

COLUMBINE LOGGING

Scale: 5" / 100'
Measured Depth Log

Well Name Waste Management Y23-712

Location Sect. 11, T2N, R64W, 787' FNL / 756' FEL

State Colorado

County Weld

Country USA

Rig Number H&P 517

API Number 05-123-44840

AFE # 204924

Spud Date

11/12/2017

Field Wattenburg

Drilling Completed 11/18/2017

Surface Coordinates

Sect. 11, T2N, R64W, 787' FNL / 756' FEL
40.157990 -104.511940

Bottom Hole Coordinates

Sect. 23, T2N, R64W, 2640' FSL / 128' FEL
40.1239 -104.5096

Ground Elevation 4895

K.B. Elevation 4925

Logged Interval 6300 **To** 19916

Total Depth 19916

Formation Codell

Type of Drilling Fluid Oil-Based

Operator

Company Noble Energy, Inc.

Address 1625 Broadway Suite 2200
Denver, CO 80202



Geologist

Name Renee Cackler

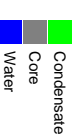
Company Noble Energy Inc

Other





































CPU: 49A

Wellsite Geologists: Jared Gerard, Ken Roberts

























































Color Coding



Rock Types

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

Accessories

 GASTROPOD	 ARGILLITE GRAIN	 HEAVY MINERAL	
 INOCERAMUS	 B BENTONITE	 K KAOLIN	
 OOLITE	 BITUMENOUS SUBSTANCE	 M MARCASITE	 ANHYDRITE STRINGER
 OSTRACOD	 BRECCIA FRAGMENTS	 T MARLSTONE	 BENTONITE STRINGER
 PELECYPOD	 CALCAREOUS	 U MICACEOUS	 COAL STRINGER
 BIOCLASTIC	 CARBONACEOUS FLAKES	 M MINERAL CRYSTALS	 DOLOMITE STRINGER
 BRACHIOPOD	 P PISOLITE	 N NODULES	 GYPSUM STRINGER
 BRYOZOA	 PLANT REMAINS	 P PHOSPHATE PELLETS	 LIMESTONE STRINGER
 CEPHALOPOD	 PLANT SPORES	 P PYRITE	 MARLSTONE (CALC) STRG
 CORAL	 SCAPHOPOD	 B SALT CAST	 MARLSTONE (DOL) STRG
 CRINOID	 STROMATOPOROID	 S SANDY	 SANDSTONE STRINGER
 ECHINOID	 FERRUGINOUS PELLET	 S SIDERITE	 SHALE STRINGER
 FISH	 F FERRUGINOUS	 S SILICEOUS	 SILTSTONE STRINGER
 FORAMINIFERA	 A ANHYDRITIC	 S SILTY	
 F FOSSIL	 A ARGILLACEOUS	 T TUFFACEOUS	

Minerals







Porosity

 CONNECTION (DOWN)	 CONNECTION GAS
 E EARTHLY	 CONNECTION GAS (L)
 F FENESTRAL	 TRIP GAS
 F FRACTURE	 TRIP GAS (LEFT)
 X INTERCRYSTALLINE	 DOWN TIME GAS
 I INTEROOLITIC	 DOWN TIME GAS (LEF
 M MOLDIC	 CORE - LOST
 O ORGANIC	 CORE - RECOVERED



Oil Show

 P PINPOINT
 V VUGGY

Engineering

 D DEAD	
 E EVEN	
 Q QUESTIONABLE	 BIT
 S SPOTTED STAINING	 CONNECTION (UP)

Other Symbols

 DST INTERVAL  WIRELINE TESTED - LEFT **E** EARTHY

 FAULT  WIRELINE TESTED - RT **FX** FINELYXLN

 FORMATION TOP  DRILL STEM TEST **GS** GRAINSTONE

 GAS SHOW  **MNDEPTH** MN DEPTH **L** LITHOGRAPHIC


 OIL SHOW **MX** MICROXLN


Rounding

 **MNDEPTH** MN DEPTH UP **MS** MUDSTONE

 **MNDEPTH** MN DEPTH (DOWN) **PS** PACKSTONE

 NORMAL FAULT **R** ROUNDED **WS** WACKSTONE

 **LEFT** OVERTURNED STRATA **S** SUBANG

 REVERSE FAULT **R** SUBRND

Sorting

 CASING **M** MODERATE

Textures

 SIDEWALL CORE (LEFT) **P** POOR

 **LEFT** SIDEWALL CORE (RIGHT) **BS** BOUNDSTONE **W** WELL

 SLIDE **C** CHALKY

 **SD** SURVEY **CX** CRYPTOXLN

ROP
ROP
GAMMA

Columbine Logging Inc. Rigged Up 2
man logging 11-14-2017. Began logging
on 11-14-2017 @ 10:13 MST @ 6300'.

Gamma, ROP, and
surveys imported from
Baker Hughes Directional

Downlink pulses to rotary
steerable while drilling
causes gamma data gaps.

MW 8.7 VIS 42

Gas data from PASON EDR

Total Gas & Chromatograph
GAS

Depth Labels

% Lith

Bit Data

Bit #: 2
Type: HUGHES AT505FX
Size: 8.5
S/N: 5273525

Sample every 100'

MD: 6.325'
Inclination: 11.69°
Azimuth: 33°
TVD: 6.223'
VS: -670'

WOB: 10.5kbs
RPM: 101rpm
SPM 1: 85spm
SPM 2: 85spm
SPP: 2.650psi

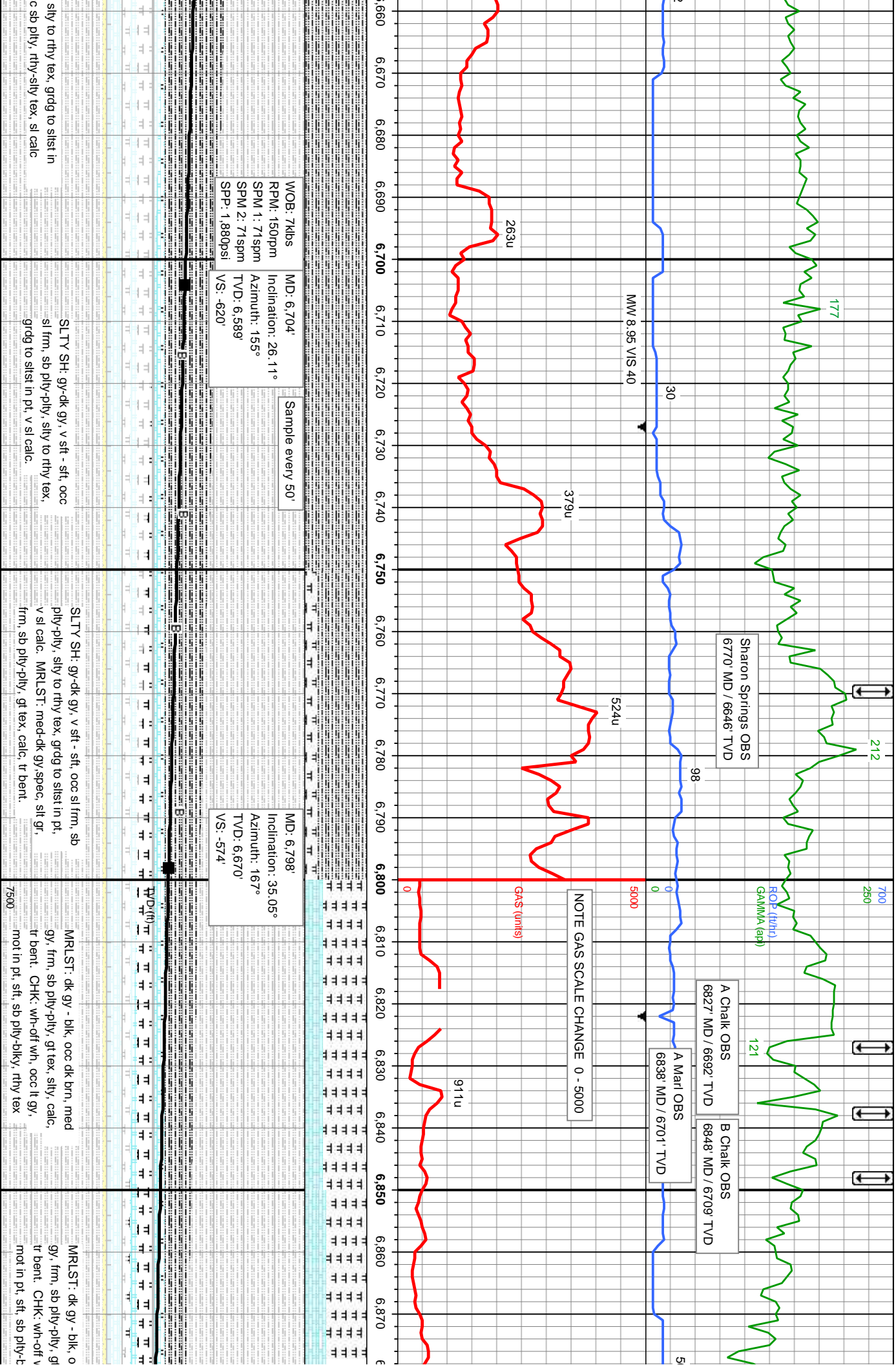
MD: 6.420'
Inclination: 9.34°
Azimuth: 85°
TVD: 6.316'
VS: -678'

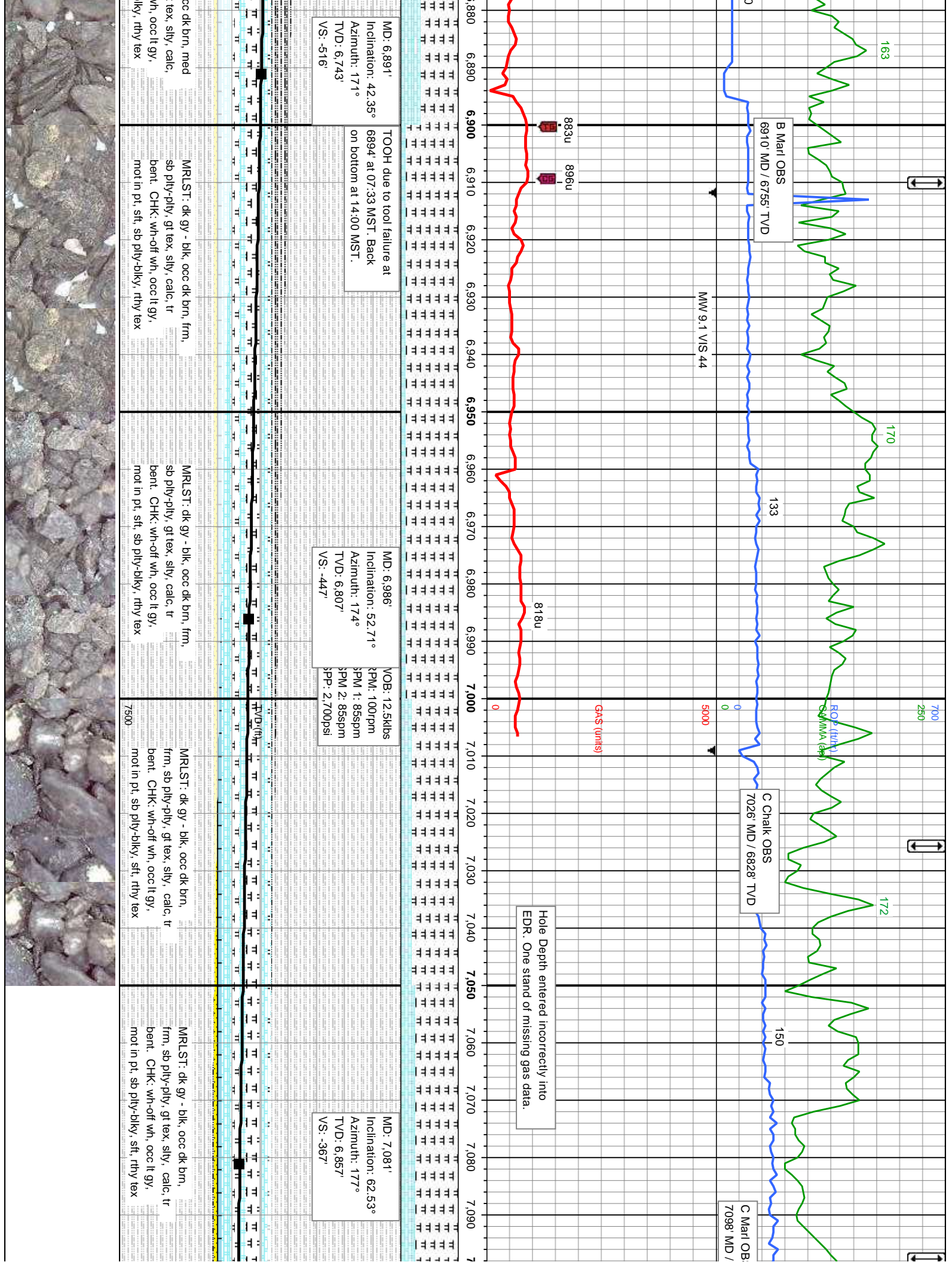
SLTY SH: gy-dk gy, v sft - sft, occ sl frm, sb ply-ply, slty to rthy tex, grdg to slst in pt,
v sl calc, tr SLTST: med gy- gy, sl frm, sb bly- occ sb ply, rthy-sily tex, v sl calc.

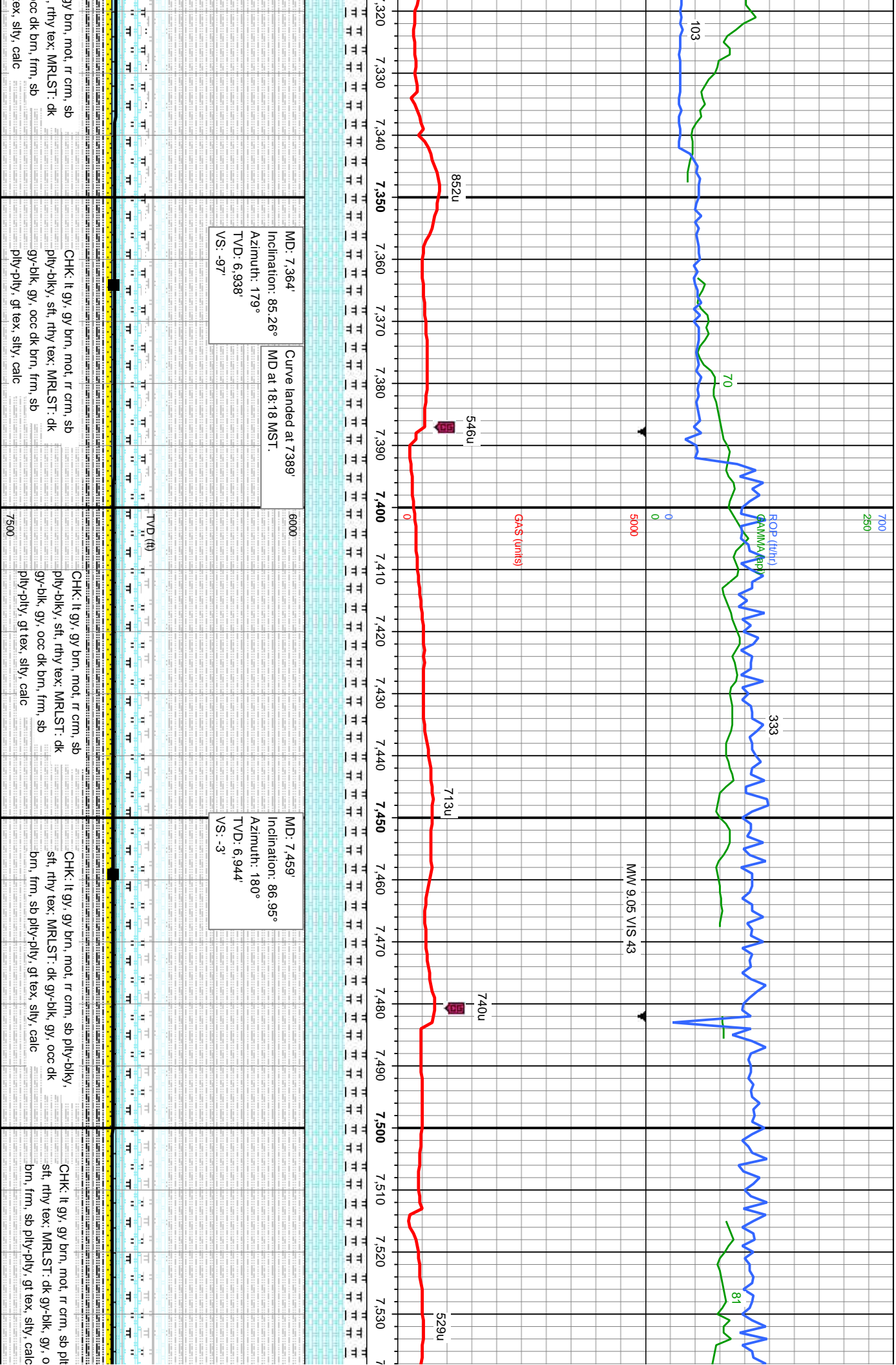
SLTY SH: gy-dk gy, v sft - sft, c
pt, v sl calc, tr SLTST: med gy-

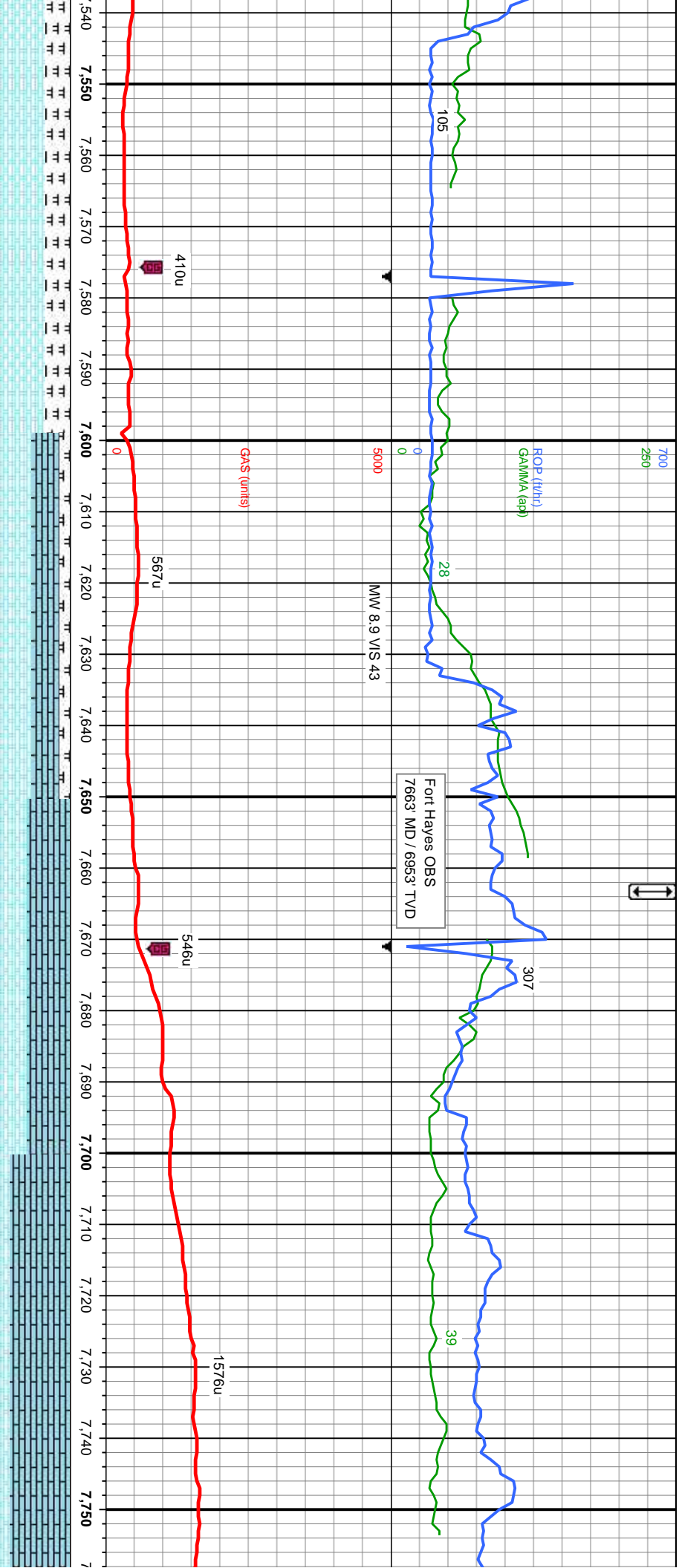
Images











MD: 7.553'
Inclination: 88.09°
Azimuth: 182°
TVD: 6.948'
VS: 91'

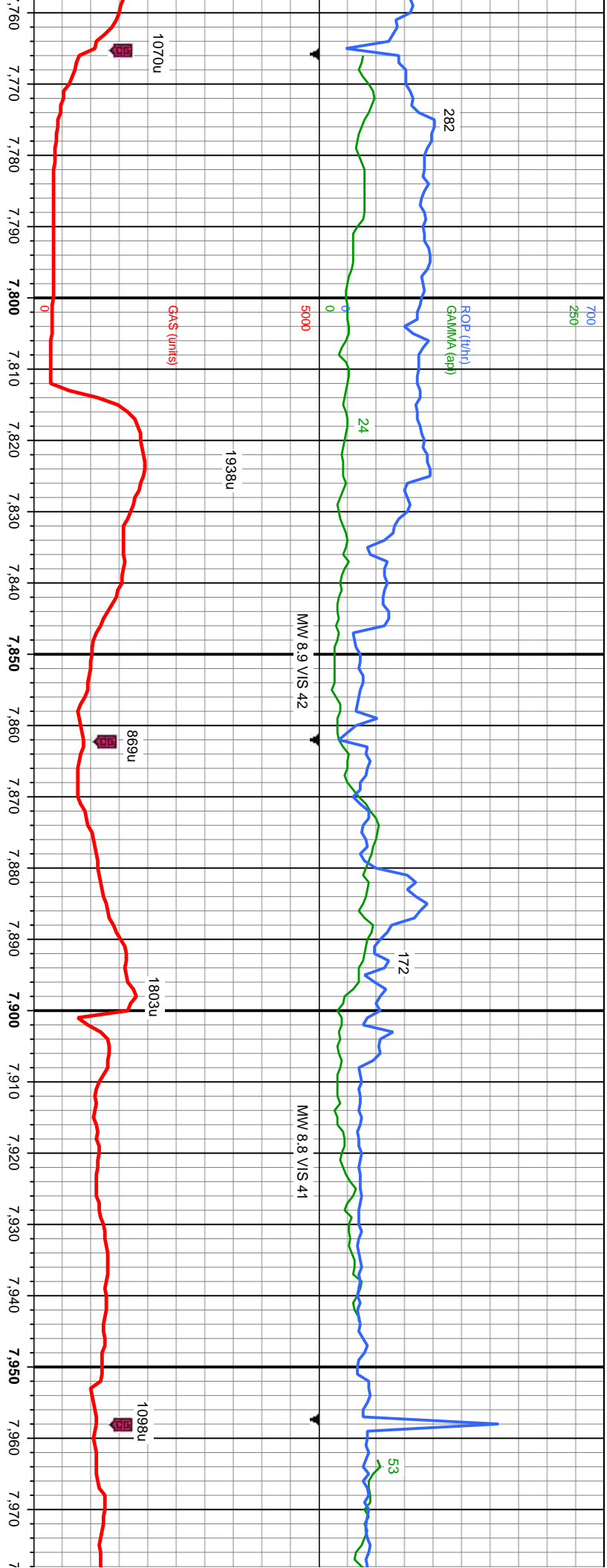
WOB: 20.3klbs
RPM: 80rpm
SPM 1: 71spm
SPM 2: 72spm
SP: 2.250psi

