Scale 1:240 (5"=100') Imperial
Measured Depth Log

Well Name:	Horsetail 19N-1924M-R
Well Id:	05-123-40630-00
Location:	SWSE 19-T10N-R57W Weld County, Colorado
License Number:	
Region:	Redtail
Spud Date:	12/5/2014
Drilling Completed:	12/11/2014
Surface Coordinates:	660' FSL & 2616' FEL
Bottom Hole Coordinates:	360' FSL & 2616' FEL
Ground Elevation (ft):	4748
K.B. Elevation (ft):	4771
Logged Interval (ft):	1585 To: 8348
Total Depth (ft):	8348
Formation:	Pierre, Hygiene, Niobrara, Bridge Creek, Entrada, Lyons and Pennsylvanian
Type of Drilling Fluid:	Water Based Mud

OPERATOR

Company: Whiting Oil & Gas Corporation
Address: 1700 Broadway Suite 2300
Denver, CO 80290
303-837-1661

GEOLOGIST

Name: Mark Denler, Craig Dreiling
Company: Acme Geologic Consulting
Address: 108 Berry Street
Little Rock, AR 72205
www.acmegeo.com

Drilling Company

Pioneer Rig #54

Comments

Lithologies and tops at drilled depths, not corrected to elogs. Where the well bore gas is 100% methane, the C1 line is moved to 85% for graphical purposes only.

ROCK TYPES

- Anhy
- Bent
- Brec
- Cht
- Clyst
- Coal
- Congl
- Dol
- Gyp
- Igne
- Lmst
- Meta
- Mrlst
- Salt
- Shale
- Shcol
- Shgy
- Sltst
- Ss
- Till
- Cyan mrlst
- Cyan chk
- Grnt wsh

ACCESSORIES

MINERAL

- Anhy
- Arggrn
- Arg
- Bent
- Bit
- Brecfrag
- Calc
- Carb
- Chtdk
- Chtlt
- Dol
- Feldspar
- Ferrpel
- Ferr
- Glau
- Gyp
- Hvymin
- Kaol
- Marl
- Minxl
- Nodule
- Phos
- Pyr
- Salt
- Sandy
- Silt
- Sil
- Sulphur
- Tuff

FOSSIL

- Algae
- Amph
- Belm
- Bioclst
- Brach
- Bryozoa
- Cephal
- Coral
- Crin
- Echin
- Fish
- Foram
- Fossil
- Gastro
- Oolite
- Ostra
- Pelec
- Pellet
- Pisolite
- Plant
- Strom

STRINGER

- Anhy
- Shstrg
- Bent
- Coal
- Dol
- Gyp
- Ls
- Mrst
- Sltstrg
- Ssstrg

TEXTURE

- Boundst
- Chalky
- Cryxln
- Earthy
- Finexln
- Grainst
- Lithogr
- Microxln
- Mudst
- Packst
- Wackest

OTHER SYMBOLS

POROSITY TYPE

- Earthy
- Fenest
- Fracture
- Inter
- Moldic
- Organic
- Pinpoint
- Vuggy

SORTING

- Well
- Moderate
- Poor

ROUNDING

- Rounded
- Subrnd
- Subang
- Angular

OIL SHOWS

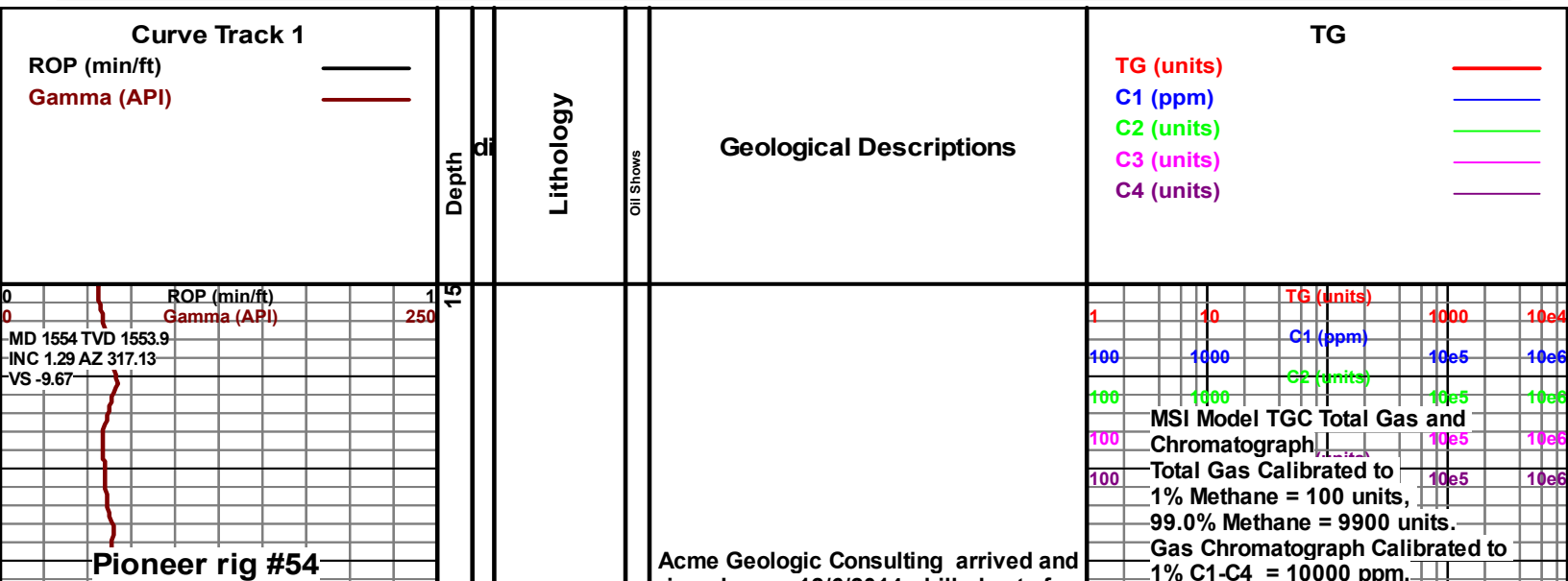
- Good
- Fair
- Poor
- Dead

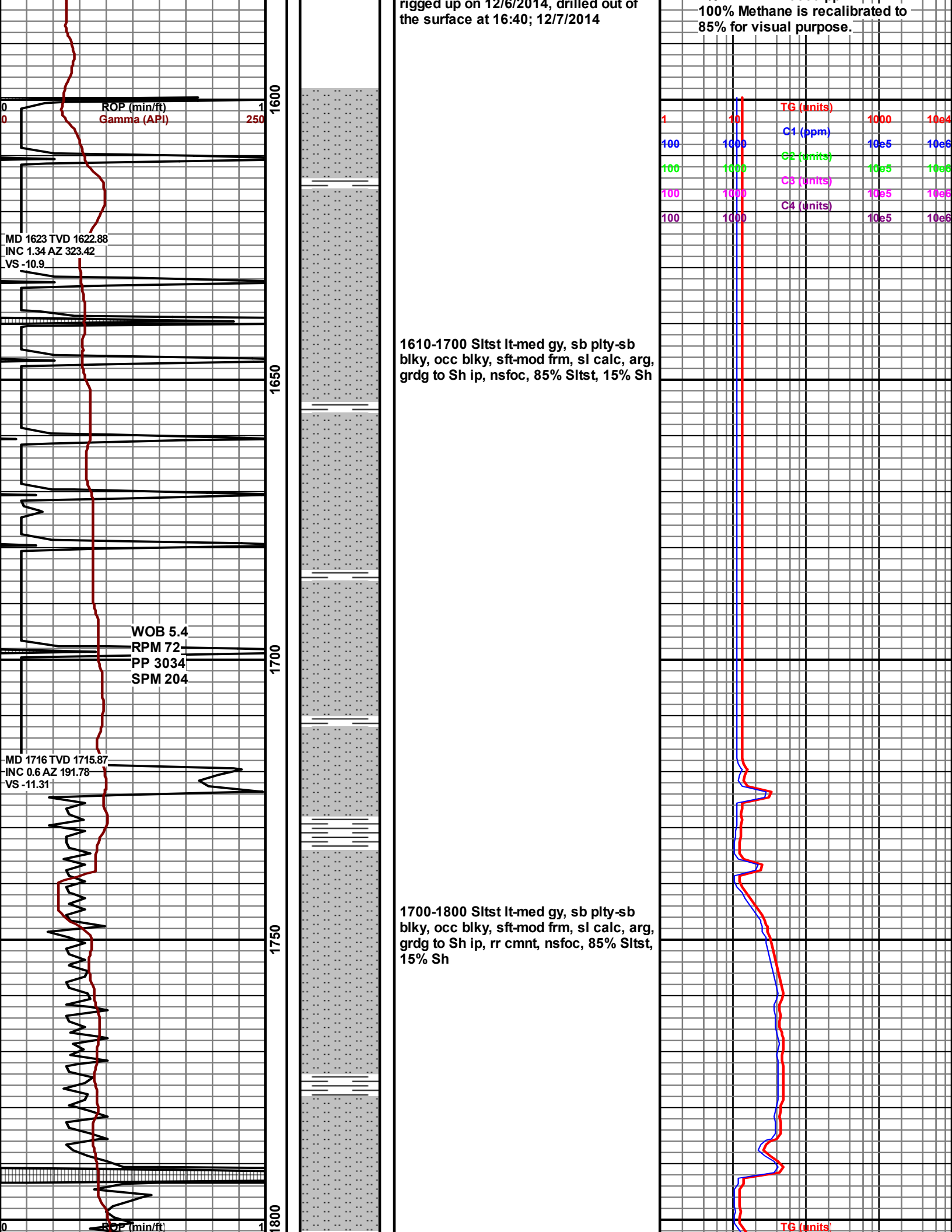
INTERVALS

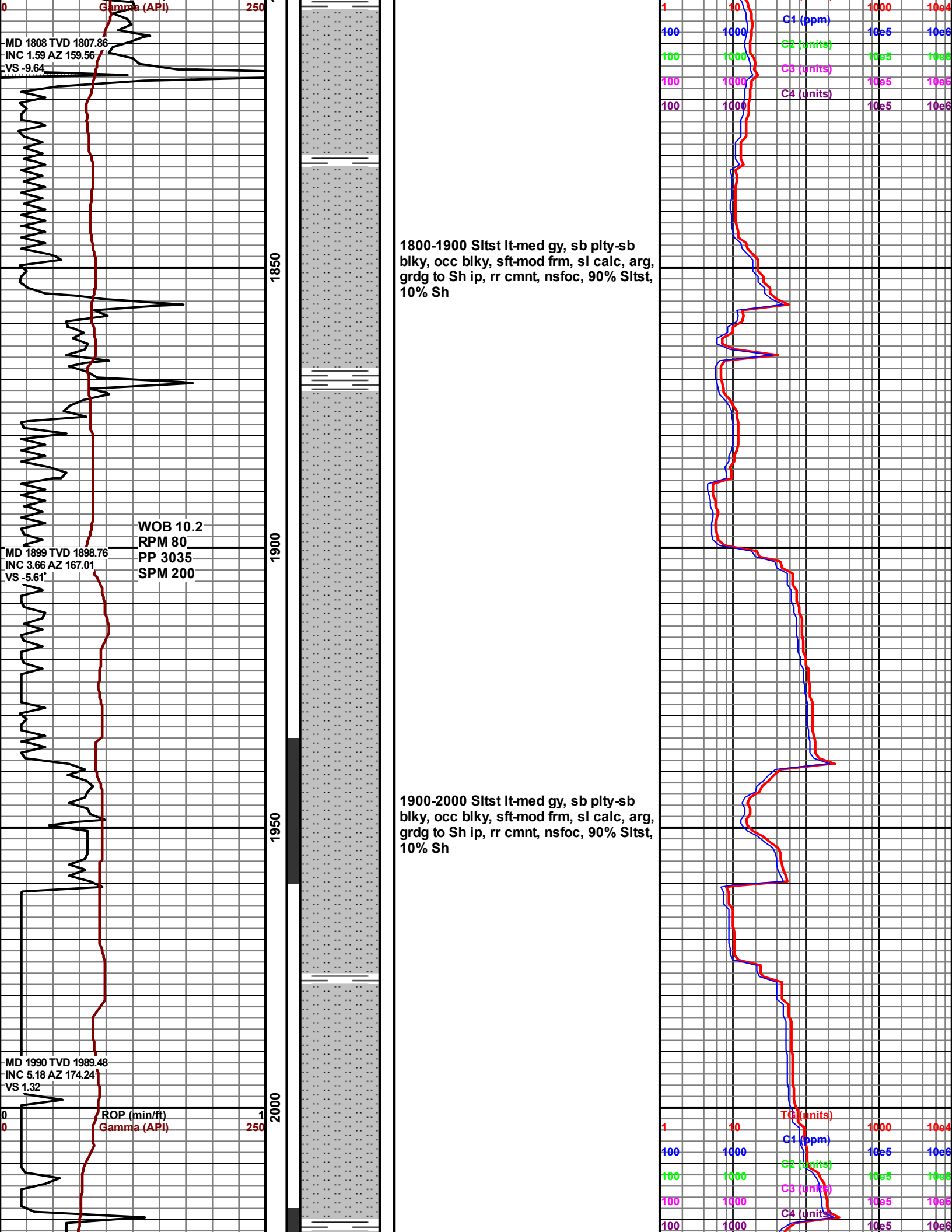
- Core
- Dst
- Srfcsg
- Cv-v
- Cv-c
- Conductor

