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Mapping Ancient Civilization, in a Matter of Days

By JOHN NOBLE WILFORD

For a quarter of a century, two archaeologists and their team slogged through wild tropical vegetation to investigate and map the remains of one of the largest Maya cities, in Central America. Slow, sweaty hacking with machetes seemed to be the only way to discover the breadth of an ancient urban landscape now hidden beneath a dense forest canopy.

Even the new remote-sensing technologies, so effective in recent decades at surveying other archaeological sites, were no help. Imaging radar and multispectral surveys by air and from space could not “see” through the trees.

Then, in the dry spring season a year ago, the husband-and-wife team of [Arlen F. Chase](#) and [Diane Z. Chase](#) tried a new approach using airborne laser signals that penetrate the jungle cover and are reflected from the ground below. They yielded 3-D images of the site of ancient Caracol, in Belize, one of the great cities of the Maya lowlands.

In only four days, a twin-engine aircraft equipped with an advanced version of lidar (light detection and ranging) flew back and forth over the jungle and collected data surpassing the results of two and a half decades of on-the-ground mapping, the archaeologists said. After three weeks of laboratory processing, the almost 10 hours of laser measurements showed topographic detail over an area of 80 square miles, notably settlement patterns of grand architecture and modest house mounds, roadways and agricultural terraces.

“We were blown away,” Dr. Diane Chase said recently, recalling their first examination of the images. “We believe that lidar will help transform Maya archaeology much in the same way that radiocarbon dating did in the 1950s and interpretations of Maya hieroglyphs did in the 1980s and ’90s.”

The Chases, who are professors of anthropology at the [University of Central Florida](#) in Orlando, had determined from earlier surveys that Caracol extended over a wide area in its heyday, between A.D. 550 and 900. From a ceremonial center of palaces and broad plazas, it stretched out to industrial zones and poor neighborhoods and beyond to suburbs of substantial houses, markets and terraced fields and reservoirs.

This picture of urban sprawl led the Chases to estimate the city's population at its [peak at more than 115,000](#). But some archaeologists doubted the evidence warranted such expansive interpretations.

“Now we have a totality of data and see the entire landscape,” Dr. Arlen Chase said of the laser findings. “We know the size of the site, its boundaries, and this confirms our population estimates, and we see all this terracing and begin to know how the people fed themselves.”

The Caracol survey was the first application of the advanced laser technology on such a large archaeological site. Several journal articles describe the use of lidar in the vicinity of Stonehenge in England and elsewhere at an Iron Age fort and American plantation sites. Only last year, Sarah H. Parcak of the [University of Alabama at Birmingham](#) predicted, “Lidar imagery will have much to offer the archaeology of the [rain forest](#) regions.”

The Chases said they had been unaware of Dr. Parcak's assessment, in her book “Satellite Remote Sensing for Archaeology” (Routledge, 2009), when they embarked on the Caracol survey. They acted on the recommendation of a Central Florida colleague, John F. Weishampel, a biologist who had for years used airborne laser sensors to study forests and other vegetation.

Dr. Weishampel arranged for the primary financing of the project from the little-known space archaeology program of the [National Aeronautics and Space Administration](#). The flights were conducted by the [National Science Foundation](#)'s National Center for Airborne Laser Mapping, operated by the [University of Florida](#) and the [University of California, Berkeley](#).

Other archaeologists, who were not involved in the research but were familiar with the results, said the technology should be a boon to explorations, especially ones in the tropics, with its heavily overgrown vegetation, including pre-Columbian sites throughout Mexico and Central America. But they emphasized that it would not obviate the need to follow up with traditional mapping to establish “ground truth.”

Jeremy A. Sabloff, a former director of the [University of Pennsylvania](#) Museum of Archaeology and Anthropology and now president of the [Santa Fe Institute](#) in New Mexico, said he wished he had had lidar when he was working in the Maya ruins at [Sayil](#), in Mexico.

The new laser technology, Dr. Sabloff said, “would definitely have speeded up our mapping, given us more details and would have enabled us to refine our research questions and hypotheses much earlier in our field program than was possible in the 1980s.”

At first, Payson D. Sheets, a [University of Colorado](#) archaeologist, was not impressed with lidar. A NASA aircraft tested the laser system over his research area in Costa Rica, he said, “but when I saw it recorded the water in a lake sloping at 14 degrees, I did not use it again.”

Now, after examining the imagery from Caracol, Dr. Sheets said he planned to try lidar, with its improved technology, again. “I was stunned by the crisp precision and fine-grained resolution,” he said.

“Finally, we have a nondestructive and rapid means of documenting the present ground surface through heavy vegetation cover,” Dr. Sheets said, adding, “One can easily imagine, given the Caracol success, how important this would be in Southeast Asia, with the Khmer civilization at places like [Angkor Wat](#).”

