

COLUMBINE LOGGING

Scale: 5" / 100'
Measured Depth Log

Well Name Mackinaw A19-79HNA VERT

Location SEC 24 T6N R65W

State COLORADO

County WELD

Country USA

Rig Number H&P 315

API Number 05-123-38147

AFE # 139587

Region DJ BASIN

Field WATTENBERG

Spud Date 7/5/2014

Drilling Completed 7/7/2014

Surface Coordinates NENE SEC 24 T6N R65W
330' FNL; 1,077' FEL

LAT/LON: 40.47782/-104.60574

Bottom Hole Coordinates SWSW SEC 19 T6N R64W
535' FSL; 240' FWL

Ground Elevation 4,684'

K.B. Elevation 4,708'

Logged Interval 2,000' To 6,069'

Total Depth 6,069'

Formation NIOBRARA A MARL

Type of Drilling Fluid LSND

Other Symbols

Oil Show

- DEAD
- EVEN
- QUESTIONABLE
- SPOTTED STAINING

Porosity

- E EARTHY
- F FENESTRAL
- F FRACTURE
- INTERCRYSTALLINE
- INTEROOLITIC
- MOLDIC

- ORGANIC
- PINPOINT
- VUGGY

Engineering

- BIT
- CONNECTION (LEFT)
- CONNECTION (RIGHT)
- CONNECTION GAS
- CONNECTION GAS DOWN...
- CONNECTION GAS DOWN
- 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
- MIX MICROXLN
- MS MUDSTONE
- PS PACKSTONE
- WS WACKSTONE

