

Independent Component Analysis of Isotopic Compositions of the Northern Lau Back-arc Basin Basalts



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Abstract: Numerous studies show that the isotopic variability of back-arc basin basalts could indicate the possible interaction among multiple mantle components or geochemical end-members. Here we present our application of independent component analysis (ICA) to investigate the contributions of the different mantle sources in the northern Lau back-arc basin (NLB) in SW Pacific, based on a compiled geochemical dataset from the Lau back-arc basin, Pacific and Indian Ocean ridges, and Samoan islands. We identified three independent components (ICs) in the five-dimensional space of Sr-Nd-Pb isotopic ratios, which can account for 96.5% of the isotopic variance. On a regional scale in the NLB, there is a broad increase in IC1, IC2 and IC3 from the north to the south. Only IC3 presents obvious decrease from the west to the east, i.e., with decreasing distance from the arc. The correlations between the ICs and incompatible trace elements ratios (i.e., (La/Sm)_N, Ba/Th and Th/Nb) were further used to examine the origin of these ICs. Our results suggest that the complex geochemical signatures of NLB basalts can be explained by the addition of Samoan mantle plume materials (IC1), subduction component (hydrous fluid: IC2) and recycled sediment (melt: IC3) to the Lau back-arc mantle.

Key words: Lau back-arc basin basalts, isotopic variability, subduction components, Samoan mantle plume, independent component analysis

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References

- Iwamori, H., Albarède, F., and Nakamura, H., 2010. Global structure of mantle isotopic heterogeneity and its implications for mantle differentiation and convection. *Earth and Planetary Science Letters*, 299: 339–351.
- Iwamori, H., and Nakamura, H., 2012. East-west geochemical hemispheres constrained from Independent Component Analysis of basalt isotopic compositions. *Geochemical Journal*, 46: e39–e46.
- Iwamori, H., and Nakamura, H., 2015. Isotopic heterogeneity of oceanic, arc and continental basalts and its implications for mantle dynamics. *Gondwana Research*, 27: 1131–1152.

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TIAN Liyan, female, graduated from Scripps Institution of Oceanography, University of California, San Diego, with a Ph.D. degree in Earth Sciences in 2011; currently working as a Research Associate Professor at Institute of Deep-sea Science and Engineering, Chinese Academy of Sciences. She is interested in the study of seafloor petrology & geochemistry, and its implications to mantle dynamics.

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