Last millenium environmental changes in Lake Bertrand sediments, Chilean Patagonia

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Aim of this study

Our aim is to document the climatic variability during the last millennium in Northern Patagonia and its impact on the environment. This study focuses on the sedimentary records from Lake Bertrand.

Location

Lake Bertrand is located near the Northern Patagonian Ice Field, on the eastern end of the Aisén Cordillera at 227 m a.s.l. (46°55'S 72°50'W). Lake area extends to 89 km², its waterbodies to 380 km². This lake flows north to south from Lago General Carrera to Rio Baker. Lake Bertrand is characterized by a basin drainage on its eastern part. The main lake is separated from a pre-glacial lake (Lago Pinedo) by a morainic barrier in the southwest.

ENE view of Lago Bertrand (blue) and Lago Pinedo (brown)

Geological context

- North and East of the watershed: Eastern Andean Metamorphic Complex, Paleocene (Oligo) - Metamorphosed schists
- Southwest: Lago Pinedo Plutonic Complex, Jurassic (Japp)
- South of the lateral extension: Phyllites silicified Perphyrites, Jurassic (Jap)
- Holocene deposits
- Alluvial, delta and fluvial deposits (Ha, Hal, Hf)
- Muscovesites (Yes)

Material

Cores were retrieved during fieldtrips in 2009 and 2011 with a Uwitec gravity corer. One core was collected in the main lake (LB109, 104 cm) and two others in the lateral extension (LB11-A, 162 cm and LB11-0, 256 cm).

14C data give average sedimentation rates of 2 mm/yr (CFCS model) for the upper core section from the main lake, allowing a decennial resolution. The 210Pb peak suggests a lower sedimentation rate in the upper 5 cm (0.6 mm/yr). Two radiocarbon dates were measured on sediment organic carbon. These glauconite ages span from 1850 BC at 54-05 cm and around 3200 BC at 80-01 cm. These ages suggest that the sedimentation rate changes drastically after the first 20 cm to 0.15-0.2 mm/yr. We applied a reversion offset of 700 years in accordance with N. C. data. Radiocarbon dates of the lake extension are in progress.

LBT09 Discussion

The main sedimentological change observed in Lago Bertrand is related to the two biogenic silica-rich layers. Our temporary age model for Lago Bertrand defines a time period between 799 BC and 1220 AD that includes the two peaks. Similar layers were also recorded in another relatively distant lake (Lago Thamnopolis at 45°36'52" 74°47' W). Then, the two peaks occur between 1430 and 2000 AD, an internal equivalent to the Little Ice Age. The low C/N ratio (25) of Lago Bertrand supports an important aquatic productivity.

LBB11-A Discussion

The more recent sediments (first 30 centimeters), essentially clayed silts, do not record many sedimentological changes. On the other hand, sediments of the core section are less clayed and present centimetric laminations. This variability is well defined in the magnetic susceptibility profile. Organic carbon is relatively high, between 0.5 and 10.5 %.

Future prospects

The identification of glacial advances and their temporal variability in both lake sediments will help to identify the origin of the two silica-rich layers. In addition, further sedimentological analysis of the Lago Bertrand extension is in progress to confirm the sedimentological changes observed in the main lake (C/N, XRD, SIs). If similar peaks or changes appeared, it would allow us to correlate the cores of the two lake parts.

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