GOOLSBY BROTHERS and associates, inc.
575 Union Blvd, Suite 208
Lakewood, CO 80228
303-945-2860 Office
Geological Wellsite Supervision
www.goolsbybrothers.com
PETCOM

Scale 1:240 (5"=100') Imperial
Measured Depth Log

Well Name:	HOWARD 27N-28HZ (Vertical Hole Section)
Location:	Section 28, T1N, R67W, WELD County, CO.
License Number:	API: 05-123-36928 — Region: DJ Basin - Wattenberg
Spud Date:	October 19, 2013 — Drilling Completed: October 25, 2013
Surface Coordinates:	NENE Sec 28 T1N R67W; 310' FNL 1094' FEL Lat N 40.028474 Long W -104.89003
Bottom Hole Coordinates:	NENE Sec 33, T1N, R67W Coordinates: 4487.68' N & 211.61' E
Ground Elevation (ft):	4983' — K.B. Elevation (ft): 4999'
Logged Interval (ft):	6937' To: 12,017' — Total Depth (ft): 12,017' DMTD
Formation:	Pierre Sands/Shales, Niobrara, Niobrara B Target
Type of Drilling Fluid:	Water & Poly to 7120', LSND 7120'-12,017'

Printed by STRIP.LOG from WellSight Systems 1-800-447-1534 www.WellSight.com

OPERATOR

Company: Kerr-McGee Oil & Gas Onshore LP
Address: Granite Tower - 1099 18th St. Ste 1800
Denver, CO 80202
CO Geologist, John Morgan

E-Logs

MWD GR 6881'-11,966'

Contractors

1) Drilling Contractor: XTREME, Rig #20
2) Company Man: Charlie Daigle & Tom Kibbe
3) Mud Comapny : AES Drilling Fluids
4) Directional Drilling: Baker Huges
Pulse Tool
Drillers: Barry Combs, Scott Stanford
MWD: Greg Dore & David Campbell
5) Gas Equipment: Mudlogging Systems Inc.
by Terra Services
Redbox # ML-462 & Ratcliff Agitator
6) Well Site Geology: Goolsby Brothers & Associates
Geologists: Hank McCroskey & Ian Harris

ROCK TYPES

Anhy, Bent, Brec, Cht, Clyst, Coal, Congl, Dol, Gyp, Igne, Lmst, Meta, Mrlst, Salt, Shale, Shcol, Shgy, Sltst, Ss, Till, Slty sh, Arg ss, Fracture, Chalk, Carb sh, Arg lmy ss, Cmt

ACCESSORIES

MINERAL: Anhy, Arggrn, Arg, Bent, Bit, Brecfrag, Calc, Carb, Chtdk, Chtlt, Dol, Feldspar, Ferrpel, Ferr, Glau, Gyp, Hvymin, Kaol, Marl, Minxl, Nodule, Phos, Pyr, Salt, Sandy, Silt, Sil, Sulphur, Tuff

FOSSIL: Algae, Amph, Belm, Bioclst, Brach, Bryozoa, Cephal, Coral, Crin, Echin, Fish, Foram, Fossil, Gastro, Oolite, Ostra, Pelec, Pellet, Pisolite, Plant, Strom

STRINGER: Anhy, Arg, Bent, Coal, Dol, Gyp, Ls, Mrst, Sltstrg, Ssstrg

TEXTURE: Boundst, Chalky, Cryxln, Earthy, Finexln, Grainst, Lithogr, Microxln, Mudst, Packst, Wackest

