

Reconstruction of the Hydrocarbon-Filling History of a Haltenbanken Oil Field, Mid-Norway Using Basin Modeling

Ondrak, Robert ¹; di Primio, Rolando ¹; Leith, Thomas L. ²; Lescoffit, Guillaume ²; Horsfield, Brian ¹ (1) Organic Geochemistry, GFZ German Research Centre for Geosciences, Potsdam, Germany. (2) StatoilHydro ASA, Trondheim, Norway.

We present a basin modeling study where we reconstructed the detailed hydrocarbon-filling history of a Haltenbanken oil field. The main focus of the study lays on the filling history of the field, specifically the identification of the spatial and temporal maturity evolution of different kitchen areas as well as the migration pathways into the reservoir.

We reconstructed the temperature and pressure history of the northern part of Haltenbanken using 3D basin modeling. The regional model was constructed based on seismic horizons of the main stratigraphic units and well-tops of about 100 exploration wells. The model was calibrated with vitrinite reflectance, temperature and pressure data. The model provided the framework to study hydrocarbon generation and migration. Large differences in burial of the upper Jurassic Spekk formation considered to be the main source rock in the Haltenbanken area led to the maturation of different kitchen areas throughout basin evolution. Onset of hydrocarbon generation in different kitchen areas with progressive burial resulted in changing drainage areas and migration pathways contributing to the filling of the reservoir structure through time. The use of source rock tracers assigned to the various kitchen areas allows unraveling the timing of HC generation and migration pathways in the study area. The filling of the reservoir started in late Paleocene times. During subsequent burial from the Cenozoic onward until today the source rock enters the oil window progressively from North-West to South-West. Hydrocarbon migration into the reservoir occurs most likely along faults in Paleocene times. During the Eocene and Miocene long-range migration along structural highs becomes the dominant migration pathway. In Miocene times fill-spill from a deeper lying reservoir adds to reservoir filling. For the last 3-4 Ma hydrocarbon supply from the deep kitchens has been cut off by diagenetic sealing of the main fault controlling also the occurrence of overpressure in the system.

This basin modeling study provides important understanding for the filling history of this Haltenbanken oil field. Subdividing the source rock into different kitchen areas based on structural elements and burial history helps to elucidate the filling history of the reservoir. We can quantify the amounts to which the different kitchen areas contribute to the charge of the reservoir as well as the dominant migration pathways into the reservoir structure.