

# COLUMBINE LOGGING

Scale: 5" / 100'  
Measured Depth Log

**Well Name** Pappenheim 6-62-23-0560BH

**Location** NENW S23-T6N-R62W

**State** COLORADO

**County** WELD

**Country** USA

**Rig Number** CADE 24

**API Number** 05-123-37264

**AFE #** 18309D

**Region** DJ BASIN

**Field** BRIGGSDALE

**Spud Date** 6/11/2013

**Surface Coordinates** 250 FNL 1977 FWL

**Bottom Hole Coordinates** SWSE S23-T6N-R62W  
650 FSL 2300 FEL

**Ground Elevation** 4699

**K.B. Elevation** 4715

**Logged Interval** 4000

**Formation** NIOBRARA B2 CHALK

**Type of Drilling Fluid** SPUD

## Operator

**Company** BILL BARRETT CORPORATION

**Address** 1099 18TH STREET, SUITE 2300  
DENVER, CO 80202

## Geologist

**Name** JASON BRAND

**Company** BILL BARRETT CORPORATION

**Address** 1099 18TH STREET, SUITE 2300  
DENVER, CO 80202

## Rock Types

- UNKNOWN
- ANHYDRITE
- BENTONITE
- BRECCIA
- CEMENT
- CHALK
- CHERT
- CLAY CHOKE SAND
- CLAYSTONE

- COAL
- CONGLOMERATE
- DOLOMITE
- GRANITE
- GYPSUM
- IGNEOUS
- LIMESTONE
- SIDERITE or LIMONITE
- MARLSTONE

- METAMORPHIC
- NO SAMPLE
- SALT
- SALT-PEPPER SAND
- SANDSTONE
- SHALE
- SHALE COLORED
- SHALE GRAY
- SHALY SANDSTONE

- SHALY SILTSTONE
- SILTSTONE
- SILTY SHALE
- TILL
- TUFF
- WELDED TUFF

## Accessories

### Fossils

- ALGAE
- AMPHIPORA
- BELEMNITE
- BIOCLASTIC
- BRACHIOPOD
- BRYOZOA
- CEPHALOPOD
- CORAL
- CRINOID
- ECHINOID
- FISH
- FORAMINIFERA

### F FOSSIL

- GASTROPOD
- INOCERAMUS
- OOLITE
- OSTRACOD
- PELECYPOD
- PELLET
- PISOLITE
- PLANT REMAINS
- PLANT SPORES
- SCAPHOPOD
- STROMATOPOROID

### Minerals

### // ANHYDRITIC

- ARGILLACEOUS
- ARGILLITE GRAIN
- BENTONITE
- BITUMENOUS SUBSTANCE
- BRECCIA FRAGMENTS
- CALCAREOUS
- CARBONACEOUS FLAKES
- CHTDK
- CHTLT
- COAL - THIN BEDS
- DOLOMITIC
- FELDSPAR
- FERRUGINOUS PELLET

### ∩ FERRUGINOUS

- GLAUCONITE
- GYPSIFEROUS
- HEAVY MINERAL
- KAOLIN
- MARLSTONE
- MINERAL CRYSTALS
- NODULES
- PHOSPHATE PELLETS
- PYRITE
- SALT CAST
- SANDY
- SILICEOUS
- SILTY

### ∇ TUFFACEOUS

### Stringer

- ANHYDRITE STRINGER
- BENTONITE STRINGER
- COAL STRINGER
- DOLOMITE STRINGER
- GYPSUM STRINGER
- LIMESTONE STRINGER
- MARLSTONE (CALC) STRG
- MARLSTONE (DOL) STRG
- SANDSTONE STRINGER
- SHALE STRINGER
- SILTSTONE STRINGER

## Other Symbols

### Oil Show

- DEAD
- EVEN
- QUESTIONABLE
- SPOTTED STAINING

### Porosity

- E EARTHY
- FENESTRAL
- FRACTURE
- INTERCRYSTALLINE
- INTEROOLITIC

### MOLDIC

- ORGANIC
- PINPOINT
- VUGGY

### Engineering

- BIT
- CONNECTION (LEFT)
- CONNECTION (RIGHT)
- CONNECTION GAS
- CORE - LOST
- CORE - RECOVERED
- DST INTERVAL

### FAULT

- FORMATION TOP
- GAS SHOW
- MN DEPTH
- NORMAL FAULT
- OIL SHOW
- OVERTURNED STRATA
- REVERSE FAULT
- SIDEWALL CORE (LEFT)
- SIDEWALL CORE (RIGHT)
- SLIDE
- SURVEY
- TRIP GAS

