

LESSONS

FROM

TEOTIHUACAN

A rare, life-size stone mask (facing page) was one of the surprise finds of David Carballo's excavations in Teotihuacan. "Even poorer people in Teo lived pretty well," Carballo says. "You can see why this city was a draw."



What the ruins of a pre-Aztec metropolis can teach us about today's cities

BY BARBARA MORAN

IT'S A SUNNY SUMMER Sunday, and the Street of the Dead looks particularly lively as archaeologist David Carballo makes his way across. The broad thoroughfare cuts a one-and-a-quarter-mile swath through the heart of the ancient Mesoamerican city of Teotihuacan, passing three monumental stone pyramids named after the sun, the moon, and the mythological Feathered Serpent, and gaggles of photo-snapping tourists. About 30 miles northeast of Mexico City, Teotihuacan—or Teo, as archaeologists call it—is a UNESCO World Heritage Site and the most visited archaeological ruin in the Western Hemisphere. Today, as in ancient times, the center of Teo is a circus of commerce. One vendor hawks colorful clay whistles that trill a birdsong or rumble a jaguar's growl. Another sells dangling pendants of serpents, skulls, plastic hearts, and peace signs. A group of friendly tourists stops Carballo, wagging their iPhones toward him, asking him to take their photo. They lean together, grinning from ear to ear, pyramids looming behind them.

Carballo, a College of Arts & Sciences assistant professor of archaeology and the

Archaeologist David Carballo has been studying Teotihuacan since 1999, trying to learn how the metropolis flourished for more than 600 years.



author of *Urbanization and Religion in Ancient Central Mexico* (Oxford University Press, 2015), has studied Teotihuacan since 1999, trying to learn how this ancient metropolis arose around the first century BCE and

the economics and social structure of Tlajinga will give him clues to the economics and social structure of the city as a whole. That knowledge, in turn, may inform a host of questions about our modern cities: Who migrates to cities and why?

people migrate to urban areas, finding answers to these questions becomes urgent. “Comparing ancient cities to modern cities is long overdue, and David Carballo has been at the forefront of this movement,” says George Cowgill, an Arizona State University (ASU) professor emeritus of archaeology, who is regarded as the world’s authority on Teotihuacan. Cowgill says that Carballo’s focus on the Tlajinga district, as well as other places, is critical for understanding the city at large. “Imagine studying Boston by just looking at the State House and a few skyscrapers—it’s ridiculous,” he says. “We need to know the whole range of the city, from the commoners to the elites.”

Carballo’s work is part of a scientific trend, says Curtis Runnels, a CAS professor and chair of archaeology, pointing to comparable studies in Pompeii and Giza. “In the early days

Teo had more than 100,000 inhabitants at its peak. By comparison, London’s population didn’t break 100,000 until the 16th century.

flourished for more than 600 years. He does this not by studying the grand pyramids and other remnants of Teo’s elite, but by examining a group of working-class neighborhoods in a district called Tlajinga. Carballo, who teaches a class called Archaeology of Cities and whose work is funded by a three-year, \$238,000 National Science Foundation (NSF) grant, says that understanding

How do rulers build and maintain complex infrastructure? And perhaps most crucial for our diverse society, how can a government attract strivers from many different cultures and mold them into a new, unified people? In other words, how can we all get along?

More than half the people in the world now live in cities, according to the World Health Organization, and as more

of scientific archaeology, they focused on the big things they could see: temples, tombs, King Tut, and the whole business,” says Runnels. “Archaeologists have moved beyond that.

“Teotihuacan is from the same time period—and it’s the same scale—as ancient Rome,” Runnels adds. “Who were the inhabitants and where did they come from? How did they organize such a city? You don’t answer those questions by looking at pyramids alone.”

The pyramids are good for one thing, at least: a sweeping view of the city. From a distance,

the parade of tourists climbing the 248 steps to the top of the Sun Pyramid looks like a trail of determined ants. Carballo makes his way to the summit and points out Tlajinga, just over a mile to the south, and ethnic enclaves elsewhere in the city that housed Zapotec, Maya, and people from Mexico’s Gulf Coast. Like many modern cities, Teo had a compact downtown area arranged on an orderly grid, with temples, open market plazas, and stylish, elite apartment housing. Simpler neighborhoods like Tlajinga arose at a distance

from downtown, as did Brighton to downtown Boston. Archaeologists estimate that Teo encompassed about eight square miles, with more than 100,000 inhabitants at its peak. For comparison, medieval London covered only about one square mile and its population didn’t break 100,000 until the 16th century.

