Soil carbon build-up during soil formation, influenced by different forms of land use

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Soil carbon is the result of solar energy and one of the two important non-living components of soils, influencing physical, chemical and biological soil characteristics. Moreover, organic carbon is the driving force of mineral weathering and soil formation [1].

Based on a chronosequence of alluvial soils in the Danube River Basin near Vienna/Austria (covering an age range from approximately 50 – 6000 years of soil formation; [2]), carbon build-up under different forms of land use (forest, grassland and agricultural cropping) is shown, looking into the vertical C distribution as well as its influence on aggregate formation and distribution within different soil aggregates. The influence of N on C-build-up in the Chernozem-soils is discussed.

[1] Blum (2010) *Geochemica & Cosmochimica Acta*, Abstracts p99. [2] Lair *et al*. (2009) *QGC*, **4**, 260–266.

Imaging nanoparticle transport through porous media using magnetic resonance imaging

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While most renowned for its use in the medical sciences, magnetic resonance imaging (MRI) has tremendous potential for revealing transport processes in engineered and geologic systems. Its ability to non-invasively image inside materials that are opaque to other imaging methods is a particular strength. Here, we report on the application of MRI to image nanoparticle transport through porous geologic media. Commercially available paramagnetically tagged (Gd) nanoparticles are used; the paramagnetic tag making the nanoparticle visible to MRI.

Nanoparticle transport was imaged as nanoparticles migrated through packed columns of quartz and dolomite sands and gravels. These images were calibrated using T_2 parameter maps to provide fully quantitative maps of nanoparticle concentration at regular time intervals throughout the column (T_2 being the spin-spin relaxation time of ^{1}H nuclei). Positively charged nanoparticle transport was significantly retarded in dolomite compared to quartz due to electrostatic attraction between nanoparticle and dolomite surfaces. Data was evaluated with CXTFIT to estimate solute transport parameters. MRI data fitted well to CXTFIT models of nanoparticle transport, indicating MRI was collecting usable and reliable datasets.