

The Middle and Late Pleistocene Mammoth remains from Hanhoffen (Bas-Rhin, France)

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SUMMARY: The paleontological study of the Proboscideans of Hanhoffen was performed on 642 cheek teeth. On one hand, we had to determine the different species, on the other hand we were interested in the possible causes of death. The analysis of the mortality profile obtained on the population of *Mammuthus primigenius* allows us to retain the hypothesis of a massive mortality of natural origin.

1. INTRODUCTION

The site is located on a Quaternary terrace of the Rhine Valley, in Alsace (eastern France), approximately 30 km from Strasbourg. The gravel pits of Hanhoffen delivered a lot of Elephantinae remains that represent almost 50% of the bony vestiges, and other big herbivores, which were excavated by workers. Unfortunately, nobody noted the stratigraphic position of the various assemblages.

This study is that of a private collection (assembled by Georges Rocques), which is now stored at the Prehistoric Museum of Arras in northern France.

Our attention particularly focused on the teeth and fragments of them, which totalise a third of the Proboscidean remains; one molar providing a great deal of information about the animal, such as its evolution degree or its death age.

2. DETERMINATION OF THE ELEPHANTIDAE PRESENT AT HANHOFFEN

Very detailed measurements of each molar and the determination of their position in the jaw and the dental series, allow us, afterwards,

to determine the species to which the animal belongs. Thus, the table 1 shows, in part, the statistic methods employed in order to differentiate the five species of Proboscidean. The main data we can take into account are the lamellar frequency index (F), the number of enamel loops measured on 10 cm of the occlusal surface, the enamel thickness (e, noted in mm), as well as the morphology of these last ones, marked or not by the specific presence of a sinus.

Indeed, the systematic presence on the enamel loops of a loxodont sinus (clear fold of enamel) characterizes the Elephant (*Palaeoloxodon antiquus*) and differentiates it easily from the Pleistocene Mammoths. Moreover, an Elephant tooth is less wide than a Mammoth one.

If we observe the last molars, the M3, we can see that the overall evolving tendency of the Mammoths line is to a reduction of the enamel thickness, accompanied by a more important lamellar frequency. This increase in the abrasive function of the molars (Fig. 1) allows Elephantidae to have a more varied alimentary diet, mainly composed of boughs and numerous graminaceous for *Mammuthus primigenius*, the most advanced Mammoth.

Tab.1 - Extract of the measures employed in order to determinate the species of Proboscidean at Hanhoffen (with "u"= wear).

