

# COLUMBINE LOGGING

Scale: 5" / 100'  
Measured Depth Log

**Well Name** Cockroft B15-69-1HNM VERT

**Location** SEC 14 T5N R64W

**State** Colorado

**County** Weld

**Country** USA

**Rig Number** H&P 315

**API Number** 05-123-37203

**AFE #** 136882

**Region** DJ Basin

**Field** Kersey

**Spud Date** 10/27/2013

**Drilling Completed** 10/28/2013

**Surface Coordinates** NENW SEC 14 T5N R64W  
674' FNL; 2,348' FWL  
  
Lat/Lon: 40.40465/-104.51854

**Bottom Hole Coordinates** NWNW SEC 15 T5N R64W  
330' FNL; 2,565' FWL

**Ground Elevation** 4585'

**K.B. Elevation** 4609'

**Logged Interval** 2000' **To** 5942'

**Total Depth** 5942'

**Formation** NIO 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

	SANDSTONE		CHALK		IGNEOUS		SHALE COLORED
	SHALY SANDSTONE		CHERT		LIMESTONE		SHALE GRAY
	SHALY SILTSTONE		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  
 CONNECTION GAS (RIGHT)  
 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

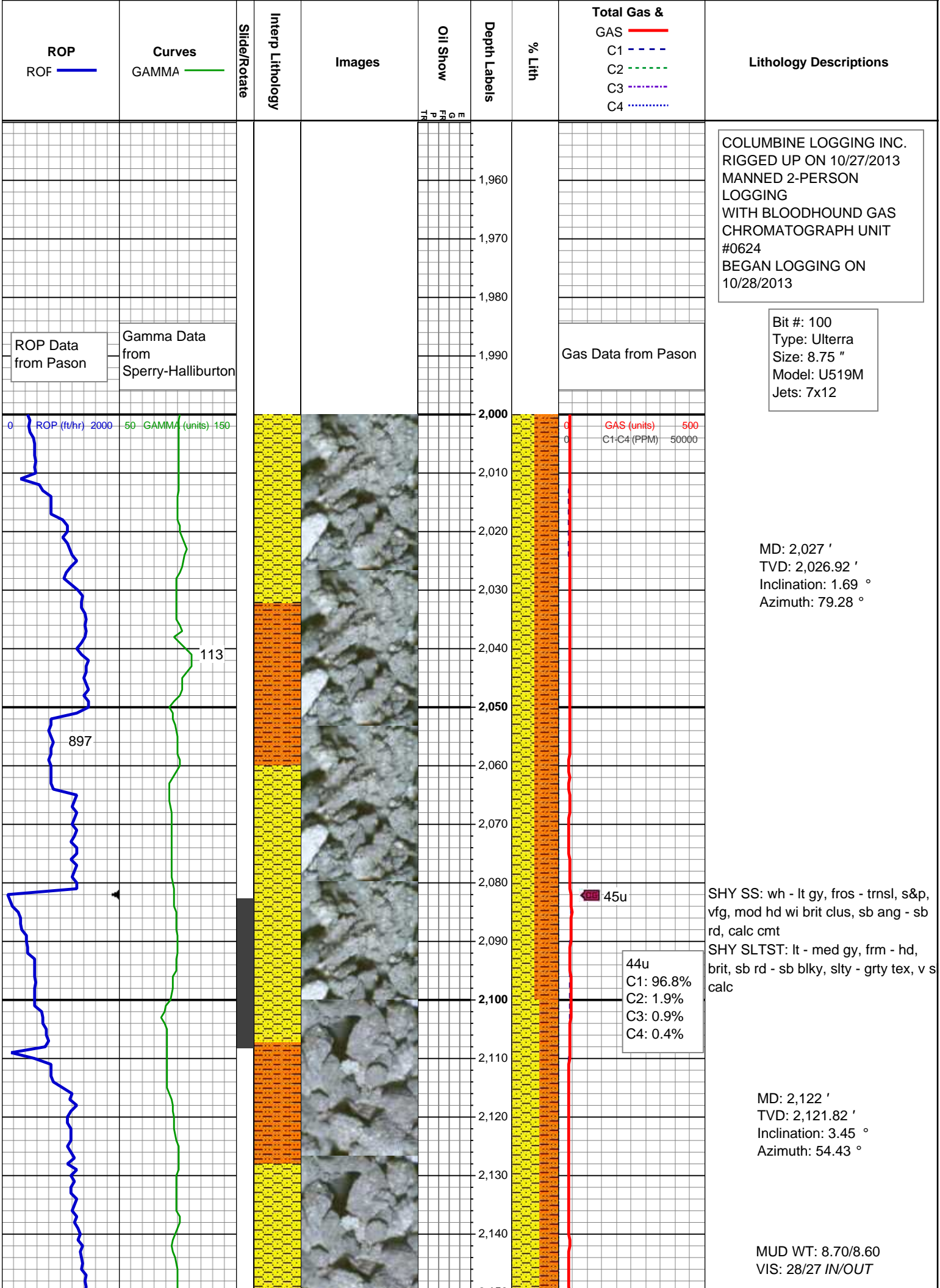
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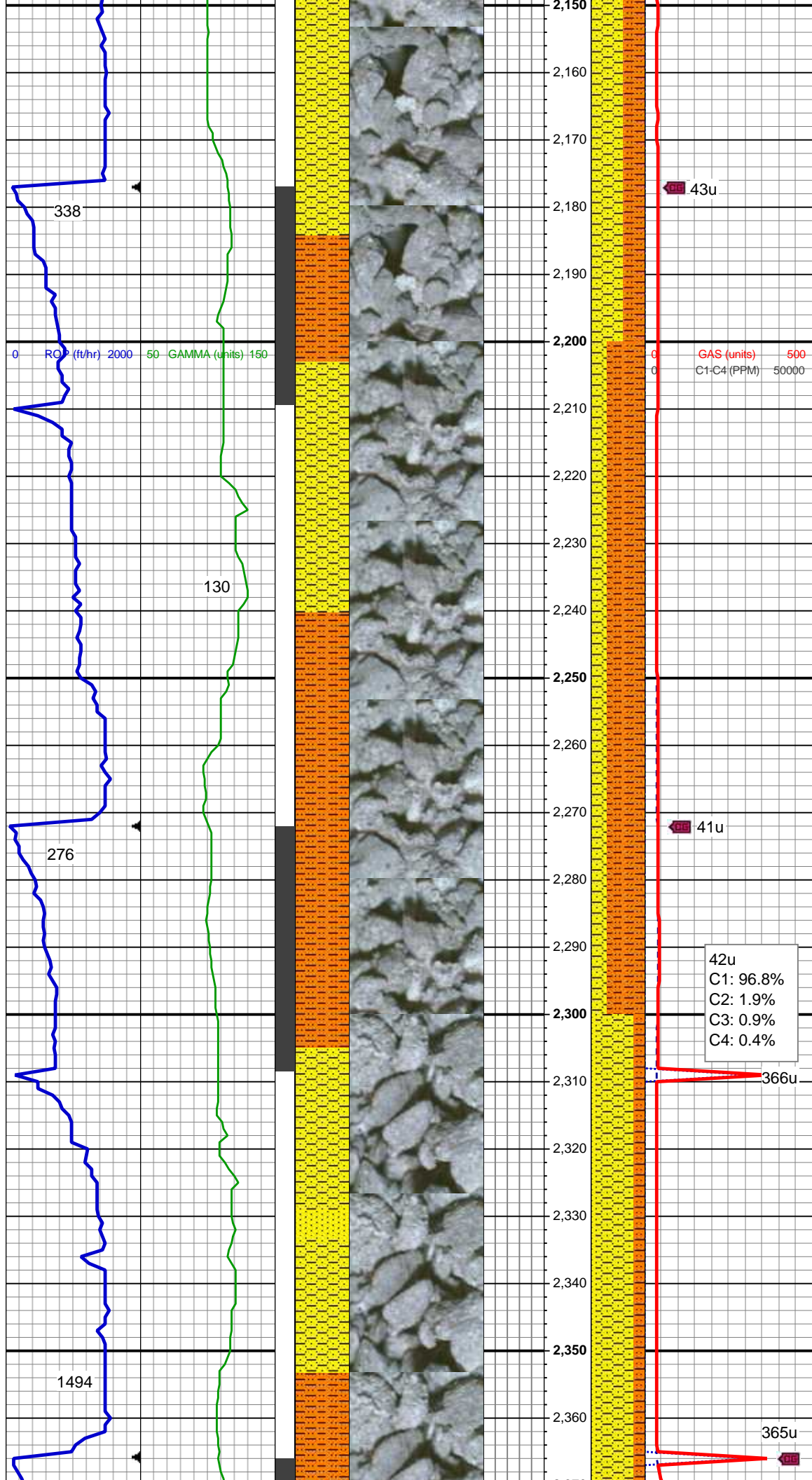
BOUNDSTONE  
 CHALKY  
 CRYPTOXLN  
 EARTHY  
 FINELYXLN  
 GRAINSTONE

