



Scale: 5" / 100'
Measured Depth Log

Well Name Ottesen LE 09-366HN Mudlog

Location SEC.33, T1N, R66W

State COLORADO

County WELD

Country UNITED STATES

Rig Number PRECISION 460

API Number 051234433600

AFE # 18DC0203

Geographic Region DJ BASIN

Field WATTENBERG

Ground Elevation 5076.5'

K.B. Elevation 5096.5'

Logged Interval 6000' MD To 17813' MD

Total Depth 17813' MD

Formation NIOBRARA C CHALK

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 12/23/2018

MUDLOG END DATE 12/26/2018

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
- TILL
- Marl
- CEMENT
- COAL
- TUFF
- SHALE
- UNKNOWN
- ANHYDRITE
- IGNEOUS
- Silty Shale
- GYPSUM
- METAMORPHIC
- Silty Siltstone
- SALT
- SHALE COLORED
- Silty Sandstone
- CLAYSTONE
- CALCARIOUS SHALE

Fossils

- GASTROPOD
- B BENTON
- OOLITE
- BITUME
- ALGAE
- OSTRACOD
- BRECC
- AMPHIPORA
- PELECYPOD
- BELEMNITE
- PELLET
- CARBO
- BIOLASTIC
- PISOLITE
- CHTDKC
- BRACHIOPOD
- PLANT REMAINS
- CHTLT
- PLANT SPORES
- COAL -
- CYPTALOPOD
- SCAPHOPOD
- CEPHALOPOD
- DOLOM
- CORAL
- STROMATOPOROID
- FELDSF
- CRINOID
- FERRUC
- ECHINOID
- FERRU
- FISH
- ANHYDRITC
- GLAUC
- FORAMINIFERA
- ARGILLACEOUS
- GYPSIF
- F FOSSIL
- ARGILLITE GRAIN
- HEAVY

Minerals

Porosity

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

Oil Show

- ORGANIC
- P PINPOINT
- DEAD
- VUGGY
- EVEN
- QUESTIONABLE
- ENGINEERING
- 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	LIMESTONE STRINGER
ANCEOUS FLAKES	PHOSPHATE PELLETS	MARLSTONE (CALC) STRG
	P PYRITE	MARLSTONE (DOL) STRG
THIN BEDS	SALT CAST	SANDSTONE STRINGER
	SANDY	SHALE STRINGER
ITIC	SILICEOUS	SILTSTONE STRINGER
AR	SILTY	CALC SHALE
IGINOUS PELLET	TUFFACEOUS	CHALK
GINOUS		
ONITE		
FEROUS		
MINERAL		

Stringer

ANHYDRITE STRINGER
BENTONITE STRINGER

Other Symbols

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

Rounding

M MUDSTONE
P PACKSTONE
W WACKESTONE

Sorting

M MODERATE
P POOR
W WELL

Textures

CALCARIUOS SHALE

CALCARIOUS SHALE

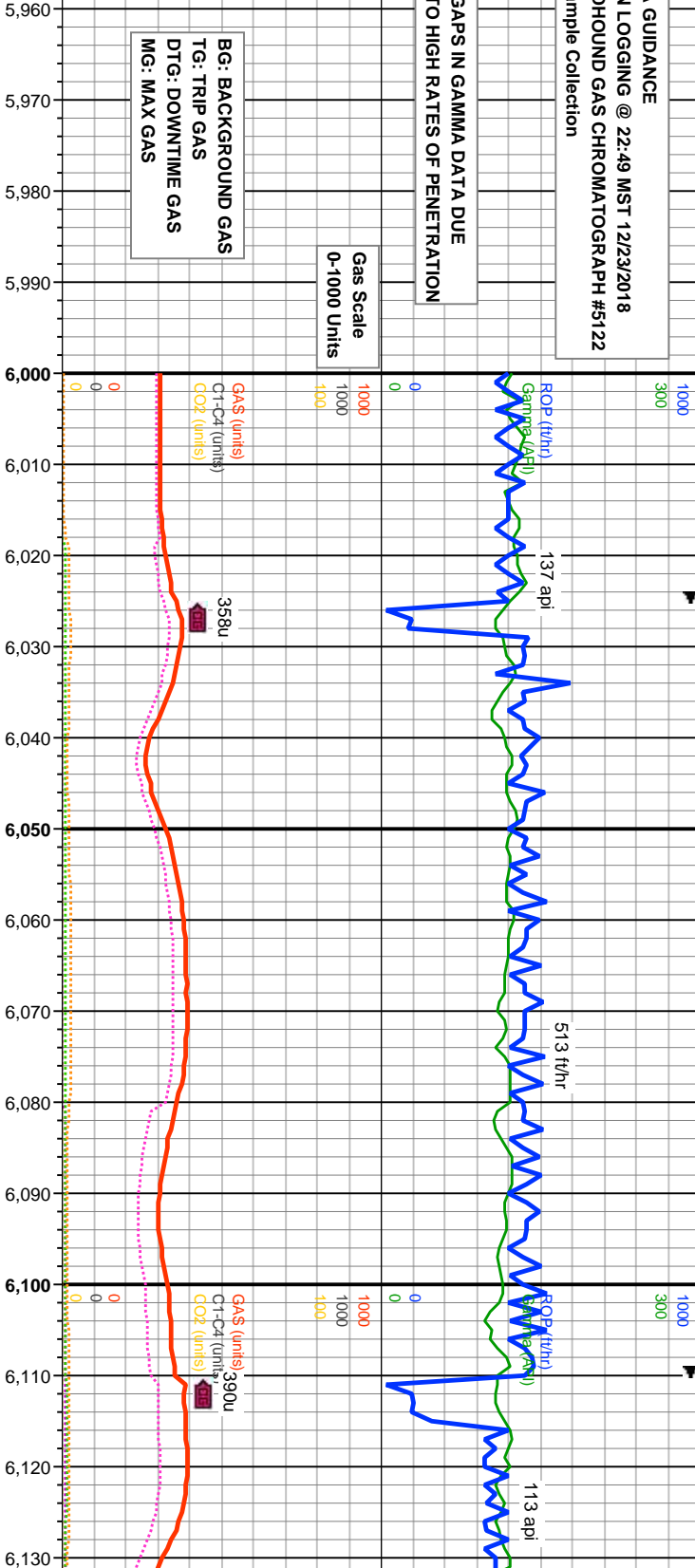
TERRA GUIDANCE
BEGAN LOGGING @ 22:49 MST 12/23/2018
BLOODHOUND GAS CHROMATOGRAPH #5122
100' Sample Collection

ROP
ROP
Gamma

GAPS IN GAMMA DATA DUE
TO HIGH RATES OF PENETRATION

Gas Scale
0-1000 Units

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



Images



% Lithology

TVD Scale
5800' - 8500'

MD: 6,000'
INC: 29.92°
AZM: 167.46°
TVD: 5,832.78'
VS: 675.27'

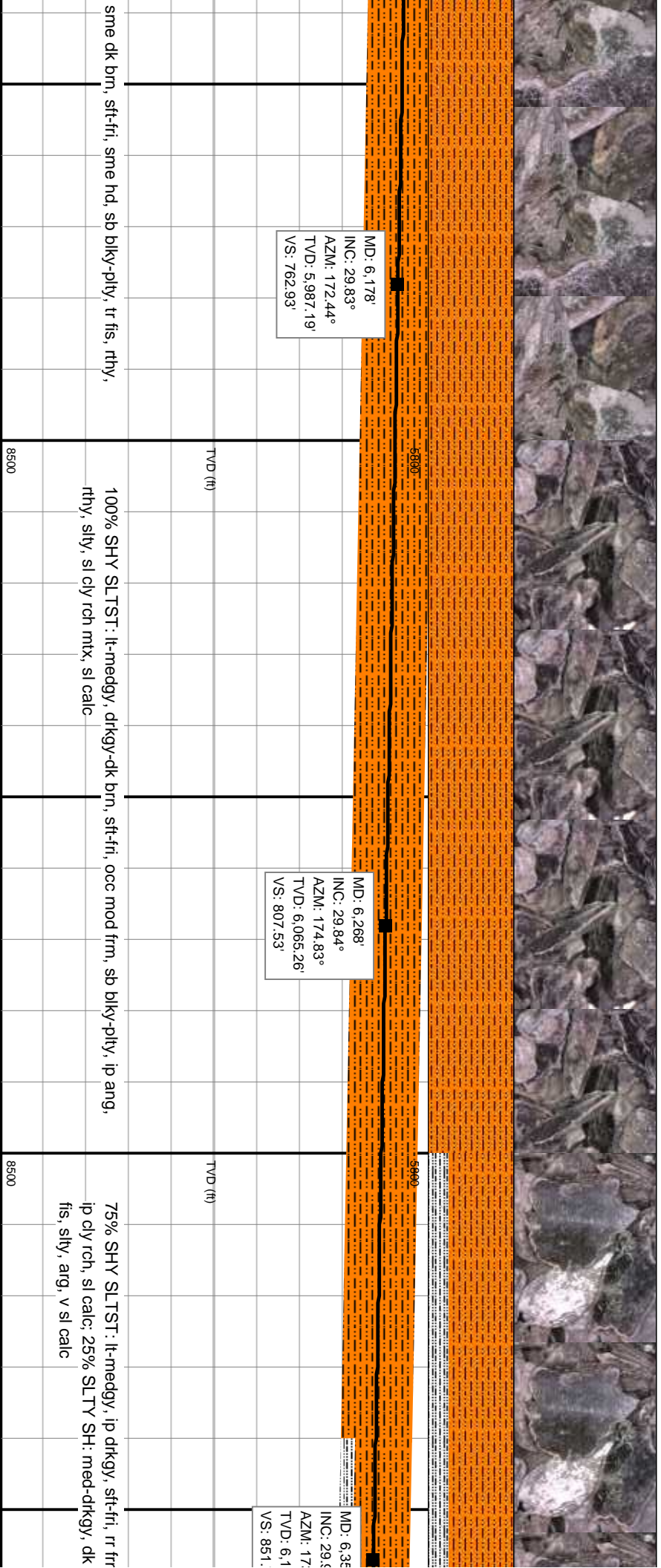
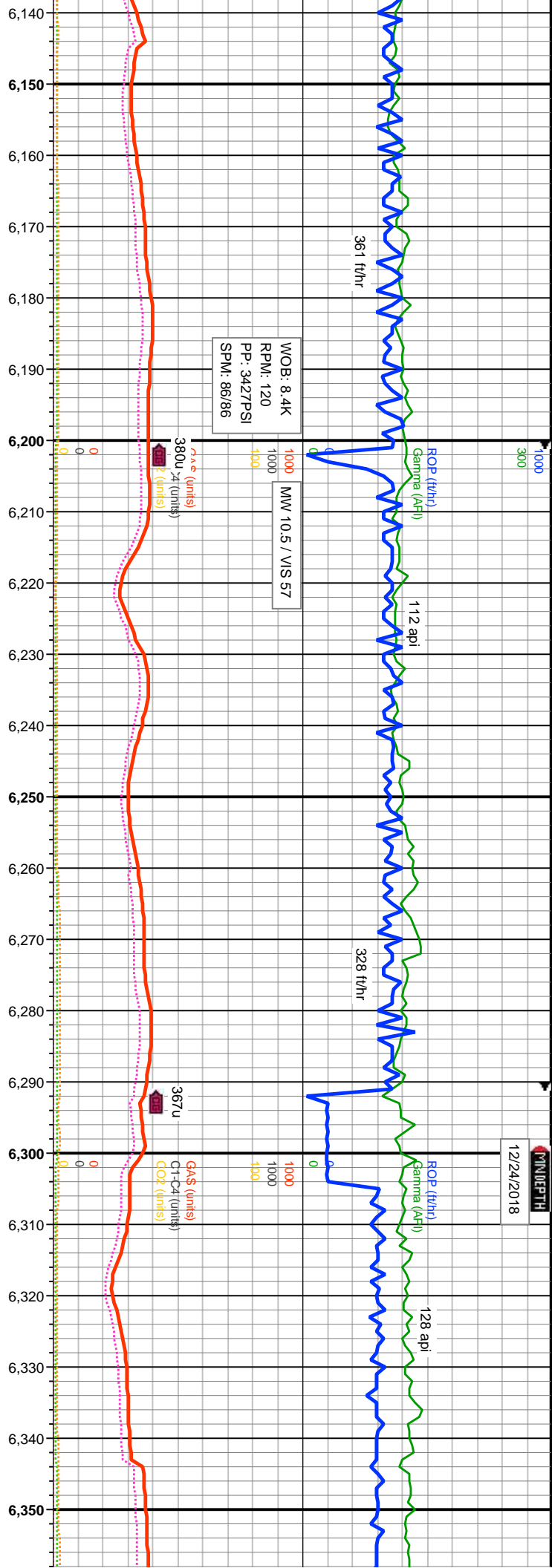
MD: 6,089'
INC: 29.81°
AZM: 171.1°
TVD: 5,909.97'
VS: 718.99'

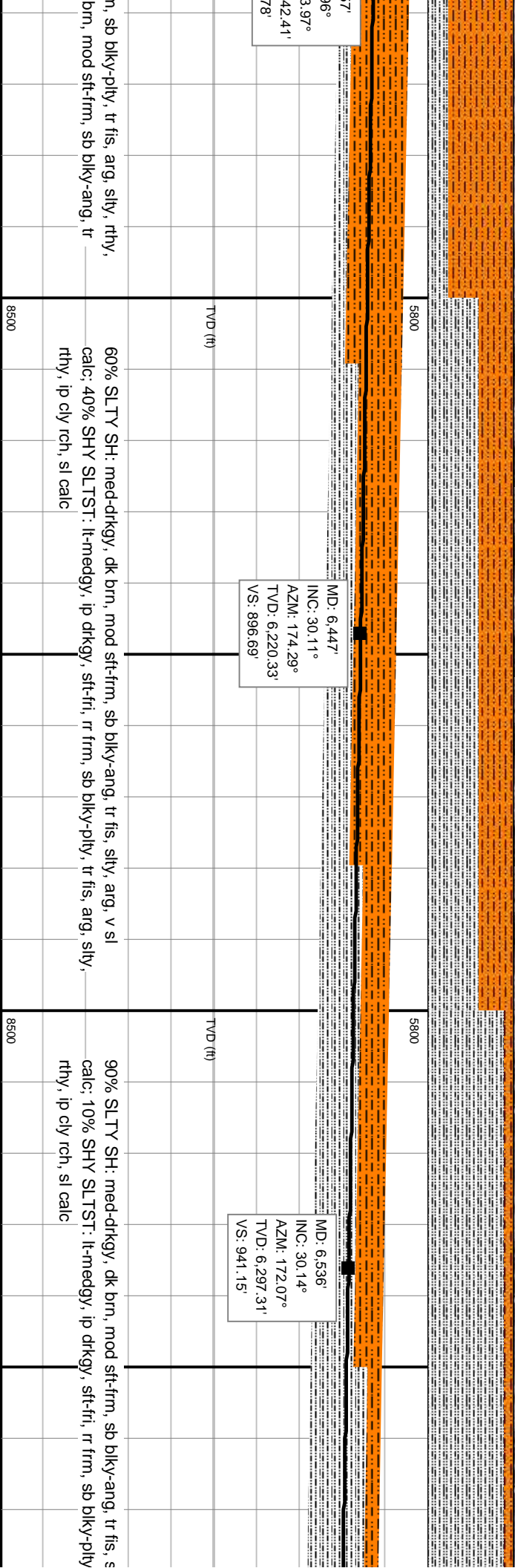
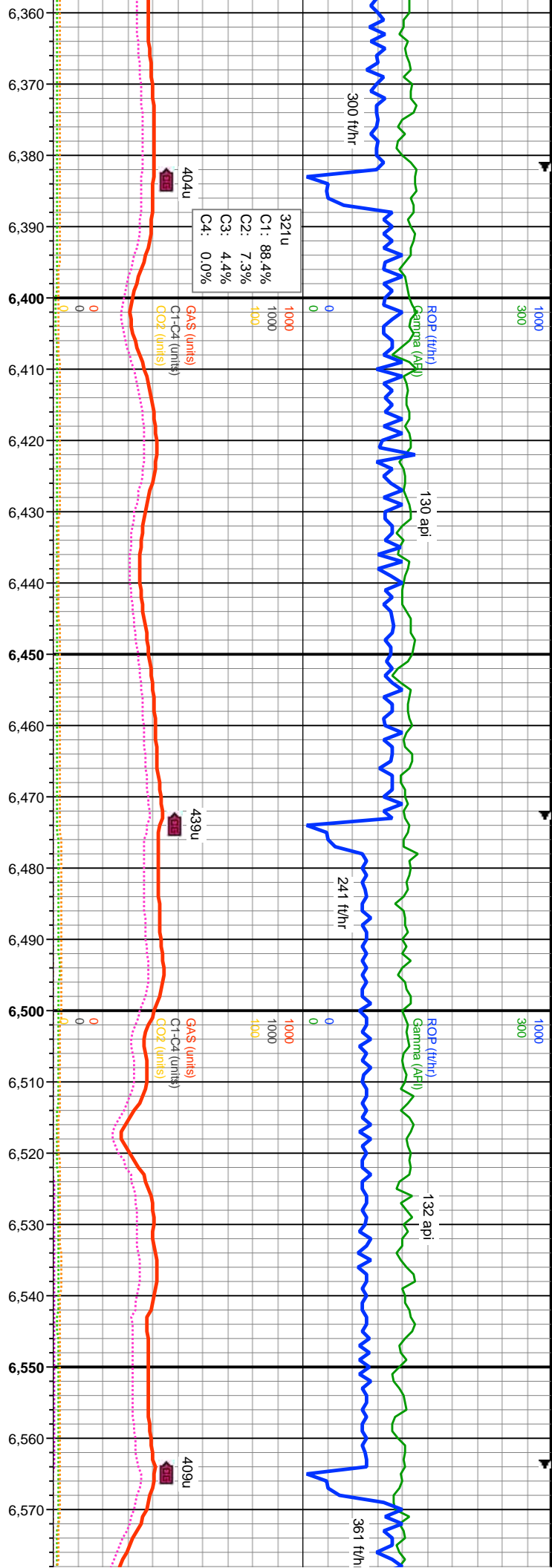
Well Bore
TVD

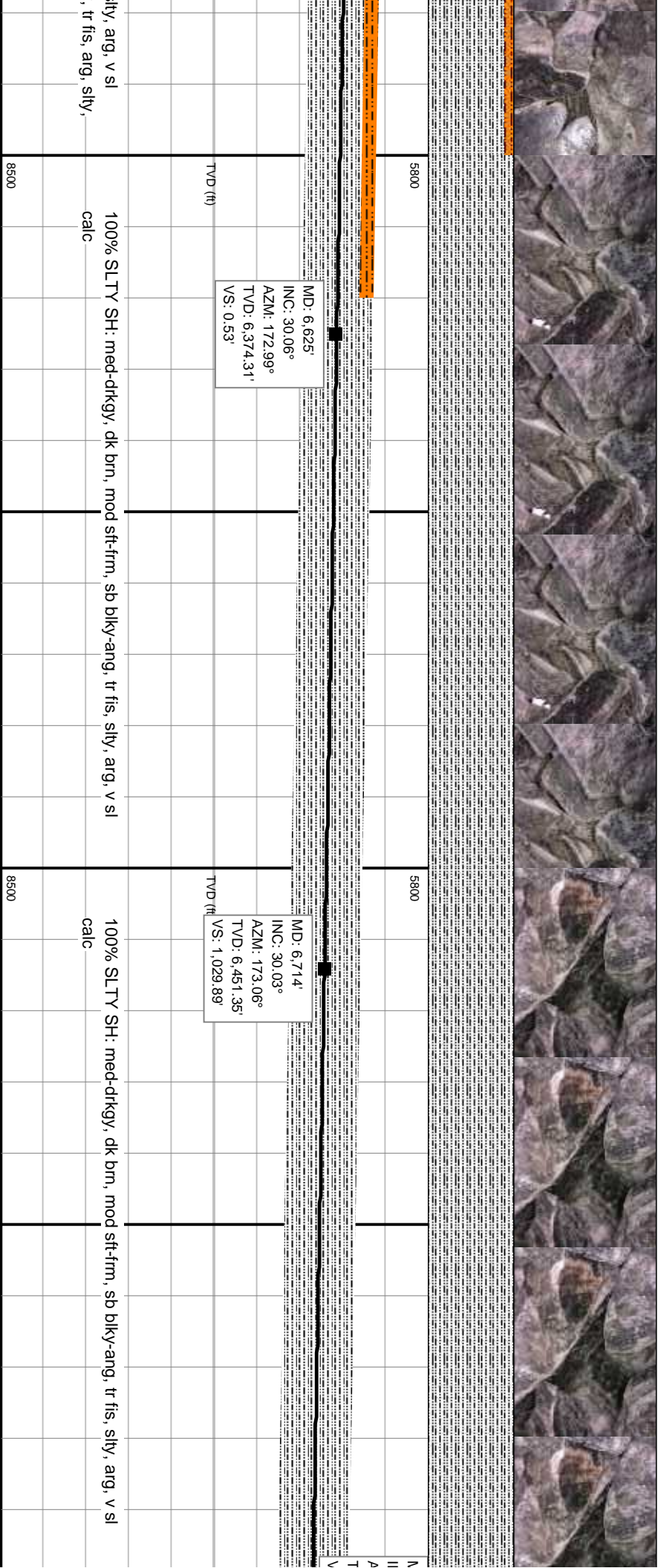
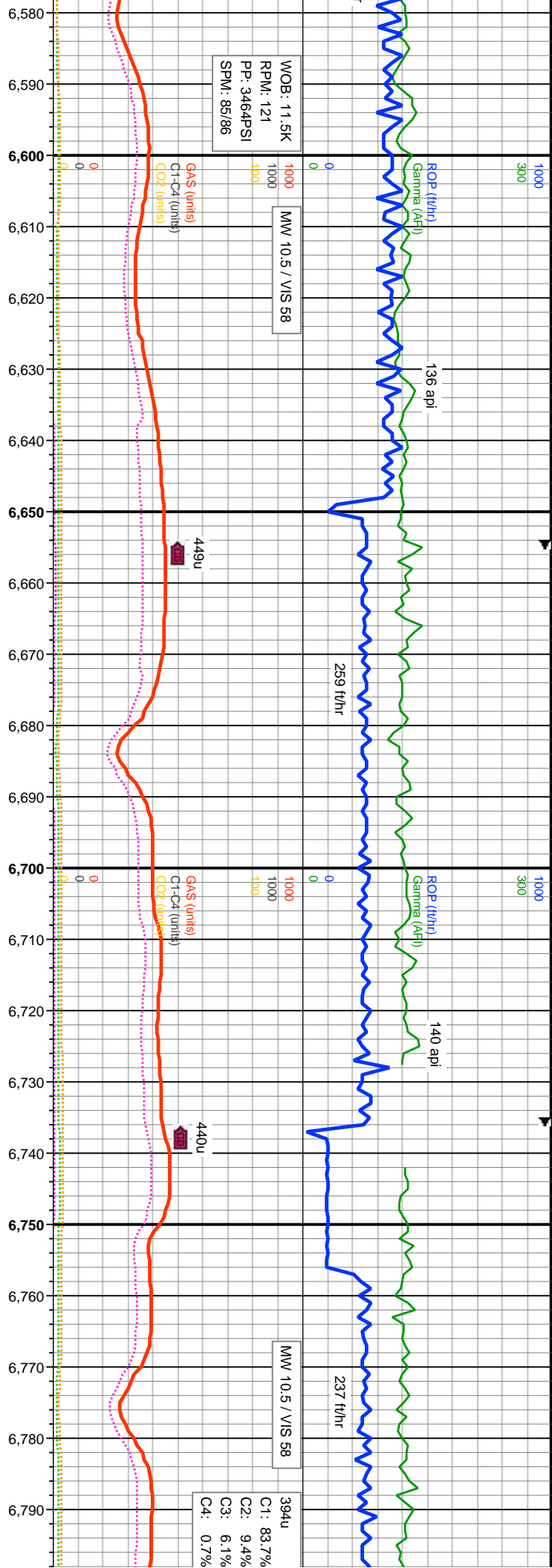
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Size: 8.5"
Make: Ulterra
Model: SPL516
Depth In: 1,772
Jets: 4x11, 4x12
S/N: 45520

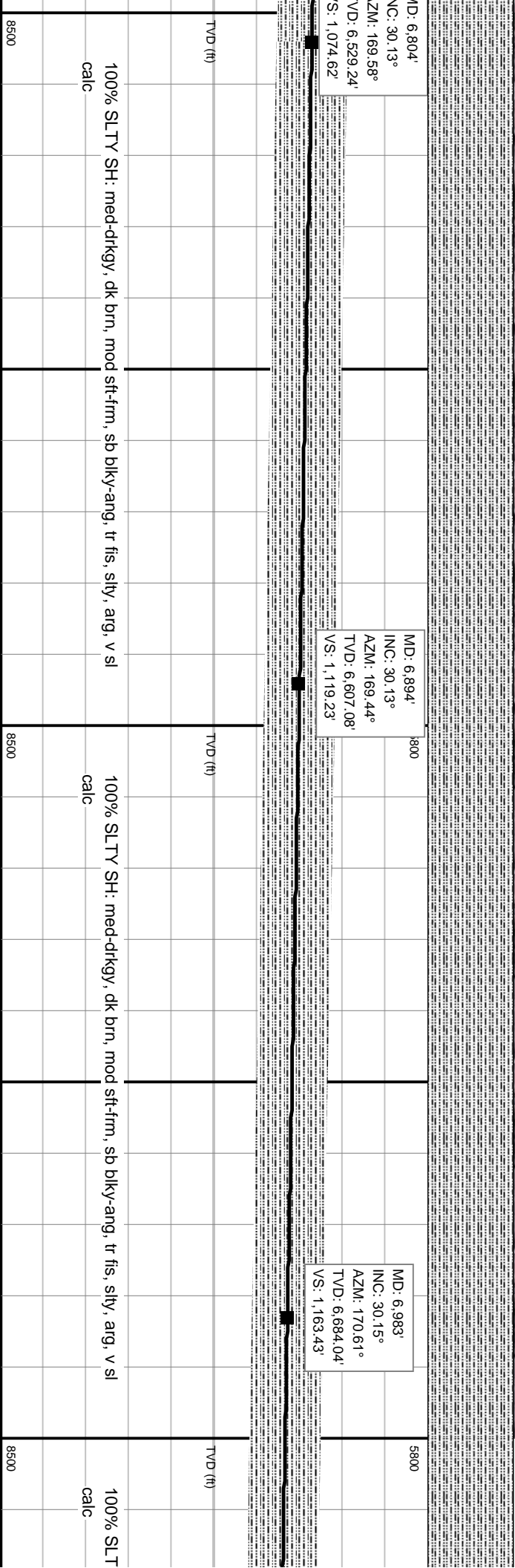
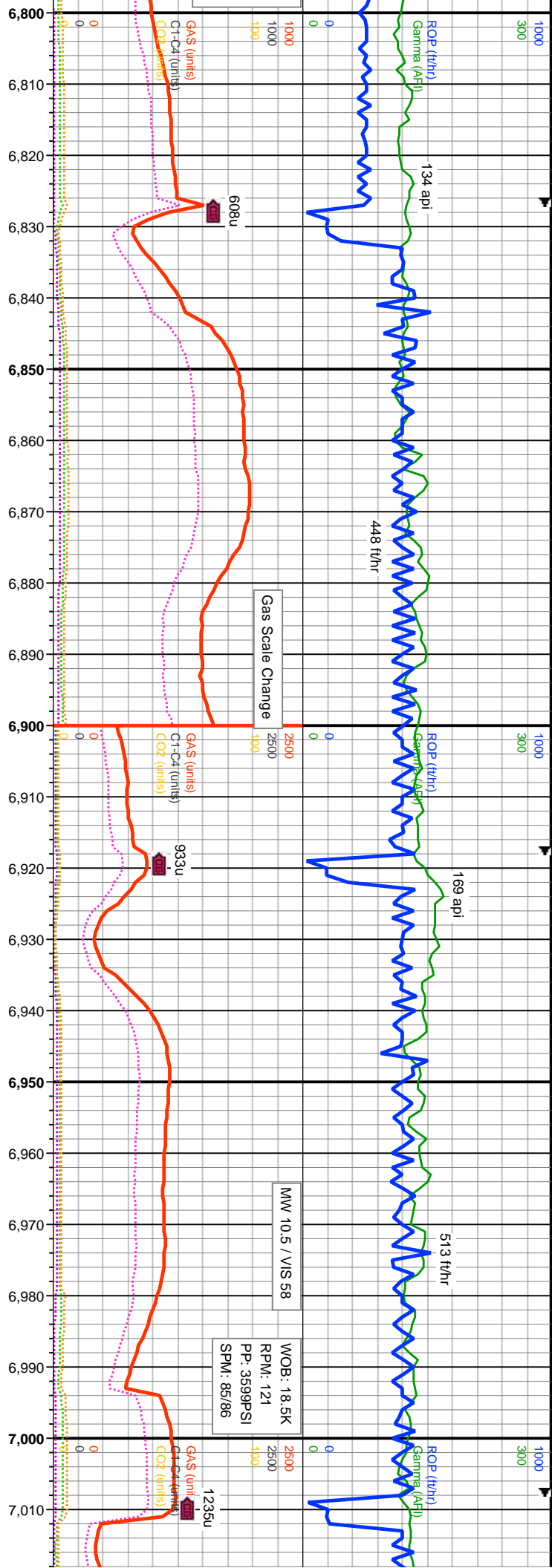
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sily, mod cly rch mtX, sl calc

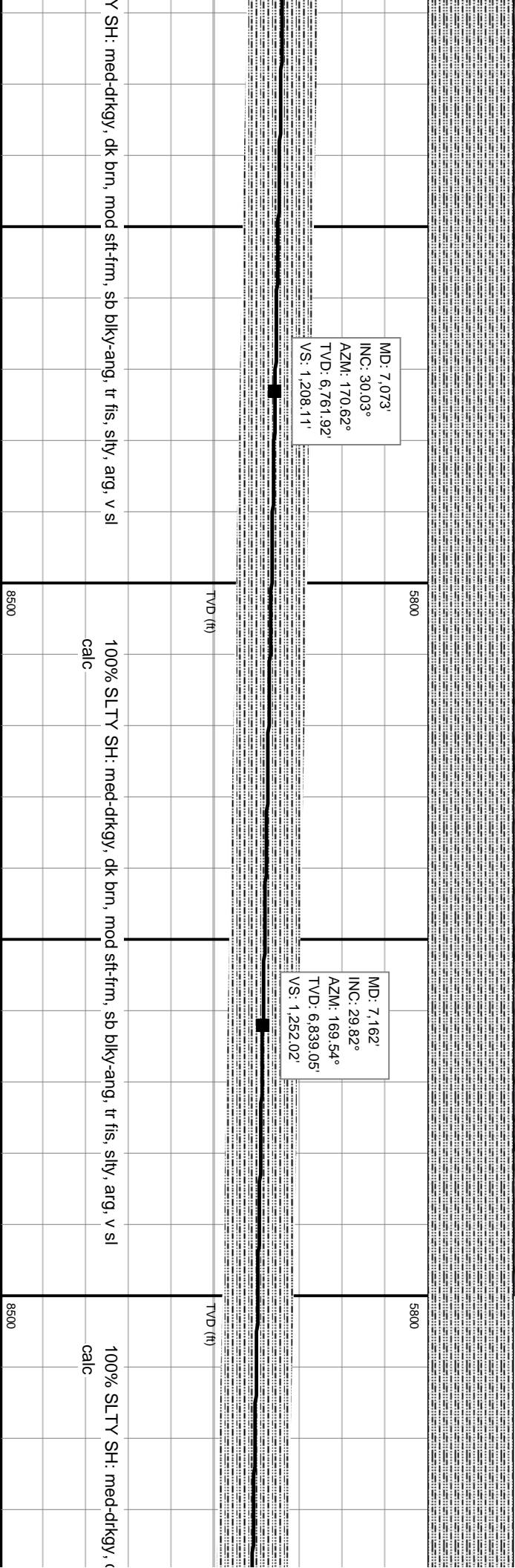
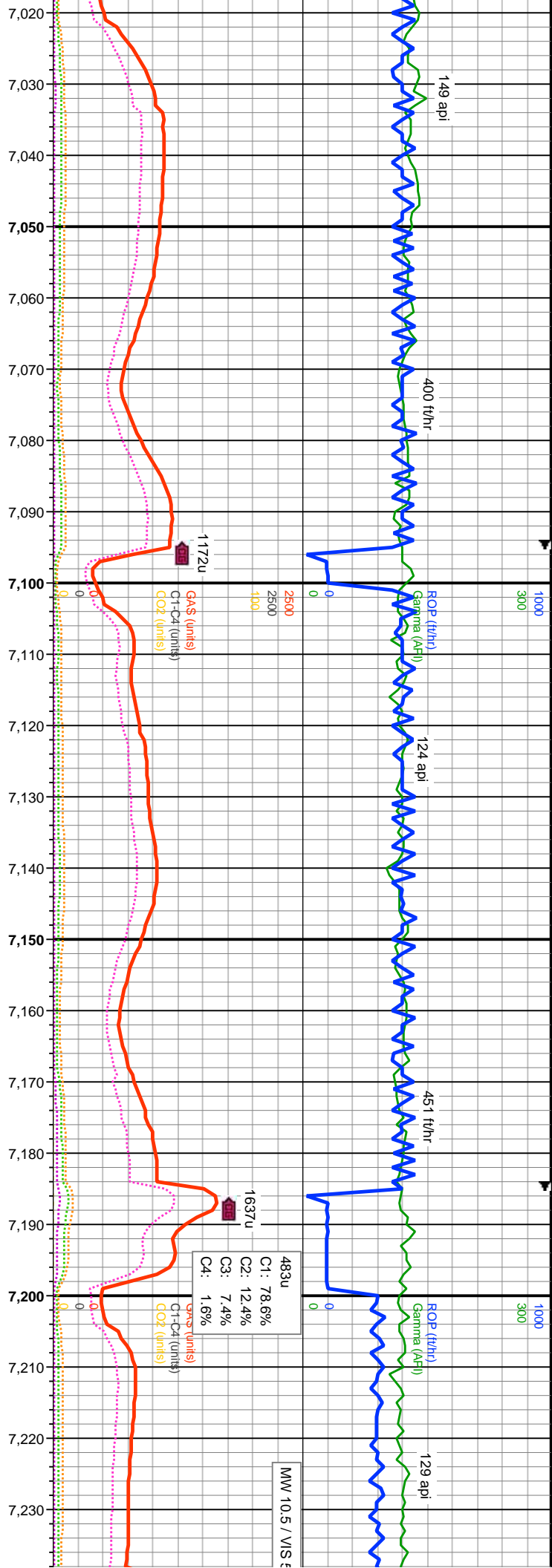
100% SHY SLTST: lt-medgy,
sily, mod cly rch mtX, sl calc

