

GEOLOGY

Summary of Previous Work

Amoco Australia Petroleum Company was awarded a permit to prospect for petroleum on Block O.P. 191, September 11, 1980. This permit covers 8854 square miles in the Northern Territory, Australia (Fig. 1) which Amoco currently operates in equal partnership with Kennecott Exploration (Australia) Ltd. (Sohio).

In 1981 and 1982 a series of shallow continuous coreholes was drilled, and surface geological mapping and sampling were conducted over the area to augment published Bureau of Mineral Resources regional mapping. The new subsurface stratigraphic control was combined with local and regional facies mapping, while fresh unweathered core was analysed for both reservoir properties and source quality. In 1983, 333 line kilometers of seismic data were acquired in O.P. 191 over the Broadmere prospect area which confirmed the presence of a large closed anticlinal structure at depth. Gravity and magnetic data were also acquired on all seismic lines.

Summary of Regional Geology

Three Proterozoic rock-groups are recognized in the area, from oldest to youngest, the Tawallah, McArthur and Roper River Groups (Fig. 2). Tawallah Group sediments consist of volcanics, clastics, and a few carbonates. The overlying McArthur consists of dolomites, black shales, occasional sandstones, and conglomerates. Development of a north trending pull-apart

basin by a northwest-trending right-lateral wrench system controlled deposition of the McArthur Group sediments. An initial phase of downwarping resulted in the deposition of red beds, sabkhas, and shallow water carbonates (Mallapunyah through Teena Formations).

Following this a series of high angle, north-trending normal faults formed. Relatively rapid subsidence of graben-like, pull-apart basins controlled deposition of deeper-water, organic rich mudrocks such as the Barney Creek and Lower Lynott Formations.

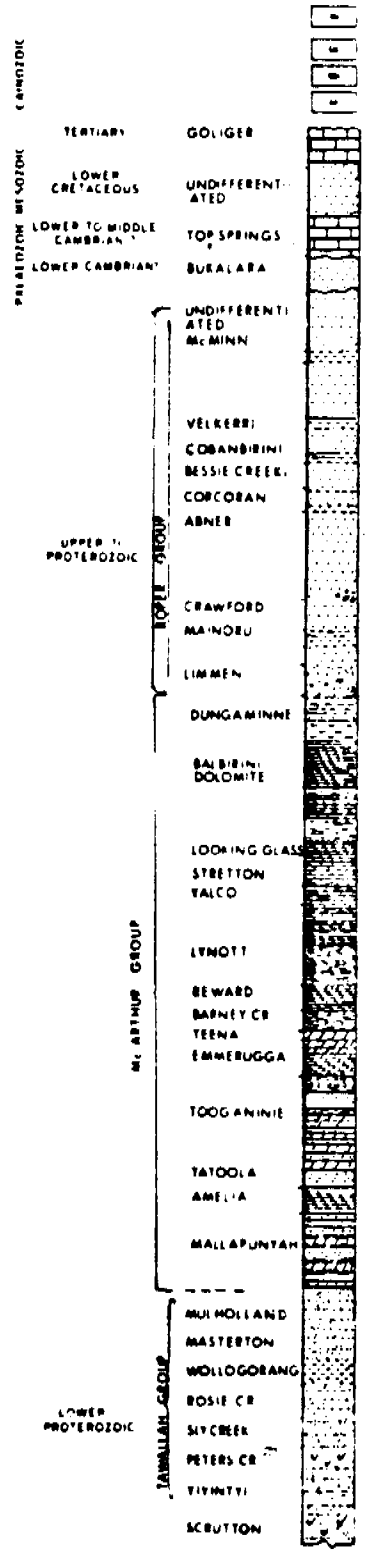
During the final phase of McArthur Group sedimentation more quiescent conditions prevailed. Fault movement was sporadic and of lesser magnitude. The result was deposition of shallow water carbonates (stromatolitic, intraclastic, oolitic), thin shale units, siltstones and sandstones (Middle Lynott through Dungaminnie Formations). Periods of emergence are evidenced by the presence of local paleokarsts within some carbonate units.

Regional downwarping of the basin maximized on the west flank, coupled with clastic deposition prograding from the west, constituted Roper Group sedimentation. Deposition of thick, clean, sheet sandstones and variably organic shales occurred. Concomitant with deposition of the Roper Group, reactivation of the north-trending normal faults through dextral-transcurrent motion caused the formation of en-echelon folds.

Following the Proterozoic little tectonic activity appears to have occurred. Flat lying Cambrian and Mesozoic cover is occasionally found and may represent remnants of what was substantial thickness.

GENERALIZED STRATIGRAPHY

McARTHUR RIVER AUSTRALIA



Stratigraphy after BMR

FIG. 2

Table 1

Formation Tops.

Age: Proterozoic. (1.3 to 1.46 BY est.)

Elevation : 555.4 ft. (169.3 m.). KB to Ground : 23.0 ft.(7.0 m.).

Group/Formation/Members.

Formation Tops.

	Measured Depth.		True Vertical		True Vertical	
			Depth.		Depth. Sub-Sea	
	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
<u>Roper Group.</u>						
Cobanbirini Fm.		Surface		Surface		Surface
Lansen Creek Shale						
Bessie Creek	1471	449.20	1473.79	449.20	895.39	272.90
Sandstone Fm.						
Corcoran Fm.	2680	816.86	2679.59	816.73	2101.19	640.43
Diorite Sill.	3198	974.75	3197.49	974.59	2619.09	798.29
Base Diorite Sill.	3767	1148.18	3766.39	1148.00	3187.99	971.70
Abner Sandstone Fm.	4339	1322.53	4338.25	1322.30	3759.85	1146.00
Hodgson Sandstone Mbr.	4339	1322.53	4338.25	1322.30	3759.85	1146.00
Jalboi Mbr.	5203	1585.87	5200.23	1585.03	4621.83	1408.73
Arnold Sandstone Mbr.	5311	1618.79	5307.56	1617.74	4729.16	1441.44
Crawford Fm.	6278	1913.53	6263.91	1909.24	5685.51	1732.94
Mainoru Fm.	6750	2057.74	6732.49	2052.06	6154.09	1875.76

Stratigraphy.

a) General.

Broadmere 1 spudded in the Cobanbirini Formation (Fig 3) of the Roper Group. The Broadmere sandstone was prognosed at approximately 600 feet (183 m.). However, the well spudded in the basal Lansen Creek Shale. The primary objectives in the Roper Group were the Bessie Creek Sandstone Formation, and Hodgson and Arnold Member sandstones. Each of these units was of well developed, clean quartz arenites, but silica cement has effectively occluded virtually all porosity.

