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A RAPID METHOD FOR RECORDING INFORMATION ABOUT MAMMAL BONES FROM ARCHAEOLOGICAL SITES

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Summary

This report describes the methods used in analysing mammal bones from archaeological sites. The criteria used in deciding whether or not to record a fragment are described. The Parts of Skeleton Always Counted (POSACs) are those which are easiest to identify and which provide information such as body-part representation, age, sex and mensural data. They have been selected in order to reduce the amount of low-grade and redundant information.

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Introduction

Zoo-archaeology, the study of animal remains from archaeological sites, provides a record of the animals with which our ancestors were associated. This record, to a large extent, reflects the economic and behavioural patterns of people in antiquity and may be invaluable in interpreting an archaeological site. Most animal bones found on archaeological sites are broken to varying degrees and derive from the kitchen waste of food species such as cattle, sheep and pigs.

A mammal skeleton comprises several hundred bones, and this number can increase several-fold as a result of butchery and fragmentation. Bones and bone fragments vary in their identifiability: some can be easily identified to species and even sex, while others are merely identifiable as mammalian bone. Most archaeological excavations produce large quantities of bones, but regrettably too few zoo-archaeologists are in posts which enable detailed studies of these collections. Time and cost are serious constraints. Different zoo-archaeologists record different parts of the skeleton. Many, like myself, adopt a "minimalist" approach and record a restricted suite of parts of bones whose identity can be established with reasonable confidence. The aim is to produce a maximum amount of useful information with minimum effort and avoid recording low grade and redundant information.

My aim here is to describe the criteria I apply when deciding whether or not to record a particular fragment of bone or tooth, and how I measure and count them, so that results similar to mine would be produced by other zoo-archaeologists working on the same material and data in my reports can be easily interpreted and used.

The **Part Of Skeleton Always Counted** (**POSAC** see also tables 1 and 2)

All bones and teeth are carefully examined, but only certain regions of some of the bones comprising the skeleton are recorded as a matter of course. These regions are similar to Watson's (1979) "diagnostic zones" and are referred to here as the Parts Of Skeleton Always Counted or POSAC for short. For example the medial half of the articulation of the distal tibia (the POSAC for the tibia) is recorded, but (unless they derive from a rare species) none of the following parts of a fully fused tibia would be recorded: the lateral half of the distal articulation, diaphysis, and proximal end.

These "parts of the skeleton always counted" include mandibles, isolated mandibular teeth, and articular ends/epiphyses and metaphyses of girdle, limb and feet bones. They are described in detail below. POSACs are the units used to calculate the frequencies of different parts of the skeleton, proportions of young (epiphysis unfused) versus adult (epiphysis fused) animals, and frequencies of different taxa.

When other parts of the skeleton such as antlers, horn cores or maxillary teeth are the only evidence for the presence of a species, these **non-countable specimens** are recorded and the presence in the archaeological assemblage of that species is denoted by a + sign, but not included in the totals in a summary table of counts of species found.

The reasons for selecting these particular POSACs are as follows: a) they are relatively easy to identify to species; b) some, such as the distal metacarpal in artiodactyls, when in sufficient quantity, can provide information about the sex ratio; c) many include a separate centre of ossification, or epiphysis, which fuses to the rest of the bone at a particular age and so, in sufficient quantity, provide a ratio of juveniles to adults; d) many provide useful measurements; and e) they come from most regions of the mammalian skeleton (head, girdles, limbs and feet) and their relative abundance provides some indication of preferences for different parts of the body such as non-meat-bearing versus meat-bearing or fore-quarters versus hind-quarters.

DETAILED DESCRIPTIONS OF POSACs

Isolated mandibular tooth

When *more than half is present*. (Due to the difficulty in distinguishing between upper and lower equid incisor teeth, all equid incisors are recorded. A similar problem exists with, for example, pig milk incisors and canines.)

Mandible

If *it has one or more countable teeth*. Teeth in mandibles are recorded separately in parentheses (see table 1). Thus a mandible containing M_2 and M_3 is recorded as a single mandible with both M_2 and M_3 recorded in parentheses.

Scapula

If *more than half the glenoid articulation* is present. A glenoid articulation from a very young animal to which the coracoid had not been fused is recorded (as 'scapula U'). The state of fusion of the coracoid cannot be ascertained for a glenoid from which the area adjacent to the coracoid (or fusion surface with the coracoid) is missing, and is therefore recorded as 'Scapula - Coracoid ?'.