MD: 7.648'
Inclination: 87.01°
Azimuth: 182°
TVD: 6.952'
VS: 185'

MD: 7.742'
Inclination: 87.11°
Azimuth: 181°
TVD: 6.957'
VS: 279'

occ dk	CHK: lt gy, gy brn, mot, rr crm, sb ply-biky, sft, rthy tex: MRLST: dk gy-bik, gy, occ dk brn, frm, sb ply-ply, gt tex, silty, calc	750'	LS: lt gy-wt, crm, frm, cyxn, sb suc-sily, com dolmtzd, calc: CHK: lt gy, gy brn, mot, rr crm, sb ply-biky, sft, rthy tex	LS: lt gy-wt, crm, frm, cyxn, sb suc-sily, com dolmtzd, calc: CHK: lt gy, gy brn, mot, rr crm, sb ply-biky, sft, rthy tex	LS: com dolmtzd, calc: CHK: lt gy, gy brn, mot, rr crm, sb ply-biky, sft, rthy tex
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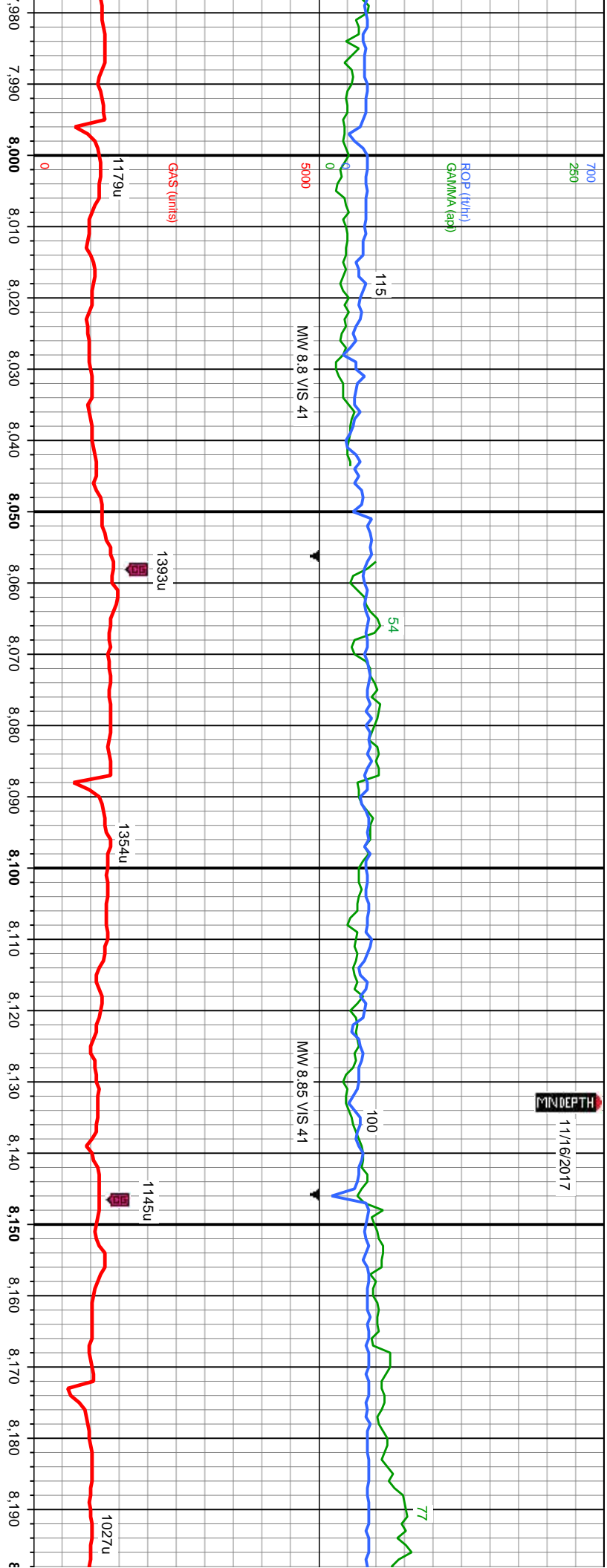


MD: 7.837' Inclination: 87.05° Azimuth: 180° TVD: 6.962' VS: 373'		WOB: 20.3kbs RPM: 80rpm SPM 1: 71spm SPM 2: 71spm SPP: 2.350psi		MD: 7.932' Inclination: 87.04° Azimuth: 179° TVD: 6.967' VS: 468'	
6000	TVD (ft)	LS: lt gy-wt, frm, cyxn, sb suc-sily, com dolmitzd, calc: CHK: lt gy, gy brn, mot, tr crm, sb ply-biky, sft, rthy tex	LS: lt gy-wt, frm, cyxn, sb suc-sily, com dolmitzd, calc: CHK: lt gy, gy brn, mot, tr crm, sb ply-biky, sft, rthy tex	LS: lt gy-wt, frm, cyxn, splt, sb suc-sily, com dolmitzd, calc: CHK: lt gy, gy brn, mot, tr crm, sb ply-biky, sft, rthy tex	LS: lt gy-wt, frm, cyxn, splt, sb suc-sily, com dolmitzd, calc: CHK: lt gy, gy brn, mot, tr crm, sb ply-biky, sft, rthy tex



11/16/2017

MINDEPTH



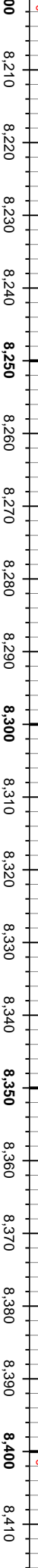
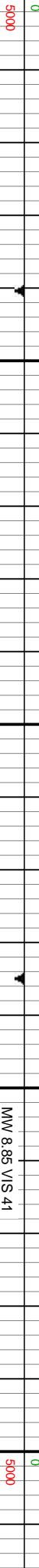
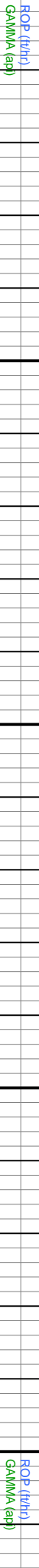
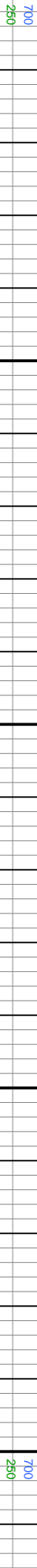
MD: 8.027'
Inclination: 88.89°
Azimuth: 179°
TVD: 6.970'
VS: 563'

MD: 8.121'
Inclination: 89.94°
Azimuth: 180°
TVD: 6.971'
VS: 657'

WOB:
RPM:
SPW
SPM
SPP:

TVD (ft)		LS: lt gy-wt, cm, frm, cyxn, spl, sb suc-sily, com dolmitzd, calc		LS: lt gy-wt, cm, frm, cyxn, spl, sb suc-sily, com dolmitzd, calc		LS: lt gy-wt, cm, frm, cyxn, spl, sb suc-sily, com dolmitzd, calc		LS: lt gy-wt, cm, frm, cyxn, spl, sb suc-sily, com dolmitzd, calc	
7500	7500	7500	7500	7500	7500	7500	7500	7500	7500

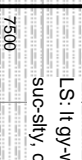
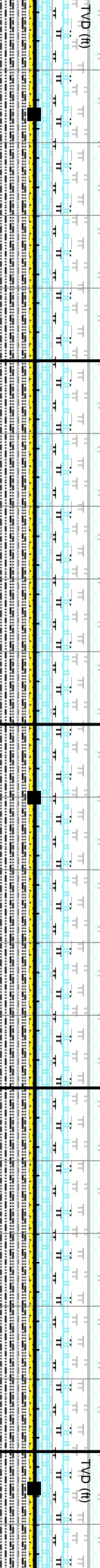


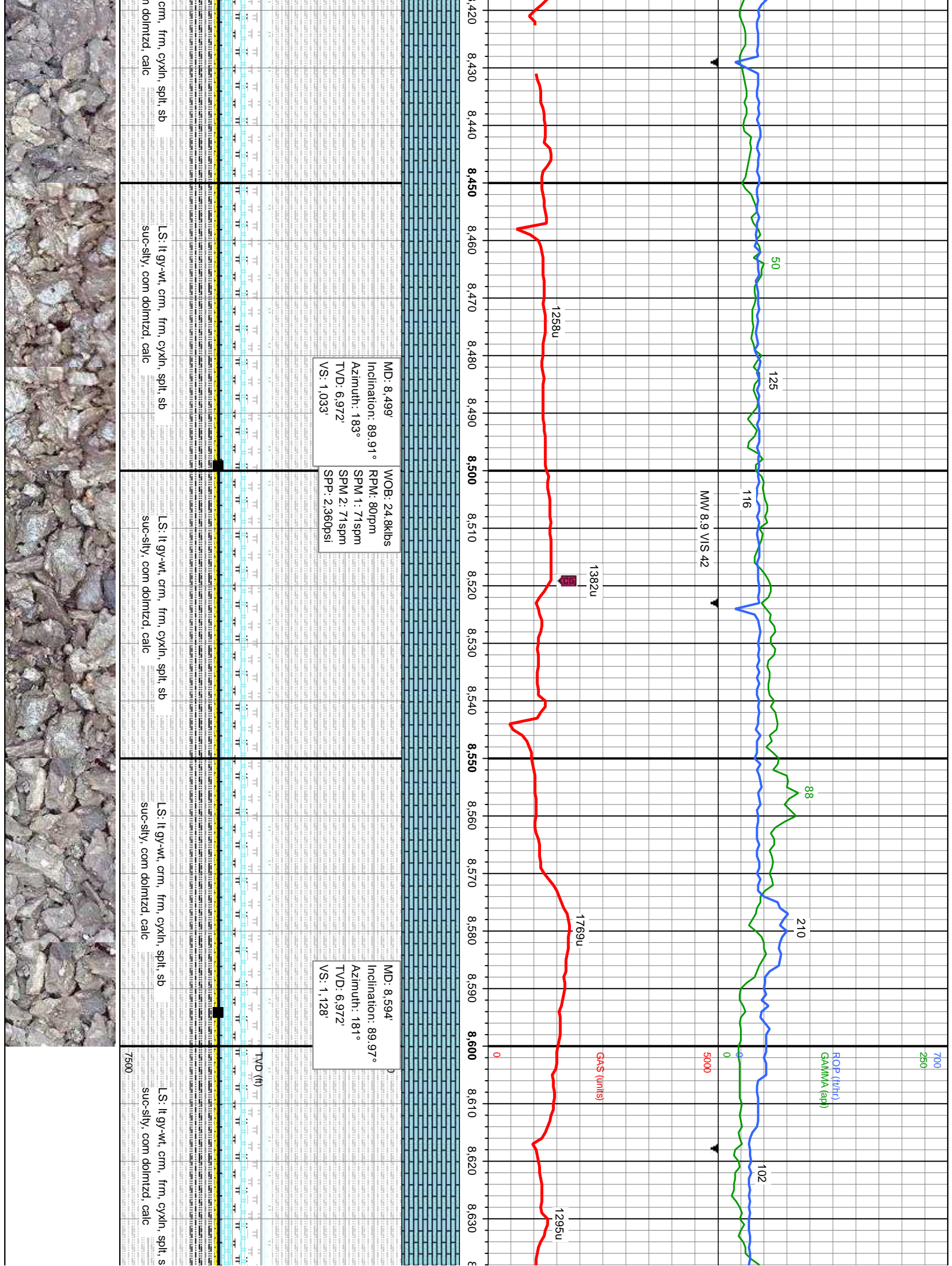


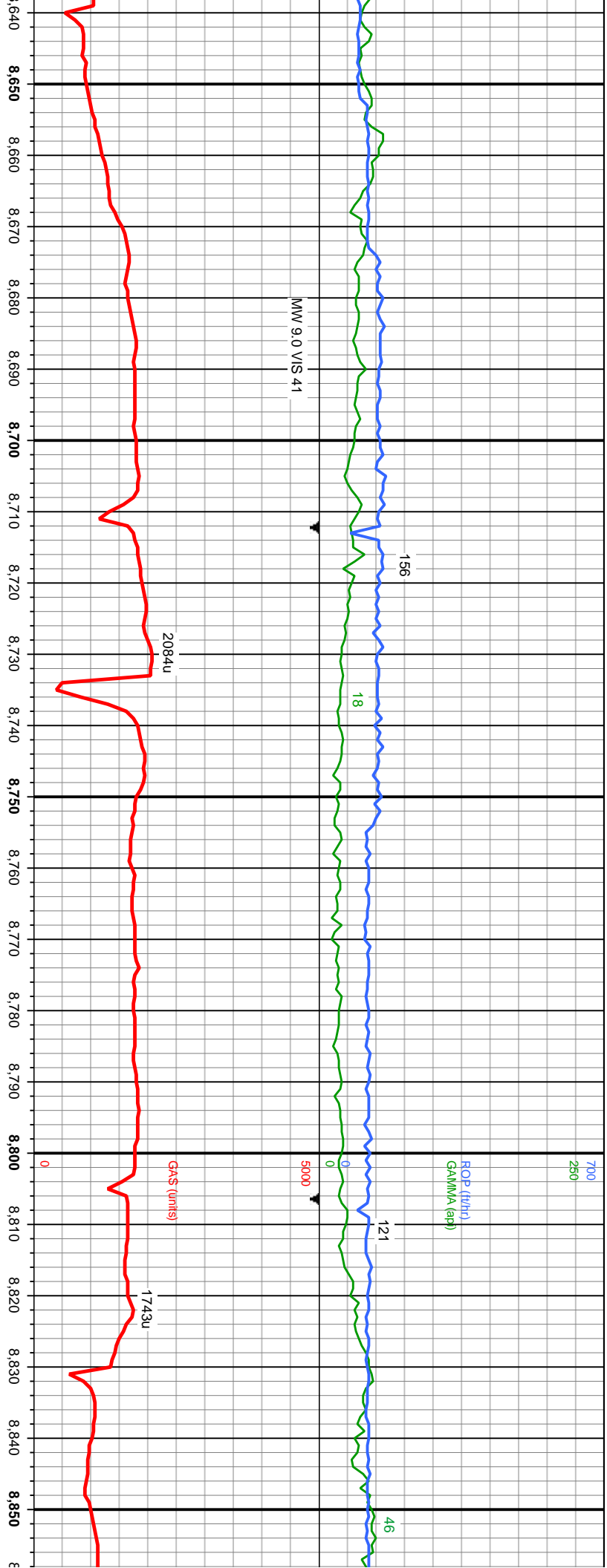
16.8klbs
80rpm
1: 71spm
2: 71spm
2.320psi

MD: 8.216'
Inclination: 89.88°
Azimuth: 179°
TVD: 6.971'
VS: 752'

MD: 8.310'
Inclination: 89.97°
Azimuth: 182°
TVD: 6.971'
VS: 845'





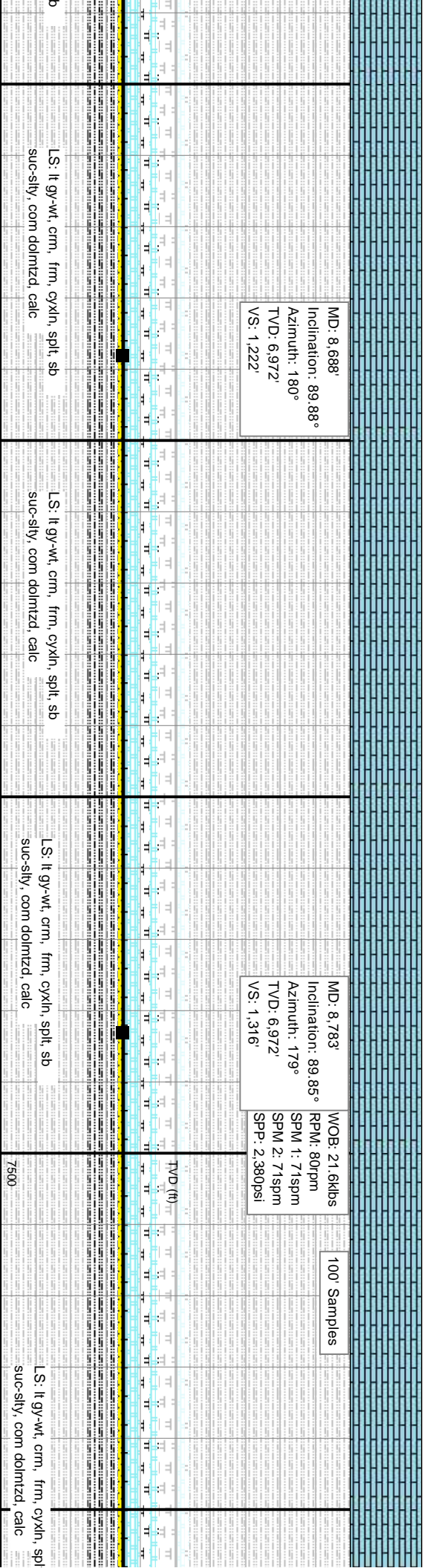


MD: 8.688'
Inclination: 89.88°
Azimuth: 180°
TVD: 6.972'
VS: 1.222'

MD: 8.783'
Inclination: 89.85°
Azimuth: 179°
TVD: 6.972'
VS: 1.316'

WOB: 21.6kls
RPM: 80rpm
SPM 1: 71spm
SPM 2: 71spm
SPP: 2.380psi

100' Samples



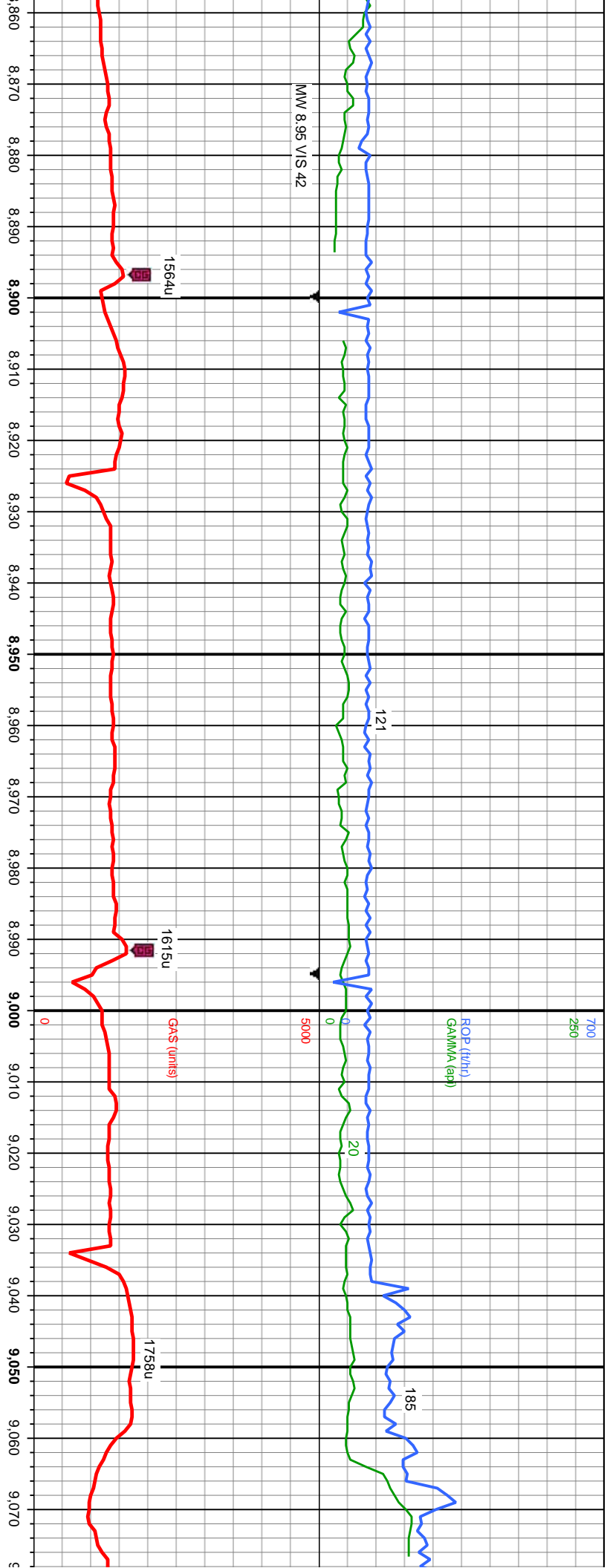
LS: lt gy-wt, crm, frm, cyxln, splt, sb
suc-sily, com dolmitzd, calc