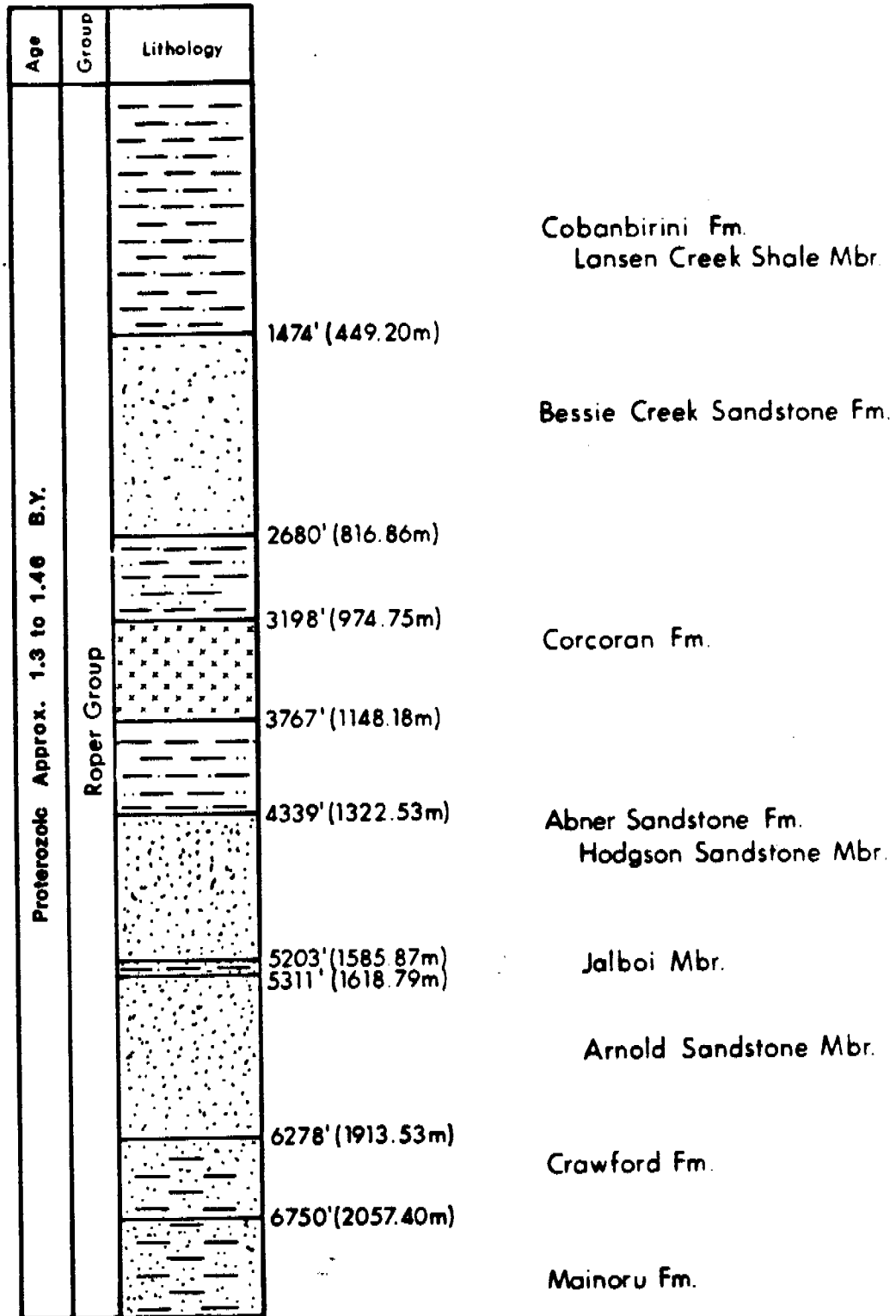
b) Stratigraphic Description by Formation and Member.

Cobanbirini Formation

Lansen Creek Shale Member

From 37 feet (11.28 m.) to 1100 feet (335.28 m.) the Lansen Creek Shale Member is predominately a consolidated grey to black, blocky to fissile shale. Common accessories include finely disseminated to botryoidal pyrite, polycrystalline quartz occurring as fracture fill material, and traces of calcite. From 1100 feet (335.28 m.) to the base at 1474 feet (449.20 m.), the facies changes to a mudstone/shale sequence. The mudstones are brown, silty to sandy, soft to firm, with blocky fracture and tight. The shales are predominately light grey-green to black, hard, fissile and non-calcareous. The base of the Cobanbirini Formation has a sharp contact with the underlying Bessie Creek Formation.

Broadmere 1
 Amoco Australia Petroleum Company
 McArthur River Basin
 O. P. 191 Northern Territory



T.D. 7133' (2174.14m) MD

All depths measured from R.K.B., 578 ft. (176.17m) above sea level

STRATIGRAPHIC CHART

Bessie Creek Sandstone Formation

The Bessie Creek Sandstone Formation, 1474 feet (419.20M.) to approximately 2410 feet (734.57 m.), is a massive, uniformly bedded, quartz arenite. The grain size is predominately medium to coarse, rarely fine, with sorting variable from poor to good. Samples were commonly disaggregated, most grains have euhedral terminations indicating common quartz overgrowths resulting in poor to no effective porosity. Accessories include pyrite, finely disseminated to botryoidal, and desiccated hydrocarbon to 1950 feet (594.36M).

From 2410 feet (734.57 m.) to the base at 2680 feet (816.86 m.) the sequence is a quartz arenite with interbedded to interlaminated siltstone red to violet, firm to hard, non-calcareous, very hematitic, and shale, violet to red, hard, non-calcareous and siliceous with fissile to blocky fracture. The shales are hematitic and clay rich. The contact with the underlying Corcoran Formation is gradational.

Corcoran Formation

The Corcoran Fm. from 2680 feet (816.86 m.) to the base at 4339 feet (1322.53 m.), is an interbedded to intercalated siltstone, shale and mudstone sequence. The dominant lithic type is shale/mudstone olive green-grey to dark grey-brown, variably silty, firm to hard, fissile, non-calcareous, siliceous. The siltstones are silica-cemented, tight, with argillaceous interbeds. Within the Corcoran Formation, from 3198 feet (974.75 m.) to 3767 feet (1148.18 m.), a diorite sill is present.

The diorite is dark green with white mottling, coarsely crystalline intergrowth of euhedral and anhedral light and dark silicate minerals. It appears as a relatively uniform unit varying only in crystal size.

The basal contact of the Corcoran Formation with the Hodgson Member of the Abner Sandstone Formation is sharp.

Abner Sandstone Formation

Hodgson Sandstone Member

The Hodgson Sandstone Member is a massive, uniformly bedded quartzite. Silica cement has nearly completely occluded all the effective porosity with traces of porosity only where a slight increase in hematitic cement and/or fracturing is present. Lithologically the sequence varies from fine to coarse grained but predominantly fine to medium grained. Color is reddish-brown to salmon due to common intergranular hematite.

Jalboi Member

The upper and lower contacts of the Jalboi Member are sharp, 5203 feet (1585.87 m.) and 5311 ft. (1618.79 m.) respectively.

The Jalboi Member a quartz arenite, predominantly fine grained with siliceous and, less common, hematitic cement. Interbeds of siltstone and shale occur. Both the siltstones and shales are maroon in color, sandy in part, non-calcareous and siliceous. Specular hematite is a rare to trace accessory.

Arnold Sandstone Member

The Arnold Sandstone Member is a massive, uniformly bedded quartz arenite/quartzite. Grain size varies from very fine to coarse but is predominately medium grained. Silica cement predominates with a trace of intergranular hematite. Trace to no effective porosity occurs through the unit. A lost circulation zone, probably caused by fracturing, was drilled in the Arnold Member. The contact with the underlying Crawford Formation is gradational.

Crawford Formation

The top of the Crawford Formation, 6278 feet (1913.53 m.), is the first occurrence of hematitic and glauconitic shale, and siltstone. The Crawford Formation is typically a fine to very fine grained sandstone with interbedded to interlaminated, hematitic, glauconitic, micaceous to micromicaceous siltstones and shales. Three coarsening upward cycles are apparent. The base, 6750 feet (2057.40 m.), is the beginning of the first cycle. The top of the Mainoru Formation is at the base of the first cycle.

Mainoru Formation

The Mainoru Formation was not completely penetrated, therefore the thickness is not known. Lithologically the sequence to the total measured depth of 7133 feet (2174.14 m.) is a sandstone, fine to very fine grained interbedded to interlaminated with siltstone and shale. Common accessories include, glauconite, pyrite and lithic fragments. Silica cement predominates with a trace of calcareous cement.

