



Scale: 5" / 100'
Measured Depth Log

Well Name Schaefer LD 13-032HC

Location SECTION 24, T1S, R67W

State COLORADO

County ADAMS

Country UNITED STATES

Rig Number PRECISION 460

API Number 050011025400

AFF # 19DC0008

Geographic Region DJ BASIN

Field WATTENBERG

Ground Elevation 5021.4'

K.B. Elevation 5041.4'

Logged Interval 6000' MD To 18218' MD

Total Depth 18218' MD

Formation CODELL

Type of Drilling Fluid OIL BASED MUD

Operator

Company Great Western Operating Company, LLC

Address 1001 17th Street, Suite 2000
Denver, CO 80202



Geologist

Name Joey Luce, Zac Olds, Mark Sowinski

Company Terra Guidance

Address 67 W. Floyd Ave. Ste 105
Englewood, CO 80110
(970) 260-5408



Other

MUDLOG START DATE 01/28/2019
MUDLOG END DATE 02/01/2019

Color Coding

- Oil
- Condensate
- Gas
- Note
- Core
- Pressure
- Error
- Water
- Seal

Rock Types

- Sandstone
- SILTSTONE
- SIDERITE or LIMONITE
- CONGLOMERATE
- LIMESTONE
- SANDSTONE
- DOLOMITE
- BRECCIA
- Chalk
- BENTONITE
- CHERT
- Tuff
- Marl
- CEMENT
- COAL
- MARLSTONE
- SHALE
- UNKNOWN
- ANHYDRITE
- CLAYSTONE
- Silty Shale
- GYPSUM
- SHALE GRAY
- Silty Sandstone
- SALT
- SHALE COLORED
- TUFF
- IGNEOUS
- METAMORPHIC
- CALCARIOUS SHALE

Fossils

- GASTROPOD
- B BENTONITE
- OOLITE
- BITUMINE
- ALGAE
- OSTRACOD
- BRECCIA
- AMPHIPODA
- PELECYPOD
- PELECYPOD
- BELEMNITE
- CARBO
- BIOLASTIC
- PISOLITE
- CHITIN
- BRACHIOPOD
- PLANT REMAINS
- BRACHIOPOD
- PLANT SPORES
- CEPHALOPOD
- SCAPHOPOD
- STROMATOPOROID
- CRINOID
- FERRUGINOUS
- FERRUG
- ECHINOID
- FERRUG
- FISH
- ANHYDRITIC
- GLAUC
- FORAMINIFERA
- ARGILLACEOUS
- GYPSIF
- F FOSSIL
- ARGILLITE GRAIN
- HEAVY

Minerals

Porosity

- DEAD
- EVEN
- QUESTIONABLE
- SPOTTED STAINING
- BIT
- CASING
- CONNECTION (LEFT)
- CONNECTION (RIGHT)
- CONNECTION GAS
- F FRACTURE
- CORE - LOST
- INTERCRYSTALLINE
- CORE - RECOVERED
- INTEROOLITIC
- DST INTERVAL
- FAULT
- MOLDIC

Engineering

- ORGANIC
- P PINPOINT
- VUGGY
- QUESTIONABLE
- SPOTTED STAINING
- BIT
- CASING
- CONNECTION (LEFT)
- CONNECTION (RIGHT)
- CONNECTION GAS
- F FRACTURE
- CORE - LOST
- INTERCRYSTALLINE
- CORE - RECOVERED
- INTEROOLITIC
- DST INTERVAL
- FAULT
- MOLDIC

Accessories

NITE	K KAOLIN	COAL STRINGER
INOUS SUBSTANCE	TT MARLSTONE	DOLOMITE STRINGER
IA FRAGMENTS	MINERAL CRYSTALS	GYPSUM STRINGER
NEOUS	MODULES	LMESTONE STRINGER
ANCEOUS FLAKES	PHOSPHATE PELLETS	TT MARLSTONE (CALC) STRG
	P PYRITE	TT MARLSTONE (DOL) STRG
THIN BEDS	SALT CAST	TT MARLSTONE (DOL) STRG
ITIC	SANDY	SANDSTONE STRINGER
AR	SILICEOUS	SHALE STRINGER
	SILTY	SILTSTONE STRINGER
IGINOUS PELLET	TUFFACEOUS	CALC SHALE
GINOUS		CHALK

Stringer

ANHYDRITE STRINGER
BENTONITE STRINGER

Other Symbols

FORMATION TOP	L LITHOGRAPHIC
GAS SHOW	MX MICROXLN
DEPTH MN DEPTH	ANGULAR
ORMAL FAULT	ROUNDED
OIL SHOW	SUBANG
VERTURNED STRATA	SUBRND
REVERSE FAULT	
SIDEWALL CORE (LEFT)	
SIDEWALL CORE (RIGHT)	BOUNDSTONE
LIDE	CHALKY
	W WELL
SURVEY	CRYPTOXLN
TRIP GAS	E EARTHY
WIRELINE TESTED - LEFT	FINELYXLN
WIRELINE TESTED - RT	GRAINSTONE

Rounding

ANGULAR	MUDSTONE
ROUNDED	PACKSTONE
SUBANG	WACKESTONE

Sorting

MODERATE	POOR	WELL
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Textures

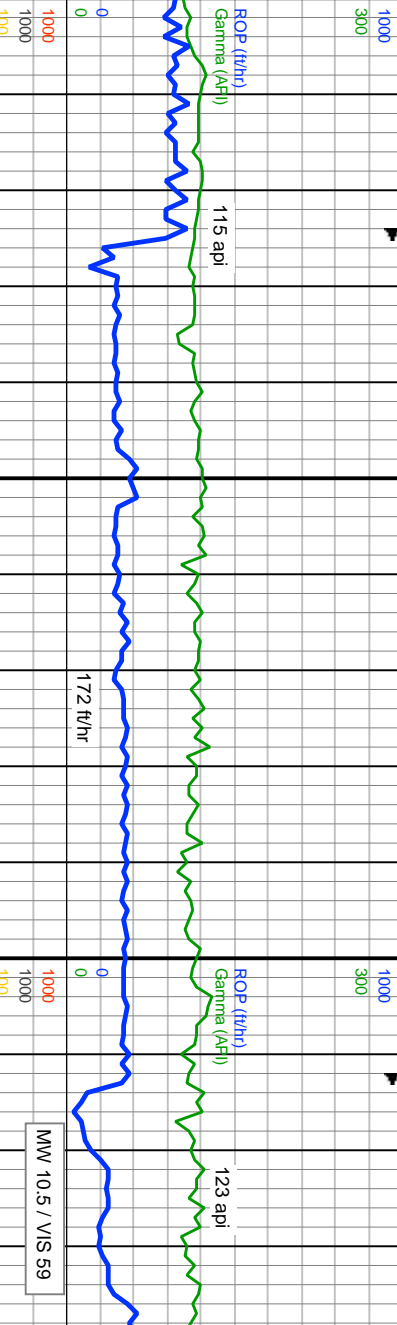
CALCARIUS SHALE

CALCARIOUS SHALE

TERRA GUIDANCE
BEGAN LOGGING @ 04:06 MST 01/29/2019
BLOODHOUND GAS CHROMATOGRAPH #5122
100' Sample Collection

ROP
ROP
Gamma

GAPS IN GAMMA DATA DUE
TO HIGH RATES OF PENETRATION



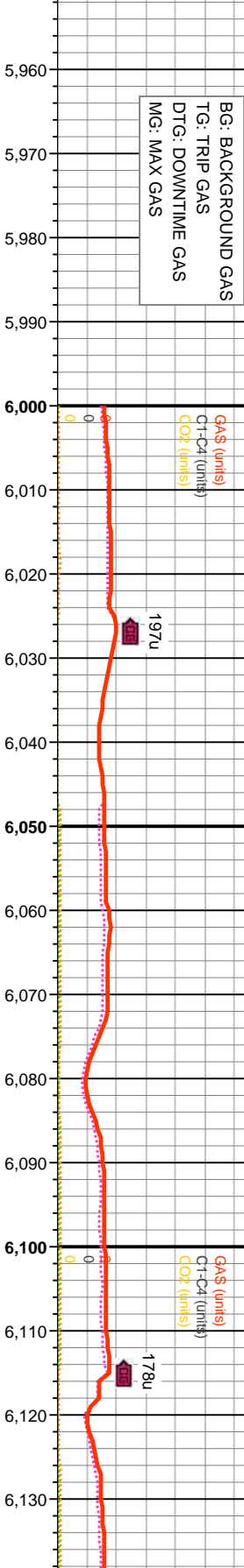
MW 10.5 / VIS 59

Total Gas & Chromatograph

GAS
C1
C2
C3
C4
CO2

BG: BACKGROUND GAS
TG: TRIP GAS
DTG: DOWNTIME GAS
MG: MAX GAS

Gas Scale
0 - 1000 Units



Depth

Images



% Lithology



TVD Scale
5900' - 8500'

MD: 6.001'
INC: 22.43°
AZM: 191.52°
TVD: 5.983.23'
VS: -133.55'

MD: 6.090'
INC: 25.05°
AZM: 189.32°
TVD: 6.064.69'
VS: -168.58'

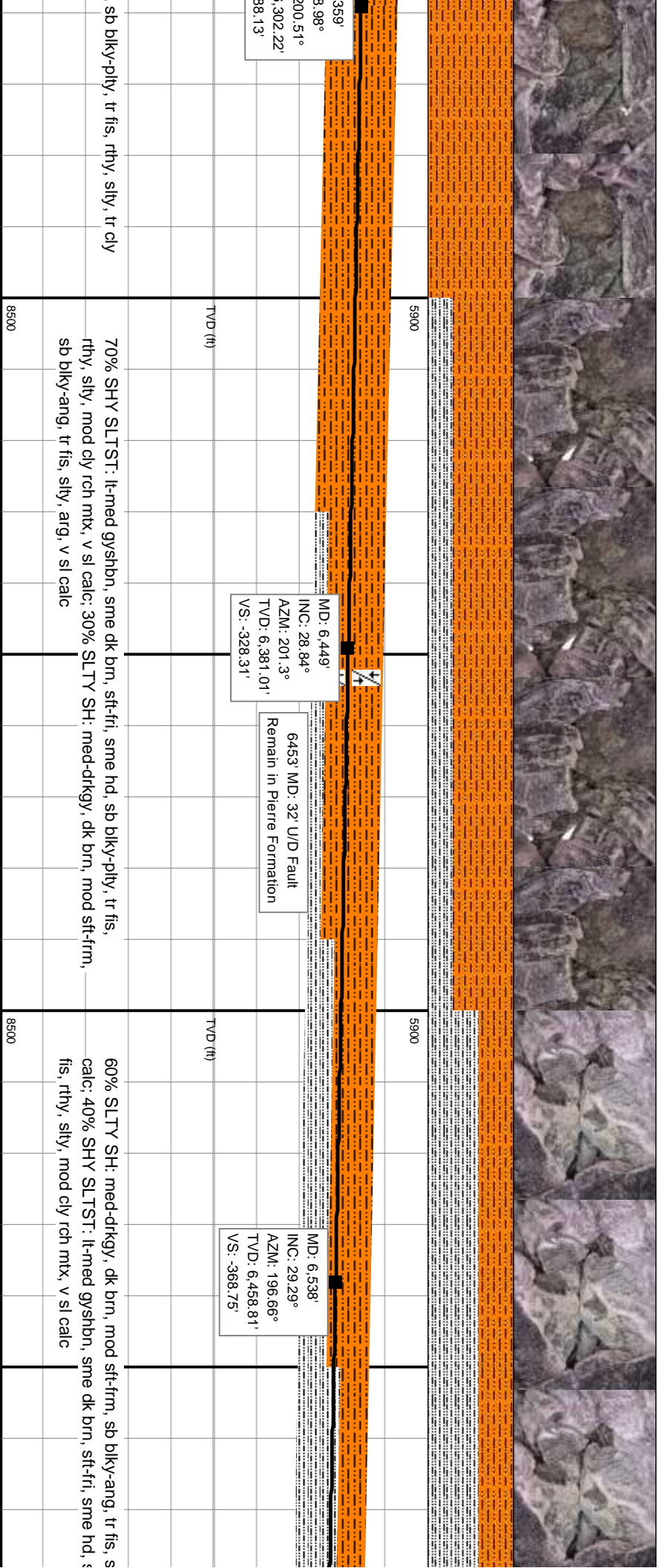
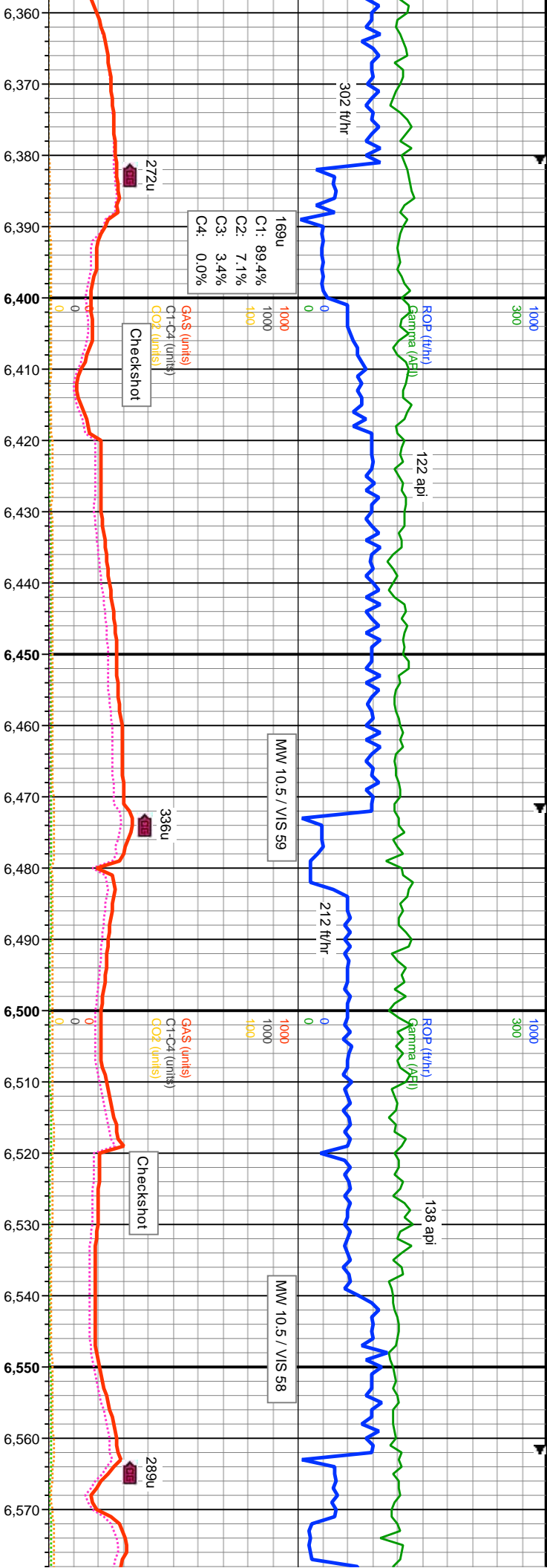
Well Bore
TVD

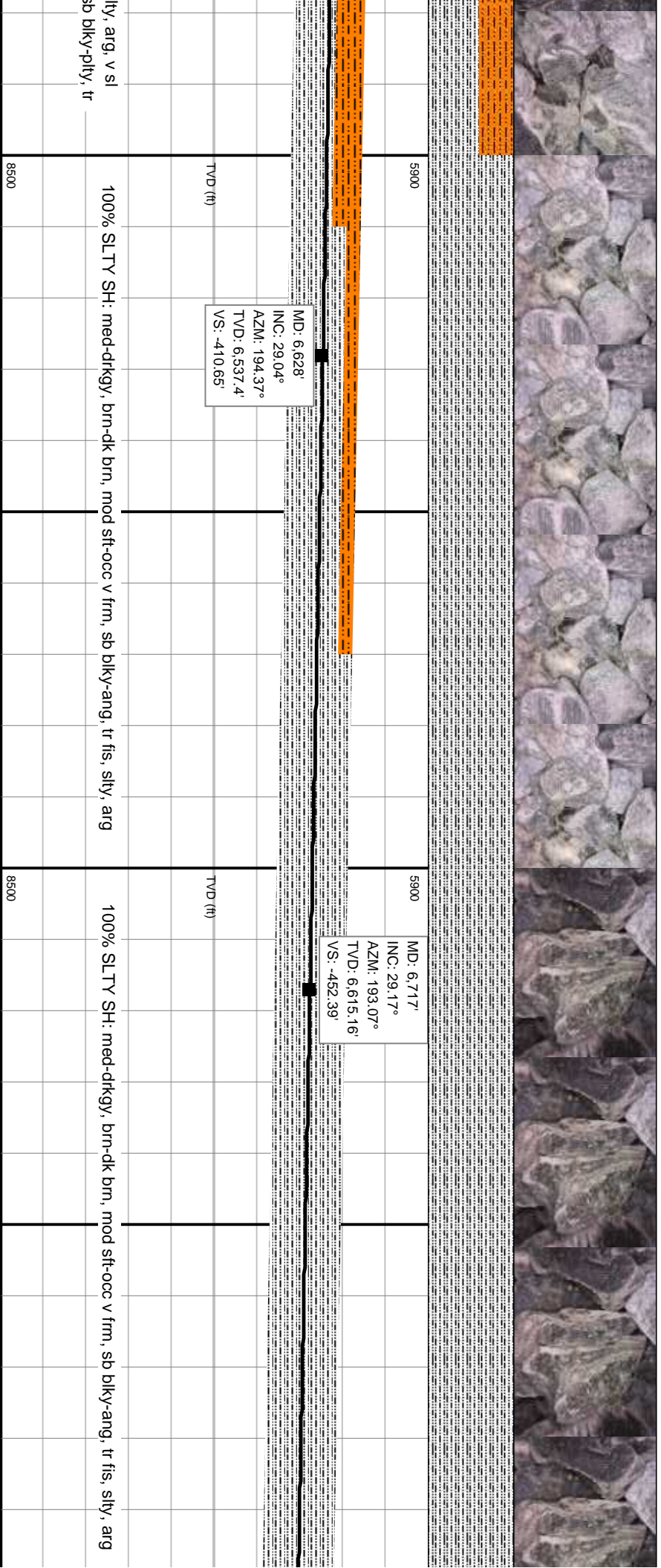
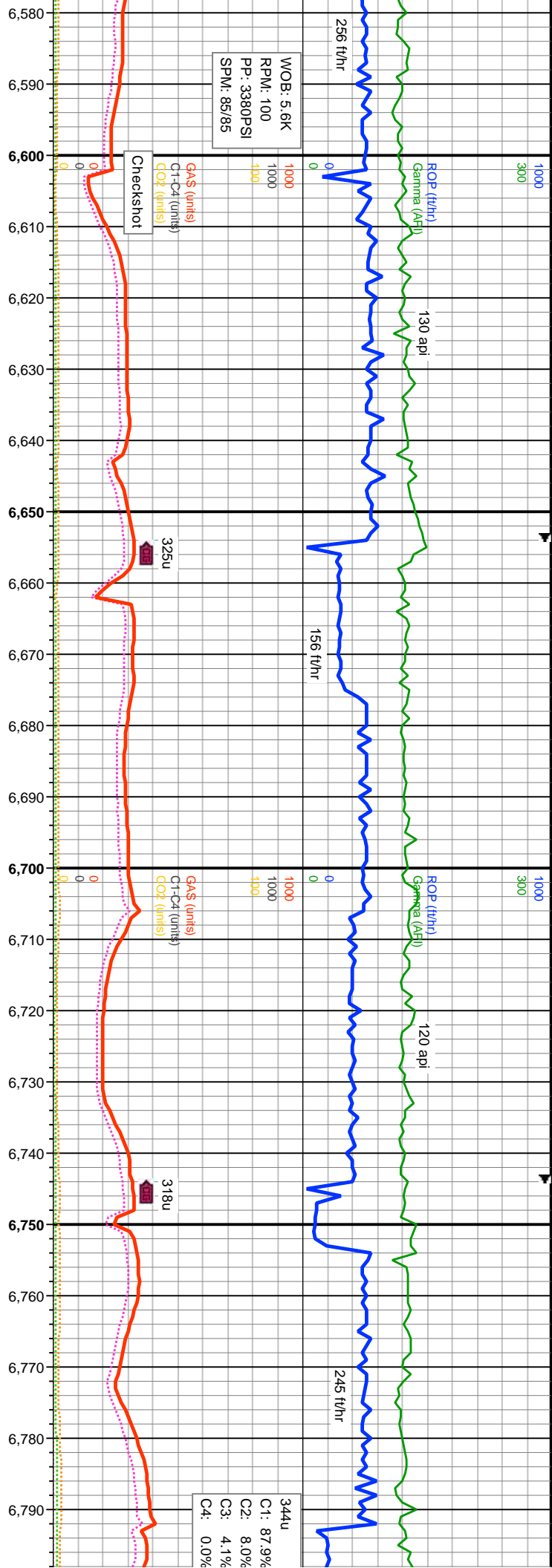
Bit #: 1
Size: 8.5
Make: Ulterra
Model: SPL516
Depth In: 1,784
Jets: 4x11, 4x12
S/N: 41556

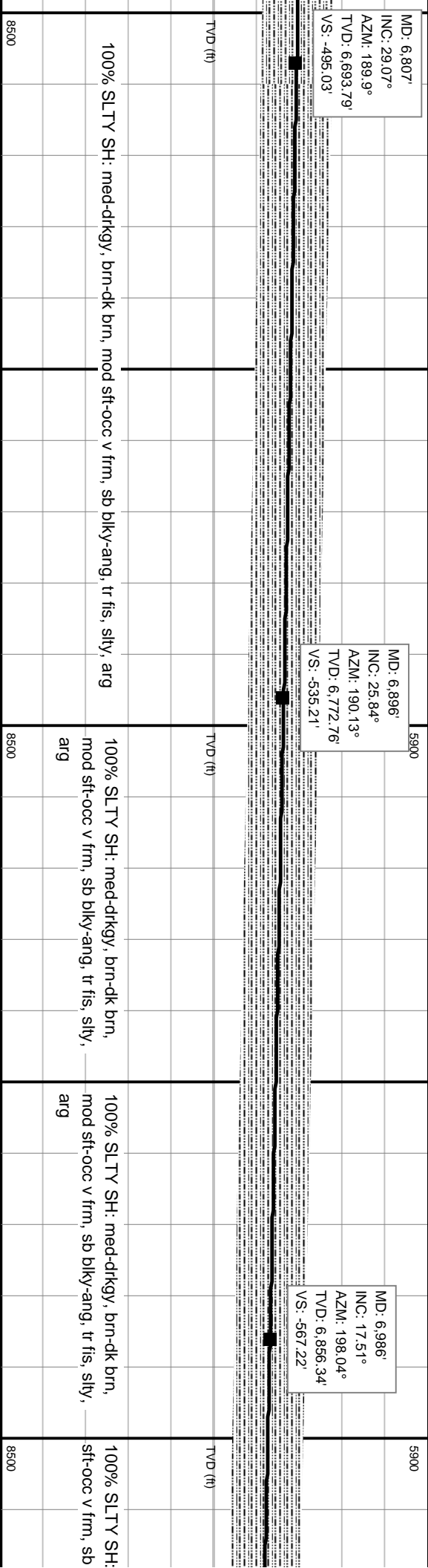
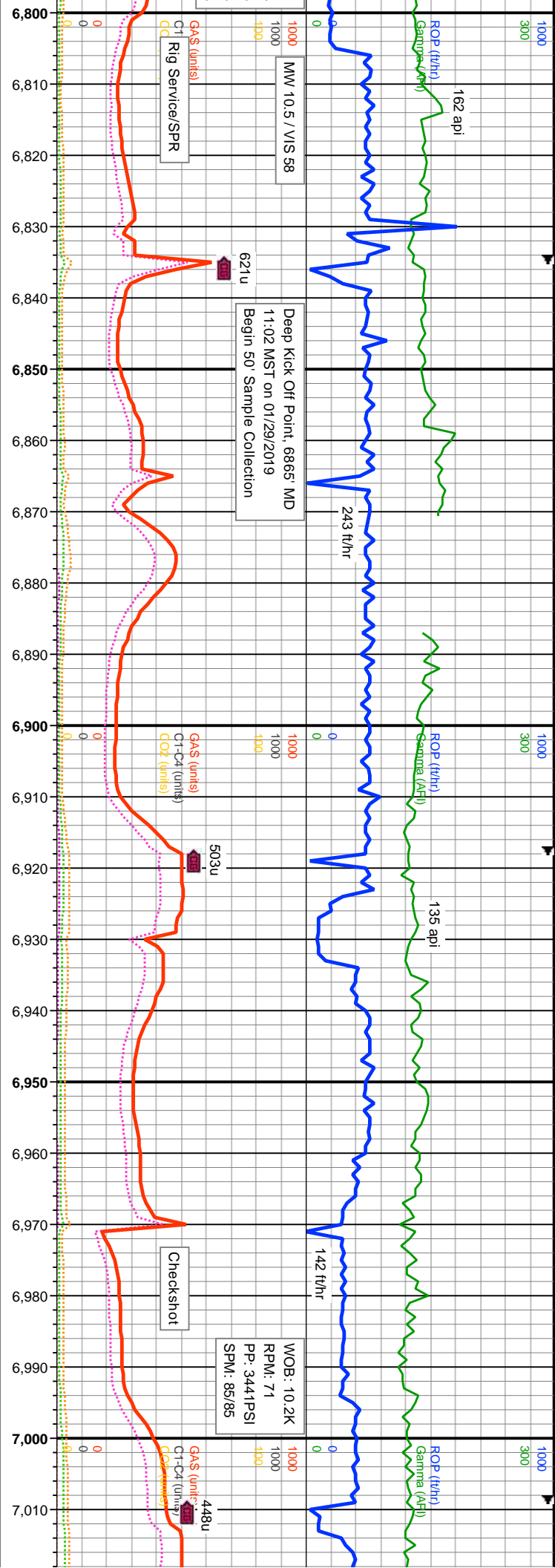
100% SHY SLTST: med-sme itgy, sft-fri, sb blk-y-plty, rthy, silty, mod cly rch mtx, v sl calc

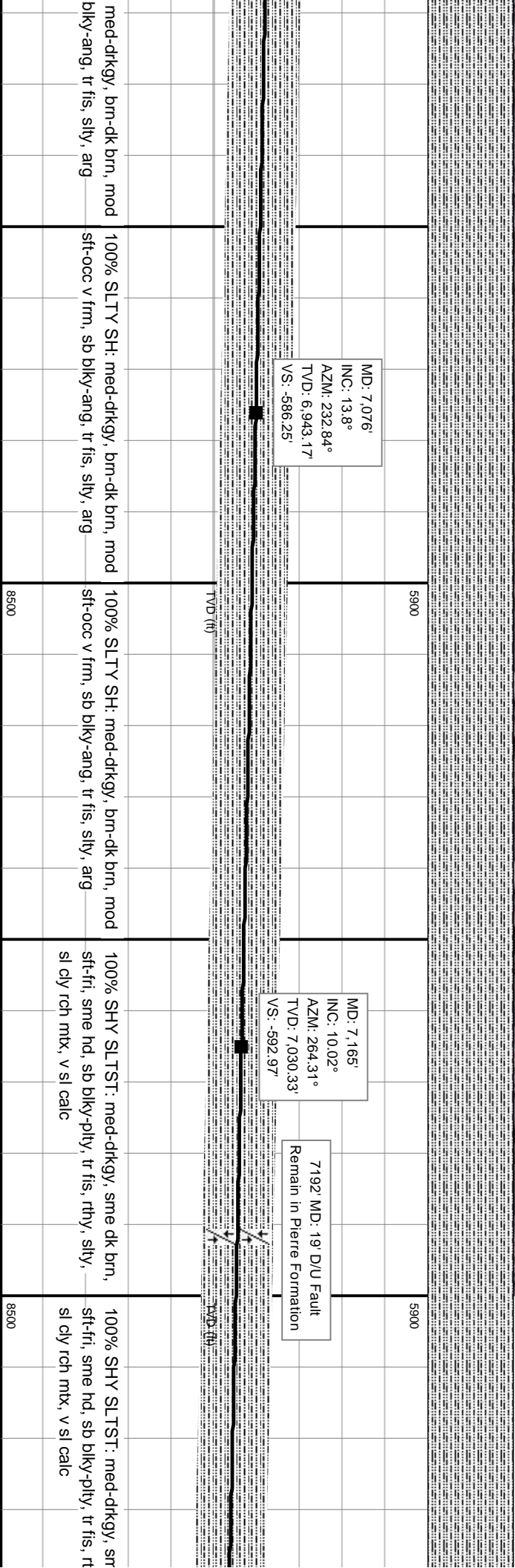
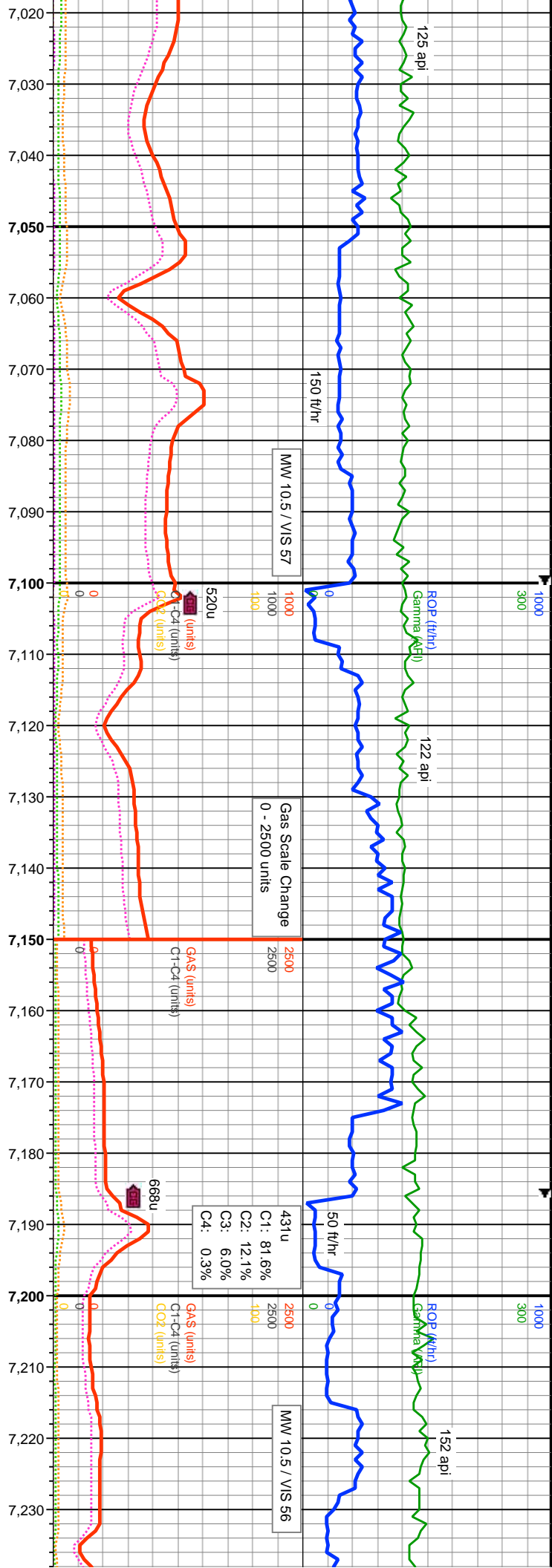
100% SHY SLTST: med-sme itgy

