Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10926

Simple and accurate determination of chalcophile and highly siderophile elements in carbonaceous chondrites using triple quadrupole ICP-MS

AKIRA ISHIKAWA, SHUN NAKANO, RYO FUJITA AND TETSUYA YOKOYAMA

Tokyo Institute of Technology

Presenting Author: akr@eps.sci.titech.ac.jp

Carbonaceous chondrites are known to possess $^{187}Os/^{188}Os$ ratios lower than those of the other chondrite groups and the bulk silicate Earth [1]. However, the processes responsible for creating variations in highly siderophile element (HSE) abundances and Os isotopic compositions among chondrite groups remain unclear. This uncertainty would stem from differences in the analytical protocols between HSEs and Os isotopes (samples are digested in closed glass tubes) and the other elements (samples are digested in Teflon vials).

In order to overcome this difficulty, we conducted analytical tests for simultaneously determining Os isotopes and elemental abundances of HSEs and chalcophile elements using the Smithsonian Allende reference powder. Less than 10 mg of the sample and isotopically enriched spikes of HSEs, S, Se, Ge, Sn, Sb, and Te were transferred into quartz glass tubes with inverse aqua regia, and were digested for 72 hours at 240ËšC in an oven. After extracting Os into CCl_4, the remaining solution was dried down with additional HF and redissolved in 0.5 M HCl for introducing into triple quadrupole ICP-MS (Thermo Scientific iCAP TQ) without any other chemical separation procedures.

Our results demonstrated that the measurement modes equipped with iCAP TQ efficiently remove multiple interferences on target masses, and successful determination of all HSEs including monoisotopic Rh and Au was achieved. Measurements of five separate dissolutions yielded excellent reproducibilities for the HSEs (RSDs <7%) excluding Ir (~11%) , Pt (~12%), and Au (~21%) as a result of powder heterogeneity [2-3]. The abundances of S, Se, Ge, As, Sn, and Te determined from the same sample solutions were consistent with the literature values [4] and displayed smaller variations than those of HSEs (RSDs <5% excepting Ge up to 10%). Thus, the developed method will allow multiple element analyses on small sample aliquots used for Re-Os isotope studies, and suitable for obtaining comprehensive data on valuable samples such as Ryugu.

[1] Walker et al. (2002) *GCA* 66, 4187–4201. [2] Fischer-Gödde et al. (2010) *GCA* 74, 356–379. [3] Phelan et al. (2022) *GCA* 318, 19-54. [4] Makishima & Nakamura (2009) *Geostand. Geoanal. Res.* 33, 369-384.