The role of mammoths in Upper Palaeolithic economies of southern Germany

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SUMMARY: New analysis of the *Mammuthus primigenius* remains from the Aurignacian deposit at Vogelherd, Germany offers information on age class distribution and skeletal element representation. A minimum of 28 (MNI) mammoths distinguishes Vogelherd as one of the key mammoth sites in central Europe. Evaluation of mammoth data from Vogelherd and other contemporaneous sites in southern Germany provides insight into the role of mammoths in Upper Palaeolithic economies in the context of changing environmental conditions throughout the late Pleistocene.

1. Introduction

The Swabian Alb region of southern Germany contains a concentration of prehistoric cave sites in the extensive karst systems of the Ach and Lone Valleys that were occupied throughout the Middle and Upper Palaeolithic. The woolly mammoth (*Mammuthus primigenius*) played an important role in Upper Palaeolithic economies as a source of raw material for bone and ivory tools, ivory artworks, building materials, fuel, and probably food.

Indisputable evidence of mammoth hunting has not yet been documented in southern Germany, although mammoth remains are found in 90% of cave localities in this region during the Upper Palaeolithic (Gamble 1986:313, Table 7.4). Most sites contain just sparse bone, tooth, and ivory fragments that only hint at the presence of mammoth, but exceptions to this include the Aurignacian deposits at Vogelherd (31900-27600 bp, ^{14}C, Hahn 1993:219, Tab. 1) and Geissenklösterle (40200 +/- 1500 bp, mean TL and 38400 +/- 850 bp, mean ^{14}C-AMS, Richter *et al.* 2000). Vogelherd contained the remains of at least 28 mammoths, distinguishing it not only in the region but as one of the key mammoth sites in central Europe. At Geissenklösterle, mammoth is represented by partial skeletal remains of two infantile individuals as well as numerous rib and ivory pieces (Münzel 1999).

2. The Vogelherd Mammoths

2.1 Dentitions

Based on maxillary molars, 28 mammoths (MNI) were recovered in the Aurignacian deposit. The MNI from this recent analysis of the Vogelherd mammoths differs from an earlier published estimate of 24 individuals (Lehmann 1954). A total of 86 molars, six deciduous tusks, and 55 miscellaneous tooth fragments make up the Aurignacian mammoth dentition assemblage at Vogelherd.

The presence of six deciduous tusks is remarkable, as they are rarely if ever recovered from archaeological or paleontological contexts due to their small size and fragile structure. Based on overall morphology and stage of development, it was determined that these tusks represent six infantile mammoths and ages ranging from two- to 12 months were estimated by comparison with specimens from Russia (Kuzmina & Maschenko 1999).

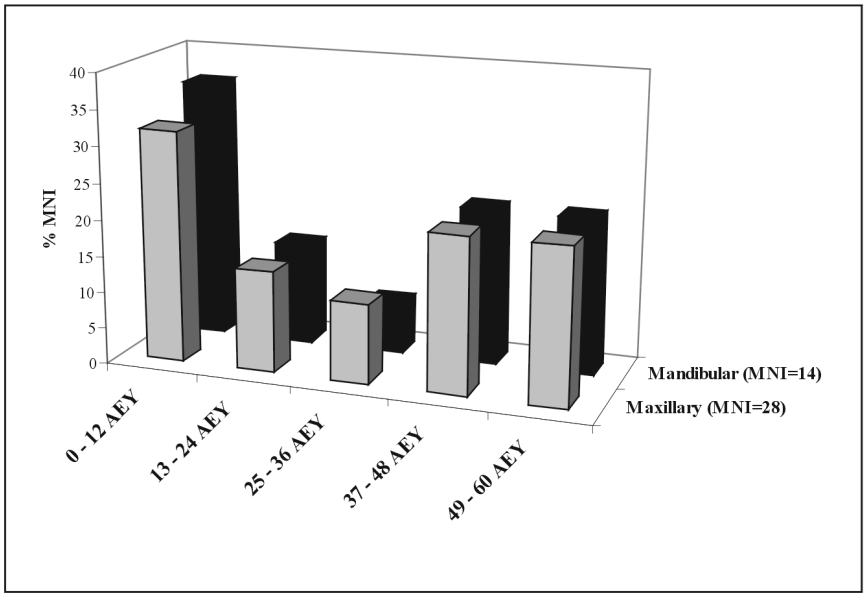

Fig.1 - Age profile for *Mammuthus primigenius* from the Vogelherd Aurignacian deposit

Whether these mammoths perished together, in smaller numbers, or in single mortality events cannot be determined, nor is the cause of death known.

All but two molars were isolated; therefore upper and lower molar sets were analyzed separately and respective MNIs were tabulated. Sixty-seven molars were aged using the system for African elephants in Laws (1966), Jachmann (1985), and Craig (in Haynes 1991) and are listed in equivalent African Elephant Years (AEY).

