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A Three-Dimensional Seismic Velocity Model of the Arabian Plate, Iranian and Turkish Plateaus

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Translational and rotational interaction between the Arabian, African and Eurasian plates over time has resulted in a challenging seismotectonic framework that is least understood in the Middle East region, in particular. Sea floor spreading along the Red Sea and Gulf of Aden, transform faulting along the Dead Sea and Own fracture zone, and compressional suture zones form the seismic and tectonic boundaries between the Arabian plate, the Iranian and Turkish plateaus. One objective of this effort is to map the three-dimensional shear-wave velocity variation using surface waves recorded by the broadband stations of North Iraq Seismographic Network (NISN), re-established Iraq Seismographic Network (ISN), and local stations of the Global Seismographic Network (GSN). Analysis of the seismograms netted a new seismicity map for the region consisting of about 2000 well located small to medium size earthquakes using all available phase arrivals including those published by the neighboring Syrian, Iranian and Turkish networks. Analysis of Rayleigh wave pure-path dispersion curves produced detailed maps showing the lateral and vertical variation of seismic velocities throughout the Middle East. These maps show a thick (10-15km) sedimentary layer that overlay the crystalline basement and a Conrad and Moho discontinuities at depths of 20-25km and 45-55km, respectively. The maps also show that the Arabian plate exhibits higher shear-wave velocities than found across the Turkish and Iranian plateaus; imprint of the Zagros Mountain roots extends down as deep as the Moho; and that the tectonic boundaries along the Dead Sea, Taurus and Zagros are more pronounced with depth describing a 60km or thicker Arabian plate. Future plans involving body wave velocity tomography modeling, high frequency wave attenuation, and moment tensor analysis to estimate the focal mechanism and magnitude of events are in preparation.