

# COLUMBINE LOGGING

Scale: 5" / 100'  
Measured Depth Log

**Well Name** 70 Ranch 4-63-4856CDH

**Location** NWSW S3-T4N-R63W

**State** COLORADO

**County** WELD

**Country** UNITED STATES OF AMERICA

**Rig Number** NABORS M-37

**API Number** 05-123-37994

**AFE #** 18535D

**Region** DENVER - JULESBURG BASIN

**Field** WATTENBERG

**Spud Date** 12/18/2013

**Drilling Completed** 12/24/2013

**Surface Coordinates** NWSW SEC3-T4N-R63W  
1,950' FSL  
234' FWL

**Bottom Hole Coordinates** SESE SEC3-T4N-R63W  
1,329' FSL  
500' FEL

**Ground Elevation** 4,559'

**K.B. Elevation** 4,582'

**Logged Interval** 4,000'

**Formation** PIERRE - CODELL

**Type of Drilling Fluid** WATER BASED POLY MUD

## Operator

**Company** Bill Barrett Corporation

## Geologist

**Name** John Roesink

**Company** Bill Barrett Corporation

**Address** 1099 18th St., Ste. 2300  
Denver, CO 80202

## Rock Types

## 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

E EARTHY
F FENESTRAL
F FRACTURE
X INTERCRYSTALLINE
Q 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 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

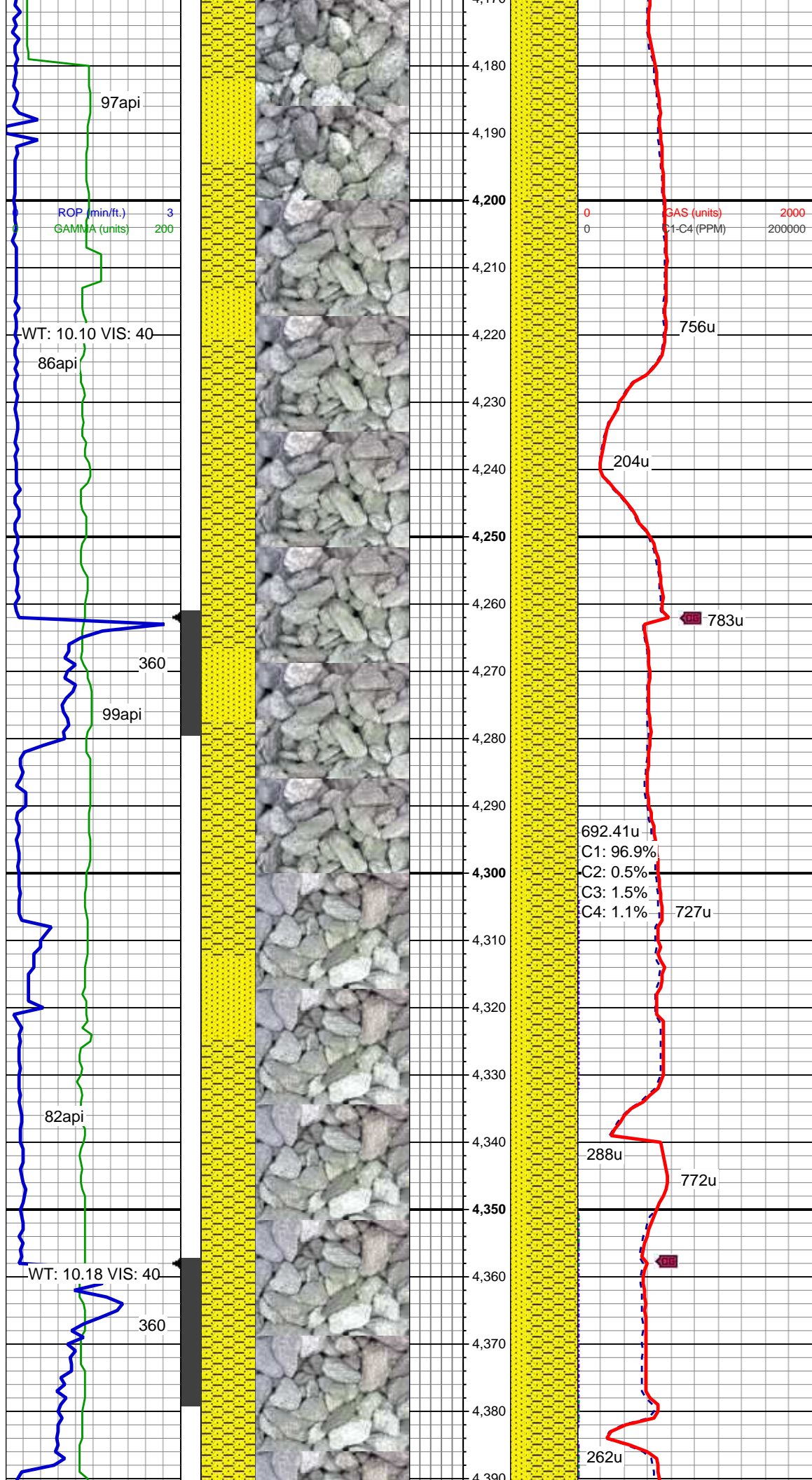
FINELYXLN
GRAINSTONE
L LITHOGRAPHIC
MX MICROXLN
MS MUDSTONE
PS PACKSTONE
WS WACKESTONE

