THE UPS AND DOWNS OF THE CAPE EGMONT FAULT: THE INFLUENCE OF SYN-RIFT STRUCTURE ON MULTI-STAGE FAULT REACTIVATION, TARANAKI BASIN, NEW ZEALAND

Professor Francesca Ghisetti
Consultant, TerraGeoLogica

AUTHORS: F.Ghisetti[1], H. Greaves[2], S. Mingard[3]
[1] Terrageologica
[2] Todd Energy Limited
[3] Mingard Geoscience Limited

Structural restoration has been applied to a series of depth-converted seismic sections to explain observed lateral variations in fault style and stratigraphic thickness along the Cape Egmont Fault Zone (CEF) from Maui, north-east towards Cape Egmont.

The geometry and timing of deformation constrained by the progressive restorations corroborate the known sequence of regional tectonic events, but also demonstrate the influence of the Cretaceous syn-rift faulting on subsequent deformation. Observations include:

1. Fault geometry is deflected from NE-SW to ENE-WSW orientation where faulting propagated laterally during the Pliocene into areas with no evidence of syn-rift inheritance. Changes in fault dip are also observed where pre-existing fault tips propagated up-section.
2. Compressional deformation is restricted to areas where the syn-rift fault was already established. The mechanical buttress effect created by the juxtaposition of the rigid basement block to the west against thick syn-rift deposits to the east was the likely cause of localisation of shortening along the CEF.
3. Reverse movement on the CEF and the associated fold-propagation folds were obliterated by renewed normal faulting. However, the shortening signature persists in the thickness decrease of the syn-compressional units in the CEF hangingwall and in the opposite tilting direction of units that were deposited before shortening compared with units deposited and deformed during the latest extensional events.
4. The northernmost segments of the CEF started growing at a later stage (mid Miocene), do not record significant components of localised shortening and accrued their displacement only during the latest extensional episodes. Accordingly, they display markedly different fault geometry, finite displacement, and deformation style.

Along-strike variation in throw along the CEF displays the history of reconstructed movements, providing an image of the strong lateral inhomogeneity of the fault system and providing a reconstruction of the juxtaposition history of permeable vs. impermeable units in the hangingwall and footwall blocks of the CEF. This has potentially important implications for the migration of hydrocarbons from the Maui and Pihama sub-basins to the Maui area and edges of the Western Platform.

The restoration has also explained unusual fault/stratal geometries and variations in thickness interpreted from the seismic which might otherwise be considered suspect.