New clues about ancient water cycles shed light on US deserts

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The deserts of Utah and Nevada have not always been dry. Between 14,000 and 20,000 years ago, when large ice caps covered Canada during the last glacial cooling, valleys throughout the desert southwest filled with water to become large lakes, scientists have long surmised. At their maximum size, the desert lakes covered about a quarter of both Nevada and Utah. Now a team led by a Texas A&M University researcher has found a new water cycle connection between the U.S. southwest and the tropics, and understanding the processes that have brought precipitation to the western U.S. will help scientists better understand how the water cycle might be perturbed in the future.

Mitch Lyle, professor of oceanography, led the study with colleagues from Columbia University, University of California-Santa Cruz, Stanford University, Hokkaido University of Japan, Brown University and the U.S. Geological Survey. Their work, funded by the National Science Foundation, is published in the current issue of *Science* magazine.

The dry shorelines of these glacial lakes were first discovered by 19th century geologists when the west was first explored, Lyle explains, adding that the source of the additional water has been a mystery. By assembling data from ocean sediments and from dry western valleys collected over the last 30 years, Lyle and the team found a new water cycle connection between the southwest U.S. and the tropics.

"Large ice caps profoundly altered where storms went during glacial

periods. Before this study, it was assumed that Pacific winter storms that now track into Washington and Canada were pushed south into central and southern California," Lyle notes.

"However, by comparing timing between wet intervals on the coast, where these storms would first strike, with growth of the inland lakes, we found that they didn't match."

The team was able to time wet periods along the California coast from pollen buried in marine sediments from cores archived by scientists at the Integrated Ocean Drilling Program at Texas A&M. They evaluated lake level studies from southeast Oregon, Nevada, Utah, eastern California, New Mexico, and west Texas to find when lakes filled in different parts of the west.

"Many teams of scientists have been working on this problem since the 1950s, when radiocarbon dating first allowed ages to be put on old shorelines," Lyle adds. "The data we synthesized covers a wide latitude so that we could determine how the glacial wet intervals operated."

Only southern California coastal wet intervals matched with the progression of high lakes inland, pointing to the development of a tropical connection, where storms cycled into the region from the tropical Pacific, west of southern Mexico.

"We think that the extra precipitation may have come in summer, enhancing the now weak summer monsoon in the desert southwest. But we need more information about what season the storms arrived to strengthen this speculation," Lyle says.

Not only is the development of the glacial lakes important from a paleoclimate perspective, but it is likely that the lakes were important to the migration of people into North America, Lyle believes. Many of the

archaeological sites where early Indians settled when they first came into the U.S. are rock shelters at the edges of these ancient lakes. The lakes were a major source of fish, and a gathering place for deer and wildfowl at that time.

"What we need to do now is look at all of this on a finer scale," Lyle points out. "We need to understand better the processes that directed the storms thousands of years ago, and to predict better what changes might occur in the future."

More information: "Out of the Tropics: The Pacific, Great Basin Lakes, and Late Pleistocene Water Cycle in the Western United States," by M. Lyle et al., *Science*, 2012.

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