Geological Survey of Canada - Open File 7031

STRATIGRAPHIC CORRELATIONS FOR FIVE OFFSHORE WELLS IN THE HUDSON BAY BASIN, NORTHERN CANADA

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Natural Resources Canada / Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

Netsiq N-01
300N016000087300

Beluga O-23
300O235920088300

Walrus A-71
300A0715840087000

Polar Bear C-11
300C0115840086450

Narwhal S. O-58
300O585810084000

DEPTH (mKB)

Mesozoic

Devonian

Silurian

Upper Ordovician

Precambrian

Sea floor

Evans Strait

Long Rapids

Williams Island

Murray Island

Moose River

Kwataboahegan

Kwataboahegan+Stooping River

Stooping River

Kenogami River

Ekwan River

Severn River

Red Head Rapids

Churchill River

Bad Cache Rapids

Basal Clastics

Precambrian

Attawapiskat

5.most likely Devonian @530~555m @620-645m

5.Mid-Upper Ordovician @890~915m

4.Mid-Upper Ordovician @900~910m

4.Mid-Upper Ordovician @985~995m

3.Upper -Mid Devonian @384~603.5m

2.Mid Devonian (Givetian) @580~590m

2.Mid Devonian (Givetian) @635~640m

2.Mid Devonian @675~680m

4.Mid-Upper Devonian (Eifelian to early Frasnian) @715~725m

5.Lower Devonian (Emsian) @705~799m

5.Lower Devonian (Emsian) @820m

6.Mid-Upper Devonian @609.6~610.2m

6.Mid Devonian @813.8~817.5m

1.Lower Silurian @914.4~975.4m

1.Lower Silurian @975.4~1024.1m

1.Lower Silurian @1112.5~1194.8m

5.Lower Devonian @1070m

5.Lower Devonian (Emsian) @1200~1205m

5.Lower Devonian (Emsian) @1475~1490m

2.Lower or Mid Devonian @1495~1500m

2.Lower Silurian @1645~1650m

4.Lower Silurian @1930~1940m

2.Upper Ordovician @2090~2095m

4.Mid-Upper Ordovician @2175~2185m

2.Upper Ordovician @2180~2185m

3.Upper-Mid Devonian @384~597.4m

4.Mid-Upper Devonian (Givetian to early Frasnian @589.8~594.4m

4.Mid-Upper Devonian (Givetian to early Frasnian @595.9~600.5m

4.Mid Devonian (Eifelian to early Givetian @789.4~821.4m

2.Mid Devonian (Eifelian to early Givetian @812.1~815.2m

4.Mid-Upper Devonian (Eifelian to early Frasnian) @823~826m

4.Devonian @931.2~937.4m

3.Devonian/Silurian boundary @932.7~963.2m

1.Lower Silurian @952.5~1104.9m

3.Lower Silurian @869.3~1024m

3.Lower Silurian @1033.3~1051.6m @1143~1271m

1.Lower Silurian (Llandovery) @1104.9~1135.4m

1.Lower Silurian (Llandovery) @1135.4~1310.6m

1.Upper Ordovician (Richmondian-Gamachanian) @1310.6~1389.9m

1.Upper Ordovician (Richmondian) @1389.9~1493.5m

2.Upper Ordovician (Richmondian) @1445.5~1477.3m

2.Upper Ordovician (Maysvillian-Late Edenian) @1495.5~1498.5m

3.Mid-Lower Devonian @371.9~381m

1.Lower Silurian @502.9~792.5m

2.Lower Silurian (Llandovery) @777.3~790.9m

2.Lower Silurian (Llandovery) @783.3~975.4m

2.Lower Silurian (Llandovery) @827.3~913.6m

2.Lower Silurian (Llandovery) @965.2~968.2m

1.Upper Ordovician @990.6~1079m

1.Upper Ordovician (Richmondian) @1079~1194.8m

2.Upper Ordovician (Richmondian) @1148.5~1183.3m

