

# COLUMBINE LOGGING

Scale: 5" / 100'  
Measured Depth Log

**Well Name** Cutthroat LC28-72HNB

**Location** SESE SEC28, T9N, R59W

**State** COLORADO

**County** WELD

**Country** USA

**Rig Number** H&P 326

**API Number** 05-123-38603

**Region** DJ BASIN

**Field** WILDCAT

**Spud Date** 7/18/2014

**Surface Coordinates** 340' FSL, 955' FEL  
40.71503 -103.9767

**Ground Elevation** 4837'

**K.B. Elevation** 4867'

**Logged Interval** 633'

**Formation** NIOBRARA, B MARL

**Type of Drilling Fl...** LSND

## Operator

**Company** NOBLE ENERGY INC.

**Address** 1625 Broadway Suite 2200  
Denver, CO 80202

## Geologist

**Name** EVAN HOWELL

**Company** NOBLE ENERGY INC.

**Address** 1625 Broadway Suite 2200  
Denver, CO 80202

## Other

COLUMBINE LOGGING INC.

MIKE KERSCHEN

## Rock Types

UNKNOWN	COAL	METAMORPHIC	SHALY SILTSTONE
ANHYDRITE	CONGLOMERATE	NO SAMPLE	SILTSTONE
BENTONITE	DOLOMITE	SALT	SILTY SHALE
BRECCIA	GRANITE	SALT-PEPPER SAND	TILL
CEMENT	GYPSUM	SANDSTONE	TUFF
CHALK	IGNEOUS	SHALE	WELDED TUFF
CHERT	LIMESTONE	SHALE COLORED	
CLAY CHOKE SAND	SIDERITE or LIMONITE	SHALE GRAY	
CLAYSTONE	MARLSTONE	SHALY SANDSTONE	

## Accessories

### Fossils

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

### 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

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

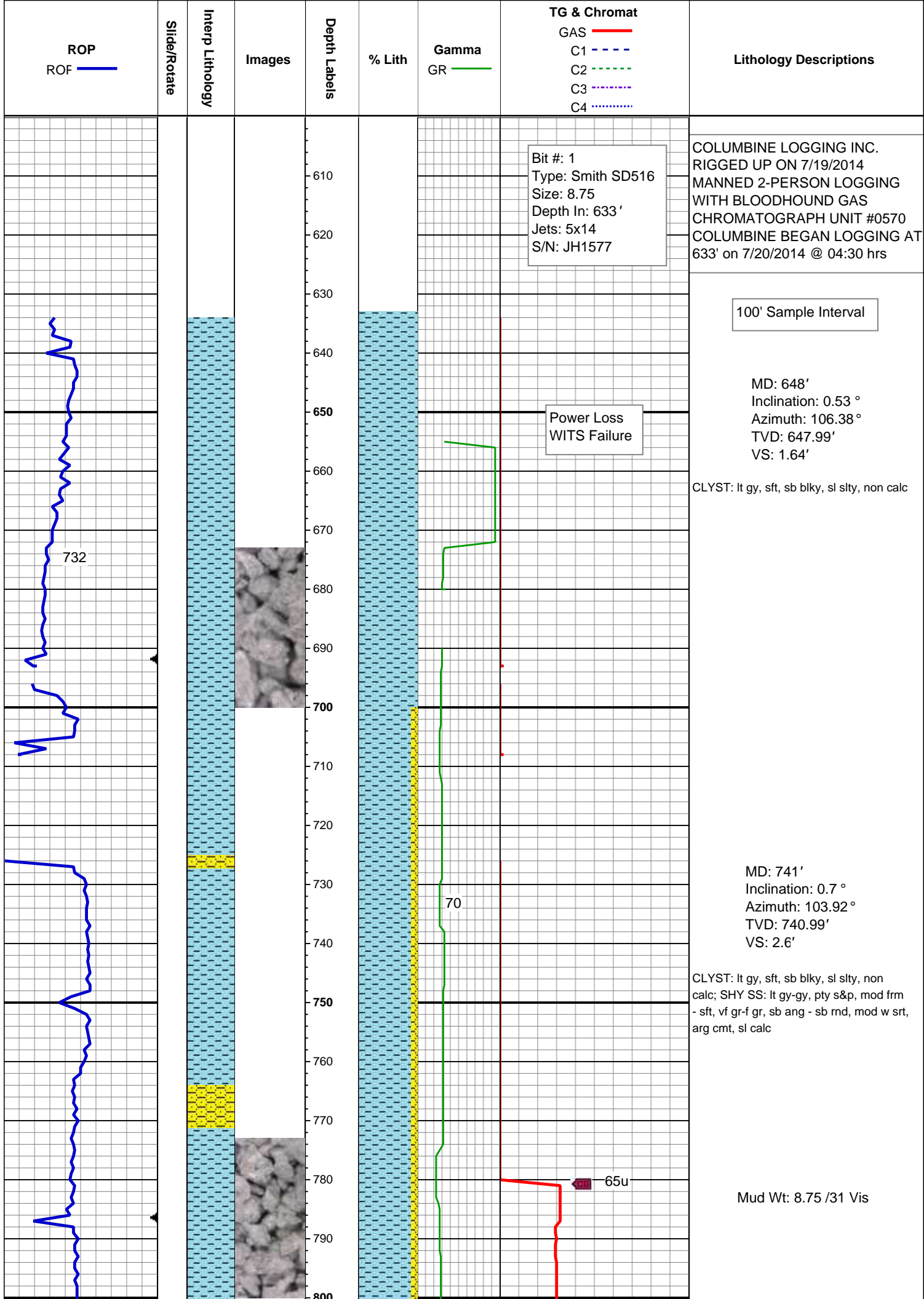
BOUNDSTONE
CHALKY
CRYPTOXLN

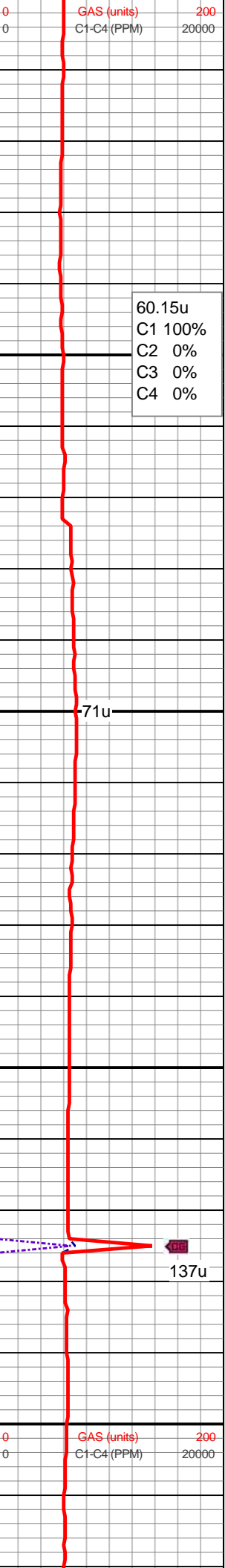
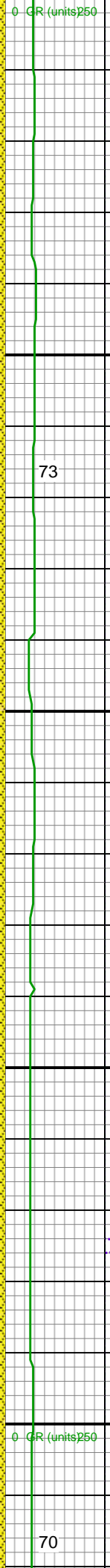
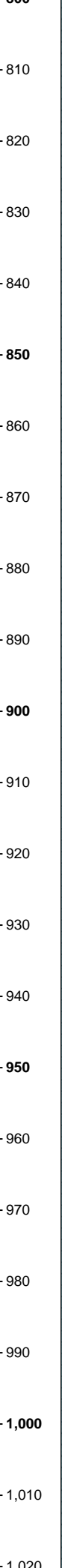
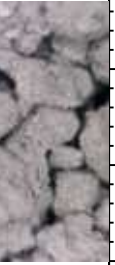
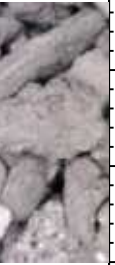
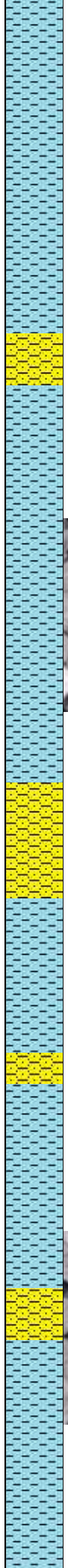
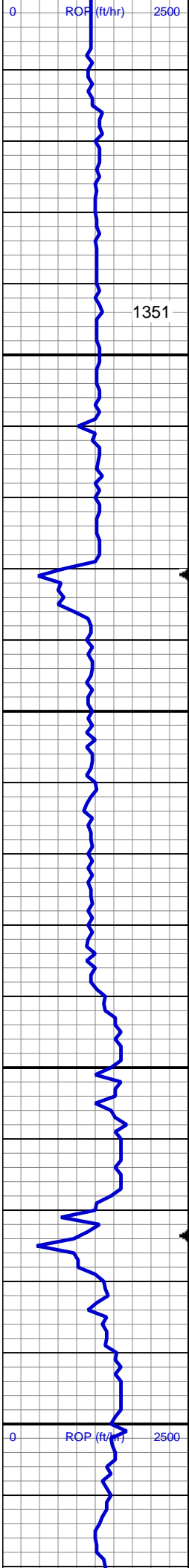
### Earthy

FINELYXLN
GRAINSTONE
LITHOGRAPHIC
MICROXLN
MUDSTONE
PACKSTONE
WACKESTONE

### Sorting

MODERATE
POOR
WELL





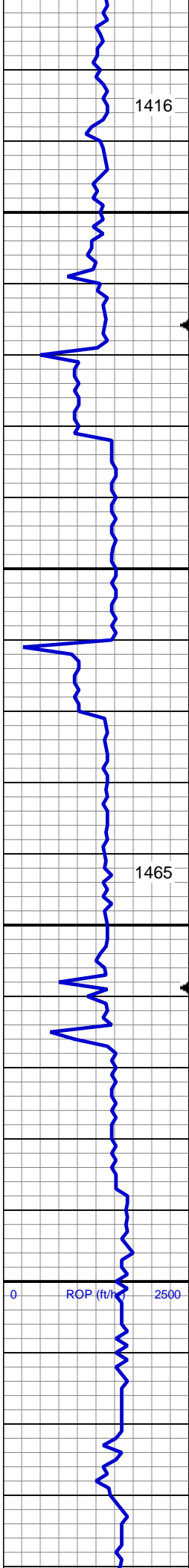
MD: 833'  
Inclination: 0.62 °  
Azimuth: 91.96 °  
TVD: 832.98'  
VS: 3.65'

CLYST: lt gy, sft, sb blkly, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 925'  
Inclination: 0.53 °  
Azimuth: 101.1 °  
TVD: 924.98'  
VS: 4.56'

