Geophysical Research Abstracts
Vol. 13, EGU2011-828-1, 2011
EGU General Assembly 2011

Polygonal fault systems in Gjallar Ridge, offshore Norway : implications for early processes of deformation, faulting and fluid flow.

Dimitri Laurent (1), Aurélien Gay (1), Sébastien Lacaze (2), Christian Bernt (3), Sverre Planke (4), Régis Mourgues (5), Roger Soliva (1), Catherine Baudon (1), and Michel Lopez (1)

(1) Géosciences Montpellier, Université Montpellier 2, France, (2) Société Eliis Montpellier, France, (3) Geomar Kiel, Germany, (4) University of Oslo, Norway, (5) Université Le Mans, France,

Interpretation of 2000 km^2 of 3D seismic data in the Gjallar Ridge (Norway), using KingdomSuite (SMT) and Paleoscan (Eliis) softwares, reveals "non-tectonic" polygonal faults affecting Tertiary mudrocks, probably associated with fluid flow. This system is characterized by normal faults, with throws ranging between 30 and 50 m, displaying a polygonal pattern in plane view. The development of this kind of faults is probably the result of shallow burial dewatering of fine-grained unconsolidated sediments.

Two vertical individual tiers (regional stratigraphic boundaries) of polygonal faults have been recognized. They are bounded by undeformed reflections. The lower tier is a Middle Oligocene - Lower Miocene sequence showing closely-spaced faults with an average spacing of 200 m. The upper tier is Middle Miocene - Pliocene interval and is characterized by faults with an average spacing of 700 m. Some faults are affecting both intervals. We used data from well 6704/12-1 (gamma ray, sonic, resistivity and density) in order to correlate individual tier with lithological properties.

We identify lateral variations in polygonal fault distribution. In particular, the upper part of Middle Miocene –Pliocene interval shows three different structures: 1) in the North-West part, polygonal faults are 5 km wide, bounded by crests, which are characterized by lower amplitudes than sediments within the polygonal cell; 2) in the North-East, polygonal faults are associated with tilted blocks dipping towards the local slope; 3) in the East North-East, faults are radial in pattern, locally branching on adjacent polygonal faults.

This study shows that the formation of polygonal faults depends on a set of parameters such as lithology, regional morphology and pre-existing structures. The main challenge is to identify which kind of fault is more influenced by physical properties and rheology of sediments (type 1), regional structural geology (type 2) and fluid flow mechanisms (type 3). Characterizing the distribution and the mechanical behavior of polygonal faults is essential for predicting sealing capacity over reservoirs and may significantly help in hydrocarbon exploration.