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Delayed upstream propagation of knickpoint and climate as controls on development of river terraces in the Mawuku River of Taiyuan Basin in the Coastal Range, eastern Taiwan

Jia-Hong Chen (1,3), Shyh-Jeng Chyi (1), Jiun-Yee Yen (2), Ting-Yi Chang (2), Chia-Hung Jen (1), and Wen-Yen Chang (2)

(1) Department of Geography, National Kaohsiung Normal University, Kaohsiung, Taiwan, (2) Department of Natural Resources and Environmental Studies, National Dong Hwa University, Hualien, Taiwan, (3) jiahong1017@gmail.com

Taiyuan basin is the largest drainage basin in the Coastal Range of eastern Taiwan that is mainly composed of Pliocene-Pleistocene sedimentary rocks. Two roughly equal size distributaries, the North and South streams, join together at the Taiyuan Township to form the Mawuku River that flow eastward from the sedimentary rock through the igneous rock gorge near the river mouth. Typical incised meander and unpaired terraces are well developed in the river basin. Even though the uplift rate of this area is very high (around 7 mm/yr), the knickpoint in the limestone and igneous rock gorge near the river mouth might work as the temporal base level, and the incision of streams and the formation of terraces in the upstream area would mainly controlled by the retreat of the knickpoint. The formation of the marine and fluvial terraces near the river mouth should be directly connected to the relative sea level fluctuation, and marine terraces had been used to derive late Quaternary regional uplift rates. Therefore, Mawuku River basin could be the best drainage basin to study how the multiple controls affect the landscape evolution and how complex the river system response to those controls. The results of our works reveal that the average bedrock incision rates, which are the slopes of the simple linear regression equation that assumes the relationship between the ages of terrace sediments (x) and the relieves of strath surface beneath the terrace sediment layers (y), are 2.5-3.9 mm/yr in the two main tributaries of Mawuku river, 3.6-6.0 mm/yr in the igneous rock and limestone gorge near river mouth, and about 7 mm/yr in the coast/river mouth area. It implies that only the highest terrace treads in the drainage basin are Pleistocene terraces, all the other river terraces should have been formed during the Holocene, and the ages of same terrace level may not be easily correlated or distinguished by the sediment ages. We propose the climate turns warm and wet since the end of the last glacial period and the retreat of knickpoint in the igneous rock and limestone gorge exert the primary influence on terrace formation in the upper reaches of Mawuku River. The relative sea level falling is the main control on the terrace formation in the coastal area. The terraces of two main tributaries which reveal the different cut-and-fill histories might be the results of complex response of sub-drainage systems to the multiple controls.