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Influence of Overpressures on Hydrocarbon Preservation

The existence of fluid overpressures is generally considered to be negative for hydrocarbon preservation, as it may lead to leakage by seal fracturing or fault reactivation. However, this relationship is not always observed offshore Norway, as several discoveries have been made in areas with extreme overpressures.

To further investigate the relationship between seal failure and fluid overpressuring, leakage characteristics were compared for the Haltenbanken, Viking Graben and Central Graben areas. Both present day observations (stress, pore pressure) and the tectonic history of these basins were investigated.

This analysis demonstrated that areas with recent flexuring (Haltenbanken, eastern Viking Graben and Central Graben) have the highest frequency of leakage. The pore pressures in these basins do not reach values close to the overburden stress, and leakage is often confined to faults or fault intersections. To the contrary, the pore pressures in traps in the western Viking Graben frequently reach values close to the overburden stress. Several of these fields leak hydrocarbons today, but still preserve significant hydrocarbon columns.

It is suggested that areas which have experienced recent flexuring have developed significant stress anisotropy, resulting in shear failure and leakage of hydrocarbons from the traps. Lack of stress anisotropy allowed for the build up of higher pore pressures, which resulted in top seal leakage through micro-fractures. This leakage was a comparatively slow process, which allowed hydrocarbons to stay in the traps although water was leaking from the pressure compartments.

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