Patterns of subsistence and settlement during the Aurignacian of the Swabian Jura, Germany

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ABSTRACT A concentration of cave sites located in the Swabian Jura of southern Germany is key to our understanding of Paleolithic central Europe, in particular the Aurignacian. Early artwork in the form of ivory animal and anthropomorphic figurines and rich bone and stone tool inventories are characteristic of Aurignacian find horizons at many of these sites. The site of Vogelherd is also noteworthy for remains of modern *Homo sapiens* and Geissenklösterle cave for dates ranging from 35-40 ka BP from the lower Aurignacian level (AH III). This paper focuses on recent analysis of the large archeofauna from the Aurignacian levels at Vogelherd, which provides data on taxonomic diversity, skeletal element frequencies, and age profiles of two well-represented species, *Equus ferus* and *Mammuthus primigenius*. Intriguing patterns in prey choice and utilization are recognized through comparison of the Vogelherd fauna with other Swabian Jura bone assemblages. Evaluating these cave faunas in the context of site location, regional environmental conditions and in association with diverse bone, ivory and stone tool inventories allows us to model human subsistence patterns and settlement during the Aurignacian in the Swabian Jura.

Introduction

The Swabian Jura region of southern Germany contains a concentration of prehistoric cave sites in the extensive karst systems of the Lone and Ach valleys (Fig. 1) that have played an important role in Paleolithic archeology during the past two centuries. A long history of research in the area began in the mid-late 1800s and continues today with ongoing excavations and analyses of material from several sites by the Universität Tübingen. The archeological significance of this region comes not only from the number of sites with dense Paleolithic deposits but from an especially rich Aurignacian record with notable highlights. In addition to large stone and bone artifact inventories, Aurignacian deposits have produced many small figurines carved from mammoth ivory at Vogelherd, Geissenklösterle, Hohlenstein-Stadel, and Hohle Fels representing the earliest artwork in Europe; fossil remains of early *Homo sapiens sapiens* from Vogelherd (the Stetten fossils); and early dates of 35-40 ka BP for Aurignacian deposits from Geissenklösterle (Richter et al., 2000; Conard and Bolus, 2003). Such factors suggest that the Swabian Jura represents a key region for early Upper Paleolithic settlement and cultural innovation (Conard and Floss, 2000; Conard and Bolus, 2003).

Although many localities in the Swabian Jura contain Aurignacian deposits with faunal material (Bockstein, Brillenhöhle, Geissenklösterle, Hohle Fels, Hohlenstein-Stadel, and Sirgenstein), the largest Aurignacian animal bone assemblage to date was found at Vogelherd. In the course of his excavation in 1931, Gustav Riek documented seven archeological find hori-

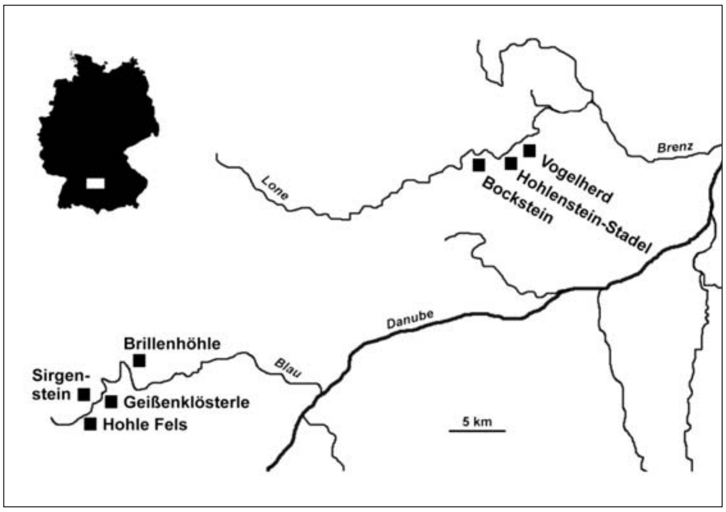

FIG. 1 – Map showing location of sites in the Swabian Jura, Germany.

zons ranging from Middle Paleolithic to Neolithic (Riek, 1934). The Aurignacian is represented by two find horizons that Riek designated as layers IV and V, which have since produced dates of 29-36 ka BP (Conard; personal communication). The early modern human remains, known as the Stetten cranium and humerus (Czarnetski, 1983; Churchill and Smith, 2000), were recovered at the bottom of horizon V (Fig. 2). Refitting of lithics and bones between layers suggests that mixing occurred between the layers and therefore the faunal remains from both are discussed as one assemblage in this paper. The wealth of material suggests that the site was used intensively during the Aurignacian, probably in the context of multiple occupations.

One positive aspect of cave archeofaunas is that most if not all the material arrives at the site by means of transport and therefore is often the product of subsistence decisions by prehistoric humans (Stiner, 1994, p. 233). Association with large stone and bone tool assemblages, ivory animal figurines, and hearth features in addition to extensive butchery traces on bones of horse, bovid, and reindeer point to human accumulation of the fauna. Large carnivores such as hyaena, lion, wolf, and bear were present and undoubtedly contributed to the assemblage, but minimal traces of carnivore bone gnawing or breakage on the Aurignacian bone indicate that these taxa were not the primary bone collectors in this deposit. Thorough recovery of most if not all faunal material during excavation is indicated by the amount of small or unidentifiable bone fragments, specimens that were often discarded in early archeological fieldwork. However, considering that the excavation of Vogelherd was conducted in just three months without sediment screening, it is possible that some smaller material was not collected by Riek and his team.