STRATIGRAPHY BY INTERVAL

Top Cobanbirini Fm: 37 ft. (11.28 m.)

Lansen Creek Shale Mbr. 37 to 145 ft. (11.28 to 44.50 m.)

Shale: Med/dk gy, hard, sub-fissile to fissile, pt v sl silty, pt pyritic with fn xtals on bedding surfaces, non- calc. No Shows.

146 to 710 ft. (44.50 to 216.41 m.)

Shale: Predom med to dark grey above 530 ft. (161.5 m.), hard to med soft, blocky to sub-fissile, thin interbeds of tan to light grey shale rare to common. Lt gy shale main lith below 530 ft. (161.54 m.), blocky to sub-fiss, hard to mod soft. Common fine disseminated pyr with occ pyr xtal aggrs, rare thin lam of tan dolomite, med to hd, blocky, argillac. From 300 to 310 ft. (91.44 to 94.49 m.), med/dk brn shale with abund v small spherical granules of dolomitized ooids, approx 0.2 mm in diameter. Scarce to common clear qtz vein material, with assoc pyr, occas clear to wht calcite vein filling. Fair Oil Show.

710 to 910 ft. (216.41 to 277.37 m.)

Shale: Lt to med green, firm to hard, blocky to sub-fissile, non-calc, rare finely disseminated pyr. Very rare pyr xtal aggr, very rare clear to transl qtz vein material with assoc pyr.
Trace Oil Show.

910 to 930 ft. (277.4 to 283.5 m.)

Shale: Med green/gr, mod firm to hd, blk to semi-fissile, non-calc, siliceous. No Shows.

930 to 1105 ft. (283.46 to 336.80 m.)

Shale: Lt green/gy grading to dk gry/blk, soft to med hard, sub-fissile, slightly calc. Common calcite xtals with Fe sulphides dissem throughout. Trace med to fine qtz xtals, sub-ang to sub-rounded. No Shows.

1105 to 1120 ft. (336.80 to 341.38 m.)

Shale: Dk gy to blk, fissile to blk, firm, non-calc, with thin interbeds of Shale: Lt gy/green, sub-fissile, soft to firm, non-calc, and Mudstone: Lt brn to brn, blk, firm to hard, non-calc, siliceous. No Shows.

1120 to 1270 ft. (341.38 to 387.10 m.) Mudstone: Lt brn, blk, soft to firm, non-calc, siliceous, interbedded with Siltstone: crmy wht, firm to hard, mottled text, non-calc, siliceous. No vis poros. Trace Oil Show.

1270 to 1360 ft. (387.10 to 414.53 m.)

Mudstone: Med gy to dk gy, firm, blk to sub-fissile, non-calc. No vis poros, interbd with Shale: Lt gy to med gy, firm to hard, blk to sub-fissile, non-calc. No Shows.

1360 to 1380 ft. (414.53 to 420.62 m.)

Mudstone: Lt green/gy, sub-fissile, firm, non-calc, clay-rich. Tr glauc (?). No vis poros. No Shows.

1380 to 1471 ft. (420.62 to 449.20 m.)

Shale: Dk gy to blk, fissile, firm to hard, non-calc, micro-micaceous.
No shows.

Top Bessie Creek Sandstone Fm: 1471 ft. (449.20 m.)

1471 to 1510 ft. (449.20 to 460.25 m.)

Sandstone:Clr to lt brn, fn to med-grnd, sub-ang to sub-rnd, disagg grains, tr siliceous cmt, fair appar poros (?), interbd with Shale: dk gy to blk, fissile, firm to hard, non-calc, micromicaceous. Tr Siltstone: clr to crmy, wht, fn-grnd, well sorted, v hard, v siliceous, tight. No Shows.

1510 to 1517 ft. (460.25 to 462.38 m.) Shale: Dk brn, soft to firm, clay-rich (kaolin), non-calc. Tr Sandstone. No vis poros. No Shows.

1517 to 1626 ft. (462.38 to 495.60 m.)

Sandstone:Clr to lt brn, med-grnd, mod sort, sub-ang to sub-rnd with common qtz overgrowths, predom disagg. Qtz Arenite, non-calc, siliceous. Fair appar poros? Thin rare interbeds of vfn Sandstone to Siltstone: med to dk brn, mod sort, sub-ang, v hard, siliceous cement, tight. Trace Oil Show.

1626 to 1670 ft. (495.60 to 509.07 m.)

Sandstone:Clr to lt tan, med-grnd with rare coarse grns, mod to well sorted, sub-ang to sub-rnd. Predom disagg qtz xtals. Qtz Arenite, non-calc. Fair appar poros? Trace siliceous cemented, med-grnd Qtz Arenite, fair to poor intergran poros? Common pyrite. Trace Oil Show.

1670 to 1760 ft. (509.02 to 536.45 m.)

Sandstone: Lt gy to tan, predom coarse-grained, mod to well sorted, ang to sub-ang, disagg qtz xtals. Qtz Arenite, non- calc. Fair appar poros, common pyrite. Trace Oil Show.

1760 to 1910 ft. (536.45 to 587.17 m.) Sandstone: Med to dk gy, med to coarse-grnd, mod sorting, sub-ang to sub-rnd, disagg qtz xtals. Qtz Arenite. Fair to poor app intergran poros? Trace silica cmted med grnd Qtz Arenite. Fair to poor app intergran poros? Common pyrite. Trace Oil Show.

1910 to 2070 ft. (582.15 to 630.94 m.)

Sandstone: Lt to med dk gy, predom med to coarse-grnd, disaggregated xtals, mod sorting, sub-ang to sub-rnd. Qtz Arenite, non-calc. Fair appar poros? Common Pyrite. Trace Oil Show.

2070 to 2100 ft. (630.94 to 640.08 m.)

Sandstone: Wht to lt gy, fn-grnd with tr med-grnd, well sort, sub-rnd. Qtz Arenite, non-calc, siliceous cement. Poor intergran poros. Trace pyrite. No Shows.

2100 to 2130 ft. (640.08 to 649.22 m.)

Sandstone: Wht to lt gy, fn to med grain, disaggregated, mod sort, sub-rnd to sub-ang. Qtz Arenite, non-calc, siliceous. Fair appar poros? Trace Pyrite. No Shows.

2130 to 2220 ft. (649.22 to 676.66 m.)

Sandstone: Med gy to tan, fn to med-grnd, mod to well sorted, sub-rnd to sub-ang. Qtz Arenite. V rare pyrite, non-calc. Poor vis intergran poros, siliceous cmt. No Shows.

2220 to 2280 ft. (676.66 to 694.94 m.)

Sandstone: Red to pink, fn to med-grnd, sub-ang to sub-rnd, mod to well sorted. Qtz Arenite. Commonly disaggregated, with hematitic stain common. Poor visible poros. Siliceous cmt. No Shows. Thin interbeds of Shale: violet to red, fissile to blk, hard, hematitic, non-calc, siliceous, clay-rich. Trace of vfn-grnd Siltstone: purple, hard, non-calc, siliceous cmt. Tight. No Shows.

2280 to 2400 ft. (694.94 to 731.52 m.)

Sandstone: Wht, fn to med-grnd, mod to well sorted, sub-ang to sub-rnd, hard, non-calc, Qtz Arenite. Poor visible intergran poros, siliceous cmt. No Shows.

2400 to 2446 ft. (731.52 to 745.54 m.)

Sandstone: Wht to pink, fn to med-grnd, mod sorting, sub-rnd, non-calc. Qtz Arenite. Poor visible intergran poros, siliceous cmt. No Shows.

