ORIAS Summer Institute for K-12 teachers
http://orias.berkeley.edu/Summer2012/Summer2012Home.htm
Technology in Human History
July 23-25, 2012

The Aztecs' Inheritance: The Development of Mesoamerican Technology

Alex Saragoza
Associate Professor of History, Department of Ethnic Studies, UC Berkeley
Summarized by Stephen Pitcher
smpitch@sbcglobal.net

Professor Saragoza's talk involved an attempt to connect three separate events: the 1854 major cholera outbreak in London; the installation of composting bins for biodegradable waste in UCB's Barrows Hall; and the costly efforts of the Mexican government between 1993 and 1998 to prevent the National Cathedral's accelerating descent into the soft soil (Saragoza's word was "muck") on which it was built. (The government's efforts culminated in the installation of concrete shafts under the Cathedral, to stabilize the foundation so that, while it would continue to sink, it would at least sink *uniformly*.) These three events, while unrelated to each other, relate in different ways to Aztec technological achievements in land use, sewage treatment, hydrology, and construction.

The Aztec Empire was the endpoint, rather than the apex, of Mesoamerican civilization. The arrival of Hernán Cortés coincided with an escalation of internal conflict in the Central Valley of Mexico, between the Aztecs and the numerous groups upon whose tribute they depended. The conquistador's timing could not have been more fortuitous: with great ease he recruited tens of thousands of Indians to join in his invasion of Tenochtitlán, without whose collaboration Spanish victory would have been doubtful. This endpoint scenario was playing out throughout Central Mexico: the Maya had long dwelt in a "post-classic" shadow-world ("post-classic," Saragoza jovially explained, was a synonym for "through—like we are now").

In addition to their political crises, the Aztecs had long faced a daunting array of technological problems specific to their location. For a city-state of 100,000 people occupying an island in a lake, sanitation was a huge issue. At this point in London, by comparison, the Thames was a cesspool, due in part to a European attitude toward sanitation which differed significantly from that of the Aztecs. The wildly fluctuating seasonal levels of the lake itself posed another challenge. Aqueducts had to be constructed to bring fresh water into the city, as the lake water was not always potable**.** Finally, agricultural production was extremely problematic, as there was no room for it on the island, and cultivating the land around the lake would result in a food source from which the Aztecs could be cut off with great ease by an enemy.

These problems found ingenious solutions among Aztec engineers. Two aqueducts served the city, rather than one, in order that while one piped in fresh water from outlying springs, the other could be cleansed of mud and silt (the Aztecs had already learned, in

quite unpleasant fashion, of the perils of drinking unclean water). Excrement was collected (there were advantages to having a large, subservient labor force), the solids rowed out in barges and used as manure, and urine used to make dyes fast. The copious quantity of used water that resulted from the Aztec fondness for taking baths (another distinction from their European contemporaries) was filtered through charcoal before being allowed to return to the aquifer. Fluctuations in the level of the lake were dealt with by a system of canals (like those in the San Joaquin Valley), sluices, and—crucially—dykes, which had roadways atop them and drawbridges and causeways connecting them.

Unlike the earthen berms used in California, which are prone to breakage, many Aztec works of civil and domestic engineering were built using *tezontle*, a light, porous volcanic rock mixed freely with rubble or pebbles. This resulted in items that were strong and durable, yet light-weight. Like adobe, *tezontle* keeps out cold in the winter and heat in the summer; and *tezontle* floors and roofs, being so light, would not cause a building to sink into the earth the way the solid stone National Cathedral is currently doing. The Aztecs also built on platforms, in order that the weight of the building would be distributed equally—again, in contrast to that of the Cathedral.

A major agricultural innovation of the Aztecs—one that would be recognized as "sustainable" nowadays—was the *chinampa*, a small, artificial island on which to plant crops. Composed of wattle, straw, and mud mixed with excrement, and anchored by trees at the corners, the *chinampas* were both highly fertile and relatively stable plots of arable land. The canals between them assisted in water diversion, the manure component provided an outlet for sewage, and the requirement for ongoing upkeep and the creation of new *chinampas* gave employment to the massive Aztec workforce.

These systems of hydrology, sewage treatment, agricultur, and construction were wholly ignored by the Spanish, who were determined to turn this alien land into something more closely resembling a European city, regardless of the wild improbability of such an enterprise. [Indeed, the manner in which the Spanish dealt with the unusual (and very un-European) circumstances of the land they'd conquered presents an intriguing departure from this conference's general trend, as the Spaniards' very *refusal* to avail themselves of the technology already developed and in place changed the course of Mexican history, and gave rise to the horde of problems Mexico City has confronted since that time.] The victorious Spanish attempted to drain the lake, being accustomed to dwelling on stretches of solid land; but water, particularly a lakeful of it, doesn't simply vanish. Removed from one location, it seeps up elsewhere, or inexorably returns to its original residence (where, after all, it had collected for a reason) once its circuit underground has been concluded.

