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## Customer Information

**Operator:** Noble Energy  
1625 Broadway  
Suite 2200  
Denver, Colorado 80202

**Geologist:** Cassidy Miller  
Noble Energy Inc.

## Mud Logging Details

**Logger:** Andrew Christiano &  
Hannah Blatchford

**Log Interval:** 2500' MD to 6700' MD

**Start Date:** October 08, 2013

**Release Date:** October 14, 2013

## Well Information

**Well Name:** Wells Ranch  
AE20-67HN

**Location:** 20-T6N-R62W  
1248' FNL, 215' FWL

**County:** Weld Co.  
**State:** Colorado

**Drilling Rig:** H&P 321

**Total Depth:** 10861' MD

**TD Date:** October 13, 2013

**Formation:** Niobrara B Chalk

**KB Elevation:** 4871'

**GR Elevation:** 4841'

**API Number:** 05-123-37212-0000

## ROCK TYPES

Siltysh  
Anhy  
Bent  
Brec  
Cht  
Clyst  
Coal

Congl  
Dol  
Gyp  
Igne  
Lmst  
Meta  
Chk

Mrlst  
Salt  
Shale  
Shcol  
Shgy  
Sltst  
Ss

Till  
gw  
lmywash  
ogw  
olmywash  
oshly gw  
shly gw

sdycgw  
hvycrbsh  
nosmpl  
Lsdetrst  
sltst  
sdy sh

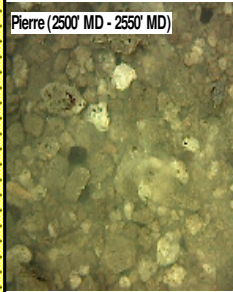
| ROP (Ft/Hr)<br>Gamma (API) | Drill Depth v. Time | Survey Data | Depth | Lithology | Lithology Percentages | Sample Photographs | Porosity | Geological Description                                                                                                                                                                                                                          | TG (1-8)<br>C1 (units)<br>C2 (units)<br>C3 (units)<br>C4 (units) | Total Gas, C1-C4 |
|----------------------------|---------------------|-------------|-------|-----------|-----------------------|--------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------|
| ROP (Ft/Hr)<br>Gamma (API) | 3000<br>350         |             | 24    |           |                       |                    |          | NOBLE ENERGY<br>WELLS RANCH<br>AE20-67HN<br>20-T6N-R62W<br>1248' FNL, 215' FWL<br>WELD COUNTY, CO<br>H&P 321<br>LOGGERS:<br>ANDREW CHRISTIANO<br>HANNAH BLATCHFORD<br>CALLED OUT BY COMPANY MAN<br>ON 10/8/2013<br>COMMENCED LOGGING @ 12:01 PM | 50<br>TG, C1-C4<br>450                                           |                  |
| SLIDE=RED<br>ROTATE=WHITE  |                     |             |       |           |                       |                    |          |                                                                                                                                                                                                                                                 | CONNECTIONS ARE MARKED<br>WITH RED TRIANGLES                     |                  |
| ROP SCALE: 0 TO 3000       |                     |             |       |           |                       |                    |          |                                                                                                                                                                                                                                                 | GAS SCALE: -50 TO 450<br>50 UNITS/DIVISION                       |                  |
| GAMMA SCALE: 0 TO 350      |                     |             |       |           |                       |                    |          |                                                                                                                                                                                                                                                 | DRILLING ON WATER-BASED MUD                                      |                  |

AC

12:01 AM  
10/09/13  
FT/24 HRS 0  
DAY 01  
WOB 21.4K  
SP 3035  
RPM 60  
SPM 67/66

MD 2503 TVD 2500.11  
INC 9.24 AZ 240.02  
VS -46.58

Pierre (2500' MD - 2550' MD)



@ 2500' MD ON 10/09/13 W/BIT # 1  
8.75 OTHER SP 516 S/N 4904 IN @  
983' MD

### PIERRE BEFORE LOGGING DEPTH

2500'- 2550': SLTST: 80% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, SANDY, IMBD  
PYR, IMBD GLAU, INTGR POR, NO  
STN, NO FLOR, NO O FLOR, NO  
CUT, NO RNG

2550'- 2650': SLTST: 90% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, SANDY, IMBD  
PYR, IMBD GLAU, INTGR POR, NO  
STN, NO FLOR, NO O FLOR, NO  
CUT, NO RNG

MD 983'  
WT 8.75  
VIS 31.0  
PH 10.8  
FIL 23.8  
CL 1400  
CAL 20.0  
H2O 97.5  
OIL 0.0  
SOL 2.2  
CAKE 1/0  
GELS 2/6/8  
PV 6.0  
YP 4.0

CG 49u

TG, C1-C4

CG 64u

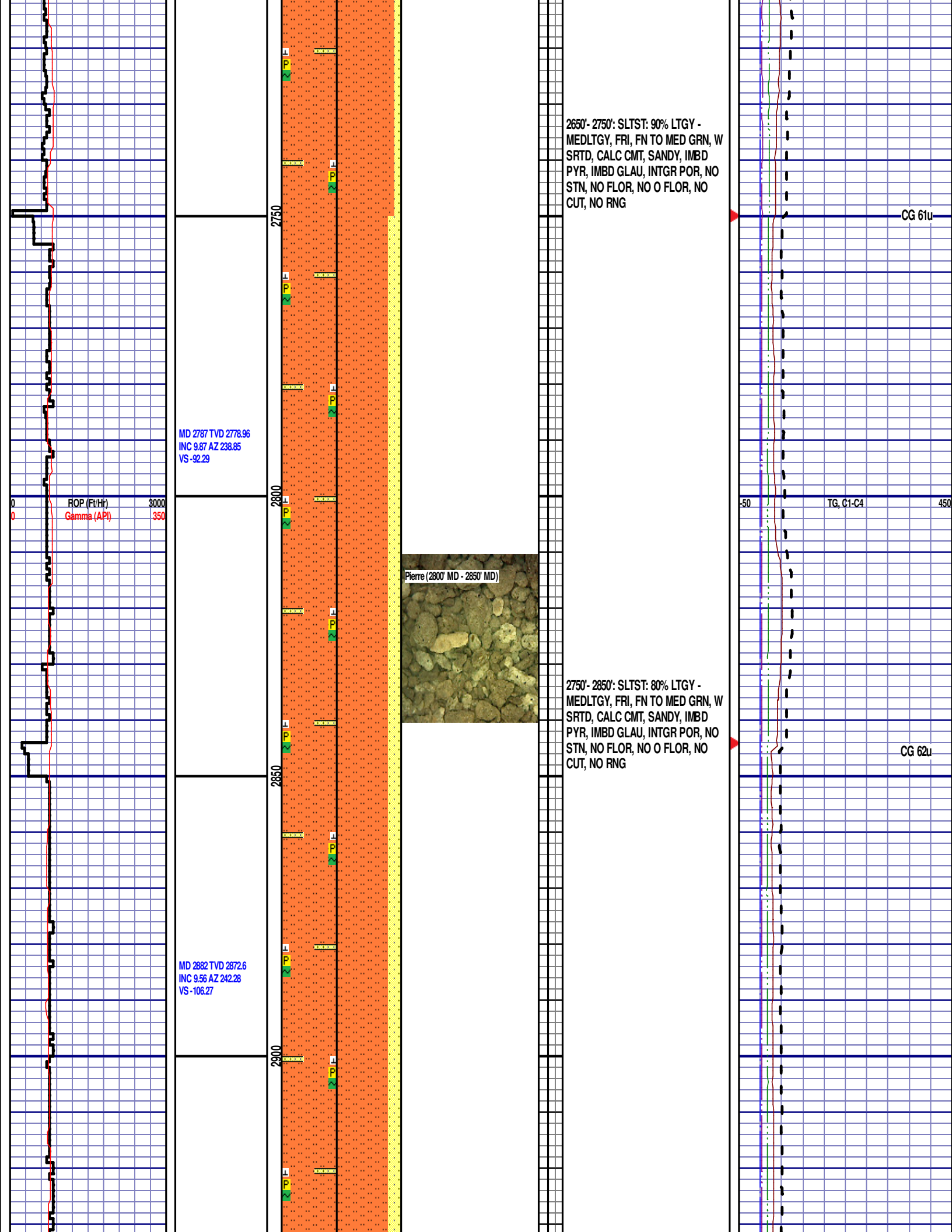
MD 2597 TVD 2592.45  
INC 12.28 AZ 238.19  
VS -61.66

