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Lake floor morphology, sediment architecture, and patterns of sedimentation in Lake Torneträsk, northern Sweden

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Lake Torneträsk (68°29' - 68°11'N, 20°01' - 18°36'E; 341 m a.s.l.) is c. 70 km long (NW-SE), c. 10 km wide (SW-NE), with a maximum depth of >180 m, and with a surface area of 332 km2, making it Sweden's seventh largest lake. The lake is hosted by a NW-SE trending depression, which was formed by glacial scouring into Caledonian nappes and Archean crystalline basement. Several small streams, draining a confined but geologically and ecologically diverse catchment, feed Lake Torneträsk, primarily during the short spring/summer melt season and heavy rainfall events. Although Lake Torneträsk's catchment has been subject to numerous studies aimed at delivering a better understanding of modern processes and paleoenvironments, the lake itself remained widely unstudied.

In July 2011 we conducted the first hydroacoustic survey at Lake Torneträsk. In total >150 km of profiles were collected providing insights into the lake's bottom morphology, sediment architecture, and sediment accumulation patterns. Features of glacial scouring appear well preserved and are widely uncovered by sediments in the large W-basin of Lake Torneträsk. The remainder of the lacustrine subsurface exhibits a broad variety of well-preserved formations from glacial accumulation processes. Deposition of glaciolacustrine and lacustrine sediments is focused in areas situated in proximity to major inlets. Sediment accumulation in central parts of the lake is either seldom above 2 m, or is not observable. We assume that lack of sediment deposition in the lake is a result of different factors including low rates of erosion in the catchment, a previously high lake level leading to deposition of sediments in higher elevated paleodeltas, tributaries carrying low suspension loads as a result of sediment trapping in upstream lakes, and an overall low productivity in the lake.

Based on the results from the hydroacoustic survey, we piston cored four long (6.3, 4.5, 2.8, 2 mblf) sediment successions from two sites situated in close proximity to the major inlets, the W-basin, and the SE-basin of Lake Torneträsk in April 2012. Analyses on the piston cores are still ongoing. Initial results from piston cores collected in the central parts of the sub-basins support the findings from the hydroacoustic survey of very low glaciolacustrine and lacustrine sediment accumulation rates in Lake Torneträsk. Piston cores from sites in close proximity to the major inlets reveal higher sedimentation rates, primarily as a result of the frequent occurrence of cm-thick flood layers. These flood layers are, based on modern observations (Jonasson & Nyberg 1998; Andrén et al. 2002), thought to be related to exceptional summer rainstorm events.

References:

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