

## **Timing of seafloor spreading cessation at the Macquarie Ridge Complex (SW Pacific) and implications for upper mantle heterogeneity**

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The Macquarie Ridge Complex (MRC) on the Australia–Pacific plate boundary south of New Zealand is an extinct mid-ocean ridge that has experienced a complex tectonic history and produced highly heterogeneous mid-ocean ridge basalts (MORBs). When and how seafloor spreading ceased along the proto-Macquarie mid-ocean ridge remain elusive, and it is unclear how the mantle source of MORBs is affected by the gradual cessation of seafloor spreading at mid-ocean ridges. To constrain the tectonic evolution of the MRC, the mantle source variations for MORBs at dying mid-ocean ridges, and the mechanisms of mantle enrichment and asthenospheric heterogeneities, we report eleven pyroxene, plagioclase, basaltic glass, groundmass, and sericite <sup>40</sup>Ar/<sup>39</sup>Ar and one zircon U–Pb ages for the MRC MORBs. Our data reveal that basalts from the MRC seamounts were erupted between 25.9–1.6 Ma and Macquarie Island at ~10 Ma. Combined age and plate reconstruction results reveal that the cessation of seafloor spreading at the MRC generally propagated from south to north along the ridge. Basalts produced by the then dying Macquarie mid-ocean ridge at different times on different seamounts/island show a large variation in isotopic compositions and there is no clear correlation between ages and isotopic ratios. The heterogeneity of mantle source for MORBs from the proto-Macquarie mid-ocean ridge suggests that the upper asthenospheric mantle is heterogeneous, and such heterogeneity becomes most obvious at dying mid-ocean ridges where the degrees of partial melting are low and a large range of melt compositions are produced.