Hominid and Carnivore activity at Middle and Upper Paleolithic cave sites in eastern Spain

KEY WORDS: Paleolithic, Carnivore activity, Spain.

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ABSTRACT

Recent analyses in zooarchaeological research have concentrated on the development of methods which can be utilized to distinguish bone refuse produced by carnivore predator scavengers from that produced by hominids. These methodologies have been applied to Pleistocene sites in Africa but they have only begun to be considered for Paleolithic sites in western Europe. A preliminary analysis of carnivore involvement in the deposition of faunal remains in north Spain by L. G. STRAUS suggests high carnivore involvement in the formation of Mousterian deposits with decreasing involvement in the in the in the deposition of faunal remains in north Spain by L. G. STRAUS suggests high carnivore involvement in the formation of Mousterian deposits with decreasing involvement in the Upper Paleolithic. In this study, carnivore/ungulate ratios from two Middle and four Upper Paleolithic sites in eastern Spain confirm this model. However, more precise methods such as body part frequency analyses and assemblage attrition measurements suggest constant or increasing carnivore involvement with these bone assemblages through time, indicating that prior interpretations about hominid subsistence strategies at these sites could be suspect.

RESUMEN

Recientes investigaciones zooarqueológicas han desarrollado métodos para distinguir entre residuos óseos producidos por depredadores carnívoros y animales de carroña, y residuos semejantes producidos por hominidos. Estas metodologías han sido aplicadas a yacimientos Pleistocénicos en Africa, mientras que sólo se han comenzado a utilizar para yacimientos paleolíticos de Europa Occidental. Un análisis preliminar del papel jugado por los carnívoros en la deposición del material faunico en el norte de España (Straus 1982) sugiere un alto envolvimiento de carnívoros en la formación de depósitos musterienses con una disminución de su papel en el Paleolítico Superior. En este estudio, las relaciones de carnívoros a ungulados de los yacimientos del Paleolítico Medio (Los Casares, Cova Negra) y tres del Superior (Parpalló, Les Mallaetes, Volcán del Faro) de la España levantina confirman la validez de este modelo. Sin embargo, métodos más precisos como el análisis de frecuencias de las partes del cuerpo y medidas en la atrición de los conjuntos faunísticos sugieren un envolvimiento constante o mayor de carnívoros en la formación de estos conjuntos a través del tiempo, indicando que anteriores interpretaciones sobre estrategias de subsistencias en estos yacimientos pueden ser sospechosas e incluso completamente equivocadas.

INTRODUCTION

The differentiation of carnivore accumulated bone assemblages from those accumulated by hominids is a current problem in modern archaeological faunal analysis (BINFORD 1981, 1984, BRAIN 1981, CLUTON-BROCK and GRIGSON eds. 1983:3-163, HESSE

and WAPNISH 1985:85-89, KLEIN and CRUZ-URIBE 1984 83-84). Its significance is related to the fact that these two bone collecting agents can produce and modify faunal remains in superficially situations. If BINFORD's (1981:1) conception that «most of the behavioral ideas regarding our ancient past are dependent on faunal remains..., not stone tools» is true, then the elucidation of this problem is critical to the study of the past.

Since the 1970's, the realization that there are a complex set of factors which can create and alter bone deposits has led to a number of sutdies which address the problem of recognizing and segregating animal bone refuse on the basis of the collecting agent. The majority of this research is dependent on the study of modern processes which are then related to the past through uniformitarian assumptions (BINFORD 1981;27). These modern studies have been concerned with (1) bone and carcass utilization by carnivores (HAYNES 1980, 1982, 1983, HILL 1983),

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humans (Binford 1978), and both (Binford 1981, Brain 1981, Bunn 1983); (2) the distinction of different surficial modifications on bones, such as tool cut marks and carnivore tooth marks (Pons and Shipman 1981, Shipman and Rose 1983, Shipman 1983) and processes which mimic these marks (Behrensmeyer et. al. 1986); (3) the study of natural versus artificial disarticulation of skeletons (Hill 1979, Hill and Behrensmeyer 1985); (4) the study of natural distributions of bone on land surfaces (Behrensmeyer and Dechant-Boaz 1980, Behrensmeyer 1983); (5) the study of bone weathering (Behrensmeyer 1978, Hill 1976, Pots 1986); and (6) the examination of natural mortality profiles for mammal populations (Klein 1982, Levine 1983) among other topics. A a consequence of this proliferation of research, there has been the development of a number of methodologies which are currently being evaluated for archaeological faunal material (Binford 1981, Brain 1981, Klein and Cruz-Uribe 1984).

Perhaps the most influencial, and consequently controversial, methodology developed to date is that of Binford (1981). Binford's methodology is based on actualistic, pattern recognition studies of observable, contemporary, dynamic bone altering processes an their static physical results. From these studies diagnostic criteria can be developed which relate the static archaeological record to dynamic processes which occurred in the past. Binford has applied his diagnostic criteria to faunal material from Olduvai Gorge (1981:249-288) and Klasies River Mouth (1984). However, his analysis of the Olduvai material has been criticized for using incomplete data (Bunn 1982, Isaac 1983:418) and for his manipulation of this data (Isaac 1983). In addition, Binford methodology has been criticized for not adequately linking the modified bone used in his study which was collected from the wolf kills, wolf dens, and dog yards to the behaviors that produced them (Bonnichsen 1983:248, Grayson 1982) and also for using a fossil faunal assemblage as control data for hyena lair behavior, thus not adequately linking behavior with material consequences (Isaac 1983:417).

Yet, Binford's study demonstrated that «there is an impressive redundancy in structure among faunal assemblages produced by various non-hominid predator scavengers operating on a variety of prey forms» (1981:238). In addition, there has been considerable research since the «Bones» book which provide data to supplement and reinforce Binford's findings (cf. Brain 1981). These findings potentially allows the identification of carnivore involvement in deposits by comparing patterned modern control assemblages with archaeological bone assemblages.

The methodologies created by Binford, Brain, Klein, and others were developed, for the most part, to make sense out of the lithic and faunal jumbles characteristic of Early and Middle Pleistocene early man sites in sub-Saharan Africa. However, these methods and indeed many of the issues concerning the separation and identification of carnivore and hominid accumulated remains have only just begun to be considered in western Europe (Gamble 1983, 1984, Straus 1982). These latter studies consider only the presence or absence of carnivore species in faunal assemblages as evidence for possible carnivore involvement on a regional scale. More detailed site specific research needs to be done in this region utilizing the recent methodology to address this problem in a more rigorous manner (e.g. Brain 1981, Binford 1981, 1984, Bunn et. al. 1980 120-125, Cruz-Uribe 1984).

The majority of faunal reports from the Middle and Upper Paleolithic sites in western Europe have not considered the possibility of a carnivore involvement in the accumulation of bone refuse. In fact, many faunal analysts, while recognizing the presence, still categorize the majority of bone refuse as being present at the site because of hominid activity. For example, in eastern Spain at the Mousterian site of Cova Negra, Perez-Ripoll (1977) explains the high number of carnivore and indigenous cave species remains as simply from animals who lived in the cave when humans were absent, but then proceeds to reconstruct the hominid subsistence strategy at the site utilizing *all* of the remains from the three most common ungulate species! In another case, at the Mousterian site of Los Casares in the province of Guadalajara, where there are also a large number of carnivore remains in the bone assemblage, all the ungulate remains are unequivocally designated as being from the activities of man (Altuna 1973:99). In both these examples it was never considered that if carnivores are utilizing these cave sites that they also might be bringing faunal remains back to these sites. Both of these sites, along with several Upper Paleolithic sites located in the Valencia province which do not have a large carnivore component in the bone assemblages, offer an opportunity to consider the possibility of carnivore generated assemblages at cave sites in western Europe in more detail.

The objectives of this analysis is to utilize a number of methodologies which are currently available to distinguish between residual assemblages of animal bones that have been accumulated primarily by carnivores from those created by hominids in 11 Mousterian and 14 Upper Paleolithic assemblages

from the provinces of Guadalajara and Valencia in Spain. In addition, the results of this study will be compared to those of STRAUS (1982) in an effort to discern whether patterns of carnivore activity at cave sites suggested for the Middle and Upper Paleolithic in northern Spain are manifest in eastern Spain as well.

Initially, I will begin by reviewing two general studies of carnivore-ungulate comparisons in Europe, concentrating on STRAUS (1982) study of carnivore/ungulate ratios form northern Spain. Following this is a presentation of the data from eastern Spain used in this analysis and a discussion of the specific methods utilized. Finally, the results of the analysis are presented and discussed.

CARNIVORE INVOLVEMENT AT CAVE SITES IN EUROPE

GAMBLE (1983) has suggested that was a greater carnivore involvement in the deposition of faunal assemblages from northern and central Europe than in southern Europe during the late Pleistocene. He argues that the difference in the number of carnivore remains between these two regions is the result of a much lower human population density in the northernmost areas (GAMBLE 1983:168). Abundant carnivore remains, and thus inferred carnivore activity, occur in areas which have less evidence of human settlement. Human settlement is thought to have been less intense in the northern and central regions of Europe due to extreme environmental conditions associated with the presence of continental ice sheets pre-20.000 years ago (GAMBLE 1983:166). As environmental conditions ameliorated post-20.000 years ago and the northern areas became more inhabitable to humans, less carnivore remains are found. Therefore, in general terms, GAMBLE is arguing that during the Upper Paleolithic in western Europe carnivore involvement in the creation of bone assemblages was affected by human population density and the increased competion for and of cave sites.

Prior to this study, STRAUS (1982) argued that human population density affected the degree of carnivore involvement in faunal assemblages. He computed a ratio of carnivore to ungulate remains (calculated with minimum numbers of individuals) for 96 faunal assemblages from 11 Middle and Upper Paleolithic sites in the Vasco-Cantabrian regions of Spain. This carnivore/ungulate ratio developed by KLEIN (1975, 1977) as a measure to suggest the degree to which a faunal assemblage is the product of carnivore behavior based on the assumption that

carnivore dens typically contain the remains of carnivores while human generated assemblages do not (cf. BRAIN 1981: 53, 77). STRAUS argues, based on fairly high carnivore/ungulate ratios, that non-human predator scavengers played a larger role in the accumulation of bones in the Mousterian levels, with decreasing evidence (i.e. decreasing ratios) of their involvement in Upper Paleolithic levels. He suggests that this pattern was a function of increasingly intensive utilization of cave sites by humans through time due to increases in human population and changes in procurement strategies from the Middle ot the Upper Paleolithic (STRAUS 1982:75).

These two studies provide guidelines with which to structure the analysis of cave faunas from eastern Spain. The sites to be analyzed in this study should contain fewer carnivore remains than the more northern sites analyzed by GAMBLE (1983) due to a greater potential human population density and «favorable» environment in southern Europe during the late Pleistocene. It is also expected that Middle Paleolithic assemblages from eastern Spain will exhibit a higher degree of carnivore involvement than Upper Paleolithic assemblages from the same area, thus providing an independent test of STRAUS (1982) model.

DATA FROM EASTERN SPAIN

The bone assemblages analyzed in this study are from five sites in the provinces of Guadalajara and Valehcia, Spain (see Figure 1). There are two Middle Paleolithic sites: Cova Negra, various sectors and levels (PEREZ-RIPOLL 1977), and Los Casares levels 7-12 (ALTUNA 1973); and three Upper Paleolithic sites: Parpalló, levels 1-10, Volcán, spits 18-29, and Les Mallaetes, containing Aurignacian, Gravettian, and Solutrean levels (DAVIDSON 1980).

Cova Negra is a Middle Paleolithic cave site located in the Valencia province near tha Albaida River in the foothills of the Serra Grossa Mountains (PEREZ-RIPOLL 1977:10). The site is 140 to 150 meters above sea level and faces east towards the Serra de la Crue and the Cordillera de la Solana. The site was initially excavated by Viñes in 1928-1933 and then again in 1950 to 1957 by ALCACER, JORDA, PLA, FLETCHER, and PASCUAL. The faunal remains analyzed by PEREZ-RIPOLL and used in this study are from the 1950's excavations. The original published sectors and levels from this site (PEREZ-RIPOLL 1977:17-24) were difficult to compare across the site so they were unified into an overall sector and the original levels were incorporated into 50 centemeter arbitrary levels I-IX. These levels were only

Figure 1. Map of eastern and central Spain showing locations of sites discussed.

Table 1. Original Levels (capas) and depths below datum (DBD) for cova negra (1) combined into arbitrary 50 cm levels I-IX by sector.

Sector B		DBD	Sector D-E		DBD
I	capa 1	0–50cm	IV	capa 25	1'93–2'00
II	capas 2–5	50–1'00	V	capas 26–30	2'–2'50
III	capas 6–10	1'–1'50	VI	capas 31–35	2'50–3'00
IV	capas 11–15	1 '50–2'00			
V	capas 16–20	2'–2'55	Sector F		DBD
VI	capas 21–23	2'55–3'10	I	capas 1–5	0–'55 cm
VII	capas 24–25	3'10–3'60	II	capas 6–9	'55–1'05
VIII	capas 26–28	3'60–405	III	capas 10–13	1'05–1'48
IX	capas 29–32	4'05–4'55	IV	capa 16	1'82–2'05
			V	capas 17–18	2'05–2'50
Sector C		DBD	VI	capas 19–22	2'50–3'00
I	capas 1–2	0–50cm	VII	capas 22–23	3'00–3'40
II	capas 3–6	50–1.02	VIII	capas 24–25	3'40–3'90
III	capas 7–10	1'02–1'55			
IV	capas 11–14	1'55–2'05	Sector J1 – J2		DBD
V	capas 15–19	2'05–2'55	I	capas 1–2	0–'45cm
VI	capas 20–22	2'55–3'05	II	capas 3–6	'45–1'05
VII	capas 23–25	3'05–3'50	III	capas 7–9	1'05–1'50
VIII	capas 26–29	3'50–4'00	IV	capas 10–12	1'50–1'95
IX	capas 30	4'00–4'15	V	capas 13–16	1'95–2'55
			VI	capa 17	2'55–2'70
Sector D		DBD			
I	capas 1–7	0–50cm	Sector K2		DBD
II	capas 8–16	'50–1'00	I	capas 1–2	0–'40cm
III	capan 17–22	1'–1'47	II	capas 3–6	'40–1'05
IV	capas 23–24	1'47–1'62	III	capas 7–9	1'05–1'50
			IV	capas 10–11	1'50–1'95
Sector E		DBD	V	capas 12–15	1'95–2'55
I	capas 1–6	0–'50 cm			
II	capas 7–12	'50–1'02			
III	capas 13–19	1'02–1'47			
IV	capas 20–23	1'47–1'80			

(1) from Perez Ripoll (1977:17-24).

used in the first stage of the analysis while subsequent stages used data from the entire site as the analytical unit in order to increase the sample size (Table 1).

The Middle Paleolithic cave site of Los Casares is located three kilometers north of Riba de Saelices at an altitude of between 1050 and 1070 meters above sea level in the Pedriza del Mirón in the province of Guadalajara (BARANDIARAN 1973:7). The site was initially excavated under the direction of Antonio BELTRAN MARTINEZ in 1966-1968 and subsequent work and analysis was directed by Ignacio BARANDIARAN MAESTU. The faunal material was analyzed by Jesús ALTUNA and consisted of three «age» groups: level 15 was a culturally sterile layer below the Mousterian layers, levels 7-12 were the Mousterian levels, and levels 4-5 were the Bronze age layers. The faunal material from levels 7-12 concern this study and they were analyzed originally as one combined level because of the difficulty the excavators had in identifying these layers separately in all levels of the cave. The total depth encompassed by these levels was only 25 centimeters and the faunal and artifactual content of these layers appeared to be similar (ALTUNA 1973:97). Therefore, levels 7-12 were also analyzed as one unit in this study (2).

