GEOLOGICAL SURVEY OF CANADA

OPEN FILE 5591

Geological and geochemical data from the Canadian Arctic Islands. Part VI: Saturate fraction gas chromatograms of organic extracts from outcrop and mining core samples

M. Obermajer, K. Dewing, and M. G. Fowler

2007

Natural Resources Canada | Ressources naturelles Canada

Canada

GEOLOGICAL SURVEY OF CANADA

OPEN FILE 5591

Geological and geochemical data from the Canadian Arctic Islands. Part VI: Saturate fraction gas chromatograms of organic extracts from outcrop and mining core samples

M. Obermajer, K. Dewing, and M. G. Fowler

2007

Available from
Geological Survey of Canada
3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7

Obermajer, M., Dewing, K., and Fowler, M.G.
2007: Geological and geochemical data from the Canadian Arctic Islands. Part VI: Saturate fraction gas chromatograms of organic extracts from outcrop and mining core samples; Geological Survey of Canada, Open File 5591, 6 p.

Open files are products that have not gone through the GSC formal publication process.

Geological and Geochemical Data from the Canadian Arctic Islands. Part VI: Saturate fraction gas chromatograms of organic extracts from outcrop and mining core samples.

Mark Obermajer, Keith Dewing and Martin G. Fowler

Geological Survey of Canada

Abstract

Digital files of C15+ saturate fraction gas chromatograms of 67 samples obtained from outcrops and mining cores in the Canadian Arctic Islands are presented. Each sample is assigned to a stratigraphic unit. The significance of the data is not discussed here.

Introduction

The Arctic Archipelago includes a land area of 780,000 km^2 covering much of the Northwest Territories and Nunavut. It contains three of the 10 largest islands in the world (Baffin, Victoria and Ellesmere) plus twenty-two others of appreciable size. There was an oil and gas exploration boom in the Arctic Islands between 1960 and 1985 that resulted in 191 exploration boreholes and the discovery of 20 major petroleum fields. Estimates of the hydrocarbon resource made by the Geological Survey of Canada predict 45 to 50 Tcf of in-place natural gas in the Sverdrup Basin, whereas the National Energy Board (NEB) predicts 45 Tcf of marketable gas in the whole Arctic Islands area.

The Geological Survey of Canada is undertaking an update of the geological and geochemical datasets for the Arctic Islands. This includes assignement to a stratigraphic unit according to Dewing and Embry (2007), Rock-Eval/TOC data (Obermajer et al., 2007), reflectance data (Dewing et al., 2007) and organic extract gas chromatography data (Obermajer et al., 2007a; 2007b; and herein). With the present report we are able to make use of recent technological advances to provide the data in an electronic format that should make it more amenable for use. The C15+ saturate fraction gas chromatograms have been

obtained over the last ten years or so and consequently there may be some variation in retention times between different samples.

The stratigraphic nomenclature is presented in Figure 1. Formation descriptions are available from the Lexicon of Canadian Geological Names (http://gdr.nrcan.gc.ca/index_e.php). These include age and lithological information, as well as the location of the type section and references. Excellent summaries of the geology of the Canadian Arctic are found in Trettin (1991).

Experimental

Solvent extraction

About 10-20 g of a hand-pulverized sample was used for extracting the solvent-soluble organic matter. The extraction was carried out for 24 hours in a Soxhlet apparatus using approximately 350 ml of an azeotropic mixture of 87% chloroform and 13% methanol. After the solvent was removed in a rotary evaporator (temperature set at 35º-40ºC), the extracts were dissolved in chloroform and treated with colloidal copper to remove elemental sulphur, which is considered to be an artifact resulting from the oxidation of pyrite during sample handling. The mixture was filtered through glass fibre filter paper to remove the copper sulphide and excess of copper, then the filtrate was rotary-evaporated, dried and weighed until a constant weight was obtained. The total yields were normalized to TOC and expressed as milligrams of total extract per gram of organic carbon. Total extracts were then dissolved in a minimal amount of chloroform, treated with pentane to precipitate asphaltenes and then vacuum filtered to remove the precipitate. The asphaltenes were dissolved in chloroform, collected to a separate tared flask, rotary-evaporated and weighed to constant weight.

Liquid chromatography

A mixture of 28-200 mesh Silica Gel (MCB) and 80-200 mesh alumina (ALCOA) (1/3:2/3 by weight respectively) was used as a support for the column. The support is activated by heating at 120º-150ºC for 12 hours. A glass wool plug is placed at a bottom of the column and covered with a 1 cm thick layer of sand. The support, weighed as 1 g of support/10 mg of deasphalted sample, is slowly settled in pentane and any air trapped is released by gentle tapping on the column. A deasphalted sample, dissolved

in a minimal amount of previously measured pentane, is then added to the column. Saturates are recovered by eluting with pentane (3.5 ml/g support), aromatics with a 50:50 mixture of pentane and dichloromethane (4 ml/g support), resins with methanol (4 ml/g support) and any remaining asphaltenes with chloroform. The solvents are rotary-evaporated, separate fractions transferred to tared 1 dram vials, dried in a slow stream of nitrogen and weighed to constant weight.

Gas chromatography

Saturate fractions were analysed using gas chromatography (GC). A Varian 3700 FID gas chromatograph was used with 30m DB-1 column with helium as the carrier gas. The temperature programmed was 60ºC to 300ºC at a rate of 6ºC/min and then isothermal for 30 min. The eluting compounds were detected and quantitatively determined using a hydrogen flame ionization detector.

Selected References

Beauchamp, B., Harrison, J.C., Utting, J., Brent, T.A., and Pinard, S.

