

# COLUMBINE LOGGING

Scale: 5" / 100'  
Measured Depth Log

**Well Name** Sandau K25-65-1HN

**Location** SEC 25 T4N R66W

**State** COLORADO

**County** WELD

**Country** USA

**Rig Number** PERCISION DRILLING 829

**API Number** 05-123-37763

**AFE #** 136988

**Region** DJ BASIN

**Field** HAMBERT

**Spud Date** 3/4/2014

**Drilling Completed** 3/15/2014

**Surface Coordinates** 40.28208, 104.73374  
2310' FSL x 318' FWL

**Bottom Hole Coordinates** 40.28228, 104.71579  
2210' FSL x 75' FEL

**Ground Elevation** 4786'

**K.B. Elevation** 4802'

**Logged Interval** 679' **To** 6435'

**Total Depth** 6435'

**Formation** NIOBRARA C CHALK

**Type of Drilling Fluid** FW LSND

## Operator

**Company** NOBLE ENERGY, INC.

**Address** 1625 BROADWAY  
DENVER, CO 80202

## Geologist

**Name** HOLLY DUNCAN

**Company** NOBLE ENERGY, INC.

**Address** 1625 BROADWAY  
DENVER, CO 80202

COLUMBINE LOGGING, INC.

2385 S. LIPAN STREET  
DENVER, CO 80223

WELL-SITE GEOLOGISTS

RYAN SHILLING  
WHITNEY JACKS

## Rock Types

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

## 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

GYP SIFEROUS

HEAVY MINERAL

KAOLIN

MARLSTONE

MICACEOUS

MINERAL CRYSTALS

NODULES

PHOSPHATE PELLETS

PYRITE

SALT CAST

SANDY

SILICEOUS

SILTY

TUFFACEOUS

ANHYDRITE STRINGER

BENTONITE STRINGER

COAL STRINGER

DOLOMITE STRINGER

GYP SUM STRINGER

LIMESTONE STRINGER

MARLSTONE (CALC) STRG

MARLSTONE (DOL) STRG

SANDSTONE STRINGER

SHALE STRINGER

SILTSTONE STRINGER

### Stringer

## Other Symbols

### Oil Show

DEAD

EVEN

QUESTIONABLE

SPOTTED STAINING

### Porosity

E EARTHY

FENESTRAL

FRACTURE

INTERCRYSTALLINE

INTEROOLITIC

MOLDIC

ORGANIC

PINPOINT

VUGGY

### Engineering

BIT CHANGE

CONNECTION (LEFT)

CONNECTION (RIGHT)

CONNECTION GAS

TRIP GAS

DOWN TIME GAS

CORE - LOST

CORE - RECOVERED

DST INTERVAL

FAULT

FORMATION TOP

GAS SHOW

OIL SHOW

MN DEPTH

MN DEPTH (RIGHT)

NORMAL FAULT

OVERTURNED STRATA

REVERSE FAULT

CASING

SIDEWALL CORE (LEFT)

SIDEWALL CORE (RIGHT)

SLIDE

SURVEY

DRILL STEM TEST

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

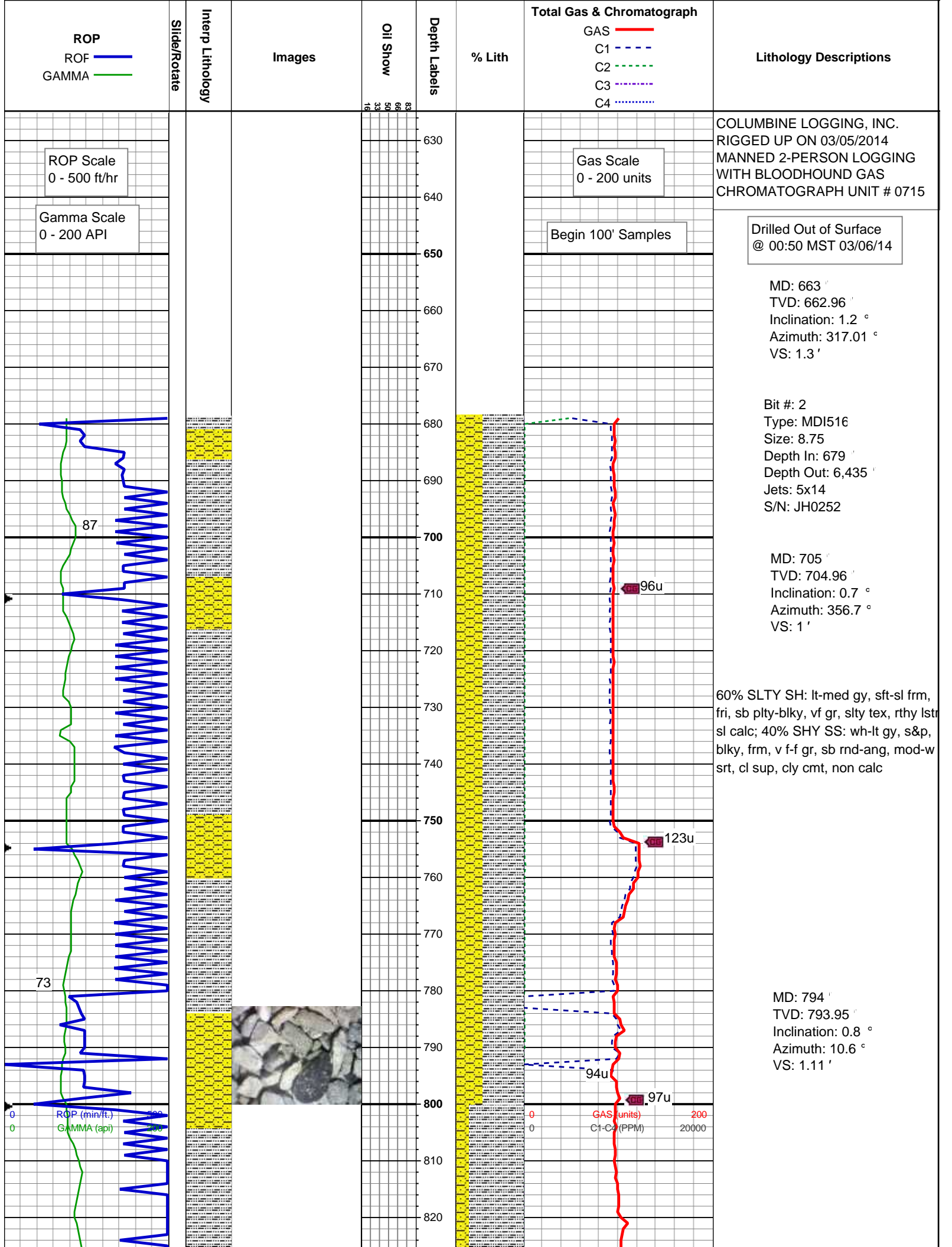
WS WACKESTONE

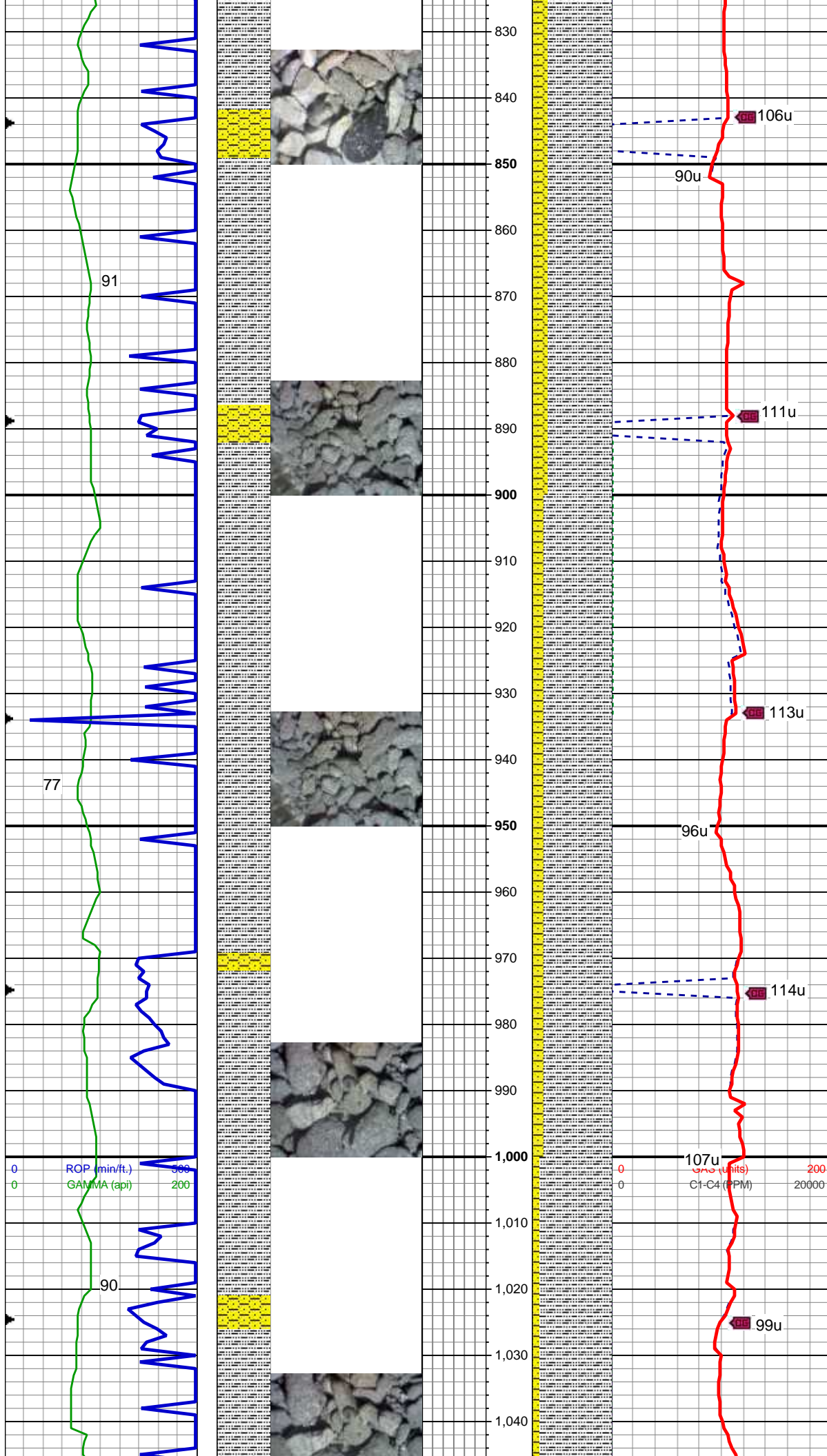
### Sorting

M MODERATE

P POOR

W WELL





80% SLTY SH: lt-med gy, sft-sl frm, fri, sb plty-blky, vf gr, slty tex, rthy lstr sl calc; 20% SHY SS: wh-lt gy, s&p, blky, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc

WT: 8.5 / VIS: 27

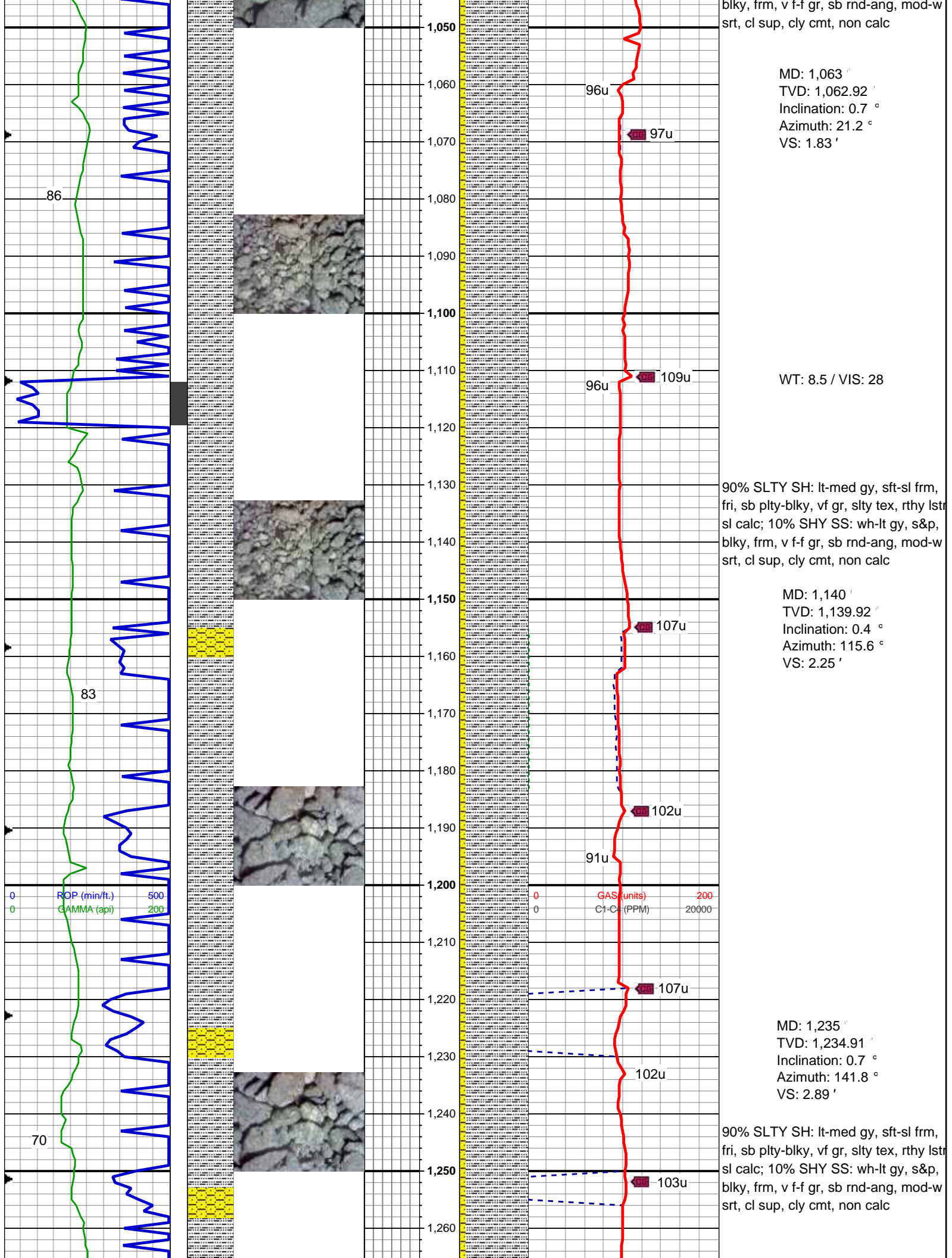
MD: 884 '  
TVD: 883.94 '  
Inclination: 0.9 °  
Azimuth: 7.3 °  
VS: 1.34 '