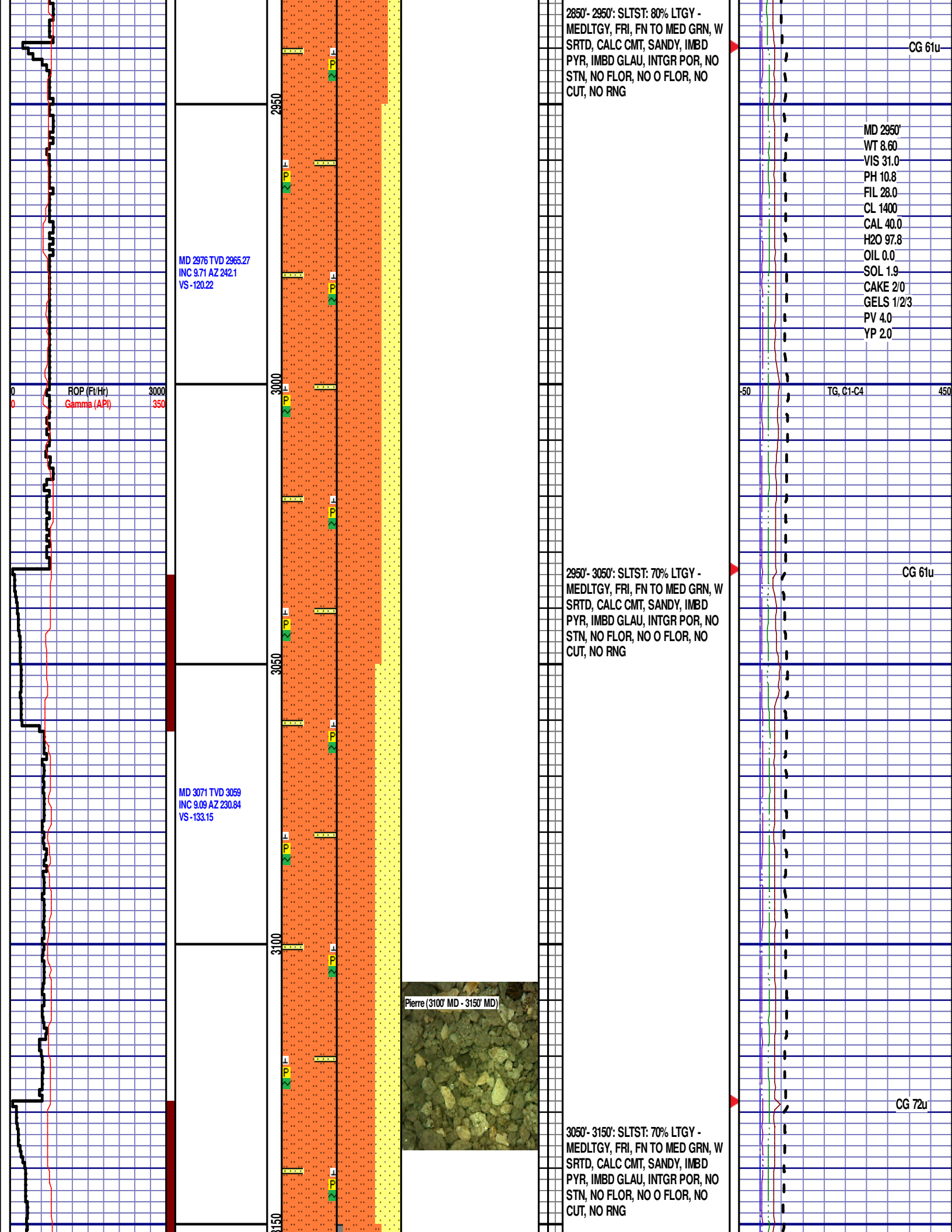
ROP (Ft/Hr)  
Gamma (API)

3000  
350

MD 2692 TVD 2685.51  
INC 10.88 AZ 236.79  
VS -77.78

2500  
2550  
2600  
2650  
2700





MD 3166 TVD 3153.19  
INC 5.82 AZ 224.52  
VS -142.37

ROP (Ft/Hr)  
Gamma (API)

3000  
350

3200

3250

3300

3350

MD 3261 TVD 3247.77  
INC 4.93 AZ 234.59  
VS -149.1

MD 3356 TVD 3342.35  
INC 5.89 AZ 234.8  
VS -156.43

3150'- 3250': SLTST: 65% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, SANDY, FREE  
SH, IMBD PYR, IMBD GLAU, INTGR  
POR, NO STN, NO FLOR, NO O  
FLOR, NO CUT, NO RNG

3250'- 3350': SLTST: 70% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, SANDY, FREE  
SH, IMBD PYR, IMBD GLAU, INTGR  
POR, NO STN, NO FLOR, NO O  
FLOR, NO CUT, NO RNG