Distal humerus

The *medial half of the trochlea* including enough bone adjacent to the shaft to identify the state of fusion of the distal epiphysis. The lateral half of a broken/chopped trochlea would not be recorded.

Distal humerus metaphysis (when epiphysis not fused)

A portion which includes at least half of the epiphysial-diaphysial junction surface of the *distal part of the shaft (i.e. the metaphysis)*.

Distal radius

The *medial half of the articular surface* including enough bone adjacent to the shaft to identify the state of fusion of the distal epiphysis.

Distal radius metaphysis (when epiphysis not fused)

As for 'distal humerus metaphysis'.

Radiale

When *more than half* is present.

C2+3

When *more than half* is present.

Distal metacarpal*
The *condyles* plus at least a small part of the region of fusion of the epiphysis (ie., enough of the distal end to identify the state of fusion of the epiphysis.) Artiodactyl distal metacarpals comprise two condyles which often break apart. A single condyle is recorded as a '1/2'. At least half of a single condyle should be present. Each of the two central pig metacarpals (Mc 3 and 4) are recorded as halves. Pig lateral metacarpal condyles (Mc 2 and 5) are not recorded. (Carnivore metapodials and equid metapodials are not recorded as '1/2's or '1/5', but see below under counting.)

Distal metacarpal metaphysis (when epiphysis not fused)*
As for 'distal humerus metaphysis', except that a single artiodactyl metaphysis is counted as a '1/2' as for distal metacarpal above.

Ischium
That part of the *acetabulum rim which is formed by the ischium.* At least half should be present.

Distal femur
More than half of the *lateral condyle* including enough bone adjacent to the shaft to identify the state of fusion of the distal epiphysis.

Distal femur metaphysis (when epiphysis not fused)
As for 'distal humerus metaphysis'.

Distal tibia
Medial part of the articulation provided this consists of half or more of the total articular surface and including enough bone adjacent to the shaft to identify the state of fusion of the distal epiphysis.

Distal tibia metaphysis (when epiphysis not fused)
As for 'distal humerus metaphysis'.

Astragalus
Half or more of the *lateral surface.*

Calcaneum
All of the sustentaculum plus half or more of the adjacent surface which articulates with the astragalus. This is essentially the central part of the calcaneum and if the ascending ramus is missing the state of fusion of the tuber calcis cannot be ascertained. Calcanea without ascending rami are therefore recorded as 'Calcaneum - tuber calcis ?'.

Distal metatarsal*
See distal metacarpal.

Distal metatarsal metaphysis (when epiphysis not fused)*
See distal metacarpal metaphysis.

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* NB: Some poorly preserved metapodials, and broken pig metapodials, cannot be identified as metacarpals or metatarsals. These are recorded as 'metapodials'.

Proximal first phalanx

Half or more of the *articular surface* including enough bone adjacent to the shaft to identify the state of fusion of the epiphysis.

Proximal first phalanx metaphysis (when epiphysis not fused)

A portion of the *proximal part of the shaft* (ie., the metaphysis) which includes at least half of the epiphysial-diaphysial junction surface

Third phalanx

The *articular surface* if half or more is present.

Age recording

The state of fusion of epiphyses is recorded as follows; "F"=fused (adult) and "U"=unfused (juvenile). An epiphysis is described as "fused" once spicules of bone have formed across the epiphysial plate joining metaphysis to epiphysis. Cases in which an epiphysis has just fused and the suture is still very visible the "F" is enclosed in a circle. The state of coracoid-scapula and tuber calcis-calcaneum fusion cannot always be determined, such cases are assigned to a separate fusion category, viz., "?".

Caprine (sheep and goat) mandibular teeth are assigned to eruption and wear-stages of Payne (1973 and 1987). Pig and cattle mandibular teeth are assigned to the eruption and wear-stages of Grant (1982).

Analysis: Epiphysial fusion and dp_4/P_4 data provide an estimate of the proportion of juveniles for a particular epiphysis and for the dentition. More detailed breakdown into separate age classes is provided by tooth eruption and wear variation.

Measurements

The table below lists the bones and teeth which are measured as a matter of course, preservation permitting. Measurements are taken with vernier callipers to the nearest 0.1 mm. Many of these bones and teeth are measured in the manner suggested by von den Driesch, 1976. Additional measurements of the distal humerus and cattle metapodials are shown in Figures 1 and 2. The lengths of other long bones such as the radius, femur, and tibia, when complete, are measured with an osteometric board to the nearest millimetre as in von den Driesch, 1976.

