RESERVOIR GROUP

Scale: 5" / 100'
Measured Depth Log

Well Name	BEF West 17		
Location	Section 2, Township 1S, Range 66W		
State	Colorado	**County**	Adams
Country	USA	**Rig Number**	True 33
API Number	05-001-10223	**AFE #**	10223
Geographic Region	Rockies	**Field**	Wattenberg
Spud Date	12/24/2018	**Drilling Completed**	1/26/2018
Surface Coordinates	2120' FNL & 321' FEL, Sec. 2, T1S, R66W Latitude: 39.99472, Longitude: -104.7347		
Bottom Hole Coordinates	1349' FNL & 460' FWL, Sec. 2, T1S, R66W		
Ground Elevation	5,049'	**K.B. Elevation**	5,076'
Logged Interval	5,000' **To** 7,960'	**Total Depth**	12,267'
Formation	Niobrara C		
Type of Drilling Fluid	Water Based Mud		

Operator

Company Petro Operating Company, LLC

Address 9033 East Easter Place, Suite 112
Centennial, CO 80112-2105

Petro Operating Company, LLC

Geologist

Name Michael Domenick

Company Petro Operating Company, LLC

Address 9033 East Easter Place, Suite 112
Centennial, CO 80112-2105

Zone Color Coding

Oil	Condensate	Gas
Note	Core	Pressure
Error	Water	Seal

Petro Operating Company, LLC

Other

Loggers: Byron Pitulski/Greg Diefenbach

Services Provided: 2 Man Logging, Geosteering

Equipment: ML-585

Start Date 01/23/2018

Release Date: 01/26/2019

Job #: 1855RK1812

Rock Types

- UNKNOWN
- ANHYDRITE
- GYPSUM
- SALT
- SIDERITE or LIMONITE
- LIMESTONE
- DOLOMITE
- CHERT
- COAL
- MARLSTONE
- CHALK
- SHALE
- SHALE GRAY
- SHALE COLORED
- SILTSTONE
- SANDSTONE
- CONGLOMERATE
- BRECCIA
- TILL
- BENTONITE
- TUFF
- IGNEOUS
- METAMORPHIC
- CEMENT

Accessories

Fossils

- ALGAE
- AMPHIPORA
- BELEMNITE
- BIOCLASTIC
- BRACHOIPOD
- BRYOZOA
- CEPHALOPOD
- CORAL
- CRINOID
- ECHINOID
- FISH
- FORAMINIFERA
- FOSSIL
- GASTROPOD
- 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
- ORGANIC
- PINPOINT
- VUGGY

Engineering

- BIT
- CASING
- CONNECTION (LEFT)
- CONNECTION (RIGHT)
- FORMATION TOP
- GAS SHOW
- MN DEPTH
- NORMAL FAULT
- OIL SHOW
- OVERTURNED STRATA
- REVERSE FAULT
- SIDEWALL CORE (LEFT)
- SIDEWALL CORE (RIGHT)