FOCUS ON HARMONY AND COOPERATION

How Teo achieved and maintained its impressive size and population has intrigued archaeologists for centuries.

WHAT BONES SAY

Maria Codlin →

(GRS’21)

STUDIES: bones

BEST FIND SO FAR: a rasp (a musical instrument made from a human bone)

Maria Codlin grabs a clear plastic bag full of tiny bones, and shakes them onto the table. Out tumble bony bits of squirrel, rabbit, turkey, deer, dog, and quail. Codlin’s job is to make sense of the jumble. “You can tell a lot from bones,” she says.

What she wants to know, first and foremost, is what the people in Tlajinga ate. The details she finds will give us important information about their economic status, farming practices, and daily routines.

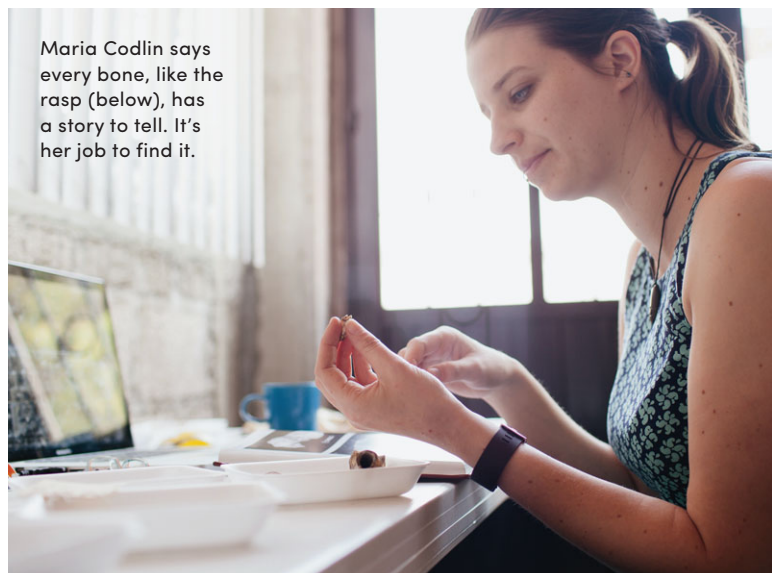
Every bone tells a story. “For things like deer, for instance, I’m interested in what part of the animal they’re eating,” says PhD candidate Codlin (GRS’21). “If they hunted it themselves, we

might expect to see a whole range of different body parts. But if they purchased it from a market or got it from trade, they might only have specific cuts of meat.”

She adds that “food is often a status marker. So if we’re finding a lot of really rich types of foods, it could indicate it’s not actually a low-status area, although that would have to be taken in conjunction with all the other evidence.”

Sometimes her work involves more than classifying and measuring bones. Occasionally she ventures into experimental archaeology. Codlin was wondering

Maria Codlin says every bone, like the rasp (below), has a story to tell. It’s her job to find it.



if the ancient Teotihuacanos raised rabbits for food, so she started searching for bones from young rabbits. The problem: the bones of young animals can look similar to one another—it’s much easier to make an accurate identification when you can compare archaeological bones to modern examples. So she bought a young rabbit from the barbecue market stall, boiled down the bones, dried them in the sun, picked off all the cartilage, and—voilà!—a full set of juvenile rabbit bones. She did the same for a turkey and has been looking to buy a gopher.

Codlin has also found bone needles, drums made from turtle shells, and two bone rasps. She’s still not sure what it all means, except that the people in lower-status Tlajinga had access to some nice goods.

“This is the stuff that you can only know through archaeology,” she says. “Everyone writes about the pyramids. Nobody writes about the working class. And that’s most of us.”



