Historical records of metal contamination in the Tantramar Salt Marshes, Nova Scotia

Ozlem Suleyman
Department of Geology, Saint Mary's University, Halifax, NS B3H 3C3, Canada

Sediment cores collected from the Tantramar salt marshes in northern Nova Scotia record changes in atmospheric metal fluxes during the past 300 years. Salt marsh sediments were collected from six locations in May 2002 and analyzed for carbon content, metal concentrations, and grain-size distributions. Field and laboratory observations show that the salt marsh cores consist of four main units: (1) brown, silty, organic-rich soil (0–30 cm); (2) dark-brown, mottled soil with thin laminations (30–125 cm); (3) grey mud with peat layers (125–140 cm); and (4) peat (140–160 cm). Depth profiles of the raw metal concentration data show significant down-core fluctuations, which result from changing sediment grain size and scavenging of some metals (e.g., Cu) by organic matter. Diagenetic remobilization of Mn has resulted in a near-surface Mn peak within the oxic zone of one core; however, diagenesis does not appear to have significantly altered the vertical profiles of other elements. To account for the effects of changing grain size on metal profiles in the sediment cores, the concentrations of Cr,

Cu, Ni, Pb, and Zn were normalized using Li, which serves as a reasonable proxy for sediment grain size in these cores. The ages of sediments at various depths within the salt marsh were calculated using measurements of the mean accretion rate of the marsh (39 cm per century) based on published results from earlier workers. The normalized profiles of all metals except Pb do not vary significantly with depth in the cores, indicating that the fluxes of Cr, Cu, Ni, and Zn to the Tantramar marshes have remained relatively consistent for the past 300 years. The normalized Pb profiles in all sediment cores correlate well with the history of atmospheric Pb pollution throughout North America. The results show a general increase in the concentrations of Pb in the 18th century, which may reflect atmospheric contamination from coal burning and increasing industrialization. A rapid increase in Pb concentrations in the sediment cores is evident from about 1875–1890, which corresponds to the North American Industrial Revolution. The highest Pb concentrations occur in the late 1960s to early 1970s, reflecting the widespread use of leaded gasoline during this time. During the 1980s and 1990s, Pb concentrations in the salt marsh cores show a progressive decline, which most likely reflects the phase-out of leaded gasoline use in North America. No evidence is seen for widespread metal pollution from local industrial centres (e.g., Amherst, NS and Sackville, NB). The results of this study show that although salt marsh geochemistry is complex, historical records of metal contamination can be derived from sediment cores provided that the effects of diagenesis and changing sediment grain size are carefully considered.