### Sorting

M MODERATE
P POOR
W WELL

ROP ROF GAMMA		Slide/Rotate	Interp Lithology	Images	Oil Show	Depth Labels	% Lith	Total Gas & Chromatograph GAS C1 C2 C3 C4	Lithology Descriptions
Bit #: 1 Type: HUGHES DP504X Size: 8.75 Jets: 6x16 S/N: 7145808						3,980 3,990 4,000 4,010 4,020 4,030 4,040 4,050 4,060 4,070 4,080 4,090 4,100 4,110 4,120 4,130 4,140 4,150 4,160 4,170			Columbine Logging 2-Manned Geosteering Operational 12/20/2013 Bloodhound# 314  100' SAMPLE INTERVAL  MD: 4,019' TVD: 3,999.33' Inclination: 10.8 ° Azimuth: 204.7 ° VS: -55.31'  SHYSS: lt gy-med gy, fri, f gr, sb rd-rd, mod-w srt, arg, com glauc & biot incl, intbdd & grd to SS: clr-lt gy, hd, med-f gr, sb ang-sb rd, mod-w srt, non calc, com glau & biot incl  MD: 4,115' TVD: 4,093.77' Inclination: 9.9 ° Azimuth: 206.6 ° VS: -58.8'  SHYSS: lt gy-med gy, fri, f gr, sb rd-rd, mod-w srt, arg, com glauc & biot incl, intbdd & grd to SS: clr-lt gy, hd, med-f gr, sb ang-sb rd, mod-w srt, non calc, com glau & biot incl
0 ROP (min/ft.) 3 0 GAMMA (units) 200								0 GAS (units) 2000 0 C1-C4 (PPM) 200000	
WT: 10.08 VIS: 60								GAS SOFTWARE ERROR DATA STARTS @ 4,069' MD	
26api								627u 821.75u C1: 95.5% C2: 1.1% C3: 0.9% C4: 2.5%	
26api								838u 190u	
								1287u	



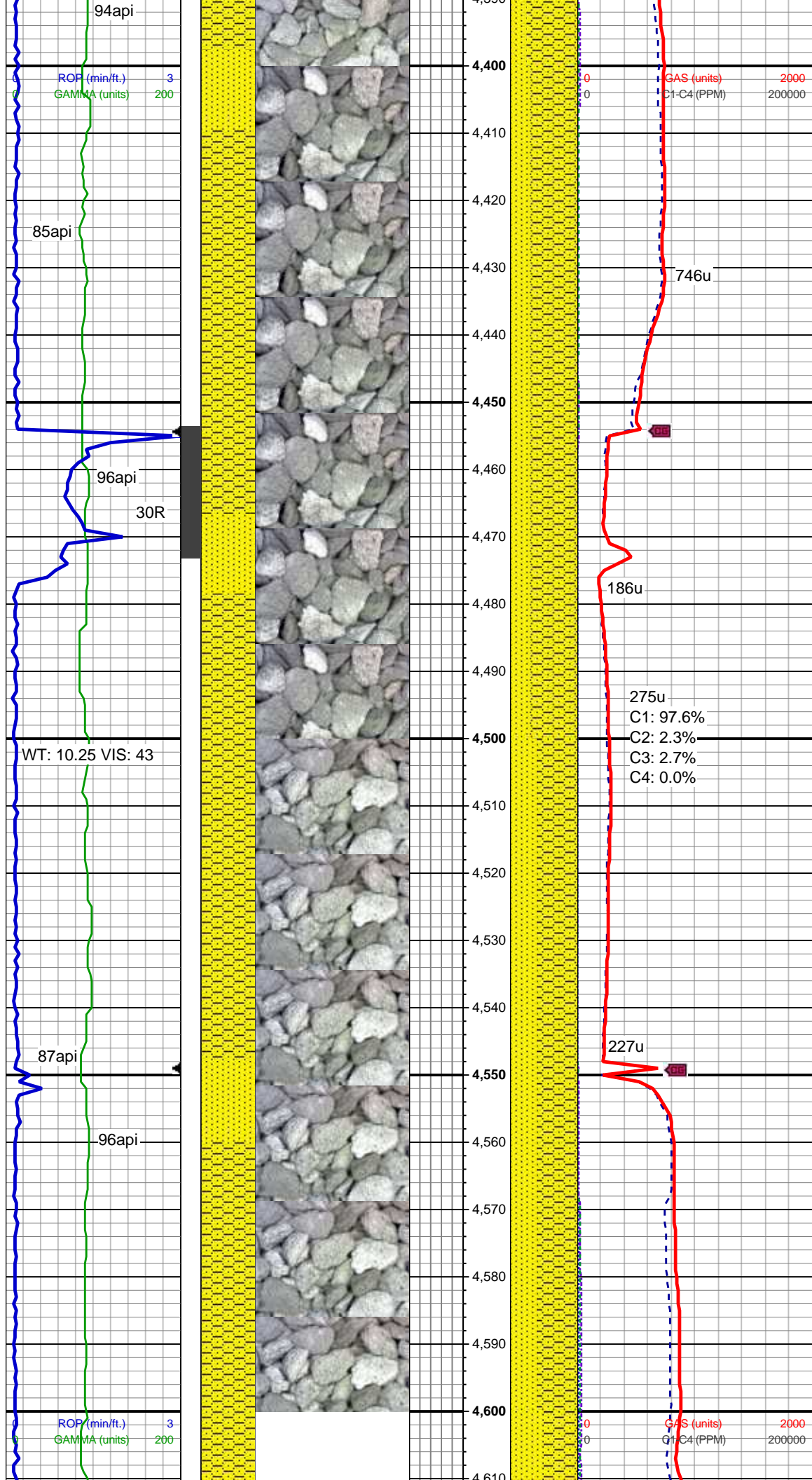


MD: 4,211'  
TVD: 4,188.42'  
Inclination: 9.3 °  
Azimuth: 208.2 °  
VS: -62.52'

