

GEOLOGY REPORT

Murfin Drilling Company, Inc.

Columbine #8-24

Sec.24, T9S, R56W

Lincoln Co, Colorado



Oakley - Tight Show

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GEOLOGY REPORT

Murfin Drilling Company, Inc.

Columbine #8-24

SE NE Sec.24, T9S, R56W

2040'FNL, 600' FEL

Lincoln County, Colorado

GEOLOGICAL REPORT

WIEPKING-FULLERTON ENERGY LLC Columbine #8-24

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Well Resume

Operator: **Murfin Drilling Company, Inc.**

WELL INFORMATION	Well Name	Columbine #8-24		
	Location (surface)	SE NE Sec.24, T9S, R56W	Bottom Hole: Straight Hole	
	County, State	Lincoln Co. Colorado	Field: Wildcat	
	Spot, (surface)	2040'FNL, 600' FEL	Designation: Tight Hole	
	API #	05-073-06753	Latitude: 39.252820	Longitude: -103.60514
	Spud Date	10/30/2018	Time: 5:00 p.m.	Drlg Started 0'
	Total Death	Driller 8574'	Logger	
	Completion Date (TD)	Wednesday, November 14, 2018	Time: 9:30 p.m. MST	
HOLE	Hole Size	12.25" to 455'	7 7/8 to TD	
	Casing	8 5/8 set at 455'		
	Cement	350 sks Class H, 3% gel, 2% CaCl		
ELEV	GL	5,380'		
	KB	5,393'		
PERSONNEL	Exploration Manager	Scott Robinson		
	Drilling Foreman	Bo Farr Murfin Drilling Co.		
	Wellsite Geologist	Gregg Smith GPS Consulting Services LLC		
	Drillers	Jason Bastion, Leonard Comer, Jose Rodriguez		
	Tool Pusher	Ray Bland		
CONTRACTORS	Drilling Company	Murfin Drilling Co.		
	Rig #	25		
	Mud Company	Mud-C0 / Service Mud, Inc.		
	Mud Type	Pre-Mix LSND/CHEM	Displace @ 6,700'	
	Mud Engineer	Tony Maestas		
	Drill Stem Testing	None		
	Petrophysical Logging Company	Weatherford		
	Logging Engineer:	Adam		
	Log Suite	Dual Induction/GR/SP, Comp Density/Neutron/Caliper, MICROLOG, SONIC		
	Cementing Company	QES,		
	SUMMARY	Drilling Days	16	
Rotating Hours		267		
DST's		None		
Bottom Hole Formation		Osage		
Potentially productive zones		None		
Final Status		P&A		

FORMATION TOPS

Murfin Drilling Company, Inc.

Columbine #8-24
SE NE Sec.24, T9S, R56W
2040'FNL, 600' FEL
Lincoln County, Colorado

Formation	KB	5,393'
	LOG TOPS	
	DEPTH	DATUM
NIOBRARA FM	3,516'	(+1,877')
FT. HAYES	3,967'	(+1,426')
CODELL	4,061'	(+1,332')
GREENHORN	4,160'	(+1,233')
GRANEROUS	4,290'	(+1,103')
BENTONITE MARKER	4,414'	(+979')
D SAND	4,507'	(+886')
J SAND	4,544'	(+849')
CHEYENNE FM	4,793'	(+600')
MORRISON	4,847'	(+546')
BLAINE	5,475'	(-82')
CEDAR HILLS	5,745'	(-352')
STONE CORRAL	5,946'	(-553')
FORAKER	6,669'	(-1,276')
HEEBNER	7,022'	(-1,629')
LANSING	7,056'	(-1,663')
STARK	7,306'	(-1,913')
MOUND CITY	7,400'	(-2,007')
EXLINE	7,412'	(-2,019')
PLEASENTON	7,432'	(-2,039')
MARMATON	7,470'	(-2,077')
MARMATON A	7,478'	(-2,085')
MARMATON B	7,504'	(-2,111')
MARMATON C	7,518'	(-2,125')
FORT SCOTT	7,554'	(-2,161')
LOWER FORT SCOTT	7,602'	(-2,209')
EXCELLO	7,619'	(-2,226')
BREEZY HILL	7,635'	(-2,242')
OAKLEY	7,667'	(-2,274')
CELIA	7,674'	(-2,281')
JOHNSON ZONE	7,753'	(-2,360')
ATOKA	7,820'	(-2,427')
MORROW	8,164'	(-2,771')
KEYES	8,391'	(-2,998')
MISSISSIPPIAN	8,470'	(-3,077')
OSAGE	8,518'	(-3,125')
TD	Driller - 8574'	Logger - 8566'

Summary and Conclusions

SUMMARY

Murfin Drilling Company Inc, drilled the Columbine 8-24 between October 30th, 2018 and November 19th, 2018 to a total drillers depth of 8,574'. A 12 ¼" hole was drilled to 455'. 8 5/8" surface casing was set at 455'. A 7 7/8" hole was drilled to total depth. Ultimately, the hole was plugged and abandoned.

OPERATIONS

Murfin Drilling Company, Rig 25 , conducted drilling operations. Deviation problems, poor mud motor implementation and performance, extensive rig repairs and lost circulation problems all contributed to a decrease in the overall rate of penetration and drilling days.

Sample evaluation began at 4500'to 4900' to evaluate the Dakota Group, was resumed at 6900', above the Lansing Formation and continued to a driller's total depth of 8187'. Total depth was achieved in 16 drilling days requiring 267 rotating hours.

OBJECTIVES

Utilizing subsurface stratigraphic interpretation in conjunction with regional seismic data, the Columbine #8-24 was drilled as a prospective oil productive wildcat located roughly 2 miles to the north east of the productive Murfin Rogue 10-25 well drilled in January 2018.

Primary objectives consist of any productive Morrow or Keyes channel sandstone devolvement as is a indicated by seismic data. Additionally Lower Lansing/Marmaton/Ft Scott/Cherokee reservoir porosity development. Secondary zones of interest include the Dakota or J Sandstone, Mississippian, and Osage porosity reservoir development. The key control well used for correlation purposes while drilling was the Harris 19-3 (SE SE Sec 11, 9S, 56W) drilled by Sohio.

CONCLUSIONS

There were no significant shows throughout any interval of the Columbine #8. All potential reservoir development appears clearly water productive.

After thorough review of e-logs, gas and sample evaluations, and in accordance with conditions of approval specified by the COGCC, the Columbine #8-24 was plugged and abandoned.

