CANADA

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THE MESOZOIC AND PALAEOZOIC FORMATIONS OF SOUTH-CENTRAL SASKATCHEWAN AS ENCOUNTERED IN THE NORCANOLS OGEMA NO. 1 WELL

By

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THE MESOZOIC AND PALAEOZOIC FORMATIONS OF SOUTH-CENTRAL SASKATCHEWAN AS ENCOUNTERED IN THE NORCANOLS OGEMA NO. 1 WELL

INTRODUCTORY REMARKS

The Ogema well is situated near the deepest part of the northern extension of the Williston basin in southern Saskatchewan, and provides a fairly representative section of the subsurface formations of that region, which range in age from Upper Cretaceous to Precambrian. The formational nomenclature adopted in the accompanying log of the well is tentative pending more complete regional studies and better means of correlation. No new names are introduced, and those used reflect the usage in surrounding areas for the various facies represented. Under these circumstances, parts of this nomenclature are applicable for wide areas in some directions, according to conditions of sedimentation, whereas their application in other directions may be relatively limited.

The lithology and contact relations of the formations are given in the log of the well, and an explanation of some features of nomenclature and correlation can be found in the notes that follow the log. In these notes the various formations and age groups are considered in order from youngest to oldest to agree with the sequence in the well log.

It should be noted that, from somewhere in the Riding Mountain formation downward to the lower part of the Jurassic section, the beds appear in the samples about 30 feet below the corresponding electric-log markers. Apparently, the samples were collected and labelled without allowing enough time for the cuttings to reach the surface from the depths at which they were drilled. For this reason, key horizons in this interval are determined from the electric log or the core. Below a depth of about 4,500 feet, the sample depths seem to agree with the electric-log indications.

The authors wish to express their appreciation to the Sohio Petroleum Company for permission to refer to fossil determinations from cores of the Sohio Standard Pense No. 1 well in l.s. 14, sec. 10, tp. 17, rge. 22, W. 2nd meridian.

LOG OF NORCANOLS OGEMA NO. 1 WELL

Location: l.s. 4, sec. 24, tp. 7, rge. 23, W. 2nd mer.

Elevation: Grd. 2,410 feet. Total depth: 9,400 feet.

Spudded: February 28, 1943. Completed: February 15, 1944.

Drill cuttings examined by L. L. Price, 1951; cores by R. T. D. Wickenden, 1945.

Depth	Lithology
Feet	
	Pleistocene (0 to 375 feet)
0-375	Glacial till
	Cretaceous (375 to 3,680 feet)
	Riding Mountain Formation (375 to 2,505 feet) (Exact depth of bedrock surface uncertain)
375-380	Shale, medium light grey; glauconite; pyrite after fucoid material
380-385	Shale, silty, brownish grey, very soft; glauconite; trace pyrite
385-390	Sandstone, argillaceous, brownish grey
390-395	Shale, medium light grey; pyrite
395-405	Shale, medium light grey; pyrite; glauconite; brownish grey sandstone; brown clay with sand grains
405-415	Shale, medium light grey; with pyrite after fucoid material
415-420	Shale with scattered, tiny, siderite nodules
420-425	Shale, medium light grey; brownish grey, silty shale
425-430	Shale, medium light grey, smooth textured; grey columnar limestone
430-435	Siltstone, calcareous, medium greyish brown, dense, with abundant dark spots

435-450 Shale, medium light grey, silty, with pyrite after fossils; glauconite

450-455 Siltstone, calcareous, argillaceous, dark brownish grey, coarse; abundant pelecypod fragments

455-470 Shale, medium light grey; pyrite after fucoid material; glauconite

470-475 Shale, medium light grey; dark brownish grey, dense, calcareous siltstone

475-485 Sandstone, light grey, with scattered dark grains, non-calcareous; some with fishbone fragments

485-490 Very poor sample

490-540 Shale, medium light grey, massive, slightly silty; abundant pyrite after fucoid material; trace glauconite

540-555 Shale, medium light grey, slightly silty; pyrite; glauconite; cephalopod fragments

555-560 Siltstone, calcareous, dark greyish brown

560-575 Shale, medium light grey, silty; pyrite; glauconite

575-580 Sandstone, yellowish brown, hard; abundant siderite cement; glauconite; fishbones

580-585 Shale, medium light grey, slightly silty, with pyrite

585-590 Shale, medium light grey, soft, with pyrite aggregates and brown ironstone nodules

590-615 Shale, medium light grey, slightly silty; pyrite aggregates; glauconite; foraminifera

615-625 Sandstone, light grey, fine-grained, with scattered dark grains

625-645 Shale, medium light grey, slightly silty; pyrite; brown ironstone

645-675 Shale, medium light grey, slightly silty; pyrite aggregates

675-720 Shale, medium light grey; interbeds of light grey, very fine-grained, argillaceous sandstone

720-775 Shale, medium light grey, slightly silty; pyrite aggregates; scattered light brown ironstone nodules

775-795 Shale, medium light grey, slightly silty; pyrite; sparse glauconite

795-930	Shale, medium light grey, slightly silty; abundant pyrite; foraminifera
930-985	Shale, medium light grey; interbeds of grey columnar limestone
985-990	Shale, medium light grey; pyrite aggregates; abundant Inoceramus prisms; fish teeth
990-1,015	Shale, medium light grey, slightly silty; pyrite aggregates; glauconite
1,015-1,025	Shale, medium light grey; pyrite; abundant foraminifera; pelecypod prisms; iridescent cephalopod fragments
1,025-1,030	Shale; grey ironstone
1,030-1,035	Shale, medium light grey; pyrite; glauconite; pelecypod prisms; cephalopod fragments
1,035-1,055	Shale, medium light grey, slightly silty
1,055-1,060	Sandstone, calcareous, medium dark grey, argillaceous, hard; contains biotite
1,060-1,065	Sandstone; columnar grey limestone
1,065-1,070	Shale, medium light grey, slightly silty; shell fragments
1,070-1,105	Shale, medium light grey, with dark specks
1,105-1,155	Shale, medium light grey, slightly silty, with finely sandy zones
1,155-1,170	Shale, medium light grey
1,170-1,175	Shale; granular brown siderite
1,175-1,180	Shale; abundant fish bones
1,180-1,185	Shale; brown ironstone
1,185-1,190	Missing
1,190-1,220	Shale, medium light grey, slightly silty
1,220-1,235	Shale, light brownish grey, clayey, smooth-textured
1,235-1,255	Shale, medium light grey, slightly silty; pyrite
1,255-1,260	Shale; thin, grey sandstone interbed

1,260-1,265	Shale; brownish grey ironstone
1,265-1,275	Shale, medium light grey; a few pyrite aggregates
1,275-1,285	Shale, reddish brown, granular; grey, dense, calcareous ironstone
1,285-1,295	Shale, medium light grey; a few pyrite aggregates
1,295-1,310	Shale; reddish brown, granular ironstone
1,310-1,330	Shale; medium grey argillaceous siltstone; light grey columnar limestone
1,330-1,375	Shale; brown ironstone; columnar limestone
1,375-1,395	Ironstone, reddish brown, dense; grey, calcareous ironstone
1,395-1,460	Shale, medium light grey, slightly silty; a few pyrite aggregates
1,460-1,465	Shale; grey columnar limestone; cephalopods
1,465-1,480	Shale, medium light grey, slightly silty; a few pyrite aggregates
1,480-1,575	Shale; brown ironstone nodules; grey columnar limestone; shell fragments
1,575-1,580	Ironstone, calcareous, brownish grey; grey, fine-grained sandstone with abundant calcite cement
1,580-1,645	Shale, medium light grey, with sandy interbeds
1,645-1,655	Sandstone, light grey, with dark biotite grains, fine-grained, friable; some with calcite cement; glauconite
1,655-1,700	Shale, medium light grey; a few, thin, columnar limestone beds; calcareous foraminifera
1,700-1,730	Shale, medium light grey; a few pyrite aggregates
1,730-1,825	Shale; abundant brown ironstone nodules, cephalopods
1,825-1,870	Shale, medium light grey; abundant pyrite aggregates; foraminifera; fish bones
1,870-1,875	Shale; thin bed of light grey calcareous sandstone
1,875-1,900	Shale, medium light grey; a few pyrite aggregates; fish bones; foraminifera

1,900-1,905	Shale; thin bed of columnar limestone
1,905-1,910	Shale, medium light grey
1,910-1,935	Shale, dark grey, argillaceous; calcareous sandstone, grading to sandy limestone
1,935-2,010	Shale; many interbeds of dark grey, dense, sandy, argillaceous limestone
2,010-2,045	Shale; brown ironstone, with trace of glauconite; cephalopods
2,045-2,050	Shale, medium light grey, slightly silty, with fine pyrite aggregates; thin sandstone interbed
2,050-2,080	Shale, medium light grey
2,080-2,085	Shale; pale grey columnar calcite
2,085-2,095	Shale; brown ironstone nodules, a few with glauconite
2,095-2,105	Shale, medium dark grey, fissile; glauconitic brown ironstone
2,105-2,120	Shale, medium light grey, slightly silty; some with sand grains; glauconite; dark grey silty limestone interbeds; ironstone
2,120-2,130	Sandstone, calcareous, grey, glauconitic, with abundant cement
2,130-2,135	Sandstone; grey limestone with cone-in-cone structure
2,135-2,150	Calcareous sandstone and sandy shale; much glauconite
2,150-2,155	Shale, medium light grey; brown glauconitic limestone
2,155-2,160	Shale, medium light grey; fine pyrite octahedra; foraminifera
2,160-2,170	Shale; interbedded, white, columnar limestone; bentonite
2,170-2,300	Shale, medium light grey; brown glauconitic ironstone nodules; a few thin calcareous sandstone and grey limestone beds
2,300-2,310	Shale, medium light grey; pyrite cubes; marcasite
2,310-2,320	Shale; grey limestone interbed

2,318-2,319½ (Core No. 1, 6") Shale, medium grey

2,319½-2,322 (Core No. 2, 8") Shale, medium light grey

2,320-2,330 Shale; thin beds argillaceous limestone; glauconitic sandstone; sandstone, with pyrite cement

2,330-2,335 Shale; bentonite

2,335-2,340 Shale, calcareous, medium light grey, mottled

2,340-2,360 Shale, medium light grey; a little pyrite in fine, spherical and rod-like aggregates

2,360-2,400 Shale, medium light grey; with thin interbeds of grey, fine-grained, glauconitic sandstone; glauconitic brown ironstone; iridescent ammonite fragments

2,400-2,410 (Core No. 3, 6'4") Shale, medium grey; three ¼- to ½-inch bands of light grey ironstone, weathering brown; a few fragments of iridescent shells near bottom of core

2,410-2,420 Shale, medium light grey; ironstone; foraminifera

2,420-2,425 Shale; brown ironstone, with soft buff specks

2,425-2,430 Shale, medium grey, with buff specks

2,430-2,436 Shale; grey, slightly silty limestone

2,436-2,446 (Core No. 4, 8'6") Shale, medium grey; fragment of Baculites near top; a few sandy partings; a few thin concretionary zones

2,446-2,465 Shale, medium light grey; brown, glauconitic ironstone

2,465-2,471 Shale; silty limestone and brownish grey sandstone beds

2,471-2,480 (Core No. 5, 9'5") Shale, medium grey; a few thin (¼ to ½ inch) ironstone concretions; a few sandy zones; a few fine fragments of carbon; many hollow, brownish yellow spheres near base

2,480-2,505 Shale, medium light grey; abundant foraminifera; worm tubes near base

2,505-2,515 (Core No. 6, 3')

