

## Biogeochemistry of sediments from Swiss lakes with different trophic levels

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The biomarker and stable isotope (C,O) composition of organic matter (OM) and carbonate from sediment cores of the oligotrophic Lake Brienz and the eutrophic Lake Lugano (both in Switzerland) are compared. Eutrophic conditions at Lake Lugano are reflected in elevated total organic carbon (TOC) content and hydrogen index (HI) values, as well as higher lipid concentrations vs. Lake Brienz. Parallel down-core trends in  $\delta^{13}\text{C}$  values of TOC and carbonate in the Lake Lugano sediments reflect bioproductivity cycles. Variations in  $\delta^{18}\text{O}$  values of calcite are consistent with changes in mean summer temperature. In contrast, stable isotope compositions of calcites at Lake Brienz reflect their allochthonous origin.

In the sediments of both lakes, fatty acid (FA) distribution patterns and the composition of *n*-alkanols and *n*-alkanes indicate highly variable proportions of autochthonous OM sources (algae, zooplankton, bacteria) and OM from land plants. Enhanced *in situ* microbial synthesis in Lake Lugano is suggested by the higher concentrations of branched-chain FAs ( $\text{C}_{15}$  -  $\text{C}_{17}$ ), hopanoic acids and triterpenoid alcohols (i.e. tetrahymanol, diplopterol). Variations in the contents of  $\text{C}_{27}$ ,  $\text{C}_{28}$  and  $\text{C}_{29}$  sterols, as well as in relative proportions of HBI alkenes and diplopterol are related to differences in the contributions from diatoms, green algae, cyanobacteria, and bacteria. The presence of archeol and hydroxyarcholeol in the Lake Lugano sediments argues for the activity of methanogens and/or anaerobic methanotrophs. High relative abundances of diplopterol are consistent with the predominance of cyanobacteria commonly observed in eutrophic lakes.

Differences in OM degradation processes are reflected in higher chlorin index values in the Lake Brienz sediments but higher saturated vs. unsaturated *n*-FAs in the core from Lake Lugano. Higher contents of branched-chain FAs and 16:1 $\omega$ 7 *n*-FA, as well as enhanced 18:1 $\omega$ 7/18:1 $\omega$ 9 *n*-FA, are consistent with enhanced bacterial biomass in the water column or sediments of Lake Lugano. Overall down-depth trends in the proportions of saturated *n*-FAs, branched-chain *n*-FAs and stanols as indicators of intensified OM degradation are missing from both sediment cores. The preservation of phytol seems to be enhanced in sediments with a high contribution of land plant OM.

## Constraints from mantle pyroxenites on highly siderophile element fractionation during melt transport in the mantle

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How melt migration affects relative and absolute abundances of highly siderophile elements (HSE) in melts and mantle samples remains poorly understood, yet is important for compositional and Os isotopic evolution models of the mantle, and for the early stage of differentiation of mantle-derived melts. Spatially resolved sampling of mantle pyroxenites identified as former melt conduits provides further constraints on these issues. HSE abundances in different lithologies of a 15 cm section of layered pyroxenite from lower Austria were analyzed. Exposed peridotite in this area were affected by melt migration in a Paleozoic convergent plate margin environment. The highest abundances of compatible and incompatible HSE occur in websterite and orthopyroxenite in proximity to peridotite, while further away in the interior of the pyroxenite (clinopyroxenite and garnetite), abundances of all HSE are lower, and the HSE pattern is shifted from a peridotite-like to a melt-like pattern.

Similar relationships were observed in a modally layered pyroxenite from the Totalp ultramafic body (Swiss Alps). Again, the highest abundances of compatible and incompatible HSE occur in websterite next to peridotite, while further away (clinopyroxenite), abundances of all HSE are lower. HSE patterns are parallel, not unlike those of basalts (van Acken et al., submitted to GCA). High HSE abundances near the peridotite-pyroxenite boundary may reflect reactive melt infiltration, leading to partial dissolution of olivine and sulfide in the peridotite, and precipitation of sulfide and pyroxenes from hybrid melts. Inferred changes in melt composition such as Fe content may have promoted increasing sulfur solubility in hybrid melt, and thus dissolution of sulfides. Enhanced sulfide and HSE abundances at the interface may be best explained by trapped hybrid melt and lithospheric cooling, a scenario also supported by enhanced abundances of lithophile incompatible elements. HSE data on sulfides and the distribution of initial  $\gamma\text{Os}$  values support this view. The  $\gamma\text{Os}$  data also suggest that the interiors of these pyroxenites have formed by multiple injections of melt.