Gregg Smith

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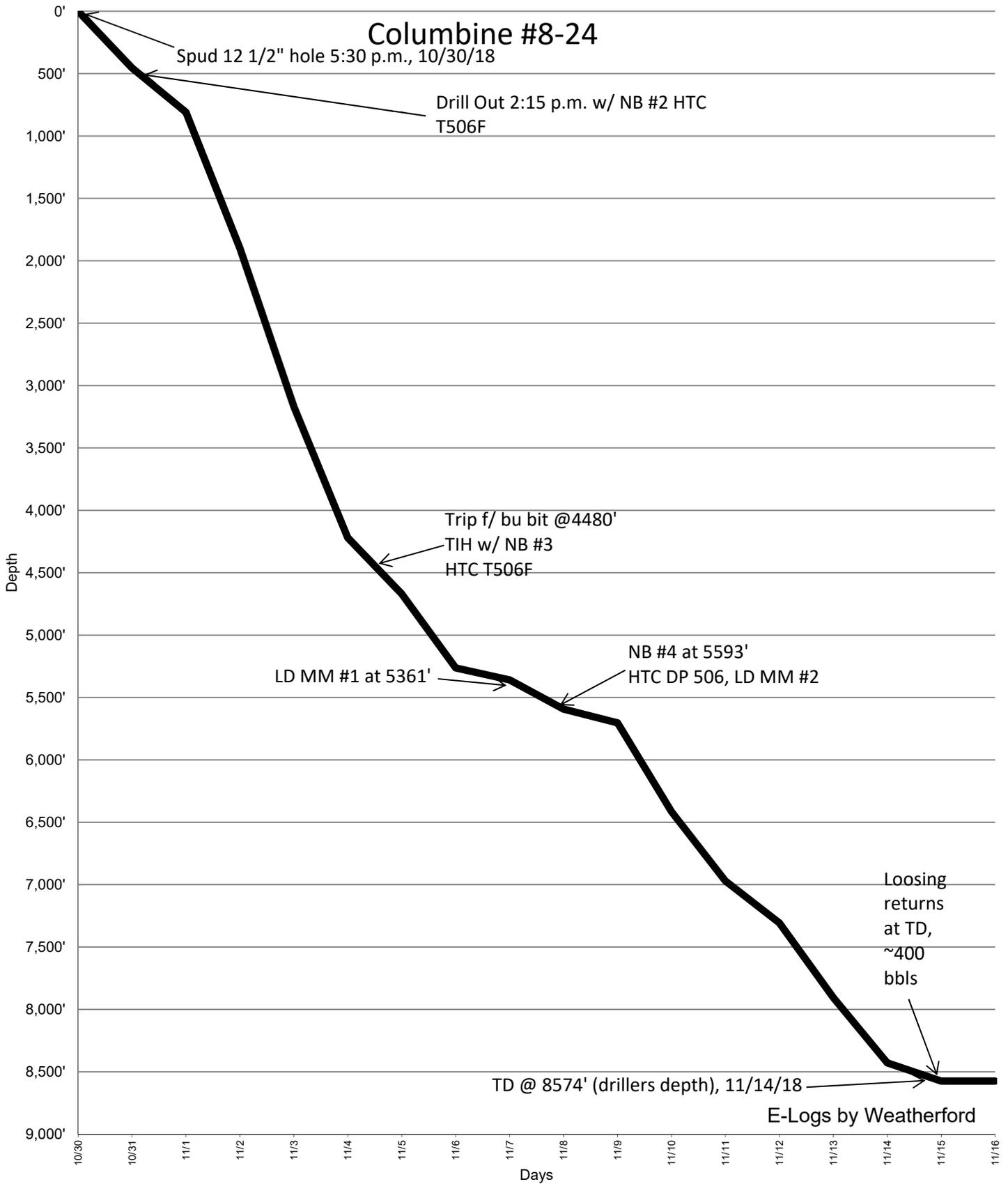


DAILY DRILLING CHRONOLOGY

Murfin Drilling Company, Inc.		Columbine #8-24		
Day	DATE (2018)	7:00 AM DEPTH (CST)	Footage Previous 24 Hrs.	Activity
1	10/30	0'	0'	Move in rig up rotary tools, spud 12 1/4" hole @ 5:00 p.m., drill to 455', make wiper trip to sfc, circulate and condition hole, run 11jts 24#, 8 5/8" surface casing, set @ 455', circulate and condition hole.
2	10/31	455'	455'	Rig up HIS cementers and pump 350sxs class H, 3%Gel, 2%CC, plug down 8:00 a.m., wait on cement, nipple up BOP trip in hole, pick up MWD, mud motor and NB #2, pressure test casing and BOP 700 psi and 400 psi for 15 minutes, tested OK, trip in hole, drilling.
3	11/1	810'	355'	Drilling, service rig, drilling.
4	11/2	1,900'	1,090'	Drilling, service rig, drilling.
5	11/3	3,170'	1,270'	Drilling. Service rig, drilling.
6	11/4	4,220'	1,050'	Drilling, trip for balled/plugged bit at 4480', trip in hole with NB #3, HTC T506F, trip in hole, circulate and condition hole, drilling.
7	11/5	4,670'	450'	Drilling, service rig, drilling.
8	11/6	5,263'	593'	Drilling, service rig, work on pumps, drilling to 5361', trip out of hole, change out mud motor, trip in hole, tight hole from 1800' to 1837'.
9	11/7	5,359'	96'	Trip in hole, ream to bottom, drilling.
10	11/8	5,593'	234'	Drilling to 5593', trip out of hole for NB #4, lay down mud motor, rig repair - kelly hose, change out swivel hammer union, trip in hole, drilling.
11	11/9	5,703'	110'	Drilling, work on MWD, drilling
12	11/10	6,415'	712'	Drilling, displace mud at 6695', drilling, make 20 stand wiper trip, drilling.
13	11/11	6,970'	555'	Drilling, loosing partial returns, ~100 barrels, while drilling at 7131', build volume and increase LCM to 6#, drilling.
14	11/12	7,307'	337'	Drilling. Service rig, drilling.
15	11/13	7,905'	598'	Drilling, service rig, drilling.
16	11/14	8,428'	523'	Drilling, drill to 8574' begin loosing returns, TD at 10:30 p.m. CST, build volume and mix lcm, regain full returns, circulate and condition hole for logs, make 50 stand wiper trip, break circulation 20 stands in hole and started loosing mud volume, mix mud and build volume.
17	11/15	8,574'	146'	Mix mud and build volume, regain full returns, finish wiper trip, circulate and condition hole, trip out of hole, rig up loggers and run in hole with logging tools, logging, rig down move out loggers, wait on orders
18	11/16	8,574'	0'	Wait on orders, lay down collars and trip in hole with plugging stands, trip out setting plugs, final plug down 4:30 a.m., rig down.
19	11/17	8,574'	0'	Rig released 8:30 a.m..

