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The dynamics of interacting salt structures and associated fluid flow in the western Norwegian-Danish Basin

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Minor secondary structures observed along the flanks of major salt structures in the Norwegian-Danish Basin appear to be generated mainly during the early stages of halokinesis. Seismic anomalies in the cover sediments at the flanks of the major salt structures and in relation to one of the secondary structures show several circular patterns. The circular patterns are generally interpreted as faults related to collapsing salt, indicating a subtle and dynamic cannibalization relationship between the secondary structure and the main diapir. High-amplitude reflections interpreted as either entrapped gas along the circular faults or diagenetic changes induced by the fluids originating from the salt-sediment interface generally enhances the seismic appearance of the circular faults, but potentially also disturb the seismic imaging of the faults. Other secondary salt structures, with a similar geometry, do not show sign of collapse, apparently due to a greater distance from the main salt structures and therefore not within the reach of being cannibalized by these. The observations furthermore suggest a trend showing a more advanced development of the main salt structures when the secondary structures are cannibalized. The lateral distribution of the main salt structures thus appears to be controlled not only by the initial thickness of the Zechstein salt, and possible underlying structures, but also by subtle variations in the location and evolution of secondary structures. The secondary structures have a major impact on the drainage of the deep Mesozoic succession as indicated by the fluid flow pattern also observed in the study, which emphasizes that a detailed mapping of salt structures including secondary structures at the flanks is of major importance during evaluation of petroleum systems in areas dominated by halokinesis.