Large-scale excavations, of varying quality, began in the early 1900s. In the 1960s, archaeologists with the ambitious Teotihuacan Mapping Project created a detailed map of the city by surveying about 14 square miles of land and collecting

or warriors standing in a line, with none clearly prominent. Teo's elaborate urban planning also demonstrates this affinity for harmony. The Street of the Dead, for instance, does not run directly north to south, but instead veers exactly 15.5 degrees off that line. This

“It's for cosmic harmony,” says Carballo. “You can't have a meandering river right at the center of creation.”

While the bustling and organized city center may have contributed to civic pride, it also required a lot of upkeep. As Carballo puts it, “You need a lot of people carrying a lot of baskets full of stone and rubble.” He says that a labor tax was probably an essential part of the economy, with residents owing days of work to their neighborhood, to the city, and to a temple or palace as well.

Why would anyone immigrate to a city where they had to lug rubble to build pyramids? That's the question that draws Carballo to Tlajinga. “We know why the elites would want to live here, but what's in it for the other 80 percent?” he asks. “It's one of the great dilemmas: how do you get people to cooperate on this scale? The temples are part of it, getting people to buy into being part of this cosmic plan. But the practical side of me

Like many modern cities, Teo had a compact downtown area, with temples, open market plazas, and stylish, elite apartment housing.

every scrap of ancient material they saw, including nearly 900,000 fragments of pottery and 230,000 pieces of the volcanic glass called obsidian.

Archaeologists say that Teotihuacan may have thrived, in part, because of the city's focus on harmony and cooperation. “Whoever ruled Teotihuacan did not emphasize the individual,” Carballo says. The colorful murals they painted, for instance, highlight timeless themes of fertility and abundance and show priests

offbeat angle sets the Pyramid of the Moon directly in front of Cerro Gordo Mountain so that it forms a perfect backdrop, and allows spectators on the Pyramid of the Sun to view the sunset through craggy mountain valleys on key days in the calendar. Teotihuacanos also altered the course of the San Juan River to conform to their city's grid. Originally draining southwest, the river now flows directly south, banks sharply west at an almost right angle, then flows south again.



Carballo believes that a labor tax kept Teotihuacan functioning, with citizens required to work for their neighborhood, temple, and city.

SHERDS HOLD SECRETS

Daniela Hernandez Sariñana →

(GRS'19)

STUDIES: ceramics

BEST FIND SO FAR: tripod polychrome vase

Around 1,500 years ago, someone in Tlajinga dug a small hole in the dirt floor of an apartment and gently placed offerings inside. They included some of the most precious objects in the household: valuable chunks of obsidian, tools for grinding corn, and a delicate ceramic vase painted with elaborate red and green motifs. During an archaeological dig in 2013, Daniela Hernandez reached into the ground and pulled out the vase, remarkably preserved after centuries underground. A video clip of the discovery shows her face awash in joy and gratitude and awe.

First-year PhD student Hernandez (GRS'19) studies ceramics,

and the vase remains her favorite piece. There's evidence that the ancient people loved it, too; it shows signs of being patched and repaired over time, much like a family heirloom. "It was some really important piece that belonged to the family living there. So it is kind of strange that they would offer their only luxury item," says Hernandez. The vase demonstrates that the residents of this working-class neighborhood had a strong connection to the city as a whole: the colored motifs mirror



large murals in downtown Teotihuacan, just as many homes in suburban Boston contain Red Sox memorabilia.

Most of Hernandez' time is spent analyzing more humble objects—the thousands of sherds, or fragments of pottery,

knows there has to be some material gain."

Carballo steers his pickup truck down a rutted dirt road and pulls off into a scrubby, overgrown field. It's an unpromising spot for archaeological insight: dotted with spiky stands of prickly pear cactus and bisected by high-voltage power lines. A freight train rumbles past as a mob of chickens clucks and crows nearby. "Here it is," says Carballo, stepping out of the

truck and shutting the door behind him. "Tlajinga—in all its glory."

He walks to a massive anthill and points to some tiny black flakes in the gravel around it: obsidian. The ground is littered with it. "These tiny little chips indicate an obsidian workshop—people who were just using obsidian tools wouldn't leave a zillion little flakes behind." A visitor stoops down for a closer look. "Watch out," says Carballo, "those are fire ants."



