

Paleolithic Zooarchaeology in Practice

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PALEOLITHIC SUBSISTENCE AND THE TAPHONOMY OF SMALL MAMMAL ACCUMULATIONS IN THE IBERIAN PENINSULA

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INTRODUCTION

Small mammal bones, and in particular those of the European rabbit (*Oryctolagus cuniculus*), are ubiquitous components of Paleolithic faunal assemblages recovered from caves and rockshelters throughout the Iberian Peninsula (Aura *et al.* 2002; Hockett and Haws 2002). Leporids (rabbits and hares [*Lepus* spp.]) were occasionally hunted by European Neanderthals (Aura *et al.* 2002; Blasco 1997), but it is not until the Upper Paleolithic in central and southern Europe, after ca. 30,000 BP, that these animals became mainstays of the diet (Aura *et al.* 2002; Hockett and Haws 2002; Musil 1994). Leporids were actively hunted in the early Upper Paleolithic throughout Iberia and central Europe, but in the eastern Mediterranean hares were taken in greater frequency much later, nearer to the Pleistocene-Holocene transition (Stiner and Munro 2002).

It has long been recognized by archaeologists that leporids are also the favorite prey of a variety of avian and mammalian predators in Iberia and elsewhere (Hockett 1989, 1991, 1999; Hockett and Haws 2002; Serra 2000; Perez-Ripoll 1993; Schmitt and Juell 1995; Schmitt 1995). In Iberia, over 30 mammalian and avian predators are known to hunt rabbits (e.g., Jaksic and Soriguer 1981; Mathias *et al.* 1998; Revilla and Palomares 2002). These predators include the eagle owl (*Bubo bubo*), lynx (*Lynx pardina*), wild cat (*Felis silvestris*), polecat or wild ferret (*Mustela putorius*), genet (*Genetta genetta*), red fox (*Vulpes vulpes*) and the badger (*Meles meles*).

Previous research suggests that eagle and owl pellets contain greater relative frequencies of forelimb bones (scapula, humerus, radius, ulna) compared to hindlimb bones (innominate, femur, tibia) (Hockett 1991, 1995; Hockett and Haws 2002; Serra 2000). Rabbit bones accumulated under the nesting or roosting sites of golden eagles (*Aquila chrysaetos*) and martial eagles (*Polemaetus bellicosus*) in North America and southern Africa, respectively, display the opposite pattern: hindlimb bones outnumber forelimb bones (Hockett 1995; Schmitt 1995; Cruz-Urbe and Klein 1998). Non-scatological rabbit bone assemblages accumulated by small carnivores in Iberia also

tend to contain larger frequencies of hindlimb bones (Hockett 1999; Hockett and Haws 2002).

Raptors sometimes puncture rabbit bones during the kill or during feeding with their beaks and talons; small carnivores also puncture bones during feeding. Raptors, however, generally leave a single puncture mark, and they tend to puncture the innominate and sacrum more frequently than other bones. Small carnivores, in contrast, often create multiple puncture marks primarily on limb bones and innominates. As many as 10-12 individual puncture marks may be present on the ends of rabbit limb bones damaged by small carnivores (Hockett 1999). Additionally, raptors generally puncture only about 2-3% of the rabbit bones left behind at a nesting or roosting site; small carnivores puncture up to 25% of the non-scatological rabbit bones they may deposit in a cave or rockshelter (Hockett 1999; Hockett and Haws 2002).

These taphonomic patterns are in contrast to those created by Upper Paleolithic foragers in Iberia. In the Upper Paleolithic of Iberia, humans often butchered, consumed, and discarded complete or near-complete carcasses in caves and rockshelters, although foot elements are sometimes rare. Therefore, forelimb bones, hindlimb bones, and head parts such as mandibles all tend to be recovered in relatively large numbers. These patterns are displayed in Tables 1 and 2.