OTHER SYMBOLS

POROSITY: Earthy, Fenest, Fracture, Inter, Moldic, Organic, Pinpoint, Vuggy

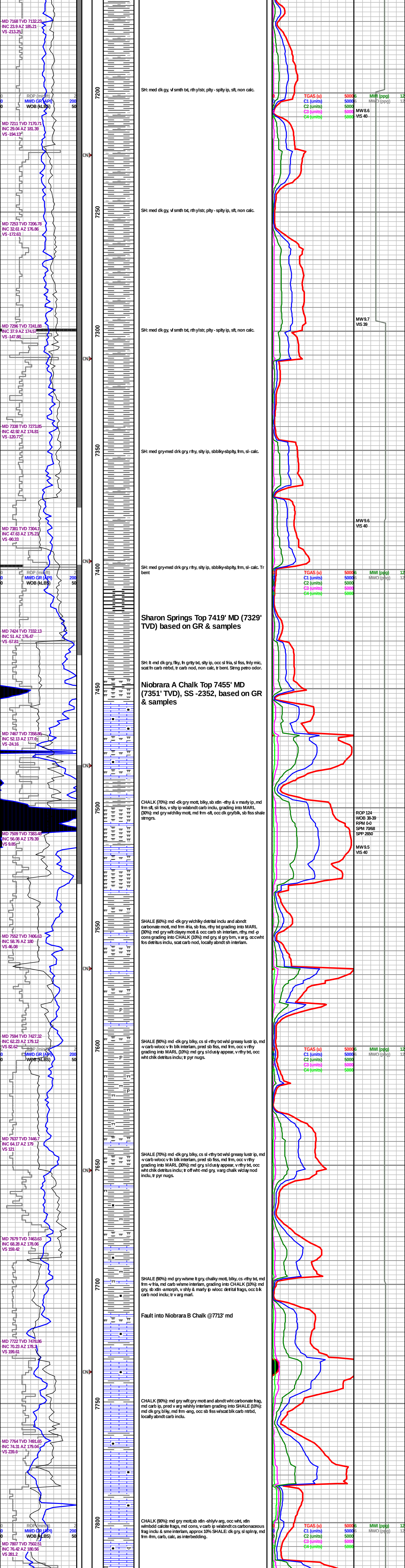
SORTING: Well, Moderate, Poor

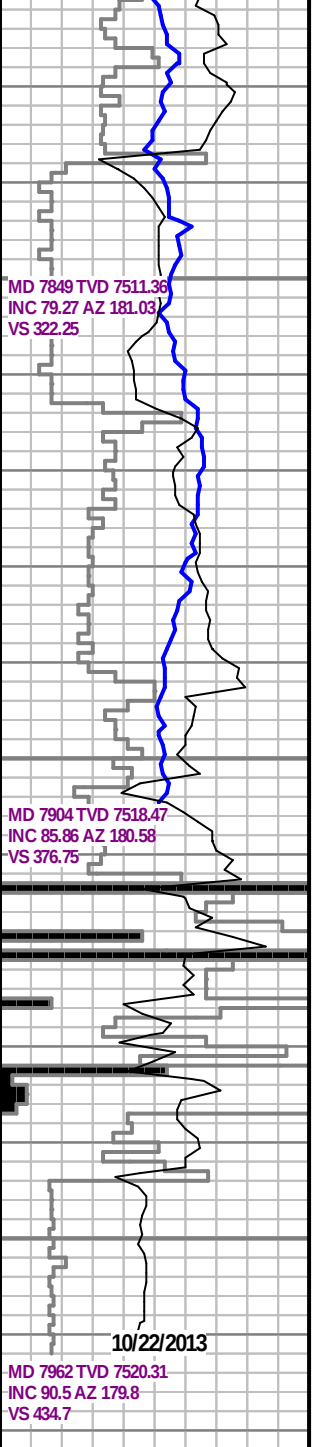
ROUNDING: Rounded, Subrnd, Subang, Angular

