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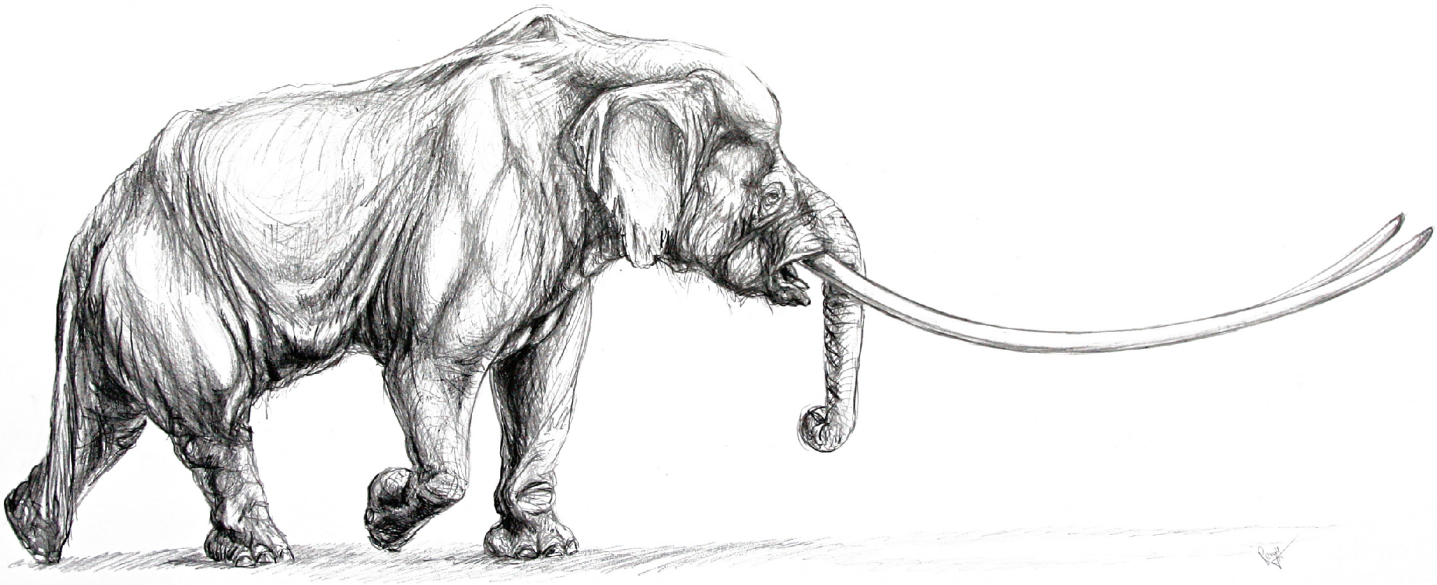

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ABSTRACT BOOK

Editors:
Dimitris S. KOSTOPOULOS, Evangelos VLACHOS, and Evangelia TSOUKALA

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An old Mexican proboscidean studied with new techniques

**Joaquín ARROYO-CABRALES ✉, Luis BARBA, Agustín ORTÍZ,
Víctor Adrián PÉREZ-CRESPO, Pedro MORALES-PUENTE, and Edith CIENFUEGOS ALVARADO**

During the Late Pleistocene, the Basin of México was inhabited by populations of large megaherbivores, being contemporaneous with the early humans. Although more than 100 mammoth localities have been found in the basin, very few of them present any trustable evidence of mammoth-human interactions (Arroyo-Cabrales et al., 2006). Most of those findings occurred in the eastern portion of what it used to be Texcoco Lake, in some of the lowest elevations in the region (2,200 masl). However, few of them have been found on the foothills of the mountains around the basin, and only last year, new mammoth remains were found in Milpa Alta at 2,800 masl., at the south easternmost portion of the Basin, in one of the few remaining rural areas, near one of the most populated cities of the World, México City.

Initial findings of upper and lower molars provided a starting point for proposing a paleontological research project in México that for the first time involved geophysical surveys combining three different methods: magnetic gradient, ground-penetrating radar (helpful in identifying location, depth and shape of anomaly), and electrical resistivity (helpful in defining bone concentration) (Barba et al., 2009, 2010). Based on the results from the collected geophysical data, one sample site was excavated to test the geophysical signals, but also because molars were found nearby.

Excavations were conducted in accordance to the usual square-grid method, which was followed as far as the nature of the sediments allowed, as they consisted mostly by loose dark volcanic ashes, and as such keeping the walls straight was quite difficult. Initial hypothesis pointed out towards a possible volcanic event causing the death of a mammoth, with late exposure of the animal bones, and a second event covering them again with volcanic ashes. During this time interval most of the limb bones moved down the hill, lower than the head and the girdles.

In order to test this hypothesis, samples from sediment in

Fig. 1. 3D-Laser scanned view of the Milpa Alta mammoth, head and pectoral girdle are in view. *Courtesy of Victor Takahashi.*

touch with the buried bones were secured for chemical analyses in order to figure out whether the bones had muscle remains still attached on due to a fast burial event.

The observed volcanic stratigraphy during the excavation suggests two different volcanic events: an ash layer identified as tutifruti produced by a first eruption event of the Popocatepetl Volcano is found right above the mammoth remains and has been dated to 14100 BP. During the burial process the soft tissue decayed and it seems that due to the tectonic and volcanic activity of the Chichinahutzin ridge, the bone remains were exposed again thousands of years later. Later on, a second eruption event covered the bones again with a lahar type layer composed of volcanic ash and water that slided down from the San Miguel volcano slopes and shifted some of the bones from their original position.

It is outstanding that a small concentration of fragmented bones was found on the side of one of the tusks, including a few bones with possible anthropic cuts. These have been studied using a SEM, and human modification seems a plausible scenario. However, dating the time of the supposed cutmarks will not be easy.

The mammoth specimen was an adult individual belonging to the species *Mammuthus columbi* (Proboscidea, Elephantidae), the Columbian mammoth. Based on the molar identification (permanent third molar), the specimen was assigned as 43 years old. The recovered skeleton was almost complete, lying on its side. Furthermore, the bones were quite weathered, probably due to the unusual conditions of the burial sediments (volcanic ashes). Also 3D-laser scanning was employed to understand the way that the deposit was formed (Fig. 1).

Molar dating is on-going, and carbon, nitrogen and oxygen stable isotopes analyses have been assayed in bone (apatite of bone and collagen), dentine and dental enamel. The obtained $\delta^{13}C$ values were -4.84‰ (enamel), -13.59‰ (dentine), -7.02‰ (apatite of bone), and -13.84‰ (collagen), which indicate that this mammoth had a mixed-diet with important intake of C_4 plants, and thus inhabiting in open habitats. In addition, $\delta^{15}N$ values were 9.82‰ for the dentine and 9.73‰ in the collagen, similar to those found in other mammoths (Pérez-Crespo et al., 2012). In contrast, oxygen isotopic values of apatite in enamel and bone were -6.16‰ and -6.26‰ respectively, which suggest that this mammoth possibly moved no more than 100 km. Further analyses are warranted to learn more on the biology of this individual.

Along with the scientific interest in learning more on this high-elevation individual, an exhibit has been planned. Certainly the community is quite interested in attracting visitors with a mammoth exhibit. They have made arrangements to purchase a piece of land nearby the area where the remains were found (Molina M., 2013; Olvera, 2013).

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arromatu5@yahoo.com.mx

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