

Models for continental breakup and deep-water basin formation: insights from integration of potential field modelling and deep seismic data on conjugate continental passive margins

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Recently acquired deep seismic reflection and refraction datasets, with coincident shipborne gravity and towed magnetometer data from the Great Australian Bight and its Antarctic conjugate margin basins, provide significant new constraints on conceptual models for continental breakup and subsequent deep-water basin formation.

Joint forward modelling of gravity and magnetic fields constrained by densities derived from refraction data, and by geometries from seismic reflection interpretation provide important new information on the structure and identity of middle and lower crustal elements that deformed in early rifting stages leading to continental breakup. The disposition of these elements is often found to significantly influence the position, depth and style of subsequent post-rift depocentres. Additional information from magnetic forward modelling constrains the whereabouts of limited products of breakup volcanism, as well as providing refined information about the location of initiation of seafloor spreading.

New results from the Great Australian Bight and conjugate margins include identification of:

- large areas of mantle structuring and thinning by low-angle detachment and normal faults, with implications for mantle rheology and isostatic responses;
- areas where lower or middle crust has been completely removed, with implications for crustal rheological response;
- widespread presence of ultra-slow spreading seafloor crust disrupted by brittle extensional structuring;
- areas of mantle uplift and inferred decompression volcanism and underplating;
- some depocentres resting directly on the brittle upper mantle.

Interpretation and synthesis of these new data has significant implications for the mechanical and thermal evolution of deep-water basins, as well as providing empirical evidence to test various theoretical models for continental breakup and non-volcanic passive margin formation.