

# Jeff Christian

PETROLEUM GEOLOGIST

Wichita, Kansas

## GEOLOGISTS' REPORT

DRILLING TIME AND SAMPLE LOG

OPERATOR **NORTHERN LIGHTS OIL CO.**

LEASE **KEENAN # 3**

LOCATION **1801' FNL & 2305' FEL**

ELEVATIONS

KB **2820'**

GL **2810'**

SEC. **3** TWP. **19 S** R. **29 W**

COUNTY **LANE** STATE **KANSAS**

FIELD **MCWHIRTER**

APR **15-101-22611-00-00**

CONTRACTOR **SOUTH WIND DRILLING** RIG NO. **1**

DRILLING STARTED **11/23/2018** COMPLETED **12/5/2018**

MUD DISPLACED **3900'** MUD TYPE **CHEMICAL**

DRILLING TIME KEYS FROM **3700'** TO **RTD**

SAMPLES SAVED FROM **3650'** TO **RTD**

SAMPLES EXAMINED FROM **3650'** TO **RTD**

GEOLOGICAL SUPERVISION FROM **3732'** TO **RTD**

MEASUREMENTS FROM KB

CASING RECORD

CONDUCTOR **NONE**

Surface **8.5/8' @ 267'**

W/ 185 SX

Production **5.1/2"**

**ELECTRICAL SURVEYS:**

WELL LOG

Radiation/Gaund

FORMATION NAME

LOG

TOP DATUM

SAMPLE

ANHYDRITE	2144'	(+676)	2146'	(+674)
HEEBNER	3928'	(-1108)	3926'	(-1106)
LANESING	3968'	(-1148)	3970'	(-1150)
STARK	4256'	(-1436)	4257'	(-1437)
MARMATON	4370'	(-1550)	4368'	(-1548)
PAWNEE	4452'	(-1632)	4451'	(-1631)
FT SCOTT	4504'	(-1684)	4502'	(-1682)
CHEROKEE	4526'	(-1706)	4523'	(-1703)
MISSISSIPPIAN	4607'	(-1787)	4606'	(-1786)
TOTAL DEPTH	4621'	(-1801)	4620'	(-1800)



DATE	7:00 AM DEPTH	REMARKS
11/23/18	MIRT	SPUD
11/24/18	378'	WOC dev 1/4 deg.
11/25/18	1640'	Drlg.
11/26/18	2401'	Drlg.
11/27/18	2972'	Drlg.
11/28/18	3542'	Drlg.
11/29/18	4081'	Drlg. dev 3/4 deg. @ 4086'
11/30/18	4180'	CFS
12/1/18	4223'	TOH for DST # 3
12/2/18	4301'	TOH for DST # 4
12/3/18	4430'	TIH for DST # 5
12/4/18	4487'	CFS
12/5/18	4620'	Logging RTD 4620' @ 12:30 am Dev 1 deg.

**Remarks**

5/2" production casing set to further test multiple zones in the Lansing Kansas City, Marmaton and Cherokee formations.

Electric log measurements correlate about even compared to rotary measurements.

