Geophysical Research Abstracts
Vol. 21, EGU2019-6123, 2019
EGU General Assembly 2019

Heterogeneous geochemical processes in mine waste dumps – Assessing the behaviour of potentially toxic elements (PTEs) in mine waste dumps and tailings in a historic copper mining area

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The safe deposition and remediation of mine wastes is a significant challenge everywhere in the world, and almost each type of mineralisation requires a different approach. At the Recsk Mining Area, Hungary, with more than 150 years of mining history, a large amount of waste material, mainly from a porphyry Cu-Au-(Mo) and from a high sulphidation epithermal Cu-Au mineralisations, was produced and placed alongside the local streams. The post-closure remediation of the mine waste sites failed in the 1970s and they still act as contamination sources.

A detailed environmental geochemical investigation of the flotation mud and the waste rock material of the H2 and H7 dumps was carried out in order to characterise the potentially toxic element distribution and to describe their behaviour in terms of speciation and mobility; furthermore, to assess the acid generation potential. We conducted ICP MS, ICP-OES and XRD measurements, coupled with static and sequential leaching tests on the collected mine waste rock and tailings samples for understanding the geochemical properties of the waste material. The obtained geochemical data was analysed with mass balance modelling methods involving descriptive statistics, regression models, homogeneity test and calculation of mobility factors, in order to identify significant element associations and the possible role of factors, controlling PTE mobility, such as pH, clay content, carbonate content, iron oxyhydroxide content, etc.

The results of this research are used for designing and implementing microbiologically stimulated remediation and secondary mineral resources extraction technologies. This research contributes to a Chinese-Hungarian Bilateral Project (TÉT_16_CN-1-2016-0006).