

COLUMBINE LOGGING

Scale: 5" / 100'
Measured Depth Log

Well Name Cougar B02_69_1HN_VERT

Location SEC 2 T5N R64W

State COLORADO

County WELD

Country USA

Rig Number H&P 315

API Number 05-123-36405

AFE # 136839

Region DJ BASIN

Field WATTENBERG

Spud Date 1/25/2014

Drilling Completed 1/27/2014

Surface Coordinates NWNW SEC2 T5N R64W
566' FNL; 702' FWL

LAT/LON 40.43407000/-104.52428000

Bottom Hole Coordinates NENE SEC2 T5N R64W
990' FNL; 660' FEL

Ground Elevation 4,641'

K.B. Elevation 4,665'

Logged Interval 2,000' **To** 5,969'

Total Depth 5,969'

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, JACK WEINERTH

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

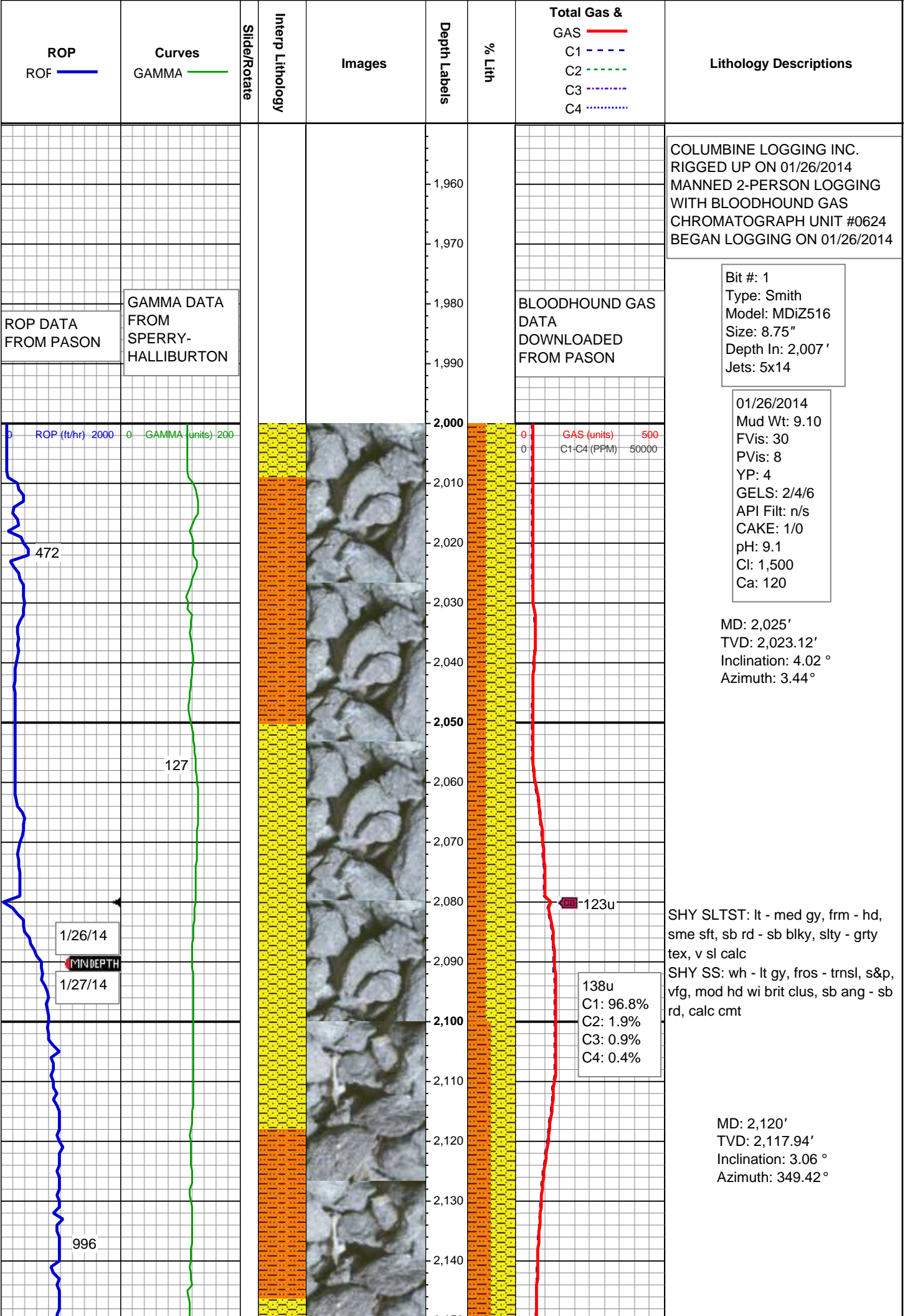
Textures

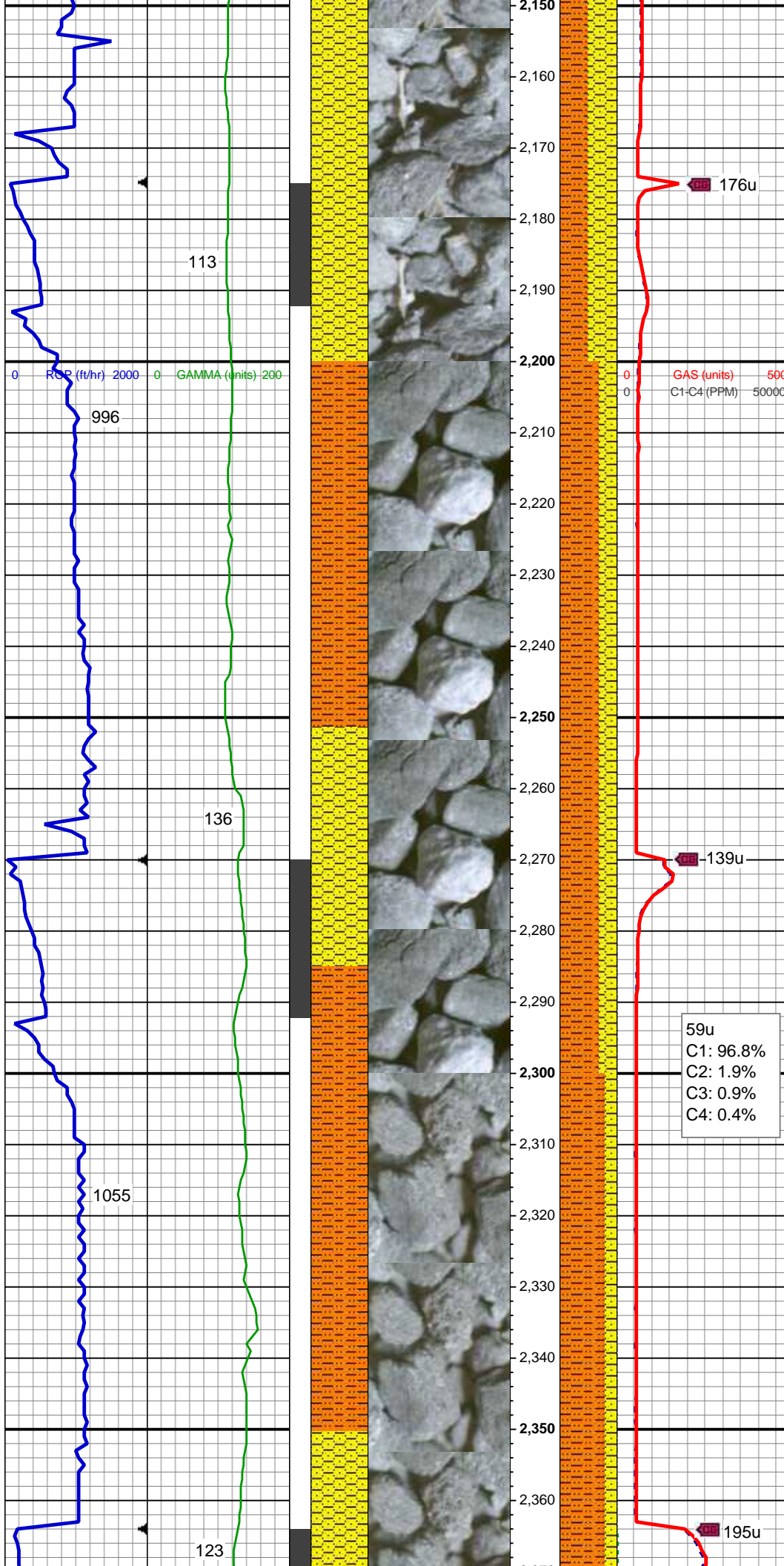
BOUNDSTONE
 CHALKY
 CRYPTOXLN

EARTHY
 FINELYXLN
 GRAINSTONE
 LITHOGRAPHIC
 MICROXLN
 MUDSTONE
 PACKSTONE
 WACKESTONE

Sorting

MODERATE
 POOR
 WELL





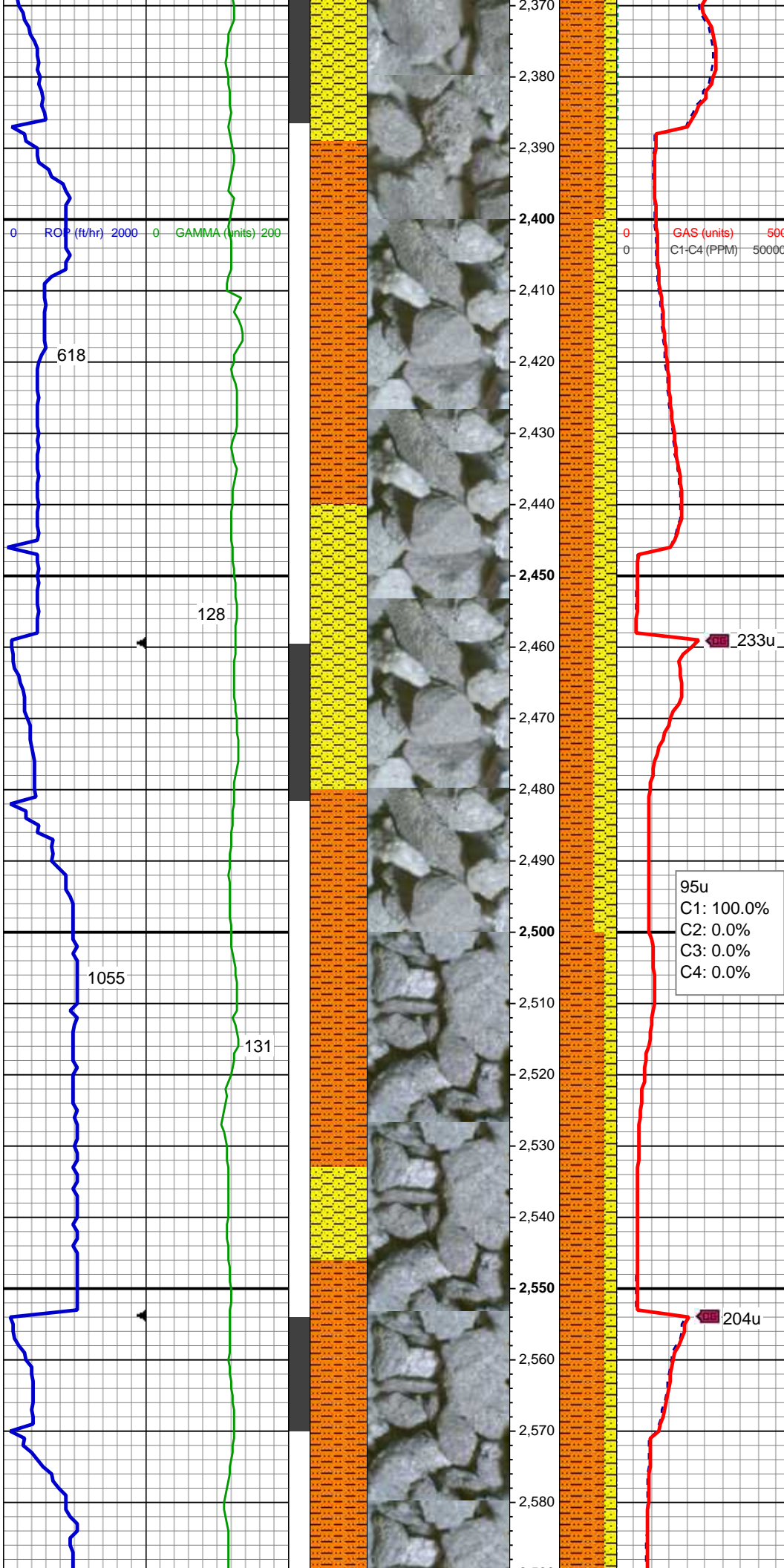
SHY SLTST: lt - med gy, frm - hd, sme sft, sb rd - sb blkly, slty - grty tex, v sl calc
