

Cretaceous magmatism along the rifted margin of Western Australia: toward a Greater Kerguelen large igneous province

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The link between the Kerguelen Large Igneous Province and magmatic occurrences emplaced on the continental lithosphere of Western Australia (WA) in close temporal and spatial proximity to the breakup triple junction of eastern Gondwana remains tentative. Tholeiitic Cretaceous magmatism along the margin was poorly investigated until recently and the involvement of the Kerguelen mantle plume was speculative due to the lack of reliable geochronological data. Here we report new ages from three key locations: the Wallaby Plateau (off-shore, NW Australia), the Bunbury Basalt (SW Australia) and the Naturaliste Plateau (off-shore, SW Australia). Our new plateau ages indicate that (1) on the Wallaby plateau, the magmatic activity occurred at or before ~124 Ma that is at least 6 Ma younger than the oldest oceanic crust in adjacent abyssal plains (~130 Ma); (2) the Bunbury Basalt erupted in three distinct phases, at 136.96 ± 0.43 Ma, 132.71 ± 0.43 Ma and 130.45 ± 0.82 Ma while only two magmatic episodes have been documented so far [1] and (3) volcanism on the Naturaliste plateau began at or prior to ca. 128 Ma, which is >25 m.y. older than previous estimations [2]. This suggests that this magmatism began during the rifting of the continental lithosphere but lasted after the onset of the oceanic spreading (~130-136 Ma, [3]). In addition, this magmatism preceded the emplacement of the Kerguelen plateau by at least 10–20 m.y. These new data led us to re-interpret the currently available Sr–Nd–Pb isotopic dataset. The isotopic data available for the WA Cretaceous magmatism suggests source contributions from the depleted asthenosphere and lithosphere with negligible contribution from the Kerguelen mantle plume. However, heat provided by the Kerguelen deep mantle plume, coupled with edge-driven convection and decompression of the asthenosphere during the rifting, was necessary to melt the asthenosphere and lithosphere. Thus, we attribute the WA Cretaceous magmatic provinces, and equivalent units in Greater India, to the Greater Kerguelen large igneous province.

[1] Frey F. et al. (1997) *EPSL*, 144, 163-183.

[2] Pyle D. et al. (1995) *JGR*, B100, 22261-22282.

[3] Gibbons A. et al. (2013) *G³*, 13, Q05W13.