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The challenge to decipher Late Pleistocene to Holocene geomorphological processes in the Taiwanese mountains

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The vegetational composition and the geomorphological processes change with the altitude in mountains. During the Pleistocene glacial stages, the altitudinal zonation shifted due to a drop of temperature. In addition, changes of the local precipitation regime occurred. The island of Taiwan represents a unique location for the research of long-term climate changes in East Asia, because its high mountains exceed 3500 m. It represents the only high-altitude mountain massifs in a radius of several thousand kilometres and can therefore provide differentiated palaeoclimate data of several altitudinal zones in the north-western Pacific region. As the present-day surface processes are strongly driven by earthquakes, regional tectonic uplift, and typhoons with catastrophic precipitation events, high erosion rates and a distinct backward erosion are destroying Pleistocene landforms and deposits. Nevertheless, in some mountain areas, remnants of "old landscapes" (late Pleistocene) are still preserved.

Evidence has been found that the vegetational and the geomorphological zonation was lowered in Taiwan accordingly by more than 1000 m during cold phases of the last glacial cycle. This is indicated 1.) by a long vegetational climatic record provided by the pollen assemblage from a sediment core in the Toushe Basin in central Taiwan (Liew et al. 2006) and 2.) by the reconstruction of extensive mountain glaciations and the respective depression of the ELA to below 3000 m. OSL and TCN dating from northern Taiwan show that most glacial traces are related to the late-glacial/Holocene transition (Hebenstreit et al. 2011). For the first time, boulders of a glaciation near the LGM were TCN-dated in the Nengao Shan (central Taiwan), recently. The most extensive glaciation is assumed for the MIS 4 from few earlier findings but mainly from palaeoclimatic correlations. It can be shown that the highest parts of the mountains were, like at present, dominated by the westerly circulation of the atmosphere more than by the monsoon. As 3.), the shift of the periglacial zone can be reconstructed from currently above ca. 3400 m, where frost weathering and solifluction dominate above the timberline, but traces of Pleistocene slope activity such as periglacial cover beds composed of weathered rock debris and aeolian dust were found as low as 2500 m.

Fluvial landforms and terraces are preserved in many mountain valleys (Wenske et al. 2012) and basins, like the Puli basin in Central Taiwan (Tseng et al. 2016). The global Pleistocene sea-level lowering affected the geomorphological processes in the mountain foreland by varying sediment transport and fluvial incision. It resulted in the formation of river terraces and tablelands and influenced the coastal development significantly (Liu et al. 2023).

Hebenstreit et al. 2011: Quaternary Science Reviews 30 (3-4), 298-311.

Liew et al. 2006: Quaternary International 147, 16–33.

Liu et al. 2023: Quaternary Research, 1–22.

Tseng et al. 2016: Quaternary Science Reviews 132, 26-39.

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