Anthropology

Bruce Bower reports from Atlanta at the annual meeting of the American Anthropological Association

Ups and downs of Yucatán Maya

During the Classic period of Maya civilization, from A.D. 250 to A.D. 900, cities in lowland regions of Mexico, Guatemala, Honduras, and Belize grew in size and amassed much power. Increasing archaeological evidence now suggests that Maya settlements in the west-central Yucatán Peninsula languished for much of that Maya "golden era" but then flourished as centers to the south fell on hard times.

Witness Yaxuna, an ancient Maya settlement in the center of the peninsula. Excavations and pottery analysis indicate that Yaxuna was a sparsely populated "backwater site" at the height of the Classic period, asserts Charles Suhler of Southern Methodist University in Dallas. However, Yaxuna expanded rapidly as the Classic period wound down, holding prominence until A.D. 1000. Military conquest of the city by as-yet-unidentified forces then occurred, Suhler says.

Ceramic evidence places the founding of Yaxuna at around 500 B.C., with the first large buildings appearing by 100 B.C. Extensive construction of monuments and residences kicked off the Classic period, during which Yaxuna maintained trade and political ties to southern Maya cities, as well as to cultures in central Mexico, Suhler contends. From A.D. 600 to A.D. 750, pottery and population dwindled at Yaxuna, he argues. The city bounced back over the next 250 years, based on the reappearance of elaborate pottery and monumental structures.

About the time of Yaxuna's military defeat in A.D. 1000, residents of the city conducted ceremonies in which they destroyed all or part of various structures, notes SMU's David A. Freidel. Little evidence of human activity at Yaxuna has been recovered for the 200 years that followed, he says.

During that period, Maya living in the northern Yucatán may have entered a cultural decline comparable to the Dark Ages of medieval Europe, theorizes Anthony P. Andrews of the New College of California in San Francisco.

Chimps reap what they groom

A chimpanzee doesn't spread nasty rumors or call a lawyer if it grooms the hair of friend who then refuses to return the favor by forking over a few bananas at mealtime. Nonetheless, chimps enforce specific rules about social obligations that show a link to the far more complex notions of fairness and justice held by humans, asserts Frans de Waal of Emory University in Atlanta.

"Violations of reciprocity or expected behavior elicit moralistic aggression among chimpanzees . . . that [is] recognizable as a root of the human anger in response to perceived injustice," he contends.

Studies of food sharing by chimps at Atlanta's Yerkes Regional Primate Research Center offer a case in point. When caretakers arrive with food, the animals first hoot and jump about in a kind of dance. This "celebration" serves to reduce tension and reaffirm the group's hierarchy of dominant and submissive members, de Waal says.

Negotiations over food distribution then begin, as chimps who want food approach those with enough to share. Food changes hands about half the time; the rest of the requests get rejected. Chimps most often get food from individuals whom they have groomed that day, de Waal maintains. Dominant males are among the most generous with their food, he notes. Fights occur rarely and usually stem from attempts either to take food without having performed grooming services or to withhold food after receiving grooming.

Chimps usually kiss, hug, or otherwise make peace after a fight, especially if they need help and cooperation from one another in the future, according to de Waal.

"Social rights aren't inborn," he argues. "In primates, rights result from negotiations between individuals."

Earth Science

Richard Monastersky reports from San Francisco at a meeting of the American Geophysical Union

Bouncing an earthquake off the sky

Minutes after the Northridge earthquake rattled Los Angeles last January, atmospheric waves from the tremor pummeled Earth's ionosphere at the edge of space, satellite measurements reveal.

Eric Calais and J. Bernard Minster of the Scripps Institution of Oceanography in La Jolla, Calif., detected the ionospheric disturbance using the Global Positioning System (GPS), an array of navigational satellites orbiting Earth. The GPS satellites can provide information about the ionosphere because they send out microwave signals that pass through the atmosphere on their way to receivers on the ground.

When Calais and Minster examined data collected before and after the quake by GPS receivers in southern California, they found evidence of ripples in the ionosphere spreading away from the earthquake's epicenter. The quake caused such distant effects by pushing the ground surface 40 centimeters upward, generating infrasonic and gravity waves that spread into the sky at speeds of 1,080 to 2,160 kilometers per hour.

Because the density of air decreases with height, the waves compensate by increasing in amplitude as they rise. When the waves reach roughly 200 km above the ground, they jostle the ionosphere.

Scientists have previously detected ionospheric disturbances from quakes and explosions using costly ground-based radar systems that bounce beams off the ionosphere to measure its lower surface. But the Northridge quake marks the first time researchers have identified such signals using GPS receivers, which cost less and are much more numerous, Calais says.

Scientists have explored earthquake effects on the ionosphere in part because they may provide a means of discriminating between quakes and small underground nuclear explosions, which generate different kinds of disturbances, says Stephen Warshaw of the Lawrence Livermore National Laboratory in Livermore, Calif.

Earthquakes: The first critical moments

Earthquakes have handily defeated almost all attempts at prediction. But while seismologists can't foresee a shock, they may have discovered a means of diagnosing the size of a quake in its infancy, even as the violent vibrations start. In theory, they could then send warnings to threatened regions in advance of the destructive waves.

William L. Ellsworth of the U.S. Geological Survey in Menlo Park, Calif., and Gregory C. Beroza of Stanford University made this discovery while studying 51 earthquakes, ranging in size from magnitude 1.0 to magnitude 8.0. All quakes began slowly before releasing most of their energy in a burst. "We're becoming convinced that this is very characteristic of how events begin," Ellsworth told SCIENCE NEWS.

Comparing quakes of different size, Ellsworth and Beroza found that bigger quakes took longer to get started. Whereas the beginning of a magnitude 1.0 shock might last only three-thousandths of a second, the early stage of a magnitude 8.0 quake measured roughly 5 seconds.

These results could help in the design of an early quake detection system, which would send out warnings once a quake starts. Because radio waves travel faster than seismic waves, such signals could provide seconds of warning to areas not immediately above the quake. Although not enough time to evacuate people from buildings, the advance notice could save lives by mobilizing emergency crews and by enabling utilities to respond immediately.

The next challenge, however, is to understand what process within earthquake faults causes the initial hesitation. "We don't know for certain what the physics are," says Ellsworth.