

COLUMBINE LOGGING

Scale: 5" / 100'
Measured Depth Log

Well Name Crow Creek State AC36-77HN VERT

Location SEC 36 T7N R63W

State Colorado

County Weld

Country USA

Rig Number H&P 315

API Number 05-123-37131

AFE # 139141

Region DJ Basin

Field Wattenberg

Spud Date 9/27/2013

Drilling Completed 9/29/2013

Surface Coordinates SESW SEC 36 T7N R63W
270' FSL; 1,755' FWL

LAT/LONG: 40.52358000/-104.38794000

Bottom Hole Coordinates NWNW SEC 36 T7N R63W
1,320' FWL; 535' FNL

Ground Elevation 4788'

K.B. Elevation 4812'

Logged Interval 2000' **To** 5974'

Total Depth 5974'

Formation Niobrara B Chalk

Type of Drilling Fluid LSND

Operator

Company Noble Energy Inc

Address 1625 Broadway Suite 2200
Denver, CO 80202

Geologist

Name MARK COLE, NATHAN MURPHY

Company COLUMBINE LOGGING, INC

Address 2385 S Lipan St
Denver, CO 80223

Rock Types

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

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

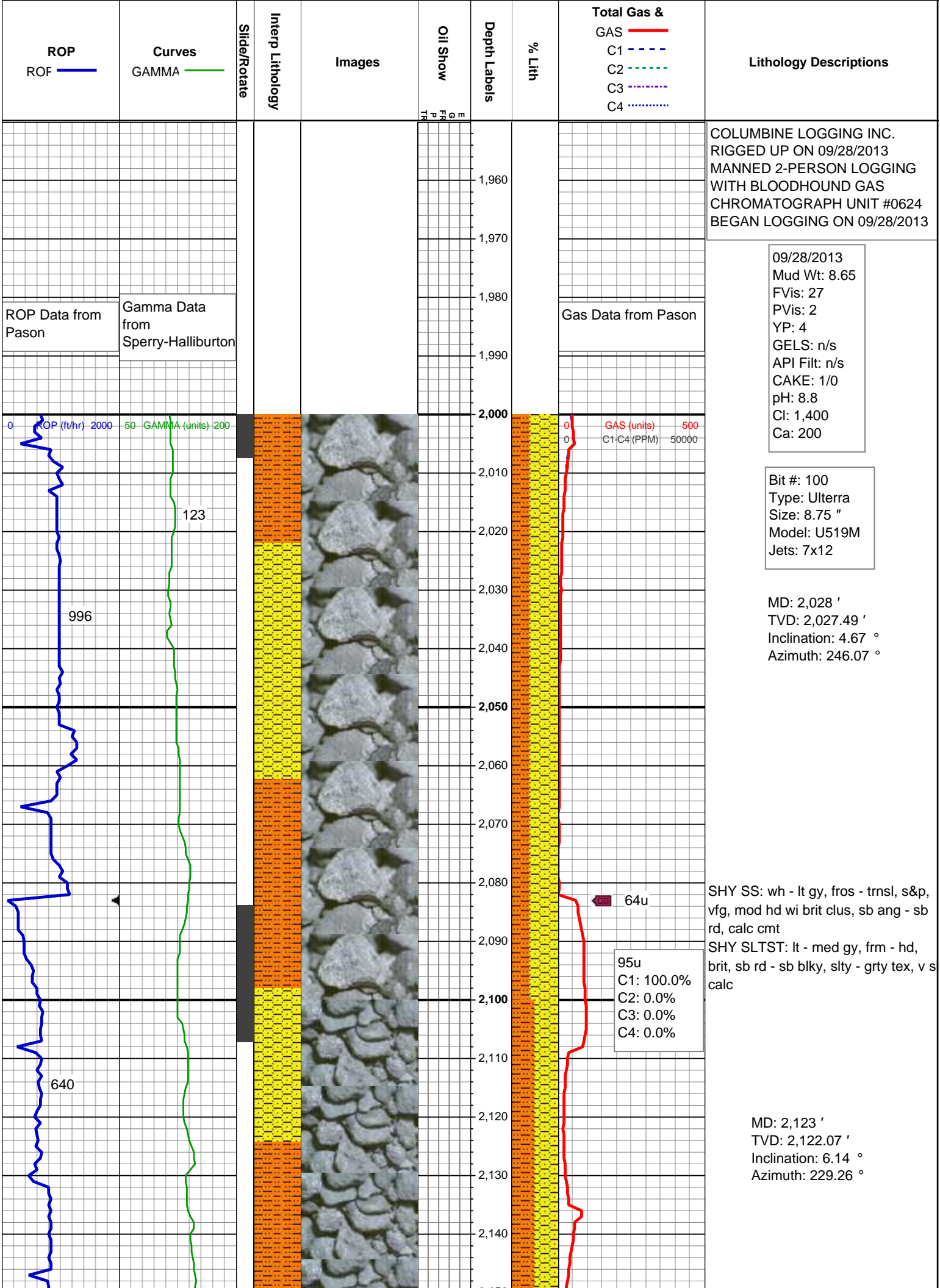
BOUNDSTONE
 CHALKY
 CRYPTOXLN

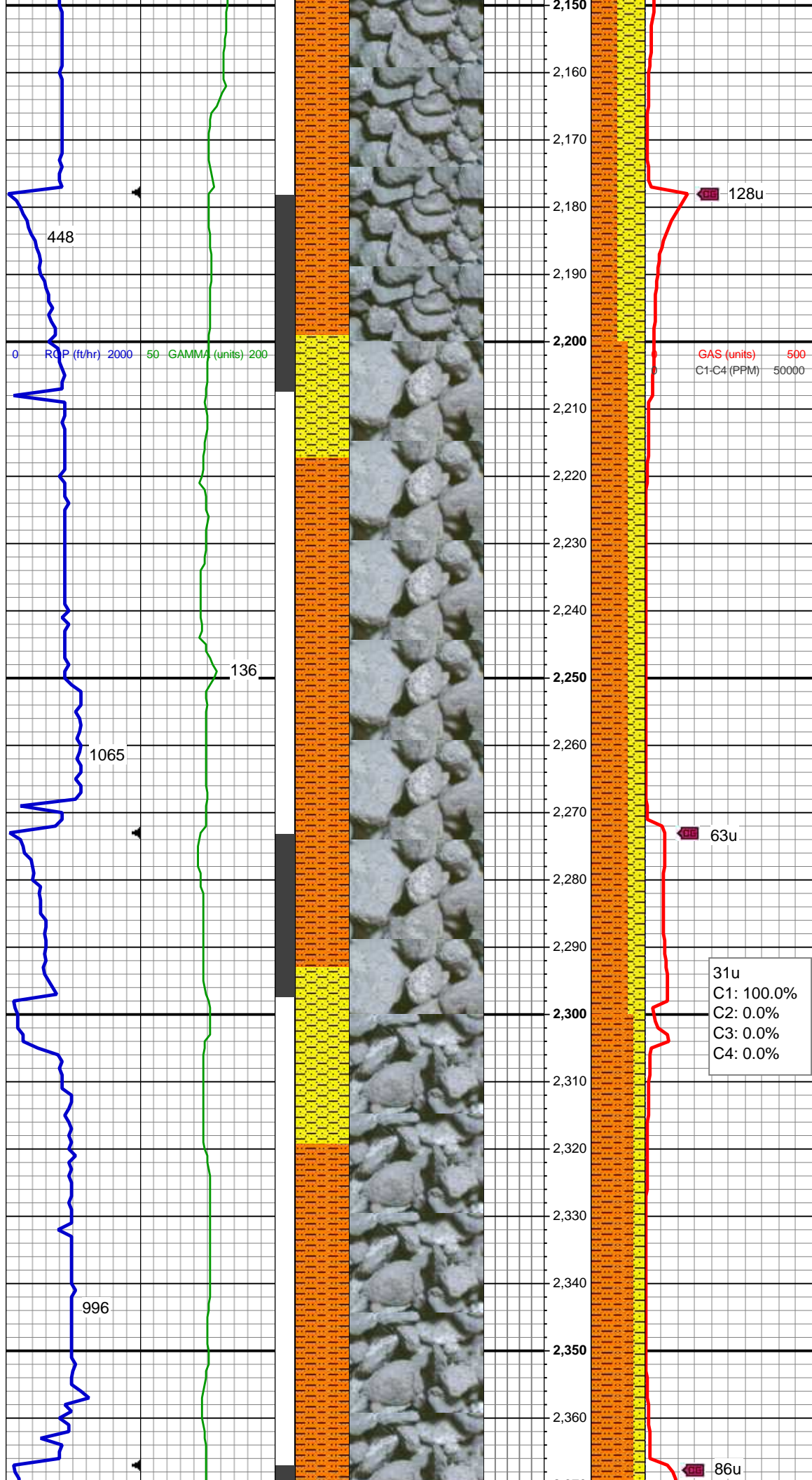
Earthy

FINELYXLN
 GRAINSTONE
 LITHOGRAPHIC
 MICROXLN
 MUDSTONE