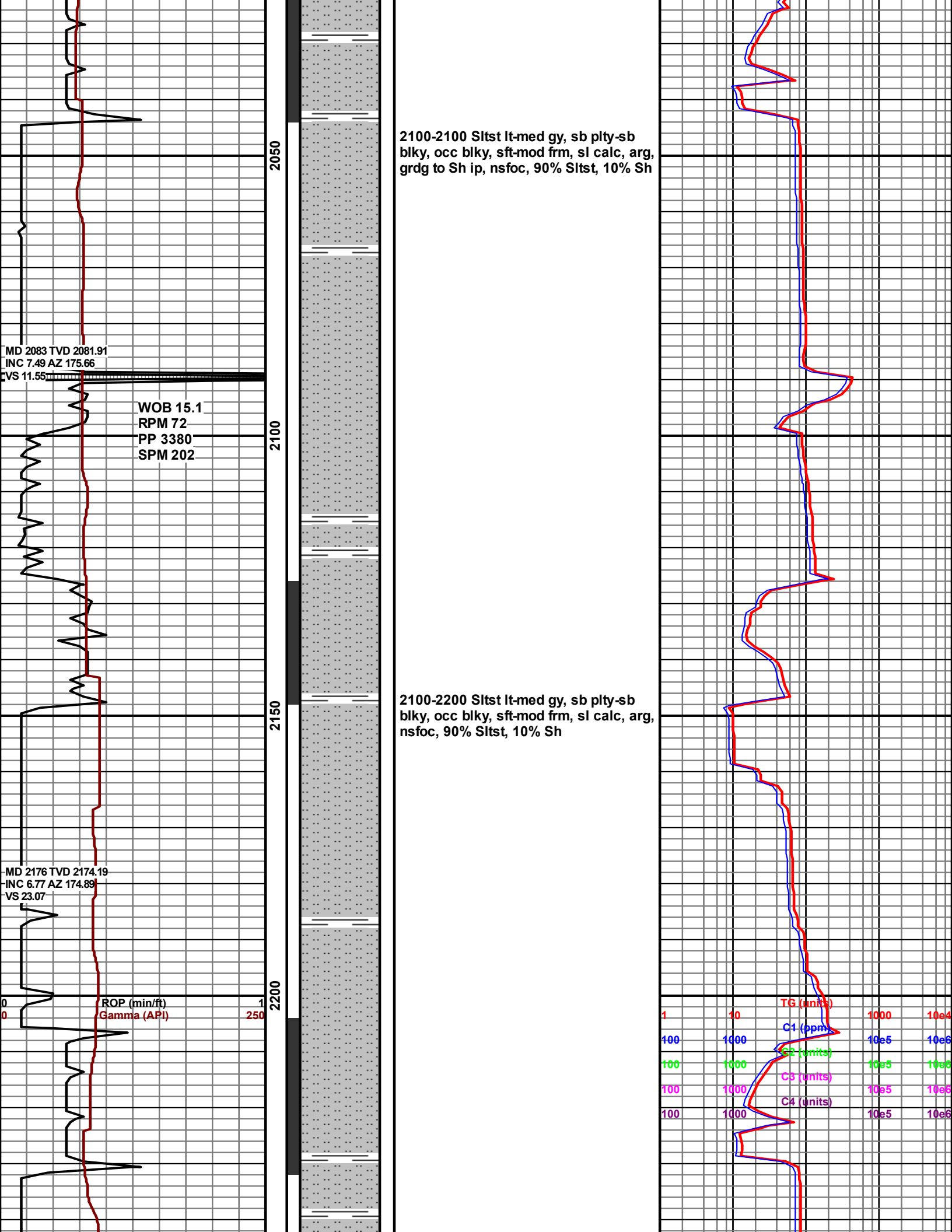
EVENTS

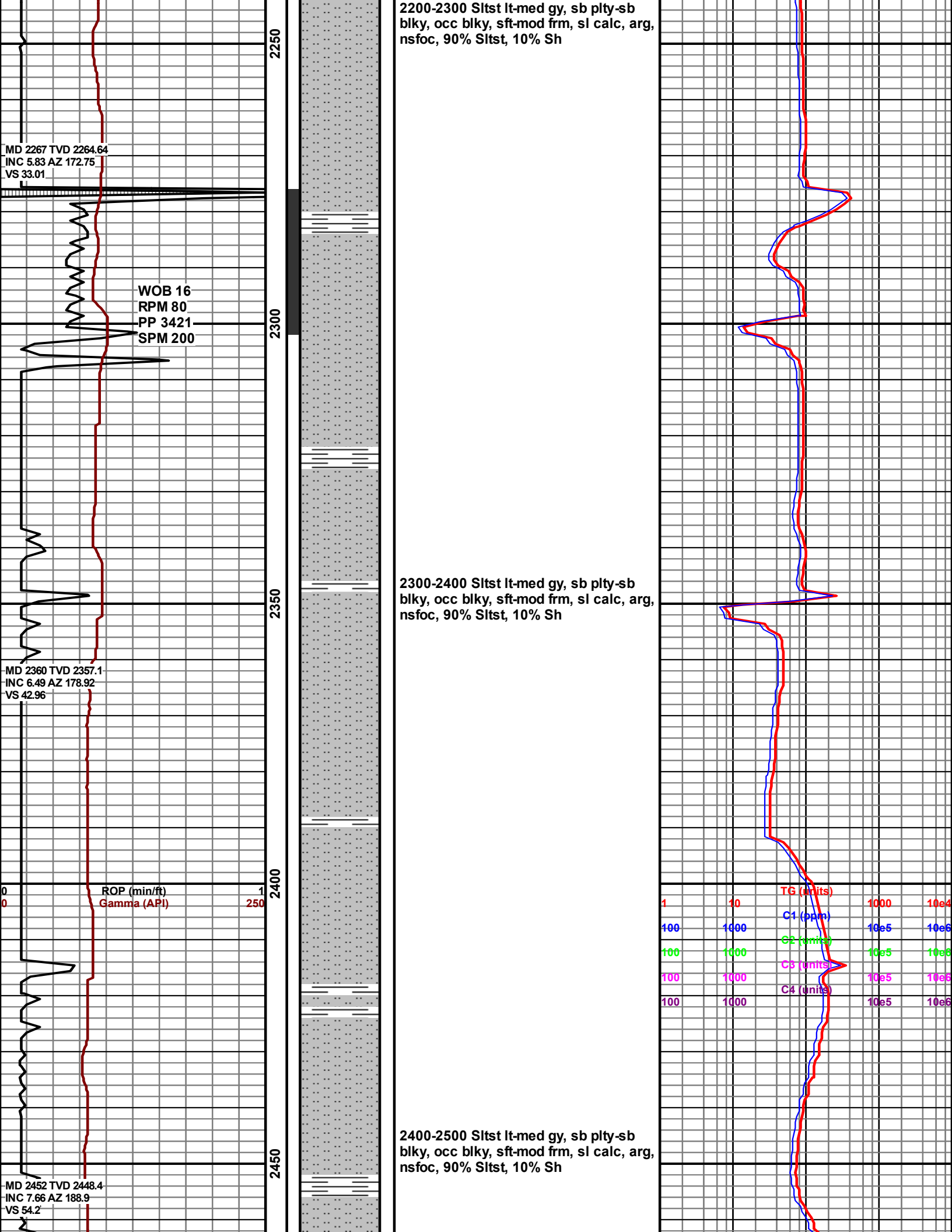
- Rft
- Sidewall
- Srfcsg

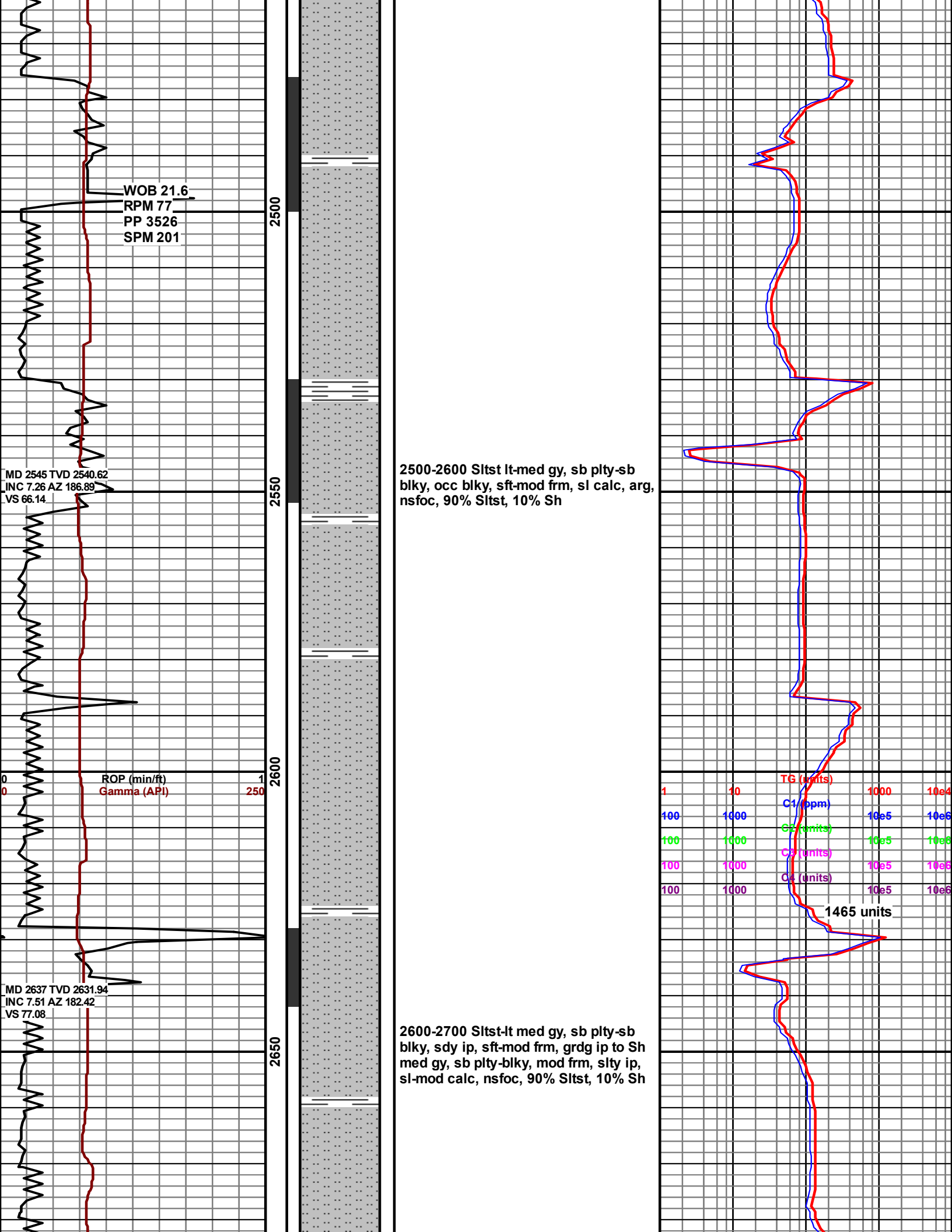


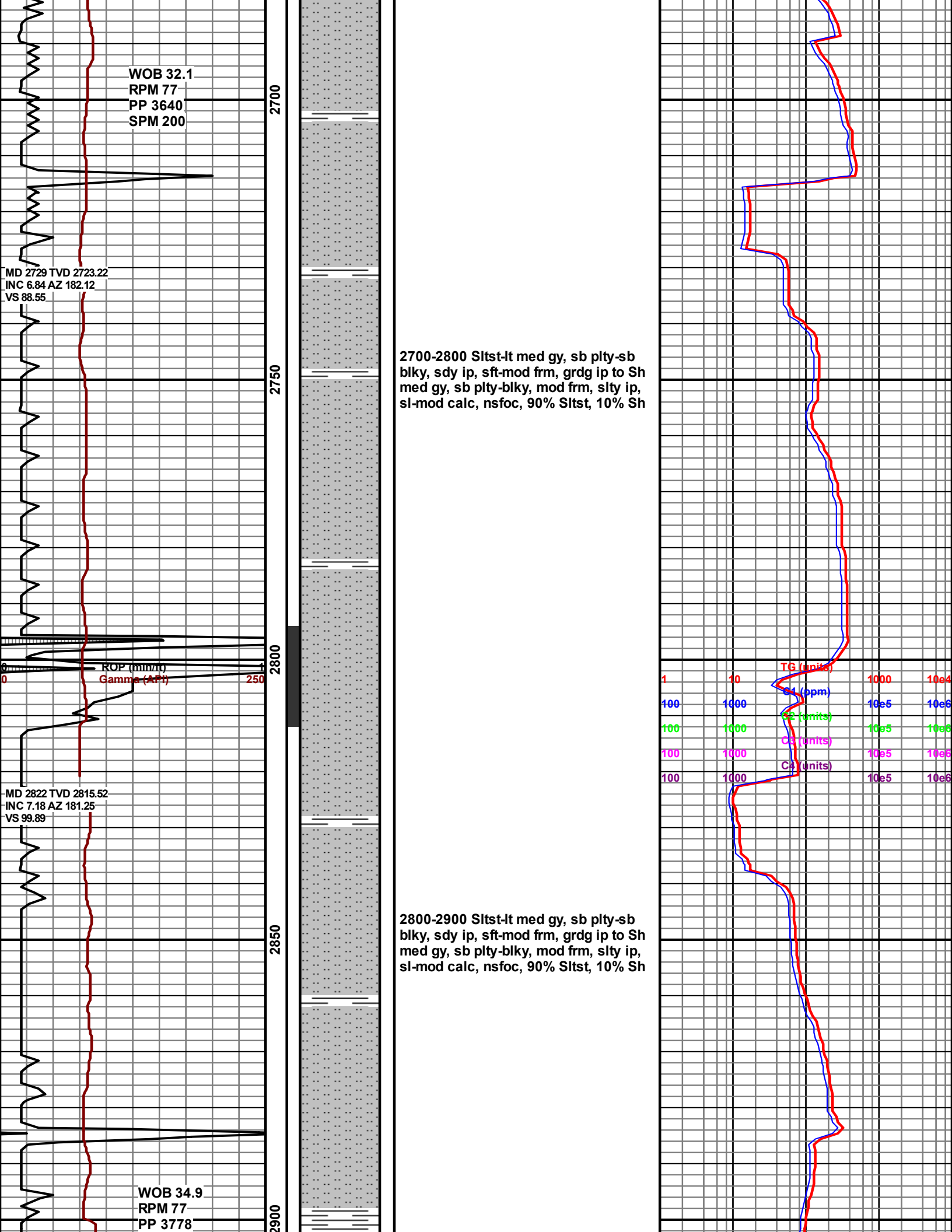

rigged up on 12/6/2014, drilled out of the surface at 16:40; 12/7/2014
100% Methane is recalibrated to 85% for visual purpose.
0
ROP (min/ft)
1
0
Gamma (API)
250
1600
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
MD 1623 TVD 1622.88
INC 1.34 AZ 323.42
VS -10.9
1650
1610-1700 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, grdg to Sh ip, nsfoc, 85% Sltst, 15% Sh
WOB 5.4
RPM 72
PP 3034
SPM 204
1700
MD 1716 TVD 1715.87
INC 0.6 AZ 191.78
VS -11.31
1700-1800 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, grdg to Sh ip, rr cmnt, nsfoc, 85% Sltst, 15% Sh
1750
0
ROP (min/ft)
1
1800
TG (units)

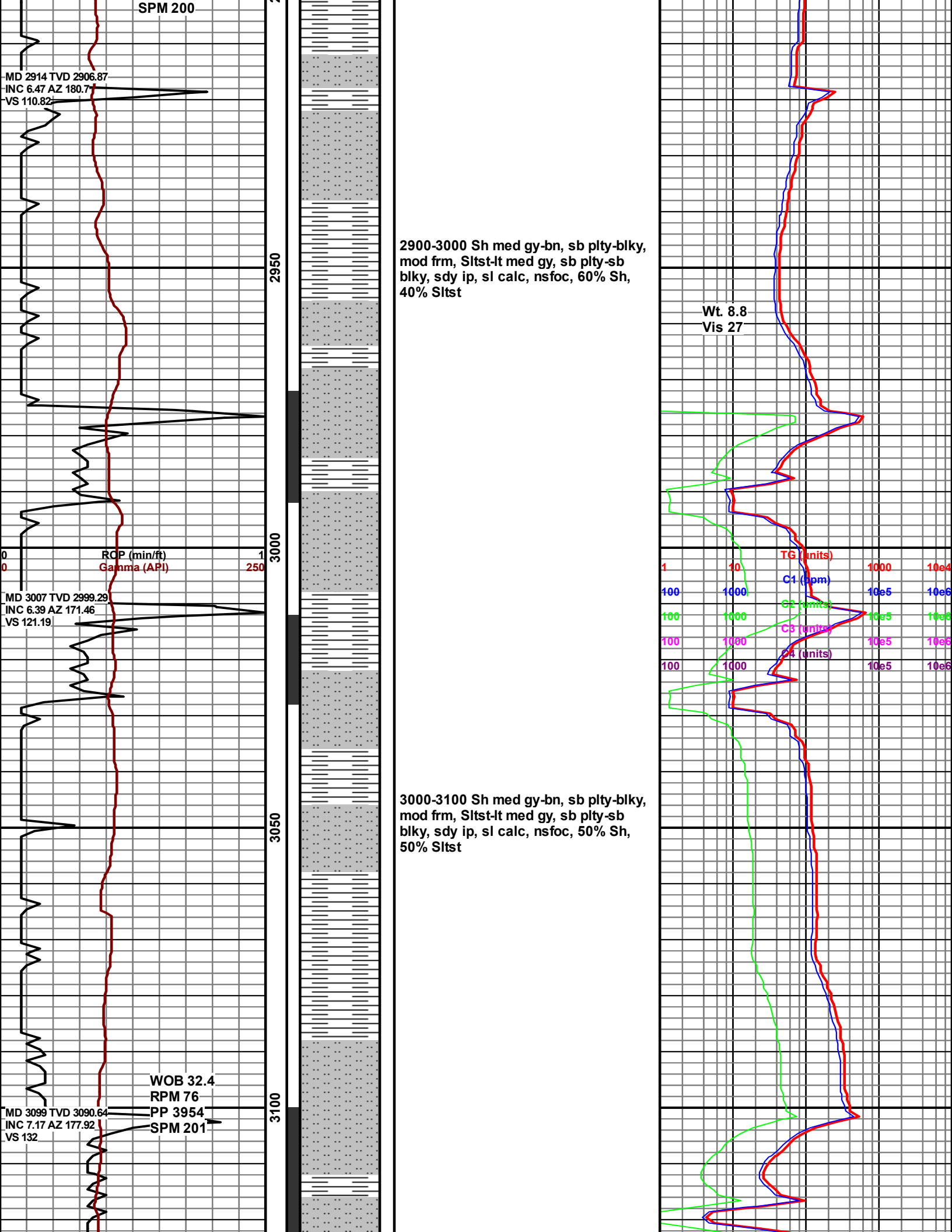

0
Gamma (API)
250
MD 1808 TVD 1807.86
INC 1.59 AZ 159.56
VS -9.64
1850
1800-1900 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, grdg to Sh ip, rr cmnt, nsfoc, 90% Sltst, 10% Sh
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
WOB 10.2
RPM 80
PP 3035
SPM 200
MD 1899 TVD 1898.76
INC 3.66 AZ 167.01
VS -5.61
1900
1950
1900-2000 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, grdg to Sh ip, rr cmnt, nsfoc, 90% Sltst, 10% Sh
MD 1990 TVD 1989.48
INC 5.18 AZ 174.24
VS 1.32
2000
0
ROP (min/ft)
1
0
Gamma (API)
250
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6

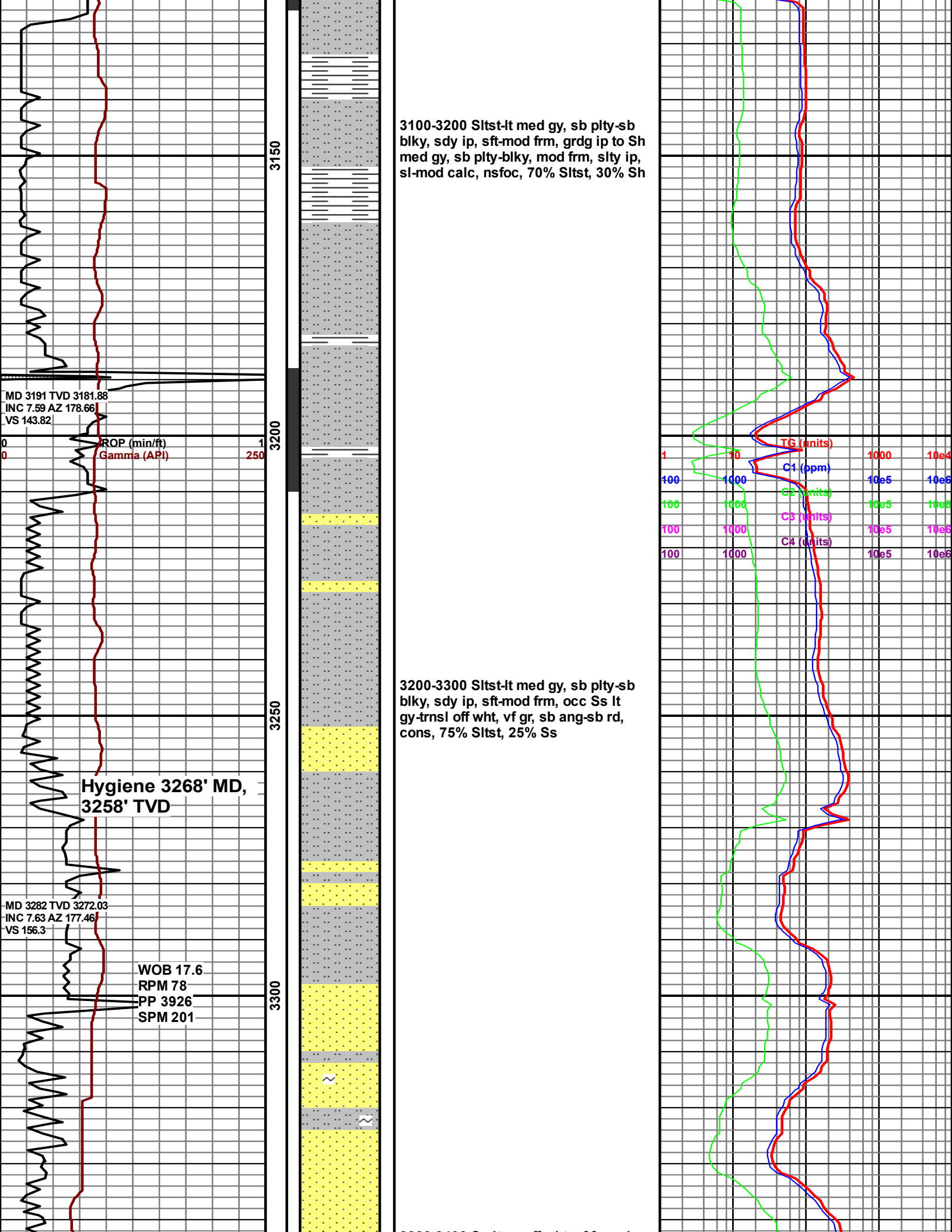

MD 2083 TVD 2081.91
INC 7.49 AZ 175.66
VS 11.55
WOB 15.1
RPM 72
PP 3380
SPM 202
MD 2176 TVD 2174.19
INC 6.77 AZ 174.89
VS 23.07
2050
2100
2150
2200
2100-2100 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, grdg to Sh ip, nsfoc, 90% Sltst, 10% Sh
2100-2200 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, nsfoc, 90% Sltst, 10% Sh
0
0
ROP (min/ft)
Gamma (API)
1
250
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
1
10
100
1000
10e4
10e5
10e6

