

**Weatherford****MICRORESISTIVITY LOG**

|                                         |             |                                          |                |  |                                                       |
|-----------------------------------------|-------------|------------------------------------------|----------------|--|-------------------------------------------------------|
| 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         | RGE                                      | Other Services |  | MDN/MPD                                               |
| 15                                      | 21S         | 9W                                       | MAI/MFE        |  |                                                       |
| API Number                              |             | 15-159-22730                             | MSS            |  |                                                       |
| Permit Number                           |             |                                          |                |  |                                                       |
| Permanent Datum GL, Elevation 1672 feet |             |                                          |                |  |                                                       |
| Log Measured From KB                    |             |                                          |                |  |                                                       |
| Drilling Measured From KB               |             |                                          |                |  | Elevations:<br>KB 1685.00<br>DF 1684.00<br>GL 1672.00 |
| Date                                    | 05-MAY-2013 |                                          |                |  |                                                       |
| Run Number                              | ONE         |                                          |                |  |                                                       |
| Service Order                           | 3539046     |                                          |                |  |                                                       |
| Depth Driller                           | 3520.00     |                                          |                |  | feet                                                  |
| Depth Logger                            | 3516.00     |                                          |                |  | feet                                                  |
| First Reading                           | 3485.00     |                                          |                |  | 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<br>inches | Depth From<br>feet | Depth To<br>feet |
| 9.625              | 585.00             | 3520.00          |

**CASING RECORD**

|         |                |                    |                    |                     |
|---------|----------------|--------------------|--------------------|---------------------|
| Type    | Size<br>inches | Depth From<br>feet | Shoe Depth<br>feet | Weight<br>pounds/ft |
| SURFACE | 11.750         | 0.00               | 585.00             | 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.

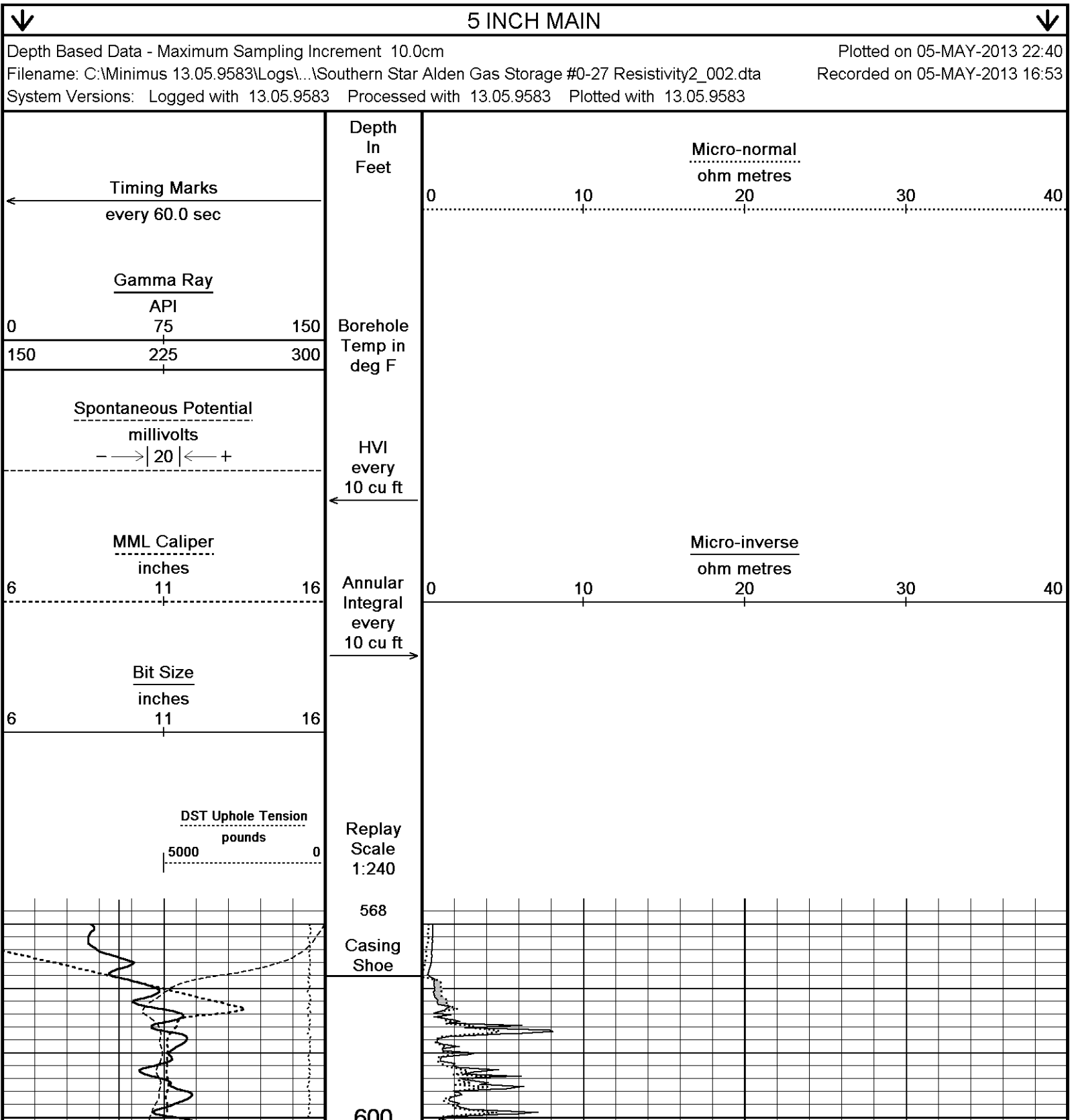
- ANNULAR HOLE VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 2200 FEET: 390 CU. FT.

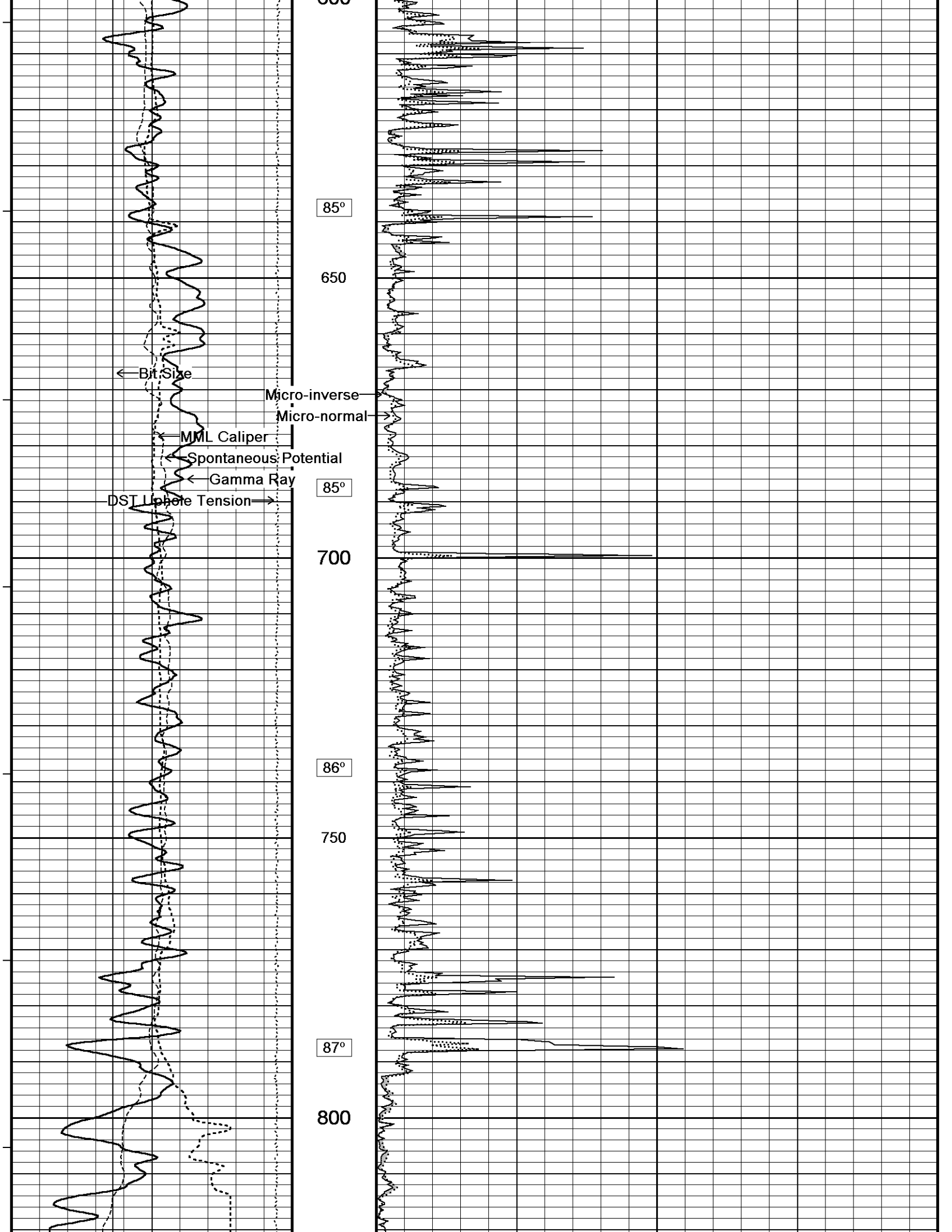
- RIG: STERLING #4.

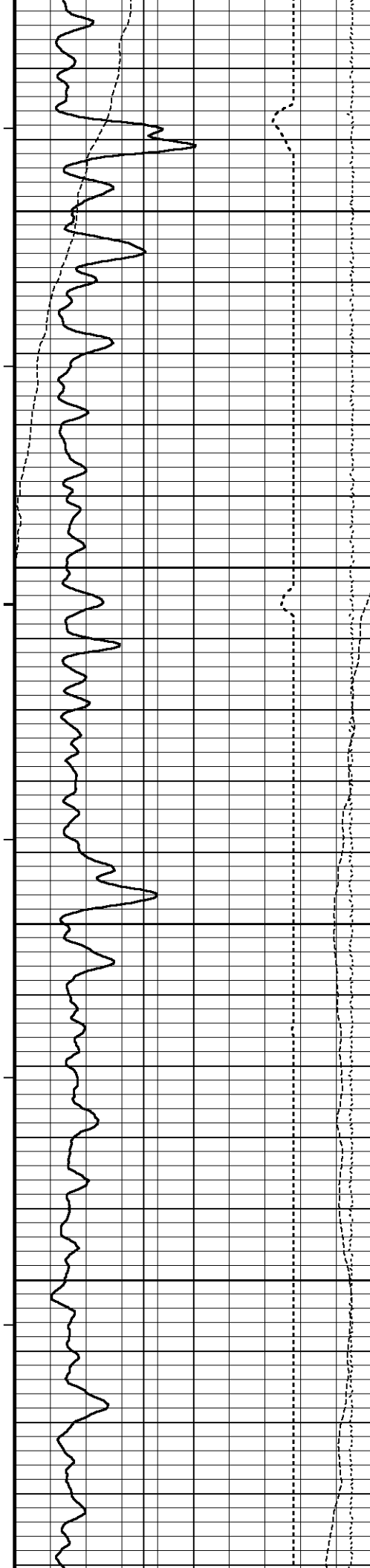
- ENGINEER: A. SILL.

- 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.