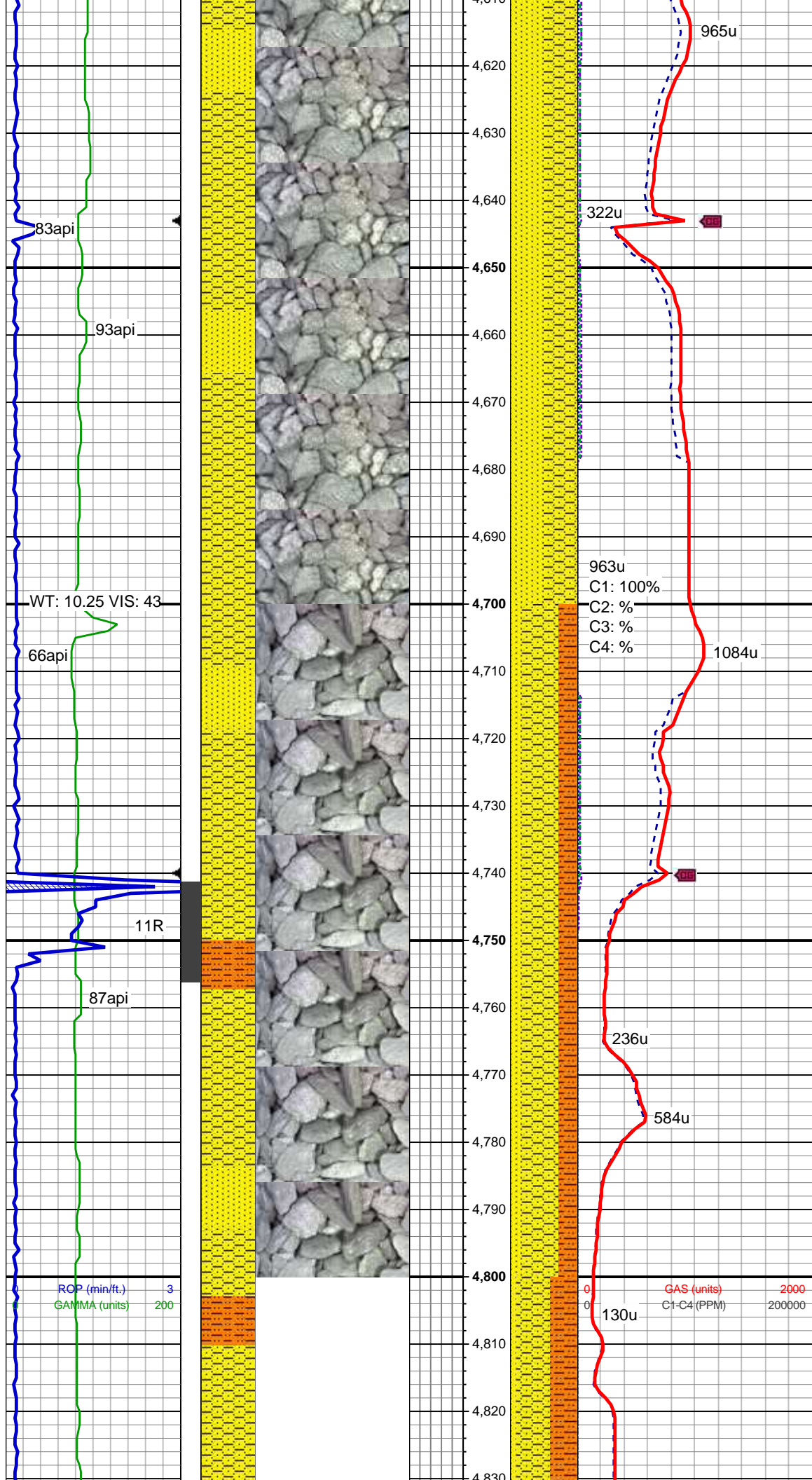
SHYSS: lt gy-med gy, fri, f gr, sb  
rd-rd, mod-w srt, arg, com glauc &  
biot incl, intbdd & grd to SS: clr-lt gy,  
hd, med-f gr, sb ang-sb rd, mod-w  
srt, non calc, com glau & biot incl

MD: 4,307'  
TVD: 4,283.06'  
Inclination: 10 °  
Azimuth: 205.7 °  
VS: -66.13'

SHYSS: lt gy-med gy, fri, f gr, sb  
rd-rd, mod-w srt, arg, com glauc &  
biot incl, intbdd & grd to SS: clr-lt gy,  
hd, med-f gr, sb ang-sb rd, mod-w  
srt, non calc, com glau & biot incl





