

Geochemical constraints on Mesozoic intraplate magmatism and related basin evolution along the Australian southern margin

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The origin of the late Mesozoic to Recent volcanism in the Australian southern continental, ‘non-volcanic’ margin is a long-standing and important problem. To date, investigations of this intraplate basaltic province have focused on the preserved, onshore record. However, an extensive record of Cenozoic magmatic activity is preserved in the sedimentary successions of the Bight, Otway, Bass and Gippsland rift basins, and remains largely undescribed.

Multiple models have been invoked in order to explain this magmatic activity. Preliminary seismic studies [1] have shown that magmatism mainly occurs at Eocene to Oligocene and Miocene to Recent times. This activity therefore post-dates the rift or breakup phases that are placed at 90, 83 and 67 Ma and related to the separation of Australia and Antarctica. This observation hence argues against a link with continental breakup and related decompressional melting processes. Additionally, clear links have been observed between basin events offshore and timing of magmatism preserved onshore. We also note the recurrence of mafic magmatic activity in the same geographic localities with apparently similar mantle source characteristics over extended time intervals. These factors suggest that the distribution of igneous activity cannot be solely explained by the classic plume model. Given the rapid northward motion of the Australian plate during this time interval they indicate either lithospheric mantle sources or a certain coupling between asthenospheric sources and the lithosphere. Melting may be driven by subtle lithospheric stretching and edge convection [2]. The competition between asthenospheric and lithospheric mantle sources is highlighted by temporal shifts in basalt major and trace elements and isotope compositions.

[1] Holford *et al.* (2012) *APPEA Journal* **52**, p. 229-252. [2] Demidjuk *et al.* (2007). *Earth and Planetary Science Letters* **261**, 517-533.