A high resolution LiDAR DEM and field investigations of Weichselian ice flow patterns in the Ice Divide zone of Central Finnish Lapland

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The Weichselian depositional history in Lapland is a result of unusual preservation of strata from consecutive glacial and non-glacial climate events offering a promising but still inadequately known window to climate history of the core area occupied by the Scandinavian Ice Sheet. In eastern and western Lapland, three distinct till units, interpreted as corresponding Early, Middle and Late Weichselian glacial events, have been observed. However, the central Finnish Lapland ice divide zone lacks sedimentary record from the Middle Weichselian glacial advance.

In this study, known features indicating ice flow directions such as till fabrics, eskers and lateral moraines were compiled in a GIS environment to study ice flow patterns within the Central Finnish Lapland ice divide zone. Additionally, 2-meter-resolution hillshaded LiDAR DEM and DEM 25 m were used to identify streamlined features indicating glacial movements. These observations were combined with OSL age determinations and field observations on Weichselian sedimentary sequences in Sodankylä area, located in the central part of the ice divide zone.

New evidence from the till fabrics and OSL age determinations indicate three glacial advances in the Sodankylä area. One of the ice advances was dated to Middle Weichselian, with the till fabric indicating a glacier flow from NNE. The DEMs of the same area, in turn, lack any lineations and overridden sediment mounds. These features indicate a local cold based and sluggish ice-flow setting for the investigated area in Sodankylä. Streamlined directed patterns are visible ca. 20 kilometers eastwards and ca. 30 kilometers westward.

Unlike in the ice divide zone in the Sodankylä area, the DEMs in western Finnish Lapland show well-developed streamlined features including crag and tail like pattern, as well as overridden and streamlined mounds and eskers. In eastern Finnish Lapland, the bedrock dominates the topography, and therefore the streamlined features are less pronounced. However, ice flow directions can be detected from the orientation of the esker chains and ribbed moraine fields in river valleys.