PENETRATION RATE / TIME CHART

Penetration Rate/Time Chart



MWD DIRECTIONAL SURVEYS/DRILLING PARAMETERS (EDR)

Murfin Drilling Company, Inc.

Columbine #8-24

Survey #	Hole Depth	Inclination	Weight On Bit	Rotary	Pump Pressure	Strokes pump #1	Pump Rate	Inclination (not true vert scale) .0° 2.0° 4.0°
	feet	deg°	1000 lbs	rev/min	psi	stk/min	gal/min	
1	456'	1.6°	0.7	79	760	66	441	
2	600'	1.6°	0.7	80	849	66	441	
3	900'	1.0°	1.2	107	1047	66	441	
4	1,200'	1.4°	7.1	137	1477	67	451	
5	1,500'	.9°	2	148	1089	66	441	
6	1,800'	.9°	0.5	115	1133	66	441	
7	2,100'	.5°	5.1	120	1325	64	427	
8	2,400'	.6°	6.3	119	1420	66	441	
9	2,700'	.5°	5.3	118	1342	66	441	
10	3,000'	.6°	0.8	113	1373	66	440	
11	3,300'	1.1°	1.8	131	1255	65	436	
12	3,600'	1.6°	1.5	127	1232	65	437	
13	3,900'	1.7°	3.3	128	1282	65	436	
14	4,200'	1.1°	3.7	123	1485	66	438	
15	4,500'	.9°	8.7	106	1387	61	409	
16	4,800'	2.8°	5.8	149	1512	63	436	
17	5,100'	.3°	15.8	92	1606	62	415	
18	5,400'	.3°	32.8	84	1844	68	456	
19	5,700'	.5°	11.7	112	1155	64	430	
20	6,000'	.9°	4.4	116	1237	65	434	
21	6,300'	.6°	15.8	114	1273	65	431	
22	6,600'	.9°	21.0	140	1300	65	431	
23	6,900'	2.1°	8.4	109	1147	65	436	
24	7,200'	1.3°	10.3	114	899	55	361	
25	7,500'	.7°	16	143	1346	65	389	
26	7,800'	1.2°	17.1	119	1347	61	411	
27	8,100'	-	16.8	155	1433	54	361	
27	8,400'	-	17.8	120	1362	56	372	

MUD RECORD

Operator	Murfin Drilling Company, Inc.	County & State	Lincoln Co.	Pump 1	6	X	16	62	SPM	Casing Program	8 5/8	set at 455'
Well	Columbine #8-24	Location	SE NE Sec.24, T9S, R56W	Pump 2	6	X	16			Hole Size:	5 1/2	
Contractor	Murfin Drilling Co.	Spot	2040'FNL, 600' FEL	D.P.	4.5 in.	16.6 XH				12.25" to 455'	DISPLACE	"@ 6,700'
Stockpoint	Lamar, CO	Spud Date	10/30/2018	Engineer	Tony Maestas	Collar	6.25 in.	621'		7 7/8 to TD	Total Depth	8574'

Report #	DATE	DEPTH	WEIGHT	VISCOSITY			GELS	pH	FILTRATION		FILTRATION ANALYS			SAND	RETORT			L.C.M.	Pump Press. PSI	CUMULATIVE COST	Remarks and Treatment
	2018	feet	lb/gal	Sec API	PV	Yp	10 sec / 10 min.	Strip Meter	ml API	Cake 32nds	Pres. #/BBL	Cl ppm	Ca ppm	Sand %	Solids %	Oil %	Water %				
1	10/24	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	MIRU
2	10/31	455'	8.4	H	-	-	-	-	-	-	-	300	-	-	-	-	-	-	-	\$ 1,927.33	WOC
3	11/1	1010'	8.9	36	6	9	4/17	7.0	10.4	-	-	300	40	-	4.2	-	95.8	-	-	\$ 2,612.11	Drilling
4	11/2	2054'	8.9	32	-	-	-	7.0	n/c	-	-	300	40	-	4.2	-	95.8	-	-	\$ 3,929.62	Drilling
5	11/3	3166'	8.9	34	4	9	3/16	7.0	n/c	-	-	300	40	-	4.2	-	95.8	-	-	\$ 4,024.52	Drilling
6	11/4	4240'	9.0	51	15	16	12/28	7.0	16.0	-	-	300	40	-	5.0	-	95.0	-	-	\$ 5,870.65	Drilling
7	11/5	4671'	9.4	78	19	23	15/41	7.0	12.0	-	-	300	40	-	7.8	-	92.2	-	-	\$ 6,815.01	Drilling
8	11/6	5267'	9.1	36	6	10	4/14	7.0	n/c	-	-	300	160	-	5.6	-	94.4	-	-	\$ 8,563.61	Drilling TOH & switch out mud motor
9	11/7	5361'	9.2	53	15	16	12/29	7.0	n/c	-	-	300	280	-	6.4	-	93.6	-	-	\$ 8,563.61	Drilling
10	11/8	5593'	9.1	39	10	11	6/18	7.0	n/c	-	-	300	440	-	5.6	-	94.4	-	-	\$ 10,343.04	TOH for mud motor TOH for mud motor Lay
11	11/9	5723'	9.1	38	8	10	5/17	7.0	n/c	-	-	300	560	-	5.6	-	94.4	-	-	\$ 10,343.04	Drilling down mud motor
12	11/10	6419'	9.1	41	10	11	7/17	7.0	n/c	-	-	500	680	-	5.6	-	94.4	-	-	\$ 12,076.13	Drilling
13	11/11	6915'	9.1	56	17	21	14/35	9.0	9.6	2	-	500	120	-	5.6	-	94.4	-	-	\$ 16,453.98	Drilling
14	11/12	7349'	9.1	72	19	23	15/40	11.0	7.2	1	-	500	40	-	5.6	-	94.4	5 #	-	\$ 23,698.86	Drilling Loast 100 bbl fluid at 7131'
15	11/13	7923'	9.3	82	20	26	17/48	10.5	7.2	1	-	500	40	-	7.2	-	92.8	5 #	-	\$ 27,810.78	Drilling GOE calling shots on LCM
16	11/14	8428'	9.4	82	20	25	17/47	10.5	8.0	1	-	500	40	-	7.8	-	92.2	3 #	-	\$ 29,844.05	Drilling Lost 300 bbl fluid at 8574'
17	11/15	8574'	9.4	70	19	22	15/40	10.5	6.4	1	-	500	40	-	7.8	-	92.2	18 #	-	\$ 38,165.63	Cir at TD. TD at 8574'.
18	11/16	8574'	9.4	74	19	23	16/47	10.0	7.2	1	-	500	40	-	7.8	-	92.2	16 #	-	\$ 39,667.73	TIH after Log
19	11/17	8574'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	\$ 39,667.73	Final