In recent reports at meetings of Mayanists and in interviews, the Chases noted that previous remote-sensing techniques focused more on the discovery of archaeological sites than on the detailed imaging of on-ground remains. The sensors could not see through much of the forest to resolve just how big the ancient cities had been. As a consequence, archaeologists may have underestimated the scope of Mayan accomplishments.

For the Caracol survey, the aircraft flew less than a half-mile above the terrain at the end of the dry season, when foliage is less dense. The Airborne Laser Terrain Mapper, as the specific advanced system is named, issued steady light pulses along 62 north-south flight lines and 60 east-west lines. This reached to what appeared to be the fringes of the city’s outer suburbs and most agricultural terraces, showing that the urban expanse encompassed at least 70 square miles.

Not all the laser pulses transmitted from the aircraft made it to the surface. Some were reflected by the tops of trees. But enough reached the ground and were reflected back to the airborne instruments. These signals, measured and triangulated by GPS receivers and processed by computers, produced images of the surface contours. This revealed distinct patterns of building ruins, causeways and other human modifications of the landscape.

The years the Chases spent on traditional explorations at Caracol laid the foundation for confirming the effectiveness of the laser technology. Details in the new images clearly matched their maps of known structures and cultural features, the archaeologists said.

When the teams returned to the field, they used the laser images to find several causeways, terraced fields and many ruins they had overlooked.

The Chases said the new research demonstrates how a large, sustainable agricultural society could thrive in a tropical environment and thus account for the robust Maya civilization in its classic period from A.D. 250 to 900.

“This will revolutionize the way we do settlement studies of the Maya,” Dr. Arlen Chase said on returning from this spring’s research at Caracol.

Lidar is not expected to have universal application. Dr. Sheets said that, for example, it would not be useful at his pre-Columbian site at [Cerén](#), in El Salvador. The ancient village and what were its surrounding manioc fields are buried under many feet of volcanic ash, beyond laser detection.

Other modern technologies, including radar and satellite imaging, are already proving effective in the land beyond the temples at Angkor, in Cambodia, and in surveys of the Nile delta and ancient irrigation systems in Iraq.

Laser signals breaking through jungle cover are only the newest form of remote sensing in the pursuit of knowledge of past cultures, which began in earnest about a century ago with the advent of aerial photography. [Charles Lindbergh](#) drew attention to its application in archaeology with picture-taking flights over unexplored Pueblo cliff dwellings in the American Southwest.

NASA recently stepped up its promotion of technologies developed for broad surveys of Earth and other planets to be used in archaeological research. Starting with a few preliminary tests over the years, the agency has now established a formal program for financing archaeological remote-sensing projects by air and space.

“We’re not looking for monoliths on the Moon,” joked Craig Dobson, manager of the NASA space archaeology program.

Every two years, Dr. Dobson said, NASA issues several three-year grants for the use of remote sensing at ancient sites. In addition to the Caracol tests, the program is supporting two other Maya research efforts, surveys of settlement patterns in North Africa and Mexico and reconnaissance of ancient ruins in the Mekong River Valley and around Angkor Wat.

Nothing like a latter-day Apollo project, of course, but the archaeology program is growing, Dr. Dobson said, and will soon double in size, to an annual budget of \$1 million.

<https://www.theguardian.com/world/2015/mar/11/honduras-lost-cities-open-letter-national-geographic-report>

Archaeologists condemn National Geographic over claims of Honduran 'lost cities'

Open letter says announcement ignores decades of research and says of indigenous peoples there: 'It is colonialist discourse which disrespects them'



A Honduran native from the Miskito tribe loads a fishing boat with gas cylinders at the pier in Port Lempira, a principal town in the Mosquitia, in Honduras. Photograph: David de la Paz/EPA

More than two dozen archaeologists and anthropologists have written an open letter of protest against the “sensationalisation” of their fields, with one accusing National Geographic of reverting to “a colonialist discourse” in announcing researchers had [found two city-like sites in the deep jungles of Honduras](#).

They also say National Geographic has ignored decades of research that suggests [Honduras](#) was home to a vibrant chain of kingless societies, which

merged qualities of the Maya to the north with other people's less stratified, more equal cultures.

The scholars criticise National Geographic and the media for what they describe as the aggrandisement of a single expedition at the expense of years of research by scientists and decades of support from indigenous people of the dense rainforests in Honduras' Mosquitia region.

John Hoopes, a signatory and professor of anthropology at the University of Kansas, said that National Geographic had shown "a disrespect for indigenous knowledge". The expedition was co-coordinated by two American film-makers, National Geographic and Honduras' national institute of anthropology.

"Any words like 'lost' or 'civilization' should set off alarm bells," said Rosemary Joyce, a professor of anthropology at the University of California at Berkeley and also a signatory, for the same reasons that the word "discover" is no longer accepted to discuss Columbus's arrival in the Americas.

