

However, *soil samples* (green land and forest) of the same areas indicate negative trends for both cadmium and lead with the water adsorption but showed positive

trends with the dissolved (mobile!) organic matter in both cases.

Reading the Paleoclimate Record of Lunana: Quaternary Research and Glacial History in the Bhutan - Himalaya

M. Meyer¹, H.Häusler¹, D. Leber¹, D. Wangda²

¹ *Institute of Geology, University of Vienna, Vienna, Austria*

² *Geological Survey of Bhutan, Ministry of Trade and Industry, Thimphu, Bhutan*

Lunana is a heavily glaciated area in the northwest of Bhutan with recurrent catastrophic glacial lake outburst floods. This work comprises the first quaternary insights into a unique glaciated landscape of the Himalaya Range, hitherto only described by A. Gansser (1983).

A succession of Pleistocene to Holocene moraine-complexes and ice marginal deposits excellently documents the decay of a huge ice stream net and thus the transition from glacial to interglacial climatic conditions in the Lunana area.

As remnants of Pleistocene glaciation an erosional trimline, thick sequences of lodgement till and huge lateral moraines, raising 500 m above the valley bottom, are preserved. The process of oversteepening valley slopes by carving Pleistocene ice flow leads to impressive U-shaped valley geometries.

A loess covered terminal moraine complex at an altitude of 4100 m asl. has been interpreted as a Late Glacial stage (THANZA STAGE). A glacier advance of 19 km (relative to the watershed boundary) is accompanied by an approximate ELA – depression of 300 m (relative to the recent situation). Ongoing OSL dating of this Pleistocene remnant will help to understand the timing and spacing of local glacier fluctuations, thus revealing the climatic change for this part of the Eastern Himalaya at the Pleistocene/Holocene transition.

The Holocene and Neoglacial moraines are restricted to the recent glaciers. The Raphstreng glacier shows particularly well developed multiple terminal moraines and multigenetic lateral moraines, indicating repeated glacier advance and decay at the scale of a few

kilometers during the last 10 000 years. Special attention has been paid to the multigenetic Holocene lateral moraines. Their formation is characterized by dumping of supraglacial debris with each glacier advance. Ongoing ¹⁴C dating of buried paleo-soils within these lateral moraines and in similar stratigraphic positions could help to reconstruct Holocene glacier fluctuations in detail.

Since the Little Ice Age, continuous vertical ablation of the glacier tongues occurred, since 1950 supraglacial lakes merge together and glacier tongues start retreating with rates up to 20 m per year. Time series analysis based on high resolution satellite images and field observations were carried out for a better quantification of this rapid glacier decay. Thus the retreat of the glaciers from their Neoglacial maxima provides insights into the glacial geological processes and the remarkable recent climatic change.

The „Glacier Elevation Index“, as a proper approximation of the Equilibrium Line Altitude, was calculated for each glacier resulting in an average altitude of 5300 m for Lunana. This strongly depressed value compared to the Western Himalaya (e.g. Mount Everest region 5550 m) may reveal the more humid climatic conditions in northwest Bhutan. The occurrence of a probably active rock glacier marks the lower limit of recent permafrost at 4700 m a.s.l.

Gansser, A., 1983: *Geology of the Bhutan Himalaya: Denkschrift Schweiz. Naturforsch. Ges.*, 96, 1-181.

Palaeoecological, amphibianfaunal comparisons between the localities Richardhof and Götzendorf/Miocene of the Vienna Basin

P.M. Miklas

Natural History Museum, Vienna, Austria

Richardhof and Götzendorf/Sandberg, Upper Miocene localities of the Southern Vienna Basin, Lower Austria,

both belong to the Neogene Mammal Zone MN 9. While Götzendorf/Sandberg can precisely be classified into the