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An Evolutionary 3D Model for the Development of the Frontal Fold-Belt, Atwater Valley and Southern Green Canyon Areas, Deep-Water Gulf of Mexico

The US Gulf of Mexico (GoM) is a major hydrocarbon bearing, salt involved, slope basin. Up-dip extension links to down-dip deepwater compressional folds and thrusts. This essentially simple system is complicated and locally obscured as a result of halokinesis. Widespread, good quality 3D depth seismic data tied to recent deep-water wells have enabled a considerable improvement in our understanding of the frontal fold system and the key role salt plays in it's evolution.

This paper will focus on the 3D geometry and development of the frontal fold system, using well-imaged extra-salt structures, and present these as analogues where the allochthonous canopy has partially obscured the frontal folds.

3D mapping and structural restoration show that the frontal folds initiated very soon after deposition of the autochthonous salt during an early compressional pulse. Initially these structures developed as subdued pillows, separated by mini-basins, superimposed on an inflated mother salt layer. This early evolutionary phase has an important effect on the deposition and deformation of reservoir intervals. Allochthonous salt canopy emplacement, basal salt withdrawal and the main phase of fold amplification occurred during the late Miocene to early Pliocene interval. This deformation was synchronous with up-dip deposition of a thick clastic succession associated with the palaeo-Mississippi delta. The salt canopy advanced and accommodated the development of deep supra-salt basins throughout the late Pliocene - Pleistocene.

Very little has been published to date on natural examples of the 3D evolution of fault related compressional folds. For the first time in the deepwater GoM, sequential 3D restorations using depth migrated seismic data tied to wells will illustrate the 3D kinematics of a series of salt-cored detachment folds.