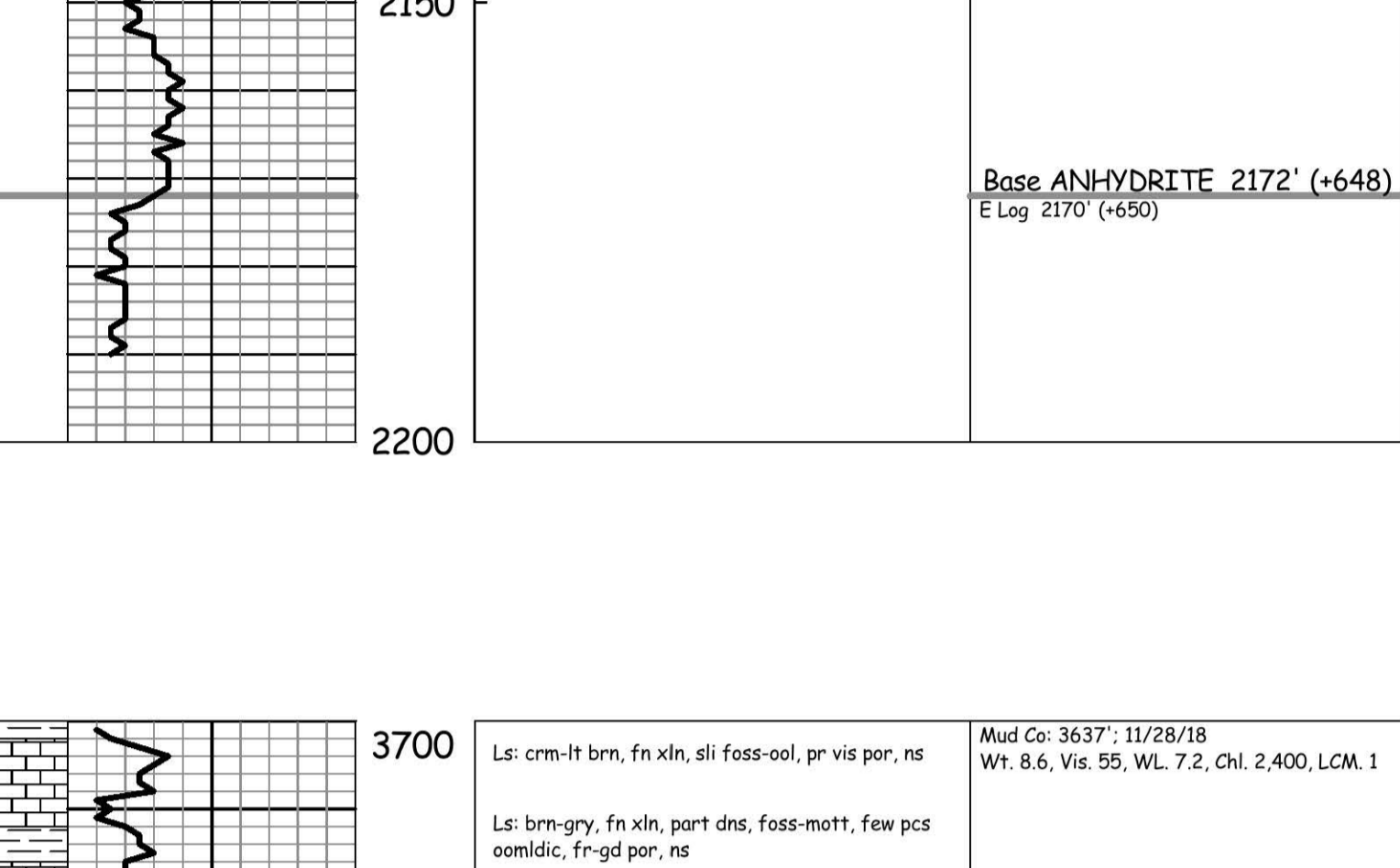
Sample tops adjusted to the electric log.

Respectfully Submitted,

*Jeff Christian*

Jeff Christian

LITH.	0	DRILL TIME (MIN/FT)	10	DEPTH	30'	SAMPLE DESCRIPTIONS	REMARKS
-------	---	---------------------	----	-------	-----	---------------------	---------



ANHYDRITE 2146' (+674)

E Log 2144' (+676)

Base ANHYDRITE 2172' (+648)

E Log 2170' (+650)

3700	Ls: crm-lt brn, fn xln, sli foss-ool, pr vis por, ns	Mud Co: 3637'; 11/28/18 Wt. 8.6, Vis. 55, WL. 7.2, Chl. 2,400, LCM. 1
------	--	--

Ls: brn-gry, fn xln, part dns, foss-mott, few pcs oomldic, fr-gd por, ns

Ls: brn, fn xln, oomld, fr-gd oomld por, ns

Ls: brn-gry, fn xln, sli grnlr, pr-fr pp-intrxn por, sct earthy stn, nsfo, no odor

3750	Ls: brn-gry, fn xln, sli grnlr, sct oomld, fr pp-vug-oomld por, ns	
------	--	--

Ls: lt gry-gry, fn xln, dns, sli foss, pr vis por, ns

Ls: lt brn-lt gry, fn xln, dns, sli foss, rare pp-vug por, ns

Ls: lt gry-lt brn, fn xln, part dns, sli foss-ool in part, sct fr pp-vug por, ns

Ls: lt gry-lt brn, fn xln, part dns, foss-ool in part, pr vis por, ns

Same

Same

Ls: crm-lt brn, fn xln, sli grnlr, vy sct pp-intrxn por, ns

Ls: as above, chrtly

3850	Ls: lt gry-lt brn, fn xln, part dns, sli foss, chrtly, pr vis por, ns	
------	---	--

Ls: crm-lt gry, fn xln, sli grnlr, sli foss, chrtly, sct pr pp-intrxn por, ns

Same

Ls: lt brn-lt gry, fn xln, dns, sli chrtly, foss in part, pr vis por, ns

Same

Ls: lt brn-lt gry, fn xln, part dns, sli grnlr, sct chrt, sli foss, pr-fr pp-intrxn por, ns

