Ecole Doctorale des Sciences Fondamentales

SUBJECT OF THE THESIS

Title of the thesis: Kinetic fractionation of sulphur isotopes.

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Project Summary:

Sulphur has four stable isotopes, ^{32}S, ^{33}S, ^{34}S, and ^{36}S, of which ^{32}S is the most common with 95% abundance. In general, chemical reactions at high temperature do not discriminate one isotope from another; all S-bearing, equilibrium phases have the same isotopic composition. Reactions at low temperature can discriminate the isotopes. However, fractionations of these four isotopes are constrained by the mass fractionation law, in which the extent of isotope fractionation is strictly constrained by the differences of masses. Exceptions are found in sediments older than ~2.4 Ga, and related old materials. These anomalous samples, plot away from the mass-fractionation line, are considered as derivatives of mass-independent fractionation (MIF) processes, mostly likely photolysis in an ozone-free atmosphere. However it seems to be rare, such MIF isotopic signals are also found in modern (less than 2.4 Ga) geological samples, for example lava samples of hotspots, ashes of large volcanic eruptions.

The proposed thesis project aims to quantify kinetic fractionation of sulphur isotopes in various geological settings, by laboratory high-temperature, high-pressure, experiments. Because of lack of laboratory determined kinetic parameters, the majority of current geochemical interpretations of sulphur isotope data precludes kinetic processes. The project is conceived to fill such obvious gap.

In addition to master-level education in Earth Sciences, following backgrounds would be particularly useful carrying this research: familiarity with thermodynamic and kinetic theories, ease with programing computations using widely available scripting programs such as MATLAB, Python, R, and other similar software, experience and/or enthusiasm working in experimental petrology lab (meaning heating and pressing rock powders).