

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Sodium chloride transport in mantle fluids and relations with diamond formation

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Summary :

Diamond is a unique window allowing access to the processes that take place in the Earth's mantle. If pure diamond is sought by jewelers, any impurity is a source of information on the conditions of nucleation and growth of crystals at depth (> 150 km). In nature, it is common for crystallized carbon to trap mineral (silicates, oxides), fluid (CO₂-H₂O) or saline (NaCl) inclusions. These inclusions allow to discuss the depth of crystallization and the source of the carbon that fuels the growth of the diamond. They are therefore the subject of many studies on natural samples. They are therefore the subject of numerous studies on natural samples in order to characterize the geodynamic cycles of chemical elements. C, H, Na or Cl initially present in surface rocks are carried by carbonate or hydrous minerals (chlorite, micas, amphiboles) which are buried in the mantle during subduction. The breakdown of these minerals at high pressure and high temperature introduces C, H, Na, Cl into the mantle. Their subsequent mobilization in magmatic and volcanic processes leads to their return to the surface, thus closing the cycle of these elements.

The goal of this project is to study in the laboratory the relationship between NaCl and C, O and H fluids under mantle conditions. The H₂O-CO₂-NaCl system is known at low pressure and up to about 3 GPa, for relatively oxidizing conditions. The proposed study will explore higher pressures corresponding to the pressures of diamond formation in nature, as well as reducing conditions. The experiments will be carried out on the multi-volume press of the Magmas and Volcanoes Laboratory (LMV). The experimental products will be characterized by electron microscopy with high resolution imaging, by electron microprobe, and by vibrational spectroscopy methods (Raman, infrared).

This project gives access to advanced experimental and analytical techniques, applied to objects and questions around which new knowledge is rapidly developing.