

THESIS ABSTRACT

The tablelands in the Puli Basin (central Taiwan) – a geochronological and geomorphological approach to Late Quaternary fluvial sedimentary and erosional processes

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Dissertation Online: http://www.diss.fu-berlin.de/diss/receive/FUDISS_thesis_000000096921

The island of Taiwan has been formed by the orogeny resulting from the convergence of the two tectonic plates, the Eurasian Plate and the Philippine Sea Plate. Modern climate in Taiwan is influenced by the East Asian Monsoon because of its geographic position offshore to the south-east of the Eurasia Continent. In the tectonic and climatic contexts, Taiwan is characterized by a diverse topography, i.e. high mountains, foothills, tablelands, basins, and plains.

A group of intramontane basins with areas larger than 1 km² exist in central Taiwan, namely the Puli Basin, the Yuchih Basin, the Sun Moon Lake, and the Toushe Basin (Figure 1). This study focuses on the Puli Basin and aims at linking the tableland formation in the Puli Basin to paleoclimatic conditions and to shed light on the tectonic framework and its possible influences on the tableland formation. The objectives of this study are to find answers to the following main research questions: 1. Does the tableland formation in the Puli Basin link to climate changes in the past? 2. Is the tectonic framework a factor that influences the tableland formation? 3. Is the Puli Basin a sole situation in Taiwan?

This study relies on various methods, such as topographical interpretations from aerial photos and digital terrain models (DTMs, 2 and 20 m/pixel), sedimentological analyses including element, mineral, and grain size measurements, and burial age estimation by applying optically stimulated luminescence (OSL) and radiocarbon (¹⁴C) dating techniques.

On the basis of the results, arguments and evidence for conclusions are stated as follows:

1. Formation of the tablelands being composed of the alluvial fan deposits in the Puli Basin indeed links to climate changes in the past during the transition from the

Late Pleistocene to the Holocene (14–9 ka). The precursor of the old Taomi River was longer than the present-day river, originating west of the Yuchih Basin collected sediments created by erosional processes in the drainage basin. Increasing river discharge owing to heavy precipitation transported the sediment loads downstream. These sediments were then deposited as an alluvial fan in the Puli Basin.

2. In addition, local and intermittent tectonic activities and resultant river incision created several levels of tablelands and terraces in the Puli Basin. The tectonic activities are proposed as downwarping, a process which curved down the crust within the Puli Basin. The upper Taomi catchment was truncated and deviated to the Nankang River resulting in less sediment transport by the shorter Taomi River.

3. Resultant landform changes due to the climate shift could prevail in Taiwan, so that mass wasting and alluvial fan formation were active from high mountains to low-altitude areas during the same period. According to the dating results and paleoclimatic records (Figure 2), geomorphic and climatic processes in each time period from the Late Pleistocene to late Holocene are further described:

- From 14 ka to 7 ka: erosional processes affecting the landforms, e.g. mass wasting and fluvial transport, caused by increased precipitation during the climatic transition between 14 ka and 7 ka can prevail over Taiwan.

- From 4 ka to 1.5 ka: a period of aggradation between 2.5 ka and 1.5 ka following a long-term period of stream incision over Taiwan. This change in geomorphic process is interpreted as the consequence of increasing precipitation or typhoon frequency and thus triggering slope failures increasing sediment yield, possibly supporting the