2446 to 2470 ft. (745.54 to 752.)

Sandstone: Reddish brn to pink, fn to med-grnd, mod to well sorted, sub-ang to sub-rnd. Qtz Arenite. V common hematitic stain, predom disaggregated. Poor intergran poros, non-calc, siliceous cmt. Trace glauconite (?). No Shows.

2470 to 2610 ft. (752.86 to 795.53 m.)

Sandstone: Reddish brn to pink, med to coarse-grnd, well sorted, sub-ang to sub-rnd. Qtz Arenite. V common hematitic stain, predom disaggregated. Poor intergran poros, non-calc, siliceous cmt. No Shows. Thin interbeds of Siltstone: vfn-grnd, purple, well sorted, hard, siliceous, tight with no shows; and Shale: reddish-brn, fissile to blk, hard, hematitic, non-calc, siliceous.

2610 to 2680 ft. (795.53 to 816.86 m.)

Sandstone:Clr to crmy wht, fn to med, occ coarse-grnd, bimodal, mod to well sorted, sub-ang to sub-rnd. Qtz Arenite. Predom disaggregated. Poor intergran poros, non-calc, siliceous cmt. V rare glauconite (?). No Shows.

Top Corcoran Fm.: 2680 ft. (816.86 m.)

2680 to 2820 ft. (816.86 to 859.54 m.)

Shale: Blk to dk gy, blk to fissile, non-calc, trace Mudstone: firm to hard, non-calc, siliceous, tr mica. Interbed with Sandstone: lt to med gy, vfn-grnd, sub-ang, mod sorting, hard, poor to no vis porosity, silica cmt, and Siltstone: dk gy, blk, hard, non-calc, commonly argillaceous, silica cmt. Tight. No Shows.

2820 to 2929 ft. (859.54 to 892.76 m.)

Mudstone: Med to dk gy, blk to sub-fissile; trace Shale: med gy, fissile, firm to hard, non-calc, siliceous, interbed with Sandstone: lt gy to crmy wht, med to vfn-grnd, trace Siltstone: lt gy, sub-ang, mod sorting, hard, non-calc, siliceous. Poor to no vis porosity. No Shows.

2929 to 3090 ft. (892.76 to 941.83 m.)

Shale/Mudstone: Blk, blk to sub-fissile, firm, silty in part, non-calc, siliceous; interbed to inter-laminated with Sandstone: gy/green, fn to med-grnd, mod sorting, sub-ang, v hard, tight. Siliceous cmt. Common pyrite. No Shows.

3090 to 3120 ft. (941.83 to 950.98 m.)

Shale: Med to lt gy, fissile, soft to firm, non-calc, siliceous; interbed with Siltstone: lt gy to wht, vfn-grnd, mottled texture, firm to hard. Tight. Siliceous cmt. Common amorphous spots throughout. Trace pyrite. No Shows.

3120 to 3198 ft. (950.98 to 974.75 m.)

Shale: Lt green/gy, fissile to blk, hard to v hard, non-calc, siliceous.

Top of Diorite Sill: 3198 ft. (974.75 m.)

3198 to 3281 ft. (974.75 to 1000.05 m)

Diorite Sill: Dk green/wht, mottled, v hard, v ang fragments. Intergrowth of euhedral to anhedral wht to dk green silicate minerals, variable in coarseness of crystallinity.

3281 to 3295 ft. (1000.05 to 1004.32 m.)

Diorite Sill: Dk green to wht, mottled texture, v hard, v ang fragments. Intergrowths of euhedral to anhedral wht to dk grn silicate minerals, increasing in coarseness of crystallinity with depth, individual cuttings fragments commonly mono-crystalline.

3295 to 3302.33 ft. (1004.32 to 1006.55 m.)

Core No. 1, 100% recovery. See Appendix 1.

3302.33 to 3450 ft. (1006.55 to 1051.56 m.)

Diorite Sill: Dk green with wht and pink mottling, coarsely crystalline (avg crystal size approx 1 cm.), v hd, v ang fragments.

Intergrowth of euhedral to anhedral lt and dk silicate minerals:

Feldspar (predom plagioclase), pyroxene, and other ferromagnesian minerals. Tr pyrite, and tr sparry calcite (vein fill?).

Cuttings fragments commonly consist of individual crystals (monominerallic).

3450 to 3598 ft. (1051.56 to 1096.67 m.)

Diorite Sill: Dk green with wht mottling, coarsely crystalline (avg crystal size approx 1 cm.), v hd, v ang fragments. Crystalline intergrowth of euhedral to anhedral lt and dk silicate minerals: Feldspar (predom plagioclase), pyroxene and other ferromagnesian minerals, tr pyrite, cuttings fragments commonly monominerallic. Calcite not observed.

3598 to 3748 ft. (1096.67 to 1142.39 m.)

Diorite Sill: Dk green with wht mottling, coarsely crystalline (avg approx 1 cm.), v hard, v ang fragments. Crystalline intergrowths of euhedral to anhedral lt and dk silicate minerals. Feldspar, pyroxene and other ferromagnesian minerals, tr pyrite. Cuttings fragments commonly monominerallic.

3748 to 3767 ft. (1142.39 to 1147.18 m.)

Diorite Sill: Dk green, with wht mottling, med to coarsely x-talline to finely x-talline, v hd, v ang fragments. X-talline intergrowths of euhedral to anhedral lt and dk silicate minerals: Feldspar, pyroxene and other ferromagnesian minerals. Tr pyrite.

Base of Diorite Sill: 3767 ft. (1148.18 m.)

3767 to 3790 ft. (1148.18 to 1155.19 m.)

Siltstone: Lt to med gy/grn, granular, in part with indistinct grain boundaries, v hard, blk to conchoidal fracture, highly silicified; tr

Shale: Lt green, v hard, conchoidal fracture to fissile, non-calc, v siliceous. No Shows.

3830 to 3940 ft. (1155.19 to 1200.91 m.)

Shale: Lt green to gy, brittle, fissile to blk, v hard, non-calc,

siliceous, with thin bedded to interlaminated Siltstone: Lt green to wht, v hard, blk, v silica cmted. Tight. No Shows.

3940 to 4000 ft. (1200.91 to 1219.20 m.)

Siltstone: Lt grn to gy, no visible grain boundaries, blk fracture, v hard, non-calc, siliceous, tight, with thin interbeds of Shale: dk gy, sub-fissile to fissile non-calc, siliceous. Trace mica. No Shows.

4000 to 4060 ft. (1219.20 to 1237.49 m.)

Shale: Variable, between med gy and lt gy/green, blk to sub-fissile, firm to hard, non-calc, siliceous, tr to common glauconite (?). No Shows.

4060 to 4142 ft. (1237.49 to 1262.48 m.)

Shale: Lt gy/green, sub-fissile, firm to hard, non-calc, siliceous, with thin bedded to interlaminated Siltstone: med gy, no visible grain boundaries, blk fracture, hard, non-calc, siliceous. Trace glauconite. Tight. No Shows.

4142 to 4152 ft. (1262.48 to 1265.53 m.)

Siltstone: Med to dk grey, vfn-grained, mod to poor sorting, firm, indeterminate grain boundaries, non-calc, siliceous. Tight. No Shows.

4152 to 4173 ft. (1265.53 to 1271.92 m.)

Siltstone: Med to dk gry, vfn grnd, firm to hd, indeterminate grain boundaries, non-calc, siliceous. Tight. No Shows.

4173 to 4339 ft. (1271.93 to 1322.53 m.)

