Wild boar - age at death estimates: the relevance of new modern data for archaeological skeletal material. 1. Presentation on the corpus. Dental and epiphyseal fusion ages

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WILD BOAR – AGE AT DEATH ESTIMATES: THE RELEVANCE OF NEW MODERN DATA FOR ARCHAEOLOGICAL SKELETAL MATERIAL. 1. PRESENTATION ON THE CORPUS. DENTAL AND EPIPHYSEAL FUSION AGES

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Abstract - The purpose of this paper is determining of skeletal age with an archaeozoological perspective. A 48 wild boar (*Sus scrofa* L.) skeletons sample constitutes the basis for this study. Dead animals (vehicle injured) have been collected in the Oise département, north of Paris. Age has been estimated on the basis of dental eruption and dental wear, with comparison of two ageing methods. Results on epiphyseal fusion ages are presented and compared to dental ages and to other data. It appears that our corpus, even if yet incomplete, is actually reliable to debate the timing of epiphyseal fusion process. We also underline the relevance and limits of this study for an archaeozoological application.

Résumé - Nouveau référentiel pour la détermination de l'âge squelettique chez le sanglier (*Sus scrofa*). 1. Présentation du corpus. Ages dentaires et épiphysaires. Un échantillon de 48 squelettes de sanglier (*Sus scrofa* L.) constitue le matériel d'une étude sur la détermination de l'âge. Les animaux, essentiellement des bêtes accidentées, ont été récoltés dans le département de l'Oise, au nord de Paris. L'âge des animaux a été estimé d'après les stades d'éruption et d'usure dentaire. Une comparaison critique des résultats obtenus par deux méthodes d'estimation des âges dentaires est d'abord présentée. Nous exposons ensuite nos observations sur les âges d'épiphysation des os. Les comparaisons avec les données existantes montrent que le présent corpus, quoique encore incomplet, est sans doute le mieux documenté à ce jour et permet de préciser la pertinence et les limites d'utilisation de la méthode dans une optique archéozoologique.

Key-words: Wild boar, *Sus scrofa*, Ageing, Dental ages, Epiphyseal fusion, Archaeozoology
Mots clés: Sanglier, *Sus scrofa*, Détermination de l'âge, âge dentaire, âge épiphysaire, Archéozoologie

IBEX J. Mt. Ecol. 5: 11-18
ANTHROPOZOOLOGICA 31: 11-18

1. Introduction

Considering the age and the season at death of animals from their bone remains is a current problem in archaeozoology. Estimations of age and season are not only conditioned by the state of preservation of the archaeological material, but also by the validity of the reference data. For wild boar reference, we found less than 10 publications (see ref. in Tab. 1) with data on tooth eruption or wear ages, based on as many present day reference collections. Most of them however deal with few individuals, partly described or insufficiently; references sometimes are based on wild boar bred in captivity. Data for Northern France are rare (see however: Varin, 1977; Baubet *et al.*, 1994). Most generally, present day reference collections

	References		Age in months	N° of individuals
WILD BOAR	Matschke, 1967	range average	23.1 - 26 25.1	24
	Briedermann, 1965		21 - 24	
	Varin, 1977		22 - 24	
	Iff, 1978		22 - 24	
	Boitani & Mattei, 1992	1st - 4th cuspids 5th - 6th cuspids	25 28	24
	Genov *et al.*, 1992	from Poland from Bulgaria	24 19 - 24	57 90
	Baubet *et al.*, 1994		22.4 - 24.5	155
DOMESTIC PIG	Higham, 1967 and Rowley-Conwy, 1993	primary eruption secondary eruption Tertiary eruption	17 - 22 19 - 21 21 - 23	
	Owen, 1866/68		18	
	Brown, 1902		17 - 18	
	Sisson & Grossmann, 1966		18 - 20	
	Silver, 1969	modern 18th century data	17 - 22 36	
	Reiland, 1978		17	
	Habermehl, 1975		16 - 20	

Tab. 1 - Timing for the third lower molar eruption in suids following various authors (note that Matschke dates the beginning of the process, see text).

focus on teeth, and exclude the post-cranial skeleton so that epiphyseal fusion data are poorly documented (see however: Bull & Payne, 1982; Van Wijngaarden-Bakker & Maliepaard, 1982).

