COLUMBINE LOGGING

Scale: 5" / 100'
Measured Depth Log

Well Name	Reliance E23-66-1HN Horz
Location	NESE 23 6N 65W 6 PM
State	COLORADO
County	WELD
Country	UNITED STATES
Rig Number	HP 326
API Number	05-123-37606
Field	WATTENBERG
Region	DJ BASIN
Drilling Completed	3/29/2015
Spud Date	3/23/2015
Surface Coordinates	NESE 23 6N 65W 6 PM 2170 FSL 280 FEL Lat/Long: 40.47017/-104.62185
Bottom Hole Coordinates	Projected Sec: 23 Twp: 6N 65W Footages: 2310 FNL 535 FFWL
Ground Elevation	4695'
K.B. Elevation	4725'
Logged Interval	817' **To** 11285'
Total Depth	11285'
Formation	NIOBRARA; A MARL
Type of Drilling Fluid	LSND, WATER BASED MUD

Operator

Company Noble Energy Inc

Address 1625 Broadway Suite 2200
Denver, CO 80202

Geologist

Name HOLLY DUNCAN

Company NOBLE ENERGY INC.

Address 1625 Broadway Suite 2200
Denver, CO 80202

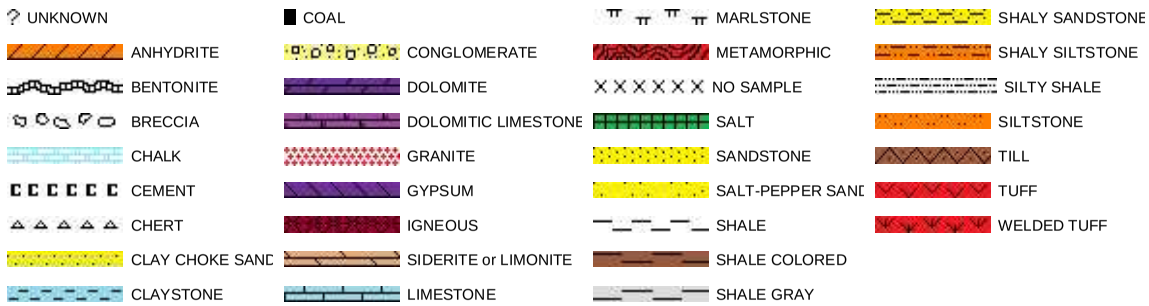
Other

Well Site Logging Company	Columbine Logging Inc.
Well Site Geologist (Days)	Brad Wilson
Well Site Geologist (Nights)	Shanna Gilbert

Zone Color Coding

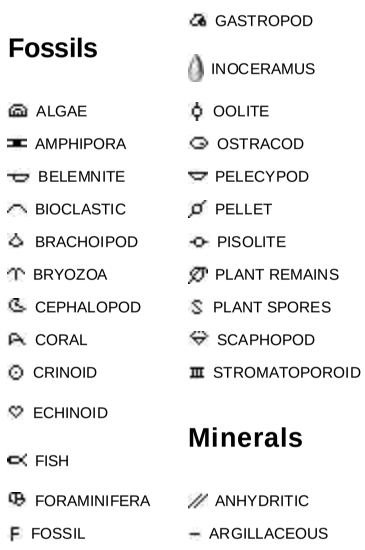
Oil	Condensate	Gas
Note	Core	Pressure
Error	Water	Seal

Rock Types



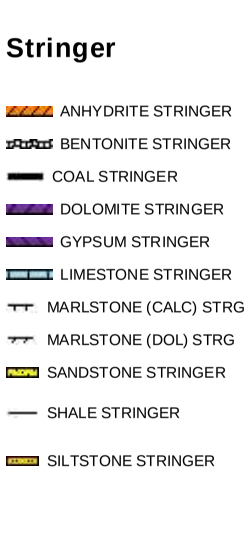
Accessories

Fossils



Minerals

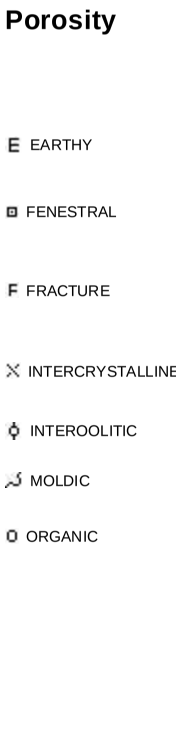
Stringer



Oil Show

Engineering

Porosity



Other Symbols

DST INTERVAL

FAULT

FORMATION TOP

GAS SHOW

OIL SHOW

MN DEPTH UP

MN DEPTH (DOWN)

NORMAL FAULT

EFT) OVERTURNED STRATA

REVERSE FAULT

CASING

SIDEWALL CORE (LEFT)

FT) SIDEWALL CORE (RIGHT)

SLIDE

SURVEY

WIRELINE TESTED - LEFT

WIRELINE TESTED - RT

DRILL STEM TEST

MN DEPTH

Rounding

A ANGULAR

R ROUNDED

SA SUBANG

SR SUBRND

Textures

BS BOUNDSTONE

C CHALKY

CX CRYPTOXLN

E EARTHY

FX FINELYXLN

GS GRAINSTONE

L LITHOGRAPHIC

MX MICROXLN

MS MUDSTONE

PS PACKSTONE

WS WACKESTONE

Sorting

M MODERATE

P POOR

W WELL

Slide/Rotate

ROP
ROP
GAMMA

COLUMBINE LOGGING RIGGED UP ON 3/25/15 MANNED 2-PERSON

ROP DATA IMPORTED FROM PASON EDR

750
350
ROP (ft/hr)
GAMMA (api)
0
100

506 ft/hr

MUD WT 9.8 VIS 37

168 api

78 ft/hr

Total Gas & Chromatograph
GAS
C1
C2
C3
C4

Mudlog Continued From "Reliance E23-66-1HN Vert.mplot"

GAS DATA FROM BLOODHOUND CHROMATOGRAPH UNIT #312 JOB NUMBER 213 via IBALL GAS CHART DATA BASE "Reliance_E23_66_1HN.mdb"

3000
300000
GAS (units)
C1-C4 (PPM)
0

2346u

1113.91u
C1: 71.1%
C2: 12.1%
C3: 10.7%
C4: 6.1%

1531u

1392u

Depth Labels

5,960 5,970 5,980 5,990 **6,000** 6,010 6,020 6,030 6,040 **6,050** 6,060 6,070 6,080 6,090 **6,100** 6,110 6,120 6,130

% Lith

Well Bore
TVD

Survey and Gamma Data Provided by Ensign Directional Services

5800
TVD (ft)

MD: 6,091'
TVD: 6,030.72'
Inclination: 10.5°
Azimuth: 8.4°
VS: -135.51'

95% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, non calc
5% SHY SLTST: lt gy-gy - gy brn,sl sft - v sft, sb blky-sb plty, f-v f gr, gt, v arg, ply srt, gr - slty sh

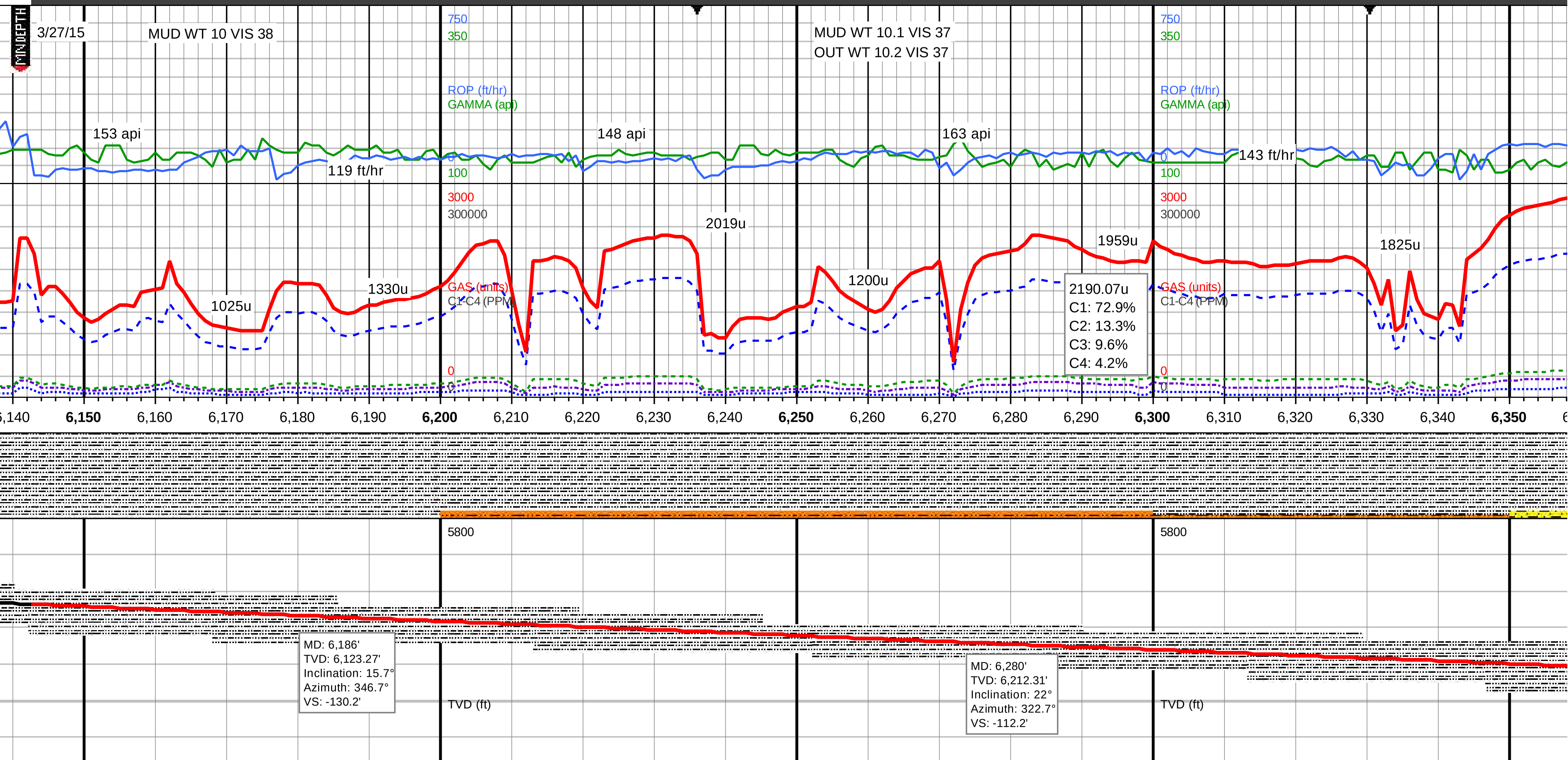
95% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, non calc
5% SHY SLTST: lt gy-gy - gy brn,sl sft - v sft, sb blky-sb plty, f-v f gr, gt, v arg, ply srt, gr - slty sh

100% SLTY SH: med gy-gr brn occ spec b
plty-plty, sft- sl frm, slt tex, sl rthy lstr, occ
non calc

7000

Oil Show
E
G
M
F
T
ST

Images



...blk, sb ...shy sltst,

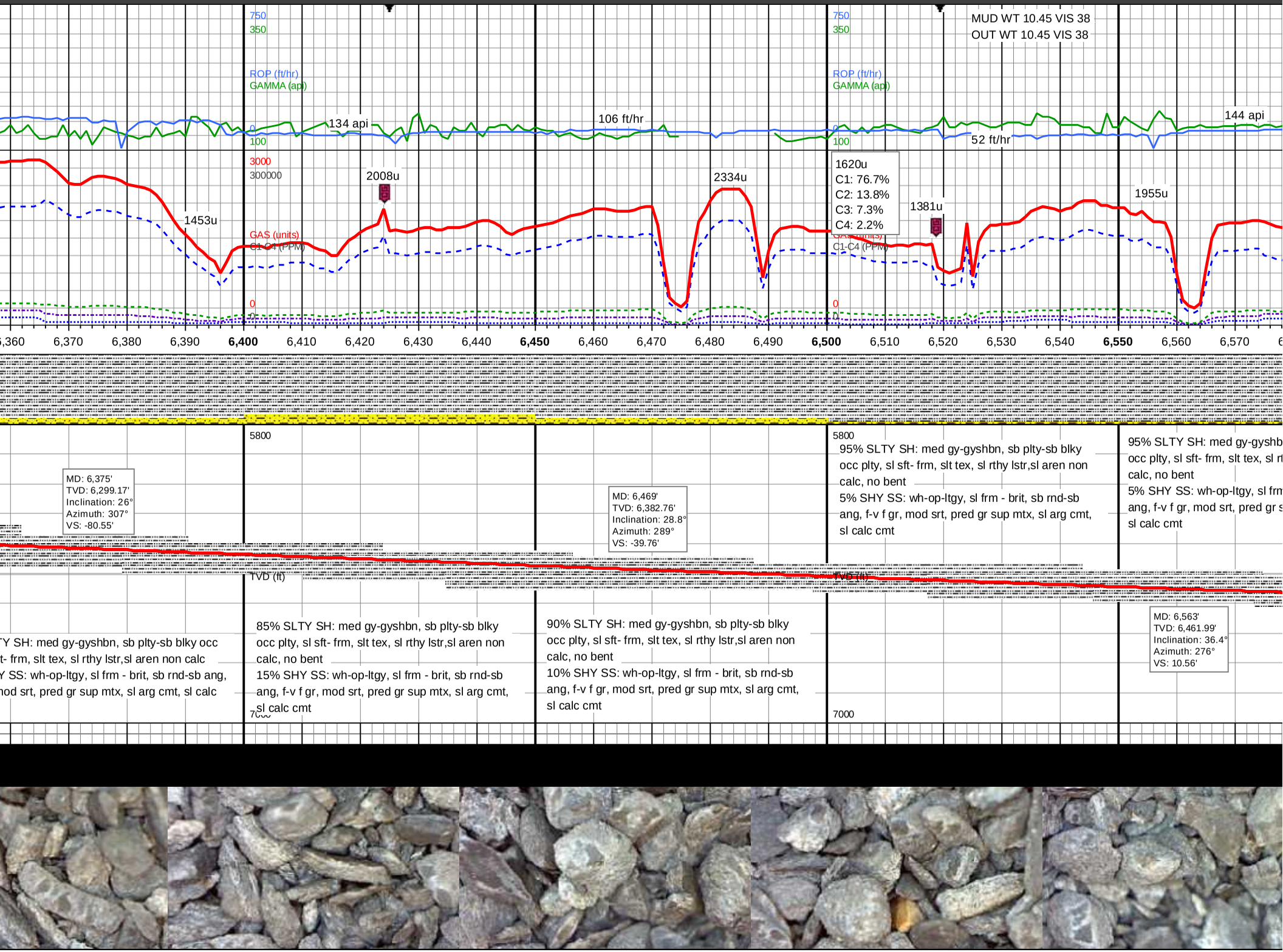
100% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, occ shy sltst, non calc