0 to 6" Shale, medium grey; a few carbon fragments

Vermilion River Formation (2,505½-2,735 feet)

Boyne Member (2,505½-2,615 feet)
(Contact appears in cuttings at 2,545 feet)

6" to 3' Shale, medium to dark grey, with white calcareous specks

2,515-2,545 Shale, medium light grey; a few, thin, glauconitic sandstone beds; vein calcite; abundant foraminifera; trace dark grey shale at base (material from Riding Mountain formation; samples apparently not lagged)

2,545-2,615 Shale, medium to dark grey, calcareous, with more or less abundant white specks; a few thin, pale grey, limestone beds; shell fragments

Morden Member (2,615-2,735 feet, electric log).
(Non-calcareous shale appears in cuttings at 2,645 feet)

2,615-2,645 Shale, medium to dark grey, calcareous, mostly white speckled (material from Boyne member; samples lagged)

2,645-2,675 Shale, dark grey, non-calcareous; thin beds of sandstone and sandy limestone; glauconite

2,675-2,735 Shale, dark grey, firm, rough fracturing; thin beds of glauconitic sandstone, with abundant calcite cement

Favel Formation (2,735-2,815 feet, electric log)
(Appears in cuttings at 2,765 feet)

2,735-2,755 Shale, dark grey, firm, rough fracturing, with sandy limestone or calcareous sandstone interbeds (material from Vermilion River formation; samples apparently not lagged)

2,755-2,765 Shale, dark grey, with calcareous white specks

2,765-2,815 Shale, dark grey, very slightly speckled, with pelecypod prisms; thick interbeds of Inoceramus(?) limestone; lower beds containing abundant tiny spheres from foraminifera

Ashville Formation (2,815-3,375 feet electric log)
(Appears in cuttings at 2,835 feet)

2,815-2,835 Shale, dark grey, sparsely speckled, with limestone interbeds containing abundant pelecypod prisms and spheres (material from Favel formation; samples apparently not lagged)

2,835-2,925 Shale, dark grey, with dark spots; much contamination from Favel limestone and speckled shale

2,925-2,930 Shale; light grey calcareous siltstone, with abundant resinous looking fish-bone fragments

2,930-2,940 Shale, medium grey, calcareous

2,940-2,980 Shale, dark brownish grey; much brown plant(?) material

2,980-3,000 Shale, medium dark grey, with dark spots

3,000-3,010 Shale; brown sandstone with siderite cement

3,010-3,035 Shale, medium dark grey; septarian ironstone nodules; a few thin glauconitic sandstone interbeds

3,035-3,045 Ironstone, brown, friable, forming coarse siderite sand

3,045-3,060 Shale, medium grey, fissile; some finely banded

3,060-3,070 (Core No. 7, 4") Shale, dark grey

3,070-3,075 (Core No. 8, 1' 1½") Shale, dark grey; a few, very fine fragments of carbon; some pyrite

3,075-3,081 (Core No. 9, 2'6") Shale, dark grey; with two, dark grey concretions (2 inches and 4 inches)

3,081-3,091 (Core No. 10, 8'2") Shale, dark grey; scattered Inoceramus prisms; glauconite; pyrite

3,091-3,101 (Core No. 11, 8'2") Shale, dark grey; thin beds of light grey sandstone, with glauconite; a few thin concretions, grey, weathering brown; a few fish bones

3,101-3,111 (Core No. 12, 1'3") Shale, dark grey; a few thin beds of sandstone; a few fish bones

3,111-3,121 (Core No. 13, 10') Shale, dark grey; a few thin beds fine grained sandstone or silt, light grey, with glauconite (mostly between 3 and 8 feet); pyrite; dark grey concretionary layers

3,121-3,131 (Core No. 14, 7'9")

0 to 5' Shale, dark grey and light grey in alternating bands up to 1 inch thick

5' to 7'9" Shale, dark grey, a little harder than above; some pyrite

3,131-3,165 Shale, dark grey; a few thin sandstone beds with fish bones; a few Inoceramus(?) prisms

3,165-3,180 Sandstone, with abundant well-rounded, polished, black, grey, and white chert pebbles; possibly Bow Island-Viking equivalent

3,180-3,205 Sandstone, calcareous, light grey, with abundant dark grains; glauconite; a few chert pebbles at base

3,205-3,212 Shale, dark grey, with dark spots; fine sandstone interbeds

3,212-3,222 (Core No. 15, 10') Shale, dark grey, with some pyrite; a few light grey silt beds; fish bones

3,222-3,240 Shale, dark grey with fine darker spots; zones with brown seed cases and resinous looking plant fragments; several thin glauconitic sandstone interbeds

3,240-3,272 Shale, dark grey; interbeds of fine, slightly calcareous sandstone, with glauconite

3,272-3,282 (Core No. 16, 10') Shale, dark grey; a few thin interbeds of light grey, fine-grained sandstone or silt; glauconite and pyrite throughout

3,282-3,332 Shale, medium dark grey, fissile; numerous interbeds of medium grey, fine-grained, glauconitic sandstone; buff ironstone

3,332-3,341 (Core No. 17, 9')

0 to 1'5" Sandstone, light grey, fine-grained, with feldspar cement

1'5" to 3'10" Shale and sandstone, in light and dark grey alternating beds; worm burrows; glauconite in some sand beds

3'10" to 9' Shale, dark grey; a few ½- to 1-inch beds of fine-grained sandstone with glauconite; Inoceramus at 3,338½ feet; fragments of Inoceramus and oysters

3,341-3,351 (Core No. 18, 10')

0 to 7'5" Shale, dark grey; a little pyrite; a very few thin beds of fine-grained sandstone; one hard, dark grey concretionary zone 2 inches thick

7'5" to 10' Shale, dark grey, with many thin beds and lenses of fine-grained, light grey sandstone; brown concretionary band 1½ inches thick at bottom of core

3,351-3,361 Core No. 19, 5'8")

0 to 2' Shale, dark grey, with some thin beds of fine-grained, light grey sandstone or silt; pyrite

2' to 5'8" Shale, dark grey; a very few sandstone beds

3,361-3,371 (Core No. 20, 2'9") Shale, dark grey, with some very thin beds and lenses of light grey silt

3,371-3,381 (Core No. 21, 3'5") Shale, dark grey, with thin sandstone beds; hollows in shale filled with sand; some fragments of carbonized plants

Swan River Group (3,375-3,680 feet, electric log)

3,381-3,391 (Core No. 22, 10')

0 to 4'2" Shale, dark grey; with many lenses and thin beds of light grey silt; a few fragments of carbonized plants; pyrite

4'2" to 5'6" Sandstone or silt, medium to light grey, fine-grained, hard, well cemented; cement partly brown like siderite

5'6" to 10' Shale, dark grey, sandy; with many thin beds of light grey, fine-grained sand

3,391-3,401 (Core No. 23, 10') Shale, dark grey, with many beds of light grey, fine-grained sand or silt

3,401-3,410 (Core No. 24, 5') Shale and sandstone or silt, dark grey and light grey, crossbedded; a few fragments of carbonized plants

3,410-3,416 Missing

3,416-3,426 (Core No. 25, 8'10") Shale and fine-grained sandstone or silt, dark grey and light grey interbedded; a few fragments of carbonized plants

3,426-3,436 (Core No. 26, 1'2") Shale and sandstone, dark and light grey, crossbedded; some worm burrows; a few fine fragments of carbon

3,436-3,446 (Core No. 27, 3'8") Shale, dark grey; with a few to many thin beds and lenses of light grey silt or sandstone; some trails and worm burrows; some fragments of carbonized plants

3,446-3,456 (Core No. 28, 2'10") Shale, dark grey; some lenses and worm burrows of light grey silt or sand; a few carbonized fragments of plants

3,456-3,466 (Core No. 29, 3'10") Shale, dark grey, with beds of very fine-grained sandstone 2 to 3 inches thick; some carbonized plants.

3,466-3,476 (Core No. 30, 6") Sandstone, light grey, very fine-grained; a little shale; some small fragments of carbon

3,476-3,481 (Core No. 31, 4') Sandstone, light grey, fine-grained, with some dark grey shale beds; some carbonized plants

3,481-3,487 (Core No. 32, 4") Sandstone, light grey, fine-grained; a little shale; some carbonized plants

3,487-3,495 (Core No. 33, 5'9")

0 to 2'2" Sandstone, light grey, nearly white

2'2" to 5'9" Shale, medium to dark grey; a few thin sand beds; some plant fragments; lower part lighter grey, possibly bentonitic

3,495-3,503 (Core No. 34, 1'6") Light grey shale, with appearance of bentonite

3,503-3,513 (Core No. 35, 3'6") Shale, light grey, with red streaks and blotches; some buff spherules and some grains of sand; fragment of buff concretion composed of spherules of sand at bottom of core

3,513-3,523 (Core No. 36, 10')

0 to 1'1" Sandstone, light greenish grey, with much shale

1'1" to 2'8" Shale, medium dark grey, with many thin beds of light grey, fine-grained sandstone or silt; some fragments of carbonized plants

2'8" to 4' Shale, light grey, sandy; slickensides

4' to 4'10" Sandstone, light to medium grey, somewhat shaly

4'10" to 5'11" Shale, light medium grey

5'11" to 6'8" Sandstone, white, fine-grained, loosely cemented

6'8" to 7'6" Shale, light grey, sandy

7'6" to 8'10" Shale, medium to dark grey, somewhat sandy

8'10" to 10' Shale, medium grey

3,523-3,540 Shale, light grey, with siderite nodules; brown sandstone, with siderite cement near top

3,540-3,575 Shale, medium grey, with many grains of siderite

3,575-3,590 Shale; greenish grey sandstone

3,590-3,595 Shale, medium grey; red shale and clay

3,595-3,615 Shale, medium grey; interbeds of brown sandstone with siderite cement

3,615-3,635 Sandstone, brown, with abundant siderite cement; carbonized wood; silty shale interbeds

3,635-3,655 Sandstone with minute brown siderite nodules; sandy ironstone band

3,655-3,680 Sandstone, white, fine-grained, poorly cemented

Jurassic (3,680-4,670 feet)

Sundance Formation (3,680-4,410 feet electric log)

(Appears in samples at 3,705-3,710 feet)

3,680-3,705 Poor samples: sandstone, medium-grained; ostracods

3,705-3,740	Shale, calcareous, light grey, brownish cast; brown specks; ostracods; foraminifera
3,740-3,835	Shale, calcareous, light greenish grey, soft, with brown specks; many thin interbeds of fine-grained, slightly calcareous, grey to green sandstone; some with glauconite; pyritized gastropods
3,835-3,840	Shale, calcareous and sandstone; much hematite
3,840-3,845	Shale, calcareous, light greenish grey
3,845-3,860	Missing
3,860-3,865	Limestone, cream, dense, very sandy
3,865-3,895	Shale, calcareous, light greenish grey; many interbeds of fine-grained, grey, calcareous sandstone
3,895-3,900	Shale, red; pale grey sandstone, with clay cement
3,900-3,905	Very poor sample
3,905-3,915	Shale, red, yellow, soft, non-calcareous
3,915-3,925	Sandstone, greyish green, fine-grained, slightly dolomitic; many shell fragments; pyritized small gastropods (electric log, 3,885 feet)
3,925-3,930	Shale, greenish grey, calcareous, soft
3,930-3,935	Shale, greenish grey sandstone, with abundant shell fragments (caved?)
3,935-3,940	Limestone, argillaceous, light brownish grey, dense, with fine dark pyrite aggregates
3,940-3,975	Shale, silty, light grey, soft, mostly non-calcareous
3,975-3,980	Shale, calcareous, light grey; abundant shell fragments
3,980-3,985	Limestone, pale grey, dense; minute hemispherical spore cases
3,985-4,065	Shale, calcareous, light grey, with brownish cast; specks of brown material; few silty zones
4,065-4,090	Shale, calcareous, medium brownish grey, abundant brown material