We therefore recently constituted a new present day reference collection at the Laboratoire d'Anatomie comparée of the Muséum national d'Histoire naturelle (Paris), including complete cleaned and preserved skeletons. This paper presents the first preliminary results obtained by investigating this collection in terms of wild boar skeletal age determination and application to archaeological material. Our results on dental and epiphyseal ages will be presented and compared to other studies on wild boar. Observations on skeletal growth, poorly documented in literature, have also been collected and analyzed. They will be presented separately (Vigne *et al.*, this volume). It must be emphasized that these results reflect the corpus state which is still to be completed.

2. Dental age determination

2.1. Materials and methods

The 48 wild boars studied here are mostly animals injured by vehicle accidents. They belong to a population living in the forests of the Oise département, 50 to 80 km north of Paris. Animals have been retrieved from the Office national de la Chasse and the Fédération départementale des chasseurs de l'Oise, between August 1991 and January 1993. The carcasess were brought to be butchered in Paris where skeletons have been cleaned by boiling and papaine enzymatic attack. Animals were sexed before butchering (except for six of them) with later on verification, based on the canines' morphology. The crystalline lenses which had not been treated quick enough could not be used for ageing, so that only the date of the death and the sex of the animals are known. Age has been therefore estimated on the base of lower tooth eruption and wear,

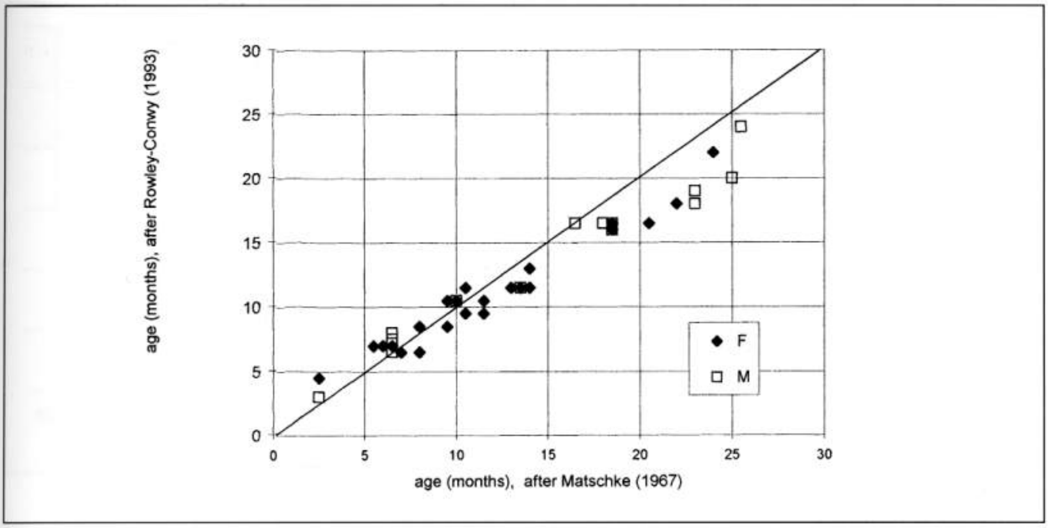

Fig. 1 - Comparison of two methods of dental ageing for the wild boar population studied.

according to Matschke (1967) and Rowley-Conwy (1993), whose criteria are complementary:
i. - The work of Matschke is based on 200 animals, progeny of wild boars captured in Europe and reared in Tennessee. He examined their dentition periodically, "from birth until the last permanent tooth began to erupt. A tooth was considered to erupt when it broke through the gum" (Matschke, 1967: 109). He obtained absolute eruption ages (mean and range are given) for all upper and lower teeth. Twelve age-groups (from 0 up to 26.5 months old, which corresponds to the latest age of initial eruption for M3) are defined, based on dentition patterns.
ii. - Rowley-Conwy (1993) uses stages of dental development as defined by Higham (1967) for domestic pigs, to age wild pig jaws retrieved from archaeological sites. Higham's table only takes into account lower premolars and molars, but details the processes of eruption (primary, secondary and tertiary eruptions) and wear. It defines 24 stages of dental development, between 0 and 30 months, the last one corresponding to the appearance of dentine on all the cusps of the third molar. Three additional later stages are also defined but they are not correlated with absolute ages.