LS: lt gy-wt, crm, frm, cyxln, splt, sb
suc-sily, com dolmitzd, calc

LS: lt gy-wt, crm, frm, cyxln, splt, sb
suc-sily, com dolmitzd, calc

LS: lt gy-wt, crm, frm, cyxln, splt, sb
suc-sily, com dolmitzd, calc

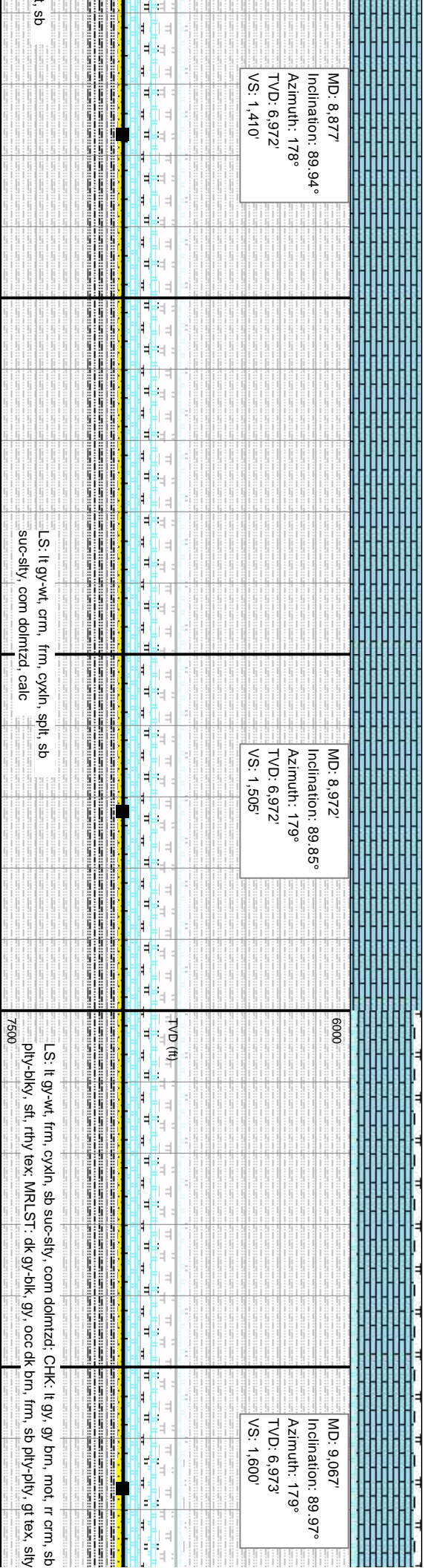


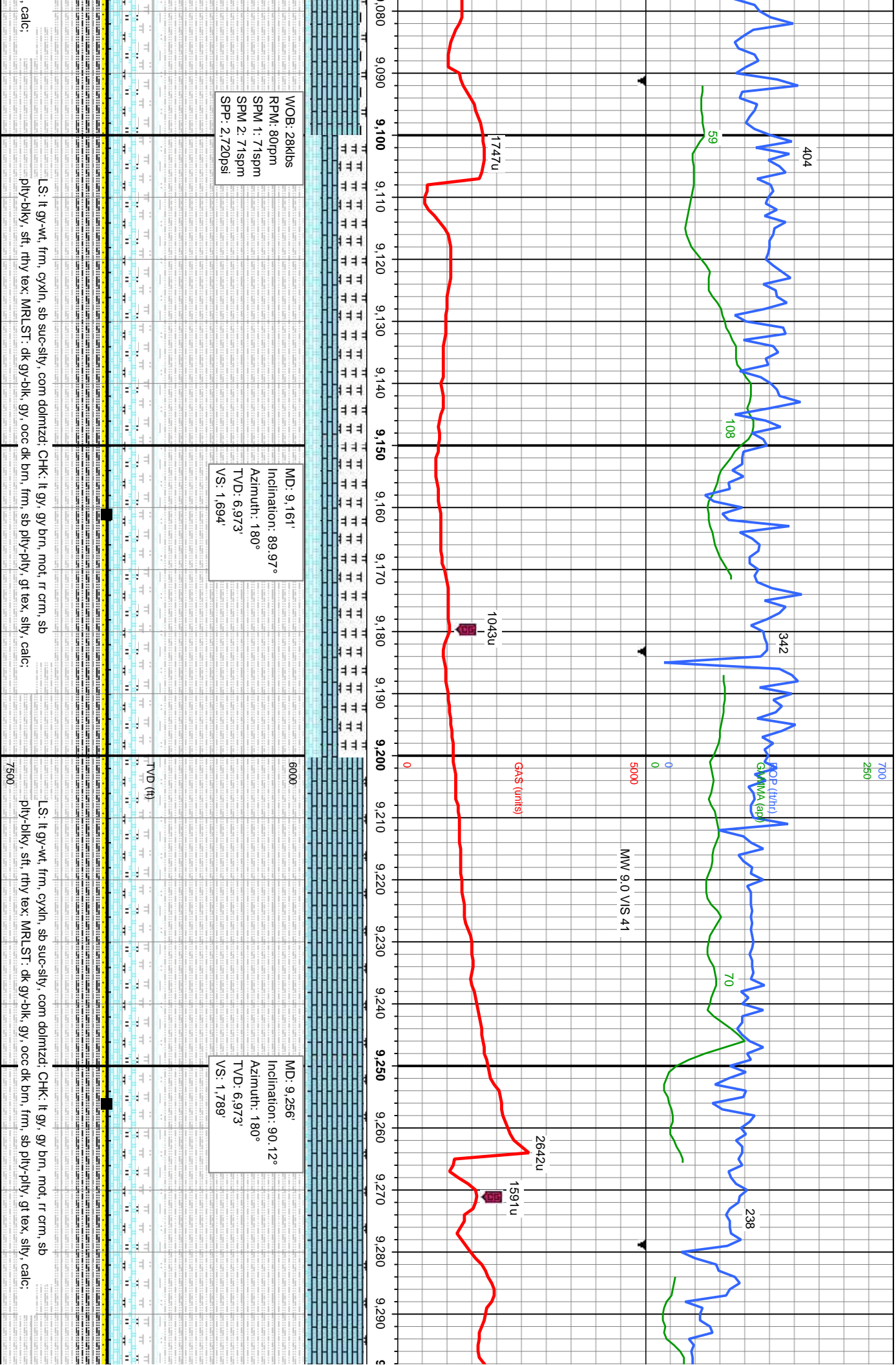


MD: 8,877'
Inclination: 89.94°
Azimuth: 178°
TVD: 6,972'
VS: 1,410'

MD: 8,972'
Inclination: 89.85°
Azimuth: 179°
TVD: 6,972'
VS: 1,505'

MD: 9,067'
Inclination: 89.97°
Azimuth: 179°
TVD: 6,973'
VS: 1,600'





WOB: 28klbs
RPM: 80rpm
SPM 1: 71spm
SPM 2: 71spm
SPP: 2.720psi

MD: 9.161'
Inclination: 89.97°
Azimuth: 180°
TVD: 6.973'
VS: 1.694'

MD: 9.256'
Inclination: 90.12°
Azimuth: 180°
TVD: 6.973'
VS: 1.789'

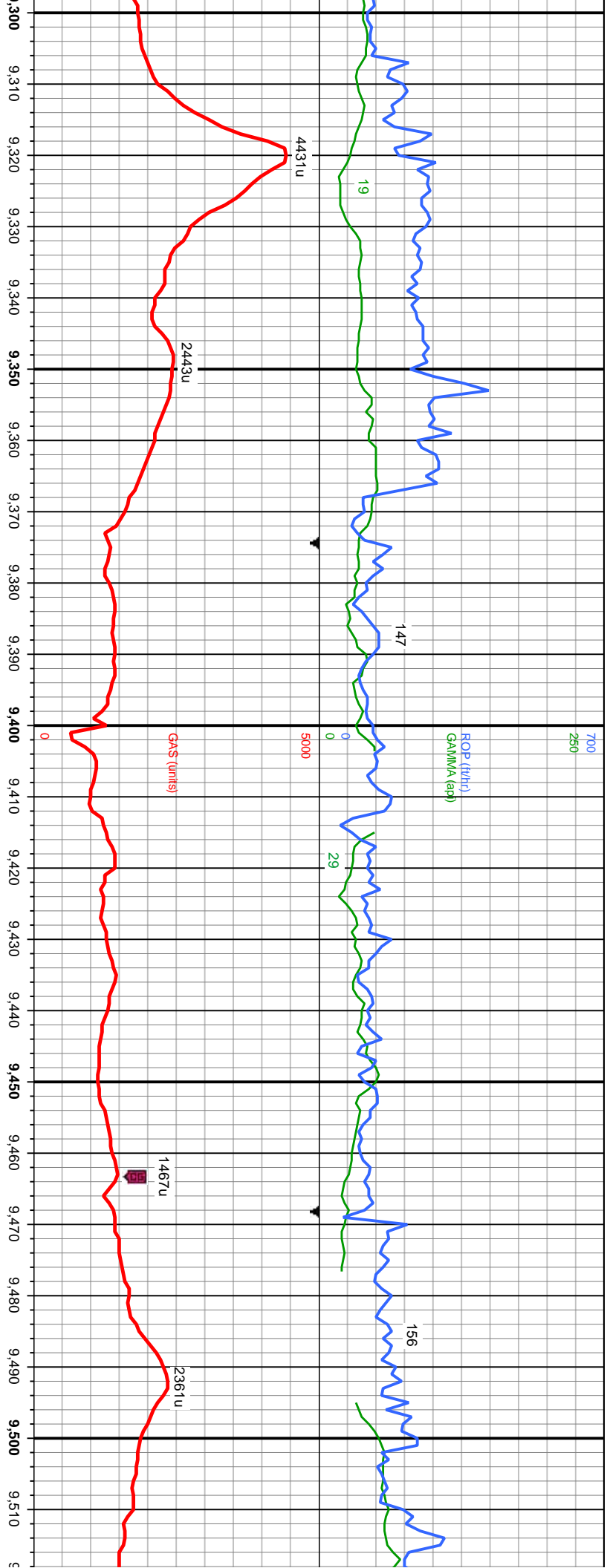
LS: lt gy-wt, frm, cyxln, sb suc-sily, com dolmztd, CHK: lt gy, gy brn, mot, rr crm, sb
ply-biky, sft, rthy tex; MRLST: dk gy-blk, gy, occ dk brn, frm, sb ply-ply, gr tex, sily, calc;

LS: lt gy-wt, frm, cyxln, sb suc-sily, com dolmztd, CHK: lt gy, gy brn, mot, rr crm, sb
ply-biky, sft, rthy tex; MRLST: dk gy-blk, gy, occ dk brn, frm, sb ply-ply, gr tex, sily, calc;

calc;

7500





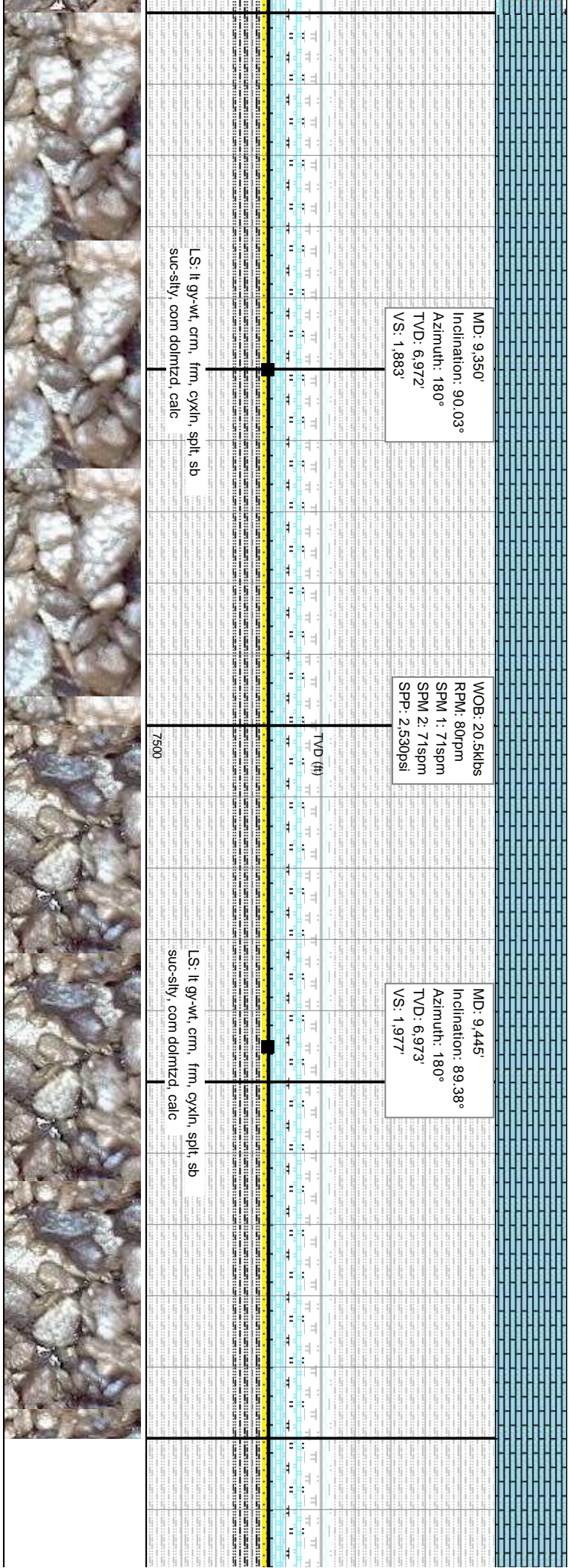
MD: 9.350'
Inclination: 90.03°
Azimuth: 180°
TVD: 6.972'
VS: 1.883'

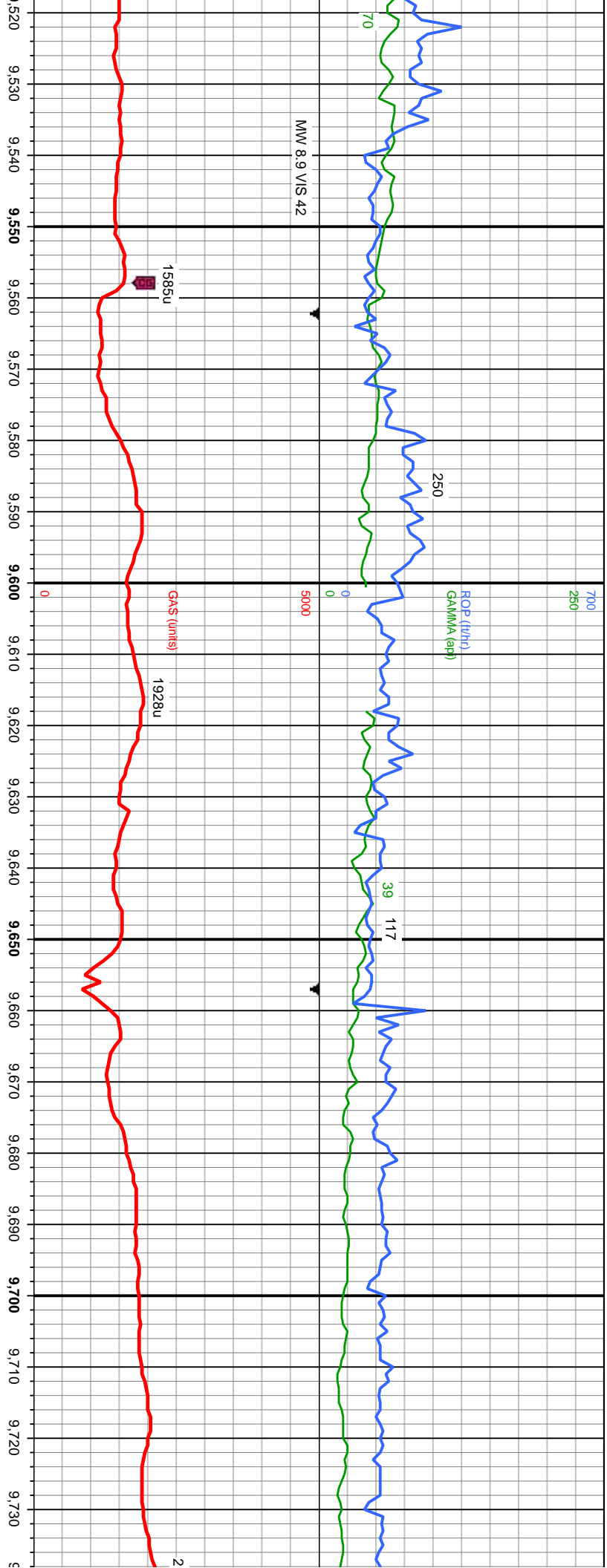
WOB: 20.5klbs
RPM: 80rpm
SPM 1: 71spm
SPM 2: 71spm
SP: 2.530psi

MD: 9.445'
Inclination: 89.38°
Azimuth: 180°
TVD: 6.973'
VS: 1.977'

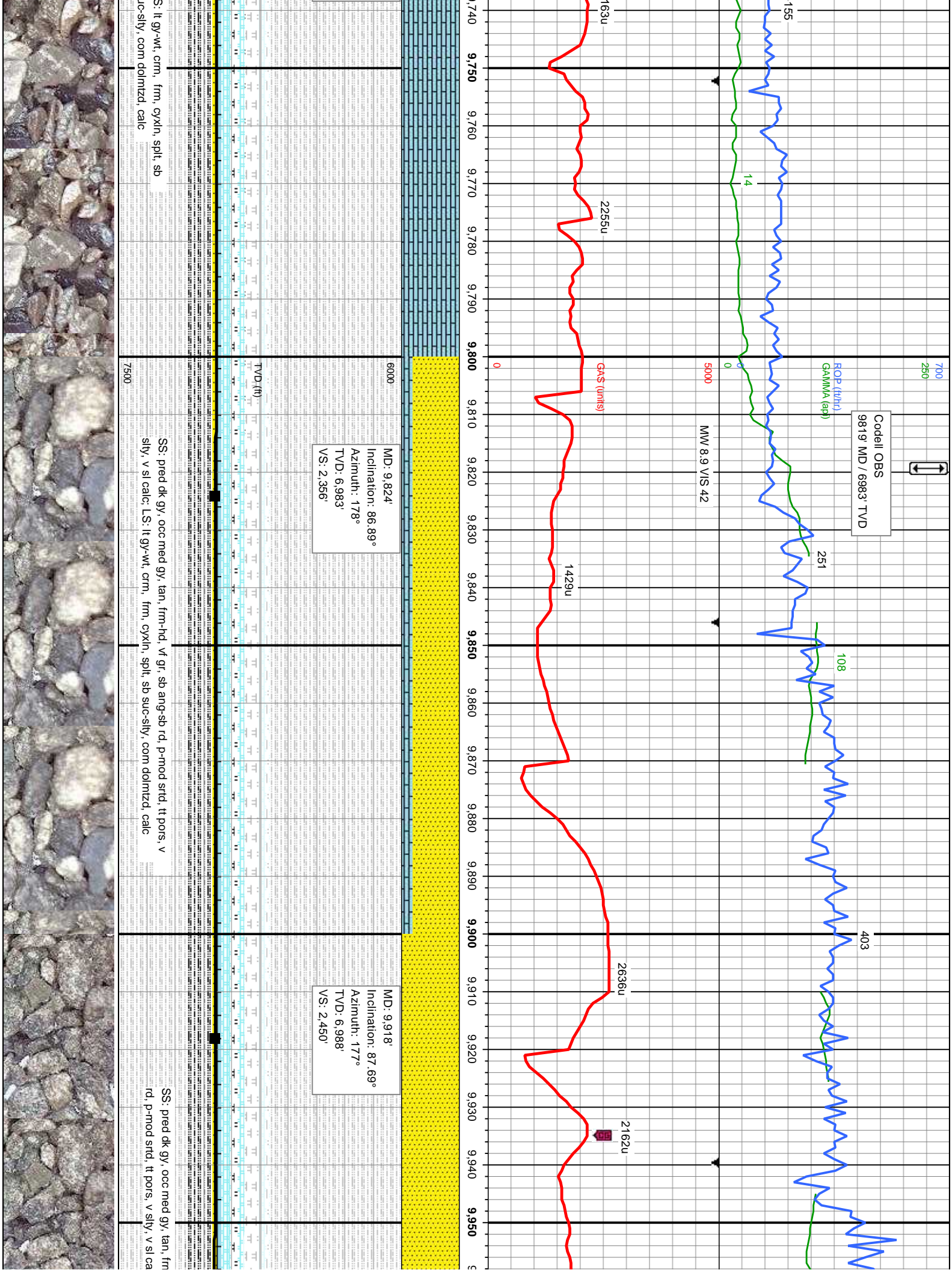
LS: lt gy-wt, crm, frm, cyxln, spl, sb
suc-sily, com dolmizd, calc

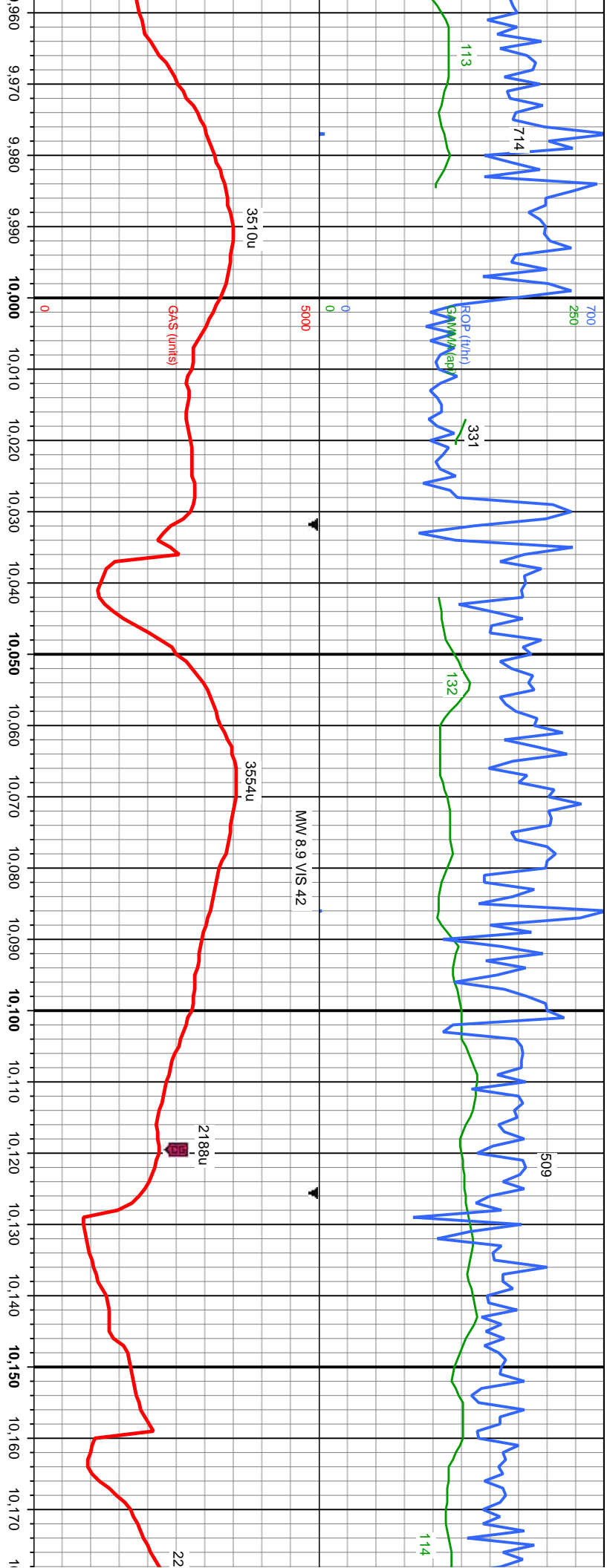
LS: lt gy-wt, crm, frm, cyxln, spl, sb
suc-sily, com dolmizd, calc





<div>MD: 9.539' Inclination: 88.74° Azimuth: 179° TVD: 6.974' VS: 2.071'</div>		6000		<div>MD: 9.634' Inclination: 89.02° Azimuth: 180° TVD: 6.976' VS: 2.166'</div>		7500		<div>MD: 9.729' Inclination: 87.91° Azimuth: 180° TVD: 6.979' VS: 2.261'</div>	
L.S: lt gy-wt, crm, frm, cyxln, splt, sb suc-sily, com dolmitzd, calc		TVD (ft)		TVD (ft)		TVD (ft)		TVD (ft)	





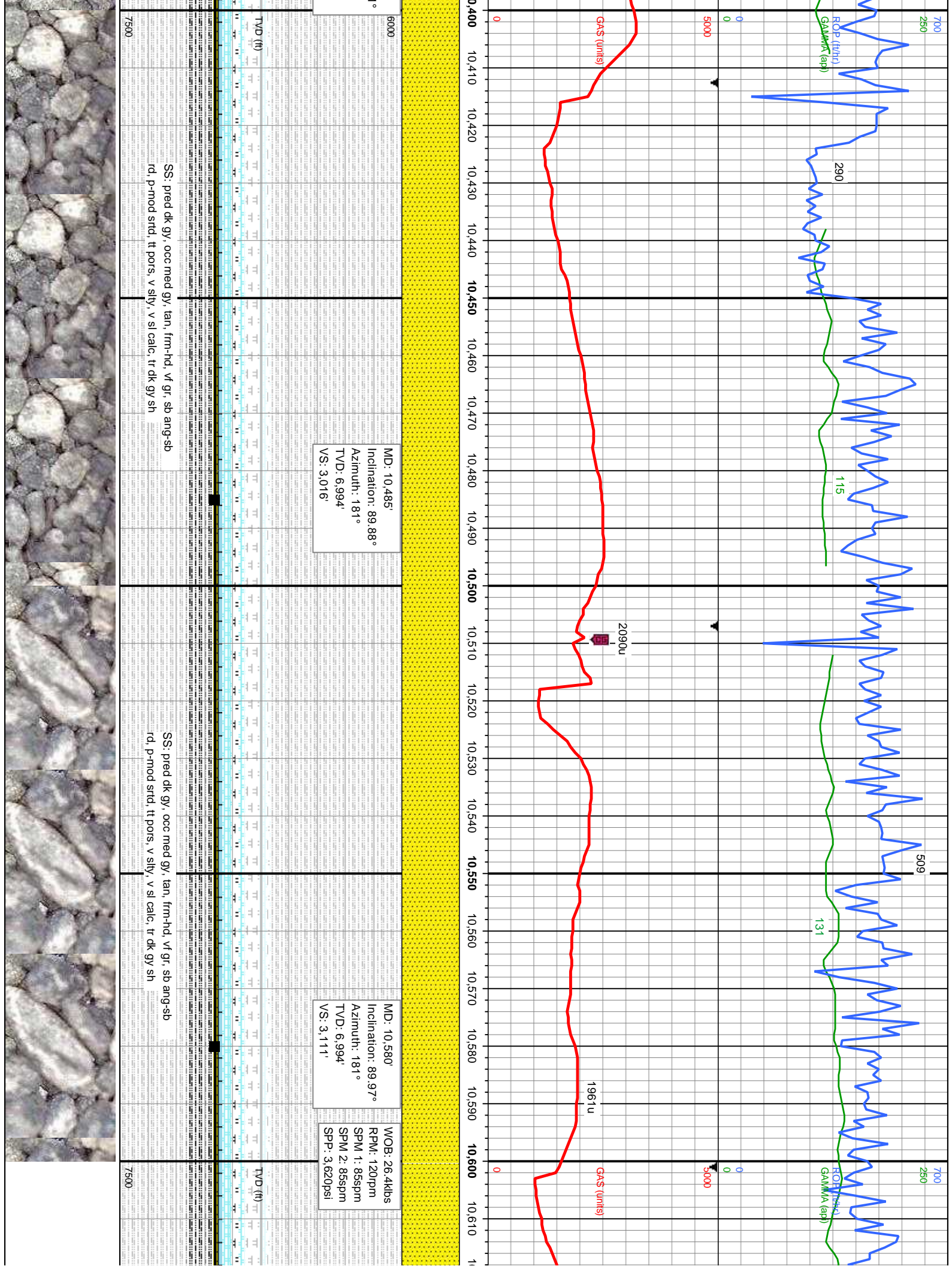
WOB: 15klbs
RPM: 120rpm
SPM 1: 85spm
SPM 2: 85spm
SPR: 2.850psi

