

**OPERATOR**

Company: Murfin Drilling Company, Inc.  
 Address: 250 N. Water Suite 300  
 Wichita, KS 67202  
 Contact Geologist: Michel Runnion  
 Contact Phone Nbr: 316-267-3241  
 Well Name: Harden #1-20  
 Location: Sec. 20 - T32S - R21W  
 Pool: Sec. 20 - T32S - R21W  
 State: Kansas  
 API: 15-025-21555-0000  
 Field: Morrison  
 Country: USA



Scale 1:240 Imperial

Well Name: Harden #1-20  
 Surface Location: Sec. 20 - T32S - R21W  
 Bottom Location:  
 API: 15-025-21555-0000  
 License Number: 30606  
 Spud Date: 1/19/2013 Time: 00:00  
 Region: Clark County  
 Drilling Completed: 2/2/2011 Time: 22:50  
 Surface Coordinates: 367' FNL & 1349' FEL  
 Bottom Hole Coordinates:  
 Ground Elevation: 2169.00ft  
 K.B. Elevation: 2180.00ft  
 Logged Interval: 3500.00ft To: 6627.00ft  
 Total Depth: 6627.00ft  
 Formation: Viola  
 Drilling Fluid Type: Chemical/Fresh Water Gel

**SURFACE CO-ORDINATES**

Well Type: Vertical  
 Longitude: Latitude:  
 N/S Co-ord: 367' FNL  
 E/W Co-ord: 1349' FEL

**LOGGED BY**



Company: Keith Reavis, Inc.  
 Address: 3420 22nd Street  
 Great Bend, KS 67530  
 Phone Nbr: 620-617-4091  
 Logged By: KLG #136 Name: Keith Reavis

**CONTRACTOR**

Contractor: Murfin Drilling Company  
 Rig #: 22  
 Rig Type: mud rotary  
 Spud Date: 1/19/2013 Time: 00:00  
 TD Date: 2/2/2011 Time: 22:50  
 Rig Release: Time:

**ELEVATIONS**

K.B. Elevation: 2180.00ft Ground Elevation: 2169.00ft  
 K.B. to Ground: 11.00ft

**NOTES**

Due to considerable hole trouble, no electrical logs or drill stem tests were run on this well. Based on sample shows and favorable structure, the operator elected to set 5 1/2" production casing and test the Viola formation through perforations and stimulation.

A Bloodhound gas detection system operated by Bluestem Environmental was employed on this well. ROP and gas data were imported into this mudlog.

Samples were saved and will be available for review at the Kansas Geological Survey Well Sample Library located in Wichita, KS.

Respectfully submitted,  
 Keith Reavis

**Murfin Drilling Company  
 daily drilling report**

DATE	7:00 AM DEPTH	REMARKS
01/23/2013	4608	Geologist Keith Reavis on location @ 0205 hrs, 4335 ft., drilling ahead Lecompton, Heebner, Toronto, Douglas, Lansing, Stark
01/24/2013	5250	drilling ahead, Marmaton, Pawnee, stop @ 5250', pull PDC bit, back in hole with button bit, ctch, resume drilling, Cherokee
01/25/2013	5456	drilling ahead, Mississippian
01/26/2013	5709	drilling ahead, Mississippian
01/27/2013	6055	drilling ahead, Mississippian, Cowley Facies
01/28/2013	6283	drilling ahead, Cowley Facies
01/29/2013	6507	drilling ahead, Cowley Facies, short trip at 6465', resume drilling show in Viola and kick warrants test, TOH for DST #1, stacked out tools At 900', lay down tools, in with bit, lost circ at 950', mix mud and lcm
01/30/2013	6530	regain circ, TIH hole with bit, hit bridge at 5700', stuck
01/31/2013	6530	spot oil, no help, run free point, shot loose 2 collars above bit
02/01/2013	6530	rig up bumper sub and jars, did not get fish first attempt, TIH for second run, successfully got fish out of hole, put on new bit, TIH, ctch
02/02/2013	6530	finish cleaning hole, displace old mud, resume drilling, TD @ 6627 ft 2250 hrs, ctch
02/03/2013	6627	TOH for logs, stuck bit @ 950' get loose, ream, operator elected to not run logs, release logging truck, TIH to condition hole and come out laying down to run production casing, geologist off location 0600 hrs

