P03

Controls on Economical Hydrocarbon Accumulations in the Askeladd Field, Barents Sea - A Post-mortem Fault Seal Analysis

A. Bernal* (StatoilHydro)

SUMMARY

The post-mortem study of a dry well is done by comparing the vertical and lateral sealing capacities of the faults bounding a dry structure with those of a proven gas filled structure.

Comparison of buoyancy pressures measured in the discover well with threshold pressures calculated along the faults bounding the gas structure suggests that membrane seals estimated from shale gouge ratio are capable of holding the proven gas column. Lateral fault seal analysis in the faults bounding the dry well also suggests that they should be able of holding a gas column of similar dimension.

Fault activity during Miocene time and the presence of seismic amplitude anomalies in sediments of Miocene age in both the dry an discover wells, the observation of a gas peak and oil inclusions in carbonate cement at the main fault and the presence of a paleo-hydrocarbon column in the reservoir in the dry well might suggest vertical leakage along the main faults bounding both the dry and gas filled structures.

Considering the close geographical location and similarities in fault-zone processes and properties, fault seal analysis by itself does not explain why one well contains an economical hydrocarbon accumulation and the other not.

The Askeladd structures are located in the south-western portion of the Hammerfest Basin, Barents Sea. The Hammerfest Basin is bounded to the north by the Bjarmeland Paltform and to the south by the Finnmark Platform while to the east is bounded b y the Nordkapp Basin. Towards the west the basin connects to the Tromsø Basin through a series of downward stepping faults. The gas filled structures in the Askeladd Field are associated with these downward stepping faults (see Fig. 1).

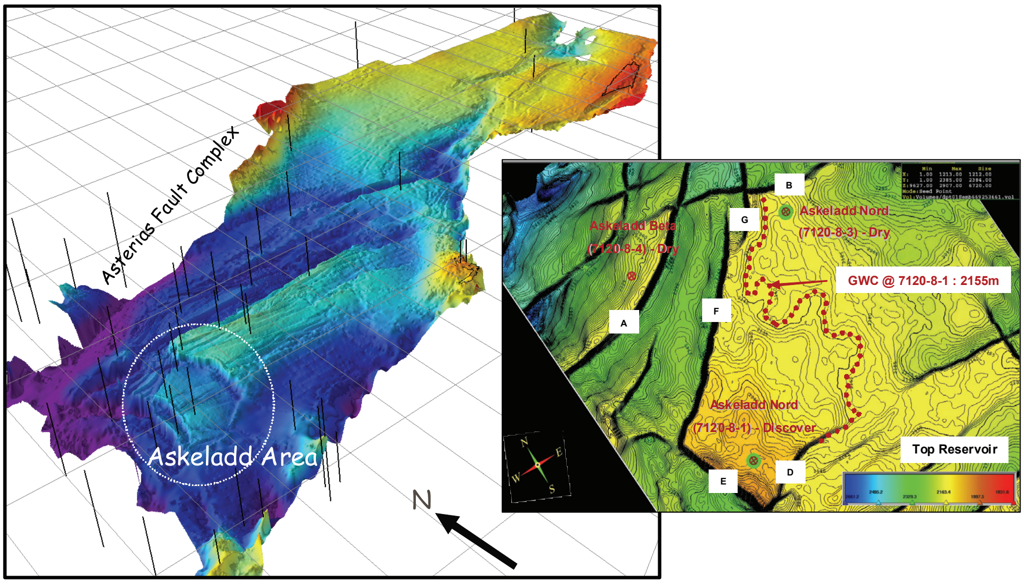

Figure 1. Location of the Askeladd Field. Faults B, D, E, F & G are significant for gas accumulation at Askeladd Nord gas filled structure. Dry well 7120/8-3 is located down dip from GWC and its accumulation might be controlled by whatever fault(s) is(are) controlling the accumulation in 7120/8-1.

The Askeladd Beta structure is located approximately 5 km to the north-west of the Askeladd Nord discover well (see Fig. 1). In spite of this prospect having a high probability of discovery considering that it is located in an area where reservoir, source, migration and trap are proven, the well was dry.

A post-mortem study of the dry well was done by comparing the vertical and lateral sealing capacities of the faults bounding the Askeladd Beta structure with those of the proven Askeladd Nord gas filled structure (see Fig. 1). Comparison of buoyancy pressures measured in the discover well with threshold pressures calculated along the faults bounding the gas filled structure (Bretan et al. 2003) suggests that membrane seals estimated from shale gouge ratio are capable of holding the proven gas column and predicts the hydrocarbon contact depth observed in the discover well (see Fig. 2a). Similar lateral fault seal analysis in the faults bounding the dry well also suggests that they should be able of holding a gas column of similar dimension (see also Fig. 2b).

