

Lake Titicaca Drilling Project

Bolivia/ Peru



Goal & Scientific Objective

The major focus of the Lake Titicaca Drilling Project is on tropical paleoclimatic (including glacial) reconstruction. Secondary goals include recovery of a record of regional Andean volcanic activity and elucidating the tectonic origin of the lake basin. Questions to be addressed include:

What is the nature of climate change in tropical South America during the past 0.5 Ma?

Are there Pleistocene millennial-scale changes in precipitation and temperature such as we have already observed in the Holocene and late glacial record of the lake?

What are the linkages between tropical climate change and global change?

To what extent was the climate of tropical South America affected by changing high-latitude boundary conditions (e.g. glaciation) and global surface temperature changes?

What is the record of volcanic activity in the late Quaternary?

What is the age and nature of seismically-identified basement underlying the late Quaternary sediments at our drill sites?

What is the heat flow at these sites and is there any evidence for deep fluid flow?

Operational Achievements

Seven cores at three locations were drilled using the GLAD 800 drilling platform and coring system.

Over 625 m of mud was recovered from paired overlapping holes. The longest recovered sequence spans 136 m.

Drilling depths range from 53 to 139 m below lake floor at water depths between 40 and 232 m.

Data & Sample Access

Core is stored at the University of Minnesota at Minneapolis, Department of Earth Sciences, National Lacustrine Core Repository (LacCore)

Web & Media Resources

<http://titicaca.icdp-online.org/>

<https://soundwaves.usgs.gov/1999/03/fieldwork.html>

<http://dosecc.com/lake-titicaca/>

Timeline

2000 ICDP proposal submission

2001 (April – May) drilling operation

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GLAD800 drilling platform on Lake Titicaca.

Scientific Findings

594 m of drill core have been recovered from seven boreholes at three sites. The longest recovered sequence consists of alternations between two primary lithologic units, indicative of four major glacial stages and the intervening interglacials.

A chronology based on radiocarbon, U-series ages on aragonite laminae, and tuning to the Vostok CO₂ record suggests that the drilled sequence extends over approximately the last 370,000 years.

Extrapolation of the radiocarbon chronology suggests that the most recent period of ice expansion in the cordillera surrounding the lake began approximately 60,000 ¹⁴C yr BP, following a major dry interval. A series of U-series dates on discrete aragonite layers suggests that the penultimate low stand of Lake Titicaca, rather than dating to the last summer solar minimum (~32,000 yr BP), is coincident with MIS5e, the penultimate interglacial stage (~125,000 yr BP).

In summary, the water balance of the lake is as strongly influenced by global-scale (an tropical) temperature changes and boundary conditions as by precession forcing of the South American summer monsoon.

Key Publications

Fritz, S.C., P.A. Baker, G.O. Seltzer, A. Ballantyne, P. Tapia, H. Cheng, R.L. Edwards. 2007. Quaternary glaciation and hydrologic variation in the South American tropics as reconstructed from the Lake Titicaca drilling project. *Quaternary Research* 68: 410-420.