1.Upper Ordovician @1079~1194.8m

2.Upper Ordovician @1227.3~1277.3m

2.Upper Ordovician @1292.4~1295.5m

Devonian

Silurian

Upper Ordovician

Precambrian

Stratigraphy

CRETACEOUS	Evans Strait
DEVONIAN	Long Rapids
	Williams Island
	Murray Island
	Moose River
	Kwataboahegan
	Stooping River
	Kenogami River
SILURIAN	Attawapiskat(?)
	Ekwan River
	Severn River
ORDOVICIAN	Red Head Rapids
	Churchill River
	Bad Cache Rapids
	Basal Clastics
PRECAMB.	Precambrian

unconformity

disconformity

uncertain boundary

facies change

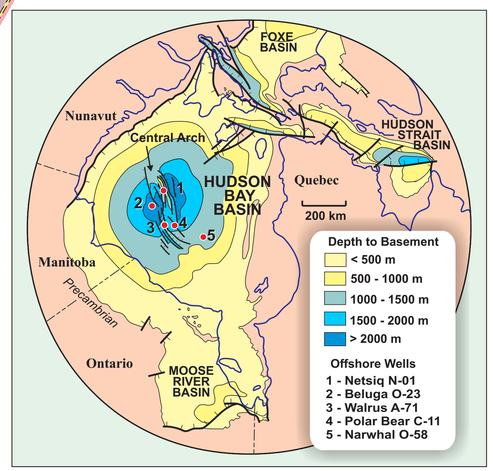
Lithology

shale; dolomite; dolomitic/calcareous sandstone; sandstone; dolomitic limestone; conglomerate; limestone; calcareous dolomite; granite; salt; anhydrite; gypsum; sandy limestone; cement; oil shale

lithology uncertain due to lack of well logs or sample data

Well Logs

DT-sonic transit time (μs/m)
GR-gamma ray log (API)
GR_-thorium (PPM)
ILD-deep induction log (ohm-m)
SFL-shallow focussed log (ohm-m)
LLD-deep laterolog (ohm-m)
LLS-shallow laterolog (ohm-m)
LL8-laterolog 8 (ohm-m)
RHOB-bulk density log (kg/m³)
POL-neutron porosity log (v/v)



Regional setting of sedimentary basins in the Paleozoic Hudson Platform, with depths to Precambrian basement and locations of the five offshore wells drilled in the Hudson Bay Basin, modified from Sanford and Grant (1998).

Biostratigraphic age determinations

1–Zhang, S. and Barnes, C.R., 2007. Late Ordovician-Early Silurian conodont biostratigraphy and thermal maturity, Hudson Bay Basin.
2–Asselin, E., 2011. Ages based on Chitinozoa.
3–S.N.P.A., 1975. Geological and geochemical study.
4–Uyeno, T.T., 1989. Report on 55 conodont samples from four offshore wells in the Hudson Bay.
5–Robertson Research Canadian Ltd., 1986. The micropaleontology and stratigraphy of the Netsiq N-01, Beluga O-23 wells in the Hudson Bay.
6–Other GSC reports, 1973.

NOTES

The well log cross-section illustrates the major stratigraphic correlations between five offshore wells drilled in the Hudson Bay Basin (Netsiq N-01, Beluga O-23, Walrus A-71, Polar Bear C-11 and Narwhal South O-58). The stratigraphic interpretations are based on an integrated study of well log, seismic and biostratigraphic data (Hu et al., 2011).

The five offshore wells penetrated Upper Ordovician to Devonian strata, with four of the wells drilled to Precambrian (granitic and metasedimentary) basement rocks. One well (Netsiq N-01) encountered strata of possible Cretaceous age unconformably overlying the Paleozoic section. Three wells (Netsiq, Walrus and Polar Bear) were drilled on fault-block highs within the Central Hudson Bay Arch. The Beluga well (the deepest well in the basin) was drilled to test a small fault block within a subbasin adjacent to the arch. The Narwhal well was drilled to test stratigraphic features in the eastern part of the basin.