### WIRELINE TESTED - LEFT

### WIRELINE TESTED - RT

### Rounding

- ANGULAR
- ROUNDED
- SUBANG
- SUBRND

### Textures

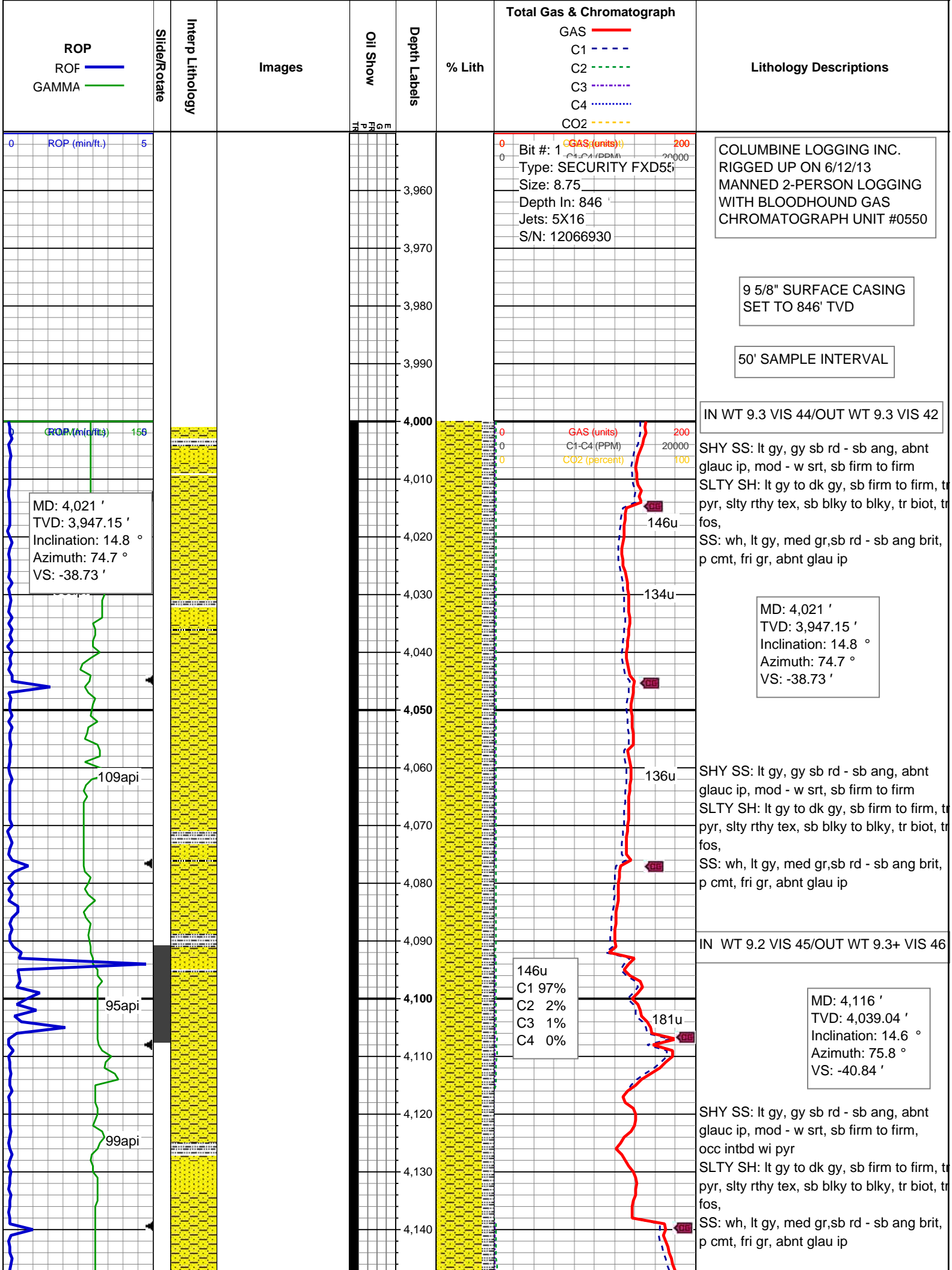
- BOUNDSTONE
- CHALKY
- CRYPTOXLN

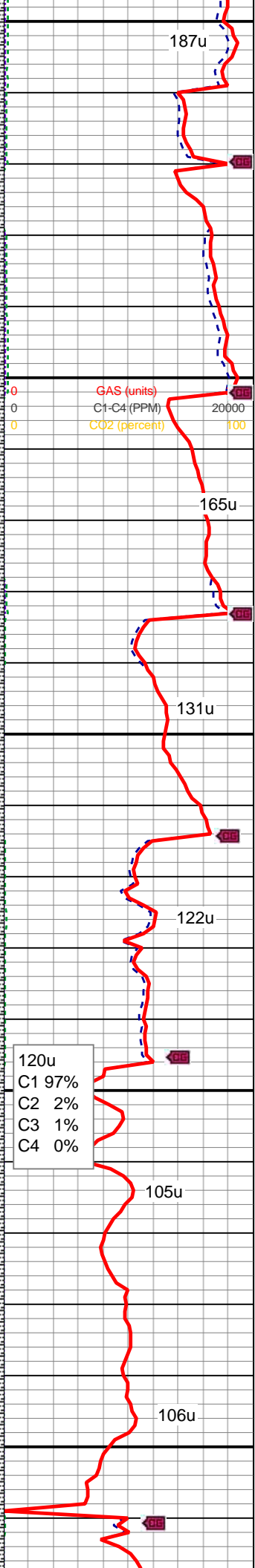
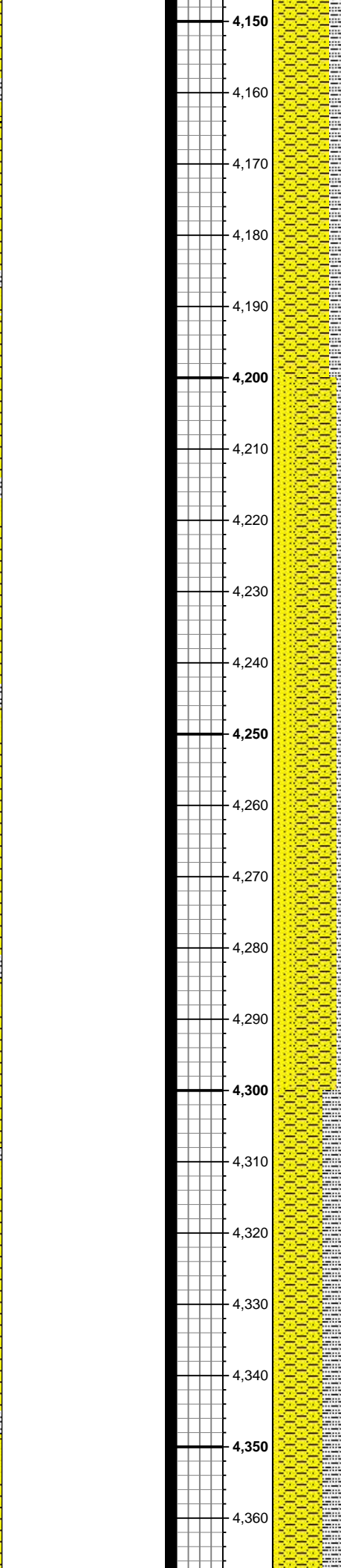
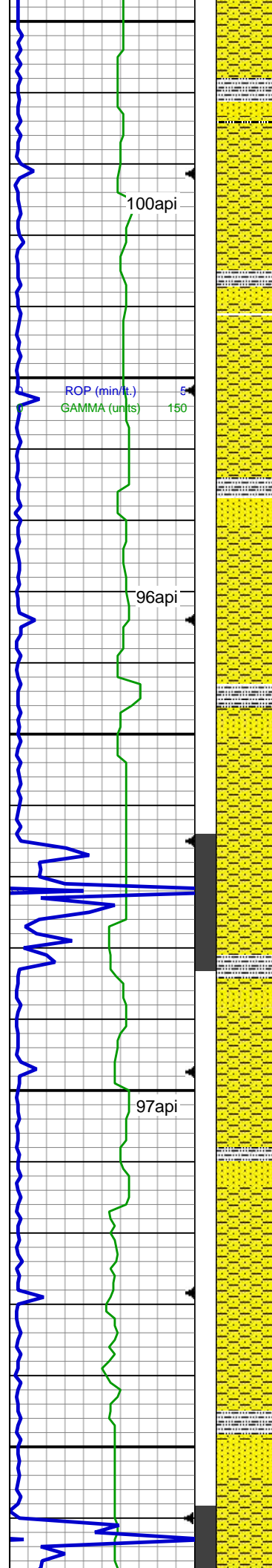
### E EARTHY

- FINELYXLN
- GRAINSTONE
- L LITHOGRAPHIC
- MX MICROXLN
- MS MUDSTONE
- PS PACKSTONE
- WS WACKESTONE

### Sorting

- M MODERATE
- P POOR
- W WELL





SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, mod - w srt, sb firm to firm, occ intbd wi pyr  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blk to blk, tr biot, tr fos,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt glau ip

