Stability and mobility of dissolved organic species in Boom Clay

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Boom Clay (BC) is a poorly indurated clay considered as a potential host rock for deep geological nuclear waste disposal in Belgium. It contains from 1 to 5 wt% of natural organic matter that governs the fate of a wide range of radionuclides. Clay sediments display small pores and the role played by dissolved organic matter (DOM) in the transport of contaminants is highly dependent on the size of the organic aggregates/molecules. The stability of DOM species is thus determinant since it controls their mobility through a clay sediment. This presentation aims to discuss the stability of DOM species in the current BC conditions at the Mol site and in conditions where the salinity and the cationic composition of the pore water are modified. The transport properties of DOM species as a function of their size is also discussed.

Under the current Boom Clay conditions, *i.e* a pore water similar to 0.015 M of $NaHCO_3$, it is estimated that around 10% of NOM is soluble in the pore water. The size distribution of soluble OM is investigated by size exclusion chromatography. DOM is highly heterogenous and contains a range of organic species from small molecules (Molecular weight (MW) < 100 Da) up to large and stable aggregates (MW > 100 kDa). With an increase in salinity the size of DOM is altered following two mechanisms: a shrinkage or a dissociation of the DOM molecules/aggregates and a coagulation. It was evidenced that the largest DOM species are more prone to coagulation which at the extreme lead to their precipitation and which decreases the DOM content and its degree of aromaticity (SUVA280). On the contrary, the shrinkage/dissociation mechanism is favoured for the small DOM speciES. The coagulation is largely promoted in presence of Ca^{2+} compared to a system with Na^{+}.

The change in size of the DOM species with salinity may affect their mobility through the BC layer. Transport experiments were performed, in BC conditions, on intact BC samples to study the mobility of DOM as a function of MW. They revealed that only DOM with MW < 10-20 kDa is mobile which is confirmed over a large part of the BC Formation by the size distribution of pore water samples collected *via* piezometers. The transport properties of DOM species are determined as a function of MW by using a 1D transport model accounting for retention, diffusion-advection and filtration.