LITHOGRAPHIC  
 MICROXLN  
 MUDSTONE  
 PACKSTONE  
 WACKESTONE

### Sorting

MODERATE  
 POOR  
 WELL





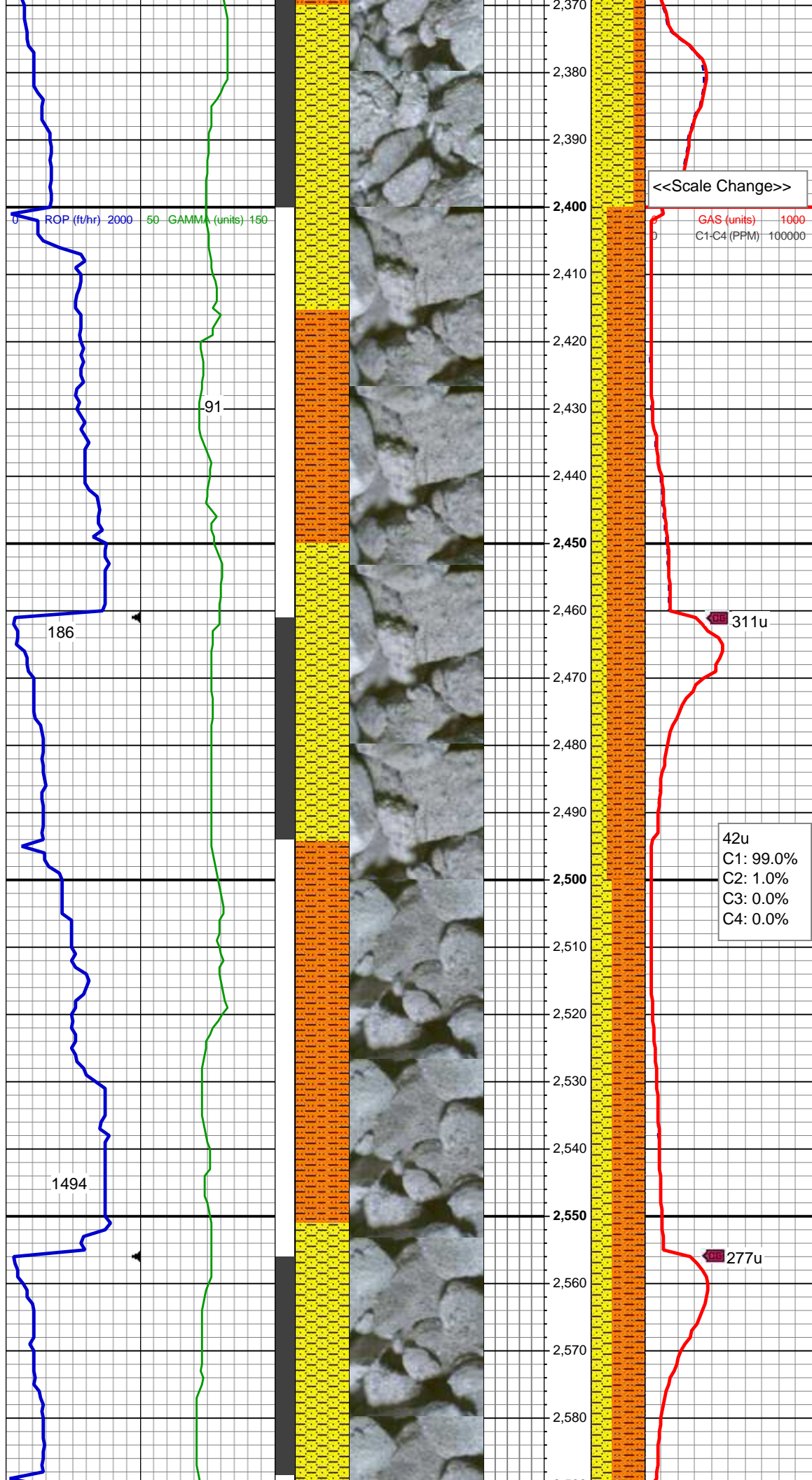
SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt  
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc

MD: 2,217 '  
TVD: 2,216.54 '  
Inclination: 5.23 °  
Azimuth: 53.37 °

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: 2,310.92 '  
Inclination: 7.83 °  
Azimuth: 58.32 °





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

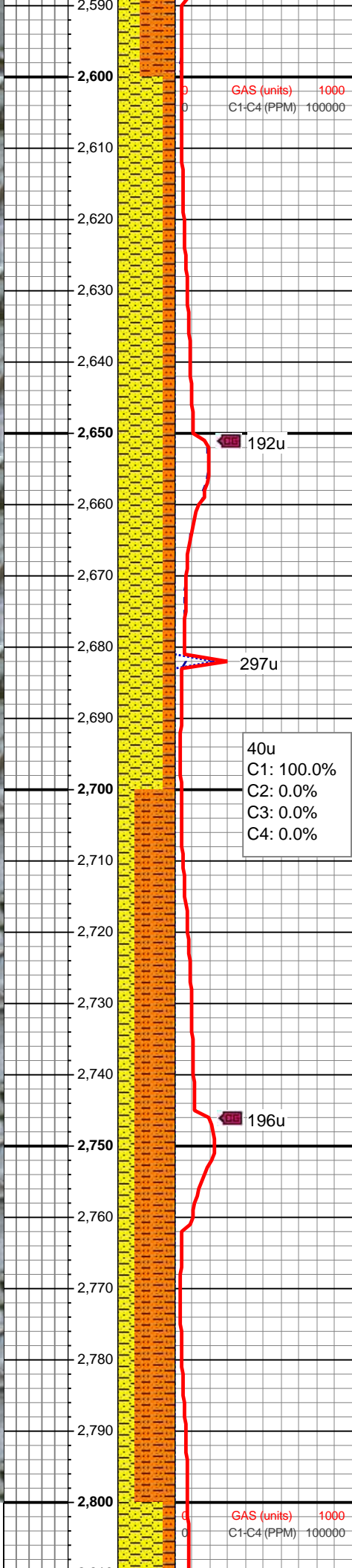
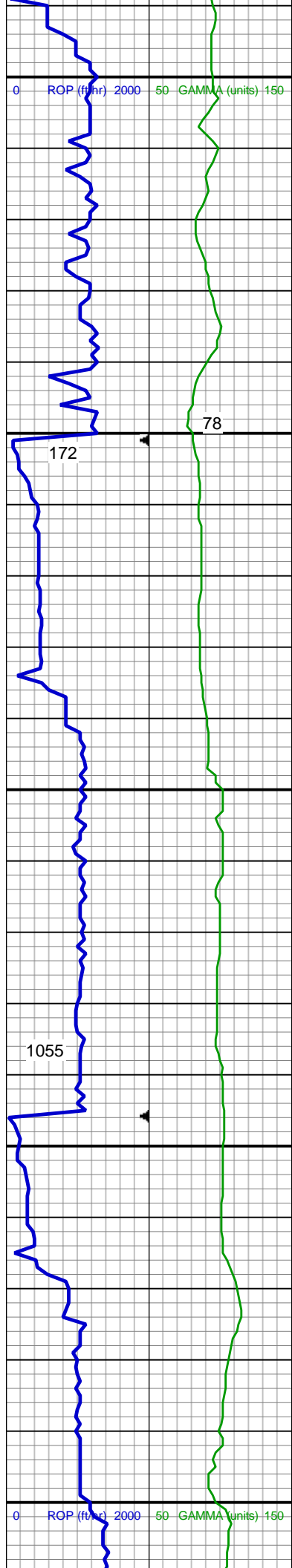
MD: 2,407 '  
TVD: 2,404.83 '  
Inclination: 9.54 °  
Azimuth: 55.47 °

MUD WT: 8.80/8.70  
VIS: 28/27 IN/OUT

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: 2,502 '  
TVD: 2,498.35 '  
Inclination: 10.7 °  
Azimuth: 50.97 °

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: 2,597 '  
TVD: 2,591.46 '  
Inclination: 12.2 °  
Azimuth: 53.72 °

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: 2,692 '  
TVD: 2,684.07 '  
Inclination: 13.54 °  
Azimuth: 47.32 °

MUD WT: 8.60/8.60  
VIS: 28/27 IN/OUT

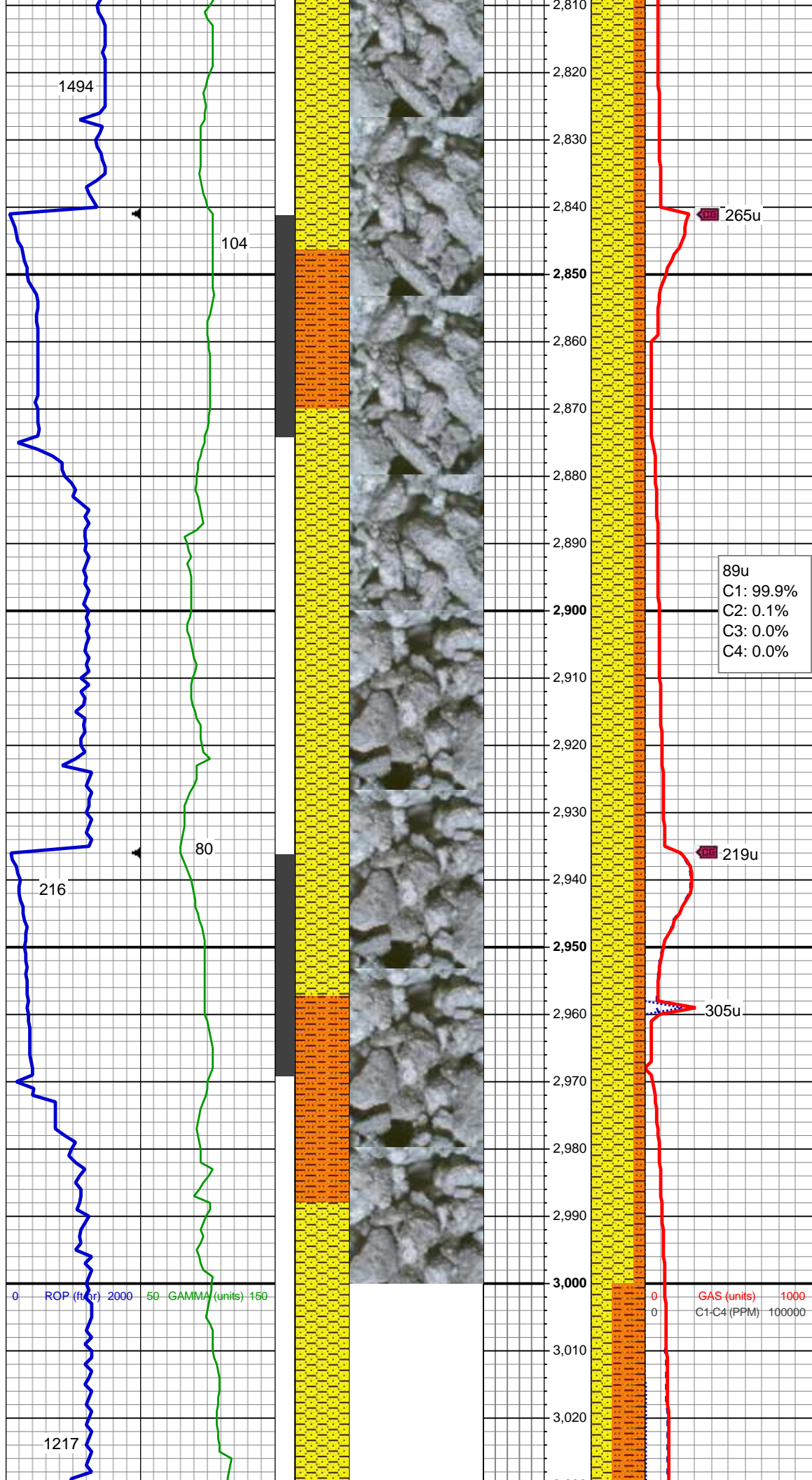
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc

