Contribution to the knowledge of domestic cattle in Africa: The osteometry of fossil *Bos taurus* L. from Kerma, Sudan (2050 – 1750 BC).

Louis Chaix
Department of Archaeozoology, Museum of Natural History, Geneva, CH

Abstract / Zusammenfassung

In this study the individual measurements on bones of prehistoric Sudanese cattle are presented. The excavations at Kerma (Northern Sudan) produced a large amount of cattle skulls and post-cranial elements. The osteometrical study of this large assemblage, which dates from 2050 to 1750 BC, provides new information on the morphology and stature of these bovines in this part of Africa.

In dieser Studie werden die an den vorgeschichtlichen Rinderknochen aus dem Sudan gewonnenen Knochenmaße vorgestellt. Die Ausgrabungen in Kerma (Nordsudan) lieferten eine große Menge an Schädeln und postkranialen Skelettelementen von Rindern. Die osteometrische Analyse dieser großen Knochenansammlung, die zwischen 2050 und 1750 v. Chr. datiert, liefert neue Informationen zu der Morphologie und Größe dieser Bovinen in diesem Teil Afrikas.

Keywords: Africa, Sudan, Kerma, Prehistory, *Bos taurus*, osteometry, archaeozoology,
Afrika, Sudan, Kerma, Vorgeschichte, *Bos taurus*, Osteometrie, Archäozoologie

Introduction

Since 1973 the Swiss Archaeological Mission has been conducting excavations in the northern part of the Sudan with particular emphasis at Kerma, the metropolis of a once large kingdom established in the second half of the third millennium BC and coming to an end around 1450 BC following the Egyptian conquest (Reisner 1923a, 1923b; Bonnet 2000, 2004a, 2004b). The archaeological exploration of the ancient town and cemetery produced a large amount of animal bones, remnants of the economic exploitation of livestock, as well as revealing evidence for funeral activities (Chaix 1988, 1993) (Fig. 1). According to the archaeological record cattle played an essential role in both the economy and religion of Kerma, a situation similar to that observed for other contemporaneous Nilotic cultures (Chaix & Grant 1992).

The archaeofaunal assemblage of the Kerma period is dominated by domestic mammals, mainly cattle and caprines (Chaix 1994a). However, obvious changes in subsistence practices were observable with the progression of time between the Early Kerma to the Classical Kerma. The most remarkable is a diminution in economic importance of cattle paralleled by an increase in the use domestic caprines, sheep and goat (Chaix 1994b) (Fig. 2). It is apparent that the impact of human demographic features and changing environmental conditions resulted in cattle becoming steadily more seldom, an indication that these animals were more precious.

The following is a presentation and discussion of the osteometrical data of bovine bones collected at a series of houses located in the metropolis and also those originating from numerous graves from the eastern necropolis.

Material and methods

The cattle bones presented here were recovered during excavations focusing on two different archaeological contexts, namely the town and the necropolis.

The town

The excavation of a series of houses and buildings in the ancient town of Kerma delivered numerous cattle remains that are interpreted as butchery refuse. In the present study we have limited the analysis to the cattle remains dating to the Middle Kerma period (2050 to 1750 BC). The general preservation of the bones is poor, a consequence related not only to their deposition within an urban context but also to fluctuating ground water levels resulting in alternating phases of moisture and dryness.

The insusceptibility of certain elements to taphonomic destruction and the types of butchering techniques em-

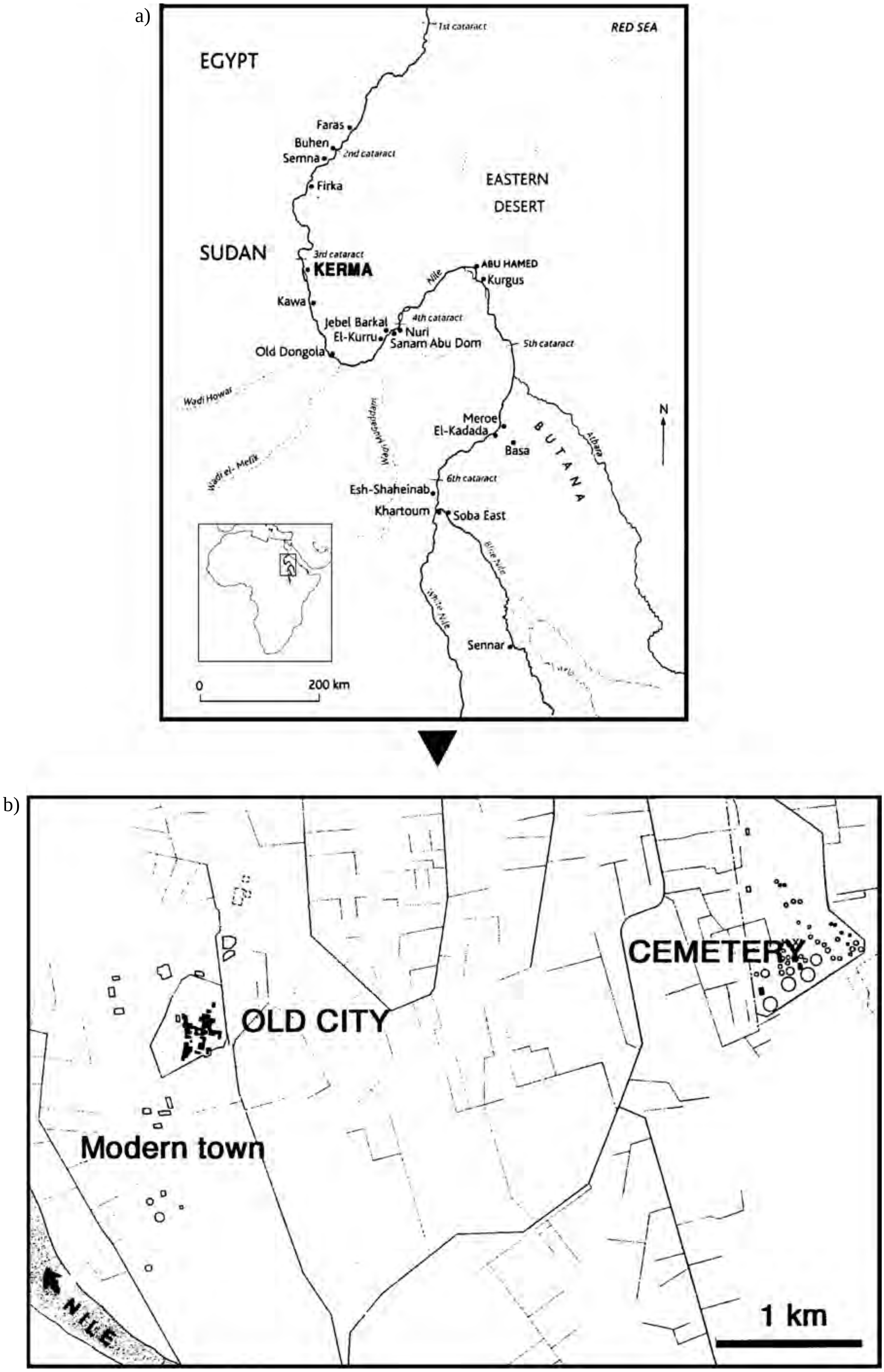


Fig. 1: Geographical position of Kerma and detailed map of the two main complexes, the city and the cemetery.

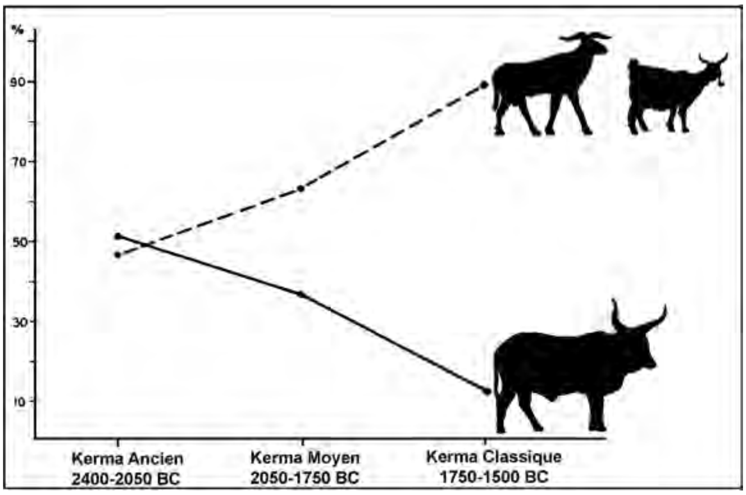


Fig. 2: Evolution of stock-breeding during the development of the Kerma culture.

ployed explain why small, compact bones like carpals, tarsals and phalanges remained well represented. In contrast, long bones were systematically broken into small pieces during food processing and therefore less well represented in their entirety. A good example of the latter is provided by the metapodials. Butchers regularly split these elements longitudinally and subsequently only a few whole proximal and distal parts were found: amongst more than ten thousand cattle bones only one single complete metatarsal was discovered.

Data on the number of preserved specimens for each skeletal element are summarized in Table 1 and Figure 3a. A comparison with the theoretical distribution of the elements in a bovine skeleton shows that the head and particularly the axial skeleton are underrepresented compared to the bones of the extremities which are much more numerous. Figure 3b reflects the poor state of preservation of the bones excavated in the town.

The cemetery

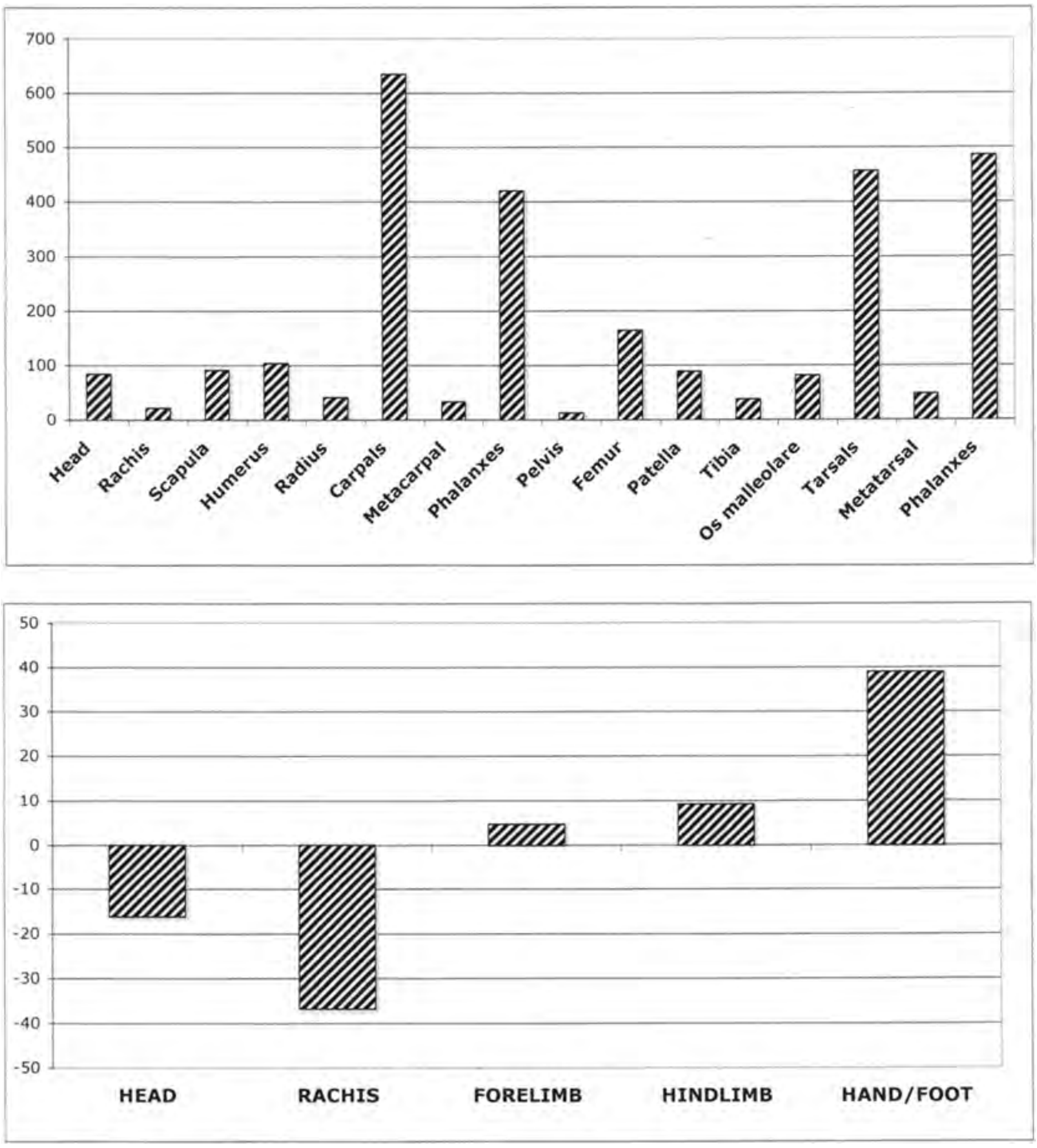
A very large cemetery was found approximately 4.5 km east of the ancient city of Kerma. It represents the capital's necropolis and contains at least 20,000 graves. Field work by Reisner (1923a, b) and also the Swiss Mission (Bonnet 2000) both indicate the topochronological expansion of the cemetery in a north to south direction.

The tumuli dating to the Middle Kerma period are characterized by large circular pits in which the human bodies were placed on cattle skins or, as seen in the later stage, upon wooden beds. Ceramics, precious objects of various origin, pieces of meat, and even whole sheep and goats were deposited south and west of the deceased. The deliberate placement of large numbers of cattle bucrania was observed outside of the grave to the south of the tumulus. Their numbers are clearly linked to the social importance the deceased possessed

Skeletal element	**N**
Maxilla	4
Mandible	37
Lower M3	43
Atlas	3
Axis	19
Scapula	91
Humerus	103
Radius	41
Ulna	10
Os carpi radiale	126
Os carpi intermedium	76
Os carpi ulnare	112
Os carpale II + III	182
Os carpale IV	138
Metacarpus	33
Phalanx 1 anterior	189
Phalanx 2 anterior	169
Pelvis	12
Femur	163
Patella	88
Tibia	38
Os malleolare	82
Talus	230
Calcaneus	25
Os centroquartale	166
Os tarsale II + III	35
Metatarsus	48
Phalanx 1 posterior	104
Phalanx 2 posterior	235
Phalanx 3	125

Table 1: Number of measurable specimens per skeletal element

a)



b)

Fig. 3: Distribution of the cattle bones found in the town of Kerma. A: histogram of the number of elements; B: comparison of the skeletal segments between Kerma and the theoretical distribution.

during life and correlate well with the diameter of the tomb (Fig. 4).

Methods

This study will be limited to the presentation and discussion of individual measurements of cattle bones from Middle Kerma contexts. Some simple statistical tests and elaboration of these data are presented for each skeletal element. In a forthcoming paper, we will use the more elaborate LSI scaling technique which allows better comparisons between different sets of metrical data (Meadow 1999; Pöllath & Peters 2005). All measurements follow the standard proposed by von den Driesch (1976). The anatomical nomenclature follows the terminology proposed in the *Nomina Anatomica Veterinaria* (Peters 1987).

The dimensions of bones acquired from the Kerma cattle were compared with similar data obtained from other *Bos* specimens in situations where the number of elements measured was sufficient to do so. The study by Linseele (2004) was consulted as a guideline for measurements of bones deriving from Northeast African wild cattle (*Bos primigenius* Boj.). A comparison with the Holocene European aurochs is based on metrical data from sites in Scandinavia (Degerbøl & Fredskild 1970), Switzerland (Boessneck et al. 1963; Stampfli 1976) and France (Arbogast 1997).

Different sets of data were available for domestic cattle (*Bos taurus* L.). For Northeastern Africa we grouped the *Bos* measurements from the Neolithic sites of Merimde-Benisalâme, Khasm el-Girba and Kadruka (von den Driesch & Boessneck 1985; Peters 1986; Chaix,

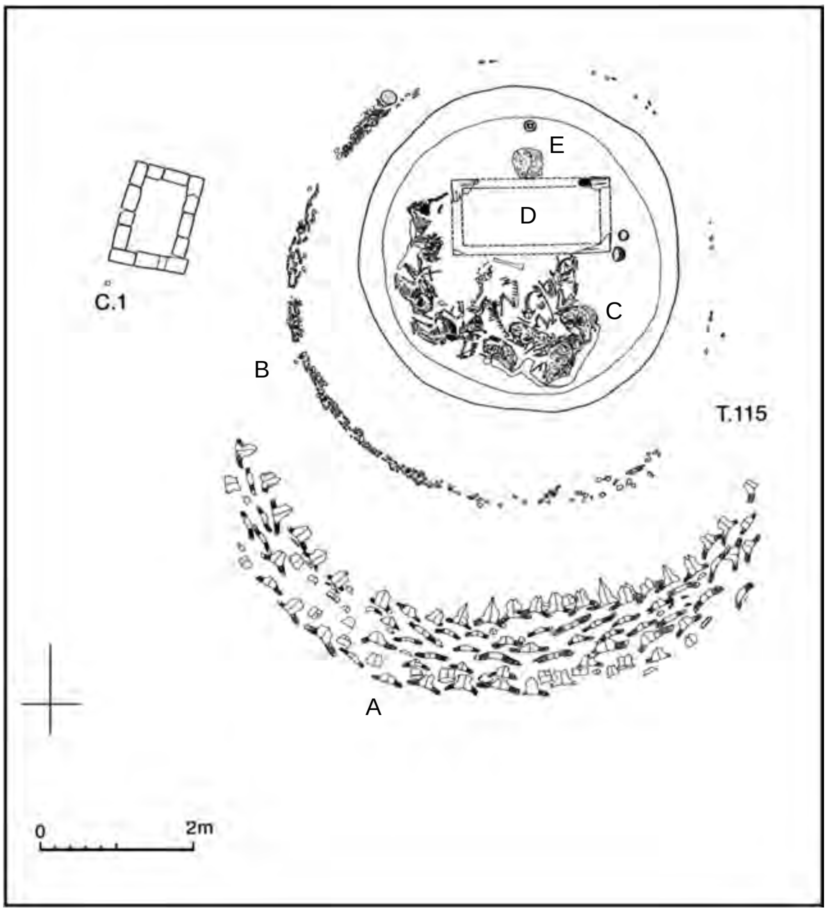


Fig. 4: Plan of a typical Middle Kerma grave (Grave 115). A: bucrania; B: remains of the tumulus; C: whole sheep deposited near the bed; D: wooden bed (the deceased was completely plundered); E: offerings.

in prep.). Osteometrical data from *Bos* in Predynastic contexts come from Maadi III (Boessneck & al. 1989) and Adaïma (Van Neer 2002). Measurements from Ptolemaic cattle come from Tell el-Dabʿa VII (Boessneck & von den Driesch 1992). With respect to prehistoric European cattle two large sets of data were used. The first is the Neolithic Swiss lake-dwelling village of Twann (Becker & Johansson 1981) and the other is an Iron Age corpus from the La Tène oppidum of Manching (Boessneck et al. 1971). In addition, some measurements obtained on modern cattle from Kerma were also included for purposes of comparison (Chaix, unpublished data).

To ascertain the approximate size of the Kerma cattle and for reasons of comparison we estimated the height at the withers of the different cattle populations. Withers heights were calculated with the aid of coefficients proposed by Boessneck (1956), Fock (1966) and Matolcsi (1970). Despite the rare measurements available for African *Bos primigenius* its stature has been estimated between 140 and 170 cm (Linseele 2004). For Scandinavian wild cattle withers height ranged between 145 and 177 cm, whereas for the West-European Holocene aurochs estimates range between 145 and 160 cm (Guintard 1999). The stature of African *Bos taurus* ranges between 125 and 141 cm for the Neolithic, between 116 and 122 cm for the Predynastic period, and from 139 to 151 cm in Ptolemaic times.

Results and discussion

Bucrania

The large corpus of bucrania collected from the necropolis presents an excellent opportunity to study the dimensions and morphology of the most prominent part of the cattle skull, a body part which is almost completely missing in the food debris from the ancient town. The bucrania are only represented by the face (frontal and nasal) and the horns, the maxillary bones are lacking. Interestingly, the way in which the skulls were treated before deposition changes throughout the necropolis's use. Nasal bones present in the bucrania from graves dating to the Early Kerma period are missing in bucrania deposited at the later stage tumuli, the nasals having been removed by cutting near nasion. During Classical Kerma times, all bucrania have been cut following a line connecting the two ectorbitalia (Fig. 5).

Fig. 5: Three types of bucrania carving from the Early Kerma to the Classical Kerma.

Our field observations indicate that bucrania were strictly deposited south of the graves and that this was conducted in a particular order. The front row contained the bucrania of cows and their juvenile offspring, followed next by a row of bucrania belonging to bulls and finally by an additional row of oxen bucrania. Sometimes, a line of bovine skulls showing parallel horns is intercalated. In large graves this arrangement is repeated many times.

Condition of preservation of the bucrania is generally good, especially for those specimens buried deeper. In these cases the horn-sheaths are still present. For those specimens deposited in the last rows, which generally are located more closely to the surface of the tumulus, bone preservation was generally very poor. It proved impossible to perform measurements on many of these specimens. Although the shape and morphological characteristics of the bucrania are of great interest since they illustrate the high degree of variability which existed amongst the Kerma cattle herds (Fig. 6), the main focus will be on the metrical analysis of this unique assemblage. The archaeological interpretation of these deposits and the determinations of age and sex will appear in a forthcoming paper using sophisticated statistical procedures including mixture and multivariate analysis (Chaix & Monchot, in preparation).

A total of 15 graves containing thousands of bucrania have been studied in detail so far. The number of specimens deposited near a single grave varies from 12 (Grave 186) to 4899 (Grave 253). Table 2 provides an overview of the number of burcrania measured per grave. Because of the particular way cattle skulls were processed only a limited set of measurements could be taken. Their position is indicated on Figure 7.

Measurements were possible on a total of 1849 bucrania. As mentioned previously, bucranial preservation depends on their stratigraphic location in the sediment, which explains why only part of the specimens recovered could be measured properly. For example, 343 bucrania were collected from Grave 238, yet only 240 could be analyzed metrically. A similar situation exists at Grave 253. It produced the hitherto largest quantity of bucrania ever found, namely 4899 specimens, of which only 25% (N = 1217) were measurable. The chronological differences in the pre-depositional processing of the cattle skulls imposed limitations to certain specific measurements, like the Acrocranion-Nasion-Length, measurable only in specimens collected in early Middle Kerma contexts, such as in graves 190, 238, 241, and 253. The metrical data obtained on the series of bucrania collected from the 15 graves are presented in Appendix 1, Tables 1 to 15. The statistical parameters for the different measurements are summarized in Appendix 2, Tables 1.1-1.15.

Grave No.	Bucrania measured
115	46
119	25
156	30
175	36
181	47
182	14
185	28
186	12
189	17
190	189
238	240
241	22
253	1217
KN24	227
B	54

Table 2: Number of measurable bucrania per grave.

For comparative analysis the basal dimensions of horn cores, specifically their circumference as well as greatest and smallest diameters were selected. With respect to Middle Kerma only the metrical data obtained on bucrania from the three main assemblages (Graves 253, 238, KN 24) were taken into consideration. Comparisons were made with horn core dimensions obtained from European aurochs, Neolithic cattle from Twann, and Iron Age cattle from Manching. Figure 8 distinctly illustrates that the cattle of Kerma carried rather strong horns compared to those found in Neolithic and Iron Age European cattle. The least basal diameter values for Kerma specimens even fall well within the range of variation observed for European aurochs. The relatively large dimensions of many horn cores from Kerma are confirmed by plotting the basal circumference (x-axis) and the greatest basal diameter (y-axis) (Fig. 9). Numerous specimens exhibit sizes similar to those characterizing female aurochs. The Neolithic and Iron Age cattle are clearly smaller.

Values obtained for basal circumference in European aurochs (Fig. 10) show a well defined separation attributable to sexual dimorphism, with the smaller female individuals positioned to the left and the larger males to the right (Fig. 10, top). The cattle finds from Kerma, however, do not exhibit this distinctive pattern, one which is often observed in domestic cattle. This problematic situation relates in part to the probable presence of bucrania at Kerma deriving from castrated individuals which are known to exhibit an intermediate morphology. This particular aspect will be addressed more closely in a forthcoming study (Chaix & Monchot, in prep.).

Fig. 6: Some examples of bucrania morphology from grave 253. (Scale = 5 cm).