The three Upper Paleolithic sites utilized in this study are all located near the Mediterranian Sea in the province of Valencia. Parpalló, located west of Gandia, is at 450 meters above sea level and is presently situated eight kilometers from the sea. This site was first excavated by PERICOT from 1920-1931 ant it is considered as one of the «classic» sites in this region because of similarities of the artifact sequence to those of southwest France and the presence of a large quantity of art plaques (DAVIDSON 1983). The fauna from this site and the following two sites were analyzed by DAVIDSON (1980).

The site of Les Mallaetes is located three kilometers from Parpalló at 600 meters above sea level and both these sites are considered to be among «the best documented and best dated sites in eastern Spain» (DAVIDSON 1983:82).

The last Upper Paleolithic site, Cueva del Volcán, is located on the coast of Valencia near Cullera, north of the estuary of the Júcar River at 120 meters above sea level. This site was excavated in spits

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(2) The sample size for each level was too small to analyze.

(18-29) and DAVIDSON (1980, 1983:82) has tentatively dated these to layers 5 and 6 at Parpalló (16800 to 17500 B.P.). In the present study, the spits are divided into two groups of nine spits each (18-26 and 26A-29) in order to obtain en adequate sample of minimum numbers of bone elements for the caiculation of minimal animal units. This could posibbly mask more specific intrasite patterning in the faunal remains, but general site wide patterns should be recognizable.

METHODOLOGY

There are four stages in the data analysis:

(1) A carnivore/ungulate ratio is calculated for 10 Middle and 12 Upper Paleolithic assemblages and the results compared to the findings os STRAUS (1982).

(2) A body part frequency analysis is undertaken on three Middle Paleolithic assemblages from two sites: Cova Negra *(Cervus* spp. and *Capra* spp.) all levels combined for each2, and Los Casares (five specimens combined) level 7-12. 14 Upper Paleolithic assemblages from two two sites are also analyzed: Volcán *(Cervus* spp. levels 18-26 combined and 26A-29 combined), and Parpalló (levels 1, 2, 3, 6, 7, and 9 + 10 for *Cervus* spp. levels 18-26 combined and 26A-29 combined), and Parpalló (levels 1, 2,3,6, 7, and 9 + 10 for *Cervus* spp. and *Capra* spp.). The outcome is compared to animal and human structured control assemblages (BINFORD 1978, 1981, BRAIN 1981).

(3) The relationship between the proximal and distal epiphyses of the humeri and tibiae of *Cervus* spp. and *Capra* spp. are plotted for three Mousterian (two from Cova Negra and one from Los Casares) and 14 Upper Paleolithic (two from Volcán and 12 from Parpalló) assemblages. These are compared to bone asemblages in which the degree of destruction by non-human predator scavengers is know in order to be able to discriminate between «ravaged» and «non-ravaged» assemblages (BINFORD 1981:217).

(4) Age (mortality) profiles are constructed for one species *(Cervus elaphus* - red deer) at Cova Negra and two species *(Cervus* and *Capra pyrenaica* - Spanish ibex) at Parpalló in order to determine the relationship between scavenging and hunting, and thus possibly the accumulating agent(s) at these sites (KLEIN 1982).

Each of these stages in the analysis is described and discussed below.

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Carnivore/Ungulate   Ratio

A carnivore/ungulate ratio is computed by calculating a percentage of carnivore minimum number of individuals (MNI) to ungulate MNI's3. If, for example, there are six carnivore MNI's in a level and 12 ungulate MNI's, then the ratio would be 50 percent.

Carnivore species which are found at the sites analyzed in this study are *Ursus spelaeus* (cave bear), *Ursus actos* (brown bear), *Crocuta crocuta* (spotted hyena), *Felis spelaeus* (cave lion), *Felis pardus* (leopard), *Felis pardina* (lynx), *Felis sylvestris* (wildcat), *Canis lupus* (wolf), *Vulpes vulpes* (red fox), and *Cuon alpinus* (dhole). The ungulate are *Cervus elaphus* (red deer), *Capra pyrenaica* (ibex), *Equus* spp. (horse), *Rupicapra rupicapra* (chamois), *Capreolus capreolus* (roe deer), and *Bos primigenius* (auroch).

STRAUS (1982:81) argues that a high carnivorelungulate ratio is indicative of a heavy carnivore involvement in the deposition of ungulate remains in a cave site. The assumption behind this reasoning is that carnivores characteristically kill and feed on other carnivores more often than do hominids (BRAIN 1981:53, 77).

How high must a ratio be before we can infer a major carnivore involvement? KLEIN reports that at the Swartklip locality, in southwestern Cape province, Sout Africa, which has no evidence of hominid activity and where the bone accumulation has been attributed to hyenas, the ratio is 29 percent (1975:284). BRAIN (1981:213, 219, 239, 245, 261) has calculated carnivore/ungulate ratios for five Plio-Pleistocene hominid bearing deposits: KROMDRAAI (57.7 %), Swartkrans-member 1 (37.5 %), and member 2 (11.7 %), and Sterkfontein-member 1 (37.5 %), and member 2 (11.7 %), and Sterkfontein-member 4 (48.3 %) and member 6 (30.0 %). All but Swartkrans-member 2 are thought to be high ratios by BRAIN, although Sterkfontein-member 6 was thought to be inconclusive. Thus, it would appear that carnivore contribution can be quite variable. An examination of STRAUS' ratios ranged from 0 to 126 percent in the Mousterian assemblages, with an average of 61.1 percent and in the Upper Paleolithic assemblages a range of 0 to 77.8 percent with an average of 20.9 percent. He suggests that while the overall trend is decreasing ratios, each cave seems to have its own history relative to carnivore versus human use (STRAUS 1982:92).

Based on the information from KLEIN, BRAIN, and STRAUS, this study will consider 30 percent or more to be a high ratio and therefore a high degree of carnivore involvement in a faunal assemblage.

Body Part Frequency Analysis.

Initially, a body part frequency analysis requires the separation of the faunal assemblages into parts of the skeleton by individual species. For the sites used in this sutdy this step was done by the original faunal investigators: PEREZ-RIPOLL (1977) for Cova Negra, ALTUNA (1973) for Los Casares, and DAVIDSON (1980) for Perpalló, Les Mallaetes, and Volcán. In this study these skeletal parts will be known as the minimum number of elements (MNE) or «the minimum number of different specimens referable to a given anatomical part used in classification» (BINFORD 1984:50). For example, if there are 12 distal tibiae, or fragments so identified in an assemblage, the MNE for that assemblage would be 12 regardless of age, sex, and side information. MNE is used in this study as a means of making inferences at the anatomical segment level without making any implications about whole animal units.

The next step in this stage of the analysis is to calculate the minimum animal units (MAU) for each part of the skeleton. MAU is calculated by dividing the MNE of each body part by the number of that part found in the living animal. For example, if the MNE for the distal tibiae of red deer is 12, then the MAU for that part would be six (12 divided by the two distal tibiae expected in the living animal). MAU is a means of studying animal units.

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In addition, where possible, the large species *(Cervus elaphus* - red deer) and small species *(Capra pyrenaica* - Spanish ibex) will be analyzed separately. This is done on the assumption that the composition of bone assemblages in cave sites is related to the portability of prey. Hence, smaller animals are likely to be brought home intact, while only selected parts of larger animals would be transported back (BRAIN 1981:44).

The assemblages from the Middle Paleolithic sites of Cova Negra and Los Casares, and the Upper Paleolithic sites of Parpalló and Volcán were selected for the body part frequency analysis (ALTUNA 1973, DAVIDSON 1980, PEREZ-RIPOLL 1977). The data from these sites are compared to control collections of animal structured (BINFORD 1981:200-201, BRAIN 1981;295, 297 and human structured (BINFORD 1978:259, 1981:231) bone assemblages which have had MNE and MAU calculated for them. The comparison of the archaeofaunas from eastern Spain with the control assemblages is achieved with graphs and by the use of the KOLMOGOROV-SMIRNOV two sample test (KLEIN and CRUZ-URIBE 198457).

Degree of Assemblage Attrition

The ability of certain skeletal parts to survive the attacks of predator scavengers is related to the density of the part (BINFORD and BERTRAM 1977:138, BRAIN 1980, 1981, LYMAN 1984). In particular, there is a definite and marked difference in the probability of survival between the proximal and distal epiphyses of the humerus and tibia (BINFORD 1981:217-219). The proximal ends of these bones have a much lower survival potential than their distal counterparts when subjected to attritional processes. BINFORD suggests that a basic diagnostic technique for distinguishing the degree of destruction of bone parts in an assemblage is to use standardized frequencies of proximal versus distal humeri and tibiae proportionately plotted on two separate graphs (1981:219). These are compared to designated areas labelled «zone of no destruction» and «zone of destruction» on the graphs which are calculated from a series of control assemblages with known degrees of destruction by carnivores. In this way it is possible to distinguish «pristine» versus «ravaged» bone assemblages.

The relationship between the proximal and distal humeri and tibiae of *Cervus elaphus* and *Capra pyrenaica* are plotted for three Middle Paleolithic and 14 Upper Paleolithic faunal assemblages and compared to control assemblages to assess tehir degree of attrition.

Age (Mortality) Profiles

The *Cervus elaphus* (red deer) remains from the Mousterian site of Cova Negra and the *Capra pyrenaica* (ibex) and *Cervus* remains from the Upper Paleolithic site of Parpalló are analyzed below with reference to age estimates. These data are compared statistically to each other and to examples of attritional and catastrophic age profiles (KLEIN 1982:155-157, KLEIN and CRUZ-URBE 198480). KLEIN has argued that the two types of age profiles which characterize mammal populations, catastrophic and attritional, can be used to make inferences about how an assemblage was formed.

While the above descriptions of catastrophic and attritional age (mortality) profiles are correct, recent research suggests that caution should be used in distinguishing between them (BERGER 1983, CONYBEARE and HAYNES 1984). in a recent study of «catastrophic mortality» of groups of wild horses in the Great Basin, it was found that the social structure of the animals affected the composition of a series of mass deaths and resulted in skewed sex and age ratios (BERBER 19831404). In addition, a study of elephant mortality around a water hole in zimbabwe, Africa during a drought suggests that occasionally produced catastrophic assemblages could be «diluted» by attritionally produced bones deposited in the same location before and after (CONYBEARE and HAYNES 19841:99). This evidence suggests that care must be exercised when considering age profiles and the mixing of both attritionally and catastrophically produced bones at a location over time.

Catastrophic profiles are those in which successive age classes contain progressively fewer individuals. An attritional profile is one in which both the very young and very old are best represented, while middle to prime age adults are fewer in number. Attritional profiles can occur in bone assemblages which are the result of mortality due to accidents, predation, and disease. Catastrophic profiles may occur in faunal material found at places of naturel catastrophies (i.e. floods, volcanic eruptions, droughts, etc.). Both of these profiles can occur at archaeological sites.

Klein asserts that a relatively high proportion of very young individuals in an attritional profile at an archaeological site suggests active hunting by hominids (1982:151). He argues that scavenging can be discounted as the procurement strategy in these cases because if the young die naturally, hominids were more poorly equipped to locate carcasses before other potential predators.

BINFORD has recently criticized this view by suggesting that hominids did not have to find the carcasses of young animals before potential competitors but that when these remains were found that they scavenged the skulls of young individuals (1984:211-215). in this way an attritional profile (determined from dental criteria) which contains a high number of young individuals could also be indicative of scavenging behavior. Although BINFORD's model is interesting, immature skeletal material is very sensitive to the attritional processes of predator scavengers, and it is not clear if there would be much skeletal material left for hominids to scavenge after a large predator like a hyena got through with a young ungulate.

The use of age (mortality) profiles in the analysis of faunal remains can still be useful as long as the caveats briefly outlined above are taken into account. In this analysis, published data of calculated ages for red deer from Cova Negra and Parpalló are compared to each other and to theoretical catastrophic and attritional profiles.

RESULTS

Carnivore/Ungulare Ratio

The carnivore/ungulate ratio from Middle and Upper Paleolithic cave sites in eastern Spain are quite variable (Table 2). The ratios range from 0 to 66,7

Table 2. Summary CF eastern and Central Spanish paleolithic Faunal Assemblages (1)

SITE & LEVEL	UNGULATES (MNI)	CARNIVORES (MNI)	CARN./UNGUL.(%)	NO. CARN. SPEC
LOS CASARES (Middle Paleolithic)				
Levels 7-12	24	16	66.7	9
COVA NEGRA (Middle Paleolithic				
Level IX	41	5	12.2	5
Level VIII	52	3	5.8	3
Level VII	30	1	3.3	1
Level VI	13	4	30.8	4
Level V	22	1	4.5	1
Level IV	16	1	6.2	1
Level III	10	0	0	0
Level II	12	1	8.3	1
Level I	8	1	12.5	1
PARPALLÓ (Upper Paleolithic)				
Level 9+10	120	2	1.6	2
Level 8	4	2	50.0	2
Level 7	39	0	0	0
Level 6	87	0	0	0
Level 5	4	0	0	0
Level 4	2	0	0.	0
Level 3	.45	0	0	0
Level 2	63	1	1.5	1
Level 1	52	1	2.0	1
LES MALLAETES (Upper Paleolithic)				
AURIG.	3	0	0	0
CRAWT.	5	1	20.0	1
SOLUT.	16	0	0	0

(1) fron Altuna (1973). Perez Ripoll (1977), Davidson (1980).

percent with an average of 15,0 percent in the Mousterian levels at Los Casares and Cova Negra, and range from 0 to 50 percent with an average of 6.26 percent in the Upper Paleolithic levels at Parpalló and Les Mallaetes. It appears that in general, carnivore predator scavengers contributed in a larger degree than did humans to the fauna in the Mousterian assemblages. However, if 30 percent is used as an indication of «high» carnivore involvement in the creation of a faunal assemblage (see argument above in methodology section), then only two out of ten Mousterian assemblages meet this requirement: Los Casares, level 7-12, and Cova Negra, level VI. In addition, six out of the ten Mousterian assemblages analyzed have ratios of less than 10 percent: levels II-V, VII, and VIII at Cova Negra, with level III having a 0 pércent ratio.

The Upper Paleolithic assemblages have one «high» ratio: level eight at Parpalló, but 10 out of 12 assemblages have ratios of less than 10 percent, with seven assemblages having a 0 percent ratio.

An examination of the number of carnivore species present in the Middle and Upper Paleolithic levels demonstrates that there are also a greater variety of species in the Mousterian assemblages of Los Casares and Cova Negra (Table 3). This suggests a greater degree of carnivore involvement as carnivore remains are usually present to a larger extent in dens than in human living sites (BRAIN 1981:53).

In summary, the carnivore/ungulate ratios from sites in eastern Spain suggest there was more carnivore involvement in the creation of faunal remains in the Mousterian assemblages from Cova Negra and Los Casares than in the Upper Paleolithic assemblages at Parpalló and Les Mallaetes and that there were more species of carnivores present at the two earlier sites. How do these results compare to those of STRAUS (1982) from northern Spain? Also, are there generally fewer carnivore remains at sites in eastern Spain than those from areas of Europe farther north, as Gamble has suggested (1983)?.