Columbine #8-24 Sample Descriptions

SAMPLE EVALUATIONS WERE CONDUCTED ON THE COLUMBINE #8-24 FROM 4500' TO 4900' BEGINNING ABOVE THE LANSING FORMATION, AND CONTINUED FROM 6900', ABOVE THE LANSING FORMATION TO TOTAL DEPTH. LAGGED SAMPLES WERE CAUGHT BY RIG PERSONNEL AND DESCRIBED WHILE WET. ALL ANNOTATED TOPS ARE LOG TOPS. SAMPLE DESCRIPTION INTERVALS ARE BASED ON DRILLERS DEPTHS.

Depth **Descriptions**

4500-4520 Very poor samples after bitumen tripolitic, predominant coarse SHALE cuttings and slough, no visible SANDSTONE present.

Dakota SANDSTONE 4507' (+886')

4420-4440 Poor Samples persist, SANDSTONE rare trace only, white to light gray, hard, fine to very fine grained, sub angular to sub rounded, well sorted and consolidated, milky white silica matrix, rare dirty gray with dark gray SHALE partings, tight throughout, no fluorescence, stain, odor or cut

4540-4550 SANDSTONE; Highly interpretive, predominant SHALE slough and cavings, rare trace dirty gray, hard, very fine gray, well trace dark gray SHALE partings, tight throughout.

J SANDSTONE 4544' (+849')

4550-4560 Distinct increase amount to SANDSTONE; milky white to light gray, firm to friable, fine grained, sub rounded occasional well rounded, moderately well sorted, well consolidated, predominant with milky white matrix, trace very fine red orange mineral inclusion, no visible porosity, no fluorescence, stain, odor or cut.

4460-4480 SANDSTONE; milky white to light gray, firm to friable, fine to very fine grained, sub rounded to sub angular, moderately well sorted, well consolidated, spotty milky white clay matrix, trace light gray SHALE partings, tight throughout, no fluorescence, stain, odor or cut

4580-4600 SANDSTONE; light gray to off white, friable to firm, very fine grained, sub angular, well sorted and consolidated, spotty white clay matrix, occasional with very thin black carbonaceous stringers, trace very friable with light tan stain, poor to fair intergranular porosity, no fluorescence, odor or cut. SHALE gray to dark gray, firm, subblocky, predominant fine gritty to silty texture, trace fine black carbonaceous inclusion.

4600-4620 SANDSTONE; light gray to off white, firm to friable, fine to very fine grained, sub rounded, moderately well sorted, well consolidated, common with fine to micro black carbonaceous inclusion, spotty white clay matrix, trace fair intergranular porosity, no fluorescence, stain, odor or cut, SHALE; dark gray to black, firm, platy to blocky, subfissile, trace black, carbonaceous. BENTONITE; light gray, soft, platy, bright yellow mineral fluorescence.

4620-4640 SANDSTONE; milky white to tan to light gray, friable to firm, fine to upper fine grained, sub rounded to well rounded, well consolidated, moderately well to poor sorted, occasional scattered fine to micro carbonaceous debris, occasional spotty milky white silica matrix, occasional fair intergranular porosity, predominant tight, no fluorescence,

Columbine #8-24 Sample Descriptions

stain, odor or cut. SHALE; gray to dark gray continued as above. BENTONITE; bright yellow mineral fluorescence, continued as above.

4640-4650 SANDSTONE; white to tan to light gray, friable to firm continued as above, trace very hard, milky white silica matrix, tight throughout, no fluorescence, stain, odor or cut SHALE; continued as above

4650-4660 SANDSTONE; white to milky white to light gray, friable to firm, fine to very fine grained, sub angular to sub rounded, well sorted and consolidated, occasional scattered fine carbonaceous inclusion, predominant tight with trace fair intergranular porosity, no fluorescence, stain, odor or cut, SHALE; gray to dark gray, continued as above.

4660-4680 SHALE; gray to dark gray, firm, platy subfissile, occasional carbonaceous, abundant cavings. SANDSTONE continued as above, tight throughout, no fluorescence, stain, odor or cut

4680-4700 SANDSTONE; light to dirty gray, firm, very fine grained to silty, common argillaceous with assoc dark gray SHALE, tight throughout.

4700-4750 SHALE; gray to dark gray, firm, subblocky predominant sandy to silty, trace thin SANDSTONE stringers, trace carbonaceous in part.

4750-4790 SHALE; gray to dark gray to black, firm, platy, subfissile, predominant fissile, carbonaceous in part.

Cheyenne 4793' (+600')

4790-4830 SHALE; gray to dark gray continued as above, predominant cavings. SANDSTONE trace only, white to light gray, firm to hard, fine grained, sub rounded, well sorted and consolidated, occasional milky white non calcareous clay matrix, tight throughout, no fluorescence, stain, odor or cut

4830-4840 SHALE; continued as above, predominant dark gray, firm, subfissile carbonaceous.

4840-4870 SANDSTONE; trace only, samples predominant dark gray SHALE cavings, white to light gray, firm to friable, fine grained, sub rounded to sub angular, well sorted and consolidated, silica with spotty white clay matrix, rare glauconite, tight throughout, no fluorescence, stain, odor or cut

4870-4900 SANDSTONE; trace only continued as above, trace very good loose grains, no visible porosity, no fluorescence, stain, odor or cut. SHALE; continued as above abundant cavings.

