Geochemical Screening of Metals in Urban Soils as Environmental Benchmarks for Human Health, Fredericton, New Brunswick, Canada

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A total of 101 locations were sampled as part of a geochemical survey of the main urban centre of Fredericton, New Brunswick. The area, which has been the provincial capital since 1785, occupies a broad floodplain located between the Saint John River and higher bedrock terrain to the west. The city of approximately 58,000, obtains ~95% of its potable water supply from an aquifer mostly confined by a discontinuous clay-silt aquitard underlying the urban centre. The aquitard has erosional scours forming gaps or "windows", which could allow surface contaminants into the aquifer. Two samples were obtained at most sites, an 'A' sample collected at a depth of ~10 centimeters and a 'B' sample collected at a depth of >30 centimeters; facilitating examination of weathering and anthropogenic contributions to the soil profile. Till samples were collected at elevations where the terrain is undisturbed by anthropogenic activity.

Soil samples <63 microns were analyzed by Instrumental Neutron Activation Analysis (INAA) or Inductively Coupled Plasma (ICP) in order to determine elemental concentrations for 50 elements. Elemental concentrations provided by laboratory analysis were compared to the Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of human health. Three elements including, As, Cr and Pb were found to exceed the CCME SQGs for human health for samples collected in the downtown area but do not necessarily indicate a danger to the public. One location with anomolous concentrations of all three elements has yet to be investigated.

Results for the 'A' urban sample group, indicated that 87% of the samples exceeded the CCME SQG for As by 3.4 times greater than the recommended limit of 12 ppm and approximately 2% of this sample group exceeded the CCME SQGs of 220 ppm for Cr by 4.0 times. Concentrations of 37% of the sampled population for Pb were also found to be 2.1 times greater than CCME SQG of 140 ppm. In comparison of 'A' samples with 'B' samples for specific elements, the higher element concentrations in urban centre 'A' samples indicate anthropogenic contributions, whereas the higher concentrations in 'B' rather than for 'A' samples from till, can likely be attributed to weathering and elemental mobility.

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