4,090-4,095 Shale; interbed of pale grey, fossiliferous limestone

4,095-4,100 Limestone, sandy, pale grey; abundant light and dark fossil fragments; pyrite; glauconite

4,100-4,105 Shale, calcareous, greenish grey

4,105-4,110 Limestone, pale cream, with darker nodules (ostracods?); sand grains

4,110-4,115 Shale, greenish grey, calcareous; red, non-calcareous shale

4,115-4,120 Limestone, pale cream; ostracods and abundant dark fragments of other fossils; non-calcareous, red and green shale

4,120-4,125 Dolomite, shell-fragmental; in part microsucrose and porous; sandy dolomite interbed

4,125-4,145 Shale, red, yellow, green, mottled, mostly non-calcareous, soft, smooth-textured; several dolomitic and argillaceous limestone interbeds

4,145-4,170 Shale, variegated, slightly calcareous; interbeds of argillaceous limestone, with abundant ostracods in lower part

4,170-4,215 Shale, mostly greenish grey, soft; thin, grey, calcareous sandstone interbeds; with ostracods and pyrite; interbeds of cream, dense limestone; some with pyrite specks; some sandy

4,215-4,230 Limestone, cream to buff; shell fragments and oolites; zones with ostracods

4,230-4,235 Shale, red and green, partly calcareous

4,235-4,255 Limestone, cream, very finely clastic to dense; oolites

4,255-4,260 Sandstone, calcareous, medium grey, tight

4,260-4,275 Shale, calcareous, greenish grey, yellow; thin, soft limestone interbeds

4,275-4,320 Shale, calcareous; numerous interbeds of white to grey, fine-grained sandstone, with pyrite and traces of glauconite; a few limestone interbeds; ostracods

4,320-4,410 Shales, calcareous, greenish grey, pale red; numerous interbeds of limestone, light to pale brown, dense; some oolitic

Piper Formation (4,410-4,670 feet)

4,410-4,427 Limestone, with shale and sandstone interbeds; limestone, dense, pale brown or grey; sandy and argillaceous beds; shale, calcareous, greenish grey, grey, or pale red; sandstone, calcareous, white to grey; abundant ostracods

4,426-4,427 (Core No. 37) No recovery

4,427-4,437 (Core No. 38, 1'11")

0 to 1'8" Shale, limestone, and sandstone; shale and sandstone both light grey, calcareous

1'8" to 1'11" Sandstone, brownish yellow and red, calcareous

4,437-4,442 (Core No. 39, 2'6") Shale, reddish brown, a little sandy; micaceous layers; a few plant fragments

4,442-4,452 (Core No. 40, 4'10")

0 to 2'2" Limestone, yellowish brown and grey, mottled, probably shaly

2'2" to 3'2" Shale, yellowish brown, splotched with grey

3'2" to 4'10" Limestone, dense, oolitic

4,452-4,462 (Core No. 41, 4'7")

0 to 4'1" Shale, medium grey and yellowish brown, calcareous; smooth, thin-shelled ostracods

4'1" to 4'7" Limestone, cream or light buff, dense, amorphous; with some very small crystals

4,462-4,470 (Core No. 42, 6'6")

0 to 1' Limestone, white, chalky, soft

1' to 2'6" Shale, medium grey, calcareous; a few fossil fragments

2'6" to 4'4" Limestone, light greenish grey, with yellowish brown blotches

4'4" to 4'11" Transition from limestone to dolomitic shale, maroon

4'11" to 6'6" Shale, dark brick-red, a little light greenish grey shale; dolomitic near top becoming less so in lower part; one or two, small, thin-shelled pelecypods

4,470-4,495 Shale, dolomitic, brick-red; greenish grey shale (caved?)

4,495-4,500 Limestone, pale brown, dense; with tiny ovoid fossils(?); brick-red shale with ostracods

4,500-4,525 Shale, brick-red and yellowish brown, dolomitic

4,525-4,555 Anhydrite, mostly white, granular; many brick-red dolomitic shale interbeds; a few thin beds of cream dolomite with anhydrite inclusions and traces of ostracods

4,555-4,670 Anhydrite, gramular,red, dolomitic, argillaceous; interbeds soft brick-red dolomitic shale containing anhydritic sandy beds; sparse ostracods; frosted quartz grains at base

Mississippian (4,670-5,865 feet)

Rundle(?) Formation (4,670-5,390 feet)

4,670-4,700 Dolomite, pale brown to cream, dense; white anhydrite inclusions; residue in acid of very fine quartz

4,700-4,710 Missing samples

4,710-4,717 Very poor sample

4,717-
4,717'4" (Core No. 43, 4") Dolomite, greyish buff, compact (abundant residue of clay-size quartz)

4,717-
4,717'9" (Core No. 44, 5") Dolomite, light grey, dense, but slightly grainy

(Core No. 45) No recovery

4,717-
4,737 Dolomite, light grey, dense to finely crystalline

4,737-4,745 Dolomite, cream, microsucrose, partly porous; very fine clastic texture, partly recrystallized

4,745-4,750 Dolomite, cream, dense; chalky appearance

4,750-4,810 Dolomite, pale to light brown, dense to microsucrose; zones of very fine intergranular and fine vuggy porosity; faint bryozoans or corals; brachiopods near base

4,810-4,815 Dolomite, light brown, microsucrose; fine vugs after fossils; patches of crystalline shell-fragment limestone; gypsum inclusions

4,815-4,821 Dolomitic limestone, shell-fragmental, light brown; inclusions of gypsum

4,821-4,823 (Core No. 46, 1'8") Limestone, light buff, somewhat oolitic and fine-grained; some fragments show fine-grained limestone with coarser, darker coloured crystals

4,823-4,833 (Core No. 47, 3'1") Limestone, fine-grained, with some darker crystals replacing fossils; band of white chert (about 1 inch) near top; a few brachiopods

4,833-4,834 (Core No. 48, 5") Limestone, brown, crystalline

4,834-4,844 (Core No. 49, 9") Core broken; some brown, crystalline limestone; buff, fine-grained limestone; buff limestone with darker crystals

4,844-4,849 (Core No. 50, 2'9") Limestone, light buff, very fine-grained, with numerous, hair-like, tubular openings, probably after fossils; some thin beds replaced by clear silica and white chert

4,849-4,854 (Core No. 51, 2'6")

0 to 1'5" Limestone, light buff, very fine-grained, with numerous fine hair-like tubes; some replacement by clear silica and white chert

1'5" to 2'6" Limestone, light buff, fine-grained, with many crystals of dark calcite; some foraminifera, probably Plectogyra

4,854-4,857 (Core No. 52, 1'4") Limestone, buff, fine-grained, with many crystals of dark buff to brown calcite

4,857-4,863 (Core No. 53, 3') Limestone, buff, fine-grained, with many crystals of darker calcite; some foraminifera, probably Plectogyra

4,863-4,873 (Core No. 54, 8") Limestone, buff, fine-grained with many crystals of darker calcite; many fossils as in previous samples

4,873-4,881 (Core No. 55, 1'4") Limestone, buff, fine-grained, with many crystals of darker calcite

4,881-4,884 (Core No. 56, 1'2") Limestone, light buff, fine-grained, somewhat crystalline; a few fossils

4,884-4,894 (Core No. 57, 11") Dolomite, very light grey, fine-grained, almost chalky

4,894-4,904 (Core No. 58, 3'10") Dolomite, very fine-grained with hair-like tubular openings; fairly porous, very fine pores

4,904-4,909 (Core No. 59, 4'3") Dolomite, light grey, very fine-grained, with fine tubular openings

4,909-4,915 (Core No. 60, 1'9") Limestone, buff, fine-grained, with coarse dark crystals of calcite; fossils include bryozoa, brachiopods, etc.

4,915-4,922 (Core No. 61, 1'7") Dolomite, light buff to grey, very fine-grained, fairly dense; small piece of brown anhydrite at bottom of core

4,922-4,927 (Core No. 62, 1'5") Dolomite, light buff, fine-grained, with small inclusions of anhydrite; small core fragment of dense, medium grey dolomite with some silica

4,927-4,932 (Core No. 63, 10") Dolomite, light greyish buff, very fine-grained, finely porous with fine hair-like tubes

4,932-4,933 (Core No. 64, ½") Fragment of dense, grey, siliceous rock

4,933-4,938 (Core No. 65, 2") Hard, dense, siliceous rock

4,938-4,943 (Core No. 66, 3'6") Dolomite, light cream to buff, fine-grained, spotted with very small dark grains; many fine tubes

4,943-4,948 (Core No. 67, 1'10") Dolomite, very light grey, nearly white, fine-grained, spotted with very small darker grains

4,948-4,953'4" (Core No. 68, 2'6") Dolomite, light buff to pink; buff zone streaked and mottled with maroon; fine-grained with dark specks as in previous samples; fine, hair-like tubular openings

4,953'4"-4,954 (Core No. 69, 1") Top shows a little buff dolomite, dense; lower part grey chert

4,954-4,959 (Core No. 70, 5') Dolomite, light grey, few fine darker spots; a few grey shale partings; some pyrite; a few very fine pores; bedding horizontal

4,959-4,965 (Core No. 71, 2'11")

0 to 7" Dolomite, light grey, fine-grained, fairly dense

7" to 2'11" Limestone, light buff, finely granular; a few fine fossil fragments

4,965-4,970 (Core No. 72, 1'6") Chert, greyish brown, dense

4,970-4,971 (Core No. 73, 11") Limestone, light buff, fine-grained, with darker fragments of crystals, some fossils partly replaced by silica

4,971-4,972 (Core No. 74, 1') Limestone, light buff, mostly crystalline after fossil fragments, some replaced by silica; Plectogyra, brachiopods, and bryozoa

4,972-4,975 (Core No. 75, 1'6")

0 to 1'2" Limestone, buff, fine-grained, with small fossil fragments; some oolites

1'2" to 1'6" Limestone, buff, coarsely crystalline; fossils; some oolites; partly replaced by silica

4,975-4,980 (Core No. 76, 1') Limestone, light buff, fine-grained; small fragments of fossils; some replacement by chert

4,980-4,983 (Core No. 77, 2'6") Limestone, buff, oolitic; many fine fragments of broken shells; some large shell fragments

4,983-4,988 (Core No. 78, 1') Limestone, buff, oolitic; many small broken fossils including sponge spicules, ostracods, brachiopods, and some bryozoa

4,988-4,993 (Core No. 79, 1') Limestone, buff, fine-grained; numerous crystalline fossil fragments; one well-preserved brachiopod

4,993-4,998 (Core No. 80, 6") Limestone, buff, fine-grained; many crystalline fossil fragments

4,998-5,003 (Core No. 81, 1'9")

0 to 1'6" Limestone, buff, crystalline, composed of fragments of fossils-brachiopods, crinoids, fluted spines, ostracods

1'6" to 1'9" Limestone, light buff, fine-grained, with many small darker spots

5,003-5,011 (Core No. 82, 5') Dolomite, light buff at top, light grey below, fine-grained; inclusions of anhydrite (speckled texture)

5,011-5,020 Missing

5,020-5,025 Limestone, light brown, coarsely shell-fragmental (largely crinoidal), slightly dolomitic; interstices filled with white chert

5,025-5,030 Dolomite, silty, greyish brc ı,microsucrose, very porous, with abundant vugs after fossils

