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Seismic Characteristics of Leakage from an Under-Filled Structure in the North Sea, Offshore Norway - Diagnostic Criteria for Other Areas?

The establishment of hydrocarbon column heights is often hampered with large uncertainties, particularly in situations were the hydrocarbons have not been filled to structural spill point (under-filled structures). Even though a great number of structures are under-filled with hydrocarbons, discrete locations where leakage takes place and which determine the hydrocarbon water contact have rarely been reported.

Seismic characteristics of hydrocarbon leakage related to a drilled and under-filled structure (35/10-2) in the North Sea, offshore Norway, were investigated in the search for such a location. Based on a proven gas-water-contact (GWC), the investigation was concentrating upon identifying a discrete location for hydrocarbon leakage which could explain the position of this GWC. The investigations were concentrated on seismic signatures in overburden rocks along the GWC and along the structure's bounding faults.

The investigation concluded that the GWC was controlled by vertical leakage at a fault intersection. This position intersected the top of the reservoir at the depth of the GWC, and coincided by several different characteristic features, including degradation of the seismic signals in overburden rocks and a cone - shaped geometrical feature above the reservoir sequence.

The fact that the position of the seismic characteristics for hydrocarbon leakage coincided with the position of the GWC in well 35/10-2 suggests that such indicators can also be used to establish the position of fluid contacts in undrilled structures, and as such supplement the information from other indicators such as possible DHIs and tectonic history analysis.