

HALLIBURTON

DUAL SPACED NEUTRON  
SPECTRAL DENSITY  
LOG

|                          |  |                         |  |                              |  |                                                     |  |
|--------------------------|--|-------------------------|--|------------------------------|--|-----------------------------------------------------|--|
| COMPANY                  |  |                         |  | HERMAN L. LOEB               |  |                                                     |  |
| WELL                     |  |                         |  | UNRUH 'D' 1-21               |  |                                                     |  |
| FIELD/BLOCK              |  |                         |  | WILDCAT                      |  |                                                     |  |
| COUNTY                   |  |                         |  | KIOWA                        |  |                                                     |  |
| STATE                    |  |                         |  | KANSAS                       |  |                                                     |  |
| COMPANY                  |  |                         |  | HERMAN L. LOEB               |  |                                                     |  |
| WELL                     |  |                         |  | UNRUH 'D' 1-21               |  |                                                     |  |
| FIELD/BLOCK              |  |                         |  | WILDCAT                      |  |                                                     |  |
| COUNTY                   |  |                         |  | KIOWA                        |  |                                                     |  |
| STATE                    |  |                         |  | KANSAS                       |  |                                                     |  |
| Permanent Datum          |  | GL                      |  | API No. 15-097-21750-00-00   |  | Other Services:<br>MICRO<br>ACRT<br>BSAT            |  |
| Log measured from        |  | KB                      |  | Location 1100' FSL 2290' FWL |  |                                                     |  |
| Drilling measured from   |  | KB                      |  |                              |  | Elev. 2191.0 ft<br>D.F. 2200.0 ft<br>G.L. 2191.0 ft |  |
| Date                     |  | 28-Feb-13               |  |                              |  |                                                     |  |
| Run No.                  |  | ONE                     |  |                              |  |                                                     |  |
| Depth - Driller          |  | 4875.00 ft              |  |                              |  |                                                     |  |
| Depth - Logger           |  | 4872.0 ft               |  |                              |  |                                                     |  |
| Bottom - Logged Interval |  | 4869.0 ft               |  |                              |  |                                                     |  |
| Top - Logged Interval    |  | 3350.0 ft               |  |                              |  |                                                     |  |
| Casing - Driller         |  | 8.625 in @ 561.0 ft     |  |                              |  | @                                                   |  |
| Casing - Logger          |  | 561.0 ft                |  |                              |  |                                                     |  |
| Bit Size                 |  | 7.875 in                |  |                              |  | @                                                   |  |
| Type Fluid in Hole       |  | WATER BASED MUD         |  |                              |  |                                                     |  |
| Density                  |  | 9.3 ppg                 |  | 64.00 s/qt                   |  |                                                     |  |
| PH                       |  | 10.00 pH                |  | 9.6 cpm                      |  |                                                     |  |
| Source of Sample         |  | FLOWLINE                |  |                              |  |                                                     |  |
| Rm @ Meas. Temperature   |  | 0.420 ohmm @ 70.00 degF |  |                              |  | @                                                   |  |
| Rmf @ Meas. Temperature  |  | 0.35 ohmm @ 70.00 degF  |  |                              |  | @                                                   |  |
| Rmc @ Meas. Temperature  |  | 0.480 ohmm @ 70.00 degF |  |                              |  | @                                                   |  |
| Source Rmf               |  | MEASURED                |  | MEASURED                     |  |                                                     |  |
| Rm @ BHT                 |  | 0.29 ohmm @ 103.0 degF  |  |                              |  | @                                                   |  |
| Time Since Circulation   |  | 8.0 hr                  |  |                              |  |                                                     |  |
| Time on Bottom           |  | 28-Feb-13 20:01         |  |                              |  |                                                     |  |
| Max. Rec. Temperature    |  | 103.0 degF @ 4872.0 ft  |  |                              |  | @                                                   |  |
| Equipment                |  | 10546696                |  | LIBERAL                      |  |                                                     |  |
| Recorded By              |  | THOMAS HYDE             |  |                              |  |                                                     |  |
| Witnessed By             |  | J. CHRISTENSEN          |  |                              |  |                                                     |  |

Fold here

|                                         |            |                                    |   |                                         |                 |               |                 |       |
|-----------------------------------------|------------|------------------------------------|---|-----------------------------------------|-----------------|---------------|-----------------|-------|
| Service Ticket No.: 900256448           |            | API Serial No.: 15-097-21750-00-00 |   | PGM Version: WL INSITE R3.8.0 (Build 2) |                 |               |                 |       |
| CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE |            |                                    |   | RESISTIVITY SCALE CHANGES               |                 |               |                 |       |
| Date                                    | Sample No. |                                    |   | Type Log                                | Depth           | Scale Up Hole | Scale Down Hole |       |
| Depth-Driller                           |            |                                    |   |                                         |                 |               |                 |       |
| Type Fluid in Hole                      |            |                                    |   |                                         |                 |               |                 |       |
| Density                                 | Viscosity  |                                    |   |                                         |                 |               |                 |       |
| Ph                                      | Fluid Loss |                                    |   |                                         |                 |               |                 |       |
| Source of Sample                        |            |                                    |   | RESISTIVITY EQUIPMENT DATA              |                 |               |                 |       |
| Rm @ Meas. Temp                         |            | @                                  | @ | Run No.                                 | Tool Type & No. | Pad Type      | Tool Pos.       | Other |

|                   |     |   |  |   |  |  |  |  |  |
|-------------------|-----|---|--|---|--|--|--|--|--|
| Rmf @ Meas. Temp. |     | @ |  | @ |  |  |  |  |  |
| Rmc @ Meas. Temp. |     | @ |  | @ |  |  |  |  |  |
| Source Rmf        | Rmc |   |  |   |  |  |  |  |  |
| Rm @ BHT          |     | @ |  | @ |  |  |  |  |  |
| Rmf @ BHT         |     | @ |  | @ |  |  |  |  |  |
| Rmc @ BHT         |     | @ |  | @ |  |  |  |  |  |

| EQUIPMENT DATA     |          |              |  |  |             |          |  |             |          |
|--------------------|----------|--------------|--|--|-------------|----------|--|-------------|----------|
| GAMMA              |          | ACOUSTIC     |  |  | DENSITY     |          |  | NEUTRON     |          |
| Run No.            | ONE      | Run No.      |  |  | Run No.     | ONE      |  | Run No.     | ONE      |
| Serial No.         | 11039640 | Serial No.   |  |  | Serial No.  | 11014296 |  | Serial No.  | 11055304 |
| Model No.          | GTET     | Model No.    |  |  | Model No.   | SDLT     |  | Model No.   | DSNT     |
| Diameter           | 3.625"   | No. of Cent. |  |  | Diameter    | 4.5"     |  | Diameter    | 3.625"   |
| Detector Model No. | T-102    | Spacing      |  |  | Log Type    | GAM-GAM  |  | Log Type    | NEU-NEU  |
| Type               | SCINT    |              |  |  | Source Type | Cs137    |  | Source Type | Am 241Be |
| Length             | 8"       | LSA [Y/N]    |  |  | Serial No.  | 5168GW   |  | Serial No.  | DSN424   |
| Distance to Source | 10'      | FWDA [Y/N ]  |  |  | Strength    | 1.5 Ci   |  | Strength    | 15 Ci    |

| LOGGING DATA |       |      |        |       |          |       |   |         |       |     |         |       |     |        |
|--------------|-------|------|--------|-------|----------|-------|---|---------|-------|-----|---------|-------|-----|--------|
| GENERAL      |       |      | GAMMA  |       | ACOUSTIC |       |   | DENSITY |       |     | NEUTRON |       |     |        |
| Run          | Depth |      | Speed  | Scale |          | Scale |   | Matrix  | Scale |     | Matrix  | Scale |     | Matrix |
| No.          | From  | To   | ft/min | L     | R        | L     | R |         | L     | R   |         | L     | R   |        |
| ONE          | 4872  | 3350 | REC    | 0     | 150      |       |   |         | 30    | -10 | 2.71    | 30    | -10 | LIME   |
|              |       |      |        |       |          |       |   |         |       |     |         |       |     |        |
|              |       |      |        |       |          |       |   |         |       |     |         |       |     |        |
|              |       |      |        |       |          |       |   |         |       |     |         |       |     |        |
|              |       |      |        |       |          |       |   |         |       |     |         |       |     |        |

| DIRECTIONAL INFORMATION |   |     |   |
|-------------------------|---|-----|---|
| Maximum Deviation       | @ | KOP | @ |

Remarks: ANNULAR HOLE VOLUME CALCULATED FOR 5.5 INCH CASING

CHLORIDES REPORTED AT 11000 MG/L

LCM REPORTED AT 2 PPB

TODAY'S CREW M. GRAHAM B. TERRELL

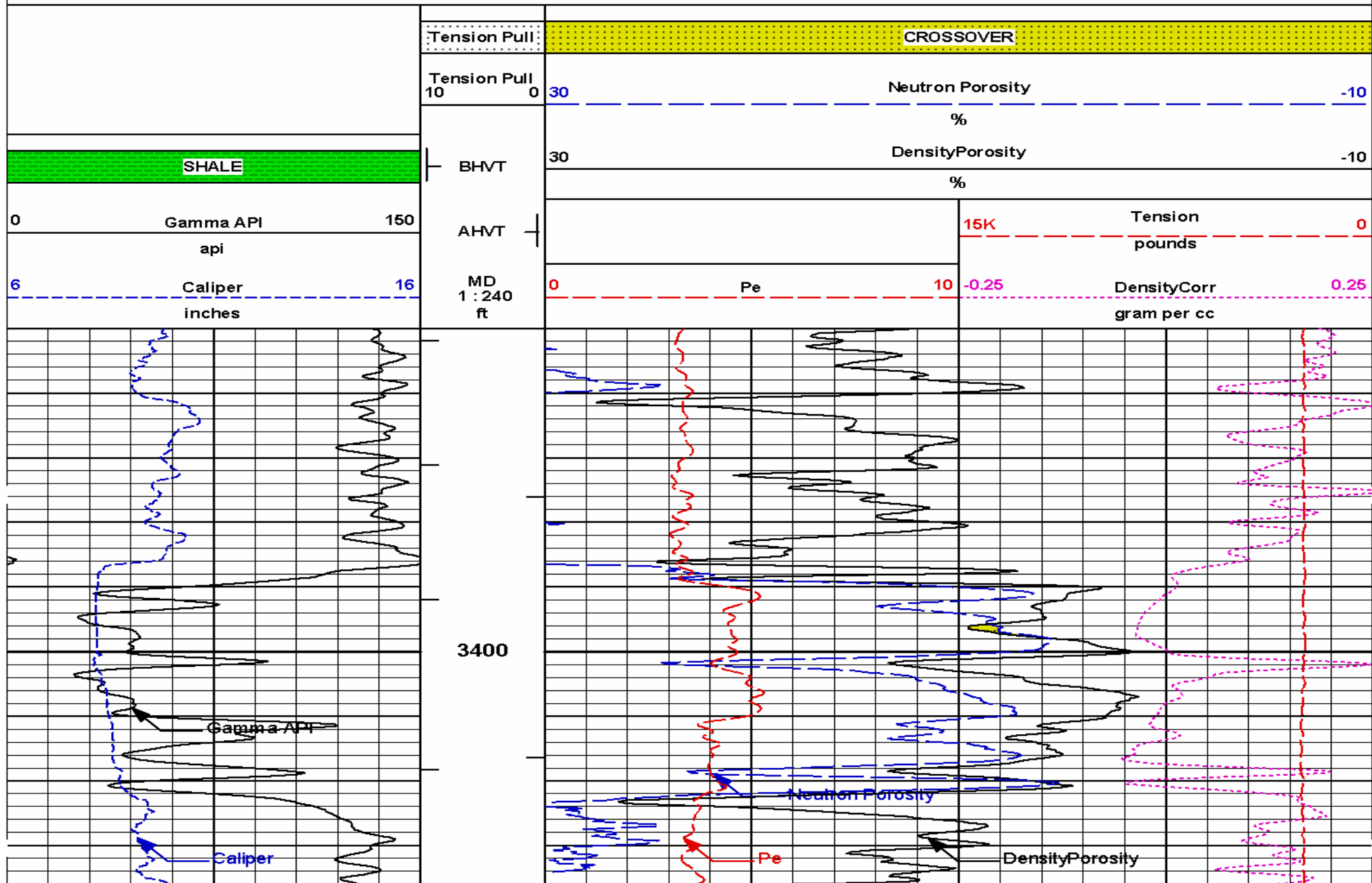
THANK YOU FOR CHOOSING HALLIBURTON ENERGY SERVICES LIBERAL, KANSAS 620-624-8123

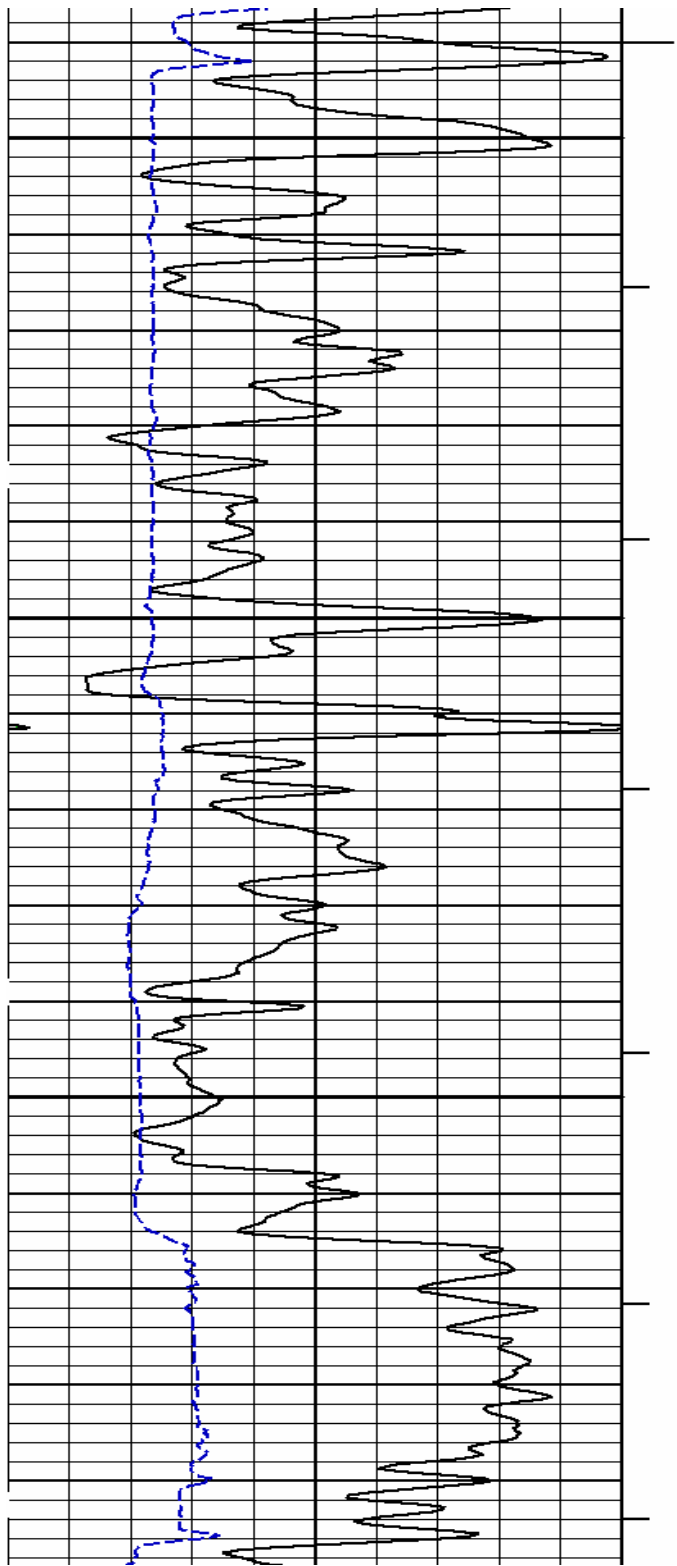
HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

HALLIBURTON

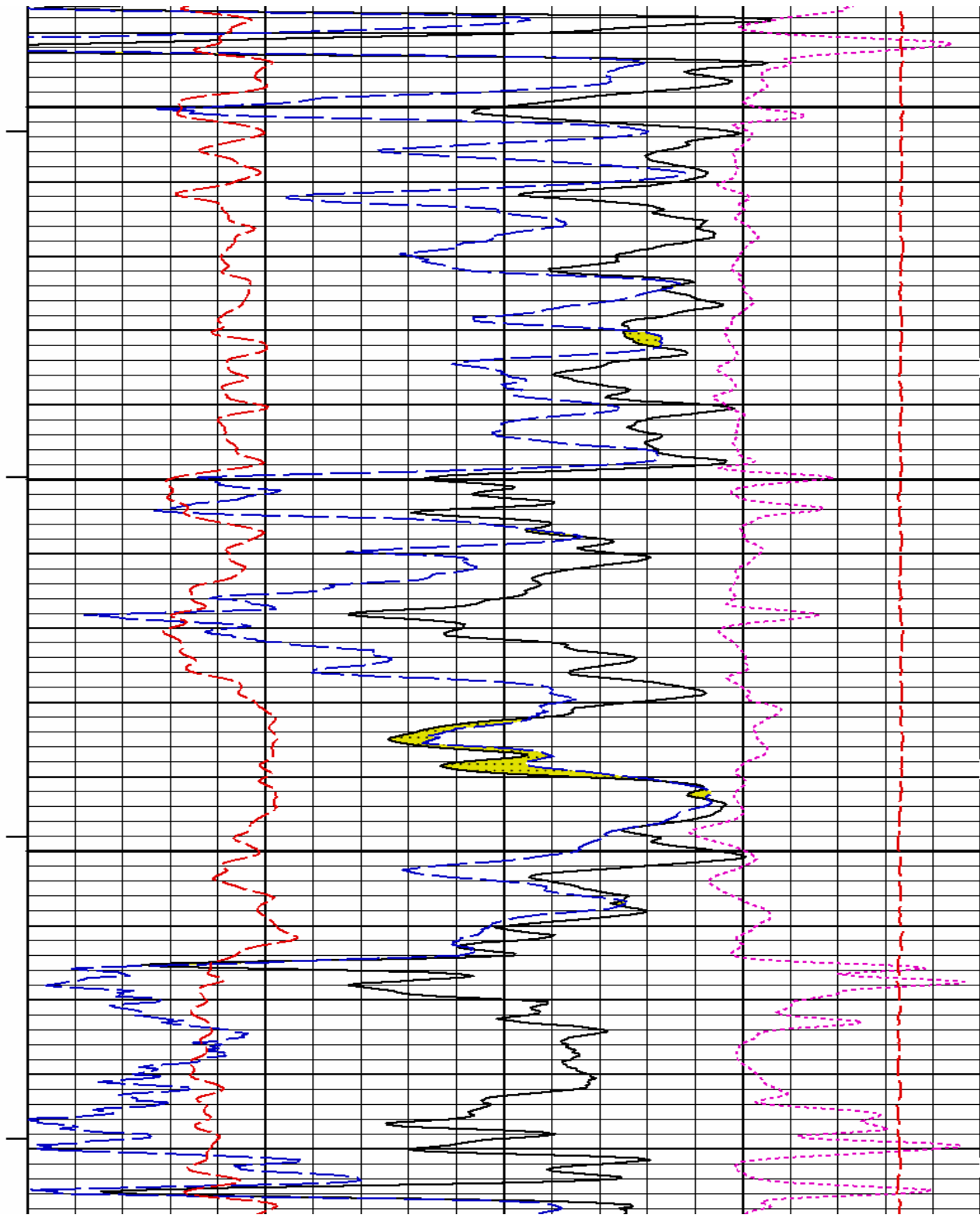
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 Plot File: \\PORO\Porosity\_Q\_5\_MAIN\_LIB

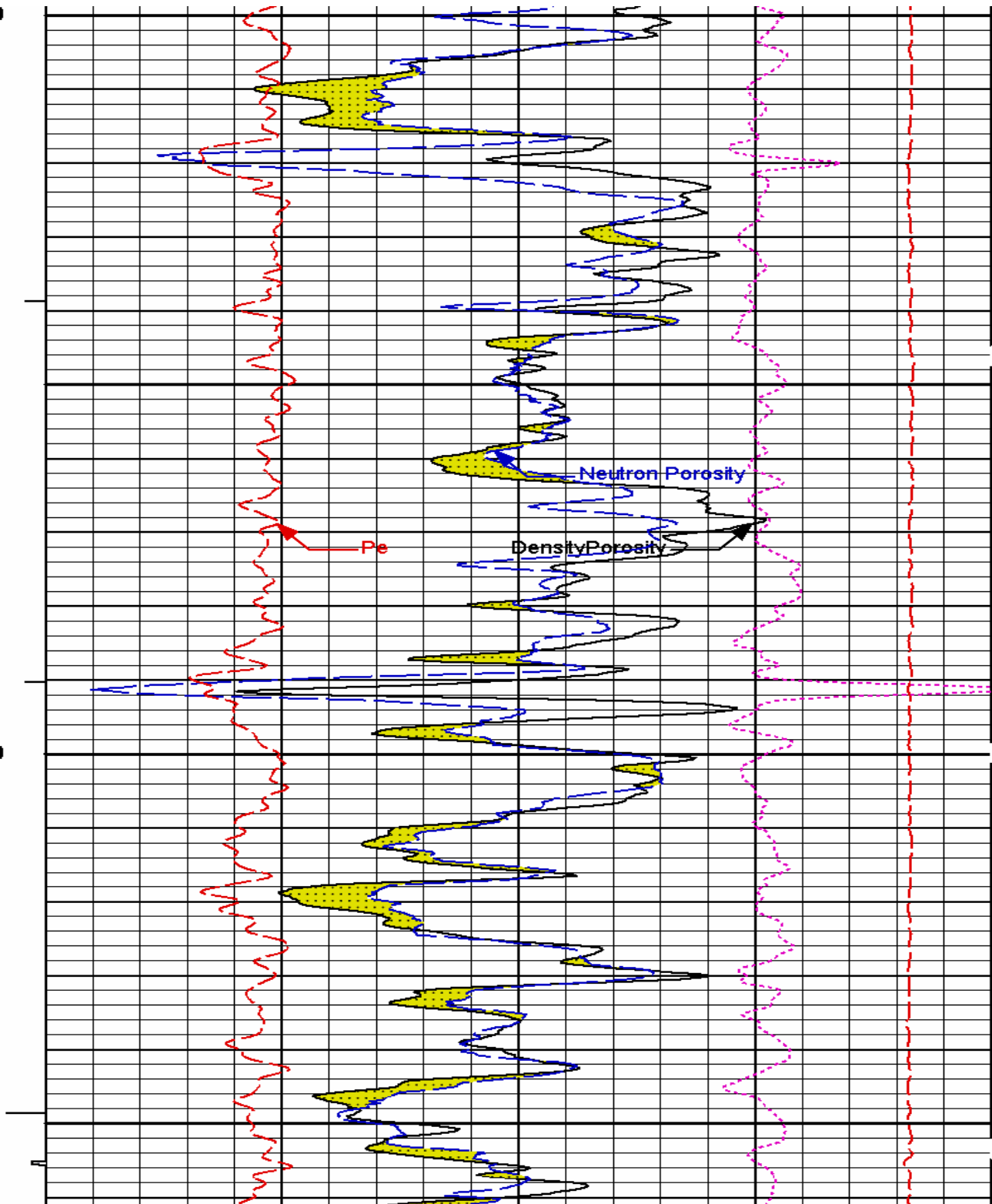
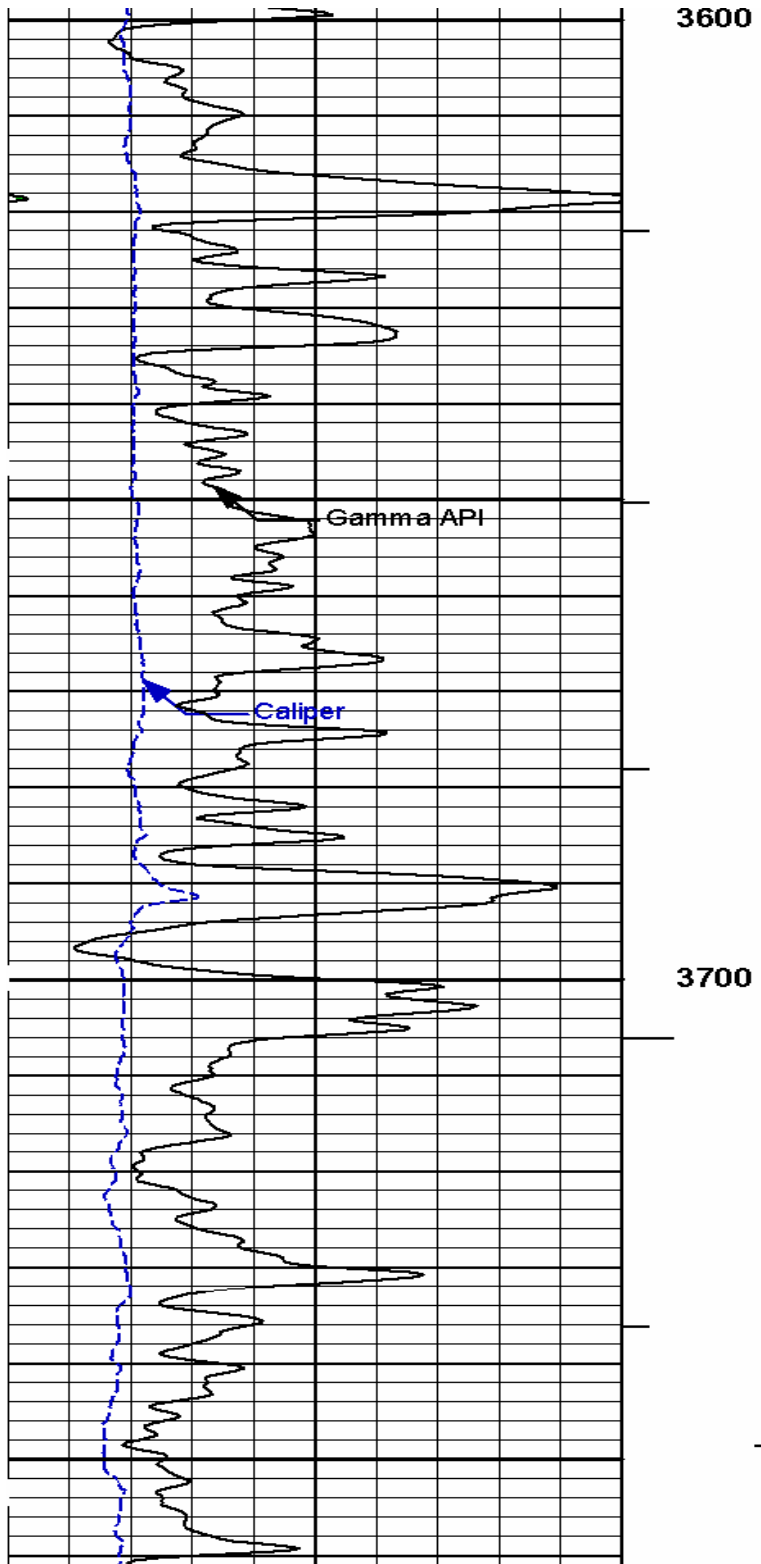
## 5 INCH MAIN LOG