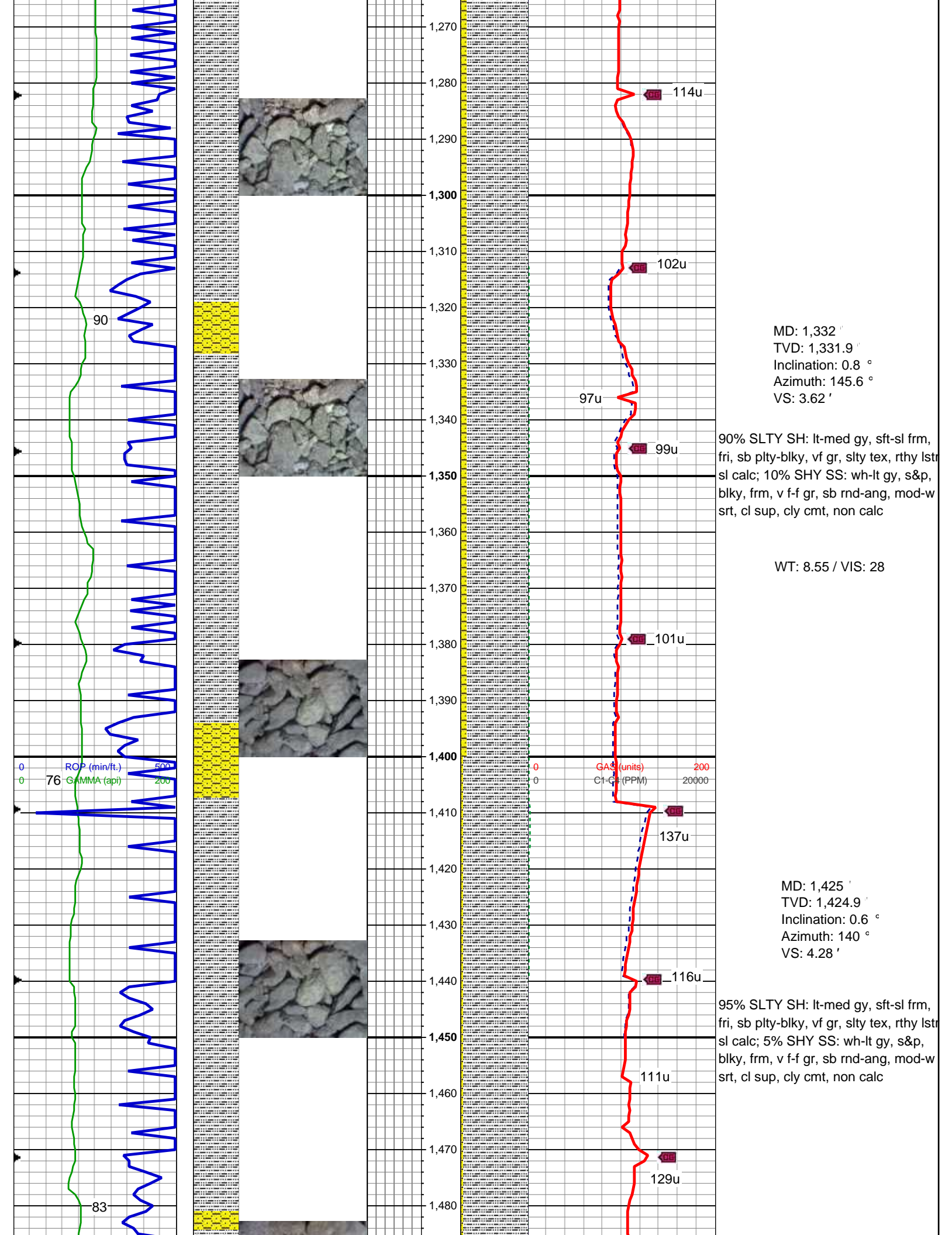
85% SLTY SH: lt-med gy, sft-sl frm, fri, sb plty-blky, vf gr, slty tex, rthy lstr sl calc; 15% SHY SS: wh-lt gy, s&p, blky, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc

MD: 974 '  
TVD: 973.93 '  
Inclination: 0.9 °  
Azimuth: 5.7 °  
VS: 1.54 '

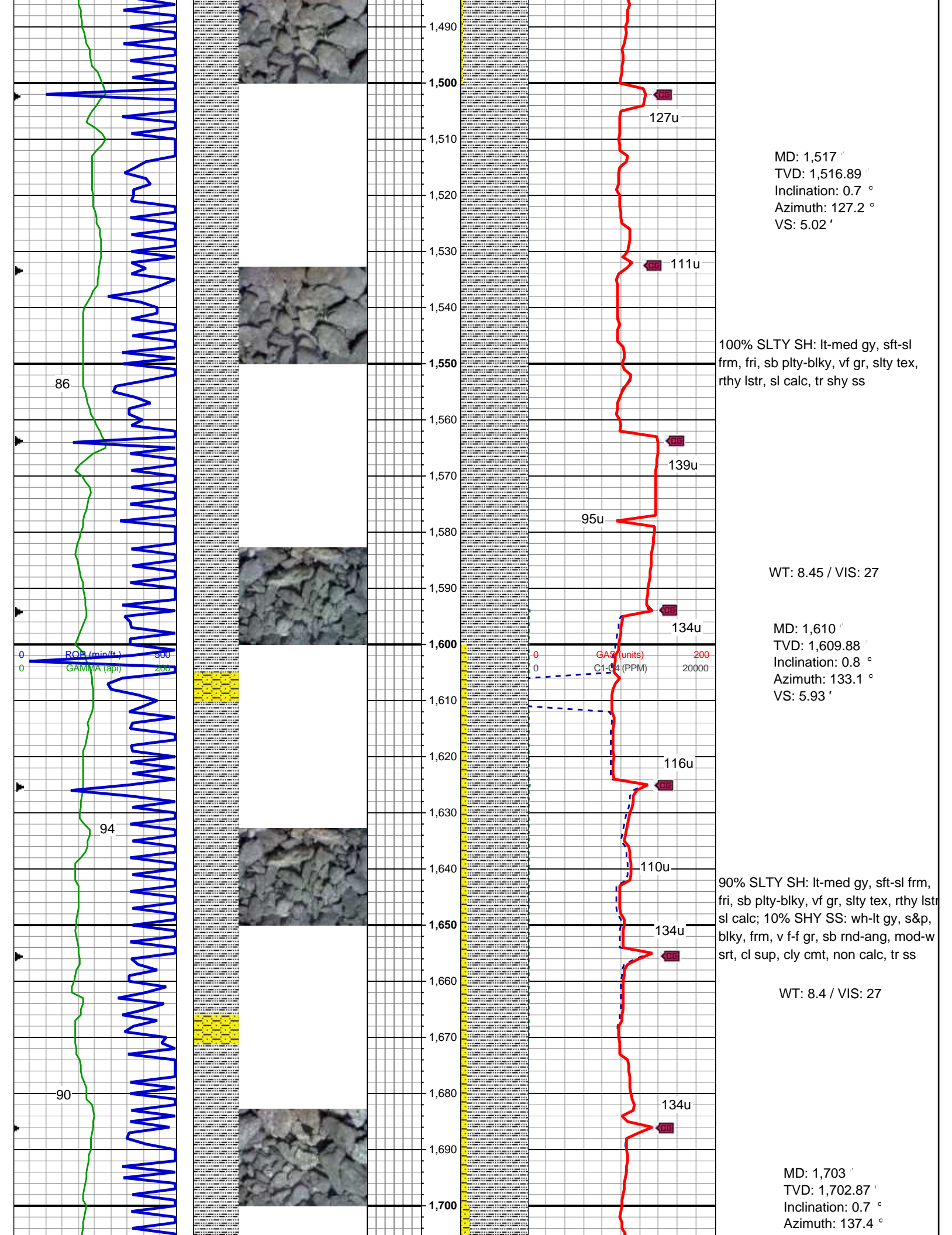
90% SLTY SH: lt-med gy, sft-sl frm, fri, sb plty-blky, vf gr, slty tex, rthy lstr sl calc; 10% SHY SS: wh-lt gy, s&p, blky, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc

