

## h28 Trace fossils of dermestid beetles

Flesh and plants and other things putrefiable play no other part, nor have any other function in the generation of insects, than to prepare a suitable place or nest into which, at the time of procreation, the worm or eggs or other seed of worms are brought and hatched by the animals; and in this nest the worms, as soon as they are born, find sufficient food on which to nourish themselves excellently.

—Francesco Redi (1626-1697?), 1688.<sup>1</sup>

In Utah, Stephen (Steve) T. (Tom) Hasiotis examined the withered corpse of a mule deer that likely had died after being hit by a car.<sup>2</sup> The carcass had been partly chewed away by a coyote but most of the scavenging was being done by insects. Flies had landed and laid eggs from which maggots (fastidious eaters of dead flesh—they can be used to clean necrotic wounds) had hatched. These had fed on the flesh while it was still moist. Bees and wasps had visited the decomposing carcass to drink its fluids. Other insects had come to lay their eggs. Ants hunting larvae crawled over the corpse. By burrowing into the flesh, insects had made tunnels. Through these bacteria gained access deep into the body and were decomposing it. By this activity, organic nutrients are ultimately degraded to inorganic compounds that plants can reclaim. However, in environments where there is little rain, as in Utah, drying-mummification arrests decomposition. Then beetles take over. On the dried flesh of a corpse, dermestid beetles lay their eggs. Their larvae which soon hatch have powerful mandibles that enable them to chew through the jerky and devour even the fur and bone when only that remains. Within two months they can bore through bone to the marrow which they consume. Cocooned in the bone they use the ingested bone-calcium to stiffen their chitinous exoskeletons as they mature into purple-black adult beetles. These emerge and fly away to other corpses. Dermestids are among the few insects that leave a trace on the skeleton itself.

Hasiotis has recently noticed borings just like the ones on the mule deer in a five-foot-long humerus at Dinosaur National Monument (located on the Utah-Colorado border).<sup>3</sup> There are so many borings in this bone that it looks as if someone had peppered the fossil with bird shot. Carl Zimmer who interviewed Hasiotis in 1998 for *Discover* magazine writes:<sup>4</sup>

Other paleontologists noticed these holes over the years, but they dismissed them as the effects of any number of trivial events—as the imprint of excavators’ picks, perhaps, or etchings made by droplets of acid that formed in the sediment. But Hasiotis has shown that they were wrong. As he points out, the holes are either smooth circles or ellipses, which are imprints a beetle can make but not acid or a pick. And when Hasiotis put a riddled dinosaur toe under a scanning electron microscope, he could even see scrape marks on the sides of the borings that perfectly match the ones made by the jaws of living dermestid beetles.

Dermestid beetle body-fossils are known to 30 million years ago. The beetles borings found by Hasiotis are trace evidence of dermestids in existence 150 million years ago. They also make for a revision of how dinosaurs found at the monument died. The dinosaur bones are a jumble in river sediment. Paleontologists had assumed that a flood had killed and then piled them up in a carcass jam. But if so, there would have been no way for the beetles to make their borings. Hasiotis explains: “Dermestid beetles have a very narrow range of environments. It has to be dry, hot, and arid. The carcasses were not in water. ... The dinosaurs must have been suffering through a harsh drought, dropping off here and there. Carnivorous dinosaurs may have scavenged some of their meat, but they left most of it on the bone for the flies, ants, bees, and wasps. Once the flesh had dried out, the dermestid beetles arrived. They chewed the bones clean and then bored into them. During this entire time there must have been little rain—otherwise the beetles wouldn’t have been able to mark the dinosaur bones so much.” Hasiotis has even found borings that overlap older ones, suggesting that two generations of dermestids managed to be hatched larvae on the bones. He estimates that it took four to nine months for the 30-ton dinosaur to be stripped bare. Only after that time did a flood gather up all the naked skeletons, still held together by ligaments, and sweep them into a channel.<sup>4</sup> □