Mineralogy and microbial diversity in As-rich waste dumps

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Fe-arsenates occur abundantly in weathered sulphides from mine waste. The geochemistry and microbial impact of the arsenates in waste dumps from Kutná Hora (Czech Republic), Rotgülden-Salzburger Land (Austria) and Chyžné (Slovakia) was studied.

The fine-grained, nanocrystalline or amorphous arsenates occur in nodular or crustal precipitations, and appear microscopically as prismatic, acicular or botryoidal crystals trapped in the fine-grained, clay-rich matrices. Earlier mineralogical and thermodynamic studies have been conducted by [1, 2 and 3]. By X-ray diffraction, scorodite ($FeAsO_4{\cdot}2H_2O$), bukovskýite [$Fe_2(AsO_4)(SO_4)(OH){\cdot}9H_2O$], kaňkite ($FeAsO_4{\cdot}3.5H_2O$) and zýkaite [$Fe_4(AsO_4)_3(SO_4)(OH){\cdot}15H_2O$] have been identified. The electron microprobe (EDX/WDX) analyses conducted on polished thin-sections show sulphoarsenates in close association with arsenic-rich gels, indicating, that different ferric arsenates progressively precipitate from gels produced from weathering eluate attack on clays.

The microbial diversity was assessed by cultivation to study the microbial community functions, ecological relevance and obtain strains for physiological characterization. The microbial prevalence was low in all samples (cfu < $2*10^5$). The bacterial community was dominated by 90 % Gram-positive; 80 % aerobic or facultative anaerobic strains. About 80 % of the strains were able to excrete siderophores and tolerate 5 to 1000 mM arsenate. Only 30 nitrate reducers have been identified. The 16S PCR DNA sequences were dominated by actinobacterial (*Bacillus* sp. and *Afipia* sp.) and proteobacterial (*Advenella* sp.) strains. Eight spore-forming ascomycetes dominate the fungal community.

[1] Majzlan *et al* (2012) *JMPS* **107**, 133-148 [2] Majzlan *et al* (2012) Hydrometallurgy **117-118**, 47-56 [3] Ettler *et al* (2010) *AMP-FGS* **2061-9766**, 7, 1-23