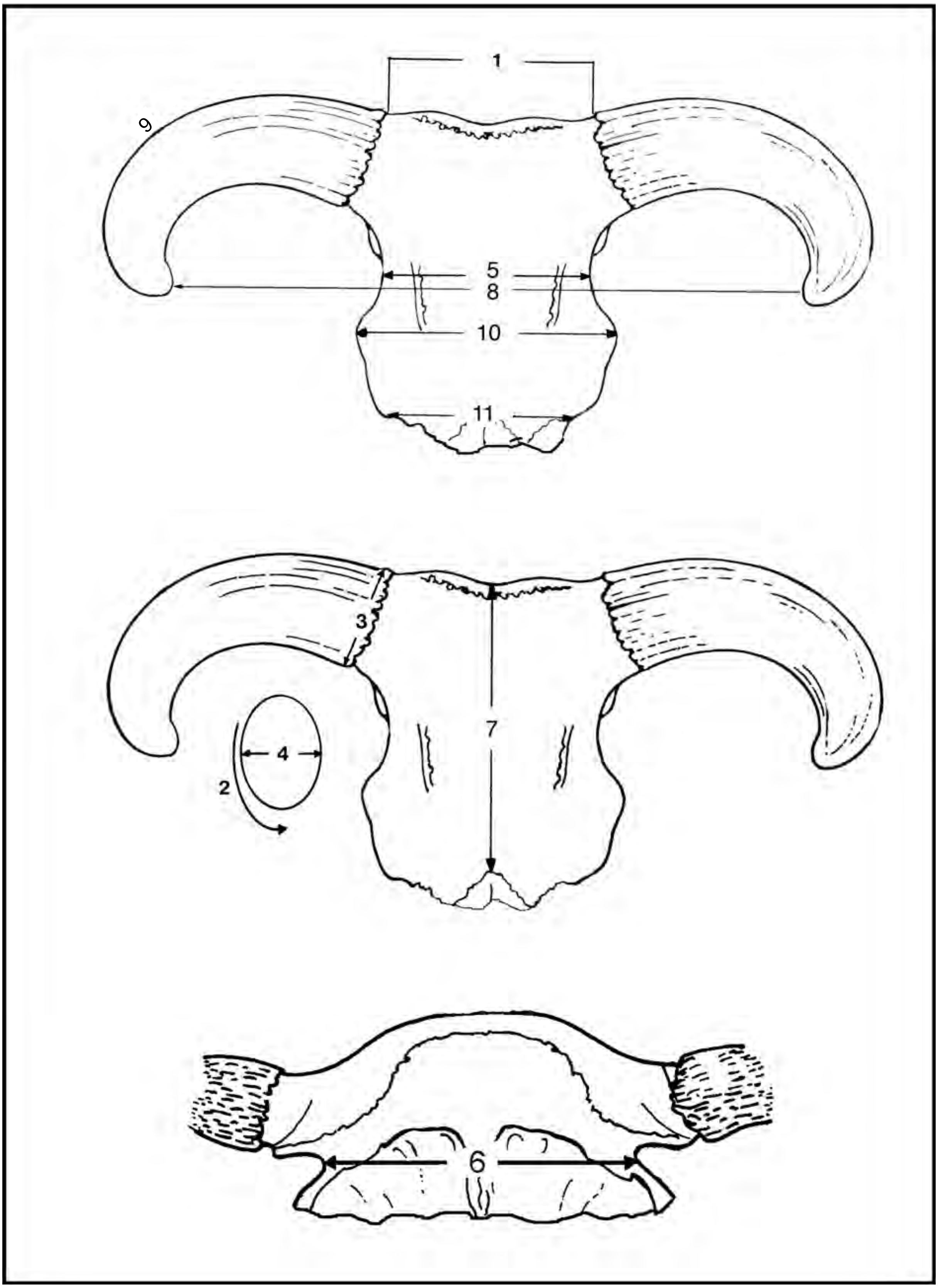


Fig. 7: Measurements on the bucrania (after von den Driesch 1976).
1: Least breadth between bases of horn cores. 2: Horn core basal circumference. 3: Greatest basal diameter of the horn core. 4: Least basal diameter of the horn core. 5: Least frontal breadth. 6: Least occipital breadth. 7: Length acrocranion-nasion. 8: Intertips breadth. 9: Length of the outer curvature. 10: Breadth ectorbitale-ectorbitale. 11: Breadth entorbitale-entorbitale.

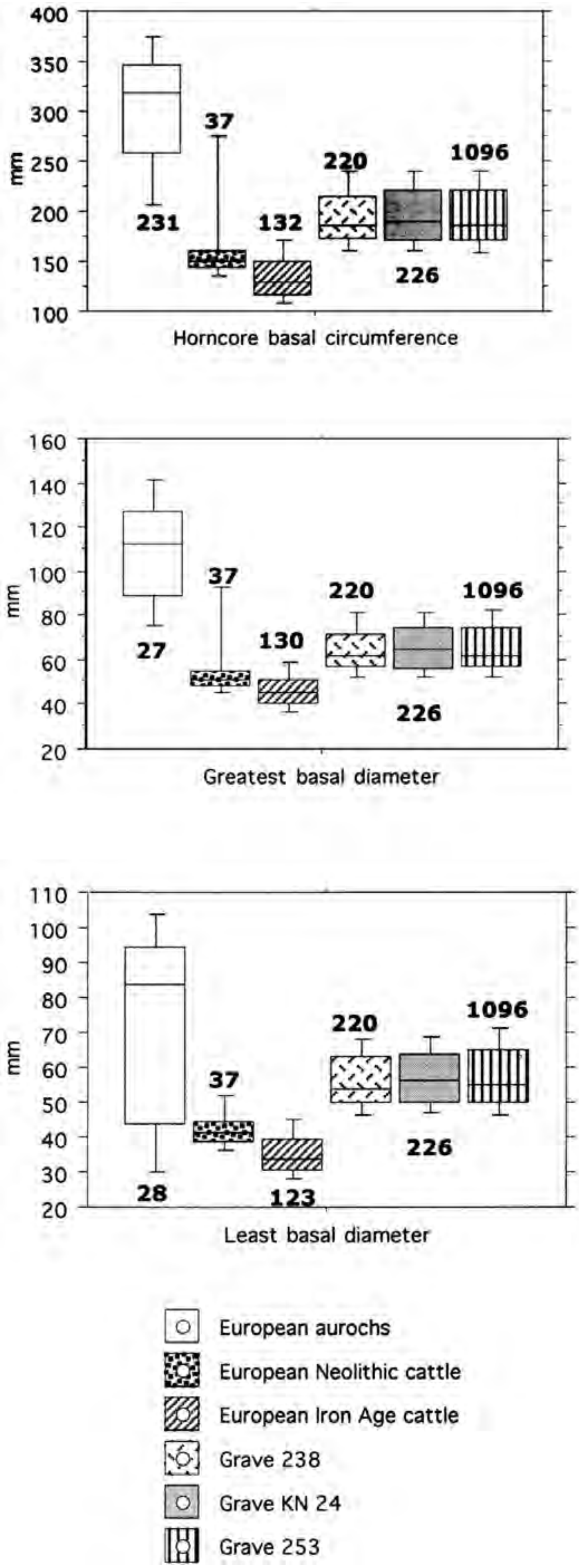


Fig. 8: Horn cores: comparative box-plots of the three main measurements.

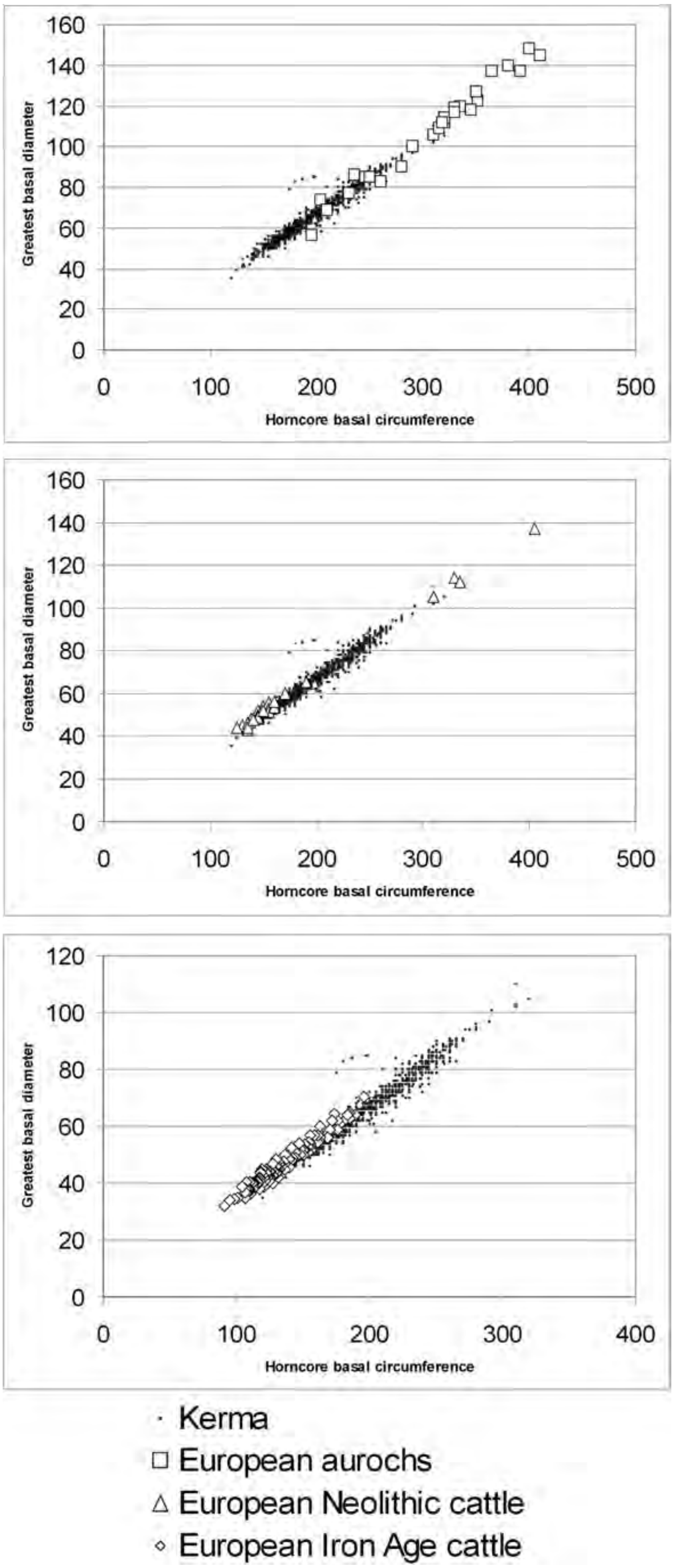


Fig. 9: Scattergrams (basal circumference versus greatest basal diameter) showing the position of Kerma horn cores in comparison to 1) aurochs, 2) European Neolithic cattle, and 3) European Iron Age cattle.

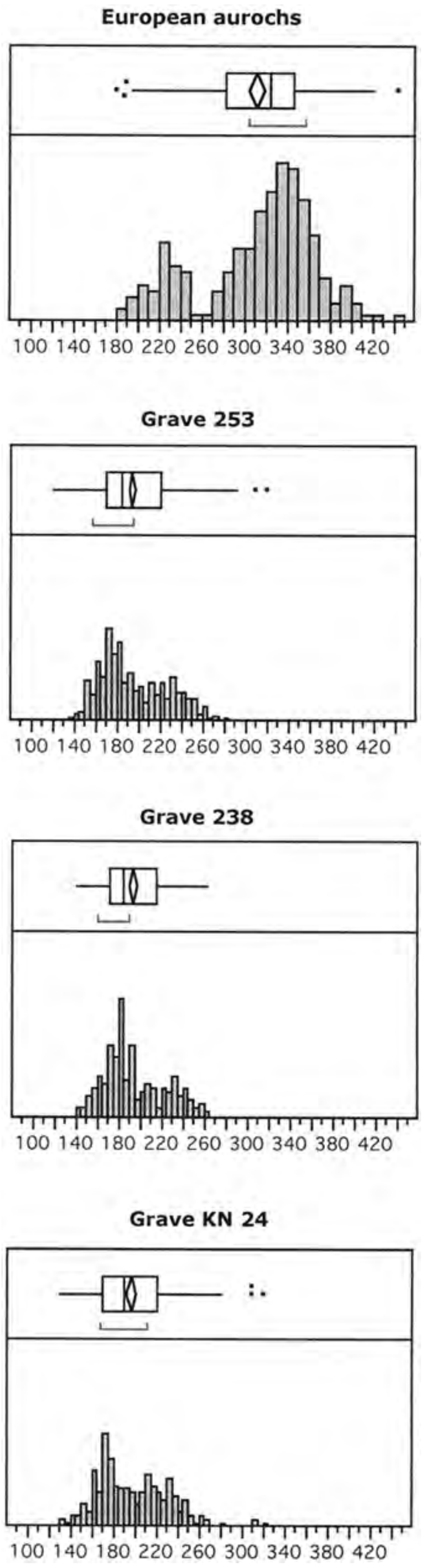


Fig. 10: Distribution of the basal circumference of the horn cores showing the clear sexual dimorphism of aurochs compared with the same distribution at Kerma.

Maxillary bone

Only very few pieces were found, the measurements of which are presented in Appendix 1, Table 16. By comparison, the site of Manching containing more than 160,000 cattle bones, produced a mere two measurable maxillas and a very limited number of complete upper molar rows. No metrical data whatsoever are available for Twann. The length of the cheek tooth row is smaller than in European aurochs (N = 36, mean = 160.5), but decisively surpasses the dimensions obtained at Manching (N = 2, mean = 121.7).

Mandible

Like the maxilla, mandibles were also scarce in the settlement debris. Individual measurement data is listed in Appendix 1, Table 17, and the statistical parameters for the different measurements are summarized in Appendix 2, Table 2.

A total of 35 lower third molars could be measured. To avoid problems linked with age, all values were obtained at the alveolar rim. A comparison of Kerma cattle molar size with M_3-values obtained in African and Danish aurochs (Fig. 11) show a clear difference in size between wild cattle and the domestic animals bred near Kerma. No overlap with the M_3-lengths recorded in African wild cattle was indicated, an observation even more markedly seen for those measured in European aurochs. If the Kerma M_3-sample is compared with data from Twann and Manching (Fig. 12), it becomes apparent that the bovines from Kerma are essentially located in the upper range of size variation established for the other two populations.

Atlas

The spongy, delicate structure of these and other vertebrae likely explain their under-representation in the refuse of the ancient town of Kerma. Only three atlases produced measurements (Appendix 1, Table 18). In the much larger cattle assemblage from Manching only four first and 17 second cervical vertebrae were measurable.

These atlas values nonetheless give further confirmation to the robustness of the cattle kept and bred in the Kerma region, displaying a mean of 107.3 mm for the breadth of the cranial articular surface (BFcr), which is smaller compared to aurochs (mean = 125.3 mm) but decidedly larger than the values noted in Neolithic (mean = 93.3 mm) and Iron Age cattle (mean = 84.8 mm).

Axis

The second cervical vertebra showed slightly better preservation, something also seen in Manching. The sturdiest

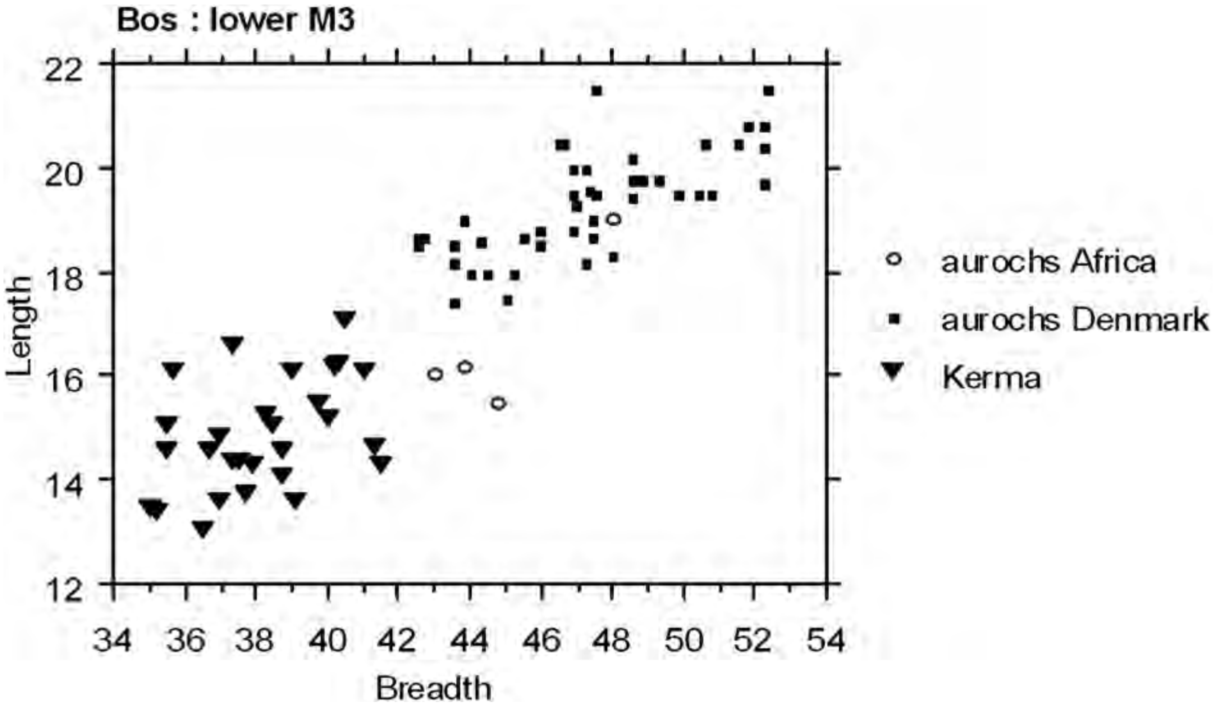


Fig. 11: Scattergram showing the position of lower M3 of Kerma compared with African and European aurochs.

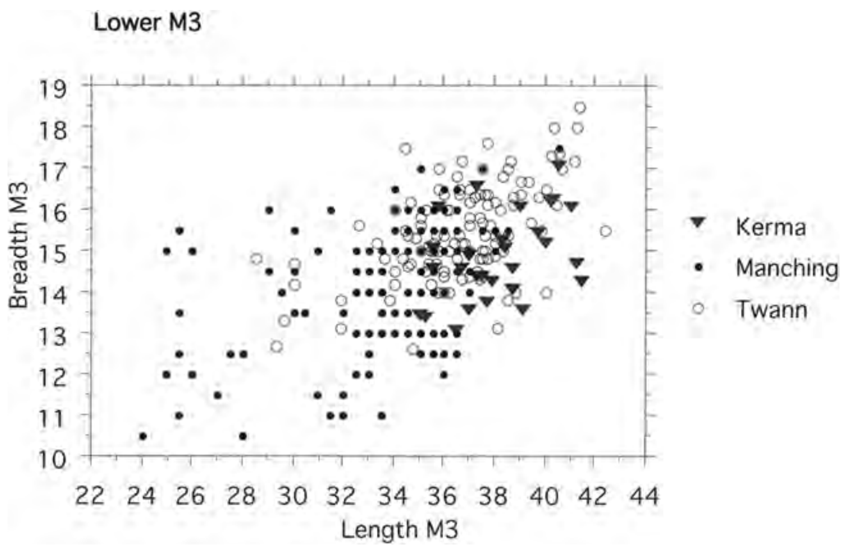


Fig. 12: Scattergram showing the position of lower M3 of Kerma compared with Neolithic domestic cattle from Twann and Iron Age cattle from Manching.

part of the second cervical vertebra appears to be the cranial portion which bears the dens and the cranial articular facet. The values obtained on the Kerma specimens are listed in Appendix 1, Table 19, whereas a summary of the statistical parameters can be found in Appendix 2, Table 3. The relatively large size of the axis finds from Kerma compared to those from Manching is illustrated by Figure 13.

Scapula

81 remains of shoulder blades were found in the settlement debris of the ancient town of Kerma. As expected, the majority of them are distal parts, which are less easily damaged than the much thinner blade portion. Individual scapula measurements are listed in Appendix 1, Table 20 and the statistical parameters appear in Appendix 2, Table 4.

Sexual dimorphism, which in scapulae can be detected by metric examination, an approach that works well for the aurochs particularly when using the smallest length of the collum (SLC), is far less evident in Kerma cattle and in domestic bovines in general (Degerbøl & Fredskild 1970). The scatter diagram in Figure 14, however, reveals the possible presence of two male individuals,

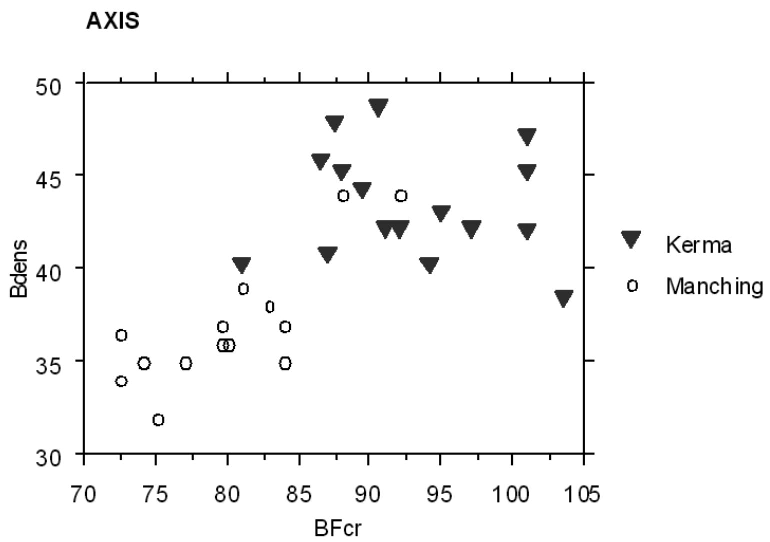


Fig. 13: Axis: Diagram illustrating the robustness of the Kerma bones, compared with those from Manching. Two large fragments from this site probably belong to bulls.

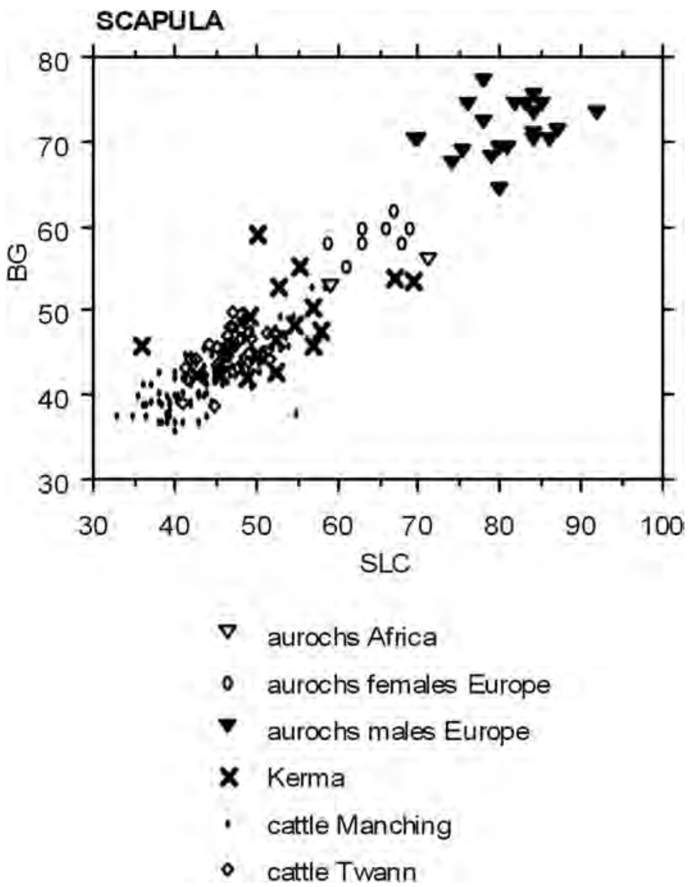


Fig. 14: Scapula: scattergram using the smallest length of the Collum scapulae (SLC) and the breadth of the glenoid cavity. The bones from Kerma are near the female aurochs and the Neolithic domestic cattle from Twann. Two bones, both in the range of aurochs, can be attributed to males.

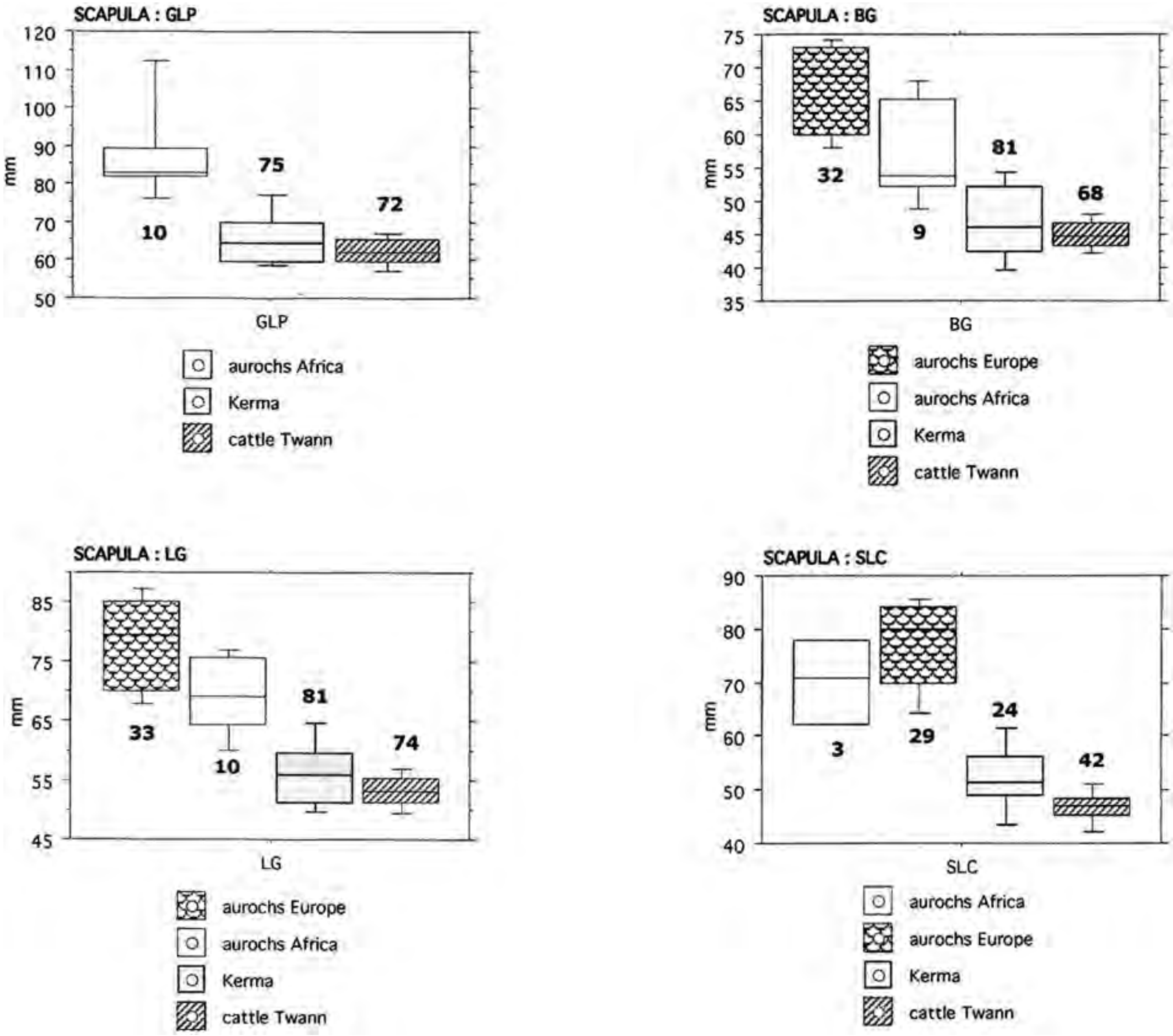


Fig. 15: Scapula: comparisons of the main measurements between Kerma, African and European aurochs and Neolithic cattle from Twann.

either bulls or oxen (SLC > 65 mm). When comparing the different sets of scapula measurements available for the African and European aurochs and those for the cattle of Neolithic Twann (Fig. 15), the size of the *Bos* specimens from Kerma clearly fall in between, showing some overlapping with female aurochs and considerable overlapping with their domestic relatives from Twann, which are decidedly smaller on average.

Humerus

As expected, only two proximal extremities of this skeletal element were found preserved compared with 74 from the distal portion. The individual osteometrical data can be found in Appendix 1, Table 21, and the statistical parameters have been summarized in Appendix 2, Table 5.

