PETROLOG

Field Copy

COMPANY: Southern California Gas Company WELL: Standard Sesnon 4B FIELD: Aliso Canyon, Los Angeles County, CA API#: 04-037-30460	LOCATION: 34.314788 -118.571823 Sec.29 T3N-R16W SBB&M ELEVATION: 2888'GL, 2910.5'KB	DEPTH: 103' to 10338' DATES: 8/16/15 to 10/17/15 SPUD DATE: 8/17/15 UNIT #7 661-301-0607	LOGGING GEOLOGISTS Nick Mitchell Jim Bean John Williams Ilir Minga Rob Curren

PENETRATION AND PETROLOGY LOG

COARSE SAND
MEDIUM SAND
FINE SAND
GRAVEL
SANDSTONE %
SILTSTONE
CLAY
LIMESTONE
DOLOMITE
KAOLINITE
CLAYSTONE
SHALE
CHERT
PORCELANITE
VOLCANICS
WEIGHT ON BIT

SHOWS

LIVE OIL
TAR

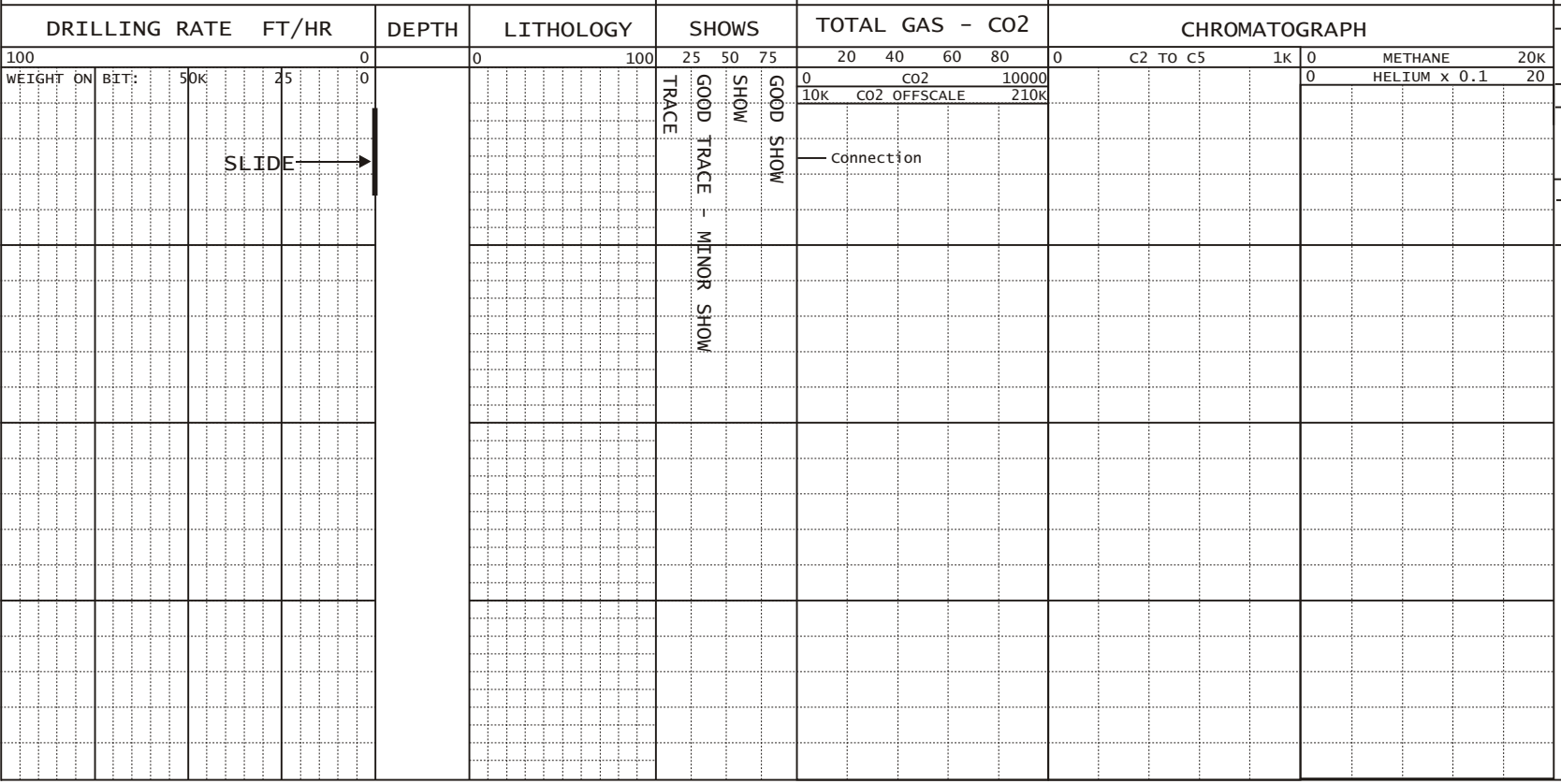
PETROLEUM GAS LOG

AGITATOR
CUTTINGS
CO2
100 UNITS = 2% METHANE

METHANE (C1)
ETHANE (C2)
PROPANE (C3)
BUTANES (C4)
PENTANES(C5)
HELIUM

DESCRIPTIVE LOG

NB	NEW BIT	WOB	WEIGHT ON BIT
RR	RERUN BIT	RPM	REVS PER MIN.
TG	TRIP GAS	PP	PUMP PRESSURE
CG	CONN. GAS	SPM	STROKES/MIN.
WG	WIPER GAS	MW	MUD WEIGHT
SG	SURVEY GAS	VIS	MUD VISCOSITY
SWG	SWAB GAS	FTG	BIT FOOTAGE
SDG	SHUTDOWN GAS	HRS	BIT HOURS

