Contribution of ectomycorrhizal fungi to biogeochemical processes during iron and calcium limitation

S.J.M. HOLMSTRÖM[1,2]*, A. ROSLING[3], R.D. FINLAY[3], P.A.W. VAN HEES[4] AND U.S. LUNDSTRÖM[1]

[1]Department of Natural Sciences, Engineering and Mathematics , Mid Sweden University, S-851 70, Sundsvall, Sweden
[2]Current Address: Department of Geology and Geochemistry, Stockholm University, S-106 91, Stockholm, Sweden (*sara.holmstrom@geo.su.se)
[3]Department of Forest Mycology and Pathology , Swedish University of Agricultural Sciences, S-750 07, Uppsala, Sweden
[4]Man-Technology-Environment Research Centre, Department of Natural Sciences, Örebro University, S-701 82 Örebro, Sweden

The symbiotic ectomycorrhizal fungi mediate nutrient uptake to boreal forest trees. Fungi are known to produce low molecular mass organic acids (LMMOAs), which are important weathering agents. Through weathering Al, Si and Fe, as well as nutrients important for plant growth i.e. P, Ca, K, Mg, and Na are released from solid minerals. The impacts of biogeochemical weathering caused by microbial exudates have been discussed but there is still a lack of knowledge regarding the production of important ligands from boreal forest tree-ectomycorrhiza interactions, as well as the effect of this symbiosis on mineral dissolution and nutrient cycling in forest soils.

Here we examine how mineral nutrient mobilization was affected by fungal exudates in a closed mineral column experiment with pine seedlings with and without symbiotic ectomycorrhizal fungi (*Hebeloma crustuliniforme* or *Suillus variegatus*) with biotite and oligoclase as the only source for iron and calcium, respectively. The experiment was conducted for 20 months. We monitored the solution chemistry continually through out the experiment. At harvest the mineral chemistry and morphology, as well as size and element composition of the plant tissue was determined.

We conclude that both the investigated ectomycorrhiza species, especially *H. crustuliniforme,* had a significant impact on the production of LMMOAs, mobilization of important mineral nutrients for plant growth, accumulation of elements in the plant shoot and root tissue, the exchangeble pool of elements, and plant growth during nutrient deficiency.

Cosmogenic neon exposure dating of young basalt lavas in Australia

M. HONDA[1]*, A.R. CHIVAS[2] AND D. PHILLIPS[3]

[1]Research School of Earth Sciences, The Australian National University, Canberra, ACT 0200, Australia (*correspondence: masahiko.honda@anu.edu.au)
[2]GeoQuEST Research Centre, School of Earth and Environmental Sciences, University of Wollongong, NSW 2522, Australia (toschi@uow.edu.au)
[3]School of Earth Sciences, The University of Melbourne, Melbourne, VIC 3010, Australia (dphillip@unimelb.edu.au)

Cosmogenic ^{21}Ne was utilised to determine exposure ages of young subaerial basaltic lava flows from the Newer Volcanic Province, western Victoria, Australia. The ages (36 – 53 ka) determined from co-existing cosmogenic ^{21}Ne and ^{3}He in olivines separated from basalts collected from four locations, the Tyrendarra flow, the Harman Valley flow, Hopkins Falls; and Mount Porndon, are consistent within analytical uncertainties with ages previously determined by cosmogenic ^{36}Cl exposure dating. Thus, the cosmogenic ^{21}Ne method can provide reasonable exposure age estimates for young basalts, and it could prove complementary to established techniques such as conventional ^{14}C dating (which is generally considered unreliable above ~60 ka) and K-Ar and Ar-Ar dating (which is problematic for samples < 100 ka old).

More research, however, is needed before cosmogenic neon exposure dating becomes accepted as an accurate and reliable method. In particular, the uncertainty in cosmogenic neon production rates could be as high as 25%. In order to obtain an improved calibration of the cosmogenic ^{21}Ne (and ^{3}He) production rate, we are currently assessing various additional sample sites in Australia that have been well characterized by previous geochronology and geomorphology studies.

The expected improvement in analytical performance of a new generation multi-collector noble gas mass spectrometer should enhance our capabilities for neon isotope analyses, and it may be possible in a near future to measure cosmogenic ^{21}Ne ages as young as 1 ka.