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# A Study of the Diagenetic Evolution of the Triassic Skagerrak Formation in the Jade and Judy Fields in the Central Graben, North Sea

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We studied the diagenetic development of HPHT clastic reservoirs from the Skagerrak Formation with anomalously high porosities in the Central Graben of the North Sea. The Triassic Skagerrak-Formation comprises mainly fluvial sandstones with thin interbedded mudstones. The sandstones contain important gas condensate reservoirs. We used detailed descriptions of petrography and quantitative analysis of mineral compositions to decipher the diagenetic history within the framework of modeled burial and temperature histories of the study area. The development of authigenic phases depends on depositional facies. The channel sandstones are affected by locally intense quartz, pervasive K-feldspar and patchy carbonate cementation. Authigenic chlorite formed mainly on top of the sandbodies. Quartz cementation seems to be controlled by interactions with the interbedded shales, because the amount of quartz cement decreases away from the sandstone-shale contact to the middle of the sand bodies, and appears to have continued after hydrocarbon charge. In zones with extensive formation of iron-rich chlorite later quartz cementation was prevented. Best reservoir properties appear to be confined to high porosity zones in the central sections of sand intervals. Here, additional secondary porosity was probably created by dissolution of early diagenetic carbonate cements. Dissolution was possibly caused by the acidification of pore waters by organic maturation products. Our favored scenario regarding transport mechanisms is a closed system regarding aqueous fluid flow and small-scale redistribution of reaction-products. Only a diffusive transport of maturation derived CO2 from deeper basin parts can occur. Alternatively, the system may be open and fluid flow may drive mineral reactions. To test the alternative hypotheses is one goal of reactive-transport modelling. We examined the stability of the mineral assemblages during burial and the timing of phase transitions and defined mineral reactions controlling the diagenetic evolution and their stabilities as a function of temperature and pressure for diagenetic modeling. Geochemical modeling was used for mass balance calculations and to derive initial fluid compositions for reactive-transport modeling which was applied to study the interaction between sandstones and mudstones. First results of 1D-reactive-transport modeling indicate that K-feldspar dissolution and albite formation is affected by organic maturation products formed during thermal maturation. Modeling results also support the assumption that diffusive transport of silica derived from clay mineral alteration in the mudstones caused quartz cementation of the sandstones. Since most diagenetic phases were formed before the onset of overpressure, no evidence was found for an influence of overpressure on diagenetic evolution in the studied reservoir rocks.