5,030-5,035 Dolomite, silty; gypsum inclusions; numerous crystals after crinoid fragments; grading to crinoidal limestone; poor sample

5,035-5,045 Very poor samples

5,045-5,055 Limestone, dolomitic,crinoidal, largely replaced by chert; poor samples

5,055-5,060 Dolomite, calcareous, pale greyish brown, finely porous; bryozoa

5,060-5,065 Limestone, dolomitic, coarsely shell-fragmental; bryozoa

5,065-5,075 Very poor samples

5,075-5,080- Limestone, dolomitic, coarsely shell-fragmental; bryozoa

5,080-5,090 Very poor samples

5,090-5,095 Dolomite, light brownish grey, microsucrose, very porous; abundant vugs after fossils

5,095-5,110 Very poor samples

5,110-5,135 Limestone, dolomitic, pale brown, crinoidal, slightly porous; scattered brachiopods

5,135-5,140 Very poor sample

5,140-5,150 Limestone, dolomitic, somewhat silicified, with chalky white chert inclusions; poor samples

5,150-5,160 Very poor sample

5,160-5,165 Limestone, crinoidal, interstices nearly filled with clear and milky quartz; poor sample

5,165-5,190 Dolomite, light greyish brown, microgranular, finely porous, heavily silicified; abundant fossil fragments; bryozoa

5,190-5,195 Very poor sample

5,195-5,230 Limestone, more or less dolomitic, crinoidal, very finely porous, with some microgranular to chalky filling; zones of white chert replacement

5,230-5,275 Very poor samples

5.275-5,285 Limestone, dolomitic, pale brown, shell-fragmental; crystalline fossil fragments with granular filling, slightly porous; zones with milky chert

5,285-5,290 Very poor sample

5,290-5,305 Limestone, dolomitic, and calcareous dolomite, light brown, granular, slightly porous; fine fossil fragments; Syringopora(?)

5,305-5,320 Limestone, dolomitic, silty, light greyish brown, microgranular to dense; fine fossil fragments; brachiopods; Syringopora(?)

5,320-5,325 Dolomite, light brown, microgranular, partly silicified; abundant crystalline fossil fragments; parts of crinoid arms

5,325-5,335 Limestone, very silty, dolomitic, light greyish brown, microgranular; crystalline fossil fragments, some silicified; bryozoa; brachiopods

5,335-5,340 Very poor sample

5,340-5,360 Limestone, silty and dolomitic, light greyish brown, microgranular; fine brown bands of organic material; Syringopora(?); silicified crinoid fragments

5,360-5,370 Limestone, dolomitic, argillaceous to very finely silty, light brown, very finely crystalline; Syringopora(?); brachiopods

5,370-5,380 Limestone, pale brown, coarsely crinoidal, with microgranular dolomite filling; porous zones; brachiopods

5,380-5,390 Very poor sample

Banff Formation (5,390-5,865 feet)

5,390-5,410 Limestone, pale brown, finely shell-fragmental, more or less porous and dolomitic; trace of interstitial chert

5,410-5,425 Limestone, pale brown, finely shell-fragmental; sparse carbon and brown organic specks

5,425-5,430 Limestone, dolomitic, finely to coarsely shell-fragmental, with a few crinoids; very porous

5,430-5,465 Limestone, pale brown, shell-fragmental; bands and abundant specks of brown organic material

5,465-5,480 Limestone, dolomitic, very finely shell-fragmental, with chitinous fragments and brown bands; finely porous; zones with interstitial white chert

5,480-5,485 Limestone, dolomitic, cream, finely granular, friable, and porous; nodules of grey chalcedony; poor sample

5,485-5,515 Limestone, dolomitic, silty, finely granular and porous to crystalline, very finely shell-fragmental; white chert zones, few dark brown bands, scattered chitinous(?) specks; light residue of silt in acid

5,515-5,535 Dolomite, calcareous, silty, pale brown, finely granular, very finely porous; white cherty zones; dolomitic shell-fragmental limestone with Syringopora(?)

5,535-5,545 Very poor sample; clear gypsum fragments

5,545-5,550 Poor sample; yellowish grey and medium grey shale with carbonized wood, etc., probably caved

5,550-5,555 Limestone, dense; cavities, after fossils, filled with granular gypsum

5,555-5.560 Limestone, dolomitic, pale brown; fine, altered, shell-fragmental material

5,560-5,570 Chert, calcareous, medium to light brown; unsilicified limestone interbeds of similar texture

5,570-5,595 Limestone, silty, dolomitic, light brown, microgranular to dense; residue of medium silt in acid

5,595-5,600 Limestone, dolomitic, light brown, very finely shell-fragmental, very finely porous; small, subangular "pebble" of greyish brown dense limestone in shell-fragmental matrix

5,600-5,630 Limestone, siliceous, greyish brown, dense (leaves heavy brown skeleton of silica in acid); interbeds of granular dolomite and silty limestone; some white chert

5,630-5,635 Limestone, light brown, silty, granular; siliceous, dense limestone; poor sample

5,635-5,645 Limestone, light greyish brown, microgranular, slightly silty and dolomitic; probably consists of very fine fossil fragments

5,645-5,665 Limestone, microgranular, with darker siliceous interbeds; thin white chert bands; sparse darkbrown banding

5,665-5,670 Limestone, silty, dark brownish grey, dense, slightly dolomitic; residue in acid of fine silt and brown flocculate

5,670-5,695 Limestone, dark greyish brown, dense; interbeds of light brown, finely granular limestone; residue in acid of very fine silt with a little argillaceous material

5,695-5,700 Limestone, pale cream, dense; a few fossil fragments; Syringopora-like coral

5,700-5,705 Limestone, pale brown, dense, slightly dolomitic, some with pink cast

5,705-5,755 Limestone, pale brown, dense, slightly dolomitic and silty; fossiliferous white chert inclusions; abundant sponge spicules; trace Syringopora-like coral

5,755-5,760 Chert, cream, dense, with fossil fragments; some limestone

5,760-5,780 Limestone, cream to pink, with fine red mottling, slightly dolomitic, slightly argillaceous; spicular chert inclusions

5,780-5,795 Limestone, dolomitic, red mottled to grey; very cherty; argillaceous red and grey bands; fossil fragments; pyrite at top

5,795-5,800 Limestone, dolomitic, brownish grey, containing much granular anhydrite or gypsum; chert inclusions

5,800-5,805 Limestone, dolomitic, dark grey, dense, slightly argillaceous; pyrite bands

5,805-5,815 Limestone, medium brownish grey, dense, slightly silty

5,815-5,820 Shale, medium brown, very hard, slightly calcareous; much brown organic material, abundant thin shell fragments; poor sample

5,820-5,845 Limestone, brownish grey, dense, slightly silty

5,845-5,850 Limestone, silty, light grey, cherty; scattered fine pyrite, rare ostracods(?); shell impressions; residue of very fine silt in acid

5,850-5,860 Limestone, silty, light brown to light grey, dense to finely granular; scattered fine pyrite; rare glauconite(?); traces of fossils

5,860-5,865 Missing

Mississippian or Devonian

Basal Banff and(?) Exshaw Formations (5,865-5,925 feet)

5,865-5,870 Shale, black, carbonaceous, with conodonts; limestone with abundant pyrite and copper-green glauconite(?) from overlying beds

5,870-5,875 Shale, black; much glauconitic silty limestone contamination; trace dolomitic siltstone

5,875-5,880 Sandstone, dolomitic, light grey; very fine, angular quartz grains; fine mica; sparse pyrite crystals

5,880-5,900 (Core No. 83, 16'5")

0 to 1'6" Sandstone and shale, thinly interbedded light grey and medium grey; dolomite cement

1'6" to 9'5" Shale, medium grey, with some lenses of light grey dolomite

9'5" to 16'5" Sandstone, medium light grey, somewhat shaly; finer grained lenses; dolomite cement

5,900-5,920 (Core No. 84, 20')

0 to 15'4" Dolomite, medium to light greenish grey; very sandy lenses; some pyrite

15'4" to 16'2" Shale, brown and greenish grey mixed, dolomitic; some sandstone

16'2" to 17'8" Sandstone, greenish grey, fine-grained, dolomitic; much pyrite in some zones

17'8" to 19'10" Sandstone, greenish grey, with breccia-like inclusions and beds of dark brown to black shale; veins of gypsum

19'10" to 20' Shale, dark brown and black, with some greyish green sandstone; some conodonts and spores

5,920-5,925 Sandstone, dolomitic and black shale; sandstone, light grey, fine-grained, with scattered pyrite; associated with brownish black, slightly dolomitic shale

Devonian (5,925-7,705 feet)

Unclassified Beds (5,925-6,015 feet)

5,925-5,930 Sandstone, dolomitic, light greenish grey, very fine grained; scattered pyrite

5,930-5,950 Very poor samples: formation not known; trace cream to flesh-coloured dolomite with green shale lens near top; greenish grey sandstone

5,950-5,955 Siltstone, argillaceous, dolomitic, light greyish green, with abundant fine pyrite; mica; a few green shale lenses

5,955-5,960 Very poor sample

5,960-5,970 Sandstone, dolomitic, flesh-coloured, hard, ranging to sandy dolomite; greyish green argillaceous interbeds with fine pyrite; abundant small green shale lenses

5,970-5,990 Sandstone, dolomitic, flesh-coloured, with numerous green shale lenses; fine pyrite

5,990-6,005 Sandstone, dolomitic, with fewer green shale lenses; thin bed of brownish red shale near base

6,005-6,010 Sandstone, dolomitic, and sandy dolomite, flesh-coloured, with green, argillaceous bands; thin brown dolomitic shale interbed

6,010-6,015 Sandstone, dolomitic, flesh-coloured, with reddish brown and green argillaceous interbeds

Amaranth Formation (6,015-6,080 feet)

6,015-6,020 Sandstone, dolomitic, pink to red, with green shale lenses and interbeds; red, sandy, gypsiferous shale with sugary white gypsum inclusions

6,020-6,075 Shale, dolomitic, brownish red, gypsiferous; white gypsum inclusions; interbeds of pink sandstone with green shale lenses and abundant gypsum

6,075-6,080 Dolomite, light green, with shaly zones and pyrite; light brown, granular dolomite; abundant small gypsum inclusions

Woodbend Formation (6,080-6,665 feet)

6,080-6,090 Limestone, dolomitic, dark to light brown, finely crystalline, with abundant sugary white gypsum; zones of pale brown, microsucrose dolomite; zone of altered pelletoid limestone

6,090-6,092 Anhydrite, dolomitic, pale grey, dense

6,092-6,112 (Core No. 85, 13'4")

0 to 1'8" Dolomite, medium grey and buff; very dense, amorphous appearance

1'8" to 2'2" Dolomite, light buff, mixed dense and finely granular; inclusions of anhydrite

2'2" to 4'6" Dolomite, buff, with grey streaks; dense, amorphous appearance

4'6" to 5' Dolomite, light buff, fine-grained, with many inclusions of anhydrite

5' to 7'5" Limestone, buff, somewhat granular, fine-grained; some inclusions of anhydrite

7'5" to 8'6" Limestone, brown, fine-grained

8'6" to 13'4" Limestone, buff, fine-grained, somewhat crystalline; some inclusions of anhydrite; lower part brown, probably stained with oil

6,112-6,115 Limestone, brown, finely crystalline, with light brown, dolomitic patches

6,115-6,130 Limestone, dolomitic, ranging to calcareous dolomite, medium brown, dense to very fine-grained; gypsum inclusions; abundant carbon specks

