Holocene climate and erosion history as recorded in the annually laminated sedimentary record of Lake Brienz

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Introduction:

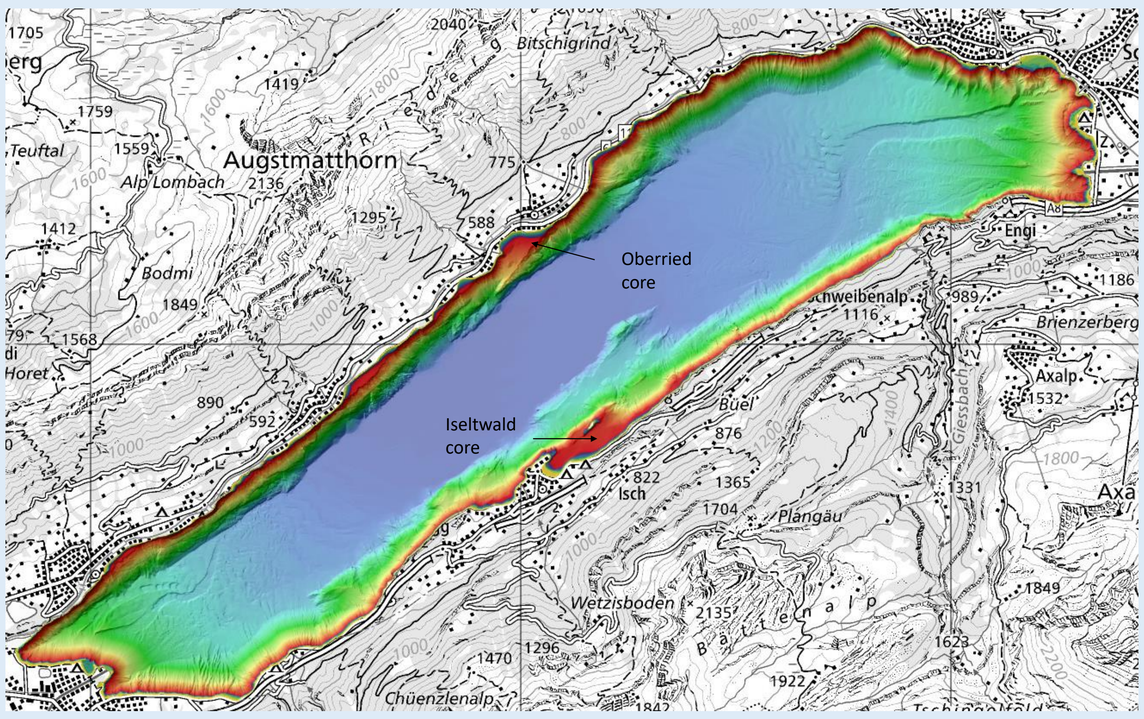
Lake Brienz is situated in the Bernese Alps and has two main inflows providing sediment inputs (The Aare and Lütschine rivers). Its biologic production in the water column is relatively low compared to other lakes due to a scarcity of nutrients. This results in an undisturbed lake floor, which can lead to warved sedimentation, in particular on the shallow slake shoulders that do not receive the direct delta-derived coarse clastic input. To reconstruct the climate and erosion history two drill cores have been taken.

Goals:

- Get a high temporal resolution of climate and erosion of the catchment area of lake Brienz.
- Show the differences between two very similar underwater plateaus and their different input.
- Look at the anthropogenic influence on particle flux made by the hydroelectrical dams

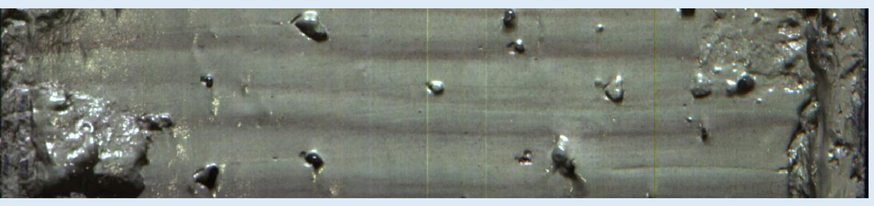
Methods:

- Retrieving two cores
- MSCL-scanning
- Line-scanning
- Varve identification and counting
- Sedimentologic description
- C14 dating
- XRF scanning

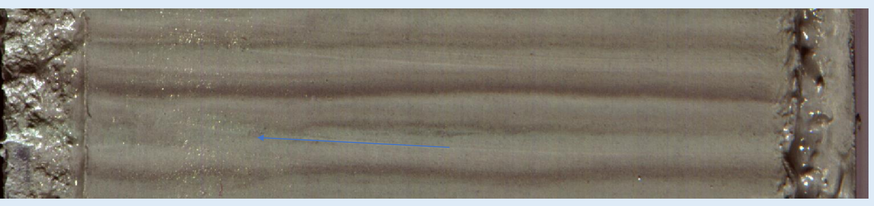


Bathymetric map of Lake Brienz
With the two coring locations

Coring platform Helvetia at the Iseltwald drill site



Detailed scan from the Oberried Shortcore



Detailed scan from the Iseltwald Shortcore

Close ups:
Those two pictures above are close-ups of the respective short cores on the right (Oberried on top and Iseltwald below). The green color on the Oberried core is an artifact of the scan process, as the two cores share a similar colour. The darker layers represent the summer months with more biogenic particles Even though they are very similar, the warves in the Iseltwald-core are sharper and less disturbed than their counterparts from Oberried.

Lake Brienz:

Lake Brienz is one of the larger Alpine lakes in Switzerland, with an area of 29.9 km2. It is located between Brienz and Interlaken at 564 m.a.s.l and measures 261 m at its deepest point. Two main channel-dominated deltas (one in the northeast and the other one in the southwest) mark the two main sediment inputs in the lake (Fig. x). The rivers Aare and Lütschine both originate high up in the Alps with glacial influence. The catchment of the Aare though is way larger, has a more glacier surface in the catchment. The Aare is strongly used for hydroelectric power whereas the Lütschine is less disturbed from its natural path (relative to the Aare).

Field Work:

Due to an observed counter clockwise water circulation in the lake due to the Coriolis force, it is hypothesized that the two main rivers also deposit preferably their finer-grained part of sediment input at the north or south shore, respectively. Conveniently, there are two shelf-like underwater plateaus. These plateaus both show very low sediment input from their respective shoreline and are such perfectly suited for forming undisturbed laminated warves. These warves, when counted, can be an accurate dating tool and database for the respective catchment. On the left the coring location in Iseltwald is shown.

Cores:

At the end of our 3-day coring campaign, two long sediment cores, consisting of a short core and three or four 3-m long piston cores could be retrieved. The first set sampled offshore Oberried adds up to an accumulated sediment length of 7 m. If calculated with a sedimentation rate of 1.5 mm/a (Vischer 21), the oldest sediment in this core could reach an age of ~4500 years. The second core from the Bay of Iseltwald is much longer with a maximal depth of 10.9 m. Considering the slightly slower sedimentation rate of 1.2 mm/a (Vischer 21), this core might reach an age of ~9000 years. As seen on the right, the warves are clearly visible and sharp in the two short cores, however, partly fade out the deeper sections. At the top of core 9C, one can still see some warves but they fade away when the bottom of the core is reached but nevertheless will provide an annually-resolved look into the past of Lake Brienz paleoenvironment.

Shortcore 1
Top 50cm of the Oberried core

Shortcore 6
First 50cm of the Iseltwald core

Core 9C
Bottom 50cm of the Iseltwald core