

GIANTS & AIRPLANES: MAMMOTHS AT THE AIRPORT IN MEXICO CITY

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Summary

North of Mexico City, a new airport was built in the past two and a half years. While digging during construction, an amazing amount of mammoth remains appeared along with other zoological components common to a landscape constituted by grassland and temperate forests. The mammoth fauna included camels, horses, mylodonts, saber-toothed cats, and dire wolves, among other animals. More than 50,000 specimens have been collected that include remains that may represent at least 500 mammoths. Based on that rich deposit, a research project was initiated a year ago. Unfortunately, the COVID-19 pandemic caused the closing of many laboratories in the country and abroad, so most analyses are pending, including radiocarbon dating, stable isotopes, and paleoproteomics assays. Furthermore, the Ministry of Defense decided to build a museum focused on those mammoths and their story in this area, with a dedicated curatorial facility for all of the materials. Results should provide a detailed knowledge of mammoth biology and ecology at the end of the Pleistocene and their possible relationship with humans.

Samenvatting

Ten noorden van Mexico-Stad is in de afgelopen tweeënhalf jaar een nieuwe luchthaven gebouwd. Bij graafwerk tijdens de bouw is er een verbazingwekkende hoeveelheid mammoetresten verschenen, samen met andere zoölogische componenten die horen bij een landschap dat wordt gevormd door grasland en gematigde bossen. De mammoetfauna omvatte kamelen, paarden, mylodonten, sabeltandkatten, reuzenwolven en andere dieren. Er zijn meer dan 50.000 specimens verzameld, waaronder overblijfselen die mogelijk minstens 500 mammoeten vertegenwoordigen. Op basis van die rijke bodemschat is een jaar geleden een onderzoeksproject gestart. Helaas heeft de COVID-19-pandemie geleid tot de sluiting van veel laboratoria in het land en in het buitenland, dus de meeste analyses zijn nog in behandeling, waaronder radiokoolstofdatering, stabiele isotopen en paleoproteomische tests. Verder besloot het Ministerie van Defensie een museum te bouwen dat gericht is op die mammoeten en hun verhaal in dit gebied, met een op alle materialen afgestemd beheer van de collectie. De resultaten moeten gedetailleerde kennis opleveren van de biologie en ecologie van mammoeten aan het einde van het Pleistoceen en hun mogelijke relatie met de mens.





ALEJANDRO LÓPEZ-JIMÉNEZ

*Entrance view of the Quinamétzin Mammoth Museum in AIFA.
Entree van het Quinamétzin Mammoetmuseum in AIFA.*

INTRODUCTION

Mammoths were the most amazing terrestrial animals during the Pleistocene of the Northern Hemisphere, constituting an actual ‘landscape engineer’. They reached North America around about one million years ago, and from their entry point in Alaska, they moved as far south as Costa Rica, evolving into an endemic species, the Columbian mammoth *Mammuthus columbi*. Because of their large size, remains of this animal are not missed when new constructions occur or when they are washed from the ground. Because of that, they are found in many regions on the continent. In Mexico, mammoths occurred in most of the country, except the Yucatan Peninsula, where another proboscidean, the gomphothere, may have outcompeted mammoths. One of the areas where a large population of those animals lived was the Basin of Mexico, where findings have occurred since the late 19th century (Arroyo-Cabrales et al., 2007).