**Murfin Drilling Company  
 well comparison sheet**

Formation	DRILLING WELL Murfin - Harden 1-20 367' FNL & 1349' FEL Sec 20-T32S-R21W				COMPARISON WELL Berexco - Harden 4-20 429' FNL & 477' FEL Sec 20-T32S-R21W				COMPARISON WELL			
	2180 KB		Log	Sub-Sea	2134 KB		Structural Relationship	Log	KB		Structural Relationship	
	Sample	Sub-Sea			Log	Sub-Sea			Log	Sub-Sea	Sample	Log
Heebner	4432	-2252			4376	-2242	-10					
Douglas	4515	-2335			4462	-2328	-7					
Lansing	4632	-2452			4577	-2443	-9					
Muncie Creek	4858	-2678			4801	-2667	-11					
Stark Shale	5018	-2838			4964	-2830	-8					
Marmaton	5143	-2963			5086	-2952	-11					
Pawnee	5231	-3051			5176	-3042	-9					
Cherokee	5312	-3132			5259	-3125	-7					
Morrow-Atoka	5391	-3211			5335	-3201	-10					
Miss-St. Gen	5401	-3221			5344	-3210	-11					
Cowley Facies	6057	-3877			6042	-3908	31					
Viola	6524	-4344			6474	-4340	-4					
Simpson Dol	not reached				6636	-4502						
Simpson Shale	not reached				6714	-4580						
Arbuckle	not reached				6781	-4647						
Total Depth	6627	-4447			6906	-4772	325					

**ROCK TYPES**

- Dolprim
- sdylmst
- Lmst fw7>
- shale, gry
- Dolsec
- Lmst fw<7
- shale, grn
- Carbon Sh