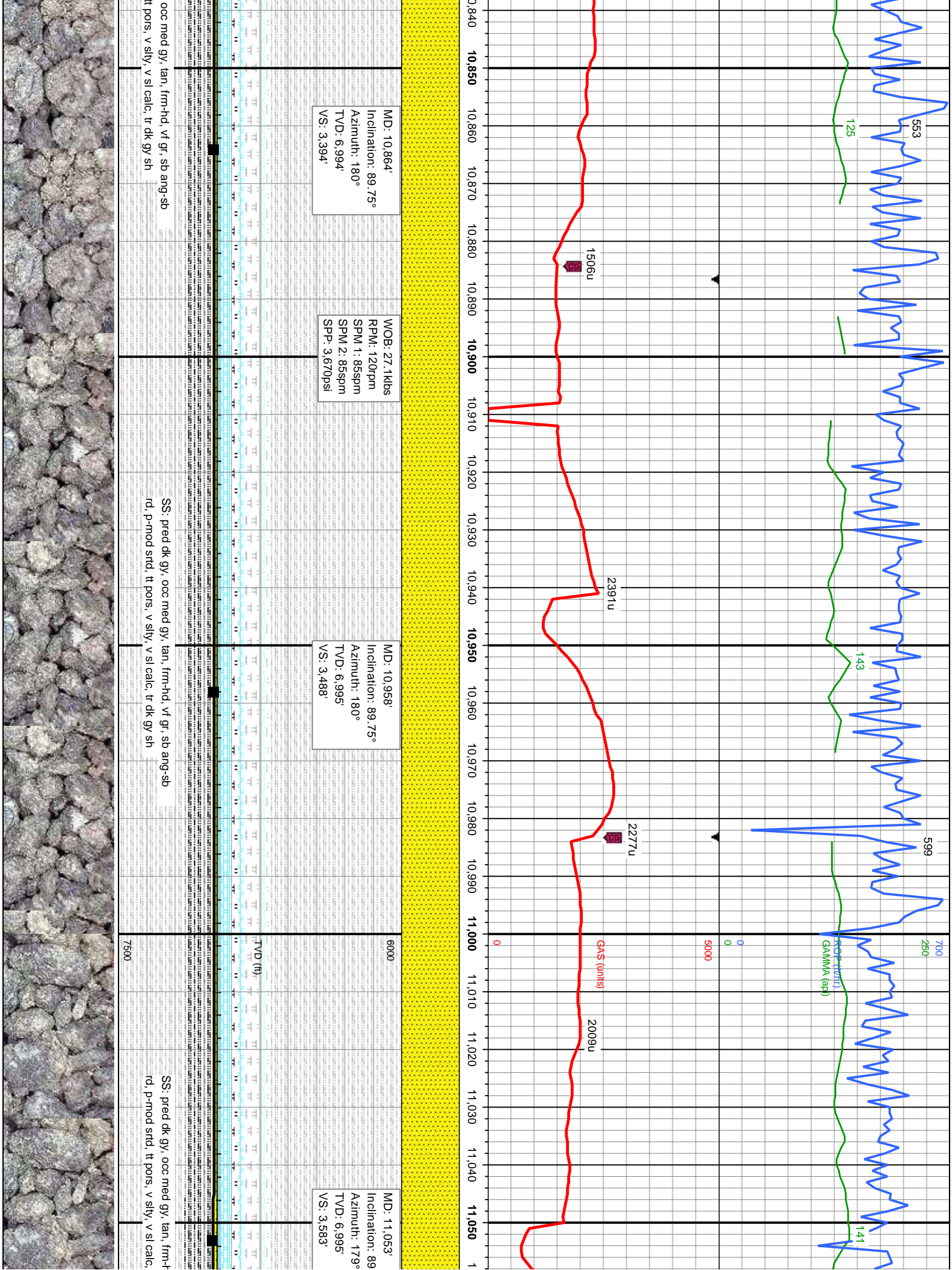
MD: 10.013'
Inclination: 88.28°
Azimuth: 176°
TVD: 6.991'
VS: 2.545'

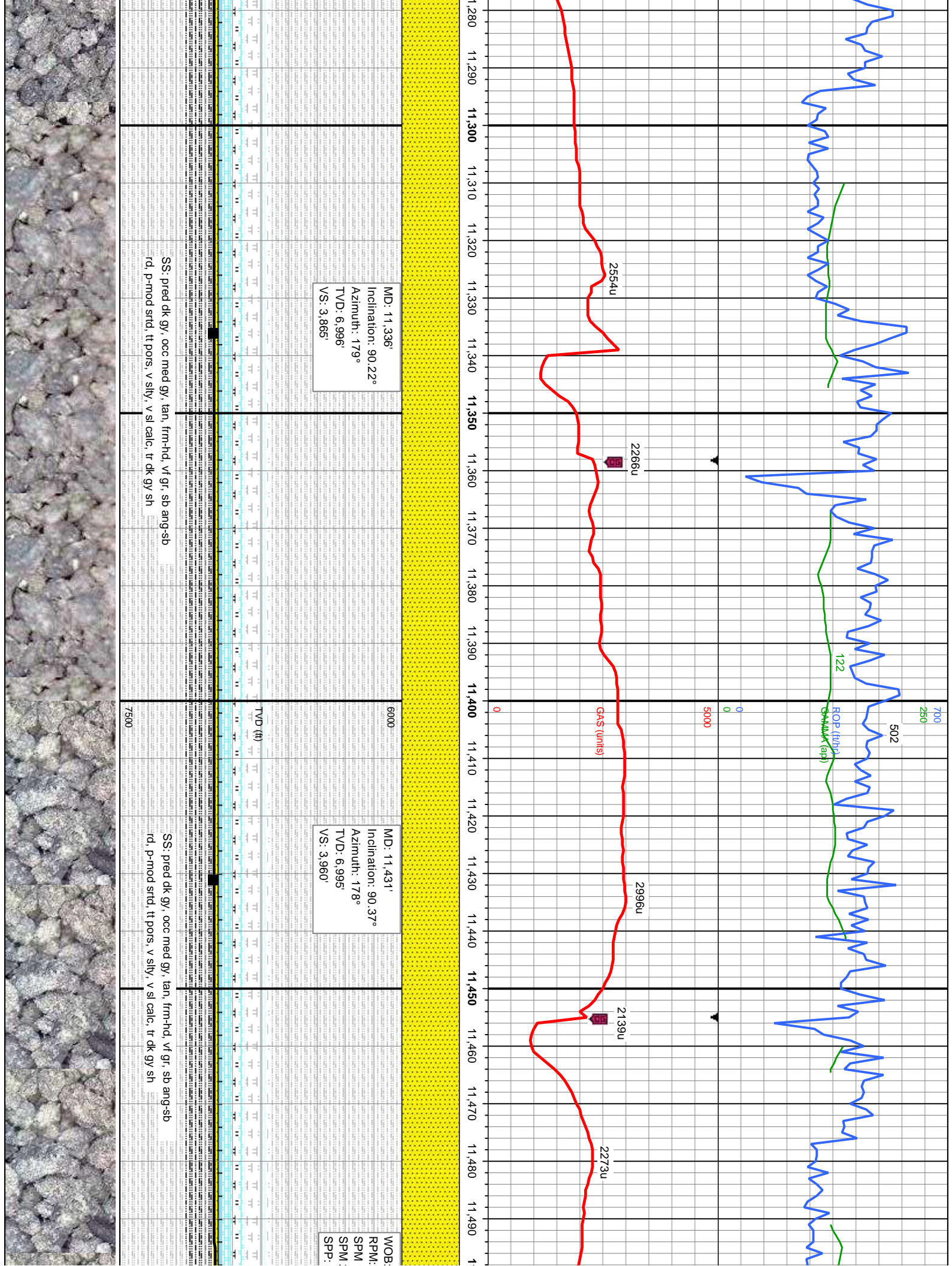
MD: 10.107'
Inclination: 89.29°
Azimuth: 176°
TVD: 6.993'
VS: 2.639'

TVD (ft)		SS: pred dk gy, occ med gy, tan, frm-hd, vf gr, sb ang-sb rd, p-mod strd, tt pors, v silty, v sl calc, tr dk gy sh	
9,960	11	11	11
9,970	11	11	11
9,980	11	11	11
9,990	11	11	11
10,000	11	11	11
10,010	11	11	11
10,020	11	11	11
10,030	11	11	11
10,040	11	11	11
10,050	11	11	11
10,060	11	11	11
10,070	11	11	11
10,080	11	11	11
10,090	11	11	11
10,100	11	11	11
10,110	11	11	11
10,120	11	11	11
10,130	11	11	11
10,140	11	11	11
10,150	11	11	11
10,160	11	11	11
10,170	11	11	11

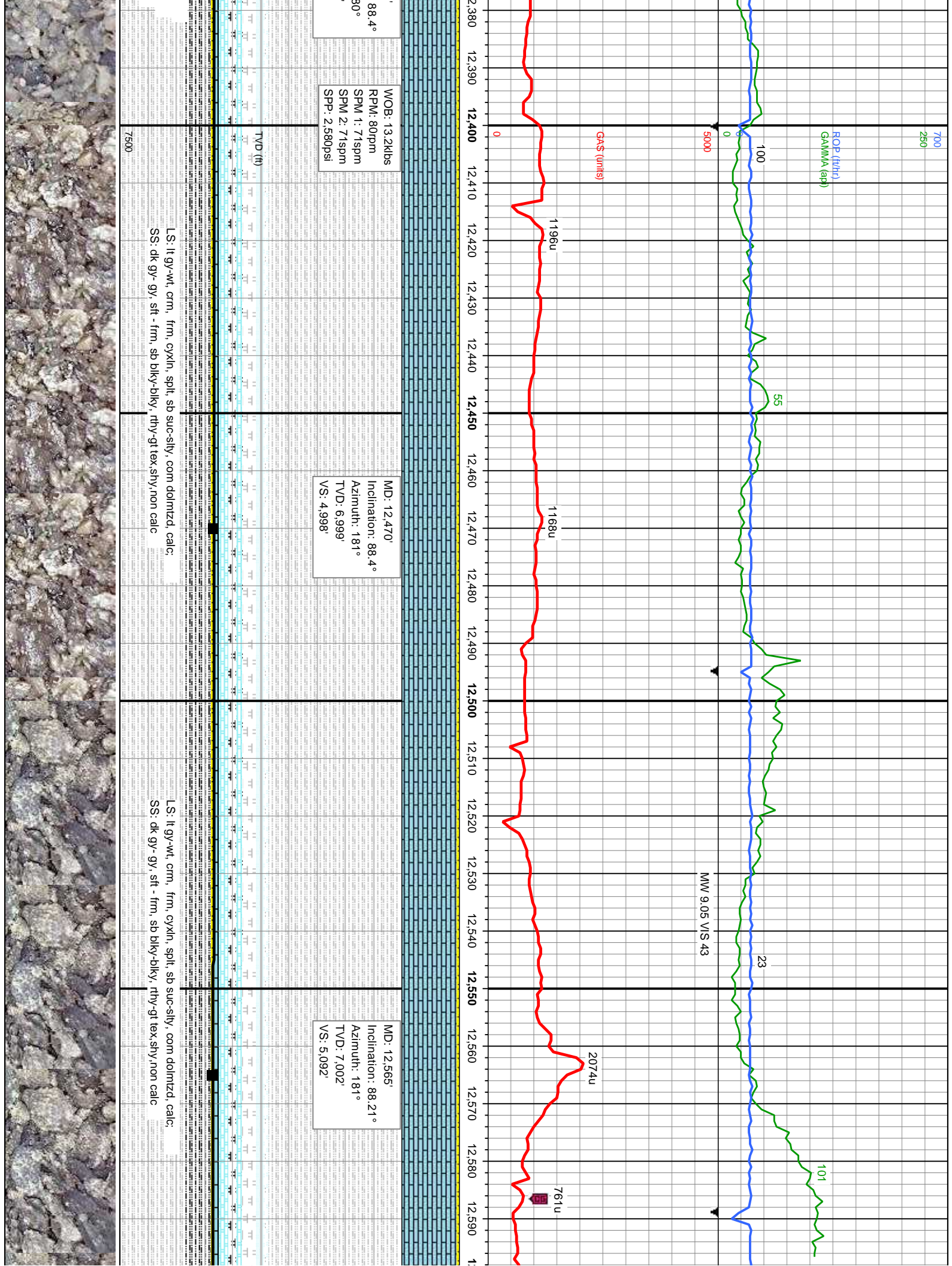


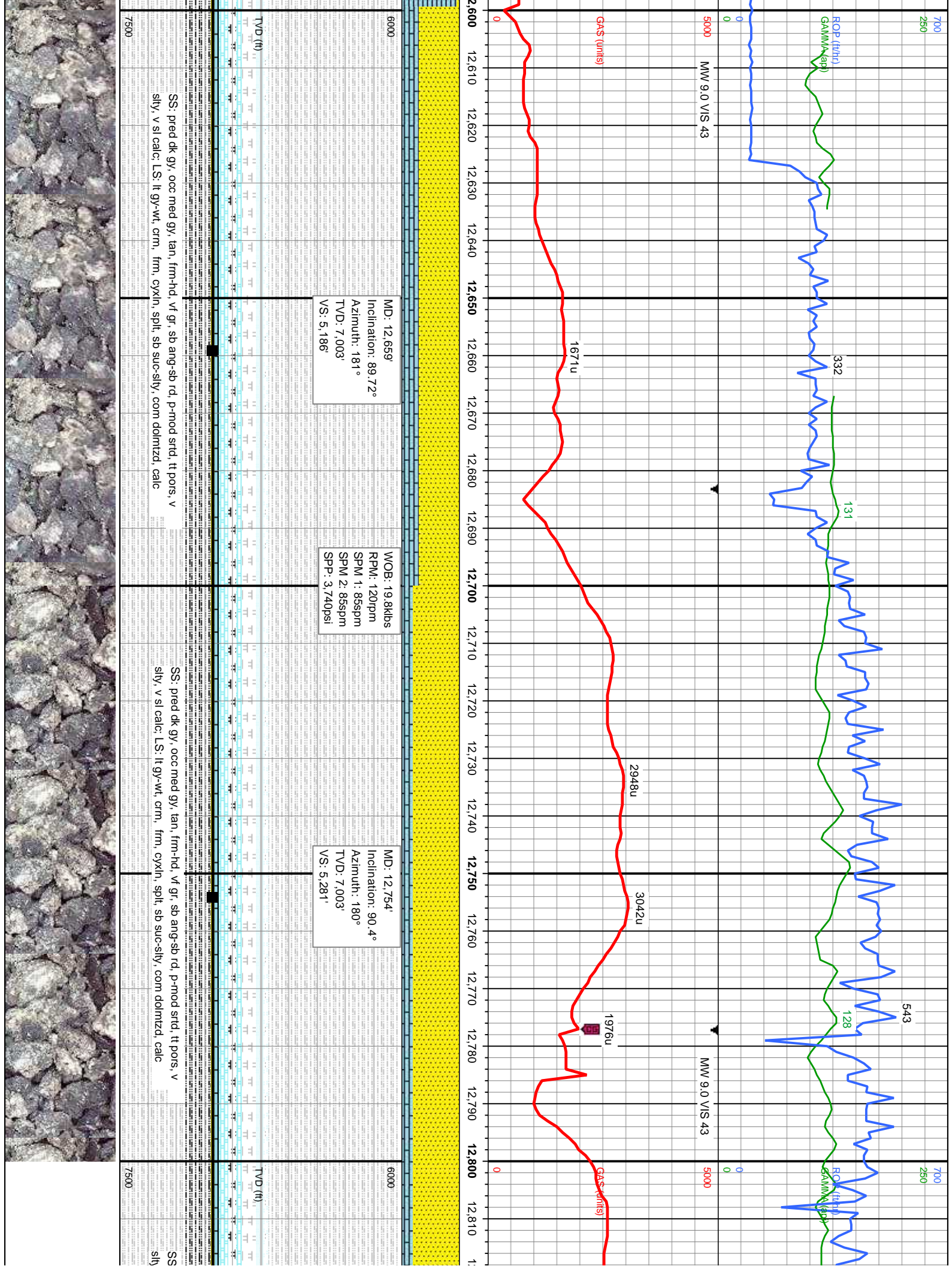


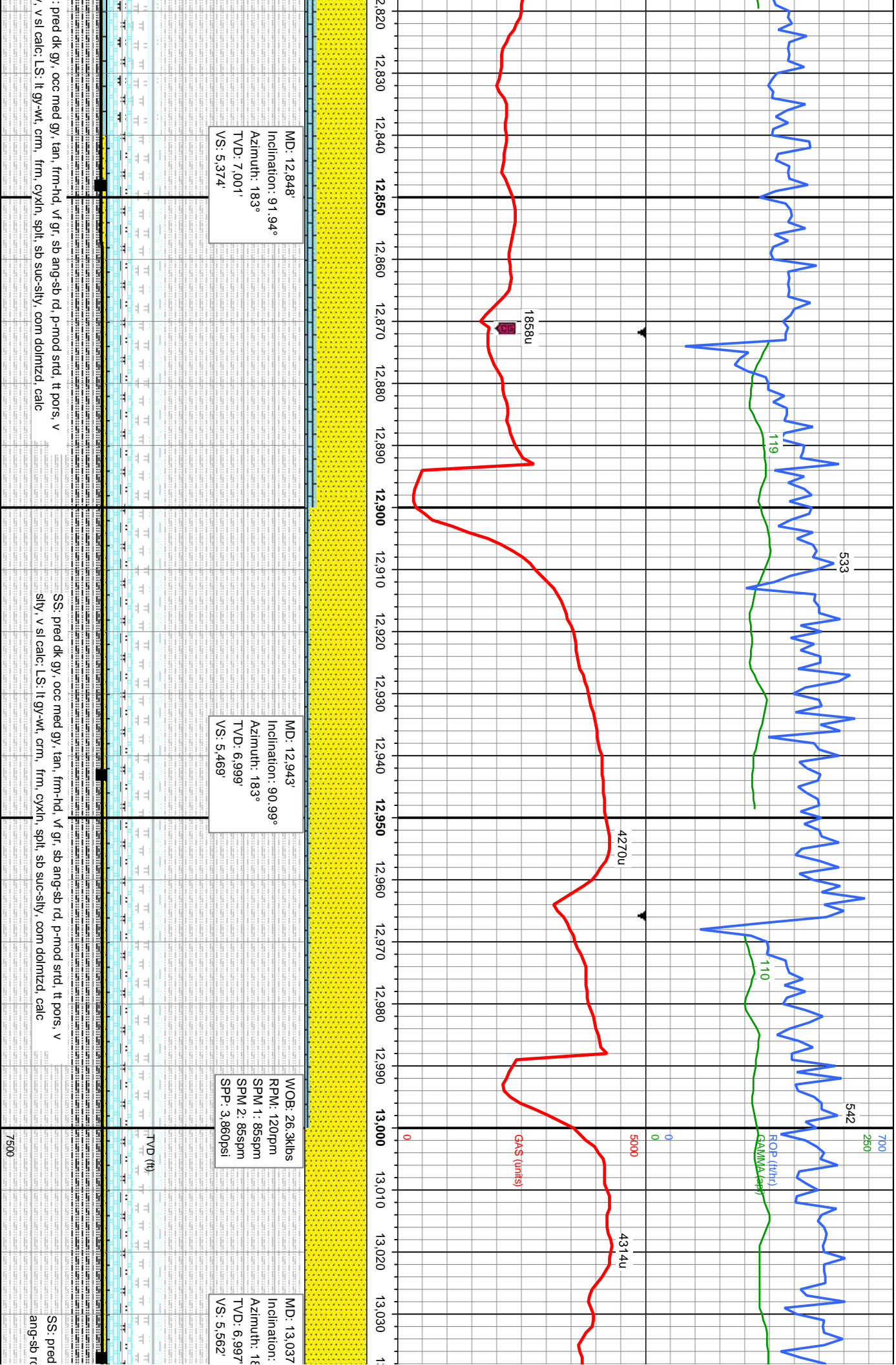












MD: 12,848'
Inclination: 91.94°
Azimuth: 183°
TVD: 7,001'
VS: 5,374'

MD: 12,943'
Inclination: 90.99°
Azimuth: 183°
TVD: 6,999'
VS: 5,469'

