

**AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003**

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The Role of Salt During Basin Extension and Inversion: A Comparative Study of the Southern North Sea and Mid-Polish Trough

The Southern North Sea (SNS) and Mid-Polish Trough (MPT) are both salt basins that were originally part of the southern Permian epicontinental basin. Both basins were subject to rifting episodes during the Triassic, Jurassic and Early Cretaceous, although their different locations led to variable extensional histories.

The MPT was strongly inverted during the Late Cretaceous and its axial part was uplifted and eroded. Basin development and inversion was accompanied by formation of numerous salt structures that also significantly influenced depositional systems. Moderate inversion also took place in the SNS during the Late Cretaceous and Tertiary.

One of the major problems concerning evolution of the MPT is apparent lack of major extensional deformation responsible for several pulses of tectonic subsidence inferred from tectonic modelling studies. This can be explained by basin-scale decoupling between pre- and post-salt successions. Major normal faulting was primarily restricted to the basement, and only secondary normal faults and associated structures developed within the post-salt sedimentary infill. In central MPT extension was strong enough to cut through the salt layer, and normal faulting involved both pre- and post-salt successions. Salt diapirs developed during extensional stage were reactivated during Late Cretaceous inversion in a compressional regime.

Within the SNS, inversion is also strongly controlled by the thickness of the salt layer. Where salt is thick, inversion is characterised by salt diapirism, whilst areas of thinner salt act as detachments for reactivated faults. In both basins, the timing of inversion and the style of inversion have significantly influenced trap development, and subsequent petroleum prospectivity.