

Sr isotope studies of melt inclusions by TIMS

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In-situ measurements by SIMS have revealed considerable variation in the Pb isotope compositions of melt inclusions from single magmas (Saal et al. 1998). Variations among such inclusions have important implications for melt aggregation processes and source variations. To examine further the potential for isotopic studies on melt inclusions we focus on Sr isotope compositions of olivine hosted melt inclusions found in the extreme (high) ³He/⁴He picrites of Vestfirðir (NW Iceland).

Our previous study of the major, trace, and volatile element systematics of these melt inclusions and their picritic host lavas suggests that melt inclusions and lavas are related by a combination of accumulation and fractionation of olivine and clinopyroxene. Furthermore, the variations in incompatible trace element ratios within each melt inclusion population reflect either (1) variations in the degree and depth of melting or (2) originate from a heterogeneous mantle source. We aim to test these alternative hypotheses using high precision Sr isotope analyses on the melt inclusions.

Melt inclusions hosted in the olivine phenocrysts range in size between 50 and 150 µm and have Sr concentrations (by LA-ICPMS) of 200 to 700 ppm. Such melt inclusions should have total Sr contents of 0.04 to 4ng. Preliminary experiments carried out on whole olivine grains containing visible melt inclusions show the potential for analyzing single grain and possibly single melt inclusions for high precision ⁸⁷Sr/⁸⁶Sr (50 to 100 ppm 2-sigma internal errors).

Using miniaturized micro-Sr chemistry techniques based around Sr spec resin (Charlier et al., in prep.), this technique gives total procedural blanks as low as 3 pg, enabling the analysis of sub- 0.5 ng samples. Samples are run using a TaF₅ activator using a Triton TIMS.

Reference

A.E. Saal, S.R. Hart, N. Shimizu, E.H. Hauri, and G.D. Layne (1998), *Science* Vol. 282 pages 1481-1484.

Hf isotopes by laser ablation multi-collector ICP-MS: Progress, pitfalls and prognosis

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Hafnium isotopes in the accessory mineral zircon are becoming an increasingly popular tool for deciphering the processes of magmatic and crustal evolution. Much of this utility stems from the physical resilience of the host phase, and its capacity to retain chemical and isotopic information that predate a given magmatic or metamorphic episode. The rapidity of analysis that reflects the combination of new generation lasers and plasma-source multi-collector mass spectrometers is another major attraction.

Hf has six naturally occurring isotopes, of which five are non-radiogenic, making correction for instrument-induced mass fractionation (IMF) routine. The isotope ratio of geological interest is ¹⁷⁶Hf/¹⁷⁷Hf, with ¹⁷⁶Hf produced by the β⁻ decay of ¹⁷⁶Lu with a half-life of 35.9 Gyr. However, the most critical factor in obtaining meaningful ¹⁷⁶Hf/¹⁷⁷Hf ratios by laser ablation concerns the ability to accurately correct for the isobaric interference of Yb and Lu on ¹⁷⁶Hf. The former is the most severe, and may exceed 300 000 ppm, depending on the REE budget of the analysed zircon. Given the chemical complexity of the matrix, molecular species (e.g. oxides) are other potential interferers, and may affect the non-radiogenic Hf isotopes and IMF factors calculated therefrom.

This contribution aims to examine the limitations and resolution of the Hf isotope in zircon technique, with particular reference to the veracity of the various methods for interference correction. Data from both homogeneous zircon standards and strongly zoned (age and compositional) detrital and igneous zircons will be reported for this purpose. Some new avenues for extracting isotopic information from zircon by micro-beam methods shall be explored, including concurrent measurement of Lu-Hf and Pb-Pb or U-Pb isotopes during laser ablation, and the correlation of these with other isotopic and chemical indices.