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The Cretaceous High Arctic Large Igneous Province

Stéphane Polteau (1), Sverre Planke (1), Jan Inge Faleide (2), Henrik Svensen (3), and Reidun Myklebust (4)

(1) Volcanic Basin Petroleum Research, Oslo, Norway (stephane@vbpr.no), (2) Departement of Geosciences, University of Oslo, Norway, (3) Physics of Geological Processes, University of Oslo, Norway, (4) TGS-NOPEC, Asker, Norway

Large igneous provinces (LIPs) define unusual periods in Earth History which are associated with massive volcanism, supercontinent fragmentation, and oceanic anoxic events (OAE). The High Arctic LIP (HALIP) includes lava flows, sills and dykes that are scattered around the Arctic Ocean. It is probably the least known volcanic province due to the remoteness of the outcrops and the harshness of the arctic environment. The HALIP is defined as a long lasting (ca. 50 Ma) diffuse volcanic period punctuated by two distinct volcanic events: the ∼120-130 Ma Barremian and the ∼80-90 Ma Turonian events. In this contribution, we sub-divided the HALIP into two separate LIPs: (1) the ∼120-130 Ma Early Cretaceous BLIP which was related to the opening of the Canada Basin, and (2) the ∼80-90 Ma Late Cretaceous SLIP which was related to the formation of the Alpha Ridge. New seismic data show that an extensive BLIP sill complex is present in a province exceeding 150,000 km2 in the eastern Barents Sea. The intrusions were mainly injected into Permian to Jurassic age sediments. The BLIP extends beyond the Barents Sea with outcrops on Svalbard, Franz Josef Land, Arctic Canada (Sverdrup Basin and Ellesmere Island) and Bennett Island. Stratigraphic correlations show that lava flows are interbedded with Barremian sediments on Svalbard and Franz Josef Land. New radiometric Ar-Ar ages of the volcanic rocks also support a Barremian age. The massive injection of hot magma into organic-rich sediments in the Barents Sea basins caused organic matter maturation and formation of thermogenic gas and oil. We estimate that about 9000 Gt of carbon was potentially degassed from the contact aureoles. This corresponds to 82 x1012 barrels of oil equivalent. If the metamorphic gas was rapidly released to the atmosphere near the Barremian-Aptian boundary it could have triggered the OAE1a. However, some of the hydrocarbons were likely trapped in the basins, and we note that theworld class Shtockman gas field that is directly overlying a large sill complexes emplaced in Triassic sediments in the eastern Barents Sea.