



Morphology, sedimentology and stratigraphic implication of debris-covered glacier deposits from the LGM and Lateglacial (Eastern Alps, Austria)

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Understanding the genesis of Quaternary sediments is crucial for establishing a climato-stratigraphy and, further on, to infer paleoclimatic conditions, if possible. Especially diamictons in the high-mountain environment may be formed by variety of processes, i.e. glacial, periglacial and gravitational. On the other hand, the interpretation of morphological features might be ambiguous as for example ridges may document latero-frontal dump moraines, flow of a rock avalanche event or constituents of a rock-glacier.

In addition, equilibrium line altitudes (ELAs) of paleo-glaciers are mostly based on calculations using the reconstructed glacier size and applying a more or less fixed accumulation area ration (e.g. AAR - method). However, such ELAs are of no use for stratigraphic correlations and climatic considerations, if the former glacial system was strongly influenced by supraglacial debris deriving from steep back walls of cirques.

We present two examples of reconstructed debris-covered or more specifically debris-mantled paleo-glaciers, their geological and morphological setting as well as their documented sedimentology and morphology.

The first example is from the easternmost part of the European Alps (Northern Calcareous Alps / Schneeberg mountains / Puchberg) where an up to 60 m high moraine systems of LGM age shows some striking morphological similarities with relict rock glacier. However, based especially on lithofacies analyses as well as on the lithology of the matrix a glacial genesis could be proven.

Lateglacial glacier deposits from the interior of the Alps (Lienz Dolomites / area of Karlsbader Hütte) display a quite similar glacial system. The geometry of the deposits in relation to proglacial sturzstrom sediments, showing typical indications of dynamic fragmentation, and the amount of angular, passively transported clasts in the till point to a rock avalanche event which had hit the glacier surface during a glacier advance. As the glacial system shows the morphostratigraphic characteristics of Younger Dryas (Egesen) stadial with multiple, sharp crested moraine ridges (e.g. Ivy-Ochs et al. 2008), the unusual large glacier extent is due to the rock avalanche debris cover and its insulating effect.

In both cases the maximum elevation of lateral moraines (MELM - method) gave the most reliable estimates of ELAs with reconstructed low AARs of around 0.5 compared to the standard assumption for Lateglacial glaciers with a ratio around 0.65. Thus, stratigraphic correlations of moraines should be done not until morphological features and lithofacies have been analyzed considering the whole geological setting.

Ivy-Ochs, S., Kerschner, H., Reuther, A., Preusser, F., Heine, K., Maisch, M., Kubik, P.W. and Ch. Schlüchter (2008): Chronology of the last glacial cycle in the Northern European Alps. Journal of Quaternary Science 23(6-7), 559-573.