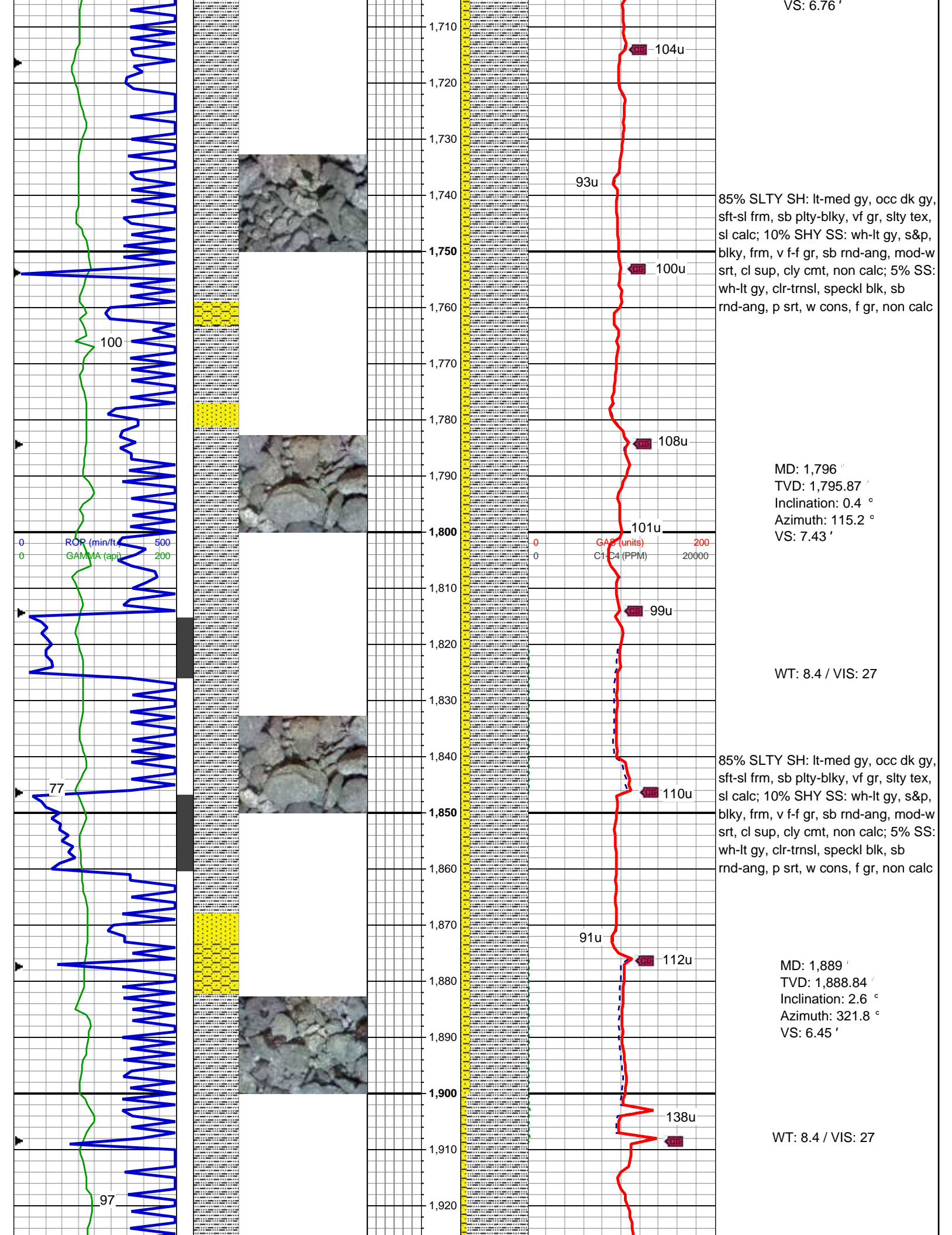




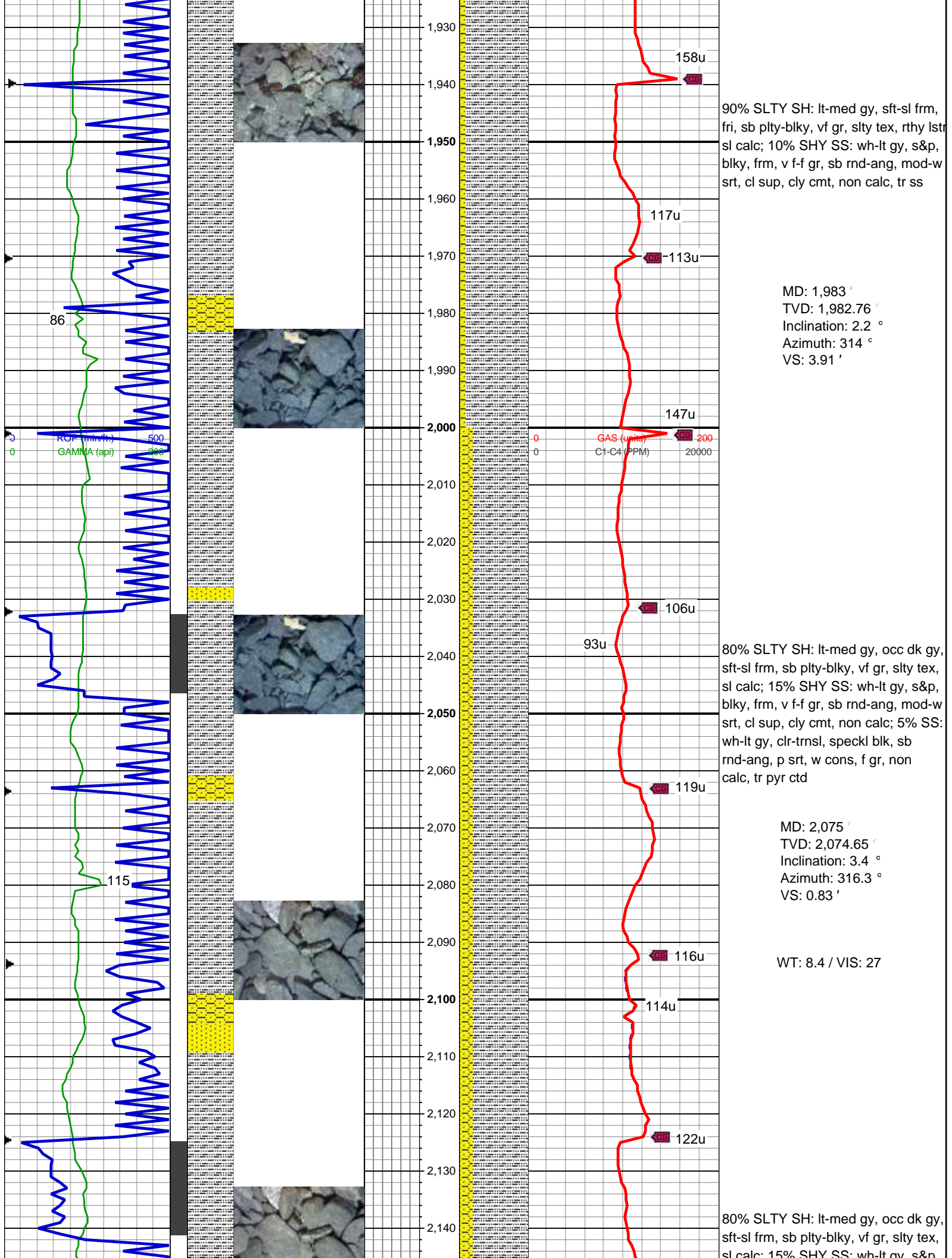


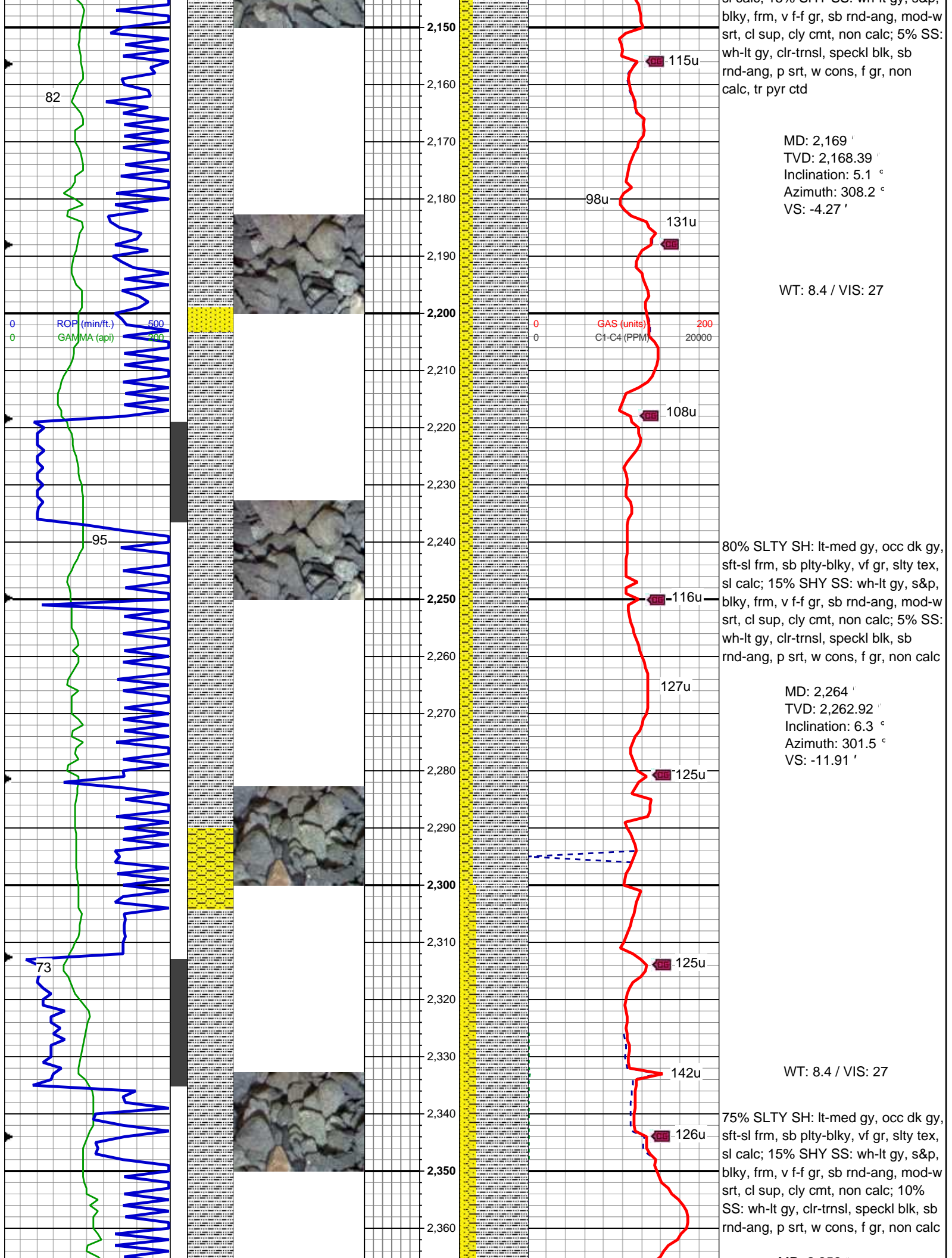




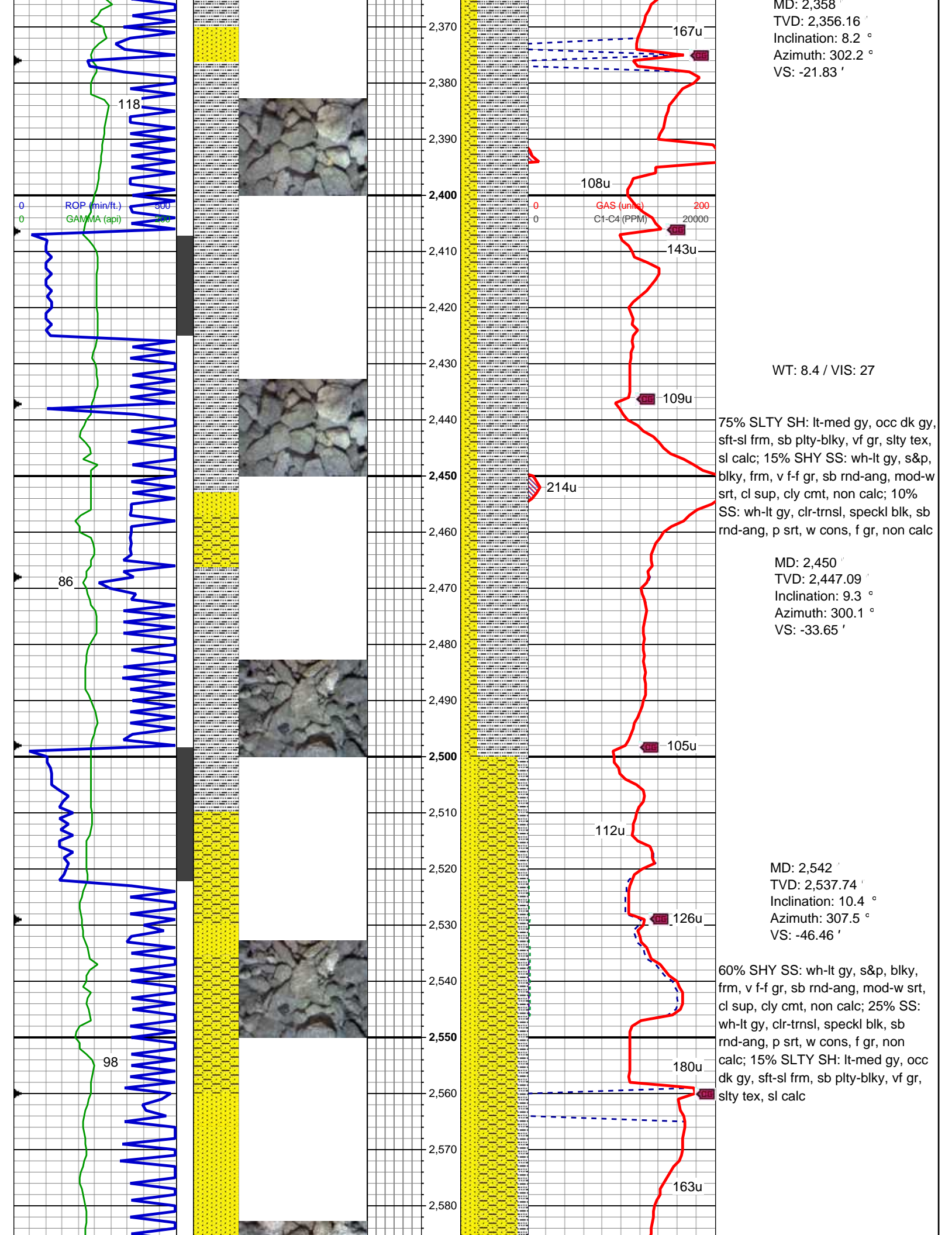




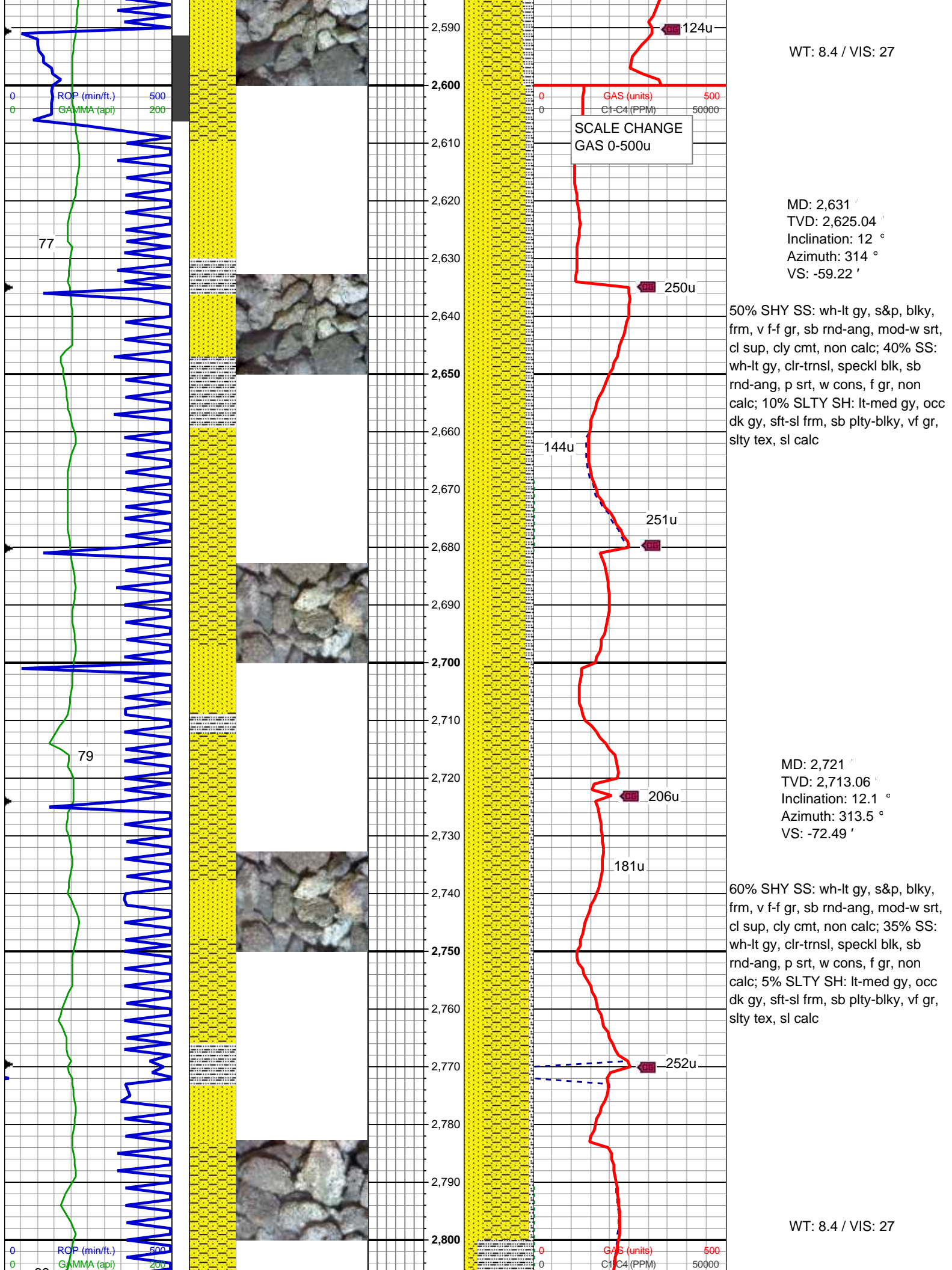


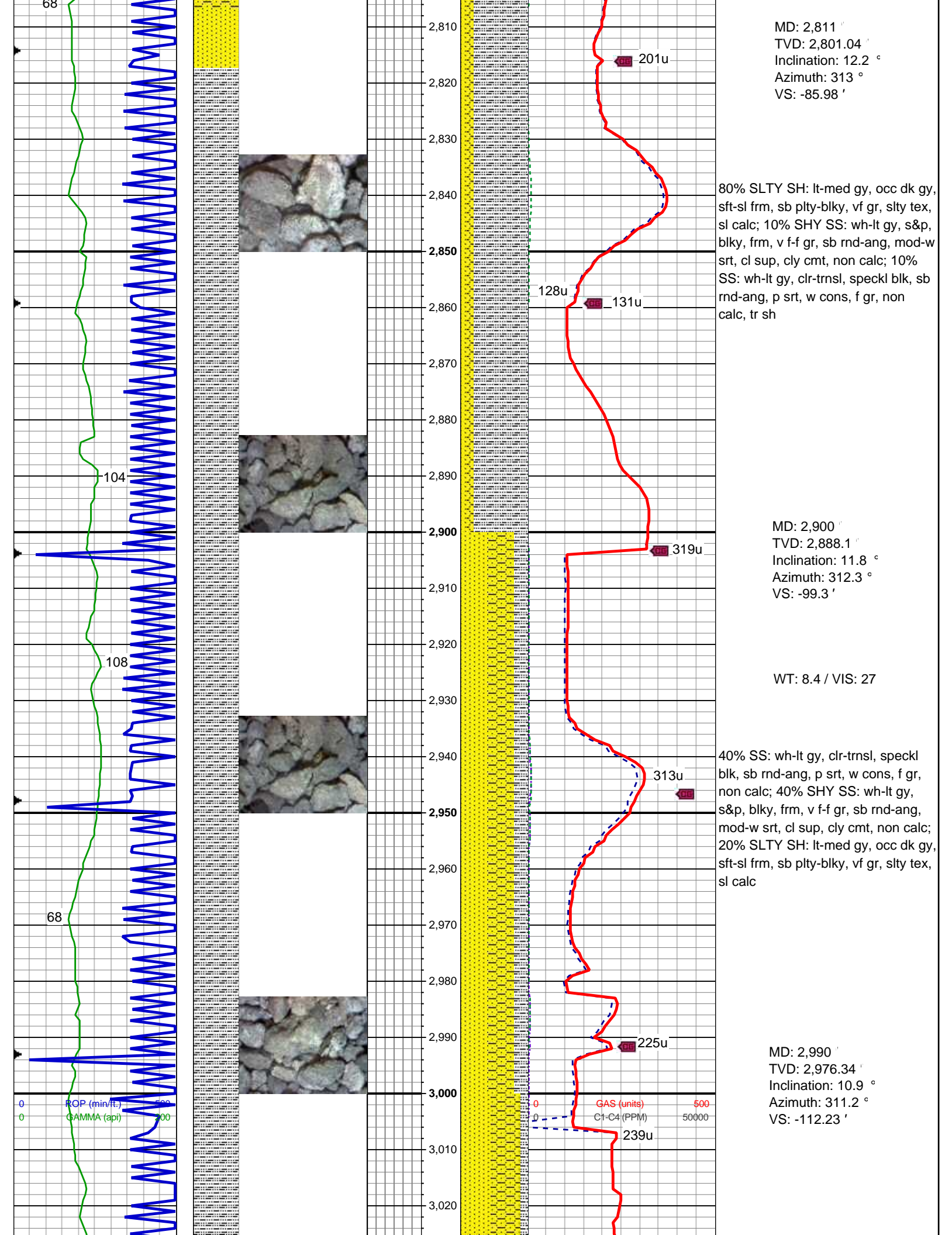




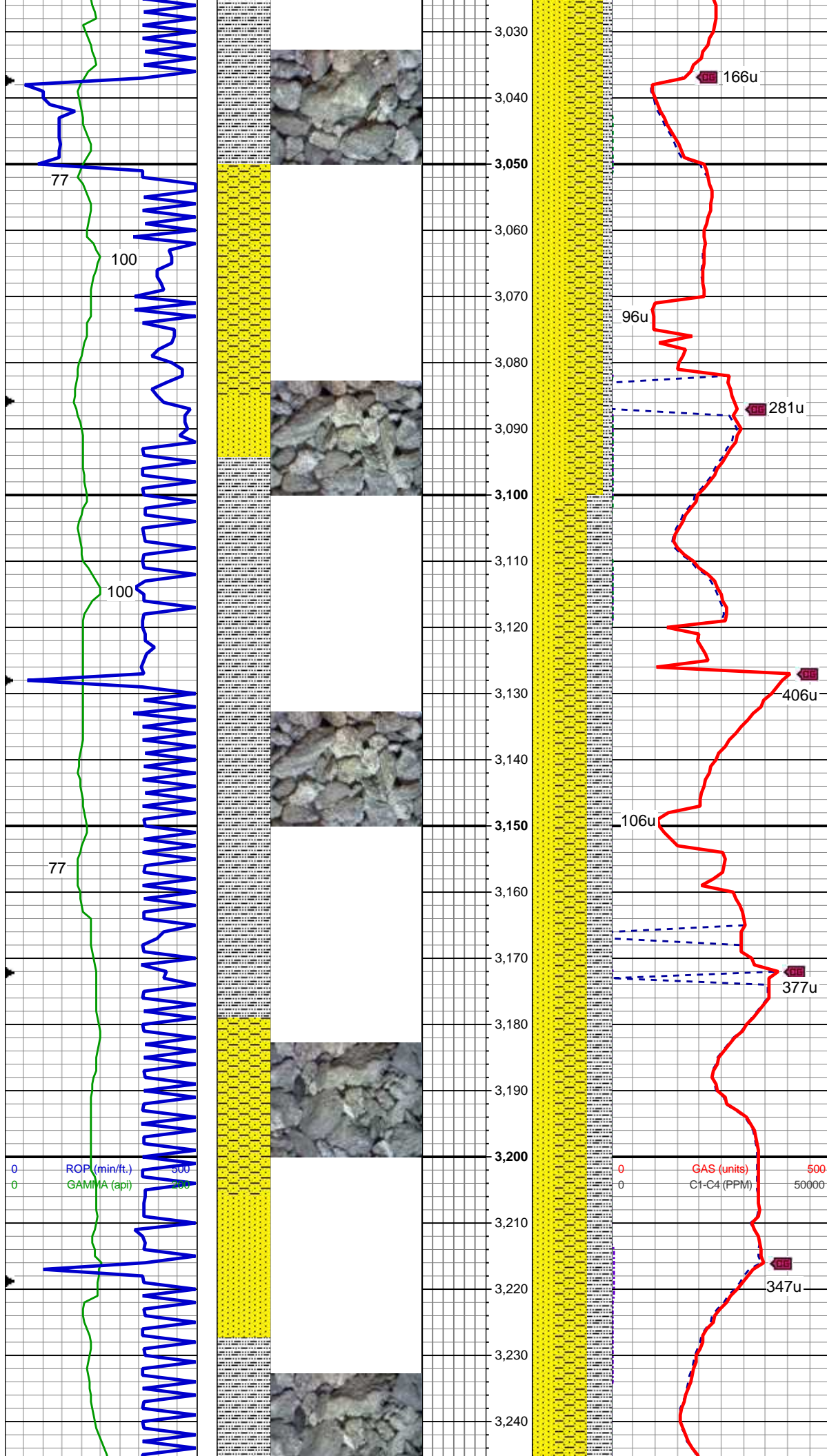












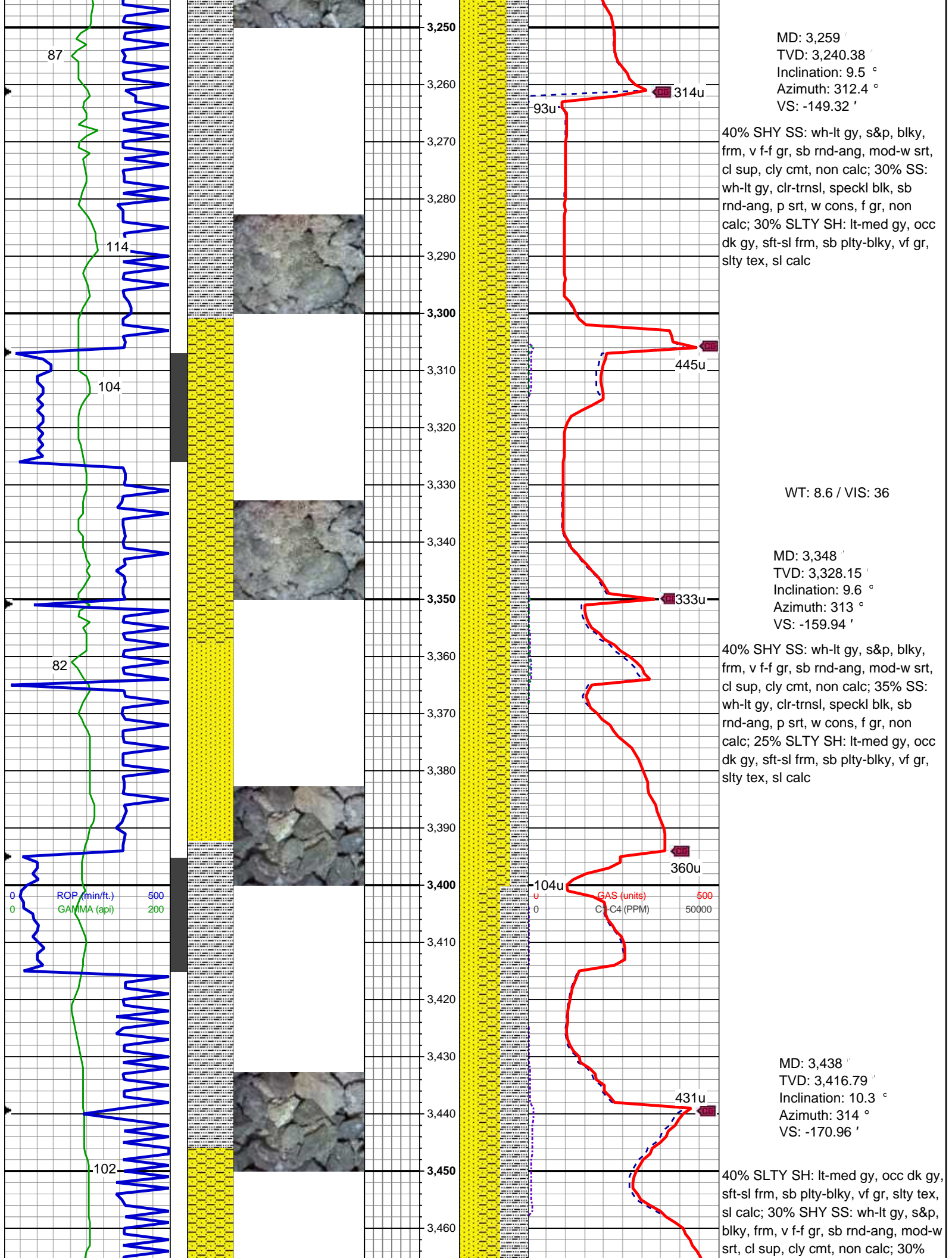
45% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc; 45% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 10% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc

MD: 3,079 '  
TVD: 3,063.58 '  
Inclination: 11.9 °  
Azimuth: 312.8 °  
VS: -125.02 '

40% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 30% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc; 30% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc

MD: 3,169 '  
TVD: 3,151.8 '  
Inclination: 10.9 °  
Azimuth: 312.4 °  
VS: -137.8 '





MD: 3,259 '  
TVD: 3,240.38 '  
Inclination: 9.5 °  
Azimuth: 312.4 °  
VS: -149.32 '

40% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 30% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc; 30% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc

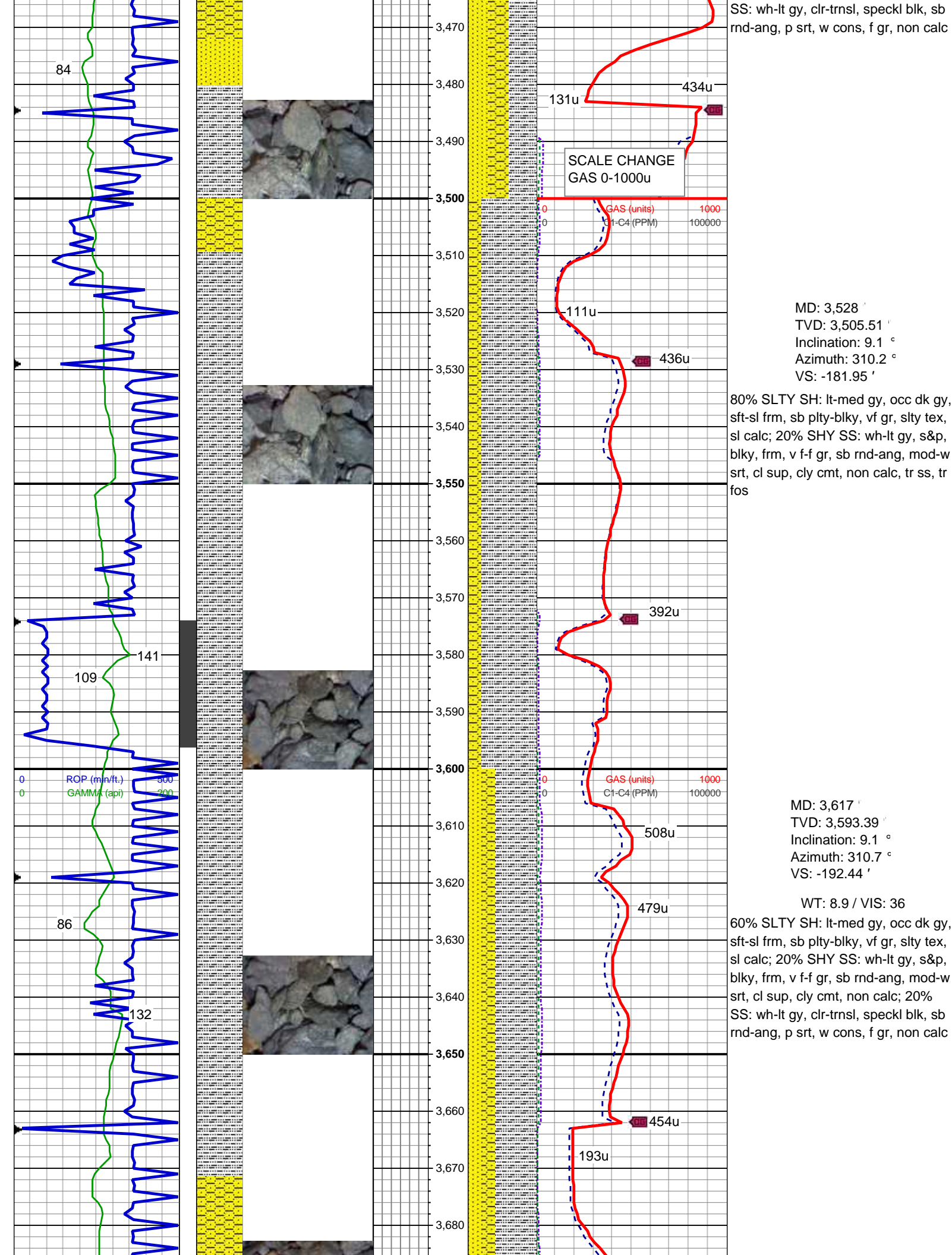
WT: 8.6 / VIS: 36

MD: 3,348 '  
TVD: 3,328.15 '  
Inclination: 9.6 °  
Azimuth: 313 °  
VS: -159.94 '