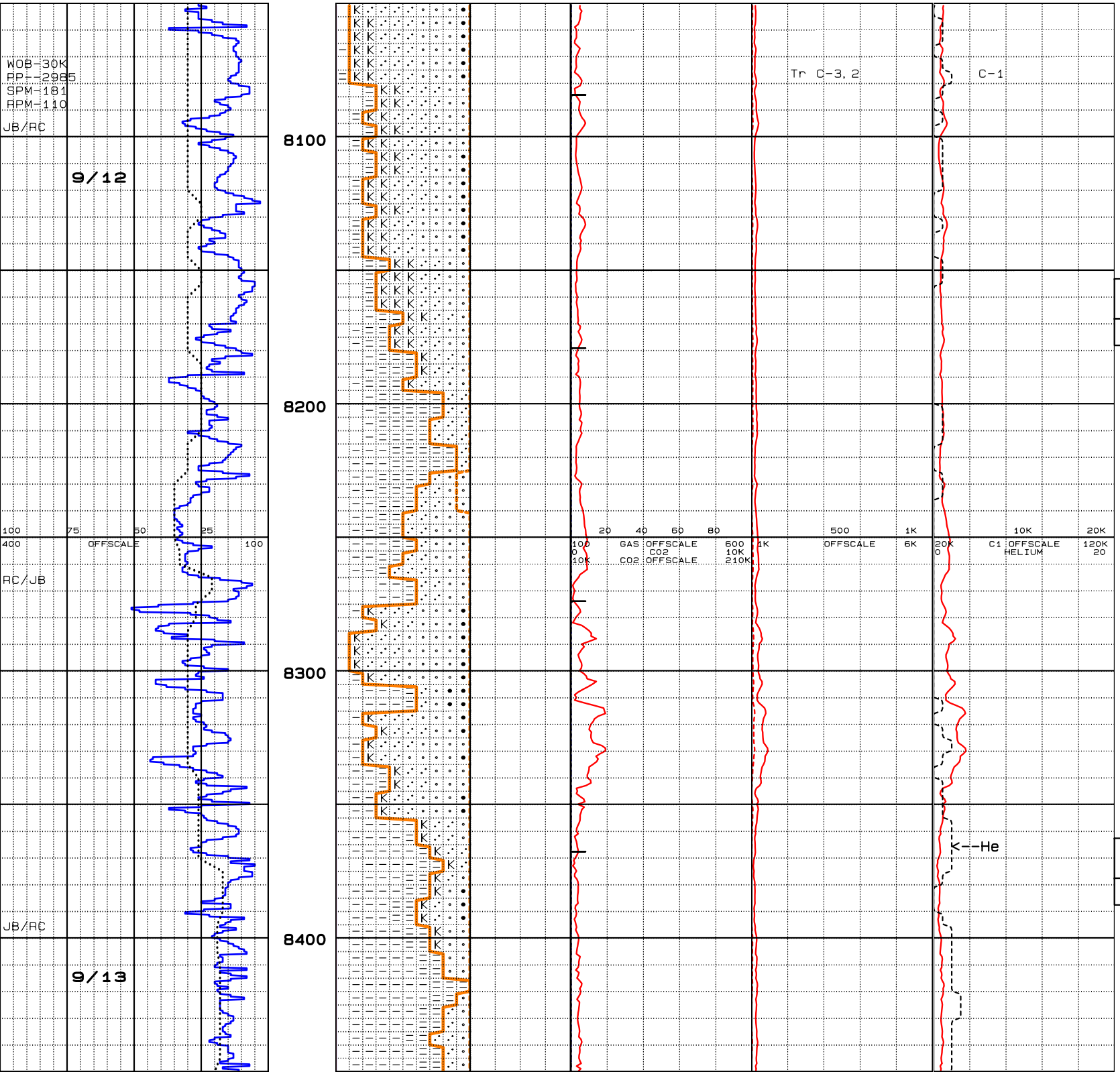


CASING:
13.375" @ 1436'
9.625" @ 8887'
7" Liner from 8695' to 9270'

HOLE SIZE:
17.5" to 1438'
12.25x14" to 9267'
8.5" to 9270'
6.125" to 10338'

MUD TYPE:
KCl/Polytek to 9270'
KCl GeoZan to T.D.

GEOLOGISTS:	Steve Cardiff Hilary Petrizzo
DRLG. REP.:	Kevin Katolas
ENGINEERS:	Todd Van de Putte Mike Dozier
CONTRACTOR:	Ensign U.S. Drilling
RIG NO.:	587
RIG TYPE:	Top-Drive Triple
DIRECTIONAL:	Baker Hughes INTEQ
MUD COMPANY:	GEO Drilling Fluids
MUD PUMPS:	#1 Gardner-Denver PZ-10 6.5"x 10" #2 Gardner-Denver PZ-10 6.5"x 10"



Sand: clr-wht-gry, incr grn, vf-cse, unconsol, ang-subrndd, pred clean w/mnr amts in Cly mtx, fair-poor sorting, pred qtz & occ feldspar, sl trc mica & dark lithic grains.

Siltstone: dk brnsh gray hues, soft, sl hydrated, mod cohes, subblocky, fn gr sandy in pt, sl calcareous, mixed with occ-cmn kaol Clay, pred clr fine-med gr Sands.

