Carbon storage technology potentials and difficulties

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The challenges of capture and purification of carbon dioxide from flue gases or from the air is a subject that has received significant attention. Of equal impotance is addressing what to do with the carbon dioxide once it has been purified. Work on the subsequent safe and permanent disposal of carbon dioxide has focused on underground injection or the production of solid mineral carbonates. However, such permanent storage represents an enormous challenge mainly because of the sheer volume of emissions. This talk will also address storage technologies and put them in perspective with regard to technical difficulties, storage capacity, permanence of storage, storage safety and the ability to account for the stored carbon.

Sequestration of trace elements during nucleation and growth of serpentine minerals under hydrothermal conditions

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Serpentinites observed in oceanic crust and exhumed mafic rocks contain high levels of trace elements or fluid mobile elements relative to primitive mantle. The concentrations in these elements are controlled by fluid-rock interactions and they represent excellent markers of mass transfert in complex geodynamics systems. Serpentinization processes have been experimentally investigated at different geological conditions, but, rare experimental studies have considered the presence of trace elements during nucleation and growth of serpentine minerals.

In the present study, serpentine nanofibers of chrysotile were nucleated-grown from H_2SiO_3-$MgCl_2$-NaOH hydrothermal system, referred as '*silica-gel system*' (300°C, Mg/Si=1.5, 76bar and pH>13). Liquid-solid distribution coefficients (K_D) for B, Cs, As, Sb and Li were estimated by fitting the experimental sequestration isotherms for each trace element (see for ex. [1]). Additionnnaly, small static-batch reactors were also used to simulate a more realistic serpentinization hydrothermal conditions in presence of the same trace elements. In this '*olivine system*', olivine (San Carlos) alteration was investigated at different physicochemical conditions of T (150-200°C), pH (0.5-13.5), particle size (1-150μm), liquid/solid weigh ratio (5-15), reaction duration (0.25-3 months). Trace element concentration in the fluid was fixed at 200mg/L.

Preliminary results by FESEM, XRDand BET reveal that the presence of trace elements has not significant effect on textural properties of chrysotile nanofibres grown from silica-gel system. Concerning the olivine system, three nanocrystal morphologies (conical, cylinder in cylinder and fibrous) of chrysotile and associated brucite nanoparticles were clearly observed at high pH (>13). Conversely, slight alteration of olivine was observed at low pH (<2) at the same T, particle size, reaction time and liquid/solid ratio conditions. More details for both experiment types (silica-gel and olivine systems) will be reported in [2].

[1] Montes-Hernandez *et al* (2009). *J. Hazard. Mater.* **166** 788–795. [2] Lafay *et al*. (in redaction)