SHY SS: wh - lt gy, fros - trnsl, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 2,215'
TVD: 2,212.75'
Inclination: 4.22 °
Azimuth: 12.61 °

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

MD: 2,310'
TVD: 2,307.37'
Inclination: 5.91 °
Azimuth: 10.15 °

59u
C1: 96.8%
C2: 1.9%
C3: 0.9%
C4: 0.4%



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

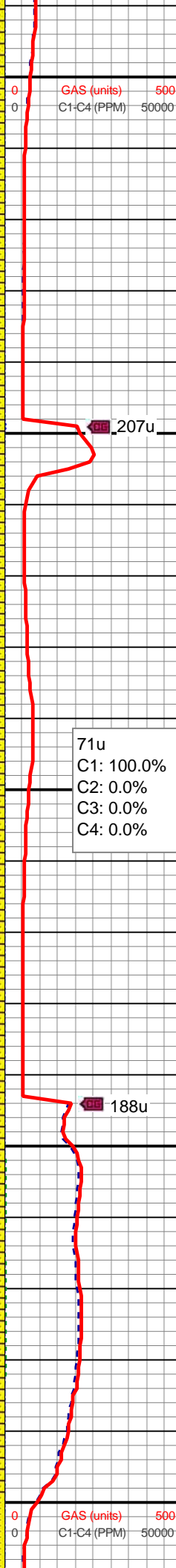
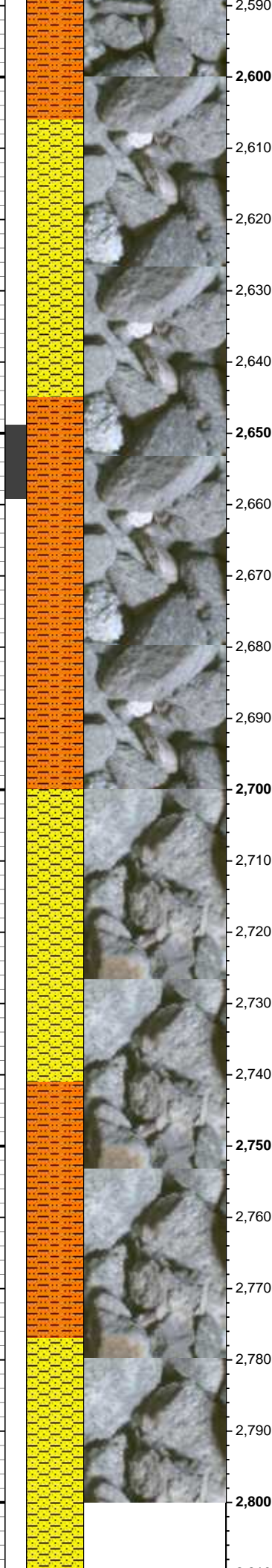
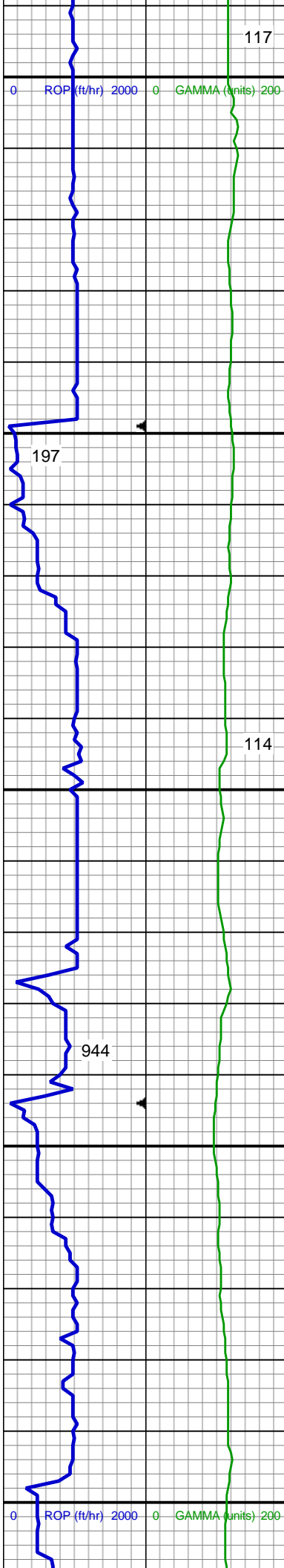
MD: 2,405'
TVD: 2,401.71'
Inclination: 7.58 °
Azimuth: 16.94 °

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

95u
C1: 100.0%
C2: 0.0%
C3: 0.0%
C4: 0.0%

MD: 2,500'
TVD: 2,495.72'
Inclination: 8.99 °
Azimuth: 8.51 °

SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc



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

MD: 2,595'
TVD: 2,589.42'
Inclination: 9.99 °
Azimuth: 2.81 °

MD: 2,690'
TVD: 2,682.99'
Inclination: 9.92 °
Azimuth: 356.75 °

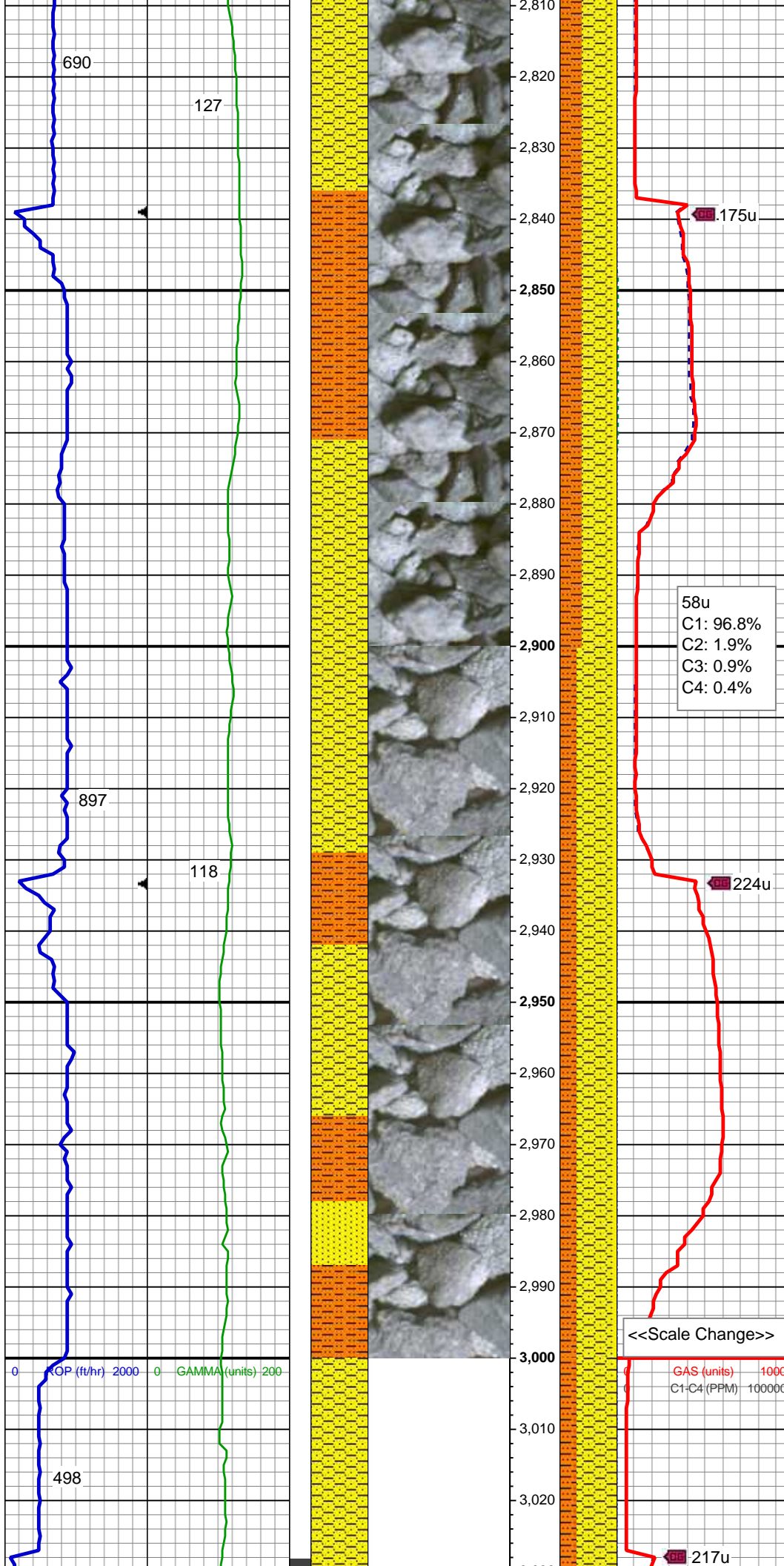
SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