Sorting

- M MODERATE
- P POOR
- W WELL

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

Rock Types

- SHALY SILTSTONE
- SHALY SANDSTONE
- SANDSTONE
- SILTY SHALE
- LIMESTONE
- CHALK
- MARLSTONE
- UNKNOWN
- ANHYDRITE

- BENTONITE
- BRECCIA
- CEMENT
- CHERT
- CLAY CHOKE SAND
- CLAYSTONE
- COAL
- CONGLOMERATE
- DOLOMITE

- GRANITE
- GYPSUM
- IGNEOUS
- SIDERITE or LIMONITE
- METAMORPHIC
- NO SAMPLE
- SALT
- SALT- PEPPER SAND
- SHALE

- SHALE COLORED
- SHALE GRAY
- SILTSTONE
- TILL
- TUFF
- WELDED TUFF

Operator

Company Noble Energy Inc

Address 1625 BROADWAY SUITE 2200
DENVER, CO 80202

Geologist

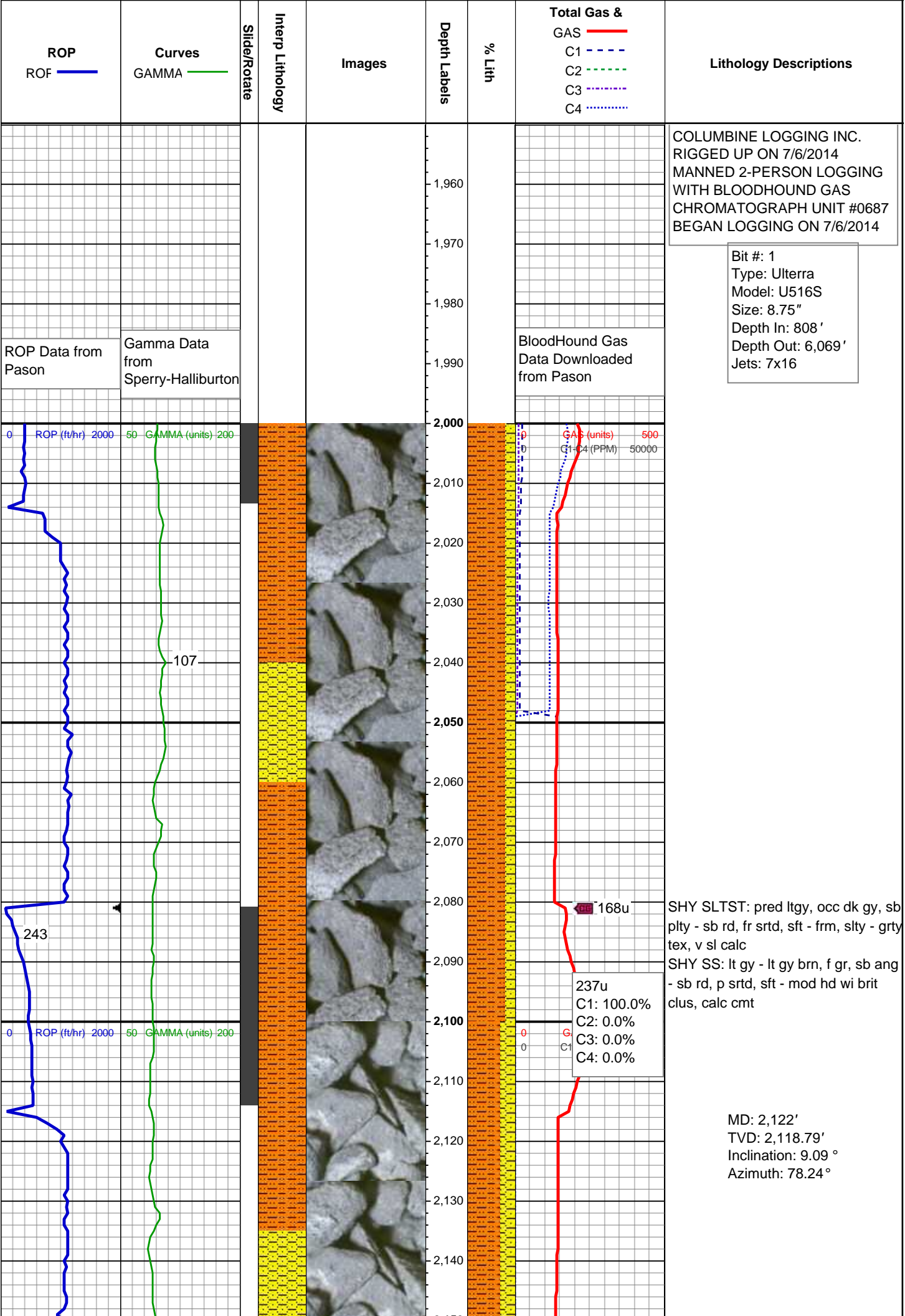
Name MARK COLE; JACK WEINERTH

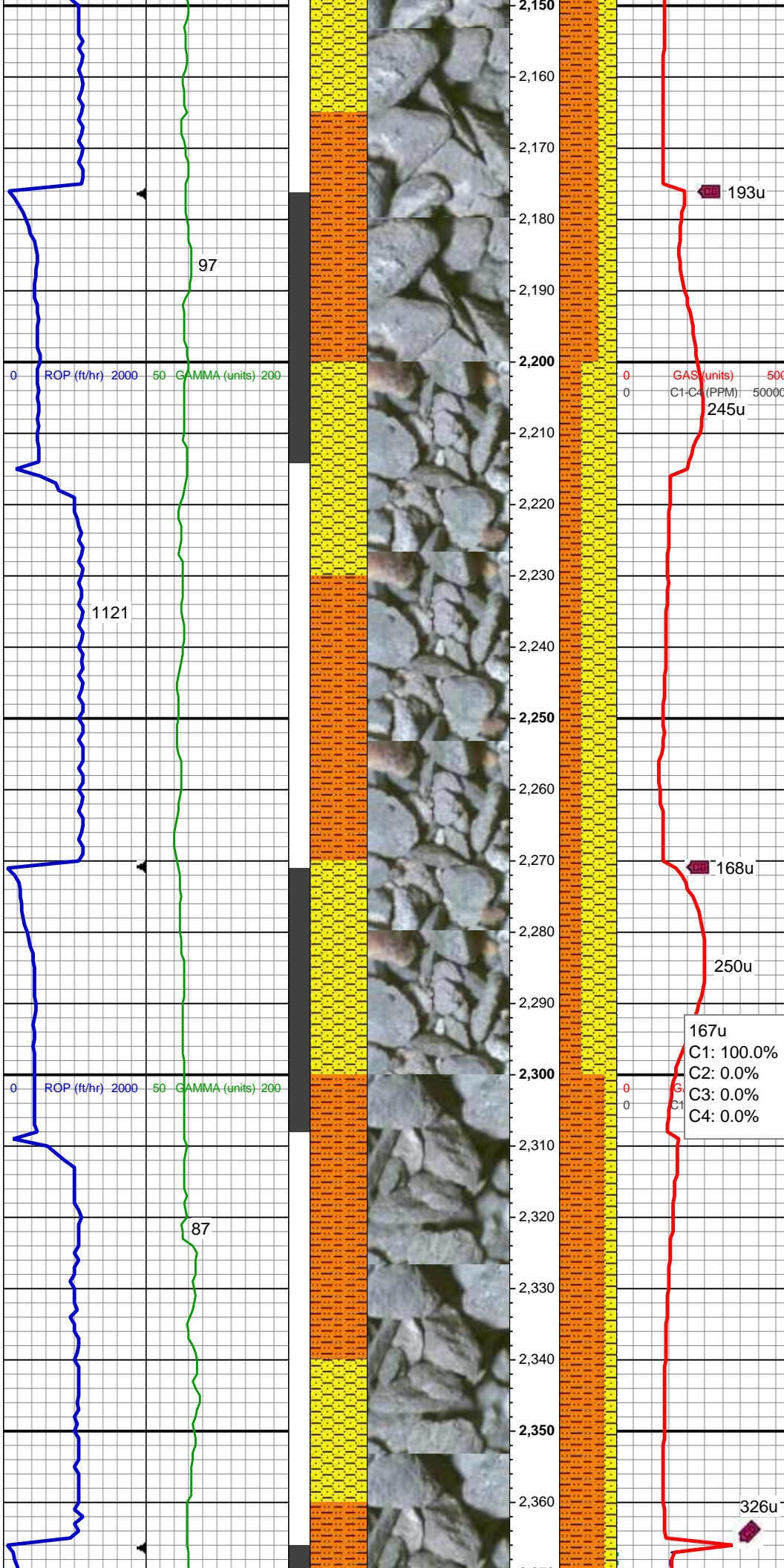
Company COLUMBINE LOGGING, INC

Address 2385 S LIPAN ST
DENVER, CO 80223

Zone Color Coding

- Oil
- Condensate
- Gas
- Note
- Core
- Pressure
- Error
- Water
- Seal





SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

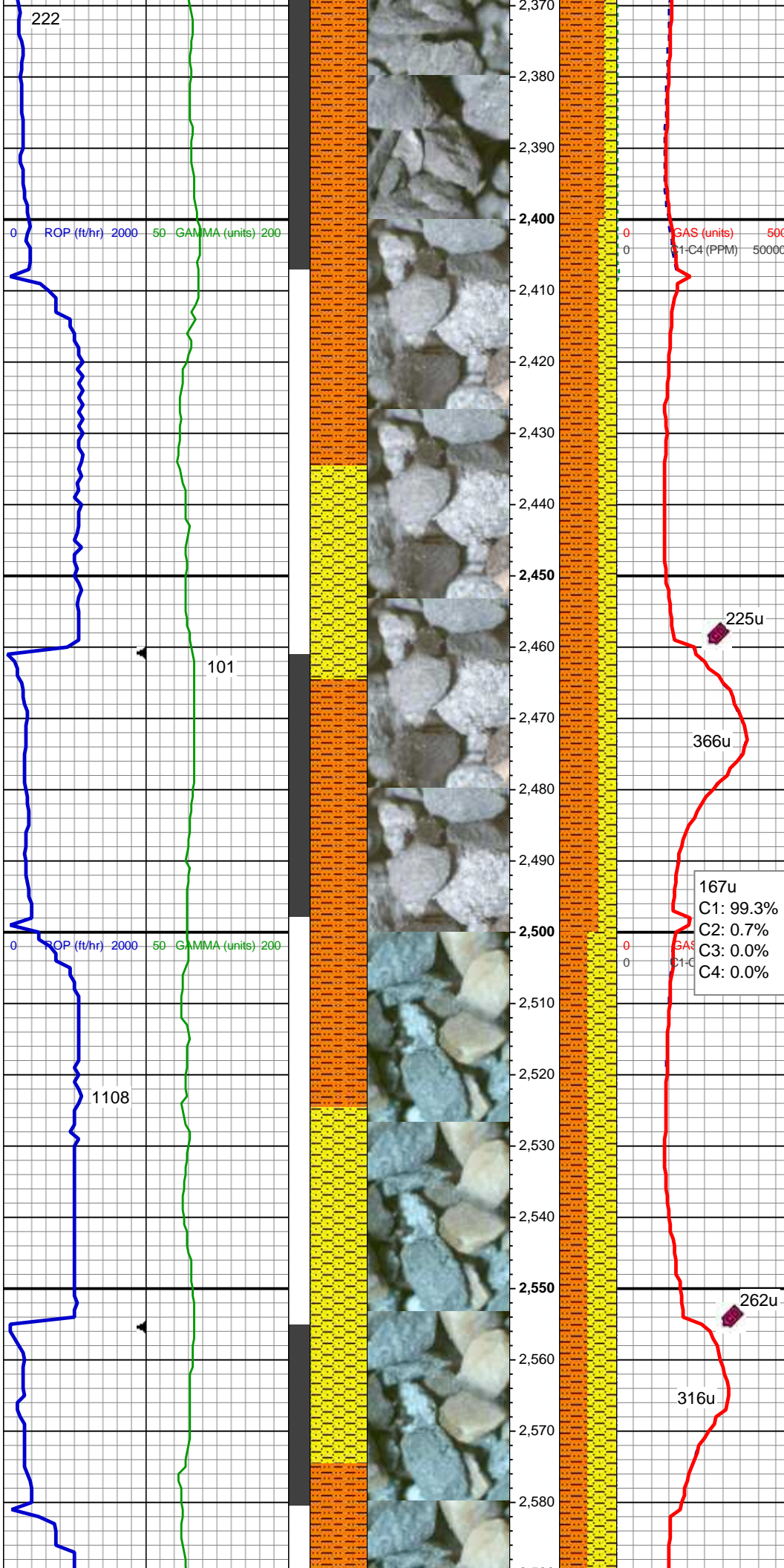
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 2,217'
TVD: 2,212.39'
Inclination: 10.58 °
Azimuth: 81.5 °

SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

MD: 2,312'
TVD: 2,305.71'
Inclination: 11.05 °
Azimuth: 78.72 °



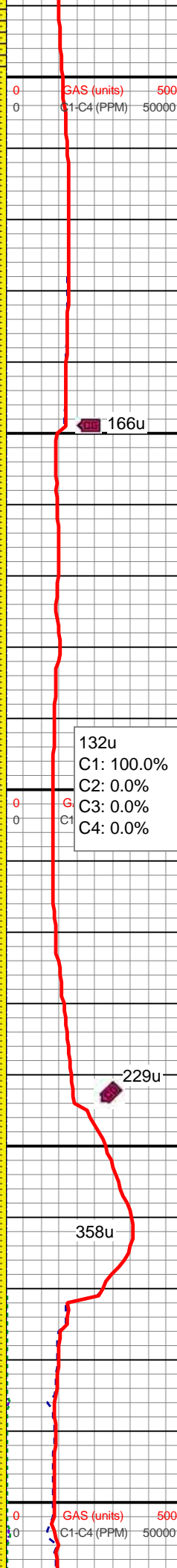
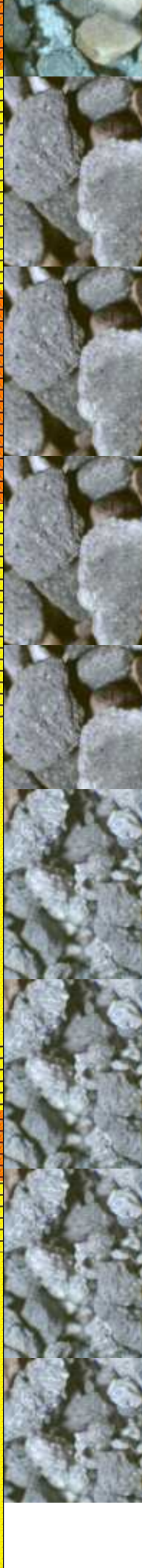
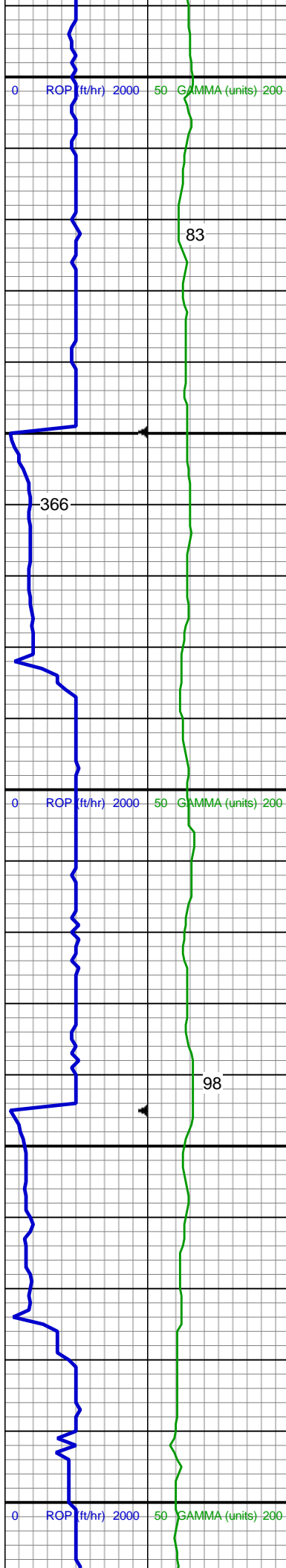
SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 2,407'
TVD: 2,398.88'
Inclination: 11.49 °
Azimuth: 88.71 °

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 2,502'
TVD: 2,491.68'
Inclination: 13.24 °
Azimuth: 89.84 °

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc



SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 2,597'
TVD: 2,584.24'
Inclination: 12.79 °
Azimuth: 86.62 °

SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

SHY SLTST: pred ltgy, occ dk gy, sb
ply - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

SS: wh, fros - trnsd, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

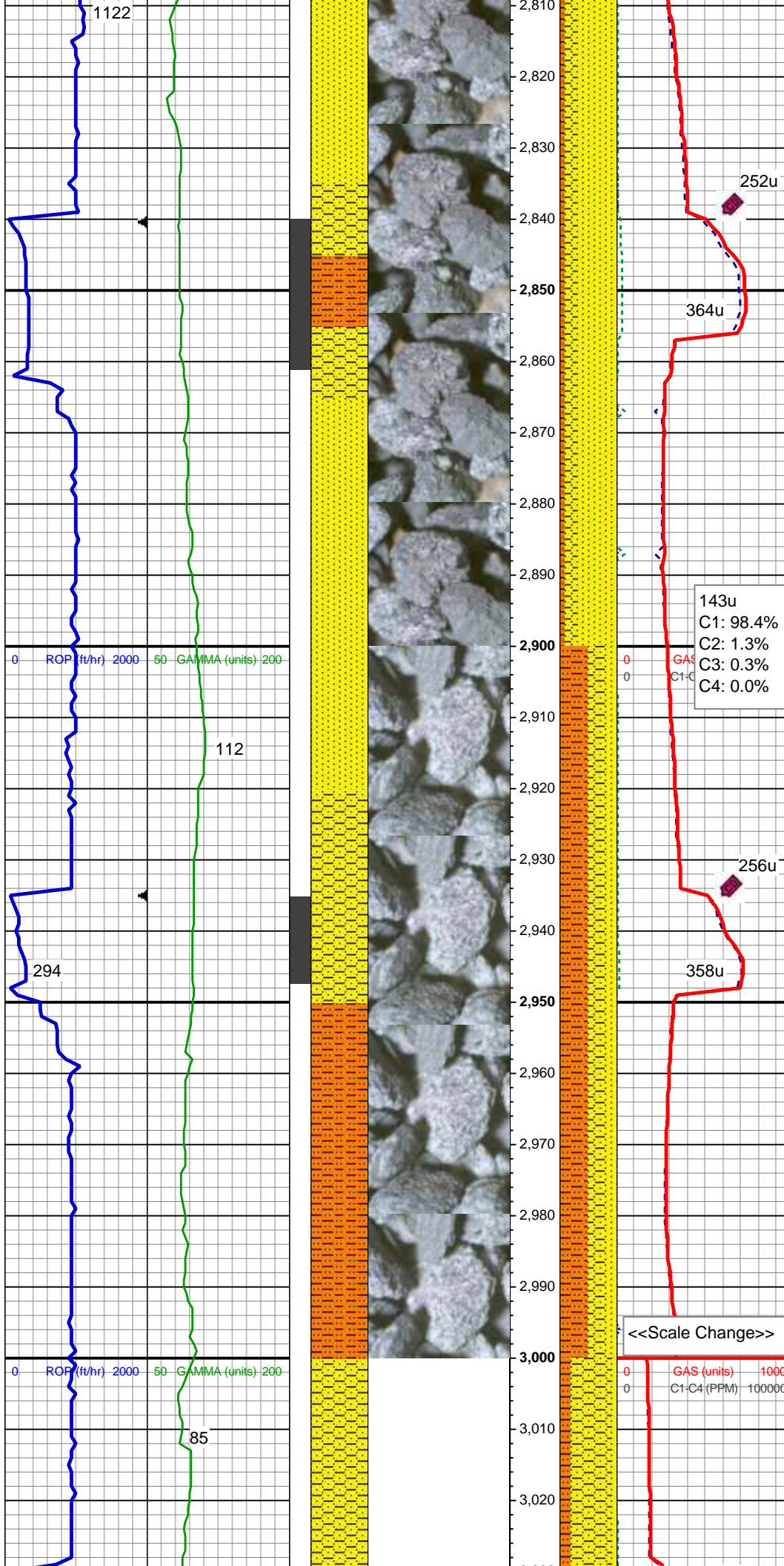
MD: 2,692'
TVD: 2,676.77'
Inclination: 13.38 °
Azimuth: 86.51 °

