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Is thallium in peat a good indicator of anthropogenic contamination? Examples from Czech sites with contrasting pollution histories

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In recent years, the behaviour and fate of thallium (Tl) in the environment have received increasing attention. Besides other trace metals, it has been seldom studied in peat, lake sediment, tree rings and other geochemical archives to reconstruct historical deposition/accumulation rates. The purpose of this study is to investigate the Tl distribution and accumulation rates in Czech peatbogs with contrasting anthropogenic loads and to compare them with those of other metals/metalloids.

Nine peat cores (max. depth 40 cm) were sampled in the mountain areas of the Czech Republic (6 cores in the northern part affected by emissions from coal-burning power plants and 3 in the pristine southern part). In addition, 3 cores were collected close to the Pb mining and smelting area of Pribram. Cores were 210-Pb dated and trace metals/metalloids were measured in the digests by ICP-MS.

Maximum Tl concentrations in peat were significantly higher in the polluted northern areas (1.16 mg/kg) and close to the Pb smelter (0.83 mg/kg) than in the pristine area (0.45 mg/kg). Thallium distribution well correlated with other metals (Pb, Hg) and metalloids (As, Sb). Thallium enrichment factors (EFs) calculated against Sc reached the maximum value of 17 indicating significant input of anthropogenic Tl. Thallium accumulation rates in peat varied between 20 and 50 μg/m2/y until 1930s, followed by a significant increase related to industrial activities in the northern part of the Czech Republic (up to 290 μg/m2/y in 1980s). In contrast, maximum Tl accumulation rate at the pristine site was 88 μg/m2/y. Data from the vicinity of Pb mines/smelter indicated higher accumulation rates even in the second half of the 19th century (between 50 and 200 μg/m2/y) followed by a significant decrease in late 1970s as a result of more efficient flue gas cleaning technology installed in the smelter during this period.