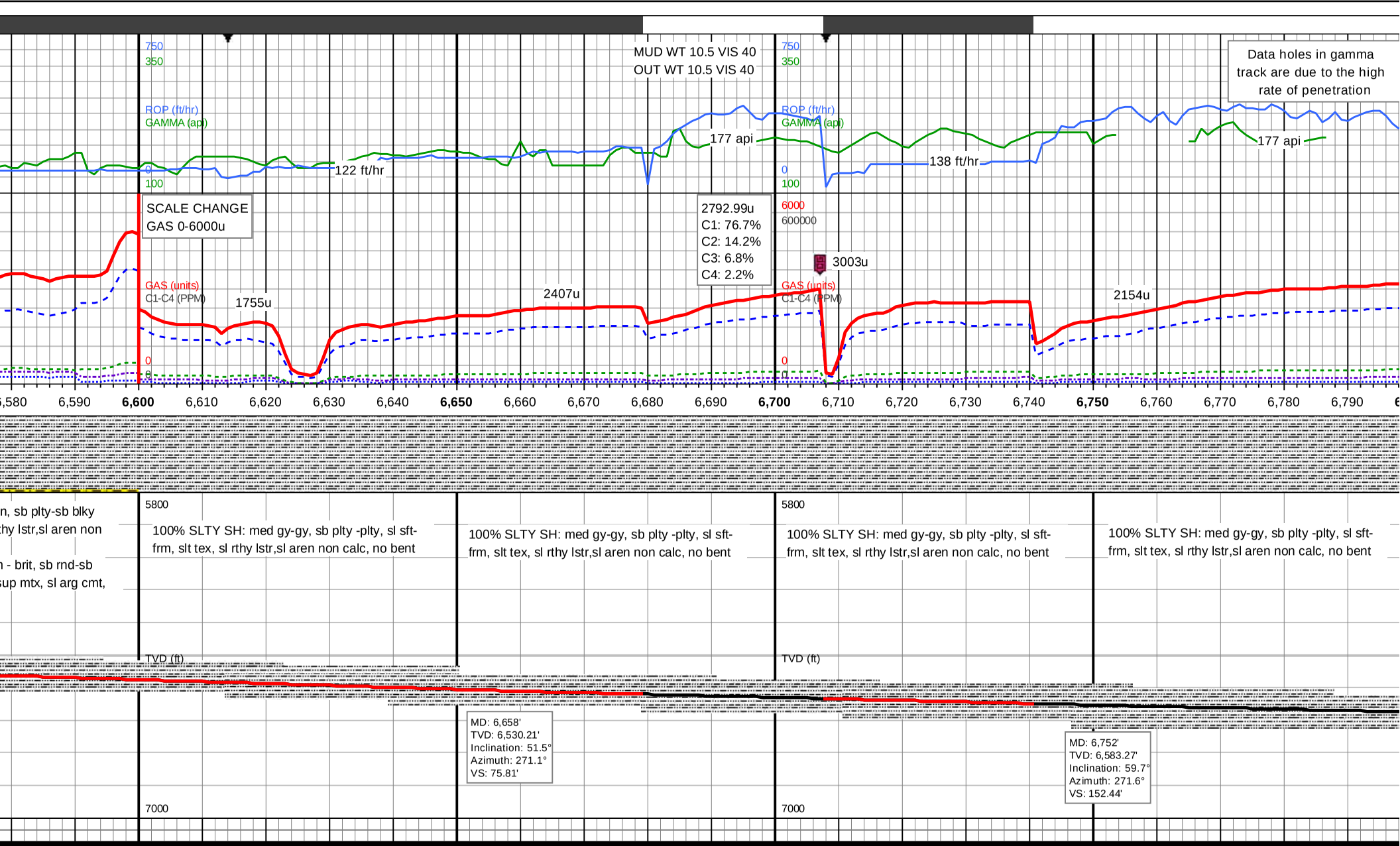
90% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, non calc
10% SHY SLTST: lt gy-gy - gy brn,sl sft - v sft, sb blky-sb plty, f-v f gr, gt, v arg, ply srt, gr - slty sh

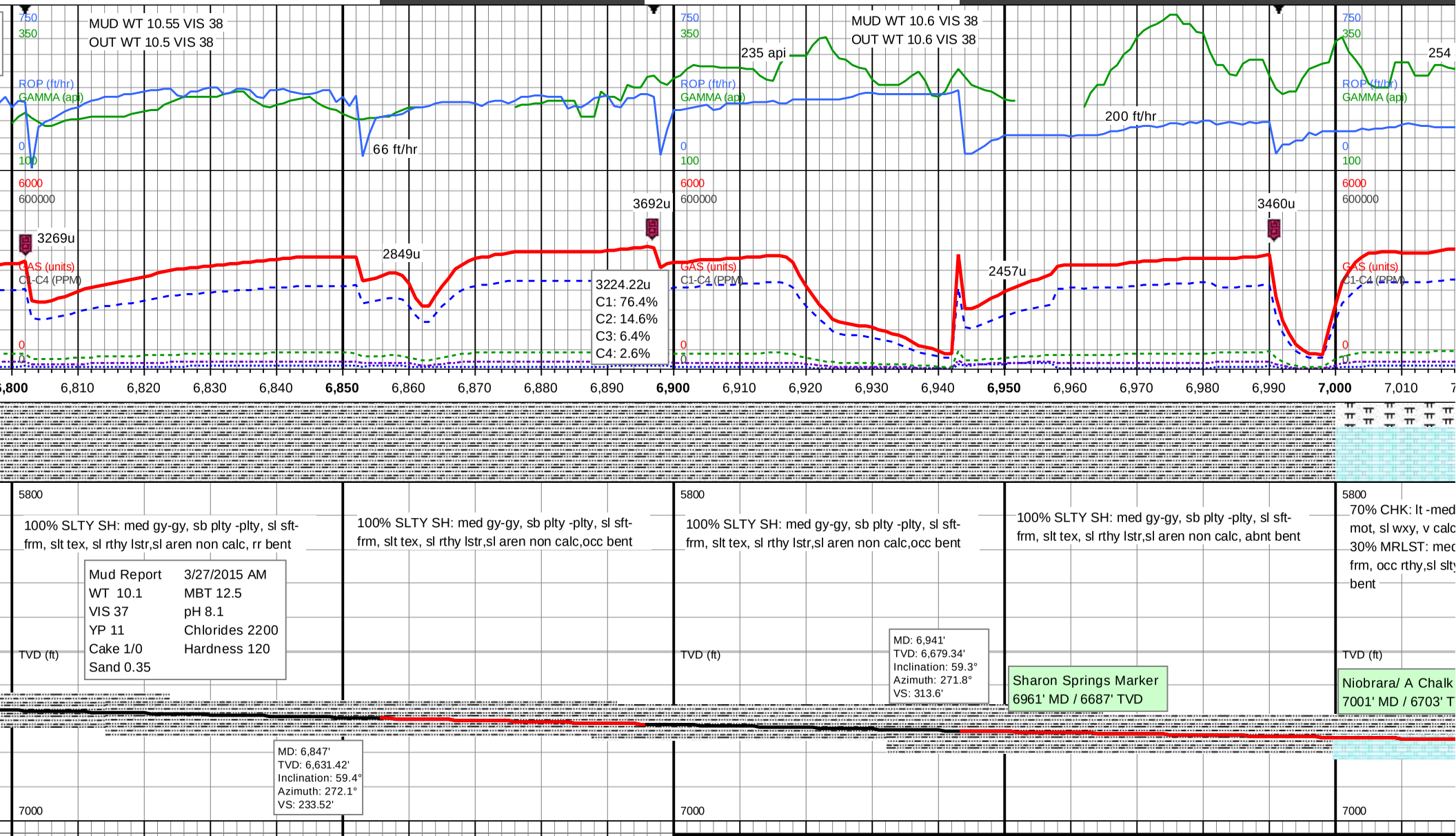
90% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, non calc
10% SHY SLTST: lt gy-gy - gy brn,sl sft - v sft, sb blky-sb plty, f-v f gr, gt, v arg, ply srt, gr - slty sh

90% SLTY SH: med gy-gr brn occ spec blk, sb plty-plty, sft- sl frm, slt tex, sl rthy lstr, non calc
10% SHY SLTST: lt gy-gy - gy brn,sl sft - v sft, sb blky-sb plty, f-v f gr, gt, v arg, ply srt, gr - slty sh

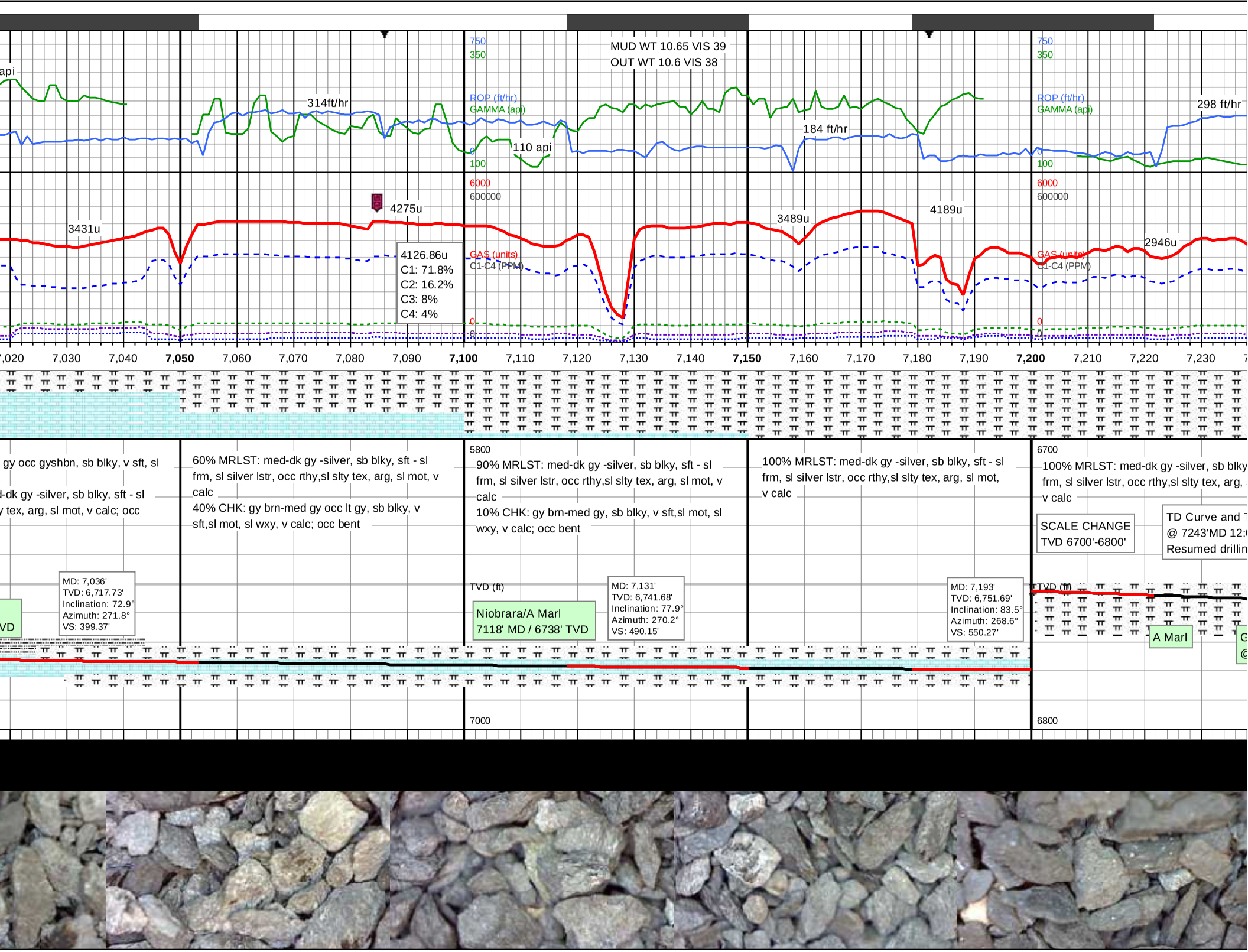
90% SLT... plty, sl sf... 10% SHY... f-v f gr, n... cmt

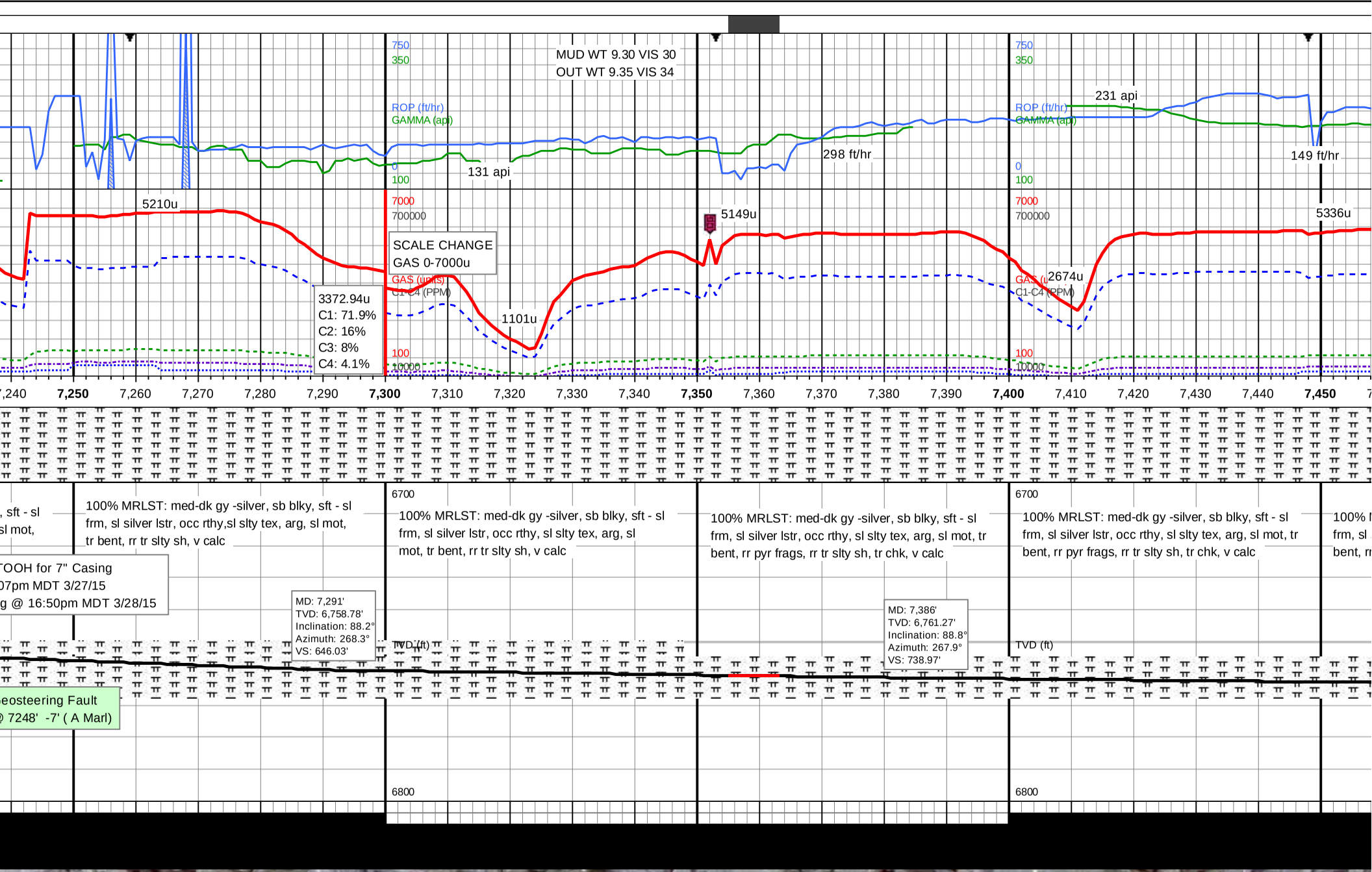

750
350
ROP (ft/hr)
GAMMA (api)
0
100
3000
300000
GAS (units)
C1-C4 (PPM)
0
0
134 api
106 ft/hr
1453u
2008u
2334u
1620u
C1: 76.7%
C2: 13.8%
C3: 7.3%
C4: 2.2%
1381u
1955u
144 api
52 ft/hr
MUD WT 10.45 VIS 38
OUT WT 10.45 VIS 38
6,360
6,370
6,380
6,390
6,400
6,410
6,420
6,430
6,440
6,450
6,460
6,470
6,480
6,490
6,500
6,510
6,520
6,530
6,540
6,550
6,560
6,570
5800
7000
TVD (ft)
MD: 6,375'
TVD: 6,299.17'
Inclination: 26°
Azimuth: 307°
VS: -80.55'
MD: 6,469'
TVD: 6,382.76'
Inclination: 28.8°
Azimuth: 289°
VS: -39.76'
MD: 6,563'
TVD: 6,461.99'
Inclination: 36.4°
Azimuth: 276°
VS: 10.56'
95% SLTY SH: med gy-gyshbn, sb plty-sb blky occ plty, sl sft- frm, slt tex, sl rthy lstr,sl aren non calc, no bent
5% SHY SS: wh-op-ltgy, sl frm - brit, sb rnd-sb ang, f-v f gr, mod srt, pred gr sup mtx, sl arg cmt, sl calc cmt
85% SLTY SH: med gy-gyshbn, sb plty-sb blky occ plty, sl sft- frm, slt tex, sl rthy lstr,sl aren non calc, no bent
15% SHY SS: wh-op-ltgy, sl frm - brit, sb rnd-sb ang, f-v f gr, mod srt, pred gr sup mtx, sl arg cmt, sl calc cmt
90% SLTY SH: med gy-gyshbn, sb plty-sb blky occ plty, sl sft- frm, slt tex, sl rthy lstr,sl aren non calc, no bent
10% SHY SS: wh-op-ltgy, sl frm - brit, sb rnd-sb ang, f-v f gr, mod srt, pred gr sup mtx, sl arg cmt, sl calc cmt

