181353
N94-12464

BIOGEOCHEMICAL FACTORS WHICH REGULATE THE FORMATION AND FATE OF SULFIDE IN WETLANDS

Mark E. Hines*, W. Berry Lyons and H.E. Gaudette
University of New Hampshire
Durham, New Hampshire 03824

Coastal wetland areas occupy a small percentage of the terrestrial environment yet are extremely productive regions which support rapid rates of belowground bacterial activity. Wetlands appear to be significant as biogenic sources of gaseous sulfur, carbon and nitrogen. These gases are important as tracers of man's activities, and they influence atmospheric chemistry. The interactions among wetland biogeochemical processes regulate the anaerobic production of reduced gases and influence the fate of these volatiles. Therefore, spatial and temporal variations in hydrology, salinity, temperature and speciation and growth of vegetation affect the type and magnitude of gas emissions thus hindering predictive estimates of gas flux. Our research is divided into two major components, the first is the biogeochemical characterization of a selected tidal wetland area in terms of factors likely to regulate sulfide flux; the second is a direct measurement of gaseous sulfur flux as related to changes in these biogeochemical conditions. Presently, we are near completion of phase one.

The New Hampshire marsh under investigation is subject to a 3m tidal range, seasonal salinity variations of ~20 ppt, contains a productive creekside stand of <u>Spartina alterniflora</u> and a nearby high marsh stand of <u>Spartina patens</u>. We have been conducting a seasonal study of pore water and solid phase chemistry in conjunction with measurements of rates of sulfate reduction and methanogenesis along a gradient between both grass species. Pore waters were collected using <u>in situ</u> "sippers" to prevent artifacts due to the destruction of plant material. Microbial activity rates were determined using radiotracers. Samples were collected weekly during summer to establish the influence of plant growth on biogeochemical processes. The <u>S. alterniflora</u> inhabited sediments which received no detrital input year round were influenced strongly by plant growth. Microbial activity, for example, increased drastically once <u>alterniflora</u> growth began and decreased again in August as the grass began to flower. Dissolved sulfide increased to > 4.0 mM during this period. Sulfate reduction was less active in the <u>S. patens</u> soils and sedimentary biogeochemistry was influenced strongly by variations in tidal regime and rainfall. Sulfide was produced throughout the <u>S. patens</u> sediment column but only accumulaed below 15 cm because the changing hydrologic conditions caused sulfide removal by the enhancement of iron cycling. The <u>alterniflora</u> soils were sulfide rich while the anoxic <u>patens</u> soils were Fe^{3+} rich. This discrepancy affected the fate of ^{35}S during rate measurements. Methanogenesis was slow in the <u>alterniflora</u> soils even when the salinity was low. Methanogenesis was absent in <u>patens</u> soils. Attempts to delineate the important methane precursors were hindered by slow rates and the possibility of gross artifacts due to sampling techniques. Diel studies of pore water chemistry demonstrated that the concentrations of certain solutes changed dramatically in response to tides. Dissolved sulfide and organic carbon varied inversely by as much as 2.0 and 0.5 mM respectively in a 6 h period. The interactions among plant activity, bacterially-mediated processes and hydrologic regime produced a rapidly changing and biogeochemically dynamic system which potentially will alter rates of production of biogenic gases and influence the immediate fate of these gases.