87°

850

88°

900

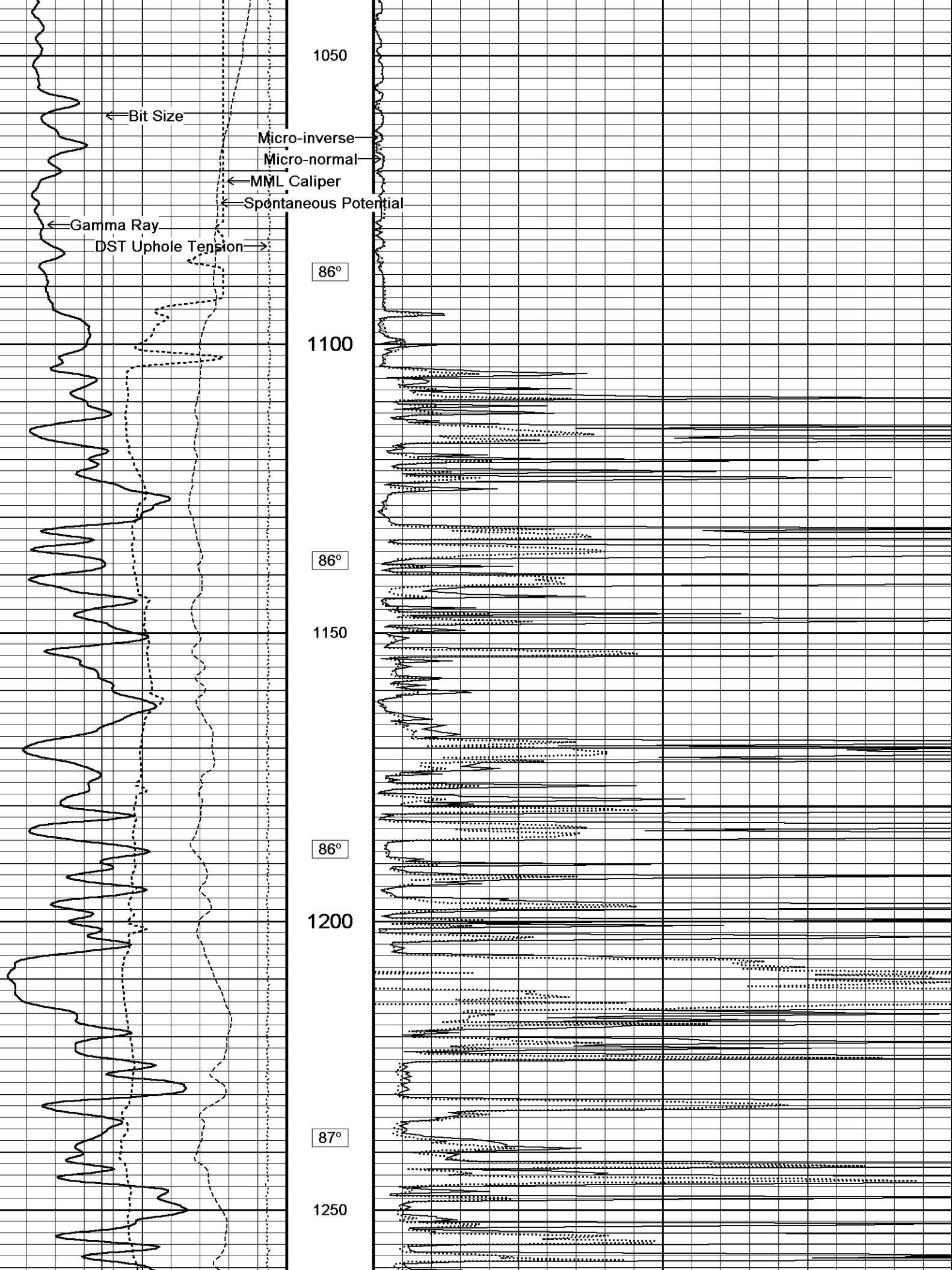
88°

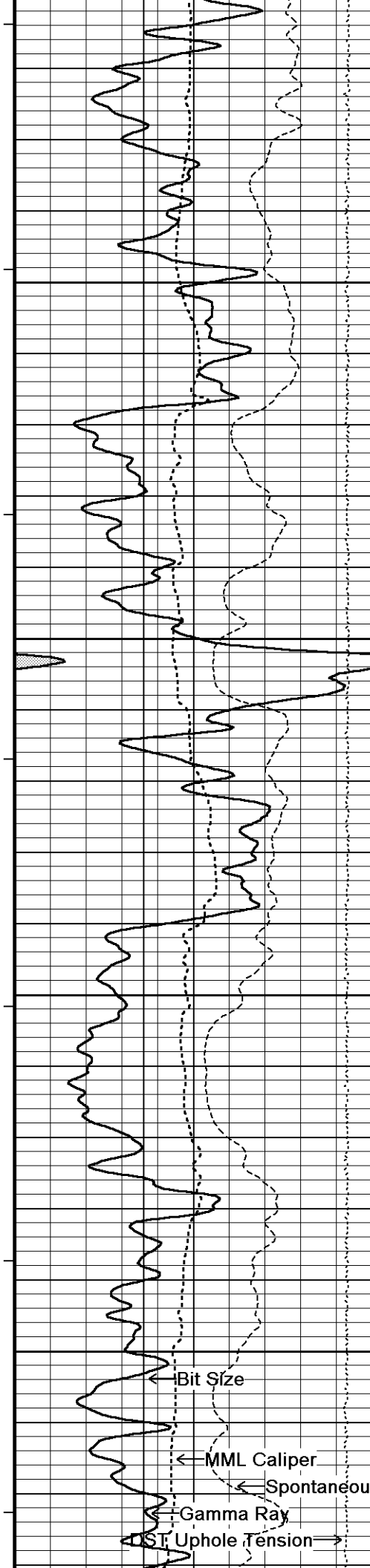
950

88°

1000

87°





87°

1300

87°

1350

87°

1400

88°

1450

Micro-inverse

Micro-normal

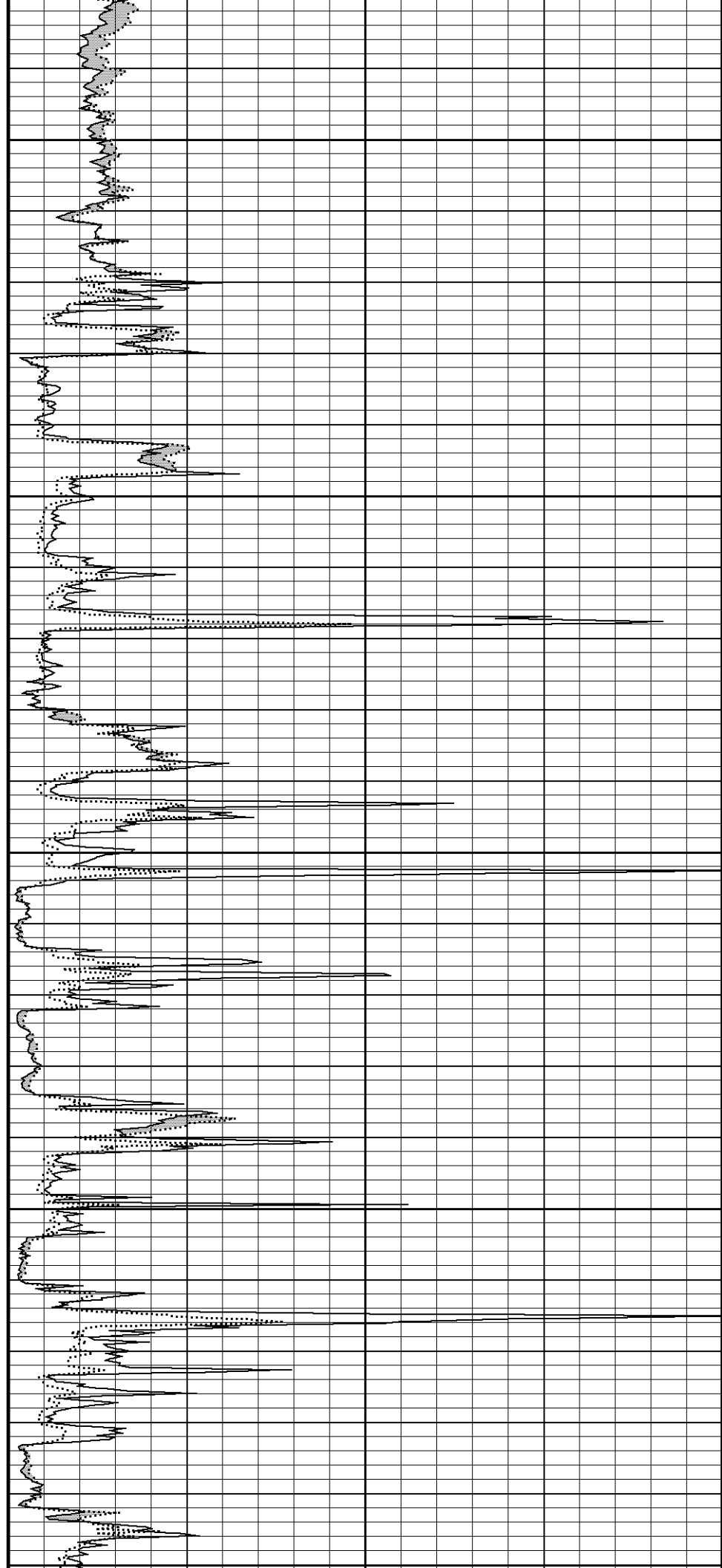
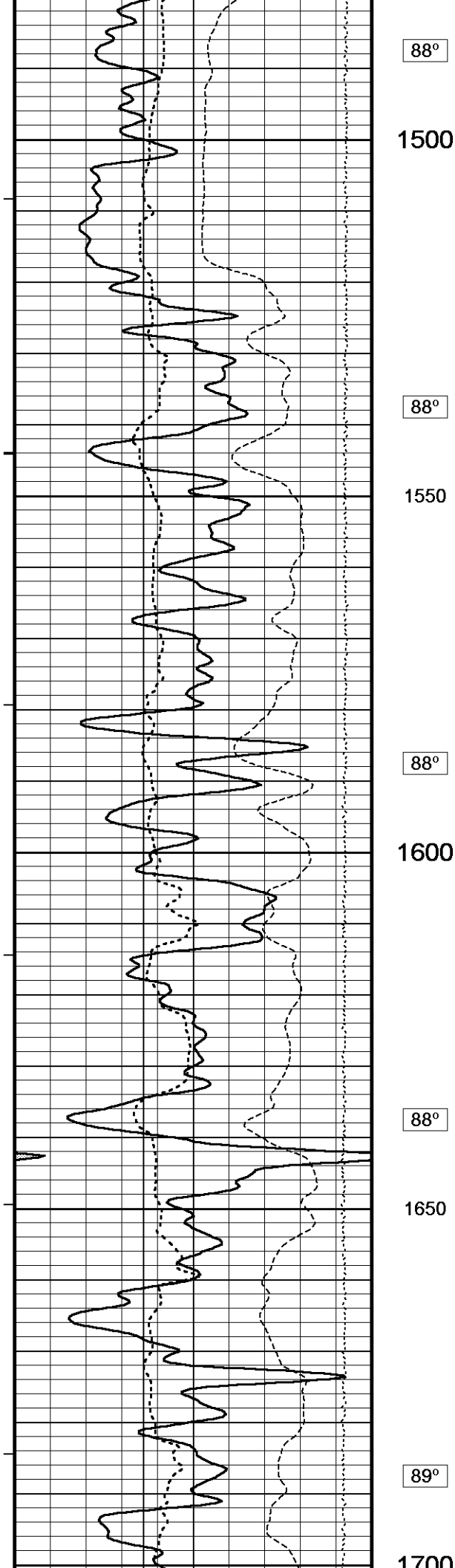
Spontaneous Potential

