## Strategies for the precise and accurate determination of Se, Te and other chalcophile trace elements in geological samples using SF-ICP-MS

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By far, most applications of ICP-MS in Earth sciences focus on the analysis of lithophile and siderophile trace elements, such as the rare earths and platinum group elements. Nominally chalcophile elements, however, received much less attention. This is, at least in part, due to analytical challenges such as the low overall abundances of many chalcophile elements in many rock samples, partial loss during sample preparation and (oxide) interferences, that are difficult to resolve for mid-mass elements even in high-resolution ICP-MS. Here, we aim at the precise and accurate analysis of Cu, Zn, Ga, Se, Ag, Sn, Cd, In, Sb, Te in peridotites and chondritic meteorites by ICP-MS in order to a) refine our knowledge of the composition of the bulk silicate Earth, b) better define conditions of terrestrial core formation and c) constrain relationships between Earth and other solar system materials and the processes that affected chalcophile element abundances, e.g. volatile element depletion.

To improve the precision and accuracy of the analysis, we currently follow three routes. First, we apply isotope dilution for all the above elements, which allows for partial loss during sample preperation without loss in accuracy. Second, we developed a simple home-made hydride generation system to boost the ion signal intensities for Se, Sb and Te. Finally we develop novel chemical separation protocols. Copper, Zn, Ga, Ag, Cd and In can be efficently separated using a common anion exchange resin and HCl-$HNO_3$ media. For the separation of Se, Sb and Te experiments with thiol cellulose powder and cellulose powder functionalized with dihydrolipoic acid display some promising capabilities. Due to a conjugated arrangement of two thiol functions, dihydrolipoic acid and selenite are able to form a cyclic selenotrisulfide that is stable in acidic solution, but not at pH 8 (Self et al., 2000). In first experiments we have achieved near quantitative adsorption and desorption of Se from acidic rock digestions at corresponding pH values. Cellulose powder functionalized with dihydrolipoic acid may therefore give access to a new, selective and efficient method of separation of Se from aqueous solutions.

References

Self WT (2000) Synthesis and characterization of selenotrisulfide-derivatives of lipoic acid and lipoamide. PNAS 97:12481-12486.

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