

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

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A Geometric Analysis of Neogene Fault Systems in the Timor Sea, Australia

Trap breach by Neogene faults is a significant exploration risk in the Timor Sea. An analysis of the geometric controls on Neogene deformation can be used as a tool for predicting trap breach. Fault maps have been compiled from regional 2D seismic data, and are compared with coherency data from selected 3D seismic surveys.

Image analysis software was used to compile fault population statistics from several stages during the Neogene. Faults with the greatest vertical displacement are usually reactivated Mesozoic faults, while clusters of smaller Neogene faults distribute strain over a larger area. The size vs frequency ratio of faults from the regional 2D seismic data is several magnitudes higher than that from the 3D seismic data, suggesting that significant faulting occurs below the resolution of the 2D seismic and that corrections must be applied to regional strain estimates.

Significant differences were also observed in average fault orientations at different resolution. In the Laminaria area, average fault orientations from 3D seismic data trend NW-SE, while using 2D seismic data they trend E-W, suggesting that the degree of fault linkage depends on the scale of observation. Changes in the average orientation of faults over time reflect regional tectonic events, in particular the collision of the Indo-Australian and Pacific plates. Present-day fault activity is confined to the border of the Timor Trough and Cartier Trough, suggesting that current deformation is mostly due to plate flexure.