Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35963

# Influence of LAB topography and mantle flow on basalt isotope signatures in NE Australia

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The elemental and isotopic composition of primitive, mantle-derived melts provide key insights into Earth's physical and chemical state and evolution. However, in intracontinental settings, where melting primarily occurs near the lithosphere-asthenosphere boundary, it is often difficult to deconvolve signatures derived from the convecting mantle and those from the overlying lithosphere. In Australia, Neogene volcanism occurs along the entire eastern seaboard, concentrated at a step-like transition from thinner to thicker continental lithosphere. Volcanic fields coincide with elevated topography and slow shear-wave velocity anomalies in the underlying asthenospheric mantle. However, in northeastern Australia, in particular, there is no evidence of recent tectonic activity or the presence of a mantle plume. Given the rapid northward movement of the Australian plate, volcanism in this region is likely linked to small-scale convective instabilities at the lithosphere-asthenosphere boundary, but there is no geochemical evidence for this hypothesis to date. Here, we report new analyses of Sr-Nd-Hf-Pb isotope ratios of 16 samples from the Pliocene Chudleigh, Nulla and Sturgeon volcanic fields, and the Miocene Camel Creek event. This study targets the asthenospheric components of melts generated at the lithosphere-asthenosphere boundary (LAB) beneath progressively thickening lithosphere. Samples were, therefore, screened based on previous major and trace element concentrations to select the most primitive compositions with minimal evidence of crystal fractionation or assimilation of lithospheric material. Sr-Nd-Hf-Pb isotopic analyses record progressively increasing melt proportions from fertile lithologies closer to the step in lithospheric thickness. This trend is correlated with decreasing asthenospheric melt fractions. Fusible lithologies could either be derived from heterogeneities within the asthenosphere or from assimilation of refertilised peridotite in the lithosphere by ascending asthenospheric melts. Our results, therefore, are evidence for mantle melting induced by shear-driven upwelling caused by the interplay of basal lithospheric topography and the northward movement of the Australian plate.