

19,000-year-long leaf wax records of hydrologic and environmental change in the Colombian Andes

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A longstanding paradigm in tropical South American paleoclimatology is that the meridional migration of the mean intertropical convergence zone (ITCZ) position, driven by changes in the latitudinal distribution of solar insolation, results in hemispherically antiphased hydroclimate conditions. In the Andes, a robust investigation of this paradigm during the deglaciation and Holocene is limited by a dearth of northern hemisphere (NH) paleoclimate records. Here, we present new leaf wax *n*-alkane records from Lake Tota (5.54 N, 72.92 W; 3015 m a.s.l), Boyacá, Colombia. Lake Tota is situated in the seasonal migration path of the ITCZ and experiences changes in mean annual precipitation and isotopic composition of precipitation (δ_{precip}) in response to variations in its mean latitude. We use these records—which are the first long, continuous leaf wax records from the NH Andes—to assess hydroclimate and environmental changes over the past ~19,000 years. Specifically, we use the compound-specific $\delta^2\text{H}$ of medium- and long-chain *n*-alkanes ($\delta^2\text{H}_{\text{wax}}$) to reconstruct the $\delta^2\text{H}$ of lake water ($\delta^2\text{H}_{\text{lake}}$) and precipitation ($\delta^2\text{H}_{\text{precip}}$), respectively. We also use the $\delta^{13}\text{C}$ of long-chain *n*-alkanes ($\delta^{13}\text{C}_{\text{wax}}$) and average chain length (ACL) to reconstruct vegetation changes. Before 15 kyr BP (thousands of years before present), $\delta^2\text{H}_{\text{precip}}$ oscillated by ~35‰, followed by a transition to lower variability (~20‰) during the late glacial/early Holocene. Pronounced $\delta^2\text{H}_{\text{precip}}$ excursions were also observed throughout the deglaciation, centered around ~16 kyr BP (-15‰), ~15.5 kyr BP (+25‰), and ~13 kyr BP (-10‰), which may have resulted from regional and/or high-latitude forcing associated with deglaciation. $\delta^2\text{H}_{\text{precip}}$ did not vary much during the Younger Dryas (12.9–11.7 kyr BP), but decreased ACL is observed, which indicates changes in vegetation composition. $\delta^2\text{H}_{\text{precip}}$ and $\delta^2\text{H}_{\text{lake}}$ exhibited a consistent negative trend throughout the Holocene, notably in-phase with several other southern hemisphere Andean and lowland δ_{precip} records from multiple paleoclimate archives and proxy types. The in-phase interhemispheric relationship between the Lake Tota