



## **New insights into the active deformation of accretionary prisms: examples from the Western Makran, Iran**

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The Makran subduction zone, along the southern coasts of Iran and Pakistan, hosts one of the largest exposed accretionary wedges in the world. The western Makran has been characterised by a lack of shallow and thrust seismicity in both the instrumental and historical periods. The Mw 6.1 2013 Minab earthquake thus provides a rare opportunity to study the deformation of the accretionary wedge in the transition region between continent-continent collision, in the Zagros, and oceanic subduction, in the Makran. We study the source parameters and slip distribution of this earthquake using seismology, geodesy and field observations. We observe left-lateral strike-slip motion on a fault striking ENE–WSW; approximately perpendicular to the faults of the Minab–Zendan–Palami fault zone, the main structure previously thought to accommodate the right-lateral shear between the Zagros and the Makran. The fault that ruptured in 2013 is one of a series of approximately E–W striking left-lateral faults visible in the geology and geomorphology. These accommodate a velocity field equivalent to right-lateral shear on N–S striking planes by clockwise rotations about vertical axes. The longitudinal range of shear in the western Makran is likely to be controlled by the distance over which the underthrusting Arabian lithosphere deepens in the transition from continent–continent collision to oceanic subduction.

The lack of observed megathrust seismicity in the western Makran has led to assertions that the convergence in this region may be aseismic, in contrast to the eastern Makran, which experienced an Mw8.1 earthquake in 1945. The right-lateral Sistan Suture Zone, which runs ~N-S along the Iran-Afghanistan border to the north of the Makran, appears to separate these regimes. However, right-lateral faulting is not observed south of ~27°N, within the wedge. The Minab earthquake and the 2013 Balochistan earthquake show that the Makran accretionary wedge is dominated by strike-slip faulting. By combining GPS, seismology and satellite imagery we assess possible kinematic scenarios for the accommodation of right-lateral motion in the Makran accretionary wedge, and their implications for earthquake hazard in the western Makran, and the dynamics of accretionary wedge deformation in general.