2001: Carboniferous and Permian subsurface stratigraphy, Prince Patrick Island, Northwest Territories, Canadian Arctic; Geological Survey of Canada, Bulletin 565, 93 p.

de Freitas, T., Harrison, J.C., and Mayr, U.

1997: Sequence stratigraphic correlation charts of the lower Paleozoic Franklinian succession, Canadian Arctic and parts of North Greenland. Geological Survey of Canada Open File 3410, 3 charts.

Dewing, K., and Embry, A.F.

2007: Geological and Geochemical Data from the Canadian Arctic Islands. Part I: Stratigraphic Tops from Arctic Islands Oil and Gas Exploration Boreholes. Geological Survey of Canada Open File 5442. 1 CD.

Dewing, K., Obermajer, M., and Goodarzi, F.

2007: Geological and Geochemical Data from the Canadian Arctic Islands. Part III: Organic matter and reflectance data. Geological Survey of Canada Open File 5476. 1 CD.

Dewing, K. and Nowlan, G.S.

2004: Correlation chart of Cambrian and Ordovician stratigraphy, Arctic Islands, Nunavut, Canada; Geological Survey of Canada, Open File 1837, 1 chart.

Embry, A.F.

1983a: Stratigraphic subdivision of the Heiberg Formation, eastern and central Sverdrup Basin, Arctic Islands. Geological Survey of Canada, Paper 83-1B, p. 205-213.

1983b: The Heiberg Group, western Sverdrup Basin, Arctic Islands. Geological Survey of Canada, Paper 83-1B, p. 381-389.

1984a: Stratigraphic subdivision of the Roche Point, Hoyle Bay and Barrow formations (Schei Point Group), western Sverdrup Basin, Arctic Islands. Geological Survey of Canada, Paper 84-1B, p. 275-283.

1984b: The Wilkie Point Group (Lower-Upper Jurassic), Sverdrup Basin, Arctic Islands. Geological Survey of Canada, Paper 84-1B, p. 299-308.

1984c: The Schei Point and Blaa Mountain Groups (Middle-Upper Triassic), Sverdup Basin, Canadian Arctic Archipelago. Geological Survey of Canada, Paper 84-1B, p. 327-336.

1985a: Stratigraphic subdivision of the Isachsen and Christopher formations (Lower Cretaceous), Arctic Islands. Geological Survey of Canada, Paper 85-1B, p. 239-246.

1985b: New stratigraphic units, Middle Jurassic to lowermost Cretaceous succession, Arctic Islands. Geological Survey of Canada, Paper 85-1B, p. 269-276.

1986a: Stratigraphic subdivision of the Blind Fiord and Bjorne formations (Lower Triassic), Sverdrup Basin, Arctic Canada. Geological Survey of Canada, Paper 86-1B, p. 329-340.

1986b: Stratigraphic subdivision of the Awingak Formation (Upper Jurassic) and revision of the Hiccles Cove Formation (Middle Jurassic), Sverdrup Basin, Arctic Canada. Geological Survey of Canada, Paper 86-1B, p. 341-349.

1994: Uppermost Triassic, Jurassic, and lowermost Cretaceous stratigraphy, Melville Island area, Arctic Canada. *In*: R.L. Christie and N.J. McMillan (eds.) The Geology of Melville Island, Arctic Canada. Geological Survey of Canada, Bulletin 450, p. 139-159.

Embry, A.F. and Klovan, J.E.

1976: The Middle-Upper Devonian clastic wedge of the Franklinian geosynclin; Bulletin of the Canadian Society of Petroleum Geologists, v. 24, p. 485-639.

Harrison, J.C.

1995: Melville Island's salt-based fold belt, Arctic Canada; Geological Survey of Canada, Bulletin 472, 331 p.

Harrison, J.C. and Brent, T.A.

2005: Basins and fold belts of Prince Patrick Island and adjacent areas, Canadian Arctic Islands; Geological Survey of Canada, Bulletin 560, 197 p.

Mayr, U.

1978: Stratigraphy and correlation of lower Paleozoic formations, subsurface of Cornwallis, Devon, Somerset, and Russell islands, Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 276, 55 p.

1980: Stratigraphy and correlation of lower Paleozoic formations, subsurface of Bathurst Island and adjacent smaller islands, Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 306, 52 p.

Mayr, U., Brent, T.A., de Freitas, T., Frisch, T., Nowlan, G.S., and Okulitch, A.V.

2004: Geology of eastern Prince of Wales Island and adjacent smaller islands, Nunavut; Geological Survey of Canada, Bulletin 574, 88 p.

Obermajer, M., Stewart, K.R, and Dewing, K.

2007: Geological and Geochemical Data from the Canadian Arctic Islands. Part II: Rock Eval/TOC data . Geological Survey of Canada Open File 5459. 1 CD.

Obermajer, M., Dewing, K., and Fowler, M. G.

2007a: Geological and Geochemical Data from the Canadian Arctic Islands. Part IV: Gasoline range and saturate fraction gas chromatograms of oil samples. Geological Survey of Canada, Open File 5483, 1 CD.

Obermajer, M., Dewing, K., and Fowler, M. G.

2007b: Geological and Geochemical Data from the Canadian Arctic Islands. Part V: Saturate fraction gas chromatograms of organic extracts from cutting and core samples from petroleum exploration boreholes. Geological Survey of Canada Open File 5534. 1 CD.

Thorsteinsson, R. and Mayr, U.

1987: The sedimentary rocks of Devon Island, Canadian Arctic Archipelago; Geological Survey of Canada, Memoir 411, 182 p.

Uyeno T.T

1990: Biostratigraphy and conodont faunas of Upper Ordovician though Middle Devonian rocks, eastern Arctic Archipelago. Geological Survey of Canada, Bulletin 401, 210 p.