MD: 2,787'
TVD: 2,768.94'
Inclination: 14.68 °
Azimuth: 83.13 °

SS: wh, fros - trnsd, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

SHY SLTST: pred ltgy, occ dk gy, sb
ply - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc



MD: 2,882'
TVD: 2,860.71'
Inclination: 15.3 °
Azimuth: 87.41 °

SS: wh, fros - trnsl, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt
SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

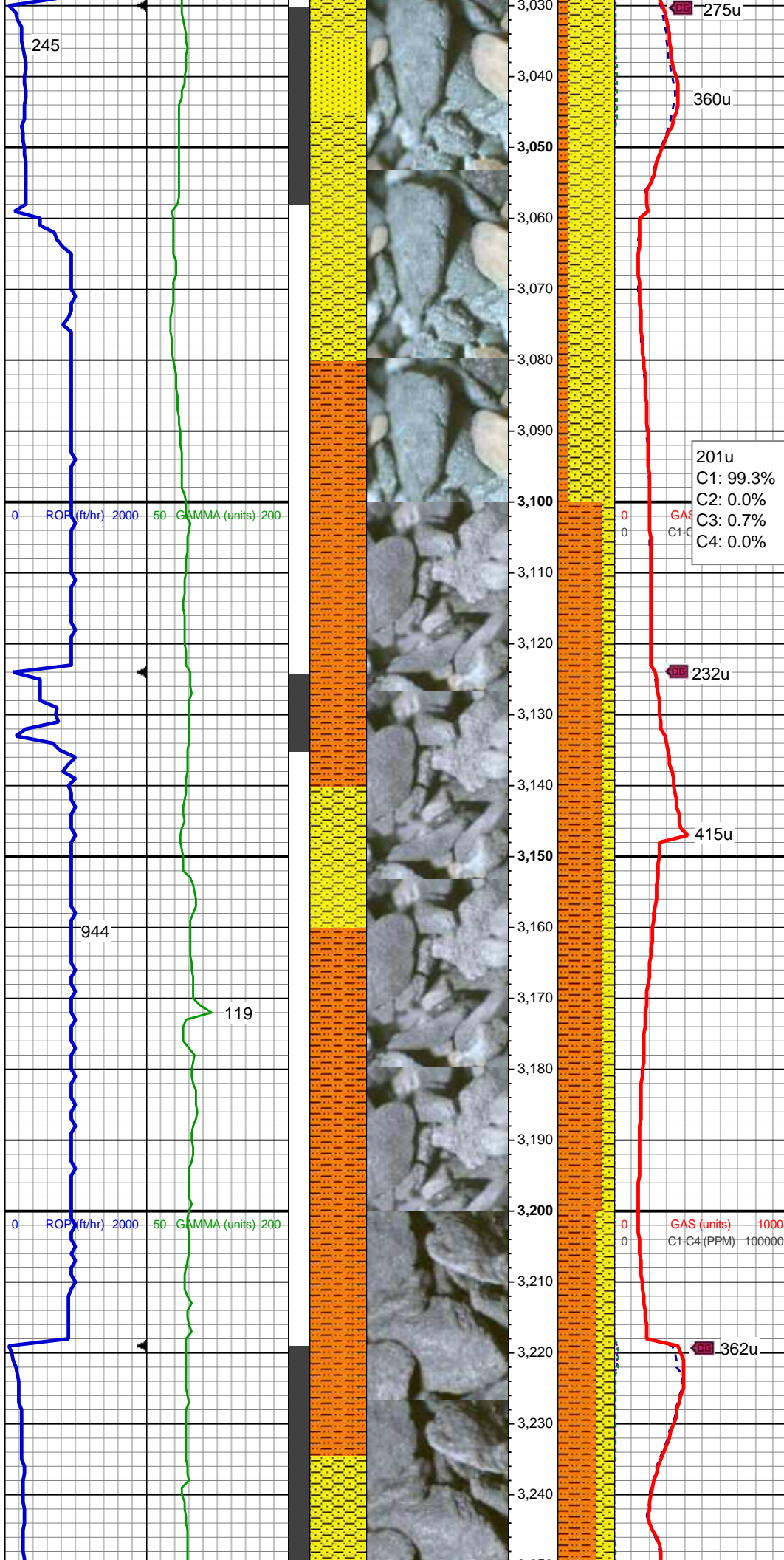
143u
C1: 98.4%
C2: 1.3%
C3: 0.3%
C4: 0.0%

MD: 2,977'
TVD: 2,952.57'
Inclination: 14.25 °
Azimuth: 84.18 °

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt
SS: wh, fros - trnsl, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

<<Scale Change>>

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



MD: 3,072'
TVD: 3,044.46'
Inclination: 15.15 °
Azimuth: 87.04 °

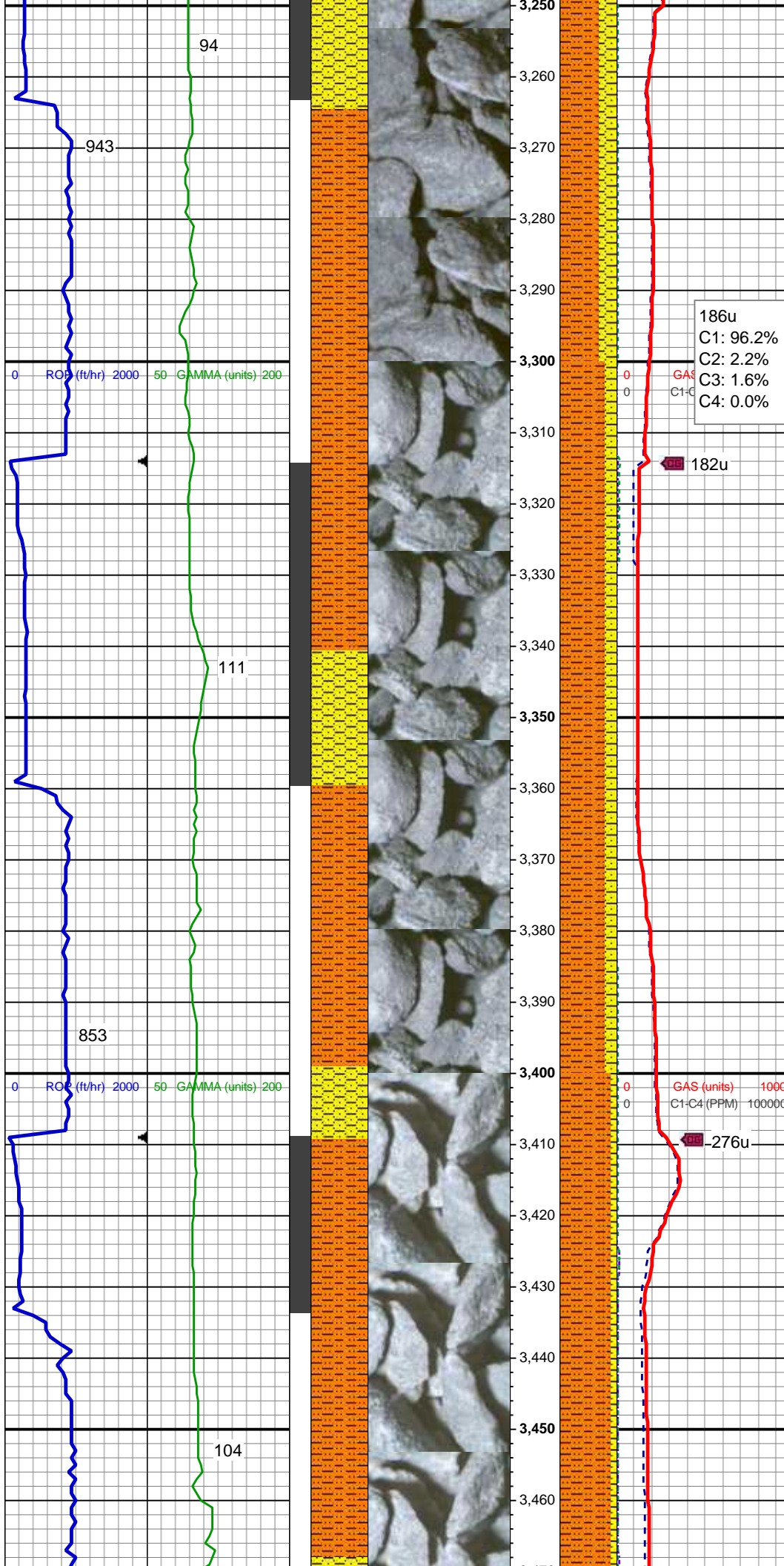
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt
SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SS: wh, fros - trnsd, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

201u
C1: 99.3%
C2: 0.0%
C3: 0.7%
C4: 0.0%

MD: 3,167'
TVD: 3,136.61'
Inclination: 12.97 °
Azimuth: 83.93 °

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

PM Mud Rpt
7/6/2014
Mud Wt: 8.80
FVis: 32
PVis: 3
YP: 2
GELS: n/s
API Filt: n/s
CAKE: 1/0
pH: 8.9
Cl: 1,600
Ca: 80



