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UPPER CRUSTAL SEISMIC ANISOTROPY IN THE SOUTHEASTERN TERMINATION OF THE ZAGROS MOUNTAINS AND QESHM ISLAND

Mohsen RANJBAR HAJEE ABADI
Ph.D. Candidate, Department of Earth Sciences, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran
mohsenranjbar@iasbas.ac.ir

Farhad SOBOUTI
Associate Professor, Department of Earth Sciences, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran
farhads@iasbs.ac.ir

Farzam YAMINIFARD
Associate Professor, IIEES, Tehran, Iran
faryam@iiees.ac.ir

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We investigate the upper crustal seismic anisotropy in the southeastern Zagros Mountains and Qeshm Island through the shear wave splitting analysis the aftershock records of three local earthquakes; the 2006 Tiab earthquake (Mw=6) in the north of the Main Zagros Thrust Fault, the 2006 Fin (Mw=5.9) event in SE Zagros, and the 2005 Qeshm Island event (Mw=5.8). The data come from three temporary local seismic networks that were installed by IIEES to study the aftershock activities. We used a total of 1180 aftershocks recorded 1 to 3 months after the main events. For data processing and measurement of splitting parameters (i.e. fast axis azimuths and delay times) we used the automated program MFAST.

The results show that fast axes orientations in the Tiab area (in the Sanandaj-Sirjan Zone) are strongly NE-SW. The general direction of regional stress as inferred from earthquake mechanisms is NNE which is related to a conjugate set of active faults that characterize the tectonics of the region north of Tiab. The conjugate set is made of NE-SW trending and NW-SE trending faults. The NE-SW faults are the dominant set. The fast axes strike parallel to this set of faults and the faults shear fabric apparently influences the anisotropic signal in the upper crust. In the vicinity of the Main Zagros Reverse Fault (MZRF) the Tiab aftershocks show fast axis trends parallel to the NW-SE strike of the Fault. This region is the location of the old subduction suture, and it seems that the metamorphic fabrics that prevail in this part have shaped the anisotropic structure of the crust. Results from the Fin event show that inside the fold belt of the Zagros, the fast axes are mainly sub-parallel with the direction of maximum horizontal stress inferred from focal solutions. This suggests that fluid-saturated microcracks that develop parallel to the direction of maximum compression dominate the structure of anisotropy at shallow depths. Further east in the Zandan-Minab Fault zone, the fast axes strike mainly N-S, parallel to the major-strike-slip structures of the Zagros-Makran transition. In the Qeshm Island the fast axes have orientations both in the NW-SE and NE-SW directions. The active faulting in the Island is controlled by a two major strike-slip faults orthogonal to one another, whose interaction with each other has produced a set of conjugate smaller faults. The fast axes orientations have a complex and not-so-obvious relationship to the faults. But it seems that the structure of seismic anisotropy reflects heterogeneous fabrics developed by numerous interacting faults and stress aligned fluid saturation microcracks which parallel to the maximum horizontal stress.

In the Tiab area and MZRF the lag time average is 0.117 ± 0.011 s and in the southeastern Zagros it is 0.07 ± 0.012 s. Our results suggest that anisotropy in the Tiab area and MZRF according to lag time average is stronger than in SE Zagros anisotropy. In addition, the cause of anisotropy is different in these areas.

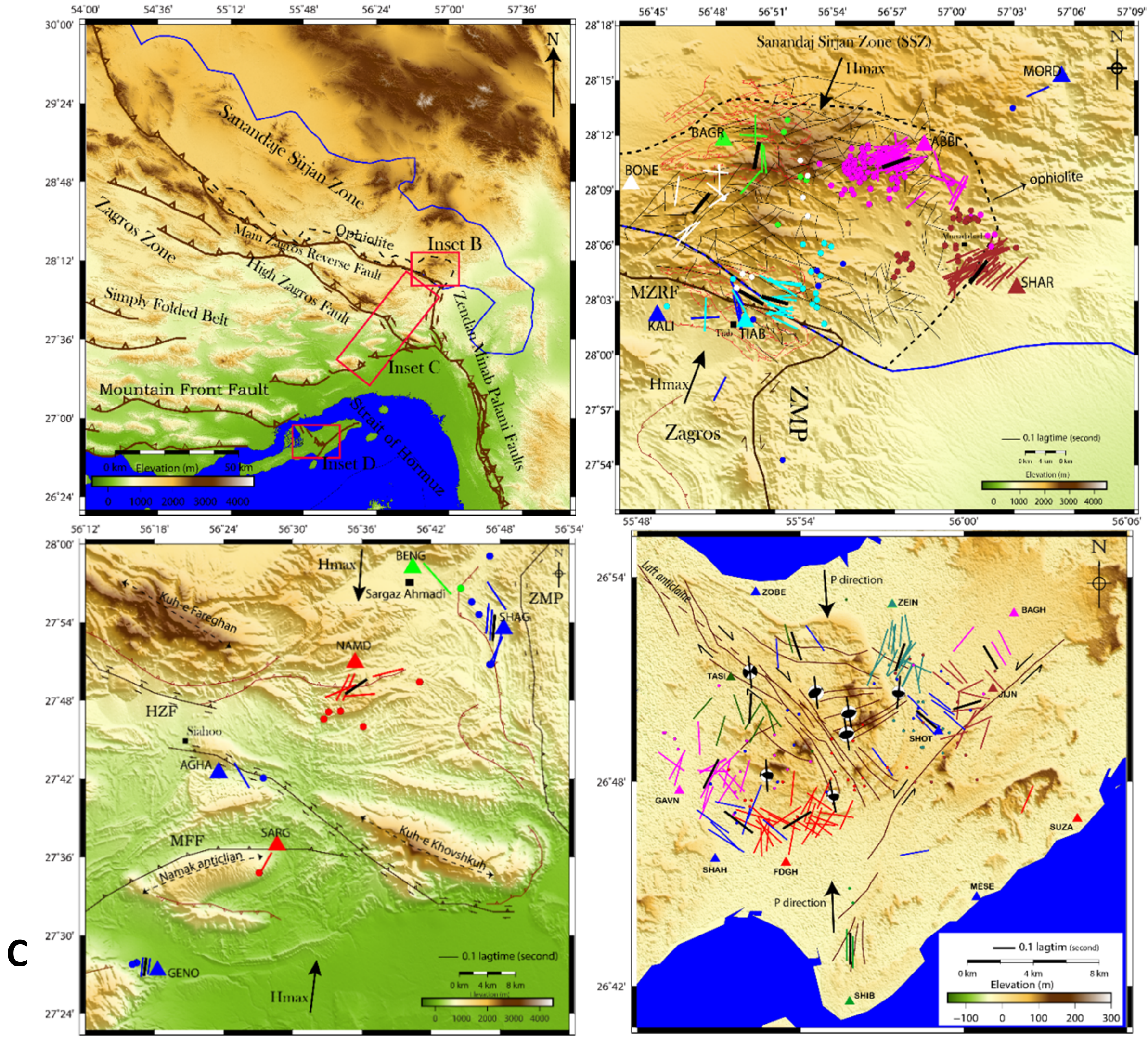

Figure 1. Results of measured anisotropy parameters in the southeastern termination of the Zagros and Qeshm Island. (A) Map of faults in SE Zagros and our study region denoted by insets B, C and D that show anisotropy orientations in the Tiab, SE Zagros and Qeshm Island, respectively. The individual fast axes (colored bars) and their station mean (black bars) have been placed midway between events and station. Triangles denote seismic stations. Black arrows denote direction of maximum horizontal compression.

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