If distal measurements are compared (Fig. 16), the sizes exhibited by the aurochs and the Kerma cattle reveal conspicuous differences, however, the latter population are clearly larger in size compared to their European Neolithic and Iron Age relatives. A comparison of the distal breadth of the trochlea (BT) from Kerma cattle with values obtained on humeri from Neolithic, Predynastic and Ptolemaic cattle from sites in NE-Africa was also conducted. The Predynastic, Ptolemaic and Kerma cattle obviously do not differ significantly in size from one another, however, the Neolithic animals are somewhat smaller (see Appendix 2, Table 6).

Radius

At Kerma a total of 40 radii could be measured. From Appendix 1, Table 22 and Appendix 2, Table 7, it can be seen that the late fusing distal part of this skeletal element is quantitatively much better represented than the early fusing proximal one, which is unexpected given the taphonomic bias against late-fusing elements. Indeed, if we compare the ratio of proximal to distal

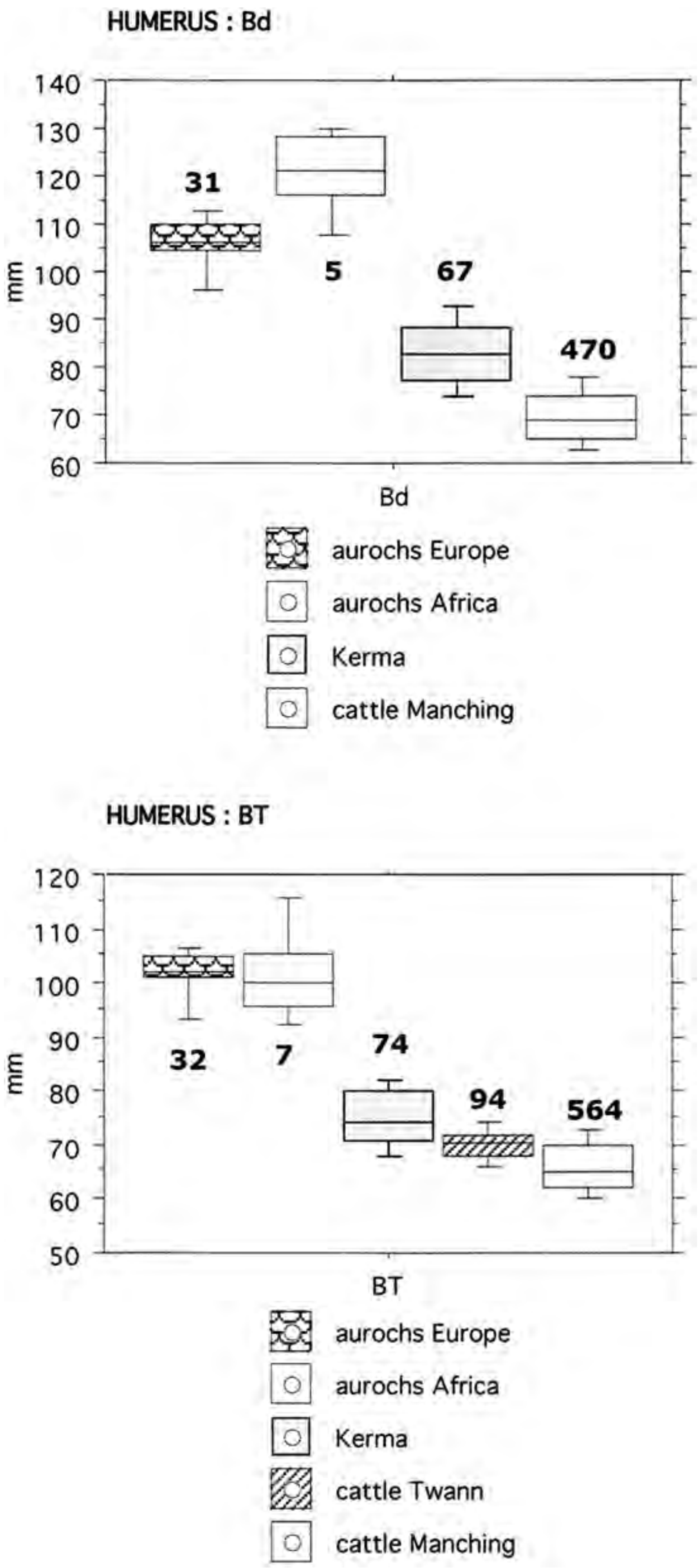


Fig. 16: Humerus: box-plots showing the position of Kerma compared to wild and domestic cattle.

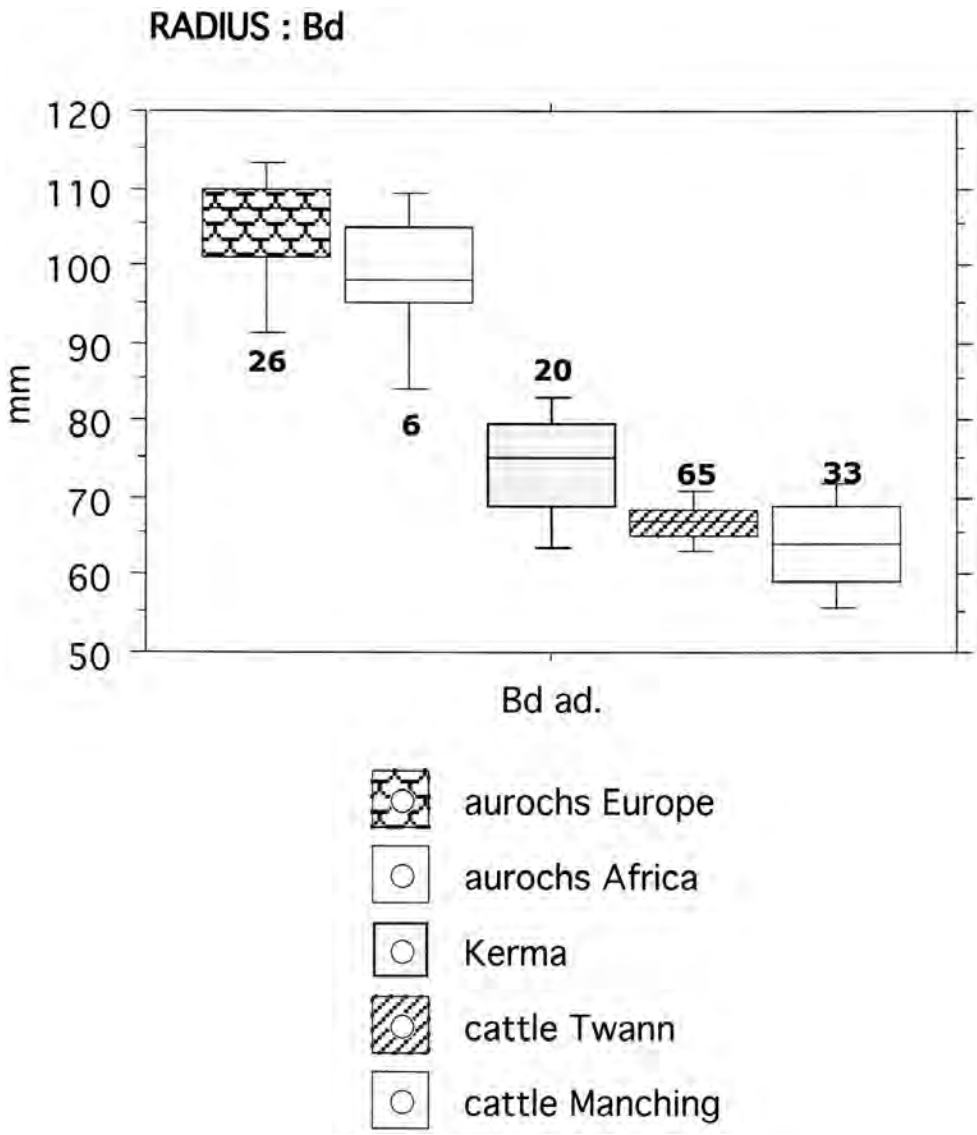


Fig. 17: Radius: comparison of the distal breadth (Bd) between Kerma, aurochs, Neolithic and Iron Age cattle.

(28.6% *vs*. 71.4%) at Kerma with that observed in Manching (65.8% vs. 34.2%) an inverse situation is noted. However, the ratio calculated for Twann radii is much closer to that observed in Kerma, with 44% of proximal versus 56% of distal parts calculated for this bone.

A size comparison of the distal breadth values obtained on radii between European and African aurochs and different domestic cattle populations is presented in Figure 17. The measurements from Kerma cattle show no overlap with those from aurochs, with the Sudanese animals on average being significantly larger than the prehistoric European cattle populations considered here. If the distribution of the distal breadth values taken from the radius (Bd) is plotted for the different populations, the only group showing clear, strong sexual dimorphism is the aurochs (Fig. 18). The only domestic cattle population showing a more or less bimodal distribution is that from Iron Age Manching (Fig. 18).

Interestingly, amongst the 40 measurable specimens 12 are still unfused, implying a high proportion of individuals (37.5%) less than 3.5 years old in the assemblage. Figure 19 shows the distribution of radial distal breadth in young and adult individuals. Although the means of the two groups differ significantly ($t = 2.04227$, $p = 0.05$), we can assume that the young individuals are already quite strong and therefore probably slaughtered at the end of their third year of life.

Ulna

Very few ulnae were found. This is best explained by the bone's intrinsic fragility and the poor preservation of the late fusing proximal end found in young animals. The metrical data and statistical parameters are presented in Appendix 1, Table 23 and Appendix 2, Table 8 respectively.

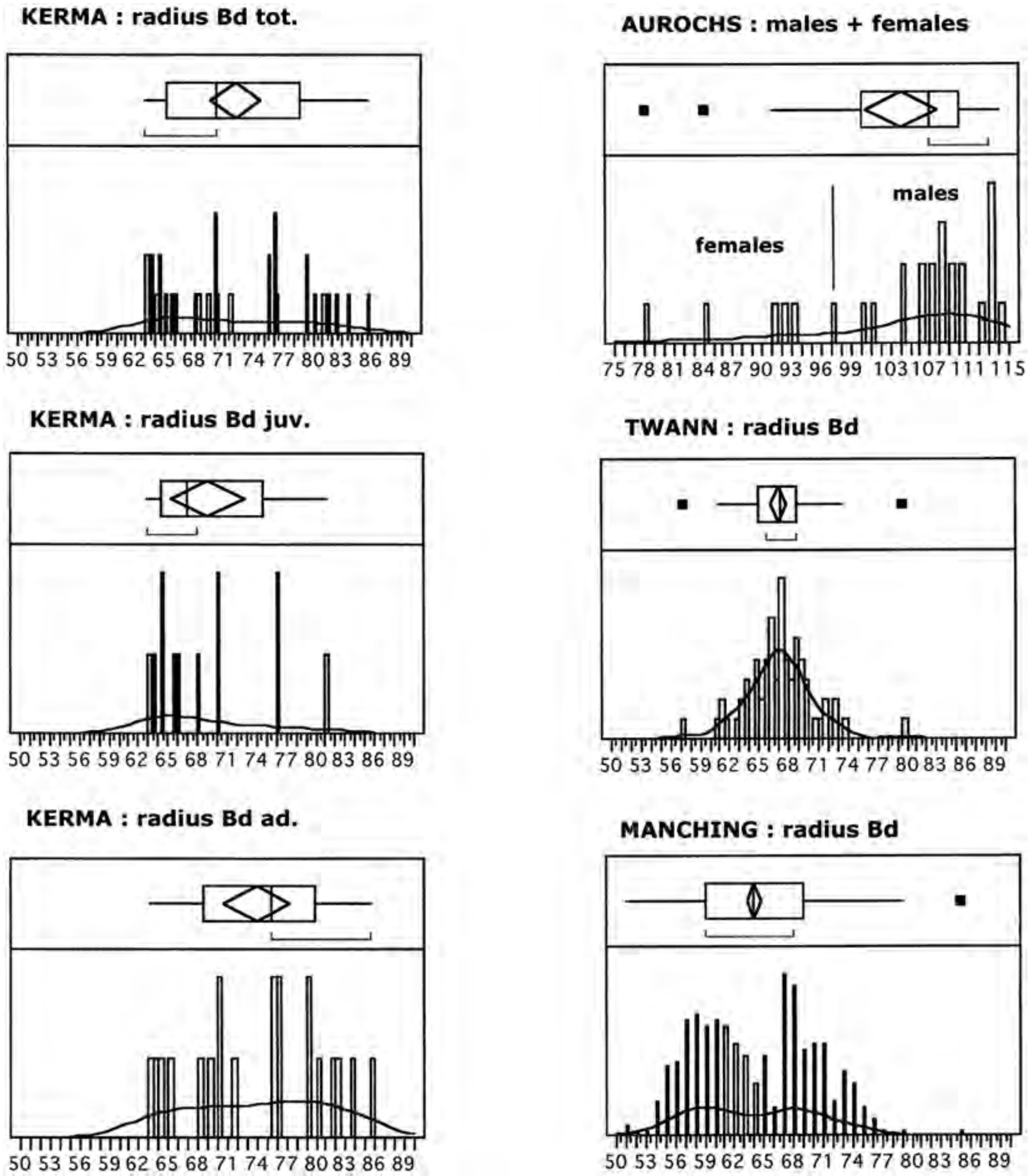


Fig. 18: Distribution of the distal breadth of the radius. This measure shows clear sexual dimorphism in aurochs and also the domestic cattle from Manching. In Kerma, the distribution, which is limited to adult individuals, does not exhibit this clear separation between the two sexes.

Carpal bones

The preservation of these small and compact bones is excellent. They make up 22.5% of all the cattle bones measured. There is a good proportional balance between the carpals of the proximal (os carpi radiale, os carpi intermedium and os carpi ulnare) and those of the distal carpal row (os carpale II+III, os carpale IV). Metrical data on these different elements will be briefly addressed, however, comparisons are limited because measurements for aurochs and domestic cattle are lacking.

Os carpi radiale: 126 specimens collected from the town of Kerma were measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 24 and Appendix 2, Table 9 respectively.

Os carpi intermedium: 76 specimens were collected and measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 25 and Appendix 2, Table 10 respectively.

Os carpi ulnare: 112 specimens were collected and measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 26 and Appendix 2, Table 11 respectively. We compared the measurements from Kerma with a small corpus of measurement data obtained on aurochs ulnar carpals from Middle Neolithic Burgäschisee-Süd (Boessneck et al. 1963). Figure 20 shows the results of this comparison. Though the means of the two samples are statistically different

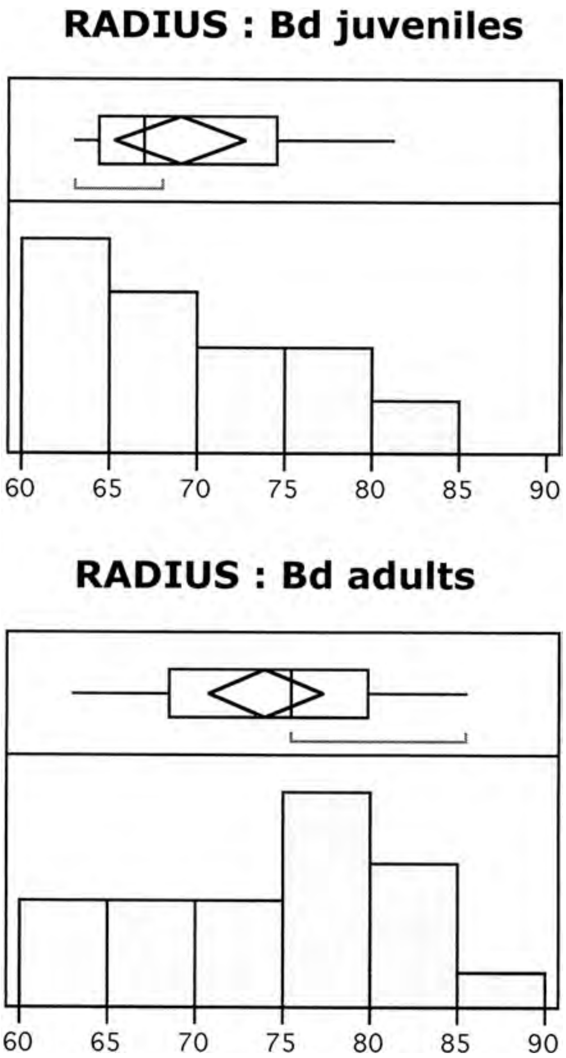


Fig. 19: Comparative distribution of the distal breadth of the radius of young and adult cattle in Kerma.

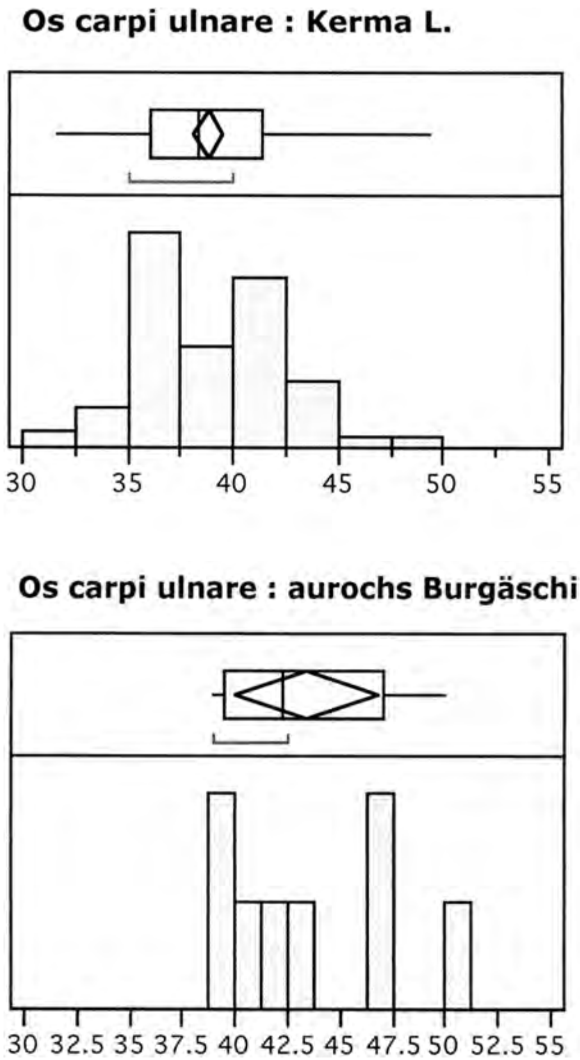


Fig. 20: Os carpi ulnare: comparison of the length between Kerma and Swiss aurochs.

($t = 1.98027$; $p = 0.05$), there is a considerable size overlapping between the two populations. This may relate to the rather low stature of the Swiss aurochs, which was clearly smaller than the wild cattle living in other parts of Europe at that time.

Os carpale II+III: 182 specimens were retrieved and measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 27 and Appendix 2, Table 12, respectively. The large dimensions recorded for many of the Kerma specimens are illustrated by the scatter diagram in Figure 21, where they are compared with the Burgäschisee-Süd aurochs.

Os carpale IV: The sample measured comprises 132 specimens. Osteometrical data and statistical parameters are presented in Appendix 1, Table 28 and Appendix 2, Table 13, respectively. If we consider the distribution of the greatest breadth (GB), we observe an overlapping in size between the Kerma cattle and the Swiss aurochs (Fig. 22), although the means for these two assemblages differ significantly ($t = 1.97944$; $p = 0.05$).

Metacarpus III+IV

As noted earlier in this paper, the butchering techniques at Kerma exerted a strong influence on long bone preservation, in particular that of the metapodials. Almost all these elements were split longitudinally (Fig. 23), which explains why so few measurements were taken. Osteometrical data and statistical parameters are presented in Appendix 1, Table 29 and Appendix 2, Table 14, respectively.

A comparison of the proximal (Bp) and distal metacarpal breadths (Bp) of the different aurochs and domestic prehistoric cattle populations appears in Figure 24. The measurements obtained on metacarpals from cattle of the Simmental breed are also included here. It can be deduced from Fig. 24 that the Kerma metacarpals fall

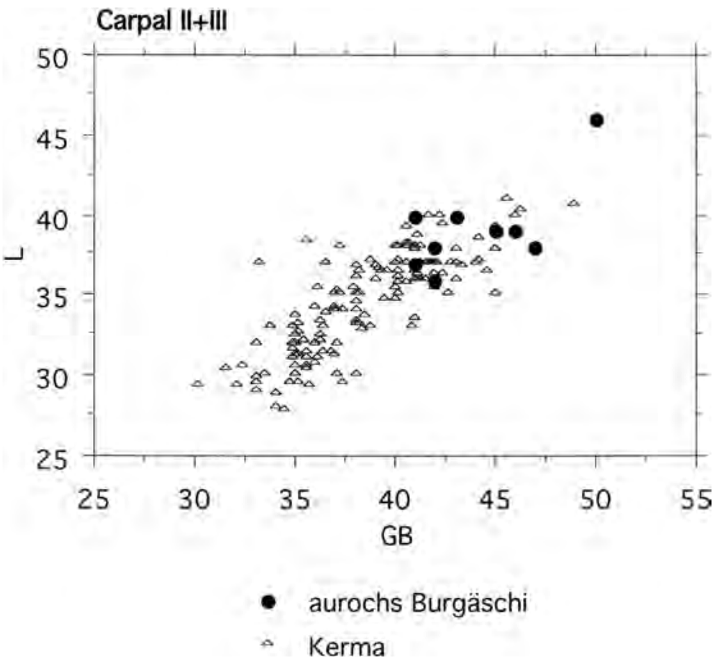


Fig. 21: Os carpale II + III: scattergram (breadth versus length) between Kerma and Swiss aurochs.

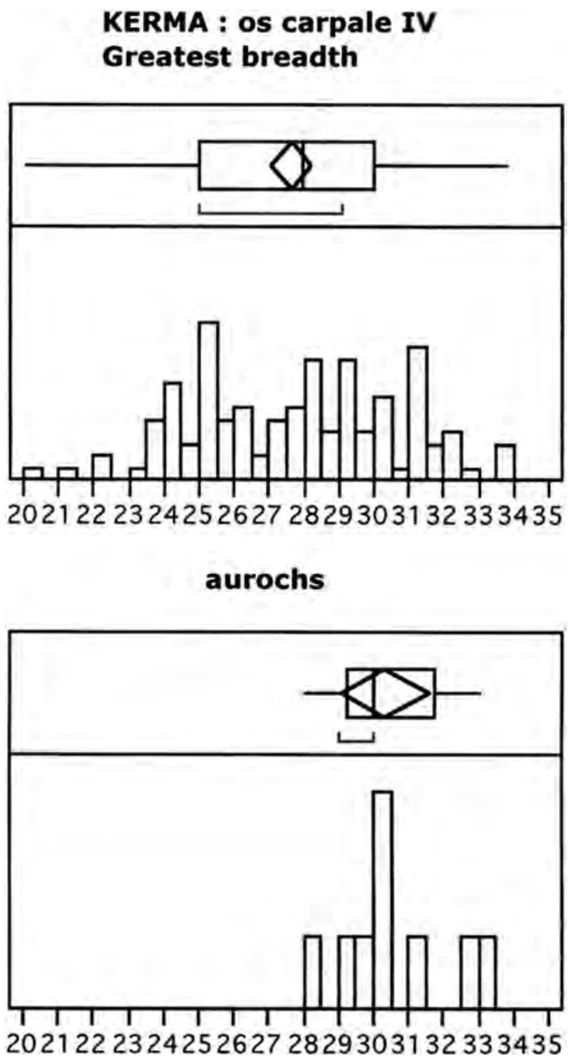


Fig. 22: Os carpale IV: comparison of the distribution of the greatest breadth (GB) between Kerma and Swiss aurochs.

Fig. 23: Examples of metapodials split by butchering.

within the size range typical for the female aurochs and the prehistoric cattle from Twann and Manching, but are decidedly smaller than the corresponding elements in modern Simmental, which clearly exhibit broader dimensions. As such, metacarpal breadth is clearly influenced by the weight of the head and particularly by that of the horns (Howard 1963; Higham 1969). Measurements of aurochs metacarpals allow for a clear separation between bulls and cows without apparent overlapping. Distal breadth data from the Kerma cattle assemblage produced a much more uniform distribution (Fig. 25). The small number of specimens might account for this difference, however, should this observation be confirmed by using larger assemblages, the distribution may well relate to the attenuation of sexual dimorphism, a phenomenon observed in many domestic breeds.

Phalanges

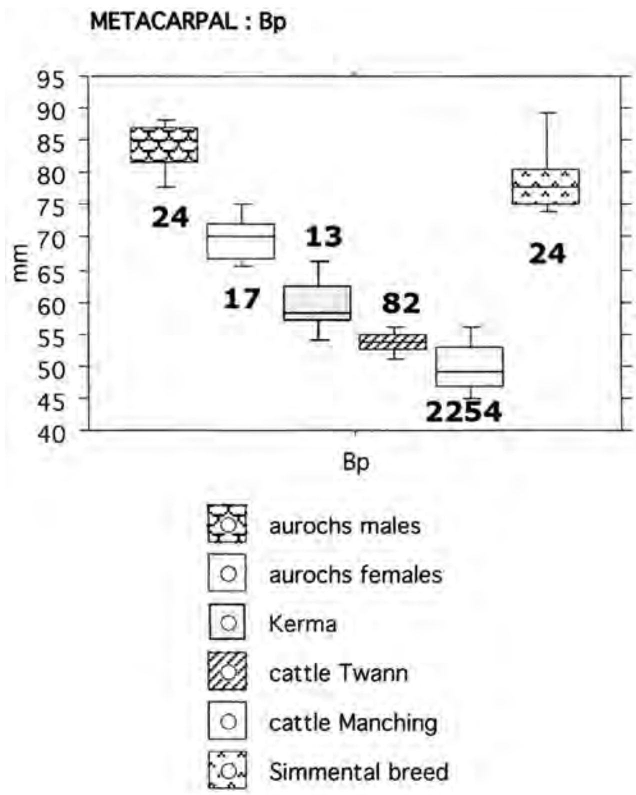
These small and compact bones are well preserved in the settlement refuse of the ancient town of Kerma. These skeletal elements obviously did not undergo further processing by the butchers. Phalanges represent 32.2% of the bones analyzed within the scope of this study, compared with 38.8% for the carpal and tarsal bones. Only fused phalanges were measured, implying that they belonged to individuals more than 15 months old.

The distinction between anterior and posterior phalanges was based on the criteria established by Dottrens (1946). These criteria are very reliable for the first and second phalanges, with a success rate of over 90%. The metrical analysis carried out in this study underscores the validity of this morphological approach, although considerable overlapping was observed (Fig. 26). An attempt to distinguish between fore and hind distal phalanges was not made because of the strong influence weight, age and sex have on their morphology and dimensions.

