Mycorrhizal weathering of minerals – The importance of the nutrient status of the tree

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Most forest trees are forming symbiotic relationships with ectomycorrhizal (EM) fungi in the soil. These fungi are well known to increase the absorptive surface for nutrient uptake to the host plants and they use a substantial part of the carbon fixed by the trees. It has been shown that certain EM fungi can obtain phosphorus from apatite in the soil and the growth of EM mycelia is usually stimulated by the presence of apatite. Elemental analysis of fungal tissue in contact with apatite, reveal accumulation of calcium oxalate crystals on the outside of the fungal hyphae. This suggest that EM fungi release oxalate to mobilize phosphorous from apatite and calcium is precipitated as a rest product. It is not well known how this fungal stimulation of apatite weathering is regulated. But we have seen that EM growth in response to apatite amendment is highly dependent on the phosphorus status of the host trees. EM growth is stimulated by apatite if the host tree is P deficient, but if a P deficient tree is fertilized with phosphorous, the growth stimulation diminish. These results suggest that EM weathering of apatite is regulated by carbon provided by the host. In our future research we will analyse the mechanism of fungal weathering of apatite by applying gene expression analysis of EM fungi interacting with the mineral. These analysis will be combined with FTIR microscopical analysis of mineral surfaces.

$\delta^{34}S$ isotopes in the groundwater at Äspö Laboratory

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Background

Data from $\delta^{34}S$ isotope measurements at Äspö, south-eastern Sweden, during the time of the tunnel construction for the SKB underground laboratory (HRL), indicates significant isotope changes with time in the dissolved sulphate. The Äspö HRL laboratory operates as a fascility for research, development and demonstration in a realistic rock environment down to repository depth. The collection of data was made between 1992 and 1996. An evaluation of the $\delta^{34}S$ isotope meaqsurements [1] was made in order to delineate isotope changes in the dissolved sulphate over time. The variation and change in isotopes in the dissolved sulphate ($\delta^{34}S$ values between +15 and up to +34 ‰ CDT) suggests a sulphate reduction induced by disturbances in the groundwater flow. [2].

Results

The results show an extensive microbial sulphate reduction in the groundwater at Äspö. This activity increased considerable during the tunnel construction phase. The time series from various drill cores at different depth, all show an increase over time in the $\delta^{34}S$ values of the dissolved sulphate. The sulphate reduction by SRB was most likely induced by the inflow of organic rich Baltic Sea water and by the up-coning of deeper saline water [3].

[1] Wallin (1992) SKB, 25-92-08, 1-44. [2] Laaksoharju (1995). SKB TR 95-25. [3] Wallin and Morales in prep.