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Skeleton keys

Mexican scientists now have the skills and technology to study their backlog of ancient bones. As this treasure trove begins to yield its secrets, Rex Dalton finds local scientists hoping to unravel the mysteries of the earliest settlers of America.

Deep in the jungle of Mexico's Yucatán peninsula, away from the flocks of tourists at the Mayan pyramids and temples, a water-filled cavern is giving local scientists a glimpse much further back in time.

Within this vine-draped sinkhole, a long passageway leads to a near-complete skeleton. Found by archaeological divers a few years ago, early evidence indicates that the remains are at least 11,600 years old — dating back to many millennia before Latin America's great tribal empires. If this age is confirmed, it will be the oldest directly dated skeleton found in the Americas.

"When I was diving and first saw it, I couldn't believe it," says Arturo González González, general director of the Museum of the Desert in Saltillo, Mexico. "I felt sure the bones were very old."

The cave skeleton may provide researchers with an insight into the origins of native American peoples, but it also symbolizes a new era in Mexican palaeoanthropology. For more than a century, the jungle-shrouded edifices of the Maya, Aztec or Olmec peoples have been the primary focus of anthropological research in Mexico. Probing these temples and tombs, some of which date back more than 3,000 years, is a scientific cottage industry and regularly sees foreign scientists troop to the various sites like tourists.

But in recent years, a growing group of Mexican scientists has begun to focus on a much earlier period — when the land now called Mexico was the crossroads for the first inhabitants of the Americas as they traversed the continents. These scientists are only now scrutinizing Mexico's vast and largely unstudied collection of skeletons, which could be anything from 100 years to tens of thousands of years old. And they are exploring new sites, some of them underwater, from Yucatán to the tip of the Baja California peninsula. The growth in local knowledge, expertise and resources is helping to solve some mysteries — and to uncover new ones — about who populated the Americas, and when.

Out of Asia

The prevailing theory is that most modern native American groups are descended from several waves of people who migrated from northern Asia between 14,000 and 10,000 years ago, crossing into America over a land bridge at the Bering Strait. Although the details of these migrations are not fully understood, it is known that a group called the Clovis people had made it to the southwestern United States by 11,500 years ago, travelling south as the ice that had gripped the north American continent slowly receded at the end of an ice age.

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But this cannot be the whole story. Archaeological remains indicate that there were people living in Monte Verde, Chile, at least 12,500 years ago — thousands of years before anyone could have travelled down through the middle of an ice-bound conti-

A. CASTRO/INAH

Remains of the day: using Mexico's vast collection of skeletons (far left) or new discoveries underwater (above), researchers such as Silvia Gonzalez (left) are piecing together the country's ancient history.

nent. Some of those who came over the Bering Strait may have travelled down the coast to reach the south more rapidly, and researchers continue to look for evidence of this coastal migration[1]. Another wave of people may have arrived at California directly from southern Asia and the Pacific islands by boat, and worked their way south from there. Some remains have hinted that modern groups of native Americans may have descended from these people as well as from the northern Asian immigrants[2,3].

But finding the evidence to support these theories isn't easy. In South America, archaeologists have mainly found signs of habitation, such as ancient campfires, rather than skeletons, making it impossible to work out where these early people came from. And in North America, most if not all of the skeletons studied seem to come from northern Asia — as would be expected, as Pacific Rim immigrants are not likely to have wandered north into chillier climes from their landing sites. Sandwiched between the two continents, Mexico may hold the much-needed evidence to clarify the origins of America's first inhabitants.

Body of evidence

Since the nineteenth century, Mexico has been collecting and storing skeletons of possible interest at the National Museum of Anthropology in Mexico City. This collection has quietly grown in the basement to some 25,000 specimens. Among the skeletons are dozens of specimens that could open new chapters about the peopling of the Americas. But these bones have so far languished in cardboard boxes, waiting for the day that local scientists have the training, access to technology and money to conduct proper research on them.