Clay: mod brn hues, soft, sl hydrated, mod cohes, non stky, some oval nodules, sl-non calc, intbdd w/ fn-med gr Sd, occ crunchy silty fn gr Ss.

Survey @ 8141' 42.0deg 265.4Az
TVD 8018.8' 103.1'S 36.1'E

MW 8.9 42

Siltstone: dk brnsh gray overall, soft-sl firm, subblocky-subplaty, cohes, argil, vfn sandy in part, tr dk thin laminations, sl calc, tr kaol Clay, no visible oil indics.

Sand: clear-wht-gray qtz, fine-med gr, subang-subrnd, mod sorted, unconsol, intbdd w/ soft sl calc Siltstone/Clyst, Sltstn fn gr sandy in part, cmn wht kaol Clay, few dark lithics, no vis oil indics.

Clay: brownish gry-olive gry, soft, slowly soluble, sticky & cohesive, weakly calc to non calc, mod to well hydrated, kaol in part, some silty, grds with Claystone.

Claystone: brownish gray to occ olive gray, sl-mod firm, subblocky, massive, some sl calcareous, sl-mod silty, occ micromicaceous, mnr f-micro carbonaceous/lignitic frags, grds to Clay & rarely Sltst.

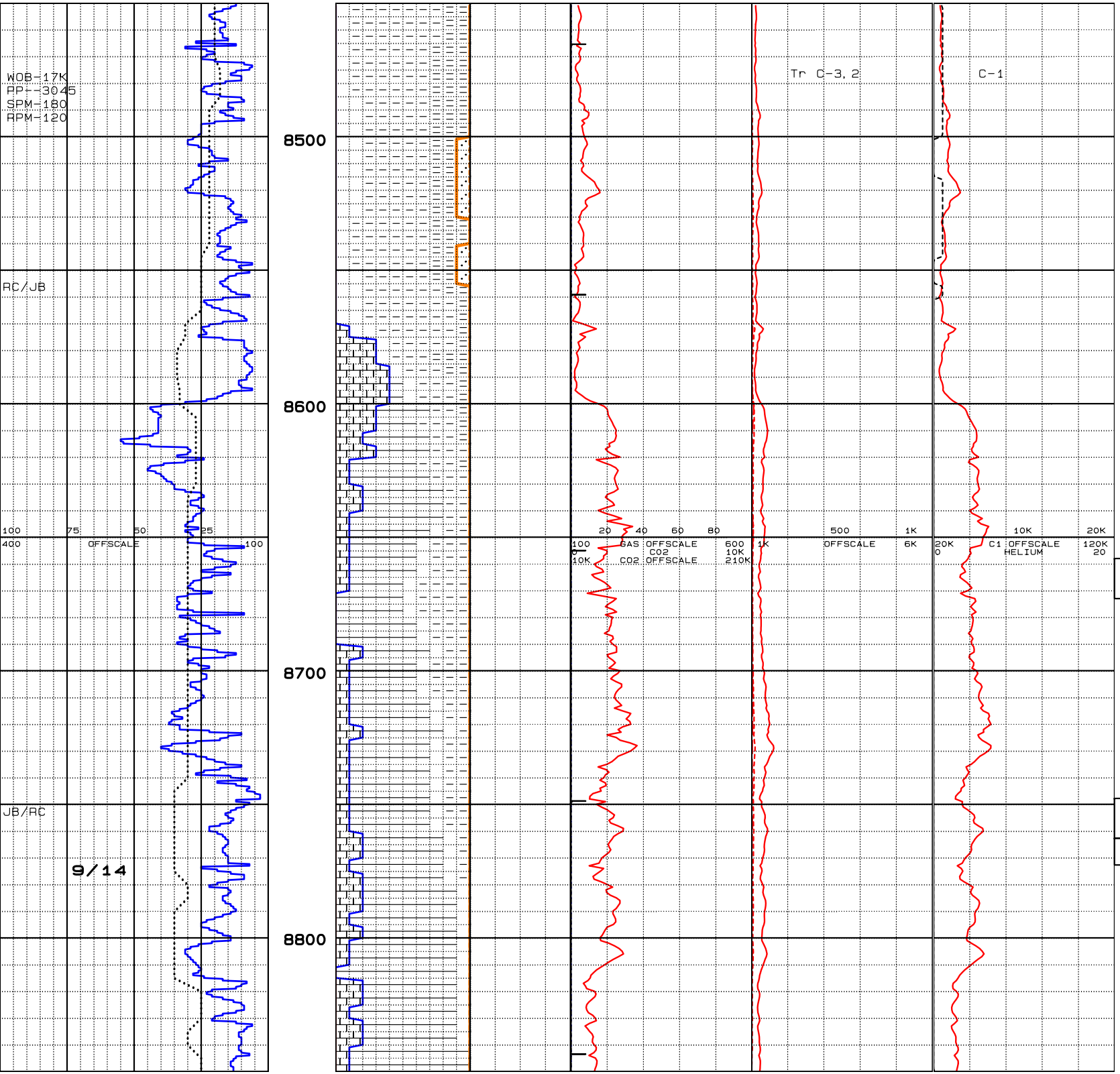
Sand: clr-wht & gray, occ grn, tr blk & brn grs, f-cse gr, unconsol, ang-rndd w/most subang & subrndd, poorly srtd, predom qtz, occ feld grs & tr lithics & mica.

Survey @ 8331' 48.8deg 265.8Az
TVD 8125.2' 113.3'S 98.7'E

MW 9.1 FV 50

Siltstone: grayish brown overall, few dk gray, sl firm, subblocky, massive, friable, non-sl calc, intbdd w/ argil soft Claystone.