Shale: Med gry, sub-fissile to blk, firm, non-calc, siliceous, interbedded with Siltstone: med to dk gry, fn grnd, firm to hard, non-calc, siliceous. Trace mica and pyrite. Common dk grn to blk inorganic opaque x-tals. Tight. No Shows.

Top Abner Sandstone Fm. 4339 ft. (1322.53 m.)

Hodgson Sandstone Mbr.

4339 to 4382 ft. (1322.53 to 1335.63 m.)

Sandstone: Clear to crmy wht, fn to med grnd, poor to mod sorting, sub-ang to sub-rnd, blocky to conchoidal fracture.

Quartz Arenite. Very hard, siliceous cmt. No vis porosity. No Shows.
Shale: Lt to med gry, firm to hard, blocky to sub-fissile, non-calc, siliceous. No Shows.

4382 to 4420 ft. (1335.63 to 1347.22 m.)

Sandstone: Creamy wht to pink, fn to med grnd, poor to moderate sort, sub-rnded, Qtz Arenite. Blocky to conchoidal fracture, very common hematitic stain, hard. No vis porosity, siliceous cmt. No Shows.

4420 to 4440 ft. (1365.63 to 1353.31 m.)

Sandstone: Pink, fine to med grnd, moderate sort, common sub-rnded. Qtz Arenite. Blky fracture, firm to hard. Fair to poor vis intergranular porosity? Siliceous and hematitic cmt. No Shows.

4440 to 4467 ft. (1353.31 to 1361.54 m.)

Sandstone: Pink, fine to med grnd, moderate sort, common indistinct grain boundaries. Qtz Arenite/Quartzite. Conchoidal fracture, hard. No vis porosity, siliceous cmt. No Shows.

4467 to 4531 ft. (1361.54 to 1381.05 m.)

Sandstone (Quartzite): Pink, med to coarse grained, mainly indistinct grain boundaries with minor amounts showing sub-rnded x-tal faces, poor sort. Quartzite. Conchoidal fracture, very hard. No vis porosity, siliceous cmt. No Shows.

4531 to 4586 ft. (1381.05 to 1397.81 m.)

Sandstone (Quartzite): Pink to clear, predominantly indistinct grain boundaries with minor amt med to coarse grnd, poor to fair sort, sub-ang. Quartzite. Conchoidal fracture, very hard. No vis porosity, siliceous cmt. No Shows.

4586 to 4649 ft. 1397.81 to 1417.01 m.)

Sandstone (Quartzite): Pink to clear, predominantly indistinct grain boundaries with trace amt vis, med to coarse grnd, poor to fair sort, sub-ang. Quartzite. Conchoidal/blky fracture, very hard. No vis porosity, siliceous cmt. No Shows.

4649 to 4693 ft. (1397.81 to 1430.43 m.)

Sandstone (Quartzite): Pink to clear, predominantly indistinct grain boundaries with common med to coarse grnd, poor sort, sub-ang grains. Quartzite. Conchoidal/blky fracture, very hard. No vis porosity, siliceous cmt. No Shows.

4693 to 4770 ft. (1430.45 to 1453.91 m.)

Sandstone (Quartzite): Pink to clear, predominantly indistinct grain boundaries with common med to coarse grnd, poor to fair sort, sub-ang grains. Conchoidal fracture, very hard. No vis porosity, siliceous cmt. No Shows.

4770 to 4826 ft. (1453.81 - 1471.10 m.)

Sandstone (Quartzite): Creamy wht to reddish brown, common indistinct grain boundaries with trace med to coarse grnd, poor to fair sort, sub-ang to sub-rnded grns. Quartzite, Conchoidal to blk fracture, hard. No vis porosity, siliceous cmt with a trace of hematite cmt. No Shows.

4826 to 4943 ft. (1470.96 to 1506.66 m.)

Sandstone (Quartzite): Creamy wht to reddish brown, predominately indistinct grain boundaries with trace, med to coarse grnd, poor to fair sort, sub-ang grns, commonly hematitic. Conchoidal to blk fracture, hard. No vis porosity, silica and tr hematite cmt. No Shows. Fracture porosity inferred from a slight increase in penetration rate.

4943 to 5020 ft. (1506.66 to 1530.11 m.)

Sandstone (Quartzite): Creamy wht to reddish brown, predominately indistinct grn boundaries with trace, med to coarse grnd, poor to fair sort, sub-ang grns, commonly hematitic. Quartzite. Conchoidal fracture, hard. No vis porosity, silica and hematite cmt. No Shows.

5020 to 5030 ft. (1530.11 to 1533.14 m.)

Sandstone (Quartzite): Creamy wht. Indistinct grn boundaries. Quartzite. Conchoidal fracture, v hard. No vis porosity, siliceous cmt. No Shows.

5030 to 5043 ft.(1533.14 to 1537.11 m.)

Sandstone (Quartzite): Creamy wht to reddish brown, predominately indistinct grn boundaries with trace med to coarse grnd, poor to fair sort, sub-ang grns, commonly hematitic. Quartzite. Conchoidal fracture, hard. No vis porosity, silica and hematite cmt. No Shows.

5043 to 5104 ft.(1533.14 to 1555.7070 m.)

Sandstone (Quartzite): Creamy wht to pink, predominately indistinct grn boundaries with trace med to coarse grnd, poor to fair sort, sub-ang grns. Quartzite. Conchoidal fracture, hard. No Shows.

5104 to 5140 ft.(1555.70 to 1566.67 m.)

Sandstone (Quartzite): Creamy wht to pink, predominately indistinct grn boundaries with trace med grnd, poor to fair sort, sub-rnd grns. Quartzite. Conchoidal fracture, hard. No vis porosity, siliceous cmt. No Shows.

5140 to 5150 ft.(1566.67 to 1569.72 m.)

Sandstone (Quartzite): Dk red, common indistinct grn boundaries with common med grnd, mod sort, sub-rnd grns. Quartzite. Blky to conchoidal fracture, hard. V common intergranular hematite, trace specular hematite? No vis porosity, siliceous and hematitic cmt. No Shows.

5150 to 5183 ft.(1569.72 to 1579.78 m.)

Sandstone (Quartzite): Creamy wht to pink, predominately indistinct grn boundaries with trace med grnd, poor to fair sort, sub-rnd grns.

Quartzite. Conchoidal fracture, hard. No vis porosity, siliceous cmt. No Shows.

5183 to 5203 ft.(1579.78 to 1585.87 m.)

Sandstone: Creamy wht to pink, fn to med grnd, mod sort, rnd, to sub-rnd.

Qtz Arenite/Quartzite. Common indistinct grn boundaries. Blky to conchoidal fracture, hard. No vis porosity, silica cmt with trace hematite cmt. No Shows.

Jalboi Mbr: 5203 ft. (1585.87 m.)

5203 to 5267 ft.(1585.87 to 1605.38 m.)

Sandstone: Creamy wht to reddish brown, fn grnd, mod to well sort, rnd to sub-rnd. Common hematite. Qtz Arenite. Trace indistinct grn boundaries.

Blky fracture, firm to hard. No vis porosity, silica and hematitic cmt.

Interlaminated with Siltstone: maroon to reddish brown, very hematitic, siliceous, firm, blky fracture, micaceous. No vis porosity. No Shows.

5267 to 5270 ft.(1605.38 to 1606.30 m.)

Sandstone: Creamy wht to reddish brown, fn grnd, mod to well sort, sub-rnd to rnd. Qtz Arenite. Blky fracture, firm to hard, non-calc. Trace to common hematite. No vis porosity, silica cmt with trace hematite cmt. No Shows. Interlaminated to interbedded with Siltstone: reddish brown to maroon. Blky fracture, firm, non-calc. Micaceous and v hematitic. No vis porosity. No Shows.

