AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Zainab Al-Musallam[1], Christopher F Elders[1], Kenneth R McClay[1] (1) Fault Dynamics Research Group, Egham, United Kingdom

4D Analysis of Inversion Kinematics, Southern North Sea

The timing of inversion in relation to charge has significant implications for the integrity of anticlinal prospects in the southern North Sea. In large parts of the basin a substantial thicknesses of Upper Permian Zechstein salt has decoupled extensional and inversion in the pre-salt and post-salt sequences such that it is seldom possible to match fault displacements in these mechanically separate layers. In the southern part of the basin, where Zechstein salt is absent, inverted extensional faults propagate directly into post rift sediments, forming spectacular growth anticlines in the Upper Cretaceous Chalk and in the Tertiary.

The extensional fault architecture comprises a complex pattern of intersecting WNW and NNW trending domino fault blocks. Detailed analysis of onlap patterns within the Chalk using high resolution 3D seismic data show that Upper Cretaceous inversion started in the Cenomanian and continued until the Campanian with four distinct pulses of uplift. Initial uplift was confined to inversion of WNW trending faults (including the South Hewett Fault) with NNW trending faults (the Swart Bank Fault trend) being reactivated later. Detailed images demonstrate the way in which extensional fault architecture transfers displacement between overlapping inversion structures. The Maastrichtian to Oligocene represents a period of quiescence, followed by renewed inversion of more widely spaced WNW faults during the Miocene.

Not all faults were reactivated and inversion broadly follows faults with the largest extensional offsets. By determining the timing and extent of reactivation on individual fault strands, prospects most at risk of seal breaching can be identified.