LOG created using LPLOT VH Version 3.0, April 12, 2013, Copyright (C) 1999-2009 Pason Systems Corp.

| | |
|---|---|
| **OPERATOR:** | **NOBLE ENERGY, INC.** |
| **WELL:** | **SHABLE FEDERAL LB33-78HN** |
| **LOCATION:** | **SEC33 T9N R60W** |
| **COUNTY:** | **WELD** |
| **STATE:** | **COLORADO** |
| **SPOT:** | **288' FNL, 400' FWL** |
| **ELEVATION:** | **4940'GL, 4956'KB** |
| **FIELD:** | **WILDCAT** |
| **SPUD DATE:** | **3/28/13** |
| **TD DATE:** | **4/1/13 (PILOT HOLE)** |
| **DATES LOGGED:** | **3/30/13 - 4/1/13 (PILOT HOLE)** |
| **DEPTHS LOGGED:** | **642' - 6716' (PILOT HOLE)** |
| **GEOLOGISTS:** | **GARY MYERS, TED STOCKWELL** |
| **DRILLING FLUID:** | **LSND** |
| **DRILLING RIG:** | **PRECISION 828** |
| **API:** | **05-123-36799** |
| **LOG TYPE:** | **VERTICAL PILOT HOLE** |
| **SCALE:** | **1:240 (5 inches per 100 feet)** |
| **REMARKS:** | **WELLSITE GEOLOGICAL SERVICES PROVIDED BY COLUMBINE LOGGING INC.** |

**LOG CONTINUES ON FILE: Shable Federal LB33-78HN Lateral.lplot**
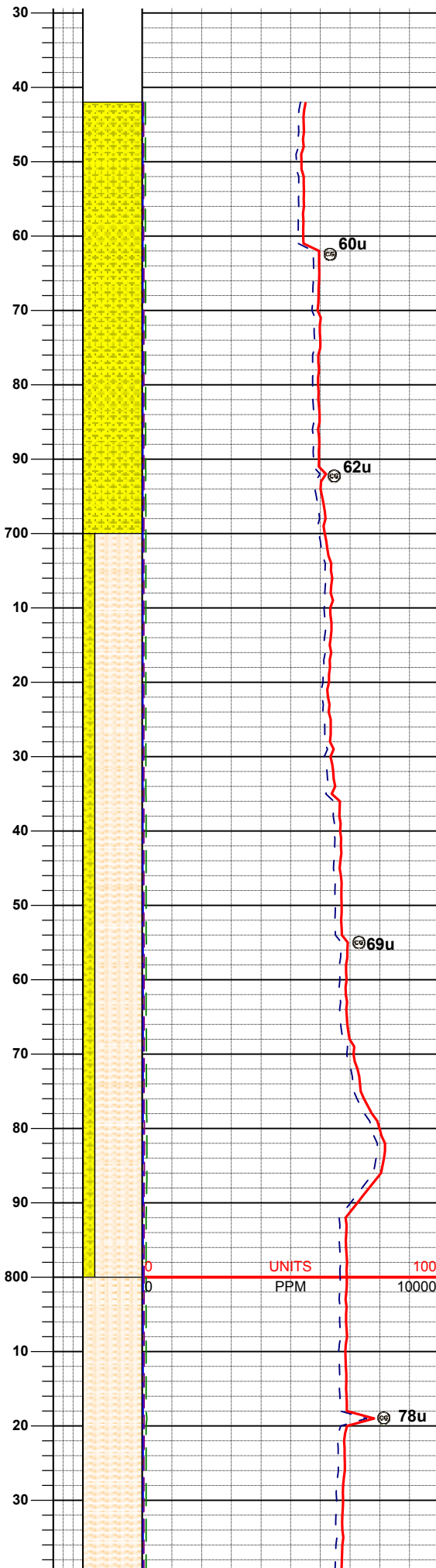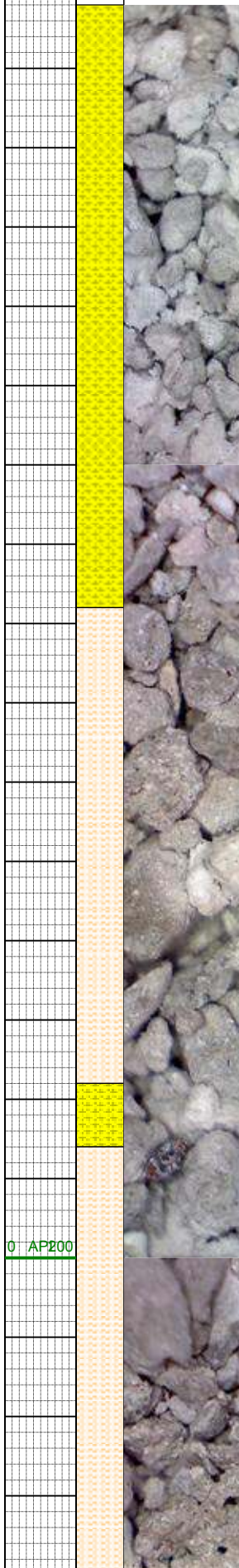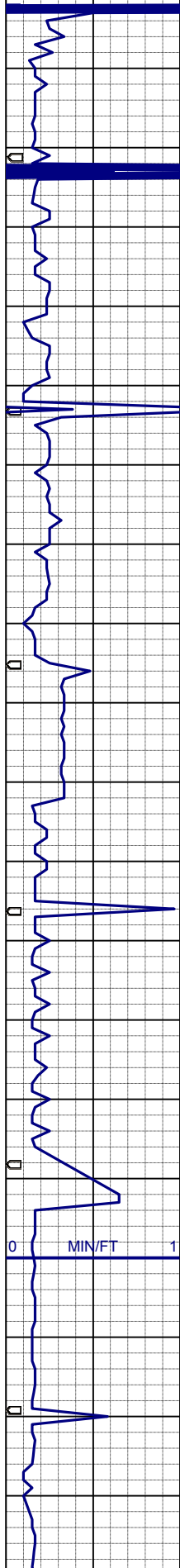
## LITHOLOGIES

Chalk   Limestone   Marl   Sandstone

Shaly Sandstone   Shaly Siltstone   Silty Shale

## MODIFIERS

B   Bentonite

## ENGINEERING SYMBOLS

Connection   Connection Gas   Midnight Depth

| | | | | | GAS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 | UNITS | 100 | | |
| | | | | | | C1 | | | |
| | | | | | 0 | PPM | 10000 | | |
| | | | | | | C2 | | | |
| | | | | | 0 | PPM | 10000 | | |
| | | | | | | C3 | | | |
| | | | | | 0 | PPM | 10000 | | |
| | | | | | | C4 | | | |
| | | | | | 0 | PPM | 10000 | | |

| ROP | | ROTATE/SLIDE | GAMMA | INTERPRETIVE LITHOLOGY | PICTURE | DEPTH (FEET) | OIL SHOWS | CUTTINGS LITHOLOGY | GAS / C1 / C2 / C3 / C4 | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 MIN/FT | 1 | | 0 API 200 | | | 620 | TFG | | | |
| BIT #2 SMITH MDi516 8.75" | | | | | | | | | | COLUMBINE LOGGING, INC. ON LOCATION 03/29/2013 |

ON LOCATION 03/29/2013
MANNED 2-PERSON LOGGING
WITH BLOODHOUND GAS
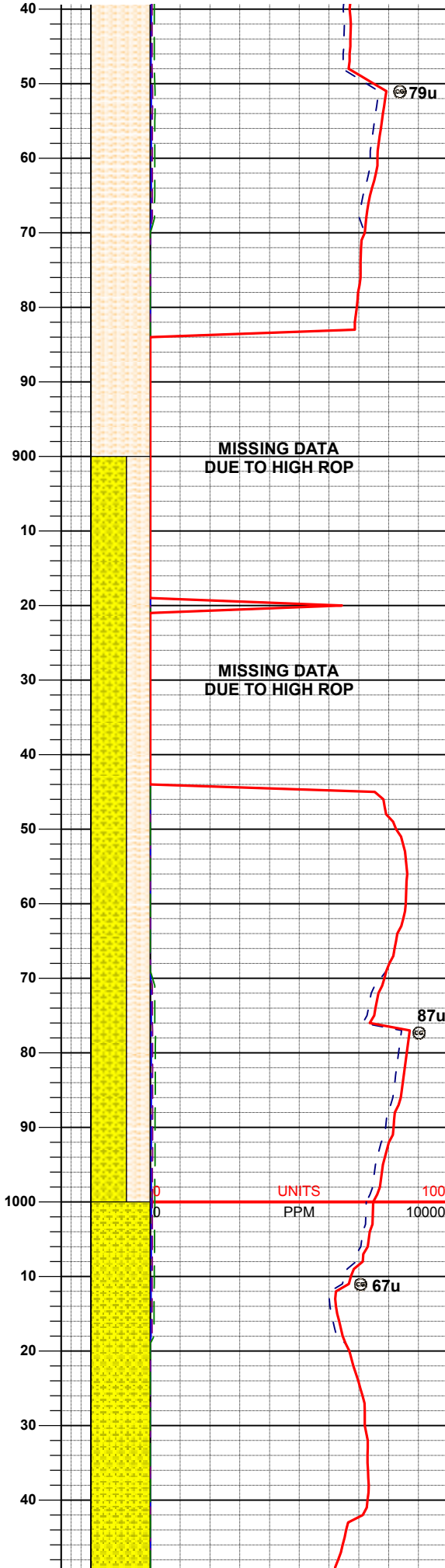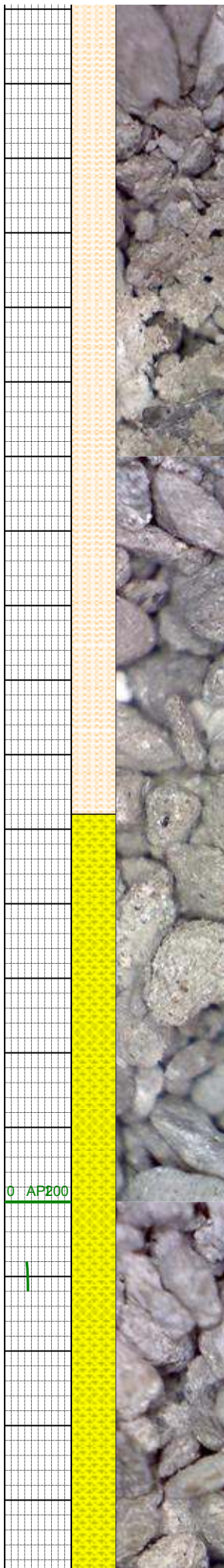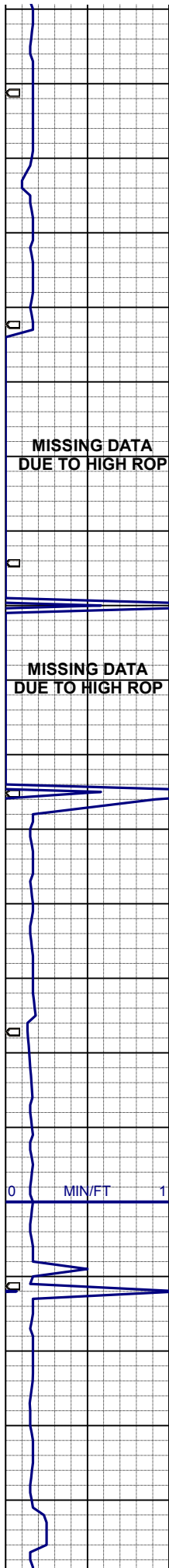CHROMATOGRAPH UNIT #0331
BEGAN LOGGING ON 03/30/2013

60u

62u

SHYSS: vlt-mgy- gybrn, trnsl- op, vf-fgr, sbrndd, psrt, vsft- sft, arg mtx, p cmt, sl calc, slty

| MD | 674' |
|---|---|
| INC | 0.7° |
| AZI | 337.7° |
| TVD | 674.0' |

BEGIN 100' SAMPLES
WITH 100' DESCRIPTIONS

SHSLTST: lt-mgy- gybrn, vf-fgr, sbrndd, occ sbplty, p srt, sft, argmtx, sl calc, slty, sdy ip, tr pyr, grdg- shyss

69u

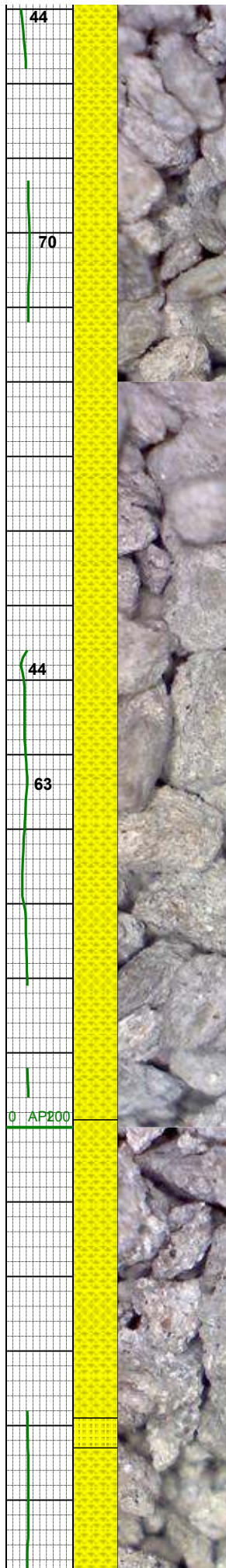| MD | 768' |
|---|---|
| INC | 0.5° |
| AZI | 4.6° |
| TVD | 768.0' |

78u

| 0 | MIN/FT | 1 |
|---|---|---|

| 0 | API | 200 |
|---|---|---|

| 0 | UNITS | 100 |
|---|---|---|
| 0 | PPM | 10000 |

MISSING DATA
DUE TO HIGH ROP

MISSING DATA
DUE TO HIGH ROP

MISSING DATA
DUE TO HIGH ROP

MISSING DATA
DUE TO HIGH ROP

| 40 |
| 50 |
| 60 |
| 70 |
| 80 |
| 90 |
| 900 |
| 10 |
| 20 |
| 30 |
| 40 |
| 50 |
| 60 |
| 70 |
| 80 |
| 90 |
| 1000 |
| 10 |
| 20 |
| 30 |
| 40 |

☺79u

☺87u

☺67u

0   MIN/FT   1       0   AP 200       0   UNITS   100
                                          PPM   10000
                                      0           10000

SHSLTST: lt-mgy- gybrn, vf-fgr, sbrndd, occ sbplty, p srt, sft- sl firm, arg mtx, sl calc, slty, sdy ip, tr pyr, grdg- shyss
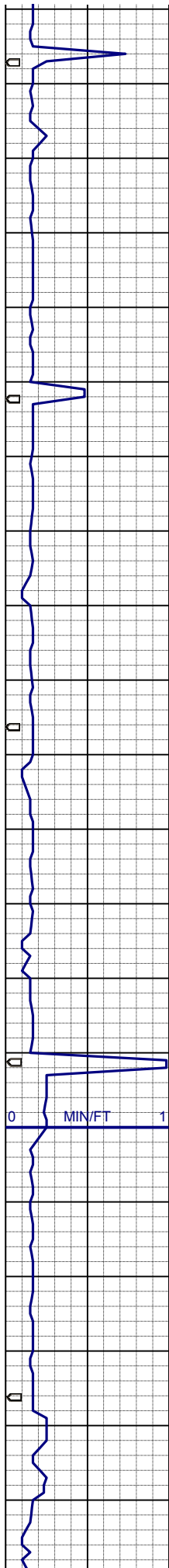
MD       863'
INC      0.4°
AZI      334.2°
TVD      863.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg-shysltst, occ clr- trnsl wh mgr ss w/ glau
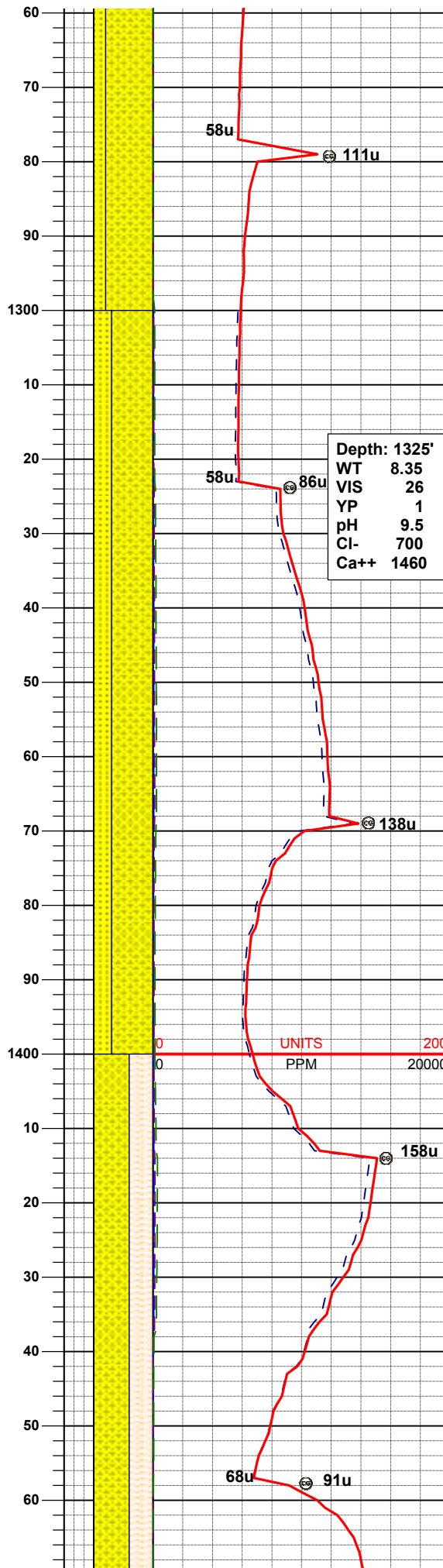
MD       960'
INC      0.4°
AZI      327.7°
TVD      960.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg-shysltst, occ clr- trnsl wh mgr ss w/ glau
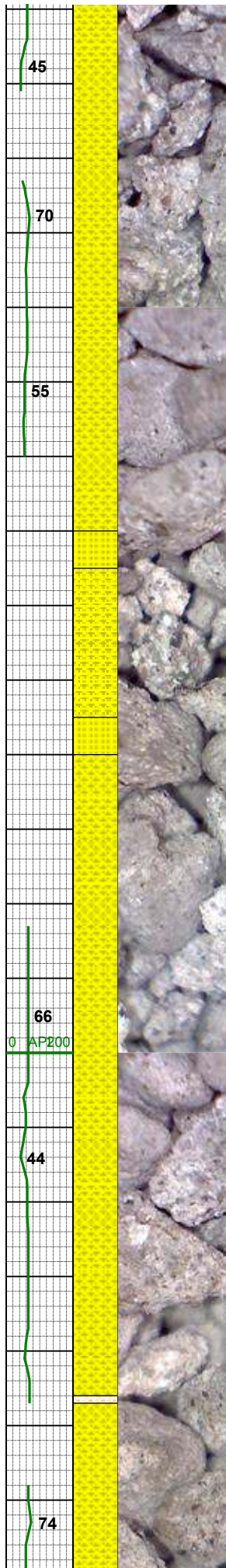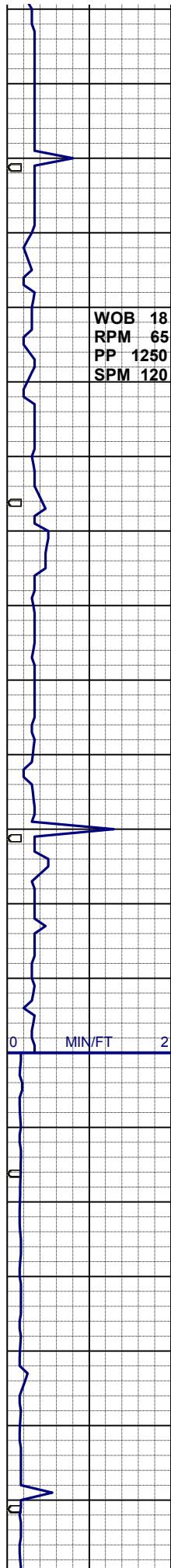
MD       1050'
INC      0.7°