6,130-6,145 Very poor samples

6,145-6,150 Limestone, dolomitic, medium light brown, dense; sparse brown organic flakes; small fossil fragments-ostracods, spines

6,150-6,175 Limestone, dolomitic, ranging downward to calcareous dolomite, light brown, finely crystalline, with sugary white gypsum inclusions; abundant highly altered fossil fragments; sparse plicate brachiopods

6,175-6,180 Dolomite, brown, very finely sugary, with white gypsum inclusions; light grey, dense, dolomitic siltstone

6,180-6,185 Dolomite, finely sugary; dolomitic siltstone; poor sample

6,185-6,200 Very poor samples

6,200-6,205 Dolomite, dark brown, dense; light brown, sugary, finely porous dolomite with some interstitial gypsum

6,205-6,215 Very poor sample

6,215-6,220 Dolomite, brown, finely crystalline, very hard, grading to cream, microsucrose dolomite

6,220-6,230 Dolomite, medium greyish brown, finely crystalline, hard; slightly porous zones; carbon specks; residue of very fine quartz

6,230-6,250 Dolomite asabove; interbeds of medium grey, microgranular, argillaceous, and silty dolomite

6,250-6,260 Dolomite, light greyish brown, microsucrose; a few specks of organic matter; dolomitic limestone at base

6,260-6,265 Limestone, dolomitic, light brown, dense to finely crystalline; abundant dark spots and fossil fragments - probably altered shell-fragmental material; residue of very fine quartz

6,265-6,280 Very poor samples

6,280-6,285 Dolomite, anhydritic, silty, light grey, dense

6,285-6,295 Very poor samples; possibly anhydrite

6,295-6,300 Limestone, medium to dark brown, some with dark bands of organic material; cream dolomite with anhydrite inclusions

6,300-6,310 Anhydrite, very finely crystalline; grey, anhydritic dolomite

6,310-6,315 Limestone, dolomitic, grading to calcareous dolomite, light brown, dense to finely granular; some chalky limestone

6,315-6,325 Limestone, light brown, dense, with granular dolomitic patches; ostracods

6,325-6,330 Shale, light greenish grey, calcareous; poor sample

6,330-6,335 Anhydrite, pale cream, with dolomite inclusions; poor sample

6,335-6,345 Limestone and dolomite, interbedded; limestone, brown, dense; dolomite, pale brown to greyish brown, very finely granular; carbon specks; poor samples

6,345-6,355 Anhydrite, pale grey to white; buff dolomite interbeds

6,355-6,360 Limestone, light brown; scattered small ostracods

6,360-6,365 Limestone, light to dark brown, dense, with dolomitic zones; anhydrite

6,365-6,395 Very poor samples

6,395-6,400 Limestone, light to dark brown, slightly to very dolomitic, dense to finely granular; thin zone with irregular oolites(?)

6,400-6,405 Dolomite, pale brown to cream, microgranular, with numerous large white anhydrite inclusions

6,405-6,410 Limestone, dolomitic, ranging to calcareous dolomite, medium to light brown, dense to finely granular

6,410-6,430 Limestone, medium brown, dense; zones with granular dolomitic patches; plicate brachiopods at top

6,430-6,435 Limestone, dolomitic, medium to light brown, dense, with tiny visible dolomite rhombs; thin bed of grey banded dolomitic siltstone; trace of cream dolomite with soft anhydrite inclusions

6,435-6,440 Shale, dark brown, calcareous, with abundant organic matter; brown, sublithographic limestone, in part brecciated

6,440-6,445 Very poor sample; trace clay with floating sand grains

6,445-6,450 Limestone, medium light brown, dense; granular, porous limestone; dark bands of organic material; fine gypsum inclusions; anhydrite band

6,450-6,455 Limestone, pale brown, dense, with vague markings after fossil (or breccia?) fragments; a few ostracods; small spores abundant - similar to spores found in Cooking Lake member of the Woodbend formation in Alberta; band of brownish black organic shale

6,455-6,465 Limestone, pale brown, dense, with dark brown bands; spores abundant; faint markings after ostracods

6,465-6,475 Very poor samples

6,475-6,480 Dolomite, calcareous, brown, finely granular, with numerous inclusions of white calcite; brown, crystalline dolomite; white anhydrite.

6,480-6,490 Very poor samples

6,490-6,510 Limestone, medium dark brown, sublithographic; stylolites; thin chalky zones

6,510-6,515 Limestone, sublithographic, with crystalline and dolomitic zones; red shale parting; thin bed of grey silty limestone

6,515-6,520 Dolomite, medium brown, coarsely granular, with interstitial anhydrite or gypsum; probably highly altered shell-fragmental material

6,520-6,525 Very poor sample

6,525-6,530 Dolomite, cream, dense, very finely porous; anhydrite inclusions

6,530-6,535 Anhydrite, pale brown, finely crystalline; brown dolomite partings

6,535-6,540 Dolomite, medium to light brown, microsucrose, porous to finely crystalline; some dense brown limestone

6,540-6,550 Limestone, dolomitic, medium dark brown, dense, grading to brown, dense dolomite with anhydrite inclusions and interbeds; microsucrose dolomite with clear gypsum inclusions; dark bands of organic(?) material

6,550-6,565 Very poor samples; possibly anhydrite

6,565-6,590 Very poor samples; trace of friable microsucrose dolomite with cavities partly filled with finely granular anhydrite

6,590-6,620 Very poor samples

6,620-6,625 Dolomite, calcareous, mixed large dark and light brown rhombs, interstitial calcite, somewhat porous; pale, crystalline limestone zones with stromatoporoids

6,625-6,640 Very poor samples; trace algal limestone

6,640-6,655 Dolomite, brown, crystalline to sugary; poor interstitial porosity; a few fine vugs

6,655-6,665 Limestone, dolomitic, pale brown, with abundant large dolomite rhombs, grading to calcareous dolomite; pores after stromatoporoids; plicate brachiopods

Beaverhill Formation (6,665-7,175 feet)

6,665-6,685 Limestone, dolomitic, silty, argillaceous, medium greyish brown, very finely crystalline to dense; abundant insoluble residue of very fine silt; more argillaceous material at top

6,685-6,700 Limestone, medium greyish brown, very finely crystalline to sublithographic; residue of very fine silt with dark brown resinous material; rare large spores

6,700-6,710 Limestone, dolomitic, light greyish brown, very finely crystalline; abundant large spores

6,710-6,715 Limestone, dolomitic, medium to pale brown; granular, clastic appearance

6,715-6,730 Limestone, dolomitic, pale brown, with visible rhombs, grading to calcareous dolomite; anhydrite interbeds and inclusions

6,730-6,740 Dolomite, medium brown, very finely crystalline to microsucrose, porous; dark bands; trace grey siltstone near base

6,740-6,760 Siltstone, argillaceous, dolomitic, and calcareous, light grey, dense, ranging to dolomitic limestone

6,760-6,765 Very poor sample; possibly limestone breccia, with grey, sugary dolomite cement

6,765-6,795 Limestone, argillaceous, grey to light brown, slightly silty and dolomitic

6,795-6,800 Limestone, medium light brown, dense, very slightly dolomitic

6,800-6,805 Dolomite, calcareous, cream, microgramular; pale grey, anhydritic dolomite

6,805-6,810 Limestone, light brown, with abundant small pelecypods mostly obliterated; oolites, with interstitial anhydrite; microgranular dolomite as above

6,810-6,815 Missing sample

6,815-6,820 Limestone, light brown, dense, more or less dolomitic, with brown, lath-like gypsum crystals; grey, anhydritic, granular dolomite

6,820-6,835 Anhydrite; brown and grey dolomite interbeds and dark brown bands of organic(?) material

6,835-6,840 Shale, dark brown, organic(?)

6,840-6,845 Shale; pale greyish brown, microgranular dolomite

6,845-6,855 Dolomite, medium to pale brown, microsucrose, calcareous in part; grey, argillaceous dolomite inclusions and interbeds

6,855-6,860 Limestone, dolomitic, ranging to sugary dolomite, medium brown, slightly to fairly porous, some with subangular breccia-like fragments of grey, dense dolomite

6,860-6,870 Calcareous dolomite, as above, with dark brown shaly bands and grey dolomite interbeds; band with small shells or oolites

6,870-6,875 Dolomite, light brown, finely sugary; brownish grey, dense, anhydritic dolomite

6,875-6,895 Limestone, light greyish brown, dense, slightly dolomitic, very finely silty

6,895-6,900 Limestone, dense as above, grading to shell-fragmental material; plicate brachiopods

6,900-6,905 Missing

6,905-6,910 Limestone, light greyish brown, dense, very slightly dolomitic

6,910-6,915	Limestone, as above; dolomite, medium brown, sugary to pale brown, dense, with small anhydrite inclusions
6,915-6,925	Dolomite, argillaceous, anhydritic, medium to dark grey
6,925-6,930	Dolomite, calcareous, light greyish brown, finely sugary, moderately porous to tight
6,930-6,935	Missing
6,935-6,940	Anhydrite, with cream dolomite bands
6,940-6,945	Dolomite, medium brownish buff, microsucrose to microgranular
6,945-6,950	Anhydrite, white, brown-mottled
6,950-6,960	Dolomite, greyish brown, microgranular to dense with argillaceous, silty zones; anhydrite inclusions and interbeds
6,960-6,965	Anhydrite with dolomitic interbeds
6,965-6,970	Dolomite, pale brown, dense, with anhydrite inclusions; dark, bituminous bands
6,970-6,975	Anhydrite, with grey, dolomitic interbeds
6,975-6,980	Dolomite, pale brown, microsucrose; zone with abundant small dark partings
6,980-6,985	Dolomite, anhydritic, light grey, dense; argillaceous zones with fine anhydrite grains
6,985-7,000	Anhydrite, dolomitic, argillaceous, light grey, with salt casts; anhydrite and dolomite, with red and grey interbeds of clay
7,000-7,005	Shale, dark greyish brown, with much organic material; poor sample
7,005-7,010	Shale, light grey, soft, dolomitic, with finely sandy interbeds; soft red shale; poor sample
7,010-7,015	Shale, calcareous, or chalky argillaceous limestone, pale grey, very soft; abundant ostracods
7,015-7,030	Dolomite, anhydritic, grey; anhydrite; red shale with salt; poor samples

7,030-7,040 Anhydrite, dolomitic, argillaceous, grey, with salt casts; anhydrite interbeds

7,040-7,055 Anhydrite, dolomitic; red shale with salt casts

7,055-7,065 Very poor samples

7,065-7,070 Shale, dolomitic; anhydritic, grey, some red; salt casts

7,070-7,075 Very poor sample

7,075-7,095 Dolomite, anhydritic, grey; white anhydrite with salt casts

7,095-7,105 Limestone, dolomitic, medium brown, dense, ranging to microsucrose; very porous dolomite with anhydrite inclusions and small vugs; trace dolomitized algal material

7,105-7,125 Limestone, medium dark brown, dense to lithographic; zones of pelletoid bodies; dark, bituminous(?) bands; fossil fragments; brachiopods

7,125-7,135 Limestone as above; abundant brachiopods

7,135-7,150 Limestone as above, porous near base; brown, bituminous band; oolites; abundant brachiopods

7,150-7,160 Limestone, medium brown, dense as above, with porous, dolomitic zones after a lobate coral and stromatoporoids; abundant brachiopods

7,160-7,165 Very poor sample

7,165-7,170 Limestone, porous, as above, fractured; much anhydrite and shale with salt casts (probably caved); poor sample

7,170-7,175 Missing

Elk Point Group (7,175 to 7,705 feet)

7,175-7,180 Dolomite, anhydritic and red shale with salt casts (caved?)