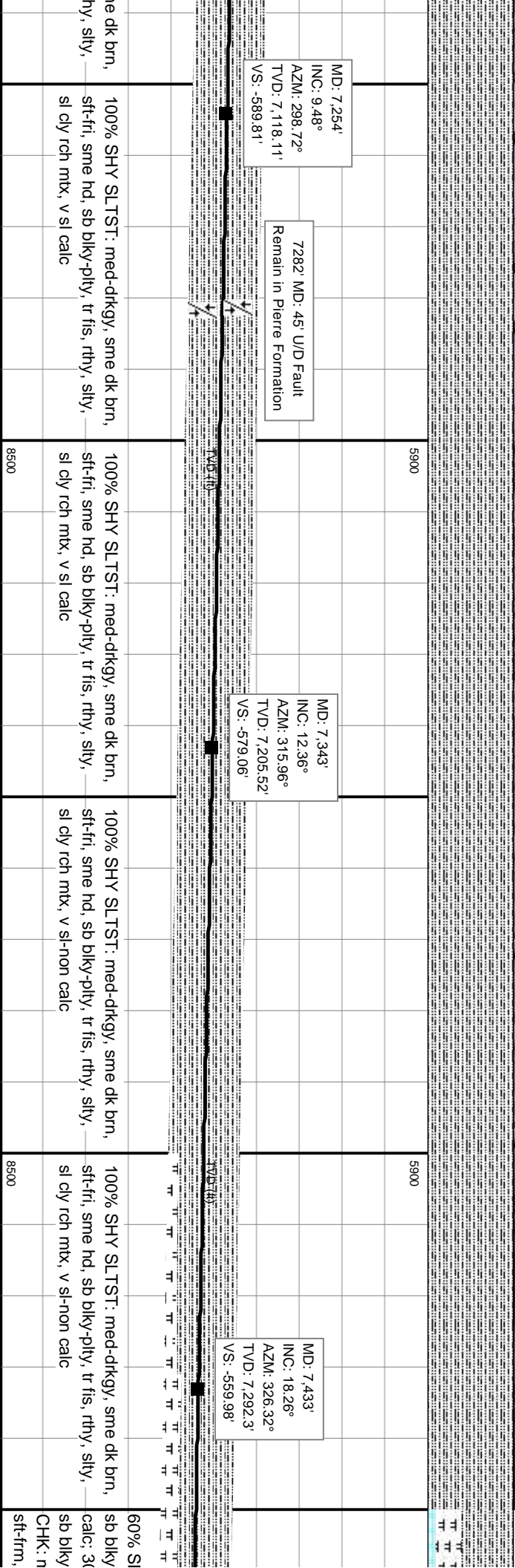
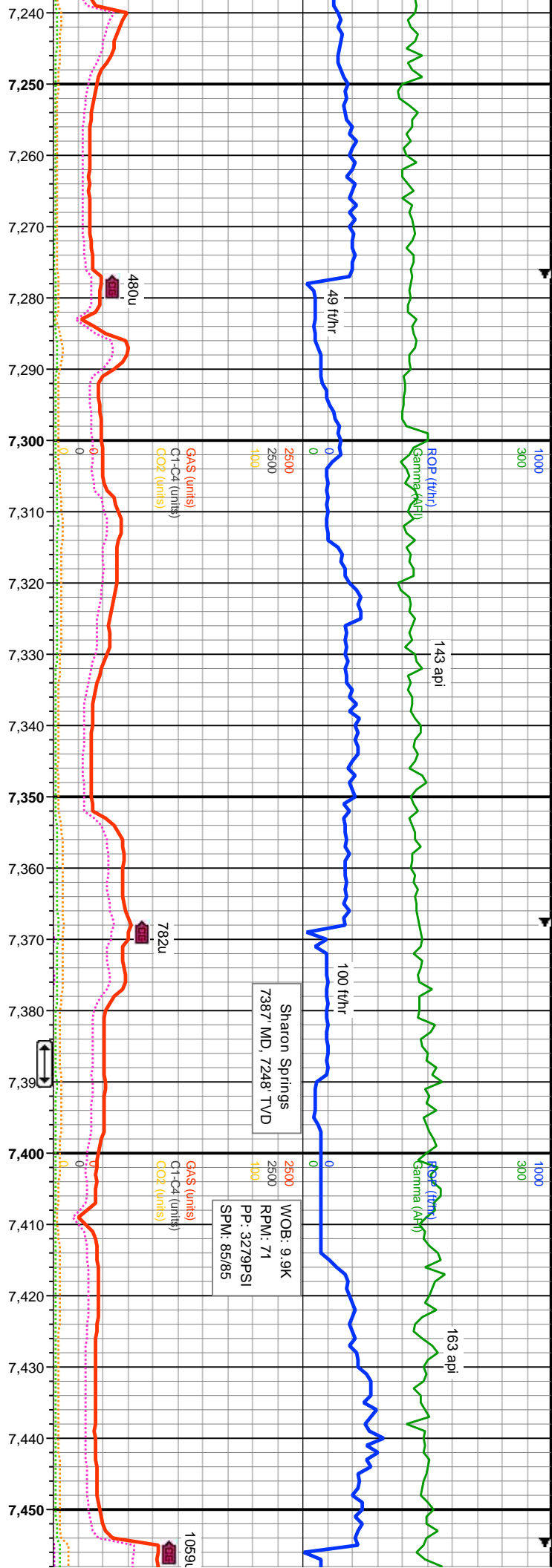












MD: 7,254'
INC: 9.48°
AZM: 298.72°
TVD: 7,118.11'
VS: -589.81'

7282 MD: 45' U/D Fault
Remain in Pierre Formation

MD: 7,343'
INC: 12.36°
AZM: 315.96°
TVD: 7,205.52'
VS: -579.06'

MD: 7,433'
INC: 18.26°
AZM: 326.32°
TVD: 7,292.3'
VS: -559.98'

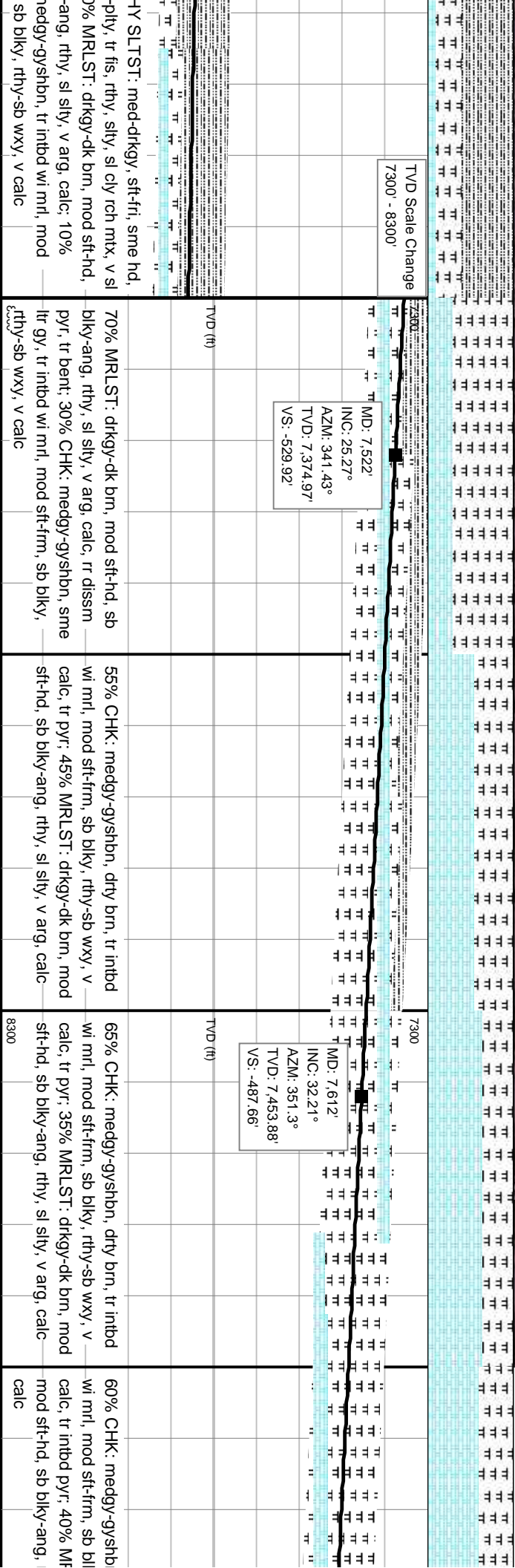
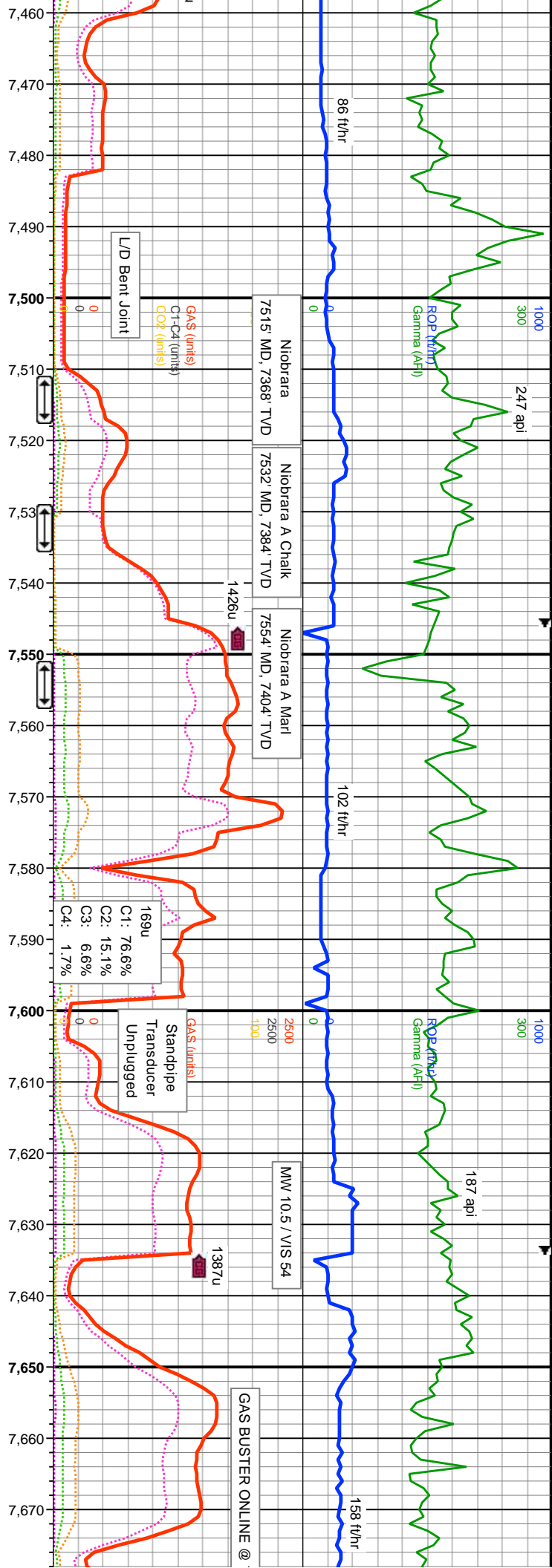
100% SHY SLTST: med-dkgy, sme dk brn,
sft-frt, sme hd, sb blkyp-pty, tr fls, rthy, slty,
sl cly rch mtx, v sl calc

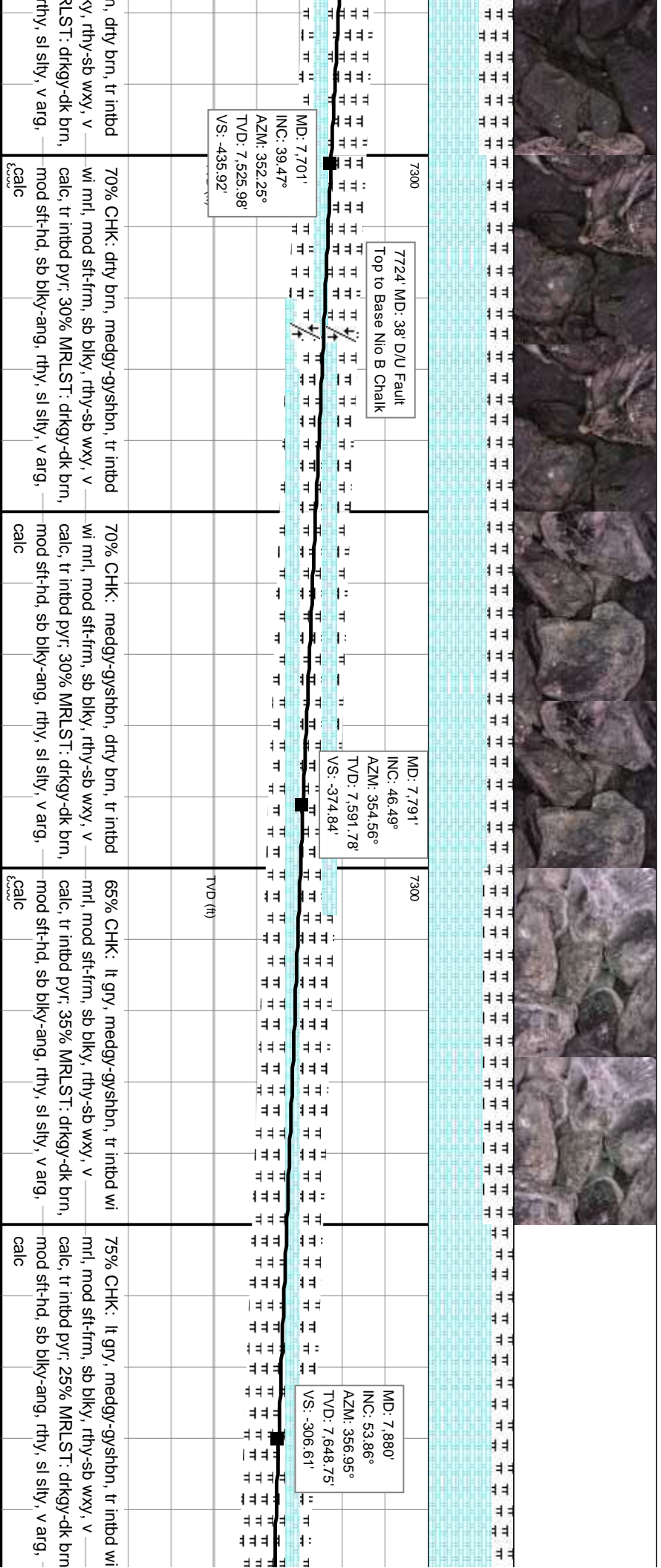
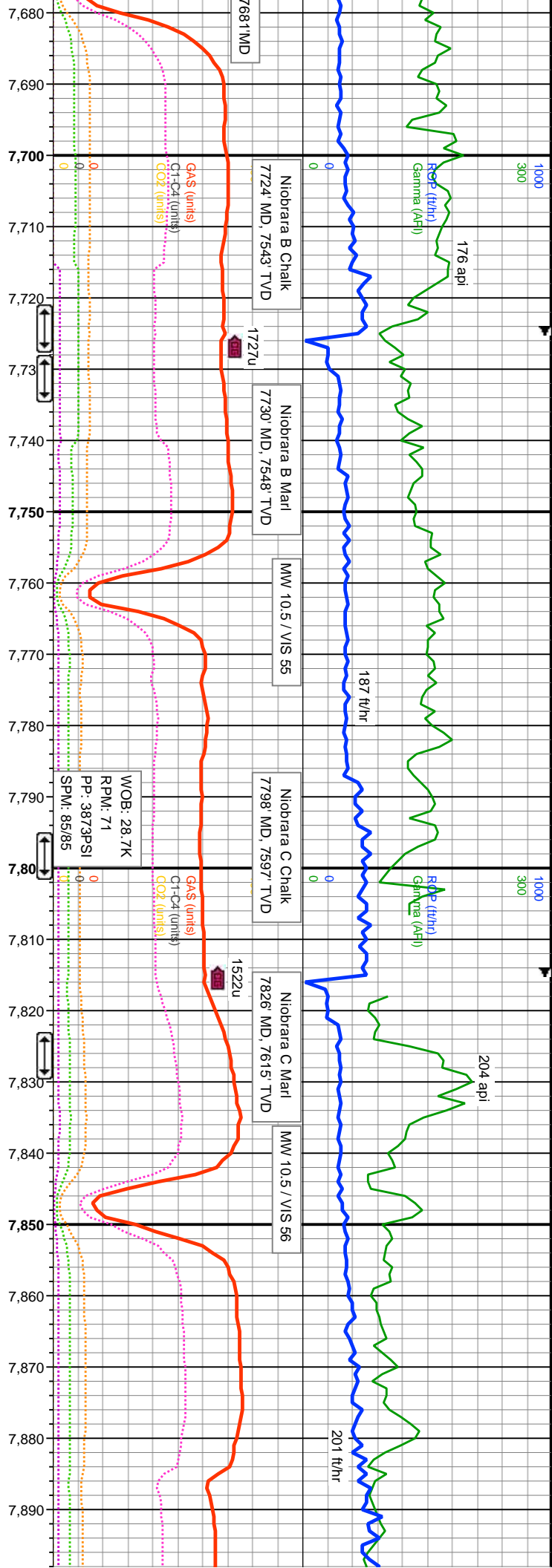
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sft-frt, sme hd, sb blkyp-pty, tr fls, rthy, slty,
sl cly rch mtx, v sl calc

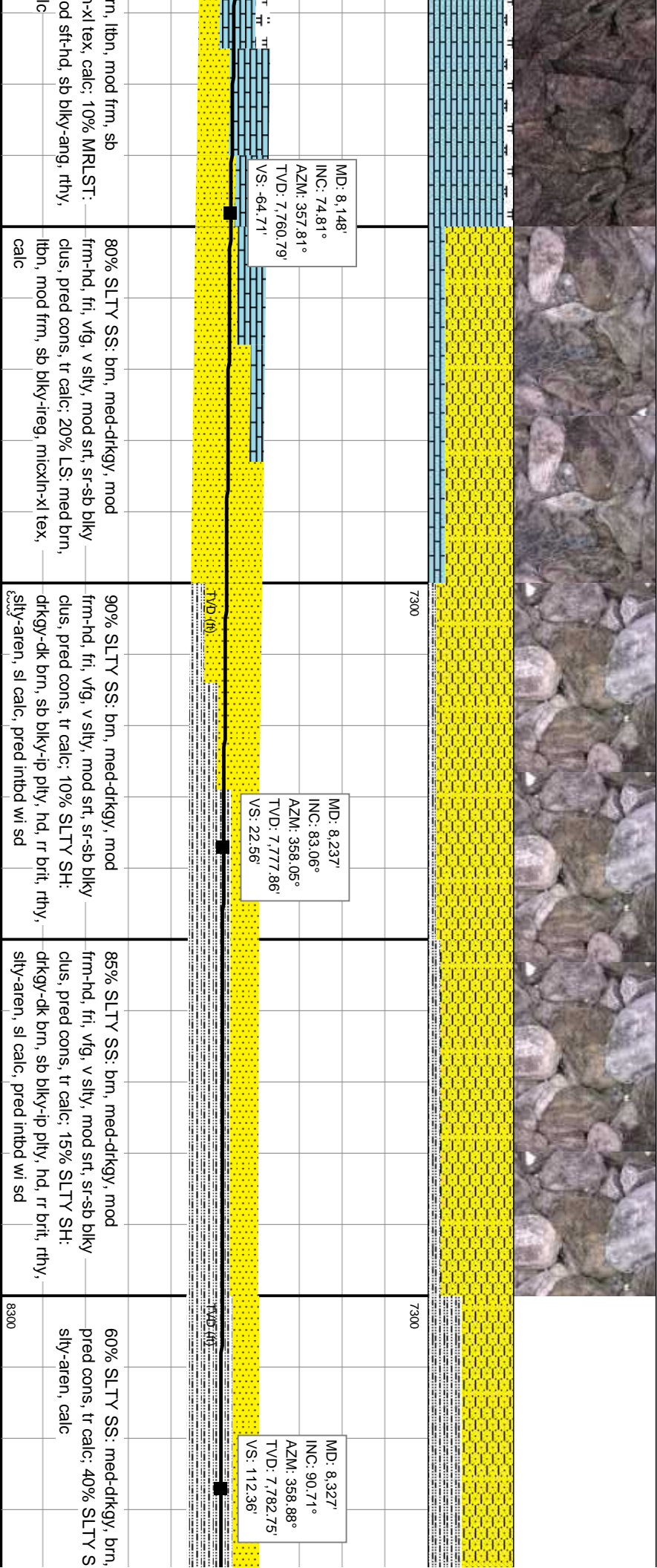
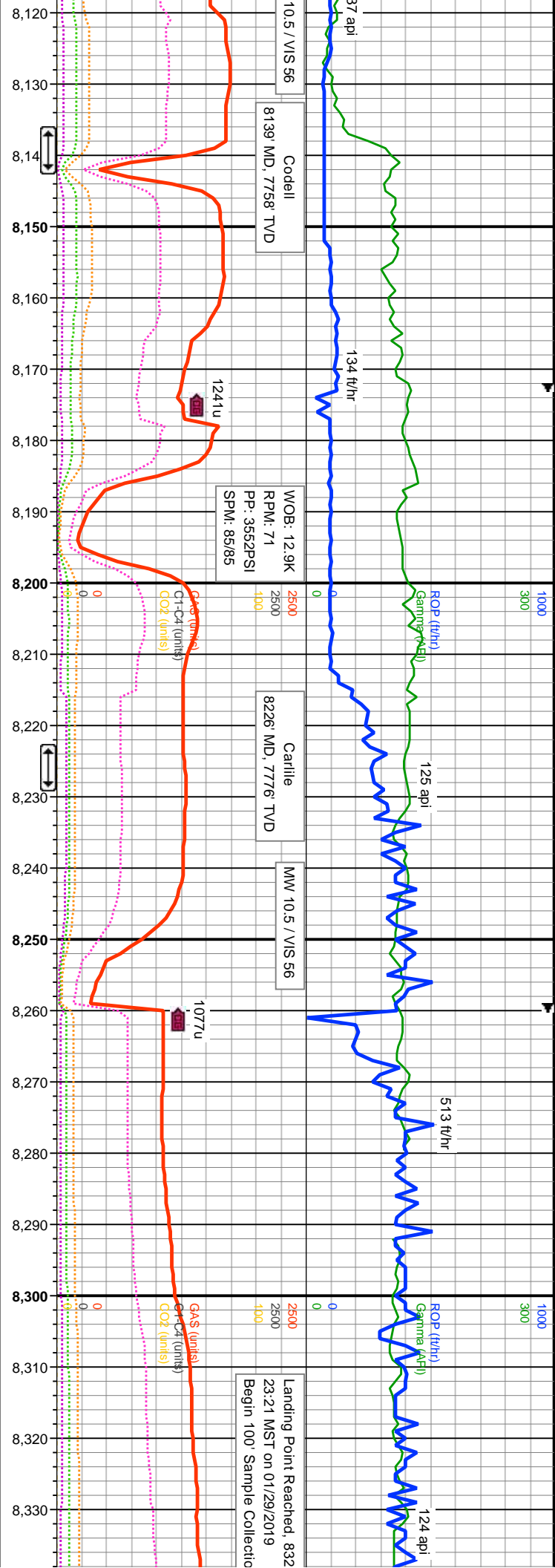
100% SHY SLTST: med-dkgy, sme dk brn,
sft-frt, sme hd, sb blkyp-pty, tr fls, rthy, slty,
sl cly rch mtx, v sl-non calc

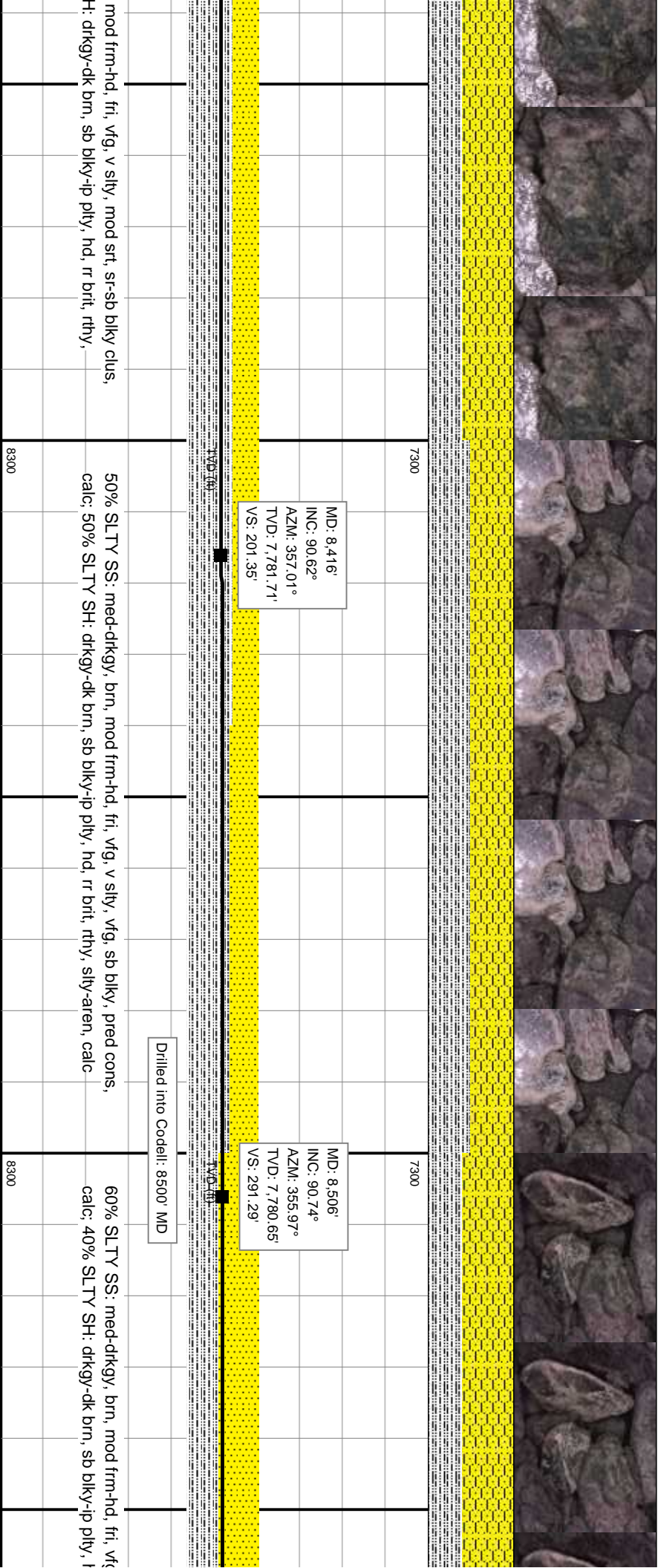
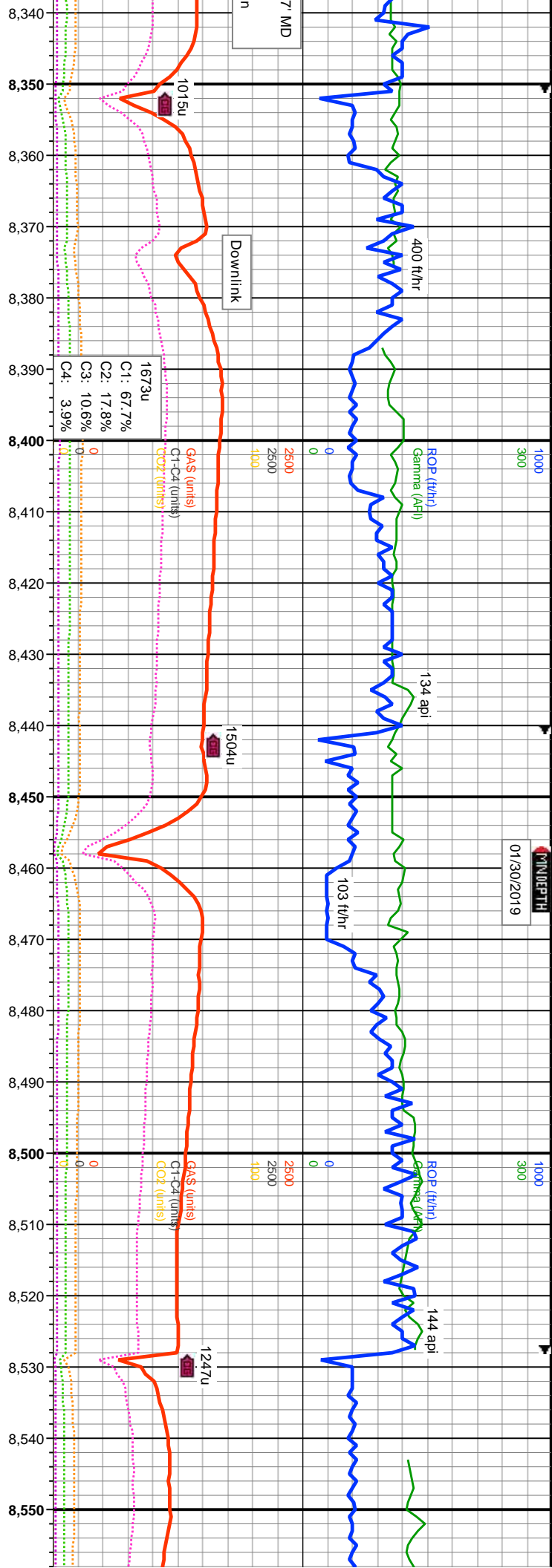
100% SHY SLTST: med-dkgy, sme dk brn,
sft-frt, sme hd, sb blkyp-pty, tr fls, rthy, slty,
sl cly rch mtx, v sl-non calc

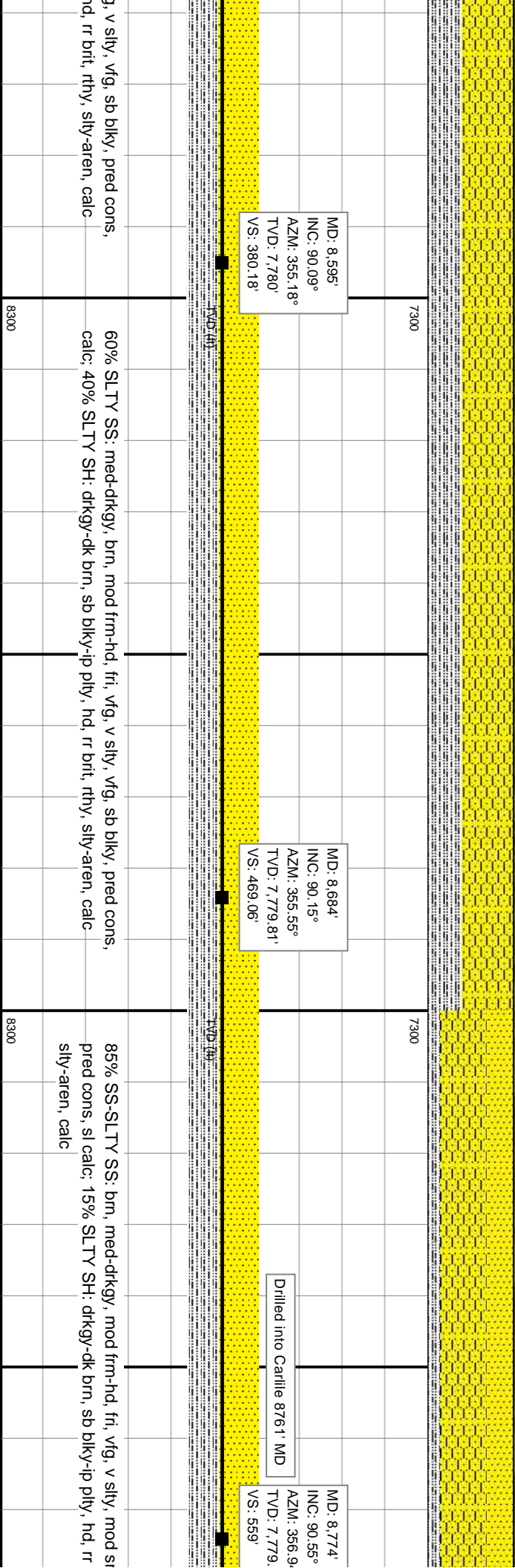
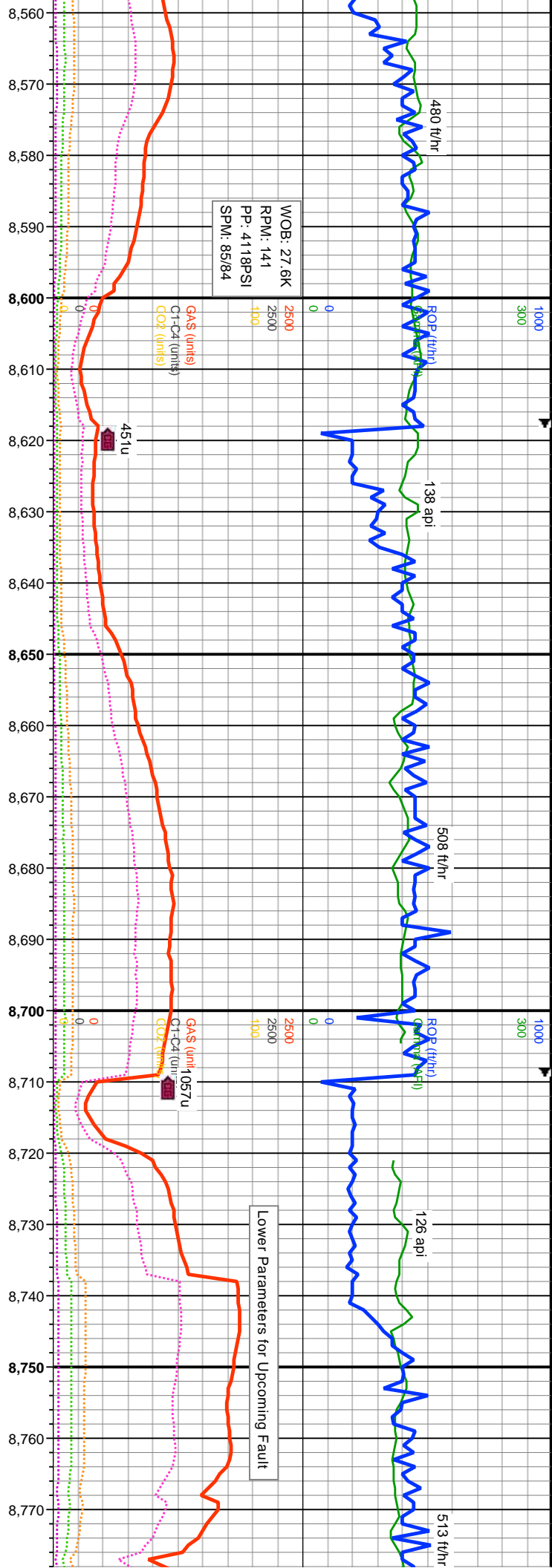
60% SI
sb blkyp
calc: 30
sb blkyp
CHK: n
sft-frm,

