Microbiogeochemistry in the rhizosphere of two Australian forest trees

D.A. LITTLE[1,2] J.B. FIELD[1,2] S.L. ROGERS[1] S.A. WELCH[1,3]

[1]Cooperative Research Centre for Landscapes Environment & Mineral Exploration (CRC LEME)
[2] School of Resources, Environment & Society, Australian National University david.little@anu.edu.au
[3]Department of Earth and Marine Sciences, Australian National University swelch@ems.anu.edu.au

This research is part of an ongoing investigation of the biogeochemistry and metal mobility in the rhizosphere of co-occurring *Eucalyptus mannifera* and *Acacia falciformis* on the Southern Tablelands of New South Wales, Australia.

BIOLOG® sole Carbon source utilisation patterns, and Denaturing Gradient Gel Electrophoresis (DGGE) of PCR amplified bacterial 16S and fungal 18S *r*DNA were used to examine potential functional and structural diversity of soil microbial communities in rhizosphere and non-rhizosphere soils beneath neighbouring mature trees growing in a near natural forest setting. The results show variability between microbial communities based on soil horizon and tree species, with more subtle variation observed between rhizosphere and non-rhizosphere soil.

Soil dissolution experiments show that milli-molar concentrations of individual low molecular weight organic acids (LMWOA's), malate and oxalate, and in particular citrate, greatly increase the release of major and trace metals to solution compared to inorganic controls. Concentrations of Al and Fe in organic acid solutions were up to 10 times greater than in the inorganic controls. Si concentrations were a factor of 2-5 greater in the organic acid solutions, suggesting preferential weathering of Fe and Al oxyhydroxide phases rather than primary silicate minerals. Dissolution of elements such as Si, Al and Fe from rhizosphere soils were about twice that observed from non-rhizosphere soils. Trace metals such as Ti and Zr, which are usually considered to be immobile during chemical weathering and are not usually taken up by plants, were also mobilised from the rhizosphere soils, especially in the citric acid treatments.

Results indicate the potential importance of LMWOA's in these soils by direct interaction with soil minerals as well as through provision of vital nutrients for soil microbial communities. Further research is required to determine the relative proportions of LMWOA's available for direct reaction with soil minerals or utilisation by resident soil microbial communities.