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POLYPHASE INVERSION TECTONICS IN WESTERN ALBORZ

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One of the fundamental issues that have been commonly addressed by early workers is the active fault kinematics in the western Alborz Mountains. Both field observations and seismicity data for the western Alborz demonstrate left lateral motion along the range-parallel faults (e.g. Allen et al., 2003). Most of previously suggested models use the obliquity of the motion between the south Caspian basin and central Iran to justify left lateral motions on NW trending faults. The main difficulty that may arias by accepting such a kinematic model is that the present-day compression direction is normal to the western Alborz range (i.e. N25E, deduced from GPS observations) and thus cannot explain the observed left lateral offsets in geomorphology and in the focal mechanism solutions of the area's earthquakes. However, Koyi et al. (2016) have already suggested that fault-bounded basement blocks in Alborz must have been rotated clockwise about vertical axes to let the rhombic structures to form across the Alborz Mountains. Here, the clockwise rotation of the basement blocks is used to explain the inconsistencies observed in the recently proposed kinematic models for the western Alborz Mountains. In fact, if the basement blocks in western Alborz as well as Central Iran and South Caspian Basin rotate clockwise with respect to Eurasia (see Mousavi et al., 2013) the left lateral motion along range-parallel faults can be justified. As a result, the following conclusions can be made from the proposed model:

1) Unlike previous suggestions, western Alborz did not initiate as a passive continental margin but it seems to have developed as several east-west trending pull-apart basins.
2) The E-W pull-apart basins were bounded by NW-SE trending left-lateral strike slip faults and E-W trending normal faults.
3) The inversion of the pre-existing E-W faults from normal to reverse (in Neogene, see Zanchi et al., 2006) is suggested to be due to the change from sinistral to dextral movements of NW-SE basement strike slip faults.
4) A last inversion along NW trending faults (this time from dextral to sinistral) caused inversion of the E-W faults from reverse to normal. The paleoseismological investigations (Ritz et al., 2006) and focal mechanism solution of the area's earthquakes (Ashtari et al., 2005) indicate that E-W trending faults are presently normal. However, GPS measurements as well as seismicity indicate that NW-SE trending faults in the western Alborz are presently left lateral (Mousavi et al., 2013; Ashtari et al., 2005).
5) The inversion of strike slip faults from sinistral to dextral (the earlier inversion phase), however, could be due to a halt in block rotations. In other words, when blocks stop rotating the faults bounding them could be affected by the northward convergence of central Iran toward Eurasia i.e. South Caspian Basin. This N-S compression would presumably cause dextral motion on NW trending basement faults in western Alborz. The resulting dextral motion on NW strike slip faults, in turn, cause inversion of pre-existing normal faults bounding the pull-apart basins as reverse faults.
6) According to the model suggested here, rotation of the Central Iran-Alborz-SCB blocks (left-lateral motion and its associated normal faulting in western Alborz) is as old as formation/opening of the western Alborz basins in the Ordovician-Silurian time.

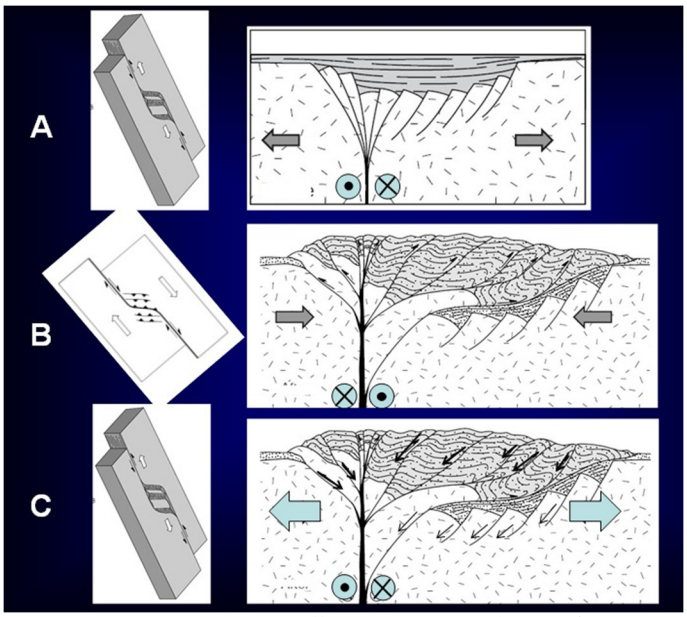

Figure 1. Cartoon showing polyphase inversion tectonics in western Alborz Mountains: A) Basin formation associated with normal faults which are resulted from left lateral motion of the basement faults; B) Neogene positive inversion tectonics caused by right lateral movements along the basement faults; C) Quaternary negative inversion tectonics indicating present-day normal faults associated with left lateral motion along the basement faults.

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