Application of nitrate $\Delta^{17}O$ as a paleoprecipitation proxy

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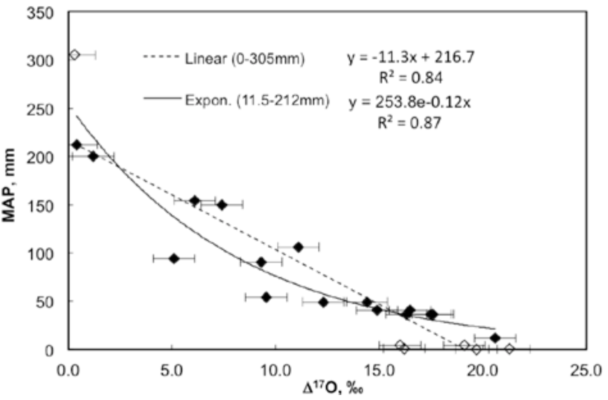
In desert soil ecosystems the nitrogen cycle in general, and nitrification in particular, is particularly sensitive to changes in precipitation because it is under water stress. This suggests that isotopes of nitrate desert environemnets may have preserved past evidence of small variations in continental precipitation. Stable oxygen isotope measurements (^{16}O, ^{17}O, and ^{18}O) on soil nitrate salts (NO_3^-) were performed on nitrate contang soils from the Atacama (Chile), Kumtag (China), Mojave (US), and Thar (India) deserts. The ^{17}O anomalies ($\Delta^{17}O$) detected in soil NO_3^- in these four deserts exhibited a strong negative correlation with MAP (Figure).



This is hypothesized to be caused by the interplay between atmospheric deposition and soil nitrification. This correlation was used to assess precipitation changes in southwestern US at the Pliocene-Pleistocene boundary, in South America during the Miocene, and the Sahara Desert 10 kyr in the past. The MAP calibration was also used to predict NO_3^- $\Delta^{17}O$ in arid regions around the globe based o n historical MAP data. The data suggests that NO_3^- $\Delta^{17}O$ in paleosols and ancient aquifers can be used as a new proxy for assessing changes in precipitation across arid landscapes over time and as a means of validating global climate model predictions of precipitation changes caused by climate change.