

Gas Hydrates in Canadian Sverdrup Basin, Canadian Arctic Archipelago: A Potential New Focus for Canadian Resource Characterization

Osadetz, Kirk G.¹; Majorowicz, Jacek A.²; Brent, Thomas A.¹; Hannigan, Peter K.¹; Chen, Zhuoheng¹; Šafanda, Jan³ (1) Energy Geoscience Subdivision, Geological Survey of Canada, Calgary, AB, Canada. (2) NGC Consultants Ltd., Edmonton, AB, Canada. (3) Institute of Geophysics, Czech Academy of Sciences, Praha, Czech Republic.

Arctic Archipelago gas hydrates (GHs) are a potentially immense, poorly constrained petroleum resource, which is typically co-located with conventional petroleum. Fifteen or more GH accumulations may have GH/free gas contacts. Both characteristics enhance their commercial potential. Sverdrup Basin is a major extensional basin containing ~13 km of strata. The succession is deformed by several events including, diapiric salt structures and Eocene orogeny. The gas hydrate stability zone (GHSZ) is inferred developed discontinuously among the islands and inter-island seaways. Both significant permafrost and low annual surface temperatures or deep water with low sea bottom temperatures characterize the islands and the inter-island seaways, respectively. The result is that GHs are stable except near coastlines. GHs are inferred to occur in 57 of 150 wells. The average thickness of these occurrences is 65 m. This indicates the GH volume that might be expected, based on a small sample, from widely spaced wells in a huge region. Much of the resource is inferred to occur within Sverdrup Basin proper where fourteen wells show evidence that the GHSZ base lies above the gas/water contact, indicating possible GH/free gas contacts, although most GH accumulations are in contact with water above the GHSZ base. Another GH/free gas contact is inferred at a seismic prospect on Ellef Ringnes Island and a bottom-simulating reflector occurs on an Alpha Ridge seismic survey in the Arctic Ocean. These observations and modeling results suggest that Arctic GHs formed both by the transformation of previously trapped conventional thermogenic natural gas accumulations and due to sub-seafloor microbial methane migrating into the GHSZ. Well data suggests that up to ~52% of the available GHSZ might contain GH. Considering the uncertainties in reservoir parameters and the lateral persistence of GH between wells the resulting Arctic Archipelago GH contingent resource is estimated at $0.19-6.2 \times 10^{14} \text{ m}^3$ methane, of which the Sverdrup Basin holds the greatest part. Twenty-three inferred GH accumulations are found co-located with conventional Sverdrup Basin petroleum discoveries and shows which also enhances their commercial potential. Following the co-location of conventional and GH resources it might be possible to use GH occurrence as a prospecting tool for identifying conventional resources.