Understanding the kinetics of clumped isotopes in heating experiments: applications to the thermal history of carbonates

The clumped isotope paleo-thermometer is a promising geochemical proxy that can be used to reconstruct the temperature of formation or recrystallization of all carbonate phases. The principle of clumped isotope is that the two heavy isotopes of oxygen and carbon will bond (“clump”) together in inorganic molecules, and the abundance of this clumping is temperature dependent.

In this project, the selected student will look at the fundamental behavior of carbonates during heating experiments in order to understand the kinetics of clumped isotope re-equilibrium within minerals. To date, a few studies have looked at this behavior, but not systematically with a range of carbonate composition and mineralogy. The project will be largely lab-based, and the student will focus mainly on clumped isotope geochemistry, a cutting edge technique that PI John is very familiar with, and the lab at Imperial College London is equipped to handle. Clumped isotope reordering happens when diffusion of oxygen and carbon within the lattice of carbonate minerals takes place. This diffusion rate is dependent on the burial temperature and cooling/heating rates, but also on the Arhenius parameters of the mineral. Thus, fundamental experiments will also be carried out to better constrain the behavior of a range of material during heating and cooling. In addition, once the behavior of common carbonates is better constrained, a case study will be selected to investigate how this knowledge can be applied to outcrop or well material in order to improve constraints on the regional thermal history of carbonates. Hence, this project has both a fundamental and an applied aspect.

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Minimum requirement for candidates: UG degree in geology, 1st class, EU/UK citizen, someone who enjoys lab work, proficient in English
Preferred candidate: all of the above but holding a master’s degree, proven ability to publish papers by being lead or co-author on a paper, computer literate and not afraid of simple coding using Matlab or equivalent (not essential)