"It's a colonialist discourse which disrespects them," Hoopes said.

'Colonialist discourse' v 'political correctness'

Joyce, Hoopes and others also noted that, like the Maya, the descendants of ancient Central Americans survive in sizable numbers today, even if researchers do not know who exactly they are and must still piece together what life was like a millennium ago.

Chris Fisher, the lead American archaeologist on the expedition, expressed bafflement at the sudden backlash, largely because "the stakes are so low".

"We never said it's Ciudad Blanca or the city of the lost monkey god," Fisher said, referring to two legendary, likely non-existent sites. "The articles aren't scientific papers though, and we don't deny that local people might have knowledge of these sites. But the area was unoccupied and relatively undisturbed after all these centuries."

National Geographic defended its coverage in a statement, saying in part that "it does not give credence to [the] 'fantastic' statements" of the eccentric journalist Theodore Morde, who claimed to have discovered a city in the Honduras jungle around 1940.

Cornell's Dr John Henderson, who neither signed the letter nor took part in the expedition, said the charge of colonialist rhetoric "strikes me as political correctness". "The most offensive part is that there's an awful lot that's known that National Geographic left out," he said.

The area is so rich with sites, Henderson said, that "you're going to point your Lidar" – the infrared surveying device that the expedition used via plane to find the site – "at almost any valley and you're going to find something like what these guys find."

"But what they've done is modest in comparison with what Chris Begley has done there for all these years," he said, bringing up the Transylvania University anthropologist hailed by his peers for his 24 years of work in this part of Honduras.

'Sites in almost every valley'

Rather than being a lone citadel in a untrammelled jungle or some mysterious civilization forgotten to time, almost "every river valley will typically have some archaeological find" in Mosquitia, Begley said.

Begley welcomed the ways Lidar and new technology will help home in on new sites, but said that indigenous people such as the Pech provide invaluable knowledge in explaining ancient life.

"It's like driving versus flying, or walking versus flying," he said. "You see all these connections that you'd miss if you'd just gone in on a helicopter. On the ground they always say there's another place we can see just around the bend, just a few days more."

"People might say we're sour grapes, but I think none of us were contacted because most of us object to this kind of presentation," Begley added. "This time we decided we're going to call this out."

"If you asked the Pech, 'Did you know about this lost civilization?' they'd say, 'Well, no, but we know about the ones our ancestors built,'" Begley said, adding that he thought them the likely descendants of people who were eventually scattered by factors including disease, war and slavery brought by the Spanish.

Not Mayan, but who?

With the Pech, Begley has documented many similar sites to those reported by National Geographic last week: communities, dating back from 800AD to 1200AD, somewhere between villages, towns and cities, with ballcourts, terraces, large structures and locations at a “cultural crossroads” of the Americas.

So while the identities of who built the new sites remains a mystery pending excavation, clues abound, the archaeologists said. Many of Honduras’ ancient sites feature Mayan-like ballcourts, paved roadways and large public buildings, but the people who lived there seem to have lacked the Maya’s intense hierarchy of kings and elites, Joyce and Henderson said.

In some of these settlements, artwork and Spanish documents suggest women were as likely as men to have held positions of power, Joyce theorizes. In contrast to Mayan society where men had authority in most roles, women sometimes appear on the ceremonial jaguar benches (whose effigies represented spiritual power), denoting status as “ritual specialists, with knowledge of the supernatural, or healing,” she said.

Joyce also said colonial texts describe men and women both playing the region’s ancient ballgame, and that the surfeit of intricate artwork suggests a prosperous society in which relatively wealthy elites could sponsor craftsmen, in a system not unlike medieval Europe or ancient Greece – without feudal lords or the idea of states.

“It’s like a chain of smaller cities where institutionalized power had not excluded so many people,” she said. “And you look at the Maya and ask how did they manage to do this trick, getting the general population to support such inequality and hierarchy – a question which obviously has relevance today.”

“One of the things that fascinates me about all this is how it’s driven by not having a label for these settlements,” Henderson said. “They’re not Maya so they must be unknown, is the thinking, but the category of Maya really constrains how we think about these questions.”

Nearly all the anthropologists and archaeologists expressed high hopes for increased research in Central America, concern for the deforestation that threatens sites there, and wishes that the steady drain of funding for universities and grants stops and reverses soon. All agreed that it would take

years more research, teamwork and debate to find answers to their questions, although they sometimes disagreed how they should work in those years to come.

“Archaeology has a real problem because our funding is drying up, and science in general has a huge language issue because we’re not communicating very well why our work is important,” Fisher said.

“If someone wants to argue with me about the definition of a city, great, I’ll buy them a beer and we’ll talk for hours,” he said. “But this is such a reminder that there’s so much out there that’s still unknown and waiting for us to find out.”

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