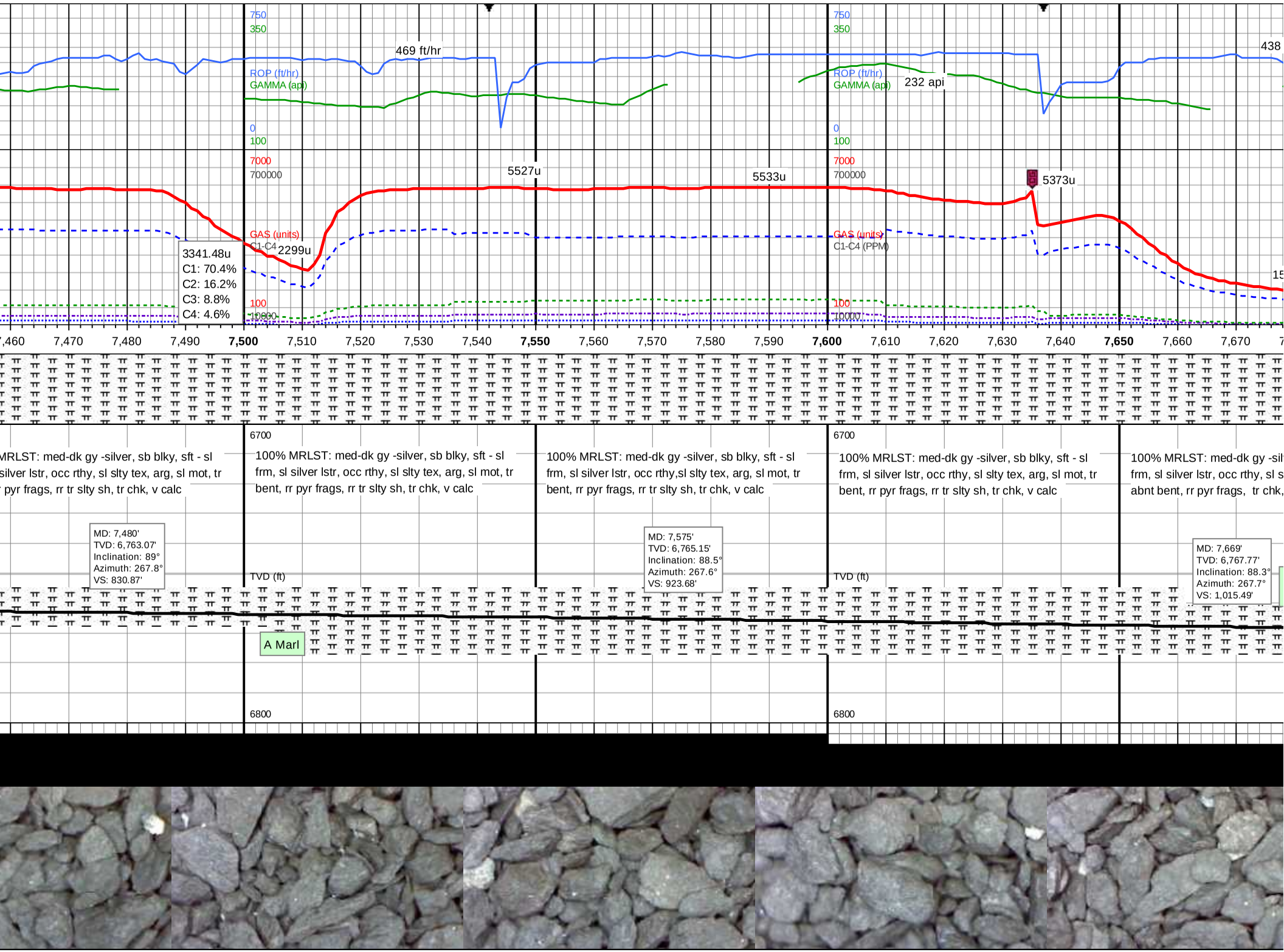

MUD WT 10.5 VIS 40
OUT WT 10.5 VIS 40
Data holes in gamma track are due to the high rate of penetration
750
350
ROP (ft/hr)
GAMMA (api)
0
100
122 ft/hr
177 api
138 ft/hr
177 api
SCALE CHANGE
GAS 0-6000u
6000
600000
2792.99u
C1: 76.7%
C2: 14.2%
C3: 6.8%
C4: 2.2%
3003u
GAS (units)
C1-C4 (PPM)
1755u
2407u
2154u
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
6,770
6,780
6,790
n, sb plty-sb blky
thy lstr,sl aren non
n - brit, sb rnd-sb
sup mtx, sl arg cmt,
5800
100% SLTY SH: med gy-gy, sb plty -plty, sl sft-frm, slt tex, sl rthy lstr,sl aren non calc, no bent
TVD (ft)
7000
MD: 6,658'
TVD: 6,530.21'
Inclination: 51.5°
Azimuth: 271.1°
VS: 75.81'
MD: 6,752'
TVD: 6,583.27'
Inclination: 59.7°
Azimuth: 271.6°
VS: 152.44'

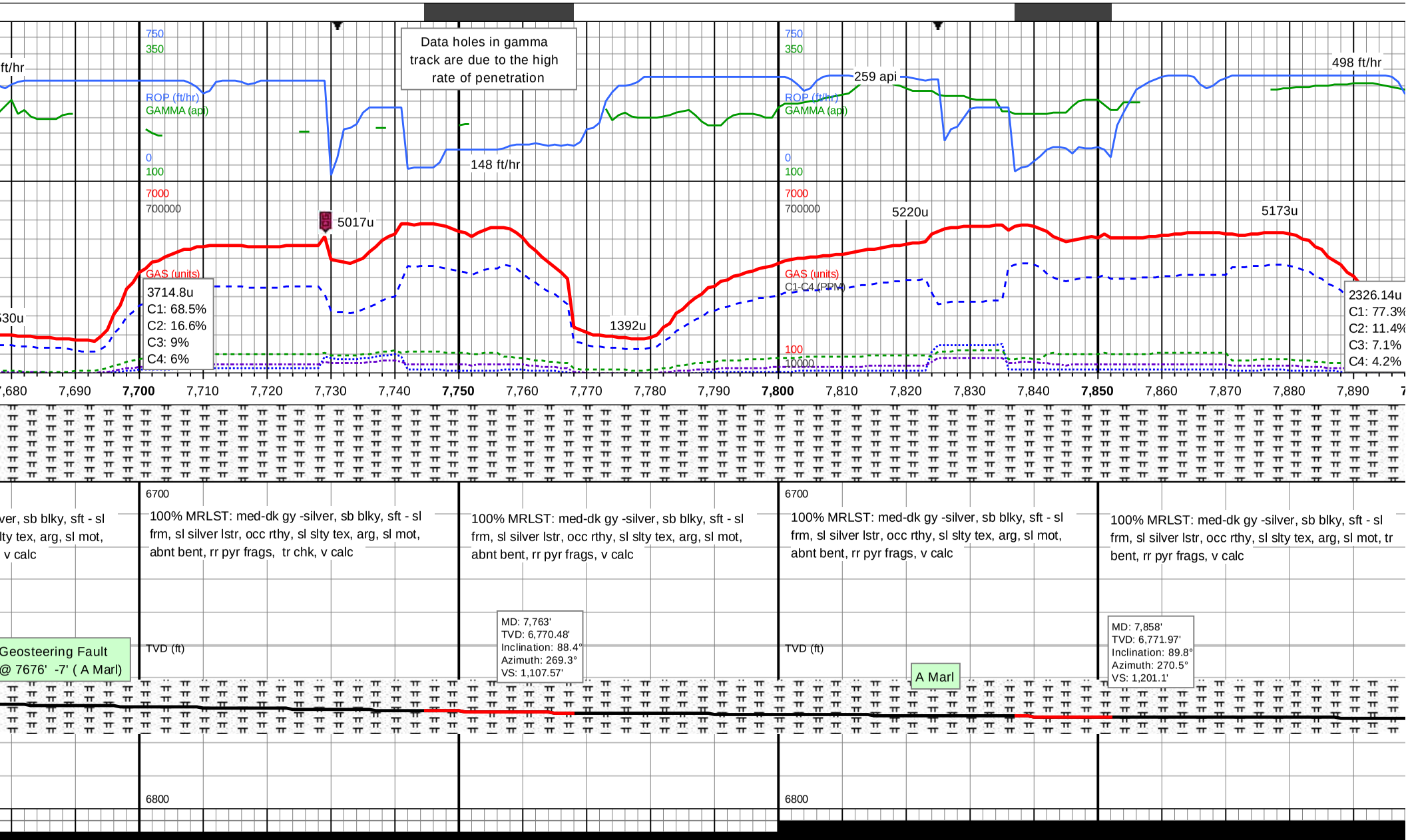

MUD WT 10.55 VIS 38
OUT WT 10.5 VIS 38
MUD WT 10.6 VIS 38
OUT WT 10.6 VIS 38
ROP (ft/hr)
GAMMA (api)
GAS (units)
C1-C4 (PPM)
66 ft/hr
235 api
200 ft/hr
254
3269u
2849u
3692u
2457u
3460u
3224.22u
C1: 76.4%
C2: 14.6%
C3: 6.4%
C4: 2.6%
6,800
6,810
6,820
6,830
6,840
6,850
6,860
6,870
6,880
6,890
6,900
6,910
6,920
6,930
6,940
6,950
6,960
6,970
6,980
6,990
7,000
7,010

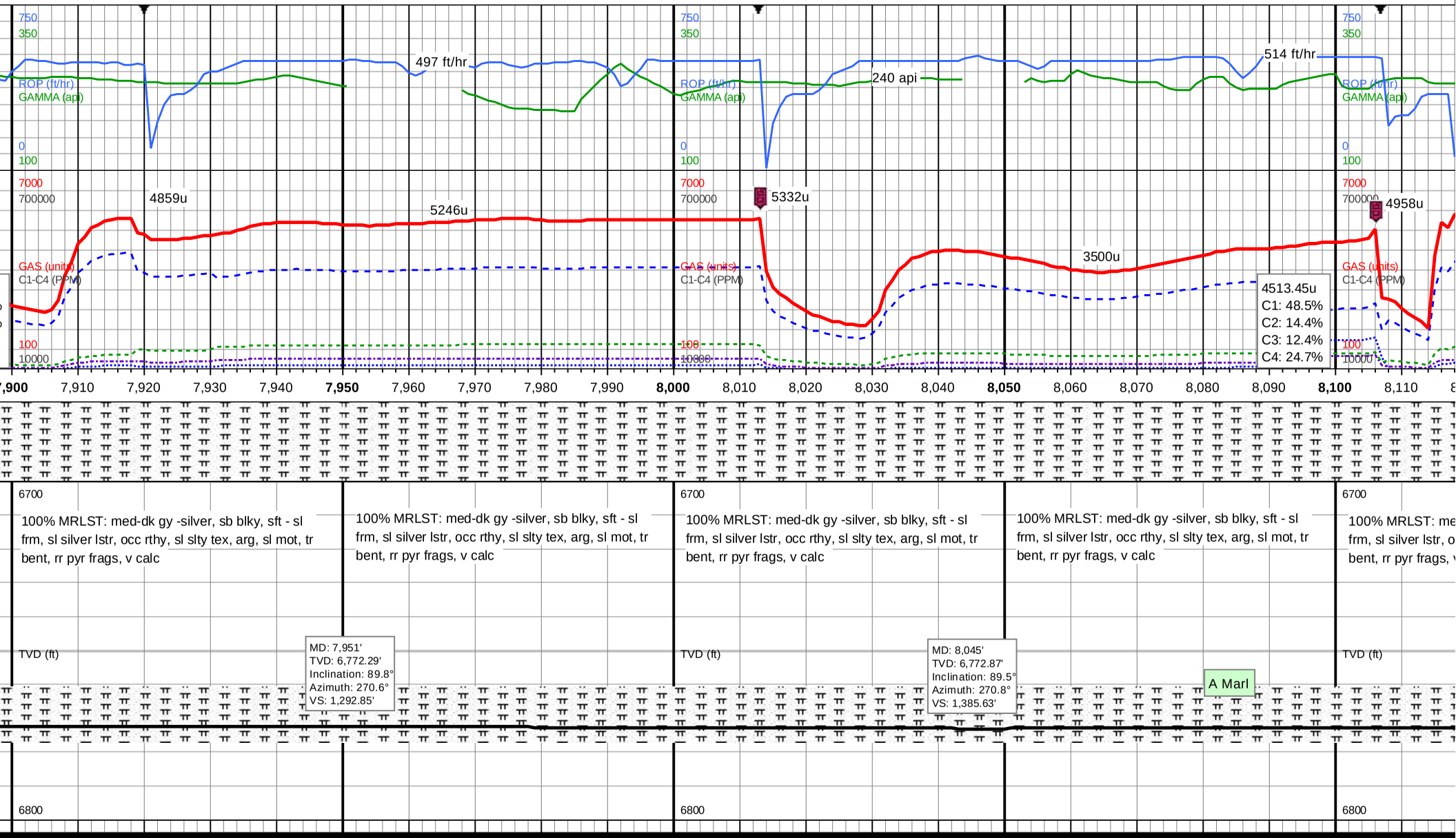
5800
100% SLTY SH: med gy-gy, sb plty -plty, sl sft-frm, slt tex, sl rthy lstr,sl aren non calc, rr bent
100% SLTY SH: med gy-gy, sb plty -plty, sl sft-frm, slt tex, sl rthy lstr,sl aren non calc,occ bent
100% SLTY SH: med gy-gy, sb plty -plty, sl sft-frm, slt tex, sl rthy lstr,sl aren non calc,occ bent
100% SLTY SH: med gy-gy, sb plty -plty, sl sft-frm, slt tex, sl rthy lstr,sl aren non calc, abnt bent
70% CHK: lt -med
mot, sl wxy, v calc
30% MRLST: med
frm, occ rthy,sl slty
bent
Mud Report 3/27/2015 AM
WT 10.1 MBT 12.5
VIS 37 pH 8.1
YP 11 Chlorides 2200
Cake 1/0 Hardness 120
Sand 0.35
TVD (ft)
MD: 6,847'
TVD: 6,631.42'
Inclination: 59.4°
Azimuth: 272.1°
VS: 233.52'
MD: 6,941'
TVD: 6,679.34'
Inclination: 59.3°
Azimuth: 271.8°
VS: 313.6'
Sharon Springs Marker
6961' MD / 6687' TVD
Niobrara/ A Chalk
7001' MD / 6703' T
7000


