PP048-03 - Reconstructing precipitation δ¹⁸O from lacustrine carbonates using δ¹⁸O, Δ₄⁷, and Δ'¹⁷O: a modern case study from Junín, Peru with implications for paleoclimate

Abstract
Paleoclimate studies often aim to reconstruct oxygen isotopes of precipitation ($\delta^{18}O_p$) because $\delta^{18}O_p$ tracks regional climate change. Lacustrine carbonates are particularly alluring archives of past $\delta^{18}O_p$, because they allow for the construction of long records, with robust chronologies. However, disentangling the influences of $\delta^{18}O_p$, formation temperature, and local hydrology on $\delta^{18}O$ of carbonates ($\delta^{18}O_C$) from lake systems can be challenging, especially if past lake temperatures or water budgets were very different from modern conditions. A recent drilling effort from Lake Junín (Chinchaycocha; 11 °S, 76 °W) in the Peruvian Andes has produced well-dated, high resolution (decadal-centennial) records of $\delta^{18}O_C$, which have the potential to provide an unprecedented record of $\delta^{18}O_p$ and climate change in the Tropics from the last 700,000 years, if we can control for the influence of water temperature and lake water evaporation. Here, we use a combination of carbonate clumped isotope paleothermometry ($\Delta T$) and triple oxygen isotope analyses ($\Delta^{17}O$) from lake waters and carbonates from the Junín region today to understand how they constrain temperature and lake water evaporation, respectively. We report data from two fast-turnover and two slow-turnover flow-through lake systems in the Junín Region (residence times of ≤ 1 year and > 1 year, respectively). We find that $\Delta$ temperatures of actively-forming carbonates agree with measured lake water temperatures. Slow-turnover lake systems have higher average $\delta^{18}O$ values and lower $\Delta^{17}O$ values than fast-turnover systems, which is consistent with triple oxygen isotope mass balance models for evaporative loss. Finally, we reconstruct unevaporated catchment precipitation $\delta^{18}O$ values ($\delta^{18}O$) from modern surface water and calculated carbonate parent-water $\delta^{18}O$ and $\Delta^{17}O$ values. The average $\delta^{18}O$ ≅ -15.3 ‰ (1 σ = 1.8 ‰; n = 24; $\lambda$ = 0.524) is in agreement with local amount weighted mean annual precipitation ($\delta^{18}O$ = -15.4 ‰). Our findings suggest that a combination of $\delta^{18}O$, $\Delta^{17}O$, and $\Delta$ measurements from Lake Junín carbonates can be used to generate regional $\delta^{18}O$ records and that this approach can be applied to carbonate from drill cores to build reliable records of $\delta^{18}O$ and past hydroclimate in the Peruvian Andes.

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