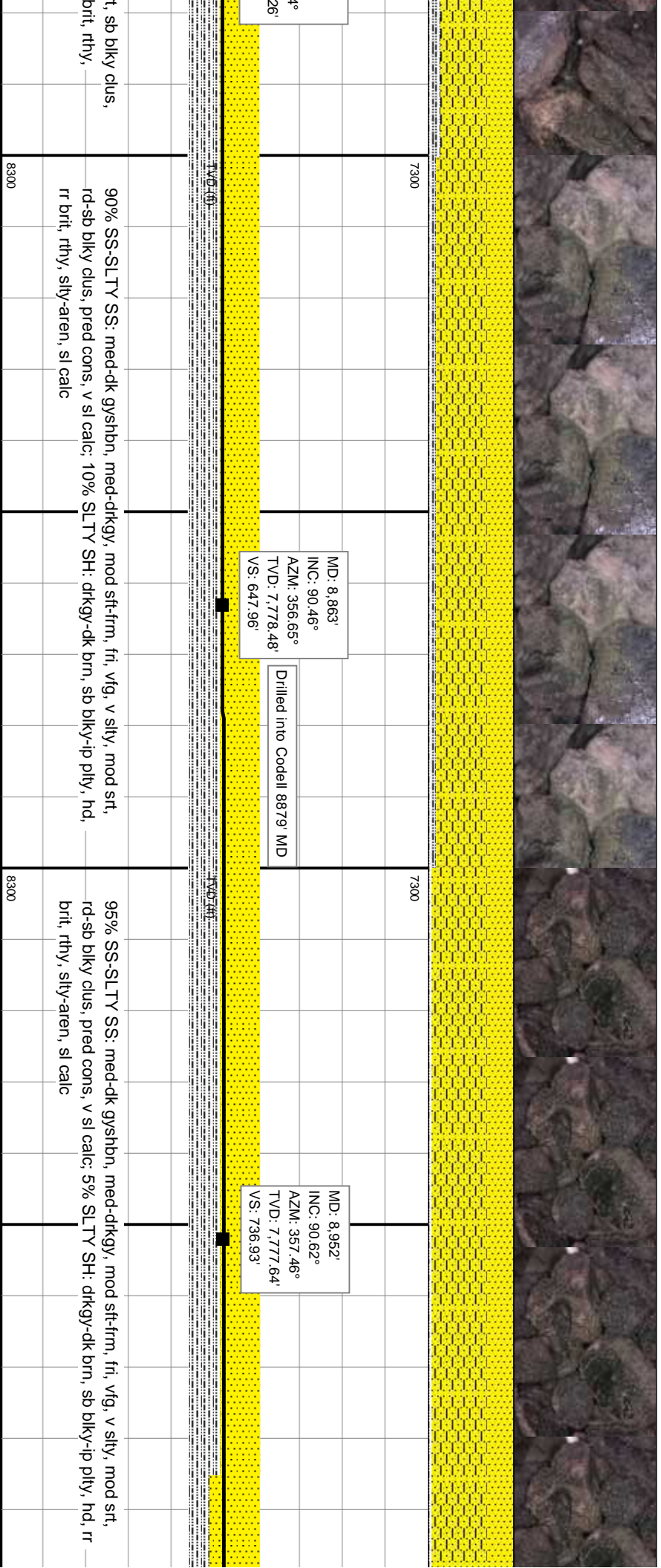
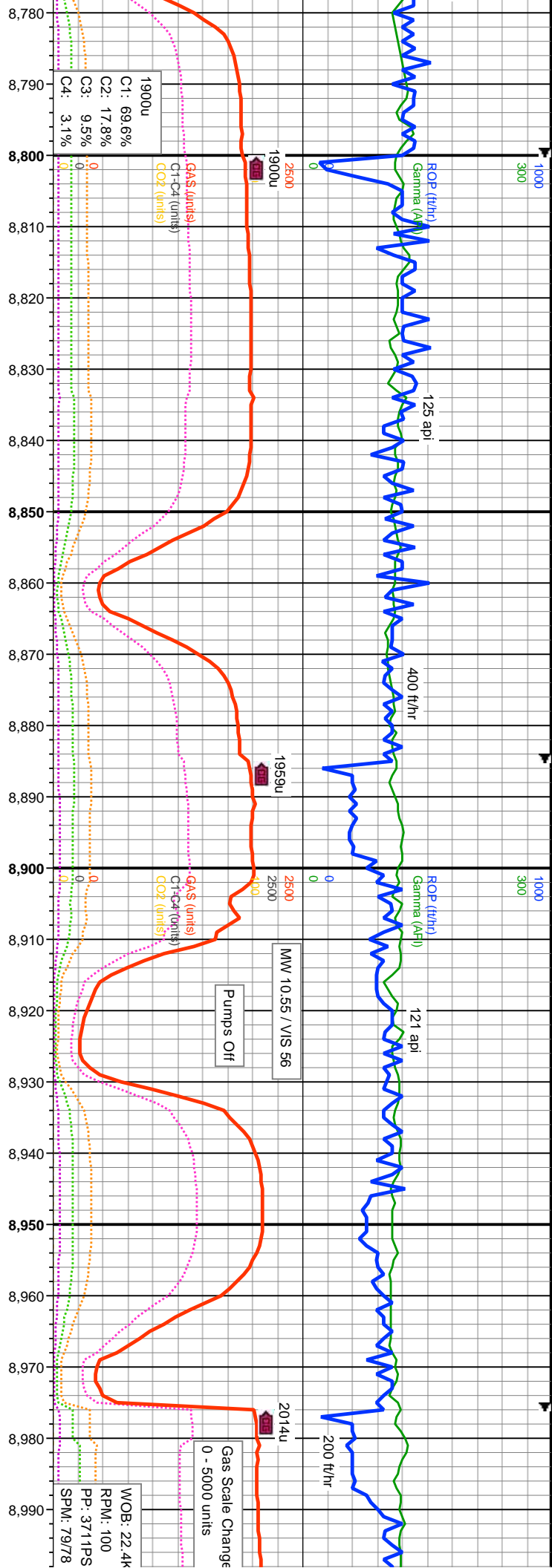


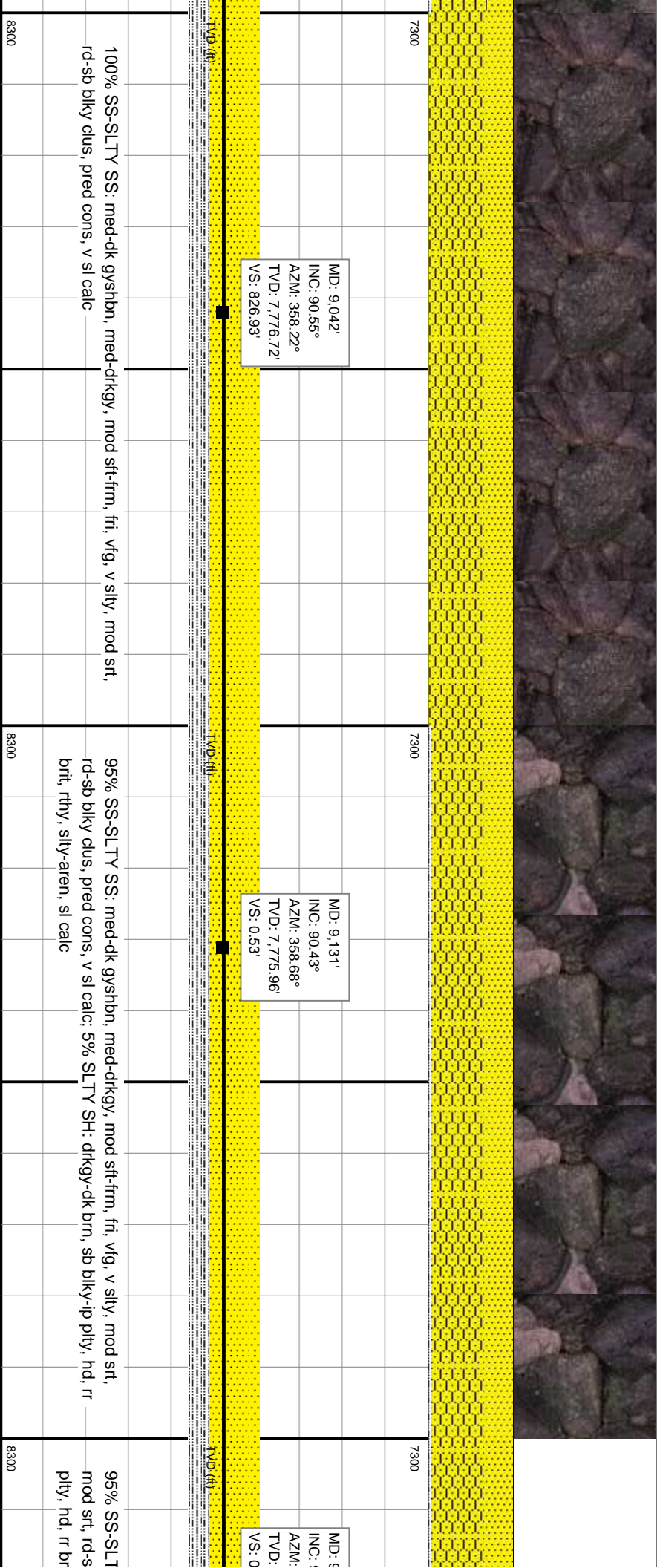
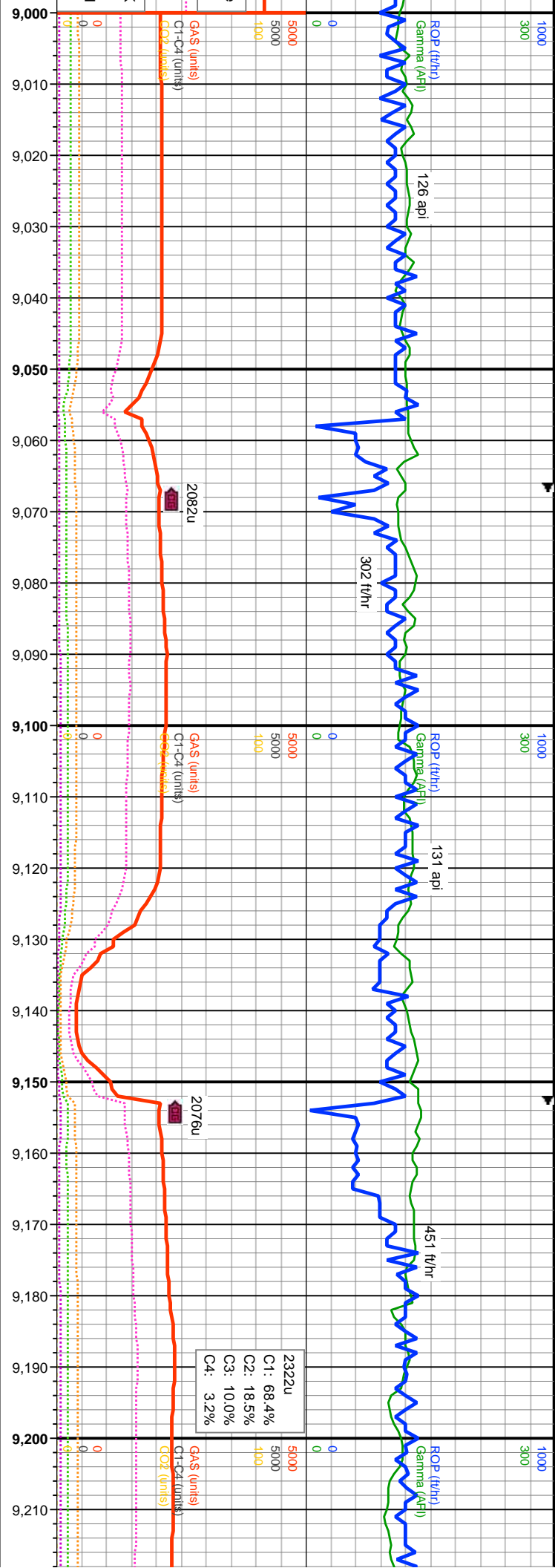


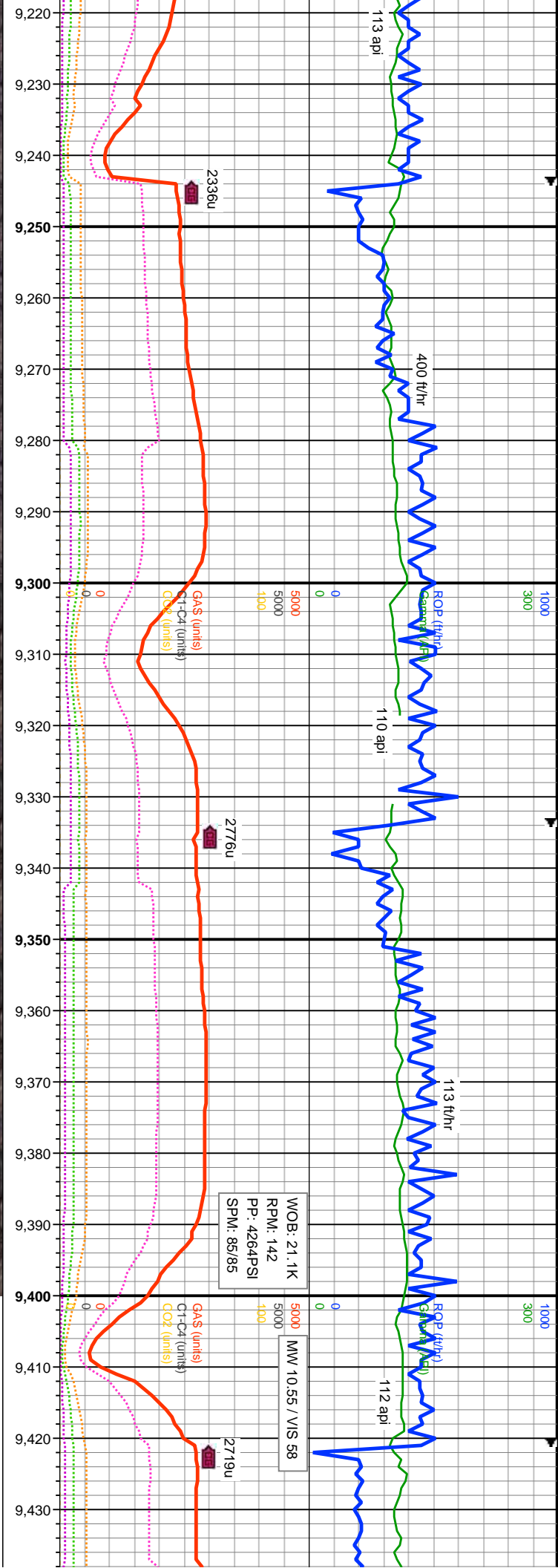




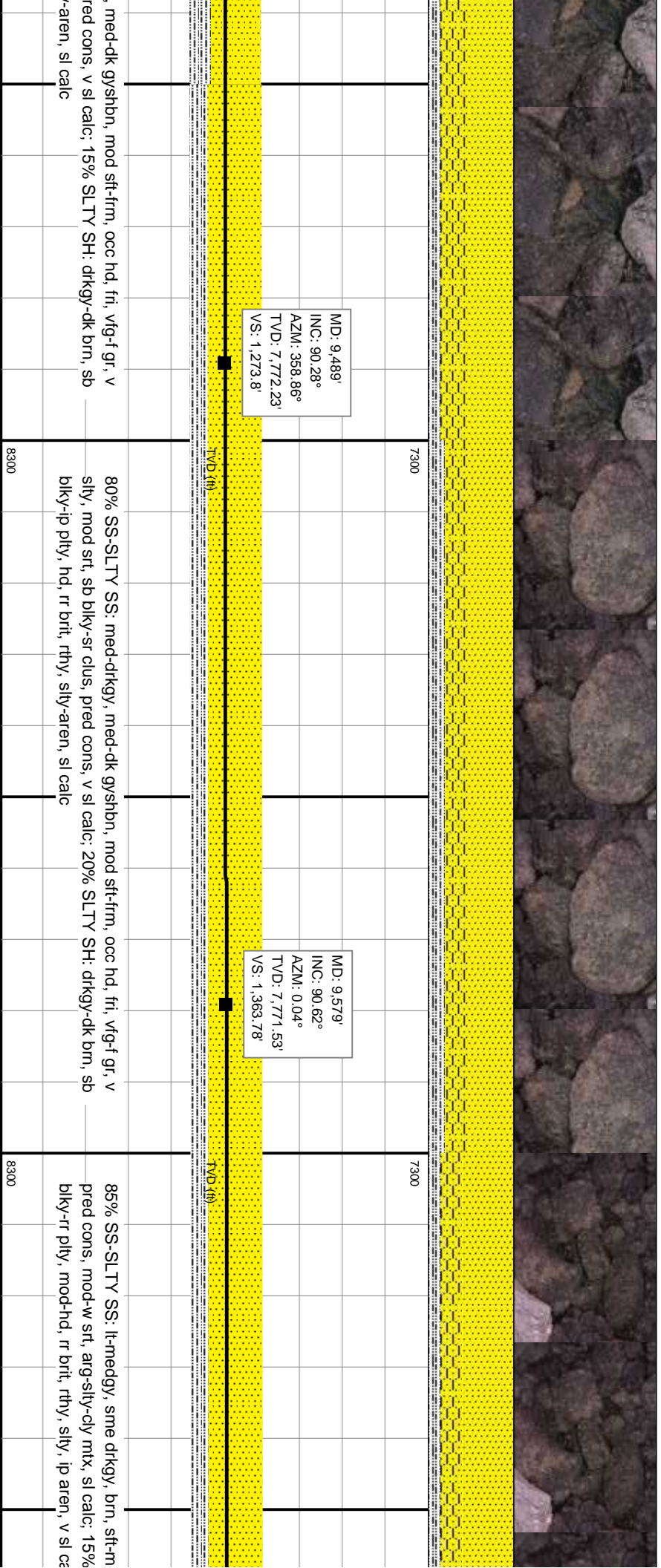
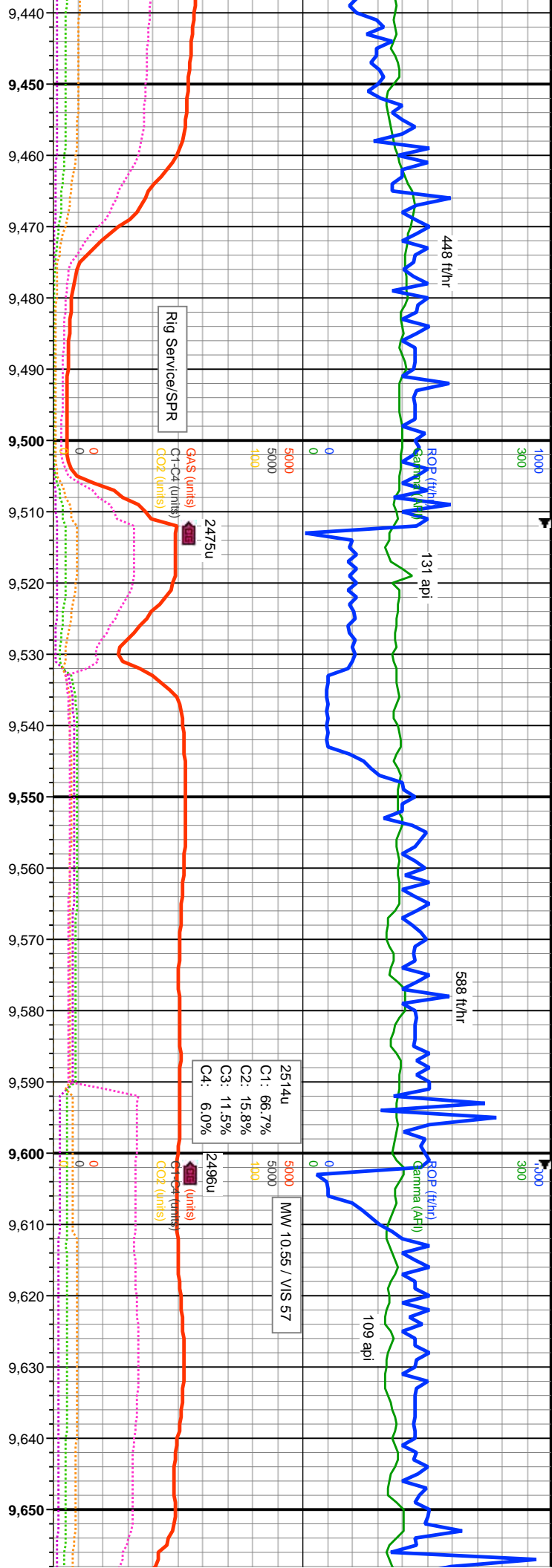


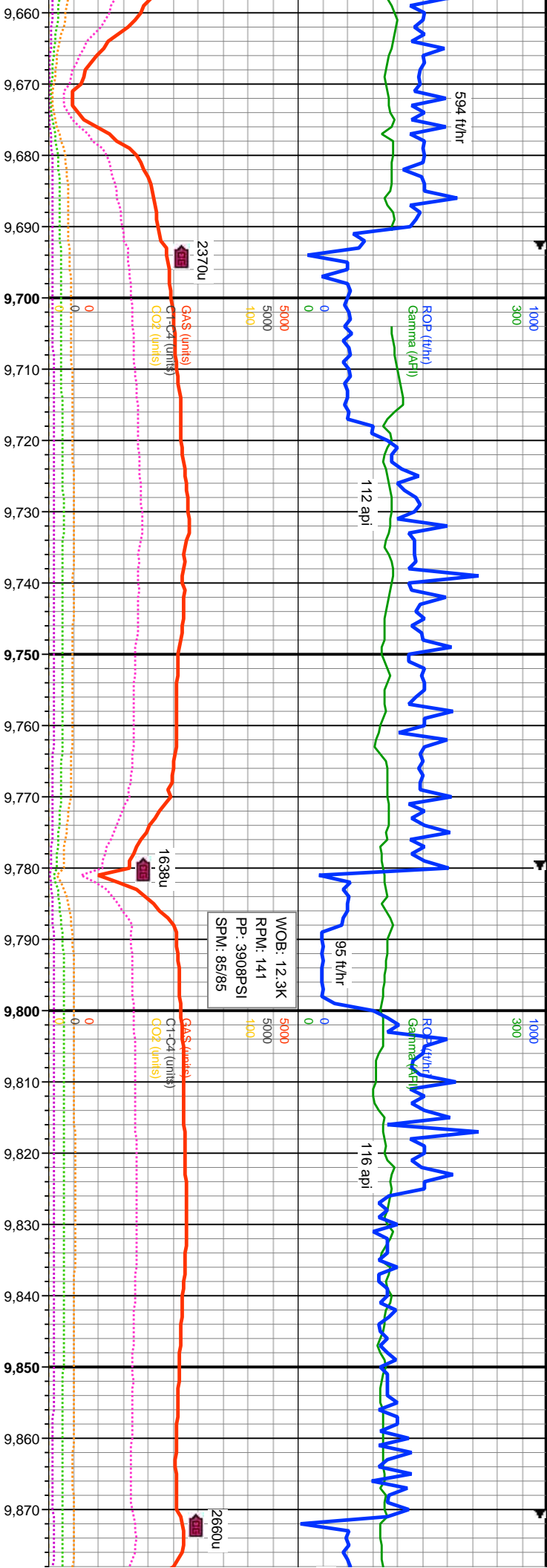






<div>220'</div> <div>30.37°</div> <div>358.93°</div> <div>7.775.34'</div> <div>2.29</div>	<div>MD: 9,310'</div> <div>INC: 90.52°</div> <div>AZM: 0.45°</div> <div>TVD: 7,774.64'</div> <div>VS: 1.7'</div>	<div>MD: 9,400'</div> <div>INC: 91.14°</div> <div>AZM: 0.02°</div> <div>TVD: 7,773.34'</div> <div>VS: 1,184.83'</div>
<div>Y SS: med-drkgy, med-dk gysbhn, mod sft-frm, tr hd, fri, vfg-gr, v silty, blky clus, pred cons, v sl calc; 5% SLTY SH: drkgy-dk brn, sb blky-ip it, rthy, silty-aren, sl calc</div>	<div>90% SS-SLTY SS: med-drkgy, med-dk gysbhn, mod sft-frm, occ hd, fri, vfg-gr, v silty, mod srt, rd-sb blky clus, pred cons, v sl calc; 10% SLTY SH: drkgy-dk brn, sb blky-ip plty, hd, rr brit, rthy, silty-aren, sl calc</div>	<div>85% SS-SLTY SS: med-drkgy silty, mod srt, sb blky-sr clus, p blky-ip plty, hd, rr brit, rthy, silty</div>





MD: 9.668'
INC: 90.58°
AZM: 358.97°
TVD: 7.770.6'
VS: 1.452.76'

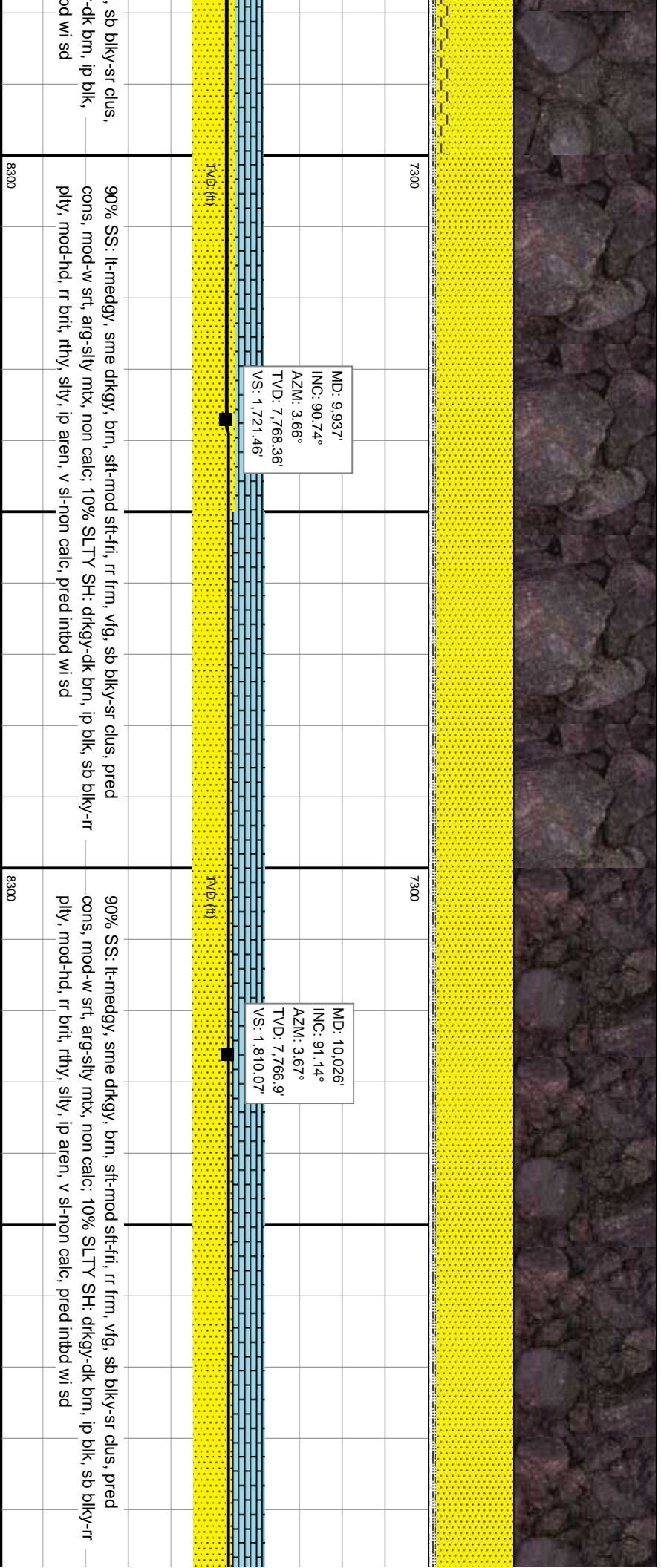
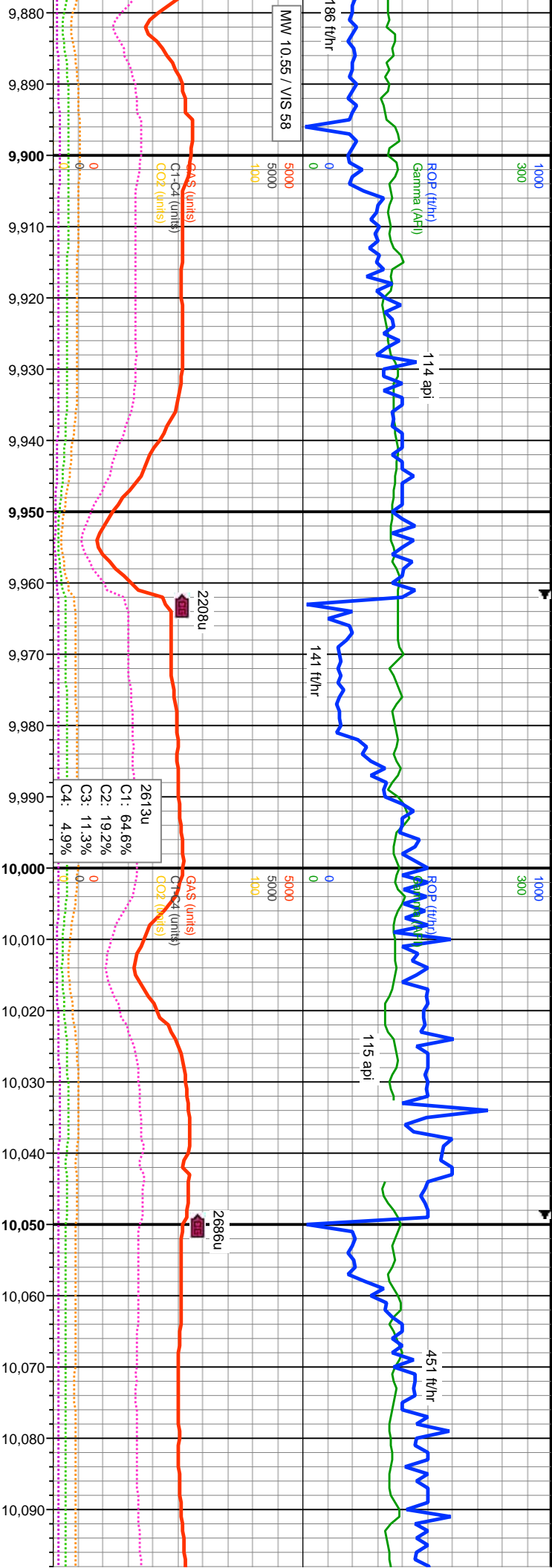
9716' MD: 6' U/D Fault
Lower to Upper Codell

