Isotope/chemical mass-balance estimation of water inflow into a constructed wetland

O. LAZAREVA[1]* AND T. PICHLER[2]

[1]Department of Geology, University of South Florida, 4202 East Fowler Ave., Tampa, FL, USA (*correspondence: olesyalaz@gmail.com)
[2]Geochemie und Hydrogeologie, FB Geowissenschaften, Universitat Bremen, 28359 Bremen, Germany (pichler@uni-bremen.de)

The objective of this study was to investigate hydrogeological pathways in an artificial wetland constructed to treat wastewater from a power plant cooling pond in Central Florida. To assess the hydrogeological conditions in the wetland, a combined isotope/chemical mass-balance approach was employed. Monthly monitoring was carried out for 18 months to evaluate the wetland performance during the dry and rainy seasons. Stable isotopes of hydrogen (δD) and oxygen ($\delta^{18}O$), and Na were analyzed in the wetland, cooling pond, adjucent water bodies to the north and south of the wetland (N-15 and SA-8) and 6 monitor wells, which were installed along the wetland to: (1) evaluate groundwater leaking in and out of the wetland; (2) differentiate potential sources of water in the wetland; (3) understand major factors controlling the performance of the wetland.

During the first 6 months the wetland water was a mix of cooling pond water, natural groundwater, and seepage from N-15 and SA-8. The water quality was impacted by two hurricanes and inconsistent pumping operations due to maintenance or power issues. Once pumping operations stabilized and without the influence of hurricanes, the wetland water was mostly composed of the cooling pond water (> 81 %), minor inflows of natural groundwater, SA-8, and N-15 that were caused by occasional rainfall events and short maintenance problems.

Our investigation showed that δD and $\delta^{18}O$ in combination with Na were useful tools to discriminate the origin of water in the wetland and monitor wells. The wetland treatment system showed high reliability and efficiency despite seasonal variations and minor technical difficulties.

Hydroxyapatite weathering by pine mycorrhizas–The role of oxalic acid

J.R. LEAKE[1]*, A.L. DURAN[1], I. JOHNSON[1], S. BONNEVILLE[2] AND M.M. SMITS[3]

[1]Animal and Plant Sciences, University of Sheffield, UK (*correspondence: j.r.leake@sheffield.ac.uk)
[2]Earth and Biosphere Institute, University of Leeds, UK
[3]Department of Microbial Ecology, Lund University, Sweden

Ectomycorrhizal Weathering

Pines are the dominant trees in the Boreal forest, the worlds largest biome, and one in which there is often intense mineral weathering. Over 90% of pine root tips are normally sheathed by ectomycorrhizal (EM) fungi that provide their major biotic interface with the soil [1]. EM fungi receive up to a third of the sugars produced by the trees. They use this to grow extensive mycelia that actively forage for phosphorus and aggressively weather minerals by releasing organic chelators and acidifying soil [2].

Weathering of ^{33}P-Hydroxyapatite (HAP) by EM

Using sterile microcosms containing seedlings of *Pinus sylvestris* inoculated with the EM fungus *Paxillus involutus*, we studied EM weathering, in experiments where roots have no contact with the minerals. We aseptically synthesised ^{33}P labelled HAP and used it to coat the centre of flakes of muscovite, one of which was then added to each microcosm where it was colonised by the fungus growing from the tree roots. Over a period of two months, growth of the fungus was stimulated once it grew across the muscovite and contacted the HAP. Dense fungal growth all around the margin of the HAP layer was accompanied by local encrustation of the fungus in calcium oxalate crystals- the organic carbon being supplied to the fungus from the pine trees. The oxalate crystals were confined to fungus in contact with, or immediately adjacent to the HAP, and were not seen on the remainder of the muscovite surface. HAP dissolution by the fungus was confirmed by digital autoradiography and scintillation counting. This showed ^{33}P throughout the fungal mycelium, some of which passed into the tree roots and shoots. These findings emphasise the role of mycorrhizal fungi as agents of biological weathering – driven by the carbon energy supply from their partner plants which they direct into secretion of organic chelators locally in response to specific minerals at the scale of individual grains.

[1] Leake *et al*. (2004). *Can. J. Bot.* **82**, 1016-1045.
[2] Landeweert *et al*. (2001).*Trends Ecol. Evol.* **16**, 248-254.