BIOGEOCHEMICAL PROCESSES CONTROLLING TRACE ELEMENTS AND HEAVY METALS IN THE GRAND BAY NATIONAL ESTUARINE RESERVE IN THE GULF OF MEXICO

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Abstract: Estuaries have the highest biotic diversity of habitats and offer a reserve of food resources and commercially significant species. Rapid human civilization has led to accumulation of heavy metals and trace elements in estuaries. The Grand Bay National Estuarine Research Reserve is a national marine protected area in southeastern Mississippi in the Gulf of Mexico. The objectives of this study are to investigate major biogeochemical processes controlling concentrations and distribution of trace elements and heavy metals in the salt marsh and wetland soil/sediment in the reserve. The results show that Hg, Cd and to some extent, As and Pb have been significantly accumulated in soils/sediments. We found strong correlations between total organic matter contents and concentrations of elements: Ni > Cr > Sr > Co > Zn, Cd > Cu> Cs. Strong correlations were also observed between total P and concentrations of Ni, Co, Cr, Sr, Zn, Cu, and Cd. The P spilling accident in 2005 caused a significant increase in P concentrations in Bang Lake site. Lead isotope ratios matched those of North American coals and Mississippi River type Pb-Zn ore from Missouri regions. The Pb isotopes were in agreement with those reported in sediments of Chesapeake Bay and South Florida Lakes. The present study implies three major biogeochemical processes controlling and contributing to the current loading of trace elements and heavy metals in the region: bioaccumulation process, anthropogenic phosphorus spilling, and atmospheric fallouts from coal power plants. Sediments transported through runoff from the Mississippi River Valley may be a possible addition.

Keywords: Trace elements, heavy metals, Grand Bay, estuary, biogeochemistry, biogeochemical processes.

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