

## Diffusive parameters of tritiated water (HTO) and U in chalk

M. DESCOSTES<sup>1,2\*</sup>, O. GANDOIS<sup>1</sup>, B. FRASCA<sup>1</sup>,  
J. RADWAN<sup>1</sup>, A. JUERY<sup>1</sup> AND E. PILI<sup>3</sup>

<sup>1</sup>CEA, DEN/DANS/DPC/SECR/Laboratory of Radionuclides Migration Measurements and Modelling, F-91191 Gif-sur-Yvette, France (michael.descostes@cea.fr)

<sup>2</sup>UMR 8587 CEA, Université d'Evry, CNRS, France

<sup>3</sup>CEA, DAM/DIF, F-91297 Arpajon cedex, France

The Cretaceous Chalk of the Basin of Paris is known for its aquifer which constitutes one of the main important groundwater resource in France. Previous study indicates that this chalk exhibits a double porosity (matrix and fracture) providing pathways for both slow and rapid migration of water [1]. The presented study is part of an ongoing project aiming at understanding and predicting the chemical contaminant transfer properties through chalk formation. This project is based on a multidisciplinary approach (field investigations, U-series disequilibria and geochemical modelling).

Mobility through the matrix porosity of U and tritiated water (HTO) taken as an inert tracer, was studied according to diffusion experiments on four different samples. Diffusive parameters, *e.g.* accessible porosity and effective diffusion coefficient, of HTO and U in samples were determined. Additional measurements of porosity were achieved according to mercury porosimetry and to water content. Results are discussed regarding to the distribution of porosity (micro, meso and macro porosity) and to both mineralogical and textural characteristics.

[1] Hubert *et al.* (2006) *GCA* **70**, 5437-5454.

## Identification of sedimentary reductive capacity and redox processes during ASR

C. DESCOURVIERES<sup>1,2\*</sup>, N. HARTOG<sup>3</sup> AND H. PROMMER<sup>1</sup>

<sup>1</sup>CSIRO Land and Water, Underwood Avenue, Floreat, Perth, Australia (Carlos.descourvieres@csiro.au, Henning.Prommer@csiro.au)

<sup>2</sup>School of Environmental Systems Engineering, University of Western Australia

<sup>3</sup>Deltares, Soil and Groundwater Systems, Utrecht, The Netherlands (niels.hartog@tno.nl)

The feasibility of aquifer storage and recovery systems (ASR) to counteract short and long term imbalances between freshwater supply and demand is currently investigated for the metropolitan area of Perth, Western Australia. During the planned injection of oxic excess water into a deep anoxic aquifer the water quality evolution will depend on the extent and structure of the physical and geochemical heterogeneity and reactivity of the aquifer.

A detailed geochemical characterisation was undertaken to determine amount and type of sedimentary reductants within different lithological facies. The incubation of sediment samples from the target aquifer for ~52 days enabled quantification of their oxygen (O<sub>2</sub>) consumption and CO<sub>2</sub> production [1]. Data analysis, in particular the identification of key redox and acid buffering processes, was underpinned by hydrogeochemical modelling.

Results showed that the average measured reductive capacities (MRC) towards O<sub>2</sub> consumption increased from the sand facies, followed by the siltstone facies, and the mudstone/shale facies.

This approach identified pyrite (20 – 100%), sedimentary organic matter (SOM; 3 – 56%), siderite (3 – 28%) and Fe(II)-aluminosilicates (8 – 55%) as the main O<sub>2</sub> reductants. Minute amounts of carbonate acted as buffering minerals, while a bounding pH of 3 indicated acid buffering by K-feldspar dissolution. The supernatants showed elevated aqueous concentrations of Ni, Cd and Pb to be a potential risk for the quality of the recovered water.

[1] Hartog, Griffioen & Van der Weijden (2002) *Environmental Science & Technology* **36**(11), 2338-2344.