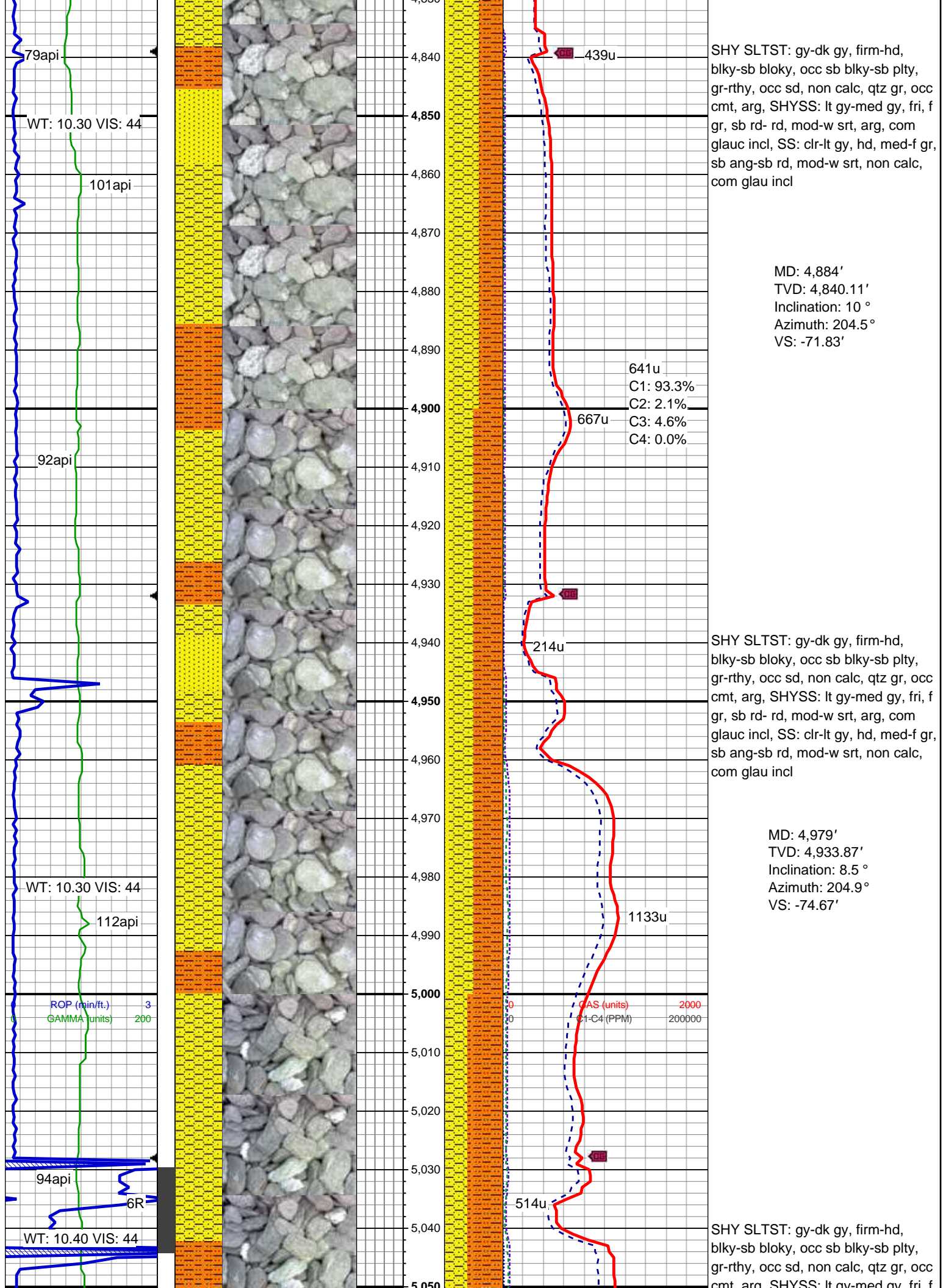


SHYSS: lt gy-med gy, fri, f gr, sb rd-rd, mod-w srt, arg, com glauc & biot incl, intbdd & grd to SS: clr-lt gy, hd, med-f gr, sb ang-sb rd, mod-w srt, non calc, com glau & biot incl

