

LiDAR-based mapping of the variable subglacial geomorphology in the central part of SIS

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An airborne LiDAR (Light Detection And Ranging) based glaciomorphological mapping has revealed new data for the morphological interpretation in the central part of the last glaciated terrain of the Scandinavian Ice Sheet (SIS). The on-going mapping project of the Geological Survey of Finland supported by the work done in the universities in Finland can be used in an examination of landscape development and glaciodynamic themes in the glaciated terrain. The mapping process combines the main geological unit (deposit) and new, landsystems-based glacial geomorphological feature information (Putkinen et al., 2017). So far, the interpretation has been focused in the areas of active ice lobes in central and northern Finland. In those areas previously detected large mega-scale glacial features, such as mega flutings, drumlins, end moraine complexes and glacial melt water systems show up in LiDAR-based digital elevation models (DEM) in greater detail than ever before. This has led to a new definition of the landform categories for supporting the mapping and creating the database (Putkinen et al., 2017).

Here we present new LiDAR-based mapping results (of the project funded by the K.H. Renlund's Foundation) close to the Late Weichselian ice-divide zone, in the central part of the Scandinavian Ice Sheet (SIS) in Finnish Lapland. The area is mostly dominated by the passive-ice, basal till cover without an indication of significant ice movement. However, on both sides of the ice divide zone, there are some narrow areas having well-formed drumlin fields and onset areas for active ice lobes; Salla Ice lobe towards SE and Inari Ice Lobe towards NE. Further on south, the glacial morphology is composed mainly of moraine morphologies such as the glacial streamlined lineations of the Kuusamo drumlin field in the eastern part and different hummocky and ribbed moraines in the western part, i.e. at the core of the Kuusamo Ice Lobe. The drumlin field was formed under surging type glacial movement during the Younger Dryas while the core part of the glacier remained cold-based. Glaciofluvial deposits (eskers and delta formations) occur in places representing the last melting phase of SIS. Particularly, the ribbed moraines represent the depositional formations formed under subglacial conditions at the transitional zone between the warm- and cold-based glacier. However, new LiDAR-based mapping showed that large areas in eastern Finnish Lapland are rich in Pulju moraine type ring-ridges and hummocks, overlapping the drumlin ridges. In addition, small end moraine ridges occur in close connection to the ring-ridges, which indicate the formation of this moraine association in the marginal zone of glacier during the late phase of last deglaciation. Presence of deep pre-glacial weathered crust and tor formation are the evidence of repeated, prevailed passive and cold-based subglacial condition through the Quaternary.

References

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