MUD WT 10.65 VIS 39
OUT WT 10.6 VIS 38
ROP (ft/hr)
GAMMA (api)
GAS (units)
C1-C4 (PPM)
750
350
0
100
6000
600000
314ft/hr
110 api
184 ft/hr
298 ft/hr
4275u
3431u
3489u
4189u
2946u
4126.86u
C1: 71.8%
C2: 16.2%
C3: 8%
C4: 4%
7,020
7,030
7,040
7,050
7,060
7,070
7,080
7,090
7,100
7,110
7,120
7,130
7,140
7,150
7,160
7,170
7,180
7,190
7,200
7,210
7,220
7,230
60% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, v calc
40% CHK: gy brn-med gy occ lt gy, sb blky, v sft,sl mot, sl wxy, v calc; occ bent
90% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, v calc
10% CHK: gy brn-med gy, sb blky, v sft,sl mot, sl wxy, v calc; occ bent
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, v calc
SCALE CHANGE
TVD 6700'-6800'
TVD (ft)
5800
7000
6700
6800
MD: 7,036'
TVD: 6,717.73'
Inclination: 72.9°
Azimuth: 271.8°
VS: 399.37'
MD: 7,131'
TVD: 6,741.68'
Inclination: 77.9°
Azimuth: 270.2°
VS: 490.15'
MD: 7,193'
TVD: 6,751.69'
Inclination: 83.5°
Azimuth: 268.6°
VS: 550.27'
Niobrara/A Marl
7118' MD / 6738' TVD
A Marl

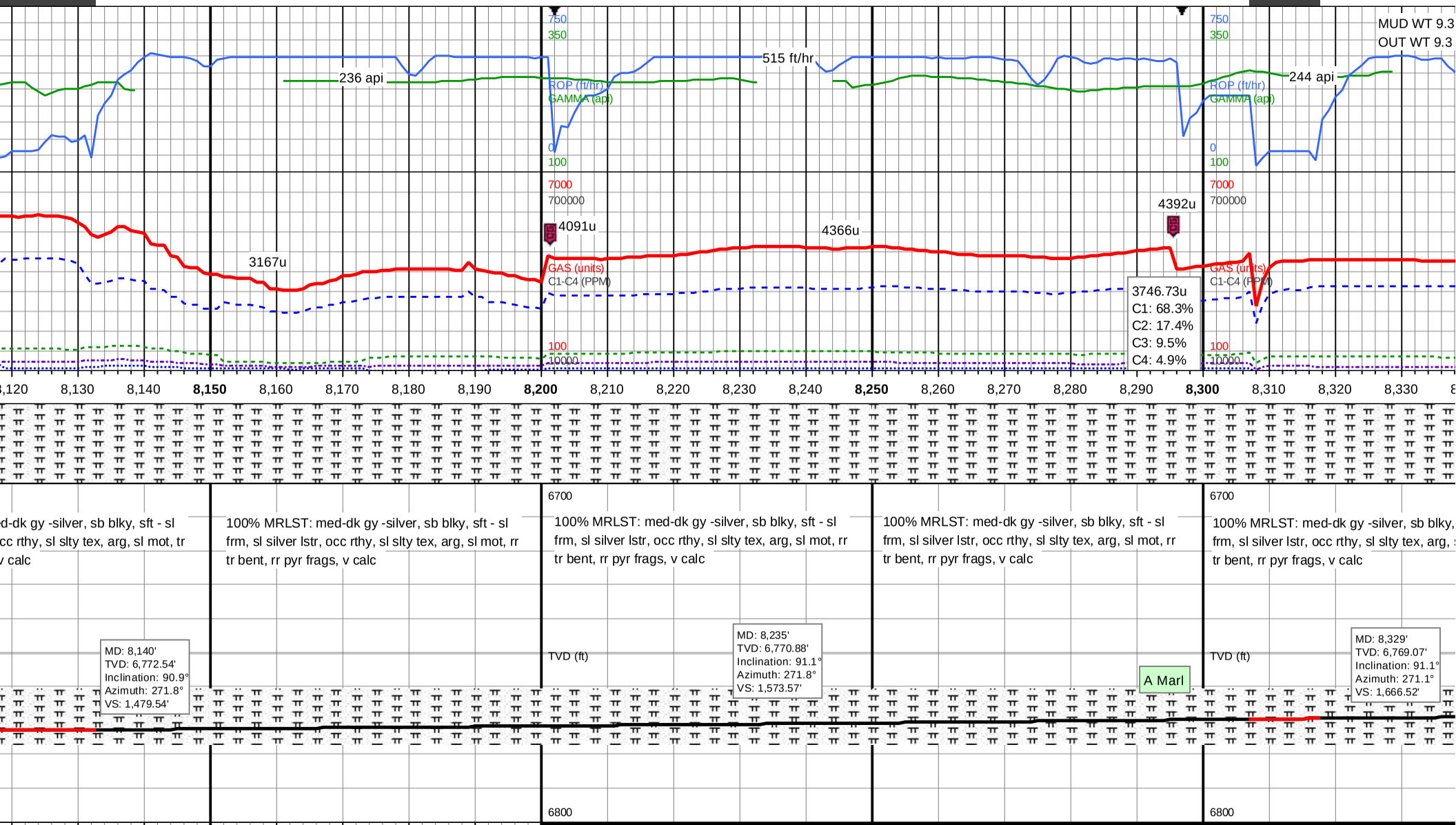

MUD WT 9.30 VIS 30
OUT WT 9.35 VIS 34
ROP (ft/hr)
GAMMA (api)
750
350
0
100
7000
700000
100
10000
5210u
131 api
298 ft/hr
231 api
149 ft/hr
5149u
5336u
2674u
1101u
SCALE CHANGE
GAS 0-7000u
GAS (units)
C1-C4 (PPM)
3372.94u
C1: 71.9%
C2: 16%
C3: 8%
C4: 4.1%
7,240
7,250
7,260
7,270
7,280
7,290
7,300
7,310
7,320
7,330
7,340
7,350
7,360
7,370
7,380
7,390
7,400
7,410
7,420
7,430
7,440
7,450
6700
6800
TVD (ft)
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, tr bent, rr tr slty sh, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr bent, rr tr slty sh, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr bent, rr pyr frags, rr tr slty sh, tr chk, v calc
MD: 7,291'
TVD: 6,758.78'
Inclination: 88.2°
Azimuth: 268.3°
VS: 646.03'
MD: 7,386'
TVD: 6,761.27'
Inclination: 88.8°
Azimuth: 267.9°
VS: 738.97'
TOOH for 7" Casing
07pm MDT 3/27/15
g @ 16:50pm MDT 3/28/15
eosteering Fault
@ 7248' -7' (A Marl)


750
350
ROP (ft/hr)
GAMMA (api)
469 ft/hr
0
100
7000
700000
GAS (units)
C1-C4
5527u
2299u
5533u
3341.48u
C1: 70.4%
C2: 16.2%
C3: 8.8%
C4: 4.6%
100
10000
232 api
5373u
GAS (units)
C1-C4 (PPM)
438
7,460
7,470
7,480
7,490
7,500
7,510
7,520
7,530
7,540
7,550
7,560
7,570
7,580
7,590
7,600
7,610
7,620
7,630
7,640
7,650
7,660
7,670
6700
MRLST: med-dk gy -silver, sb blky, sft - sl
silver lstr, occ rthy, sl slty tex, arg, sl mot, tr
pyr frags, rr tr slty sh, tr chk, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl
frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr
bent, rr pyr frags, rr tr slty sh, tr chk, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl
frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, tr
bent, rr pyr frags, rr tr slty sh, tr chk, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl
frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr
bent, rr pyr frags, rr tr slty sh, tr chk, v calc
100% MRLST: med-dk gy -sil
frm, sl silver lstr, occ rthy, sl s
abnt bent, rr pyr frags, tr chk,
MD: 7,480'
TVD: 6,763.07'
Inclination: 89°
Azimuth: 267.8°
VS: 830.87'
MD: 7,575'
TVD: 6,765.15'
Inclination: 88.5°
Azimuth: 267.6°
VS: 923.68'
MD: 7,669'
TVD: 6,767.77'
Inclination: 88.3°
Azimuth: 267.7°
VS: 1,015.49'
TVD (ft)
TVD (ft)
A Marl
6800
6800

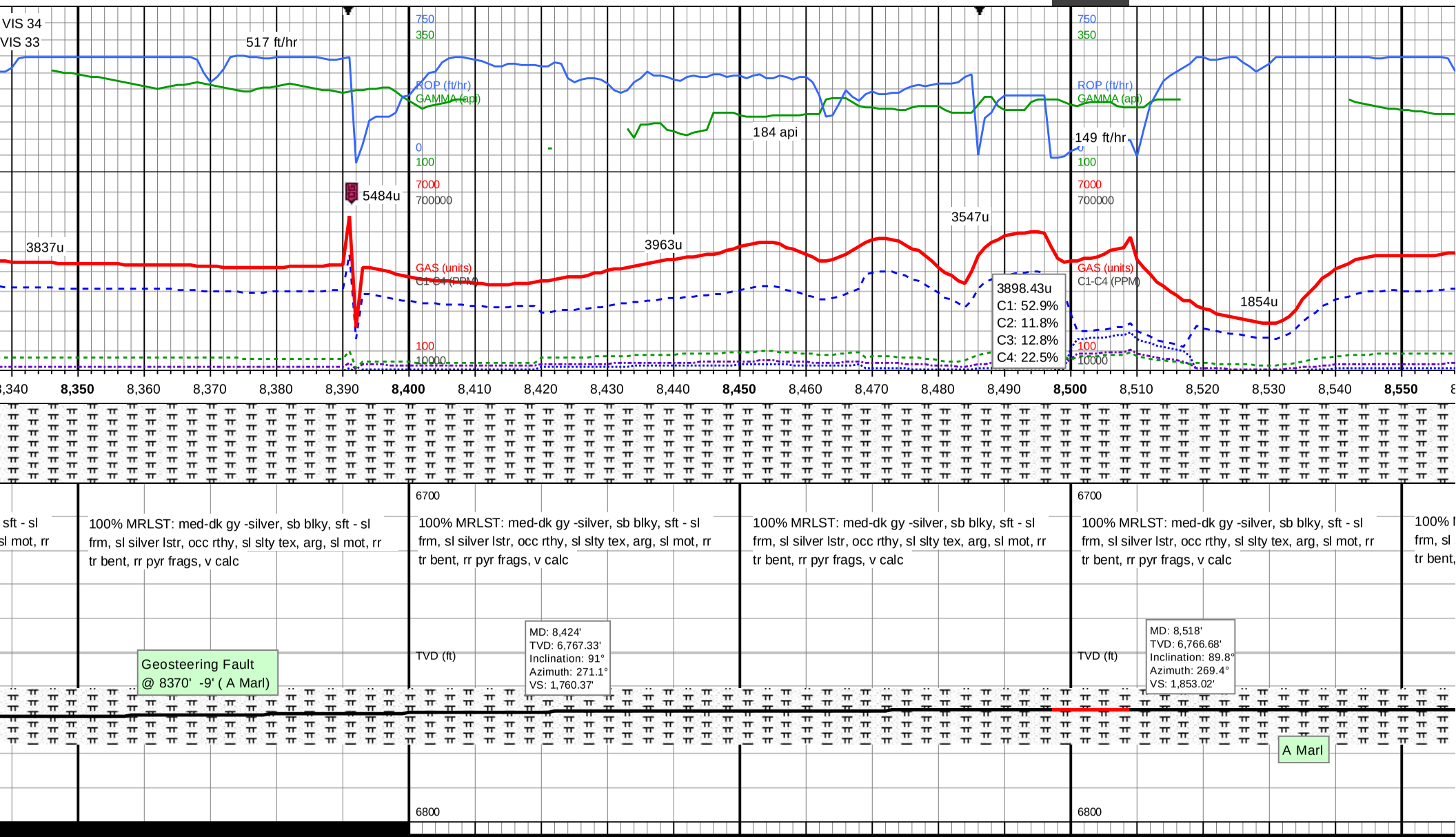

Data holes in gamma track are due to the high rate of penetration
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
GAS (units)
C1-C4 (PPM)
100
10000
148 ft/hr
259 api
498 ft/hr
5017u
5220u
5173u
1392u
3714.8u
C1: 68.5%
C2: 16.6%
C3: 9%
C4: 6%
2326.14u
C1: 77.3%
C2: 11.4%
C3: 7.1%
C4: 4.2%
7,680
7,690
7,700
7,710
7,720
7,730
7,740
7,750
7,760
7,770
7,780
7,790
7,800
7,810
7,820
7,830
7,840
7,850
7,860
7,870
7,880
7,890
6700
6800
TVD (ft)
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, abnt bent, rr pyr frags, tr chk, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, abnt bent, rr pyr frags, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr bent, rr pyr frags, v calc
Geosteering Fault
@ 7676' -7' (A Marl)
MD: 7,763'
TVD: 6,770.48'
Inclination: 88.4°
Azimuth: 269.3°
VS: 1,107.57'
A Marl
MD: 7,858'
TVD: 6,771.97'
Inclination: 89.8°
Azimuth: 270.5°
VS: 1,201.1'

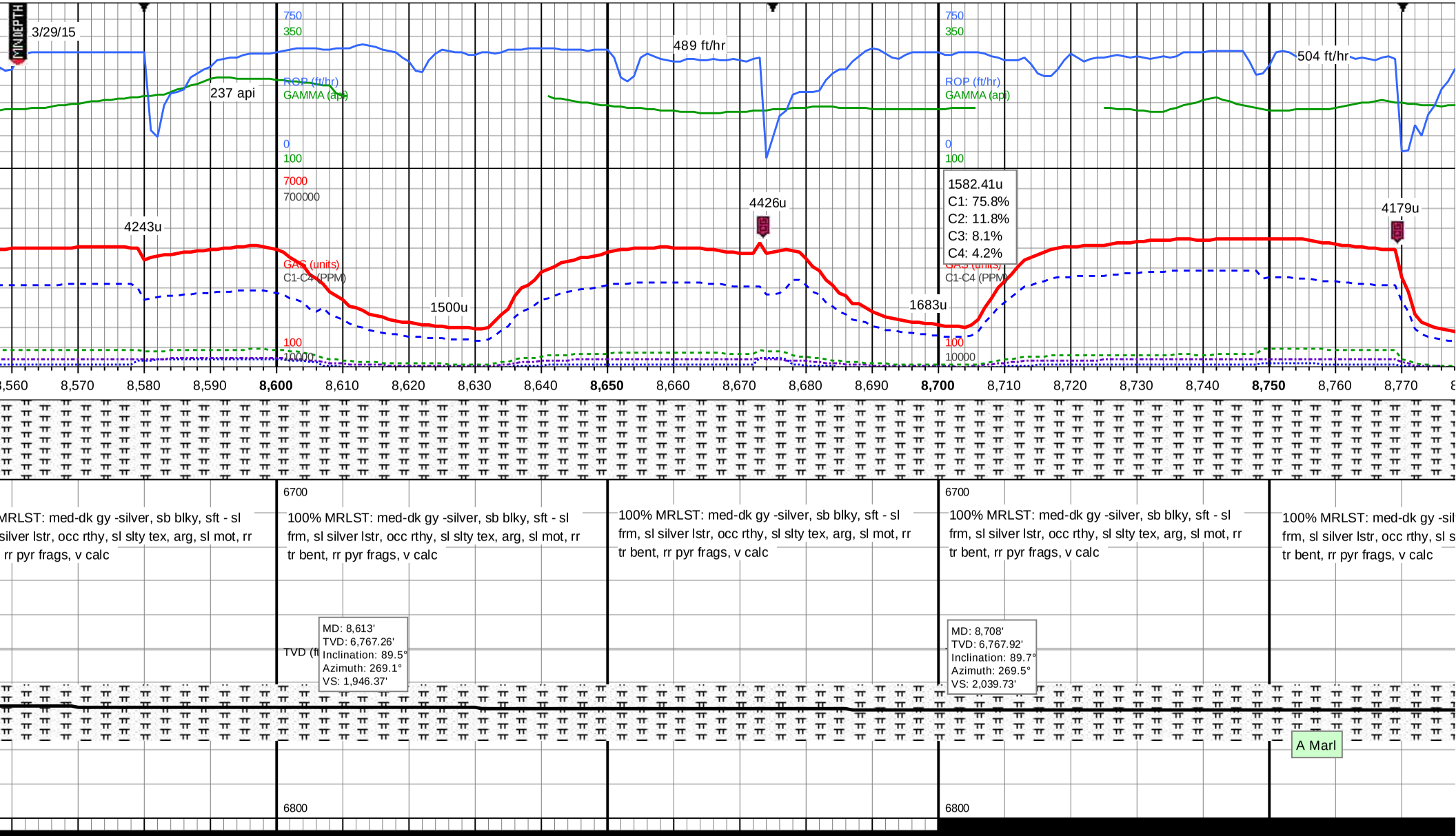

750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
GAS (units)
C1-C4 (PPM)
100
10000
497 ft/hr
240 api
514 ft/hr
4859u
5246u
5332u
3500u
4958u
4513.45u
C1: 48.5%
C2: 14.4%
C3: 12.4%
C4: 24.7%
7,900
7,910
7,920
7,930
7,940
7,950
7,960
7,970
7,980
7,990
8,000
8,010
8,020
8,030
8,040
8,050
8,060
8,070
8,080
8,090
8,100
8,110