-50

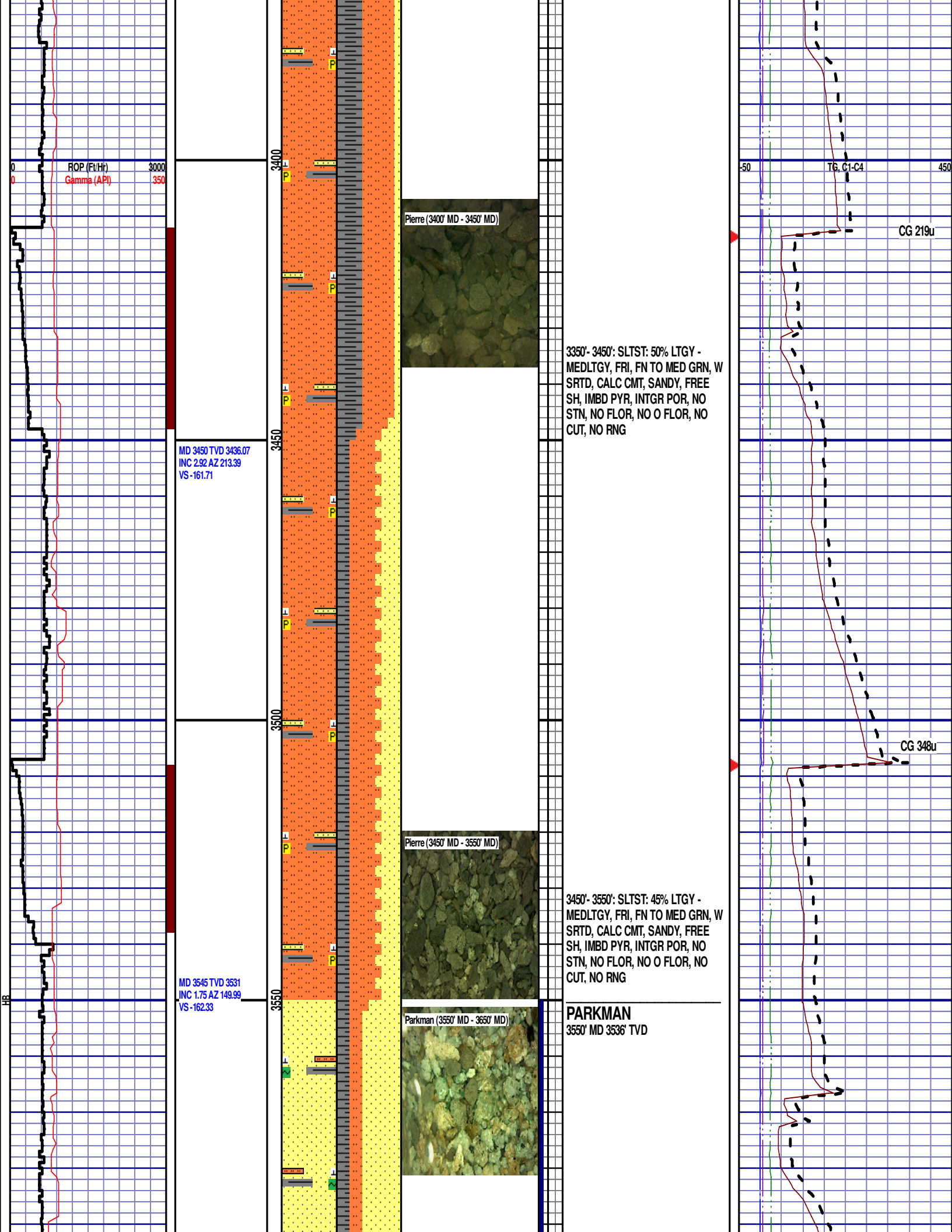
TG, C1-C4

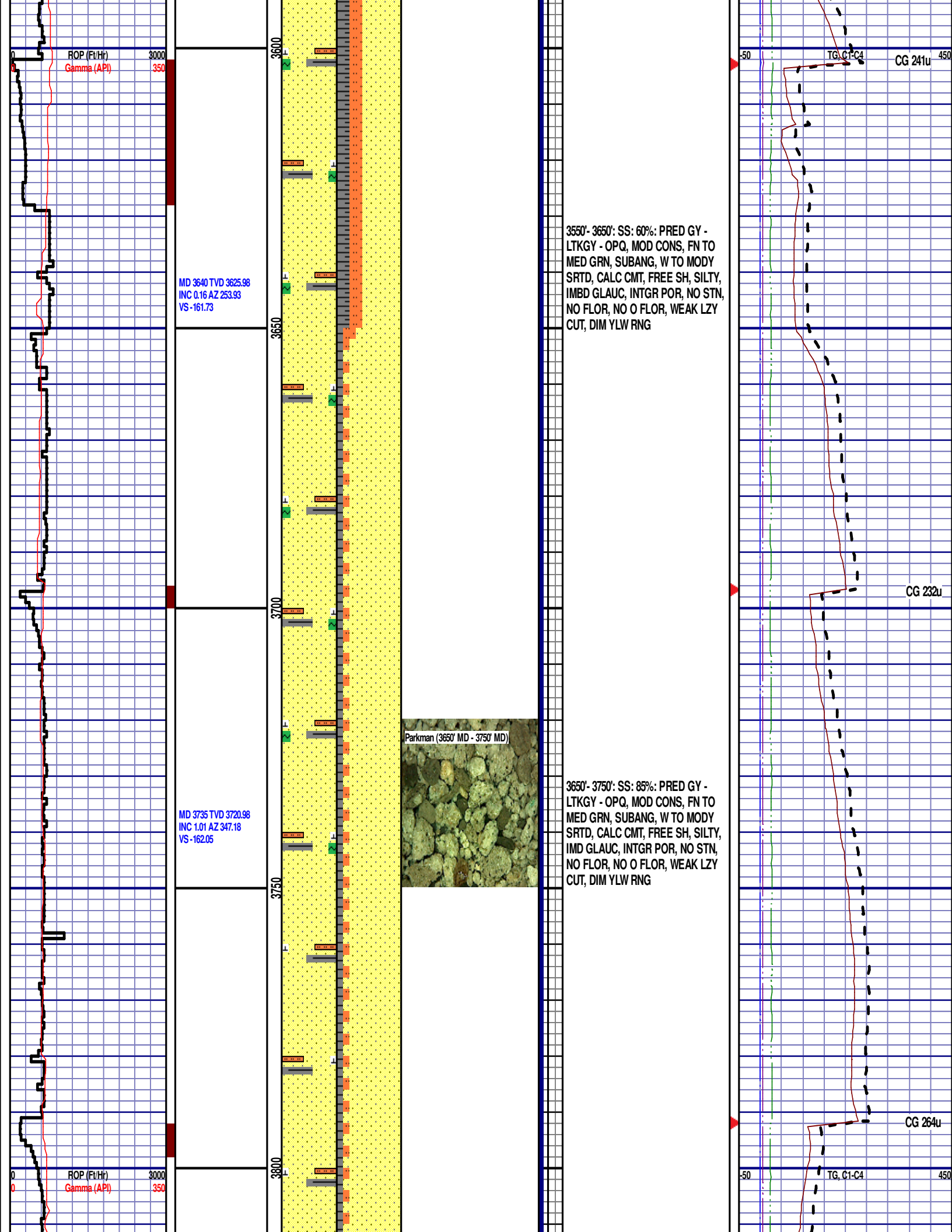
450

CG 74u

CG 166u







MD 3830 TVD 3815.95  
INC 1.97 AZ 342.93  
VS -162.7

MD 3925 TVD 3910.91  
INC 0.94 AZ 350.58  
VS -163.3

MD 4019 TVD 4004.91  
INC 0.55 AZ 52.68  
VS -163.06

3750'- 3850':SS: 85%: PRED GY -  
LTKGY - OPQ, MOD CONS, FN TO  
MED GRN, SUBANG, W TO MODY  
SRTD, CALC CMT, FREE SH, SILTY,  
INTGR POR, NO STN, NO FLOR, NO  
O FLOR, WEAK LZY CUT, DIM YLW  
RNG

3850'- 3950':SS: 75%: PRED GY -  
LTKGY - OPQ, MOD CONS, FN TO  
MED GRN, SUBANG, W TO MODY  
SRTD, CALC CMT, FREE SH, SILTY,  
INTGR POR, NO STN, NO FLOR, NO  
O FLOR, WEAK LZY CUT, DIM YLW  
RNG