These two methods have been tested to determine the age of our wild boars. The results are compared in Fig. 1, where each individual is defined by two average ages: one on the Y-axis is after Rowley-Conwy/Higham, and the other after Matschke. The straight line indicates where both methods would totally be congruent. For the youngest age classes, Rowley-Conwy tends to make the individuals older compared to Matschke (points over the straight line on Fig. 1). From 12 months old, Matschke's method conversely gives relatively higher estimations (points under the straight line on figure 1). On the whole, there are little disparities between the two estimations: 0.5 to 2 months in 75% of the cases ; for ages over 16-17 months, the difference reaches 3 to 5 months. This can be explained by the fact that Rowley-Conwy & Higham's method gives an early date of eruption of the M3

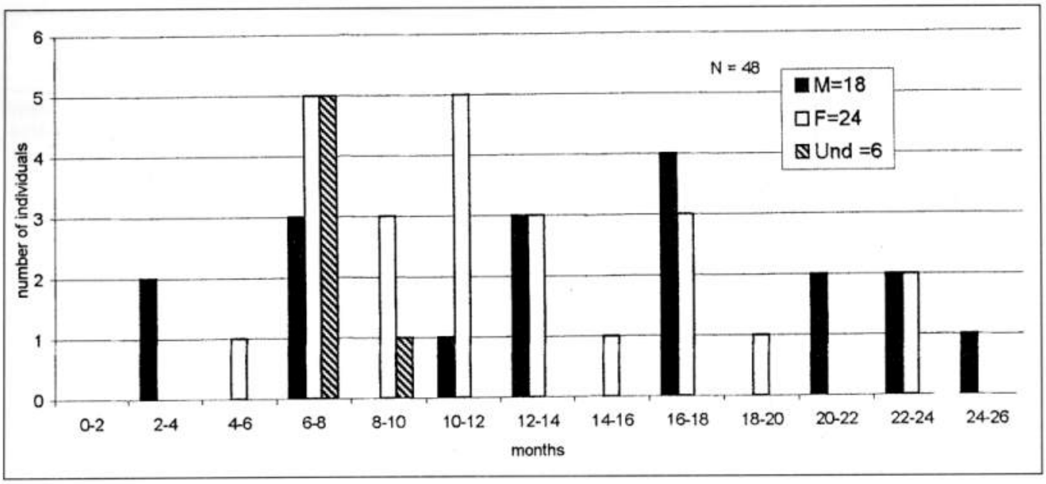

Fig. 2 - Age and sex structure of the reference wild boar Oise population.

(between 17 and 19 months), whereas Matschke gives a later age (between 23.1 and 25 months). In fact, various studies on other wild boar populations (Briedermann, 1965; Varin, 1977; Iff, 1978; Boitani *et al.*, 1992; Genov *et al.*, 1992; Baubet *et al.*, 1994) confirm the dates of eruption given by Matschke (Tab.1).

Examination of some data on the age determination for domestic pigs (Habermehl, 1975; Bull *et al.*, 1982) also underlines that the date of M3 eruption is earlier for domestic pigs than for wild boar. The early date of M3 eruption, around 17-18 months, given by Rowley-Conwy/Higham, is therefore in accordance with data for pig.

For that reason, we assigned an average age (which is the mean of the two estimations) to the individuals up to 16-17 months of age in our collection. On the other hand, we only took into account Matschke's method to age older animals.

2.2. Dental age and sex structure of the reference Oise population

Fig. 2 shows the age (dental age) and sex structures of the Oise collection. All age classes between 3 and 25.5 months are represented; mature individuals are lacking. The 6-8 months age class is better represented (13 individuals). Sex-ratio is unbalanced: 24 females versus 18 males (no statistically significant difference with reference to the balanced hypothesis; $e= 0.65< 1.96$); however, six young individuals (with lacteal canines) have not been sexed before butchering.