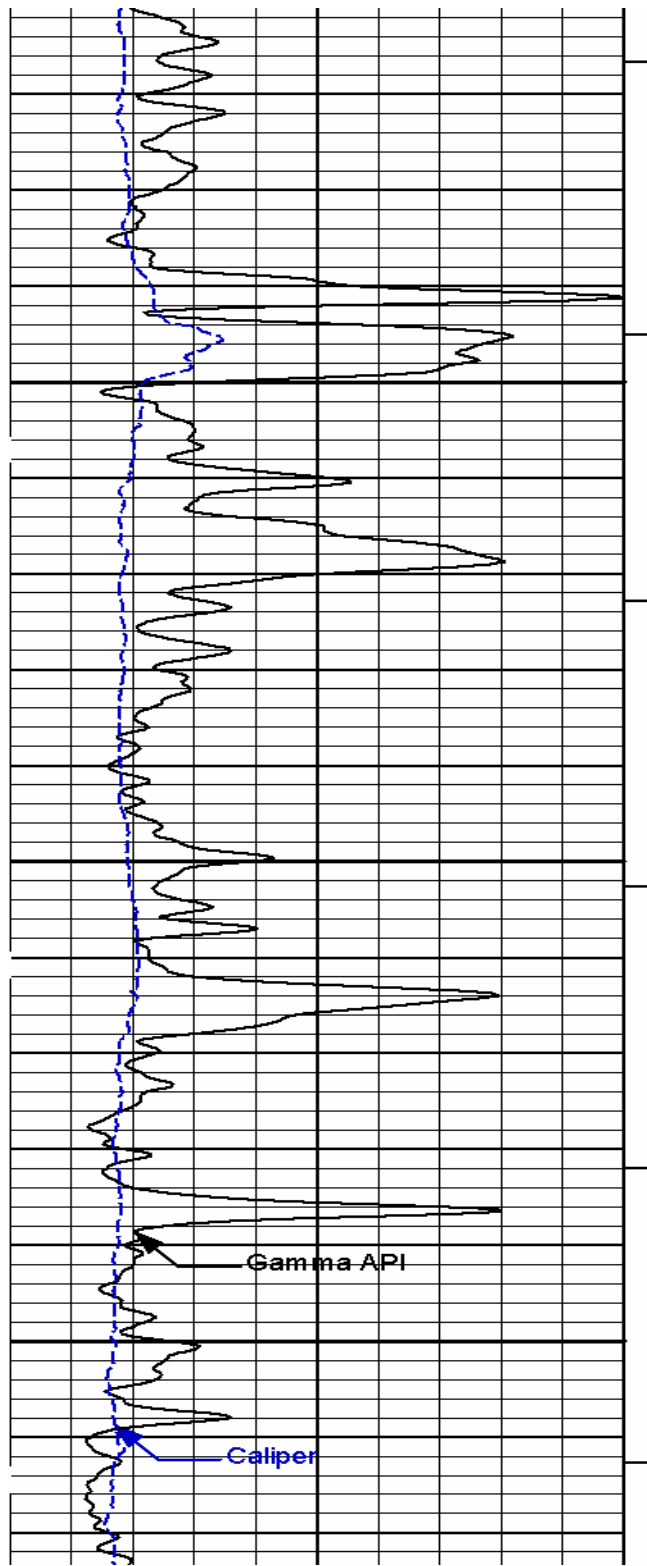




3500

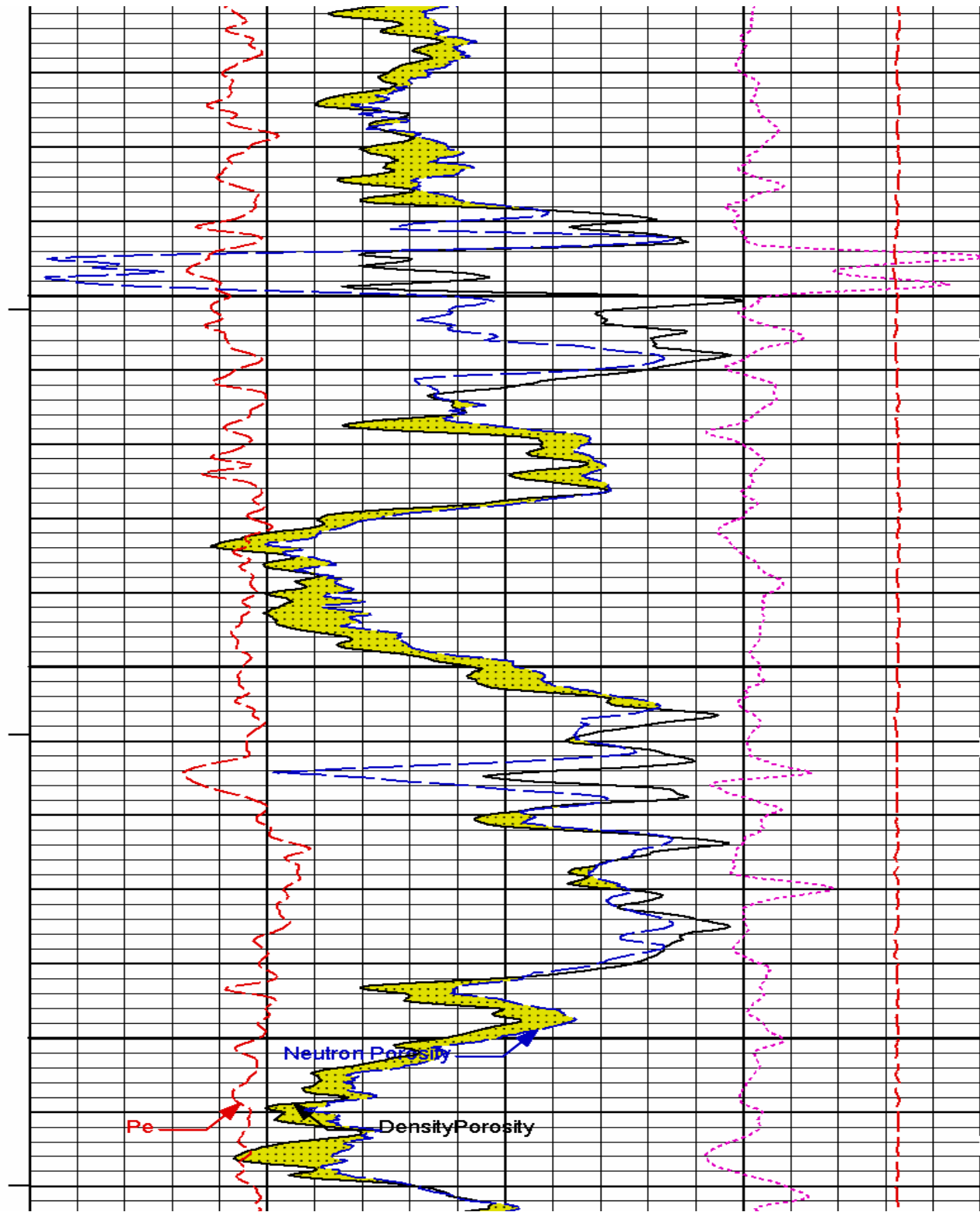


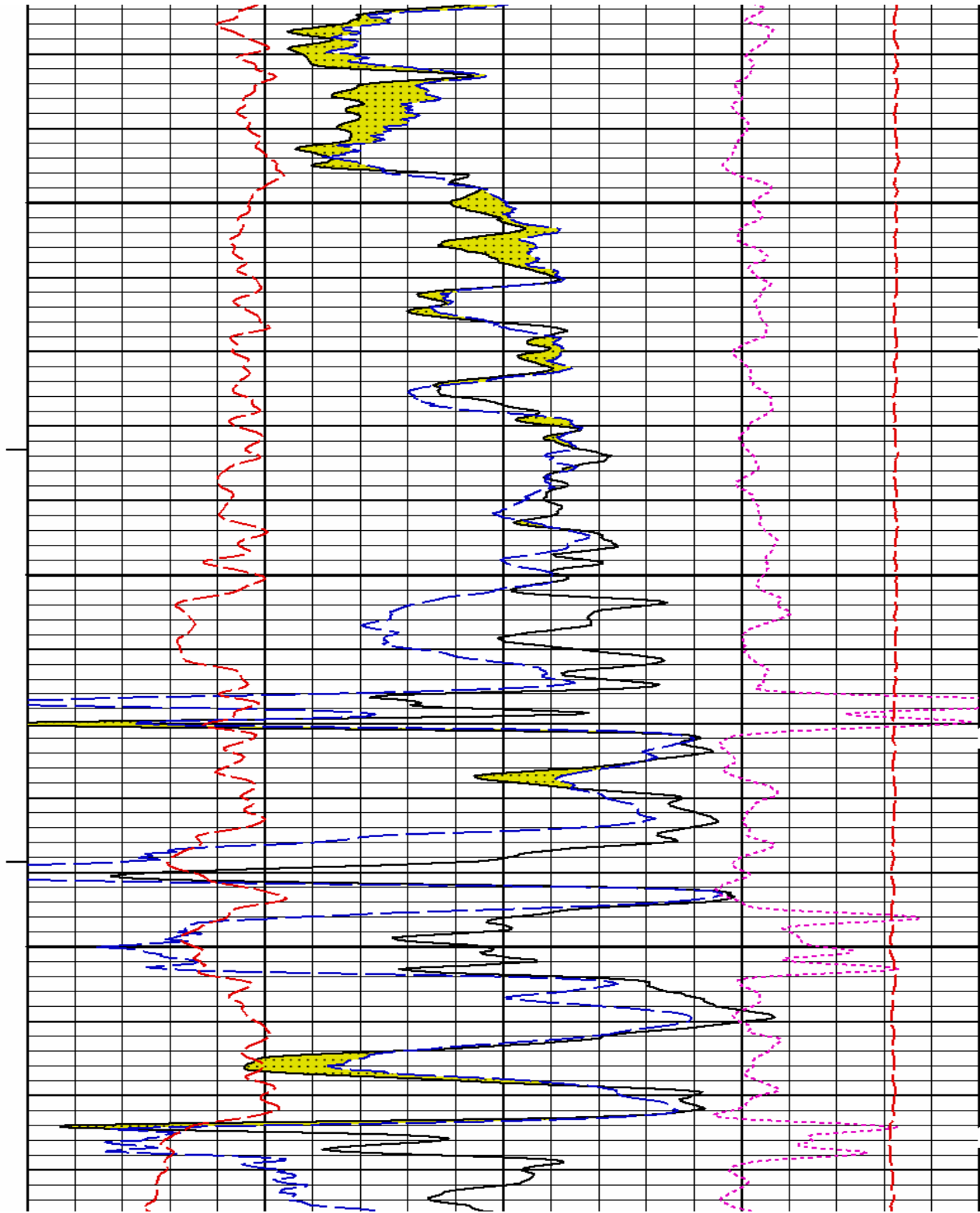
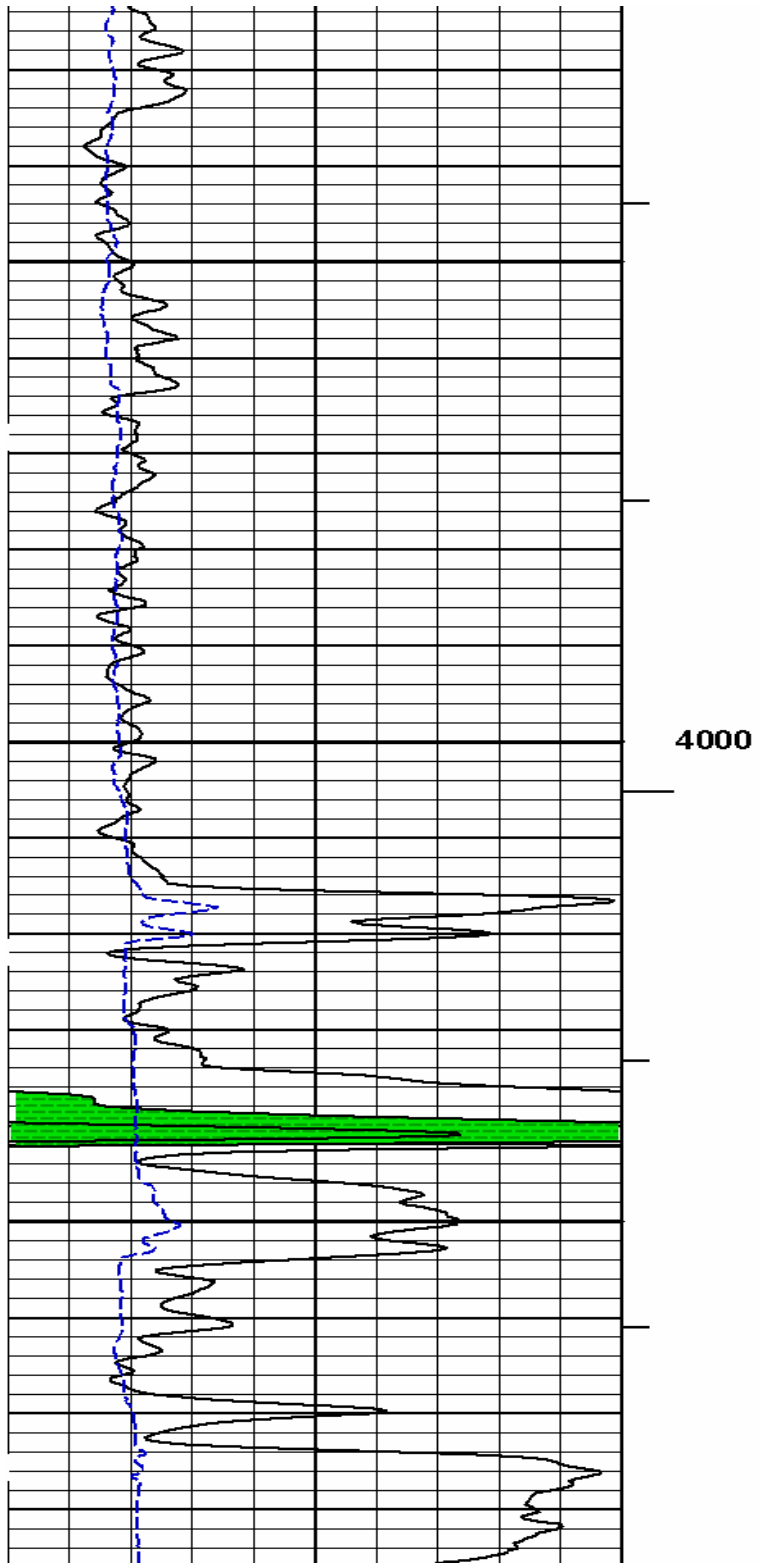


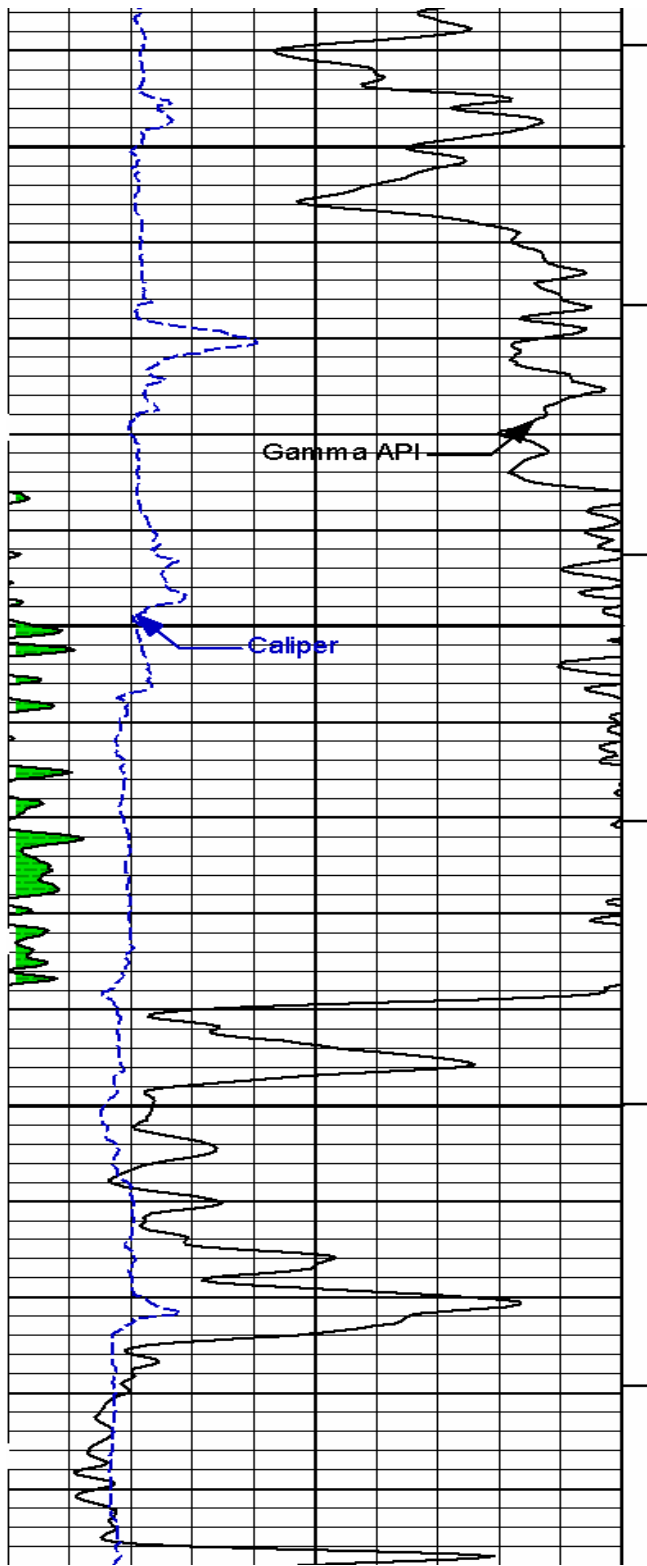


3800

3900

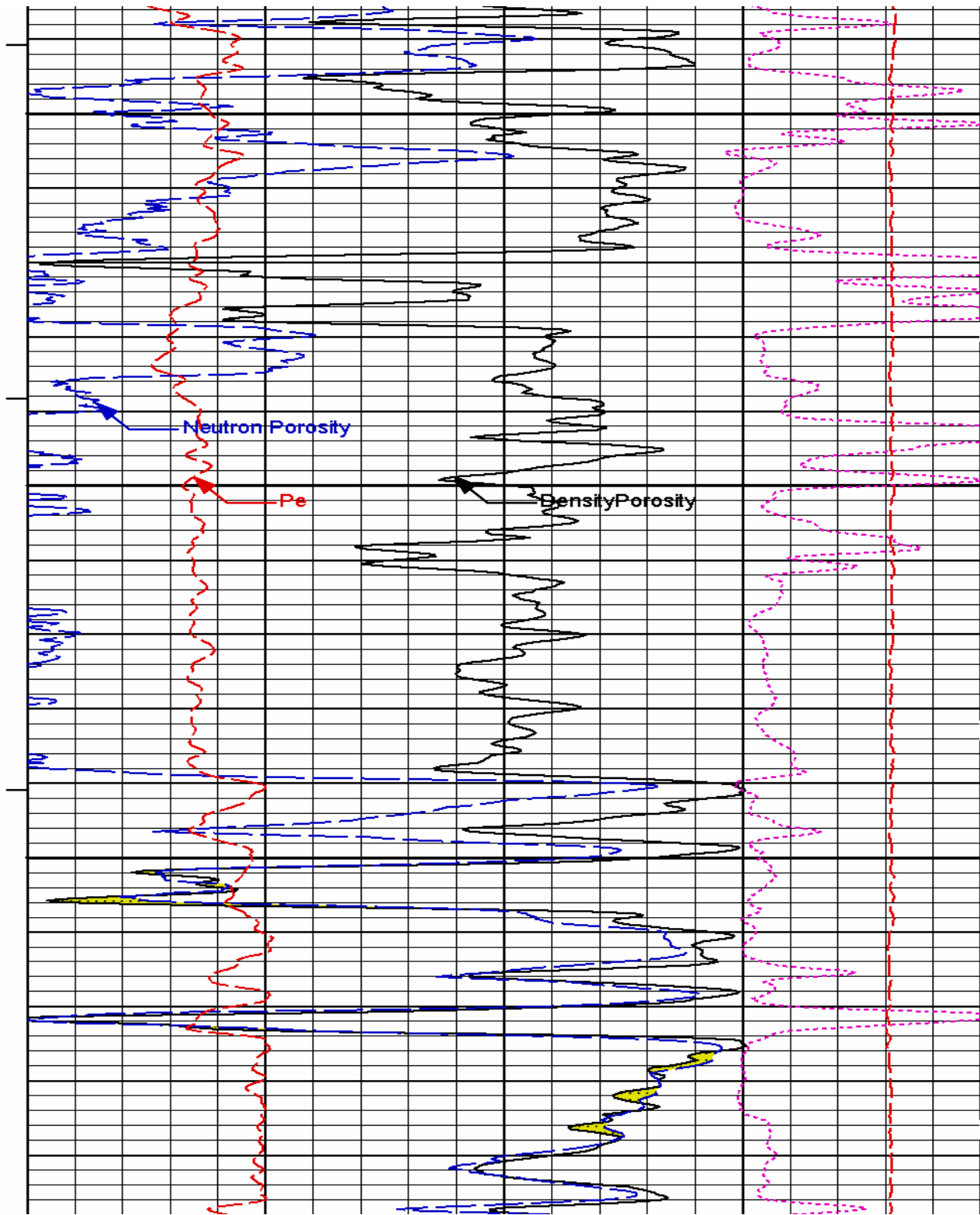


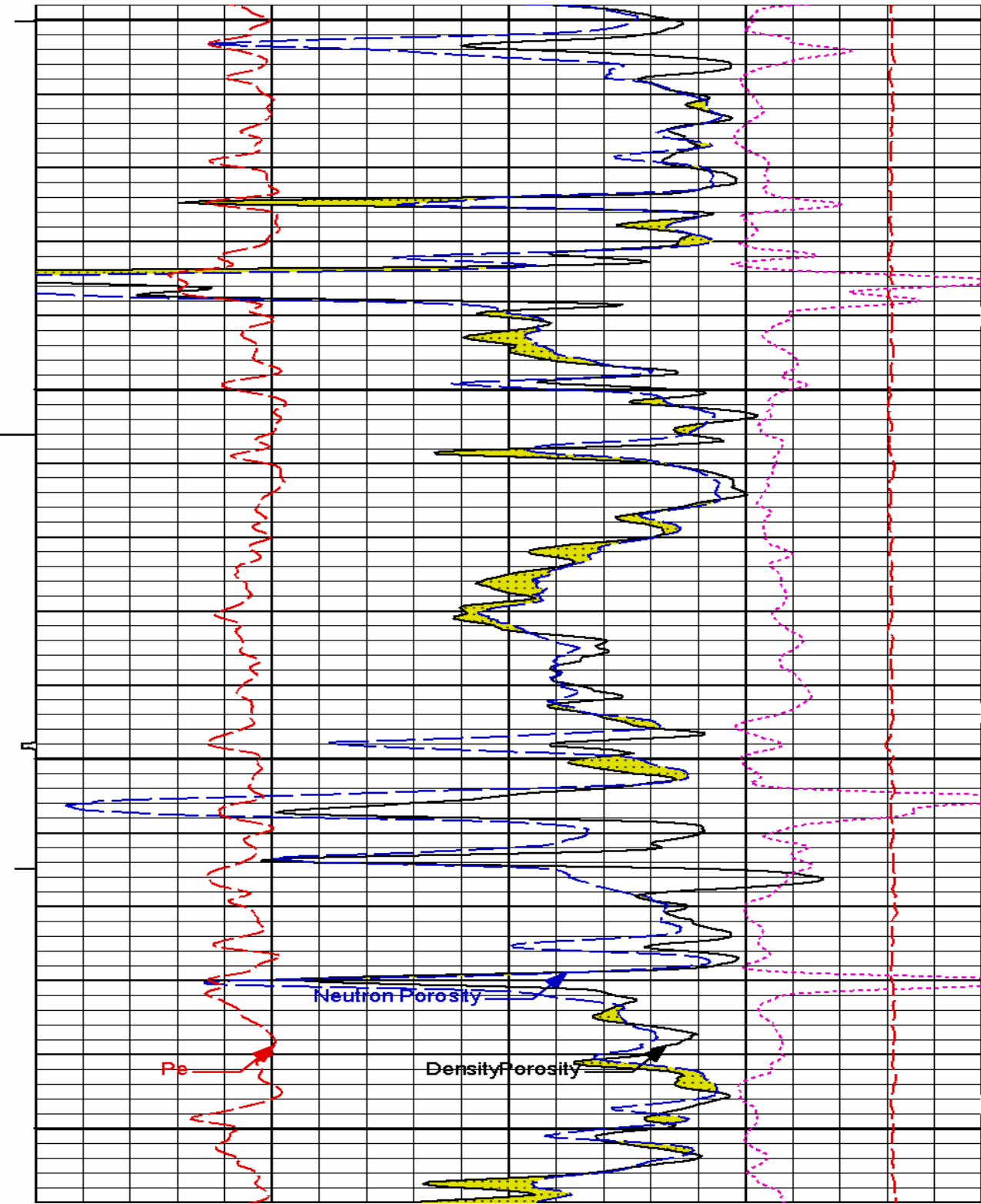
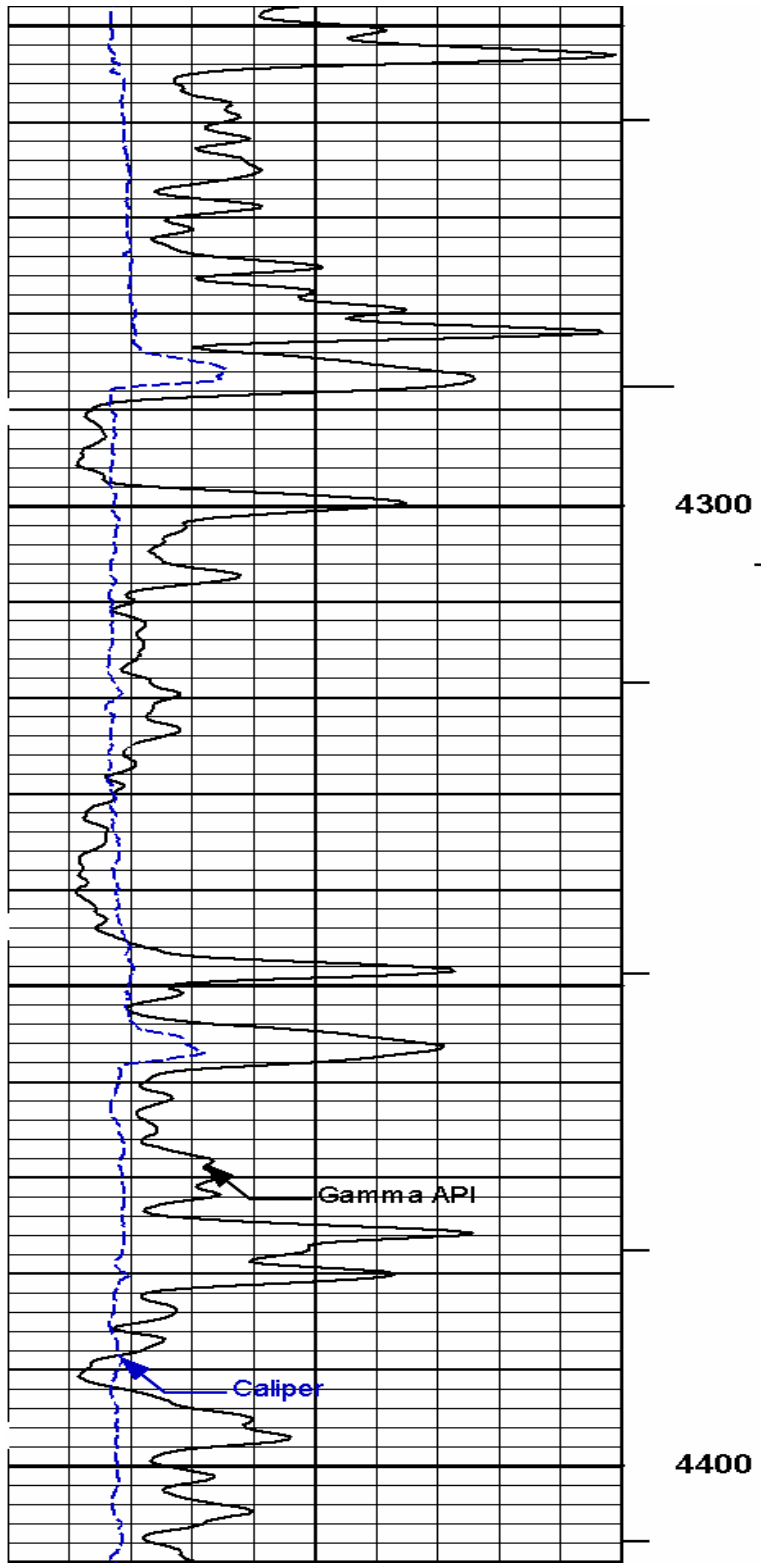