7,180-7,185 Dolomite, light brown, silty, microgranular; anhydrite inclusions

7,185-7,190	Dolomite, light pinkish brown, anhydritic
7,190-7,195	Dolomite, dark brown, dense, very hard
7,195-7,210	Dolomite, light brown to light grey, microgranular, very finely porous, anhydritic in part; anhydrite interbeds
7,210-7,225	Very poor samples possibly anhydrite
7,225-7,240	Limestone, dark brown, dense, with porous zones after stromatoporoids; granular dolomite zones, anhydrite inclusions, brachiopods
7,240-7,245	Limestone, with dolomitic zones as above; Lingula
7,245-7,250	Limstone, dolomitic, brown, dense, ranging to sugary porous dolomite; abundant fossil fragments - stromatoporoids, brachiopods
7,250-7,275	Limestone, dolomitic and sugary, porous dolomite; dark bands of organic(?) material; a few fossil fragments
7,275-7,285	Limestone, dolomitic, ranging to calcareous dolomite, light brown; poorly preserved fossil fragments
7,285-7,290	Limestone, dolomitic, medium greyish brown, dense
7,290-7,315	Limestone, dolomitic, brownish grey, dense, very finely silty
7,315-7,360	Salt, with interbeds of anhydritic dolomite; red clay with salt casts; abundant limestone cavings; poor samples
7,360-7,605	Salt, with anhydritic dolomite and red clay interbeds as above
7,605-7,610	Anhydrite, dolomitic, grey, very finely crystalline; salt casts abundant
7,610-7,615	Dolomite, light brown, dense; gypsum inclusions or veinlets; dark brown bands of organic(?) material
7,615-7,640	Dolomite, pale brown to cream, very finely crystalline; zones of vuggy porosity; disseminated fine anhydrite or gypsum

7,640-7,650 Dolomite, pale brown to cream, very finely crystalline to granular, tight; sugary porous zones; abundant stromatoporoids

7,650-7,655 Very poor sample

7,655-7,660 Dolomite, pale brown to cream, as above; a few stromatoporoids

7,660-7,665 Very poor sample

7,665-7,680 Dolomite, pale brown to cream, as above; some fine vuggy porosity; interbeds of grey anhydrite with selenite crystals (caved?)

7,680-7,700 Dolomite, pale brown, finely crystalline; a few vugs

7,700-7,705 Dolomite, pale to medium brown, finely crystalline, as above

Silurian (7,705-8,210 feet)

Ashern Formation(7,705-7,770 feet)

7,705-7,710 Dolomite, pink, crystalline, with scattered vugs and pyrite; grey dolomitic shale interbed

7,710-7,715 Dolomite, pink to cream, finely crystalline, hard

7,715-7,720 Dolomite, pale brown, very finely crystalline, hard

7,720-7,740 Mudstone, dolomitic, dark brownish grey, dense, very hard, silty; interbeds of red dolomitic shale associated with pink dolomite

7,740-7,755 Dolomite, argillaceous, light grey, dense to microgranular, with shaly zones; scattered pyrite crystals

7,755-7,760 Dolomite, argillaceous, as above; red dolomitic shale

7,760-7,765 Shale, dolomitic, dull reddish brown, massive; some white, dense, finely crystalline dolomite

7,765-7,770 Dolomite, pale brown, some coarsely crystalline, with interstitial green clay

Interlake Group (7,770-8,210 feet)

7,770-7,810	Dolomite, cream to white, finely crystalline, very dense
7,810-7,815	Dolomite, as above; very thin bed of brown dolomite, with bright green shale
7,815-7,825	Dolomite, cream and flesh-coloured, finely crystalline to dense
7,825-7,865	Dolomite, pale cream to pink, finely crystalline
7,865-7,870	Dolomite, cream, crystalline to pink, granular, dense in part; green shale partings; trace argillaceous dolomite
7,870-7,890	Dolomite, cream, finely crystalline
7,890-7,895	Dolomite, silty, pale brown, microcrystalline; dark green shaly partings
7,895-7,920	Dolomite, cream, very finely crystalline
7,920-7,925	Dolomite, as above; thin bed of pink dolomitic clay with angular quartz grains
7,925-7,940	Dolomite, pale cream, very fine to medium crystalline; crystals after faint fossil fragments; some poor vuggy porosity
7,940-7,945	Dolomite, cream, finely crystalline; dark shale parting
7,945-7,965	Dolomite, cream, finely crystalline; faint crinoid fragments; slightly porous zone
7,965-7,970	Missing
7,970-7,975	Dolomite, cream, with floating sand grains, ranging to pale grey, with light residue of coarse silt
7,975-7,980	Dolomite, pale brown to cream, dense
7,980-8,000	Dolomite, cream, very finely crystalline to dense
8,000-8,010	Dolomite, silty, light brown, some with greenish cast; cream, dense dolomite with very faint crinoid fragments
8,010-8,020	Dolomite, cream, very finely crystalline, with faint fossil traces - crinoids

8,020-8,040 Dolomite, cream, very finely crystalline; very sparse faint fossils; a few zones of vuggy porosity; stylolites

8,040-8,055 Dolomite, cream, dense to finely crystalline; abundant small fossils and fragments of plicate brachiopods

8,055-8,065 Dolomite, light greyish brown, silty

8,065-8,070 Dolomite, cream, dense, with very faint, fine mottling; consists of fine angular dolomite fragments in translucent cement

8,070-8,100 Dolomite, cream, dense to microgranular; a few crinoids and other fossil fragments; stylolites

8,100-8,120 Dolomite, cream, microcrystalline to microgranular; rare faint fossil fragments; stylolites

8,120-8,135 Dolomite, pale brown, dense; stylolites

8,135-8,145 Dolomite, cream, finely crystalline to dense, hard; floating, well-rounded, frosted quartz grains to 0.25 mm.; interbedded grey, silty dolomite, with abundant sand grains

8,145-8,150 Dolomite, cream, very finely crystalline to dense; scattered fossil fragments

8,150-8,160 Dolomite, pale brown, dense

8,160-8,165 Dolomite, pale greyish brown, dense, argillaceous, slightly silty

8,165-8,180 Dolomite, cream, microcrystalline to microgranular: scattered small fossil fragments; zone of slight porosity near base, with crinoid and tabulate coral fragments

8,180-8,185 Dolomite, cream, very finely crystalline; grey, dense, finely silty dolomite interbed

8,185-8,190 Dolomite, cream, dense, with dull chalky appearance; abundant crystalline crinoid fragments

8,190-8,205 Dolomite, pale brown, dense to microgranular; scattered crinoid fragments

8,205-8,210 Dolomite, silty, medium grey, dense, with scattered pyrite and rare inclusions of brown, dense dolomite

Ordovician (8,210-8,755 feet)

Red River Formation (8,210-8,605)

8,210-8,215 Dolomite, pale brown, dense; abundant, lath-like, amber gypsum crystals

8,215-8,220 Dolomite, as above; amber gypsum veinlets

8,220-8,225 Dolomite, pale cream, microgranular to microcrystalline; clear gypsum

8,225-8,235 Limestone, dolomitic, pale brown, microgranular; abundant crystalline fossil fragments

8,235-8,240 Dolomite, light brown, finely crystalline, very hard

8,240-8,252 Dolomite, light to pale brown, finely crystalline to granular; scattered vugs and fossil fragments; porous zones

8,252-8,280 Dolomite, pale cream, very finely crystalline to granular; scattered crinoid fragments; zones of clear gypsum inclusions

8,280-8,290 Dolomite, calcareous, light brown, dense to microgranular; abundant crinoid fragments

8,280-8,295 Limestone, dolomitic, medium brown, dense; abundant crinoid, brachiopod, and other fossil fragments

8,295-8,310 Limestone, as above, with red specks and specks of carbon

8,310-8,330 Limestone, light brown, ranging to calcareous dolomite, dense to granular and chalky; abundant fossil fragments, some dark; carbon specks

8,330-8,335 Dolomite, calcareous, light greyish brown, microgranular; contains much granular anhydrite

8,335-8,340 Dolomite, light brown, microsucrose, porous; thin bed of grey dolomitic mudstone

8,340-8,345 Dolomite, buff, finely crystalline; fine vuggy porosity; thin grey anhydrite interbed

8,345-8,355 Limestone, medium brown, shell-fragmental in part; clear gypsum crystals; abundant fossils including brachiopods; carbon specks; chert interbed

8,355-8,365 Anhydrite, brown to grey; light brown finely crystalline dolomite at top, with fine vuggy porosity

8,365-8,370 Anhydrite; cream, dense, dolomite containing very small oolites(?)

8,370-8,385 Dolomite, with oolites(?) as above

8,385-8,400 Dolomite, pale brown, dense; granular spots and vugs after oolites or ovoid fossils

8,400-8,405 Dolomite, light brown, dense, with very fine vuggy porosity; large ostracods

8,405-8,435 Dolomite, light greyish brown, dense to finely crystalline; abundant fossil fragments, some dark; fine vugs and pores after fossils; shell fragmental zones

8,435-8,445 Limestone, light brown, dense, with microgranular dolomitic zones; abundant fragments of crinoids and other fossils

8,445-8,465 Dolomite, light to medium brown, microgranular; abundant calcareous fossil fragments, some porous; dolomitic limestone bands; clear gypsum inclusions

8,465-8,475 Dolomite, as above; microsucrose, porous zones; fewer fossil fragments; bands of greyish brown dolomite

8,475-8,480 Limestone, dolomitic, medium light brown, dense, shell-fragmental

8,480-8,495 Dolomite, medium brown, microgranular; some porous zones; calcareous fossil fragments; dolomitic limestone bands; clear gypsum inclusions

8,495-8,535 Limestone, shell-fragmental; band of white, chalky, and powdery dolomitic chert

8,535-8,545 Limestone, dolomitic, medium brown, shell-fragmental, with visible dolomite rhombs

8,545-8,565 Dolomite, light brown, finely crystalline to granular; abundant crystalline fossil fragments

8,565-8,585 Dolomite, light brown, finely crystalline; granular, slightly porous zones; fossil fragments

8,585-8,590 Dolomite, light brown, finely crystalline; zone of good porosity after stromatoporoids

8,590-8,595 Dolomite, light brown, finely crystalline, some with coarse, poorly sorted frosted quartz grains, grading to dolomitic sandstone

8,595-8,605 Sandstone, dolomitic, white; poorly sorted, frosted quartz grains; abundant dolomite cement

Winnipeg Formation (8,605-8,755 feet)

8,605-8,610 Sandstone, dolomitic, pink, medium- to coarse-grained; cement of dolomite with hematite

8,610-8,615 Sandstone, dolomitic, argillaceous, fine-grained, greyish green, with pink bands and red hematite

8,615-8,620 Sandstone, white with pink zones; medium, subangular quartz grains; little dolomite cement; sparse, small quartz pebbles

8,620-8,635 Sandstone, white to cream, medium-grained; dolomite cement

8,635-8,645 Sandstone, white and pink, quartzitic, with silicified coral(?) fragments; interbeds of medium grey, non-calcareous shale

8,645-8,657 Shale, dark grey, splintery, some with sand grains; interbeds of dark grey to white, quartzitic sandstone, poorly sorted, some with hematite specks

8,657-8,675 Sandstone, red to white, with poorly sorted quartz grains and abundant dolomite cement; pyrite; abundant fossil fragments; green shale band near base

8,675-8,695 Missing

8,695-8,725 Sandstone, dolomitic, white, fine- to coarse-grained, poorly sorted, partly porous; red sandstone; green shale bands at 8,705 feet