Sand: clear-wht-gray qtz, tr fspar, fine-med gr, subang-subrnd, unconsol, intbdd w/ sl firm subplaty Clyst/Sltst, few dk lithics, tr mica.



Claystone: dk brn hues, soft-sl firm, argil, subblocky-subplaty, sl-non calcareous, silty in part grdg to Sltst, massive, tr lt brn mottling, no visible oil indicators.

Siltstone: dusky brn, mod cohesive, platy, fissle, brittle poss laminated, sl calc, fine gr sandy in part, intbdd w/ soft more massive Claystone, tr fn gr sands.

Sand: dk brnsh gray overall, clr-gray qtz, vfn-fn gr, subrndd-rndd, consol w/in dk brn clayey/silty matrix, mod calc fn gr Ss, intbdd w/ sl firm Claystone.

Claystone: occ brt grn med-cse chlorititized mica flakes, strong tr Limestone @ 8575', Ls as 1-2mm cuttings.

Limestone: pale yellowish brn, firm-sl hard, predom subplaty but structure gen obscured by PDC bit scalloping, mod to v argil/impure, tr Chert interlaminations, mnr qtz & calcite veining, occ dusky brown silty Shale interbeds.

Shale: dusky yelsh brown, some brnsh blk, firm, weak to strong fisslilty, some w/rough irreg break, sl-v calcareous, micromicaceous.

Survey @ 8616' 58.5deg 266.0Az
TVD 8367.9' 137.6'S 409.6'W

Claystone: dusky yellowish brown, some mod brn, sl firm-firm, subblky-subplaty w/some grdg to Shale, micromicac, sl-very calcareous, intbdd argil Limestone & tr Marl, trace Forams.

Limestone: mod brown-pale yel brown, occ mottled or faintly banded, firm w/mnr sl hard, subblky, pred impure/argil.

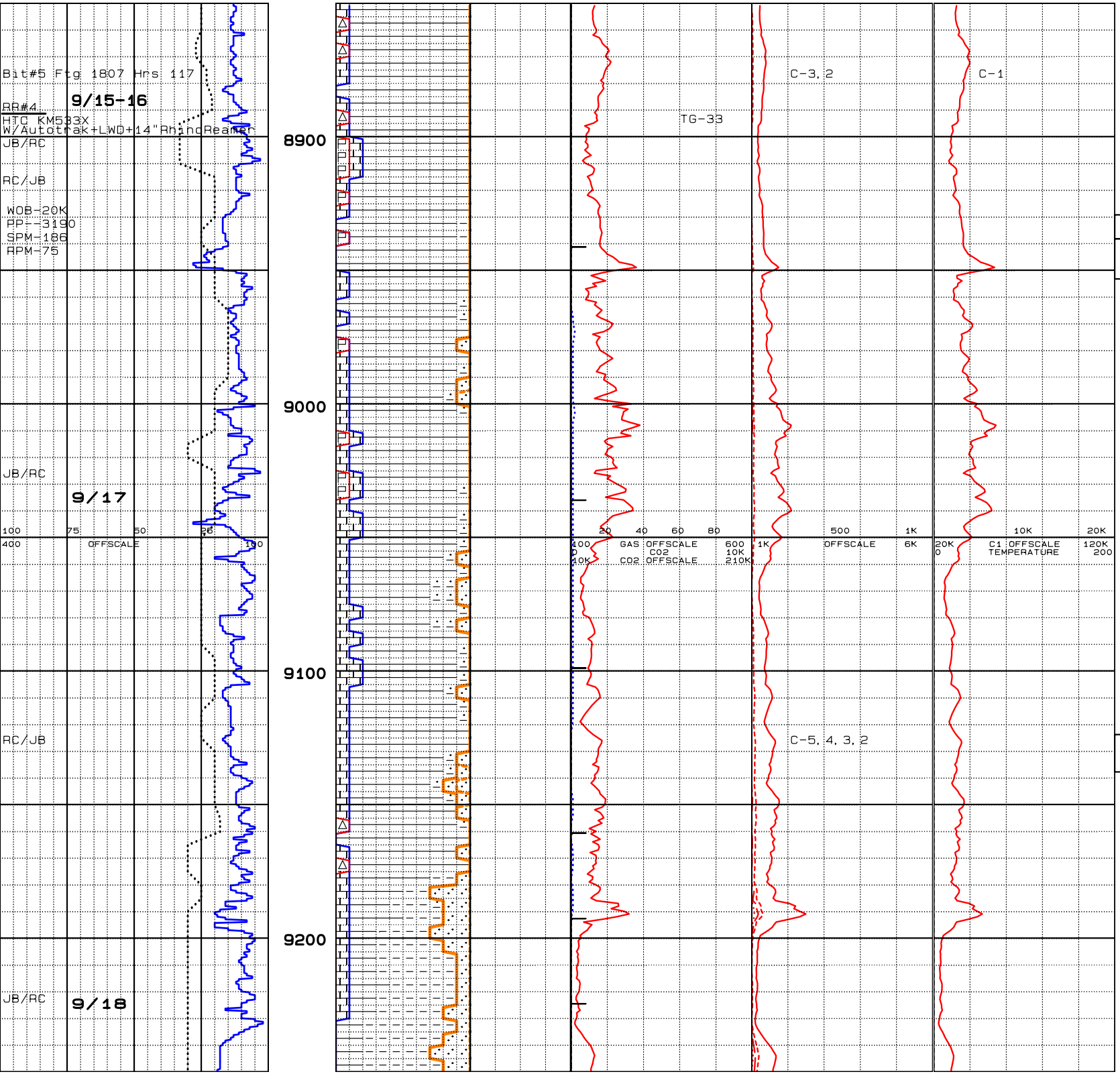
Tr lt grn waxy tuff.

