

Unravel the role of lake ice cover on the methane budget: A multi-proxy analysis

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Large uncertainties exist on the evolution of the atmospheric methane (CH₄) budget in the future. Concern about possible feedbacks of natural sources in a changing climate is growing, especially concerning the role of thawing of permafrost areas in the Arctic regions. Subarctic lakes are considered as “hotspots” for CH₄ emissions, but the role of the ice cover during the winter period is not well understood to date. Different types of gas bubbles with high CH₄ mixing ratios have been identified in lake ice cover. A recent study revealed that the gas composition of those bubbles depends on, inter alia, the bubble type, the lake depth and the hydrological status of the lakes.

Analysing mixing and stable isotope ratios of CH₄ and CO₂ on those bubbles is an efficient tool to identify the mechanisms involved in the release, the oxidation and transport of CH₄ in permafrost lakes and to better constrain the potential influence of lake characteristics. Those analyses together with lipid biomarkers distribution analysis on lake ice samples reveal that different bubble types contain different isotopic signatures and that oxidation of dissolved CH₄ is the most important process determining the isotopic composition of CH₄ in bubbles. This shows that the increased exchange time between gases coming from the sediments and the water column, due to the capping effect of the lake ice cover, reduces the amount of CH₄ released and favours its oxidation into carbon dioxide.

Leaching of Zn, Cu and Pb from oxidised sulphidic mine waste as a function of temperature, L/S ratio and leaching reagents

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Formation of low pH drainage from sulphidic mine waste enhances trace element mobility and posing a serious threat to the surrounding environment [1]. A sustainable and cost effective remediation method is therefore desired. Utilization of the sulphidic waste as a secondary source for metals might be a viable alternative. In this laboratory scale study chemical extraction has been employed to assess the potential of metal release and possible metal recovery from oxidised sulphidic mine waste. Waste from an old copper and lead mine in Kopparberg, mid Sweden, was used for the experiments. Mine waste was extracted with four leaching agents: (i) distilled water, (ii) sulphuric acid, (iii) sodium hydroxide and (iv) sodium bicarbonate (0.01 M), at three liquid solid ratios (5, 10, 20) and at four temperatures (25, 45, 65, 85 °C), for a time of 6 hours during intermittent shaking. Generated solutions were analysed with respect to pH, electrical conductivity, acidity and metal concentrations.

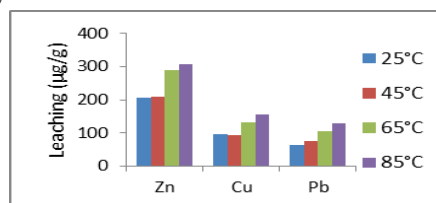


Figure 1. Effect of temperature on metal leaching from sulphidic mine waste using sulphuric acid.

Results indicate that increasing temperature enhances extraction of elements due to increase in reaction rates. Increasing L/S ratio increased extraction only to a certain extent after which it decreased or had no prominent effect. Sulphuric acid proved to be the best extraction media extracting as much as 14 % Zn, 10 % Cu and 3 % Pb of the total content. Leaching of Zn and Pb decreased from acid to neutral pH so it is a very crucial factor governing the extraction. Lead extraction with sulphuric acid is probably limited by anglesite (PbSO₄(s)).

[1] Alena Luptakova, *et al.* (2010) Metals Recovery from Acid Mine Drainage, *Nova Biotechnologica* 23, p 1-10.