Columbine #8-24 Sample Descriptions

RESUME SAMPLE DESCRIPTIONS

- 6900-6920 LIMESTONE' tan to light gray, firm to hard, blocky, fine to microcrystalline, occasional micro pyrite inclusion, tight throughout.
- 6920-6950 LIMESTONE; tan to light brown, common hard, blocky, microcrystalline, dense, occasional with fine grained scattered ooids and occasional fossil fragments, trace poor interparticle porosity, no stain, odor or cut. SHALE; dark gray, firm, splintery, occasional carbonaceous in part.
- 6950-6980 LIMESTONE; light brown; hard, blocky, microcrystalline, trace finely crystalline, earthy luster, fossil in part, rare brown, micro sucrosic texture, possible dolomitic in part, tight throughout. SHALE; gray to dark gray, occasional black, firm, platy, subfissile, trace pale green, sub waxy, trace carbonaceous.
- 6980-7000 LIMESTONE; tan to light brown, hard, blocky, fine to medium crystalline, trace fine granular to sucrosic texture, dolomitic in part, no to poor visible porosity, no stain, odor or cut. SHALE; dark gray to black, firm, platy, trace carbonaceous.
- 7000-7020 LIMESTONE; tan to light brown, hard, platy to blocky. predominant finely crystalline, trace fine granular texture, srg, possible dolomitic in part, tight throughout. SHALE; abundant dark gray to red orange cavings, trace black, subfissile, carbonaceous in part.
- 7020-7040 SHALE; gray to dark gray, firm to soft, platy, subfissile, occasional carbonaceous in part, abundant up to hole cavings. LIMESTONE; continued as above, tight throughout.
- 7040-7050 LIMESTONE; medium to light brown, hard, blocky to platy, microcrystalline, trace granular, argillaceous, tight throughout. SHALE; abundant cavings continued as above.
- 7050-7060 LIMESTONE; off white to light tan to medium brown, firm to hard, blocky, micro to finely crystalline, rare granular with poor inter-particle porosity, occasional soft chalky, no stain, odor or cut.

Lansing 7056' (-1663')

- 7060-7080 LIMESTONE; off white to light tan, firm to soft, blocky, finely crystalline, abundant earthy to chalky, occasional microcrystalline, dense, sub lithographic texture, tight throughout. SHALE; gray to gray green to dark gray, firm to soft, platy, trace carbonaceous.
- 7080-7100 LIMESTONE; off white to tan, common medium brown, hard, blocky, microcrystalline, lithographic texture, common with earthy to chalky texture, tight throughout.
- 7100-7120 LIMESTONE; tan to light brown, firm to hard, subblocky, fine to microcrystalline, occasional with fine granular texture earthy luster, trace fair to poor intrprt porosity, ff fossil, no stain, odor or cut
- 7120-7130 NO SAMPLE, loosing returns

Columbine #8-24 Sample Descriptions

- 7130-7150 LIMESTONE; off white to tan to light brown, hard to firm, fine to microcrystalline, common dense, lithographic texture, tight throughout.
- 7150-7170 LIMESTONE; tan to off white to light brown, hard, blocky, microcrystalline, common soft, chalky to earthy, rare micro fragmental with poor inter particle porosity, no stain, odor or cut. SHALE; black to dark gray, firm, platy, common carbonaceous in part.
- 7170-7190 LIMESTONE; tan to light brown, firm, subblocky, finely crystalline, occasional light gray, granular, argillaceous in part, trace loose coarse fossil fragments, no to poor visible porosity, no stain, odor or cut. SHALE; dark gray to black, firm platy, predominant carbonaceous, trace pale green to gray green, granular texture.
- 7190-7210 LIMESTONE; tan to medium brown, firm, finely crystalline, predominant mottled texture, fragmental with scattered fossil fragments, trace light gray sandy to silty in part, tight throughout.
- 7210-7230 LIMESTONE; tan to light brown, continued as above, distinct increase dark brown to dark gray, firm, micro granular, very argillaceous with scattered black carbonaceous inclusion, tight throughout, trace CHERT dark brown, sharp, opaque. SHALE; dark gray to black, firm platy, common carbonaceous.
- 7230-7250 LIMESTONE; tan to brown to dark brown, firm to hard, subblocky, fine to medium ic crystalline, abundant scattered very fine fossil fragments, common argillaceous to carbonaceous in part, trace light gray silty to sandy in part, tight throughout. SHALE; dark gray to black, occasional carbonaceous, occasional pale green to light gray, granular texture.
- 7250-7270 LIMESTONE; gray to light gym friable to firm, common silty to sandy in part, occasional tan, microcrystalline, common dark brown to gray, argillaceous, rare carbonaceous, tight throughout. SHALE; dark gray to black, continued as above.
- 7270-7290 LIMESTONE; medium to light brown, soft to firm, predominant mottled, fragmental earthy with scattered poor sorted fossil fragments, occasional earthy to chalky, soft, occasional dark brown mottled texture, argillaceous in part, poor visible porosity trace poor micro chalky porosity only.
- 7290-7310 LIMESTONE; light tan to light brown, firm to hard, blocky, microcrystalline, trace earthy, fossil, tight throughout.

Stark 7306' (-1913')

- 7310-7320 LIMESTONE; light tan, firm to soft, blocky, finely crystalline, trace earthy to chalky, trace fossil in part, rare with thin white calcite stringers, tight throughout, no stain, odor or cut
- 7320-7330 NO Sample
- 7330-7340 LIMESTONE; dark brown to dark gray, firm, blocky, predominant mottled with fine to micro black argillaceous and carbonaceous stringers and inclusion, trace black

Columbine #8-24 Sample Descriptions

carbonaceous SHALE stringers and partings, common good granular texture, trace silty in part, occasional grad to slightly calcareous SHALE, tight throughout, no stain, odor or cut.

- 7340-7360 LIMESTONE; dark gray to dark brown, predominant argillaceous, carbonaceous in part, rare trace sandy with scattered very fine angular quartz grains, no visible porosity, very faint non streaming cut, no stain odor.
- 7360-7370 LIMESTONE; dark brown to dark gray, firm, subblocky, predominant mottled texture with scattered dark gray to black carbonaceous and argillaceous stringers and micro inclusion, no visible porosity, trace scattered ooids rare with fair oolmoldic porosity, no stain, odor or cut.
- 7370-7390 LIMESTONE; dark gray to dark brown, hard, blocky, predominant fine to micro granular texture, argillaceous, spotty micro black carbonaceous inclusion, occasional black SHALE partings, occasional light tan to light brown, soft, mottled, earthy with scattered fine grained ooids, predominantly tight with trace poor oolmoldic porosity, no stain, odor or cut.
- 7390-7400 SHALE; gray to dark gray, firm, platy, common fine gritty texture, occasional carbonaceous, trace fossil. LIMESTONE; light tan to gray to dark brown, predominant argillaceous continued as above, no stain, odor or cut

Mound City 7400' (-2007')

- 7400-7410 LIMESTONE; off white to tan to light brown, firm to hard, finely crystalline, common fine to coarse fragmental with scattered fossil fragments and occasional ooids, trace granular dolomitic in part, trace poor inter particle porosity, no stain, odor or cut. SHALE; gray to dark gray, common black, carbonaceous, continued as above.