6700
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, tr bent, rr pyr frags, v calc
TVD (ft)
MD: 7,951'
TVD: 6,772.29'
Inclination: 89.8°
Azimuth: 270.6°
VS: 1,292.85'
MD: 8,045'
TVD: 6,772.87'
Inclination: 89.5°
Azimuth: 270.8°
VS: 1,385.63'
A Marl
6800

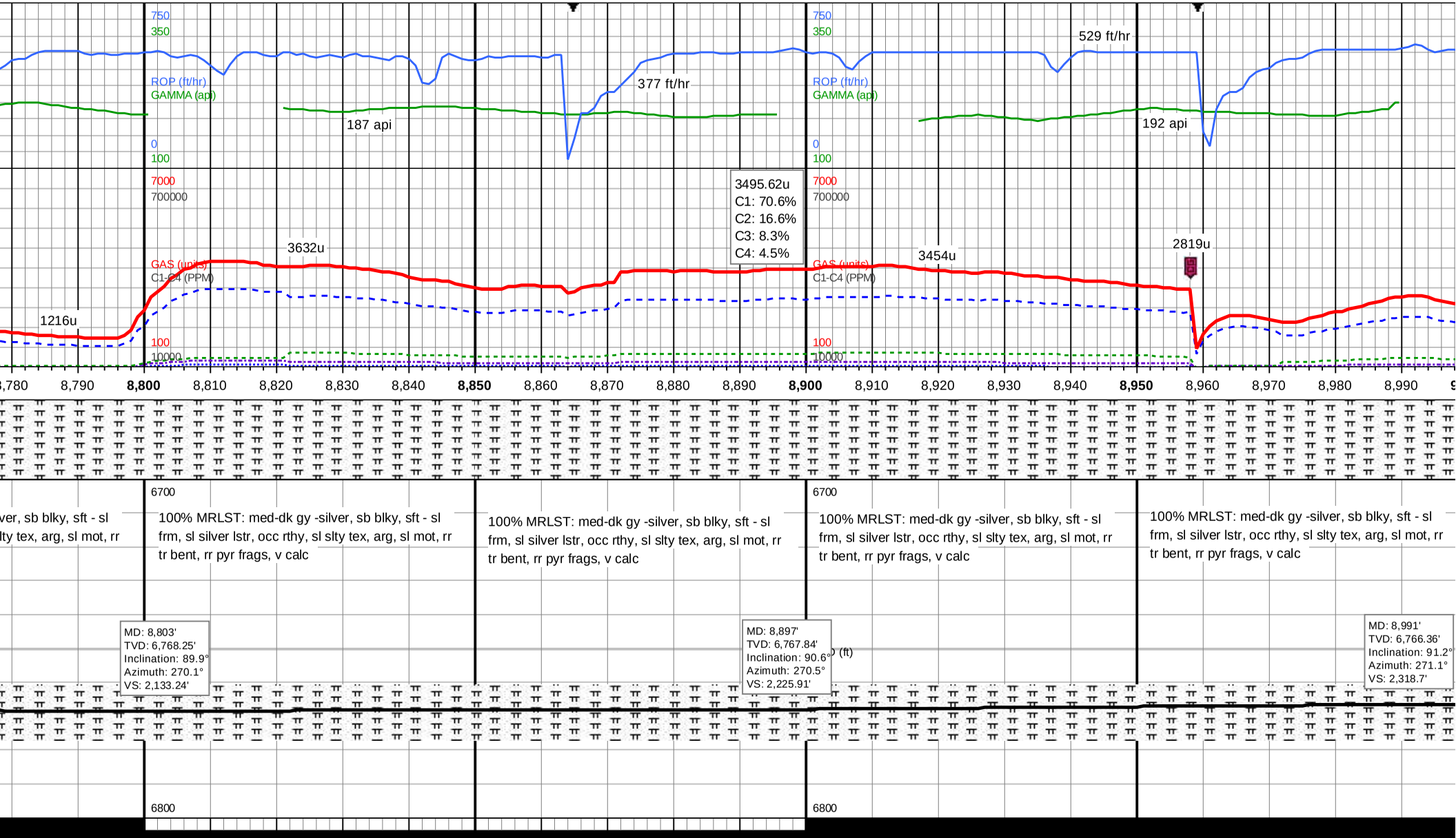

750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
100
10000
236 api
515 ft/hr
244 api
MUD WT 9.3
OUT WT 9.3
4091u
4366u
4392u
3167u
GAS (units)
C1-C4 (PPM)
3746.73u
C1: 68.3%
C2: 17.4%
C3: 9.5%
C4: 4.9%
8,120
8,130
8,140
8,150
8,160
8,170
8,180
8,190
8,200
8,210
8,220
8,230
8,240
8,250
8,260
8,270
8,280
8,290
8,300
8,310
8,320
8,330

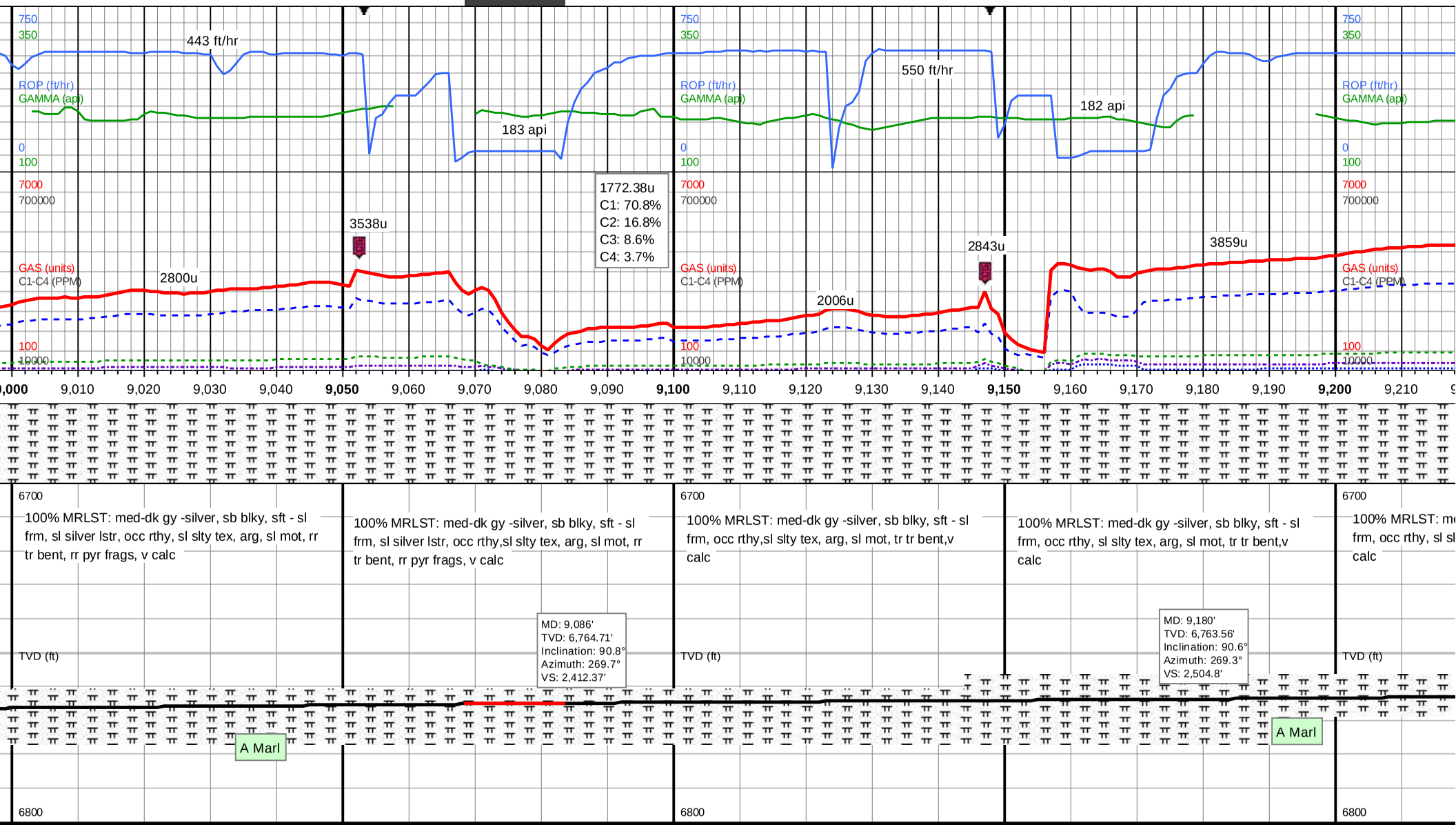
6700
d-dk gy -silver, sb blky, sft - sl
cc rthy, sl slty tex, arg, sl mot, tr
v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl
frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, rr
tr bent, rr pyr frags, v calc
MD: 8,140'
TVD: 6,772.54'
Inclination: 90.9°
Azimuth: 271.8°
VS: 1,479.54'
MD: 8,235'
TVD: 6,770.88'
Inclination: 91.1°
Azimuth: 271.8°
VS: 1,573.57'
A Marl
MD: 8,329'
TVD: 6,769.07'
Inclination: 91.1°
Azimuth: 271.1°
VS: 1,666.52'
TVD (ft)
6800


VIS 34
VIS 33
517 ft/hr
ROP (ft/hr)
GAMMA (api)
750
350
0
100
7000
700000
5484u
3837u
3963u
3547u
184 api
149 ft/hr
1854u
GAS (units)
C1-C4 (PPM)
100
10000
3898.43u
C1: 52.9%
C2: 11.8%
C3: 12.8%
C4: 22.5%
8,340
8,350
8,360
8,370
8,380
8,390
8,400
8,410
8,420
8,430
8,440
8,450
8,460
8,470
8,480
8,490
8,500
8,510
8,520
8,530
8,540
8,550
sft - sl
sl mot, rr
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, rr tr bent, rr pyr frags, v calc
6700
TVD (ft)
Geosteering Fault @ 8370' -9' (A Marl)
MD: 8,424'
TVD: 6,767.33'
Inclination: 91°
Azimuth: 271.1°
VS: 1,760.37'
MD: 8,518'
TVD: 6,766.68'
Inclination: 89.8°
Azimuth: 269.4°
VS: 1,853.02'
A Marl
6800

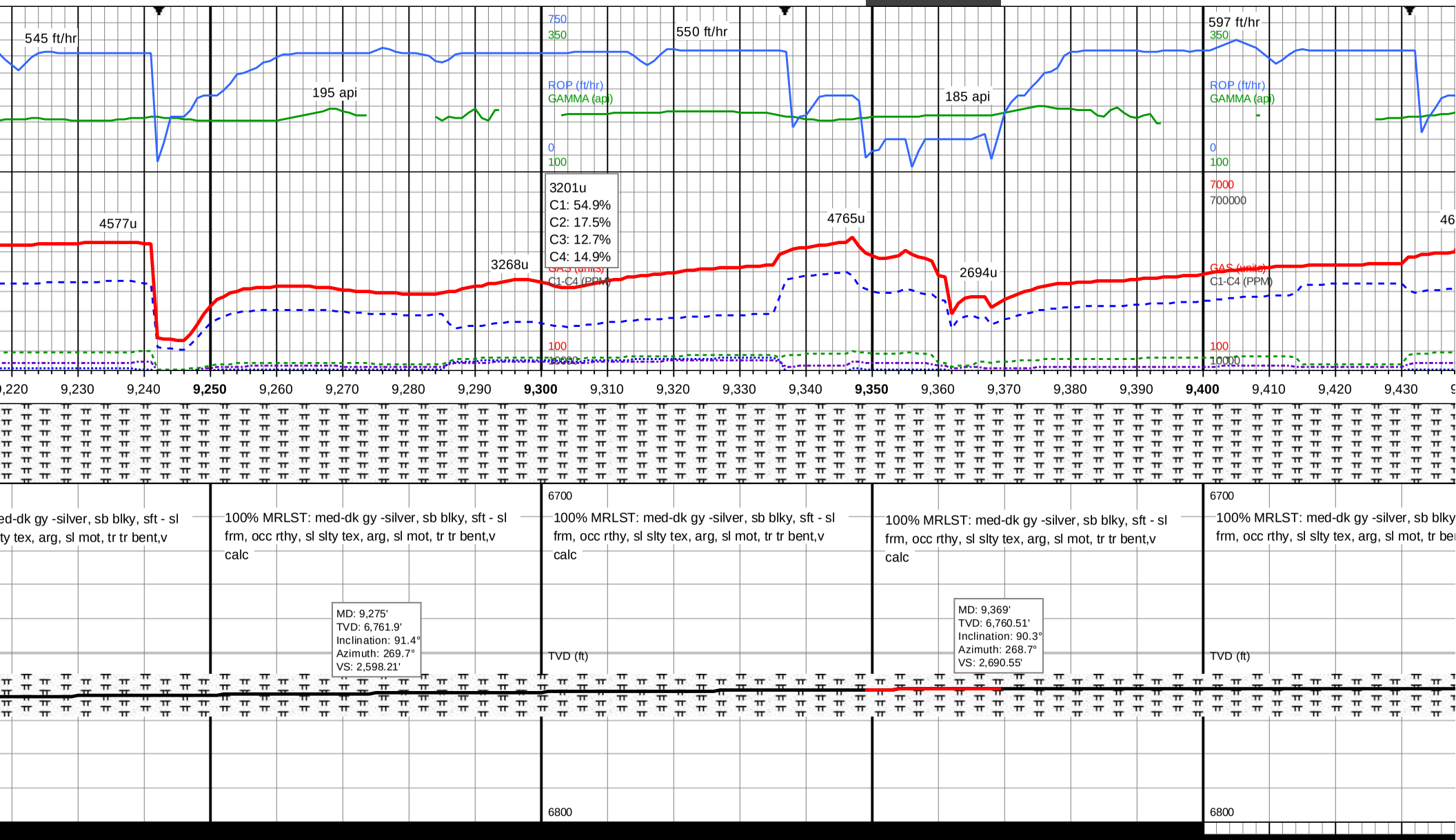

MD DEPTH
3/29/15
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
237 api
4243u
1500u
489 ft/hr
4426u
1683u
504 ft/hr
4179u
1582.41u
C1: 75.8%
C2: 11.8%
C3: 8.1%
C4: 4.2%
GAS (units)
C1-C4 (PPM)
100
10000
8,560
8,570
8,580
8,590
8,600
8,610
8,620
8,630
8,640
8,650
8,660
8,670
8,680
8,690
8,700
8,710
8,720
8,730
8,740
8,750
8,760
8,770