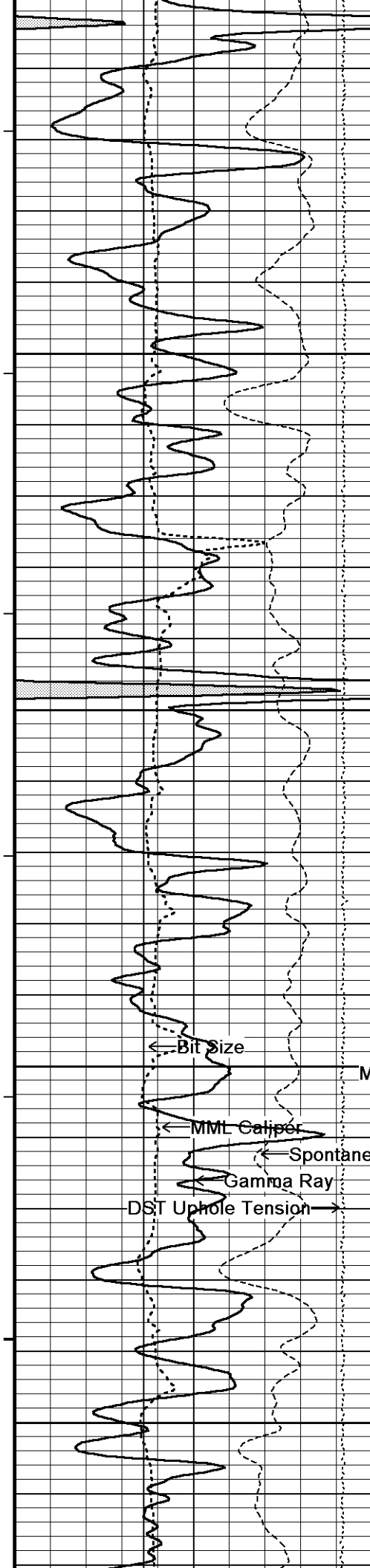
MML Caliper

Gamma Ray

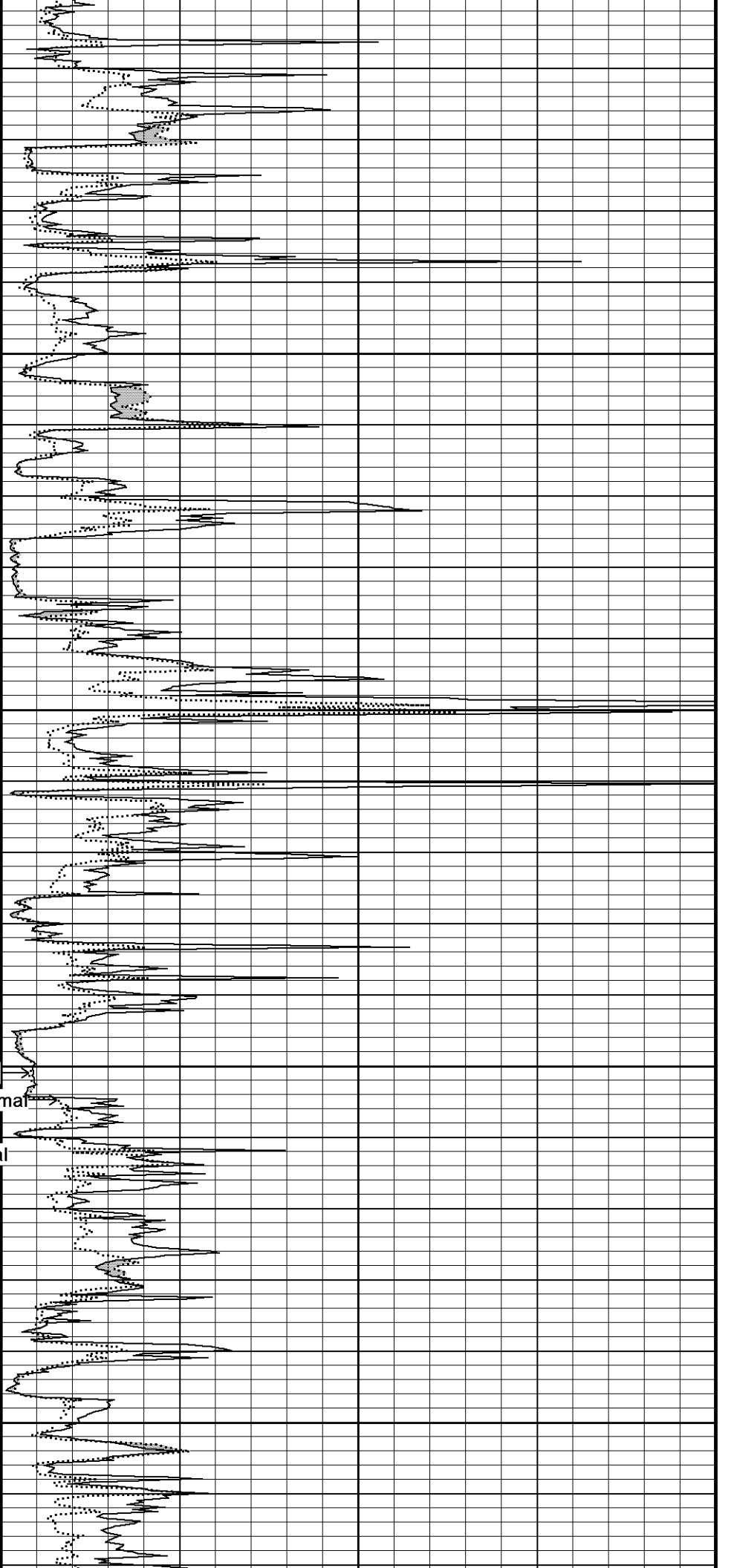
DST Uphole Tension

Bit Size





1750  
1750  
1800  
1850  
1900

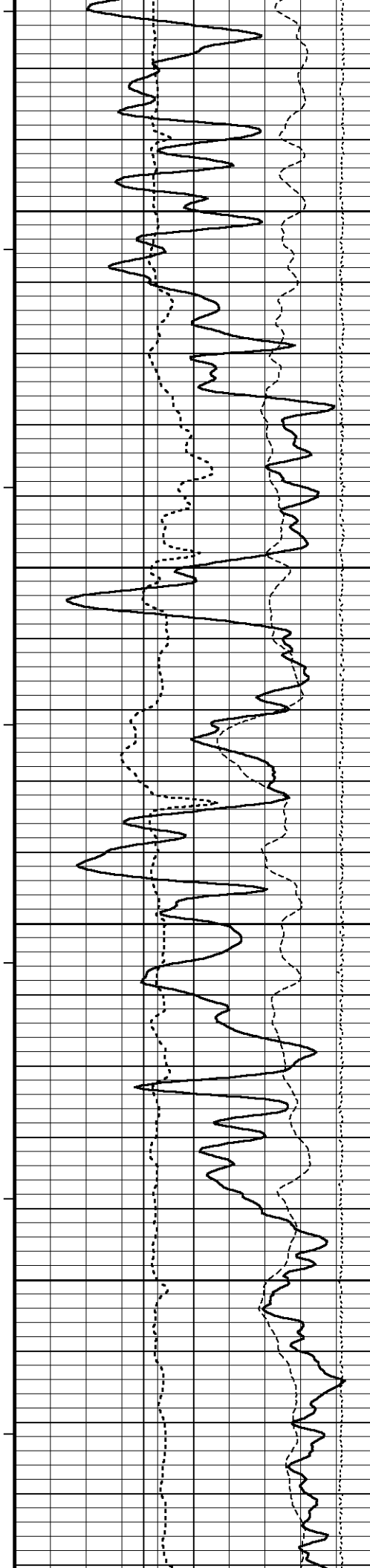


Bit Size  
MML Caliper  
Gamma Ray  
DST Uphole Tension

Micro-contrast  
Micro-normal

