Journal of Conference Abstracts
Volume 5(2), 599

The Effect of Colonization by Spartina Alterniflora on Pore Water Redox Geochemistry at a Saltmarsh on Sapelo Island, GA

Carla Koretsky (koretsky@eas.gatech.edu)[1], **Christof Meile** (meile@geo.uu.nl)[2], **Beth Curry** (gte177g@prism.gatech.edu)[1], **Johnson Haas** (jrhaas@email.uncc.edu)[1], **Kimberley Hunter** (kimh@eas.gatech.edu)[1] & **Philippe Van Cappellen** (pvc@geo.uu.nl)[2]

[1] School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA, 30332, USA
[2] Institute of Earth Science, Utrecht University, 3508 TA Utrecht, The Netherlands

The redox geochemistry of saltmarsh sediments is influenced by many factors, including tidal flushing, bioturbation, climate, and the presence of vegetation. Previous studies have shown that *Spartina alterniflora* roots are capable of pumping oxygen into the surrounding sediment (Lee et al. 1999), and from this it has been postulated that pore water species such as sulfide should be reoxidized to a greater extent in vegetated as compared to similar non-vegetated saltmarsh sites. Thus, pumping of oxygen by roots would be expected to lead to lower concentrations of reduced solutes such as manganese, ferrous iron and sulfide in pore waters of vegetated sediments.

To test the influence of oxygen pumping by roots on pore water redox geochemistry, two sites in a saltmarsh at Sapelo Island, GA were studied using pore water diffusion equilibrators. The two sites selected for this study are located on the edge of a tidal creek with a tidal amplitude of approximately 2-3 m. One site is entirely non-vegetated, and the other, located at a distance of approximately 1.5 m from the non-vegetated site, is in an area being actively colonized by *Spartina alterniflora*, with a stalk density of approximately 100 per m^2. Pore waters were sampled at 1-2 cm intervals from the sediment-water interface to a depth of approximately 50 cm at both sites during April 1999 and May 2000, and analyzed for pH, alkalinity, salinity, dissolved sulfide, sulfate, ferric and ferrous iron, manganese, ammonia and phosphate.

Although previous studies of oxygen-pumping by roots suggest that reduced pore water species concentrations should be higher at the non-vegetated sites (Lee et al. 1999), pore water profiles measured in this study demonstrate that dissolved manganese, ferrous iron and sulfide concentrations are considerably higher at the vegetated site. Alkalinity, which is primarily produced by anaerobic organic matter oxidation, rather than by aerobic respiration or reoxidation reactions, is also higher at the vegetated site compared to the non-vegetated site. Reoxygenation and aerobic respiration reactions produce protons, so significant addition of oxygen at the vegetated site might also be expected result in a decrease of pH. However, pH profiles measured at the two sites are quite similar. Salinity is generally higher at the vegetated site, presumably due to enhanced evapotranspiration. Dissolved phosphate, which is produced by organic matter oxidation, is similar at the two sites, but dissolved ammonia is higher at the non-vegetated site. This may reflect uptake of ammonia by the *Spartina*, which has been postulated to be N-limited in many saltmarshes (e.g., Dai and Wiegert 1997). The increased concentration of alkalinity, dissolved manganese, ferrous iron and sulfide at the vegetated saltmarsh site indicates that the presence of vegetation enhances anaerobic microbial activity in the surrounding sediment, in spite of oxygen pumping by the roots.

It has been shown previously that microbial organic matter degradation at these saltmarsh sites is dominated by anaerobic sulfate reduction (e.g. Howarth and Giblin, 1983), and that sulfate reduction is probably limited primarily by temperature and labile organic carbon availability (e.g., Koretsky et al., 2000). Therefore, oxygen-pumping by roots may be important within the rhizosphere, and may enhance aerobic respiration and reoxidation reactions within microzones. However, the pore water profiles measured in this study suggest that the addition of labile organic matter in vegetated zones stimulates anaerobic respiration to such a great extent that the effects of oxygen introduction by roots is entirely overwhelmed in the bulk pore water composition. Thus, vegetated saltmarsh sites are dominated by relatively more reduced pore water species, compared to similar non-vegetated sites in spite of enhanced oxygen supply via root networks.

Dai T and Wiegert RG, *Estuarine, Coastal and Shelf Science*, **45**, 273-283, (1997).

Howarth RW and Giblin A, *Limnology and Oceanography*, **28**, 70-82, (1983).

Koretsky CM, Moore C, Van Cappellen P and DiChristina TJ, *American Society of Limnology and Oceanography Meeting, Copenhagen, Denmark*, (2000).

Lee RW, Kraus DW and Doeller JE, *Limnology and Oceanography*, **44**, 1155-1159, (1999).