44

70

44

63

44

0   MIN/FT   1

0   AP200

66u

91u

98u

62u

0          UNITS          200

GAS SCALE CHANGE

0          PPM          20000

96u

**MD       1140'**
**INC       0.6°**
**AZI       328.4°**
**TVD    1140.0'**

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst, occ clr- trnsl wh mgr ss w/ glau

**MD       1230'**
**INC       0.8°**
**AZI       9.2°**
**TVD    1230.0'**

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst
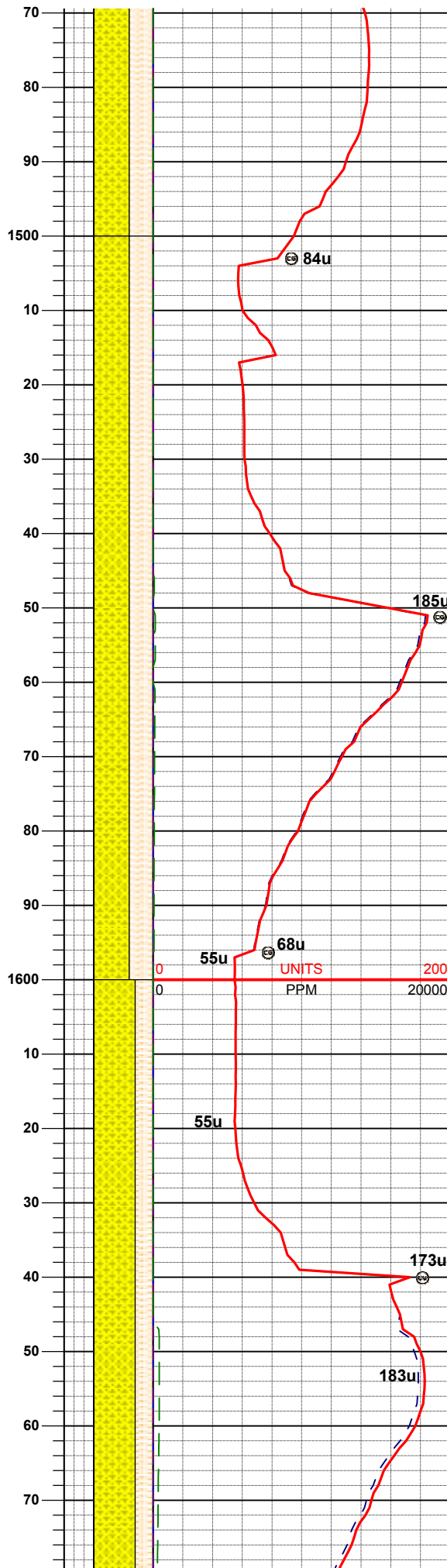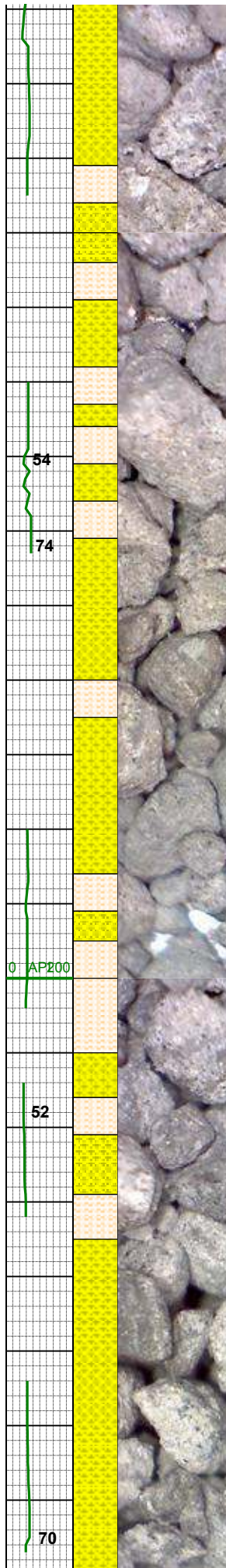SS: wh-mgy, clr- trnsl, f-mgr, sbblky, mod srt, fri, p cmt, arg- sil mtx, sl calc,

occ glau

WOB  18
RPM  65
PP  1250
SPM  120

45

70

55

66

0  AP100  200

44

74

0  MIN/FT  2

58u

111u

58u

86u

Depth: 1325'
WT    8.35
VIS    26
YP    1
pH    9.5
Cl-    700
Ca++  1460

138u

158u

68u

91u

0  UNITS  200
0  PPM  20000

MD    1320'
INC    0.7°
AZI    12.7°
TVD  1320.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-
fgr, sbrndd- sbblky, psrt, sft, arg mtx,
p cmt, sl calc, slty, tr glau, grdg-
shysltst
SS: wh-mgy, clr- trnsl, f-mgr, sbblky,
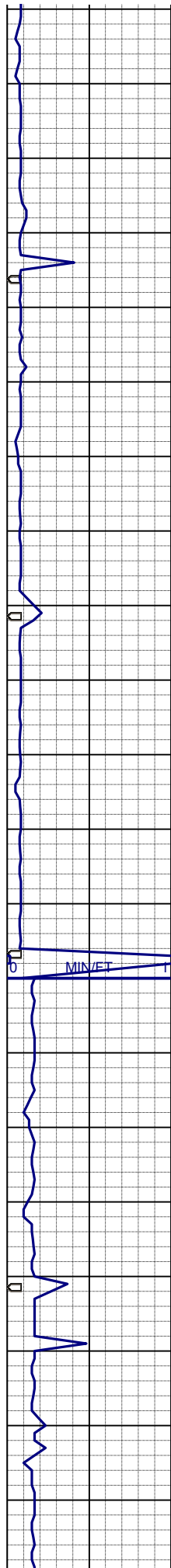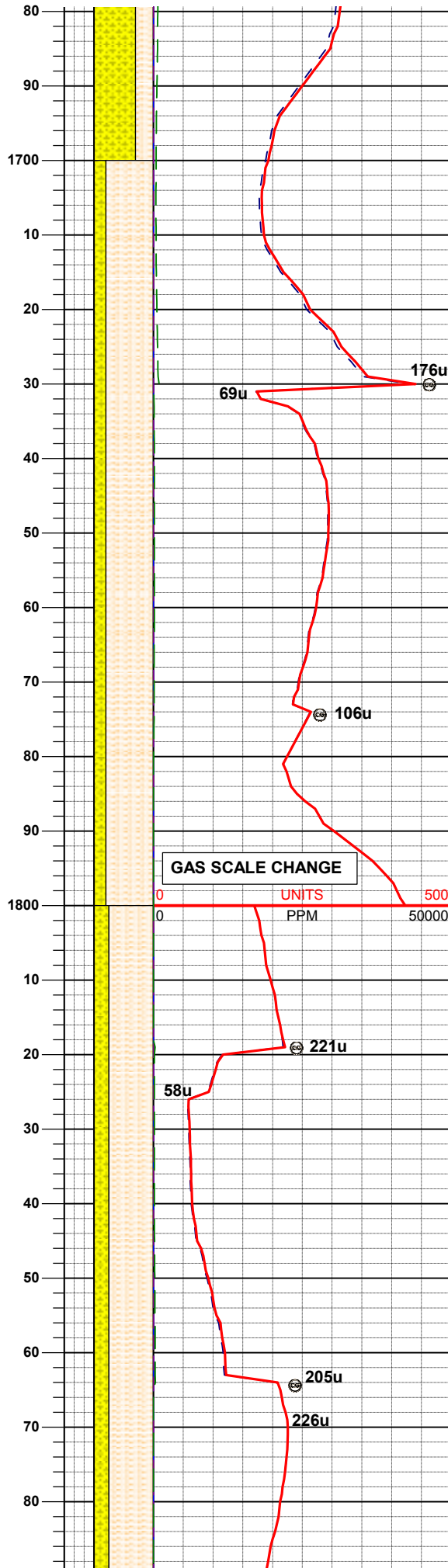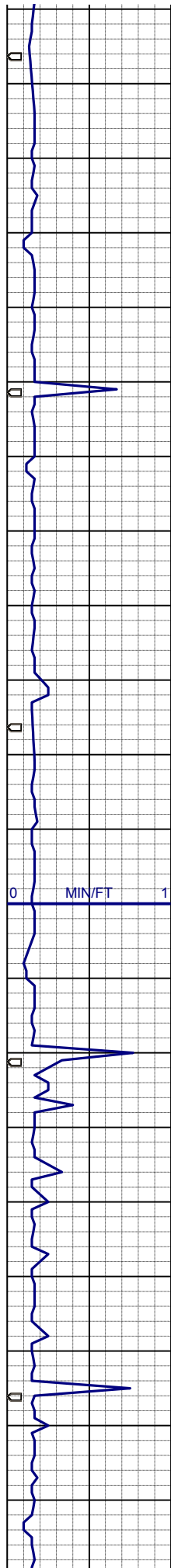mod srt, fri, p cmt, arg- sil mtx, sl calc,
occ glau

MD    1410'
INC    0.6°
AZI    340.9°
TVD  1410.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-
fgr, sbrndd- sbblky, psrt, sft, arg mtx,
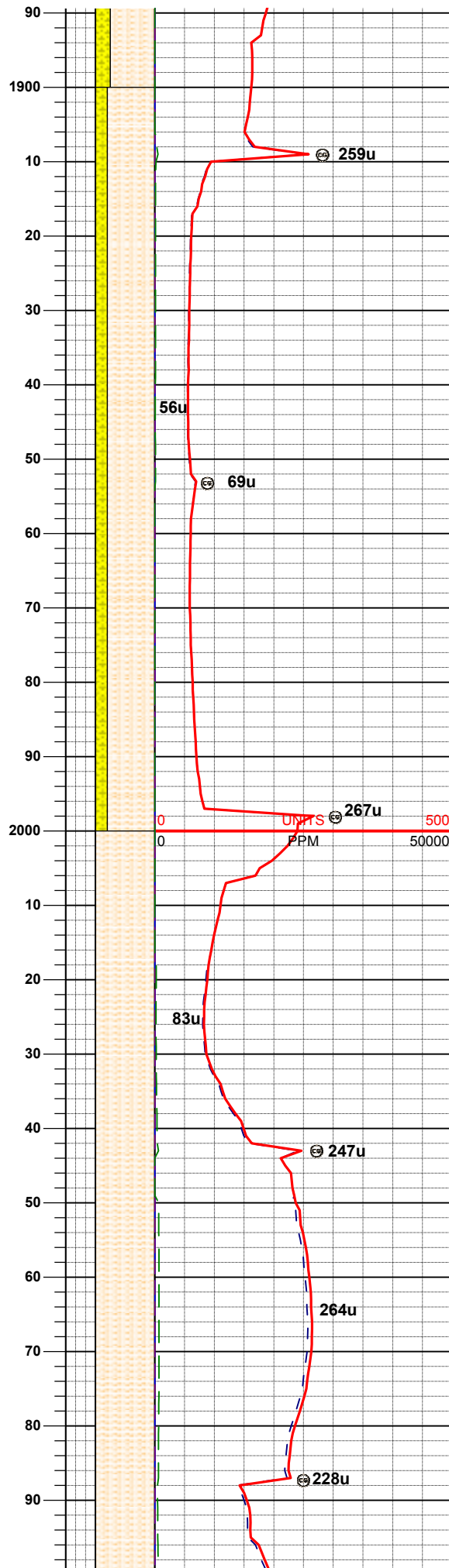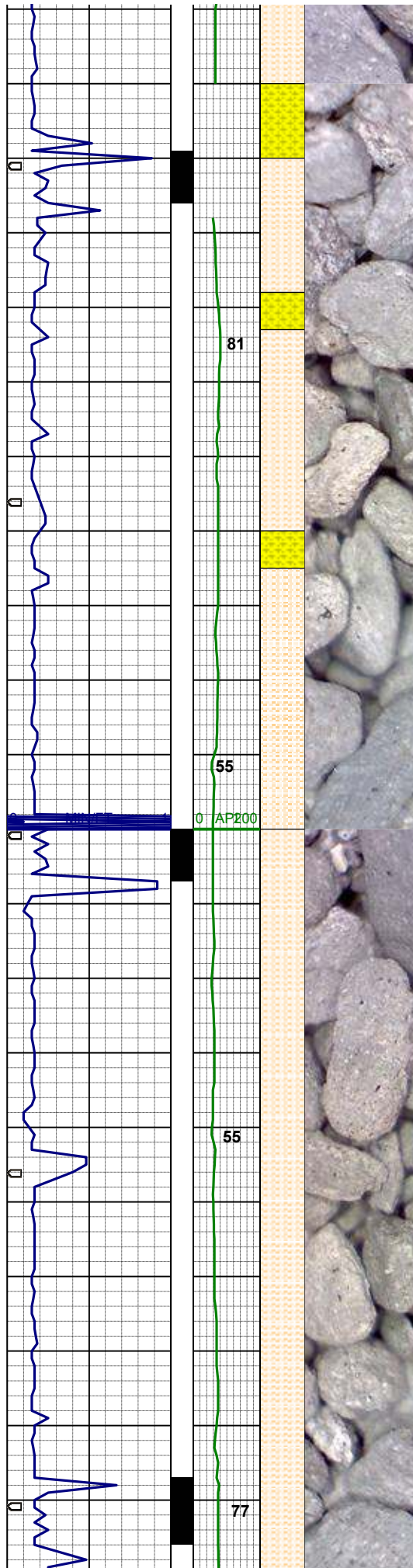p cmt, sl calc, slty, tr glau, grdg-
shysltst

MD      1500'
INC     0.8°
AZI     0.5°
TVD    1500.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst
SHSLTST: lt-mgy, vfgr-fgr, sbblky-sbplty, sft, arg mtx, sl calc, occ sdy ip

MD      1590'
INC     0.5°
AZI     3.5°
TVD    1590.0'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst
SHSLTST: lt-mgy, vfgr-fgr, sbblky-sbplty, sft, arg mtx, sl calc, occ sdy ip

MD      1680'
INC     0.4°

AZI 346.8°
TVD 1679.9'

63

81

106u

69u
176u

GAS SCALE CHANGE

0      MIN/FT      1    0   AP  200      0      UNITS      500
                                          0       PPM      50000

SHSLTST: lt-mgy-dkgy, vfgr-fgr,
sbblky-sbplty, sft, varg mtx, sl calc,
occ sdy ip, tr pyr
SHYSS: vlt-mgy- gybrn, trnsl -op, vf-
fgr, sbrndd- sbang, blky-sbblky, psrt,
sft, arg mtx, p cmt, sl calc, slty, tr
glau, grdg- shysltst

MD      1770'
INC      0.8°
AZI      21.3°
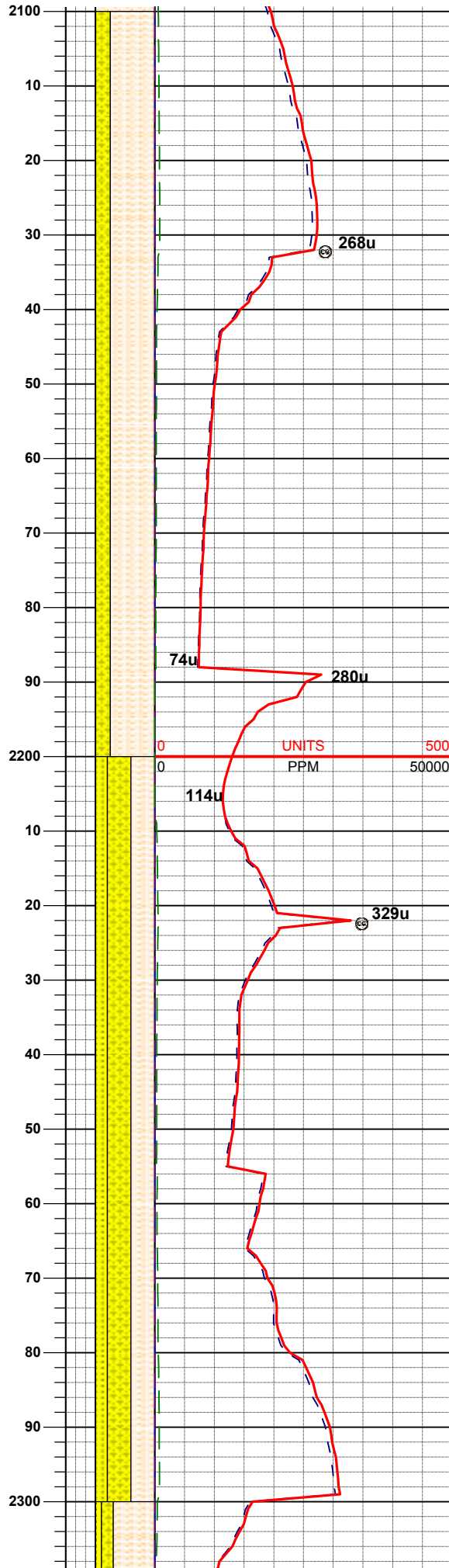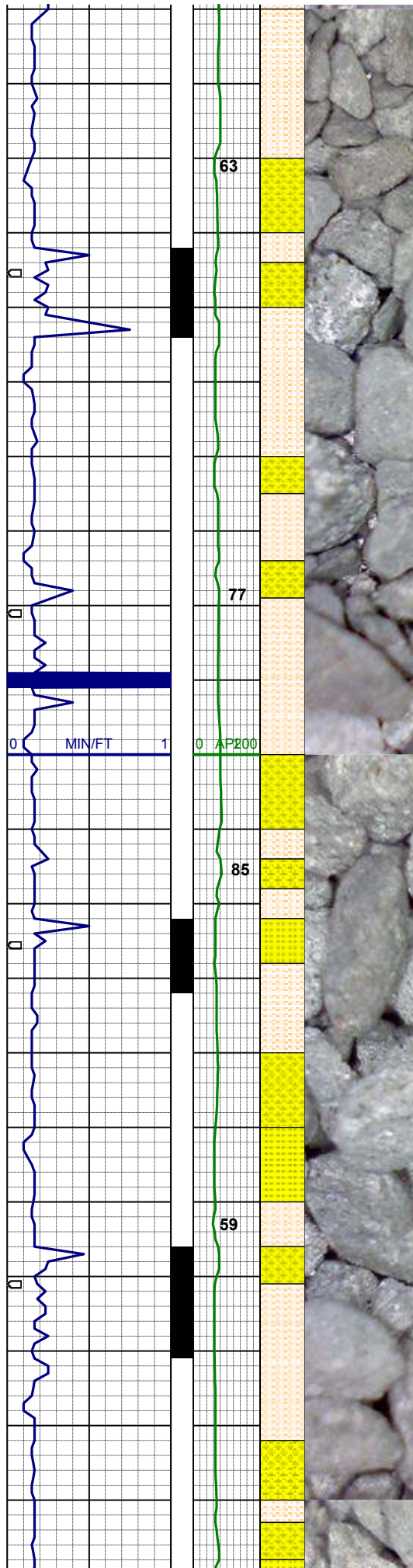TVD     1769.9'

221u

58u

96

66

205u

226u

SHSLTST: lt-mgy-dkgy, vfgr-fgr,
sbblky-sbplty, sft, varg mtx, sl calc,
occ sdy ip, tr pyr, tr dkgy sltysh, grdg-
sltysh
SHYSS: vlt-mgy- gybrn, trnsl -op, vf-
fgr, sbrndd- sbang, blky-sbblky, psrt,
sft, arg mtx, p cmt, sl calc, slty, tr
glau, grdg- shysltst

