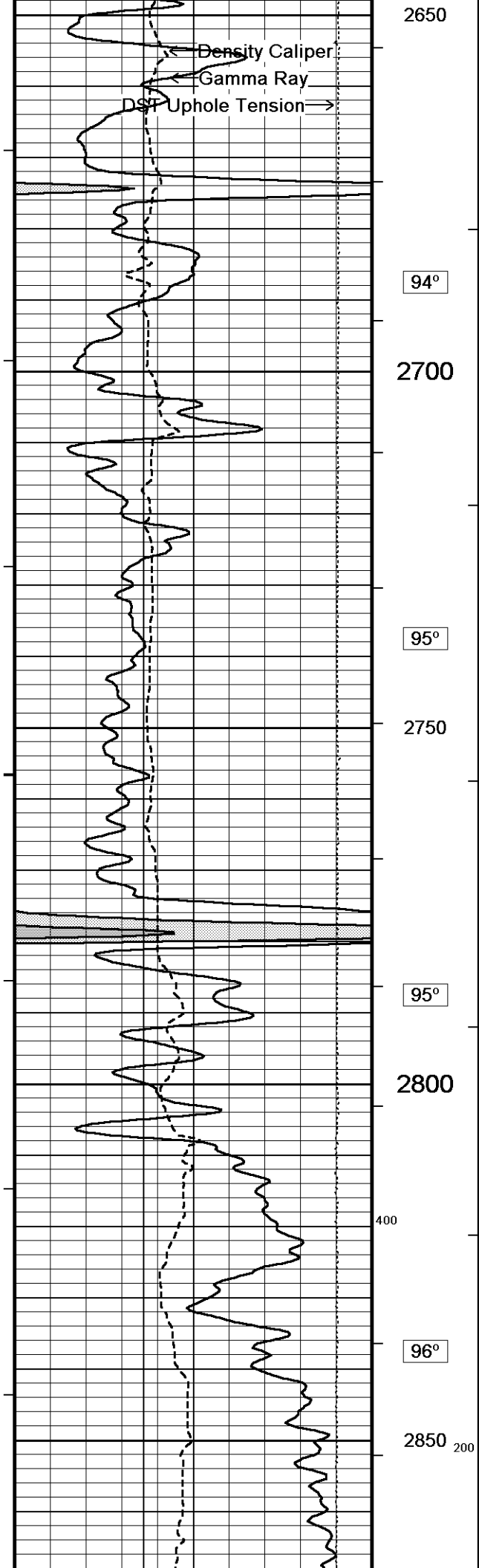
2350

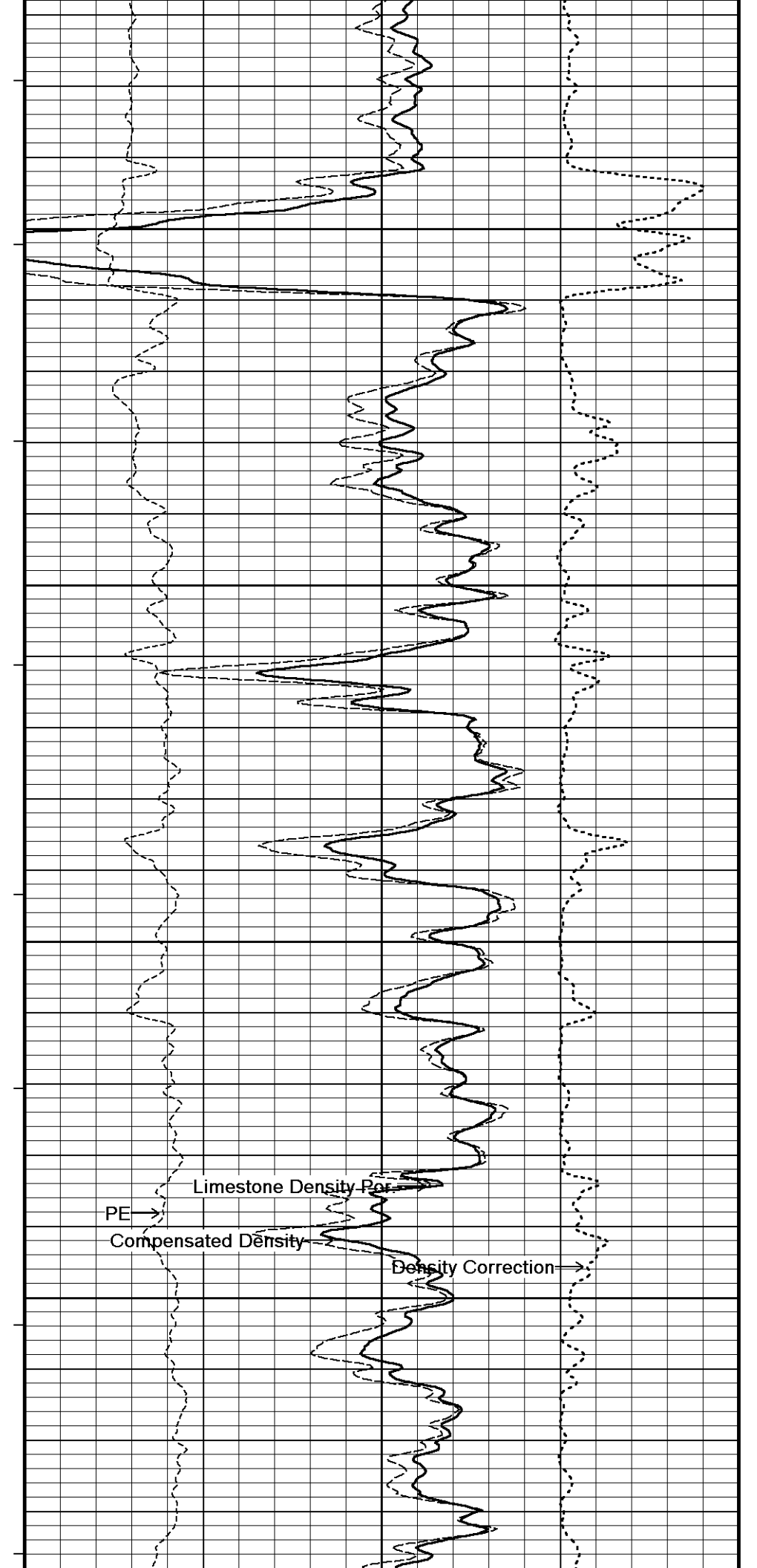
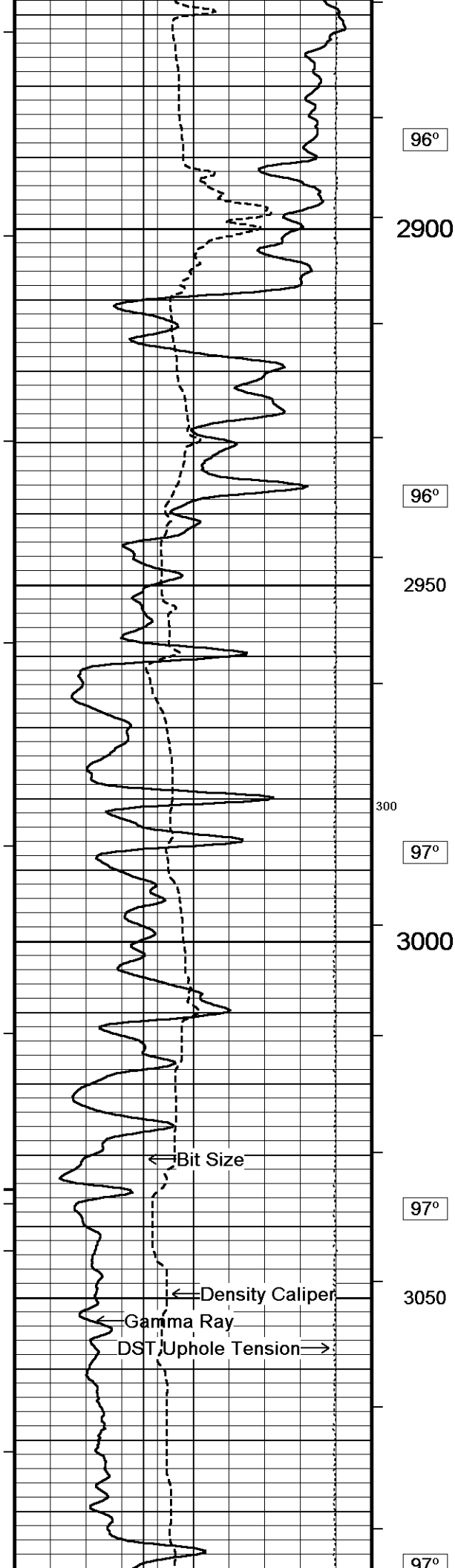
92°