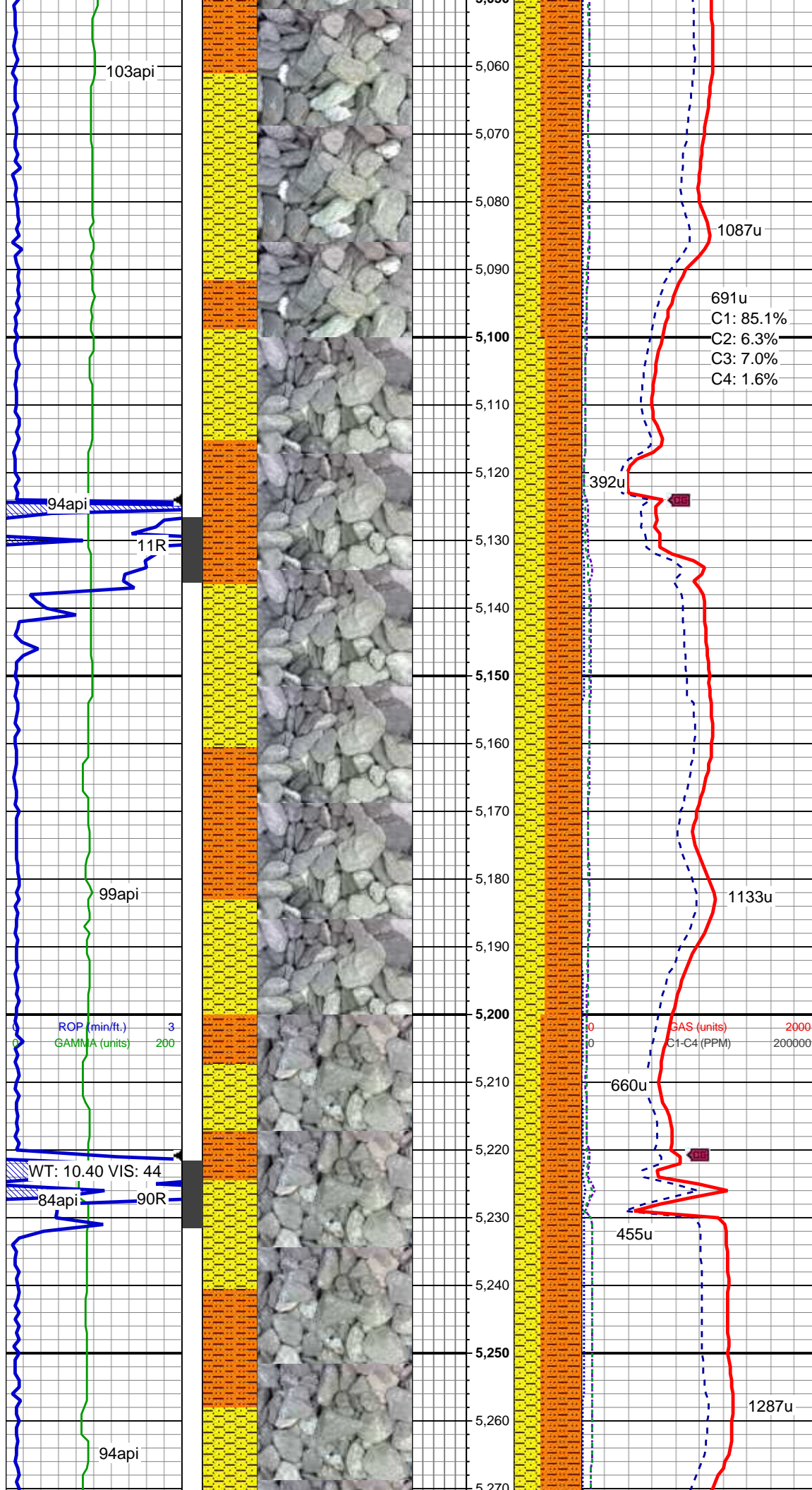
MD: 4,691'  
TVD: 4,650.53'  
Inclination: 10.6 °  
Azimuth: 205.7 °  
VS: -64.72'

SHY SLTST: gy-dk gy, firm-hd, blk-sb bloky, occ sb blk-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, SHYSS: lt gy-med gy, fri, f gr, sb rd-rd, mod-w srt, arg, com glauc incl, SS: clr-lt gy, hd, med-f gr, sb ang-sb rd, mod-w srt, non calc, com glau incl

MD: 4,788'  
TVD: 4,745.77'  
Inclination: 11.3 °  
Azimuth: 205.4 °  
VS: -68.43'







Unit, arg, SS: lt gy med gy, fri, f  
gr, sb rd- rd, mod-w srt, arg, com  
glauc incl, SS: clr-lt gy, hd, med-f gr,  
sb ang-sb rd, mod-w srt, non calc,  
com glau incl

MD: 5,076'  
TVD: 5,029.82'  
Inclination: 8.4 °  
Azimuth: 200.6 °  
VS: -76.86'

