

## ACTIVE TECTONIC ANALYSIS OF AVAJ-ABEGARM AREA (NW IRAN)

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The study area is situated in southern Central Alborz at the boundary of northwestern Central Iran. Thrusts and reverse faults are dominant brittle structures in this zone. Major fault and fold structural trends in this seismic zone is NW trending. Fault planes in this zone mostly involve left-lateral strike-slip component. Changoureh-Avaj earthquake (Mw 6.4) occurred on June 22, 2002 in southern Qazvin. Avaj earthquake is the most destructive recorded seismic event in this region after Buin Zahra earthquake (Ms 7.2, Mw 7.0) in 1962. Avaj earthquake completely destroyed Avaj, Abegarm, Abdarreh, Changoureh, Razan and several villages. This earthquake triggered numerous landslides over a widespread area (Bagheri et al., 2018). Focal depth is reported to range between 5 km to 10 km (MahdaviFar et al., 2006). Gheitanchi (2004) reported 10-12 km earthquake focal depth based on modeling body waves. A peak horizontal ground acceleration of 0.5 g was recorded at the closest station in Avaj, 28 km far from the epicenter (BHRC, 2002). Fair agreement was observed between simulated and observed records up to 40 km for peak acceleration and duration (Hamzehloo, 2005). Based on this study, the simulation represented that NW trending rupture is started at depth of 8 km.

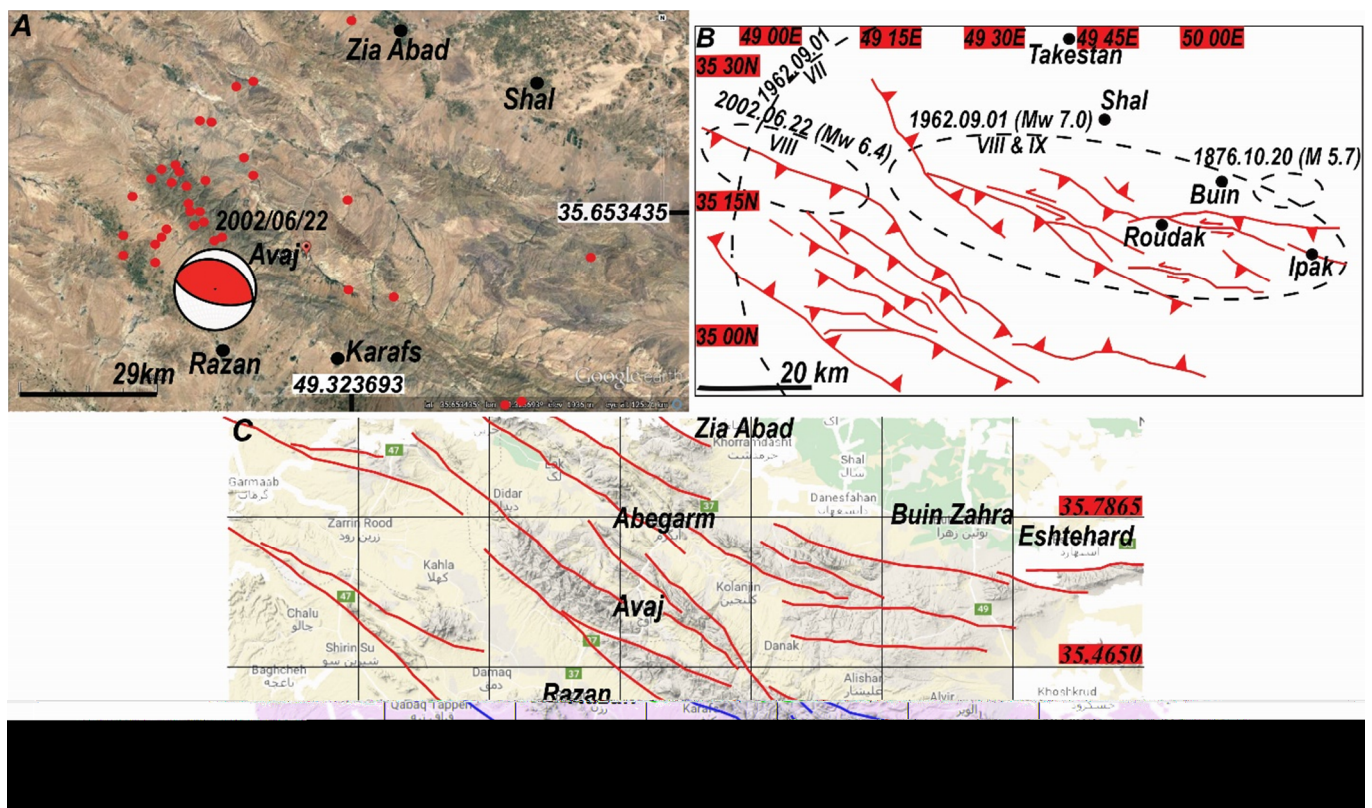


Figure 1. A. Recent earthquake epicenters ( $M \geq 4$ ) surrounding the study region. Earthquake fault-plane solution for Avaj earthquake is presented. B. Macroseismicity of earthquakes occurred in Buin Zahra-Avaj zone (Berberian, 2014). C. Major fault traces mapped on Avaj-Abegarm satellite image.

Historical M 6.5 Qazvin earthquake occurred on December 10, 1119 (Ambraseys and Melville, 1982). An earthquake happened in May 1177 (M ~6.5) in Rey-Qazvin region (Ambraseys, 1974). Another seismic event happened in October 20, 1876 (M ~5.7) in Buin Zahra (Ambraseys and Melville, 1982; Alaei et al., 2017). E-W trending Ipak fault is about 100 km long. Ipak fault has been probably responsible for Buin Zahra earthquakes. This seismic fault is extending between Ipak village in East and Abegarm in West. NW trending active Hassan Abad fault situated in northern Avaj-Abegarm fault zone is extended about 90 km. Dominant fault movement is reverse with left-lateral strike-slip component for both Hassan Abad and Ipak fault. This fault is extended in northern part of Abegarm zone, dividing this zone to two different sub-zones. Last motion for Hassan Abad fault is reported in 1962 Buin Zahra earthquake.

There is a high concentration of seismic events in eastern parts of Avaj (Figure 1-A). Accurate mapping on satellite images complemented by field investigations helped fault offset determination. Avaj earthquake was accompanied by a surface fault rupture. Abdarreh fault has been probably responsible for Avaj earthquake (see Walker et al., 2005; Alipoor et al., 2018). NW trending Avaj fault is situated in north of Razan zone running for about 35 km. Avaj fault cuts Quaternary deposits in southeastern parts.

Compressional stresses affecting the area are due to movement of Arabian plate towards Iranian Plateau. Major NW trending structures in this district are formed by this stress. Major fault segments were mapped in order to recognize regional structural and geomorphic features. Geomorphic, seismic and structural data confirm active tectonic processes in Avaj-Abegarm zone. Recent earthquakes emphasize actual hazard posed by hidden thrust faults in this region.

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