Fault-Propagation folding in extensional settings: a combined seismic, outcrop and analogue modelling study

Paul Whipp
Imperial College London - Department of Earth Science and Engineering
Royal School of Mines
Prince Consort Road
London SW7 2BP
United Kingdom
paul.whipp@imperial.ac.uk

Fault-propagation folds develop as a result of deformation beyond the vertical and lateral tip lines of propagating faults. These folds are considered an important process during the early stages of fault growth in extensional settings and large-scale fault-propagation folds have been documented from both field (Gulf of Suez) and seismic studies (North Sea).

Even where 3D seismic is available, the typically low resolution of data inhibits detailed analysis of fault-propagation folds. Outcrop data supports detailed analysis but outcrops are commonly too small to allow the true spatial complexity of these structures to be appreciated. Physical, numerical and mechanical modelling of fault growth has increased our understanding of their geometric and kinematic evolution but can only predict bulk strain distribution through time. Thus studies have tended focused on gross fold geometry rather than the significant secondary deformation associated with fault related folding.

Structural analysis of several normal fault zones in the Suez Rift will document the geometry, orientation, scale and distribution of spatially-related macro and meso-scale structures within large-scale fault-propagation folds supported by high-resolution, 3D seismic data from the Northern North Sea. Physical analogue models are complimentary to these two data types as they can successfully replicate some structures in evolving fault systems, thereby allowing us to test hypothesised controls on the temporal-spatial distribution of this deformation.

To better understand the distribution of deformation the study specifically focuses on the fault-tip region where the fault-propagation monocline is preserved.

Close integration of these three datasets represents a novel approach to the study of fault-related folds and a step towards generating a more comprehensive model the distribution of meso and macro-scale deformation in these prospective hydrocarbon traps.