Addressing these questions in reverse order, it appears that, in general, the relative occurrence of carnivore species in eastern Spain is lower than that of England, southern Germany, Hungary, southwest France, and Cantabrian Spain (GAMBLE 1983:167, 169). This could be related to a higher population density in eastern Spain, however, population density is notoriously difficult to determine archaeologically. If the number of faunal assemblages is used to infer density of human settlement, as GAMBLE suggests, then eastern Spain was fairly well populated in the Middle and Upper Paleolithic but not more so than southwestern France or Cantabrian

Table 3. Carnivore representation by species (MNI's)

SITE & LEVEL	LEOPARD	LYNX	WILDCAT	HYENA	WOLF	FOX	BROWN BEAR	CAVE BEAR	DHOLE	LION
LOS CASARES										
Level 7-12	1	1	1	3	1	3	(3)	2	1	
COVA NEGRA										
I	1									
II										1
III										
IV			1							1
V					1					
VI	1	1		1	1					
VII					1					
VIII	1	1			1					
IX		1	1	1		1	1			
PARPALLÓ										
9+10	1	1								
8	1	1								
7										
6										
5										
4										
3										
2								1		
1	1									
LES MALLAETES										
AURIG.										
GRAVET.	1									
SOLUT.										

(1). fron Altuna (1973). Perez Ripoll (1977), Davidson (1980).

Spain. It is clear that while GAMBLE's theory has merit, it is difficult and problematical to apply archaeologically.

A comparison of the carnivore/ungulate ratios between eastern Spain and the Vasco-Cantabrian region is much more revealing. STRAUS' ratios are, on the average, higher for both the Middle and Upper Paleolithic (1982:85, Table 5) than the ratios presented here (Table 2). However, the general trend in both studies is one of decreasing carnivore/ungulate ratios, and therefore decreasing carnivore involvement, through time from the Middle to the Upper Paleolithic. In this study, as in STRAUS', the specific intra-site trends are variable and «each cave seems to have its own history relative to carnivore versus human use» (STRAUS 1982:92). Yet, despite this, it is difficult to argue that decreasing ratios through time indicate increasingly intensive use of cave sites by humans in eastern Spain, as STRAUS suggests for the Vasco-Cantasbrian region (STRAUS 1982:75). The

Table 4, Cova negra bone frequencies of *Cervus elaphus* by level (1)

LEVEL	I	II	III	IV	V	VI	VII	VIII	IX	MNE[2]	MAU[2]	%
SKULL	1	-	1	-	-	-	-	-	-	2	2	44
MANDIBLE	-	-	1	-	-	-	-	-	-	1	.5	11
ATLAS	-	-	-	-	-	-	-	-	-	-	-	-
AXIS	-	-	-	-	-	-	-	-	-	-	-	-
CERVICAL VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-
THORACIS VERTEBRAE	-	-	-	-	1 (vert.)	-	-	-	-	-	-	-
LUMBAR VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-
PELVIS	-	1	-	-	-	-	-	-	-	1	.5	11
RIBS	-	-	-	-	-	-	-	-	-	-	-	-
SCAPULA	2	3	1	-	-	-	-	-	-	6	3	66
PROXIMAL3 HUMERUS	(1)	(1)	(3)	-	-	-	-	-	-	-	-	-
DISTAL HUMERUS	-	1	-	-	-	-	-	-	-	1	.5	11
PROXIMAL3 RADIUS/ULNA	1 (3)	1 (2)	1 (1)	- (1)	1	-	-	-	-	4	2	44
DISTAL RADIUS/ULNA	1	1	1	-	-	1	-	-	-	4	2	44
CARPALS	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL METACARPAL	-	-	-	-	-	-	-	-	-	-	-	-
DISTAL METACARPAL	-	2	-	-	-	-	-	1	-	3	1.5	33
PROXIMAL FEMUR	-	-	-	-	-	-	-	-	-	-	-	-
DISTAL FEMUR	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL3 TIBIA	(2)	(2)	-	-	-	-	-	-	-	-	-	-
DISTAL TIBIA	2	1	-	-	-	-	1	-	-	4	2	44
TARSALS	-	-	-	-	-	-	-	-	-	-	-	-
ASTRAGALUS	3	6	-	-	-	-	-	-	-	9	4.5	100
CALCANEUS	-	-	-	1	-	-	-	-	-	1	.5	11
PROXIMAL METATARSAL	-	-	-	-	-	-	-	-	-	-	-	-
DISTAL METATARSAL (metapod)	6	16	5	3	5	3	1	-	-	39	4.5	100
PHALANGES	29	33	14	12	10	3	5	2	2	110	4.5	100

(1) Assembled from Perez Ripoll 1977: 62-67.
(2) Calculated according to procedures outlined in Binford 1984 50-51.
(3) () denotes unknown epiphysis.

Table 5. Cova negra bone frequencies of *Capra pyrenaica* by level (1)

LEVEL	I	II	III	IV	V	VI	VII	VIII	IX	MNE[2]	MAU[2]	%
SKULL	-	-	-	-	1	-	-	-	-	1	1	28
MANDIBLE	-	1	3	1	1	-	-	-	-	6	3	85
ATLAS	-	-	-	-	-	-	-	-	-	-	-	-
AXIS	-	-	-	-	-	-	-	-	-	-	-	-
CERVICAL VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-
THORACIS VERTEBRAE	-	-	1	-	-	-	-	-	-	-	-	-
LUMBAR VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-
PELVIS	1	1	-	-	-	-	-	-	-	2	1	28
RIBS	-	-	-	-	-	-	-	-	-	-	-	-
SCAPULA	3	1	-	-	-	-	-	-	-	4	2	57
PROXIMAL3 HUMERUS	(2)	(2)	-	(2)	(1)	(1)	-	-	-	-	-	-
DISTAL HUMERUS	-	1	2	-	-	-	-	-	-	3	1.5	43
PROXIMAL3 RADIUS/ULNA	-	1	-	-	1	-	-	-	-	2	1	25
DISTAL RADIUS/ULNA	-	-	-	-	-	-	-	-	-	-	-	-
CARPALS	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL3 METACARPAL	(5)	3	(4)	2	2	(2)	-	-	-	7	3.5	100
DISTAL METACARPAL	-	1	1	2	2	-	-	-	-	6	3	85
PROXIMAL FEMUR	-	-	-	-	-	-	-	-	-	-	-	-
DISTAL FEMUR	-	-	1	-	-	-	-	-	-	1	.5	14
PROXIMAL3 TIBIA	(1)	(3)	-	-	-	(1)	-	-	-	-	-	-
DISTAL TIBIA	-	-	1	1	-	2	-	-	-	4	2	57
TARSALS	-	-	-	-	-	-	1	-	-	1	.12	-
ASTRAGALUS	2	1	-	1	1	1	-	1	-	7	3.5	100
CALCANEUS	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL3 METATARSAL (Metapodials)	(4)	(2)	(5)	(4)	(3)	(2)	-	-	-	-	-	-
DISTAL METATARSAL	1	-	-	-	1	-	-	-	-	2	1	28
PHALANGES	15	10	4	7	3	3	1	-	-	43	1.7	48

(1) Assembled from Perez Ripoll 1977: 52-57.
(2) Calculated according to procedures outlined in Binford 1984 50-51.
(3) () denotes unknown epiphysis.

decreasing ratios could be related to a decrease in the use of these sites by a declining population of carnivores becoming extinct (KURTEN 1968:272, 1976:142).

The fact remains that the carnivore/ungulate ratios suggest a relatively «high» degree of carnivore involvement in the formation of the Mousterian assemblages as compared to the Upper Paleolithic assemblages in eastern Spain. These ratios are not as high as those in BRAIN (1981), KLEIN (1975), or STRAUS (1982) intimating that both hominids and carnivores contributed to the formation on these assemblages.

Body Part Frequency Analysis

The archaeofaunas from Cova Negra, Los Casares, Volcán, and Parpalló were subjected to a body part frequency analysis. The results of this analysis are presented on a site-by-site basis below.

Cova Negra

Initially, the skeletal parts from this Mousterian site (PEREZ-RIPOLL 1977) were separated by levels I- IX for *Cervus elaphus* (Table 4) and for *Capra pyrenaiica* (Table 5). However, it was found that the levels had to be combined for these species in order to have an adequate sample size of minimum numbers of elements (MNE) for the calculation of minimum animal units (MAU). A preliminary examination of Tables 4 and 5 suggest that for *Cervus* the most common units are from the lower legs and feet (i.e. astragali, metapodials, and phalanges) and for *Capra* the most abundant units are the astragali, the metacarpals, and mandibles. Graphs of the bone frequencies and MAU percentages further demonstrate the patterns described above and point out additional high frequencies of scapulae and distal tibiae for *Capra* (Figures 2 and 3).

In order to try to determine the agent of bone accumulation at this site, the body part frequencies in Figures 2 and 3 were visually compared to control assemblages from hyena (Table 10, Figure 3), leopard (Table 11, Figure 14), and wolf dens (Table 12, Figure 3), and to human residential, transported, and hunting stand assemblages (Table 13, Figures 16-18).
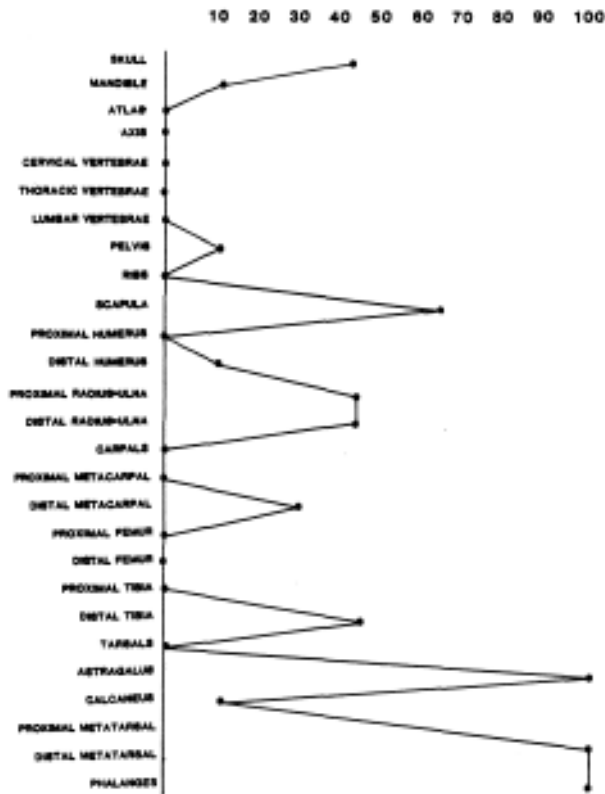
Figure 2. Cova Negra bone frequencies for *Cervus elaphus* as MAU percentages for all levels from Table 4.

Figure 3. Cova Negra bone frequencies for *Capra pyrenaica* as MAU percentages for all levels from Table 5.

The *Cervus* bone frequency graph (Figure 2) does not appear to be similar to any of the carnivore-generated assemblages (Figures 13-15). The graph also does not correspond closely to the human generated residential and transported assemblages (Figures 16 and 17). However, there is some siilarity to hunting stand assemblages (Figure 18) which contain a high frequency of lower leg parts such as proximal and distal metatarsals, proximal and distal metacarpals, astragali, and calcanei, with high numbers of distal tibiae and scapulae. The primary differences are in the large number of caribou mandibles present at the hunting stands compared with very few at Cova Negra for Cervus and the relatively small number of Caribou phalanges at hunting stands, esoecually for tall and summer, compared with an extremely large number of this elements at Cova Negra. The difference in mandible frequency might be explicable if the number os loose teeth at Cova Negra is considered. Loose teeth were the most abundant element at the site but were no separated by PEREZ-RIPOLL (1977) into macillary or mandibular teeth and so could not be included in the body part frequency analysis in this study. Thus, the comparison of graphed body part frequiencies as MAU percentages suggests that the Cervus data from Cova Negra resemble human created hunting stand assemblages.
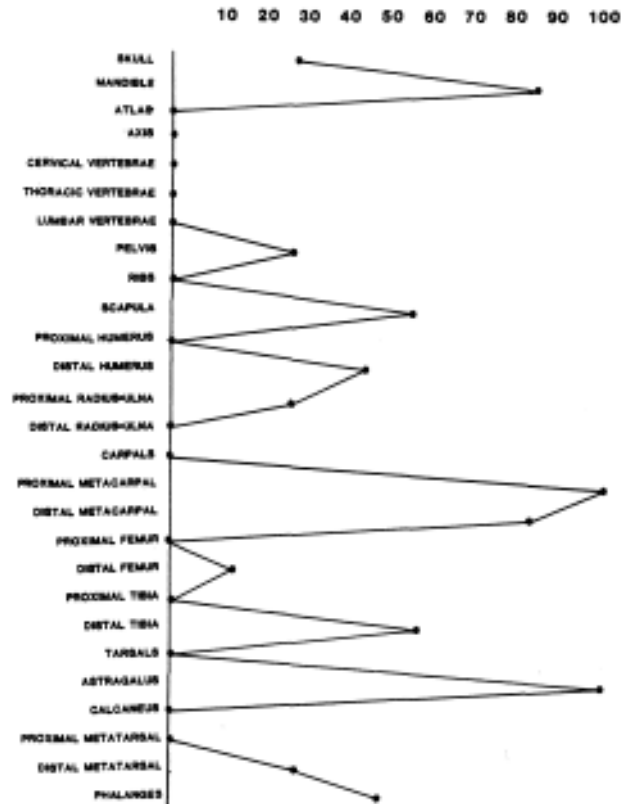
The Kolmogorov-Smirnov test was used to determine whether the observed differences and similarities between red deer body part frequencies at this site varied significantly from the control assemblages. The bone frequencies were significantly different (at .05, .01, and .001 levels) from the animal control assemblages and human residential assemblage but did not differ significantly from human hunting stand and transported assemblages (Table 14).

The ibex body part graph is slightly different from the deer graph having a higher percentages of mandibles, pelves, distal humeri, and distal femora, and a lower percentage of distal radii-ulnae, calcanei, metatarsals, and phalanges.

A visual comparison of the Capra (Figure 3) with the animal and human control assemblages (Figures 13-18) does not suggest any overwhelming similarities. The Kolmogorov-Smirnov two sample test indicates that ibex body part frequencies are significantly different only from hyena den (small prey assemblages) and human hunting stand assemblages, while they did not differ significantly from leopard dens (small prey), or wolf den assemblages, nor from human residential and transported assemblages (Table 14). It is interesting to note that wolf remains are the most common carnivore MNI at Cova Negra

with one individual occuring in each of levels V-VIII (Table 3). This suggests that the faunal remains at Cova Negra might be attributed to primarily hominid activity in the case of Cervus and to both hominid and carnivore activity for *Capra*.

Los Casares

The faunal remains of five ungulate species are used in the body part frequency analysis for this Mousterian site in order to analyze the largest sample size possible (Table 6). The species were red deer *(Cervus elaphus),* roe deer *(Capreolus capreolus),* auroch *(Bos primigenius),* chamois *(Rupicapra rupicapra),* and ibex *(Capra pyrenaica).* The overwhelmingly most common units at this site are skulls and mandibles followed by proximal metatarsals, astragali, distal radii-ulnae and distal humeri.

