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Did the Central Kerguelen Plateau form due to Long-term Ridge-Hotspot Interaction?

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All published plate tectonic models for the Australian-Antarctic plate pair imply some unlikely relative plate motion scenarios either in the vicinity of the Kerguelen Plateau or between Tasmania and Antarctica. The models of both Whittaker (2007) and Tikku and Cande (1999; 2000) essentially aim to minimize the relative motion between Broken Ridge and the Central Kerguelen Plateau from ∼50 Ma to ∼102 Ma, when the Central Kerguelen Plateau is believed to have rapidly erupted. These models aimed to minimize the motion between Broken Ridge and the Kerguelen Plateau prior to ∼50 Ma in order to conform with two main pieces of evidence, (1) that the Central Kerguelen Plateau formed rapidly between 105-100 Ma, and (2) that the well-fitting conjugate boundaries of the Kerguelen Plateau and Broken Ridge preclude any significant relative motion that would have led to upper plate deformation.

An implication of these models is that the rifting of the William Ridge from the South Kerguelen Plateau and the opening of the intervening Labuan Basin occurred between the rapid bursts of volcanism that formed the Southern and Central Kerguelen Plateaus at 120-110 Ma and105-100 Ma, respectively. This implies a relatively unlikely plate tectonic scenario, where there was an active plate boundary between Australia and Antarctica from ∼110 Ma to ∼100 Ma, which connected the Australian and Indian portions of the SEIR but then became inactive for ∼30 million years until Broken Ridge finally separated from the Central Kerguelen Plateau from about 50 Ma.

We propose a more likely scenario in which the Central Kerguelen Plateau did not form rapidly over ∼5 million years as commonly purported, but rather formed as the result of approximately 30 million years of interaction between the Southeast Indian Ridge (SEIR) and the Kerguelen hotspot. This hypothesis is consistent with the available data from the Central Kerguelen Plateau, where only two basement age dates have been obtained, i.e. 100.4 Ma (Site 1138) and 83.7-84.8 Ma (Site 747). We construct a plate tectonic model using both traditional least-squares fitting techniques and the approach of Williams et al. (2010) to quantitatively constrain reconstructions during continental rifting and so revise the relative motions of Australia and Antarctica from the onset of continental rifting to the reorganisation of the spreading system at ∼50 Ma. Our model shows that slow spreading along the Kerguelen section of the SEIR is compatible with a host of other constraints including, crustal stretching, fracture zone and continental transform margin orientations, and magnetic anomaly identifications.