3. Epiphyseal age determination

3.1. Results

In Fig. 3, individuals are ranked following increasing dental ages. Most of the skeletal elements are listed in columns. Each cell mentions the coded state for epiphyseal fusion. Given that our sample comprises very few individuals older than 2 years of age, data obtained on the epiphyseal fusion process can only be used for bones that fuse early. There is a rather good correlation between dental and epiphyseal ages. Bones are more or less reliable for ageing. Cranial sutures are not considered because of a long fusion process that varies greatly among

		SKELETAL ELEMENTS																					
Individuals Ref.	Dental AGE	EXO BAS	EXO ECA	ATL	SCA T	RAD P	PELV A	PH2 AX	HUM D	PH1 AX	TIB D	Mtc AX	Mtt AX	Mtp AB	FIB D	FEM P	CALC P	Uln D	ULN P	Fem D	Fib P	Rad D	Hu P
S25	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S24	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S33	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S23	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS	6	?	?	0	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
S28	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S9	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S8	6.5	?	?		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S18	7	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S34	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SVER	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S50	7	0	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	7	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S42	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S58	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S45	9	1.0	1.0	3.0	3.0	2.0	1.0	2.0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S20B	9	2.0	2.0	0	0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S37	9.5	0	0	3.0	1.0	2.0	1.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S7	10.0	2.0	2.0	3.0	3.0	3.0	0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S43	10.0	1.0	1.0	3.0	3.0	2.5	3.0	3.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S30	10.5	0	0	0.5	2.0	0	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S40	11	0	0.5	2.0	3.0	3.0	3.0	2.5	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SF	11.5	1.0	1.0	3.0	3.0	3.0	1.0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S17	12.0	2.0	2.0	3.0	3.0	3.0	3.0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S54	12.5	0	0	1.0	0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX	12.5	0	0	2.5	2.0	3.0	2.0	1.5	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S44	12.5	2.0	2.0	3.0	3.0	3.0	3.0	2.0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S53	12.5	?	?	3.0	3.0	3.0	3.0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S21	13.5	0	0	3.0	3.0	3.0	3.0	3.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S29	13.0	0	0	3.0	3.0	3.0	3.0	1.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S27	16.5	1.5	1.5	3.0	3.0	3.0	3.0	3.0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S59	17.0	2.0	2.0	3.0	3.0	3.0	3.0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	17.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0
S13	17.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	0	0	0	0	0	0	0	0	0	0	0	0
SS?3?	17.5	2.0	2.0	3.0	3.0	3.0	3.0	3.0	1.0	1.5	1.5	0	0	0		0	0	0	0	0		0	0
S32	17.5	2.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	0&2		0	0	0	0	0	0	0	0	0	0	0	0
S20A	17.7	3.0	3.0	3.0	?	3.0	3.0	3.0	2.0	3.0	2.0	?	?	?	0	0	0	0	0	0	0	0	0
SE	20.5	1.0	1.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	1.0	0	0	0	0	0	0	0	0	0	0	0	0
SA	22.0	2.0	2.0	?	3.0	?	?	?	?	?	3.0	2.0	2.0	2.0	0	0	0	0	0	0	0	?	?
S47	23.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0&2	0	0	0	0	0	0	0	0	0	0	0
S57	23.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	0	0	0	0	0	0	0	0		0	0
S35	25.0	1.5	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.5	0&2	0	0	0	0	0	0	0	0	0	0
S31	25.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	2.5	3.0	2.0	2.0	2.0	3.0	0	0	0	0	0	0	0	0
S51	25.0	3.0	2.0	3.0	3.0	3.0	3.0	2.5	3.0	3.0	3.0	2.5	2.5	2.5	3.0	0&2	0	0	0	0	0	0	0
S52	25.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.5	3.0	0	2	0	0	0	0

0 unfused; 1,0 partly fused; 2,0 just fused, line visible; 3,0 fused, line unvisible

Fig. 3 - Comparison of dental age and epiphyseal fusion process for the wild boar Oise population.

individuals: it begins between c. 9 and c. 23 months (Fig. 3, columns 3 and 4); similarly, distal humerus fuses between 9 to 17 months. Conversely, atlas, proximal radius, pelvis acetabulum and first axial phalanx fused in a shorter age interval. Atlas, for instance, starts fusing very early with reference to other vertebrae: at 7 months (one case out of six) and around 12.5 months (one case out of four); beyond this age, atlas are always fused (n=16; Fig. 4). Fusion processes of proximal radius and pelvis acetabulum are rapid as well: we did not observe stage 1 (*cf.* Fig. 2) which corresponds to a partial epiphyseal fusion; it occurs at 9 months (two cases out of two) and mostly around 12.5 months. Second phalanx exhibits a longer fusion process, taking place between 9 and 17.5 months. The other bones start fusion when the animal is more than one year old.

