

LiDAR-based geomorphological mapping and Quaternary stratigraphy in the Sodankylä region, northern Finland

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The high resolution of LiDAR-derived Digital Elevation Models (DEMs) has improved the mapping process by clarifying interpretation of densely forested areas and allowing the identification of fine-scale land surface features not originally distinguished in the aerial photos and in the field. Such geomorphologies include low-relief features on top of moraine hills. The Geological Survey of Finland (GTK) carried out geomorphological mapping in 2013-2014 in the Sodankylä region of northern Finland. The mapping process was supported by the Quaternary stratigraphical and geochronological works.

Geomorphological mapping was based on an aerial LiDAR analysis supported by field observations, ground penetrating radar measurements and test pit surveys in a glaciogenic environment. The mapping area covered about 370 km², with the LiDAR data having a pixel size of 2 m x 2 m and vertical resolution 0.3 m. The geomorphology of the area consists of large till-covered hills, ground moraine plains, glaciofluvial sand and gravel deposits composed of esker systems and related delta and outwash formations of the Weichselian cold stages, followed by pro-glacial glaciolacustric and post-glacial lacustric and fluvial sand/silt deposits. Large areas in low land areas are covered by Holocene mires.

The study proved that the benefit of LiDAR data compared with traditional interpretation methods was in more detailed identification of surface deposits particularly in densely forested areas. This is an advantage, for example, in the case of till-covered stratified sand and gravel deposits, and in shallow till areas where the LiDAR interpretation provides more precise edging of the morphologies. As an example, based on the LiDAR mapping it was possible to distinguish several till-covered delta and sandur deposits which based on OSL dating date back to the Early Weichselian stadial (74-89 ka).