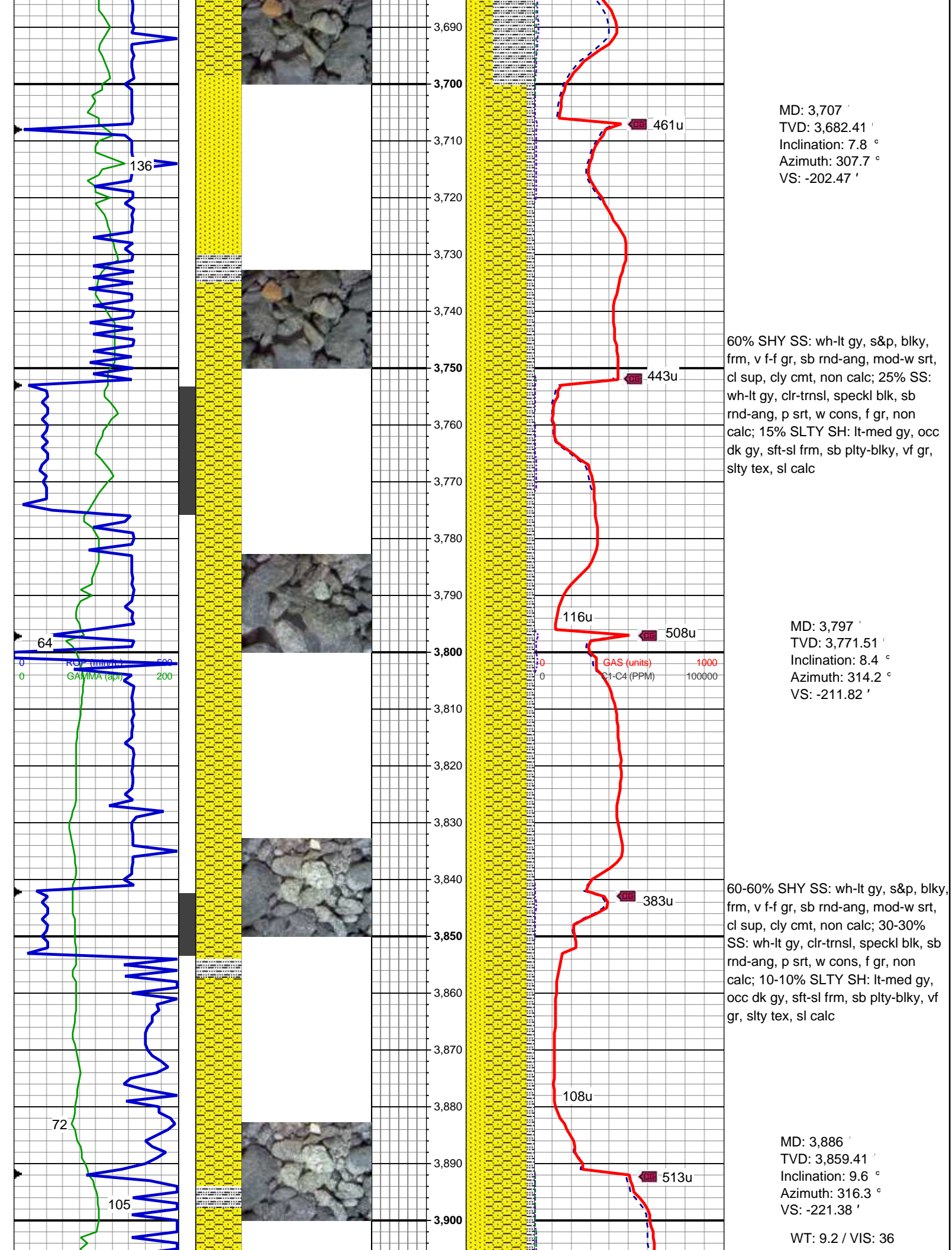
40% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 35% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc; 25% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc

MD: 3,438 '  
TVD: 3,416.79 '  
Inclination: 10.3 °  
Azimuth: 314 °  
VS: -170.96 '

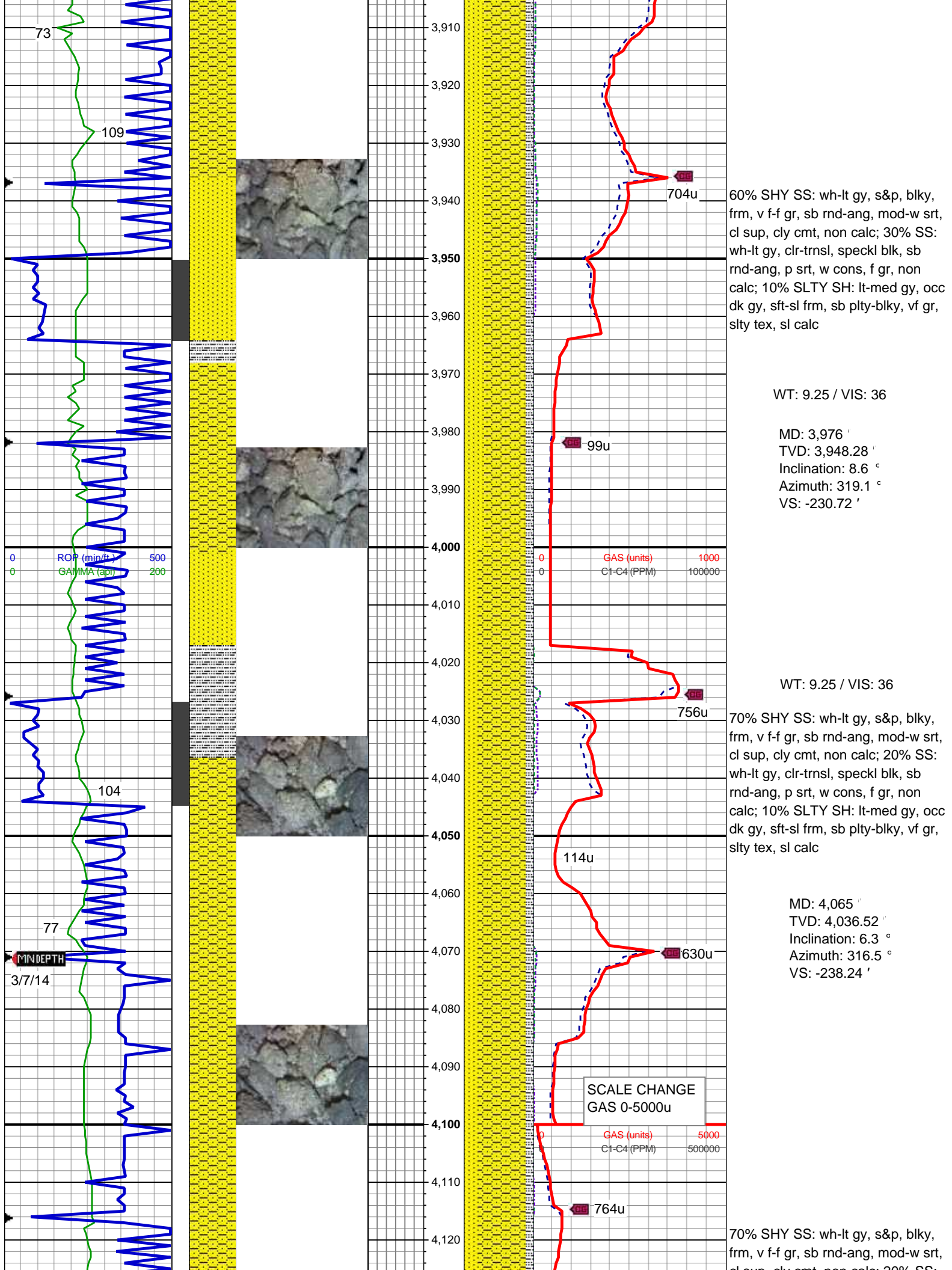
40% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc; 30% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 30%

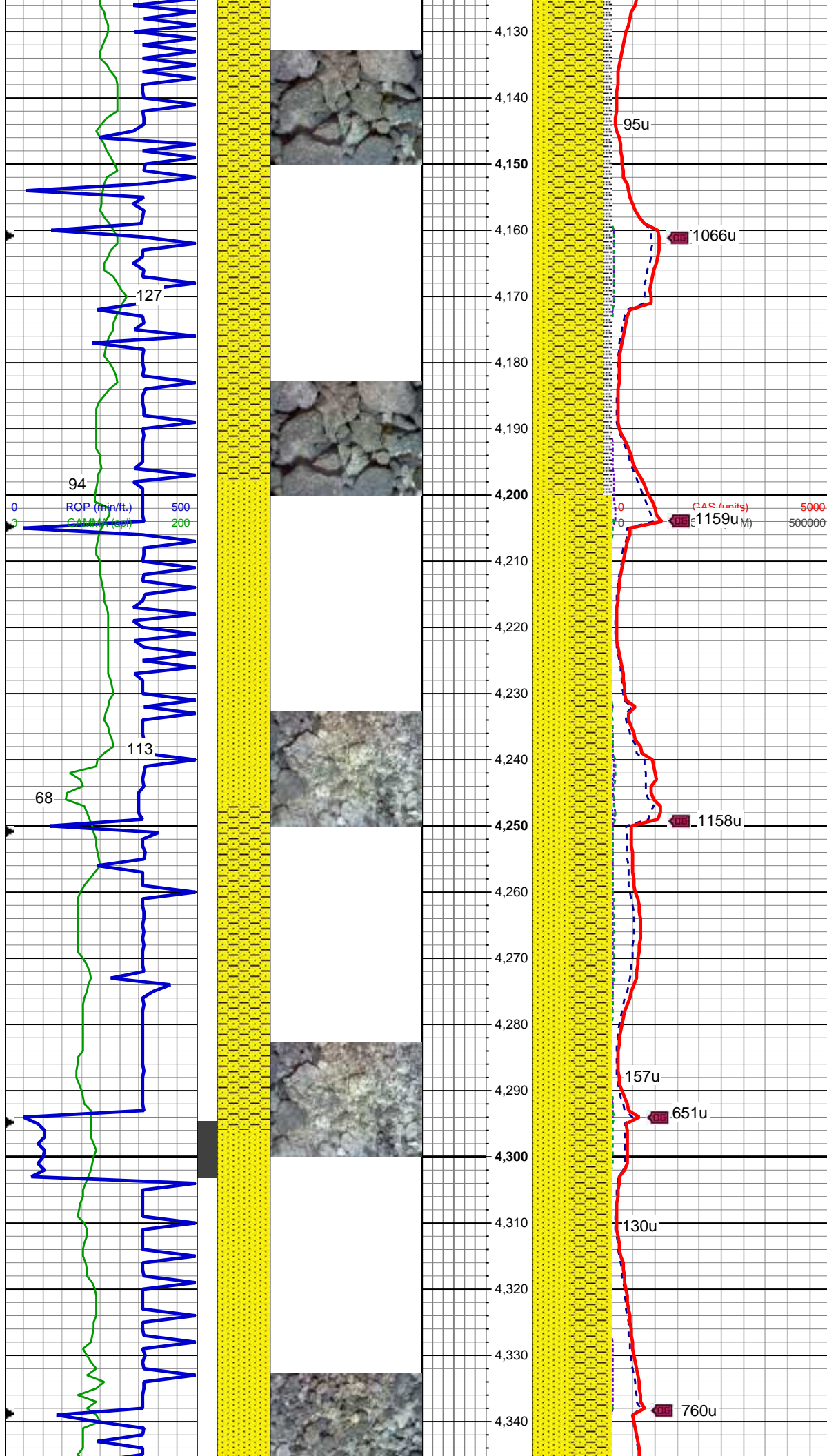












ci sup, cly cmt, non calc; 20% SS:  
wh-lt gy, clr-trnsl, speckl blk, sb  
rnd-ang, p srt, w cons, f gr, non  
calc; 10% SLTY SH: lt-med gy, occ  
dk gy, sft-sl frm, sb plty-blky, vf gr,  
silty tex, sl calc

MD: 4,155 '  
TVD: 4,126.04 '  
Inclination: 5.6 °  
Azimuth: 313.3 °  
VS: -244.68 '