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

MD: 2,787 '  
TVD: 2,776.46 '  
Inclination: 12.12 °  
Azimuth: 53.72 °



Inclination: 13.42 °  
Azimuth: 51.12 °

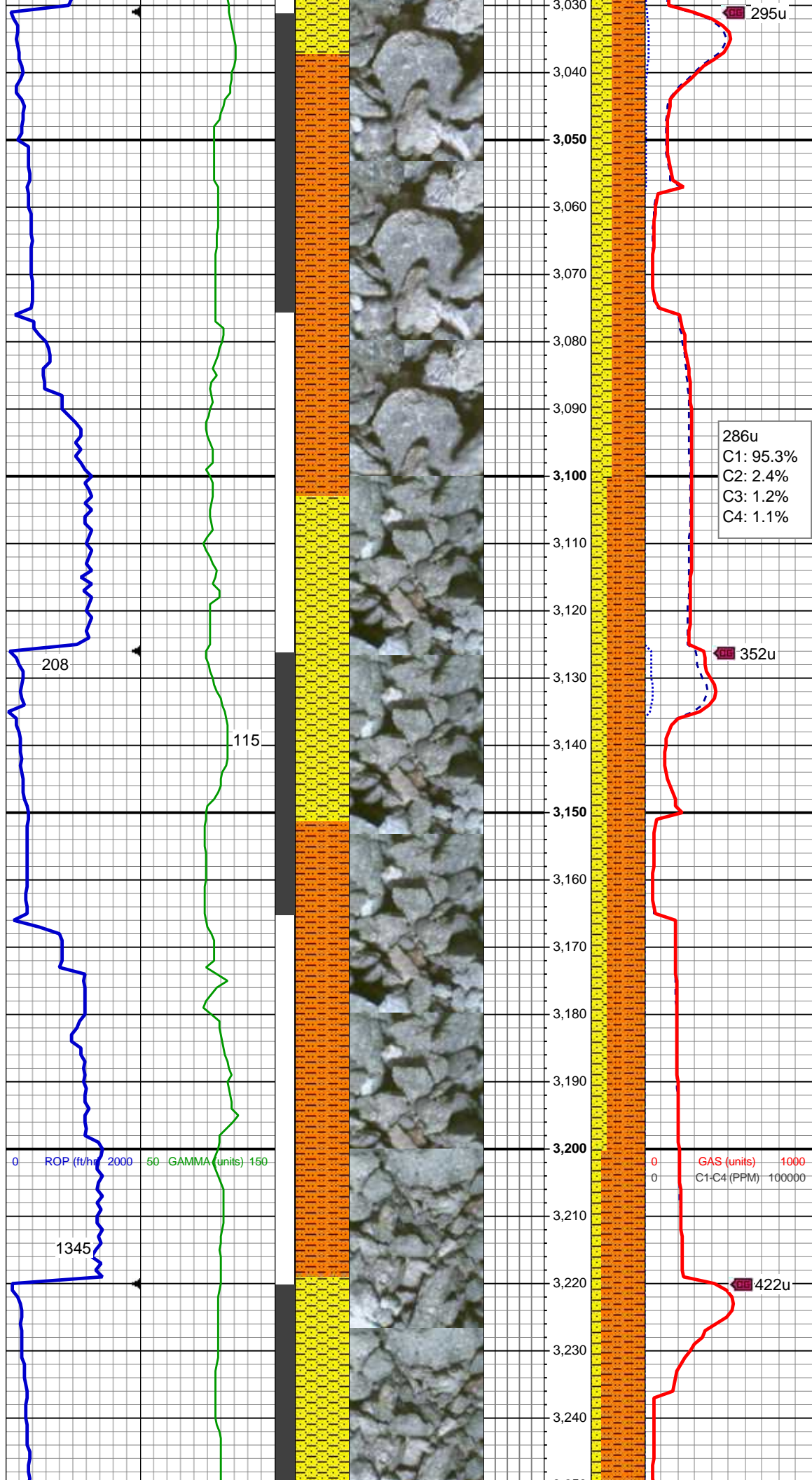


MD: 2,881 '  
TVD: 2,867.76 '  
Inclination: 14.12 °  
Azimuth: 44.76 °

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 blkly, slty - grty tex, v s calc

MD: 2,976 '  
TVD: 2,959.79 '  
Inclination: 14.63 °  
Azimuth: 43.53 °

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 blkly, slty - grty tex, v s calc



MD: 3,071 '  
TVD: 3,051.76 '  
Inclination: 14.41 °  
Azimuth: 48.13 °

SHY SLTST: lt - med gy, frm - hd,  
brit, sb rd - sb blk, slty - grty tex, v s  
calc

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

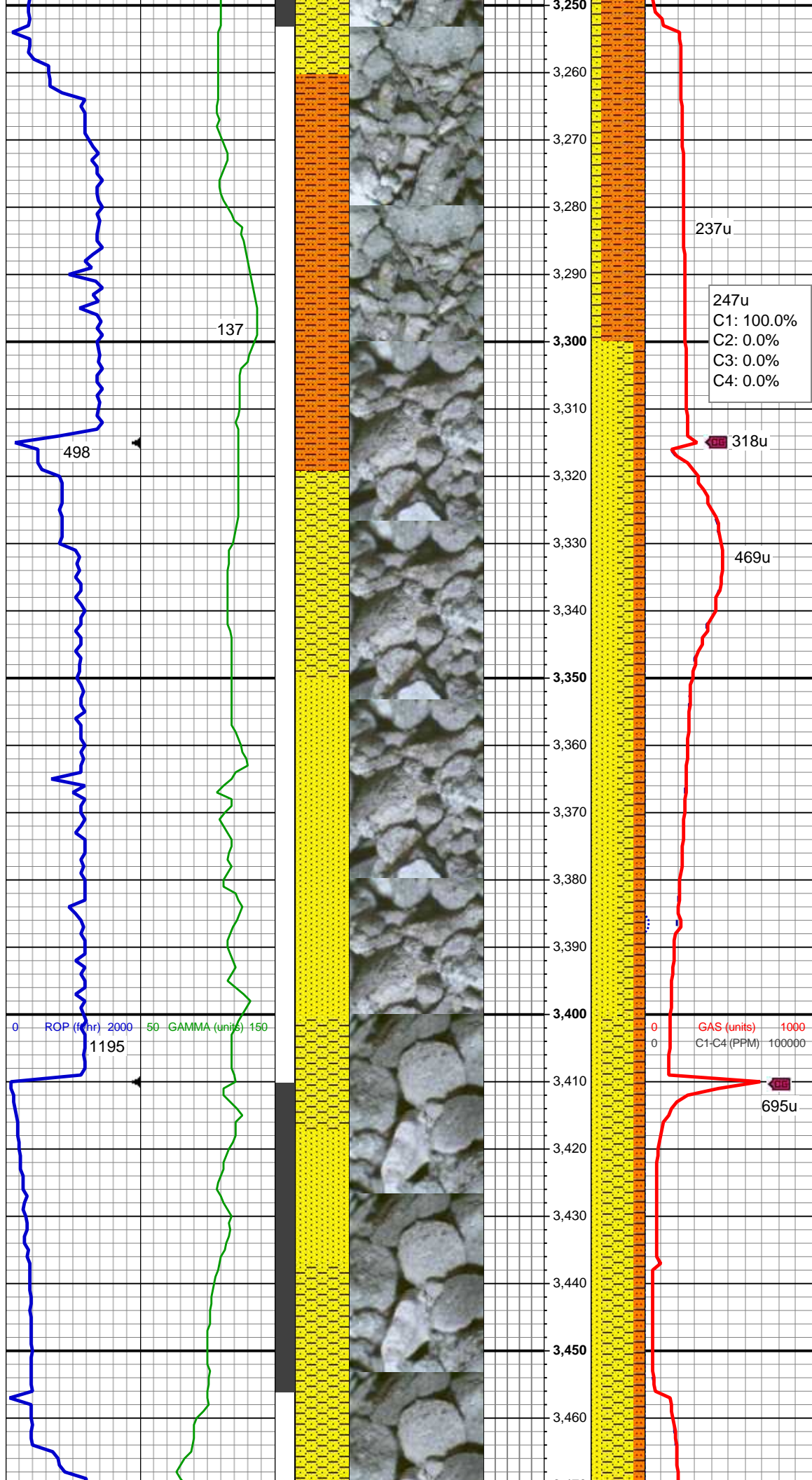
MD: 3,166 '  
TVD: 3,143.71 '  
Inclination: 14.69 °  
Azimuth: 50.7 °

SHY SLTST: lt - med gy, frm - hd,  
brit, sb rd - sb blk, slty - grty tex, v s  
calc