WOB: 26.3klbs
RPM: 120rpm
SPM 1: 85spm
SPM 2: 85spm
SP: 3.860psi

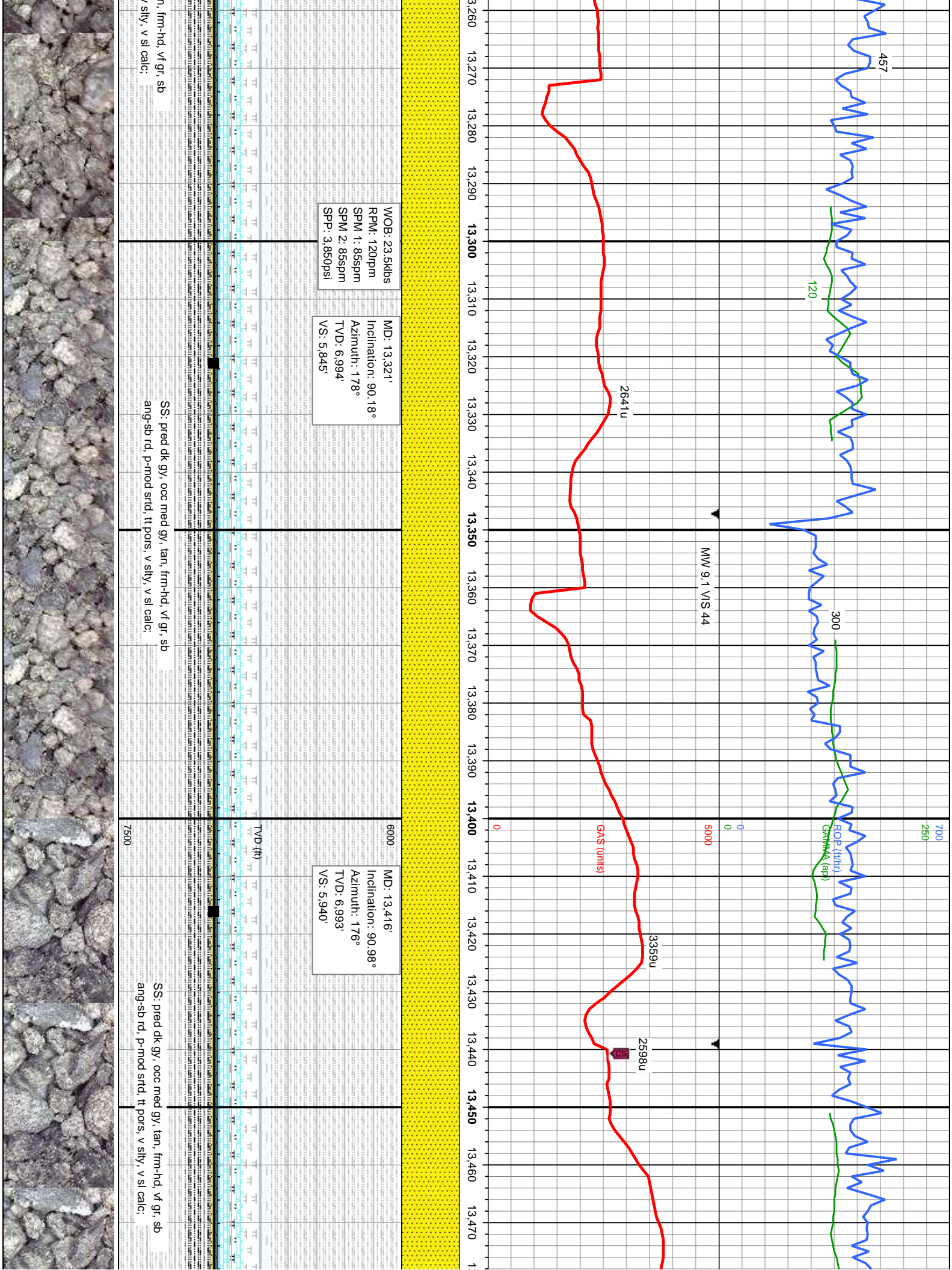
MD: 13,037'
Inclination:
Azimuth: 18°
TVD: 6,997'
VS: 5,562'

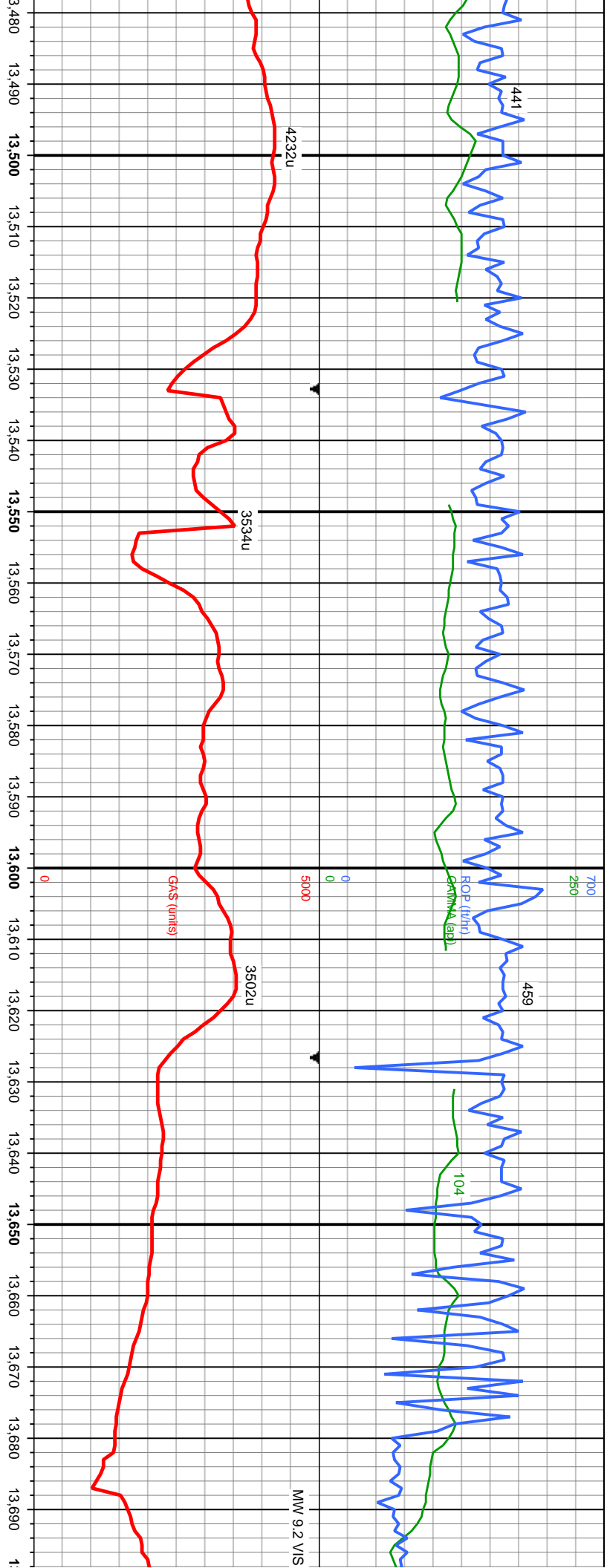
p. pred dk gy, occ med gy, tan, frm-hd, v/ gr, sb ang-sb rd, p-nod strd, tt pors, v
, v sl calc; LS: lt gy-wt, crm, frm, cyxn, spl, sb suc-sily, com dolmizd, calc

SS, p. pred dk gy, occ med gy, tan, frm-hd, v/ gr, sb ang-sb rd, p-nod strd, tt pors, v
sily, v sl calc; LS: lt gy-wt, crm, frm, cyxn, spl, sb suc-sily, com dolmizd, calc

SS, p. pred
ang-sb rd







MD: 13.510'
Inclination: 90.99°
Azimuth: 176°
TVD: 6.991'
VS: 6.034'

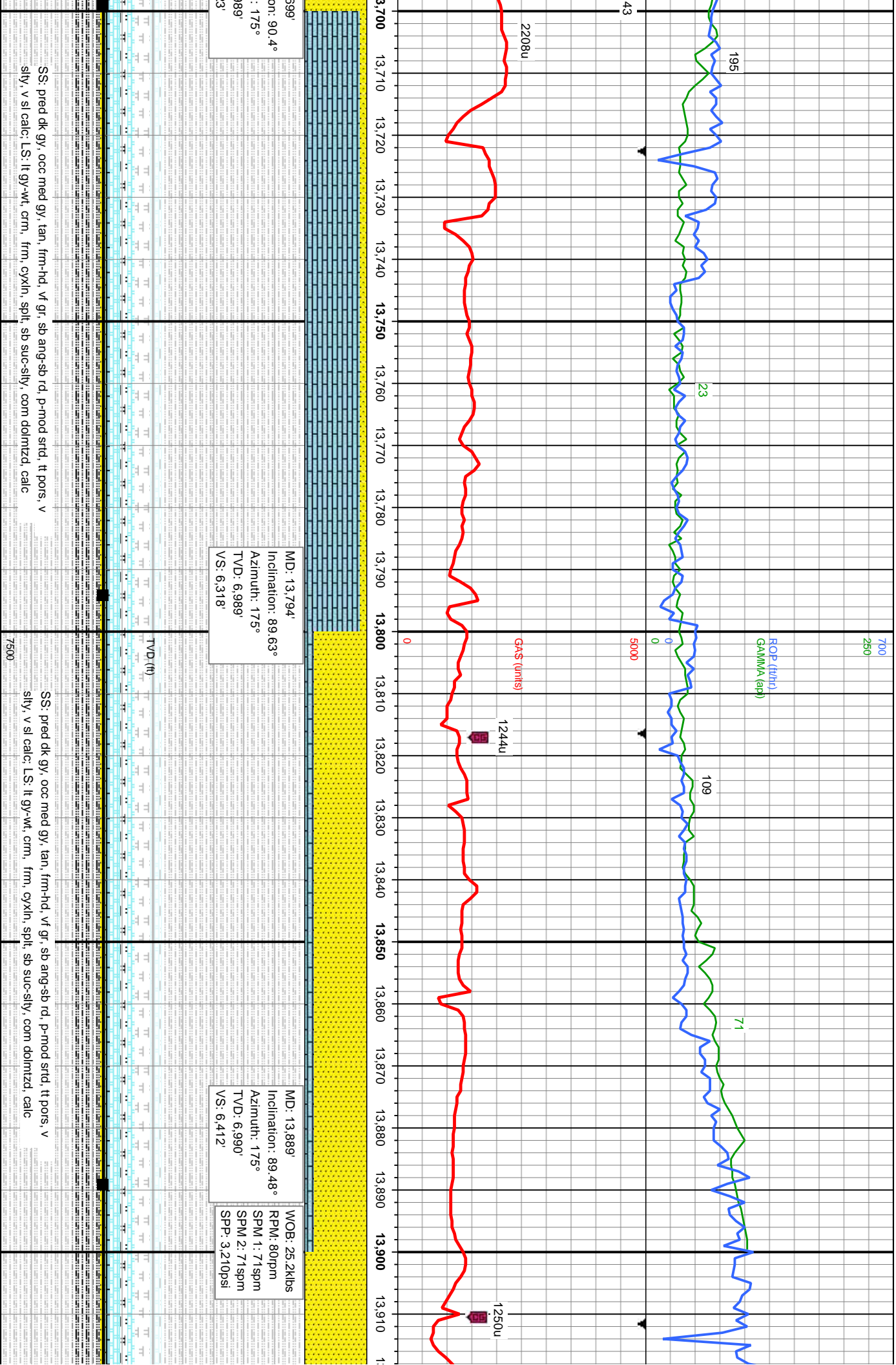
WOB: 26.2kbs MD: 13.605'
RPM: 120rpm Inclination: 90.86°
SPM 1: 85spm Azimuth: 176°
SPM 2: 85spm TVD: 6.990'
SPP: 4.010psi VS: 6.129'

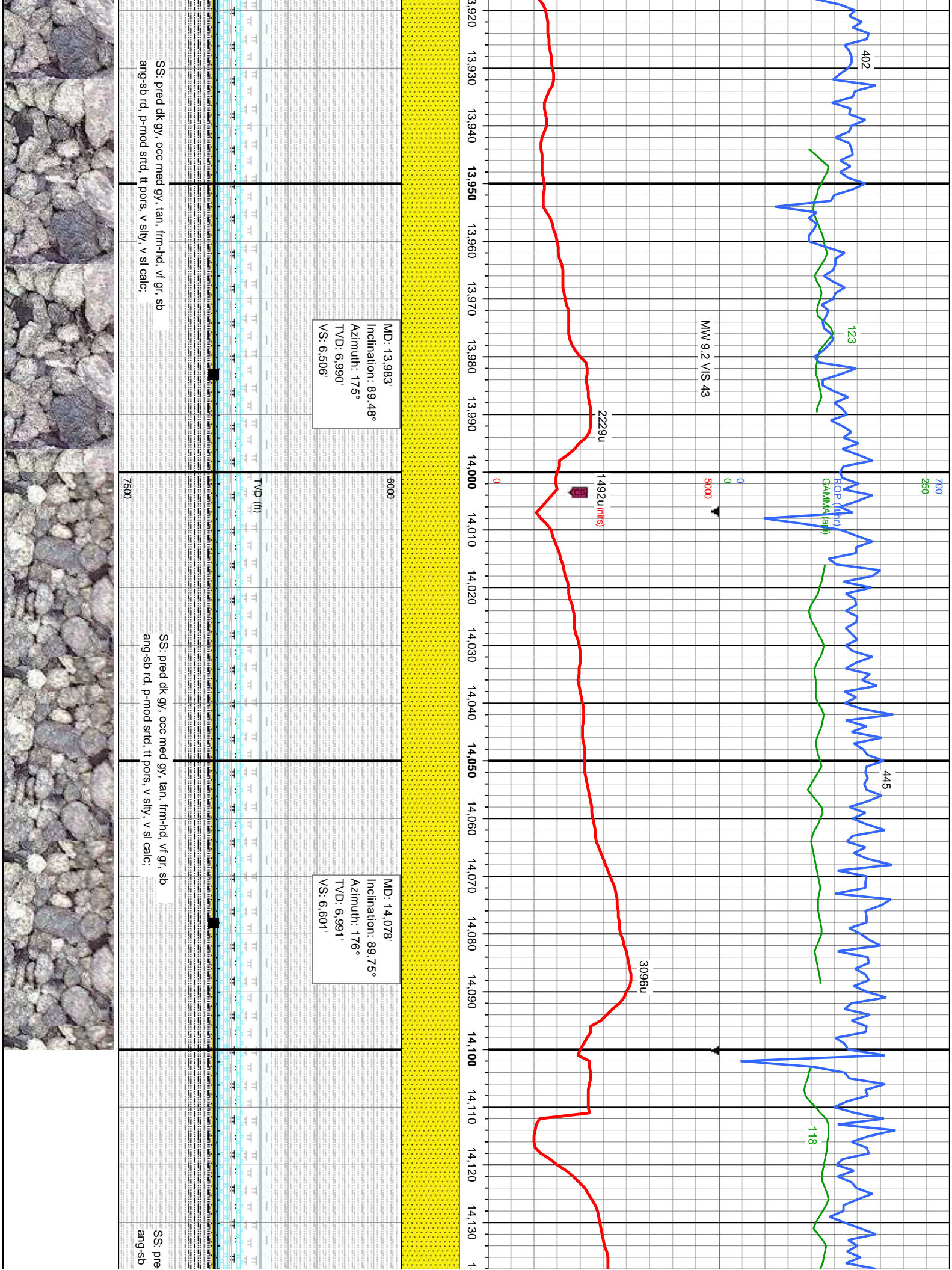
MD: 13.605'
Inclination: 90.86°
Azimuth: 176°
TVD: 6.990'
VS: 6.22'

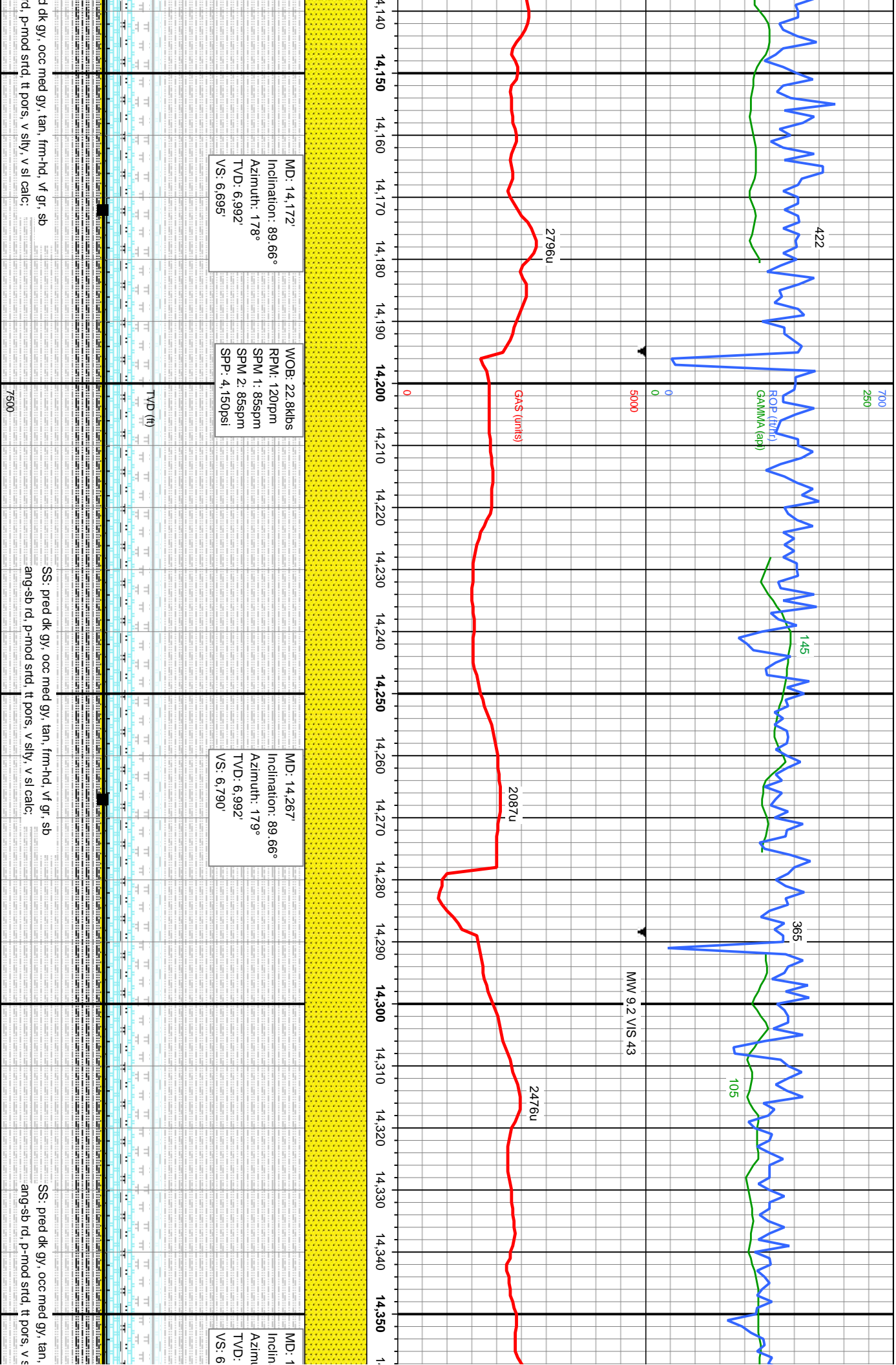
SS: pred dk gy, occ med gy, tan, firm-hd, v/ gr, sb
ang-sb rd, p-mod strd, lt pors, v slty, v sl calc;

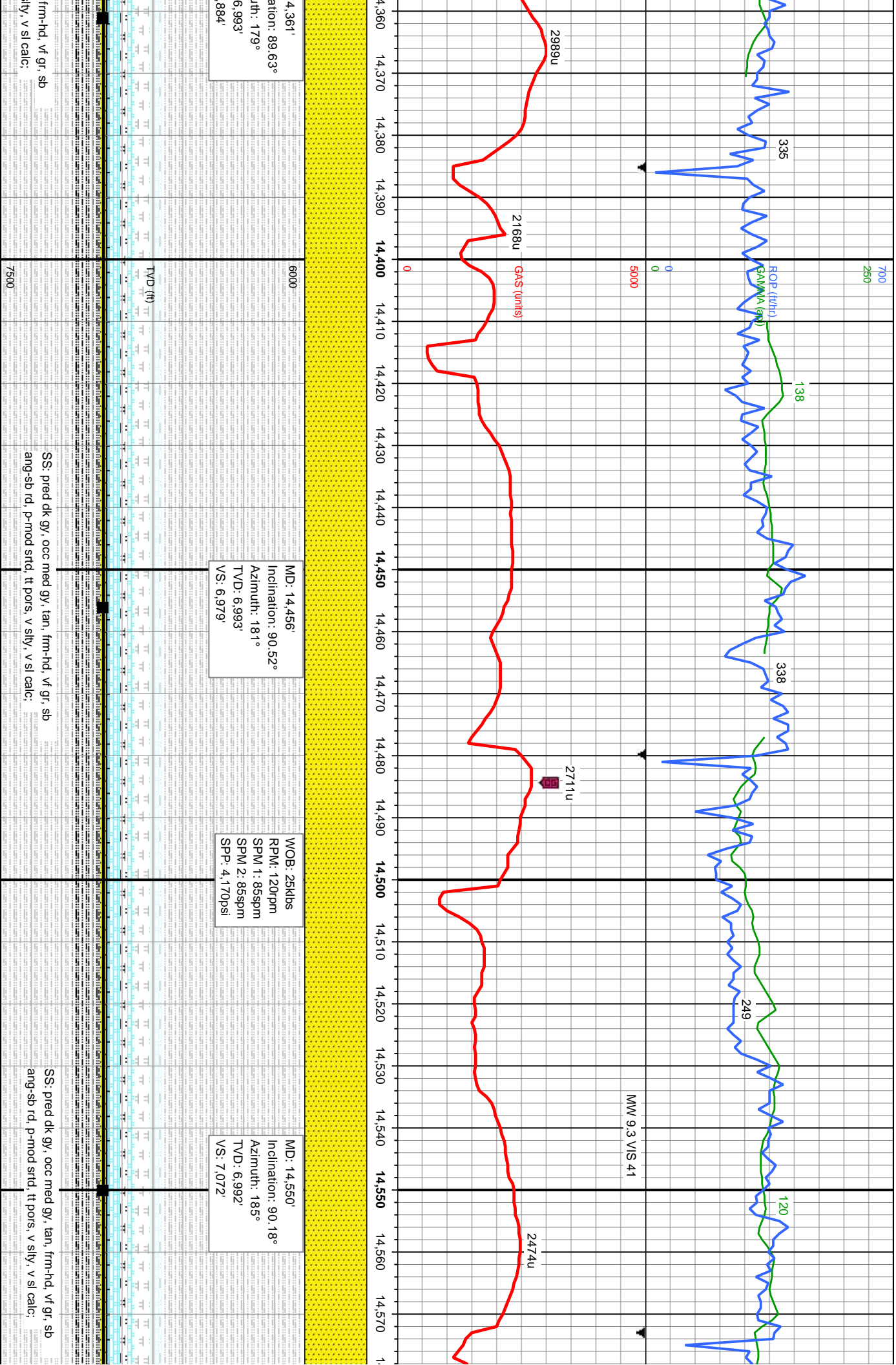
SS: pred dk gy, occ med gy, tan, firm-hd, v/ gr, sb
ang-sb rd, p-mod strd, lt pors, v slty, v sl calc;