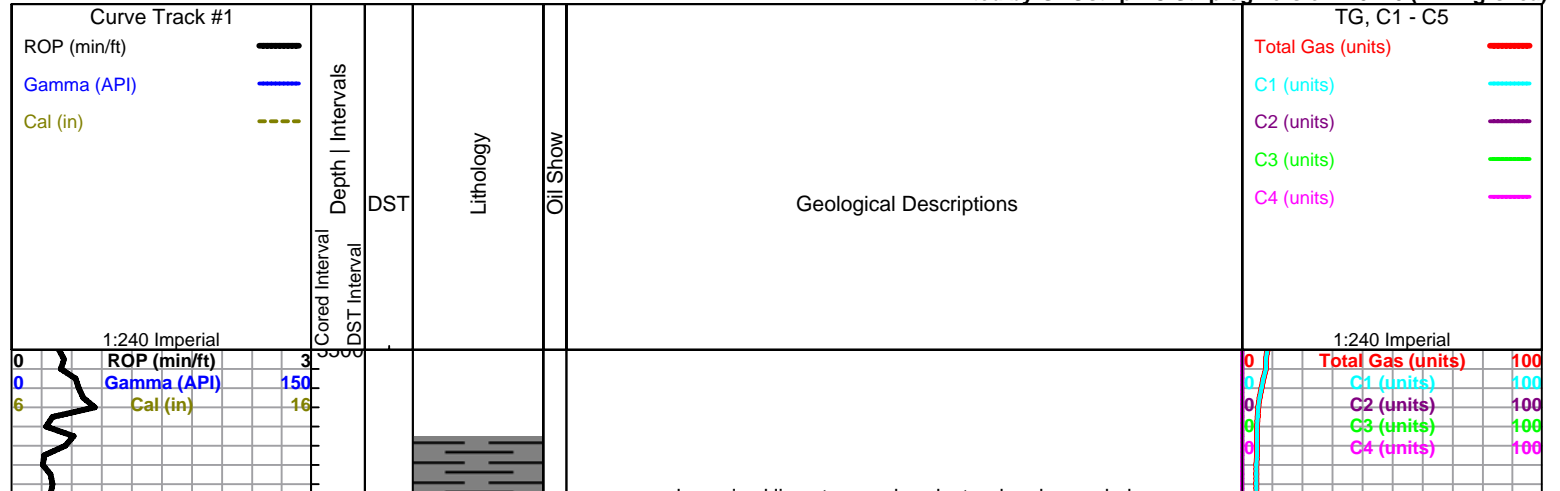
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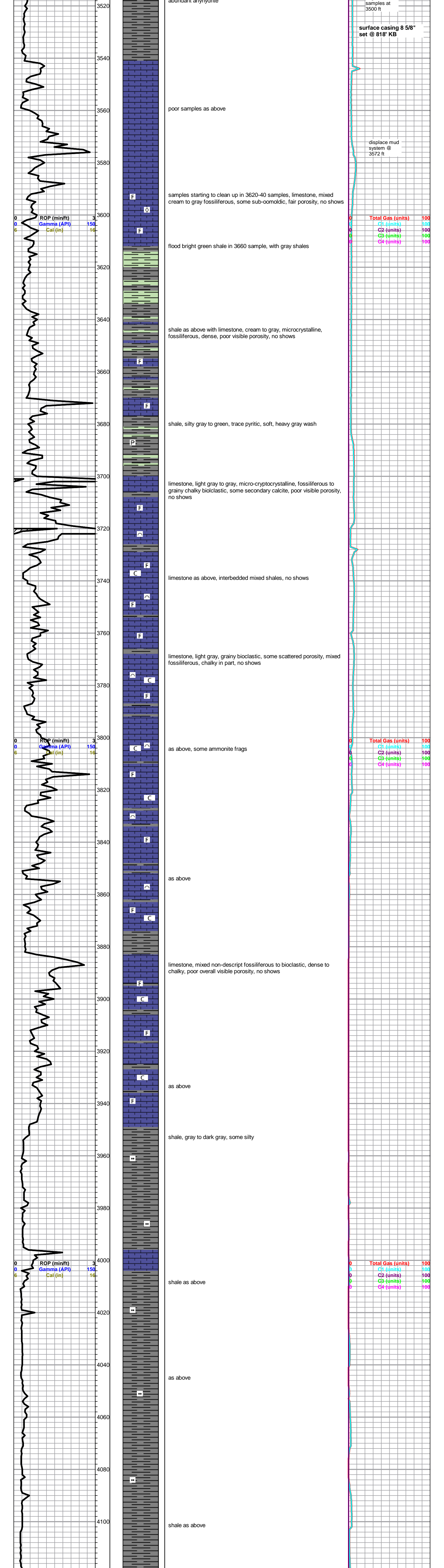
- |                     |                            |                 |                |
|---------------------|----------------------------|-----------------|----------------|
| <b>MINERAL</b>      | <b>FOSSIL</b>              | <b>STRINGER</b> | <b>TEXTURE</b> |
| - Argillaceous      | ^ Bioclastic or Fragmental | ■ Dolomite      | C Chalky       |
| ▲ Chert, dark       | F Fossils < 20%            | ■ Limestone     | L Lithogr      |
| ▣ Chert, tripolitic | φ Oolite                   | ■ Sandstone     |                |
| ▤ Dolomitic         |                            | ■ Siltstone     |                |
| ∩ Glauconite        |                            | ■ Shale         |                |
| P Pyrite            |                            |                 |                |
| ^ Siliceous         |                            |                 |                |
| △ Silty             |                            |                 |                |
| △ Chert White       |                            |                 |                |

