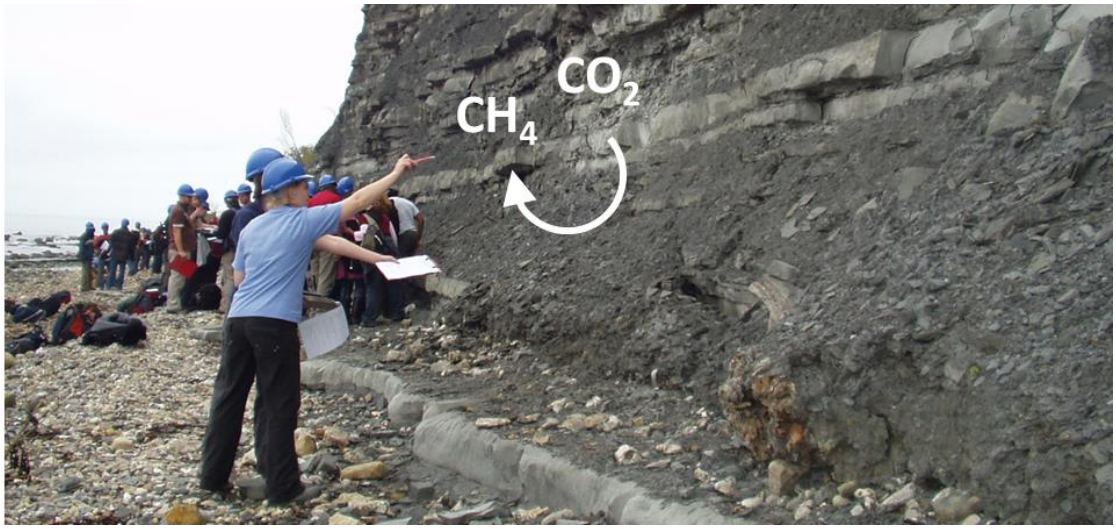
Imperial College London

DEPARTMENT OF EARTH SCIENCE AND ENGINEERING

Capture Carbon Dioxide on Shales

Professors Mark A. Sephton, Craig Smalley, Al Fraser



Storage of carbon dioxide in the Earth's subsurface has the potential to reverse the increase in atmospheric carbon dioxide brought about by the historical utilisation of fossil fuels. Aquifers, petroleum reservoirs and coal seams are all suggested subsurface targets for carbon dioxide storage. One relatively neglected but abundant target for carbon dioxide storage is shales, rich in clay mineral and organic matter. Carbon dioxide competitively adsorbs, relative to methane, onto shale constituent surfaces. Once strongly adsorbed onto shale constituents the carbon dioxide may be chemically stable and secure from future leakage.

The mechanisms of geochemical adsorption of carbon dioxide on shale constituents needs to be investigated to understand the full potential of shales of different compositions for carbon dioxide storage. This project involves examining the mechanisms of competitive carbon dioxide and methane adsorption. The project will also develop a quantitative technique to monitor the progress, completion and security of the adsorption process, so that the feasibility of large-scale gas storage in shales can be assessed and optimised.

At Imperial College London we have developed a unique shale adsorption/desorption experimental facility. Powders or plugs of representative samples of shales and their constituents can be loaded into a specially-designed cell. Known volumes and compositions of gas can be introduced and adsorbed/desorbed

while monitoring the pressure and composition of the gases. The gases introduced and recovered from the shale are analysed using coupled online gas chromatography – flame ionising detector (GC-FID) and online gas chromatography – isotope ratio mass spectrometry (GC-C-IRMS) systems to study molecular and stable carbon isotopic fractionation.

This project will be the first study to use such our methods to investigate sorption of methane and carbon dioxide mixtures in shales. The project has the potential to make an important contribution to the search for carbon dioxide storage options in the subsurface.

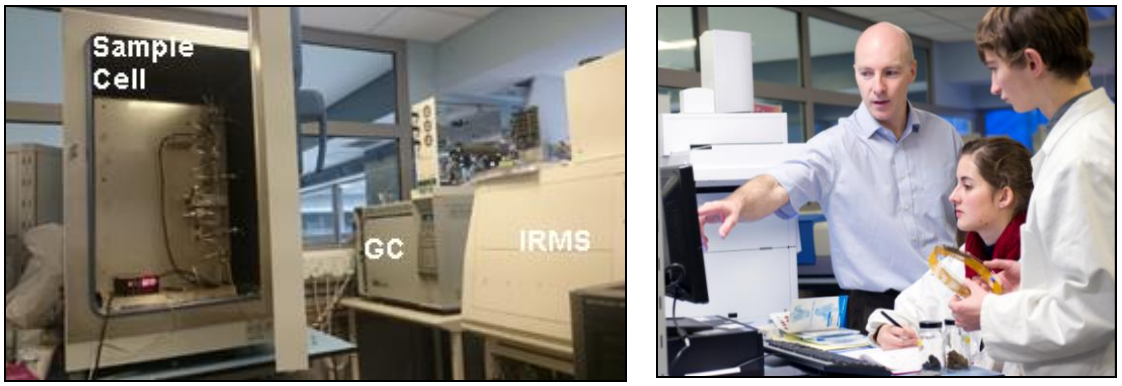


Figure 1. The online shale adsorption/desorption cell-gas chromatography-combustion-isotope ratio mass spectrometry system at Imperial College London.

The project would suit a candidate with enthusiasm for environmental geochemistry and a background in Earth Science, Chemistry or a subject that develops similar skills.

- For more information contact: Professor Mark Sephton (m.a.sephton@imperial.ac.uk).
- Details of how to apply are at: https://www.imperial.ac.uk/study/pg/apply/how-to-apply/.
- Funding details can be found at: https://www.imperial.ac.uk/study/pg/fees-and-funding/scholarships/.