MD: 4,210 '  
TVD: 4,130.23 '  
Inclination: 13.5 °  
Azimuth: 73.1 °  
VS: -43.14 '

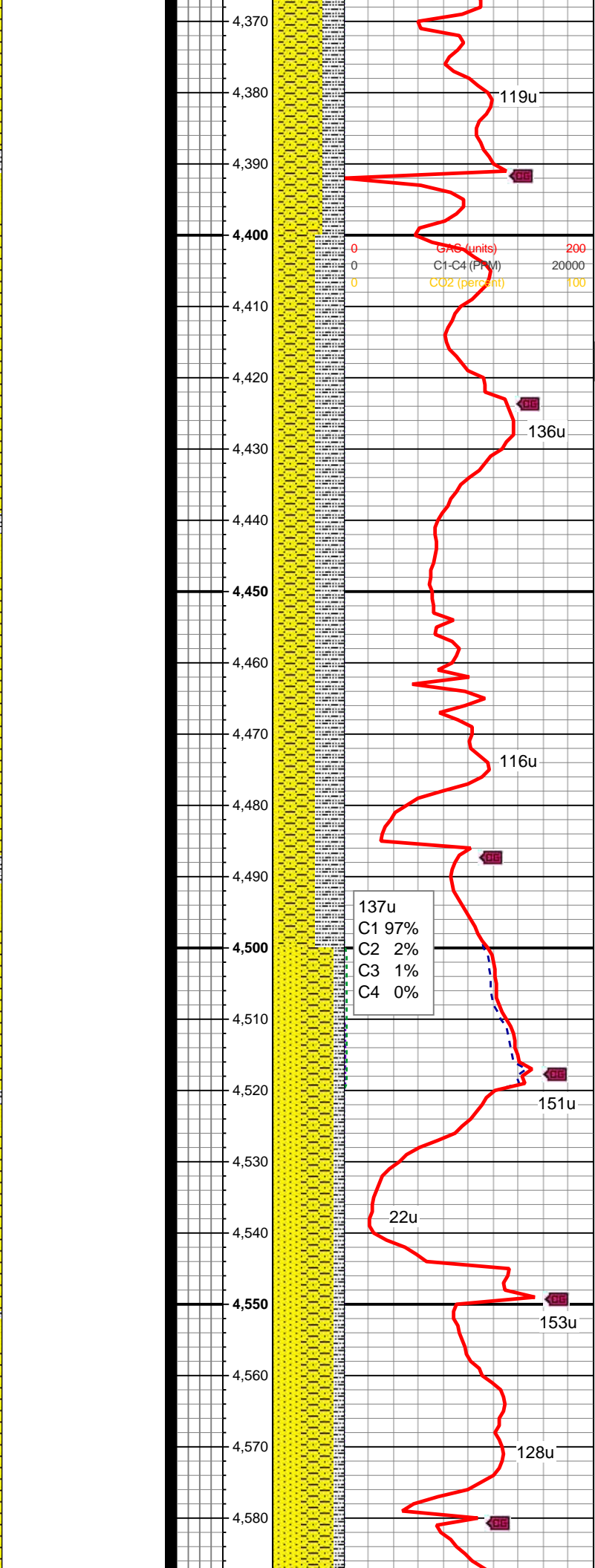
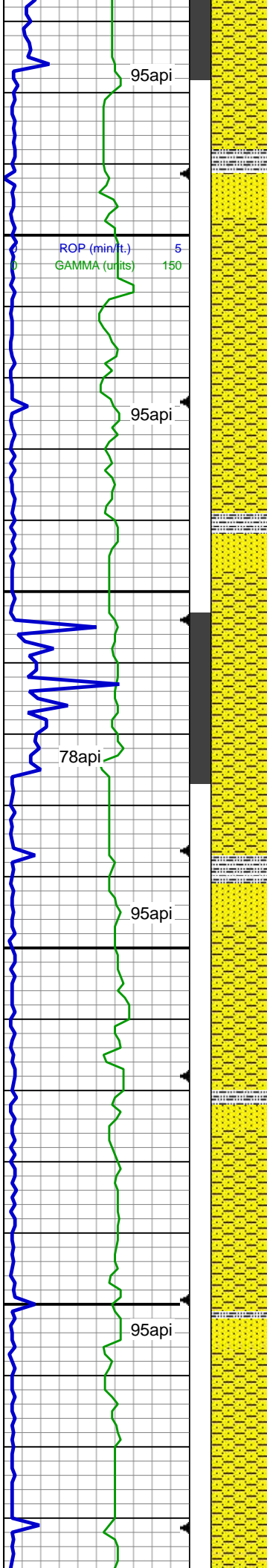
SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, mod - w srt, sb firm to firm, SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blk to blk, tr biot, SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt glau ip

IN WT 9.2 VIS 46/OUT WT 9.2+ VIS 47

SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, mod - w srt, sb firm to firm, SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blk to blk, tr biot, SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt glau ip

120u  
C1 97%  
C2 2%  
C3 1%  
C4 0%

SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm, SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blk to blk, tr biot, SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt glau ip



SHY SS: lt gy, gy sb rd - sb ang, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt glau ip

MD: 4,399 '  
TVD: 4,313.53 '  
Inclination: 14.7 °  
Azimuth: 73.8 °  
VS: -48.59 '

INWT 9.2+ VIS 46/OUTWT 9.2+ VIS 48

SHY SS: lt gy, gy sb rd - sb ang, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip

SHY SS: lt gy, gy sb rd - sb ang, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip

LOGGERS TOP  
TERRY/SUSSEX  
4504' MD/4415' TVD

MD: 4,494 '  
TVD: 4,405.67 '  
Inclination: 13.5 °  
Azimuth: 77.8 °  
VS: -50.43 '

