



Isotopic composition ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) of carbonates from the ICDP-site Laguna Potrok Aike: origin, methodology and potential for environmental reconstruction

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The ICDP site Laguna Potrok Aike ($51^{\circ}57'S$, $70^{\circ}23'W$) is a polymictic lake in the Patagonian steppe of Argentina. A 106 m long sediment composite profile from the profundal zone was recovered that corresponds to an archive covering the last $\sim 54,000$ years. The carbonate isotopes from this lake bear the potential to reconstruct past water temperatures and hydrological variability. However, low carbonate content of the sediments is often combined with relatively high organic matter content. Moreover, the carbonate content of the sediments from Laguna Potrok Aike is high in the Holocene (up to 20 wt. %) but low or even absent during the Glacial period. The study of the isotopic composition ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) of bulk carbonates is hampered by the release of organic-matter derived CO_2 during analysis. The frequently used treatments to remove the organic-matter prior to carbonate stable isotope analyses are not applicable to these sediment samples. However, our results with artificial mixtures of a carbonate standard and different organic substances show that isotope analyses to minimum TIC/TOC ratios of ~ 0.05 are reliable and need no pre-treatment. Thus, so far only sediment samples with higher TIC/TOC ratios were analysed. The $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values of the resulting sediment record increase from the present to the early Mid-Holocene. Thereafter, $\delta^{18}\text{O}$ values decrease towards the Last Glacial Maximum, whereas $\delta^{13}\text{C}$ values increase to extremely high values above 10 ‰ during the last Glacial. These ^{13}C -enriched values either reflect extreme conditions or early diagenetic effects which will be the subject of further studies.

Ongoing investigations also deal with the origin of carbonates. During the ICDP drilling campaign in spring 2008, ikaite precipitation was observed. Ikaite ($\text{CaCO}_3 \cdot 6\text{H}_2\text{O}$, monoclinic) is a hydrated calcium carbonate mineral very rarely found in non-marine environments which precipitates only at temperatures below 5°C . After air exposure and/or rising temperature the ikaite at Laguna Potrok Aike disintegrated quickly to calcite powder. Thus, the abundantly present crystals of less than $10\ \mu\text{m}$ in the profundal sediment cores from Laguna Potrok Aike could either be a product of disintegration of ikaite or of endogenically precipitated calcite. Currently the isotopic fingerprints of both sources of calcites are investigated to help to distinguish them from each other.