691u  
C1: 85.1%  
C2: 6.3%  
C3: 7.0%  
C4: 1.6%

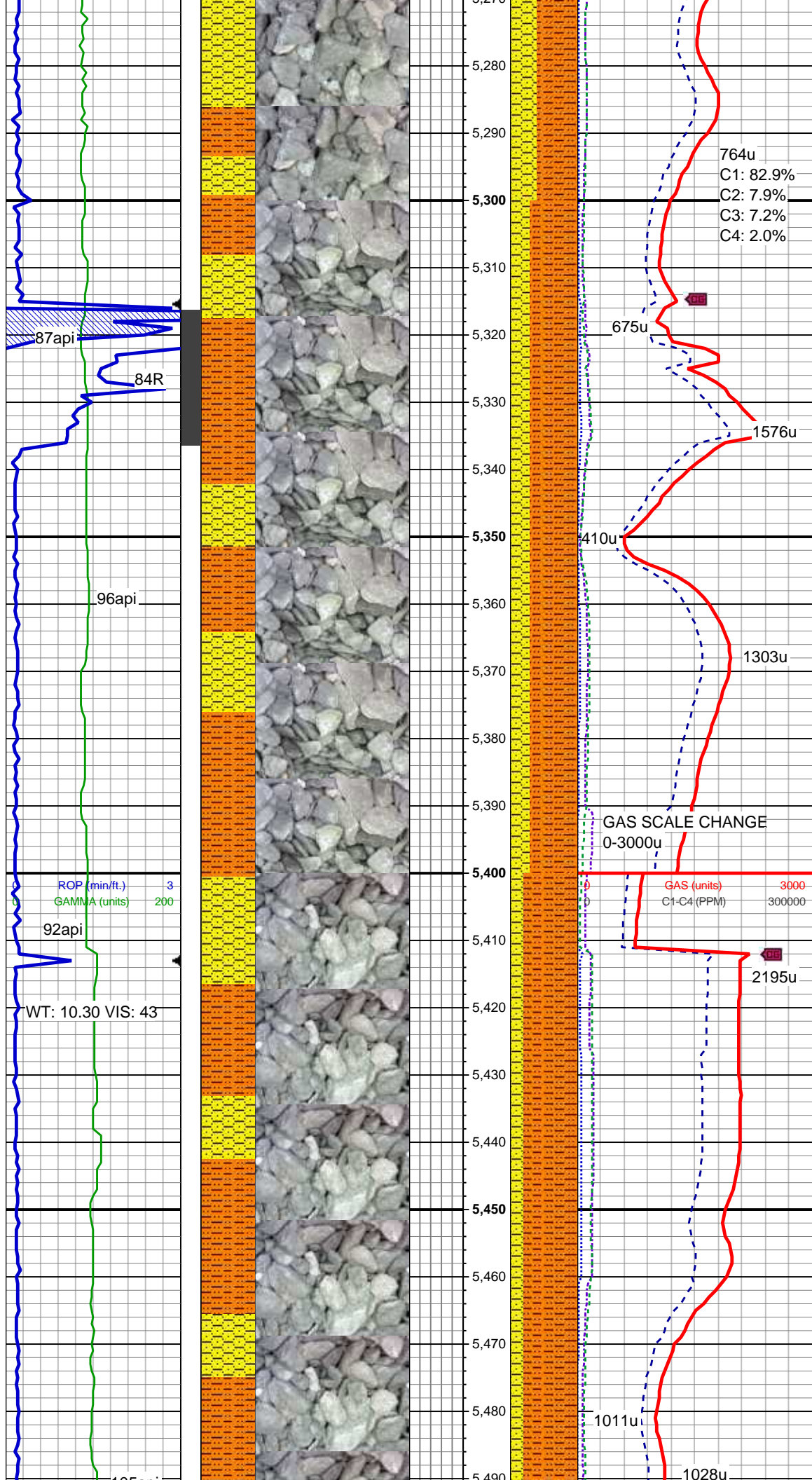
SHY SLTST: gy-dk gy, firm-hd,  
blky-sb bloky, occ sb blky-sb plty,  
gr-rthy, occ sd, non calc, qtz gr, occ  
cmt, arg, SHYSS: lt gy-med gy, fri, f  
gr, sb rd- rd, mod-w srt, arg, com  
glauc incl, SS: clr-lt gy, hd, med-f gr,  
sb ang-sb rd, mod-w srt, non calc,  
com glau incl

MD: 5,171'  
TVD: 5,123.8'  
Inclination: 8.4 °  
Azimuth: 197.8 °  
VS: -78.14'

SHY SLTST: gy-dk gy, firm-hd,  
blky-sb bloky, occ sb blky-sb plty,  
gr-rthy, occ sd, non calc, qtz gr, occ  
cmt, arg, SHYSS: lt gy-med gy, fri, f  
gr, sb rd- rd, mod-w srt, arg, com  
glauc incl, SS: clr-lt gy, hd, med-f gr,  
sb ang-sb rd, mod-w srt, non calc,  
com glau incl

MD: 5,266'  
TVD: 5,217.87'  
Inclination: 7.7 °  
Azimuth: 199.4 °





VS: -79.21'