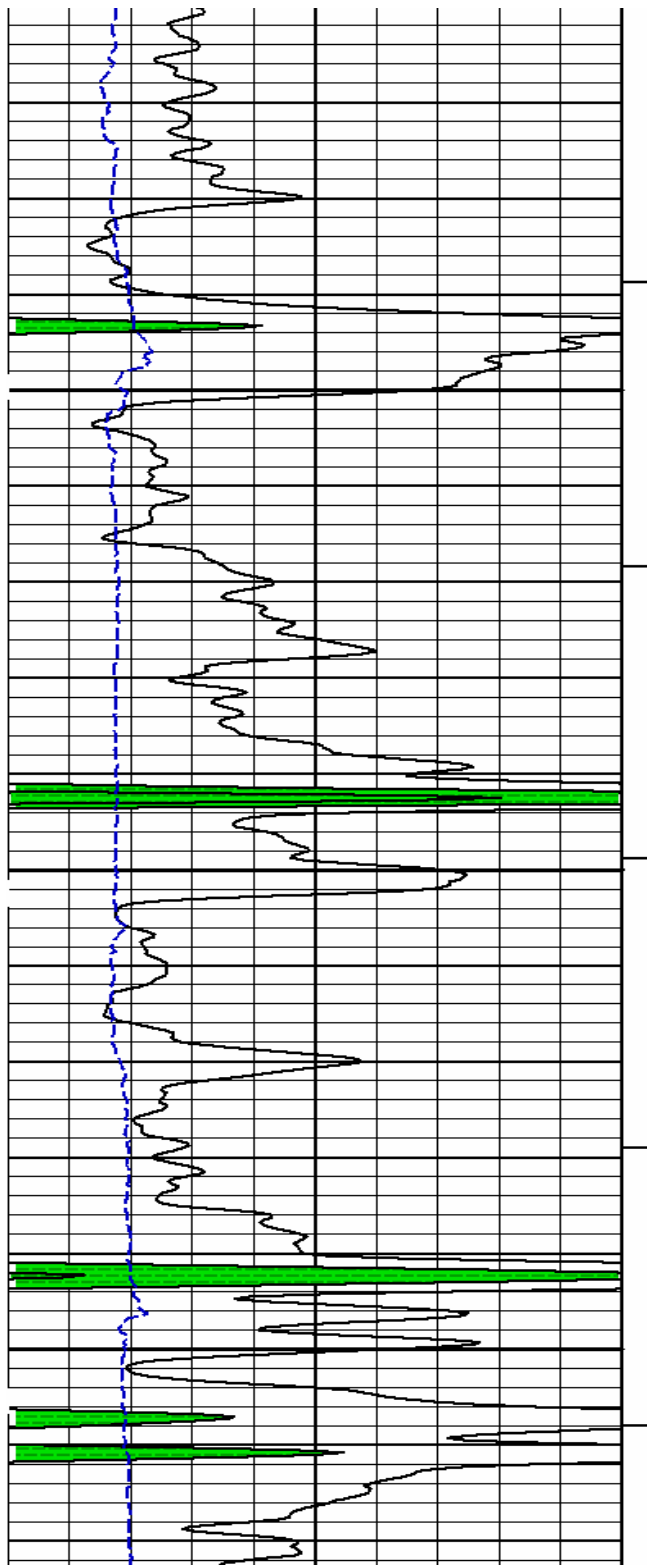


4100

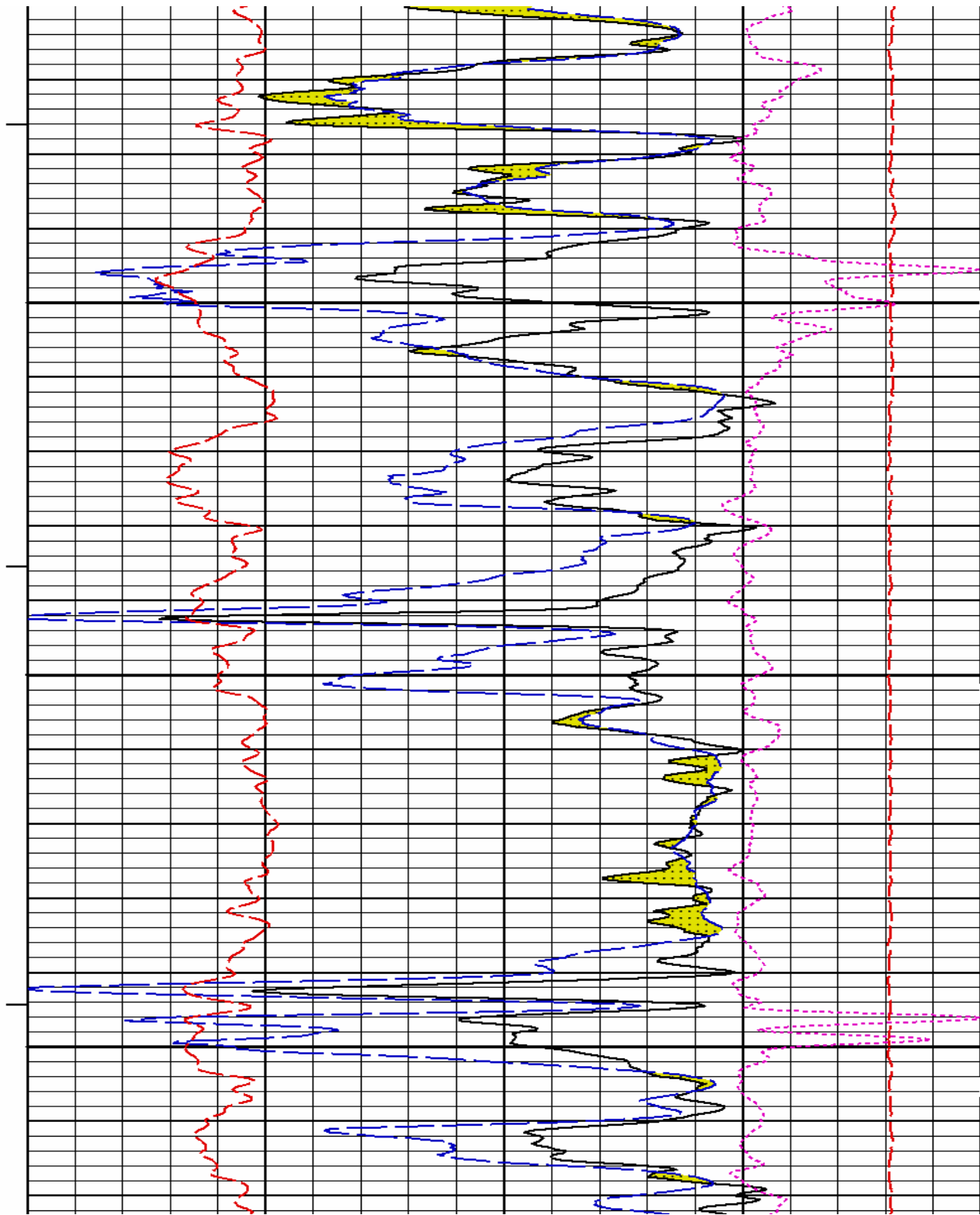
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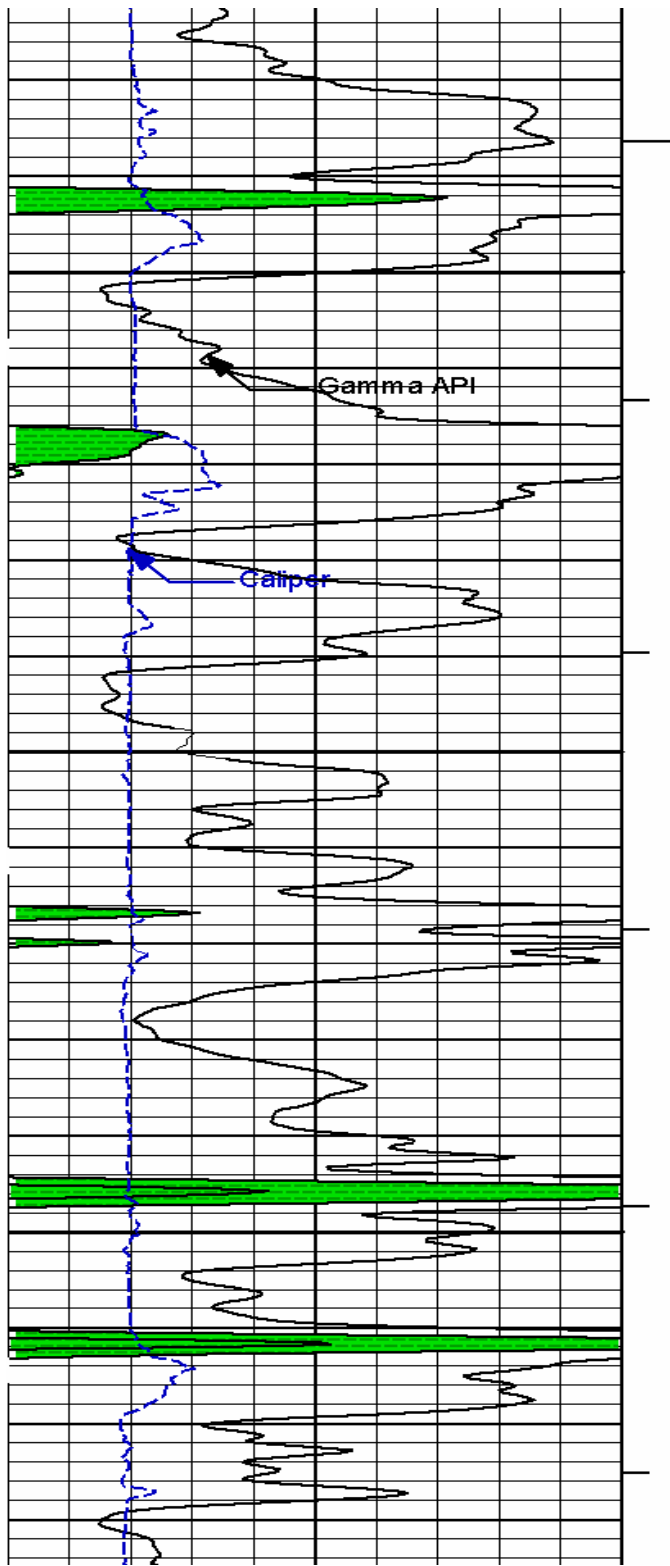






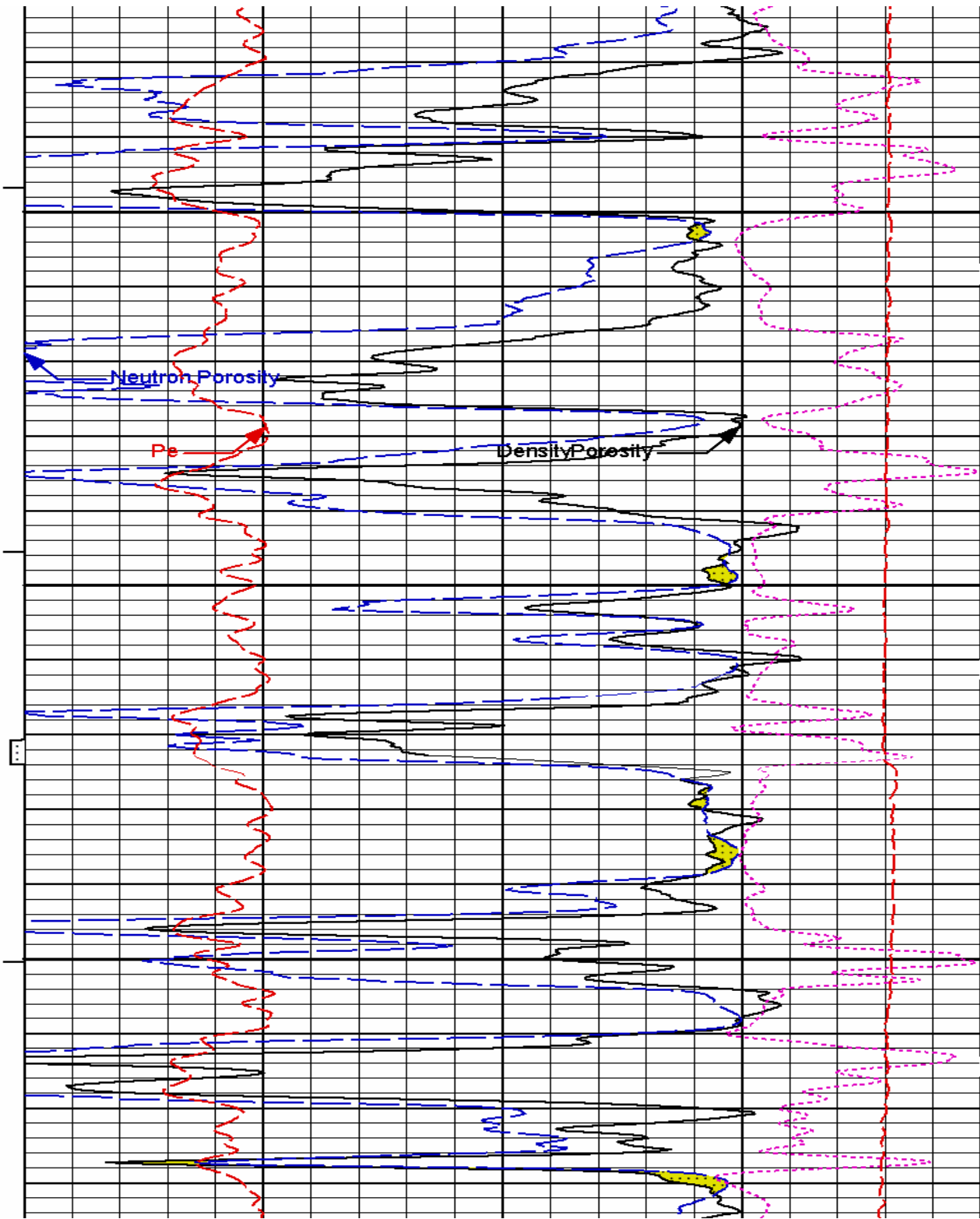
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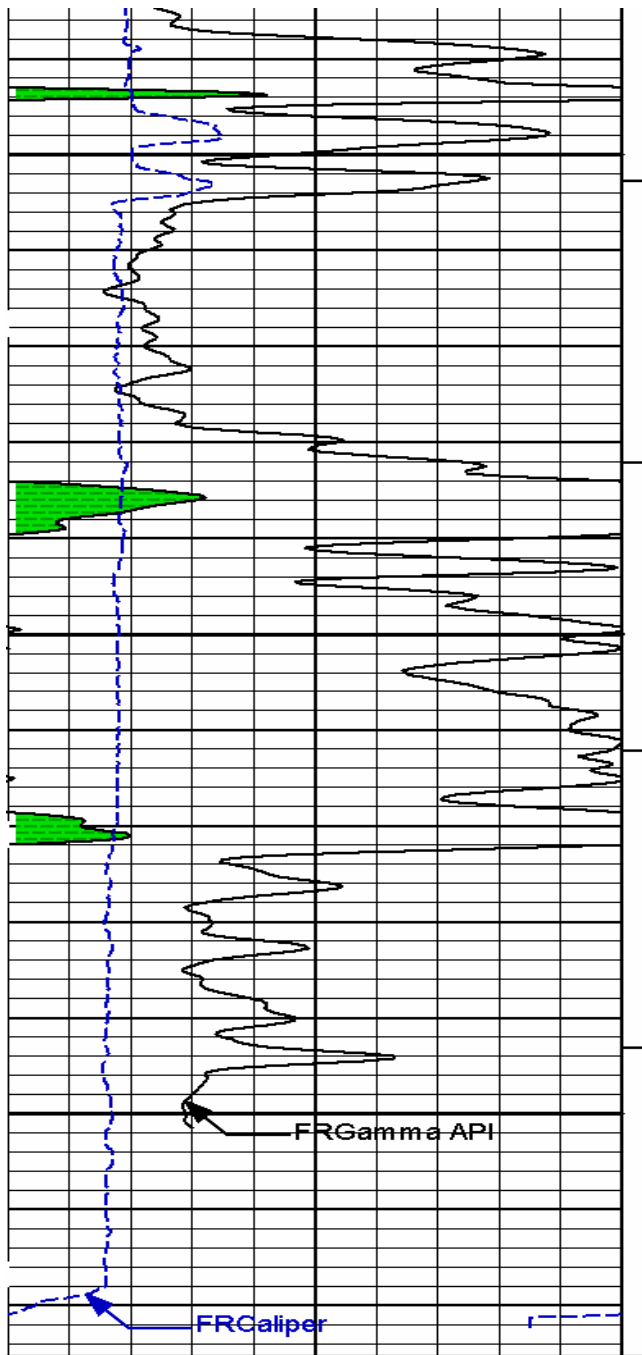




4600

4700



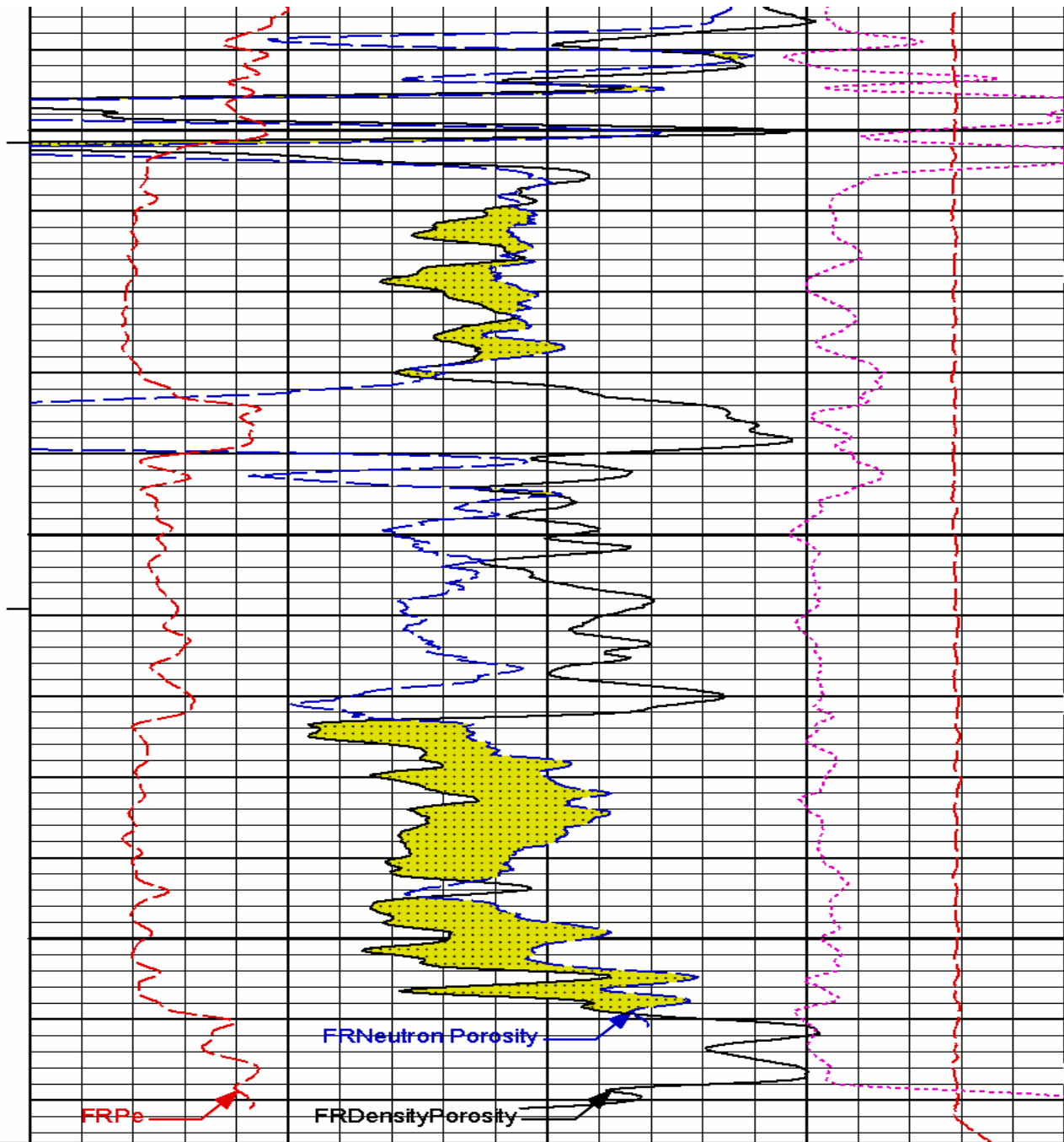


|        |           |     |
|--------|-----------|-----|
| 6      | Caliper   | 16  |
| inches |           |     |
| 0      | Gamma API | 150 |
| api    |           |     |

4800

MD  
1 : 240  
ft

AHVT



|   |    |    |             |             |      |
|---|----|----|-------------|-------------|------|
| 0 | Pe | 10 | -0.25       | DensityCorr | 0.25 |
|   |    |    | gram per cc |             |      |
|   |    |    | 15K         | Tension     | 0    |
|   |    |    | pounds      |             |      |

|       |              |           |                  |     |
|-------|--------------|-----------|------------------|-----|
| SHALE | BHVT         | 30        | DensityPorosity  | -10 |
|       |              |           | %                |     |
|       | Tension Pull | 10 0 30   | Neutron Porosity | -10 |
|       |              |           | %                |     |
|       | Tension Pull | CROSSOVER |                  |     |

**HALLIBURTON**

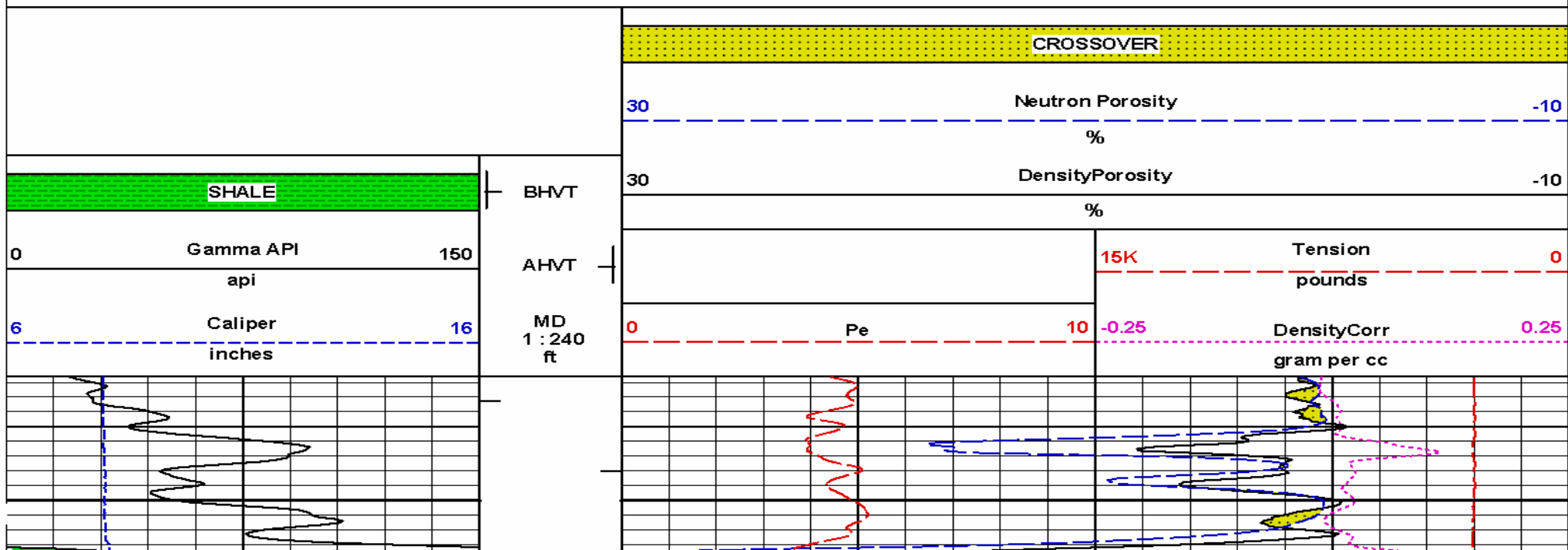
Plot Time: 28-Feb-13 21:06:29  
Plot Range: 3350 ft to 4875.25 ft  
Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-003\  
Plot File: \\PORO\Poro\_IQ\_5\_MAIN\_LIB

