The onset of hyper-aridity in the Atacama Desert: Nitrate $\Delta^{17}O$ as a tracer of soil moisture

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Nitrate minerals are abundant in the Atacama Desert of northern Chile. The large $\Delta^{17}O$ signal (~20‰) observed in these nitrates substantiates the hypothesis that they are the results of 200k to 1M years of atmospheric deposition of photochemically produced nitrate. In wetter regions, the $\Delta^{17}O$ signal is tempered by mixing with nitrate produced by N fixation or nitrification of organic N. Recent measurements of $\Delta^{17}O$ in nitrate found within the Barros Arana paleosol (~10M y, elev.1500-2000m) are substantially lower (~10 ‰) than those found in modern Atacama soils and suggests that the Atacama was substantially wetter during the formation Barros Arana paleosol . This has implications for determining the onset hyperarid causalities such as the uplift of the central Andes, changes in the strength of the Humboldt Current, and global climate change.

The mass-independent oxygen isotope anomaly in CO_2: From single collision experiments to global climate change

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Observations of the triple oxygen isotope anomaly in stratospheric CO_2 from whole air samples collected from the NASA ER-2 aircraft [1] and high altitude balloons, combined with chemical dynamics experiments on the reaction $O(^1D)+CO_2$, [2,3] laboratory experiments photolyzing CO_2 and O_2 gas mixtures in the ultraviolet, [4] and 0D and 2D modeling, [4] are providing new insights into the mass-independent isotope anomaly in stratospheric CO_2. Recent results are providing the molecular level detail and understanding needed to use the CO_2 isotope anomaly as a tracer of biosphere productivity on annual [5] to millennial [6] timescales. Highlights of these laboratory, atmospheric, and modeling studies and their geochemical applications will be presented.

References

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