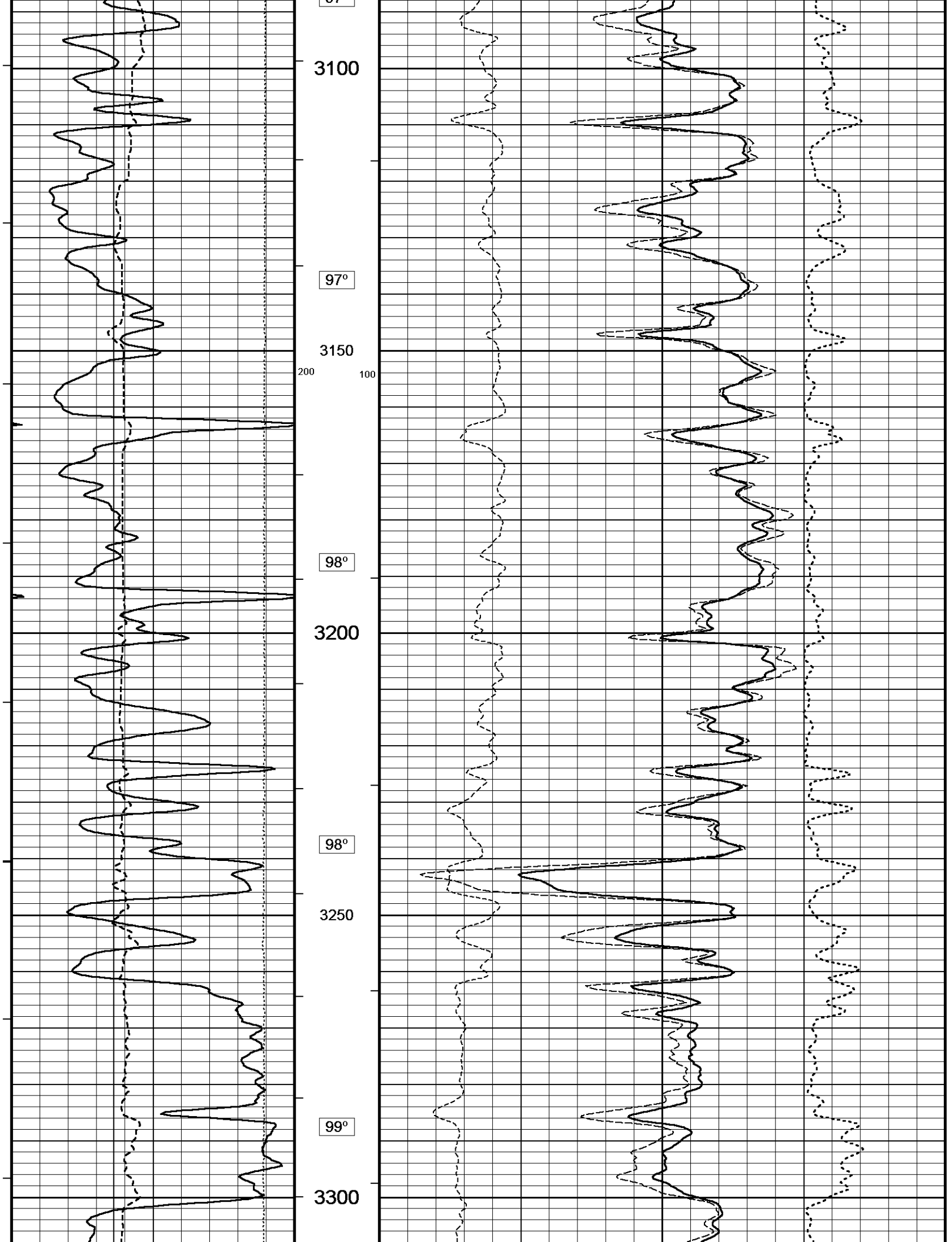
2400

