



A new rock glacier inventory at the eastern margin of the European Alps

Andreas Kellerer-Pirklbauer, Gerhard Karl Lieb, and Harald Kleinferchner

Institute of Geography and Regional Science, University of Graz, Austria (corresponding author: andreas.kellerer@uni-graz.at)

During the Last Glacial Maximum/LGM at ca.25-18 cal. ka BP a large interconnected glacier system consisting of ice domes, ice streams and piedmont glaciers covered a substantial part of the Austrian Alps. The eastern part of the Niedere Tauern Range marked the easternmost limit of this interconnected LGM-glacier system within central Austria. Only small local glaciers existed further to the east and large areas in higher elevations experienced periglacial and permafrost conditions even during the LGM. The glaciation pattern during the LGM was caused by the combined topoclimatic effect of a general decrease of mountain heights and lower precipitation amounts (higher continentality) from west to east and, therefore, due to the general decline of potential accumulation areas for glaciers from central to more eastern Austria. In the following Lateglacial period, rock glaciers were able to form earlier in already deglaciated cirques and valley heads in the east of the Niedere Tauern Range compared to the still glaciated cirques further west. This deglaciation pattern combined with harsh periglacial conditions enhancing cryogenic rock weathering during the Lateglacial period allowed the formation of a high number of rock glaciers. Climate warming in the subsequent Holocene period caused permafrost degradation and turned most of these rock glaciers into relict permafrost features. These rock glaciers are currently mapped and analysed by our research group in order to elaborate a rock glacier inventory of central and eastern Austria. The research is carried out within the framework of the EU co-funded project “PermaNET – Permafrost long-term monitoring network”. Our preliminary results from the most important mountainous area at the eastern margin of the European Alps, the Federal Province of Styria, indicate that some 330 rock glaciers with both length and width exceeding 100 metres occur at elevations above 1500 m a.s.l. in Styria. This gives a relatively high rock glacier density value of 13.2 per 100 km². Considering spatial extent, about 1.1% of the total area above 1500 m a.s.l. is covered by rock glacier sediments. About 80% of the rock glaciers are tongue-shaped (length>width) forms whereas about 20% are lobate forms (length<width). By far most of them are located in the Niedere Tauern Range and are relict landforms containing no (or only very little) patches of permafrost. Less than ten rock glaciers might be regarded as intact still containing a notable amount of permafrost. Most of the mapped rock glaciers are monomorphic rock glaciers. However, there are also some with more than two lobe generations along a longitudinal profile possibly related to different rock glacier favourable periods in the past. More than 60% of the rock glaciers are facing towards N, NE or E. The smallest mapped rock glacier covers an area of about 0.006 km² whereas the largest rock glacier is a multiunit or polymorphic rock glacier with a length of 1.8 km, covering an area of 1.23 km², consisting of four distinct lobe generations and hence indicating a long formation period of some thousand years possible spanning most of the Lateglacial period.