The graph of body part frequencies as MAU percentages for the Mousterian combined level 7-12 (Figure 4) was visually compared to carnivore and human accumulated control assemblages (Figure 13-18) in an attempt to determine the agent responsible for the bone refuse at this site. In this case, the graph compares closely to the animal produced assemblages but does not compare well to the human produced faunal remains. When the Kolmogorov-
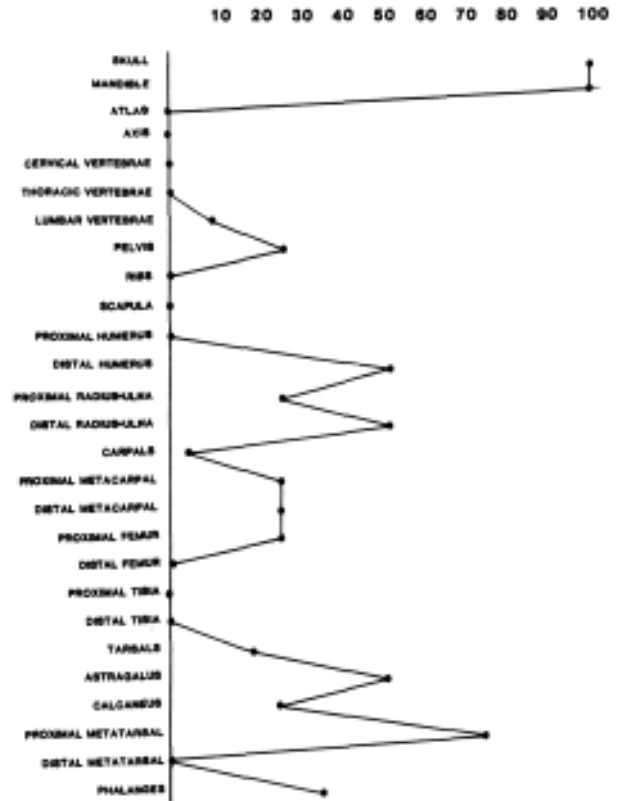

Figure 4. Los Casares bone frequencies for five ungulate species as MAU percentages for levels 7-12 from Table 6.

Smirnov two sample test was applied, it showed that this assemblage did not differ significantly from any of the control assemblages (Table 14). It appears that the Middle Paleolithic faunal assemblages at Los Casares were accumulated by both carnivores and hominids.

Volcán

Cervus elaphus was the only species from this Upper Paleolithic site for which there was an adequate sample. As mentioned in the methodology section above, this site was arbitrarily subdivided into two assemblages of nine spits each.

There are slight differences in the MAU percentage frequencies between the two assemblages. Levels 18-26 have a high number of mandibles, followed by high percentages of skulls and proximal metatarsals. Levels 26A-29 also have a high percentage of mandible MAU's. However, the percentage difference between mandibles and the next three most common units (skull, proximal metacarpal, and proximal metatarsal) is quite large, averaging an 11.5 to 12 MAU difference (Table 7).

A visual comparison of levels 18-26 (Figure 5) with the control assemblages suggests similarity with the carnivore den assemblages and dissimilarity with the human produced assemblages. The re-

Table 6. Los casares body part frequencies for five ungulate species from level 7-12 (1)

	Cervus	Capreolus	Bos	Rupicapra	Capra	MNE[2]	MAU[2]	%
SKULL	-	1	-	-	1	2	2	100
MANDIBLE	3	-	-	-	1	4	2	100
ATLAS	-	-	-	-	-	-	-	-
AXIS	-	-	-	-	-	-	-	-
CERVICAL VERTEBRAE	-	-	-	-	-	-	-	-
THORACIC VERTEBRAE	-	-	-	-	-	-	-	-
LUMBAR VERTEBRAE	1	-	-	-	-	1	.17	8.5
PELVIS	-	-	-	-	1	1	.5	25
RIBS	-	-	-	-	-	-	-	-
SCAPULA	-	-	-	-	-	-	-	-
PROXIMAL HUMERUS	-	-	-	-	-	-	-	-
DISTAL HUMERUS	-	-	-	-	2	2	1	50
PROXIMAL RADIUS/ULNA	-	-	-	1	-	1	.5	25
DISTAL RADIUS/ULNA	-	1	-	-	1	2	1	50
CARPALS	-	-	-	-	1	1	.08	4
PROXIMAL METACARPAL	-	-	-	1	-	1	.5	25
DISTAL METACARPAL	-	-	-	-	1	1	.5	25
PROXIMAL FEMUR	-	-	-	1	-	1	.5	25
DISTAL FEMUR	-	-	-	-	-	-	-	-
PROXIMAL TIBIA	-	-	-	-	-	-	-	-
DISTAL TIBIA	-	-	-	-	-	-	-	-
TARSALS	-	1	2	-	-	3	.375	18.7
ASTRAGALUS	-	-	-	1	1	2	1	50
CALCANEUS	-	-	-	-	1	1	.5	25
PROXIMAL METATARSAL	2	1	-	-	-	3	1.5	75
DISTAL METATARSAL	-	-	-	-	-	-	-	-
PHALANGES	1	3	-	3	9	16	.67	33.5

(1) Assembled from Altuna 1973: 109-111.
(2) Calculated according to procedures cutlined in Binford 1984 50-51.

Table 7. Cueva del Volcán del faro Body part frequencies for *Cervus elaphus* by grouped levels (1).

	MNE FOR LEVELS 18-26²	MAU²	%	MNE FOR LEVELS 26A-29²	MAU²	%
SKULL	12(11maxil.(	6.5	87	9(all maxil.)	4.5	28
MANDIBLE	15	7.5	100	32	16	100
ATLAS	-	-	-	-	-	-
AXIS	-	-	-	-	-	-
CERVICAL VERTEBRAE	-	-	-	-	-	-
THORACIC VERTEBRAE	-	-	-	-	-	-
LUMBAR VERTEBRAE	-	-	-	-	-	-
PELVIS	3	1.5	20	4	2	13
RIBS	-	-	-	-	-	-
SCAPOTA	-	-	-	2	1	6
PROXIMAL HUMERUS	1	.5	7	-	-	-
DISTAL HUMERUS	3	1.5	20	1	.5	3
PROXIMAL RADIUS/ULNA	1	.5	7	1	.5	3
DISTAL RADIUS/ULNA	1	.5	7	-	-	-
CARPALS	5	.41	5	5	.41	3
PROXIMAL METACARPAL	1	.5	7	9	4.5	28
DISTAL METACARPAL*	2	1	13	2	1	6
PROXIMAL FEMUR	2	1	13	1	.5	3
DISTAL FEMUR	-	-	-	-	-	-
PROXIMAL TIBIA	3	1.5	20	-	-	-
DISTAL TIBIA	2	1	13	3	1.5	9
TARSALS	-	-	-	-	-	-
ASTRAGALUS	-	-	-	1	.5	3
CALCANEUS	2	1	13	3	1.5	9
PROXIMAL HETATASAL (Metapodials)	8	4	54	8 (11)	4	25
DISTAL METATASAL	4	2	27	4	2	12
PHALANGES	40	1.7	23	26	1.1	7

(1) Assembled from Davidson 1980, Table 8.10.

(2) Calculated according to procedures cutlined in Binford 1984: 50-51.

Figure 5. Volcán bone frequencies for *Cervus elaphus* as MAU percentages for levels 18-26 from Table 7.
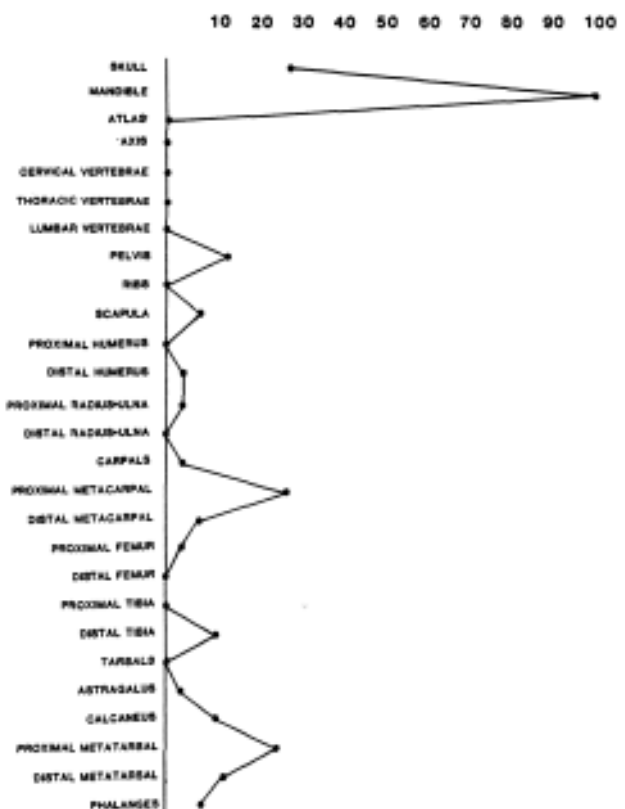
Figure 6. Volcán bone frequencies for *Cervus elaphus* as MAU percentages for levels 26A-29 from Table 7.

sults of the Kolmogorov-Smirnov two sample test confirms this observation rather strikingly (Table 15). There are no significant differences between this assemblage and the assemblages from the dens of hyenas, leopards, and wolves, but there is a very significant difference (<. 001) between levels 18-26 and the human control assemblages, pointing to the possibility of a substantial carnivore involvement in the formation of these deposits.

Levels 26A-29 (Figure 6) also compares closely with the animal created assemblages (Figure 13-15) and not as well with the human generated fauna (Figure 16-18). The Kolmogorov-Smirnov test strongly supports this observation. As with levels 18-26, there are no significant differences (>.05) between levels 26A-29 and the assemblages formed by carnivores, but there are significant (<.001) differences between this assemblage and the human generated remains (Table 15). The results of the body part frequency analysis for the Upper Paleolithic assemblages from Volcán strongly suggest that the red deer remains could be attributed primarily to carnivore related activity.
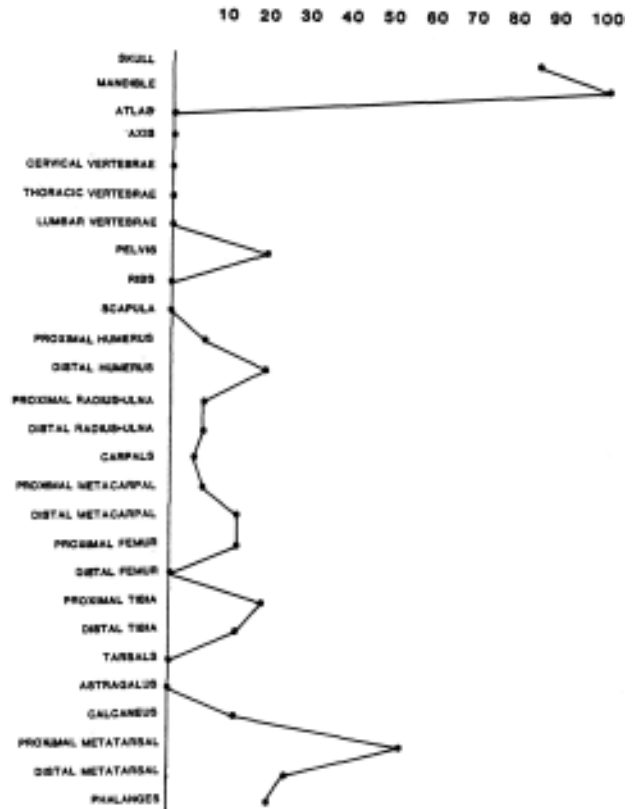
Parpalló

The body part frequency analysis includes six Upper Paleolithic levels from this site utilizing the remains of *Cervus elaphus* and *Capra pyrenaica* (Tables 8 and 9). The levels analyzed are, 1, 2, 3, 6, 7, and 9 + 10. A graph was constructed for each of these levels showing deer and ibex MAU percentages (Figures 7-12). Each of these figures was compared with the control assemblages (Figures 13-15).

An examination of Tables 8 and 9 shows that for *Capra,* the most frequent skeletal element was the atlas in levels 2, 6, 7, and 9 + 10, while the mandible is most frequent in level 1 and the astragalus is most frequent in level 3. For *Cervus* the most common body parts are the skull in levels 2 and 3, the astragalus in levels 1, 6 and 9 + 10, and the distal humerus in level 7. An inspection of Figures 7-12 indicates that in some cases the comparison by level

Table 8. Parpallo body part frequencies for *Capra pyrenaica* from levels 1, 2, 3, 6, 7, and 9+10 (1)

	LEVEL 1			LEVEL 2			LEVEL 3			LEVEL 6			LEVEL 7			LEVEL 9+10		
	MNE[2]	MAU[2]	%	MNE[2]	MAU[2]	%	MNE[2]	MAU[2]	%	MNE[2]	MAU[2]	%	MNE[2]	MAU[2]	%	MNE[2]	MAU[2]	%
SKULL[3]	16	24	76	28	28	97	17	17	83	6	6	10	19	19	65	29	29	39
teeth	–(82)																	
MANDIBLE[3] teeth-()	(296)	31.5	100	(127)	13.5	46	(87)	9	44	(94)	10	17	(40)	4	14	690)	73	97
ATLAS	13	13	41	29	29	10	17	17	83	59	59	100	29	29	100	75	75	100
AXIS	12	12	38	9	9	31	12	12	59	49	49	83	22	22	76	71	71	95
VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PELVIS	3	1.5	5	10	5	17	1	.5	2	5	2.5	4	4	2	7	109	54.5	73
RIBS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPULA	17	8.5	27	12	6	21	14	7	34	37	8.5	31	24	12	41	130	65	87
PROXIMAL	1	.5	1	-	-	-	-	-	-	1	.5	1	4	2	7	25	12.5	17
DISTAL HUMERUS	35	17.5	56	44	22	76	21	10.5	51	51	25.5	43	37	18.5	64	112	56	75
PROXIMAL RADIUS	6	3	10	16	8	28	8	4	20	4	2	4	15	7.5	26	60	30	40
DISTAL	1	.5	1	4	2	7	1	.5	2	1	.5	1	3	1.5	5	46	23	31
PROXIMAL	1	.5	1	-	-	-	1	.5	2	-	-	-	2	1	3	27	13.5	18
DISTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL METACARPAL	37	16.5	59	-	-	-	-	-	-	-	-	-	6	3	10	56	28	37
DISTAL METACARPAL	18	9	28	9	4.5	16	13	6.5	32	7	3.5	6	9	4.5	15	27	3.5	10
PROXIMAL	-	-	-	7	3.5	12	3	1.5	7	4	2	2	9	4.5	15	60	30	40
DISTAL FEMUR	2	1	3	-	-	-	2	1	5	1	.5	1	12	6	21	84	42	56
PROXIMAL	4	2	6	-	-	-	-	-	-	2	1	2	4	2	7	59	29.5	39
DISTAL TIBIA	11	5.5	17	2	1	3	5	2.5	12	4	2	4	16	8	28	61	30.5	41
CARPALS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ASTRAGALUS	34	17	54	31	15.5	53	41	20.5	100	37	18.5	31	9	4.5	15	10	9	12
CALCANEUS	12	6	20	9	4.5	16	5	2.5	12	6	3	5	6	3	10	24	12	16
PROXIMAL METATARSAL	-	-	-	34	17	59	2	1	5	-	-	-	6	3	10	62	31	41
DISTAL METATASAL	20	10	32	4	2	7	6	3	15	7	3.5	6	4	2	7	33	16.5	22
PHALANGES	3	.12	-	23	1	3	7	.29	1	2	.08	-	-	-	-	21	.87	1

(1) Assembled from Davidson 1980, Table 7.11.
(2) Calculated according to procedures outlined in Binford 1984 50-51.
(3) Teeth were divided by 10.1 for maxillary and 9.4 for mandibular per Binford 1984: 81.

for the two species is fairly similar (i.e., levels 1, 3, and 7) and in others fairly dissimilar (i.e., levels 2, 6, and 9 + 10).

