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Mr. J.E. Rakaskas
125 N. Market
Suite 1750
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Dear Joe,

Please find attached detailed descriptions of the cores taken during the drilling of the Theodore Gore Company #4 Findlay, Trego County, Kansas. These are intended to supplement those descriptions given in the geological report.

Sincerely,

Martin K. Dubois

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MKD:td

Lynn,

These zone designations are used locally and may correlate to Morgan's zones. If you get around to looking at them, please let me know if they do.

Marty

#4 Findlay
23-11-21w

Core #1 L-KC "F" Zone
 Core depth 3622-37.5 (3625-40.5 on log)
 Recovered 13.3 feet

	3622-22.5	Shale, green-gray, with thin (1-2 cm) limestone stringers; abundant crinoids, moderate amount of brachiopods and bryozoan.
Marine shale	3622.5-24.2	Shale, upper part is green, lower part is dark green to black; slightly fossiliferous in upper part (brachiopods and crinoids).
Marine transgressive limestone	3624.2-25.5	Limestone, light tan, very fine crystalline, very dense; fossiliferous, mostly small bivalves and few crinoids (wackestone)
	3625.5-26.1	Shale, dark green-gray, limestone nodules; abundant crinoids
	3626.1-27	Limestone, tan, dark green shale laminae; very abundant "Osagia" grains up to 1 cm (shaley packstone-grainstone)
Nonmarine shale	3627-30.8	Shale, dark red-gray in upper part, dark (lost 2 ft.)*maroonish-green in lower part
Marine regressive limestone	3630.8-31.7	Limestone, tan, with green shale laminae; fine crystalline, dense (mudstone)
	3631.7-32.6	Limestone, light tan, fine-medium grained, rounded skeletal grains and pellets, tightly cemented (packstone)
	3632.6-35	Limestone, tan; coarse grained, ooids and coated grains most with bivalve nuclei, few gastropods and fusulinids, coarser towards base; poor to fair intergranular porosity from 32.6-32.8, 33.2-33.7, 33.9-34.7, porosity is bleeding oil, remainder is tightly cemented.
	3635-35.8	Limestone, tan; very coarse grained, coated grains in upper part; green shale laminae towards base; tightly cemented (packstone-grainstone)
Marine shale	3635.8-36.3	Shale, green
Marine transgressive limestone	3636.3-36.8	Limestone; coarse grained, "Osagia" grains (up to 1.5 cm), bivalve nucleus, tightly cemented (packstone)
Nonmarine shale	3636.8-37.5	Shale, green-gray
	(lost 0.2 ft.)*	Core barrel wedged at 3637.5

* A total of 2.2 feet of core was lost from these intervals.

Core #2 L-KC "G" Zone
 Core depth 3646-64 (3649-67 on log)
 Recovered 18 feet

Marine transgressive limestone	3646-49	Limestone, light tan, very fine crystalline; small bivalves (less than 1 cm) towards top; few large (1-2 cm) vugs and vertical fractures filled with calcite; shaley (green) and stylolitic in lower part (wackestone-mudstone)
Nonmarine	3649-50.3	Limestone solution breccia in green shale matrix; pebble and cobble sized limestone clasts are fenestral mudstone
Marine regressive limestone	3650.3-53.8	Limestone, light tan; unconnected fenestral voids (2-6 mm) most abundant in upper part, most are open, some are filled with green clay or calcite; solution fissures (in upper part) filled with green clay; stylolitic in lower part; few large vugs filled with calcite; no effective porosity, no show (fenestral mudstone)
	3653.8-55	Limestone, white to light tan; fine rounded skeletal grains, mostly bivalves, and possibly pellets, scattered whole gastropods; large vertical burrow measures 3 cm wide and 25 cm long is filled with wall rock, carbonate mud, and calcite cement; tightly cemented throughout, no show (fine grained packstone)
	3655-57	Limestone, white to light tan; medium grained, rounded bivalves and few whole gastropods; poor moldic and intergranular porosity, no show (bivalve packstone-grainstone)
	3657-59	Limestone; as above only tightly cemented
	3659-60	Limestone, grayish-green; slightly fossiliferous; becomes silty downward; tight (wackestone)
Marine shale?	3660-63.7	Shaley limestone and limey shale, generally more shale downward; shale is green in upper part and dark gray in lower part; very abundant fusulinids especially in upper part, crinoids, ramose bryozoan, and brachiopods (shaley wackestone)
?	3663.7-64	Limestone, tan, very fine crystalline, very dense (mudstone)

