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Fluvial incision history that controlled the distribution of landslides in the Central Range of Taiwan

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Hillslope processes, which are affected by long-term river incision, give rise to the risk of landsliding in active orogens. We studied the river incision history and the subsequent response of rock slopes in the upstream Dahan River catchment, north Taiwan, by analyzing river long profiles, hillslopes, and landslide scars. The results were combined with chronological data from several landform surfaces to reconstruct the history of landscape evolution. At the study area, the landscape comprises three levels of knickpoints and corresponding slope breaks. These knickpoints propagated upstream along trunk and tributary rivers, undercutting and destabilizing nearby slopes, of which the oldest is a paleosurface dated to ca. 150 kyr by cosmogenic nuclide dating. Consequently, three levels of V-shaped inner gorges (up to 600 m deep) are incised into the paleosurface. The inner slopes of the three levels of gorges have mean inclinations of 35.6 degrees , 37.7 degrees, and 39.8 degrees, and steepen from the higher to the lower inner gorges. These three series of knickpoints and corresponding slope breaks suggest the occurrence of three phases of river incision. Based on analyses of the steepness indices of the river long profiles, cosmogenic nuclide dating, and the regional tectonic and climatic history, the two earlier phases of incision are inferred to have been caused by prevailing tectonic uplifts during the middle to late Pleistocene, and the most recent phase by climate change in addition to uplift. The long-term history of river incision has controlled the distribution of deep-seated gravitational slope deformation and landslides. Many areas of deep-seated gravitational slope deformation and deep-seated rockslide-avalanches are aligned along the higher and middle slope breaks, and debris slide avalanches are concentrated along the middle and lower slope breaks.

Reference:

Tsou, C.-Y., Chigira, M., Matsushi, Y., Chen, S.-C., 2014. Fluvial incision history that controlled the distribution of landslides in the Central Range of Taiwan. Geomorphology 226, 175?192.

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