In this presentation the Aztecs could be seen to have managed sanitation in a way that would probably have prevented the 1854 outbreak of cholera in London; created productive and sustainable public composting systems on a scale far exceeding that of Barrows Hall; and discovered a building material in many ways more suitable to a variety of environments than the European favorites stone, wood, and brick. Yet Professor Saragoza feels that the Aztecs would eventually have become unable to handle the systemic, mounting problems they faced, given the limits of their technology and the

absence of beasts of burden, and would (had their enemies allowed them the luxury of doing so) have sunk into their own post-classic decline. In their place is a society still trying frantically to cope with the very problems they, for a time, had solved.

Q&A

Q: Why did the Aztecs build a city there in the first place?

A: At some point early on the Aztecs were riff-raff. Some time in the 11th or 12th century they came from somewhere to the north—they were not native to the Central Valley—to escape what is suggested might have been climate change (similar to our Southwest becoming arid). They were often attacked, because they were encroaching on someone's resource base, and because they became good fighters out of self-defense, adept at being warriors, they began to be hired as mercenaries by warring tribes, in what could be termed "strategic marriages" (unlike our romantic kind). Within 200 years they went from being "riff-raff" to being powerful. Other tribes of the region didn't care about Mexico City, so it was kind of making the best of what was to be had for the Aztecs; and there was ostensibly the omen of the eagle eating the snake to decide it. And it was a good location from the standpoint of a people accustomed to being attacked: hard to reach, easy to defend. Then they began conquering other tribes and demanding tribute. (They were never like Rome, never into occupying conquered territory.)

Q: With the *chinampas,* did they use crop rotation?

A: Yes. They would allow a *chinampa* to go fallow; they kept good records of the production of the *chinampas.* But you can only do that exponentially for a certain time.

Q: Did their conquests start happening more and more?

A: Yes, the cycle of conquests accelerated. Their system was that you never go to war in the harvest: first you make sure the agricultural infrastructure is good, then you go to war.

Q: Were the huge public works projects [like the aqueducts and *chinampas*] handled via religion?

A: It was an ideocratic society: a priestly elite shared power with a nobility who had some military prowess and some elite lineage. Most evidence suggests that over time the priests became less influential in terms of policy, while the nobility became more so, and more military, as there was a demand for more and more tribute. A 5,000-person workforce needs feeding. This led to increasing militarism: they went from a defensive to an offensive orientation; but they were only able to war for a short time because they had to carry all that provision.

Q: Why did the Spaniards destroy the city?

A: It was such a religiously based society—the architectural orientation of the buildings, all the rituals . . . a very religious society. It's hard for us, being so secular, to imagine. The priests who accompanied Cortés were extremely zealous (flagellants)—they wanted to destroy what they regarded as essentially one huge religious site. So they erased as much as possible of the monumental aspect of Aztec society, and put up the National Cathedral. Then of course there's the tendency to attempt to replicate life back home, which actually was medieval and not particularly efficient or healthy.

Q: Were the pyramids strictly ceremonial or did they have other functions.

A: They were just ceremonial, and to some extent political—but religion *was* politics. The grandeur of the pyramids was associated with the grandeur of political spectacle. Kind of like the Soviets. They invited chiefs of surrounding tribes to view spectacles. Food was a huge element too—kind of like in *Hunger Games:* food plays a huge role. And food is part of power.

Q: [inaudible]

A: When Cortés made his initial entry into the city he was kicked out, with major losses of troops. Had the Aztecs attacked *then,* they might have been able to wipe out the Spanish; Spanish allies would have renegotiated. But it was too close to harvest time, and they let Cortés off the hook, and he readied for a second attack. The Aztecs were more ready, and attempted diplomacy, sending emissaries to local tribes. The *Tarascos* (whose name means "stubborn") repelled them three times and refused to help them. Maybe it wouldn't have made a difference.

Q: How deep were the *chinampas?*

A: Pretty shallow—twelve, fifteen feet of water.

Q: [question about Chichen Itza pyramids]

A: The Toltecs were more militaristic [than the Maya], and they entered Yucatán and conquered cities under the Mayan aegis. At Chichen Itza there is the eagle/dragon motif up and down the stairway—which is not Mayan. Chichen Itza is more representative of the post-classic Maya; at Tikal you don't see this militaristic architecture. Uxmal and Tulum are more reflective of the classic Maya.

Q: Did the Aztecs use the draft as tribute, drafting engineers and scribes and such?

A: Absolutely: they had an H1-B visa. They drafted for talent, mathematics.

Q: What was they radius of their depredation—they didn't get as far as Oaxaca, right?

A: They did! It was a forced march. They had granaries in order to stock up on their way, which allowed them to extend their range. The Zapotecs were weak by this time. There wasn't much resistance from them: they were post-classic.