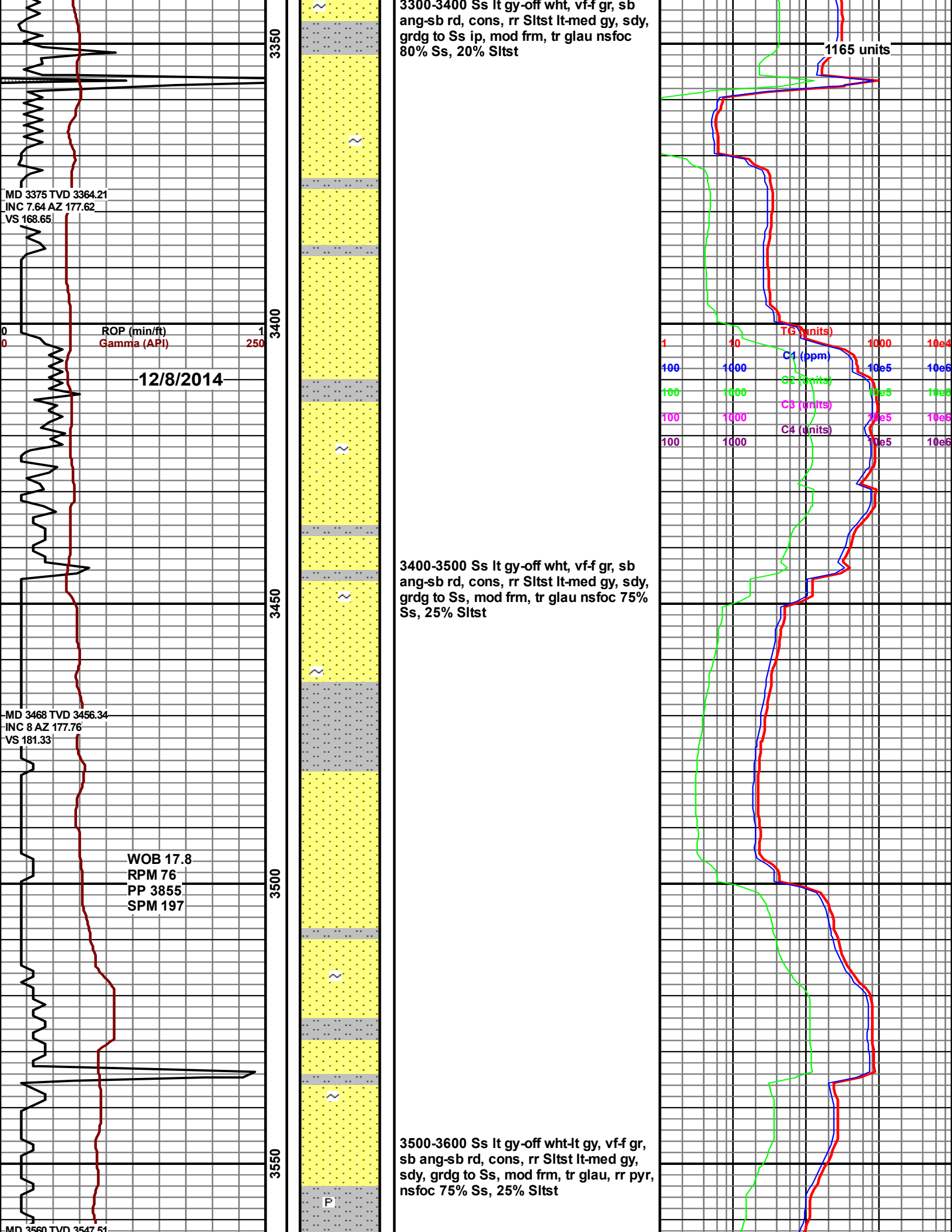

2200-2300 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, nsfoc, 90% Sltst, 10% Sh
2300-2400 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, nsfoc, 90% Sltst, 10% Sh
2400-2500 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, nsfoc, 90% Sltst, 10% Sh
MD 2267 TVD 2264.64
INC 5.83 AZ 172.75
VS 33.01
WOB 16
RPM 80
PP 3421
SPM 200
MD 2360 TVD 2357.1
INC 6.49 AZ 178.92
VS 42.96
MD 2452 TVD 2448.4
INC 7.66 AZ 188.9
VS 54.2
2250
2300
2350
2400
2450
0
0
ROP (min/ft)
Gamma (API)
1
250
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
1
10
100
1000
10e4
10e5
10e6

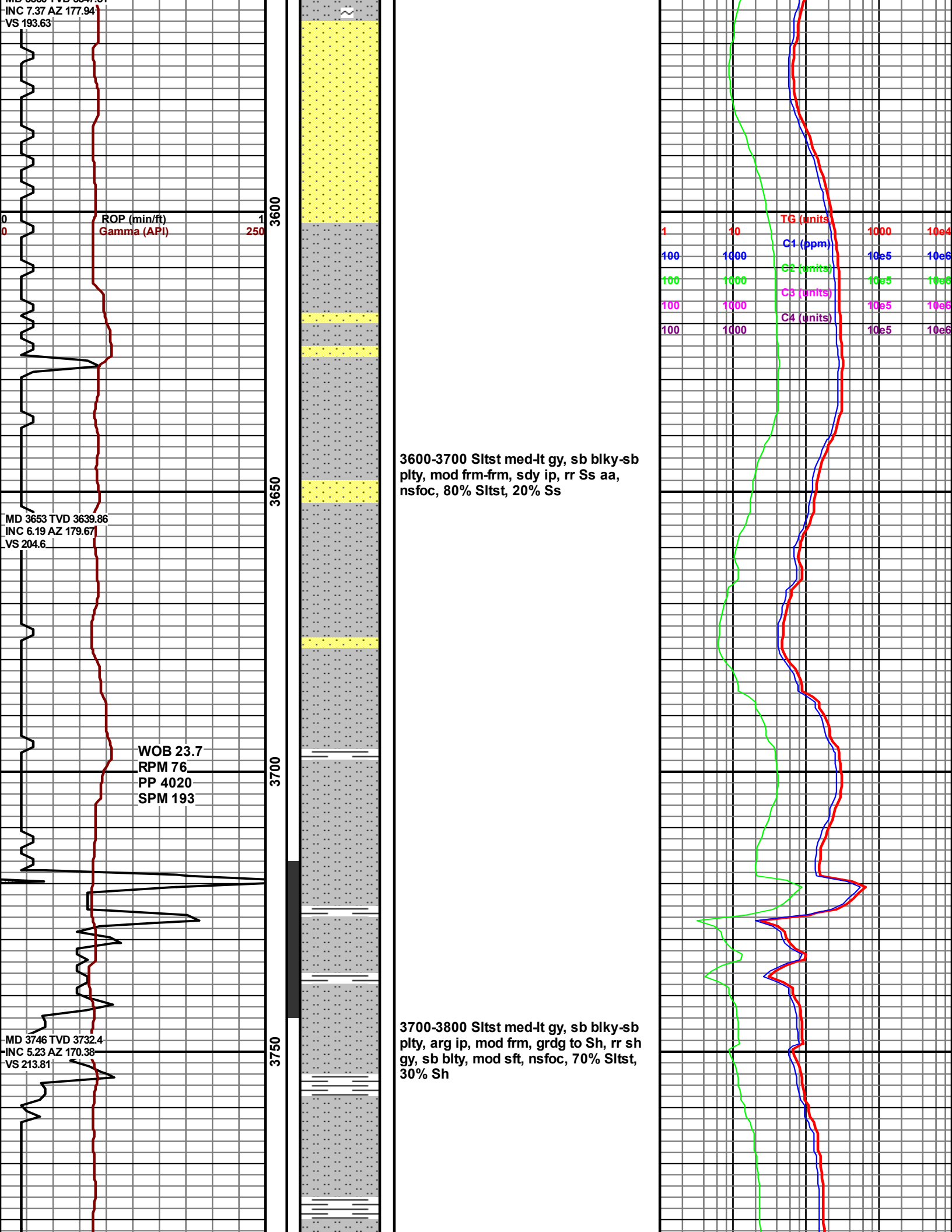

WOB 21.6
RPM 77
PP 3526
SPM 201
MD 2545 TVD 2540.62
INC 7.26 AZ 186.89
VS 66.14
MD 2637 TVD 2631.94
INC 7.51 AZ 182.42
VS 77.08
0
0
ROP (min/ft)
Gamma (API)
1
250
2500
2550
2600
2650
2500-2600 Sltst lt-med gy, sb plty-sb blky, occ blky, sft-mod frm, sl calc, arg, nsfoc, 90% Sltst, 10% Sh
2600-2700 Sltst-lt med gy, sb plty-sb blky, sdy ip, sft-mod frm, grdg ip to Sh med gy, sb plty-blky, mod frm, slty ip, sl-mod calc, nsfoc, 90% Sltst, 10% Sh
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
1465 units

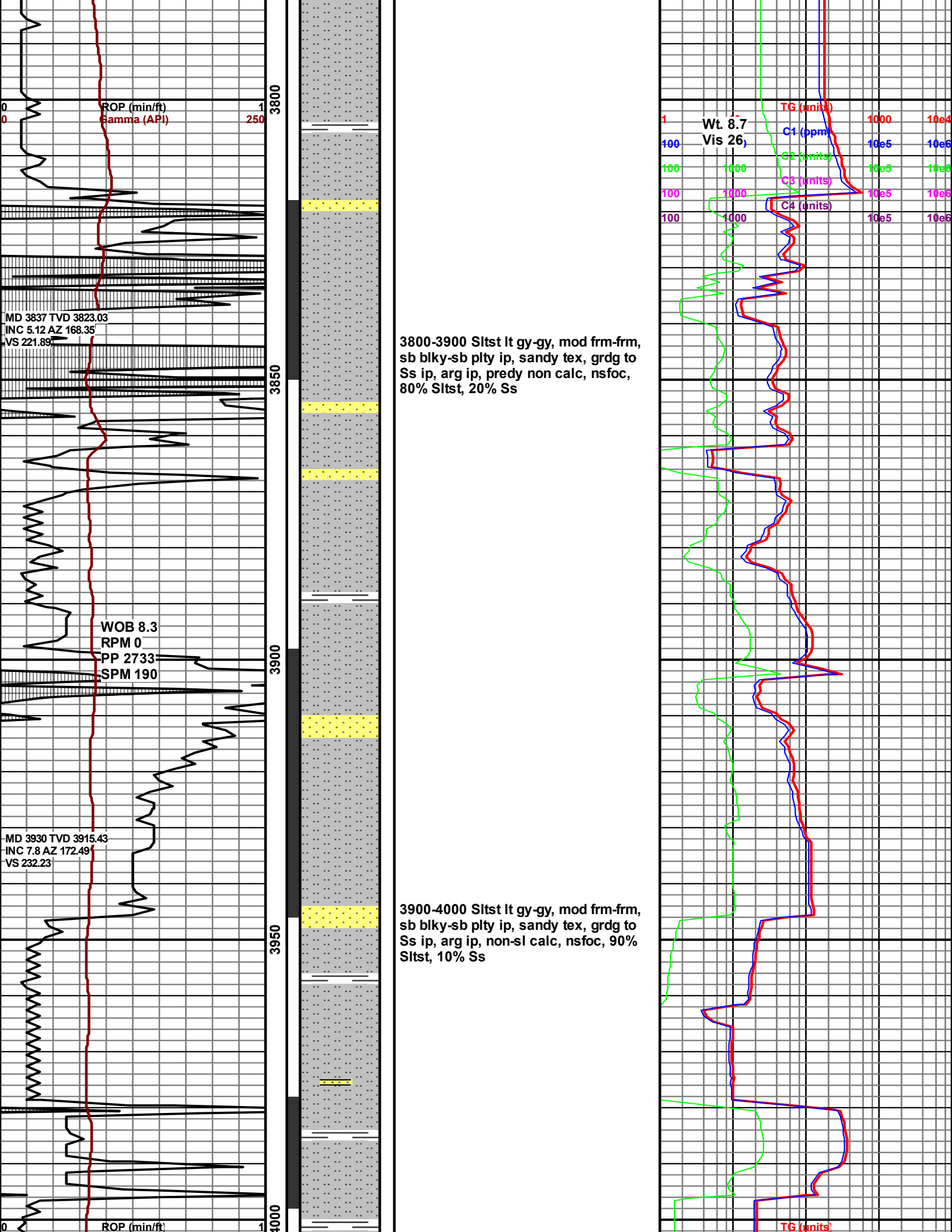

WOB 32.1
RPM 77
PP 3640
SPM 200
MD 2729 TVD 2723.22
INC 6.84 AZ 182.12
VS 88.55
2700
2750
2800
2850
2900
ROP (min/ft)
Gamma (API)
0
250
2700-2800 Sltst-lt med gy, sb plty-sb blky, sdy ip, sft-mod frm, grdg ip to Sh med gy, sb plty-blky, mod frm, slty ip, sl-mod calc, nsfoc, 90% Sltst, 10% Sh
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
1
10
100
1000
10e4
10e5
10e6
MD 2822 TVD 2815.52
INC 7.18 AZ 181.25
VS 99.89
2800-2900 Sltst-lt med gy, sb plty-sb blky, sdy ip, sft-mod frm, grdg ip to Sh med gy, sb plty-blky, mod frm, slty ip, sl-mod calc, nsfoc, 90% Sltst, 10% Sh
WOB 34.9
RPM 77
PP 3778

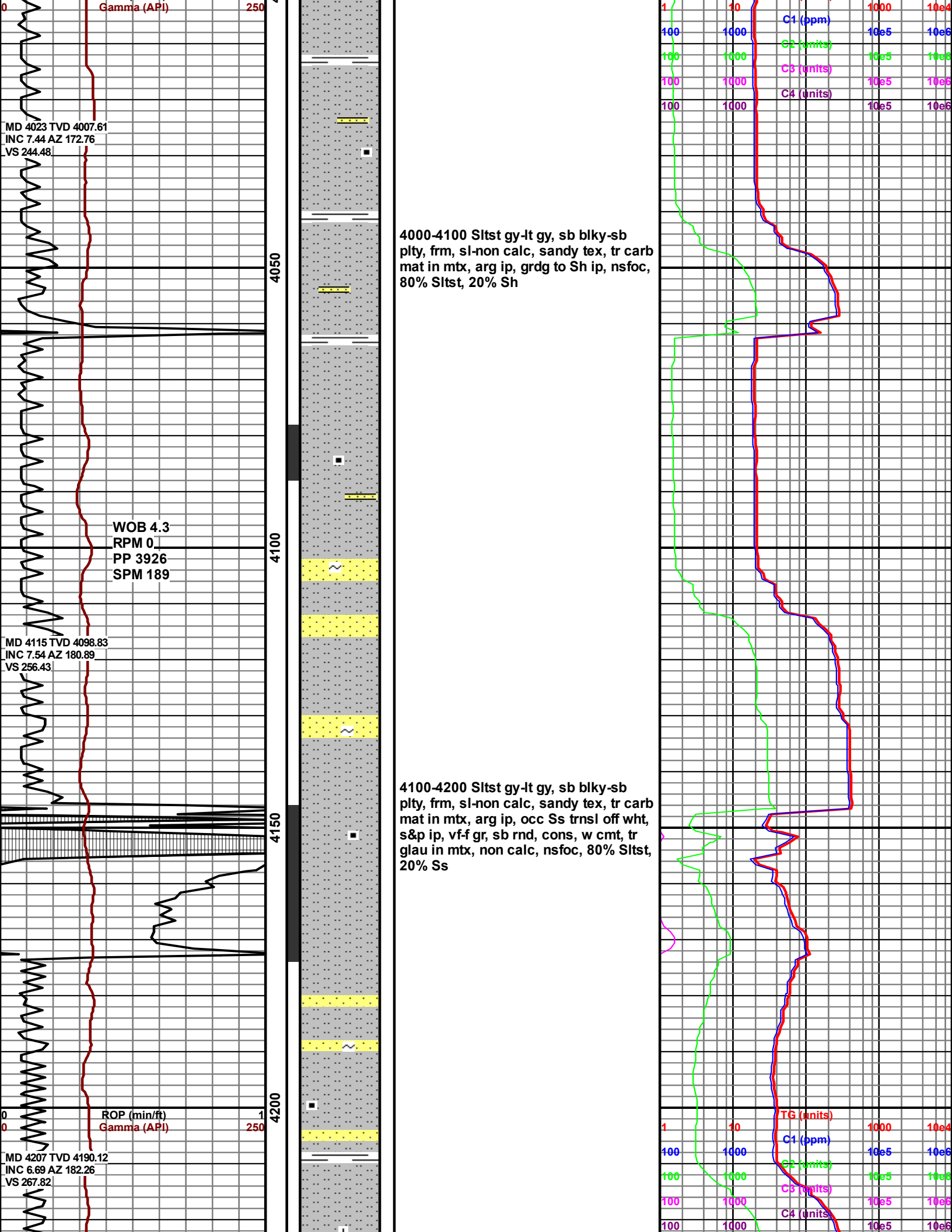

SPM 200
MD 2914 TVD 2906.87
INC 6.47 AZ 180.7
VS 110.82
2900-3000 Sh med gy-bn, sb plty-blky, mod frm, Sltst-lt med gy, sb plty-sb blky, sdy ip, sl calc, nsfoc, 60% Sh, 40% Sltst
Wt. 8.8
Vis 27
2950
3000
0
ROP (min/ft)
1
0
Gamma (API)
250
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
MD 3007 TVD 2999.29
INC 6.39 AZ 171.46
VS 121.19
3000-3100 Sh med gy-bn, sb plty-blky, mod frm, Sltst-lt med gy, sb plty-sb blky, sdy ip, sl calc, nsfoc, 50% Sh, 50% Sltst
3050
WOB 32.4
RPM 76
PP 3954
SPM 201
MD 3099 TVD 3090.64
INC 7.17 AZ 177.92
VS 132
3100

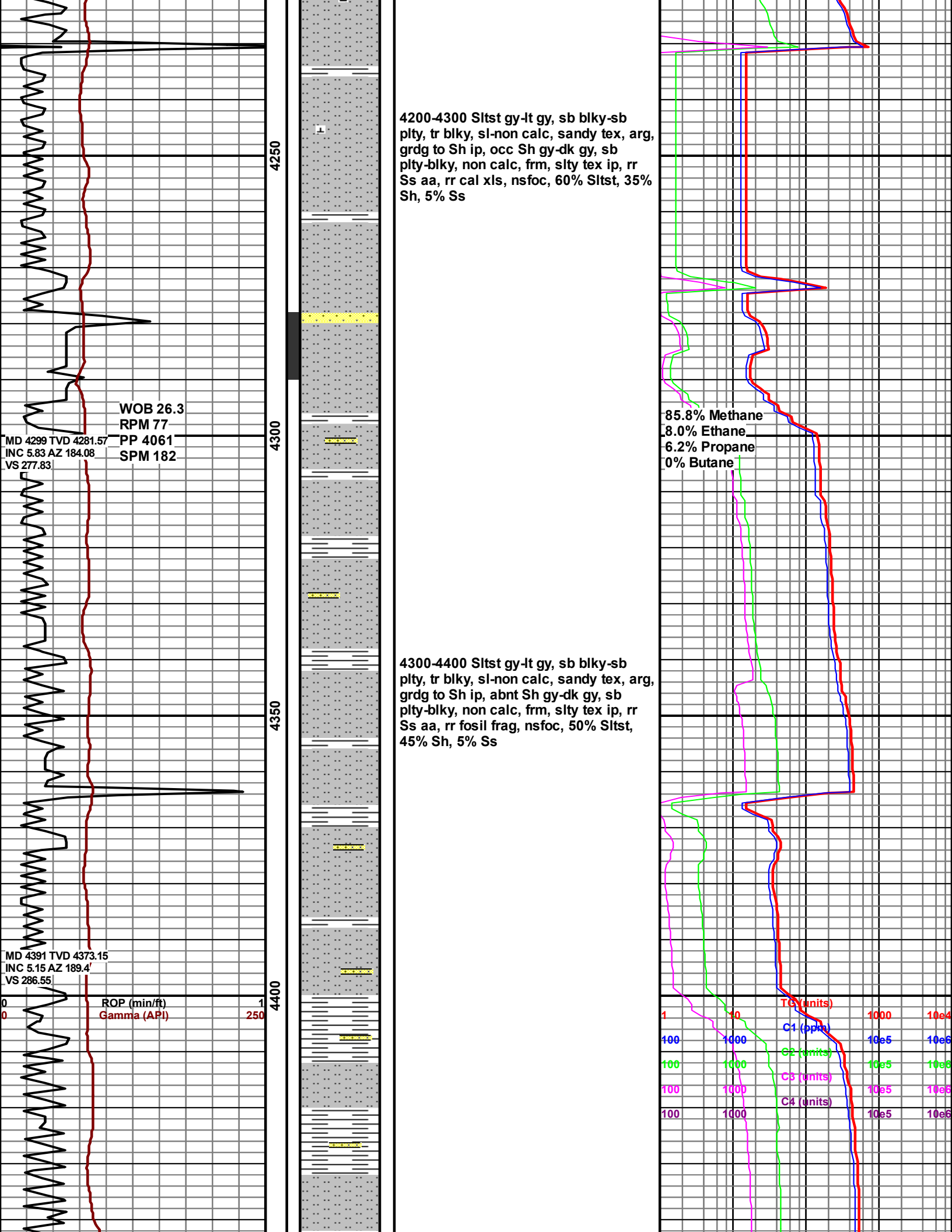

3150
3200
3250
3300
MD 3191 TVD 3181.88
INC 7.59 AZ 178.66
VS 143.82
0
ROP (min/ft)
1
0
Gamma (API)
250
3100-3200 Sltst-lt med gy, sb plty-sb blky, sdy ip, sft-mod frm, grdg ip to Sh med gy, sb plty-blky, mod frm, slty ip, sl-mod calc, nsfoc, 70% Sltst, 30% Sh
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
Hygiene 3268' MD, 3258' TVD
3200-3300 Sltst-lt med gy, sb plty-sb blky, sdy ip, sft-mod frm, occ Ss lt gy-trnsl off wht, vf gr, sb ang-sb rd, cons, 75% Sltst, 25% Ss
MD 3282 TVD 3272.03
INC 7.63 AZ 177.46
VS 156.3
WOB 17.6
RPM 78
PP 3926
SPM 201