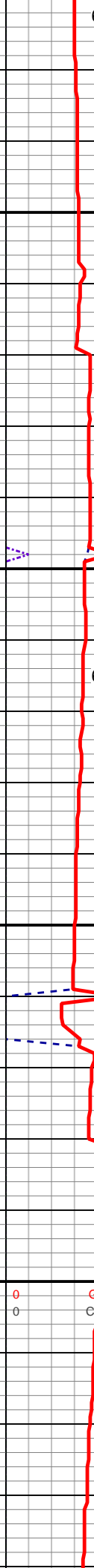
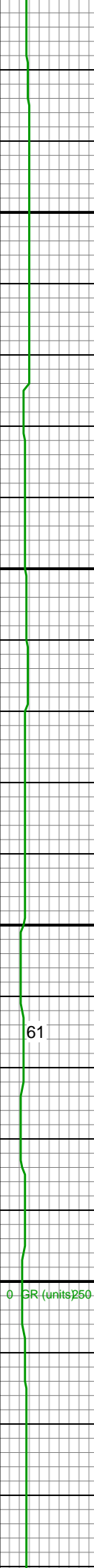
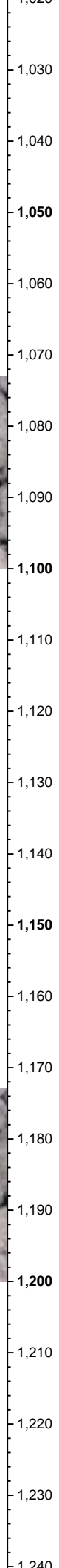
CLYST: lt gy, sft, sb blkly, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 1,012'



1416

1465



60u

64.58u  
C1 100%  
C2 0%  
C3 0%  
C4 0%

75u

69u

61

99u

79u

66.76u  
C1 100%  
C2 0%

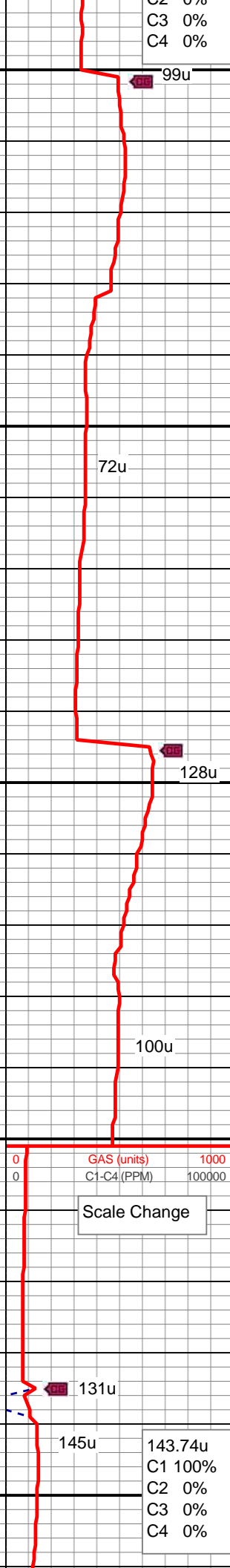
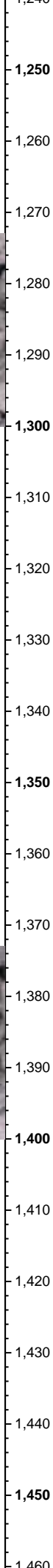
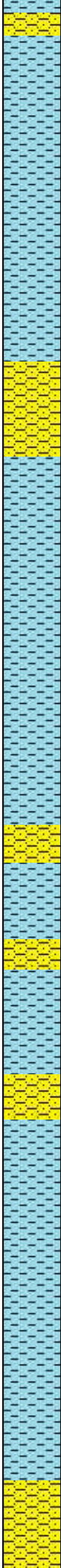
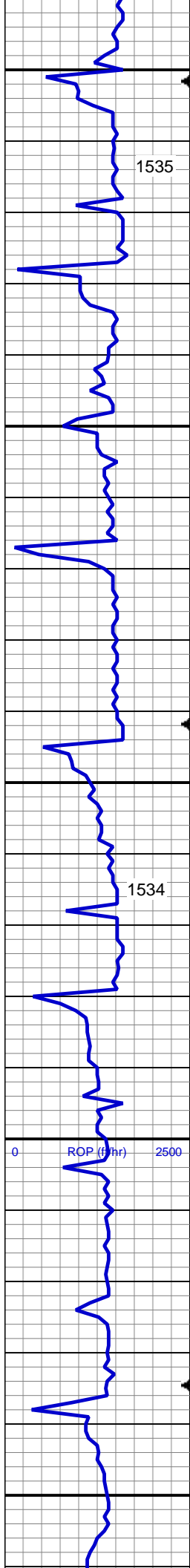
CLYST: lt gy, sft, sb blk, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 1,111'  
Inclination: 0.44 °  
Azimuth: 104.97 °  
TVD: 1,110.97'  
VS: 6.18'

CLYST: lt gy, sft, sb blk, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 1,204'  
Inclination: 0.7 °  
Azimuth: 120.97 °  
TVD: 1,203.97'  
VS: 7.01'





C2 0%  
C3 0%  
C4 0%

CLYST: lt gy, sft, sb blk, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 1,295'  
Inclination: 0.97 °  
Azimuth: 141.71 °  
TVD: 1,294.96'  
VS: 7.97'

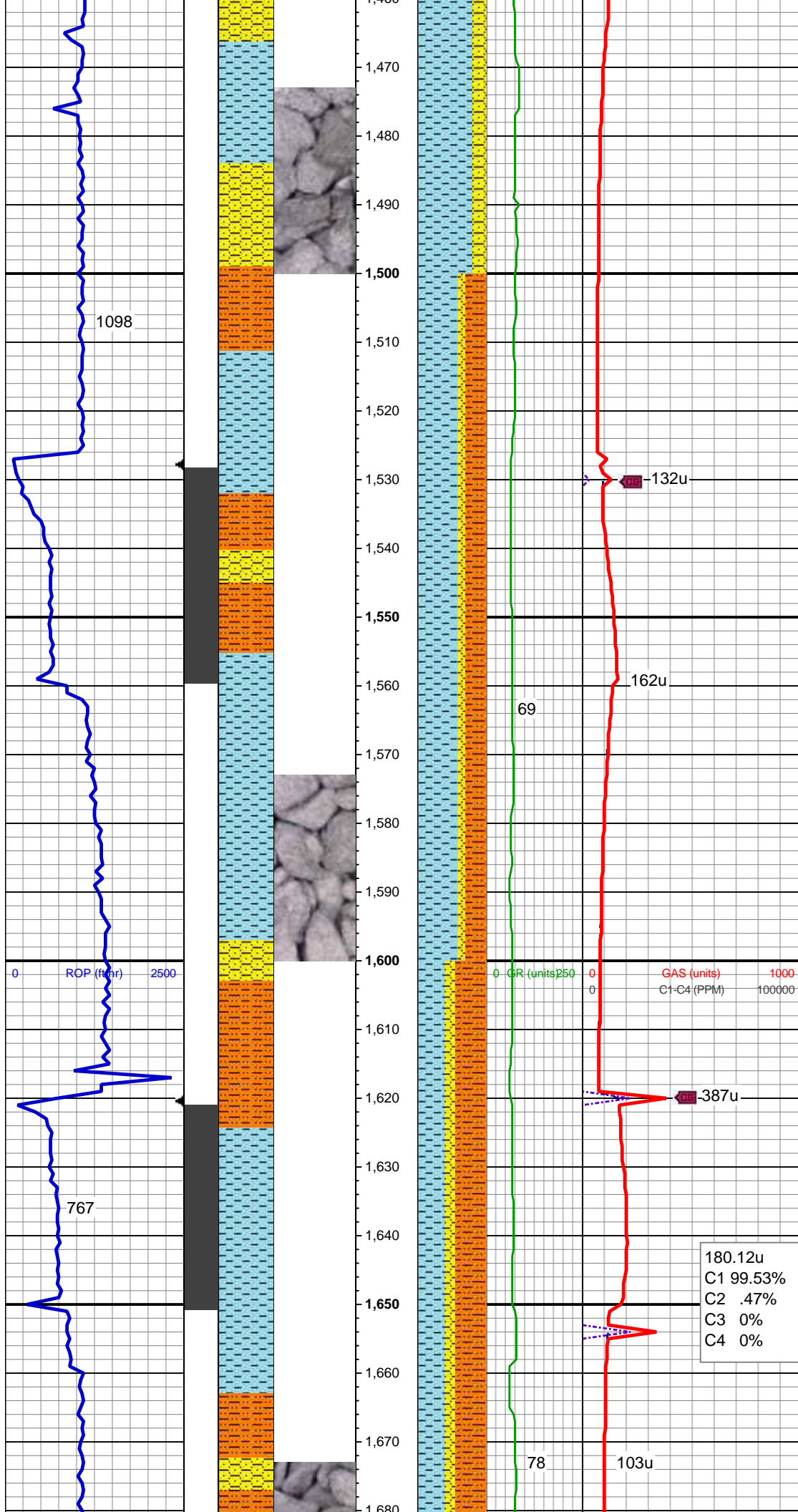
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MD: 1,387'  
Inclination: 1.06 °  
Azimuth: 137.67 °  
TVD: 1,386.94'  
VS: 9.02'

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

Scale Change

143.74u  
C1 100%  
C2 0%  
C3 0%  
C4 0%



MD: 1,480'  
Inclination: 1.23 °  
Azimuth: 134.68 °  
TVD: 1,479.92'  
VS: 10.31'

CLYST: lt gy, sft, sb blkly, sl slty, non  
calc; SHY SLTST: lt gy-gy, frm, sb  
blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty  
s&p, mod frm - sft, vf gr-f gr, sb ang - sb  
rnd, mod w srt, arg cmt, sl calc; abnt cly