Piece	Specie	Position	N	Nd	Nf	Li	I	H	h	u	e	F
HAH 2179	<i>M.primigenius</i>	M3 inf. d.	19	**18x-		252	71			B4	1,6	8,5
HAH 2196	<i>M.primigenius</i>	M3 inf. d.	23	22-	10	276	81	132	163	B2	1,6	11
HAH 2207	<i>M.primigenius</i>	M3 inf. d.	23	22x	11?		98	150	153	B3	1,5	8,5
HAH 2238	<i>M.primigenius</i>	M3 inf. d.	22	**21x	13	288	75	122	163	B3	1,5	9
HAH 2261	<i>M.primigenius</i>	M3 inf. d.	14	14-	8		85	128	151	B3	1,7	8
HAH 2265	<i>M.primigenius</i>	M3 inf. d.	20	**20-	13		91	130	143	B3	1,7	8,5
HAH 2315	<i>M.primigenius</i>	M3 inf. d.	16	**16-	7		85	138	162	B2	1,5	9,5
HAH 2357	<i>M.primigenius</i>	M3 inf. d.	12	-11x	6		74			B4	1,9	12
HAH 2366	<i>M.primigenius</i>	M3 inf. d.	22	**21x	16	306	90	134	149	B4	1,3	8
HAH 2518b	<i>M.primigenius</i>	M3 inf. d.	22	**21x	17	270	80	123	154	C	2	9
HAH 2600	<i>M.primigenius</i>	M3 inf. d.	18	18-	0		84	151	180	A2	1,8	10
HAH 2625	<i>M.primigenius</i>	M3 inf. d.	16	16x	15	237	75	113	151	C	1,8	8,5
HAH 2632	<i>M.primigenius</i>	M3 inf. d.	8	**8-	8					D4	1,7	8
HAH 2028	<i>M.primigenius</i>	M3 inf. g.	22	**22-	8		73	132	181	B2	1,4	11
HAH 2034	<i>M.primigenius</i>	M3 inf. g.	23	23-	13		100	151	151	B3	1,7	8
HAH 2092	<i>M.primigenius</i>	M3 inf. g.	15	-15-	8		81	143	177	B	1,6	10
HAH 2163	<i>M.primigenius</i>	M3 inf. g.	18	18-	15		79	137	173	B4	1,5	10
HAH 2177	<i>M.primigenius</i>	M3 inf. g.	23	**23-	11		87	149	171	B3	1,7	10
HAH 2214	<i>M.primigenius</i>	M3 inf. g.	7	6x	4		80	108	135	C	2,2	10
HAH 2250	<i>M.primigenius</i>	M3 inf. g.	16	-16-	4		84	116	138	B3	1,6	12
HAH 2254	<i>M.primigenius</i>	M3 inf. g.	22	**22-	6		73	116	159	B2	1,3	11
HAH 2277	<i>M.primigenius</i>	M3 inf. g.	21	-20x	14	271	69	120	174	B2	1	9,5
HAH 2281	<i>M.primigenius</i>	M3 inf. g.	25	**24x	11	265	66	137	208	B2	1,5	12
HAH 2288	<i>M.primigenius</i>	M3 inf. g.	23	x21x	9	265	80	136	170	B2	1,2	12
HAH 2373	<i>M.primigenius</i>	M3 inf. g.	19	-19-	7		80	117	146	B2	1,1	12
HAH 2448	<i>M.primigenius</i>	M3 inf. g.	21	-21-	14		66	127	192	B3	1,2	12
HAH 2449	<i>M.primigenius</i>	M3 inf. g.	20	19x	15	279	90	136	151	B3	1,5	9
HAH 2582	<i>M.primigenius</i>	M3 inf. g.	21	-21-	12		74	111	150	B3	2	9,5
HAH 2458	<i>M.primigenius</i>	M3 inf. g.	24	**23x	13	295	92	126	137	B3	1,8	8,5

3. HANHOFFEN ELEPHANTINAE

3.1 Elephantinae taxa present in the sample

Five species of Pleistocene Proboscidean are present at Hanhoffen, however the representation of each one is not the same (Fig. 2). On the one hand, *Mammuthus primigenius* groups about two thirds of the specimens, while *Mammuthus trogontherii* represents only a fifth. On the other hand, *Mammuthus "intermedius"*, which gathers morphological and biometric characteristics of the two previous species, represents only a tenth of the total. Lastly, the oldest one, *Mammuthus meridionalis*, as the Elephant (*Palaeoloxodon antiquus*) are in the minority. The minimum number of Elephantinae in Hanhoffen, in frequency, is about 98, with 56 for *Mammuthus primigenius*, 11 for *Mammuthus "intermedius"* and 20 for *Mammuthus trogontherii*.

3.2 Description of the mortality profile of the *Mammuthus primigenius* of Hanhoffen.

Here, we have particularly paid attention to *Mammuthus primigenius*, the most represented Elephantidae in Hanhoffen, in order to draw the mortality profile of its population. To that effect, it was necessary to define some age groups, by taking into account the position of each tooth in the cheek teeth series, as well as its worn level (Beden 1979; Germonpré 1993), the whole correlated with the model of extant elephants (Craig in Haynes 1991).

The mortality profile (Fig. 3) presents a dominant group which corresponds to 22-35 years old adults, with nearly 40% of dead individuals on the total strength, followed by the group of the young adults (12-22 years old) with a representation of almost 25%.

