

Atmospheric deposition of arsenic and selenium in ombrotrophic peat bogs

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Abstract: Peat bogs serve as faithful archives of atmospheric Pb deposition, and there is growing evidence that they preserve reliable records of atmospheric Hg and Cu deposition as well. Far less is known about As and Se in peat, despite their environmental relevance, because there have been so few studies; the lack of study probably is due partly to the difficulties associated with the measurement of these elements at low concentrations in complex matrices. In peat which is contaminated with anthropogenic As (e.g. bogs near smelters), and in minerotrophic peat which may be naturally enriched with this element, As can be measured in solid samples containing 1 to 100 or more ppm using XRF or INAA. Similarly, Se can be measured in blanket peats from maritime locations using either of these methods, because marine emissions of DMSe give rise to elevated Se concentrations (1 to 10 ppm) in these peats. However, in pre-anthropogenic peats from continental bogs, the concentrations of As and Se are far lower (< 0.1 ppm), and only recently has As been reliably measured in peat samples at these levels (Krachler et al., 2002). Clearly, accurate and precise measurements are needed both to describe the geochemical cycles of these elements, and for the reconstruction of atmospheric metal deposition rates. Thus, there is a real need to develop robust and reliable analytical methods with low detection limits for the determination of As and Se in ombrotrophic peat.

Methods

The following analytical methods for the determination of trace concentrations of As and Se in peat samples are being evaluated: (a) hydride generation - atomic absorption spectrometry (HG-AAS), (b) hydride generation - graphite furnace atomic absorption spectrometry (HG-GFAAS), (c) sector field - inductively coupled plasma - mass spectrometry (SF-ICP-MS) (d) hydride generation - atomic fluorescence spectrometry (HG-AFS). As a first step in this process, As and Se are being measured in acid digests of peat using HG-AAS.

Results

The concentrations of As and Se measured using HG-AAS are consistent with the XRF and INAA data, where such data exists (ie recent peats contaminated by anthropogenic As, and Se-rich peats from coastal sites). However, in continental peat samples dating from pre-anthropogenic times (ca. 8,000 to 6,000 14C yr BP, during the Holocene climate optimum, when trace metal concentrations were at their lowest), only HG-AAS could provide reliable measurements of As and Se. Accuracy and precision of the measurements were evaluated using international, certified, standard reference materials, and using replicate analyses of several "in-house" peat reference materials.

Reference

Krachler M., Emons H., Barbante C., Cozzi G., Ceson P., Shotyk W. (2002), *Anal. Chim. Acta* 458, 387-396.