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Genesis of sub-seismic intra-salt layers and their use as tracers for salt deformation

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From Zechstein salt mine galleries and well data it is known that thick rock salt layers can contain anhydrite and carbonate layers with thicknesses on the millimetre to tens of metre scale. The relatively thick Zechstein 3 (Z3) anhydrite-carbonate layer in the northern Netherlands has been studied using 3D seismic data. Observations from geophysical well logs in this study reveal the presence of thin sulphate layers on the sub-seismic scale imbedded in the Zechstein 2 (Z2) salt. Core samples, thin sections, seismic data, and geochemical measurements were used to determine the mineralogy and genesis of these Z2 sulphate layers. Bromine analyses show that they mark freshening events in the Z2 salt, which can be correlated over large distances in the northern Netherlands. Such salt internal heterogeneities can be used to distinguish between different deformation mechanisms. The distribution of sulphate layers within the Zechstein 2 salt indicates that subjacent salt dissolution was not the dominant process leading to salt-related deformation. Further, the mineralogy and thickness of the sulphate layers is interpreted to vary between synsedimentary morphologic lows (thin anhydrite-polyhalite couplets) and highs (thicker anhydrite layers). Such a combination of core observations and well log analysis is a powerful tool to detect lateral trends in evaporite mineralogy and to reconstruct the environmental setting of their formation.