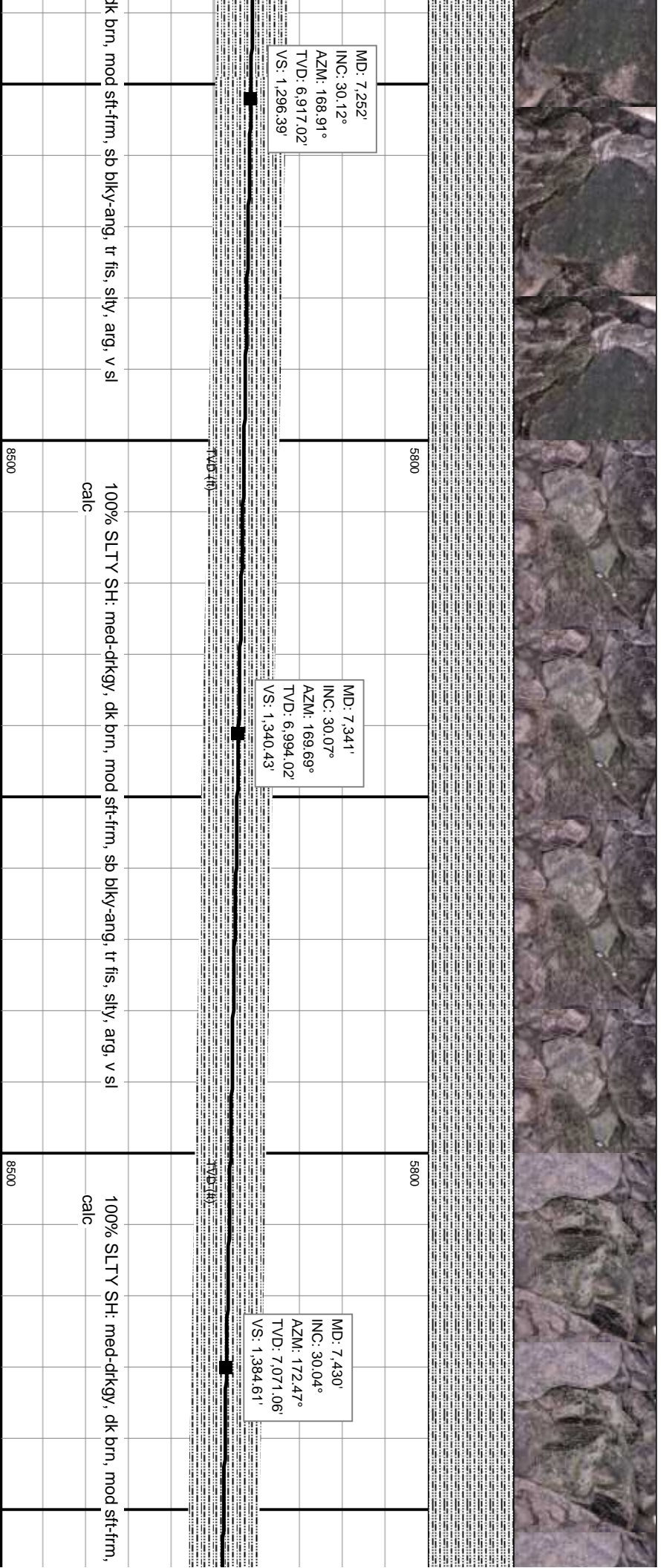
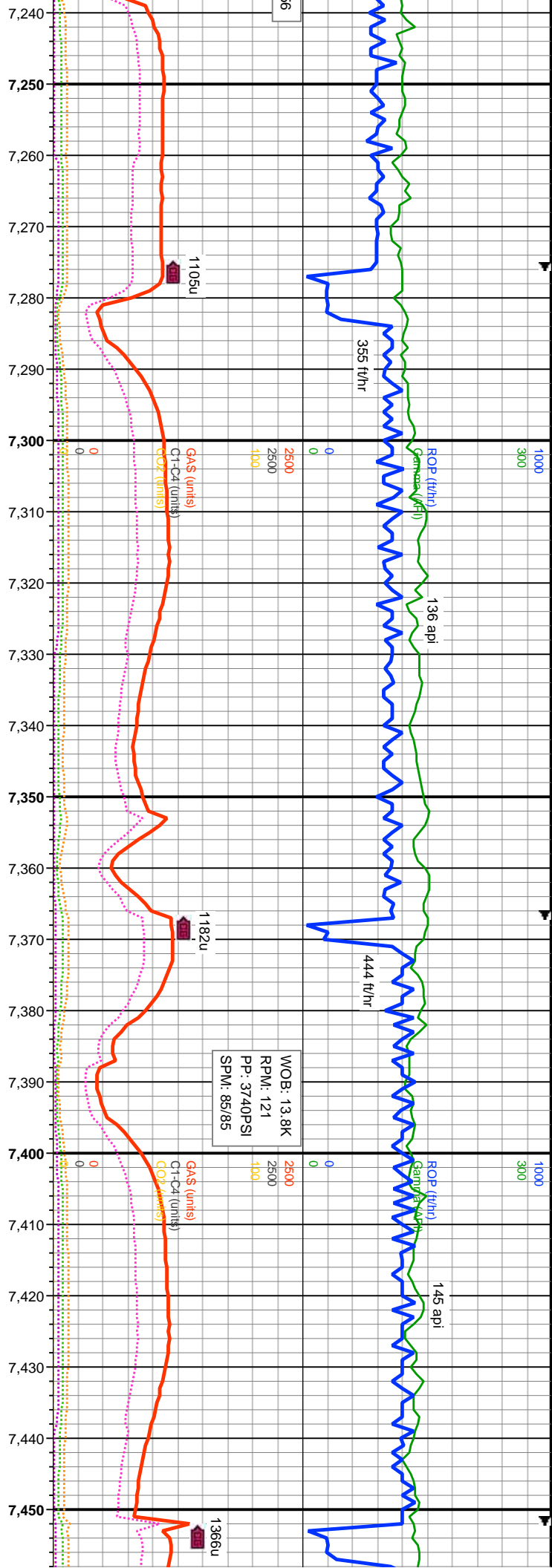


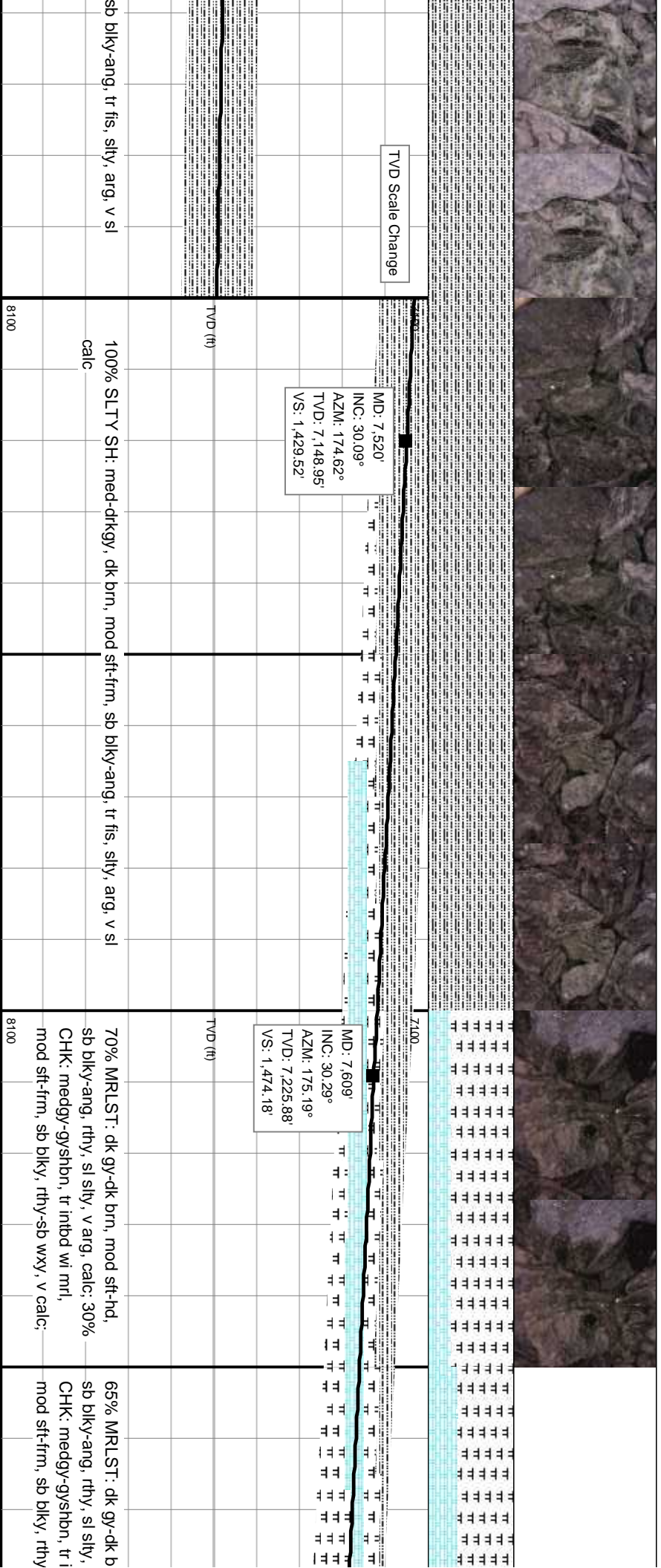
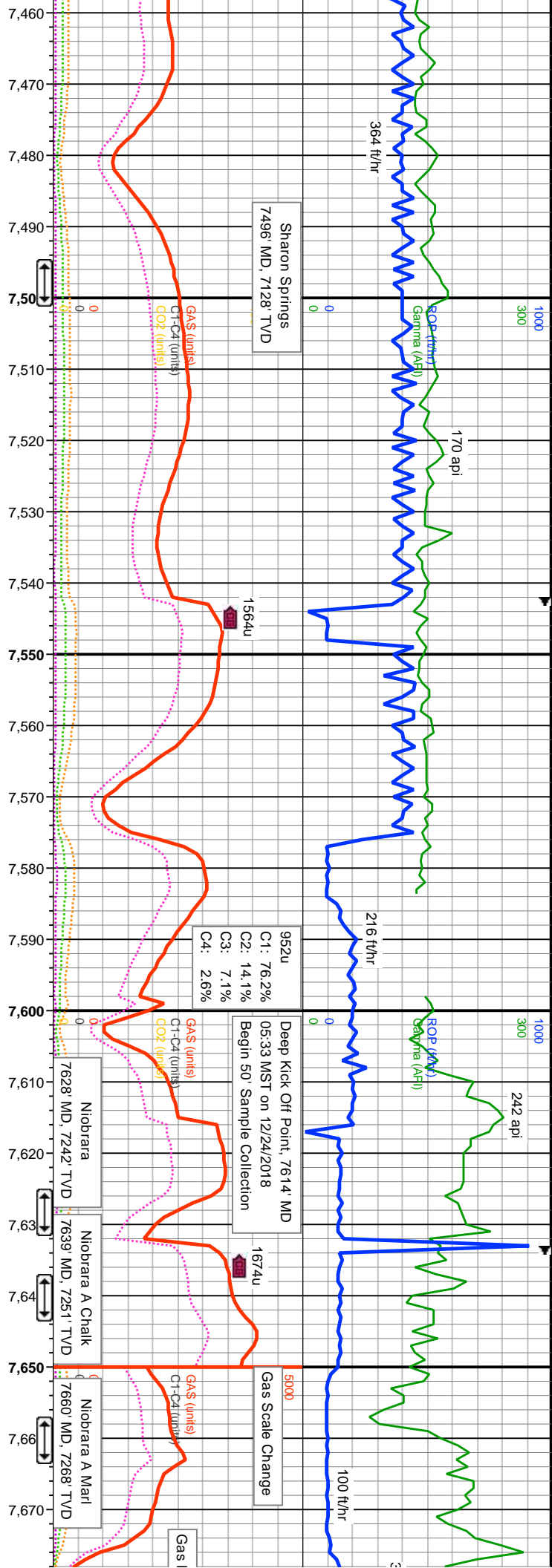


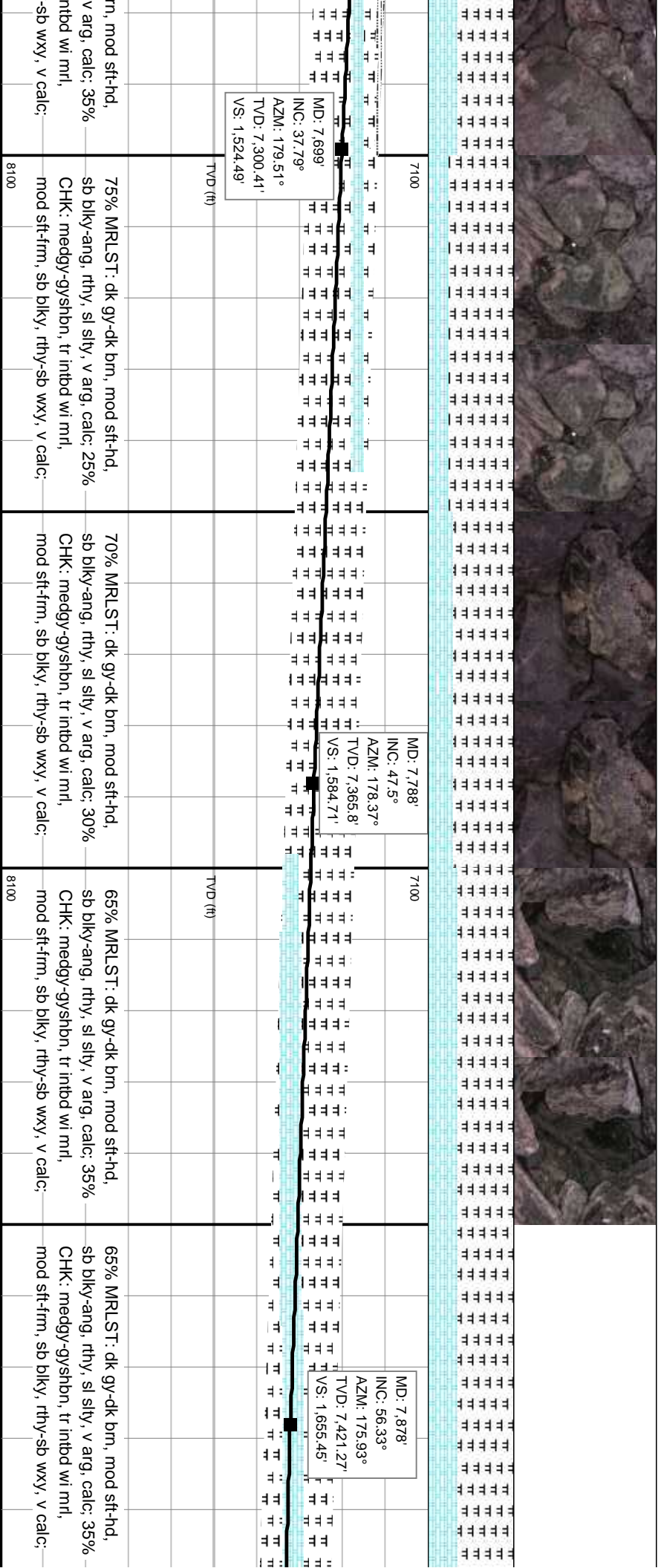
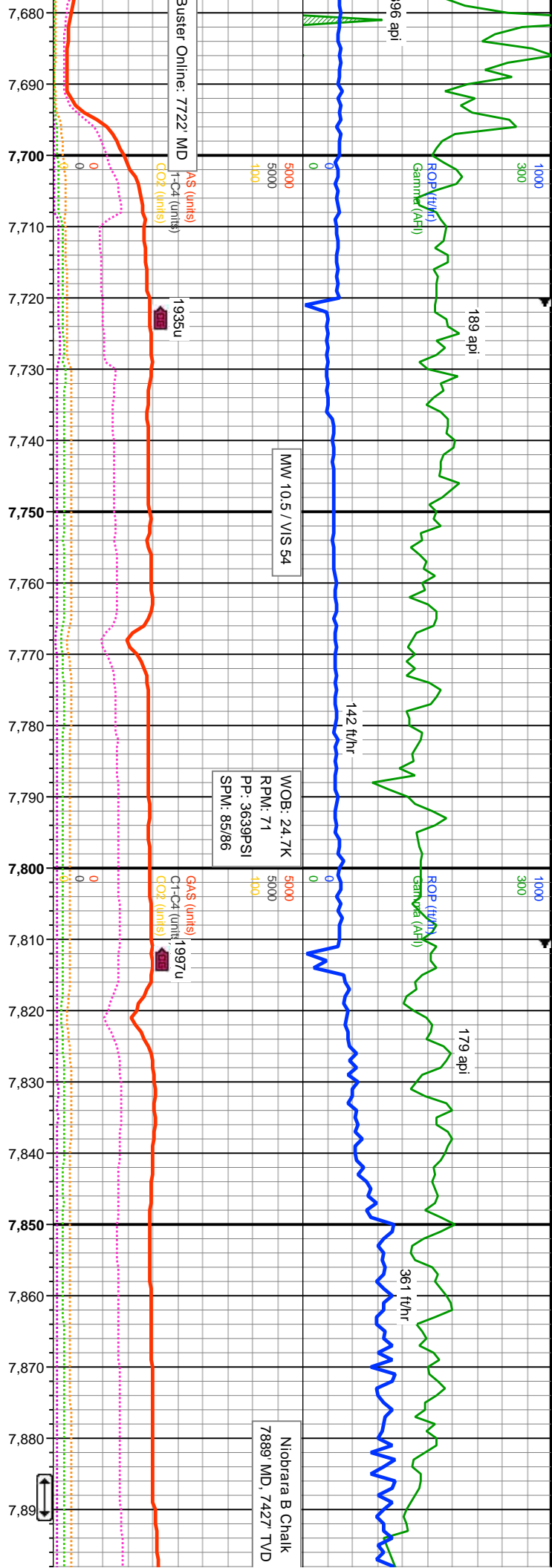


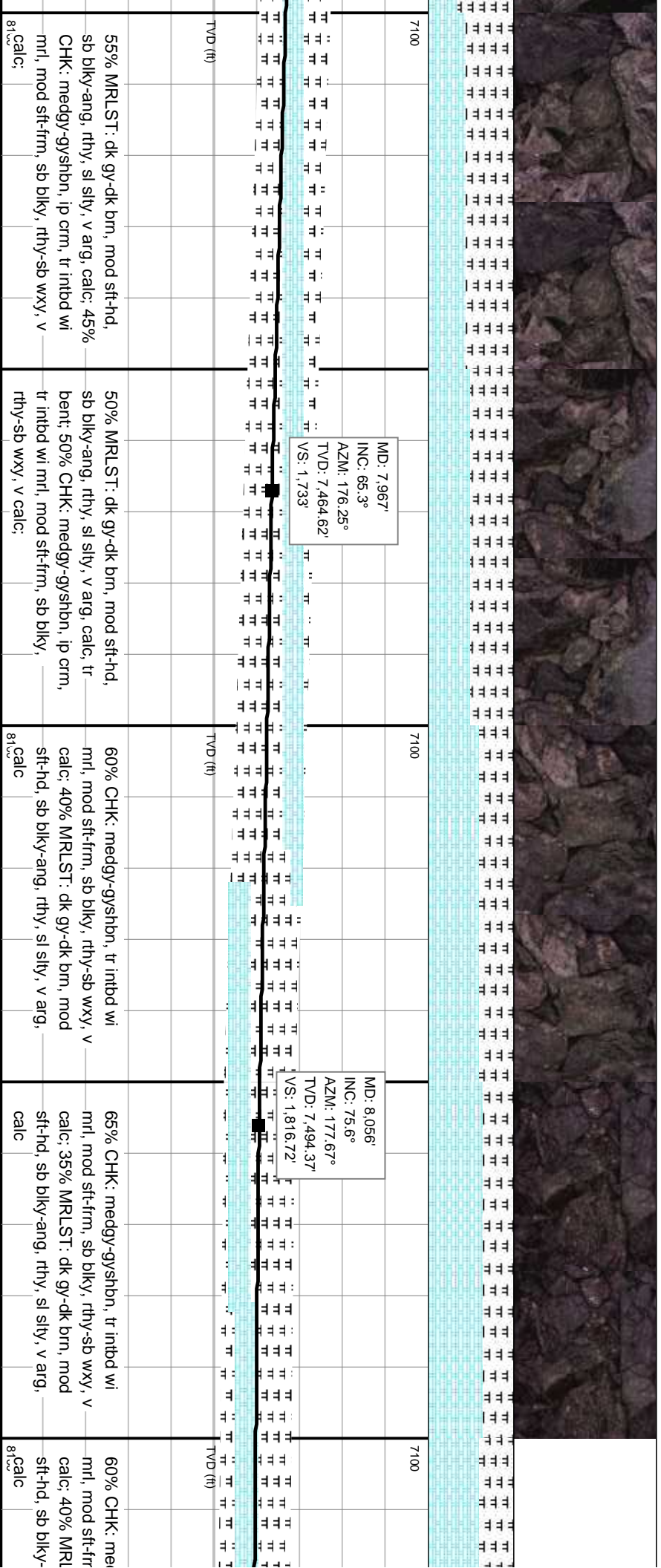
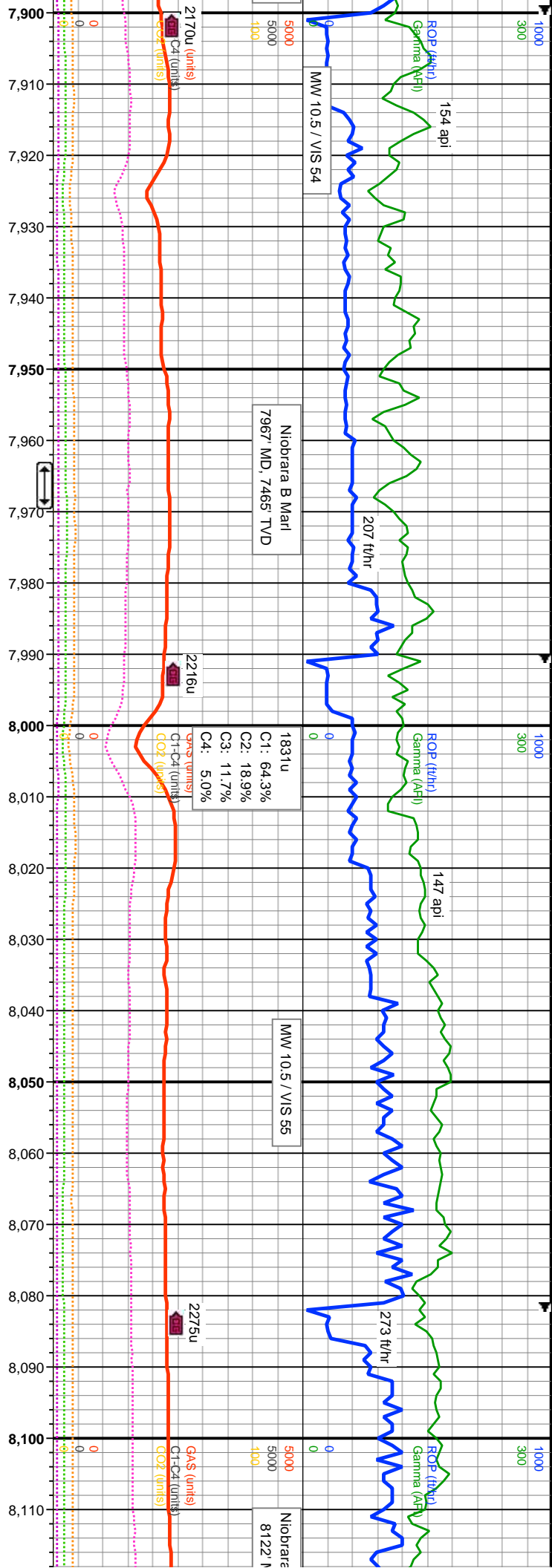


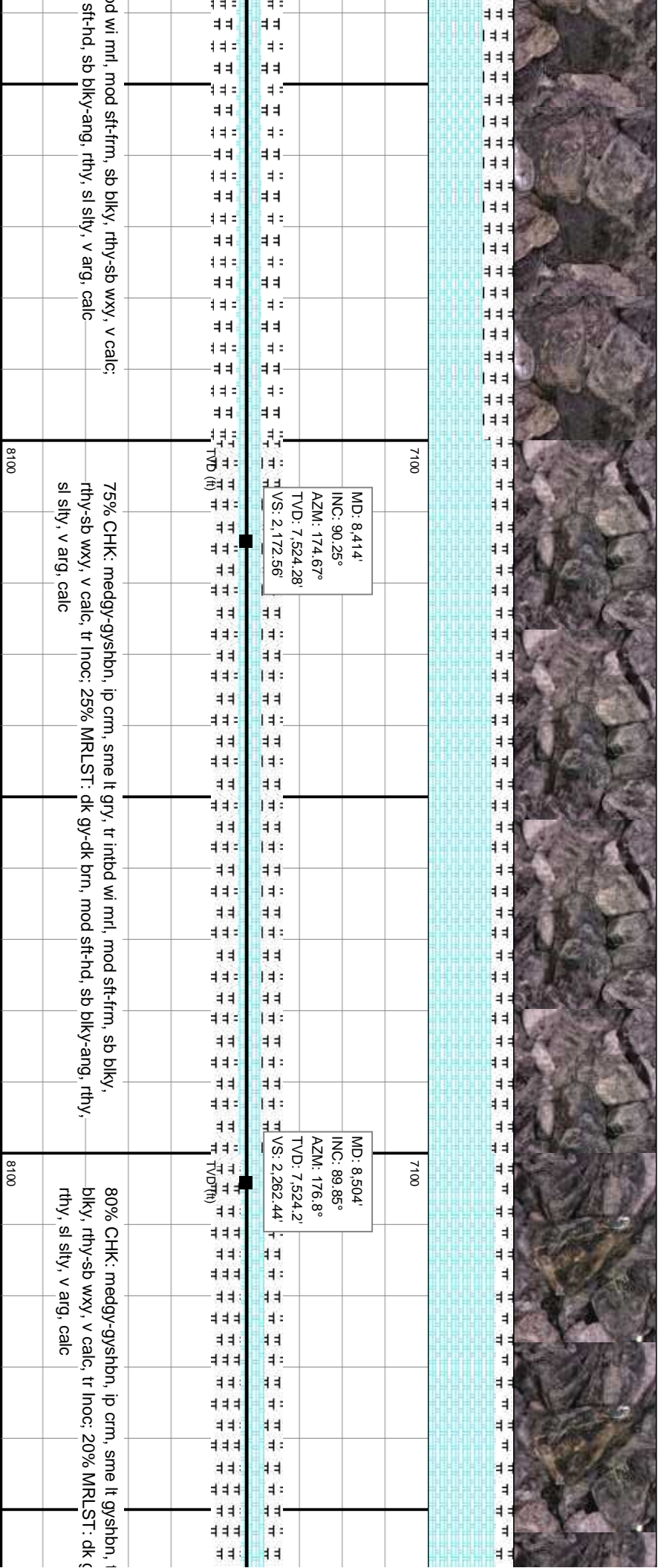
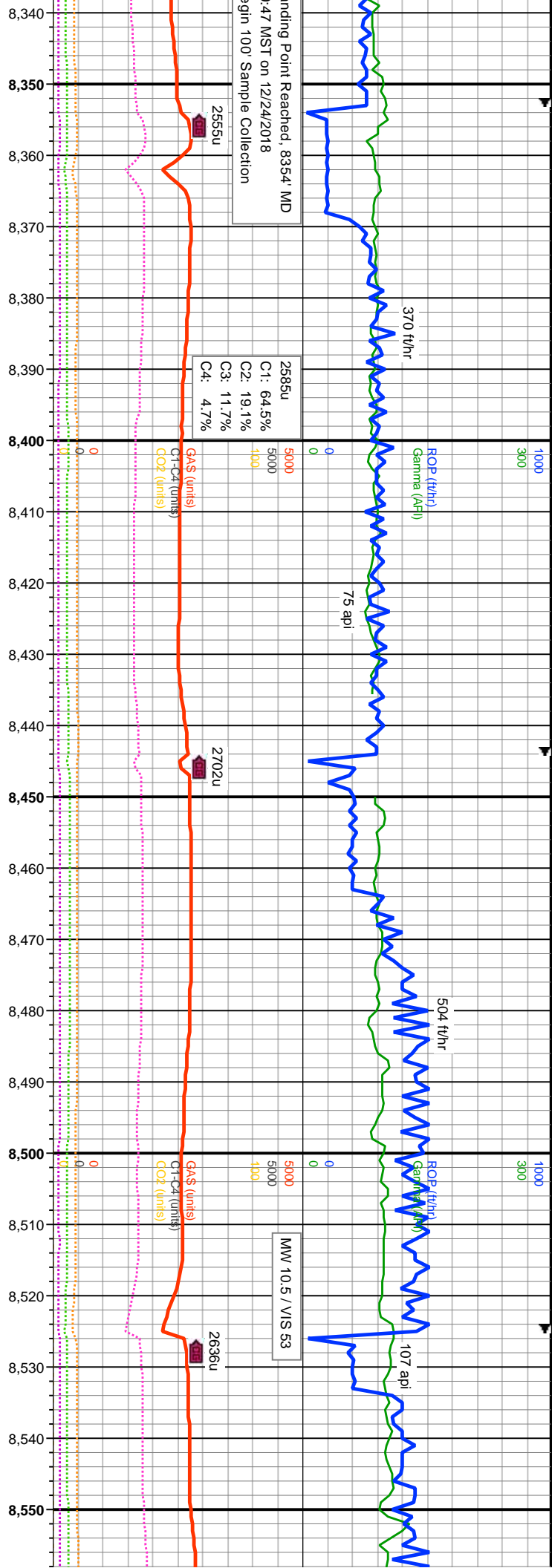