Anterior first phalanx

183 specimens were measurable. Osteometrical data and statistical parameters are presented in Appendix 1, Table 30 and Appendix 2, Table 15, respectively.

In Figure 27 metric data from Kerma cattle phalanges are compared to aurochs and domestic cattle from Manching. It was impossible to incorporate the Neolithic cattle from Twann in these graphs because no distinction was made between the anterior and posterior phalanges (Becker & Johansson 1981). The GLpe, SD and Bd values from Kerma cattle fall in between those re-



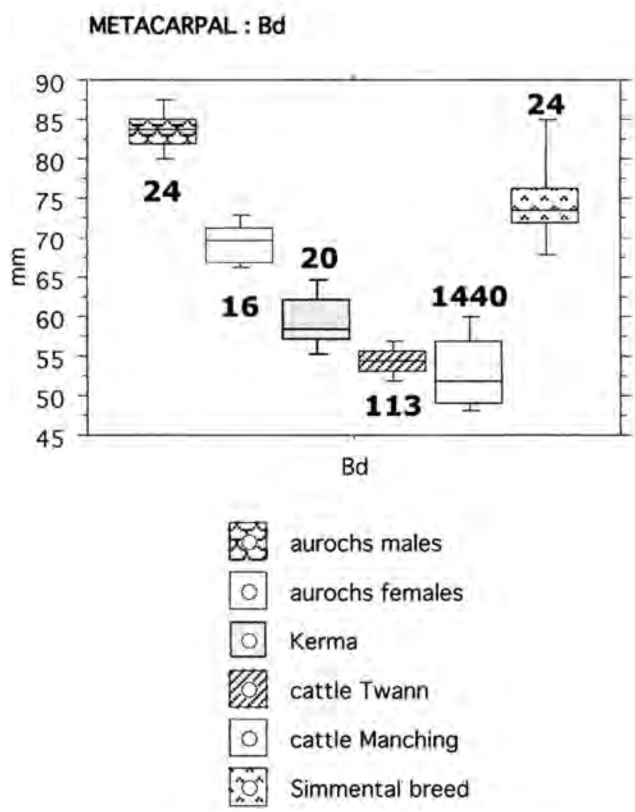


Fig. 24: Box-plots of the proximal breadth of the metacarpal (Bp) and of the distal breadth (Bd) of the same element. Metacarpals from Kerma are clearly robust.

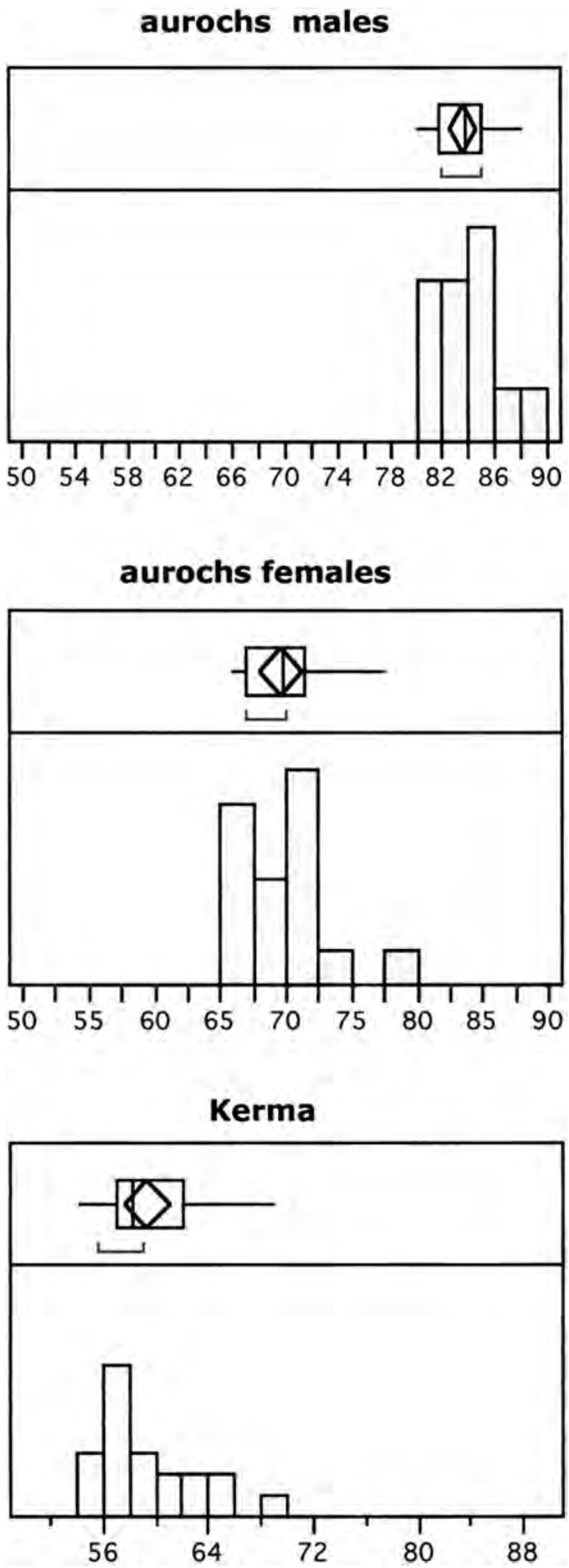


Fig. 25: Comparative distributions of the distal breadth of the metacarpal (Bd) in aurochs, males and females and bone elements from Kerma.

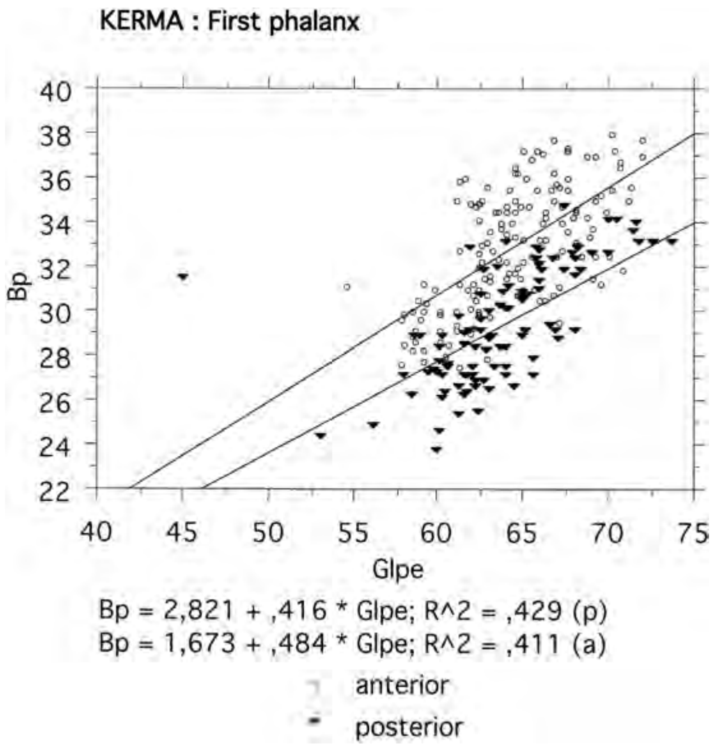


Fig. 26: First phalanx: metrical discrimination between anterior and posterior.

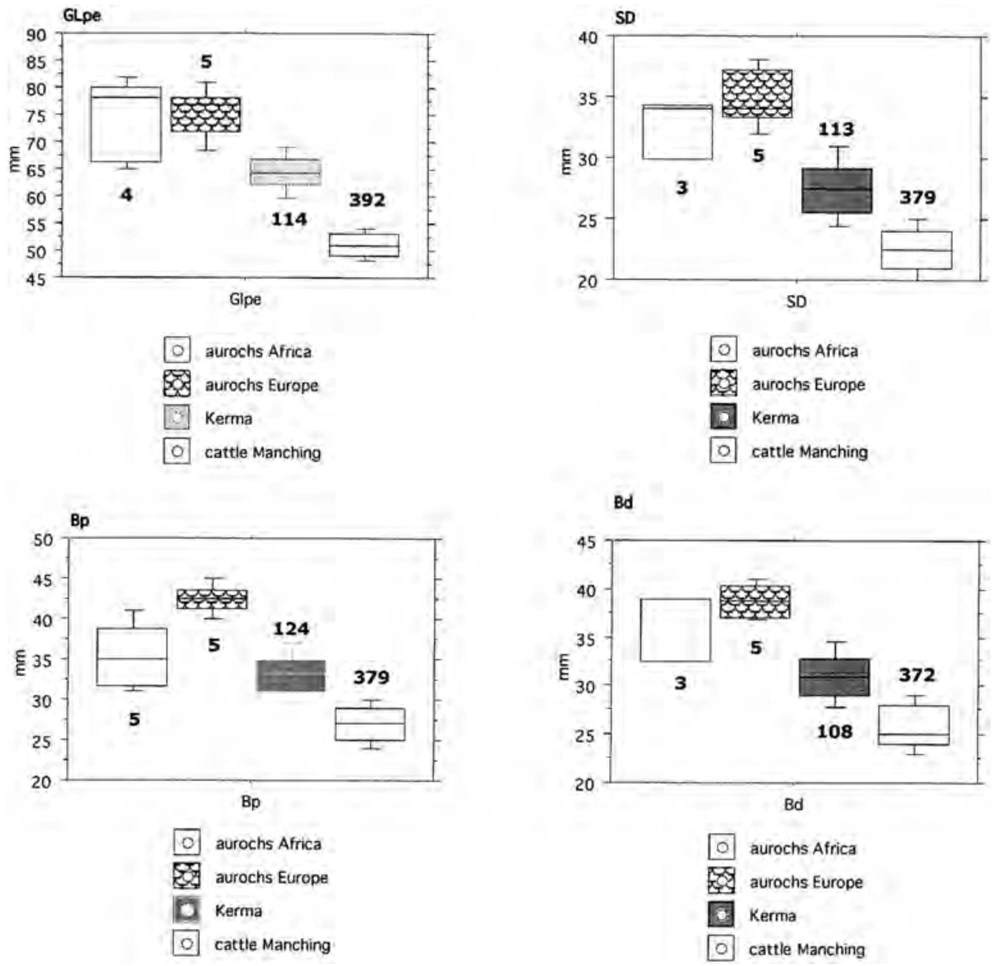


Fig. 27: First phalanx anterior: box-plots showing the position of the measurements of Kerma compared with other corpus.

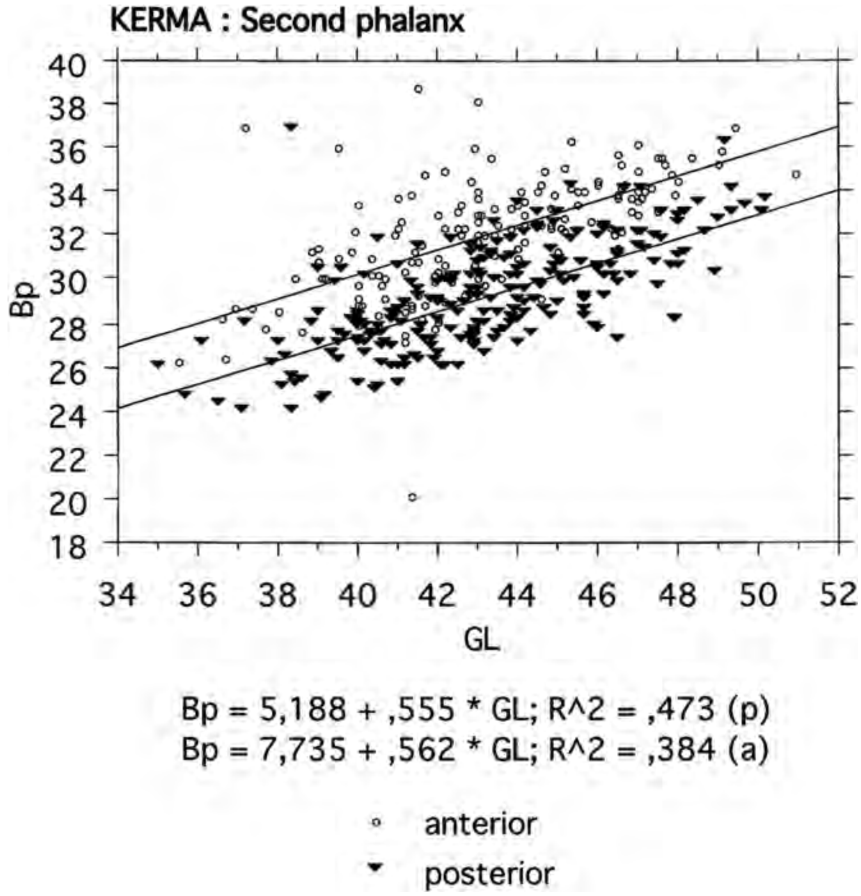


Fig. 28: Second phalanx: metrical discrimination between anterior and posterior.

corded for aurochs and Manching cattle. The statistical analysis for proximal breadth (Bp) indicate that the means for African aurochs (N = 5) and Kerma cattle (N = 124) do not differ significantly, although the majority of the Kerma specimens are similar to the lower size range of (female) aurochs.

If we compare the measurements from Kerma with those obtained in other African domestic cattle from Neolithic, Predynastic and Ptolemaic contexts (see Appendix 2, Table 16), it becomes apparent that Kerma and Neolithic cattle differ significantly with respect to GLpe, Bp and SD, and that Kerma cattle and Predynastic animals statistically differ in GLpe, SD and Bd.

Three indexes for robusticity were calculated (Bp/GLpe, SD/GLpe and Bd/GLpe). No statistical differences could be found between the means of the different groups. However, a comparison of the robustness of the first phalanges from the Kerma cattle with those from animals bred at Iron Age Manching shows clear differences in all indexes. Obviously the cattle kept by the Kerma community were considerably more slender than the animals raised at Manching. This slenderness seems to be a feature characteristic of the African bovines.

Anterior second phalanx

The distinction between the anterior and posterior second phalanges was made applying the criteria of Dottrens (1946). A metrical analysis does not allow for a clear separation between the front and hind medial phalanges (Fig. 28), it does, however, confirm that as a rule the latter are more slender than the first. A total of 169 anterior second phalanges could be measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 31 and Appendix 2, Table 17, respectively. Kerma cattle generally exhibit an intermediate size which falls within the ranges ascertained for the aurochs and Manching population. As illustrated by Figures 29 and 30, a considerable overlap with female aurochs was observed for some of the measurements (SD, Bd).

Pelvis

Relatively few measurable examples of this bone (N = 12) were preserved. Measurements of the acetabular length including the lip (LA) are known to be imprecise and difficult to take (von den Driesch 1976). Osteometrical data and statistical parameters are presented in Appendix 1, Table 32 and Appendix 2, Table 18, respectively.

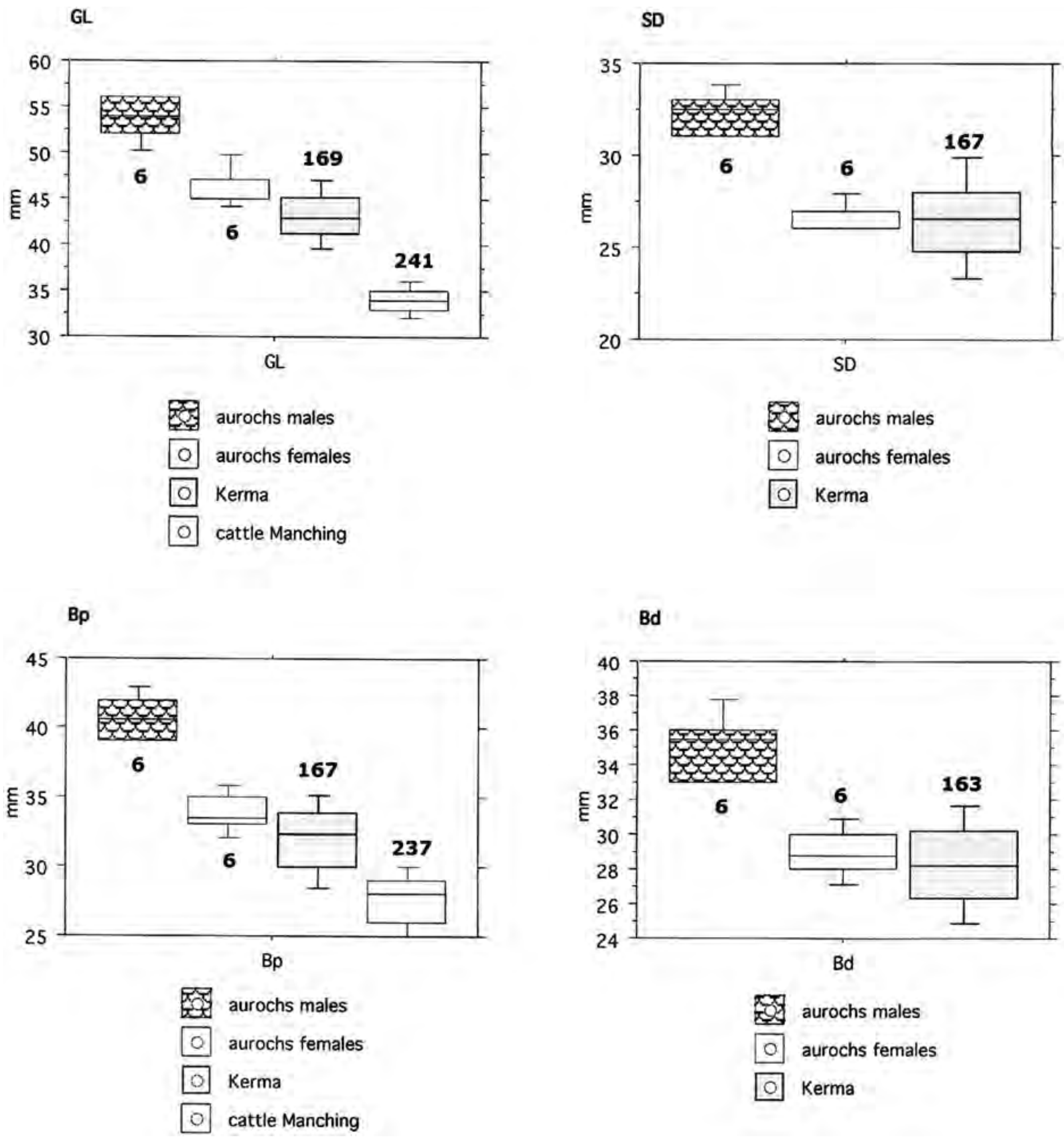


Fig. 29: Second anterior phalanx: box-plots of the four measurements.

Os femoris

The femoral head *Caput femoris* is the most frequently measured section on the femur (N =143). It is the most robust portion of this long bone, which explains its frequently good level of preservation. In addition, four proximal (Bp) and 20 distal articular ends (Bd) could be measured. Amongst the femur finds we noted the presence of 25 specimens belonging to subadult individuals. Their bones characteristically display lines of epiphyseal fusion, indicating animals less than 3.5 years of age. The remaining 118 specimens represent adult animals. Osteometrical data and statistical parameters are presented in Appendix 1, Table 33 and Appendix 2, Table 19, respectively.

A comparison of the distal breadth (Bd) of the os femoris of wild cattle and domestic stock from Kerma with the northeastern African Neolithic reveals the intermediate position garnered by cattle raised near Kerma in the 2nd millennium BC (Fig. 31). If we consider the distribution of the distal breadth (Bd) of adult cattle from Kerma (Fig. 32), we observe a clear separation of males and females. This sexual dimorphism is less distinct in European wild cattle.

Patella

A total of 83 specimens could be measured. Osteometrical data and statistical parameters are presented in Ap-

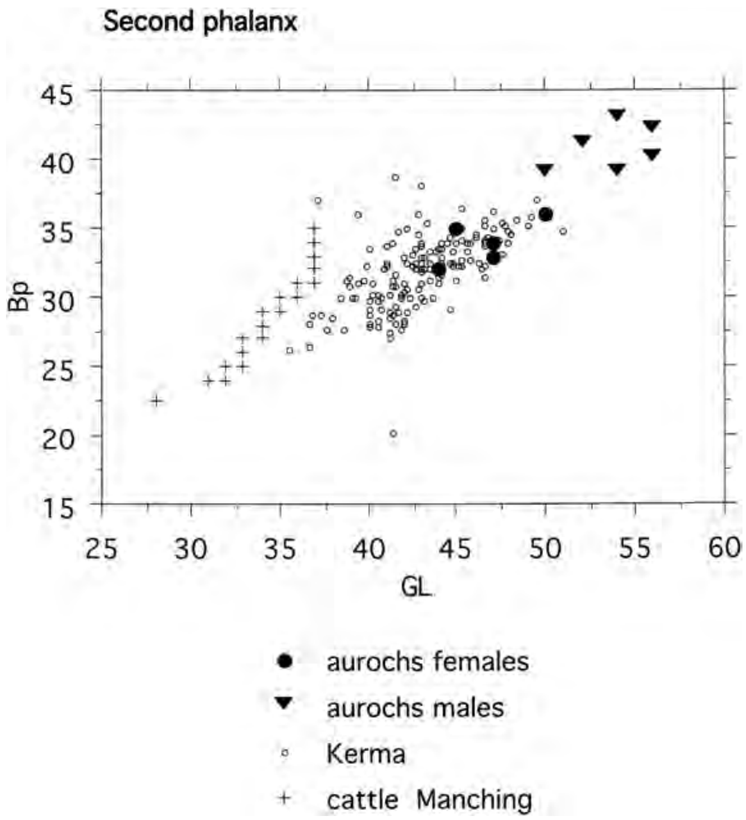


Fig. 30: Second anterior phalanx: scattergram (GL versus Bp) between Kerma, aurochs and domestic cattle from Manching (Iron Age).

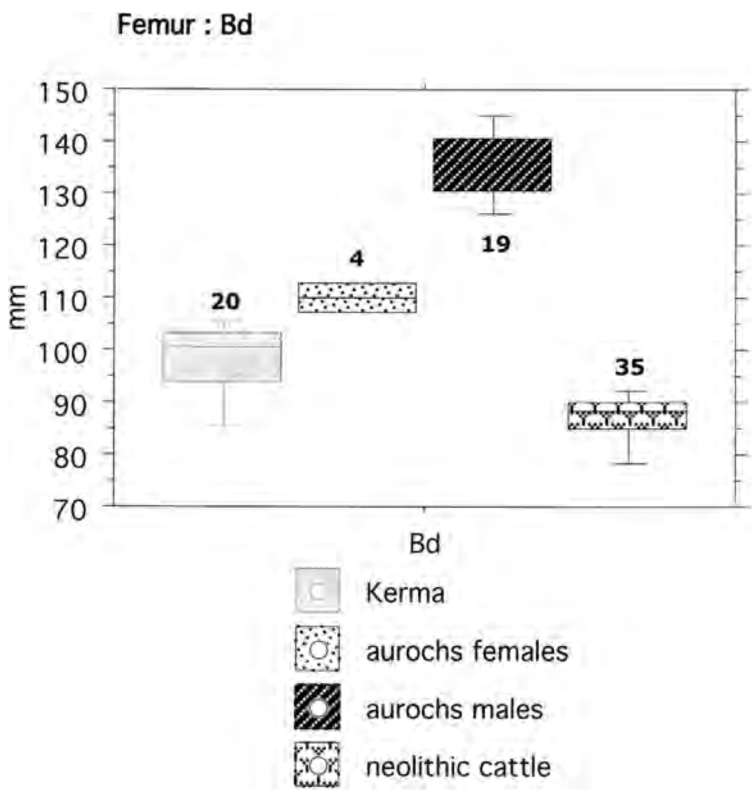


Fig. 31: Femur: comparative box-plots of the distal breadth (Bd) between Kerma, European aurochs and Neolithic cattle.

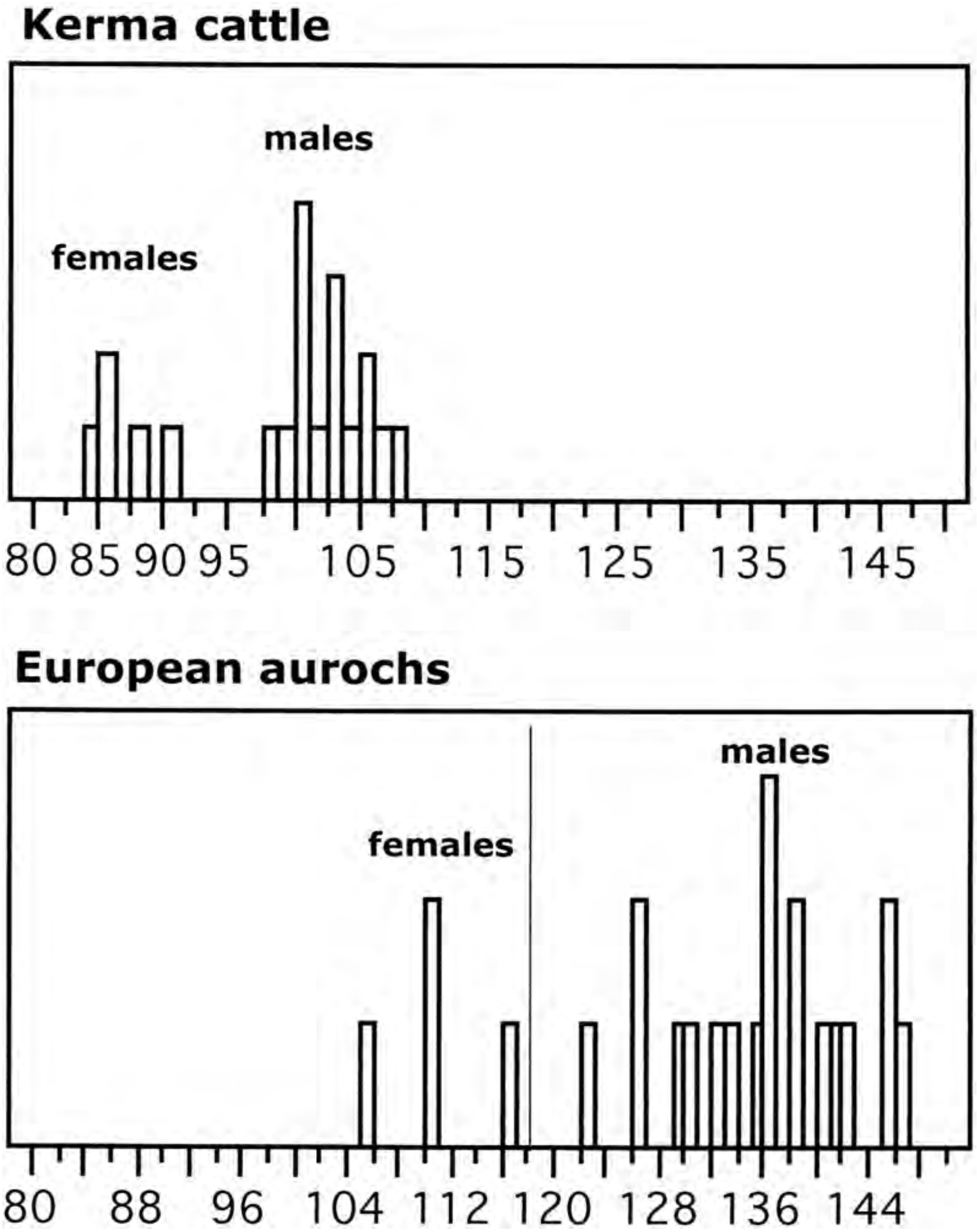


Fig. 32: Femur: comparative distribution of the distal breadth (Bd) between sexes in Kerma and amongst European aurochs.