Ls: lt brn-lt gry, fn xln, dns, foss, argil

3900	Sh: blk, carb	HEEBNER 3929' (-1109)
------	---------------	-----------------------

E Log 3928' (-1108)

Ls: lt brn-lt gry, fn xln, dns, sli foss, pr vis por, ns

Ls: crm-lt brn, fn xln, part chiky, chrtly, rare intrxn por, ns

Ls: as above, trc pp-vug por, ns

3950	Ls: crm-lt brn, fn xln, sli chiky, part dns, sli foss-ool, chrtly, trc pp-vug por, ns	LANESING 3970' (-1150)
------	---	------------------------

E Log 3968' (-1148)

Ls: crm-lt gry, fn xln, dns, part chiky, sli foss, sct chrt, pr vis por, ns

Sh: gry-trc blk w/ Ls: brn-gry, fn xln, dns

Ls: crm-lt brn-lt gry, fn xln, subchiky, foss-ool in part, chrtly, rare vug-intrxn por, ns

Ls: crm-lt gry, fn xln, dns, sli chiky, sli foss, chrtly, pr vis por, ns

Ls: crm-lt gry, fn xln, dns, part chiky, sli foss, pr vis por, ns

Same

4050	Ls: crm-lt gry-gry, fn xln, dns, prt chiky, pr vis por, ns w/ sct Sh: gry	DST # 1
------	---	---------

Same

Ls: crm-lt gry, fn xln, sli foss-trc ool, fr pp-vug por, ssfo, fr odor, brn sptd-subst stn, trc sat stn

Ls: as above, chrtly, dcns in show

Ls: crm-lt gry, fn xln, part chiky, ool-trc oomldic, some calc xtls, fr oomld por, nsfo, no odor

Ls: crm-lt brn, fn xln, few ool, trc oomld, fr oomld por, ns

Ls: crm-lt brn-lt gry, fn xln, part dns, part chiky, trc brn oomld w/ fr xln, ns

Ls: crm-lt gry, fn xln, dns, chiky in part, sli foss, pr vis por, ns

Same

4100	Sh: blk, carb	DST # 2
------	---------------	---------

DST # 2 4148' to 4195'

30"-30"-30"-30"

IF: BOB/8" ISI: Blow Built to 1/2"

FF: BOB/11" FSI: No Return

RECOVERY: 632' total fluid

2' CO

126' M&O (50%O, 50%M)

189' GOCW (10%G, 10%W, 80%M)

189' G&OCWM (10%G, 5%O, 40%W, 45%M)

252' MCW (80%W, 20%M)

IFP: 26-181# ISIP: 679#

FFP: 184-308# FSP: 677#

IHP: 2046# FHP: 2008#

BHT: 122 deg, F

4150	Ls: gry, fn xln, part dns, chrtly, pr pp-vug por, vsfo, fr odor, brn sptd-stn	DST # 3
------	---	---------

Ls: crm-lt gry, fn xln, ool, pr-fr introol-vug por, ssfo, fr odor, brn sptd-stn

Ls: crm-lt gry, fn xln, dns, chiky in part, pr vis por, ns

Ls: crm-lt gry, fn xln, dns, part chiky, ool in part, pr vis por, ns

Sh: gry-w/ Ls: as above

Ls: crm-lt gry, fn xln, dns, sli chrtly, pr por, ns

Ls: lt gry, fn xln, oomld, gd oomld por, sct pcs w/ barren, fr odor, brn sptd-stn

Ls: crm-lt brn, fn xln, dns, sli foss, few calc xtls, vsfo, odor, brn sptd-stn

Sh: blk, carb

4200	Ls: crm-lt brn-lt gry, fn xln, dns, chrtly, vy sct ool-sli foss, pr vis por, vsfo, fr odor, sptd stn	DST # 4
------	--	---------

Ls: lt gry, fn xln, foss-sli ool, fr vug por, ssfo, fr odor, brn subst-sat stn

Ls: lt brn-lt gry, fn xln, dns, some crm, subchiky

Ls: crm-lt gry, fn xln, dns, subchiky, chrtly, pr vis por, ns, no odor

Sh: blk, carb

Ls: brn, fn xln, abndnt lrg calc xtls, gd intrxn-vug por, ssfo, fr odor, brn sat stn