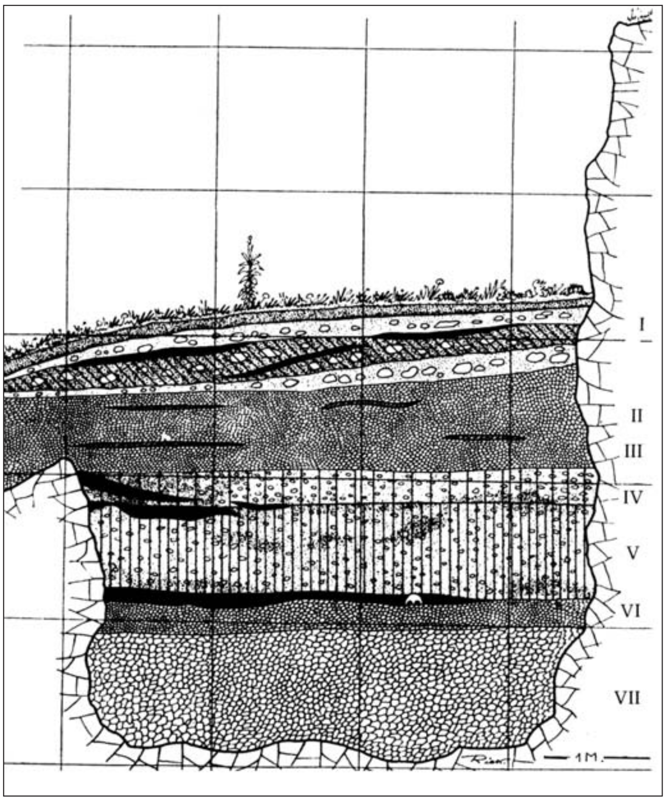

FIG. 2– Vogelherd cave stratigraphy (Profile 1) showing location of Stetten cranium (*Homo sapiens sapiens*) at the bottom of Aurignacian layer V (from Riek, 1934, p. 41, Fig. 3).

Although a rich archeofauna was recovered from Vogelherd, analysis of the bone assemblage is limited to one paleontological study by Ulrich Lehmann (1954). An archeozoological study of the faunal material is currently being conducted by the author in an attempt to elucidate patterns of faunal exploitation by prehistoric humans in the Swabian Jura. With a sample size of approximately 15 000 pieces, the Aurignacian faunal remains make up the largest portion of the Vogelherd archeofauna and represent a variety of mammalian taxa. *Equus ferus* and *Mammuthus primigenius* are the best-represented species in this deposit and provide information on skeletal element frequency, age class distribution, and butchery that are used to address questions about prey choice and utilization by early modern humans in the region.

The Vogelherd Aurignacian Archeofauna

Species diversity is generally similar between the Swabian Jura sites but clear differences are noticeable in dominant taxa (Table 1). Since Number of Identified Specimens (NISP) or Minimum Number of Individuals (MNI) data are not available for all of the listed sites, presence or absence and most frequent taxon (when available) are listed in Table 1. Two remarkable features that distinguish Vogelherd in terms of species representation are the significantly higher abundance of megamammals (mammoth, woolly rhinoceros), while cave bear remains are minimal in comparison to the other sites in the region. Mammoth and rhinoceros are present in nearly all regional faunas during the Aurignacian but amounts are small with the exception of Vogelherd, which contains a minimum number of 28 mammoth and 12 rhinoceros individuals. Whether these megaherbivores were hunted is unknown, however it is clear that mammoth bone and ivory were used for nonsubsistence needs. This point will be discussed in a later section. Cave bear was not a subsistence species, although humans exploited this animal at Geissenklösterle and Hohle Fels (Münzel et al., 2001). The abundant cave bear remains at most of the Swabian Jura sites clearly point to the alternating use of these caves between this species and humans. Small fauna do not appear to have played an important role in Aurignacian subsistence at Vogelherd or other Swabian Jura caves, although the scarcity of these taxa at the sites might be a factor of excavation recovery methods. Geissenklösterle, which was excavated with great care by Joachim Hahn, contains the most small fauna remains of the Swabian Jura caves, while assemblages collected without sieving contain few small fauna remains. These small assemblages do indicate some utilization by humans of leporids and birds and possibly of fox. Remains of fox are found in nearly all of the caves but it is not clear whether they were exploited for hides by humans or if they are natural background fauna.

Equus ferus and *Rangifer tarandus* are the most frequent hunted taxa in the Vogelherd and other Swabian Jura Aurignacian deposits, with other cervids and bovids also present in most assemblages. It is probable that horse and reindeer were hunted seasonally, although season of death indicators are sparse. One tooth row from reindeer at Vogelherd was aged at 12-14 months, indicating death in summer. Horse remains from Geissenklösterle (AH II, Aurignacian) point to hunting in winter (Münzel, 1999) but no reindeer provided seasonal information.

