



## **Cryo-conditioning of landform and landscape development - suggestions and examples from northern Europe**

Bernd Etzelmueller (1) and Ivar Berthling (2)

(1) University Oslo, Department of Geoscience, Physical Geography Section, Oslo, Norway (bernd.etzelmueller@geo.uio.no),

(2) Department of Geography, Norwegian University of Science and Technology, Trondheim, Norway  
(ivar.berthling@svt.ntnu.no)

Glacial and periglacial geomorphology are distinct subjects within geomorphology. While glacier work relates to processes directly associated to the action of glacier ice, periglacial geomorphology considers freeze-thaw action as the major component. Thus, we can distinguish between specific glacier and periglacial landforms although some landforms may be influenced by both these process regimes. Periglacial landscapes exist only as associations of landforms, not as large scale bedrock topography. There are, however, a multitude of examples clearly showing that the ground thermal regime is a major governing factor modulating fluvial, gravitational and glacial processes rates and thus landform and landscape development. This is especially obvious for areas dominated by seasonal frost and permafrost.

We therefore propose "cryo-conditioning", defined as the interaction of cryotic surface and subsurface thermal regimes and geomorphic processes, as a useful overarching concept to investigate landform and landscape evolution in cold regions (Berthling and Etzelmueller, 2010, in press). By focusing on the controls on processes this concept circumvents scaling problems in analysing long-term landscape evolution from short-term processes.

The presentation will emphasize the development of several key elements in the Norwegian geomorphic landscape that can be explained in terms of cryo-conditioning. This includes cryo-conditioning of glacial land systems, their paraglacial responses, the geomorphic role of block fields and landscape preservation during glaciations and how numerical modelling of ground thermal regime in space and time can be used as an important constraint for Holocene landform evolution.

Berthling, I. & Etzelmueller, B. 2010: The concept of cryo-conditioning in landscape evolution.. Quaternary Research, in press.