Survey @ 8711' 61.6deg 266.0Az
TVD 8367.9' 137.6'S 409.6'W

MW 9.3 FV 55

Shale: dk brn hues, sl firm-firm, calcareous, subblocky-subplaty, splintery, occ lt brn intbds, cmn lt brn mottling, occ firm-sl hard Ls.

Limestone: lt orngsh brn hues, firm-sl hard, brittle, subplaty-platy, splintery, calc, intbdd w/ dk brn sl firm Sh, tr Clay, sl tr lt grn waxy volcanic tuff, no visible oil indicators.



Shale: predom dusky yellowish brown, mmr mod brn or brownsh black, mod firm to firm, fair-strong fissility, sl to very calcareous, few thin Chert interbeds & interlaminations, micromicaceous in part, argil.

Limestone: light brownish gry, some brnsh-yelsh gray, sl firm to sl hard, pred subplaty, sl-very argil w/some clean intervals, thinly bedded, microxln in part, few Porc interbds.

MW 9.2 V 52 Downhole Temp 166F

Survey @ 8902' 68.5deg 266.9Az
TVD 8448.8' 142.6'S 582.2'W

Trace very fine argil silty Sandstone @ 8965'.

Shale: dusky yellowsh brn, v frm-mod hard, fair to strong fisslilty, noncalc to very calc, micromicaceous, tr Forams tr vf pale brn-gry Sandstone.

Limestone: dk orngsh yel hues, firm-v firm, brittle, subplty -irreg fracture, brittle, calc, sucrosic txt in part, intbdd w/ mod firm Shale, tr red/rdsh orng hard Porcel/ Chert fragments.

Sandy Silt: med gray overall, argil-vfn gr, consol Ss w/ sl calc mtrx, subblocky, weakly cemented, subfiss-subfria, tr lt grn glauc min, micro micaceous, pred clr-gray qtz, partial smpl taken from desander.

Shale: dusky yelsh brn hues, occ lt brn mottling, sbblky-subplaty, calcareous, firm-v firm, mod-v fissle, intbdd w/ sl hard brittle Limestone, tr mod gray sandy Siltstone, sl tr Porcelaneous Chert.

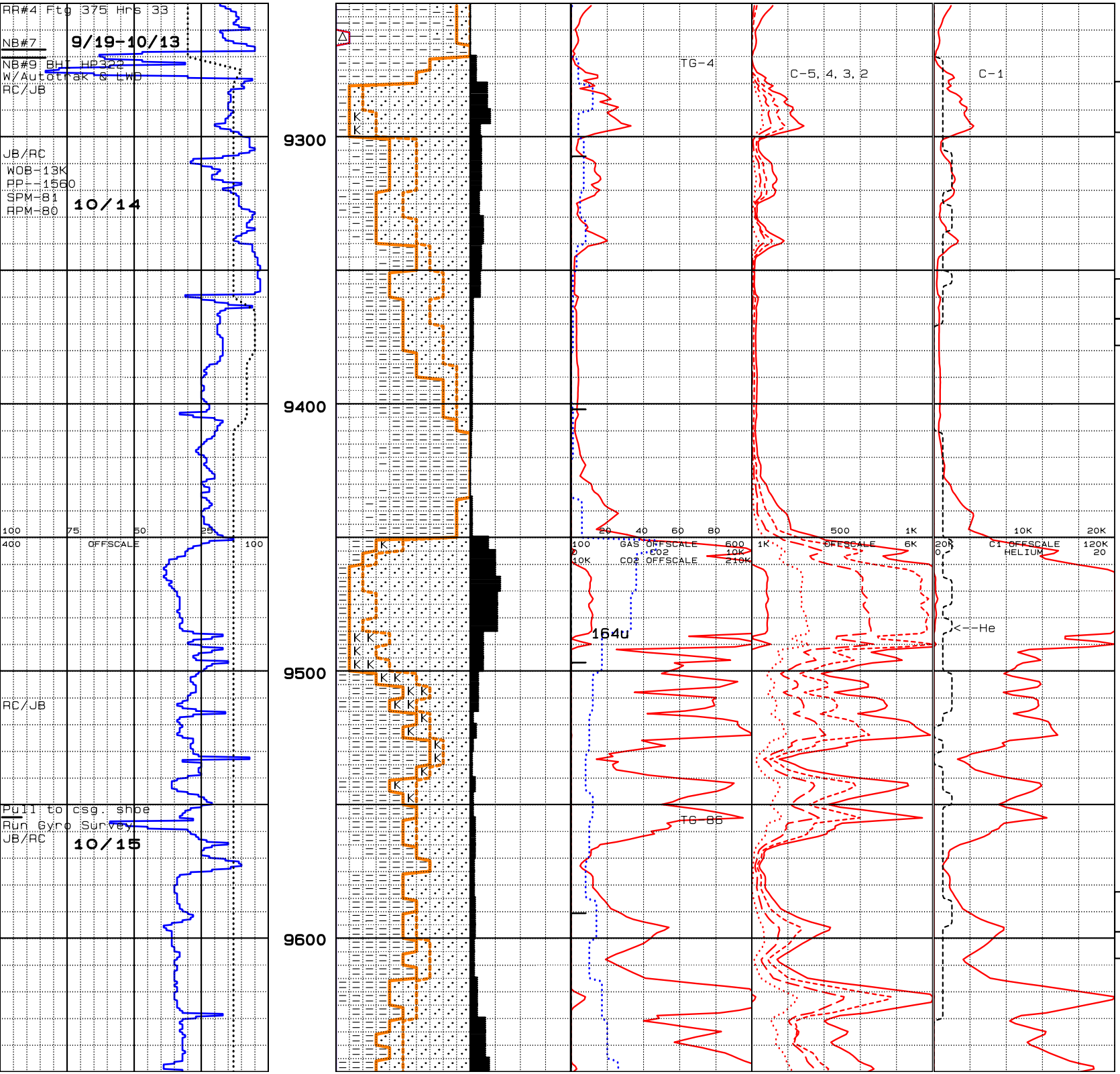
Survey @ 9124' 77.0deg 266.5Az
TVD 8513.8' 162.5'S 793.8'W

