

Aeolian sediments on the Tibetan Plateau

G. Stauch, P. Schulte and F. Lehmkuhl

¹ Dept. of Geography, RWTH Aachen University, Germany
gstauch@geo.rwth-aachen.de

Aeolian sediments in high mountain environments often show a complex spatial pattern. Different types of aeolian sediments have been studied in four different catchments on the north-eastern Tibetan Plateau. Beside variations in the climatic parameters, e.g. variations in the intensity of the different monsoonal systems, additional components like the geomorphological configuration of the basins and sediment availability play an important role. Four different intramontane basins have been studied in the area, including the Gonghe Basin at 3000 m a.s.l.(above sea level), the catchment of the Donggi Cona (4000 m a.s.l.) and the Heihai (4500 m a.s.l.) and basin of the Hala Hu in the central Qilian Shan (4100m a.s.l.). Aeolian sediments are widespread in all studied basins, including loess, sandy loess and sands. However, the spatial distribution of the sediments and the grain size distribution show some remarkable differences. An important factor for the formation of the aeolian archives is the coupling with local fluvial processes.

In the catchment of the Donggi Cona several phases of enhanced aeolian activity and reworking of the sediments have been documented [1]. The deposition of sand started at around 14 ka. However, enhanced deposition of sand and loess occurred from 10.5 to 7.5 ka. The formation of these sediments is related to the strengthening of the Asia summer monsoons. Wetter climatic conditions and the development of a denser vegetation cover lead to the trapping and accumulation of the aeolian sand. This pattern is different from the accumulation processes in the Chinese Loess Plateau, where highest accumulation rates are related to glacial times. Presumably aeolian activity at the Donggi Cona was even high before that time but no related archives were preserved due to arid conditions. In the high mountain environment formation of aeolian deposits is mainly related to environmental conditions in the depositional area, while the Chinese Loess Plateau shows the general sediment availability. Older aeolian sediments also have been found in lower elevations like the Gonghe Basin [2] and the eastern Qaidam Basin [3]. These basins might document an intermediate position.

Fluvial erosion of aeolian sediments at the Donggi Cona under full monsoonal conditions was strongest from 9 to 6 ka. However, the end of this erosional phase is probably more related to sediment availability than to a more arid climate. At around 6 ka most of the erodible material was already transported into the basin. From around 3 ka the formation of new dunes indicate a reactivation of the aeolian sand. This is coherent with drier and cooler climate conditions. Additionally the lowering of the lake level of the Donggi Cona provided additional sediment sources which enhanced formation of dunes. This new sediment source is clearly documented in a different geochemical composition of the aeolian sediments.

[1] G. Stauch, J. IJmker, S. Pötsch, H. Zhao, A. Hilgers, B. Diekmann, E. Dietze, K. Hartmann, S. Opitz, B. Wünnemann and F. Lehmkuhl. Quaternary Science Reviews 57, 74-84 (2012).

[2] M. Qiang, F. Chen, L. Song, X. Liu, M. Li and Q. Wang Quaternary Research 79, 403-412 (2013).

[3] L. Yu and Z. Lai. Palaeogeography, Palaeoclimatology, Palaeoecology 337-338, 120-129 (2012).

Key words (for online publication): Tibet, aeolian sediments, monsoon, geomorphology