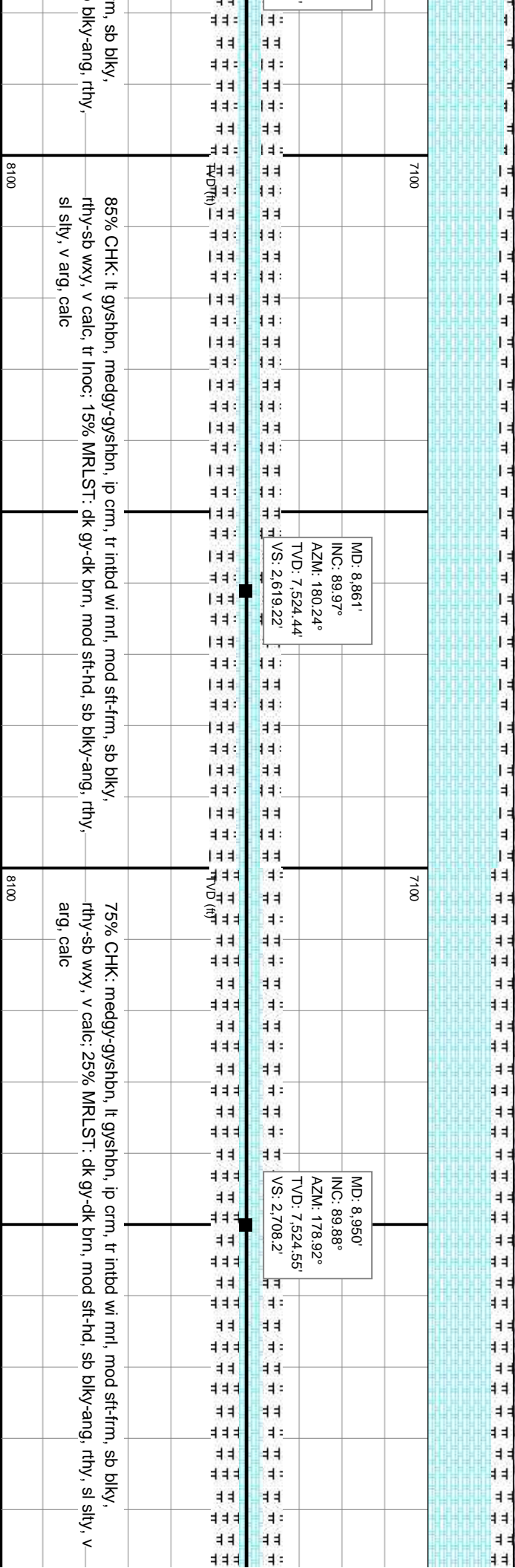
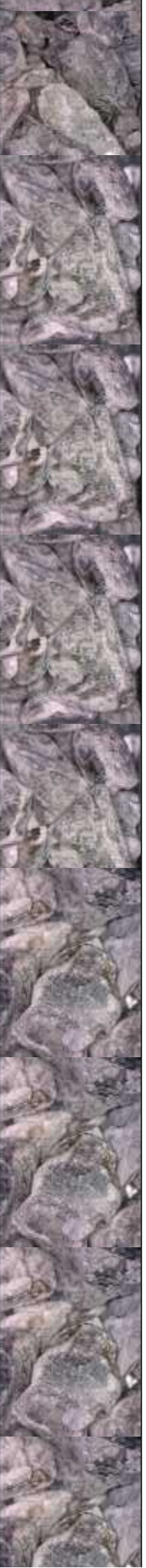
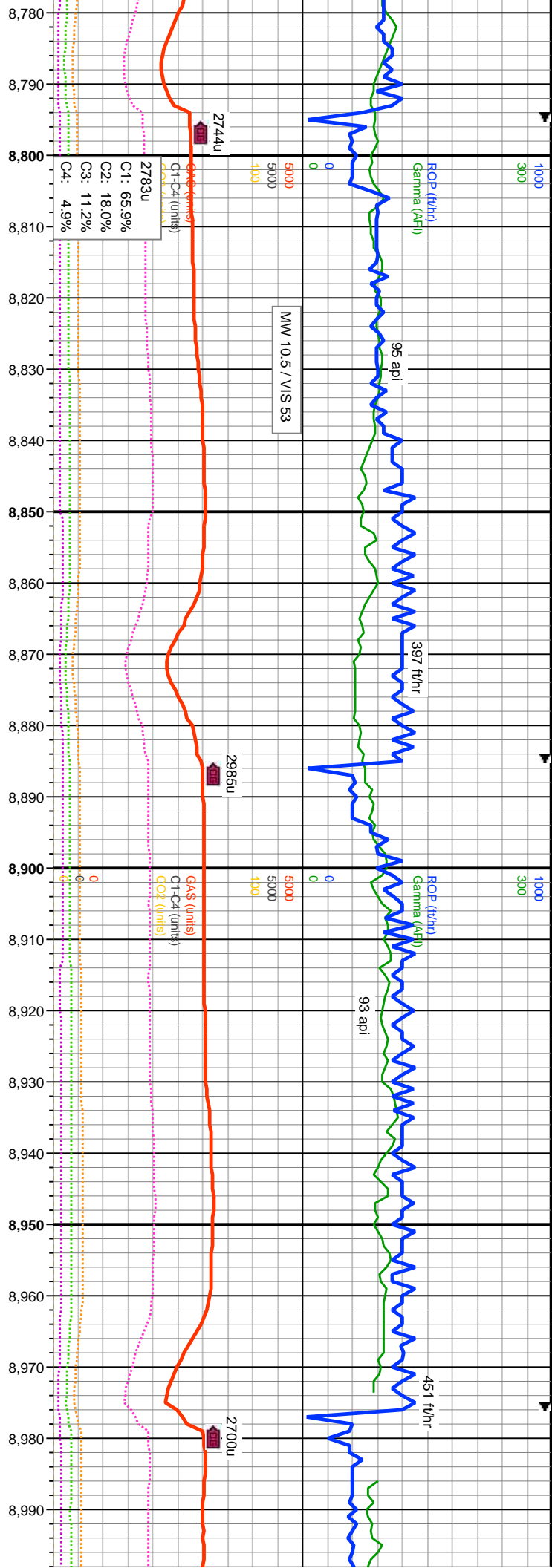


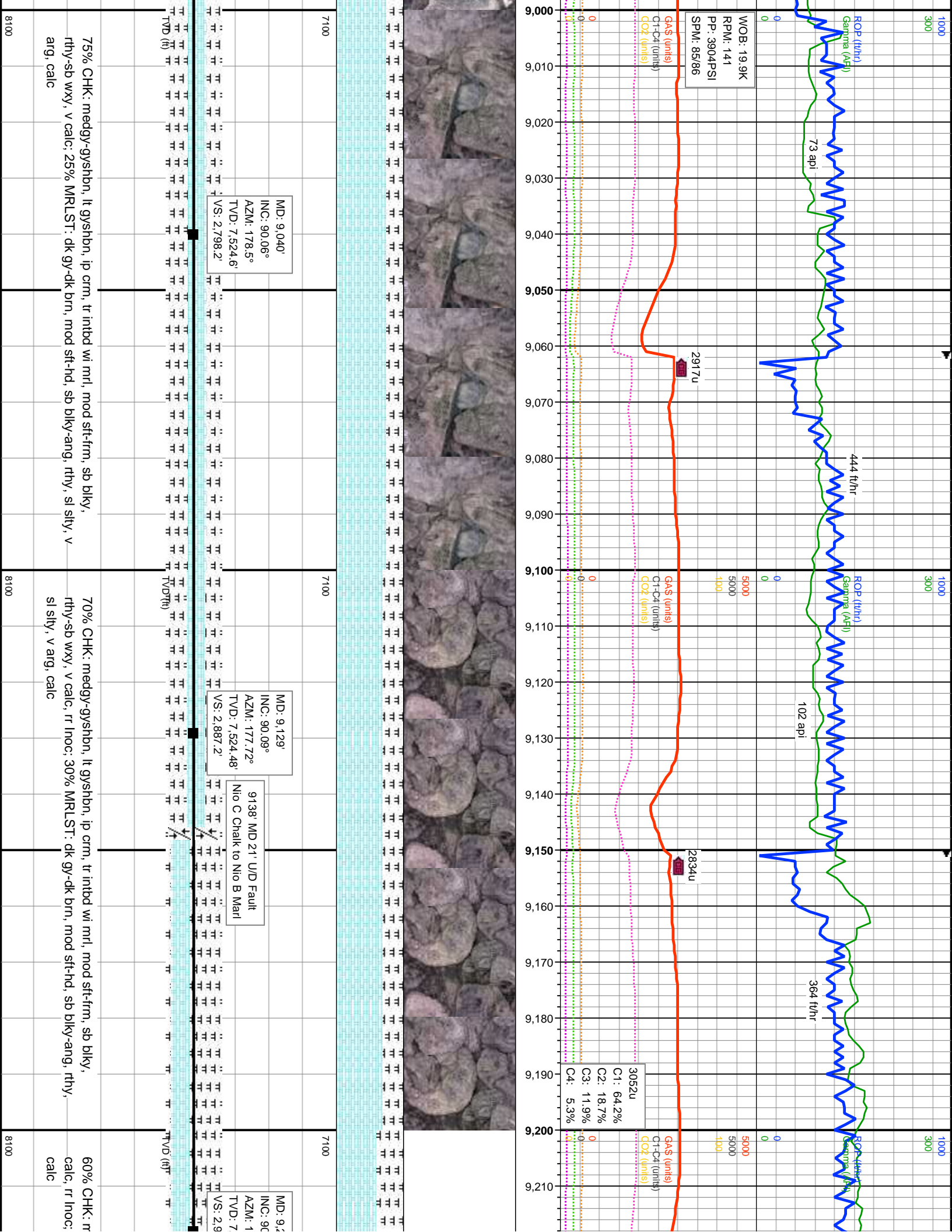


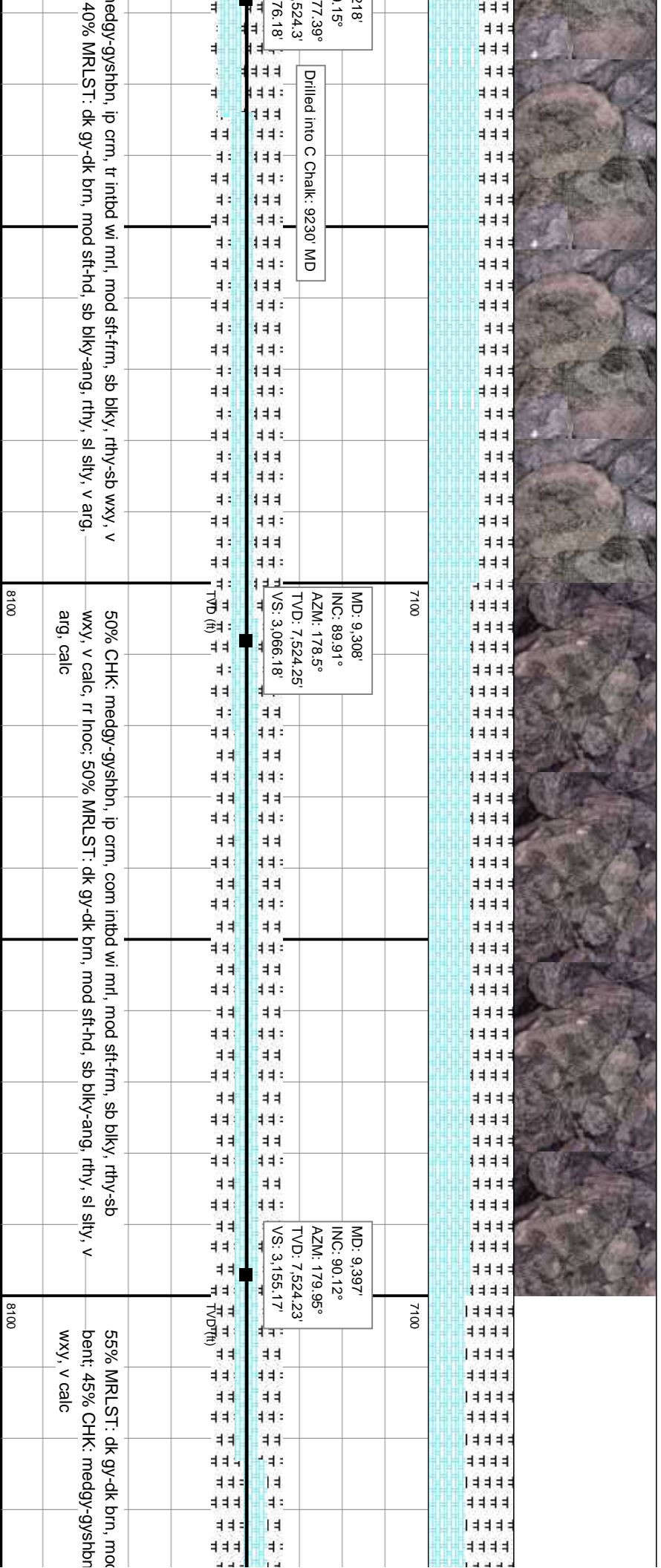
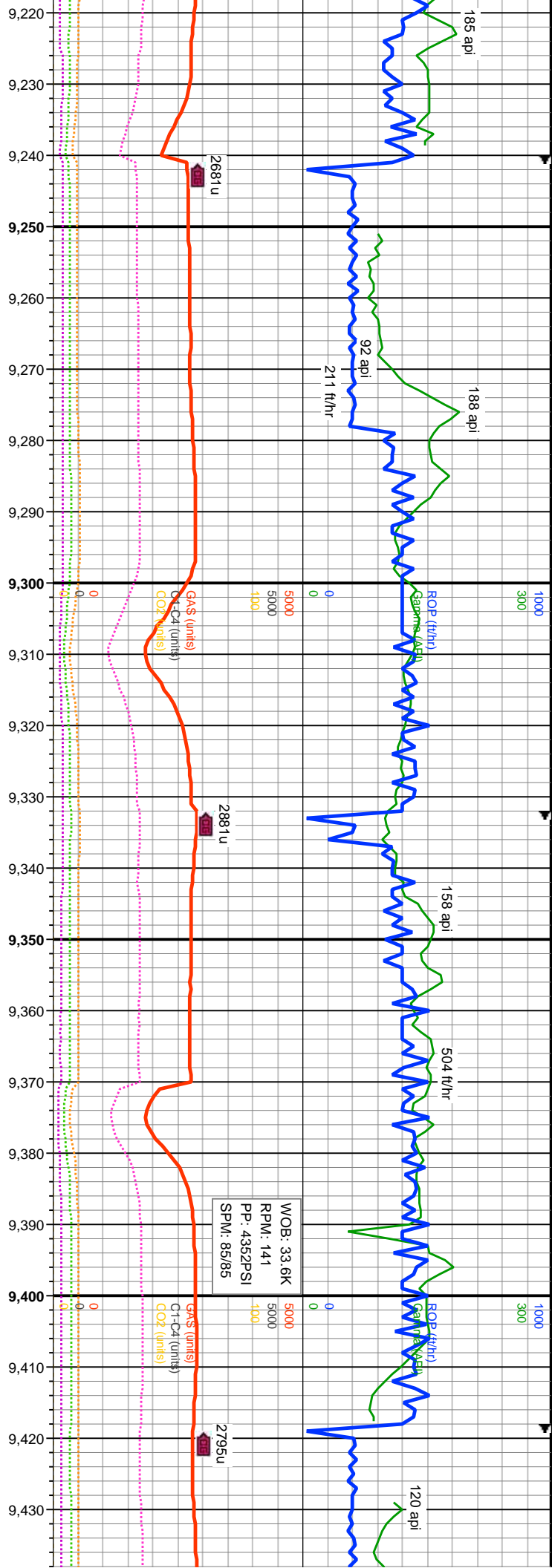


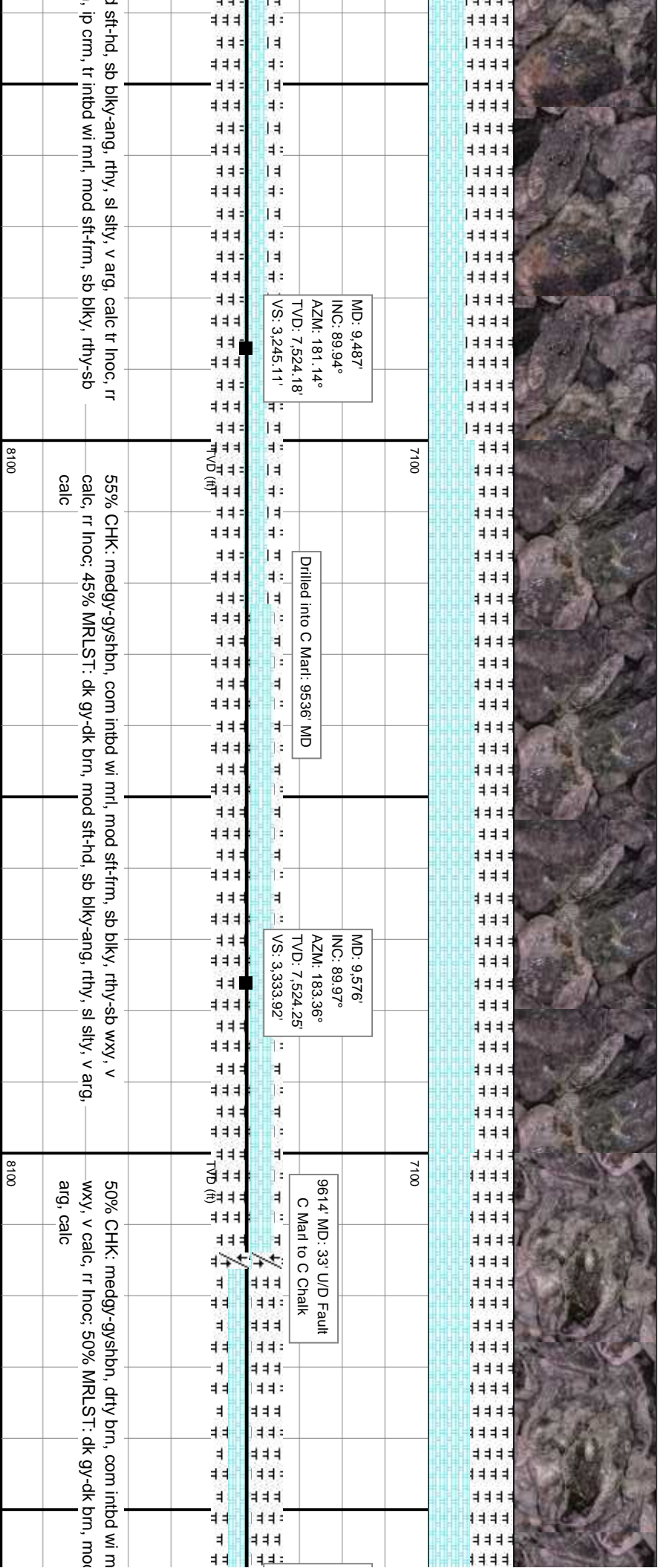
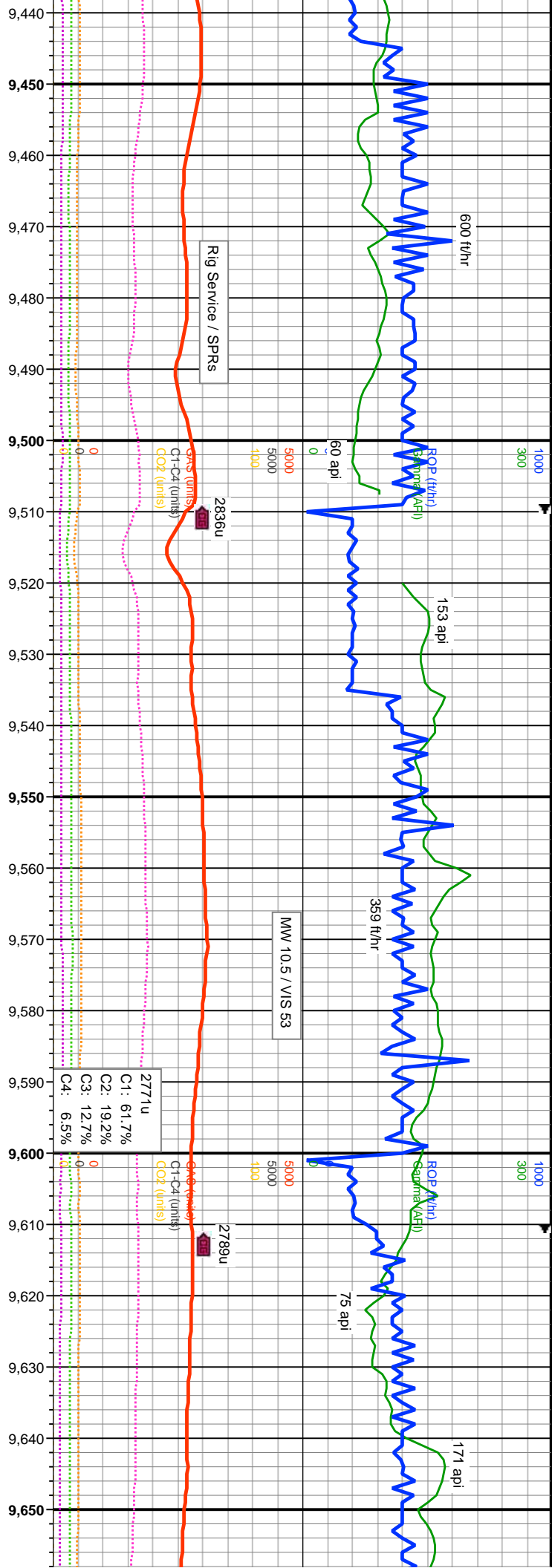


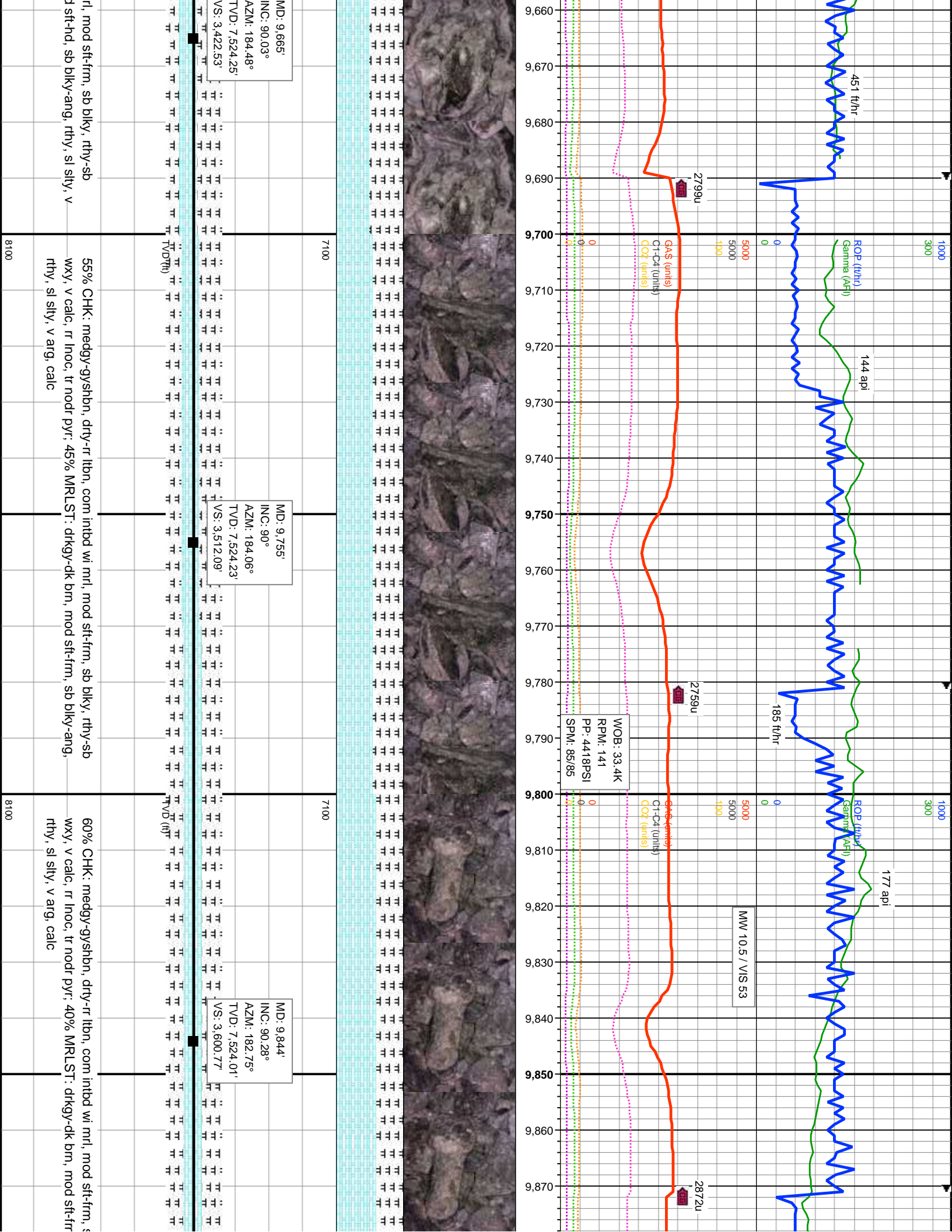


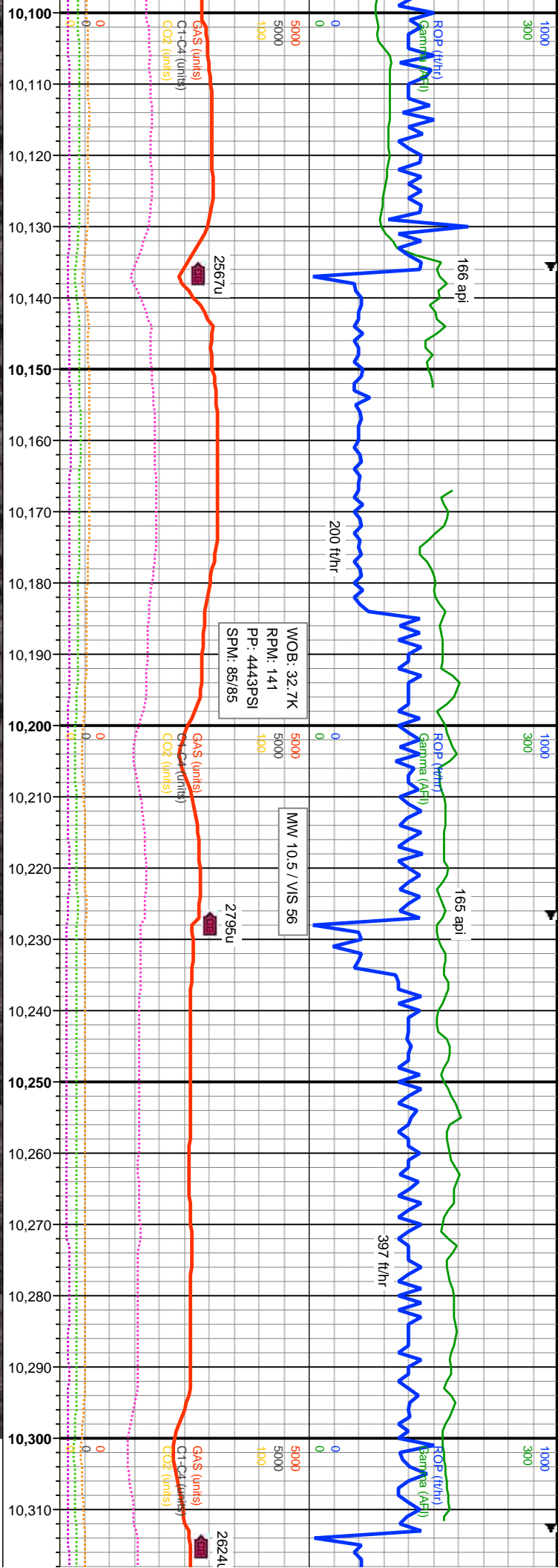




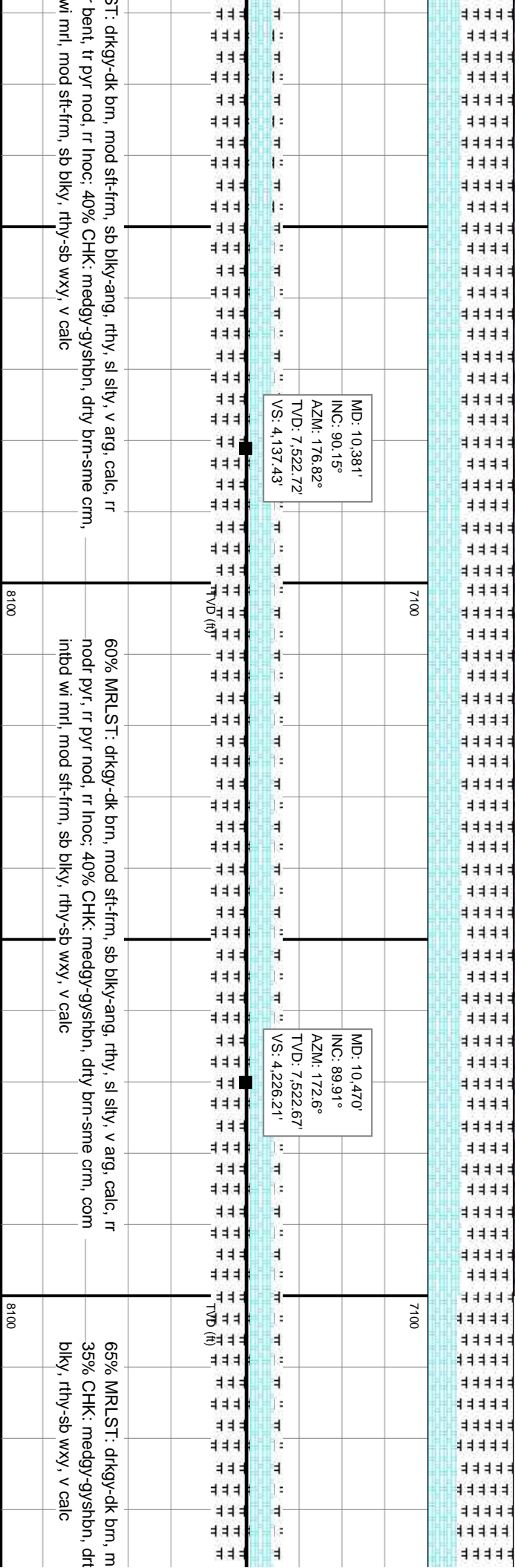
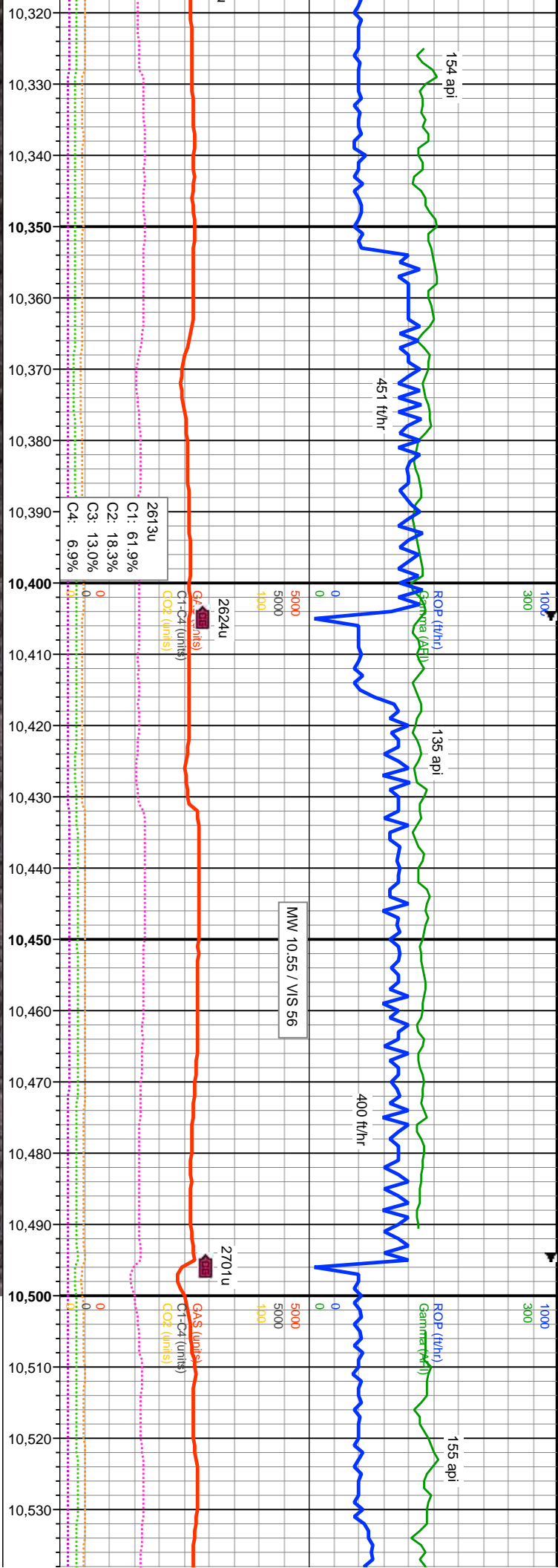


