Extensional basin-forming structures in the Bass Basin

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Major Cretaceous normal faults bounding substantially tilted blocks were recognised early in the interpretation of the 1982 BMR Bass Strait seismic survey. This recognition led to a specific structural study of the early fault configurations, using extensional faulting concepts. The structural study, which also utilised all post-1974 company data, concentrated on the gross fault pattern at Cretaceous level, without detailed horizon picking.

The Early Cretaceous basin-forming normal faults are shallow to moderately dipping, rotational, and approximately planar down to the base of the section (6 sec TWT; 10-12 km). They have displacements of up to 10 km, strike consistently 290 to 300 degrees, mostly dip towards the south-southwest. Rotation on these faults has produced tilts of up to 35 degrees in the basement surface. Mapping shows that the faults are relatively short along strike, being disrupted by a set of steeply-dipping transfer faults that trend 020 to 030 degrees across the full width of the basin. The transfer faults developed at the same time as the normal faults, and are thus restricted to the Early Cretaceous and older sequences. They do not simply displace the normal faults and tilt blocks, but accommodate variations in the positions of and displacements on the extensional structures. They are therefore analogous to oceanic transform faults. The transfer faults in Bass Basin tend to displace the normal faults in a right-lateral sense, giving rise to the basin's overall northwesterly trend.

In the southeast corner of the Bass Basin, an apparently separate set of extensional normal faults and tilt blocks developed during the Late Cretaceous. These faults trend about 320 degrees and dip towards the northeast. Because their age and orientation are different from those of faults underlying most of the basin, and because they are superimposed on an Early Cretaceous graben fill, we conclude that they were not primary basin-forming structures. This conclusion is supported by preliminary thermomechanical modelling, and we further suggest that these structures are related to the early stages of opening of the Tasman Sea.

Preliminary interpretation of BMR and company seismic data from the Gippsland and Otway Basins has identified Early Cretaceous normal and transfer faults with the same trends as those throughout the Bass Basin. It is therefore proposed that all three basins developed by north-northeast to south-southwest extension, and that their gross configuration resulted from offsets on major transfer fault systems.