Mobilization of Metals in Podzolic Soils of the Sudbury Smelter Footprint

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Since the early 1960s, the Sudbury area smelting complex has been one of the world's largest point sources of sulphur emissions, and the source of thousands of tons of metal particulates which have been deposited onto the thin podzolic soils of the region. A column leaching study was performed using contaminated soils from near the Copper Cliff and Falconbridge smelter sites at Sudbury, Ontario to determine the effects of leaching with deionized (DI) water and simulated acid rain (SAR) on the distribution and movement of heavy metals through the soil horizons. The effects of different species of tree litter on the mobilization of heavy metals were also tested by leaching soil columns with a poplar *(Populus tremuloides)* leaf litter layer and a white pine (*Pinus strobus)* needle littler layer. Changes in pH and the concentrations of Fe, Mn, Ni, Cu, Zn, As, and Pb in the soil horizons and leachate samples were analyzed to assess the relationships between the pH of the soil solution and the mobilization of these metals.

Concentrations of Fe, Ni, Cu, and As in the surface organic horizons (LFH) were shown to be above Ontario Ministry of the Environment guidelines. This observation indicates that the elevated contents of these metals may be a result of atmospheric deposition from the nearby smelting and roasting operations over the past century. Poplar leaf litter significantly increased the solubility of metals in the LFH when leached with DI water. Generally, the metals in all columns were leached from the LFH and Ae horizons and deposited in the B horizon. A portion of the more highly concentrated dissolved phase metals such as Fe, Mn, and Ni were leached through the re-constituted B horizon as well. The total mass of metals leached through the B horizon was significantly greater in columns with a white pine needle litter layer when leached with both DI water and SAR. Results thus suggest that significant amounts of these metals can be leached from the topsoil into soil parent material and deeper surficial material layers, and could possibly lead to groundwater contamination. The potential for groundwater contamination appears to be greater in forested areas dominated by pine species.