

Where Does the Manganese Come From? Metal Quantities and Associations in Modern Alluvium of the Mississippi River Delta

Mielke, Howard: Xavier University of Louisiana (with)
Gonzales, C.R.; Powell, E; Sturghill, A.L.; Shah, A

ABSTRACT

The parent materials of the lower Mississippi River Delta alluvial soils originate from sediments of the entire Mississippi-Missouri watershed. The samples for this study are from the Bonnet Carré Spillway flood control structure upstream from New Orleans. The gates were last opened March and April 1997, and the Spillway was flushed and loaded with fresh alluvium during that event. This study evaluates alluvium concentrations of Mn and other metals (Pb, Zn, Cd, Ni, Cu, Cr, Co and V) and their associations. Three sets of alluvium samples were stratified by location in the Spillway as follows: an open land area greater than 100 m from a road and a railroad (A); within 5 meters of a roadway (RD); and, within 5 meters of a railroad (RR). Surface (2.5 cm deep) alluvial samples were air-dried and sieved (2 mm screen). Metals were extracted using a 5:1 ratio of 1 mol L⁻¹ nitric acid (room temperature) to soil, shaking for 2 hours, centrifuging (1000 x g - 15 min.), and then filtering. Metals were determined with inductively coupled plasma-atomic emission spectrometry (ICP-AES). The hypothesis was tested that soils near the RR would be associated with larger quantities of metals than soils along the RD. The medians (and Kruskal-Wallis P-values) for groups A, RD and RR are Mn 93, 216, 154 (5.0E-06); Pb 3.2, 21.5, 3.9 (<1.0E-10); Zn, 8.1, 16.0, 8.0 (<1.0E-10); Cd 0.5, 0.8, 0.6 (1.0E-06); Ni 2.9, 4.0, 2.9 (8.0E-06); Cu 1.5, 5.3, 2.9 (<1.0E-10); Cr 0.6, 2.2, 0.6 (<1.0E-10); Co 2.0, 2.3, 1.9 (1.9E-03); and V 1.6, 4.2, 2.5 (<1.0E-10). The smallest quantities of metals exist in fresh alluvial soils at a distance of greater than 100 meters from both the road and the railroad. The largest quantities of manganese and other soil metals exist along the road instead of the railroad, thereby rejecting the hypothesis. Group A and RR are similar for all metals except for Cu and V, which are higher along the RR. The overall results show that metal concentrations of A ~ RR << RD. Pearson's product moment correlation shows different associations of metals within each group. This research suggests that road networks and their vehicle traffic may be a more substantial ongoing source of environmental loading of manganese and other metals than is generally recognized.