Aseismic slip on a shallow thrust imaged by SAR interferometry: the Shahdad thrust, SE Iran

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Some of the convergence between the Arabian plate and the Eurasian plate is accomodated by shear in eastern Iran. The strain manifests itself primarily in a series of large strike-slip faults combined with narrow thrust belts, separated by less deformed blocks. One of the strike-slip fault systems, the Gowk Fault, runs between the Central Iranian Plateau and the Lut block. The central Gowk fault orientation is slightly oblique to the plate motion direction and a fold-thrust belt has formed beside this section near the town of Shahdad in southeast Iran.

Shallow and gently dipping thrust faults are believed to be present beneath many fold-thrust belts. Movement on these faults is difficult to observe, but a Synthetic Aperture Radar interferogram has imaged slip on a 800 km^{2} portion of the Shahdad thrust. The approximately 80 mm of thrust motion on the roughly 6 degrees dipping Shahdad thrust occurred 8 to 30 km to the east of the 14 March 1998 Fandoqa earthquake ($M_{w}=6.6$) that involved about 2 m of oblique slip on a steeply dipping fault. That earthquake transferred stress to the Shahdad fault, probably triggering slip on it either immediately or in the following six months. We use nonlinear inversion of the interferograms with the Okada elastic half-space approximation to determine the slip geometry and magnitude of both the Fandoqa and Shahdad ruptures. Further elastic calculations show Coulomb stress change due to the Fandoqa rupture was positive in exactly the area of the Shahdad thrust that slipped. The material above the Shahdad thrust is likely to have a very low strength, and there are hints of plastic behavior. The anomalous slip-to-length ratio for the slip on the Shahdad thrust suggests a mechanism unlike most earthquakes, likely aseismic.

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