Stream water geochemistry of boron and boron isotopes in a small boreal catchment affected by a major forest fire

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Previous research [1] has suggested that the boron (B) isotope system has a potential to be used as a tracer for detecting historic wood fire events. It was hypothesized that highly elevated B concentrations in sediments of a lake, accompanied by an enrichment of ^{10}B, were a result of an urban wood fire event in the 19th century. The δ^{11}B decrease in these sediments exceeded 9 ‰, coinciding with a peak in the B concentration.

To evaluate this hypothesis, seasonal isotopic pattern of boron (B) was investigated during spring and summer 2007 in a small stream draining a boreal forest area which was severely burnt in a major forest fire in the summer of 2006. Dissolved (< 0.22 µm) boron concentrations of the burnt area were significantly higher compared to a non-burnt reference stream, while ^{11}B/^{10}B ratios were significantly lower. Dissolved δ^{11}B differences between the reference and the burnt area stream were found to be -9 to -22 ‰. We interpret the elevated B concentrations, accompanied by enrichment of ^{10}B, in the burnt stream as wood and plant ash leaching of biogenic B from the burnt forest by surface run-off.

Our results suggest that a boreal forest fire event significantly increases the leached amount of isotopically lighter B in the dissolved phase of stream run-off.

[1] Peltola & Åström (2006), *Appl. Geochem.* **21** (2006) 941-948.

Soil carbon stabilization under jack pine along the Boreal Forest Transect Case Study

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Boreal forests, containing more than 20 % of the total carbon present at the surface of the Earth, are expected to be highly vulnerable to global warming. The objective of this study was to compare soil organic carbon (OC) stocks and chemistry in jack pine stands located along a latitudinal climatic transect. Total OC stocks (0-1 m) increased with decreasing mean annual temperature (MAT) and increasing mean annual precipitation (MAP). We used a combination of physical fractionation of soil particle size along with associated OC pools, ^{13}C isotopic determination and cross-polarization, magic-angle spinning ^{13}C nuclear magnetic resonance (NMR) spectroscopy to further characterize OC associated with different sizes at all sites. The labile carbon associated with the sand sized fractions dominated the OC content. In addition, the labile water soluble OC pool was determined to increase in proportion with decreasing MAT. While litter inputs did not greatly vary across sites, the macromolecular chemistry of soil OC as seen by NMR did, thus indicating differences with regards to the degree of decomposition. These results suggest that if the MAT were to increase by 4°C in the northern boreal forest, the overall jack pine soil OC stocks would decrease by as much as 2.5 kg m^{-2}, which corresponds to more than half of the existing stocks. Results also indicate that the remaining OC would become more decomposed, and likely more stabilized than what is currently present within the soils.