

## Ecole Doctorale des Sciences Fondamentales

**Title of the thesis: “Primary magma compositions and melting conditions of the Earth’s mantle under the French Massif Central: petrological and experimental study”**

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**Summary :** The French Massif Central has been the site of continuous volcanic activity for more than fifteen million years. The two youngest volcanic provinces (Chaîne des Puys in the Puy-de-Dôme department and Bas-Vivarais in the Ardèche department) are considered still active, and the most recent eruption is dated at only 6700 years BP (Lake Pavin). The geodynamic context of mantle melting under the Massif Central is still poorly understood and will be the subject of new investigations in the framework of a seismic imaging program aimed at highlighting convection movements within the upper Earth’s mantle. In parallel to the geophysical approach, the petrological approach provides important information on the melting conditions (pressure and temperature, nature of the mantle source). The petrological approach is based on complementary techniques: (i) characterization of primary magmas via the study of glass inclusions in olivine phenocrysts of the most primitive volcanic products (e.g., basanites); and (ii) high pressure-high temperature (HP-HT) experiments to characterize the melting conditions and partial melt compositions of rocks representative of the Earth’s mantle. Complementary information can be provided by the petrological and geochemical study of mantle xenoliths brought to the surface by alkaline basalts, of which the Massif Central hosts several world-renowned deposits.

The objective of this thesis is to use the petrological approach to provide information on the conditions of magma production under the Massif Central and to compare them with the results of seismic imaging campaigns. To begin with, experiments will be carried out to determine the melting conditions (pressure, temperature, importance of water and carbon dioxide) at the origin of the primary basanitic magmas of the Bas-Vivarais volcanic province. Then, the subject will be extended to another volcanic province: Cézallier, Chaîne des Puys...

**Methods:** petrology (studies of glass inclusions in phenocrysts); experimental petrology (HP-HT piston-cylinder experiments); scanning electron microscopy (textural characterization of samples; phase identification; elemental mapping; tomographic approach by coupling with a focused ion beam [FIB-SEM]); electron microprobe (analysis of mineral phases and glasses); Raman spectrometry (volatile concentrations in natural and experimental glasses).