NEAR-SURFACE GAS GEOCHEMISTRY OF THE NORTHERN BARENTS SEA

P. Weniger, K. Berglar, M. Blumenberg, A. Ehrhardt, D. Franke, P. Klitzke, R. Lutz

Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany

While extensive hydrocarbon exploration and drilling in the Southern Barents Sea offshore Norway has led to numerous oil and gas discoveries, little is known on the petroleum systems and potential hydrocarbon reservoirs in the northern Barents Sea. If subsurface hydrocarbons migrate from source rocks or reservoirs to the surface by macro- or microseepage, traces of these hydrocarbons can remain in the near-surface sediment. Near-surface hydrocarbon prospecting is a method frequently used in hydrocarbon exploration of frontier areas, where no direct geochemical information from drilling is available (Abrams, 1996). To improve knowledge of subsurface structures and the evolution of potential petroleum systems, a BGR research cruise in 2015 collected seismic data in the area south and south east of Svalbard. Additionally, sediment samples were collected by gravity coring along some of the seismic profiles to evaluate the abundance and geochemistry of bound (sorbed) gases in the near surface sediments.

Sediment cores of up to 1.9m length were recovered, comprising mostly Holocene mud or glaciomarine sediment. The concentration of hydrocarbon gas extracted from these sediments was generally low (CH_4 <100 ppb) but at some places exceeded 3000 ppb. However, active seepage was not indicated. The geochemical composition (wetness >20) and stable carbon isotope values ($\delta^{13}C$ CH_4 -38 ‰ - -48 ‰) of samples with elevated concentration of bound gases detected south of Spitsbergen and near the Olga Basin indicate a thermogenic origin, most likely from source rocks of oil window maturity. Correlation between $\delta^{13}C$ of ethane and propane supports an origin from a source rock with type II kerogen and maturity estimates above.

Comparison of bound gas abundance with seismic data from the Olga Basin, south east of Svalbard, reveals that higher concentrations occur near the southern border of the basin corresponding to Jurassic subcrops, whereas elevated concentration in the northern Olga Basin are associated with reactivated faults (Klitzke et al., 2017). Sediments above the centre of the basin show significantly lower bound gas concentration. These observations indicate that the Jurassic could act as a regional seal for hydrocarbons and that reactivated faults at the basin margin could represent pathways for migration to the surface.

References

Abrams, M.A., 1996. Distribution of Subsurface Hydrocarbon Seepage in Near-Surface Marine Sediments, in: Schumacher, D., Abrams, M.A. (Eds.), Hydrocarbon Migration and Its Near-Surface Expression - AAPG Memoir 66. AAPG, Tulsa, Oklahoma, USA, pp. 1-14.

Klitzke et al. (2017) New insights into the crustal configuration of the Olga Basin from deep seismic and geochemistry data. EGU2017-14184 (abstract)