Small Mammals from the Hell Gap Site, Wyoming and Their Paleoecological Significance

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ABSTRACT

Limited small mammal remains were recovered from the Hell Gap site during the early 1960s. Based on these remains, a lowering of "life zones" was proposed at Hell Gap around ca. 10,800 years B.P. In 1997, the Early Holocene small mammal population of Locality I was strategically sampled. Flotation samples were collected by five-centimeter intervals within defined stratigraphic units. Small mammal remains were also collected during archaeological excavations in 1996-1998. Since 1998, additional small mammal remains continued to be collected during excavations and have been recently examined. This endeavor did not identify an new rodent species that were not previously known from the site, and overall rodent abundance and representation of species throughout the stratigraphic profile did not change even with changes in recovery and mapping protocols over the years of excavations at the site. While the rodent sample from the Hell Gap site continues to be sparse compared with medium or large mammals, these small mammals remain critical for paleoenvironmental reconstructions of this early Holocene period. Paleoenvironmental reconstruction based on the rodent sample indicates the habitat and environment of the Hell Gap area was established before the human occupation of the area and has not substantially changed in the ca. 10,800 years since.

INTRODUCTION

Rodents recovered from archaeological sites are beneficial in providing valuable paleoenvironmental data, even if their ability to shed light on human cultural practices is limited. However, this can only be done if proper identifications are made of the recovered remains and the extant living fauna and its habitat and environmental requirements are adequately understood. Roberts (1970) published a summary of paleoenvironmental data from the Hell Gap site based on faunal remains from the 1962-1966 excavations and 1967 testing he conducted alongside the 1966 excavations. Based on the presence of three species in the Late Glacial (Folsom through Hell Gap) occupation levels, Roberts proposed montane life zones may have been lowered by up to 600 meters and mean annual air temperatures would have averaged more than 3.5 degrees C cooler than today.

The three species on which Roberts based this conclusion were *Marmota flaviventris* (marmot), *Spermophilus richardsonii* (Wyoming or Richardson's Ground Squirrel), and *Microtus montanus* (montane vole), which all normally found at elevations above 1800 meters in Wyoming. Based on small mammal remains from the same time period recovered from the Medicine Lodge Creek site in the Bighorn Mountains of northern Wyoming, Walker (1975, 2002) questioned Roberts' conclusions and countered that life zones and mammalian distributions in Wyoming were established before 11,000 years B.P. as evidenced in the faunal sequence at Medicine Lodge Creek. Additional later studies on faunal remains from other regional localities were summarized by Walker (1986, 1987). Based on those studies, the published paleoenvironmental reconstruction proposed by Roberts (1970) for the Hell Gap site can only be considered an anomaly. That is, if the paleoenvironment were such as Roberts suggested, then the Hartville Uplift existed in a vacuum, separate from the paleoenvironmental regime of the rest of the region.

FIGURE 1: Overview looking across Hell Gap site Locality 1 (arrow) toward east and the prairie uplands of the Great Plains.

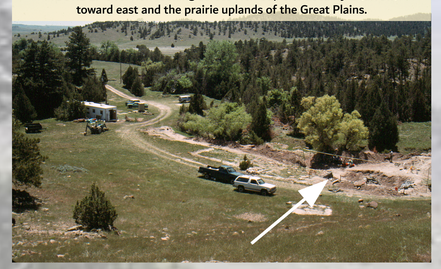
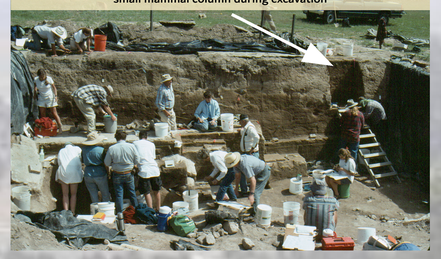


FIGURE 2: 1997 excavations at Hell Gap site, showing location (arrow) of small mammal column during excavation



METHODOLOGY

In 1997, excavations at Locality I provided the opportunity to strategically examine the small mammal remains at the site (Figure 1). A location along the back wall of Locality I was chosen because the complete stratigraphic sequence was present allowing collection of small mammals from the modern soil horizon to the bottom of the sediment sequence at Hell Gap, dating to the Pleistocene (Figure 2). The various sediment layers defined by Haynes were readily visible in this profile, allowing for tight control of the samples to be collected (Figure 3). Each collected rodent sample was a maximum of five centimeters thick and restricted to a specific stratigraphic unit defined by Haynes (Figure 4). Most stratigraphic units contained several collection samples, allowing for fine control of the recovered small mammals. The various samples were removed *en masse* and bagged for later water-screening under controlled conditions.

Fifty-six bulk samples were collected from the 2.7 meter-tall profile in 1997. These samples were water-screened through 16-mesh window screen at the University of Wyoming Zooarchaeology Lab after a six month drying period to allow all ground moisture to be evaporated from the samples. The matrix was allowed to again dry after the initial wash and all faunal remains and cultural materials were picked from the remaining sediment. Recovered faunal materials were then identified by comparison to known specimens in the Department of Anthropology Comparative Osteological Museum. Additionally, rodent materials mapped *in situ* or recovered through field water-screening since the 1997 work have now been re-examined to determine if there were differences in the small mammal signature between samples recovered under different excavation and screening protocols.