MD      1860'
INC      0.5°
AZI      37.3°
TVD     1859.9'

Depth track (left, TVD/MD scale):
90, 1900, 10, 20, 30, 40, 50, 60, 70, 80, 90, 2000, 10, 20, 30, 40, 50, 60, 70, 80, 90

Gamma/resistivity track labels: 81, 55, 0 AP 200, 55, 77

Gas/chromatography track annotations:
56u
69u
259u
267u
83u
247u
264u
228u

Scale bars: 0 UNITS 500, 0 PPM 50000

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh, grdg-sltysh

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst

| | |
|---|---|
| MD | 1949' |
| INC | 1.1° |
| AZI | 31.5° |
| TVD | 1948.9' |

| | |
|---|---|
| MD | 2039' |
| INC | 1.1° |
| AZI | 44.7° |
| TVD | 2038.9' |

SHSLTST: lt-mgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh

**WT 8.40 / VIS 27**

**Track scales:**
- 0 MIN/FT 1
- 0 AP200 (gamma)
- 0 UNITS 500 / 0 PPM 50000

**Depth markers (left cuttings track, green numbers):** 63, 77, 85, 59

**Gas/chromatograph annotations:**
- 268u (at ~2132')
- 74u / 280u (at ~2190')
- 114u (at ~2202')
- 329u (at ~2222')

**Survey data:**

MD 2129'
INC 2.0°
AZI 52.8°
TVD 2128.9'

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh, grdg-sltysh

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst

MD 2219'
INC 2.5°
AZI 55.0°
TVD 2218.8'

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh, grdg-sltysh

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx, grdg-shyss
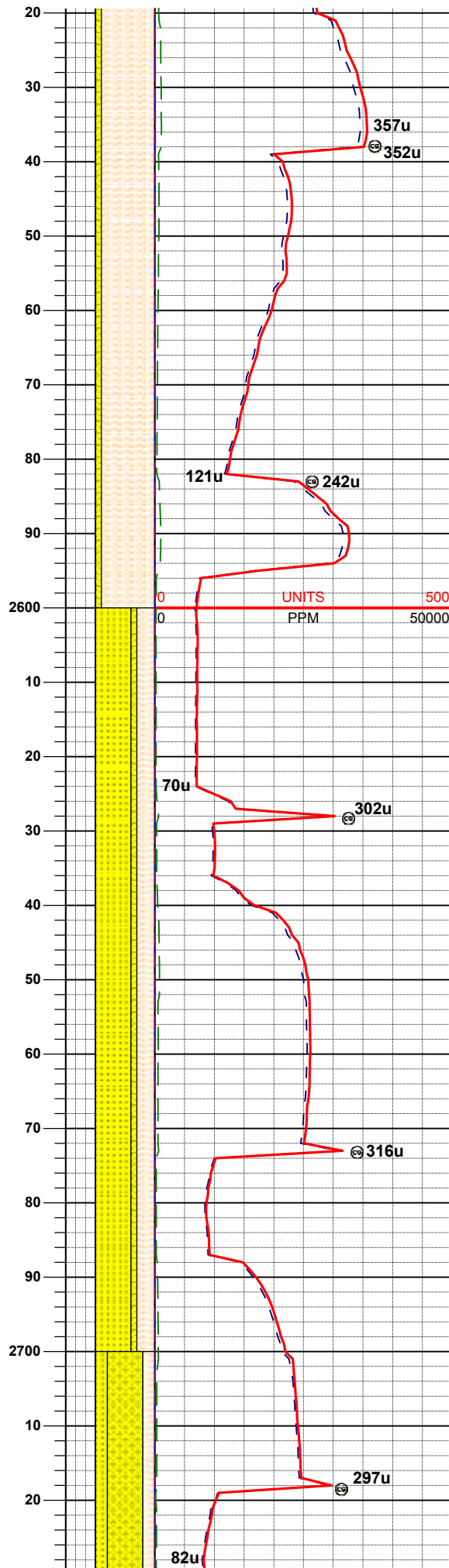
MD 2309'
INC 3.7°
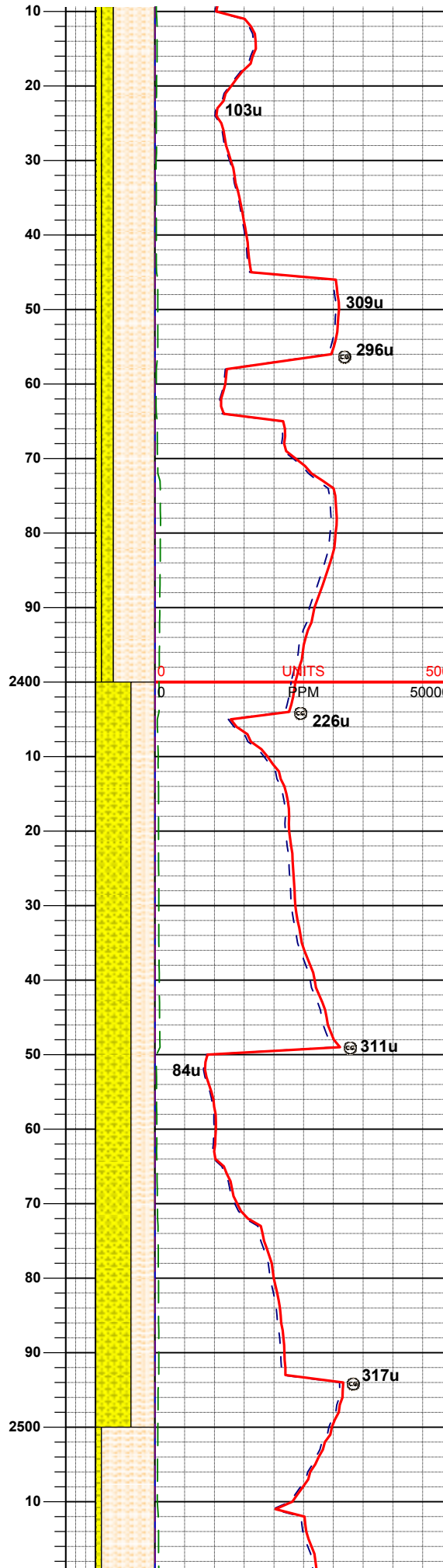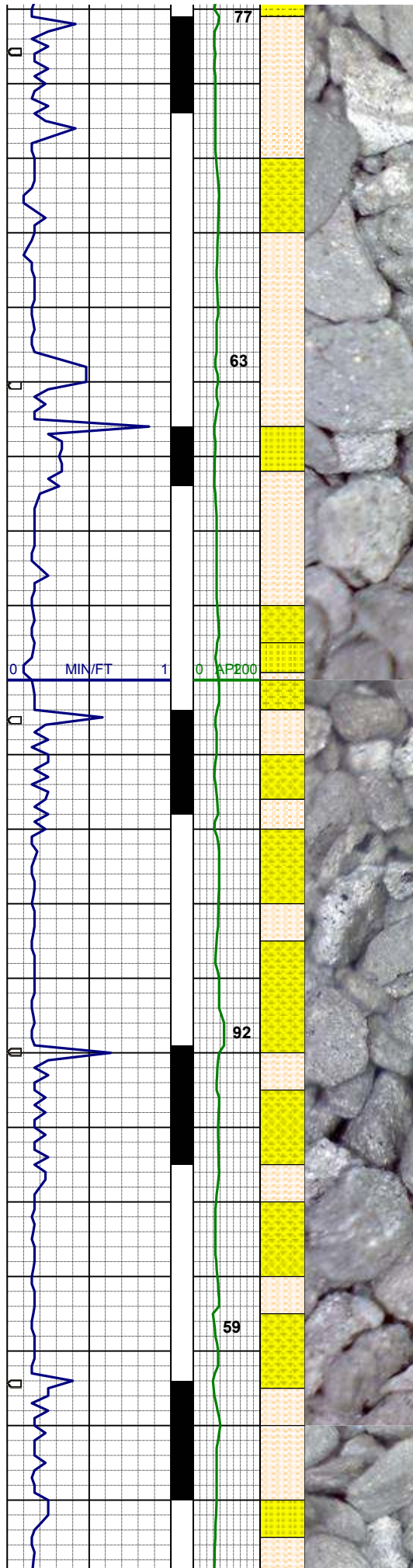
103u

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh, grdg-sltysh

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx, grdg-shyss
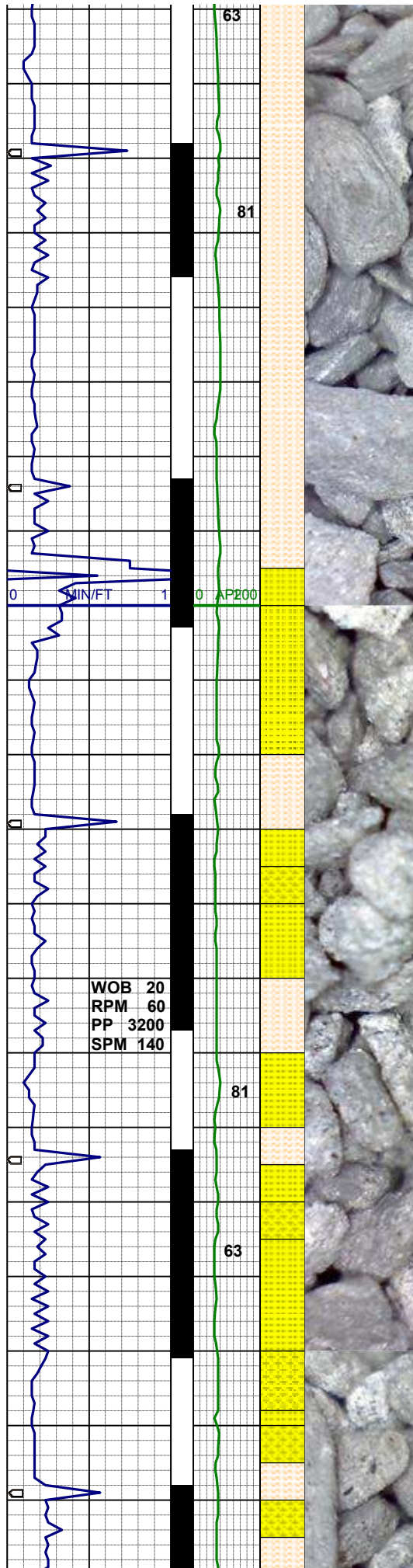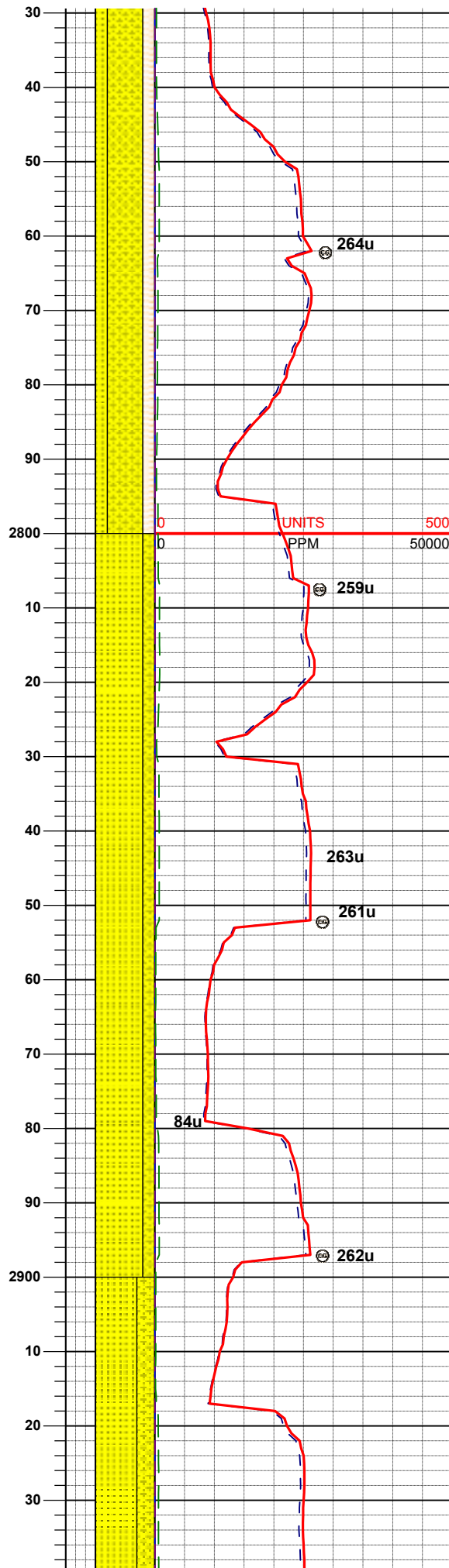
309u

296u

0 MIN/FT 1    0 AP200

0 UNITS 500

0 PPM 50000

**WT 8.50 / VIS 30**

| MD | 2398' |
|---|---|
| INC | 4.4° |
| AZI | 54.2° |
| TVD | 2397.5' |

226u

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst, tr fos

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr dkgy sltysh, grdg-sltysh

311u

84u

| MD | 2488' |
|---|---|
| INC | 5.5° |
| AZI | 58.0° |
| TVD | 2487.1' |

317u

77

63

92

59

77

## Track Headers

| 0   MIN/FT   1 | 0   API   200 |

WOB   20
RPM   60
PP   3200
SPM   140

Track values: 63, 81, 81, 63

Gas scale:
0   UNITS   500
0   PPM   50000

## Gas Annotations

357u
352u
121u   242u
70u
302u
316u
297u
82u

## Lithology Descriptions

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr dkgy sltysh, grdg-sltysh
SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, grdg-shysltst
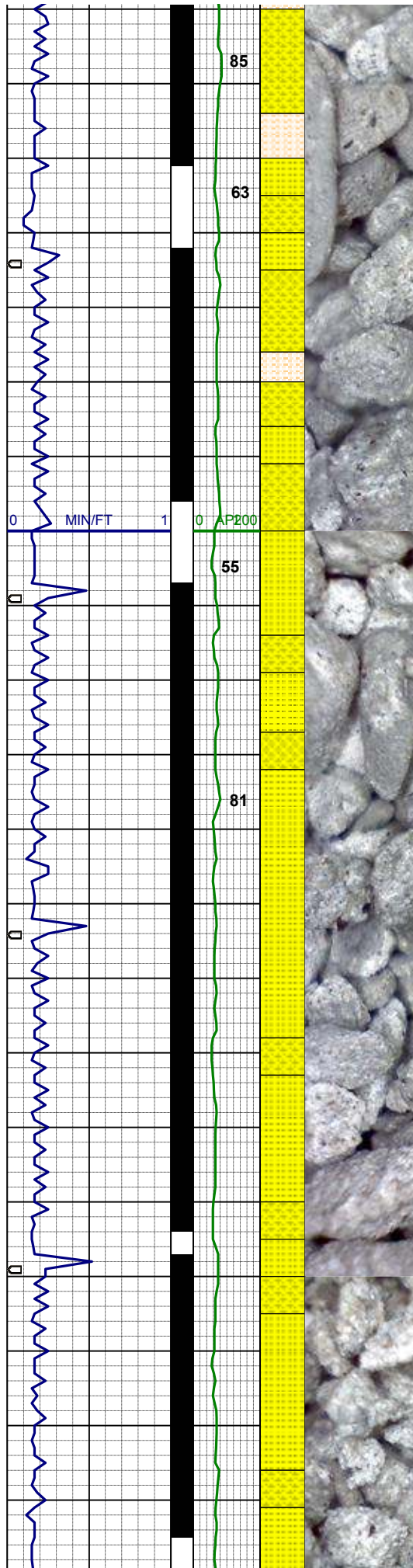
MD        2578'
INC        6.0°
AZI        56.6°
TVD      2576.7'

**WT 8.50 / VIS 29**

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx,
SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr pyr, tr dkgy sltysh, grdg-sltysh
SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst

MD        2668'
INC        7.0°
AZI        53.6°
TVD      2666.1'

SHYSS: vlt-mgy- gybrn, trnsl -op, vf-fgr, sbrndd- sbang, blky-sbblky, psrt,

Depth scale: 20, 30, 40, 50, 60, 70, 80, 90, 2600, 10, 20, 30, 40, 50, 60, 70, 80, 90, 2700, 10, 20
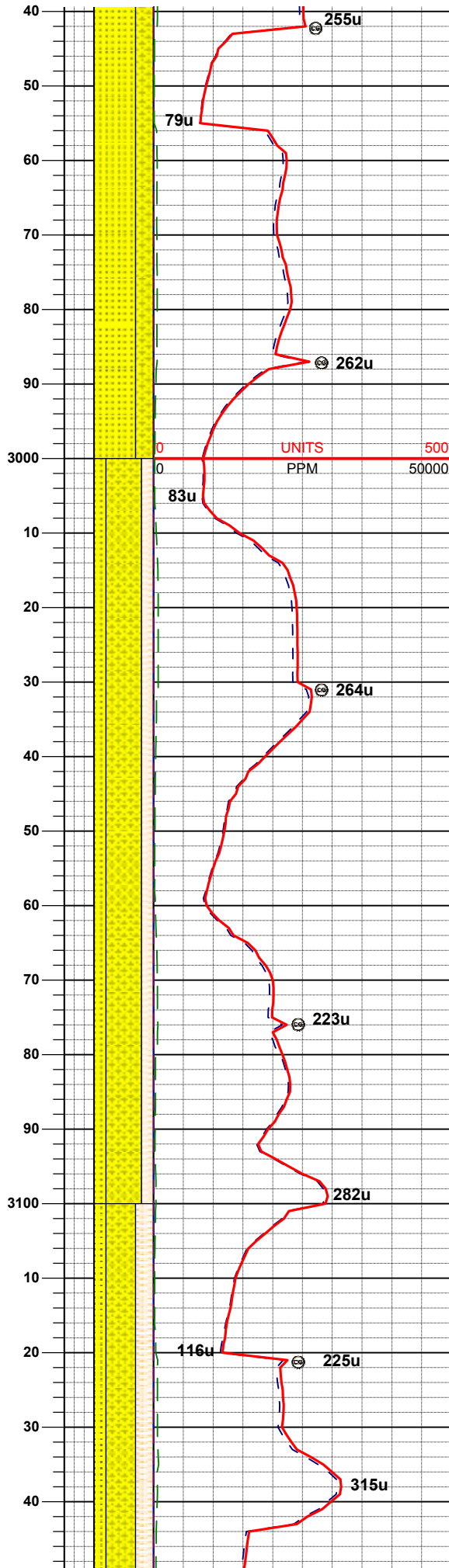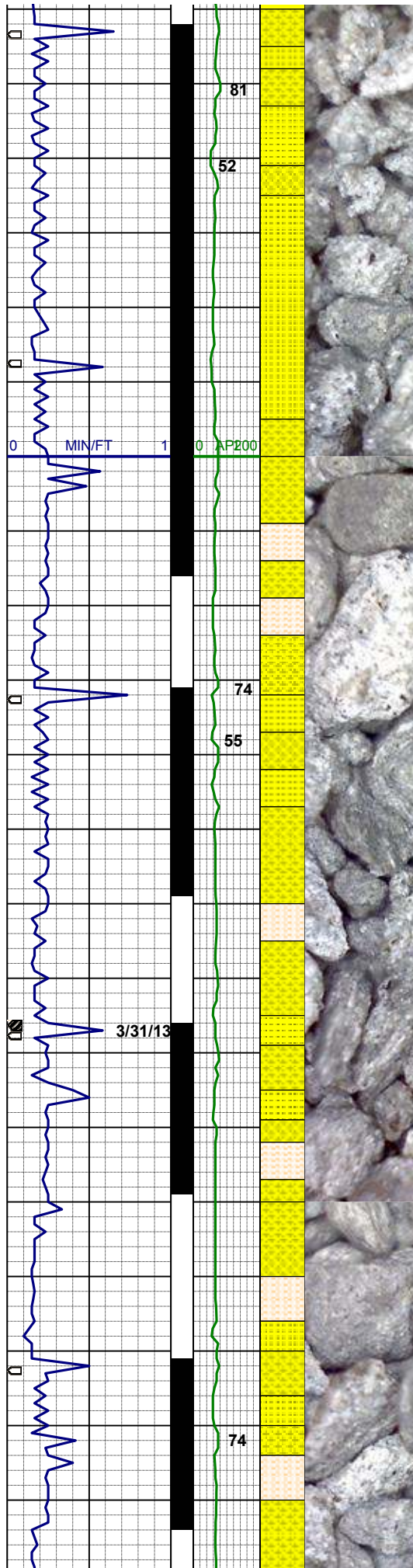
fgr, sbrndd- sbang, blky-sbblky, psrt,
sft, arg mtx, p cmt, sl calc, slty, tr
glau, grdg- shysltst
SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-
sbang, blky-sbblky, modsrt, sft-firm, sl
arg-sil mtx,
SHSLTST: lt-mgy-dkgy, vfgr-fgr,
sbblky-sbplty, sft, varg mtx, sl calc,
occ sdy ip, tr pyr, tr dkgy sltysh, grdg-
sltysh