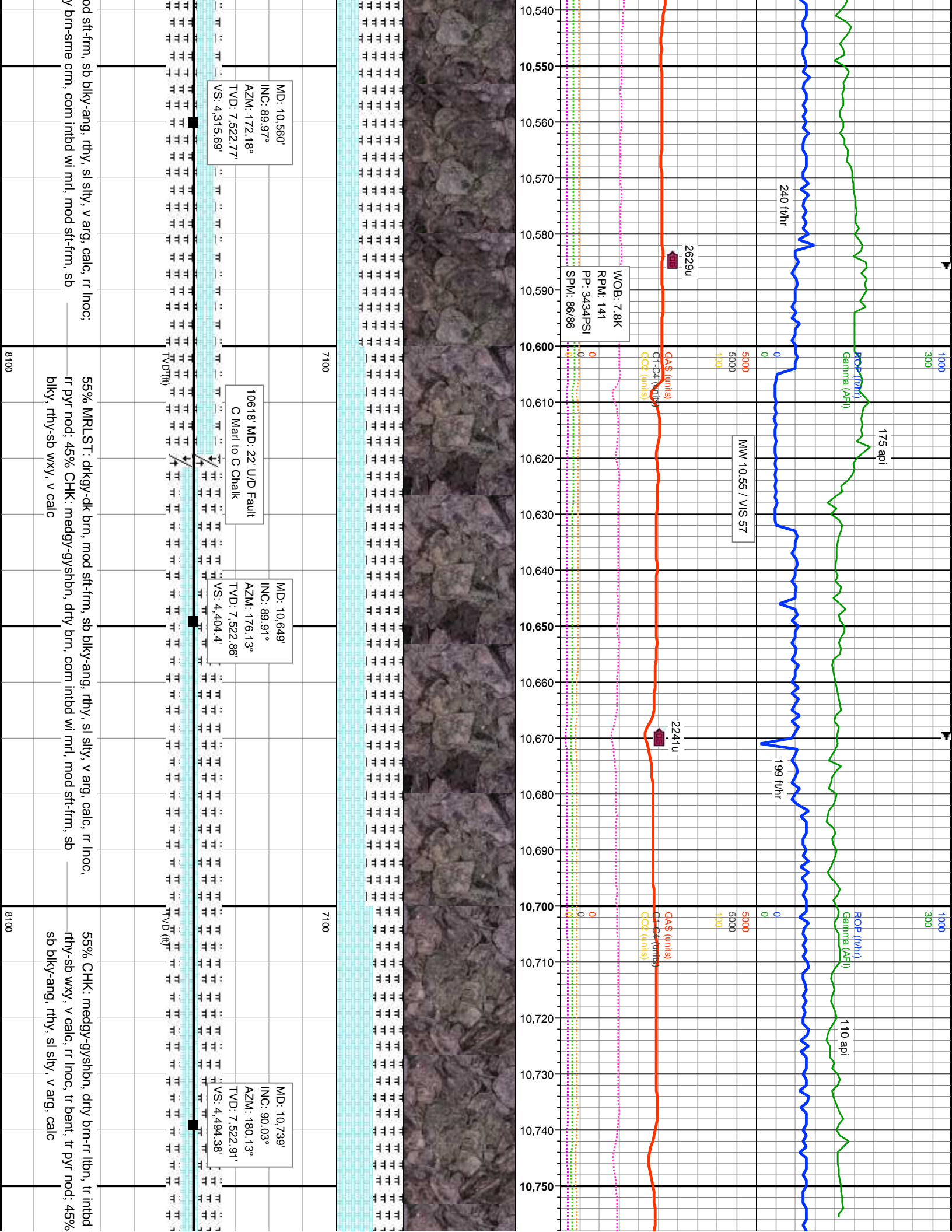


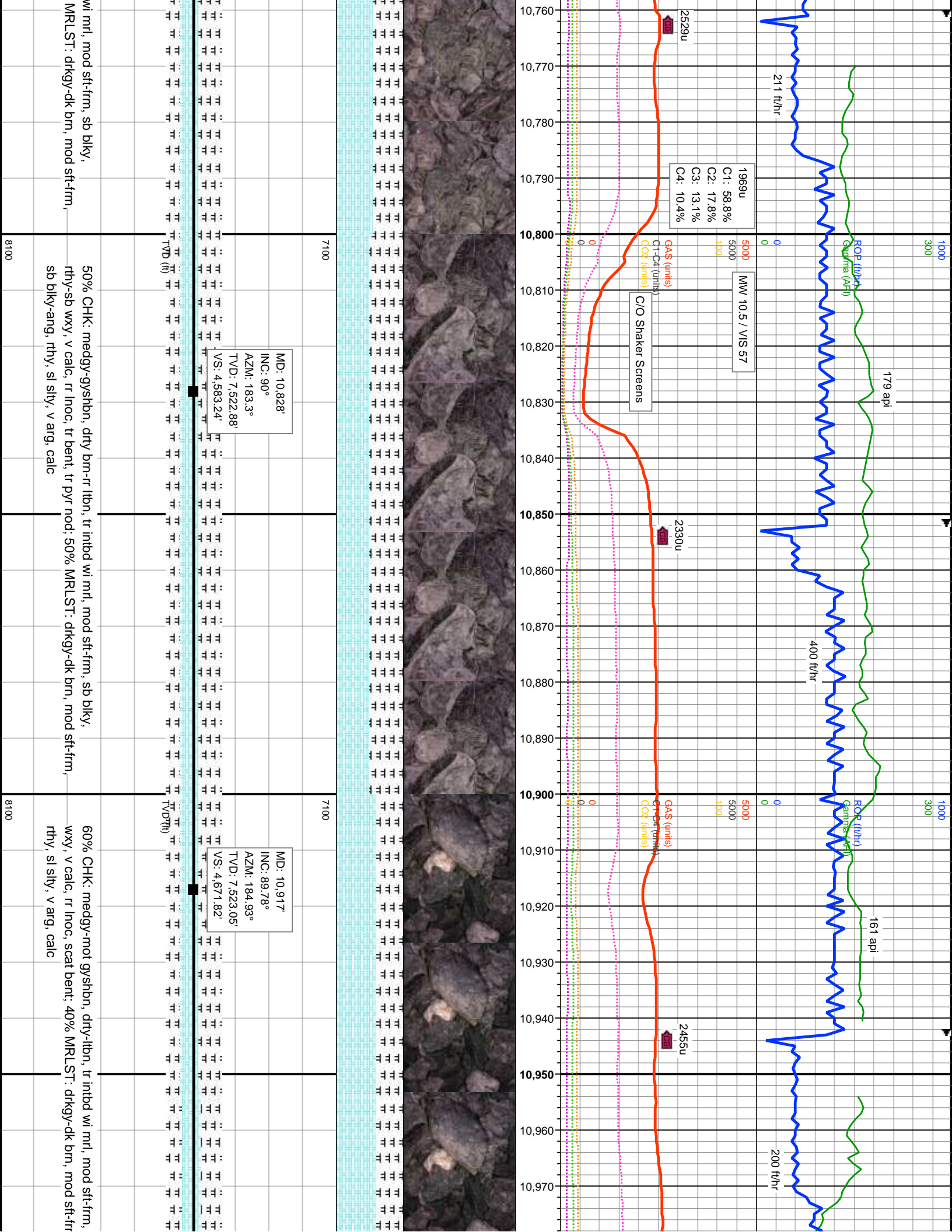


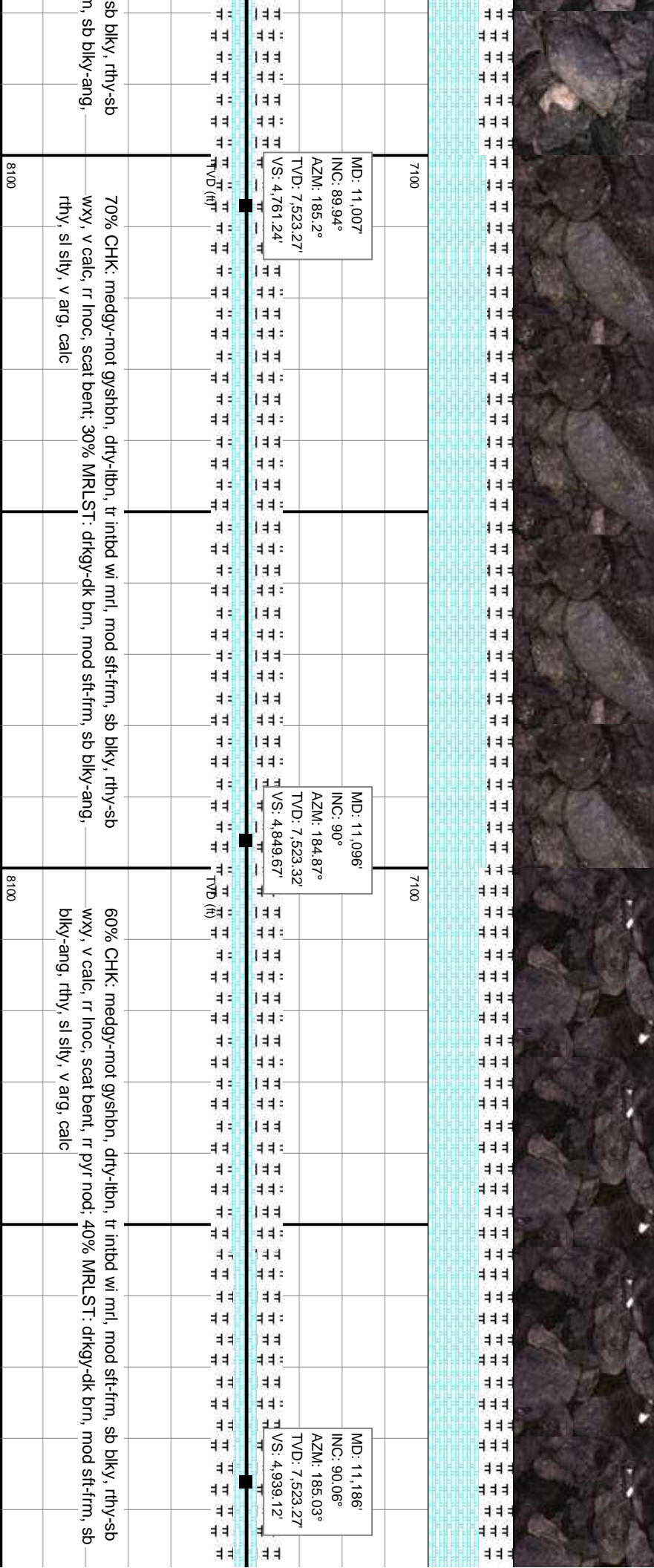
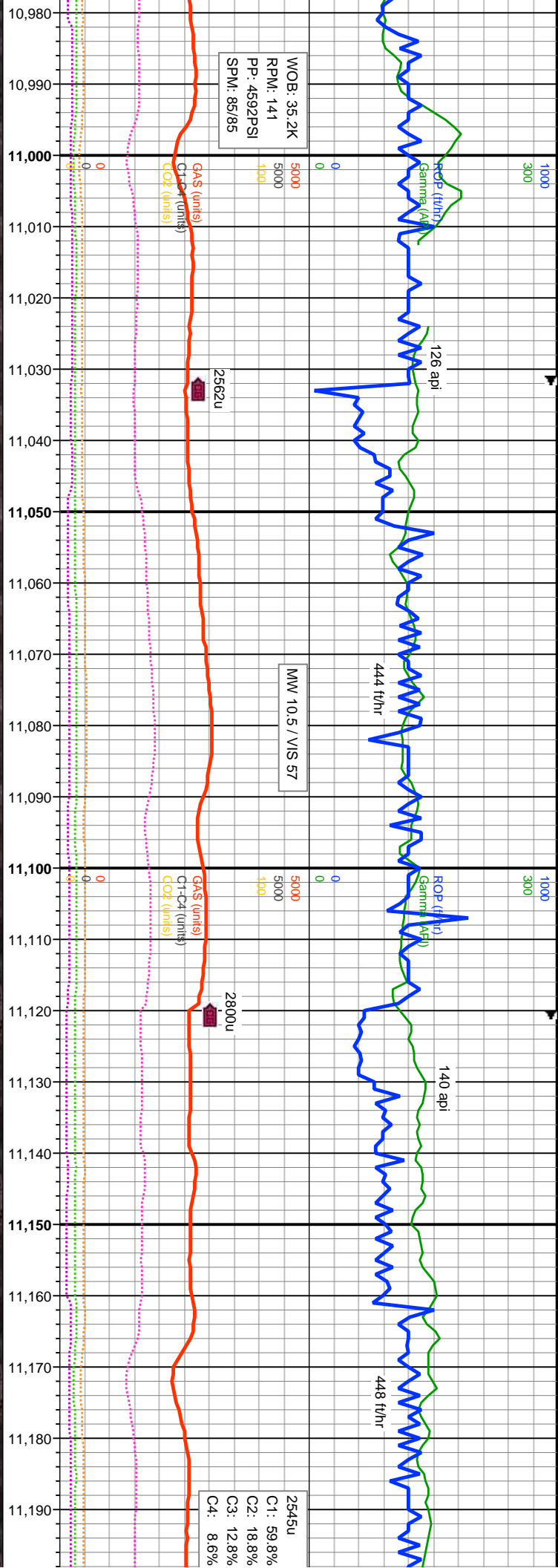


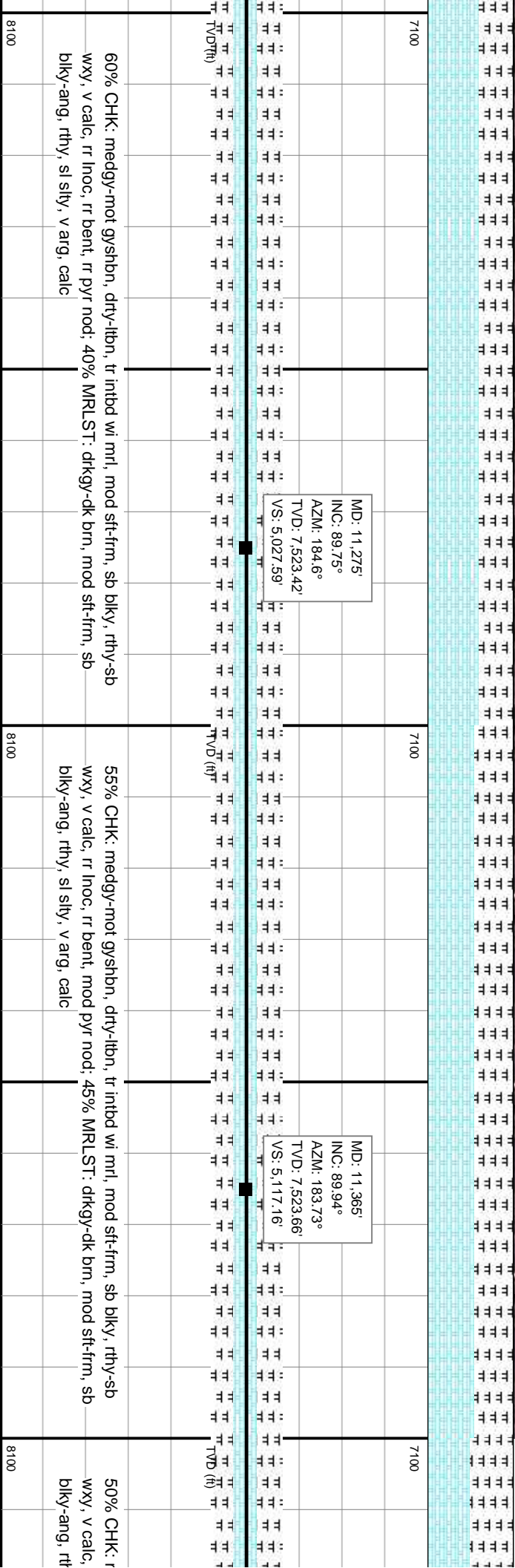
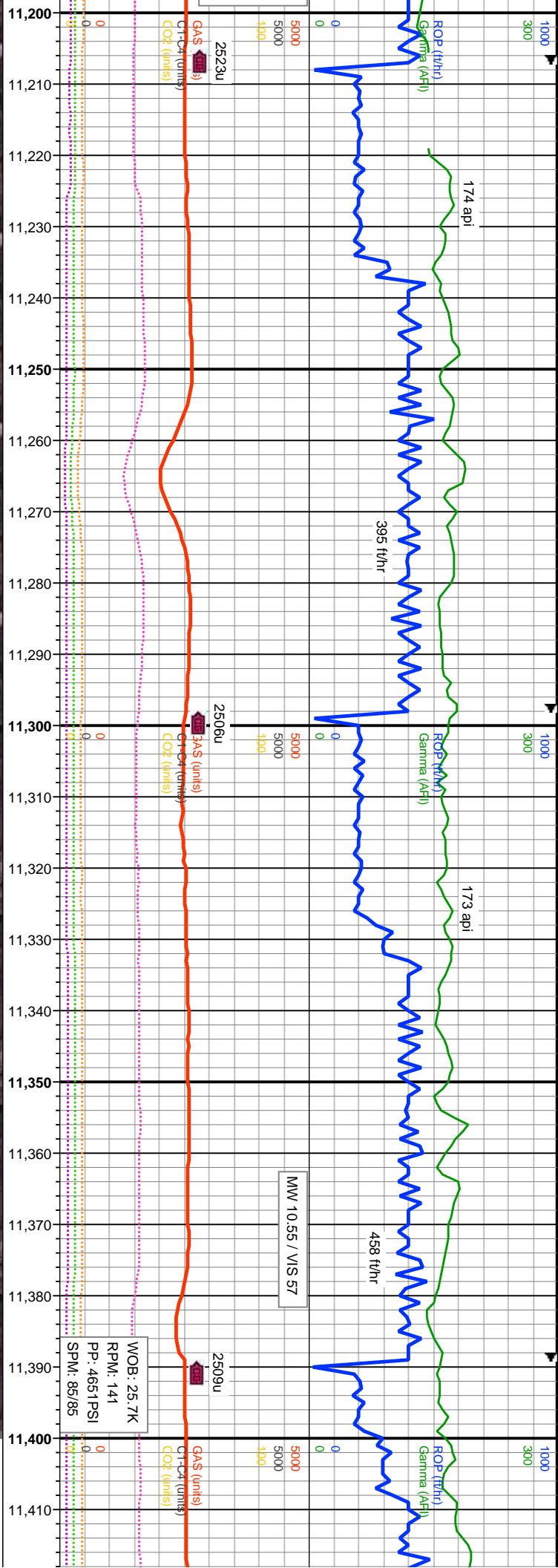
7100	MD: 10,113' INC: 90.12° AZM: 181.32° TVD: 7,523.51' VS: 3,869.52'	7100	60% MRLST: dkgy-dk brn, mod sft-fm, sb blk-ang, rthy, sl silty, v arg, calc, rr nodl pyr, rr bent, rr inoc, 40% CHK: medgy-gyshbn, dry brn-sme crm, com intbd w/ mtl, mod sft-fm, sb blk-ky, rthy-sb wxy, v calc
7100	MD: 10,202' INC: 90.15° AZM: 179.69° TVD: 7,523.3' VS: 3,958.46'	7100	65% MRLST: dkgy-dk brn, mod sft-fm, sb blk-ang, rthy, sl silty, v arg, calc, rr nodl pyr, rr bent, rr inoc, 35% CHK: medgy-gyshbn, dry brn-sme crm, com intbd w/ mtl, mod sft-fm, sb blk-ky, rthy-sb wxy, v calc
7100	MD: 10,292' INC: 90.22° AZM: 177.54° TVD: 7,523.01' VS: 4,048.46'	7100	60% MRLST: dkgy-dk brn, mod sft-fm, sb blk-ang, rthy, sl silty, v arg, calc, rr nodl pyr, rr bent, rr inoc, 35% CHK: medgy-gyshbn, dry brn-sme crm, com intbd w/ mtl, mod sft-fm, sb blk-ky, rthy-sb wxy, v calc

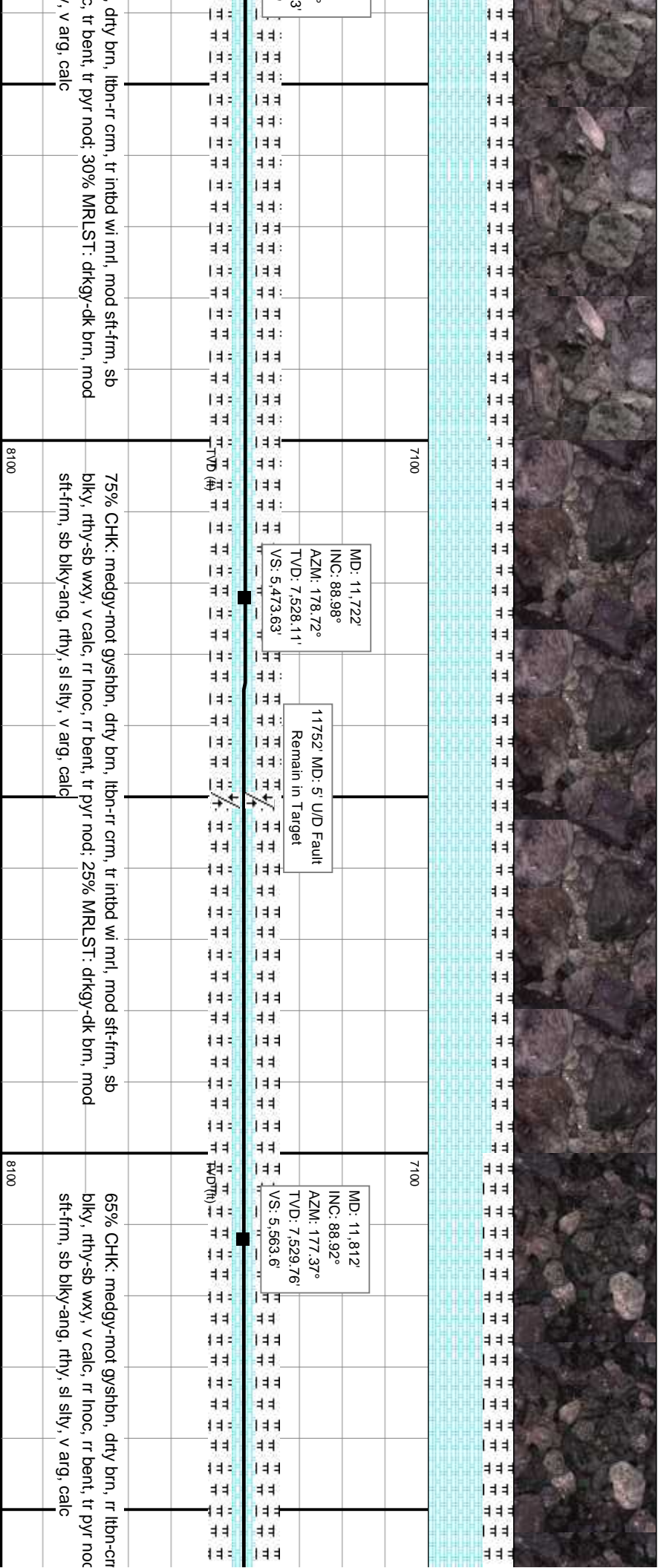
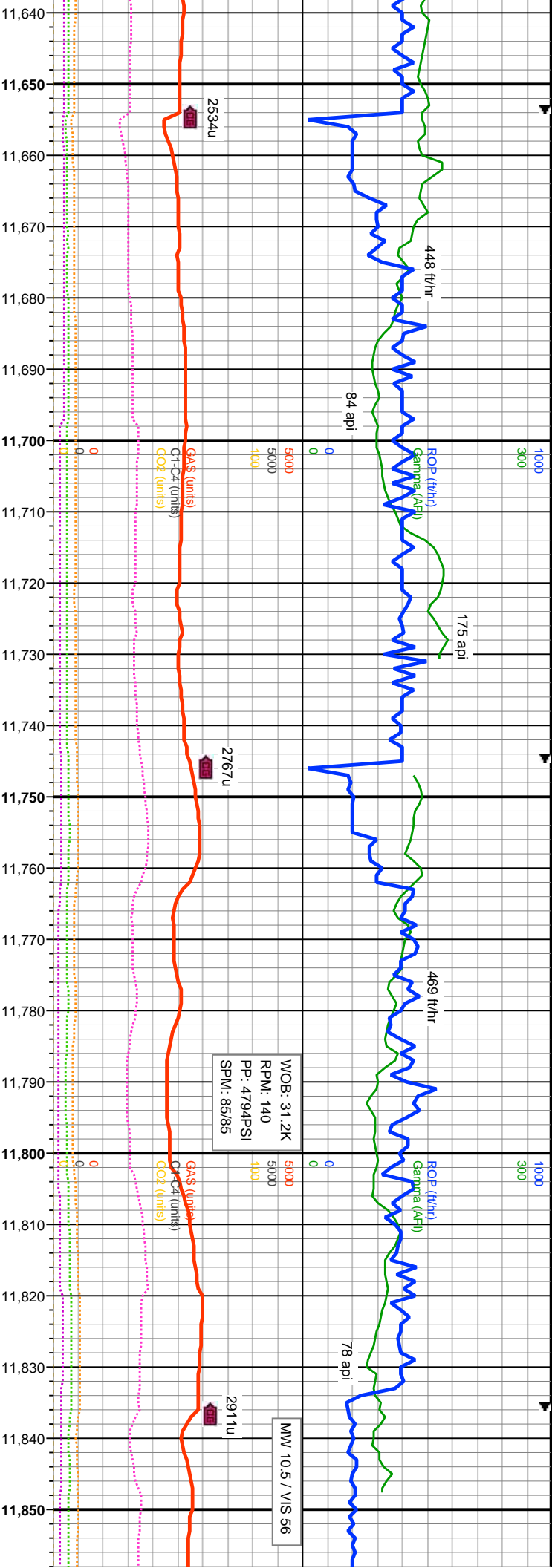


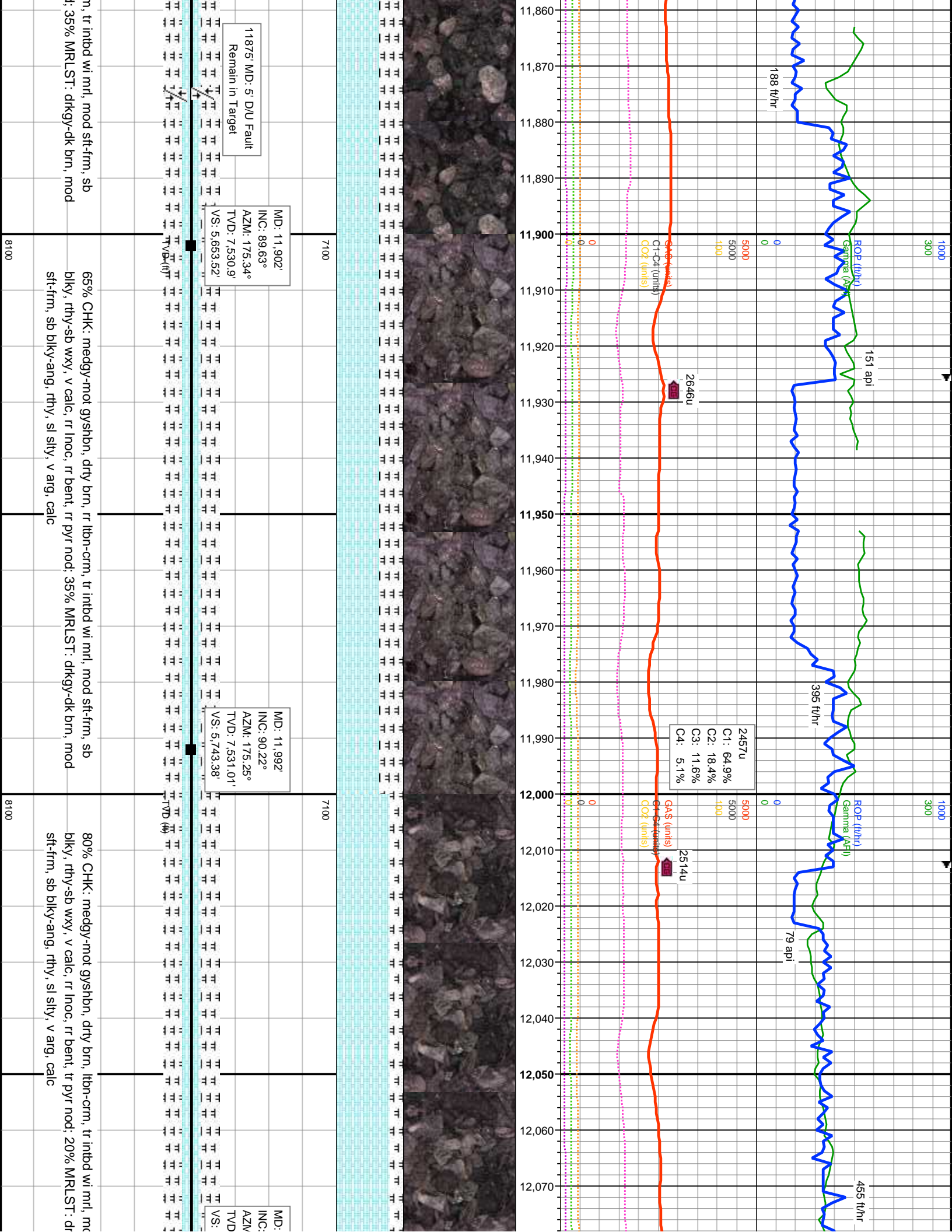


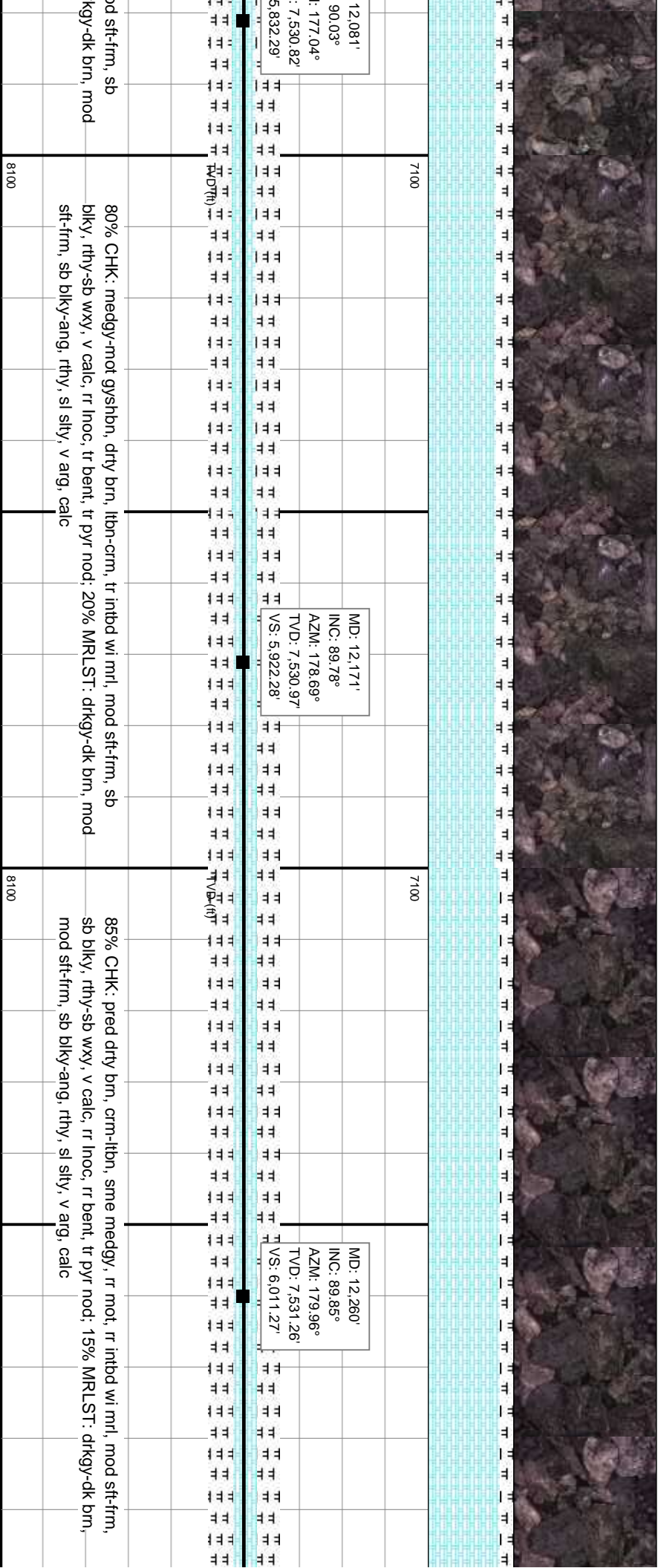
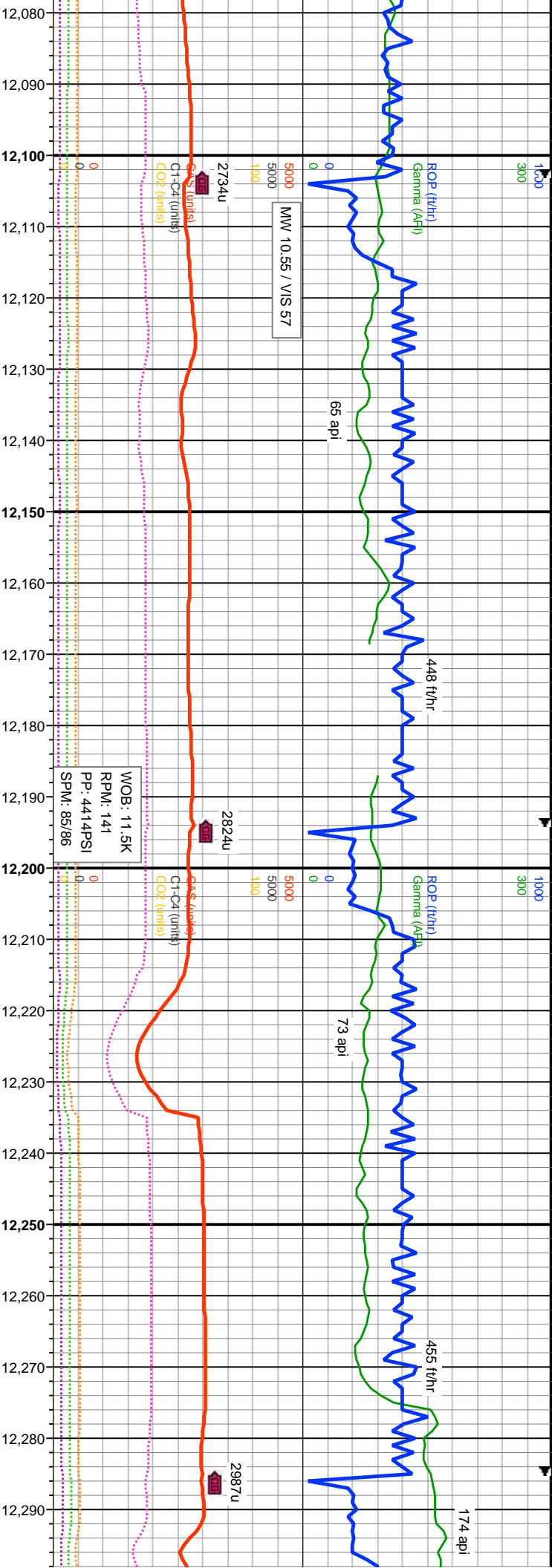


