Strontium isotopes highlight change in Ca sources in forest ecosystems

TH. DROUET[1], J. HERBAUTS[1], AND D. DEMAIFFE[2]

Université Libre de Bruxelles, Belgium
[1]Lab Génétique et d'Ecologie Végétales, (tdrouetd@ulb.ac.be; jherbaut@ulb.ac.be)
[2]Lab GéochimieIsotopique(ddemaif@ulb.ac.be)

Many studies made in Europe and North America have shown an increasing depletion of exchangeable base cations that may cause tree nutritional deficiencies in sensitive soils. The two main sources of Ca in forest ecosystems are mineral weathering release and atmospheric inputs. We use the $^{87}Sr/^{86}Sr$ ratio (Sr is used as a proxy for Ca) to determine the relative Ca contributions of soil mineral weathering and atmospheric deposition to vegetation in two forest ecosystems growing on Devonian shales in High Belgium. Contributions were calculated using a mixing equation based on the Sr isotopic ratio of bulk precipitation (atmospheric end-member), of 0.1 M HCl-extractable soil fraction (weathering end-member) and of beech wood (mixing compartment) [1]. A second estimation of the weathering end-member using the Sr isotopic composition and the Cl/Ca ratio of stream waters [2] was undertaken. The radial variation of the $^{87}Sr/^{86}Sr$ ratio in beech and oak tree-rings was used to monitor possible changes of the contributions of the two Ca sources over time. Our results emphasize the importance of the atmospheric Ca-contribution for tree nutrition, but principally show a steep radial decrease of the $^{87}Sr/^{86}Sr$ ratio since ~1870. This suggests that the atmospheric contribution increases at the expense of the mineral weathering recharge. The studied ecosystems are thought to be sensitive to chemical changes in the environment (atmospheric acid deposition) which are known to increase the loss of soil exchangeable base cations.

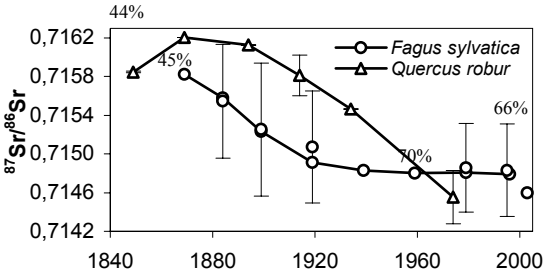

Fig. 1. Sr isotope signal records in tree-rings of European beech and pedunculate oak in a forest stand of High Belgium. Numerals are the estimation of Ca percentage derived from atmospheric source.

References

[1] Drouet Th., Herbauts J., Gruber W. and Demaiffe D. (2004), *Geoderma (in press)*
[2] Kennedy M.J., Hedin L.O. and Derry L.A. (2002), *PNAS.* **99**, 9639-9644.

Basalt and granite dissolution rates in the presence of citrate

E.M. HAUSRATH[1], A. NEAMAN[2] AND S.L BRANTLEY[3]

[1]302 Hosler Building, Department of Geosciences, Penn State University, University Park, PA 16802, USA (emh191@psu.edu)
[2]Facultad de Agronomia, Pontificia Universidad Catolica Valparaiso (alexander.neaman@ucv.cl)
[3]2217 Earth and Engineering Building, Penn State University, University Park, PA 16802, USA (brantley@essc.psu.edu)

Bacteria, fungi, lichen and plants all produce organic acids, which can strongly affect weathering by increasing the solubility and mobility of elements. Leaching by organic acids may produce trace element signatures which could record the presence of life.

To determine the effect of organic acid on rock dissolution, powdered Columbia River basalt, and Half-Dome granite Tuolumne River Series sampled in Yosemite National Park were dissolved in the presence of 0.01 M citrate and deionized water in long-term column dissolution experiments. In previous experiments, citrate significantly enhanced element mobilization from basalt. The pH of the input solutions was adjusted to 6, and sodium azide or lithium azide was added to prevent microbial growth. Two empty columns were also eluted with identical inlet solutions (with and without citrate) as controls.

Preliminary results indicate that the elements Ca, Mg, Si, Fe, Al, Sr, Y, Zr, La, Ce, W, Th, P, Sc, Ti, V, Cr, Mn, Co, Ni, and Zn may be leached from the basalt to a greater extent in the presence of the citrate as compared to the ligand-free solution. Na, Mg, Ca, Al, P, Ti, Mn, Fe, Y, La, Ce, Th and Si may be leached from the granite to a greater extent in the presence of the citrate as compared to the ligand-free solution. Further work is needed to quantify and better understand this effect, but these results indicate that organic acids may significantly affect the weathering rates of granite and basalt in natural environments, and the trace element signatures of these rocks after weathering.