

# Any source rock potential on southern Baffin Island, Nunavut? - a point of view on Ordovician stratigraphy and oil shale Rock-Eval data

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## GeoConvention 2012: Vision

### Introduction

Southern Baffin Island retains part of Foxe Basin, one of the Paleozoic sedimentary basins in Canada. The Ordovician on southern Baffin Island was previously divided into Middle Ordovician Frobisher Bay Formation, and Upper Ordovician Amadjuak, Akpatok and Forster Bay formations consisting mainly of carbonate with minor shale (Sanford and Grant, 2000). The stratigraphy and hydrocarbon potential of the Ordovician sequence in Foxe Basin are poorly understood. Over the past few decades there has been considerable debate on whether there is oil shale within the Ordovician on southern Baffin Island. If there is, where is its stratigraphic position? is it geographically widely distributed? does it have any petroleum potential? Answers to these questions are part of the Hudson Bay – Foxe Basin project under NRCan's Geo-mapping for Energy and Mineral (GEM) Program.

### Method

Field studies in 2011 were designed to test the stratigraphic position, geographic distribution and petroleum potential of the oil shale on southern Baffin Island. A total of 39 locations were visited through out the Paleozoic area on southern Baffin Island; 130 conodont samples (processing is not finished yet) and 46 shale samples were collected from representative sections for biostratigraphic study and Rock-Eval data collection, respectively.

One oil shale interval was sampled in a large Paleozoic outlier by the Jordan River, which is stratigraphically in the lower Amadjuak Formation, rather than between Amadjuak and Akpatok formations as previously interpreted (Sanford and Grant, 2000). Owing to facies change, this oil shale laterally changed into non-oil shale, which is seen on the western shore of Amadjuak Lake.

### Results of Rock-Eval Analysis

The preliminary data show:

- 1) A 2-m-thick outcrop of lower Amadjuak Formation by the Jordan River gradually changes from black laminated papery oil shale to grey mudstone upwards. This interval contains TOC ranging 1.68%–12.97%, with an average of 7.79%. It is primarily immature Type I marine oil shale (Fig. 1).
- 2) The black laminated papery oil shale rubble samples from various locations with the same lithology as those at the above locality contain 8.83%–14.91% TOC, with an average of 12.68%. All the oil shale rubble samples show an immature nature. When plotted on van Krevelen diagram, rubble samples exhibit a Type I-II kerogen, which may be a false impression caused by the oxidation that tends to remove hydrogen and add oxygen to the kerogen (Fig. 1).

3) The grey shale and mudstone samples from a 2–3-m-thick outcrop of lower Amadjuak Formation on the western shore of Amadjuak Lake only contain 0.31%–0.76% TOC, showing no potential (Fig. 1).

4) The brown flaggy argillaceous limestone rubble from various locations is either covering the outcrop of Amadjuak or Akpatok Formation and most likely belongs to the Forster Bay Formation which has been totally eroded off in the study area. The rubble samples contain 2.82%–5.13% TOC, with an average of 4.21%. The brown argillaceous limestone might exist in the offshore area as another low yield source rock.

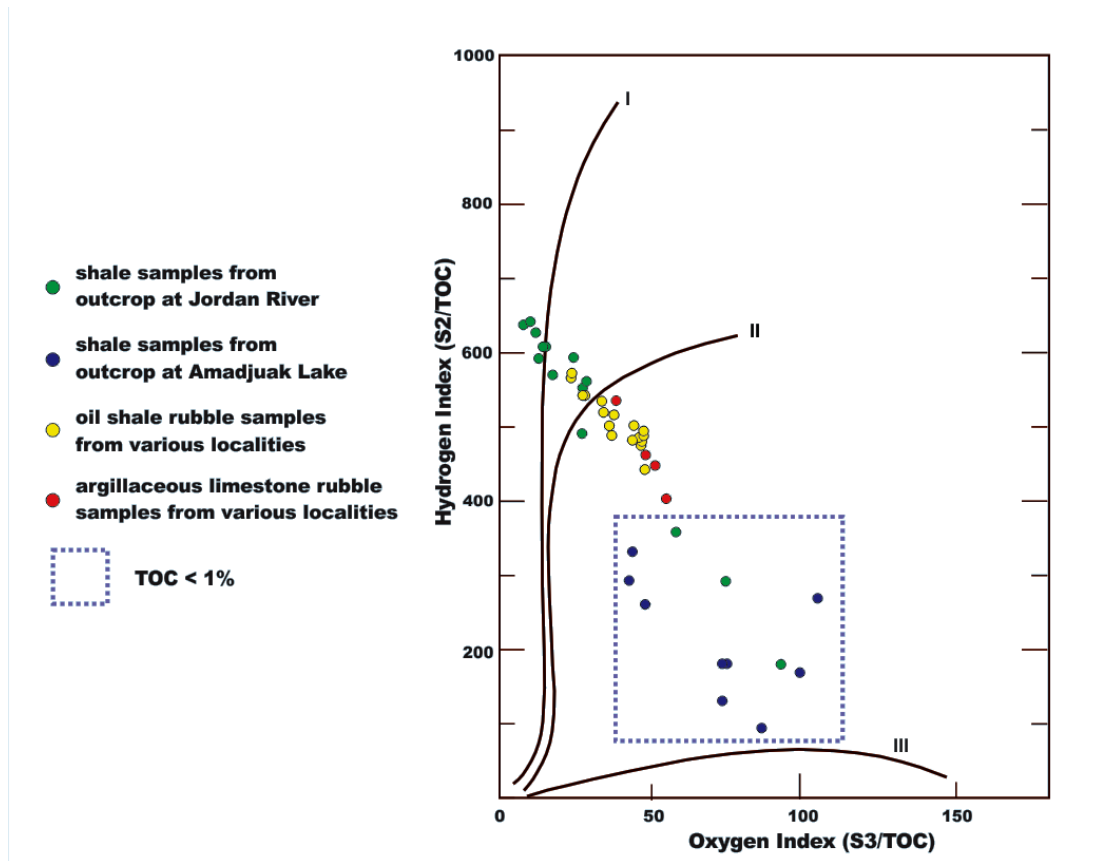


Figure 1: Modified van Krevelen diagram showing relationship between Hydrogen and Oxygen indices of shale samples from different localities, southern Baffin Island

## Conclusions

The 2011 field study on southern Baffin Island

- 1) established the stratigraphic position of the oil shale interval in the lower Amadjuak Formation, Upper Ordovician;
- 2) identified the oil shale laterally changed into non-oil shale;
- 3) recognized another low yield interval in a higher stratigraphic level that has been eroded off in the study area;

4) demonstrated that previously interpreted Forster Bay Formation overlaying Akpatok Formation does not exist on southern Baffin Island owing to the erosion.

## **Acknowledgements**

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## **Reference**

Sanford, B.V. and Grant, A.C. 2000. Geological framework of the Ordovician System in the southern Arctic Platform, Nunavut. Geological Survey of Canada Bulletin **557**, p. 13–38.