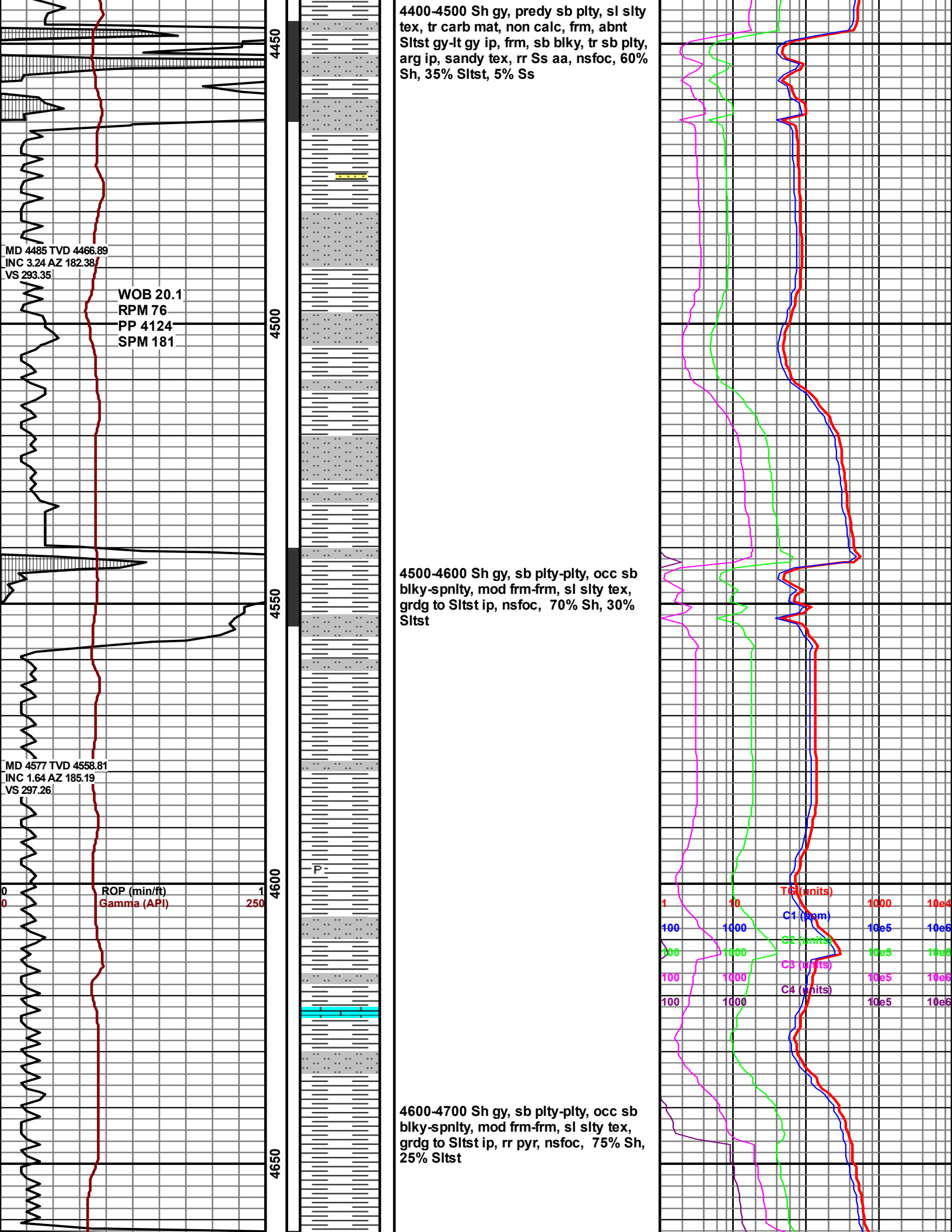

3300-3400 Ss lt gy-off wht, vf-f gr, sb ang-sb rd, cons, rr Sltst lt-med gy, sdy, grdg to Ss ip, mod frm, tr glau nsfoc 80% Ss, 20% Sltst
1165 units
MD 3375 TVD 3364.21
INC 7.64 AZ 177.62
VS 168.65
ROP (min/ft)
Gamma (API)
12/8/2014
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
3400-3500 Ss lt gy-off wht, vf-f gr, sb ang-sb rd, cons, rr Sltst lt-med gy, sdy, grdg to Ss, mod frm, tr glau nsfoc 75% Ss, 25% Sltst
MD 3468 TVD 3456.34
INC 8 AZ 177.76
VS 181.33
WOB 17.8
RPM 76
PP 3855
SPM 197
3500-3600 Ss lt gy-off wht-lt gy, vf-f gr, sb ang-sb rd, cons, rr Sltst lt-med gy, sdy, grdg to Ss, mod frm, tr glau, rr pyr, nsfoc 75% Ss, 25% Sltst
MD 3560 TVD 3547.51

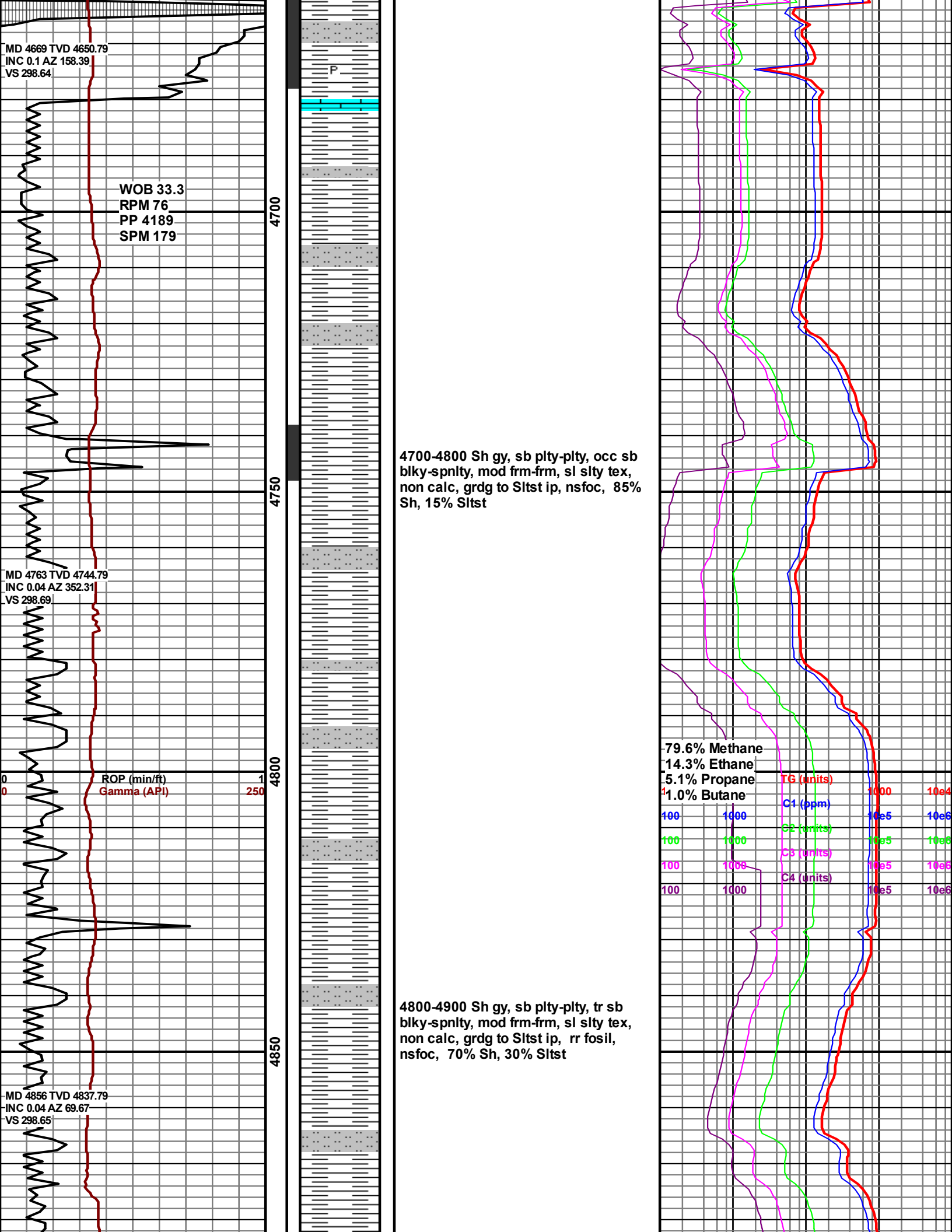

INC 7.37 AZ 177.94
VS 193.63
0
0
ROP (min/ft)
Gamma (API)
1
250
3600
3650
3700
3750
MD 3653 TVD 3639.86
INC 6.19 AZ 179.67
VS 204.6
WOB 23.7
RPM 76
PP 4020
SPM 193
MD 3746 TVD 3732.4
INC 5.23 AZ 170.38
VS 213.81
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
3600-3700 Sltst med-lt gy, sb blky-sb plty, mod frm-frm, sdy ip, rr Ss aa, nsfoc, 80% Sltst, 20% Ss
3700-3800 Sltst med-lt gy, sb blky-sb plty, arg ip, mod frm, grdg to Sh, rr sh gy, sb blty, mod sft, nsfoc, 70% Sltst, 30% Sh

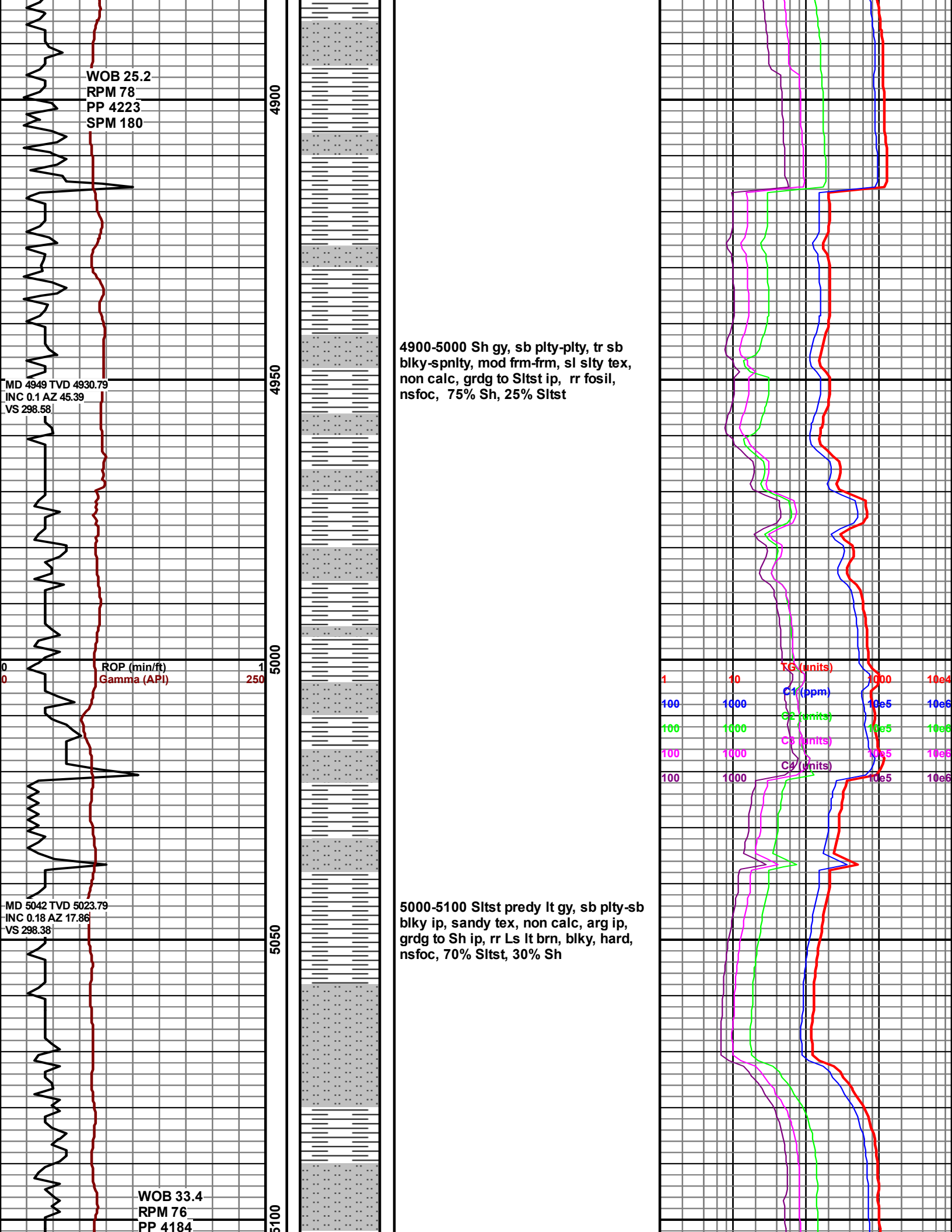

0
ROP (min/ft)
1
0
Gamma (API)
250
3800
MD 3837 TVD 3823.03
INC 5.12 AZ 168.35
VS 221.89
3850
WOB 8.3
RPM 0
PP 2733
SPM 190
3900
MD 3930 TVD 3915.43
INC 7.8 AZ 172.49
VS 232.23
3950
4000
0
ROP (min/ft)
1
3800-3900 Sltst lt gy-gy, mod frm-frm, sb blky-sb plty ip, sandy tex, grdg to Ss ip, arg ip, predy non calc, nsfoc, 80% Sltst, 20% Ss
3900-4000 Sltst lt gy-gy, mod frm-frm, sb blky-sb plty ip, sandy tex, grdg to Ss ip, arg ip, non-sl calc, nsfoc, 90% Sltst, 10% Ss
TG (units)
1
1000
10e4
Wt. 8.7
Vis 26
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
TG (units)

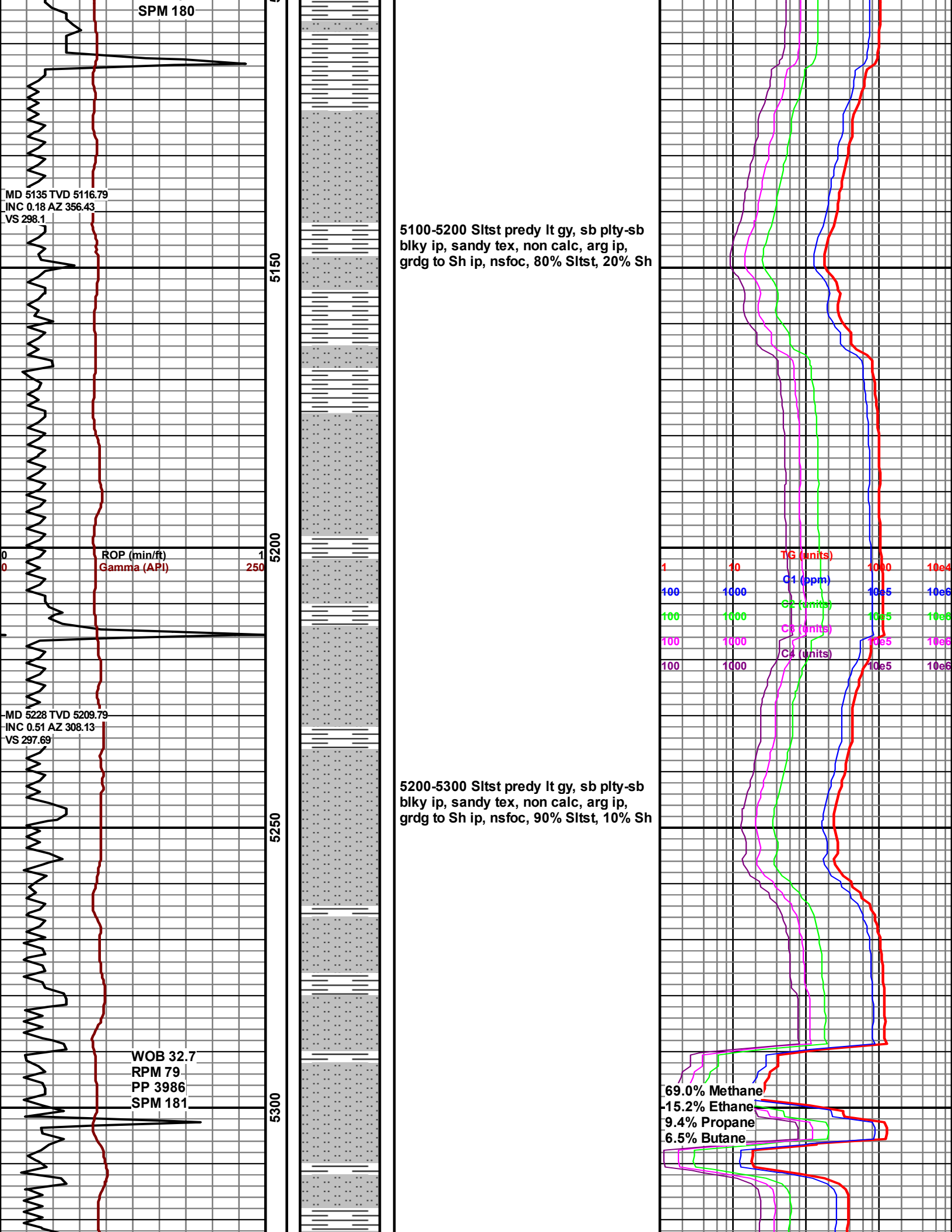

0
Gamma (API)
250
MD 4023 TVD 4007.61
INC 7.44 AZ 172.76
VS 244.48
4050
WOB 4.3
RPM 0
PP 3926
SPM 189
4100
MD 4115 TVD 4098.83
INC 7.54 AZ 180.89
VS 256.43
4150
4200
0
ROP (min/ft)
1
0
Gamma (API)
250
MD 4207 TVD 4190.12
INC 6.69 AZ 182.26
VS 267.82
4000-4100 Sltst gy-lt gy, sb blky-sb plty, frm, sl-non calc, sandy tex, tr carb mat in mtx, arg ip, grdg to Sh ip, nsfoc, 80% Sltst, 20% Sh
4100-4200 Sltst gy-lt gy, sb blky-sb plty, frm, sl-non calc, sandy tex, tr carb mat in mtx, arg ip, occ Ss trnsl off wht, s&p ip, vf-f gr, sb rnd, cons, w cmt, tr glau in mtx, non calc, nsfoc, 80% Sltst, 20% Ss
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
C3 (units)
C4 (units)
TG (units)