The Vogelherd archeofauna most certainly represents numerous depositional events and such palimpsests present a noisier picture of prehistoric lifeways (Binford, 1982). Unfortunately, we are rarely presented with archeofaunas created under single hunting-butchering events or larger, repeated events that might be separated through such factors as stratigraphy and/or season of death estimates, examples that often provide less ambiguous reflections of decisions about body part transport and utilization of prey. This does not mean that time-averaged archeofaunas are not informative about past subsistence patterns; it simply means that these patterns must be interpreted more carefully.

TABLE 1

Summary of identified taxa (excluding avian, rodent taxa) from Aurignacian horizons, Swabian Jura, Germany. "X" marks presence, X* marks best-represented taxon, when available.

Taxon	Vog.[a]	GK II[b]	GK III[b]	HS[c]	Sir.[d]	BH[e]	BT[f]	HF III[g]	HF IV[g]
Snowhare, *Lepus timidus*		X			X	X			
Unidentified hare, *Lepus* sp.	X	X	X	X			X	X	
Wolf, *Canis lupus*	X	X	X	X	X	X	X	X	X
Red fox, *Vulpes vulpes*	X	X		X					
Arctic fox, *Alopex lagopus*	X	X		X					
Red/Arctic fox, *Vulpes/Alopex*		X	X	X	X	X	X	X	X
Cave bear, *Ursus spelaeus*	X	X*	X*	X*	X	X*	X	X*	X*
Cave lion, *Felis spelaea*	X			X	X				
Lynx, *Felis lynx*		X			X				
Unidentified Wild cat, *Felis* sp.	X				X				
Ermine, *Mustela erminea*			X	X					
Polecat, *Mustela putorius*		X		X					
Unidentified Marten, *Martes* sp.		X							
Wolverine, *Gulo gulo*	X	X	X		X				
Cave hyaena, *Crocuta spelaea*	X	X	X	X	X		X		
Woolly mammoth, *Mammuthus primigenius*	X*	X	X	X	X		X	X	X
Horse, *Equus ferus*	X*	X	X	X	X	X	X*		X
Woolly rhinoceros, *Coelodonta antiquitatis*	X	X	X	X	X		X	X	X
Wild pig, *Sus* sp.	X								
Giant deer, *Megaloceros giganteus*	X	X							
Red deer, *Cervus elaphus*	X	X	X	X	X				
Reindeer, *Rangifer tarandus*	X	X	X	X	X	X	X	X	X
Large bovid, *Bos/Bison*	X						X		
Ibex, *Capra ibex*		X	X		X	X			
Chamois, *Rupicapra rupicapra*	X	X	X		?	X			

[a] Vog (Vogelherd, IV/V), Lehmann, 1954:115, Niven n.d.; [b] GK (Geissenklösterle, AH II and AH III), Münzel, 1999; [c] HS (Hohlenstein-Stadel IVa/IV), Gamble, 1979, p. 40, Table 4; [d] Sir. (Sirgenstein, IV-VI), Schmidt, 1912; [e] BH (Brillenhöhle, XIV), Boessneck and von den Driesch 1973); [f] BT (Bockstein-Törle, VIII), Krönneck, personal communication; [g] HF II, HF III (Hohle Fels), Conard et al., 2002.

Exploitation of Equids

The horse assemblage from Vogelherd includes 452 bone and 402 molar specimens of medium- to large caballoid horses. This amount is probably only a portion of what was originally present but unfortunately an additional 500 specimens, many of which are likely from horse, cannot be confidently identified to species and were therefore placed in a "body

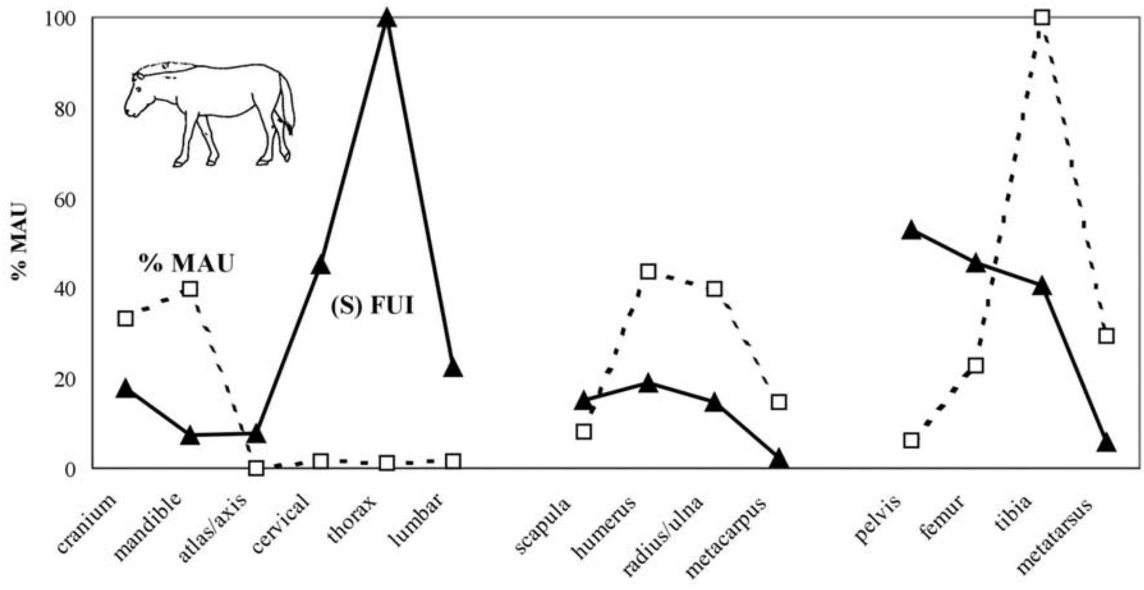

FIG. 3 – Vogelherd equid remains (Aurignacian) expressed in %MAU (dotted line) in comparison with standardized food utility index (S) FUI (solid line), or the skeletal elements theoretically most likely to be transported by humans based on data from modern horse (Outram and Rowley-Conwy, 1998, p. 845, Table 6). Isolated molars (n = 402) not included.