BONE/TOOTH	SPECIES	MEASUREMENT
dp_4	Pig	L, wIII[1]
M_1, M_2 and M_3	Pig	L, wI, wII[1]
M_3	Cattle	L, wI (as for pig M_3)
Humerus	Caprine, Cattle	GLC, BT, HTC (see also fig 1)
Humerus	Pig	GLC, BT, HTC (as in Payne and Bull, 1988)
Metacarpal	Caprine	GL, SD, BFd, Dd, W.Cond and W.Troch[2]
Metacarpal	Cattle	see fig 2
Tibia	Caprine	GL, Bd
Astragalus	Caprine, Cattle	GLl, Bd, Dl
Astragalus	Pig	GLl
Metatarsal	Caprine	GL, SD, BFd, Dd
Metatarsal	Cattle	see fig 2

[1] Pig teeth are measured as in Payne and Bull (1988), I, II and III refer respectively to the first, second and third "units" of the tooth. For example Payne and Bull's WP of M_2 is equivalent to my M_2 wII.

[2] W. Cond and W. Troch measurements suggested by Payne (1969) are taken by me as shown by a/b and 1/4 respectively in fig 2. Where possible the medial condyle is distinguished from the lateral condyle. Note that Payne's W. Troch is measured across the 'outer' rim of the trochlea, whereas I take this measurement across the trochlea adjacent to the verticillus. The size of my W. Troch is often, therefore, slightly less than Payne's W. Troch.

Counting

Teeth in mandibles are totalled separately in parentheses (see table 2). Thus a mandible containing M_2 and M_3 is recorded as a single mandible in the 'mandible' count but both the M_2 and the M_3 are included in the counts in parentheses in their respective rows. At Lake Wobegone (table 2) 18 cattle M_3s were found, 14 are isolated and 4 are in mandibles.

In order to take into account their anatomical frequency, isolated metapodial condyles of artiodactyls are counted as halves. Carnivore metapodials are divided by their anatomical frequency, i.e. 5. So an isolated dog metacarpal would be counted as 1/5. Equid phalanges are doubled. Carnivore and leporid phalanges, for example, would have to be divided by 5 and multiplied by 2 (a problem I have yet to encounter). This admittedly bizarre method of counting foot-bones derives from my early days as a faunal analyst in 1971. At that time I considered the bovid foot as a 'standard' to which the foot-bones of other mammals had to be compared. Hence the need to count pig metapodials as halves, to double the numbers of equid phalanges, to multiply the counts of dog phalanges by 2/5, and so on.

To calculate the total count of bones for a particular species in an assemblage all bone fragments, mandibles, isolated teeth but NOT teeth in mandibles (i.e. in parentheses) are summed - see table 2.

Acknowledgements

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Table 1

Printed copy of page 7 of my recording sheets of the bones from the Anglo-Scandinavian settlement by Lake Wobegone (Keilor excavations). Columns are arranged thus from left to right:

1) Context, area, phase, and any other relevant archaeological information.

2) POSAC. (Abbreviations: Phal = phalanx, metaph = metaphysis, prox/dist = proximal/distal.)

3) Taxon. (Abbreviations: Bos = cattle, Sh/G = sheep/goat, Br hare = brown hare.)

4) Number of POSACs. (Abbreviations: U = unfused, F = fused, ? = state of epiphysis fusion unknown.)

5) Comments and measurements. The wear stages of teeth are given according to Grant (1982) and Payne (1987). The Payne (1973) mandibular wear stage is given for mandibles which include the most posterior tooth. "c." measurements are accurate to an estimated 0.3 mm, measurements without a digit to the right of the decimal point are only accurate to an estimated 1 mm. Measurements followed by a '-' are burnt or too damaged to allow measurement. (Abbreviations: med = medial, lat = lateral.)