Daniela Hernandez Sariñana found that some of the pottery is made from clay that is not local, even though local clay was plentiful.

unearthed at Tlajinga that she is trying to sort, classify, and sometimes reconstruct. "Ceramics can tell you so much if you ask the right questions," she says. "You can have as many approaches as you like. You can have the food approach—what they were cooking and how they served it; you can have the different-decorations-through-time approach; and you can have a more scientific approach: chemical residue, petrography. There are so many sources of information in just one pot."

Most of the sherds live in the lab in Mexico, but Hernandez received permission to bring samples back to Boston for detailed chemical analysis. By looking at the composition of the clay—which contains quartz, feldspar, volcanic rock, amphibole crystals, iron nodules, and mica—she hopes to learn more about the ancient people's economic system and trade. "Some of the clay is not local. It comes from who knows where," she says. "But it comes into Teotihuacan, and I'm interested in why they're bringing that stuff and what they're using it for, instead of using the more local stuff that's easier to get."

Ultimately Hernandez hopes to learn more about the daily lives of the citizens of Tlajinga, and how they helped the city thrive. "I'm always interested in looking from the household point of view. I'm more into what common people are doing, like you and me, rather than the king," she says. "Normal people were the backbone of the city."

Ancient people used obsidian to craft blades, spear points, scrapers, and beads, and it's the key to understanding the economy of Tlajinga. To make obsidian tools, workers delicately peeled thin blades off a hefty core—a skilled process called knapping—leaving bits and pieces and chunks and shards behind. These scraps allow patient archaeologists to precisely reconstruct the sequence of production, learning who made what, and where.

This information is critical for understanding Teotihuacan. Because the ground at Tlajinga is so rich in obsidian, archaeologists have speculated that the city had hundreds of workshops. But those workshops would have produced far more tools than the inhabitants of Teo could use.

“You don’t need that many craftsmen,” says Carballo’s

of obsidian—more than 900 pounds. Carballo’s students and colleagues are now analyzing the artifacts in the ASU-managed Teotihuacan Research Laboratory in nearby San Juan, and they are already gaining a deeper understanding of the ancient economy.

At the lab, Hirth picks up one of his favorite artifacts—a near-perfect obsidian pressure core.

skill. This seems to indicate that individual workshops managed by master craftsmen, rather than an all-powerful state government, drove obsidian production and innovation.

“We can only reconstruct a model of economic activity based on what we know,” says PhD candidate David Walton (GRS’19), who is analyzing a portion of the obsidian artifacts found at Tlajinga (*see sidebar on page 43*). “If all that’s been excavated and analyzed are the big institutions, you’re going to say they’re controlling the economy. But the more we excavate households in Mesoamerica, the more we realize that domestic economies are the engine that’s driving the whole economic system. It’s coming from the ground up.”

Carballo’s biggest surprise during the Tlajinga excavation was the range and quality of goods found in this working-class enclave: turtle shells and a bone rasp that were probably musical instruments, a delicately painted ceramic vessel, a rare life-size stone mask. “The take-home message is that even poorer people in Teo lived pretty well,” he says. “You can see why this city was a draw.”

Over the next three years, Carballo, along with colleagues

Carballo is convinced that Teo’s rulers did not emphasize the individual. Murals depict priests in a line; no one person stands out.

colleague Ken Hirth, a Pennsylvania State University professor of anthropology. “So what’s going on?”

Some scientists suggest that Teo was a regional manufacturing hub, with a strong central government controlling obsidian supply and trade. Others say the workshop estimates were simply overblown. Carballo believes that digging there might help settle the debate.

In summers 2013 and 2014, Carballo, his students, and colleagues excavated parts of two multihousehold apartment blocks at Tlajinga. They recovered thousands of pieces of pottery and bone, and about one million pieces

Black and shiny as anthracite coal, the core is a cylinder, tapered at one end, a bit smaller than a liter bottle of water. Shallow grooves run down the sides—places where a master craftsman could press off sharp blades of obsidian.

“This guy had a load of talent, because there’s not an error on here,” Hirth says. He grabs a core from a nearby table for comparison. Stubby and chipped, it looks like a hunk of rock that had been chucked out a car window and found lying on the roadside. It was decidedly not the work of a master.