The age profile reflects selective deaths of individuals from all age groups, most likely the result of time-averaged, cumulative single mortalities as opposed to a one-time catastrophic kill event (Fig. 1). A high proportion of subadults is common in nearly all types of proboscidean death assemblages, as these age classes are more vulnerable to death by predation or natural causes (Haynes 1987). Presence but not predominance of the young adult and adult age classes is also seen at Vogelherd and characteristic of selective or non-selective proboscidean death assemblages. Vogelherd differs from many proboscidean sites in its proportions of the adult and old adult classes. Like juveniles, old animals are more susceptible to death by predation, disease, and nutritional stress and thus an age profile showing similar numbers of these age classes might reflect repeated, single mortalities by these causes. The Vogelherd 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 (Conybeare & Haynes 1984; Haynes 1991) and proboscideans' dietary dependence on sodium and calcium is known to drive them to isolated sources (i.e. Redmond 1982). Hunting of proboscideans or scavenging of carcasses from natural deaths at such locations have been proposed at several prehistoric sites in both Eurasia and North America (Abracskinskas 1994; Derevianko *et al.* 2000; Haynes 1999), and such scenarios may be reflected in the Vogelherd age profile. The site is approximately 200 m from a river and is located in a limestone outcrop, a probable source of both sodium and calcium.

2.2 Skeletal Element Representation

A total of 729 specimens were identified to element (Tab. 1) and 41 long bone fragments and approximately 2500 ivory fragments were documented. The number of petrous and occipital portions suggest that some complete or nearly complete crania were transported into the cave, while the presence of carpals and tarsals attests to transport of articulated limb portions. As a consequence of 70 years in storage and numerous moves, nearly all the bone is broken, with the exception of one complete femur. Differential weathering stages on some of the elements suggests collecting of already weathered bone on the landscape, a scenario proposed at many of the mammoth bone "dwellings" and bone pile sites in central Europe and Russia (Soffer 1993; Wojtal 1997). Similar skeletal element representation between these sites and Vogelherd supports the hypothesis that mammoth bone could have been used as building material at Vogelherd.

3. The use of Mammoth Resources

Mammoth bone and ivory were used extensively by Upper Palaeolithic groups in southern Germany (Hahn 1977; Münzel this volume). The most elegant examples are the small ivory figurines depicting animals (mammoth, horse, lion, bovid, bear) and anthropomorphs from Vogelherd, Geissenklösterle, and Hohlenstein-Stadel. Ivory was also used to fashion tools, jewelry, and other objects, while bone spearpoints and other tools were produced from mammoth ribs and long bone shaft fragments.

Utilitarian use of mammoth bone at Vogelherd is suggested by a bone pile containing several tusks, molars, scapulae, one mandible, a "smashed" cranium, and other unidentified bone documented in the southern entrance of the cave (Riek 1934:53-54). Taphonomic studies have shown that bone piles can be formed by various natural agents (Frison & Todd 1986; Voorhies 1969) and should therefore not always be interpreted as the result of

Tab.1 - Skeletal element representation listed in number of individual specimens (NISP), minimum number of elements (MNE), and minimum number of individuals (MNI) for *Mammuthus primigenius* from the Vogelherd Aurignacian deposit.

Skeletal Element	NISP	MNE	MNI
Cranium			
- Petrous Portion	16	17	8
- Occipital Condyle	15	9	7
- Other	358	-	-
Mandible	13	4	3
Molars/Tooth Frag.	147	86	28
Scapula	54	8	8
Humerus	11	6	3
Radius	2	1	1
Ulna	10	2	2
Carpals	3	4	2
Innominate	20	2	1
Femur	13	6	4
Patella	1	1	1
Tibia	4	2	2
Tarsals	1	1	1
Phalanges	5	4	2
Vertebrae	11	8	1
Ribs	45	8	1

cultural processes, but considering that Vogelherd has three entrances, Aurignacian people might have used bulky elements such as the cranium, mandible, innominate, and scapula to construct some sort of barricade or closure against weather, carnivores, or both. The bone pile might also have been a fuel supply, as wood would have been scarce in the glacial steppe.

The abundance of crania might indicate that this element was used as a source of food in addition to building materials and/or fuel. The cranium would have provided a rich source of fats and nutrition in addition to the substantial meat resources from limb elements, although there is no evidence of cut marks or impact fractures on the Vogelherd mammoth bone that indicates butchery or processing.

4. Conclusions

Evaluation of mammoth data from Upper Palaeolithic cave sites in the Swabian Alb region highlights three primary points: 1) although mammoth is nearly always present in archaeofaunas, the amount tends to be small with the exception of Vogelherd and Geissenklösterle, 2) rich bone and ivory tool inventories point to specific use of mammoth resources during the Aurignacian, and 3) significantly larger amounts of mammoth were transported into Vogelherd cave for several possible reasons, including but not limited to use as building materials, fuel, and food.

It would be exaggerating to say that hunter-gatherer groups focused on mammoth at Vogelherd, since horse was present in nearly equal numbers (MNI = 24) in the Aurignacian deposit. However, in comparison to neighbouring sites, the abundance of mammoth at Vogelherd points to a different use of this cave during the Aurignacian and raises questions about its place in the regional settlement system. This observation also suggests 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, or both. The mammoth data raise many intriguing questions that will be explored in the ongoing research on the entire faunal assemblage from Vogelherd.

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