Rounding

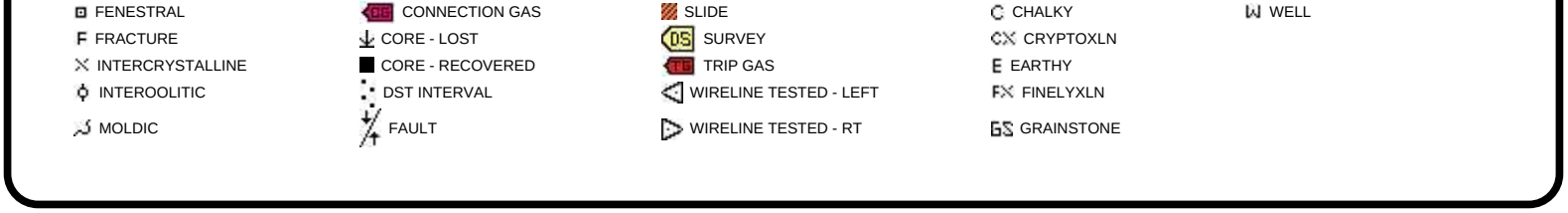
- ANGULAR
- ROUNDED
- SUBANG
- SUBRND

Textures

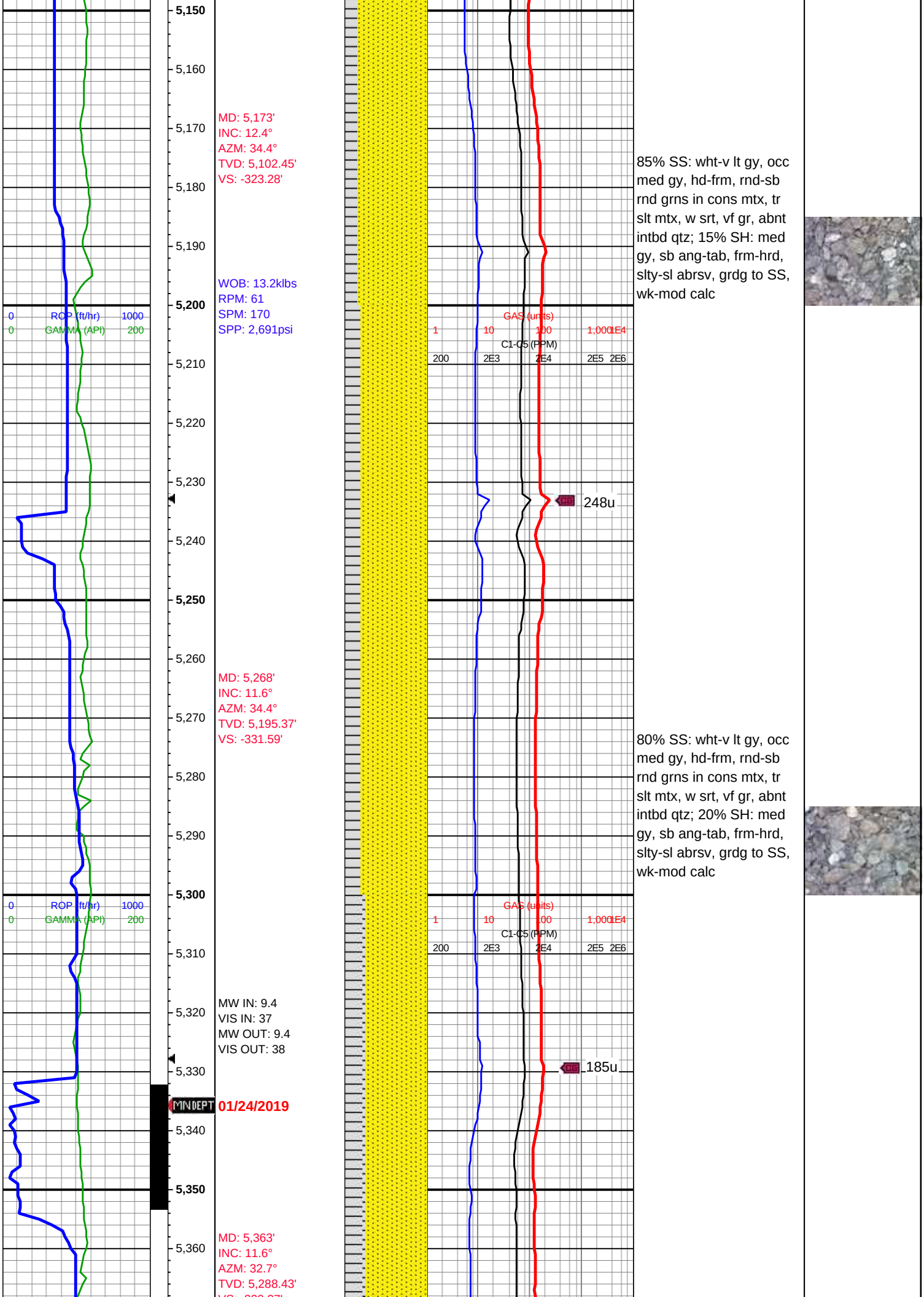
- BOUNDSTONE
- LITHOGRAPHIC
- MICROXLN
- MUDSTONE
- PACKSTONE
- WACKESTONE

Sorting

- MODERATE
- POOR

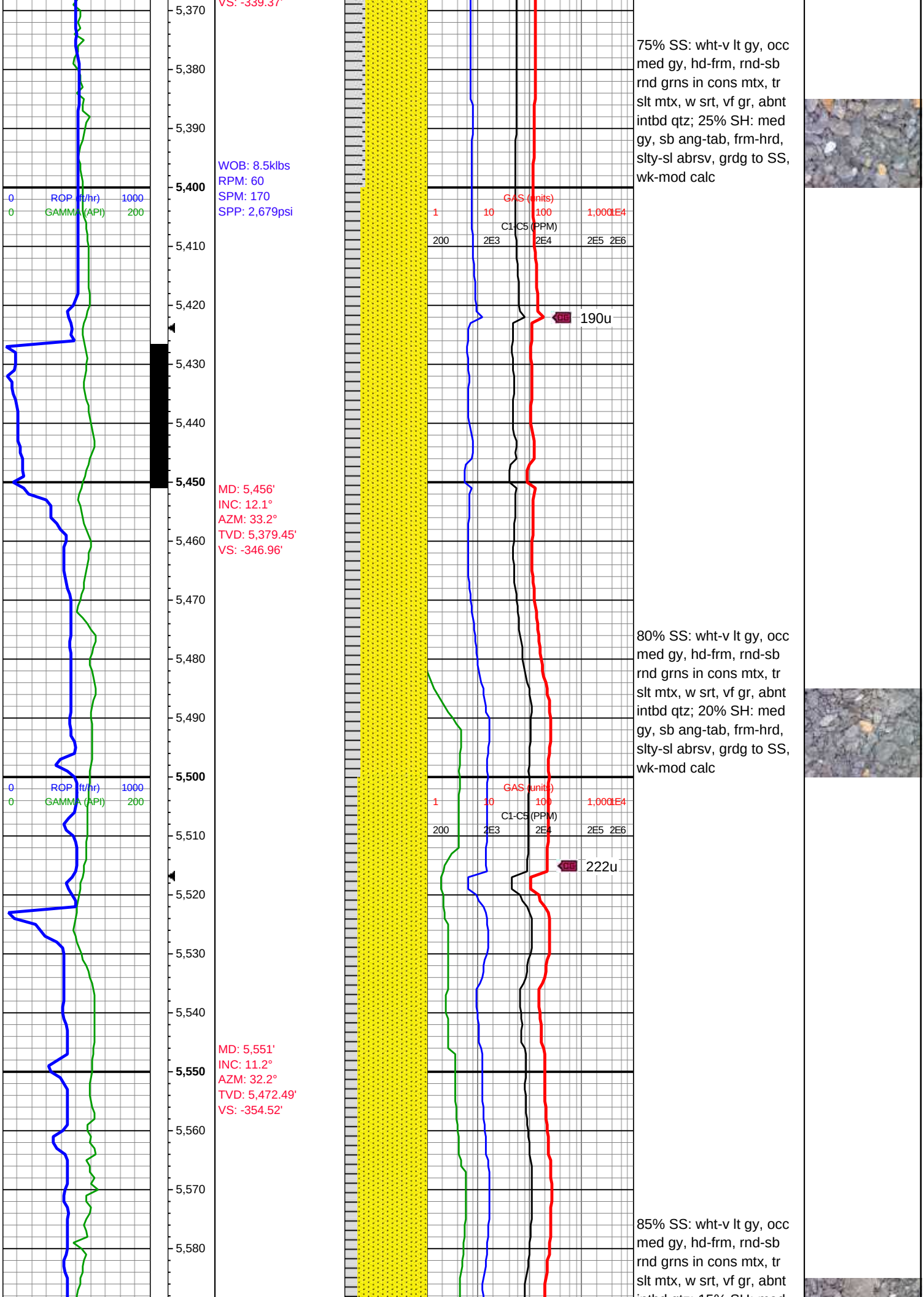

FENESTRAL
CONNECTION GAS
SLIDE
CHALKY
WELL
FRACTURE
CORE - LOST
SURVEY
CRYPTOXLN
INTERCRYSTALLINE
CORE - RECOVERED
TRIP GAS
EARTHY
INTEROOLITIC
DST INTERVAL
WIRELINE TESTED - LEFT
FINELYXLN
MOLDIC
FAULT
WIRELINE TESTED - RT
GRAINSTONE

ROP / GAMMA	Slide/Rotate	Depth Labels	Notes	% Lith	Total Gas (GAS, C1, C2, C3, C4, C5)	Lithology Descriptions	Images
Petro Operating Co. **BEF West 17** **9 5/8' Surface Casing @ 1,535'** **Spud Date: 12/24/2018** **2 Man Logging Began 01/23/2019** **All Depths Correspond to Driller's Pipe Tally** 0 GAMMA (API) 200 0 ROP (ft/hr) 1000 0 GAMMA (API) 200		4,960 4,970 4,980 4,990 **5,000** 5,010 5,020 5,030 5,040 **5,050** 5,060 5,070 5,080 5,090 **5,100** 5,110 5,120 5,130 5,140	Bit #: 2 Type: Z519S(Q) Size: 8.5 Depth In: 1,547' Depth Out: 12,267' Hours: 49.7 hrs Avg Ft/Hr: 216 '/hr Jets: 5x13,3x12 S/N: JP1122 **GD** MW IN: 9.3 VIS IN: 52 MW OUT: 9.3 VIS OUT: 37 MD: 5,078' INC: 13.5° AZM: 33.4° TVD: 5,009.87' VS: -314.5' MW IN: 9.3 VIS IN: 36 MW OUT: 9.3 VIS OUT: 38		**Loggers** **GD - Greg Diefenbach** **BP - Byron Pitulski** **System Calibrated** **1% Methane = 100 Units** **100% Methane = 10000 Units** GAS (units) 1 10 100 1,000 1E4 C1-C5 (PPM) 200 2E3 2E4 2E5 2E6 GG 212u GAS (units) 1 10 100 1,000 1E4 C1-C5 (PPM) 200 2E3 2E4 2E5 2E6 GG 177u	90% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 10% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc	



85% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 15% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc

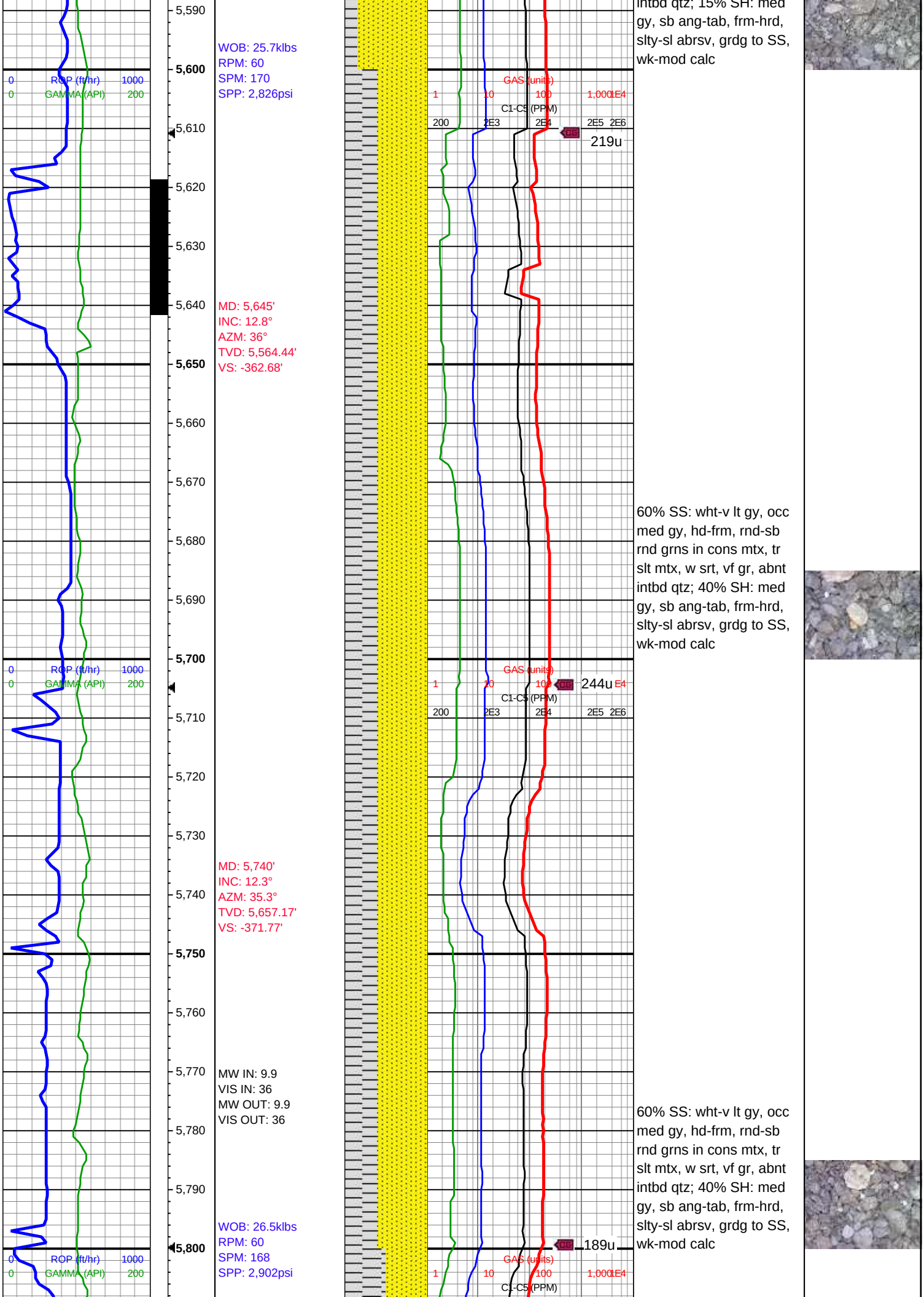
80% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 20% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc

