Introduction

The mantle volatile budget reflects primordial volatiles delivered during accretion, radiogenic in-growth of isotopic species, volcanou( plastic outgassing of the mantle, and regassing of atmospheric volatiles through subduction. Xe isotopic compositions are powerful tools for tracing the evolution of Earth's volatile budget because they are sensitive to volatile exchange between several possible reservoirs (e.g., [1]).

The evolution of the mantle volatile budget is coupled with the atmosphere through continuous degassing and regassing of the mantle (via subduction) over Earth history. Here we present new isotopic evolution models that can explore a range of past geodynamic scenarios (i.e., rates of mantle degassing and regassing). In addition, we present Ne and Xe isotope data from a 2.9 Gyr old Greenland anorthosite, an ancient mantle derived rock. We present scenarios (i.e., rates of mantle degassing and regassing) and investigate how large does a single outgassing event need to be to affect mantle Xe?

Numerical modeling of Xe isotopes: Does episodic outgassing have a measurable effect on mantle Xe?

Ne and Xe isotopes in a 2.9 Gyr old Greenland Anorthosite

How large does a single outgassing event need to be to affect mantle Xe?

Investigation of large single outgassing events. We investigated how large of a magmatic event would be required to produce a resolvable difference in modern mantle Xe composition, given a certain time of outgassing. The evolution of the mantle volatile budget is coupled with the atmosphere through continuous degassing and regassing of the mantle (via subduction) over Earth history. Here we present new isotopic evolution models that can explore a range of past geodynamic scenarios (i.e., rates of mantle degassing and regassing). In addition, we present Ne and Xe isotope data from a 2.9 Gyr old Greenland anorthosite, an ancient mantle derived rock. We present scenarios (i.e., rates of mantle degassing and regassing).

Xe isotopes suggest non-crustal component

Conclusions

Numerical modeling results:
- Episodic outgassing produces mantle evolution plots that are not distinguishable from smoothly decreasing processing histories.
- Extremely voluminous single magmatic events are required to obtain detectable deviations from smoothly decreasing processing rates.

Future work will result in additional NG analysis of this sample and additional anorthosites ranging in age.

References: