



## NERC Centre for Doctoral Training in Oil & Gas (2017 start)

**Project Title:** Sedimentology and Thermal history of Carbonate-rich shales (Jura region, France and Switzerland): a dual approach combining fieldwork and clumped isotopes

**Host institution:**

**Supervisor 1:** Dr Cédric M. John, Imperial College London

**Supervisor 2:** Dr. Cathy Hollis, University of Manchester

**Project description:**

Unconventional resources, including shale gas, present new challenges when it comes to understanding their depositional history and the history of burial and maturation. Here, we propose a dual approach of fieldwork on exposed outcrops in the Jura region, and laboratory experiment to understand the fundamentals of shale deposition and maturation on a regional scale. The selection of the Jura region is dictated by the fact that 1) abundant and well studied outcrops of Mesozoic rocks exist in the region, and 2) the shale of Jurassic age are world-class source rocks in the North Sea, and are potential unconventional reserves elsewhere within the UK and Europe.

The research project will first consist of fieldwork in France and Switzerland. This will entail work on the sedimentologic the limestones and shales in the selected region (depositional environment, sequence stratigraphic context), as well as vertical and lateral sampling of the rocks. Although it is the thermal history of the shales that is the main focus of this project, samples need to be taken across a wider range of the stratigraphy to be able to reconstruct a coherent thermal history for the basin. The thermal history will be reconstructed using clumped isotopes reordering, a cutting edge technique that PI John is very familiar with, and the lab at Imperial College London is equipped to handle. The method is based on diffusion of oxygen and carbon within the lattice of carbonate minerals, and the rate of exchange is dependent on the burial temperature and cooling/heating rates. Some fundamental experiments will also be carried out to better constrain the behaviour of the particular limestones under investigation during heating. Petrographic analysis of each sample will be needed to gain a clear understanding of the diagenetic overprinting, and to reconstruct the environment of deposition of the rocks. The main outcome of this project will be a greater understanding on the thermal history of shales in a depositional context.

**CDT Research theme(s):**

Both “**Effective production of unconventional hydrocarbons**” and “**Exploitation in Challenging Environments**”

Science objectives addressed by this research are fundamental understanding of clumped isotope thermal history reconstruction, which will be useful for both unconventional reservoir production and when planning for exploration in challenging environments.

**Research context:**

PI John has 5 PhD students working on fundamental research with application to oil and gas. Many of them work on clumped isotopes, but in different contexts. Co-PI Hollis is an expert in burial diagenesis and basin-scale fluid flow reconstruction.

**Research costs:**

Main costs will be buying a computer (£4k), travel to conferences (£3k per year), and consumables in the lab (total of £10k). PI John can cover for lab costs above and beyond what would normally be provided by a CDT.

**Career routes:** This PhD project will equip the student in reservoir characterization skills, as well as basin thermal history modelling. Potential future avenues are geosciences and EOR (numerical skills, reactive transport and flow behaviours). The student will attend relevant oil and gas conferences in order to further their career.

Submissions must conform to this single-sided A4 format. The Awards Committee reserves the right not to consider submissions that do not adhere to this condition.