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# The role of deformation bands controlling reservoir quality in a salt-walled mini-basin, Central North Sea, UK

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At shallow burial depths, sediments are typically poorly consolidated and subject to low confining pressure and differential stress. Fractures that form in poorly consolidated and therefore non-lithified sediments would be unable to remain open. However, the large amount of pore space present would allow for processes such as grain sliding and grain rolling, resulting in the formation of deformation bands. The structure and style of the resulting deformation bands would depend on the size, shape and sorting of the grains, as well as early cementation, porosity and the orientation and magnitude of the local stresses. Previous studies on deformation bands in general have shown that they produce an anisotropy that can affect fluid flow. Early deformation band formation near the surface may also influence later diagenesis at greater burial depths, and thus have a further impact on fluid flow in sandstone. Dilatant (deformation) bands are commonly reported for poorly consolidated sandstones at surface or near-surface conditions (<1000 m), where only minor vertical effective stress is applied to the grain framework. Dilatant bands are commonly characterized by small shear displacement, a reduced grain framework density, larger pores, and a small porosity increase with respect to the host rock (up to 8%). Increased porosity and decreased grain framework density makes dilatant bands a preferential pathway for meteoric water influx, which is commonly associated with clay mineral infiltration and diagenetic alterations. This study has focused on the Triassic Skagerrak Formation, of the central Graben, North Sea, where abundant deformation bands have been observed near the margins of the salt-walled mini-basins in which the fluvial facies of the Skagerrak Formation was deposited. Some of these bands have a small, but clear shear offset, whilst others do not. There is a lack of fragmented grains found within these bands, and little evidence for significant amounts of phyllosilicate minerals along the majority of bands. These deformation bands were infilled by contemporaneous Skagerrak Formation Sands sediment from the basin before being buried. Together, these observations suggest that the dominant deformation features can be kinematically classified as either dilation bands, or dilatant shear bands. The greater occurrence of these deformation bands at the mini-basin margin also complicates fluid flow and reservoir quality prediction for the Skagerrak Formation further as fractures, faults and deformation bands create a complex system of permeable fluid pathways and cemented baffles at deeper burial. The results presented highlight the importance of constraining the occurrence of dilation and dilatant shear bands along the margins of salt-walled mini-basins to better understand the kinematics of the salt movement and additional loading on adjacent sediments. Furthermore, this research identifies the importance of early formed deformation bands in controlling meteoric water influx and governing later reservoir quality for spatially and temporally complex sedimentary fills of salt-walled mini-basins.