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NEWS FOCUS

PALEOCLIMATE:
A Variable Sun and the Maya Collapse

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A record of drought from the bottom of Yucatán lakes suggests that an inconstant sun may have helped drag down the mighty Maya

Tackling a touchy question outside the mainstream of opinion usually gives a scientist pause. But on page 1367 of this issue paleoclimatologist David Hodell and his colleagues take on two touchy subjects at once. They argue that subtle variations in the sun's brightness helped trigger a drastic climate change, and that, in turn, played a role in the downfall of a whole civilization. Drawing on a mucky lake-bottom core from the Yucatán Peninsula, home to ancient Mayas, they confirm that the area's worst drought in many millennia struck just as Maya civilization began its accelerating decline. That drought was only one of many that tended to return every 200 years, in step with and presumably driven by 200-year oscillations in solar activity.

Mayanists are guardedly receptive of the climate-culture connection. The evidence for a major drought "seems pretty compelling," says archaeologist Takeshi Inomata of the University of Arizona in Tucson. "It's quite possible it was a major factor, but I don't think climate itself is the sole factor of Maya collapse." Paleoclimatologists are perhaps more enthusiastic about the sun-climate connection. "The Hodell result adds to a string of recent papers that document the importance of solar variability for climate change," e-mails paleoceanographer Peter deMenocal of Lamont-Doherty Earth Observatory in Palisades, New York, from his research ship exiting the Suez Canal. Tightening such sun-climate-culture connections will take more mucking about in Maya country.

The new record of Maya climate is actually an improved version of one that Hodell, who works at the University of Florida, Gainesville, analyzed in 1995. The new 1.9-meter core came from a different part of Lake Chichancanab in the central Yucatán, a spot where sediment accumulated more rapidly. That allowed analyses as frequent as every 6 or 7 years along the 2600-year-long core. And a greater number of samples

of organic matter could be dated by accelerator mass spectrometry, improving dating. All in all, Hodell extracted a more detailed, more accurately timed chronology of drought in the vicinity of the lake than before, principally through measurements of the varying amount of gypsum--calcium sulfate--deposited on the lake floor. Whenever rainfall decreased, evaporation from the lake would concentrate salts in the lake water and begin precipitation of gypsum.

Sun-struck· The astronomically inclined Maya--this structure marks a solar alignment--may have succumbed to a sun-induced drought

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The new Lake Chichancanab drought record shows just how hard times were for the Maya at the end of their heyday. Droughts of varying intensity and duration pepper the 2600-year record, but its most intense, most prolonged drought runs from about A.D. 750 to 850. In fact, this was the region's worst drought in 7000 years, according to a longer, less detailed record of Hodell's from the same lake. And the megadrought came just as Maya civilization entered its decline, which ran from about A.D. 750 to 900. The decline was measured by the number of sites where people were building the massive temples and stone monuments that typify the Maya Classic Period. "It's hard for me to believe that's just a coincidence," says Hodell. "I think drought did play an important role, but I'm sure there were other factors, such as increasing population, degradation of the land, and sociopolitical change, that interacted. Civilization collapse has got to be complex."

However complex the collapse, its timing may have been a simpler matter to explain. The well-dated, high-resolution Chichancanab record allowed a comparison with solar activity over the same period. In the lake record, drought had a tendency to recur every 208 years on average. Solar activity--including varying sunspot numbers and the brightness of the sun--is recorded in the abundance of cosmic ray-produced radioactive carbon-14 preserved in tree rings. Solar activity also varies in a "bicentennial oscillation" with a period variously reported to be between 206 and 208 years. Comparing records, Hodell found that the bicentennial oscillations in each were in step throughout. Solar variations, therefore, could have triggered the recurring drought, he speculates, conceding that "there have to be other factors involved" to account for the varying intensity of recurring drought.

As might be expected, reaction to the sun-climate-culture connection varies with the specialty. Archaeologists express concerns about how paleoclimatologists view the archaeology, emphasizing that cultural evolution is more complex than talk about a "collapse" might suggest. Rather than a sudden downturn from one end of the Maya

homeland to the other, they say, the collapse began in the wetter southern highlands of Guatemala around A.D. 750. At the same time, the drought was settling over the typically drier northern Yucatán lowlands even as civilization there flourished. Only 100 years later did Classic Maya culture succumb in the drier north. "The biggest problem," says archaeologist Matt E. O'Mansky of Vanderbilt University in Nashville, Tennessee, "is why, in a drought, does the dry area last longer than the wet area·" Physical geographer Timothy Beach of Georgetown University in Washington, D.C., allows that the drought is real enough, and "some people would say it's part of the mix of causes for the collapse."

Paleoclimatologists are loath to meddle in matters of archaeology, but many of them are impressed by the sun-climate connection supported by the Chichancanab record. Given that the drought and solar cycles are in step, "they've made the case as far as I'm concerned," says statistical climatologist Michael Mann of the University of Virginia in Charlottesville. Coincidentally, environmental physicist Ulrich Neff of the Heidelberg Academy of Sciences in Germany and his colleagues make the same case in this week's issue of Nature using a climate record of the Indian Ocean monsoon preserved in a stalagmite from a cave in Oman. They too find a bicentennial climate signal in step with the tree-ring record of solar activity. No cultures collapsed there, but the meteorological setting is much the same as in Mesoamerica. That should go some ways toward making sun-climate a less touchy subject.

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David A. Hodell, Mark Brenner, Jason H. Curtis, and Thomas Guilderson
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