 PACKSTONE
 WACKESTONE

Sorting

MODERATE
 POOR
 WELL



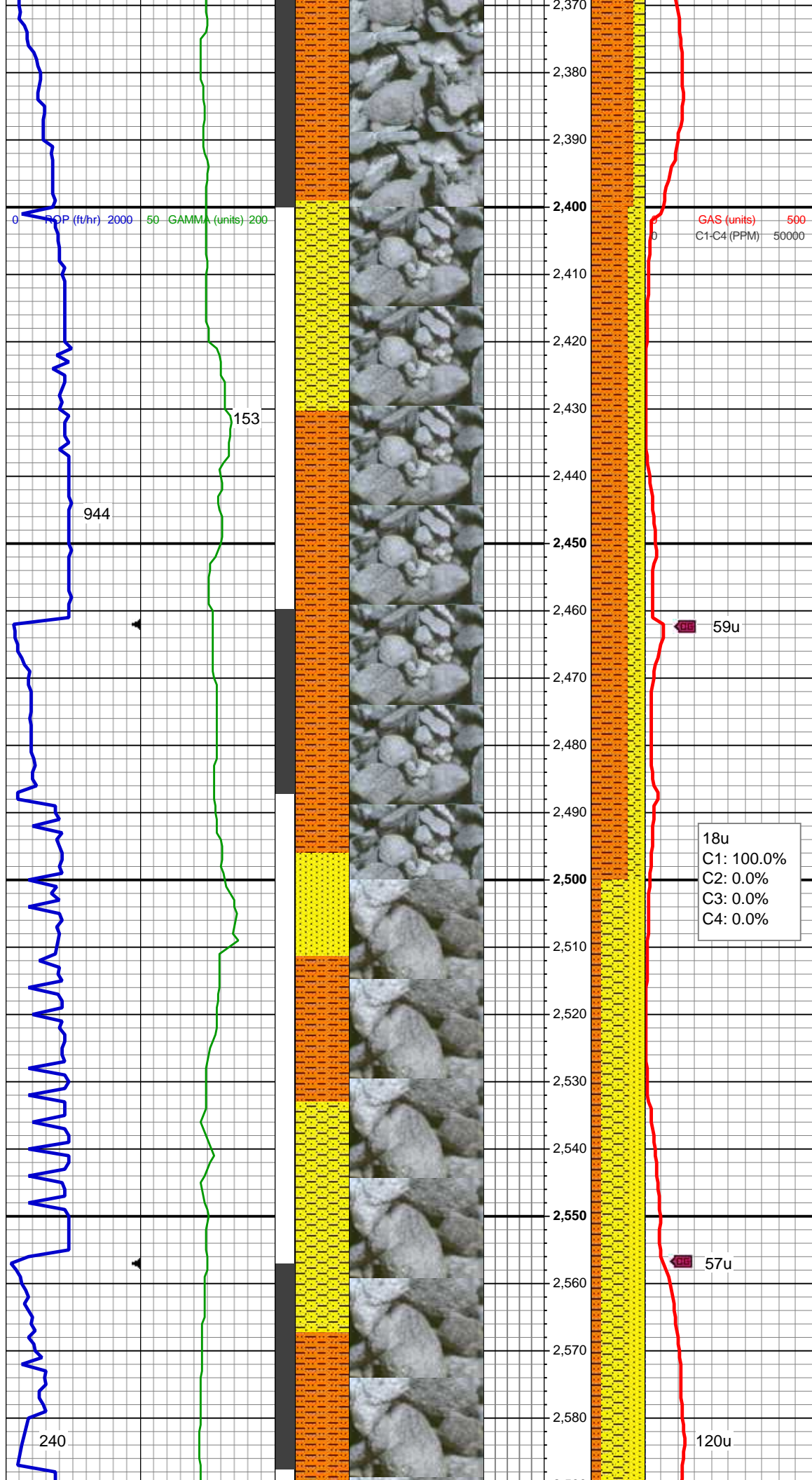


SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc

MD: 2,218 '
TVD: 2,216.31 '
Inclination: 8.31 °
Azimuth: 230.84 °

SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc
SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 2,312 '
TVD: 2,309.17 '
Inclination: 9.52 °
Azimuth: 234.39 °



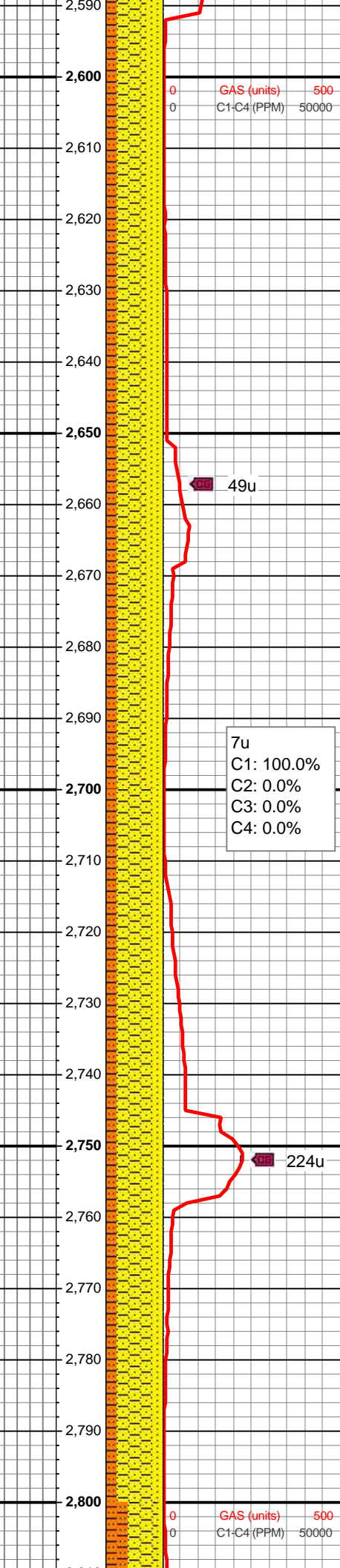
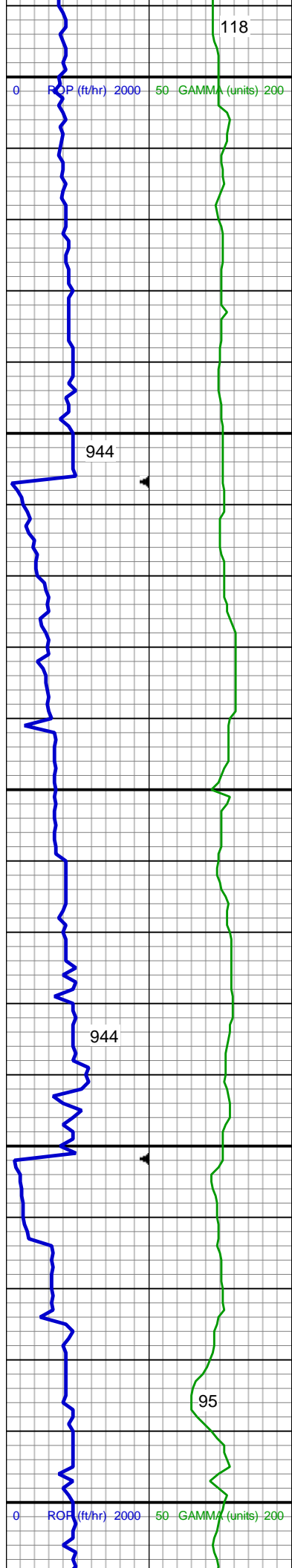
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc
SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 2,407 '
TVD: 2,402.61 '
Inclination: 11.32 °
Azimuth: 243.04 °

SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt

MD: 2,502 '
TVD: 2,495.68 '
Inclination: 11.8 °
Azimuth: 246.22 °

SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang



mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

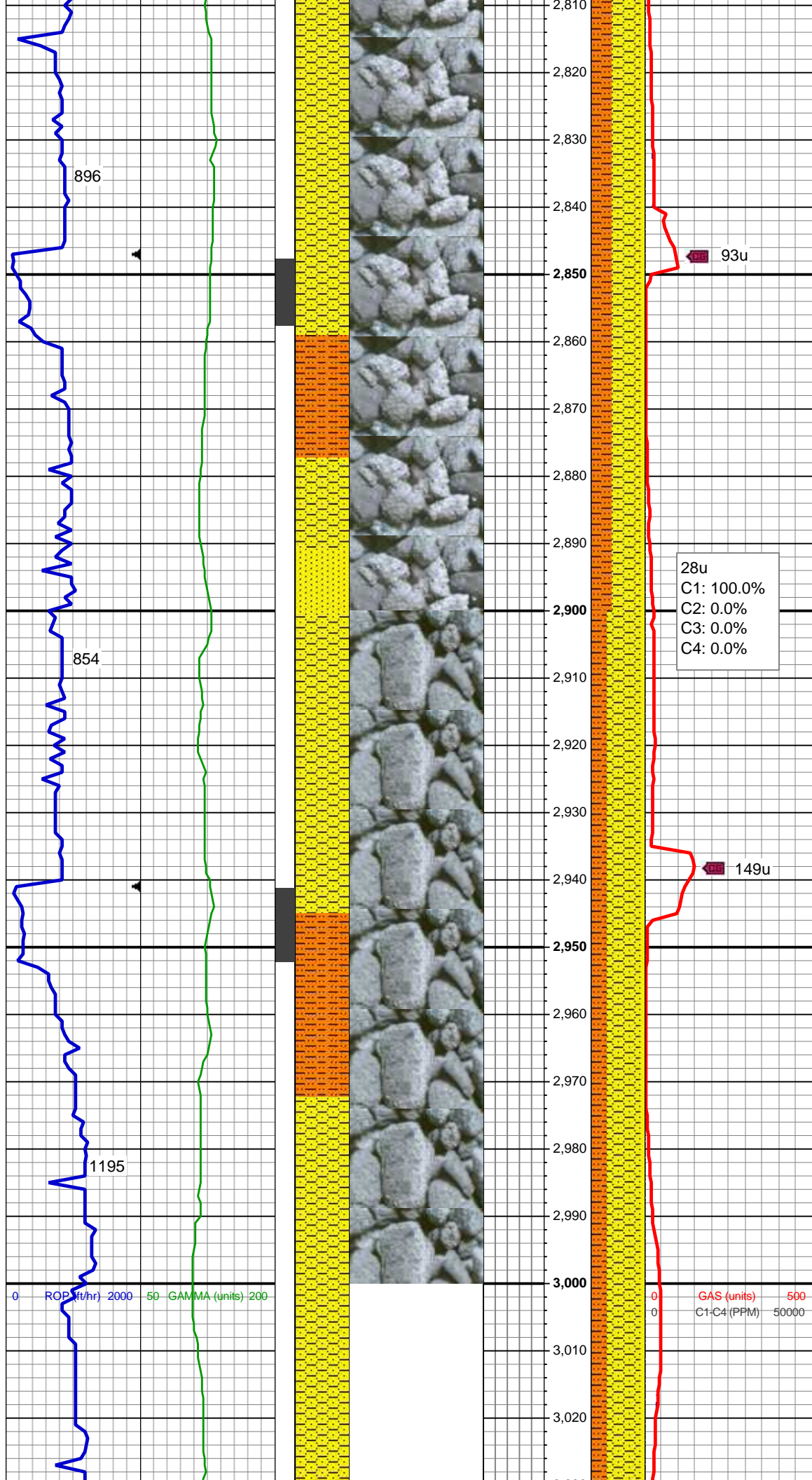
MD: 2,597 '
TVD: 2,588.34 '
Inclination: 13.66 °
Azimuth: 250.64 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SS: wh - lt gy, fros - trnsl, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