MD: 3,262'
TVD: 3,229.23'
Inclination: 12.76 °
Azimuth: 83.93°

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

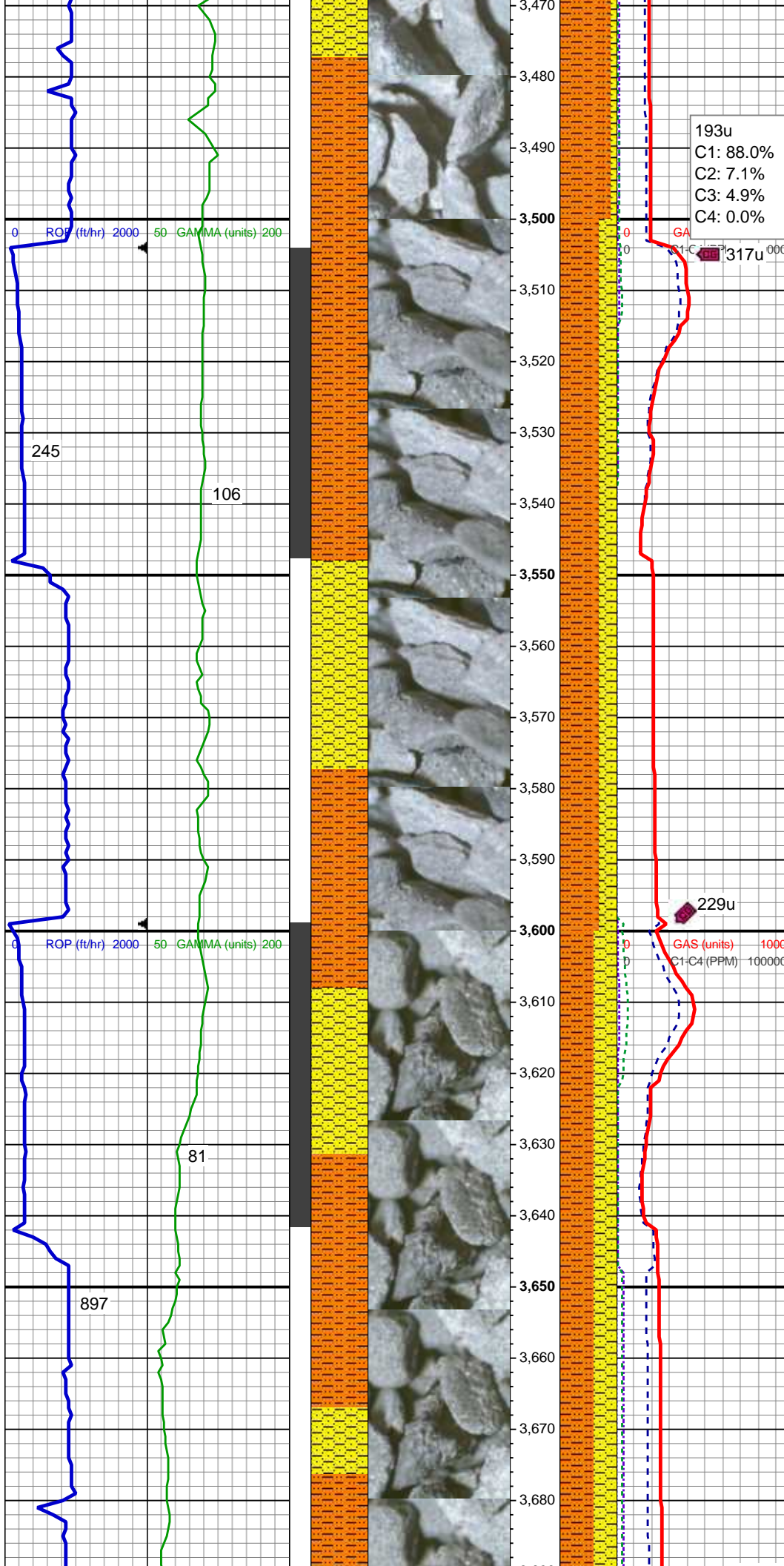
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 3,357'
TVD: 3,321.93'
Inclination: 12.5 °
Azimuth: 89.82°

SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc

SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

MD: 3,452'
TVD: 3,414.82'
Inclination: 11.72 °
Azimuth: 87.53°



SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

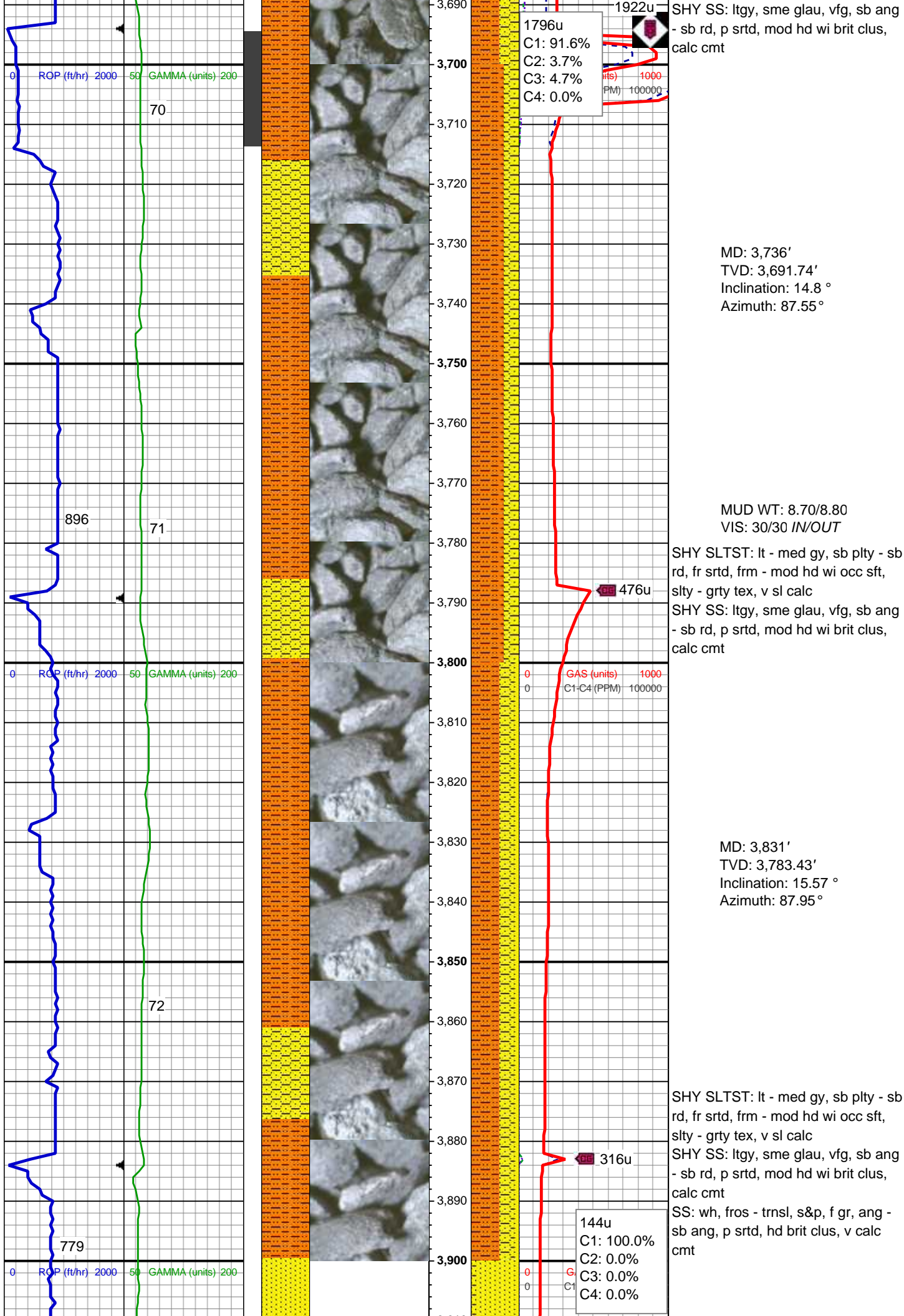
MD: 3,547'
TVD: 3,507.74'
Inclination: 12.28 °
Azimuth: 87.98 °

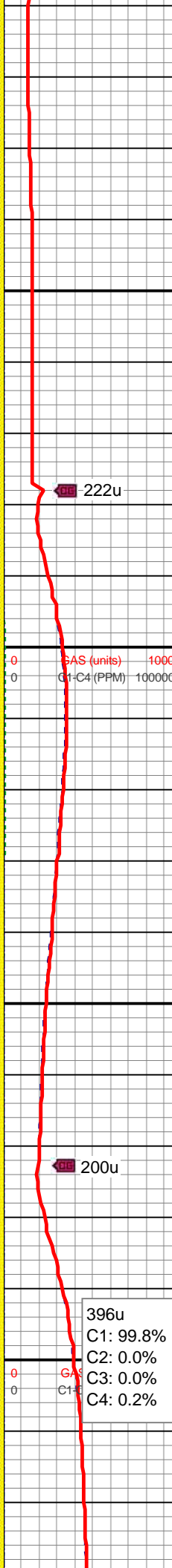
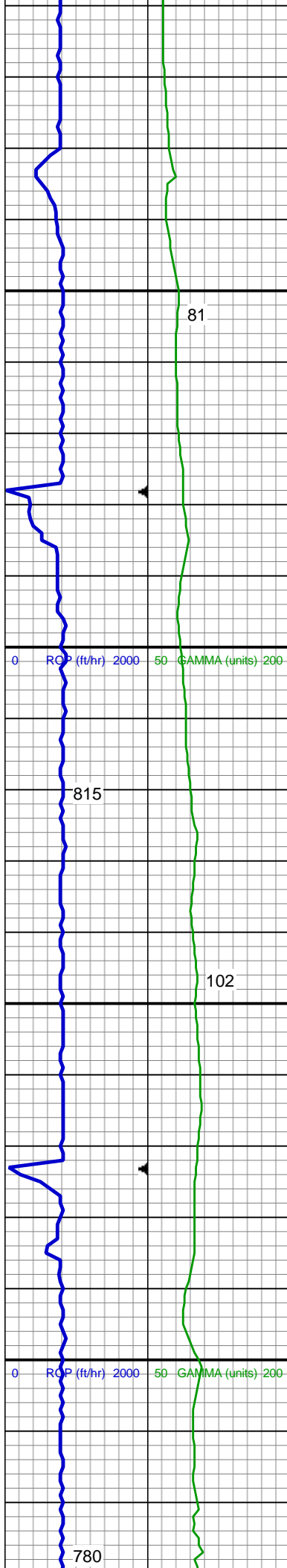
SHY SLTST: pred ltgy, occ dk gy, sb
plty - sb rd, fr srted, sft - frm, slty - grty
tex, v sl calc
SHY SS: lt gy - lt gy brn, f gr, sb ang
- sb rd, p srted, sft - mod hd wi brit
clus, calc cmt

