Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.4922

Combined Cr-Ti isotope analyses of planetary materials

YUKI HIBIYA

The University of Tokyo

Presenting Author: yuki-hibiya@g.ecc.u-tokyo.ac.jp

Meteorites show mass-independent ^{54}Cr and ^{50}Ti isotopic anomalies that depend on meteorite groups [1]. The combination of these two isotope systems serves as a new tool to explore the genetic relationship between planetary materials. We have recently developed a sequential chemical separation procedure for combined high-precision Cr and Ti isotope ratio measurements of planetary materials [2]. The method reduces the amount of sample required for the analyses and allows to closely link the Cr and Ti isotope data. We have applied this method to a variety of samples, including carbonaceous chondrites (CCs), primitive achondrites, HED meteorites, terrestrial rocks, and chondrules [e.g., 2-4]. Applications are now extended to terrestrial spherule samples, where the combination of Cr and Ti isotopes can set stronger constraints on impactor sources than Cr isotope alone could [5].

What is noteworthy about our method is that it can be applied to single meteorite constituent materials. In particular, Cr and Ti isotope analyses of 3 chondrules extracted from Allende (CV) [4] showed a wide compositional range spanning CCs and non-CCs. This suggests that the parent body contained materials originated from the inner solar system, and that there was reprocessing of non-CC components in the CC reservoir. Further applications will reveal a detailed picture of mass transport in the protoplanetary disk in unprecedented detail, which cannot be obtained from whole rock meteorite samples.

Our high-precision Cr-Ti isotope analyses are also expected to be a powerful tool in the on-going and future sample return missions. In such missions, not only are the locations and surface information of the parent bodies known, but also the geological contexts of returned samples are known. The comparison of those information with meteorite Cr-Ti data will allow us to understand the origin of the target bodies' building blocks, and will provide the strongest link between the returned samples and the origins of meteoritic materials.

[1] Warren (2011) *EPSL* 311, 93–100, [2] Hibiya et al. (2019) *GGR* 43, 133–145, [3] Hibiya et al. (2020) *Goldschmidt2020*, [4] Fukuda, Hibiya et al. (2021) *LPSLII*, #1319, [5] Trinquier et al. (2006) *EPSL* 241, 780–788.