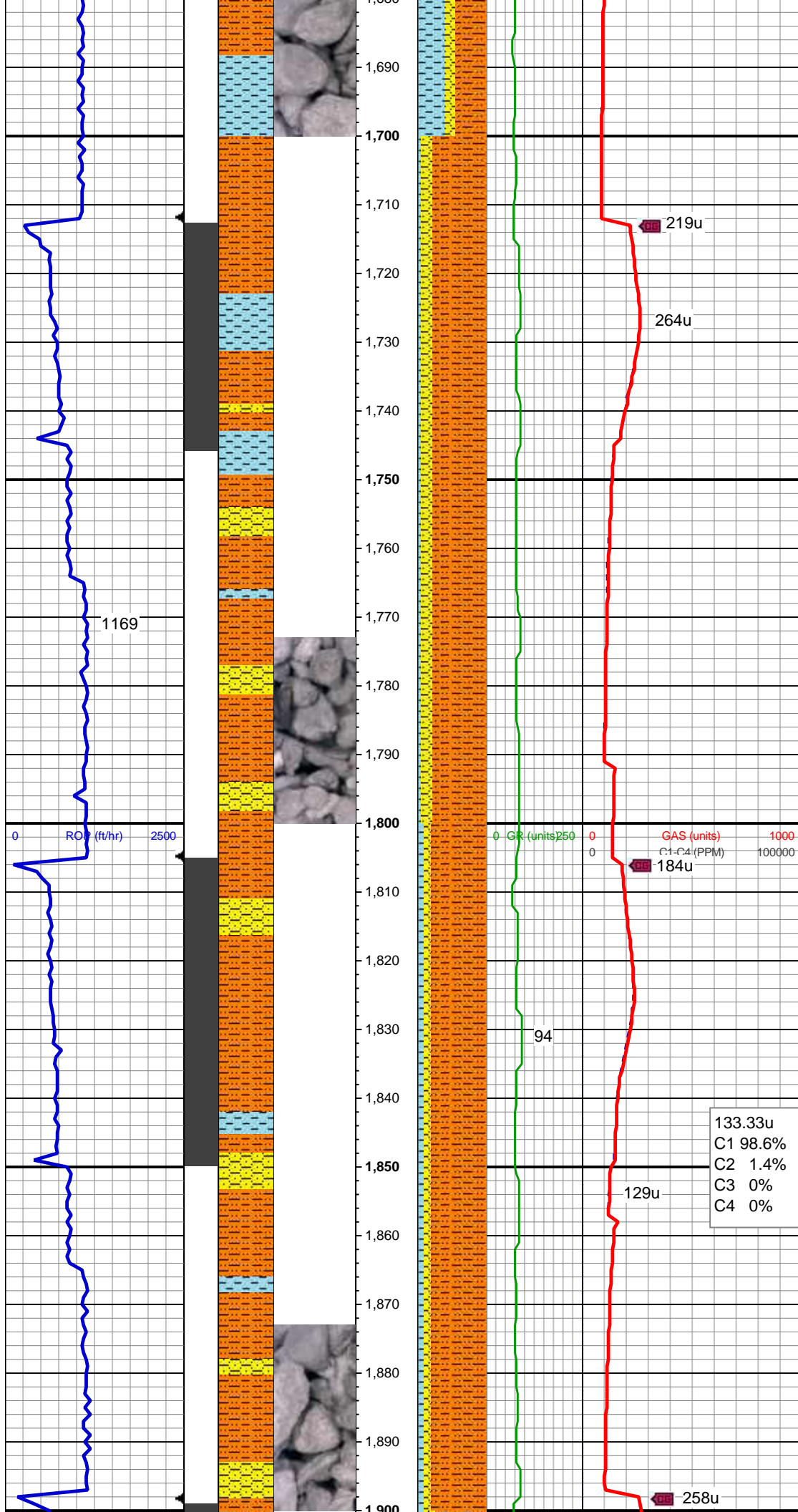
Mud Wt: 8.65 / 29 Vis

MD: 1,572'  
Inclination: 3.08 °  
Azimuth: 146.45 °  
TVD: 1,571.85'  
VS: 12.38'

CLYST: lt gy, sft, sb blkly, sl slty, non  
calc; SHY SLTST: lt gy-gy, frm, sb  
blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty  
s&p, mod frm - sft, vf gr-f gr, sb ang - sb  
rnd, mod w srt, arg cmt, sl calc; abnt cly

MD: 1,664'  
Inclination: 5.1 °  
Azimuth: 140.65 °  
TVD: 1,663.62'  
VS: 16.34'

180.12u
C1 99.53%
C2 .47%
C3 0%
C4 0%



SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc;CLYST: lt gy, sft, sb blkly, sl slty, non calc

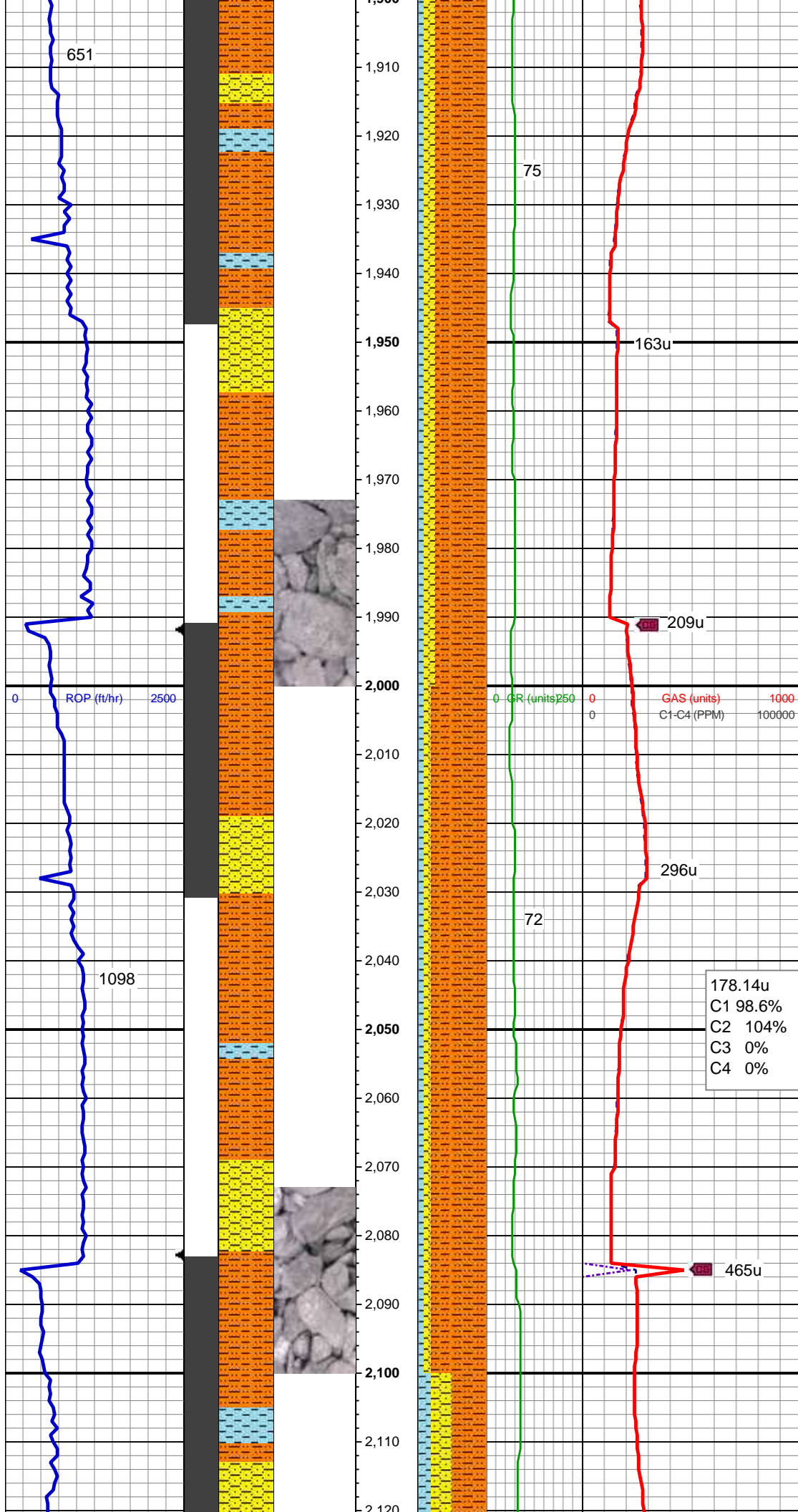
MD: 1,758'  
Inclination: 6.51 °  
Azimuth: 130.63 °  
TVD: 1,757.13'  
VS: 23.03'

Mud Wt: 9.25 / 25 Vis

SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc;CLYST: lt gy, sft, sb blkly, sl slty, non calc

MD: 1,850'  
Inclination: 8.97 °  
Azimuth: 132.39 °  
TVD: 1,848.29'  
VS: 32.29'



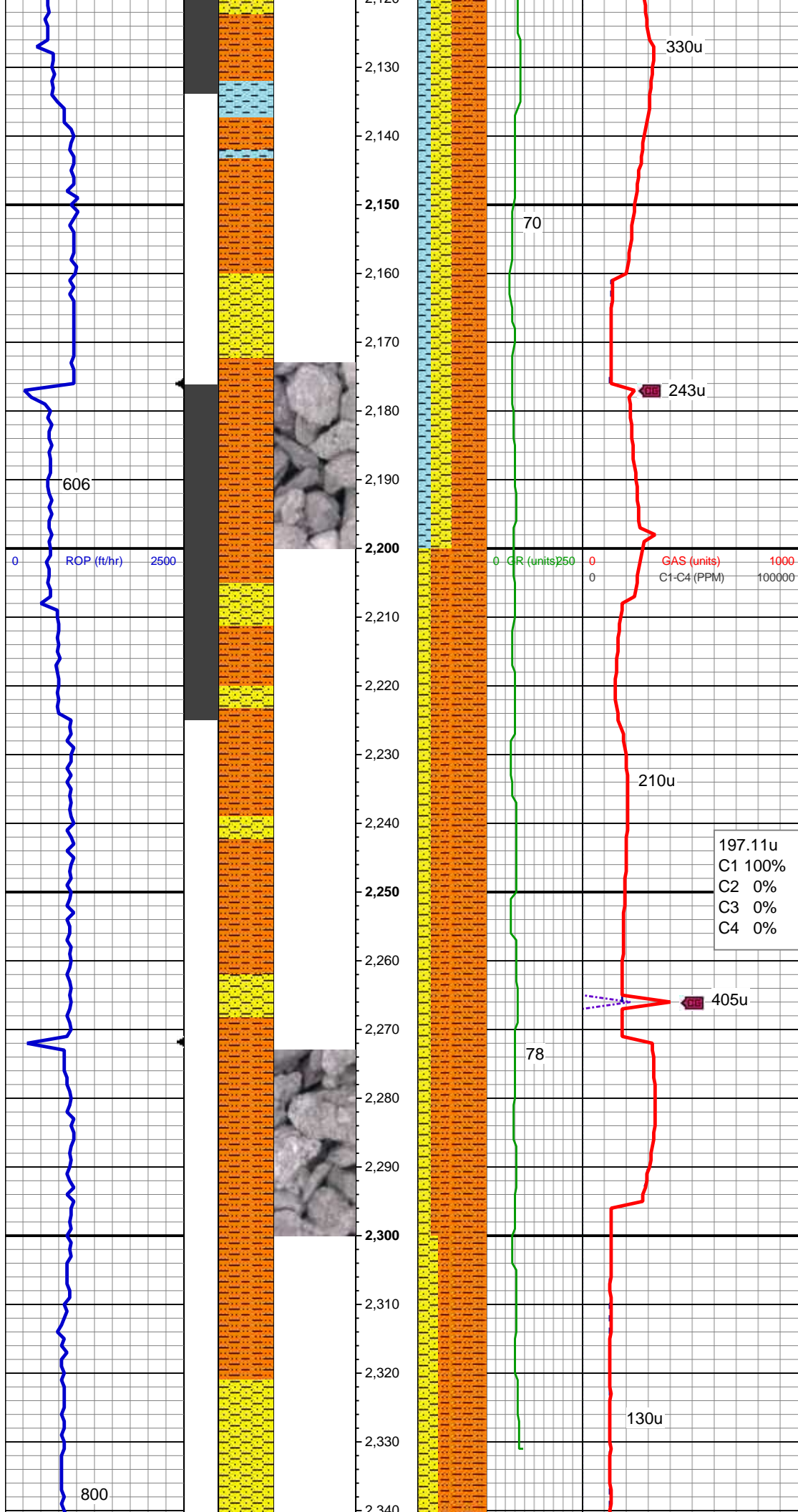


SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc;CLYST: lt gy, sft, sb blkly, sl slty, non calc

MD: 1,943'  
Inclination: 11.17 °  
Azimuth: 132.92 °  
TVD: 1,939.85'  
VS: 44.24'

