

# VERTEBRATE TAPHONOMY OF THE BLONQUIST ROCKSHELTER (PLEISTOCENE-HOLOCENE), SUMMIT COUNTY, UTAH: A CASE FOR RAPTORAL ACCUMULATION OF BONES

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## ABSTRACT

The Blonquist Rockshelter is located on the northern flank of the Uinta Mountains in Summit County, Utah, approximately 80 km northeast of Salt Lake City. The sediment package in the alcove is stratified, containing both exogenous and endogenous sediment, and ranges in age from late Pleistocene (ca. 11.14 ka) to Holocene (<5.91 ka). The entire package is fossiliferous, and thousands of mollusks, insects, teleost fish, amphibians, reptiles, birds, mammals, and plants have been recovered. The completeness of the individual elements preserved, the apparent gastrointestinal etching, the association of hair with some of the bones, and the similar size of the animals represented by the fossils support the conjecture that the fauna is predominately a raptor deposit.

## INTRODUCTION

The Blonquist Rockshelter is located in Summit County, Utah, approximately 80 km northeast of Salt Lake City. The west-facing shelter was formed in the Eocene Wasatch Conglomerate and is filled with exogenous and endogenous detritus (Nelson et al., 1989). This alcove is approximately 6 m wide across the front opening and 3 m in depth at the center, and takes the form of a one-quarter sphere. Ten stratigraphic layers have been identified within the shelter, and five organic-rich layers have been radiometrically dated: 11.14 ka (the basal layer of the sediment package), 9.67 ka, 7.99 ka, 6.06 ka, and 5.91 ka. Vertebrate fossils and plant debris have been recovered from all layers and most specimens await taxonomic description. Mammals comprise the majority of the specimens (> 95 per cent), although mollusks, insects, teleost fish, amphibians, reptiles,

and birds (28 species; Beasley, personal communication, 1991) are present.

## TAPHONOMY

The mode of accumulation of vertebrate fossils in the rockshelter may be attributed to a combination of external factors. The presence of significant *Neotoma* coprolites and plant debris in some of the organic-rich layers would suggest that packrats (*Neotoma*) incorporated these fossils into their middens. Human-altered obsidian chips located in the 7.99-ka layer suggest the presence of early Americans in the shelter. Some larger bones appear to contain toothmarks, an indication of gnawing carnivores, rodents, or insectivores. However, accumulations of microvertebrates produced primarily by mammalian carnivores are characterized by highly fragmented bones with a high incidence of unidentifiable fragments and digestive erosion

(Kusmer, 1990). This is not the case with the majority of the rockshelter fossils. It is our contention that many of the bones are the result of accumulation by raptors, and this note presents our findings and evidence.

### DISCUSSION

Numerous studies have shown that raptors, especially owls, may make significant contributions to the accumulation of organic debris in caves and rockshelters (Guilday et al., 1977; Mayhew, 1977; Dodson and Wexlar, 1979; Levinson, 1982; Hoffman, 1988; Andrews, 1990; Kusmer, 1990; Burns, 1991). Owls swallow prey whole, or in large pieces, and later regurgitate pellets containing hair and bony material (Moon, 1940). Large collections of these pellets are usually present at nesting and roosting sites. Kusmer (1990) listed six characteristics of owl pellet assemblages. A synopsis of these characteristics includes: 1) large quantities of bone from a restricted number of taxa, consisting of a restricted size range and a possible high percentage of nocturnal and crepuscular animals; 2) a possible high percentage of nocturnal and crepuscular animals; 3) a high-frequency representation of all skeletal elements; 4) high relative frequency of complete femora, radii, mandibles, and humeri, and a low relative frequency of complete scapulae and innominates; 5) large proportion of fragmentary crania; and 6) a large proportion of bones in good condition.