Parkman Top @
3,608' MD; 3,567' TVD

MD: 3,641'
TVD: 3,599.5'
Inclination: 12.83 °
Azimuth: 85.28 °

SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc





MD: 3,926'
TVD: 3,874.76'
Inclination: 16.38 °
Azimuth: 87.95 °

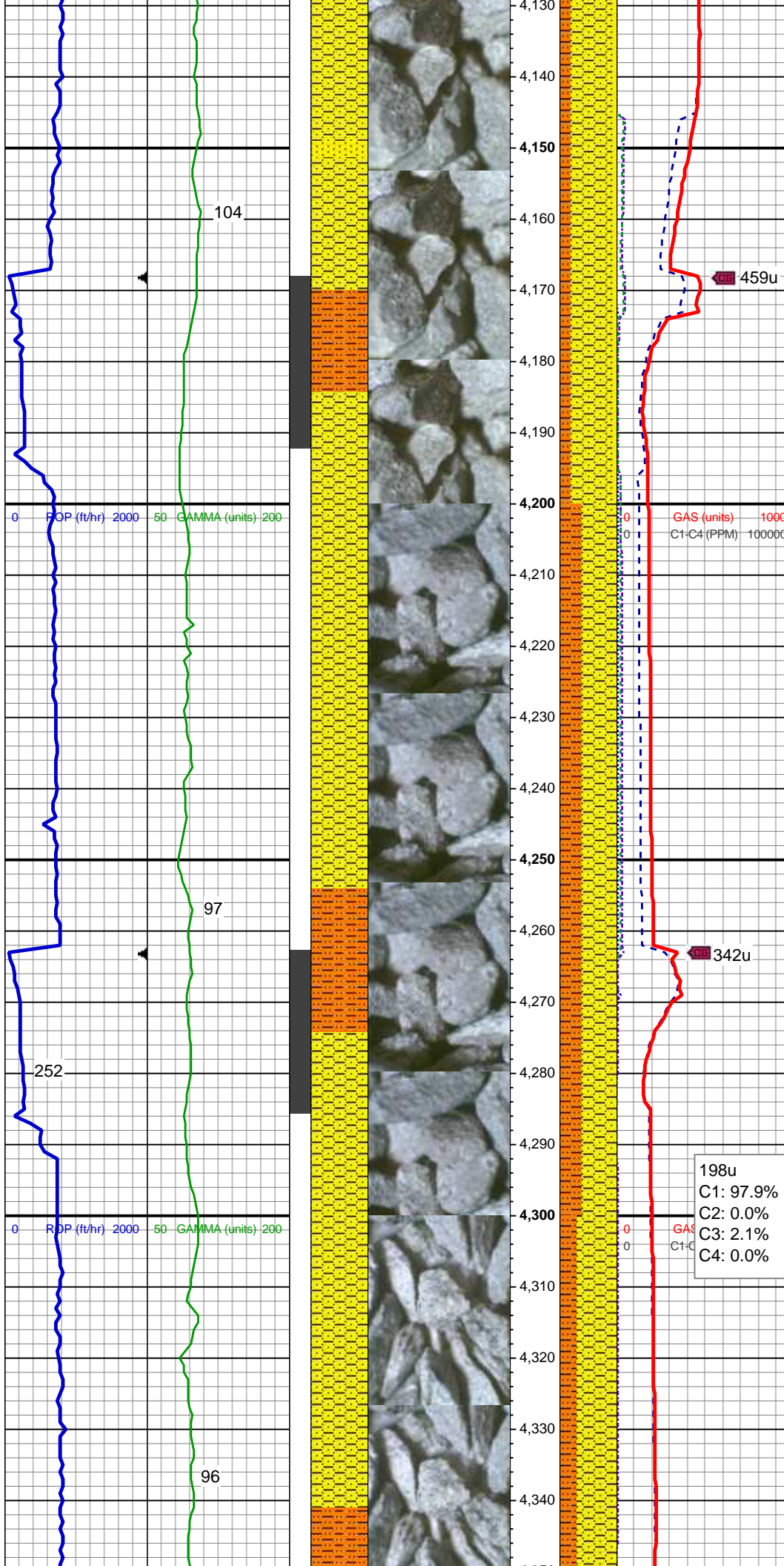
SS: wh, fros - trnsl, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt
SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt

MD: 4,021'
TVD: 3,965.86'
Inclination: 16.54 °
Azimuth: 88.19 °

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
silty - grty tex, v sl calc
SS: wh, fros - trnsl, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

396u
C1: 99.8%
C2: 0.0%
C3: 0.0%
C4: 0.2%

MD: 4,116'
TVD: 4,057.5'
Inclination: 13.99 °
Azimuth: 87.14 °



Sussex Top @
4,148' MD; 4,088' TVD

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc
SS: wh, fros - trnsf, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