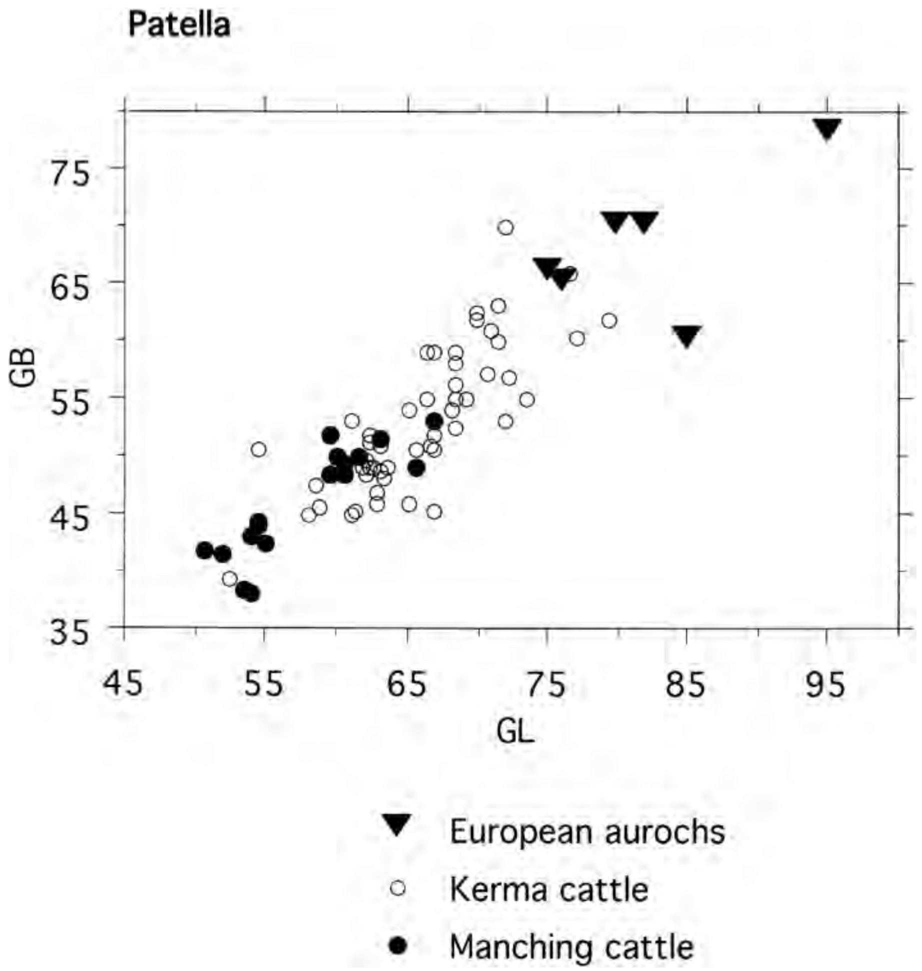


Fig. 33: Patella: scattergram (GL versus GB) between Kerma, European aurochs and Iron Age cattle.

pendix 1, Table 34 and Appendix 2, Table 20 and 21 respectively. From the scatter diagram illustrating a combination of the two main measurements (GL and GB) (Fig. 33) it can be seen that patellae from Kerma cattle occupy an intermediate position. The positioning of some of the patellar measurements within the upper size range calculated for Manching might be explained by the difficulty encountered in determining individual ages for this skeletal element. It is conceivable that some of the patellae originate from subadult individuals.

Tibia

Differential preservation of this bone explains why only a single proximal end could be measured versus 37 distal ends. Of the latter, growth plates of seven (= 18.9%) were not fused. They belong to subadult animals less than 2.5 years of age. There is no significant difference between the tibial size of adults and subadults. Osteometrical data and statistical parameters are presented in Appendix 1, Table 35 and Appendix 2, Table 22, respectively.

In Figure 34 the distal breadth (Bd) of the tibia from African and European aurochs, Neolithic European cattle and prehistoric and modern cattle inhabiting the area of Kerma are compared. The cattle from ancient Kerma are decidedly smaller that the European and African aurochs, but on average larger than their European Neolithic relatives. Size differences between ancient and modern Kerma cattle are minimal. A scatter diagram plotting tibial distal breadth (Bd) against distal depth (Dd) shows that all fossil and most of the modern specimens from Kerma are smaller than those of African aurochs (Fig. 35). Three tibia from exceptionally large modern cattle (bulls, oxen) fall within the size range of African aurochs.

Os malleolare

A total of 82 malleolar bones were measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 36 and Appendix 2, Table 23, respectively. Comparisons with other populations are limited because of the lack of measurements for this bone documented in the literature. Figure 36 shows the results of such an approach, however, sample size in other populations is far too small to provide a basis for discussion. It is highly probable that the Kerma

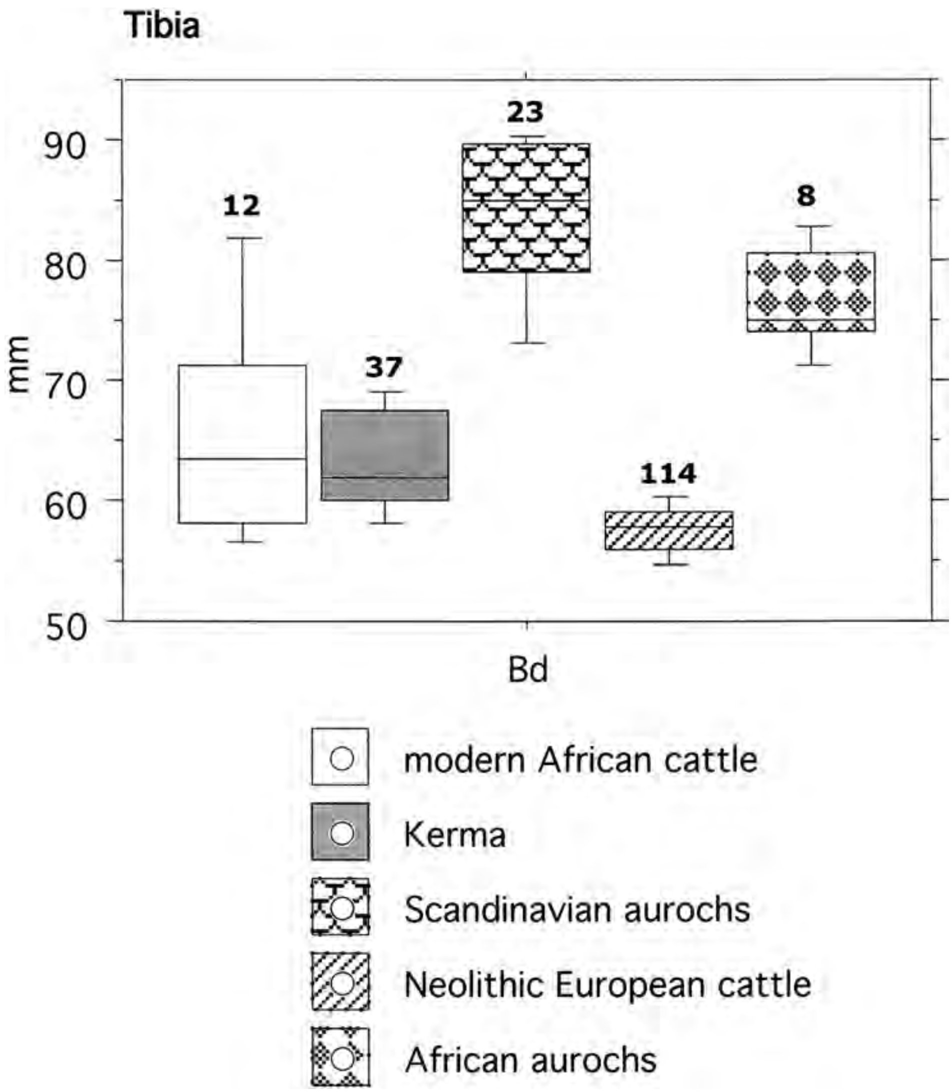


Fig. 34: Tibia: comparative box-plots of the distal breadth (Bd) between Kerma, aurochs, Neolithic cattle and modern African cattle.

sample also contained malleolar bones from younger animals.

Talus

Together with the second phalanx of the hind limb this compact bone is one of the best preserved parts of the skeleton in the assemblage studied (Tab. 1). Although a total of 230 tali could be measured, the determination of the individual age of this element proved problematic because of its short length and lack of epiphyses. A mixture of tali from subadult and adult cattle in the Kerma collection certainly exists. Tali from clearly younger (infantile and juvenile) individuals were excluded from the statistical analysis. Osteometrical data and statistical parameters are presented in Appendix 1, Table 37 and Appendix 2, Table 24 respectively.

A scatter diagram combining the greatest lateral length (GLl) and the distal breadth (Bd) shows the intermediate position of the tali from Kerma take compared to aurochs and Neolithic European domestic cattle (Fig. 37). The means for these two measurements were statistically tested. No significant differences could be found between the European and African aurochs, whereas all the other groups tested (Kerma, European Neolithic and Iron Age) differ significantly from each other. Figure 38 illustrates the results of a similar approach using the talus measurements from domestic cattle stemming from Neolithic and Predynastic Sudanese and Egyptian sites. The means for GLl and Bd are significantly different between the Kerma tali and those from Neolithic and Predynastic contexts.

Calcaneus

A total of 25 calcanei could be measured, with two of these representing subadult animals whose identification was based on the presence of an epiphyseal fusion line separating the tuber from the body of the calcaneus.

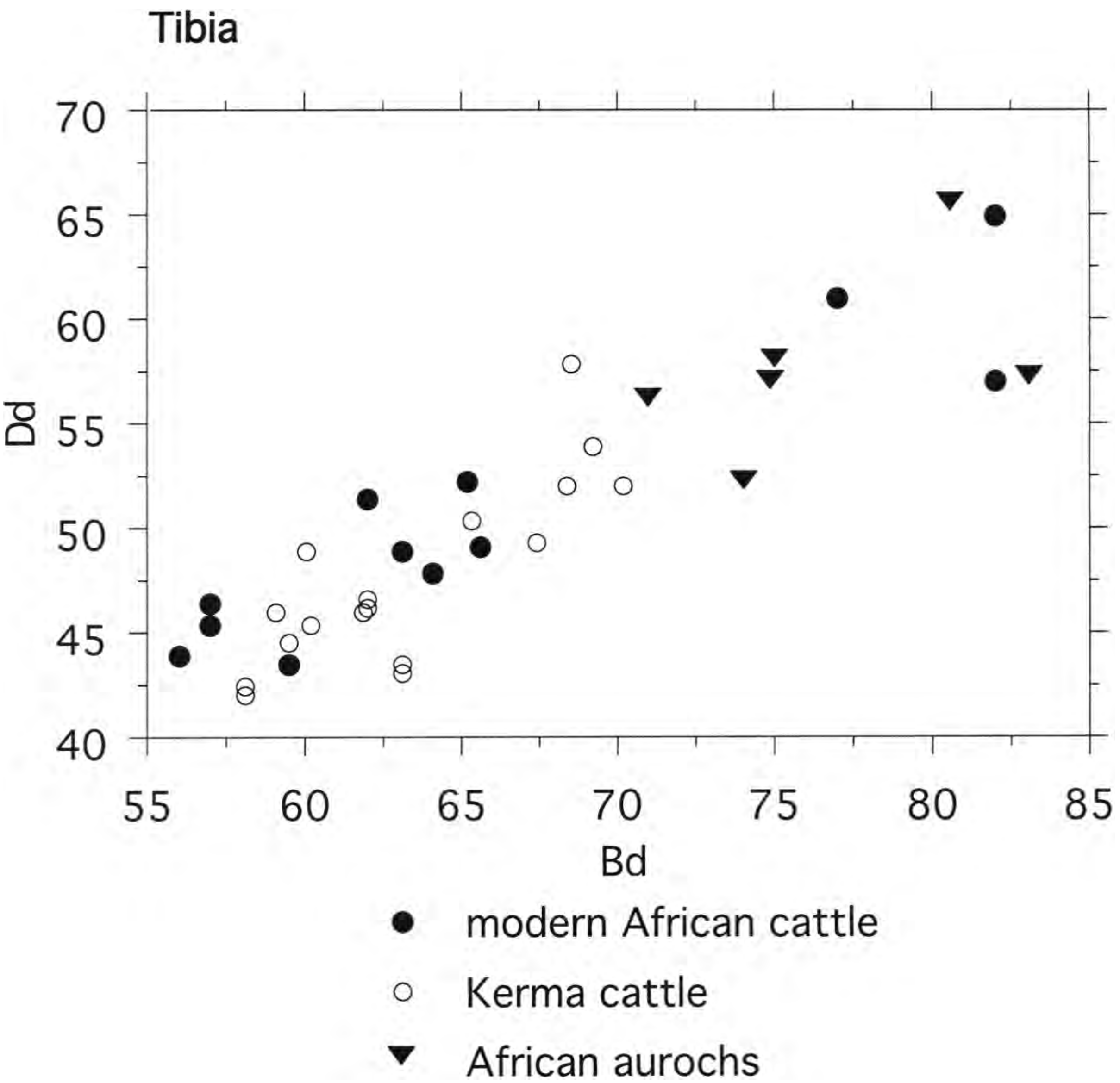


Fig. 35: Tibia: scattergram of the distal part (Bd versus Dd) showing the distribution found for Kerma compared with African aurochs and modern African cattle.

Accordingly, the majority of the specimens analyzed are assumed to be older than three years. Due this skeletal element's poor state of preservation, breadth (GB) measurements could only be taken on two occasions, whereas in all 25 cases it was possible to measure its greatest length (GL). Osteometrical data and statistical parameters are presented in Appendix 1, Table 38 and Appendix 2, Table 25 and 26, respectively.

The greatest length of the calcaneus (GL) of different domestic and wild cattle populations across North Africa and Europe were compared (Fig. 39). African domestic cattle obviously possess longer calcanei that European domestic animals. Some African specimens even fall within the lower range of the size spectrum characteristic for European female aurochs. Although there is no statistically significant difference in size between the European male aurochs and the African aurochs, a statistical difference between European male and female wild cattle was detectable. While the calcanei from Kerma and Maadi are comparative in size, the specimens collected elsewhere in Africa or in Europe differ significantly.

Interestingly, the distribution curve for the greatest length of the calcaneus taken from Kerma cattle is bimodal, which is very likely sex linked. There is a significant difference between the means of the two groups. For males (N = 8), a mean of 152.1 mm and a range of variation between 149.9 to 156.0 mm was calculated. For females (N = 17), the average for greatest length is 134.3 mm with a range of variation between 124.8 and 144.9 mm.

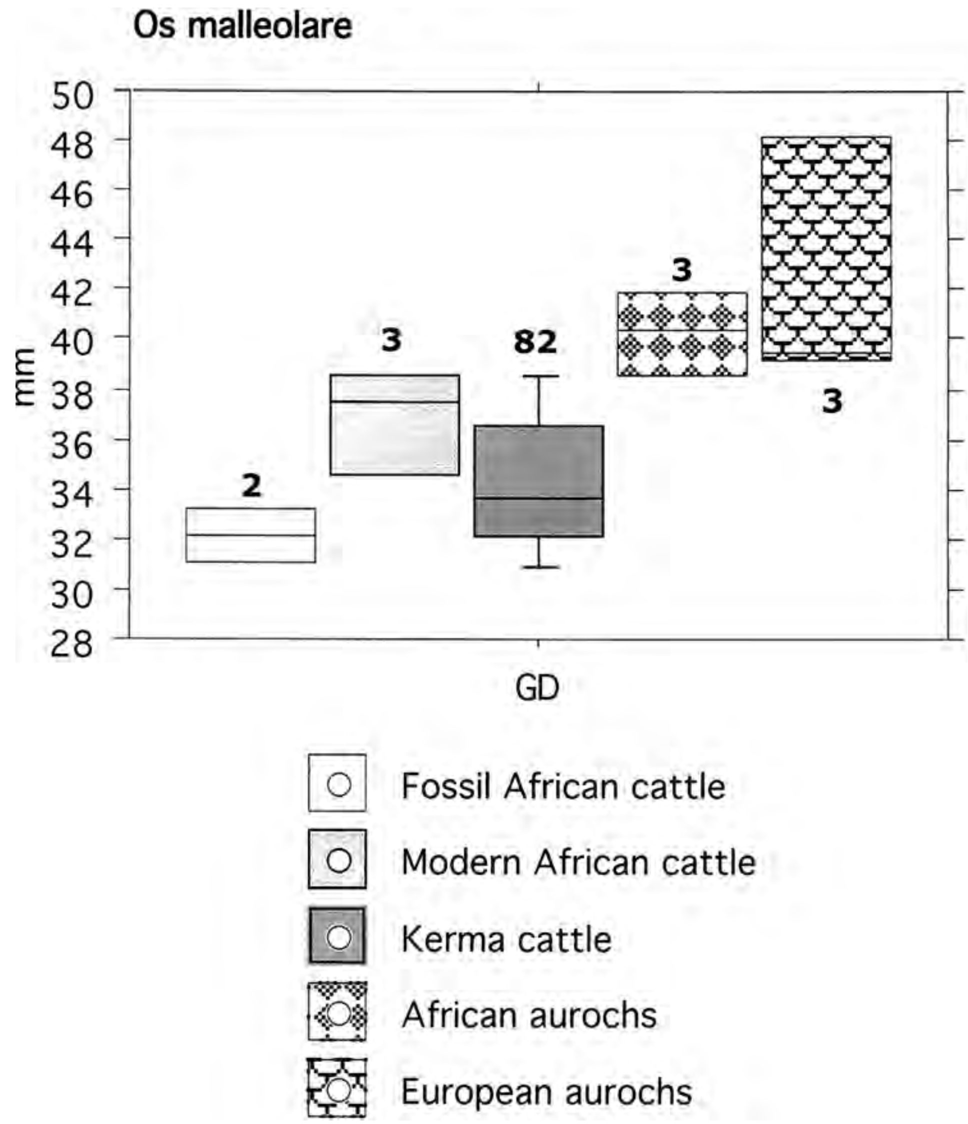


Fig. 36: Os malleolare: box-plots of the greatest diameter (GD) of fossil and modern African cattle and African and European aurochs compared with Kerma cattle.

Os centroquartale

A total of 166 bones from the assemblage were measured, illustrating the relatively good level of preservation displayed by this skeletal element. Osteometrical data and statistical parameters are presented in Appendix 1, Table 39 and Appendix 2, Table 27, respectively.

We compared the greatest breadth (GB) of the Kerma specimens with the values obtained on similar bones of European and African aurochs and also of domestic cattle of various origins (Fig. 40). The dimensions of this tarsal bone are clearly smaller in Kerma cattle than the values obtained for the aurochs. However, they closely match the values obtained in Neolithic cattle from Africa and appear even bigger than their European relatives.

As a rule, the greatest breadth (GB)-values correlate well with the sex of the animal. In the European aurochs, for example, the difference between the means for the males and females within a population are highly significant. The two groups can be distinguished from one another by analyzing this dimension's distribution for the Kerma cattle. The first group shows values that range between 48 and 58 mm, which likely represent the females (and perhaps a few young individuals), the second group exhibits values between 60 and 70 mm and probably represent the males.

Os tarsale II+III

A total of 35 specimens were retrieved and measured. Osteometrical data and statistical parameters are presented in Appendix 1, Table 40 and Appendix 2, Table 28, respectively. The lack of measurements in the literature prevented any comparative analyses with other groups.

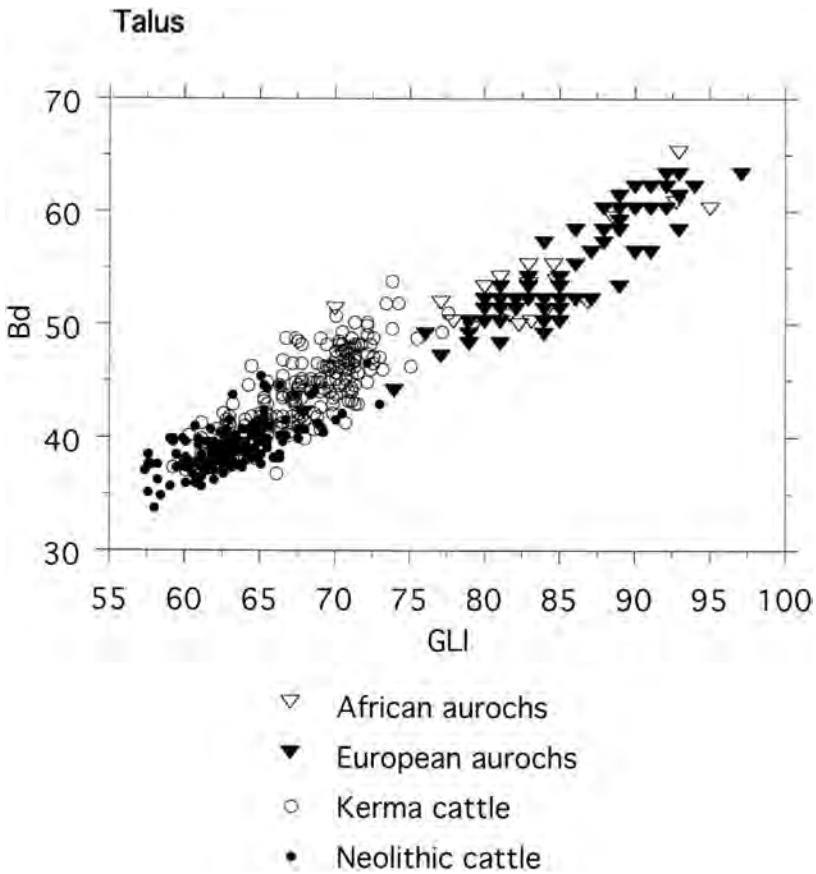


Fig. 37: Talus: scattergram (GLl versus Bd) showing the intermediate position of the bones from Kerma, between aurochs and European domestic cattle.

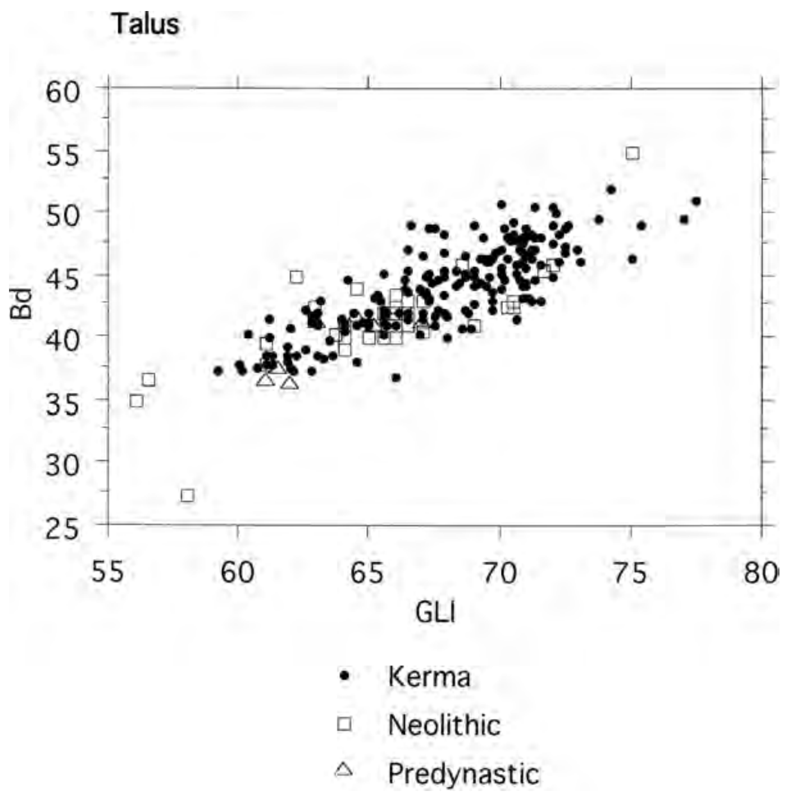


Fig. 38: Talus: Position of the tali (GLl versus Bd) from Kerma compared with examples from Sudanese and Egyptian Neolithic and Predynastic sites.