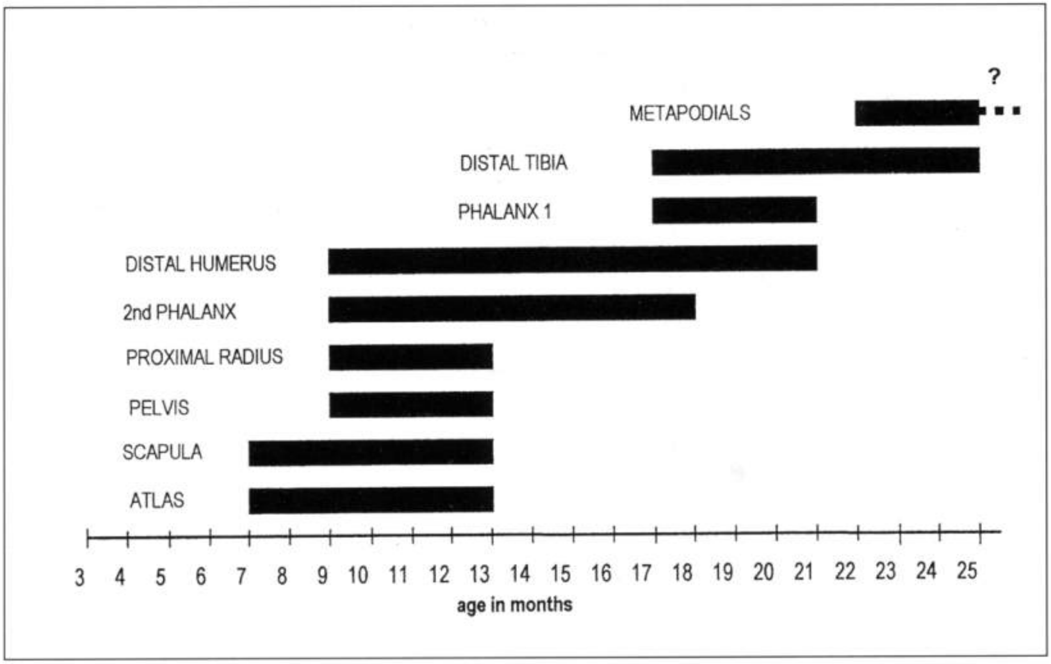

Fig. 4 - Timing for epiphyseal fusion in some wild boar bones of the Oise population (from stage 1 to stage 3 of the process).

3.2. Comparisons

Comparison has been established with data from Bull & Payne (1982), given that their corpus of 18 wild boars from Turkey is better documented than the one published by Van Wijngaarden-Bakker & Maliepaard (1982). "These animals are not of known age, but as they were all shot within a limited season (late December to early March), and as local information is that most wild boar are born in April and May, the developmental groups in which the younger animals fall can be aged with confidence" (Bull & Payne, 1982: 57). The 18 individuals are divided into four age classes: 7-11 months, 19-23 months, 31-35 months and over 35 months. It appears that this corpus lacks data for individuals under 7 months, between 12 and 18 and between 23 and 30 months of age.

Our results concerning the timing of epiphyseal fusion seems in rather good accordance with the Turkey wild boars results for skeletal elements such as pelvis (acetabulum), scapula, first phalanx and distal tibia (Fig. 5). It seems nonetheless that both the acetabulum and the scapula achieve fusion earlier in the Turkish population.