5270 to 5311 ft.(1606.30 to 1618.79 m.)

Siltstone: Reddish brown to maroon. Blky fracture, firm, non-calc. Micaceous and v hematitic. No vis porosity. No Shows. Interbedded to interlaminated with Sandstone: creamy wht to reddish brown, fn grnd, mod to well sort, sub-rnd to rnd. Qtz Arenite. Blky fracture, firm to hard, non-calc. Trace to common hematite. No vis porosity, silica cmt with trace hematite cmt. No Shows.

Top Arnold Sandstone Mbr: 5311 ft. (1618.79 m.)

5311 to 5375 ft.(1618.79 to 1638.30 m.)

Sandstone: Creamy wht to pale yellow, fn to med grnd, mod to well sorted, sub-rnd, Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. No Shows. Interbedded grading with depth, to interlaminated Siltstone: maroon to reddish brown, blky fracture, firm. Micaceous and v hematitic. No vis porosity. No Shows.

5375 to 5442 ft.(1638.30 to 1658.72 m.)

Sandstone:Clr to v pale yellow, fn to med grnd, well sorted, sub-rnd to rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. Trace hematite stain. No Shows.

5442 to 5546 ft.(1658.72 to 1690.42 m.)

Sandstone:Clr to pale reddish brown, fn to med grnd, well sorted, sub-rnd to rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. Trace intergranular hematite and specular hematite? No Shows.

5546 to 5595 ft.(1690.42 to 1705.36 m.)

Sandstone: Creamy wht to reddish brown, fn to med grnd, mod to well sorted, sub-rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. Trace to common intergranular hematite and specular hematite. No Shows.

5595 to 5620 ft. (1705.36 to 1712.98 m.)

Sandstone: Pale pink to reddish brown, vfn to coarse grnd, mod to well sorted, sub-ang to sub-rnd. Qtz Arenite. Blky fracture, firm. Trace intergranular porosity, siliceous and hematitic cmt. Trace interstitial kaolin. No Shows.

5620 to 5636 ft.(1712.98 to 1717.85 m.)

Sandstone: Creamy wht to pale yellow, fn to med grnd, mod to well sorted, sub-rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. No Shows.

5636 to 5640 ft. (1717.85 to 1719.07 m.)

Sandstone: Creamy wht to pale yellow, fn to med grnd, mod to well sorted, sub-rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt. No Shows.

5640 to 5670 ft.(1719.07 to 1728.22 m.)

Sandstone: Translucent to pale pink, fn to coarse grnd predominately med grnd, poor to fair sort, sub-ang. Qtz Arenite. Blky to conchoidal fracture, hard. No vis porosity, siliceous with trace hematite cmt. No Shows. Interlaminated with Sandstone: reddish brown, fn grnd, poor sort, sub-ang. Blky fracture, firm. Trace to poor vis porosity, hematitic cmt with common siliceous cmt. No Shows.

5670 to 5747 ft.(1728.68 to 1751.68 m.)

Sandstone:Clr to reddish brown, fn to med grnd, mod to well sort, sub-rnd to rnd. Qtz Arenite. Blky fracture, firm to hard. No vis porosity, siliceous cmt with trace to common intergranular hematite and specular hematite. No Shows.

5747 to 5770 ft (1752.13 to 1759.15 m.)

Sandstone: Clear to wht to reddish to maroon, dom fine w/some medium and very fine, mod to well sorted, dom sub-rnd w/rnd and sub-ang. Dominant silica cement completely infilling all pore space with variable hematite cement ranging from trace to abundant. Relict grain boundaries visible, breakage dominantly across primary grains. No visible porosity. No Shows.

5770 to 5830 ft.(1759.15 to 1777.44 m.)

Sandstone: Clear, wht to light grey, pink, buff. Dominantly fn grnd with minor vfn med and rare coarse. Mod to well sorted, sub-rnd with minor sub-ang and round. Very hard, dense, brittle. Quartz overgrowth cement with minor dusty hematite, dark grey to black, specular. Hematite locally abundant. Variable rare to minor earthy red hematite cmt becoming more abundant below 5820 ft. Rare cherty lithics, trace kaolinitized vis, porosity. No Shows.

5830 to 5851 ft.(1777.44 to 1783.84 m.)

Sandstone: Fine to med grnd, sub-round to round, mod to well sorted, quartz overgrowth cmt completely infills porosity. Black specular and maroon hematite cmt common to abundant. No vis porosity, hard brittle and blocky to splintery fracture, primary grain outlines clearly vis, fracture through grains. No Shows.

5851 to 5876 ft.(1783.84 to 1791.46 m.)

Sandstone: Fine to vfn grnd, minor medium. Buff to deep maroon colour. Sub-ang to sub-rnded, well sorted. Most returns as single grains of quartz overgrowth and hematite coated quartz clasts. No vis porosity in larger SS chips. Probably slightly consolidated in subsurface. No Shows.

5876 to 5896 ft. (1791.46 to 1797.56 m.)

Sandstone: Fine to medium grained, subround to rounded, mod to well sorted, wht, buff to maroon, brick red. Variable mixture of hematite and silica cement completely infilling all visible porosity. Hematite

dominantly earthy red, black specular type also variable common.- All returns as sandstone chips, moderately to very hard, brittle, blocky to splintery fracture. SS breaks through grains except in most hematitic areas which tend to break around grains. No Shows.

5896 to 5906 ft.(1797.56 to 1800.61 m.)

Sandstone: Light grey to red-brown, dom fine to medium grnd, well sorted, sub-rnded to rnd. Authigenic quartz and hematitic cements. No visible porosity. Variable qtz and specular hematite fracture fill. No Shows.

5906 to 5983 ft.(1800.61 to 1823.62 m.)

Sandstone: Translucent to pale pink, dominantly fn to med grnd, mod to well sorted, sub-rnded. Blky fracture, firm to hard. No vis porosity. Siliceous cmt with trace hematitic cmt. Rare specular hematite. No Shows.

5983 to 5990 ft.(1823.62 to 1825.95 m.)

Sandstone: Translucent to pale pink, dominantly fn to med grnd, mod to well sorted, sub-rounded. Blky fracture, firm to hard. No vis porosity, siliceous cmt with trace of hematitic cmt. V rare specular hematite. No Shows. Trace Shale: lt green, blocky fracture, soft to firm, calc. No Shows.

5990 to 6045 ft. (1825.75 to 1842.52 m.)

Sandstone: Creamy wht to pale pink, fn to med grnd, predominately fn grnd, mod to well sorted, sub-rnd to rnd. Blky fracture, hard. No vis porosity, siliceous cmt with trace hematitic cmt. Common authigenic Quartz: translucent to clear, v hard, conchoidal fracture, occurring as fracture fill, decreasing with depth. No vis porosity. No Shows.

6045 to 6095 ft. (1842.52 to 1857.76 m.)

Sandstone: Creamy wht to pale pink, fn to med grnd, rare coarse grains mod to well sorted, sub-rnd to rnd. Blky/ conchoidal fracture, hard to v hard. No vis porosity, silica cmt with trace hematitic cmt. Trace specular hematite and glauconite. No Shows.

6095 to 6137 ft. (1857.76 to 1870.55 m.)

Sandstone: Creamy wht to pale pink, fn to med grnd, mod to well sorted, sub-rnd to rnd. Blky to conchoidal fracture, hard to v hard. No vis porosity, siliceous cmt. Trace hematite and trace to common glauconite. No Shows.

6137 to 6216 ft. (1870.55 to 1894.64 m.)

