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Variations in hydrogen and oxygen isotope composition of meteoric water across the Central Anatolian Plateau

Tamás Mikes and Andreas Mulch
Leibniz Universität Hannover, Institut für Geologie, Hannover, Germany (mikes@geowi.uni-hannover.de)

The hydrogen and oxygen isotopic composition of meteoric waters is governed by a number of factors including distance to the moisture source, regional climate, and topography. The latter effect allows estimates to be made about how surface elevation changed over time and relate this to the combined effects of continentality and aridity on δD and δ^{18}O values.

We present hydrogen and oxygen isotope compositions of modern surface waters such as springs, small tributaries and lakes from the Central Anatolian Plateau (CAP) in an attempt to place quantitative constraints on the orographic and continentality effects that ultimately determine meteoric water composition within the plateau interior. The aim of this ongoing study is to provide a robust dataset of surface water δD and δ^{18}O values across the CAP and the topographically pronounced Pontide and Tauride mountain ranges at its northern and southern margin, respectively. These values serve as direct proxies for the spatial pattern and magnitude of the orographic, continentality and aridity effects, which are fundamental in modifying meteoric water compositions during cloud formation, ascent, rainout and surface runoff. Our proxy data will then serve to reconstruct the δ^{18}O of surface water from which Neogene to recent fluvio-lacustrine and pedogenic carbonates. We conclude that despite, changing local climatic conditions proxy data for δ^{18}O and dD in meteoric waters have been strongly controlled by the uplift of the CAP.

Isotopic compositions of analyzed 118 surface water samples reveal the following first-order characteristics:

- δD and δ^{18}O values range from -80 to -25 ‰ (SMOW) and -12.0 to -5.5 ‰ respectively.
- Around δD = 60, there is a marked break in the range of the δ^{18}O vs. δD data pairs that clearly define at least two Local Water Lines (LWL's).
- The LWLs reveal a rather strong geographic control. LWL 1 has a slope of ca. 3.5 and consists nearly exclusively of samples from the interior and from the northern margin of the CAP; LWL 2 comprises samples collected at the S margin of the CAP and defines a slope of ca. 7.8.
- At both margins, the δ^{18}O values decrease by ca. 2.5 ‰ per 1000 m of elevation gain. The regressed isotopic lapse rate curve in the CAP is shifted by ca. -3 ‰ relative to that at the S margin of the CAP.
- δ^{18}O values on the CAP indicate a slight northward-directed decrease of ca. 0.8 ‰°latitude and most probably reflect the progressive rainout from Southern, moist air masses.
- A systematic shift of ca. 1 ‰ and 1 to 5 ‰ is observed in case of snow and lake water δ^{18}O, respectively, relative to those from small catchments at the same altitude.