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

MD: 2,784'
TVD: 2,775.5'
Inclination: 10.52 °
Azimuth: 356.25 °

SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

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



MD: 2,879'
TVD: 2,869.03'
Inclination: 9.66 °
Azimuth: 354.18 °

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,
sme sft, sb rd - sb blkly, slty - grty
tex, v sl calc
SS: wh, fros - trnsl, speckl wi mica,
f gr, hd brit clus, ang - sb ang, glau,
v calc cmt

58u
C1: 96.8%
C2: 1.9%
C3: 0.9%
C4: 0.4%

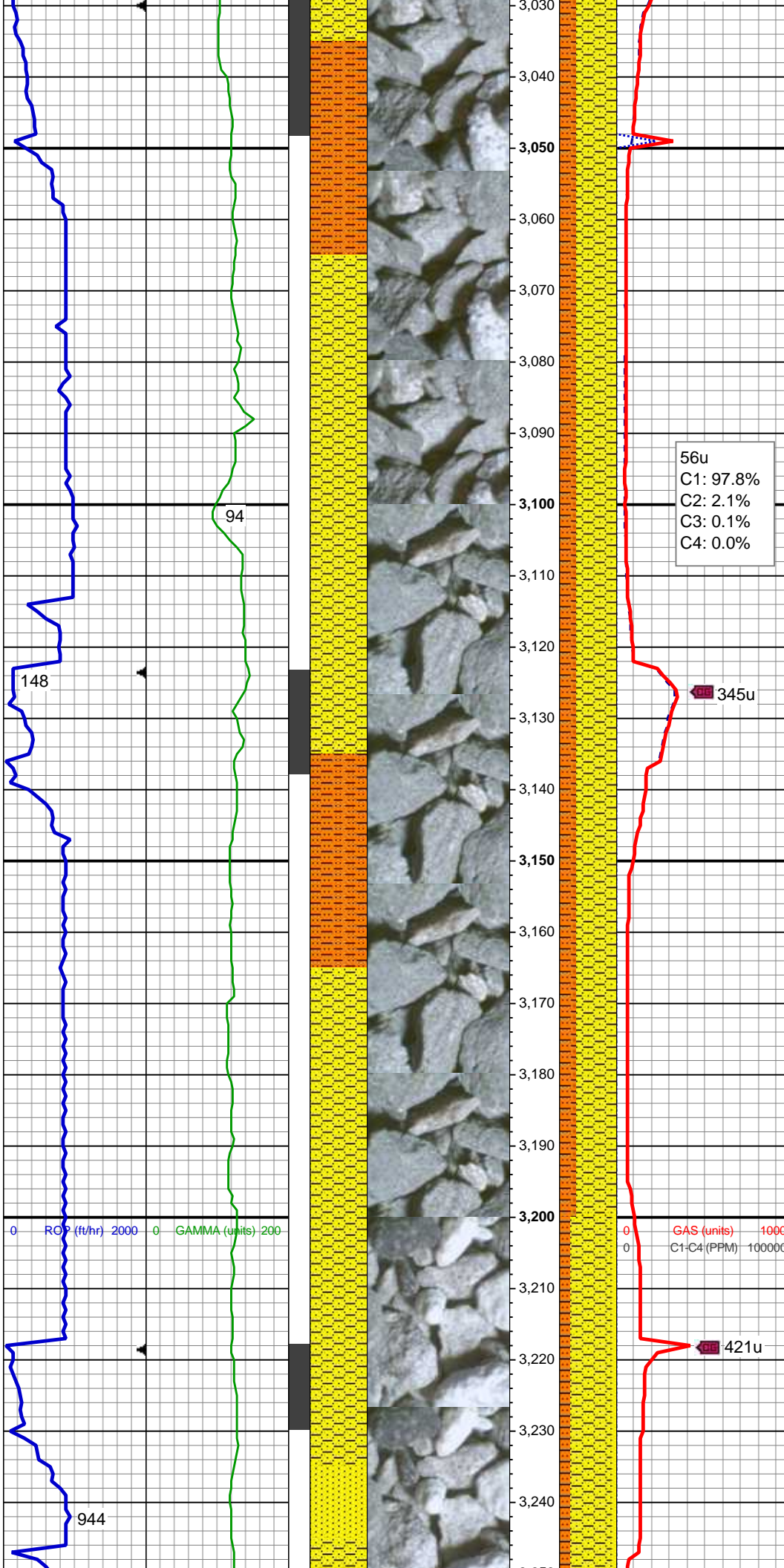
MD: 2,974'
TVD: 2,962.66'
Inclination: 9.8 °
Azimuth: 354.12 °

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,
sme sft, sb rd - sb blkly, slty - grty
tex, v sl calc
SS: wh, fros - trnsl, speckl wi mica,
f gr, hd brit clus, ang - sb ang, glau,
v calc cmt

<<Scale Change>>

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

01/27/2014
Mud Wt: 8.50
FVis: 28
PVis: 5
YP: 2
GELS: n/s
API Filt: n/s
CAKE: 1/0
pH: 11.6



Cl: 1,500
Ca: 120

MD: 3,069'
TVD: 3,056.52'
Inclination: 7.97 °
Azimuth: 355.49 °

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,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

56u
C1: 97.8%
C2: 2.1%
C3: 0.1%
C4: 0.0%

MD: 3,164'
TVD: 3,150.79'
Inclination: 6.2 °
Azimuth: 1.52 °

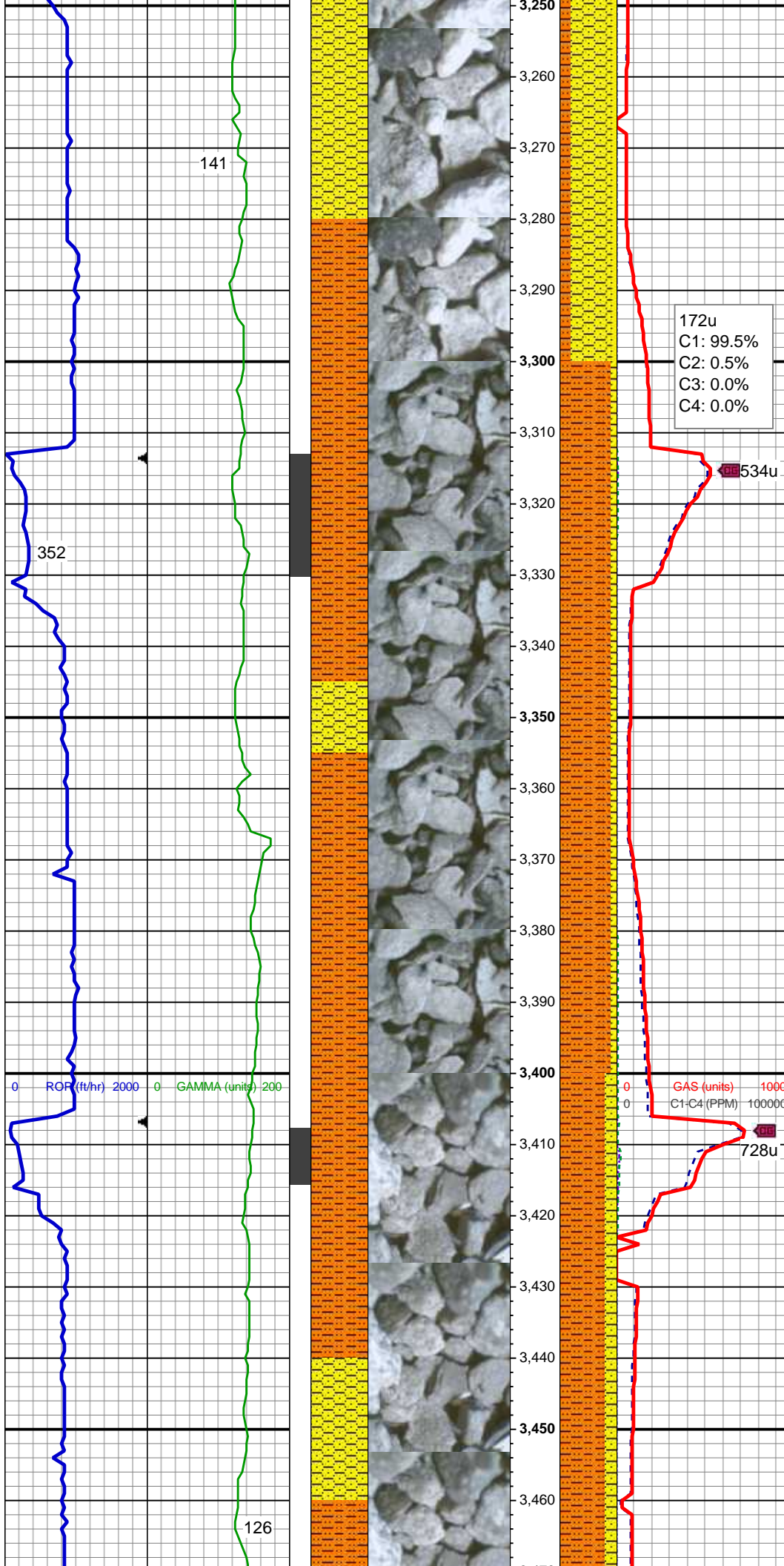
SHY SS: wh - lt gy, fros - trns, s&p,
vfg, mod hd wi brit clus, sb ang - sb
rd, calc cmt

SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

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

0 ROP (ft/hr) 2000 0 GAMMA (units) 200

944



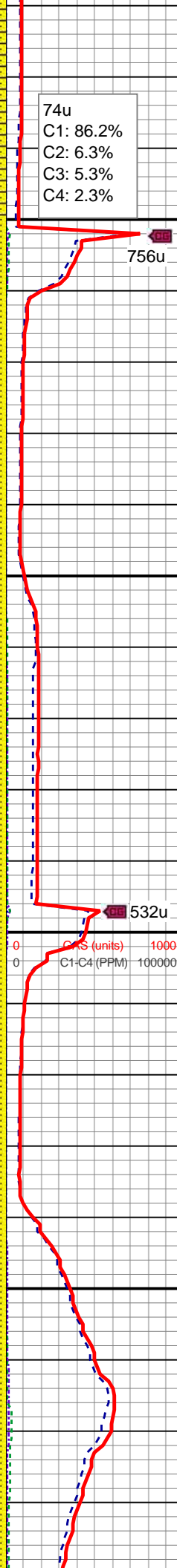
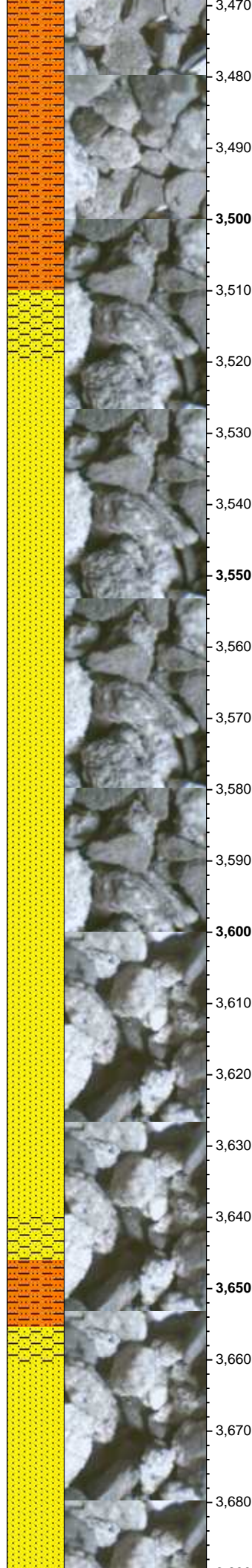
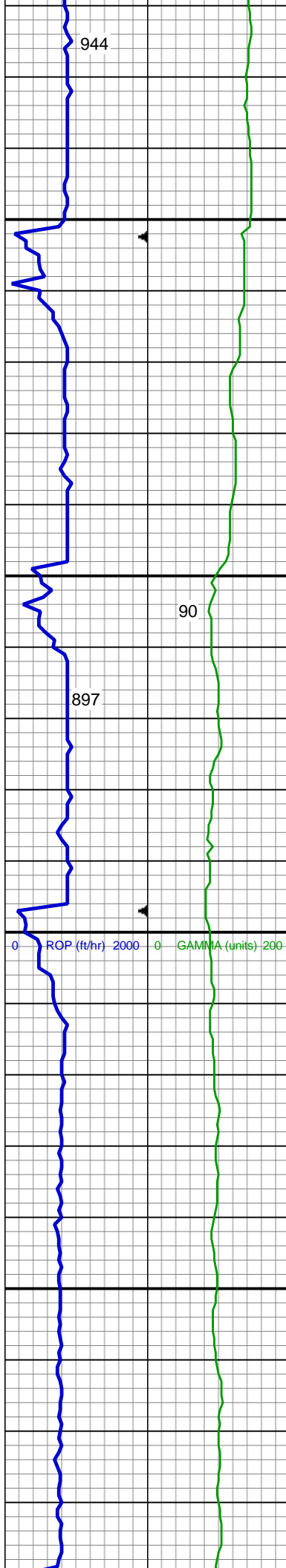
MD: 3,259'
TVD: 3,245.32'
Inclination: 5.2 °
Azimuth: 357.83 °

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, sme sft, sb rd - sb blkly, slty - grty tex, v sl calc
SS: wh, fros - trnsl, speckl wi mica, f gr, hd brit clus, ang - sb ang, glau, v calc cmt

MD: 3,354'
TVD: 3,340.1'
Inclination: 2.59 °
Azimuth: 1.9 °

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

MD: 3,449'
TVD: 3,435.03'
Inclination: 1.59 °
Azimuth: 340.81 °



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

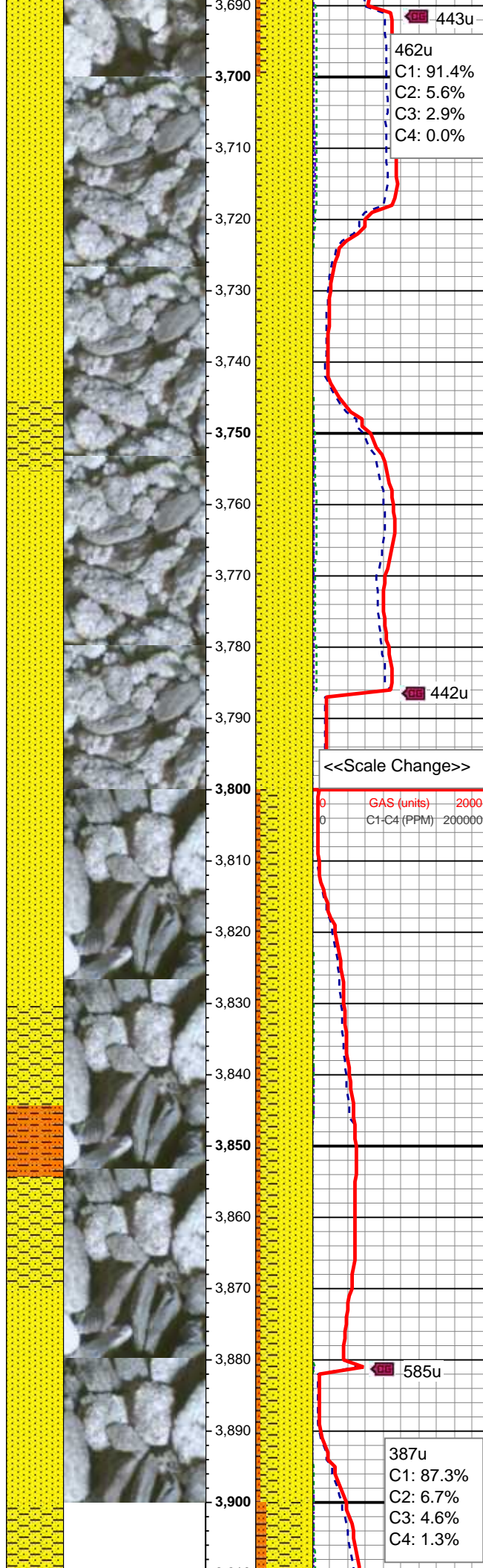
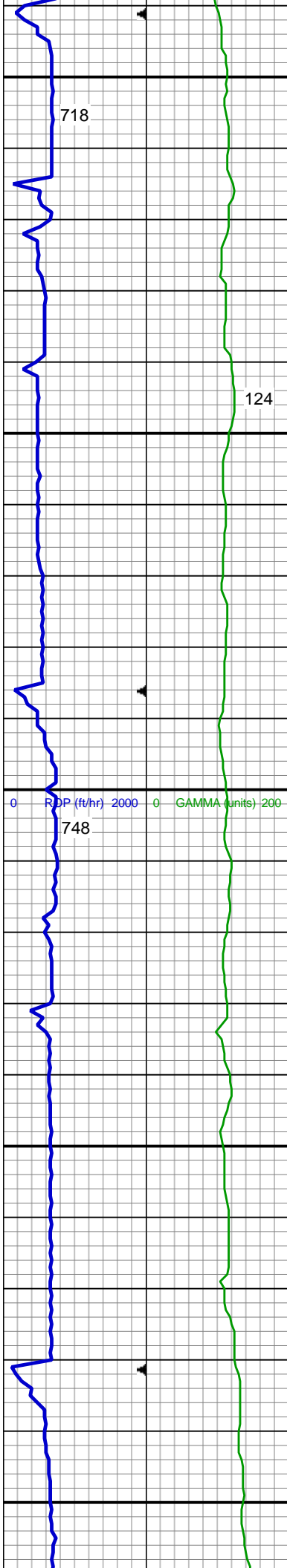
MUD WT: 9.05/9.30
VIS: 29/31 IN/OUT

Parkman Top @
3,520' MD; 3,506' TVD

MD: 3,544'
TVD: 3,530.01'
Inclination: 1.13 °
Azimuth: 7.65 °

SS: wh, fros - trns, s&p, speckl wi mica, f gr, hd brit clus, sb ang - sb rd - sb blk, 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, sme sft, sb rd - sb blk, slty - grty tex, v sl calc

SS: wh, fros - trns, s&p, speckl wi mica, f gr, hd brit clus, sb ang - sb rd - sb blk, 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,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