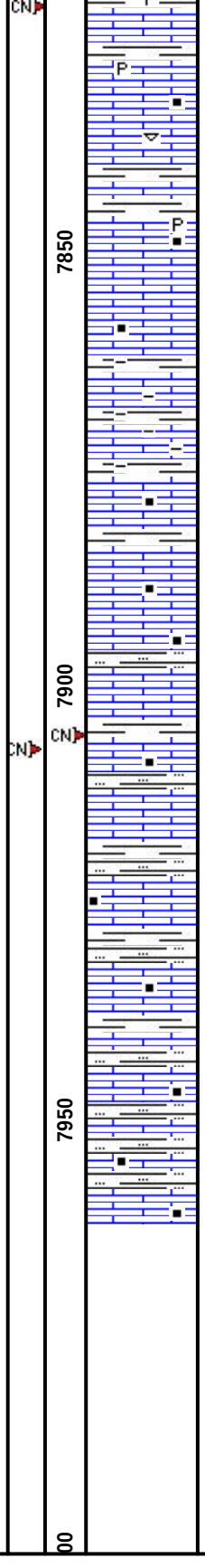
OIL SHOW: Even, Spotted, Ques, Dead

INTERVAL: Core, Dst

EVENT: New bit, Rft, Off btm, Conn, Casing, Casing_right


MD 7168 TVD 7132.23
INC 23.9 AZ 185.21
VS -213.25
ROP (min/ft)
MWD GR (API)
WOB (kLBS)
MD 7211 TVD 7170.71
INC 29.04 AZ 181.39
VS -194.13
MD 7253 TVD 7206.78
INC 32.61 AZ 176.86
VS -172.63
MD 7296 TVD 7241.88
INC 37.9 AZ 174.57
VS -147.88
MD 7338 TVD 7273.85
INC 42.92 AZ 174.81
VS -120.77
MD 7381 TVD 7304.1
INC 47.63 AZ 175.23
VS -90.33
MD 7424 TVD 7332.13
INC 51 AZ 176.47
VS -57.81
MD 7467 TVD 7358.86
INC 52.13 AZ 177.6
VS -24.16
MD 7509 TVD 7383.48
INC 56.08 AZ 179.39
VS 9.85
MD 7552 TVD 7406.63
INC 58.76 AZ 180
VS 46.08
MD 7594 TVD 7427.32
INC 62.23 AZ 179.12
VS 82.62
MD 7637 TVD 7446.7
INC 64.17 AZ 179
VS 121
MD 7679 TVD 7463.63
INC 68.28 AZ 178.06
VS 159.42
MD 7722 TVD 7478.86
INC 70.23 AZ 178.2
VS 199.61
MD 7764 TVD 7491.65
INC 74.31 AZ 179.04
VS 239.6
MD 7807 TVD 7502.51
INC 76.42 AZ 180.56
VS 281.2
7200
7250
7300
7350
7400
7450
7500
7550
7600
7650
7700
7750
7800
SH: med dk gy, vf smth txt, rth ylstr, plty - splty ip, sft, non calc.
SH: med gry-med drk gry, r thy, slty ip, sbblky-sbplty, frm, sl- calc.
SH: med gry-med drk gry, r thy, slty ip, sbblky-sbplty, frm, sl- calc. Tr bent
Sharon Springs Top 7419' MD (7329' TVD) based on GR & samples
SH: lt -md dk gry, flky, fn grtty txt, slty ip, occ sl fria, sl fiss, fnly mic, scat fn carb ntrbd, tr carb nod, non calc, tr bent. Strng petro odor.
Niobrara A Chalk Top 7455' MD (7351' TVD), SS -2352, based on GR & samples
CHALK (70%): md -dk gry mott, blky, sb xtln -rthy & v marly ip, md frm sft, sli fiss, v slty ip w/abndt carb inclu, grading into MARL (30%): md gry w/chlky mott, md frm -sft, occ dk gry/blk, sb fiss shale strngrs.
SHALE (60%): md -dk gry w/chlky detrital inclu and abndt carbonate mott, md frm -fria, sb fiss, rthy txt grading into MARL (30%): md gry w/lt clayey mott & occ carb sh interlam, rthy, md -p cons grading into CHALK (10%): md gry, sl gry brn, v arg, occ wht fos detritus inclu, scat carb nod, locally abndt sh interlam.
SHALE (90%): md -dk gry, blky, cs sl -rthy txt w/sl greasy lustr ip, md -v carb w/occ v fn blk interlam, pred sb fiss, md frm, occ v rthy grading into MARL (10%): md gry, sl dusty appear, v rthy txt, occ wht chlk detritus inclu; tr pyr nugs.
SHALE (70%): md -dk gry, blky, cs sl -rthy txt w/sl greasy lustr ip, md -v carb w/occ v fn blk interlam, pred sb fiss, md frm, occ v rthy grading into MARL (30%): md gry, sl dusty appear, v rthy txt, occ wht chlk detritus inclu; tr off wht -md gry, v arg chalk w/clay nod inclu, tr pyr nugs.
SHALE (90%): md gry w/sme lt gry, chalky mott, blky, cs -rthy txt, md frm -v fria, md carb w/sme interlam, grading into CHALK (10%): md gry, sb xtln -amorph, v shly & marly ip w/occ detrital frags, occ blk carb nod inclu; tr v arg marl.
Fault into Niobrara B Chalk @7713' md
CHALK (90%): md gry w/lt gry mott and abndt wht carbonate frag, md carb ip, pred v arg w/shly interlam grading into SHALE (10%): md dk gry, blky, md frm -ang, occ sb fiss w/scat blk carb ntrbd, locally abndt carb inclu.
CHALK (90%): md gry mott,sb xtln -shly/v arg, occ wht, xtln w/mbdd calcite frags, md cons, v carb ip w/abndt cs carbonaceous frag inclu & sme interlam, approx 10% SHALE: dk gry, sl splnty, md frm -frm, carb, calc, as interbedding.
TGAS (u)
C1 (units)
C2 (units)
C3 (units)
C4 (units)
MWI (ppg)
MWO (ppg)
MW 8.6
VIS 40
MW 9.7
VIS 39
MW 9.6
VIS 40
ROP 124
WOB 38-39
RPM 0-0
SPM 70/68
SPP 2650
MW 9.5
VIS 40