To the archaeologists, these finds are evidence of an obsidian workshop housing crafters with different levels of



The symmetry of Teotihuacan’s pyramids shows a mastery of geometry and an affinity for harmony.

BLOOD TALKS**David Walton** →*(GRS'19)***STUDIES:** stone tools**BEST FIND SO FAR:** bloodstained bloodletter

David Walton holds up a tiny greenish-black object the size of a matchstick. "This is going to be a fairly big discovery," he says. "I'm kind of excited."

The object is a bloodletter, a razor-sharp blade made of a volcanic glass called obsidian. Because the ancient Mesoamericans did not work with metal, obsidian was their go-to material for sharp tools. "People have looked at the production of stone tools in Mesoamerica, not so much at how they're actually used," says doctoral student Walton (GRS'19). "If what we know about production is a B+, what we know about consumption is an F-." He is trying to fill that gap by examining hundreds of obsidian knives, drills, scrapers, and blades under a high-power microscope. He's looking for distinctive wear patterns, as well as embedded bits of ancient meat, shell, wood, and cactus or other plants, and creating a database that describes his observations. He hopes that his analysis, which is funded by a National Science Foundation doctoral dissertation improvement grant, will give archaeologists clues about how ancient people actually used the tools. That's where the bloodletter comes in.

"We thought that people in Mesoamerica used to ritually let blood," Walton says. "You would let blood over paper in a bowl, and you would burn the paper. And the smoke that would come up from that paper would communicate whatever you were trying to communicate to the ancestral spirit realm." That was the conventional wisdom, anyway, but little physical evidence of this ritual exists. Walton has brought the practice into focus,



David Walton identified red blood cells on a blade used for ritual bloodletting 1,500 years ago.

under his microscope. "I was able to find isolated blood cells actually on the blade," he says. How does he know the blood wasn't left over from, say, cutting up some rabbit meat? In that case, he'd see minuscule scraps of meat trapped inside tiny cracks in the obsidian. But here, he saw red blood cells on the surface of the blade. "I can confirm that this was used for ritually letting blood 1,500 years ago," he says.

By observing and recording such tiny details, he hopes to address bigger questions of how and why technology changes over time. What drives innovation? Is it top-down or bottom-up? Already he sees evidence of craftsmen innovating with obsidian in their household workshops. Walton likens these tinkers to the early Silicon Valley innovators building computers in the garage: "I think of people in Mesoamerica trying to come up with new ways to accomplish a task, and wondering, how do I do that?"

Saburo Sugiyama of ASU and Nawa Sugiyama of the Smithsonian Institution, will begin a new NSF-sponsored excavation at Teotihuacan, at a likely palace complex called the Plaza of the Columns.

The complex sits in an overgrown field where large grassy mounds probably cover temples. But Carballo isn't interested in temples, impressive as they may be. He'll be excavating an out-of-the-way area tucked behind one of the mounds, looking for storage areas, kitchens, or living quarters of a servant class, to help him better understand the politics of the ancient

Teotihuacano economy. He hopes to find parallels to Tlajinga, in how commoners interacted with power.

"In Tlajinga, you could be a humble craftsman and still have a niche within the economy," he says. "People had really nice houses, with courtyards and drains, and access to goods from all over. You had minerals coming from the north, shells coming from the coast, jade from the Maya region. People were moving, ideas were moving with them, and Teo became celebrated. People recognized, OK this is the biggest game in town."

Teo wasn't just an economic

hub, according to Carballo—it was a political, cultural, and religious center. It had ball games and grand temples and gambling. The same things that drew migrants to Teo are the things that draw immigrants to cities today: better entertainment, bigger ideas, diverse people, different food, and of course, a shot at a better life.

"There's a quote that's attributed to Mark Twain—'History doesn't repeat itself, but it often rhymes,'" he says. "You see these patterns, these ripples. The way that humans tend to do things resonates into later generations." ■

WEB EXTRA
Watch videos of archaeologist David Carballo and his team investigating the pyramids, neighborhoods, and artifacts of Teotihuacan at bu.edu/bostonia.