MD: 2,036'  
Inclination: 12.13 °  
Azimuth: 136.96 °  
TVD: 2,030.94'  
VS: 57.51'

SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc;CLYST: lt gy, sft, sb blkly, sl slty, non calc



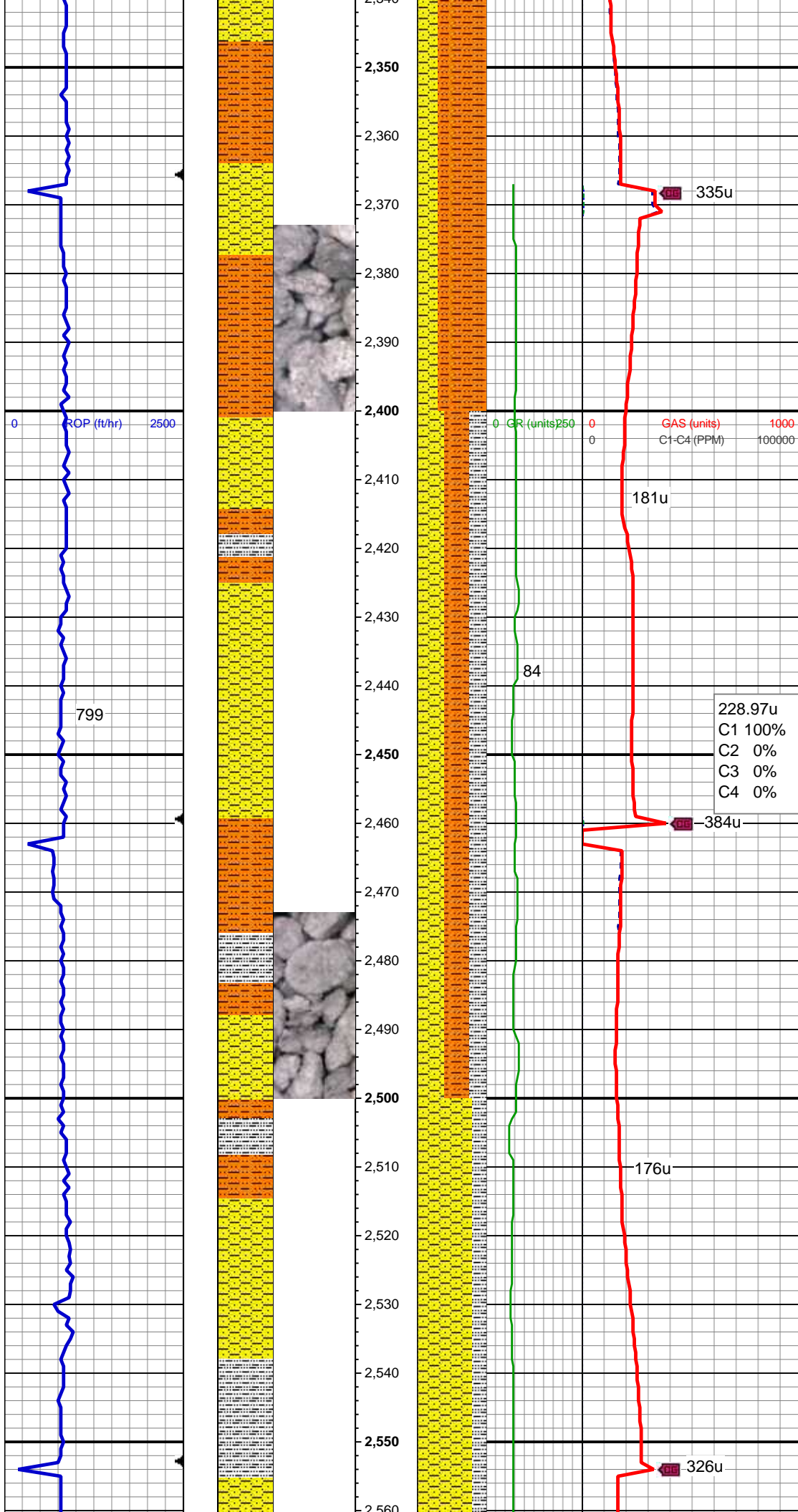
MD: 2,129'  
Inclination: 12.49 °  
Azimuth: 139.42 °  
TVD: 2,121.8'  
VS: 70.72'

SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy CLYST: lt gy, sft, sb blkly, sl slty, non calc; SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 2,223'  
Inclination: 13.72 °  
Azimuth: 142.94 °  
TVD: 2,213.35'  
VS: 84.05'

SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 2,317'  
Inclination: 12.57 °  
Azimuth: 140.3 °  
TVD: 2,304.89'  
VS: 97.3'



SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

MD: 2,412'  
Inclination: 11.7 °  
Azimuth: 139.95 °  
TVD: 2,397.76'  
VS: 110.1'

Mud Wt: 8.6 / 25 Vis

SHY SLTST: lt gy-gy, frm, sb blkly-blky, gritty, sdy SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc SLTY SH: lt-dk gy, occ tan, sft-frm, sb blkly-sb plty, gritty, tr sdy ip

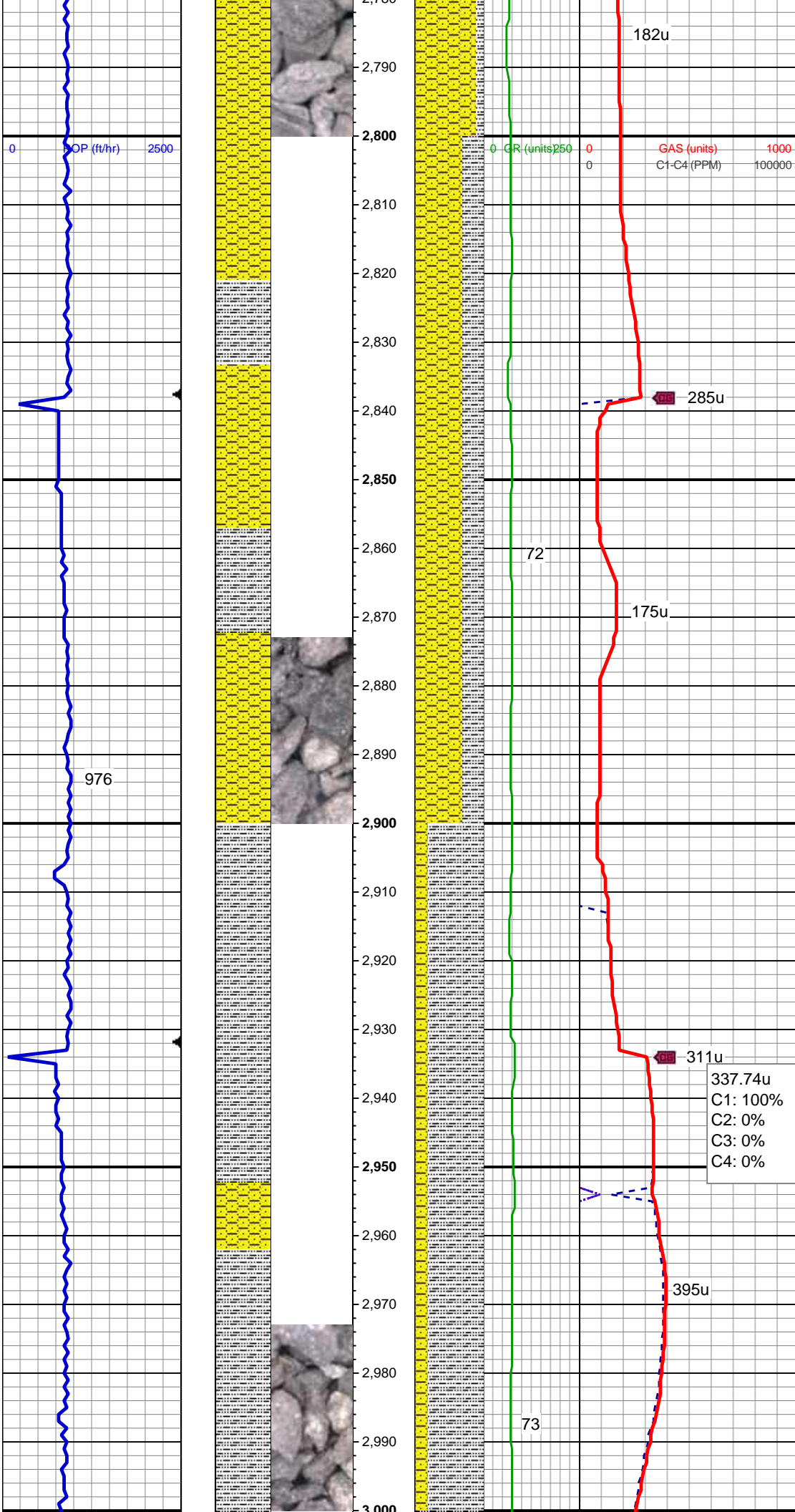
MD: 2,506'  
Inclination: 10.55 °  
Azimuth: 137.84 °  
TVD: 2,489.99'  
VS: 122.01'

SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc SLTY SH: lt-dk gy, occ tan, sft-frm, sb blkly-sb plty, gritty









MD: 2,790'  
Inclination: 11.43 °  
Azimuth: 137.14 °  
TVD: 2,768.78'  
VS: 158.65'

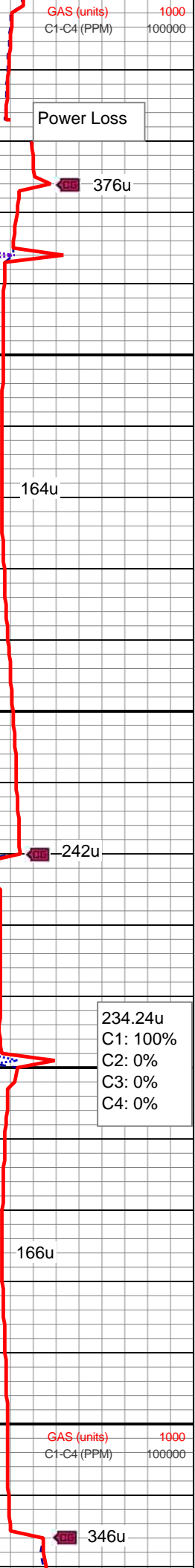
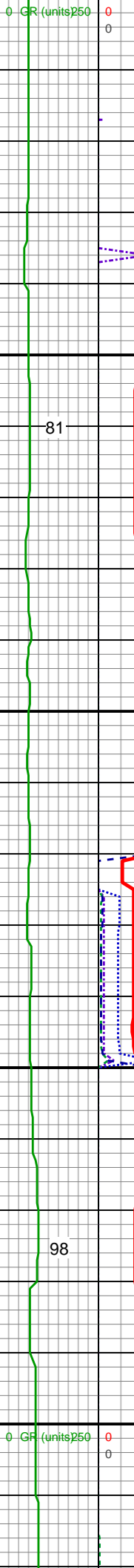
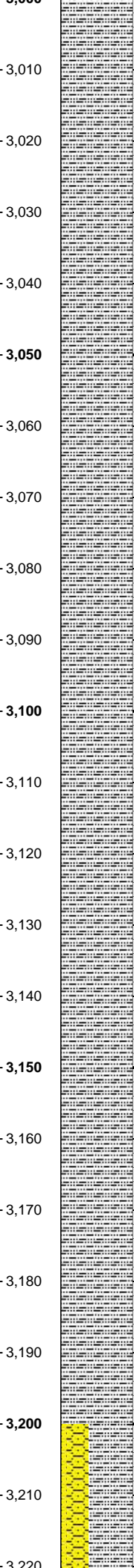
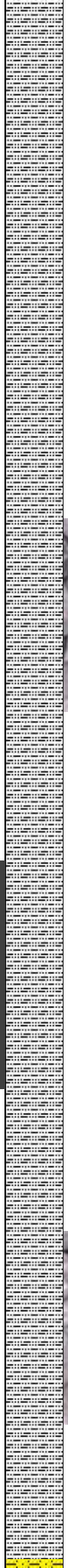
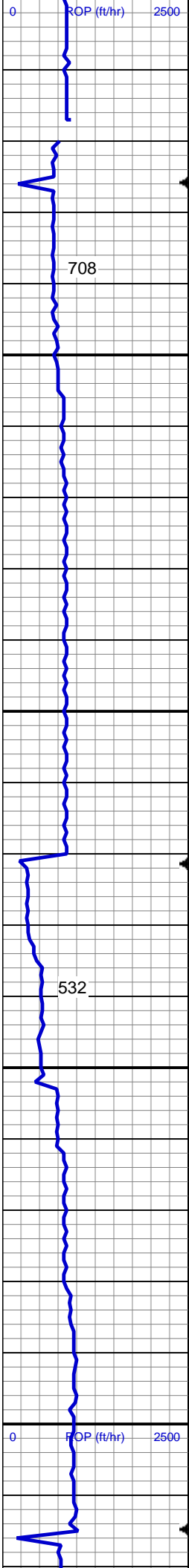
SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc SLTY SH: lt-dk gy, occ tan, sft-frm, sb blk-y-sb plty, gritty

