Fault-Related Folding in Deepwater Fold-and-Thrust Belts with Shale Detachment Systems

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Deepwater fold and thrust belts form on both active and passive continental margins. In active margins, these belts are driven by plate convergence and subduction whereas in passive margins they develop from contraction related to up-dip differential sedimentation and gravity sliding and/or spreading. In this presentation, the structural styles of fold belts in the Mexican Ridges, offshore eastern Mexico, the offshore southern Niger Delta, Gulf of Guinea, the Makran accretionary prism, offshore Iran, and the Sulawesi fold belt, Makassar Straits, Indonesia, are analysed and compared using modern, high-resolution industry seismic data.

The data reveal that in both active and passive margins, deepwater fold and thrust belts that have developed on shale detachments have consistently formed fault-bend folds, fault-propagation folds, shear fault-bend folds, wedge thrust systems and detachment folds. After their initiation as detachments folds, the folds were subsequently faulted and sheared to produce fault-propagation folds. Structurally filtered seismic data indicate that the early detachment folding was influenced by small-scale extensional faults developed in the foreland sediments ahead of the deformation front. Growth stratal patterns indicate that front and backlimb rotation occurred as the folds amplified.

Based on the study results, a model for the progressive evolution of these fault-related fold systems is presented. The results indicate that deepwater fold and thrust belts may have consistent structural styles and evolutionary histories.