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Size distribution of trace elements in *Sphagnum* mosses within the Athabasca Bituminous Sands Region

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The Athabasca Bituminous Sands (ABS) industry drives the economy of Alberta, Canada. However, with its increasing industrial extent, environmental concerns have grown regarding trace element (TE) contamination of air and water. The ABS are composed of both minerals (ca. 85%) and bitumen (ca. 15%), with V, Ni, Mo, and Re found primarily in bitumen while other potentially toxic TEs such as As, Cd, and Pb mostly occur in minerals. Industrial mechanical processing of ABS generates considerable volumes of dust particles from open-pit mining, quarrying, road construction, etc. These dusts are dominated by coarse aerosols with short atmospheric residence time, consisting primarily of recalcitrant silicate minerals enriched in lithophile elements such as Al, Fe, and Mn. In contrast, high-temperature industrial processes such as the smelting and refining of metallic ores and coal combustion yield fine aerosols (< 2 μm) that can be transported for thousands of kilometers. These fine aerosols are respirable and mostly in the form of oxides and hydroxides rich in potentially toxic TEs, posing a risk to all living organisms. Hence, it is important to differentiate between TEs in these two aerosol fractions.

Here, *Sphagnum* mosses collected from ombrotrophic (rain-fed) bogs within the ABS region are used as biomonitors of atmospheric deposition, and compared with mosses from a reference site 264 km to the southwest. The aim is to determine the size distribution of TEs, i.e., the percentage of TEs associated with the fine versus coarse aerosol fraction in *Sphagnum*, by determining the abundance of TEs in the acid soluble ash (ASA) and acid insoluble ash (AIA). Trace element concentrations (total, in ASA and in AIA) were obtained using ICP-MS.

Concentrations of AIA and total concentrations of TEs increased towards industry, reflecting increasing dust deposition. Lithophile elements were more abundant in moss samples collected near industry, and in their AIA and ASA fractions. However, chalcophile elements exhibited either insignificant differences, or were more abundant at the control site. Clearly, measuring only the total concentrations of TEs in moss from a dusty industrial region provides limited information about their associated health risks.