3950'-4050': SLTST: 70% LTGY -  
MEDLTGY. FRI. FN TO MED GRN. W

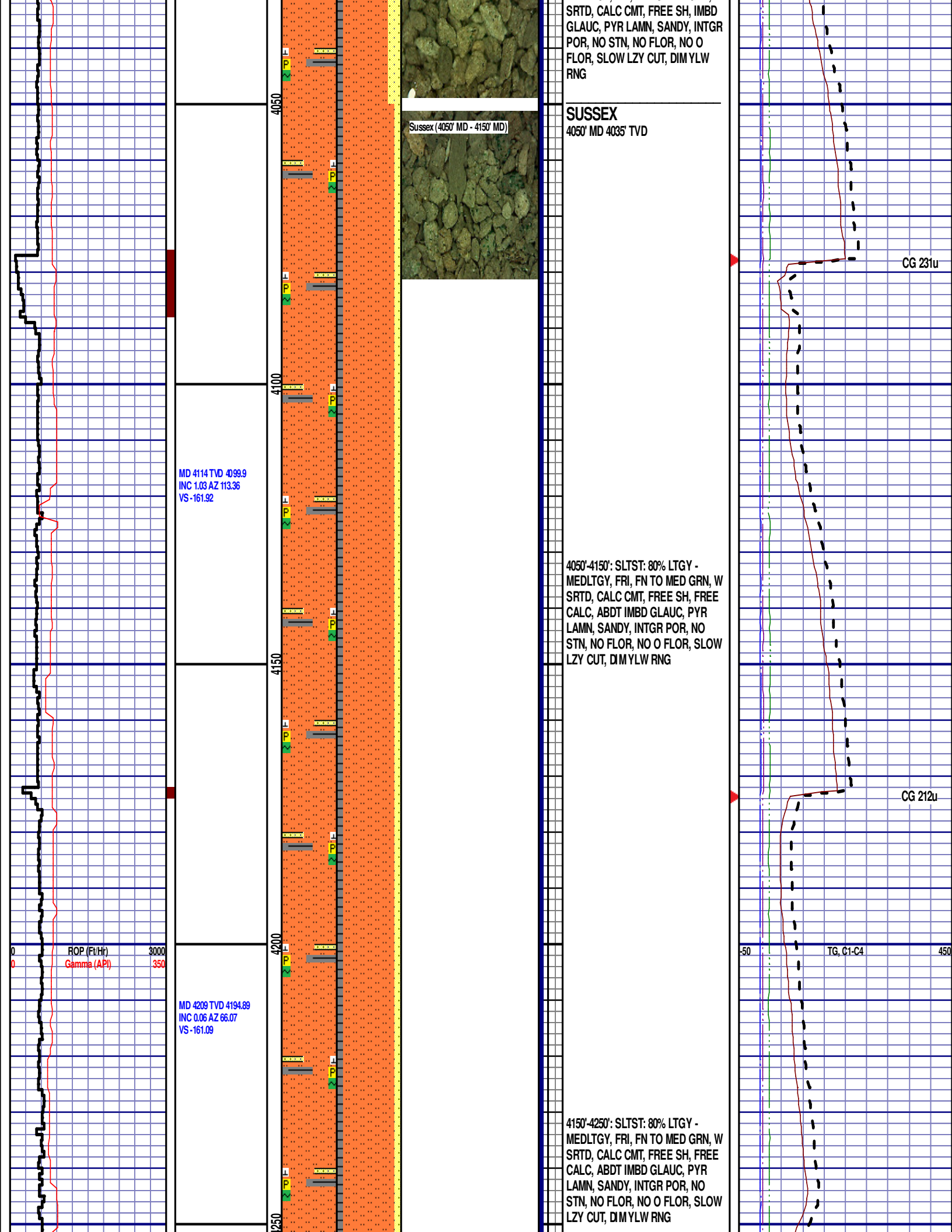
CG 154u

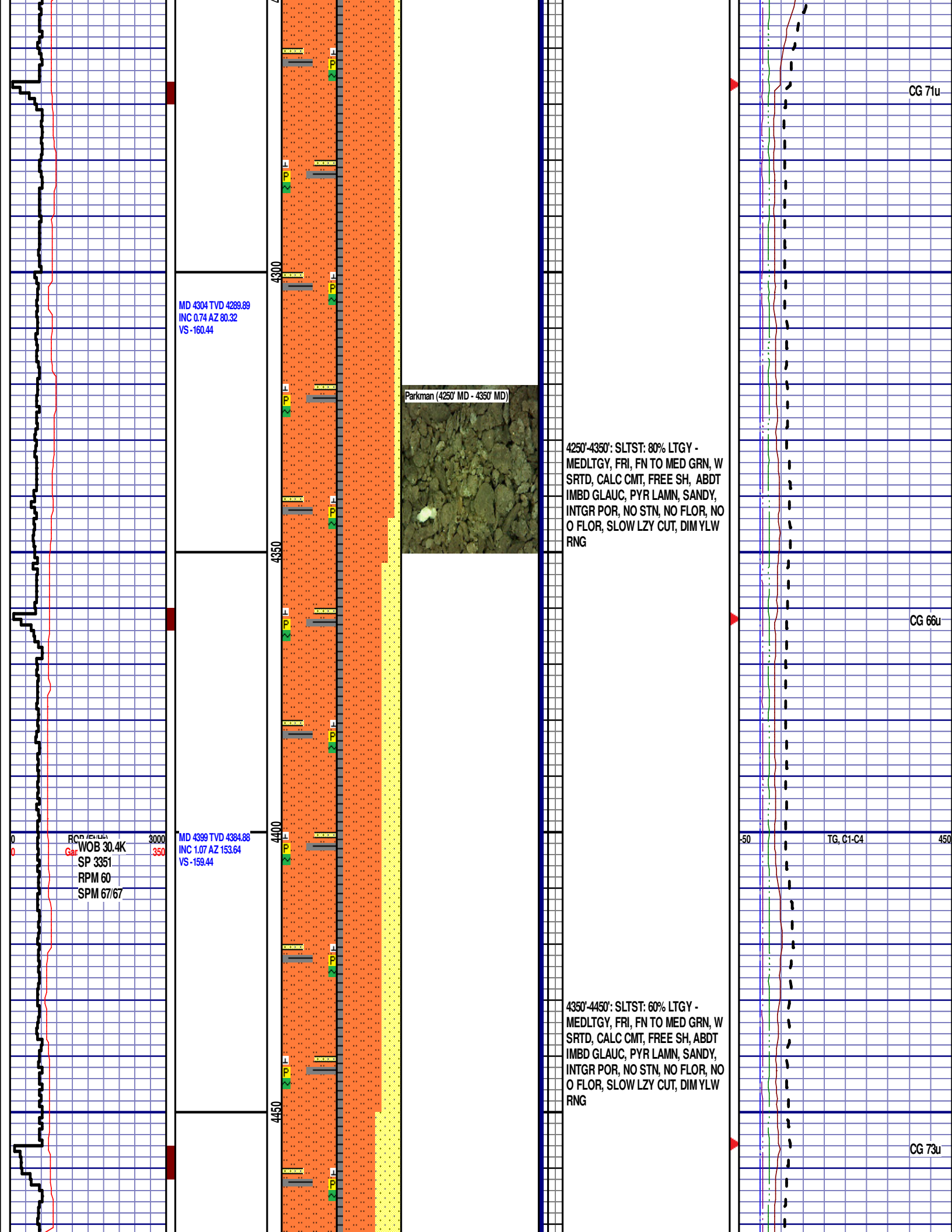
CG 191u

TG, C1-C4

Parkman (3950' MD - 4050' MD)

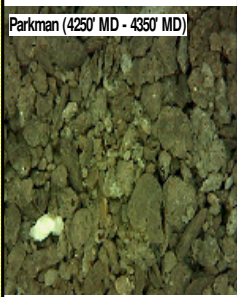






CG 71u

MD 4304 TVD 4289.89  
INC 0.74 AZ 80.32  
VS -160.44



Parkman (4250' MD - 4350' MD)

4250'-4350': SLTST: 80% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, FREE SH, ABDT  
IMBD GLAUC, PYR LAMN, SANDY,  
INTGR POR, NO STN, NO FLOR, NO  
O FLOR, SLOW LZC CUT, DIM YLW  
RNG

CG 66u

WOB 30.4K  
SP 3351  
RPM 60  
SPM 67/67

MD 4399 TVD 4384.88  
INC 1.07 AZ 153.64  
VS -159.44

4350'-4450': SLTST: 60% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, FREE SH, ABDT  
IMBD GLAUC, PYR LAMN, SANDY,  
INTGR POR, NO STN, NO FLOR, NO  
O FLOR, SLOW LZC CUT, DIM YLW  
RNG

TG, C1-C4

CG 73u

MD 4494 TVD 4479.86  
INC 1.38 AZ 152.39  
VS -158.52

4500

4550

4600

4650

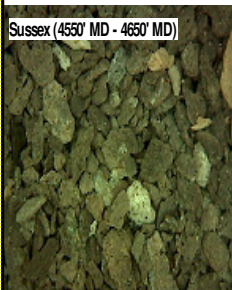
MD 4589 TVD 4574.83  
INC 1.7 AZ 125.27  
VS -156.85

MD 4684 TVD 4669.79  
INC 1.52 AZ 134.23  
VS -154.8

ROP (Ft/Hr)  
Gamma (API)

3000  
350

Sussex (4550' MD - 4650' MD)



4450'-4550': SLTST: 50% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, FREE SH, TRC  
IMBD GLAUC, PYR LAMN, SANDY,  
INTGR POR, NO STN, NO FLOR, NO  
O FLOR, SLOW LZC CUT, DIM YLW  
RNG

