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Deformation, uplift and exhumation across the northern sectors of the Iranian Plateau: insights from low-temperature thermochronology data and intermontane basins fill units

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The Iranian Plateau represents a NW-SE striking, elongated, elevated (mean elevation of ~1.8 km), arid, mostly internally drained (~65 % of its area) and aseismic morphotectonic feature of the Arabia-Eurasia collision zone. With a crustal thickness up to ~65 km, the southern plateau margin includes the High Zagros Mountains and the plate suture zone. The northern plateau margin, instead, consists of the Urumieh-Dokhtar Magmatic Zone and the western Alborz-Talesh Mountains from SE and NW Iran, respectively, which exhibit a crustal thickness ranging from 40 to 50-55 km. The plateau interior is characterized by a low-topographic relief morphology with six major, mostly internally drained intermontane sedimentary basins. The backbones of these basins are mainly represented by the Sanandaj-Sirjan Zone. Plateau uplift commenced after ~17 Ma, as documented by the occurrence of Lower Miocene shallow-water marine sediments of the Qom Formation within the plateau interior. Although the Iranian Plateau represents the second largest collisional plateau after Tibet, the chronology of the events and the mechanisms that built it are poorly constrained.

In this study, we combine a new low-temperature thermochronologic dataset including apatite fission- track and apatite (U-Th-Sm)/He ages from the northern plateau sectors and its interior with structural and stratigraphic data from different intermontane basins and literature thermochronology data. Combined, this information shows that after a mild phase of post late Eocene contractional deformation, collisional deformation started in the early Miocene along the plate suture zone to the south and in the middle Miocene (~16 Ma) in the Talesh-Alborz Mountains to the north. Subsequently, around 12-10 Ma, deformation jumped in the plateau interior over a

rather large area including the Urumieh-Dokhtar and Sanandaj-Sirjan zones, apparently without a specific pattern of propagation. Upper plate deformation occurred mostly through the reactivation of older NE-dipping structures that led to the topographic growth of several mountain ranges spanning a wavelength of ~50-60 km. This was associated with the compartmentalization of the upper plate and the development of different intermontane basins. There, basin filling processes inhibited intrabasinal deformation and faulting along the major range-bounding faults producing the smoothed, low-relief landscape typical of an orogenic plateau.

Combined, these results provide new information concerning the mechanisms and the timing of the lateral, orogen-perpendicular, growth of the Iranian Plateau