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# Aseismic fold growth and backthrusting within the foothills of southwestern Taiwan along the Tsengwen River

**Maryline Le Beon[1],** Chang-Chih Chen[1], Jhih-Wei Shi[1], Wen-Jeng Huang[1], Ya-Chu Tseng[2], Yi-Wei Chiu[3], Yen-Chiu Liu[4], Meng-Long Hsieh[5], Chih-Heng Lu[6], Kuo-En Ching[6], Erwan Pathier[7]

[1] National Central University
[2] National Taiwan Normal University
[3] Sinotech Engineering Consultants, Tld.
[4] Geological Survey and Mining Management Agency, MOEA
[5] National Chung-Cheng University
[6] National Cheng-Kung University
[7] IsTerre, Universite Grenoble-Alpes

This study investigates the present and Holocene activity of a geological structure located within the foothills of southwestern Taiwan, about 12 km east of the deformation front. At this latitude, GNSS observations indicate about 2 cm/yr of westward shortening across a 20-km-wide zone. The targeted geological structure includes, from west to east, a tight upright anticline, the Wushantou anticline, with early Pleistocene mudstone at the anticline axis, a major thrust fault with a steep dip to the east, the Lunhou fault, that brought early Pliocene strata against Pleistocene strata, and an active west-dipping backthrust with limited separation, the Kouhsiaoli fault. These structures are crossed over by the Tsengwen River, which formed a series of 11 Holocene river terraces dated from 10 ka to 2 ka using radiocarbon dating. The highest terrace is located near the anticline fold axis and lies 140 m above the modern river. We determined bedrock incision rates across the investigated structure and accounted for sedimentation rates in the Holocene foreland basin to determine uplift rates. Uplift rates are 5-7 mm/yr west of the anticline, progressively increase to reach 15-20 mm/yr from the anticline axis to the Kouhsiaoli backthrust, and rapidly decrease to 5-7 mm/yr east of the backthrust. Present deformation observed by InSAR indicates a similar deformation pattern. Our observations demonstrate that the backthrust and anticline are the main active structures since the early Holocene at least and that the Lunhou thrust was likely inactive during this time period, implying a recent rearrangement in the distribution of shortening. Observations also indicate that the active structures are currently slipping aseismically. Seismicity plotted on a preliminary geological cross-section shows fewer events within the 5-7-km-thick Upper Miocene and younger strata. Particularly devoid of seismicity are the 1-km-thick muddier facies that are expected to host the detachment above which the anticline and backthrust are inferred to root. This study emphasises the potential role of lithology as a controlling factor for the mode of slip of active faults.

Keywords: river terraces; bedrock incision rate; Holocene; uplift rate; InSAR; geological cross-section