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Chimie
Mathématiques
Sciences de l'Univers
Physique

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Planetary materials: Isotope anomalies in the Sm-Nd systematics

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Laboratory : Laboratoire Magmas et Volcans, UCA-CNRS
University : University of Western Ontario, Canada

Summary :

In 2005 the first high-precision ^{142}Nd measurements on chondrites revealed a difference of 20 ppm (part per million) with the modern terrestrial samples. Since ^{142}Nd is a radiogenic isotope partly produced by the decay of ^{146}Sm (half-life of 103 Ma), a very early differentiation event of the silicate Earth (< 30 million years) had been proposed to explain this offset. This scenario has been challenged by the discovery of variations in stable Nd isotope ratios in planetary materials as for example in chondrites. These results show that using the ^{146}Sm-^{142}Nd systematics as a precise chronometer of the silicate differentiation is no more possible and for the Earth, assumption on the initial composition must be made.

We propose in this project to measure the Nd isotope compositions of a large number of extra-terrestrial samples including chondrites and achondrites. To accomplish this work, all samples will be measure for Sm and Gd isotopes in order to evaluate precisely the potential effect of secondary nuclear reaction due to cosmic ray exposure. Finally the precise measurement of Sm/Nd ratio will be achieved by isotope dilution techniques. The two long-lived systematics ^{147}Sm-^{143}Nd and ^{176}Lu-^{177}Hf will be measured in order to date extra-terrestrial objects and establish the timescales for planetary formation and the chemical evolution of silicate reservoirs. Earth was constructed from compositionally diverse materials. Obtained results will shed new light on the birth of the Earth and its early 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”. One part of the project (2 months/year) will be realized in the University of Western Ontario with Audrey Bouvier. 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: mineral separation, MEB, ion-probe, clean room chemistry, mass spectrometry (ICPMS, TIMS, MC-ICPMS), isotope dilution techniques.

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