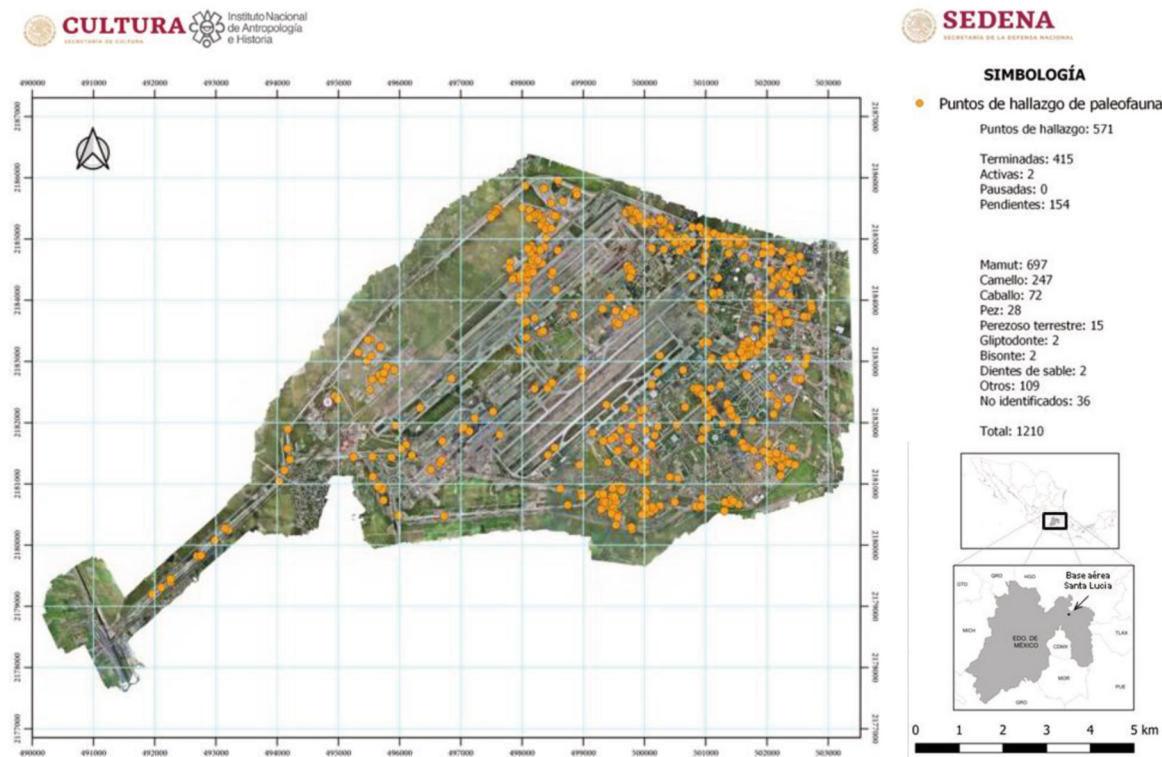
The Military Air Base of Santa Lucía, at the northwestern portion of the Basin of Mexico, will hold within its perimeter the new international airport of Mexico City, “General Felipe Ángeles” (AIFA) (Fig. 1). In its more than 3,700 hectares, archaeological evidence has been found of two villages of fishing farmers from the Late Classic and Epiclassic periods, related to the Teotihuacan and Coyotlatelco ceramic complexes, as well as Early to Late Postclassic contexts, related to the headquarters of the Otomi lordship of Xaltocan (Brumfiel, 2005). However, the highlight of the archaeological rescue has been the paleontological findings, which have yielded a bone collection of late Pleistocene megafauna that already

points to being the most important in Latin America. Following here is a brief report on the progress of the investigations.

BACKGROUND

In March 2019, the Ministry of National Defense (SEDENA) established contact with the National Institute of Anthropology and History (INAH), to comply with the provisions of article 18 of the Federal Law on Archaeological, Historical, Artistical, and Cultural Monuments and Zones. Article 18 mentions that the Federal Government and any other governmental office will require to hire anthropologists for advising and guiding salvage excavations under the direction of INAH, the federal institution in care of all historical, archaeological, and paleontological heritages.

On June 13, 2019, the INAH issued the decision in which it was determined that the civil work was feasible, authorizing SEDENA to start the works in the area where the Institute determined the immediate feasibility. However, it was necessary to execute an archaeological salvage project for the recovery of the archaeological and paleontological remains that might exist in the areas with the potential for discoveries (Manzanilla López & Arroyo Cabrera, 2021). On August 3 of that same year, the first SEDENA-INAH collaboration agreement was formalized to carry out the rescue of archaeological and paleontological remains during the construction of the AIFA. Because of the large number of finds, it was necessary to subscribe five other agreements between March 2020 and February 2022.



DRAWING BY NAIRA ATZIRI AGUILAR GARCÍA AND ALBERTO FRUTOS ANDRADE / SECRETARÍA DE CULTURA, INAH, MODIFIED BY DEBORAH V. ESPINOSA MARTÍNEZ

Figure 1. Area where the new airport for México City has been built. The area is about 4,000 hectares. Yellow dots indicate where mammoths were found.

Kaart van waar de nieuwe luchthaven van México City is gebouwd. Het gebied is ongeveer 4.000 hectare groot. Gele stippen geven aan waar mammoeten zijn gevonden.

RESEARCH PROJECT

After initial, abundant finds of Columbian mammoth and other animal remains during the airport construction, it was decided to initiate a scientific research project that could provide the analyses for learning about the paleoenvironmental context as well as the prehistory of the Basin of Mexico. To that end, a team of specialists on Quaternary studies, including volcanology, sedimentology, palynology, archaeozoology, vertebrate paleontology, geochemistry (stable and radiogenic isotopes, dating, etc.), and paleoproteomics, were listed and these jointly submitted an initial proposal to the INAH's Paleontology Council for getting the required permit to undertake the study. Furthermore, since there had been mention of possible megafaunal traps in Tultepec, nearby Santa Lucía, the project also addresses the testing of the trap hypothesis (Corona-M. et al., 2020).

PALEONTOLOGY

The paleontological discoveries in Santa Lucía began in 1976 (Lorenzo & Mirambell, 1986), when Jesús Mora and Oscar Rodríguez excavated two mammoths, together with camel and saber-toothed tiger bones, to which, by dating an obsidian flake, they assigned an age of $23,900 \pm 660$ to $26,300 \pm 300$ BP. At the end of 1980, remains of three more mammoths and a camel bone were found, rescued by Rosa Avilés (Santa Lucía II Site); by hydration of an obsidian flake, a date of $11,170 \pm 1,650$ BP was obtained. In March 1992, Córdoba et al. (1997) rescued another mammoth; its antiquity, by stratigraphic position, was calculated at 11,000 BP. Finally, Gonzalez et al. (2013) reported various dates of human remains and bones of extinct animals, mainly for the Basin of Mexico, with a *Camelops hesternus* camel jaw from the site called Santa Lucía II.

