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Sulphate release from building rubble of WWII

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Sulphate concentration in the upper aquifer of Berlin, Germany is increasing continuously since 40 years. In downtown Berlin they particular exceed the precaution values of drinking water ordinance.
We assume that the main source of sulphate in the groundwater is technogenic material, which is part of building rubble from WW II bombing. Nearly 115 Mio t of this material have been deposited in Berlin.
Our aim is,
to identify rubble components which contain S and to quantify the S-pool of this material
to identify factors, influencing the release of SO4 and
to predict sulphate release from building rubble of WW II
We analyzed total and water soluble S of various components and the fine earth fraction of the soils containing the rubble.
We investigated the influence of physical and chemical parameters on the release of SO4 using unsaturated column experiments (With an automatic percolation system). Thereby, the particle size, the flow rate and the pH of the solution has been varied.
Among the components, slag shows the highest total S-contents of up to 0,7% . Lignite Coal-ashes from Lusatia, Germany are also rich in SO4. The total S of brick varies between 0,01% and 0,3%. Mortar shows S-Values between 0,08 and 0,12%.
In 75% of all samples show total S of less than 0,14%. There was no significant correlation between total S-amount and water-soluble SO4, which is caused by different chemical compounds in the samples.
In the percolation experiments technogenic components with grain size <2mm cause a higher density, resulting in a lower percolation velocity. The concentration of ions in the according leachate is higher than in the leachate of coarse fraction (2 – 20mm).
Gypsum-rich material (10%) released constant SO4 -concentration over the whole experiment. Slag-rich material released high initial SO4-concentrations which then fastly decreased.
We concluded, that the kind of technogenic component and its grain size strongly influences the release of SO4 to the soluble phase.
Based on SO4-Desorption rate from different lab experiments we are able to estimate the release from several sources in urban soils, containing building rubble (WII).