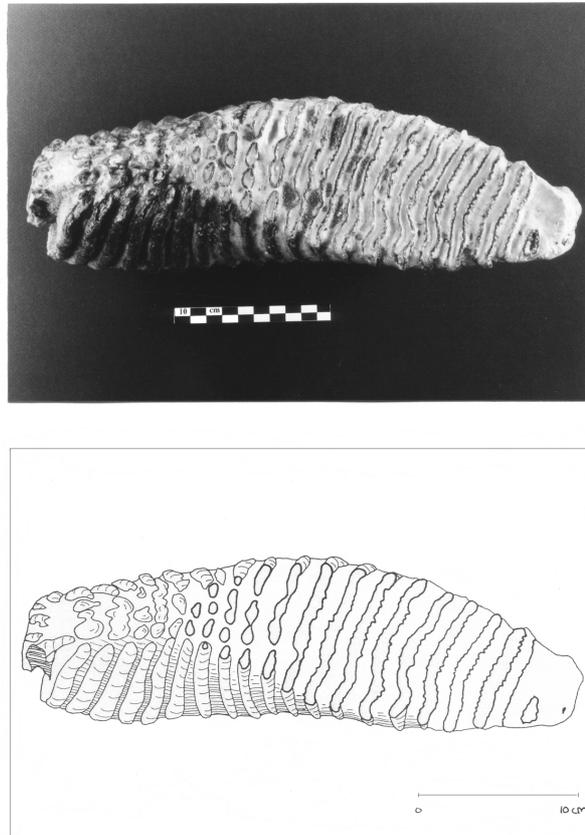


Fig.1 - Right lower M3 of *Mammuthus primigenius* (HAH 2366). Collection of Georges Rocques. Photograph taken by Marie-Claire Mussault. Tooth drawn by Sophie Louguet.

3.3 Hypothesis on the possible causes of death

First of all, the taphonomic analysis of bones, carried out by P. Auguste¹, shows that no mark of human activity (like cuts) is present among the 1361 bones remains. Therefore, we can say that hominids do not seem to have practised hunting at Hanhoffen.

Moreover, we must specify that the population of *Mammuthus primigenius* is not regarded as homogeneous, so its mortality profile, obtained from more than 400 dental remains, shows the dominant trend noticeable on a long time.

This profile does not show an important percentage of very young individuals, as it would be the case in such models as selective hunting or catastrophic massive death assigning a population in extension. Also, the oldest individuals are not dominant, which means that the whole

mnnnpopulation of Elephantidae is not dead of old age, every age group being represented on the site.

This age profile is rather similar to the “model C” defined by Haynes (1987), where the populations were probably declining. Then, we can also add, several individuals who died of old age. However, as the bones and dental remains have been collected over a very long periods, we speak here of a general tendency. Consequently, Proboscideans do not seem to have been the victims of a single phenomenon, it would rather result from several factors, which, added or considered distinctly, would have carried out the individuals to their loss. Among them, the most probable are the diseases, the accidents (fall, drowning, etc...), malnutrition (worsened by the drought), the old age, and often predators, others that Hominids

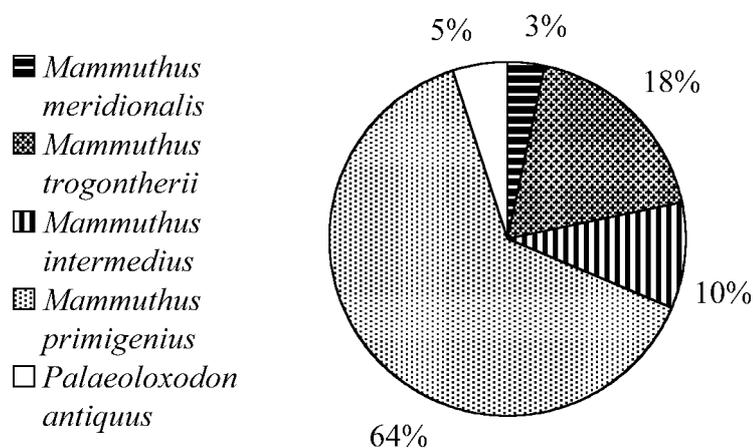


Fig.2 - Percentage of various species of Pleistocene Proboscideans at Hanhoffen.

