Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16901

An experimental approach to trace water in Earth's deep mantle

YA-NAN YANG[1,2], ZHIXUE DU[1,2] AND WENHUA LU, PHD[1,2]

[1]Guangzhou Institute of Geochemistry, Chinese Academy of Sciences

[2]CAS Center for Excellence in Deep Earth Science

Presenting Author: yangyn@gig.ac.cn

Melt, likely volumetrically minor in Earth's deep mantle today, can play a major role in Earth's dynamics thanks to its great ability to retain and transfer volatiles. Seismological and geochemical observations suggest that melt might be present in lowermost mantle and enriched in volatiles, such as water [1]. However, how water partitions between melt and ambient mantle minerals remains unknown under these conditions. Laser-heated diamond anvil cell (LH-DAC) may be the only approach available to synthesize and recover analog specimens down to the Earth's core that is out of human's current reach [2,3]. Yet quenched minerals and melt from LH-DAC, typically of micron sizes, present an immense challenge to quantify their volatile contents. Nano-scale secondary ion mass spectrometry (NanoSIMS) is the technique of choice given its excellent ability to characterize chemical compositions at micron to submicron scale [4,5]. In this presentation, we integrate LH-DAC with NanoSIMS to measure water contents in silicate melt and SiO_2 at conditions greater than 1000 km depth. The significance of hydrous melt and SiO_2 within Earth's deep interior is explored. With its versatile multicollection system, NanoSIMS can extract comprehensive information from a single analysis, opening a new window to probe water and other volatiles in Earth's deep mantle.

[1] Williams and Garnero (1996). *Science*, 273, 1528-1530. [2] Akahama and Kawamura, H. (2006). *J. Appl. Phys.* 100, 43516. [3] Anzellini and Boccato (2020). *Crystals.* 10,459. [4] Fischer et al. (2020). *Proc. Natl. Acad. Sci. U.S.A.* 117, 8743 [5] Blanchard et al. (2022). *Earth Planet. Sc. Lett.* 580, 117374.