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Sphagnum mosses from twenty-one ombrotrophic bogs in the Athabasca Bituminous Sands region fail to reveal significant atmospheric contamination of "heavy metals": from contemporary mining and upgrading activities

William Shotyk (1), Rene Belland (1), John Duke (2), Heike Kempter (3), Michael Krachler (4), Tommy Noernberg (1), Melanie Vile (5), Kelman Wieder (5), Shuangquan Zang (6), Claudio Zaccone (1,7)

(1) Dept. of Renewable Resources, University of Alberta, Edmonton, Canada, (2) SLOWPOKE Nuclear Reactor Facility, University of Alberta, Edmonton, Canada, (3) CEZ Curt Engelhorn Centre for Archaeometry, Mannheim, Germany, (4) Institute for Transuranium Elements, European Commission Joint Research Centre, Karlsruhe, Germany, (5) Dept. of Biology, Villanova University, Villanova, Pennsylvania, USA, (6) Dept. of Earth Sciences, Carleton University, Ottawa, Canada, (7) Dept. of the Sciences of Agriculture, Food and Environment, University of Foggia, Foggia, Italy

Samples of Sphagnum moss were collected from three sites at each of twenty-one ombrotrophic (rain-fed) peat bogs in the vicinity of and surrounding open pit mines and upgrading facilities of Athabasca Bituminous Sands in Alberta (AB). Compared with contemporary Sphagnum moss from multiple sites at each of four bogs in rural locations of southern Germany, the AB mosses yielded lower concentrations of Ag, Cd, Ni, Pb, Sb and Tl, similar concentrations of Mo, but greater concentrations of Ba, Th and V. Compared to the “cleanest”, ancient peat samples ever tested from the northern hemisphere and dating from the mid-Holocene (ca. 6,000 to 9,000 years old), with the exception of V, the concentrations of each of these metals in the AB mosses are within a factor of three of natural, background values. The concentrations of "heavy metals" in the mosses are proportional to the concentration of Th (a conservative, lithogenic element) and therefore are contributed to the plants primarily in the form of mineral dust particles. Although it has been claimed that bitumen mining is a significant source of atmospheric Pb contamination, compared with the surface layer (1 cm slice) of peat cores collected in recent years from across Canada (13 cores in five Provinces from British Columbia to New Brunswick), the Pb concentrations in the mosses from AB are far lower. Vanadium, the single most abundant trace metal in bitumen, is the only exception: on average V in the AB mosses exceeds that of ancient peat by a factor of six; it is therefore enriched in the mosses, relative to Th, by a factor of two.