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Late Quaternary climate of tropical South America from drilling of Lake Titicaca

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The expansion and contraction of northern continental ice sheets is a fundamental characteristic of the Quaternary period. However, the timing and extent of tropical glaciation is practically unknown for stages prior to the Last Glacial Maximum (LGM). Likewise, the magnitude and timing of hydrologic variation in tropical South America is not known prior to the LGM. Furthermore, the degrees to which glacial and hydrologic mass balances are forced by global temperature change, insolation control of precipitation change, or other extrinsic factors are unknown. In order to address these problems, we have reconstructed the timing of glaciation and lake-level variability in the tropical Andes of South America using drill cores recovered from some of the deepest parts of Lake Titicaca, Bolivia/Peru.

The core (site LT01-2B, 235 m water depth, 136 m total length) strata consist of two main lithotypes: silt-dominated units characterized by high magnetic susceptibility (MS), low organic and inorganic carbon (TOC and TIC) are inter-bedded with laminated units characterized by low MS and high TOC and TIC. The former were deposited during glacial advance in the adjacent cordillera, high lake level, and a deep, fresh, overflowing lake; the latter were deposited during glacial recession, resulting in decreased detrital input, accompanied by lower lake level and increased salinity. There are four major interbeds of these two lithotypes indicating that the core spans four major glacial/interglacial (highstand/lowstand) periods (core chronology is based on radiocarbon, U-series, and tuning to the Vostok CO_2 record)–all four glacial periods in the tropical Andes appear to be synchronous with glacial periods in the high latitudes. Again, similar to high latitudes, there was millennial-scale variability during

the last glacial stage between 20 and 65 kyr BP involving frequent deposition of turbidites, characterized by low biogenic silica concentrations, elevated benthic diatom abundances, high δ^{13}C and C/N ratios, and increased mean grain size. These turbidites may represent distal portions of flood deposits formed by increased precipitation and glacial advance in the cordillera.