

Arsenic and its compounds in plants growing in soils contaminated by mining activities

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Areas of silver and gold ore deposits associated with elevated concentrations of arsenic-bearing elements of the Bohemian Massif were investigated to assess uptake of arsenic species by individual plant species growing at these sites. The areas of the interest were: i) Kaňk near Kutná Hora, Central Bohemia, where the plant species were collected at dump remaining after medieval silver mining. The total arsenic contents in the soil ranged from 100 to 450 mg kg⁻¹. ii) Spoil close to former gold mine in Roudný, Central Bohemia, where the mining activities were stopped in 1930's. The total arsenic contents in the soil ranged from 50 to 1100 mg kg⁻¹. iii) Former mining area Nalžovské Hory, Western Bohemia, where silver was mined till the beginning of 17th century with total As concentrations in the soil between 70 and 75 mg kg⁻¹.

Results and Discussion

Arsenite, arsenate, dimethylarsinic acid (DMA), methylarsonic acid (MA), trimethylarsine oxide (TMAO), the tetramethylarsonium ion (TETRA), arsenocholine (AC), and arsenobetaine (AB) were commonly found in the plant species. Among the species determined, high arsenobetaine concentrations represent the most interesting finding. Among the plant families, AB was identified in the species representing *Poaceae*, *Cyperaceae*, and *Plantaginaceae* families. Similar findings were already published by Geiszinger *et al.* [1] where arsenocholine and arsenobetaine were detected in *Trifolium pratense*, *Dactylis glomerata*, and *Plantago lanceolata* collected at an arsenic containing ore vein. The results showed the ability of higher plants to produce and/or accumulate a wide spectrum of arsenic species. Their fate and transformations in plant tissues needs intensive research especially when elevated total As concentrations are in the plant biomass.

[1] Geiszinger *et al.* (2002) *Appl. Organomet. Chem.* **16**, 245–249. Financial support for these investigations was provided by Aktion 061002 project.

The $\delta^{18}\text{O}$ fingerprint of spring water pathways with evaporating recharge areas

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Evaluation of the mean recharge elevation of a spring in a mountainous area by extrapolation using the vertical isotopic gradient of local precipitation assumes that evaporation is limited during the period of recharge. Usually, this assumption fails when recharge takes place in low permeability rocks (e.g. granites). In these cases, water remains variable periods of time in the recharge cells to ensure replenishment of local, intermediate and regional flow circuits. Preservation in the recharge area potentiates evaporation and therefore the enrichment of recharge water in ¹⁸O. Resulting from evaporation, an isotopic gradient develops for spring waters, represented by a negative correlation between $\delta^{18}\text{O}$ in spring water and elevation. The lines representing the isotopic gradients of precipitation and spring water are expected to converge towards the recharge area and diverge in the opposite direction. The recharge area will be defined by the sectors of the catchment where $\delta^{18}\text{O}$ (precipitation) - $\delta^{18}\text{O}$ (spring) = 0. A result corroborating this approach is illustrated in Fig. 1 for the Sordo River basin (North of Portugal).

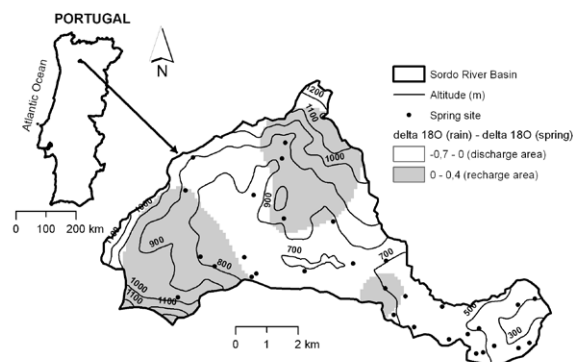


Figure 1: Recharge areas of Sordo River basin