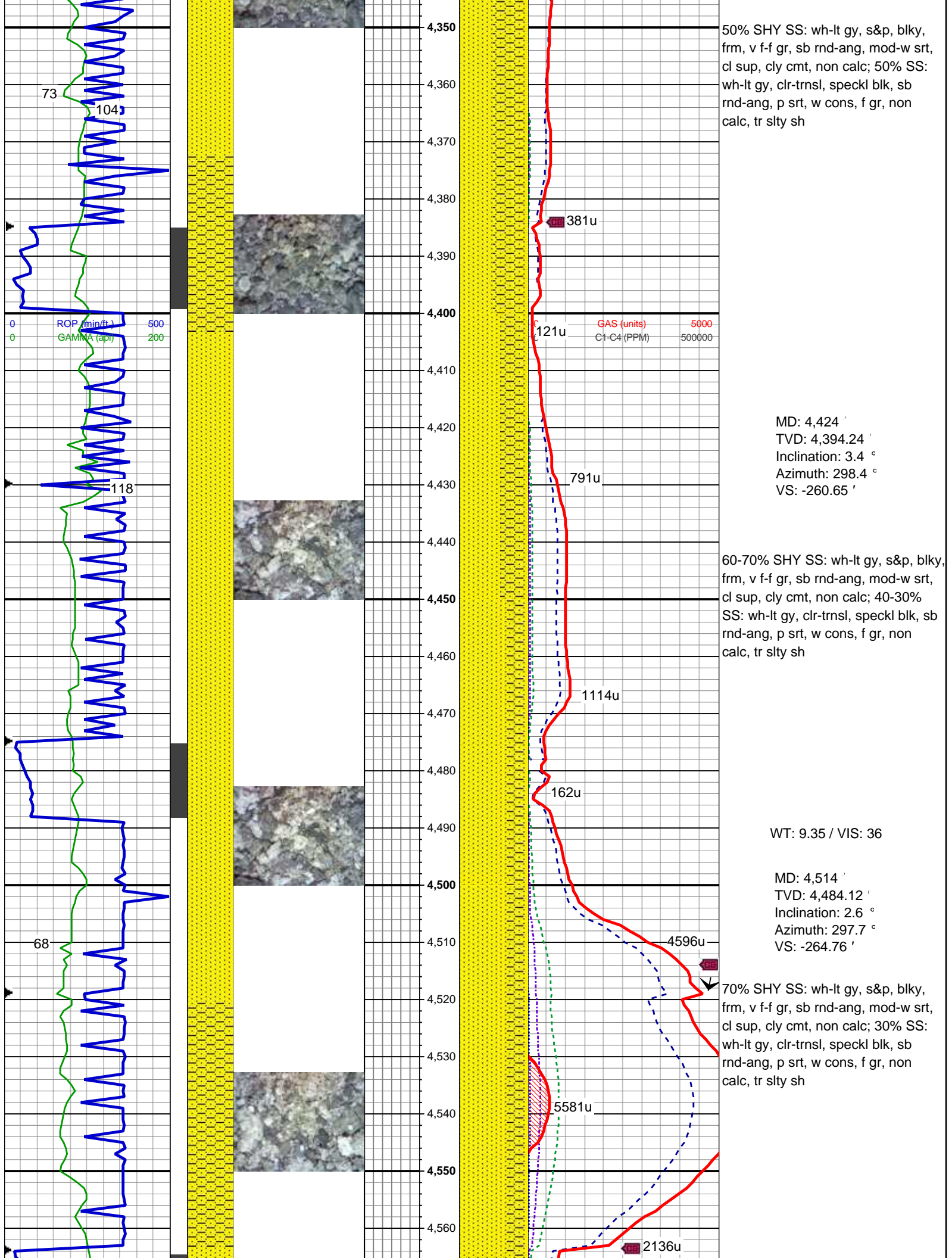
WT: 9.25 / VIS: 36

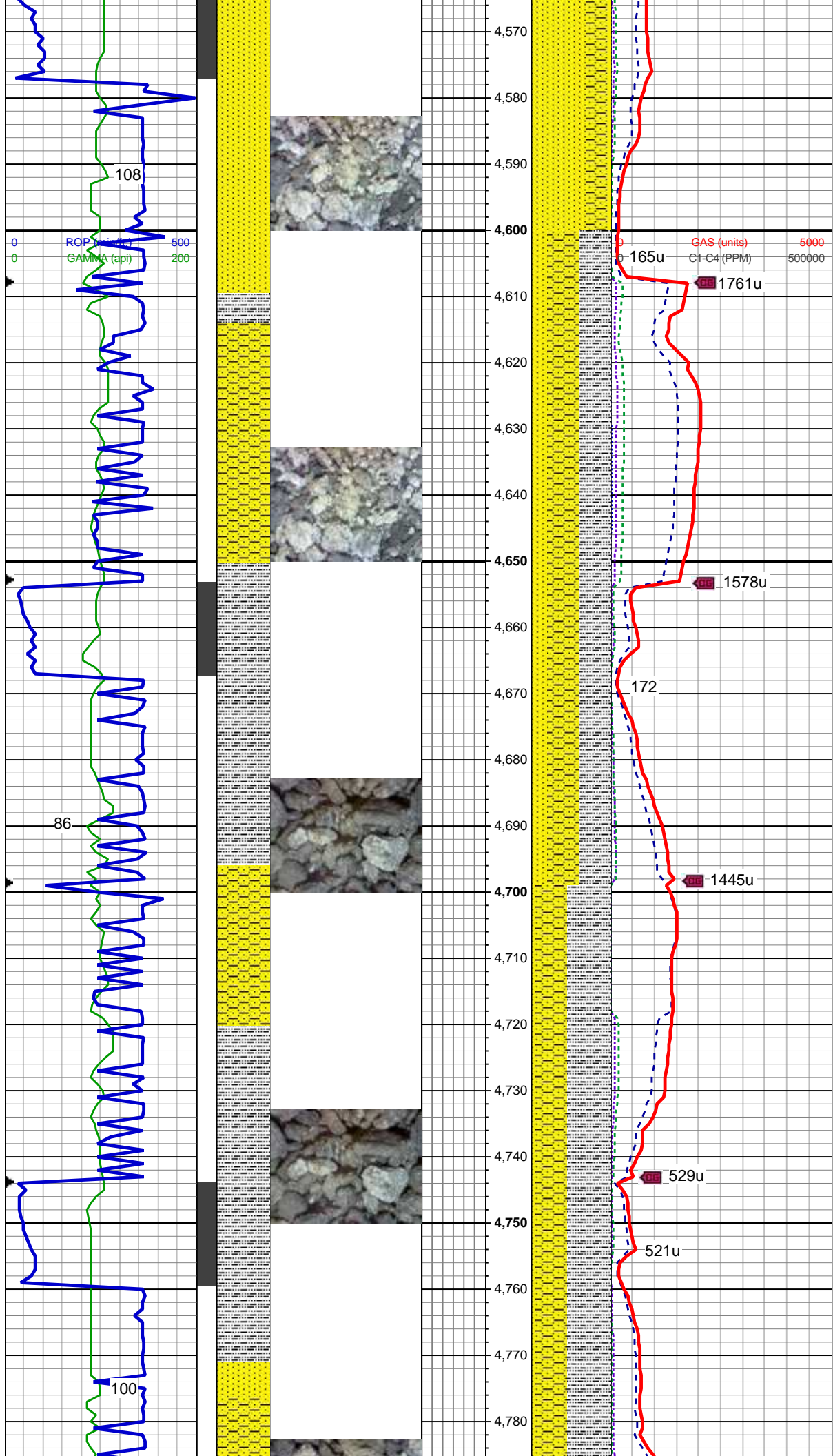
MD: 4,245 '  
TVD: 4,215.68 '  
Inclination: 4.6 °  
Azimuth: 306.1 °  
VS: -250.67 '

50% SHY SS: wh-lt gy, s&p, blk,  
frm, v f-f gr, sb rnd-ang, mod-w srt,  
cl sup, cly cmt, non calc; 50% SS:  
wh-lt gy, clr-trnsl, speckl blk, sb  
rnd-ang, p srt, w cons, f gr, non  
calc, tr slty sh

MD: 4,334 '  
TVD: 4,304.43 '  
Inclination: 4 °  
Azimuth: 308 °  
VS: -255.91 '







MD: 4,603 '  
TVD: 4,573.07 '  
Inclination: 1.2 °  
Azimuth: 281.3 °  
VS: -267.43 '

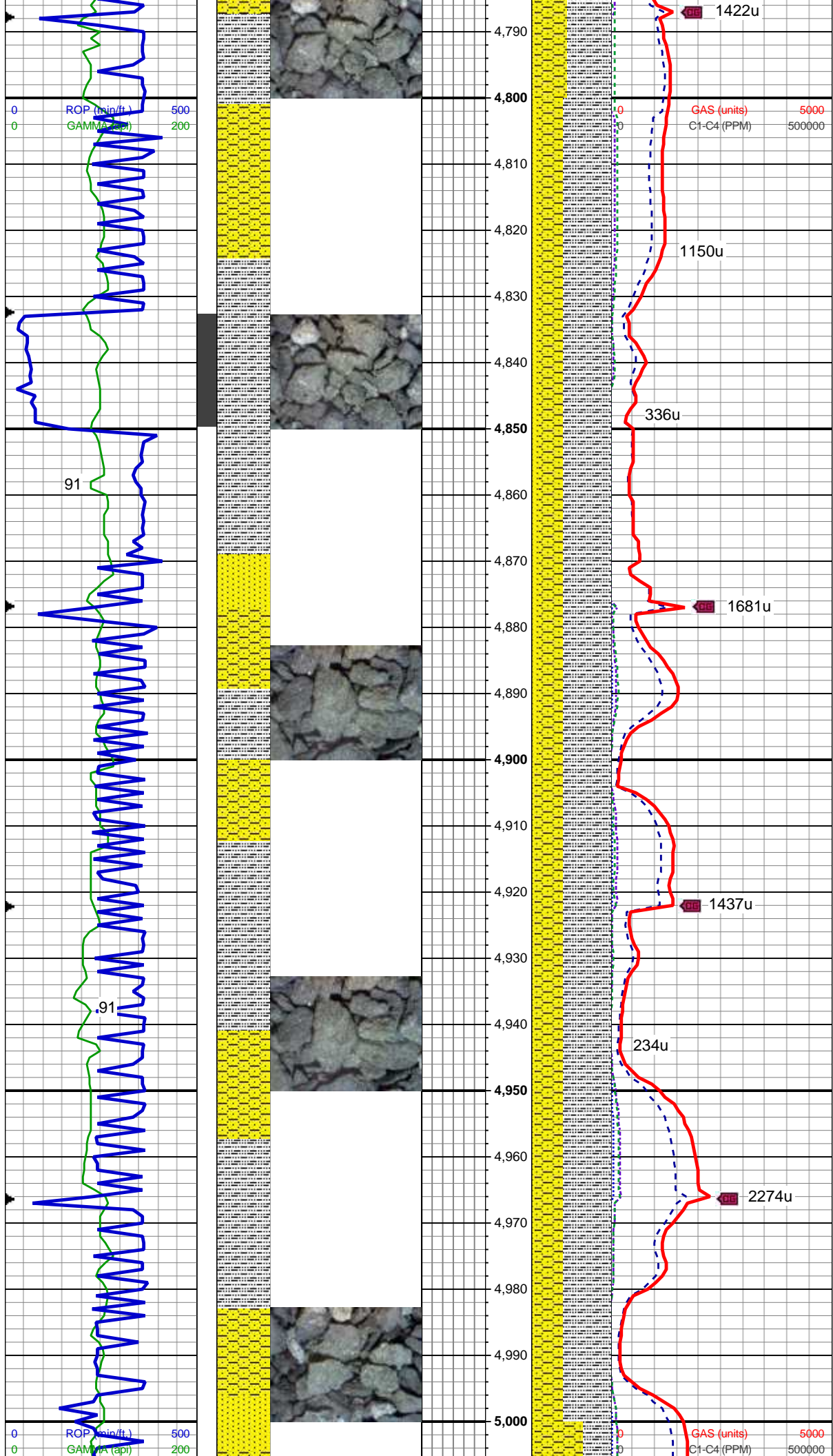
WT: 9.4 / VIS: 36

MD: 4,693 '  
TVD: 4,663.06 '  
Inclination: 0.3 °  
Azimuth: 282.6 °  
VS: -268.58 '

WT: 9.45 / VIS: 36

MD: 4,782 '  
TVD: 4,752.06 '  
Inclination: 0.7 °  
Azimuth: 155.6 °  
VS: -268.59 '