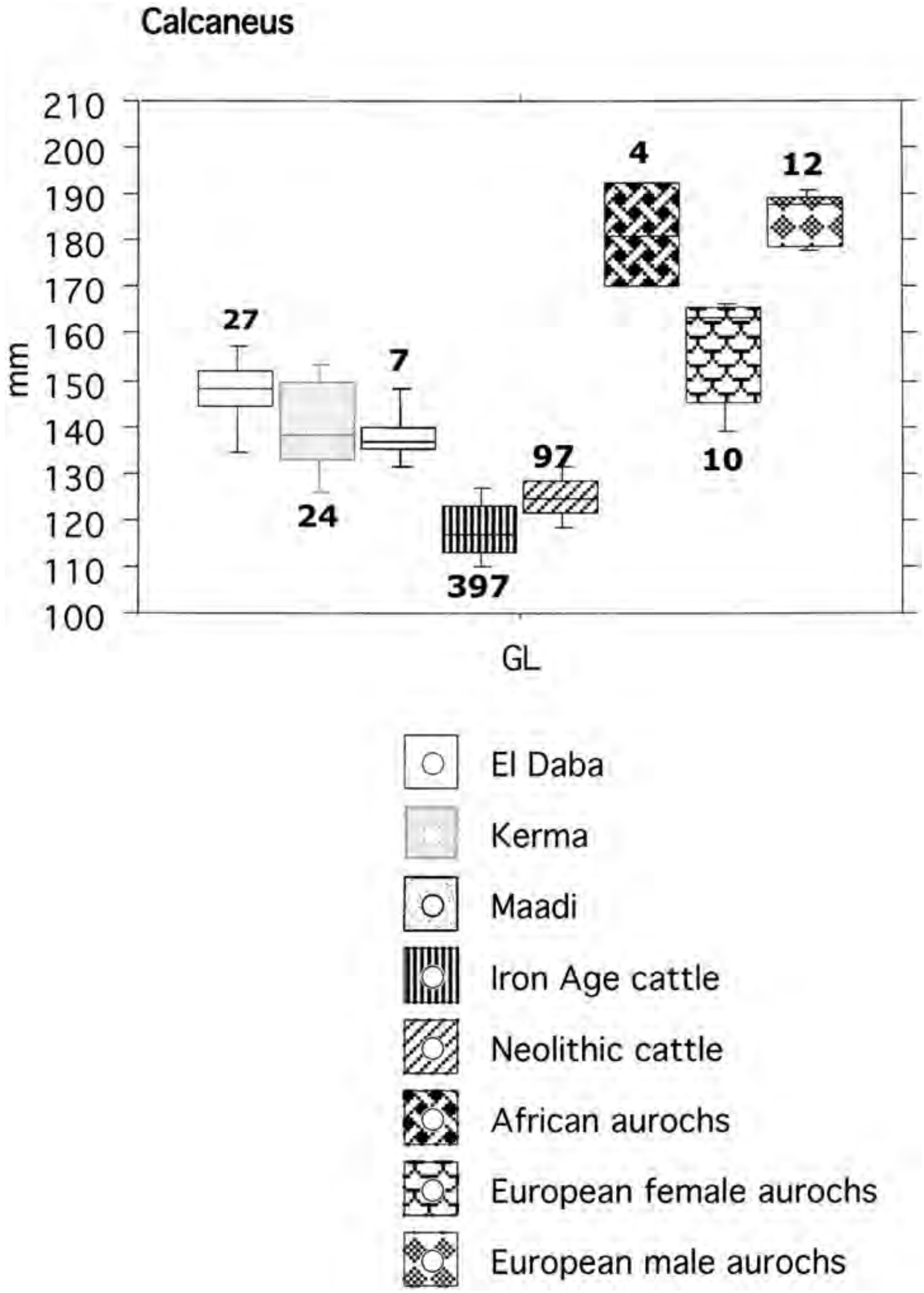


Fig. 39: Calcaneus: box-plots of the greatest length (GL) between Kerma, African and European cattle and aurochs.

Metatarsus III+IV

As in case of the metacarpals, this long bone was systematically split down the sagittal plane during carcass processing (cf. Fig. 23), which explains why only one single complete metatarsus was discovered in the settlement debris of the ancient town. Fourteen proximal and 31 distal ends were measured. This difference is probably due to the technique of splitting employed, which caused damage to the proximal extremity more often than distally. Osteometrical data and statistical parameters are presented in Appendix 1, Table 41 and Appendix 2, Table 29, respectively.

Based on the slenderness of its structure (Bd/GL and SD/GL), the single complete metatarsal recovered at Kerma was identified as belonging to a female. The withers height was calculated using coefficients proposed by Boessneck (1956), Zalkin (1960), Fock (1966), and Matolcsi (1970). The estimated stature of the animal is 1.39 m (1.36-1.45m), which indicates a large individual.

The measurements and the robusticity indexes are compared to similar data sets from aurochs, modern African cattle and prehistoric domestic cattle (Fig. 41). Figure 41 illustrates that fossil metatarsal from Kerma closely

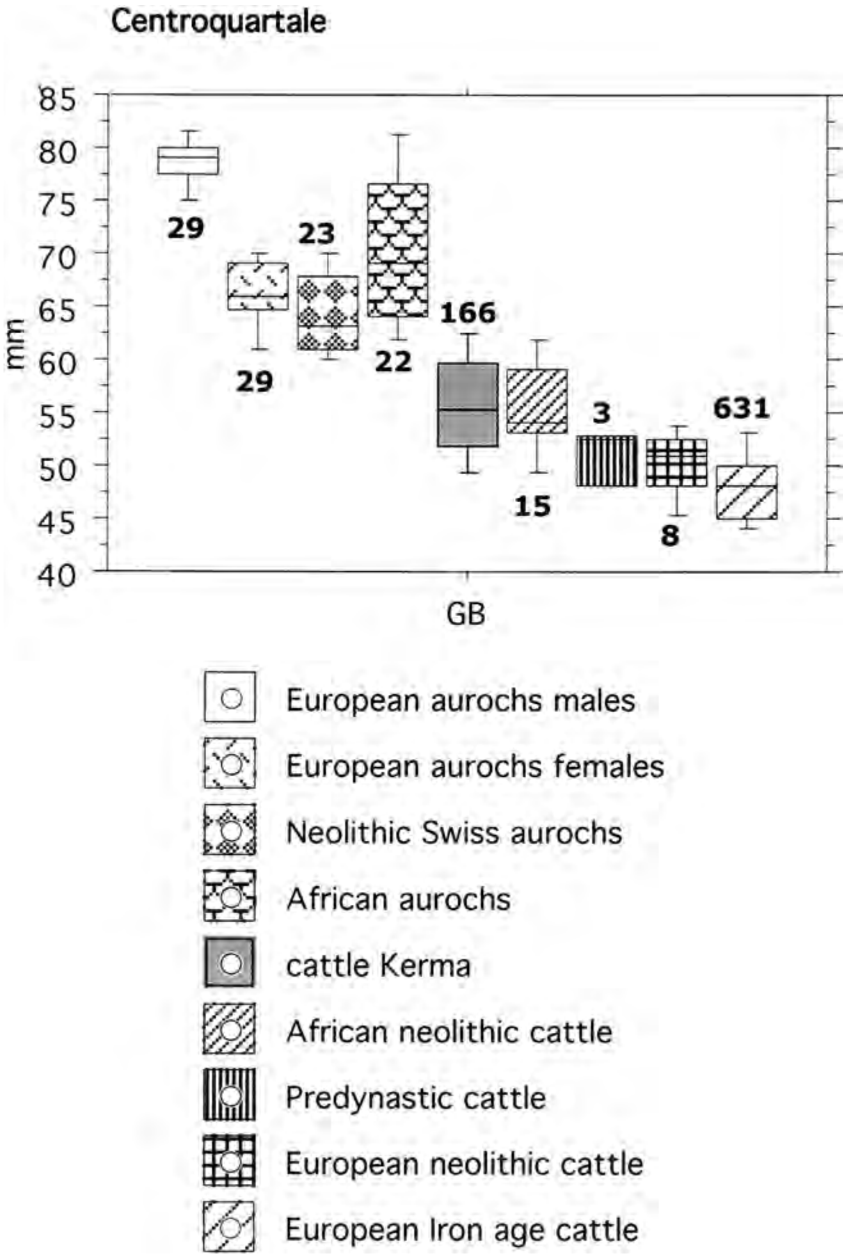


Fig. 40: Os centroquartale: box-plots of the greatest diameter (GB) of aurochs and various domestic cattle compared with Kerma.

match the modern Kerma cattle in size and proportions. Its structure is clearly more slender compared to metatarsals from other domestic breeds, extant and fossil. A similar observation is made when comparing metapodials of Kerma sheep with those in fossil African and European breeds (Chaix & Grant 1987). This pronounced slenderness probably represents an adaptation to the type of soil but also to the local climate.

If the metatarsal proximal and distal extremity dimensions are compared with those measured in different *Bos* populations (Fig. 42), the gracility of the Kerma bones once more becomes readily apparent.

Posterior first phalanx

According to the criteria proposed by Dottrens (1946), a total of 104 bones were identified as belonging to the hind limb. This skeletal element is less well represented in the assemblage than its fore limb counterpart (N = 189). Osteometrical data and statistical parameters are presented in Appendix 1, Table 42 and Appendix 2, Table 30, respectively.

Four measurements (GLpe, BD, SD and Bd) were taken on each specimen and compared with similar data obtained from different *Bos* populations (Fig. 43). Figure 43 reveals a close similarity in size and proportions be-

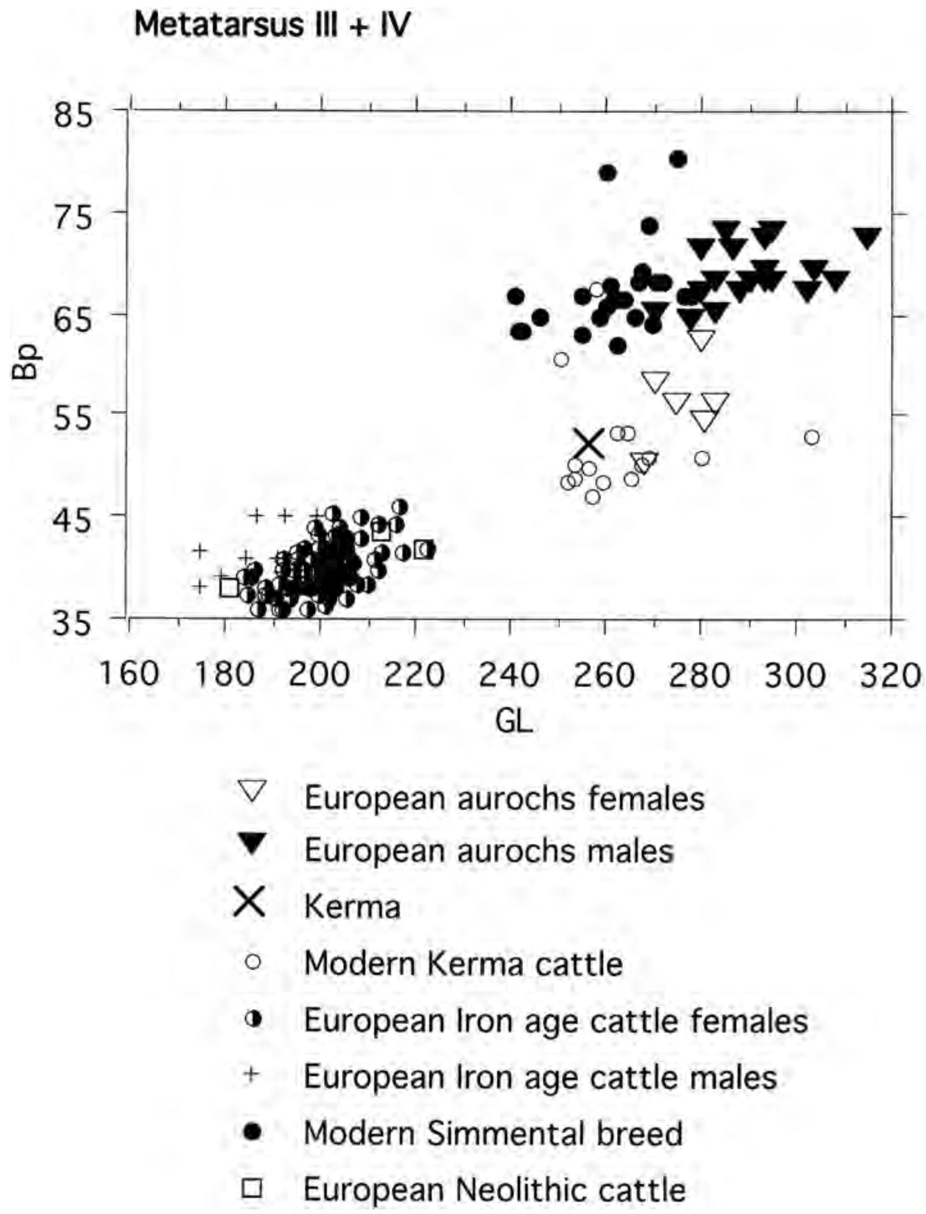


Fig. 41: Metatarsus III + IV: scattergram (GL versus Bp) showing the position of Kerma amongst different wild and domestic cattle.

tween the ancient and modern cattle living in the Kerma area. A statistical analysis of the GLpe between the cattle from Kerma and all other groups showed that their means differ significantly. Relative to the measurements Bp, SD, and Bd, the means calculated for ancient and modern Kerma cattle and African Neolithic cattle (Merimde) do not differ. However, this group differs significantly from African aurochs and the Predynastic cattle from Adaïma.

Posterior second phalanx

Based on features described by Dottrens (1946), a total of 235 specimens could be classified as second phalanges from the hind limb. Posterior second phalanges outnumber those from anterior (N = 169) by a substantial margin. Osteometrical data and statistical parameters are presented in Appendix 1, Table 43 and Appendix 2, Table 31 respectively.

Figure 44 illustrates the size variation for the posterior second phalanx in different samples of domestic and wild cattle. Based on a statistical analysis of the greatest length (GL), we noted that the means between aurochs and a group of domestic cattle encompassing the fossil and modern animals from Kerma and the Neolithic cattle from Merimde differ significantly. The Predynastic cattle from Adaïma and the European Iron Age breed are statistically different from the two groups mentioned beforehand. On average, the posterior second phalanges of European Iron Age cattle are decidedly shorter than their homologues in the other *Bos* populations (Fig. 45).

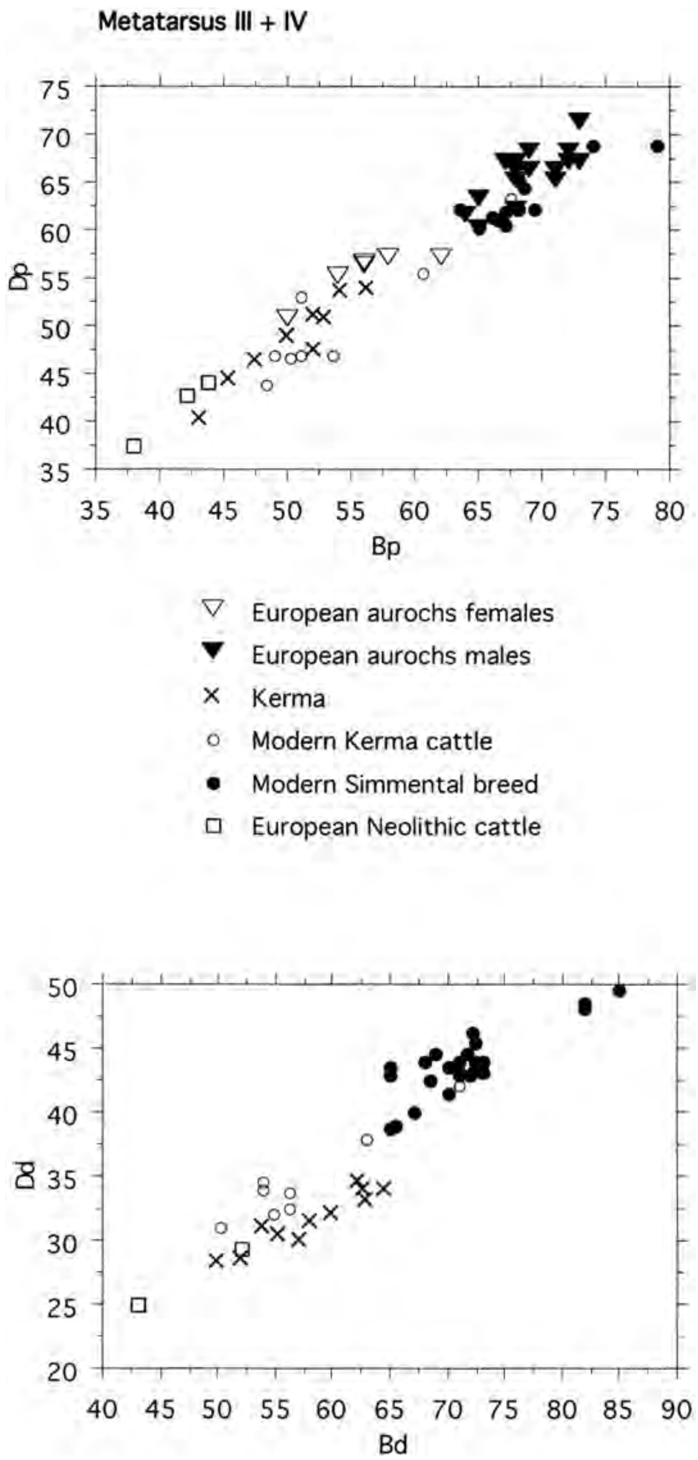


Fig. 42: Metatarsus III + IV: scattergram of the proximal (BP versus Dp) and distal (Bd versus Dd) parts of the metatarsal. Note the intermediate position of the bones from Kerma.

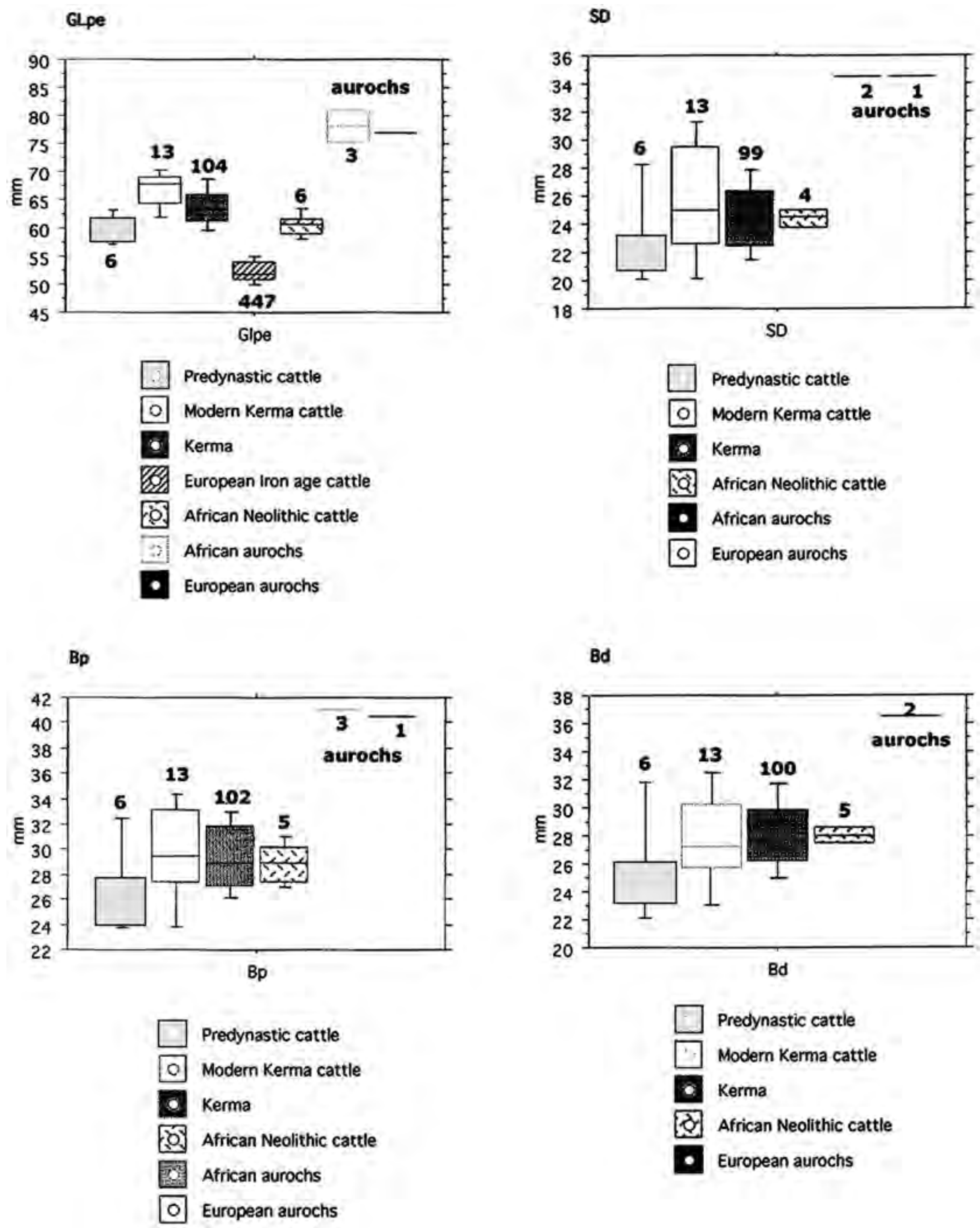


Fig. 43: First posterior phalanx: comparative box-plots of the four measurements.

With respect to the greatest proximal breadth (Bp) and smallest breadth of the diaphysis (SD), a more or less similar situation is observable, indicating a significant difference between African cattle and European aurochs on the one hand and Iron Age cattle on the other hand. Unfortunately, the distal breadth (Bd) was not always recorded. The African domestic cattle samples compared within the scope of this study, however, did not reveal any diachronic statistical differences.

Figure 45 again shows the robusticity of some of the phalanges collected in ancient Kerma, with some specimens even exceeding dimensions recorded for wild cattle. The aurochs considered here was indigenous to Neolithic Switzerland, and is clearly smaller than its contemporaneous Scandinavian relatives. In a study conducted by Degerbøl and Fredskild (1970), no distinction was made between phalanges from the fore and the hind limbs, which is the reason why they are missing from Figure 45. The other specimens included in the graph originate from Pleistocene and Holocene African sites (Linseele 2004).

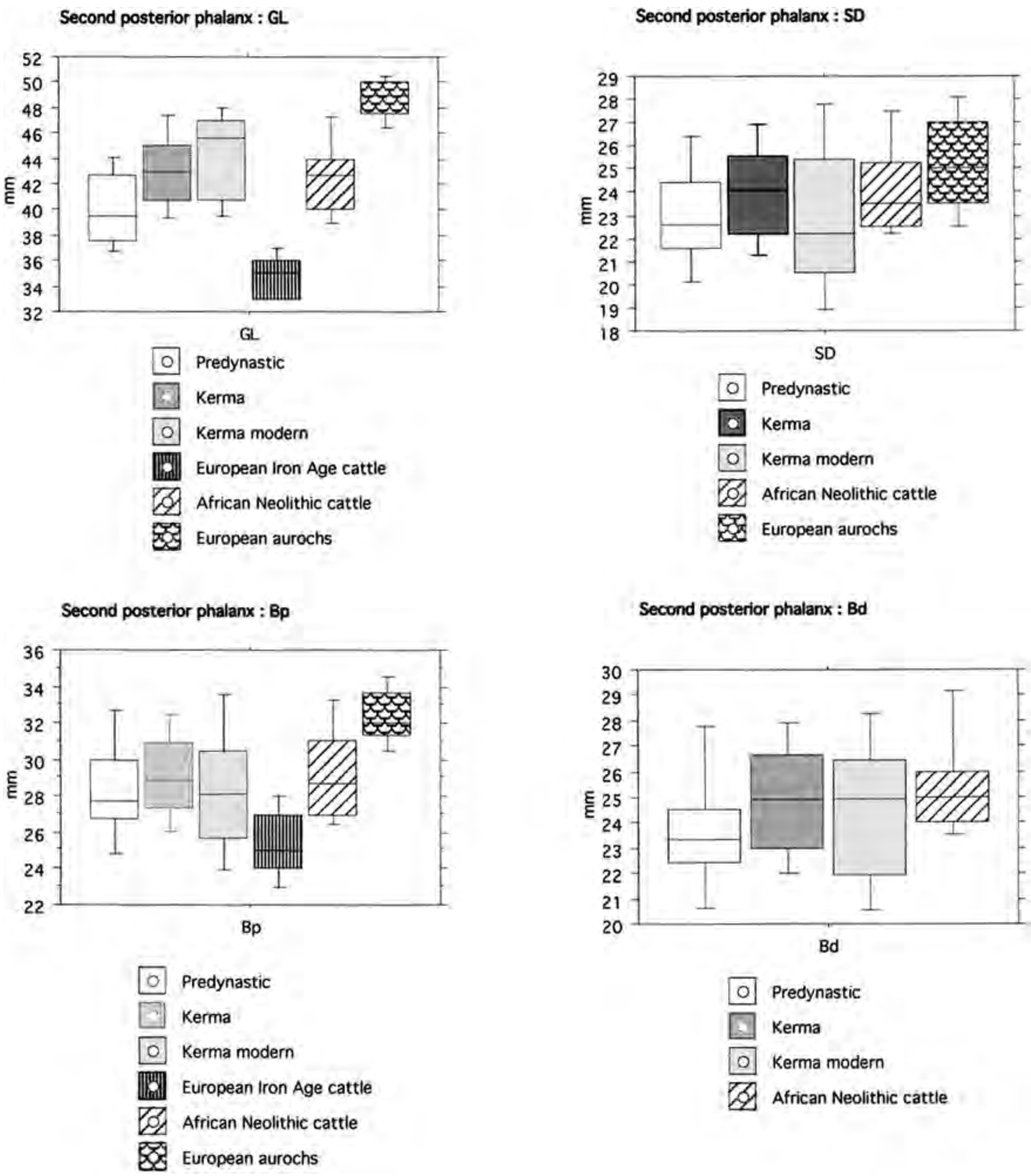


Fig. 44: Second posterior phalanx: comparative box-plots of the four measurements.

Third phalanx

As already mentioned before, we did not distinguish fore and hind in the third phalanges. The number of specimens measured totals 125. The mainly cancellous nature of the bone explains the relatively poor level of preservation witnessed in this skeletal element. It is very difficult or even impossible to estimate their individual age on the based solely on bone texture and in the absence of any epiphyses. Osteometrical data and statistical parameters are presented in Appendix 1, Table 44 and Appendix 2, Table 32, respectively. The high values for standard deviation result from the mixing of anterior and posterior phalanges stemming from animals of varying age groups (juvenile, subadult, adult, senile).

Figure 46 shows the distribution of the diagonal length of the sole (DLS). With respect to size, the Kerma specimens show overlap well with European Neolithic cattle but differ significantly from the African and European aurochs.