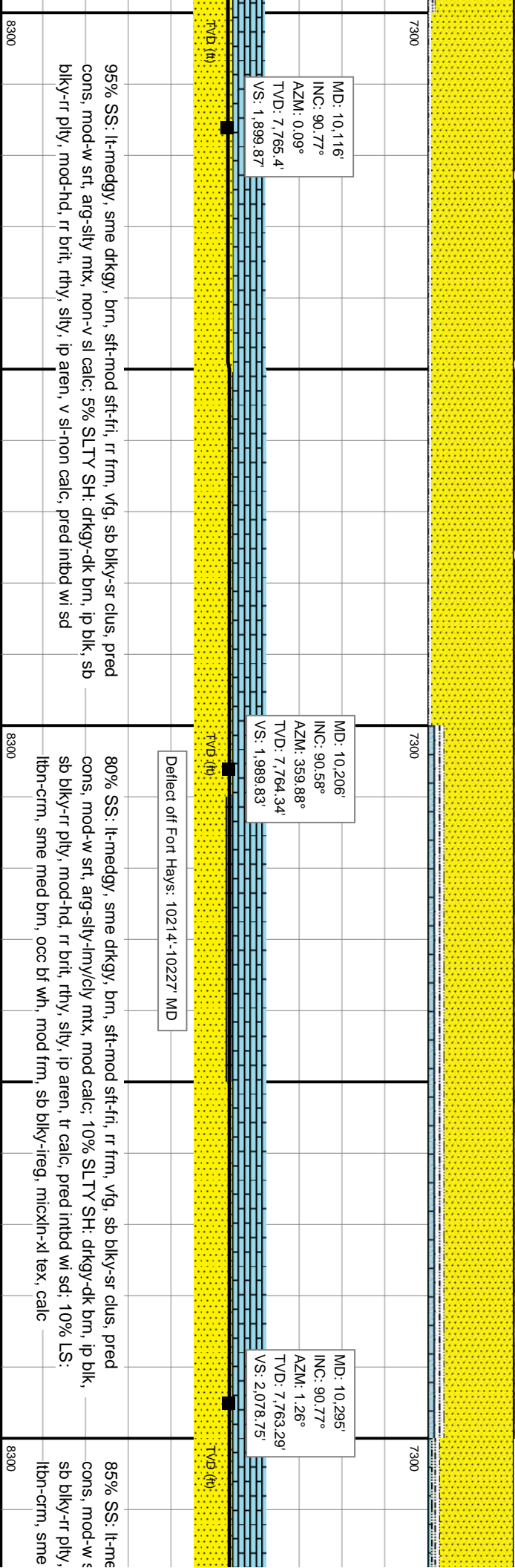
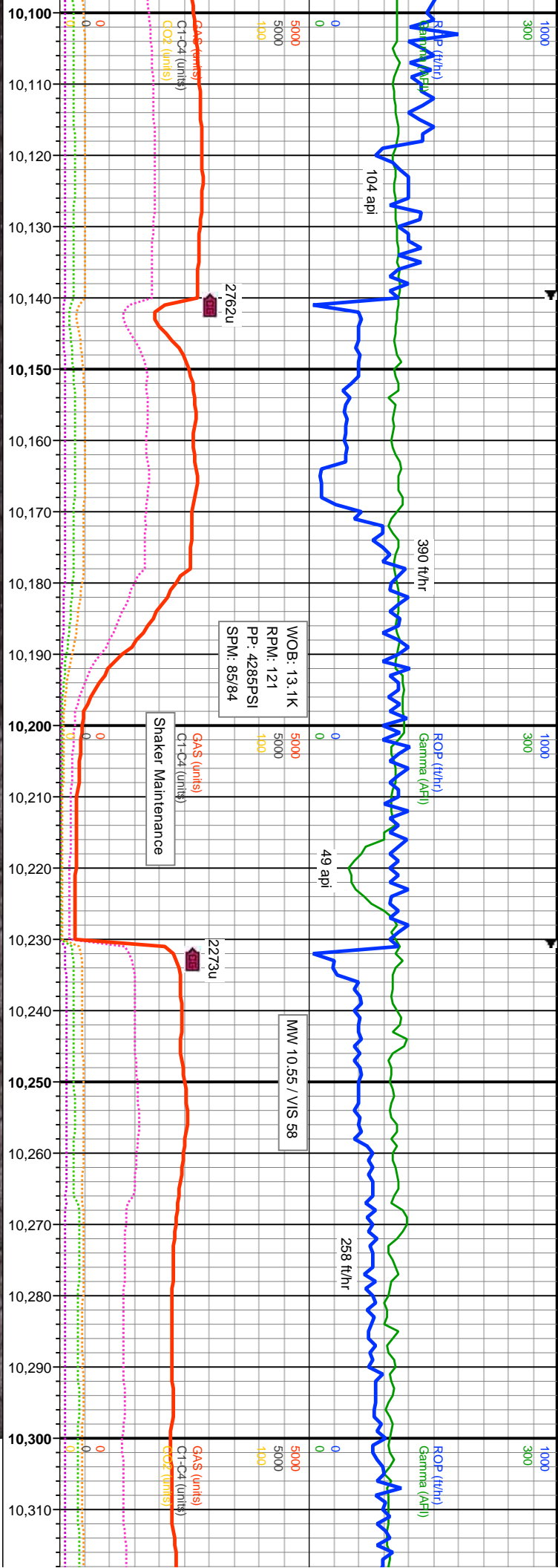
MD: 9.758'
INC: 90.31°
AZM: 359.35°
TVD: 7.769.9'
VS: 1.542.75'

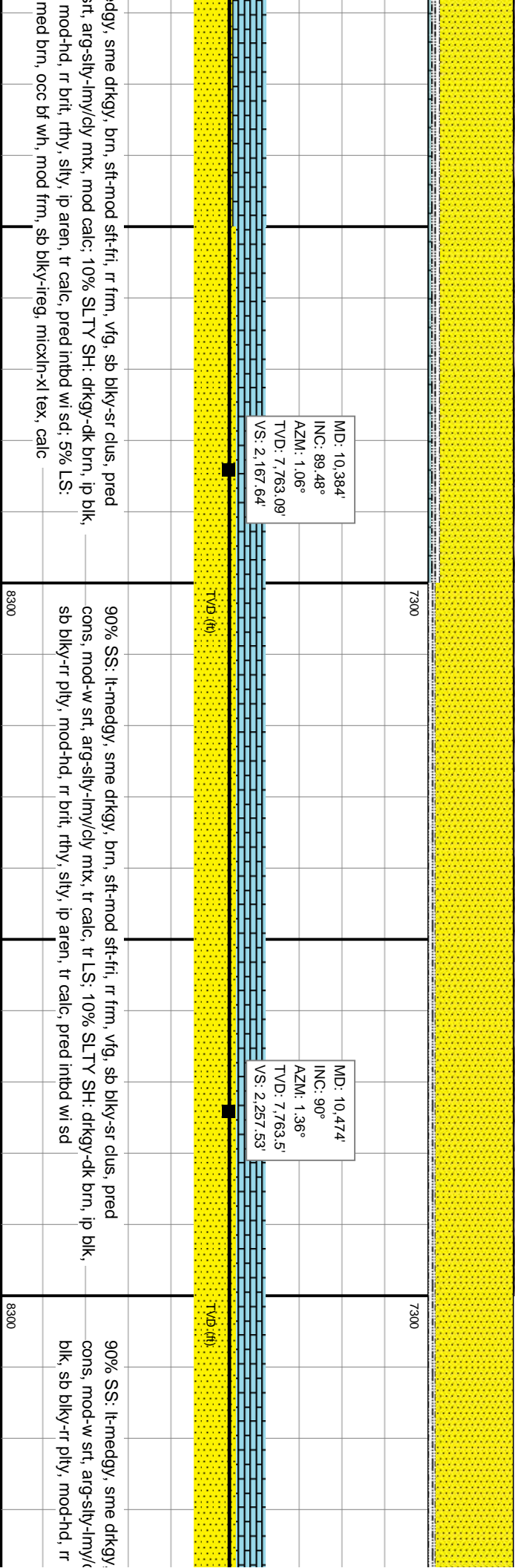
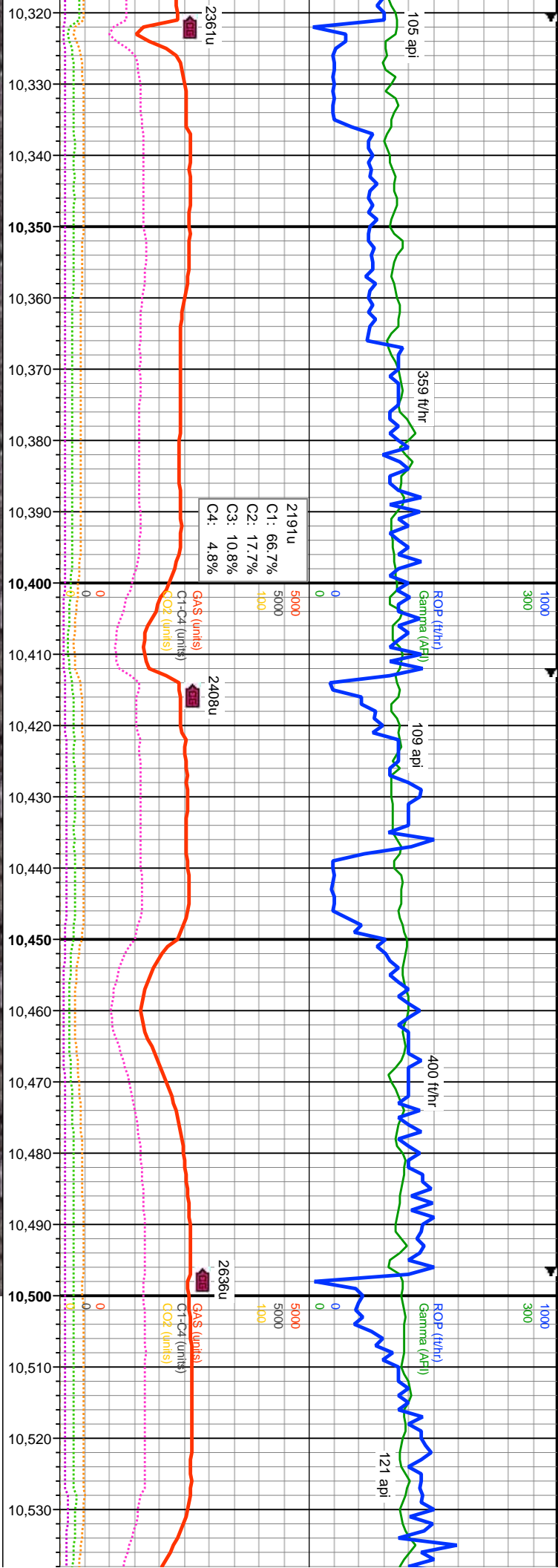
MD: 9.847'
INC: 90.46°
AZM: 1.01°
TVD: 7.769.3'
VS: 1.631.69'

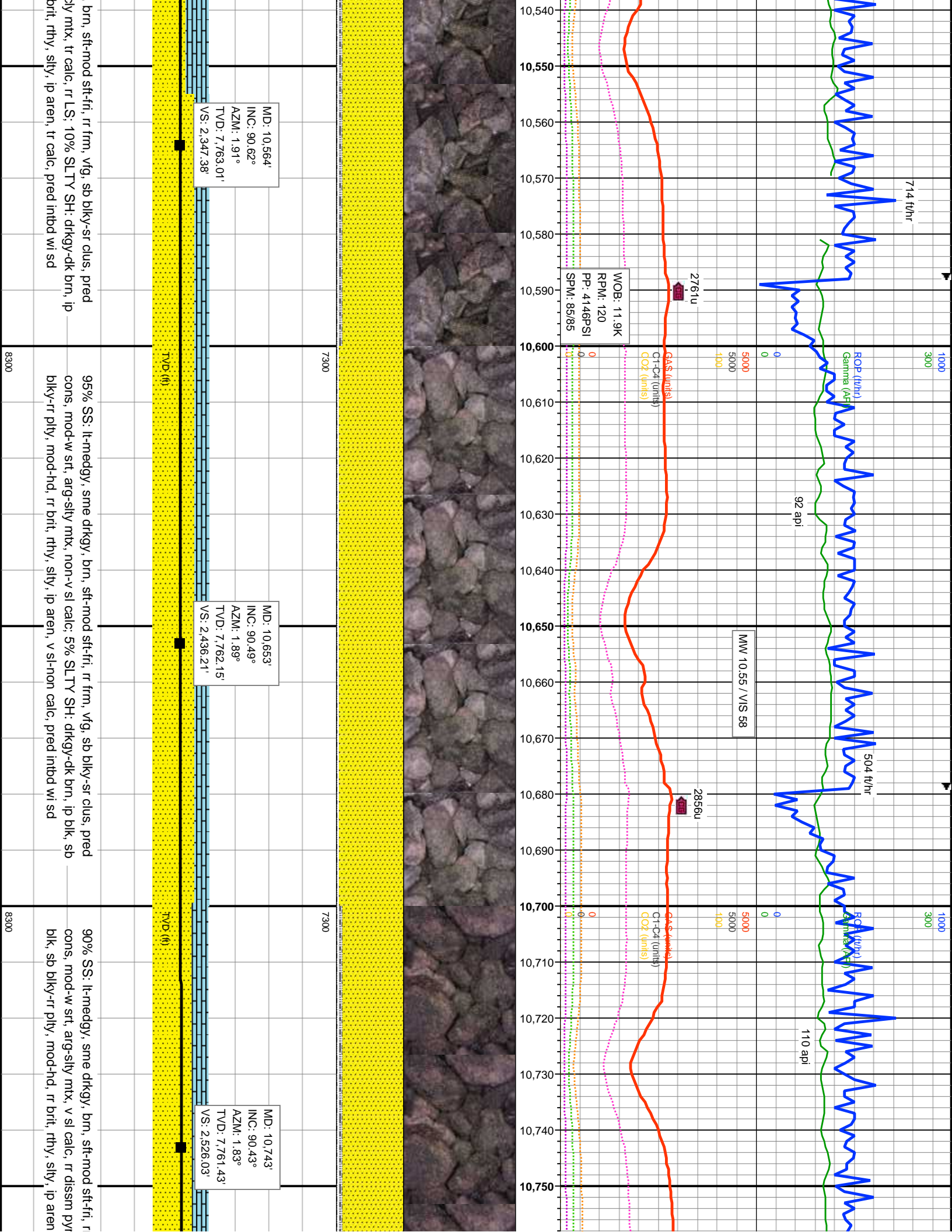
85% SS-SLTY SS: lt-medgy, sme drkgy, brn, sft-mod sft-fri, rr frm, vfg, sb blk-sr clus, pred cons, mod-w srt, arg-slt-y-clx mtx, v sl-non calc, 15% SLTY SH: drkgy-dk brn, ip blk, sb blk-rr ply, mod-hd, rr brit, rthy, slty, ip aren, v sl-non calc, pred inbnd wi sd

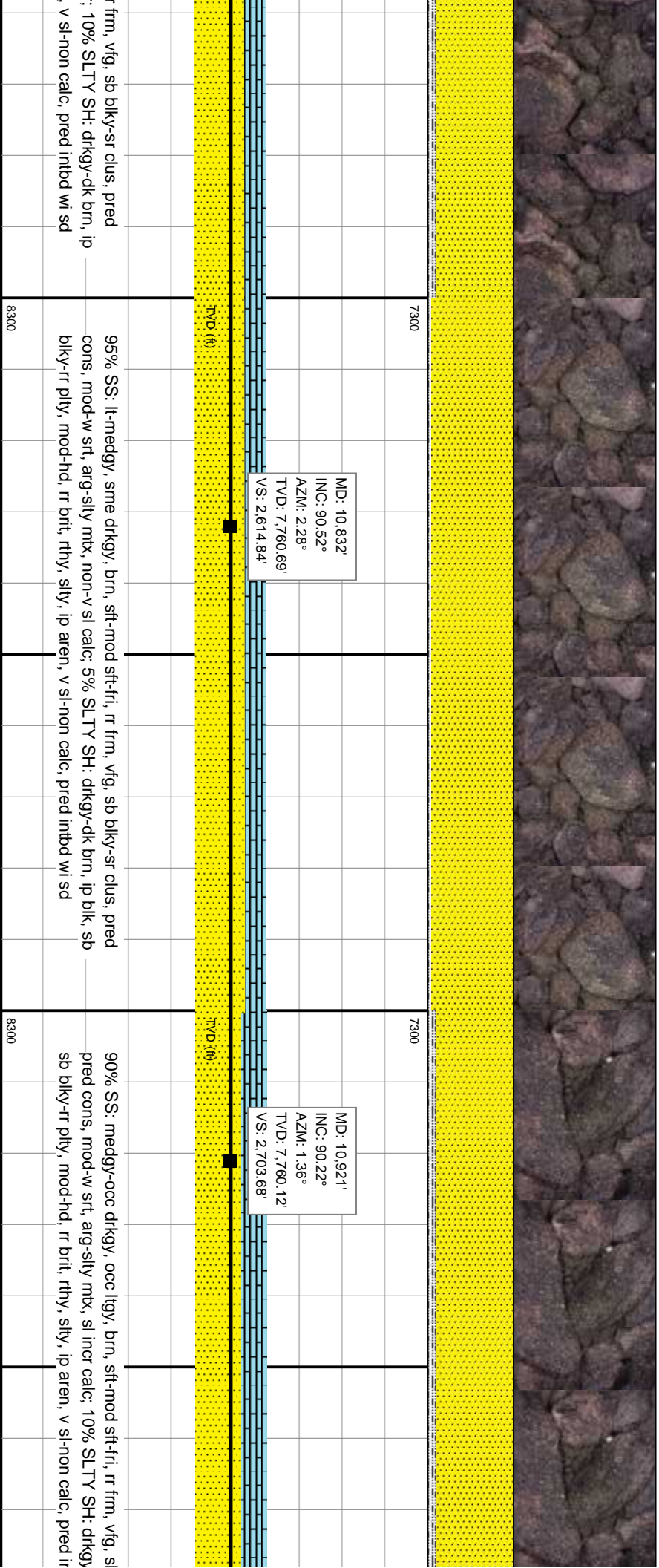
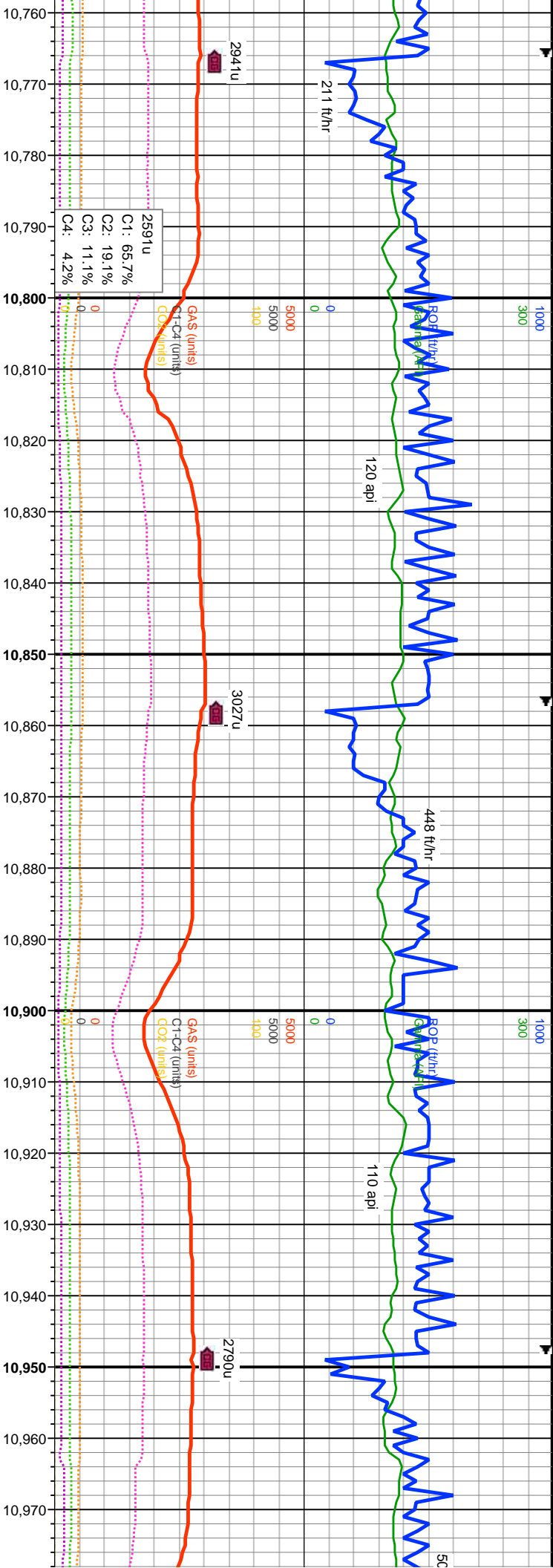
90% SS-SLTY SS: lt-medgy, sme drkgy, brn, sft-mod sft-fri, rr frm, vfg, pred cons, mod-w srt, arg-slt-y-clx mtx, non calc, 10% SLTY SH: drkgy sb blk-rr ply, mod-hd, rr brit, rthy, slty, ip aren, v sl-non calc, pred inbnd wi sd

