Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27752

Stable neodymium isotope fractionation during plate subduction: insights from back-arc basin basalts

FANG LIU[1], HONGLI ZHU[2], ZHAOFENG ZHANG[1], XIN LI[1] AND YAJUN AN[1]

[1]Research Center for Planetary Science, College of Earth and Planetary Sciences, Chengdu University of Technology
[2]Institute of Oceanology, Chinese Academy of Sciences

Subduction zones are the primary pathways for crustal materials to enter the mantle. As the subducting slab descends, it releases fluids and melts that induce metasomatic reactions in the overlying mantle wedge. This process not only drives plate tectonics but also plays a pivotal role in the generation of arc magmas, which are essential for the formation of continental crust. Understanding the geochemical signatures of subduction-related magmas provides insights into mantle processes, slab dehydration, and the transfer of volatiles and trace elements from the subducting slab to the mantle wedge.

Neodymium (Nd), as one of light rare earth elements (LREEs), is preferentially enriched in subduction-related fluids and melts. Back-arc basin basalts (BABBs) are crucial for understanding the complex interplay between subduction dynamics and mantle processes. Back-arc basins form behind subduction zones due to slab rollback and extension of the overlying plate. In this study, we investigate the stable Nd isotopic composition ($\delta^{146/144}$Nd) of back-arc basin basalts (BABBs) from Woodlark Basin, Vate Trough, and Lau Basin in the southwestern Pacific. Their basaltic compositions range from MORB-like to arc-like, reflecting varying degrees of subduction input. Our results reveal that the majority of samples exhibit limited variation in $\delta^{146/144}$Nd ranging from -0.041‰ to -0.005‰ with an average of -0.021±0.018‰ (2SD, N=21), simialr to that of the BSE (-0.025±0.013‰). The relatively uniform stable Nd isotopes in BABBs suggest that either there is no Nd isotopic discrepancy between subducted components and mantle, and/or the amount of Nd that is transferred from the subducting Pacific slab to the studied BABB mantle sources is insignificant.