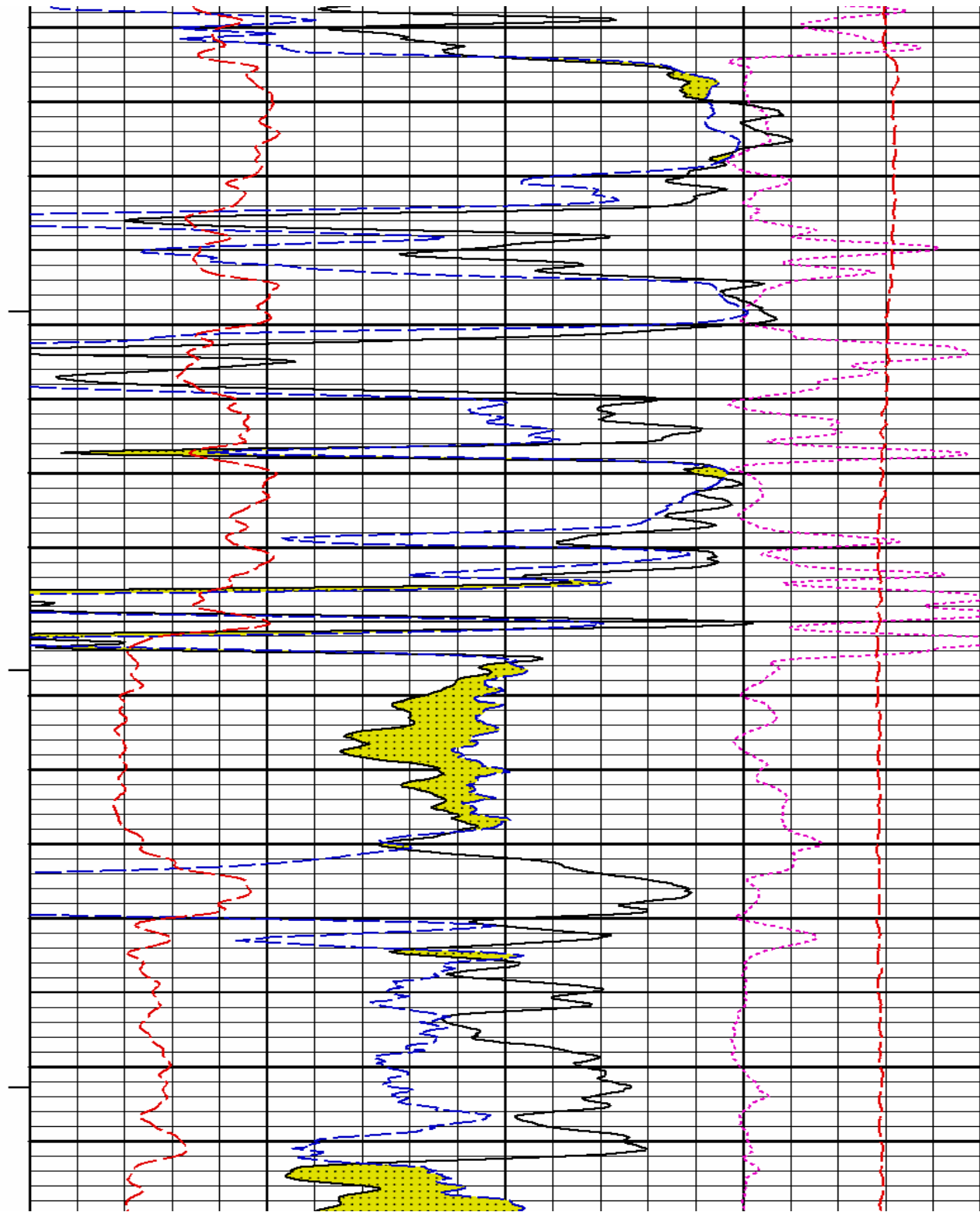
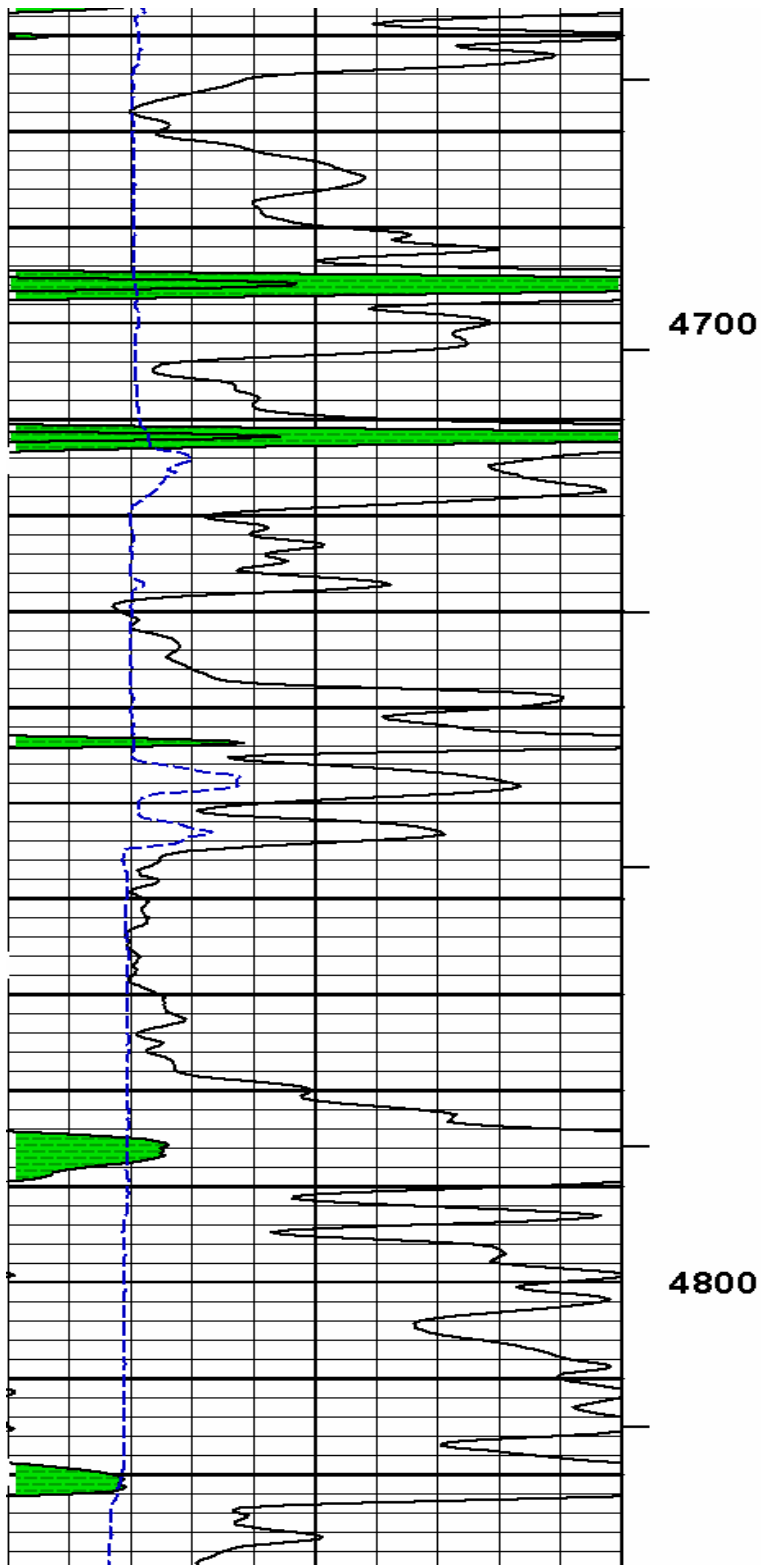
## 5 INCH MAIN LOG

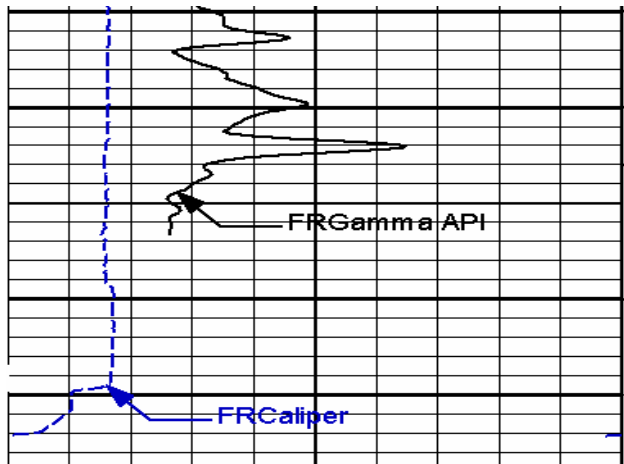
**HALLIBURTON**

Plot Time: 28-Feb-13 21:06:29  
Plot Range: 4643.25 ft to 4877.5 ft  
Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-002\  
Plot File: \\PORO\Poro\_IQ\_5\_REP\_LIB

## REPEAT SECTION

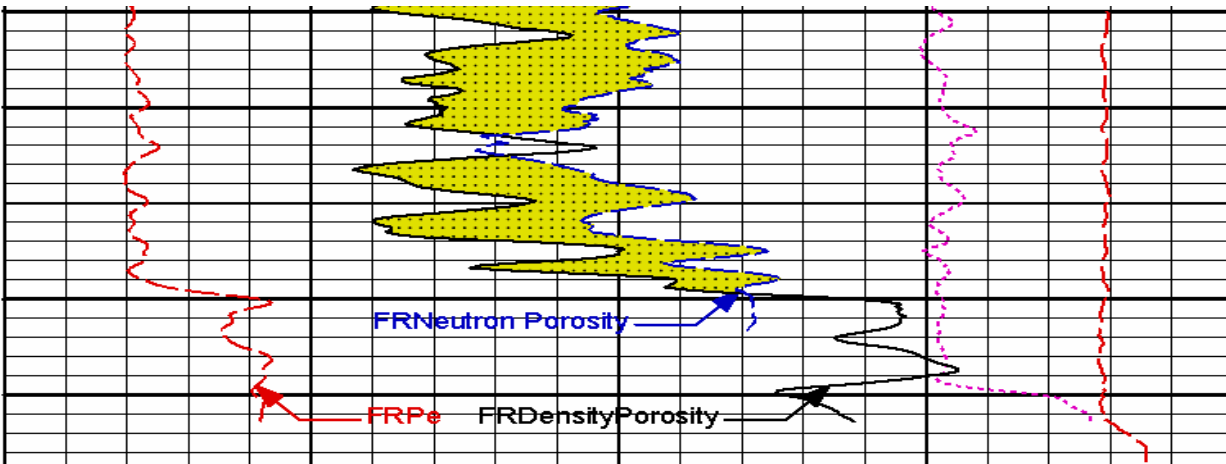






|   |           |     |
|---|-----------|-----|
| 6 | Caliper   | 16  |
|   | inches    |     |
| 0 | Gamma API | 150 |
|   | api       |     |
|   | SHALE     |     |

|      |         |
|------|---------|
| MD   | 1 : 240 |
| ft   |         |
| AHVT |         |
| BHVT |         |



|    |                  |    |       |             |      |
|----|------------------|----|-------|-------------|------|
| 0  | Pe               | 10 | -0.25 | DensityCorr | 0.25 |
|    |                  |    |       | gram per cc |      |
|    |                  |    | 15K   | Tension     | 0    |
|    |                  |    |       | pounds      |      |
| 30 | DensityPorosity  |    |       |             | -10  |
|    | %                |    |       |             |      |
| 30 | Neutron Porosity |    |       |             | -10  |
|    | %                |    |       |             |      |
|    | CROSSOVER        |    |       |             |      |

**HALLIBURTON**

Plot Time: 28-Feb-13 21:06:30  
 Plot Range: 4643.25 ft to 4877.5 ft  
 Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-002\  
 Plot File: \\PORA\Porosity\_Q\_5\_REP\_LIB

## REPEAT SECTION

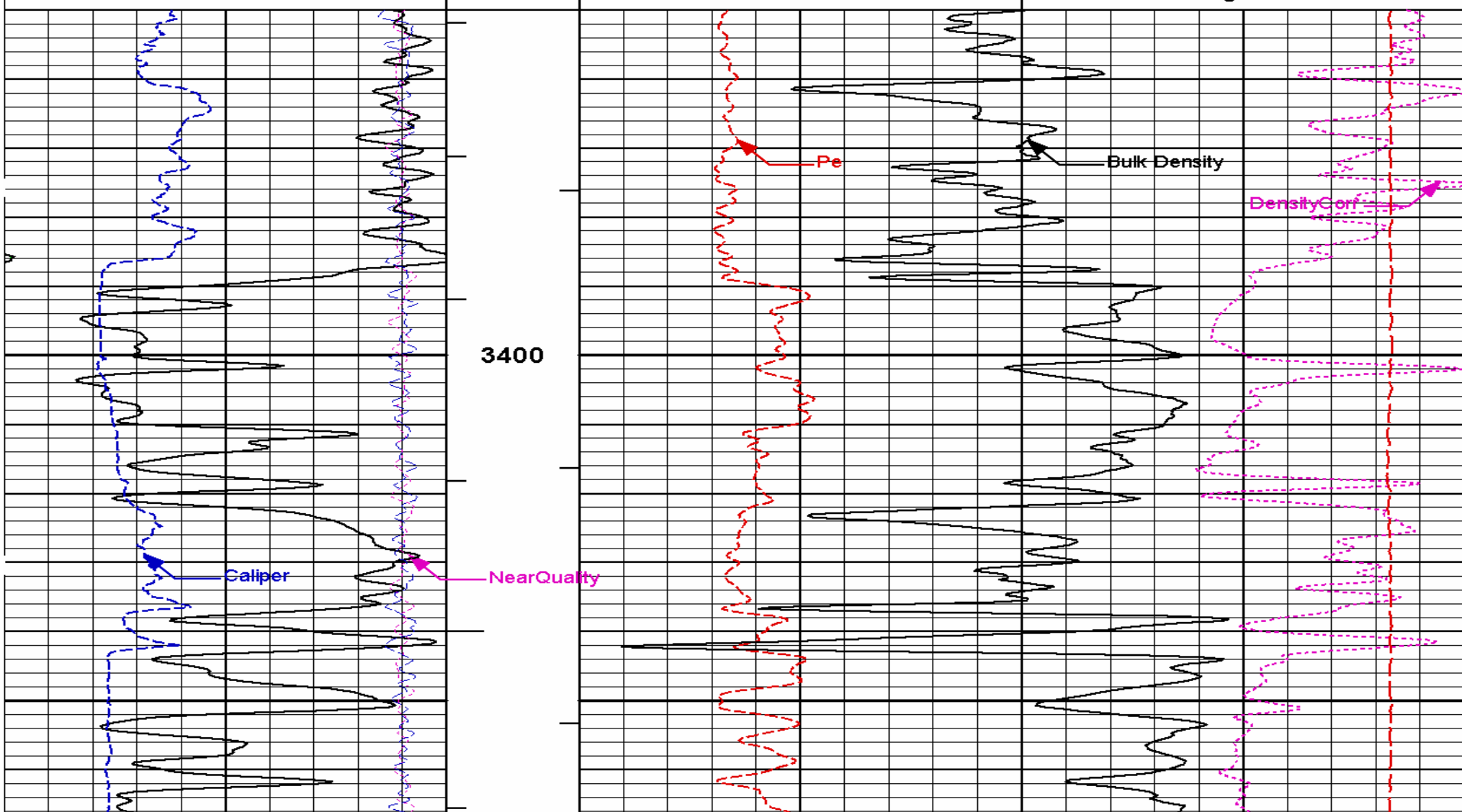
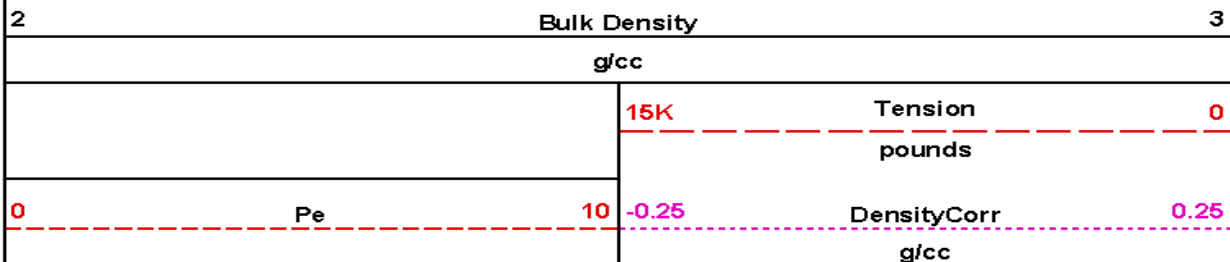
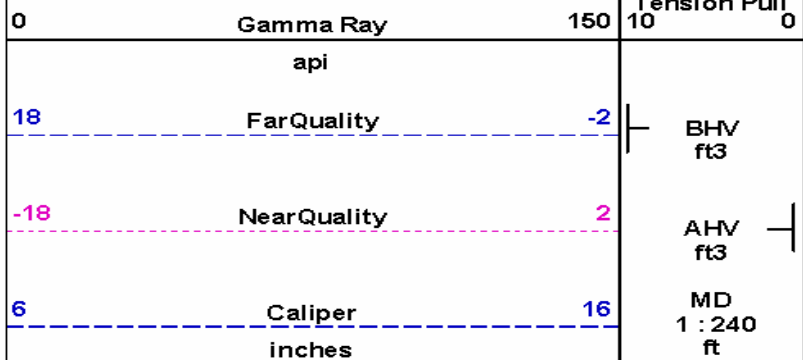
**HALLIBURTON**

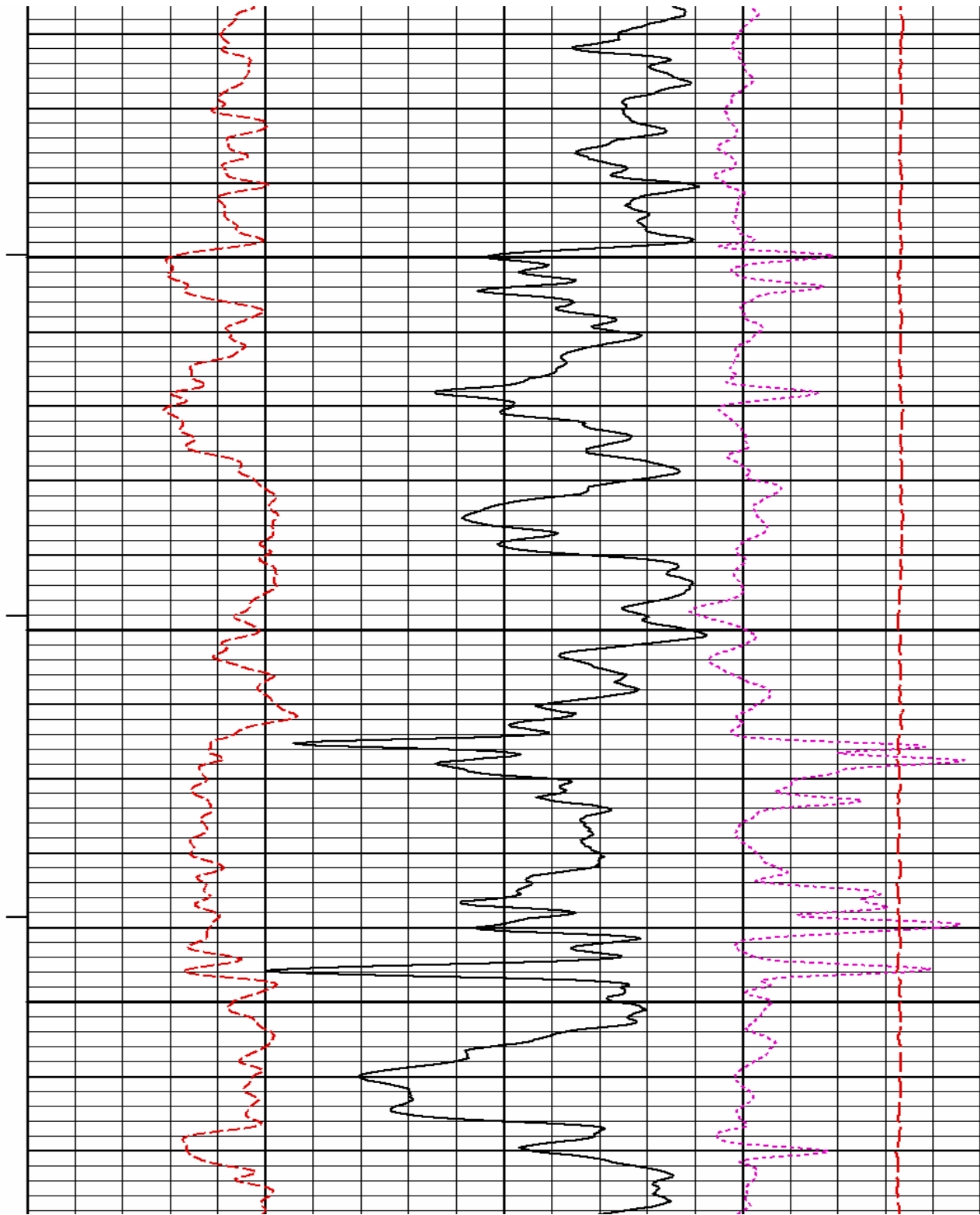
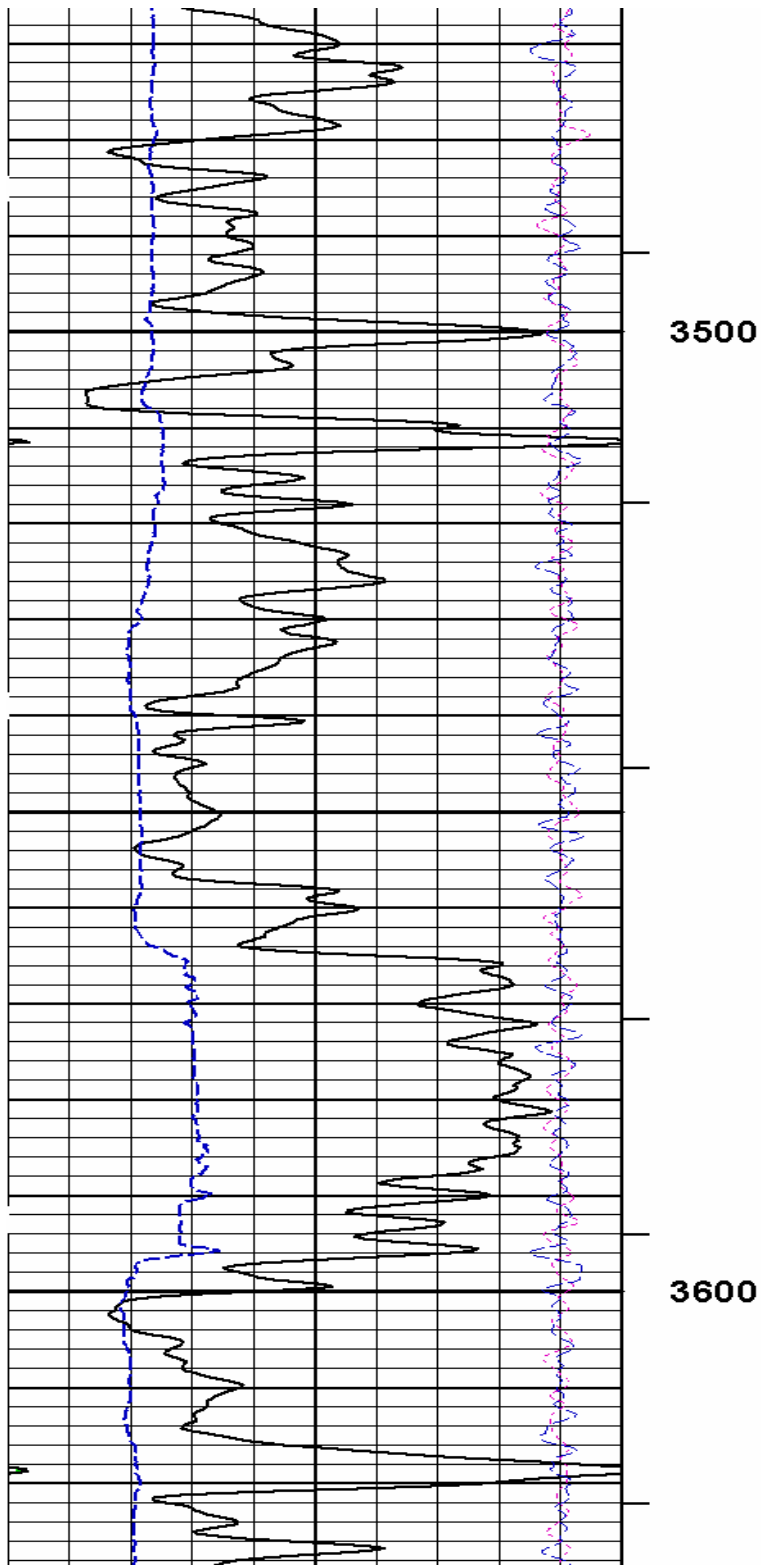
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 Plot File: \\LOCAL\UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BN\PORA\BULKD\_5\_MAIN\_LIB