MD: 2,884'  
Inclination: 11.61 °  
Azimuth: 135.56 °  
TVD: 2,860.88'  
VS: 171.61'

SLTY SH: lt-dk gy, occ tan, sft-frm, sb blk-y-sb plty, gritty grd ss ip SHY SS: lt gy-gy, pty s&p, mod frm - sft, vf gr-f gr, sb ang - sb rnd, mod w srt, arg cmt, sl calc

Mud Wt: 8.6 / 30 Vis

MD: 2,979'  
Inclination: 11.08 °  
Azimuth: 133.62 °  
TVD: 2,954.03'  
VS: 184.91'



Mud Wt: 8.9 / 29 Vis

Power Loss

376u

SLTY SH: lt-dk gy, occ tan, sft frm, sb  
blky-sb plty, gritty occly intbd /w ss

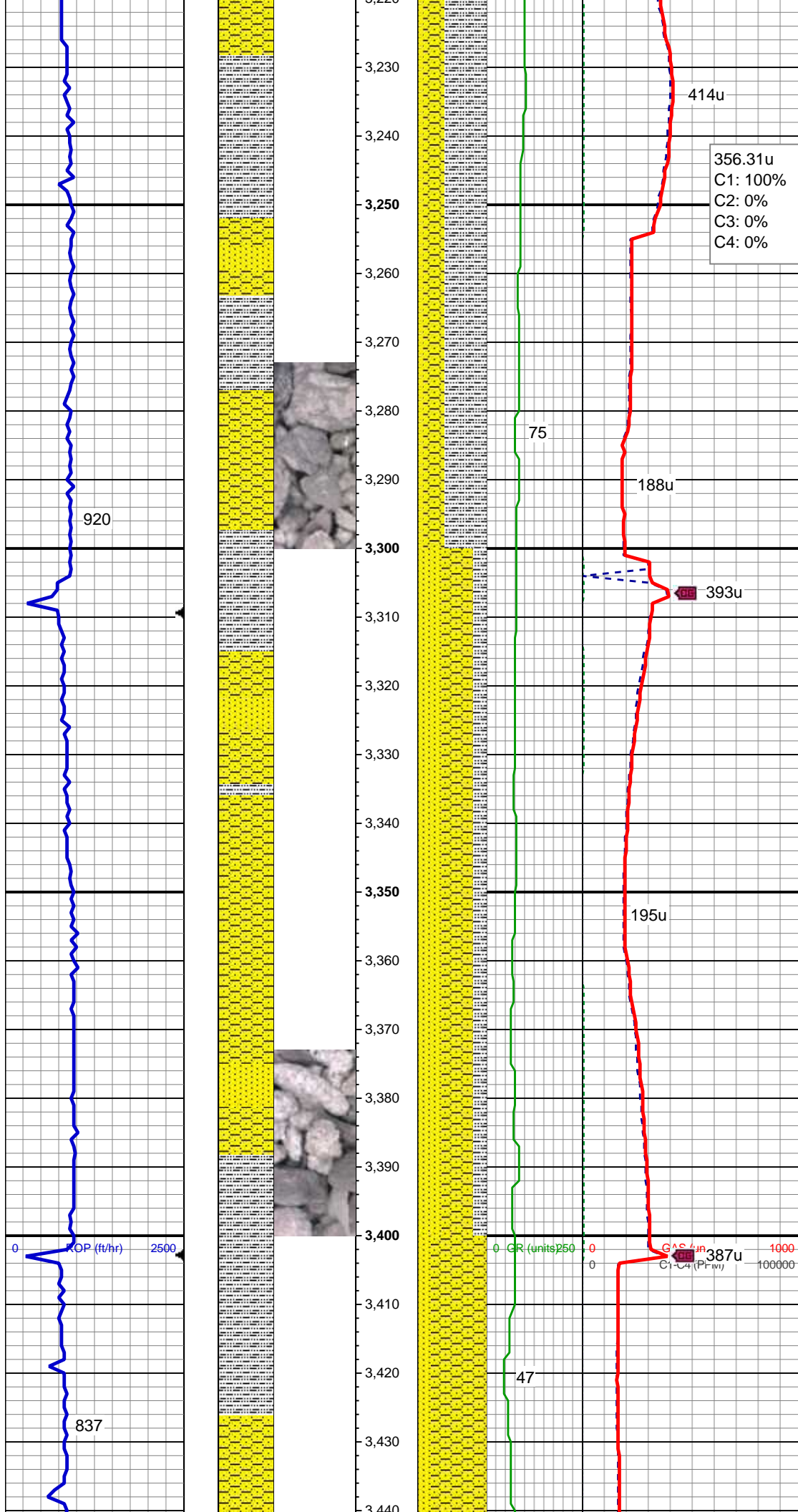
MD: 3,073'  
Inclination: 10.02 °  
Azimuth: 131.16 °  
TVD: 3,046.44'  
VS: 197.61'

234.24u  
C1: 100%  
C2: 0%  
C3: 0%  
C4: 0%

SLTY SH: lt-dk gy, occ tan, sft frm, sb  
blky-sb plty, gritty occly intbd /w ss

MD: 3,168'  
Inclination: 7.74 °  
Azimuth: 142.41 °  
TVD: 3,140.3'  
VS: 207.73'

346u



SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl arg, SLTY SH: lt-dk gy, occ tan, sft-frm, sb blk-y-sb pty, gritty

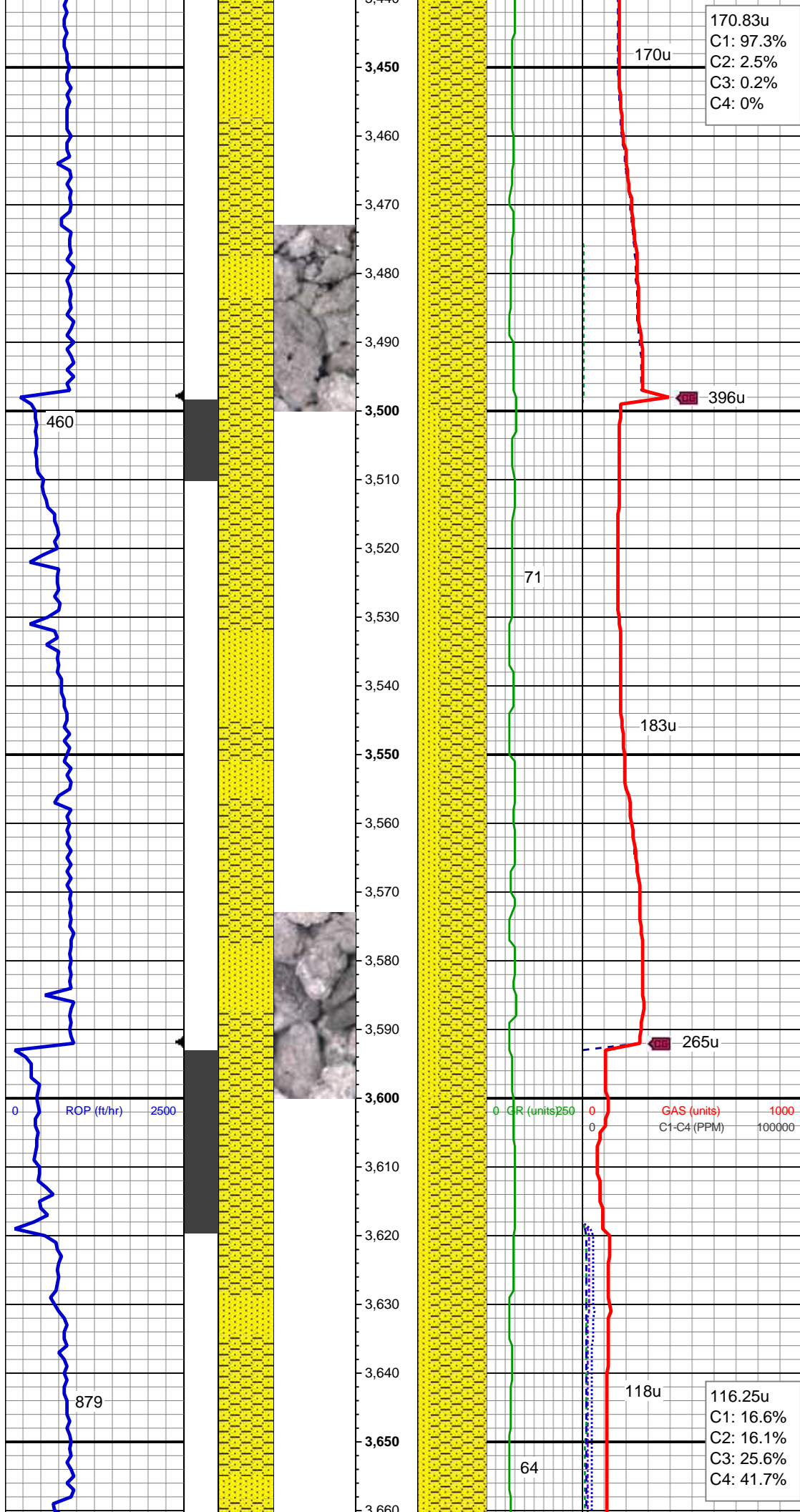
MD: 3,262'  
Inclination: 6.68 °  
Azimuth: 140.3 °  
TVD: 3,233.56'  
VS: 215.09'

SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl calc SLTY SH: lt-dk gy, occ tan, sft-frm, sb blk-y-sb pty, gritty