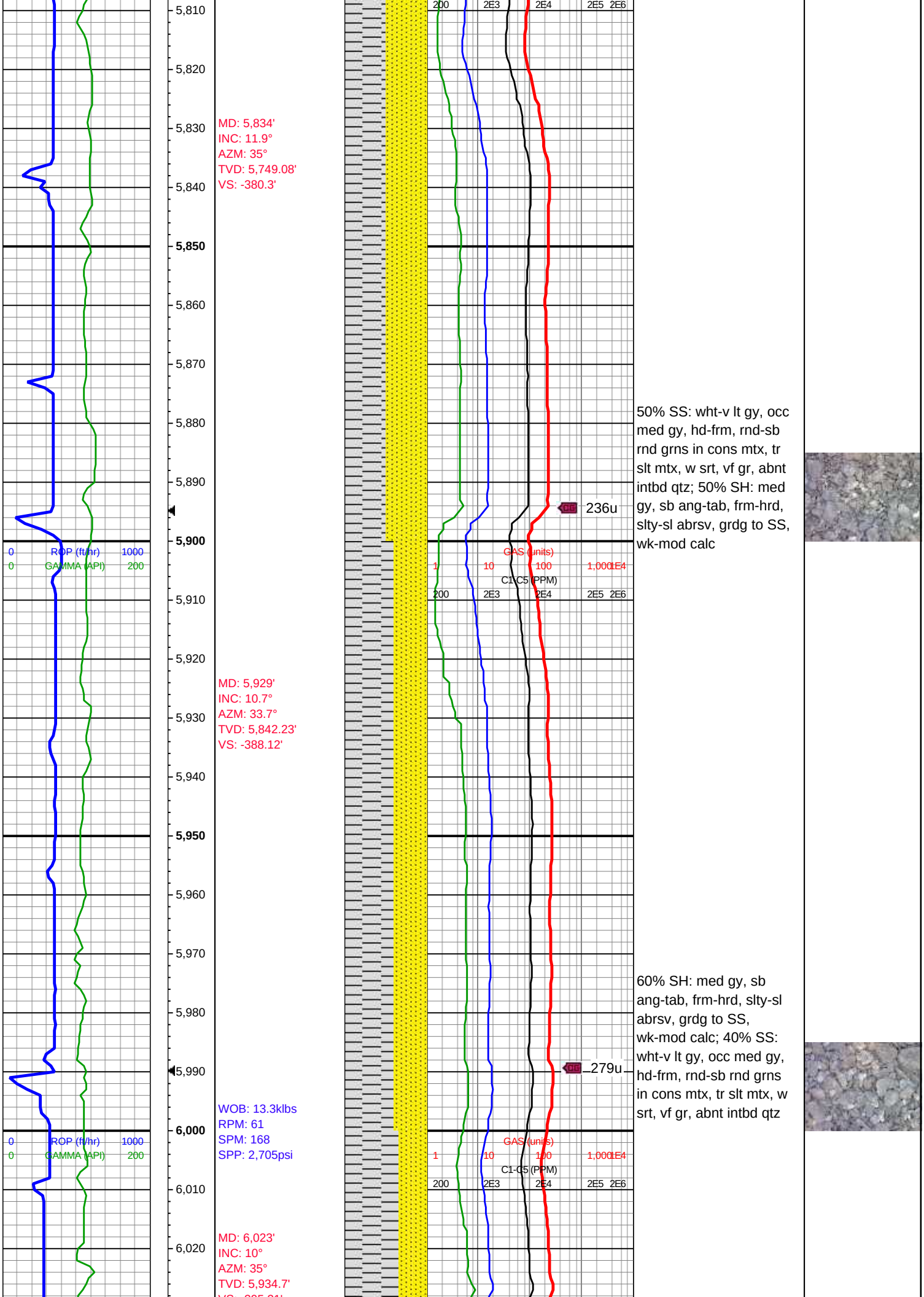


75% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 25% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc

80% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 20% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc

85% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt


0 ROP (ft/hr) 1000
0 GAMMA (API) 200
5,590
5,600
5,610
5,620
5,630
5,640
5,650
5,660
5,670
5,680
5,690
5,700
5,710
5,720
5,730
5,740
5,750
5,760
5,770
5,780
5,790
5,800
WOB: 25.7klbs
RPM: 60
SPM: 170
SPP: 2,826psi
MD: 5,645'
INC: 12.8°
AZM: 36°
TVD: 5,564.44'
VS: -362.68'
MD: 5,740'
INC: 12.3°
AZM: 35.3°
TVD: 5,657.17'
VS: -371.77'
MW IN: 9.9
VIS IN: 36
MW OUT: 9.9
VIS OUT: 36
WOB: 26.5klbs
RPM: 60
SPM: 168
SPP: 2,902psi
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6
219u
244u
189u
intbd qtz; 15% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc
60% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 40% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc
60% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 40% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc


0 ROP (ft/hr) 1000
0 GAMMA (API) 200
5,810
5,820
5,830
5,840
5,850
5,860
5,870
5,880
5,890
5,900
5,910
5,920
5,930
5,940
5,950
5,960
5,970
5,980
5,990
6,000
6,010
6,020
MD: 5,834'
INC: 11.9°
AZM: 35°
TVD: 5,749.08'
VS: -380.3'
MD: 5,929'
INC: 10.7°
AZM: 33.7°
TVD: 5,842.23'
VS: -388.12'
WOB: 13.3klbs
RPM: 61
SPM: 168
SPP: 2,705psi
MD: 6,023'
INC: 10°
AZM: 35°
TVD: 5,934.7'
200 2E3 2E4 2E5 2E6
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
236u
279u
50% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz; 50% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc
60% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc; 40% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz

VS: -395.21'

MW IN: 10
VIS IN: 37
MW OUT: 10
VIS OUT: 40

MD: 6,118'
INC: 9°
AZM: 32°
TVD: 6,028.4'
VS: -401.6'

WOB: 28.1klbs
RPM: 60
SPM: 170
SPP: 2,987psi

MD: 6,212'
INC: 8.5°
AZM: 32.2°
TVD: 6,121.31'
VS: -407.09'

MW IN: 10
VIS IN: 36
MW OUT: 10
VIS OUT: 37

0 ROP (ft/hr) 1000
0 GAMMA (API) 200

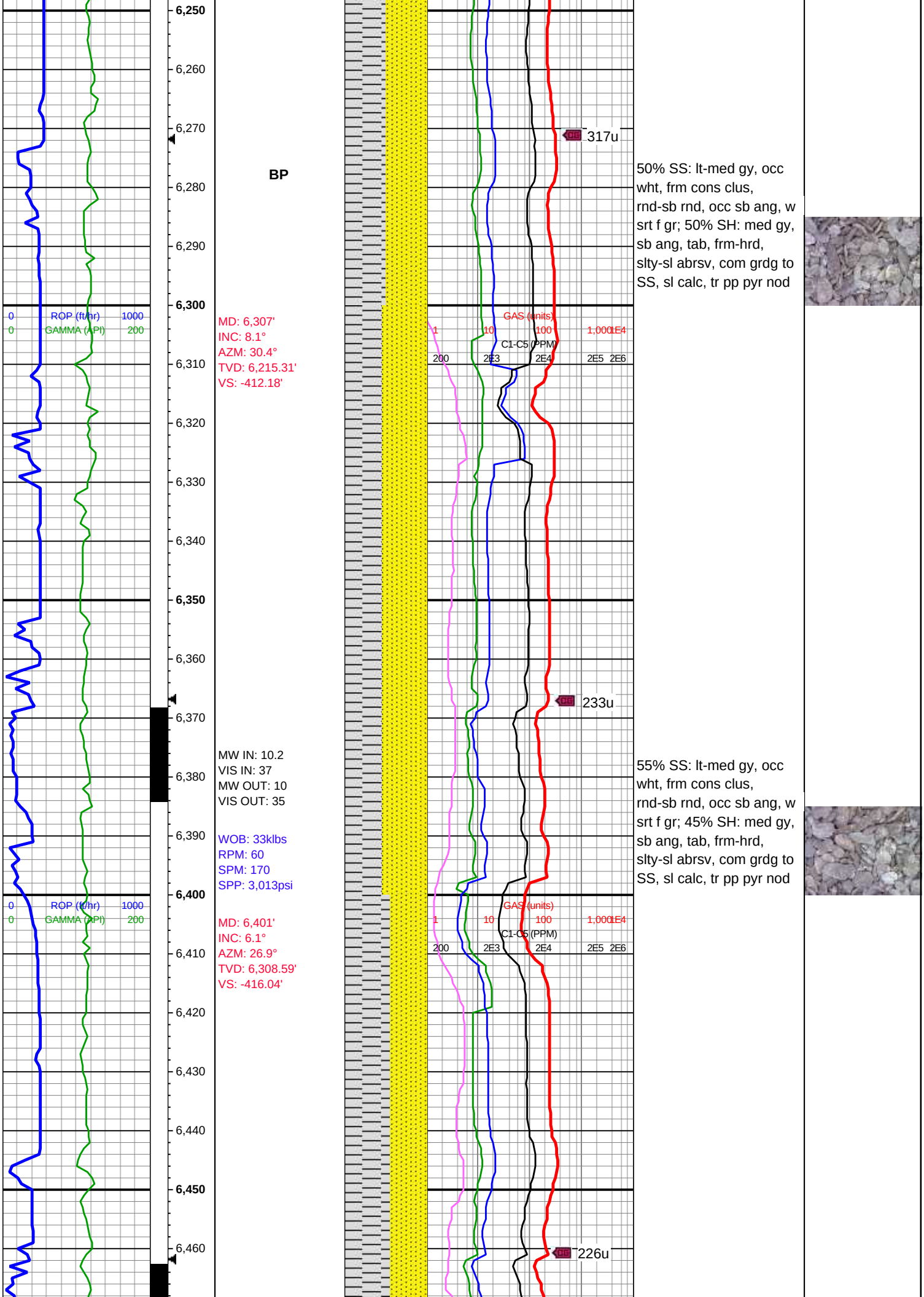
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6