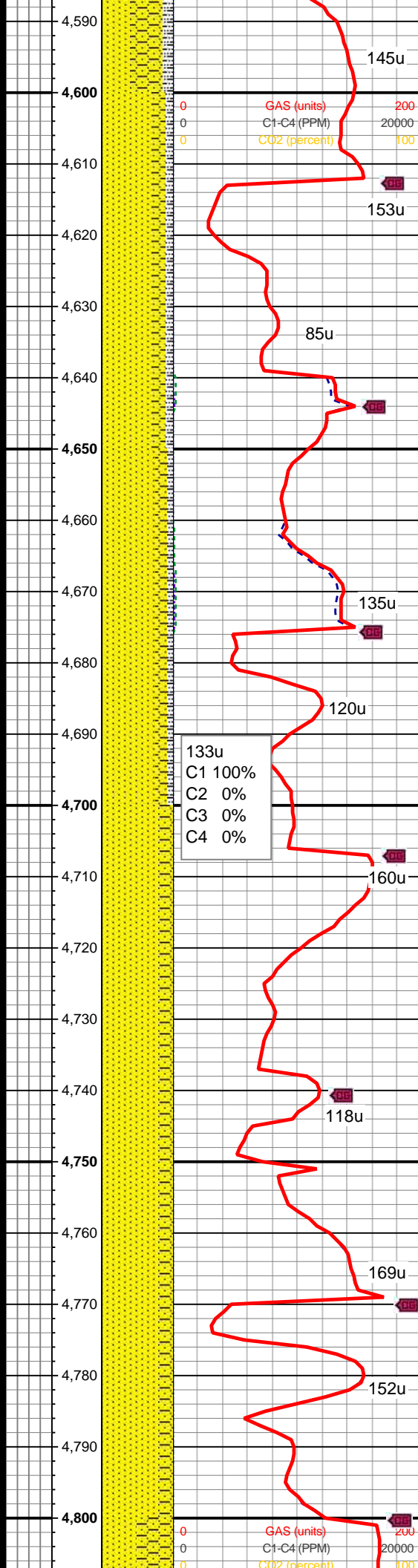
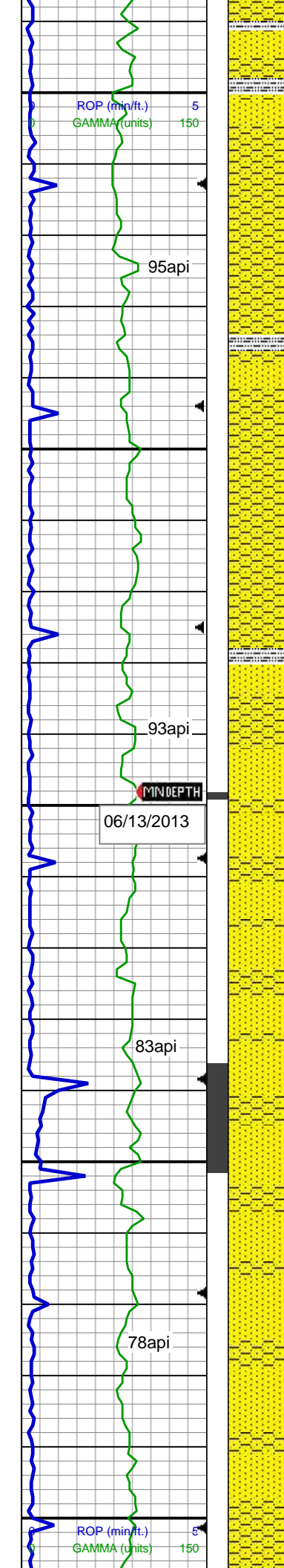
SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, slty rthy tex, sb blkly to blkly, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, slty rthy tex, sb blkly to blkly, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,589 '

GRC (units) 200  
C1-C4 (Pr V) 20000  
CO2 (percent) 100

137u  
C1 97%  
C2 2%  
C3 1%  
C4 0%



TVD: 4,498.34 '  
Inclination: 11.9 °  
Azimuth: 77.3 °  
VS: -51.41 '

IN WT 9.3 VIS 49/OUT WT 9.3+ VIS 52

MD: 4,620 '  
TVD: 4,528.69 '  
Inclination: 11.7 °  
Azimuth: 77.7 °  
VS: -51.72 '

SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, slty rthy tex, sb blk to blk, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,652 '  
TVD: 4,560.03 '  
Inclination: 11.6 °  
Azimuth: 76.8 °  
VS: -52.06 '

MD: 4,683 '  
TVD: 4,590.4 '  
Inclination: 11.4 °  
Azimuth: 75.8 °  
VS: -52.49 '

SHY SS: lt gy, gy sb rd - sb ang, abnt glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SLTY SH: lt gy to dk gy, sb firm to firm, slty rthy tex, sb blk to blk, tr biot,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,714 '  
TVD: 4,620.8 '  
Inclination: 11.3 °  
Azimuth: 76 °  
VS: -52.95 '

SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

IN WT 9.2+ VIS 46/OUT WT 9.3 VIS 48

MD: 4,746 '  
TVD: 4,652.2 '  
Inclination: 10.9 °  
Azimuth: 80.4 °  
VS: -53.18 '

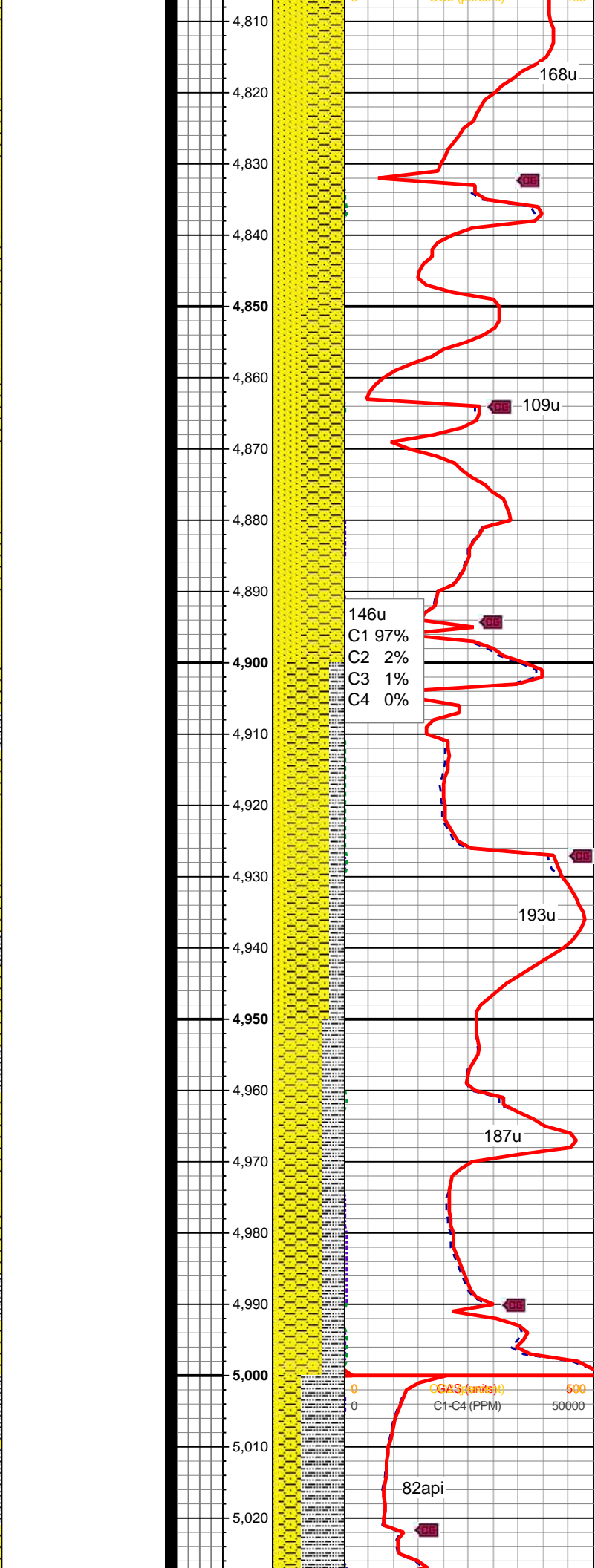
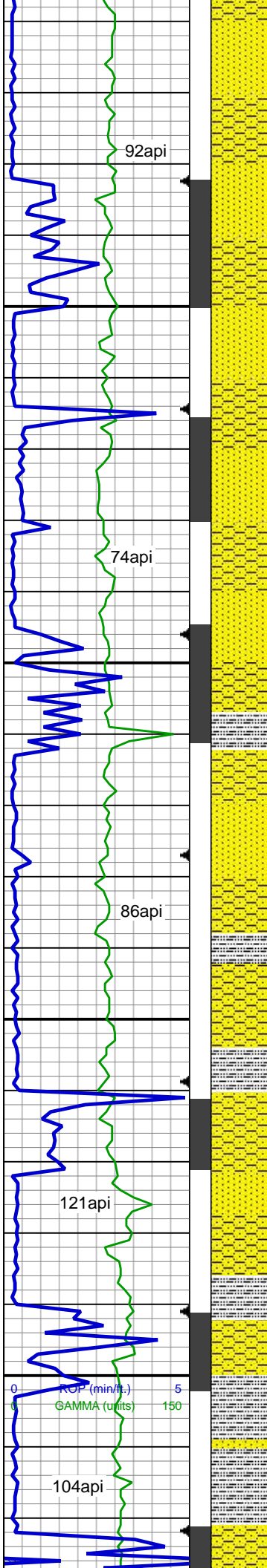
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, abnt biot, mod - w srt, sb firm to firm,  
SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,777 '  
TVD: 4,682.65 '  
Inclination: 10.8 °  
Azimuth: 80.4 °  
VS: -53.17 '