FIGURE 3: 1997 Hell Gap site Locality I small mammal column before excavation showing various stratigraphic units.

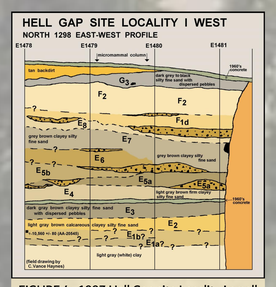


FIGURE 4: 1997 Hell Gap site Locality I small mammal column as shown on a profile map with Haynes' defined strata.

Lemmiscus curtatus	sagebrush vole
Microtus ochrogaster	prairie vole
Microtus sp.	either montane or long-tailed vole
Neotoma cinerea	packrat
Peromyscus sp.	deer mouse
Reithrodontomys sp.	harvest mouse
Sorex cinereus	shrew
Thomomys talpoides	Northern pocket gopher
Spermophilus	ground squirrel

TABLE 1: Latin and common names of all identified rodent species ever recovered from Locality I.

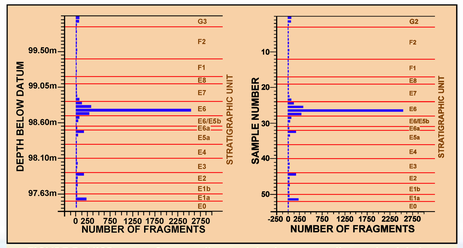


FIGURE 5: NISP counts from small mammal column according to depth below datum (left) and per sample (right) . Note peaks in counts in stratigraphic units E1a, E2, and E6.

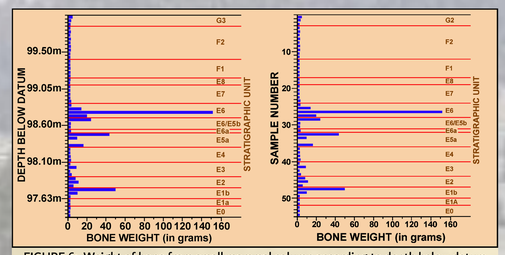


FIGURE 6: Weight of bone from small mammal column according to depth below datum (left) and per sample (right). Again, note peaks in counts in stratigraphic units E1a, E2, and E6 and additional peak in E5.

TAXON	STRATIGRAPHIC UNIT
Microtus sp.; *Microtus ochragaster*	G3
Microtus sp.; *Reithrodontomys* sp.	F1/E6
Microtus sp.; *Thomomys talpoides*	F2
Microtus sp.; *Reithrodontomys* sp.	F
Thomomys talpoides; *Spermophilus* sp.	E7
Microtus sp.; *Lemmiscus curtatus*; *Neotoma cinerea*; *Thomomys talpoides*; *Peromyscus* sp.; *Spermophilus* sp.; colubrid snake	E6
Microtus sp.; *Microtus ochrogaster*; *Microtus montanus/longicaudus*; *Reithrodontomys* sp.; *Sorex cinereus*	E5/A1
Microtus sp.; *Microtus ochrogaster*, *Thomomys talpoides*; *Peromyscus* sp.; *Sorex cinereus*	E4
Microtus sp.; *Lemmiscus curtatus*; *Neotoma cinerea*; *Thomomys talpoides*; *Reithrodontomys* sp.	E3
Microtus sp.; *Lemmiscus curtatus*; *Neotoma cinerea*; *Thomomys talpoides*	E2
Microtus sp.; *Microtus montanus/longicaudus*; *Lemmiscus curtatus*; *Neotoma cinerea*; *Thomomys talpoides*	E1B
Microtus sp.; *Microtus montanus/longicaudus*; *Peromyscus* sp.	E1A
Microtus sp.; *Mictotus montanus/longicaudus*; *Microtus ochrogaster*; *Lemmiscus curtatus*; *Peromyscus* sp.	E1
Microtus sp.; *Peromyscus* sp.	E0

FIGURE 7: Small mammal taxa present, by stratigraphic unit, as recovered from Hell Gap site Locality I excavations 1996 through 2018. Taxa in blue are those considered paleoenvironmentally sensitive.

RESULTS

The first obvious result of this project was that rodent, small mammal, and other small animal remains are sparse in the sediments at Locality I when compared to bison and medium-sized ungulates. Only occasionally were more than 6-10 small animal specimens recovered from any one 1997 five-centimeter collection level (Figure 5). Collection units with higher NISP counts were those from major cultural occupation levels also containing fragmented artiodactyl bone. This has distorted the overall NISP counts from the project and illustrates one of the main problems with looking at NISP counts without allowing for body size or cultural or other bone breakage. Another method often used for comparative purposes in zooarchaeology is weight of the collected bone. Similar distributions by level were noted when material from each collection level were examined in this manner (Figure 6).