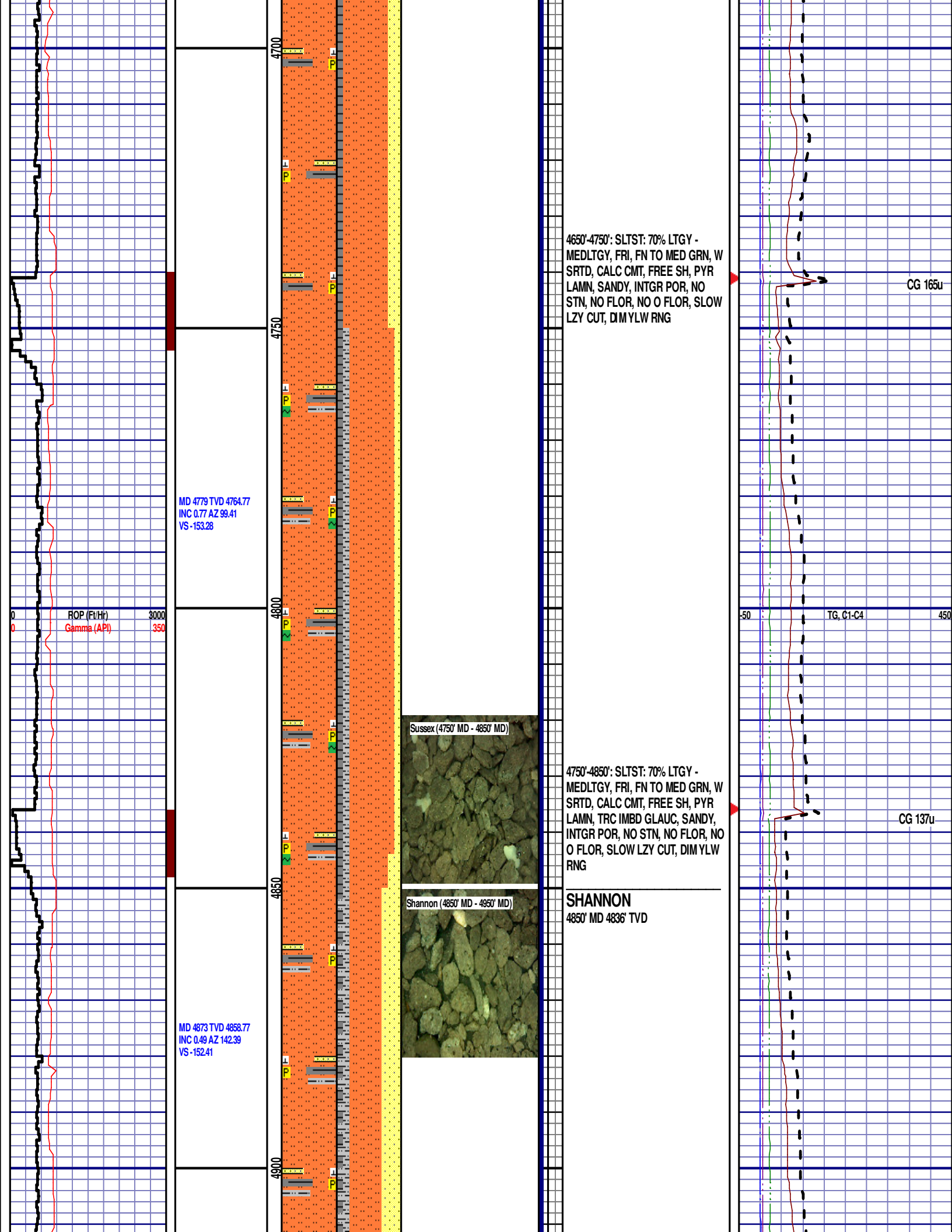
CG 152u

TG, C1-C4

450

4550'-4650': SLTST: 60% LTGY -  
MEDLTGY, FRI, FN TO MED GRN, W  
SRTD, CALC CMT, FREE SH, PYR  
LAMN, SANDY, INTGR POR, NO  
STN, NO FLOR, NO O FLOR, SLOW  
LZY CUT, DIM YLW RNG

CG 142u



4650'-4750': SLTST: 70% LTGY - MEDLTGY, FRI, FN TO MED GRN, W SRTD, CALC CMT, FREE SH, PYR LAMN, SANDY, INTGR POR, NO STN, NO FLOR, NO O FLOR, SLOW LZY CUT, DIM YLW RNG

CG 165u

MD 4779 TVD 4764.77  
INC 0.77 AZ 99.41  
VS -153.28

ROP (Ft/Hr)  
Gamma (API)

3000  
350

TG, C1-C4

450

Sussex (4750' MD - 4850' MD)

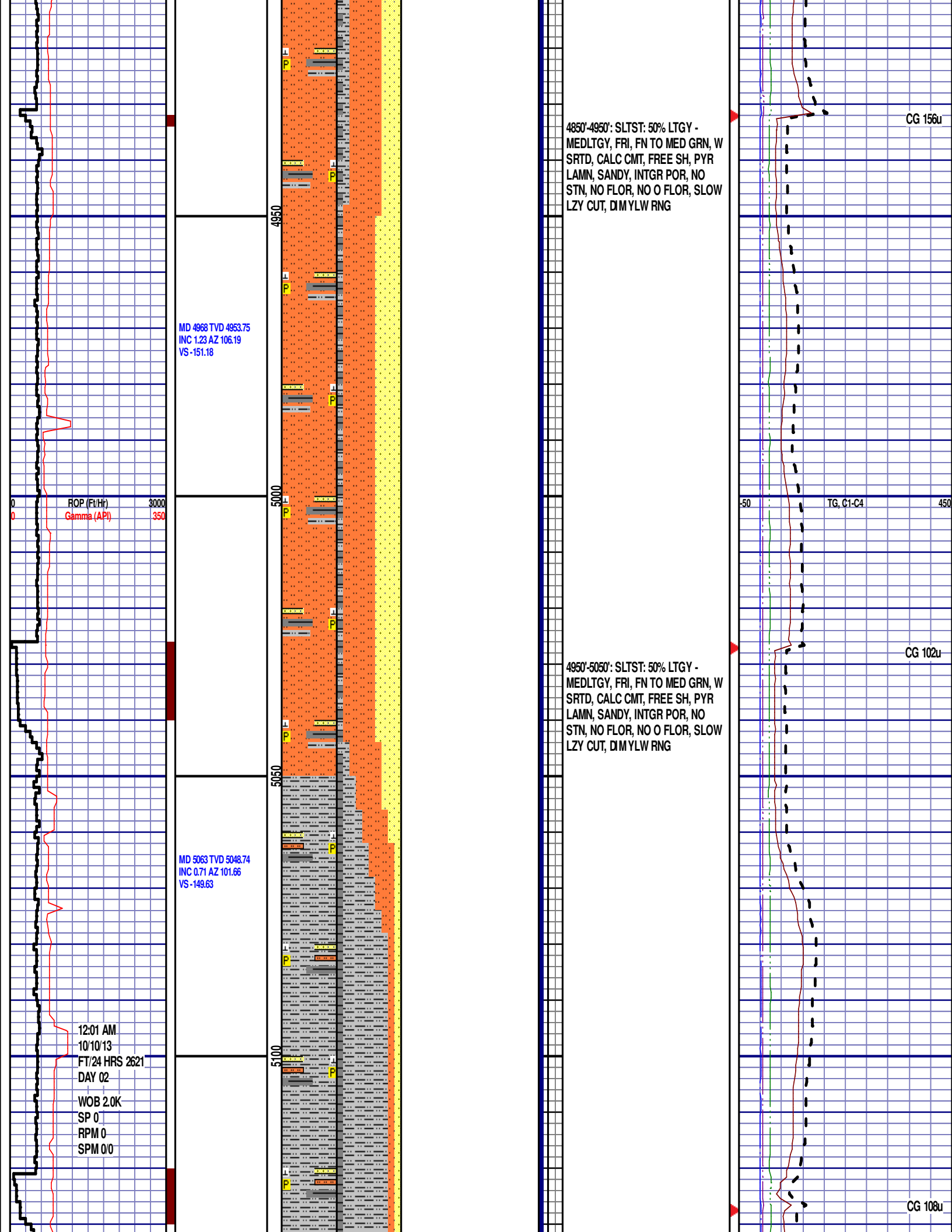
4750'-4850': SLTST: 70% LTGY - MEDLTGY, FRI, FN TO MED GRN, W SRTD, CALC CMT, FREE SH, PYR LAMN, TRC IMBD GLAUC, SANDY, INTGR POR, NO STN, NO FLOR, NO O FLOR, SLOW LZY CUT, DIM YLW RNG