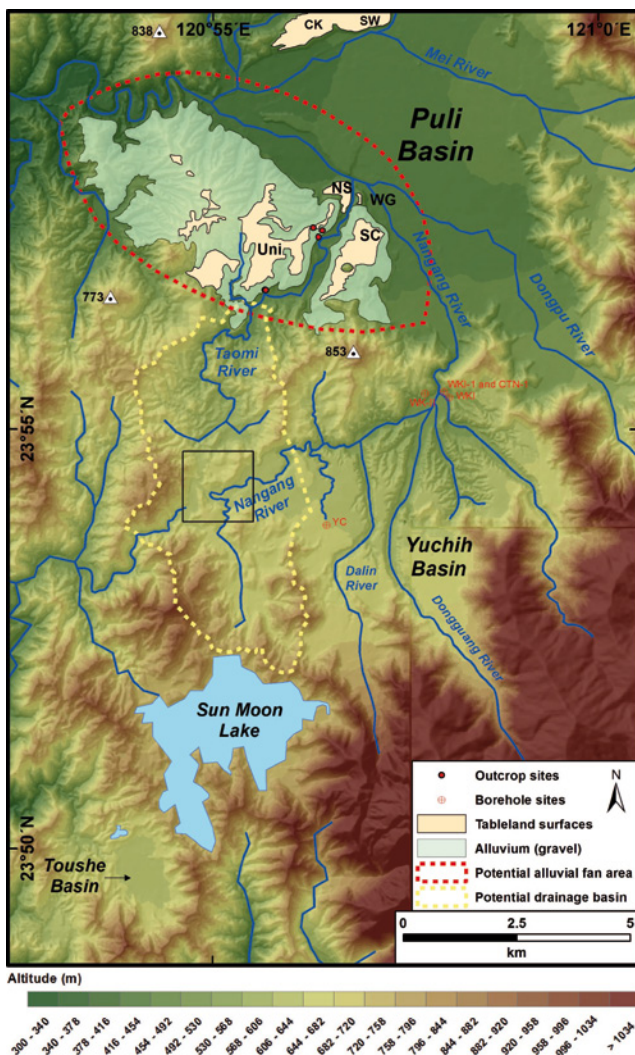
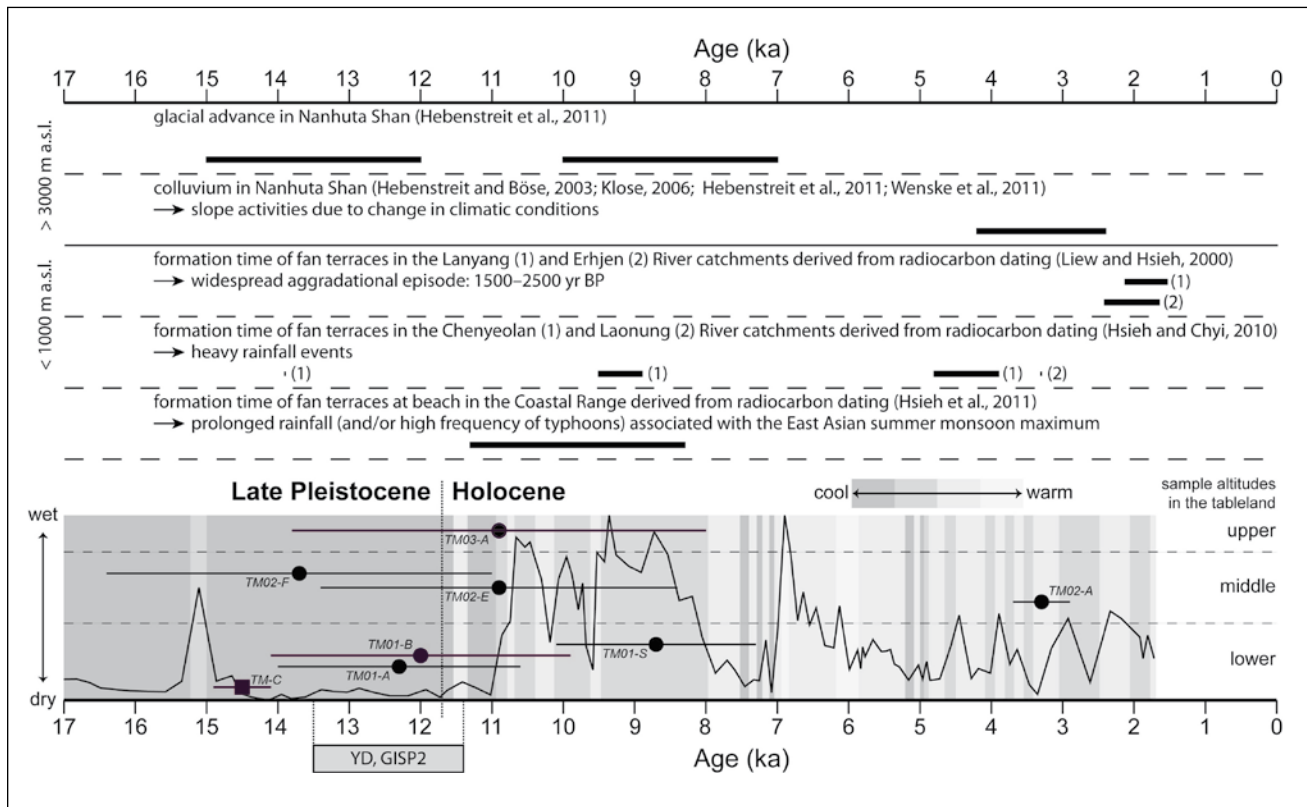


Fig. 1: The intra-mountainous basins in central Taiwan and the tablelands, consisting of fluvial deposits, in the Puli Basin. The black rectangle marks the truncation area of the Taomi River.

slope failure in the Taomi River (3.3 ± 0.4 ka). The processes also probably had influenced areas in high mountain areas (above 3000 m a.s.l.). In central northern Taiwan, sediments dated between 3.7 ka and 3.1 ka are assumed to result from slope movements caused by climate change (i.e. turned into much wetter conditions). However, reports on geomorphic units or events during 7 ka to 4 ka are rare, so the geomorphic processes in the period are still an open question.

Erosion created several levels of tablelands and fluvial terraces in the Puli Basin.

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TSENG, C.-H., WENSKE, D., BÖSE, M., REIMANN, T., LÜTHGENS, C. & FRECHEN, M. (2013): Sedimentary features and ages of fluvial terraces and their implications for geomorphic evolution of the Taomi River catchment: A case study in the Puli Basin, central Taiwan. – *Journal of Asian Earth Sciences* 62, 759–768.

Fig. 2: Comparison between the burial ages of the studied sediments (black solid circles with uncertainties) and the paleoclimatic record in the Toushe Basin. The dry/wet curve is derived from the pollen and spores record, whereas variations in temperature are derived from forest types. Black bars show ages including uncertainties for respective geomorphological events.