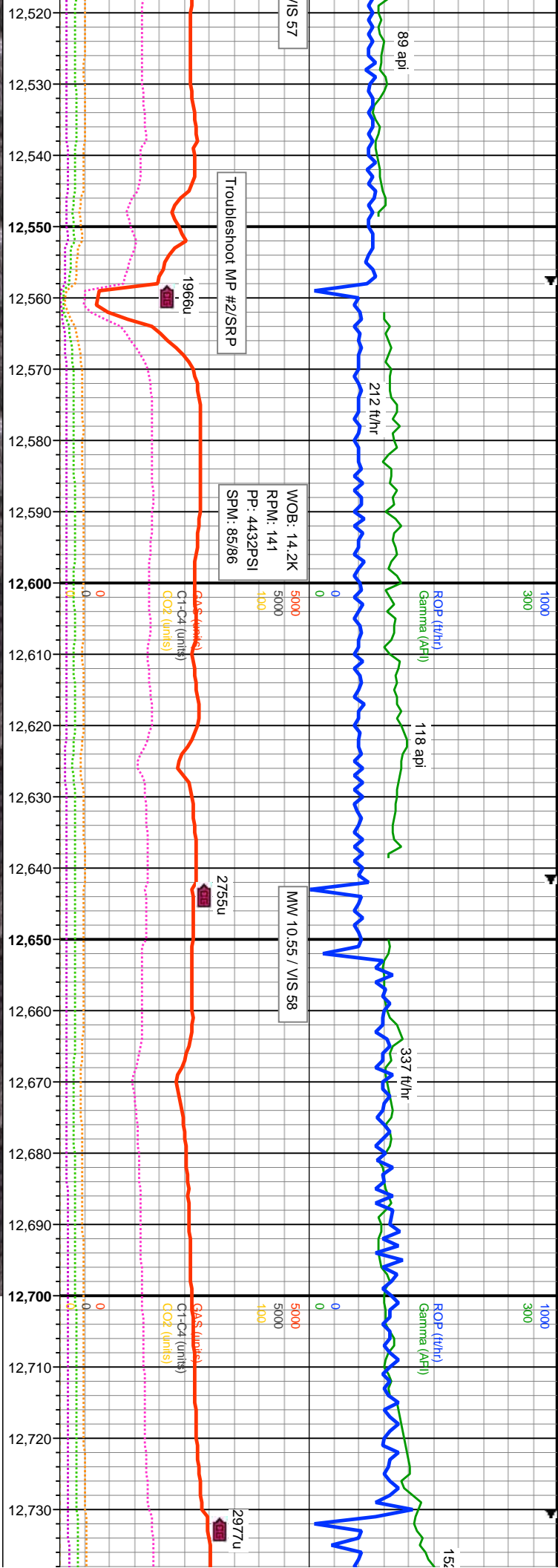












MD: 12,529'
INC: 89.97°
AZM: 185.23°
TVD: 7,531.63'
VS: 6,279.15'

12535 MD: 5' U/D Fault
Remain in Target

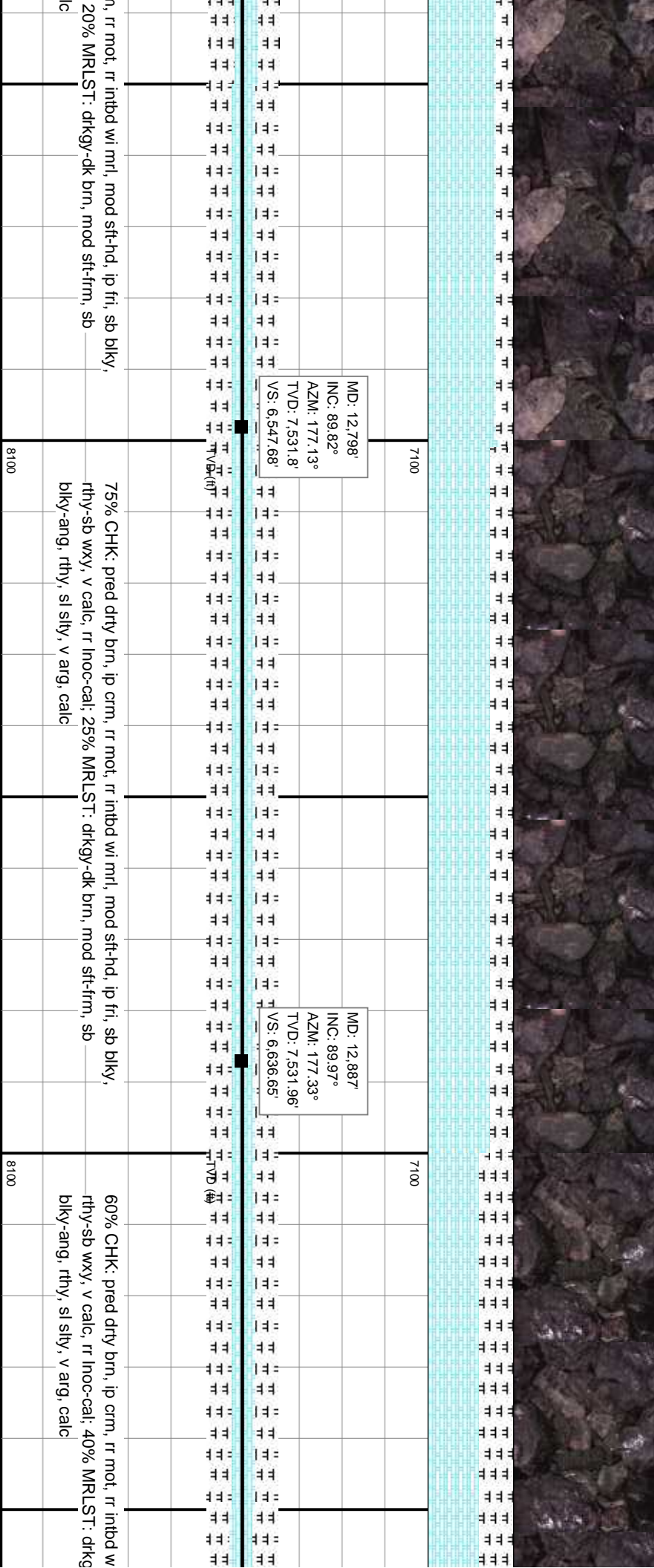
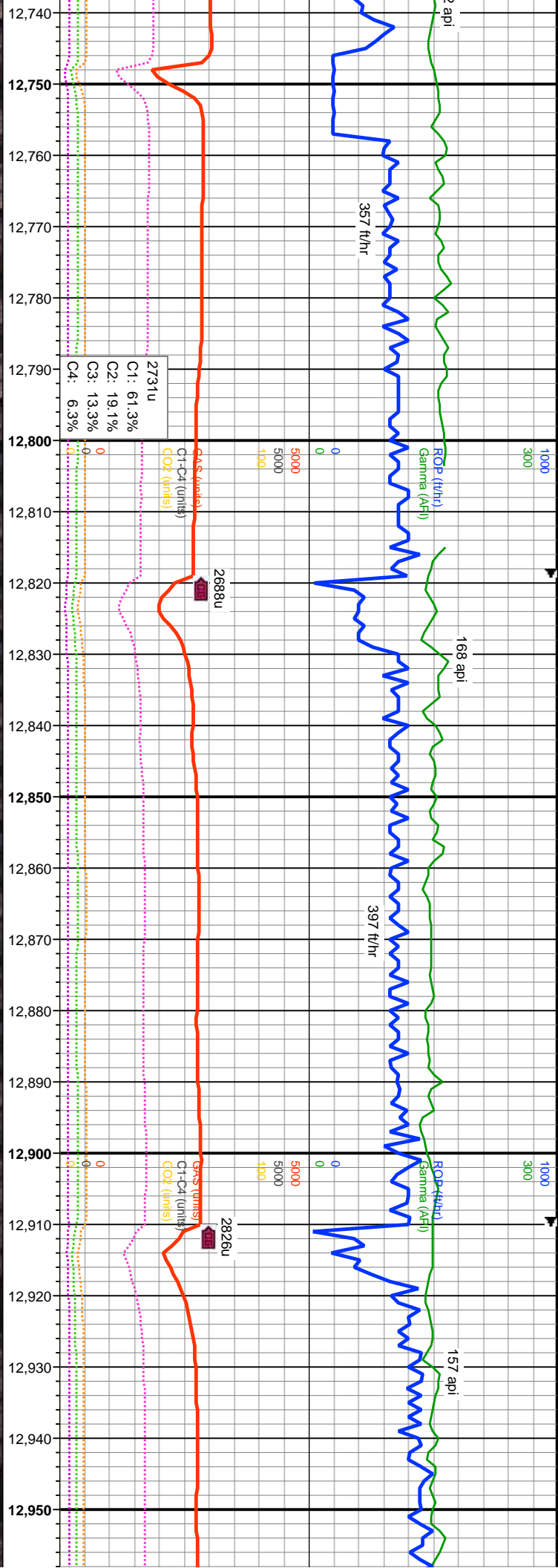
MD: 12,619'
INC: 89.97°
AZM: 182.47°
TVD: 7,531.68'
VS: 6,368.76'

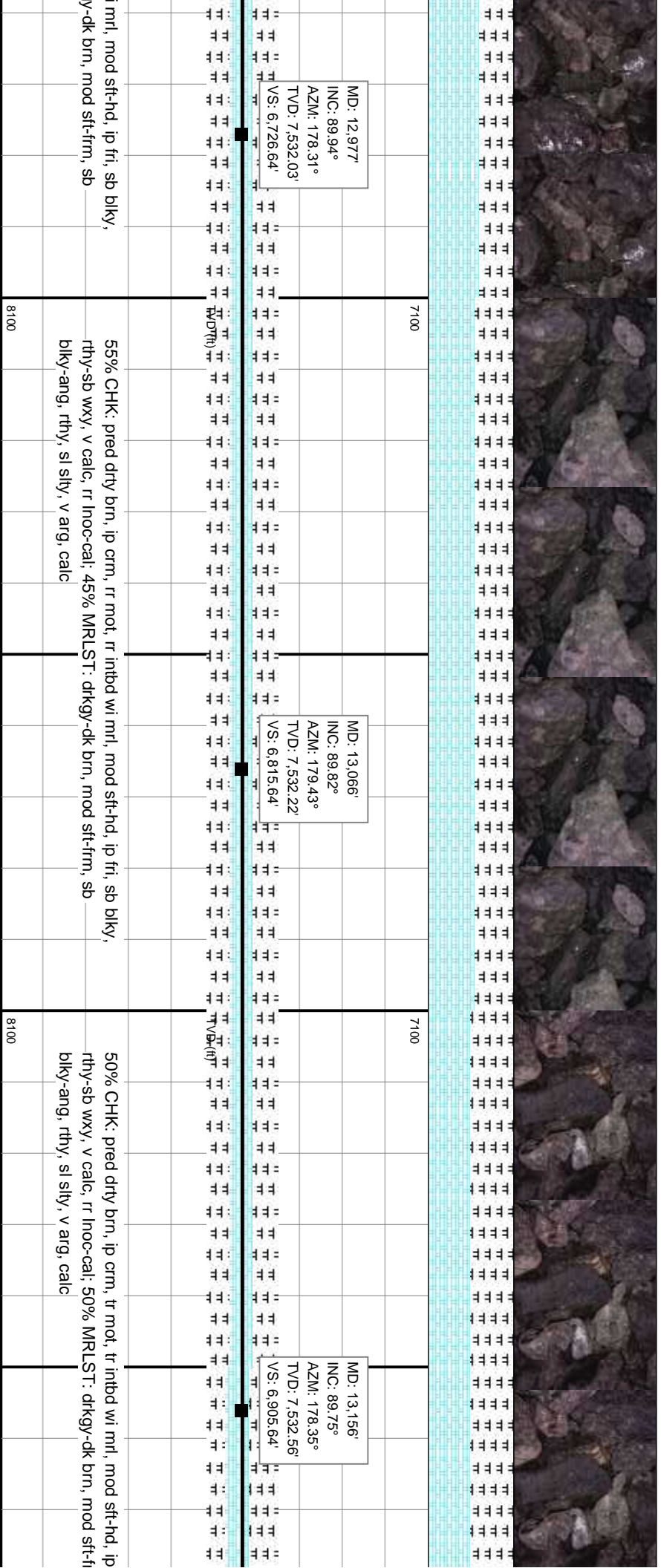
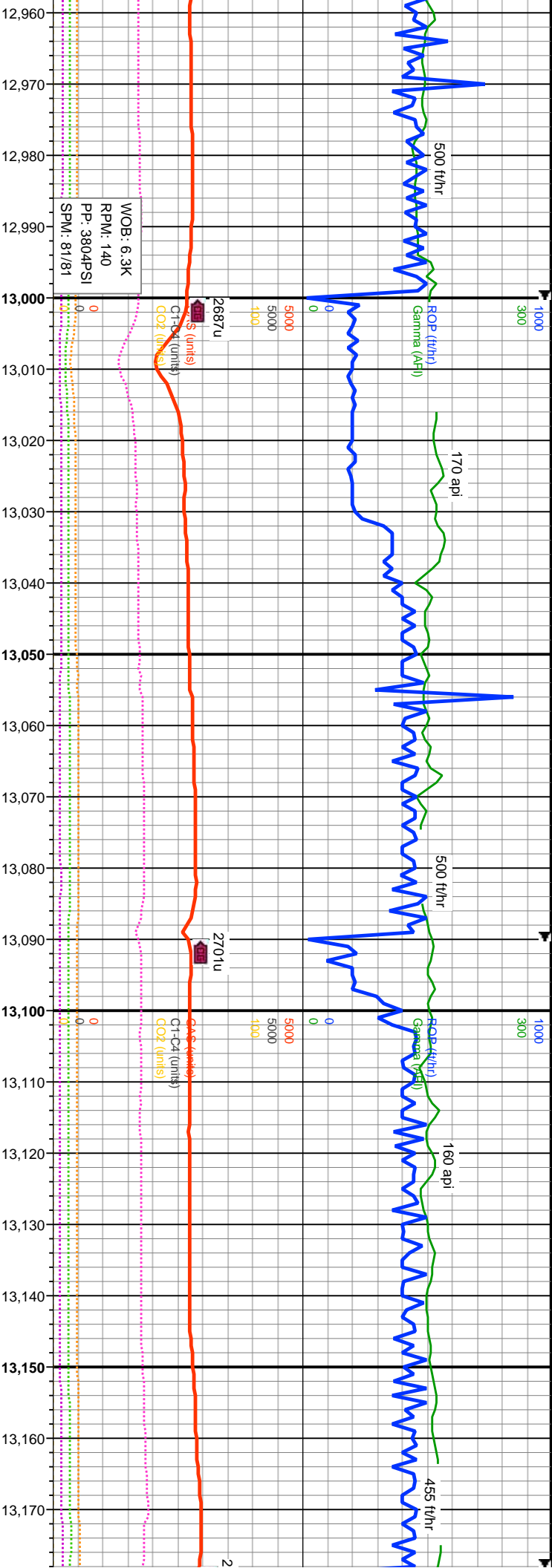
MD: 12,708'
INC: 90.03°
AZM: 179.13°
TVD: 7,531.68'
VS: 6,457.68'

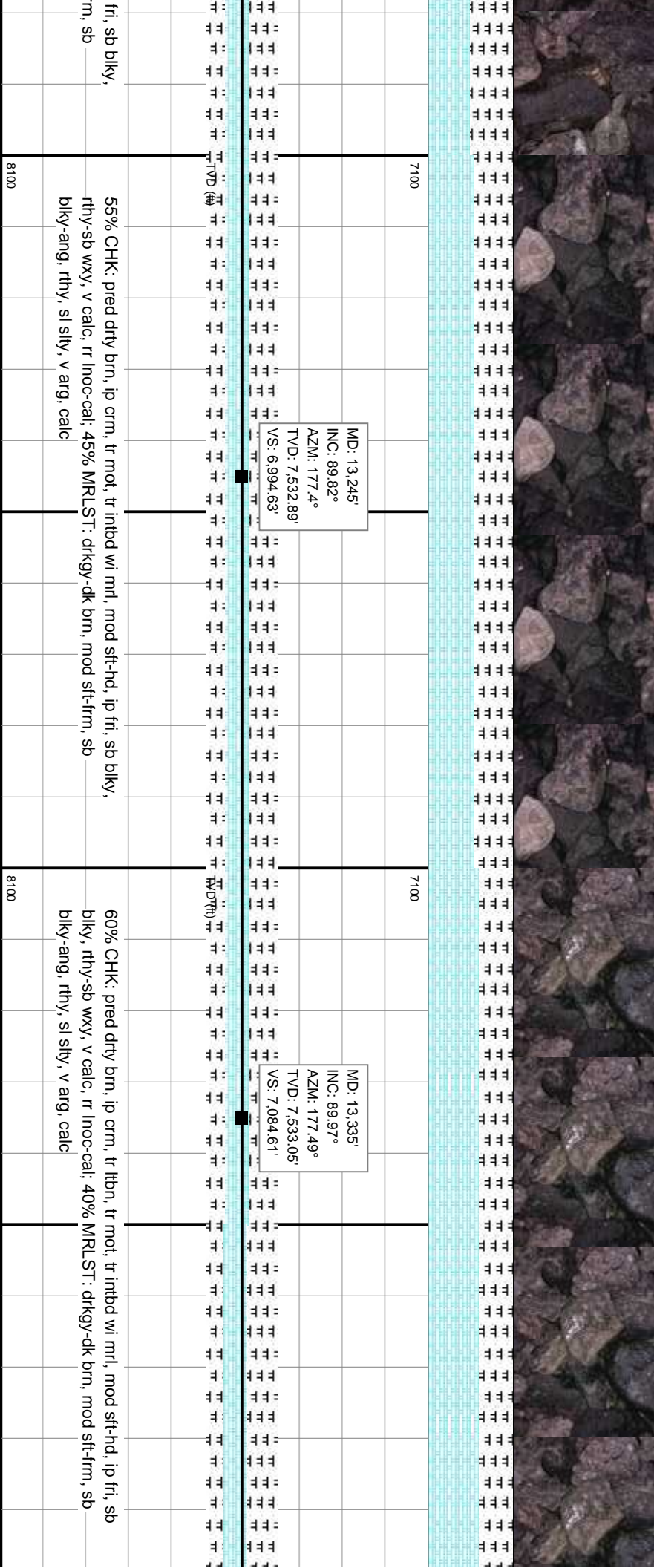
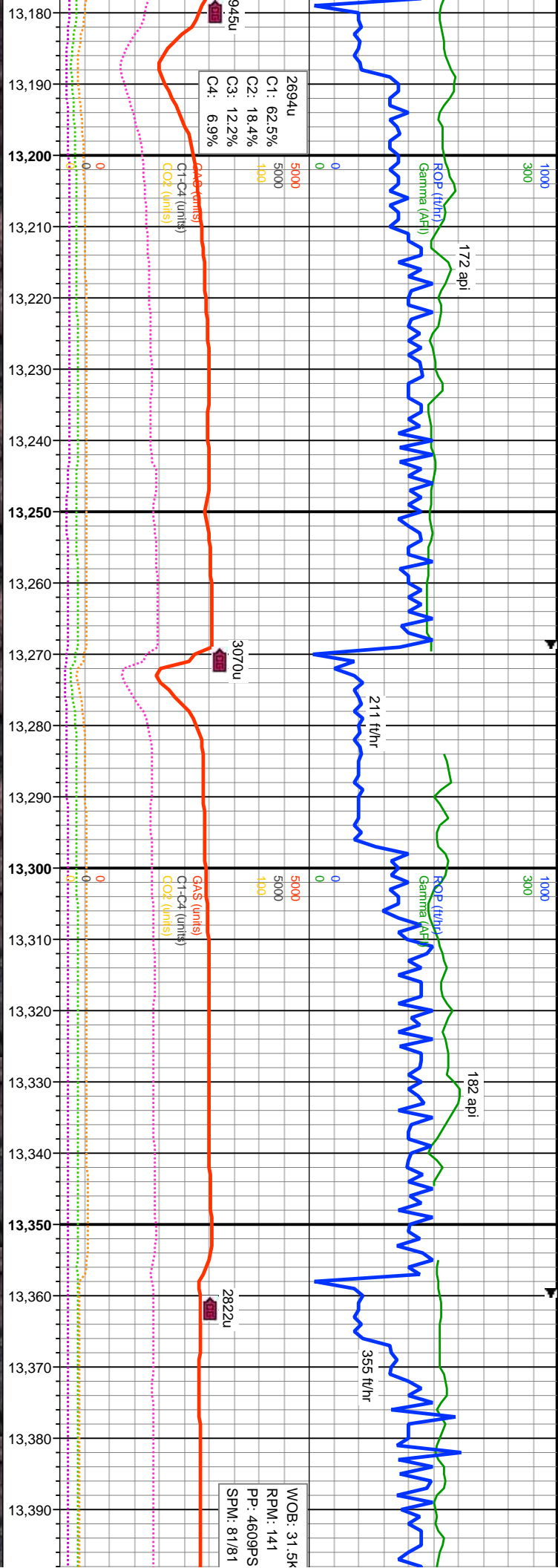
mod drty brn, crm-lbn, sme medgy-gyshbn, rr mot, rr intbd wi mtl, ip fri, sb blkly, rthy-sb wxy, v calc, rr lnoc-cal: 10% MRLST: drkgy-dk -frm, sb blkly-ang, rthy, sl slty, v arg, calc

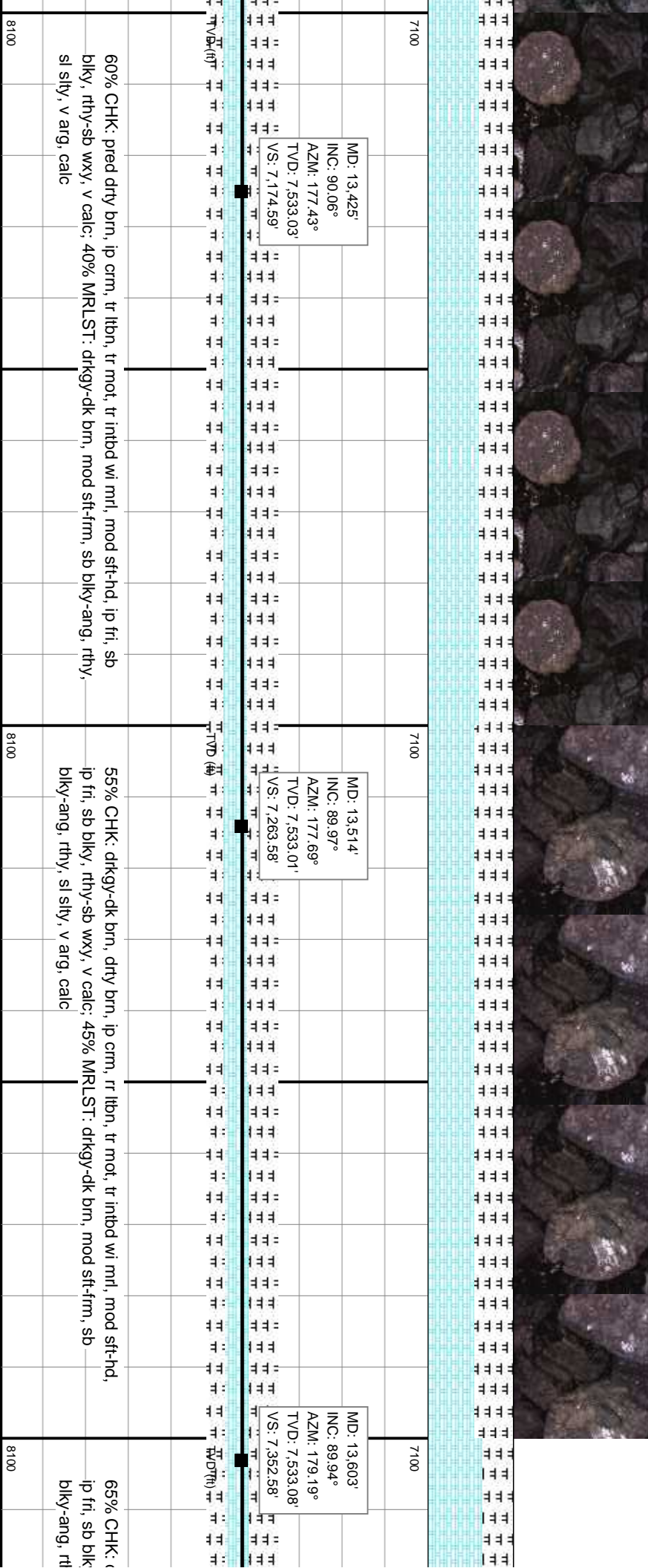
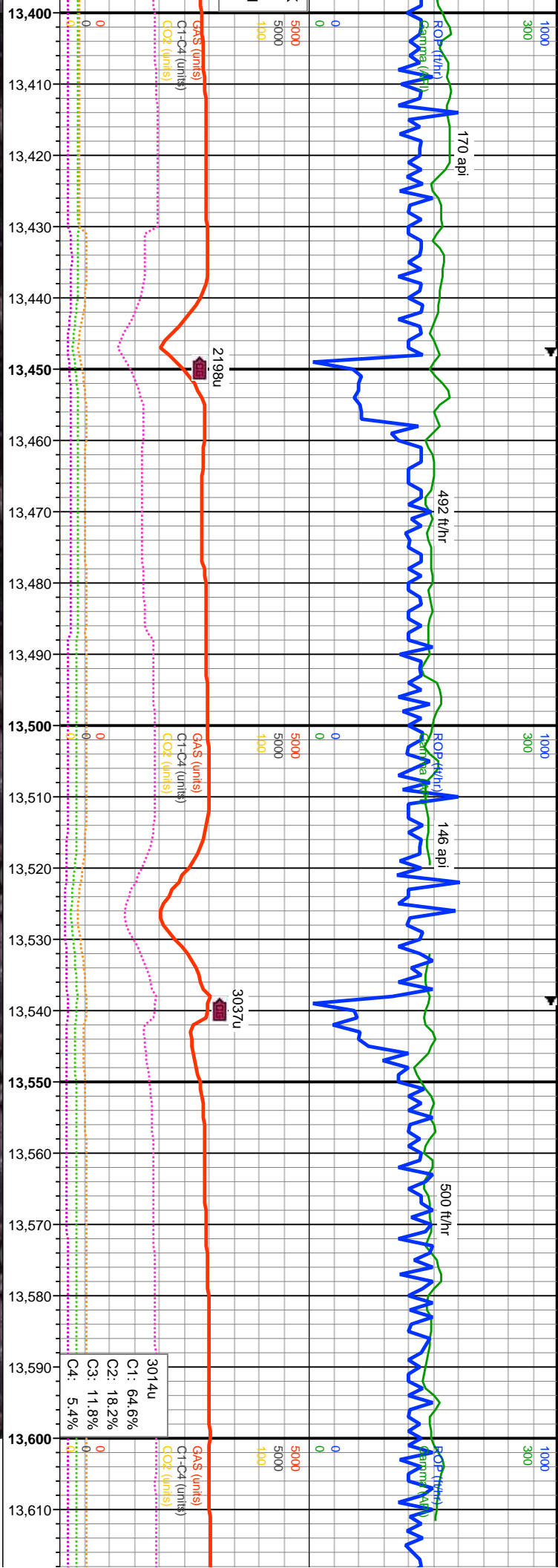
85% CHK: pred drty brn, sme medgy-gyshbn, rr mot, rr intbd wi mtl, mod sft-hd, ip fri, sb blkly, rthy-sb wxy, v calc, rr lnoc-cal: 15% MRLST: drkgy-dk brn, mod sft-frm, sb blkly-ang, rthy, sl slty, v arg, calc

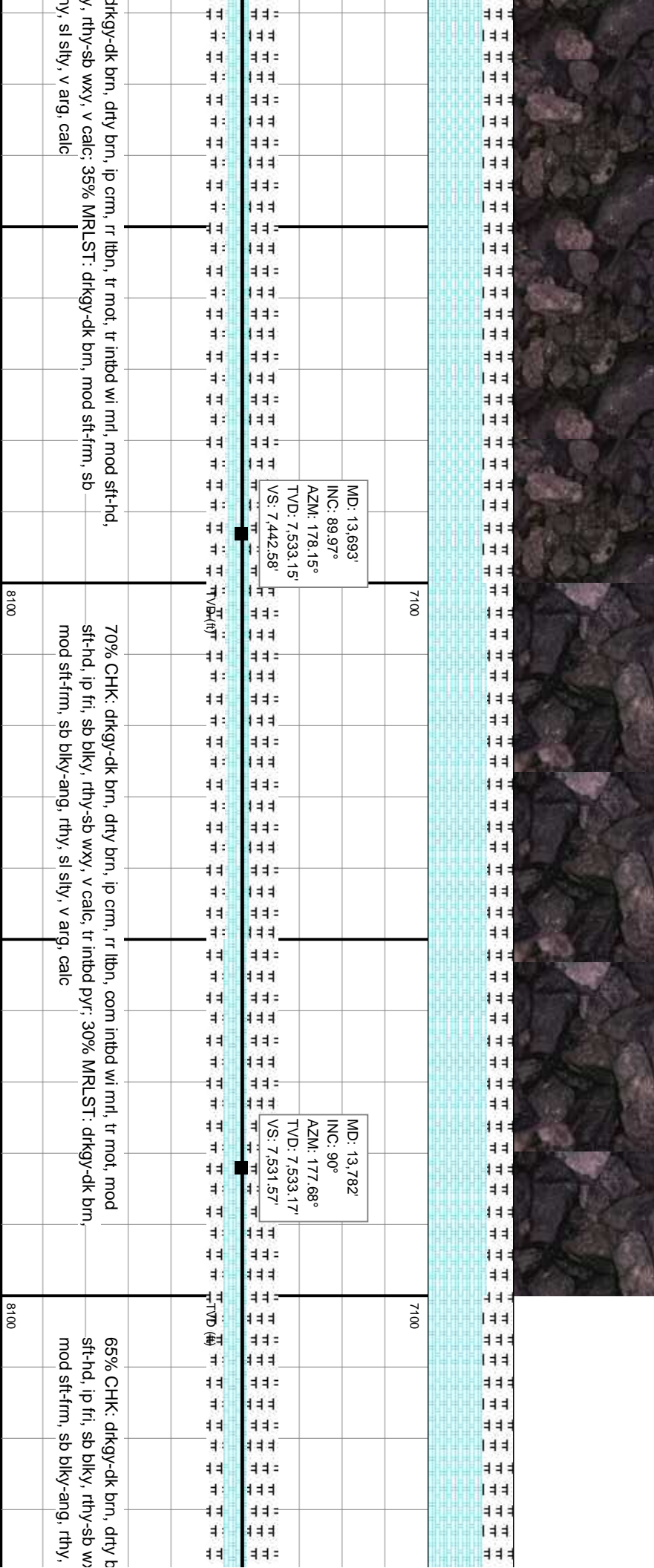
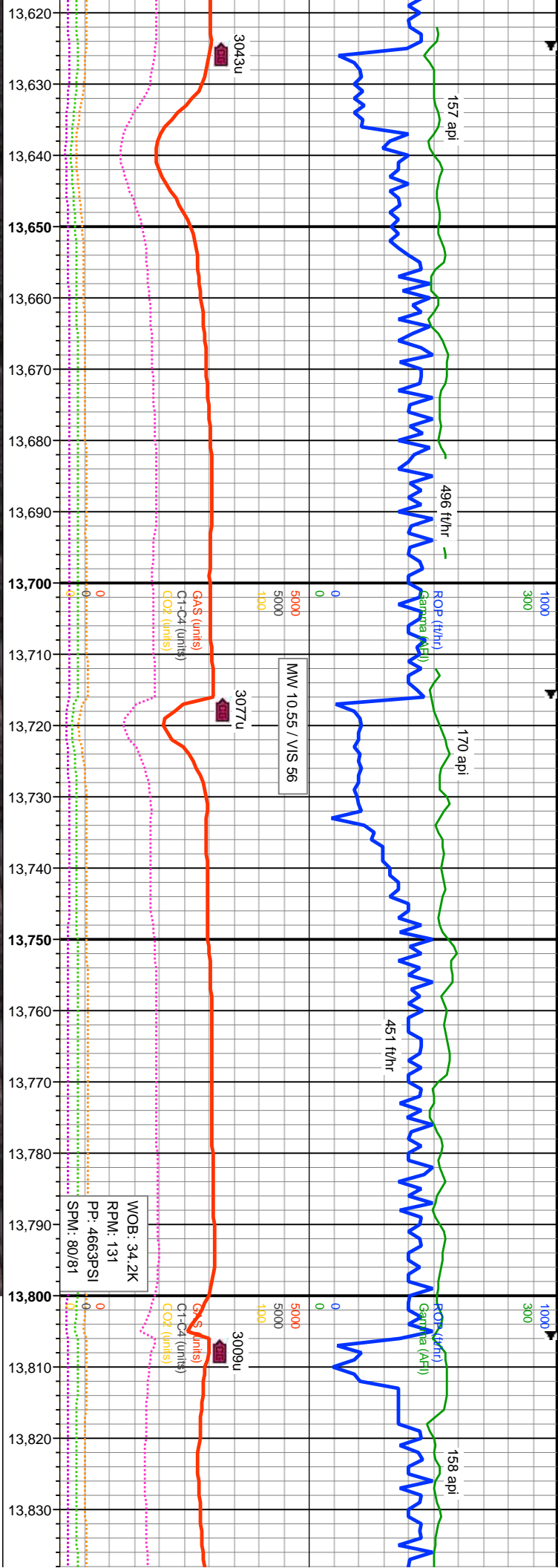
80% CHK: pred drty brn, ip crm-lbn, sme medgy-gyshbn, rr mot, rr intbd wi mtl, mod sft-hd, ip fri, sb blkly, rthy-sb wxy, v calc, rr lnoc-cal: 10% MRLST: drkgy-dk brn, mod sft-frm, sb blkly-ang, rthy, sl slty, v arg, calc