Spontaneous Potential

90°



90°

1950

90°

2000

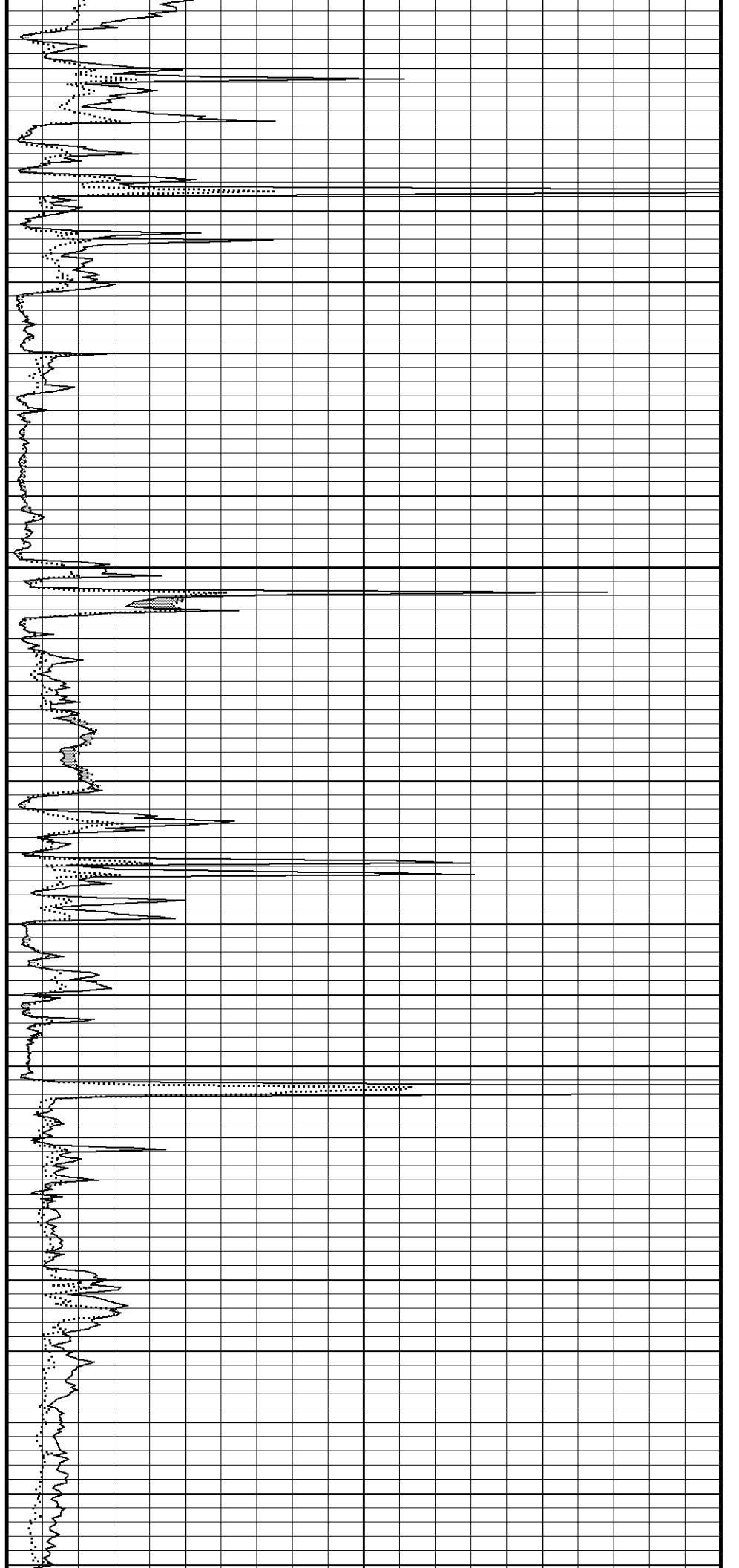
90°

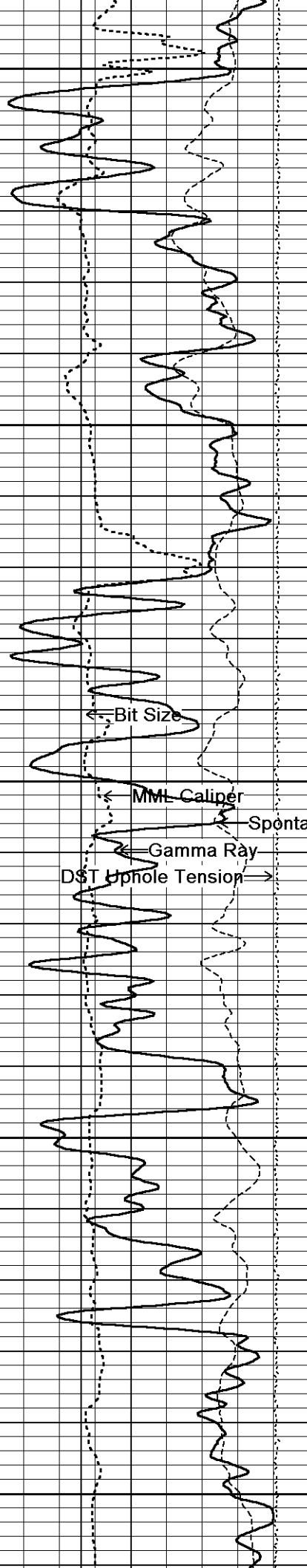
2050

91°

2100

91°





2150

91°

2200

92°

2250

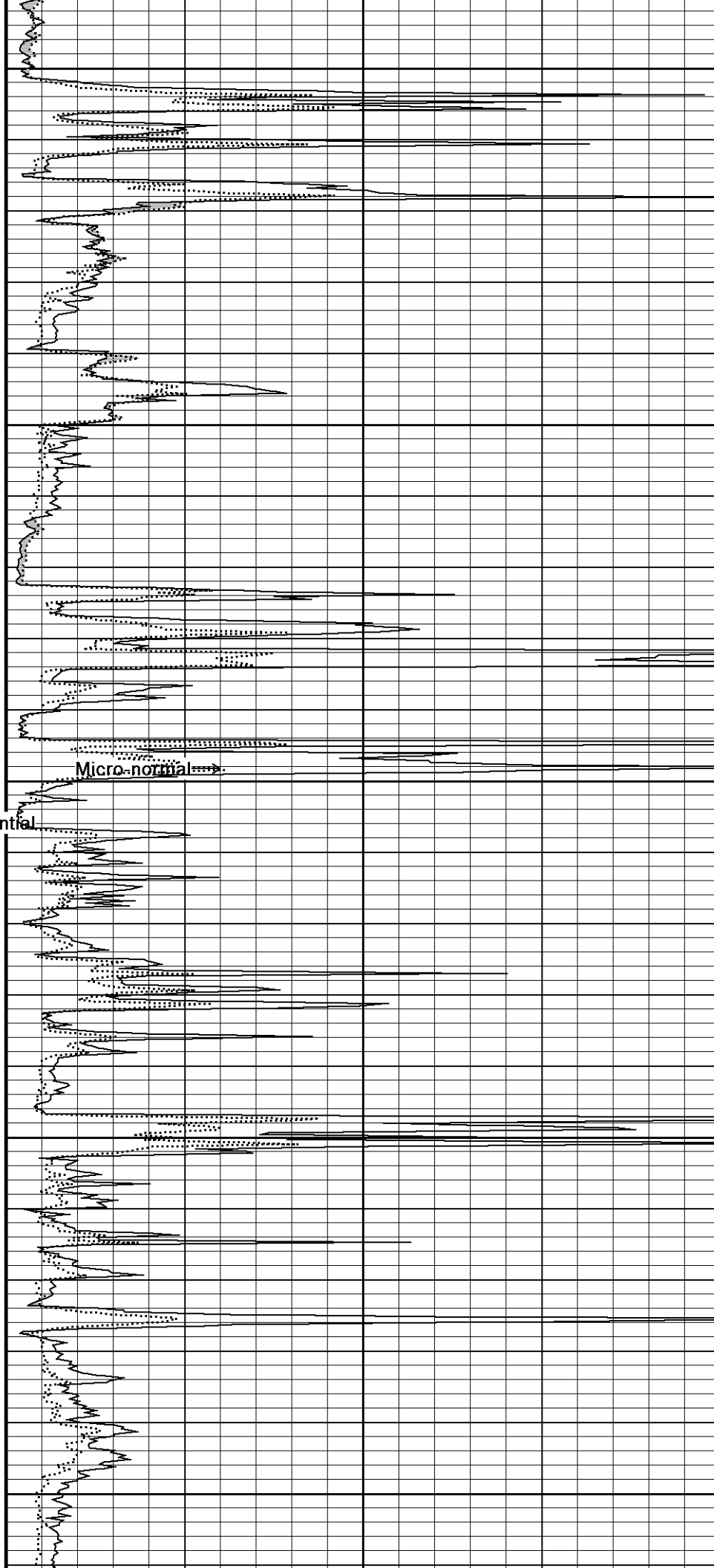
Spontaneous Potential

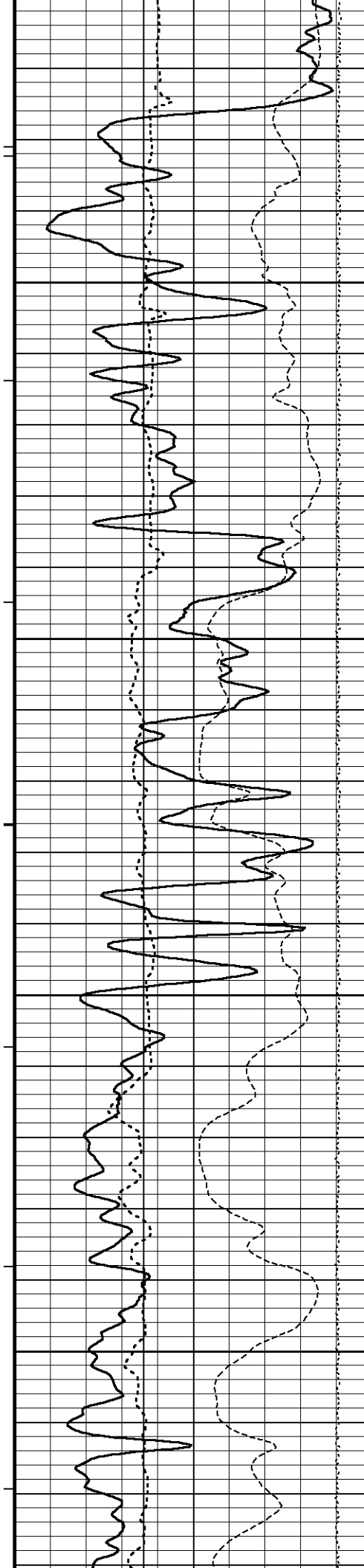
92°