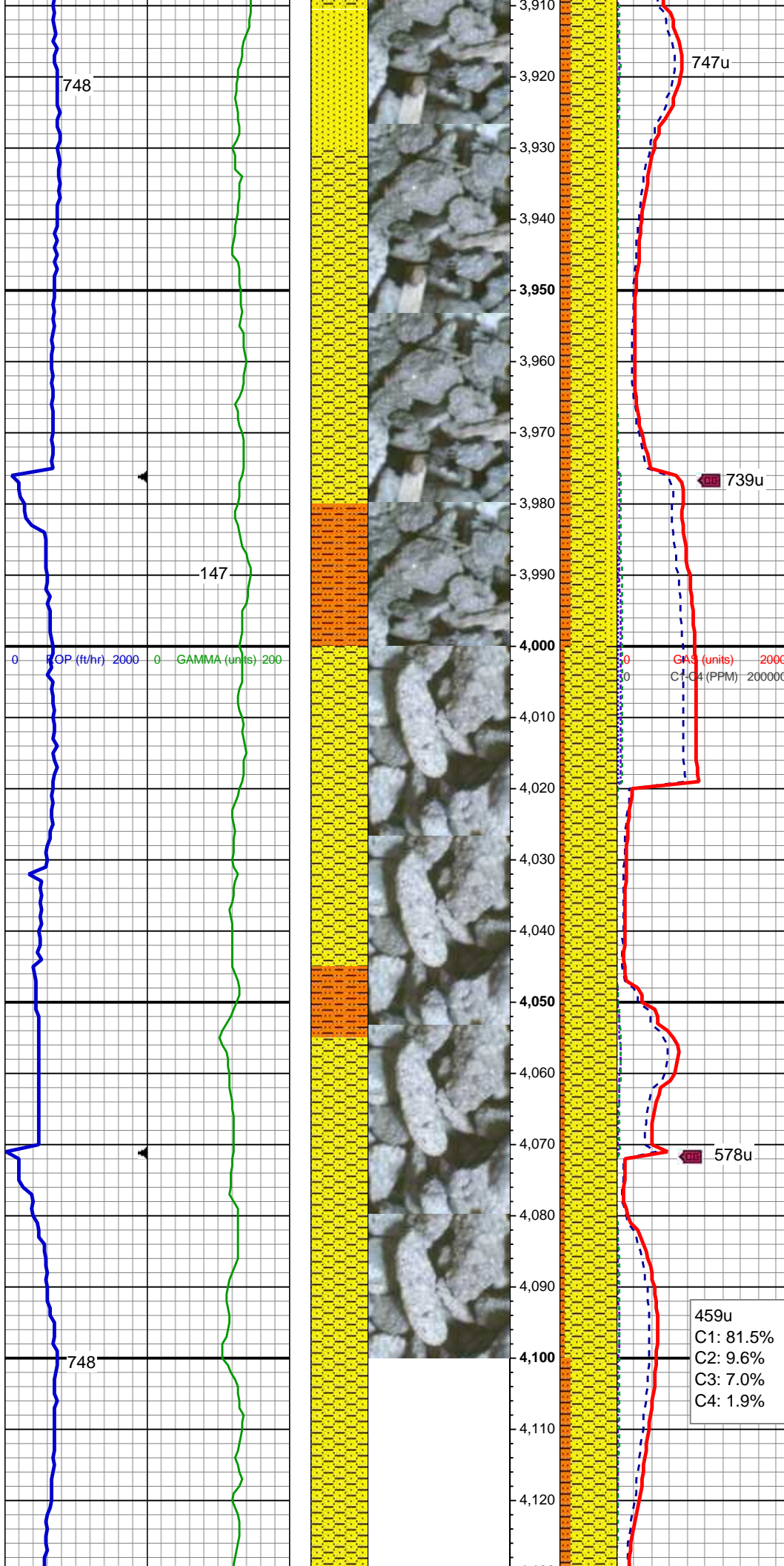
SS: wh, fros - trnsl, s&p, speckl wi
mica, f gr, hd brit clus, sb ang - sb
rd - sb blk, v calc cmt
SHY SS: wh - lt gy, fros - trnsl, s&p,
vfg, mod hd wi brit clus, sb ang - sb
rd, calc cmt

MD: 3,828'
TVD: 3,813.94'
Inclination: 1.33 °
Azimuth: 354.88 °

SS: wh, fros - trnsl, s&p, speckl wi
mica, f gr, hd brit clus, sb ang - sb
rd - sb blk, v calc cmt
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,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

Sussex Top @

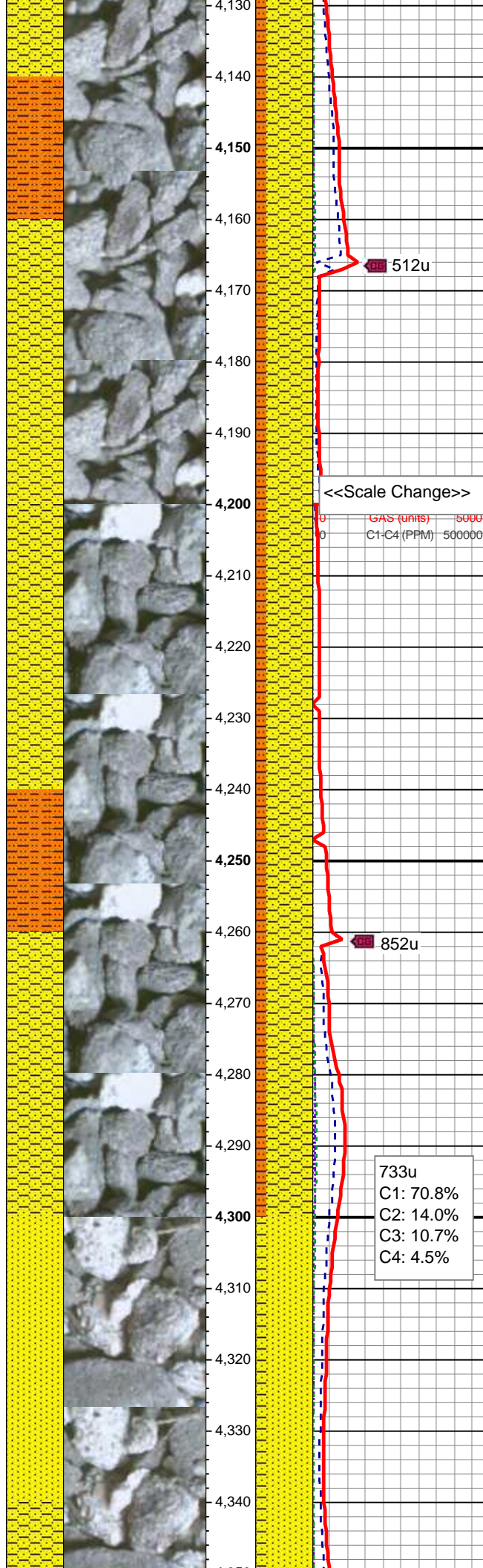
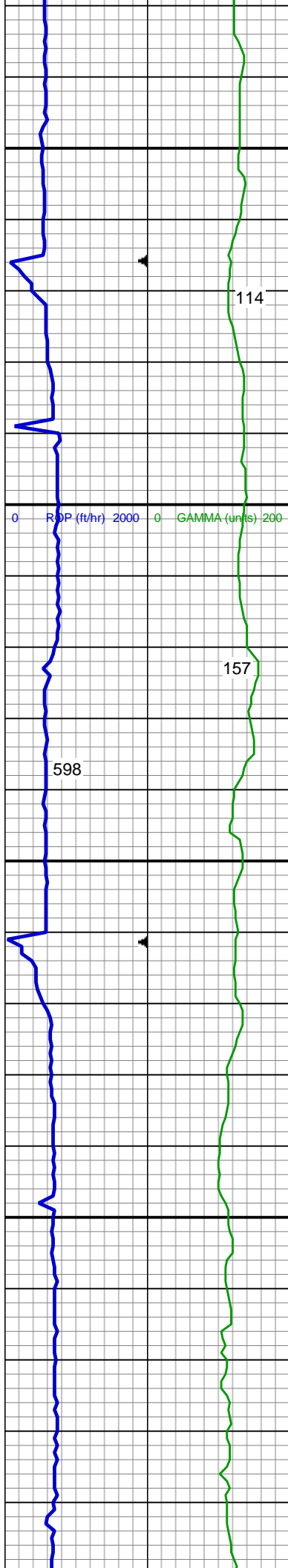
3,910' MD; 3,896' TVD