| | |
|---|---|
| MD | 2757' |
| INC | 8.0° |
| AZI | 51.3° |
| TVD | 2754.3' |

| | |
|---|---|
| MD | 2847' |
| INC | 9.2° |
| AZI | 50.1° |
| TVD | 2843.3' |

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-
sbang, blky-sbblky, modsrt, sft-firm, sl
arg-sil mtx, tr glauc, tr pyr, tr mica
SHYSS: vlt-mgy, trnsl -op, vf- fgr,
sbrndd- sbang, blky-sbblky, psrt, sft,
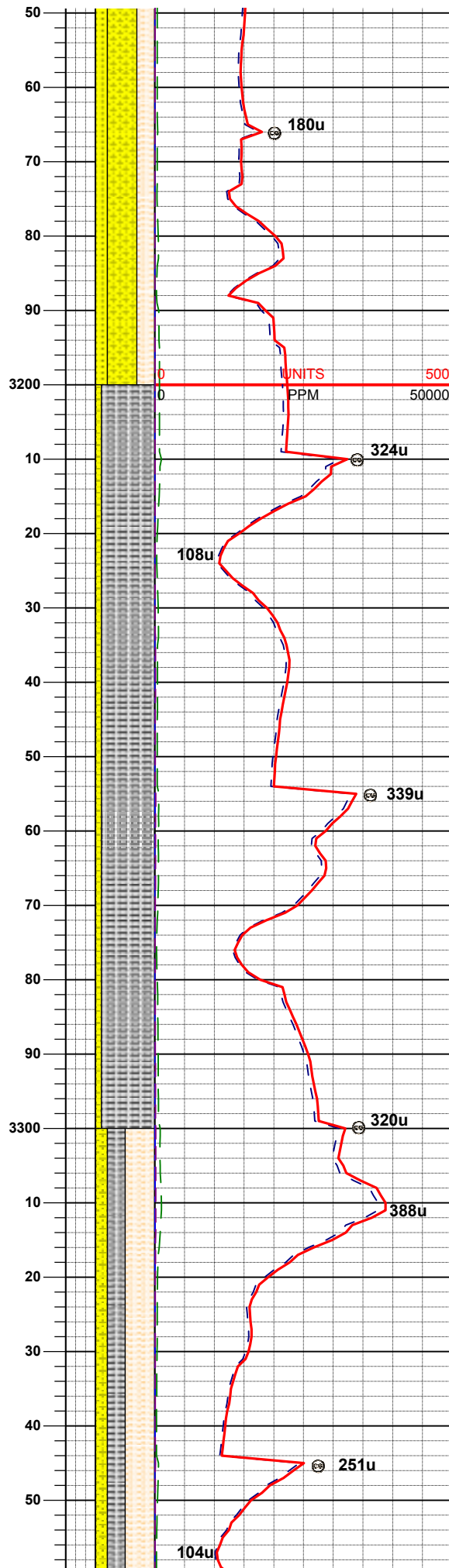arg mtx, p cmt, sl calc, slty, grdg-
shysltst

| | |
|---|---|
| MD | 2936' |
| INC | 10.4° |
| AZI | 48.0° |
| TVD | 2931.0' |

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx, tr glauc, tr pyr, tr mica
SHYSS: vlt-mgy, trnsl -op, vf- fgr, sbrndd- sbang, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, grdg-shysltst
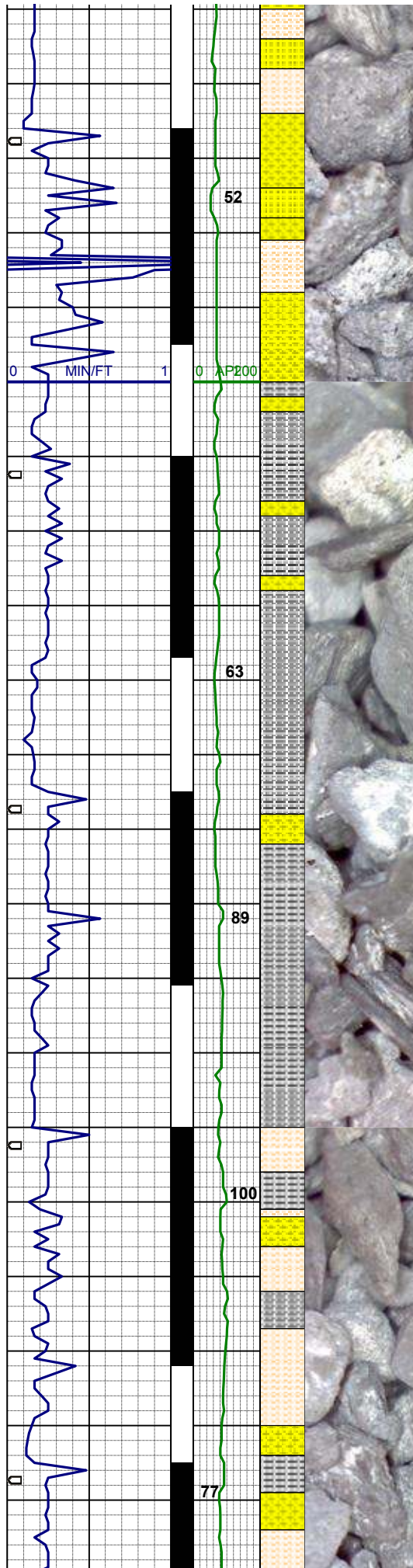
**WT 8.55 / VIS 30**

| | |
|---|---|
| MD | 3026' |
| INC | 11.3° |
| AZI | 46.4° |
| TVD | 3019.4' |

SHYSS: lt-dkgy, trnsl -op, vf- fgr, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst
SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx,
SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr dkgy sltysh, grdg-sltysh

| | |
|---|---|
| MD | 3116' |
| INC | 11.4° |
| AZI | 46.4° |
| TVD | 3107.6' |

SHYSS: lt-dkgy, trnsl -op, vf- fgr, blky-sbblky, psrt, sft, arg mtx, p cmt, sl calc, slty, tr glau, grdg- shysltst
SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx,

SHSLTST: lt-mgy-dkgy, vfgr-fgr, sbblky-sbplty, sft, varg mtx, sl calc, occ sdy ip, tr dkgy sltysh, grdg-sltysh

52

63

89

100

77

0 MIN/FT 1

0 API 200

50
60
70
80
90
3200
10
20
30
40
50
60
70
80
90
3300
10
20
30
40
50

0 UNITS 500
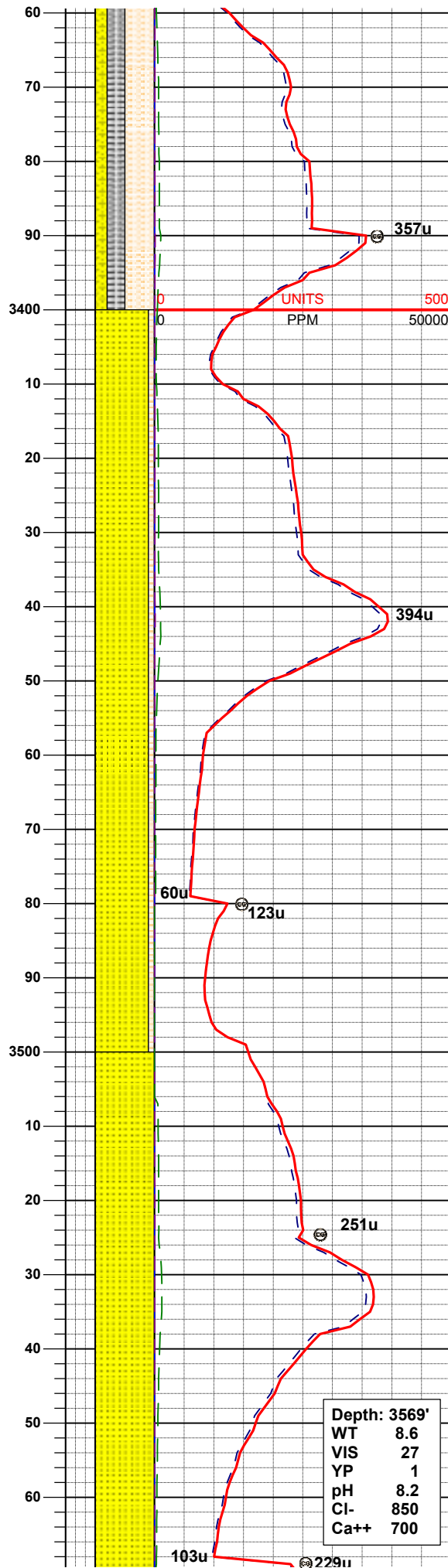0 PPM 50000

180u
324u
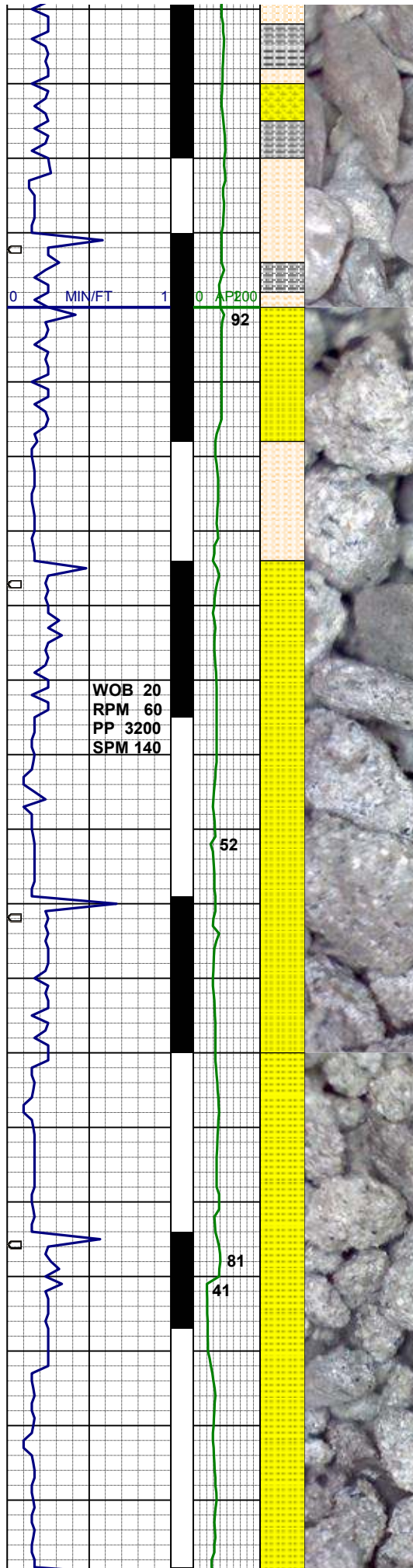108u
339u
320u
388u
251u
104u

MD 3206'
INC 11.1°
AZI 44.7°
TVD 3195.9'

SLTYSH: lt-dkgy, vfgr-fgr, sbplty-plty, occ sbblky, stf, arg mtx
SHYSS: lt-dkgy, trnsl -op, vf- fgr, blky-sbblky, psrt, sft, arg mtx, sl calc, slty

MD 3296'
INC 10.2°
AZI 47.7°
TVD 3284.4'

WT 8.5 / VIS 28

SHSLTST: lt-mgy, vfgr-fgr,sbblky-sbplty, sft, arg mtx, sl calc, occ sdy ip, grdg-sltysh, tr pyr
SLTYSH: lt-dkgy, vfgr-fgr, sbplty-plty, occ sbblky, stf, arg mtx
SHYSS: lt-dkgy, trnsl -op, vf- fgr, blky-sbblky, psrt, sft, arg mtx, sl calc, slty

0  MIN/FT  1    0  AP 200

**WOB 20**
**RPM 60**
**PP 3200**
**SPM 140**

92

52

81
41

0  UNITS  500
0  PPM  50000

357u

394u

60u
123u

251u

103u  229u

**MD    3385'**
**INC    12.2°**
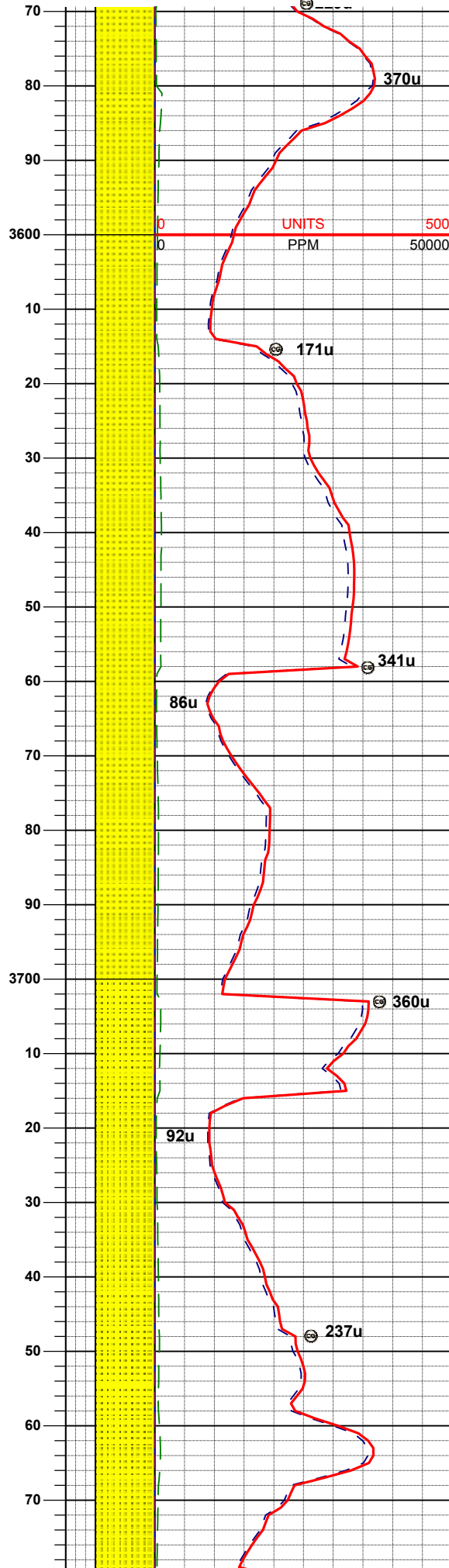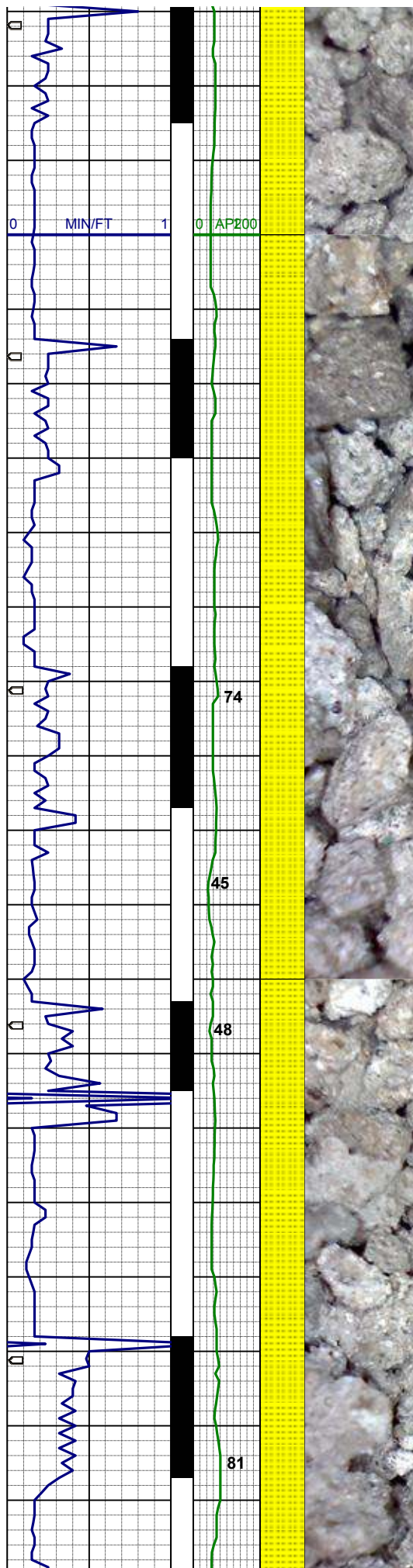**AZI    62.4°**
**TVD   3371.7'**

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx, tr glauc
SHSLTST:lt-mgy-dkgy, vfgr-fgr,sbblky-sbplty, sft, arg mtx, occ sdy ip, grdg-sltysh

**MD    3475'**
**INC    13.7°**
**AZI    60.0°**
**TVD   3459.4'**

| Depth: 3569' | |
|---|---|
| WT | 8.6 |
| VIS | 27 |
| YP | 1 |
| pH | 8.2 |
| Cl- | 850 |
| Ca++ | 700 |