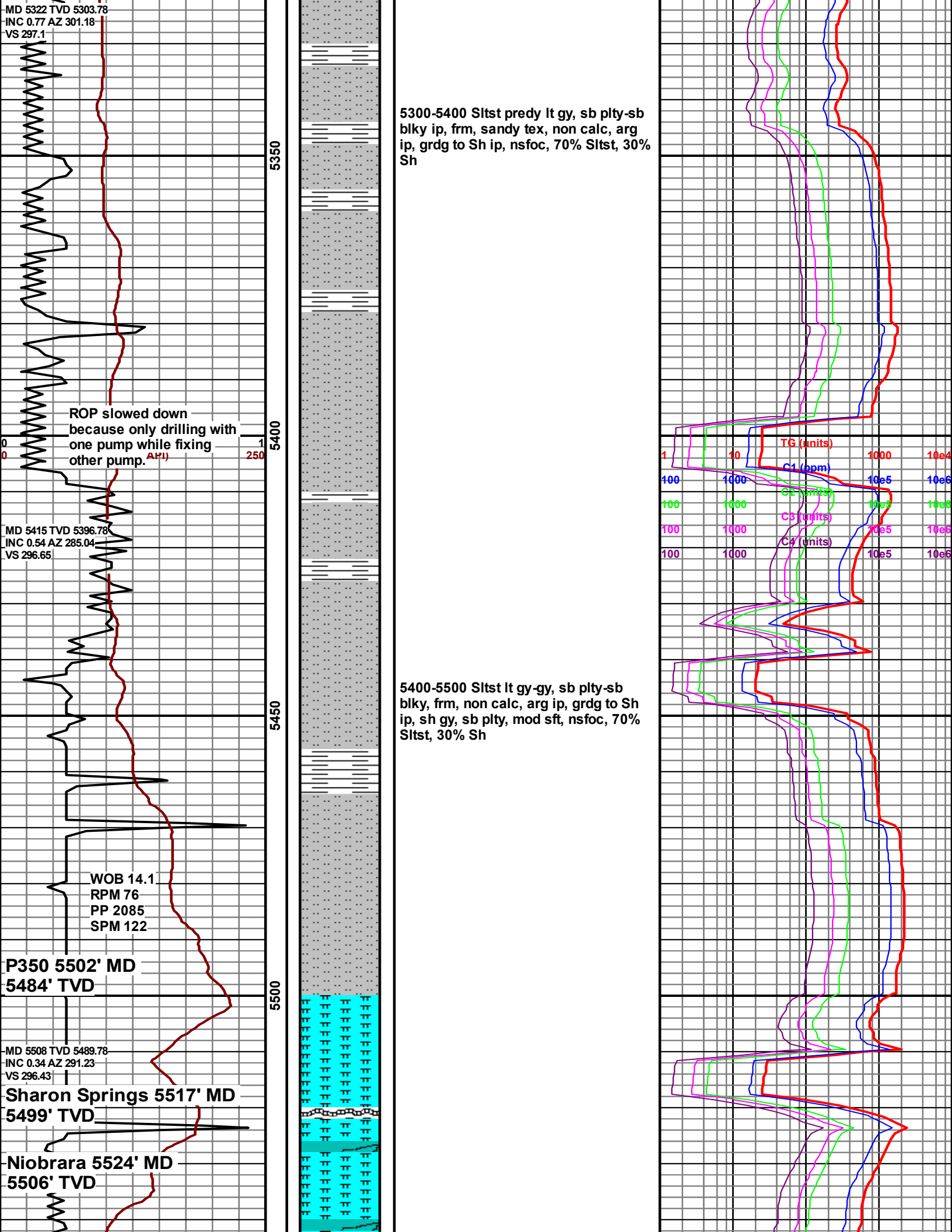

4250
4300
4350
4400
WOB 26.3
RPM 77
PP 4061
SPM 182
MD 4299 TVD 4281.57
INC 5.83 AZ 184.08
VS 277.83
MD 4391 TVD 4373.15
INC 5.15 AZ 189.4
VS 286.55
0
ROP (min/ft)
1
0
Gamma (API)
250
4200-4300 Sltst gy-lt gy, sb blky-sb plty, tr blky, sl-non calc, sandy tex, arg, grdg to Sh ip, occ Sh gy-dk gy, sb plty-blky, non calc, frm, slty tex ip, rr Ss aa, rr cal xls, nsfoc, 60% Sltst, 35% Sh, 5% Ss
4300-4400 Sltst gy-lt gy, sb blky-sb plty, tr blky, sl-non calc, sandy tex, arg, grdg to Sh ip, abnt Sh gy-dk gy, sb plty-blky, non calc, frm, slty tex ip, rr Ss aa, rr fosil frag, nsfoc, 50% Sltst, 45% Sh, 5% Ss
85.8% Methane
8.0% Ethane
6.2% Propane
0% Butane
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6

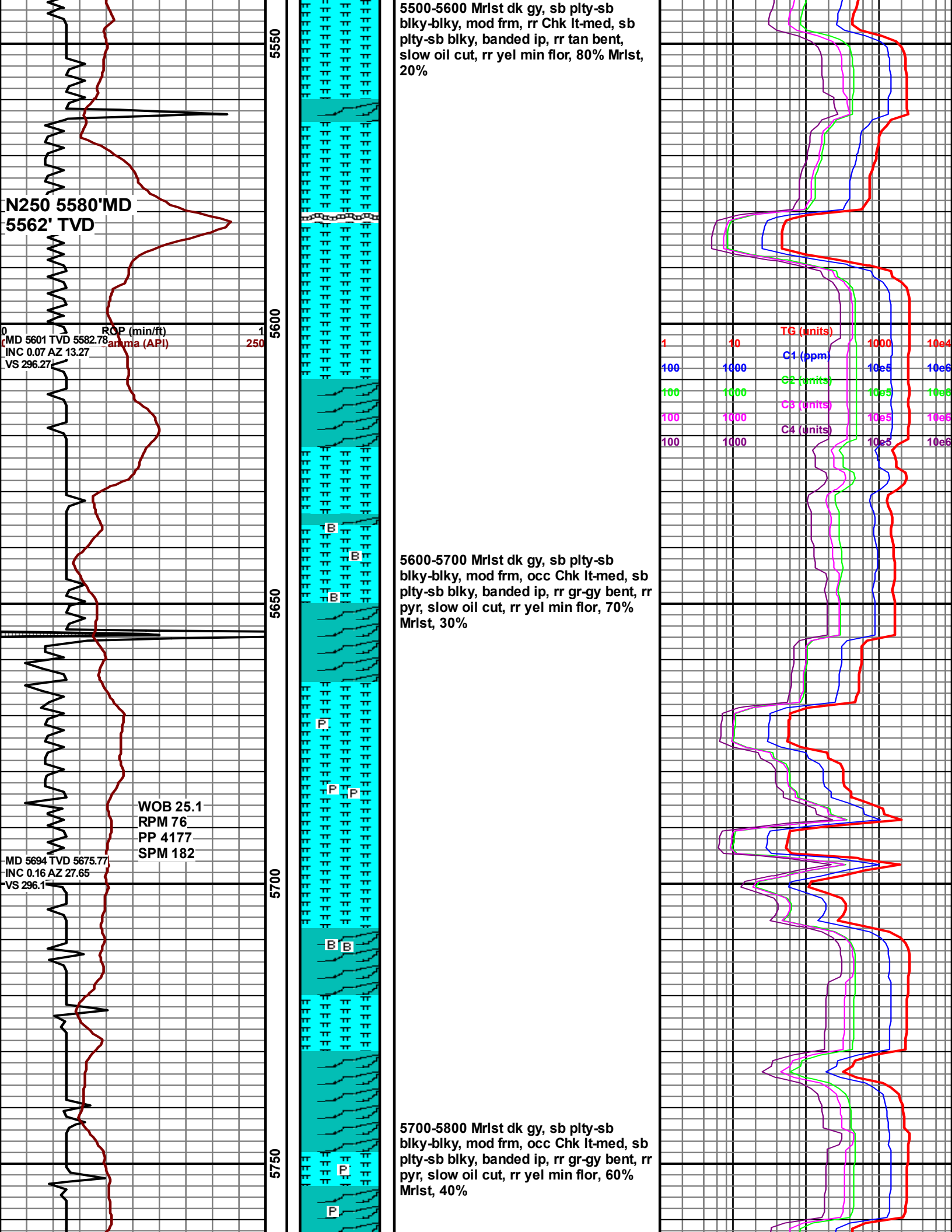

4400-4500 Sh gy, predy sb plty, sl slty tex, tr carb mat, non calc, frm, abnt Sltst gy-lt gy ip, frm, sb blky, tr sb plty, arg ip, sandy tex, rr Ss aa, nsfoc, 60% Sh, 35% Sltst, 5% Ss
MD 4485 TVD 4466.89
INC 3.24 AZ 182.38
VS 293.35
WOB 20.1
RPM 76
PP 4124
SPM 181
4500-4600 Sh gy, sb plty-plty, occ sb blky-spnlty, mod frm-frm, sl slty tex, grdg to Sltst ip, nsfoc, 70% Sh, 30% Sltst
MD 4577 TVD 4558.81
INC 1.64 AZ 185.19
VS 297.26
4600-4700 Sh gy, sb plty-plty, occ sb blky-spnlty, mod frm-frm, sl slty tex, grdg to Sltst ip, rr pyr, nsfoc, 75% Sh, 25% Sltst
4450
4500
4550
4600
4650
0
ROP (min/ft)
1
0
Gamma (API)
250
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6

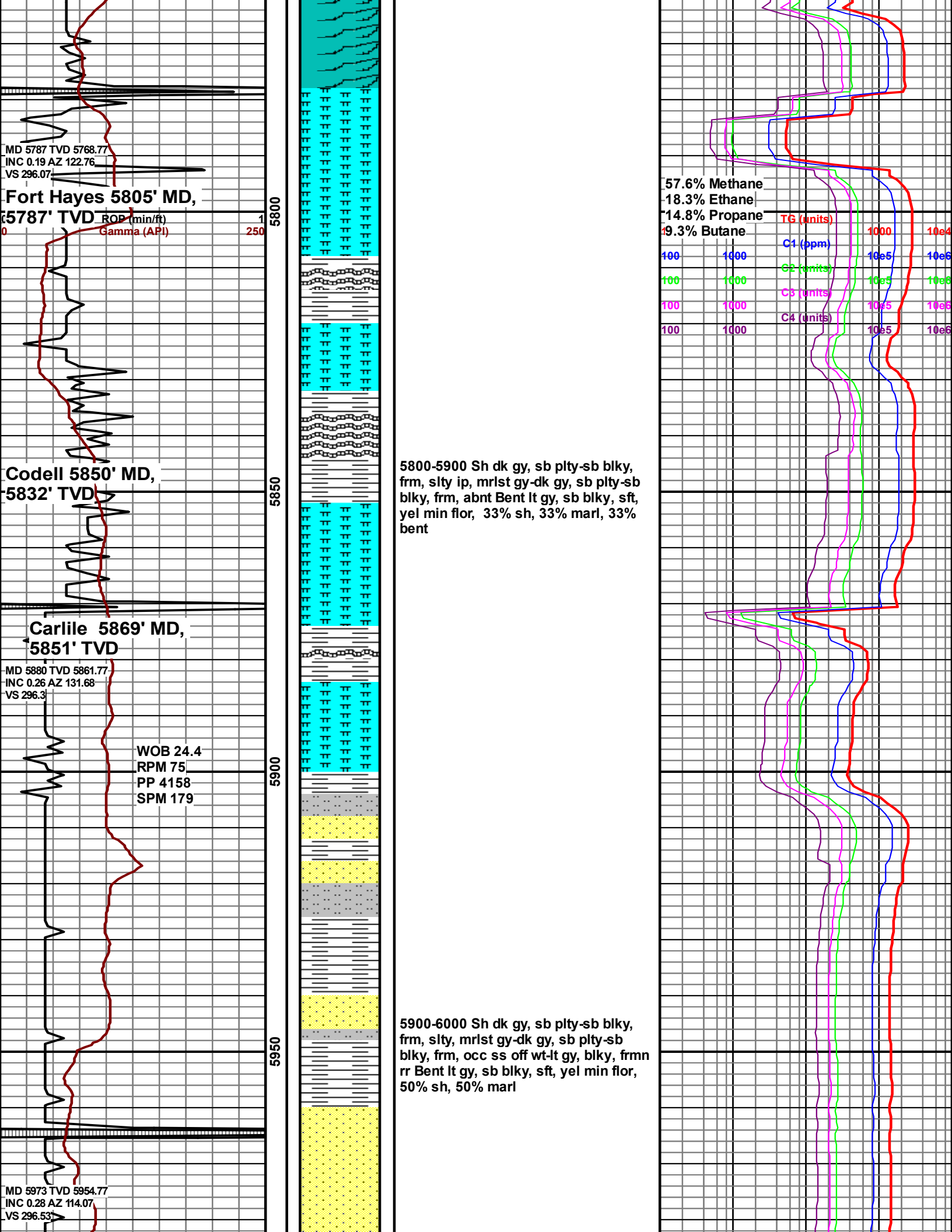

MD 4669 TVD 4650.79
INC 0.1 AZ 158.39
VS 298.64
WOB 33.3
RPM 76
PP 4189
SPM 179
4700
4750
MD 4763 TVD 4744.79
INC 0.04 AZ 352.31
VS 298.69
4800
0
ROP (min/ft)
1
0
Gamma (API)
250
4850
MD 4856 TVD 4837.79
INC 0.04 AZ 69.67
VS 298.65
P
4700-4800 Sh gy, sb plty-plty, occ sb blky-spnlty, mod frm-frm, sl slty tex, non calc, grdg to Sltst ip, nsfoc, 85% Sh, 15% Sltst
79.6% Methane
14.3% Ethane
5.1% Propane
1.0% Butane
TG (units)
1
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
4800-4900 Sh gy, sb plty-plty, tr sb blky-spnlty, mod frm-frm, sl slty tex, non calc, grdg to Sltst ip, rr fosil, nsfoc, 70% Sh, 30% Sltst

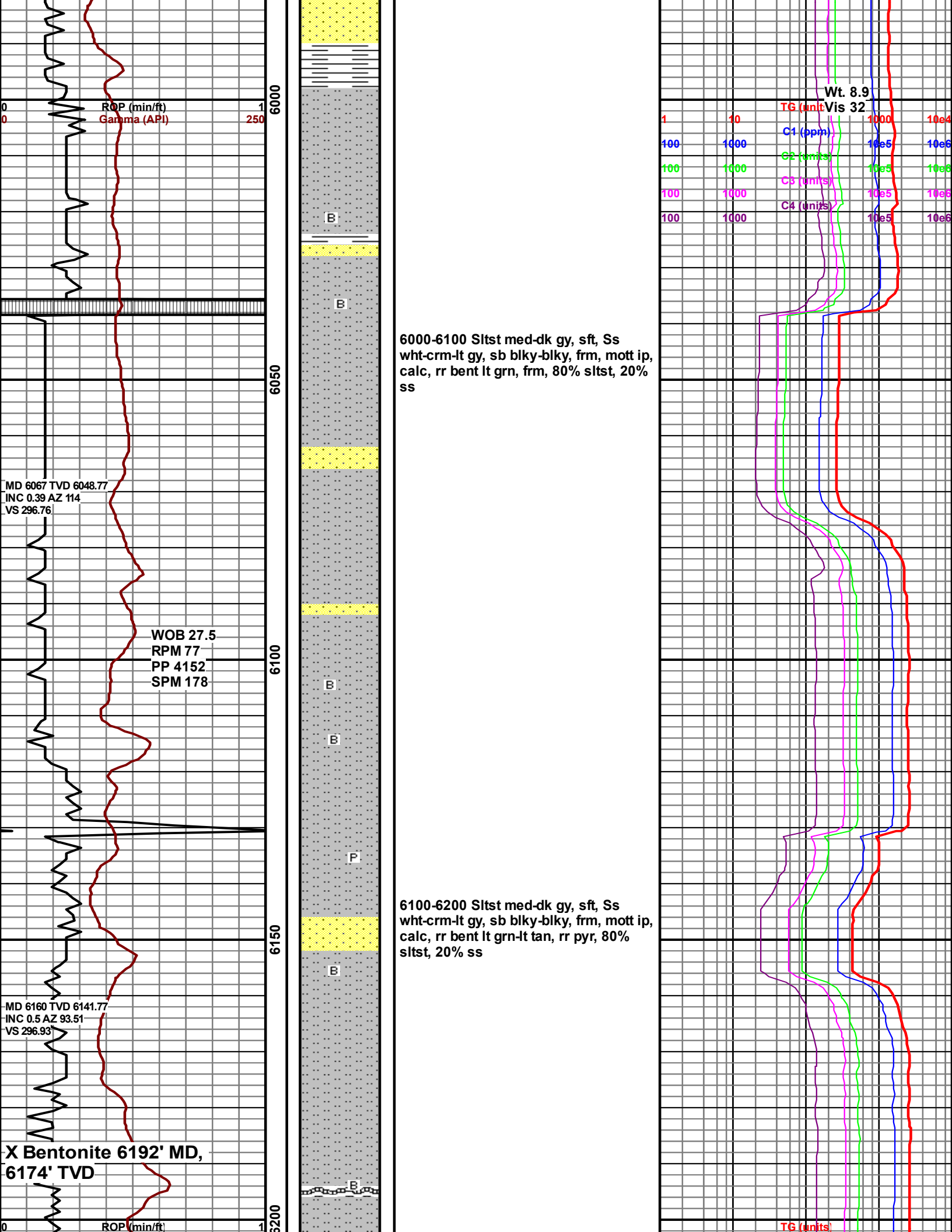

WOB 25.2
RPM 78
PP 4223
SPM 180
4900
MD 4949 TVD 4930.79
INC 0.1 AZ 45.39
VS 298.58
4950
0
ROP (min/ft)
1
0
Gamma (API)
250
5000
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
4900-5000 Sh gy, sb plty-plty, tr sb blky-spnlty, mod frm-frm, sl slty tex, non calc, grdg to Sltst ip, rr fosil, nsfoc, 75% Sh, 25% Sltst
MD 5042 TVD 5023.79
INC 0.18 AZ 17.86
VS 298.38
5050
5000-5100 Sltst predy lt gy, sb plty-sb blky ip, sandy tex, non calc, arg ip, grdg to Sh ip, rr Ls lt brn, blky, hard, nsfoc, 70% Sltst, 30% Sh
WOB 33.4
RPM 76
PP 4184
5100