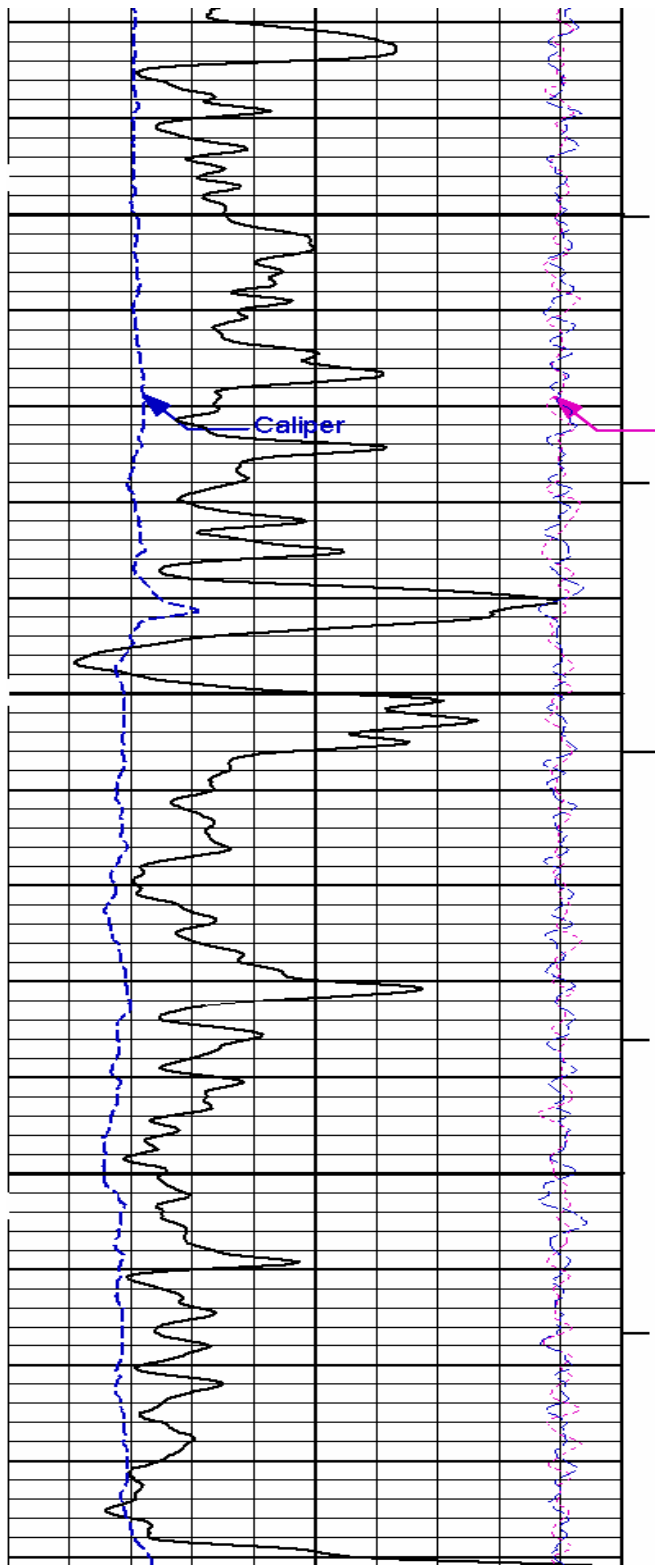
## 5 INCH MAIN LOG

SHALE

Tension Pull

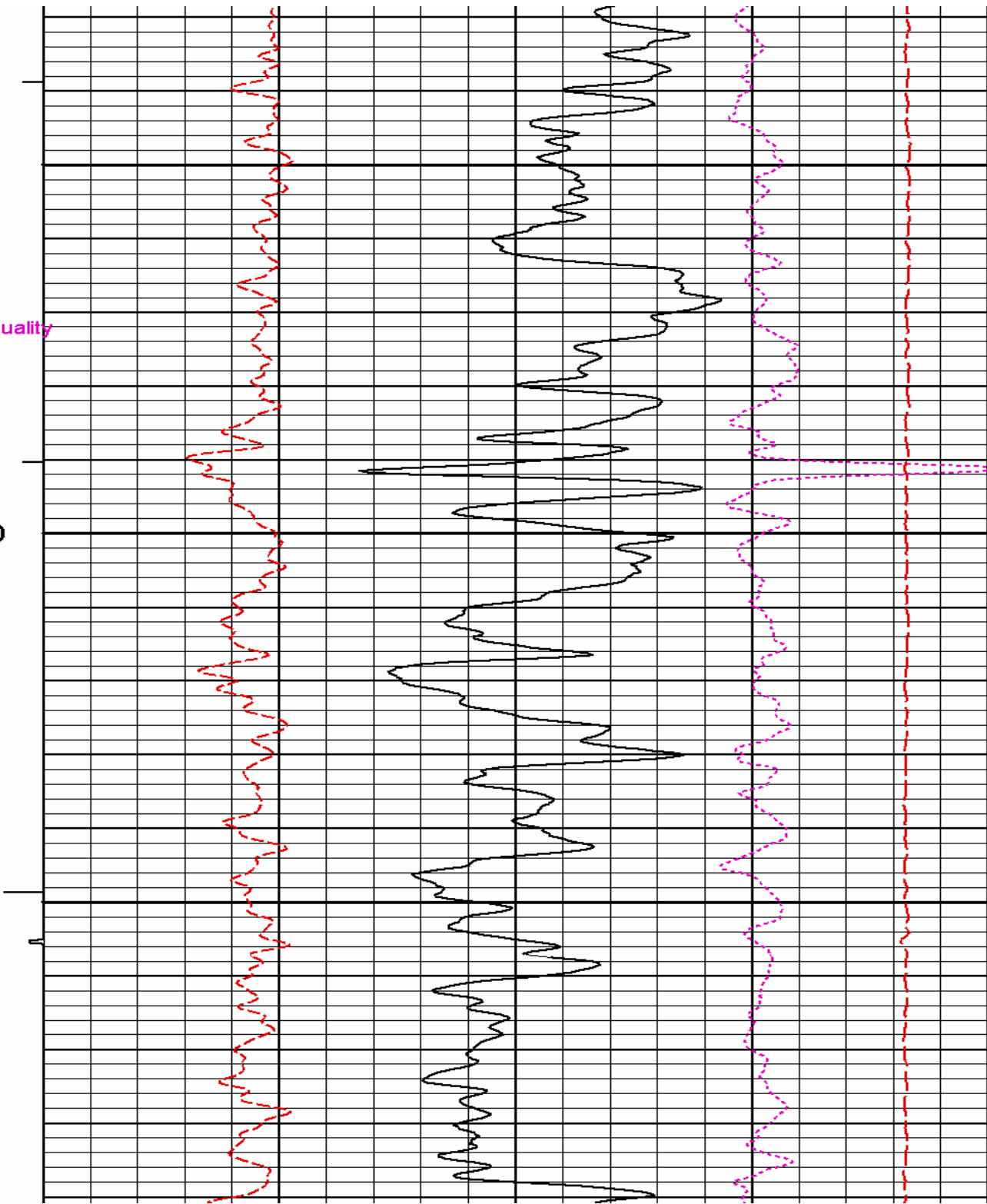


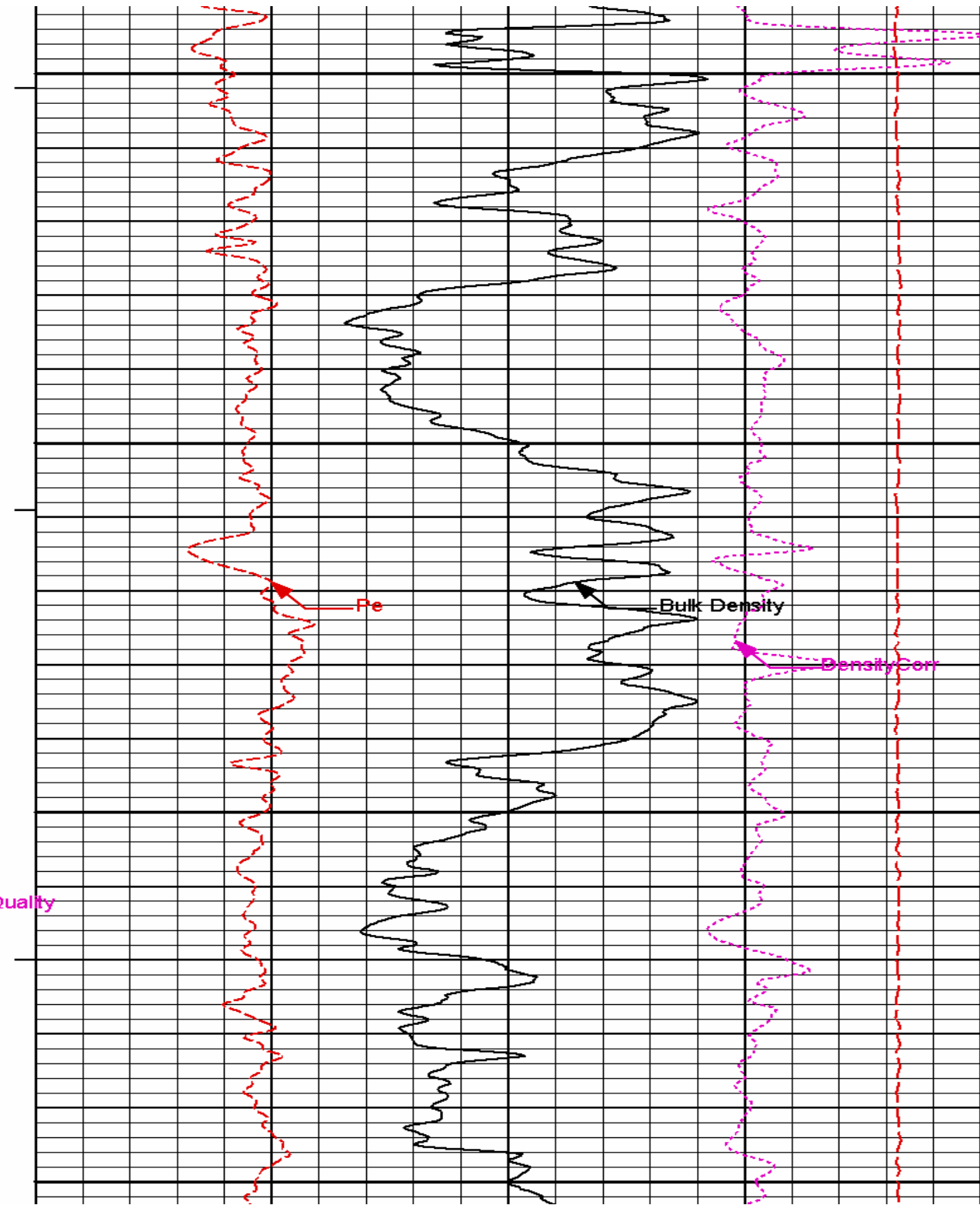
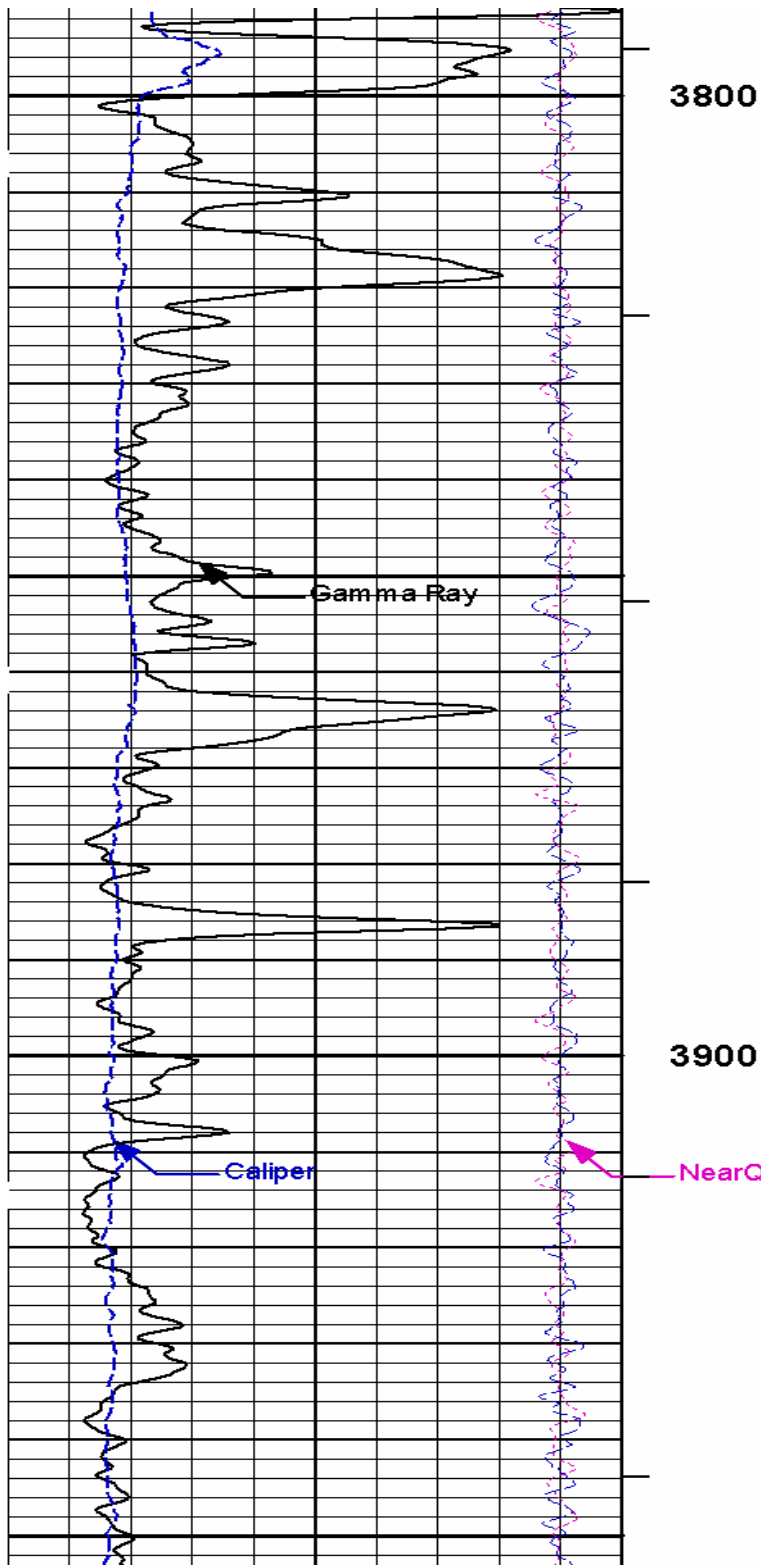


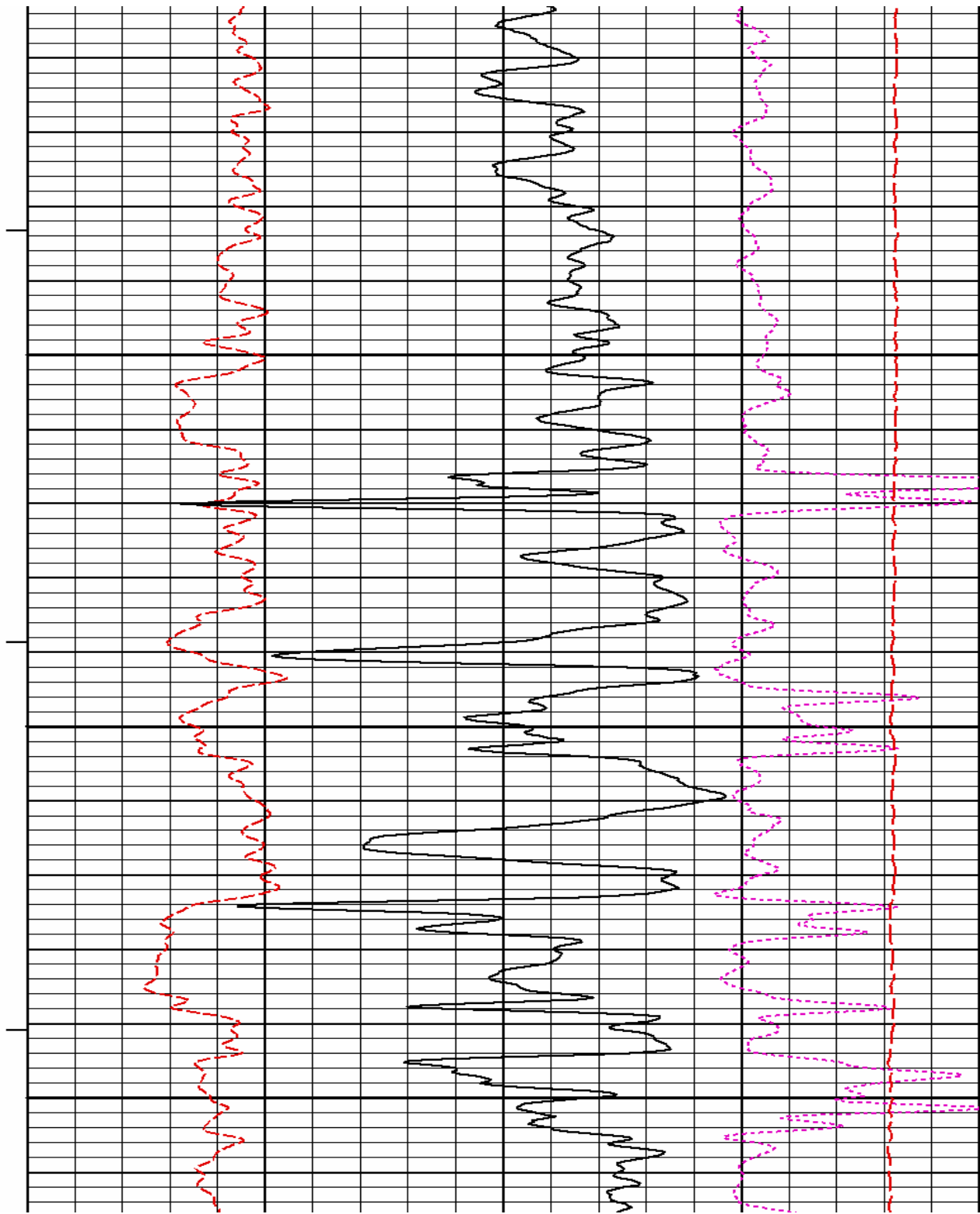
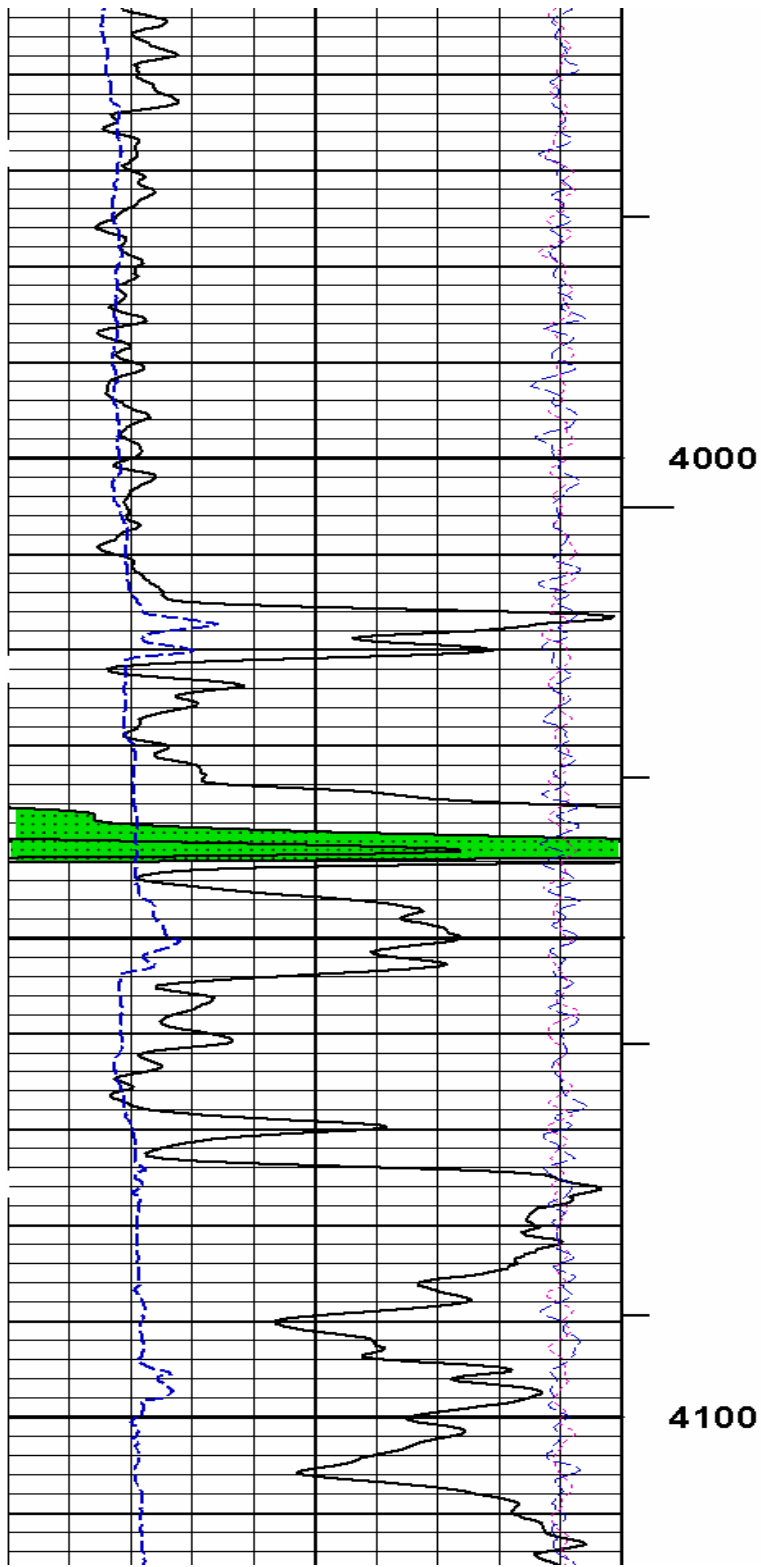