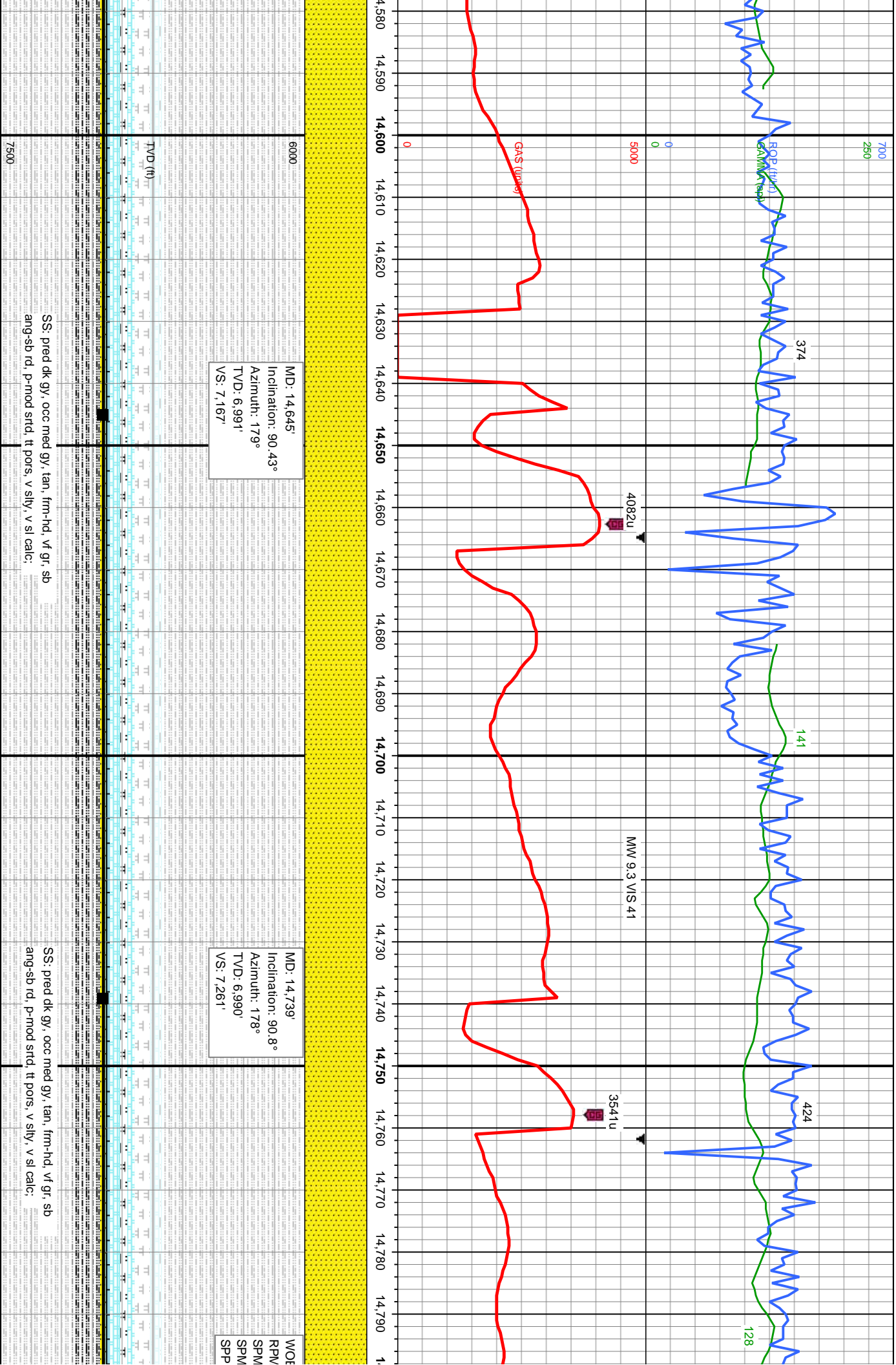


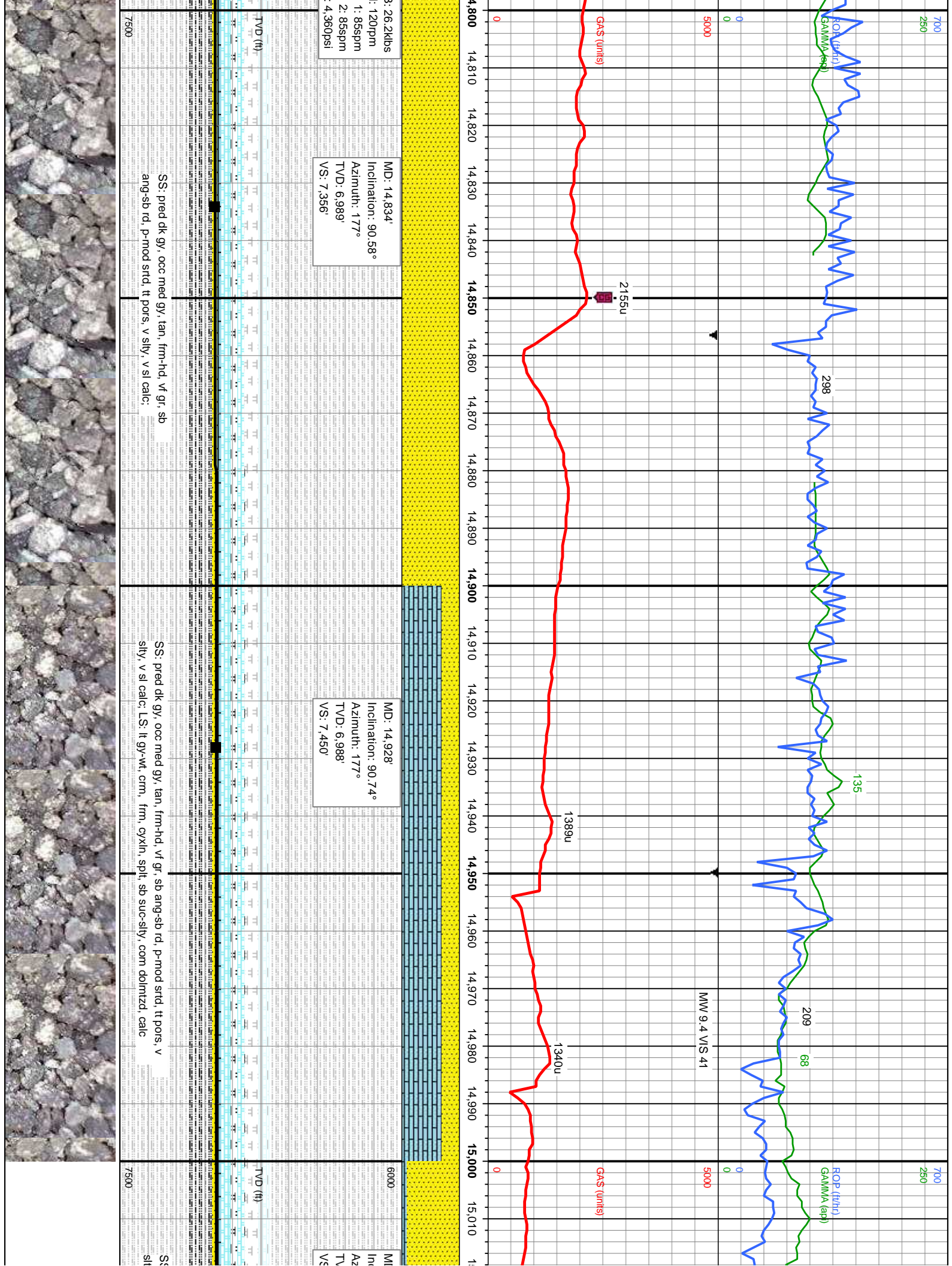


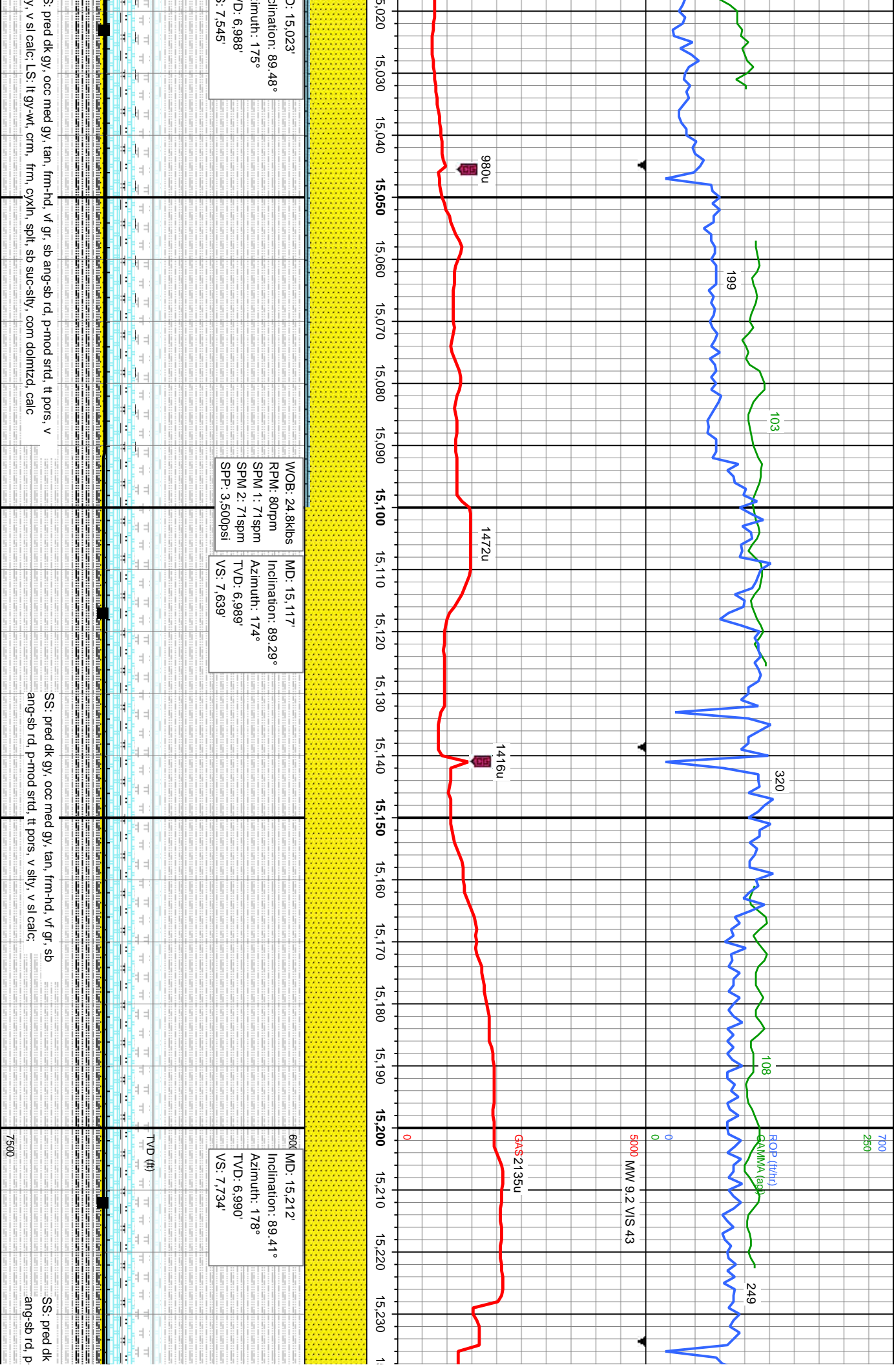


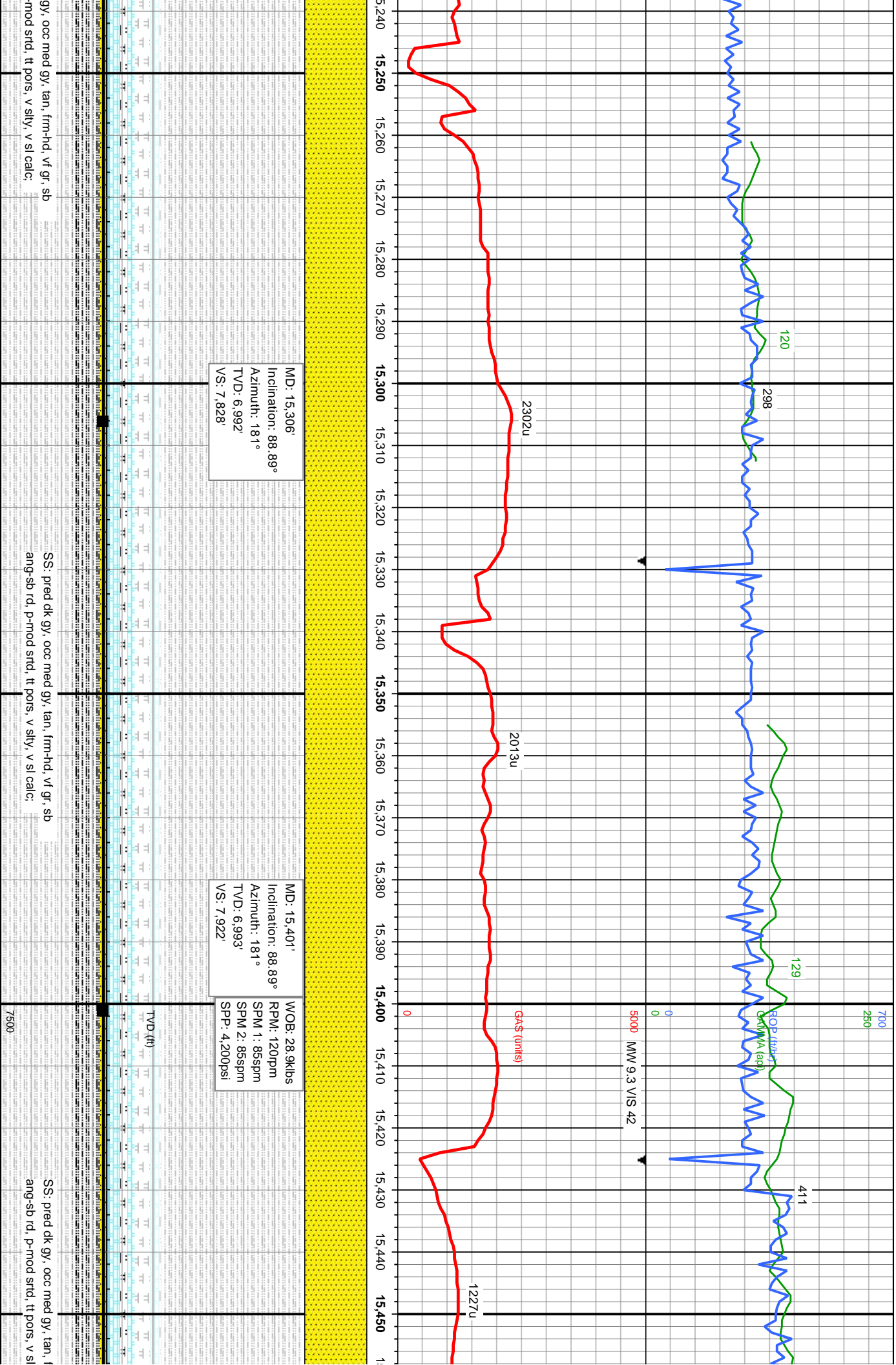


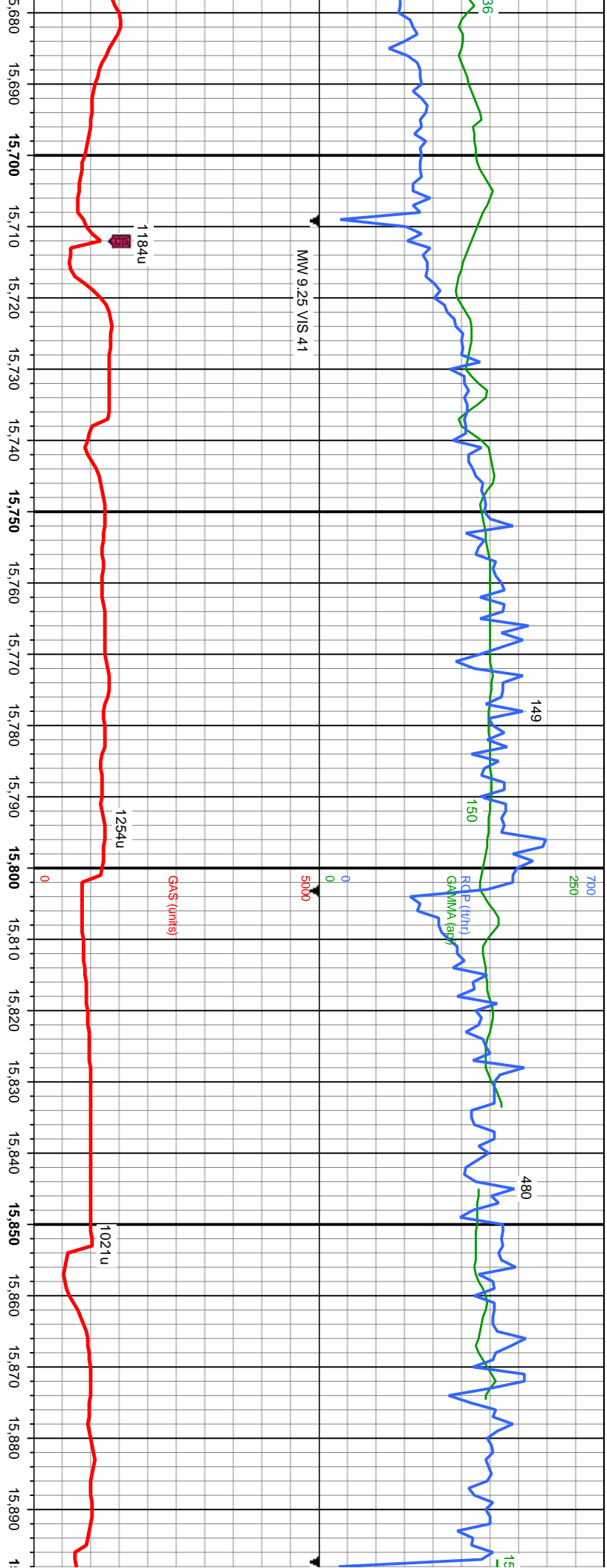




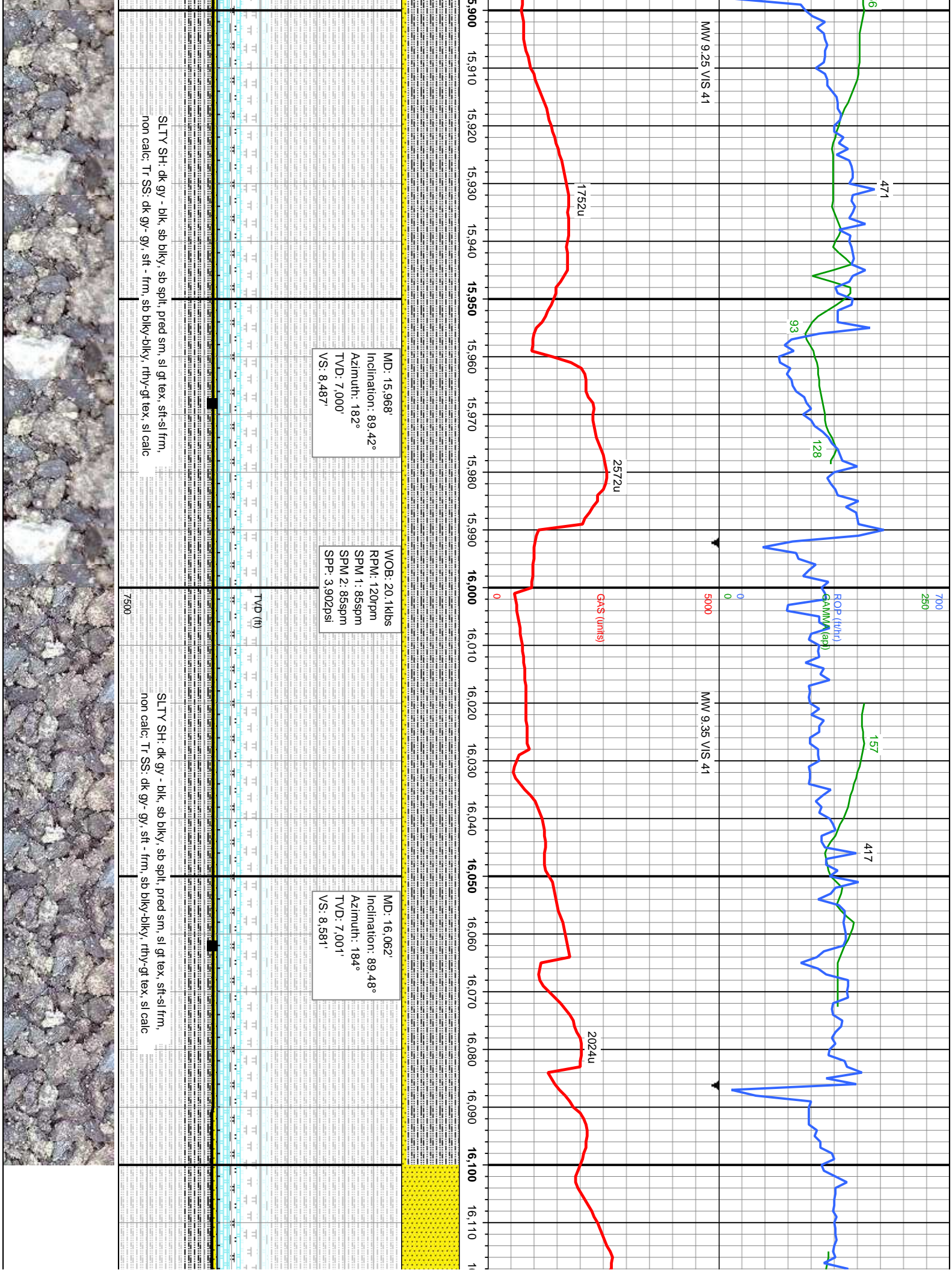


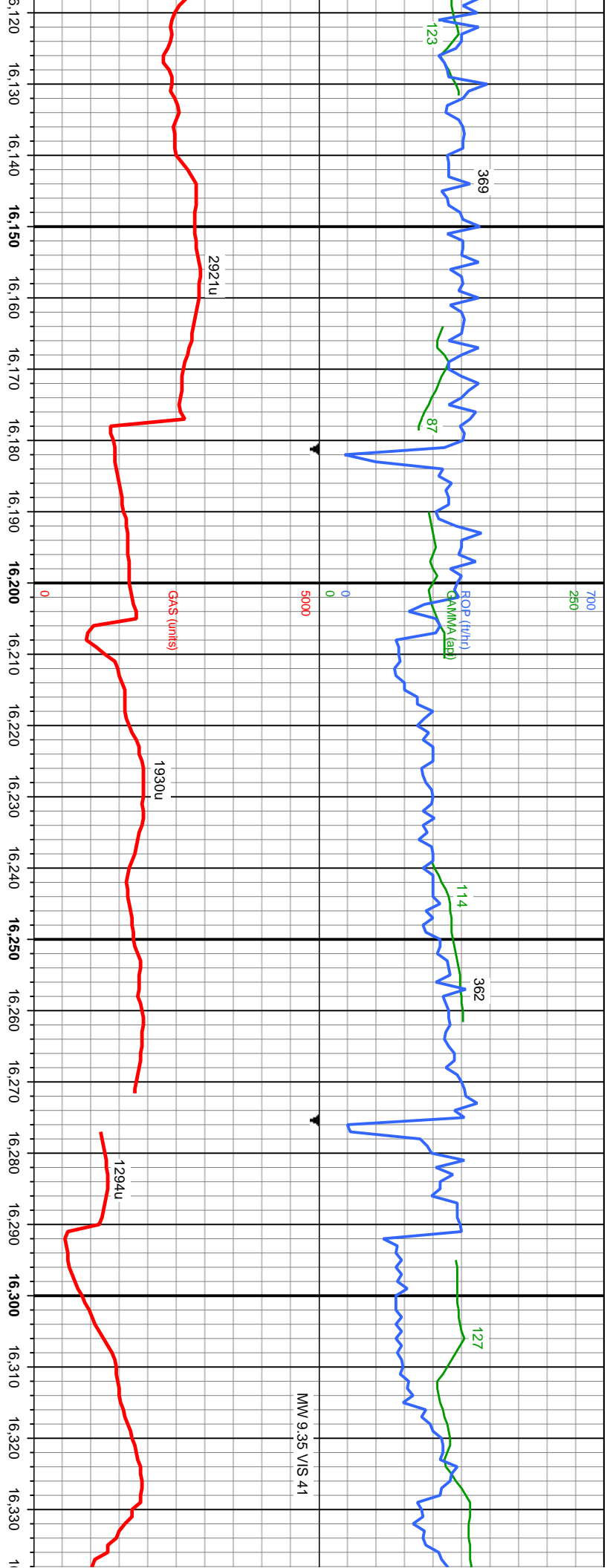




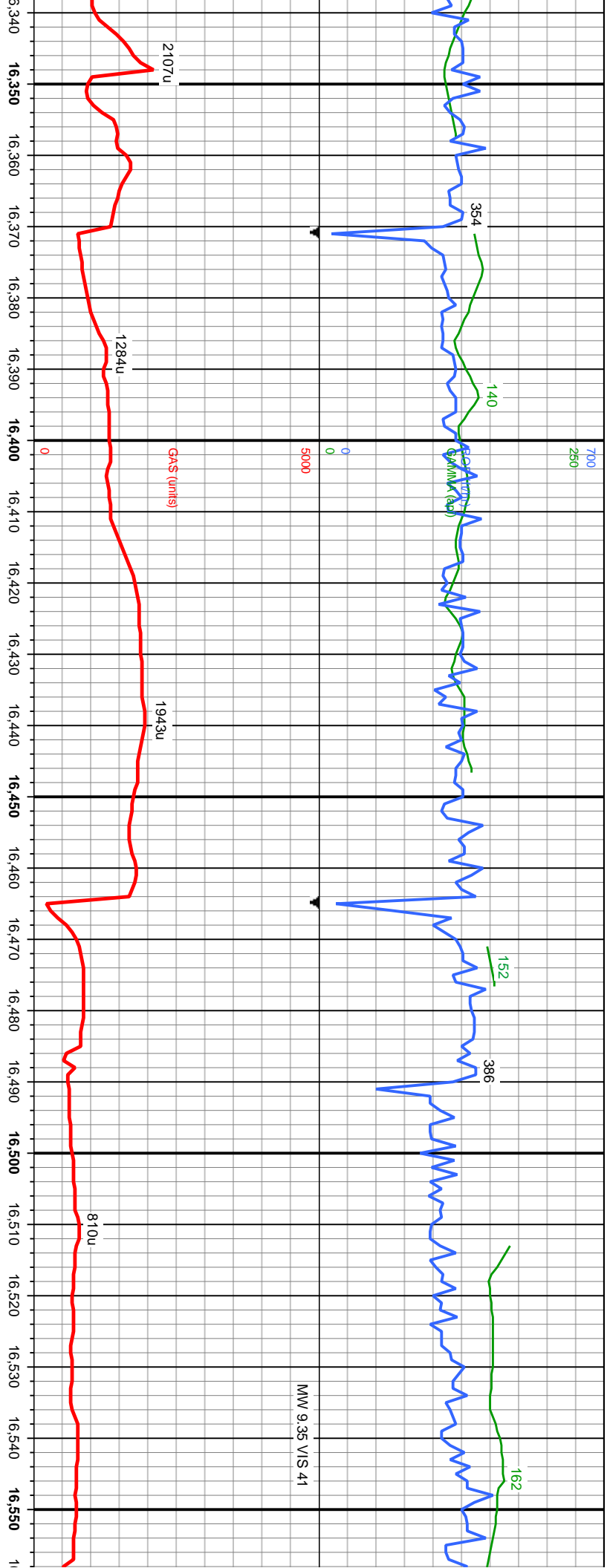


No Reported Survey										MD: 15,779 Inclination: 89.42° Azimuth: 180° TVD: 6,998' VS: 8,299'										6000										MD: 15,873' Inclination: 89.42° Azimuth: 181° TVD: 6,999' VS: 8,393'									
WOB: 31.6kbs RPM: 121rpm SPM 1: 85spm SPM 2: 85spm SPP: 4.331psi										SS: pred dk gy, occ med gy, tan, frm-hd, v'f gr, sb ang-sb rd, p-mod strd, tt pors, v sily, v sl calc;										TVD (ft)										SLTY SH: dk gy - blk, sb blk, sb splt, pred sm, sl gt tex, sft-sl frm, non calc; Tr SS: dk gy- gy, sft - frm, sb blk, blk, rthy-gt tex, sl calc									