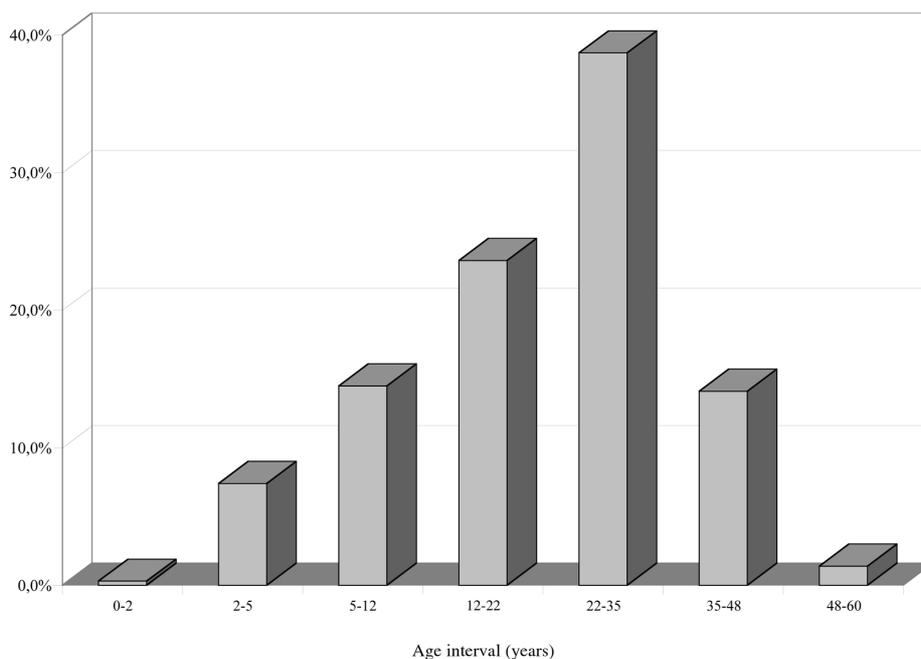


Fig.3 - Mortality profile of *Mammuthus primigenius* at Hanhoffen.

in the case of Hanhoffen, since hunting does not seem to have been practised there.

Moreover, the mortality rise was certainly influenced by climatic deteriorations. Indeed, in Winter, when water and food were running out, competition between herbivores, which consequently were concentrated in valleys, was increased. So, some individuals could some-

times suffer of malnutrition. Only the strongest animals could survive, while the weakest became the prey of carnivores. However, in the case of Hanhoffen, we do not know if the few traces of bites observed on the bones are attributable to predators, or more simply if they are marks of scavengers.

Besides, we can explain the relatively strong

percentage of mortality of the 12-22 years old individuals in Hanhoffen if we compare the fossil species with the current ones. Indeed, African Elephants, for example, reach their sexual maturity between 8 and 14 years, while for the Elephants living in Asia, puberty occurs between 8 and 10 years. Two or three years later, the young male leaves the group, and lives alone for some time, which makes it more vulnerable (Haynes 1988; Laws 1966).

4. CONCLUSION

The mortality profile obtained from representatives of *Mammuthus primigenius* would correspond to a massive death of natural origin affecting a declining population. Consequently, the hominids of the time do not seem to have practised hunting in Hanhoffen.

At last, if we consider the evolving stages of the different species of Elephantinae, we can attribute the faunal remains of that site to a stratigraphic sequence whose minimal extension would be from the Cromerian, since is present here an advanced form of *Mammuthus meridionalis*, such as that found in Wissant in the north of France (Bouchud 1963), until the end of Weichselian, depending on the presence of a very advanced *Mammuthus primigenius*.

5. REFERENCES

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