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Propagation of syn-sedimentary faults within the passive margin Otway Basin, Australia

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Faults are often interpreted in 3-D seismics, but they are more rarely analysed in terms of their kinematics and growth. This is nevertheless important to understand the true structural development of a tectonic structure. We attempt such an analysis here and show how neighbouring faults grew in very different fashions.
We interpreted a 3-D reflection seismic cube (32.3 km $\times$ 14.35 km $\times$ 4100 ms TWT) from the onshore Otway Basin, which is part of the passive margin that developed from the Late Jurassic onwards in response to the breakup of the southern Australian margin. Over 2.2 km thick syn-rift Late Cretaceous to recent sediments were deposited, which we identified between a dense pattern of SW-dipping growth faults. Analysis of thickness maps shows faulting was constantly active during sediment deposition, and yet the faults were in retreat until ca. 50 Ma, when nearly all died out completely. No seismically-visible post-rift faulting took place.
Using juxtaposition maps of the faults we observe two very different behaviours of the faults' tip line propagation and isolines of fault slip: while all fault strike lengths decrease stratigraphically upwards, the isolines and tip lines are either symmetrical or strongly asymmetrical (but always in a dextral sense). We interpret the latter as oblique dextral propagation of the faults. The distribution of the oblique dextral and dip-slip faults suggests strain partitioning took place on a kilometre scale.