**OTHER SYMBOLS**

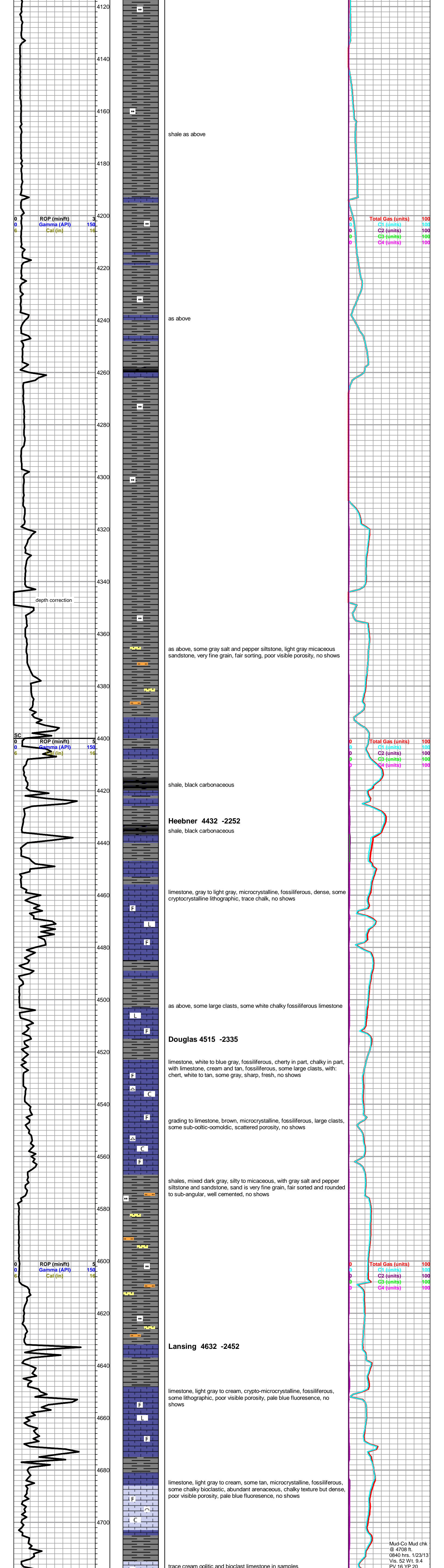
- DST**
- DST Int
  - ▲ DST alt
  - Core
  - || tail pipe

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shale as above

as above

as above, some gray salt and pepper siltstone, light gray micaceous sandstone, very fine grain, fair sorting, poor visible porosity, no shows

shale, black carbonaceous

**Heebner 4432 -2252**  
shale, black carbonaceous

limestone, gray to light gray, microcrystalline, fossiliferous, dense, some cryptocrystalline lithographic, trace chalk, no shows

as above, some large clasts, some white chalky fossiliferous limestone

**Douglas 4515 -2335**

limestone, white to blue gray, fossiliferous, cherty in part, chalky in part, with limestone, cream and tan, fossiliferous, some large clasts, with: chert, white to tan, some gray, sharp, fresh, no shows

grading to limestone, brown, microcrystalline, fossiliferous, large clasts, some sub-oolitic-oolitic, scattered porosity, no shows

shales, mixed dark gray, silty to micaceous, with gray salt and pepper siltstone and sandstone, sand is very fine grain, fair sorted and rounded to sub-angular, well cemented, no shows

**Lansing 4632 -2452**

limestone, light gray to cream, crypto-microcrystalline, fossiliferous, some lithographic, poor visible porosity, pale blue fluorescence, no shows

