Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11106

Potassium isotope evidence for water cycle from stagnant slab into mantle transition zone

KAICHEN XING[1], FENG WANG[1], WENLIANG XU[2] AND FANG-ZHEN TENG[3]

[1]Jilin University
[2]College of Earth Sciences, Jilin University
[3]University of Washington
Presenting Author: xingkc17@mails.jlu.edu.cn

Water cycle plays a key role in driving the coevolution of surface environment and Earth's deep interior and habitability of the planet. Geophysical and mineral physics data indicate the mantle transition zone (MTZ) is wet with heterogeneous water distribution [1]. The source of water in MTZ, therefore, remains debate. Fortunately, K isotope is a potential tool to trace the source of water in deep mantle since water performs similar incompatibility to potassium during magmatism process. Recent geophysical studies reveal that volcanism in NE Asia is caused by hot and wet upwelling flows in the big mantle wedge above the stagnant Pacific slab in MTZ [2-3], which provides an ideal window to tracing whether the subduction provides the water into MTZ. In present study, the K isotopic data for Cenozoic inter-plate volcanic rocks (20.6 ~ 18.7 Ma) in NE Asia show generally lighter K isotopic compositions than the primitive mantle ($\delta^{41}K$=-0.42‰ ± 0.08‰), with $\delta^{41}K$ values ranging from -0.36‰ to -0.83‰. This result, together with decoupling of radioisotopes and K isotope, jointly stresses that low $\delta^{41}K$ values of samples were related to water from nominally anhydrous minerals (NAMs) of eclogites dehydration at the stagnant slab front in MTZ. This study highlight the contribution of water released from NAMs of subducted eclogite in MTZ to deep water circulation. K isotope has great potential for tracing water transporting from surface to deep interior of Earth.

[1] Ohtani E. (2020) Annu. Rev. Earth Planet. Sci. 49, 253-278.
[2] Zhao et al. (2021) Earth-Science Review 214, 103507.
[3] Xu et al. (2021) Geology 49, 19-24.