Standard archaeological excavations between 1996 and 2018 also recovered small animal remains, including rodents and turtle. Overall, more small animal remains were recovered during these excavations than were recovered from the 1997 sample column, probably related to the much larger sampling areas involved (five centimeter levels in 50 by 50 centimeter quads in multiple units during regular excavations). All small mammal remains recovered from 1996 to 2018 were combined to examine species distributions through the entire sedimentary sequence (Figure 7). Re-examining the rodent material recovered during post-1999 excavations did not result in the identification of any species not already present in the earlier samples and therefore does not change the overall conclusions of the earlier 1997 study.

The small mammal sequence identified is illustrated here (Figure 7, Table 1). A variety of taxa were recovered, but often only a single specimen represents a taxon from any individual stratigraphic unit. The most interesting result of this study of the small mammal remains from the Hell Gap site is that the small mammal fauna appears to be dominated by grassland species, primarily *Microtus ochrogaster*, the prairie vole, and *Lemmiscus curtatus*, the sagebrush vole (Table 1). Both species occur throughout the Early Holocene sequence, along with other species that occur in a variety of habitats. These two species are highly distinctive in their dental characteristics and cannot be misidentified.

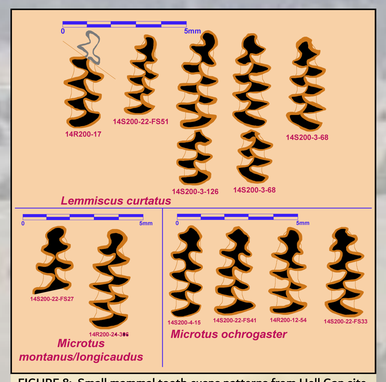


FIGURE 8: Small mammal tooth cusps patterns from Hell Gap site, 1996-1999 excavations.

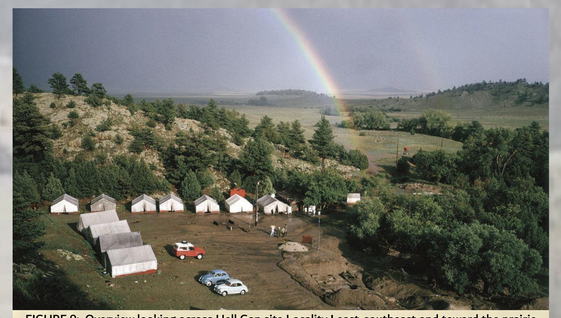


FIGURE 9: Overview looking across Hell Gap site Locality I east-southeast and toward the prairie uplands of the Great Plains. Note evidence for ecotonal variation between prairie uplands and the forested Laramie Range. Photograph from the 1960s excavations, courtesy of PiRL.

DISCUSSION OF PALEOENVIRONMENT AND CONCLUSIONS

Roberts (1970) based his paleoenvironmental reconstruction of Hell Gap on the presence of three montane species: marmot, montane vole, and Wyoming ground squirrel. He argued the montane vole cannot be distinguished from the long-tailed vole (*Microtus longicaudus*) based on cranial or mandibular characters, but still chose to identify all the vole material specifically as the montane vole. Walker was more conservative with the current study, only identifying these specimens to the group of *Microtus sp.* (Figure 8). Environmentally, these two taxa occur in different habitats, with only the long-tailed vole found in the Hell Gap site region today (Long 1965; Clark and Stromberg 1987), away from a montane habitat. If one assumes the specimens identified by Roberts are long-tailed vole, most of Roberts' conclusions are negated, and small mammal remains from the 1960s excavations agree with the results of the 1997 study and are not substantially different from the rodent remains recovered in recent years, either.

The presence of the prairie vole and sagebrush vole, and strong probability of the long-tailed vole, throughout the early Holocene sequence at Hell Gap is suggestive of a paleohabitat around the site area similar to that seen today in the region - an area of open grasslands bordering more forested upland regions under the climatic conditions necessary for those type of habitat (Figure 9). We accept the fact that further away from the foothills toward the interior of the Hartville Uplift the forest cover may have been denser than it is today, but there cannot have been an overall lowering of the life zones by 600 meters as proposed by Roberts. That would have placed this woodland and forest far out into the plains to the east of the site.

The 1997 collection of small mammals from the Hell Gap site and subsequent samples from later years shows the paleoenvironment of the site area fits the sequence proposed for the rest of Wyoming over the past 25 years (Walker 1975, 1986, 1987, 2002). The modern environment, habitat, and associated mammalian faunas were well-established over the region before 11,000 years B.P. and not substantially changed since that time. The area around Locality I offers a wide-open view shed over the adjacent short-grass prairie which would have been present throughout the human occupation of the Hell Gap site, allowing for easy sighting of the big game animals upon which they depended for a major food source. Additionally, despite changes in excavation, mapping, and screening protocols over the years, the rodent assemblage from Hell Gaps is consistent in representation of species and in overall abundance.

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