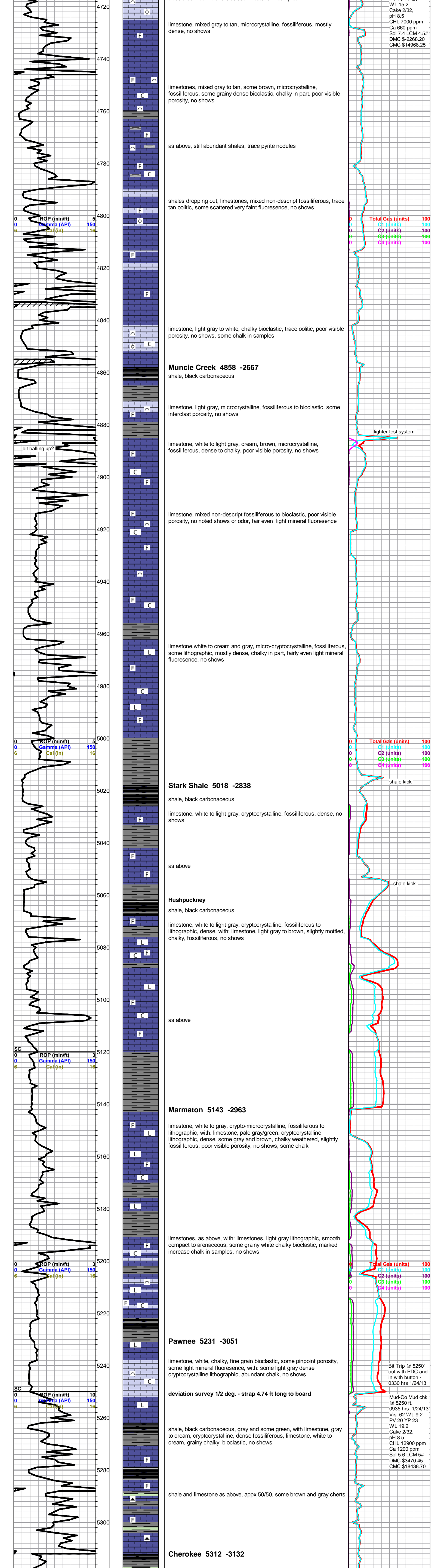
limestone, light gray to cream, some tan, microcrystalline, fossiliferous, some chalky bioclastic, abundant arenaceous, chalky texture but dense, poor visible porosity, pale blue fluorescence, no shows

trace cream oolitic and bioclast limestone in samples

Total Gas (units) 100  
C1 (units) 100  
C2 (units) 100  
C3 (units) 100  
C4 (units) 100

Total Gas (units) 100  
C1 (units) 100  
C2 (units) 100  
C3 (units) 100  
C4 (units) 100

Total Gas (units) 100  
C1 (units) 100  
C2 (units) 100  
C3 (units) 100  
C4 (units) 100



limestone, mixed gray to tan, microcrystalline, fossiliferous, mostly dense, no shows

WL 15.2  
Cake 2/32,  
pH 8.5  
CHL 7000 ppm  
Ca 660 ppm  
Sol 7.4 LCM 4.5#  
DMC \$-2268.20  
CMC \$14968.25

limestones, mixed gray to tan, some brown, microcrystalline, fossiliferous, some grainy dense bioclastic, chalky in part, poor visible porosity, no shows

as above, still abundant shales, trace pyrite nodules

shales dropping out, limestones, mixed non-descript fossiliferous, trace tan oolitic, some scattered very faint fluorescence, no shows

Total Gas (units) 100  
C1 (units) 100  
C2 (units) 100  
C3 (units) 100  
C4 (units) 100

limestone, light gray to white, chalky bioclastic, trace oolitic, poor visible porosity, no shows, some chalk in samples

**Muncie Creek 4858 -2667**  
shale, black carbonaceous

limestone, light gray, microcrystalline, fossiliferous to bioclastic, some interclast porosity, no shows

lighter test system

limestone, white to light gray, cream, brown, microcrystalline, fossiliferous, dense to chalky, poor visible porosity, no shows

limestone, mixed non-descript fossiliferous to bioclastic, poor visible porosity, no noted shows or odor, fair even light mineral fluorescence

limestone, white to cream and gray, micro-cryptocrystalline, fossiliferous, some lithographic, mostly dense, chalky in part, fairly even light mineral fluorescence, no shows

**Stark Shale 5018 -2838**  
shale, black carbonaceous

limestone, white to light gray, cryptocrystalline, fossiliferous, dense, no shows

as above

**Hushpuckney**  
shale, black carbonaceous

limestone, white to light gray, cryptocrystalline, fossiliferous to lithographic, dense, with: limestone, light gray to brown, slightly mottled, chalky, fossiliferous, no shows

as above

**Marmaton 5143 -2963**

limestone, white to gray, crypto-microcrystalline, fossiliferous to lithographic, with: limestone, pale gray/green, cryptocrystalline lithographic, dense, some gray and brown, chalky weathered, slightly fossiliferous, poor visible porosity, no shows, some chalk

limestones, as above, with: limestones, light gray lithographic, smooth compact to arenaceous, some grainy white chalky bioclastic, marked increase chalk in samples, no shows