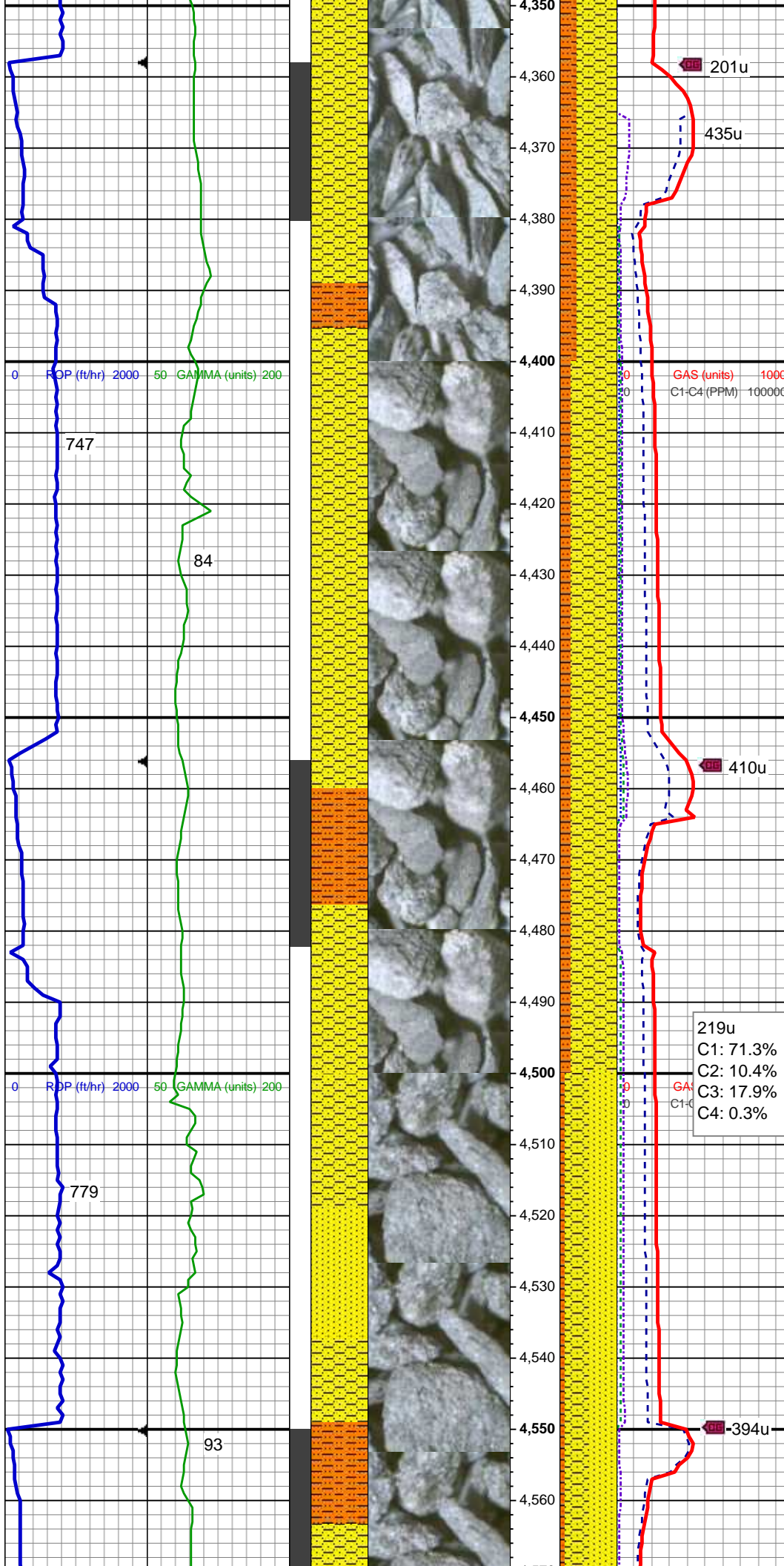
MUD WT: 8.80/9.05
VIS: 30/30 IN/OUT

MD: 4,211'
TVD: 4,149.7'
Inclination: 13.92 °
Azimuth: 84.67 °

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc

MD: 4,306'
TVD: 4,241.98'
Inclination: 13.56 °
Azimuth: 83.72 °

198u
C1: 97.9%
C2: 0.0%
C3: 2.1%
C4: 0.0%



SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc

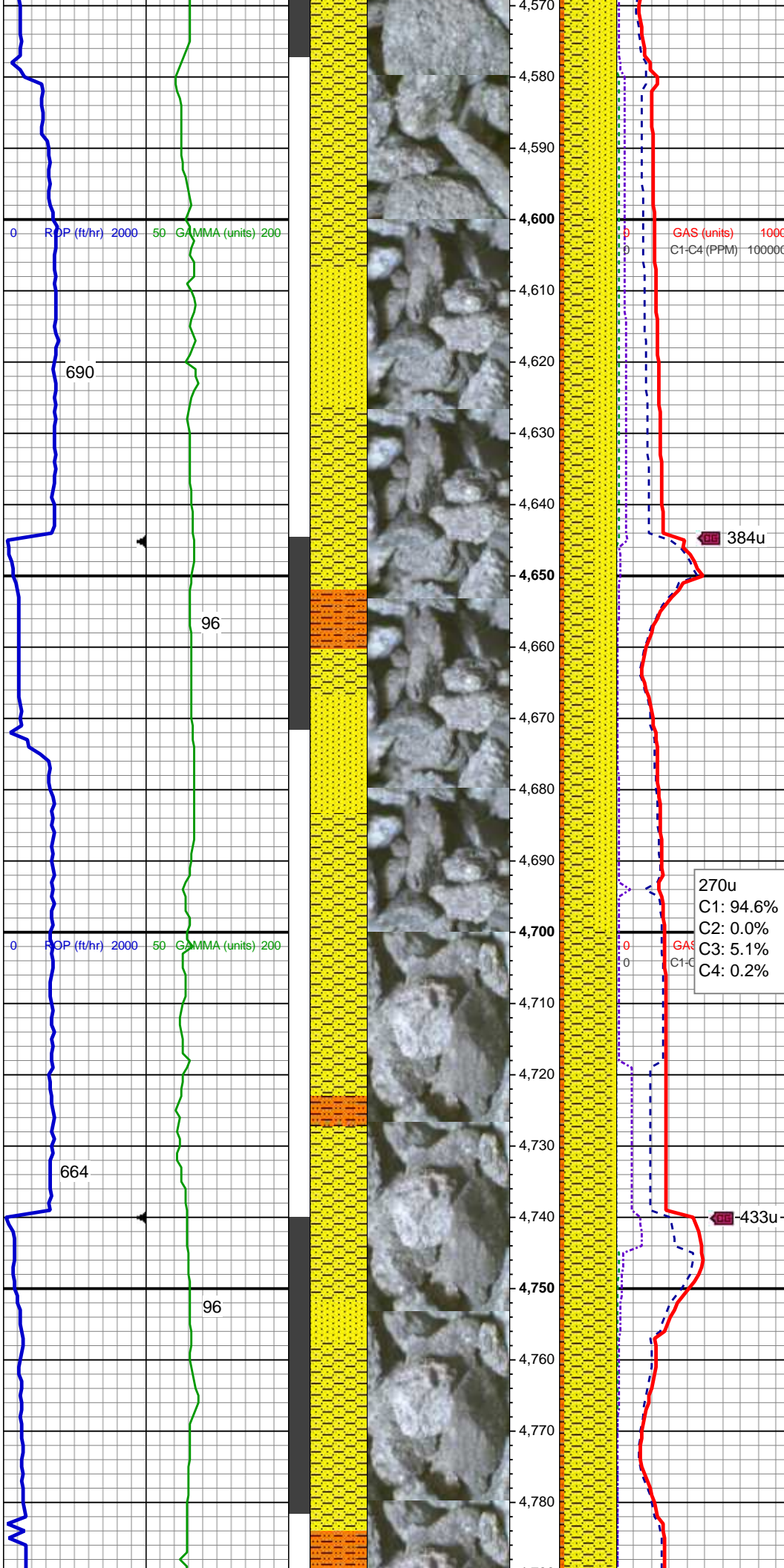
MD: 4,401'
TVD: 4,334.53'
Inclination: 12.5 °
Azimuth: 86.3 °

MD: 4,496'
TVD: 4,427.29'
Inclination: 12.44 °
Azimuth: 84.41 °

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc

219u
C1: 71.3%
C2: 10.4%
C3: 17.9%
C4: 0.3%

MUD WT: 8.90/9.10
VIS: 31/30 IN/OUT



SS: wh, fros - trnsl, s&p, f gr, ang - sb ang, p srted, hd brit clus, v calc cmt
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt
SHY SLTST: lt - med gy, sb plty - sb rd, fr srted, frm - mod hd wi occ sft, slty - grty tex, v sl calc

MD: 4,591'
TVD: 4,520'
Inclination: 12.78 °
Azimuth: 86.42 °

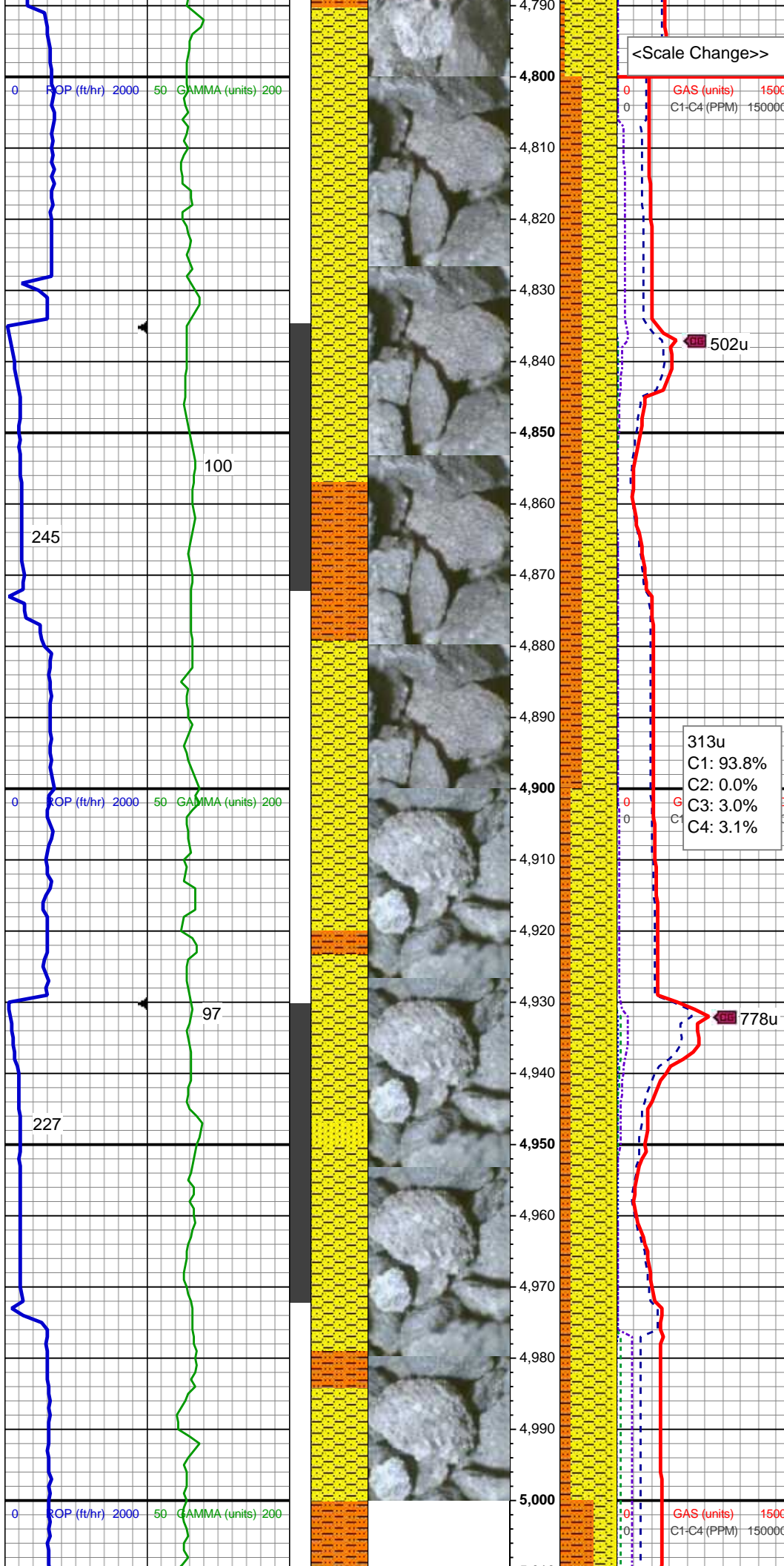
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt
SS: wh, fros - trnsl, s&p, f gr, ang - sb ang, p srted, hd brit clus, v calc cmt
SHY SLTST: lt - med gy, sb plty - sb rd, fr srted, frm - mod hd wi occ sft, slty - grty tex, v sl calc

MD: 4,685'
TVD: 4,611.92'
Inclination: 11.35 °
Azimuth: 85.23 °

MUD WT: 8.90/9.05
VIS: 30/29 IN/OUT

MD: 4,780'
TVD: 4,705.09'
Inclination: 11.19 °
Azimuth: 88.41 °

SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt
SS: wh, fros - trnsl, s&p, f gr, ang - sb ang, p srted, hd brit clus, v calc cmt



SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc

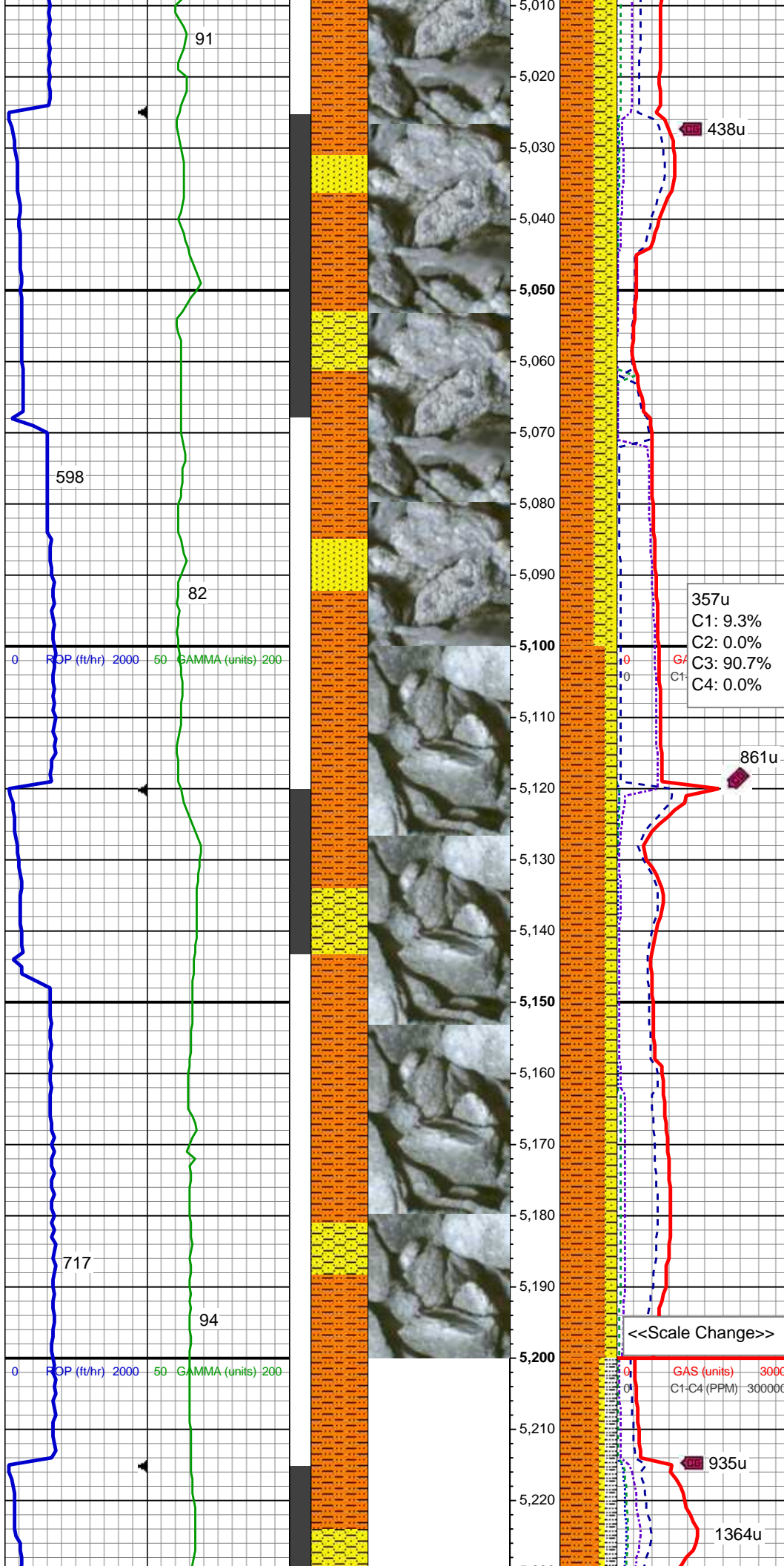
MD: 4,875'
TVD: 4,798.22'
Inclination: 11.61 °
Azimuth: 81.03 °