If these data are compared graphically to the human and animal generated control assemblages, it becomes clear that the Parpalló assemblages are most similar to the carnivore accumulated faunal remains, but there are still some major differences, chiefly the tremendously high number of astragali in the Parpalló assemblages. This cannot be explained by referral to the high survivorship of this part since it has only «moderate» survival percentage (BINFORD 1981:218, BRAIN 1981:23).

The Kolmogorov-Smirnov two sample test was applied to determine whether the observed difference in the body Part frequency analysis are statisti-

Table 9. Parpallo body part frequencies for Cervus elaphus from levels 1, 2, 3, 6, 7, and 9+10 (1)

	LEVEL 1 MNE[2]	MAU[3]	%	LEVEL 2 ME[2]	MAU[2]	%	LEVEL 3 MNE[2]	MAU[2]	%	LEVEL 6 MNE[2]	MAU[2]	%	LEVEL 7 MNE[2]	MAU[2]	%	LEVEL 9+10 MNE[2]	MAU[2]	%
SKULL[3] teeth - (138)	8 (138)	21	71	23 (38)	27	100	19 (36)	22	100	13 (49)	18	73	3 (5)	3.5	47	9 (230)	32	91
MANDIBLE[3] (all teeth)	144	15	51	34	4	15	41	4	17	16	2	8	10	1	14	155	16.5	47
ATLAS	5	5	17	4	4	15	10	10	43	4	4	16	2	2	27	7	7	20
AXIS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	17	49
VERTEBRAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PELVIS	4	2	7	10	2.5	9	5	1.25	5	10	2.5	10	4	2	27	38	9.5	27
RIBS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPULA	20	10	34	9	4.5	17	5	2.5	11	4	2	8	7	3.5	47	63	31.5	90
PROXIMAL HUMERUS	3	1.5	5	1	.5	2	-	-	-	1	.5	2	-	-	-	21	10.5	30
DISTAL HUMERUS	23	11.5	39	19	9.5	35	9	4.5	20	31	15.5	63	15	7.5	100	55	27.5	79
PROXIMAL RADIUS	8	4	14	18	9	34	2	1	4	2	1	4	1	.5	7	29	14.5	41
DISTAL RADIUS	-	-	-	5	2.5	9	6	3	13	5	2.5	10	1	.5	7	22	11	31
PROXIMAL ULNA	1	.5	2	2	1	4	-	-	-	2	1	4	-	-	-	2	1	3
DISTAL ULNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL METACARPAL	2	1	3	11	5.5	20	10	5	22	1	.5	2	-	-	-	14	7	20
DISTAL METACARPAL	10	5	17	6	3	12	-	-	-	6	3	12	4	2	27	15	7.5	21
PROXIMAL FEMUR	11	5.5	19	4	2	7	5	2.5	11	8	4	16	3	1.5	20	21	10.5	30
DISTAL FEMUR	6	3	10	1	.5	2	2	1	4	2	1	4	6	3	40	6	3	9
PROXIMAL TIBIA	1	.5	2	3	1.5	6	2	1	4	4	2	8	4	2	27	14	7	20
DISTAL TIBIA	7	3.5	12	7	3.5	13	19	9.5	41	6	3	12	5	2.5	34	35	17.5	50
CARPALS/ TARSALS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ASTRAGALUS	59	29.5	100	52	26	96	36	18	78	49	24.5	100	11	5.5	74	70	35	100
CALCANEUS	9	4.5	15	15	7.5	28	5	2.5	11	5	2.5	10	14	7	94	48	24	69
PROXIMAL METATARSAL	6	3	10	25	12.5	46	4	2	8	1	.5	2	1	.5	7	15	7.5	21
DISTAL METATARSAL	9	4.5	15	8	4	15	9	4.5	20	8	4	16	4	2	27	21	10.5	30
PHALANCES	15	.62	2	20	.84	3	12	.5	2	8	-	-	6	-	-	36	1.5	4

(1) Assembled from Davidson 1980, Table 7. 20.
(2) Calculated according to procedures outlined in Binford 1984 50-51.
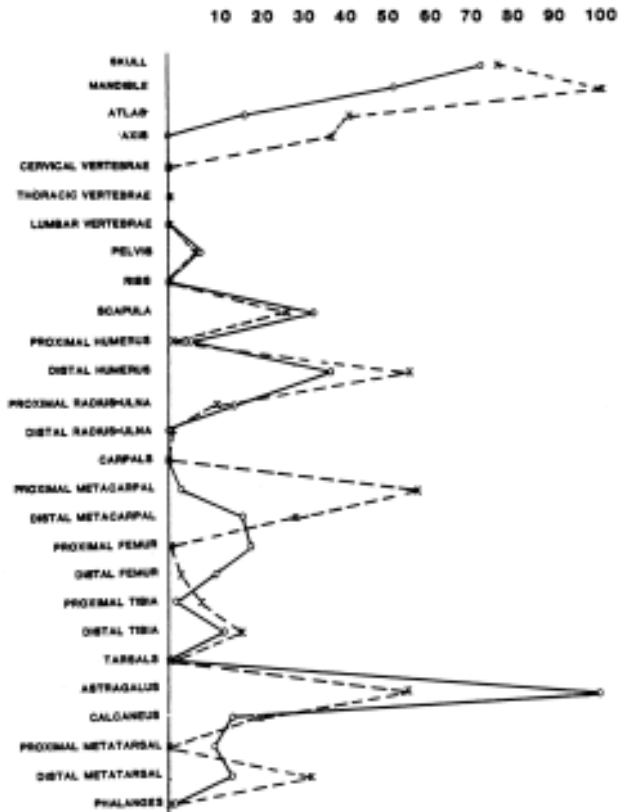(3) Teeth were divided by 10.1 for maxillary and 9.4 for mandibular per Binford 1984 81.

Figure 7. Parpalló, level 1 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.
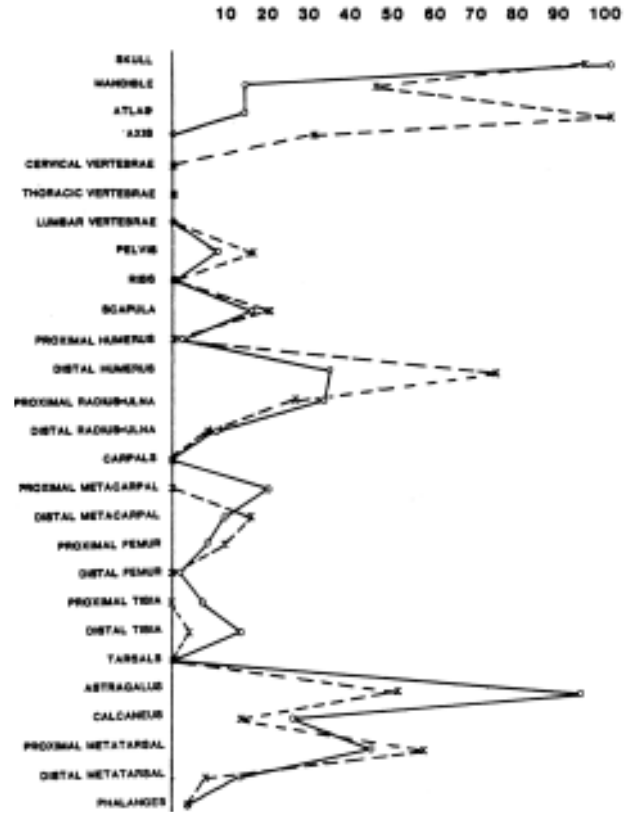

Figure 8. Parpallo, level 2 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.
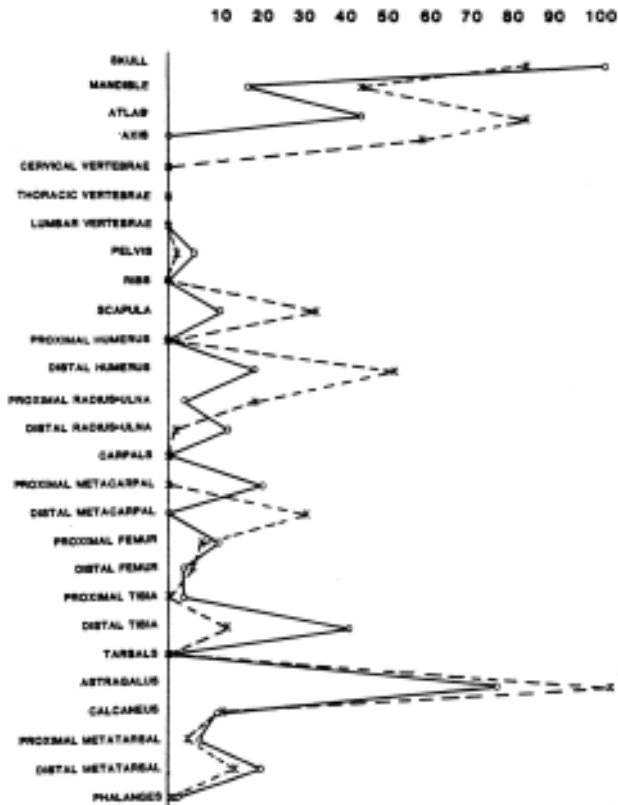

Figure 9. Parpalló, level 3 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.
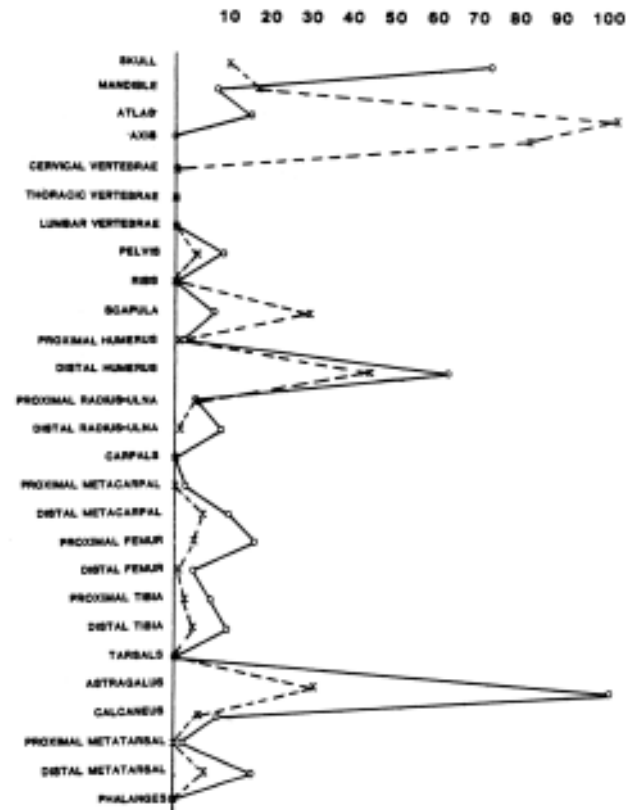

Figure 10. Parpalló, level 6 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.
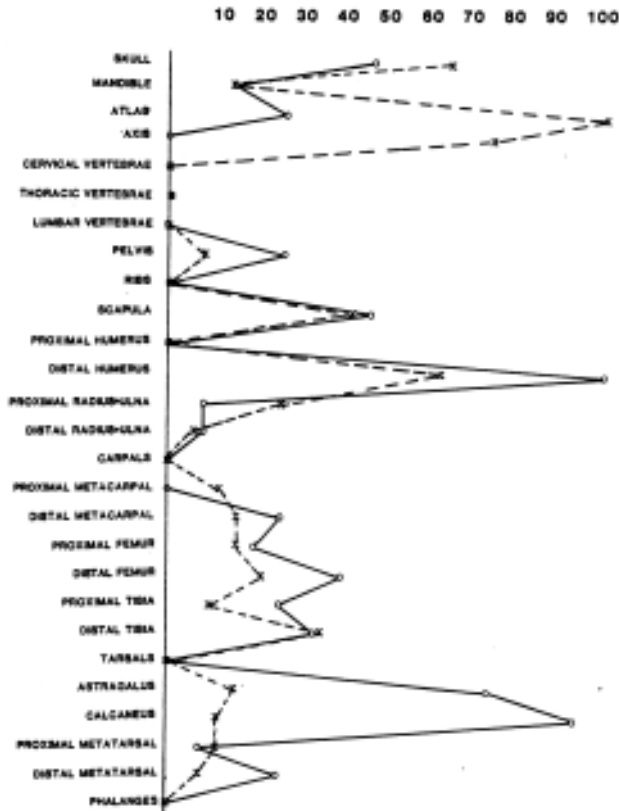
Figure 11. Parpalló, level 7 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.
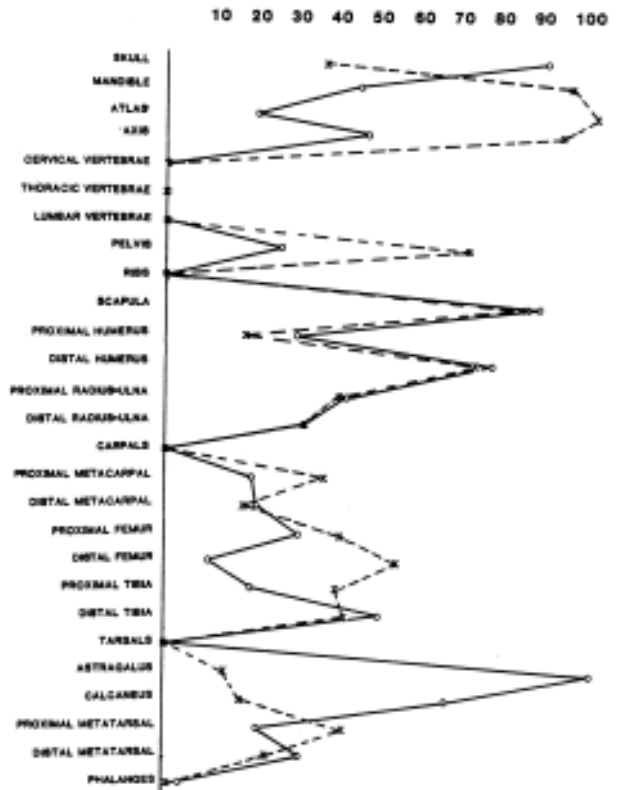

Figure 12. Parpalló, level 9 + 10 bone frequencies for *Cervus elaphus* (o) and *Capra pyrenaica* (x) as MAU percentages from Tables 8 and 9.

cally significant (Table 15). For red deer, level 1 differed significantly from all the control assemblages except leopard dens, level 2 was statistically different from all the control assemblages, level 3 did not differ from leopard and wolf dens, level 6 is dimissilar to all but the leopard den assemblage, level 7 differed from all but leopard dens and human transported assemblages, and level 9 + 10 was statistically different from all but leopard den assemblages.

For ibex, levels 1, 2, 7, and 9 + 10 were statistically different from all the control assemblages except that of leopard generated faunal remains, level 3 was dissimilar to all but the hyena and leopard den assemblages, and level 6 differed significantly from all the control assemblages. The above analysis suggests that the Upper Paleolithic assemblages from Parpalló might be attributed primarily to carnivore activity because of the strong similarity between every level for both species and the carnivore generated assemblages except for level 7-Cervus which include a similarity to human trasported assemblages.