Exline 7412' (-2019')

- 7410-7420 LIMESTONE; off white to light tan, soft to firm, blocky, predominant earthy to chalky, trace fossil in part, chalky micro porosity only, no stain, odor or cut. SHALE; continued as above.
- 7420-7440 LIMESTONE; off white to tan, soft to firm, predominately chalky, fragmental with coarse angular fossil fragments, trace pellet rare ooids, trace poor inter particle porosity, predominant chalky micro porosity, no stain, odor or cut.

Pleasanton 7432' (-2039')

- 7440-7450 LIMESTONE; tan to off white, firm to soft, finely crystalline, scattered micro fossil fragments, trace ooids, occasional chalky in part, chalky micro porosity only, rare with light brown possible dead oil stain. N odor or cut.
- 7450-7470 LIMESTONE; off white to tan, firm to soft, finely crystalline, common with scattered medium grained ooids, trace fair to good oolmoldic porosity, common chalky in part and loose chalky material, no stain, odor or cut.

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7470-7480 LIMESTONE dirty gray, to light gray to light tan, soft to firm, predominant fine to micro granular, sandy in part, occasional argillaceous, tight throughout no stain, odor or cut

Marmaton 7430' (-2077')

7480-7490 LIMESTONE; gray to light gray to dirty gray, sandy, argillaceous, continued as above, common light tan, firm, finely crystalline, predominant fossil, no visible porosity, trace loose soft chalky fossil rare with bright yellow fluorescence faint non streaming cut, no stain, odor.

7490-7500 LIMESTONE; light tan, firm to soft, blocky, finely crystalline, common earthy texture with scattered very fine to medium grained ooids, no to poor visible porosity, no stain, odor or cut.

Marmaton B 7504' (-2111')

7500-7520 LIMESTONE; tan to light brown, firm to hard, finely crystalline, common with scattered poorly sorted ooids, trace fair to poor inter oolites porosity, no stain, odor or cut.

Marmaton C 7518' (-2125')

7520-7530 LIMESTONE; off white to tan to light brown, firm to hard, subblocky finely crystalline common fine fossil fragments, occasional silty to sandy, trace poor inter particle porosity, no stain, odor or cut.

7530-7540 LIMESTONE tan to light brown, firm to hard, blocky, fine to microcrystalline, trace earthy fossil, no visible porosity, no stain, odor or cut. SHALE; dark gray to black, firm, platy, subfissile trace carbonaceous.

7540-7550 LIMESTONE; light tan to light brown, hard to firm, subblocky, fine to microcrystalline, trace earthy fossil, tight throughout.

7550-7560 LIMESTONE; brown to dark brown, hard, blocky, finely crystalline. predominant mottled, argillaceous trace granular texture, tight throughout.

Fort Scott 7554' (-2161')

7560-7580 LIMESTONE; tan to brown to light brown, hard, blocky, fine to microcrystalline, occasional mottled, pseudo fossil. SHALE; gray to light gray, soft to firm, common light gray.

7580-7600 LIMESTONE; light tan, firm to soft, mottled abundant distinct dark gray ooids, possible re-worked, common with earthy matrix, no to poor micro porosity, no fluorescence, stain, odor or cut.

7600-7610 SHALE; dark gray to dark brown to black, firm, platy to subblocky, predominant with micro black to dark gray carbonaceous inclusion, trace fissile, carbonaceous.

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Lower Ft Scott 7602' (-2209')

7610-7630 LIMESTONE; tan to light brown, firm to hard, blocky, fine to microcrystalline, trace earthy to chalky, fine fragmental, trace fossil fragments, no visible porosity, no fluorescence, stain, odor or cut.

Excello 7619' (-2226')

7630-7640 SHALE; dark gray to dark brown to black, firm, platy, occasional fine granular texture, occasional black very carbonaceous, predominant carbonaceous in part. LIMESTONE; continued as above.

Breezy Hill 7635' (-2242')

7640-7660 LIMESTONE; tan to off white to light brown, firm to hard, blocky, common fragmental, fossil, tight throughout, no stain, odor or cut, SHALE; continued as above.

7660-7770 LIMESTONE; tan to light brown, firm to hard, finely crystalline, off fossil, trace light brown, granular texture, dolomitic in part, occasional argillaceous in part, tight throughout, no stain, odor or cut

Oakley 7667' (-2274')

7670-7680 LIMESTONE; light tan, firm to hard, platy, finely crystalline, abundant micro to fine granular texture, no to poor visible porosity, common/ very bright yellow fluorescence, weak non streaming cut, fair to good crush cut, no stain, fair odor.

Celia 7674' (-2281')

7680-7700 LIMESTONE; brown to dark brown to dark gray, hard, blocky, microcrystalline, predominant dense, trace granular, dolomitic, trace argillaceous in part, tight throughout. SHALE; dark gray to black, firm platy subfissile, predominant carbonaceous in part.

7700-7720 LIMESTONE; brown to dark brown to dark gray, hard, blocky, microcrystalline, common mottled texture, with fine to micro PYR, occasional argillaceous stringers, tight throughout. SHALE; continued as above.

7720-7730 SHALE; dark gray to black, firm, platy, subfissile, predominant very carbonaceous. LIMESTONE; brown to dark brown, continued as above, occasional light brown, mottled, with scattered dark brown to dark gray pellet and occasional ooids, no visible porosity, no stain, odor or cut

7730-7750 LIMESTONE; tan to brown to dark gray, hard, blocky to platy, microcrystalline, dense, occasional mottled texture, with poor sorted dark gray fossil fragments, tight throughout. SHALE; dark gray to black, continued as above.

Johnson Zone 7753' (-2360')

7750-7770 SHALE; dark gray to black, firm, platy to subblocky, subfissile, predominant carbonaceous, trace fine granular texture. LIMESTONE; brown to dark brown, hard, subblocky, fine to microcrystalline, common micro granular texture possible dolomitic, argillaceous in part, tight throughout.

