

## **Modelling of Erosion and Uplift Effects on Water-Fluid Build-up, Fracturing and Leakage – Example From the Barents Sea**

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### **ABSTRACT**

During the last decades, the exploration interest has increased for the Barents Sea. The focus has been on hydrocarbon migration, and less on water fluid pressure, since the measured pressures from wells have been hydrostatic or close to hydrostatic. The objective of this work is to simulate water-fluid pressure build up, and possible fracturing and leakage in the Fingerdjupet Sub-Basin, for two reservoir units. The fluid flow modelling is carried out over geological time, with uplift and erosion scenario implemented. The pressure simulator Pressim (in-house SINTEF software) models 3D pressure generation and dissipation over geological time scale (Borge 2000) and Lothe et al. (2004). The basic assumption is that the fluid flow dynamics can be represented and described by pressure compartments defined by faults. The tool quantifies pressure dissipation using a unique model for lateral cross-fault fluid flow and Darcy flow equations in the vertical direction. The Griffith-Coulomb failure criterion and the frictional sliding criterion are used to simulate hydraulic fracturing from the overpressured compartments (Lothe et al. 2004). Seven interpreted seismic horizons (resolution 100 x 100 m) were used to build the model. Pseudo-layers were implemented for eroded sections for 40 Ma, 34 Ma and 10 Ma. It is assumed that erosion occurred in two periods: from 40 to 34 Ma with 2/3 net erosion and from 10-2 Ma with 1/3 of the net erosion (e.g. timing from Green & Duddy 2010). We see that varying the amount of erosion strongly influences the magnitude of the paleo-pressure, and the location of the hydraulic leakage. The present pressure distribution for the reservoir units is mainly the same. For the Stø Formation, we mainly model hydrostatic pressures in the Fingerdjupet Sub-basin and Hoop area. In the deeper southwestern part of the area (Bjørnøya Basin), higher overpressure is simulated, but there exists no well control. Borge, H. 2000: Fault controlled pressure modelling in sedimentary basins. A thesis Doktor Ingenør at the NTNU, Norway. Green, P. F. & Duddy, I. R. 2010: Synchronous exhumation events around the Arctic including examples from Barents Sea and Alaska Slope. Petroleum Geology Conference Series, 7, 633-644. Lothe, A.E., Borge, H. & Gabrielsen, R. H. 2004: Modelling of hydrocarbon leakage by pressure and stress simulations and implications for Biot's constant: an example from the Halten Terrace, offshore Mid-Norway. Petroleum Geoscience, 10, 3, 199-213.