# Nitrogen Turnover in Lake Sediments – seen with Ion-Selective Electrodes

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## Introduction

This study focuses on the turnover of nitrogen at different water depths along a gradient from oxic to anoxic sediments in the highly eutrophic Lake Zug (Switzerland). A profiling lander system equipped with ion-selective electrodes was used for *in situ* measurements of $O_2$, $NO_3^-$ and $NH_4^+$. Since $O_2$ and $NO_3^-$ are typically depleted within the uppermost millimeters of lake sediments only high resolution measurements provide information on their vertical distribution in the sediment porewater and thus allow calculations of fluxes and reaction rates.

## Results

$O_2$ was consumed rapidly within 0.2 to 1mm creating a flux of 2-55mmol $m^{-2}\,d^{-1}$. The $NO_3^-$ profile showed a steep decrease at the sediment water interface resulting in a penetration depth of 5-10mm whereas $NH_4^+$ increased continuously with increasing sediment depth (Fig.1). Fluxes varied with increasing water depth from 0.25-0.4 for $NO_3^-$ and 2.3-1.8mmol $m^{-2}\,d^{-1}$ for $NH_4^+$.

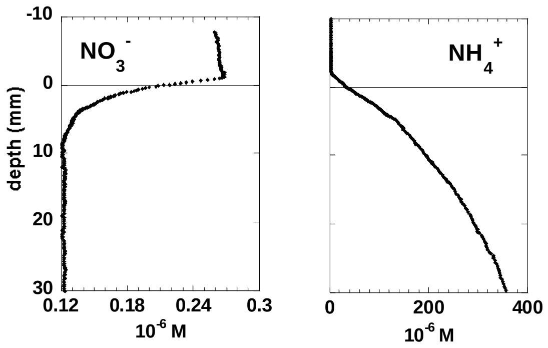

**Fig.1 Concentration profiles of $NO_3^-$ and $NH_4^+$ in the oxic sediment of Lake Zug at 35m depth**

## Discussion

Theoretical $O_2$ consumption was calculated from the flux of $NH_4^+$ and oxidation of organic carbon estimated from the C:N ratio in the top sediment layers. Comparison with $O_2$ fluxes obtained from electrode profiles shows a good agreement in the oxic sediment (35m depth). In greater depth (120m), where $O_2$ is almost depleted, denitrification explains only around 5% of the oxidation of organic carbon indicating that other electron acceptors might be much more important than $NO_3^-$.

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# Lithium and Calcium Isotope Fractionation in Inorganically Precipitated Calcite: Assessing their Potential as a Paleothermometer

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Lithium and calcium isotopes are fractionated during incorporation into calcium carbonate. Temperature dependent fractionation of $\delta^{44}Ca$ in cultured *G. sacculifer* foraminifera suggests the potential of $\delta^{44}Ca$ as a paleothermometer[1]. Variations in $\delta^{44}Ca$ may also reflect changes in the marine calcium cycle caused by changes in weathering inputs[2]. Lithium isotope variations are also thought to be caused by weathering effects[3] and the large relative mass difference between the isotopes suggests $\delta^7Li$ may show temperature dependent fractionation.

In this study inorganic calcite has been precipitated following a similar method to Tesoriero and Pankow[4]. The conditions of the inorganic reaction have been altered to examine how variations in temperature, growth rate and the initial composition of the reaction solution affect $\delta^7Li$, $\delta^{44}Ca$ and Li/Ca of the grown calcite.

A clean separation from Na and Ca and a 100% yield of lithium from the samples was achieved using a 20ml AG50WX8 column and a mixed 1MHCl, 80% methanol solution. The $\delta^7Li$ and $\delta^{44}Ca$ ratios were measured on a Nu Instruments MC-ICP-MS with an external repeatability of 0.4‰ and 0.13‰ ($2\sigma$) respectively. Accuracy of the Li isotope measurements has been confirmed by measurement of L-SVEC and seawater after chemistry.

Preliminary results show that grown carbonates are generally ~10‰ lighter in their $\delta^7Li$ than the reaction solution with little sign of a temperature dependent fractionation effect. There is, however, a strong correlation of the Li/Ca ratio in the grown calcite with temperature. The Kd for Li/Ca decreases by a factor of 4 as temperature varies from 5-30°C. $\delta^{44}Ca$ will be measured on these and other inorganic calcites. Results from both Li and Ca isotopes will also be compared to various biogenically produced carbonates.

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