8,725-8,735 Sandstone, as above, with white, chalky silica in upper part

8,735-8,745 Sandstone, dolomitic, white, poorly sorted

8,745-8,755 Sandstone, as a bove, with many coarse amber quartz grains

Cambrian (8,755-9,400 feet)

8,755-8,790 Sandstone, dolomitic, white, some pink; poorly sorted fine to medium quartz grains; scattered pyrite

8,790-8,795 Sandstone, dolomitic, pale pink, medium-grained; abundant fine glauconite grains; splintery green shale with scattered glauconite

8,795-8,800 Siltstone, dolomitic, red and green; shale, as above; glauconite; fine mica

8,800-8,845 Sandstone, dolomitic, pink to grey, medium-grained, glauconitic; interbeds of greyish green shale, with maroon bands; scattered glauconite; abundant sericite

8,845-8,850 Sandstone, dolomitic, fine-grained, micaceous, glauconitic; abundant crystalline dolomite cement

8,850-8,855 Sandstone, glauconitic; interbeds of green shale as above

8,855-8,900 Shale, greenish grey, with purplish red bands, sericite, and scattered glauconite; interbeds of glauconitic sandstone with dolomite cement, as above

8,900-9,000 Shale, greenish grey and maroon, micaceous as above; interbeds of glauconitic, dolomitic sandstone, becoming less numerous toward base of interval

9,000-9,020 Sandstone, white, with medium to coarse, poorly sorted quartz grains showing marked secondary crystal growth; much caved shale; poor samples

9,020-9,105 Sandstone, white to grey, coarse, poorly sorted, somewhat quartzitic, with secondary crvstal growth; many fine fragments of thin linguloid shells; rare, tiny, narrow, cone-shaped shells; thin interbeds of dark grey, firm shale with sand grains and rare shell fragments

9,105-9,110 Sandstone, as above, but coarser grained; abundant shell fragments; pyrite

9,110-9,115 Shale, dark grey, flaky, waxy; a few sand grains

9,115-9,145 Shale, dark to medium grey, splintery, with much sericite; interbeds of white quartzitic sandstone, slightly dolomitic, with abundant coarse glauconite; rare, thin shell fragments; brown mica

9,145-9,150 Sandstone, light grey quartzitic glauconitic; interbeds of grey splintery shale

9,150-9,160 Shale; sandstone interbeds, as above

9,160-9,170 Sandstone, light grey, fine-grained, quartzitic, with abundant fine glauconite; brown mica; thin shell fragments; shale interbeds, dark grey, with greenish cast, sandy, glauconitic in part

9,170-9,180 Shale, with glauconitic sandstone lenses, as above; brown quartzitic sandstone with glauconite

9,180-9,190 Sandstone, brown, argillaceous, glauconitic; lenticular, finely speckled fossils - probably sponges; shaly interbeds

9,190-9,195 Sandstone, reddish brown; coarse quartz grains with brown argillaceous material, dolomite cement, and glauconite

9,195-9,200 Sandstone, slightly quartzitic, partly porous; coarse, clear quartz grains with marked secondary crystal growth; scattered fine glauconite; zones of fine pyrite; rare shell fragments

9,200-9,240 Sandstone, as above; poor samples

9,240-9,255 Sandstone, as above, porous, mottled; abundant shell fragments

9,255-9,280 Sandstone, grey, medium-grained, porous, slightly quartzitic; glauconitic; shaly partings

9,280-9,310 Sandstone, white, coarse, porous; clear quartz grains with brown inclusions, secondary crystal growth; sparse shell fragments

9,310-9,315 Sandstone, white, coarse crystal grains, as above; larger frosted quartz grains. abundant

9,315-9,320 Sandstone, as above; salmon-pink, medium- to coarse-grained, quartzitic sandstone

9,320-9,325 Sandstone, pink to red; much pale argillaceous material; mica; thin interbeds or partings of greyish green shale; fine shell fragments and brown specks

9,325-9,365 Sandstone, as above; coarse, white to amber, frosted grains; hematite; interstitial clay

9,365-9,380 Sandstone, as above, with sericitic, green, splintery shale interbeds

9,380-9,390 Sandstone, coarse, poorly sorted; large frosted amber quartz grains and pebbles; pink, slightly quartzitic sandstone matrix

9,390-9,395 Sandstone, as above; much red material

Precambrian

9,395-9,400 Granite, red; gneissic

NOTES ON FORMATIONS ENCOUNTERED IN WELL

Pleistocene (0-375 feet)

The thickness of 375 feet assigned to glacial overburden may be a little greater than is actually the case. A few fragments of shale and some glauconitic sand occur in the samples above 375 feet, but most of the samples consist of sand and fragments of limestone and igneous rocks that are associated with the glacial debris of the area.

Cretaceous

Riding Mountain Formation (375-2,505 feet)

The strata between 375 feet and the first occurrence of speckled shale at 2,505 feet are, apparently, all of marine origin, and contain very few sandy zones. These are characteristics of the Riding Mountain formation of Manitoba,

which has been defined as covering the same interval (Wickenden, 1945, p. 47), although the thickness in Manitoba is about half that in the Ogema well. The beds occurring at 375 feet and immediately below in the Ogema well are undoubtedly equivalent to some in the upper part of the Bearpaw, but lithological changes to brackish and non-marine beds do not occur here, and it is not possible to distinguish the Oldman and Foremost formations, which underlie the Bearpaw in Alberta. It is probable that some of the marine shales and shaly sands that occur here merge into these formations farther west. Undoubtedly, too, some of these beds are continuous with the Lea Park formation of western Saskatchewan.

It is to be expected that the transition between the thick marine shale section of the Riding Mountain formation and the subdivided marine and non-marine section farther west takes place gradually and in an interfingering fashion. Just how far west the name Riding Mountain may be applied is uncertain, and varies from south to north.

The Riding Mountain formation is also equivalent to the Pierre shale of parts of the United States, but as the extent and definition of this shale are uncertain it seems safer, at present, to identify the beds in this well with the Riding Mountain of Manitoba.

The upper contact of the Riding Mountain formation with the glacial drift seems to occur at beds that are a little below the top of the formation. The lower beds of the formation appear to be in direct contact with the Boyne member of the Vermilion River formation, possibly indicating an erosional interval at the top of that formation.

Vermilion River Formation (2,505-2,735 feet)

Apparently, the black shales and bentonitic beds of the Pembina member of this formation are missing in this well, and the speckled shales of the Boyne member are the youngest beds of the formation. The thickness of the Boyne and Morden members is very similar to that of these members on the Manitoba escarpment. The appearance of a sandy zone in the samples, a little more than 100 feet below the top of the Boyne beds, suggests that these beds may be related to the Medicine Hat gas sand. It is possible that lenses of this sand may occur in some localities in southern Saskatchewan.

Favel Formation (2,735-2,815 feet)

The beds assigned to the Favel formation show the same characteristics as those of this formation exposed on

the Manitoba escarpment. The formation is also referred to as the "second white specks" in well logs in Alberta. The Favel is also equivalent to part, if not all, of the Greenhorn formation of the Black Hills of South Dakota.

Ashville Formation (2,815-3,375 feet)

The non-calcareous shales underlying the Favel formation and overlying the Swan River group have been assigned to the Ashville formation, although it is probable that more study may prove that the part of the section included under Ashville represents more than one formation, as it does in parts of Alberta. The sand at a depth of 3,190 feet may be the equivalent of the Viking formation, or one of the Bow Island sands of western Saskatchewan and Alberta.

Swan River Group (3,375-3,680 feet)

The beds below the shales of the Ashville formation and overlying the Jurassic strata are assigned to the Swan River group, as they show the characteristics of this eastern Plains group more than those of the Blairmore group of Alberta.

The upper contact of the group is placed at a depth of 3,375 feet on the basis of a change from dark grey to light grey shales. The shales above this horizon appear, in the cores examined, to be mostly of marine origin. Apparently, the first sands were not obtained in the cores, but the change is indicated in the electric log. There is a possibility that the contact is only approximately correlative with that observed in Manitoba, as the change from marine to continental deposits, and shale to sand, may not be at exactly the same horizon at every locality. The trend to the lithology of the Lower Cretaceous of the Black Hills of South Dakota and Montana may obtain in southern Saskatchewan, and members may occur there that are not present elsewhere in the Canadian Plains.

The lower part of the Swan River group includes beds that contain numerous nodules of ferruginous material, a band of ironstone, and carbonized plants. These features are characteristic of beds at about the same horizon in several other wells in southern Saskatchewan, and may serve to distinguish it as a good marker.

There is no evidence as to how old the lowest beds of the Swan River group are, or even that they are of Lower Cretaceous age. However, the sediments seem more closely related lithologically to those of the overlying beds and are probably of the same age.

Jurassic (3,680-4,670 feet)

The upper boundary of beds assigned to the Jurassic System has been placed at the top of a shale unit that contains Jurassic foraminifera typical of those in the Redwater shale member of the Sundance formation in the Black Hills of South Dakota (Loeblich and Tappan, 1950, pp. 39-60). No evidence was found for identifying beds equivalent to the overlying Morrison formations of western South Dakota and eastern Wyoming, and it is probable that a period of erosion occurred in Saskatchewan during late Jurassic or early Lower Cretaceous time.

The beds assigned to the Jurassic are divided into four units, which, in downward succession, are: a soft, calcareous shale, with thin sandstone beds and lenses; a predominantly non-calcareous, grey and red shale, with a few sand beds, believed to be of continental origin; a thick section, of marine origin, consisting of variegated, calcareous shale and numerous limestone bands, many of which are oolitic; and the basal unit, consisting of 200 feet of gypsiferous red shale and granular gypsum, with much red clay. The upper three units resemble members of the Sundance formation, and the lowest unit the Piper formation referred to by Imlay (1952, pp. 969-970). It is probable that some of the members of the Sundance will eventually be recognized as formations, and the term may be restricted, or even abandoned. Although the section assigned to the Jurassic in this well appears to cover the same time interval as the Ellis group, as defined by Cobban (1945, pp. 1,262-1,303), the difference in lithological character and apparent facies does not warrant the use of this term.

The red shales and associated sediments encountered between depths of 3,895 and 3,915 feet resemble the Lak member of the Sundance formation in colour and position in the section, but their difference otherwise in lithology makes application of the name of that member unwarranted. These beds normally contain numerous chara and smooth ostracods, and their fossil content and colour make for easy identification. They are fairly extensive, having been recognized in wells in both Saskatchewan and Manitoba. Some of the sand below the red beds (3,915 to 3,925 feet) may be related to the Huelett member of the Sundance. The Stockade-Beaver shale member of the same formation, also described by Imlay (1947, pp. 251-254), may be related to the shale and limestone beds at depths of from 3,925 to 4,215 feet. There are various beds of limestone and shale down to a depth of 4,255 feet and some of the limestones are oolitic, and resemble limestone of the Rierdon formation in wells farther west in southern Saskatchewan. Calcareous shale predominates from there to a depth of 4,410 feet. No diagnostic fossils were found in the samples between depths of 3,925 and 4,410 feet, but the lithology resembles that of the Stockade-Beaver

shale and other members of the lower part of the Sundance formation, and, although the thickness is greater than observed in the Black Hills, it seems justifiable to assume that the beds are correlative.

The beds between 4,410 and 4,670 feet have been assigned to the Piper formation, chiefly because they contain numerous beds of anhydrite and otherwise resemble the Piper described by Imlay (1952, pp. 969-970). These beds have been commonly called the Spearfish formation, but the anhydrite, limestone, and dolomite seem to be more characteristic of the Piper. Apparently, there is no Spearfish formation in this well.

