Geometry and growth of a reactivated normal fault system in the Timor Sea

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It is widely recognised that basement faults exercise a strong control on the geometries of normal faults within overlying cover sequences formed during subsequent extension. Details of the evolution of reactivated fault systems are, however, poorly defined. Using high quality seismic data for a fault system from the Timor Sea (NW Australia), we examine how Permian-Jurassic basement faults control the initiation and growth of faults in a Tertiary cover sequence, during subsequent Miocene-Recent extension (Figure 1).

Detailed analysis of fault displacement rates, fault geometry and fault population systematics confirms the findings of earlier studies, which suggest that cover sequence faults establish their lengths at the early stages of faulting and during subsequent extension total strain becomes progressively localised onto fewer and larger faults. The growth of cover sequence faults is a direct response to basement fault reactivation. Larger basement faults have higher displacement rates than low displacement faults. Faults that dip towards the Tertiary basin grow preferentially. A rhombic fault pattern within the basement gives way upwards to a unidirectional Tertiary fault pattern, by way of twists in fault geometry, i.e. hard-linkage, or by fault segmentation, i.e. soft-linkage. Though the latter is a *response* to basement fault reactivation, as opposed to upward extensions of reactivated faults, these new, soft-linked, faults grow just as rapidly. All faults in the cover sequence establish their lengths before 2% extension has occurred. Hereafter fault growth is dominated by increasing displacements. Reactivation and upward propagation of basement faults is not, therefore, a pre-requisite to early, and rapid, fault propagation.

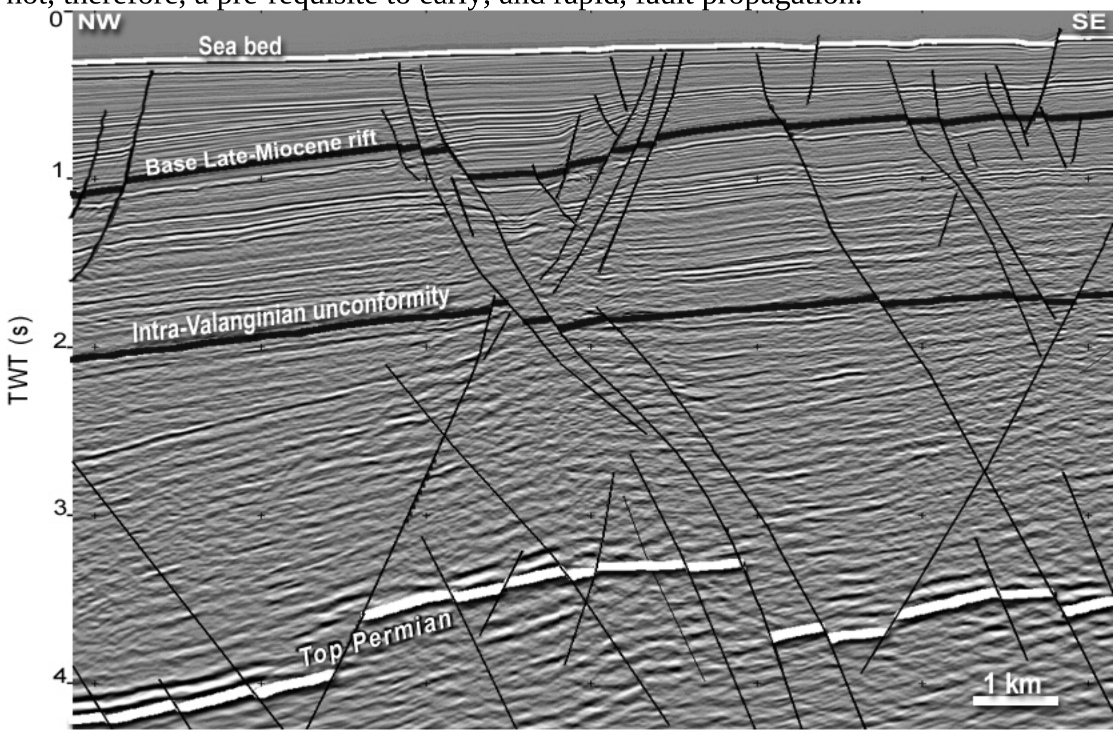

Figure 1. Reactivated fault system from Timor Sea. Synsedimentary Miocene-Recent faulting reactivates pre-existing Permian-Jurassic basement faults.