WT: 9.4 / VIS: 36

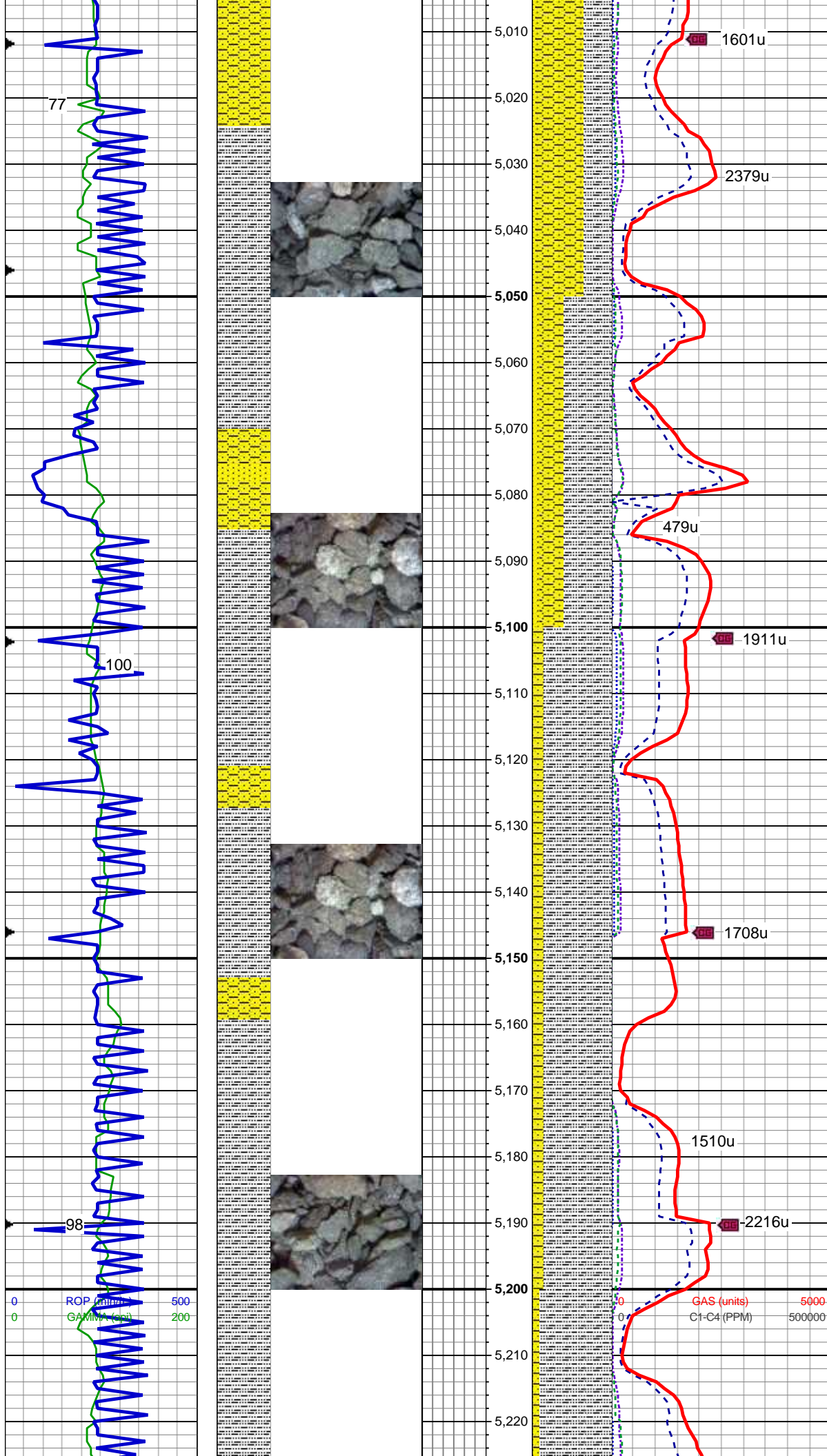
60% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc; 30% SHY SS: wh-lt gy, s&p, blky, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 10% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc

MD: 4,872 '  
TVD: 4,842.05 '  
Inclination: 1.2 °  
Azimuth: 178.1 °  
VS: -268.37 '

WT: 9.6 / VIS: 42

60% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc; 35% SHY SS: wh-lt gy, s&p, blky, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 5% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc

MD: 4,962 '  
TVD: 4,932.03 '  
Inclination: 1.3 °  
Azimuth: 211.4 °  
VS: -268.91 '



MD: 5,052 '  
TVD: 5,022 '  
Inclination: 1.5 °  
Azimuth: 209.3 °  
VS: -270.06 '

35-60% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc; 60-30% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc; 5-10% SS: wh-lt gy, clr-trnsl, speckl blk, sb rnd-ang, p srt, w cons, f gr, non calc

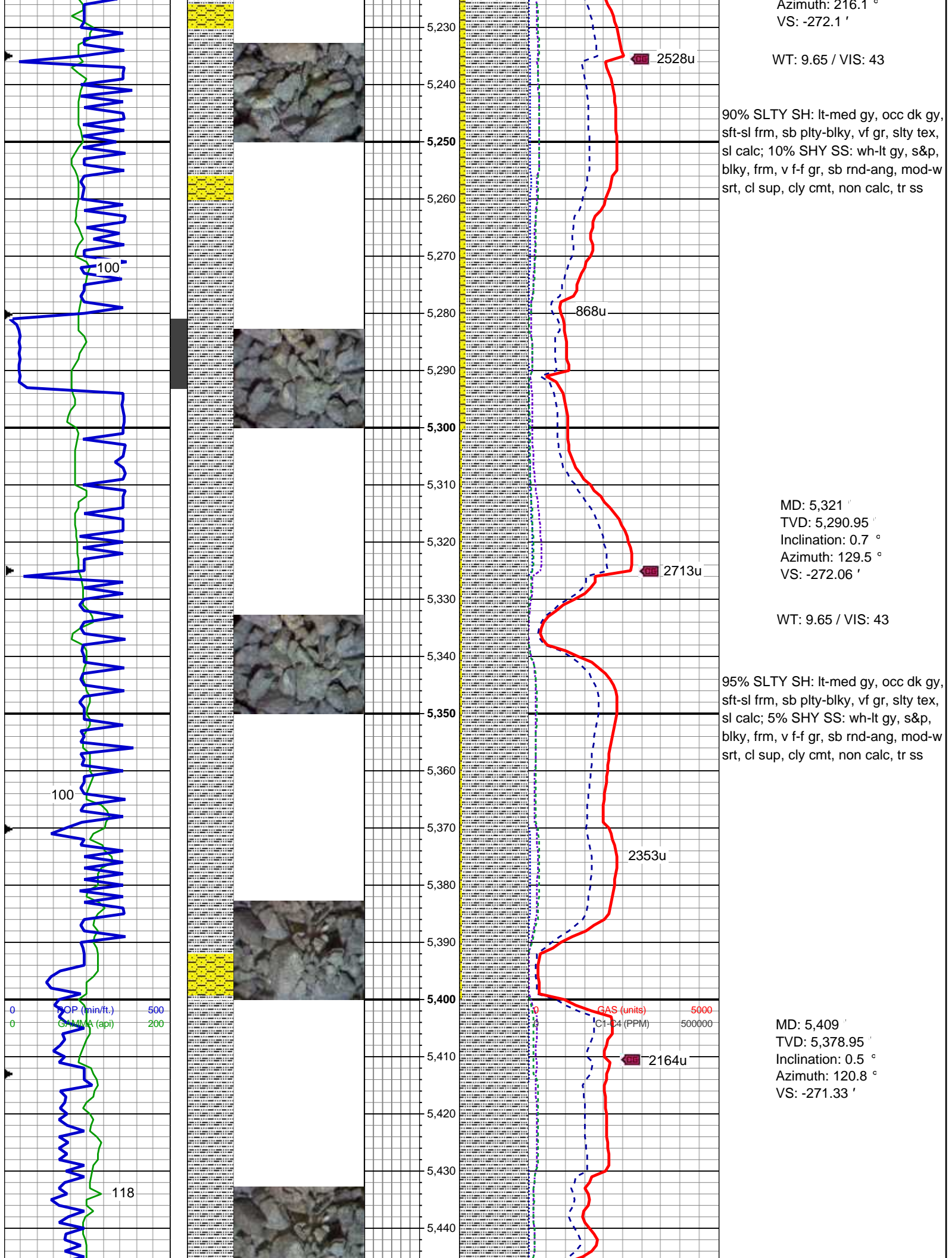
WT: 9.6 / VIS: 42

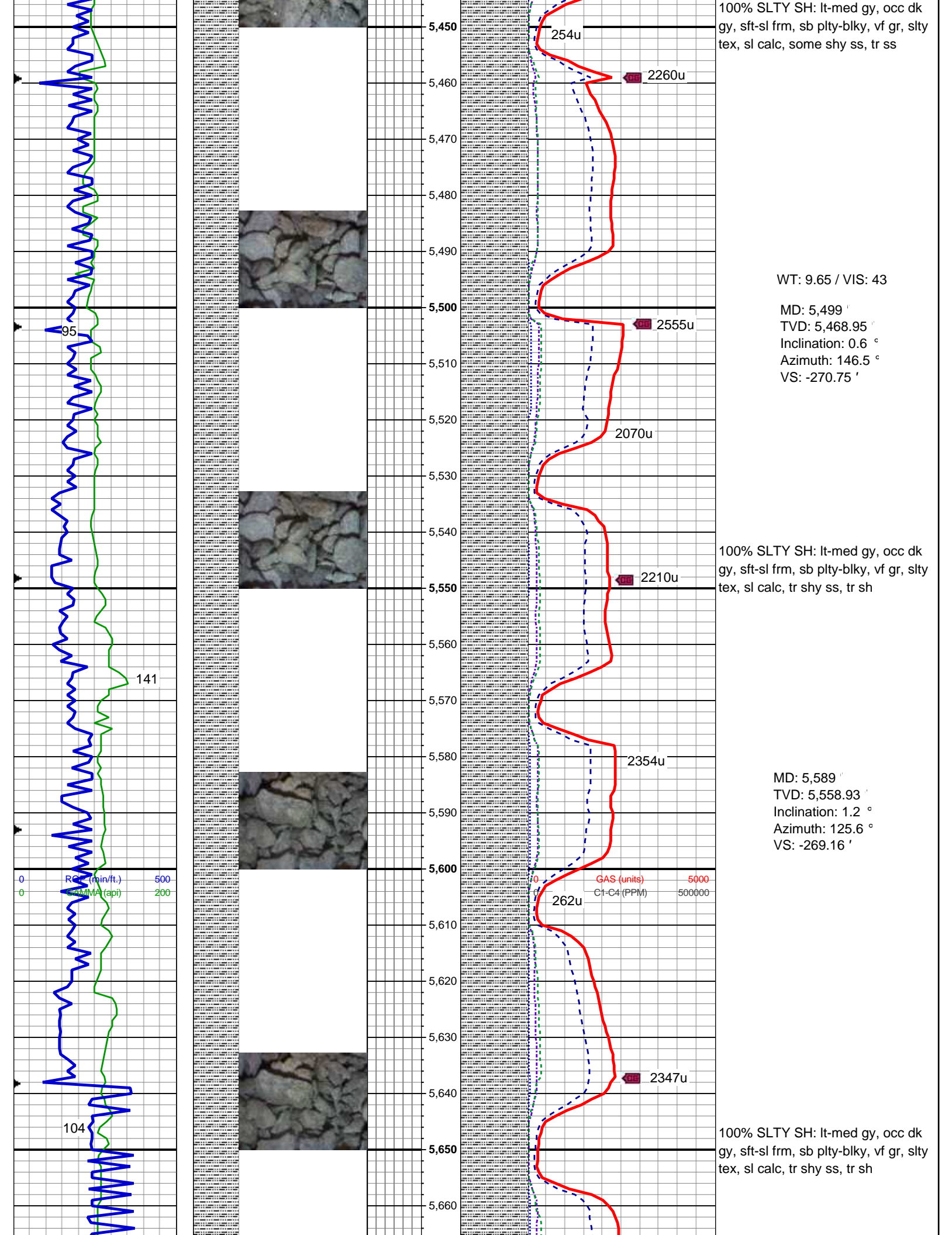
MD: 5,141 '  
TVD: 5,110.97 '  
Inclination: 1.2 °  
Azimuth: 213.1 °  
VS: -271.18 '

85% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc; 15% SHY SS: wh-lt gy, s&p, blk, frm, v f-f gr, sb rnd-ang, mod-w srt, cl sup, cly cmt, non calc, tr ss

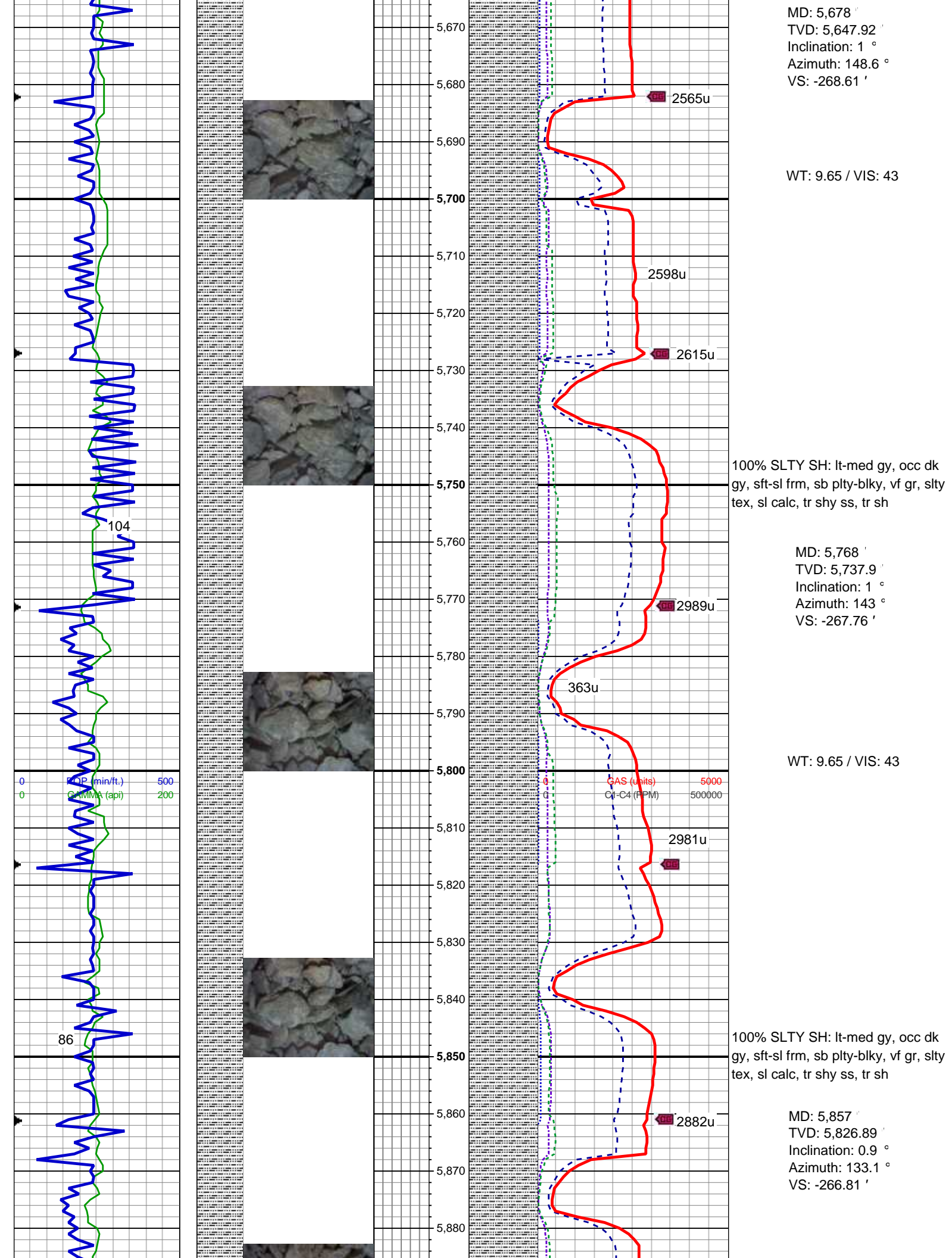
MD: 5,231 '  
TVD: 5,200.96 '  
Inclination: 0.8 °