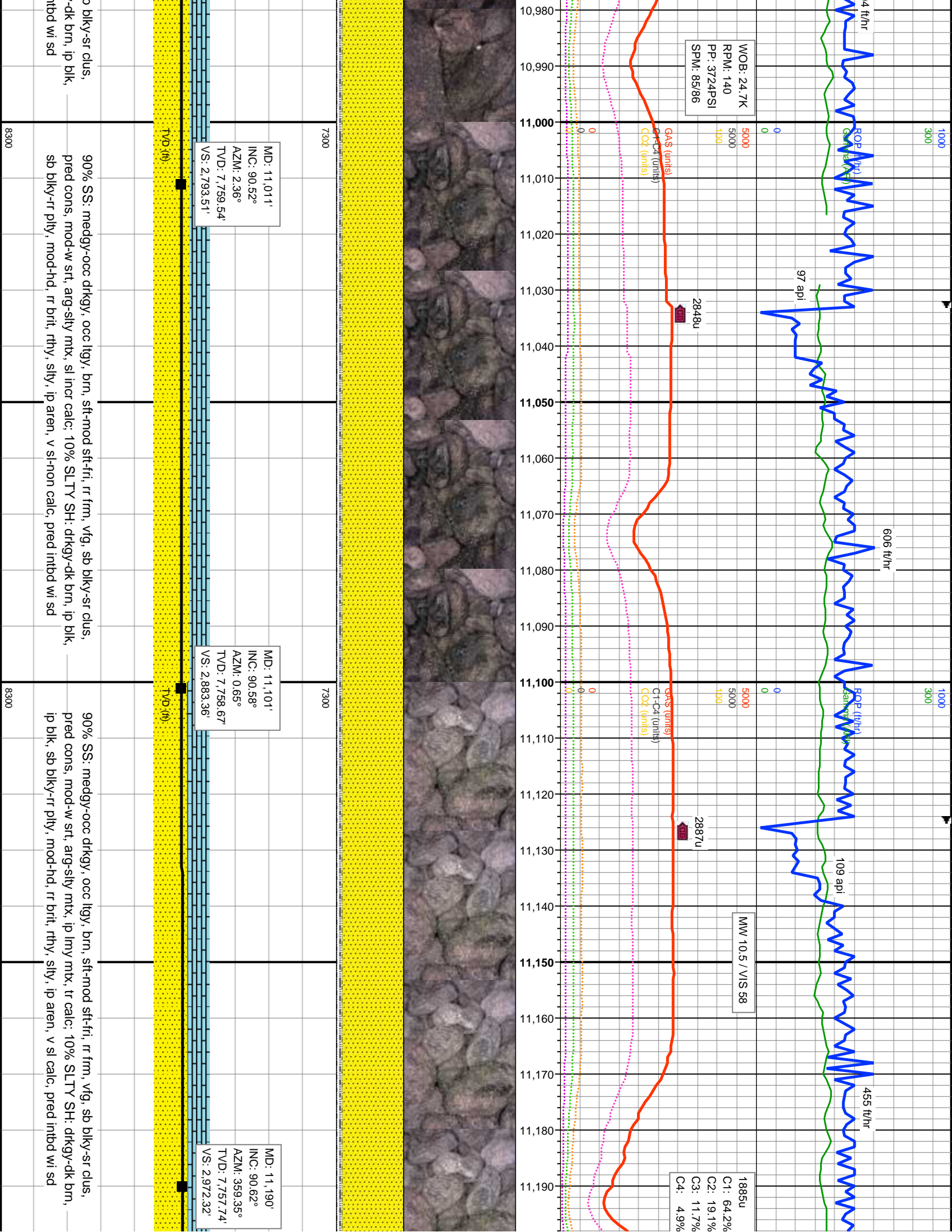


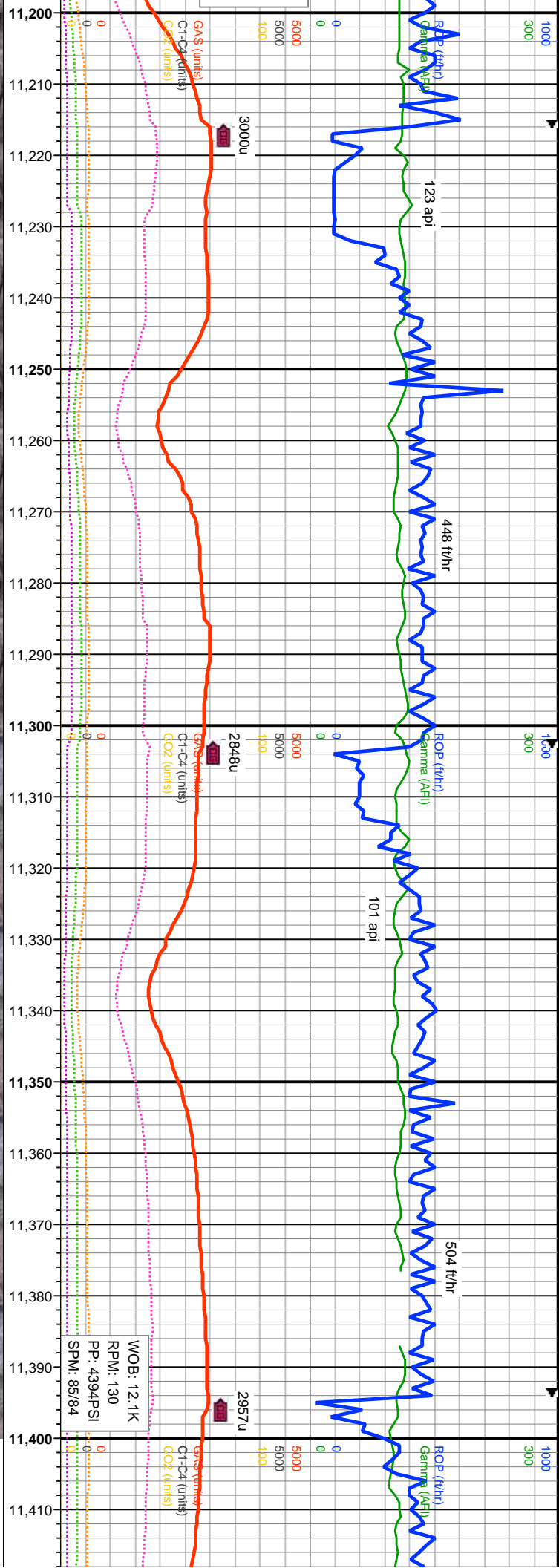




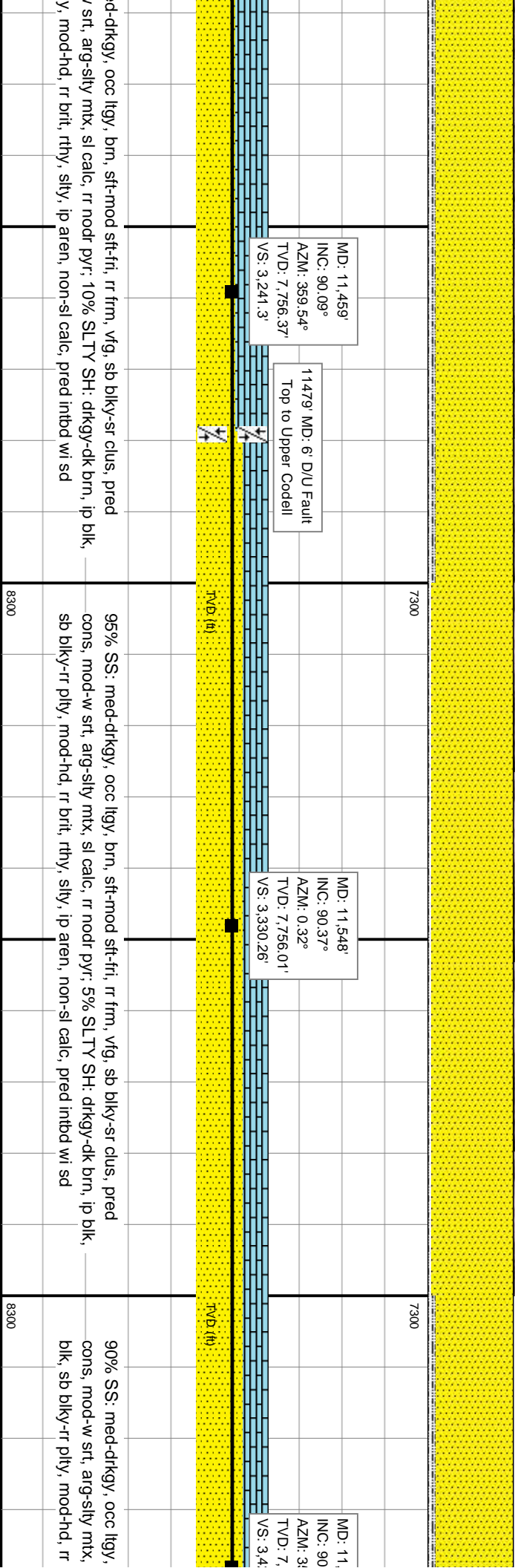


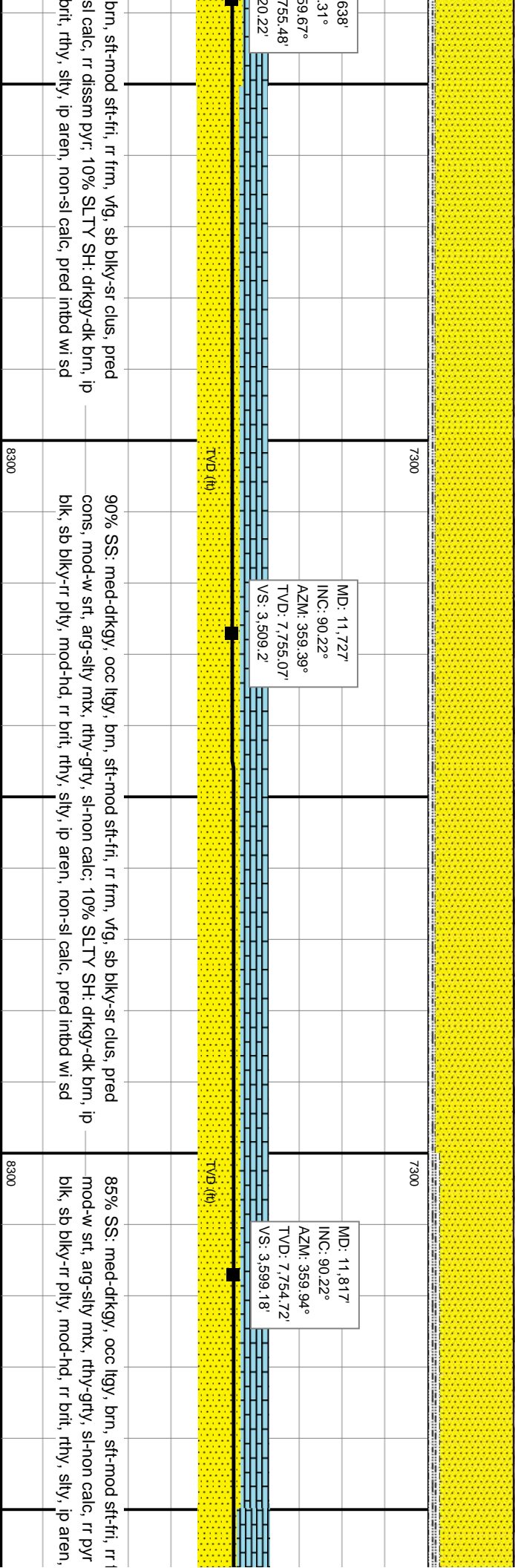


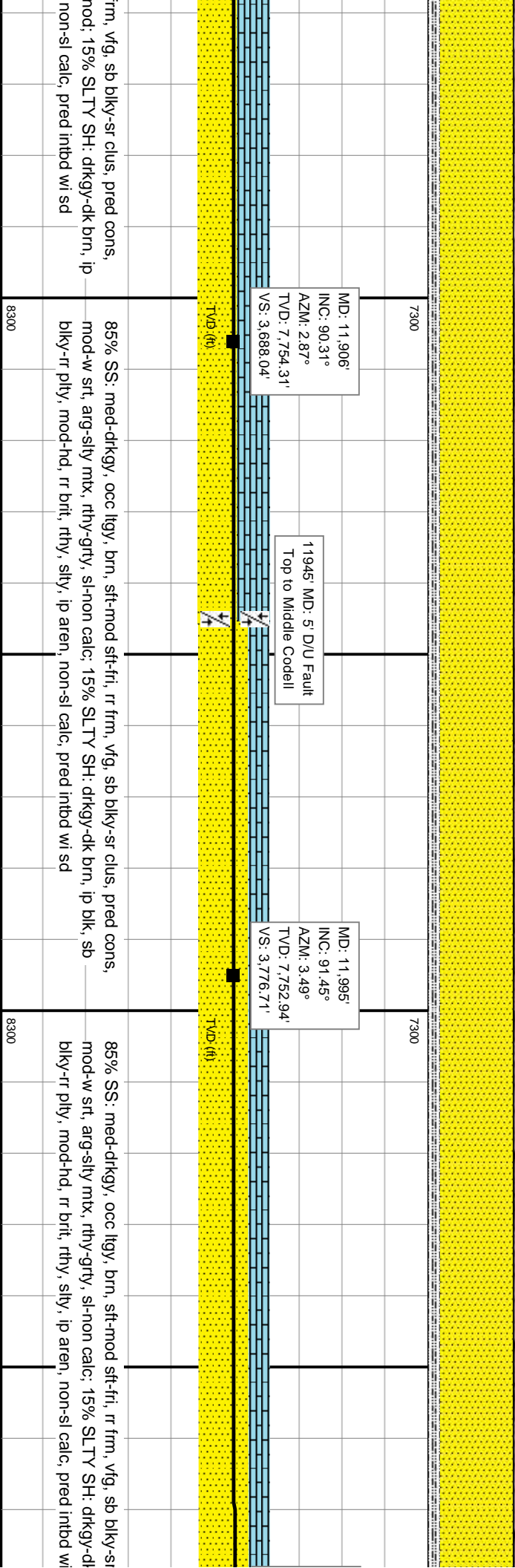
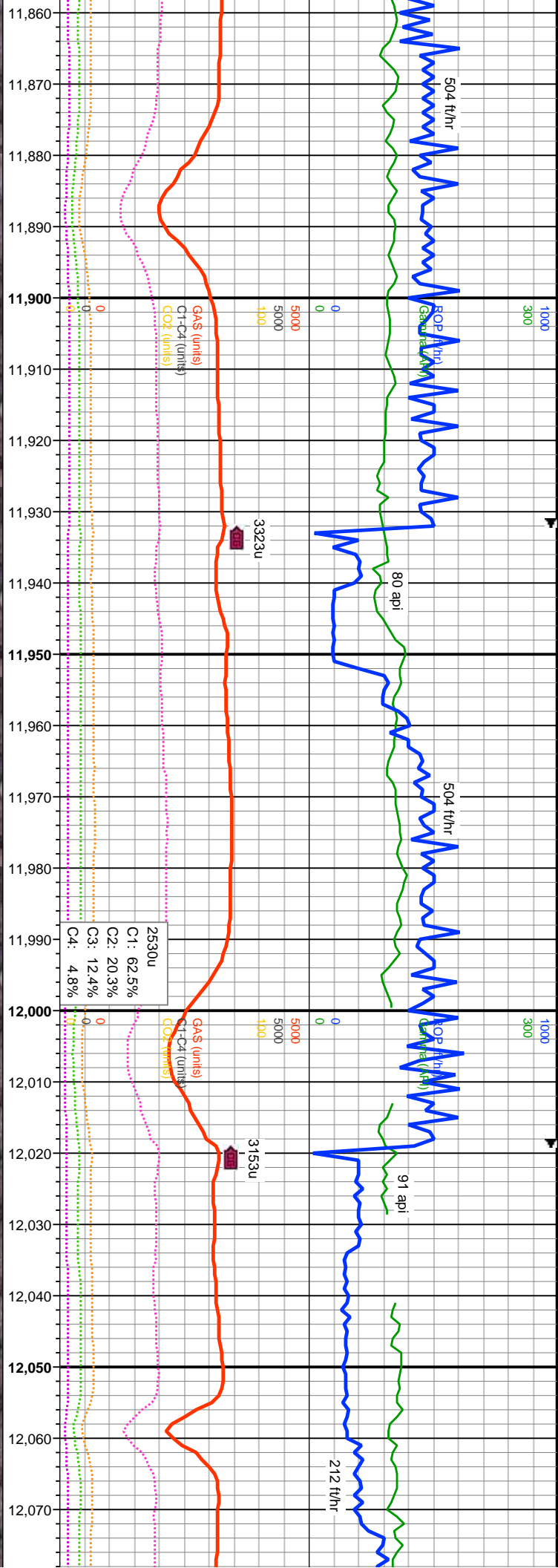


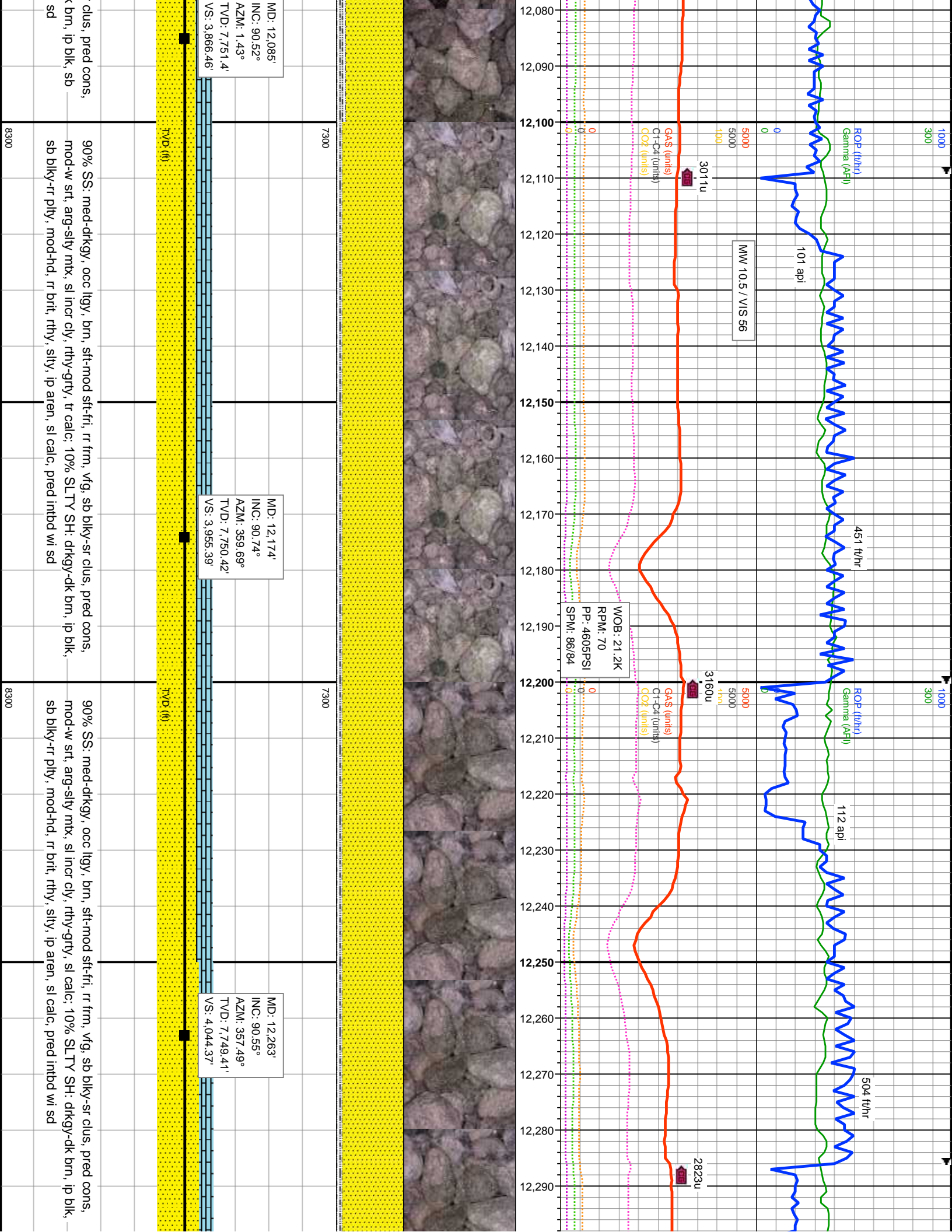


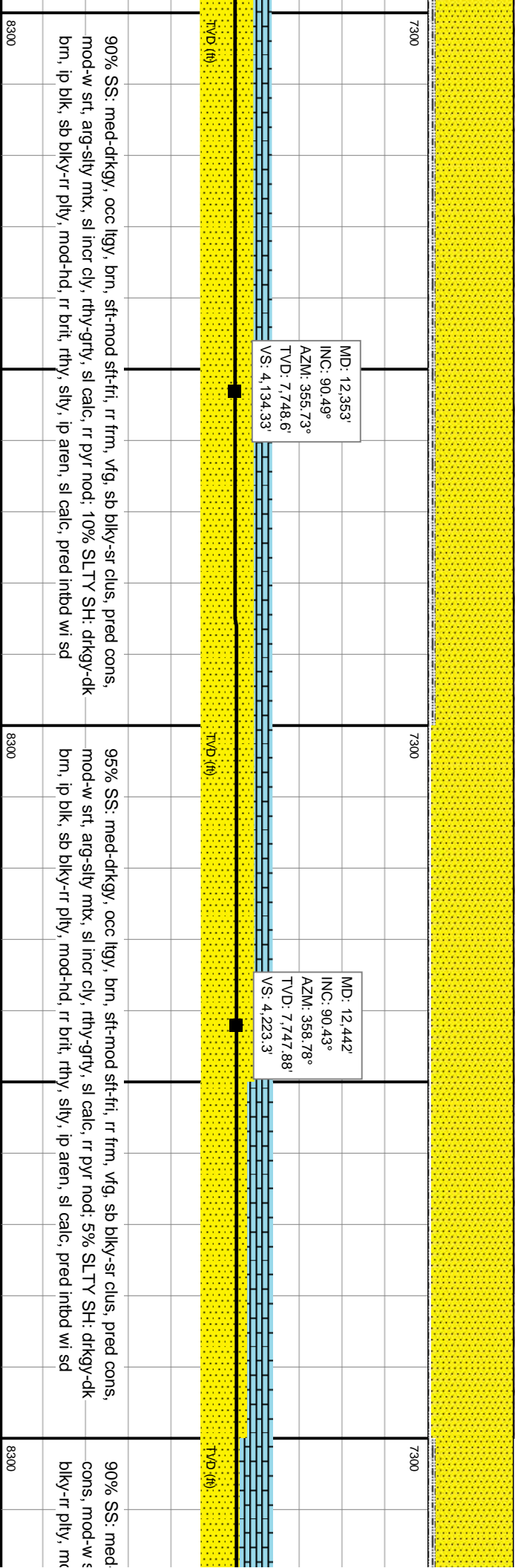
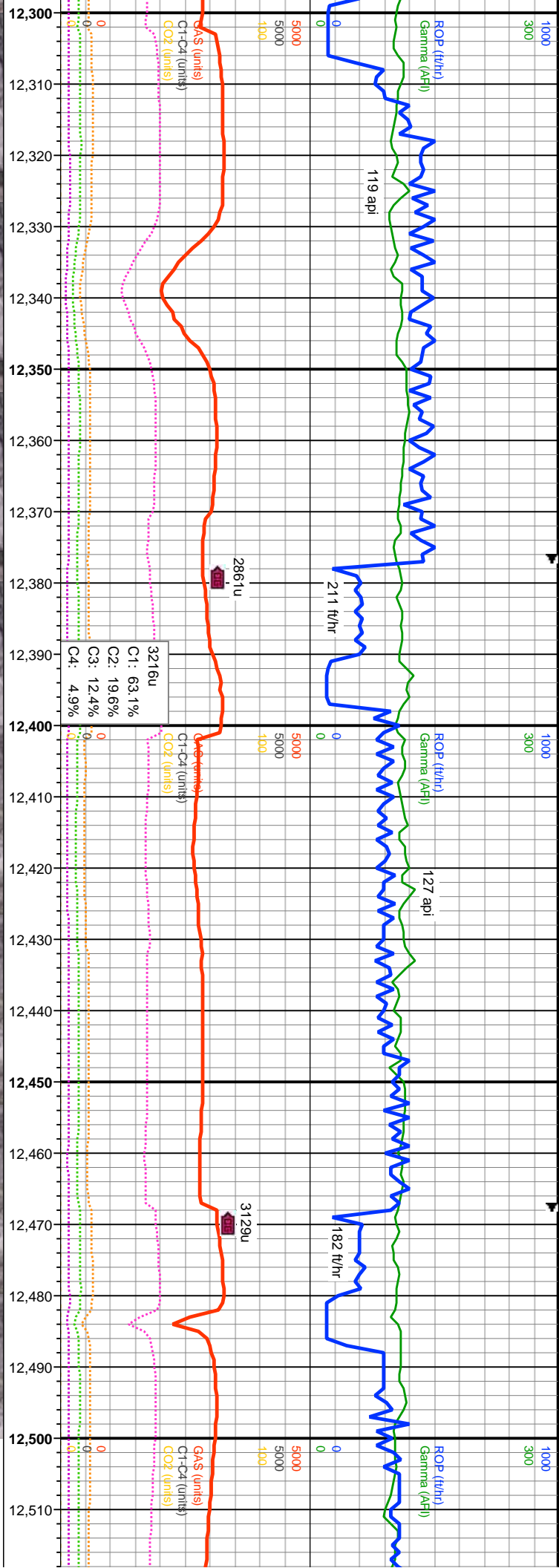
7300		7300	7300
85% SS: med-dkgy, occ ltgy, brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, ip lmy/clty mix, tr-mod calc; 15% SLTY SH: drkgy-dk brn, ip blk, sb blk-y-rr ply, mod-hd, rr brit, rthy, sily, ip aren, non-sl calc, pred inlbd wi sd	MD: 11.280' INC: 90.34° AZM: 358.65° TVD: 7.756.99' VS: 3.062.31'	85% SS: med-dkgy, occ ltgy, brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, ip lmy/clty mix, tr-mod calc; 15% SLTY SH: drkgy-dk brn, ip blk, sb blk-y-rr ply, mod-hd, rr brit, rthy, sily, ip aren, non-sl calc, pred inlbd wi sd	90% SS: me cons, mod-w sb blk-y-rr pli
TVD: (ft)		TVD: (ft)	TVD: (ft)
8300		8300	8300

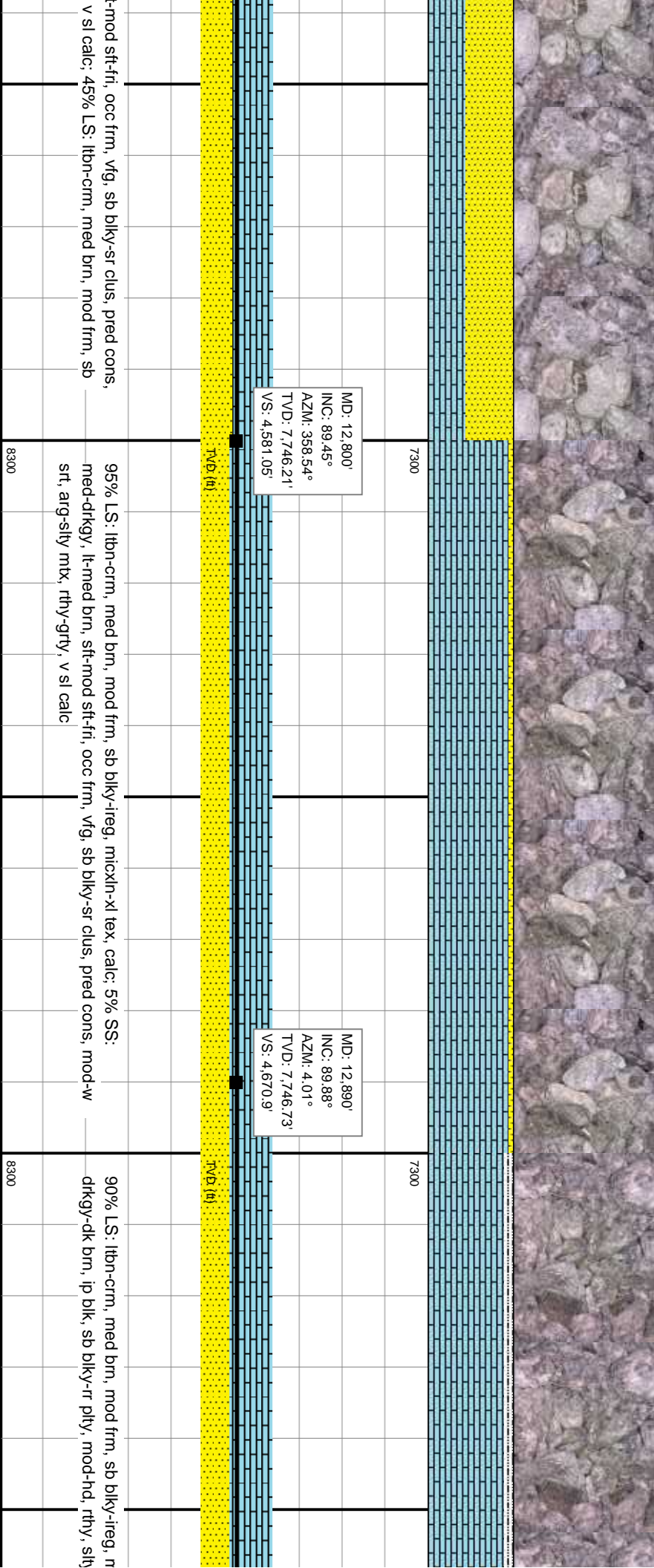
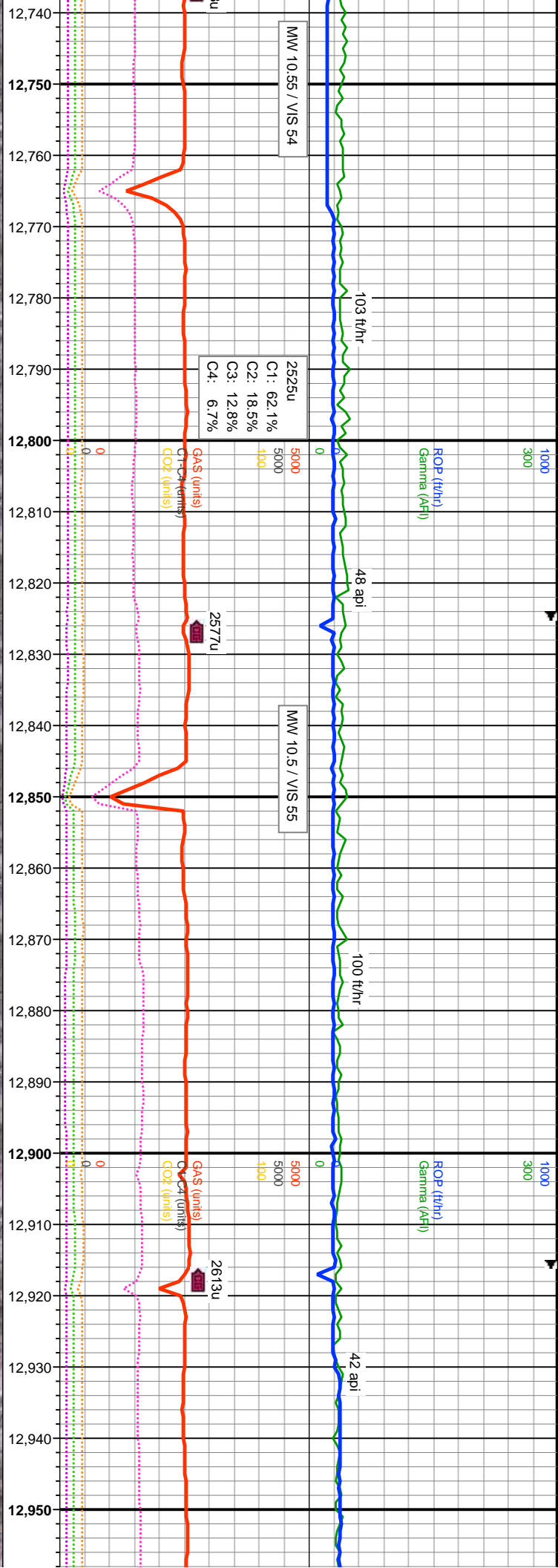


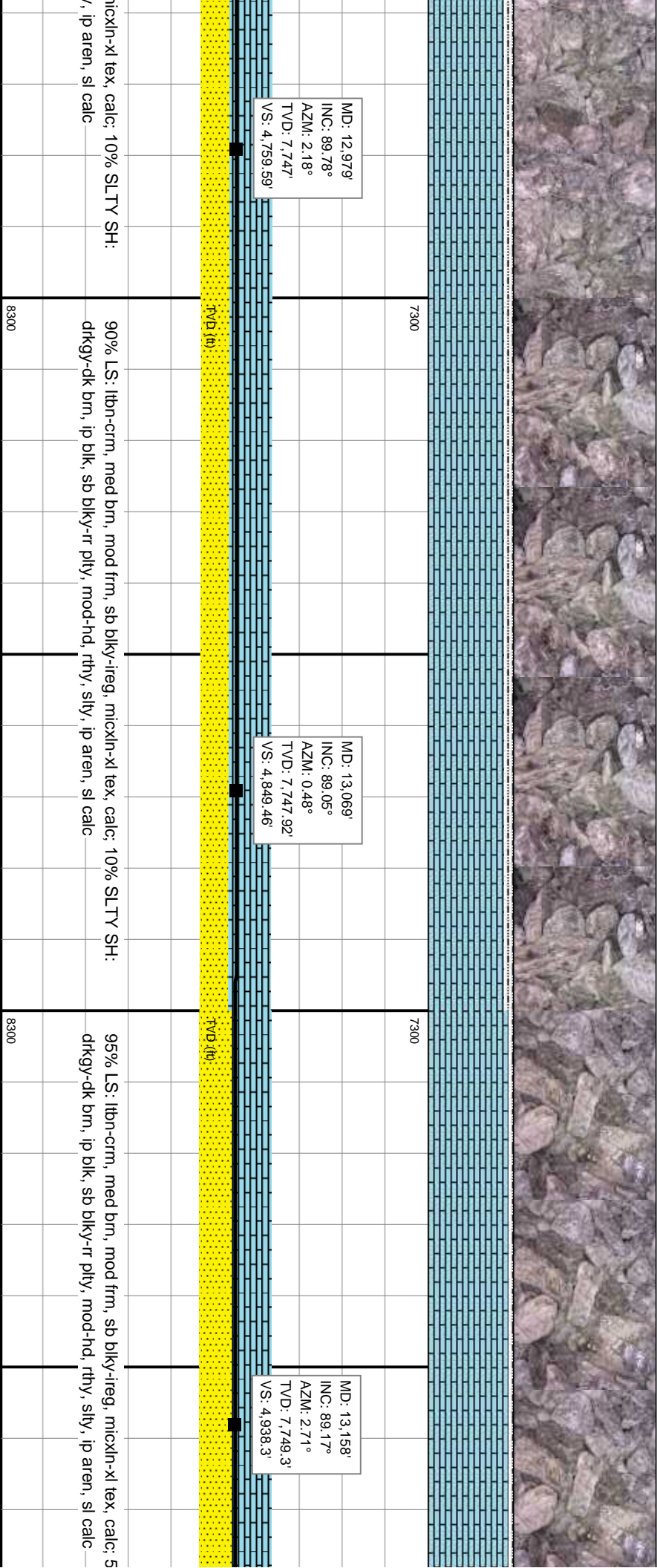
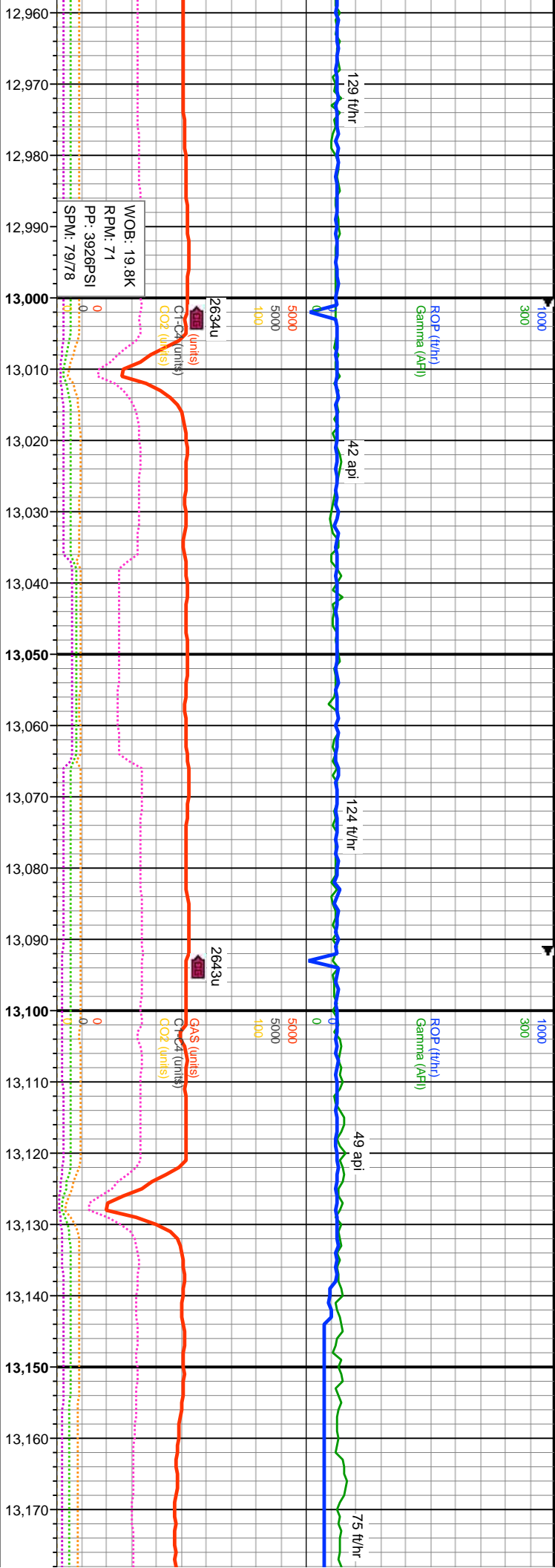


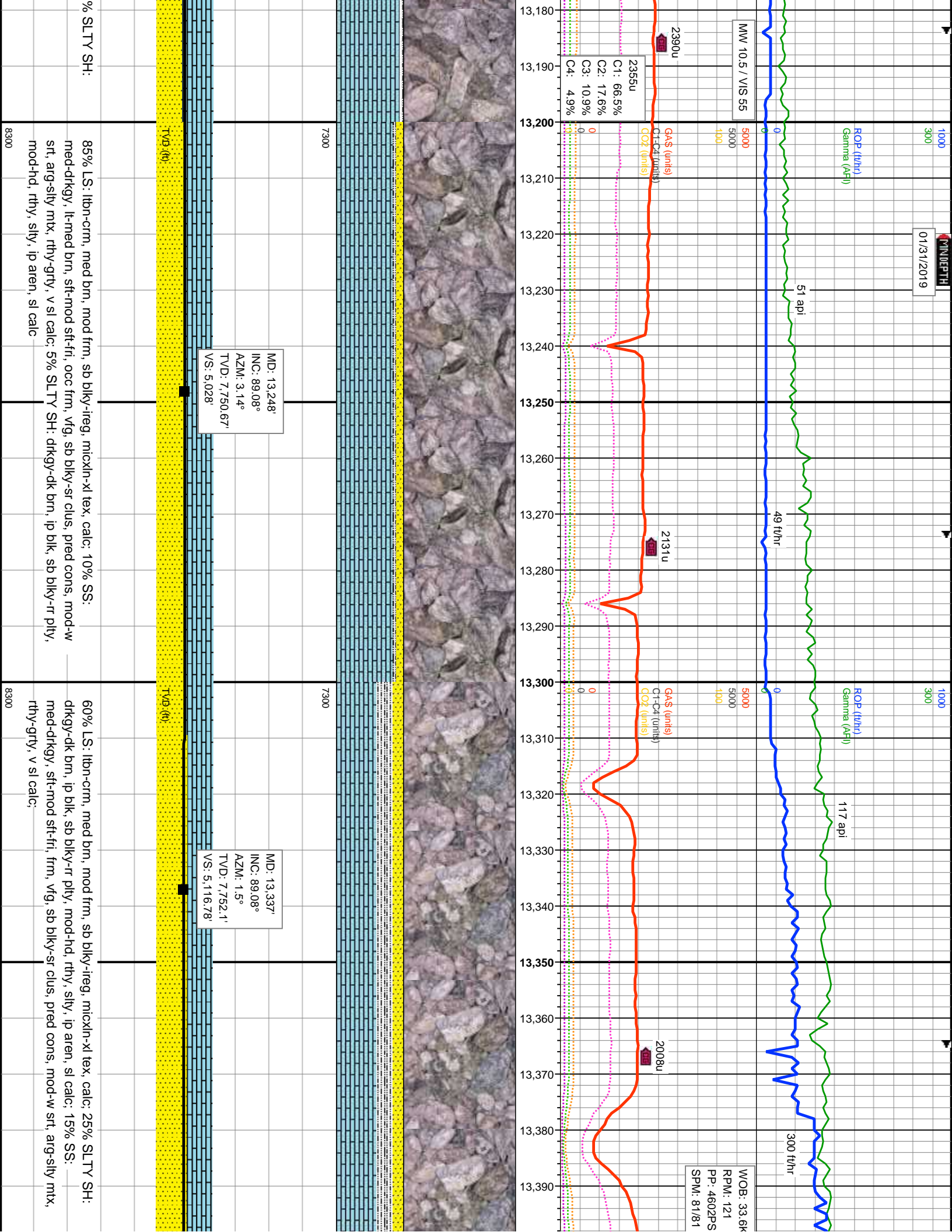


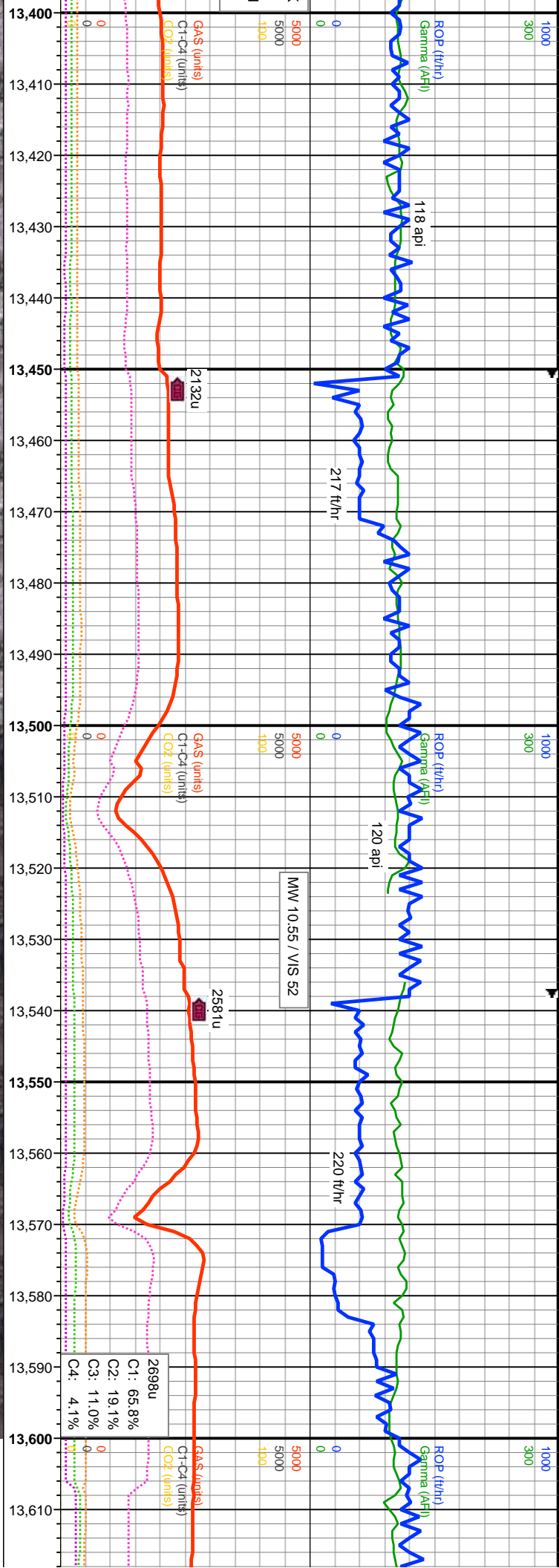












MD: 13,426'
INC: 89.17°
AZM: 0.27°
TVD: 7,753.46'
VS: 5,205.68'