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

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

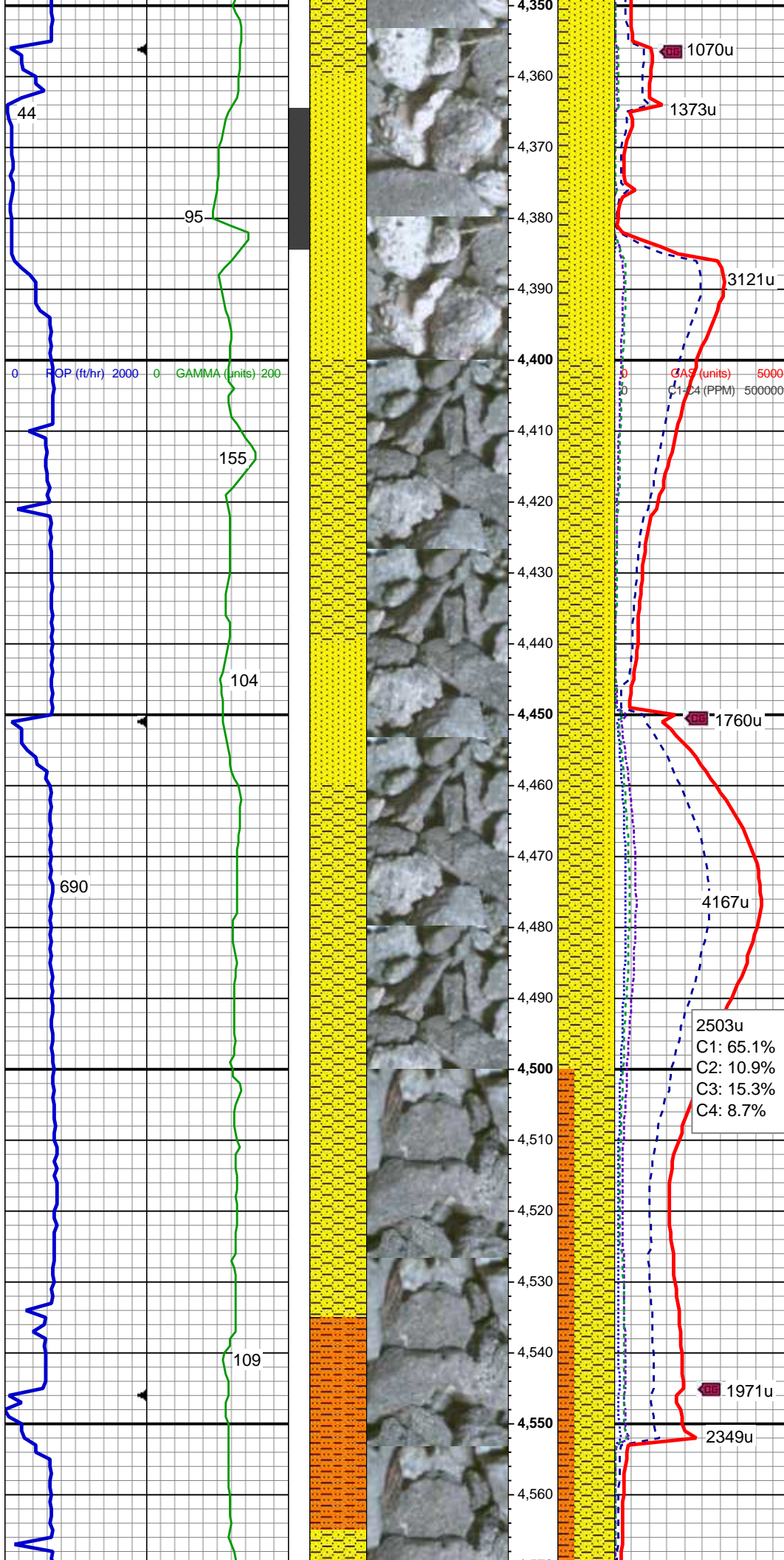
MD: 4,112'
TVD: 4,097.84'
Inclination: 1.79 °
Azimuth: 356.85 °



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

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

MUD WT: 9.10/9.10
VIS: 29/27 IN/OUT

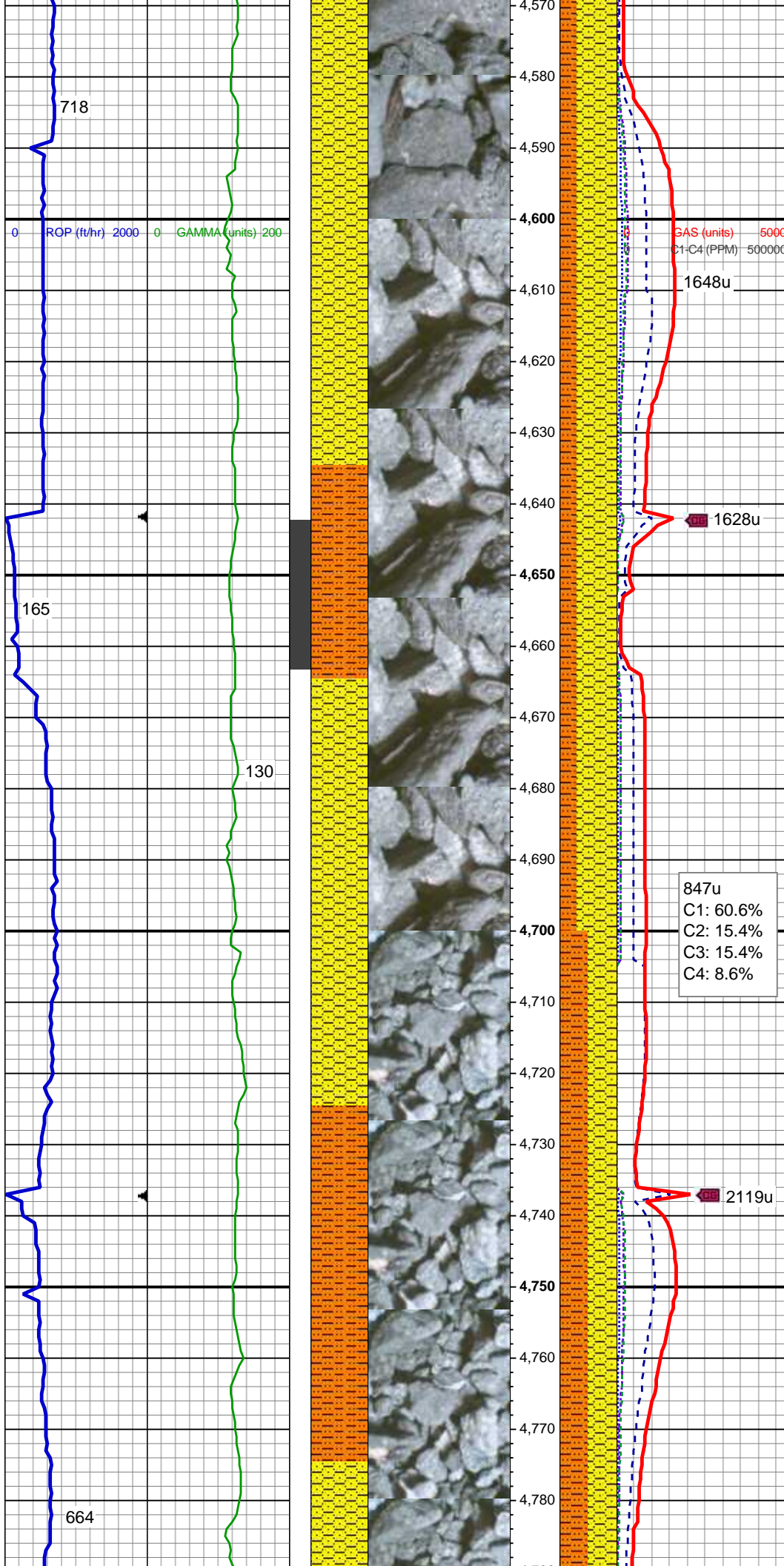


SS: wh, fros - trns, s&p, speckl wi mica, f gr, hd brit clus, sb ang - sb rd - sb blk, v calc cmt
SHY SS: wh - lt gy, fros - trns, s&p, vfg, mod hd wi brit clus, sb ang - sb rd, calc cmt

MD: 4,397'
TVD: 4,382.78'
Inclination: 0.53 °
Azimuth: 299.34 °

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

2503u
C1: 65.1%
C2: 10.9%
C3: 15.3%
C4: 8.7%

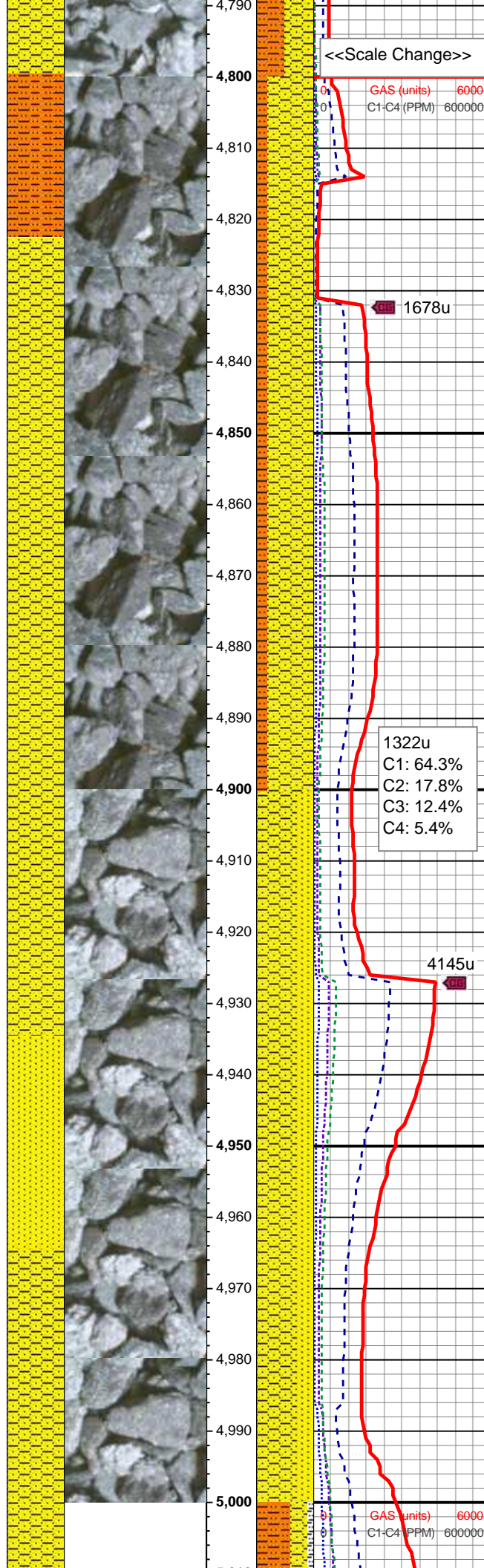


SHY SS: wh - lt gy, fros - trnsl, s&p,
vfg, mod hd wi brit clus, sb ang - sb
rd, calc cmt, grdg to SS
SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blkly, slty - grty
tex, v sl calc