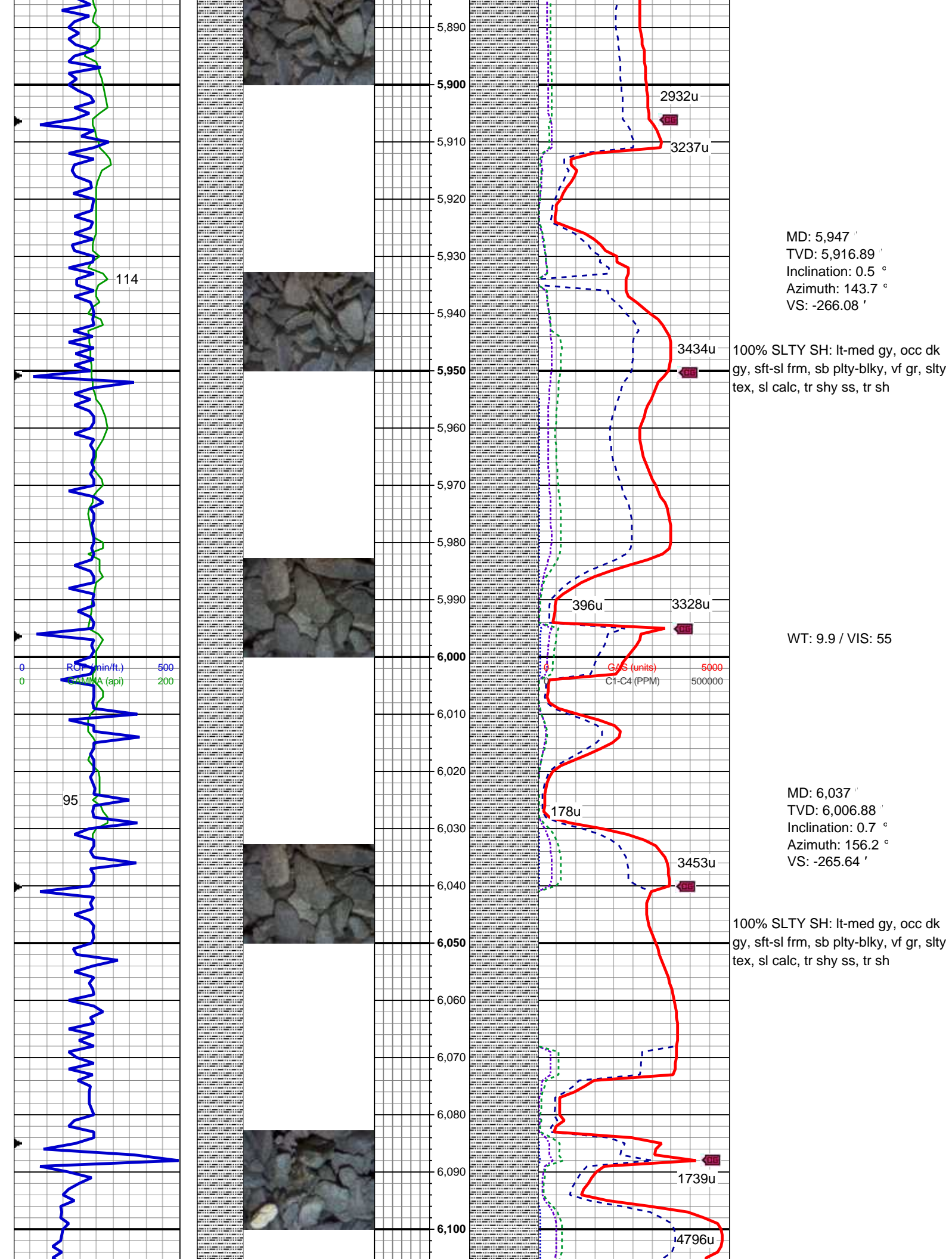




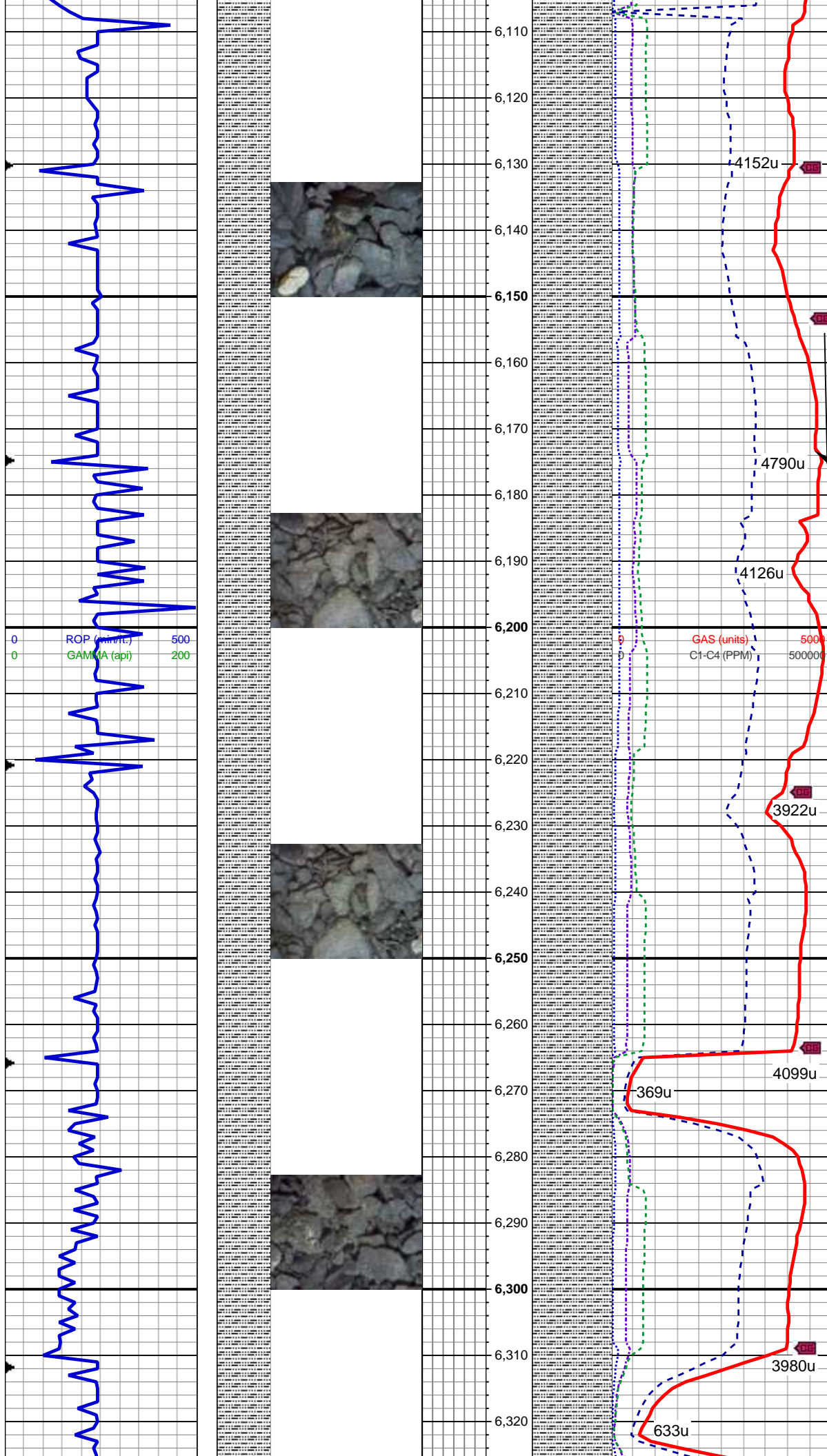










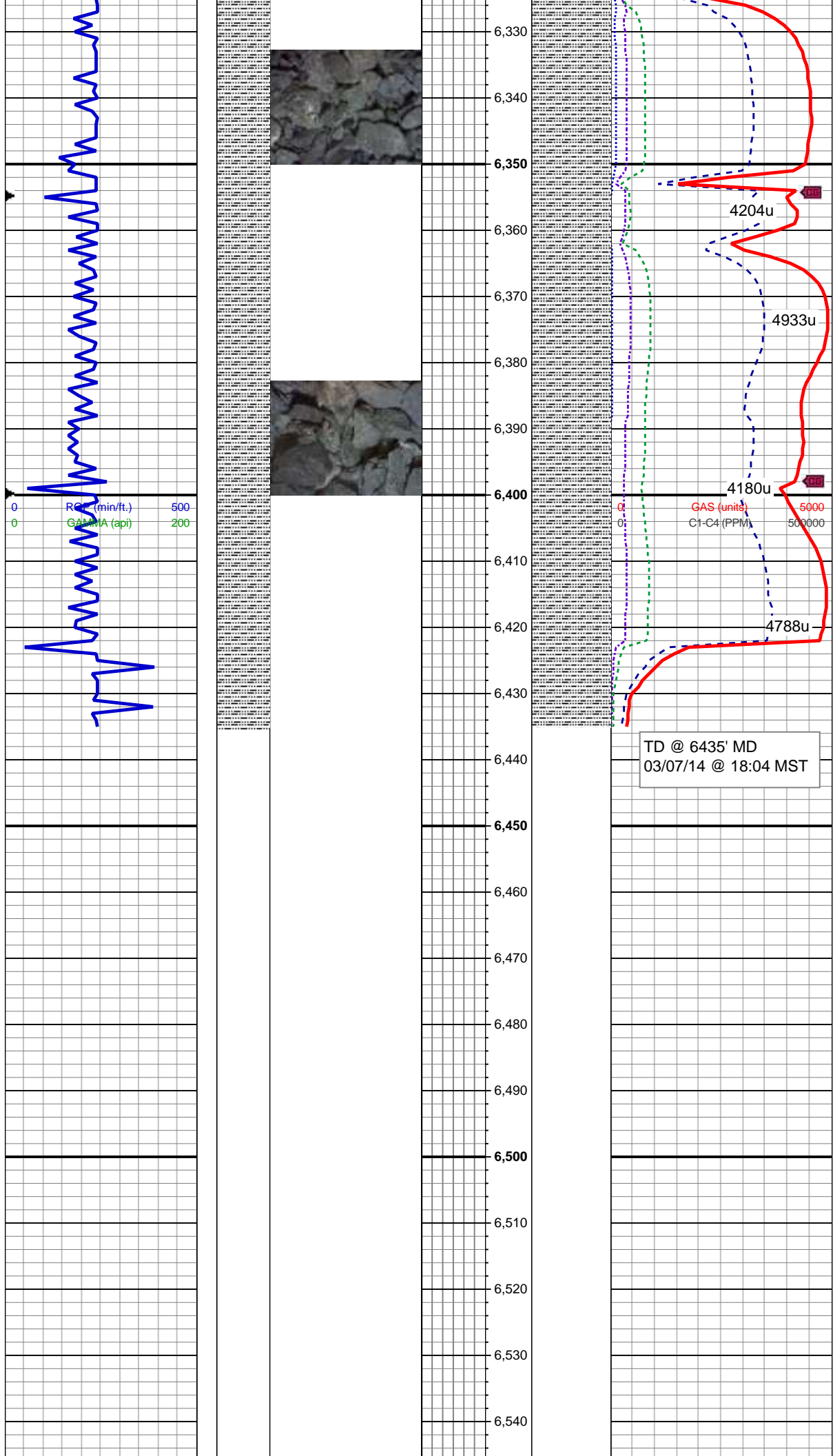


WT: 10.1 / VIS: 54

100% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc, tr shy ss, tr sh, tr ss

100% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc, tr shy ss, tr sh

100% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty



tex, sl calc, tr shy ss, tr sh

WT: 9.8 / VIS: 50

100% SLTY SH: lt-med gy, occ dk gy, sft-sl frm, sb plty-blky, vf gr, slty tex, sl calc, tr shy ss, tr sh

WT: 9.9 / VIS: 46

Log Continues on  
Sandau K25-65-1HN-HORZ

Thank you for using  
Columbine Logging, Inc.



0 ROP (min/ft.) 500  
0 GAMMA (api) 200

6,550

6,560

6,570

6,580

6,590

6,600

6,610

6,620

6,630

6,640

6,650

6,660

6,670

6,680

6,690

6,700

6,710

6,720

6,730

6,740

6,750

6,760

0 GAS (units) 5000  
0 C1-C4 (PPM) 500000

ROP (min/ft.) 500  
GAMMA (api) 200

6,770  
6,780  
6,790  
6,800  
6,810  
6,820  
6,830  
6,840  
6,850  
6,860  
6,870  
6,880  
6,890  
6,900  
6,910  
6,920  
6,930  
6,940  
6,950  
6,960  
6,970  
6,980

GAS (units) 5000  
C1-C4 (PPM) 500000



[illegible]

A vertical number line with major tick marks every 10 units, labeled from 6,990 to 7,060. Minor tick marks are present every 1 unit. A shaded gray region is located between 7,040 and 7,050, with a darker gray area between 7,045 and 7,048.

0	GAS (units)	5000
0	C1-C4 (PPM)	500000