Fossil insect traces reveal ancient climate, entrapment, and fossilization at La Brea Tar Pits

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This image shows a horse sesamoid (foot bone) riddled with insect damage. The bone, between 33,000-36,000 years old, is housed at the Page Museum at the La Brea Tar Pits. Credit: Page Museum at the La Brea Tar Pits

The La Brea Tar Pits have stirred the imaginations of scientists and the public alike for over a century. But the amount of time it took for ancient animals to become buried in asphalt after enduring their

gruesome deaths has remained a mystery. Recent forensic investigations, led by Anna R. Holden of the Natural History Museum of Los Angeles County (NHM) and colleagues, reveal new insights into fossilization and the prevailing climate at the Rancho La Brea Tar Pits toward the end of the last Ice Age.

The paper, entitled "Paleoecological and taphonomic implications of insect-damaged Pleistocene vertebrate remains from Rancho La Brea, southern California," will be published in the journal *PLoS One* on July 3, 2013.

The first step was to identify the insect traces. Holden and colleagues determined that different larval beetles were responsible for the exceptionally preserved traces on the bones of ancient mammals. By identifying those traces and researching the biology of the trace-maker, the team was able to pinpoint the climatic conditions and the minimum number of days it took for some of the carcasses to become submerged in the entrapping asphalt. Even after 10,000-60,000 years, the traces provide clear evidence that submergence took at least 17-20 weeks and occurred during warm to hot weather.

Holden conducted the study with paleontologist Dr. John M. Harris, Chief Curator of the Page Museum at the La Brea Tar Pits, and Robert M. Timm, from Kansas University, who manages a dermestid beetle colony for research specimen preparation. They fed bones to insect colonies and used forensic entomology to decipher fossil insect traces. Because the insects that made the fossil traces still live today, the team was able to link the climate restrictions of these culprits to late Ice Age environmental conditions. "These are rare and precious fossils because they provide a virtual snapshot of a natural drama that unfolded thousands of years ago in Los Angeles," Holden said.

The La Brea Tar Pits is the only constantly active, urban excavation site in the world. Credit: Page Museum at the La Breat Tar Pits

Aside from adding to the documented list of insects that eat bone, research by Holden et al. also sheds light on the conditions under which such insects will feed, and why mammalian herbivores offer a great setting for larval development. Although carnivorans vastly outnumber the amount of mammalian herbivorans excavated from the tar pits, no insect damage was found on their bones. The team believes that the thicker skin surrounding mammalian herbivore feet dried out and provided a stable, protected, and humid sub-environment complete with the right balance of tendons, muscle and fat for dermestid and tenebrionid larvae.

This is an exterior view of one of the asphalt seeps at the La Brea Tar Pits. Credit: Page Museum at the La Brea Tar Pits

These unique specimens, housed at the Page Museum, were recovered from multiple asphalt deposits from excavations that took place over the last century and continue today. "Most people associate the tar pits with research on saber-toothed cats and mammoths." Holden said. "But we show that the insects offer some the most valuable clues for our ongoing efforts to reconstruct Los Angeles's prehistoric environment."

Provided by Natural History Museum of Los Angeles County

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