Summary of Body Part Analysis

The preceding body part frequency analysis of the Middle Paleolithic sites of Cova Negra and Los Casares, and the Upper Paleolithic sites of Volcán

Table 10. Control assemblages from *Hyaena brunnea* dens (1).

| | SMALL ANIMALS[2] | | | | | LARGE ANIMALS[2] | | | | | COMBINED | | |
| | I | II | TOTAL | | | III | IV | TOTAL | | | TOTAL | | |
	MNE[3]	MNE[3]	MNE[3]	MAU[4]	%	MNE[3]	MNE[3]	MN[3]	MN[3]	%	MNE[3]	MAU[3]	%
SKULL	10	6	16	16	100	3	10	13	13	100	29	29	100
MANDIBLE	6	9	15	7.5	47	4	7	11	5.5	42	26	13	45
ATLAS	-	2	2	2	13	-	-	-	-	-	2	2	7
AXIS	-	1	1	1	6	-	-	-	-	-	1	1	3
CERVICAL VERTEBRAE	3	10	13	2.6	16	4	-	4	.8	6	17	3.4	12
THORACIC VERTEBRAE	1	1	2	.16	1	1	-	1	.08	-	3	.25	1
LUMBAR VERTEBRAE	4	-	4	.5	3	-	-	-	-	-	4	.5	2
PELVIS	4	-	4	2	13	5	-	5	2.5	19	9	4.5	16
RIBS	-	1	1	.03	-	-	-	-	-	-	1	.03	-
SCAPULA	-	2	2	1	6	2	2	4	2	15	6	3	10
PROXIMAL	-	-	-	-	-	-	-	-	-	-	-	-	-
DISTAL HUMERUS	-	1	1	.5	3	1	-	1	.5	4	2	1	3
PROXIMAL RAIUS/ULNA	-	1	1	.5	3	1	-	1	.5	4	2	1	3
DISTAL RADIUS/ULNA	-	1	1	.5	3	1	-	1	.5	4	2	1	3
CARPALS	-	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL METACARPAL	-	6	6	3	19	3	8	11	5.5	42	17	8.5	29
DISTAL METACARPAL	-	1	1	.5	3	2	8	10	5	38	11	5.5	19
PROXIMAL	2	2	4	2	13	-	3	3	1.5	12	7	3.5	12
DISTAL FEMUR	2	2	4	2	13	1	3	4	2	15	8	4	14
PROXIMAL	1	-	1	.5	3	1	3	4	2	15	5	2.5	9
DISTAL TIBIA	2	-	2	1	6	1	3	4	2	15	6	3	10
TARSALS	-	-	-	-	-	4	-	4	.5	4	4	2	7
ASTRAGALUS	-	-	-	-	-	-	-	-	-	-	-	-	-
CALCANEUS	-	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL METATARSAL	-	2	2	1	6	1	1	2	1	8	4	2	7
DISTAL METATARSAL	-	1	1	.5	3	1	1	2	1	8	3	1.5	5
PHALANGES	1	-	1	.04	-	-	-	-	-	-	1	.04	-

(1) Assembled from Brain 1981: 295, Tables 40-41.
(2) Bovids divided into two separate weight classes by combi ning Brain (1981) Class I and II, and Classes III and IV.
(3) Calculated according to procedures outlined in Binford 1984: 50-51.

Table 11. Control assemblages from *Panthera pardus* dens (1).

	SMALL ANIMALS2 I MNE3	II MNE3	TOTAL MNE3	MAU3	%	LARGE ANIMALS2 III MNE3	IV MNE3	TOTAL MNE3	MAU3	%	COMBINED TOTAL MNE3	MAU3	%
SKULL	1	-	1	1	29	7	-	7	?	100	8	8	100
MANDIBLE	2	-	2	1	29	4	-	4	2	29	6	3	38
ATLAS	-	-	-	-	-	2	-	2	2	29	2	2	25
AXIS	-	-	-	-	-	-	-	-	-	-	-	-	-
CERVICAL VERTEBRAE	4	-	4	.8	23	?	-	?	1.4	20	11	1.8	23
THORACIC VERTEBRAE	3	1	4	.31	9	7	-	?	.54	8	11	.8	10
LUMBAR VERTEBRAE	1	-	1	.17	5	9	-	9	1.1	16	10	1.3	16
PELVIS	-	1	1	.5	14	2	-	2	1	14	3	1.5	19
RIBS	-	-	-	-	-	3	-	3	.12	2	3	.12	2
SCAPULA	2	5	7	3.5	100	1	-	1	.5	?	8	4	50
PROXIMAL HUMERUS		(1c)a	1	.5	14	(9c)a		9	4.5	64	10	5	63
DISTAL HUMERUS			1	.5	14			9	4.5	64	10	5	63
PROXIMAL RADIUS/ULNA	(1C)a	-	1	.5	14	(2c)a		2	1	14	3	1.5	19
DISTAL RADIUS/ULNA			1	.5	14			2	1	14	3	1.5	19
CARPALS	6	-	6	.5	14	-	-	-	-	-	6	.5	6
PROXIMAL METACARPAL		-	2	1	29	-	-	-	-	-	2	1	13
DISTAL METACARPAL	(2C)a	-	2	1	29	-	-	-	-	-	2	1	13
PROXIMAL FEMUR	-	1	1	.5	14	(6f)b		-	-	-	1	.5	6
DISTAL FEMUR	-	-	-	-	-	-	-	-	-	-	-	-	-
PROXIMAL TIBIA	(1c)a		1	.5	14	10	-	10	5	71	11	5.5	69
DISTAL TIBIA		-	1	.5	14	3	-	3	1.5	21	4	2	25
TARSALS	1	1	2	.25	7	-	4	4	.5	7	6	.75	9
ASTRAGALUS	1		1	.5	14	-	-	-	-	-	1	.5	6
CALCANEUS	-	-	-	-	-	6	-	6	3	43	6	3	38
PROXIMAL METATARSAL	-	-	-	-	-	(1c)a(1c)a		2	1	14	2	1	13
DISTAL METATARSAL	-	-	-	-	-			2	1	14	2	1	13
PHALANGES	6	8	14	.58	17	27	-	27	1.1	16	41	1.7	21

(1) Assembled from Brain 1981, Tables 42-44.
(2) Bovide divided into two separate weight classes by combi hing Brain 1981 Classes I and II, and Classes III and IV.
(3) Calculated according to procedures dutlined in Binford 1984 50-51.
(4) Denotes complete body part.
(5) Denotes feagment of body part.

Table 12. Control assemblages from *Canis lupus* dens (1).

	BENTCREEK WOLF DEN MAU3	ITIKMALAIYAK WOLF DEN MNE	MAU3	ANAKTIQTAUK WOLF DEN MNE	MAU3	COMBINED TOTAL MAU	%
SKULL teeth -()	12	30(11)	31	1	1	44	100
MANDIBLE teeth -()	12.5	3(7)	2.2	-	-	14.7	33
ATLAS	9	-	-	-	-	9	20
AXIS	5	-	-	-	-	5	11
CERVICAL VERTEBRAE	.86	-	-	-	-	.86	2
THORACIC VERTEBRAE	.29	-	-	-	-	.29	-
LUMBAR VERTEBRAE	1.7	-	-	-	-	1.7	4
PELVIS	9.5	-	-	-	-	9.5	22
RIES	-	5	.2	5	.2	.4	1
SCAPULA	8	1	.5	-	-	8.5	19
PROXIMAL HUMERUS	3.5	-	-	-	-	3.5	8
DISTAL HUMERUS	14	-	-	-	-	14	32
PROXIMAL RADIUS/ULNA	10.5	2	1	2	1	12.5	28
DISTAL RADIUS/ULNA	6.5	1	.5	1	.5	7.5	17
CARPALS	4.5	-	-	5	.42	4.92	11
PROXIMAL METACARPAL	10	6	3	-	-	13	30
DISTAL METACARPAL	9.5	3	1.5	-	-	11	25
PROXIMAL FEMUR	2	-	-	-	-	2	5
DISTAL FEMUR	3	-	-	-	-	3	7
PROXIMAL TIBIA	2	-	-	-	-	2	5
DISTAL TIBIA	8.5	3	1.5	2	1	11	25
TARSALS	5	-	-	3	.25	5.25	12
ASTRAGALUS	4.5	1	.5	2	1	6	14
CALCANEUS	5	3	1.5	2	1	7.5	17
PROXIMAL METATARSAL	7	4	2	1	.5	9.5	22
DISTAL METATARSAL	4	1	.5	-	-	4.5	10
PHALANGES	6.5	12	.5	7	.29	7.29	17

(1) Assembled from Binford 1981: 200–201 and Table 5.01, col. 27.
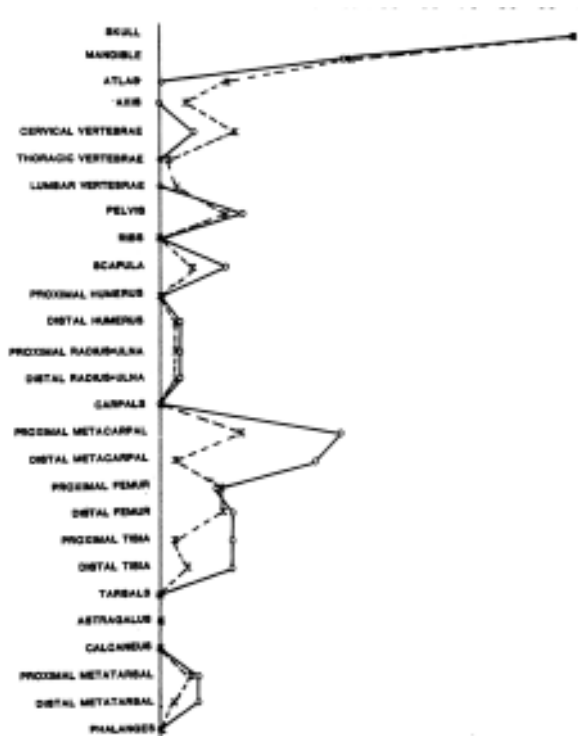(2) Calculated according to procedures outlined in Binford 1984: 50-51.

Figure 13. Control assemblages from Hyaena brunnea den bone frequencies as MAU percentages for large prey (o) and small prey (x) from Table 10.
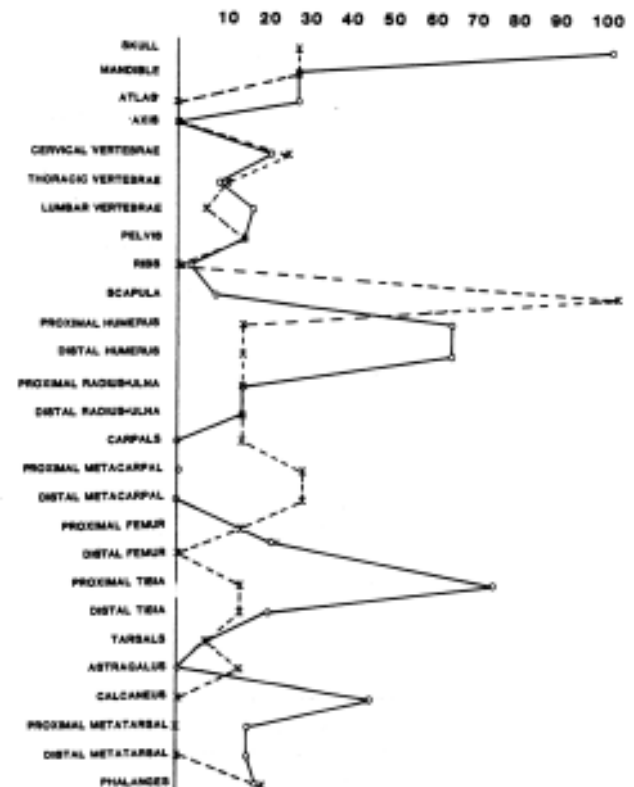

Figure 14. Control assemblages from *Panthera pardus* den bone frequencies as MAU percentages for large prey animals (o) and small prey animals (x) from Table 11.

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Table 13. Control assemblages from humans for caribou remains.

	RESIDENTIAL[1] MAU[4]	%	TRANSPORTED[2] MAU[4]	%	HUNTING STANDS[3] SPRING MAU[4]	%	SUMMER MAU[4]	%	FALL MAU[4]	%
SKULL	3	3.5	3	20	11	74	2	40	10	24
MANDIBLE	3	3.5	4	27	10.5	70	4.5	90	9.5	23
ATLAS	20.5	24.2	3	20	-	-	3	60	-	-
AXIS	20.5	24.2	3	20	-	-	2	40	1	2
CERVICAL VERTEBRAE	22	26	3	20	-	-	1	20	1	2
THORACIC VERTEBRAE	74.4	87.9	5	33	.8	6	.2	4	3.6	9
LUMBAR VERTEBRAE	69.4	82.8	4	27	1.5	10	2.5	50	1.5	4
PELVIS	73.4	86.9	4	27	1	7	1	20	.5	1
RIBS	84.6	100	6	40	.6	4	.2	4	8.9	22
SCAPULA	68.5	81	7	47	1	7	3.5	70	1.5	4
PROXIMAL	60.5	71.5	7	47	.5	4	.5	10	1.5	4
DISTAL	60.5	71.5	7	47	.5	4	4	80	2	5
PROXIMAL RADIUS/ULNA	59	69.7	7	47	1.5	10	3	60	10	24
DISTAL RADIUS/ULNA	59	69.7	7	47	4	27	3	60	11.5	28
CARPALS	51.5	60.9	7	47	6	40	2.5	50	12.7	31
PROXIMAL METACARPAL	43.9	51.9	7	47	7.5	50	3	60	19	46
DISTAL METACARPAL	43.9	51.9	7	47	11	74	2.5	50	23	56
PROXIMAL METACARPAL	61.6	72.8	15	100	2.5	17	.5	10	0.5	26
DISTAL FEMUR	61.6	72.8	14.5	97	3.5	24	1	20	12	29
PROXIMAL TIBIA	61.1	72.2	11	73	8.5	57	2	40	29.5	72
DISTAL TIBIA	60.1	71	9	60	9.5	64	5	100	15.5	87
TARSALS	57	67.4	8.5	57	8.5	57	3	60	15.5	87
ASTRAGALUS	57	67.4	8.5	57	8	54	3	60	37	90
CALCANEUS	57	67.4	8.5	57	9	60	3	60	36	88
PROXIMAL METATARSAL	46	54.4	11	73	12.5	04	4	80	39.5	96
DISTAL METATARSAL	46	54.4	11	73	15	100	1.5	30	41	100
PHALANGES	32.8	38.7	9	60	9.4	64	.3	5	7	17

(1) Assembled from Binford 1978: 259, col. 5.

(2) Assembled from Binford 1978: 231, col. 12.

(3) Assembled from Binford 1978, Table 5.1 (spring), Table 6.6 (summer), and Tables 7.1-7.4 (fall).

(4) Note that MNI in original data has been changed to MAU per Binford 1984 50-51.
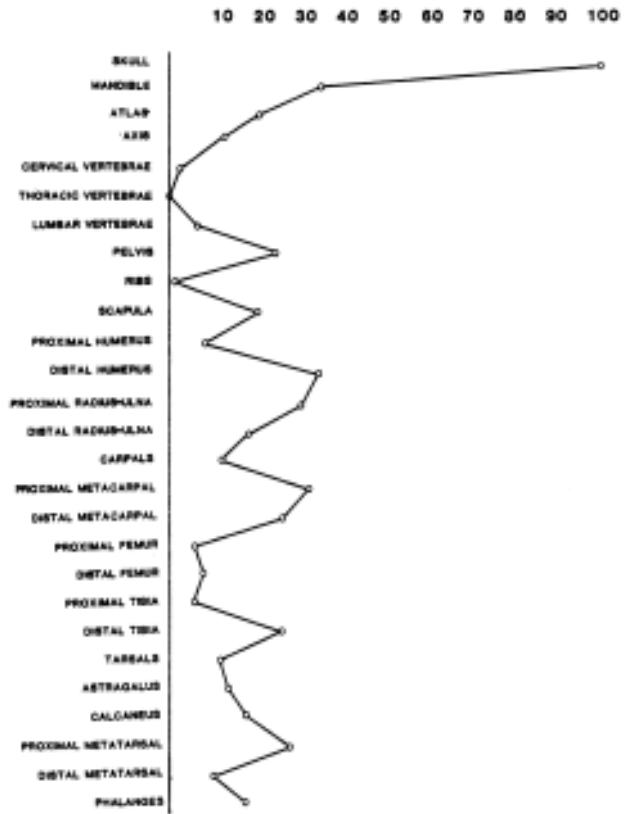
Figure 15. Control assemblage for *Canis lupus* den bone frequencies as MAU percentages from Table 12.