MD: 3,356'  
Inclination: 7.3 °  
Azimuth: 139.6 °  
TVD: 3,326.86'  
VS: 222.45'

Mud Wt: 8.9 / 29 Vis





SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl calc

MD: 3,451'  
Inclination: 8.27 °  
Azimuth: 139.07 °  
TVD: 3,420.98'  
VS: 230.84'

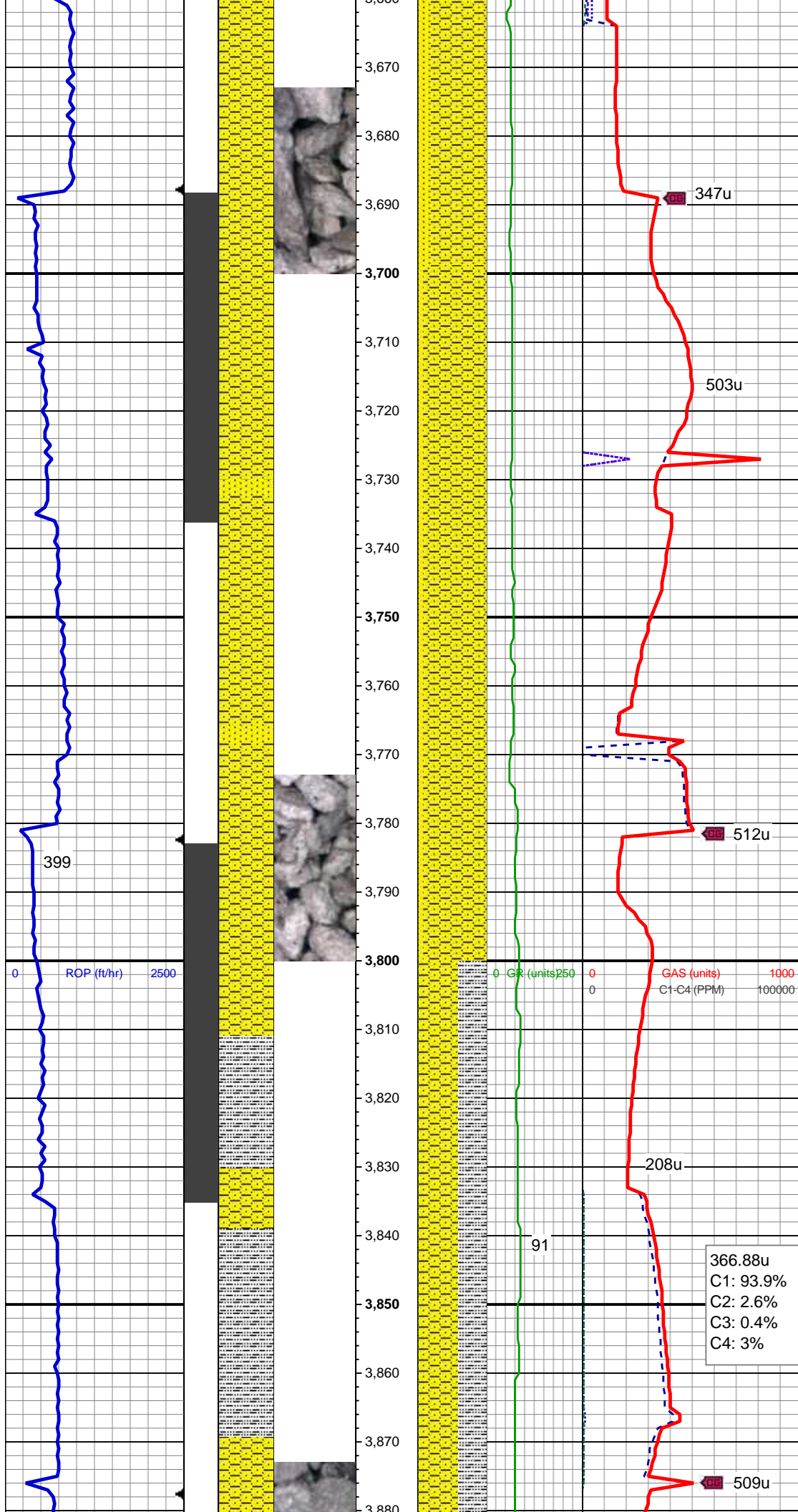
MD: 3,545'  
Inclination: 7.56 °  
Azimuth: 141.53 °  
TVD: 3,514.08'  
VS: 239.11'

SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl calc

MD: 3,640'  
Inclination: 6.95 °  
Azimuth: 144.87 °  
TVD: 3,608.32'  
VS: 246.31'

SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt,sl calc SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl calc



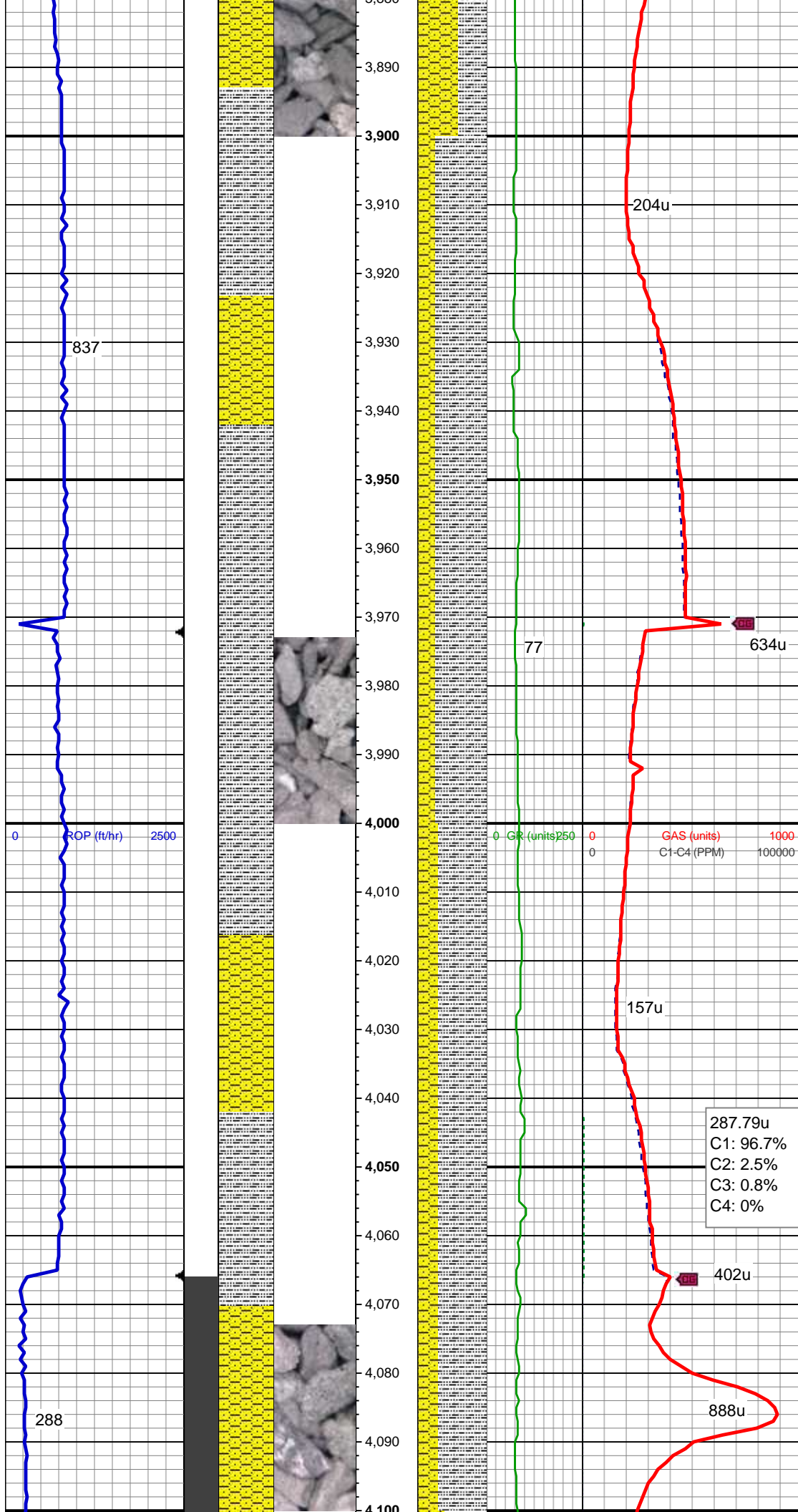


MD: 3,735'  
Inclination: 5.36 °  
Azimuth: 132.39 °  
TVD: 3,702.78'  
VS: 252.89'

SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc SS: med gy-wh, s&p, vf-med grn, sb rd-sb ang, mod p srt, frm-friable, occ glau, sl calc

MD: 3,829'  
Inclination: 2.9 °  
Azimuth: 136.08 °  
TVD: 3,796.53'  
VS: 257.79'

SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt,sl calc SLTY SH: lt-dk gy, sft-frm, sb blk-y-sb plty, gritty



MD: 3,924'  
Inclination: 2.81 °  
Azimuth: 137.49 °  
TVD: 3,891.41'  
VS: 261.03'

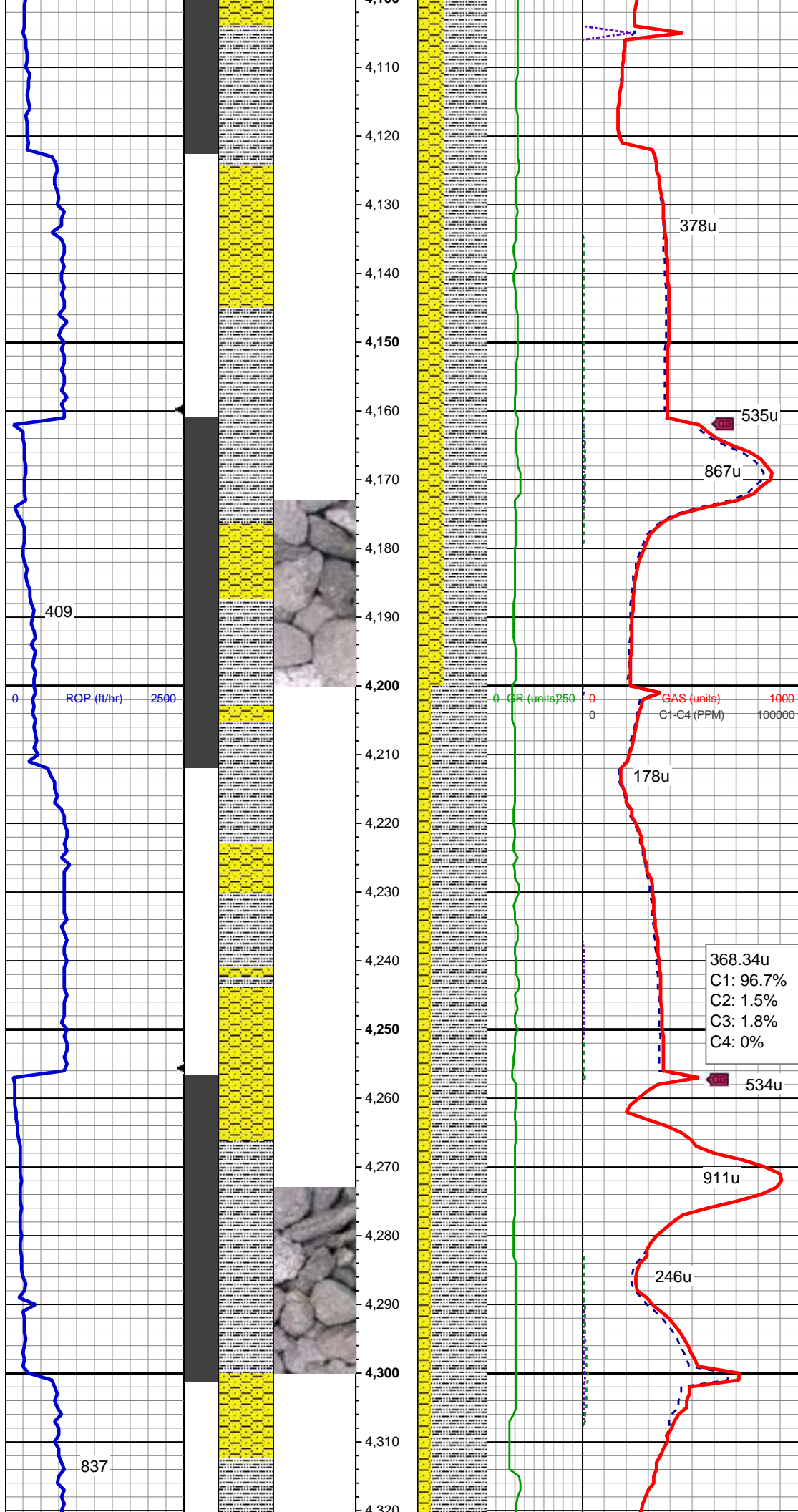
SLTY SH: lt-dk gy, sft-frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