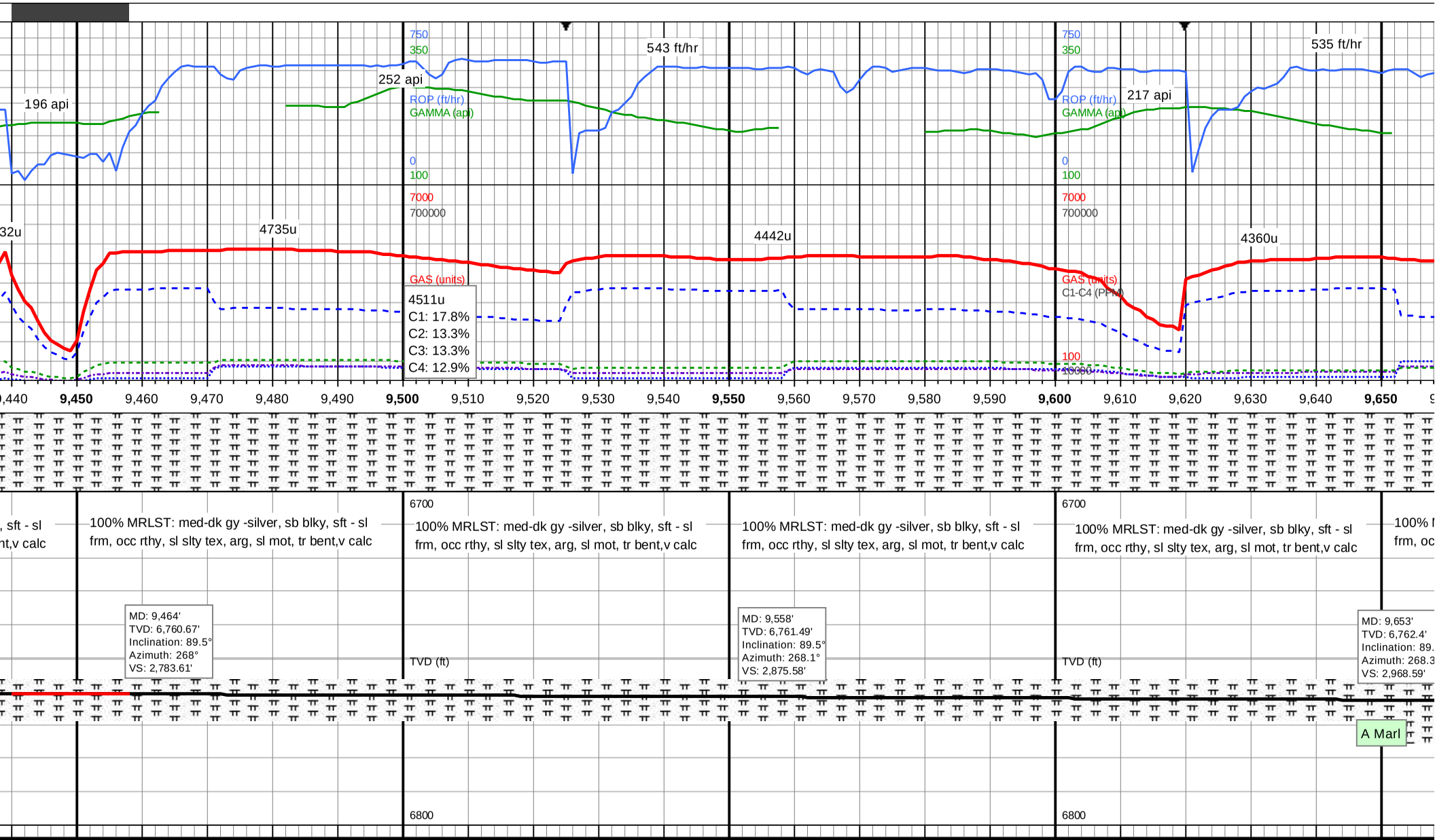
6700
MRLST: med-dk gy -silver, sb blky, sft - sl
silver lstr, occ rthy, sl slty tex, arg, sl mot, rr
rr pyr frags, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl
frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, rr
tr bent, rr pyr frags, v calc
MD: 8,613'
TVD: 6,767.26'
Inclination: 89.5°
Azimuth: 269.1°
VS: 1,946.37'
MD: 8,708'
TVD: 6,767.92'
Inclination: 89.7°
Azimuth: 269.5°
VS: 2,039.73'
A Marl
6800

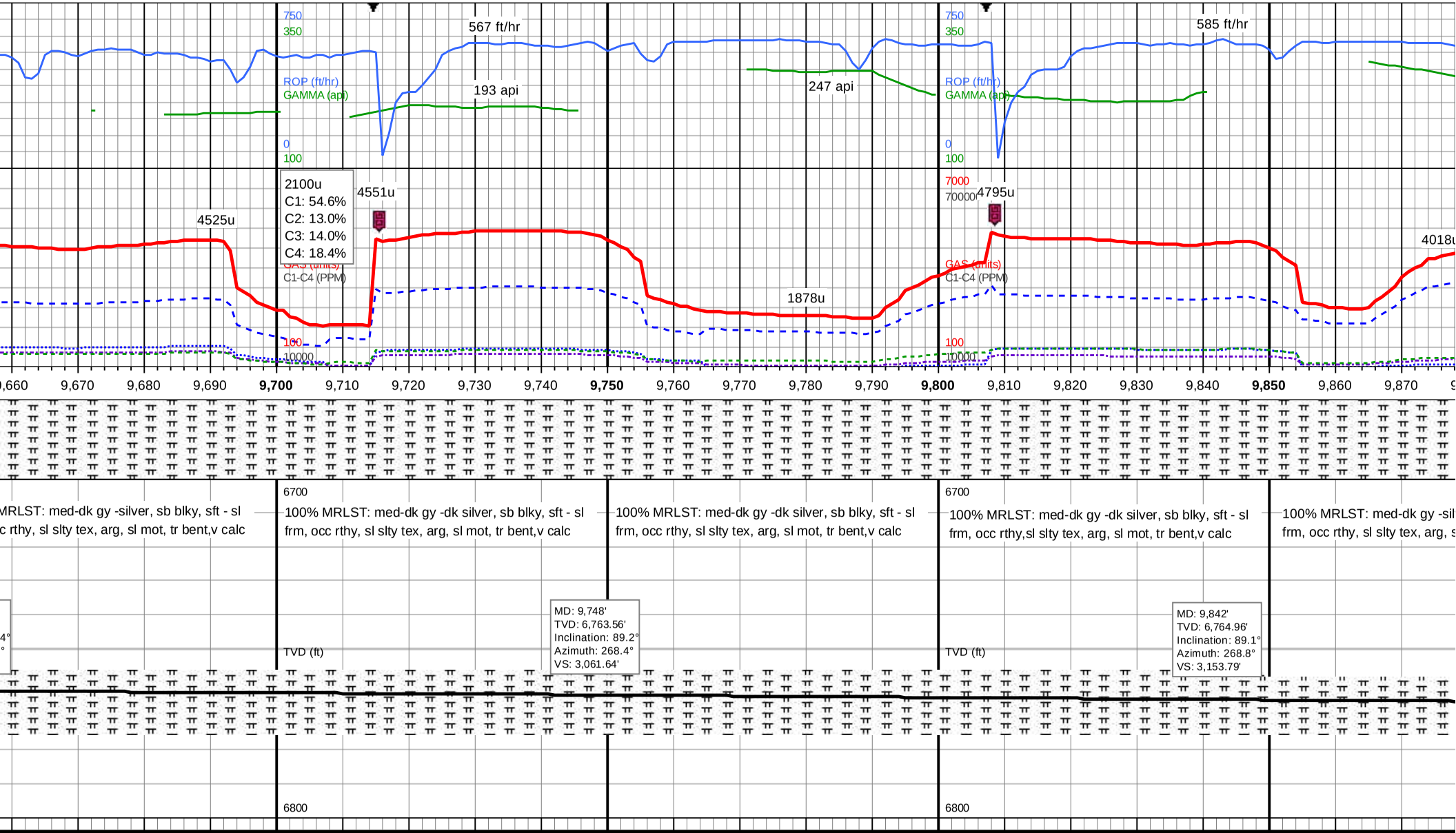

750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
GAS (units)
C1-C4 (PPM)
100
10000
377 ft/hr
187 api
529 ft/hr
192 api
3495.62u
C1: 70.6%
C2: 16.6%
C3: 8.3%
C4: 4.5%
3632u
3454u
2819u
1216u
8,780
8,790
8,800
8,810
8,820
8,830
8,840
8,850
8,860
8,870
8,880
8,890
8,900
8,910
8,920
8,930
8,940
8,950
8,960
8,970
8,980
8,990
6700
6800
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, rr tr bent, rr pyr frags, v calc
MD: 8,803'
TVD: 6,768.25'
Inclination: 89.9°
Azimuth: 270.1°
VS: 2,133.24'
MD: 8,897'
TVD: 6,767.84'
Inclination: 90.6°
Azimuth: 270.5°
VS: 2,225.91'
MD: 8,991'
TVD: 6,766.36'
Inclination: 91.2°
Azimuth: 271.1°
VS: 2,318.7'

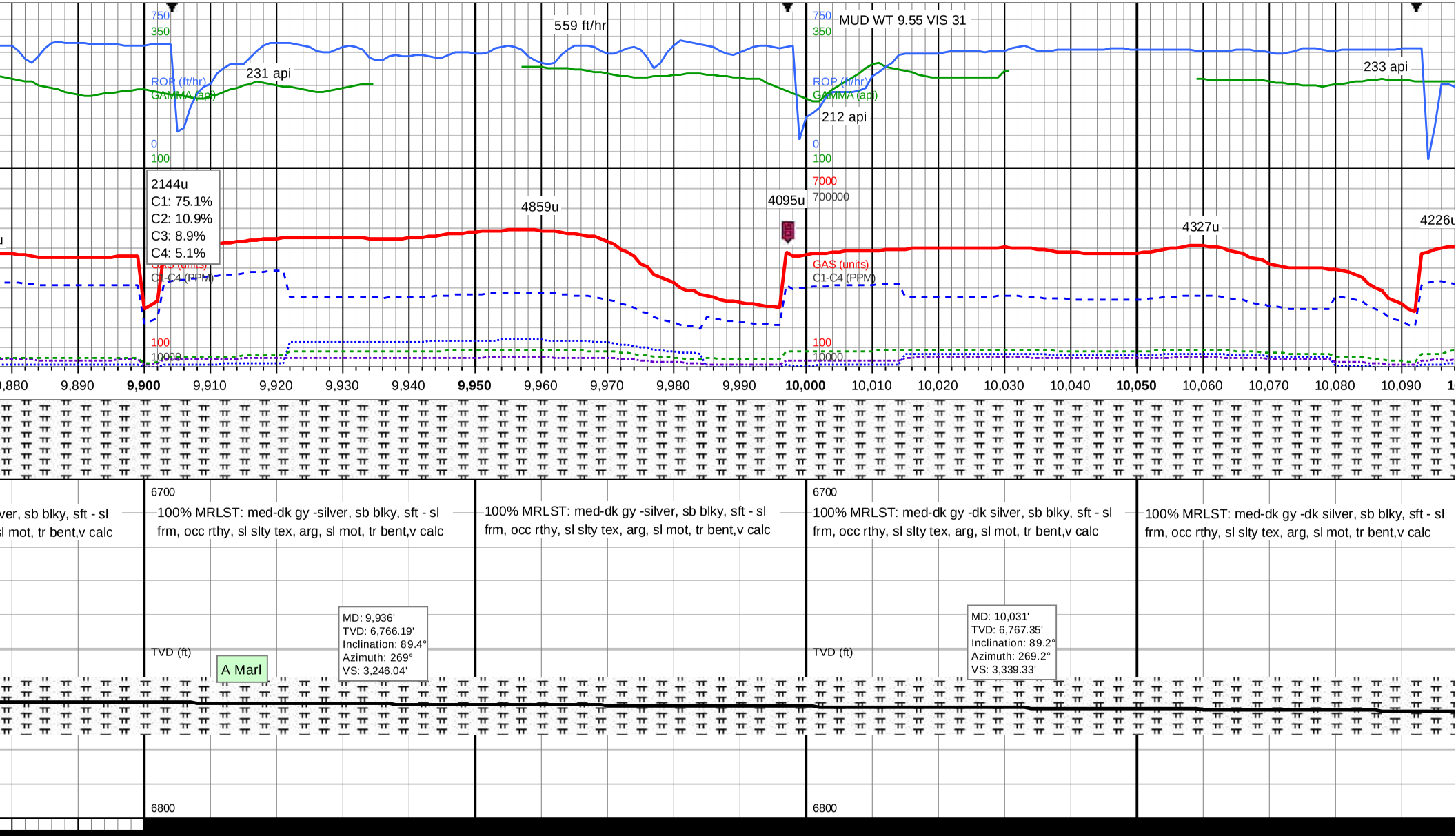

750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
GAS (units)
C1-C4 (PPM)
100
10000
443 ft/hr
183 api
550 ft/hr
182 api
1772.38u
C1: 70.8%
C2: 16.8%
C3: 8.6%
C4: 3.7%
3538u
2800u
2006u
2843u
3859u
9,000
9,010
9,020
9,030
9,040
9,050
9,060
9,070
9,080
9,090
9,100
9,110
9,120
9,130
9,140
9,150
9,160
9,170
9,180
9,190
9,200
9,210