MD: 4,682'
TVD: 4,667.77'
Inclination: 0.47 °
Azimuth: 151.89 °

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

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



SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

Shannon Top @
4,823' MD; 4,809' TVD

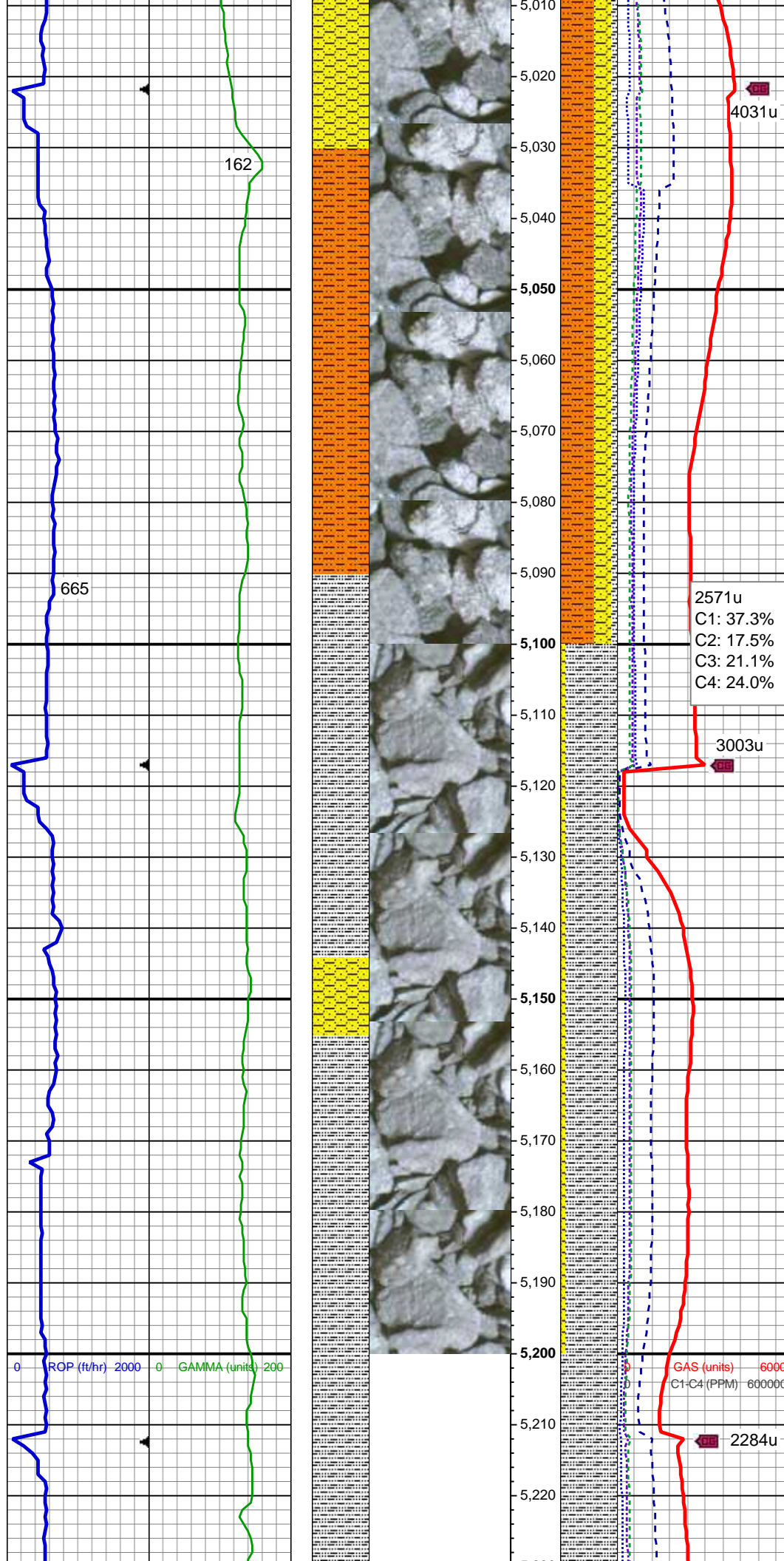
SHY SS: wh - lt gy, fros - trns, s&p,
vfg, mod hd wi brit clus, sb ang - sb
rd, calc cmt

SHY SLTST: lt - med gy, frm - hd,
sme sft, sb rd - sb blk, slty - grty
tex, v sl calc

MD: 4,967'
TVD: 4,952.75'
Inclination: 1.34 °
Azimuth: 260.68 °

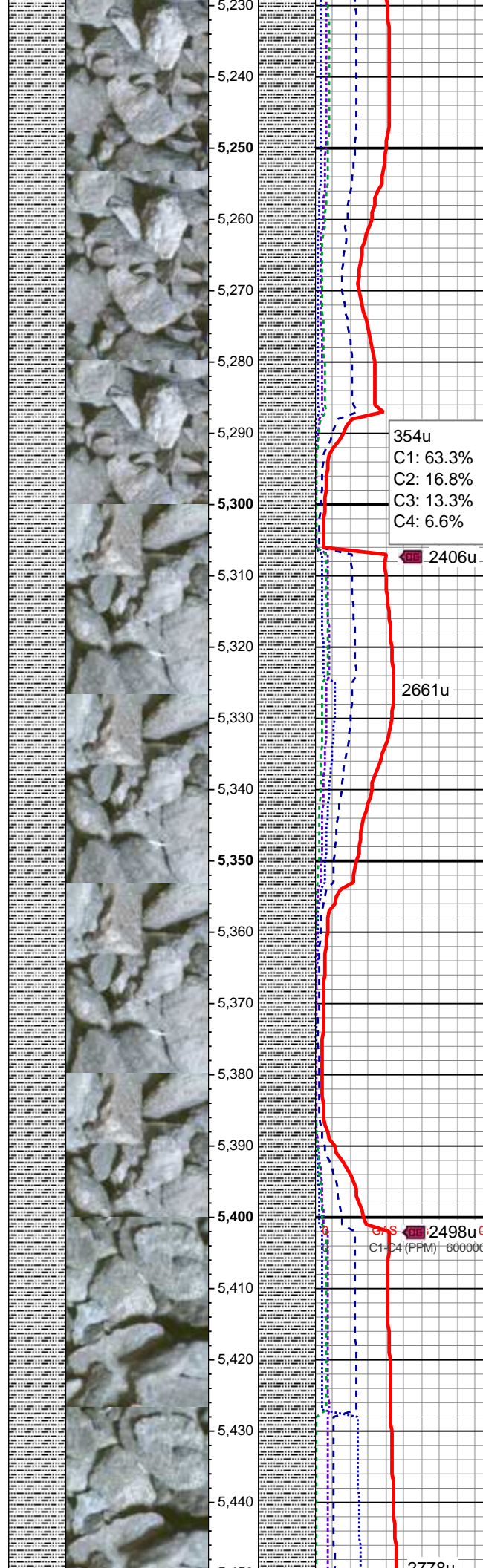
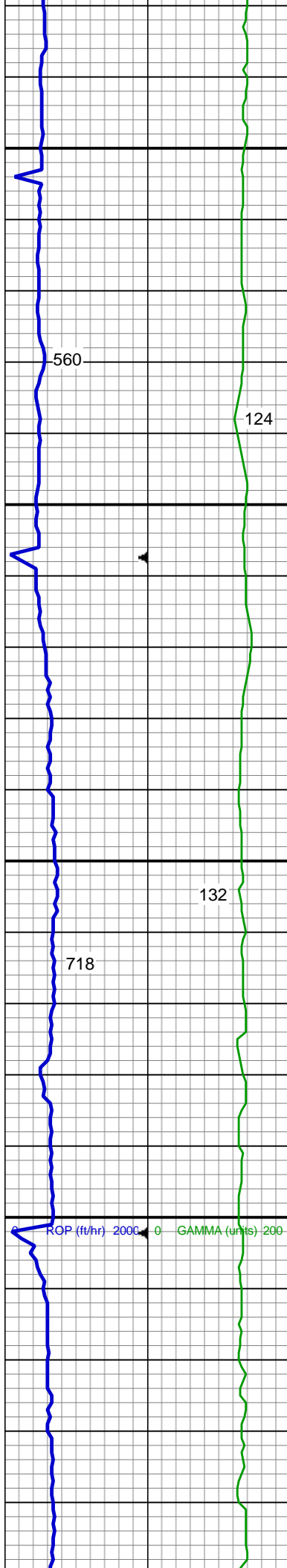
SHY SS: wh - lt gy, fros - trns, s&p,
vfg, mod hd wi brit clus, sb ang - sb
rd, calc cmt

SS: wh, fros - trns, s&p, speckl wi
mica, f gr, hd brit clus, sb ang - sb
rd - sb blk, v calc cmt



