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# Central Anatolian (Turkey) and Aegean (Greece) soil carbonate $\delta^{18}O$ values reveal Late Miocene surface uplift of the southern plateau margin and post−Miocene aridification of the northeastern Mediterranean region

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In recent years, numerous studies focused on reconstructing the surface uplift history of the Central Anatolian Plateau (CAP) and the associated driving mechanisms such as slab breakoff, removal of lithospheric mantle, or crustal thickening (e.g. McPhee et al., 2021). The CAP forms the westward portion of the Turkish−Iranian plateau and has mostly been above sea level since ca. 41 Ma (Okay et al., 2020). Most of its present-day topography, featuring mean elevations of ca. 1.0-1.5 km, however, has been shaped since the Late Miocene (e.g. Meijers et al., 2018; Schildgen et al., 2012a,b). Perhaps the most spectacular discovery is the recognition of 2 km of surface uplift of a portion of the southern plateau margin, the Tauride Mountains, since ca. 0.5 Ma (Öğretmen et al., 2018).

Here, we provide stable isotope paleoaltimetry estimates for the Late Miocene for the southern CAP margin. The method is based on the inverse relationship between the oxygen isotopic composition ($\delta^{18}O$) of meteoric waters and elevation. We therefore contrast the $\delta^{18}O$ values of age−equivalent low and (potential) high elevation soil carbonates (the δ−δ method; Mulch, 2016) from central Anatolia with published Anatolian and Aegean soil carbonate $\delta^{18}O$ values (Böhme et al., 2017; Meijers et al., 2018; Quade et al., 1994). Our results reveal a low (ca. 0.5 km) orographic barrier between the Aegean and Mediterranean coastlines and central Anatolia at ca. 10 Ma, which increased to an elevation of ca. 1 km by ca. 8−6 Ma. This trend in increasing surface elevations during the Late Miocene is in agreement with stable isotope−derived paleoelevation estimates from Anatolian lacustrine carbonate records (Meijers et al., 2018). Given proposed post−0.5 Ma surface uplift of the southernmost plateau margin (Öğretmen et al., 2018), our results imply a phase of significant local subsidence bracketed between the latest Miocene and ca. 0.5 Ma. From the Pliocene onward, we also observe long-term trends toward higher $\delta^{18}O$ values in soil

carbonate data sets from the Aegean Sea and CAP region, which indicate increased aridification and possibly seasonality of rainfall in the region since the Pliocene. Additionally, our ‘modern’ soil carbonate records from central Anatolia underestimate the elevation of the modern Tauride orographic barrier (ca. 2.2 ± 0.5 km) at the southern plateau margin by ca. 0.5 to 1.0 km (non−linear vs. linear lapse rate, respectively). We attribute this underestimation to the mixing in of higher $\delta^{18}O$ atmospheric moisture derived from the Black Sea compared to atmospheric moisture derived from the Mediterranean Sea during spring and early summer, a signal that is likely incorporated into soil carbonates that form at the onset of the dry summer season. Although atmospheric moisture derived from the Black Sea yields lower $\delta^{18}O$ values than Mediterranean atmospheric moisture at sea level (Schemmel et al., 2013), the former undergoes less distillation across the significantly lower northern plateau margin (the Pontide Mountains). The presently observed mixing of Black Sea and Mediterranean Sea moisture sources might have also led to an underestimation of southern orographic barrier elevations in the geologic past.