Table 14. Kolmogorov-Smirnow two sample test results of differences between middle paleolithic faunal assemblages and control Faunal assemblages (1).

	COVA NEGRA Cervus elaphus ALL LEVELS COMBINED	NEGRALOS Capra pyrenaica DALL LEVELS COMBINED	CASARES FIVE SPECIES LEVEL 7-12
	TESTED	AGAINST	
Hyena dens - large prey	1.96	-	.82
Hyena dens - small prey	-	2.40	1.16
Leopard dens - large prey	1.51	-	1 .15
Leopard dens - small prey	-	.88	.55
Wolf dens	1.64	1.03	.42
Human residential	1.66	.79	1.13
Human transported	1.29	.84	.94
Human hunting stands	.82	1.41	1.23
Parpalló - Cervus spp.	1.25	-	.35
Parpallo - Capra spp.	-	1.58	
Cova Negra - Cervus spp.	-	-	.74

(1) 1.22 = difference significant at the .10 level, 1.36 = difference significant at the .05 level. 1.63 = difference significant at the .01 level, 1.95 = difference significant at the .001 level.
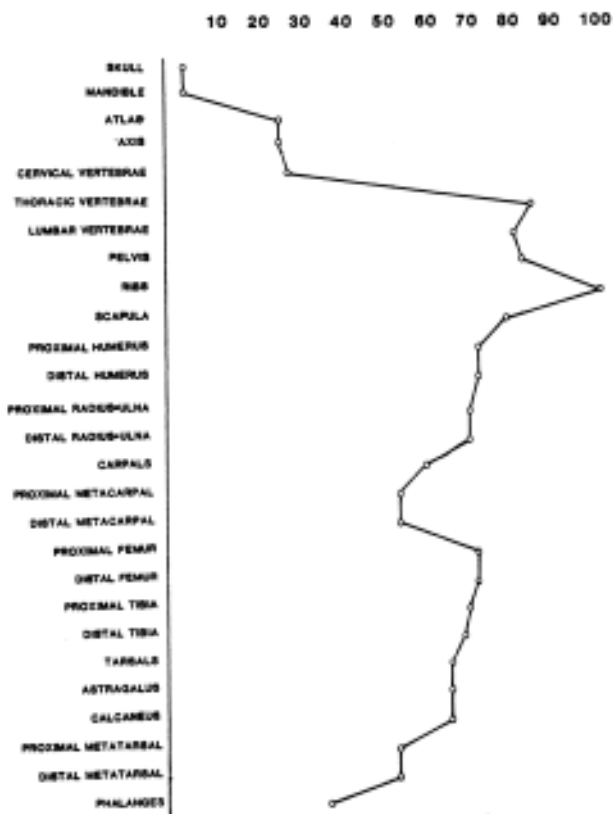
| | CUEVA DEL VOLCAN | CUEVA DEL VOLCAN | PARPALLÓ | | | | | | PARPALLÓ | | | | | |
| | Cervus elaphus LEVELS 18-26 | Cervus elaphus LEVELS 26A-29 | Cervus elaphus - LEVELS | | | | | | Capra pyrenaica - LEVELS | | | | | |
			1	2	3	6	7	9+10	1	2	3	6	7	9+10
Hyena dens														
large prey	1 .00	.84	1.67	2.13	1.60	1.70	1.43	1.63	-	-	-	-	-	-
small prey	-	-	-	-	-	-	-	-	1.37	1.95	.57	3.04	2.31	3.64
Leopard dens														
large prey	.94	1.27	1.01	1.45	1.02	1.07	1.07	.72	-	-	-	-	-	-
-.mall prey	-	-	-	-	-	-	-	-	1.10	1.06	1.01	1.70	1.10	.87
Wolf dens	.74	1.17	1.42	2.11	1.28	1.43	1.47	1.54	2.25	2.09	1.55	6.33	2.46	3.17
Human														
residential	2.37	3.04	3.36	2.79	3.46	2.12	1.00	3.43	5.19	4.80	4.56	7.65	5.25	6.58
transported	2.01	2.63	2.47	2.10	2.71	1.50	.85	2.50	3.79	4.05	3.60	6.13	4.50	4.74
hunting stands	2.34	2.60	3.71	2.85	2.97	2.93	1.77	5.08	5.44	6.21	5.15	8.50	6.62	9.32

(1) 1.22 = difference significant at the .10 level, 1.36 = difference significant at the .05 level, 1.63 = diference significant at the .01 lebel, 1.95 = difference significant at the .001 level.

Figure 16. Human produced faunal assemblage for caribou - bone frequencies for residential sites as MAU percentages from Table 13.
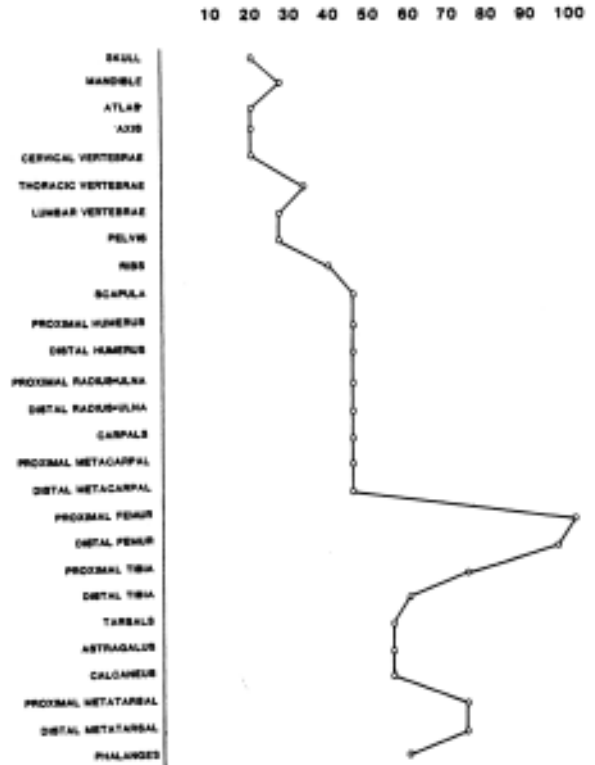
Figure 17. Human produced faunal assemblage - caribou bone frequencies from transported assemblages as MAU percentages from Table 13.
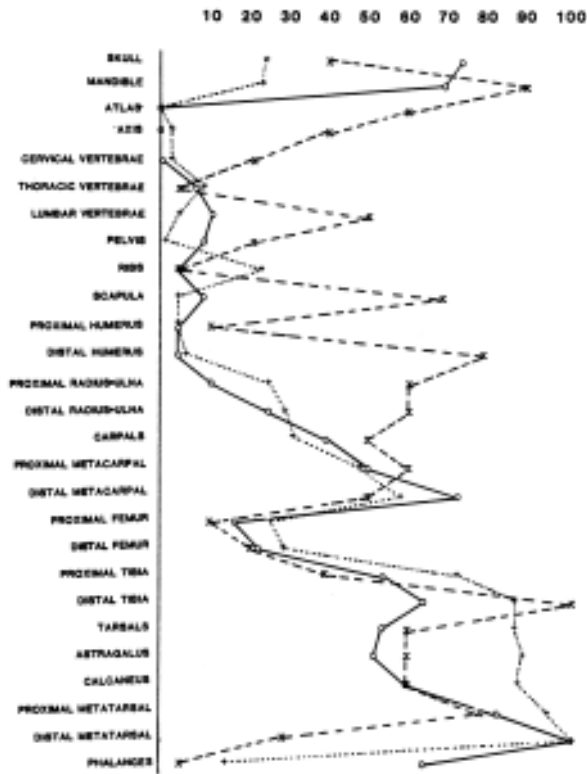
Figure 18. Human produced faunal assemblages - caribou bone frequencies for spring (o), summer (x), and fall (+) hunting stands as MAU percentages from Table 13.
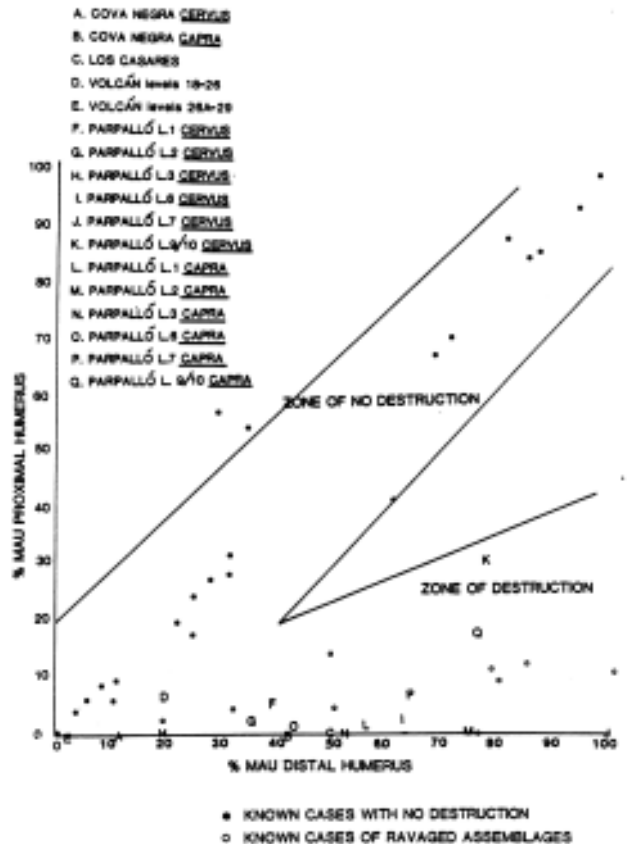

Figure 19. Relationship between percentage MAU's of proximal and distal humerus for 17 faunal assemblages compared with values in a series of control assemblages with known degrees of destruction by predator-scavengers (adapted from Binford 1981: 219).

and Parpalló does not corroborate the expectations of decreasing carnivore activity from the Middle to Upper Paleolithic presented at the beginning of this paper. If anything, the carnivore activity in this region, as inferred from the preceding analysis, has remained relatively constant or has increased through time. The Mousterian assemblages from Cova Negra and Los Casares, when analyzed with the Kolmogorov-Smirnov test, show similarities to both human and carnivore generated assemblages suggesting a joint utilization of these sites by hominids and other animals. The Upper Paleolithic faunal assemblages from Parpalló and Volcán, however, show an overwhelming similarity to the carnivore generated assemblages suggesting possibly a greater carnivore involvement with the deposition of these assemblages.

Degree of Assemblage Attrition

Figure 19 and 20 compare the percentage MAU of the proximal versus distal ends of the humeri and tibiae of 17 faunal assemblages. As mentioned in the methodology section above, these bones are particularly sensitive to attritional processes (BINFORD 1981:217-219). The probability of survival between the epiphyses of these bones is very different when exposed to the gnawing of predator scavengers and,

as such, they are excellent indicators of the degree of attrition suffered by an assemblage. The percentage MAU's of proximal and distal humeri and tibiae from the Middle Paleolithic assemblages at Cova Negra and Los Casares and the Upper Paleolithic assemblages from Volcán and Parpalló are plotted with a series of control assemblages in order to assess the degree of attrition suffered at these sites (Figures 19 and 20). The MAU percentages were taken from Tables 4-9.

For the humerus (Figure 19), all 17 assemblages clearly fall within the zone of destruction. This suggests that these assemblages have suffered at least some destruction by predator scavengers and it follows that they are at least, in part, a result of carnivore predator scavenger activity.

The tibia graph (Figure 20) show both Cova Negra assemblages, levels 3 and 9 + 10 for *Cervus* at Parpalló, and levels 3 and 7 for Capra at Parpalló in the zone of destruction. Volcán (levels 18-26), Parpalló (Levels 2, 7 - Cervus), and Parpalló (levels 3, 9 + 10 - Capra) are clearly in the zone of no destruction. All the remaining assemblages are distri-
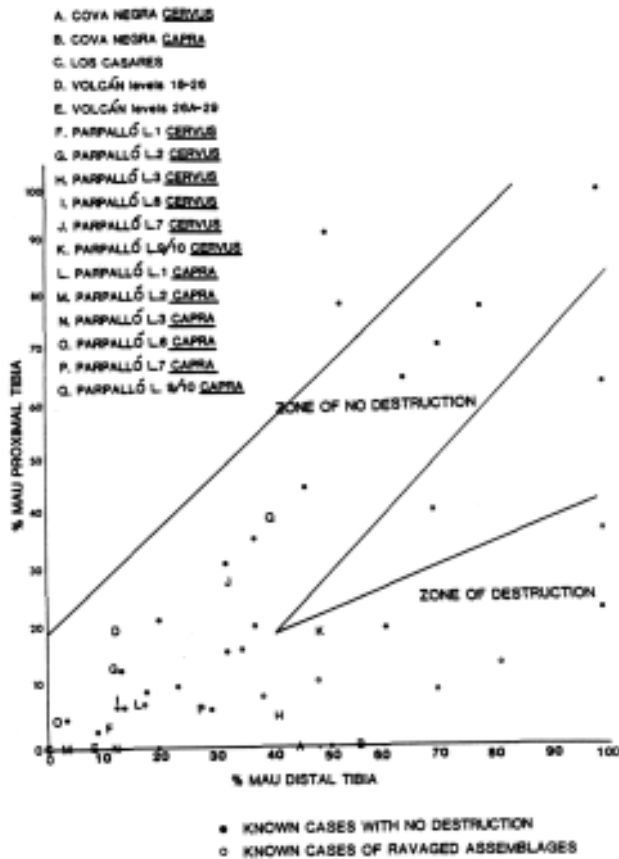
A. COVA NEGRA CERVUS
B. COVA NEGRA CAPRA
C. LOS CASARES
D. VOLCÁN levels 18-26
E. VOLCÁN levels 26A-29
F. PARPALLÓ L.1 CERVUS
G. PARPALLÓ L.3 CERVUS
H. PARPALLÓ L.3 CERVUS
I. PARPALLÓ L.6 CERVUS
J. PARPALLÓ L.7 CERVUS
K. PARPALLÓ L.9/10 CERVUS
L. PARPALLÓ L.1 CAPRA
M. PARPALLÓ L.2 CAPRA
N. PARPALLÓ L.3 CAPRA
O. PARPALLÓ L.6 CAPRA
P. PARPALLÓ L.7 CAPRA
Q. PARPALLÓ L. 9/10 CAPRA

• KNOWN CASES WITH NO DESTRUCTION
○ KNOWN CASES OF RAVAGED ASSEMBLAGES

Figure 20. Relationship between percentage MAU's of proximal and distal tibia for 17 faunal assemblages compared with values in a series of control assemblages with known degrees of destruction by predator-scavengers (adapted from Binford 1981:219).

buted between the two zones and are «too close to call». The discrepancy between the two graphs is explicable by the fact that the tibia is a less sensitive indicator of destructive processes than the humerus (BINFORD 1981:217).