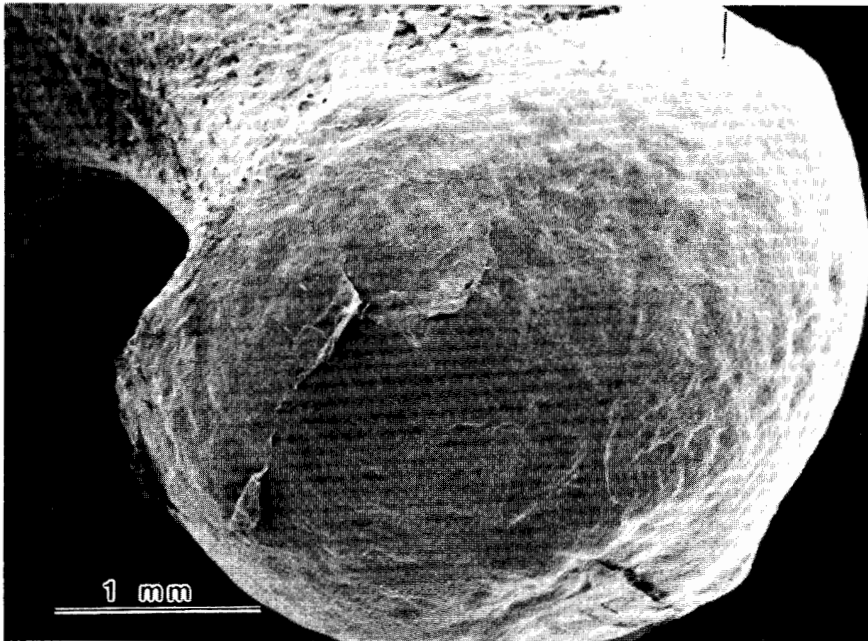
There is a restricted number of mammalian species in the marmot-sized and smaller size range (mostly *Neotoma*, *Spermophilus*, *Microtus*, *Marmota*, and lagomorphs). This size range would be the preferred prey-size range of raptorial birds; however, there are many individuals of each taxon represented. There are numerous complete elements in the shelter fauna, including crania, humeri, radii, ulni, tibiae, and femora, and even some articulated vertebrae. It is not uncommon to find articulated vertebrae and feet in modern owl pellets. The remaining elements in the shelter are broken, but readily identifiable as to element, and in most cases to taxon.

### MICROSCOPIC EVIDENCE

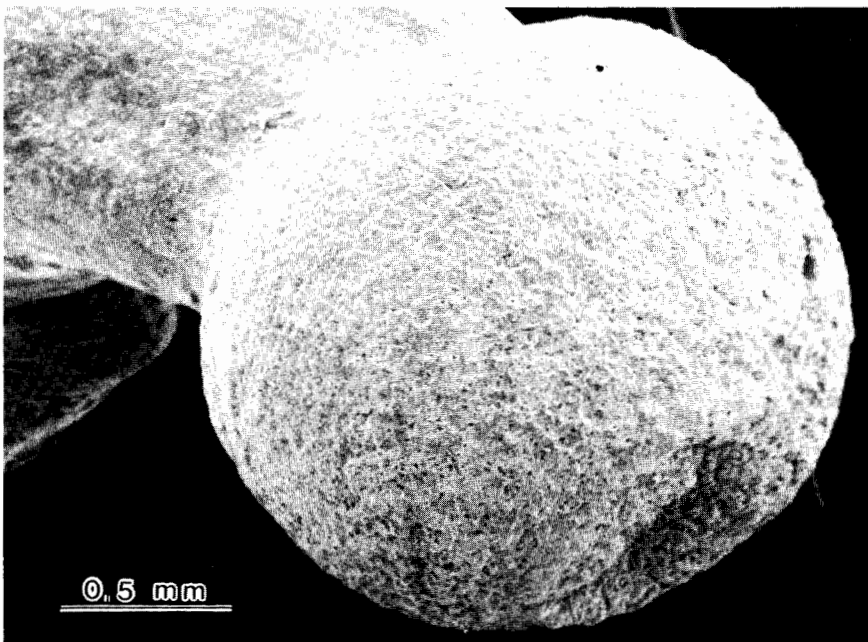
It has been noted by a number of workers

(Kusmer, 1990; Shipman, 1981; Andrews, 1990) that bones from owl pellets may show etching as a result of the time spent in the gastrointestinal track. Fossil bones collected from the Blonquist Rockshelter, as well as a sample of bones from modern owl pellets, were examined with a scanning electron microscope (SEM) to ascertain whether etching could be noted. The fossil bones were chosen from the lower stratigraphic layers (between 9.7 ka and 8.0 ka levels) in order to minimize the chance of contamination by modern owl pellets. Bones from modern owl pellets (barn owl, *Tyto* sp.) were used as control samples. Elements thought most likely to show erosion were singled out for preparation and viewing under the SEM. These elements, and affected areas, are 1) edges of scapulas, 2) teeth and their alveoli, and 3) epiphyses. Etching was not unambiguously evident in either the modern or fossil material. Some of the specimens showed evidence of minor erosion (Figures 1 and 2) when compared to the photomicrographs published by Andrews (1990). The lack of etching could be due to the fact that owls (Strigiformes) do not erode the bone as fully as diurnal raptors (Falconiformes) because of the higher pH in the gastric juices of diurnal birds (Duke et al., 1975; Leprince et al., 1979). The minimal amount of etching in the rockshelter specimens could imply that owls were predominately responsible for the rockshelter deposit. Some support for the idea that the rockshelter represents an owl deposit is offered by the fact that *Microtus* and *Neotoma* are predominately nocturnal, when owls would be hunting. However, many species of owls will hunt during the day in overcast weather, or in the early morning and late afternoon (Eckert and Karalus, 1987). This fact could explain the common occurrence in the fauna of *Spermophilus*, a diurnally active ground squirrel.