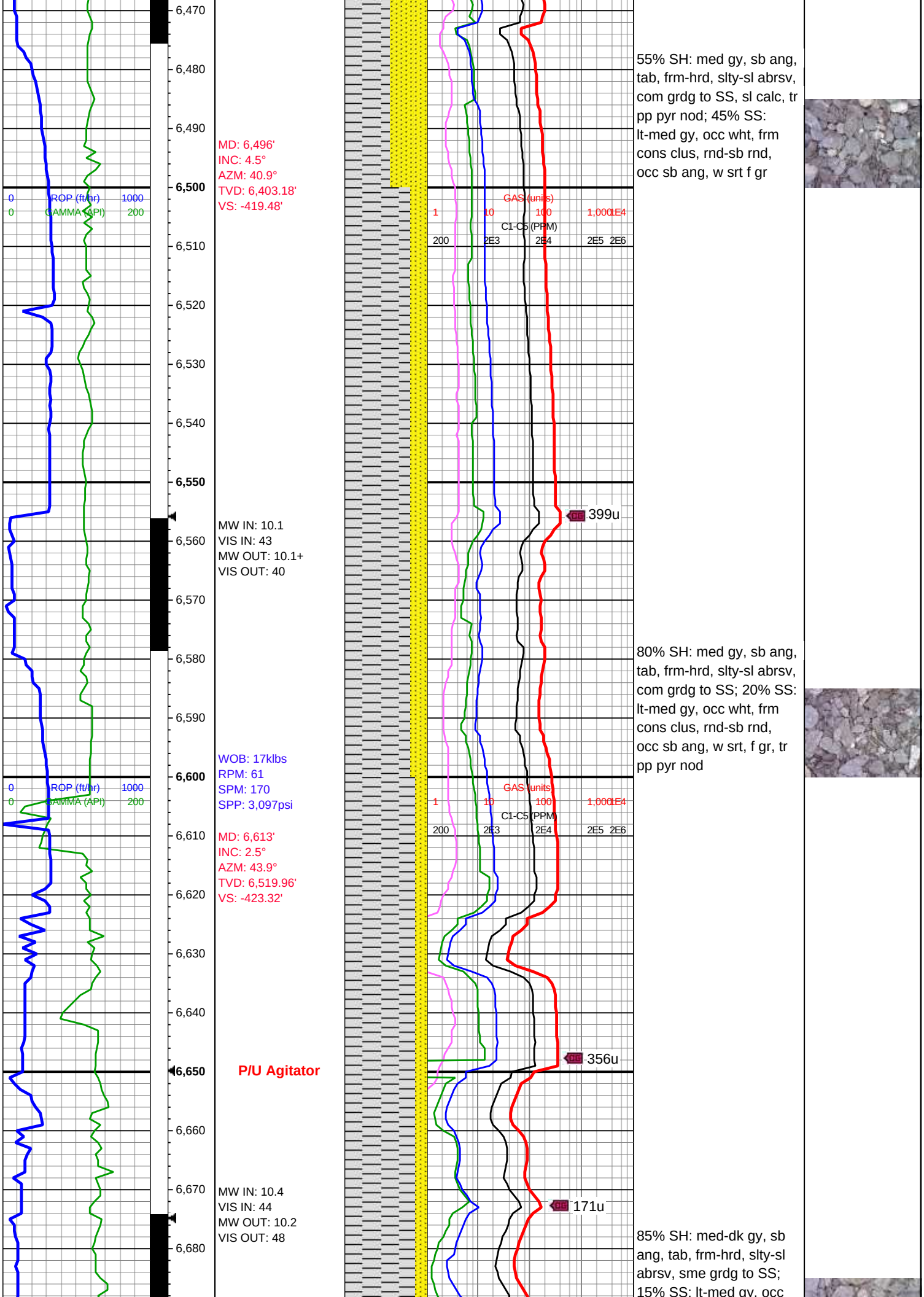
264u

65% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc; 35% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz

281u

70% SH: med gy, sb ang-tab, frm-hrd, slty-sl abrsv, grdg to SS, wk-mod calc; 30% SS: wht-v lt gy, occ med gy, hd-frm, rnd-sb rnd grns in cons mtx, tr slt mtx, w srt, vf gr, abnt intbd qtz