CG 137u

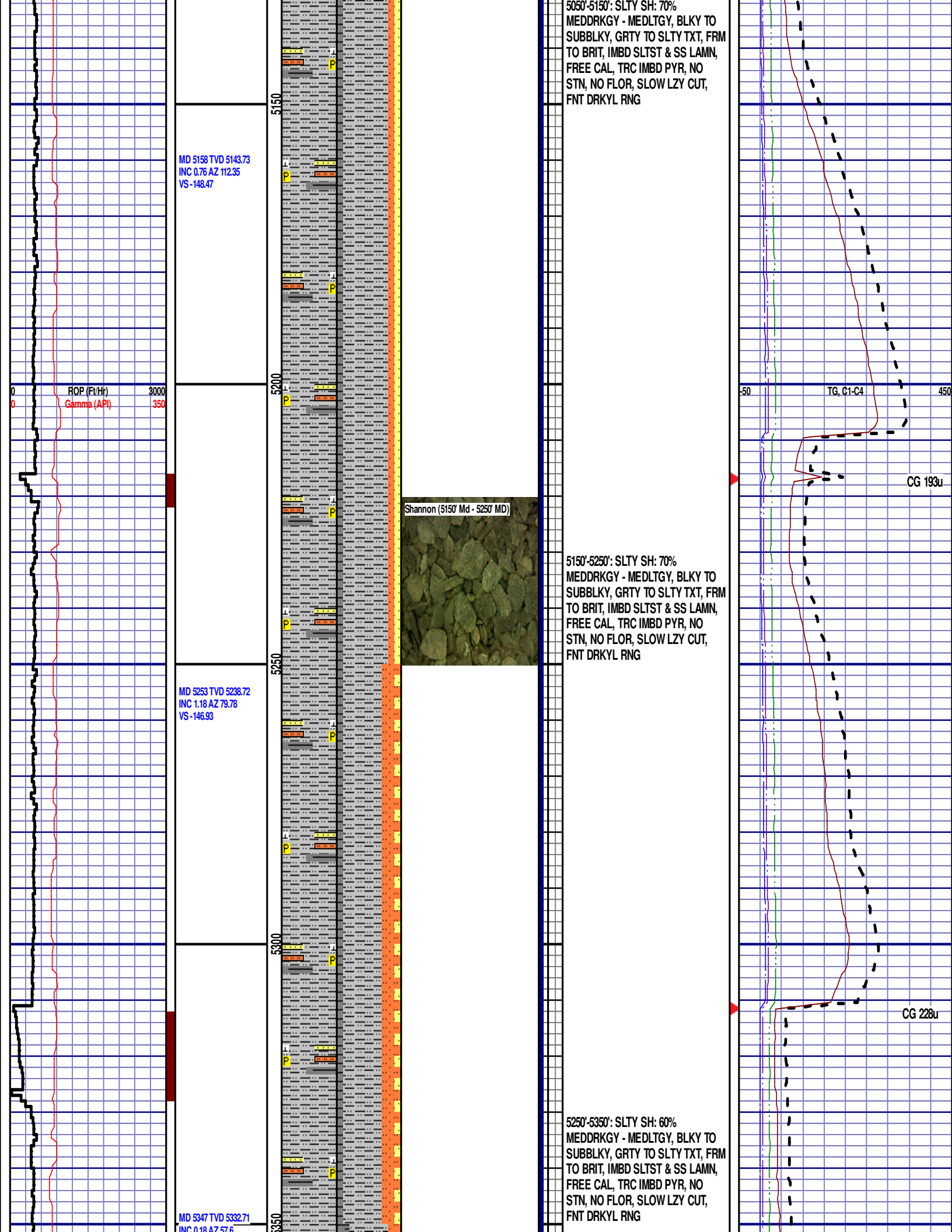
MD 4873 TVD 4858.77  
INC 0.49 AZ 142.39  
VS -152.41

Shannon (4850' MD - 4950' MD)