No Reported Survey									
				6000					
				TVD (ft)					



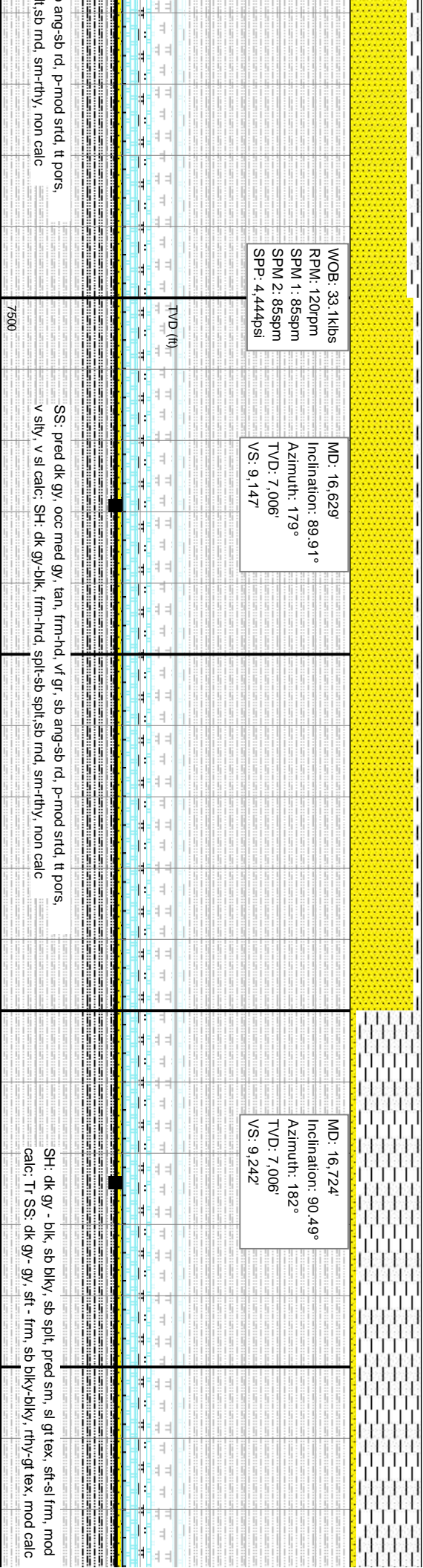
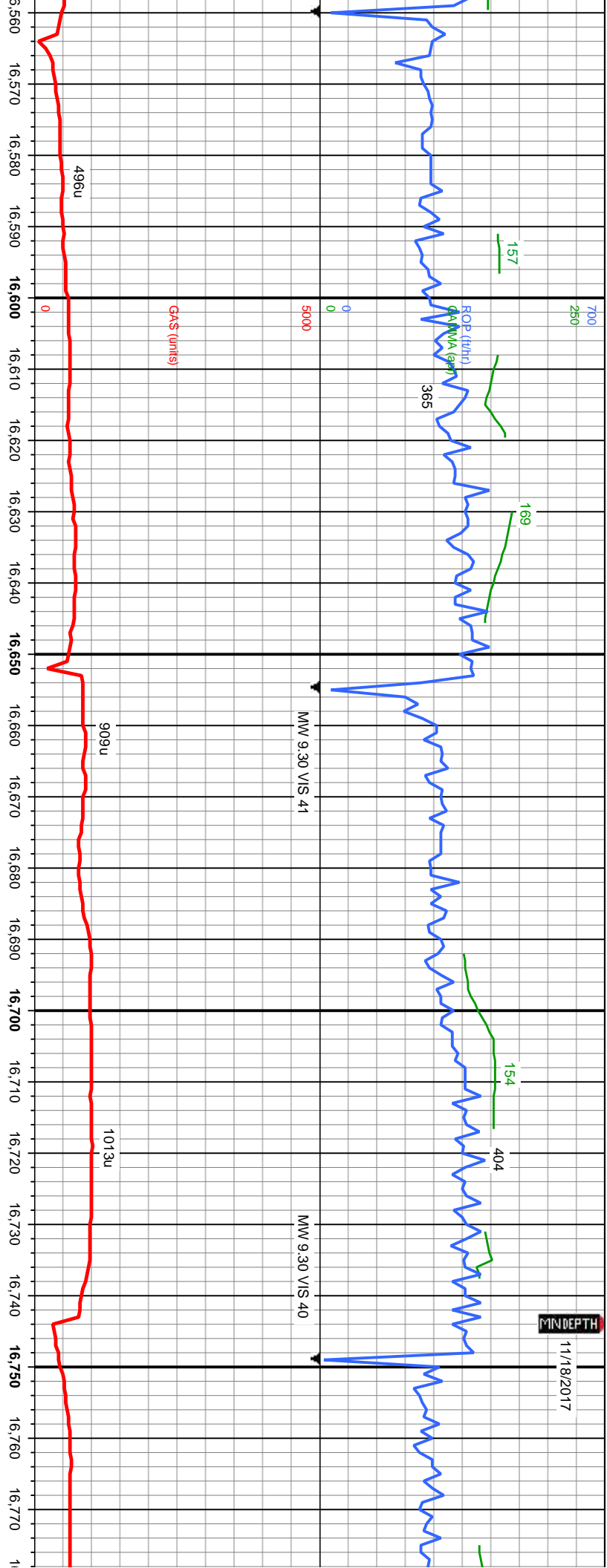
ID: 16,346'
Inclination: 89.26°
Azimuth: 178°
VD: 7.004'
VS: 8.864'

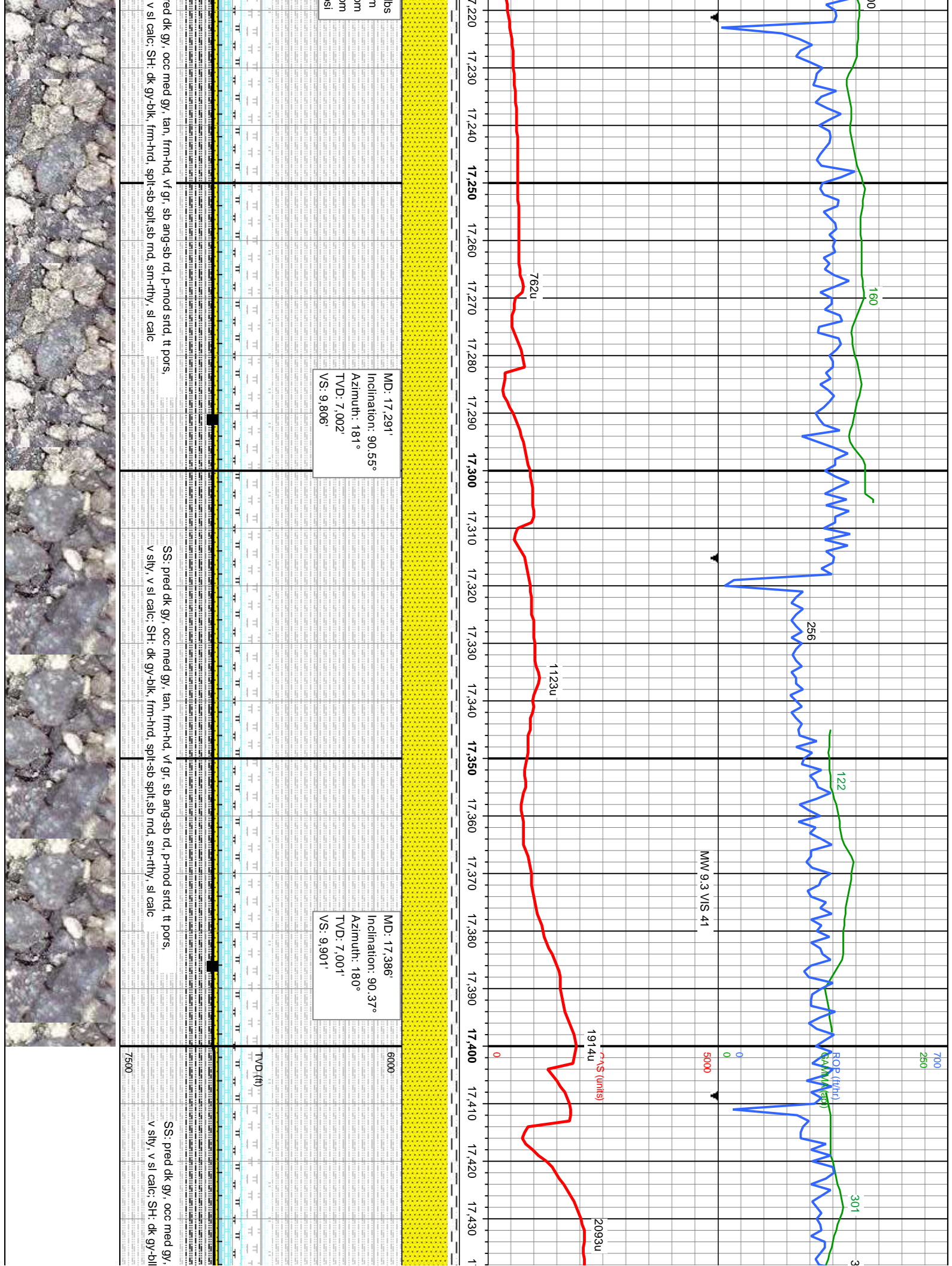
MD: 16,440'
Inclination: 89.38°
Azimuth: 178°
TVD: 7.005'
VS: 8.958'

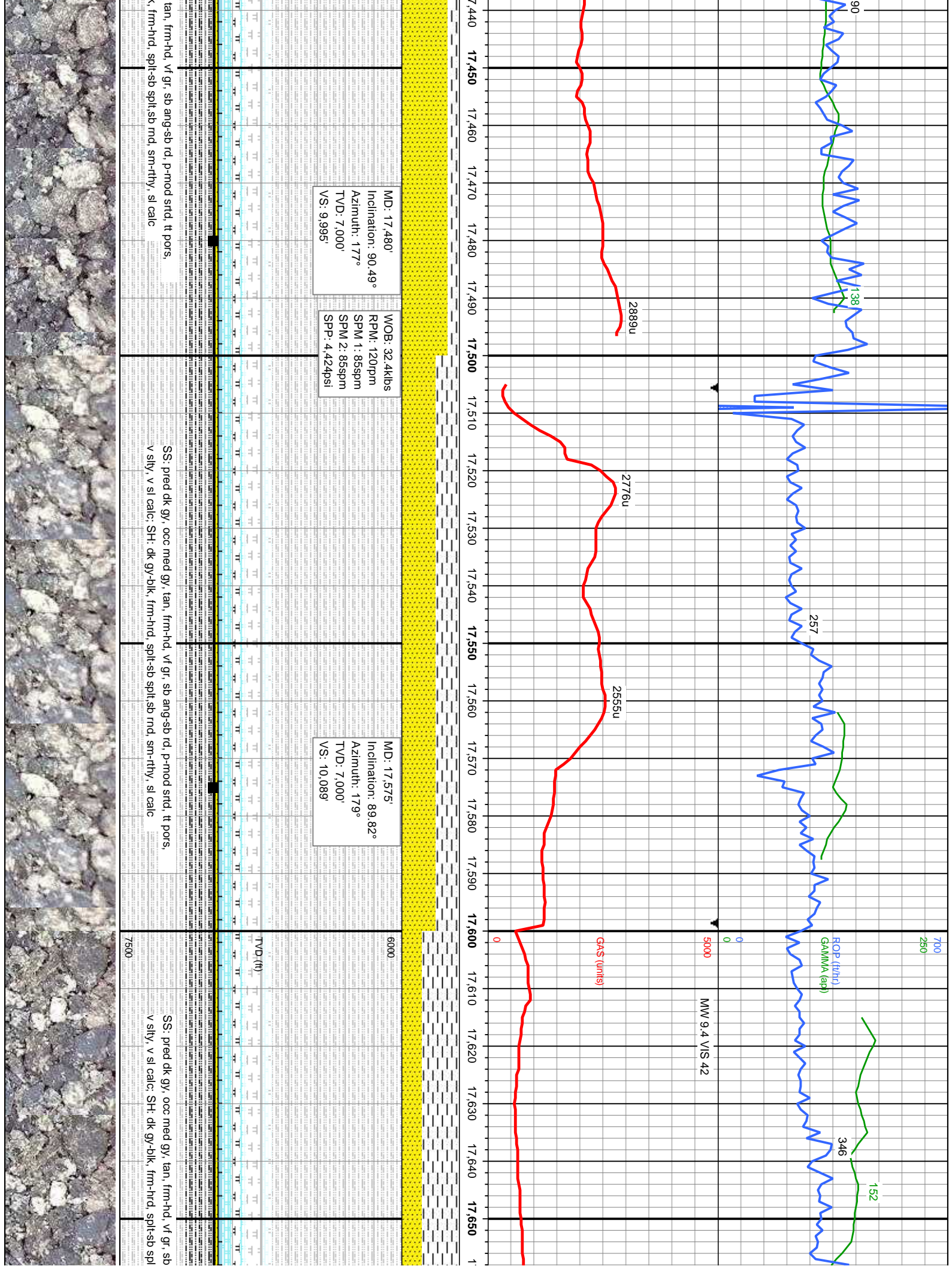
MD: 16,535'
Inclination: 89.48°
Azimuth: 177°
TVD: 7.006'
VS: 9.053'

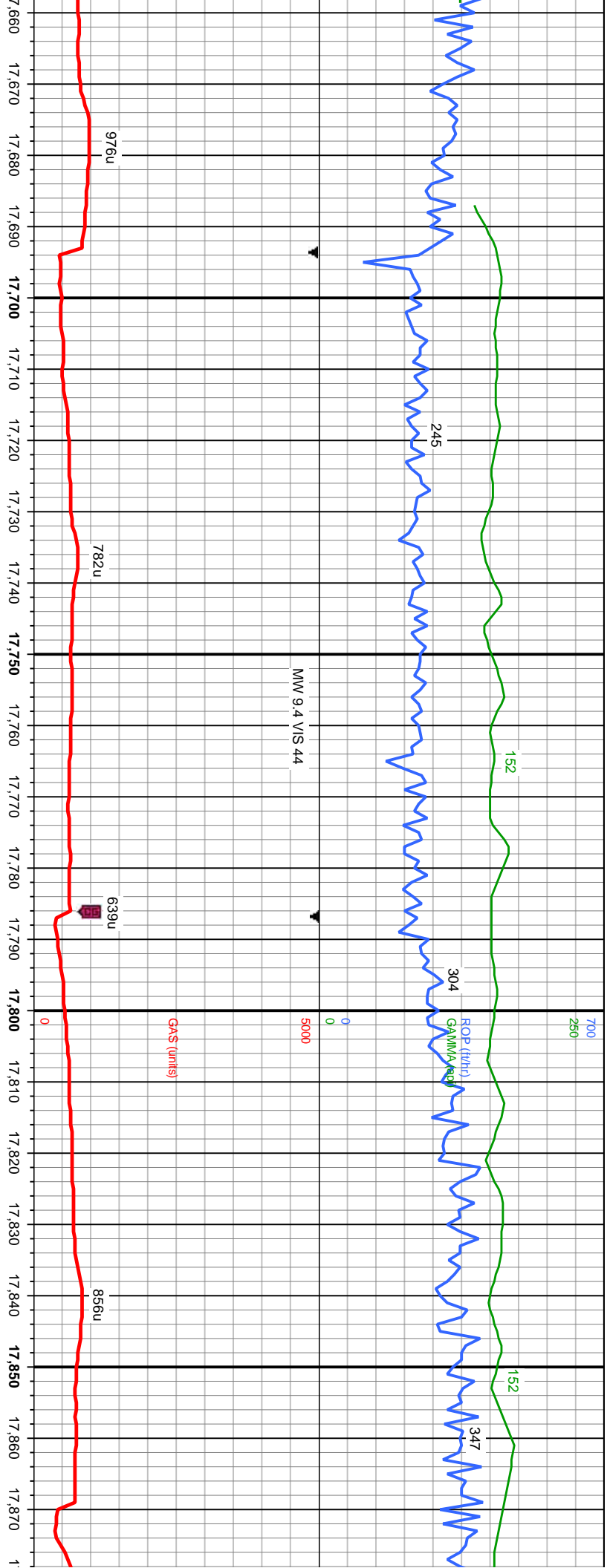
k g y, o c c m e d g y, t a n, f r m - h d, v f g r, s b		TVD (ft)		SS: p r e d d k g y, o c c m e d g y, t a n, f r m - h d, v f g r, s b a n g - s b r d, p - m o d s r t d, t t p o r s, v s l t y, v s i c a l c, S H: d k g y - b l k, f r m - h r d, s p l t - s b s p l t - s b r n d, s m - r t h y, n o n c a l c		SS: p r e d d k g y, o c c m e d g y, t a n, f r m - h d, v f g r, s b a n g - s b r d, p - m o d s r t d, t t p o r s, v s l t y, v s i c a l c, S H: d k g y - b l k, f r m - h r d, s p l t - s b s p l t - s b r n d, s m - r t h y, n o n c a l c	
p - m o d s r t d, t t p o r s, v s l t y, v s i c a l c:		7500					











MD: 17,670'
Inclination: 89.88°
Azimuth: 179°
TVD: 7,000'
VS: 10,184'

MD: 17,764'
Inclination: 90°
Azimuth: 180°
TVD: 7,001'
VS: 10,278'

WOB: 25.4klbs
RPM: 120rpm
SPM 1: 85spm
SPM 2: 85spm
SP: 4.480psi

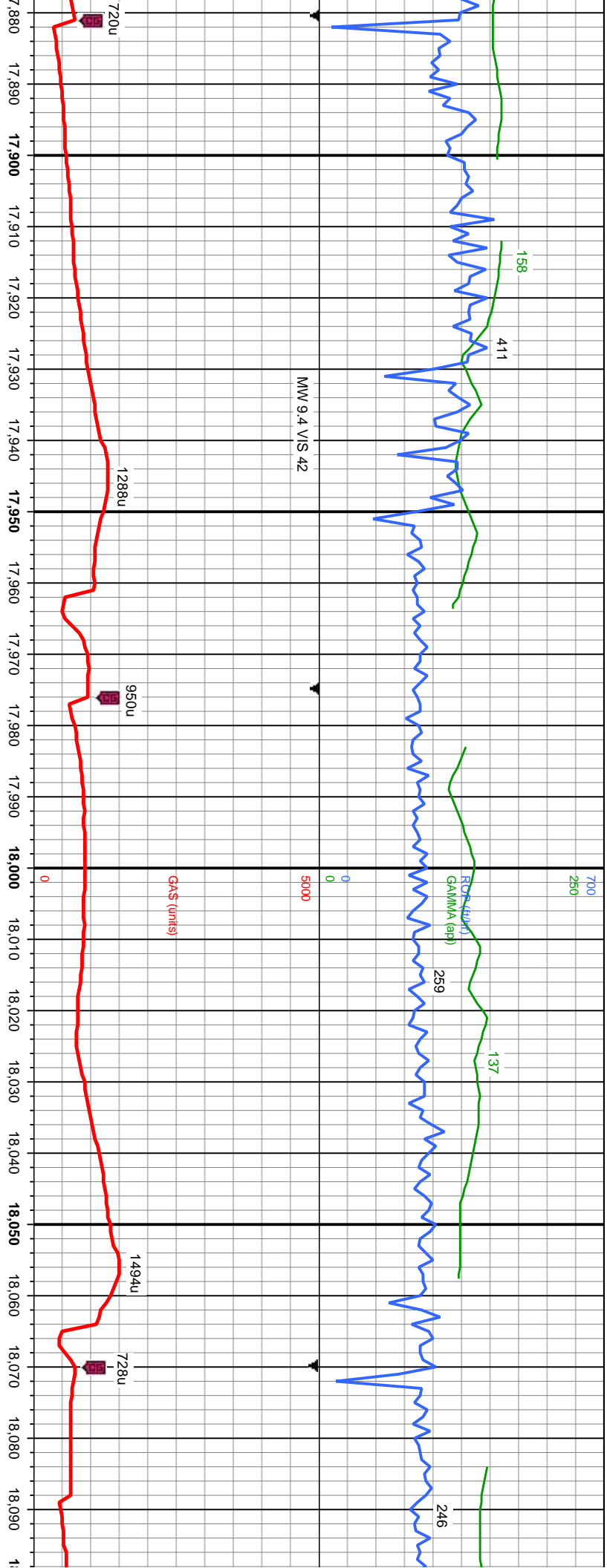
MD: 17,859'
Inclination: 90.43°
Azimuth: 180°
TVD: 7,000'
VS: 10,373'

ang-sb rd, p-mod strd, tt pors,
sb md, sm-rthy, sl calc

SS: pied dk gy, occ med gy, tan, frm-hd, v! gr, sb ang-sb rd, p-mod strd, tt pors,
v silty, v sl calc; SH: dk gy-blk, frm-hrd, spl-sb spl, sb md, sm-rthy, sl calc