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc

Shannon Top @
4,902' MD; 4,825' TVD

MD: 4,970'
TVD: 4,891.17'
Inclination: 12.21 °
Azimuth: 79.09 °

SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc
SS: wh, fros - trnsd, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt



MUD WT: 8.90/8.95
VIS: 30/29 IN/OUT

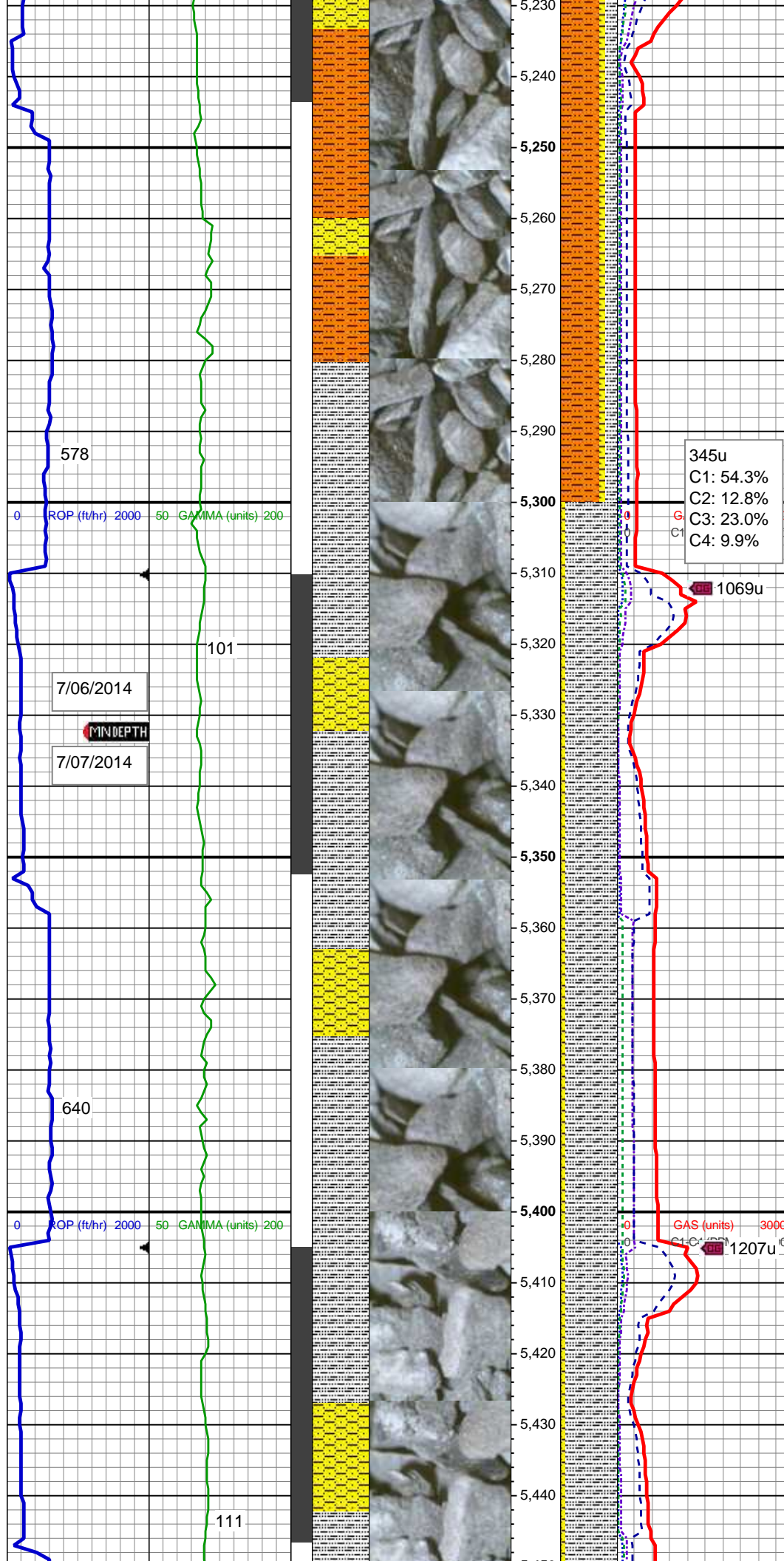
MD: 5,065'
TVD: 4,983.76'
Inclination: 13.66 °
Azimuth: 77.31 °

SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt
SS: wh, fros - trns, s&p, f gr, ang -
sb ang, p srted, hd brit clus, v calc
cmt

MD: 5,160'
TVD: 5,076.08'
Inclination: 13.61 °
Azimuth: 80.64 °

SHY SLTST: lt - med gy, sb plty - sb
rd, fr srted, frm - mod hd wi occ sft,
slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt

MUD WT: 9.15/9.10
VIS: 30/29 IN/OUT



MD: 5,255'
TVD: 5,168.65'
Inclination: 12.37 °
Azimuth: 79.98 °

SHY SLTST: lt - med gy, sb plty - sb rd, fr srted, frm - mod hd wi occ sft, slty - grty tex, v sl calc
SLTY SH: lt - med gy - gy brn, frm - hd, plty - sb plty, occ sb blkly, slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt

345u
C1: 54.3%
C2: 12.8%
C3: 23.0%
C4: 9.9%

1069u

MD: 5,350'
TVD: 5,261.35'
Inclination: 12.89 °
Azimuth: 82.54 °

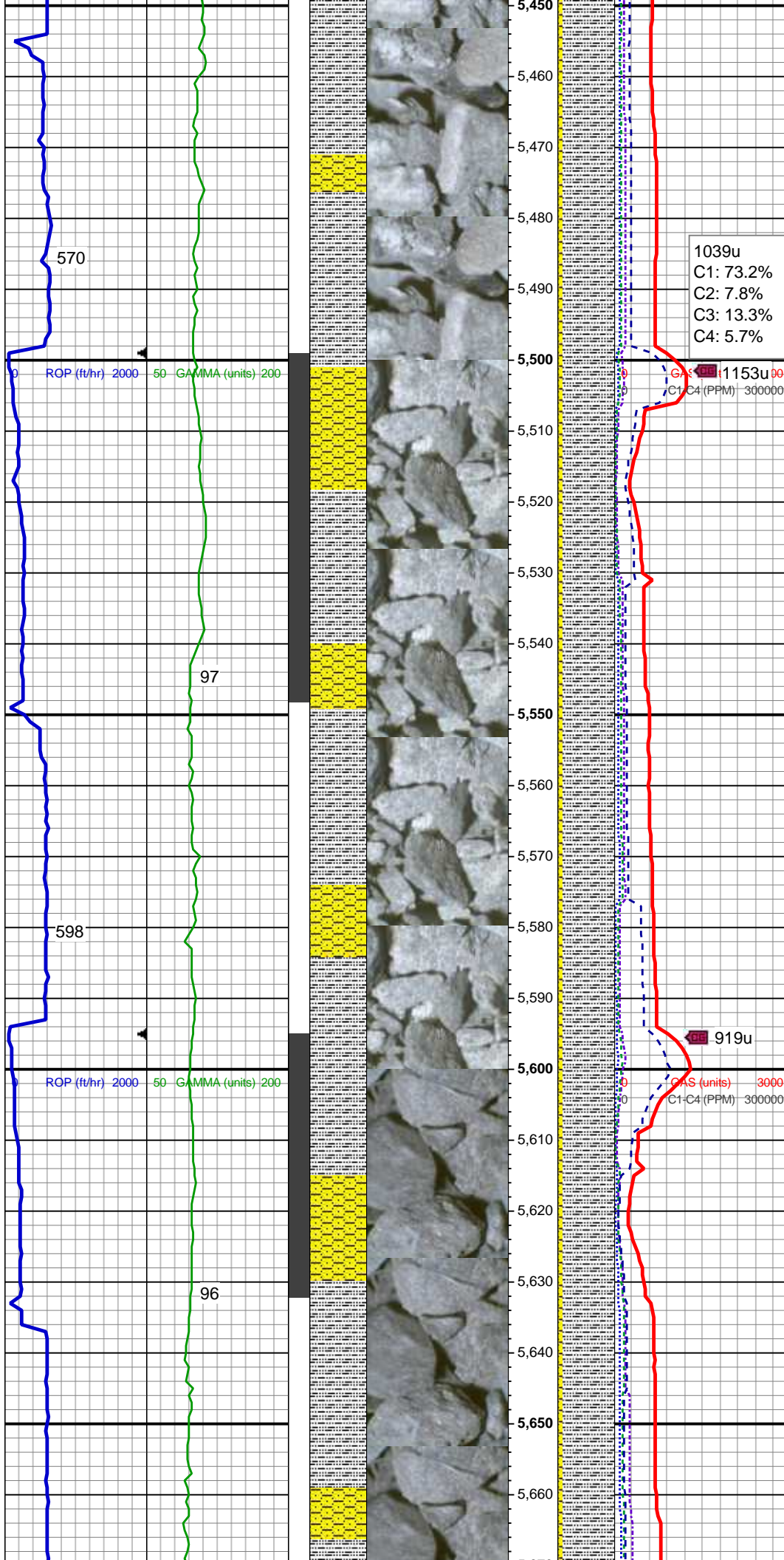
SLTY SH: lt - med gy - gy brn, frm - hd, plty - sb plty, occ sb blkly, slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt

GAS (units) 3000
C1-C4 (units) 1207u

MUD WT: 9.30/9.25
VIS: 32/32 IN/OUT

MD: 5,445'
TVD: 5,353.93'
Inclination: 13.03 °

Azimuth: 82.98°



1039u
C1: 73.2%
C2: 7.8%
C3: 13.3%
C4: 5.7%

SLTY SH: lt - med gy - gy brn, frm - hd, plty - sb plty, occ sb blk, slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt

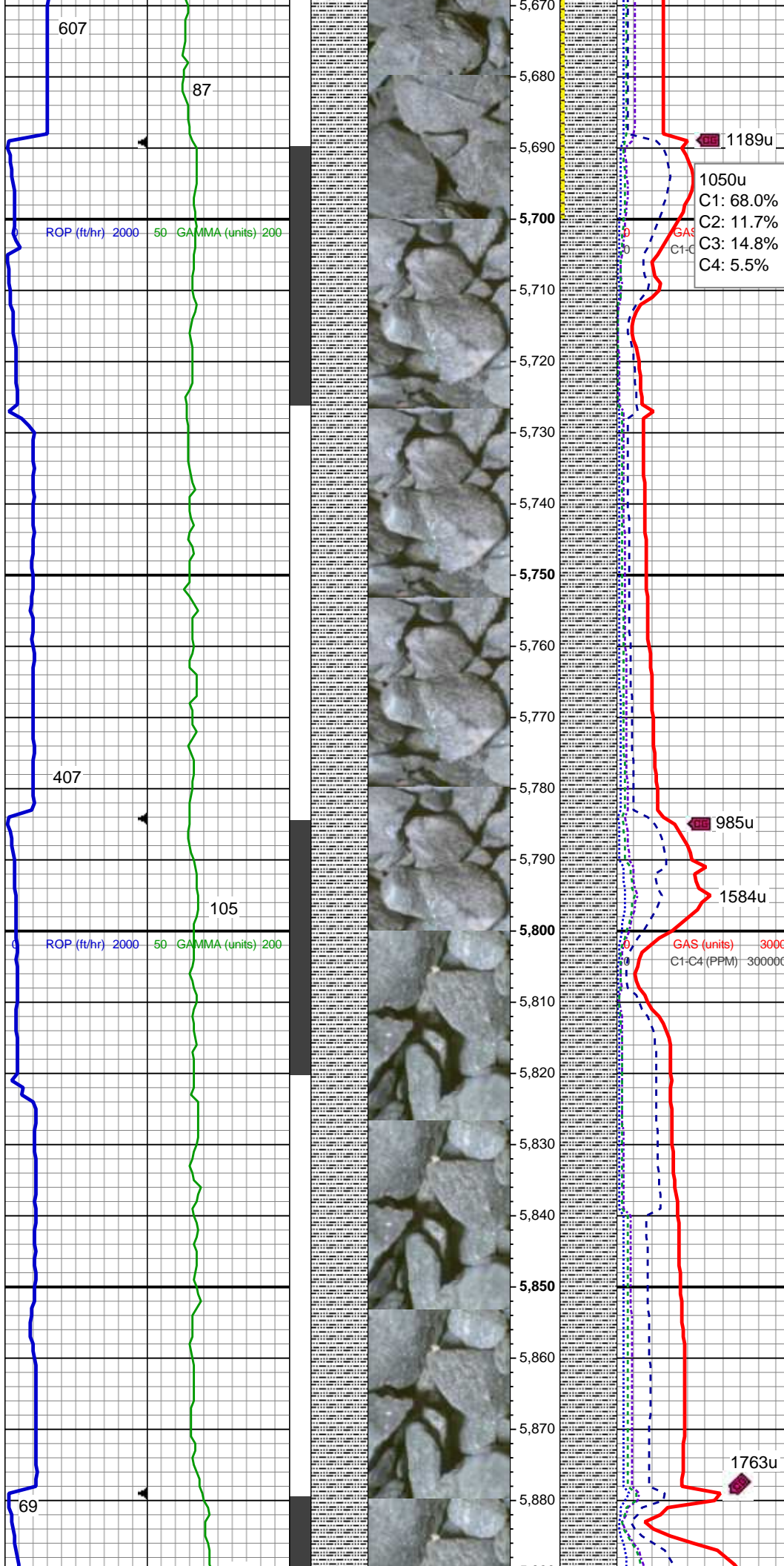
MD: 5,540'
TVD: 5,446.34'
Inclination: 13.84 °
Azimuth: 78.07 °

MUD WT: 9.45/9.40
VIS: 37/37 IN/OUT

919u

SLTY SH: lt - med gy - gy brn, frm - hd, plty - sb plty, occ sb blk, slty - grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang - sb rd, p srted, mod hd wi brit clus, calc cmt

MD: 5,635'
TVD: 5,538.58'
Inclination: 13.83 °
Azimuth: 80.78 °



SLTY SH: lt - med gy - gy brn, frm -
hd, plty - sb plty, occ sb blk, slty -
grty tex, v sl calc
SHY SS: ltgy, sme glau, vfg, sb ang
- sb rd, p srted, mod hd wi brit clus,
calc cmt

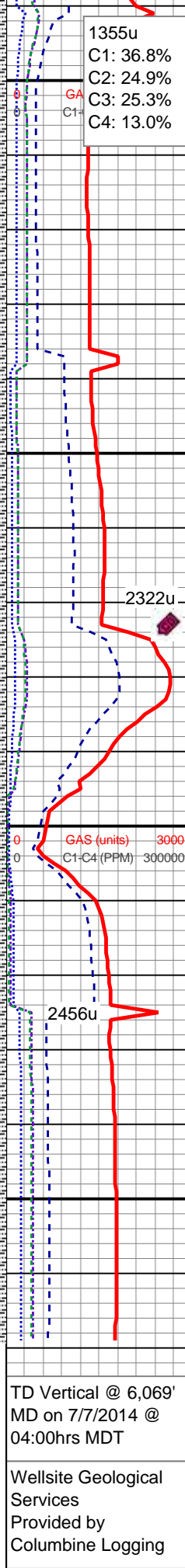
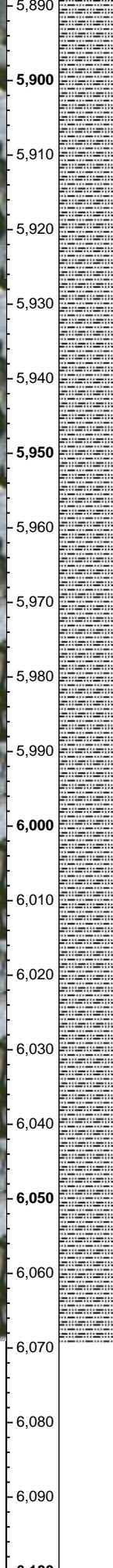
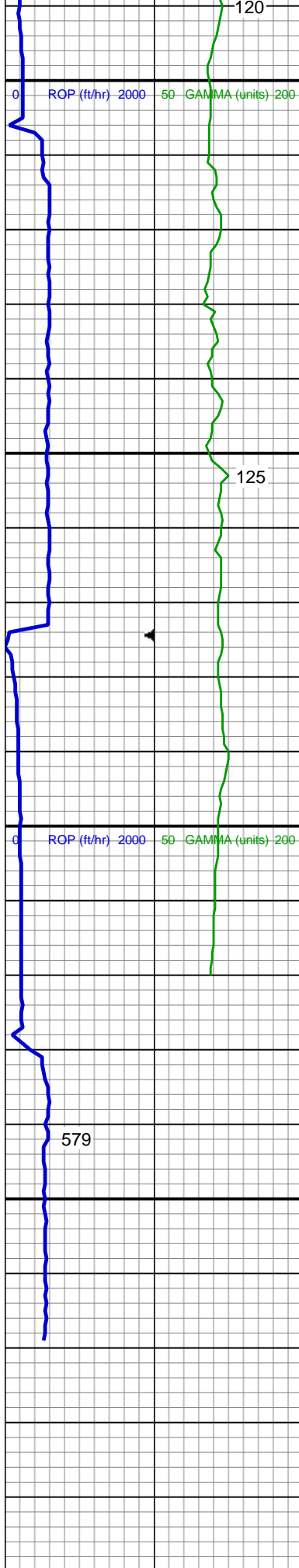
MD: 5,730'
TVD: 5,630.91'
Inclination: 13.44 °
Azimuth: 84 °

MUD WT: 9.60/9.50
VIS: 38/38 IN/OUT

SLTY SH: lt - med gy - gy brn, frm -
hd, plty - sb plty, occ sb blk, slty -
grty tex, v sl calc

MD: 5,825'
TVD: 5,723.23'
Inclination: 13.84 °
Azimuth: 81.8 °

AM Mud Rpt
7/7/2014
Mud Wt: 9.50
FVis: 37
PVis: 6
YP: 8
GELS: 3/8/15
API Filt: 9.5
CAKE: 2/0
pH: 9.1
Cl: 1,600
Ca: 120



SLTY SH: pred ltgy, rr med gy, frm -
hd, plty - sb plty, sme sb blk, slty -
grty tex, v sl calc

MD: 5,920'
TVD: 5,815.72'
Inclination: 12.55 °
Azimuth: 79.54 °

SLTY SH: pred ltgy, rr med gy, frm -
hd, plty - sb plty, sme sb blk, slty -
grty tex, v sl calc

MD: 6,013'
TVD: 5,906.56'
Inclination: 12.22 °
Azimuth: 87.63 °

Teepee Buttes Top @
6,043' MD; 5,936' TVD

SLTY SH: pred ltgy, rr med gy, frm -
hd, plty - sb plty, sme sb blk, slty -
grty tex, v sl calc

TD Vertical @ 6,069'
MD on 7/7/2014 @
04:00hrs MDT

Wellsite Geological
Services
Provided by
Columbine Logging

See Corresponding Horizontal Log
Mackinaw A19-79HNA HORZ