Conclusions

The site of Kerma produced a large assemblage of bones from domestic cattle. The finds originate either from ancient Kerma, representing remains of human alimentation, or from the cemetery, where the ritual deposition of cattle bucrania was regularly practiced. These elements provide valuable insight to the morphology of the

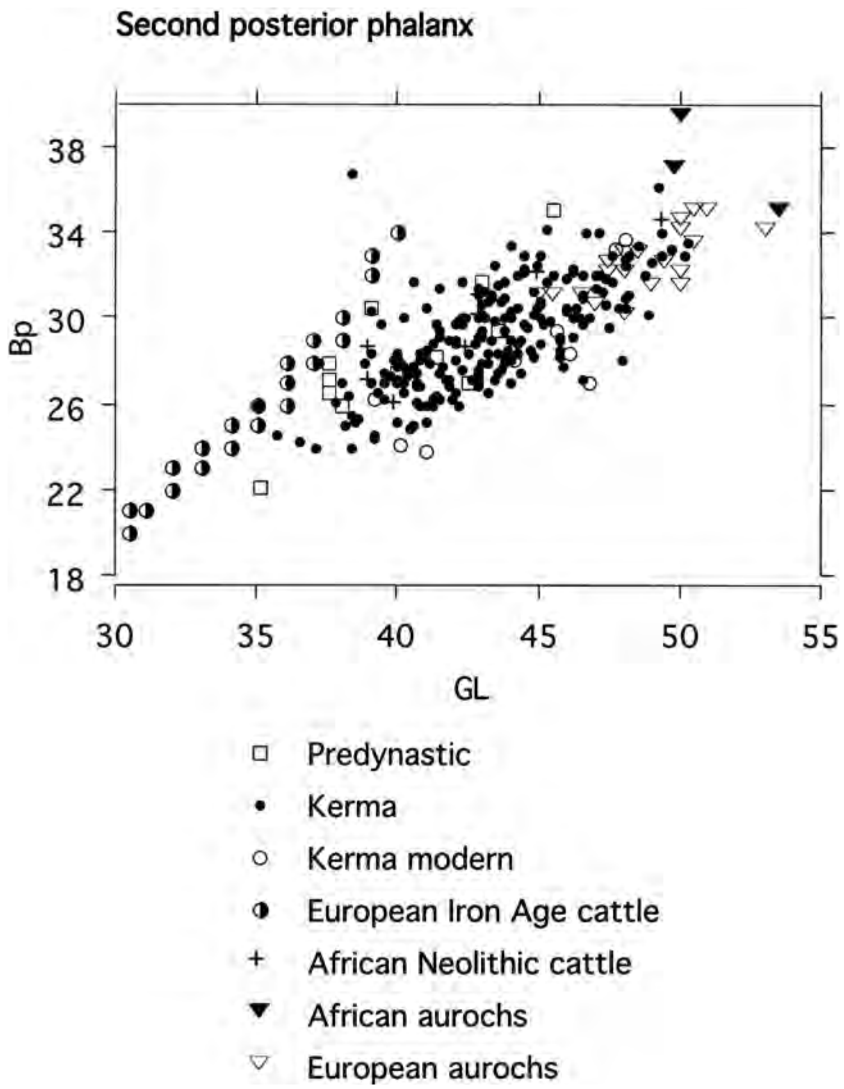


Fig. 45: Second posterior phalanx: scattergram (GL versus Bd) showing the position of Kerma cattle amongst different wild and domestic bovines.

cattle skeleton as well as the dimensions these bovines inhabiting the northern Sudan between 2050 and 1750 years BC exhibited.

Kerma cattle predominantly possessed a strong build reaching an average stature of *c*. 1.40 m. Their horn core size indicate a long-horned type very similar to the animals found in Saqqarah or Abusir (Lortet & Gaillard 1903) and also like cattle breeds recorded from Northeast Africa's historical past (Ghoneim 1977; Boessneck 1988).

The aim of this study was to present a large corpus of hitherto unpublished data on cattle breed(s) inhabiting Northeast Africa during the first half of the 2nd millennium BC. This unique set of data contributes significantly to our knowledge concerning the size, proportions and stature of prehistoric cattle, conceivably the most important domestic species in this part of Africa, not only from an economical but also from a religious standpoint.

Bibliography

Arbogast R.M., 1997.
La grande faune de Chalain 3. In: Pétrequin P. (dir.), *Les sites littoraux néolithiques de Clairvaux-les-Lacs et de Chalain (Jura).* III. Chalain station 3, 3200-2900 av. J.-C., vol. 2: 641-691. Paris: Maison des Sciences de l'Homme.

Becker C. & Johansson F., 1981.
Die neolithischen Ufersiedlungen von Twann. Band 11. Tierknochenfunde. Zweiter Bericht. Mittleres und oberes Schichtpaket (MS und OS) der Cortaillod –Kultur (Ergänzung zur Publikation). Bern: Staatlicher Lehrmittelverlag.

Boessneck J., 1956.
Ein Beitrag zur Errechnung der Widerristhöhe nach Metapodienmaßen bei Rindern. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* **68**: 75-90.

Boessneck J., 1988.
Die Tierwelt des Alten Ägypten. München: C.H. Beck Verlag.

Boessneck J., Jéquier J.-P. & Stampfli H.R., 1963.
Seeberg-Burgäschisee-Süd – Die Tierreste. Acta Bernensia II, 3.

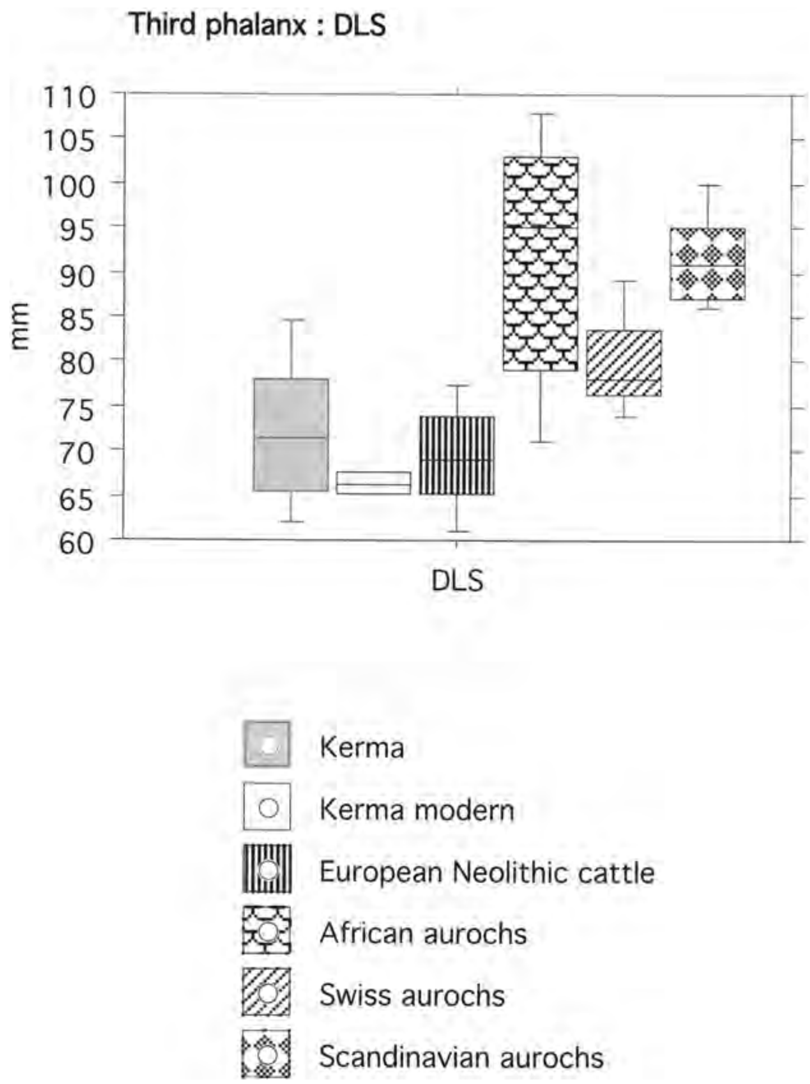


Fig. 46: Third phalanx: box-plots of the greatest diagonal length of the sole (DLS).

Boessneck J., Driesch A. von den, Meyer-Lemppenau U. & Wechsler-von Ohlen E., 1971.
Die Tierknochen aus dem Oppidum von Manching. Die Ausgrabungen in Manching 6. Wiesbaden : Franz Steiner Verlag.

Boessneck J., Driesch A. von den & Ziegler R., 1989.
Die Tierreste von Maadi und Wadi Digla. In: Rizkana I. & Seeher J. (Hrsg.), *Maadi III. The non-lithic small finds and the structural remains of the Predynastic settlement*: 87-128. Mainz am Rhein: von Zabern.

Boessneck J. & Driesch A. von den, 1992.
Tell El-Dab'a VII. Tiere und historische Umwelt im Nordost-Delta im 2 Jahrtausend v. Chr. anhand der Knochenfunde der Ausgrabungen 1975-1986. Wien: Österreichische Akademie der Wissenschaften, Denkschriften der Gesamtakademie, Band XI.

Bonnet C., 2000.
Edifices et rites funéraires à Kerma. Paris: Errance.

Bonnet C., 2004a.
The Kerma culture. In: Welsby D.A. & Anderson J.R. (eds), *Sudan, Ancient treasures. An exhibition of recent discoveries from the Sudan National Museum*: 70-89. London: The British Museum Press.

Bonnet C., 2004b.
Le temple principal de la ville de Kerma et son quartier religieux. Paris: Errance.

Chaix L., 1988.
Le monde animal à Kerma (Soudan). *Sahara* **2**: 77-84.

Chaix L., 1993.
The archaeozoology of Kerma (Sudan). In: Davies W.V. & Walker R. (eds), *Biological anthropology and the study of Ancient Egypt*: 175-185. London: British Museum Press.

Chaix L., 1994a.
Das Rind: eine wichtige und allgegenwärtige Komponente der Kerma-Kultur (N. Sudan, zwischen 3000-1500 v. Chr.). *Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg* **53**: 163-167.

Chaix L., 1994b.
Nouvelles données de l'archéozoologie au nord du Soudan. Hommages au Professeur J. Leclant. *Bibliothèque d'Etudes*, IFAO, volume 2: Nubie, Soudan, Ethiopie, **106** (2): 105-110.

Chaix L., 2001.
Animals as symbols: the bucrania of the grave KN 24 (Kerma, North-

ern Sudan). In: Buitenhuis H. & Prummel W. (eds), *Animals and man in the past. Essays in honour of Dr. A. T. Clason emeritus professor of archaeozoology*: 364-370. Groningen: ARC Publicatie 41.

Chaix L., 2004.
Déformations anciennes et actuelles du cornage bovin en Afrique du Nord-Est. In: *Elevage d'hier et d'aujourd'hui. Mélanges d'Ethnozootechnie offerts à Bernard Denis* : 21-32. Rennes: Presses Universitaires de Rennes.

Chaix L. & Grant A., 1987.
A study of a prehistoric population of sheep (*Ovis aries* L.) from Kerma (Sudan) - Archaeozoological and archaeological implications. *Archaeozoologia* **1**,1: 77-92.

Chaix L. & Grant A., 1992.
Cattle in Ancient Nubia. *Anthropozoologica* **16**: 61-66.

Degerbøl M. & Fredskild B., 1970.
The Urus (*Bos primigenius* BOJANUS) and Neolithic domesticated cattle (*Bos taurus domesticus* LINNE) in Denmark. *Dat Kongelige Danske Videnskabernes Selskab*, Biologiske Skrifter **17**, 1.

Dottrens E., 1946.
I. Etude préliminaire : les phalanges osseuses de *Bos taurus domesticus. Revue Suisse de Zoologie* **53**(33): 739-774.

Driesch A. von den, 1976.
A guide to the measurement of animal bones from archaeological sites. Harvard University MA, Peabody Museum Bulletin **1**.

Driesch A. von den & Boessneck J., 1985.
Die Tierknochenfunde aus der neolithischen Siedlung von Merimde-Benisalâme im westlichem Nildelta. München: Uni-Druck.

Fock J., 1966.
Metrische Untersuchungen an Metapodien einiger europäischer Rinderrassen. Diss. med. vet., München.

Ghoneim W., 1977.
Die ökonomische Bedeutung des Rindes im Alten Ägypten. Bonn: Habelt.

Guintard C., 1999.
On the size of the ure-ox or the aurochs (*Bos primigenius* Bojanus, 1827). In: Weniger G.C. (ed), *Archaeology and biology of the aurochs*: 7-21. Wissenschaftliche Schriften des Neanderthal Museums 1.

Higham C.F.W., 1969.
The metrical attributes of two samples of bovine limb bones. *Journal of Zoology London* **157**: 63-74.

Howard M.M., 1963.
The metrical determination of the metapodials and skull of cattle. In: Mourant A. & Zeuner F.E. (eds), *Man and cattle*: 91-100. *Royal Anthropological Institute, Occasional Paper* 18.

Linseele V., 2004.
Size and size change of the African aurochs during the Pleistocene and Holocene. *Journal of African Archaeology* **2**(2): 165-185.

Lortet L.C. & Gaillard C., 1903.
La faune momifiée de l'Ancienne Egypte. *Archives du Muséum d'Histoire Naturelle de Lyon* **8**, Mémoire 2: 1-206.

Matolcsi J., 1970.
Historische Erforschung der Körpergröße des Rindes auf Grund von ungarischem Knochenmaterial. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* **87**: 89-137.

Meadow R.H., 1999.
The use of size index scaling techniques for research on archaeozoological collections from the Middle East. In: Becker C., Manhart H., Peters J. & Schibler J. (eds), *Historia animalium ex ossibus. Festschrift für Angela von den Driesch.* Rahden/Westfalen: Marie Leidorf: 285-300.

Peters J., 1986.
Bijdrage tot de Archeozoölogie van Soedan en Egypte. Doktoraat in de Wetenschappen (groep Dierkunde). Gent, Rijksuniversiteit Gent.

Peters J., 1987.
Cuboscaphoids, naviculo-cuboids, language barriers and the use of standardised osteological nomenclatures in archaeozoological studies. *Archaeozoologia* **I**(2): 43-46.

Pöllath N. & Peters J., 2005.
On the possible use of the LSI scaling technique for stature analysis in cattle. *Revue de Paléobiologie*, Genève, Special Vol. **10:** 225-235.

Reisner G.A., 1923a.
Excavations at Kerma. Parts I-III. Cambridge, Harvard African Studies 5.

Reisner G.A., 1923b.
Excavations at Kerma. Parts IV-V. Cambridge, Harvard African Studies 6.

Stampfli H.R., 1976.
Osteo-archaeologische Untersuchung des Tierknochenmaterials der spätneolithischen Ufersiedlung Auvernier La Saunerie nach den Grabungen 1964 und 1965. Solothurn.

Van Neer W., 2002.
Le matériel faunique. In: Midant-Reynes B. & Buchez N. (éds), *Adaïma. 1. Economie et habitat*: 521-565. Le Caire: IFAO, Fouilles de l'IFAO 45.

Zalkin V.I., 1960.
Die Variation der Metapodien und ihre Bedeutung für die Erforschung des Rindes in der Frühgeschichte. *Bull. der Moskauer Gesellschaft der Naturforscher, Abt. Biologie* **65**: 109-126.

Appendix 1:
Individual measurements of the different skeletal elements

GRAVE 115 - Bucrania				
1	**2**	**3**	**4**	**5**
119,5		62,5	57,5	154,5
133,5				139,5
137,5	180,0	65,5	54,5	151,5
139,5	171,0	60,5	53,5	166,5
145,5		76,5		149,5
147,5	166,0	57,5	53,5	158,5
147,5	182,0	61,5	56,5	162,5
151,5				166,5
151,5	196,0	68,5	59,5	164,5
154,5	193,0	67,5	58,5	161,5
154,5	195,0	68,5	55,5	168,5
154,5	165,0	55,5	48,5	158,5
155,5	192,0	68,5	55,5	155,5
156,5				164,5
156,5	200,0	72,5	60,5	171,5
157,5	175,0	62,5	51,5	162,5
157,5				175,5
157,5		66,5	53,5	158,5
159,0	174,0	61,5	51,5	190,5
159,5		68,5	58,5	164,5
161,5	180,0	62,5	55,5	161,5
161,5		71,5	48,5	181,5
162,5		56,5		161,5
162,5	167,0	59,5	52,5	160,5
164,5	165,0	56,5	49,0	161,5
164,5	152,0	54,5	44,5	163,5
165,5	175,0	58,5	54,5	167,5
165,5	168,0	63,5	50,5	165,5
165,5	260,0	94,5	77,5	192,5
166,5	165,0	59,5	52,5	167,5
166,5	258,0	90,5	72,5	154,5
169,5	175,0	57,5	55,5	131,5
169,5	260,0	104,5	74,5	194,5
170,5				121,5
171,5				193,5
172,5				164,5
174,5	171,0	60,5	51,5	154,5
174,5	235,0	86,5	67,5	176,5
175,5	215,0	79,5	59,5	186,5
175,5				189,5
184,5		71,5		174,5
186,5	240,0	86,5	64,5	161,5
186,5				190,5
199,5		79,5		186,5
214,5				181,5
216,5				175,5

Table 1

GRAVE 119 - Bucrania					
1	**2**	**3**	**4**	**5**	**8**
132,0	175,0	59,5	49,5	156	570
135,0	170,0	55,4	52,4	154	
140,0				154	
145,0	175,0	49,5	45,0		506
145,0	178,0	57,5	50,0	147	520
146,0	150,5	53,0	47,0	153	
150,0	203,0	67,0	56,0	168	600
151,0	165,0	56,0	50,0	147	505
152,0	193,0	66,0	56,0	178	
153,0	173,0	54,0	52,0	157	580
154,0		65,0	48,0	162	
156,0	165,0	60,0	46,0	161	602
157,0	140,5	47,3	43,0	153	
157,0	160,0	53,5	47,0	154	
159,0	144,5	47,5	45,0		
161,0	170,0	57,5	53,0	170	
164,0	170,0	56,0	52,0	159	
169,0	240,0	79,0	71,0	174	
172,0	175,0	57,0	49,0	157	
176,0	174,0	54,0	51,0	163	610
176,0	170,0	55,0	51,0	159	
180,0	250,0	75,0	66,0	187	
182,0	175,0	57,5	54,0	172	
187,0	290,0	87,0	74,0	195	
200,0	225,0	78,0	63,0	164	
	190,0	63,0	57,0		580

Table 2

GRAVE 156 - Bucrania					
1	**2**	**3**	**4**	**5**	**8**
130,0	200,0	67,0	55,0		500
130,0	173,0	79,0	49,0	115	380
148,0	210,0	71,0	61,0	114	
150,0	195,0	66,0	55,5	120	550
150,0	265,0	88,0	76,0		800
160,0		67,0			580
160,0					900
160,0		82,0			
160,0	240,0	72,0	70,0	140	
160,0	190,0	62,0	55,0	120	615
160,0	275,0	95,0	80,0	180	830
160,0	175,0	60,0	51,0		660
165,0	190,0	65,0	57,0	130	800
170,0	190,0	63,0	56,0	132	
170,0	195,0	64,0	58,5	140	700
170,0	215,0	74,0	63,0		
170,0	215,0	72,0	61,0	145	400
170,0	260,0	91,0	65,0		640
170,0	225,0	76,0	60,0		800
170,0	240,0	80,0	72,0	160	630
175,0	250,0	83,5	70,0		750
175,0	240,0	78,0	71,0	155	750
175,0	210,0	72,0	61,0		730
180,0	240,0	82,0	72,0	140	
200,0	170,0	54,5	49,5		
	270,0	90,0	80,0		1000
	170,0	60,0	47,0		
	225,0	74,0	67,0		1460
	145,0	46,0	44,0		
	260,0	85,0	83,0		
	150,0	49,0	43,5		

Table 3

1 = Least breadth between bases of horncores
2 = Horn core basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth

GRAVE 175 - Bucrania					
1	**2**	**3**	**4**	**6**	**8**
115	120	39,0	36,0		480
135	215	70,0	64,0	130	600
135	185	64,0	52,0	111	600
138	170	54,0	50,0	111	610
139	180	60,0	53,0	110	
140	163	52,0	49,5	108	530
140	173	59,0	51,0	124	770
145	215	71,0	62,0	98	600
145	200	67,0	59,5		
145	180	61,0	50,0		540
150	155	49,0	47,0		560
150	200	67,0	59,0		700
150	170	57,0	51,5	105	600
155	187	61,0	57,0	118	520
155	180	62,0	52,0		680
155	175	59,5	50,0	120	630
155	170	58,0	49,0	116	560
157	175	58,5	51,0	109	540
160	181	61,5	52,5	126	
160	190	63,0	57,0		540
160	200	70,0	57,0	150	700
160	190	63,0	54,0	109	680
160	180	60,0	49,0	95	420
170	190	60,0	53,0	123	600
170	230	76,0	69,0	144	580
175	200	65,0	59,0	110	940
180	265	92,0	75,0	150	840
	190	66,0	54,0		
	260	87,0	78,0		
	205	66,5	62,0		
	155	52,0	46,0		
	190	63,0	56,0		
	155	51,0	45,0		
	185	62,5	51,0		
	190	64,0	55,0		
	260	90,0	77,0	150	

Table 4

GRAVE 181 - Bucrania				
1	**2**	**3**	**4**	**6**
124	200	87,5	57,5	
140	185	65,0	51,0	
140	140	47,0	38,5	
140	260	88,5	77,0	
140	178	61,5	53,0	130
140	175	57,5	53,0	100
140	193	66,5	54,0	
144	195	67,0	56,5	130
145	180	59,0	53,0	120
147	260	90,0	73,0	
150	172	58,0	49,0	
155	190	62,0	51,0	
160	265	90,0	72,0	145
160	235	78,5	76,5	152
160	190	64,5	54,0	
160			65,0	
160	230	78,0	67,0	
160	275	94,0	72,0	
164	235	84,0	80,0	
170	270	89,0	79,0	160
170	210	70,0	63,5	
170	185	63,0	55,0	
172	235	84,0	80,0	150
180	255	87,0	69,0	
190	162	54,0	48,5	
200	180	58,0	52,0	
206	245	87,0	76,0	168
220				
	250	76,0	70,0	
	230	74,0	70,0	
	250	83,0	69,0	
	240	82,0	67,0	
	230	75,0	67,0	
	240	78,0	70,0	
	240	80,0	65,0	
	193	66,0	56,0	
	250	87,0	70,0	
	185	60,0	56,0	
	210	70,0	59,0	
	195	70,0	52,0	
	205	78,5	76,5	
	185	63,0	52,5	
	222	74,0	63,0	
	192	64,0	54,0	
	175	55,5	52,0	
	183	57,5	57,0	
	200	63,0	57,0	
	182	61,0	54,0	

Table 5

GRAVE 182 - Bucrania					
1	**2**	**3**	**4**	5	**6**
110	90	29,0	26,5	120	
130		54,0		166	
140	154	55,0	44,0	150	110
140	170	55,0	47,0	160	
145	266	86,5	79,5	190	
146	190	66,0	52,0	160	
150	160	53,0	47,0	150	
150	173	58,5	51,0	160	140
155	166	55,0	48,0	148	126
155	174	55,0	52,7	160	
160	190	56,6	56,4	150	
160	210	89,0	59,0	170	140
170	240	80,0	68,8	196	
180	193	62,0	54,0	106	

Table 6

GRAVE 185 - Bucrania						
1	**2**	**3**	**4**	**5**	**6**	**8**
125	180	59,0	54,0	161	116	510
130	145	46,5	42,5	136	117	390
134	220	77,0	61,0	185	154	680
140	175	58,0	50,0	160	128	
140	173	58,0	49,0	152	126	
146	187	64,0	52,0	163		
150	190	61,5	54,0	151	116	580
156	176	59,0	52,5	152	116	560
157	172	57,0	48,5	156	110	600
162	195	66,0	57,0	165	120	
162	180	60,0	51,0	160	110	
165	206	70,0	57,0	169	116	650
165	240	85,0	65,0	181	140	
165	188	65,0	54,0	159	120	
165	170	56,0	50,5	155	130	550
170	180	60,0	53,5	160		
170	185	61,0	56,0	164	135	
170	180	61,0	52,5	150		
172	170	56,0	50,5	160		
173	238	81,0	71,5	195	148	
179	174	57,0	48,0	173		580
180	235	79,0	67,0	175	131	
183	164	55,0	46,5	170		510
184	190	62,0	56,0		136	
190	190	64,0	56,5	184		580
195	185	61,0	54,5	157		600
195	233	80,0	64,5	200	155	
	175	60,0	51,0			

Table 7

1 = Least breadth between bases of horncores	**5 = Least frontal breadth**
2 = Horncore basal circumference	**6 = Least occipital breadth**
3 = Greatest basal diameter	**7 = Length acrocranion-nasion**
4 = Least basal diameter	**8 = Intertips breadth**

GRAVE 186 - Bucrania

1	2	3	4	5	6	8
138	195	63,0	56,5	167	130	
145	170	53,5	51,0	147		400
150	170	53,5	49,0	157		
155	222	75,0	65,0	165	127	800
160	175	57,0	52,0	145		420
160	175	57,5	51,0	165	128	540
170	165	55,5	48,0	165	125	580
171	158	52,0	46,0	163		530
174	185	64,5	54,5	176	144	
175	240	78,0	64,0	175	140	
180	220	73,0	64,0	185	154	630
188	200	68,0	56,0	174	150	

Table 8

GRAVE 189 - Bucrania

1	2	3	4	5	8
140	178	57,0	53,5	155	
144	180	58,5	51,5	142	
145	195	63,5	57,0	165	
150	195	66,0	58,0	160	
150	240	83,5	67,0	180	
150	190	63,0	56,0	170	
150	150	48,5	44,5	150	
150	175	57,0	45,0	155	
160		75,0	58,0	185	
160	225	72,0	68,0	174	
165	224	73,5	64,5	180	
168	186	63,0	56,5	164	
170	175	56,5	51,0	162	480
170	163	53,5	48,5	168	520
180	180	58,5	53,0	160	
180	233	80,0	62,0	180	
	144	48,5	41,5		

Table 9

GRAVE 190 - Bucrania

1	2	3	4	5	8
135	190	66,0	54,0	160	560
140	153	51,0	46,0	135	420
140	165	54,0	49,5	150	520
140	148	48,0	42,5	150	
145	170	51,0	49,0	140	480
150	160	52,0	48,5	156	460
150	155	53,0	44,0	145	
155	192	66,0	54,0	160	
155	150	50,0	44,0	150	470
160		47,0	40,0	160	
160		52,0		160	
160	180	58,0	55,0	180	
160	165	55,5	48,5	154	
160		56,5	47,0	150	
165	187	62,0	53,5	155	
165	193	63,0	57,0	160	
170	230	78,0	68,0	190	
170				160	
170	175	59,0	51,0	150	620
170	195	62,0	58,5	160	800
180	170	57,0	49,0	164	
180	260	88,0	64,0	188	
180	178	63,0	49,0	170	600
180		62,0	50,0	160	
180	183	58,5	54,0	170	550
180		64,0	50,0	170	
180	205	68,0	59,0	184	600
190		84,0	78,0	190	
190	235	78,5	69,0	166	800
190	255	85,0	75,0	190	680
200	220	67,5	67,5	170	600
		62,0	45,0	170	
		75,0	60,0	184	