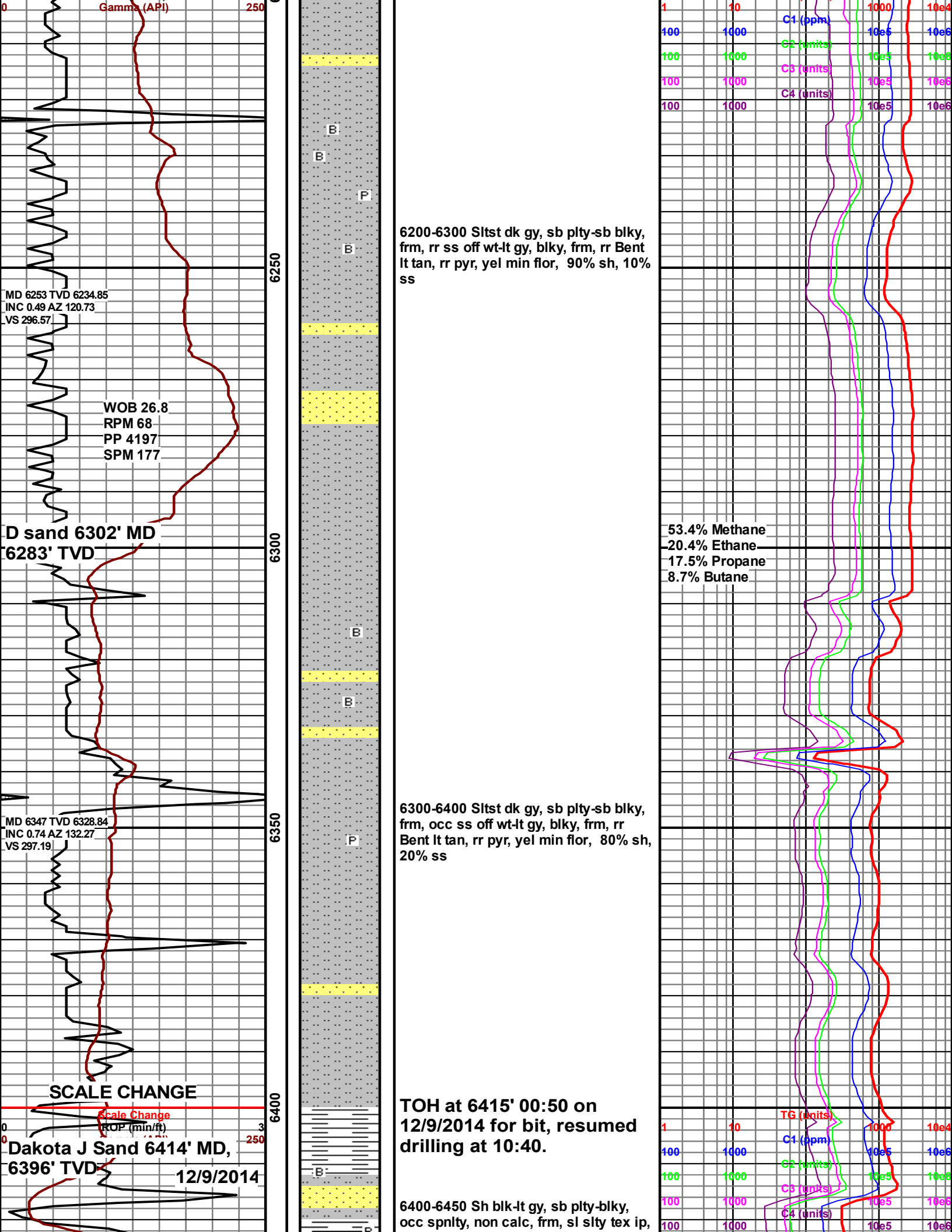

SPM 180
MD 5135 TVD 5116.79
INC 0.18 AZ 356.43
VS 298.1
5150
0
ROP (min/ft)
1
0
Gamma (API)
250
5200
MD 5228 TVD 5209.79
INC 0.51 AZ 308.13
VS 297.69
5100-5200 Sltst predy lt gy, sb plty-sb blky ip, sandy tex, non calc, arg ip, grdg to Sh ip, nsfoc, 80% Sltst, 20% Sh
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
5250
5200-5300 Sltst predy lt gy, sb plty-sb blky ip, sandy tex, non calc, arg ip, grdg to Sh ip, nsfoc, 90% Sltst, 10% Sh
WOB 32.7
RPM 79
PP 3986
SPM 181
5300
69.0% Methane
15.2% Ethane
9.4% Propane
6.5% Butane

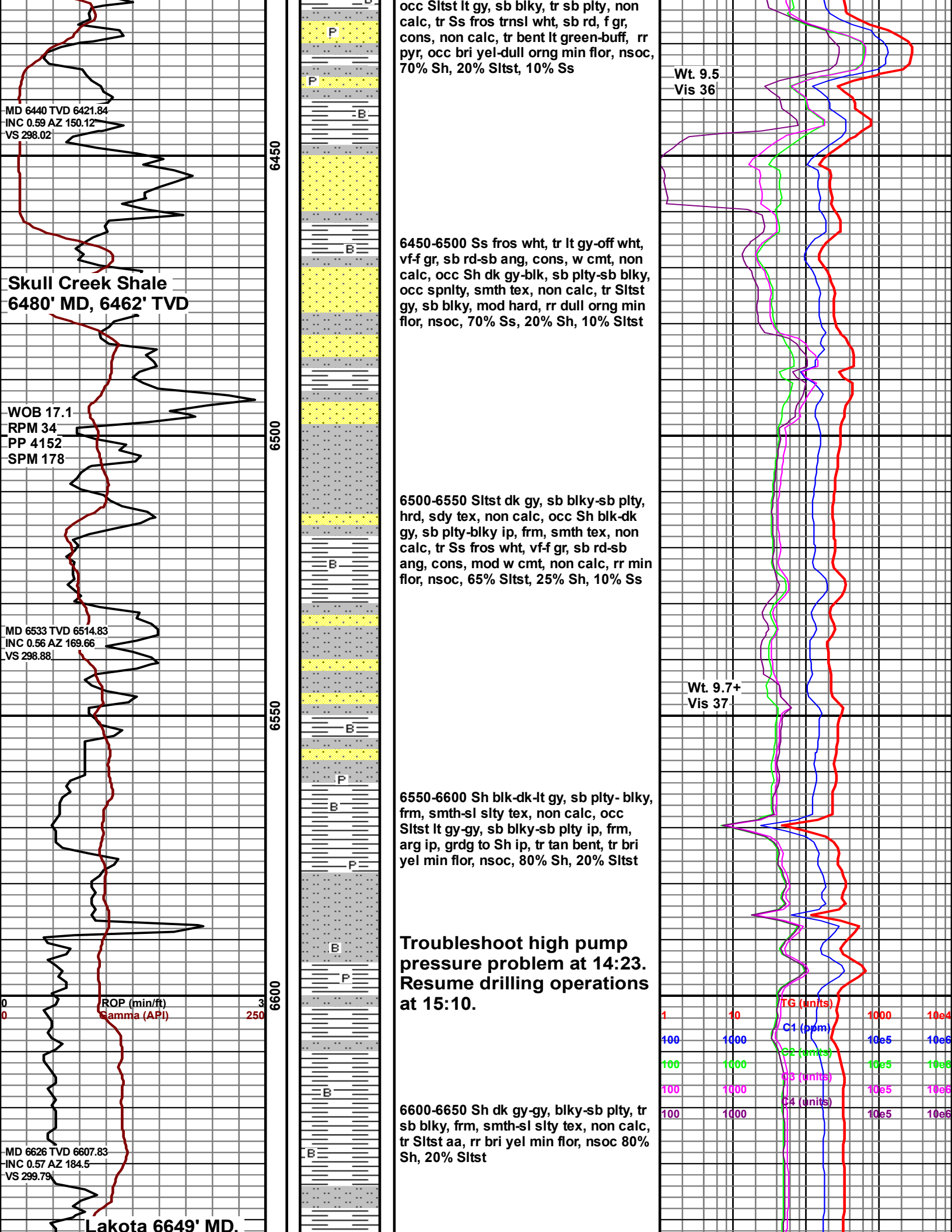

MD 5322 TVD 5303.78
INC 0.77 AZ 301.18
VS 297.1
5350
5300-5400 Sltst predy lt gy, sb plty-sb blky ip, frm, sandy tex, non calc, arg ip, grdg to Sh ip, nsfoc, 70% Sltst, 30% Sh
ROP slowed down because only drilling with one pump while fixing other pump.
0
0
1
250
API)
5400
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
MD 5415 TVD 5396.78
INC 0.54 AZ 285.04
VS 296.65
5450
5400-5500 Sltst lt gy-gy, sb plty-sb blky, frm, non calc, arg ip, grdg to Sh ip, sh gy, sb plty, mod sft, nsfoc, 70% Sltst, 30% Sh
WOB 14.1
RPM 76
PP 2085
SPM 122
P350 5502' MD
5484' TVD
5500
MD 5508 TVD 5489.78
INC 0.34 AZ 291.23
VS 296.43
Sharon Springs 5517' MD
5499' TVD
Niobrara 5524' MD
5506' TVD

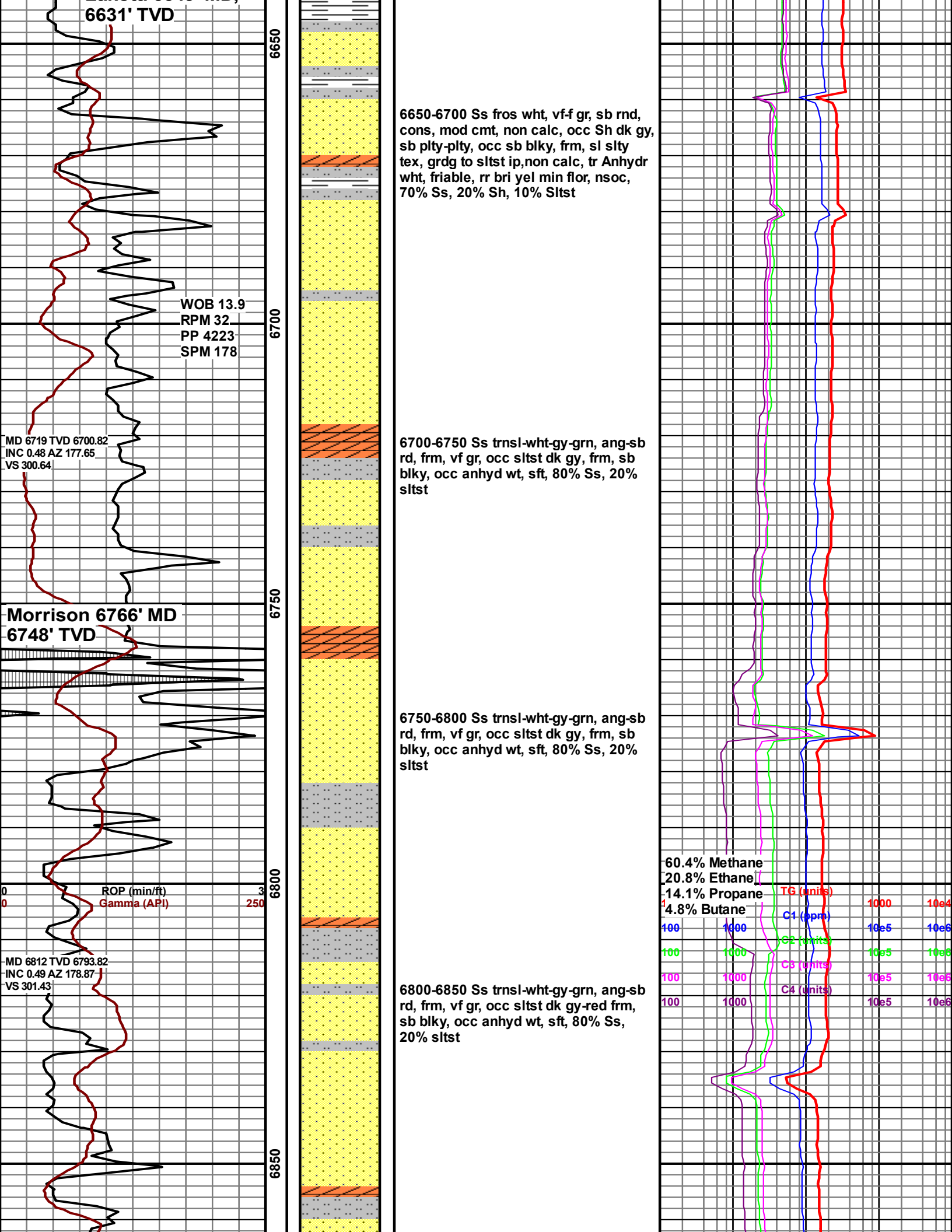

5500-5600 Mrlst dk gy, sb plty-sb blky-blky, mod frm, rr Chk lt-med, sb plty-sb blky, banded ip, rr tan bent, slow oil cut, rr yel min flor, 80% Mrlst, 20%
N250 5580'MD
5562' TVD
ROP (min/ft)
Gamma (API)
MD 5601 TVD 5582.78
INC 0.07 AZ 13.27
VS 296.27
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
5600-5700 Mrlst dk gy, sb plty-sb blky-blky, mod frm, occ Chk lt-med, sb plty-sb blky, banded ip, rr gr-gy bent, rr pyr, slow oil cut, rr yel min flor, 70% Mrlst, 30%
WOB 25.1
RPM 76
PP 4177
SPM 182
MD 5694 TVD 5675.77
INC 0.16 AZ 27.65
VS 296.1
5700-5800 Mrlst dk gy, sb plty-sb blky-blky, mod frm, occ Chk lt-med, sb plty-sb blky, banded ip, rr gr-gy bent, rr pyr, slow oil cut, rr yel min flor, 60% Mrlst, 40%

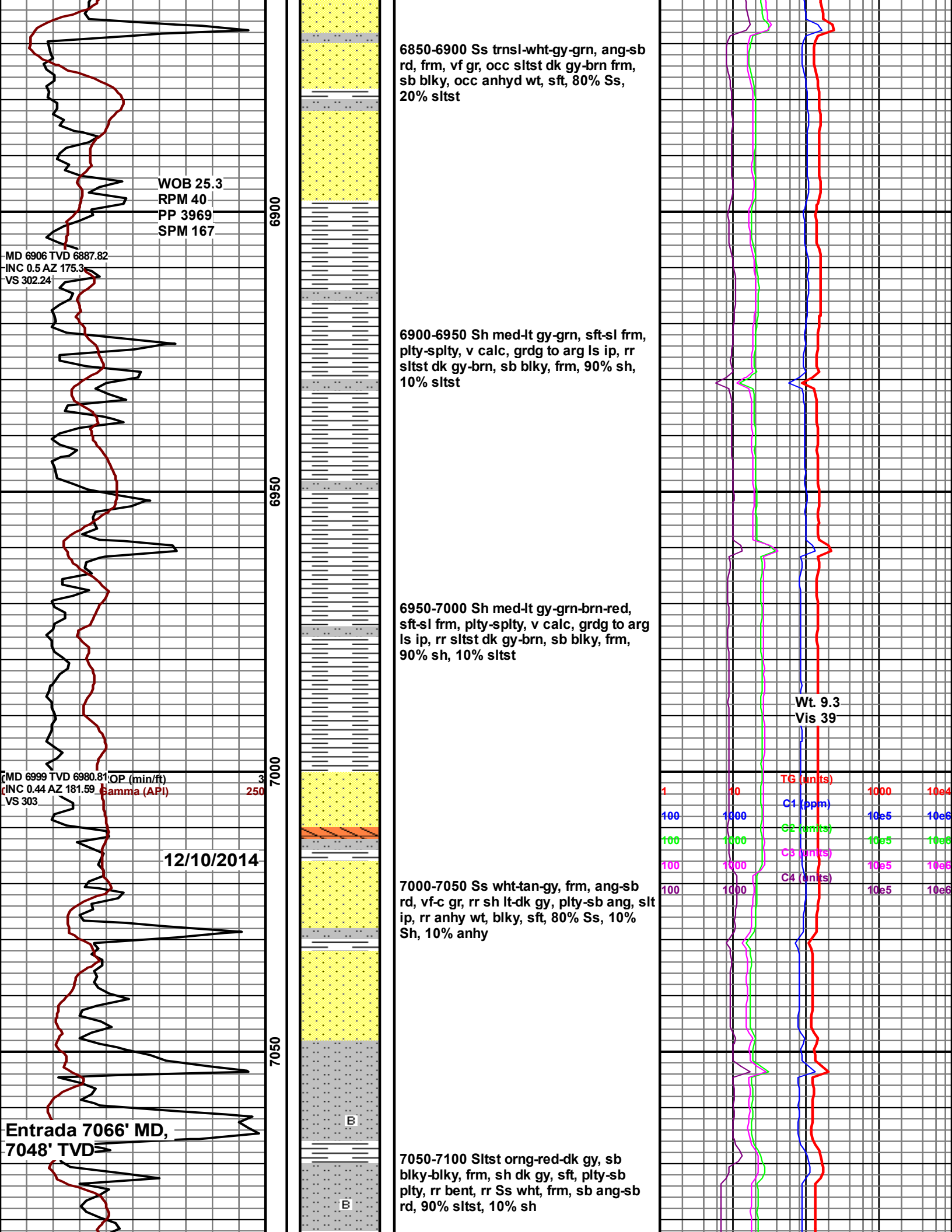

MD 5787 TVD 5768.77
INC 0.19 AZ 122.76
VS 296.07
Fort Hayes 5805' MD,
5787' TVD
ROP (min/ft)
Gamma (API)
0
250
1
5800
Codell 5850' MD,
5832' TVD
5850
Carlile 5869' MD,
5851' TVD
MD 5880 TVD 5861.77
INC 0.26 AZ 131.68
VS 296.3
WOB 24.4
RPM 75
PP 4158
SPM 179
5900
5950
MD 5973 TVD 5954.77
INC 0.28 AZ 114.07
VS 296.53
5800-5900 Sh dk gy, sb plty-sb blky, frm, slty ip, mrlst gy-dk gy, sb plty-sb blky, frm, abnt Bent lt gy, sb blky, sft, yel min flor, 33% sh, 33% marl, 33% bent
5900-6000 Sh dk gy, sb plty-sb blky, frm, slty, mrlst gy-dk gy, sb plty-sb blky, frm, occ ss off wt-lt gy, blky, frmn rr Bent lt gy, sb blky, sft, yel min flor, 50% sh, 50% marl
57.6% Methane
18.3% Ethane
14.8% Propane
9.3% Butane
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
100
1000
10e5
10e6
10e4