MD: 2,692 '
TVD: 2,680.65 '
Inclination: 13.69 °
Azimuth: 249.81 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SS: wh - lt gy, fros - trnsl, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

MD: 2,787 '
TVD: 2,773.01 '
Inclination: 13.41 °
Azimuth: 246.96 °



MD: 2,882 '
TVD: 2,865.37 '
Inclination: 13.63 °
Azimuth: 247.75 °

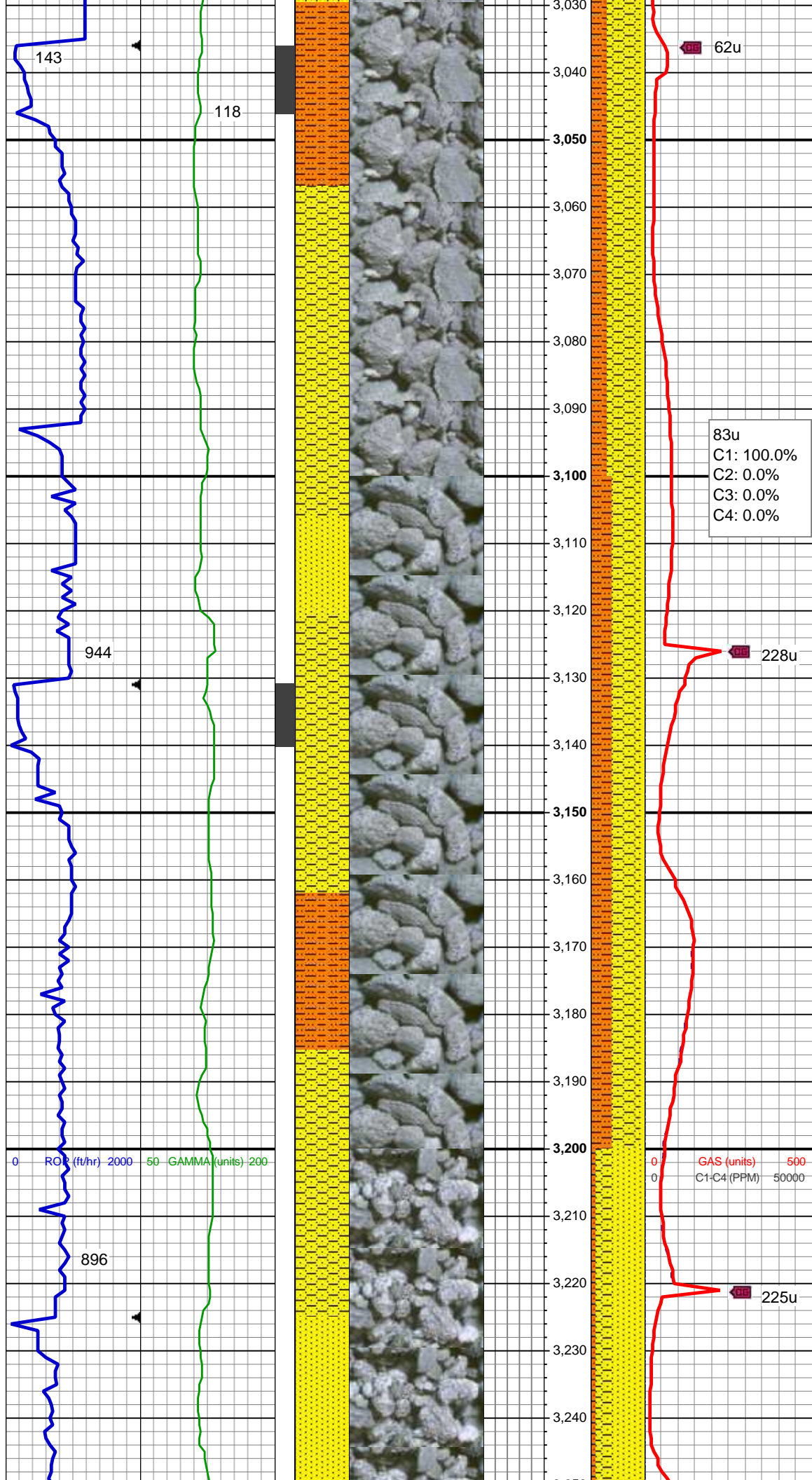
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt

28u
C1: 100.0%
C2: 0.0%
C3: 0.0%
C4: 0.0%

MD: 2,976 '
TVD: 2,956.7 '
Inclination: 13.78 °
Azimuth: 249.08 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt

GAS (units) 500
C1-C4 (PPM) 50000

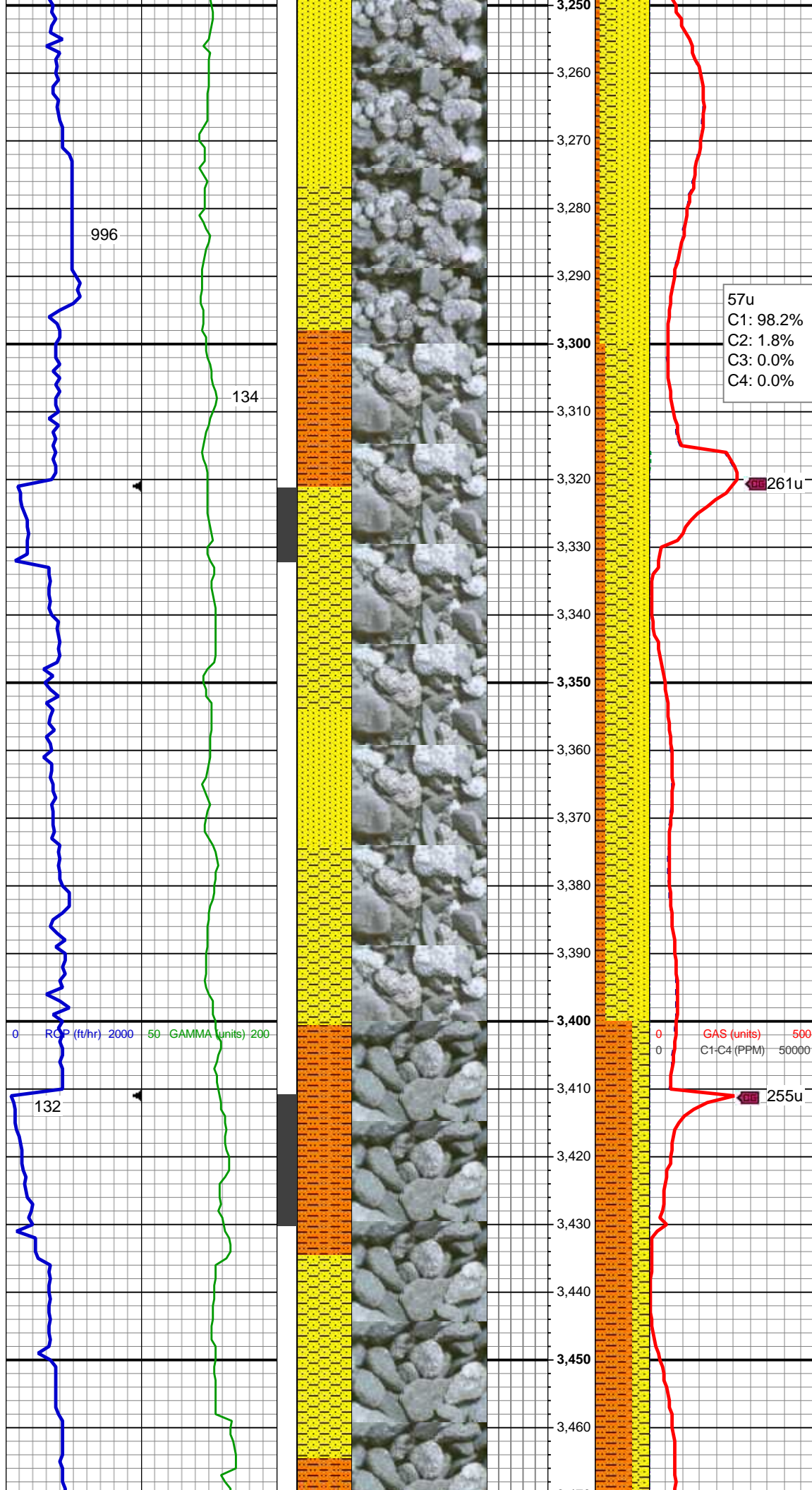


MD: 3,071 '
TVD: 3,048.86 '
Inclination: 14.3 °
Azimuth: 248.79 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt

MD: 3,166 '
TVD: 3,141.15 '
Inclination: 13.13 °
Azimuth: 248.31 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt



