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Diagenetic Controls on Reservoir Quality and Seal Integrity: Deep Jurassic Targets, Norwegian Sea

Reservoir quality and seal integrity are key to exploration success in overpressured Jurassic sandstones in the Halten Terrace of the Norwegian Sea. Due to the link between diagenetic porosity loss and fluid overpressure, diagenesis is a significant factor in both seal integrity and reservoir quality.

The reservoir quality of Jurassic sandstones we have studied suffers due to diagenetic porosity loss. The dominantly subarkosic reservoirs have lost an average of 10 porosity units due to quartz cementation although locally developed clay coatings are observed to inhibit quartz cementation. These coatings preserve a maximum of 5 to 9 porosity units compared to uncoated sandstones, depending on the formation. In addition, authigenic illitic clays bridge pores and reduce permeability.

Diagenesis is a principle control on seal integrity. In a representative overpressured exploration well, the Jurassic reservoir and the Cretaceous seal are presently at the fracture pressure. Our models indicate that diagenetic processes cause 25% of the present-day overpressure. Diagenesis controls the timing and duration of hydraulic fracturing of seals. This is because, in contrast to mechanical compaction, diagenetic reactions contribute to overpressure generation even after overpressures have begun to develop. Mechanical compaction contributes to the overpressures; however, it is unlikely to cause hydraulic fracturing of seals.