

Abstract

Lake Neuchâtel, located at the foothills of the Jura Mountains in Western Switzerland, is one of the numerous perialpine lakes on the Swiss Plateau. It overlies a SW–NE trending paleovalley eroded during Quaternary glaciations through a branch of the Rhône Glacier extending northeastwards over the Swiss Plateau. This paleovalley, cut into Molasse siliciclastics and accessorially Mesozoic carbonates, was filled by late Quaternary sediments.

A grid of high-resolution seismic profiles (5-inch³ and 1-inch³ airguns) images at lake-scale the up to 200 m thick sedimentary sequence down to the bedrock. The latter is locally affected by a major strike-slip fault zone (La Lance) that has influenced glacial erosion. The infill consists of four seismic stratigraphic units (Units U1–U4), the shallowest two being subdivided into three subunits each (U3a,b,c and U4a,b,c). Units U1 and U2 are directly related to the Rhône Glacier and Jura Ice Cap activity. Unit U1 corresponds to acoustically chaotic subglacial deposits interpreted as tills (and locally eskers) and is associated to the Last Glacial Maximum (Würm Glacial Maximum, WGM) and probably to the beginning of deglaciation of the Rhône Glacier and Jura Ice Cap. Unit U2 is restricted to the central axis of the glacial paleovalley and reaches a thickness of over 100 m at some places. Its dominantly transparent seismic facies is interpreted as pro- to subglacio-lacustrine fine sediments deposited during the main phase of deglaciation. In the southern part of the lake, higher acoustic amplitudes indicate more compacted, coarser sediments forming a mound structure, interpreted as moraine deposits. This moraine facies points to phases of Rhône Glacier readvances during Unit U2, as seen in other perialpine lakes. With its continuous and subparallel reflections, Subunit U3a marks the beginning of a glacio-lacustrine, and later, lacustrine environment. Subunit U3a extends over the whole lake and contains two more localized subunits (U3b and U3c) displaying prograding and downlapping reflections, as well as signatures of mass transport deposits. These two subunits are interpreted as deltaic sequences from the La Mentue (Subunit U3b) and Areuse (Subunit U3c) tributary rivers. The base of these sequences marks the synchronous onset of a major melting phase in respectively the Rhône Glacier and Jura Ice Cap. Correlation with previously obtained core data indicates that the lower part of Unit U3 most certainly dates back to the Oldest Dryas and that the U3 depositional processes lasted at least until the end of the Younger Dryas and possibly until the Boreal biozone. By contrast with the deltaic seismofacies of the Mentue River (Subunit U3b), which stops close to the base of Subunit U4a, the Areuse River deltaic unit (Subunit U3c) continues to build up as Subunit U4c deposited synchronously with subunits U4a and U4b, probably because of the larger size, higher altitude and partly glacial nature of the catchment area of the Areuse River. Subunits U4a and U4b, with continuous and subparallel seismic reflections extending over the whole lake, are interpreted as lacustrine sequences. Correlation with previously collected sediment cores in Lake Neuchâtel and similar deposits in Lake Annecy dates the onset of lacustrine sedimentation sometimes between the end of the Younger Dryas and the Boreal biozones.

This reconstruction of Lake Neuchâtel seismic stratigraphic infill, partly correlated with sediment data, sheds new light on the history of the northeastern branch of the Rhône Glacier and Jura Ice Cap deglaciation. In particular, it highlights the synchronous onset of clastic sediment input due to massive meltwater inflow from the two ice masses, leading to the formation of deltaic sequences during the Lateglacial.