**Pawnee 5231 -3051**

limestone, white, chalky, fine grain bioclastic, some pinpoint porosity, some light mineral fluorescence, with: some light gray dense cryptocrystalline lithographic, abundant chalk, no shows

deviation survey 1/2 deg. - strap 4.74 ft long to board

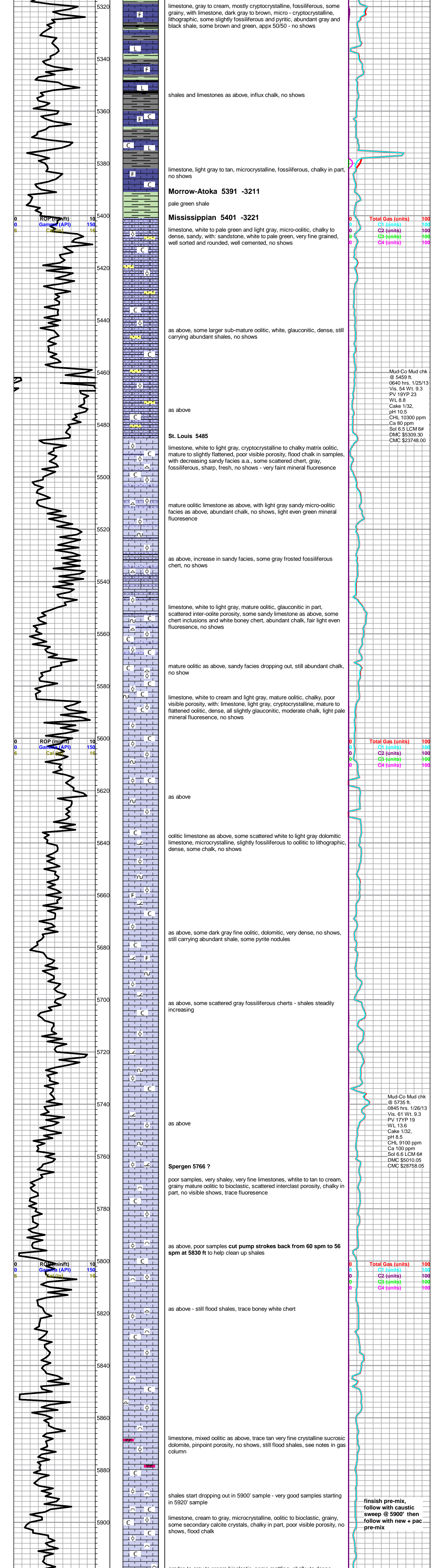
shale, black carbonaceous, gray and some green, with limestone, gray to cream, cryptocrystalline, dense fossiliferous, limestone, white to cream, grainy chalky, bioclastic, no shows

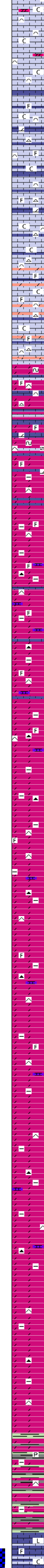
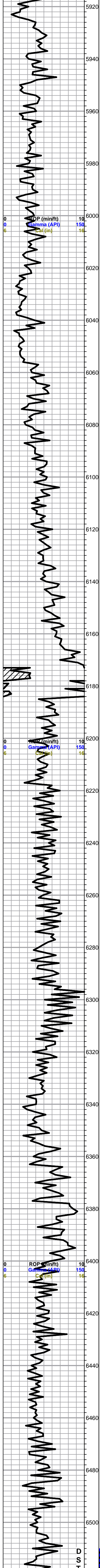
Bit Trip @ 5250' out with PDC and in with button - 0330 hrs 1/24/13  
Mud-Co Mud chk @ 5250 ft. 0935 hrs. 1/24/13 Vis. 62 Wt. 9.2 PV 20 YP 23 WL 19.2 Cake 2/32, pH 8.5 CHL 12900 ppm Ca 1200 ppm Sol 5.6 LCM 5# DMC \$3470.45 CMC \$18438.70

