

Speaking of Science

An ancient lake holds secrets to the Mayan civilization's mysterious collapse, study finds

by **Kate Furby** August 2

The sediment under a lake in Mexico contains some of the long-sought answers to the mystery of the Mayan demise.

[Ancient Mayans](#), primarily concentrated in what is now the Yucatan Peninsula, were among the most advanced civilizations of their time. Mayans were some of the first to build cities. They used astronomy to advance agricultural production, and they created calendars and used advanced mathematics. But despite all of their progress, the Mayan empire, built over thousands of years, [may have crumbled in just a few hundred](#).

Scientists have several theories about why the collapse happened, including deforestation, overpopulation and extreme drought. New research, [published in Science](#) Thursday, focuses on the drought and suggests, for the first time, how extreme it was.

While analyzing sediment under Lake Chichancanab on the Yucatan Peninsula, scientists found a 50 percent decrease in annual precipitation over more than 100 years, from 800 to 1,000 A.D. At times, the study shows, the decrease was as much as 70 percent.

The [drought was previously known](#), but this study is the first to quantify the rainfall, relative humidity and evaporation at that time. It's also the first to combine multiple elemental analyses and modeling to determine the climate record during the Mayan civilization demise.

Matthew Lachniet, a professor of geosciences at the University of Nevada at Las Vegas, who was not involved in the study, said the quantification of the drought is important, because it illustrates the power of natural climate variability alone.

“Humans are affecting climate. We’re making it warmer and it’s projected to become drier in Central America,” Lachniet said. “What we could end up with is double-whammy of drought. If you coincide drying from natural causes with drying from human causes, then it amplifies the strength of that drought.”

The new research analyzed sediment cores, something climate scientists commonly do to determine conditions of the past, using the ancient dirt like a geological time capsule. Each layer of sediment buried deep underground contains evidence of rainfall, temperature and even air pollution. Via chemical processes and interactions, the climate conditions are “recorded” in the surface soil at the time and eventually buried. Scientists can bore a deep core of dirt and carefully analyze it layer by layer, year by year, to reconstruct a timeline.

For this study, scientists painstakingly examined the layers of mud and clay in the cores from under Lake Chichancanab. During dry periods, the lake volume would have shrunk, said Nick Evans, a graduate student studying paleoclimatology at Cambridge University and first author of the study. As the water evaporated, lighter particles would have evaporated first, leaving behind heavier elements.

If the drought was intense and long-lasting, gypsum crystals formed and incorporated existing lake water directly into their structure. The “fossil water” inside the crystals allowed Evans and his co-authors to analyze the properties of the lake water during each period.

“It’s as close as you’ll ever get to sampling water in the past,” Evans said.

The chemical composition of the fossil water indicated periods of drought in the Mayan timeline and revealed how long and intense this particular drought was.

Many theories about the drought triggers exist, but there is no smoking gun some 1,000 years later. The drought coincides with the beginning of the Medieval Warm Period, thought to have been caused by a decrease in volcanic ash in the atmosphere and an increase in solar activity. [Previous studies](#) have shown that the Mayans’ deforestation may have also contributed. Deforestation tends to decrease the amount of moisture and destabilize the soil. Additional theories for the cause of the drought include changes to the atmospheric circulation and decline in tropical cyclone frequency, Evans said.

Evans and his team hope their research will help archaeologists understand how the ancient drought may have impacted Mayan agriculture at a critical time in their history.

Currently, vast areas of North America, northern Africa, the Middle East, Southwest Asia and most of Australia are in significant drought, according to the National Oceanic and Atmospheric Administration's [Global Drought Information System](#). Sociopolitical research suggests that drought may cause [war, famine and large human migrations](#). And many countries affected [lack the resources to cope](#).

“Drought does have the potential to be a driving force for a lot of the issues that can cause civilization stress,” Evans said. He noted, though, that today's globalized economy and modern technology have the potential to prevent a Mayan-style, world-ending drought. Probably.

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