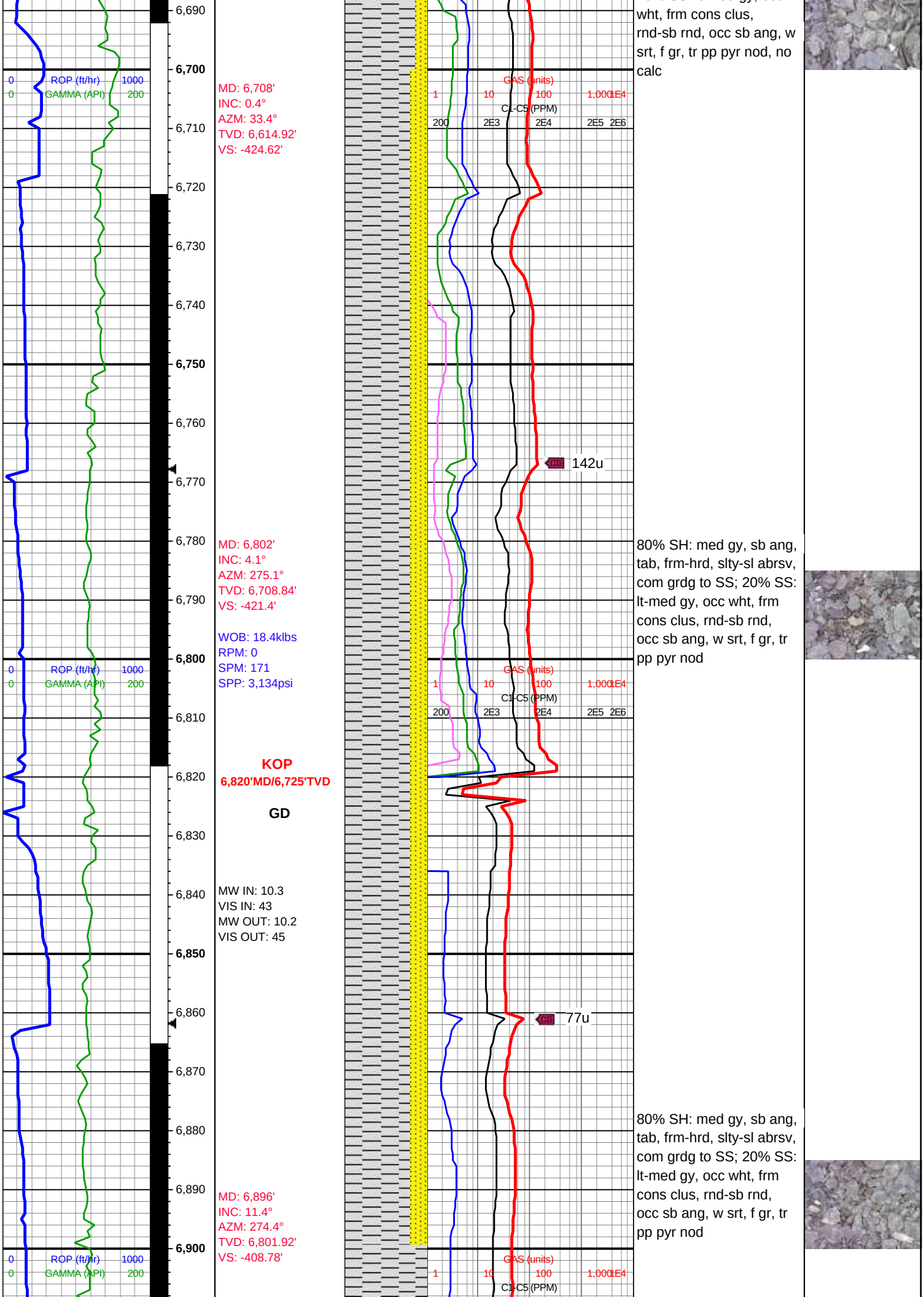

6,250
6,260
6,270
6,280
6,290
6,300
6,310
6,320
6,330
6,340
6,350
6,360
6,370
6,380
6,390
6,400
6,410
6,420
6,430
6,440
6,450
6,460
0 ROP (ft/hr) 1000
0 GAMMA (API) 200
BP
MD: 6,307'
INC: 8.1°
AZM: 30.4°
TVD: 6,215.31'
VS: -412.18'
MW IN: 10.2
VIS IN: 37
MW OUT: 10
VIS OUT: 35
WOB: 33klbs
RPM: 60
SPM: 170
SPP: 3,013psi
MD: 6,401'
INC: 6.1°
AZM: 26.9°
TVD: 6,308.59'
VS: -416.04'
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6
317u
233u
226u
50% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt f gr; 50% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS, sl calc, tr pp pyr nod
55% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt f gr; 45% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS, sl calc, tr pp pyr nod

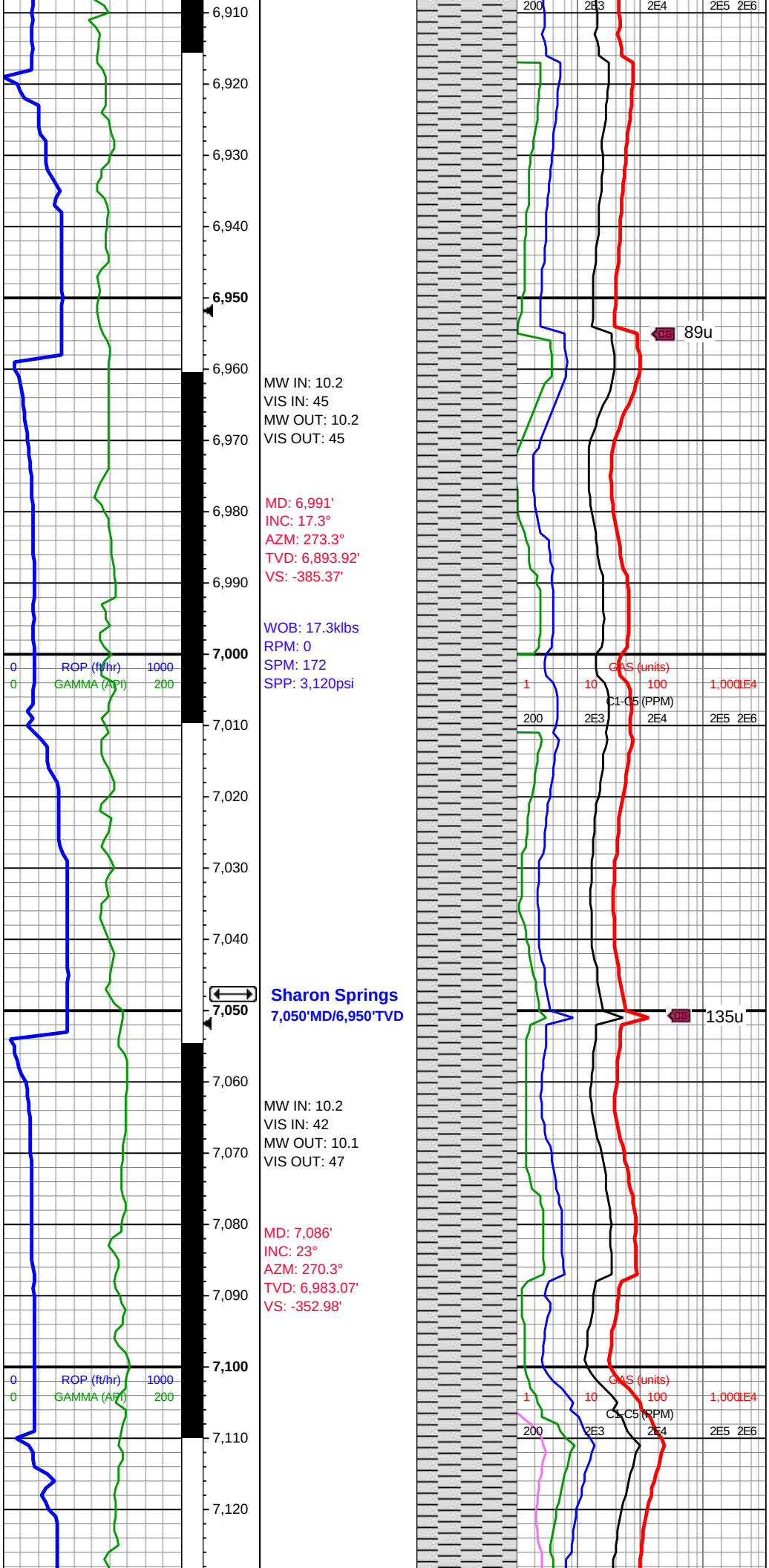


55% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS, sl calc, tr pp pyr nod; 45% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt f gr

80% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS; 20% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt, f gr, tr pp pyr nod