**Cherokee 5312 -3132**

shale and limestone as above, appx 50/50, some brown and gray cherts







grades to gray to cream bioclastic, some mottling, chunky to dense, some scattered gray dolomitic bioclastic limestone, poor visible porosity, no shows, abundant chalk, very faint mineral fluorescence

limestone, white to light gray to cream, some mottled, fossiliferous to bioclastic, some re-crystallized, altered, dolomitic in part, poor visible porosity, fresh boney white chert and white to light gray fossiliferous cherts, abundant chalk, no shows

as above

limestone and chert as above, with influx limestone, white to gray, very chalky/ weathered bioclastic, some scattered porosity, with: dolomite, white to light blue/gray, slight mottling, altered fossiliferous, dense, abundant chalk, no shows, faint to scattered fair mineral fluorescence

increasing dolomite and increased mottling, decreasing limestone, increase chalk

**Cowley Facies 6057 -3877**  
dolomite to dolomitic limestone, gray mottled and gray green mottled, microcrystalline, altered fossiliferous, slightly to very glauconitic, dense, with: limestone as above, chert, gray mottled, fossiliferous, weathered to sub-tripolitic, dolomite, light gray, arenaceous-argillaceous, dense, abundant loose quartz shards, moderate chalk, no shows

grades to : dolomite, gray to light gray, microcrystalline, arenaceous to sub sucrosic, dense, with glauconitic facies as above, chalky bioclastic limestones fall out, still carrying weathered cherts and quartz shards

6130 sample, further decrease in glauconitic facies

as above, primarily gray argillaceous/arenaceous facies with stringers glauconitic facies, glauconitic facies primarily dolomite now, quartz shards, some scattered gray spiculitic to fossiliferous cherts, scattered limestone, cream, bioclastic, dolomitic, dense, no shows

as above

primarily gray argillaceous/arenaceous dolomite facies, glauconitic facies and limestone drops out, trace chert and quartz shards

as above

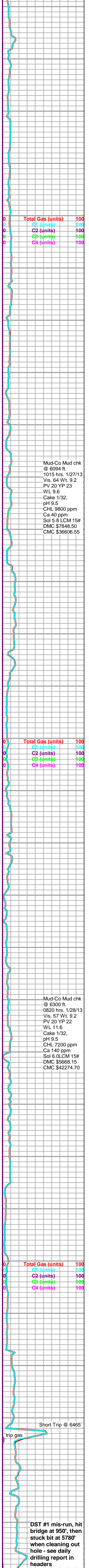
as above, no fluorescence or shows

mixed dark gray argillaceous/arenaceous dolomites as above, some scattered light gray to cream dolomitic limestone, fossiliferous, scattered cherts, quartz shard decrease, no shows

as above

as above, with shale, gray, dense limey to soft, some green and turquoise, silty to dense limey, some quartz inclusions and loose quartz shards, some brown shale, trace pyrite, gray wash in samples

limestone, cream to gray, microcrystalline, slightly fossiliferous to lithographic, some very chalky but mostly dense, no visible porosity, no shows or fluorescence



Mud-Co Mud chk @ 6094 ft. 1015 hrs. 1/27/13 Vis. 64 Wt. 9.2 PV 20 YP 23 WL 9.6 Cake 1/32, pH 9.5 CHL 9800 ppm Ca 40 ppm Sol 5.8 LCM 15# DMC \$7848.50 CMC \$36606.55

Mud-Co Mud chk @ 6300 ft. 0820 hrs. 1/28/13 Vis. 57 Wt. 9.2 PV 20 YP 22 WL 11.6 Cake 1/32, pH 9.5 CHL 7200 ppm Ca 140 ppm Sol 6.0 LCM 15# DMC \$5668.15 CMC \$42274.70

DST #1 mis-run, hit bridge at 950', then stuck bit at 5780' when cleaning out hole - see daily drilling report in headers