In addition, beginning in the early Upper Paleolithic human foragers in Iberia systematically extracted marrow from the tibia, femur, and humerus of rabbit carcasses (Pérez Ripoll 1993, 2001; Hockett and Bicho 2000; Hockett and Haws 2002). The marrow was extracted by snapping or biting the ends off these bones, creating diaphysis cylinders that sometimes number in the hundreds in Iberian Upper Paleolithic caves. Raptors and carnivores sometimes inadvertently create leporid diaphysis cylinders as well during feeding (Hockett 1991), but they are infrequent compared to the number of rabbit long bones with attached epiphyses (Hockett and Haws 2002). In these latter accumulations, as mentioned above, they will be accompanied by bones displaying puncture marks, particularly the innominate, sacrum and the ends of long bones.

Table 1. Relative frequencies of rabbit head, hindlimb, and forelimb bones from five nonhuman predator assemblages (data summarized in Hockett and Haws 2002).

	Assemblage 1	Assemblage 2	Assemblage 3	Assemblage 4	Assemblage 5
Head:					
mandible					
Hindlimb:					
innominate	.60	.41	.73	1.0	1.0
tibia	1.0	.57	1.0	.89	.70
Forelimb:					
humerus	.18	1.0	.33	.28	.16
ulna	.19	.91	.31	.17	.08

Table 2. Rabbit bones accumulated by a variety of nonhuman and human predators grouped into three blocks by relative frequencies.

	Assemblage 1	Assemblage 2	Assemblage 3	Assemblage 4	Assemblage 5
1.0					
femur	femur	radius	femur	tibia	
				humerus	
				ulna	
	mandible	innominate	mandible	mandible	femur
	ulna	scapula	femur		
		radius	scapula		
.20					
radius					
0.0					

This short note reports on the analysis of rabbit bones collected under a degraded raptor nest in the Estremadura region of central Portugal. Although the taphonomic patterning of leporid bones accumulated under raptor nests have been reported from the Great Basin of North America (Hockett 1995; Schmitt 1995; Hockett and

Haws 2002) and from Africa (Cruz-Urbe and Klein 1998), I sought a similar assemblage of bones from central Portugal for comparative purposes. Serra (2000) has reported on rabbit bones extracted from eagle owl pellets in Spain, but this study did not include an assemblage of unswallowed bones typically left behind at eagle owl nesting sites. The bones described below

Table 3. Rabbit bones of the axial skeleton and limbs from the Alvados Roost, central Portugal

mandible	8	1	9	8		
sacrum	9		9	9		
femur	12	21	11	4	48	33
scapula	3			3	3	
radius	4	2	2	8	6	
vertebra	54			54	54	

demonstrate continuity in taphonomic patterning of rabbit bones accumulated by raptors under nesting or roosting sites on three continents, building on the earlier research of Hockett (1989, 1991, 1995, 1996), Schmitt (1995), Cruz-Urbe and Klein (1998), and Hockett and Haws (2002).

ALVADOS ROOST

During the summer of 2001, approximately 250 rabbit bones were found lying alongside a steep cliff face near Buraca Glorioso, a collapsed 'rockshelter' in central Portugal that also serves as the opening to a large cave system (Table 3). The surface of Buraca Glorioso contained a number of rabbit bones accumulated by small carnivores (Hockett and Haws 2002). The rabbit bones reported on here were located along a narrow ledge and side slope below a nearly vertical cliff face. Although no active raptor roost was present, the rabbit bones most probably derived from a collapsed roost as the cliff face would have provided ideal ledges for the construction of an owl or eagle nest, but it afforded no room or protection for carnivores to den and accumulate bones. All bones from the surface were collected, and the top 2-3cm of sediment was scraped in order to collect bones that had been covered by recent vegetation. All bones were tightly clustered within an area measuring only 1-2m in diameter, again suggesting that they had fallen from a raptor nest built above the slope. Further, none of the bones exhibit the taphonomic traces of polishing, thinning, and corrosion characteristic of bones deposited in raptor pellets or carnivore scats. These bones allow for comparison to leporid bones recovered from eagle roosts in North America (Hockett 1995; Schmitt 1995; Hockett and Haws 2002) and southern Africa (Cruz-Urbe and Klein 1998).