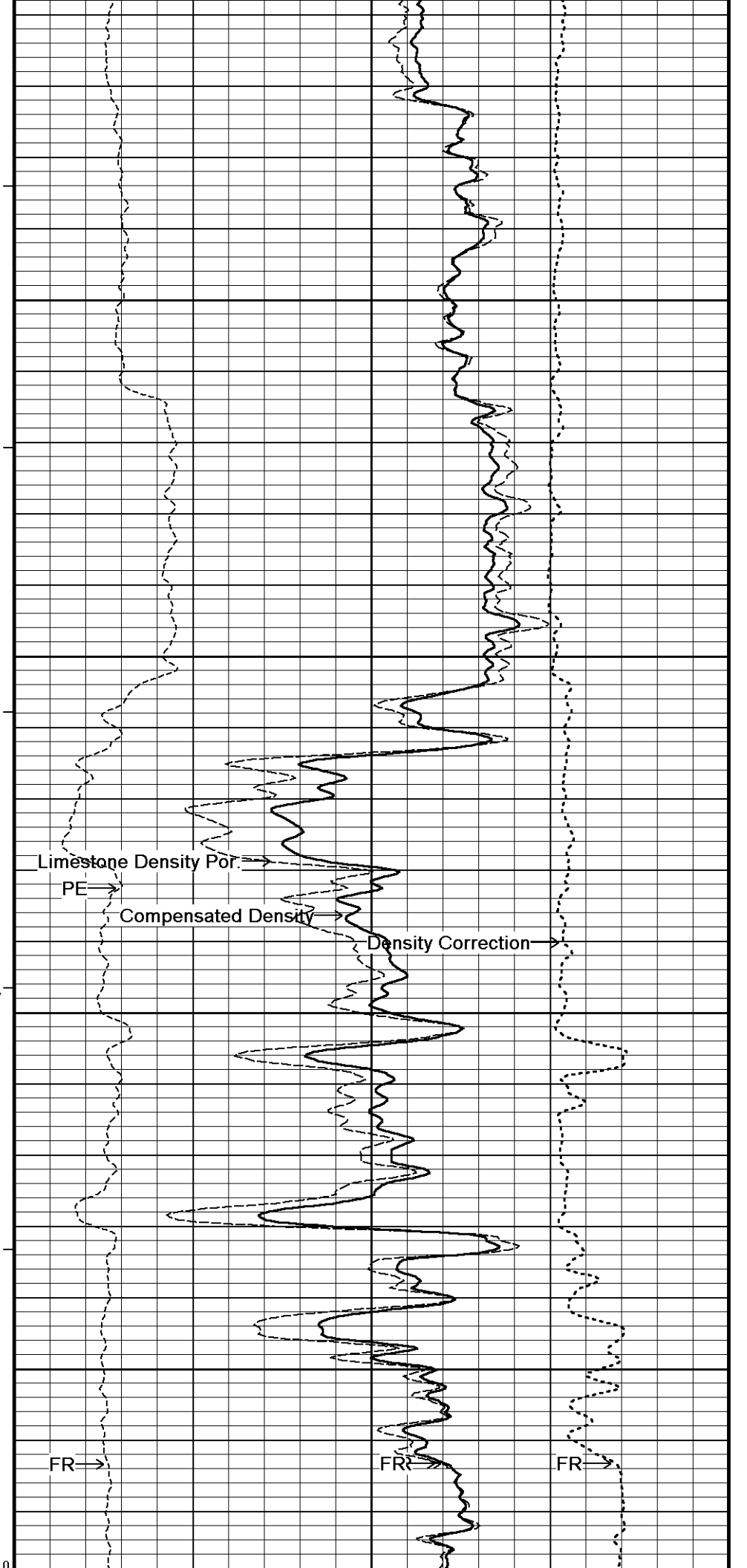
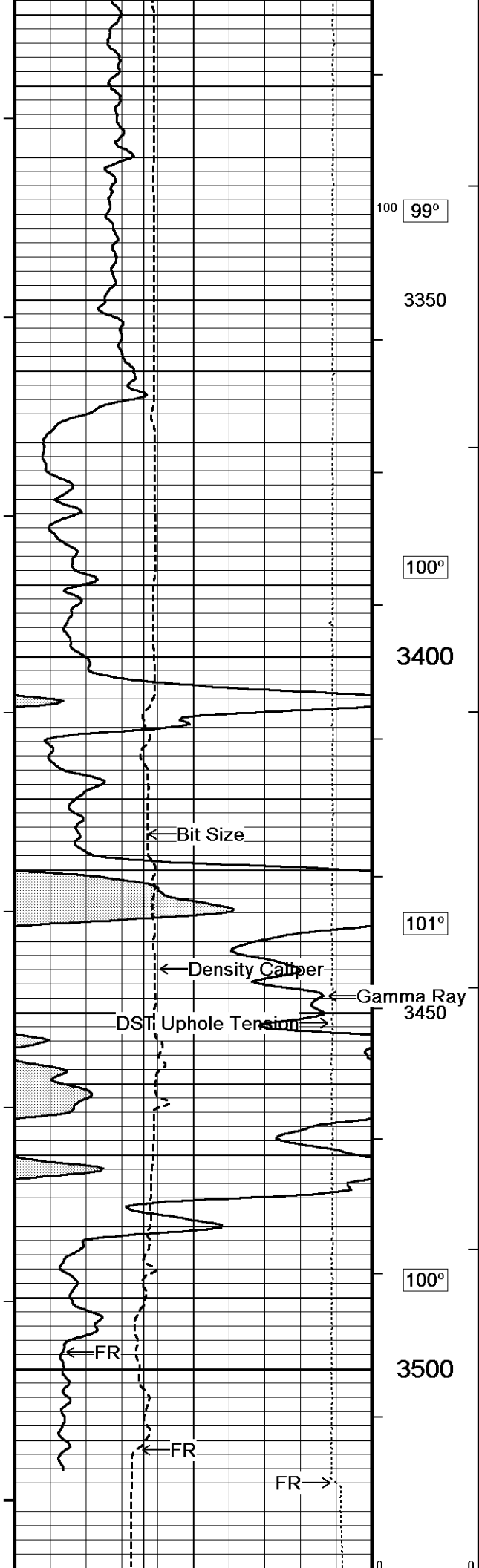


