Aluminium-organic matter precipitation as a geoengieering tool for *in situ* permeability reduction in a porous media

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The utilization of natural processes for engineering purposes has been widely discussed in recent years since they might enable the development of cost-effective, robust and environmentally compatible engineering technologies. Biomineralization is one of the many possible biogeochemical processes that is currently investigated in detail. We propose the use of another natural process, namely podzolisation, as a novel geoengineering tool for *in situ* permeability reduction.

Podzolisation is a soil formation process where the mobilization and subsequent leaching of aluminium, iron and organic matter (OM) in the topsoil is followed by their precipitation at greater depth. The accumulation of Al/Fe-OM precipitates results in the formation of an almost impermeable soil layer [1].

In situ permeability reduction is interesting for several engineering questions, e.g., prevention of piping, leaking water bodies, and contaminant spreading.

Preliminary experiments and modelling results revealed that Al-OM precipitates can reduce the hydraulic conductivity in sand by up to 4 orders of magnitude. In order to apply the podzolisation process for engineering purposes, it is, however, necessary to control the reaction kinetics and ensure Al-OM precipitation over the entire desired treatment zone within a porous media. Therefore, a 2D experimental setup (80x160x5 cm) equipped with numerous pressure and electrical resistance tomography (ERT) sensors is used to tests different kind of injection strategies and their effect on the permeability reduction within a porous media.

A reactive transport model coupling a MATLAB-based toolbox and ORCHESTRA (equilibrium reaction processor) is used (1) to design the injection strategies and (2) to simulate the solute transport, the geochemical reactions and their effect on the permeability within the experimental setup. The experimental results will be used to validate the model and to implement the most promising injection strategy in the field.

[1] U.S. Lundstroem, N. van Breemen, D.Bain, Geoderma 94, 2000, 91-107