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

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



MD: 5,251'
TVD: 5,236.68'
Inclination: 1.26 °
Azimuth: 239.27 °

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

354u
C1: 63.3%
C2: 16.8%
C3: 13.3%
C4: 6.6%

2406u

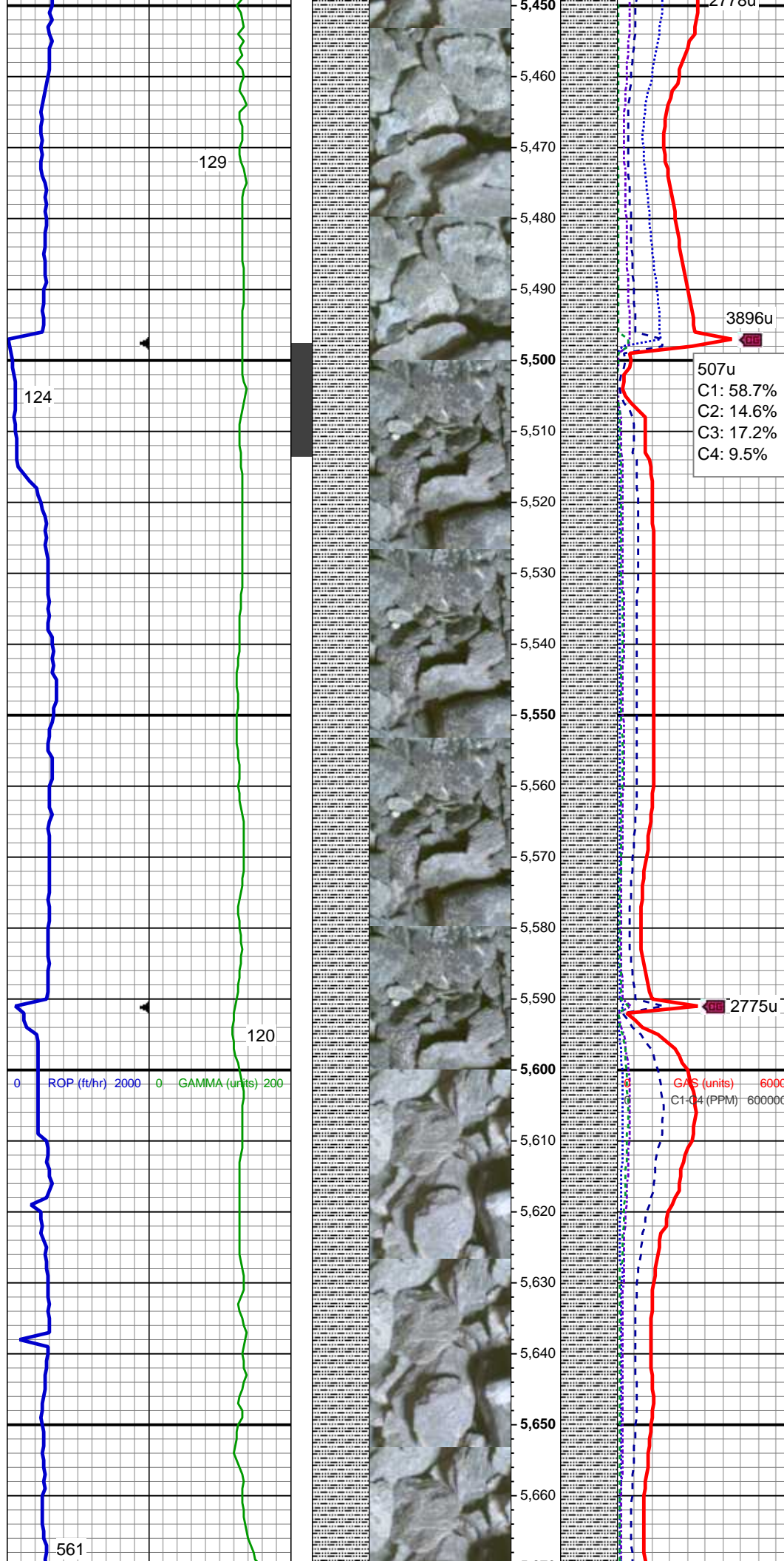
2661u

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

2498u
C1-C4 (PPM) 600000

MUD WT: 9.00/9.10
VIS: 30/28 IN/OUT

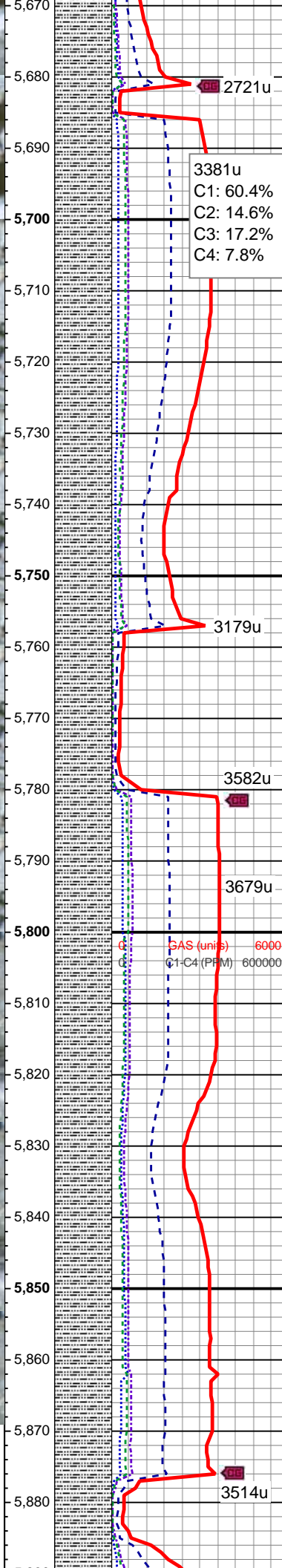
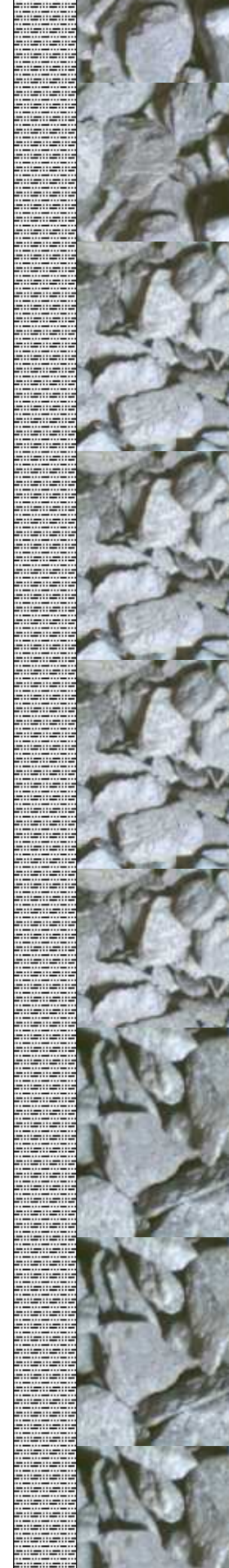
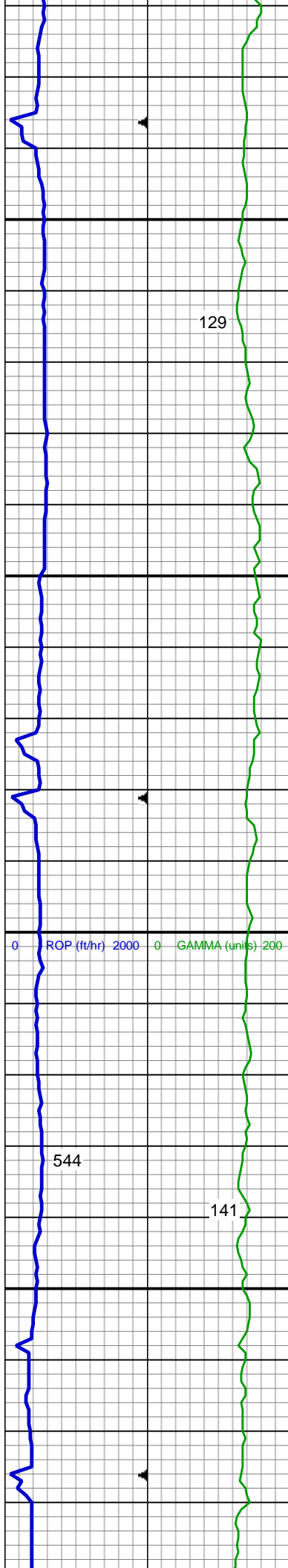
2779u



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

MD: 5,536'
TVD: 5,521.63'
Inclination: 1.41 °
Azimuth: 148.6 °

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

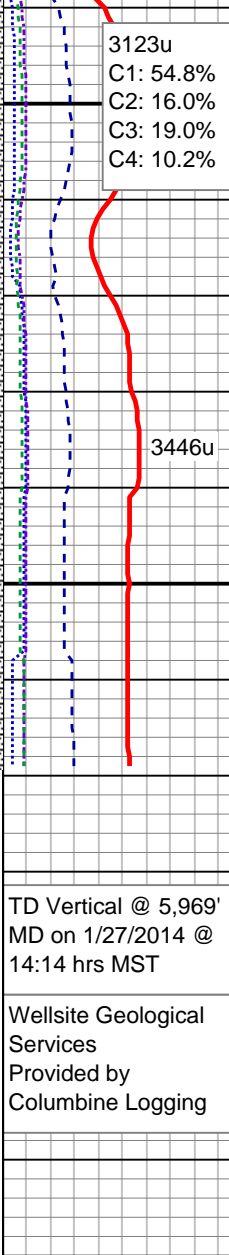
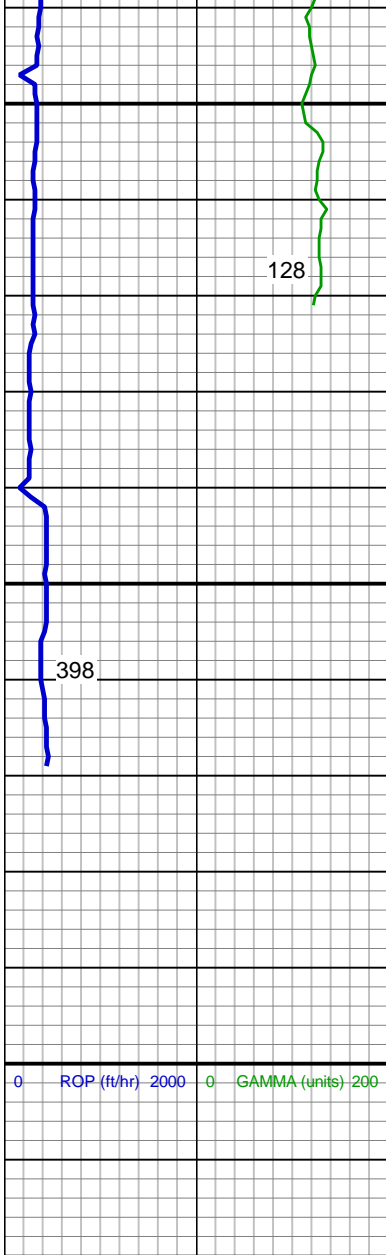


SLTY SH: lt - med gy brn, occ dk gy,
frm - hd, plty - sb plty - sb blk, slty -
grty tex, sl calc

MUD WT: 9.10/9.10
VIS: 34/34 IN/OUT

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

MD: 5,820'
TVD: 5,805.52'
Inclination: 1.71 °
Azimuth: 144.07 °



SLTY SH: lt - med gy brn, occ dk gy, frm - hd, plty - sb plty - sb blk, slty - grty tex, sl calc	
Teepee Buttes Top @ 5,900' MD; 5,887' TVD	
MD: 5,913' TVD: 5,898.48' Inclination: 1.72 ° Azimuth: 111.51 °	
SLTY SH: lt - med gy brn, occ dk gy, frm - hd, plty - sb plty - sb blk, slty - grty tex, sl calc	
TD Vertical @ 5,969' MD on 1/27/2014 @ 14:14 hrs MST	
Wellsite Geological Services Provided by Columbine Logging	
See Corresponding Horizontal Log COUGAR B02-69-1HN HORZ	