Linking noble gas and CH_4 concentrations in the sediment porewater of Lake Lungern, Switzerland

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Noble gases are powerful tracers for gas transfer processes in lake sediments. They were successfully applied in the sediment of Swiss Lake Sopensee [1] to study CH_4 ebullition in the past. Here, we employed a newly developed method for quantitative sampling of dissolved CH_4 and noble gases [2] to determine both CH_4 and noble gas concentrations in the porewater. In order to asses the depth of active CH_4 production, and to investigate gas transfer processes in the lake sediment we sampled the uppermost metre of the sediments of Lake Lungern, a Swiss hydropower reservoir. This lake is characterised by lake level variations and the formation of CH_4 bubbles in the sediment due to super saturation of dissolved gases in the porewater.

Using the new sampling method, we observed CH_4 concentrations exceeding the in-situ saturation concentration. Compared to the overlying water body, the noble-gas concentration in the sediment porewater showed a depletion of the lighter, more volatile gases relative to the heavier, more soluble gases. This elemental fractionation indicates stripping of noble gases into the CH_4 bubbles released from the sediment. In addition, the absolute noble gas concentrations in the sediment porewater indicate an air excess relative to the concentrations in the overlying water body. We attribute this to the formation of excess air resulting from the dissolution of air bubbles entrapped in the sediment when the lake level falls below the depth of our sampling site. Linking CH_4 and noble gas concentrations in the sediment porewater therefore allows assessing importance of the physical transport processes related to CH_4 emission from the sediments into the water body of the Lake Lungern.

[1] Brennwald *et al.* (2005) *Earth Planet Sc. Lett.* **235**, 31-4.

[2] Tomonaga, Y., Brennwald, M. S., & Kipfer, R. (2011) *Limnol. Oceanogr.: Methods* **9**, 42-49.

What is hidden in a slag heap?

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A slag heap after Zn-Pb ore smelting (Świętochłowice, Upper Silesia, Poland) was disturbed during recent slag removal and the freshly uncovered surfaces are examined in this study. The material forming the interior of the slag heap is fine grained (up to 5 cm) and strongly weathered contrary to the large slag boulders on the slag heap surface (up to 2 m), which are only slightly weathered. It is composed of gypsum and hematite plus a mixture of primary and other secondary phases. The weathered material as whole is chemically more homogenous than unweathered slags and has lower Si and higher Fe, Pb (up to 3 wt. %), Cd (up to 560 mg/kg). The examined surfaces are 3 – 4 meters high and 10 – 30 meters wide suggesting that such an extensive slag weathering may have occurred in larger parts of the slag heap.

The implication is that the slag confined in the interior of the slag heap may have extensively reduced grain size and mineralogy dominated by secondary minerals and may contain more potentially toxic elements than the unweathered slag. As such it poses risk to the environment, especially when the slag heap is disturbed.

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