Some discrepancies also appear between the two studies but they are due to the discontinuity of the age classes distribution in Bull & Payne's corpus and to the size of their age classes. For the proximal radius, for instance, we find that the fusion occurs between 9 and 12.5 months, whereas Bull & Payne's results suggest a fusion between 11-12 and 18 months (a period for which they lack data). Similar disparities are found in the distal humerus, 1st and 2nd phalanges and metapodials. In each case, the period for which the Turkish corpus lacks data could in fact correspond more or less with our fusion sequence.

4. Conclusion

Our results on dental and epiphyseal fusion ages are based on a collection of wild boar

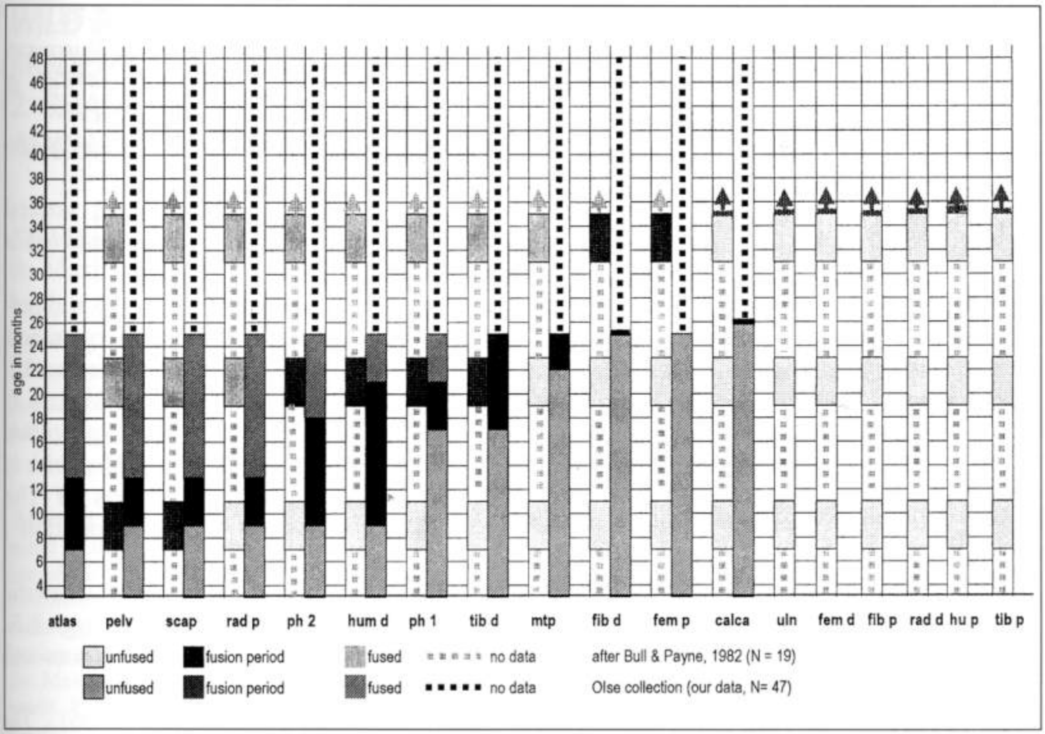

Fig. 5 - Comparison for epiphyseal fusion timing in wild boar bones.

skeletons characterized by a continuous distribution of age classes between 3 and 25.5 months. Although lacking mature and old animals and including a too small number of individuals younger than 6 months, this corpus of complete skeletons is to date the best documented one for debating the timing of epiphyseal fusion process and, more generally speaking, post-cranial growth of wild boar. It is thus useful to complete it. Testing methods of dental ageing on this corpus has allowed to enlighten some discrepancies in the literature and to emphasize some critical methodological points. It appears in particular that the validity of archaeological age estimations highly depends on the use of an appropriate corpus of references. In this perspective, basing age determination on epiphyseal fusion is less precise and reliable than on tooth eruption (and furthermore ageing based on bone measurements; Vigne *et al.*, this volume). The aim to be targeted is to collect large, well characterized present day collections of complete wild boar skeletons, yielding accurate estimations of the possibilities and limits of each ageing technique: archaeozoologists need a large panel of well mastered techniques available for different geo-climatic situations, for different states of bone preservation and for different questions to be solved.

Aknowledgements

Many thanks are due to Nathalie Serrand and Cornelia Becker which corrected the English language.

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