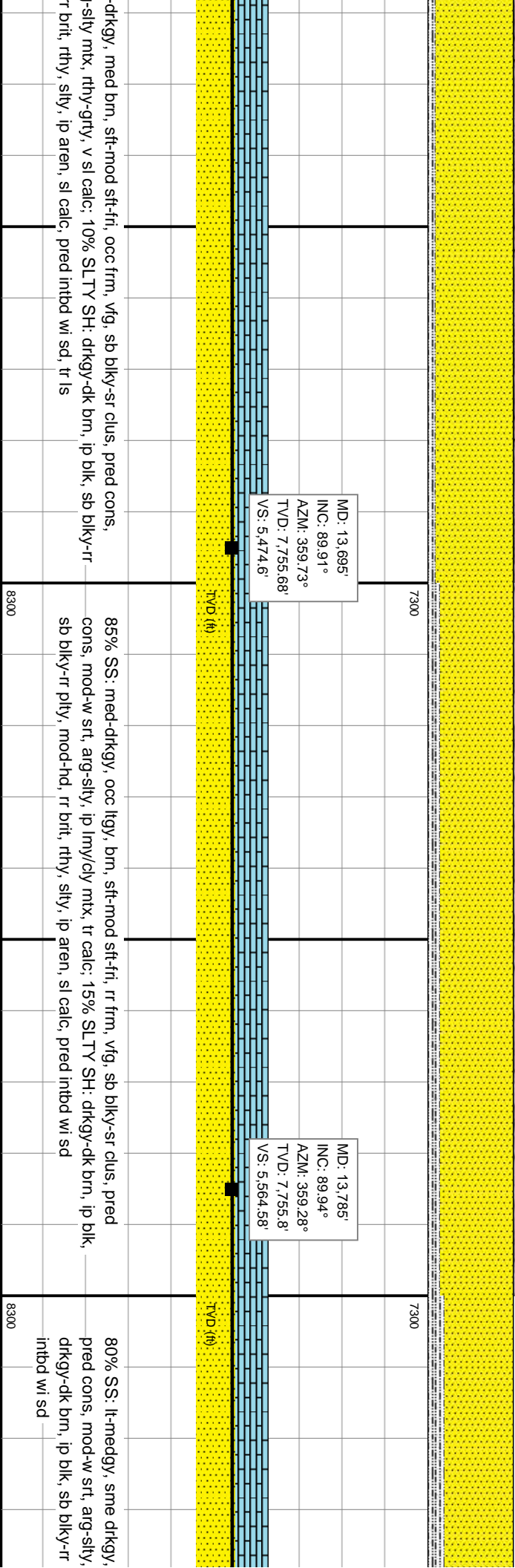
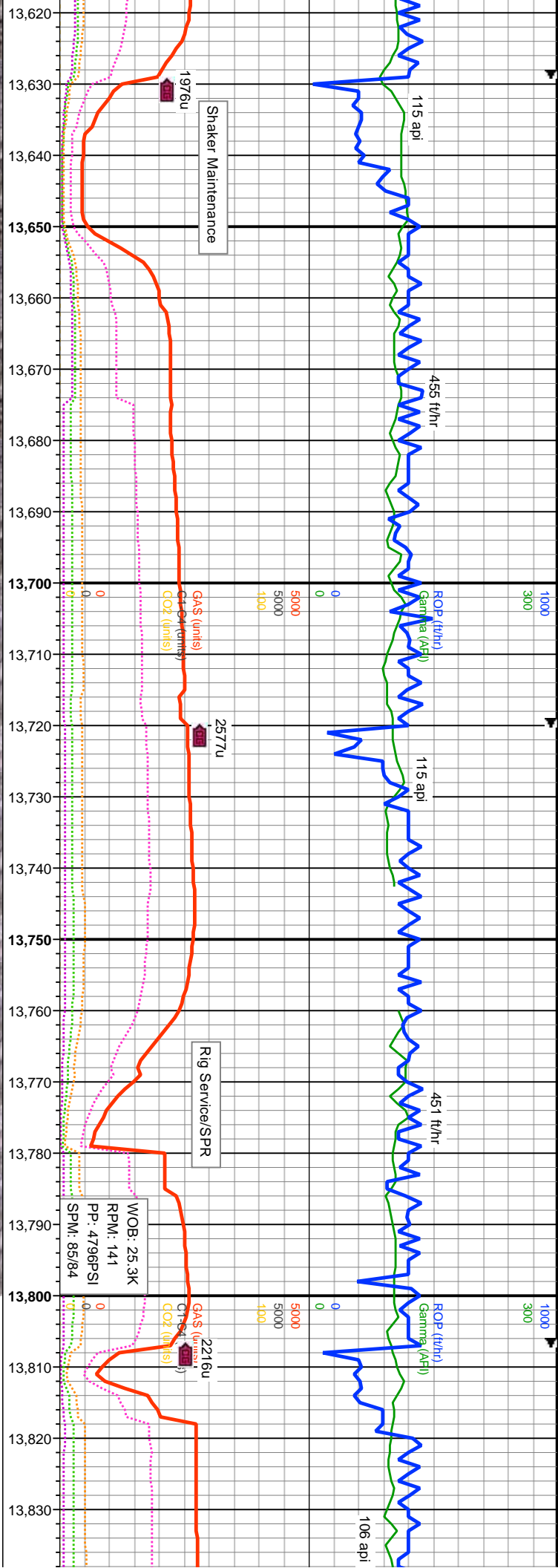
MD: 13,516'
INC: 88.98°
AZM: 359.46°
TVD: 7,754.91'
VS: 5,295.63'

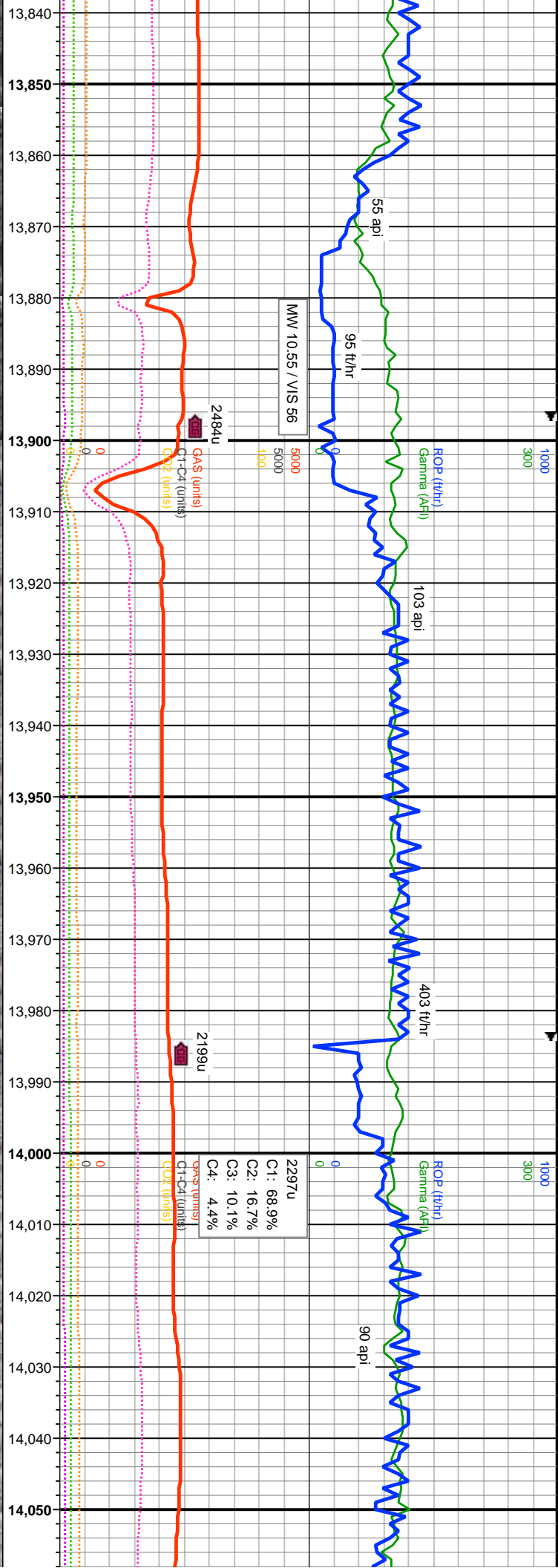
MD: 13,605'
INC: 90.06°
AZM: 359.19°
TVD: 7,755.66'
VS: 5,384.62'

85% SS: med-dkgy, occ ltgy, med brn, sft-mod sft-fri, occ frm, vfg, sb blk-sr clus, pred cons, mod-w srt, arg-sily mtz, rthy-grty, v sl calc; 10% SLTY SH: drkgy-dk brn, ip blk, sb blk-rr plty, mod-hd, rr brit, rthy, sily, ip aren, sl calc, pred inbd wi sd; 5% LS: lbn-crm, med brn, mod frm, sb blk-irreg, micxln-xl tex, calc

90% SS: med-dkgy, occ ltgy, med brn, sft-mod sft-fri, occ frm, vfg, sb blk-sr clus, pred cons, mod-w srt, arg-sily mtz, rthy-grty, v sl calc; 10% SLTY SH: drkgy-dk brn, ip blk, sb blk-rr plty, mod-hd, rr brit, rthy, sily, ip aren, sl calc, pred inbd wi sd, tr ls

90% SS: med-dkgy, occ ltgy, med brn, sft-mod sft-fri, occ frm, vfg, sb blk-sr clus, pred cons, mod-w srt, arg-sily mtz, rthy-grty, v sl calc; 10% SLTY SH: drkgy-dk brn, ip blk, sb blk-rr plty, mod-hd, rr brit, rthy, sily, ip aren, sl calc, pred inbd wi sd, tr ls





MD: 13,874'
INC: 89.69°
AZM: 358.26°
TVD: 7,756.09'
VS: 5,653.58'

MD: 13,963'
INC: 89.2°
AZM: 358.52°
TVD: 7,756.95'
VS: 5,742.57'

MD: 14,053'
INC: 89.02°
AZM: 358.23°
TVD: 7,758.3°
VS: 5,832.56'

Deflect off Fort Hays: 13858'-13862' MD

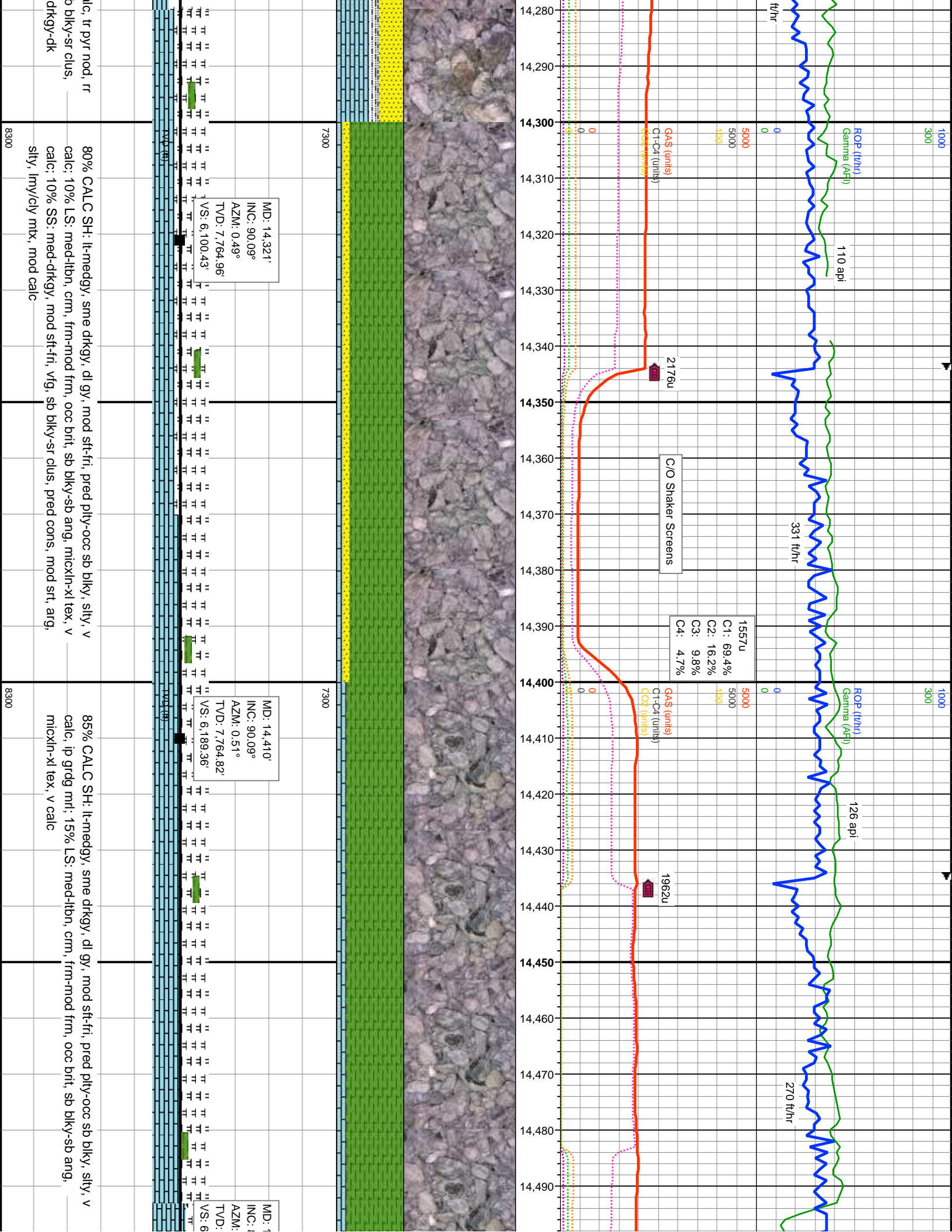
TVD (ft)

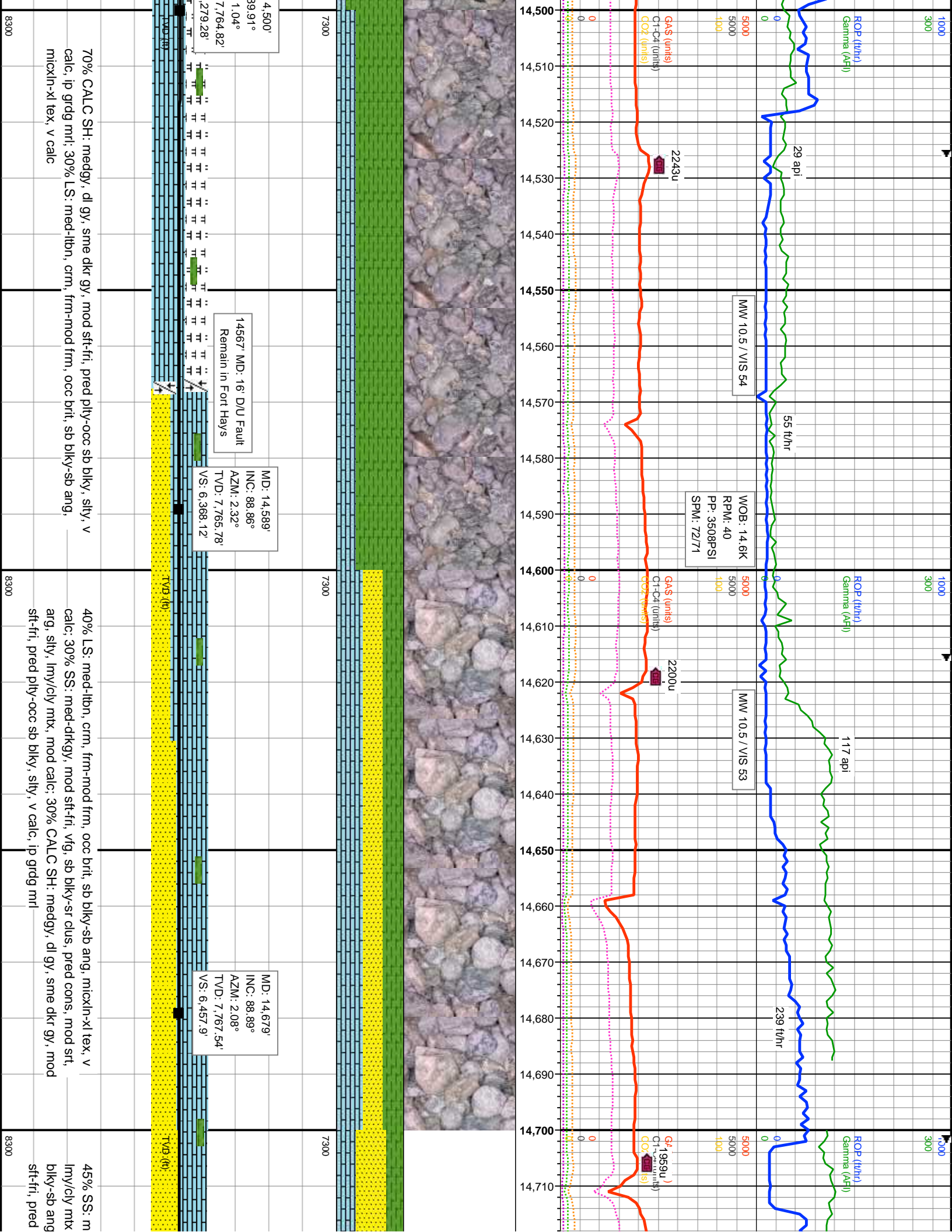
TVD (ft)

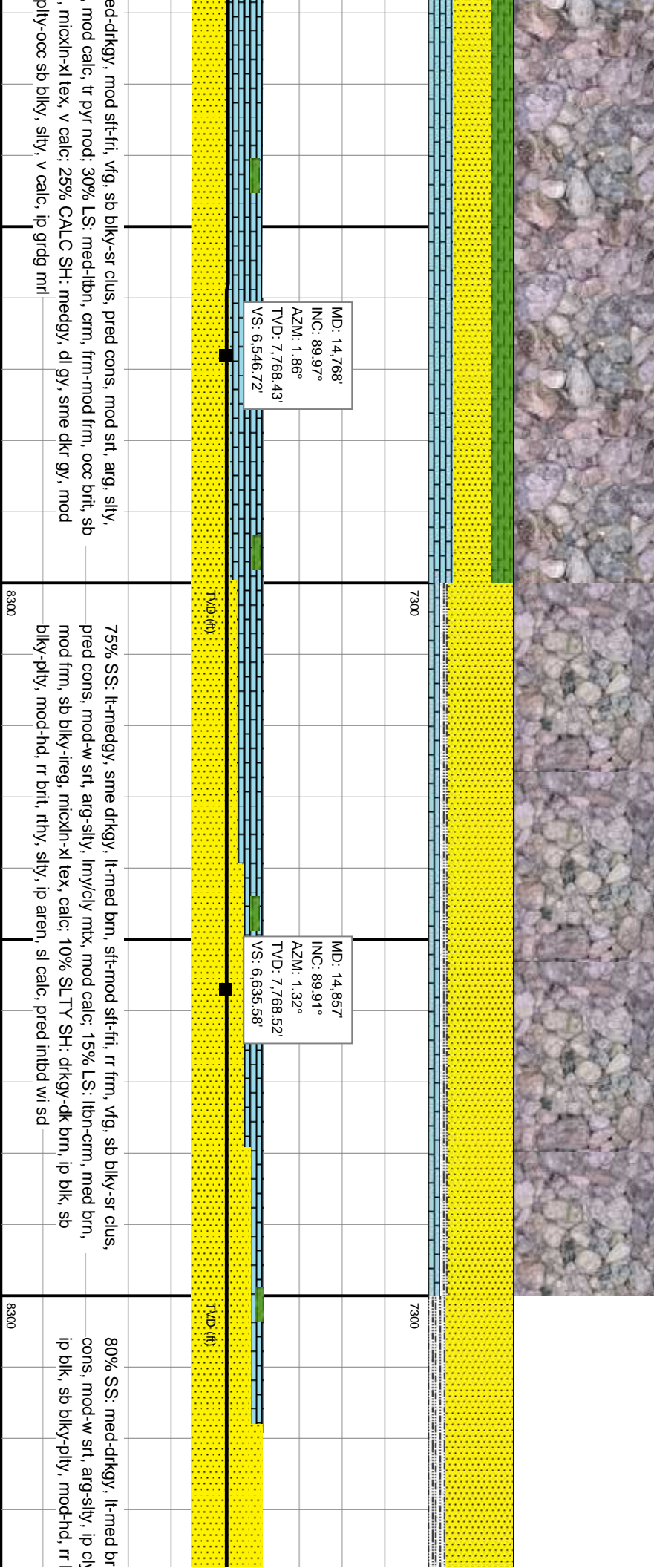
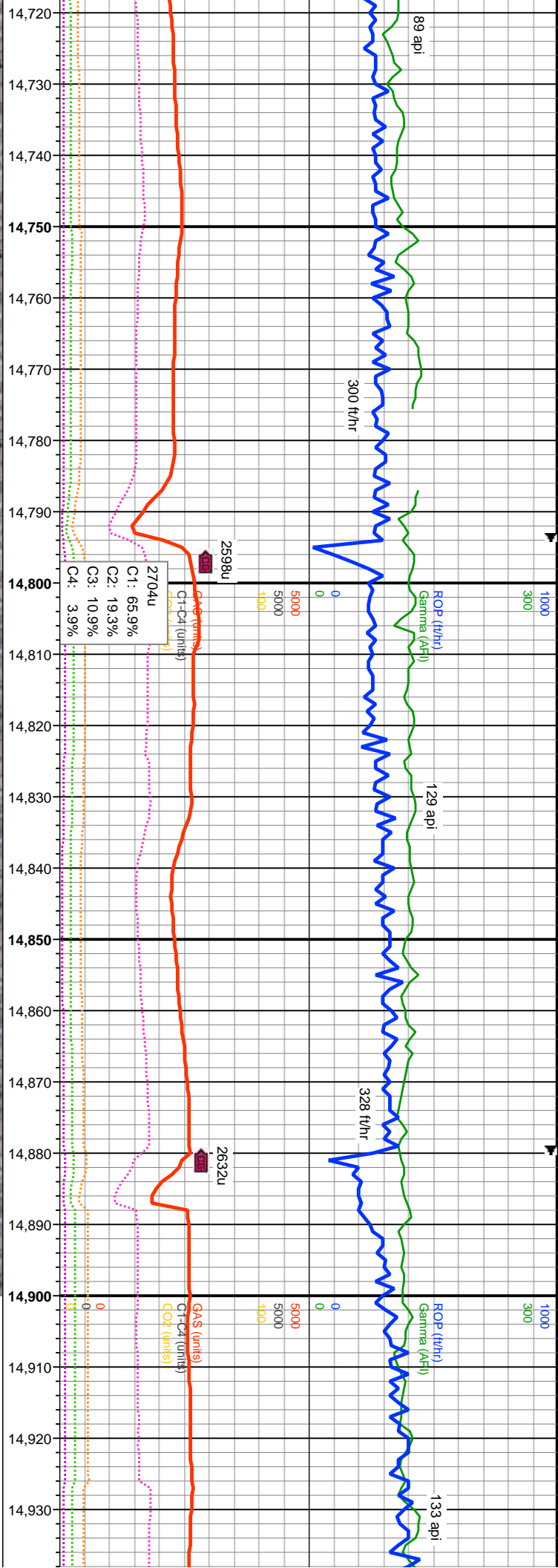
lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, lmy/cly mtz, tr-mod calc, tr LS; 20% SLTY SH: ply, mod-hd, rr brit, rthy, silty, ip aren, sl calc, pred

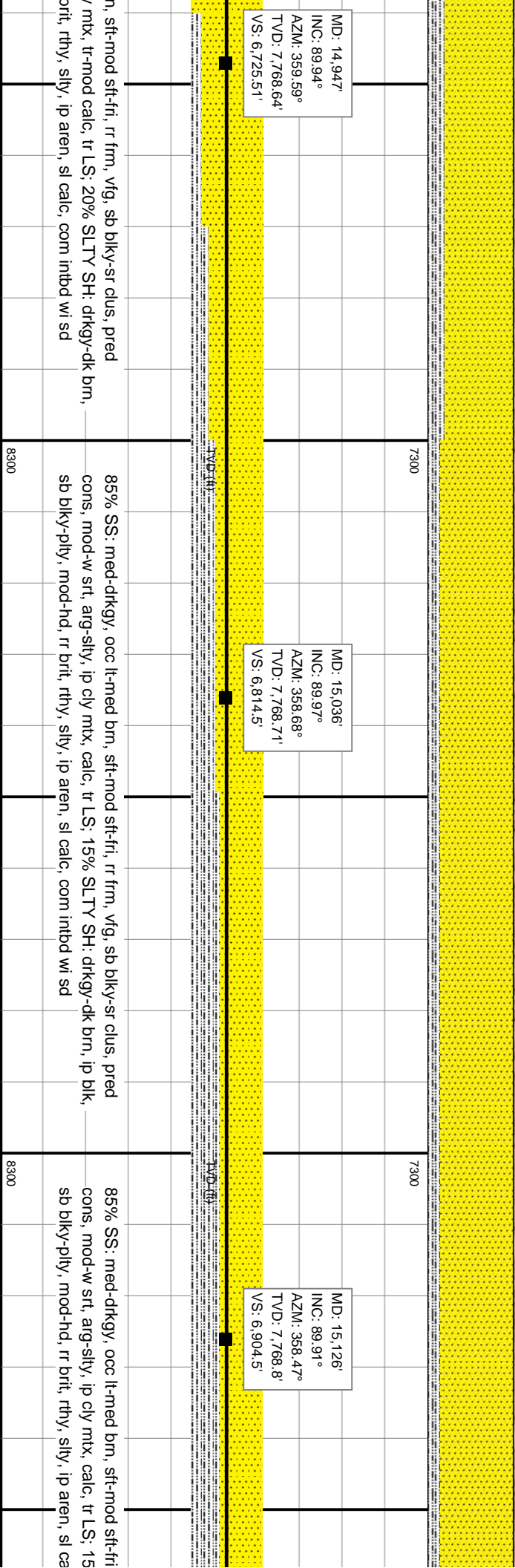
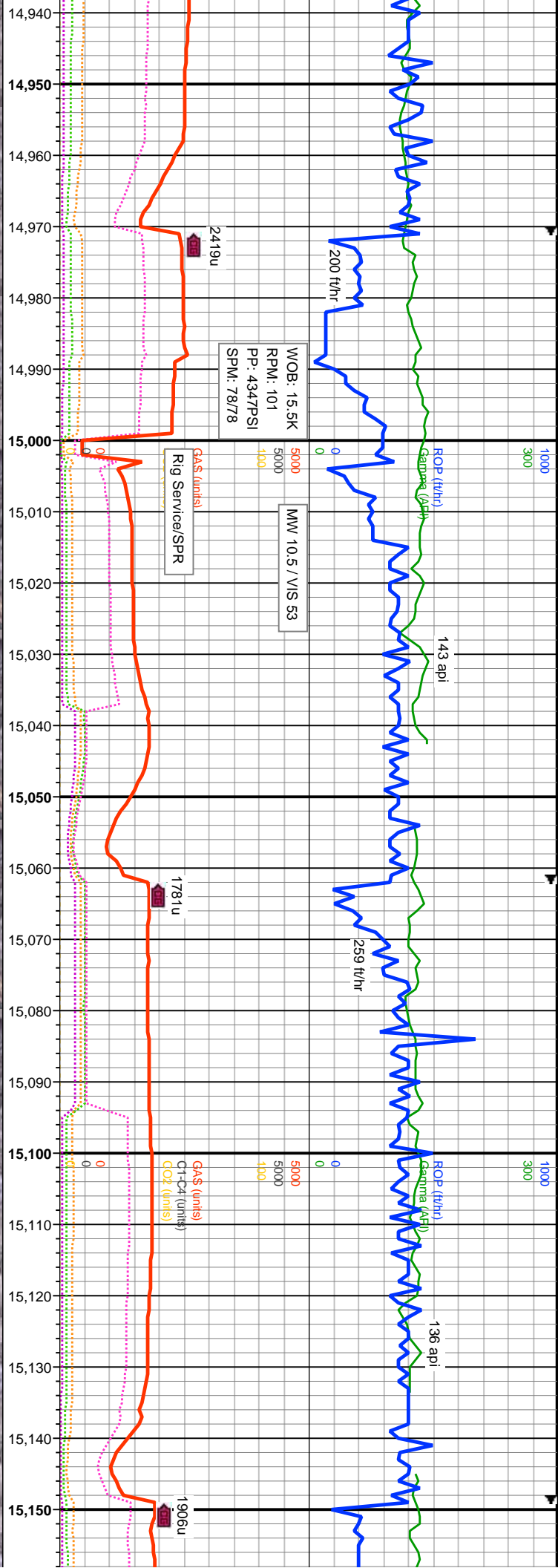
85% SS: lt-medgy, sme drkgy, lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, lmy/cly mtz, tr-mod calc, tr LS; 15% SLTY SH: drkgy-dk brn, ip blk, sb blk-y-rr ply, mod-hd, rr brit, rthy, silty, ip aren, sl calc, pred inbd wi sd

