Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28116

Small-scale coexistence of two material-transport models and its mantle dynamics from the NE Asian Margin in Cenozoic

KE CHUN HONG, FENG WANG AND WENLIANG XU

College of Earth Sciences, Jilin University

Subduction zones are the main sites of surficial material transfer from subducted slab into the mantle wedge. Arc magmatism represents the products of material transport in subduction zones. Arc magmas can be formed by two material-transport models: metasomatised mantle-wedge melting and mélange-diapir melting[1]. However, whether these two models can coexist in a subduction zone and its dynamic mechanism remain unclear.

Here, we report zircon U-Pb dating, major- and trace-element, and Sr-Nd-Pb-Hf-Mg-Zn isotopic results for Cenozoic syenites and gabbros in NE Asia with along-strike distribution in short distance (ca. 450 km). SIMS dating results show the similar Oligocene ages of the syenites and gabbros with ages of 29-32 Ma. Syenites have relatively concentrated SiO_2 contents (56.3~61.4 wt.%) and high total alkali contents (11.4~12.3 wt.%), consistent with experimental results of mélange melting. These syenites exhibit Hf-Nd fractionation but little variation in Nd isotopes[1]. Moreover, the samples have heavy Mg isotopic compositions (δ^{26}Mg=−0.02‰~+0.57‰), consistent with the inferred residual components of mélange after dehydration, jointly supporting the mélange-diapir melting model. In contrast, gabbros exhibit little Hf-Nd fractionation but variations in Nd isotopes, consistent with the metasomatised mantle-wedge melting model[1]. Furthermore, the Sr-Nd-Pb-Hf isotopic compositions indicate the recycled material related to the western Pacific seamounts, supported by the reconstruction of the Pacific Plate development[2].

The results indicate that these two material-transport models can coexist in a small-scale subduction zone. The trench-perpendicular mantle flow, the low manlte viscosity and a relatively extensional stress field in the NE Asia triggered the occurrence of mélange-diapir melting[3]. Whereas subduction of low-density seamounts led to a limited compressional stress field, which inhibited the mélange-diapir melting and resulted in the coexistence of two material-transport models.

This work was financially supported by the National Natural Science Foundation of China (Grant 42372065).

References:

[1] Nielsen and Marschall (2017), *Science Advances* 3.

[2] Miyazaki et al. (2015), *Geochemistry, Geophysics, Geosystem* 16, 3309–3332.

[3] Hong et al. (2024), *Geology* 52, 539–544.