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Uniwersytet Łódzki

Inese Grīnbauma* • Kristaps Lamsters

University of Latvia, Riga

E-mail: **i.grinbauma@gmail.com*

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Landforms of the Lubāns ice lobe in the Atzele elevated plain

In this study, a 1 m digital elevation model (DEM) derived from airborne LiDAR data was used to analyse the glacial geomorphology of the Atzele Elevated Plain (AEP), in eastern part of Latvia. The study area is located in the SE sector of the Scandinavian Ice Sheet (SIS) where the Lubāns Ice Lobe (LIL) operated. The glacial geomorphology of the study area provides an excellent opportunity to study subglacial processes and ice streaming/surging.

The aim of this research is to determine morphology, origin, development of glacial landforms in AEP, and reconstruct the dynamics of the LIL. To fulfil this aim, the following objectives were addressed: (1) mapping of glacial landforms; (2) analyses of their morphometric parameters and arrangement.

The geomorphic imprint left by the LIL range form mega-scale glacial lineations (MSGLs) to small transverse geometric ridge network and glacial meltwater landforms (eskers, meltwater channels and tunnel valleys). Geomorphological mapping revealed 216 streamlined bedforms, many of which were identified mostly in the northern part of the study area. They have NE–SW orientation indicating the LIL flow direction. Majority of MSGLs are segmented indicating postglacial fluvial erosion. The mean length of the separate segments is 2 km (max 20 km), height – 5 m and width – 580 m. MSGLs are superimposed by low–amplitude transverse ridges, which are interpreted as crevasse squeeze ridges (CSRs).

In the central part of the study area, CRSs (~4903) have orientation mainly perpendicular and oblique to the ice flow direction. Individual segments are between 0,5 m and 13 m (mean – 1,52 m) high, 10 m – 550 m (mean 151 m) long and 8 – 155 m wide. Also, prominent ridges with 'zig-zag' appearance have been observed.

The landform assemblage provides the evidence of the surging behaviour of the LIL in the AEP during the deglaciation. CSRs in the AEP were likely produced by till squeezing upwards into basal crevasses when the deformable sediments (subglacial till) were saturated either during or immediately after a surge. Thus, the CSRs imprint in paleo--glaciated terrain can be used as indicator of surge behaviour in paleoglaciological reconstructions. Eskers and tunnel valley systems give clue to understanding how large subglacial meltwater drainage operated under LIL.