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Correcting for prior calcite precipitation in coeval speleothem isotope records

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Oxygen isotope values in speleothem calcite reflect changes in climate over time. These paleoclimate archives, however, may be influenced by multiple environmental factors over time. Recently, efforts have been made to correct for the influence of prior calcite precipitation (PCP), precipitation of calcite prior to reaching the stalagmite surface, using trace metal concentrations. Trace metals (i.e., Mg, Sr, and Ba) used to detect PCP readily substitute for Ca in the mineral lattice. The trace metal concentration increases relative to Ca during drier periods when cave conditions cause the preferential removal of Ca during calcite precipitation on the cave ceiling prior to precipitation at the stalagmite. During PCP, the preferential inclusion of ^{16}O over ^{18}O in the calcite can cause a shift in the oxygen isotope values that mirrors those in the trace metals. Here, we compare the oxygen-isotope and trace-metal concentrations of four coeval speleothem records from two nearby caves in the Peruvian Andes Pacupahuain and Antipayargunan. We use the slope of ln Sr/Ca vs. ln Mg/Ca to confirm the intervals over which the samples were affected by PCP. We then correct the oxygen isotope records for PCP within these intervals using the trace metal concentrations and compare the overlapping segments. The code generated by this study enables correction for intermittent PCP across a record. The overlap between multiple samples and additional climate records over this time period facilitates testing of this approach. The results suggest that PCP may occur over parts of records, but the PCP correction alone does not always explain coeval differences. Of the four samples, one shows PCP throughout its growth interval, and while the correction improves the record's baseline value relative to the others, it does not fully explain all the differences. This suggests that other factors, such as kinetic effects or differences in the seasonality of formation, may explain discordance between coeval records.

Figure 1. **Coeval Speleothems from Peru**