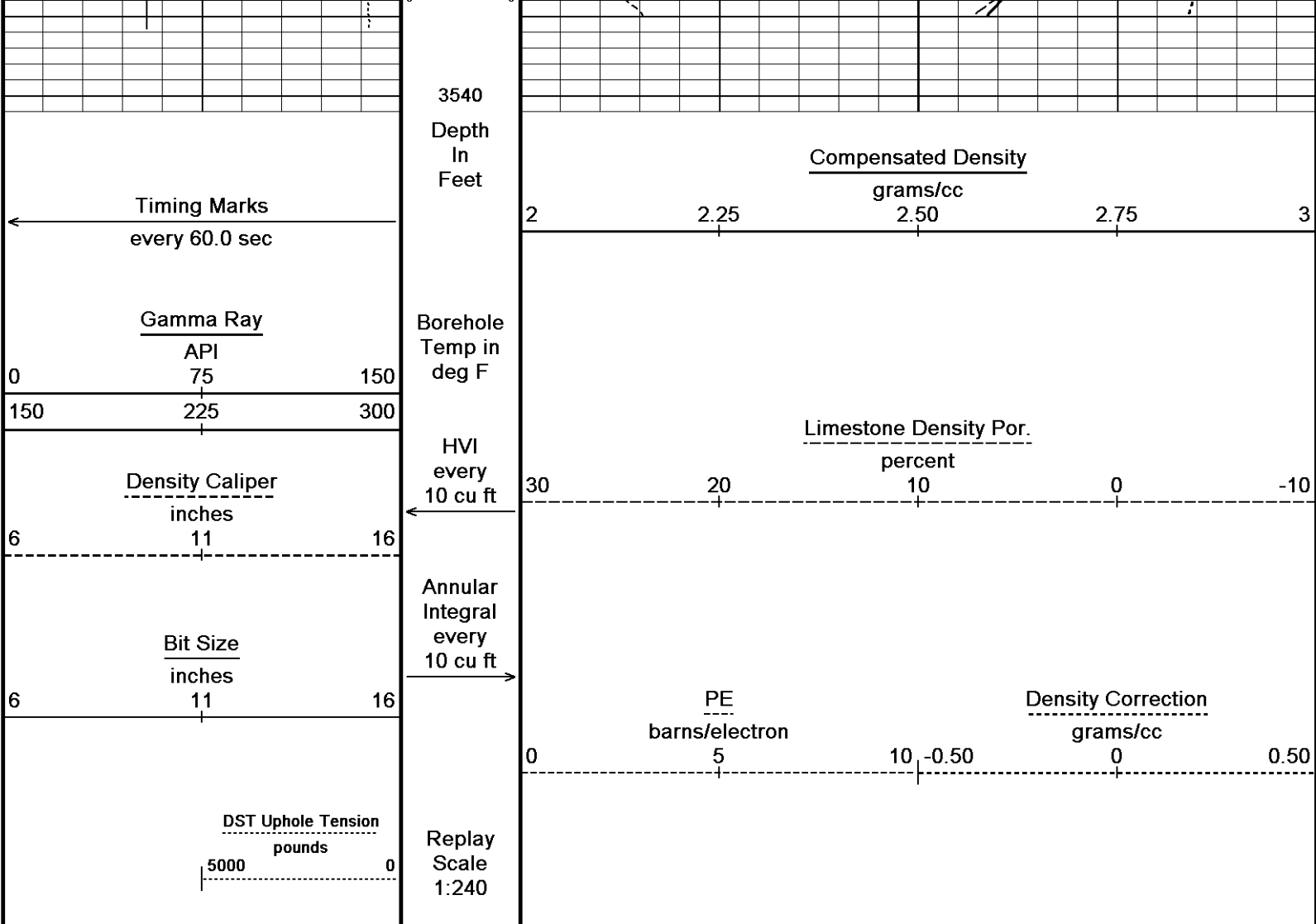












Depth Based Data - Maximum Sampling Increment 10.0cm		Plotted on 05-MAY-2013 22:37
Filename: C:\Minimus 13.05.9583\Logs\Sou...\Southern Star Alden Gas Storage #0-27 Porosity_002.dta		Recorded on 05-MAY-2013 19:57
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583		