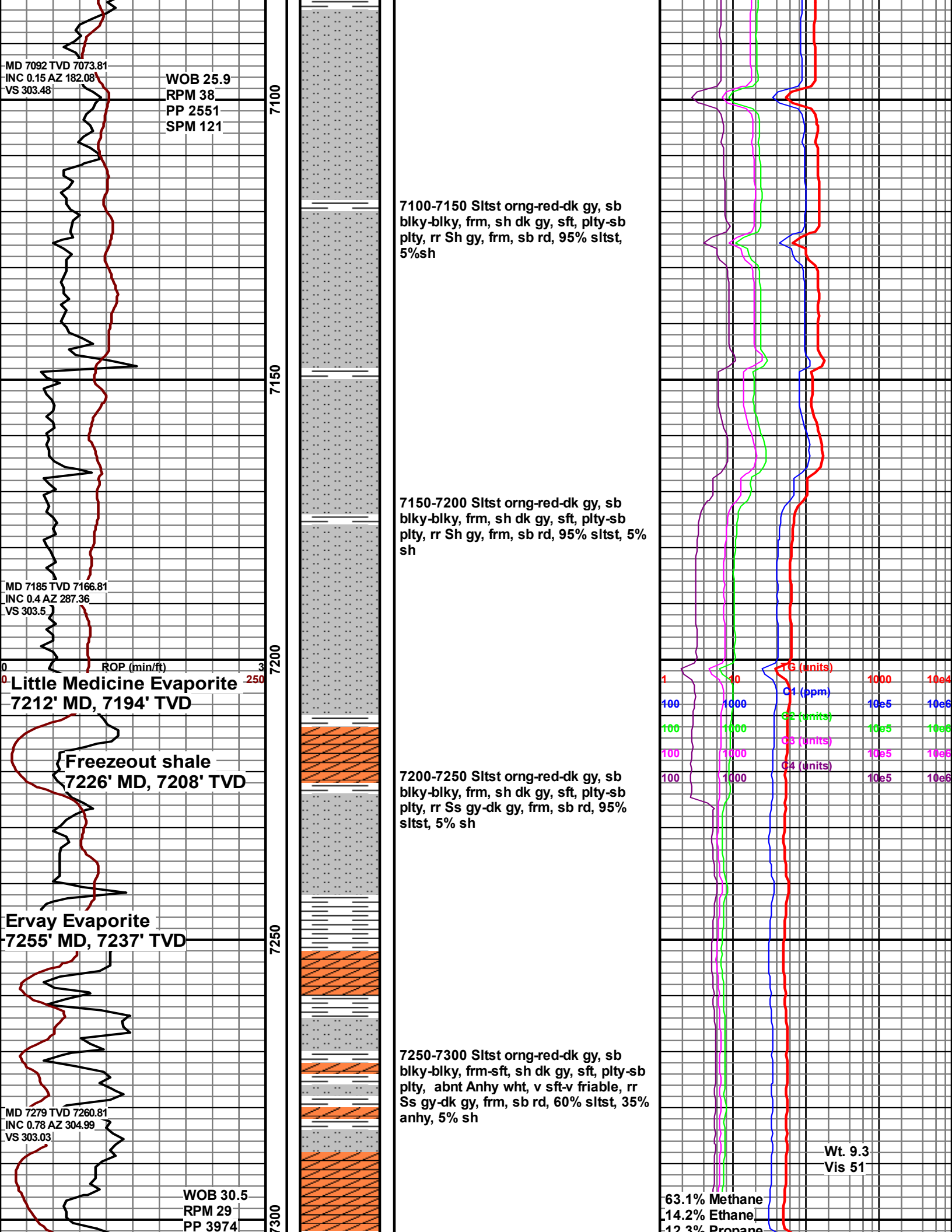

0
ROP (min/ft)
1
0
Gamma (API)
250
6000
6050
6100
6150
6200
MD 6067 TVD 6048.77
INC 0.39 AZ 114
VS 296.76
WOB 27.5
RPM 77
PP 4152
SPM 178
MD 6160 TVD 6141.77
INC 0.5 AZ 93.51
VS 296.93
X Bentonite 6192' MD, 6174' TVD
0
ROP (min/ft)
1
B
B
B
B
P
B
B
6000-6100 Sltst med-dk gy, sft, Ss wht-crm-lt gy, sb blky-blky, frm, mott ip, calc, rr bent lt grn, frm, 80% sltst, 20% ss
6100-6200 Sltst med-dk gy, sft, Ss wht-crm-lt gy, sb blky-blky, frm, mott ip, calc, rr bent lt grn-lt tan, rr pyr, 80% sltst, 20% ss
Wt. 8.9
Vis 32
TG (units)
1
10
100
1000
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
TG (units)

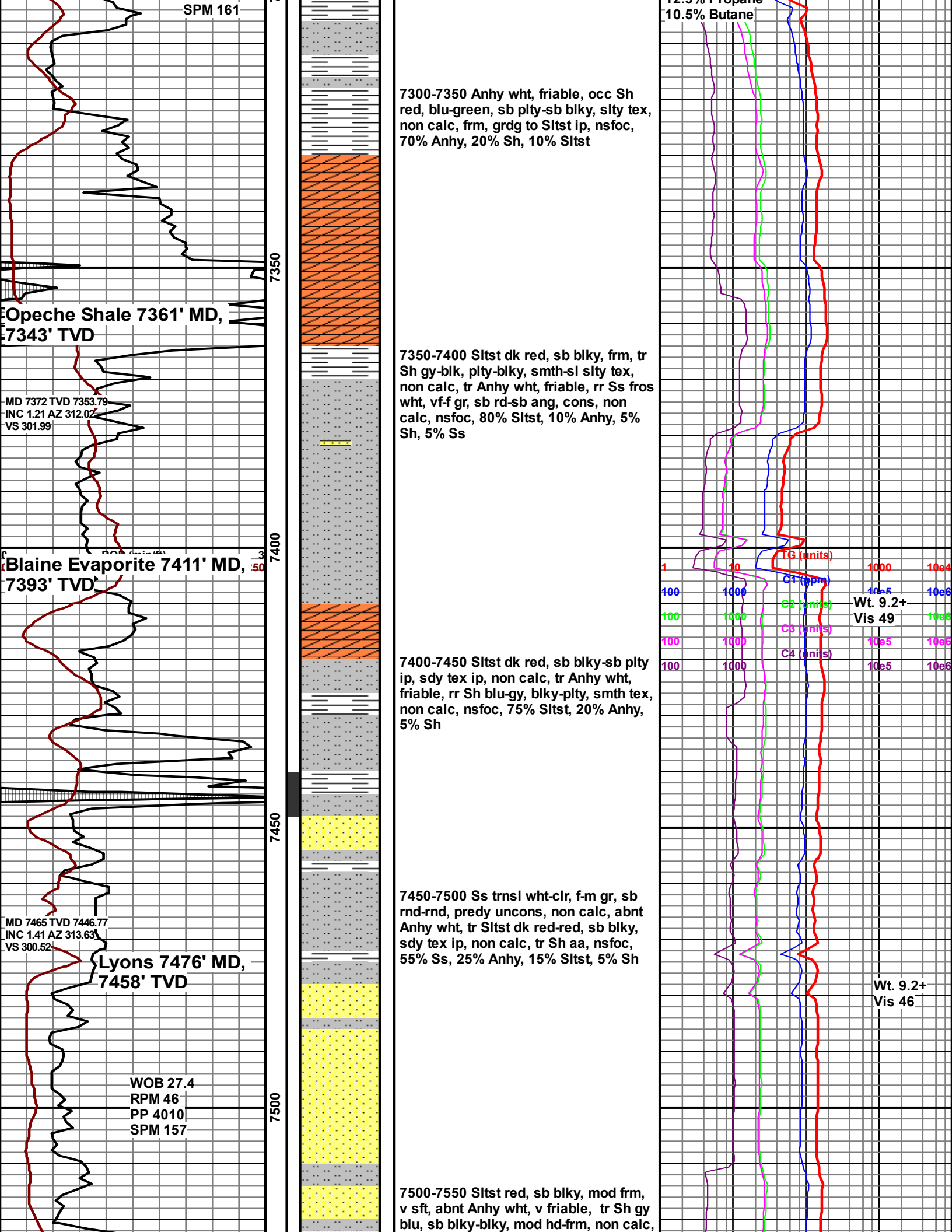

0
Gamma (API)
250
6250
MD 6253 TVD 6234.85
INC 0.49 AZ 120.73
VS 296.57
WOB 26.8
RPM 68
PP 4197
SPM 177
D sand 6302' MD
6283' TVD
6300
MD 6347 TVD 6328.84
INC 0.74 AZ 132.27
VS 297.19
6350
SCALE CHANGE
Scale Change
ROP (min/ft)
0
3
0
250
Dakota J Sand 6414' MD,
6396' TVD
12/9/2014
6400
B
B
P
B
B
P
B
B
P
B
6200-6300 Sltst dk gy, sb plty-sb blky, frm, rr ss off wt-lt gy, blky, frm, rr Bent lt tan, rr pyr, yel min flor, 90% sh, 10% ss
6300-6400 Sltst dk gy, sb plty-sb blky, frm, occ ss off wt-lt gy, blky, frm, rr Bent lt tan, rr pyr, yel min flor, 80% sh, 20% ss
TOH at 6415' 00:50 on 12/9/2014 for bit, resumed drilling at 10:40.
6400-6450 Sh blk-lt gy, sb plty-blky, occ spnlty, non calc, frm, sl slty tex ip,
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
C3 (units)
C4 (units)
53.4% Methane
20.4% Ethane
17.5% Propane
8.7% Butane
TG (units)

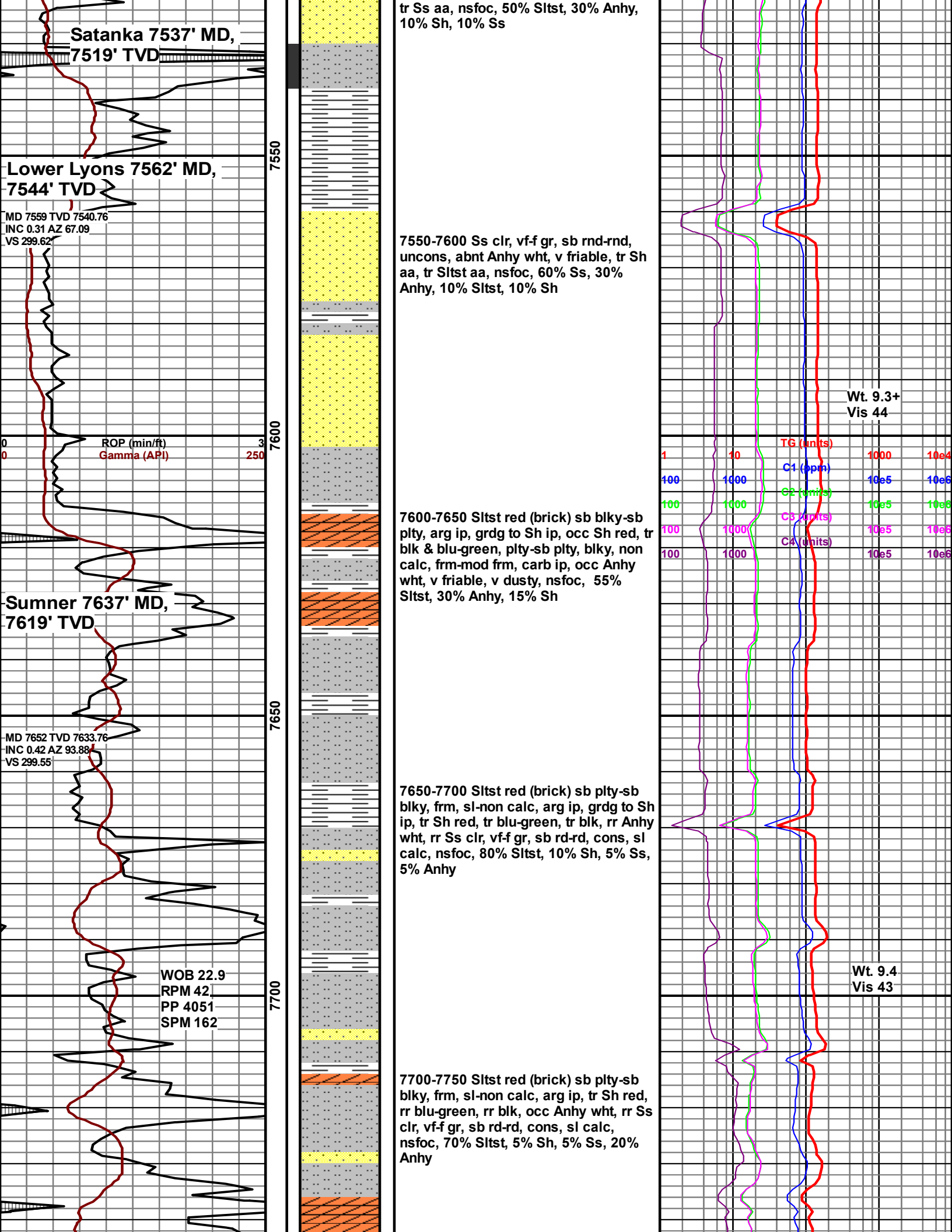

MD 6440 TVD 6421.84
INC 0.59 AZ 150.12
VS 298.02
Skull Creek Shale
6480' MD, 6462' TVD
WOB 17.1
RPM 34
PP 4152
SPM 178
MD 6533 TVD 6514.83
INC 0.56 AZ 169.66
VS 298.88
MD 6626 TVD 6607.83
INC 0.57 AZ 184.5
VS 299.79
Lakota 6649' MD,
6450
6500
6550
6600
0
0
ROP (min/ft)
Gamma (API)
3
250
P
B
occ Sltst lt gy, sb blky, tr sb plty, non calc, tr Ss fros trnsl wht, sb rd, f gr, cons, non calc, tr bent lt green-buff, rr pyr, occ bri yel-dull orng min flor, nsoc, 70% Sh, 20% Sltst, 10% Ss
Wt. 9.5
Vis 36
6450-6500 Ss fros wht, tr lt gy-off wht, vf-f gr, sb rd-sb ang, cons, w cmt, non calc, occ Sh dk gy-blk, sb plty-sb blky, occ spnlty, smth tex, non calc, tr Sltst gy, sb blky, mod hard, rr dull orng min flor, nsoc, 70% Ss, 20% Sh, 10% Sltst
6500-6550 Sltst dk gy, sb blky-sb plty, hrd, sdy tex, non calc, occ Sh blk-dk gy, sb plty-blky ip, frm, smth tex, non calc, tr Ss fros wht, vf-f gr, sb rd-sb ang, cons, mod w cmt, non calc, rr min flor, nsoc, 65% Sltst, 25% Sh, 10% Ss
Wt. 9.7+
Vis 37
6550-6600 Sh blk-dk-lt gy, sb plty- blky, frm, smth-sl slty tex, non calc, occ Sltst lt gy-gy, sb blky-sb plty ip, frm, arg ip, grdg to Sh ip, tr tan bent, tr bri yel min flor, nsoc, 80% Sh, 20% Sltst
Troubleshoot high pump pressure problem at 14:23. Resume drilling operations at 15:10.
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
1
10
100
1000
10e4
10e5
10e6
6600-6650 Sh dk gy-gy, blky-sb plty, tr sb blky, frm, smth-sl slty tex, non calc, tr Sltst aa, rr bri yel min flor, nsoc 80% Sh, 20% Sltst

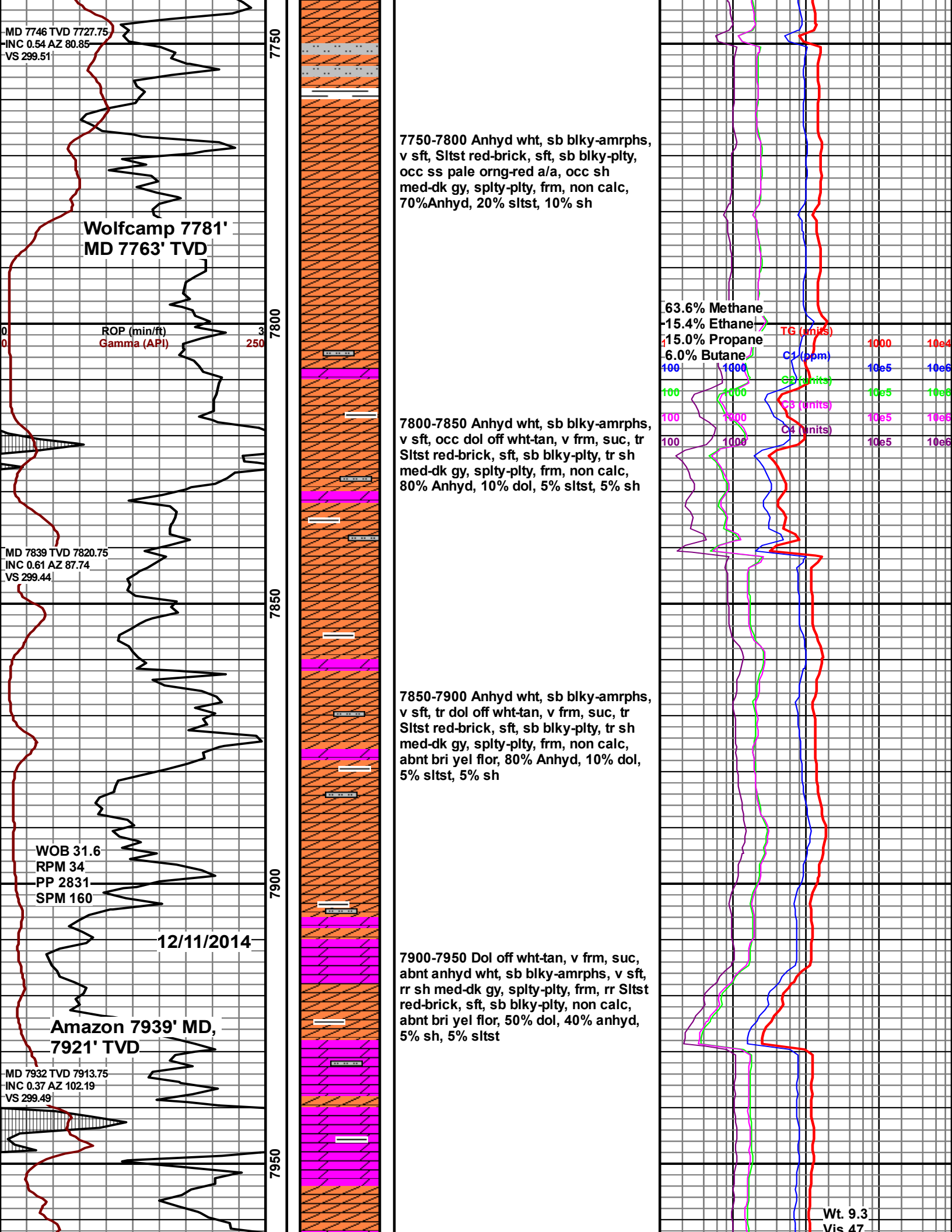

6631' TVD
6650
WOB 13.9
RPM 32
PP 4223
SPM 178
6700
MD 6719 TVD 6700.82
INC 0.48 AZ 177.65
VS 300.64
6650-6700 Ss fros wht, vf-f gr, sb rnd, cons, mod cmt, non calc, occ Sh dk gy, sb plty-plty, occ sb blky, frm, sl slty tex, grdg to sltst ip,non calc, tr Anhydr wht, friable, rr bri yel min flor, nsoc, 70% Ss, 20% Sh, 10% Sltst
6700-6750 Ss trnsl-wht-gy-grn, ang-sb rd, frm, vf gr, occ sltst dk gy, frm, sb blky, occ anhyd wt, sft, 80% Ss, 20% sltst
6750
Morrison 6766' MD
6748' TVD
6750-6800 Ss trnsl-wht-gy-grn, ang-sb rd, frm, vf gr, occ sltst dk gy, frm, sb blky, occ anhyd wt, sft, 80% Ss, 20% sltst
60.4% Methane
20.8% Ethane
14.1% Propane
4.8% Butane
6800
0
ROP (min/ft)
3
0
Gamma (API)
250
TG (units)
1
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
MD 6812 TVD 6793.82
INC 0.49 AZ 178.87
VS 301.43
6800-6850 Ss trnsl-wht-gy-grn, ang-sb rd, frm, vf gr, occ sltst dk gy-red frm, sb blky, occ anhyd wt, sft, 80% Ss, 20% sltst
6850