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

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





MD: 3,261 '  
TVD: 3,235.44 '  
Inclination: 15.47 °  
Azimuth: 45.66 °

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

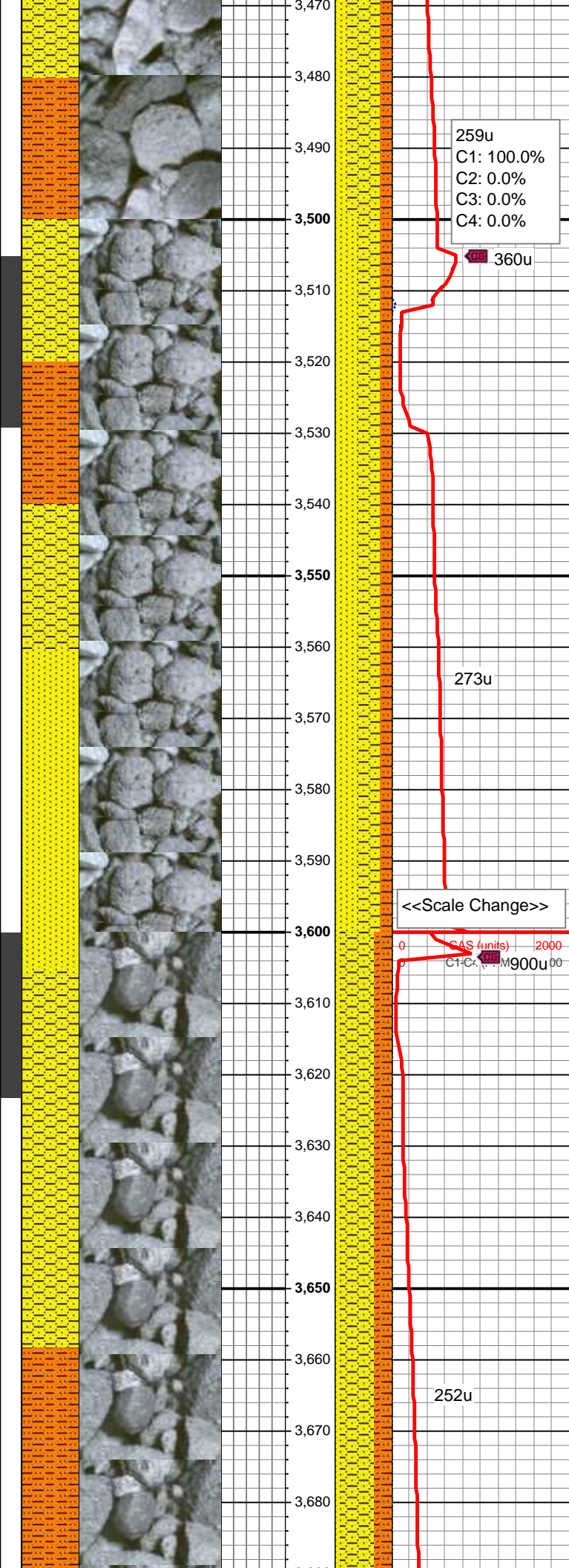
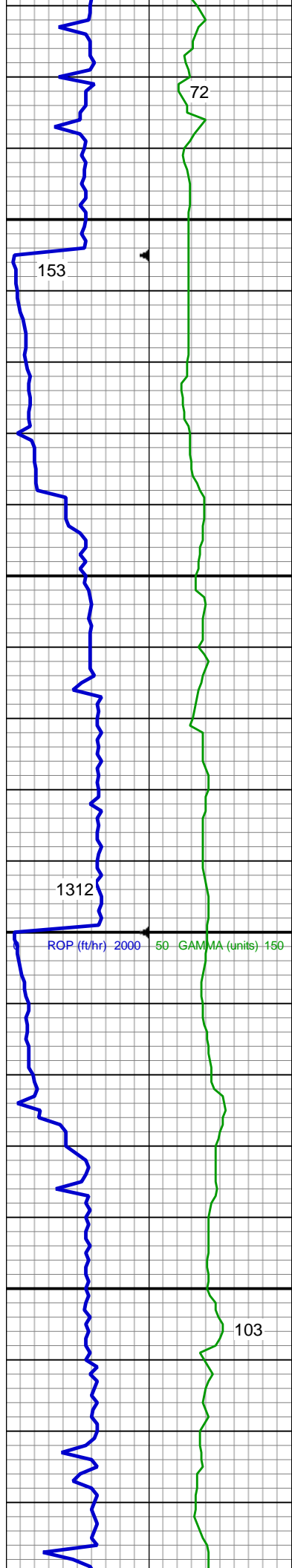
MUD WT: 8.70/8.60  
VIS: 28/27 IN/OUT

MD: 3,356 '  
TVD: 3,327.67 '  
Inclination: 12.25 °  
Azimuth: 47.59 °

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

Parkman Top @  
3,417' MD; 3,387' TVD

MD: 3,451 '  
TVD: 3,420.25 '  
Inclination: 13.62 °  
Azimuth: 48.45 °



SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, 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, brit, sb rd - sb blk, slty - grty tex, v s calc

MD: 3,546 '  
TVD: 3,512.13 '  
Inclination: 15.85 °  
Azimuth: 46.21 °

SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, 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, brit, sb rd - sb blk, slty - grty tex, v s calc

MUD WT: 8.90/8.80  
VIS: 28/28 IN/OUT

MD: 3,641 '  
TVD: 3,603.78 '  
Inclination: 14.66 °  
Azimuth: 43.44 °

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

259u  
C1: 100.0%  
C2: 0.0%  
C3: 0.0%  
C4: 0.0%

360u

273u

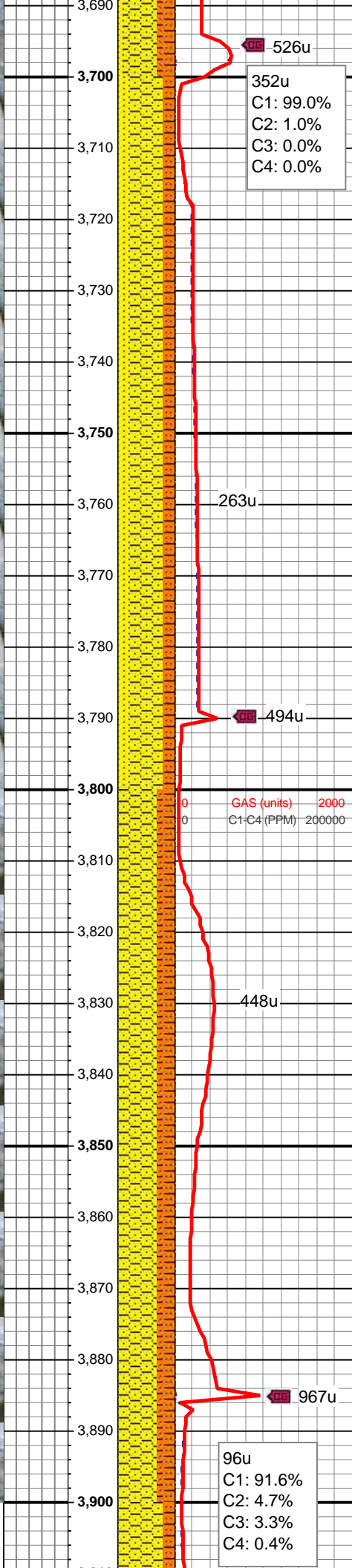
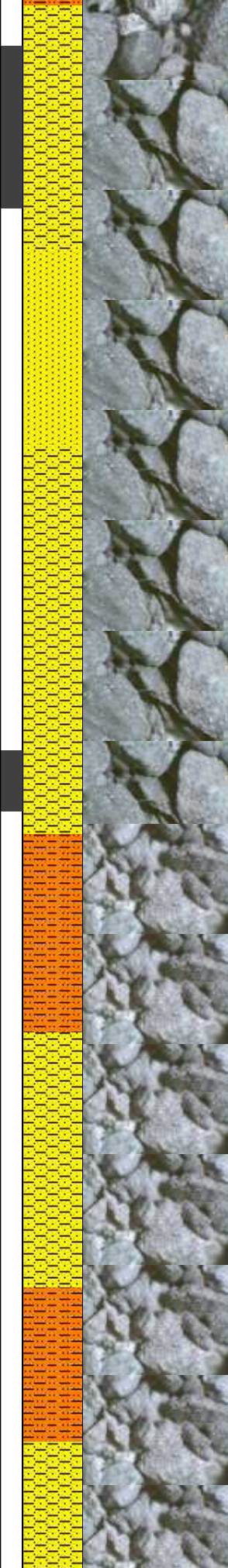
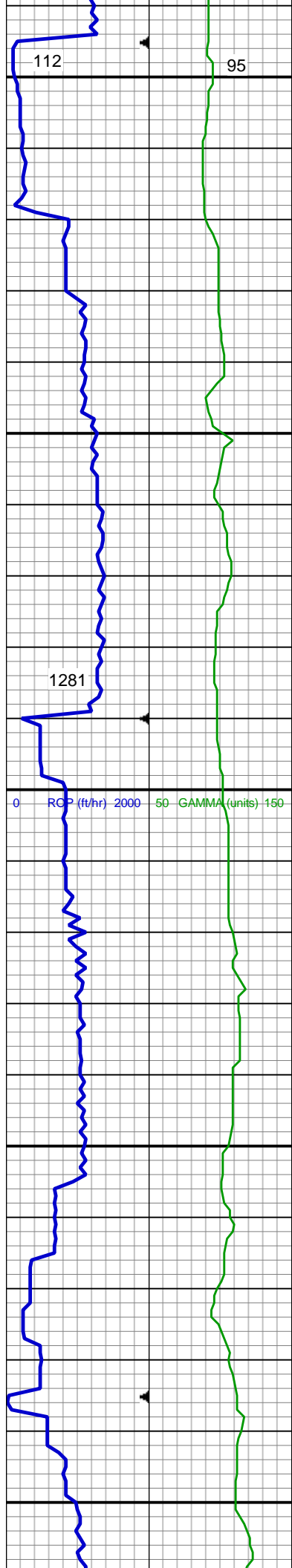
<<Scale Change>>

0 2000  
CAS (units)  
C1-C4: 0.0% 100.0%

900u

252u





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

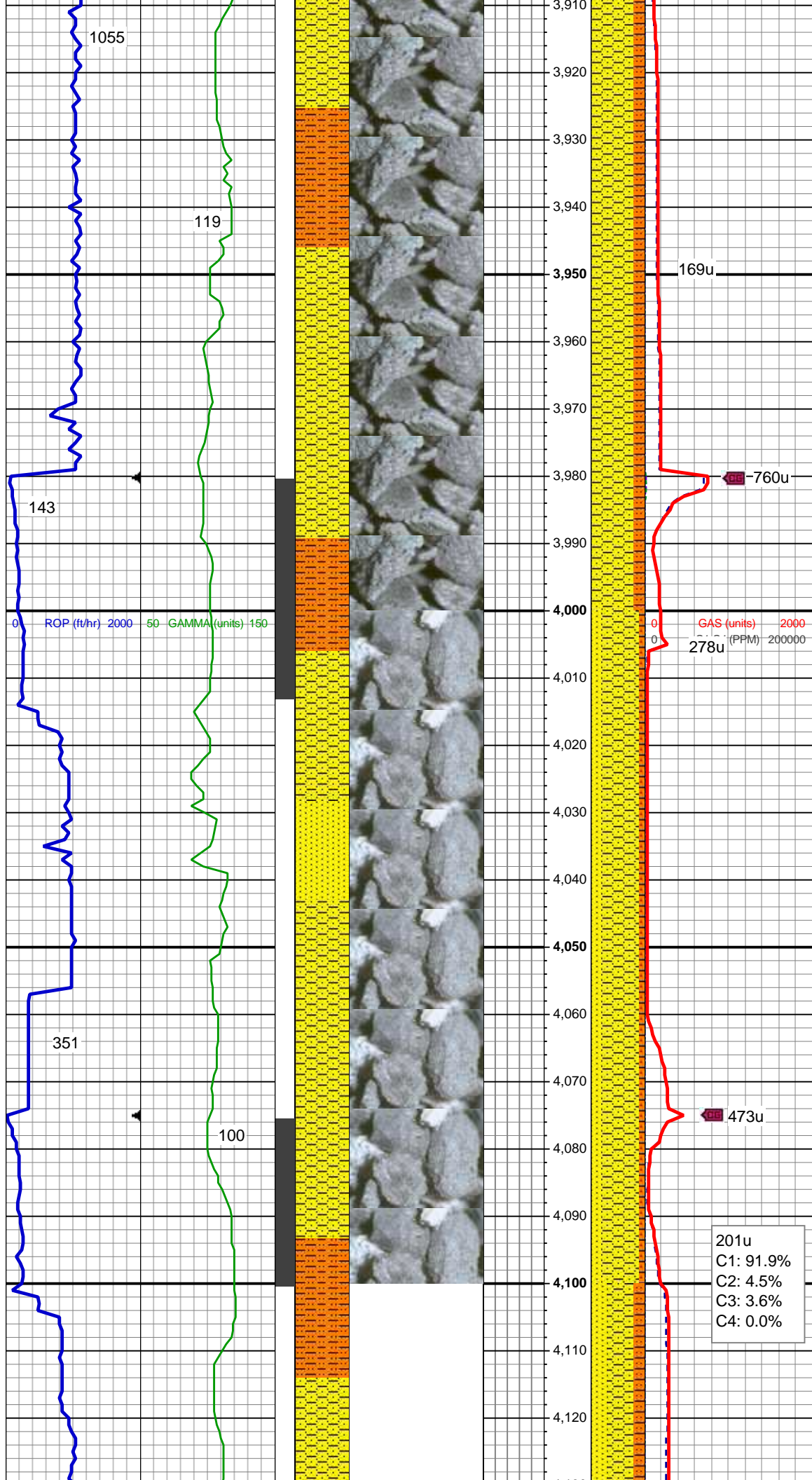
MD: 3,736 '  
TVD: 3,695.93 '  
Inclination: 13.47 °  
Azimuth: 39.39 °

