

Paleoclimates of the Central Andes

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The tropical Andes contain archives of late Quaternary climate change in lake and wetland sediments, glaciers, rodent middens, and other deposits. The analysis of these records provides a unique perspective on tropical climate change, and a variety of questions can be considered in this context. For example, when did the last glacial maximum (maximum ice volume) occur in the tropics and what were climate conditions at the time? Were there millennial-scale climate changes in tropical South America, such as the Heinrich Events and the Younger Dryas, and how do these changes compare with those at higher latitudes? What was the pacing of El Niño during the Holocene and did this pacing change as a result of forcing from external factors (e.g. seasonal insolation overhead or over remote regions teleconnected with the South American tropics)? These questions and more were discussed by ~50 scientists who attended the workshop.

The workshop was prompted by the wealth of information that is now coming out of South America on tropical paleoclimate from high elevation ice cores, large and small lakes, the Amazon Fan, and the Atacama Desert. In general, the height of the last glacial maximum appears to be coincident with high northern latitudes and conditions were significantly colder (5–6°C lower than today). However, it is still debatable if conditions were wetter or drier throughout the vast region of the Amazon drainage basin and the adjacent Andes. Also, the late Glacial interval remains somewhat enigmatic. Glaciers were in fast retreat during the Younger Dryas, but it is unclear what conditions drove this retreat. It is also clear that many sites on the Altiplano and the eastern flank of the Andes showed relatively warm and dry conditions in the early to middle Holocene. Paradoxically, during the late glacial/early Holocene, sum-



Lullillaco (6739m) standing high above the Altiplano covered with a dusting of snow, but no glacier. In the foreground is the Altiplano, at about 4000 meters above sealevel, which receives only about 200mm of rain annually today. On the left a small "salar" (salt pan) with open water in the center and exposed higher lake level terraces on the right, indicating moister conditions in the past. (for more information see Baker et al. (2001) The History of South American Precipitation for the Past 25,000 years, Science 291:640–643. Photo by Bruno Messerli)

mer precipitation was more than 3 times greater than today on the Pacific slope of the Andes, in the Atacama Desert, according to several proxies. For the middle Holocene, however, the same proxies have been interpreted to show both wet and dry conditions in the Atacama Desert. Resolution of these discrepancies is not trivial, but some of the differences between the Altiplano and the Atacama might lie in the sharp climatic gradients across the region. Finally, the latest Holocene is characterized by neoglaciation and wet conditions on the Altiplano. Variations in climate also appear to have affected prehistoric cultures that may be evident in changing settlement patterns on the Pacific coast and the Andean highlands.

The Andes provide a great diversity of archives from which records of tropical paleoclimate can be derived. The strength of the paleoclimatic analysis from the region may ultimately be the diversity of these records and their geographic distribution. Certainly for tropical South America the Andes will contain some of the best clues for late Pleistocene and Holocene climate change. Further refinement and syn-

thesis of these records could determine the relative phasing and relationship of climate change in the tropics with higher latitude regions on decadal to millennial time scales.

Additional information, including extended abstracts and author contact information, can be found at <http://www.paztcn.wr.usgs.gov/pcaw/>.

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Correction

The brief description of the LUCIFS Project that appears on page 10 of PAGES News Vol.8 No.3 omitted to list the co-author:

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