Timing and Climatic Conditions at the Last Glacial-Interglacial Transition in the Tropical Andes

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Maximum late-Pleistocene glaciation in the tropics was associated with an ~800 to 1000 m elevation decrease in glacier equilibrium-line altitudes and a 4° to 6°C reduction in mean annual temperature (Klein et al., 1999; Hostetler and Clark, in press; Porter, in press). The timing of the last glacial maximum (LGM) in the tropics remains uncertain, which makes for equivocal comparisons among proxies of climate change in tropical and extratropical regions. However, the magnitude and timing of climatic change in the tropics at the LGM are important for our understanding of the driving mechanisms for glacial-interglacial cycles on a global scale (e.g. Broecker, 1997; Hostetler and Mix, 1999). The high and relatively dry environments where most tropical glaciers are found provide little organic material for direct radiocarbon dating of glacial moraines. Here we present the stratigraphy from two Andean lakes located beyond the glacial limit that provide a record of the LGM in the tropics. The magnetic susceptibility (MS) and total organic carbon (TOC) profiles in a sediment core from Lake Junin (11°S, 4100 m) indicate that maximum glaciation occurred between 30,000 and 22,000 cal yr BP (calendar years before present). Magnetic susceptibility profiles from piston cores from Lake Titicaca (16°S, 3810 m) show an abrupt end to maximum glaciation 18-20,000 cal yr BP (Figure 1). Diatom stratigraphy indicates that deep and overflowing conditions persisted at least until 16,000 cal yr BP at Lake Junin and 15,000 cal yr BP at Lake Titicaca. Thus the end of the LGM in the tropical Andes occurred amid relatively wet climatic conditions, which indicates that warmer atmospheric temperatures and an increase in summer insolation must have been the triggers for deglaciation in the tropical Andes.

Broecker, W. S., 1997, Mountain glaciers: Recorders of atmospheric water vapor content?: Global Biogeochemical Cycles, v. 11, no. 4, p. 589-597.

Hostetler, S. W., and Clark, P. U., in press, Tropical Climate at the Last Glacial Maximum Inferred from Glacier Mass-Balance Modeling. Science.

Hostetler, S. W., and Mix, A. C., 1999, Reassessment of ice-age cooling of the tropical ocean and atmosphere: Nature, v. 399, no. 6737, p. 673-676.

Klein, A. G., Seltzer, G. O., and Isacks, B. L., 1999, Modern and Last Glacial Maximum Snowlines in the Central Andes of Peru, Bolivia, and Northern Chile: Quaternary Science Reviews, v. 18, p. 63-84.

Porter, S.C., in press, Snowline depression in the tropics during the last glaciation. Quaternary Science Reviews.

Figure 1. Volume magnetic susceptibility of sediment cores from Lake Junin, Peru, and Lake Titicaca, Peru/Bolivia. The triangles indicate the radiocarbon dates used to constrain the age models applied to these records. Deglaciation from the LGM is inferred to have occurred between ca. 18,000 and 22,000 cal yr BP. We expect to constrain further this time interval for the onset of deglaciation as the age models and magnetic susceptibility records are refined for these sites.