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

MD: 3,830 '  
TVD: 3,787.49 '  
Inclination: 12.69 °  
Azimuth: 40.92 °

SHY SS: wh - lt gy, fros - trns, 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: 3,925 '  
TVD: 3,880.41 '  
Inclination: 11.32 °  
Azimuth: 40.66 °

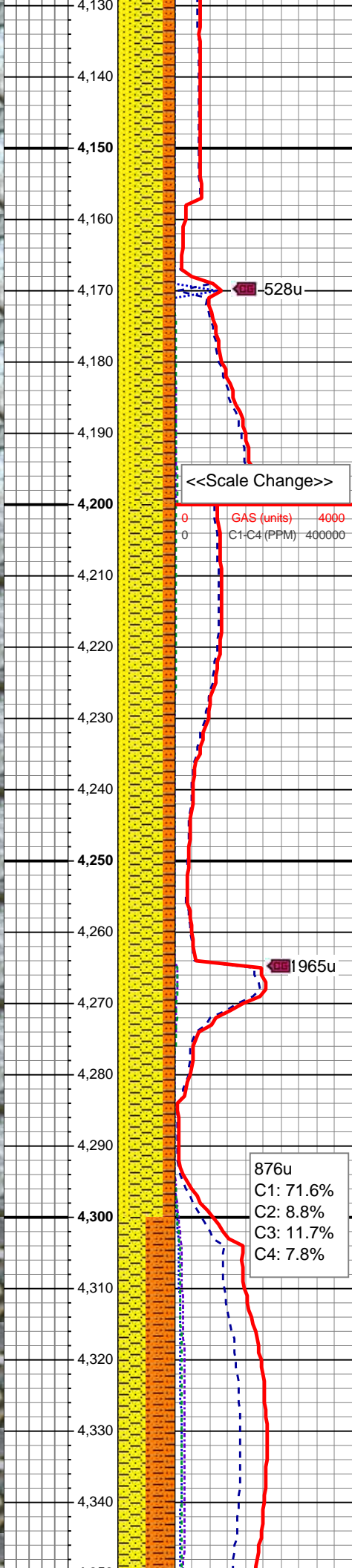
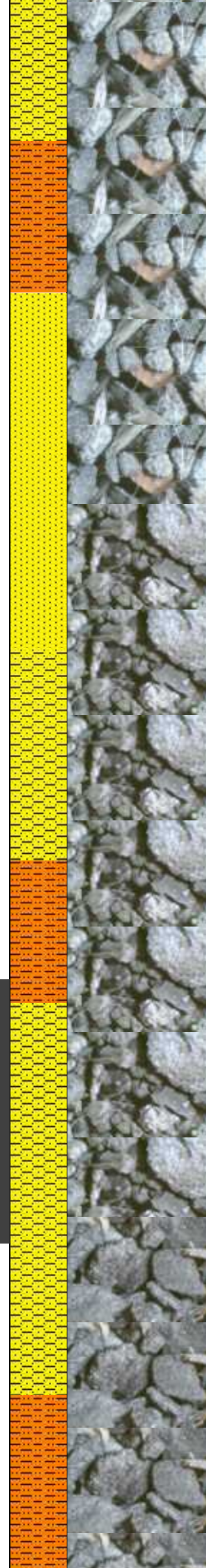
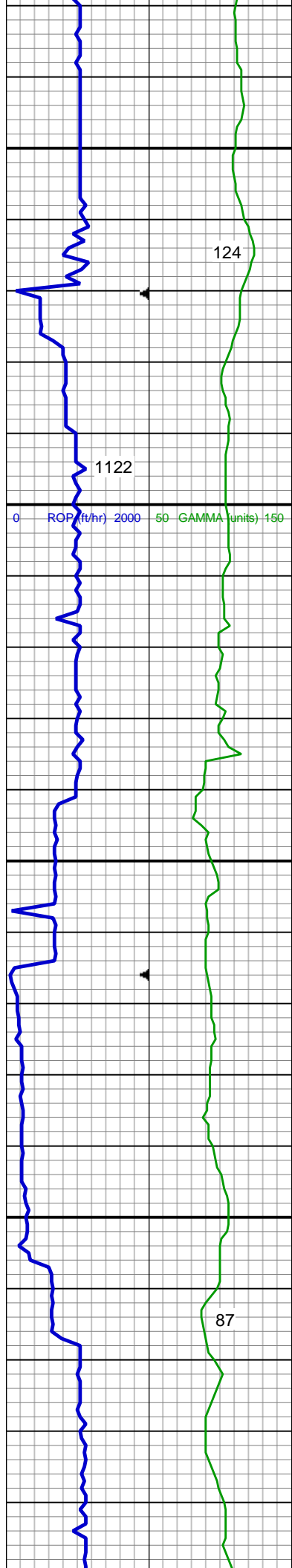
SHY SS: wh - lt gy, fros - trnsl, s&p,  
vfg, mod hd wi brit clus, sb ang - sb  
rd, calc cmt  
SHY SLTST: lt - med gy, frm - hd,  
brit, sb rd - sb blkly, slty - grty tex, v s  
calc

MD: 4,020 '  
TVD: 3,973.65 '  
Inclination: 10.87 °  
Azimuth: 52.05 °

SHY SS: wh - lt gy, fros - trnsl, s&p,  
vfg, 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,  
brit, sb rd - sb blkly, slty - grty tex, v s  
calc

201u  
C1: 91.9%  
C2: 4.5%  
C3: 3.6%  
C4: 0.0%

MD: 4,115 '  
TVD: 4,066.83 '  
Inclination: 11.57 °  
Azimuth: 53.07 °



Sussex Top @  
4,170' MD; 4,120' TVD

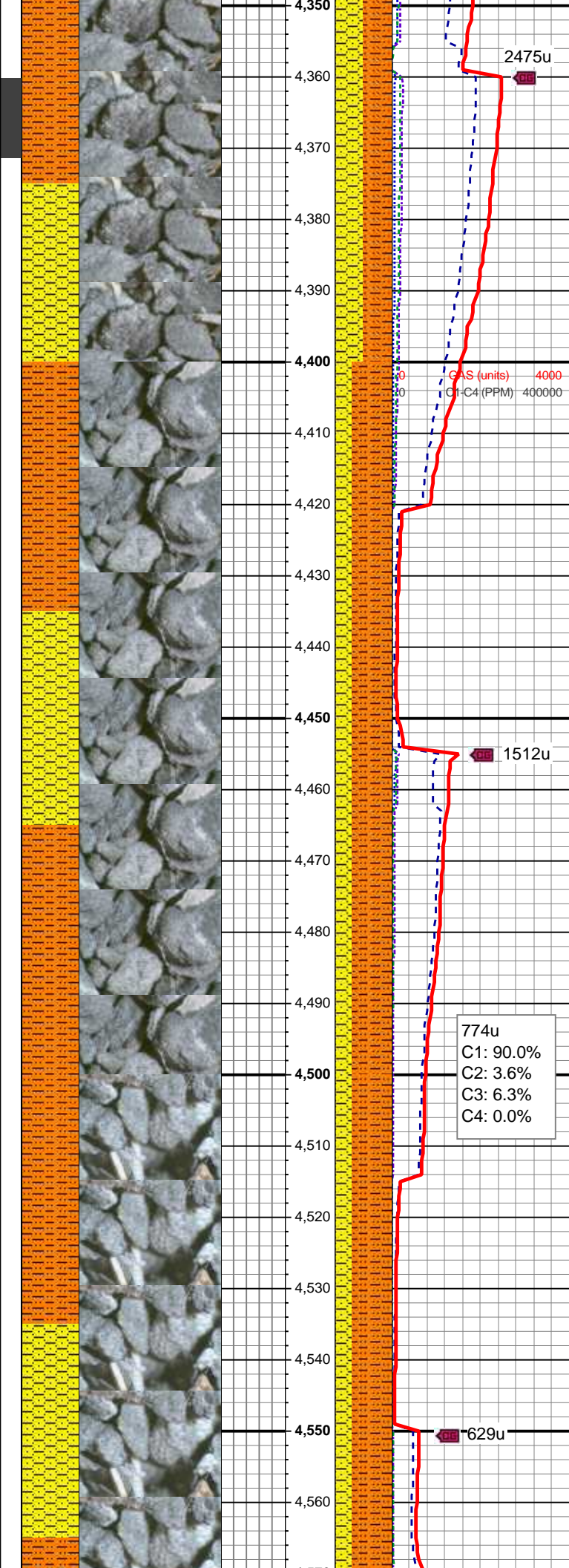
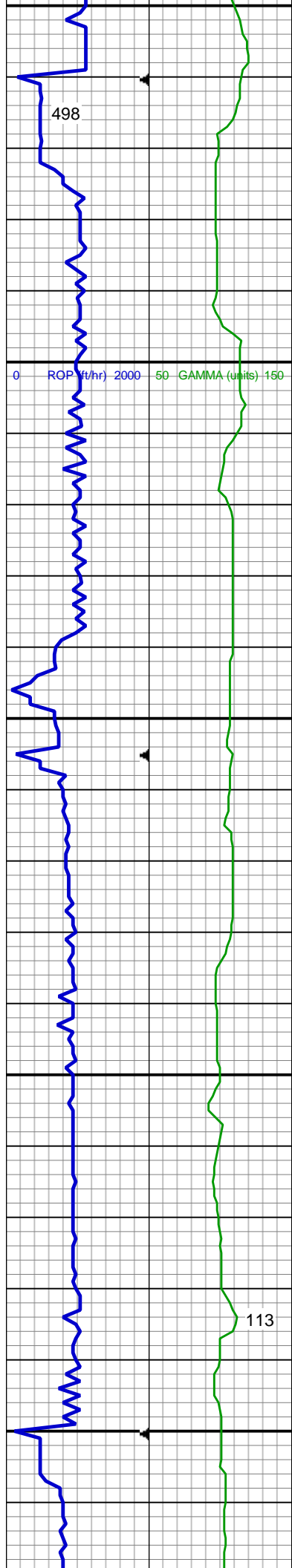
SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt  
SS: wh - lt gy, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, v calc cmt  
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blkly, slty - grty tex, v s calc