Table 3 shows that hindlimb bones greatly outnumber forelimb bones, and head parts are relatively rare at

Alvados Roost. The greater relative frequencies of hindlimb bones compared to forelimb bones matches that of other reported raptor nest and non-scatological small carnivore assemblages; the relative scarcity of head parts (mandible, maxilla) matches the patterning of raptor nest

assemblages from North America and Africa. I have previously noted that golden eagles in North America often decapitate and 'skin' hare carcasses before feeding them to their young (Hockett 1995), which would account for the scarcity of head parts being accumulated under these nests. This behavior may have been repeated by the raptor that nested within Alvados Roost. Additionally, eagles often 'houseclean' their nests of rotting carcass parts not consumed by chicks in order to prevent potentially dangerous insects from invading roosts. This behavior tends to remove the upper body segment of leporid carcasses from nesting sites, while the lower limb segment from the tibia downward tends to remain at the nest and become incorporated into the nest as building material along with sticks, twigs, and the like. This would account for the consistently high relative frequencies of rabbit hindlimb bones under raptor nesting sites.

Similar to raptor-accumulated rabbit bone assemblages, only 3% of the bones from Alvados Roost display puncture marks, and all of these bones exhibit a single puncture. This is consistent with bones that have been punctured by raptor beaks and talons either during the kill or during feeding, in contrast to the multiple puncture marks caused by small carnivore teeth during feeding. Overall, then, these data suggest that leporid bone assemblages accumulated under raptor nests exhibit consistent taphonomic patterning across three continents: North America, Africa, and Europe. This patterning consists of 1) higher relative frequencies of hindlimb bones compared to forelimb bones; 2) relatively low frequencies of head parts; 3) 2-3% of bones exhibiting

puncture marks; and 4) bones displaying single puncture marks; bones with multiple puncture marks will be relatively rare.

SIGNIFICANCE AND RELATION TO PALEOLITHIC SUBSISTENCE

These data are important because small carnivores and raptors probably both accumulated large numbers of rabbit bones in some archaeological sites in the Iberian Peninsula, particularly before ca. 30,000 BP. In fact, in some cases it conceptually may be better to state that Neanderthals deposited some artifacts in carnivore dens and under raptor nests rather than to state that nonhuman predators accumulated bones in archaeological sites inhabited by Neanderthals. For examples, previous studies in central Portugal near Alvados Roost suggest that some pre-30,000 BP faunal assemblages were accumulated primarily by small carnivores, such as at Pego do Diabo Cave (Valente 2000). Preliminary results of the analysis of more than 10,000 rabbit bones from the early Middle Paleolithic site Galeria Pesada in central Portugal (Hockett 2001) suggests that the majority of these bones may have accumulated under a raptor nest, despite the fact that large mammal bones cut by stone tools and hundreds of lithic artifacts were found amongst the rabbit bones (Marks *et al.* 2002).

In contrast, rabbit bone assemblages dating to the Upper Paleolithic in Portugal consistently display patterns suggesting that all or nearly all of these bones were deposited by humans rather than by nonhuman predators. Upper Paleolithic sites such as Picareiro Cave, Anecrial, and Lapa dos Coelhos (Hockett and Bicho 2000; Hockett and Haws 2002) contain thousands of rabbit bones accumulated by humans. There is scant evidence that nonhuman predators occupied these caves and deposited rabbit bones within them when they were unoccupied by Upper Paleolithic foragers. Central Portuguese caves that contain both Middle Paleolithic and Upper Paleolithic deposits such as Caldeirão Cave tell the same tale: during the Middle Paleolithic fewer rabbit bones were deposited into the cave, and those that are present exhibit good evidence that the majority of them were accumulated by nonhuman predators. In contrast, the Upper Paleolithic deposits of Caldeirão contain many more rabbit bones, the majority of which exhibit no evidence of nonhuman predator modification such as puncture marks (e.g., Davis 2002). This general pattern is repeated in caves throughout much of Spain, such as the central, eastern, and southern regions (Pérez Ripoll 2001; Aura *et al.* 2002).