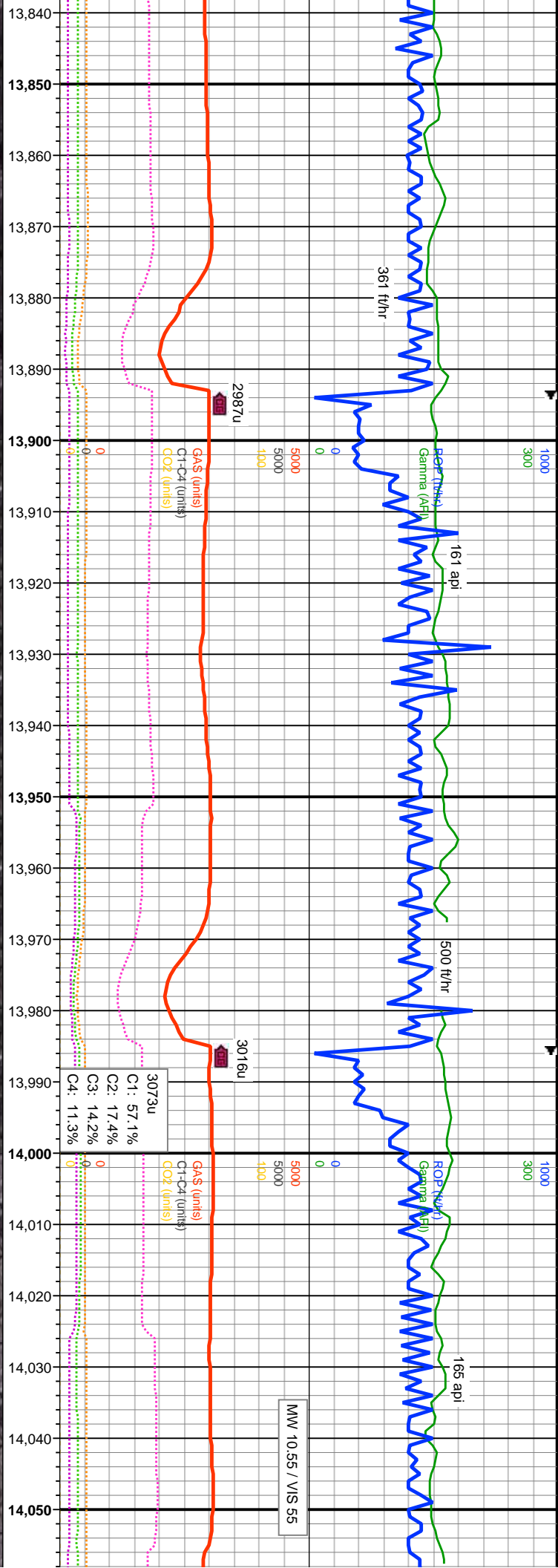










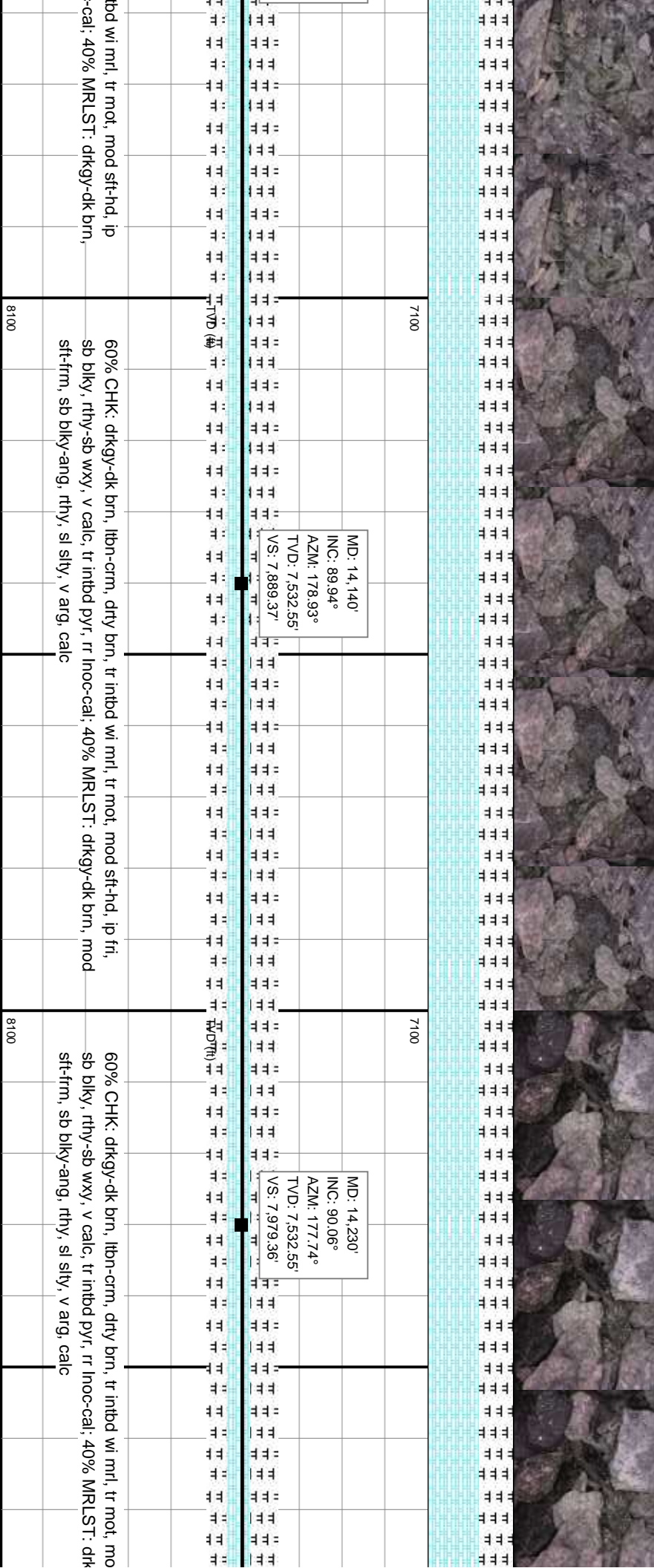
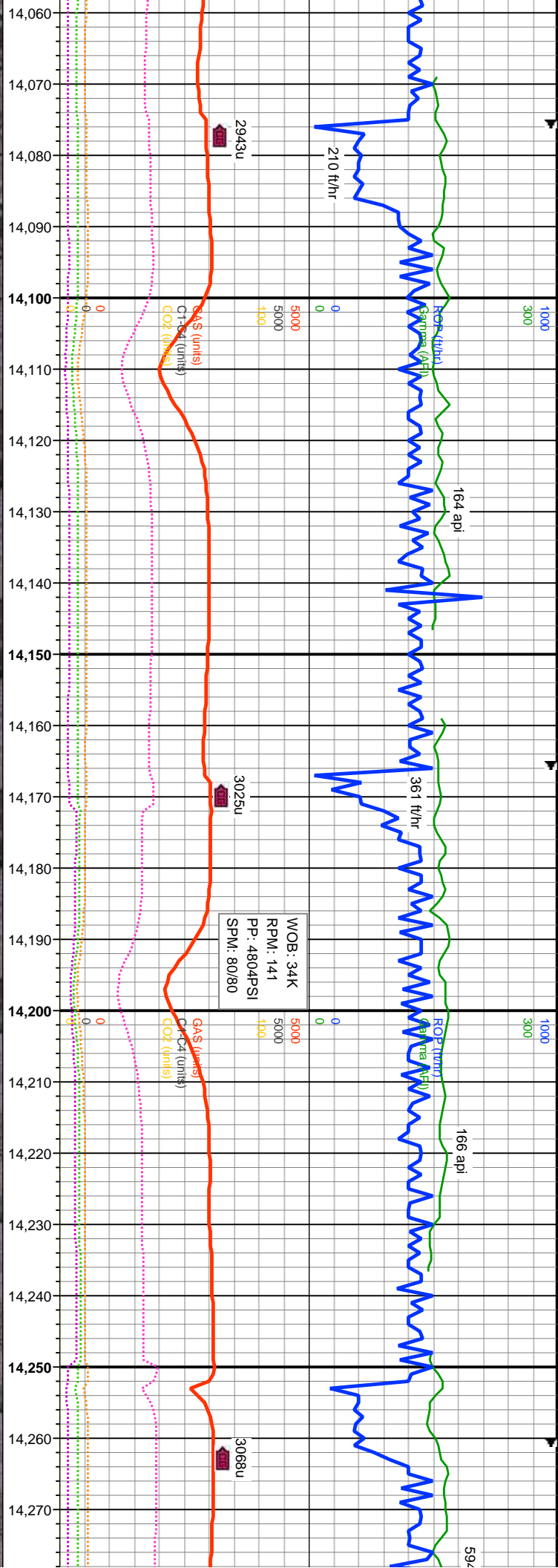


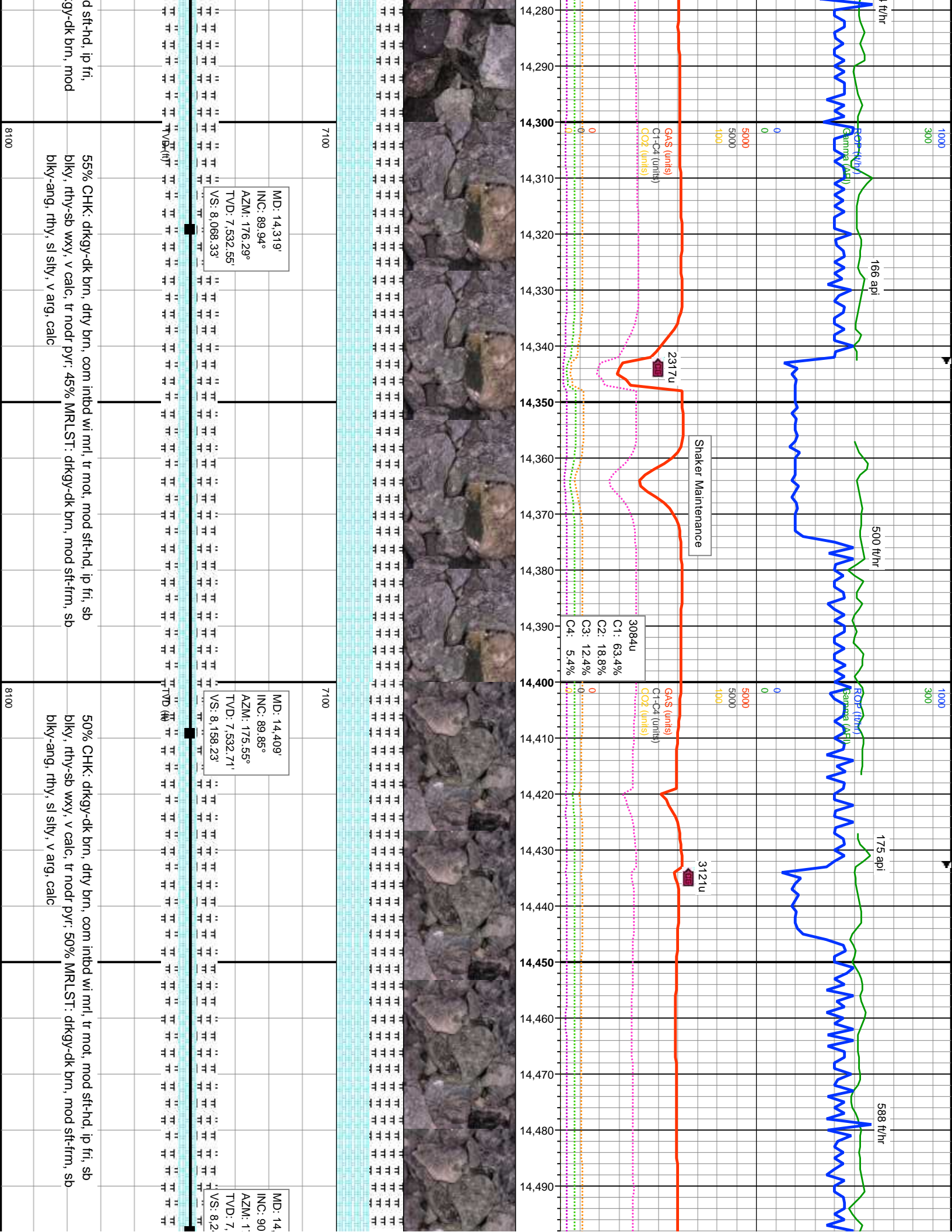
MD: 13.872'
INC: 90.22°
AZM: 177.79°
TVD: 7.533'
VS: 7,621.56'

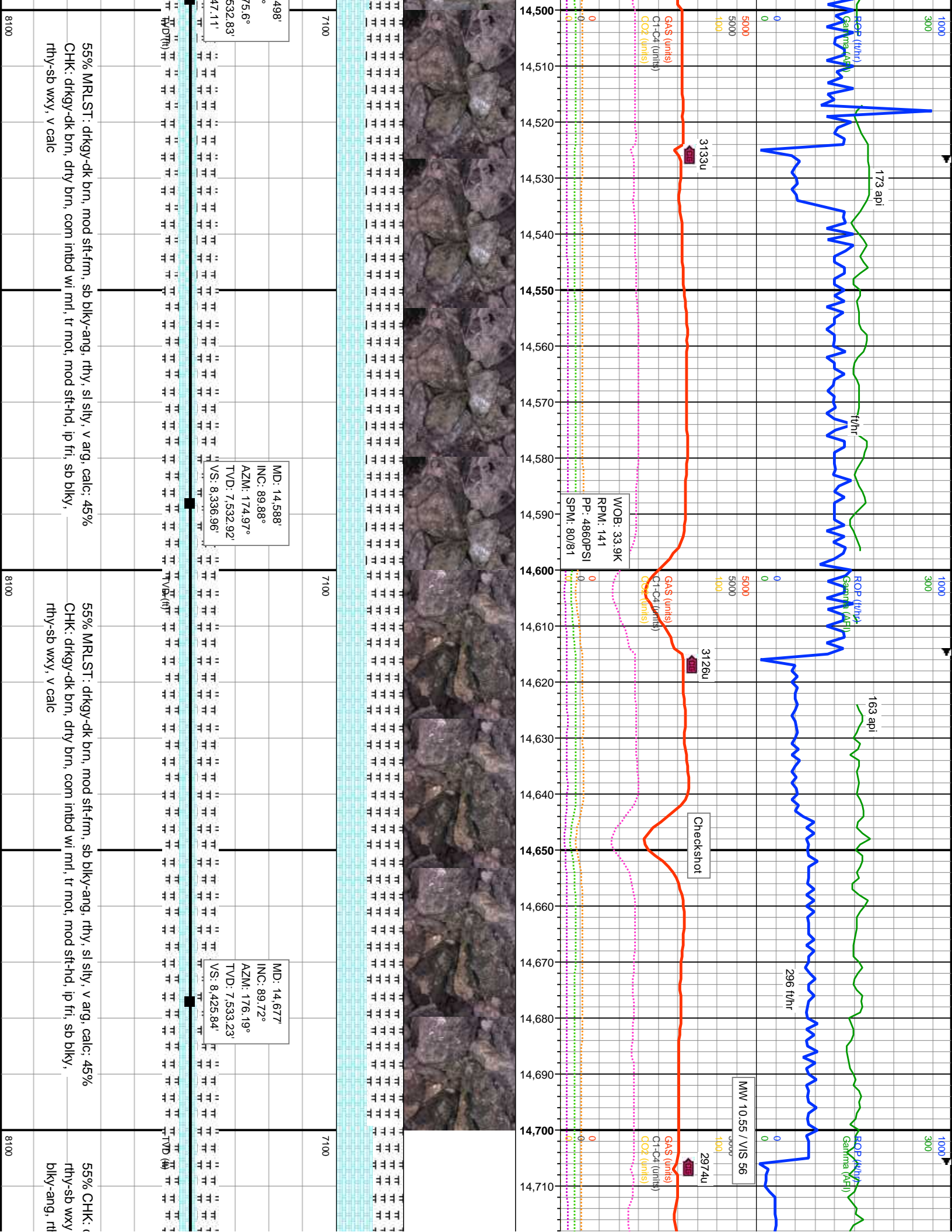
MD: 13.961'
INC: 90.15°
AZM: 181.63°
TVD: 7.532.71'
VS: 7,710.52'

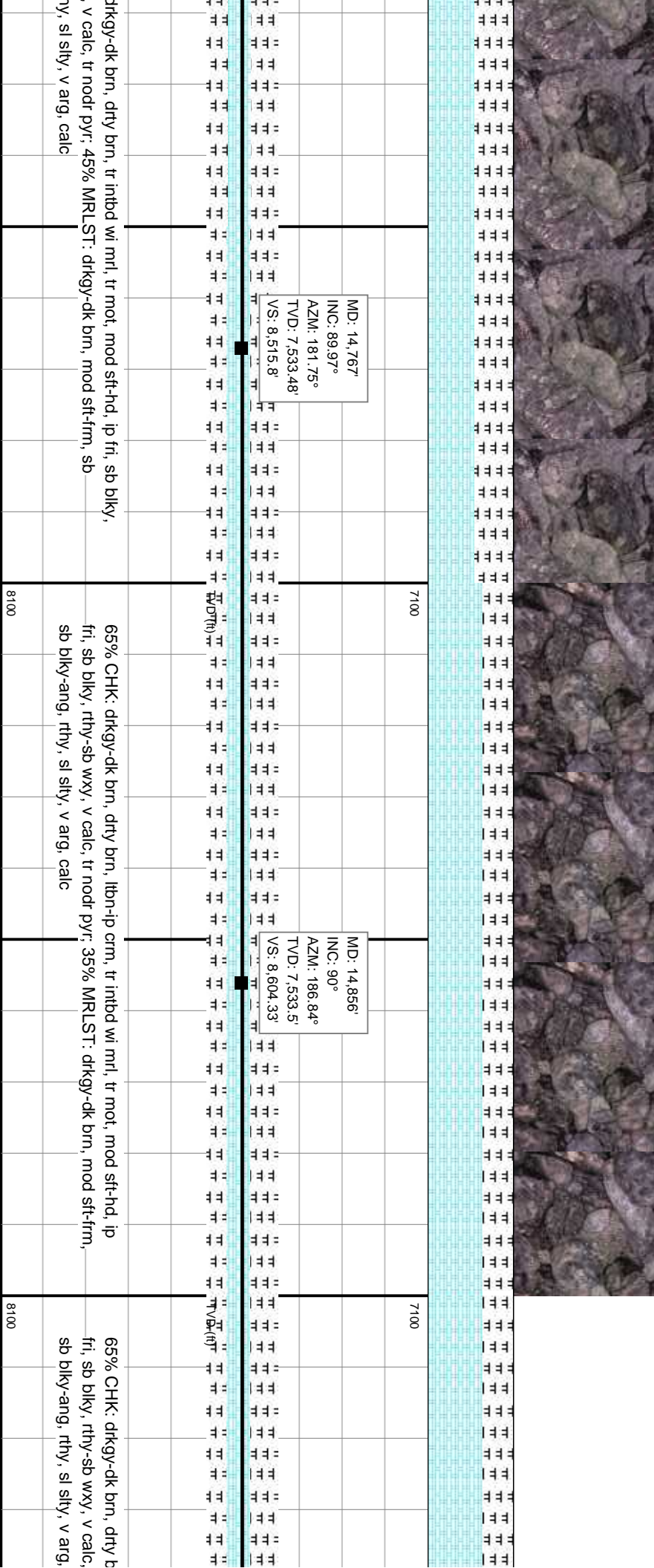
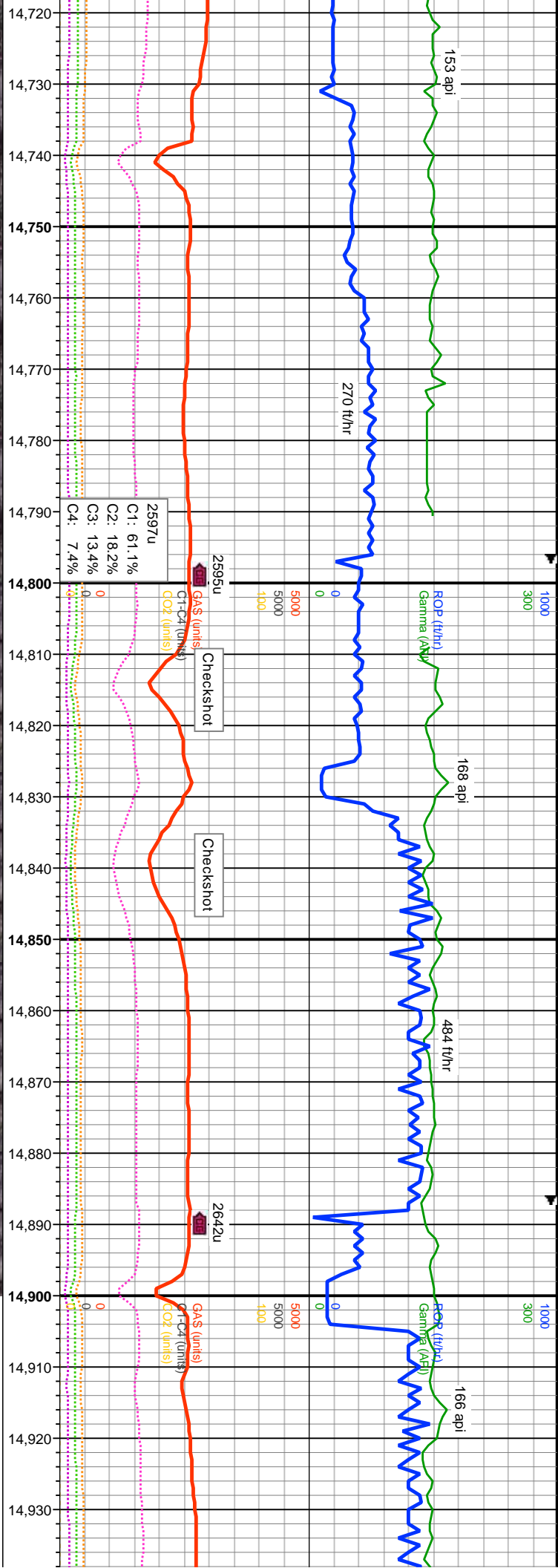
MD: 14.051'
INC: 90.06°
AZM: 181.38°
TVD: 7.532.55'
VS: 7,800.41'

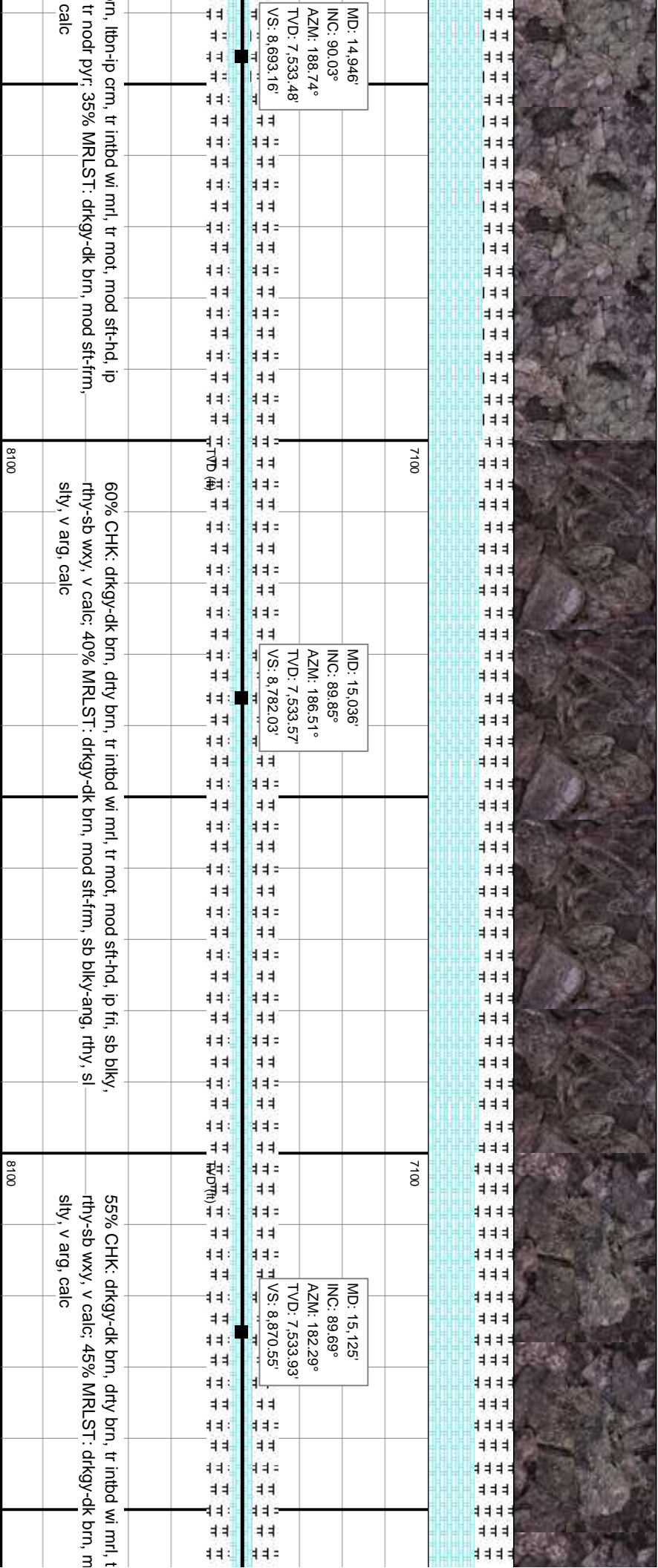
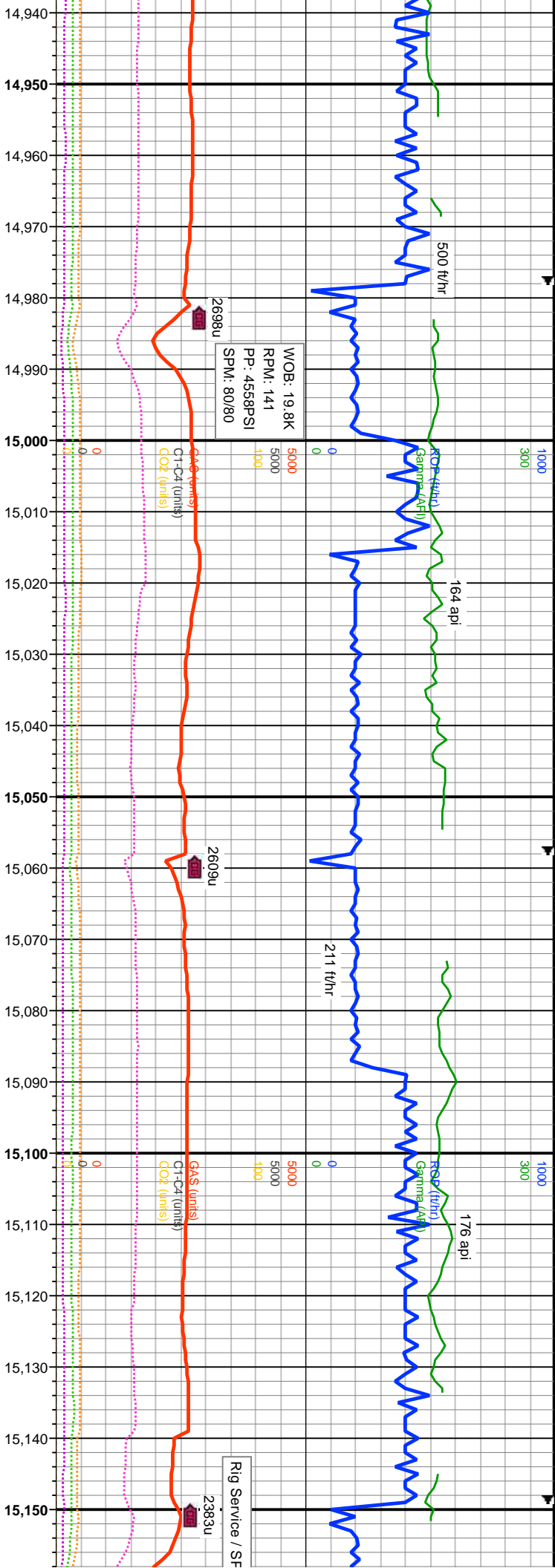
rn, ip cmm, rr lbm, com intbd wi mrl, tr mot, mod y, v calc, tr intbd pyr, 35% MRLST: drkg-y-dk brn, sl stly, v arg, calc	7100	8100
60% CHK: drkg-y-dk brn, drty brn, tr lbm-crm, tr intbd wi mrl, tr mot, mod sft-hd, ip fri, sb blk, rthy-sb wxy, v calc, tr intbd pyr, rr lnoc-calc, 40% MRLST: drkg-y-dk brn, mod sft-frm, sb blk-y-ang, rthy, sl stly, v arg, calc	7100	8100
60% CHK: drkg-y-dk brn, drty brn, tr lbm-crm, tr intbd wi mrl, tr mot, mod sft-hd, ip fri, sb blk, rthy-sb wxy, v calc, tr intbd pyr, rr lnoc-calc, 40% MRLST: drkg-y-dk brn, mod sft-frm, sb blk-y-ang, rthy, sl stly, v arg, calc	7100	8100

