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Assessment of the trace element composition of peat soils from the European Arctic in a changing climate conditions

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The trace element composition of stratified peat soils is interesting for the reconstruction of the geochemical background of atmospheric aerosol. The monitoring of trace element contents in peat deposits is often used for the identification of pollution around large industrial centers. The destabilization of the peatlands of the cryolithozone presents a global environmental hazard of the input of inorganic pollutants into the hydrologic network and their subsequent transport into the Arctic Ocean. Climate warming and permafrost degradation enhance the influence of deep peat layers on the trace element composition of groundwater and rivers. The purpose of the work is to assess the accumulation of trace elements in peat soils as a result of the aerogenic pollution of the territory and to identify their internal profile migration and accumulative characteristics. The peatlands investigated are in the far north taiga (Northeastern European Russia, 65°54' N, 60° 26' E), ecoton south tundra – forest-tundra (67°03' N, 62° 56' E) and ecoton north tundra – south tundra (68°02' N, 62° 43' E). The upper level of trace element accumulation was confined to the active (seasonally thawed) layer owing to airborne contamination over a long time span and related to the bioaccumulation of Hg, Cd, Pb, Cu, and other heavy metals (HMs) by plants and humus materials. The character of element accumulation and migration in the active layer is controlled by the stability of HM humates. Under high-acidity conditions, HMs are highly mobile and migrate to the lower boundary of the active layer, which is indicated by an increase in the fraction of water-soluble forms of a number of elements. Analysis with a scanning electron microscope revealed the presence of spherical and semispherical particles up to 1 μm in size containing Pb, Zn, Cr, and Ni in the upper peat levels, which indicates an anthropogenic source of their input owing to long-distance and local transport of air masses. The central level of element accumulation was confined to peat layers in the permafrost zone (60–120 cm), where enrichment in As and Cd relative to the mean contents in the Earth's crust (and approximate permissible concentrations, APC, for soils) and accumulation of Fe, Al, S, and siderophile elements were observed. The source rocks of the peatlands are loams enriched in Cd, Zn, and As. The statistical analysis of relations of the contents of major and trace elements in the stratified peat horizons with the composition of peat-forming materials showed a significant contribution of the biogenic accumulation of elements. The reported study was funded by the RFBR No 18-05-60195 (No AAAA-A18-118062090029-0).