↑

5 INCH MAIN

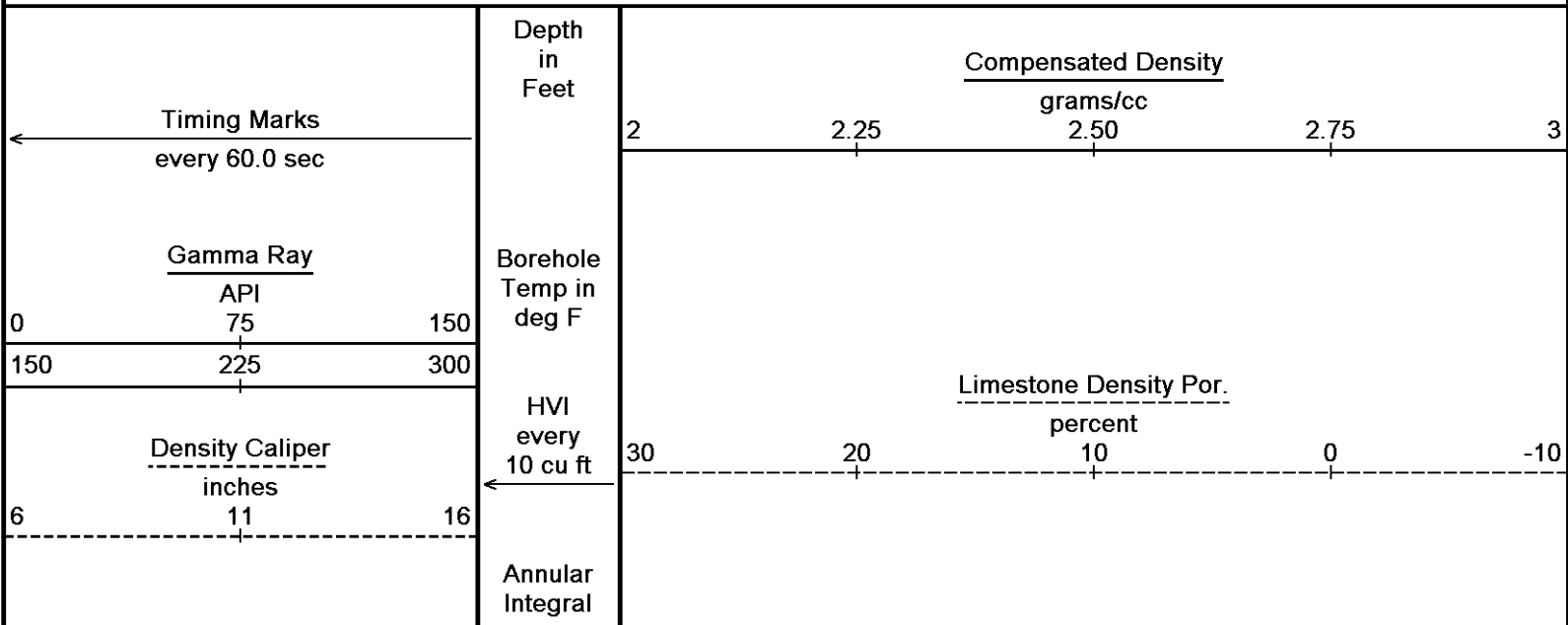
↑

↓

REPEAT SECTION

↓

Depth Based Data - Maximum Sampling Increment 10.0cm		Plotted on 05-MAY-2013 22:37
Filename: C:\Minimus 13.05.9583\Logs\Sou...\Southern Star Alden Gas Storage #0-27 Porosity_001.dta		Recorded on 05-MAY-2013 19:40
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583		



Bit Size
inches

6 11 16

DST Uphole Tension
pounds

5000 0

every
10 cu ft

Replay
Scale
1:240

PE

barns/electron

Density Correction
grams/cc

0 5 10 -0.50 0 0.50

3214

3250

98°

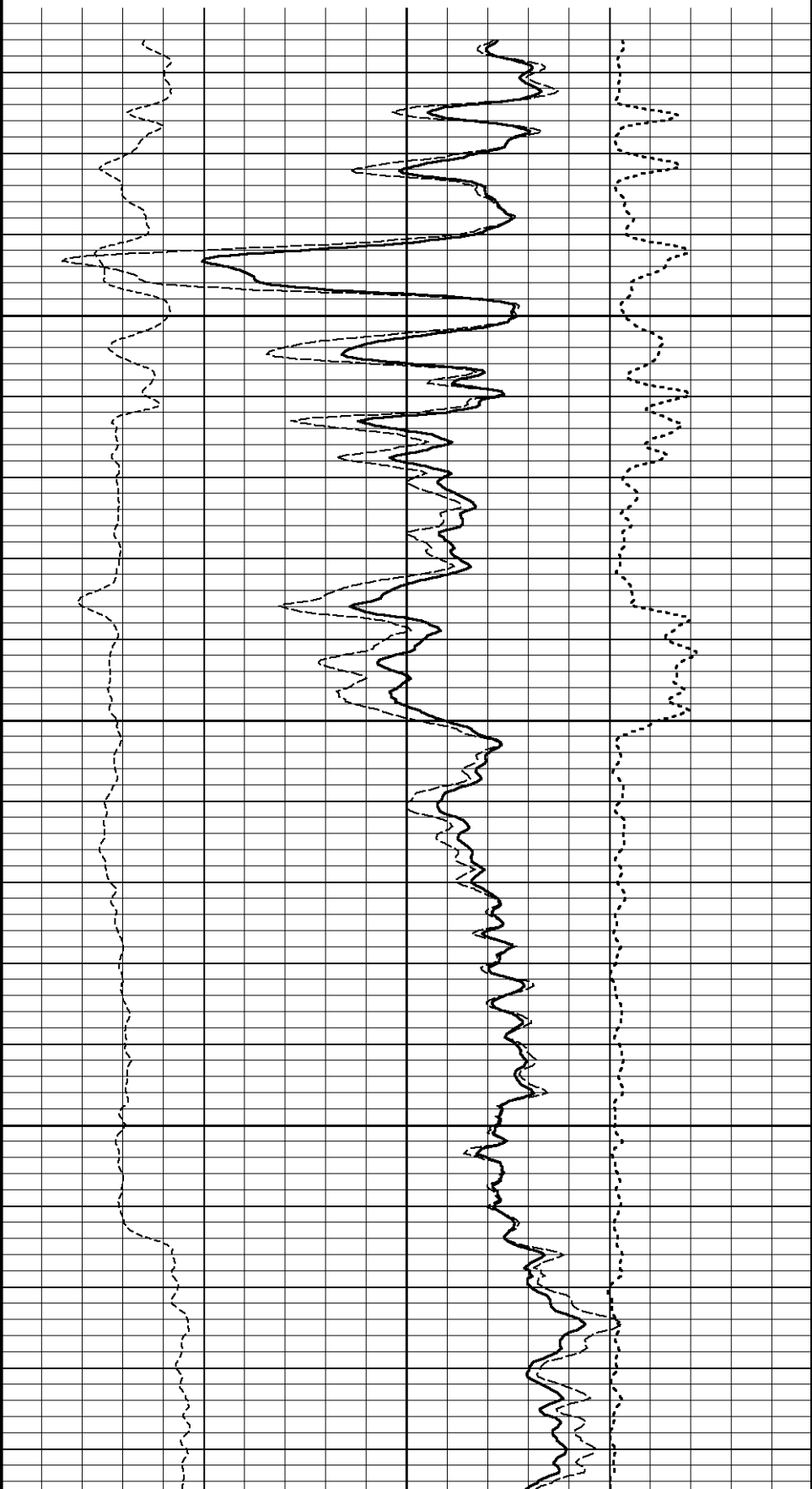
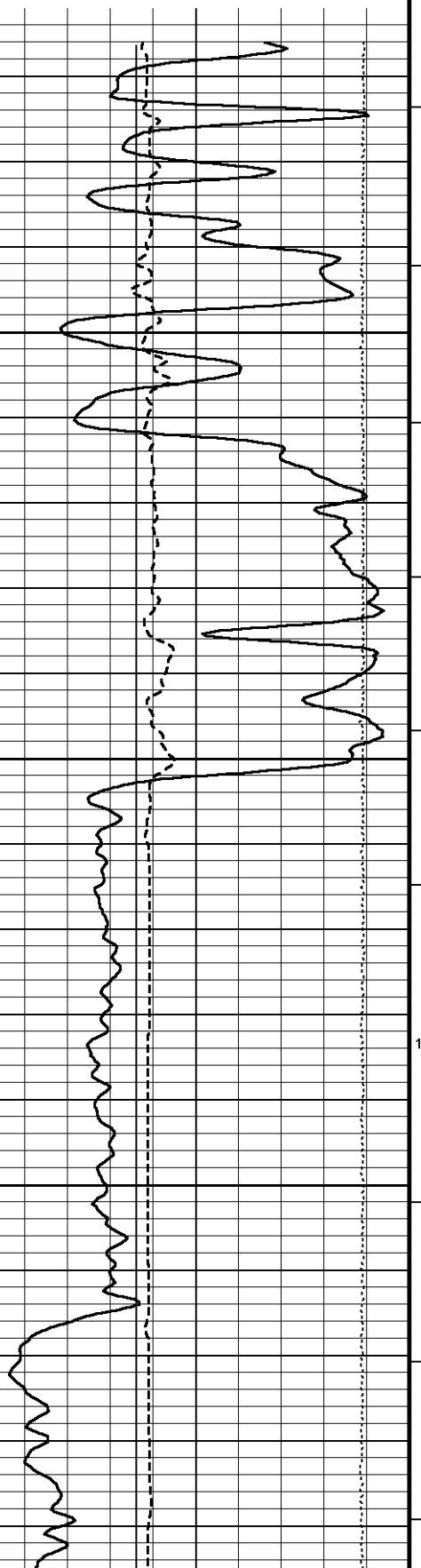
3300

