

Molybdate sorption from steel slag eluates by soils

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Steel slags are an industrial by-product. The latest statistic of 2009 show a use which amounted to 4.62 mio. t slag in Germany [1]. Over 60 % have been used as construction material (ways, roads, earthworks). Molybdenum is added during steel processing in order to harden the steel. The objective of this study was to evaluate the sorption behavior of molybdate from slag eluates towards different soils to assess the risk that may arise from contamination of ground water by leaching of molybdate.

Molybdate sorption batch experiments were carried out with eluates obtained from (i) steel slag (Linz-Donawitz operation, LD) and (ii) electric furnace slag (EF).

Six different soils and sediments were chosen to provide a wide range of chemical properties (pH 4.0 to 7.6; dithionite-extractable Fe 0.73 to 14.69 mg kg⁻¹). Molybdate sorption experiments were carried out at pH of the steel slag eluates (pH 11 to 12) as well as at pH adjusted to soil pH. The data were evaluated with the Freundlich equation.

Molybdate sorption exhibited a maximum near pH 4 for steel slag eluates which were adjusted to soil pH and decreased rapidly with increasing pH until sorption was virtually zero at pH > 11. Sorption was greater for soils with high amounts of dithionite-extractable iron oxides. Molybdate sorption behavior of both eluates was similar. After reaching equilibrium, the pH of the EF steel slag eluate was lower than the pH of the LD steel slag eluate that was caused by different buffer capacities. Some soils were able to decrease the pH of the EF steel slag eluates by about four pH units enhancing the sorption of molybdate.

The Mo-sorption behavior from steel slag eluates is similar to sorption experiments with commercial Mo standard solutions. The same factors affect Mo-sorption, but Mo-sorption from steel slag eluates is more complex as a result of eluate chemistry.

[1] Merkel (2010) *Report des FEhS-Institutes* **1**, 14.

Brackish marine water intrusion in deep fractured granitic bedrock

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Groundwater residing in the fractures of granitic bedrock in a costal environment can be related to the climate changes and seawater stages. The purpose of this study is to hydrogeochemically characterise the different brackish marine water types present at the Äspö Hard Rock Laboratory, an underground bedrock laboratory situated at the Baltic Sea shore, in south-east Sweden [1].

Groundwater samples collected from the different boreholes along the tunnel at 50-560m depth were classified according to their Cl content and δ¹⁸O signature. Groundwater classified as brackish marine component was used to study the Mg/Cl and Mg/K ratios in detail.

For samples with Mg/Cl ratio higher than 0.03, two different trends can be observed both with respect to the Mg and the Cl concentrations. One group of samples is distributed along an evolution line from the present Baltic Sea water (Cl = 3380 mg.L⁻¹). The other group, consisting of fewer samples and higher Cl concentration, appears to gather along an evolution line from the ancient Baltic Sea, also called the Littorina Sea (Cl = 6500mg.L⁻¹; [2]). However, the samples of the second group have lower Mg and Cl concentration than the original Littorina Sea composition. The brackish marine water considered to be influenced by Littorina Sea water is located in relatively shallow fracture sections at 30-180m depth. This suggests storage of Littorina Sea water as pockets in some fractures. Nevertheless the high Mg/K ratio, which is more than four times the ratio of the Littorina Sea water, indicates that a strong water-rock interaction occurred since the Littorina sea water intrusion. The alignment of the samples along different evolution lines of the two different brackish Sea water types shows that mixing processes with other water types [3] take place in the fracture network.

[1] Laaksoharju *et al.* (1999) *Appl. Geoch* **14**, 835–859. [2] Sjöberg *et al.* (1984) *Chem. Geol.* **42**, 147–158. [3] Smellie *et al.* (1995) *Jour Hydro* **172**, 147–169.