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Deformation above mobile substrates, salt rheology and spatial distribution of salt structures: A 3D seismic study of the Permian southern North Sea

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At ~255 Ma, cycles of evaporation of seawater led to deposition of evaporites including halite (rock salt) in the North Sea Basin. After later burial by denser sediments, the salt beds rose as pillows and diapirs. Assuming mobilization is due to Rayleigh-Taylor gravitational instability of heavy fluid (sediments) overlying light fluid (salts), theory suggests that the spacing between diapirs should be proportional to the original thickness of the salt layer. For example, a description of the theory in Turcotte and Schubert (1982) predicts structure wavelength to be 2.6 times the salt thickness.

Previous research has explored mobilization of salt deposits assuming they have uniform rheology. However, this is not justified as halite rheology varies with temperature, grain size and pore brine content. Furthermore, evaporitic sequences contain various minerals besides halite (e.g., anhydrite, gypsum), which have different rheological properties.

3D seismic and well data reveal the internal structure of salt beds. The data have allowed characterization of structure wavelengths and salt thickness, so that the impact of internal composition and other properties on halokinetic behaviour can be assessed.