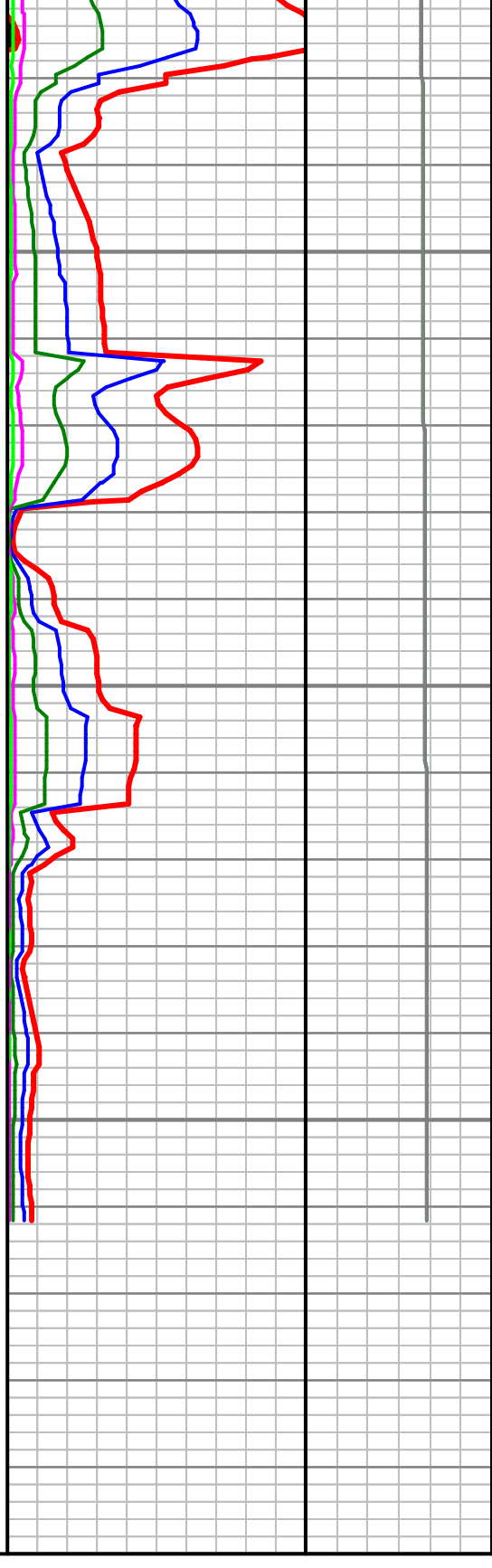


CHALK (90%): md gry mott,sb xtln -shly/v arg, occ wht, xtln w/mbdd calcite frags, md cons, v carb ip w/abndt cs carbonaceous frag inclu & sme interlam; SHALE (10%): dk gry, sl splnty, md frm -frm, carb, calc; tr inoceramus frags.

CHALK (80%): md -dk gry w/occ lt mott, md cons, sb xtln rthy txt, v shly/arg, scat blk carb spk inclu & occ fiss carb ntrbd, v shly overall; SHALE (20%): md dk gry, blky, sl splnty, md frm, carb, slty ip; tr bent, tr shell frags.

CHALK (60%): md -dk gry, fn, shly grtty txt, md cons, abndt wht free shell frags, v arg grading into SHALE (40%): md dk gry, blky, sb splnty, md frm, md carb, sb fiss, tr bent.

END Vertical Hole Log Section, Begin Horizontal Log Section

Formation Top Picks by John Morgan, Anadarko

Sharon Springs	7419' MD (7329' TVD)
Niobrara A Chalk	7455' MD (7351' TVD)
land in Niobrara B Chalk by faulting	
DMTD	12,017' ('TVD)
Production csg	12,002'