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# A stable isotope record of orographic precipitation and continental evaporation across the Central Anatolian Plateau

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The Central Anatolian Plateau (CAP) in central Turkey, much like its larger counterparts in Tibet or the Andes, has a clear influence on regional atmospheric circulations and thus creates a distinct pattern of orographic rainout and rainshadow. Reconstructing these patterns over geological time is a major challenge for understanding the interplay of tectonic and Earth surface processes and their subsequent impact on atmospheric circulation and regional hydrology and ultimately on changes in biodiversity and ecosystems over time. Here we present the first large-scale characterization of hydrogen ($\delta$D) and oxygen ($\delta$18O) stable isotopes in precipitation from more than 480 spring and surface water samples from the CAP as well as its northern (Pontic Mts.) and southern (Taurus Mts.) margins. The aim of this study is to quantify the influence of orographic rainout and secondary evaporation on the stable isotopic composition of these meteoric waters and further to establish a robust first-order isotopic template against which continental paleoclimate proxy data can be interpreted.

The CAP is bordered by two E-W trending mountain ranges: the Pontic Mountains at the Black Sea coast and the Taurus Mountains at the Mediterranean coast that both serve as major orographic barriers to the transport of moisture, hence developing semi-humid climatic conditions on their windward flanks and arid conditions over the plateau interior. Differences in $\delta$D and $\delta$18O values on the northern and southern plateau margins indicate different source regions and are in agreement with observed air parcel trajectories. The orographic rainout on the windward flanks of the Pontic Mountains exhibits isotopic lapse rates of –19 ‰km for $\delta$D and –2.6 ‰km for $\delta$18O whereas the lapse rates of the Taurus Mountains are slightly higher with –20 ‰km for $\delta$D and –2.9 ‰km for $\delta$18O across an elevation range of nearly 3000 m. The $\delta$D and $\delta$18O values immediate lee of both mountain ranges attain the lowest observed values and hence form a clearly discernible 'isotopic rainshadow'. However both $\delta$D and $\delta$18O follow the same increasing trend towards the plateau interior, a result of secondary evaporation caused by the predominantly arid climatic conditions in the area, an observation supported further by the local meteoric water line (LMWL) of the plateau interior which indicates evaporation by a slope <8 (s = 4.0).

Albeit both plateaus share general topographic and climatological similarities, a comparison of our data with stable isotopic data from the Tibetan Plateau suggests that, $\delta$D and $\delta$18O values from the Tibetan Plateau are mainly influenced by mixing of air masses and to a lesser degree by evaporation. We propose here that the CAP is an example of the initial stage of plateau growth where (semi-)arid conditions shape the $\delta$D and $\delta$18O patterns of meteoric waters. Only during later stages of plateau uplift, temperature decrease restricts the influence of evaporative processes on isotopic fractionation, allowing air mass mixing to become increasingly dominant for meteoric $\delta$D and $\delta$18O patterns.