Sandstone: Clear to reddish brn, fn to med grnd, mod to well sorted, sub-rnd. Common indistinct grain boundaries (authigenic qtz) and qtz overgrowths. Blky to conchoidal fracture, hard to v hard. No vis porosity, siliceous cmt. Trace specular hematite, hematite and glauconite. No Shows.

6216 to 6240 ft. (1894.64 to 1901.95 m.)

Sandstone: Clear to reddish brown, fn to med grnd, rare coarse grnd, mod sort, sub-rnd. Common to rare (decreasing with depth) indistinct grain boundaries (authigenic qtz), and qtz overgrowths. Blky to conchoidal fracture, hard. No vis porosity, siliceous cmt. Trace specular hematite, and hematite. No Shows.

6240 to 6278 ft.(1901.95 to 1913.53 m.)

Sandstone: Pale pink to reddish brown, fn to med grnd, mod to well sorted, sub-rnd. Rare authigenic qtz and qtz overgrowths. Blky fracture, firm to hard. No vis porosity. Siliceous cmt with v common intergranular hematite and specular hematite. No. Shows.

Top Crawford Fm: 6378 ft. (1913.53 m.)

6278 to 6290 ft.(1913.53 to 1917.19 m.)

Sandstone: Clear to reddish brn, pred fn grnd, rare med grnd, poor to fair sort, sub-rnd. Firm, siliceous cmt. Trace to common intergranular hematite, and trace kaolin. No vis porosity. No Shows. Interbedded with

Sandstone: lt green to pale yellow, fn to vfn grnd, poor sort, sub-rnd.

Rare to common qtz overgrowths. Common glauconite. No vis porosity. No Shows.

6290 to 6340 ft.(1917.19 to 1932.43 m.)

Sandstone: Clear to lt red/brn, med to coarse grnd, occ fn grnd, sub-ang to sub-rnd, poor sort. Firm, siliceous cmt. Trace intergranular hematite. Common kaolin and glauconite. No vis porosity. No Shows. Thin inter-

beds of Shale: variable from dk grey to blk, green to red/brn, fissile to blk, non-calc, siliceous (tuffaceous?). Soft to firm. V glauconitic and hematitic. Trace to common kaolin. No Shows.

6340 to 6361 ft. (1932.43 to 1938.83 m.)

Sandstone: Clear to pale yellow, fn to med grnd, predom fn grnd, poor to fair sort, sub-rnd to rnd. Firm, siliceous cmt. Rare intergranular hematite. Trace of common qtz overgrowths. Trace glauconite. No vis porosity. No Shows.

6361 to 6370 ft. (1938.83 to 1941.48 m.)

Sandstone: Clear to pale yellow, pink, fn to med grnd, poor to fair sort, sub-rnd. Firm, siliceous cmt. Rare to common intergranular hematite. Trace qtz overgrowths. No vis porosity. No Shows.

6370 to 6380 ft. (1941.58 to 1944.62 m.)

Sandstone: Variable from clear to lt green/grey to grey/black, fn to med grnd, poor sort, sub-rnd to rnd. Firm to hard, blk to conchoidal fracture. No vis porosity, siliceous cmt, trace intergranular hematite. Trace qtz overgrowths. Glauconitic in part. Trace pyrite. No Shows. Interbedded to interlaminated with Shale: lt grey to red/brn. Blk to fissile, non-calc, siliceous. Glauconitic and hematitic. Siltstone: yellow to orange, blk fracture, siliceous. No vis porosity. No Shows.

6380 to 6414 ft. (1944.62 to 1954.99 m.)

Sandstone: Clear to creamy wht, med grey to lt green/grey, fn to vfn grnd, poor to mod sort, sub-rnd to rnd. Blk to conchoidal fracture, firm to

hard. Trace qtz overgrowths. No vis porosity, siliceous cmt. Glauconitic in part, trace pyrite and kaolin. No Shows. Interbedded to interlaminated with Shale: dk grey to blk, fissile to blk, firm, non-calc, siliceous, silty in part. No Shows.

6414 to 6440 ft. (1955.48 to 1963.41 m.)

Sandstone: Dom wht frags with minor frsted transp and frsted transluc to gd tr greenish-wht and rare very lt green (glauconitic?); abund frags with gd tr to abund lt to dk grn, waxy-lustered, pelletoid fecal glauc; very fn to fn with rare med, and to sub-ang, clr to frsted with minor wht qtz; poorly sorted; very hard to brtl with dom blk frac and gd tr sub-conchoid frac; a highly siliceous SS with clr to frsted silica matrix and tr qtz overgrowths (non-calc); vis por absent; crush cut absent; very abund free wht to brnsh-wht, tr striated kaolin. No Shows. Shale: (very abund): dk brn to brnsh-blk; very hd, siliceous; poorly to mod fis; abund mica (slough?).

6440 to 6490 ft. (1963.41 to 1978.15 m.)

Sandstone: Brnsh-wht to frsted with very minor wht and rare greenish-wht to very rare wht with incl green glauc; very fn to fn; poorly sorted; very hd and brtl with dom blk frac and gd tr sub-conchoid frac; highly siliceous with clr, frsted to minor brnsh matrix silica and tr qtz overgrowths (non-calc), vis por absent; crush cut absent; gd tr tan-wht to rare wht free kaolin. (Note: abund frags with incl very dk brn sh interlaminated). No Shows. Shale: Dk brn to brnsh-blk, dom poorly fiss, very abund mod fiss and gd tr highly fiss with rare "splintery"; very hd and brtl, highly siliceous, highly micro-micaceous, tr to rare very silty and very rare very

fn sdy; gd tr as interlaminae in SS frags; high count in all sieves (10,60,230 - mesh) indicative of insitu sh (high degree of confidence); crush cuts absent. No shows.

6492 to 6500 ft.(1978.76 to 1981.20 m.)

Sandstone: Clear (transparent) to lt grey, fn to vfn grnd, poor to fair sort, sub-rnd to sub-ang. Blky to sub-conchoidal fracture, hard to very hard. No vis porosity, siliceous cmt, trace to common qtz overgrowths. Trace to common emerald green glauconite. No Shows. Interbedded to interlaminated with Shale: dk grey to black, blky to splintery, firm to hard. Non-calc, siliceous. Micromicaceous to micaceous. Grades to siltstone in part. Sharp contacts with sandstone commonly vis. No vis porosity. No Shows.

6500 to 6510 ft.(1981.20 to 1984.25 m.)

Sandstone: Translucent to lt grey, fn to vfn grnd, poor to fair sort, sub-ang. Common indistinct grn boundaries. Blky to sub-conchoidal fracture, hard to v hard. Trace to common intergranular hematite. No vis porosity, siliceous cmt. Trace glauconite, pyrite and specular hematite. No Shows. Thin interbeds of Siltstone: lt green to lt grey. Blky fracture, siliceous and glauconitic (?). Hard. Micromicaceous. No vis porosity, siliceous cmt. No Shows. Thin interlaminations of Shale: dk grey to blk, splintery to fissile, firm to hard. Non-calc, siliceous. Micromicaceous. No Shows.

6510 to 6520 ft. (1981.20 to 1987.30 m.)

Sandstone: Translucent, fn to vfn grnd, very common indistinct grn boundaries, poor to fair sort, sub-ang. Conchoidal fracture, hard to v hard. Siliceous cmt. No vis porosity. Common to v common emerald green glauconite. Trace kaolin. No Shows. Shale: dk grey to blk, splintery to fissile, firm to hard. Non-calc, siliceous. Micromicaceous. No Shows.

6520 to 6530 ft. 1987.30 to 1990.34 m.)

