

EGU2020-9900

<https://doi.org/10.5194/egusphere-egu2020-9900>

EGU General Assembly 2020

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Interactions between tectonics and Earth surface processes of the Central Anatolian Plateau and its southern margin during Mio-Pliocene surface uplift

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Quantifying the interactions between tectonics and Earth surface processes on orogenic plateaus requires the acquisition of a multitude of field observations and geological proxies. Here, we reconstruct the topographic development of the Central Anatolian Plateau (Turkey), identify the geodynamic drivers of plateau formation, and constrain the climatic boundary conditions that shaped the fluvio-lacustrine basins, drainage integration, and vegetation and biodiversity dynamics.

Our comprehensive dataset includes sedimentological and field observations, ⁴⁰Ar/³⁹Ar ages, magnetostratigraphy, lacustrine carbonate $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ data (n=665) from thirteen sections in upper Oligocene to Pliocene continental basins of the CAP interior, and ¹⁰Be erosion rates. We also analyze existing fossil faunal (mammal) and floral databases to assess biodiversity dynamics through time and we model isostatic rebound to understand drainage integration.

The CAP and its steep, southern Tauride margin emerged from the Mediterranean Sea ~12-11 Ma and ~8-7 Ma ago, respectively. Contemporaneously to surface uplift, a fluvio-lacustrine system covered extensive parts of the rising CAP. Today, the semi-arid CAP interior – except for the Konya Closed Catchment (KCC) – drains towards the Black Sea, Mediterranean Sea and Persian Gulf.

Our stable isotope paleoaltimetry data show similar-to-present elevations (~2 km) of the southern CAP margin by 5 Ma. Surface uplift affected the diversity of plants and large mammals, and was coeval with ignimbritic magmatism, forearc shortening and distributed compression. We suggest that removal of lithospheric mantle below Anatolia led to surface uplift of the CAP interior,

followed by surface uplift of the southern CAP margin as a result of subduction-related crustal thickening. Persistently (>1 Myr) stable paleoenvironmental and hydrological conditions recorded by the former fluvio-lacustrine Anatolian depocenters suggest that a low-relief environment characterized the CAP during plateau uplift. Throughout the late Miocene, various open and closed lakes of the southern CAP drained into closed, terminal lakes within the plateau interior. Sedimentation east of the Tuz Gölü Fault ceased rapidly during the early Pliocene (from 5.3-3.6 Ma), when river incision led to a connection with marine base level. Analysis of incision patterns reveals that drainage integration was not driven by capture of the interior drainage by aggressive rivers draining the plateau margin, but rather by top-down avulsion or overflow due to the establishment of a more positive water balance in some of the closed catchments of the plateau interior. Drainage integration occurred shortly after the switch from regional compression to extension and the onset of escape tectonics of the new Anatolian microplate, when fault partitioning of the existing low-relief plateau interior may have led to drainage integration.

In a next step to reconstruct the paleoenvironmental conditions of the CAP, we obtain $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values from fossil mammal tooth enamel, which allows for the reconstruction of mammalian diet, and in turn reflects paleovegetation, as well as seasonality for the Mio-Pliocene climate.

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