size four" category and not considered in the analysis presented here. Most of the horse remains are highly fragmented and surface condition of the bone ranges from good to substantially weathered (Stage 1 to 3 under Todd's [1987] system for temperate environments modified from Behrensmeyer [1978]).

Several main points can be made about the horse assemblage: 1) appendicular elements dominate; 2) these limb elements are represented almost entirely by shaft fragments with articular ends being rare; 3) axial elements are scarce; and 4) crania and mandibles are relatively abundant as represented by molars and some bone. Despite the level of fragmentation and abundance of shaft fragments, distinctive anatomical features or "landmarks" on limb elements allow accurate identification and quantification of such assemblages (Todd and Rapson, 1988; Morlan, 1994; Marean and Kim, 1998). Minimum Number of Elements (MNE; Binford, 1984) was tabulated based on the most frequent bone portion or landmark, which was then used to calculate Minimum Animal Units (MAU; Binford, 1978).

Appendicular elements are predominant but when the frequencies of these elements are plotted against equid utility indices, it appears that the most overall nutritionally valuable skeletal units are underrepresented in the Vogelherd assemblage with the exception of the femur (Fig. 3). The standardized food utility index (S) FUI (Outram and Rowley-Conwy, 1998, p. 845, Table 6) incorporates meat and marrow weight from three modern horses and proposes that the thorax, pelvis, and femur are the skeletal units most likely to be transported by humans. This might suggest that transport decisions by Aurignacian groups at Vogelherd were not always based on overall economic value of specific skeletal units but on more specific factors.

The skeletal element frequencies seen at Vogelherd are better explained by a closer look at nutritional aspects of certain portions or single bones. Ratio MAUs for horse elements at Vogelherd are plotted against marrow volume indices (Fig. 4; Outram and Rowley-Conwy, 1998, p. 843, Table 4) and mean meat weight (Fig. 5; Outram and Rowley-Conwy, 1998, p. 840, Table 2) for modern equids. The marrow volume plot results in positive relationships for the humerus, radius, femur, and tibia, suggesting that within-bone nutrients were a

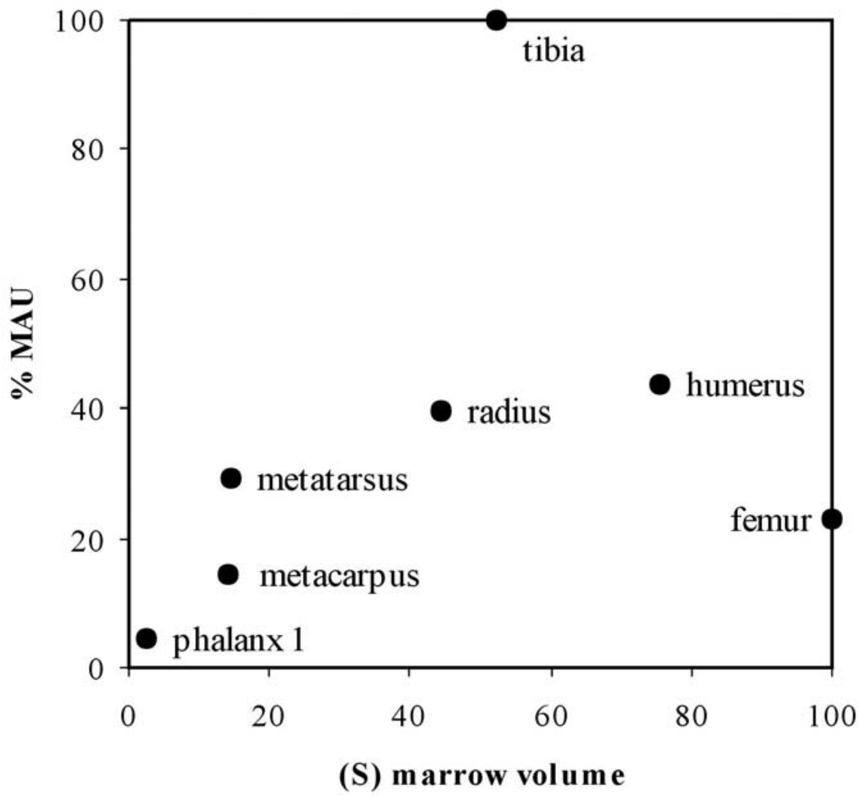

FIG. 4 – Vogelherd equid remains (Aurignacian) expressed in %MAU in comparison with standardized marrow volume index for modern horse (Outram and Rowley-Conwy, 1998, p. 843, Table 4).

