34, avenue Carnot
63006 Clermont-Ferrand
Cedex 1 - France
www.univ-bpclermont.fr

Ecole Doctorale des Sciences Fondamentales

The Nd-Ce isotopic composition of the Bulk Silicate Earth

Supervisor : Maud Boyet
Laboratory : Laboratoire Magmas et Volcans, UCA-CNRS
University : Université Clermont Auvergne
Email and Phone : maud.boyet@uca.fr, 0473346735
Possible co-supervisor : Régis Doucelance
Laboratory : Laboratoire Magmas et Volcans, UCA-CNRS
University : Université Clermont Auvergne

Summary :

The understanding of evolution of the Silicate Earth (mantle-crust system) through Earth's history is a difficult task. Samples available for measurements may give a biased view of the modern mantle and rocks formed early in Earth's history are extremely rare. We propose in this study to combine the measurement of two isotope systems (138La-138Ce and 147Sm-143Nd). Parent and daughter isotopes are from the rare earth element group and their behavior are well-known during magmatic processes (the order of incompatibility has been established). Moreover these elements are carried by the same mineral phases.

Here a large number of samples coming from the main silicate reservoirs will be analyzed (continental crust, oceanic crust, mantle) in order to determine precisely the terrestrial Ce-Nd array. Samples from Hadean-Archean time to present will be selected with the aim to compare the Archean and modern mantles. The ^{138}La-^{138}Ce system was first developed in the 80s, but very few studies have so far been published. ^{138}La exhibits branched decay to ^{138}Ce by β- disintegration ($T_{1/2}$ = 292.5 Ga) and to ^{138}Ba by electron capture ($T_{1/2}$ = 156.1 Ga). The deviation of 138Ce/142Ce is small and the measurement of this ratio is difficult because 138Ce represents only 0.25% of the total Ce. New analytical developments on the Laboratoire Magmas et Volcans TIMS (Triton *Plus*) offer a significant improvement of the analytical precision (15-20 ppm). Results obtained on terrestrial samples will be compared to those of chondrites that represent the Earth building's blocks and achondrites. This new database will provide new constraints on the accretion process, which is able to generate chemical fractionations early in the planetary evolution.

The appointment is for three years. This research program is supported by the European Research Council (ERC Consolidator Grant 2017-2022) and will be conducted in the Laboratoire Magmas et Volcans with strong interactions with the group "Early Earth". Contracts will start preferentially on October 1st, 2017. Candidates must have a strong interest

in geochemistry and a first experience in clean lab work and/or mass spectrometry is essential.

Methods: clean room chemistry, mass spectrometry (ICPMS, TIMS, MC-ICPMS), isotope dilution techniques.

Directeur : Pr Patrice Malfreyt
tél. 04.73.40.72.04
E-mail : Patrice.Malfreyt@univ-bpclermont.fr

Secrétariat : Suzanne Hernandez
tél. 04.73.40.53.76
E-mail : Sylvie.Desmet@univ-bpclermont.fr