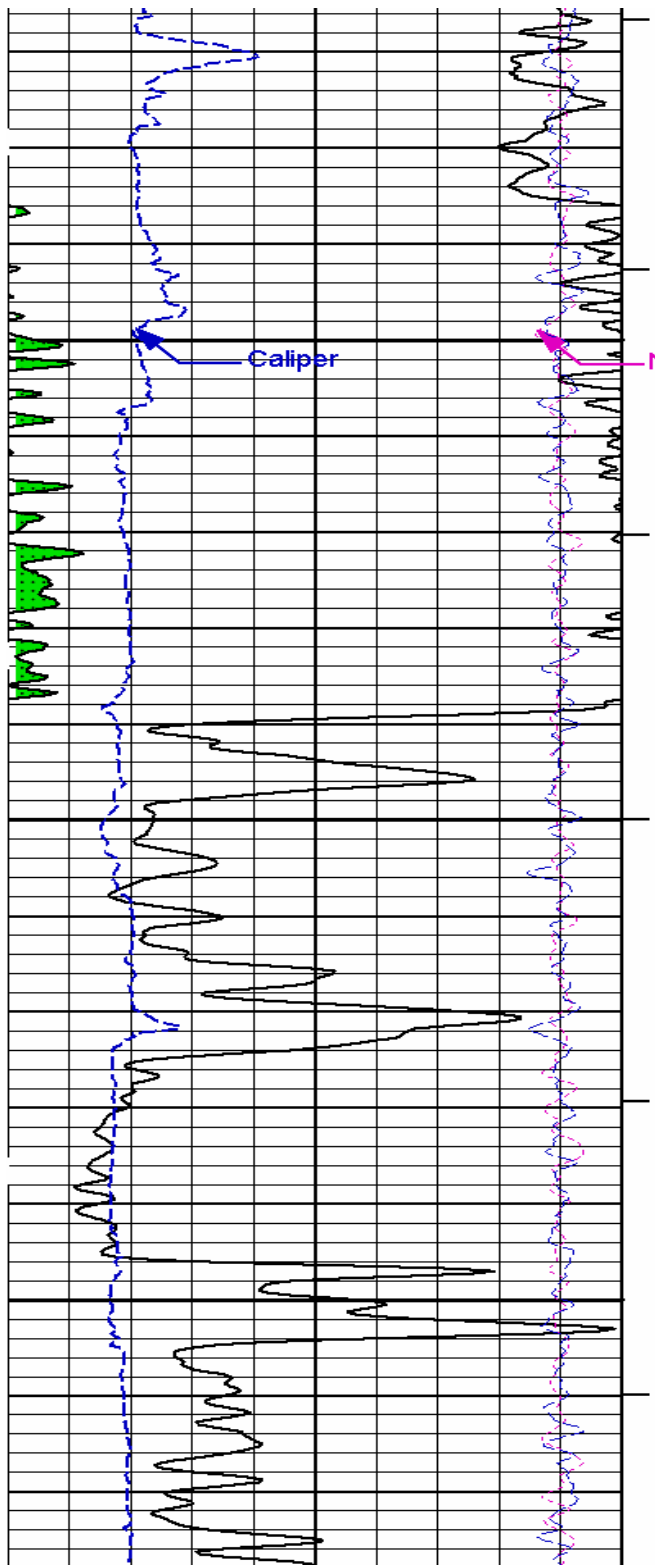
NearQuality

3700



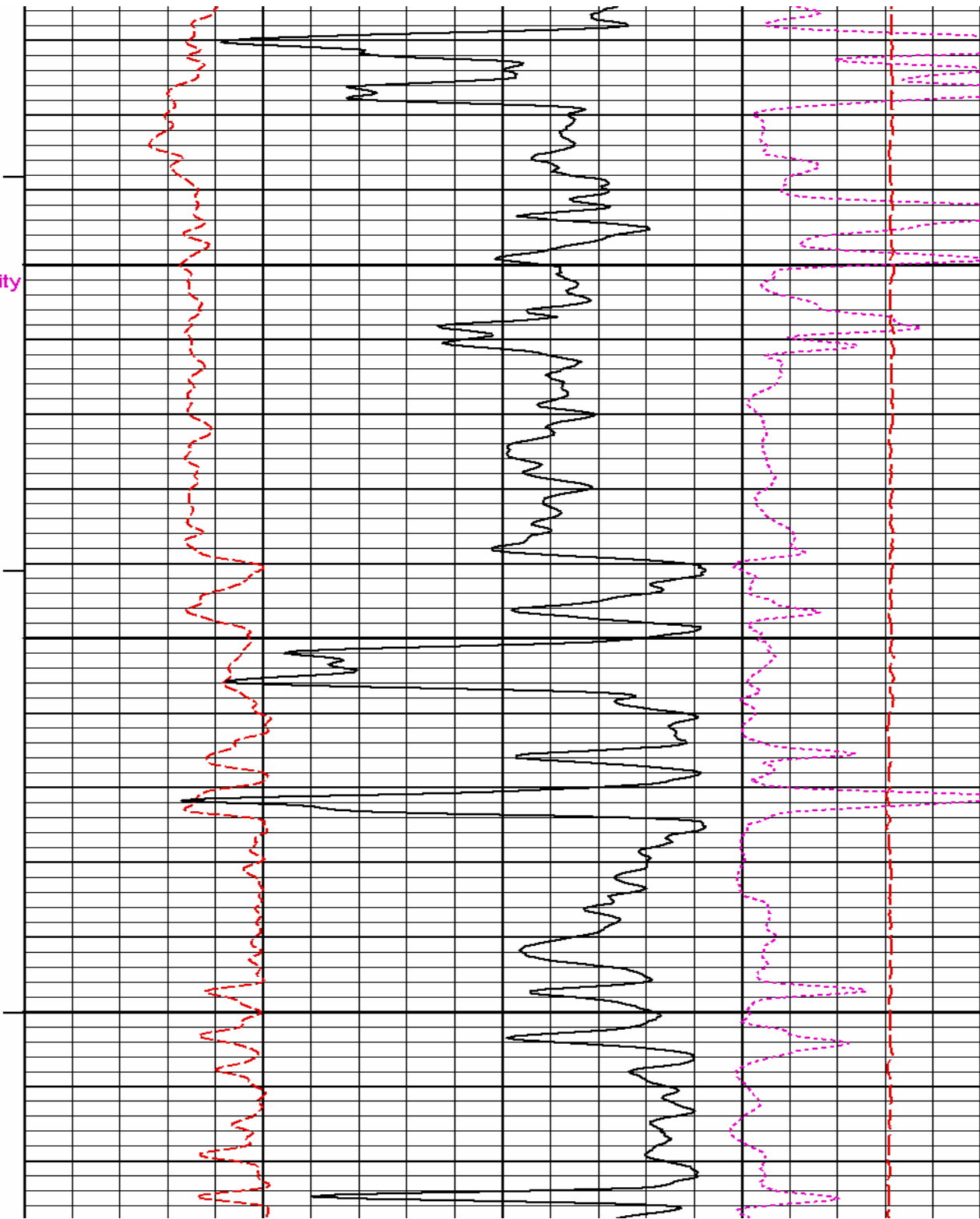


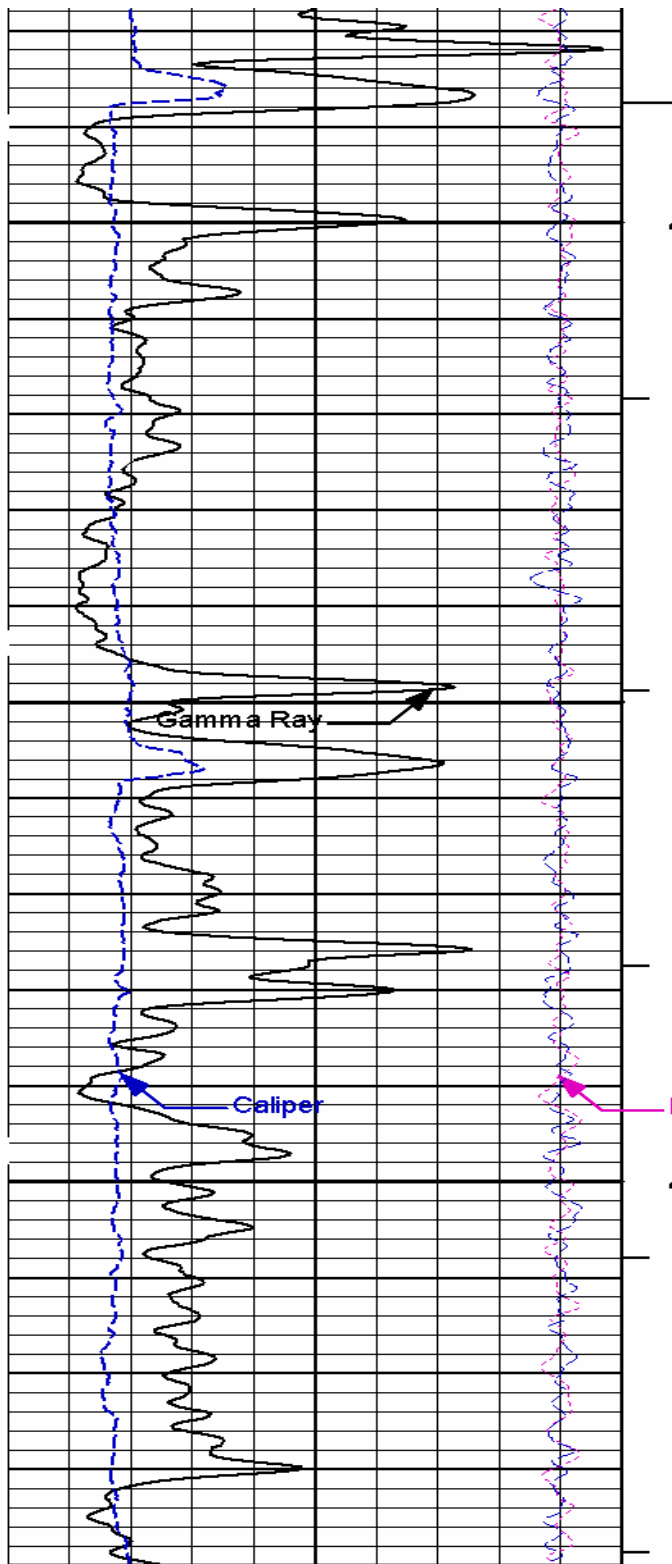




NearQuality

4200





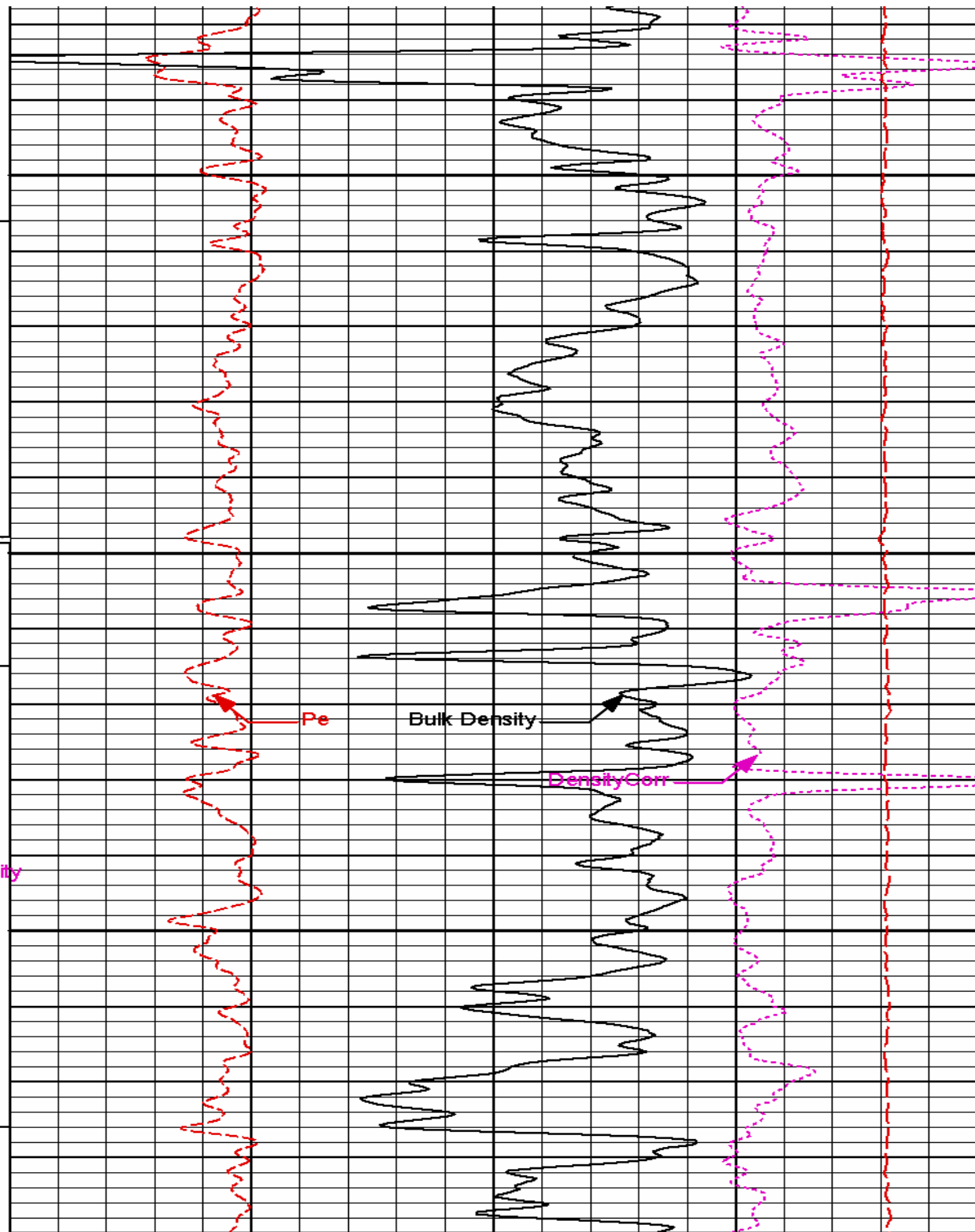
4300

Gamma Ray

Caliper

NearQuality

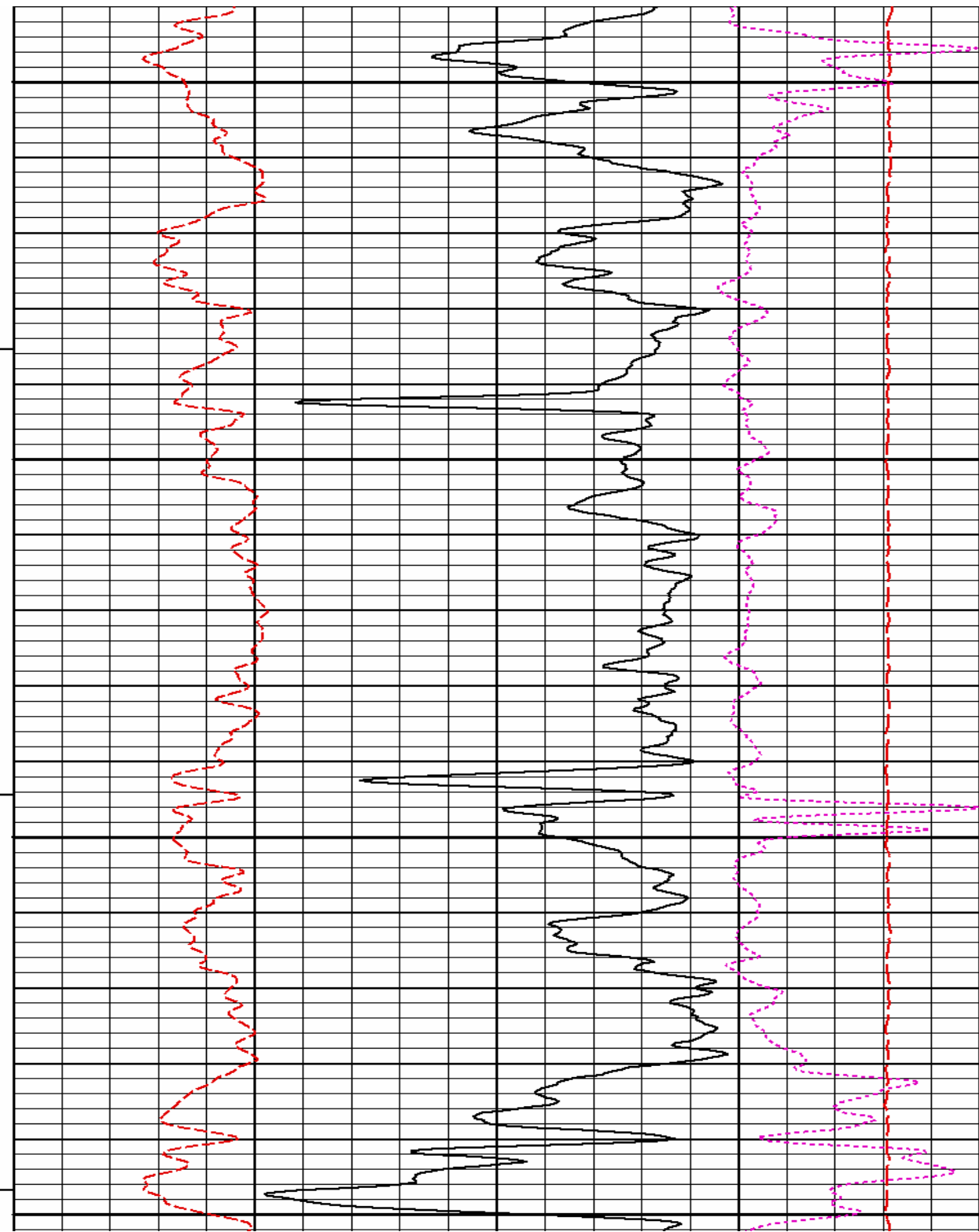
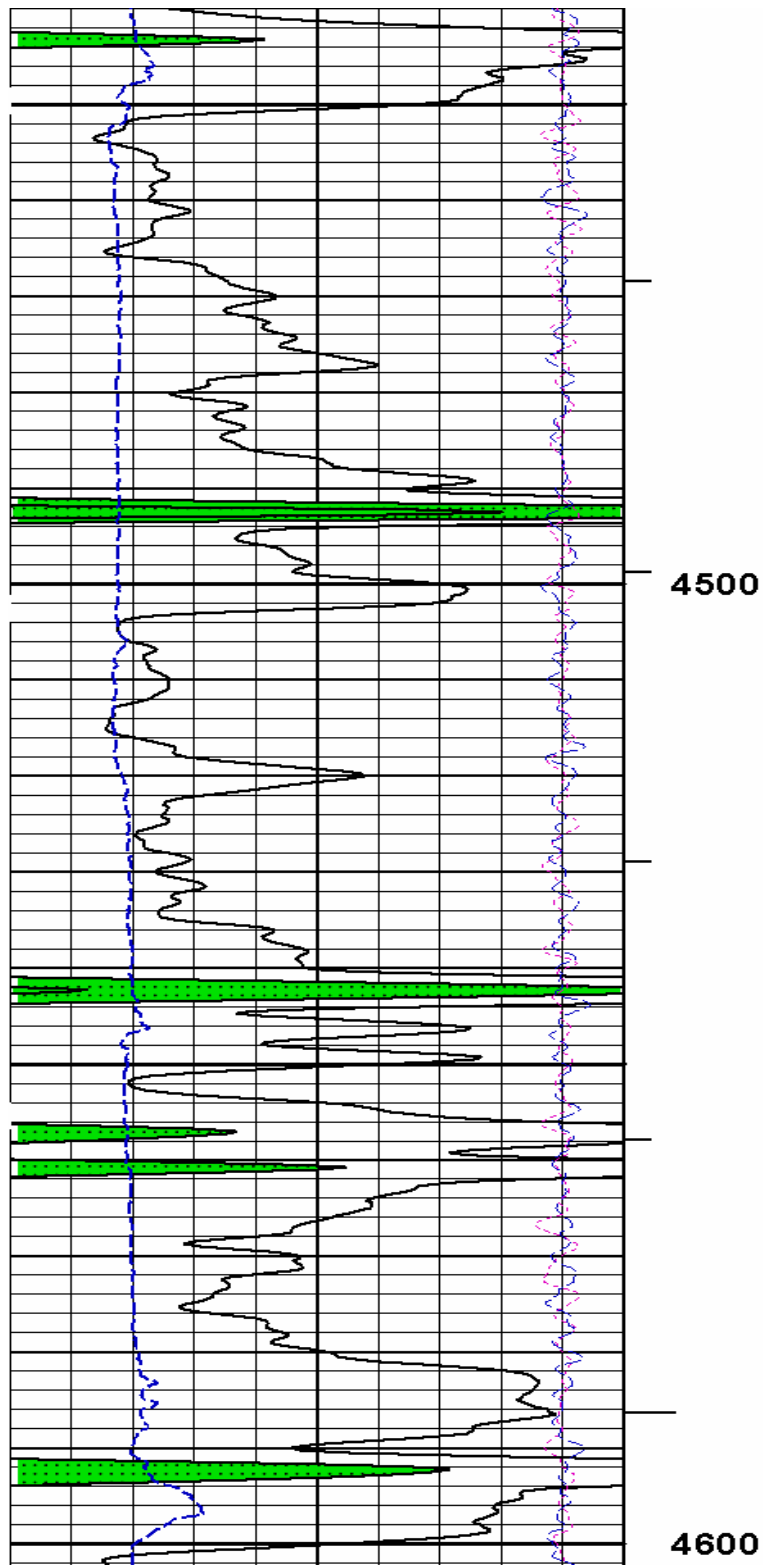
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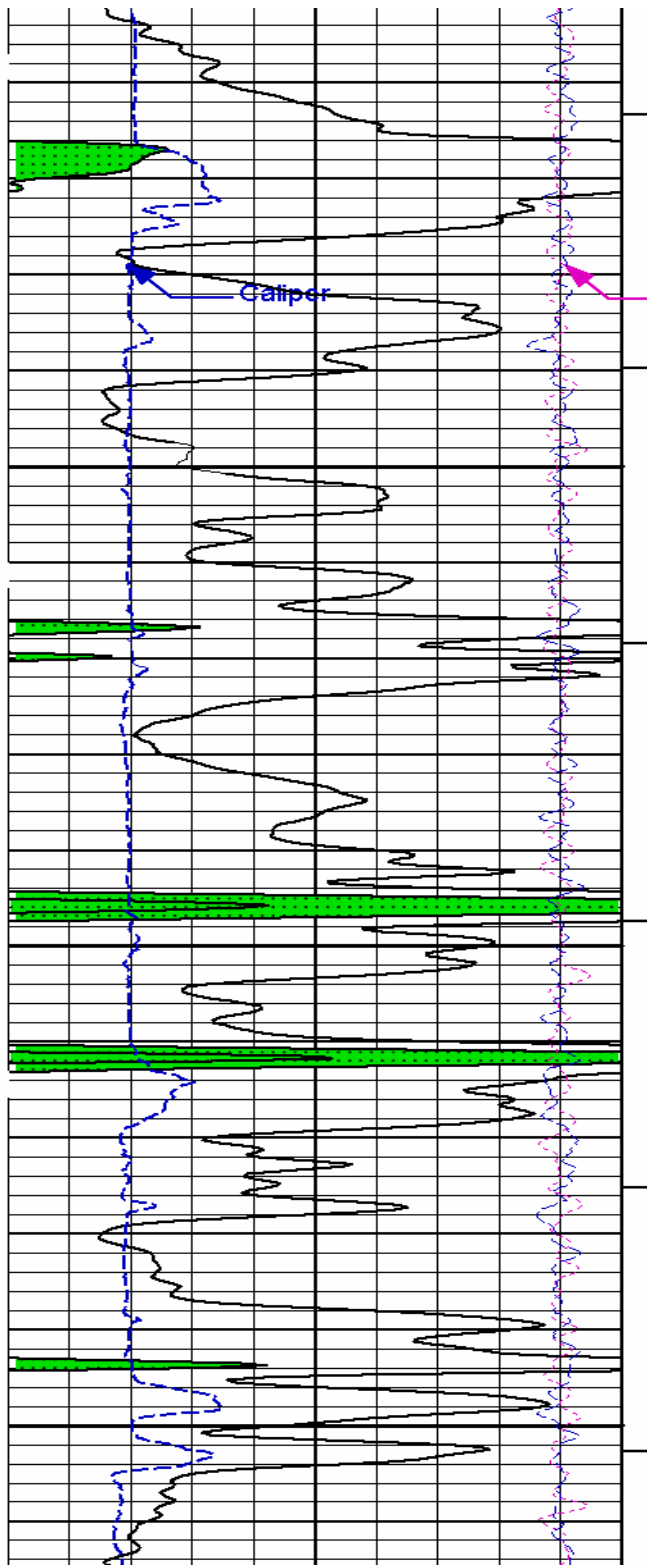


Pe

Bulk Density

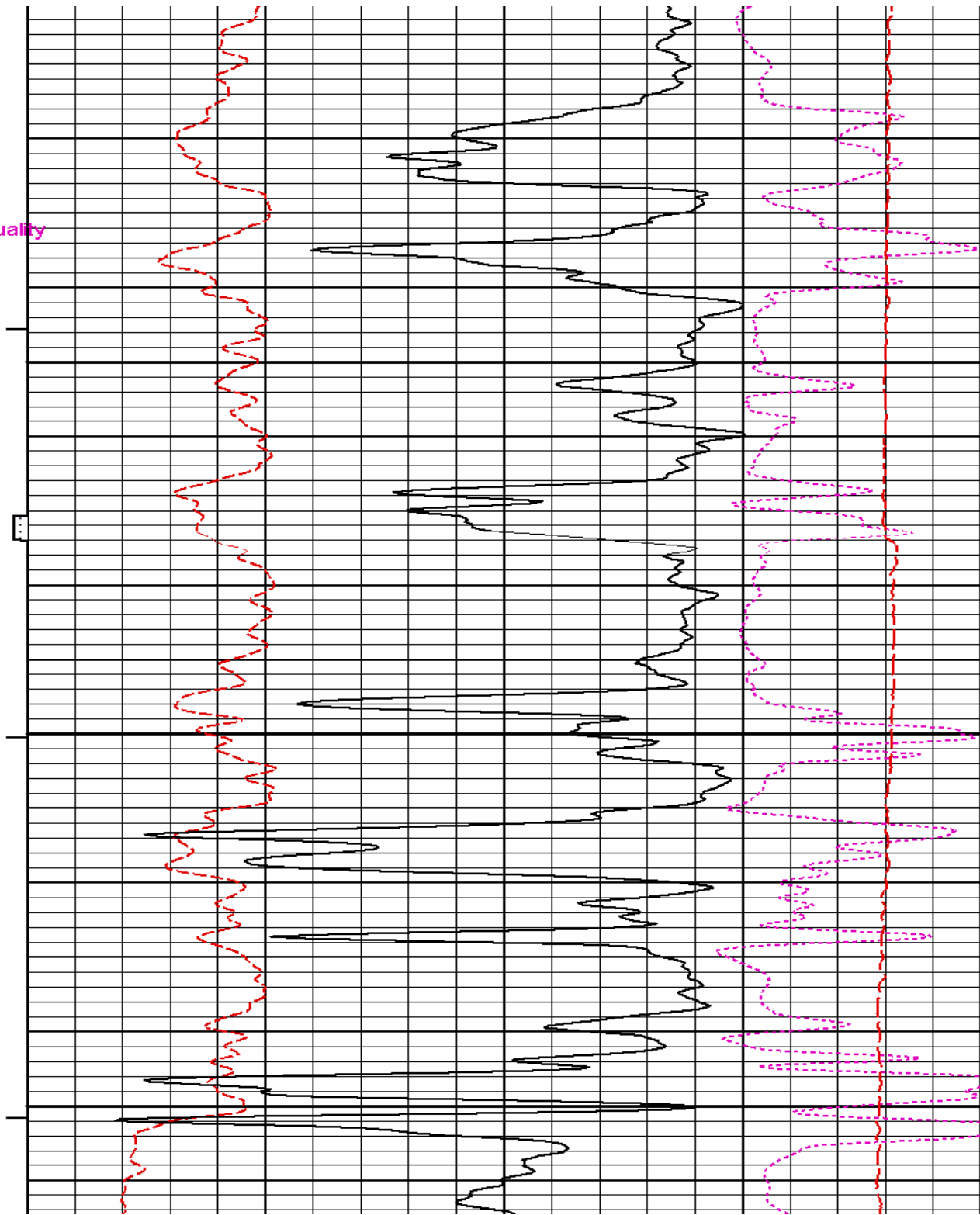
DensityCorr

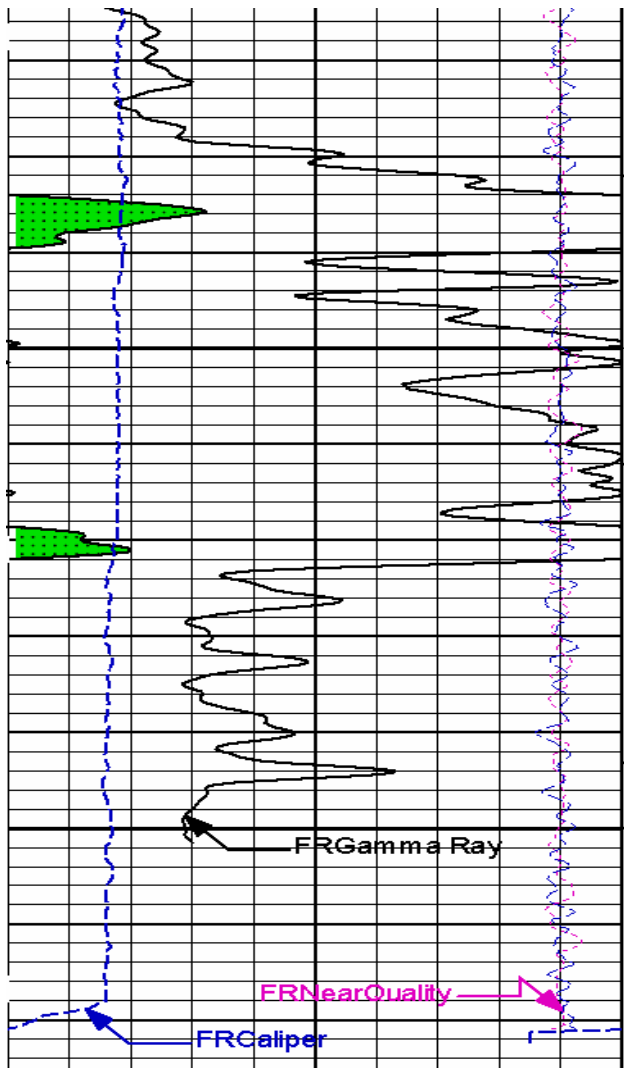




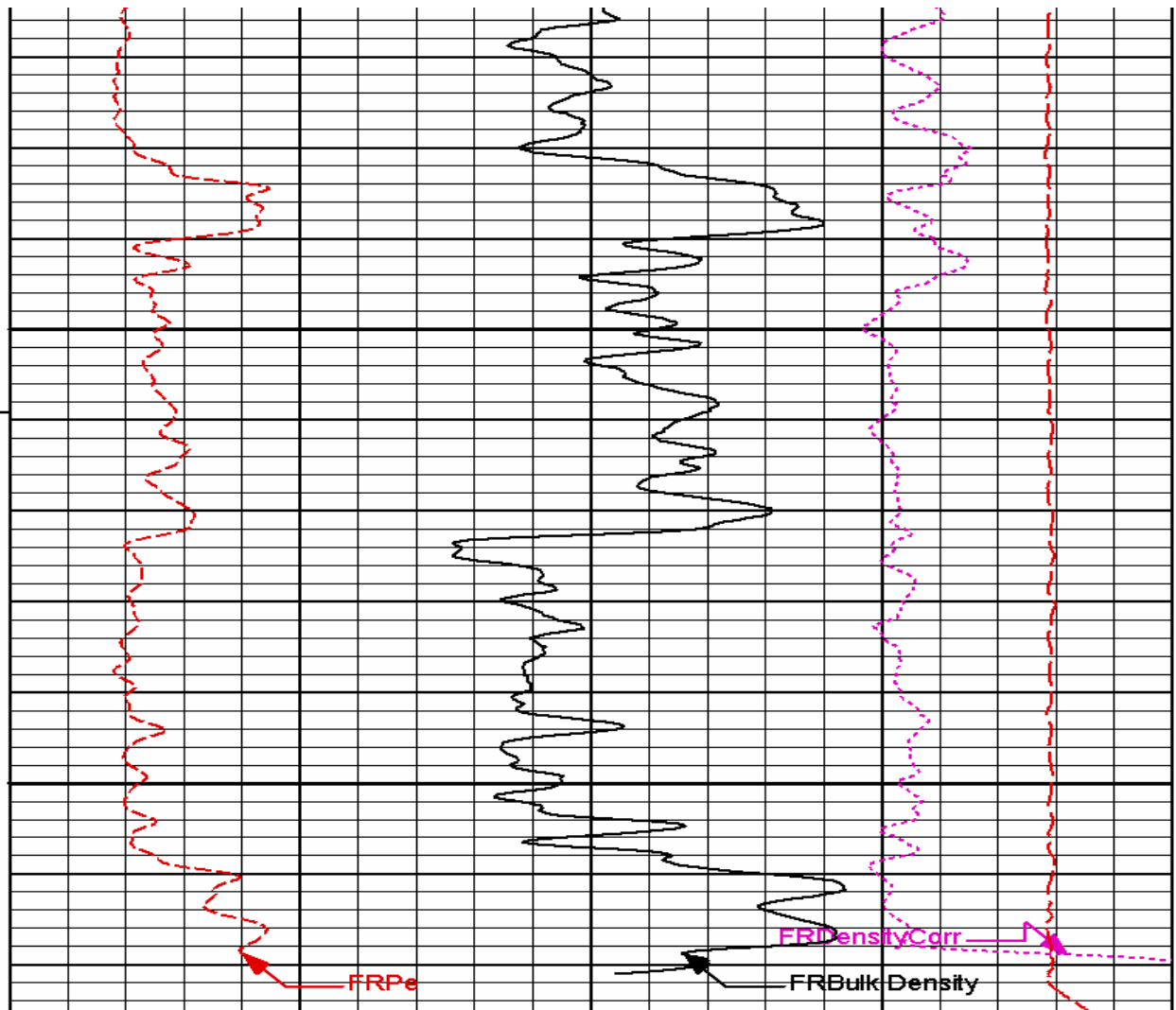
NearQuality

4700





4800



|     |             |     |
|-----|-------------|-----|
| 6   | Caliper     | 16  |
|     | inches      |     |
| -18 | NearQuality | 2   |
|     |             |     |
| 18  | FarQuality  | -2  |
|     |             |     |
| 0   | Gamma Ray   | 150 |
|     | api         |     |
|     | SHALE       |     |

|              |         |
|--------------|---------|
| MD           | 1 : 240 |
| ft           |         |
| AHV          | ft3     |
| BHV          | ft3     |
| Tension Pull | 10      |
|              | 0       |
| Tension Pull |         |

|   |              |    |       |             |      |
|---|--------------|----|-------|-------------|------|
| 0 | Pe           | 10 | -0.25 | DensityCorr | 0.25 |
|   |              |    |       | g/cc        |      |
|   |              |    | 15K   | Tension     | 0    |
|   |              |    |       | pounds      |      |
| 2 | Bulk Density |    |       |             | 3    |
|   | g/cc         |    |       |             |      |

HALLIBURTON

Plot Time: 28-Feb-13 21:06:33

Plot Range: 3350 ft to 4875.25 ft

Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-003\

Plot File: \\-LOCAL-\\UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNIPORO\BULKD\_5\_MAIN\_LIB

## 5 INCH MAIN LOG

HALLIBURTON

Plot Time: 28-Feb-13 21:06:33

Plot Range: 4649.25 ft to 4877.5 ft

Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-002\

Plot File: \\-LOCAL-\\UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNIPORO\BULKD\_5\_REP\_LIB

