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Cenozoic intracontinental deformation of the Kopeh Dagh Belt, Northeastern Iran

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Compressional intracontinental orogens represent large tectonic zones far from plate boundaries. Since intracontinental mountain belts cannot be framed in the conventional plate tectonics theory, several hypotheses have been proposed to account for the formations of these mountain belts. The far-field effect of collision/subduction at plate margins is now well accepted for the origin and evolution of the intracontinental crust thickening, as exemplified by the Miocene tectonics of central Asia.

In northern Iran, the Binalud-Alborz mountain belt witnessed the Triassic tectonothermal events (Cimmerian orogeny), which are interpreted as the result of the Paleotethys Ocean closure between the Eurasia and Central Iran blocks. The Kopeh Dagh Belt, located to the north of the Binalud-Alborz Belt, has experienced two significant tectonic phases: (1) Jurassic to Eocene rifting with more than 7 km of sediments; and (2) Late Eocene-Early Oligocene to Quaternary continuous compression. Due to the high seismicity, deformation associated with earthquakes has received more and more attention; however, the deformation pattern and architecture of this range remain poorly understood.

Detailed field observations on the Cenozoic deformation indicate that the Kopeh Dagh Belt can be divided into a western zone and an eastern zone, separated by a series of dextral strike-slip faults, i.e. the Bakharden-Quchan Fault System. The eastern zone characterized by km-scale box-fold structures, associated with southwest-dipping reverse faults and top-to-the NE kinematics. In contrast, the western zone shows top-to-the SW kinematics, and the deformation intensifies from NE to SW. In the northern part of this zone, large-scale asymmetrical anticlines exhibit SW-directed vergence with subordinate thrusts and folds, whereas symmetrical anticlines are observed in the southern part.

In regard to its tectonic feature, the Kopeh Dagh Belt is a typical Cenozoic intracontinental belt without ophiolites or arc magmatism. During the Jurassic to Eocene rifting, this belt acted as the southern boundary of the Amu Darya Basin with normal faulting, which is also widespread in the South Caspian Sea and the Black Sea. Moreover, such an extended area became a relatively weak zone within the Eurasian Plate, and could be easily reworked. Because of the collision in the Zagros Belt, the intracontinental compression commenced as early as Late Eocene to Early Oligocene, which is interpreted as tectonic inversion along this weak zone. The western zone of the Kopeh Dagh Belt was

also affected by southerly indentation/extrusion of the South Caspian block since middle Miocene, possibly resulting in the different deformation patterns between the western and eastern zones.