

Historic seismic-event produced by a slip on the Chelungpu fault zone, Taiwan

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In this study, we strived to determine when large historic (or paleo-) seismic events occurred in the Chelungpu fault by field surveys and excavation investigations. Excavation investigation and ¹⁴C dating results show that at least one historical seismic event occurred in the Chelungpu fault in the period during 450 y.B.P and 210 y.B.P., which is probably associated with the historic earthquake occurred in Chin Dynasty (1616~1911 AD). The observational results show that the vertical displacement produced by this historic seismic faulting event is >1 m. It is inferred that the magnitude of this historic earthquake is about 7.0-7.5 and that the recurrence of seismic event with surface ruptures in the Chelungpu fault intervals 250~400 years.

On 21 September 1999, an earthquake (called Chi-Chi earthquake) with a magnitude of 7.6 (Ms) shook Nantou country, central Taiwan, killing approximately 2,300 people and causing widespread damage. A nearly 100km-long Chelungpu surface rupture zone accompanying this earthquake occurred mostly along the pre-existing Chelungpu fault on the northwestern side of Taiwan (e.g. Central Geological Survey of Taiwan, Lin et al., 2000).

In this study, we strived to determine when large historic (or paleo-) seismic events occurred in the Chelungpu fault, thereby deriving an understanding of the frequencies and irregularities of their occurrences by field surveys and excavation investigations on two artificially-excavated exposures in the Chelungpu surface rupture zone occurred accompanying with the 1999 Chi-Chi earthquake. This knowledge of the long-term behavior of faults provides important information for seismic hazard evaluation and the historic (paleo-) seismicity for the Chelungpu fault.

Historical documents report that an earthquake occurred in Chin Dynasty (1616~1911 AD) in Nantou Country where is the same region as the epicentral area of the Chi-Chi earthquake, which caused the rise of four small hills in the Sun-Moon Lake in Nantou Country (Wang et al., 2000). There is, however, no detail historic record on the damage, location of epicenter and surface ruptures about this historic earthquake. Furthermore, there were four instrumentally-recorded earthquakes (M=5.9~6.8) occurred in the period of August 28, 1916 to January 7, 1927 in Taiwan, which caused 71 persons injured and several thousand houses collapsed (Wang et al., 2000). There is, however, no data showing that the epicentral locations of these seismic events and the source seismic faults. The lack of the historic records and paleoseismic data, therefore, hinder to further evaluate seismic hazard in Taiwan and to assess the recent seismic activity of active faults.

Field and excavation investigations show that at least one historical seismic event occurred in the Chelungpu fault in the period during 450 y.B.P and 210 y.B.P., which is probably associated with the historic earthquake occurred in Chin Dynasty (1616~1911 AD) before the 1999 Chi-Chi earthquake. The observational results show that the vertical displacement produced by this historic seismic faulting event is >1 m. It is inferred that the magnitude of this historic earthquake is about 7.0-7.5 and that the recurrence of seismic event with surface ruptures in the Chelungpu fault intervals 250~400 years.