These data in turn suggest that Upper Paleolithic foragers in Iberia may have occupied caves and rockshelters for longer periods of time than did the Neanderthals. The Iberian Neanderthals had more competition for food from a wider variety of principally large mammalian carnivores than did Upper Paleolithic foragers (Valente 2000). These combined data may support earlier

interpretations that Iberian Neanderthals were more mobile than many populations of Upper Paleolithic foragers (e.g., Villaverde *et al.* 1996). While reductions in mobility may have been a contributing factor to the increase in rabbit hunting during the Upper Paleolithic of Iberia, this explanation seems inadequate to entirely explain the virtual absence of rabbit hunting at cave sites inhabited by *H. heidelbergensis* or Neanderthals such as Galeria Pesada. In the latter case, these early humans occupied the cave during a time in which rabbits were clearly abundant near the cave, just as they were during Upper Paleolithic times. Yet the early human occupants focused on large mammalian herbivores, ignoring a wide variety of small animals such as rabbits and birds (Marks *et al.* 2002) that probably could have been taken while the cave was occupied. Because there is no evidence for a decrease in the abundance of large herbivores in the region during the Upper Paleolithic, it seems that the virtual absence of rabbit hunting in central Portugal before the Upper Paleolithic may be due to a combination of mobility patterns and differences in cognitive choice between early and later humans about which animals to pursue and eat. I reject the notion that large-scale rabbit hunting required specialized technology such as nets or snares, although these tools certainly would have made their capture more efficient than digging rabbits out of their burrows or ambushing the animals along their easily defined trails (e.g., Hockett and Haws 2002).

CONCLUSION

The brief discussion presented above regarding differences in subsistence and mobility patterns between the Middle and Upper Paleolithic occupation of Iberia based on small game hunting would have no substance without the taphonomic details necessary to adequately distinguish between rabbit bone assemblages deposited by nonhuman predators from those accumulated by humans. Taphonomic analysis of rabbit bones, including patterns of element frequencies and puncture marks, must occur before interpretations are offered about the hunting of small fauna during the Paleolithic of Iberia and elsewhere. Taphonomic data from 'naturally' accumulated sites such as Alvados Roost assist in formulating these interpretations.

Yet additional work is needed. Controlled experiments in which rabbit carcasses are fed to small carnivores such as lynx and wild cat would be a valuable addition to the 'naturally' accumulated assemblages that I have reported on from the Great Basin in North America and from Portugal (Two Ledges Chamber, Matrac Roost, Waterfall Roost, Dondero Cave, Mineral Hill Cave, Picareiro Cave, Buraca Glorioso, Alvados Roost). In each case, these actualistic assemblages represent bones accumulated in cave and rockshelter settings, although I have witnessed the accumulation of thousands of leporid bones in open-air contexts as well, particularly in sand dunes in Nevada and Oregon and near coastal settings in California (e.g., Hockett 1989). While the precise species of predator was

not always known to me, I purposively chose this class of actualistic data in order to most closely approximate the end result of rabbit bone accumulations on the landscape. These complex biotic and abiotic interactions cannot be duplicated by feeding carcasses to caged raptors or mammalian carnivores; but I recognize that this latter class of actualistic data has offered key insights into the taphonomic patterning of predator damage to large mammal bones. While this latter experimental research has been conducted on a variety of large carnivores, such studies are relatively rare on predator-prey relationships involving smaller carnivores and rabbits. These data, as well as those from sites such as Alvalos Roost, will continue to be critical to the development of models that account for differences in the subsistence patterns of the early and later Paleolithic foragers of the Iberian Peninsula.

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