



## **Evolution of the NW Iranian Plateau: from lateral expansion to fluvial incision and plateau excavation**

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The Iranian Plateau represents a NW-SE striking, elongated ( $\sim 1500 \times 200\text{-}300$  km), elevated (mean elevation of  $\sim 1.8$  km), arid (mean annual precipitation  $< 500$  mm/yr), thickened (locally with an up to  $\sim 60$ -km-thick crust), internally drained ( $\sim 65\%$  of its area) and aseismic morphotectonic province of the Arabia-Eurasia collision zone. The plateau interior exhibits a typical low relief morphology that includes six major sedimentary basins sculptured on the Sanandaj-Sirjan Zone. Conversely, its margins are steep and highly dissected and comprise the High Zagros Mountains to the South and the Urumieh-Dokhtar Magmatic Zone and part of the western Alborz and Talesh Mountains to the North. Plateau uplift commenced after  $\sim 17$  Ma, as documented by uplifted Early Miocene shallow marine sediments of the Qom Formation within the plateau interior, however, very little is known about the chronology of plateau plateau-building events.

Our stratigraphic, geochronology and thermochronology data document an overall northward propagation of the deformation fronts from the plate suture zone at least by 17-16 Ma. This led to the compartmentalization of the formerly contiguous foreland into several intermontane basins and to the development of a contractional basin and range morphology by 11-10 Ma. These basins experienced a major episode of filling, locally in association with basin coalescence and formation of larger internally drained basins. Sediment loading during basin filling appears to have inhibited faulting within the basins and along their margins, causing a progressive reduction of topographic relief and the development of a low relief morphology. In the NW sectors of the Iranian Plateau, however, an external drainage system (Qezel-Owzan River) adjusting to the Caspian Sea developed leading to basin incision and excavation with the destruction of the typical low relief landscape. Our data suggest that the establishment of fluvial connectivity with the Caspian Sea occurred most likely during a wetter period which triggered the development of a large and deep lake in the intermontane Mianeh Basin between 5 and 4 Ma. This led to lake overspill along a sector of the plateau margin characterized by a subdued topography at  $\sim 4$  Ma and resulted in the cutting of a  $\sim 1$ -km-deep bedrock gorge.

Overall, our data: 1) document orogen-perpendicular plateau expansion associated with contractional deformation and the development of a smoothed topography during basin filling processes and 2) highlight the interplay between surface process (which are primarily driven by climate) and tectonics in building, preserving and destroying a plateau morphology.