Co-seismic conjugate Riedel faulting associated with the 2014 M_w 6.9 Yutian earthquake on the Altyn Tagh Fault, Tibetan Plateau

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The Altyn Tagh Fault is located at the northwestern edge of the Tibetan Plateau, and is the largest active strike-slip fault in Asia with a total length of ~2000 km. The fault accommodates sinistral motion between the Tibetan Plateau and the Tarim Basin within the India–Eurasia collision zone. Although the Altyn Tagh Fault plays a key role in accommodating India–Eurasia convergence, little is known about its nature as a seismogenic strike-slip fault due to a lack of instrumentally recorded large earthquakes on the fault. The 12 February 2014 M_w 6.9 Yutian earthquake, which occurred in the Yutian region of the Tibetan Plateau, provides an opportunity to study the seismotectonic nature of the Altyn Tagh strike-slip fault system.

Field investigations reveal that the 2014 M_w 6.9 Yutian earthquake on the left-lateral strike-slip Altyn Tagh fault system, Tibetan Plateau, produced a ~25-km-long surface rupture zone that contains conjugate Riedel shear faults (Li et al., 2016). The co-seismic surface ruptures occurred mainly along two parallel ENE-trending active left-lateral strike-slip faults. Rupture also occurred in a conjugate, WNW-trending zone along an active right-lateral strike-slip fault. The ENE-trending ruptures are concentrated in a zone of <500 m wide and ~25 km long, and are characterized by Riedel shear structures including distinct shear faults (Y) with a maximum sinistral displacement of ~1 m, right-stepping en echelon cracks, and mole tracks. In contrast, the WNW-trending ruptures occur within a zone of up to 1.5 km wide and ~4 km long in the jog area between the two parallel ENE-trending faults, and this zone is characterized by discontinuous shear faults with dextral displacements of <0.5 m, left-stepping en echelon cracks, and mole tracks, all oriented oblique to the ENE-trending rupture zones at an angle of 30°–40°. The lengths and displacements of the co-seismic surface ruptures measured in the field are comparable with those obtained from the empirical relationships between magnitude and co-seismic surface rupture length and displacement. Our findings demonstrate that the co-seismic conjugate Riedel faulting was controlled mainly by pre-existing active faults of the Altyn Tagh fault system, reflecting the present-day tectonic stress field associated with the ongoing penetration of the Indian Plate into the Eurasian Plate.

References

Li, L., Pan, J., Lin, A. (*corresponding author), other 8, 2016. Co-seismic surface ruptures associated with the 2014 M_w 6.9 Yutian earthquake on the Altyn Tagh Fault, Tibetan Plateau. Bulletin of Seismological Society of America, in press.

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