



## **The Australia-Antarctica divorce: a study of the forces that lead to their break-up**

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About 70 million years (Myr) ago, Antarctica and Australia separated and the entire Australian continent began migrating north, while Antarctica remained around the South pole until the present-day. The kinematics of the Australian plate migration from Antarctica have been reconstructed from the geologic record. However, we still lack a detailed understanding of the forces driving this event, and their variations through geologic time. Two major tectonic events coincided with the break-up of Antarctica-Australian plates and the subsequent northward speed-up of Australia. In the northern hemisphere, the ridge bounding the Pacific plate to the north migrated north-westward between 70 and 60 Myr ago, eventually plunging into Earth's mantle along the Aleutian trench. At the same time, the Indian plate was converging towards the larger Eurasian plate at rates among the fastest ever reconstructed. Cessation of spreading between India and Australia at around 40 Ma caused these plates to merge into the larger Indo Australian plate. Here we try to quantify the forces that have been driving the Antarctica and Australian plates apart, from ~70 Myr ago through to the present day. To this end, we make use of a novel coupled global model for mantle and lithosphere dynamics. Our model builds on the available codes TERRA (a global, spherical finite-element code for mantle convection) and SHELLS (a thin-sheet, finite-element code for lithosphere dynamics). By merging these two independent models we are able to simulate the rheological behaviours of brittle lithosphere and viscous mantle. We use these models, which perform well on clustered machines, to test the hypotheses mentioned above. We discuss the dominant controls that determined the separation of Australia from Antarctica.