LAKE MOBEGONE 1988 — London, 23 Savile Row 5 Oct 1991 (7)

Context	Area	Phase				
244	2	5				
			P_2	Bos	1	
			P_3	"	1	
			$M_{1/2}$	"	1	f
			Radius dist	"	2F	
			Astragalus	"	1	GLl= - Bd=c.41.3 Dl=36.5
			Metatarsal	"	1F	damaged
			Phal 1 complete	"	1	
			I	Sh/G	2	
			single M_3	"	2	11G, 2A
			post Mandible (M_1-M_3)	"	1	M_1=9A, M_2=9A, M_3=7G Payne stage=G
			Humerus	"	1F	HTC=14.5 BT=29.2
			Radius	"	1F	
			Metacarpal	Sheep	1F	BFd=25.7 Dd=15.6 W.Cond=12.0 W.Troch=9.9 (med) W.Cond=12.3 W.Troch=10.4 (lat)
			Tibia	"	2F	Bd=23.7, Bd=c.22.8
			Astragalus	Sheep	1	GLl=27.8 Bd=17.5 Dl=c.15.1
			Metatarsal metaph	Sh/G	1U	
			Metapod half	"	1/2F	
			Phal 1 complete	"	3	one burnt at prox end
248	2	5	Mandible (P_3-M_3)	Sh/G	1	P_4=7A M_1=9A M_2=7A M_3=7A Payne stage=E
			Radius metaph	"	2U	
			Radius	"	1F	
			Metatarsus	Bos	1F	B at F=50.0 BFd=55.6 a=28.6 b=24.4 1=22.9 2=31.4 3=27.3 4=21.5 5=30.2 6=27.4 assymmetrical, small eburnated patch on end of medial trochlea.
			Phal 3	Bos	1	
			Phal 1 prox	Pig	2F1U	
			Phal 1 prox metaph	"	1U	
			Phal 1 complete	"	1	
179	1	5	Scapula	Sh/G	1?	
			P_4	Pig	1	b
			Mandible (M_2-M_3)	Pig	1	M_2=e M_3=a M_2:L=22.3 WI=13.1 WII=14.2 M_3:L=33.4 WI=15.5 WII=14.7
191	1	5	Metatarsal metaph	Bos	1/2U	
181	3	5	Calcaneum	Sh/G	1?	
			I	Bos	1	'v' shaped notch on side at crown base ?grass pulling
			M_3	"	1	k/l L=35.4 WI=15.6
			C2-3	"	1	
			Tibia dist epiphysis	"	1U	
			i	Pig	1	
			dp_3	Pig	1	
			Humerus	Pig	1	BT=42.2 HTC=27.8 (?rodent gnaw marks on shaft)
			M_1	Dog	1	L=18.7 w=7.7
202	3	6	Radius dist	Dog	1F	
			Calcaneum	Sh/G	1F	
			Astragalus	Sheep	1	GLl=- Bd=19.5 Dl=-
			Humerus dist	Br hare	1F	

Table 1

Table 2

Numbers of bones and teeth found at the Anglo-Scandinavian settlement by Lake Wobegone (Keilor excavations).

Key: Sh = sheep, G = goat, F = epiphysis fused (adult), U = epiphysis unfused (juvenile). Vt = vertebra, Tmt = tarsometatarsus. A mandible fragment with one or more teeth is counted as a mandible. Counts for loose teeth and for teeth in mandibles are given separately, the count for teeth in mandibles being in parentheses. Single metapodial condyles are counted as halves.

