400-km-long surface rupture zone produced by the 2001 Ms 8.1 Central Kunlun, China, earthquake

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The Ms 8.1 Central Kunlun earthquake of14 November 2001 was triggered by the active Kunlun fault in the Central Kunlun mountain area, northern Tibet. A co-seismic surface rupture zone of a nearly 400 km long, called Kunlun rupture zone, occurred along the western segment of the Kunlun fault. Field investigations show that the surface ruptures are distributed in a zone with width ranging from few to several hundreds of meters, generally from 5 to 50 m. The rupture zone is composed of distinct shear faults, extensional cracks, and mole tracks. The landsat and SPOT images obtained after the event show that the rupturing in westmost segment was terminated at the Buka Daban Peak (EL 6860 m), where the ruptures show a horsetail structures with a width up to 2-3 km. The left-lateral offsets are measured by using the surface deformation marker such as present-day glacier, moraine, stream channel, gully, and road, which vary from few tens of cm to 16.3 m, but generally from 4 m to 8 m. The maximum displacement up to 16.3 m was observed across a rupture zone of 550 m wide. Both the rupture length and maximum displacement are the largest among the co-seismic surface rupture zones ever reported worldwide. The co-seismic deformation characteristics of surface markers reveal that the earthquake had a purely strike-slip focal mechanism. Both the geological and geomorphological evidence indicates that the geometry of the ruptures is controlled by the pre-existing Kunlun fault. The large amounts of strike-slip and rupture length produced by the earthquake support the hypothesis that the Kunlun fault plays an important role of strike-slip partitioning in the rapid eastward extrusion of Tibet to accommodate the continuing penetration of Indian plate into Euro-Asia plate. The Central Kunlun earthquake provides an exceptional opportunity to study the geometry of co-seismic rupture structures along a large strike-slip fault for further understanding the relationship between the fault geometry and rupturing process.