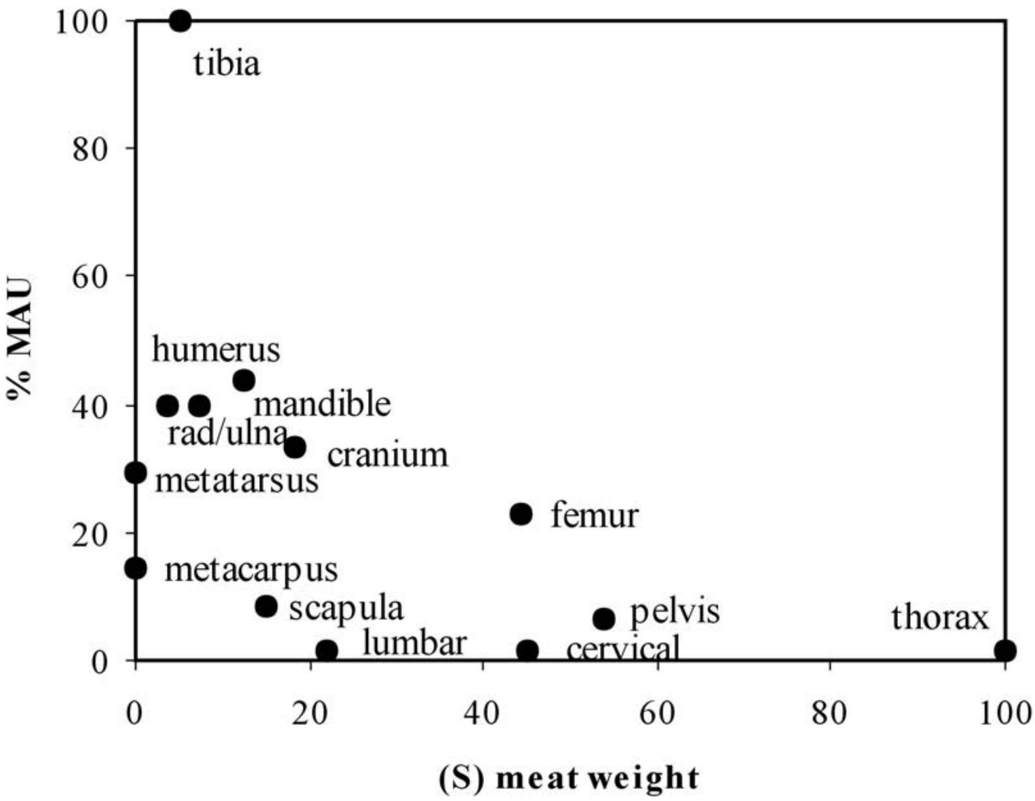

FIG. 5 – Vogelherd equid remains (Aurignacian) expressed in %MAU in comparison with standardized meat weight index for modern horse (Outram and Rowley-Conwy, 1998, p. 840, Table 2).

deciding factor in transport decisions at Vogelherd. The higher levels of fatty acids found in within-bone nutrients would have made horse bones an especially important nutritional source (Levine, 1998) and evidence of impact fractures and fresh spiral breakage on marrow-rich elements indicates exploitation of this resource at Vogelherd. In Fig. 5, the femur shows the only positive relationship between element frequency and meat weight, while the thorax and cervical vertebrae are strongly inverse.

Although limb elements are abundant at Vogelherd, the less dense articular ends make up a tiny fraction of the long bone NISP and shaft portions are what remain. The shaft is the densest portion of a long bone (Lyman, 1984) and is therefore the most likely to survive attritional processes, however several potential forces might account for the lack of articular ends in the Vogelherd assemblage, including but not limited to density-mediated attrition, carnivore destruction, or processing by humans for within-bone nutrients. Comparison between bone density values for equids found in Lam et al. (1999) and portions preserved in the Vogelherd assemblage show that density-mediated attrition played some role in which bone portions remain. There are exceptions, such as several complete infantile long bones or unfused long bone diaphyses that were preserved, but overall the remaining fragments represent the densest portions of the bone. Carnivore gnawing is exhibited on just ten percent of the equid specimens overall but is occasionally visible on limb elements and the softer carpals/tarsals. As discussed above, the skeletal element frequencies and anthropogenic modifications on long bones indicate utilization of the elements that are richest in within-bone nutrients, which might have included processing of the spongy articular ends to obtain grease and fats. In sum, several factors suggest that one or all of these destructive forces might have affected the ratio of articular ends to shaft flakes.

The scarcity of axial elements might be explained by the same factors proposed for the limb bone assemblage. Considering the relationship between portions preserved and bone density of the limb elements, density-mediated attrition seems the most likely cause of the missing axial bone. Carnivore gnawing was an additional contributor, as marked on a few of the axial specimens. The possibility of human transport decisions behind the paucity of axial elements cannot be ruled out but other evidence suggests that various destructive forces were the primary causes of this pattern.