SS: wh-ltgy, trnsl-op, fgr-mgr, sbrndd-sbang, blky-sbblky, modsrt, sft-firm, sl arg-sil mtx, tr glauc, tr sltysh-shyss
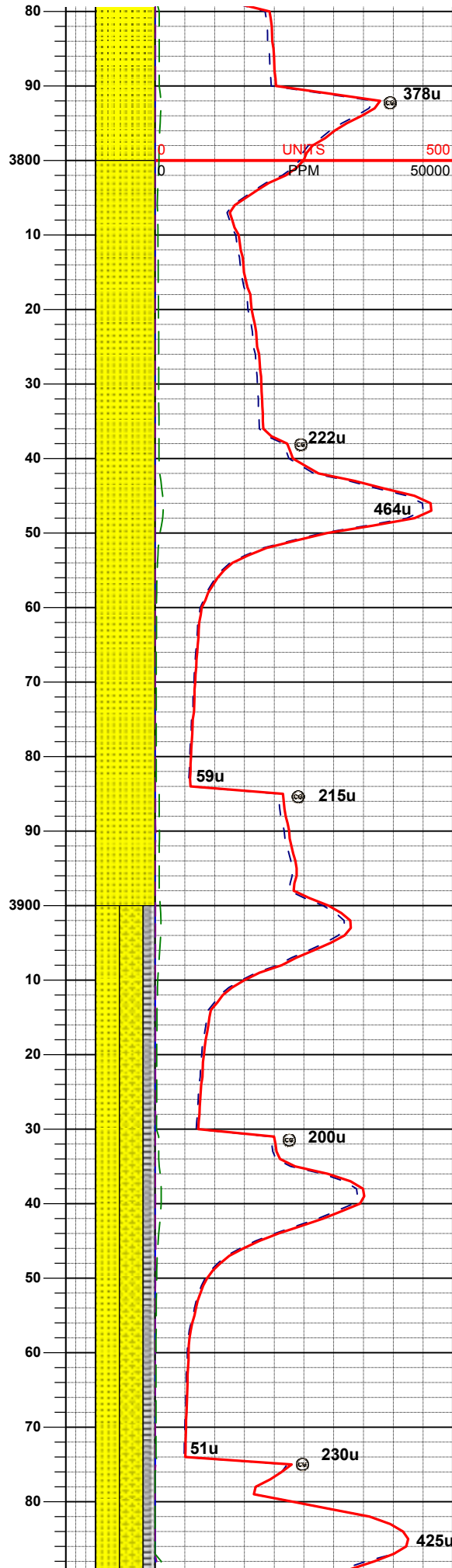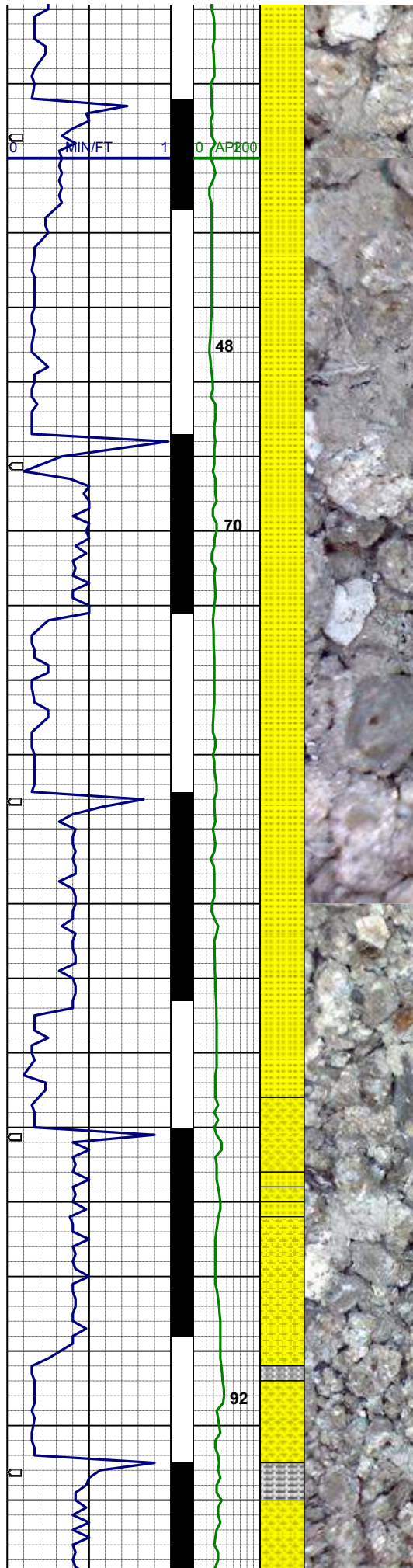
**MD    3565'**
**INC    14.3°**
**AZI    55.4°**
**TVD   3546.7'**

MIN/FT 0 — 1

0 AP200

0 UNITS 500
0 PPM 50000

370u
171u
341u
86u
360u
92u
237u

74
45
48
81

SS: wh- mgy- gybrn, clr- trnsl, f- mgr,
sbrndd- sbang, mod srt, sft-mfirm, fri,
p cmt, arg-sil mtx, occ glauc

| | |
|---|---|
| MD | 3655' |
| INC | 15.1° |
| AZI | 51.0° |
| TVD | 3633.8' |

WT 8.5 / VIS 31

| | |
|---|---|
| MD | 3745' |
| INC | 14.4° |
| AZI | 48.0° |
| TVD | 3720.8' |

SS: wh- mgy- gybrn, clr- trnsl, f- mgr,
sbrndd- sbang, mod srt, sft-mfirm, fri,
p cmt, arg-sil mtx

0  MIN/FT  1    0  API  200    UNITS  0  500

PPM  0  50000

48

70

92

3800

3900

378u

222u

464u

59u

215u
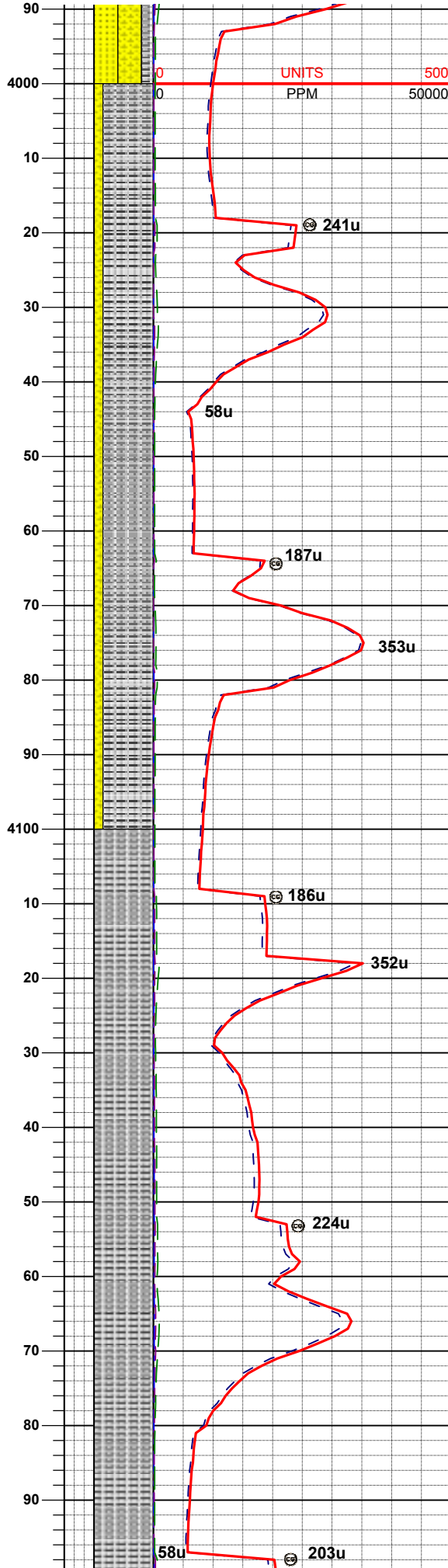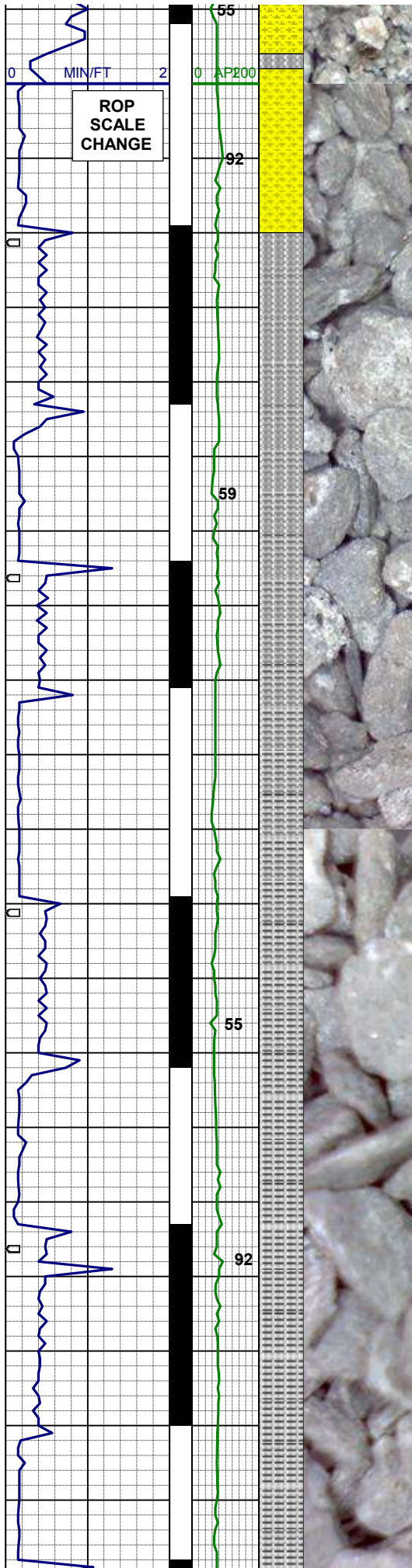
200u

51u

230u

425u

MD     3835'
INC    13.1°
AZI    43.1°
TVD    3808.2'

SS: wh- mgy- gybrn, clr- trnsl, f- mgr,
sbrndd- sbang, mod srt, sft-mfirm, fri,
p cmt, arg-sil mtx

MD     3925'
INC    11.1°
AZI    42.2°
TVD    3896.2'

SS: wh- mgy- gybrn, clr- trnsl, f- mgr,
sbrndd- sbang, mod srt, sft-mfirm, fri,
p cmt, arg-sil mtx, occ glau
SHYSS: mgy, trnsl -op, vf- fgr, sbblky-
sbplty, psrt, sft- sl firm, arg mtx, sl
calc, slty, occ pyr, grdg- sltysh

## Track Headers

| 0 | MIN/FT | 2 | 0 | AP200 | | | 0 | UNITS | 500 |

**ROP SCALE CHANGE**

PPM: 0 — 50000

## Depth Track (left gamma/ROP section)

- 55
- 92
- 59
- 55
- 92

## Depth markings (right track)

- 90
- 4000
- 10
- 20 — 241u
- 30
- 40
- 58u
- 50
- 60
- 187u
- 70
- 353u
- 80
- 90
- 4100
- 10 — 186u
- 20 — 352u
- 30
- 40
- 50 — 224u
- 60
- 70
- 80
- 90
- 58u — 203u

## Survey Data

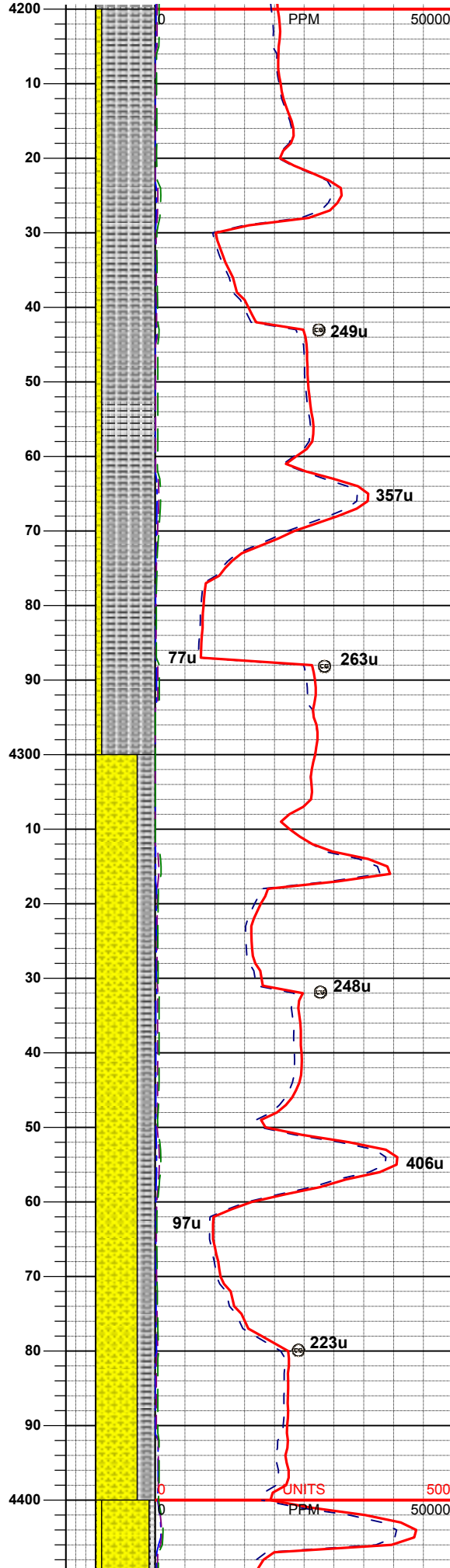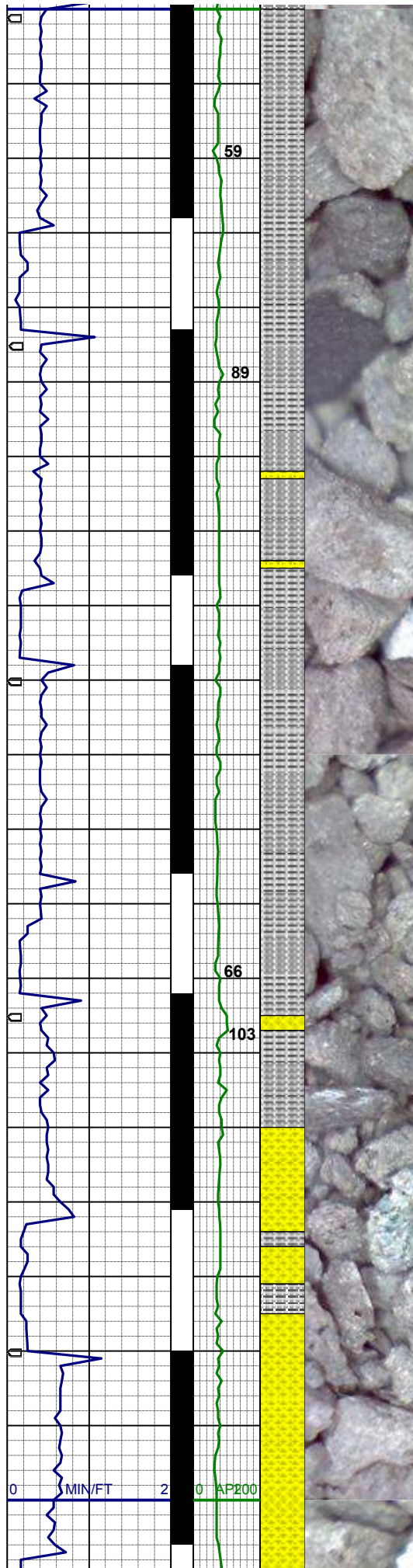| MD | 4015' |
|---|---|
| INC | 8.8° |
| AZI | 39.9° |
| TVD | 3984.9' |

SLTYSH: mgy- gybrn, sft- mod firm, sbrndd- sbplty, occ sbblky, gt tex, sdy ip, sl calc, occ pyr, grdg- shyss

| MD | 4105' |
|---|---|
| INC | 7.0° |
| AZI | 36.2° |
| TVD | 4074.0' |

SLTYSH: mgy- gybrn, sft- mod firm, sbrndd- sbplty, occ sbblky, gt tex, sdy ip, sl calc, occ pyr, grdg- shyss

**WT 8.4 / VIS 29**

| MD | 4194' |
|---|---|
| INC | 6.2° |
| AZI | 22.7° |
| TVD | 4162.4' |

4200
10
20
30
40
50
60
70
80
90
4300
10
20
30
40
50
60
70
80
90
4400

59

89

66

103

0   MIN/FT   2

0   API   200

0   PPM   50000

249u

357u

77u   263u

248u

406u

97u

223u

0   UNITS   500

0   PPM   50000

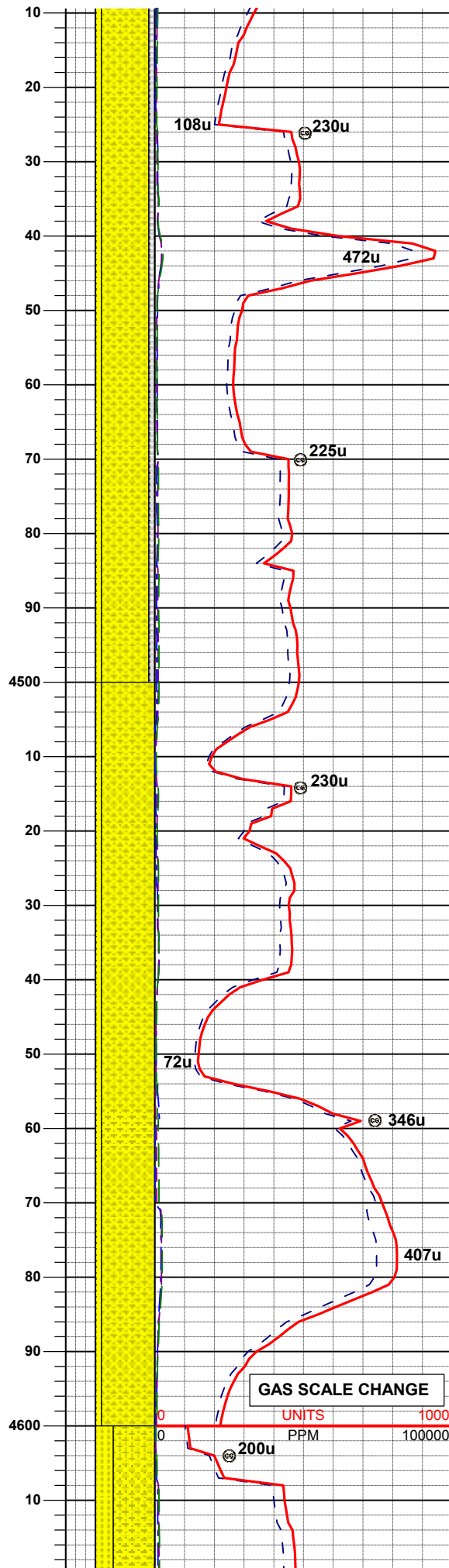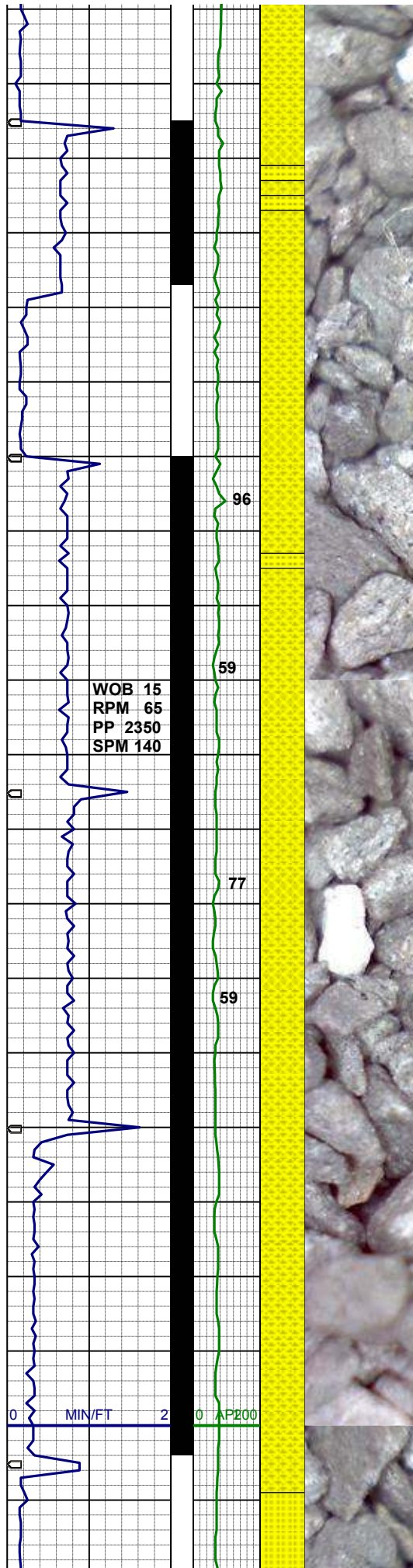SLTYSH: lt- mgy, sft- mod firm, sbrndd- sbplty, occ sbblky, gt tex, sdy ip, sl calc, tr pyr, tr fos frag, grdg- shyss

