Award Abstract #0620160

SGER: Chlorine Isotopes as Tracers of Subduction Zone Fluids

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ABSTRACT

Intellectual merit. A proof-of-concept study is proposed to evaluate stable chlorine isotope abundances as a novel geochemical tracer of fluids derived in subduction zones. The PI has developed a robust analytical method for determination of delta37Cl values of different potential reservoirs - including sediments, pore waters, and serpentinites -

all of which have distinct isotopic compositions. It is proposed that the Cl isotopic composition of fluids involved in arc magmatism should be faithfully recorded in either in volcanic gases (e.g., fumaroles) or glasses and ash. Contamination by surficial waters would have the effect of driving samples toward a near-zero delta37Cl value. The fact that preliminary data on fumarolic gases cover a range in excess of 10 permil demonstrates that this effect is minimal. Cl isotope systematics will be determined for already well characterized fumarolic gases, volcanic glasses and volcanic ash samples from the Central American volcanic arc, which is one of the MARGINS focal sites. All samples are in hand, the technique has been perfected and the postdoctoral student for whom funds are requested is an expert in the field of chlorine isotope geochemistry, thus almost no developmental time is required to carry out this pilot study. In addition, numerous tectonic forcing functions vary over the arc length - allowing relations to geochemical parameters to be evaluated. This study aims to determine whether or not there is sufficient variation in Cl isotopic composition in arcs to serve as a useful petrogenetic tool. Broader impacts. This work will test the utility of using Cl isotopes for tracing fluids in subduction zone settings. It will take advantage of the well classified Central American arc, where samples are already in hand, and can be compared directly with other existing geochemical data (e.g., N and C isotopic composition, He/Ar). If successful, it should have wide applicability to other arc systems. The work will form the basis for a postdoctoral fellowship for J. Barnes, allowing her to expand her geochemical expertise into active volcanism/tectonism. In addition, an undergraduate student will undertake a subset of this work for an honors thesis and a minority high school student will be employed for the summer.

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