Sulfur and oxygen isotopes of sulfate from lakes in the Great Basin, USA

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Objectives and Methods

Many pluvial lakes in the Great Basin of the southwestern United States contain sulfate-bearing sediments. Sulfur and oxygen isotopic analyses of these sedimentary sulfates may provide additional clues about climatic and environmental changes during the Late Quaternary. A pre-requisite for such paleoclimatic and environmental assessments is, however, a better understanding of the complexity of sources, transfer, and cycling of sulfur in the basin today. As initially inspired by the early work of Longinelli and Craig [1], we revisited some of their study sites and carried out a suite of chemical (pH, Cl, and SO_4) and isotopic (δ^2H, $\delta^{18}O$, $\delta^{18}O_{SO4}$, and $\delta^{34}S_{SO4}$) analyses on water samples from the three states of California, Nevada, and Utah during a reconnaissance survey in December 2014.

Results and Discussion

All the water samples were alkaline (pH=8.2-10.5) and, except for a few samples from alpine lakes or reservoirs, non-freshwater ([Cl]=0.4-168.2 g/L; [SO_4]=0.3-49.3 g/L). δD and $\delta^{18}O$ values ranged from -116 to -9‰ (V-SMOW) and from -15.2 to 4.9‰ (V-SMOW), respectively. The averaged *d*-excess value was -27‰, with a range from -63 to 5‰, indicating varying degrees of evaporative enrichments of oxygen-18 and deuterium in these surface waters. $\delta^{18}O_{SO4}$ and $\delta^{34}S_{SO4}$ values from these pluvial lakes ranged from 5.4 to 21.1‰ (V-SMOW) and from 6.3 to 19.5‰ (V-CDT). We found that $\delta^{18}O_{SO4}$ and $\delta^{34}S_{SO4}$ of these closed-basin lakes were considerably higher than those of lakes, reservoirs, and wetlands in alpine or temperate climatic settings, and that there was a robust correlation between $\delta^{18}O_{SO4}$ and $\delta^{18}O$ values. These results could be interpreted to indicate a strong influence of hydroclimatic conditions on sulfur transfer and cycling in enrichment of sulfur-34 and oxygen-18 in sulfate from pluvial lakes within the Great Basin of the American Southwest. Comparison with the early results from Longinelli and Craig [1] showed some differences in $\delta^{18}O_{SO4}$, suggesting the presence of active sulfur cycling in these saline lakes.

[1] Longinelli, A. and H. Craig (1967) *Science* **156**, 56-59.