Biogeochemistry of Inundated Actual Acid Sulfate Soils, Cairns, Australia

John Broughton[1] and Bernd Lottermoser[2]

[1] School of Earth & Environmental Sciences, James Cook University, Cairns 4870 Australia
Email: John.Broughton@jcu.edu.au

[2] School of Earth & Environmental Sciences Sciences, James Cook University, Townsville 4811 Australia
Email: Bernd.Lottermoser@jcu.edu.au

Abstract

Tidal exchange is used to rehabilitate actual acid sulfate soils at East Trinity, Cairns, Australia. The aims of this study were to evaluate the biogeochemistry of inundated actual acid sulfate soils and to establish the uptake and exclusion of environmentally significant elements by plants colonising such soils. The survey was designed not only to test different native plant species, but also to assess different plant tissue, such as roots and the above- ground biomass. The chosen site was ideal for this research as the East Trinity site has undergone recent inundation with seawater. Hence, the selected site was particularly suitable for establishing the transfer of environmentally significant elements during the remediation process. The biogeochemical analyses indicate pronounced enrichment of Al and lesser concentrations of As, Co, Cr, Cu, Pb and Zn in the tissue of the mangrove fern Acrostichum speciosum and the grass species Paspalum vaginatum. In particular, the uptake of Al, As, Co, Cu and Zn by Paspalum vaginatum and Acrostichum speciosum increases linearly with EDTA-extractable soil metal concentrations. In comparison to background samples, the roots and stems of Acrostichum speciosum and of Paspalum vaginatum display higher Co, Cr and Zn and higher Cu and Zn concentrations, respectively. In general, the two plant species growing on the inundated soils have translocation factors (TF, metal concentration ratio of plant foliage to roots) for all elements less than one. These plants growing in inundated soils acquire higher metal concentrations despite their tendency to exclude metals from their biomass. Thus, the applied remediation technique at East Trinity promotes the transfer of environmentally significant elements (Co, Cd, Cu, Zn) into local plant species. Also, the Al concentrations in roots and stems of Paspalum vaginatum from inundated soils and background sites are distinctly elevated. Such Al concentrations exceed NRC (1980) animal feed guidelines, indicating that this plant species, prevalent in coastal mangrove grasslands, poses a toxicity threat to farmed animals.

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