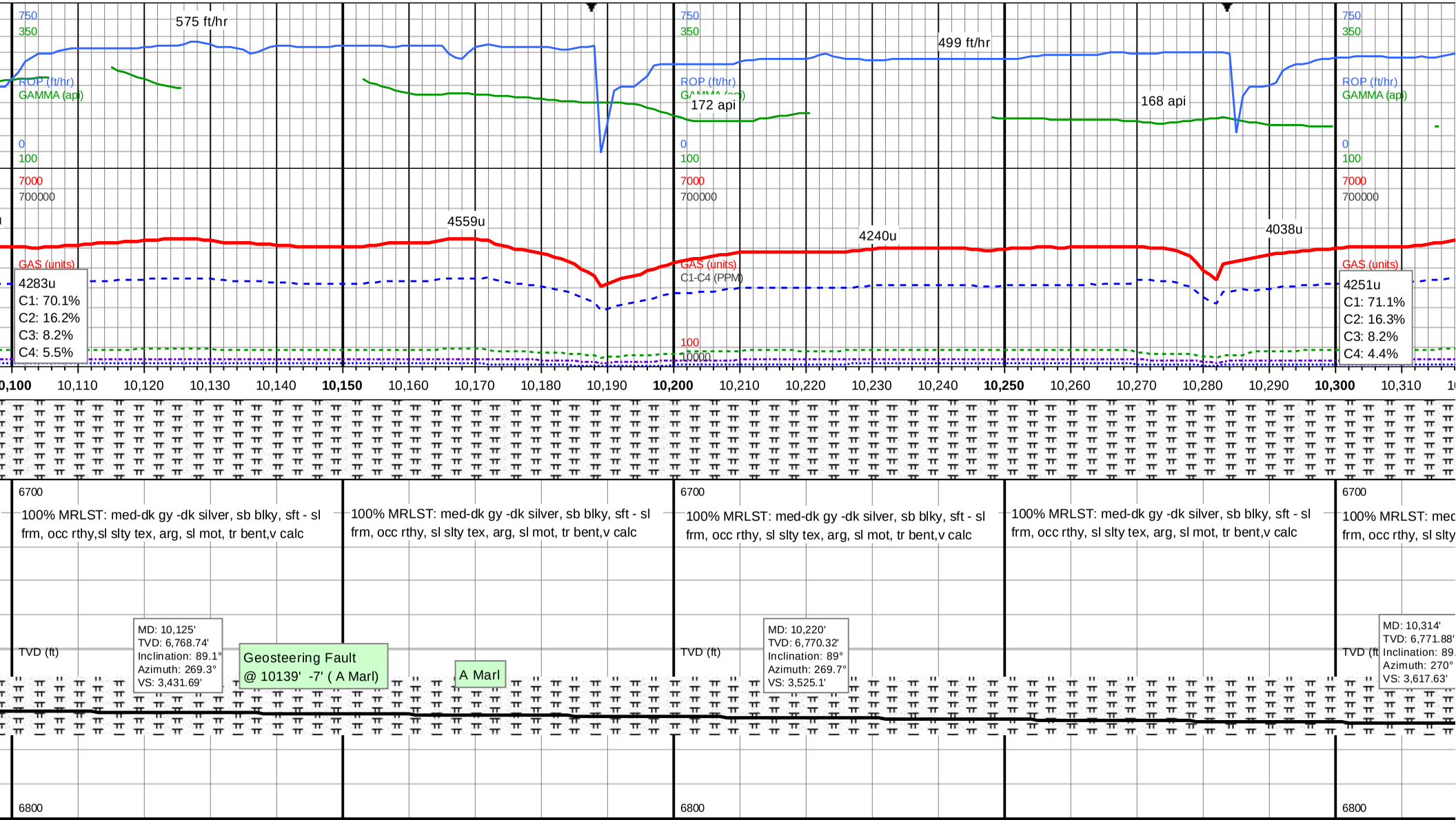
6700
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy, sl slty tex, arg, sl mot, rr tr bent, rr pyr frags, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, sl silver lstr, occ rthy,sl slty tex, arg, sl mot, rr tr bent, rr pyr frags, v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, occ rthy,sl slty tex, arg, sl mot, tr tr bent,v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr tr bent,v calc
TVD (ft)
MD: 9,086'
TVD: 6,764.71'
Inclination: 90.8°
Azimuth: 269.7°
VS: 2,412.37'
MD: 9,180'
TVD: 6,763.56'
Inclination: 90.6°
Azimuth: 269.3°
VS: 2,504.8'
A Marl
A Marl
6800

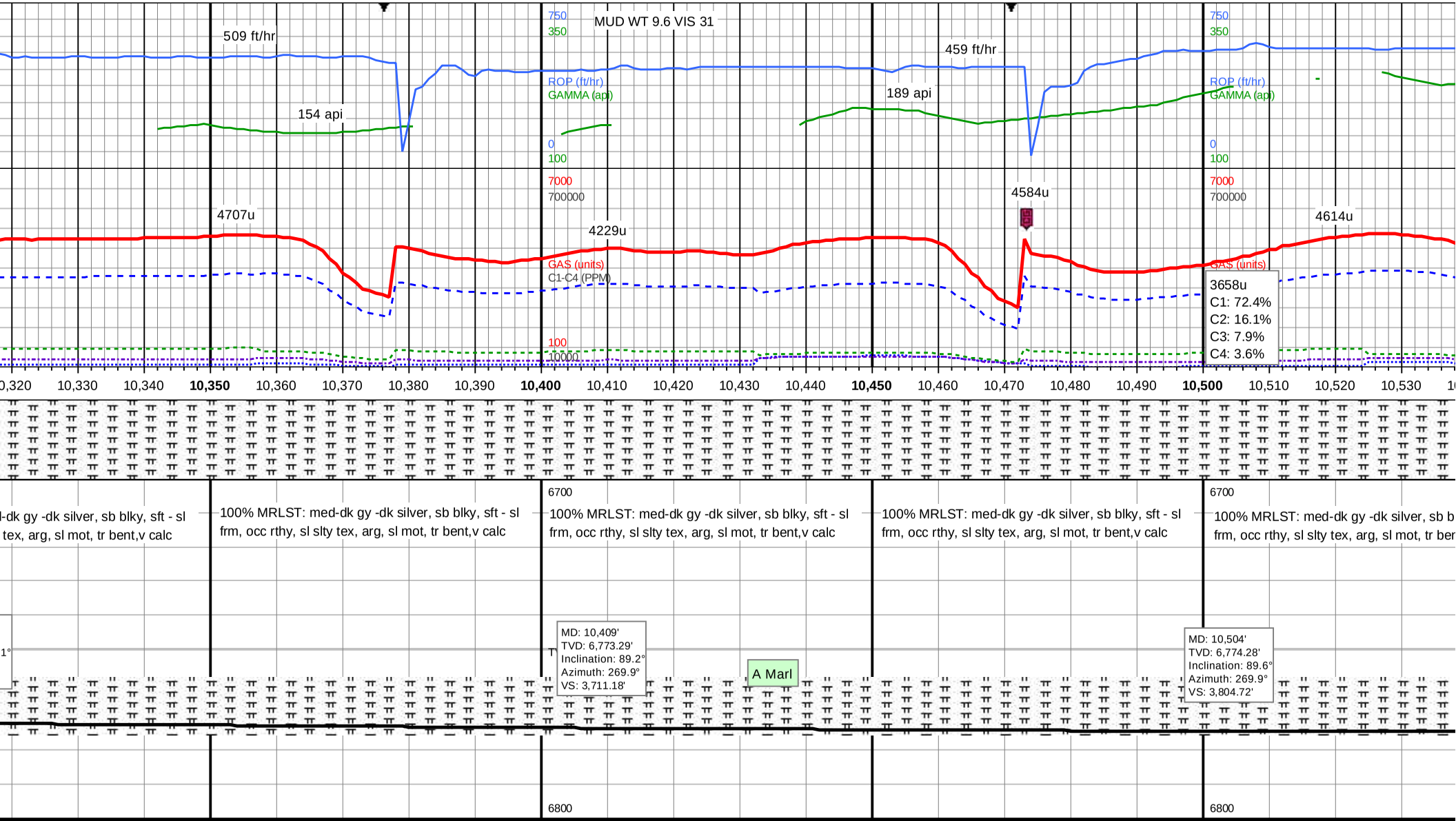

545 ft/hr
195 api
4577u
3268u
550 ft/hr
185 api
4765u
2694u
597 ft/hr
ROP (ft/hr)
GAMMA (api)
750
350
0
100
7000
700000
3201u
C1: 54.9%
C2: 17.5%
C3: 12.7%
C4: 14.9%
C1-C4 (PPM)
GAS (units)
9,220
9,230
9,240
9,250
9,260
9,270
9,280
9,290
9,300
9,310
9,320
9,330
9,340
9,350
9,360
9,370
9,380
9,390
9,400
9,410
9,420
9,430
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr tr bent,v
calc
MD: 9,275'
TVD: 6,761.9'
Inclination: 91.4°
Azimuth: 269.7°
VS: 2,598.21'
MD: 9,369'
TVD: 6,760.51'
Inclination: 90.3°
Azimuth: 268.7°
VS: 2,690.55'
TVD (ft)
6700
6800

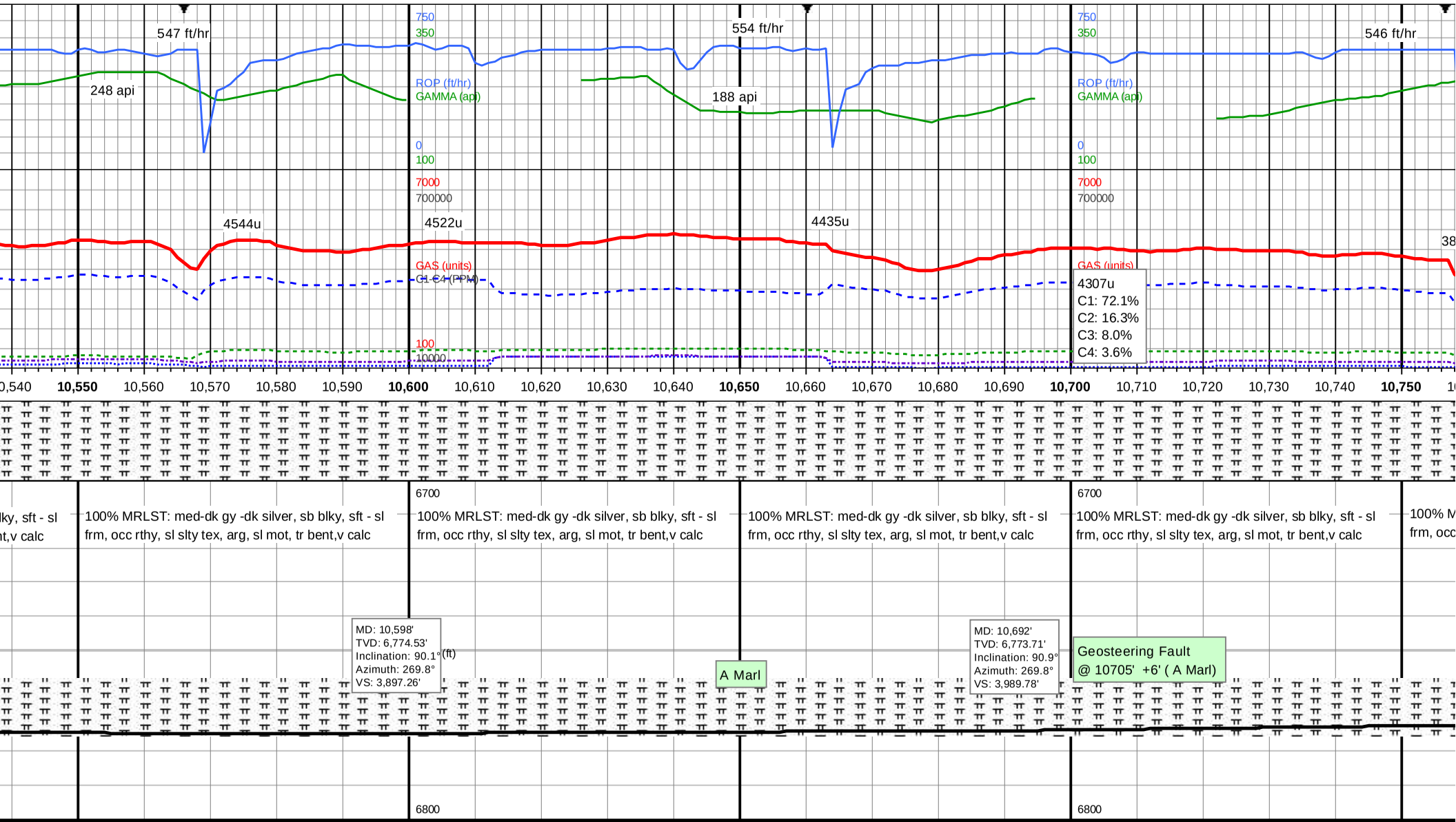

196 api
252 api
543 ft/hr
535 ft/hr
217 api
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
32u
4735u
4442u
4360u
GAS (units)
4511u
C1: 17.8%
C2: 13.3%
C3: 13.3%
C4: 12.9%
C1-C4 (PPM)
100
9,440
9,450
9,460
9,470
9,480
9,490
9,500
9,510
9,520
9,530
9,540
9,550
9,560
9,570
9,580
9,590
9,600
9,610
9,620
9,630
9,640
9,650
6700
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
MD: 9,464'
TVD: 6,760.67'
Inclination: 89.5°
Azimuth: 268°
VS: 2,783.61'
MD: 9,558'
TVD: 6,761.49'
Inclination: 89.5°
Azimuth: 268.1°
VS: 2,875.58'
MD: 9,653'
TVD: 6,762.4'
Azimuth: 268.3
VS: 2,968.59'
TVD (ft)
6800
A Marl

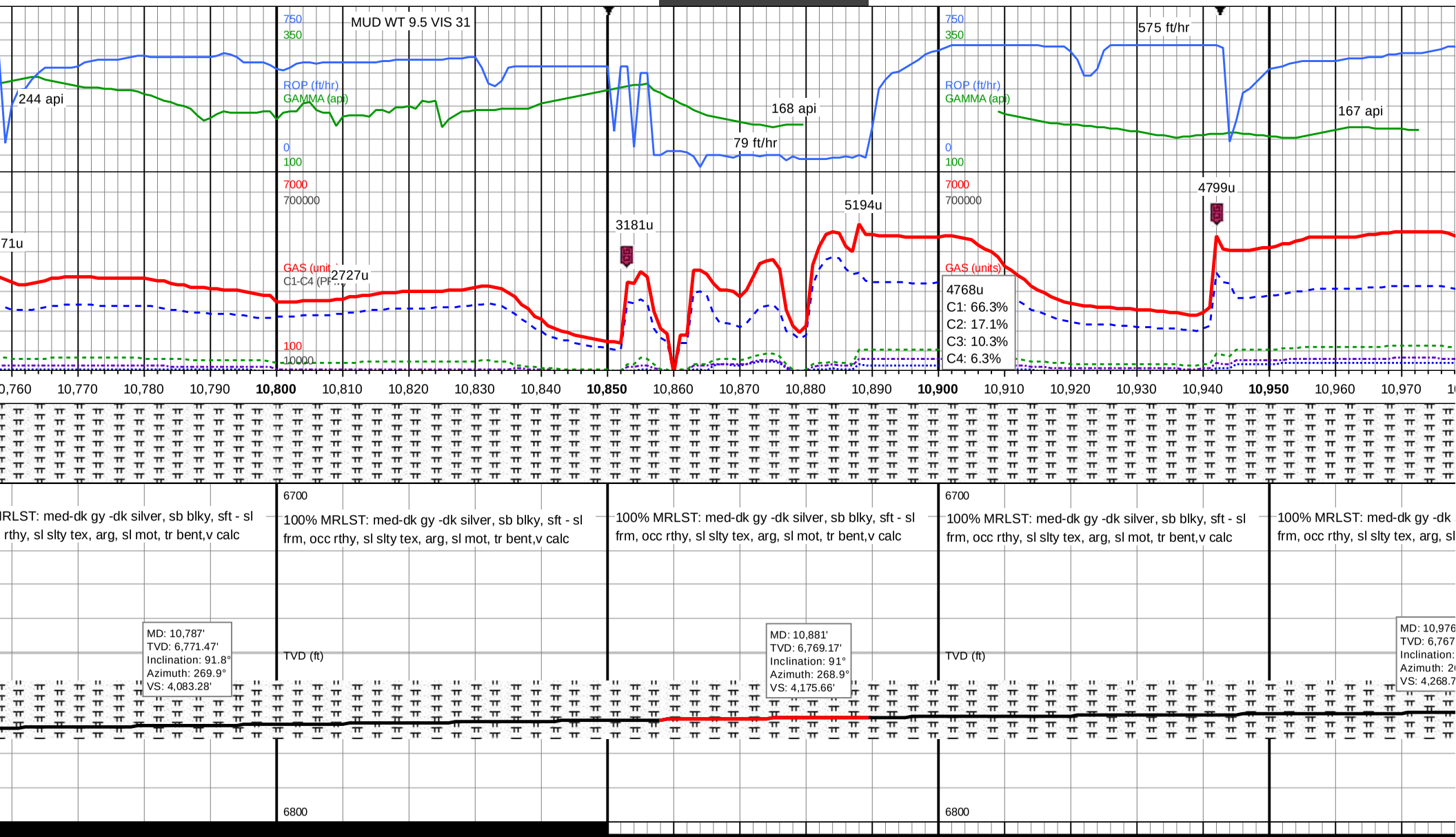

750
350
ROP (ft/hr)
GAMMA (api)
0
100
567 ft/hr
193 api
247 api
585 ft/hr
2100u
C1: 54.6%
C2: 13.0%
C3: 14.0%
C4: 18.4%
C1-C4 (PPM)
4525u
4551u
4795u
1878u
4018u
7000
70000
GAS (units)
100
10000
9,660
9,670
9,680
9,690
9,700
9,710
9,720
9,730
9,740
9,750
9,760
9,770
9,780
9,790
9,800
9,810
9,820
9,830
9,840
9,850
9,860
9,870
6700
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
MD: 9,748'
TVD: 6,763.56'
Inclination: 89.2°
Azimuth: 268.4°
VS: 3,061.64'
MD: 9,842'
TVD: 6,764.96'
Inclination: 89.1°
Azimuth: 268.8°
VS: 3,153.79'
TVD (ft)
6800