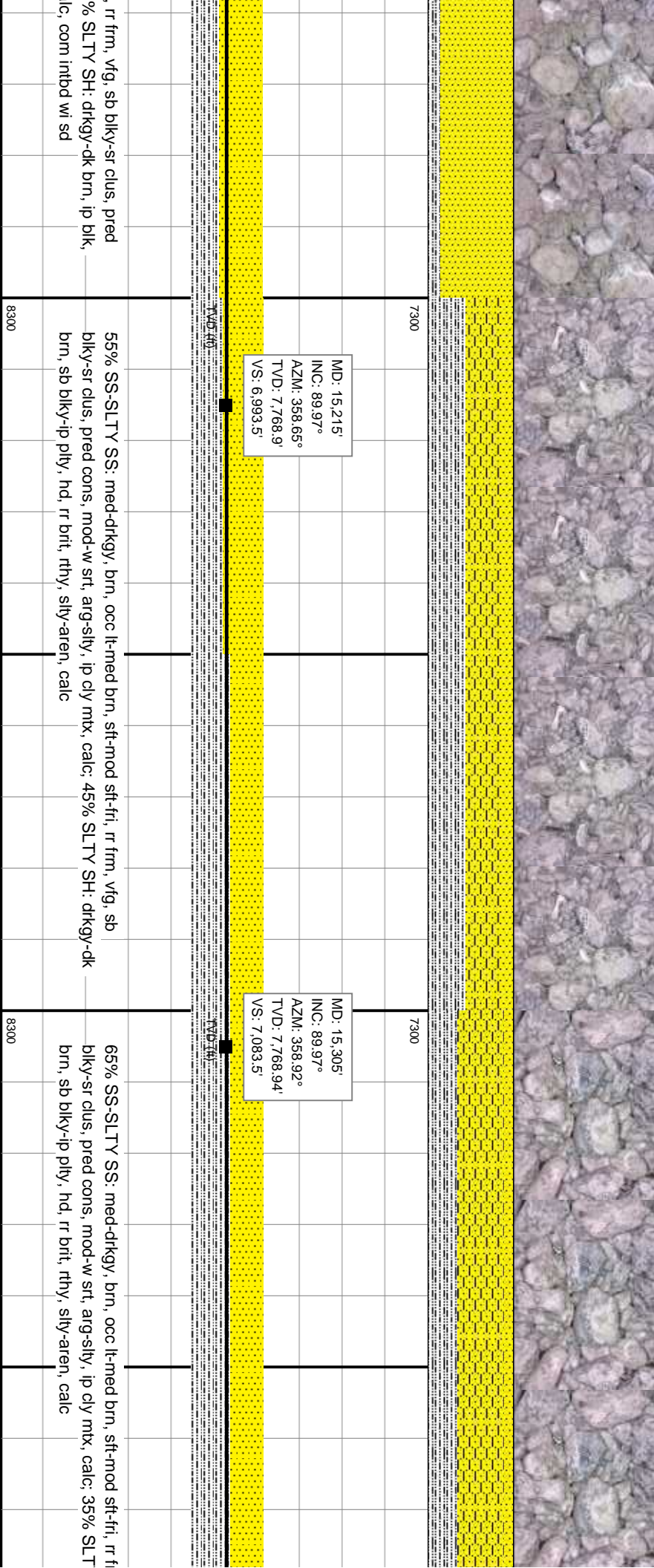
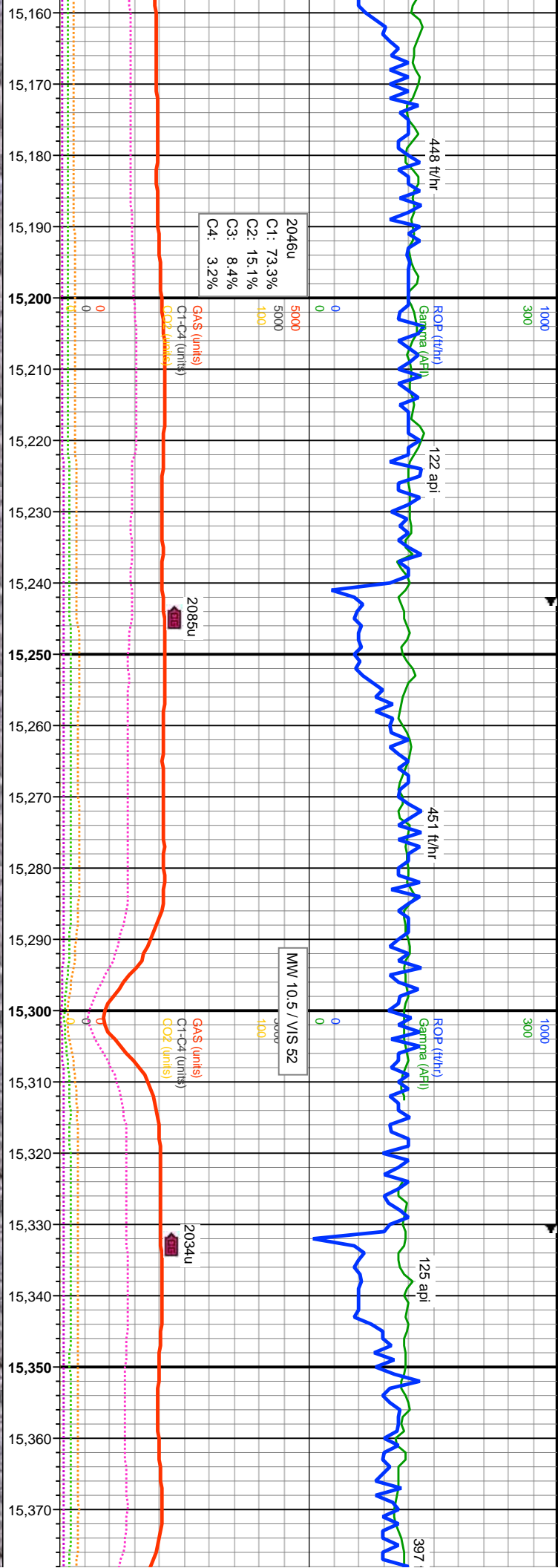
85% SS: lt-medgy, sme drkgy, lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, lmy/cly mtz, mod ce ip blk, sb blk-y-rr ply, mod-hd, rr brit, rthy, silty, ip aren, sl calc, pred LS: lbbrn-crm, med brn, mod frm, sb blk-y-ireg, mlox

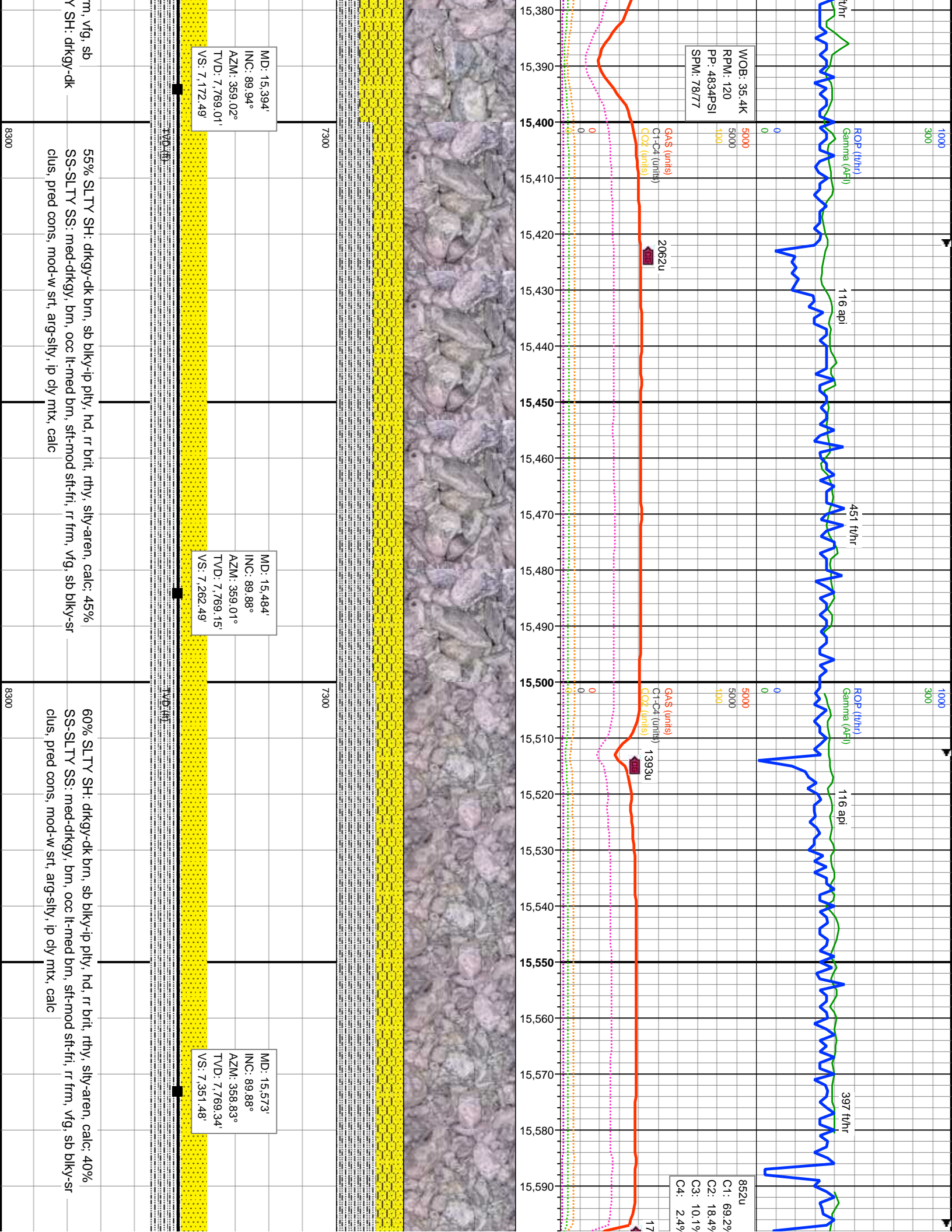


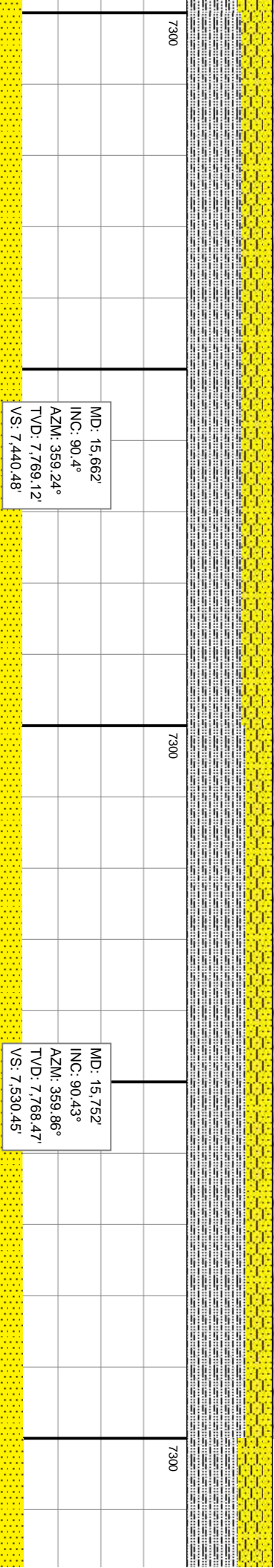
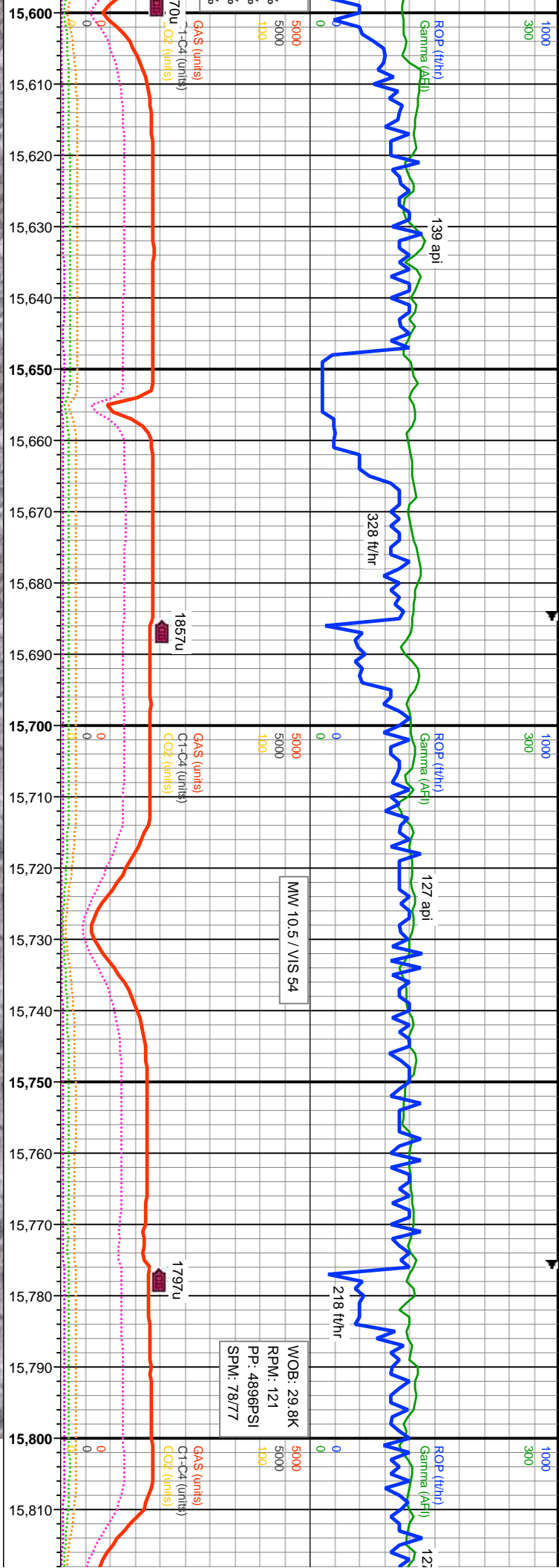




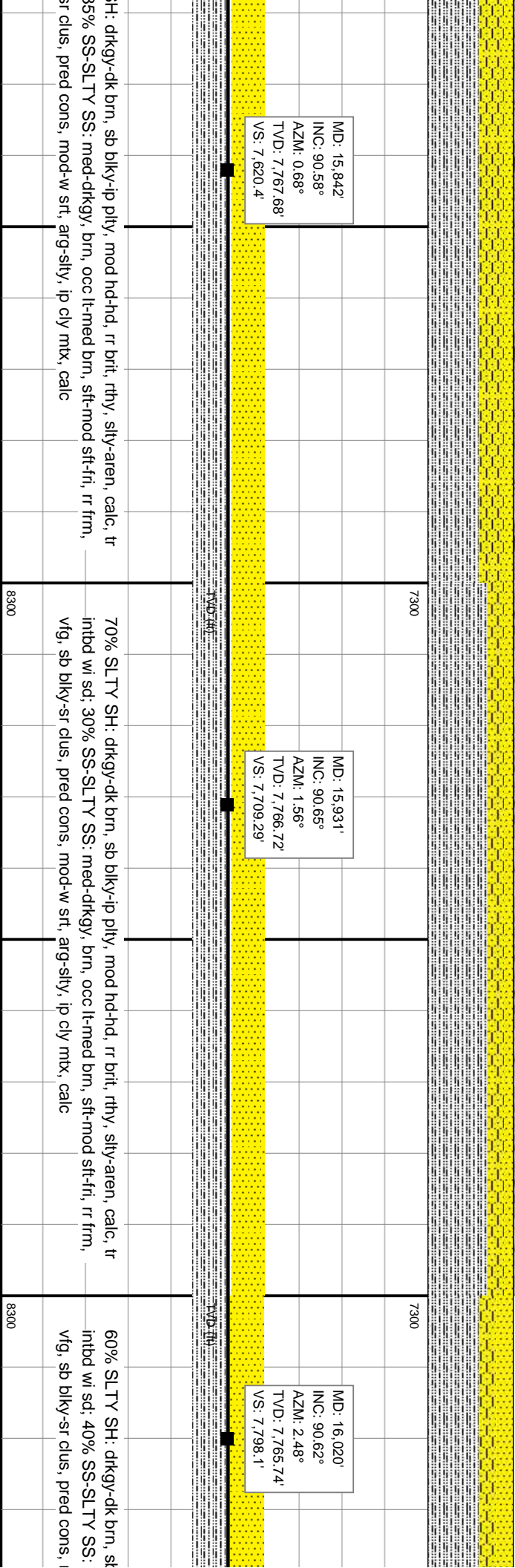
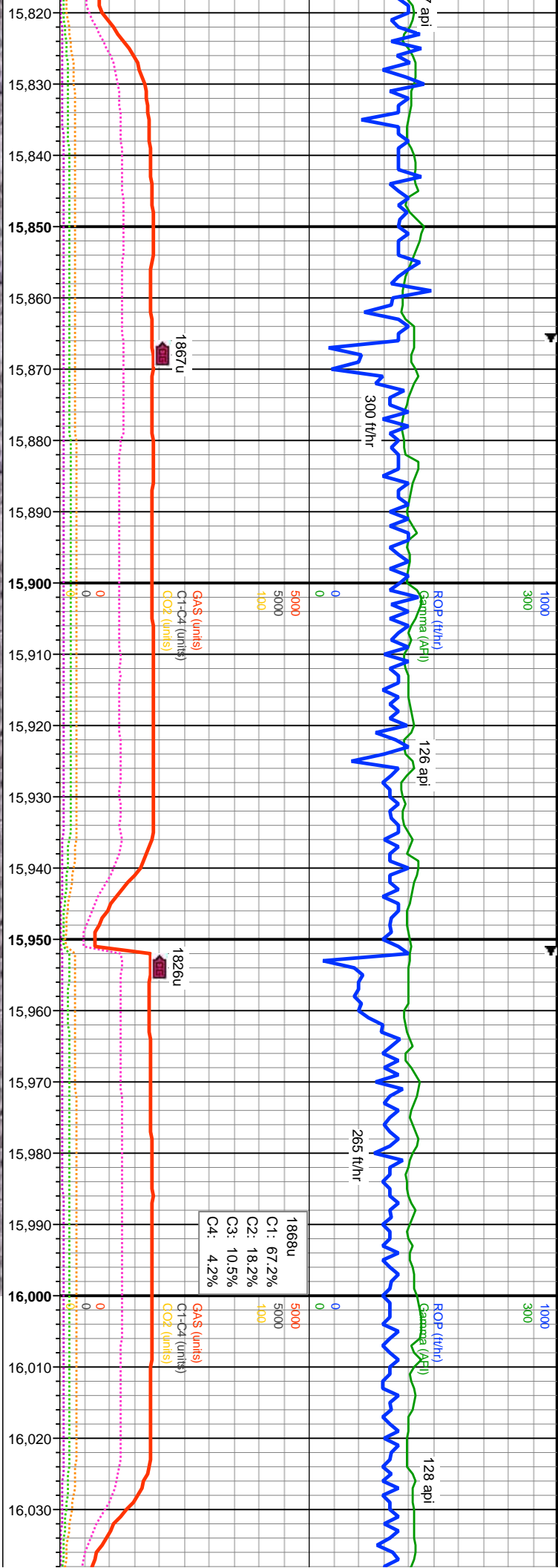


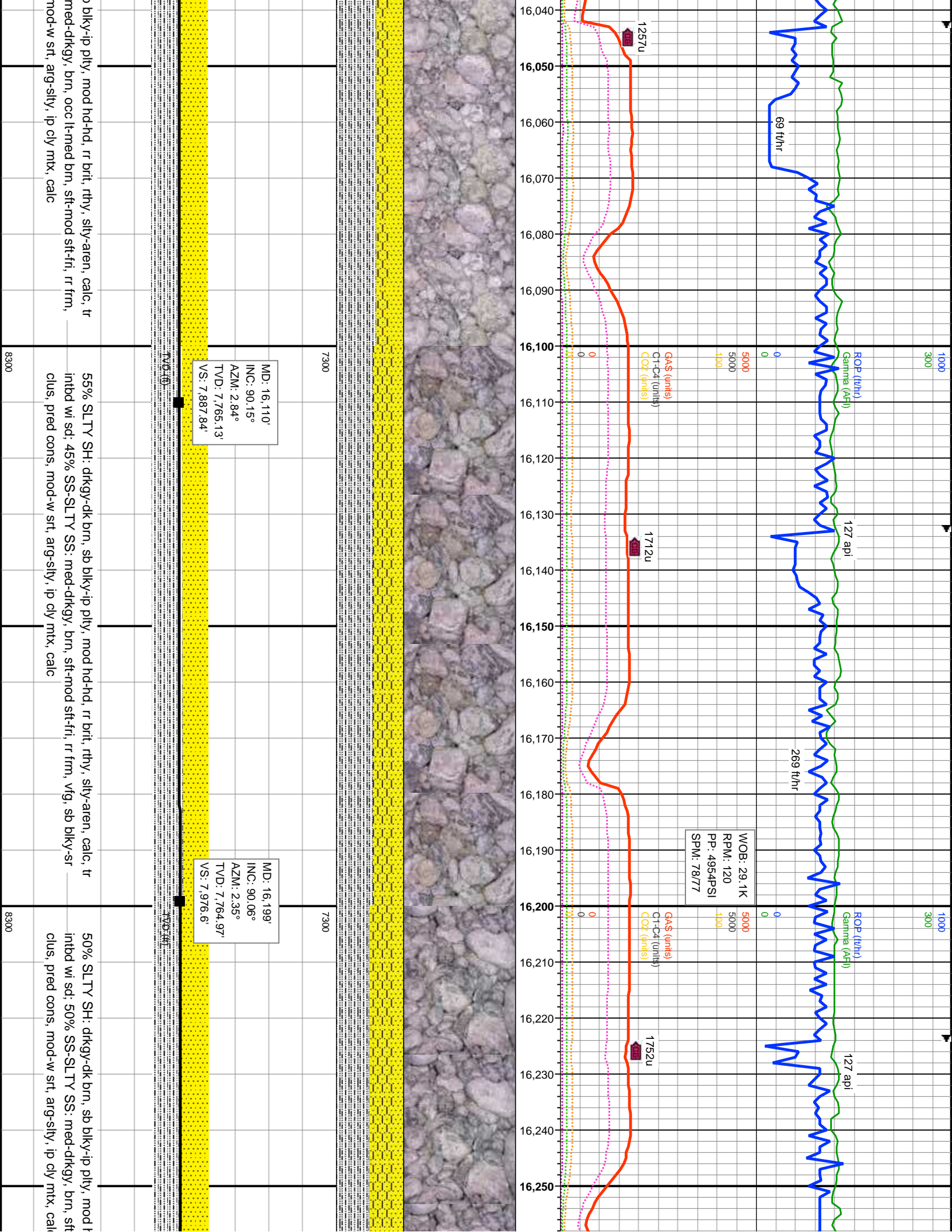


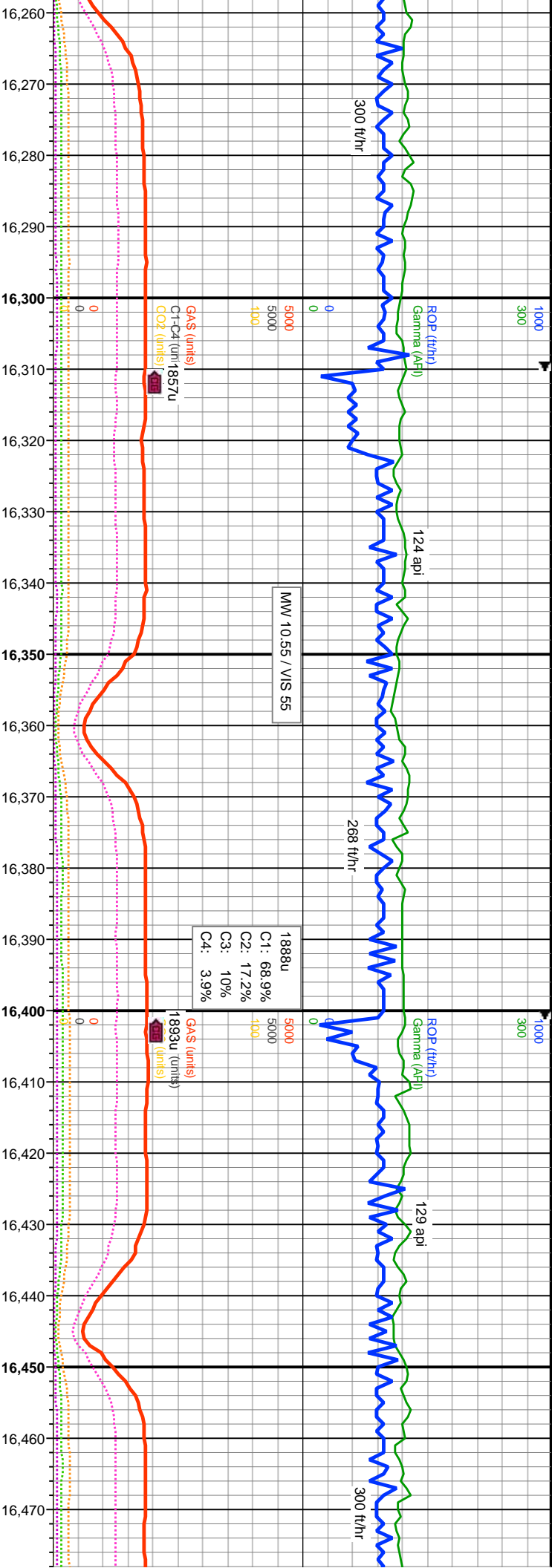




65% SLTY SH: drkgy-dk brn, sb blk-y-ip pily, mod hd-hd, rr brit, rthy, silty-aren, calc, 35% SS-SLTY SS: med-drkgy, brn, occ lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, ip cly mx, calc	70% SLTY SH: drkgy-dk brn, sb blk-y-ip pily, mod hd-hd, rr brit, rthy, silty-aren, calc, tr intbd wi sd, 30% SS-SLTY SS: med-drkgy, brn, occ lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, ip cly mx, calc	65% SLTY SH: drkgy-dk brn, sb blk-y-ip pily, mod hd-hd, rr brit, rthy, silty-aren, calc, tr intbd wi sd, 30% SS-SLTY SS: med-drkgy, brn, occ lt-med brn, sft-mod sft-fri, rr frm, vfg, sb blk-y-sr clus, pred cons, mod-w srt, arg-sily, ip cly mx, calc
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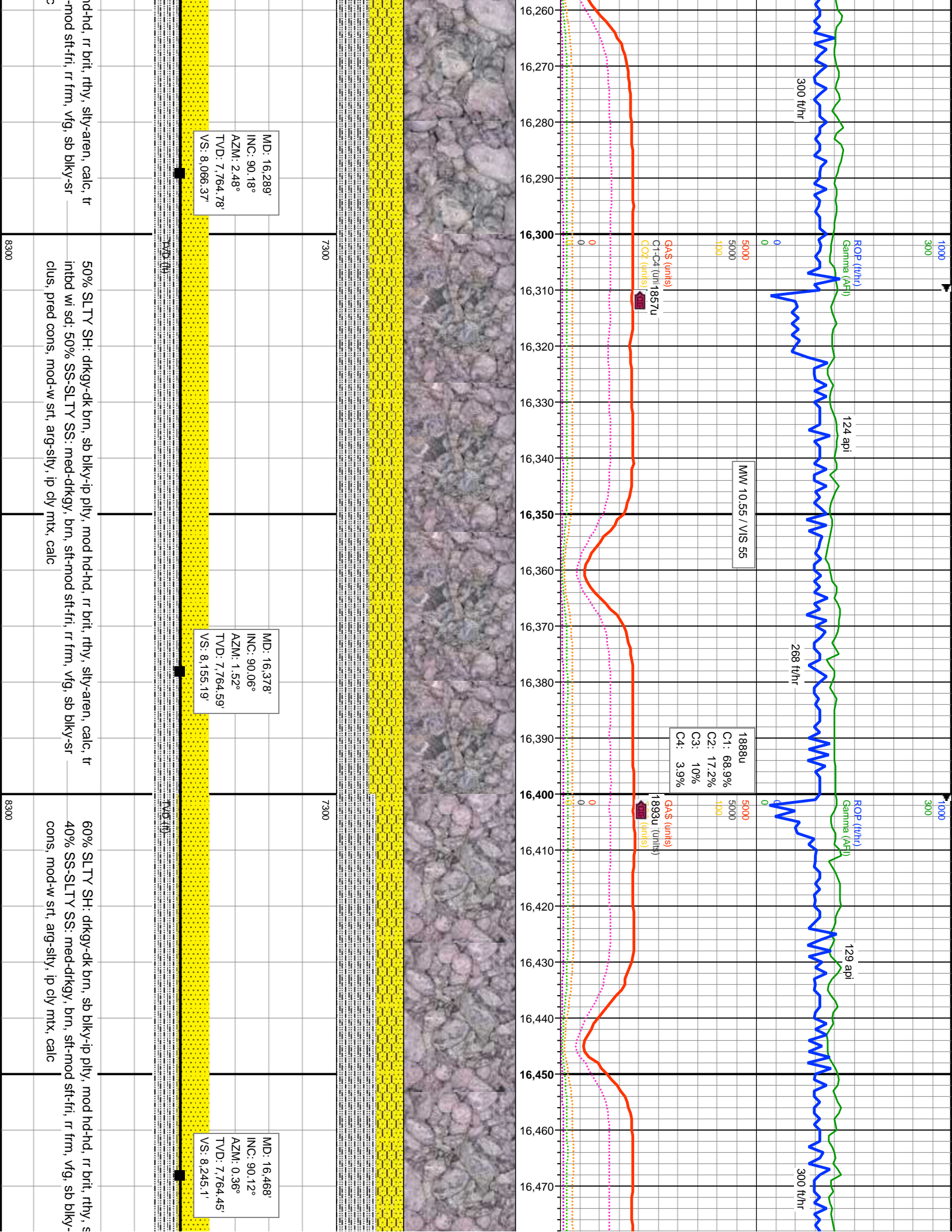