SHYSS: lt- mgy, trnsl -op, fgr, sbblky- sbplty, mod srt, sft- sl firm, arg mtx, sl calc, slty, grdg- sltysh, occ wh cl- trnsl mgr ss w/ glau

| MD | 4284' |
| INC | 4.0° |
| AZI | 8.3° |
| TVD | 4252.1' |

WT 8.4 / VIS 28

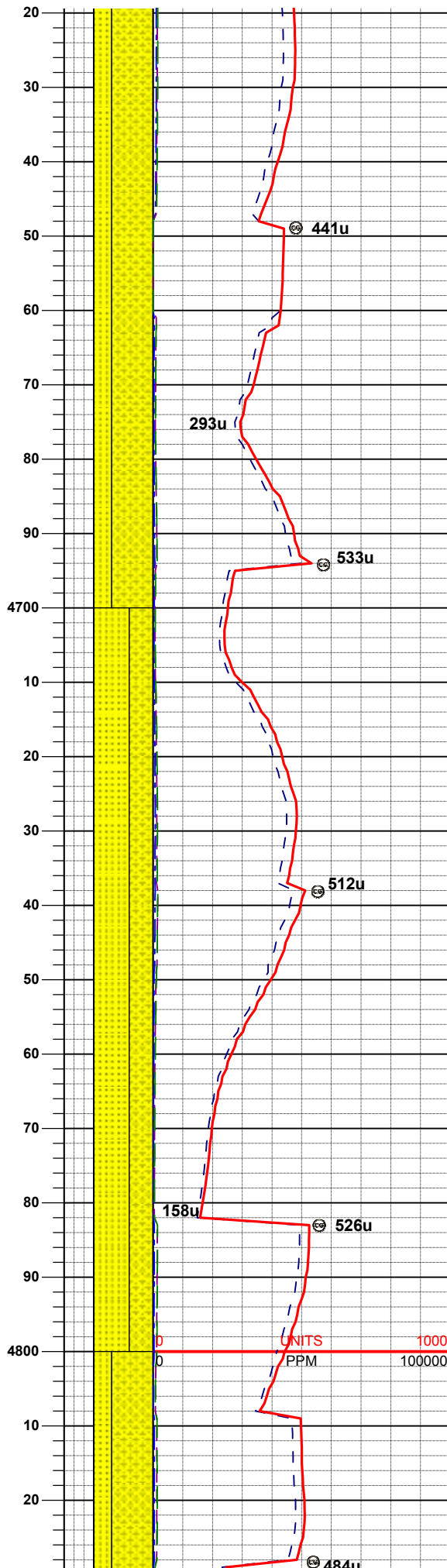| MD | 4374' |
| INC | 3.0° |
| AZI | 359.8° |
| TVD | 4341.9' |

SHYSS: lt- mgy, trnsl -op, fgr, sbblky-sbplty, mod srt, sft- sl firm, arg mtx, sl calc, slty, grdg- sltysh
SS: wh- mgy, clr- trnsl, f- mgr, sbblky-sbang, p- mod srt, sft-mfirm, fri, p cmt, arg-sil mtx

**WT 8.4 / VIS 29**

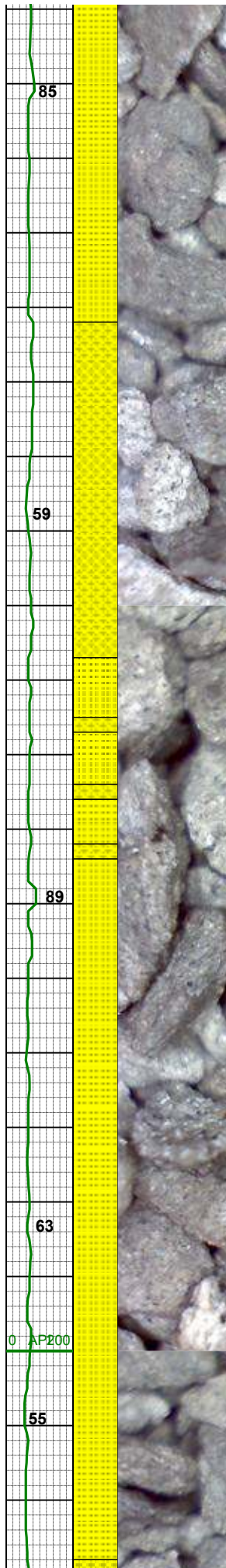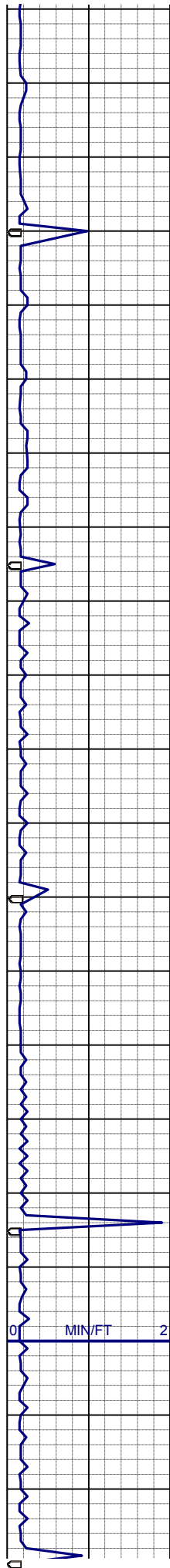| | |
|---|---|
| **MD** | **4464'** |
| **INC** | **2.4°** |
| **AZI** | **348.9°** |
| **TVD** | **4431.8'** |

SHYSS: lt- mgy, trnsl -op, fgr, sbblky-sbplty, mod srt, sft- sl firm, arg mtx, sl calc, slty, grdg- sltysh
SS: wh- mgy, clr- trnsl, f- mgr, sbblky-sbang, p- mod srt, sft-mfirm, fri, p cmt, arg-sil mtx

| | |
|---|---|
| **MD** | **4554'** |
| **INC** | **1.4°** |
| **AZI** | **341.9°** |
| **TVD** | **4521.7'** |

WOB 15
RPM 65
PP 2350
SPM 140

96
59
77
59

0   MIN/FT   2
0   AP  200

108u
230u
472u
225u
230u
72u
346u
407u

**GAS SCALE CHANGE**

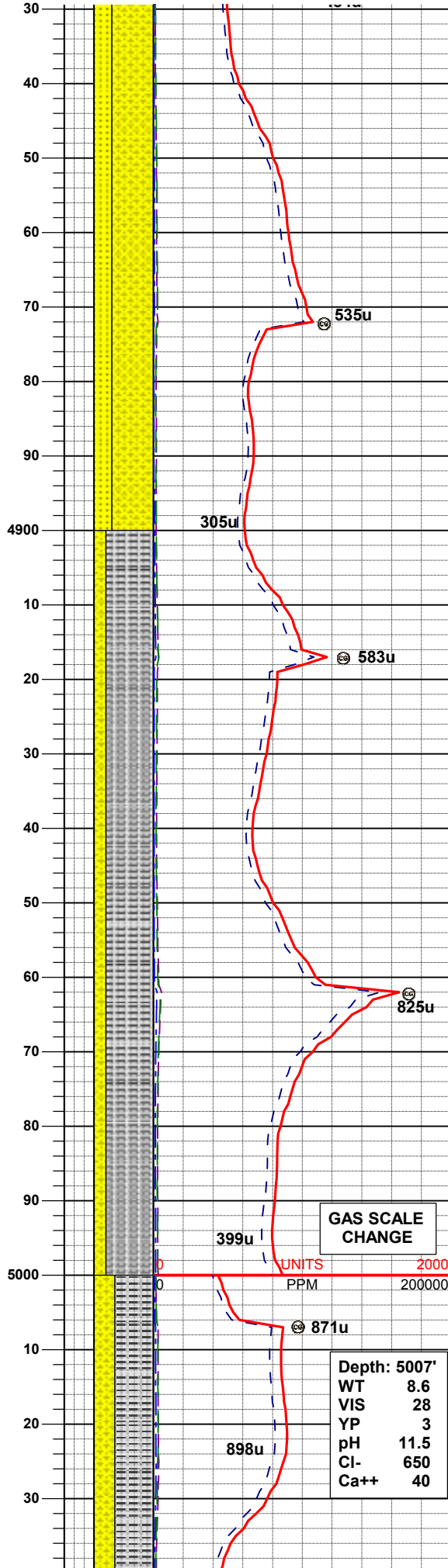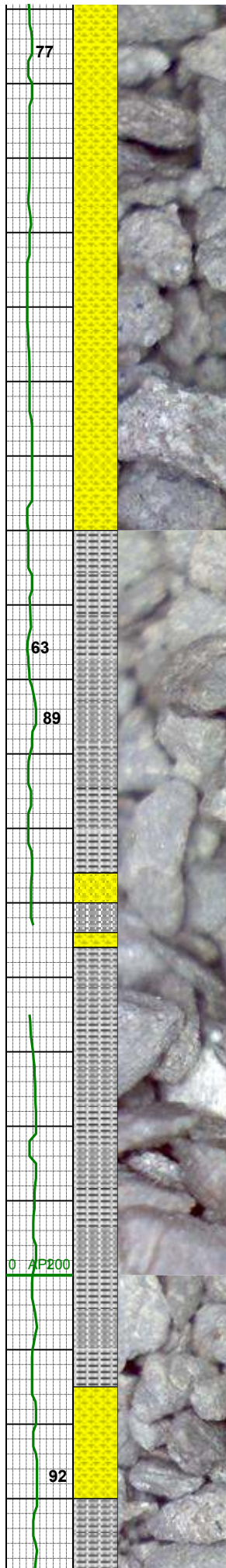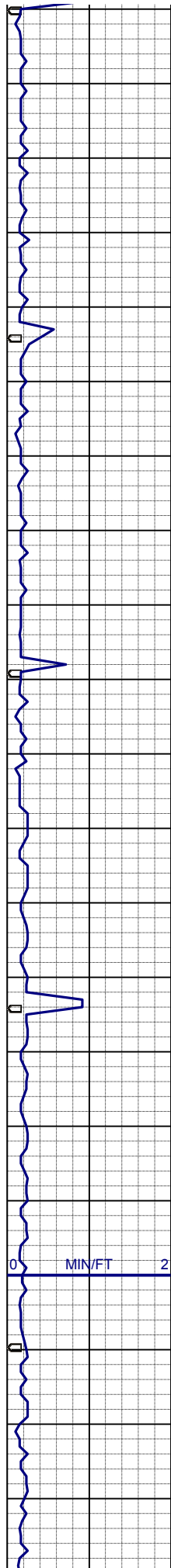| 0 | UNITS | 1000 |
|---|---|---|
| 0 | PPM | 100000 |

200u

**MD** 4644'
**INC** 1.3°
**AZI** 0.0°
**TVD** 4611.7'

SHYSS: lt- mgy, trnsl -op, fgr, sbblky-sbplty, mod srt, sft- sl firm, arg mtx, sl calc, slty, grdg- sltysh
SS: wh- mgy, clr- trnsl, f- mgr, sbblky-sbang, p- mod srt, sft-mfirm, fri, p cmt, arg-sil mtx, tr glau

**MD** 4734'
**INC** 1.2°
**AZI** 27.6°
**TVD** 4701.7'

SS: wh- mgy, clr- trnsl, f- mgr, sbblky-sbang, p- mod srt, sft-mfirm, fri, p cmt, arg-sil mtx, tr glau
SHYSS: lt- mgy, trnsl -op, fgr, sbblky-sbplty, mod srt, sft- sl firm, arg mtx, sl calc, slty, grdg- sltysh

**MD** 4823'
**INC** 1.4°
**AZI** 32.9°
**TVD** 4790.7'

**77**

SHYSS: lt- mgy, trnsl -op, fgr, sbblky-
sbplty, mod srt, sft- sl firm, arg mtx, sl
calc, slty, grdg- sltysh
SS: wh- mgy, clr- trnsl, f- mgr, sbblky-
sbang, p- mod srt, sft-mfirm, fri, p
cmt, arg-sil mtx, tr glau

535u

305u
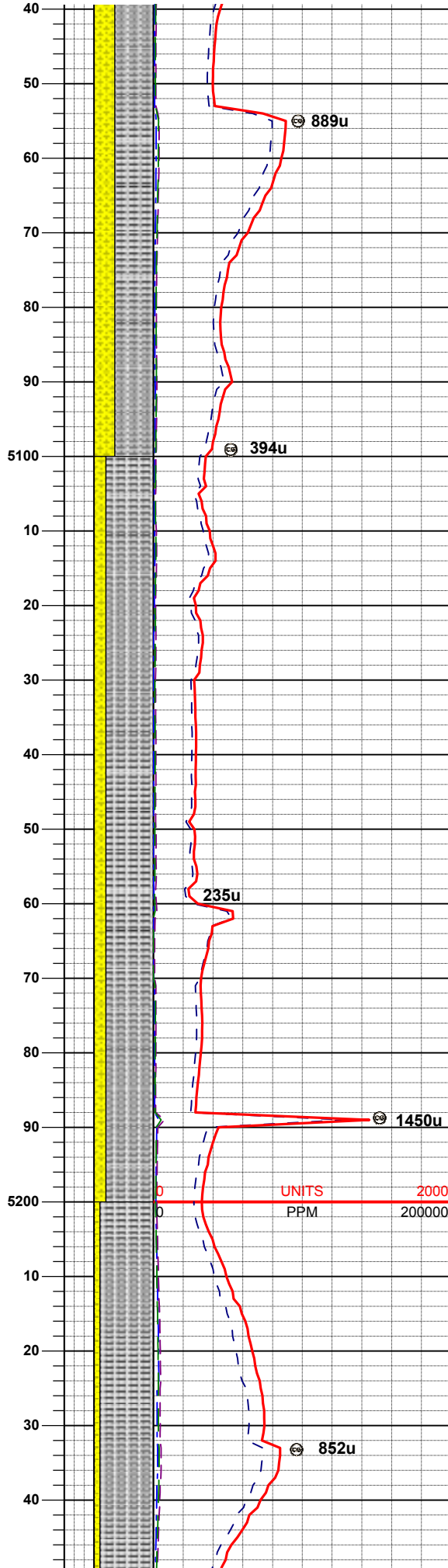
**63**

**89**

583u

MD     4913'
INC    1.2°
AZI    59.4°
TVD    4880.7'

SLTYSH: lt- mgy- buf, sft- mod firm,
sbang- sbplty, gt tex, sdy ip, sl calc,
occ calc frag, tr fos frag, grdg- shyss

825u

399u

GAS SCALE
CHANGE

0    MIN/FT    2        0  AP200

0    UNITS    2000
0    PPM    200000

MD     5003'
INC    1.2°
AZI    68.2°
TVD    4970.3'

871u

| Depth: 5007' | |
|---|---|
| WT | 8.6 |
| VIS | 28 |
| YP | 3 |
| pH | 11.5 |
| Cl- | 650 |
| Ca++ | 40 |
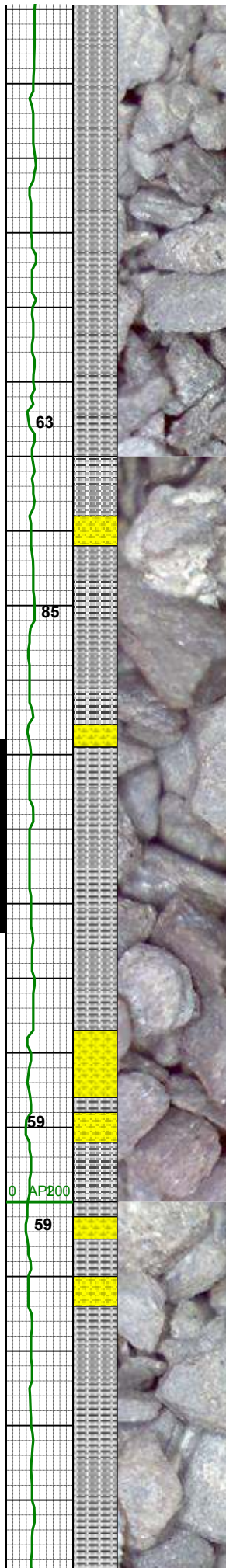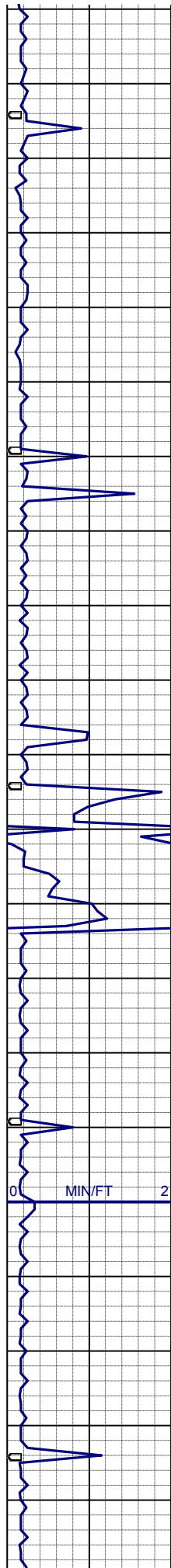
**92**

898u

SLTYSH: lt- mgy- buf, sft- mod firm, sbang- sbplty, gt tex, sdy ip, sl calc, occ calc frag, occ pyr, tr fos frag, grdg - shyss

**889u**

**MD    5093'**
**INC    1.4°**
**AZI    68.0°**
**TVD   5060.6'**

**394u**

**235u**

SLTYSH: lt- mgy- buf, sft- mod firm, sbang- sbplty, gt tex, sdy ip, sl calc, occ calc frag, occ pyr, tr fos frag, grdg - shyss