Crania and mandibles are well-represented in the Vogelherd Aurignacian equid assemblage. Although cranial bone is sparse, the large number of molars indicates that crania were at one time present in the deposit. Although crania are usually categorized as a low-utility element, utility indices (Outram and Rowley-Conwy, 1998) and experimental butchery on modern equids (Lupo, 1998) rank this element higher. Skulls could have been a rich source of fats and overall nutrition in an animal, even in seasons when it was nutritionally stressed. Consumption of fat-rich cranial tissues has been discussed for modern hunter-gatherers (Binford, 1978, 1984; O'Connell et al., 1988) and proposed for Neandertals as well (Stiner, 1994). Except in rare cases (e.g., Frison, 1970), animal crania from archeological contexts rarely preserve evidence of butchery such as impacts or smashing and therefore exploitation of this element is speculative. However, the abundance of crania in many assemblages in addition to the experimental butchery on modern equids suggests this element might have been utilized for food by prehistoric groups. Mandibles also contain some marrow and their frequency as well as impact fractures in the Vogelherd assemblage suggest exploitation of this food resource.

Cut mark and impact fracture data from the Vogelherd equid assemblage provide additional insight into carcass utilization at the site. Frequencies and placement of cut marks suggest removal of muscle masses from high- and medium-utility skeletal parts, however cut marks are exhibited on only 10% of the equid bone (Byerly et al., 2002). This might be due to deterioration of bone surface from weathering or fragmentation but experimental butchery of modern horses has shown that a small percentage of tool strokes are visible as cut marks on the bone (Egeland, 2003) and therefore cut mark frequency is not necessarily a reliable indicator of carcass processing intensity. In summary, skeletal element frequencies as well as anthropogenic bone modifications point to an equid exploitation strategy that included the transport of primarily high- and medium-utility body parts and utilization of certain elements for their within-bone nutrients.

Evaluating the Vogelherd horse data with equid assemblages from a variety of Middle and Upper Paleolithic sites shows some interesting similarities and differences. An abundance of molars is also seen at Hohlenstein-Stadel V-VII (Gamble, 1999), Gabasa 1 (Blasco, 1997), Kamenka (Germonpré and Lbova, 1996), and Wallertheim F (Prindiville, 1998). Similar to Vogelherd, selective transport of upper limb bones or marrow-rich elements characterizes Geissenklösterle AH II and AH III (Münzel, 1999), Starosele Level 3 (Burke, 2000), Combe Grenal (Chase, 1986), Wallertheim B1 (Gaudzinski, 1995) and D (Conard and Prindiville, 2000), and Tönchesberg 2B (Conard, 1992). In terms of butchery traces, the frequency of cut marks is also relatively low on equids from Staroselje (Burke, 2000), Solutré (Olsen, 1989), Wallertheim F (Prindiville, 1998), and Gabasa 1 (Blasco, 1997). Scarcity of cut marks on horse is not always the rule, however, as seen in sites such as Boxgrove (Parfitt and Roberts, 1999). While this is by no means a complete survey of Old World equid assemblages, this selected number of equid sites serves as context in which to view the Vogelherd horse material. Age distribution of the Vogelherd Aurignacian horses has not been completed at the time of this publication, but when available will provide additional data for evaluation of variability in utilization of equids across time.

Horse played an essential role in Aurignacian subsistence at cave sites of the Swabian Jura. It was the best-represented prey species at Vogelherd and evaluation of the equid assemblage reveals a pattern of utilization in which some high- and many medium-utility skeletal elements were utilized. Marrow-rich limb bones are especially frequent and point to selection of these body parts for exploitation of within-bone nutrients. Although this pattern can be discerned, the picture is somewhat noisy due to the complex deposition of the Vogelherd Aurignacian deposit and interpretations have been made with this in mind. Skeletal element data from the Vogelherd reindeer assemblage, which is still under examination, will be helpful as comparisons of such data among different species often help to elucidate subsistence strategies.

Exploitation of Mammoths

Mammoth remains are present in all but one of the Aurignacian faunal assemblages listed in Table 1. The specimens are primarily limited to fragments of teeth, ivory, and bone or in the case of Geissenklösterle, selectively chosen long bone fragments and ribs to be used in tool production. In contrast, the Vogelherd deposit contains an extensive mammoth assemblage made up of molars from a minimum of 28 individuals as well as bones from 12 animals. The question of whether mammoths were hunted or collected remains unanswered but age, skeletal element data, and bone preservation suggest a combination of these activities. Sixty-seven molars and six deciduous tusks were aged using published African and Asian elephant and Siberian mammoth molar data (Laws, 1966; Haynes, 1991; Kuzmina and Maschenko, 1999), reflecting selective deaths of individuals from all age groups, most