Fault activity during Miocene time and presence of seismic amplitude anomalies in sediments of Miocene age close to both the dry an discover wells, the observation of a gas peak and oil inclusions in carbonate cement in the fault zone bounding the Askeladd Beta structure and the presence of a paleo-hydrocarbon column in the reservoir in the dry well might suggest vertical leakage along the main faults bounding both the gas filled and dry structures.

It might be concluded that the Askeladd Beta structure was once fill with hydrocarbons and later leakage along the fault plane of the main fault bounding the structure or the intersection points between the main and secondary faults. Considering the close geographical location and similarities in fault-zone processes and properties, fault seal analysis by itself does not explain why one well contains an economical hydrocarbon accumulation and the other not.

Hydrocarbon Contact Depth (calculated from SGR using Sperrevik *et al*., 2002) on Low Vsh Overlap Š F-wall & H-wall

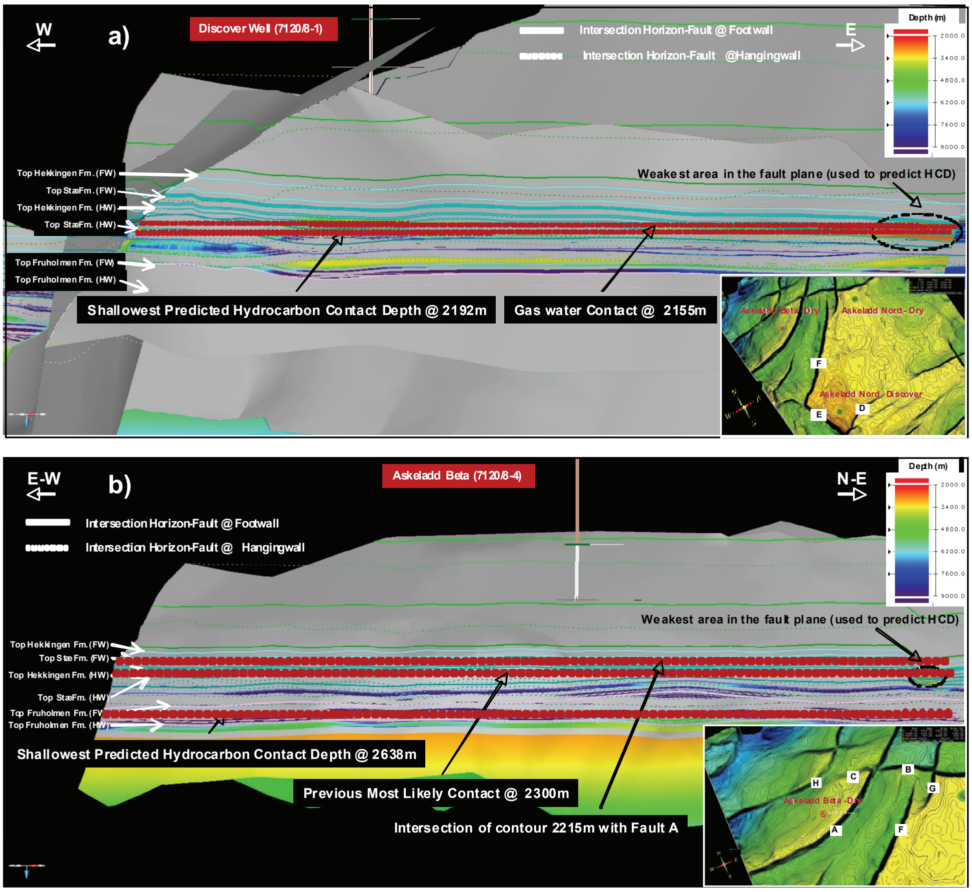

Figure 2. (a) Gas-Water Contact in Well 7120/8-1 (Discover) and possible 7120/8-3 (Dry) might be controlled by Fault D. Shale Gouge Ratio (SGR) ≥ 22% are capable of holding the hydrocarbon column observed in well 7120/8-1. (b) Fault A is capable of holding a hydrocarbon column ≥ 100m. Fault A is laterally sealing.

In order to explain why the Akeladd Beta well is dry while the Askeladd Nord well is a discover, it is necessary to include in the sealing analysis migration pathways and frequency of fault activity (fluid flow along fault planes). The economical accumulation of hydrocarbons in the Askeladd area responds to a balance between leaking due to fault activity and hydrocarbon charging of structures during or after leakage.

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