**WT 8.9 / VIS 31**

**MD    5183'**
**INC    0.7°**
**AZI    81.8°**
**TVD   5150.6'**

**1450u**

0    MIN/FT    2
0    AP200
0    UNITS    2000
0    PPM    200000

**852u**

SLTYSH: lt- mgy- buf, sft- mod firm, sbang- sbplty, gt tex, sdy ip, sl calc,

63

85
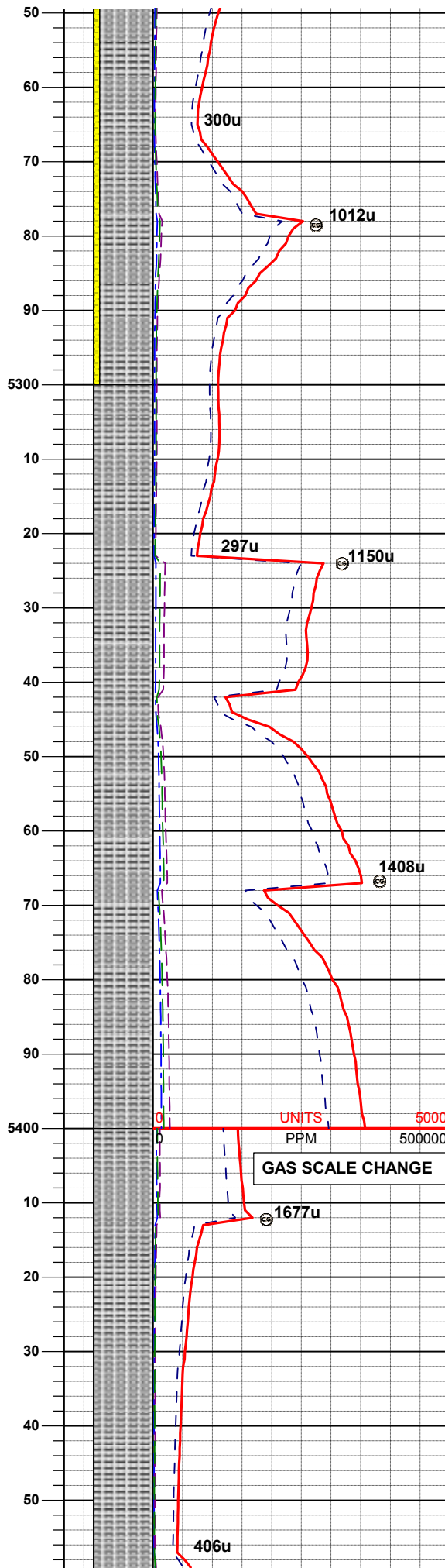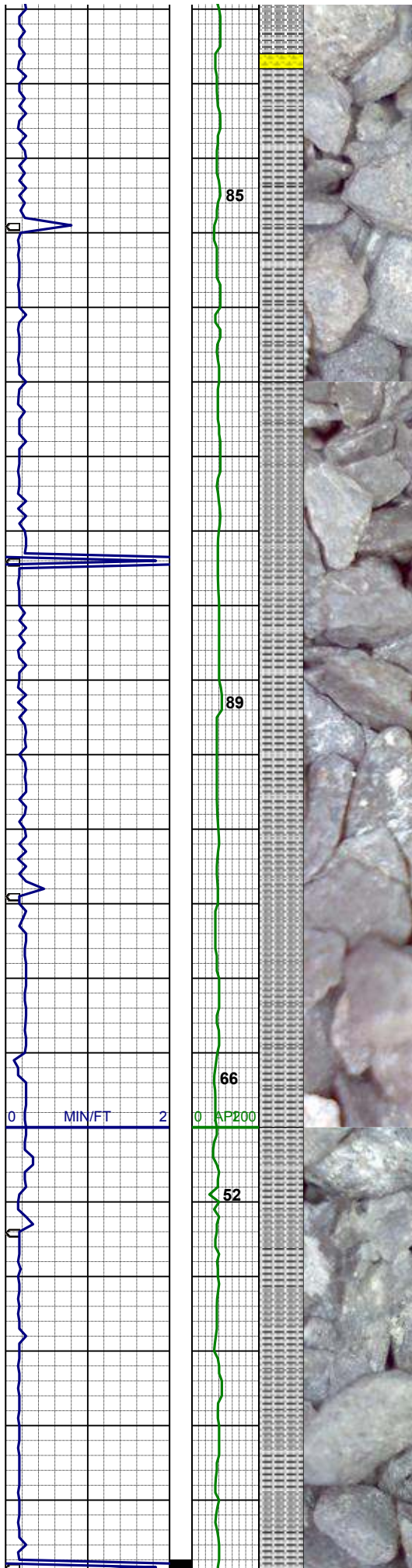
59

59

occ calc frag, occ pyr, tr fos frag, grdg - shyss

MD 5273'
INC 0.1°
AZI 257.5°
TVD 5240.6'

300u

1012u

85

297u 1150u

89

SLTYSH: lt-dkgy, sft- mod firm, sbplty -plty, occ sbblky, gt tex, tr sdy ip, sl calc, sl mica, tr fos frag, tr gla, occ shysltst

MD 5362'
INC 1.1°
AZI 224.3°
TVD 5329.6'

1408u

66

0 MIN/FT 2    0 AP 200    0 UNITS 5000

52

PPM 500000

**GAS SCALE CHANGE**

1677u

WT 8.9 / VIS 37

SLTYSH: lt-dkgy, sft- mod firm, sbplty -plty, occ sbblky, gt tex, tr sdy ip, sl calc, sl mica, tr fos frag, tr gla, occ shysltst

406u

MD 5452'
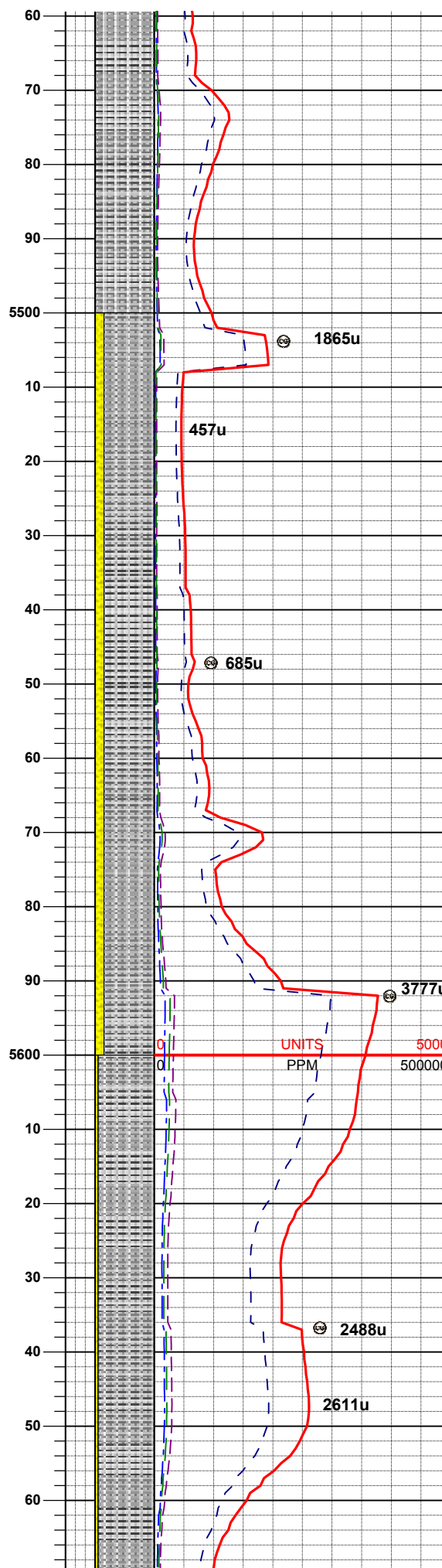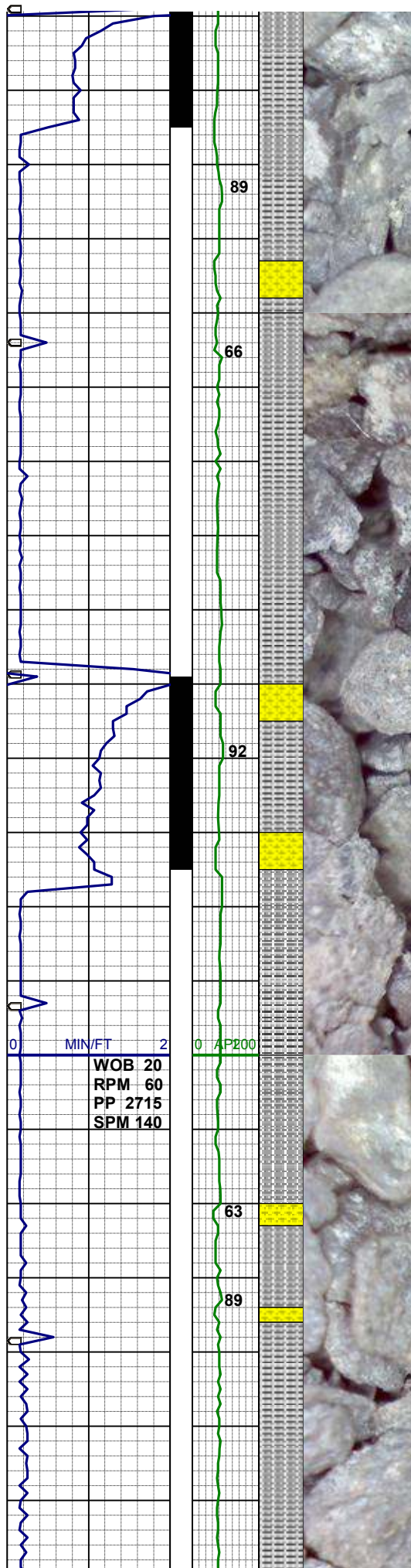INC 1.8°
AZI 232.0°
TVD 5419.5'

MIN/FT  0 — 2

WOB 20
RPM 60
PP 2715
SPM 140

0 API 200

89
66
92
63
89

UNITS 0 — 5000
PPM 0 — 500000

1865u
457u
685u
3777u
2488u
2611u

WT 8.9 / VIS 36

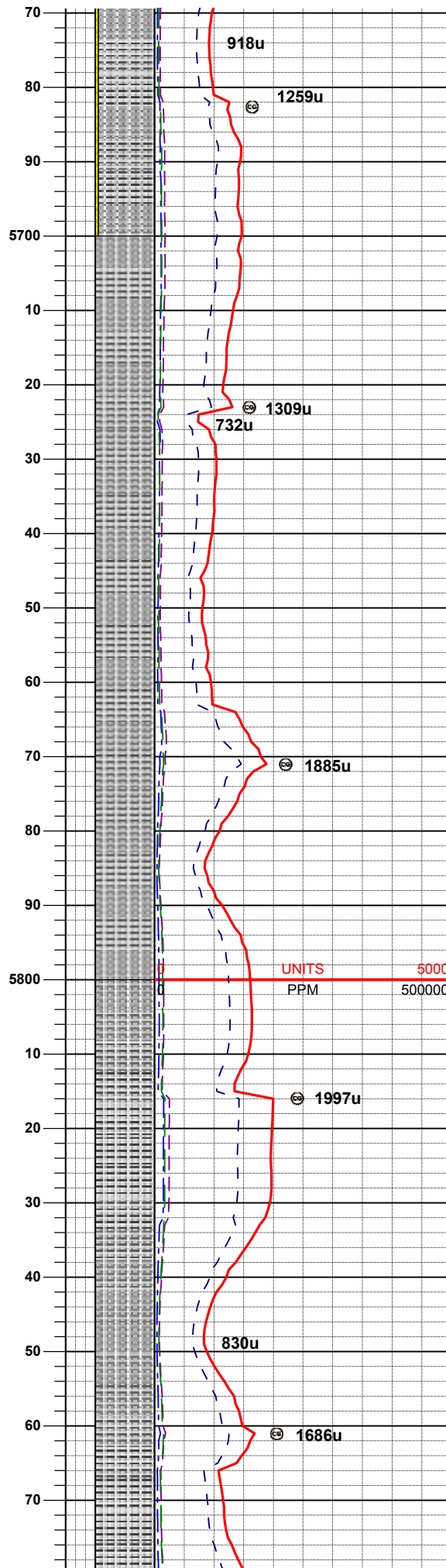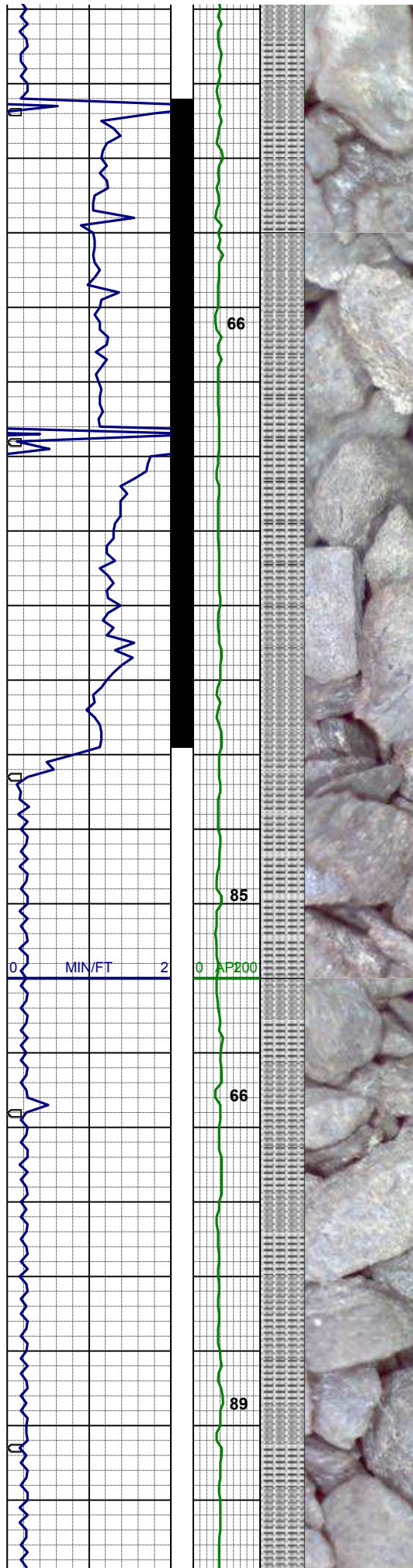| | |
|---|---|
| MD | 5542' |
| INC | 1.9° |
| AZI | 233.6° |
| TVD | 5509.5' |

SLTYSH: lt-mgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, sl mica, tr fos frag, tr gla, grdg-shyss

| | |
|---|---|
| MD | 5632' |
| INC | 2.2° |
| AZI | 236.8° |
| TVD | 5599.5' |

SLTYSH: lt-mgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, sl mica, tr fos frag, tr gla, grdg-shyss

**WT 9.8 / VIS 45**

918u

1259u

**MD 5722'**
**INC 1.4°**
**AZI 262.1°**
**TVD 5689.4'**

1309u
732u

1885u

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, sl mica, tr fos frag

66

85

66

| 0 | MIN/FT | 2 |
| 0 | API | 200 |

UNITS 5000
PPM 500000

**MD 5811'**
**INC 0.4°**
**AZI 345.1°**
**TVD 5778.4'**

**WT 9.4 / VIS 46**

1997u

830u

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, sl mica, tr shyss

89

1686u

**4/1/13**

63

89

55

362

0 MIN/FT 2

0 GAP 200

80

90

5900

10

20

30

40

50

60

70

80

90

6000

10

20

30

40

50

60

70

80

⊕ 2157u

1079u

⊕ 2352u

⊕ 2473u
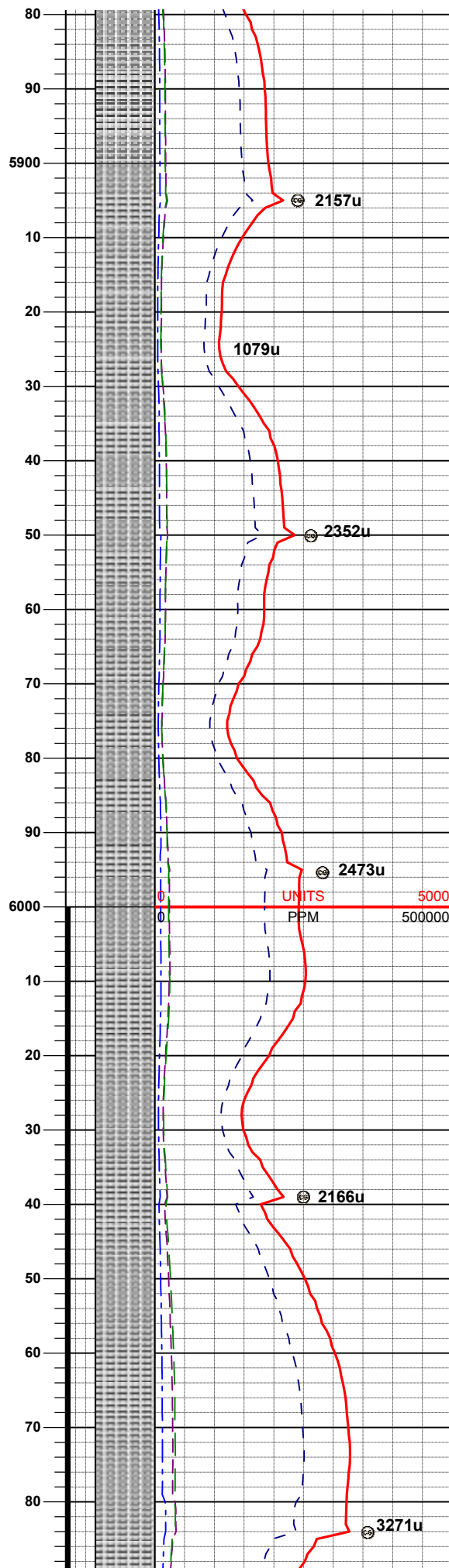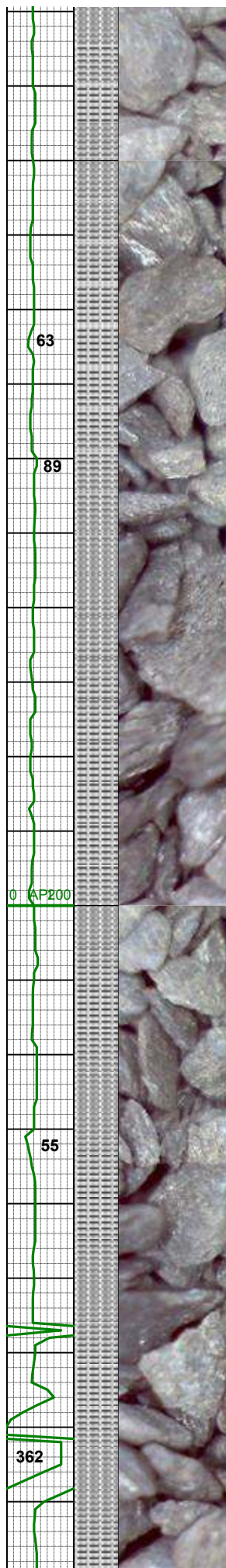
⊕ 2166u

⊕ 3271u

0 UNITS 5000

0 PPM 500000

**MD 5901'**
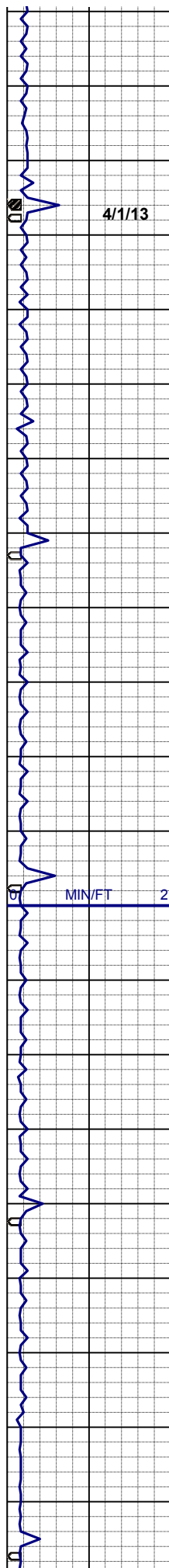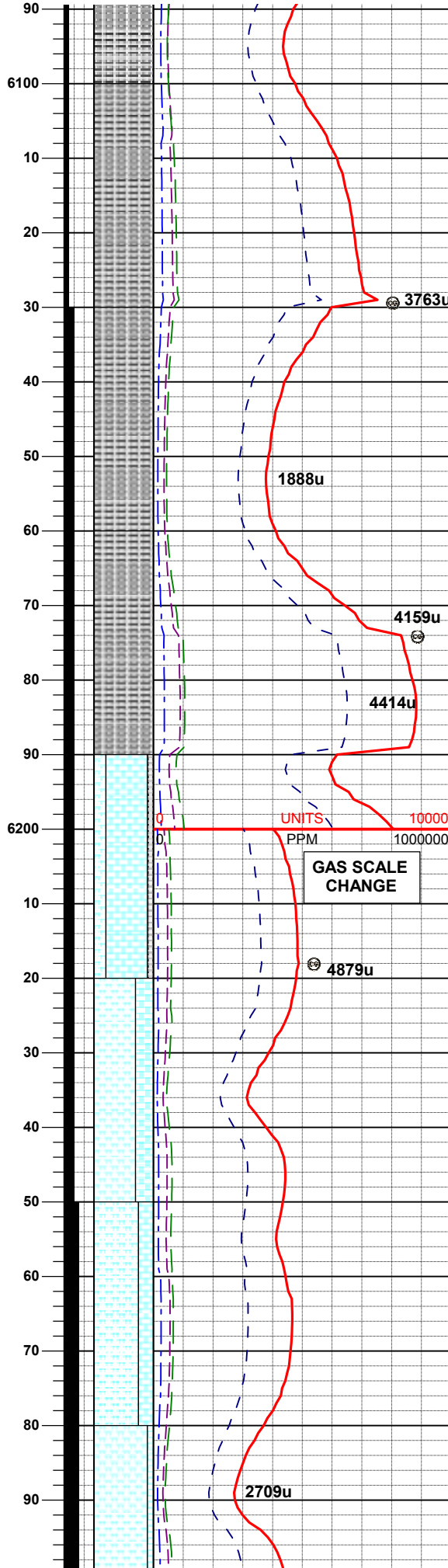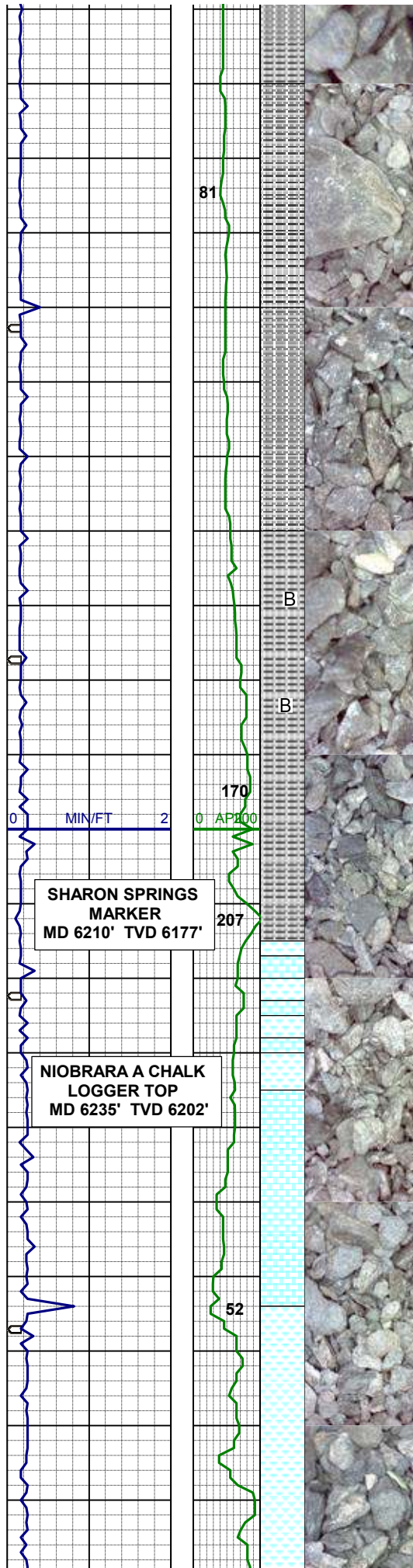**INC 0.2°**
**AZI 30.4°**
**TVD 5868.4'**

