PP51F-1432 - Triple Oxygen Isotope ($\Delta^{17}O$) Signatures of Evaporation at Bear Lake, Utah since the Last Glacial Maximum

Friday, 13 December 2019

08:00 - 12:20

Moscone South - Poster Hall

Swirl Topics

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Abstract

Oxygen isotopes of lake carbonates are widely used to reconstruct paleoclimate. Evaporation can strongly influence $\delta^{18}O$ of lake waters, and distinguishing this influence from changes in $\delta^{18}O$ of catchment precipitation can be difficult. Triple oxygen isotope ($\Delta^{17}O$) analysis of carbonates is a new method that shows great potential in elucidating the evaporative signal from the regional climate (precipitation $\delta^{18}O$) signal. Local evaporative processes should lower $\Delta^{17}O$ as $\delta^{18}O$ values increase, while regional climate change should have little to modest effect on $\Delta^{17}O$. This study aims to understand how evaporative processes have affected the oxygen isotopic composition of Bear Lake, Utah over the last ~25 ka. Bear Lake is an excellent locality to evaluate this method, since there is a ~5 per mil positive shift in $\delta^{18}O$ values going from the Last Glacial Maximum into the Holocene. An accompanying change from calcite to aragonite mineralogy suggests that this was the result of a change from a fresher lake to the highly-evaporated, nearly closed-basin lake that existed prior to the diversion of the Bear River into the lake. Our new $\Delta^{17}O$ data show a distinct ~20 per meg negative shift that accompanies the positive $\delta^{18}O$ shift. $\Delta^{17}O$ and $\delta^{18}O$ values are anti-correlated, and the $\delta'^{17}O$ - $\delta'^{18}O$ slope is ~0.5224. Together, these lines of evidence suggest that temporal changes in the Bear Lake $\delta^{18}O$ record were largely, if not entirely, driven by changes in evaporative efflux from the lake. Using clumped isotopes, we can determine carbonate growth temperatures, and combined with the carbonate $\Delta^{17}O$ data we are then able to calculate the composition of lake water $\Delta^{17}O$. Increasing dolomite content from glacial flour, transported by Bear River, poses a complication to interpreting data from the older part of the core where authigenic carbonate is less abundant. We plan to use XRD and stepped acid digestions of carbonate to better understand the influence of this dolomite on the Bear Lake stable isotope record. Ultimately, the combination of $\Delta^{17}O$ and clumped isotopes promises to help resolve evaporative signals from regional climate signals in lake carbonate records, offering a unique window into the recent hydrologic past of the western U.S. and beyond.

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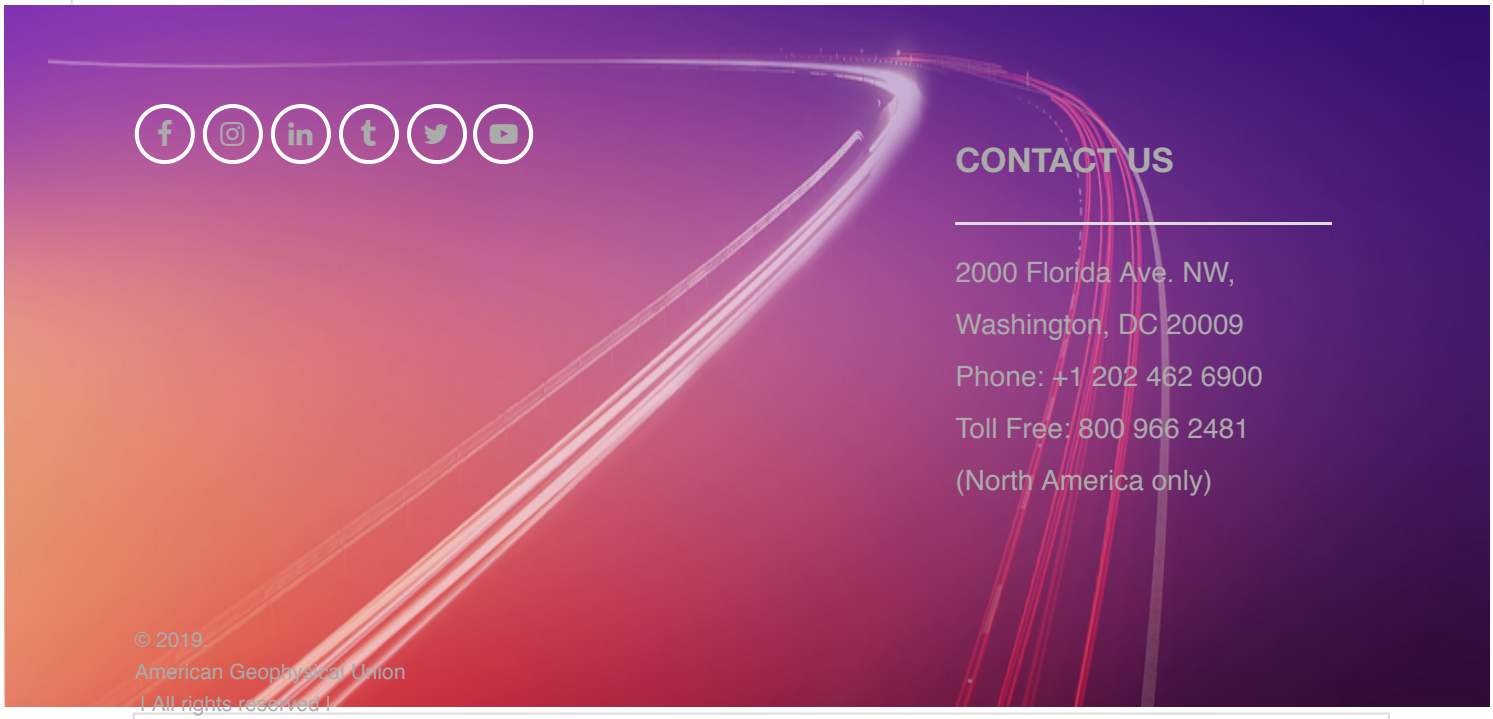

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Evaluation of triple oxygen isotopes in daily East African precipitation as a potential tracer of recycled continental moisture

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