## REPEAT SECTION

SHALE

0 Gamma Ray 150

api

18 FarQuality -2

-18 NearQuality 2

6 Caliper 16  
inches

BHV  
ft3

AHV  
ft3

MD  
1 : 240  
ft

2 Bulk Density 3

g/cc

15K

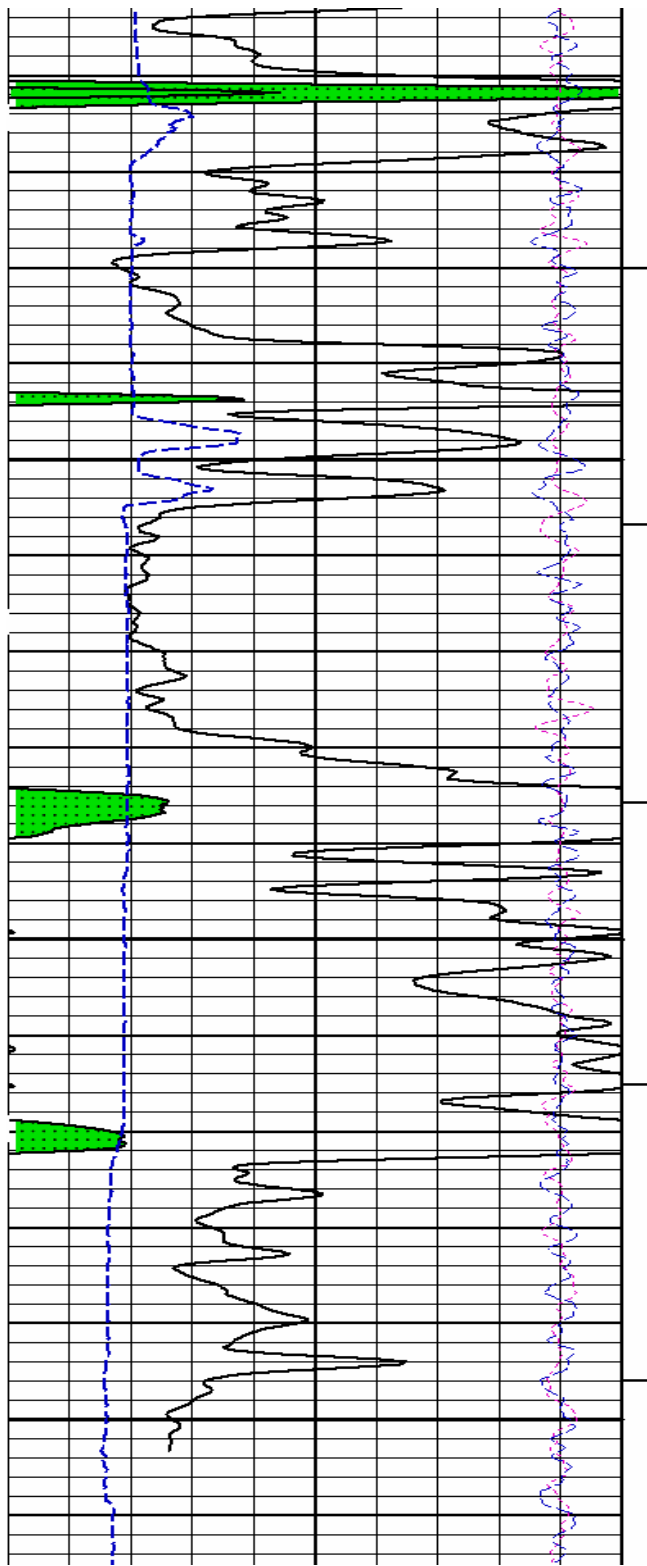
Tension  
pounds

0

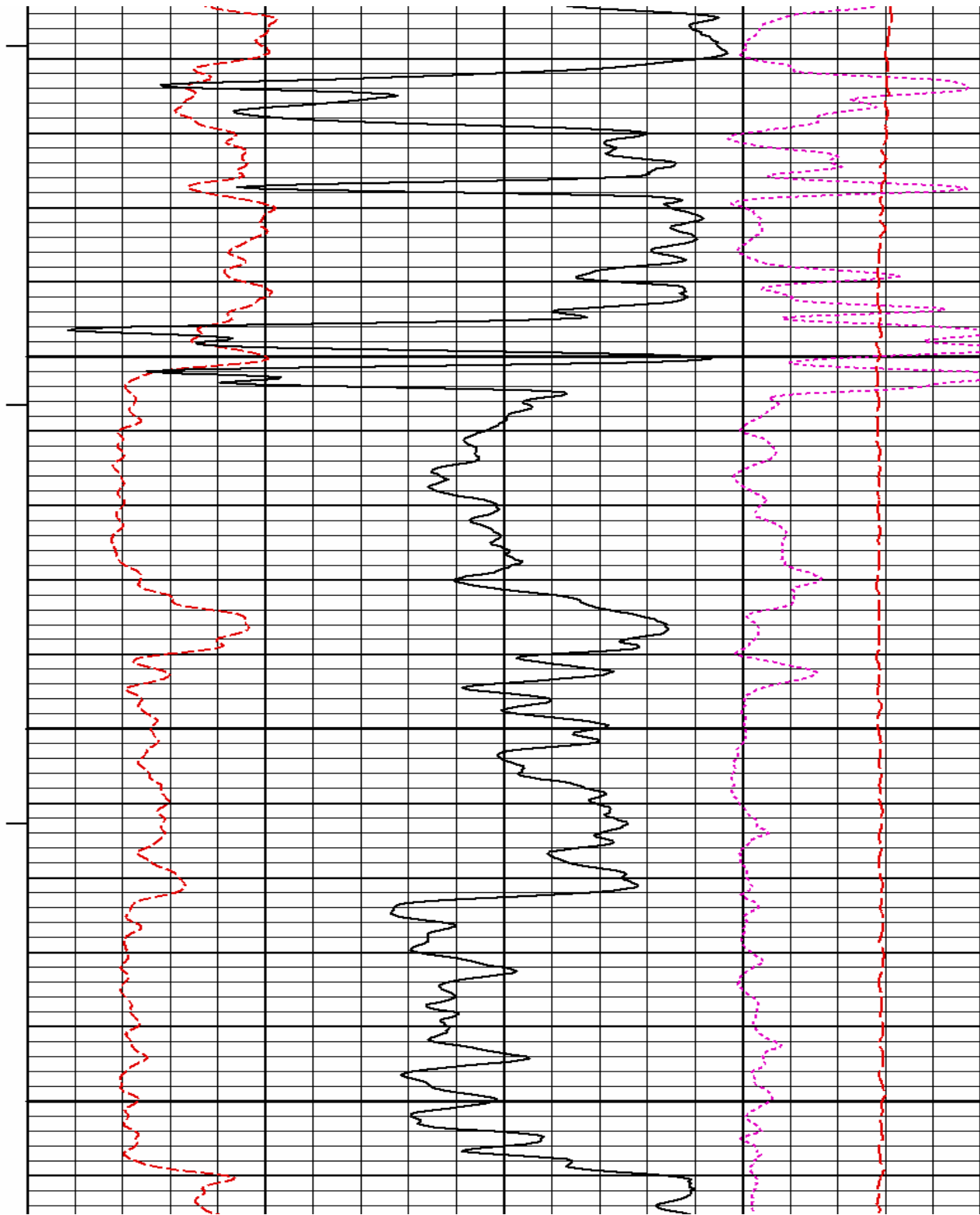
0 Pe 10 -0.25 DensityCorr 0.25

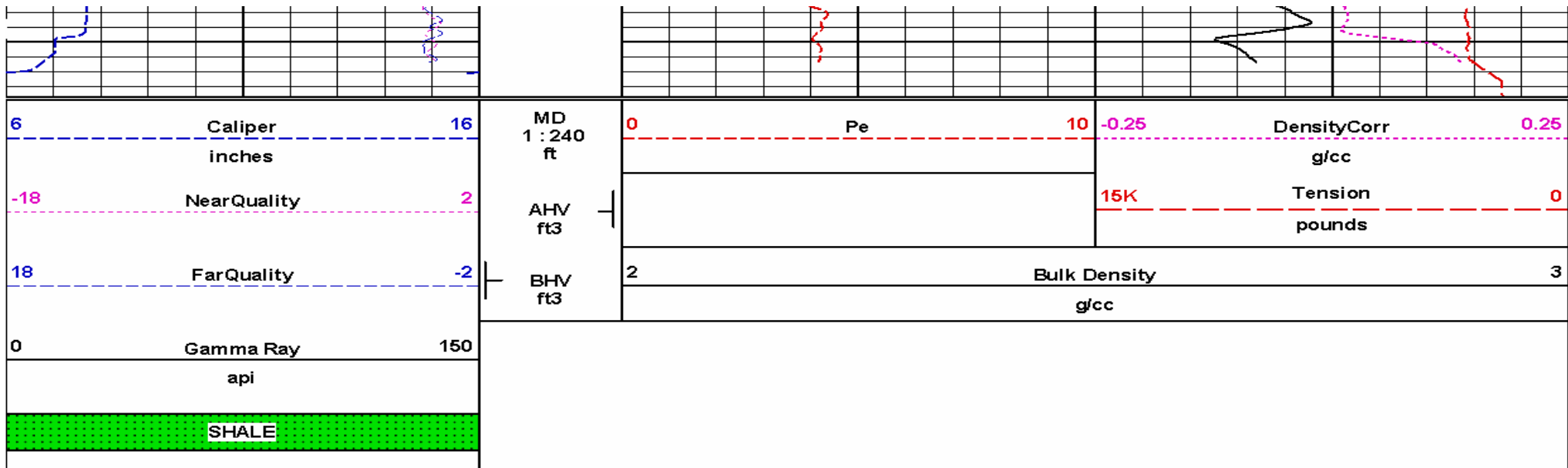
g/cc

4700



4800





**HALLIBURTON**

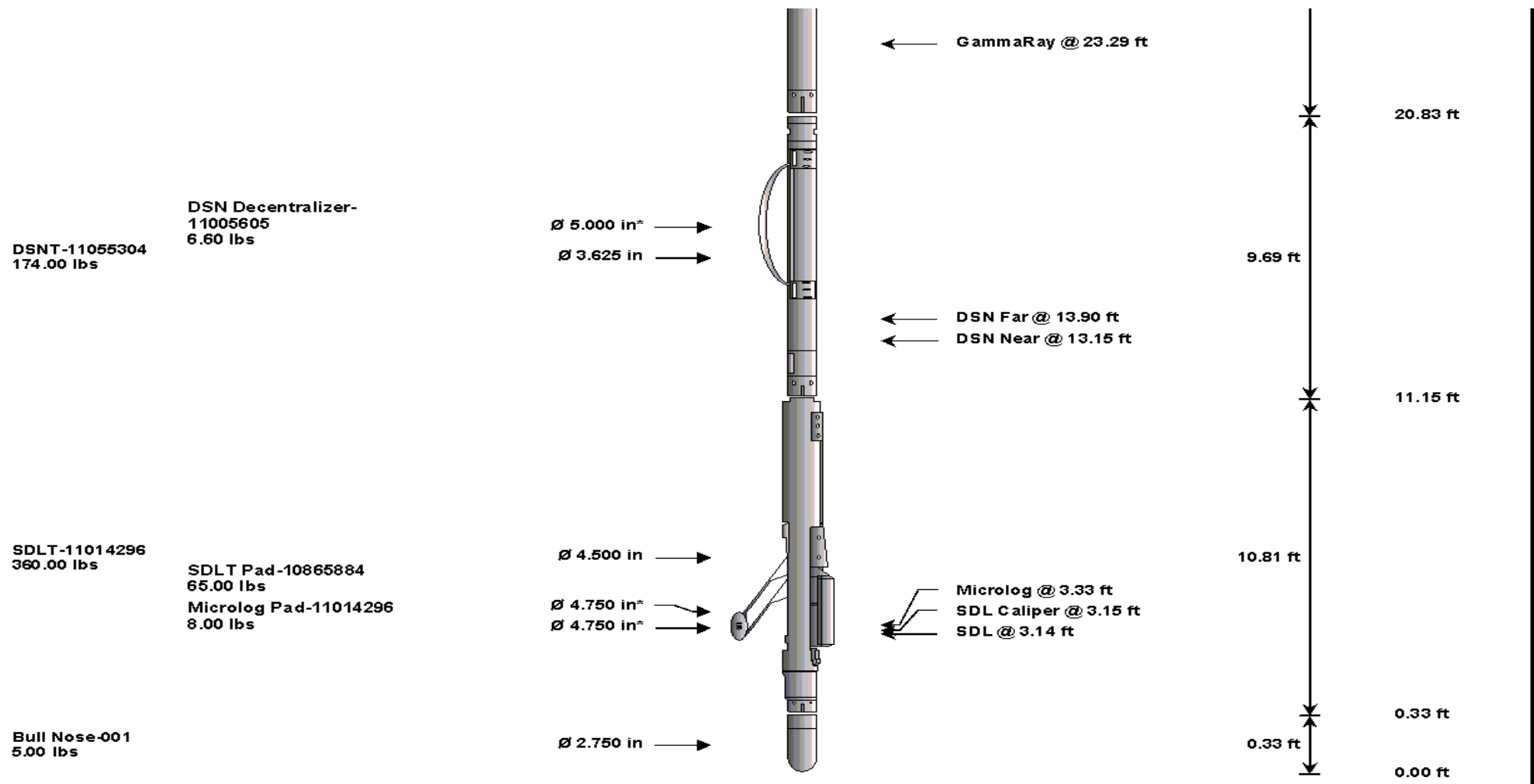
Plot Time: 28-Feb-13 21:06:35  
 Plot Range: 4649.25 ft to 4877.5 ft  
 Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-002\  
 Plot File: \\-LOCAL-\\UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNMPORO\BULKD\_5\_REP\_LIB

## REPEAT SECTION

**HALLIBURTON**

## TOOL STRING DIAGRAM REPORT

| Description                        | Overbody Description | O.D.         | Diagram | Sensors @ Delays | Length  | Accumulated Length |
|------------------------------------|----------------------|--------------|---------|------------------|---------|--------------------|
| Cable Head-<br>PROT01<br>30.00 lbs |                      | Ø 3.625 in → |         |                  | 1.92 ft | 35.01 ft           |
| SP Sub-11441455<br>60.00 lbs       |                      | Ø 3.625 in → |         | ← SP @ 31.31 ft  | 3.74 ft | 33.09 ft           |
|                                    |                      |              |         |                  |         | 29.35 ft           |
| GTET-1 1039640<br>165.00 lbs       |                      | Ø 3.625 in → |         |                  | 8.52 ft |                    |



| Mnemonic     | Tool Name              | Serial Number | Weight (lbs)  | Length (ft)  | Accumulated Length (ft) | Max.Log. Speed (fpm) |
|--------------|------------------------|---------------|---------------|--------------|-------------------------|----------------------|
| CH           | Standard OH Cable Head | PROT01        | 30.00         | 1.92         | 33.09                   | 300.00               |
| SP           | SP Sub                 | 11441455      | 60.00         | 3.74         | 29.35                   | 300.00               |
| GTET         | Gamma Telemetry Tool   | 11039640      | 165.00        | 8.52         | 20.83                   | 60.00                |
| DSNT         | Dual Spaced Neutron    | 11055304      | 174.00        | 9.69         | 11.15                   | 60.00                |
| DCNT         | DSN Decentralizer      | 11005605      | 6.60          | 5.13         | *                       | 14.48                |
| SDLT         | Spectral Density Tool  | 11014296      | 360.00        | 10.81        | 0.33                    | 60.00                |
| MICP         | Microlog Pad           | 11014296      | 8.00          | 1.00         | *                       | 2.83                 |
| SDLP         | Density Insite Pad     | 10865884      | 65.00         | 2.55         | *                       | 2.54                 |
| BLNS         | Bull Nose              | 001           | 5.00          | 0.33         | 0.00                    | 300.00               |
| <b>Total</b> |                        |               | <b>873.60</b> | <b>35.01</b> |                         |                      |

\* Not included in Total Length and Length Accumulation.

Data: UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNIDLE

Date: 28-Feb-13 19:43:58

**CALIBRATION REPORT****NATURAL GAMMA RAY TOOL SHOP CALIBRATION****Tool Name:** GTET - 11039640**Reference Calibration Date:** 14-Jan-13 11:39:27**Engineer:** J. BOLLUM**Calibration Date:** 13-Feb-13 13:51:32**Software Version:** WL INSITE R3.8.0 (Build 2)**Calibration Version:** 1

Calibrator Source S/N: TB146

Calibrator API Reference:265.00 api

Equivalent Calibrator API Reference:269.6 api

| Measurement             | Measured | Calibrated | Units |
|-------------------------|----------|------------|-------|
| Background              | 77.6     | 79.8       | api   |
| Background + Calibrator | 339.7    | 349.5      | api   |
| Calibrator              | 262.1    | 269.6      | api   |

**NATURAL GAMMA RAY TOOL FIELD CALIBRATION****Tool Name:** GTET - 11039640**Reference Calibration Date:** 13-Feb-13 13:51:32**Engineer:** THOMAS HYDE**Calibration Date:** 28-Feb-13 16:56:33**Software Version:** WL INSITE R3.8.0 (Build 2)**Calibration Version:** 1

Calibrator Source S/N: TB146

Calibrator API Reference:265.00 api

Equivalent Calibrator API Reference:269.6 api

| Field Verification      | Shop  | Field | Units |
|-------------------------|-------|-------|-------|
| Background              | 79.8  | 51.9  | api   |
| Background + Calibrator | 349.5 | 326.6 | api   |
| Calibrator              | 269.6 | 274.7 | api   |

| Shop  | Field | Difference | Tolerance |
|-------|-------|------------|-----------|
| 269.6 | 274.7 | -5.1       | +/- 9.00  |

**DUAL SPACED NEUTRON SHOP CALIBRATION****Tool Name:** DSNT - 11055304**Reference Calibration Date:** 19-Dec-12 16:48:47**Engineer:** J. BOLLUM**Calibration Date:** 13-Feb-13 13:44:56**Software Version:** WL INSITE R3.8.0 (Build 2)**Calibration Version:** 1

Logging Source S/N: 696

Tank Serial Number: LIBERAL NEUTRON

Tank Construction: EPOXY-REINFORCED

Reference value assigned to Tank: 51.680

Snow Block S/N: 696

Calibration Tank Water Temperature: 60 degF

Min. Tool Housing Outside Diameter: 3.620 in

| CALIBRATION CONSTANTS |             |           |                            |
|-----------------------|-------------|-----------|----------------------------|
| Measurement           | Prev. Value | New Value | Control Limit On New Value |
| Gain:                 | 0.986       | 0.986     | 0.900 - 1.100              |

| WATER TANK SUMMARY (Horizontal Water Tank) |                                  |                        |        |                         |
|--------------------------------------------|----------------------------------|------------------------|--------|-------------------------|
| Measurement                                | Current Reading (Previous Coef.) | Calibrated (New Coef.) | Change | Control Limit On Change |
| Porosity (decP):                           | 0.2106                           | 0.2106                 | 0.0000 | +/- 0.0020              |
| Calibrated Ratio:                          | 9.72                             | 9.72                   | 0.000  | +/- 0.050               |

| VERIFIER                    |        |                   |
|-----------------------------|--------|-------------------|
| Measurement                 | Value  | Control Limit     |
| Snow-Block Porosity (decP): | 0.0624 | 0.02000 - 0.09000 |

| PASS/FAIL SUMMARY |        |
|-------------------|--------|
| Background Check: | Passed |
| Gain-Range Check: | Passed |
| Snow-Block Check: | Passed |

### DUAL SPACED NEUTRON FIELD CALIBRATION

**Tool Name:** DSNT - 11055304

**Reference Calibration Date:** 13-Feb-13 13:44:56

**Engineer:** THOMAS HYDE

**Calibration Date:** 28-Feb-13 16:58:45

**Software Version:** WL INSITE R3.8.0 (Build 2)

**Calibration Version:** 1

Logging Source S/N: 696

Snow Block S/N: 696

| NEUTRON FIELD-CHECK SUMMARY |        |        |            |                         |
|-----------------------------|--------|--------|------------|-------------------------|
|                             | Shop   | Field  | Difference | Control Limit On Change |
| Snow-Block Porosity (decP): | 0.0624 | 0.0706 | 0.0082     | +/- 0.0150              |

| PASS/FAIL SUMMARY   |        |
|---------------------|--------|
| Block Change Check: | Passed |

Snow Block Stat Check:

Passed

Temperature Check:

Passed

**DENSITY CALIPER SHOP CALIBRATION****Tool Name:** SDLT - 11014296**Reference Calibration Date:** 13-Feb-13 09:52:34**Engineer:** J. BOLLUM**Calibration Date:** 13-Feb-13 09:56:36**Software Version:** WL INSITE R3.8.0 (Build 2)**Calibration Version:** 1**Host Tool Name:** DSNT - 11055304**CALIBRATION COEFFICIENTS**

| Measurement | Previous Value | New Value   | Control Limit On New Value |
|-------------|----------------|-------------|----------------------------|
| Pad Offset  | -4115.63       | -3940.88    | -7000.00 - -1000.00        |
| Pad Gain    | 0.0003908      | 0.0003812   | 0.000200 - 0.000600        |
| Arm Offset  | -2144.15       | -2009.50    | -5000.00 - 3000.00         |
| Arm Gain    | 0.0004162      | 0.0004246   | 0.000300 - 0.000700        |
| Arm Power   | 0.000002688    | 0.000001261 | -0.000010000 - 0.000010000 |

The ring diameter is computed from:  $\text{DIAMETER} = \text{PAD EXTENSION} + \text{ARM EXTENSION} + \text{TOOL DIAMETER}$ 

Tool Diameter: 4.50 in

**CALIBRATION RINGS**

| Measurement      | Current Reading (Previous Coeff.) | Calibrated (New Coeff.) | Change | Control Limit On New Value |
|------------------|-----------------------------------|-------------------------|--------|----------------------------|
| PAD EXTENSION:   |                                   |                         |        |                            |
| Small Ring (in)  | 1.98                              | 2.00                    | 0.02   | +/- 0.20                   |
| Medium Ring (in) | 3.78                              | 3.75                    | -0.03  | +/- 0.20                   |
| RING DIAMETER:   |                                   |                         |        |                            |
| Small Ring (in)  | 6.35                              | 6.50                    | 0.15   | +/- 0.20                   |
| Medium Ring (in) | 8.10                              | 8.25                    | 0.15   | +/- 0.20                   |
| Large Ring (in)  | 15.00                             | 15.00                   | 0.00   | +/- 0.20                   |

**PASS/FAIL SUMMARY**

Calibration-Coefficients Range Check:

Passed

Ring-Measurement Check:

Passed

**PASS/FAIL SUMMARY**

Calibration-Coefficients Range Check:

Passed

**SPECTRAL DENSITY SHOP CALIBRATION****Tool Name:** SDLT Pad - 10865884**Reference Calibration Date:** 04-Jan-13 10:30:13**Engineer:** J. BOLLUM**Calibration Date:** 13-Feb-13 10:47:49**Software Version:** WL INSITE R3.8.0 (Build 2)**Calibration Version:** 1

Logging Source S/N: 5168GW  
Aluminum Block S/N: LIBERAL  
Magnesium Block S/N: LIBERAL

Density: 2.598g/cc  
Density: 1.684g/cc

Pe: 3.170  
Pe: 2.598

#### DENSITY CALIBRATION SUMMARY

| Measurement          | Previous Value | New Value | Control Limit |
|----------------------|----------------|-----------|---------------|
| Near Bar Gain        | 1.0591         | 1.0409    | 0.90 - 1.10   |
| Near Dens Gain       | 1.0204         | 1.0144    | 0.90 - 1.10   |
| Near Peak Gain       | 1.0236         | 1.0045    | 0.90 - 1.10   |
| Near Lith Gain       | 0.9918         | 0.9897    | 0.90 - 1.10   |
| Far Bar Gain         | 1.0142         | 1.0119    | 0.90 - 1.10   |
| Far Dens Gain        | 1.0021         | 1.0002    | 0.90 - 1.10   |
| Far Peak Gain        | 0.9953         | 0.9961    | 0.90 - 1.10   |
| Far Lith Gain        | 0.9734         | 0.9709    | 0.90 - 1.10   |
| Near Bar Offset      | -0.3434        | -0.1754   | NONE          |
| Near Dens Offset     | -0.0183        | 0.0332    | NONE          |
| Near Peak Offset     | -0.0641        | 0.0950    | NONE          |
| Near Lith Offset     | 0.1634         | 0.1786    | NONE          |
| Far Bar Offset       | 0.0078         | 0.0343    | NONE          |
| Far Dens Offset      | 0.0906         | 0.1130    | NONE          |
| Far Peak Offset      | 0.1244         | 0.1196    | NONE          |
| Far Lith Offset      | 0.2556         | 0.2809    | NONE          |
| Near Bar Background  | 831.89         | 829.24    | 700 - 1450    |
| Near Dens Background | 276.96         | 275.13    | 230 - 480     |
| Near Peak Background | 118.93         | 119.99    | 100 - 210     |
| Near Lith Background | 146.93         | 146.82    | 125 - 260     |
| Far Bar Background   | 515.51         | 513.05    | 450 - 900     |
| Far Dens Background  | 202.64         | 200.66    | 175 - 345     |
| Far Peak Background  | 78.62          | 79.48     | 70 - 140      |
| Far Lith Background  | 81.88          | 82.22     | 75 - 145      |

#### CALIBRATION BLOCK SUMMARY

| Measurement    | Current Reading<br>(Previous Coef) | Calibrated<br>(New Coef) | Change | Control Limit<br>On Change |
|----------------|------------------------------------|--------------------------|--------|----------------------------|
| MAGNESIUM      |                                    |                          |        |                            |
| Density (g/cc) | 1.688                              | 1.684                    | -0.004 | +/- 0.015                  |
| Pe             | 2.534                              | 2.552                    | 0.018  | +/- 0.150                  |

**ALUMINUM**

|                |       |       |        |             |
|----------------|-------|-------|--------|-------------|
| Density (g/cc) | 2.600 | 2.598 | -0.002 | +/- 0.01500 |
| Pe             | 3.081 | 3.120 | 0.039  | +/- 0.150   |

**TOOL SUMMARY**

| Measurement                | Near Detector |                | Far Detector |                |
|----------------------------|---------------|----------------|--------------|----------------|
|                            | Value         | Control Limits | Value        | Control Limits |
| QUALITY                    |               |                |              |                |
| Background                 | -0.0003       | +/- 0.0110     | -0.0017      | +/- 0.0140     |
| Magnesium Block            | -0.0024       | +/- 0.0110     | -0.0007      | +/- 0.0140     |
| Aluminum Block             | 0.0005        | +/- 0.0110     | 0.0001       | +/- 0.0140     |
| Resolution                 | 9.15          | 6.00 - 11.50   | 8.96         | 6.00 - 11.50   |
| Internal Verifier(B+D+P+L) | 1371          | 1200 - 2700    | 875          | 800 - 1700     |

**PASS/FAIL SUMMARY**

|                                |        |
|--------------------------------|--------|
| Background Quality Check:      | Passed |
| Background Range Check:        | Passed |
| Background Resolution Check:   | Passed |
| Background Verification Check: | Passed |
| Magnesium Quality Check:       | Passed |
| Aluminum Quality Check:        | Passed |
| Gains Check:                   | Passed |
| Changes in Calibration Blocks: | Passed |

**SPECTRAL DENSITY FIELD CHECK****Tool Name: SDLT Pad - 10865884****Reference Calibration Date: 13-Feb-13 10:47:49****Engineer: THOMAS HYDE****Calibration Date: 28-Feb-13 17:04:31****Software Version: WL INSITE R3.8.0 (Build 2)****Calibration Version: 1**

Pad Temperature: 61.1 degF

**DENSITY FIELD CALIBRATION SUMMARY**

| Measurement        | Shop     | Field    | Change | Control Limit +/- |
|--------------------|----------|----------|--------|-------------------|
| Near (B+D+P+L) cps | 1371.181 | 1372.238 | 1.057  | 14.965            |
| Far (B+D+P+L) cps  | 875.410  | 873.343  | -2.067 | 16.158            |
| Near Resolution    | 9.15     | 9.16     | 0.010  | 0.50              |
| Far Resolution     | 8.96     | 8.98     | 0.020  | 1.00              |

**PASS/FAIL SUMMARY**

|                         |        |
|-------------------------|--------|
| Bkg Quality Check:      | Passed |
| Bkg Resolution Check:   | Passed |
| Bkg Verification Check: | Passed |

### SDLT CALIPER FIELD CALIBRATION

Tool Name: SDLT - 11014296

Reference Calibration Date: 13-Feb-13 09:56:36

Engineer: THOMAS HYDE

Calibration Date: 28-Feb-13 17:00:30

Software Version: WL INSITE R3.8.0 (Build 2)

Calibration Version: 1

#### MEASURED CALIPER VALUES

| Measurement   | Shop | Field | Change | Control Limit On New Value |
|---------------|------|-------|--------|----------------------------|
| Pad Extension | 3.75 | 3.69  | -0.06  | +/- 0.10                   |
| Ring Diameter | 8.25 | 8.24  | -0.01  | +/- 0.15                   |

#### PASS/FAIL SUMMARY

|                      |        |
|----------------------|--------|
| Pad Extension Check: | Passed |
| Diameter Check:      | Passed |

### CALIBRATION SUMMARY

| Sensor               | Shop     | Field    | Post  | Difference | Tolerance  | Units |
|----------------------|----------|----------|-------|------------|------------|-------|
| GTET-11039640        |          |          |       |            |            |       |
| Gamma Ray Calibrator | 269.6    | 274.7    | ----- | -5.1       | +/- 9.00   | api   |
| DSNT-11055304        |          |          |       |            |            |       |
| Snow-Block Porosity  | 0.0624   | 0.0706   | ----- | -0.0082    | +/- 0.0150 | decg  |
| SDLT-11014296        |          |          |       |            |            |       |
| Pad Extension        | 3.75     | 3.69     | ----- | 0.06       | +/-0.10    | in    |
| Ring Diameter        | 8.25     | 8.24     | ----- | 0.01       | +/-0.15    | in    |
| SDLT Pad-10865884    |          |          |       |            |            |       |
| Near(B+D+P+L)        | 1371.181 | 1372.238 | ----- | -1.057     | +/-14.965  | cps   |
| Far(B+D+P+L)         | 875.410  | 873.343  | ----- | 2.067      | +/-16.158  | cps   |