MD: 4,809 '  
TVD: 4,714.00 '  
Inclination: 10.7 °  
Azimuth: 80.4 °  
VS: -53.17 '

GAS (units) 200  
C1-C4 (PPM) 20000  
CO2 (percent) 100

GAS (units) 200  
C1-C4 (PPM) 20000  
CO2 (percent) 100



TVD: 4,714.09'  
Inclination: 10.6 °  
Azimuth: 80.9 °  
VS: -53.13'

SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, abnt biot, mod - w srt, sb firm to firm, SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,841'  
TVD: 4,745.57'  
Inclination: 10.1 °  
Azimuth: 80.1 °  
VS: -53.1'

SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, abnt biot, mod - w srt, sb firm to firm, SS: wh, lt gy, med gr, sb rd - sb ang brit, p cmt, fri gr, abnt bio, tr glau ip

MD: 4,872'  
TVD: 4,776.14'  
Inclination: 8.9 °  
Azimuth: 78.1 °  
VS: -53.2'

MD: 4,904'  
TVD: 4,807.8'  
Inclination: 7.9 °  
Azimuth: 78.6 °  
VS: -53.36'

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

MD: 4,935'  
TVD: 4,838.52'  
Inclination: 7.6 °  
Azimuth: 80.2 °  
VS: -53.43'

MD: 4,967'  
TVD: 4,870.25'  
Inclination: 7.1 °  
Azimuth: 83.1 °  
VS: -53.33'

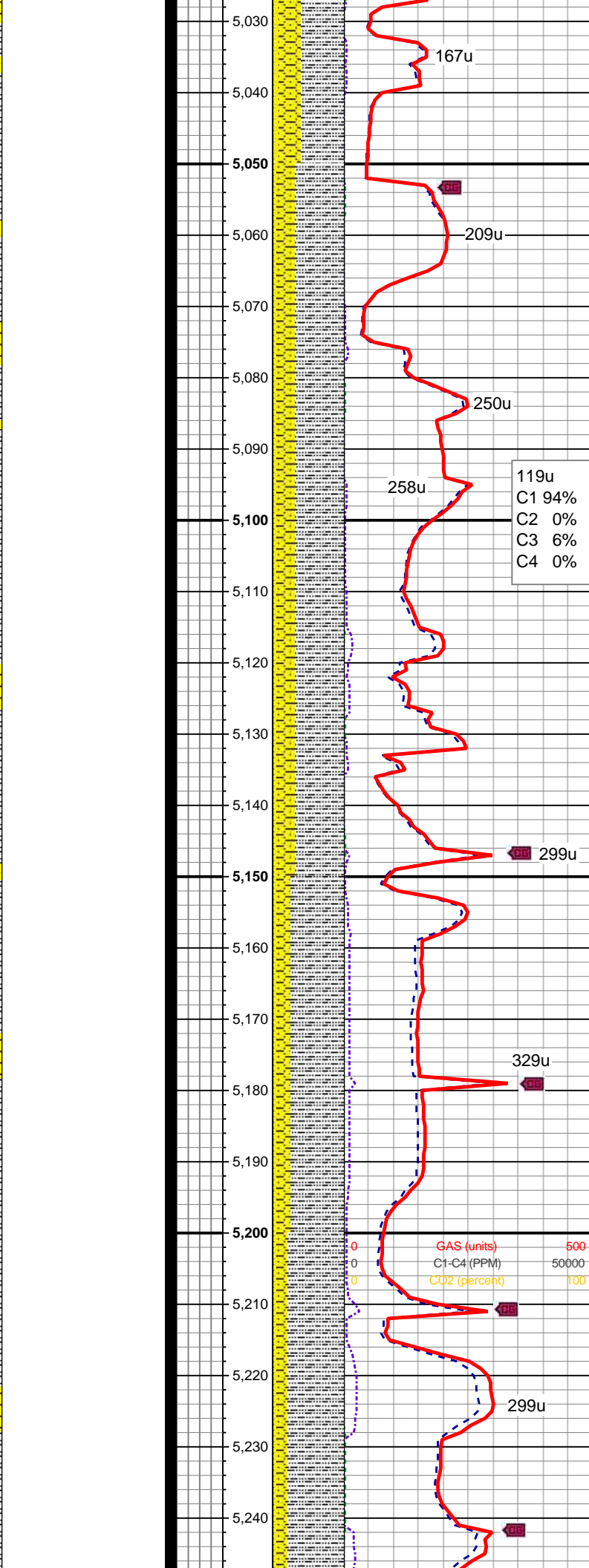
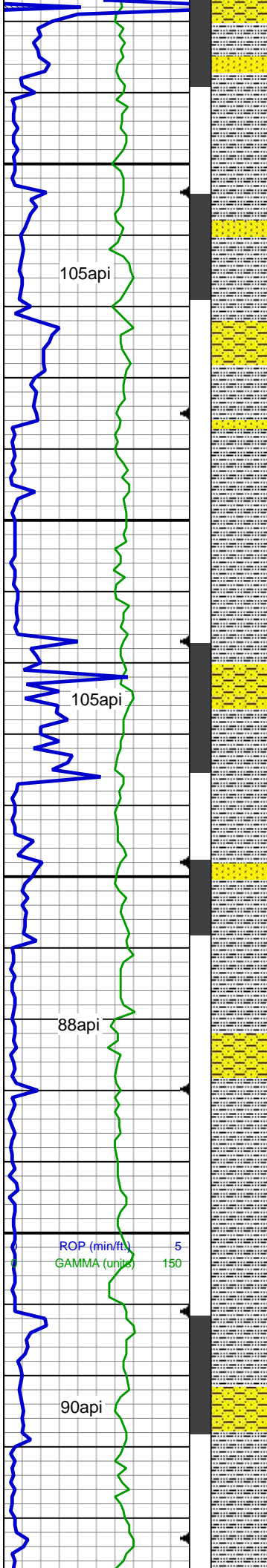
LOGGER'S TOP  
SHANNON  
4972' MD/4875' TVD