Columbine #8-24 Sample Descriptions

7770-7790 SHALE; dark gray to black, firm, platy, subfissile, predominant carbonaceous. LIMESTONE; tan to light brown, firm to hard, subblocky, finely crystalline, common mottled granular texture dolomitic in part, occasional dark gray argillaceous inclusion, tight throughout.

7790-7820 LIMESTONE; light tan to light brown to gray, firm to hard, subblocky, finely crystalline, common with fine to micro granular texture, dolomitic in part, occasional argillaceous with dark gray argillaceous inclusion and partings, occasional mottled earthy, fossil, tight throughout. SHALE; dark gray to black, continued as above.

Atoka 7820' (-2427')

7820-7850 SHALE; dark gray to black, predominant carbonaceous continued as above, occasional pale green to gray green, splintery, sub waxy. LIMESTONE; tan to brown to light gray, hard, subblocky, finely crystalline, commonly mottled, fossiliferous, occasional argillaceous in part, tight throughout.

7550-7870 LIMESTONE; tan to light gray, hard, fine crystalline, commonly mottled with dark gray pseudo ooid inclusion, occasional dark gray elongated pellet fragments, tight throughout. SHALE. dark gray to black, firm to soft, platy, predominant carbonaceous.

7870-7900 LIMESTONE; gray to dark gray to dark brown, firm to hard, fine to micro crystalline, occasional fine to micro granular texture, argillaceous, possible dolomitic in part, tight throughout. SHALE; gray to dark gray to black, firm, platy to blocky, occasional splintery, fissile, common carbonaceous.

7900-7920 LIMESTONE; brown to dark brown to gray, hard, blocky, microcrystalline, tight. SHALE; dark gray to black, firm, platy, occasional pale green to light gray, rare sub waxy, variegated.

7920-7950 LIMESTONE; brown to dark brown, hard, blocky, fine to microcrystalline, occasional fine to micro granular texture, dolomitic in part, trace argillaceous, tight throughout. SHALE; dark gray to black, firm, platy, subfissile, common carbonaceous, occasional pale green to light gray.

7950-7970 SHALE; gray to dark gray to gray green, firm, platy, occasional fissile splintery, occasional carbonaceous, trace sub waxy. LIMESTONE; brown to dark brown, hard, blocky, finely crystalline, trace granular dolomitic, trace loose fossil fragments.

7970-8000 SHALE; gray to dark gray to black, firm, platy to subblocky, occasional splintery, subfissile, trace mottled, variegated, predominant carbonaceous. LIMESTONE; tan to light brown, hard, blocky, finely crystalline, trace mottled texture, fossil in part, trace dolomitic in part, tight throughout.

8000-8020 LIMESTONE; tan to dark brown, firm to hard, finely crystalline, occasional soft, granular argillaceous, occasional with thin fossil fragments, tight throughout. SHALE; dark gray to black, firm to soft, splintery, subfissile, common carbonaceous.

Columbine #8-24 Sample Descriptions

- 8020-8050 SHALE; dark gray to black, firm, platy, splintery, fissile, carbonaceous, common pale green to gray green to light gray, occasional . scattered chalk carbonaceous inclusion, common sub waxy, rare variegated. LIMESTONE; continued as above.
- 8050-8070 LIMESTONE; brown to light brown to light gray, firm, finely crystalline, occasional mottled fossil, trace scattered ooids, trace granular dolomitic in part, tight throughout. SHALE; gray to dark gray to black, carbonaceous, continued as above.
- 8070-8080 SHALE; gray to dark gray to black, firm, splintery, carbonaceous, trace sub waxy variegated. LIMESTONE; tan to brown, hard, blocky, finely crystalline, rare fossil in part, tight throughout.
- 8080-8100 SHALE; dark gray to black, carbonaceous, continued as above. LIMESTONE; light tan, hard, blocky, finely crystalline, trace dark brown, mottled, coarsely fragmental with scattered angular fossil fragments, tight throughout.
- 8100-8120 LIMESTONE; brown to light brown, firm to hard, finely crystalline, common mottled with dark gray fossil fragments, tight throughout. SHALE; gray to dark gray to black, firm, platy, subfissile, splintery, carbonaceous.
- 8120-8140 SHALE; dark gray to black, firm platy, subblocky, predominant carbonaceous, trace gray green splintery, sub waxy, trace black carbonaceous partings and stringers. LIMESTONE; off white to light tan, hard, blocky, finely crystalline, common fossil, tight throughout.
- 8140-8150 SHALE; gray to dark gray to gray green, firm, splintery, subfissile, trace sub waxy, rare variegated, abundant carbonaceous. LIMESTONE, continued as above.

Morrow 8164' (-2771')

- 8150-8170 SHALE; gray to light gray to gray green, firm to soft, platy, splintery, trace sub waxy, rare variegated, trace black carbonaceous. LIMESTONE; tan to light brown, hard, blocky fine to microcrystalline, trace scattered coarse fossil fragments, tight throughout.
- 8170-8190 SHALE; gray to light gray, firm, splintery, subfissile, trace thin black vitreous carbonaceous stringers, and partings, LIMESTONE; continued as above.
- 8190-8200 SHALE; medium to dark gray, firm, splintery, subfissile, occasional black, carbonaceous. LIMESTONE; light tan, firm to hard, finely crystalline, occasional with micro pyrite, tight throughout.
- 8200-8210 SHALE; gray to light gray to gray green to trace red orange, firm, splintery, subfissile to fissile, trace sub waxy, rare variegated, carbonaceous in part. LIMESTONE; continued as above.
- 8210-8220 SHALE; continued as above, LIMESTONE; light tan to off white, hard, blocky, finely crystalline to microcrystalline, trace lithographic texture, tight throughout.