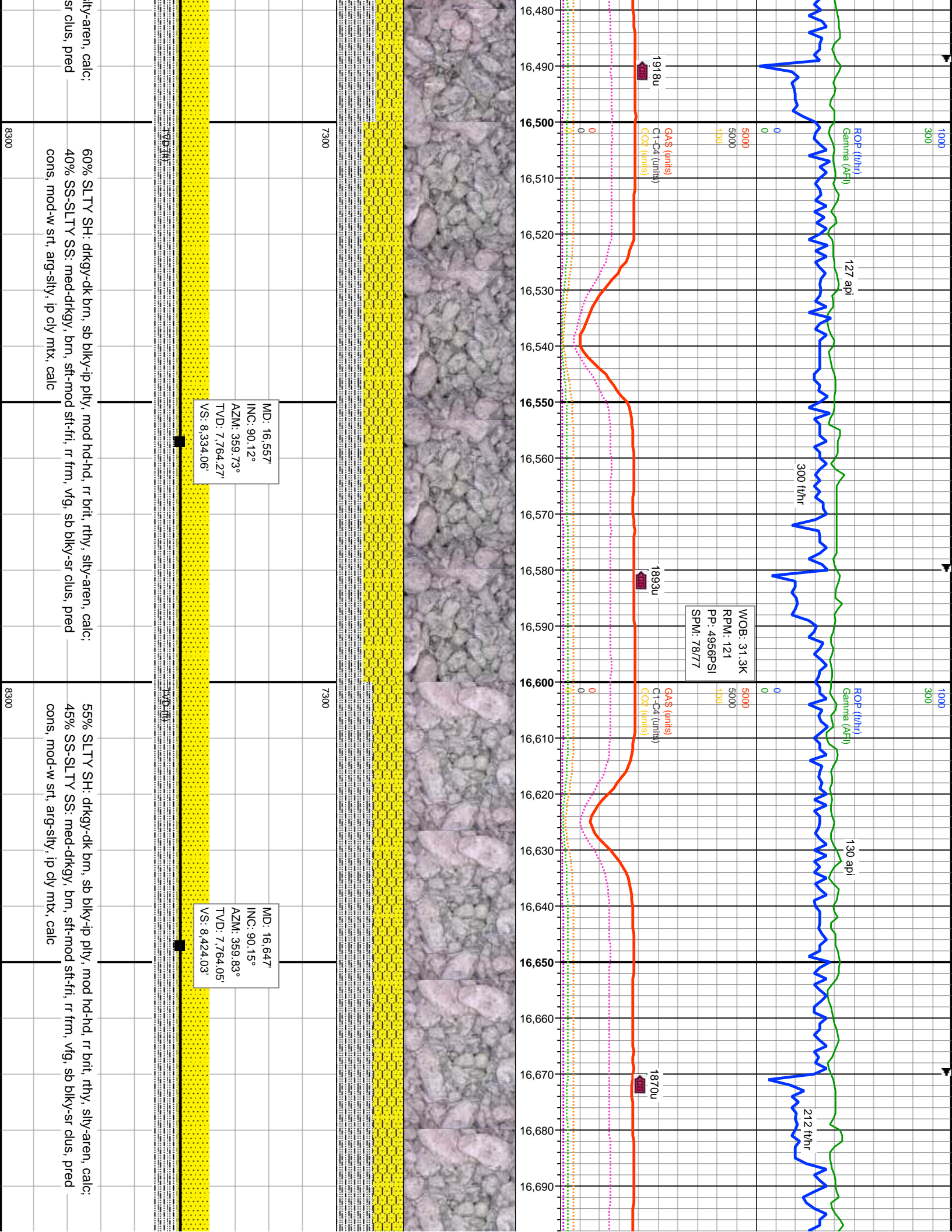


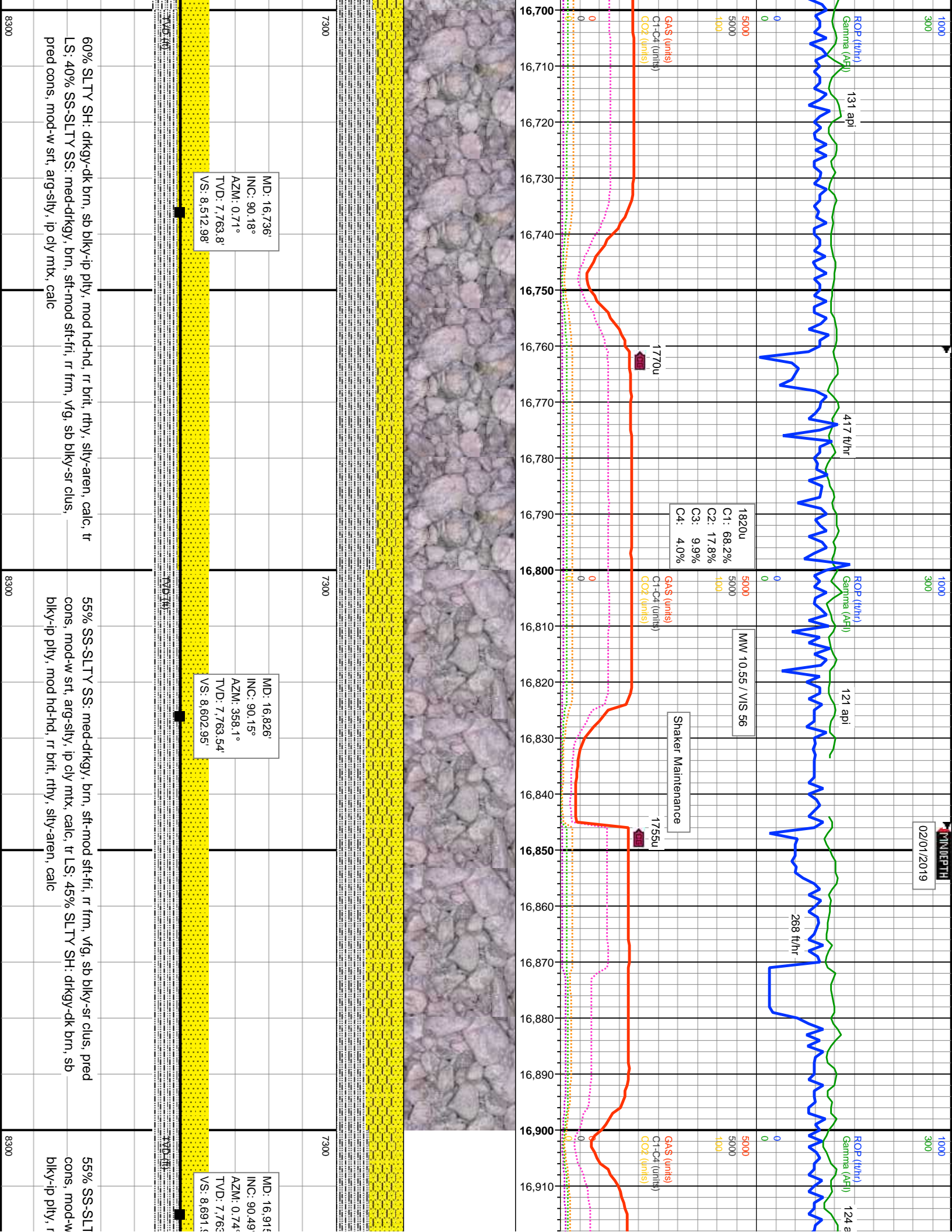
MD: 16,289'
INC: 90.18°
AZM: 2.48°
TVD: 7,764.78'
VS: 8,066.37'

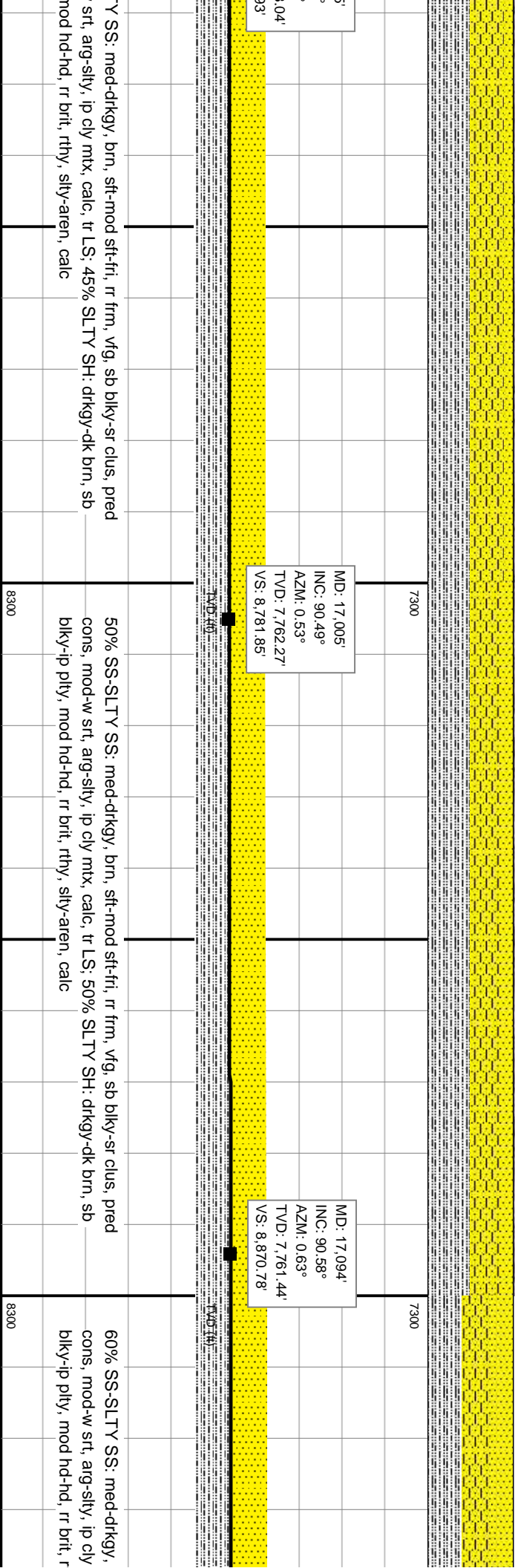
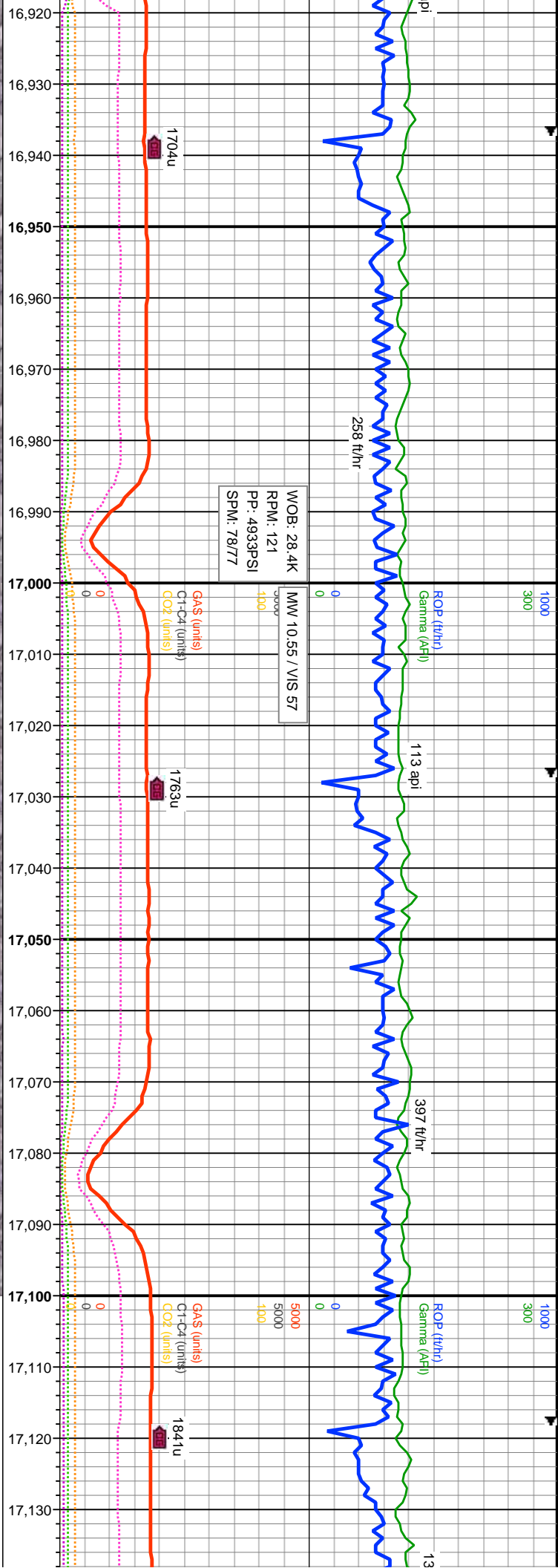
MD: 16,378'
INC: 90.06°
AZM: 1.52°
TVD: 7,764.59'
VS: 8,155.19'

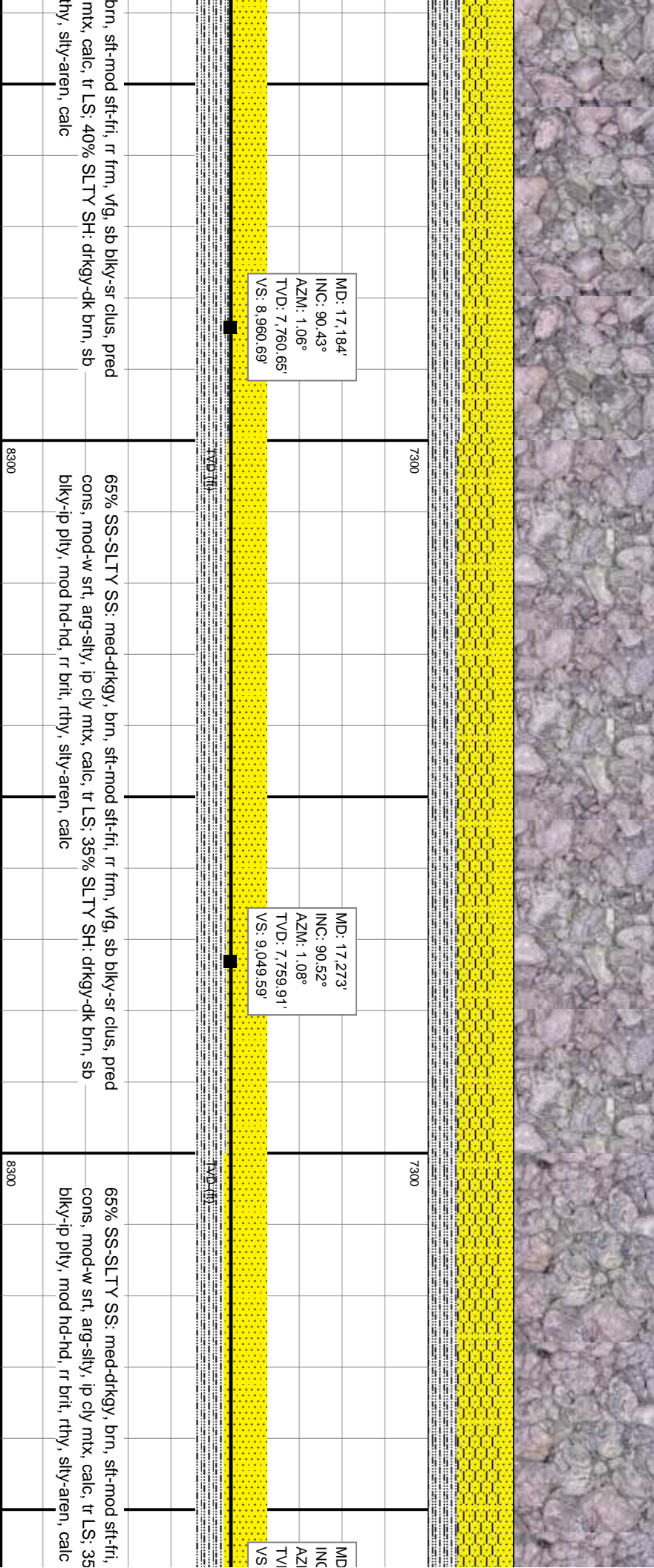
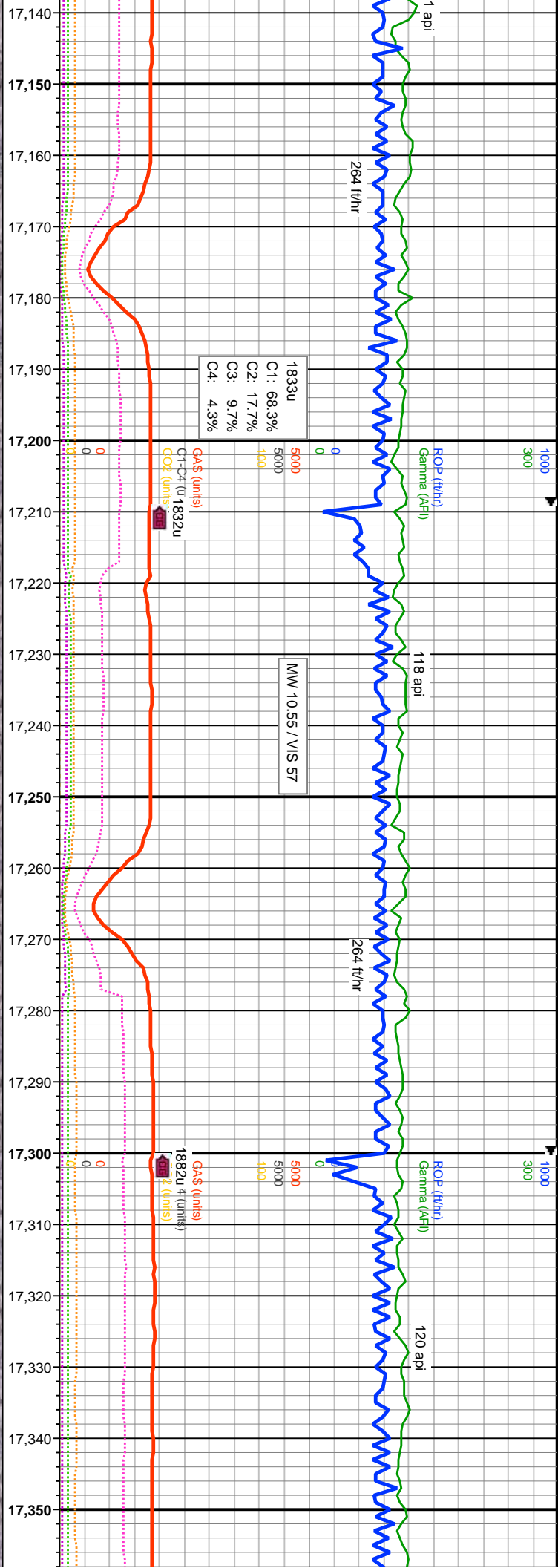
MD: 16,468'
INC: 90.12°
AZM: 0.36°
TVD: 7,764.45'
VS: 8,245.1'

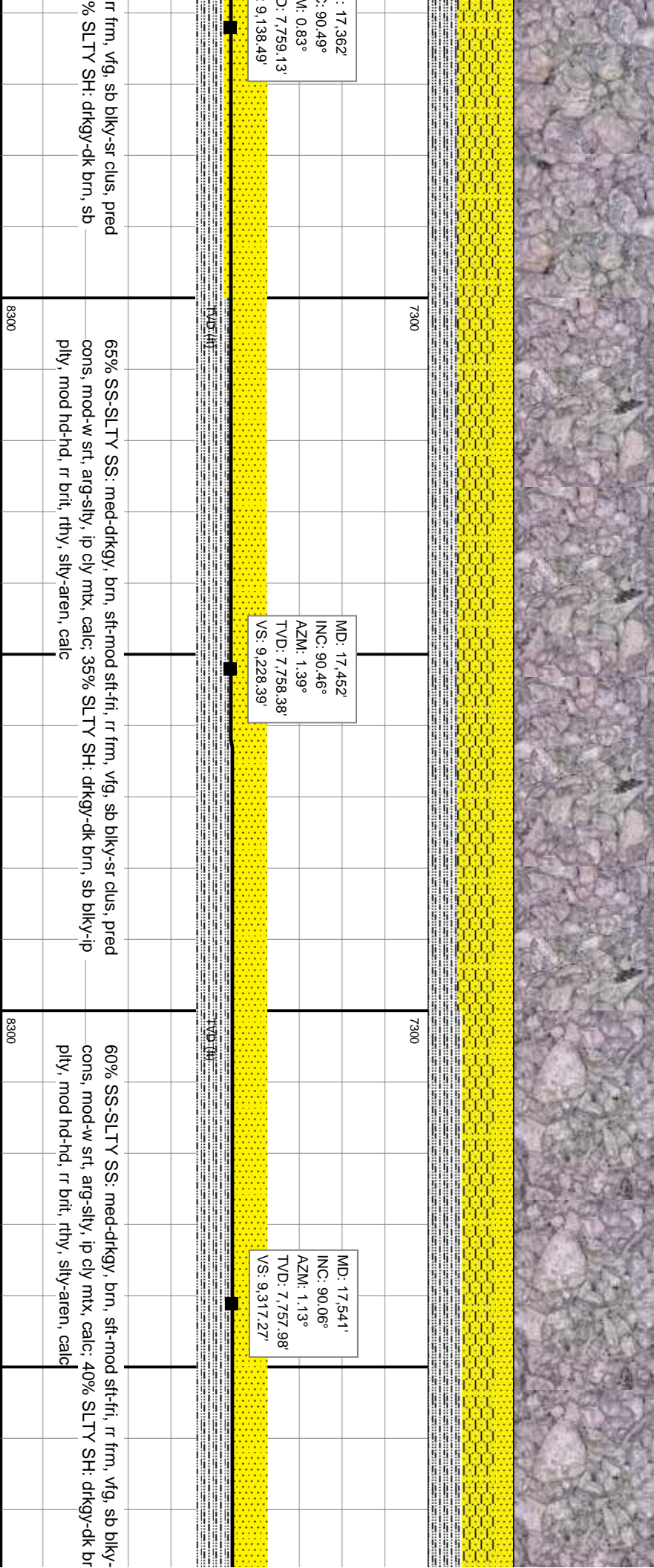
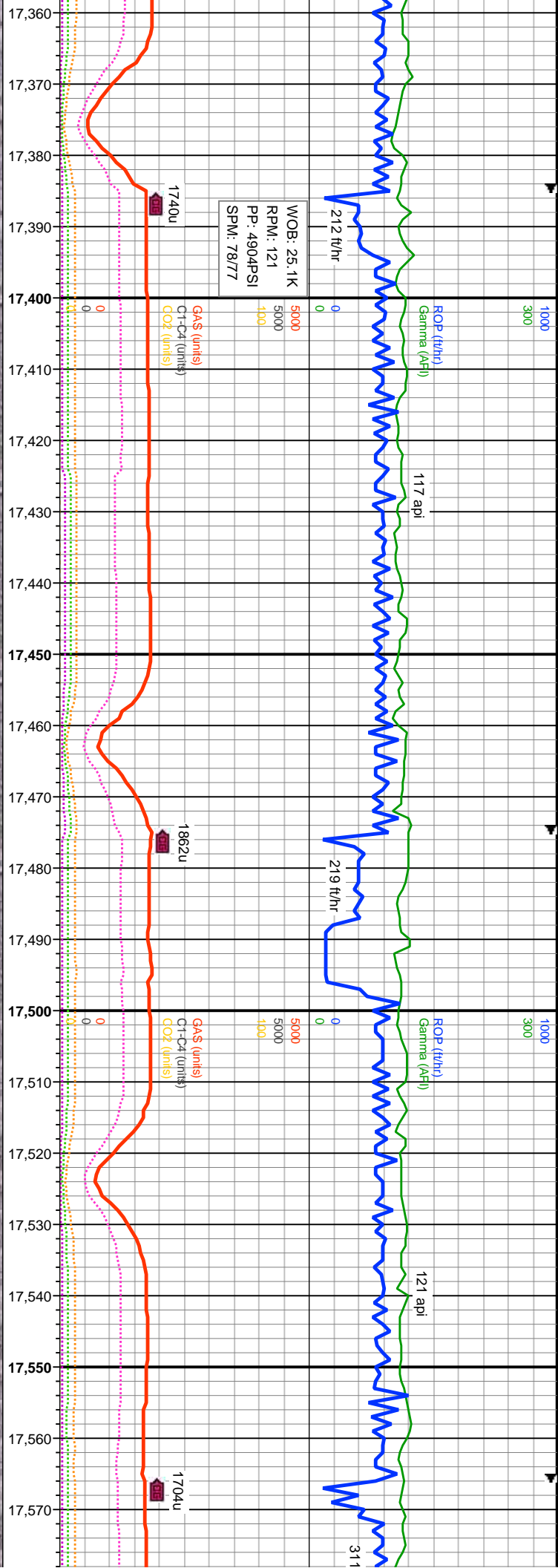


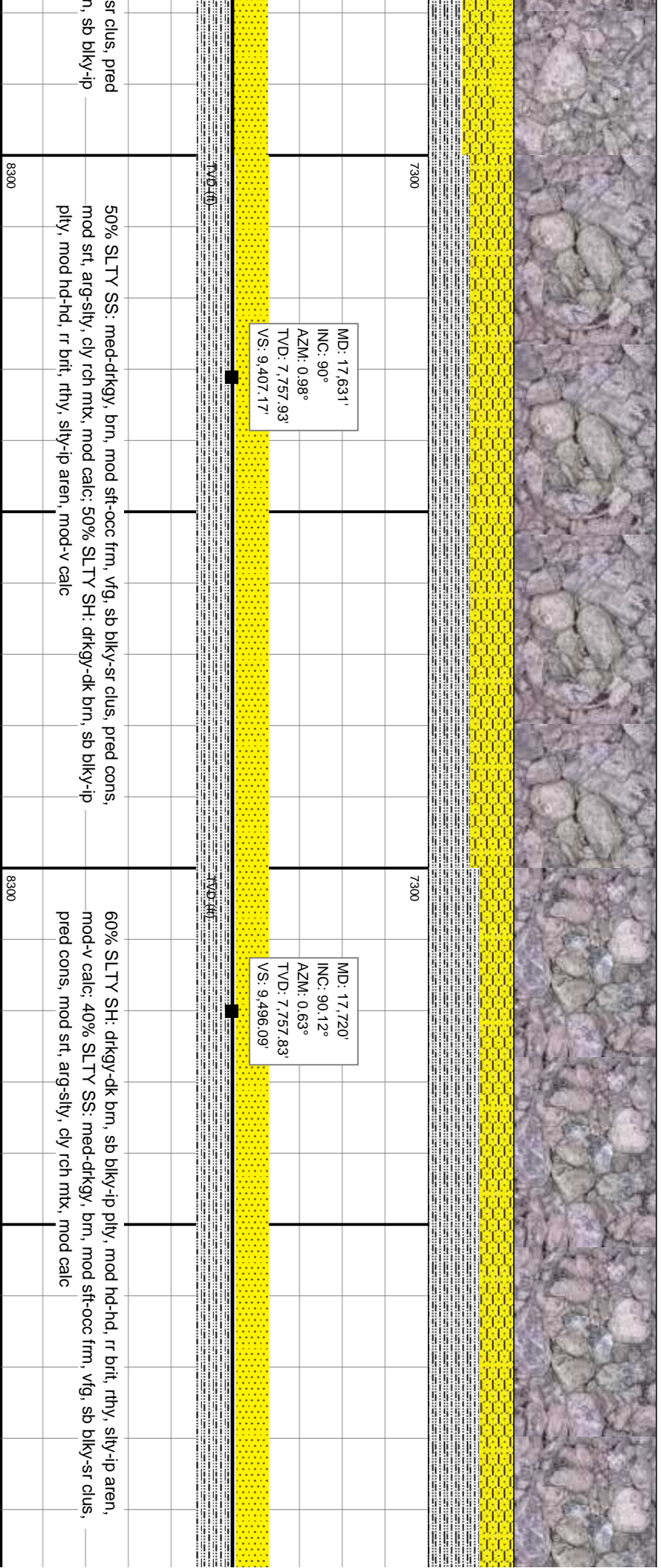
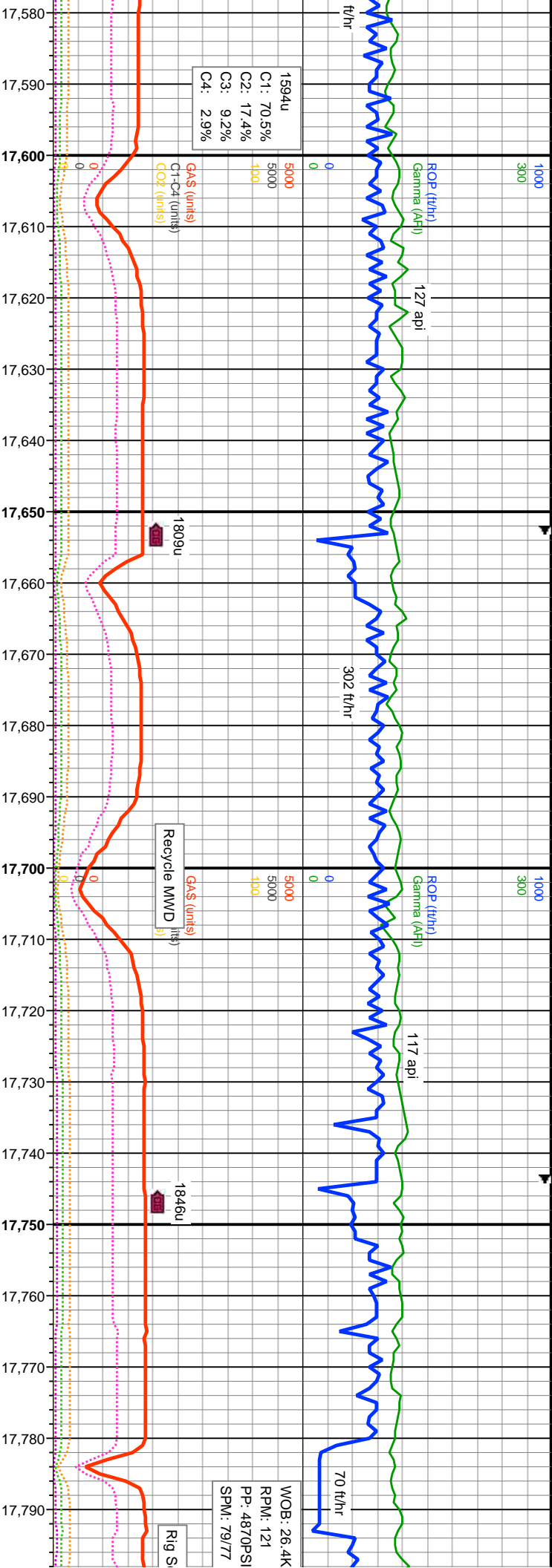


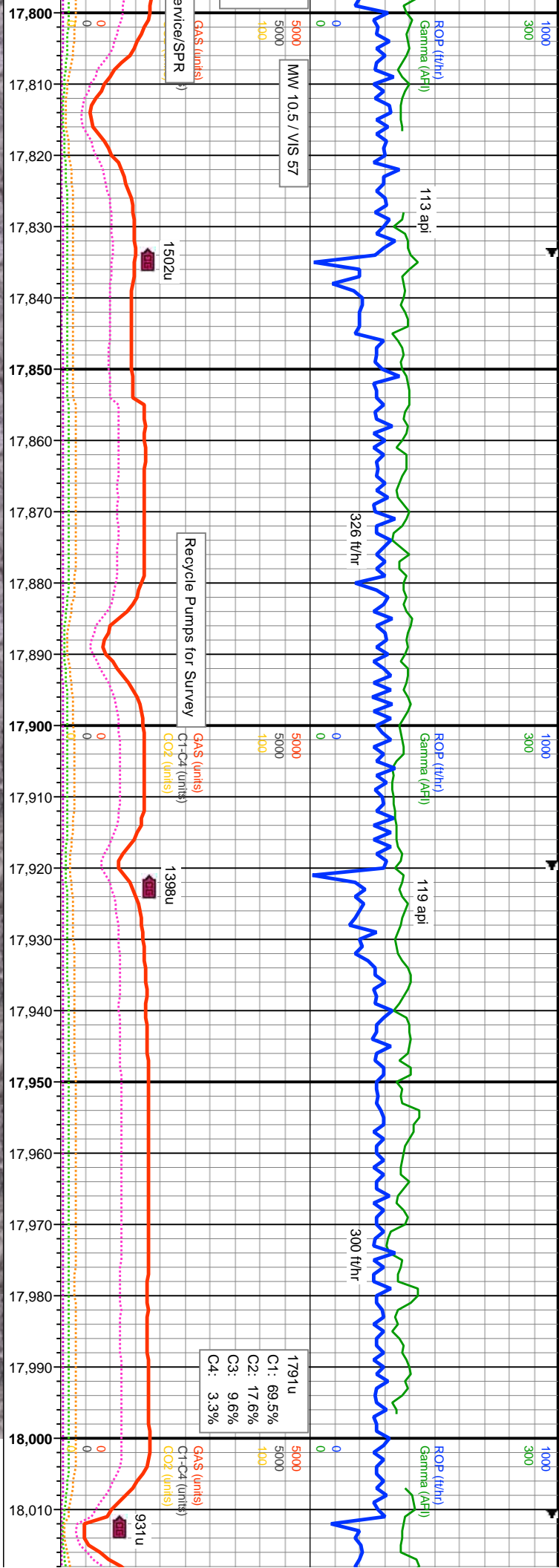












MD: 17,810'
INC: 90.95°
AZM: 0.16°
TVD: 7,756.99'
VS: 9,586.03'

MD: 17,899'
INC: 90.86°
AZM: 0.52°
TVD: 7,755.59'
VS: 9,674.96'

MD: 17,989'
INC: 90.83°
AZM: 0.5°
TVD: 7,754.26'
VS: 9,764.89'

60% SLTY SH: drkgy-dk brn, sb blkyl-ip pily, mod hd-hd, rr brit, rthy, silty-ip aren, mod-v calc; 40% SLTY SS: med-drkgy, brn, mod sft-occ frm, vfg, sb blkyl-sr clus, pred cons, mod srt, arg-sily, sl cly rch mtx, mod calc

55% SLTY SH: drkgy-dk brn, sb blkyl-ip pily, mod hd-hd, rr brit, rthy, silty-ip aren, mod calc; 45% SLTY SS: med-drkgy, brn, mod sft-occ frm, vfg, sb blkyl-sr clus, pred cons, mod srt, arg-sily, sl cly rch mtx, mod calc

60% SLTY SH: drkgy-dk brn, sb blkyl-ip pily, mod hd-hd, rr brit, rthy, silty-ip aren, mod-v calc; 40% SLTY SS: med-drkgy, brn, mod sft-occ frm, vfg, sb blkyl-sr clus, pred cons, mod srt, arg-sily, sl cly rch mtx, mod calc