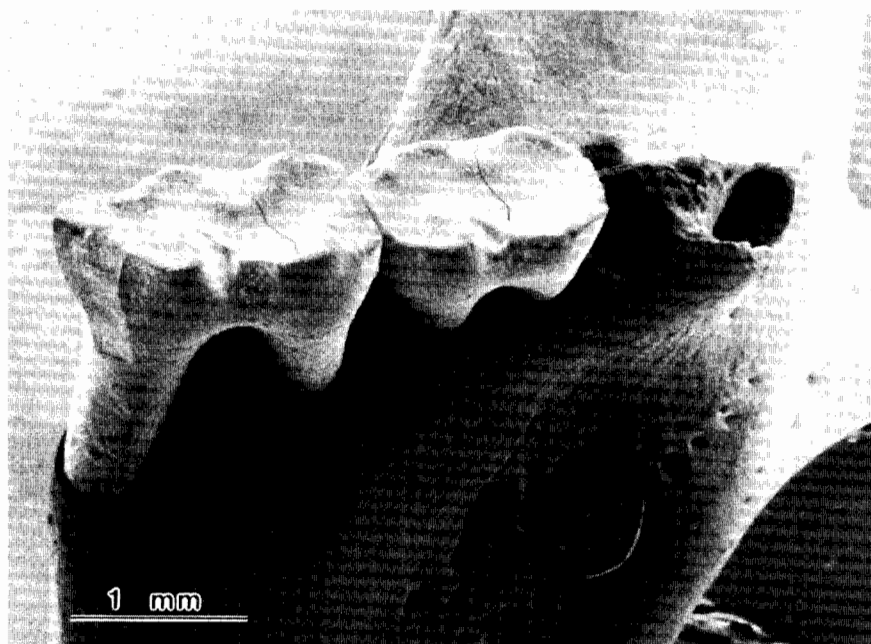
Shipman (1981) noted that in modern pellets, hair is squeezed into vascular foramina or other holes during the pellet-making process. Hair is likely to have decayed in older accumulations, but there is some evidence for it in the rockshelter material. At least two specimens (FHSM VP-10929 and VP-10927) have what has been interpreted as hair (Figures 3, 4, and 5). These "hairs" do not show the characteristic scales seen



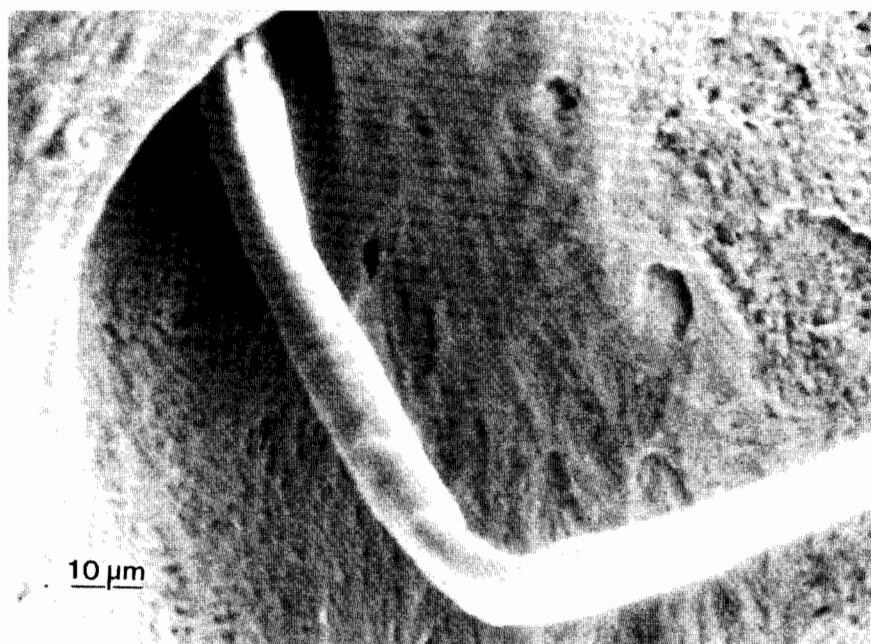
**Figure 1.** Modern gopher (*Geomys*) femur. This specimen is not from an owl pellet.



