Taphonomic Processes Associated with the Merrell Local Fauna (Pleistocene, Rancholabrean) in the Greater Yellowstone Ecosystem, Centennial Valley, Southwestern Montana

Christopher L. Hill

The Merrell Local Fauna (MLF), recovered from sedimentary deposits near the Red Rock River within Centennial Valley in southwestern Montana, comprises four classes of taxa: Osteichthyes (bony fish), Aves (waterfowl), Amphibia (amphibians), and Mammalia (Dundas et al. 1996; Hill and Davis 2005; Hill 2006). The locality demonstrates the diversity of the Rancholabrean fauna within the Greater Yellowstone Ecosystem. Finite radiocarbon ages obtained from 13 direct radiocarbon measurements made on bone range from 49,350 ± 1500 RCYBP (Beta-116519) to 19,310 ± 90 RCYBP (Beta-77826). Several measurements indicate some remains are > 52,800 RCYBP (see below). The faunal assemblages that form the MLF have been affected by a variety of taphonomic processes resulting from pre-burial deposition, burial, and post-burial events.

Stratigraphic contexts and sedimentologic facies associated with the MLF reflect variability in depositional and post-depositional processes, providing information on the factors leading to the accumulation of the fossils. Five strata have been recognized (Figure 1). Vertebrate remains found within stratum A are usually rare and isolated, except near its contact with stratum B. An example of an isolated find within stratum A is a patella of a proboscidean (cf. *Mammuthus*). It is likely that some of the fossils found within stratum A, especially near its upper contact with stratum B, have been moved by post-depositional events.

The first taphonomic context in which there are higher frequencies of vertebrate bones is along the interface of strata A–B and in the lowest part of stratum B. There are no articulated specimens, but there are concentrations of bones, tusk, and teeth of mammoth. Other faunal materials from this taphonomic context include *Ondatra zibethicus* (muskrat) and bivalves. These may include bones that first accumulated on the surface of stratum A then were buried within stratum B, as well as elements that accumulated during the deposition of stratum B. Radiocarbon measurements, if reliable, suggest that this taphonomic context contains a temporally mixed assemblage. Fragments of mammoth teeth were dated at > 52,800 RCYBP (SR-6012, SR-6013), while 14C ages on tusk fragments are 32,470 ± 270 RCYBP (Beta-111325) and 23,120 ± 1190 RCYBP (SR-6014). These could reflect a taphonomic context associated with surface exposure within a small basin and burial in or incorporation into a marsh.

Christopher L. Hill, Department of Anthropology, Boise State University, Boise, ID; e-mail: chill2@boisestate.edu
The alluvial deposits of stratum C also contain vertebrate remains, including limb bone, tooth, and tusk fragments of mammoth, and fragments from *Camelops* (camel), *Equus* (horse), *Canis latrans* (wolf), a large artiodactyl, *Lemniscus curtatus* (sagebrush vole), Pisces (fish), and Anatidae (duck). The $^{14}$C age on camel is 30,400 ± 590 RCYBP (SR-6018). These fossils are distributed throughout the sequence of stratum C, within gravels and sands interleaved with silt-dominated sediments. Thus these vertebrate remains represent a taphonomic context primarily associated with fluvial transport and burial.

A third taphonomic context is associated with the faunal assemblage from stratum D, consisting of a fine-grained matrix with cobbles and bones, interpreted as a debris flow. Most of the faunal material consists of remains of mammoth (tusk, teeth, and bones) as well as some elements of *Equus* (horse) and *Bison* (bison). Based on the $^{14}$C ages, this assemblage is temporally mixed. Fragments of mammoth and horse bone have measurements indicating ages of > 52,800 (SR-6016, SR-6017). Bone collagen ages range from 26,630 ± 190 RCYBP (SR-6015) to 19,310 ± 90 RCYBP (Beta-77826).

The depositional variability reflected in the stratigraphic record indicates that the MLF consists of faunal assemblages that are the result of at least three different taphonomic contexts. The dispersal, scattering, and accumulation of bones associated with strata A–B appear to have occurred in a marsh-pond basin. Transport, deposition, and burial of skeletal parts recovered within stratum C were the result of hydraulic events associated with fluvial conditions. The concentration of mammoth fossils in stratum D occurs within a debris flow. Subsurface movements—post-depositional crushing by sediment overburden along with liquefaction and faulting—have also affected the character of the MLF. Horse remains are associated with both fluvial and debris flow deposits. Camel and wolf remains have been identified from alluvial contexts, while bison was recovered only in association with the debris flow. All three taphonomic contexts contain evidence of mammoth.
These findings suggest that the Pleistocene faunal assemblages are the product of shifting local depositional environments and erosional events. Some animals may be directly linked to paludal or lacustrine contexts (e.g., stratum B). Taphonomic contexts also indicate some faunal materials have been affected by erosion, transport, and redeposition, resulting in temporally mixed assemblages (within strata B–C, Figure 1). Based on the radiocarbon measurements and stratigraphy, the vertebrate remains indicate that some fauna may have been part of the Greater Yellowstone Ecosystem since at least the Last Glacial Maximum. The faunal inventory includes extinct taxa (e.g., *Mammuthus*, *Camelops*, *Equus*) as well as biotic elements that are found in the present Greater Yellowstone Ecosystem, for example, trumpeter swan (*Olor buccinator*), sagebrush vole, muskrat, beaver (*Castor canadensis*), coyote (*Canis latrans*), wolf, bear (*Ursus* sp.), and bison.

**References Cited**

