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Salt Tectonics Above Complex Basement Extensional Fault Systems: Results from 3D Seismic Analysis of Central Graben Salt Structures

The Central Graben, North Sea, is a world-class hydrocarbon province. Triassic and Jurassic extension created an elongate rift which has experienced thermal subsidence since the early Cretaceous. The buried rift contains many structures strongly influenced by halokinesis, and is dominated by sub-vertical, high-relief (up to 5km) salt diapirs that exhibit a long (200Ma) and complex structural history.

9 salt diapirs have been studied using high-quality 3D seismic data, and all show common features related to the broad-scale evolution of the rift system:

-Early-stage diapir evolution characterised by reactive formation of linear salt walls during Triassic and Jurassic regional extension.

-Local salt migration fed from distinct salt-withdrawal cells which remained active until the end Early Cretaceous. Pre-salt structure played a key role in constraining the geometry of these features.

-Co-eval transformation of linear salt-walls to mature point-source diapirs during the Early Cretaceous, co-incident with the onset of thermal subsidence and increased sedimentation rates.

-Late-stage evolution of the mature diapirs driven by gravitational downbuilding during rapid deposition of a thick Late Cretaceous and Tertiary sequence.

-Active diapiric episodes triggered by late-stage regional inversion, particularly during the Mid-Miocene.

The broad-scale geometry of the rift basin facilitated different styles of halokinesis locally, with thin-skinned gravity glide identified in the East Central Graben.

Current models for the growth of salt structures fail to adequately describe the entire evolution of diapirs in a rift basin. In such regimes diapir growth combines thick- and thin-skinned extension, bouyancy and compression.