

# Research reveals water management and climate change in ancient Maya city

20 February 2012, By Dawn Fuller

(PhysOrg.com) -- Meticulous mapping and excavations at an ancient cave in the Yucatan Peninsula are revealing the vitality of the site to the ancient Maya - for both religious ritual and human survival. The University of Cincinnati research will be a key topic of discussion on Feb. 24, at the annual meeting of the Association of American Geographers in New York.

The [city](#) is located in the elevated Puuc Region of the Yucatan in Mexico. The city - featuring a great pyramid and other elaborate architecture - was built above one of the few [cave](#) systems in the region that penetrates the permanent water table. Mapping and excavations of the ancient city revealed a network of cisterns and reservoirs that fed the community's water supply. The cave exploration has discovered hills of broken pottery and charred sacrifices, also indicating the cave was a key religious site that involved worship of the rain gods.

Researcher Nicholas Dunning, a UC professor of geography, says the cave, located in the ancient ruins of the city of Xcoch, was used continuously from at least 800 BC until the 19th century, when it was still used for rituals. UC geography doctoral student Eric Weaver has led a team mapping Xcoch Cave, assisted by other experienced cavers including UC biology graduate students Beth Cortright and Jane Slater.

"This is in a region that has no surface water," says Dunning. "There are only a handful of caves that go deep enough to get to the permanent water table, so for anyplace that's bone dry for five months out of the year, this is a pretty special location."

Two large reservoirs are located in the middle of the city - next to the monumental architecture - and the smaller reservoirs and cisterns extend into the residential area and surrounding farm land.

Dunning says the area was by far the largest city in the region during the Preclassic Period around 800 BC to 100 AD, but adds that there are significant signs the city was abandoned between 100 AD and 300 AD, most likely due to drought.

"The Maya built a stairway to the cave entrance that we have to crawl in to enter and look for stalagmites - cave formations," says Dunning. "Since this is a seasonal climate, the stalagmites act in the way that tree rings do - recording the rainfall - because they only grow during a part of the year when there's rain."

The field work is far from glamorous. Entering the deep cave involves a good deal of crawling through long, narrow tunnels. The summer expeditions also involve working in hot, humid temperatures that can rise as high as 105 degrees. "The oxygen content is so low, you can't even light a match," says Dunning.

"We found all kinds of broken pottery," Dunning says. "The Maya 'sacrificed' pottery by putting materials in it, then ritually killing it, as a means of releasing its essence, or to receive blessings from the rain gods with their sacrifices," Dunning says. Human and animal remains were also found, but researchers are still exploring whether those remains were sacrifices or burials.

Authors on the paper include Dunning, Xcoch project director Michael Smyth, an anthropological archaeologist for The Foundation for Americas Research, Eric Weaver and Philip van Beynen, professor of geography and environmental science at the University of South Florida.

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The Association of American Geographers (AAG) is

a nonprofit scientific and educational society founded in 1904. For a century, the AAG has contributed to the advancement of geography. Its members from more than 60 countries share interests in the theory, methods and practice of geography.

Provided by University of Cincinnati

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