2300

92°

2350





92°

2400

92°

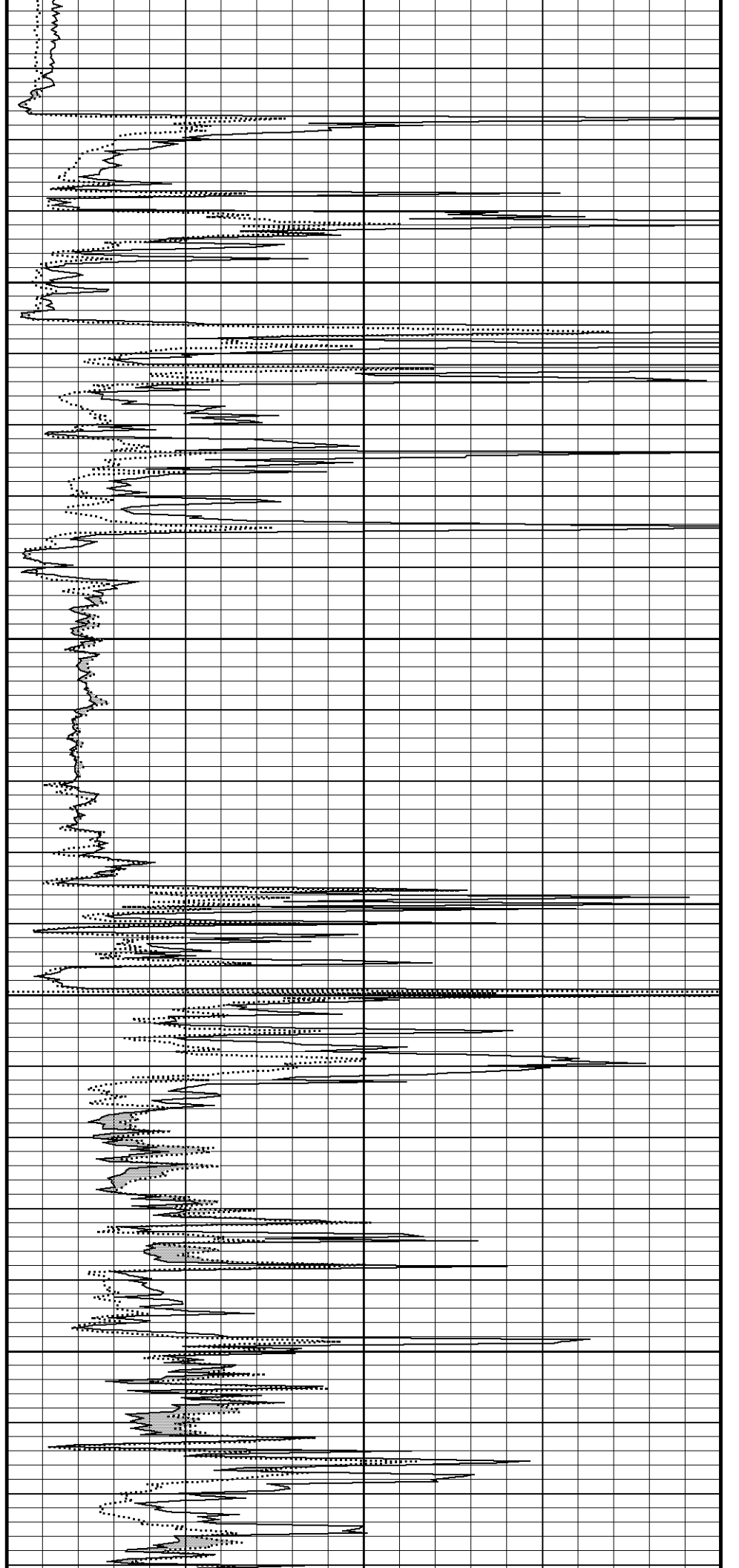
2450

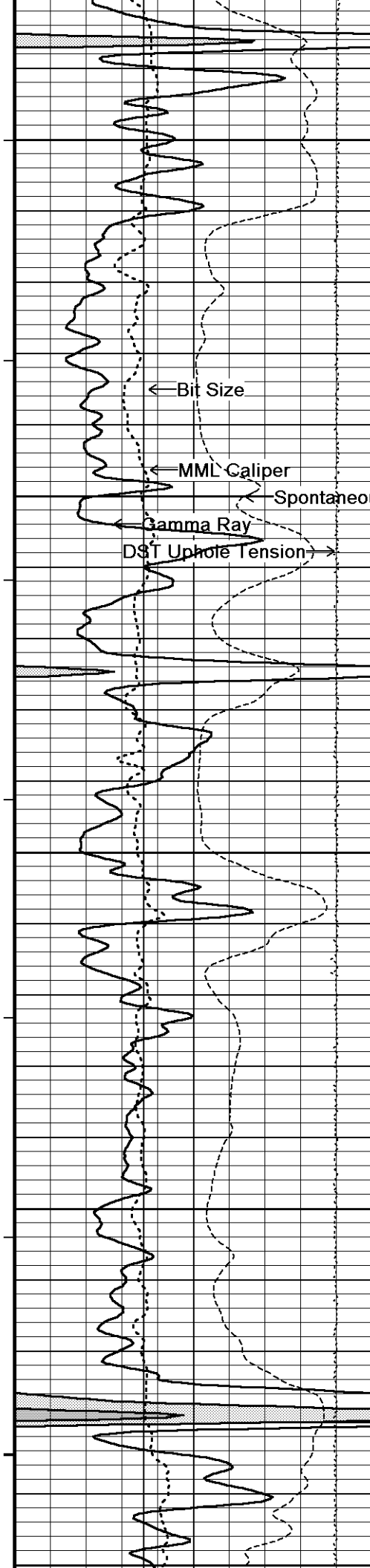
93°

2500

93°

2550





93°

2600

93°

Micro-inverse

Micro-normal

94°

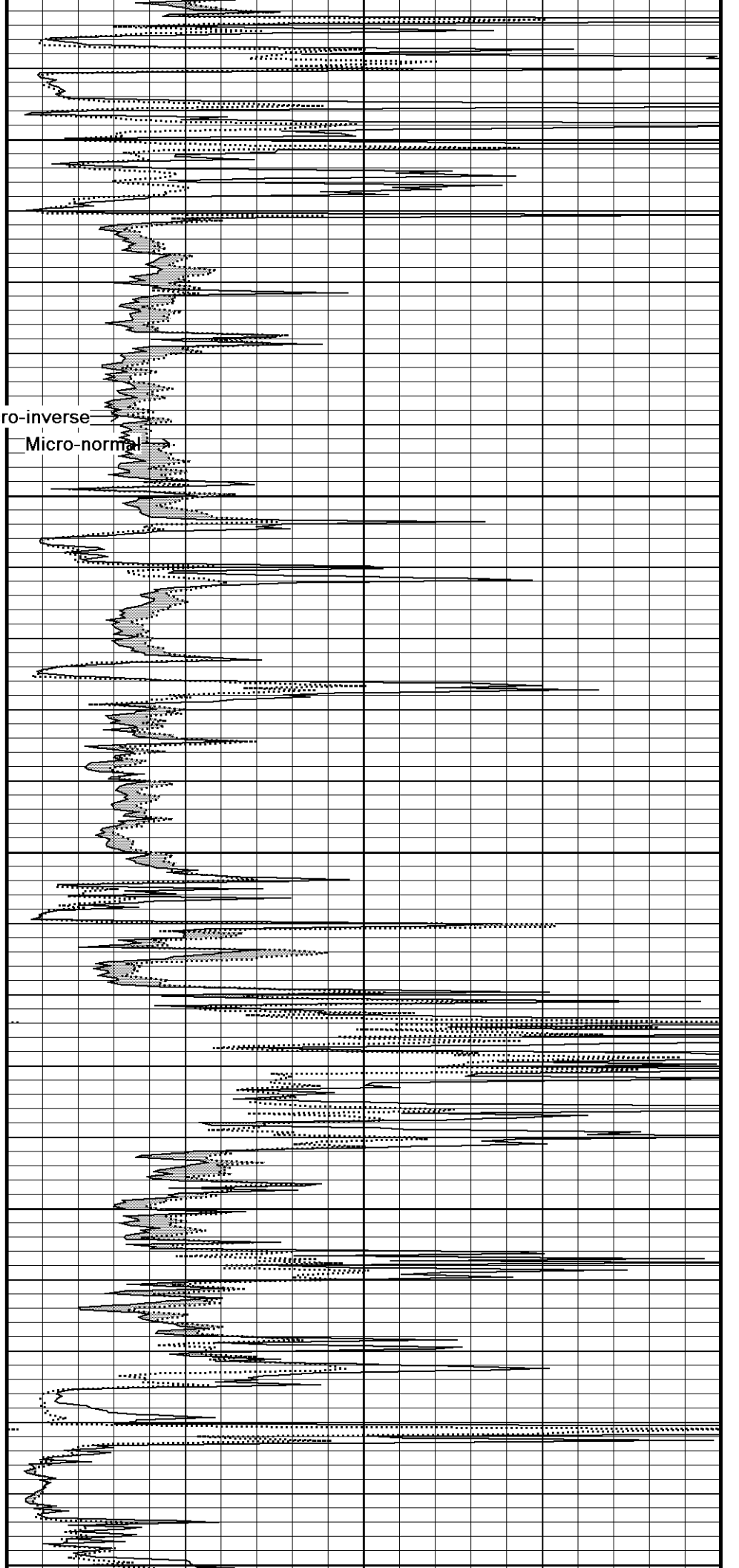
2700

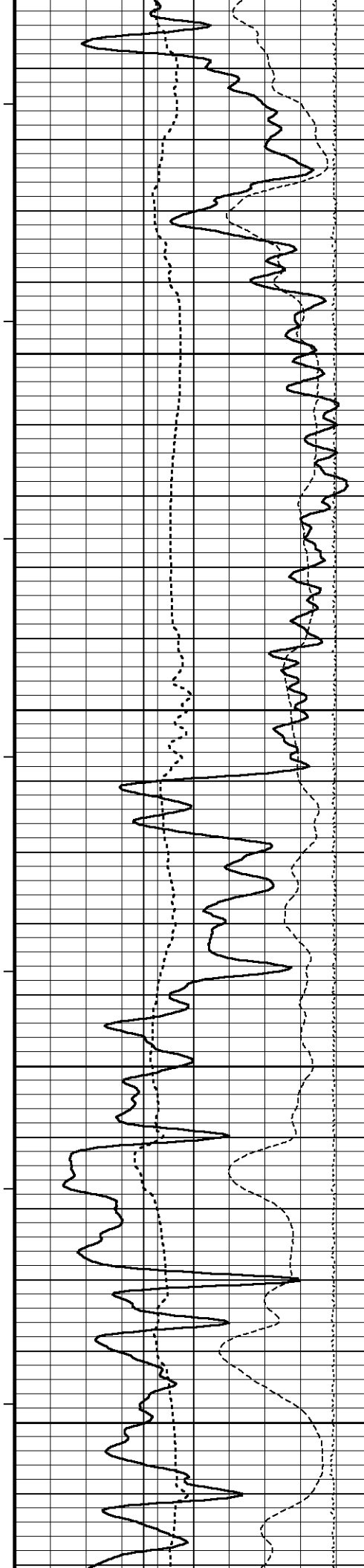
94°

2750

94°