Mud Wt: 9.0 / 28 Vis

MD: 4,018'  
Inclination: 2.99 °  
Azimuth: 112.53 °  
TVD: 3,985.29'  
VS: 264.85'

SLTY SH: lt-dk gy, sft-frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

287.79u  
C1: 96.7%  
C2: 2.5%  
C3: 0.8%  
C4: 0%



MD: 4,113'  
Inclination: 2.37 °  
Azimuth: 119.21 °  
TVD: 4,080.19'  
VS: 268.85'

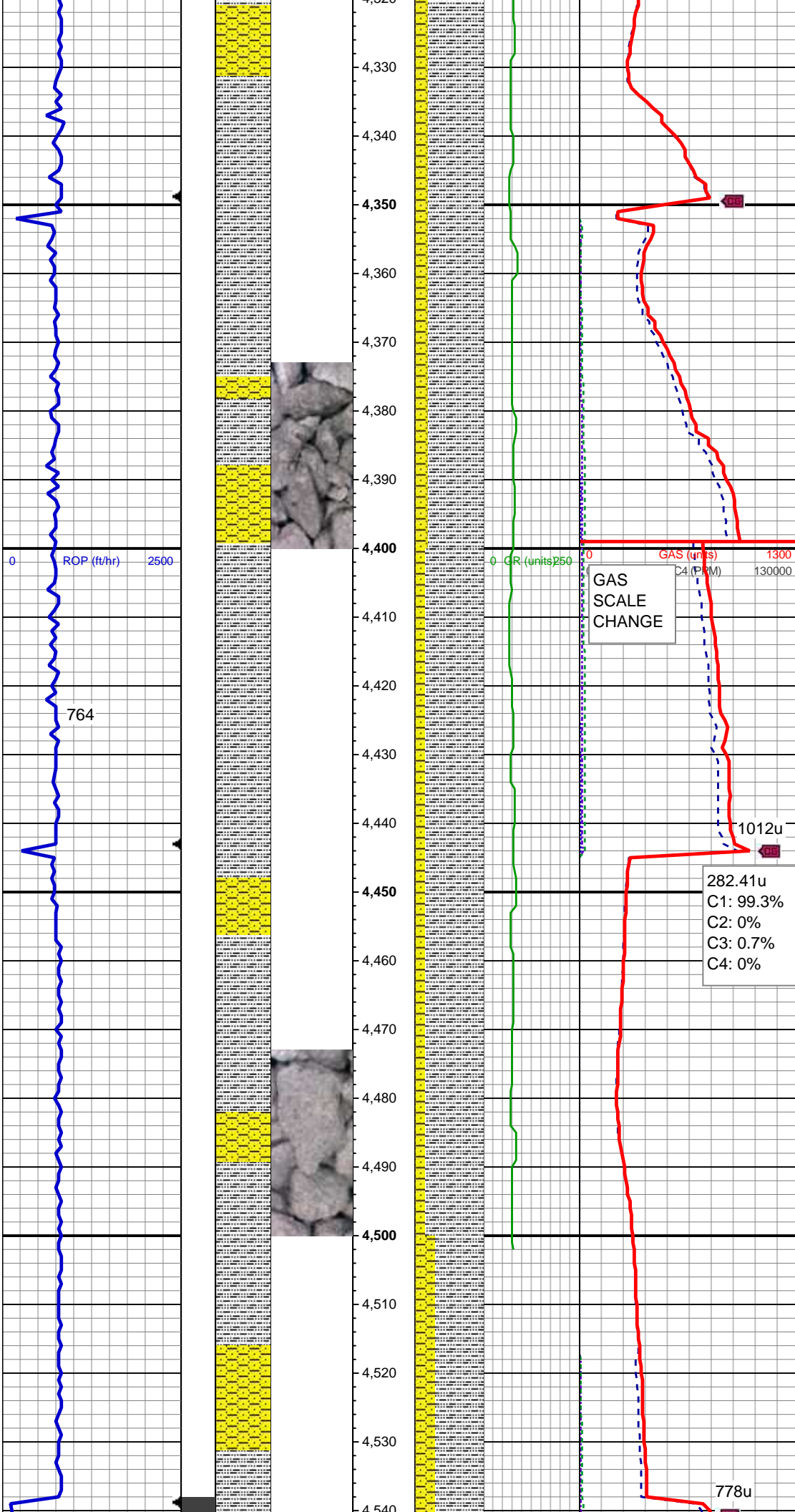
SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

MD: 4,207'  
Inclination: 2.46 °  
Azimuth: 182.67 °  
TVD: 4,174.12'  
VS: 270.46'

SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

MD: 4,302'  
Inclination: 0.97 °  
Azimuth: 269.68 °  
TVD: 4,269.09'  
VS: 269.56'





SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

MD: 4,396'  
Inclination: 0.88 °  
Azimuth: 314.15 °  
TVD: 4,363.07'  
VS: 268.24'

GAS SCALE  
CHANGE

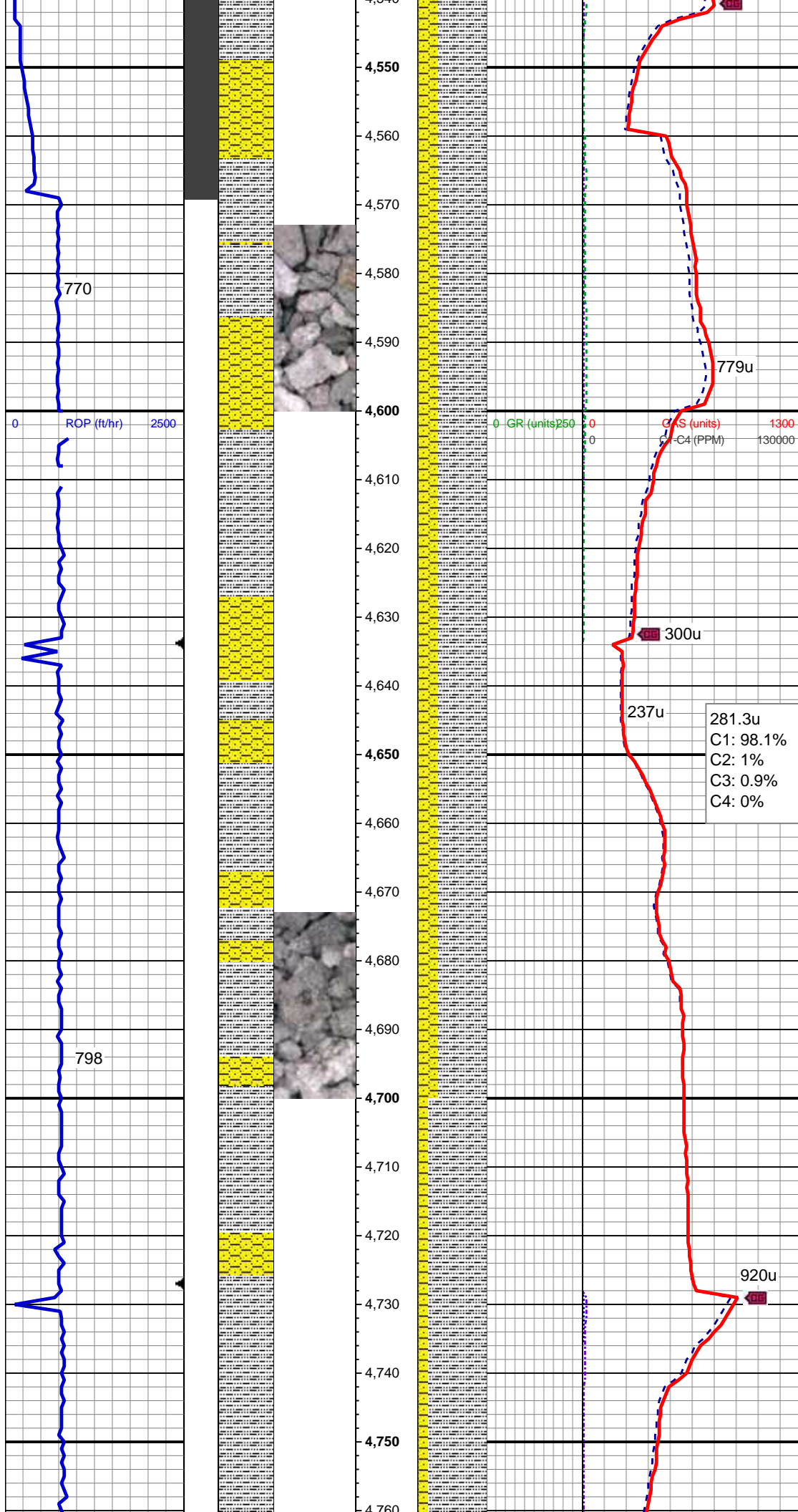
SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

282.41u  
C1: 99.3%  
C2: 0%  
C3: 0.7%  
C4: 0%

MD: 4,491'  
Inclination: 0.88 °  
Azimuth: 309.05 °  
TVD: 4,458.06'  
VS: 267.15'