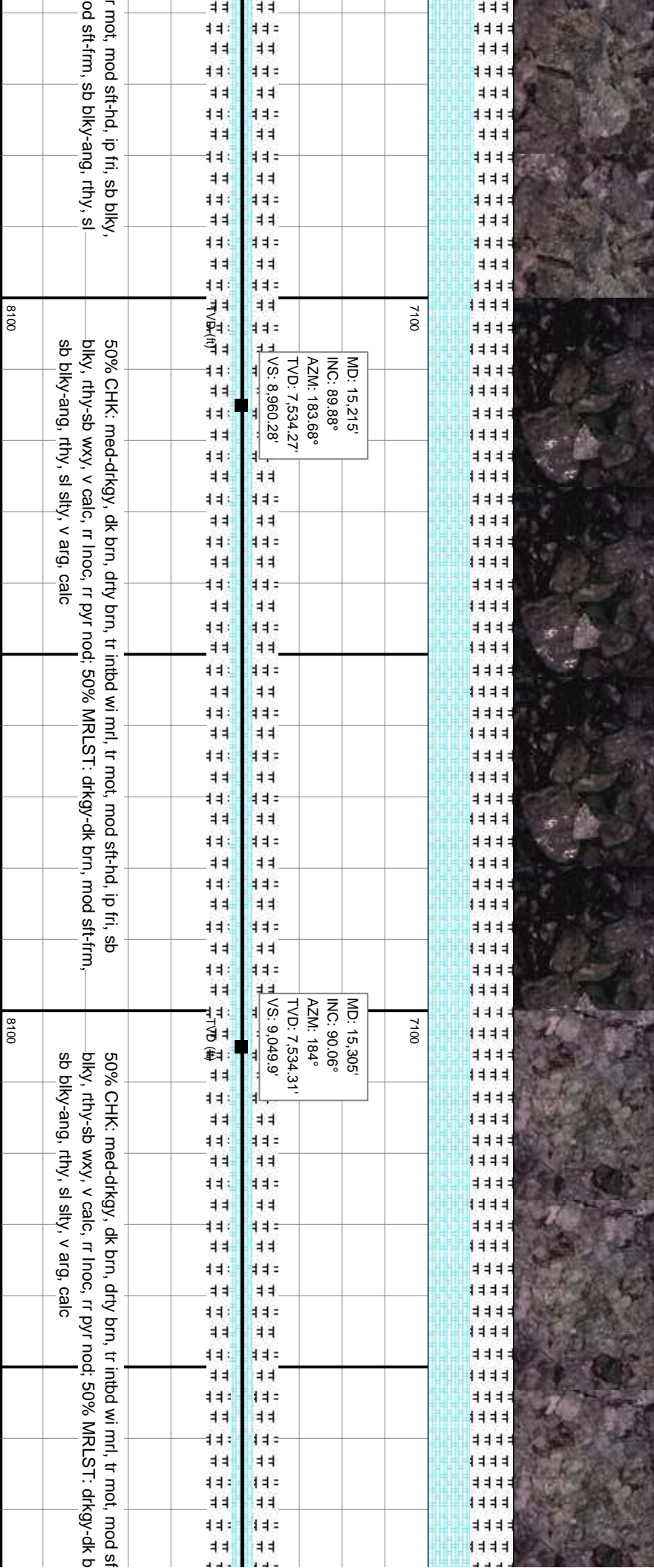
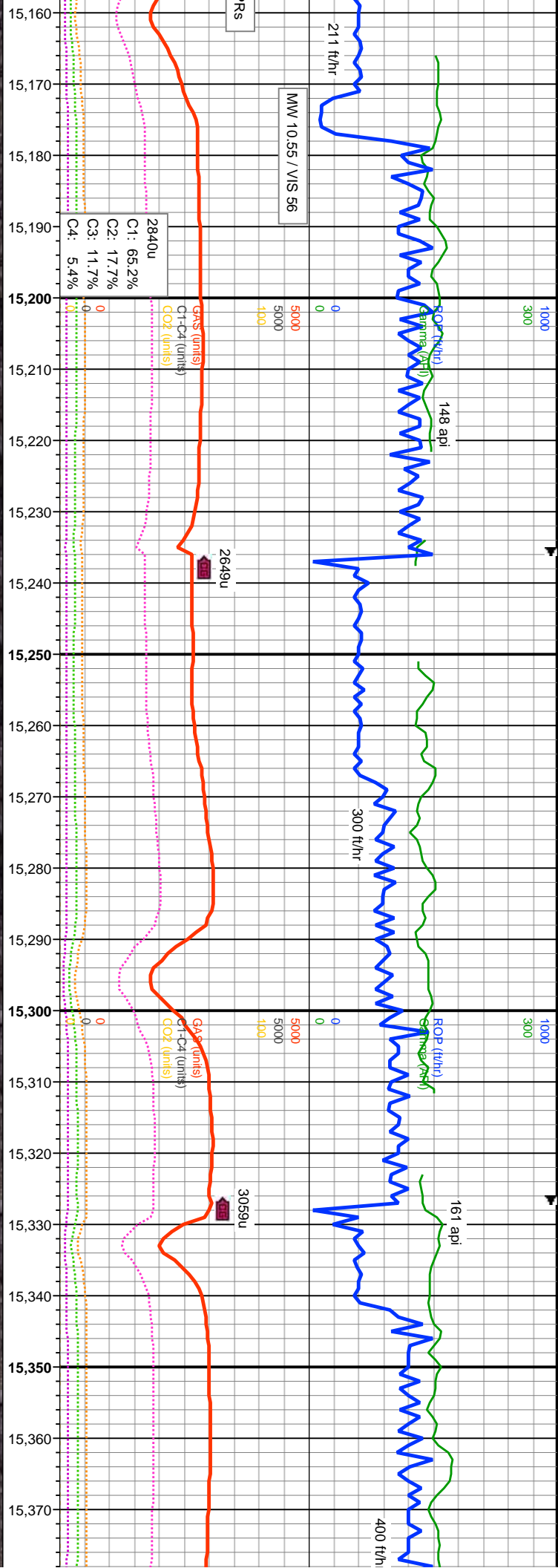


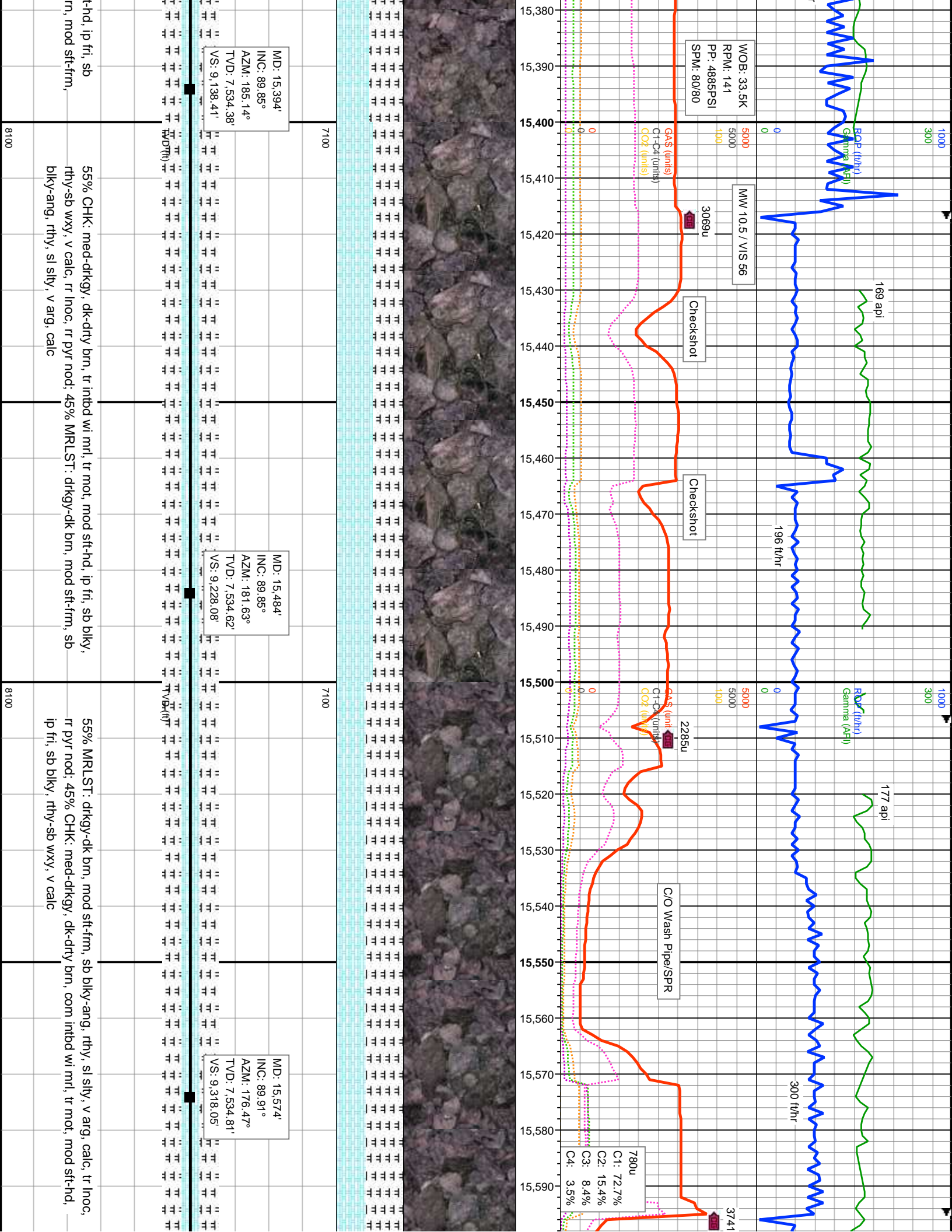


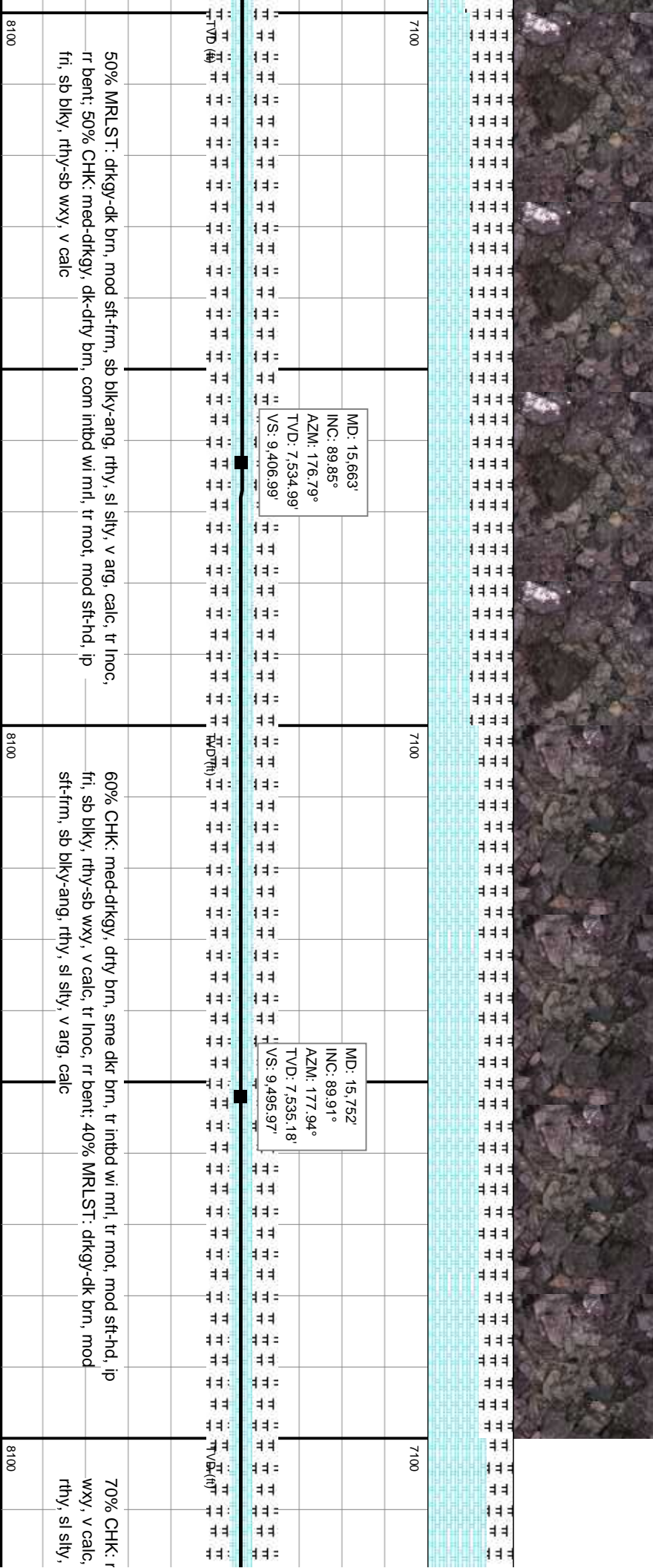
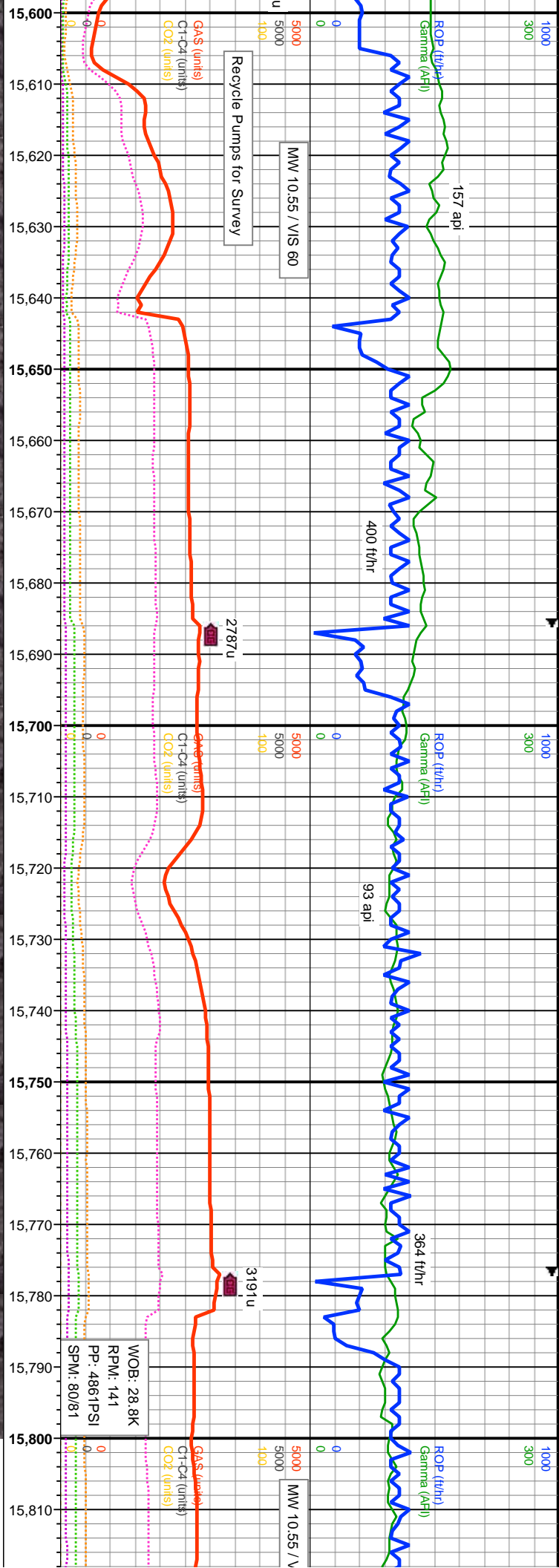


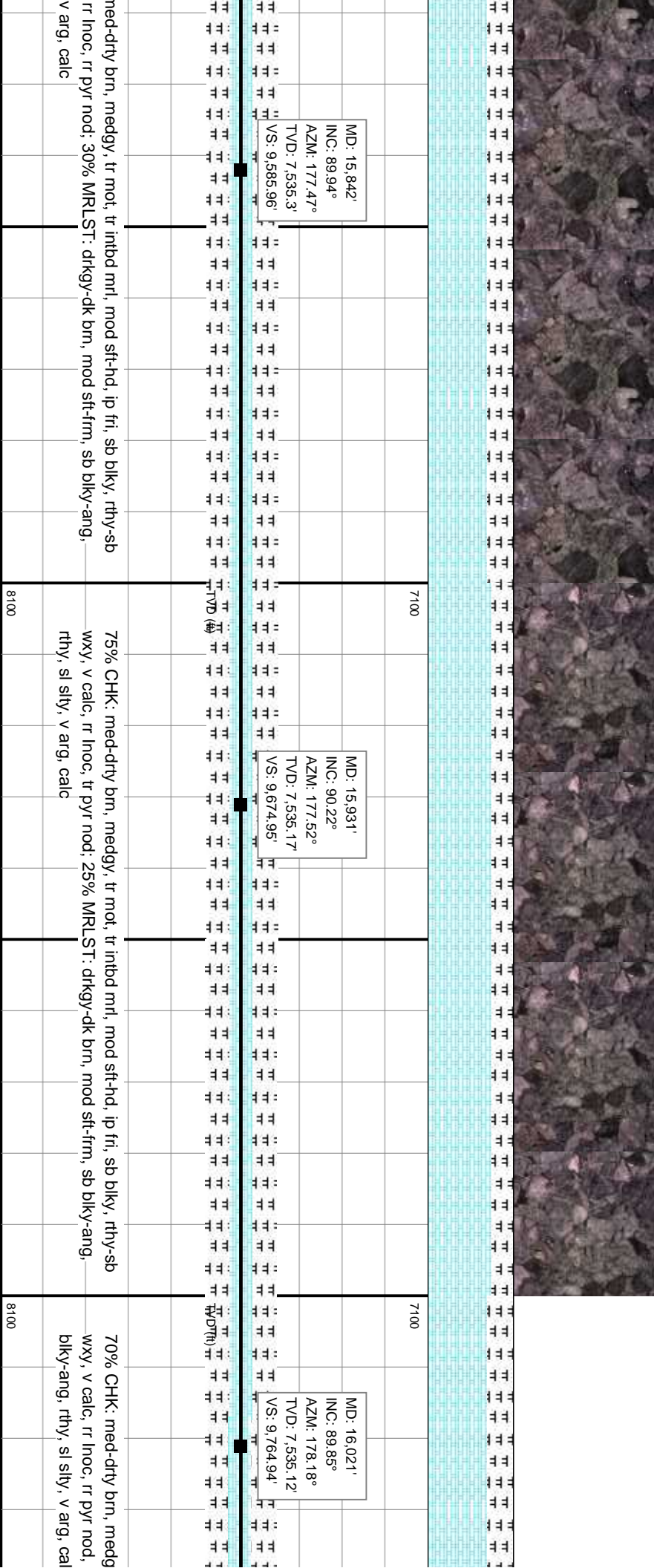
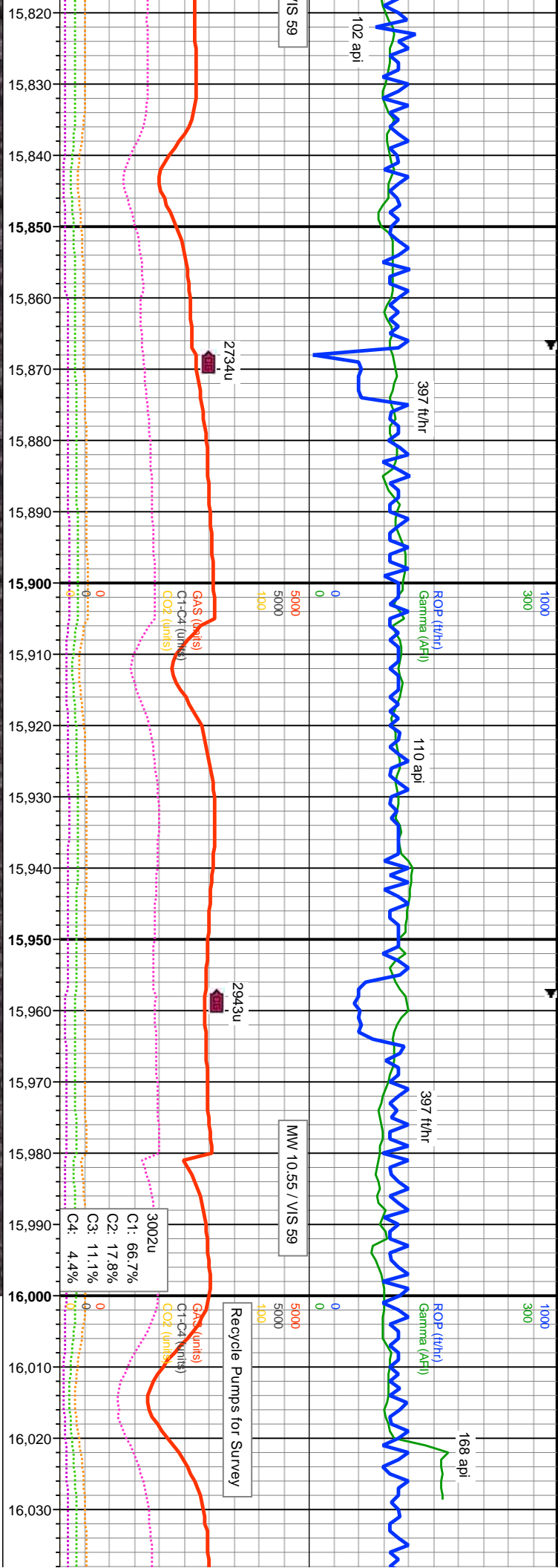


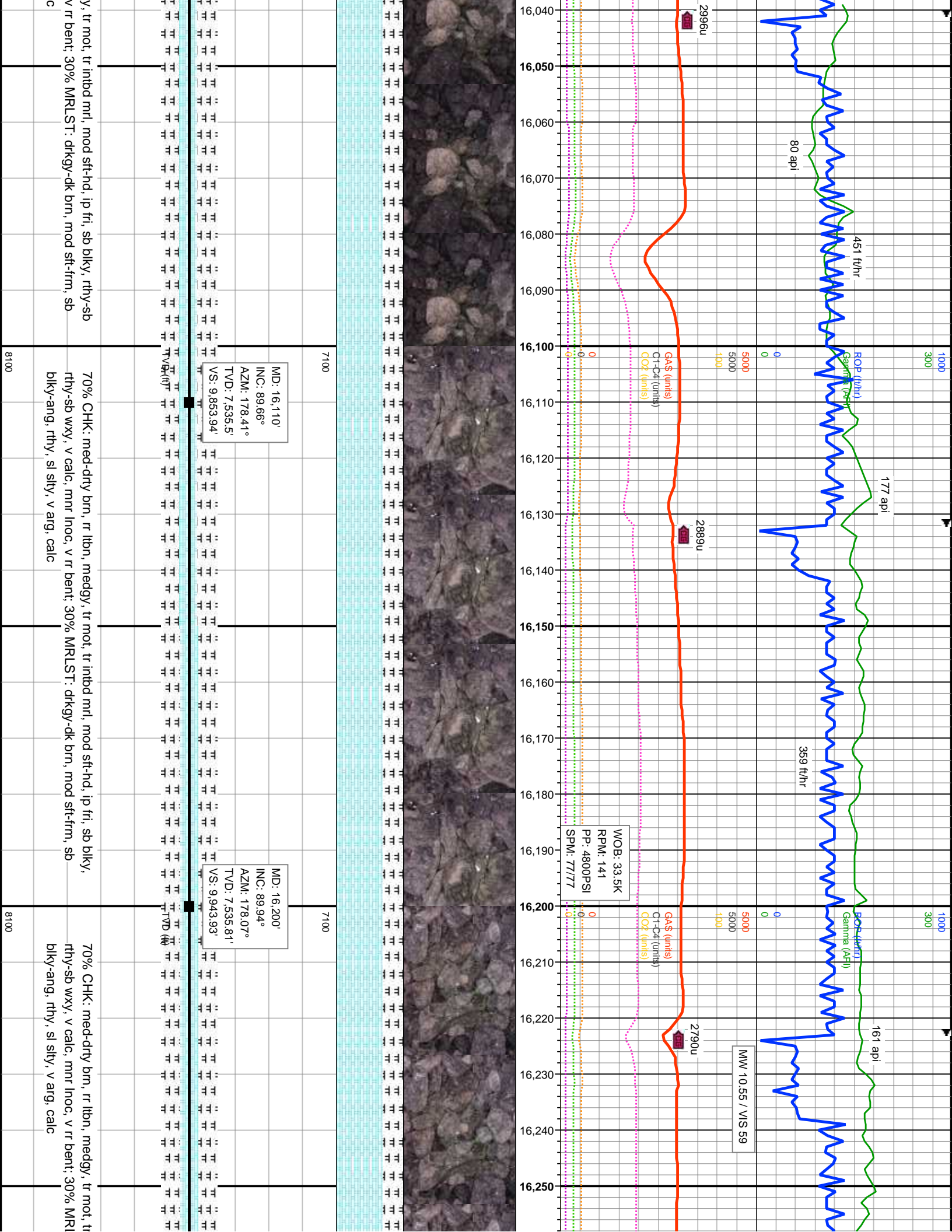


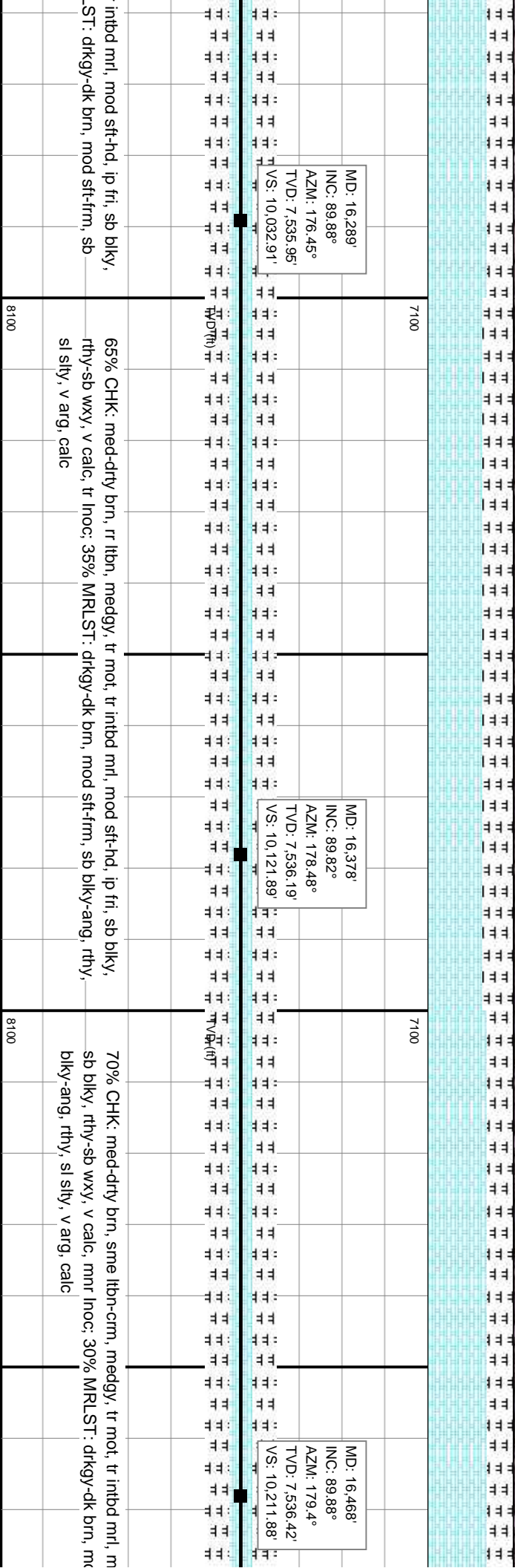
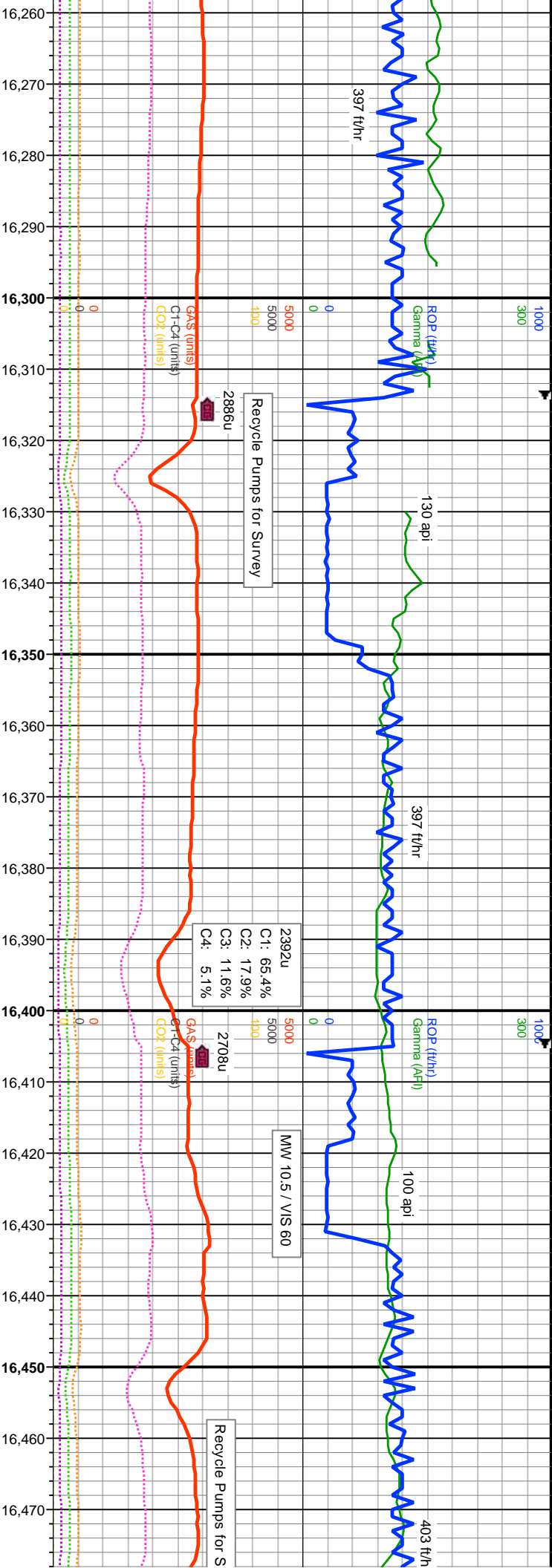


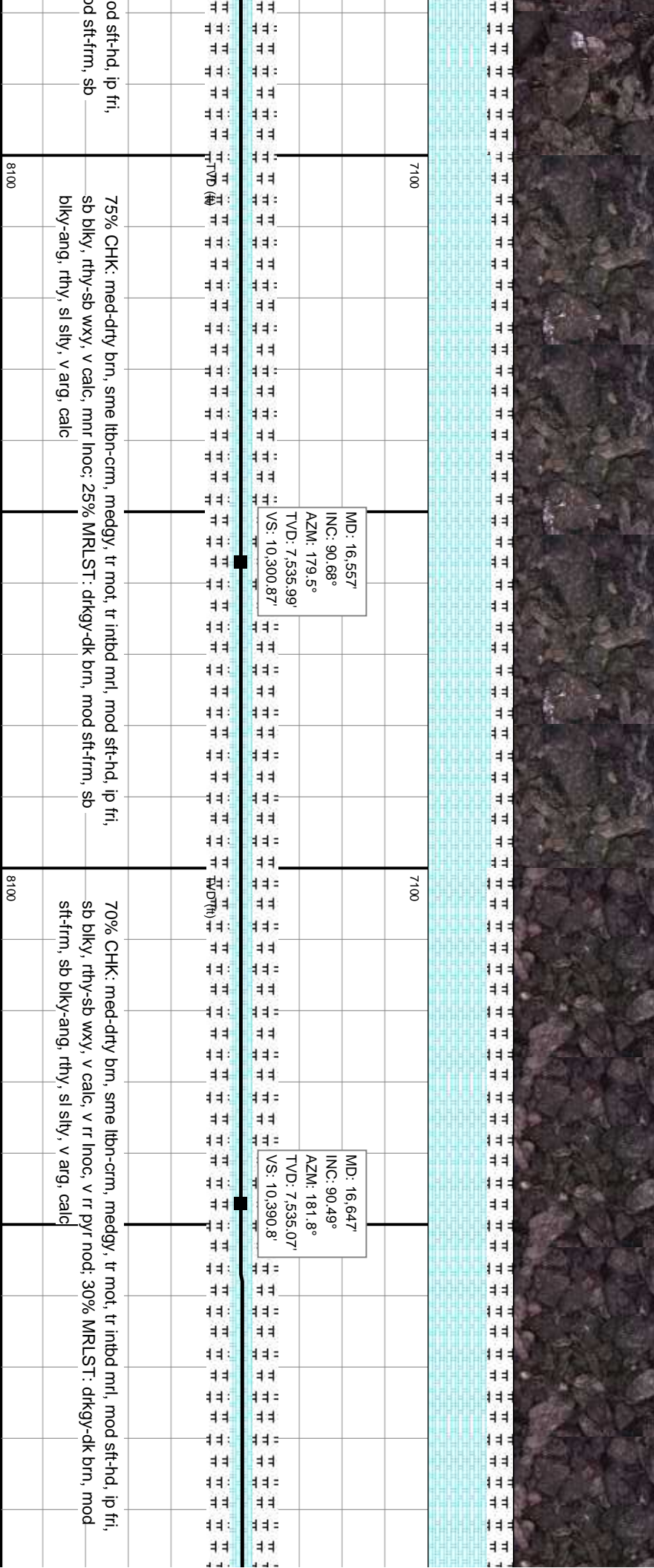
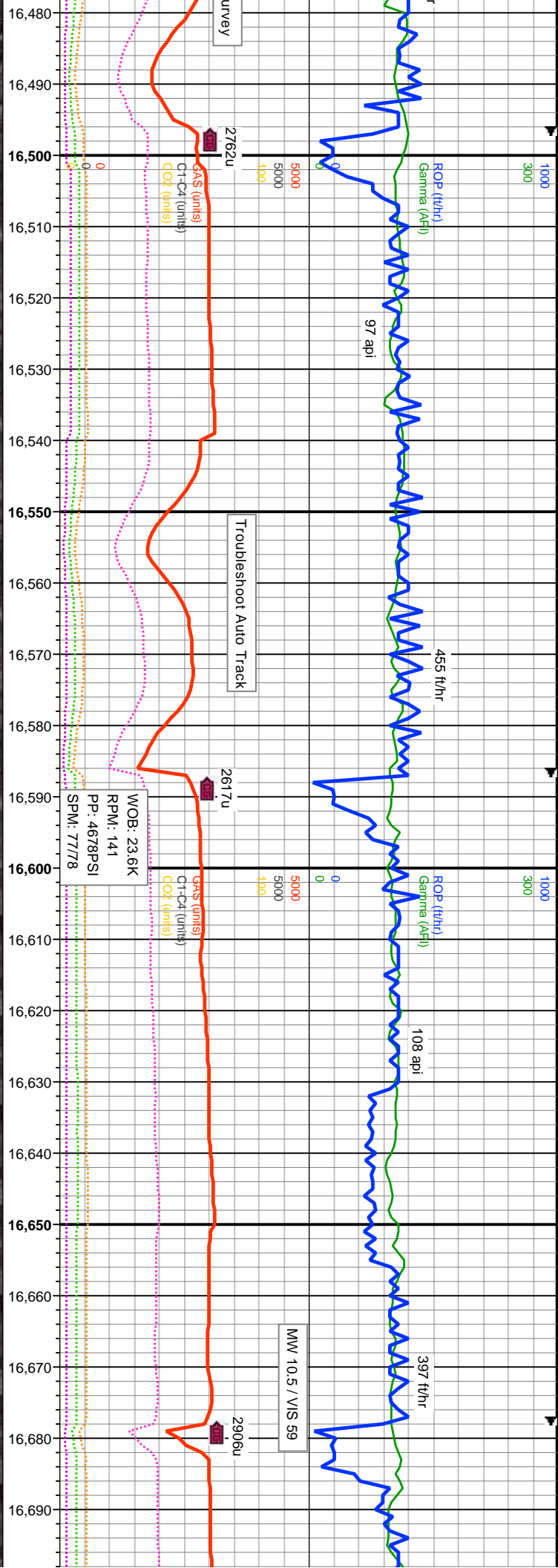