Core #3 L-KC "J" Zone
 Core depth 3726-38 (3729-41 on log)
 Recovered 12 feet

Base of marine regressive limestone	3726-27.1	Limestone, light gray, fine crystalline; fossiliferous, fusulinids, brachiopods, bryozoan, crinoids; very dense (wackestone)
Marine shale	3727.1-27.8	Shale, dark green-gray
Marine transgressive limestone	3727.8-28.2	Limestone breccia, light tan, pebble and cobble sized breccia result of solution, are cemented tight (original texture was mudstone)
Marine regressive limestone	3728.2-35.5	Limestone, light gray, fine crystalline; very abundant solution fissures and large irregular vugs (1-2 cm) are filled with green shale (makes up 20-30% of rock), green shale filled vertical solution fissure (1-2 cm wide) from 28.4-29.2 and opens to width of core from 29.2-29.7, another fissure extends from 30.4-31.2; upper one foot (28.2-29.2) may be fenestral mudstone; dark oil stain in proximity of many fissures and vugs extend less than 0.5 cm into rock matrix; very slight show of free oil along few fissures and vugs at 3729, 3730 and 3730.5-32 (mudstone)
	3735.5-38	Limestone; light gray; fine crystalline; abundant green shale laminae; dense; no show (shaley mudstone)

Core #4 L-KC "K" Zone
 Core depth 3738-58 (3741-61 on log)
 Recovered 20 feet

Base of regressive limestone	3738-39.6	Limestone, gray, very fine crystalline, dense; abundant green shale laminae; few fusulinids and crinoids (mudstone)
	3739.6-41.2	Limestone, gray, very fine crystalline; abundant thin shale laminae (green); moderately abundant fusulinids, few brachiopods and crinoids (wackestone)
Marine shale	3741.2-41.8	Shale, dark green to dark green-gray; silty in upper part
Marine transgressive limestone	3741.8-42.6	Limestone, tan; scattered "Osagia" in upper part very abundant "Osagia" in lower part accompanied by 1 cm caliche lithoclasts [Wackestone (top), Packstone (base)]
Nonmarine	3742.6-44.4	Caliche, nodular and massive in a maroon and maroonish green siltstone matrix
	3744.4-45.7	Siltstone, maroonish green and maroon; scattered caliche nodules
	3745.7-47.7	Shaley siltstone, maroonish green and maroon; moderate amount of carbonate appears to be limestone residue essentially in place (possibly caliche)
Marine regressive limestone	3747.7-49.1	Limestone, light tan, very fine crystalline, dense; few large irregular vugs filled with calcite; minor dark oil staining in horizontal bands 0.5-2 cm thick making appx. 10% of rock, no show of free oil (mudstone)
	3749.1-51.3	Shale, green
	3751.3-52.6	Limestone, tan; medium grained oolites, very tightly cemented; few large (1 cm) rounded grains from underlying mudstone; slight show of dark staining (no free oil) along a few bedding plains, less than 5% of rock is stained (oolitic grainstone)
	3752.6-58	Limestone, light tan, very fine crystalline, very dense; small bivalves in lower part; stylolitic throughout with minor dark staining along the stylolites, very slight show of free oil along some of them, staining on less than 5% of rock (mudstone in upper part, wackestone in lower part)

