

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Chemical and physical characterization of the lithosphere-asthenosphere boundary (LAB)

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Summary :

Kimberlite volcanic vent from diamond deposits are natural boreholes through the earth's crust and mantle. Kimberlite magmas on their way to the surface sampled the rocks they passed through over 300 km. Of the thousands of mantle xenoliths collected, a small fraction come from the lithosphere-asthenosphere boundary. This boundary (LAB) located under the very old terrestrial cratons (more than 2.5 billion years old) between 150 and 250km, is a crucial zone in the knowledge of the terrestrial dynamics and in the chemical and thermal exchanges between the convective deep mantle and the conductive lithospheric continental mantle. This boundary also reflects a profound rheological change in mantle rocks (from brittle to ductile) where the role of fluids seems crucial (hydrogen –H– content of the minerals plays a determining role on the deformation mechanisms, viscosity and electrical conductivity). This limit is known indirectly by its geophysical properties (seismic and conductimetric). The subject thus proposes, thanks to the exceptional personal and Cape Town University mantle xenoliths collections to directly study the petrology, mineralogy, geochemistry (H, δ D, major and trace elements) and petrophysical characteristics of these rocks (EBSD, modeling of seismic velocities, conductivity, seismic and conductimetric anisotropy). This set of geochemical and petrophysical methods are developed at the highest level in the LMV. The objective of this PhD is a better chemical and physical knowledge of this interface and to bring to the geophysics community strong constraints for their seismic and conductimetric models.

The study of cratonic peridotites and the chemical and physical properties of the lithosphere-asthenosphere boundary is also fully in line with axis 5 (“Mantle control of magma sources”) and axis 3 (“Volatile elements: the driving force behind volcanic activity”) of the Labex ClerVolc carried by the UMR "Magmas and Volcanoes" as well as in the transverse theme of the UMR "Early Earth". The project will be part of an international partnership with Pr Christopher Harris (CapeTown University). The thesis is already part of the International France-South Africa Laboratory in which I participate (LIA CNRS-NRF) "BuCoMO": Building continents, from mantle to Ore), which will allow a partial support of the student's mobility.