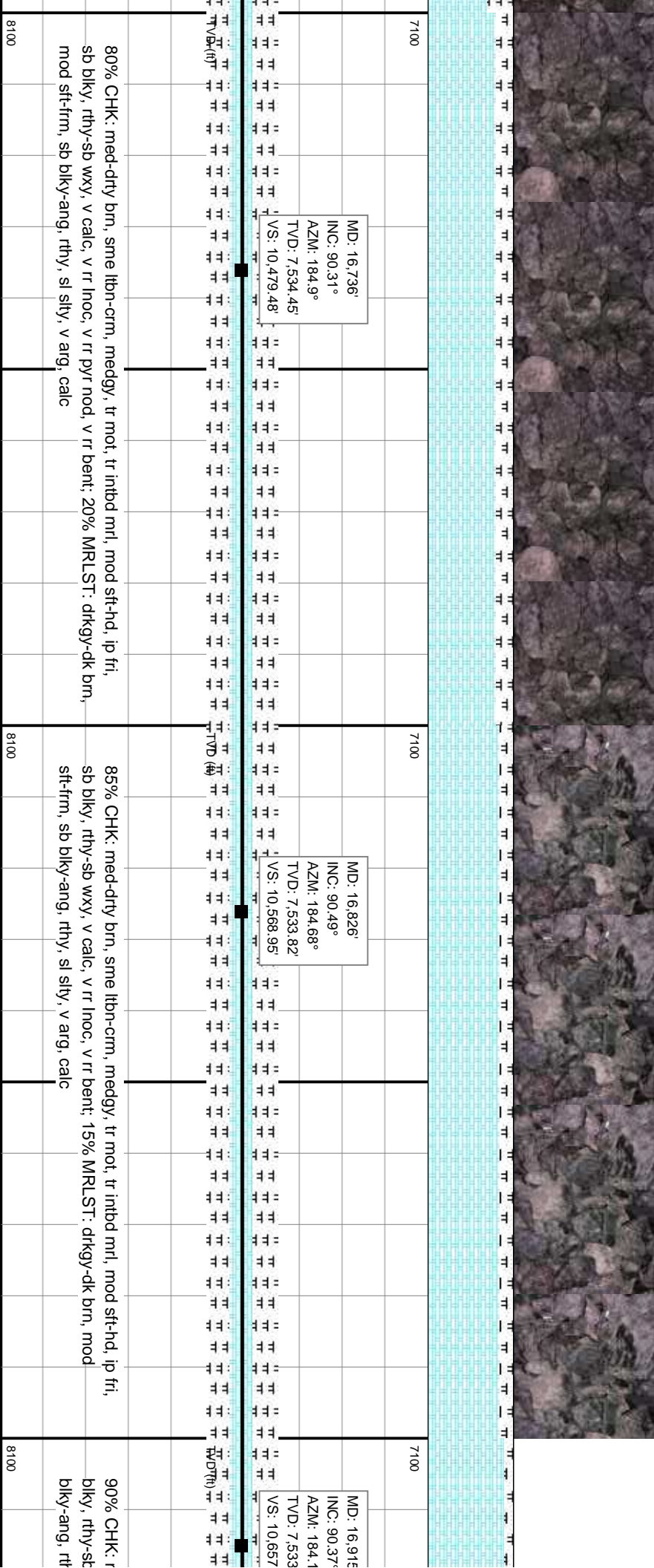
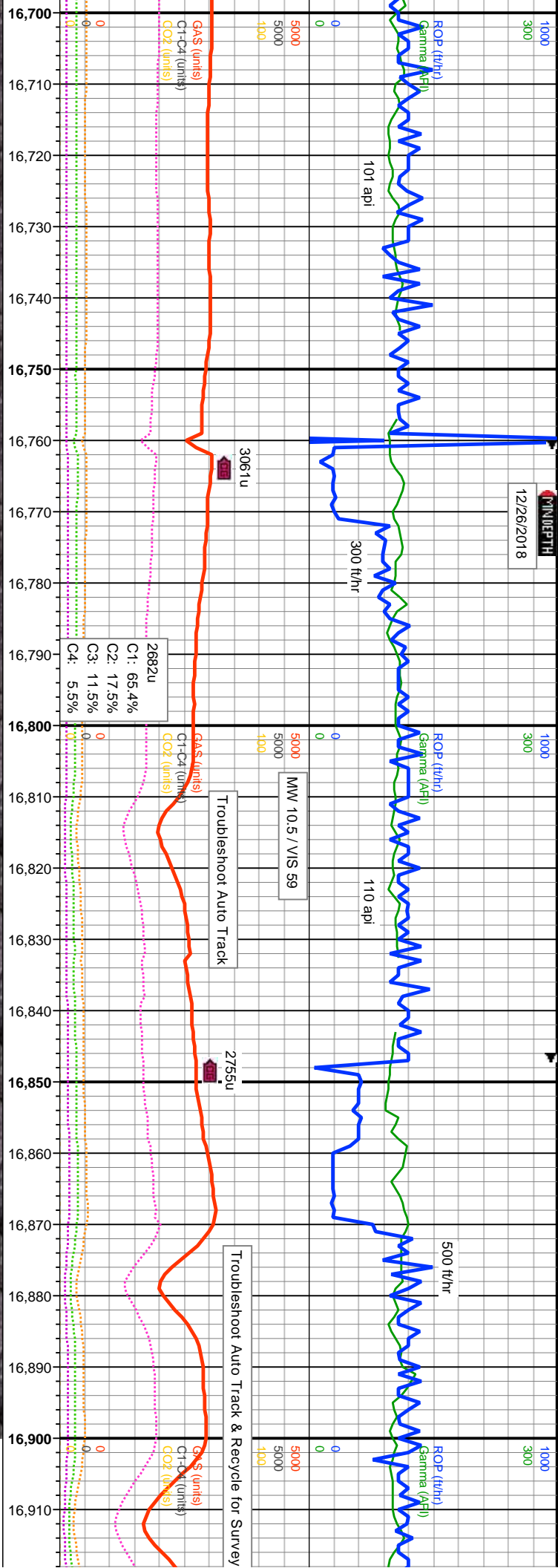


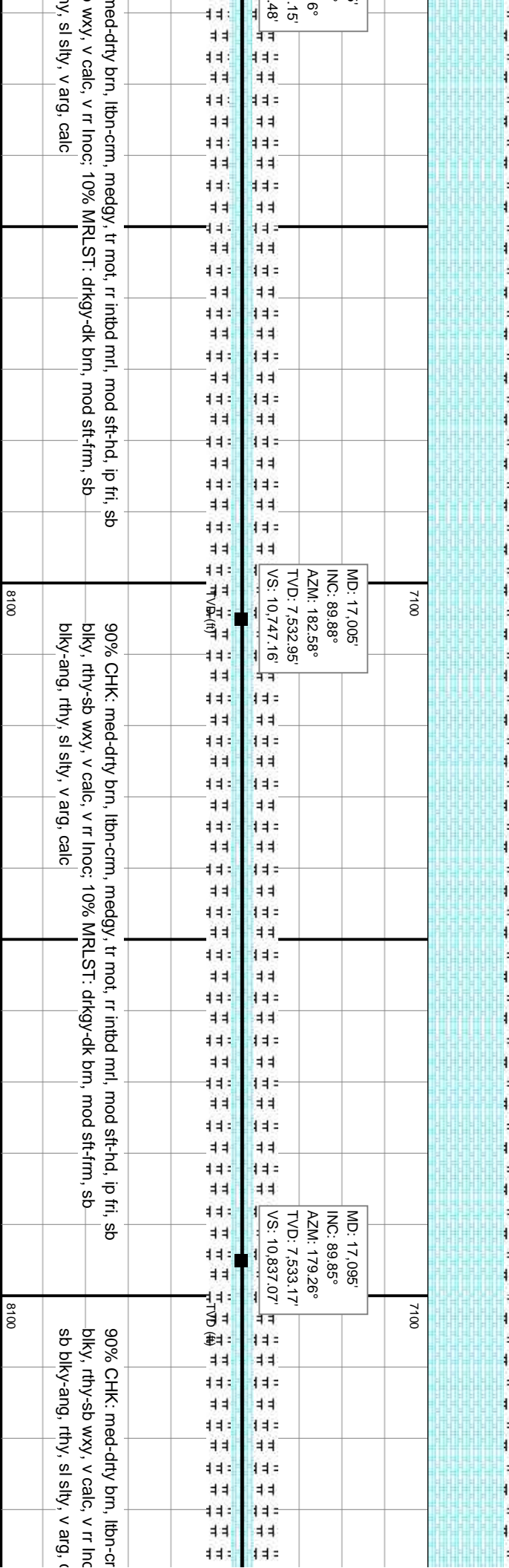
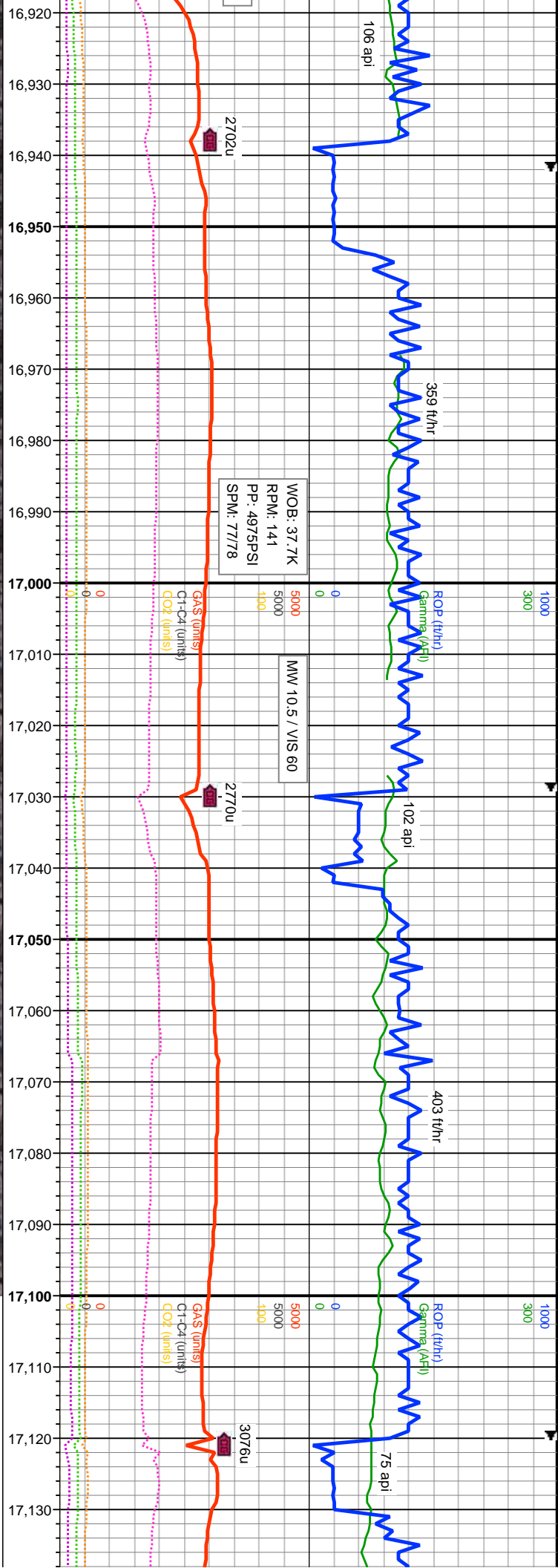


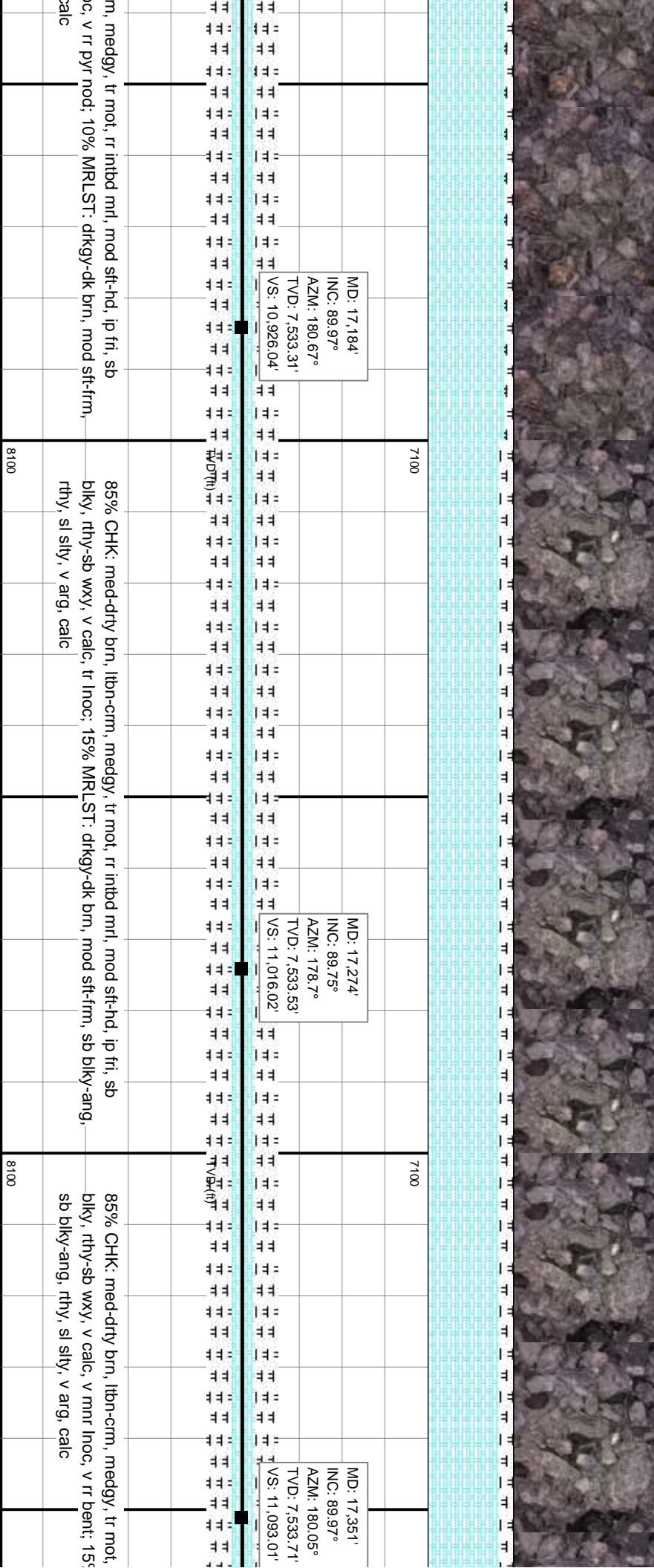
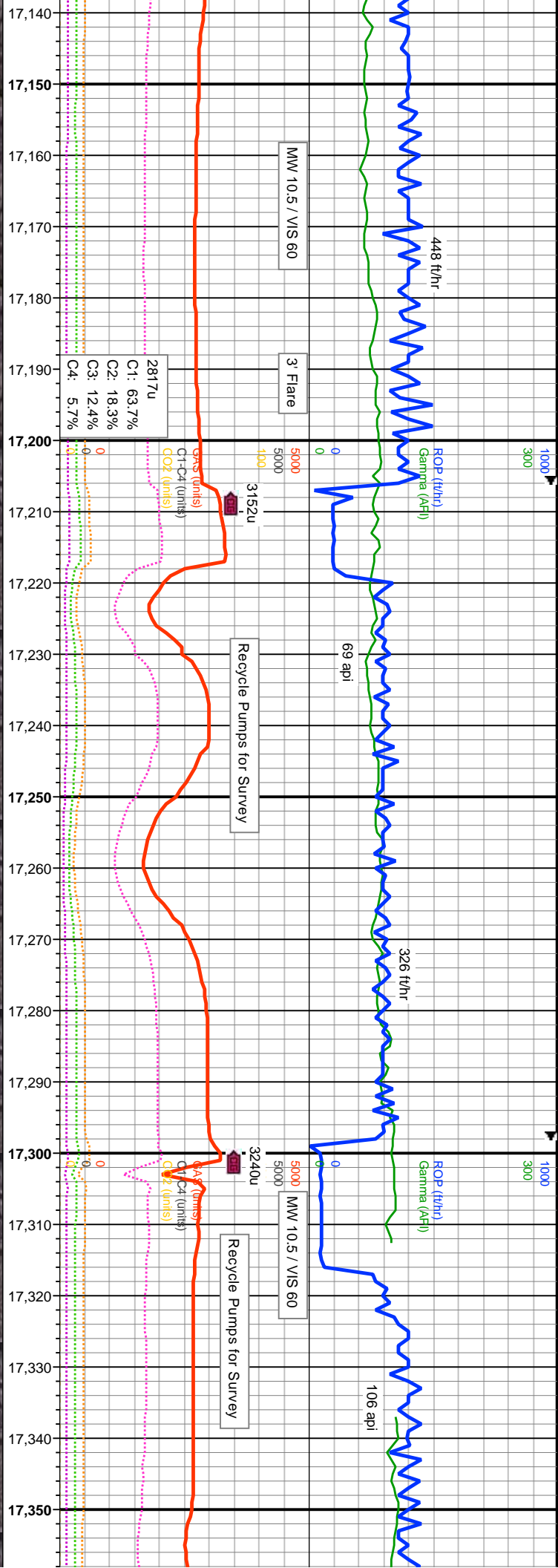


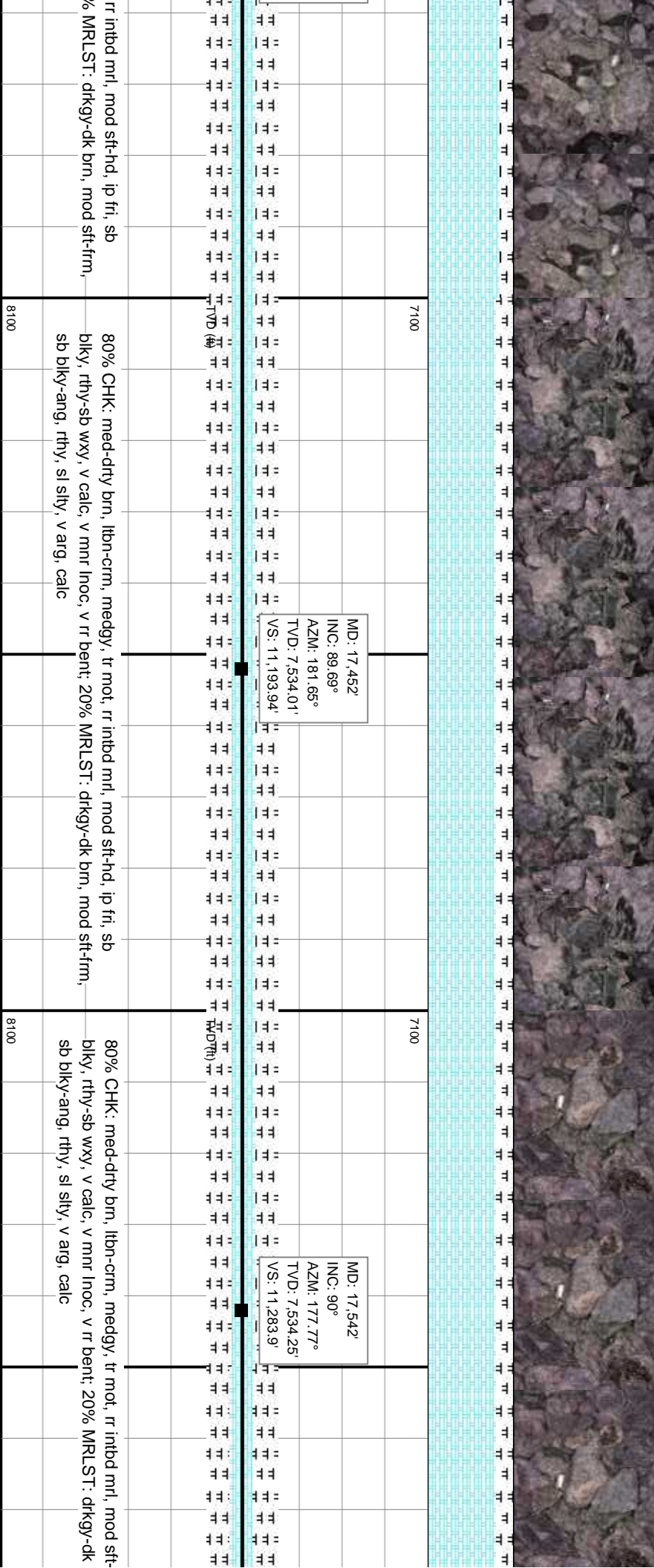
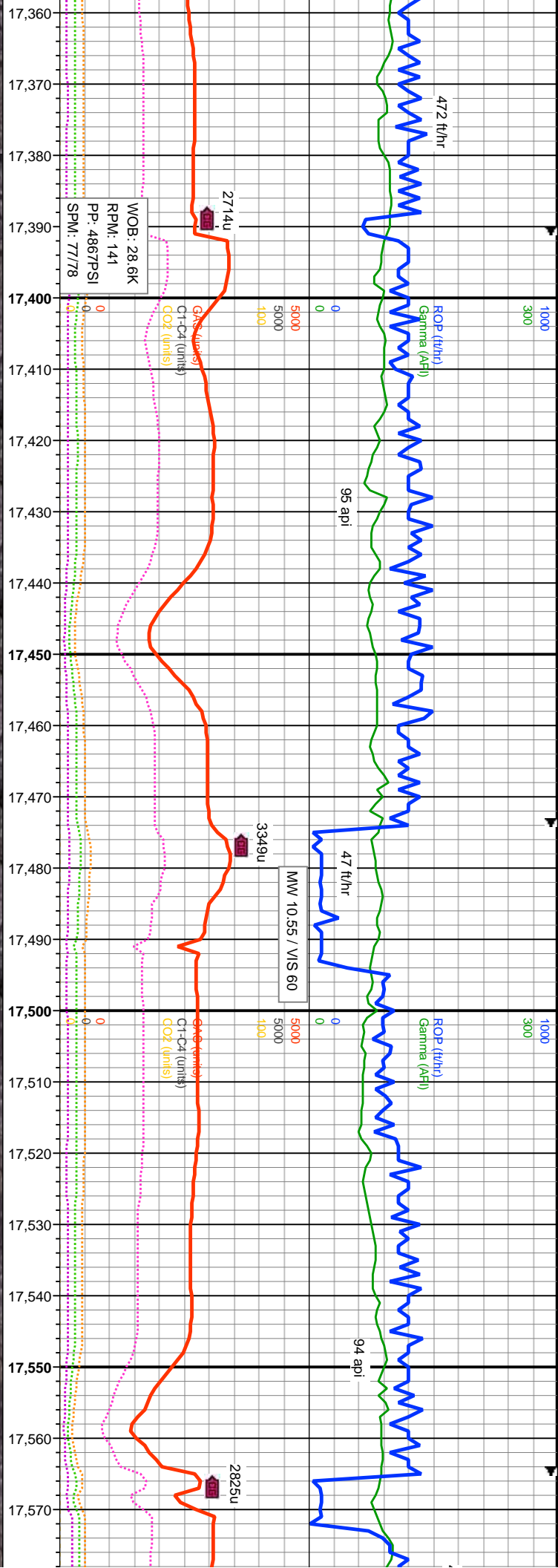


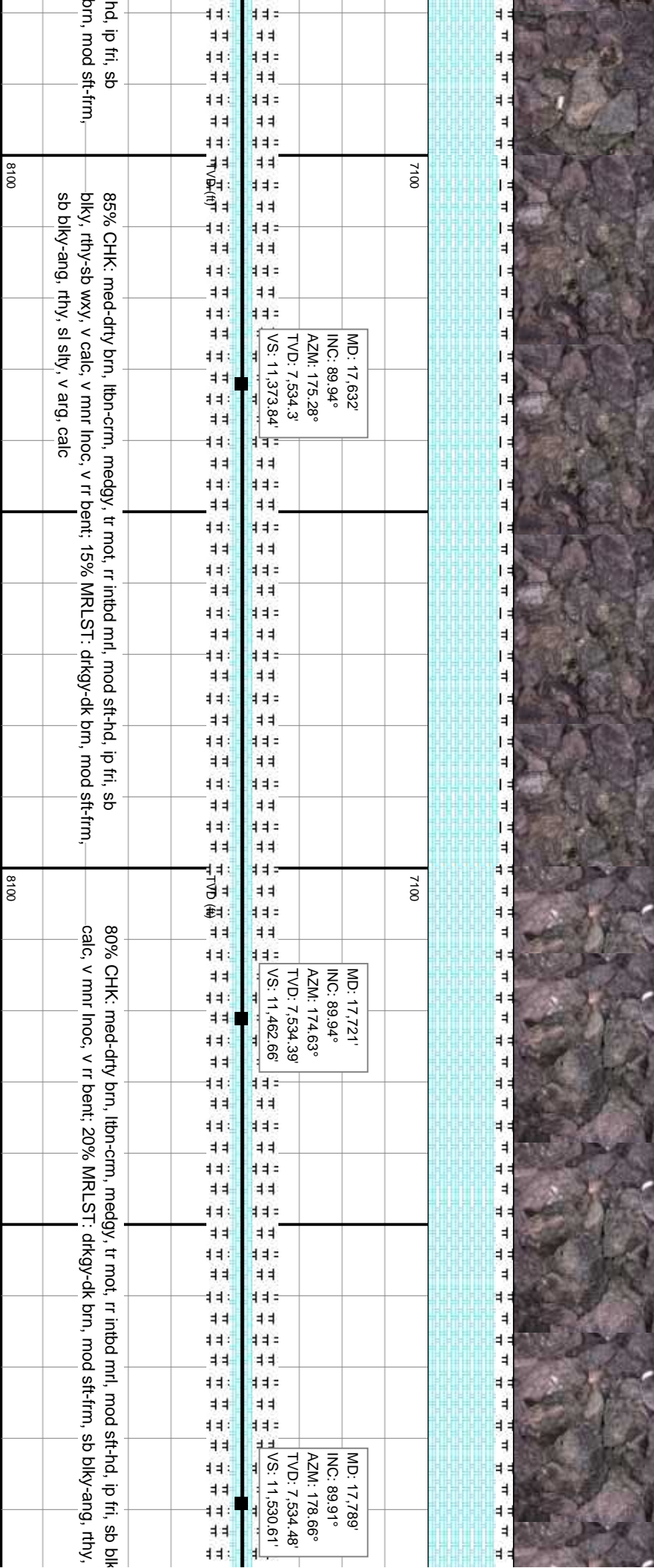
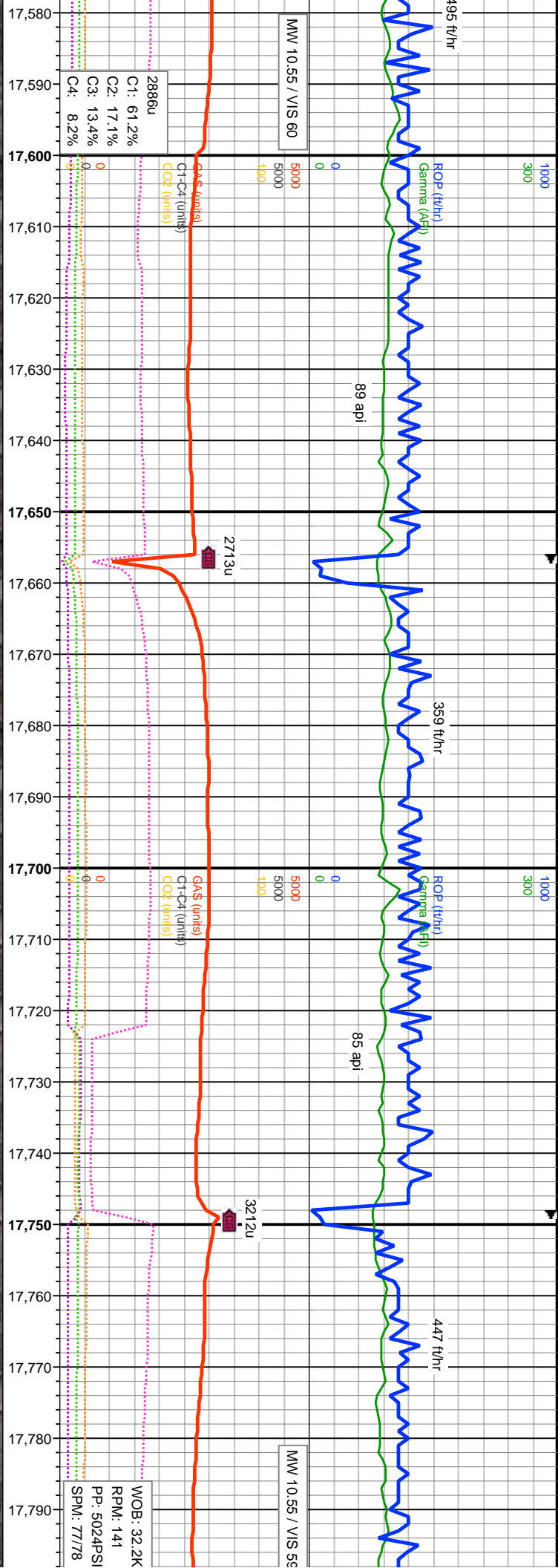


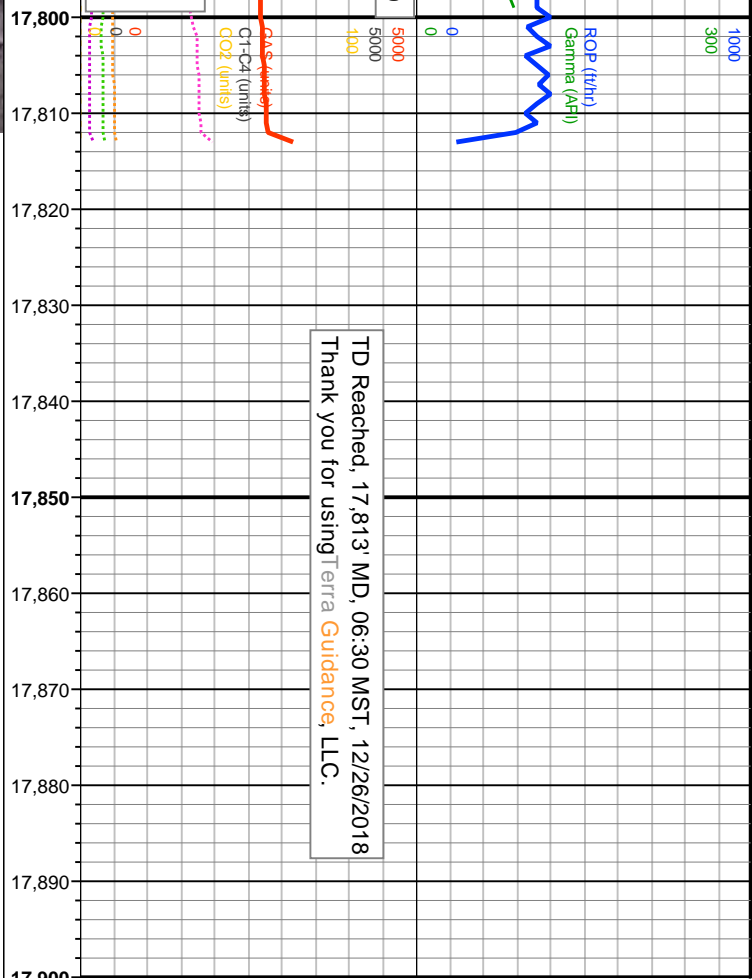












7100

Projection to Bit

MD: 17,813'
INC: 89.91°
AZM: 178.66°
TVD: 7,534.52'
VS: 11,554.61'

FM Name	Excursion Depths		
Sharon Springs	7496		
Niobrara	7628		
Ft Hays			
Codell			
Carlile			
Greenhorn			

y, rthy-sb wxy, v
sl sity, v arg, calc

8100