Core #5 Conglomerate and Arbuckle
Core depth 3848-61 (3850-63 on log)
Recovered 13 feet

	3848-51.2	Shaley limestone and limey shale; large irregular carbonate nodules in a dense shale matrix, green at top and maroon at base, shale increases downward; irregular fractures filled with calcite
Conglomerate	3851.2-55.7	Conglomerate; pebbles, cobbles, and small boulders in green shale matrix; cobbles and boulders of limestone some with bedding at high angles, abundant chert pebbles (yellow, orange, gray) few dolomite cobbles in lower part are bleeding oil
Arbuckle	3855.7-61	Dolomite, light tan to tan; fine crystalline and sucrosic in upper one foot which is tight except along fractures; fine to medium crystalline from 57-61, poor intercrystalline porosity from 57-60, poor vuggy porosity from 60-60.5, fair vuggy and fracture porosity from 60.5-61; all porosity is oil stained and bleeding oil; abundant fractures and irregular solution channels in upper four feet most filled with green and dark gray shale and pyrite (30-40% of total rock), less abundant in lower 1.3 feet (5-10% of rock); large stromatolite head at 59; slightly cherty in upper 4.3 feet.

Core #6 Arbuckle
Core depth 3861-67 (3863-69 on log)
Recovered 6 feet

- 3861-61.2 Dolomite, tan, fine crystalline, cherty (cream-colored); poor intercrystalline porosity, uniform oil stain
- 3861.2-61.5 Chert, cream-colored (stromatalite that has been replaced by chert) tight
- 3861.5-62.3 Solution breccia in green shale matrix (50% shale), abundant dark gray chert nodules and few dolomite breccia clasts.
- 3862.3-63.4 Dolomite, cream-colored, very fine crystalline, possibly stromatalitic, tight, very little oil stain
- 3863.4-63.8 Solution breccia as in 61.5-62.3
- 3864.3-64.8 Dolomite, tan, fine crystalline, lenticular dark gray chert nodules, poor intercrystalline porosity, uniform oil stain, bleeding oil
- 3864.8-65 Chert nodules, dark gray, in green shale matrix
- 3865-67 Dolomite, tan, with thin bands of dolomitized oolite (less than 10% of rock) having good moldic porosity; scattered small vugs are bleeding oil; poor intercrystalline porosity overall is uniformly oil stained, few solution channels that are filled with green shale

Core #7 Arbuckle
Core depth 3867-73 (3869-75 on log)
Recovered 6 feet

- 3867-67.8 Dolomite, tan, very fine crystalline; horizontal laminae (possibly algal) in lower part; tight in upper part, very poor intercrystalline porosity in lower part is bleeding oil, uniform light stain throughout
- 3867.8-68.9 Chert nodules (dark gray) and dolomite nodules (light tan) in green shale matrix (shale is appx. 50% of rock); dolomite is medium crystalline and tight except in lower part where poor intercrystalline porosity is bleeding oil, uniform light stain throughout
- 3868.9-69.7 Dolomite, tan, very fine crystalline and very tight in upper part; fine crystalline, poor intercrystalline porosity in lower part, bleeding a little oil; uniform light stain throughout
- 3869.7-70.9 Dolomite and chert with abundant solution channels filled with green shale (20% of rock); dolomite is tan, medium to coarse crystalline, poor intercrystalline porosity bleeding a little oil, uniform light stain throughout
- 3870.9-71.9 Fractured chert (light tan) and dolomite, tan, medium to coarse crystalline, poor-fair intercrystalline porosity, bleeding oil; green shale fills fractures
- 3871.9-72.5 Dolomite, high angle bedding (25 degrees) is possibly algal lamination, very fine crystalline, some laminae are oil stained others are not.
- 3872.5-73 Dolomite, tan, medium crystalline, very cherty (gray and light orange; large vugs and solution channels filled with green shale; poor intercrystalline, bleeding a little oil, uniform light stain throughout