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Age Estimates of the High River Terraces of the Hsinwulu River in the Taiwan Central Range and their Implication for Recent Tectonic Uplift History

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River terraces have long been a natural and useful geomorphic marker that records the combined effects of tectonic, sea level changing, and erosional forces. They have provided important information about not only their own formation processes but also the tectonic activities of the mountain ranges. Still, more information can be extracted through river terraces, particularly in tectonically active regions like the Taiwan Central Range. High river terraces are observed within the Taiwan Central Range although most of them are poorly preserved due to possibly higher rates of erosion and are not well geologically dated. The Hsinwulu River flows through the eastern flank of the southern Taiwan Central Range and its river terraces are relatively well preserved in comparison with other parts of the Range. The river terraces may well record the recent tectonic uplift history of the most tectonically active region in Taiwan. Along the more than 20 km long river, there are three major groups of river terraces: the Hsinwu, Wulu and Lidau terrace groups. Field observations indicate that the river terraces are composed of both river sediments and debris flow deposits with unknown geologic ages. We mapped all the river terraces and associated rare strath exposures along the river and projected them onto the longitudinal river profile. We estimated the ages of the strath exposures by plotting ages vs a range of possible incision rates for the river, constrained by the vertical heights between the strath exposures to the river basement rocks. To further and independently evaluate the ages for the river terraces, we applied recent continuous GPS data along the upper, middle and lower reaches of the Hsinwulu river showing vertical displacements of 3.6, 8.0 and 9.1 mm/yr, respectively. Our results indicate that these terraces are much older than previously thought. The terraces range possibly from 20,000 to 60,000 years and their formation may likely relate to the curve of sea level change during the period in addition to the tectonic uplift by the plate convergence.