2800





2800

94°

2850

95°

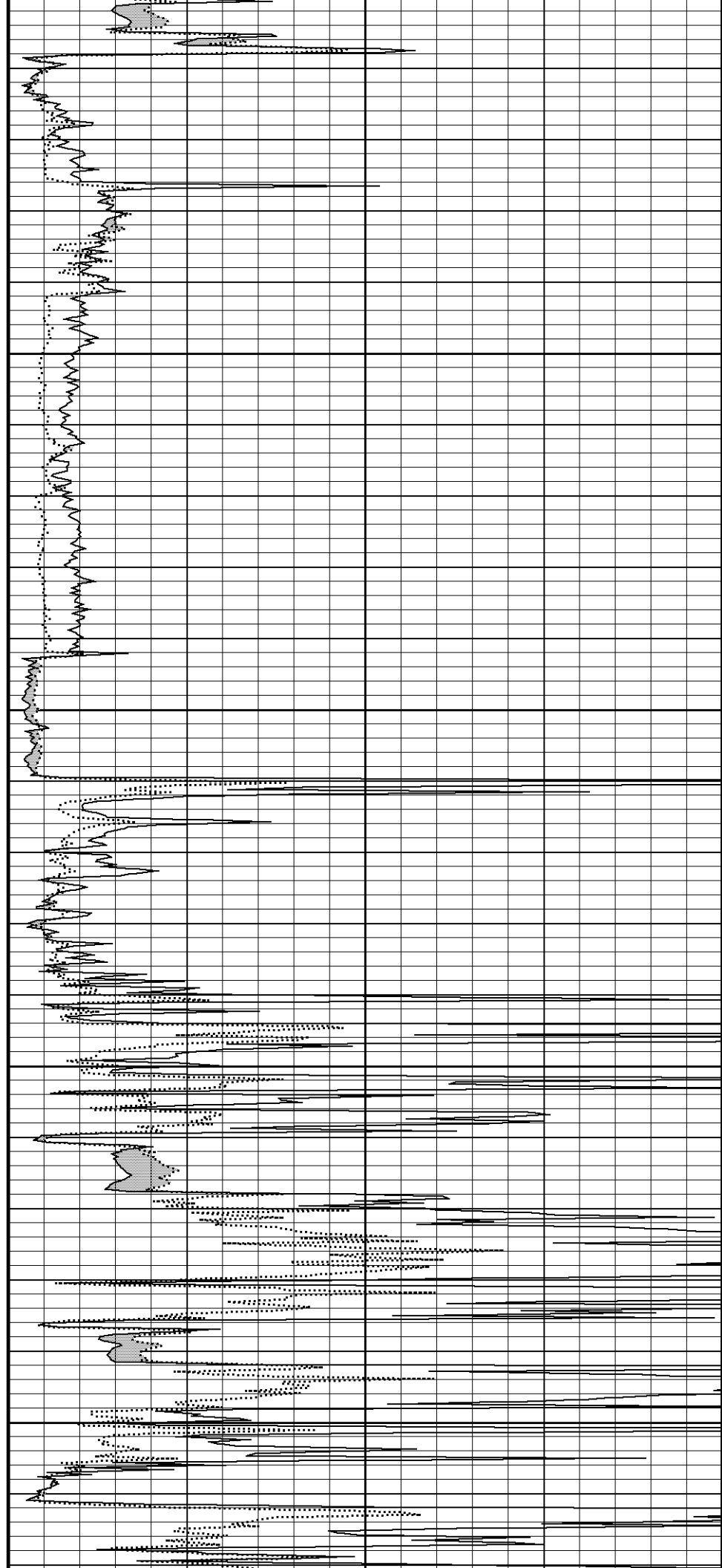
2900

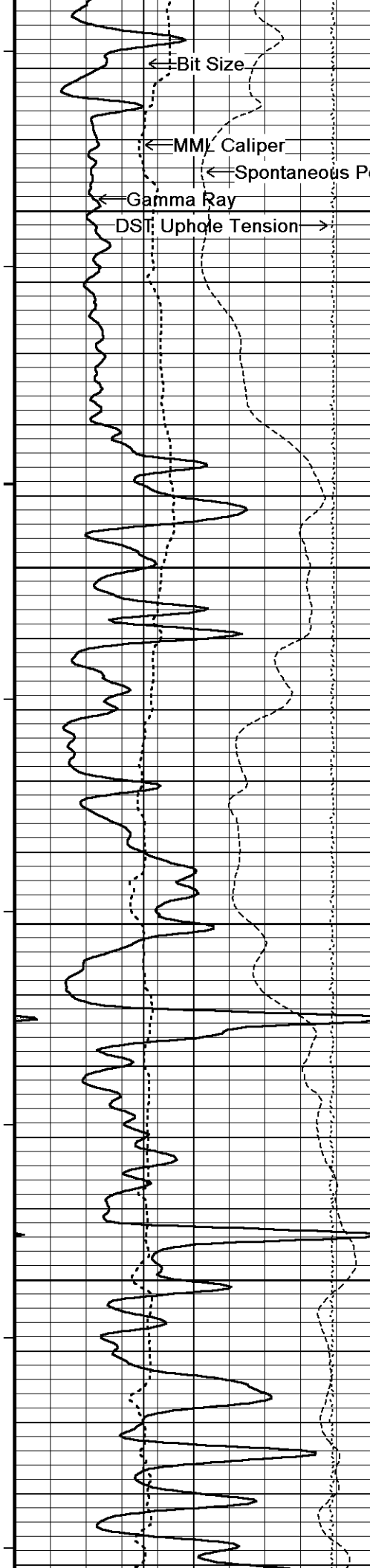
95°

2950

95°

3000





95°

3050

95°

3100

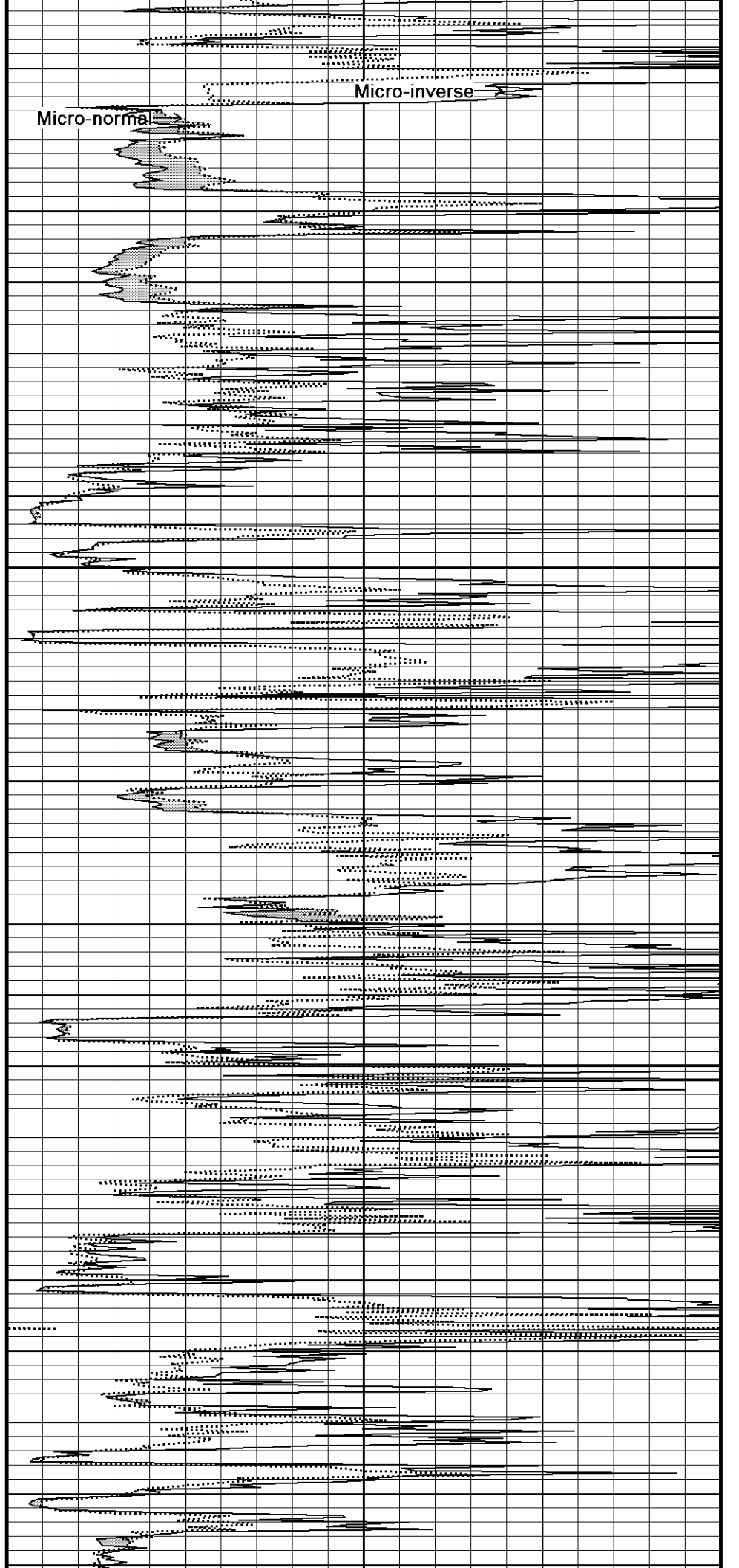
95°

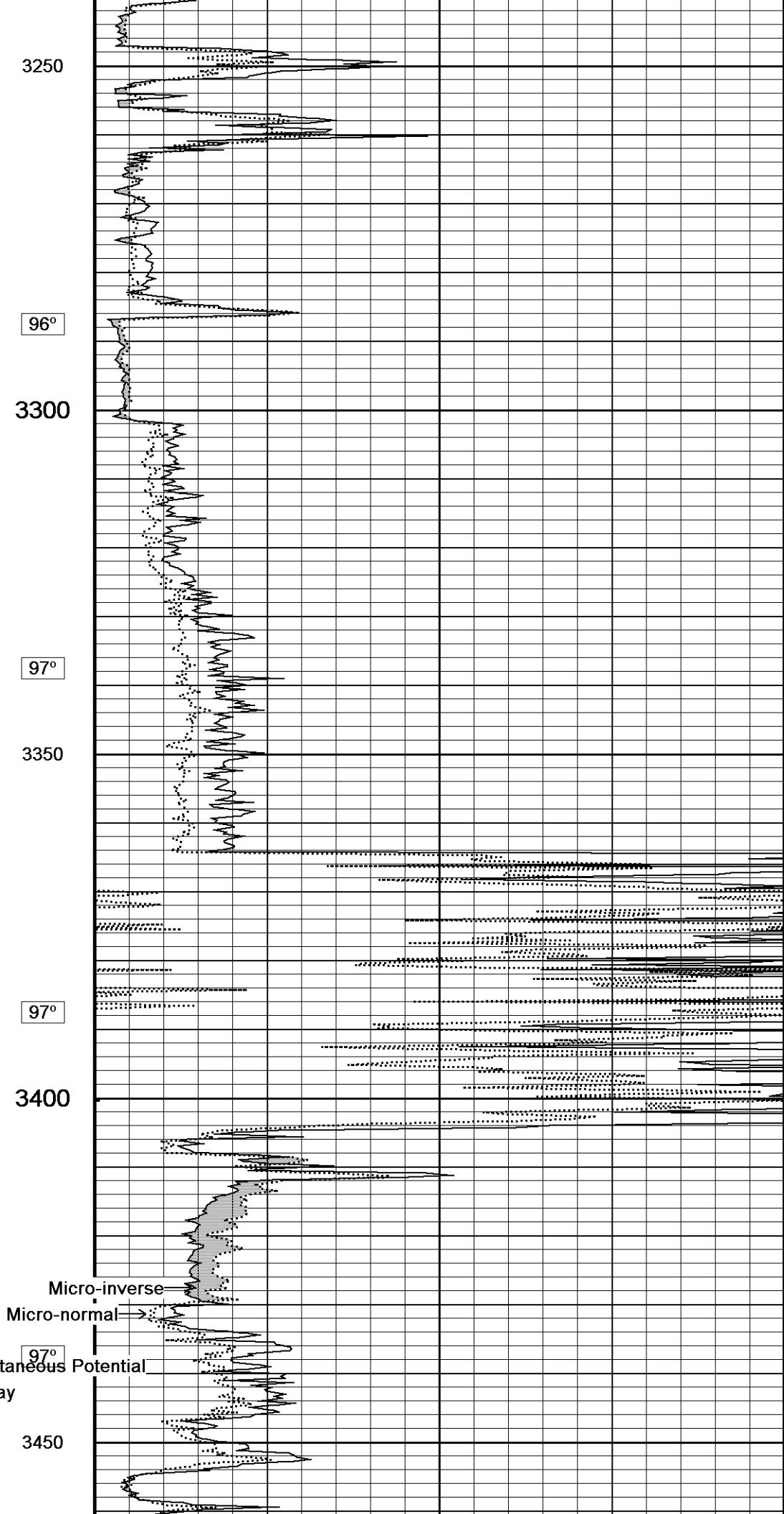
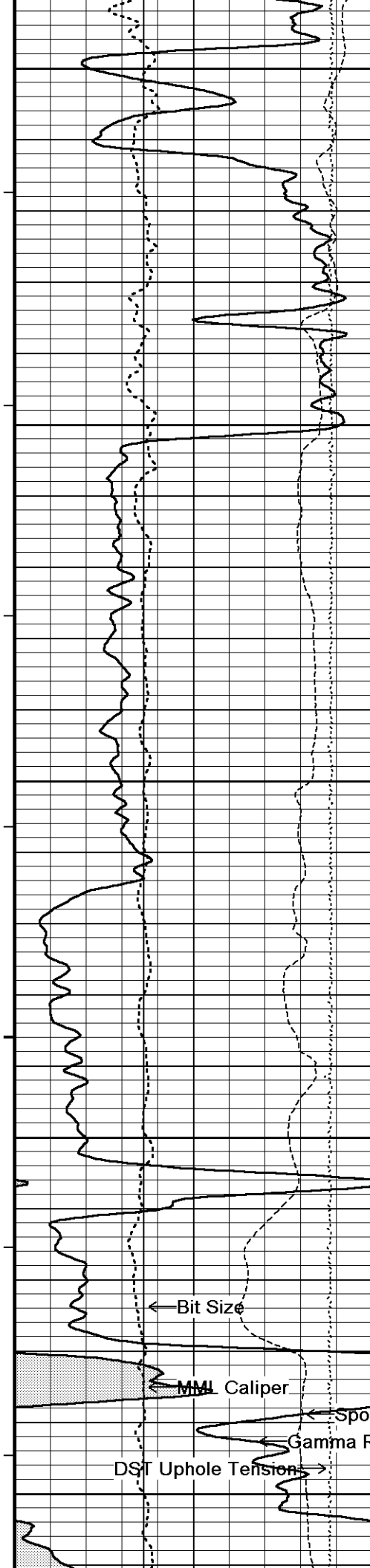
3150