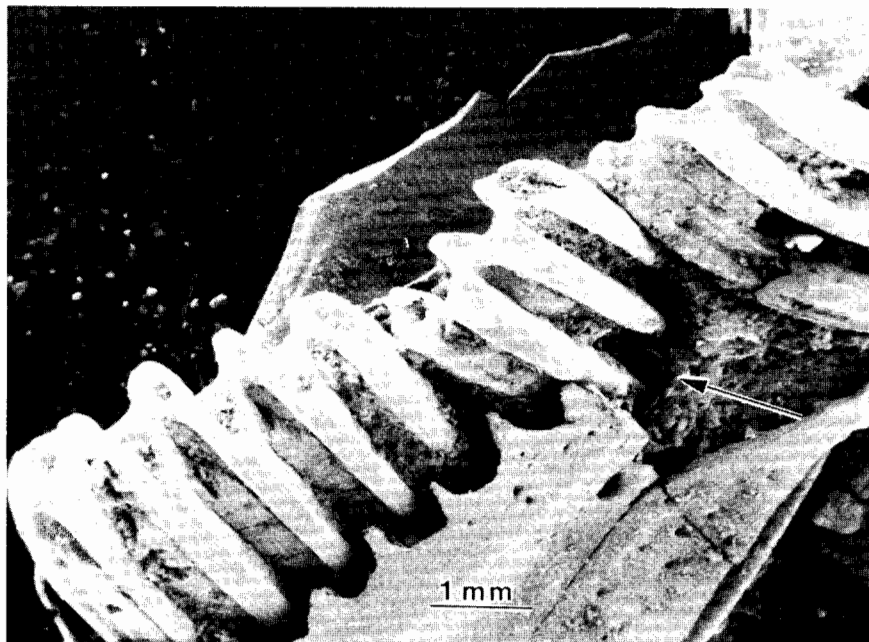
**Figure 2.** Head of rodent femur (FHSM VP-11374) from the Blonquist Rockshelter showing slight etching.



**Figure 3.** Fossil rodent dentary (FHSM VP-10927) with "hair" in the foramen.



**Figure 4.** Enlargement of Figure 3.



**Figure 5.** Fossil rodent dentary (FHSM VP-10929) with "hair" in the alveolus.

on modern hair in microscopic inspection, but these scales may have been lost over time. One of the "hairs" (Figures 3 and 4) is in a foramen, as is typical of hair in modern pellets. The "hairs" could also be rootlets from a plant; however, a woody cell structure is not evident.

Due to the characteristic completeness of the individual skeletal elements retrieved from the shelter, the wide variety of elements, the size bias of the animals represented in the fauna, the possible erosion of some of the bones due to gastric juice, and the hairs in association with the bones, it is presumed that much of the fauna of the Blonquist Rockshelter was deposited by raptors.

Among the bird material found in the shelter was a tarsometatarsus (FHSM VP-10534) with unusual scratches. These scratches are subparallel along one side of the bone (Figure 6) and compare well with published descriptions of tooth-marks (Shipman, 1981); however, it is uncertain whether the marks represent the actions of carnivores or rodents.

#### CONCLUSION

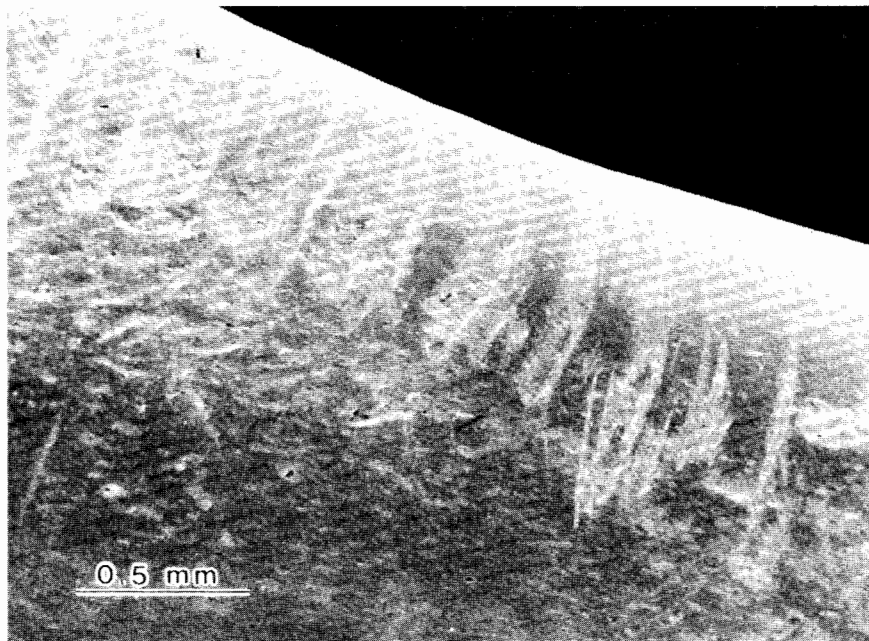
During the latest Pleistocene and early Holocene, the Blonquist Rockshelter served as a shelter and roosting site for raptorial birds, and perhaps intermittently as a refuge for packrats and other rodents. Continued work is needed to gain the full resolution possible from this rich faunal site.

#### ACKNOWLEDGMENTS

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**Figure 6.** Tarsometatarsus (FHSM VP-10534) from the Blonquist Rockshelter with scratch-marks.

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