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

IN WT 9.4 VIS 40/OUT WT 9.6 VIS 48

MD: 4,998'  
TVD: 4,901.03'  
Inclination: 6.7 °  
Azimuth: 86.8 °  
VS: -53.03'

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm



SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

MD: 5,030 '  
TVD: 4,932.84 '  
Inclination: 5.7 °  
Azimuth: 89.7 °  
VS: -52.56 '

MD: 5,061 '  
TVD: 4,963.68 '  
Inclination: 6 °  
Azimuth: 88.6 °  
VS: -52.07 '

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

MD: 5,093 '  
TVD: 4,995.57 '  
Inclination: 3.6 °  
Azimuth: 88.5 °  
VS: -51.68 '

IN WT 9.3+ VIS 37/OUT WT 9.3 VIS 39

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

Depth 5132	Gels 11/25	Water 91
MW 9.55	Cake 1	Oil 0
MG 0.4966	pH 8.3	Hard 40
FV 38	Fil .05/.65	MBT 35
PV 10	Sand TR	Ch 300
YP 11	Solids 9	LCM 0

MD: 5,156 '  
TVD: 5,058.45 '  
Inclination: 3.3 °  
Azimuth: 80.7 °  
VS: -51.27 '

MD: 5,124 '  
TVD: 5,026.5 '  
Inclination: 3.6 °  
Azimuth: 88 °  
VS: -51.41 '

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

MD: 5,187 '  
TVD: 5,089.4 '  
Inclination: 2.9 °  
Azimuth: 80.5 °  
VS: -51.26 '

IN WT 9.3+ VIS 38/OUT WT 9.4 VIS 40

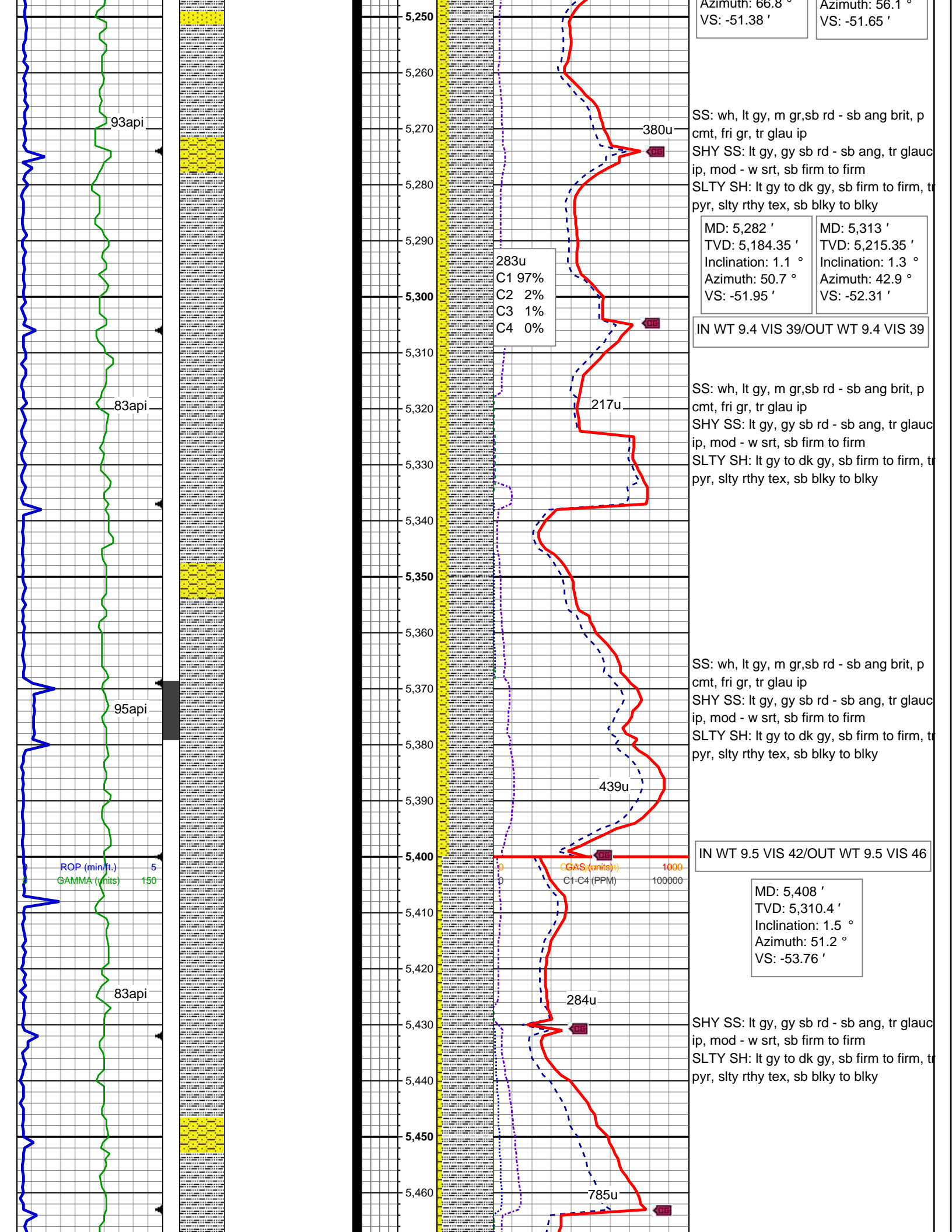
SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, slty rthy tex, sb blkly to blkly

MD: 5,219 '  
TVD: 5,121.37 '  
Inclination: 1.9 °  
Azimuth: 88.5 °  
VS: -51.26 '

MD: 5,250 '  
TVD: 5,152.36 '  
Inclination: 1.3 °  
Azimuth: 88.5 °  
VS: -51.26 '

ROP (min/ft) 5  
GAMMA (units) 150

GAS (units) 500  
C1-C4 (PPM) 50000  
CO2 (percent) 100



Azimuth: 66.8 ° VS: -51.38'      Azimuth: 56.1 ° VS: -51.65'