Sandstone: light gray, vf gr, firmly to easily friable, non calc, predom qtz, few dk lithic grs, occ grn chlorite mica, some argil &/or silty.

Sand: clr-wht, vf-silt sized, unconsol, predom subang, qtz w/ few grn mica flks, w sorted.

Claystone: dark yellowsh brn, mod firm-firm, subblky, massive sl-noncalcareous.

Shale: dusky yelsh brn hues, mod firm-firm, sblky-splty, fissle, calcareous, grdg to soft argil Claystone, increase silt/vfn gr sands, clr-gry qtz, sl consol in gray Sltst.



Sand: clr-wht-gry qtz, silt-vfn sand, rndd, well sorted, consol w/in Silty Ss, intbdd with firm Sh grdg to Clyst.

Set 9.675" casing @ 8887'.
Set 7" liner from 8695'-9270'.
Change mud to KCl.

Sandstone: pl-mod brn, vfn, fri, lt-mod oil stains, 1-2mm ctgs.

Siltstone: lt gray smpl color overall, lt brn Sltst, soft, friable, calcareous, silty-vfn sandy, argil, intbdd w/ soft vfn gr Ss w/ lt gry Clay matrix, fast transl yelsh wht cut fl, pale straw vis cut.

Survey @ 9362' 77.2deg 265.3az
TVD 8592.8' 179.6'S 1017.4'W

MW 8.4 FV 39

Clay: med gray, soft, slow solu, sl-non sticky, massive, mod to very silty.

Siltstone: medium-dark gray, mod firm-fria, subplaty, mod to noncalcareous, predom very argillaceous, very finely sdy in part, grades to Clay and Sandstone.

Sandstone: med brown, vf gr, easily friable, weakly cmtd w/ calcite, thinly bedded, predom quartz w/mnr feldspar.
Oil: 45-90% dull gold sample fluor w/brt yel wht cut flr, pale straw to straw visible cuts, oil sheen on shakers and unwashed samples, 45-90% oil staining, good petro odor from blender sample.

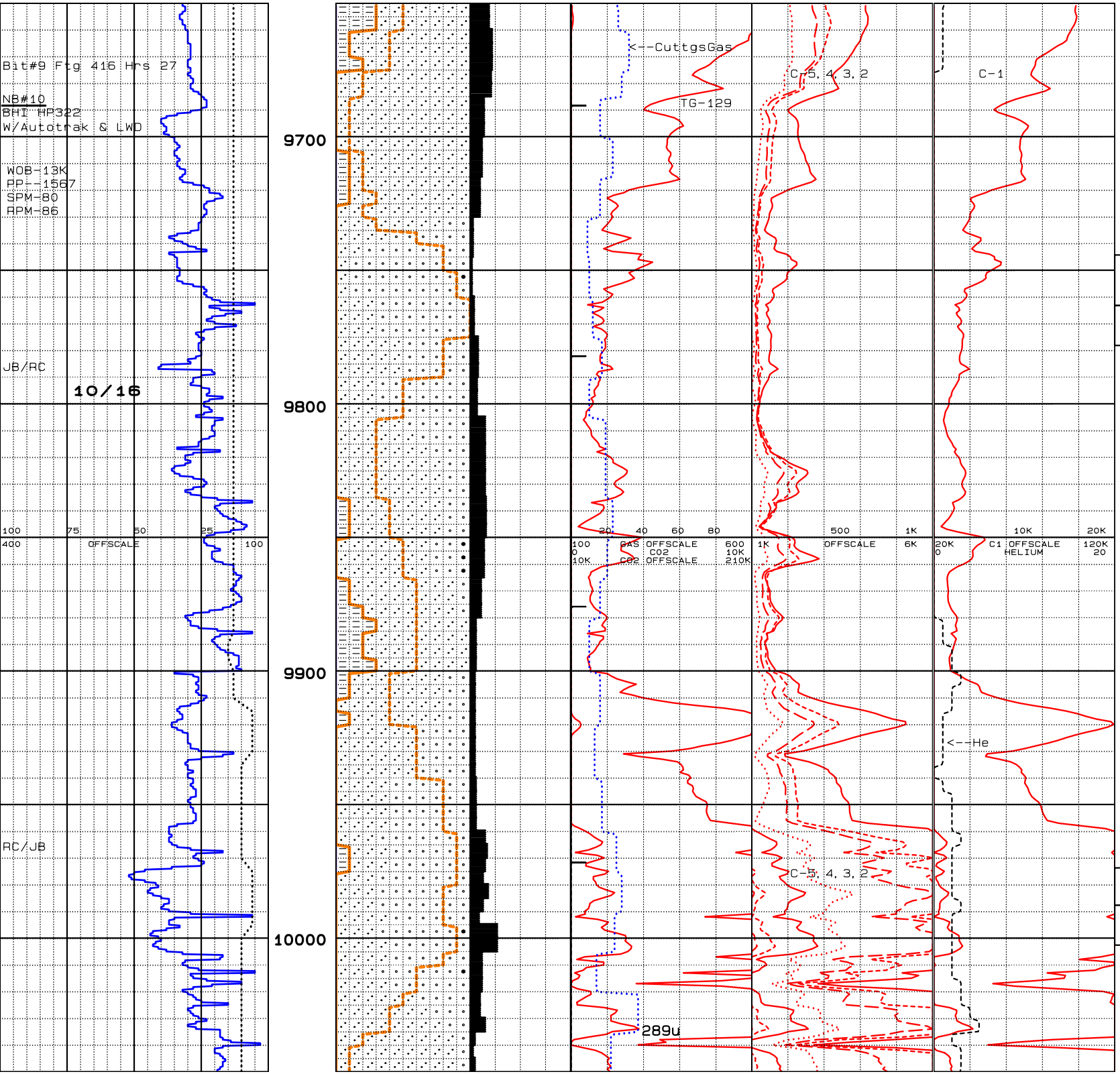
Sandstone: grayish wht w/some lt brown, vf-f gr, easily fria, weakly cmtd w/calcite, some sl argil or kaol, well sorted, predom qtz w/occ feldsp & sl alt'd mica flks, tr lithics, 5-10% dull gold smpl fluor, slow diffuse weak yel cut flr w/pale straw to no vis cuts, 10-50% of Ss fraction is oil stained.