MD: 3,261 '
TVD: 3,233.89 '
Inclination: 11.87 °
Azimuth: 247.72 °

SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc

57u
C1: 98.2%
C2: 1.8%
C3: 0.0%
C4: 0.0%

261u

MD: 3,356 '
TVD: 3,326.93 '
Inclination: 11.48 °
Azimuth: 249.06 °

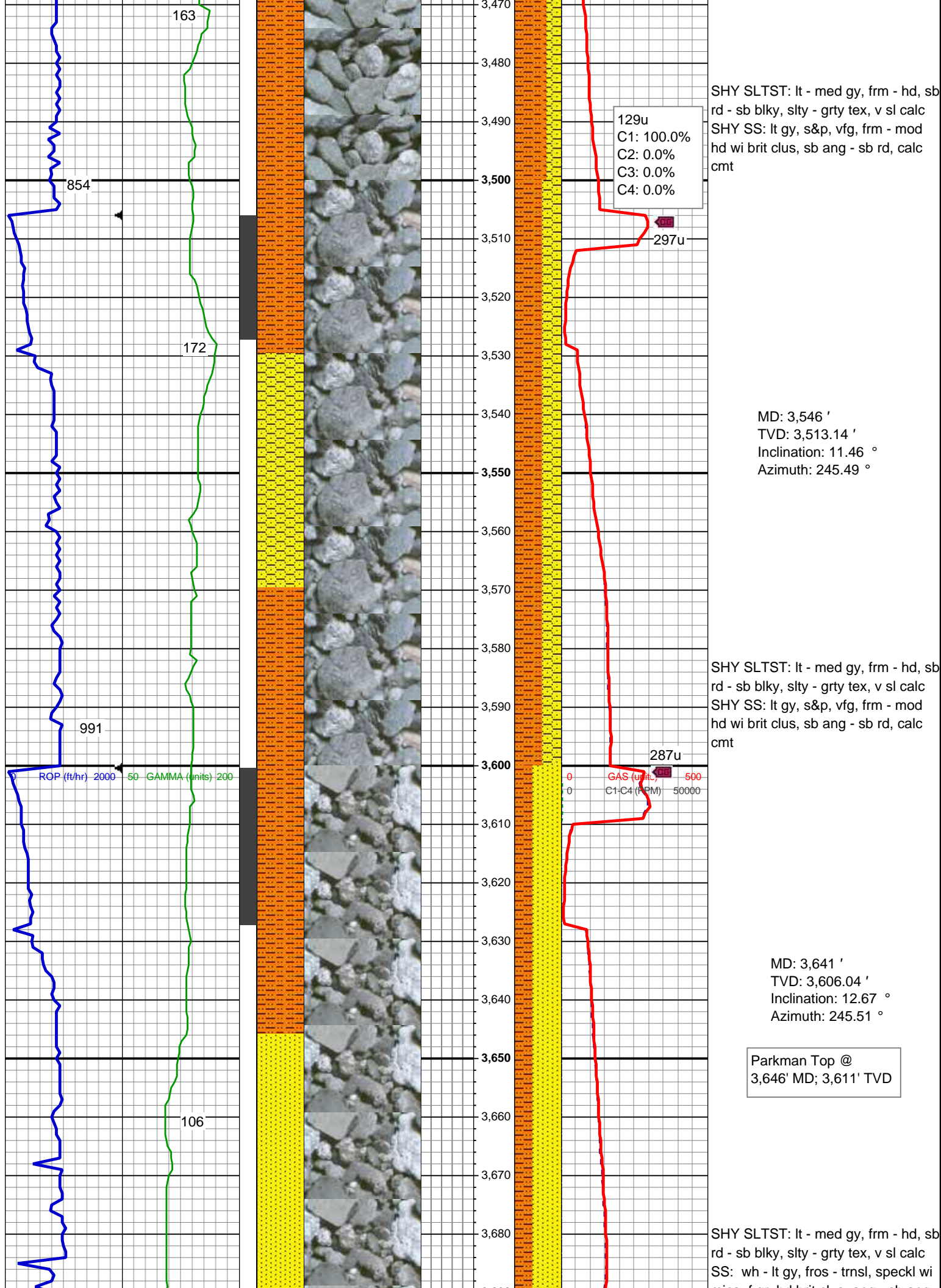
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SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc

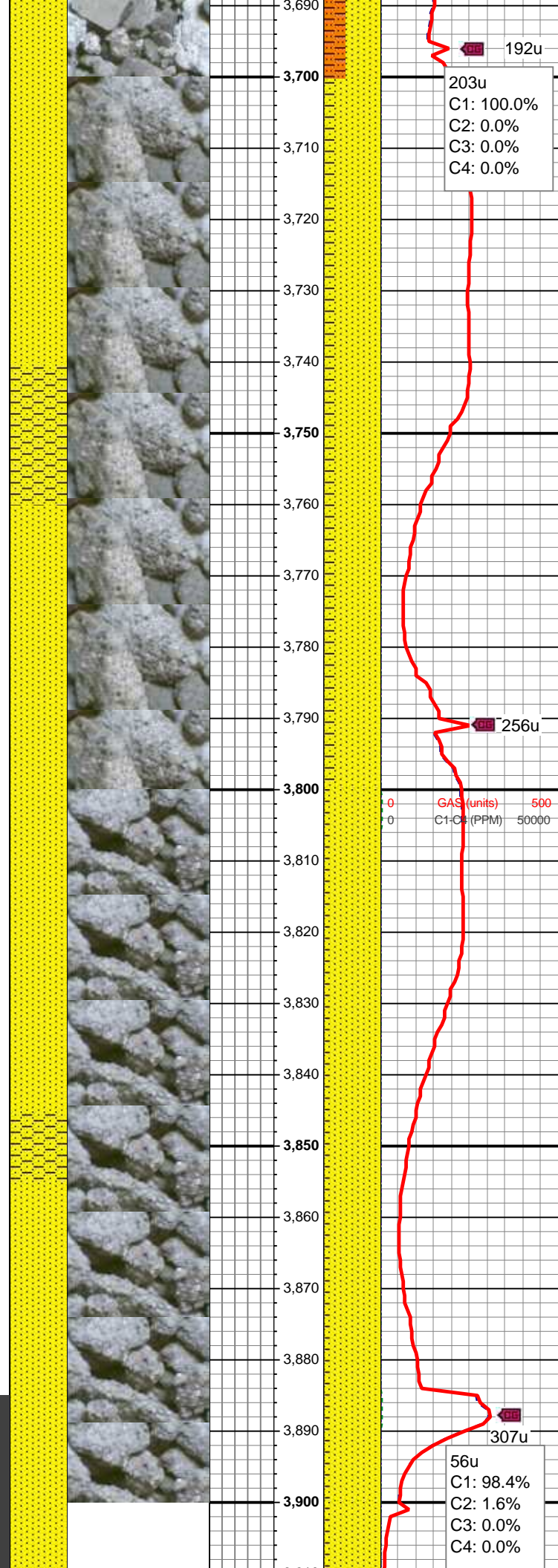
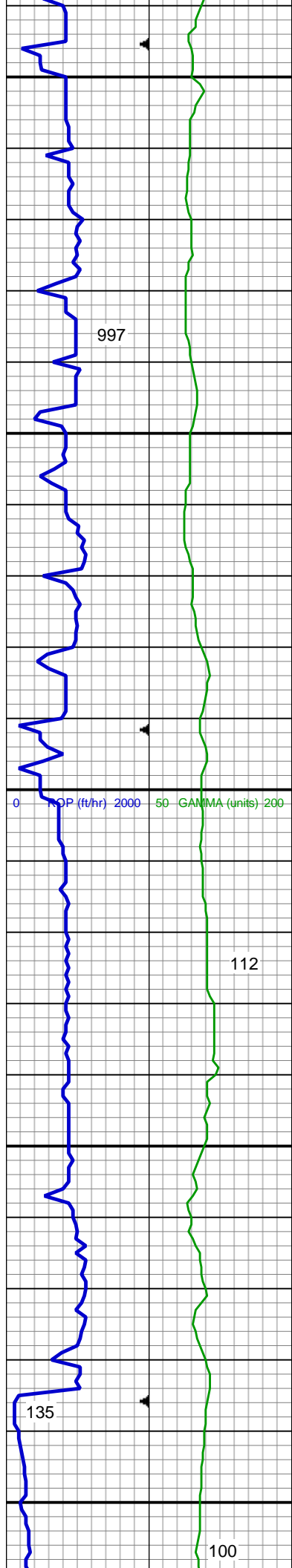
GAS (units) 500
C1-C4 (PPM) 50000

255u

09/29/2013
Mud Wt: 8.85
FVis: 29
PVis: 4
YP: 5
GELS: n/s
API Filt: n/s
CAKE: 1/0
pH: 9.5
Cl: 1,400
Ca: 160

MD: 3,451 '
TVD: 3,420.03 '
Inclination: 11.45 °
Azimuth: 248.09 °





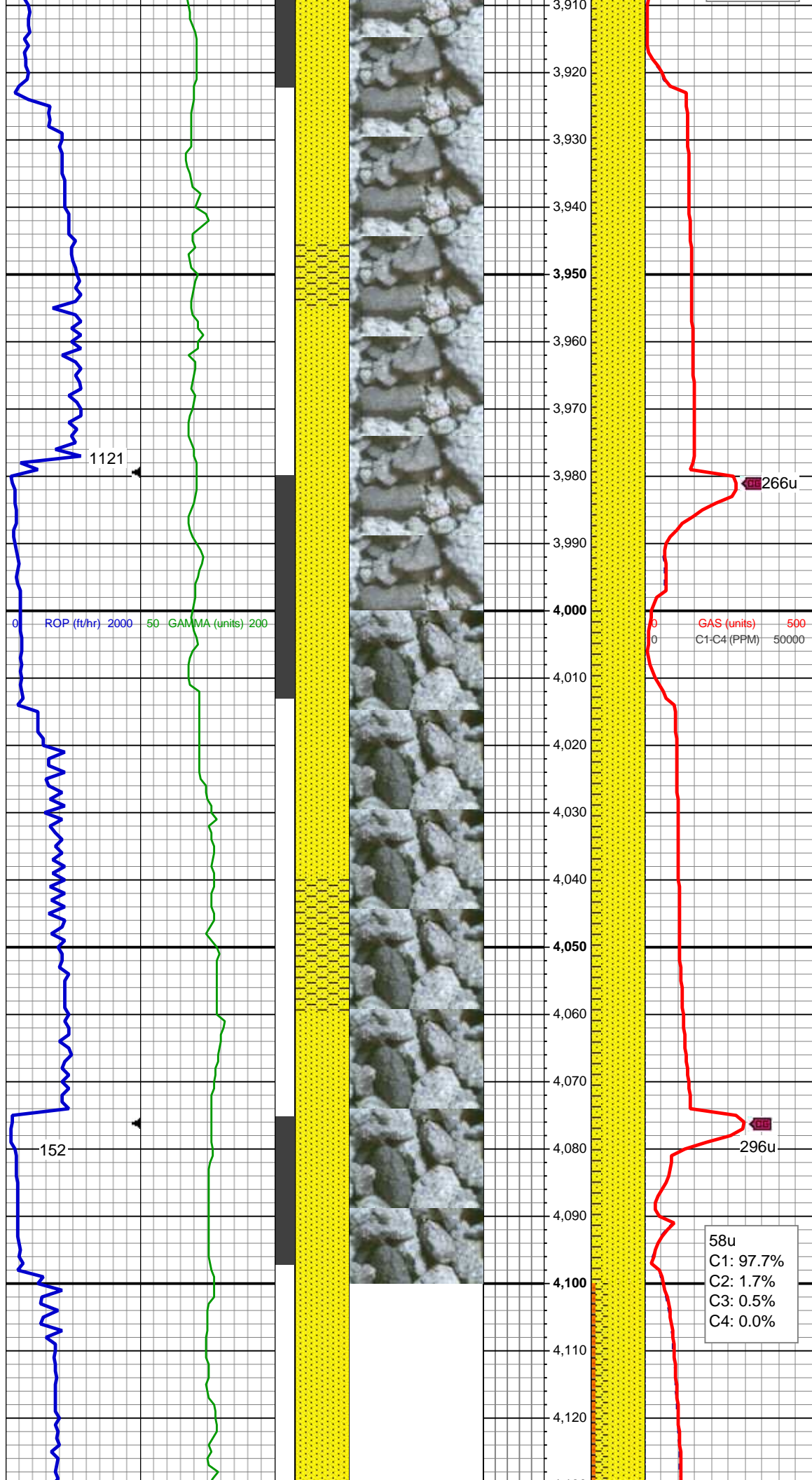
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt