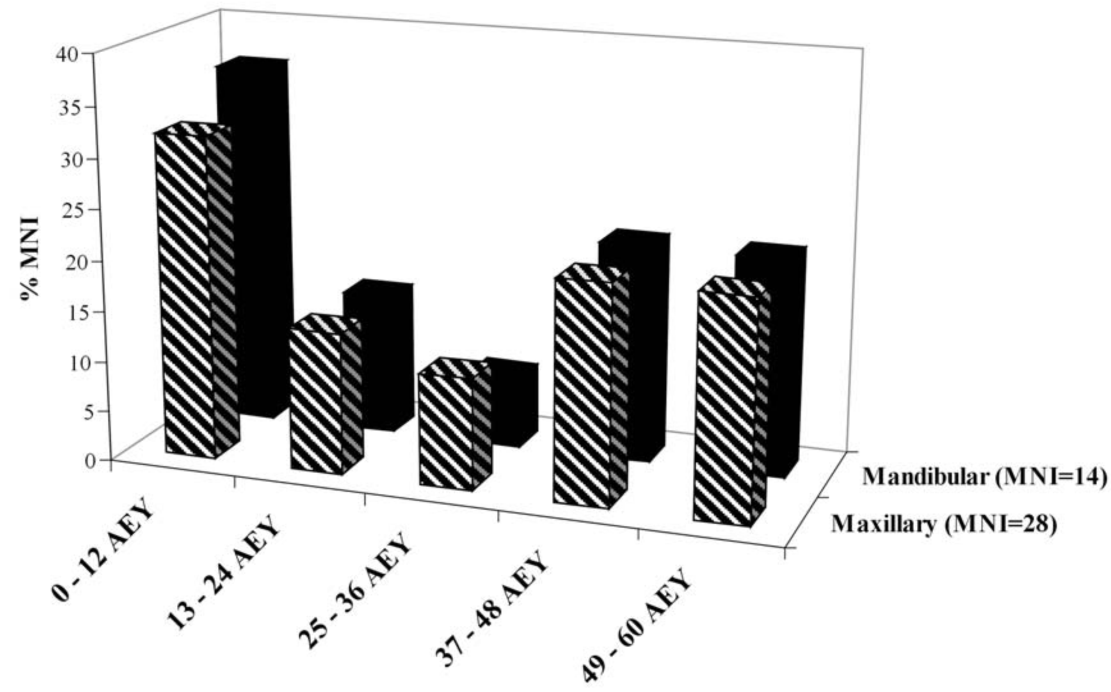

FIG. 6 – Age profile of mammoth remains (Aurignacian) expressed in African Elephant Years (AEY).

likely the result of time-averaged, cumulative single mortalities as opposed to one, catastrophic kill (Fig. 6). High proportions of juveniles and old adults may reflect death by natural causes or predation; this age profile might also reflect opportunistic predation by humans of single animals or small groups from all age classes at sources of water, vegetation, or minerals. Periods of drought or extreme cold would have forced mammoths to concentrate near water and patches of vegetation and proboscideans' dietary dependence on sodium and calcium is known to drive them to isolated sources (Redmond, 1982). Hunting of proboscideans or scavenging of carcasses from natural mortalities at such locations has been proposed at several prehistoric sites in both Eurasia and North America (Abracskinskas, 1994; Haynes, 1999; Derevianko et al., 2000), and such scenarios may be reflected in the Vogelherd age profile. The site lies near a river and is located in a limestone outcrop, a probable source of both calcium and sodium.

The mammoth bone assemblage is dominated by cranial portions (Fig. 7), which in addition to the molars, points to complete or nearly complete heads being transported to the cave. Tusk portions, scapulae and innominates are also well-represented, followed by smaller numbers of limb elements. Differential weathering on much of the bone might reflect collecting of already weathered bone on the landscape, similar to what has been proposed at many of the mammoth bone "dwellings" and bone pile sites in central Europe and Russia (Soffer, 1993). In the Aurignacian deposit at Vogelherd, a mammoth bone pile containing several tusks, molars, scapulae, one mandible, a "smashed" cranium, and other unidentified bone was documented in the south entrance of the cave (Riek, 1934, p. 53-54). According to the excavator, Riek (1934, p. 53), the pile was carefully constructed and quite sturdy, which suggests a special use of these elements or the bone pile as a whole. Considering that the cave has three entrances, Aurignacian groups might have used bulky elements such as the crania, mandibles, innominates, and scapulae to construct some sort of barricade or closure. Similar skeletal element frequencies between Vogelherd and the "dwelling" sites sup-