Upper Ordovician strata in the Hudson Bay Basin consist of a thin basal clastic unit and a carbonate-dominant succession that includes the Bad Cache Rapids Group, Churchill River Group and Red Head Rapids Formation. The Bad Cache Rapids Formation consists of fossiliferous limestone and dolomitic limestone. These carbonates are conformably overlain by dolomite, limestone and minor anhydrite of the Churchill River Group. The Red Head Rapids Formation consists of interbedded carbonates, shale and anhydrite and an overlying salt section (in the Beluga, Polar Bear and Narwhal wells). Oil shales are identified from well logs in the Red Head Rapids Formation, consistent with previous interpretations (Zhang, 2008). The oil shales very in thickness from 0.9 to 3.7 metres, with the thickest oil shales in the Beluga well.

The Lower Silurian succession includes the Severn River and Ekwan River formations, consisting of fossiliferous limestone and dolomite. Anhydrite is present in most wells and dolomitic sandstone is present (in the Severn River Fm) in the Beluga well. Seismic and dipmeter data indicate the Polar Bear and Narwhal wells encountered carbonate reefs (Attawapiskat Formation). The Silurian-Devonian boundary occurs in the lower Kenogami River Formation in the Polar Bear well. The formation consists of limestone and minor dolomite and dolomitic sandstone, overlain by evaporites. Kenogami River strata were not deposited over high-standing fault blocks penetrated by the Netsiq and Walrus wells.

The Devonian succession consists of the upper Kenogami River, Stooping River, Kwataboahegan, Moose River, Murray Island and Long Rapids formations. Significant thickness and lithofacies variations occur in the Lower Devonian succession. The Beluga well penetrated a thick evaporite (halite) section in the Stooping River Formation, which is thin or absent in other wells. The correlations presented here differ from a previous interpretation of a Silurian age for the evaporite section in the Beluga well (Sanford and Grant, 1998). A shale to carbonate facies transition occurs in the Kwataboahegan Formation, between the Narwhal and Polar Bear wells. Disconformities occur at the base of the Middle–Upper Devonian Murray River and Williams Island formations. The Williams Island Formation consists of a lower shale unit, overlain by limestones and minor sandstones. The Long Rapids Formation (in the Walrus and Polar Bear wells) is a shale dominant unit.

Strata of possible Cretaceous age (Evans Strait Formation) in the Netsiq well were identified from high-resolution seismic data (Sanford and Grant, 1998). Although interpreted as a clastic unit by Sanford and Grant (1998), there are no log or sample data available to determine the lithology of the Evans Strait Formation in the Netsiq well.

Acknowledgements:

The authors thank Tony Hamblin for a review of the report, and Godfrey Nowlan, Sandy McCracken and Tom Uyeno for their discussions on micropaleontology reports for the five wells. This work was supported by the Hudson Bay-Foxe Basin project of the GEM Energy program.

References:

Hu, K., Dietrich, J., Dewing, K., Zhang, S., Asselin, E., Pinet, N., and Lavoie, D. (2011). Paleozoic stratigraphy and petroleum reservoir potential in the Hudson Bay Basin, Northern Canada. GAC-MAC-SEG-SGA, Annual Convention, Program with Abstracts.

Sanford, B.V. and Grant, A.C., 1998. Paleozoic and Mesozoic geology of the Hudson and southeast Arctic platforms. GSC, Open File 3595.

Zhang, S. 2008. New insights into Ordovician oil shales in Hudson Bay Basin: their number, stratigraphic position, and petroleum potential; Bulletin of Canadian Petroleum Geology, v. 56, p. 300–324.

doi:10.4095/289545

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7031
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2011

Recommended citation:
Hu, K., Dietrich, J., Dewing, K., Zhang, S., Asselin, E., Pinet, N., and Lavoie, D., 2011. Stratigraphic correlations for five offshore wells in the Hudson Bay Basin, northern Canada; Geological Survey of Canada, Open File 7031. doi:10.4095/289545

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