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Mantle delamination as the cause for the Miocene-Recent evolution of the Central and Eastern Anatolian Plateau

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Stratigraphic and geomorphological data of the southern margin of Central Turkey suggest that the Central Anatolian plateau underwent regional uplift to its present day elevation since the Late Miocene (8-5.45Ma). This uplift was preceded by the onset of widespread volcanism in central Anatolia (13Ma-8Ma). There is no evidence for crustal shortening and sub-crustal seismic velocities beneath Central Anatolian Plateau are low. This suggests that mantle processes may be responsible and it is the aim of our TOPOEUROPE/VAMP project is to identify the cause of the regional uplift.

Seismic tomographical results for the top of the lower mantle suggest a single slab from the Aegean to Bitlis in the past. Based on the upper mantle tomography, this slab became fragmented later. These constraints were used to add evolving plate boundaries to published Middle East Basins Evolution (MEBE) maps. In the reconstruction, the laterally continuous Northern Neotethys slab broke west of the Kisehir block into two slab fragments; an Aegean slab and a Central-East Anatolian slab. In Eastern Anatolia, roll-back of the Central-East Anatolian slab and delamination of the lithospheric mantle has been proposed to be the cause of uplift and widespread volcanism. Here, we propose that this process also took place beneath the Central Anatolian plateau and that both plateaus genetically form a single “Anatolian plateau”.

If true, delamination is expected to have had a thermal and isostatic imprint. Using a 3D thermal-flexural model and accounting for changes in the effective elastic thickness due to thermal evolution, we aim to quantify the possible imprints of delamination in the geological record of the Central and Eastern Anatolian plateau. Our model results show that a combination of a single delamination event and minor crustal thickening (1-5km) in Eastern Anatolia can explain the present day elevation of both plateaus. Delamination can also explain the observed anomalously high surface heat flow, widespread volcanism and low sub-crustal seismic velocities. Results thus demonstrate that our scenario with a single delamination reconciles geological observations at the surface with results from tomography.