Columbine #8-24 Sample Descriptions

- SANDSTONE; rare trace only, white to clear, hard, medium to upper medium grained, angular, poor sorted, well consolidated silica, tight, no fluorescence, stain, odor or cut
- 8220-8230 SHALE; gray to dark gray to light gray to gray green, trace red orange, soft to firm, splintery, subfissile, trace sub waxy, rare variegated, occasional carbonaceous. LIMESTONE; light tan to light brown, hard, blocky, fine to microcrystalline, tight.
- 8230-8250 SHALE; continued as above, consolidated varicolored, red brown to gray green to pale green to tan to coppery, soft, splintery, sub waxy, trace variegated. LIMESTONE; tan to light brown, hard, blocky, fine to microcrystalline, tight.
- 8250-8270 SHALE; gray to dark gray, firm, splintery, subfissile, common light gray to gray green, soft, sub waxy, rare vgts, trace black, very carbonaceous, ca\radiate to COAL. LIMESTONE; continued as above.
- 8270-8290 SHALE; varicolored, gray to light gray to gray green to light green to red brown, soft to firm, splintery, fissile to subfissile, trace black very carbonaceous, rare variegated, LIMESTONE; off white to light tan, hard, blocky, finely crystalline, occasional earthy texture, tight throughout.
- 8290-8300 SHALE; varicolored; light gray to pale green to red brown, to gray to dark gray, occasional yellow green, soft, splintery, subfissile, common sub waxy, occasional variegated, trace black very carbonaceous.
- 8300-8320 SHALE; varicolored continued as above, trace with thin black carbonaceous stringers, trace pyritic, common variegated. LIMESTONE; off white to tan, firm, finely crystalline, occasional earthy mottled, fossil, trace light brown microcrystalline, with lithographic texture, tight throughout.
- 8320-8330 SHALE; varicolored, continued as above, trace black vitreous coal fragments. LIMESTONE light tan to light brown, hard, blocky, microcrystalline, trace lithographic texture, tight throughout.
- 8330-8350 SHALE; varicolored, light gray to gray green to pale green to red brown to yellow, soft, splintery, subfissile, common variegated, sub waxy, trace black carbonaceous. LIMESTONE; light tan to off white, firm, finely crystalline, predominant earthy mottled texture, fragmental with trace coarse scattered fossil fragments, tight throughout.
- 8350-8360 LIMESTONE; tan to off white, firm to hard, finely crystalline, common with earthy to chalky texture, trace mottled, fossil, trace very coarse fossil fragments, trace loose coarse fossil fragments, rare sandy in part, tight throughout, no stain, odor or cut. SHALE; varicolored, continued as above, trace assoc shell fragments.
- 8360-8370 SHALE; varicolored, gray green, to light gray to pale green to red brown, firm to soft, splintery, sub waxy, occasional variegated, trace scattered fossil fragments, occasional carbonaceous.

Columbine #8-24 Sample Descriptions

8370-8390 SHALE; varicolored, continued as above. LIMESTONE; pale tan to light brown, firm to hard, subblocky, earthy, common mottled, fossil, trace loose PYR, tight throughout.

Keyes 8391' (-2998')

8390-8400 SHALE; gray to dark gray, firm, splintery, trace black vitreous COAL, common varicolored continued as above. LIMESTONE; light tan to off white, hard, earthy mottled fossil, tight throughout.

8400-8410 SHALE; gray to dark gray, firm, splintery, subfissile, occasional carbonaceous, occasional gray green to pale green, sub waxy, variegated.

8410-8430 LIMESTONE; tan to off white, firm to hard, finely crystalline, common earthy, mottled, fossil, occasional with assoc dark green chlorite, trace micro crystalline, dense, tight throughout SHALE continued as above. SANDSTONE trace only white to light gym firm to hard, fine grained, sub angular well sorted and consolidated, silica, common with very fine dark green glauconite pellet, tight throughout, no stain, odor or cut.

8430-8450 LIMESTONE; tan to light brown, firm to hard, predominant earthy texture, mottled with dark gray pseudo fossil and argillaceous inclusions, rarely sandy in part, trace glauconite, tight throughout. SHALE; varicolored continued as above, predominant Morrow cavings. SANDSTONE; trace only, light gray, very fine grained, silica, glauconite, tight, no fluorescence, stain, odor or cut.

8450-8460 Poor samples, abundant Morrow SHALE cavings. LIMESTONE; tan to light brown, firm to hard, finely crystalline, common earthy texture, common very fine sandy, trace scattered dark gray fossil fragments, no visible porosity. SANDSTONE; trace only continued as above.

8460-8470 DOLOMITE; trace only, brown to dark brown, firm to hard, fine to micro granular texture, argillaceous, tight throughout. LIMESTONE and SHALE; continued as above.

8470-8480 Poor Samples continued. SANDSTONE; trace only white to clear, firm to friable, very fine to fine grained, sub rounded to sub angular, well sorted and consolidated, silica matrix, no to poor visible intergranular porosity, no fluorescence, stain, odor or cut. LIMESTONE; tan to light brown, continued as above, common sandy, glauconite, occasional bright orange SHALE partings and stringers, tight throughout, no stain, odor or cut. SHALE predominant varicolored Morrow cavings.

Mississippian 8470' (-3077')

8480-8500 LIMESTONE; tan to light brown, hard, blocky, microcrystalline, occasional medium brown, lithographic texture, tight throughout. Predominately varicolored Morrow SHALE cavings.

8500-8520 LIMESTONE; tan to light brown, hard, blocky, fine to microcrystalline, trace granular texture, rare fossil, trace light tan, lithographic texture, tight throughout. Very poor sample predominant Morrow SHALE cavings.

Columbine #8-24 Sample Descriptions

Osage 8518' (-3125')

- 8520-8530 Poor sample, Morrow SHALE cavings continued. DOLOMITE; trace only pale orange to pale pink to red orange, friable to firm, finely crystalline, occasional fine to micro granular to sucrosic texture, no visible porosity, no fluorescence, stain, odor or cut.
- 8530-8550 Poor samples continued as above. DOLOMITE pale orange to pink to red orange, occasional brick red, firm to soft, blocky, finely crystalline, trace granular to sucrosic texture, trace light pink, very soft gummy material, no visible porosity, no stain, odor or cut. LIMESTONE; light tan, hard, blocky, fine to microcrystalline, tight.
- 8550-8560 Poor samples continued as above. DOLOMITE; pale red orange to pink, to brick red, firm to hard, finely crystalline, trace calcite stringers, no visible porosity, rare with flat quartz grains, no fluorescence, stain, odor or cut.
- 8560-8574 Poor samples predominant Morrow SHALE cavings. DOLOMITE continued as above, tight throughout, trace with scattered quartz grains. SANDSTONE slightly trace only, loose clear. occasional frost, unconsolidated, sub rounded to well rounded, upper medium to lower coarse grained, quartz grains, no fluorescence, stain, odor or cut. possible assoc with DOLOMITE.