MD: 4,210 '  
TVD: 4,160.27 '  
Inclination: 9.15 °  
Azimuth: 53.93 °

SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, 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, brit, sb rd - sb blkly, slty - grty tex, v s calc

MD: 4,305 '  
TVD: 4,253.89 '  
Inclination: 10.45 °  
Azimuth: 52.87 °





SHY SLTST: lt - med gy, frm - hd,  
brit, sb rd - sb blkly, 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: 4,400 '  
TVD: 4,347.42 '  
Inclination: 9.72 °  
Azimuth: 50.78 °

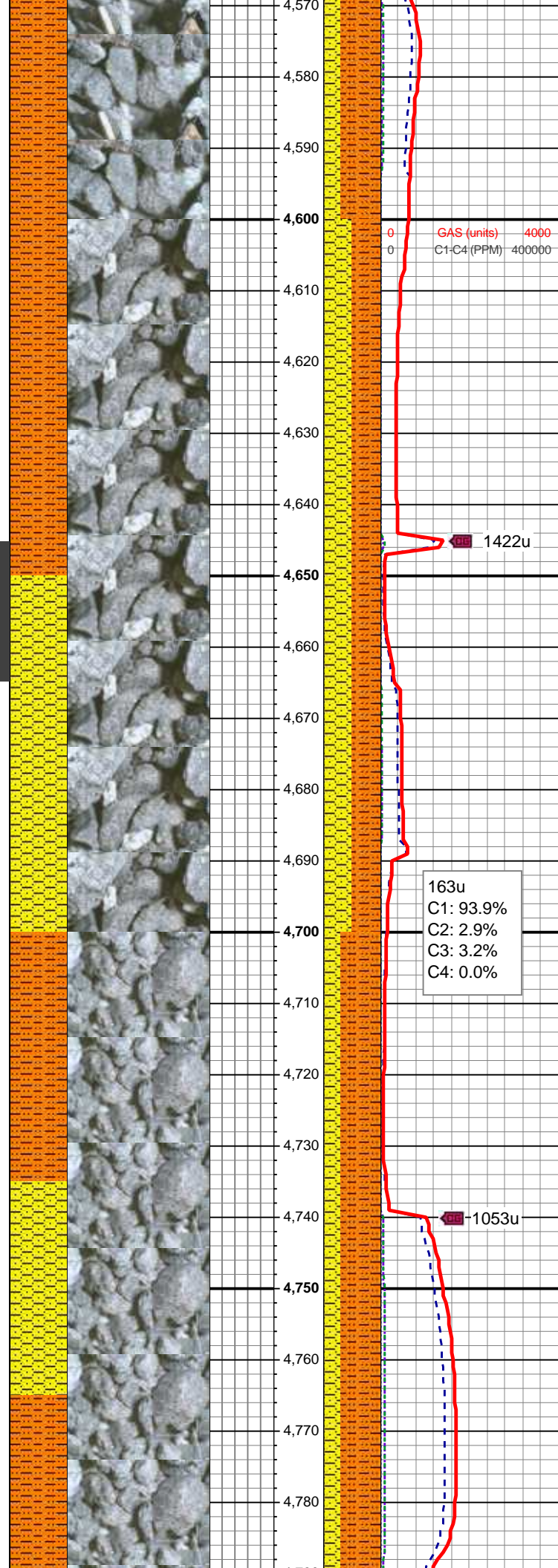
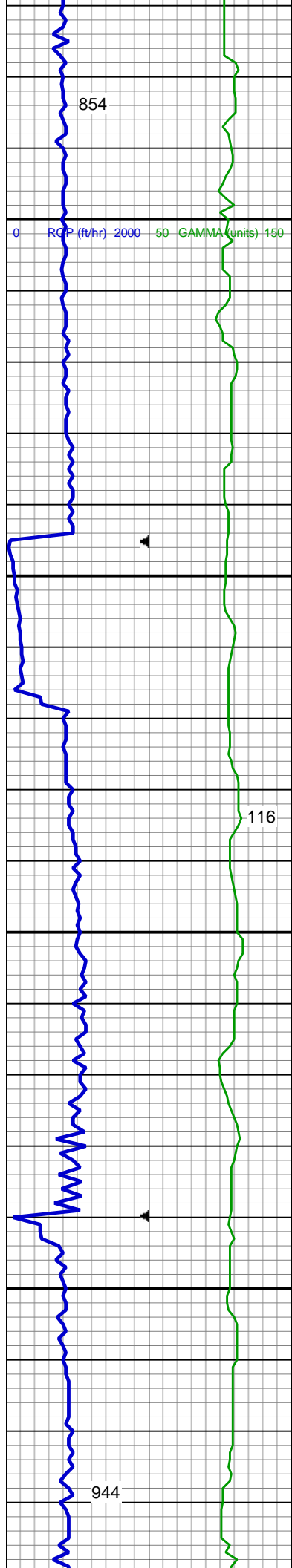
SHY SLTST: lt - med gy, frm - hd,  
brit, sb rd - sb blkly, slty - grty tex, v s  
calc  
SHY SS: wh - lt gy, fros - trnsl, s&p,  
vfg, mod hd wi brit clus, sb ang - sb  
rd, calc cmt

MD: 4,495 '  
TVD: 4,441.33 '  
Inclination: 7.64 °  
Azimuth: 51.08 °

MUD WT: 8.90/8.80  
VIS: 29/27 IN/OUT

MD: 4,590 '  
TVD: 4,525.55 '





TVD: 4,535.55 '  
Inclination: 6.97 °  
Azimuth: 48.47 °

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

0 GAS (units) 4000  
0 C1-C4 (PPM) 400000

1422u

MD: 4,685 '  
TVD: 4,630.07 '  
Inclination: 4.47 °  
Azimuth: 47.11 °

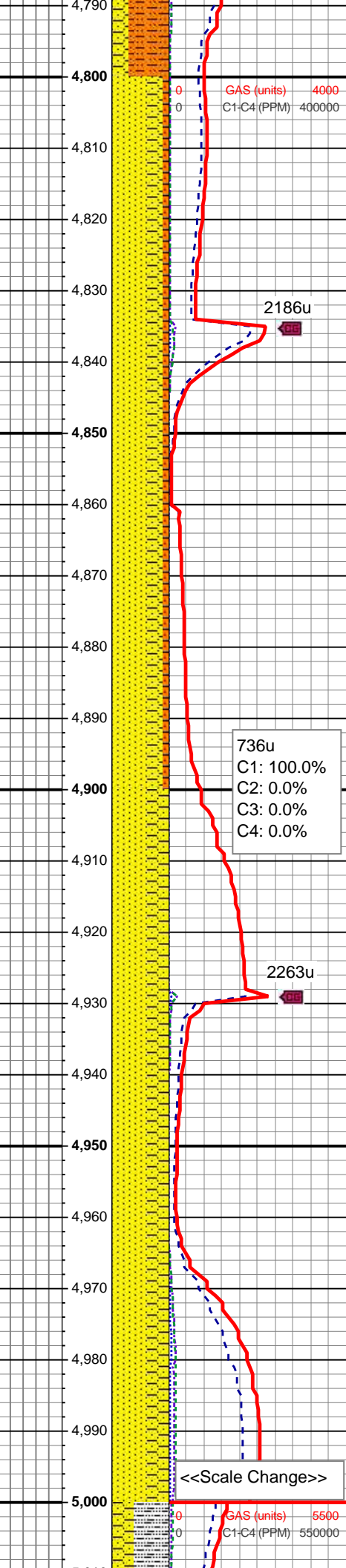
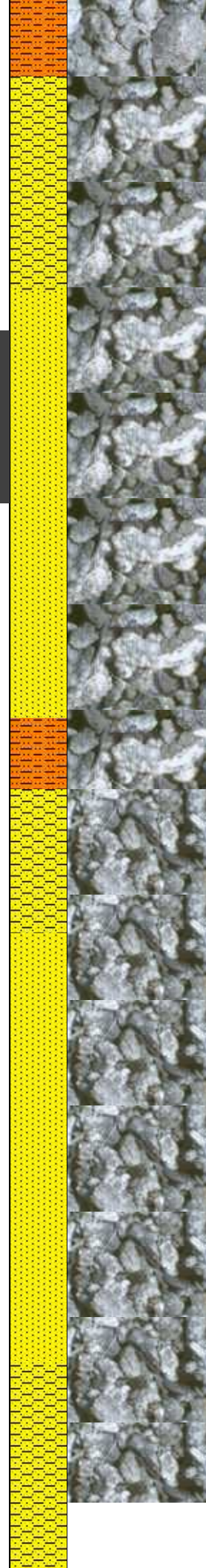
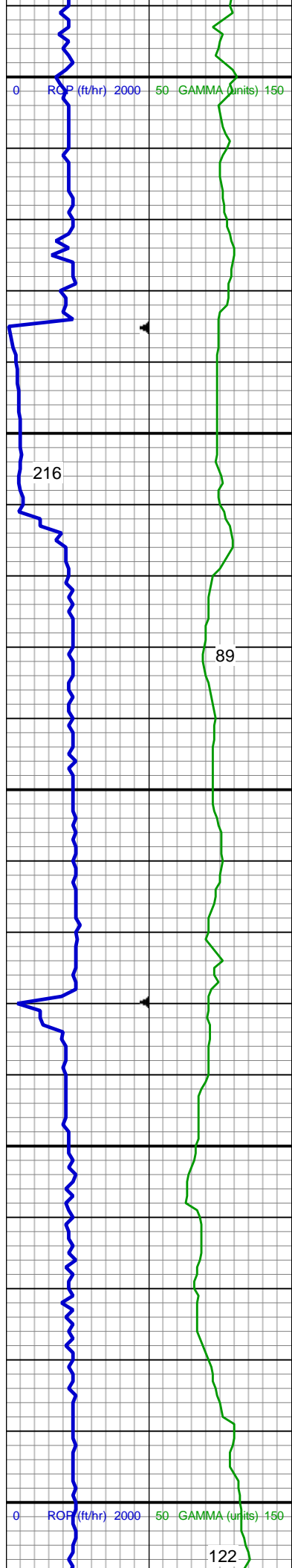
SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc  
SHY SS: pred lt gy, sme wh, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