93api

380u

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
 SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
 SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, stly rthy tex, sb blkly to blkly

MD: 5,282'	MD: 5,313'
TVD: 5,184.35'	TVD: 5,215.35'
Inclination: 1.1 °	Inclination: 1.3 °
Azimuth: 50.7 °	Azimuth: 42.9 °
VS: -51.95'	VS: -52.31'

283u  
 C1 97%  
 C2 2%  
 C3 1%  
 C4 0%

IN WT 9.4 VIS 39/OUT WT 9.4 VIS 39

83api

217u

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
 SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
 SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, stly rthy tex, sb blkly to blkly

95api

439u

SS: wh, lt gy, m gr, sb rd - sb ang brit, p cmt, fri gr, tr glau ip  
 SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
 SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, stly rthy tex, sb blkly to blkly

IN WT 9.5 VIS 42/OUT WT 9.5 VIS 46

ROP (min/ft.) 5  
 GAMMA (units) 150

CGAS (units) 1000  
 C1-C4 (PPM) 100000

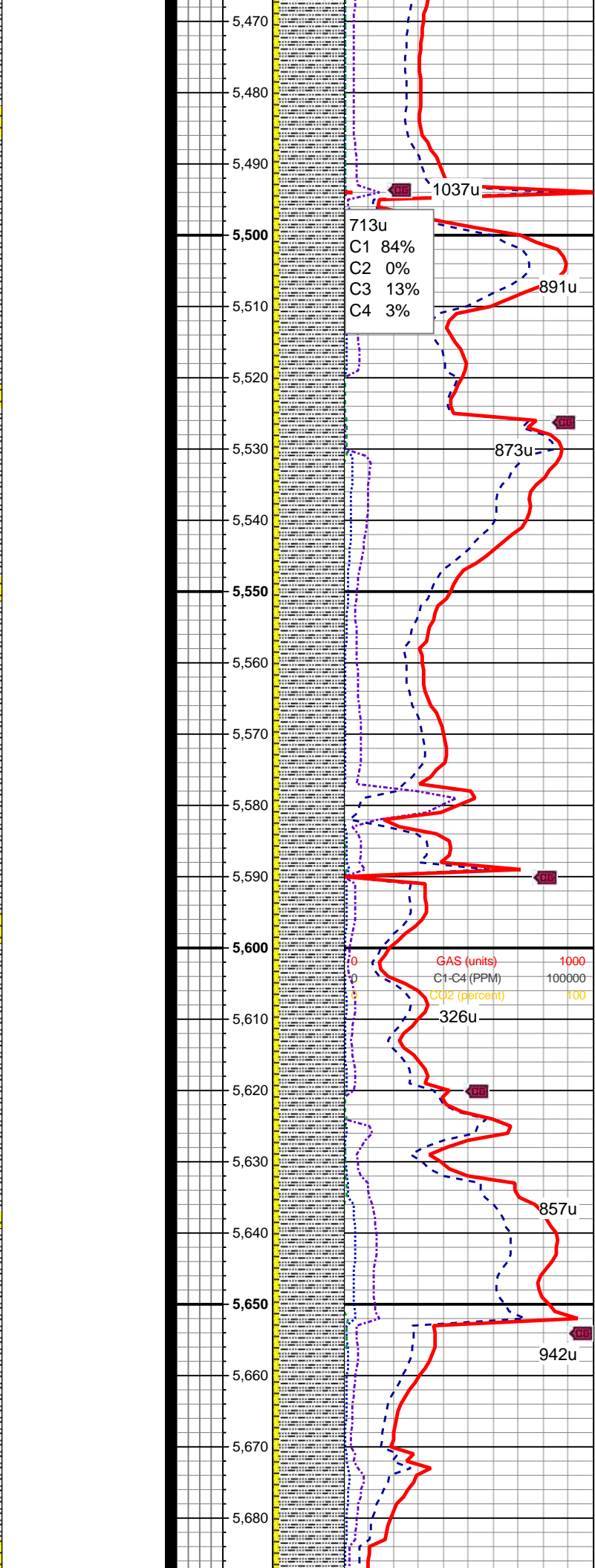
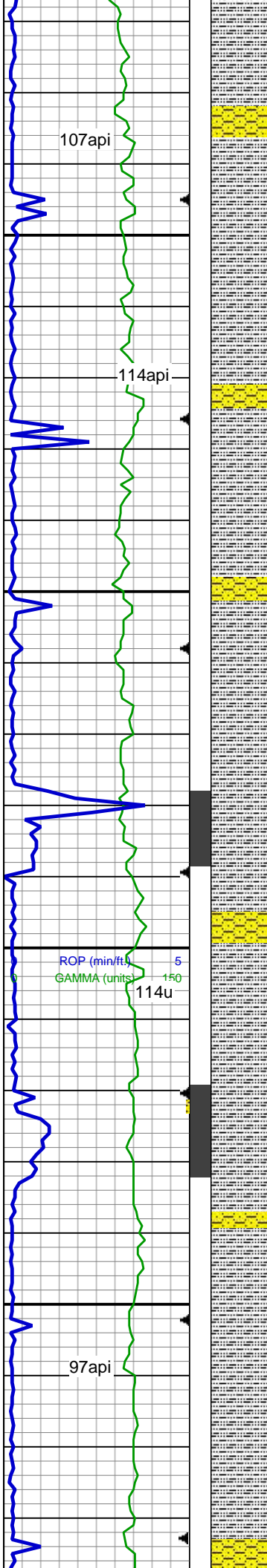
MD: 5,408'  
 TVD: 5,310.4'  
 Inclination: 1.5 °  
 Azimuth: 51.2 °  
 VS: -53.76'

83api

284u

SHY SS: lt gy, gy sb rd - sb ang, tr glauc ip, mod - w srt, sb firm to firm  
 SLTY SH: lt gy to dk gy, sb firm to firm, tr pyr, stly rthy tex, sb blkly to blkly

785u



SHY SS: lt gy, gy sb rd - sb ang, tr glauc  
ip, mod - w srt, sb firm to firm  
SLTY SH: lt gy to dk gy, sb firm to firm, tr  
pyr, slty rthy tex, sb blkly to blkly

MD: 5,502 '  
TVD: 5,404.37 '  
Inclination: 1.4 °  
Azimuth: 25 °  
VS: -55.3 '

SHY SS: lt gy, gy sb rd - sb ang, tr glauc  
ip, mod - w srt, sb firm to firm, sl calc  
SLTY SH: lt gy to dk gy, sb firm to firm, tr  
pyr, slty rthy tex, intbd wi carb, sb blkly to  
blkly, non calc

SHY SS: lt gy, gy sb rd - sb ang, tr glauc  
ip, mod - w srt, sb firm to firm, sl calc  
SLTY SH: lt gy to dk gy, sb firm to firm, tr  
pyr, slty rthy tex, intbd wi carb, sb blkly to  
blkly, non calc