	SHEEP/GOAT	CATTLE	PIG	RHINO	DOG	OTHERS
Mandible	30 (4Sh)	14	11	-	2	Rabbit (I-P_4)
Mandibular tooth: i	- (-)	- (-)	2 (-)	- (-)	-	
" " I	11 (-)	36 (-)	9 (-)	3 (-)	1 (-)	
" " dp_2	- (1)	- (-)	2 (1)	- (-)	-	
" " dp_3	1Sh (4Sh+1)	- (-)	2 (-)	- (-)	-	
" " dp_4	10Sh+1G (2Sh+1)	5 (1)	2 (3)	- (-)	-	
" " P_1			- (-)		- (-)	
" " P_2	- (-)	3 (2)	- (-)	- (-)	- (1)	
" " P_3	1 (8)	15 (4)	1 (-)	- (-)	- (2)	
" " $P_{3/4}$				-		
" " P_4	6 (12)	15 (5)	2 (-)	- (-)	- (2)	
" " M_1	- (14)	- (7)	- (2)	- (-)	1 (2)	
" " M_2	- (18)	- (5)	- (4)	- (-)	- (-)	
" " M_3	29 (13)	14 (4)	2 (4)	- (-)	- (-)	
" " $M_{1/2}$	42 (-)	28 (1)	3 (1)	1		
" " C			4 (-)	1 (-)	1 (-)	
Scapula - Coracoid U	2	-	3	-	-	
" " F	11	8	3	-	-	
" " ?	4	1	-	-	-	
Humerus - dist metaph U	9	-	1	-	-	
" dist epiph U	4	-	-	-	-	
" dist F	53	9	-	-	2	Brown hare:2
Radius - dist metaph U	7	1	1	-	-	
" dist epiph U	3	3	-	-	-	
" dist F	9	3	-	-	-	
Radiale	1	3	-	1	-	
C2+3	-	6	-	-	-	
Metacarpal - dist metaph U	13	2	1	-	-	
" dist epiph U	4.5Sh+.5	1	-	-	-	
" dist F	57Sh+3.5	7	-	-	1.2	Cat:1
Ischium	21	8	-	-	2	Rabbit:1
Femur - dist metaph U	3	-	2	-	-	Black Rat:1
" dist epiph U	2	4	-	-	-	Black Rat:1
" dist F	5	3	-	-	1	
Tibia - dist metaph U	5	-	1	-	-	
" dist epiph U	1	-	2	-	-	
" dist F	21	4	-	-	4	Fallow deer:1
Astragalus	17Sh+1	18	3	-	-	
Calcaneum - tuber calcis U	6	3	-	-	-	
" tuber calcis F	10	7	-	-	-	
" tuber calcis ?	1	3	1	1	-	
Metatarsal - dist metaph U	15	6	-	-	-	
" dist epiph U	-	1	-	-	-	
" dist F	44Sh	12	.5	-	1	Rabbit:1 Fox:1
Metapodial - dist metaph U	2	1	-	-	-	
" dist epiph U	8	1.5	.5	-	-	
" dist F	5	3	.5	-	0.8	
Phalanx 1 - prox metaph U	7	-	2	-	-	
" prox epiph U	-	-	2	-	-	
" prox F	84	31	1	-	3.4	Brown Hare:1
Phalanx 3	13Sh+1	19	1	-	-	Eel Vt:1 Dodo Tmt:1
TOTALS	584.5	298.5	65.5	7	20.4	

Table 2

Figure 1

Distal end of an artiodactyl humerus in longitudinal section and in frontal view to illustrate how the measurements are taken. BT is the medio-lateral width of the distal trochlea, taken along the axis of rotation of the joint and with the tip of each calliper jaw at the centre of either side of the trochlea. HTC is the diameter of the distal trochlea at its narrowest point.

Figure 2

Cattle metapodial to illustrate how the condyles are measured. B at f is approximately perpendicular to GL. a and b are the widths of the medial and lateral condyles measured along the middle of each condyle. 1 and 4 are measured across the medial and lateral trochleae adjacent to the verticilli. 2 and 5 are the maximum diameters of the verticilli. 3 and 6 are the diameters of the lateral part of the medial condyle and the medial part of the lateral condyle respectively and are measured by holding the callipers perpendicular to the axis of the metapodial.