To a great extent, that time has now arrived. Mexico's steady scientific development over recent years has given birth to a generation of researchers ready, willing and able to tackle those collections. But in many cases, they are still sorely lacking funds. Richer nations have government agencies to fund such research projects. And for more than a century, wealthy US or European philanthropists have paid for digs at home and abroad. Researchers in a developing nation such as Mexico don't have many governmental or philanthropic options; they must scramble for every peso.

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> — Tim White

Some local researchers have looked for funding from media outlets, be it *National Geographic* or the Discovery Channel. Others — including González — have had to resort to promoting off-road vehicles to win funds for their work. In exchange for cash, González puts pictures of Dodge trucks in his slide presentations at conferences.

They may have their money worries, but there is one thing González and his colleagues don't have to cope with. Unlike the United States, Mexico sees very little conflict between researchers and indigenous peoples when it comes to research on human remains. Native American tribes have delayed or halted US genetic studies of early skeletons — including the famous Kennewick man, a 9,000-year-old human skeleton found in Washington state in the 1990s — as they say that such studies would violate their notions of respect for the dead.

In Mexico, the museums and their operations are seen as encompassing all peoples, whether they are indigenous or progeny of natives and Spanish conquerors. Today's population, mainly of mixed origins, has no strong feelings about the treatment of these bones. For the moment, this relatively relaxed attitude is encouraging US researchers to head south.

Ancestral ties

These growing links are also seeing more Mexican researchers collaborate with teams outside the country, which in turn is helping to bolster the nation's skills base. Last November, Alejandro Terrazas Mata, a physical anthropologist at the National Autonomous University of Mexico (UNAM) in Mexico City, began a winter field season in Ethiopia — home to some of the most important specimens showing man's evolution from primate and journey out of Africa. There he worked with a team headed by Tim White, a palaeoanthropologist from the University of California, Berkeley. "We are hoping to transplant some of the remote-sensing and fieldwork methods we've used successfully in Africa to assist Mexican palaeoanthropologists," says White. For Terrazas, it was an opportunity to learn how to do fieldwork in the hotbed of anthropology. "This is a dream of a lifetime," he says.

Silvia Gonzalez (no relation to Arturo), a geoarchaeologist trained in Mexico City and Germany and now at Liverpool John Moores University in Britain, has also found useful collaborations. Although a rising star in her field back home, she has had to scramble for funds. Fortunately, she managed to secure sufficient cash in Britain to continue her work, and now has a $60,000 grant from Britain's Natural Environment Research Council to study specimens in her homeland, with an emphasis on the interaction between ancient peoples and climate. Although the grant is modest, Gonzalez says that it has attracted collaborations with colleagues from the University of Oxford and the University of Bristol, along with countrymen from Mexico's National Institute of Anthropology and History in Mexico City and other institutions.

One of the most exciting studies in Mexico's anthropology labs today involves

the comparison of ancient and modern bones with those of the Pericú — a tribe that lived near the tip of Baja California from about 2,500 years ago until the late 1800s. The Pericú lived in the hot, harsh desert of Baja in apparent isolation from other humans, surviving on sea life and cacti. The tribe was only discovered by researchers in the late 1940s, and has been a subject of much interest ever since.

Last year, a team of Argentine, Spanish and Mexican researchers published a study of the shape of 33 Pericú skulls found in museum collections[2,3]. The skulls are long and narrow — similar to skulls in south Asia and the Pacific Rim, and not much like the more rounded skulls typical in northern Asia. This implied that some modern peoples may have evolved from an early wave of Australasian migrants, whereas many had assumed that all descendants had been from the later Asian migrations.

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Picking up the pieces: human remains from the early inhabitants of the Americas are still being uncovered in rock shelters in Baja California Sur.