85% SH: med-dk gy, sb ang, tab, frm-hrd, slty-sl abrsv, sme grdg to SS; 15% SS: lt-med gy, occ


6,690
6,700
6,710
6,720
6,730
6,740
6,750
6,760
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
0 ROP (ft/hr) 1000
0 GAMMA (API) 200
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6
MD: 6,708'
INC: 0.4°
AZM: 33.4°
TVD: 6,614.92'
VS: -424.62'
142u
MD: 6,802'
INC: 4.1°
AZM: 275.1°
TVD: 6,708.84'
VS: -421.4'
WOB: 18.4klbs
RPM: 0
SPM: 171
SPP: 3,134psi
KOP
6,820'MD/6,725'TVD
GD
MW IN: 10.3
VIS IN: 43
MW OUT: 10.2
VIS OUT: 45
77u
MD: 6,896'
INC: 11.4°
AZM: 274.4°
TVD: 6,801.92'
VS: -408.78'
wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt, f gr, tr pp pyr nod, no calc
80% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS; 20% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt, f gr, tr pp pyr nod
80% SH: med gy, sb ang, tab, frm-hrd, slty-sl abrsv, com grdg to SS; 20% SS: lt-med gy, occ wht, frm cons clus, rnd-sb rnd, occ sb ang, w srt, f gr, tr pp pyr nod



MW IN: 10.2
VIS IN: 45
MW OUT: 10.2
VIS OUT: 45

MD: 6,991'
INC: 17.3°
AZM: 273.3°
TVD: 6,893.92'
VS: -385.37'

WOB: 17.3klbs
RPM: 0
SPM: 172
SPP: 3,120psi

100% SH: med gy, sb ang, tab, frm-hrd, suc, mod fis, slty-sl abrsv, silc vns, com grdg to SS

Sharon Springs
7,050'MD/6,950'TVD

MW IN: 10.2
VIS IN: 42
MW OUT: 10.1
VIS OUT: 47

MD: 7,086'
INC: 23°
AZM: 270.3°
TVD: 6,983.07'
VS: -352.98'

100% SH: predy med-dk gy, lt gy ip, sb blky-ang, mod-v fis, frm-hrd, slty-sl abrsv, suc ip, com silc lamn, wkly calc

7,130
7,140
7,150
7,160
7,170
7,180
7,190
7,200
7,210
7,220
7,230
7,240
7,250
7,260
7,270
7,280
7,290
7,300
7,310
7,320
7,330
7,340

0 ROP (ft/hr) 1000
0 GAMMA (API) 200

MW IN: 10
VIS IN: 44
MW OUT: 10
VIS OUT: 48

MD: 7,180'
INC: 29.1°
AZM: 270.9°
TVD: 7,067.48'
VS: -312.21'

WOB: 18.5klbs
RPM: 0
SPM: 168
SPP: 2,982psi

MD: 7,275'
INC: 35.3°
AZM: 271.4°
TVD: 7,147.83'
VS: -262.15'

MW IN: 10
VIS IN: 43
MW OUT: 10
VIS OUT: 47

205u

GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6

325u

GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6

339u

100% SH: predy med-dk gy, lt gy ip, sb blky-ang, mod-v fis, frm-hrd, slty-sl abrsv, suc ip, com silc lamn, wkly calc

100% SH: predy med-dk gy, lt gy ip, sb blky-ang, mod-v fis, frm-hrd, slty-sl abrsv, suc ip, com silc lamn, wkly calc

7,350

Niobrara A
7,350'MD/7,207'TVD

7,360

MD: 7,369'
INC: 41.2°
AZM: 268.6°
TVD: 7,221.62'
VS: -204.81'

7,370

7,380

7,390

WOB: 21.2klbs
RPM: 0
SPM: 168
SPP: 3,154psi

7,400

0 ROP (ft/hr) 1000
0 GAMMA (API) 200

GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6

7,410

7,420

7,430

722u

7,440

MW IN: 10.1
VIS IN: 44
MW OUT: 9.9
VIS OUT: 48

7,450

MD: 7,464'
INC: 48.7°
AZM: 266.3°
TVD: 7,288.81'
VS: -139.25'