764u  
C1: 82.9%  
C2: 7.9%  
C3: 7.2%  
C4: 2.0%

675u

1576u

410u

1303u

GAS SCALE CHANGE  
0-3000u

2195u

1011u

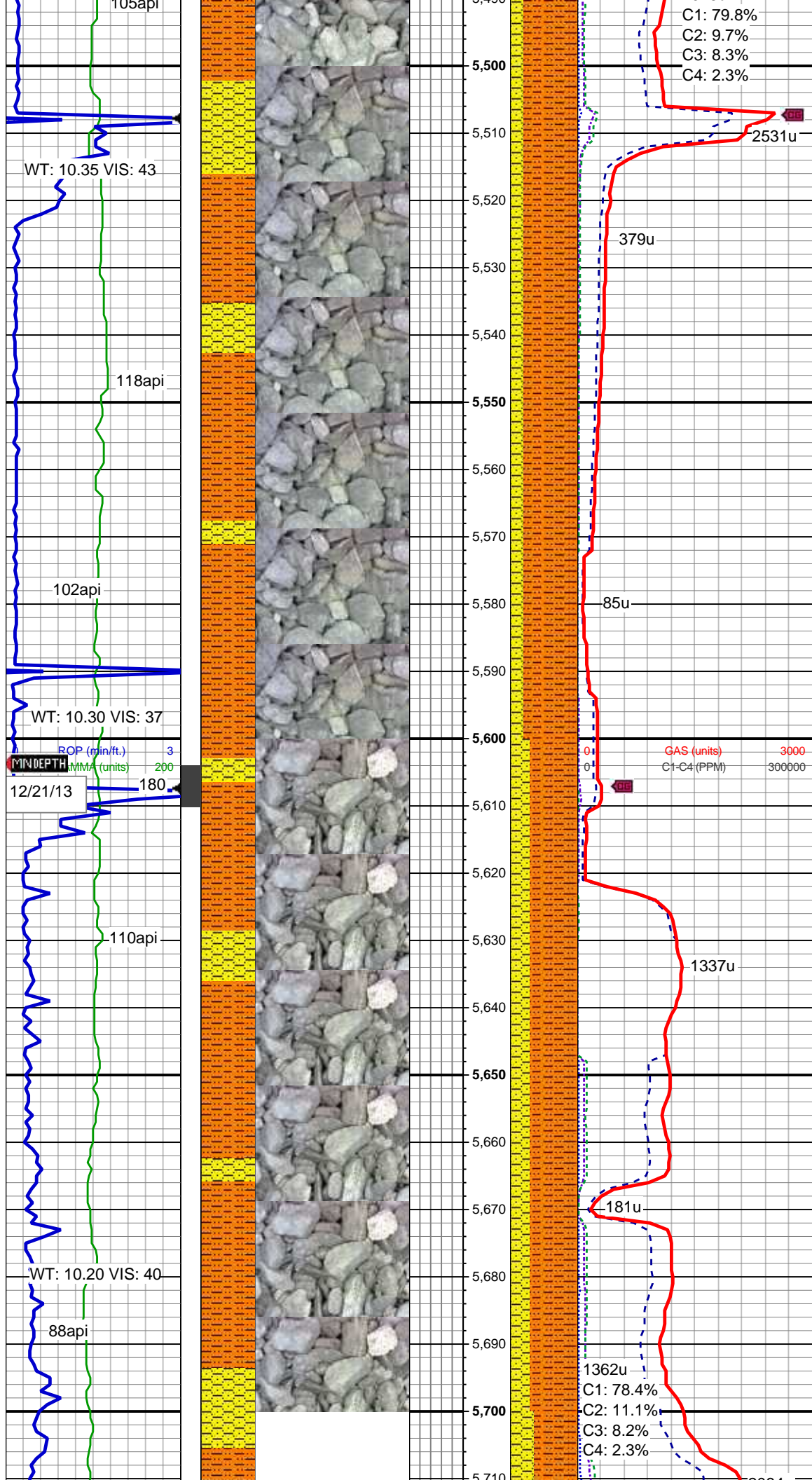
1028u

SHY SLTST: gy-dk gy, firm-hd, blk-y-sb blk-y, occ sb blk-y-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS

MD: 5,363'  
TVD: 5,314.08'  
Inclination: 6.9 °  
Azimuth: 208.9 °  
VS: -81.34'

SHY SLTST: gy-dk gy, firm-hd, blk-y-sb blk-y, occ sb blk-y-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS

MD: 5,458'  
TVD: 5,408.52'  
Inclination: 5.6 °  
Azimuth: 206.8 °  
VS: -83.84'



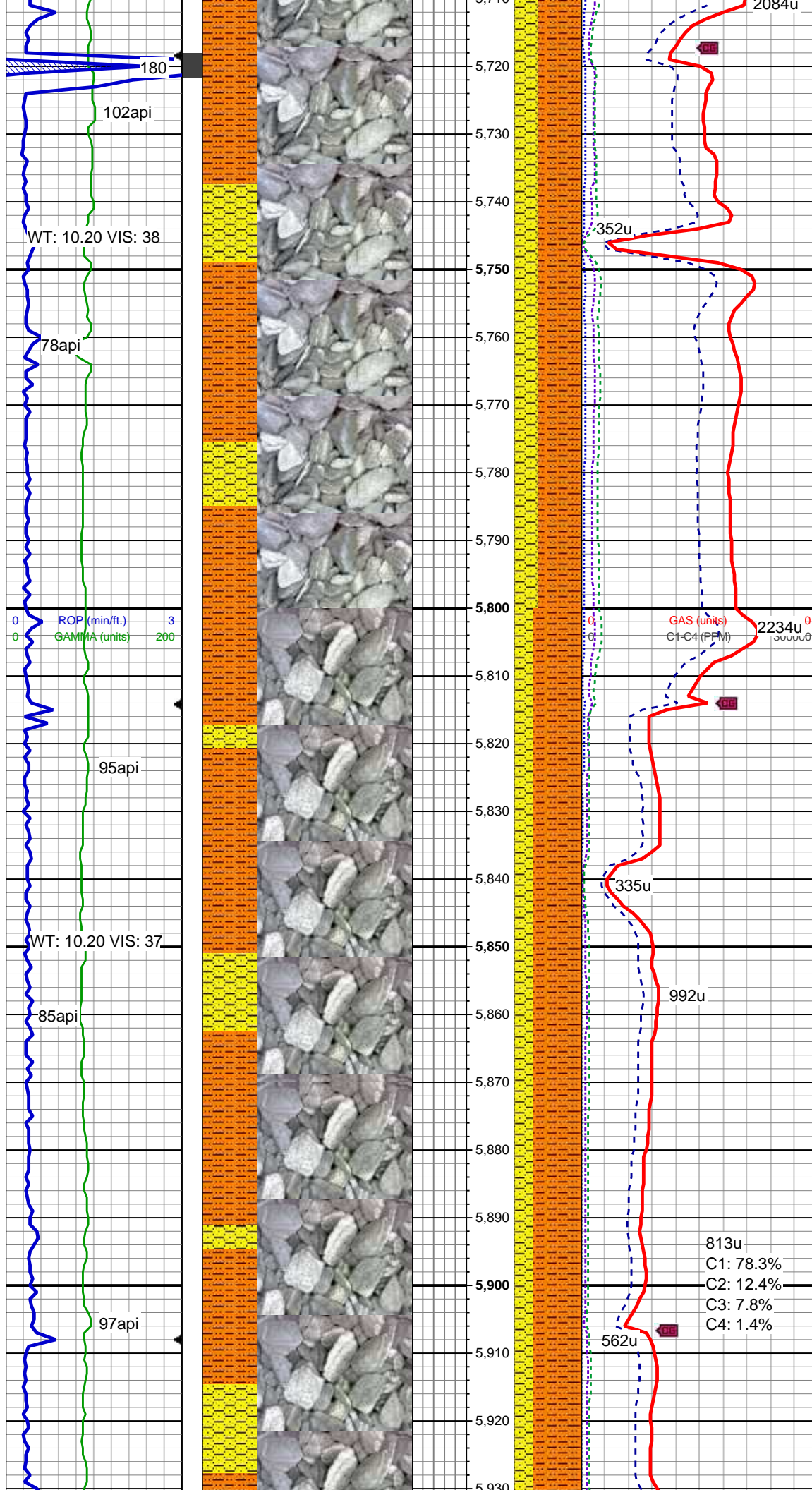
SHY SLTST: gy-dk gy, firm-hd, blky-sb blky, occ sb blky-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS

