Immobilization of arsenic released from excavated rocks affected by hydrothermal alteration

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New Method for the Disposal of Excavated Rocks Containing Arsenic

We have developed the adsorption-layer system as a simple and effective disposal method for disposing excavated rocks containing toxic elements like arsenic (As). This system is composed of a bottom adsorption layer and a low-permeability soil cover that incase the altered rock. The low-permeability soil cover lowers the water infiltration rate while the adsorption layer scavenges As leached out from the rock.

Discussion of Results

The altered rock sample used in this study was collected from a tunnel project in Hokkaido, Japan, and is composed of silicate minerals (*e.g.* quartz and plagioclase), calcite (minor mineral) and pyrite (trace mineral). Sequential extraction showed that the rock was capable of releasing as much as 18.4 mg of As per kg of altered rock. Based on these results, we conservatively estimated the amounts of natural and artificial adsorbents required to capture all of the leachable As content of the rock and tested these calculations through column experiments. All four adsorbents when used in the bottom adsorption layer effectively lowered the As released from 185 μg/L to below the drinking water standard of 10 μg/L (Figure 1). These results indicate that the adsorption-layer system is an effective countermeasure for the disposal of excavated rocks enriched in As.

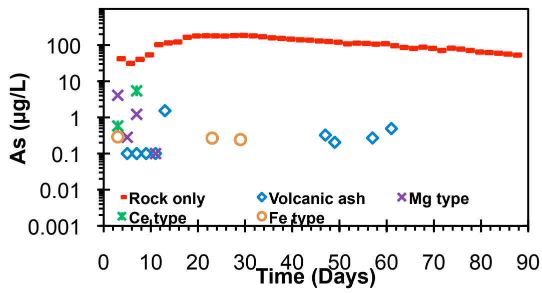

Figure 1: Evolution of As concentration in the effluent with and without adsorption layer. Missing points denotes concentrations below the detection limit of ICP-AES+Hydride generation.

Towards past climate reconstruction of speleothems by atmospheric sampling LA-ICPMS

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Trace elemental distributions in paleoclimatic archives such as stalagmites represent a precious source of information on past climate variability. Analytical procedures play a pivotal role in the assessment of monthly to sub-annual trace metal variations in these paleoclimate archives [1]. The analysis of stalagmite samples requires a method that allows for the quantification of major and minor trace elements in high spatial resolution. This demand can be addressed by laser ablation combined with detection by inorganic mass-spectrometry.

Classically, airtight ablation cells are utilized for laser ablation strategies. Following the tradition of sealed cell designs, a *low dispersion high capacity laser ablation cell* was developed [2]. However, even such a cell is restricted to samples less than 25 cm in length and therefore, it cannot host the majority of stalagmite samples without modification. Large samples have to be broken or cut into smaller pieces, which unfortunately leads to the destruction of many years of valuable information. Atmospheric sampling rudiments enabled by recent developments [3] and/or quasi-closed cell designs [4] promise to overcome this limitation and provide full-scale climatic records.

This study investigated potential sample inlet systems by computer modeling of gas flow characteristics of new sample-transportation device geometries. Based on the results of computational flow dynamics, prototype inlet systems were built and characterized. Results are compared to those obtained by large closed cell approaches. Further, the newly developed method was applied to investigate seasonal trace element variations in a stalagmite sampled from Sofular Cave in northwestern Turkey.

[1] Fairchild *et al.* (2006) *Earth-Sci Rev* **75**, 105. [2] Fricker *et al.* (2011) *Int J Mass Spectrom*, doi: 10.1016/j.ijms.2011.01.008. [3] Kovacs *et al.* (2010) *J Anal Atom Spectrom* **25**, 142. [4] Asogan *et al.* (2009) *J Anal Atom Spectrom* **24**, 917.