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Structural evolution and internal deformation of the Turkish-Iranian Plateau in northwestern Iran

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The Turkish Iranian Plateau (TIP) is located on the southern margin of the Eurasian plate where it forms a low relief, mainly internally drained, relatively arid, elevated region (ca. 1.5 km in average) with high and steep mountain ranges along its margins of more than 3 – 4 km of elevation. The presence of ca. 17-m.yr.-old, shallow-water marine deposits on the plateau interior indicates that the TIP is a relatively young morphotectonic feature, which developed during continental collision processes. It reached today's elevation approx. before 2 Ma. Crustal thickening and shortening led to a ca. 45-km-thick crust in the TIP.

Here, we present the structural evolution of the excellent exposed Mio-Pliocene continental deposits in the internal parts of the TIP, south of the city of Mianeh. This is part of an ongoing research on the kinematics of the deformational regimes and the magnitudes of the tectono-sedimentary processes that causes the plateau growth within the framework of the late Cenozoic Arabia-Eurasia continental collision.

The Miocene continental deposits are composed of sandstones, marls, gypsum and volcaniclastic deposits evolving from playa-lake/shallow-lacustrine to fluvial (meandering and braided) systems. These units are characterized by close to tight, rarely isoclinal folds with a wavelength of 2 – 4 km and an amplitude of up to 1 km. Fold axes are generally WNW – ESE trending in the northwestern part of the studied area and bend towards a NW – SE direction in the southeastern part. Due to the strong competence contrast between the gypsum dominated layers and the siltstones, sandstones, conglomerates and marls, the folding style is polyharmonic with well developed parasitic folds. Locally, growth folds developed. We propose that they formed on a shallow décollement (approx. depth 1 – 2 km).

The Pliocene units, mainly conglomerates and intercalated sandstones and marls are unconformably deposited on top of the Miocene units. The Pliocene deposits show gentle to open folds with a wavelength of 15 – 25 km and amplitude of < 1 km. They form a large anticline with a culmination in the central part, where the fold axis trends E – W and two plunging segments, in the WNW with a ESE – NW trending fold axis and in the SE with a SE – NW trending fold. In the core of the anticline, the Miocene strata are well exposed. The most recent sub-horizontal basin filling of the Mianeh basins is characterized by synsedimentary normal faults, probably caused by local gravitational collapse.

The structural evolution of the internal part of TIP in the Neogene is characterized by a SW – NE shortening. However, style of deformation changes from growth folding and polyharmonic folding in the Miocene to long wavelength folding in the Pliocene. This internal plateau deformation leads to efficient unroofing of the Pliocene sediments and therefore localizes incision. If these local effects have the potential to modify general plateau development, explicitly on the feedback mechanism between incision and crustal rebound, depends strongly on an effective sediment routing system from the internal plateau across the plateau edges. At this point, low precipitation in the internal zone limits the transport capacity; however, large parts of the northwestern Iranian Plateau are not longer internally drained, instead their sediments are transported into the Caspian Sea. Ongoing research will focus on the feedback between deformation, structural evolution, and erosion and their consequences for Plateau development in NW Iran.