But it is in the archaeological rescue project at the AIFA that, from October 2019 to date, more than 55,000 bones have been rescued, from more than 600 discovery points, accounting for about 500 individuals of Columbian mammoth (*Mammuthus columbi*). There were also other animals commonly known to occur with mammoths, like camels (*C. hesternus*), horses (*Equus* sp., at least two species), saber-toothed tigers (*Smilodon* sp.), bison (*Bison* sp.), ground sloths (*Paramylodon* sp.), dire wolves (*Aenocyon dirus*), few genera of Antilocapridae (pronghorns), minor terrestrial species (lagomorphs, rodents, birds, turtles, and frogs, among others), and fishes, from about 24,000 to 11,700 BP.

PROPOSED CONTEXTS

In Santa Lucía, due to the progress of the "Prehistory and Paleoenvironment of the Northwest Basin of Mexico" research project, a progressive drying process of Lake Xaltocan and repeated volcanic ash rains have been detected, which between 24,000 and 11,700 BP converted its most superficial strata into a swamp, in which hundreds of animals may have been trapped; derived from this, three taphonomical distribution contexts were distinguished.

The first corresponds mainly to the northern part of the AIFA polygon, an old lake shore, which contains sets of large quantities of bones of various species that occur in the same stratum and do not share an anatomical relationship (Fig. 2). The second is found mainly in the east-central part of the AIFA, which corresponds to a retreat of the lacustrine body; it is characterized by mammoth individuals that are located in the muddy sediment of the lake shores, which are relatively close and retain most of their anatomical relationship (Fig. 3). The third is found mainly in the center-south area of the site



Figure 2. Remains pertaining to individuals of several species spread in a nearby area close to Excavation Unit 1.

Overblijfselen van verschillende diersoorten verspreid in een gebied dichtbij Excavation Unit 1.

polygon, which corresponds to the deepest part of the lake, where there are isolated bones in sandy strata.

So far, based on the observations of the stratigraphy specialists of the research project, three possible moments of death due to swamping have been identified for the Pleistocene fauna, which we have called early, late and terminal stages; according to the proximity of their bones to the current surface, all between 24,000 and 11,700 (BP), which indicates that the main cause of death of these large animals, in the muddy bed of the lake, repeated itself continuously during the centuries that followed and during which they inhabited the area.

It is important to point out that at the moment there is no evidence of a man-fauna interaction, such as that recorded in the nearby sites of Santa Isabel Ixtapan and Tocuila, where projectile points were found between the mammoth bones (Aveleyra Arroyo de Anda & Maldonado Koernell, 1952) and a set of bone fragments with anthropic modifications (Morett-Alatorre et al., 2001), respectively.

CONSERVATION THROUGH THE RESEARCH CENTER AND DISSEMINATION THROUGH THE QUINAMÉTZIN MUSEUM

SEDENA, in coordination with INAH, is building two museum spaces and a research center within the AIFA, which will contain the materials recovered during the archaeological salvage work: those are an archaeology room in the

new military aviation museum, the *Quinamétzin* Mammoth Museum and the paleontological collection storage area. With these actions, the objectives of preserving, researching and disseminating the collections recovered in the project are fulfilled.

The *Quinamétzin Mammoth Museum* (Fig. 4) with its research center is a SEDENA-INAH inter-institutional project that is being built in an area of 7,328 m². The researchers of the *Prehistory and Paleoenvironment of the Northwest Basin of Mexico* prepared the main scientific script project, which is displayed in six rooms, while museography was developed by the National Coordination of Museums and Exhibitions of the INAH along with personnel from the Military Ministry dedicated to such an endeavor. These room themes are:

1. Geology and paleoenvironments of the Basin of Mexico;
2. The Columbian mammoth. The trajectory of an American species;
3. Biodiversity of the Basin of Mexico in the late Pleistocene;
4. Early settlement of Mexico;
5. Fossils and cultural imaginaries in the present (paleontology and biocultural processes);
6. The excavation process in Santa Lucía.

In turn, the storage area was designed to function in more than 4,000 m², a space to adequately preserve the osteological collection as well as to have the conditions to allow and generate future research.



Figure 3. Remains of an almost complete single mammoth skeleton with many bones in anatomical association.
Overblijfselen van een bijna compleet skelet, grotendeels in anatomisch verband, van één enkele mammoet.

FINAL REMARKS

The excavations will finish during the first half of this year (2022), and hopefully, during the material analysis phase, which we will report on in future publications, we will learn more about past landscapes in the northwestern portion of the Basin of Mexico. Also, learning in detail the life history of mammoth populations in one of the southernmost localities where a large population is known, would be one of our major goals. Finally, if any interactions between mammoths and humans are found, as expected, we would also deepen our knowledge of the hunter-gatherer societies that lived in this region of Mexico.

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Figure 4. Landscape view on the Quinamétzin Mammoth Museum in AIFA.
Aanzicht van het Quinamétzin Mammoetmuseum in AIFA.