

## Waste Characterisation of a Uranium Conversion Facility

T. FERNANDES<sup>1,3</sup>, L. DURO<sup>1</sup>, T. SCHÄFER<sup>2</sup>, P. MASQUÉ<sup>3</sup>,  
A. DELOS<sup>4</sup>, J.S. FLINOIS<sup>5</sup> AND G. VIDEAU<sup>5</sup>

<sup>1</sup>Amphos 21, Barcelona, Spain

<sup>2</sup>Karlsruhe Institute of Technology (KIT) – Institute for Nuclear Waste Disposal (INE), Karlsruhe, Germany

<sup>3</sup>Departament de Física & Institut de Ciència i Tecnologia Ambientals. Universitat Autònoma de Barcelona, Bellaterra. Spain

<sup>4</sup>Arcadis, Villeurbanne, France

<sup>5</sup>AREVA, France

At the front end of the nuclear-fuel cycle, the process of conversion of uranium ore concentrate into uranium tetrafluoride generates a waste stream. Understanding the geochemistry of this waste is fundamental for risk assessment of the final disposal.

Here we present the work carried out to characterise uranium in the decanted waste of a uranium conversion facility.

The industrial site of interest is the first step in the treatment of uranium mining concentrate. The process waste, resulting from the conversion of yellowcake into uranium tetrafluoride (UF<sub>4</sub>) has been managed in settling basins, which were built on the tailings of a former sulphur mine. The waste contains a variety of chemicals (nitrates, carbonates, fluorides and sulphates) and radioactive elements, of which uranium contributes with 30% of the total alpha activity. The porewaters are characterised by high ionic strength, of up to 2M.

The work comprised static (batch-type) and dynamic (column) experiments of disturbed and undisturbed material obtained from the site to investigate the release of uranium. The chemical form of the uranium was also studied. Thermodynamical modelling was carried out in parallel to the laboratory work.

Static and dynamic experiments show that the release of uranium from the waste is kinetically controlled. Source term characterisation suggests U is present in different degrees of crystallinity. Although the solubility-limiting mineral phase has not been identified, it is likely to be either a U-Si phase or a phase similar to meta-schoepite. An important pH buffer effect from calcite in the waste was observed.

## Calibration of the Siderite CO<sub>2</sub> ‘Clumped’ Isotope Paleothermometer

ALVARO FERNANDEZ<sup>1</sup>, JIANWU TANG<sup>2</sup>  
AND BRAD ROSENHEIM<sup>3</sup>

<sup>1</sup>Department of Earth & Environmental Sciences, Tulane University, New Orleans, Louisiana 70118-5698, U.S.A., (afernan4@tulane.edu)

<sup>2</sup>Department of Earth & Environmental Sciences, Tulane University, New Orleans, Louisiana 70118-5698, U.S.A., (jtang@tulane.edu)

<sup>3</sup>Department of Earth & Environmental Sciences, Tulane University, New Orleans, Louisiana 70118-5698, U.S.A., (brosenhe@tulane.edu)

Siderite (FeCO<sub>3</sub>) is commonly found in lake sediments, paleosol profiles and modern soils. Its presence in the geologic record has been shown to provide a useful archive of paleoclimate variables in environments that are generally exclusive of calcite (e.g. Sheldon and Tabor 2009). Clumped isotope measurements can be used to exploit the paleoclimatic potential of this archive; however, the applicability of this method is held back by the lack of clumped isotope calibrations of mineralogies other than calcite and aragonite. Here we present an inorganic calibration of siderites grown in the laboratory between 22-50° C. Synthetic siderites were precipitated by slow titration (0.15 ml/min) of a sodium bicarbonate solution with an anoxic iron (II) chloride solution followed by active degassing of CO<sub>2</sub> with N<sub>2</sub>. We also report measurements of natural siderites collected from Holocene aged sediments of the Mississippi River Delta. We find no difference in the  $\Delta_{47}$  vs. temperature relationship between synthetic calcites (also measured in our laboratory) and siderites. Our results suggest that the model of Guo *et al* [1] may not accurately predict the difference in acid fractionations between the different carbonate minerals, and instead imply that a single clumped isotope calibration is appropriate for samples of different mineralogies.

[1] Guo *et al*, (2006) *GCA* **73**, 7203-7225