Mississippian (4,670-5,865 feet)

No attempt has been made by the authors to subdivide strata of this age further than into Rundle and Banff formations. The thickness of the Rundle is greater than that in the type area of the eastern Rocky Mountains, and it is possible that younger beds are included. The location of the top of the underlying Banff formation is based on the change to finer grained, clastic limestones and a tendency to more argillaceous and silty rocks. No fossil evidence was found to assist in dating the beds above or below this contact.

Mississippian or Devonian

Basal Banff and (?) Exshaw Formations (5,865-5,925 feet)

Two black shales with sandstone between comprise this unit. The shales contain spores and conodonts, and resemble shales that have been called Exshaw or Banff in wells in some parts of the Plains. It is uncertain, however, if either shale is related to the Exshaw of the type locality on Jura Creek in Alberta. The lower shale is very thin, and it is possible that some of the sandy beds above it represent some of the thicker shale section found at other localities.

Devonian (5,925-7,705 feet)

The uppermost known Devonian beds consist of greenish dolomitic sandstone and siltstone, and have been referred to the Three Forks formation by some oil company geologists. A core taken at this horizon in the Sohio Standard Pense No. 1 well, in l.s. 14, sec. 10, tp. 17, rge. 22, W. 2nd mer., contained brachiopods that were

identified by D. J. McLaren, of the Geological Survey of Canada, as Martinia cf. sublineata. This species has been found in the Pine Point formation of the Great Slave Lake area and in the Flume formation of the eastern Rocky Mountains of Canada, and appears to range from the lower part of the Middle Devonian into the lower part of the Upper Devonian. A few specimens of ostracods showing surface markings similar to those of the genus Entomis were also found in samples from this zone in the Pense well, but none was complete enough to show the hinge and relationship of the two valves, and the identification as to genera is uncertain.

None of the samples studied in the Ogema district shows the numerous bryozoa, ostracods, and coarsely plicated brachiopods that are common in samples from beds usually called the Three Forks formation by oil geologists in Alberta and western Saskatchewan.

Similar green shales, with spores, occur near the top of the Devonian in wells farther west, and this zone seems to be traceable into the base of the shale member usually assigned to the Three Forks formation in the Kindersley area in Saskatchewan as well as western Alberta. Thus, these green shales appear to be traceable into a late Upper Devonian formation, but also contain some fossils that have been found only in older beds. Under these circumstances the exact correlation is uncertain. Either these beds are part of the Three Forks formation and the fossils have a longer range than has been determined, or they represent deposition similar to the Three Forks formation in earlier Devonian time, and may lie unconformably below the "Three Forks" shale in part of western Saskatchewan.

Below these green shales and limestone is a group of gypsiferous, silty, dolomitic, red shale and gypsum beds between depths of 6,015 and 6,075 feet. These beds resemble the Amaranth of Manitoba in lithology and stratigraphic position, especially if compared with this formation in wells in western Manitoba. There the contacts at the top and the base of the Amaranth appear to be unconformable. To what extent this is true in the Ogema district is uncertain, but it does seem probable that the contact with the overlying beds is unconformable, as the same types of beds are not everywhere found at this contact. The possibility, however, that this is due to a facies change should not be overlooked.

Between depths of 6,080 and 7,180 feet, the Devonian beds may be equivalent to parts of the subsurface, Woodbend and Beaverhill formations of the western Plains. The occurrence of small, spherical, orange-brown spores in the limestone from 6,445 to 6,465 feet suggests the top of the Cooking Lake member of the Woodbend formation, and it is assumed, therefore, that the 365 feet above this is

equivalent to some of the upper part of the Woodbend.

The beds between the limestone series, correlated with the Cooking Lake member, and the top of the Elk Point group are defined as those of the Beaverhill formation because they occupy the same position in the section and are similar lithologically. The top of this formation is chosen arbitrarily where a change occurs downward from pale brown, dolomitic, reef limestone to greyish brown, finely silty, or argillaceous limestone, a change easily recognized in southern Saskatchewan but one that may occur slightly higher or lower in the section in other areas. No attempt has been made to differentiate the part of this Beaverhill section equivalent to the Manitoban formation. The latter, as exposed in the Lake Manitoba and Lake Winnipegosis area, is only 370 feet thick according to Baillie (1950, p. 60). Wells west of the outcrop area, in Manitoba, show a greater thickness of Manitoban and related younger beds, and the 585 feet of beds included in the Beaverhill in the Ogema well suggest that the Manitoban or its equivalent is probably only a part of this unit.

Elk Point Group (7,180-7,705 feet)

The evaporite, limestone, and dolomite section included between depths of 7,180 and 7,705 feet in this interval is closely related to the Elk Point group of east-central Alberta in lithology, and the name has been used here rather than Winnipegosan, which is probably a time equivalent. The top of the group in this well is placed at the top of a thin red shale bed that resembles a similar shale in the Elk Point in wells in eastern Alberta and western Saskatchewan. The interbedded dolomite, limestone, and anhydrite above the salt seems to be thicker here than in wells farther north. The samples are poor in the salt section, and the limits of the salt are only approximate.

Below the salt, the stromatoporoid dolomite may be equivalent to the Elm Point formation of northern Manitoba, although the limestone of the type Elm Point is not present. There is probably an unconformity between the Elk Point and underlying Ashern formation.

Silurian

Ashern Formation (7,705-7,770 feet)

The dull red dolomitic shale and associated dolomite beds of this part of the well section are assigned to the Ashern formation of northern Manitoba on the basis

of lithology and stratigraphic position. They are placed in the Silurian in agreement with Baillie's (1951, p. 33) determinations in Manitoba. It is probable that an unconformity occurs at their base.

Interlake Group (7,710-8,210 feet)

The term Interlake group proposed by Baillie (1951, p. 6) is used here, as it was not found possible to subdivide this part of the well section into formations. Eventually, it may prove possible to trace the formations from the outcrops into the basin, and the surface names can then be applied. It should be noted, however, that the section assigned to the Interlake group in this well is somewhat thicker than that occurring in the outcrop in Manitoba.

The lower part of the section assumed to be of Silurian age seems to resemble the Stonewall formation of Manitoba lithologically, but is much thicker than indicated by Baillie (1951, pp. 15-16), and it is possible that some members occur here that are not found in Manitoba. The base of the Silurian System has been placed at the silty dolomite with pyrite that occurs below the zone with the frosted sand grains. This horizon seems to represent a break in sedimentation that may mark the beginning of Silurian deposition in southern Saskatchewan.

Ordovician (8,210-8,755 feet)

Red River Formation (8,210-8,605 feet)

The sandy limestone and fossils usually found in the Stony Mountain formation in wells in Manitoba were not found in the Ogema well, and it is assumed that this formation was eroded here. The uppermost lithological units assigned to the Ordovician appear to belong to the Red River formation, and it is possible that even a little of this formation may have been eroded.

The base of the Red River formation has been placed at the base of the sandstone at a depth of 8,605 feet, as this poorly sorted sand, with its content of hematite indicating weathering in the underlying beds, seems to mark a break in sedimentation.

Winnipeg Formation (8,605-8,755 feet)

It is assumed that the sandstones and shales underlying the Red River formation represent the Winnipeg formation. No fossils were found in these beds, and the

correlation is based on similarity of position and lithology. The base of the Winnipeg is placed where there seems to be a change in type of sedimentation, and probably an interval of erosion, above the glauconite-bearing sands of the Cambrian.

Cambrian

The glauconite-bearing sands are assigned to the Cambrian because similar sandstones in cores from other wells contain numerous small, inarticulate brachiopods presumed to be of Cambrian age.

Precambrian

The well bottoms in red granite-gneiss of Precambrian age.

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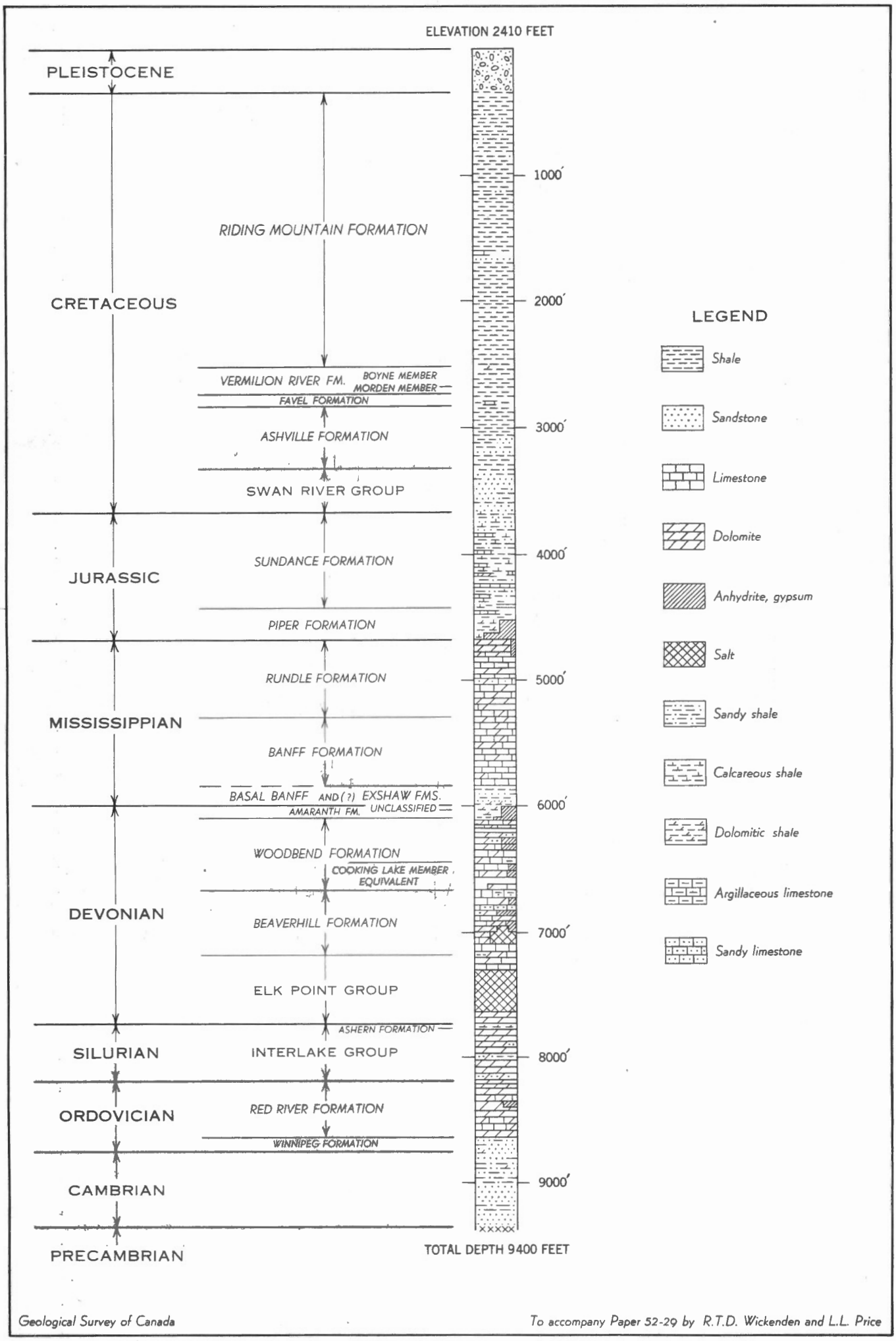

Figure 1

Graphic log of Norcanols Ogema No. 1 well, l.s. 4, sec. 24, tp. 7, rge. 23, W. 2nd mer., Saskatchewan