Sandstone: Wht to med grey, fn, vfn to supra fn grnd, poor sort, sub-rnd. Blky to conchoidal fracture, hard to v hard. No vis porosity, siliceous cmt. Trace lithic fragments. No Shows. Thinly laminated with Shale: dk grey to blk. Splintery to fissile, firm to hard. Non-calc, siliceous, micromicaceous. No Shows.

6530 to 6550 ft. (1990.34 to 1996.44 m.)

Sandstone: Wht to med grey, fn to supra fn grnd, poor sort, sub-rnd. Blky to sub-conchoidal fracture, hard to v hard. No vis porosity, siliceous cmt, trace to common quartz overgrowths. Trace glauconite (emerald green), specular hematite and lithic fragments. No Shows. Thinly laminated to interbedded with Shale: dk grey to blk. Splintery to fissile, firm to hard. Non-calc, siliceous, micaceous and micromicaceous. Trace silt size qtz grains. No Shows.

6550 to 6580 ft. (1996.44 to 2005.58 m.)

Sandstone: Wht to med grey, fn to vfn grnd, poor to mod sort, sub-rnd to rnd. Hard to v hard. Blky to conchoidal fracture. Trace to rare indistinct grn boundaries. Siliceous cmt. No vis porosity. Rare lithic fragments, trace to rare glauconite. No Shows. Interbedded to inter-laminated with Siltstone: lt green/grey to olive, blky fracture, hard, non-calc, siliceous. Tight. No Shows. Shale: med grey to blk, fissile, firm to hard, non-calc, siliceous. Micromicaceous. No Shows.

6580 to 6649 ft. (2005.58 to 2026.61 m.)

Sandstone: Clear to med grey, fn to vfn grnd, poor to fair sort, sub-ang. Hard to v hard. Blky to conchoidal fracture. Trace to common indistinct grn boundaries, common qtz overgrowths. No vis porosity, siliceous cmt. Trace to common emerald green glauconite, trace pyrite and lithic fragments. No Shows. Interlaminated with Shale: med grey to blk, splintery to fissile, firm to hard. Non-calc, siliceous, trace silt size qtz grns. Micromicaceous. No Shows.

6649 to 6680 ft. (2026.61 to 2036.06 m.)

Sandstone: Translucent thru to med grey, vfn grnd, mod sort, sub-rnd. Hard to v hard, blky to sub-conchoidal fracture. Siliceous cmt, trace to common qtz overgrowths. No vis porosity. Trace pyrite, glauconite and lithic fragments. No Shows.

6680 to 6700 ft. (2036.06 to 2042.16 m.)

Sandstone: Lt to med grey, predom fn grnd, occ med grnd, poor sort, sub-ang. Hard, blk to conchoidal fracture. Siliceous cmt, trace qtz overgrowths. No visible porosity. Trace glauconite, pyrite, and lithic fragments. No Shows. Interlaminated with Shale: med grey to grey blk, splintery to fissile. Firm to hard, siliceous. Very micaceous and micro-micaceous, appears with phyllitic sheen. No Shows.

6700 to 6750 ft. (2042.16 to 2057.74 m.)

Sandstone: Translucent to lt grey, fn to vfn grnd, fair to poor sort, sub-rnd. Hard, blk to conchoidal fracture. No vis porosity, siliceous cmt. Common qtz overgrowths. Trace glauconite, rare lithic fragments, and specular hematite. No Shows.

Top Mainoru Fm: 6750 ft. (2057.40 m.)

NOTE:

The contact with the overlying Crawford Fm is not readily apparent from the drill cuttings. This estimated formation top is primarily based on drill rate analysis and the DXC curve. In corehole 82-3 coarsening upward cycles varying from 72' to 157' were observed. Three apparent cycles are observed on the R.O.P. plot from 6750 to 6535 ft with the thicknesses of the cycles similar to those of the corehole. More rapid drill rates are observed where the shale appears more common, slowing down in the predominately sandstone portion. This relationship does not appear below 6750 ft.

The DXC curve indicates a slight break in the corrected drilling curve also at 6750 ft. This may indicate a minor change in the amount of silica cementation rather than a facies change, as one is not apparent; however, the estimated top should be corrected to 6750 ft.

6750 to 6823 ft. (2057.74 to 2079.65 m.)

Sandstone: Lt to med grey, vfn to fn grnd, mod to poorly sorted, sub-ang to sub-rnd. Common indistinct grn boundaries. Hard, sub-conchoidal to conchoidal fracture. No vis porosity, siliceous cmt. Trace pyrite and glauconite. No Shows. Interlaminated with Shale: dk grey, firm, sub-fissile to fissile, silty in part, non-calc, siliceous. Micaceous. Trace of phyllitic sheen in places. No Shows.

6823 to 6900 ft. (2079.65 to 2103.12 m.)

Sandstone: Lt to med grey, vfn to fn grnd, med to poorly sorted, sub-ang to sub-rnd. Trace to common indistinct grn boundaries. Hard, sub-conchoidal fracture. No vis porosity, siliceous cmt. Trace glauconite with rare pyrite. No Shows. Interlaminated with Shale: Dk grey, firm, sub-fissile, silty in part, non-calc, siliceous. Trace phyllitic sheen in places. No Shows.

6900 to 7048 ft. (2103.12 to 2148.23 m.)

Sandstone: Lt to med grey, med to fn grnd, mod sort, sub-ang to sub-rnd. Blky fracture, firm to hard. No vis porosity, siliceous with trace of calcareous cmt. Trace of Siltstone: med to dark grey, poorly sorted,

siliceous cmt, micaceous, hard, blk fracture, tight. Commonly with shale laminae. No shows. Interlaminated with Shale: dk grey, firm, sub-fissile to fissile, silty, siliceous. Trace of phyllitic sheen in places. No Shows.

7048 to 7133 ft. (2148.23 to 2174.14 m.)

Sandstone: Lt to med grey, fn to vfn grnd, poor sort, sub-rnd to rnd. Blky fracture, no vis porosity, silica cmt. Sandstone is becoming increasingly calcareous. Rare glauconite and lithic fragments. No Shows. Interlaminated to interbedded with Siltstone: dk grey, blk to sub-fissile, poor sort. Hard, siliceous and micaceous, non-calc. No vis porosity. No Shows. Shale: dk grey, firm to hard, fissile, non-calc, siliceous. Micro-micaceous, silty in part. Occurs with a trace of phyllitic sheen. No Shows.

Broadmere No. 1, sidetrack.

Top Crawford Formation:

6618 to 6637 ft (2017.17 to 2022.96 m.)

Cement with trace Sandstone: Drill returns are severely contaminated by cement. Trace Sandstone: Creamy wht, fn grnd, poor sort, sub-rnd. Hard, siliceous cmt. Glauconitic in part. No vis porosity. No Shows.

6637 to 6666 ft.(2022.96 to 2031.80 m.)

Sandstone: Translucent to med grey, fn to vfn grnd, poor to fair sort, sub-rnd. Hard, blk fracture to sub-conchoidal fracture. No vis porosity, silica cmt. Trace glauconite and lithic fragments. No Shows. Trace Shale: dk grey to blk, blk to fissile, firm to hard, micaceous, non-calc. No Shows. NOTE: All samples heavily contaminated with cmt.

6666 to 6673 ft. 2031.80 to 2033.93 m.)

Sandstone: Translucent through to med grey, fn to vfn grnd, poor to mod sort, sub-rnd. Hard to v hard, blk to sub-conchoidal fracture. Siliceous cmt, trace quartz overgrowths. No vis porosity. Trace glauconite and lithic fragments. No Shows. Siltstone: med to dark grey, hard, siliceous, blk to sub fissile fracture. Tight. No Shows.