Clay: lt gray, soft, soluble, pred matrix w/in fn gr Ss, calc, slow transp brt yelsh wht cut fl, no visible cut, tr subtle pops.

Survey @ 9552' 84.6deg 266.7az
TVD 8620.0' 196.8'S 1204.8'W

MW 8.5 FV 40

Siltstone: lt gray hues, soft, friable, subblocky, sm ctngs, argil, tr thin brn lams, int-bdd w/ vfn Sandstone, Ss lt brn due to oil stnng, fast transl brt wht cut fl, dark straw vis cut, subtle sheen.



Sand: brown hues overall, clr-wht qtz, vfn gr, subrnd-rndd, mod calcareous, well sorted, consol in mod calc Ss, cmn brn oil stnng, fast transl brt wht cut fl, amber vis cut subtle sheen on water.

Sandstone: med brown, mnr gray to graysh wht, vf gr, weakly consol w/calcite cmt, predom qtz, some feld & mica, 20-60% v dull gold sample fluor, mod fast translu yel wht cut fl, very light to light straw vis cuts, 20-50% oil staining, few floating Sd grs on washwater.

MW 8.5 FV 40 PV 5 YP 16 FC 1
Gel 5/7 pH 7.8 Fil 5.8 Sd 2
Sol 5.8 Cl 15500 Ca 100 Oil .1

Survey @ 9742' 84.7deg 268.2az
TVD 8637.6' 209.7'S 1393.5'W

Sand: clear-wht qtz, occ dark lithics, tr mica/feld, vfn-md gr, subang-subrndd, weakly consol w/ calcite cement.
Oil: 50-70% dull brnsh orange smpl fl, fast transl brt yel wht cut fl, dk straw-amber vis cut, thin subtle sheen, few floating Sd grs on water, faint petrol odor.

Siltstone: lt gray hues, soft friable, subblocky, vfn sandy in part, few dk micro lams, sparkly, argillaceous, intbdd w/ pred vfn qtz Ss, calcareous, tr vis oil stnng, mod slow transp yelsh wht cut fl, straw vis cut.