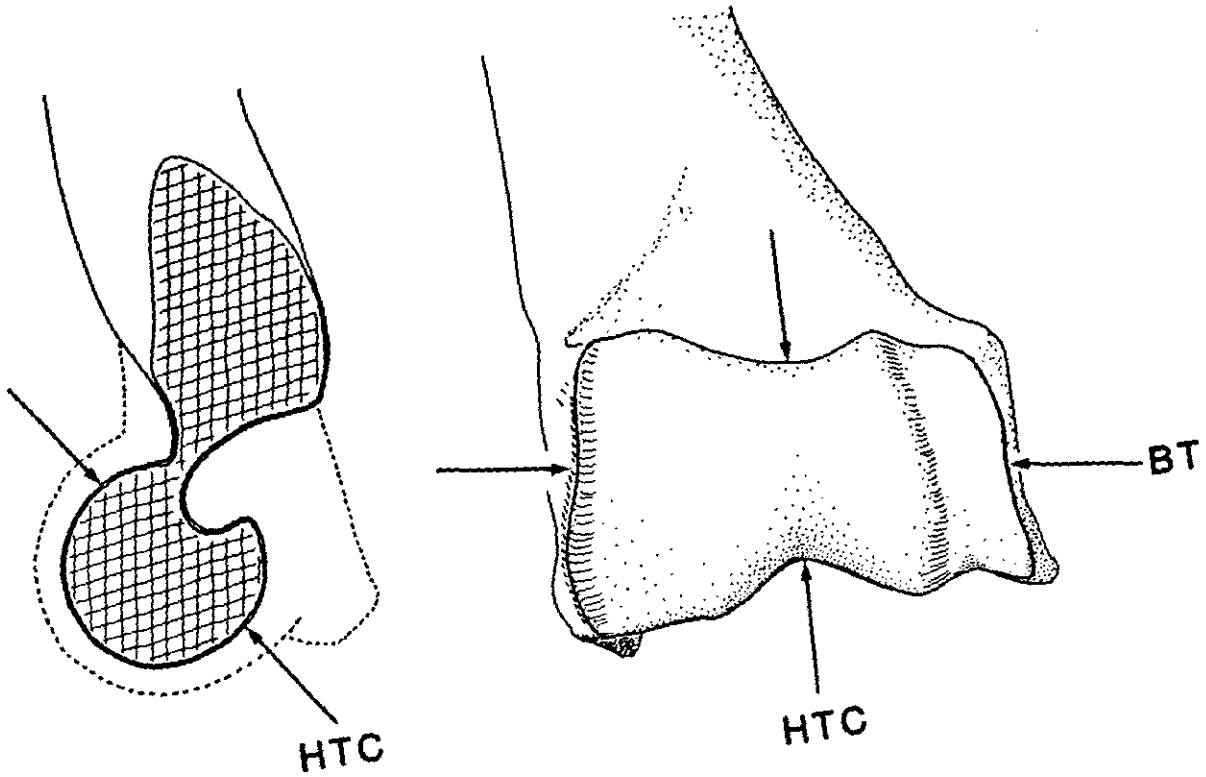
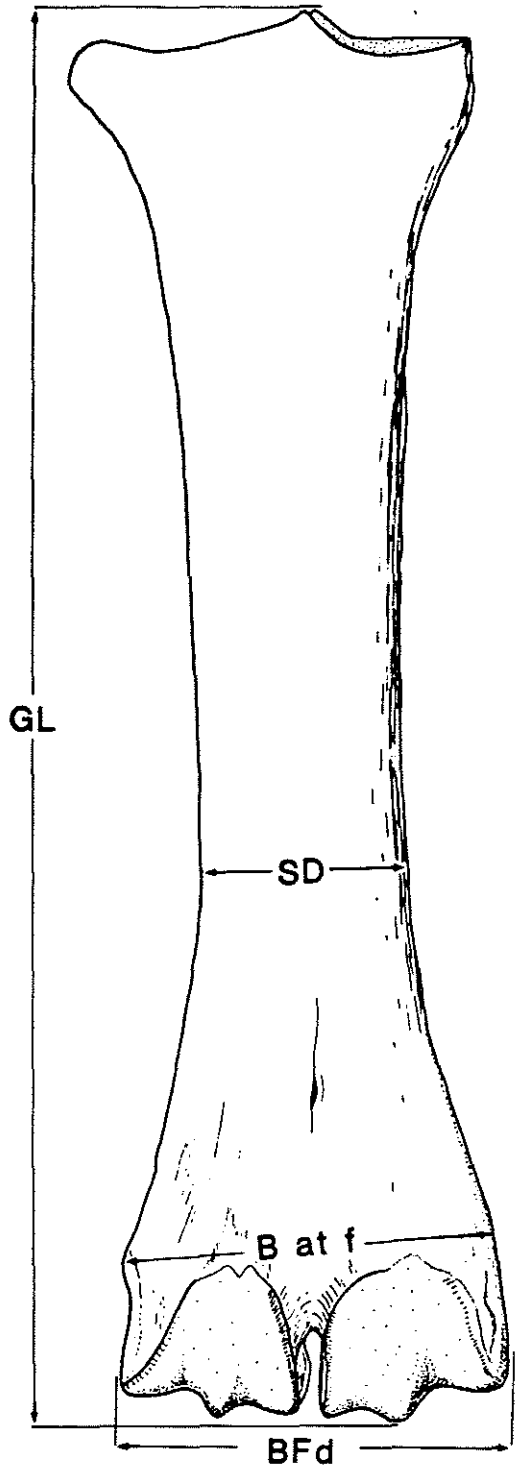
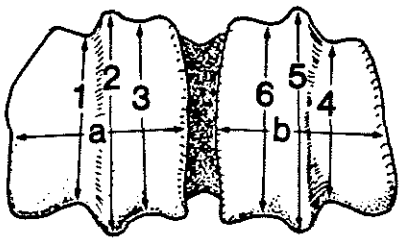


Fig 1





2=Ddm
5=Ddl

a=BFdm
b=BFdl

medial condyle lateral condyle

Fig 2