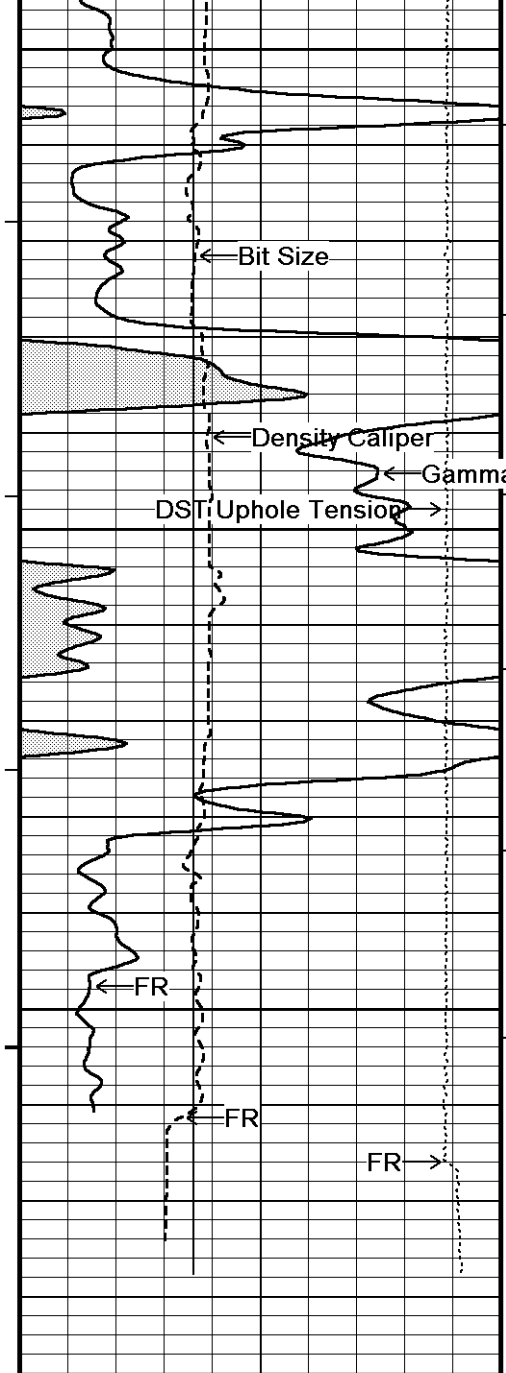
100

99°

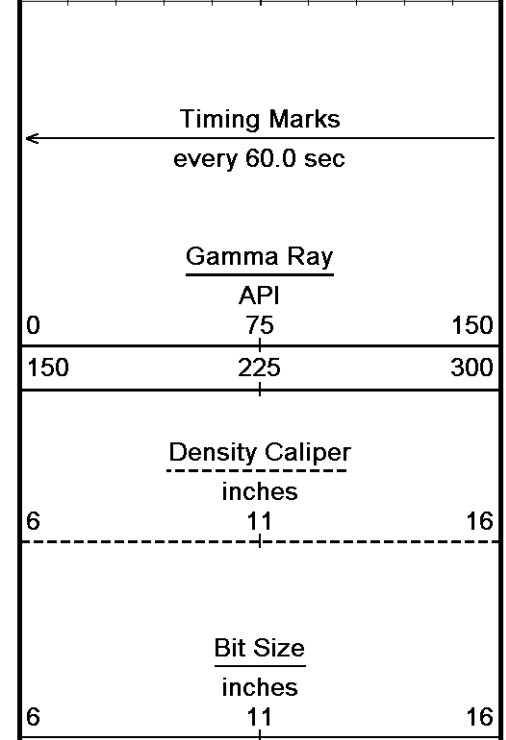
3350

100°

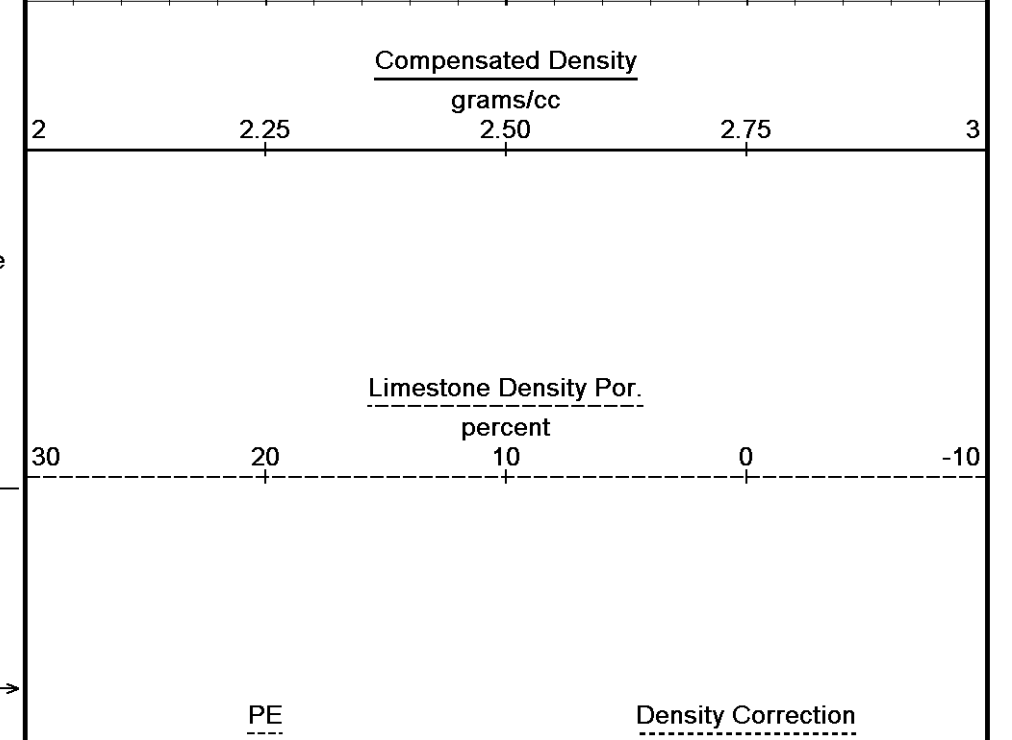
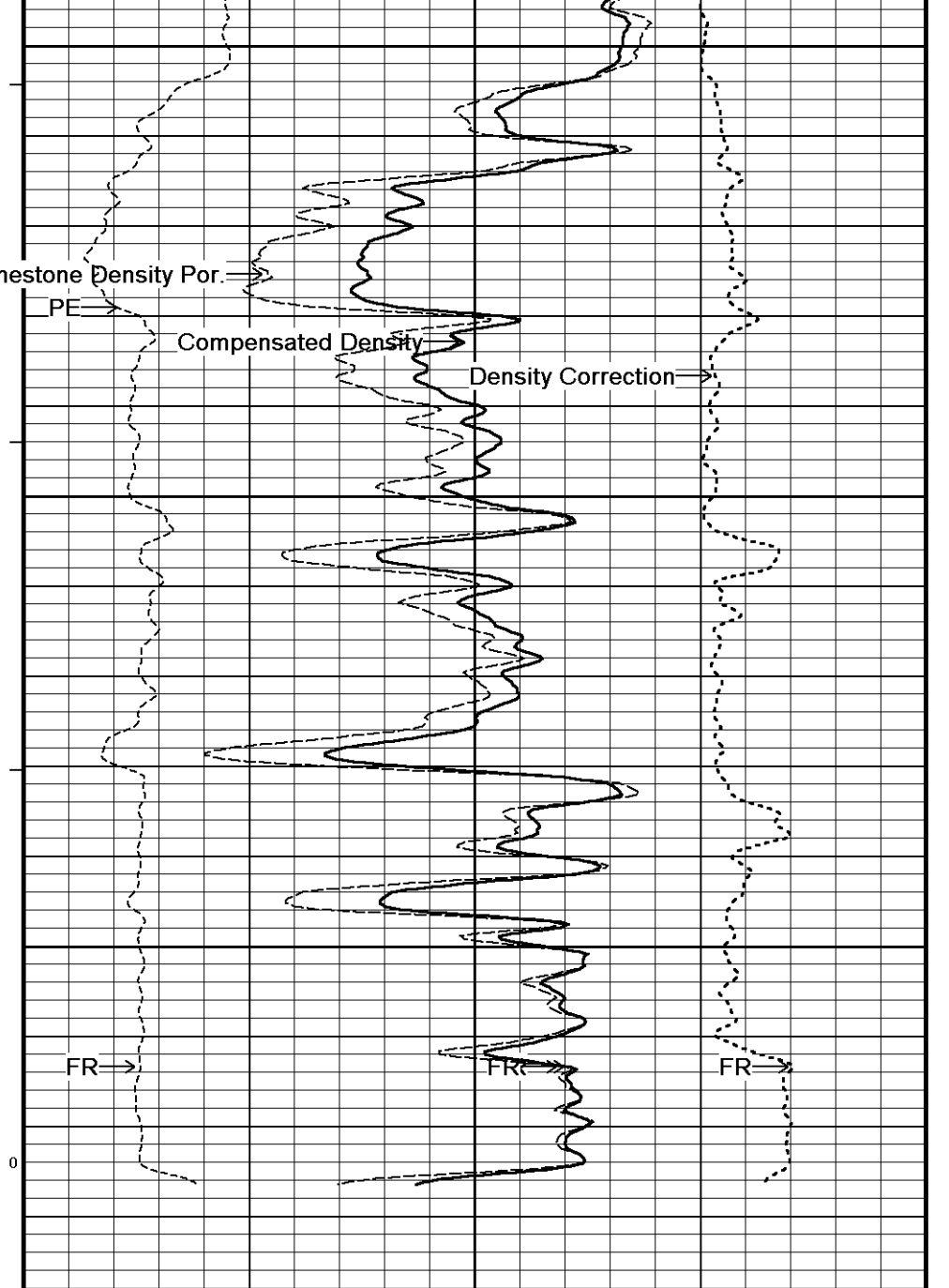




3400
100°
3450
100°
3500
0
3536
Depth
in
Feet



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

0 5 10 -0.50 0 0.50
barns/electron grams/cc

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 05-MAY-2013 22:37
Filename: C:\Minimus 13.05.9583\Logs\Southern Star Alden Gas Storage #0-27 Porosity_001.dta Recorded on 05-MAY-2013 19:40
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

↑ REPEAT SECTION ↑

BEFORE SURVEY CALIBRATION

C:\Minimus 13.05.9583\Logs\Southern Star Alden Gas Storage #0-27\Southern Star Alden Gas Storage #0-27 Porosity_001.dta

General Constants All 000

Last Edited on 05-MAY-2013,19:13

General Parameters

Mud Resistivity	1.080	ohm-metres
Mud Resistivity Temperature	89.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	

Hole/Annular Volume and Differential Caliper Parameters

HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	7.000	inches
Caliper for Differential Caliper	Density Caliper	

Rwa Parameters

Porosity used	N/A
Resistivity used	N/A
RWA Constant A	N/A
RWA Constant M	N/A
SW/APOR Tool Source	

Down-hole Tension Calibration SMS 0

Field Calibration on 27-APR-2013 09:10

Reading No	Measured	Calibrated (lbs)
1	15120.33	0.00
2	15943.78	471.80

SP Calibration MCG-D.K 442

Field Calibration on 30-APR-2013 09:21

	Measured	Calibrated (mV)
Reference 1	100.9	100.0
Reference 2	-100.5	-100.0

High Resolution Temperature Calibration MCG-D.K 442

Field Calibration on 24-APR-2013,09:31

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

High Resolution Temperature Constants MCG-D.K 442

Last Edited on 05-MAY-2013,08:10

Pre-filter Length	11
-------------------	----

Gamma Calibration MCG-D.K 442

Field Calibration on 05-MAY-2013 01:40

	Measured	Calibrated (API)
Background	72	49
Calibrator (Gross)	1134	774
Calibrator (Net)	1061	725