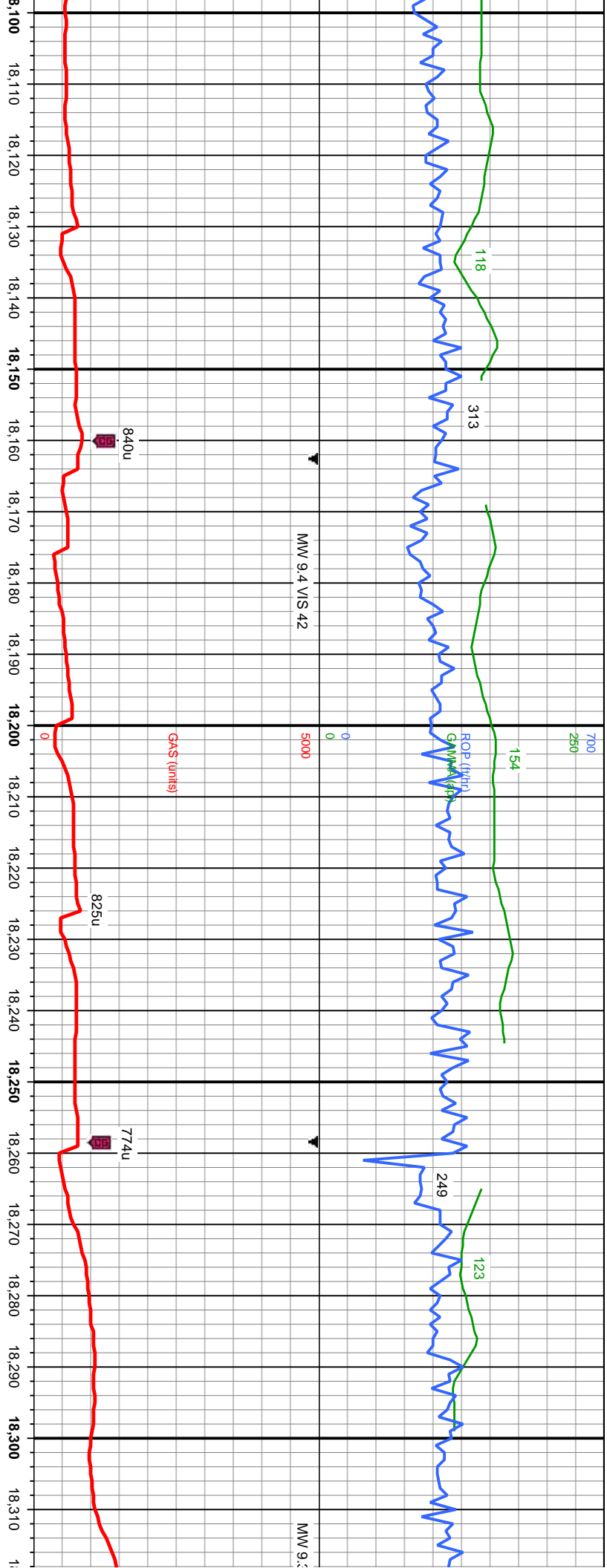
SS: pied dk gy, occ med gy, tan, frm-hd, v! gr, sb ang-sb rd, p-mod strd, tt
v silty, v sl calc; SH: dk gy-blk, frm-hrd, spl-sb spl, sb md, sm-rthy, sl calc





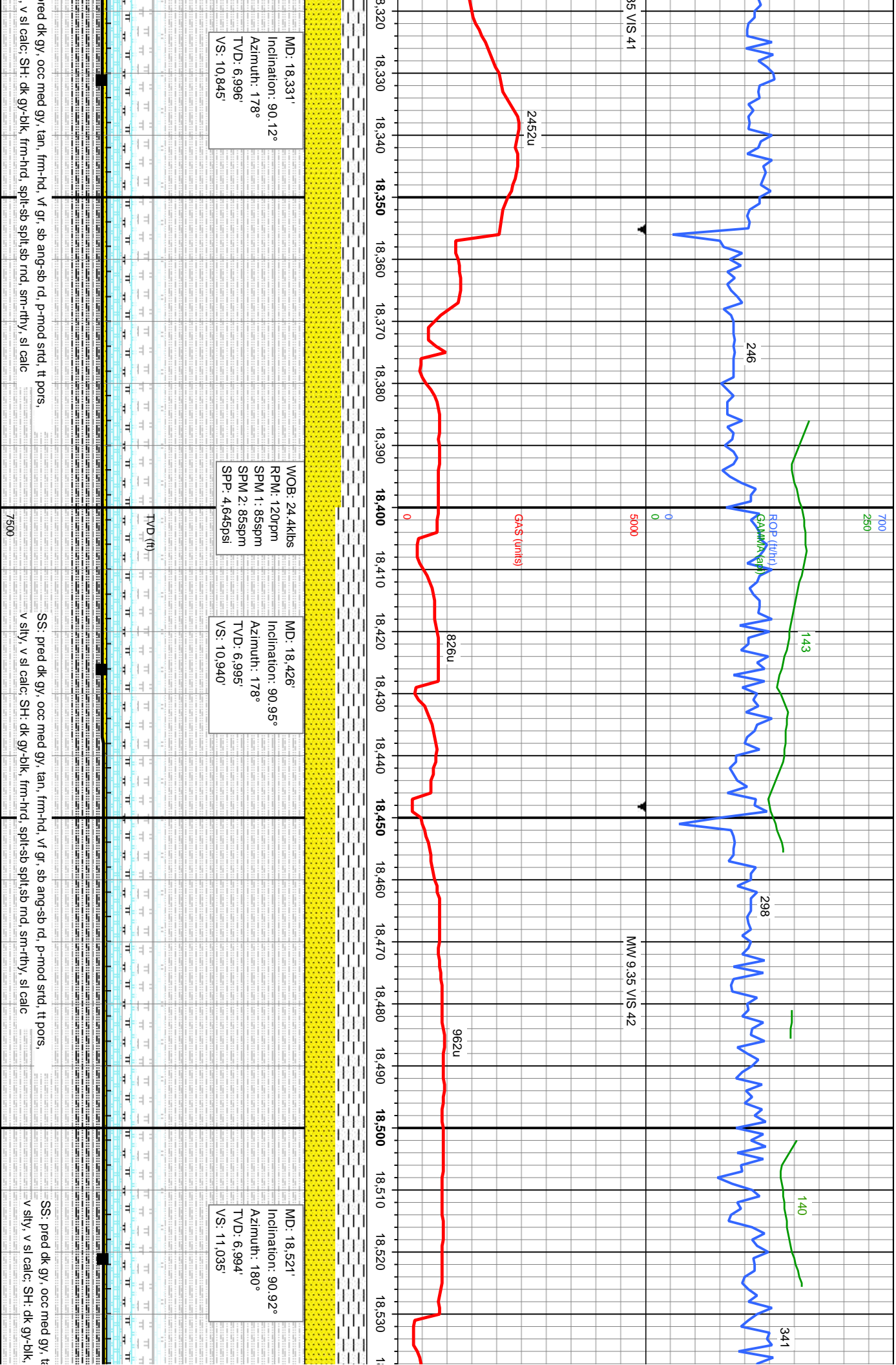
MD: 17,953' Inclination: 90.98° Azimuth: 179° TVD: 6,999' VS: 10,467'		MD: 18,047' Inclination: 91.02° Azimuth: 178° TVD: 6,997' VS: 10,561'	
SS: pred dk gy, occ med gy, tan, frm-hd, v/ gr, sb ang-sb rd, p-mod strd, tt pors, v silty, v sl calc; SH: dk gy-blk, frm-hrd, split-sb split-sb rnd, sm-rthy, sl calc		SS: pred dk gy, occ med gy, tan, frm-hd, v/ gr, sb ang-sb rd, p-mod strd, tt pors, v silty, v sl calc; SH: dk gy-blk, frm-hrd, split-sb split-sb rnd, sm-rthy, sl calc	

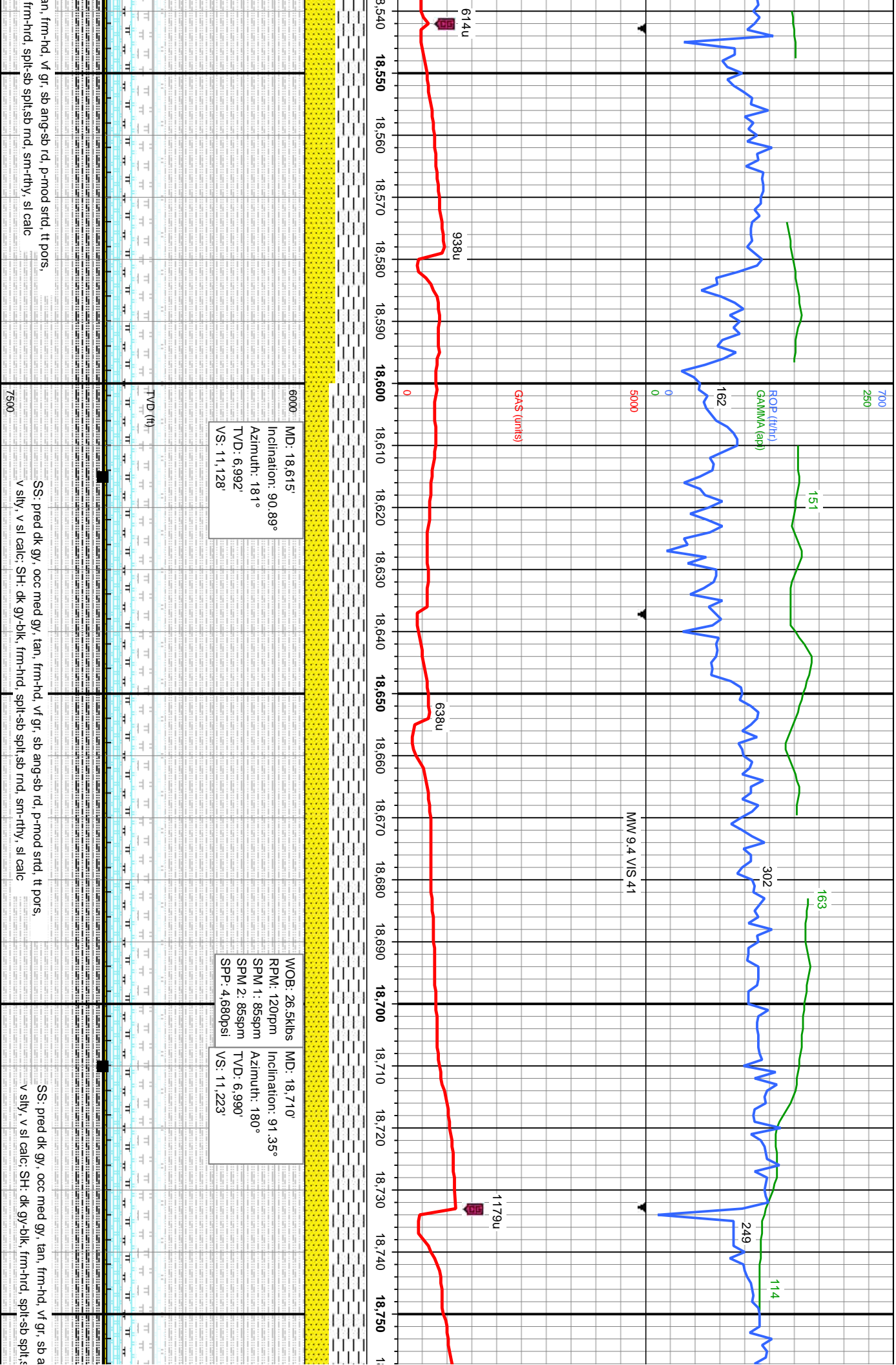


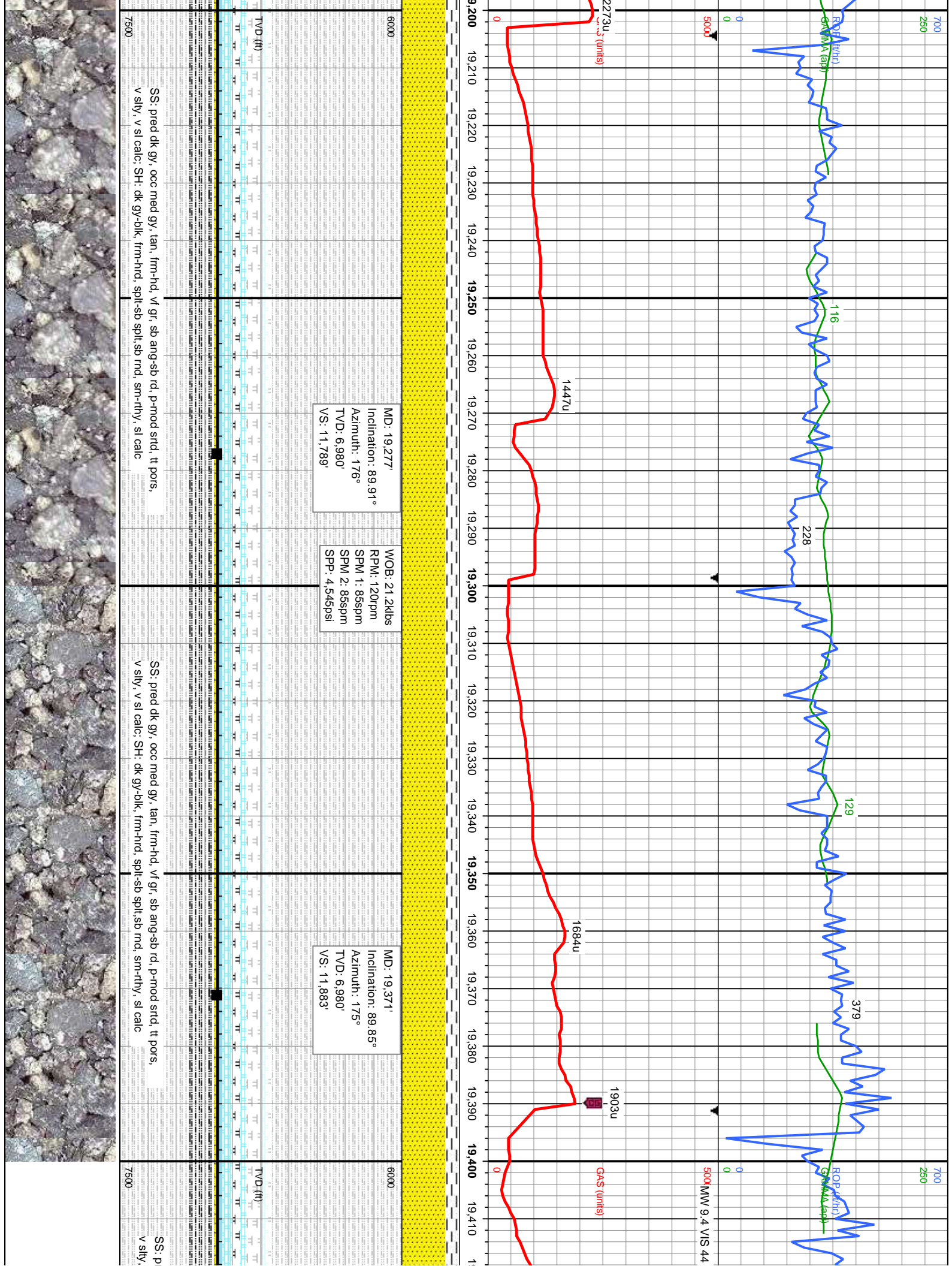


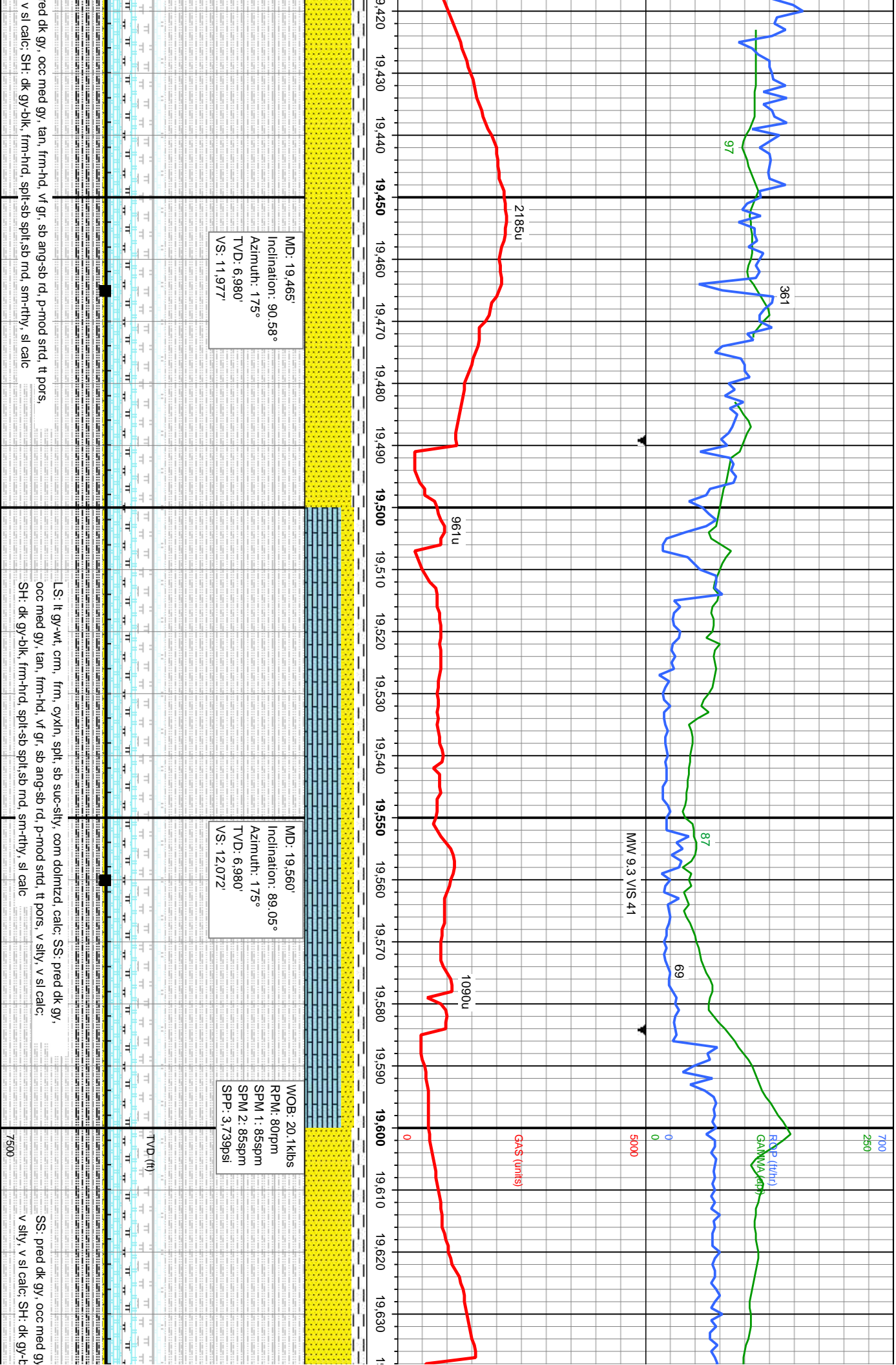
3: 23.7klbs : 120ppm 1: 85spm 2: 85spm 4: 525psi		MD: 18,142' Inclination: 90.12° Azimuth: 177° TVD: 6,996' VS: 10,656'		6000		MD: 18,237' Inclination: 90.15° Azimuth: 177° TVD: 6,996' VS: 10,751'		7500	
SS: pred dk gy, occ med gy, tan, frm-hd, vl gr, sb ang-sb rd, p-mod srtd, tt pors, v silty, v sl calc; SH: dk gy-blk, frm-hrd, split-sb split-sb md, sm-rthy, sl calc		TVD (ft)		SS: pred dk gy, occ med gy, tan, frm-hd, vl gr, sb ang-sb rd, p-mod srtd, tt pors, v silty, v sl calc; SH: dk gy-blk, frm-hrd, split-sb split-sb md, sm-rthy, sl calc		SS: f v silty			



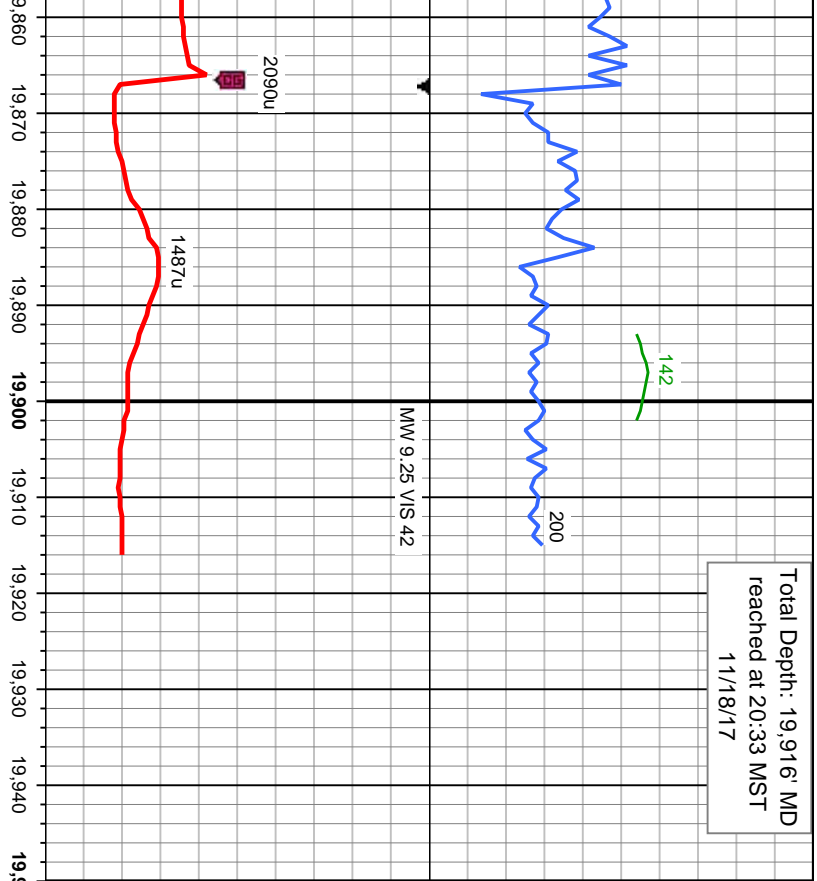








Total Depth: 19,916' MD
reached at 20:33 MST
11/18/17



MD: 19,892' Inclination: 89.72° Azimuth: 181° TVD: 6,985' VS: 12,404'		MD: 19,916' Inclination: 89.72° Azimuth: 181° TVD: 6,985' VS: 12,428'	
PTD		PTD	
WOB: 19.2klbs		WOB: 19.2klbs	
RPM: 120rpm		RPM: 120rpm	
SPM 1: 85spm		SPM 1: 85spm	
SPM 2: 85spm		SPM 2: 85spm	
SPP: 4,699psi		SPP: 4,699psi	
g-sb rd, p-mod strd, tt pors,		g-sb rd, p-mod strd, tt pors,	
b rd, sm-rthy, sl calc		b rd, sm-rthy, sl calc	

