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The geochemical origin of Australia's only subaerial OIB

ANGUS ROGERS[1], MICHAELA FLANIGAN[2], HUGH ST.C O'NEILL[1], YONA NEBEL-JACOBSEN[1], XUEYING WANG[1], RICHARD ARCULUS[2], BEN MATHER[3] AND OLIVER NEBEL[1]

[1]Monash University
[2]Australian National University
[3]University of Sydney
Presenting Author: angus.rogers@monash.edu

Lord Howe Island (LHI) sits on the edge of the submerged microcontinent Zealandia, between Australia and New Zealand, in the Tasman Sea. It is the youngest and only subaerial expression of a chain of seamounts and guyots that stretch ~1000 km N-S[1]. Volcanism on the island has been attributed to plume activity at ~6-7 Ma, justified largely by the age-progression in the seamount chain which matches expected plate motion over a stationary hotspot[2]. We have investigated the major, trace element, and Sr-Nd-Hf-Pb-isotope geochemistry of 26 legacy lava samples[2] from Lord Howe Island to reveal the relationship between the island's lavas and known mantle endmember compositions.

Trace elements reveal depletion in HREE, indicating melting occurred in the garnet stability field, but likely at low *F* due to enrichment in LREE. Radiogenic Sr and Nd isotopes have a remarkably limited spread, clustering close to the hypothetical 'prevalent mantle' (PREMA). Hafnium exhibits much greater variation and appears decoupled from Nd-isotopes. $^{208,207,206}Pb/^{204}Pb$ isotopes are slightly enriched, overlapping with the nearby Taupo Seamount of the Tasmantids[3].

These results indicate that the LHI basalts derive from low-degree partial melting of a garnet peridotite source. Trace element ratios and isotopic Sr-Nd mixing models are inconsistent with assimilation of Lord Howe Rise crustal materials, indicating there was little to no crustal contamination from underlying or neighbouring continental basement. Radiogenic isotopes show great similarity with the nearby Tasmantid Seamounts, suggesting a common plume source may be shared between these two plume tracks. This geochemical similarity between LHI, other plumes in the Pacific, and the Tasmantids supports the hypothesis of a common deep mantle source for all.

References

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