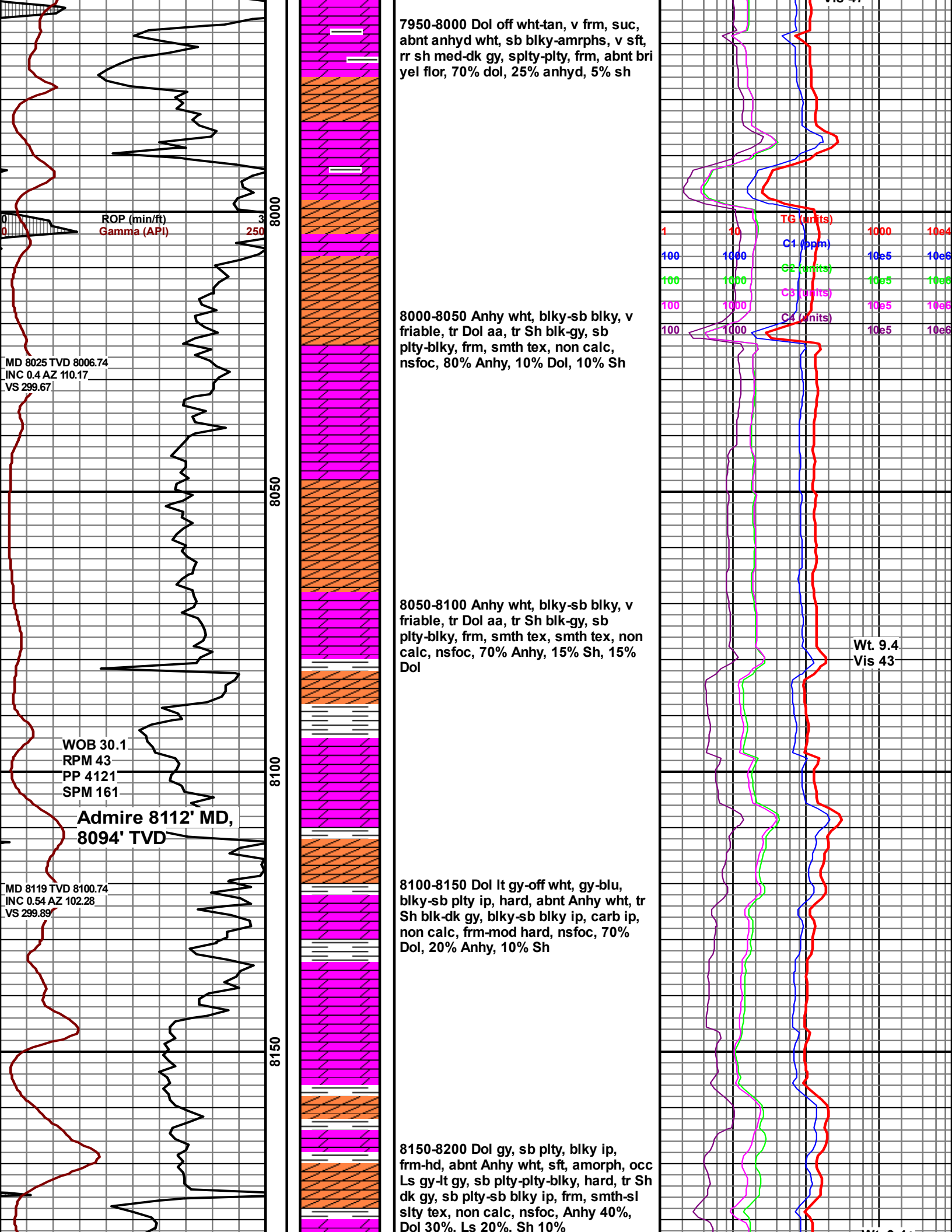

WOB 25.3
RPM 40
PP 3969
SPM 167
MD 6906 TVD 6887.82
INC 0.5 AZ 175.3
VS 302.24
6900
6950
7000
7050
MD 6999 TVD 6980.81
INC 0.44 AZ 181.59
VS 303
ROP (min/ft)
3
Gamma (API)
250
12/10/2014
Entrada 7066' MD,
7048' TVD
B
B
6850-6900 Ss trnsl-wht-gy-grn, ang-sb rd, frm, vf gr, occ sltst dk gy-brn frm, sb blky, occ anhyd wt, sft, 80% Ss, 20% sltst
6900-6950 Sh med-lt gy-grn, sft-sl frm, plty-splty, v calc, grdg to arg ls ip, rr sltst dk gy-brn, sb blky, frm, 90% sh, 10% sltst
6950-7000 Sh med-lt gy-grn-brn-red, sft-sl frm, plty-splty, v calc, grdg to arg ls ip, rr sltst dk gy-brn, sb blky, frm, 90% sh, 10% sltst
Wt. 9.3
Vis 39
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
7000-7050 Ss wht-tan-gy, frm, ang-sb rd, vf-c gr, rr sh lt-dk gy, plty-sb ang, slt ip, rr anhy wt, blky, sft, 80% Ss, 10% Sh, 10% anhy
7050-7100 Sltst orng-red-dk gy, sb blky-blky, frm, sh dk gy, sft, plty-sb plty, rr bent, rr Ss wht, frm, sb ang-sb rd, 90% sltst, 10% sh

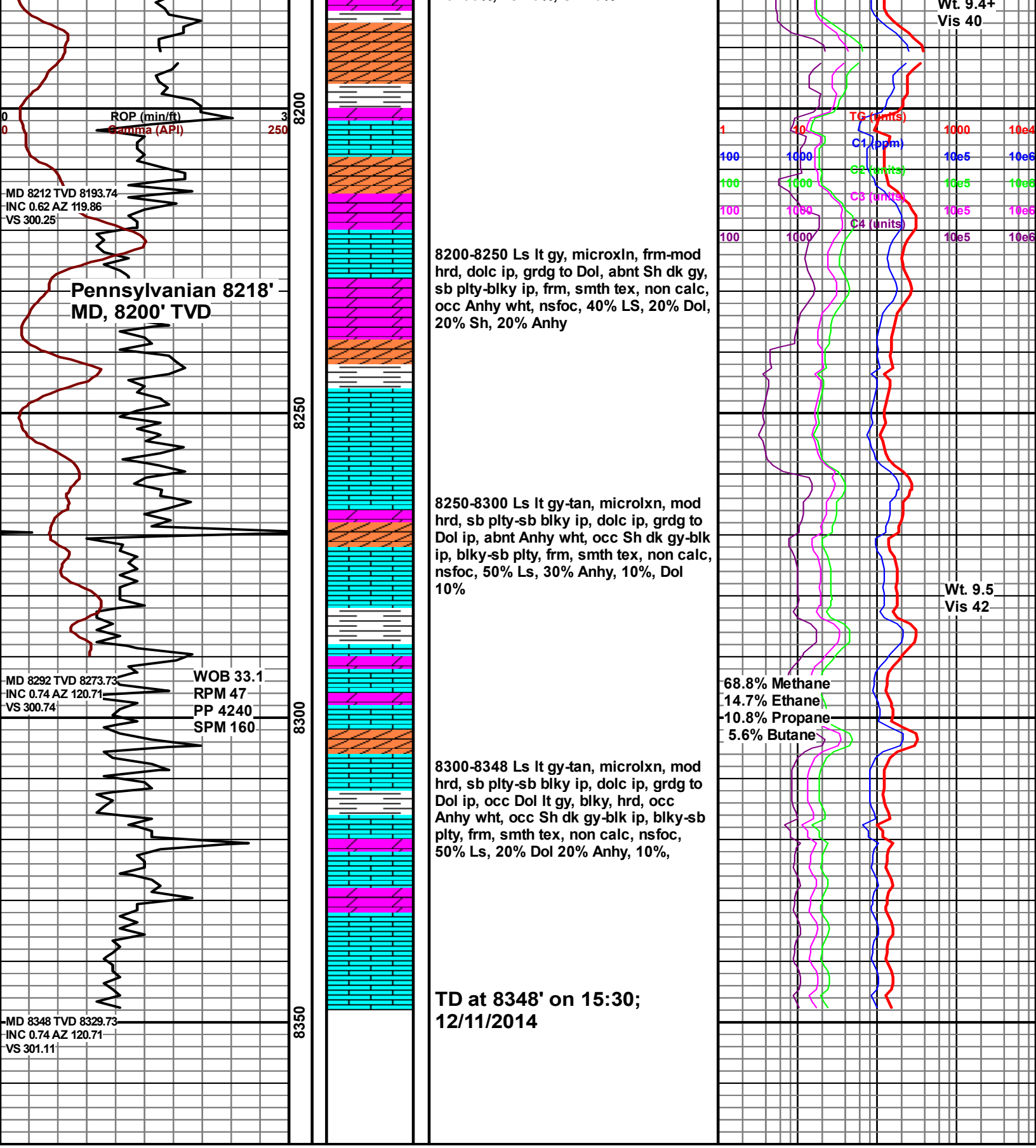

MD 7092 TVD 7073.81
INC 0.15 AZ 182.08
VS 303.48
WOB 25.9
RPM 38
PP 2551
SPM 121
7100
7150
MD 7185 TVD 7166.81
INC 0.4 AZ 287.36
VS 303.5
7200
0
ROP (min/ft)
3
0
250
Little Medicine Evaporite
7212' MD, 7194' TVD
Freezeout shale
7226' MD, 7208' TVD
Ervay Evaporite
7255' MD, 7237' TVD
7250
MD 7279 TVD 7260.81
INC 0.78 AZ 304.99
VS 303.03
WOB 30.5
RPM 29
PP 3974
7300
7100-7150 Sltst orng-red-dk gy, sb blky-blky, frm, sh dk gy, sft, plty-sb plty, rr Sh gy, frm, sb rd, 95% sltst, 5%sh
7150-7200 Sltst orng-red-dk gy, sb blky-blky, frm, sh dk gy, sft, plty-sb plty, rr Sh gy, frm, sb rd, 95% sltst, 5% sh
7200-7250 Sltst orng-red-dk gy, sb blky-blky, frm, sh dk gy, sft, plty-sb plty, rr Ss gy-dk gy, frm, sb rd, 95% sltst, 5% sh
7250-7300 Sltst orng-red-dk gy, sb blky-blky, frm-sft, sh dk gy, sft, plty-sb plty, abnt Anhy wht, v sft-v friable, rr Ss gy-dk gy, frm, sb rd, 60% sltst, 35% anhy, 5% sh
TG (units)
1
10
100
1000
10e4
C1 (ppm)
1000
10e5
10e6
C2 (units)
C3 (units)
C4 (units)
Wt. 9.3
Vis 51
63.1% Methane
14.2% Ethane
12.3% Propane


SPM 161
7350
Opeche Shale 7361' MD, 7343' TVD
MD 7372 TVD 7353.79
INC 1.21 AZ 312.02
VS 301.99
7400
Blaine Evaporite 7411' MD, 7393' TVD
7450
MD 7465 TVD 7446.77
INC 1.41 AZ 313.63
VS 300.52
Lyons 7476' MD, 7458' TVD
WOB 27.4
RPM 46
PP 4010
SPM 157
7500
7300-7350 Anhy wht, friable, occ Sh red, blu-green, sb plty-sb blky, slty tex, non calc, frm, grdg to Sltst ip, nsfoc, 70% Anhy, 20% Sh, 10% Sltst
7350-7400 Sltst dk red, sb blky, frm, tr Sh gy-blk, plty-blky, smth-sl slty tex, non calc, tr Anhy wht, friable, rr Ss fros wht, vf-f gr, sb rd-sb ang, cons, non calc, nsfoc, 80% Sltst, 10% Anhy, 5% Sh, 5% Ss
7400-7450 Sltst dk red, sb blky-sb plty ip, sdy tex ip, non calc, tr Anhy wht, friable, rr Sh blu-gy, blky-plty, smth tex, non calc, nsfoc, 75% Sltst, 20% Anhy, 5% Sh
7450-7500 Ss trnsl wht-clr, f-m gr, sb rnd-rnd, predy uncons, non calc, abnt Anhy wht, tr Sltst dk red-red, sb blky, sdy tex ip, non calc, tr Sh aa, nsfoc, 55% Ss, 25% Anhy, 15% Sltst, 5% Sh
7500-7550 Sltst red, sb blky, mod frm, v sft, abnt Anhy wht, v friable, tr Sh gy blu, sb blky-blky, mod hd-frm, non calc,
12.5% Propane
10.5% Butane
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
C3 (units)
100
1000
10e5
C4 (units)
100
1000
10e5
10e6
Wt. 9.2+
Vis 49
Wt. 9.2+
Vis 46


Satanka 7537' MD, 7519' TVD
Lower Lyons 7562' MD, 7544' TVD
MD 7559 TVD 7540.76
INC 0.31 AZ 67.09
VS 299.62
0
ROP (min/ft)
3
0
Gamma (API)
250
Sumner 7637' MD, 7619' TVD
MD 7652 TVD 7633.76
INC 0.42 AZ 93.88
VS 299.55
WOB 22.9
RPM 42
PP 4051
SPM 162
7550
7600
7650
7700
tr Ss aa, nsfoc, 50% Sltst, 30% Anhy, 10% Sh, 10% Ss
7550-7600 Ss clr, vf-f gr, sb rnd-rnd, uncons, abnt Anhy wht, v friable, tr Sh aa, tr Sltst aa, nsfoc, 60% Ss, 30% Anhy, 10% Sltst, 10% Sh
7600-7650 Sltst red (brick) sb blky-sb plty, arg ip, grdg to Sh ip, occ Sh red, tr blk & blu-green, plty-sb plty, blky, non calc, frm-mod frm, carb ip, occ Anhy wht, v friable, v dusty, nsfoc, 55% Sltst, 30% Anhy, 15% Sh
7650-7700 Sltst red (brick) sb plty-sb blky, frm, sl-non calc, arg ip, grdg to Sh ip, tr Sh red, tr blu-green, tr blk, rr Anhy wht, rr Ss clr, vf-f gr, sb rd-rd, cons, sl calc, nsfoc, 80% Sltst, 10% Sh, 5% Ss, 5% Anhy
7700-7750 Sltst red (brick) sb plty-sb blky, frm, sl-non calc, arg ip, tr Sh red, rr blu-green, rr blk, occ Anhy wht, rr Ss clr, vf-f gr, sb rd-rd, cons, sl calc, nsfoc, 70% Sltst, 5% Sh, 5% Ss, 20% Anhy
Wt. 9.3+
Vis 44
TG (units)
1
10
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
Wt. 9.4
Vis 43


MD 7746 TVD 7727.75
INC 0.54 AZ 80.85
VS 299.51
Wolfcamp 7781'
MD 7763' TVD
ROP (min/ft)
Gamma (API)
MD 7839 TVD 7820.75
INC 0.61 AZ 87.74
VS 299.44
WOB 31.6
RPM 34
PP 2831
SPM 160
12/11/2014
Amazon 7939' MD,
7921' TVD
MD 7932 TVD 7913.75
INC 0.37 AZ 102.19
VS 299.49
7750
7800
7850
7900
7950
7750-7800 Anhyd wht, sb blky-amrphs, v sft, Sltst red-brick, sft, sb blky-plty, occ ss pale orng-red a/a, occ sh med-dk gy, splty-plty, frm, non calc, 70%Anhyd, 20% sltst, 10% sh
7800-7850 Anhyd wht, sb blky-amrphs, v sft, occ dol off wht-tan, v frm, suc, tr Sltst red-brick, sft, sb blky-plty, tr sh med-dk gy, splty-plty, frm, non calc, 80% Anhyd, 10% dol, 5% sltst, 5% sh
7850-7900 Anhyd wht, sb blky-amrphs, v sft, tr dol off wht-tan, v frm, suc, tr Sltst red-brick, sft, sb blky-plty, tr sh med-dk gy, splty-plty, frm, non calc, abnt bri yel flor, 80% Anhyd, 10% dol, 5% sltst, 5% sh
7900-7950 Dol off wht-tan, v frm, suc, abnt anhyd wht, sb blky-amrphs, v sft, rr sh med-dk gy, splty-plty, frm, rr Sltst red-brick, sft, sb blky-plty, non calc, abnt bri yel flor, 50% dol, 40% anhyd, 5% sh, 5% sltst
63.6% Methane
15.4% Ethane
15.0% Propane
6.0% Butane
TG (units)
C1 (ppm)
C2 (units)
C3 (units)
C4 (units)
Wt. 9.3


ROP (min/ft)
Gamma (API)
250
8000
8050
8100
8150
MD 8025 TVD 8006.74
INC 0.4 AZ 110.17
VS 299.67
WOB 30.1
RPM 43
PP 4121
SPM 161
Admire 8112' MD,
8094' TVD
MD 8119 TVD 8100.74
INC 0.54 AZ 102.28
VS 299.89
7950-8000 Dol off wht-tan, v frm, suc, abnt anhyd wht, sb blky-amrphs, v sft, rr sh med-dk gy, splty-plty, frm, abnt bri yel flor, 70% dol, 25% anhyd, 5% sh
8000-8050 Anhy wht, blky-sb blky, v friable, tr Dol aa, tr Sh blk-gy, sb plty-blky, frm, smth tex, non calc, nsfoc, 80% Anhy, 10% Dol, 10% Sh
8050-8100 Anhy wht, blky-sb blky, v friable, tr Dol aa, tr Sh blk-gy, sb plty-blky, frm, smth tex, smth tex, non calc, nsfoc, 70% Anhy, 15% Sh, 15% Dol
8100-8150 Dol lt gy-off wht, gy-blu, blky-sb plty ip, hard, abnt Anhy wht, tr Sh blk-dk gy, blky-sb blky ip, carb ip, non calc, frm-mod hard, nsfoc, 70% Dol, 20% Anhy, 10% Sh
8150-8200 Dol gy, sb plty, blky ip, frm-hd, abnt Anhy wht, sft, amorph, occ Ls gy-lt gy, sb plty-plty-blky, hard, tr Sh dk gy, sb plty-sb blky ip, frm, smth-sl slty tex, non calc, nsfoc, Anhy 40%, Dol 30%, Ls 20%, Sh 10%
TG (units)
1
10
100
1000
C1 (ppm)
10e4
10e5
10e6
C2 (units)
C3 (units)
C4 (units)
Wt. 9.4
Vis 43


ROP (min/ft)
Gamma (API)
0
0
3
250
8200
8250
8300
8350
MD 8212 TVD 8193.74
INC 0.62 AZ 119.86
VS 300.25
Pennsylvanian 8218'
MD, 8200' TVD
MD 8292 TVD 8273.73
INC 0.74 AZ 120.71
VS 300.74
WOB 33.1
RPM 47
PP 4240
SPM 160
MD 8348 TVD 8329.73
INC 0.74 AZ 120.71
VS 301.11
8200-8250 Ls lt gy, microxln, frm-mod hrd, dolc ip, grdg to Dol, abnt Sh dk gy, sb plty-blky ip, frm, smth tex, non calc, occ Anhy wht, nsfoc, 40% LS, 20% Dol, 20% Sh, 20% Anhy
8250-8300 Ls lt gy-tan, microlxn, mod hrd, sb plty-sb blky ip, dolc ip, grdg to Dol ip, abnt Anhy wht, occ Sh dk gy-blk ip, blky-sb plty, frm, smth tex, non calc, nsfoc, 50% Ls, 30% Anhy, 10%, Dol 10%
8300-8348 Ls lt gy-tan, microlxn, mod hrd, sb plty-sb blky ip, dolc ip, grdg to Dol ip, occ Dol lt gy, blky, hrd, occ Anhy wht, occ Sh dk gy-blk ip, blky-sb plty, frm, smth tex, non calc, nsfoc, 50% Ls, 20% Dol 20% Anhy, 10%,
TD at 8348' on 15:30; 12/11/2014
Wt. 9.4+
Vis 40
TG (units)
1
10
100
1000
10e4
C1 (ppm)
100
1000
10e5
10e6
C2 (units)
100
1000
10e5
10e6
C3 (units)
100
1000
10e5
10e6
C4 (units)
100
1000
10e5
10e6
Wt. 9.5
Vis 42
68.8% Methane
14.7% Ethane
10.8% Propane
5.6% Butane