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On the cause of Miocene uplift of the Central Anatolian plateau: new insights from thermal-flexural modeling

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Volcanic activity with a mantle signature commenced 14-11 Ma throughout Central Anatolia. Regional observations document the onset of significant uplift of the Central Anatolian plateau 5-8 Ma. Flat lying shallow marine deposits in elevated regions indicate that Late Miocene uplift was epeirogenic. Seismological observations suggest that the present subcrustal mantle is anomalously hot.

For the East Anatolian plateau region, various authors have attributed similar observations to delamination of the lithospheric mantle. Here, retreat of the Bitlis slab is thought to have been the main driver of volcanism and uplift. Recent results from high-resolution seismic tomography indicate that the Bitlis slab is laterally continuous below the East and Central Anatolian plateau regions. We therefore propose that the mantle delamination event that uplifted the East Anatolia plateau extended also beneath the Central Anatolian plateau. In this scenario, delamination commenced ~14 Ma along the Izmir–Ankara- Erzincan suture zone.

We use 3D coupled thermal-flexural evolution models to predict possible imprints of this scenario, and to compare model predictions with available observations of uplift, stress change, volcanism and crustal temperatures. In the models, we account for temperature-induced changes in both body forces and rheology.

Model predictions of surface heat flow and lithospheric temperature structure are broadly consistent with available observations. A short pulse (few Myr) of upper mantle melting and a longer period of crustal magmatism are predicted. Mantle delamination beneath Anatolia is expected to result in epeirogenic uplift by ~1500 m, enough to explain the present day elevation of the Central Anatolian plateau.

Our models predict only ~1000 m uplift of the East Anatolia plateau, which is not enough to explain the current topography here. However, when we adjust the models to include crustal thickening due to Arabia-Eurasia convergence since delamination, we find a good fit to the large-scale topography also.

Miocene delamination of the Anatolia lithospheric mantle thus explains the current topography of the East and Central Anatolia plateau regions.