The degree of assemblage attrition for the three Middle Paleolithic assemblages (two from Cova Negra and one from Los Casares) and 14 Upper Paleolithic assemblages (12 from Parpalló and two from Volcán) confirms the conclusion arrived at in the body part frequency analysis: there appears to be no vectored change in the extent of carnivore activity through time from the Middle to the Upper Paleolithic for these sites in eastern Spain. In the following age (mortality) profile analysis the type of procurement is examined with the hope of shedding some light on the «type» of procurer, man or beast.

Age (Mortality) Profiles

To briefly reiterate the basis for this analysis, there are two bipolar types of age profiles which characterize mammal populations: catastrophic and attritional, and KLEIN (1982) has argued that the

presence of a high number of young individuals in a attritional profile at an archaeological site suggests active hunting by hominids. In addition, catastrophic profiles can be indicative of mass kills by humans and as such could be used to infer a human involvement with a faunal assemblage, especially in the case of the cave sites analyzed here.

Davidson (1980) determined ages for *Capra pyrenaica* and *Cervus elaphus* at Parpalló using dental criteria. These were converted into histograms with intervals of 10 percent of potential lifespan for the following study. Levels 1, 2, 3, 6, 7, and 9 + 10 for *Capra* are presented along with theoretical «catastrophic» and «attritional» profiles in Figure 21. Levels 1, 2, 3 and 9 + 10 for *Cervus* are presented in Figure 22.

A cursory examination of the age profiles for Capra (Figure 21) suggest that levels 2, 3, 6, 7, and 9 + 10 all have attritional profiles, while the level 1 profile appears to be somewhat catastrophic. The 20-30 percent interval is large in levels 2 and 9 + 10. To test whether the differences observed are statistically significant, the age profiles were analyzed by the Kolmogorov-Smirnov test.

The *Capra pyrenaica* age (mortality) profiles from levels 1, 2, 3, 6, and 7 do not differ significantly (> .05) from one another. However, level 9 + 10 is significantly different from levels 1, 2, and 3. While this suggests a different pattern of mortality, it is clear that these profiles are all attritional in nature and there are no levels with a large number of very young individuals (i.e., those which died in the first 10-20 percent of lifespan). This could be the result of post depositional removal of young individuals through attritional processes such as predator scavenging or prey selection by human hunters for prime age adults.

If the age profiles for *Cervus elaphus* are compared, it becomes apparent that levels 1, 2, 3, and 9 + 10 are all essentially attritional profiles (Figure 22). The Kolmogorov-Smirnov test confirms this observation; these profiles are not significantly different from one another. It is interesting to note that these assemblages have a low number of «very young» individuals (10-20 percent of lifespan) but a very high number of individuals who died as young adults (20-30 percent of lifespan). These types of attritional profiles can, unfortunately, be created by both humans and carnivores.

A comparison of the age profiles between *Capra* and *Cervus* for each level indicates that there are different mortality patterns for these species in levels 2 and 9 + 10. It is possible that this is related to.different collectors or different collection strate-
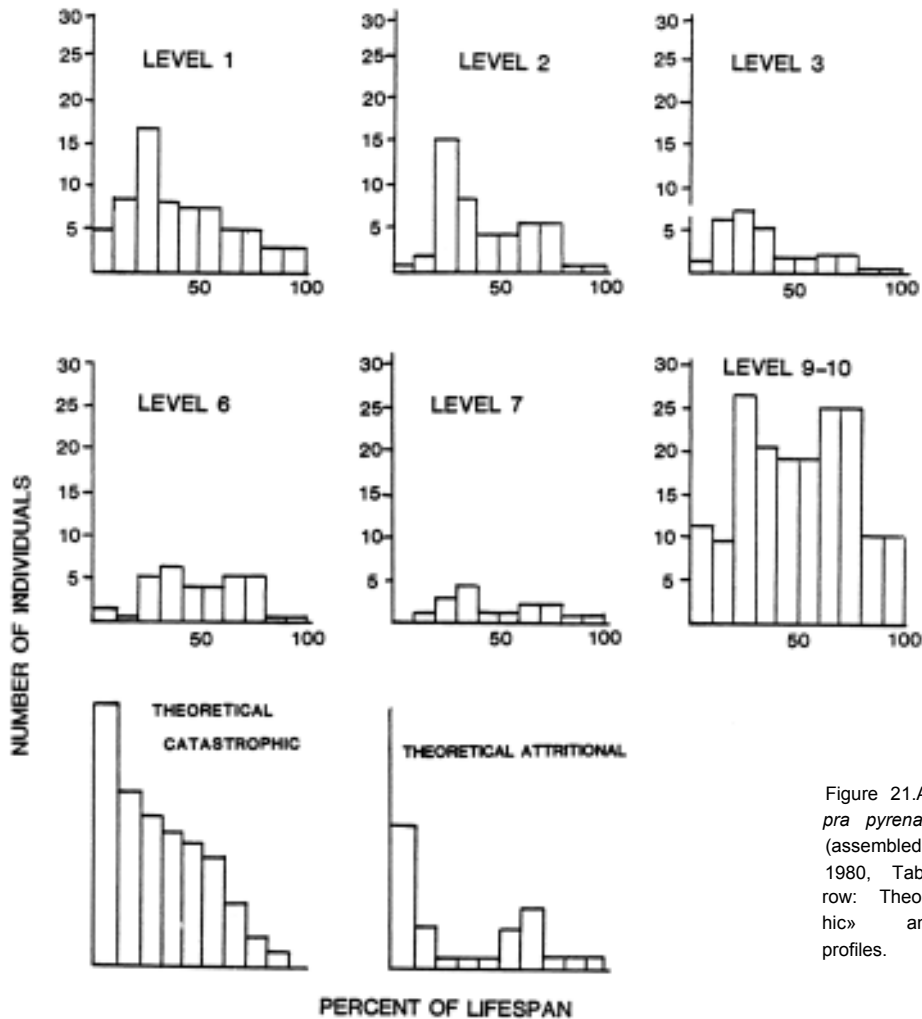
Figure 21. Age profiles of *Capra pyrenaica* from Parpalló (assembled from Davidson 1980, Table 7.87). Bottom row: Theoretical «catastrophic» and «attritional» profiles.

gies by the same collector, but this is not possible to determine at this time.

The only Mousterian site with age profile data is Cova Negra. However, the data are problematical for two reasons: (1) the ages were determined by examination of both dental criteria (using limited and somewhat dated technique) and epiphysial fusion (a restricted and unreliable method), and (2) the procedures described in (1) allow for only a gross generalization about age (i.e., PEREZ-RIPOLL 1977:60 uses only the categories of 0-2 years, 2-3 years, and > 3 years). These data were, nevertheless, made into a comparable histogram for *Cervus elaphus* (Figure 23) including theoretical catastrophic and attritional profiles. The Cova Negra mortality profile appears to be attritional in shape. Like Parpalló, it also has a large number of individuals in the 20-30 percent range, as seen in Figures 21 and 22.

In summary, the age (mortality) profile analysis was not very informative regarding the identification of the collecting agent at Parpalló and Cova Negra.

Because of the low number of very young individuals it was not possible to specifically identify human predation at these sites. There was an indication of differential mortality patterns in the levels at Parpalló for ibex which might be the result of different collectors of the faunal remains. In addition, there was also an indication of different mortality patterns between species in certain levels which might be suggestive of different collecting agents. Unfortunately, because of the limitations of the data from Cova Negra, it is only possible to state that age (mortality) profiles do not appear to change from the Middle to the Upper Paleolithic through time at these sites in this area of eastern Spain. This relates well with the evidence presented earlier of very little change in suggested collectors of bone at these sites.

SUMMARY AND CONCLUSION

This analysis of faunal remains from two Middle and three Upper Paleolithic caves in eastern Spain
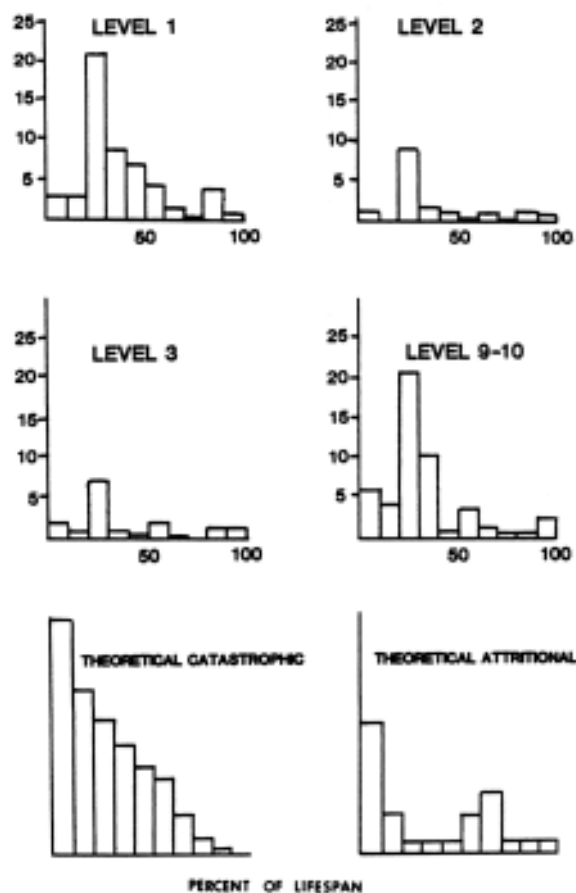
Figure 22. Age profiles of *Cervus elaphus* from Parpalló (assembled from Davidson 1980, Table 7.91). Bottom row; Theoretical «catastrophic» and «attritional» profiles.
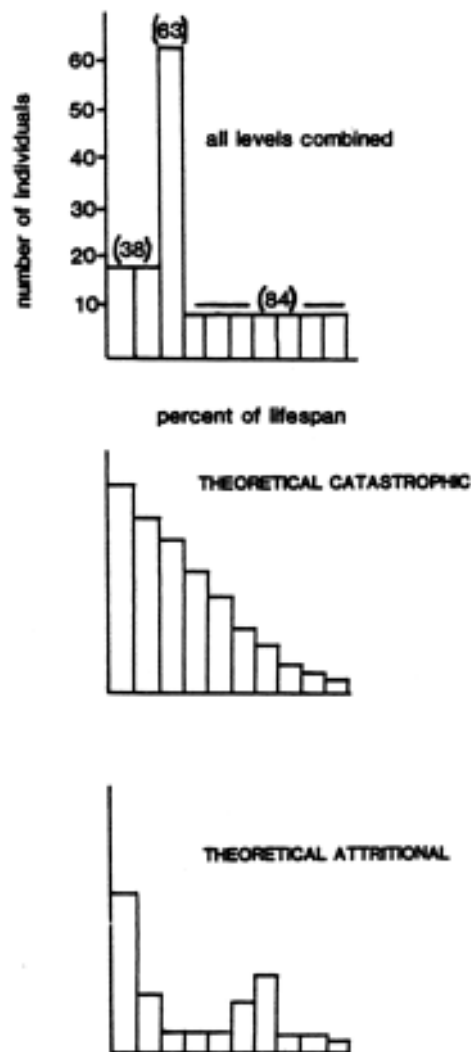

Figure 23. Age profile of *Cervus elaphus* from Cova Negra compared with theoretical «catastrophic» and «attritional» profiles (assembled from Perez Ripoll 1977:60, Table 5).

rather strongly indicates that carnivore predator scavengers contributed in some considerable degree to the deposition of the ungulate skeletal material found at these sites. Unexpectedly, the degree of carnivore involvement does not appear to decrease from the Middle to the Upper Paleolithic, as has been documented for comparable north Spanish data (STRAUS 1982). Any inferences made about prehistoric hunter-gatherer subsistence organization based on the faunal material from these sites should be tempered by an awareness of the natural processes which can affect faunal remains at archaeological sites.

To summarize the results of this study: the carnivore/ungulate ratios calculated showed that at the Middle Paleolithic sites of Cova Negra and Los Casares the faunal assemblages had relatively higher ratios with more of a variety of carnivore species than did the assemblages from the Upper Paleolithic sites of Parpalló and Les Mallaetes. This suggested that the Mousterian sites had more carnivore involvement in the deposition of faunal remains than did the Upper Paleolithic sites, results with are con-

sistent with those of STRAUS (1982) for Cantabrian Spain.

The body part frequency analysis, however, showed that the Mousterian assemblages at Cova Negra and Los Casares were probably formed by both carnivores and hominids while the Upper Paleolithic assemblages from Volcán and Parpalló had an almost exclusive carnivore den assemblage structure. These results are the opposite of what was expected based on the carnivore/ungulate ratios and point out general and potentially misleading inaccuracies associated with the ratio. As has been noted by GAMBLE (1983:244), the degree to which carnivores den, and hence bring food including the remains of carnivores to that location, is related to competition arriong carnivores and the raising of young, that these species prey less on one another and in these

cases the carnivore/ungulate ratio would be less accurate.

The analysis of assemblage attrition appeared to confirm the results of the body part frequency analysis suggesting a high degree of destruction of the faunal remains by predator scavengers through time from the Middle to the Upper Paleolithic and very little change in carnivore activity at these sites.

The age (mortality) profiles were the most difficult method to use and hence gave the most inconclusive results for the assessment of the degree of carnivore versus hominid activity in the deposition of bone refuse at these sites. Both the Middle (Cova Negra) and Upper (Parpalló) Paleolithic sites analyzed had attritional age profiles but the agent of accumulation could not be determined.

Of the four methods used in this study, the age profiles were the most disappointing. However, the carnivore/ungulate ratio proved to be a useful, if somewhat limited, preliminary technique which can be utilized to isolate faunal assemblages which might require closer examination before they are used for any hominid subsistence studies. The body part frequency analysis and the study of assemblage attrition are more detailed specific techniques which can be utilized on assemblages in order to determine more precisely the degree of carnivore activity at a site.

Given the results of this study, what can be inferred about the current hominid subsistence strategies developed for the Middle and Upper Paleolithic in eastern Spain? First, I think it is clear that it can no longer be assumed that the Mousterian faunal assemblages from Cova Negra and Los Casares are solely the results of the activities of man (cf. ALTUNA 1973:99, PEREZ-RIPOLL 1977:138). A more detailed re-analysis of these assemblages is required before the hominid subsistence organization at these sites can be understood. Second, sites with little or no carnivore remains in their faunal assemblages, such as with the Upper Paleolithic sites used in this study, might be suspect as being only the accumulation of humans. DAVIDSON's (1983:85) assumption that «all mammal bone (except possibly rabbits) was introduced to these three sites (Parpalló, Volcán, and Les Mallaetes) by humans» might require reevaluation. His use of the lack of surficial evidence for carnivore gnawing on the bones from these sites as an indication of little carnivore involvement with the assemblages could be problematical because percentages of these marks are highly variable even at definite carnivore modified bone deposits. At modern Bisa elaphant kills, which also have been utilized by carnivores, percentages of bone showing gnaw marks

vary from 18.5 to 45.4 percent (CRADER 1983:115). Modern Hyena dens have only 50 percent of the bone showing gnaw marks (BUNN 1983:146). With such low percentages of bones having gnaw marks, the chances of recovering this evidence in assemblages which have been subjected to postdepositional processes are limited.

In addition, DAVIDSON's model of prehistoric economies in the Levante (1976, 1980, 1983) which emphasizes changes in the patterns of exploitation of the environment (as determined for the most part from faunal remains) through time might also require reevaluation, potentially being based on both hominid and carnivore generated bone refuse.

Accurate models of Middle and Upper Paleolithic subsistence strategies and changes through time can only be constructed once the problem of segregating out the carnivore generated bone debris has been resolved. We must utilize the methods available and endeavor to develop new and better techniques for studying the faunal remains at archaeological sites in order to dissect the many palimpsest deposits which seem to characterize Paleolithic research in western Europe.

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