163u  
C1: 93.9%  
C2: 2.9%  
C3: 3.2%  
C4: 0.0%

1053u

MD: 4,779 '  
TVD: 4,723.81 '  
Inclination: 4.15 °  
Azimuth: 68.38 °

SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc



SHY SS: pred lt gy, sme wh, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

MUD WT: 9.00/8.80  
VIS: 29/27 IN/OUT

Shannon Top @  
4,830' MD; 4,775' TVD

MD: 4,874 '  
TVD: 4,818.69 '  
Inclination: 1.51 °  
Azimuth: 83.71 °

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

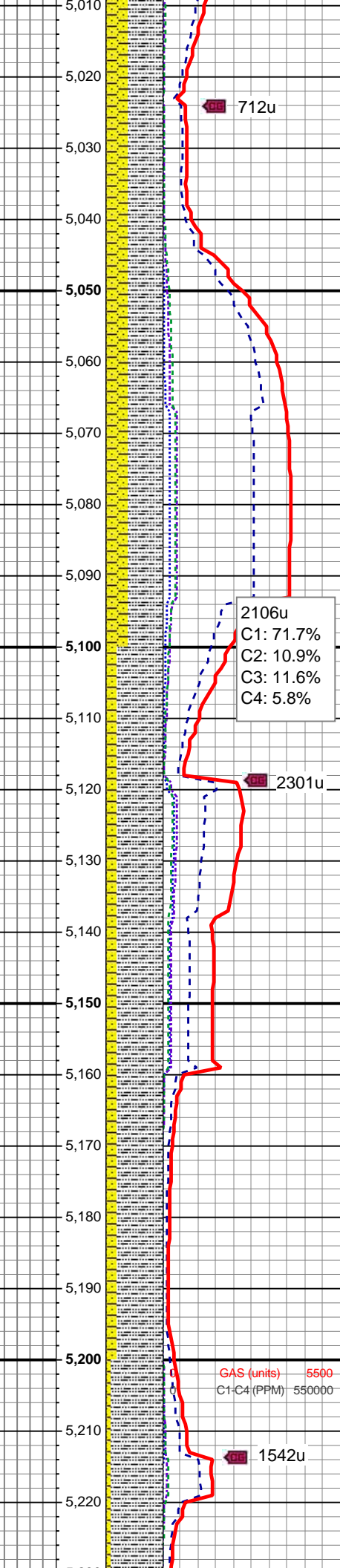
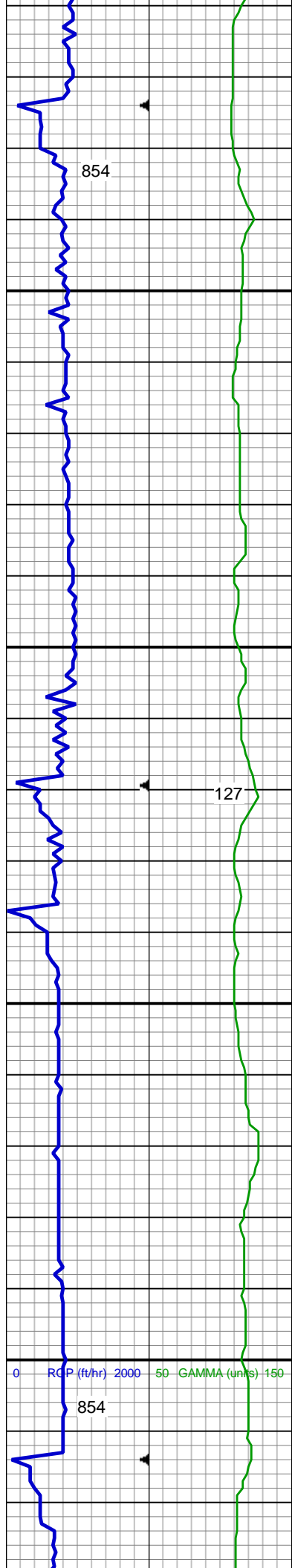
SHY SS: pred lt gy, sme wh, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

SHY SLTST: lt - med gy, frm - hd, brit, sb rd - sb blk, slty - grty tex, v s calc

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

SHY SS: pred lt gy, sme wh, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt





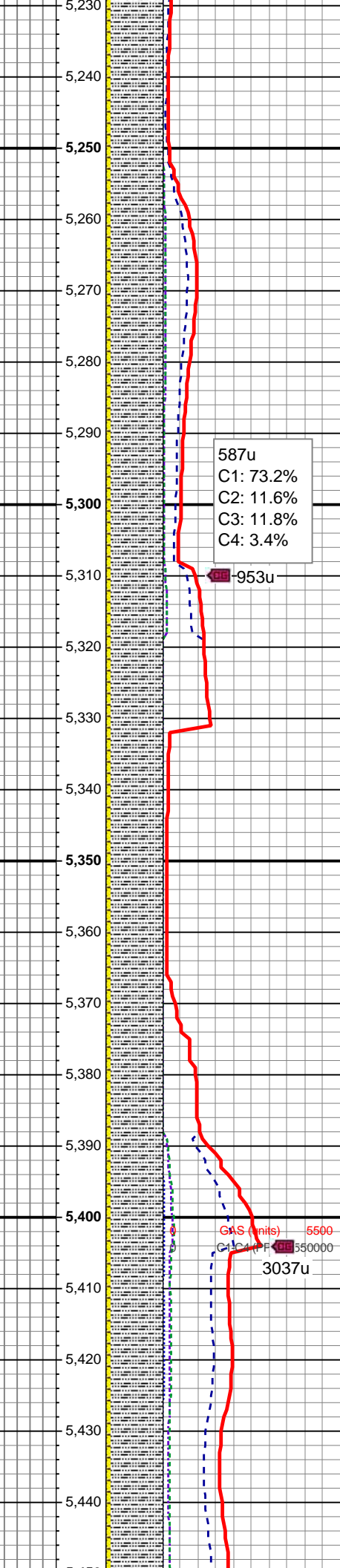
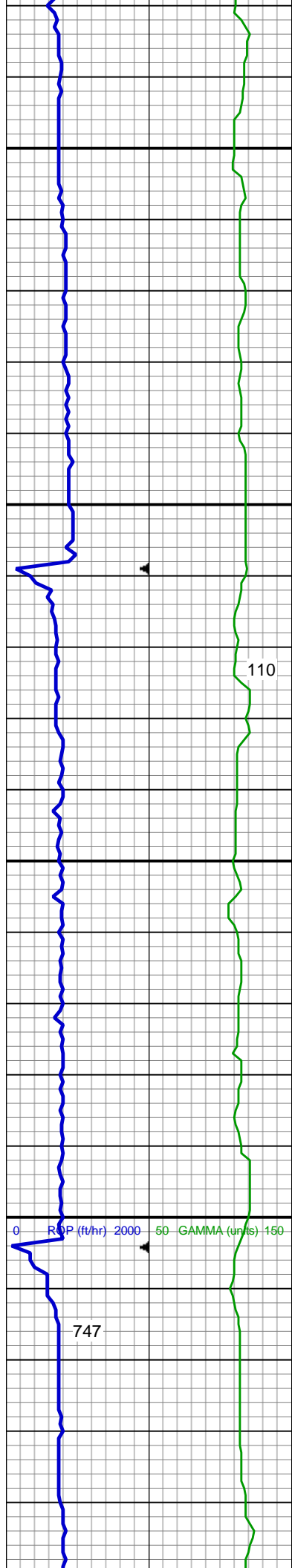
SLTY SH: lt - med gy, occ dk gy, frm  
- hd, plty - sb plty - sb blkly, slty - grty  
tex, v sl calc  
SHY SS: pred lt gy, sme wh, fros -  
trns, s&p, vfg, mod hd wi brit clus,  
sb ang - sb rd, calc cmt

MD: 5,159 '  
TVD: 5,103.63 '  
Inclination: 0.94 °  
Azimuth: 35.52 °

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

MUD WT: 9.10/8.80  
VIS: 31/28 IN/OUT

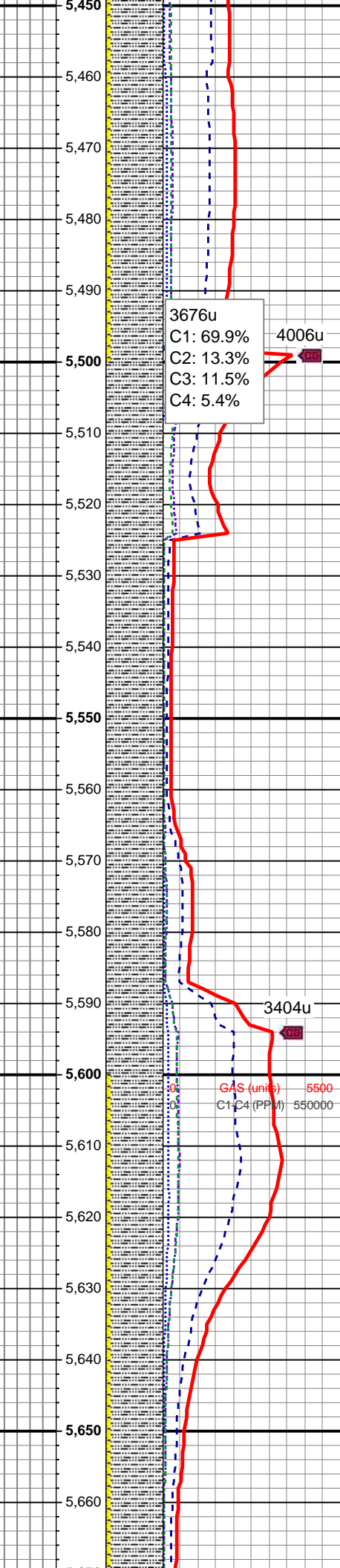
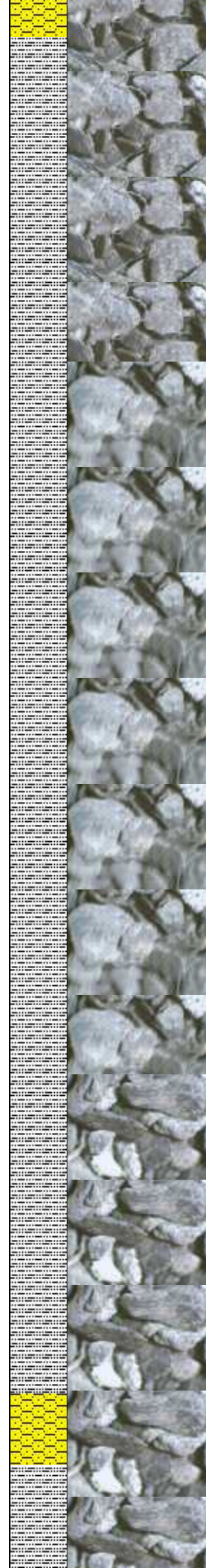
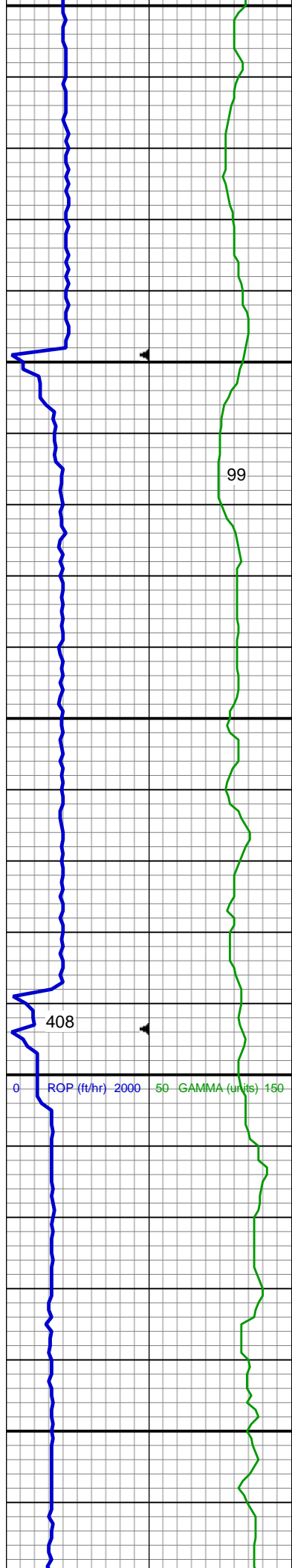




