EGU General Assembly 2024

EGU24-4498, updated on 24 Jul 2024
https://doi.org/10.5194/egusphere-egu24-4498
EGU General Assembly 2024

Role of sediment-derived melts in Mo cycling of subduction zone

Feng Huang[1], Jie Li[2], Jifeng Xu[1], and Yunchuan Zeng[1]
[1]State Key Laboratory of Geological Processes and Mineral Resources, and School of Earth Science and Resources, China University of Geosciences, Beijing 100083, China
[2]State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China

While heavy molybdenum (Mo) isotope compositions in arc-related rocks have been linked to slab-derived fluids, the origins of arc lavas with light isotopic Mo compositions remain enigmatic. The two potential sources for the origin of light Mo isotopes in arc rocks are (1) dehydrated oceanic crust [1, 2] and (2) subducting sediments [3, 4]. Although the former has been extensively recognized, the latter still poses an enigma. We present the Mo-Sr-Nd-Hf isotope compositions and elemental data of a suite of Jiang Tso andesites to elucidate the chemical compositions of sediment-derived melts in the central Tibetan Plateau. The andesites from the Jiang Tso area show elevated Mg# values, along with trace element characteristics reminiscent of melts derived from sediments. Their Sr-Nd-Hf isotope compositions ($^{87}Sr/^{86}Sr_i$ = 0.710260–0.710671, $\varepsilon_{Nd}(t)$ = –10.63 to –8.97, and $\varepsilon_{Hf}(t)$ = –9.38 to –8.02) closely resemble those of contemporaneous sediments in the central Tibetan Plateau. In addition, these andesites exhibit higher Ce/Mo ratios (396–587) and extremely lighter $\delta^{98/95}Mo$ values (−1.62‰ to −0.69‰) compared to the depleted mantle ($\delta^{98/95}Mo$ = –0.21‰ ± 0.02‰) [5, 6] and the majority of arc lavas ($\delta^{98/95}Mo$ = –0.07‰ ± 0.04‰) [3], suggesting a more plausible explanation lies in the involvement of subducting sediments rather than dehydrated oceanic crust in the source. Our latest findings, integrated with previous studies, indicate that the arc-related rocks exhibiting light Mo isotopes may not solely originate from the rutile-breakdown oceanic crust source but could also result from sediment melting at various sub-arc depths. Consequently, sediment-derived melts play a crucial role in Mo isotope cycling and the formation of arc magmas in subduction zones.

[1] Chen, S., et al., *Nat. Comm.* **10**, 4773 (2019). [2] Freymuth, H., et al., *EPSL* **432**, 176-186 (2015). [3] Huang, F., et al., *GCA* **341**, 75-89 (2023). [4] König, S., et al., *EPSL* **447**, 95-102 (2016). [5] McCoy-West, A.J., et al., *Nat. Geos.* **12**, 946-951 (2019). [6] Willbold, M. & Elliott T., *CG 449*, 253-268 (2017).