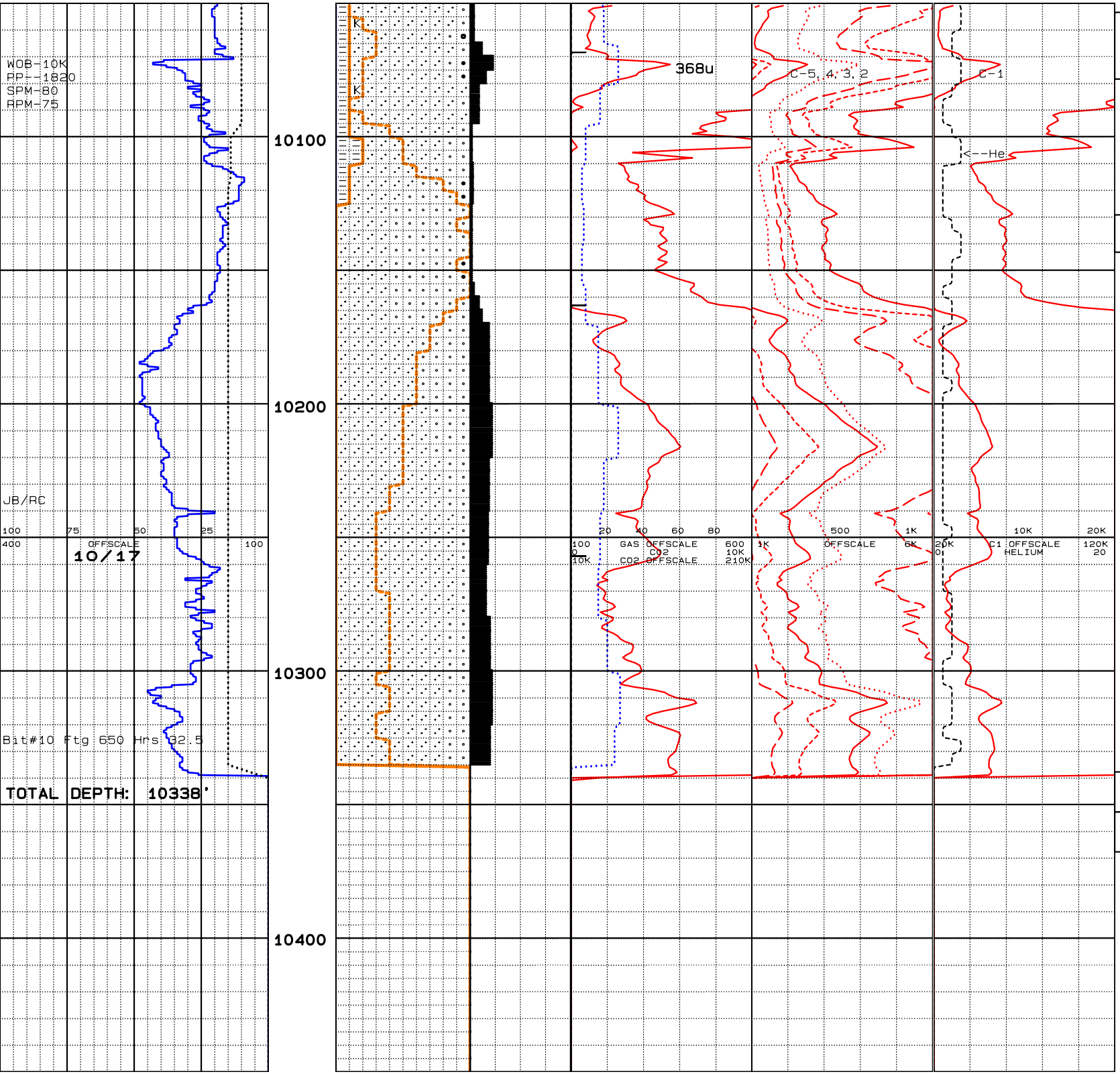
Sand: clear-gray-wht qtz, vfn-med gr pred vfn-fn, subang-subrnd, mod well sorted, weakly consol w/ calc cement, tr dk lithics, tr mica flakes.
Oil: tr vis oil stnng on Ss grs, 40-50% dull brnsh orng smpl fl, slow transp yelsh wht cut fl, straw vis cut.

Sand: clear-gray wht qtz, occ pink fspar, tr dk lithics, tr mica flakes, vfn-med gr, pred fn-med, subang-subrndd, pred unconsol, intbdd w/ weakly cemented fn gr Ss, tr Kaoline clay, slow transp yelsh wht cut fl, straw vis cut.

Gas sample taken by SoCal Gas at 9960'.

Survey @10027' 83.6deg 269.3az
TVD 8668.2' 213.0'S 1676.8'W

Sand: clr-wht, occ gry, some stnd brn, vf-med, tr cse, unconsol w/occ calc Ss interbeds, mod well sorted, subang to subrndd, predom qtz w/occ mica & feld, v fnt smpl fluor, mod fast yel wht cut flr w/ v faint straw to straw vis cut.



MW 8.6 FV 40 PV 6 YP 17 FC 1
Gel 6/7 pH 7.5 FL 5.6 Sol 2.73
Sd .3 Cl 16500 Ca 80 Oil .1
Flowline Temp 146 deg. F

Sandstone: med brown, some gray wht, vf-f gr, easily fria, ang-subangular, predom qtz, occ feld & mica, weakly cmtd w/ calcite, tr thin kaol streaks, few interbeds of Siltst, mod fast weak translu yel wht cut fluor, pale straw to no vis cuts, light oil stains on grs.

Survey @ 10122' 82.5deg 267.6A
TVD 1784.2' 215.6'S 1771.1'W

Sand: clr-wht, occ gray, tr grn & dk gry-blk, vf-cse, unconsol, pred sbang, fair-poor sorting, quartz w/mnr feld & occ mica, 5-10% very faint orng gold smpl fluor, fast v weak translucent yel wht cut fluor w/ lt straw to no visible cuts.

Sand: clear-gray-wht qtz, tr feld, occ calcite grs, vfn-md gr, subang-subrnd, mod well sorted, sl consol w/in weak calc Ss, occ mica flakes.
Oil: cmn oil stnng on Ss grs, 70-80% orng smpl fl, fast transl brt yelsh wht cut fl, amber vis cut.

Sand: clear-wht qtz, few fspar tr calcite, pred vfn-fn gr, tr med, tr non-hyd Kaol clay, subang-subrnd, well sorted, mod calc, occ mica flakes.
Oil: vis oil stnng on Sd grs, 60-70% dull orng smpl fl, fast transl brt yelsh wht cut fl, amber vis cut.

Sand: pred fn gr clr-wht qtz, subang-subrnd, mod well srtd, occ feld, tr mica flakes, mod consol w/ calc cement.
Oil: cmn vis micro oil stnng, occ floating Ss grs on water, 70-80% dull orng smpl fl, fast transl brt yelsh wht cut fl, amber vis cut.

Survey @ 10338' 82.4deg 266.4A
TVD 8708/1' 229.7'S 1984.8'W

Reached TD at 0335 on 10/17/15
Released at 1200 on 10/17/15.