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Paleomagnetic constraints on Cenozoic deformation in Central Iran

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Iran has been considered since long time a key area for understanding tectonic processes in continental regions, where deformation is distributed over wide areas characterized by a complex faulting architecture. In this region, during the Cenozoic, shortening related to the Arabia-Eurasia convergence has been mainly localized in high mountain ranges (Zagros, Alborz, and Kopeh Dag Mts.), which in turn surround relatively undeformed crustal blocks, such as the Tabas, Yazd, and Lut blocks of Central Iran and the Southern Caspian Sea. Different deformation patterns are observed in high-topography mountain belts and flat-lying desert areas, the former characterized by curved shape, active folding and thrusting distributed over a wide area and the latter by large strike-slip faults, which bound almost rigid crustal blocks. These strike-slip faults show different orientation and kinematics: NE-SW to E-W oriented left-lateral faults characterize the tectonic boundary between Central Iran and the Alborz Mts., whereas N-S right-lateral strike-slip faults prevail along the tectonic boundary between the the Yazd, Tabas and Lut blocks. Vertical axis rotations of fault-bounded crustal-blocks have been considered as a possible mechanism to explain the active pattern of deformation in several regions of Iran. In fact, one of the most important aspects of fault sets in domains is the rotation of the blocks between the faults when they slip, leading to the consequent rotation of the faults themselves. Based on structural and seismological data, it has been proposed that E-W oriented left-lateral faults of eastern Iran and N-S right-lateral faults of Central Iran can accommodate the NNE-SSW Arabia-Eurasia convergence if these faults rotate clockwise (CW) and counterclockwise (CCW), respectively.
In order to define the pattern of vertical axis rotations associated to the Arabia-Eurasia shortening, new paleomagnetic data from Miocene units from the different tectonic blocks of Central Iran (Torud, Jandaq, Anarak, Tabas, Yazd, Ferdows and Shahdad regions) and from the curved orogenic belts from northeastern Iran (Central and Eastern Alborz Mts.) have been collected. In north-eastern Iran a general correspondence between the orientation of the different sectors of the curved orogen which comprises the Central and Eastern Alborz Mts. and the trend of paleomagnetic rotations was observed. This correspondence suggests that oroclinal bending is a valuable mechanism to explain the present-day curvature of these orogenic belts. In Central Iran, CCW paleomagnetic rotations have been measured in the Yazd and Tabas block, which are characterized by N-S to NNW-SSE oriented right-lateral strike-slip faults, whereas CW paleomagnetic rotations have been measured in areas where E-W oriented left-lateral strike-slip faults are predominant (e.g. Ferdows area in the Lut block) and Torud and Jamdag area north of the Great Kavir fault. Accordingly, vertical axis rotations could have accommodated a significant portion of N-S shortening related to the Arabia-Eurasia convergence during the Tertiary.