Deglaciation history and subsequent lake dynamics in the Siljan region, south-central Sweden - LiDAR evidence and sediment records

Möller, Per; Björck, Svante; Dowling, T.P.F.; Hammarlund, Dan; Jakobsson, Martin; Ljung, Karl; Lund, Martin; Paradeisis-Stathis, Savvas

2024

Document Version:
Publisher's PDF, also known as Version of record

Deglaciation history and subsequent lake dynamics in the Siljan region, south-central Sweden - LiDAR evidence and sediment records

Per Möller[a], Svante Björck[a†], Thomas P.F. Dowling[b], Dan Hammarlund[a], Martin Jakobsson[c], Karl Ljung[a], Martin Lund[d], Savvas Paradeisis-Stathis[e]

[a]Department of Geology/ Quaternary Sciences, Lund University, Sweden (per.moller@geol.lu.se); [b]School of Environment, University of Auckland, New Zealand; [c]Department of Geological Sciences, Stockholm University, Sweden; [d]Department of Geosciences, University of Oslo, Norway, [e]Department of Crop, Soil, and Environmental Sciences, Auburn University, USA

The Siljan region hosts Europe´s largest impact structure. The high-relief landscape, with a central granite dome bordered by lake basins, contains an array of glacial and shore-level landforms. We investigated its deglaciation history by mapping and analysing landforms on high resolution LiDAR-based Digital Surface Models coupled with well-dated sediment successions from peat and lake sediment cores. The granite dome and bordering areas are characterized by streamlined terrain and ribbed moraine with a streamlined overprint. These suggest an ice-flow direction from NNW with wet-based thermal conditions prior to deglaciation. During its retreat, the ice sheet was split into thinner plateau ice and thicker basin ice. Sets of low-gradient glaciofluvial erosion channels suggest intense ice-lateral meltwater drainage across gradually ice-freed slopes, while 'down-the-slope' erosion channels and eskers show meltwater drainage from stagnated plateau ice. Thick basin ice receded with a subaqueous margin across the deep Siljan–Orsasjön Basin c. 10,700–10,500 cal. BP. During ice recession the ingression of the Baltic Ancylus Lake led to diachronous formation of highest shoreline marks, from ~207 m in the south to ~220 m a.s.l. in the north. Differential uplift resulted in shallowing of the water body, which led to the isolation of the Siljan–Orsasjön Basin from the Baltic Basin at c. 9800 cal. BP. The post-isolation water body – the ‘Ancient Lake Siljan' – was drained through the ancient Åkerö Channel with a water level at 168–169 m a.s.l. during c. 1000 years. A later rerouting of the outlet to the present course was initiated at c. 8800 cal. BP, which led to a lake-level lowering of 6–7 m to today’s level of Lake Siljan (~162 m a.s.l.). This study shows the strength of an integrated methodological approach for deciphering the evolution of a complex landscape, combining highly resolved geomorphological analysis with well-dated sediment successions.