96°

3200

96°





3250

96°

3300

97°

3350

97°

3400

97°

3450

← Bit Size

← MML Caliper

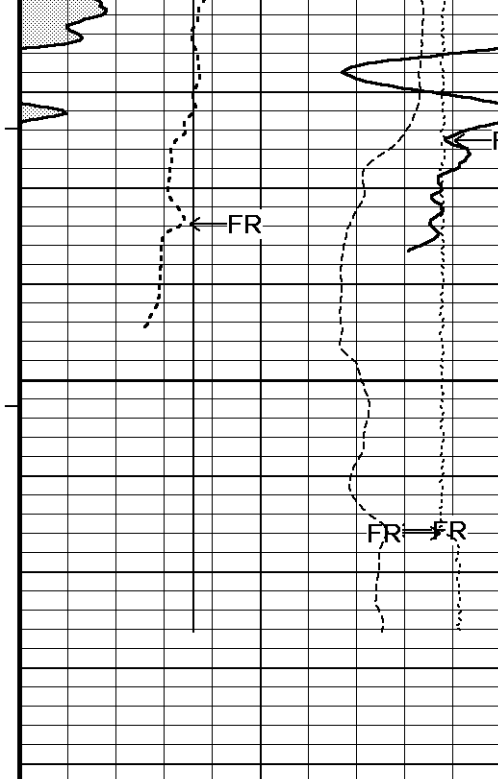
← Spontaneous Potential

← Gamma Ray

DST Uphole Tensions →

Micro-inverse

Micro-normal →



96°

3500

3540  
Depth  
In  
Feet

Timing Marks  
every 60.0 sec

Gamma Ray

API

75

0

150

225

150

300

Borehole  
Temp in  
deg F

Spontaneous Potential

millivolts

- - - - - 20 - - - - - +

HVI  
every  
10 cu ft

MML Caliper

inches

11

6

16

Annular  
Integral  
every  
10 cu ft

Bit Size

inches

11

6

16

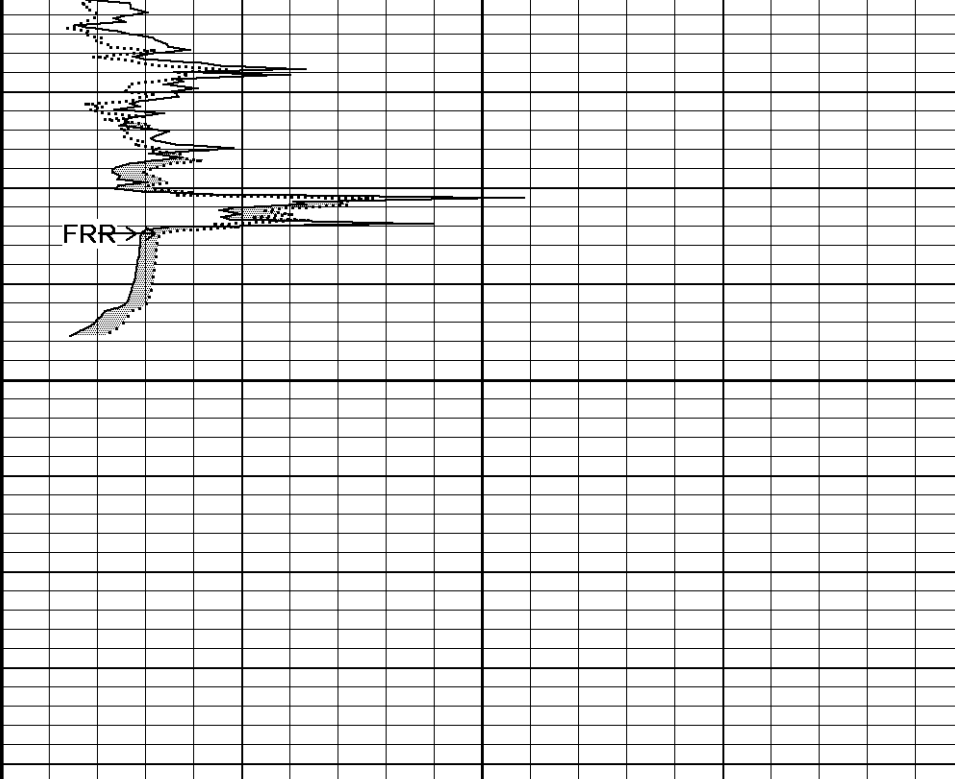
DST Uphole Tension

pounds

5000

0

Replay  
Scale  
1:240



Micro-normal  
ohm metres

0

10

20

30

40

Micro-inverse  
ohm metres

0

10

20

30

40

Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 05-MAY-2013 22:40

Filename: C:\Minimus 13.05.9583\Logs\...\Southern Star Alden Gas Storage #0-27 Resistivity2\_002.dta