MD: 3,736 '
TVD: 3,698.66 '
Inclination: 13.03 °
Azimuth: 242.23 °

SS: wh - lt gy, fros - trnsl, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

MD: 3,831 '
TVD: 3,791.03 '
Inclination: 14 °
Azimuth: 240.34 °

SS: wh - lt gy, fros - trnsl, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt



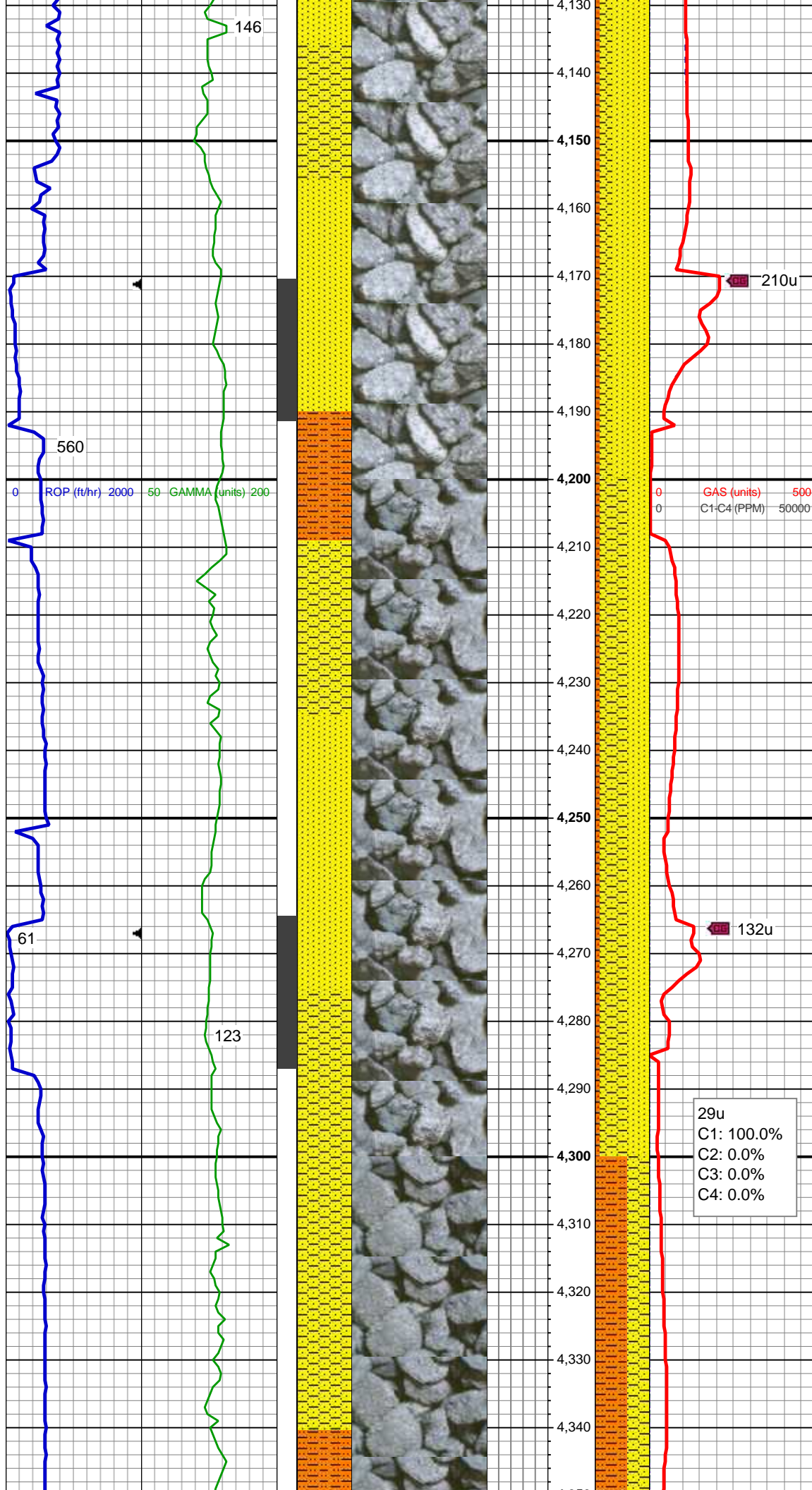
MD: 3,926 '
TVD: 3,883.44 '
Inclination: 12.79 °
Azimuth: 242.88 °

SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 4,021 '
TVD: 3,976.56 '
Inclination: 9.98 °
Azimuth: 240.64 °

SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 4,116 '
TVD: 4,070.35 '
Inclination: 8.35 °
Azimuth: 244.39 °

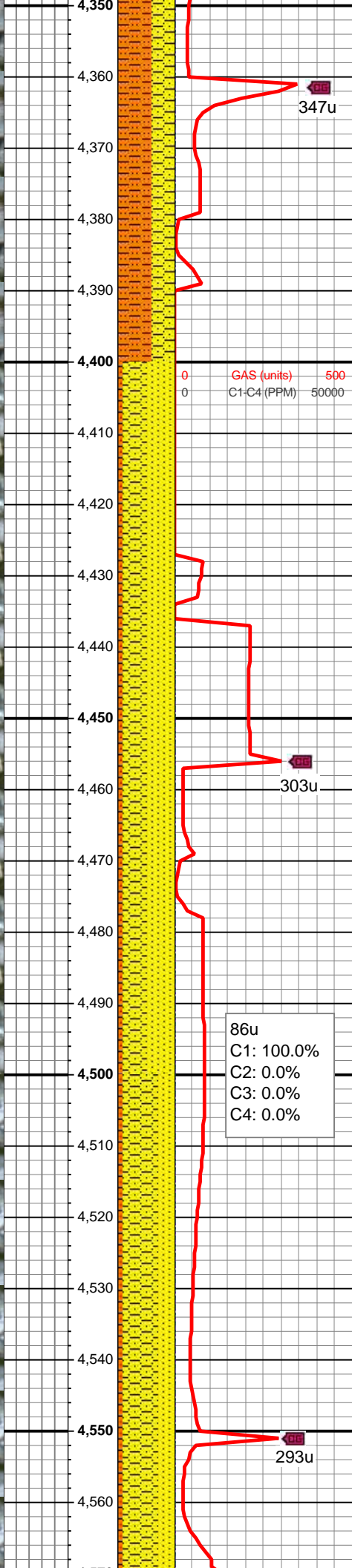
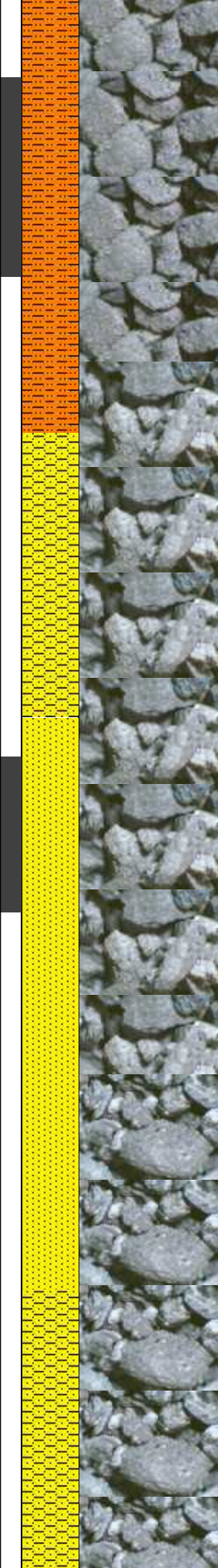
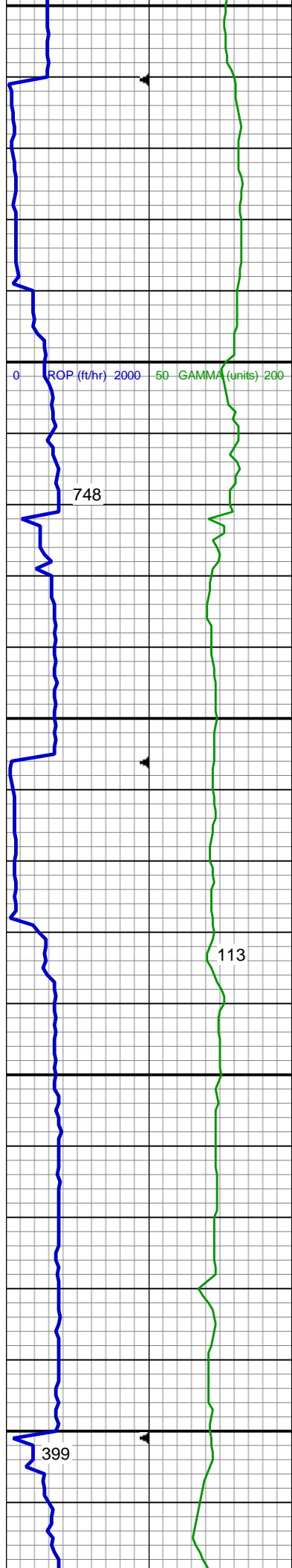


SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc

MD: 4,211 '
TVD: 4,164.49 '
Inclination: 7.09 °
Azimuth: 237.53 °

SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc

MD: 4,306 '
TVD: 4,258.94 '
Inclination: 5.13 °
Azimuth: 244.66 °



MUD WT: 8.7/8.8
VIS: 27/27 IN/OUT

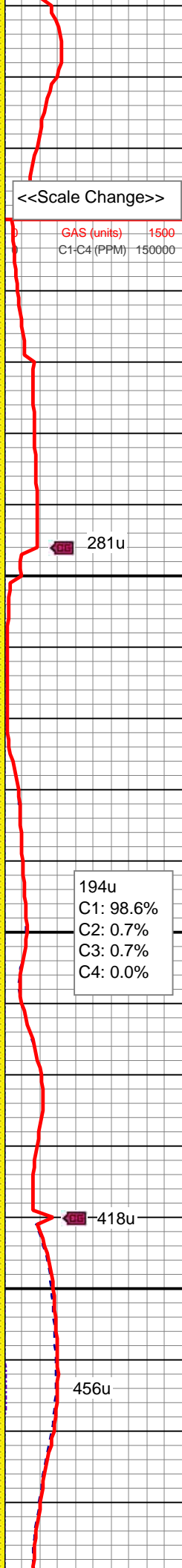
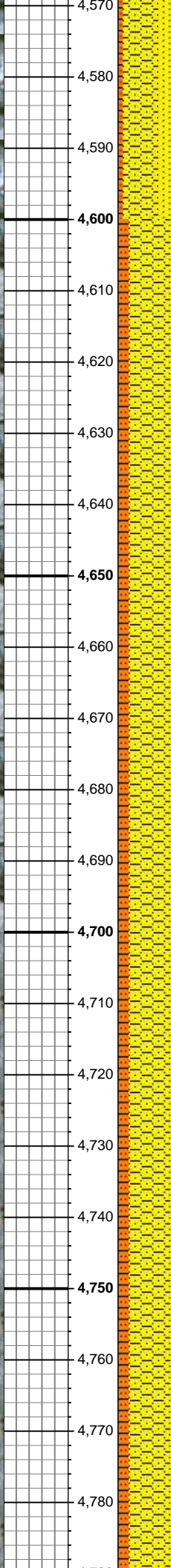
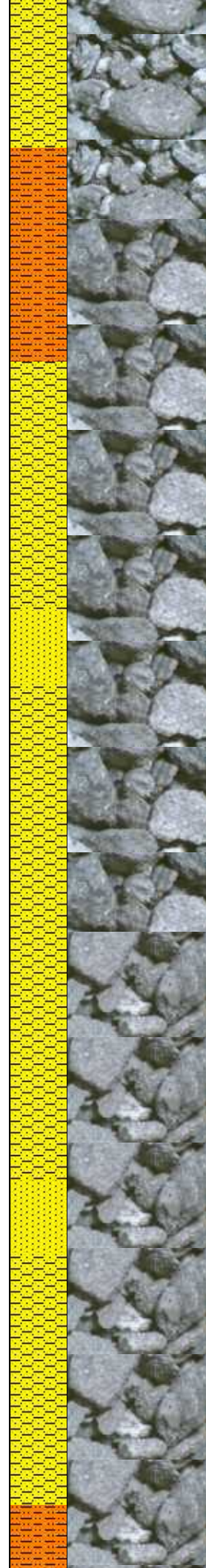
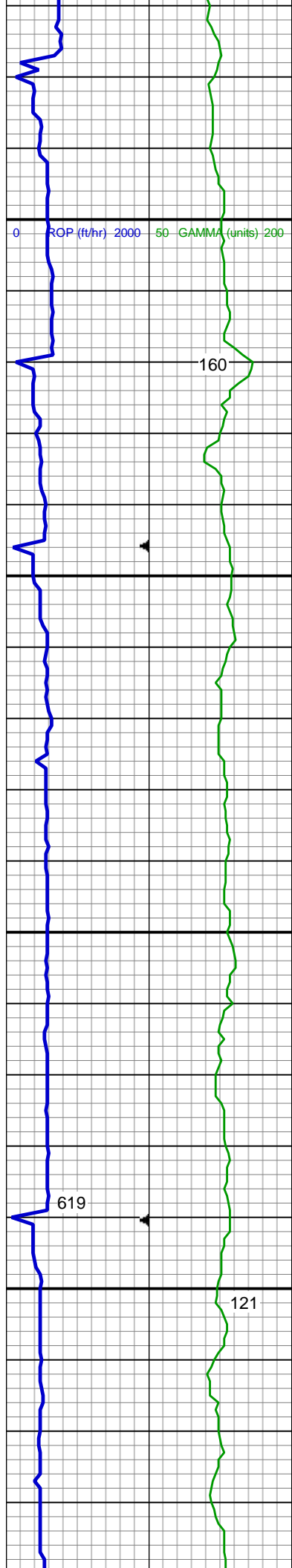
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

MD: 4,400 '
TVD: 4,352.73 '
Inclination: 2.35 °
Azimuth: 241.44 °

Sussex Top @
4,450' MD; 4,403' TVD

SS: wh - lt gy, fros - trnsl, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

MD: 4,495 '
TVD: 4,447.7 '
Inclination: 0.78 °
Azimuth: 257.9 °

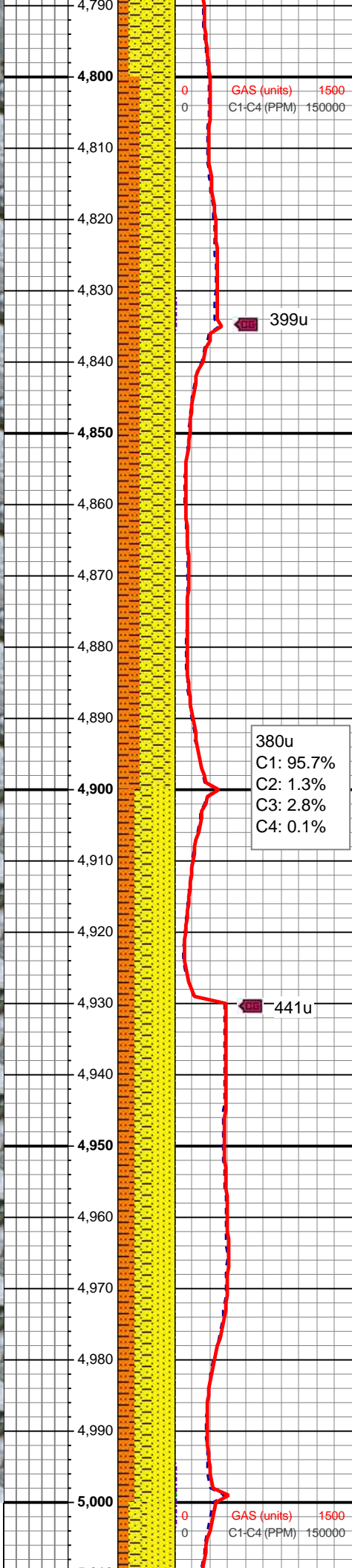
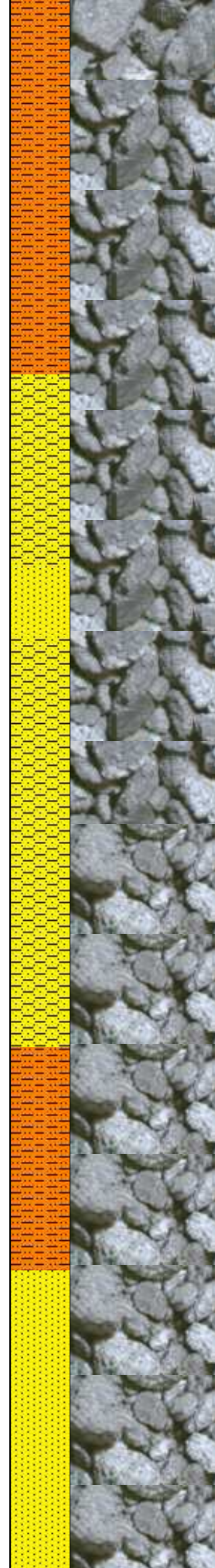
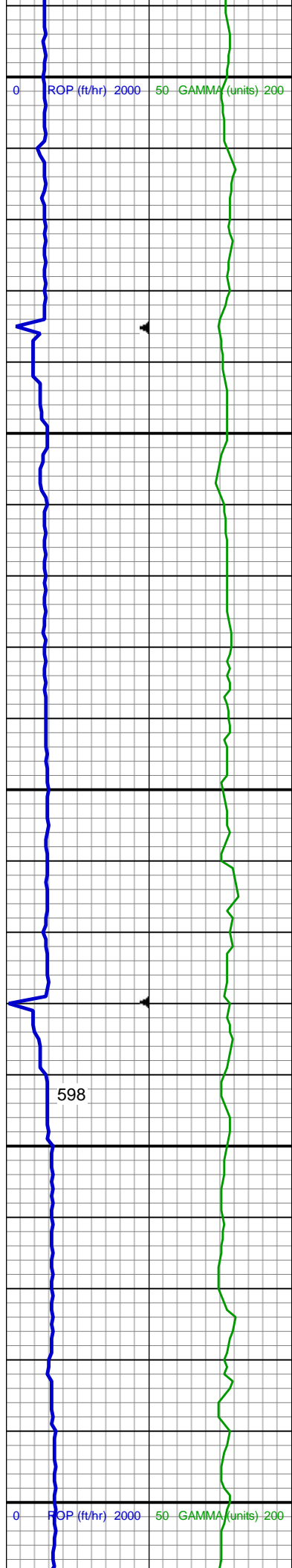


SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi
mica, f gr, hd brit clus, ang - sb ang,
v calc cmt