Ls: crm-lt gry, fn xln, dns, subchiky, pr vis por, trc stn, nsfo, no odor

Ls: crm-lt gry, fn xln, subchiky, part dns, pr vis por, ns

Ls: lt brn-lt gry, fn xln, dns, sli foss-ool in part, pr vis por, ns

Same

4250	Ls: crm-lt gry, fn xln, dns, sli chrtly, pr vis por, ns	DST # 5
------	---	---------

Ls: lt gry, fn xln, dns, sli chrtly, pr vis por, ns

Ls: lt brn-lt gry, fn xln, dns, some crm, chiky, pr vis por, ns

Ls: crm-lt gry, fn xln, subchiky, part dns, chrtly, pr vis por, ns

Sh: blk, carb

Ls: crm-lt brn-gry, fn xln, part dns, part chiky, few pcs w/ pr vug por, vsfo, sptd stn, no odor

Ls: as above, more chiky @ base

4300	Sh: blk, carb	DST # 6
------	---------------	---------

DST # 6 4394' to 4430'

15"-30"-15"-45"

IF: BOB/5" ISI: No Return

FF: Blow Built to 5' 3/4"

RECOVERY: 20' total fluid

103' GP

10' CO

10' OCM (10%O, 90%M)

IFP: 12-16# ISIP: 150#

FFP: 16-26# FSP: 148#

IHP: 2115# FHP: 2028#

BHT: 114 deg, F

4350	Ls: crm-lt gry, fn xln, subchiky, part dns, pr vis por, ns	DST # 7
------	--	---------

Ls: lt gry, fn xln, dns, sli chrtly, pr vis por, ns

Ls: lt brn-lt gry, fn xln, dns, some crm, chiky, pr vis por, ns

Ls: crm-lt gry, fn xln, subchiky, part dns, chrtly, pr vis por, ns

Sh: blk, carb

Ls: crm-lt brn-gry, fn xln, part dns, part chiky, few pcs w/ pr vug por, vsfo, sptd stn, no odor

Ls: as above, more chiky @ base

4400	Sh: blk, carb	DST # 8
------	---------------	---------

DST # 8 4536' to 4587'

30"-30"-45"-45"

IF: BOB/5" ISI: No Return

FF: Blow Built to 15'

RECOVERY: 650' total fluid

272' WCM (30%W, 70%M)

378' MCW (70%W, 30%M)

IFP: 30-199# ISIP: 484#

FFP: 198-310# FSP: 482#

IHP: 2247# FHP: 2141#

BHT: 128 deg, F

4450	Ls: lt gry, fn xln, dns, sli chrtly, pr vis por, ns	DST # 9
------	---	---------

Ls: lt brn-lt gry, fn xln, dns, some crm, chiky, pr vis por, ns

Ls: crm-lt gry, fn xln, subchiky, part dns, chrtly, pr vis por, ns

Sh: blk, carb

Ls: crm-lt brn-gry, fn xln, part dns, part chiky, few pcs w/ pr vug por, vsfo, sptd stn, no odor

Ls: as above, more chiky @ base

4500	Sh: blk, carb	DST # 10
------	---------------	----------

DST # 10 4594' to 4632'

30"-30"-30"-30"

IF: BOB/8" ISI: No Return

FF: BOB/11" FSI: No Return

RECOVERY: 632' total fluid

2' CO

126' M&O (50%O, 50%M)

189' GOCW (10%G, 10%W, 80%M)

189' G&OCWM (10%G, 5%O, 40%W, 45%M)

252' MCW (80%W, 20%M)

IFP: 26-181# ISIP: 679#

FFP: 184-308# FSP: 677#

IHP: 2046# FHP: 2008#

BHT: 122 deg, F

4550	Ls: crm-lt brn-lt gry, fn xln, dns, chiky in part, sli foss, pr vis por, ns	DST # 11
------	---	----------

Sh: gry w/ Ls: as above

Ls: crm-lt gry, fn xln, dns, part chiky, sct pr vug por, trc fo, sli odor, sptd brn stn

Sst: clr, med grn, some fn & crs grn, qtz mtx, fri, fr intrgn por, fsfo, sli odor, brn sat stn, some blk, some barren

Sh: gry-gn-some red w/ Sst as above, more barren, some calc

Ls: crm-lt brn, fn xln, chiky, pr vis por, ns

Sst: wt, fn-med grn, hard-subfri, subqtz in part, pr vis por, ns

Ls: lt brn-lt gry, fn-some med xln, sli foss-ool in part, pr vis por, abndnt wt chik, ns, no odor

4600	Ls: lt brn-lt gry, fn-some med xln, sli foss-ool in part, pr vis por, abndnt wt chik, ns, no odor	DST # 12
------	---	----------

Mississippian 4606' (-1786)

E Log 4607' (-1787)

RTD 4620' (-1800)

E Log 4621' (-1801)

4650		
------	--	--

### Drill Stem Test Charts