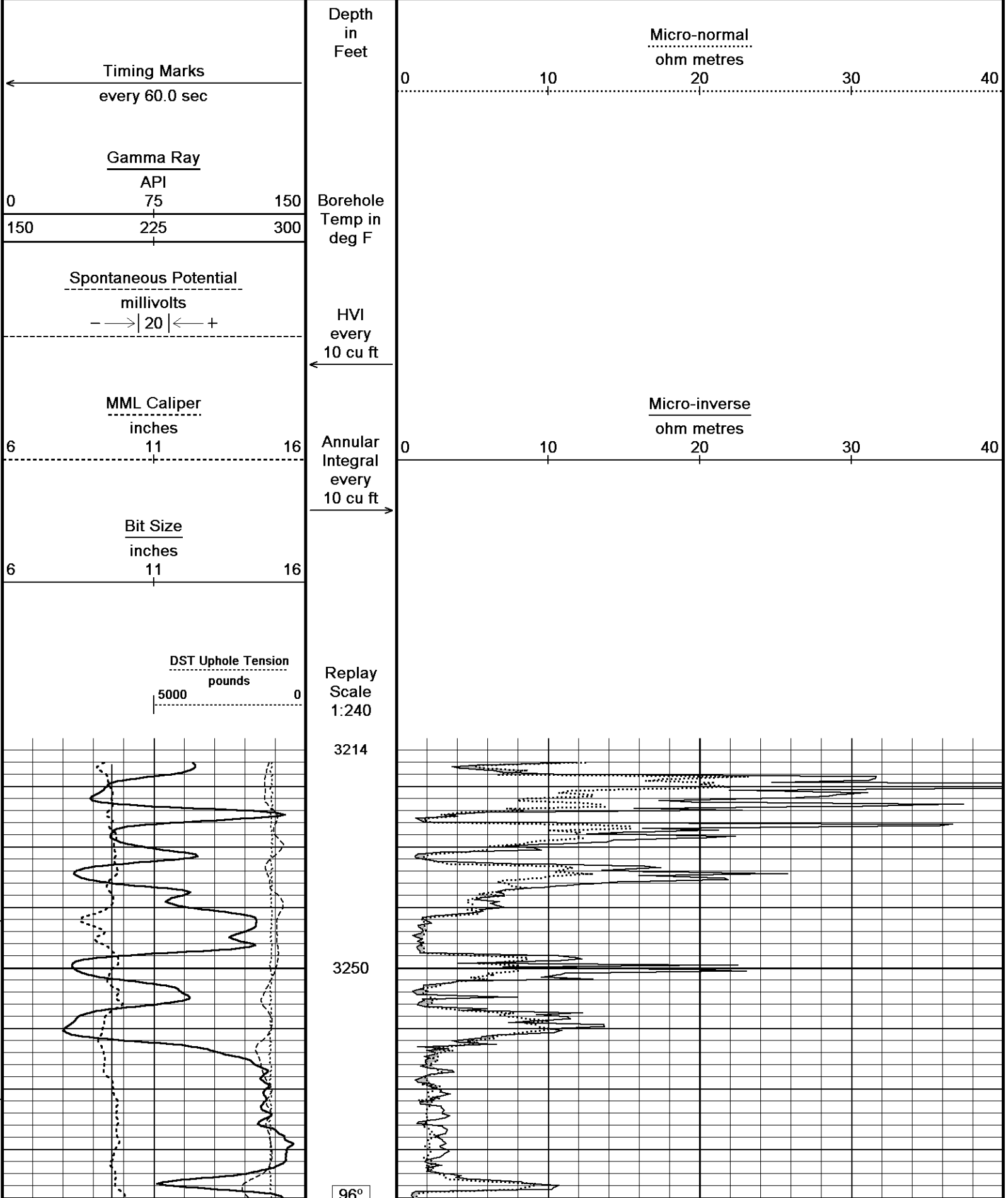
Recorded on 05-MAY-2013 16:53

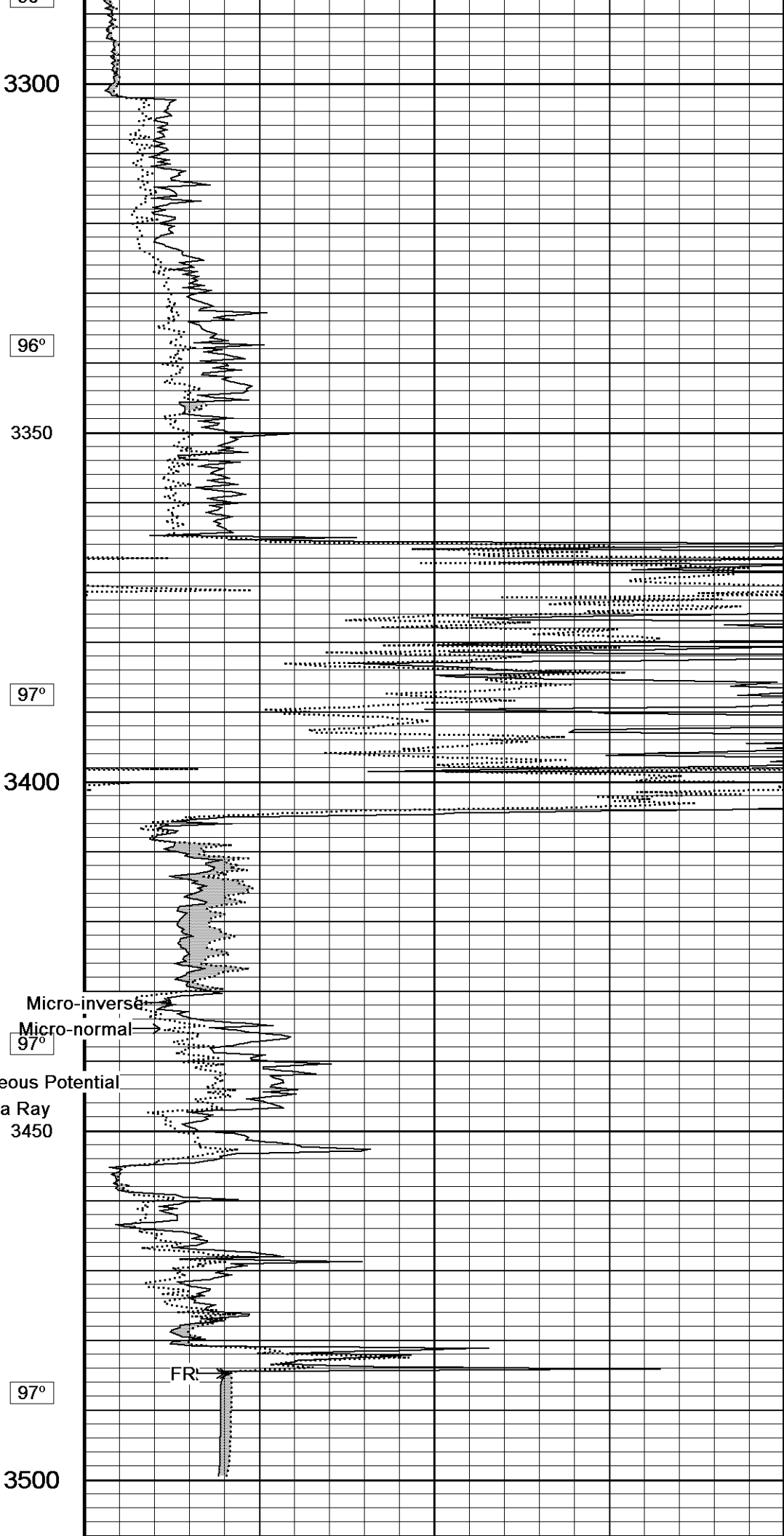
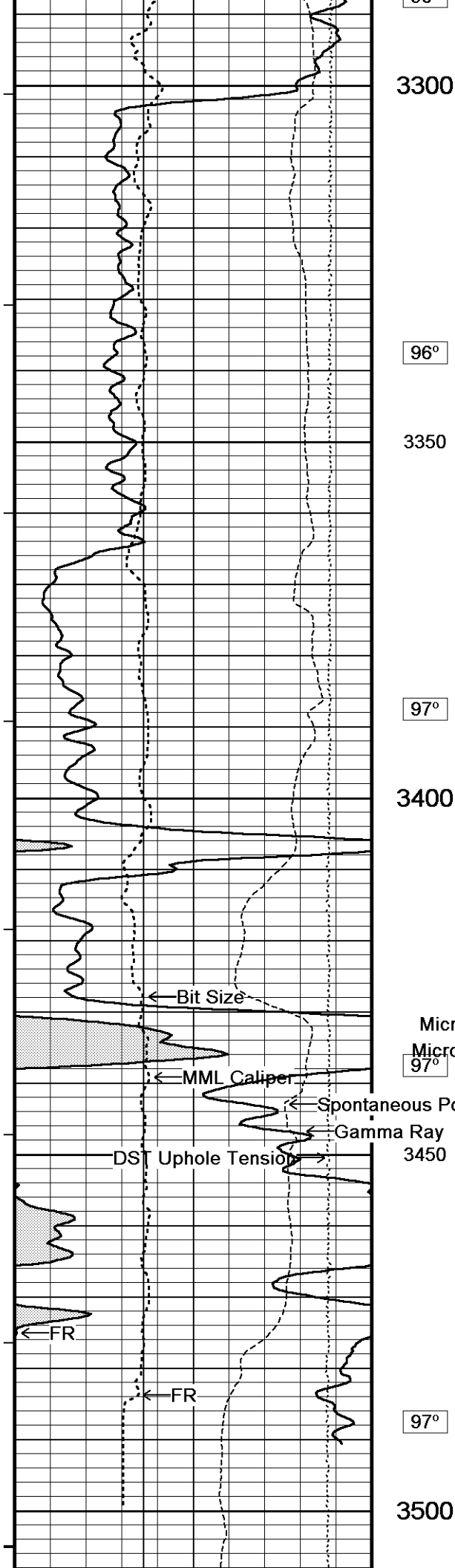
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583



5 INCH MAIN









|                                                         |                                             |                   |                                                                                 |            |
|---------------------------------------------------------|---------------------------------------------|-------------------|---------------------------------------------------------------------------------|------------|
| Hole/Annular Volume and Differential Caliper Parameters |                                             |                   |                                                                                 |            |
| HVOL Method                                             | Single Caliper                              |                   |                                                                                 |            |
| HVOL Caliper 1                                          | MMR Caliper                                 |                   |                                                                                 |            |
| HVOL Caliper 2                                          | N/A                                         |                   |                                                                                 |            |
| Annular Volume Diameter                                 | 7.000                                       | inches            |                                                                                 |            |
| Caliper for Differential Caliper                        | MMR Caliper                                 |                   |                                                                                 |            |
| Rwa Parameters                                          |                                             |                   |                                                                                 |            |
| Porosity used                                           | Wyllie Lime. Sonic Por.                     |                   |                                                                                 |            |
| Resistivity used                                        | Array Ind. Six Res Rt                       |                   |                                                                                 |            |
| RWA Constant A                                          | 0.610                                       |                   |                                                                                 |            |
| RWA Constant M                                          | 2.150                                       |                   |                                                                                 |            |
| SW/APOR Tool Source                                     | 0.000                                       |                   |                                                                                 |            |
| 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-2013,08:10                                                |            |
| Gamma Calibrator Number                                 | GRC38                                       |                   |                                                                                 |            |
| Mud Density                                             | 1.13                                        | gm/cc             |                                                                                 |            |
| Caliper Source for Processing                           | MMR Caliper                                 |                   |                                                                                 |            |
| Tool Position                                           | Eccentred                                   |                   |                                                                                 |            |
| Concentration of KCl                                    |                                             |                   | kppm                                                                            |            |
| K Mud Type                                              | Chloride                                    |                   |                                                                                 |            |
| K Mud Concentration                                     | 0.00                                        | %                 |                                                                                 |            |
| Micro Normal and Micro Inverse Calibration MML-A 16     |                                             |                   | Base Calibration on 17-APR-2013 18:27<br>Field Check on 05-MAY-2013 01:26       |            |
| Base Calibration                                        |                                             |                   |                                                                                 |            |
|                                                         |                                             | Measured          | Calibrated (ohm-m)                                                              |            |
| Channel                                                 | Resistor 1                                  | Resistor 2        | Resistor 1                                                                      | Resistor 2 |
| Micro Normal                                            | 12.1                                        | 60.2              | 5.0                                                                             | 25.0       |
| Micro Inverse                                           | 15.6                                        | 78.4              | 5.0                                                                             | 25.0       |
|                                                         |                                             |                   |                                                                                 |            |
| Channel                                                 | Base Check (ohm-m)                          |                   | Field Check (ohm-m)                                                             |            |
| Micro Normal                                            | 62.9                                        |                   | 62.9                                                                            |            |
| Micro Inverse                                           | 48.2                                        |                   | 48.2                                                                            |            |
| Micro Normal and Micro Inverse Constants MML-A 16       |                                             |                   | Last Edited on 05-MAY-2013,14:58                                                |            |
| Pad Type                                                | 8-12 in Soft Rubber Inflatable 006-9011-159 |                   |                                                                                 |            |
| Micro Normal K Factor                                   | 1.0000                                      |                   |                                                                                 |            |
| Micro Inverse K Factor                                  | 1.0000                                      |                   |                                                                                 |            |
| Standoff Offset                                         | N/A                                         |                   | inches                                                                          |            |
| Caliper Calibration MML-A 16                            |                                             |                   | Base Calibration on 17-APR-2013 18:35<br>Field Calibration on 05-MAY-2013 01:28 |            |
| Base Calibration                                        |                                             |                   |                                                                                 |            |
| Reading No                                              | Measured                                    |                   | Calibrator Size (in)                                                            |            |
| 1                                                       | 14233                                       |                   | 5.98                                                                            |            |
| 2                                                       | 17427                                       |                   | 7.97                                                                            |            |
| 3                                                       | 20674                                       |                   | 9.86                                                                            |            |
| 4                                                       | 24554                                       |                   | 11.92                                                                           |            |
| 5                                                       | 0                                           |                   | 0.00                                                                            |            |
| 6                                                       | N/A                                         |                   | N/A                                                                             |            |
| Field Calibration                                       |                                             |                   |                                                                                 |            |
|                                                         | Measured Caliper (in)                       |                   | Actual Caliper (in)                                                             |            |

## DOWNHOLE EQUIPMENT

C:\Minimus 13.05.9583\Logs\Southern Star Alden Gas Storage #0-27\Southern Star Alden Gas Storage #0-27 Resistivity2\_002.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

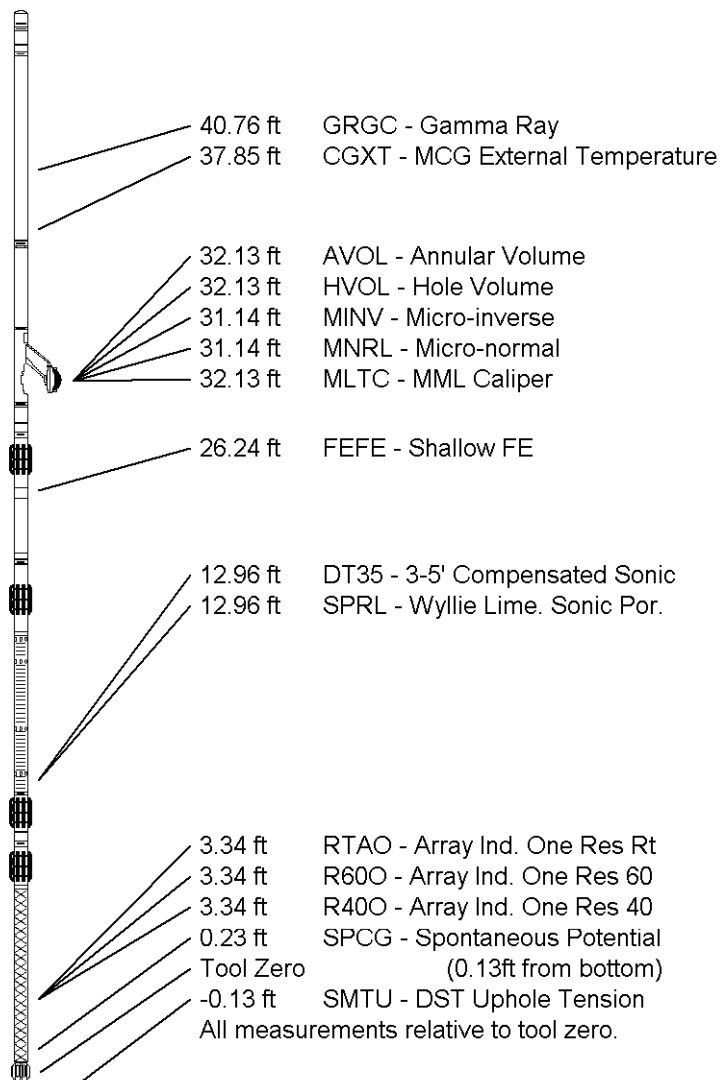
Compact Micro-log  
MML-A 16 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

Compact Focussed Electric  
MFE-B.J 352 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Sonic  
MSS-C.K 330 LG: 12.52 ft WT: 72.8 lb OD: 2.24 in

Compact Induction  
MAI-A.A 45 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 47.62 ft Weight: 330.7 lb



|                 |                                          |
|-----------------|------------------------------------------|
| COMPANY         | SOUTHERN STAR CENTRAL GAS PIPELINE, INC. |
| WELL            | ALDEN GAS STORAGE #0-27                  |
| FIELD           | ALDEN                                    |
| PROVINCE/COUNTY | RICE                                     |
| COUNTRY/STATE   | U.S.A. / KANSAS                          |

|                         |         |      |               |         |      |
|-------------------------|---------|------|---------------|---------|------|
| Elevation Kelly Bushing | 1685.00 | feet | First Reading | 3485.00 | feet |
| Elevation Drill Floor   | 1684.00 | feet | Depth Driller | 3520.00 | feet |
| Elevation Ground Level  | 1672.00 | feet | Depth Logger  | 3516.00 | feet |



**Weatherford®**

MICRORESISTIVITY LOG