MD: 4,780 '
TVD: 4,732.65 '
Inclination: 1.36 °
Azimuth: 216.78 °

SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc

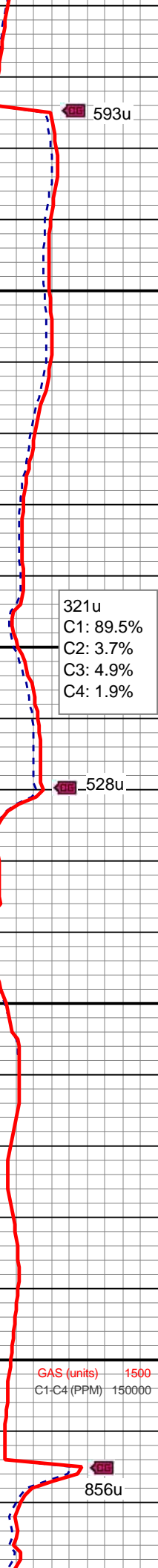
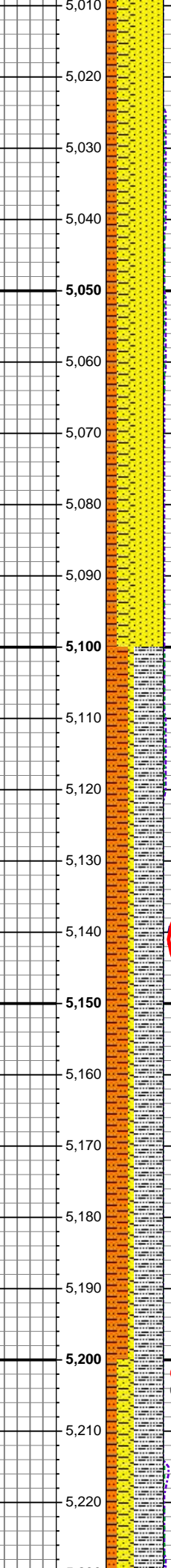
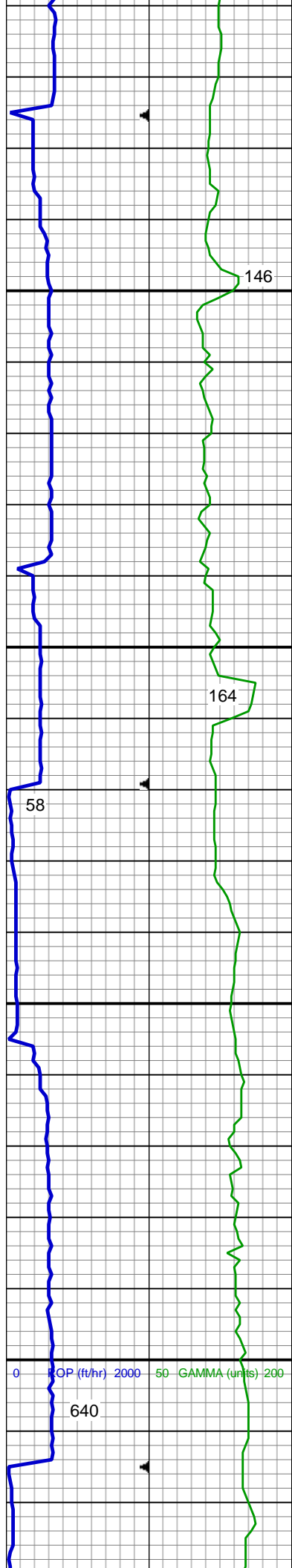


SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt

SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc
SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt

Shannon Top @
4,960' MD; 4,914' TVD

SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc



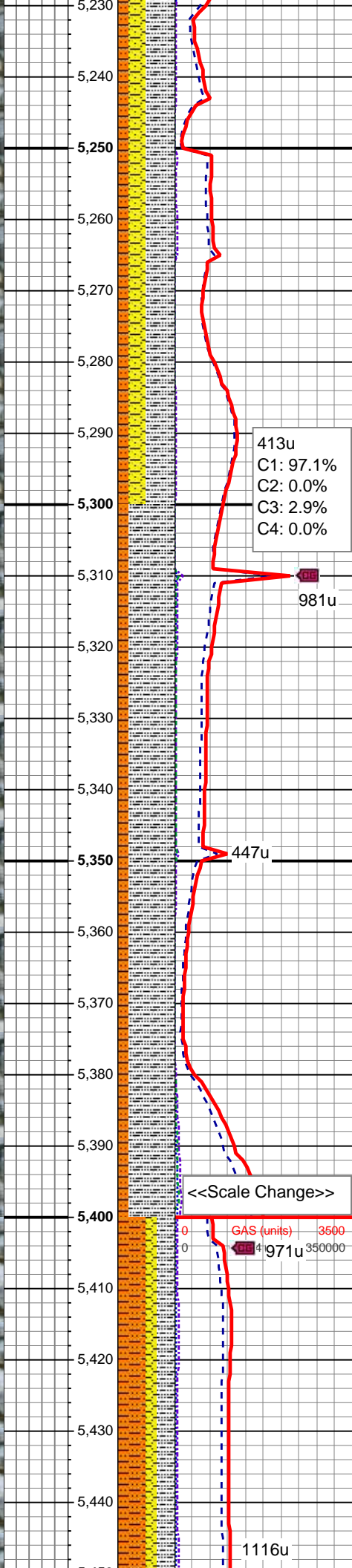
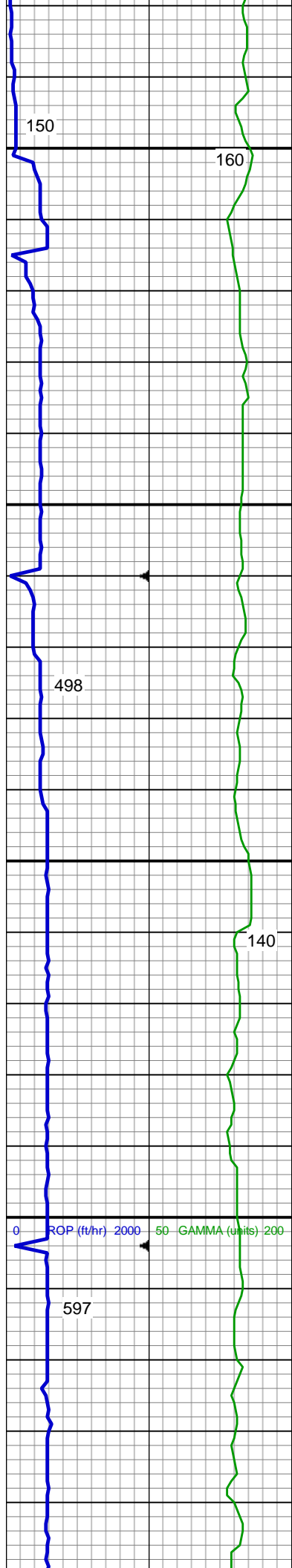
MD: 5,065 '
TVD: 5,017.46 '
Inclination: 2.89 °
Azimuth: 170.16 °

SS: wh - lt gy, fros - trns, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc

MUD WT: 8.85/9.00
VIS: 28/28 IN/OUT

MD: 5,160 '
TVD: 5,112.4 '
Inclination: 1.33 °
Azimuth: 117.68 °

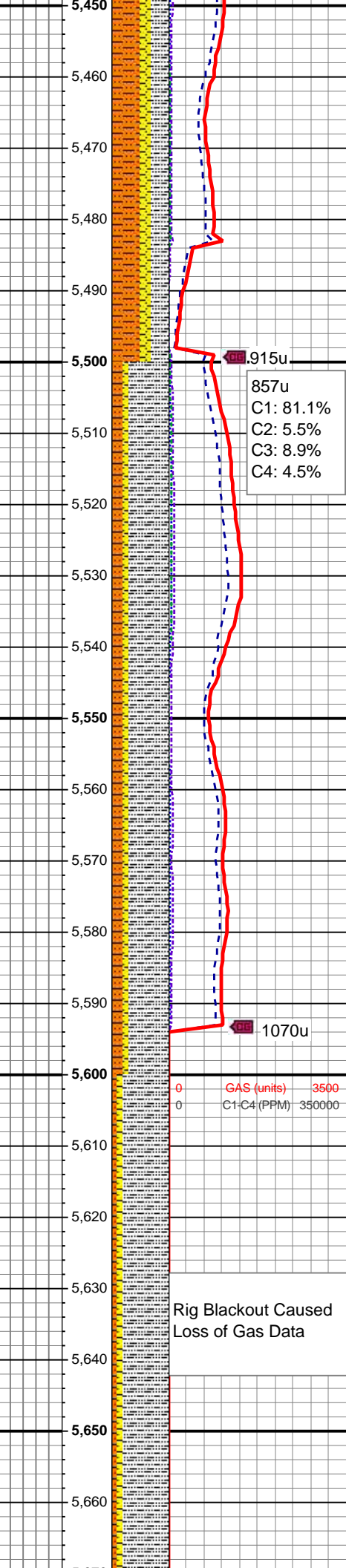
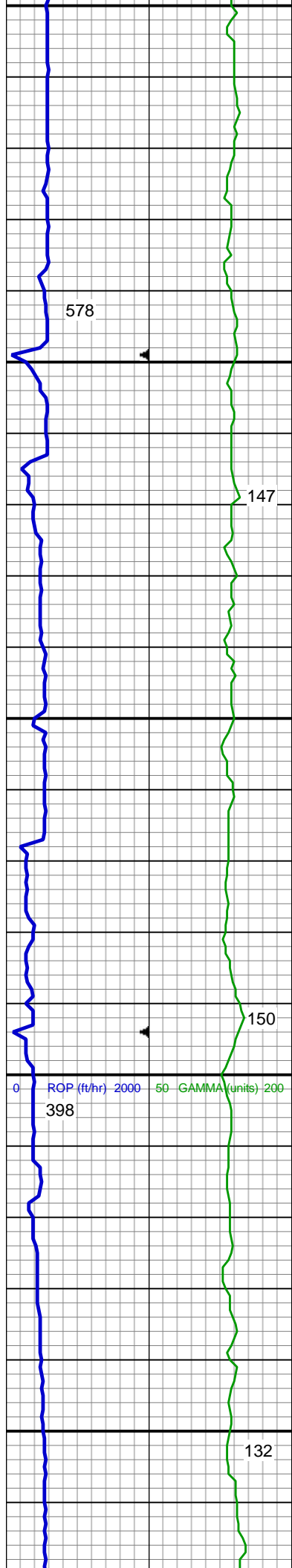
SLTY SH: lt - med gy, occ dk gy, frm - hd, plty - sb plty - sb blk, slty - grty tex, v sl calc
SHY SLTST: lt - med gy, frm - hd, sb rd - sb blk, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod hd wi brit clus, sb ang - sb rd, calc cmt



