

PhD Thesis

Title: Cerium isotopic composition of the upper mantle

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Mid-ocean ridge basalts (MORB) have homogeneous isotopic compositions (Sr, Nd, Pb) compared to those of ocean island basalts (OIB). This is generally interpreted as reflecting (1) the homogenization by mechanical mixing of the upper mantle source of MORB, and (2) the great variety of materials (oceanic crust, sediments, sub-continental lithosphere, ...) recycled within the deep source of OIB.

The isotope ^{138}La decays into ^{138}Ce by beta emission with a half-life of 292.5 Gyr. The recent development of $^{1013}\Omega$ amplifiers allows precise determinations of Ce isotope compositions in mantle-derived samples, complementary to those of Nd isotope compositions. Coupled together, they can provide information on the shape of the Light REE pattern of the source material. The $^{138}\text{Ce}/^{142}\text{Ce}$ isotope ratios measured in MORB show unexpectedly “large” variations, similar to those recorded in OIB (1 epsilon-Ce-unit in MORB against 1.5 units in OIB, to be compared for example with the 3 and 12 epsilon-Nd-units variations observed for MORB and OIB, respectively). To date, the origin of these variations has not been identified.

The PhD project aims to increase the number of MORB samples analyzed for La-Ce systematics, and to establish the Ce isotope composition of the upper mantle. The selected candidate will combine radiogenic (Ce-Nd-Hf-Sr-Pb) and stable (Fe, Cr, Ca) isotopes. The results will be used to better understand the isotopic heterogeneity of the MORB mantle source.

The methods involved include clean room chemistry, mass spectrometry (ICPMS, TIMS, MC-ICPMS), isotope dilution techniques.

<http://clervolc.uca.fr/recruitment/>

<https://sf.ed.uca.fr/financement-doctoral/offres-de-these/autre-financement-uca>

The annual (three-year) salary for a ClerVolc PhD is 1920 euros per month, before any tax. The ability to speak French is not necessary, but any successful non-francophone candidates will be required to attend courses in the language. Overseas applicants will be required to apply for a student visa, aided by the university.

Please note that only candidates who have either completed a Masters degree (or equivalent, to be specified), or who are in the processes of studying for one and will graduate this year, are eligible to apply for PhD grants in the French system.

Application procedure

Interested candidates are invited to:

1. Contact the main supervisor(s) in order to discuss the project.

2. Send the following package to the main supervisor (with copy to tim.druitt@uca.fr)
 - A curriculum vitae including name, nationality, contact details, education history with dates and annual exam results, employment history, and any other information.
 - Photocopies of official certificates for undergraduate and Masters years, with courses taken and grades.
 - A letter of motivation no longer than two pages.
3. Arrange for letters of support by two academic referees to be sent confidentially by email to the main project supervisor. These letters should be sent directly by each referee and should not transit via the candidate. The application package and references may be in French or English. They should reach us no later than 20 May 2021. Applications will be reviewed after the deadline if it not filled. Candidates for the project will be shortlisted, and the shortlisted applicants will be invited to an online interview at the beginning of June for a decision immediately afterwards. In the event of enquiries or problems, please contact ClerVolc scientific director T. Druitt (tim.druitt@uca.fr).