

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Development of Sr-Pb isotope micro-analysis for tracing magma and gas sources in volcanic arcs.

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Project Summary:

Volcanic arcs represent one of the most complex geodynamic settings of the Earth. Despite the development of a wide range of cutting-edge geochemical tracers, the source of arc magma remains difficult to characterize. This is due to features inherent to arc magmatism: on the one hand, extensive crustal processing of magmas, especially in continental arc settings, hampers the characterization of deep magma sources and metasomatic processes occurring at the level of the mantle wedge and the subducted oceanic crust. On the other hand, the activity of andesitic volcanoes generally consists of long degassing periods interspersed with short and violent eruptions. This discontinuous eruptive activity makes the progressive evolution of magmatic systems difficult to assess.

This project aims to develop improved isotopic methods for tracing the source of magmas and gases in volcanic arcs. The approach consists in analyzing Pb and Sr isotopes on micro-samples that record selectively the composition of primary magmas or magmatic gas: the project plans to micro-drill 1) early crystallizing minerals and their host melt inclusions, so as to identify the composition of primary melts, 2) cross-sections of fumarole deposits to reconstruct the evolution of gas composition. This project involves miniaturization of element separation methods in the clean room, and optimization of isotope ratios measurement on mass spectrometers.

The project will focus on volcanoes of Ecuador and Chile, but other geographic targets are not excluded.

Methods: clean room chemistry, mass spectrometry (TIMS, ICPMS, MC-ICPMS \pm laser ablation), micro-petrology tools (SEM, EMP)