Rifting and Development of Continental Margins: Insights from Geological and Geophysical Studies in Australia

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Australian data suggests sedimentary basins have been formed by emplacement of dense, magnetic, mushroom-shaped masses of mantle plume material at mid crustal levels. Doming and subsequent erosion, followed by thermally and gravitationally induced subsidence appear to have created the basin's depocentres. Rifts sometimes develop as V-shaped crustal splits narrowing away from the culmination of the mantle plumes. Differential extension along the axes of rifts, which exhibit typical half-graben asymmetry, is accommodated by transfer zones. Increasing extension, associated with progressive crustal thinning, almost invariably results in the development of dense intrusions / underplating beneath the rift axes. These magnetic bodies, presumably resulting from mantle decompression, exhibit degrees of development related to deeper extensional processes. Intrusions sometimes cause doming of sediments beneath the rift axes and source volcanic activity.

The ultimate stage of rift development is crustal rupture which typically bifurcates the intrusions. Oceanic crust is produced as continued extension separates halves of the rift which become conjugate continental margins. Prograding sediment wedges developed on continental margins often cover "outer highs" of domed sediments and dense, magnetic, high velocity (7.5 km/sec) fragments of axial intrusions. The sedimentary section overlying outer highs may contain lava flows imaged as seaward dipping reflections, probably sourced by the axial intrusions. These observations generally apply to the southern Australian margin, whereas the eastern margin is characterized by crustal splitting accompanied by massive igneous intrusion along the western edge of a rift. The marginal plateaus off the western and north eastern Australian coasts require different models.