Pacific links

This theory captured the imagination of scientists and the public alike, with press headlines proclaiming that Aboriginals from islands off southeastern Asia had founded America. Interest was further inflamed when the media ran a story saying that preliminary DNA tests showed that the Pericú were related to the Maori, a tribe from the Pacific islands. But, at a symposium in Mexico City last September, Phillip Endicott, a PhD student at the Henry Wellcome Ancient Biomolecules Centre at the University of Oxford, UK, revealed that the Pericú DNA matched modern native Americans of north Asian descent. A lone DNA sample reflecting Maori genes could not be replicated, he said, indicating it was probably a contamination from other tests he was performing on Maori samples in the same lab.

Although the team's early expectations of a link between the Pericú and the Maori were dashed, the DNA results posed an even more interesting question: if they're not genetically different, why do the Pericú have skull shapes so different from those of other natives of North America? The Mexican researchers and their colleagues are now exploring a promising hypothesis: over generations, the skulls of the Pericú may have become elongated because the tribe used their teeth as tools for net or fishing-line work. Graduate students at the Autonomous University of Baja California Sur in La Paz are now examining the teeth closely for signs of wear in an attempt to help corroborate this theory.

But if this idea gains support, it will throw up a fresh problem. For the Pericú it will mean that DNA tests now contradict a study based on skull shape that made it into the pages of *Nature*[3]. "This could have very profound implications," says Silvia Gonzalez, as it would cast doubt on all past and future work using skull shape alone to make decisions about a skeleton's ancestry. Without supporting evidence from DNA, such decisions could well be wrong, she says.

> "To draw any firm conclusions about possible Australasian immigrants to early America, far more bones will need to be analysed."

To draw any firm conclusions about possible Australasian immigrants to early America, far more bones will need to be analysed. So that is what Silvia Gonzalez's group is doing now. Team-member Alfonso Rosales López and his colleagues at the National Institute of Anthropology and History Museum in La Paz have been collecting Pericú specimens from rock shelters, cave floors or coastal shell middens for more than a dozen years. The collection is so substantial that even some of the more extraordinary finds — including a skull where the back half was cleanly cut off by a blow from something like a machete — have not yet been scientifically described. The skull slice is now being studied as possible evidence of cannibalism or some kind of ritual. Although Rosales López is a co-author of a book on the Pericú culture[4], his publications have been limited because of monetary and language barriers. That is changing now, thanks to Gonzalez's funding and her help with translation.

Meanwhile, researchers are hot on the trail of much older skeletons to investigate similar questions. Among the most anticipated results is evidence from DNA extracted from 'Peñon woman'. Found in 1959 near the airport outside Mexico City, this skull has been dated to 10,755 years ago[5]. And its DNA is the oldest sample yet extracted from a skeleton in the Americas. Endicott is now analysing DNA from Peñon woman. He declined to discuss his results until they are published or presented at a conference.

Arturo González is also on the lookout for more specimens from the watery caves of the Yucatán, searching for ancient bones that may yield DNA. Many of the bones he has studied so far were found by recreational divers, who spotted them while exploring the kilometre-long networks of caverns. Amid the remains of camels and elephants that died off during an ice age some 12,000 years ago, they have found some of America's earliest inhabitants. González is slowly retrieving these bones for study, and sharing the results with local colleagues at conferences such as last September's symposium in Mexico City.

Determining the age of skeletons after millennia under water "is a mess", acknowledges Ervin Taylor, an expert in dating techniques at the University of California, Riverside. But DNA left in the watery bones of the skeleton from Yucatán so far hints at a date at least 11,600 years old, he notes — if not older. To be sure, "I need more bone", Taylor says.

Arturo González is ready to secure those specimens. He is heading into the caves this spring to follow up new hints of specimens, bones that he hopes will provide sufficient DNA for this new chapter in genetic testing. Together, Mexican scientists are at last pulling skeletons from cardboard boxes, the dusty recesses of museums and watery graves into the light of scientific study. ■

Rex Dalton is *Nature*'s US West Coast correspondent.

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