Gamma Constants MCG-D.K 442

Last Edited on 05-MAY-2013,08:13

Gamma Calibrator Number	GRC38
-------------------------	-------

Mud Density	1.13	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

Neutron Calibration MDN-A.B 65				Base Calibration on 26-APR-2013 10:27	
				Field Check on 05-MAY-2013 01:44	
Base Calibration					
		Measured		Calibrated (cps)	
	Near	Far		Near	Far
	3017	93		3714	110
Ratio	32.364			33.764	
Field Calibrator at Base					
				Calibrated (cps)	
				1705	2446
Ratio				0.697	
Field Check					
				Calibrated (cps)	
				1689	2447
Ratio				0.692	

Neutron Constants MDN-A.B 65			Last Edited on 05-MAY-2013,19:13	
Neutron Source Id	PN-521			
Neutron Jig Number	5824NE			
Epithermal Neutron	No			
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	None			
Temperature	N/A	degrees F		
Mud Salinity	0.00	kppm		
Salinity Correction	Not Applied			
Formation Fluid Salinity Source	Constant Value			
Formation Fluid Salinity	0.00	kppm		
Barite Mud Correction	Not Applied			

Caliper Calibration MPD-B 31			Base Calibration on 17-APR-2013 18:44
			Field Calibration on 05-MAY-2013 01:25
Base Calibration			
Reading No	Measured	Calibrator Size (in)	
1	16608	3.99	
2	25136	5.98	
3	33984	7.97	
4	42270	9.86	
5	51619	11.92	
6	N/A	N/A	
Field Calibration			
	Measured Caliper (in)	Actual Caliper (in)	
	6.01	5.98	

Photo Density Calibration MPD-B 31			Base Calibration on 17-APR-2013 20:24	
			Field Check on 05-MAY-2013 01:23	
Density Calibration				
Base Calibration		Measured	Calibrated (sdu)	
	Near	Far	Near	Far
Reference 1	45975	23397	59556	30836
Reference 2	19130	1945	24941	2541
Field Check at Base				
	678.5	833.5		
Field Check				
	677.1	831.9		

PE Calibration

Base Calibration

	WS	Measured WH	Ratio	Calibrated Ratio
Background	125	599		
Reference 1	18590	45855	0.408	0.371
Reference 2	5557	19045	0.295	0.272

Field Check at Base

124.9 598.8

Field Check

126.3 600.7

Density Constants MPD-B 31

Last Edited on 05-MAY-2013,08:13

Density Source Id	254
Nylon Calibrator Number	DNCE695
Aluminium Calibrator Number	DACD698
Density Shoe Profile	8 inch
Caliper Source for Processing	Density Caliper
PE Correction to Density	Not Applied
Mud Density	1.13 gm/cc
Mud Density Z/A Multiplier	1.11
Mud Filtrate Density	1.00 gm/cc
Dry Hole Mud Filtrate Density	1.00 gm/cc
DNCT	0.00 gm/cc
CRCT	0.00 gm/cc
Density Z/A Correction	Hybrid

Matrix Density (gm/cc)	Depth (ft)
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

DOWNHOLE EQUIPMENT

C:\Minimus 13.05.9583\Logs\Southern Star Alden Gas Storage #0-27\Southern Star Alden Gas Storage #0-27 Porosity_001.dta

3/8" Triple Cone Cable Head (MCB C A)

MCB-C.A 5 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Comms Gamma

MCG-D.K 442 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron

MDN-A.B 65 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

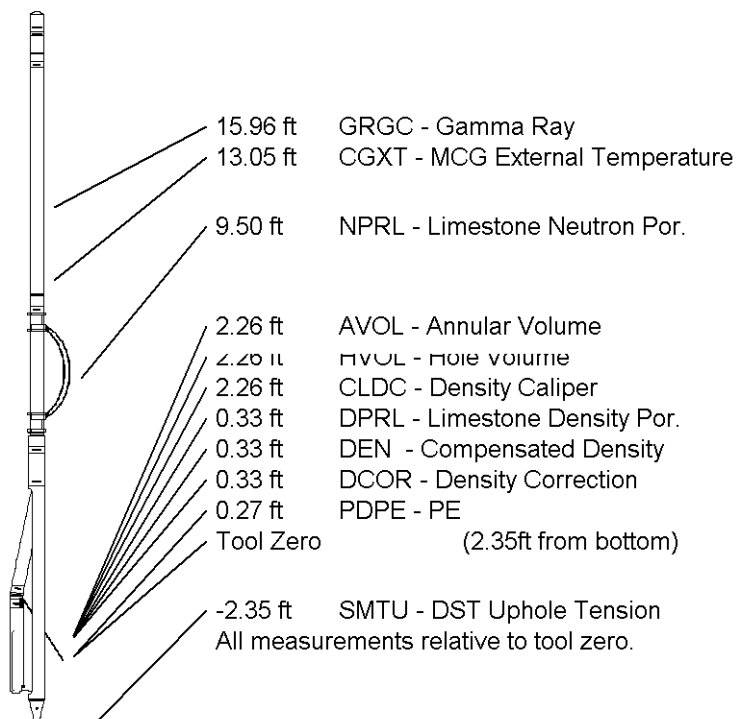
Compact Density/Caliper

MPD-B 31 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

Compact Pressure Bung

HFS 2 LG: 0.13 ft WT: 4.4 lb OD: 2.24 in

Total Length: 25.04 ft Weight: 224.9 lb



COMPANY	SOUTHERN STAR CENTRAL GAS PIPELINE, INC.		
WELL	ALDEN GAS STORAGE #O-27		
FIELD	ALDEN		
PROVINCE/COUNTY	RICE		
COUNTRY/STATE	U.S.A. / KANSAS		

Elevation Kelly Bushing	1685.00	feet	First Reading	3516.00	feet
Elevation Drill Floor	1684.00	feet	Depth Driller	3520.00	feet
Elevation Ground Level	1672.00	feet	Depth Logger	3516.00	feet


Weatherford[®]

COMPACT PHOTO DENSITY
COMPENSATED NEUTRON