7,460

7,470

7,480

7,490

7,500

0 ROP (ft/hr) 1000
0 GAMMA (API) 200

GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6

7,510

MW IN: 10.1
VIS IN: 44
MW OUT: 10.1
VIS OUT: 48

7,520

480u

MWDEPT **01/25/2019**

7,530

7,540

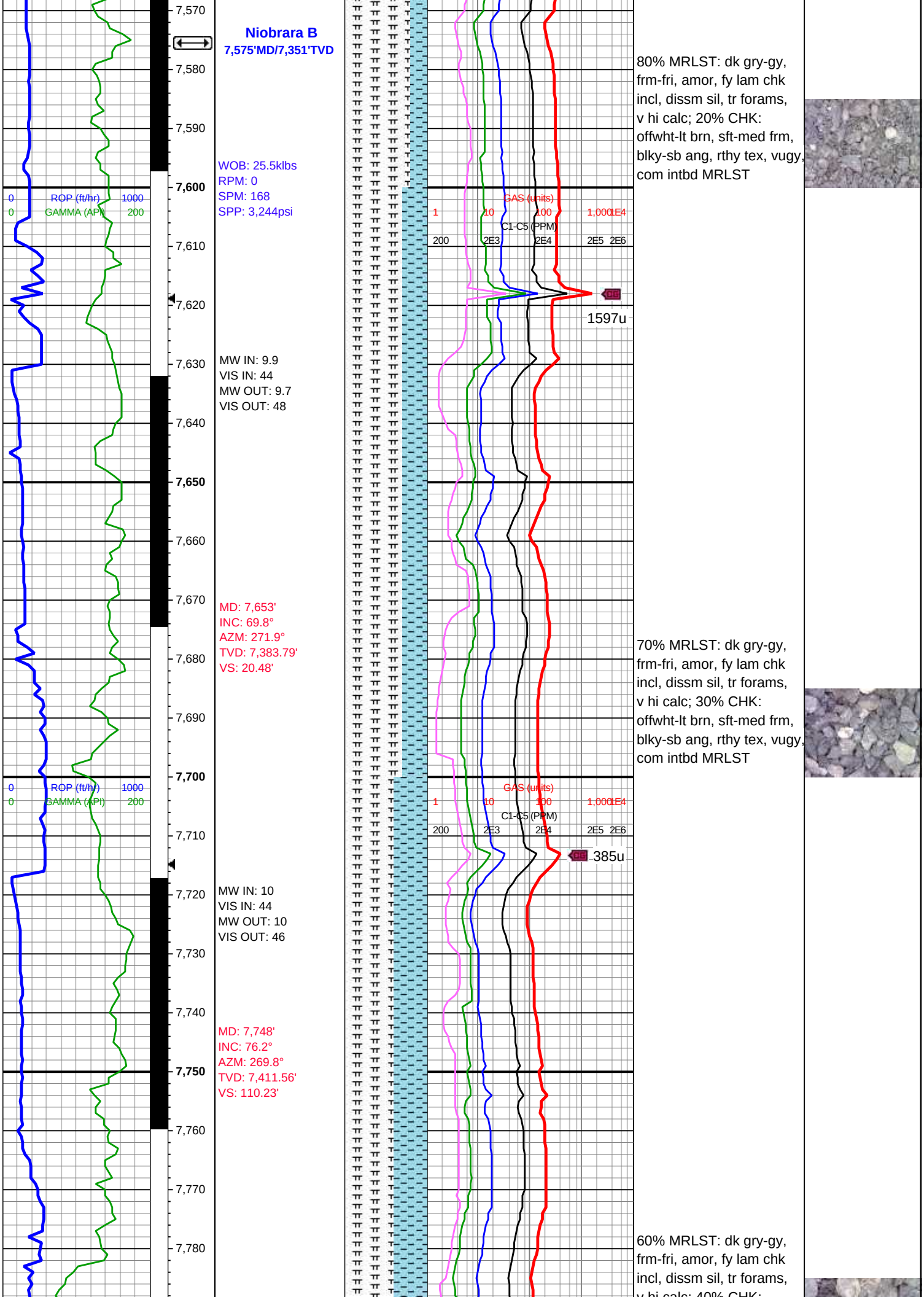
7,550

MD: 7,559'
INC: 60.1°
AZM: 270°
TVD: 7,344.04'
VS: -63.63'

7,560

80% CHK: offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST; 20% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams, v hi calc

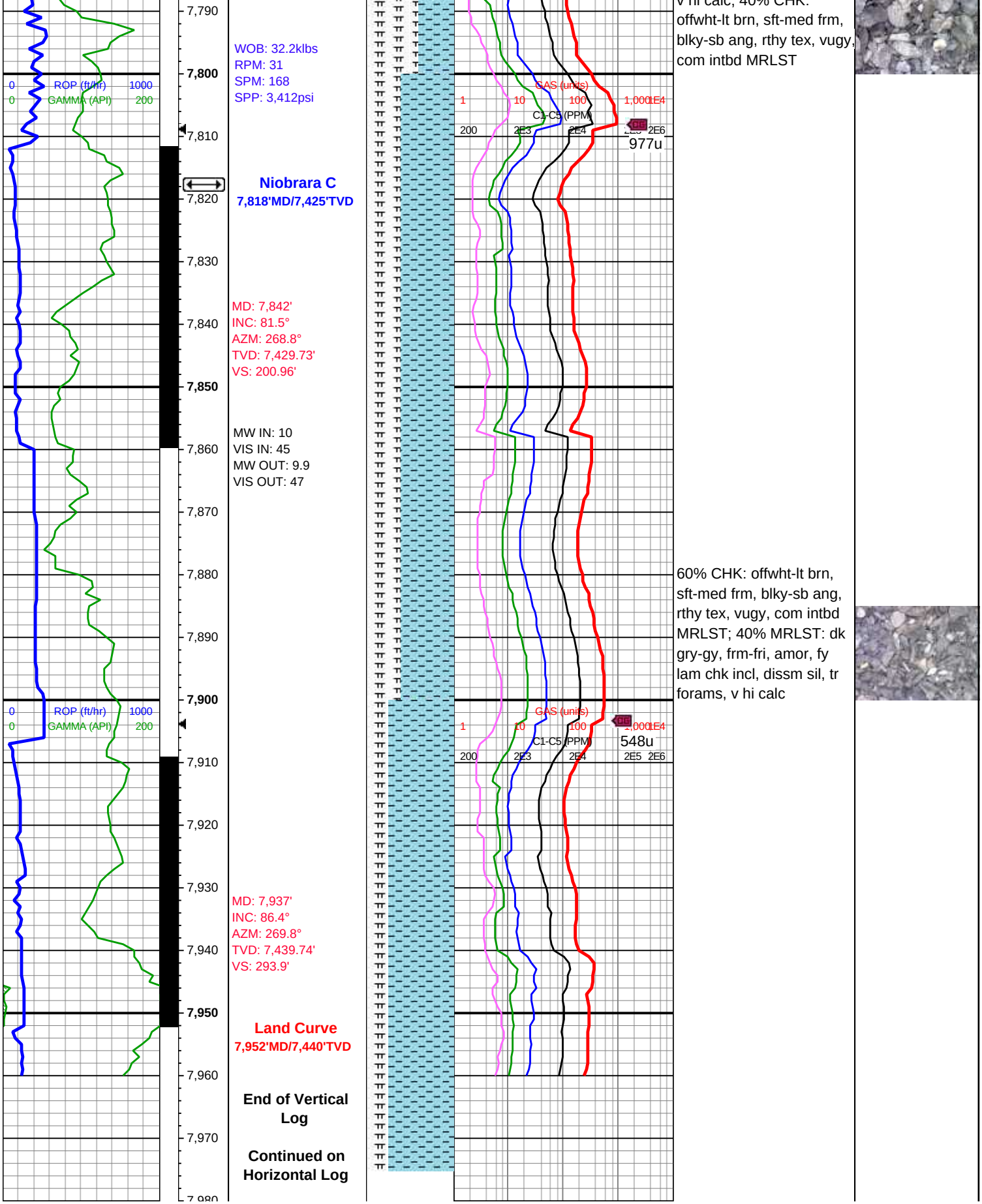
75% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams, v hi calc; 25% CHK: offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST



80% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams, v hi calc; 20% CHK: offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST

70% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams, v hi calc; 30% CHK: offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST

60% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams,


0 ROP (ft/hr) 1000
0 GAMMA (API) 200
7,790
7,800
7,810
7,820
7,830
7,840
7,850
7,860
7,870
7,880
7,890
7,900
7,910
7,920
7,930
7,940
7,950
7,960
7,970
7,980
WOB: 32.2klbs
RPM: 31
SPM: 168
SPP: 3,412psi
Niobrara C
7,818'MD/7,425'TVD
MD: 7,842'
INC: 81.5°
AZM: 268.8°
TVD: 7,429.73'
VS: 200.96'
MW IN: 10
VIS IN: 45
MW OUT: 9.9
VIS OUT: 47
MD: 7,937'
INC: 86.4°
AZM: 269.8°
TVD: 7,439.74'
VS: 293.9'
Land Curve
7,952'MD/7,440'TVD
End of Vertical Log
Continued on Horizontal Log
GAS (units)
1 10 100 1,000 1E4
C1-C5 (PPM)
200 2E3 2E4 2E5 2E6
977u
548u
offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST
60% CHK: offwht-lt brn, sft-med frm, blky-sb ang, rthy tex, vugy, com intbd MRLST; 40% MRLST: dk gry-gy, frm-fri, amor, fy lam chk incl, dissm sil, tr forams, v hi calc