MD: 5,254 '
TVD: 5,206.39 '
Inclination: 1.09 °
Azimuth: 355.65 °

SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blk, slty - grty
tex, v sl calc
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blk, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

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



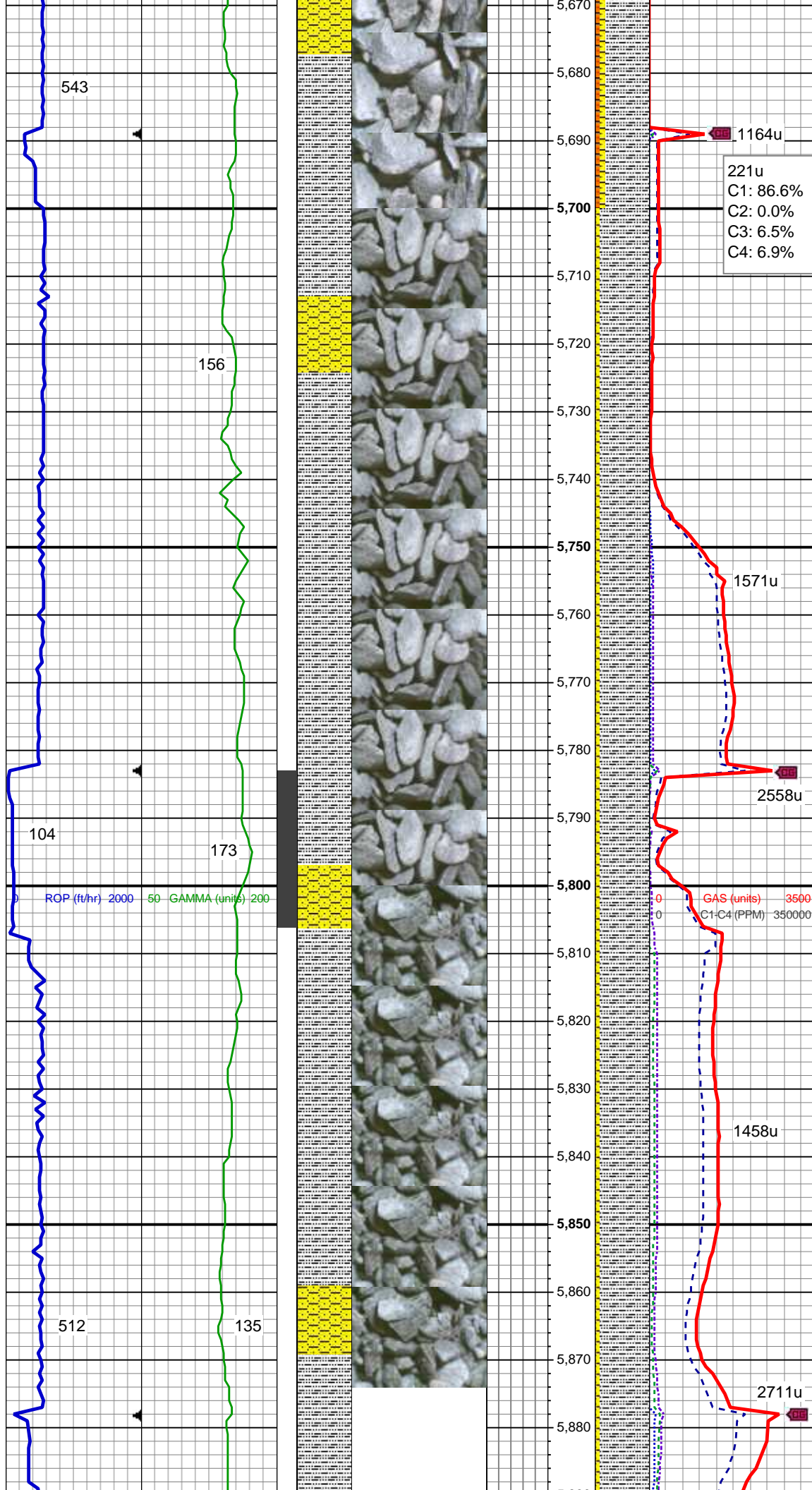
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blkly, slty - grty tex, v sl calc
SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blkly, slty - grty
tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

MD: 5,539 '
TVD: 5,491.38 '
Inclination: 0.44 °
Azimuth: 222.2 °

SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blkly, slty - grty
tex, v sl calc
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blkly, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

09/29/2013
Mud Wt: 9.25
FVis: 33
PVis: 9
YP: 7
GELS: 3/6/10
API Filt: 9.0
CAKE: 1/0
pH: 9.4
Cl: 1,400

Ca: 160



SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blkty, slty - grty
tex, v sl calc
SHY SLTST: lt - med gy, frm - hd, sb
rd - sb blkty, slty - grty tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

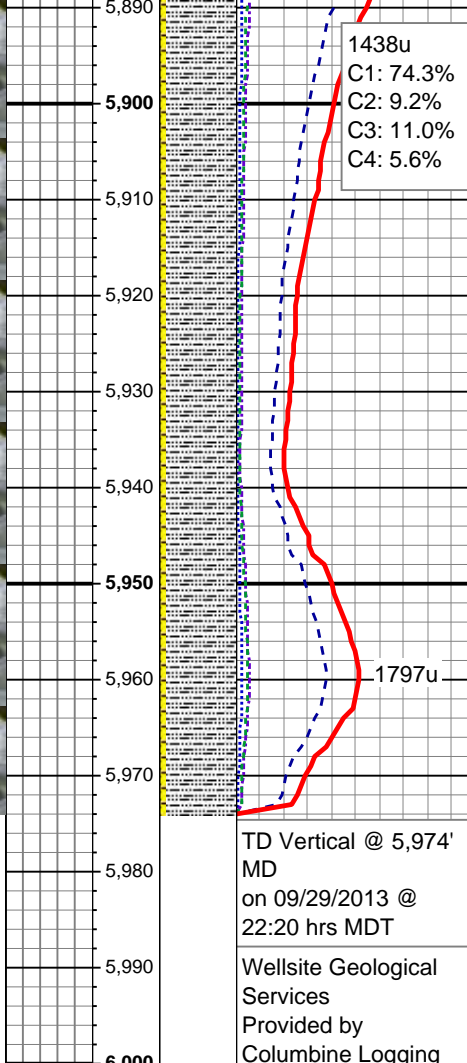
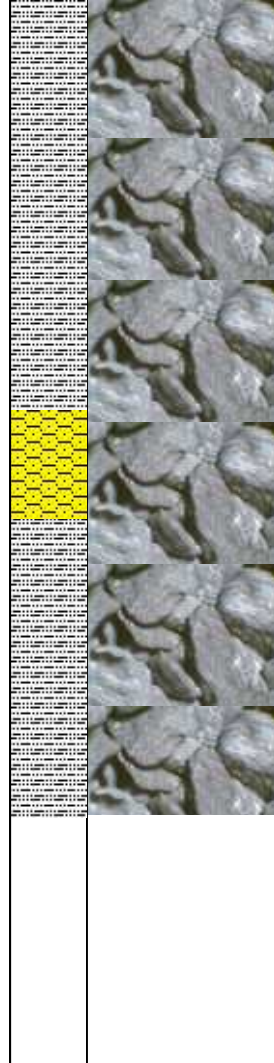
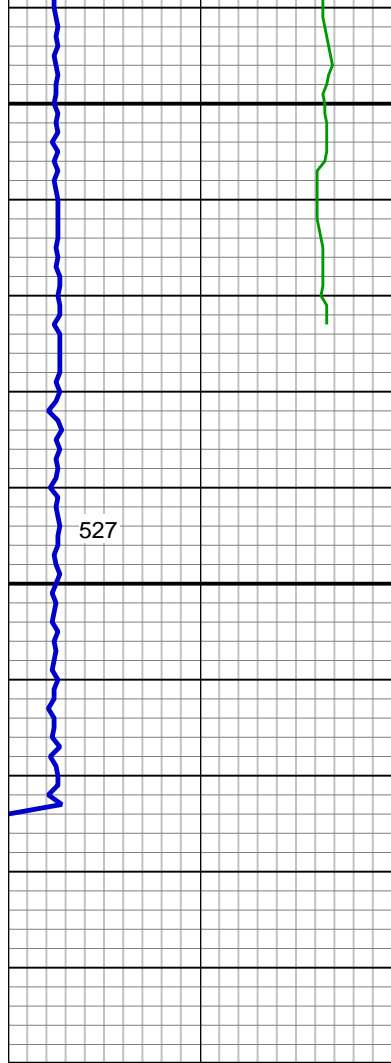
MUD WT: 9.35/9.35
VIS: 32/32 IN/OUT

SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blkgy, slty - grty
tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

MD: 5,824 '
TVD: 5,776.36 '
Inclination: 1 °
Azimuth: 4.18 °

TeePee Buttes Top @
5,840' MD; 5,792' TVD

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



SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

Projection to Bit:
MD: 5,974 '
TVD: 5,926.34 '
Inclination: 1 °
Azimuth: 4.18 °

SLTY SH: lt - med gy, occ dk gy, frm
- hd, plty - sb plty - sb blkly, slty - grty
tex, v sl calc
SHY SS: lt gy, s&p, vfg, frm - mod
hd wi brit clus, sb ang - sb rd, calc
cmt

1797u

TD Vertical @ 5,974'
MD
on 09/29/2013 @
22:20 hrs MDT

Wellsite Geological
Services
Provided by
Columbine Logging

See Corresponding Horizontal Log
Crow Creek State AC36-77HN
HORZ