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Lake Biel Holocene sediment record before and after the Aare river deviation (1878 AD)

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Lake sediments are excellent archives of environmental and climate changes as well as human impact on lake- and river-systems. Lake Biel is a medium-sized peri-alpine lake in Switzerland, with a maximum depth of 74 m, and lies at an altitude of 429 m a.s.l. Lake Biel, which formed during the Pleistocene by glacial erosion, is part of the Aare river system. Our study focuses on the south-west part of the lake basin where the lake sedimentation was originally (i.e. naturally) mainly controlled by autochthonous sedimentation. This area is currently under a strong influence of water and sediment input from this river catchment since the Aare river deviation through the Hagneck canal in 1878.

A 10.05 m long composite sediment sequence, cored from a 52 m water depth in September 2011, was built from two long cores retrieved with the ETH Zurich/Eawag Uwitec system. A radiocarbon age model indicates that the retrieved sedimentary sequence spans the last 7500 years. The upper sediments were correlated to previous short core radionuclide stratigraphy for the 1.5 m upper part (Thevenon et al., 2013). Magnetic susceptibility and density were measured by Geotek MultiSensor Core Logger at 0.5 cm resolution. Granulometry was measured with a CILAS grain sizer every 10 cm, and X-ray fluorescence (XRF) was carried out using an Avaatech core scanner at 1-cm resolution. This technique provides semi-quantitative information of the sediment elemental composition and shows how runoff and river input (Ti, Al, Si) or redox conditions (Fe/Mn) vary through time.

Lake Biel sediment record suggests marked environmental changes with runoff decrease linked to climate and vegetation change during Atlantic chronobiozone, as well as a complex climate-human impact during the ‘La Tène’ and Roman cultural times. The most prominent recorded feature is the 10-times increase of sediment rate that occurred after the Aare river deviation through the Hagneck canal into Lake Biel in 1878. This artificial new river input is also linked to a massive and sudden Ti increase, and inversely abrupt Ca decrease in XRF data. This record reveals the significant alteration in the sediment dynamics, and the lake oxygenation changes that the lake experienced when it shifted from a relatively closed basin to a river and delta-influenced basin.

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Reference

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