



## **Comaparison of late pleistocene glacier extensions along a meridian Himalaya transect by geomorphological and pedological methods**

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There is still a controverse discussion on Late Pleistocene glacier extensions for many parts of the Himalaya. Besides differing geomorphological results, more recent pedological relative datings of moraines delivered further inconsistent findings. For a meridian Himalaya transect along the Kali Gandaki a detailed field review of these different glaciogeomorphological reconstructions has been carried out, supplemented by new equilibrium line altitude (ELA) calculations. In a second step these findings have been used as benchmark to explore the options and limits of pedological relative dating of glaciogene accumulations in the Higher Himalaya.

A review of the already existing glaciogeomorphological results clearly approved the more extended glaciation and the detailed relative chronology found in Kuhle (1982), while the more restricted glaciation view advanced by Fort (2000) is the result of faulty and missing geomorphological interpretations.

To reconstruct former ELA depressions within the very steep and highly dynamic landforms of the Himalaya, „Toe-To-Summit-Altitude-Methods“ (TSAM) are most adequate. Only the upper and lower glacier margin need to be known, which can be identified quite certain even for pre-existing glacier extensions. The method Kuhle is proved to provide the most suitable results, because the strong influence of the valley topography and the degree of debris cover on the position of the ELA within the vertical extension of the glacier can be simulated by the „factor of snowline deviation“ (FSD). Maximum ELA depressions of 1300 to 1500 m can be observed for the south-face of the Higher Himalaya as well as for the arid north-face and the Inner Himalaya. The extreme topographical changeover arising from the inflow of the former glaciers from the tributary valleys into the wide and flat valley bottoms lead to little uncertainty, but the relative chronology of the glacier stages can certainly be derived.

Most of the granulometric weathering indices are inapplicable as relative dating methods because of the typically high textural variability within till deposits. On the other hand around the central mountain range crossing section of the Kali Gandaki most of the pedochemical weathering indices mirror the relative chronology of deglaciation correctly, since comparable soil development conditions can be found. Thereby not only a differentiation between the High-, Late-, and Neoglacial is possible, but also within the Late Glacial. North of the Himalaya main range, only a few very certain pedochemical relative dating methods are applicable as a consequence of the drier climatic conditions. South of the Higher Himalaya variations of the parent material and the for the southern slope typical characteristics, e.g., a high degree of relief energy, precipitation, and anthropogenic use, preclude a reliable deduction of the relative age of the glaciogenic accumulations from the soil age, since a required undisturbed soil development and primary form conservation of the accumulations, is nearly impossible.