

Two Earthquake Sequences Nearly a Century Apart Reveal a Conjugate Seismogenic System in Central Taiwan

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Seismically active central Taiwan is considered part of an orogenic wedge with low-angle east-dipping active faults above a detachment surface and an active mountain-building process later. In 2013, two moderate reverse-faulting earthquakes of magnitudes M_L 6.2 and 6.5 occurred in Nantou. They brought to mind the historically damaging sequence of four earthquakes in the same area that claimed a total of 71 lives in 1916. The 2013 earthquake sequence provides a good opportunity to study the 1916 sequence. We compared the historical Omori record of the main event in the 1916 sequence, discovered in the Seismogram Archives at the Earthquake Research Institute, University of Tokyo, and the corresponding simulated Omori records of the 2013 events. Our comparison shows significant similarity among the earthquakes, although they are separated by nearly 100 yr. To understand the seismogenic structure associated with these earthquake sequences, we further studied the source rupture properties of earthquakes in this region since 1999 using local broadband records to determine the rupture fault planes. Results show that all events have similar focal mechanisms with one low-angle east-dipping and another high-angle west-dipping nodal planes. Rupture plane determination indicates that whereas events at shallow depths (<20 km) ruptured on the low-angle east-dipping plane, events at greater depths (>20 km) slipped on the high-angle west-dipping plane in a conjugate fault system. The comparison also suggests that the 1916 sequence occurred on the low-angle east-dipping plane of this conjugate fault system in the orogenic wedge as part of a mountain-building process. Given the active mountain-building process in central Taiwan, occurrences of this type of earthquake must be addressed in seismic hazard mitigation efforts.

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