MD: 5,597 '  
TVD: 5,499.34 '  
Inclination: 1.5 °  
Azimuth: 32.1 °  
VS: -57.18 '

IN WT 9.5 VIS 46/OUT WT 9.6 VIS 44

SHY SS: lt gy, gy sb rd - sb ang, tr glauc  
ip, mod - w srt, sb firm to firm, sl calc  
SLTY SH: lt gy to dk gy, sb firm to firm, tr  
pyr, slty rthy tex, intbd wi carb, sb blkly to  
blkly, non calc

SHY SS: lt gy, gy sb rd - sb ang, tr glauc  
ip, mod - w srt, sb firm to firm, sl calc  
SLTY SH: lt gy to dk gy, sb firm to firm, tr  
pyr, slty rthy tex, intbd wi carb, sb blkly to  
blkly, non calc

IN WT 9.6 VIS 47/OUT WT 9.6+ VIS 47

713u  
C1 84%  
C2 0%  
C3 13%  
C4 3%

GAS (units) 1000  
C1-C4 (PPM) 100000  
CO2 (percent) 100

107api

114api

97api

ROP (min/ft) 5  
GAMMA (units) 150  
114u

1037u

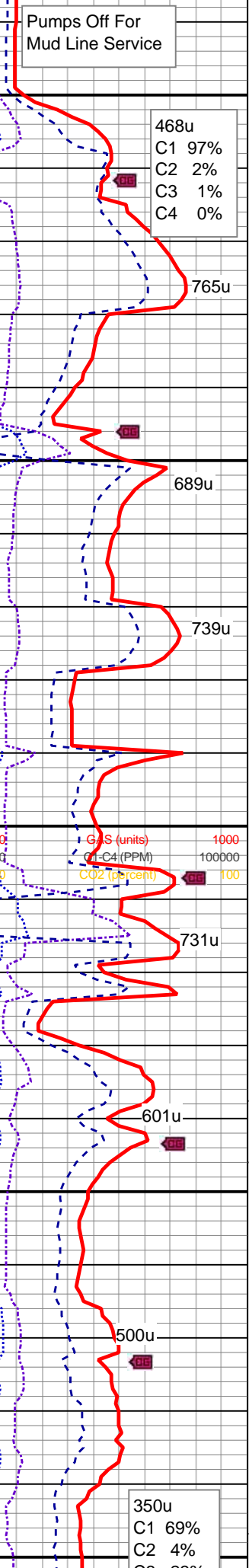
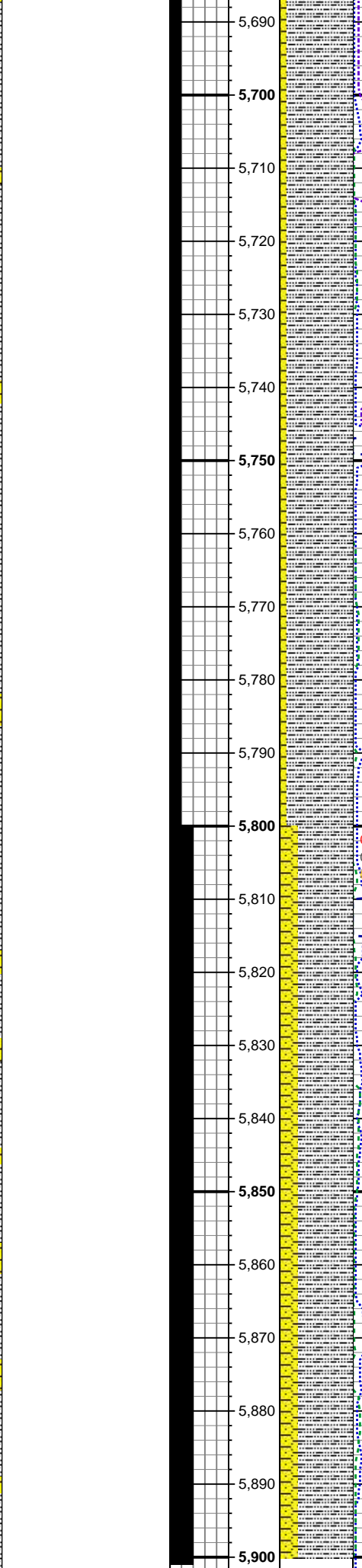
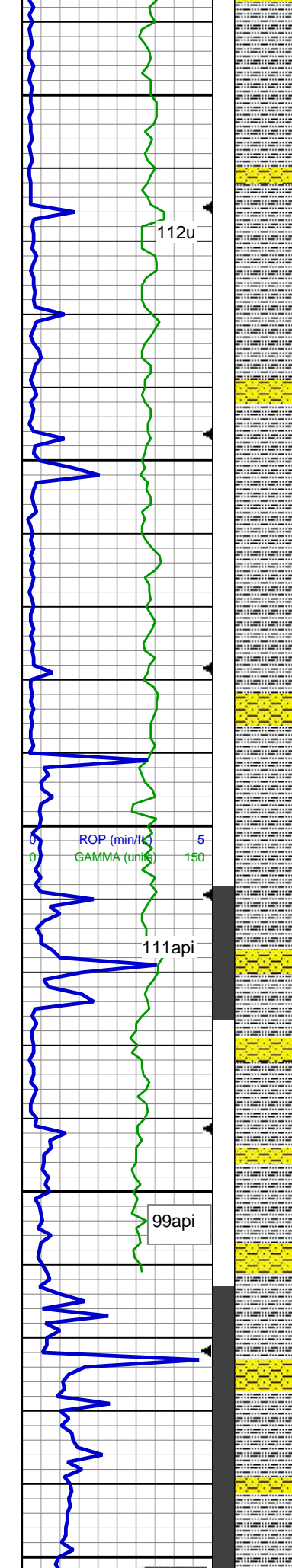
891u

873u

326u

857u

942u



Pumps Off For Mud Line Service

MD: 5,691' TVD: 5,593.3' Inclination: 1.8° Azimuth: 22.1° VS: -59.35'

MD: 5,735' TVD: 5,637.28' Inclination: 2° Azimuth: 14° VS: -60.64'

MD: 5,786' TVD: 5,688.25' Inclination: 1.7° Azimuth: 4.9° VS: -62.18'

MD: 5,817' TVD: 5,719.24' Inclination: 1.5° Azimuth: 354.1° VS: -63.03'

MD: 5,848' TVD: 5,750.23' Inclination: 1.1° Azimuth: 359.9° VS: -63.73'

IN WT 9.6+ VIS 46/OUT WT 9.7 VIS 48

IN WT 9.7+ VIS 45/OUT WT 9.7+ VIS 47

IN WT 9.7 VIS 50/OUT WT 9.7 VIS 52

468u  
C1 97%  
C2 2%  
C3 1%  
C4 0%

765u

689u

739u

731u

601u

500u

350u  
C1 69%  
C2 4%  
C3 23%  
C4 4%