SLTY SH: lt - med gy, occ dk gy, frm  
- hd, plty - sb plty - sb blk, slty - grty  
tex, v sl calc  
SHY SS: pred lt gy, sme wh, fros -  
trnsl, s&p, vfg, mod hd wi brit clus,  
sb ang - sb rd, calc cmt

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

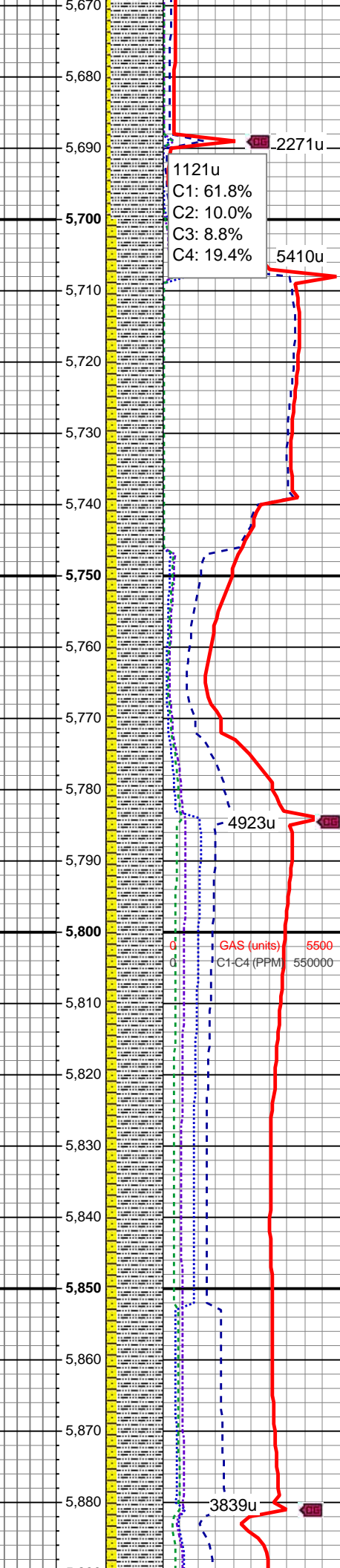
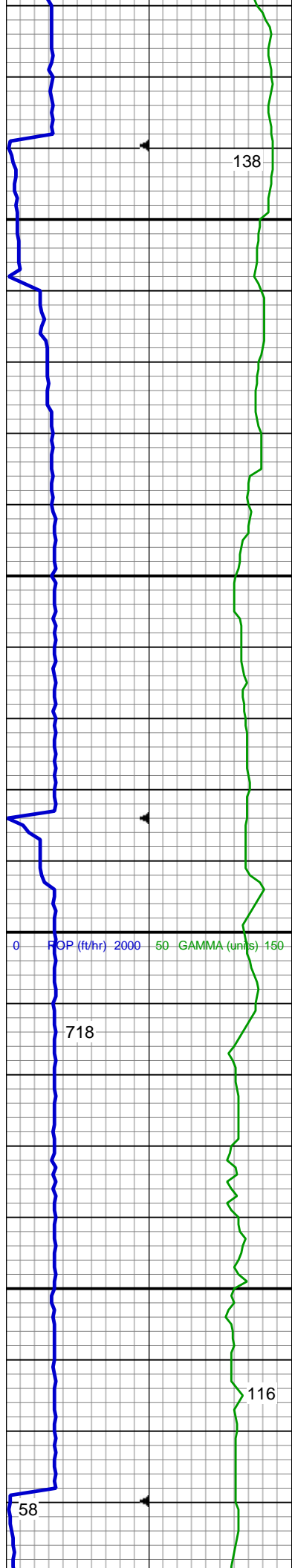
MD: 5,443 '  
TVD: 5,387.57 '  
Inclination: 1.48 °  
Azimuth: 27 °



SLTY SH: lt - med gy, occ dk gy, frm  
- hd, plty - sb plty - sb blk, slty - grty  
tex, v sl calc  
SHY SS: pred lt gy, sme wh, fros -  
trnsl, s&p, vfg, 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





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

MD: 5,728 '  
TVD: 5,672.53 '  
Inclination: 0.47 °  
Azimuth: 79.3 °

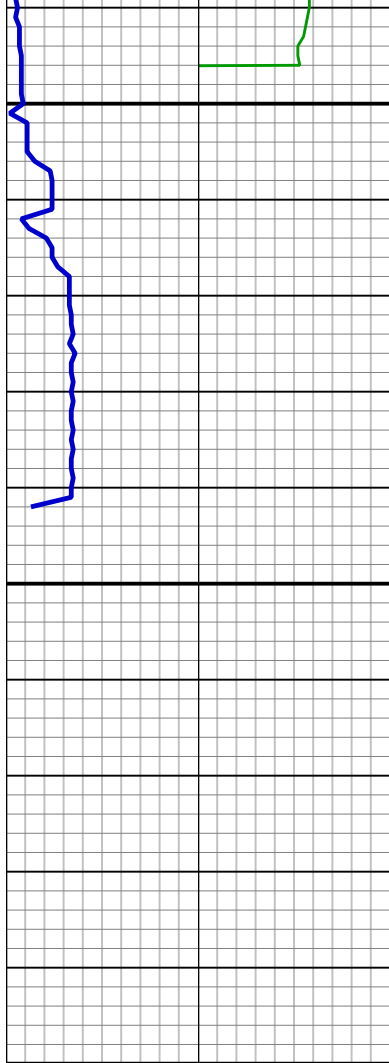
SLTY SH: lt - med gy, occ dk gy, frm  
- hd, plty - sb plty - sb blkly, slty - grty  
tex, v sl calc  
SHY SS: pred lt gy, sme wh, fros -  
trnsl, s&p, vfg, mod hd wi brit clus,  
sb ang - sb rd, calc cmt

Tepee Buttes Top @  
5,810' MD; 5,754' TVD

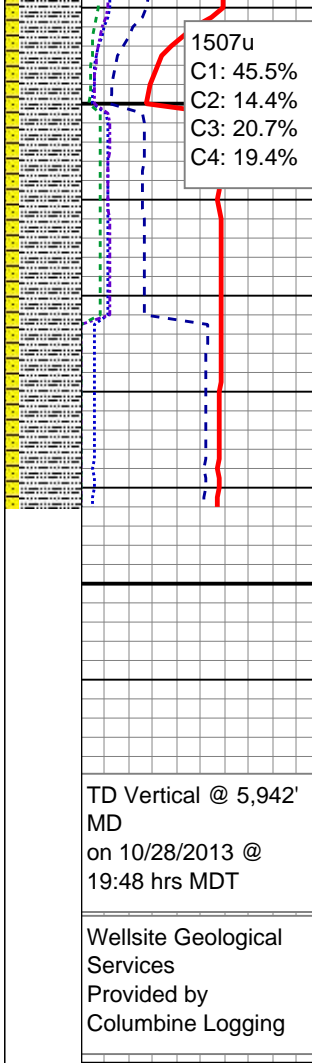
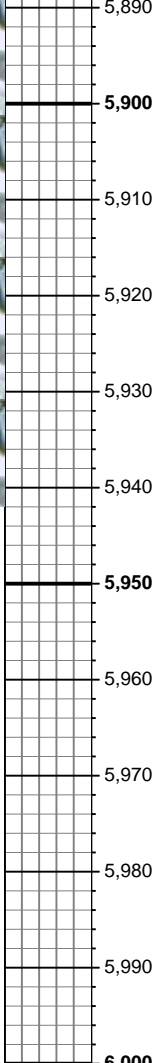
MD: 5,886 '  
TVD: 5,830.52 '  
Inclination: 0.36 °  
Azimuth: 212.56 °

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





1507u  
C1: 45.5%  
C2: 14.4%  
C3: 20.7%  
C4: 19.4%



SHY SS: pred lt gy, sme wh, fros -  
trns, s&p, vfg, mod hd wi brit clus,  
sb ang - sb rd, calc cmt

MUD WT: 9.35/9.25  
VIS: 36/35 IN/OUT

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

SHY SS: pred lt gy, sme wh, fros -  
trns, s&p, vfg, mod hd wi brit clus,  
sb ang - sb rd, calc cmt

Projection to Bit:  
MD: 5,942 '  
TVD: 5,886.52 '  
Inclination: 0.36 °  
Azimuth: 212.56 °

TD Vertical @ 5,942'  
MD  
on 10/28/2013 @  
19:48 hrs MDT

Wellsite Geological  
Services  
Provided by  
Columbine Logging

See Corresponding Horizontal Log  
Cockroft B15-69-1HNM HORZ