Data: LINRUH'D' 1-210002 SP-GTET-DSN-SDI -BNIDLE

Date: 28-Feb-13 20:11:15

**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                                 | 9.300      | 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                                       | 0.420      | ohmm |
| SHARED             | TRM  | Temperature of Mud                                    | 70.0       | degF |
| SHARED             | CSD  | Logging Interval is Cased?                            | No         |      |
| SHARED             | ICOD | AHV Casing OD                                         | 5.500      | in   |
| SHARED             | ST   | Surface Temperature                                   | 70.0       | degF |
| SHARED             | TD   | Total Well Depth                                      | 4872.00    | ft   |
| SHARED             | BHT  | Bottom Hole Temperature                               | 103.0      | degF |
| SHARED             | SVTM | Navigation and Survey Master Tool                     | NONE       |      |
| SHARED             | AZTM | High Res Z Accelerometer Master Tool                  | GTET       |      |
| SHARED             | TEMM | Temperature Master Tool                               | NONE       |      |
| SHARED             | BHSM | Borehole Size Master Tool                             | NONE       |      |
| Rwa /<br>CrossPlot | XPOK | Process Crossplot?                                    | Yes        |      |
| Rwa /<br>CrossPlot | FCHO | Select Source of F                                    | Automatic  |      |
| Rwa /<br>CrossPlot | AFAC | Archie A factor                                       | 0.6200     |      |
| Rwa /<br>CrossPlot | MFAC | Archie M factor                                       | 2.1500     |      |
| Rwa /<br>CrossPlot | RMFR | Rmf Reference                                         | 0.10       | ohmm |
| Rwa /<br>CrossPlot | TMFR | Rmf Ref Temp                                          | 75.00      | degF |
| Rwa /<br>CrossPlot | RWA  | Resistivity of Formation Water                        | 0.05       | ohmm |
| Rwa /<br>CrossPlot | ADP  | Use Air Porosity to calculate CrossplotPhi            | No         |      |
| GTET               | GROK | Process Gamma Ray?                                    | Yes        |      |
| GTET               | GRSO | Gamma Tool Standoff                                   | 0.000      | in   |
| GTET               | GEOK | Process Gamma Ray EVR?                                | No         |      |
| GTET               | TPOS | Tool Position for Gamma Ray Tools.                    | Eccentered |      |
| DSNT               | DNOK | Process DSN?                                          | Yes        |      |
| DSNT               | DEOK | Process DSN EVR?                                      | No         |      |
| DSNT               | NLIT | Neutron Lithology                                     | Limestone  |      |
| DSNT               | DNSO | DSN Standoff - 0.25 in (6.35 mm) Recommended          | 0.250      | in   |
| DSNT               | DNTP | Temperature Correction Type                           | None       |      |
| DSNT               | DPRS | DSN Pressure Correction Type                          | None       |      |

|              |      |                                   |       |      |
|--------------|------|-----------------------------------|-------|------|
| DSNT         | SHCO | View More Correction Options      | No    |      |
| DSNT         | UTVD | Use TVD for Gradient Corrections? | No    |      |
| DSNT         | LHWT | Logging Horizontal Water Tank?    | No    |      |
| SDLT         | CLOK | Process Caliper Outputs?          | Yes   |      |
| SDLT Pad     | DNOK | Process Density?                  | Yes   |      |
| SDLT Pad     | DNOK | Process Density EVR?              | No    |      |
| SDLT Pad     | CB   | Logging Calibration Blocks?       | No    |      |
| SDLT Pad     | SPVT | SDLT Pad Temperature Valid?       | Yes   |      |
| SDLT Pad     | DTWN | Disable temperature warning       | No    |      |
| SDLT Pad     | DMA  | Formation Density Matrix          | 2.710 | g/cc |
| SDLT Pad     | DFL  | Formation Density Fluid           | 1.000 | g/cc |
| Microlog Pad | MLOK | Process MicroLog Outputs?         | Yes   |      |

BOTTOM

Data: UNRUH 'D' 1-210002 SP-GTET-DSN-SDL-BNIDLE

Date: 28-Feb-13 20:14:03

**HALLIBURTON**

## INPUTS, DELAYS AND FILTERS TABLE

| Mnemonic    | Input Description                                       | Delay (ft) | Filter Type | Filter Length (ft) |
|-------------|---------------------------------------------------------|------------|-------------|--------------------|
| Depth Panel |                                                         |            |             |                    |
| TENS        | Tension                                                 | 0.00       | NO          |                    |
| SP Sub      |                                                         |            |             |                    |
| PLTC        | Plot Control Mask                                       | 31.31      | NO          |                    |
| SP          | Spontaneous Potential                                   | 31.31      | BLK         | 1.250              |
| SPR         | Raw Spontaneous Potential                               | 31.31      | NO          |                    |
| SPO         | Spontaneous Potential Offset                            | 31.31      | NO          |                    |
| GTET        |                                                         |            |             |                    |
| TPUL        | Tension Pull                                            | 23.29      | NO          |                    |
| GR          | Natural Gamma Ray API                                   | 23.29      | TRI         | 1.750              |
| GRU         | Unfiltered Natural Gamma Ray API                        | 23.29      | NO          |                    |
| EGR         | Natural Gamma Ray API with Enhanced Vertical Resolution | 23.29      | W           | 1.416 , 0.750      |
| ACCZ        | Accelerometer Z                                         | 0.00       | BLK         | 0.083              |
| DEVI        | Inclination                                             | 0.00       | NO          |                    |
| DSNT        |                                                         |            |             |                    |
| TPUL        | Tension Pull                                            | 13.05      | NO          |                    |

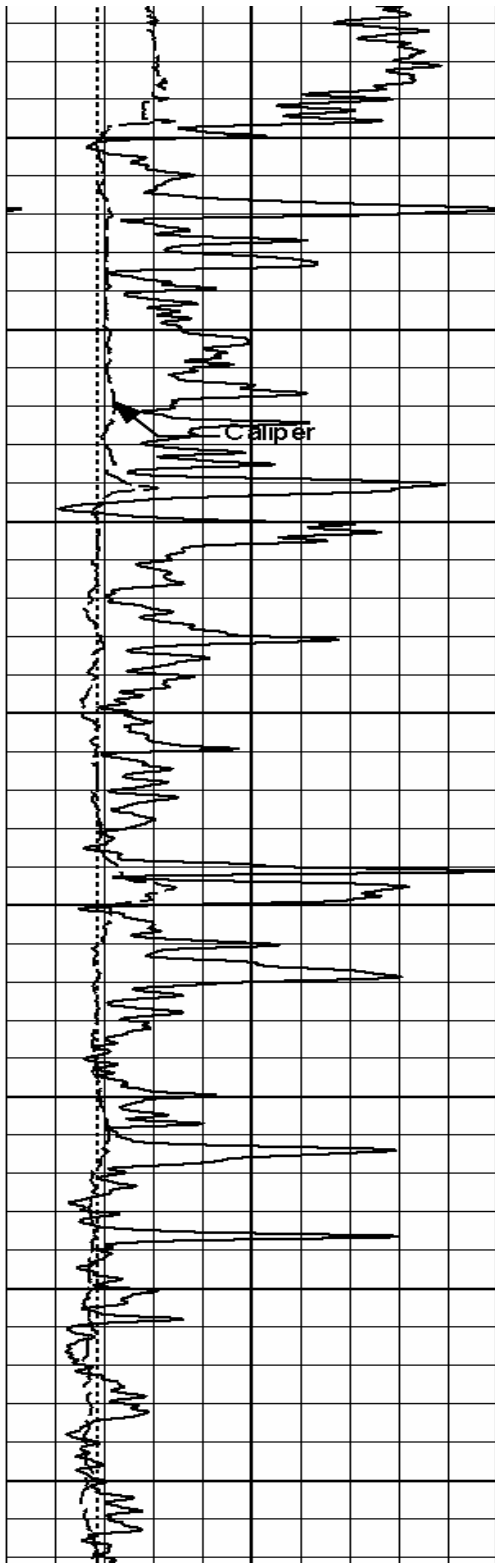
|                     |                                    |       |     |       |
|---------------------|------------------------------------|-------|-----|-------|
| RNDS                | Near Detector Telemetry Counts     | 13.15 | BLK | 1.417 |
| RFDS                | Far Detector Telemetry Counts      | 13.90 | TRI | 0.583 |
| DNTT                | DSN Tool Temperature               | 13.15 | NO  |       |
| DSNS                | DSN Tool Status                    | 13.05 | NO  |       |
| ERND                | Near Detector Telemetry Counts EVR | 13.15 | BLK | 0.000 |
| ERFD                | Far Detector Telemetry Counts EVR  | 13.90 | BLK | 0.000 |
| ENTM                | DSN Tool Temperature EVR           | 13.15 | NO  |       |
| <b>SDLT</b>         |                                    |       |     |       |
| TPUL                | Tension Pull                       | 3.15  | NO  |       |
| PCAL                | Pad Caliper                        | 3.15  | TRI | 0.250 |
| ACAL                | Am Caliper                         | 3.15  | TRI | 0.250 |
| <b>SDLT Pad</b>     |                                    |       |     |       |
| TPUL                | Tension Pull                       | 3.14  | NO  |       |
| NAB                 | Near Above                         | 2.96  | BLK | 0.920 |
| NHI                 | Near Cesium High                   | 2.96  | BLK | 0.920 |
| NLO                 | Near Cesium Low                    | 2.96  | BLK | 0.920 |
| NVA                 | Near Valley                        | 2.96  | BLK | 0.920 |
| NBA                 | Near Barite                        | 2.96  | BLK | 0.920 |
| NDE                 | Near Density                       | 2.96  | BLK | 0.920 |
| NPK                 | Near Peak                          | 2.96  | BLK | 0.920 |
| NLI                 | Near Lithology                     | 2.96  | BLK | 0.920 |
| NBAU                | Near Barite Unfiltered             | 2.96  | BLK | 0.250 |
| NLIU                | Near Lithology Unfiltered          | 2.96  | BLK | 0.250 |
| FAB                 | Far Above                          | 3.31  | BLK | 0.250 |
| FHI                 | Far Cesium High                    | 3.31  | BLK | 0.250 |
| FLO                 | Far Cesium Low                     | 3.31  | BLK | 0.250 |
| FVA                 | Far Valley                         | 3.31  | BLK | 0.250 |
| FBA                 | Far Barite                         | 3.31  | BLK | 0.250 |
| FDE                 | Far Density                        | 3.31  | BLK | 0.250 |
| FPK                 | Far Peak                           | 3.31  | BLK | 0.250 |
| FLI                 | Far Lithology                      | 3.31  | BLK | 0.250 |
| PTMP                | Pad Temperature                    | 3.15  | BLK | 0.920 |
| NHV                 | Near Detector High Voltage         | 2.54  | NO  |       |
| FHV                 | Far Detector High Voltage          | 2.54  | NO  |       |
| ITMP                | Instrument Temperature             | 2.54  | NO  |       |
| DDHV                | Detector High Voltage              | 2.54  | NO  |       |
| <b>Microlog Pad</b> |                                    |       |     |       |
| TPUL                | Tension Pull                       | 3.33  | NO  |       |

|      |     |       |
|------|-----|-------|
| 3.33 | BLK | 0.750 |
| 3.33 | BLK | 0.750 |

Date: 28-Feb-13 20:14:15

Plot Time: 28-Feb-13 21:06:35  
Plot Range: 3350 ft to 4875.25 ft  
Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-003\  
Plot File: \\-LOCAL-\\UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNIPOR01\AHV\_2\_IQ\_LIB

| 0      Gamma API      150 |          |    |    |          |         |          |         |      |         |  |
|---------------------------|----------|----|----|----------|---------|----------|---------|------|---------|--|
| api                       |          |    |    |          | MUDCAKE |          | MUDCAKE |      |         |  |
| 6                         | Bit Size | 16 | 20 | Bit Size | 0 0     | Bit Size | 20      |      |         |  |
| inches                    |          |    |    |          |         |          |         |      |         |  |
| 6                         | Caliper  | 16 | 20 | Caliper  | 0 0     | Caliper  | 20      | BHVT | AHVT    |  |
| inches                    |          |    |    |          |         |          |         |      |         |  |
|                           |          |    |    |          |         |          |         |      |         |  |
|                           |          |    |    |          |         |          |         |      |         |  |
| 3400                      |          |    |    |          |         |          |         |      | 517 274 |  |
| 3500                      |          |    |    |          |         |          |         |      | 496 261 |  |
|                           |          |    |    |          |         |          |         |      | 477 250 |  |
|                           |          |    |    |          |         |          |         |      | 458 240 |  |

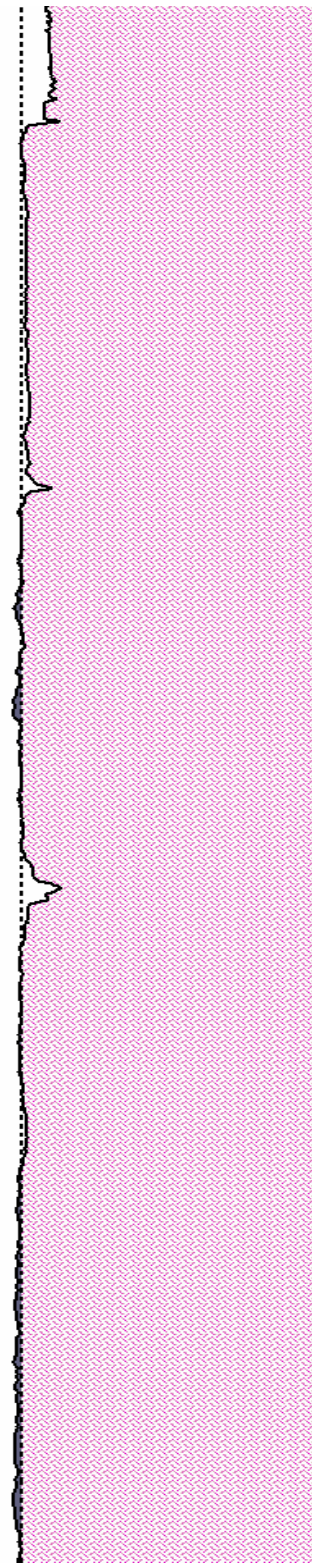
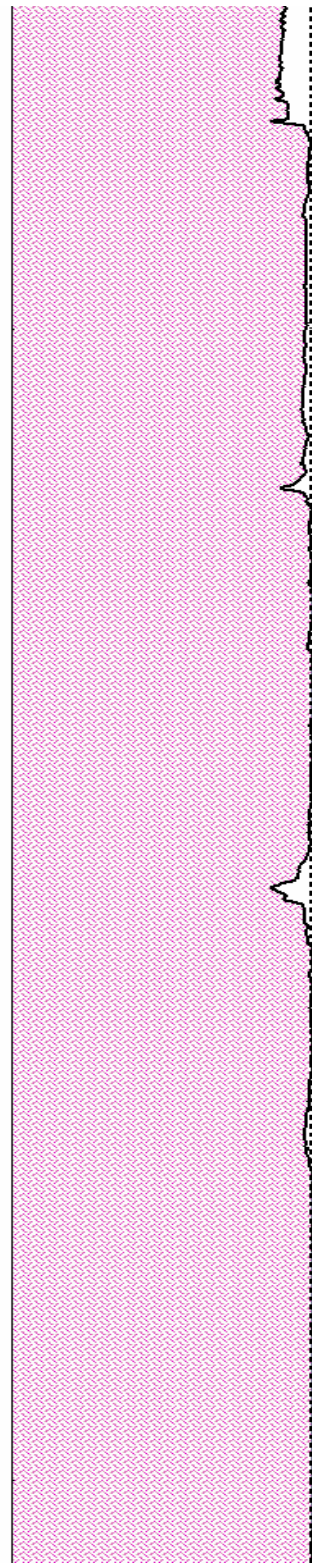


3600

3700

3800

3900



438

420

402

386

368

351

334

318

227

218

208

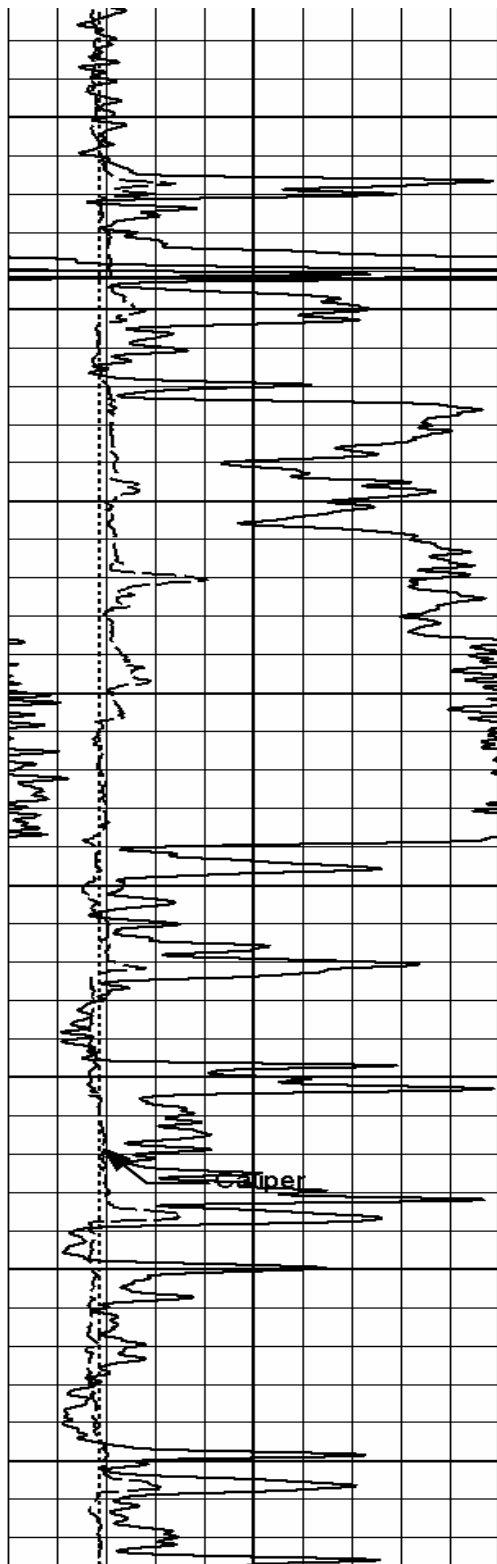
200

190

182

173

165



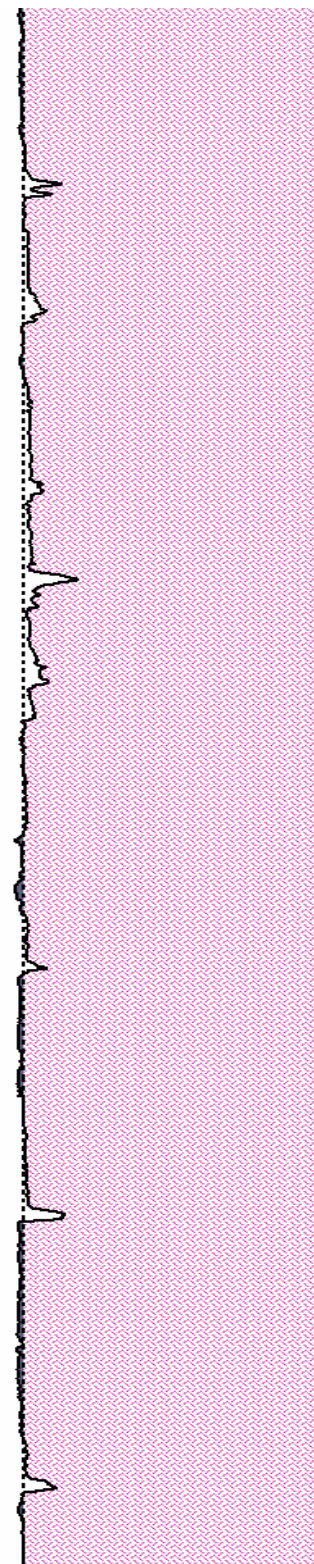
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4100

4200

4300

Caliper



302

284

266

247

230

213

196

180

157

148

138

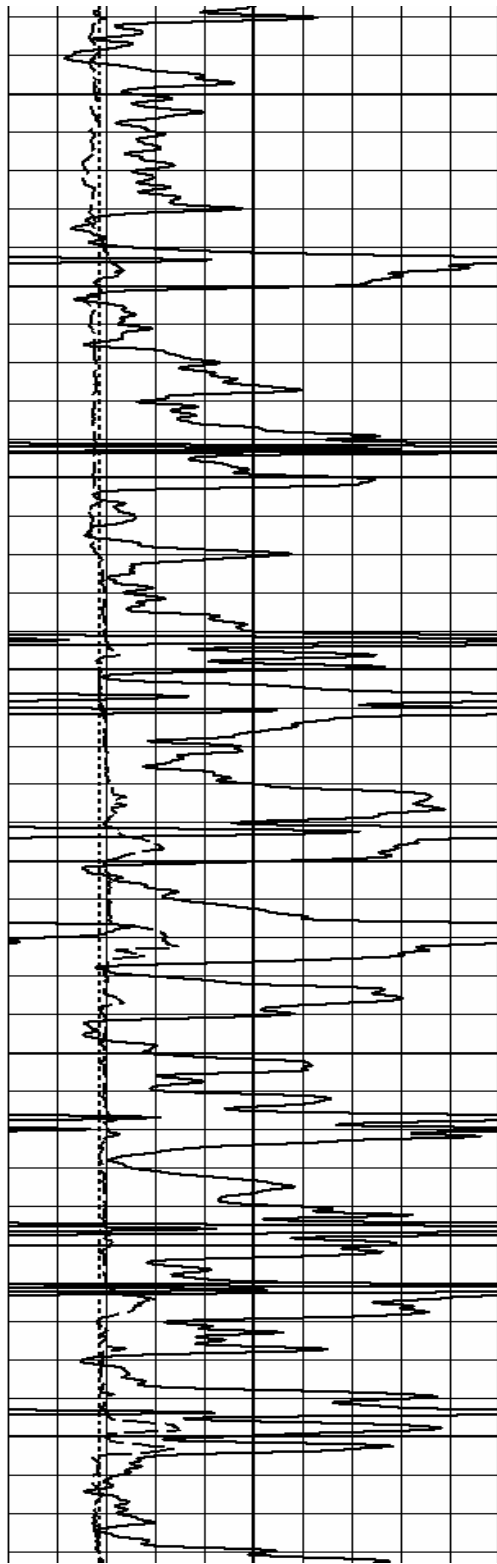
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118

110

101

93

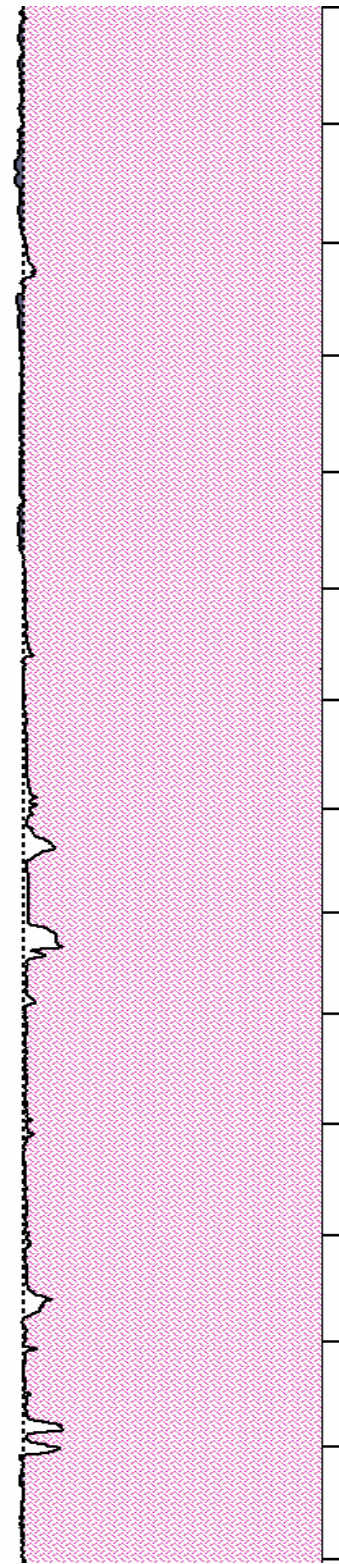
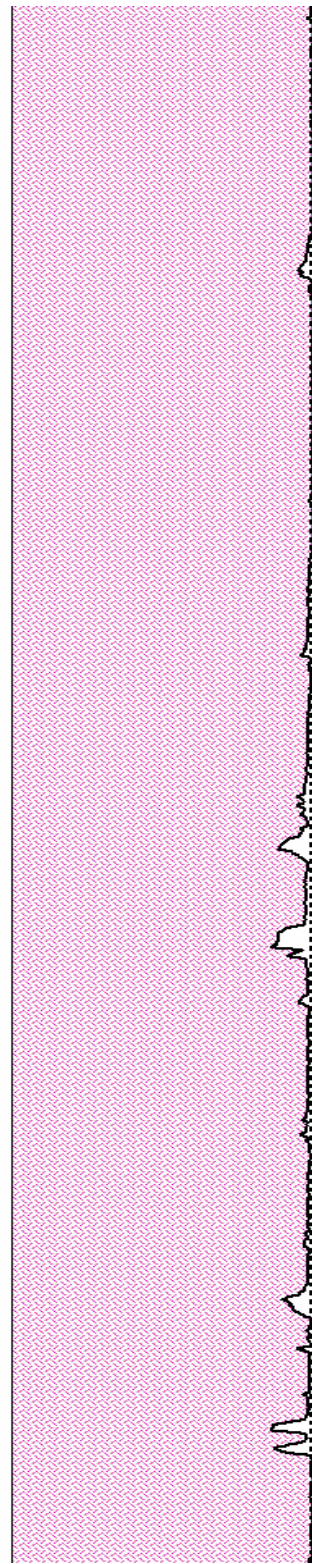


4400

4500

4600

4700



163

146

130

113

95

76

59

41

84

76

68

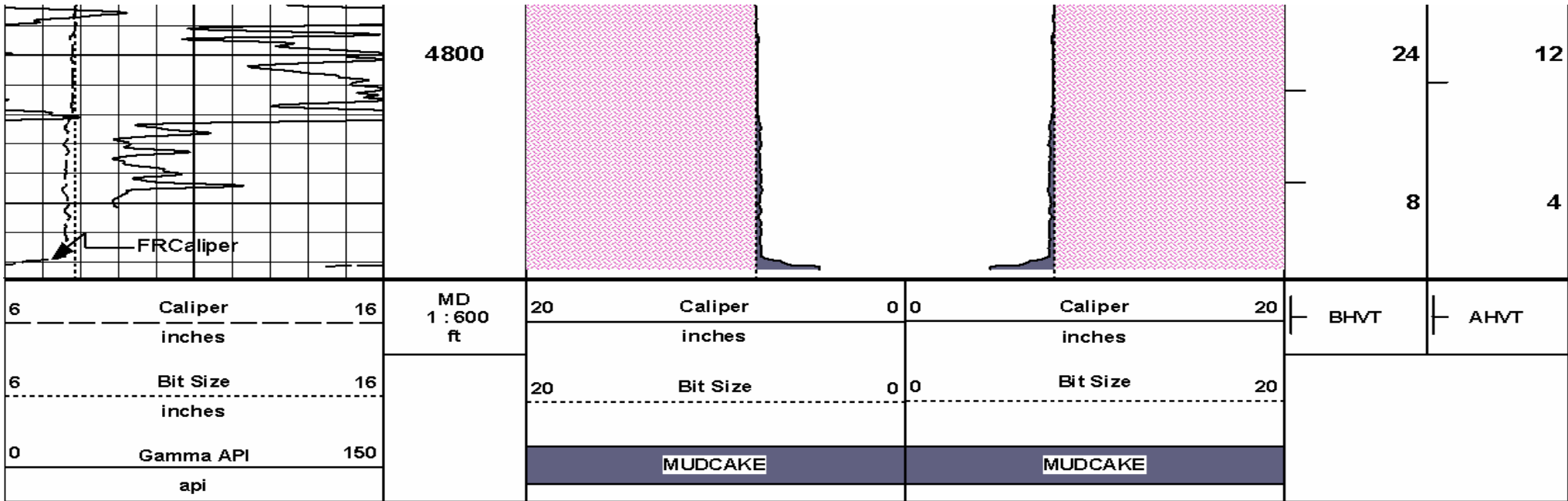
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49

39

30

20



**HALLIBURTON**

Plot Time: 28-Feb-13 21:06:37  
Plot Range: 3350 ft to 4875.25 ft  
Data: UNRUH 'D' 1-21\Well Based\DAQ-0002-003\  
Plot File: \\LOCAL-UNRUH 'D' 1-21\0002 SP-GTET-DSN-SDL-BNMPORO\AHV\_2\_IQ\_LIB

## ANNULAR HOLE VOLUME PLOT

COMPANY        **HERMAN L. LOEB**

WELL            **UNRUH 'D' 1-21**

FIELD          **WILDCAT**

COUNTY        **KIOWA**

STATE                **KANSAS**

**HALLIBURTON**

**DUAL SPACED NEUTRON  
SPECTRAL DENSITY  
LOG**