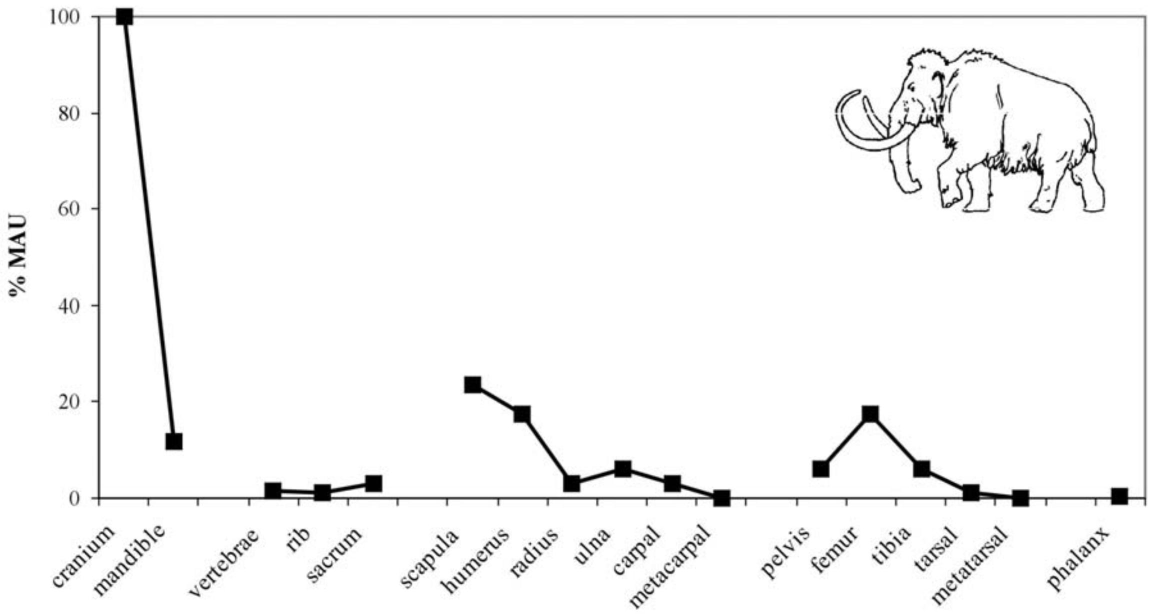

FIG. 7 – Vogelherd mammoth remains (Aurignacian, n = 729) expressed in %MAU. Isolated molars (n = 86), ivory fragments (n = 2532), and long bone flakes (n = 41) not included.

port the hypothesis that mammoth bone could have been used as a building material at Vogelherd. The bone pile might also have been a store of fuel, as wood would have been scarce in the landscape.

Although neither indisputable evidence of mammoth hunting nor butchery has been found at Vogelherd, mammoth as a source of food cannot be ruled out. Crania might have been an important source of nutrition for human groups in addition to their utilitarian use. Limb portions, also present in the Vogelherd assemblage, would have been a rich source of meat.

Regardless of whether mammoths played a role in subsistence, it is clear they were used extensively for other purposes by Aurignacian groups in the Swabian Jura. The most elegant example of the use of ivory are the small figurines depicting animals (mammoth, horse, lion, bear, bovid) and anthropomorphs from Vogelherd, Geissenklösterle, Hohlenstein-Stadel, and Hohle Fels. Ivory was also used to fashion ornaments, tools, and other objects, while mammoth ribs and long bone flakes served as raw materials for bone points and various tools. Vogelherd is the only regional cave that contained a pile of mammoth remains and vast amounts of bone and complete molars, which possibly reflect a special use for the material. The significantly larger mammoth assemblage at Vogelherd is just one aspect of an exceptionally rich Aurignacian deposit that points to an intensive use of this cave. The Vogelherd mammoths also suggest that fluctuating environmental conditions could have influenced the location and number of mammoths in the local area, provided natural death sites to collect bone, possibilities for opportunistic hunting by Aurignacian groups, or both. Mammoths are represented in various amounts and forms in the Swabian Jura cave sites and in turn provide insight into several aspects of Aurignacian life in the region.

Discussion

The numerous cave sites of the Swabian Jura offer a good opportunity to model human subsistence and settlement patterns during the Aurignacian, as these localities contain a variety of artifact assemblages and rich archeofaunas. The Aurignacian deposit at Vogelherd is especially dense with stone and bone artifacts, ivory artwork, and faunal remains, which points to intensive use and possibly continuous occupation of this cave. Rich Aurignacian deposits continue to be excavated at the caves of Hohle Fels and Geissenklösterle in the Ach Valley and in time might reflect similar patterns of use (Conard et al., 2002).

A couple of characteristics distinguish the Vogelherd Aurignacian archeofauna in the region. Cave bears are underrepresented at the site, while this taxon dominates most of the other Swabian Jura cave faunas. The megaherbivores, mammoth and woolly rhinoceros, are particularly abundant at Vogelherd but much less frequent in the other caves. A combination of topographical, ecological, and cultural factors appear to have influenced these two unique features of Vogelherd. Considering that Vogelherd was used intensively by Aurignacian groups, it would have been occupied by humans regularly and therefore not attractive to cave bears for hibernation. Ecological conditions might have influenced the location and number of mammoth and woolly rhinoceros in the Lone Valley, providing localities to collect bone from natural deaths, possibilities for hunting, or both. The mammoth bone pile documented in the cave suggests a special use for the large skeletal elements, while ivory and bone were also fashioned into artwork and tools. Vogelherd's topographical location 18 m above the Lone Valley floor with entrances to the south, southwest, and north makes it an ideal location for monitoring the movements of game, a factor that undoubtedly inspired intensive use of the cave during the Aurignacian. Ongoing analysis of the Vogelherd archeofauna will evaluate whether hunting of horse and reindeer at the site was different from neighboring caves in terms of season and age structure.

The numerous cave sites in the Swabian Jura of southern Germany are key to our understanding of Paleolithic central Europe. Aurignacian deposits from this region have produced early artwork, modern human fossils, and radiocarbon dates of 35-40 ka BP, which together suggest that the Upper Danube was an area of early cultural innovation and settlement (Conard and Floss, 2000; Conard and Bolus, 2003). Evaluating Swabian Jura archeofaunas in this context provides insights into Aurignacian subsistence and settlement both in a regional and in a wider European framework. Analyses of several archeofaunas, stone tools, and bone/ivory artifact assemblages currently being conducted by different researchers at the Universität Tübingen have the goal of increasing our knowledge of this important region.

Acknowledgments

The Vogelherd analysis has been partly supported by the Sondersforschungsbericht 275 under the Deutsche Forschungsgemeinschaft. Thanks to Ryan Byerly, Dr. Nicholas Conard, Petra Krönneck, Dr. Susanne Münzel, Dr. Hans-Peter Uerpmann, and Dr. Reinhard Ziegler for their input in this research.

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