CRUSTAL STRUCTURE OF THE NORTHWESTERN IRANIAN PLATEAU REVEALED BY AMBIENT NOISE TOMOGRAPHY

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The Iranian Plateau was formed during the collision of the Arabian plate and Eurasia plate since ~30 Ma following the closure of the Neo-Tethys ocean (e.g., Chiu et al., 2013; McQuarrie and van Hinsbergen, 2013). Comparing with the Tibetan Plateau to the east, the Iranian Plateau has lower elevation, thinner crust and less internal deformation (Hatzfeld and Molnar, 2010). Whether these differences can be attributed to two successive stages of a common continent-continent collision process or two different orogenic processes is still under debate. Detailed information of structures at depth can provide key constraints on this debate and is essential for understanding the formation of the plateau.

To investigate the deep structure of the Iranian Plateau, we (IGGCAS, IASBS, RIESGSI) operated a temporary seismic array in northwestern Iran from October 2013 to October 2014, under a collaborative project named CIGSIP (China-Iran Geological and Geophysical Survey in the Iranian Plateau). This array started from the south of the Zagros belt, trending northeastward and ending at the coast area of the southern Caspian Sea. It consists of 3 linear sub-arrays with a total of 63 broadband stations. The central main sub-array is a very dense array with station intervals of 10-15 km. The two offline sub-arrays have a much sparser station distribution. Using the continuous seismic data recorded by this seismic array of the CIGSIP project, we adopted ambient noise tomography to image the 3-D crustal shear velocity structure beneath the sampled area in northwestern Iran. To stabilize the inversion for shear velocities, we incorporated the prior constraints on the depths of the Moho and strong intra-crustal discontinuities from teleseismic receiver functions recorded by the same array. Systematic comparisons were further conducted among images with and without depth constraints incorporated and with various initial models adopted in the inversion, indicating that the resultant shear velocity images reveal robust structural features beneath the study area.

Our results show that bounding by the Main Zagros Thrust (MZT), the crust exhibits different structural features on the two sides. Low velocity anomalies are mainly confined to the south of the MZT. The crust north of MZT is characterized by high velocities. Low velocity anomalies are also observed in the lower crust beneath the Alborz orogenic belt adjacent to the southern Caspian Sea. This preliminary image may imply that the crust of Arabian plate stopped just at the MZT. Some of the old orogenic belts, such as the Alborz orogenic belt, may have been reactivated by the Arabia-Euroasia collision due to its mechanical weakness.

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