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Deformation pattern and permeability characterization of the chalk overlying the Krempe salt ridge at Laegerdorf, NW Germany

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Chalk is predominantly a white biomicrite consisting almost entirely of fine grained skeletal material, particularly coccoliths. Owing to the lack of intergranular cementation, most chalks are relatively weak, high porosity rocks. The very small grain size however, results in a very low primary permeability. Despite this, chalk is a well known hydrocarbon reservoir rock, particularly in regions with salt diapirs and ridges like the Gulf of Mexico and North Sea, because of the different trap types associated with these structures. High effective permeability is imparted to chalk by tectonic fracturing. The orientation, spacing, persistence, and type of these mechanical discontinuities are all important factors controlling both permeability magnitude and anisotropy. Owing to the wide variety of kinematic pathways that can drive the growth of salt-related structures, predictions of fracture (joints and fault zones) and stylolite attributes greatly benefit from field analogue studies. In this work we present results of a field study of the fracture pattern in the chalk overlying the Krempe salt ridge at Laegedorf, in NW Germany. We analyzed the occurrence, orientation and spacing of joints and extensional fault zones as a function of bed thickness and attitude. We also investigated the deformational architecture of fault zones as a function of displacement. Moreover, we acquired in situ permeability data from the undeformed chalk, from tight joints, and from brecciated chalk. Implications for fracture pattern predictions in chalk reservoirs are discussed.