Mud Wt: 9.0 / 29 Vis

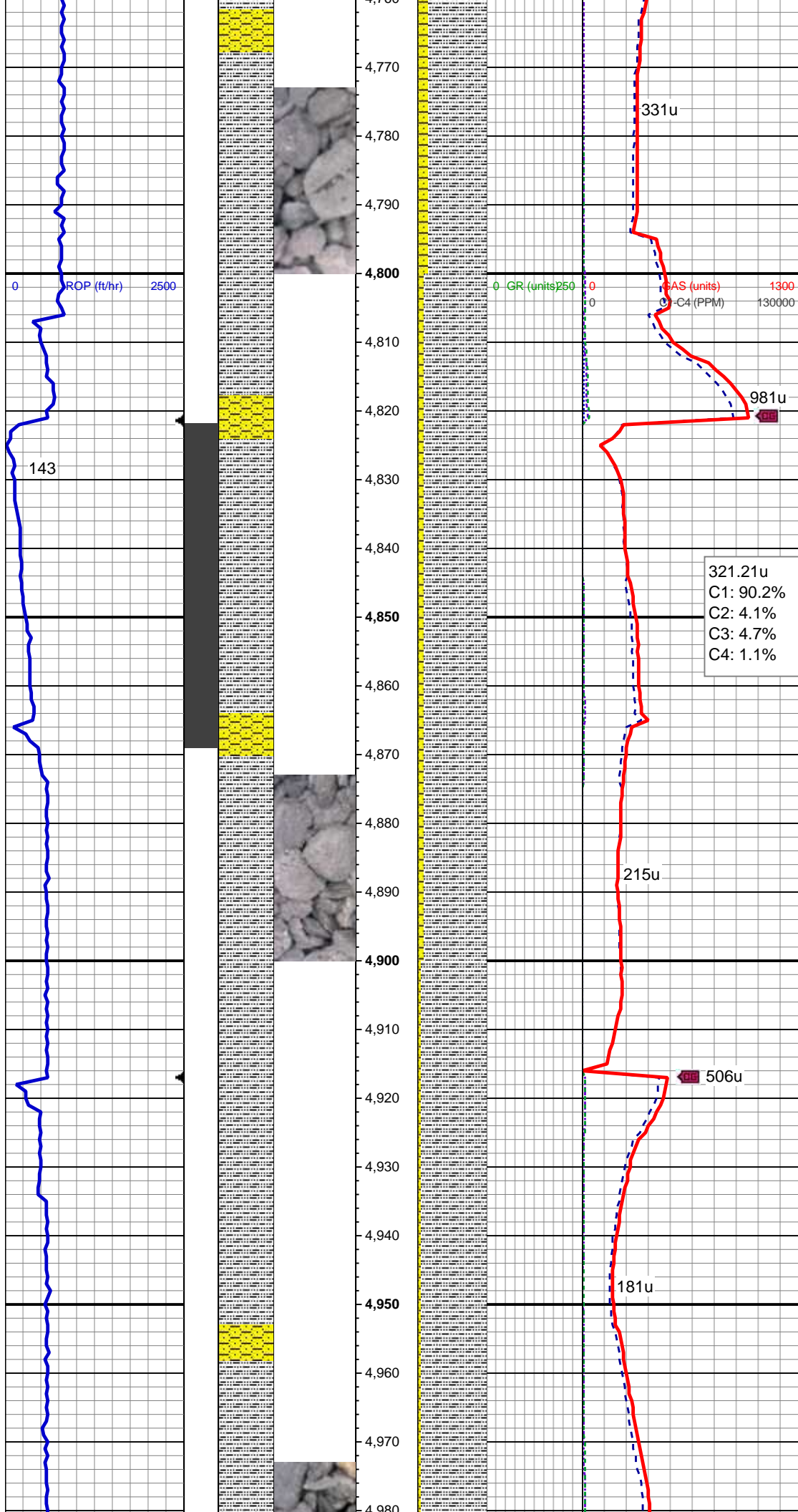




SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty, gritty SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc

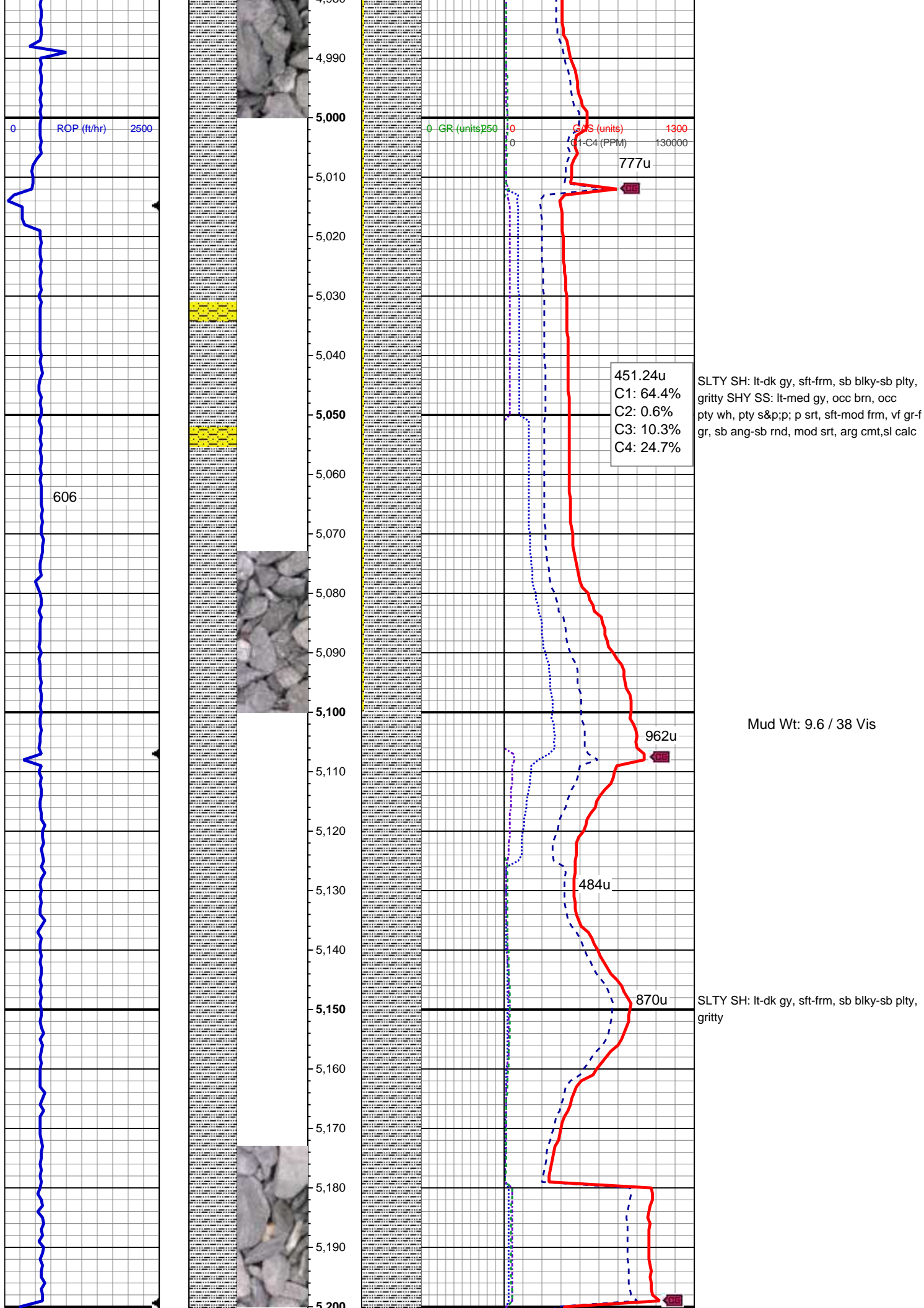
SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty, gritty SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc

SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty, gritty SHY SS: lt-med gy, occ brn, occ pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f gr, sb ang-sb rnd, mod srt, arg cmt, sl calc

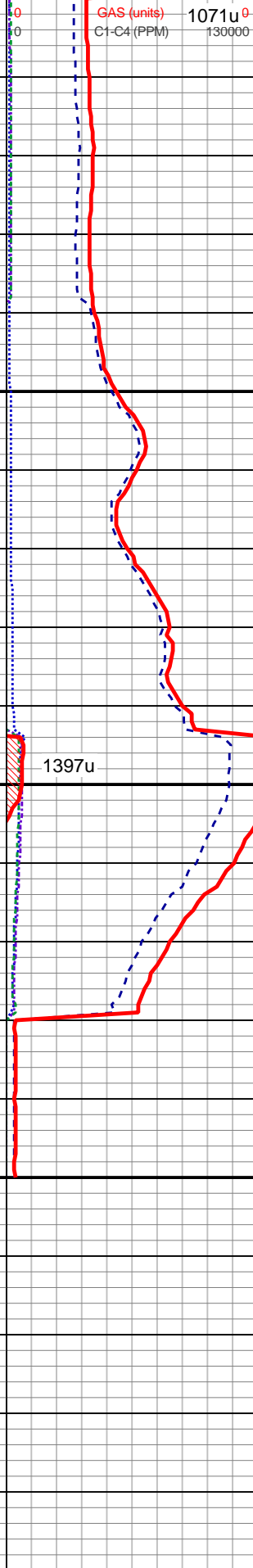
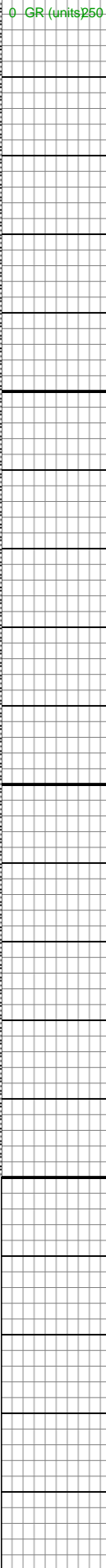
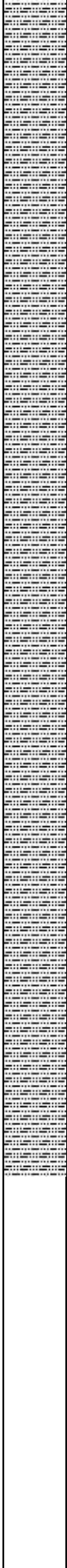
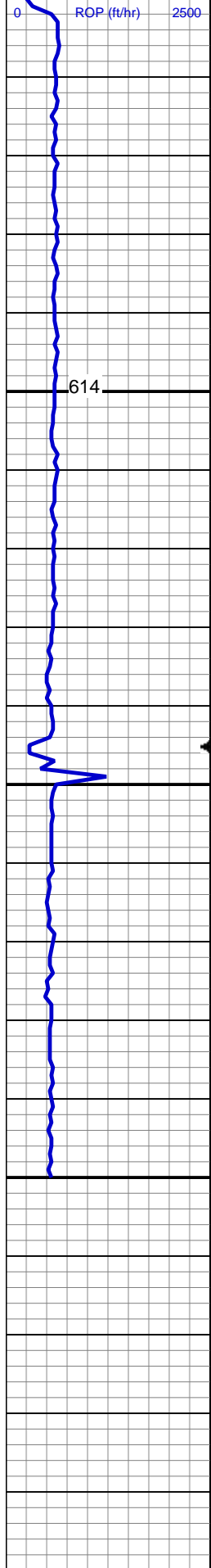


SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc

SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty,  
gritty SHY SS: lt-med gy, occ brn, occ  
pty wh, pty s&p;p; p srt, sft-mod frm, vf gr-f  
gr, sb ang-sb rnd, mod srt, arg cmt,sl calc







SLTY SH: lt-dk gy, sft frm, sb blk-y-sb plty, gritty

TOOH FOR BHA #2 @ 5350' MD  
LOG CONTINUES ON MPlot  
Cutthroat LC28-72HNB Horz