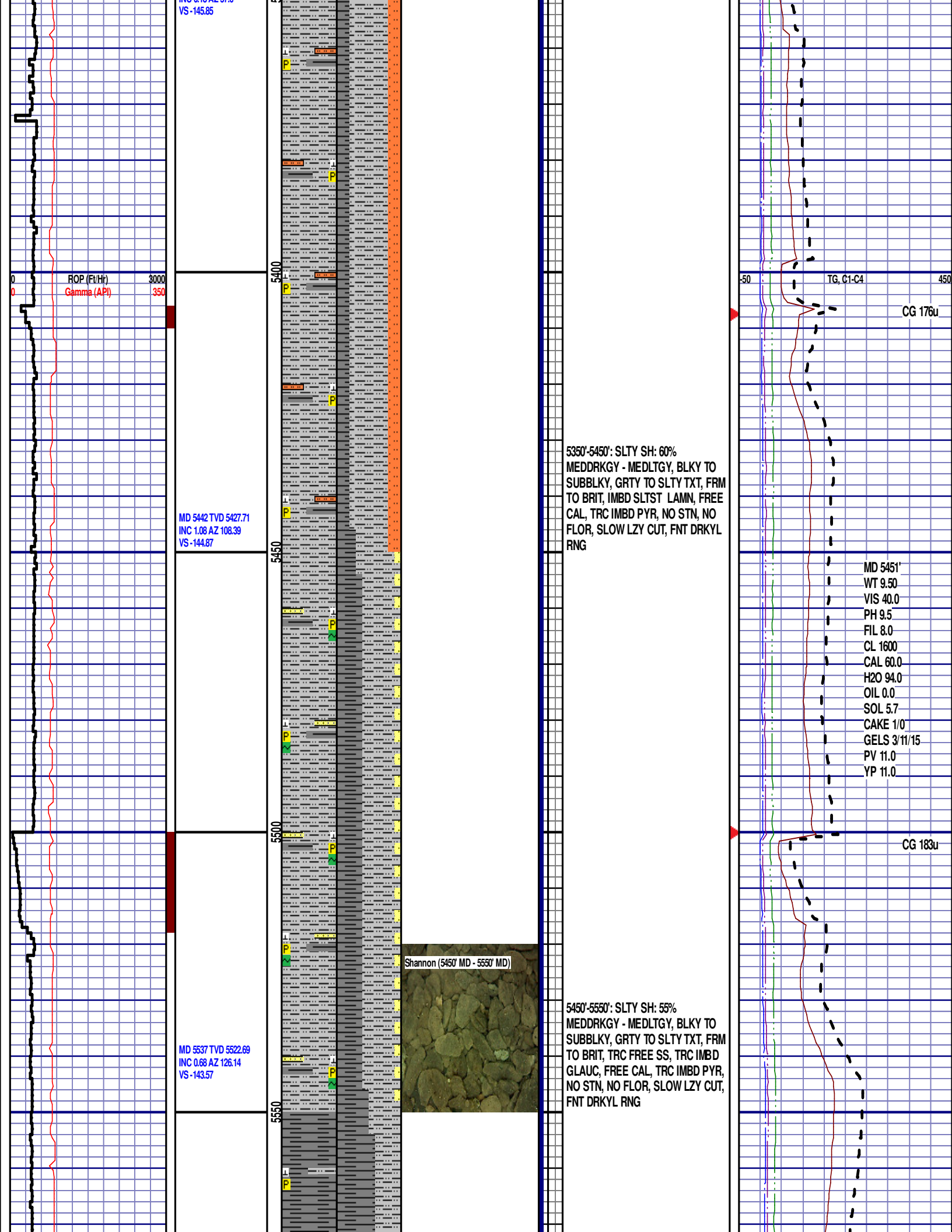
**SHANNON**  
4850' MD 4836' TVD

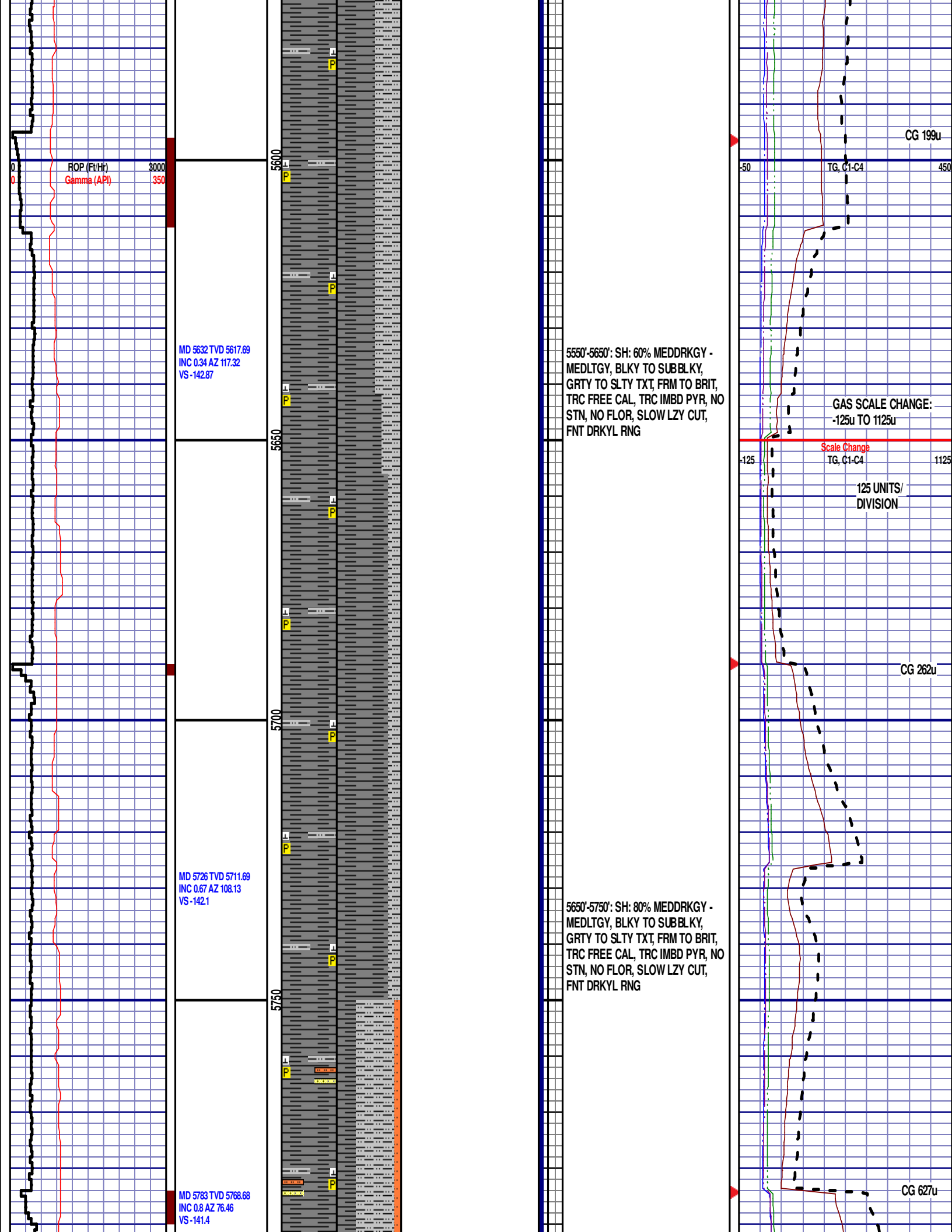


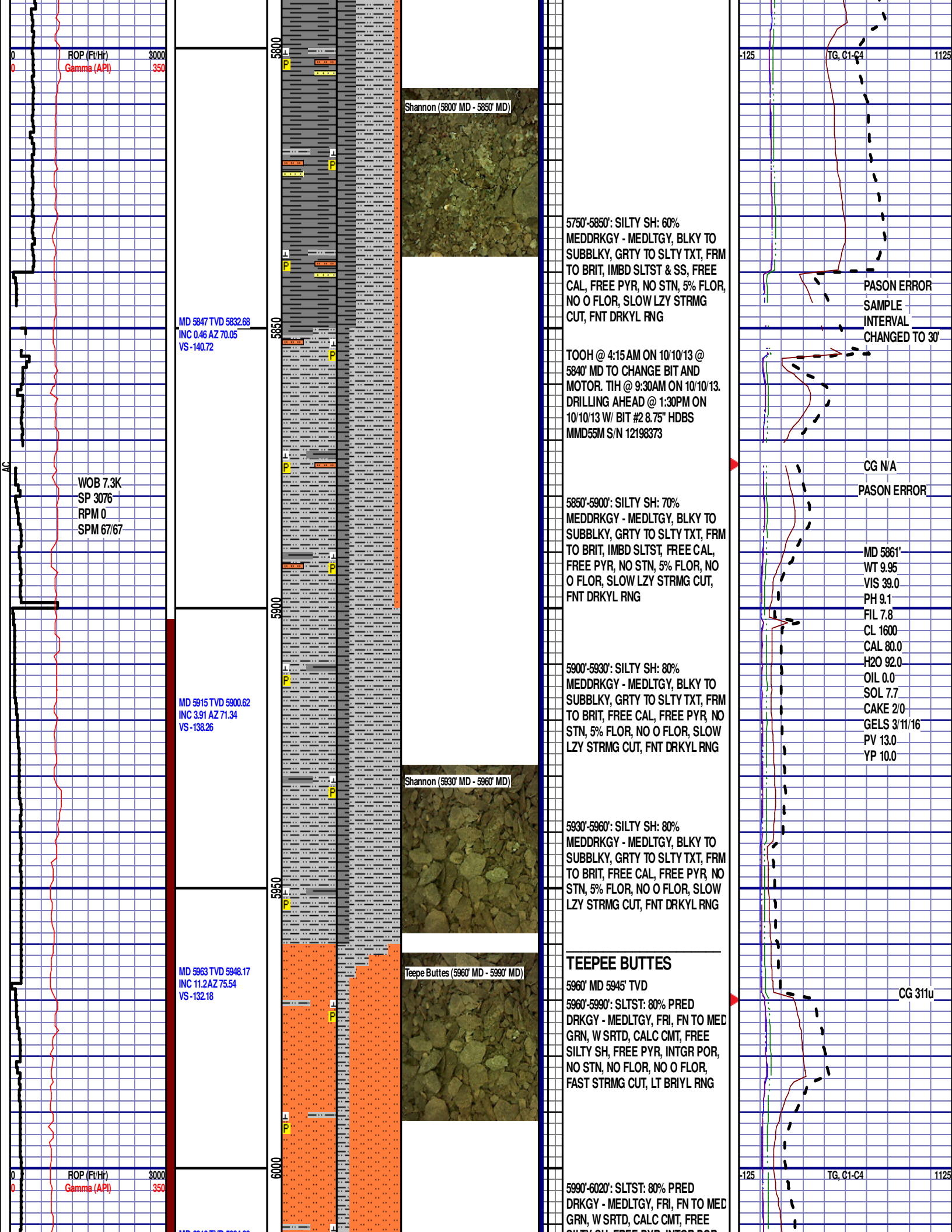


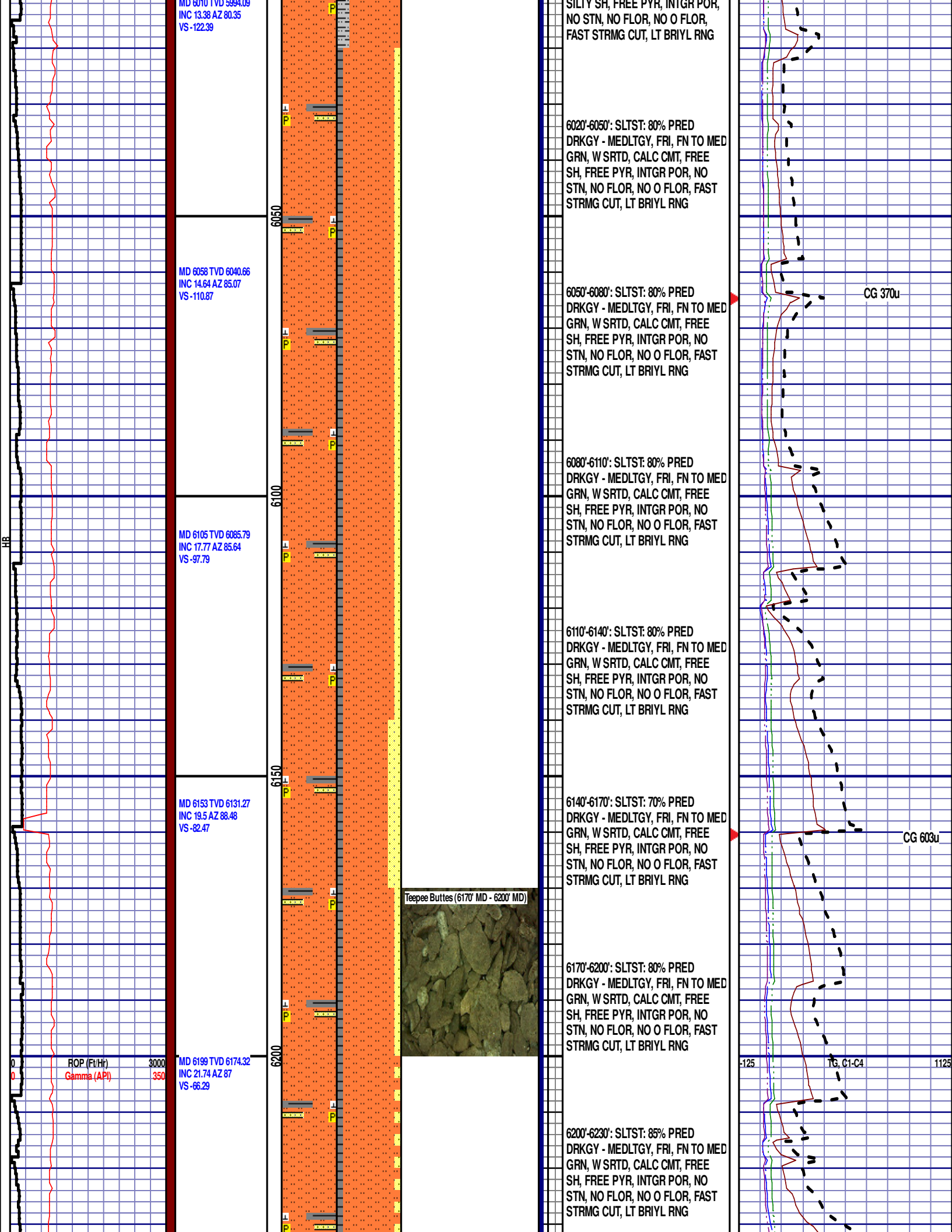


VS -145.85

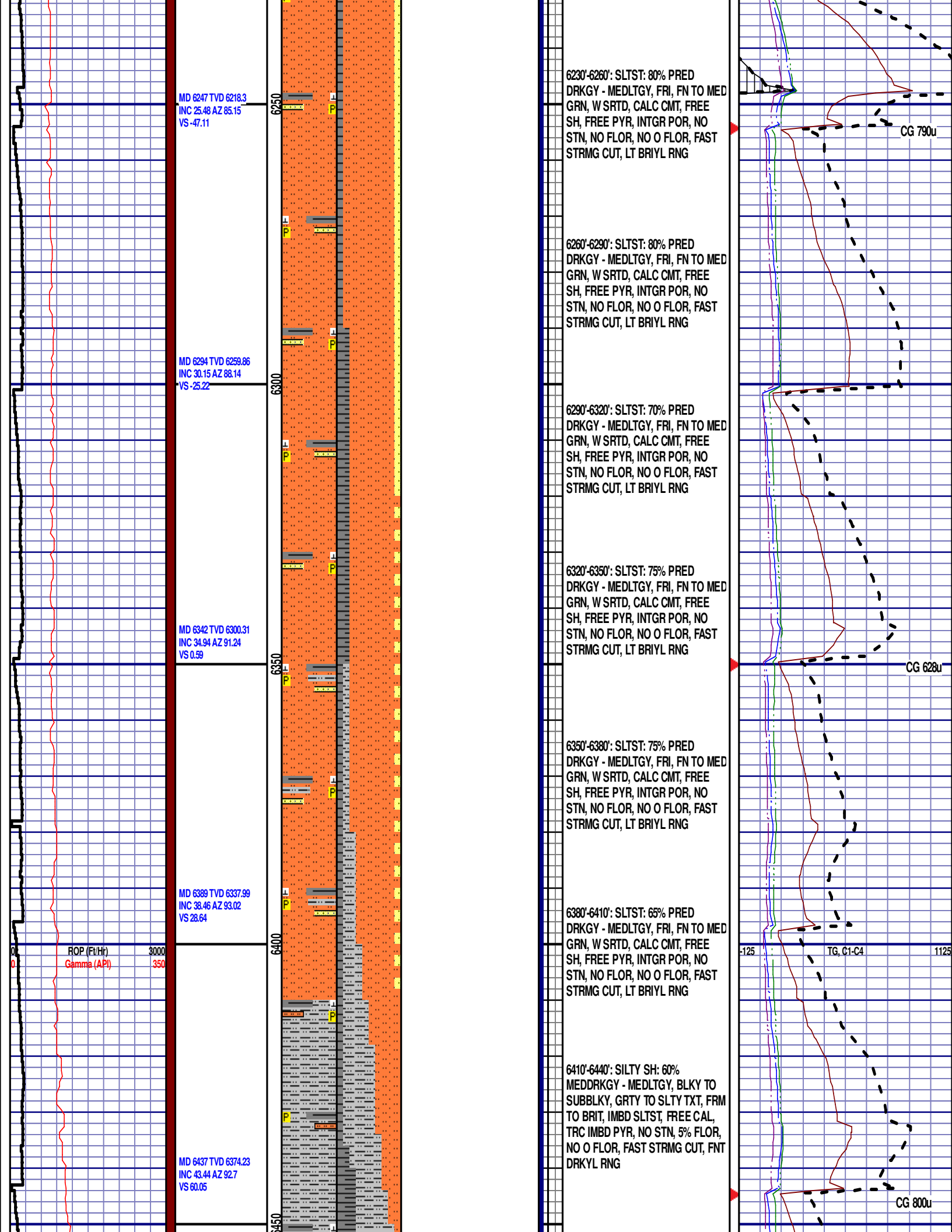


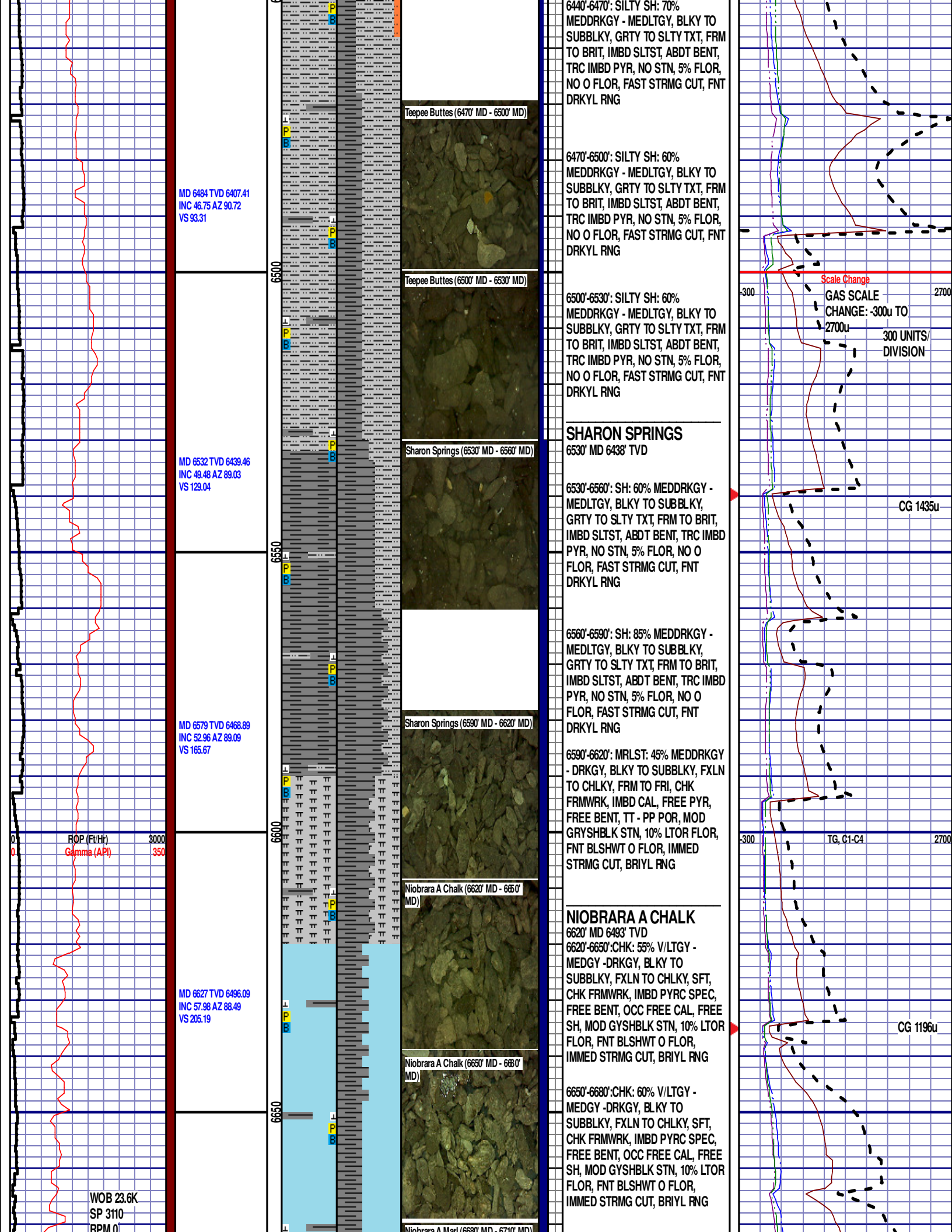












## DAY 03

MD 6674 TVD 6519.43  
INC 62.45 AZ 87.67  
VS 245.96

6700

50

## NIOBRARA A MARL

6680' MD 6520' TVD

6680'-6710': MRLST: 45% MEDDRKGY

- DRKGY, BLKY TO SUBBLKY, FXLN

TO CHLKY, FRM TO FRI, CHK

FRMWRK. IMBD CAL. FREE PYR.

FREE BENT. TT - PP POR. MOD

GRYSHBLK STN, 10% LTOR FLOR.

FNT BLSHWT 0 FLOR. IMMED

STRMG CUT, BRIYL RING

END OF VERTICAL LOG @ 6700' MD  
ON 10/11/13. CONTINUED ON  
HORIZONTAL LOG.