

Morning Mix

Scientists find possible cause for mystery epidemic that wiped out Mexico 500 years ago

By **Samantha Schmidt** January 16

From 1545 to 1548, a mysterious disease killed about 80 percent of the population of Mexico. It was one of the worst epidemics in human history, felling an estimated 5 million to 15 million people, and was known by natives as *cocoliztli* — a word meaning pestilence.

About three decades later, *cocoliztli* struck again, wiping out half of the remaining native population between 1576 and 1578.

“The place we know as New Spain was left almost empty,” wrote a Franciscan friar who witnessed the horrors. “In the cities and large towns, big ditches were dug, and from morning to sunset the priests did nothing else but carry the dead bodies and throw them into the ditches.”

For more than 100 years, scientists have sought clues to what may have caused this disease of epic proportions. Some have suspected illnesses such as measles, smallpox or a type of hemorrhagic fever — potentially brought over to Mexico by the Spanish.

Now, using ancient DNA, a team of researchers has for the first time identified a possible cause of the colonial-era epidemic: *Salmonella enterica*, a pathogen that causes enteric or typhoid fever.

The study, published Monday in *Nature Ecology and Evolution*, was led by researchers from the Max Planck Institute for the Science of Human History, Harvard University and the Mexican National Institute of Anthropology and History.

Up until now, scientists studying ancient epidemics have been forced to mostly rely on historical descriptions of symptoms, which were subject to cultural biases and inaccuracies. Most infectious diseases are incredibly tough to track on the DNA of skeletal remains.

But using a new computer program, this team of researchers was able to analyze ancient DNA from the teeth of 29 skeletons. Most of the remains were excavated from the only known cemetery linked to the *cocoliztli* epidemic of 1545 to 1550 AD, a burial site located in the Mixtec town of Teposcolula-Yucundaa, in Oaxaca, Mexico. After the epidemic, this city was relocated to a neighboring valley, leaving the epidemic cemetery essentially untouched, according to the study.

A new computer algorithm called MALT allowed scientists to screen broadly for all bacterial DNA in the extracted samples, without specifying a target organism beforehand.

“We could look at anything and everything,” Åshild Vågane, one of the authors of the study, said in an interview with The Washington Post. The program allowed researchers to filter out all environmental DNA, such as fragments from plants or fungi, she said.

Matching up the DNA fragments with a large database containing all known environmental and pathogenic bacterial genomes, the scientists were able to find traces of *Salmonella enterica* Paratyphi C in 10 of the skeletons.

The study does not identify the precise source of the bacteria. At this point, scientists cannot be certain whether it was a pathogen brought over by the Spaniards or one that originated locally and flourished with the social changes brought by the Europeans.

However, “we believe it is likely that it was brought over by Europeans,” Vågane said, because research indicates this strain type already existed in Norway long before it broke out in Mexico. Moreover, the Nahuatl word and concept *cocoliztli* only appeared in the native language after the arrival of the Spaniards.

Francisco Hernández, a lead physician in the Spanish colony, described *cocoliztli* based on autopsies he performed on the dead:

The fevers were contagious, burning, and continuous, all of them pestilential, in most part lethal. The tongue was dry and black. Enormous thirst. Urine of the colors sea-green, vegetal-green, and black, sometimes passing from the greenish color to the pale. Pulse was frequent, fast, small, and weak — sometimes even null. The eyes and the whole body were yellow. This stage was followed by delirium and seizures. Then, hard and painful nodules appeared behind one or both ears along with heartache, chest pain, abdominal pain, tremor, great anxiety, and dysentery [diarrhea]. The blood that flowed when cutting a vein had a green color or was very pale [and] dry . . .

Vågane said the team of scientists extracted DNA from only one particular burial site, containing victims of one particular wave of the disease. Therefore, further work must be done to find out whether DNA at other sites can be traced to *Salmonella enterica*.

This specific pathogen may be one of several causes for the disease, Vågane said.

“We can only look for pathogens that we know exist today,” she said. “We can’t look for things that we don’t know existed.”

Still, the study marks a first step toward understanding the disease exchange in colonial Mexico. And the MALT program could be used to find causes to other ancient and modern diseases in other periods and parts of the world, Vågene said.

“It’s the first piece of the puzzle to perhaps finding out what caused this epidemic mystery,” she said.

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Samantha Schmidt is a reporter for The Washington Post's Morning Mix team. She previously worked as a reporting fellow for the New York Times. [!\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\) Follow @schmidtsam7](#)