MD: 5,554'  
TVD: 5,504.2'  
Inclination: 3.6 °  
Azimuth: 214.2 °  
VS: -85.93'

MD: 5,645'  
TVD: 5,595.08'  
Inclination: 2.3 °  
Azimuth: 216.5 °  
VS: -87.62'

SHY SLTST: gy-dk gy, firm-hd, blky-sb blky, occ sb blky-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS





MD: 5,742'  
TVD: 5,692.03'  
Inclination: 1.2 °  
Azimuth: 218.4 °  
VS: -88.79'

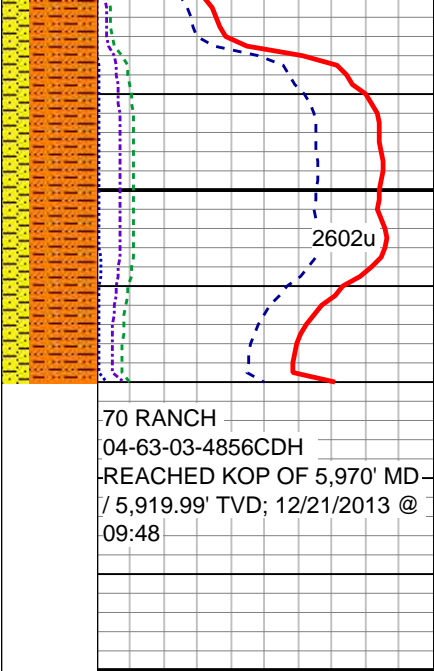
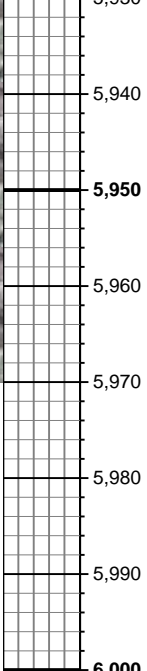
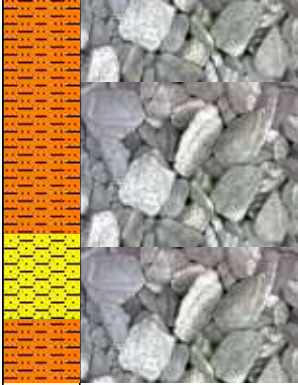
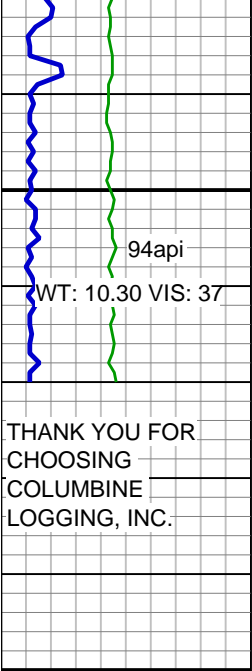
SHY SLTST: gy-dk gy, firm-hd, blky-sb blky, occ sb blky-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS

MD: 5,838'  
TVD: 5,788.02'  
Inclination: 0.9 °  
Azimuth: 206.3 °  
VS: -89.37'

SHY SLTST: gy-dk gy, firm-hd, blky-sb blky, occ sb blky-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS

813u  
C1: 78.3%  
C2: 12.4%  
C3: 7.8%  
C4: 1.4%

MD: 5,934'  
TVD: 5,884'



Inclination: 1 °  
Azimuth: 194.8 °  
VS: -89.54'  
SHY SLTST: gy-dk gy, firm-hd, blky-sb blky, occ sb blky-sb plty, gr-rthy, occ sd, non calc, qtz gr, occ cmt, arg, biot incl, SHYSS: lt gy-med gy, fri, f gr, sb rd- rd, mod-w srt, arg, com glauc & biot incl, tr SS  
MD: 5,962'  
TVD: 5,912'  
Inclination: 0.9 °  
Azimuth: 136.7 °  
VS: -89.36'

70 RANCH  
04-63-03-4856CDH  
REACHED KOP OF 5,970' MD / 5,919.99' TVD; 12/21/2013 @ 09:48

LOG CONTINUED ON 70 RANCH  
04-63-03-4856CDH HZ