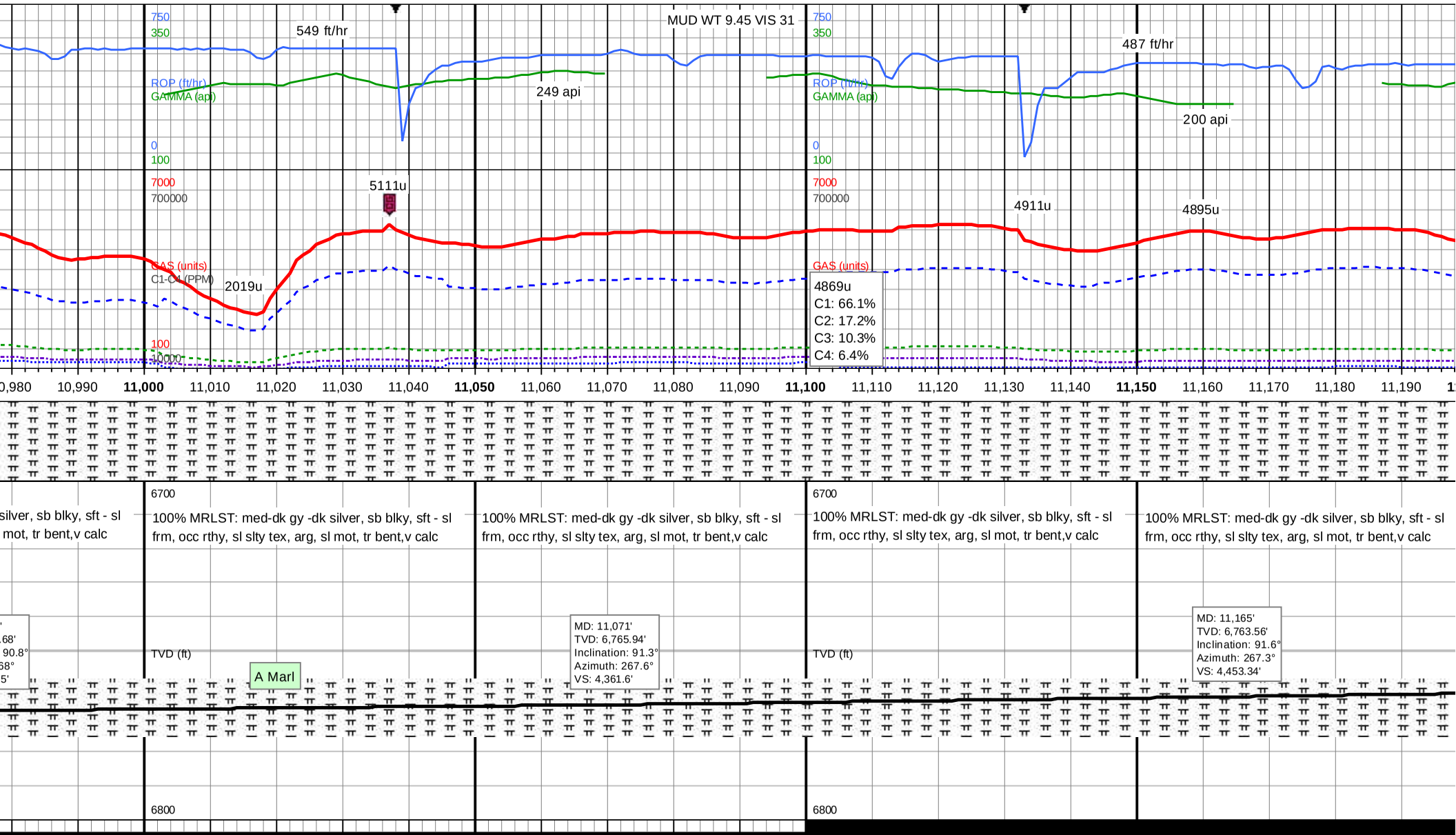

750
350
ROP (ft/hr)
GAMMA (api)
0
100
231 api
559 ft/hr
MUD WT 9.55 VIS 31
233 api
212 api
2144u
C1: 75.1%
C2: 10.9%
C3: 8.9%
C4: 5.1%
GAS (units)
C1-C4 (PPM)
4859u
4095u
4327u
4226u
7000
700000
100
10000
9,880
9,890
9,900
9,910
9,920
9,930
9,940
9,950
9,960
9,970
9,980
9,990
10,000
10,010
10,020
10,030
10,040
10,050
10,060
10,070
10,080
10,090
6700
ver, sb blky, sft - sl
l mot, tr bent,v calc
100% MRLST: med-dk gy -silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
TVD (ft)
A Marl
MD: 9,936'
TVD: 6,766.19'
Inclination: 89.4°
Azimuth: 269°
VS: 3,246.04'
MD: 10,031'
TVD: 6,767.35'
Inclination: 89.2°
Azimuth: 269.2°
VS: 3,339.33'
6800

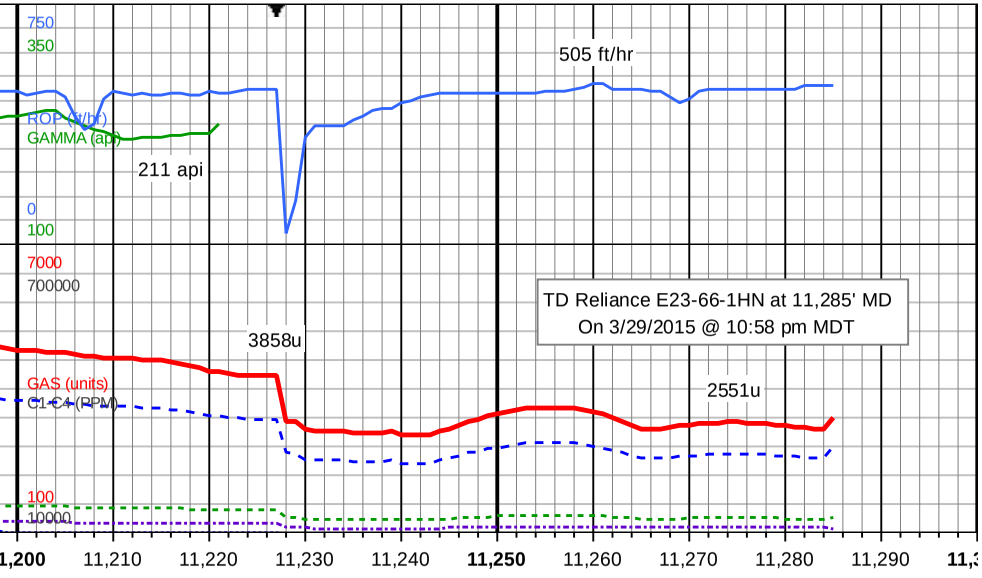

750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
575 ft/hr
499 ft/hr
172 api
168 api
4559u
4240u
4038u
GAS (units)
C1-C4 (PPM)
100
10000
4283u
C1: 70.1%
C2: 16.2%
C3: 8.2%
C4: 5.5%
4251u
C1: 71.1%
C2: 16.3%
C3: 8.2%
C4: 4.4%
10,100
10,110
10,120
10,130
10,140
10,150
10,160
10,170
10,180
10,190
10,200
10,210
10,220
10,230
10,240
10,250
10,260
10,270
10,280
10,290
10,300
10,310
6700
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy,sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med
frm, occ rthy, sl slty
TVD (ft)
MD: 10,125'
TVD: 6,768.74'
Inclination: 89.1°
Azimuth: 269.3°
VS: 3,431.69'
Geosteering Fault
@ 10139' -7' (A Marl)
A Marl
MD: 10,220'
TVD: 6,770.32'
Inclination: 89°
Azimuth: 269.7°
VS: 3,525.1'
MD: 10,314'
TVD: 6,771.88'
Inclination: 89.
Azimuth: 270°
VS: 3,617.63'
6800

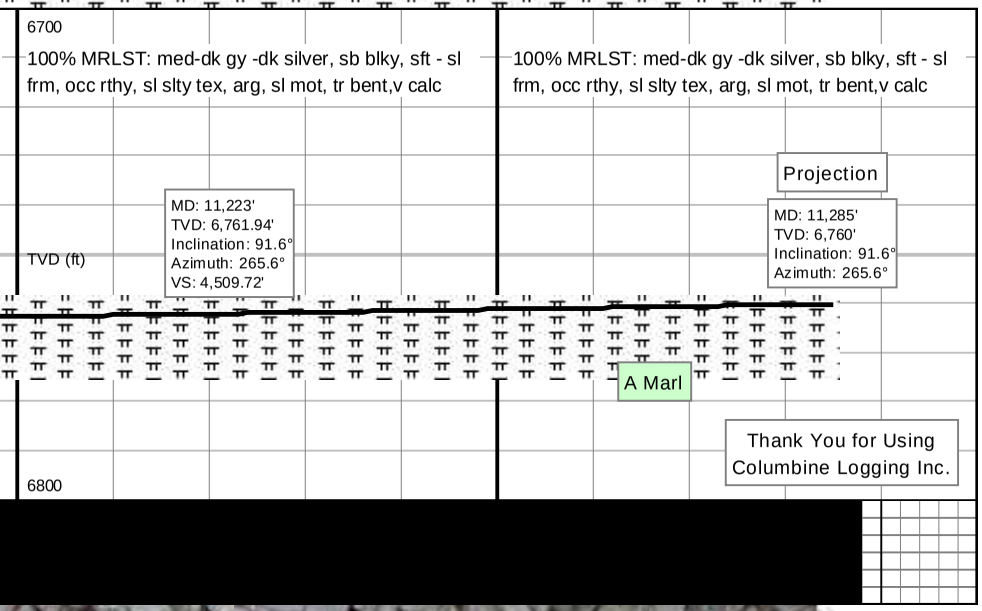

509 ft/hr
154 api
MUD WT 9.6 VIS 31
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
4707u
4229u
GAS (units)
C1-C4 (PPM)
100
10000
459 ft/hr
189 api
4584u
4614u
3658u
C1: 72.4%
C2: 16.1%
C3: 7.9%
C4: 3.6%
10,320
10,330
10,340
10,350
10,360
10,370
10,380
10,390
10,400
10,410
10,420
10,430
10,440
10,450
10,460
10,470
10,480
10,490
10,500
10,510
10,520
10,530
6700
6800
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
MD: 10,409'
TVD: 6,773.29'
Inclination: 89.2°
Azimuth: 269.9°
VS: 3,711.18'
A Marl
MD: 10,504'
TVD: 6,774.28'
Inclination: 89.6°
Azimuth: 269.9°
VS: 3,804.72'


547 ft/hr
248 api
554 ft/hr
188 api
546 ft/hr
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
4544u
4522u
4435u
GAS (units)
C1-C4 (PPM)
100
10000
4307u
C1: 72.1%
C2: 16.3%
C3: 8.0%
C4: 3.6%
10,540
10,550
10,560
10,570
10,580
10,590
10,600
10,610
10,620
10,630
10,640
10,650
10,660
10,670
10,680
10,690
10,700
10,710
10,720
10,730
10,740
10,750
6700
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
MD: 10,598'
TVD: 6,774.53'
Inclination: 90.1°
Azimuth: 269.8°
VS: 3,897.26'
(ft)
A Marl
MD: 10,692'
TVD: 6,773.71'
Inclination: 90.9°
Azimuth: 269.8°
VS: 3,989.78'
Geosteering Fault
@ 10705' +6' (A Marl)
6800


MUD WT 9.5 VIS 31
750
350
ROP (ft/hr)
GAMMA (api)
0
100
7000
700000
244 api
168 api
79 ft/hr
575 ft/hr
167 api
3181u
5194u
4799u
2727u
GAS (units)
C1-C4 (PP...)
100
10000
4768u
C1: 66.3%
C2: 17.1%
C3: 10.3%
C4: 6.3%
10,760
10,770
10,780
10,790
10,800
10,810
10,820
10,830
10,840
10,850
10,860
10,870
10,880
10,890
10,900
10,910
10,920
10,930
10,940
10,950
10,960
10,970
6700
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
TVD (ft)
MD: 10,787'
TVD: 6,771.47'
Inclination: 91.8°
Azimuth: 269.9°
VS: 4,083.28'
MD: 10,881'
TVD: 6,769.17'
Inclination: 91°
Azimuth: 268.9°
VS: 4,175.66'
6800


750
350
549 ft/hr
MUD WT 9.45 VIS 31
ROP (ft/hr)
GAMMA (api)
249 api
0
100
7000
700000
5111u
GAS (units)
C1-C4 (PPM)
2019u
100
0000
750
350
487 ft/hr
ROP (ft/hr)
GAMMA (api)
200 api
0
100
7000
700000
4911u
4895u
GAS (units)
4869u
C1: 66.1%
C2: 17.2%
C3: 10.3%
C4: 6.4%
0,980
10,990
11,000
11,010
11,020
11,030
11,040
11,050
11,060
11,070
11,080
11,090
11,100
11,110
11,120
11,130
11,140
11,150
11,160
11,170
11,180
11,190
6700
silver, sb blky, sft - sl
mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
68'
90.8°
68°
5'
TVD (ft)
A Marl
MD: 11,071'
TVD: 6,765.94'
Inclination: 91.3°
Azimuth: 267.6°
VS: 4,361.6'
TVD (ft)
MD: 11,165'
TVD: 6,763.56'
Inclination: 91.6°
Azimuth: 267.3°
VS: 4,453.34'
6800
6800


750
350
505 ft/hr
ROP (ft/hr)
GAMMA (api)
211 api
0
100
7000
700000
TD Reliance E23-66-1HN at 11,285' MD
On 3/29/2015 @ 10:58 pm MDT
3858u
GAS (units)
C1-C4 (PPM)
2551u
100
10000
11,200
11,210
11,220
11,230
11,240
11,250
11,260
11,270
11,280
11,290


6700
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
100% MRLST: med-dk gy -dk silver, sb blky, sft - sl frm, occ rthy, sl slty tex, arg, sl mot, tr bent,v calc
Projection
MD: 11,223'
TVD: 6,761.94'
Inclination: 91.6°
Azimuth: 265.6°
VS: 4,509.72'
MD: 11,285'
TVD: 6,760'
Inclination: 91.6°
Azimuth: 265.6°
TVD (ft)
A Marl
Thank You for Using
Columbine Logging Inc.
6800