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, sl mica, tr shyss

**MD 5991'**
**INC 0.3°**
**AZI 20.2°**
**TVD 5958.4'**

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl mica, tr shyss

**MD 6081'**
**INC 0.3°**
**AZI 29.0°**
**TVD 6048.4'**

Depth track values (left to right annotations):

- **81**
- **B**
- **B**
- **170**
- **207**
- **52**

Depth scale (right track): 90, 6100, 10, 20, 30, 40, 50, 60, 70, 80, 90, 6200, 10, 20, 30, 40, 50, 60, 70, 80, 90

Gas readings:
- ⊗ 3763u
- 1888u
- 4159u
- 4414u
- ⊗ 4879u
- 2709u

Log scales (bottom of upper section):
- 0   MIN/FT   2
- 0   API   100
- 0   UNITS   10000
- 0   PPM   1000000

**GAS SCALE CHANGE**

Markers:
- **SHARON SPRINGS MARKER**
  **MD 6210'   TVD 6177'**
- **NIOBRARA A CHALK LOGGER TOP**
  **MD 6235'   TVD 6202'**

Right column notes:

**BEGIN 30' SAMPLES**

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl mica, tr shyss

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl mica, tr shyss

| MD | 6171' |
|---|---|
| INC | 0.5° |
| AZI | 68.9° |
| TVD | 6138.4' |

SLTYSH: lt-mgy, tr dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc, scat bent

**WT 9.5 / VIS 50**

CHK: lt- mgy, mot, sft-sl firm, arg, sbblky-sbplty, rthy lstr, stri, tr pyr, vcalc

MRL: m-dkgy, sft- mfirm, sbblky-sbplty, occ plty, rthy, tr stri, v arg, org/calc mtx, mod calc

SLTYSH: m-dkgy, sft- mod firm, sbplty-plty, occ sbblky, slty tex, sdy ip, sl calc

MRL: m-dkgy, sft- mfirm, sbblky-sbplty, occ plty, rthy, tr stri, v arg, org/calc mtx, mod calc

CHK: lt- mgy, mot, sft-sl firm, arg, sbblky-sbplty, rthy lstr, stri, tr pyr, vcalc

| MD | 6261' |
|---|---|
| INC | 0.7° |
| AZI | 108.6° |
| TVD | 6228.4' |

MRL: m-dkgy, sft- mfirm, sbblky-sbplty, occ plty, rthy, tr stri, v arg, org/calc mtx, tr bent, tr pyr, tr fos, mod calc

CHK: lt- mgy, mot, sft-sl firm, arg, sbblky-sbplty, rthy lstr, stri, tr pyr, vcalc,
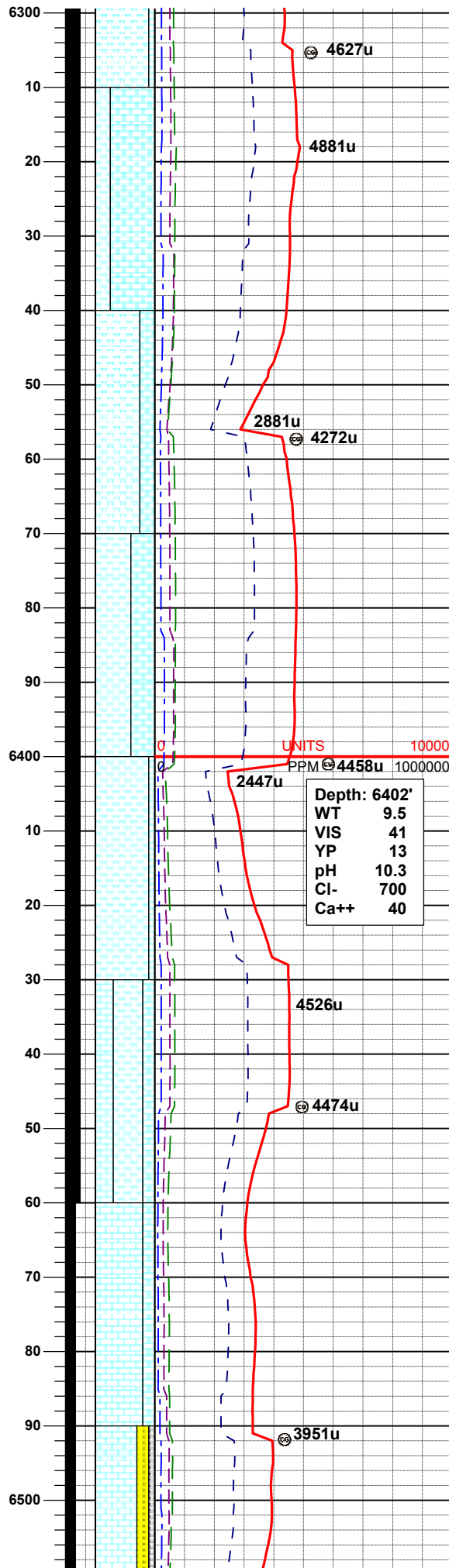
**WT 9.5 / VIS 47**

MRL: m-dkgy, sft- mfirm, sbblky-sbplty, occ plty, rthy, tr stri, v arg, org/calc mtx, tr bent, tr pyr, tr fos, mod calc

CHK: lt- mgy, mot, sft-sl firm, arg, sbblky-sbplty, rthy lstr, stri, tr pyr

WOB 20
RPM 65
PP 3200
SPM 140

**NIOBRARA B CHALK LOGGER TOP**
**MD 6321'  TVD 6288'**

44

**NIOBRARA C CHALK LOGGER TOP**
**MD 6390'  TVD 6357'**

133

| 0 | MIN/FT | 2 |
| 0 | API | 200 |

44

144

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sbblky-sbplty, rthy lstr, stri, tr pyr,
vcalc

4627u

4881u

CHK: lt- mgy, mot, sft-sl firm, arg,
sbblky-sbplty, rthy lstr, stri, tr pyr,
vcalc, tr bent, tr pyr, tr fos
MRL: m-dkgy, sft- mfirm, sbblky-
sbplty, occ plty, rthy, tr stri, v arg,
org/calc mtx, mod calc

**MD      6350'**
**INC      0.6°**
**AZI      96.7°**
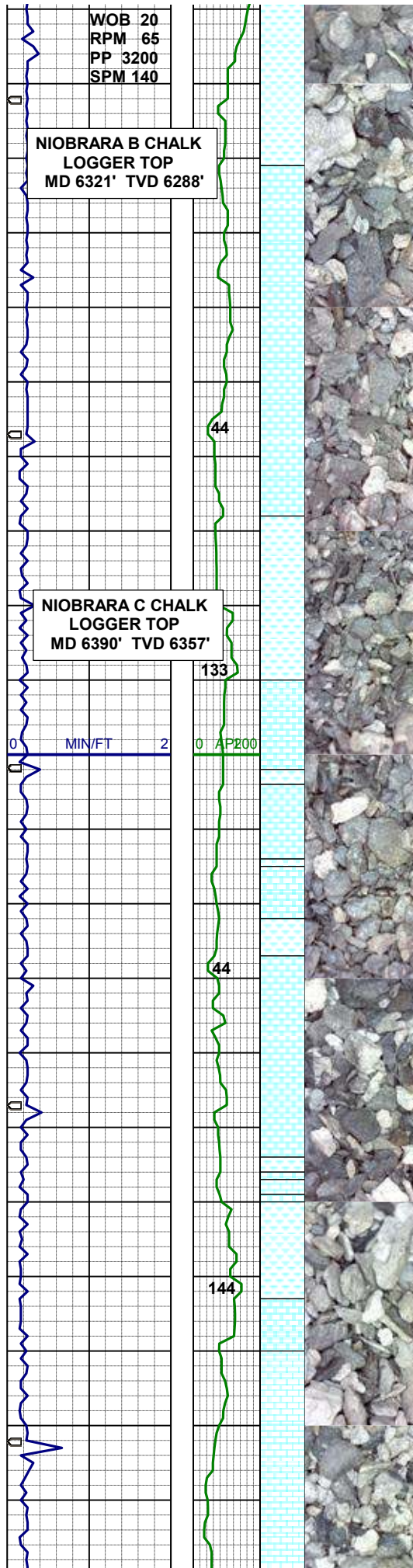**TVD    6317.4'**

2881u  4272u

MRL: m-dkgy, sft- mfirm,  sbblky-
sbplty, occ plty, rthy, tr stri, v arg,
org/calc mtx, tr bent, tr pyr, tr fos, mod
calc
CHK: lt- mgy,  mot, sft-sl firm, arg,
sbblky-sbplty, rthy lstr, stri, tr pyr,
vcalc,

MRL: m-dkgy, sft- mfirm,  sbblky-
sbplty, occ plty, rthy, tr stri, v arg,
org/calc mtx, tr bent, tr pyr, tr fos, mod
calc
CHK: lt- mgy,  mot, sft-sl firm, arg,
sbblky-sbplty, rthy lstr, stri, tr pyr,
vcalc,

| 0 | UNITS | 10000 |
| 0 | PPM | 1000000 |

4458u

2447u

| Depth: 6402' | |
| --- | --- |
| WT | 9.5 |
| VIS | 41 |
| YP | 13 |
| pH | 10.3 |
| Cl- | 700 |
| Ca++ | 40 |

MRL: m-dkgy, sft- mfirm,  sbblky-
sbplty, occ plty, rthy, tr stri, v arg,
org/calc mtx, tr bent, tr pyr, tr fos, mod
calc
CHK: lt- mgy, mot, sft-sl firm, arg,
sbblky-sbplty, rthy lstr, stri, tr pyr,
vcalc

4526u

**MD      6440'**
**INC      0.4°**
**AZI      99.7°**
**TVD    6407.4'**

MRL: m-dkgy, sft- mfirm, sbblky-
sbplty, occ plty, rthy, tr stri, v arg,
org/calc mtx, scat bent, vcalc
CHK: lt- mgy, mot, sft-sl firm, arg,
sbblky-sbplty, rthy, vcalc

4474u

LS: wh-crm, mod sft- firm, pred firm,
sbblky, rthy- wxy tex, arg ip, mcroxln,
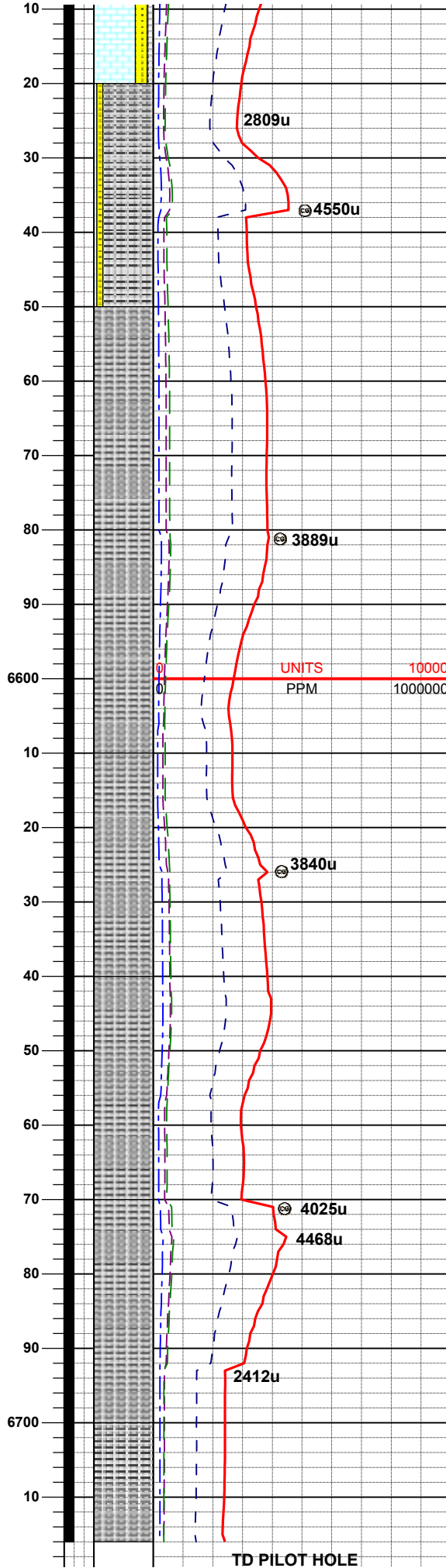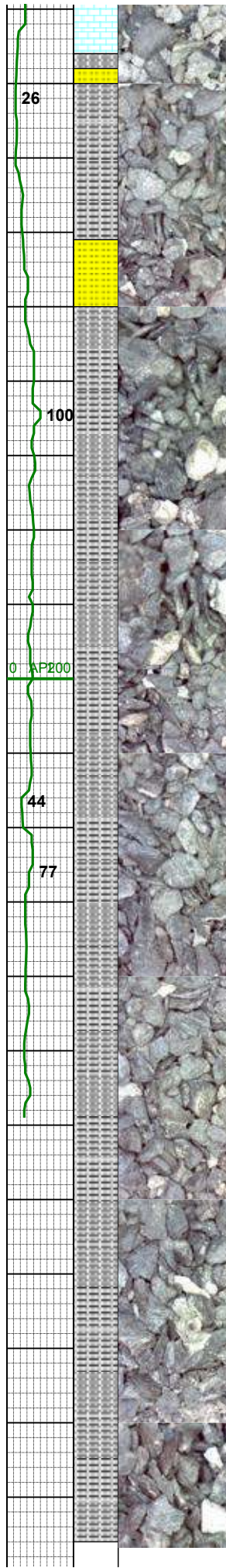occ fos frag, cln fizz, bri blgn flor

LS: wh-crm, mod sft- firm, pred firm,
sbblky, rthy- wxy tex, arg ip, mcroxln,
occ fos frag, cln fizz, bri blgn flor
CHK: lt- mgy, mot, sft-sl firm, arg,
sbblky-sbplty, rthy tex , vcalc, occ mrl

3951u
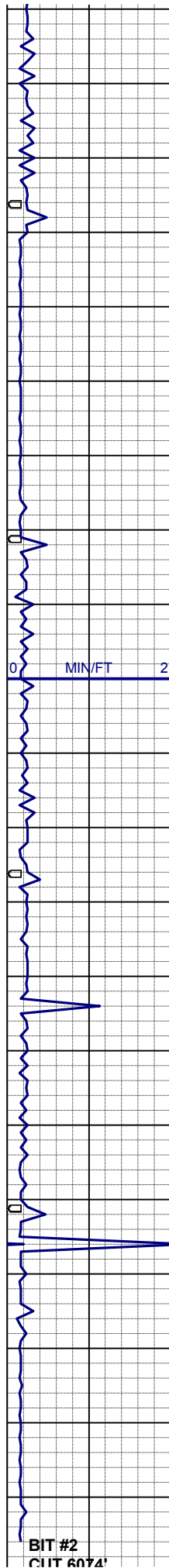
LS: wh-crm, mod sft- firm, pred firm,
sbblky, rthy- wxy tex, arg ip, mcroxln,
occ fos frag, cln fizz, bri blgn flor
SS: mgy, clr- trnsl, occ op, f- mgr,
sbblky, mod srt, mod sft, p cmt, calc
mtx, tr pyr
SLTYSH: dkgy- blk, firm- vfirm, sbplty

Left curve track: MIN/FT scale 0 — 2

Second track: AP200 scale 0 — 200

Gamma / lithology values: **26**, **100**, **44**, **77**

BIT #2
CUT 6074'

Gas curve scale:
UNITS 0 — 10000
PPM 0 — 1000000

Depth markers (ft): 10, 20, 30, 40, 50, 60, 70, 80, 90, 6600, 10, 20, 30, 40, 50, 60, 70, 80, 90, 6700, 10

Gas shows / readings:
- 2809u
- 4550u
- 3889u
- 3840u
- 4025u
- 4468u
- 2412u

TD PILOT HOLE

Right column (lithology / survey descriptions):

-plty, slty tex, mod calc, tr mrl

MD    6530'
INC    0.4°
AZI    55.2°
TVD   6497.4'

SLTYSH: dkgy- blk, occ lt- mgy, firm-vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng- shyss, tr mrl, occ ls
SS: mgy, clr- trnsl, occ op, f- mgr, sbblky, mod srt, mod sft, p cmt, calc mtx

SLTYSH: dkgy, occ mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng- shyss, tr pyr, occ ls (3%), 1% ss

SLTYSH: dkgy, occ mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng- shyss, tr pyr, occ ls, tr ss

**WT 9.5 / VIS 46**

MD    6620'
INC    0.8°
AZI    24.8°
TVD   6587.4'

SLTYSH: lt- mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng-shyss, tr pyr, tr ls, tr ss

SLTYSH: lt- mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng-shyss, tr pyr, tr ls, tr ss

MD    6665'
INC    0.9°
AZI    40.3°
TVD   6632.4'

SLTYSH: lt- mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng-shyss, tr pyr, tr ls, tr ss

SLTYSH: lt- mgy, firm- vfirm, sbplty-plty, slty tex, mod calc, sdy ip, grdng-shyss, tr pyr, tr ls, tr ss

**THANK YOU FOR CHOOSING COLUMBINE LOGGING, INC.**

IN 40.5 HRS

20

30

40

50

MD 6716' @ 0500 HRS
4/1/13

**LOG CONTINUES ON FILE:**
**Shable Federal LB33-78HN Lateral.lplot**