Table 10

GRAVE 241 - Bucrania

1	2	3	4	5	6	7	8
135	195	62	61	150	123		
135	174	58	51	155		225	
150	175	56	53	160		215	
150	255	84	74	190	175	250	
150	148	49	42	148		210	490
150	165	50	47	155		215	
155	160	52	46	155	111	230	
155	190	61	56	160		230	
160	185	63	55	155			
160	150	50	45	160		230	
160	165	55	48	158			460
160	170	53	50	155	114	220	490
160	168	55	48	155	127	230	
160	240	75	68	172		225	
160	185	64	54	160	104	220	500
160	173	55	48	150		230	
165	170	55	50	160		225	
170	220	75	63	188		245	
180	240	78	69	178		240	
180	160	54	47	160		235	580
210	222	71	64	200		265	760
210	250	87	66	195	170	270	

Table 12

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth

GRAVE 238 - Bucrania

1	2	3	4	5	6	7	8
120	173	57	50	150		205	450
125	165	54	47	148	110	215	
130	165	52	50	150		220	
130	157	52	46			215	
130	235	79	88	170		235	640
130	245	85	65	180	151	240	
130	185	64	50	145	115	215	
135	235	82	67	170		260	570
135	153	52	45	150		210	460
135	145	48	44	140		200	520
135	168	55	49	150	115	210	
135	180	61	52	155		220	
135	190	64	52	148		230	
135	175	59	51	150		230	490
135	190	64	58	150			
140	190	70	52	170			
140	175	57	52	150		220	
140	185	65	54	150		210	
140	160	51	48	145		210	320
140	140	46	43	150		220	450
140	160	54	51	150		215	430
140	182	62	53	155		230	
140	170	56	50	150			
140	187	84	52	155		230	
140	180	58	53	155	130	220	
140	178	60	53	155	132	220	
140	198	85	55	163	128	235	
140	170	55	50	150			
140	180	58	53	145		200	450
140	242	83	64	190	136	250	
140	190	65	52	165		230	
140	170	56	46		120	215	500
140	175	59	51	163		220	
140	145	52	41	150		220	
144	180	60	53	160		230	
144	168	56	47	160		215	
145	205	68	61	165		240	
145	172	57	51	165		220	
145	192	65	55	160		215	
145	180	60	50	155			600
145	180	54	49	155		230	470
145	250	85	69	170			
145	180	61	51	152		240	
145	193	65	55	150	115	240	
145	235	78	66	180	160	230	
145	180	60	55	160	124	215	
145	160	51	50	147	118		
145	158	52	47	152	110	230	
145	170	55	47	148	117	215	520
145	180	59	54	174	125	230	

1	2	3	4	5	6	7	8
150	175	58	50	160		220	
150	165	54	53	155		220	460
150	183	61	54			220	
150	170	60	53	160			
150	195	67	54	155			
150	180	62	52	155		240	
150	190	66	52	160		235	620
150	200	65	57	160		215	
150	150	51	45	155		235	
150	155	52	46	160		225	
150	163	54	48	160		210	
150	142	48	42	145		215	460
150	170	57	53	160		215	
150	235	85	62	180			
150	210	70	61	160		240	
150	173	59	47	160		220	
150	185	64	50	165		220	480
150	142	48	42				
150	165	52	52	150		210	520
150	185	62	55	170		215	580
150	180	60	52	153		230	
150	155	51	45	155		215	500
150	210	70	61	185		245	
150	190	63	56	155		215	660
150	165	58	46	150		220	
150	201	67	59	160			
150	180	60	51	160		210	
150	250	84	70	194	154	270	
150	207	71	57	170		230	
150	178	60	52	152		235	
150	160	52	46	153		205	
150	242	82	69	180	150		
150	225	80	63	170	148	250	
150	188	62	58	160		220	590
150	180	55	52	150		235	
150	170	57	47	160		220	
155	180	60	50	155			
155	160	53	46	145		210	
155	152	51	44	164		230	

1	2	3	4	5	6	7	8
155	240	84	64	185	155	245	
155	182	61	51	165		235	
155	175	58	50	155			
155	184	60	55	160		230	
155	180	58	53	155		235	590
155	190	64	56	160			
155	230	75	68	170		245	
155	230	78	65	180	160	240	
155	238	81	68	183	142	255	
155	180	61	53	160		215	
155	160	50	50	150		210	440
155	180	64	50	160		220	500
160	175	582	52	180		210	
160	190	66	55	160			
160	240	79	71	173		210	
160	175	58	47	150			
160	170	57	49	164			
160	190	63	55	150		230	
160	160	53	47	160		230	
160	158	50	45	155		210	
160	165	56	47	150			
160	160	55	44	160			560
160	190	61	51	150		220	
160	255	87	70	210		255	580
160	170	54	53	160		225	
160	183	59	56	155			510
160	188	63	51	160			560
160	155	49	46	140		195	
160	173	57	50	150		230	
160	185	58	57	155		225	640
160	255	83	74	195			550
160	190	64	53	160			405
160	152	54	49	155		240	620
160	170	56	49	150		220	
160	233	81	68	175		240	650
160	165	51	50	145			
160	210	67	64	160	118	215	580
160	170	53	50	160	112		580
160	176	60	51	165	120	220	

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth

Table 11

GRAVE 238 (cont.) - Bucrania																									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
160	180	62	51	160	140	245			170	210	69	61	170					200	183	59	54	173		255	660
160	210	69	63	175		220			170	159	53	45	160	125	235			200				200	180		860
160	215	72	62	180		250			170	240	79	71	195	160	250			200	210	70	60	175		240	
160	227	75	69	175		235	560		170	229	77	67	190	170	235			200	200	61	58	183		245	
160	192	66	53	175		245			170	235	77	71	175		250			200			65	180		260	
160	178	59	53	160	110	220	600		170	245	82	71	190	180	245			200	205	66	63	190	138	250	
160	179	57	52	160		210	680		170	180	60	55	163	125	225			205	225	74	66			250	620
160	200	66	59	163		235			170	200	67	57	166		225	710		210	190	60	60	180		275	
160	230	75	66	180		225			170	229	77	67	182	146	235			210	255	88	72	190			
160	198	68	57	155		240			175	220	75	60	185		245			210	180	55	55	170		235	660
160	190	64	55		124				175	230	76	65	188		240	740		215	230	78	70	185		250	
160	152	52	41	155		210			175	180	59	55	165		230	600		220	220	72	64	190		260	
160	180	58	50	150		230	680		175	190	63	53	150		220	540		220	210	68	63	200	161	255	
160	207	69	60	160	132	240			175	175	57	53	163	122	230	600		240	245	75	72	160			
164	175	59	52	155	110	235	600		175	225	71	67	175		235					71	58	170		250	
165	180	60	54	160		225			180	175	59	51	160		220							165			
165	242	79	71	180		250			180	195	65	57	170		255							170			
165	172	55	51	155		225			180	170	55	50	155		205							175			
165	185	63	54	170		240			180	220	75	60	180									180			
165	250	83	70	200	180	245	620		180	180	60	55	160		220							170			
165	247	84	67	178	145	240			180	220	73	60	190		235	680						190			
170	222	73	65	180		250			180				160												
170	190	62	57	175		210			180	215	73	63	180		245					48		152			
170	160	51	49	150		220			180	205	70	60	130		240							180			
170	205	69	57	170		240			180	187	60	55	168		245							190			
170	205	71	60	180		250			180	230	78	63	180		255				190			165	128	240	
170	170	58	48	155		220	700		180	150	50	44	160		210	540						170			
170	160	51	50	170					180	262	89	72	200	168	265							164			
170	228	76	63	190		260			180	230	80	70	190		265										
170	190	63	56	170		220			180	217	74	63	180												
170	230	75	68	190		230	700		185	205	67	62	180	150	235							166			
170	200	65	59	180	130		610		185	240	82	66	200	170	240							170			
170	220	72	70	180		240			185	195	64	57	165		225							160			
170	156	52	46	160		220	520		185	232	74	68	170		250										
170	180	57	54	155		220			190	202	66	61	175		240							174			
170	147	48	42	153					190	255	89	69	175		265							155			
170	245	82	69	190		250			190	240	80	68										164		230	
170	260	89	70	185		275			190	172	60	47	183		255							175			
170	212	71	61	175		245			190	230	75	68	175		245							160			
170	205	64	59	165	123	235			200	222	78	63	190		260							170			
170	175	62	50	160		225			200	220	71	65	180		240							145		210	

Table 11 (cont.)

GRAVE 253 - Bucrania

1	2	3	4	5	6	7	8	9	10	11
110	160	51	47	160					180	
115	238	80	68	172		250	580	400		
120	180	60	52	150		225			190	140
120	200	72	58	140		220				
120	170	57	50	145		205			190	150
120	170	57	49	140		230			190	150
120	169	56	51	145		215				
120	255	85	76	175		270	460	340	225	170
125	180	61	55	135		230	430	300	160	
125	180	61	51	140	118		460	360		
125	200	67	60	150	103	225	450	280	190	150
125	155	52	42	140		210			160	
125	160	53	48	150		215			180	135
130	175	56	54	150			420	250		
130	120	35	43	140		205	600	260	170	
130	170	58	46	145		210	430	300	170	140
130	170	57	50	145			380	240		
130	172	58	51	150		210	440	290	190	150
130	172	56	51	150		205			185	140
130	131	42	41	137		215	340	290		
130	169	56	49	143		215	500	290	180	135
130	175	55	52	155		210			190	160
130	175	58	51	155		220				
130	232	77	69	180		260			200	
130	163	55	46	140		215			180	120
130	190	63	56	160		210	530	330	190	150
130	175	58	52	155	109	225	440	330	185	140
130	199	67	56	155	112					
130	182	63	53	150	106		480	260		
130	175	57	49	160		230	400	270	180	
130	175	61	51	150	113	220			180	
135	175	59	52	155			480	410	190	
135	142	47	43	143			350	230	160	
135	170	60	48	145		225			180	
135	170	57	48	150		210	480	270	180	130
135	170	53	53	145			460	310		
135	186	64	56	155		215	490	330		
135	160	54	45	142		215	300	375	175	145
135	170	59	48	160		240			200	150
135	260	91	76	180		245			220	170
135	250	85	70	185		265	560			
135	180	63	53	150		215	500	230	190	145
135	185	62	53	150		220	520	260		
135	180	60	55	145		210	410	360		
135	175	61	52	155		225	500	310		
135	180	62	55	150		210	420	210		
135	195	64	56	150		210			180	
140	165	55	50	150		210	320	330	195	
140	170	54	52	150		210	400	280	180	140
140	173	60	50	160			450	300		
140	170	59	47	150		220	500	330	180	
140	170	55	50	155		220	460	350		

1	2	3	4	5	6	7	8	9	10	11
140	185	62	55	154						
140	175	56	50	155		215	540	330		
140	245	80	75				700	450		
140	170	56	48	150		215	470	310	180	
140	155	53	46	150			380	310	190	150
140	150	51	45	155		230	500	280	185	145
140	175	57	52	160		230	420	290	190	
140	150	50	40	145		220			170	
140	170	56	48	160		215				
140	160	54	48	150		235			185	
140	162	55	52	150		240			180	130
140	172	58	50	160		235			190	160
140	170	58	47	145		200			185	140
140	175	58	51	150			440	380		
140	182	62	52	163		220	440	350	190	160
140	260	88	77	180		270			210	170
140	185	65	54	160		250				
140	150	49	45	150		215	410	300		
140	238	80	71	175		240				
140	150	51	44	135		235	460	310		
140	203	67	61	160		240			190	
140	160	53	46	153		210	440	260		
140	165	57	48	145		210			177	140
140	175	57	47	140		230				
140	202	66	54	153		235			188	
140	203	61	55	155		230			185	
140	180	61	53	160		235				
140	240	81	68	175		225				
140	247	85	74	185		250			215	
140	222	75	64	170		225				
140	170	57	48	155		220	480	250	170	140
140	150	50	45	145		210	420	310		
140	248	86	69	180		245				
140	165	56	48	150		210	440	350	180	
140	150	49	44	150		215				
140	178	59	51	155		230			170	
140	170	56	54	160		215				
140	190	64	57	150		215			200	125
140	190	64	55	155		200			195	
140	150	48	44	145	120	220	420	330		
140	135	46	40	140		220	430	320		

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13

GRAVE 253 (cont.) - Bucrania																						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
140	245	82	71	180	157	230	570	370	200	160		145	190	62	54	142			450	270	180	150
140	240	82	70	190		245						145	160	55	47	150		230	430	280		
140	190	64	56	160		235			185	150		145	180	62	51	160		230	500	280	180	145
140	160	54	46	150		215	530	310				145	208	69	60	160		240			190	
140	250	85	74	200	144	250						145	155	54	45	150		230	460	280	185	150
140	230	79	68	180		230						145	170	57	48	150		230				
140	205	70	58	165		220						145	160	54	48	145		220	380	240		
140	194	66	55	150		240						145	160	54	45	145		235	480	220		
140	160	53	51	150		205	580	360	190			145	175	59	52	150		225	540	320	170	130
140	165	56	46	150		220			180			145	190	62	56	145		210	600	380		
140	165	57	46	145		230						145	150	49	45	150		220			180	
140	165	56	50	150		230			180			145	190	65	55	160	108	230	470	320		
144	160	55	47	150								145	178	58	54	160		225	430	280	180	140
145	175	60	52	150		225	470	370				145	180	61	53	155	117	235	580	220	180	140
145	190	62	52	165		235	570	380				145	150	51	44	155	109	210	480	250	180	140
145	160	55	48	160		240	470	280				145	190	63	55	150		210	520	430	180	
145	185	61	54	160			450	380				145	260	88	76	185	141	250	740	500		
145	150	50	44	145		200	295	310	175			145	175	59	50	160		220	460	220		
145	170	54	52	150			500	300	170			145	198	68	58	160	116	220				
145	165	56	48	150		220	490	300				145	178	59	51	160	125	225				
145	175	58	52	150		215	480	320	190	140		145	170	56	51	145	120	225	500	340	170	130
145	172	58	51	160		215	460	270	180	140		145	148	52	42	160			460	320		
145	165	54	50	145		225			180	140		145	165	53	48	145		220	460	240	170	
145	190	63	56	150		220	460	270	180	140		145	150	49	44	145		200	540	270	180	
145	170	58	52	150		205	580	310				145	180	61	54	150	107	215			170	
145	173	58	50	150		225	450	300				145	200	66	60	155		225			200	
145	192	69	57	155			430	410				145	180	60	52	155		220			190	
145	255	87	73	185		250	760	450				145	185	61	57	160		220			190	
145	162	54	47	145		215						146	195	64	58	170		210				
145	180	61	52	160		225	620	350				150	195	68	53	160		218	490	340		
145	247	86	70	180		240	680	420	215	170		150	180	60	52	150		225	450	400	180	150
145	190	66	56	160		220	520	290	220			150	235	77	65	160					200	
145	175	59	53	155		215	460	315				150	165	56	47	155		230			180	
145	178	59	54	153		230			200	160		150	165	55	48	145		225	470	350	185	155
145	157	51	46	148		220	500	320				150	205	70	58	165		220			185	
145	160	52	47	145			380	395				150	175	61	50	150		230	550	360	190	
145	160	51	46	155		225	500	340	180			150	225	77	67	170		205	400	380		
145	185	65	54	158		230			200			150	170	56	51	160		220	520	330		
145	175	58	53	143		210			180			150	170	56	48	145			430	360		
145	185	61	56	147		210			185			150	160	55	48	155			480	260		
145	172	60	51	155		220	520	280				150	210	70	65			240				
145	185	64	55	160		225	520		200	170		150	165	55	50	160		240				
145	170	59	49	150		225	440	275				150	160	55	47	150		230	450	280		
145	195	65	57	155		235						150	170	58	52	155		225	500	390	180	
145	222	73	66	165		260						150	180	60	51	140		220	560	290	170	
145	170	60	49	155			560	360				150	170	56	50	150		230	540	340	184	150
145	165	54	48	150		230						150	172	57	49	160		230			190	150
145	199	70	55	170		215			210	170		150	158	54	45	160		225			190	150
145	155	53	44	150								150	180	60	49	150		225			185	145
145		60	50	160								150	150	49	42	145		230	460	270	170	140
145	198	62	55	150		225						150	145	47	43	140		230	430	270		
145	183	59	53	155		240	520	350				150	175	55	50	150		225	510	310	200	160

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
150	190	64	54	165		230	540	330	190	160
150	175	57	52	145		235	500	360	180	160
150	160	56	46	140		225	460	270	170	
150	155	49	47	150		220	500	240	180	
150	175	58	50	165			520	300		
150	150	51	43	150		215	490	310		
150	170	58	49	150		230			180	140
150	162	55	49	150		220	560	370		
150	175	58	51	145		220	560	410		
150	225	76	62	170		285	520	350		
150	151	50	46	140		220	490	300		
150	235	80	68	170						
150	180	62	52	150		210			170	130
150	170	58	50	155			520	330	180	
150	180	59	54	155		240	500	320	190	150
150	275	94	79	180						
150	205	71	60	170		240			200	160
150	202	67	59	160		240	640	480	185	
150	233	75	72	180		250			210	160
150	178	59	51	155		220			190	150
150	180	60	52	150		220			180	140
150	228	76	69	173		235	610	400	210	165
150	190	65	52	160		235			200	170
150	168	54	51	155		220				
150	182	63	51	163		245			204	150
150	168	56	51	145		215	480	360	184	150
150	238	79	71	180		240				
150	175	60	52	155		235			180	
150	180	62	53	155		240	520	300	185	140
150	155	53	48	158		230	560	360	190	150
150	170	56	51	153		215	440	220	175	
150	183	61	54	155			550	340		
150	248	88	68	180		245			215	180
150	173	56	52	154		235	500	280		
150	245	81	74	190		240				
150	162	58	47	160		220	450	280		
150	158	56	46	155		210			190	
150	169	54	51	155						
150	165	56	49	145		225				
150	185	64	52	150		230			185	160
150	180	58	55	155		235			200	150
150	212	72	61	155		235	480			
150		52	50	145		225			180	140
150	150	50	46	150			400	145		
150	170	59	50	152					195	
150	170	55	51	152		225	500	250	183	140
150	183	63	53	165		230				
150	160	52	47	144		210			188	
150	182	62	54	160		235				
150	175	57	51	150		230			190	140
150	182	60	49	153		230			175	140
150				160		225			200	150

1	2	3	4	5	6	7	8	9	10	11
150	182	59	49	155		235			185	145
150	158	52	47	145		230	500	245	170	
150	180	62	51	170		215			200	150
150	182	61	55	155		230			185	
150	250	85	71	185		260				
150	173	59	50	155		215				
150	220	74	66	175		230			210	160
150	180	60	51	155		210	640	340	180	140
150	170	56	51	155		230			180	
150	171	58	53	155		220				
150				155		225			190	150
150	155	52	46	150		235	440	300	180	
150	240	81	73	195		245			220	
150	250	87	70	190		255				
150	165	56	50	160		220			200	
150	145	49	46	145		210	480	260		
150	220	75	64	180		230				
150	172	59	51	160		230	580	280	190	
150	235	78	71	180		240	560	280	210	160
150	178	58	52	155		225				
150	150	50	45	170		230	530	290		
150	162	51	47	155		210	500	280	190	150
150	175	59	50	160		235	490	320	185	145
150	225	76	65	180	143	250	590	370	210	180
150	245	83	74	180					200	
150	170	59	48	150		235	530	340	185	145
150	170	56	51	165		225	500	360	190	
150	185	64	56	160	120	235				
150	170	57	49	160	110	225	500	320	190	150
150	185	63	53	160		225			190	140
150	163	56	48	160		230	480	230		
150	150	50	45	155		220	600	420	190	140
150	174	58	63	160	133	210				
150	170	56	47	150		205				
150	185	58	56	160		220	560	330	175	
150	180	60	53	150		205				
150	150	47	45	150		200	600	320	170	
150	160	53	46	155	119	215				
150	240	82	70	180		245				
150				155		225			170	

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11		1	2	3	4	5	6	7	8	9	10	11
150	167	55	48	155	115	220	510	430	170	140		155	172	56	54	155		215	500	320		
150	175	57	54	160	102	225	530	320				155	175	60	50	150		230	520	310	180	140
150	165	55	50	150	111	220	600	410	165	140		155	193	64	57	160		230	580	360	185	145
150	160	53	50	155	112	205	640	400	170	130		155	190	65	54	160		235	600	330	190	150
150	190	66	56	165	123	240	480	290	200	160		155	144	49	44	145		215	440	230	180	130
150	182	61	57	160		220			185	140		155	168	57	50	155		210	490	270	160	
150	235	80	68	180								155	160	54	46	165		215	560	280	170	
150	190	63	53	155	113	225			190	140		155	185	63	53	150		240	500	300		
150	170	58	51	155		220						155	180	61	52	160			580	350		
150	182	60	55	150	113	235	580	320	180			155	190	61	57	155			590	440		
150	165	52	47	155		220	400	190				155	170	58	52	160			600	350		
150	140	47	41	155	116	220	450	220	190	140		155	253	86	71	185		225	700	460	200	160
150	170	52	49		124							155	228	76	67	170			640	380		
150	310	103	90	220	162							155	152	52	44	148		240				
150	170	57	45	160		215						155	165	56	49	148		220	490	370		
150		62	51	160		240			190	160		155	229	80	64	188		240	670	390		
150	183	62	56	155	113	220			190	155		155	173	60	50	167		225	510	360	190	
150	210	71	65	170		225			190			155	185	62	56	155		230	480	330	210	170
150	170	58	49	155	100	215			190	150		155	187	62	59	160		220	580	380		
150	175	57	53	155		225	530	300				155	165	55	51	162		240	560	350	190	
150	170	61	47	160			570	430				155	197	68	59	175		230				
150	167	56	48	160		240	540	330				155	165	57	45	157		215	490	410	190	
150	152	51	46	150			500	350	180			155	184	61	53	155		230	570	360		
150	170	57	48	160	124	235			190			155	162	50	47	150		220	550	320	180	
150	225	75	69	175			600	340	200			155	171	58	51							
150	185	62	53	155		240						155	160	53	45	145		225	420	250	175	135
150				160								155	200	67	56	162						
150	172	57	52	150		220	580	330				155	182	61	52	158		210	490	300	200	
150	170	56	52	150	117	220			180			155	185	62	56	152		220	500	350		
150	220	73	64	190		255						155	220	73	65	170		240	640	340		
150	200	68	58	160					190			155	160	52	46	150			500	310		
150	245	85	71	185		255			210			155	245	84	72	190		250				
150	165	56	50	150		205			160			155	175	60	52	160		225	500	290		
150	150	49	44	145		230	450	230	170			155	160	53	49	155		220			190	135
150	187	62	55	165		235			190			155	170	59	48	158		230	540	270	180	
150	193	62	57	170		235			200			155	160	52	48	147		225	540	310		
150	160	52	48	150								155	152	51	43	155		225	450	230		
150	165	56	50	150								155	168	59	47	152		215	480	290	190	150
150	175	57	49	155		210	460	220				155	180	56	51	157		225	460	280	188	150
150	182	63	53	165		210						155	171	58	50	150		220			165	
155	175	60	52	155		225	550	350				155	190	65	55	162		225			190	170
155	195	67	56	165		225	600	400				155	173	58	52	155		230			185	160
155	160	54	47	155			440	300				155	170	56	54	155		225	650	350	180	
155	160	52	45	150		205	520	330	170	140		155	158	53	47	160		220	500	290		
155	170	56	50	152		215	580	370				155	235	76	72	170		250	620	330	210	180
155	155	52	43	150		240	500	370				155	222	75	66	190		250				
155	150	52	45	150			460	330				155	230	76	67	180		255				
155	140	45	41	150		220	430	280	180			155	230	78	65	170		245	600	330		
155	200	69	56	160		220	580	350	190	140		155				155		230			180	150
155	182	62	50	165		230	630	380				155	175	61	52	160		225	570	350		
155	150	51	43	160		220	420	230	180	140		155	180	61	52	150		220	600	380	180	
155	150	51	44	150			480	310				155	225	76	65	170	152	240	650			

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
155	245	82	73	185		225				
155	175	59	50	145	119	230	530	320		
155	183	62	53	165		235	620	360		
155	145	48	41	150	122	220	530	310		
155	150	48	44	155		210	430	220		
155	240	80	72	180		240				
155	230	77	66	185		255			210	180
155	172	57	51	160		230	540	360	190	
155	160	53	45	150	123	225			200	150
155	165	54	51	160		220	420	320	190	140
155	150	49	46	160		225				
155	220	76	65	170		235				
155	172	55	53	150		230	480	250		
155	185	62	57	150		225	520	270	175	
155	175	60	52	160		210			180	
155	193	66	62	160		225				
156	190	66	53	180						
157			60	195					150	
160	170	55	48	155		230	520	400	190	160
160	210	68	60	165		245	560			
160	180	61	51	160		230			190	
160		60		150		240			180	150
160	165	55	48	160		215	610	340	190	
160	185	58	56	165		225				
160	185	59	54	150		225	560	320		
160	190	67	53	160		225	580	370	180	
160	180	59	50	160		225			180	
160	179	60	51	160		220				
160	185	60	56	145		220			170	
160	160	55	46	150		220			180	140
160	172	57	51	160						
160	170	57	47	155		235	500		190	140
160	205	70	58	160		235			195	140
160	195	67	58	170			600	330		
160	215	72	61	180		240				
160	160	55	50	145		210			170	130
160	180	61	50	155		230	490	310	190	140
160	162	56	47	155		225	500	260		
160	168	56	47	155		230				
160	190	64	54	170		220	570	310	155	170
160	190	65	54	160		235				
160	153	51	47	155		210	620	380		
160	162	55	46	155		210			190	145
160	180	58	53	155		240	560	290		
160	200	69	57	160		230				
160	195	65	57	160			700	490		
160	172	57	52	150			690	500		
160	253	86	74	185		255	740	450	210	160
160	254	85	75	185		250	900	560		
160	245	85	71	180		250	700		210	180
160	150	49	45	145		210	480	270		
160	139	47	39	140		225	510	290	170	

1	2	3	4	5	6	7	8	9	10	11
160	218	74	64	175		260			200	
160	188	63	56	155		215	580	320		
160	158	54	44	155		215	460	260	170	
160	185	62	56	160		240				
160	195	67	57	155		215			200	160
160	193	66	57	155		230				
160	200	68	59	160		220				
160	170	58	50	155		225	580	330		
160	250	83	75	200		235	700	410		
160	221	76	64	175		255			190	
160	229	76	64	175		265			205	170
160	150	48	43	150		230	480	260		
160	202	65	60	170		240				
160	210	71	63	160		230	610	380		
160	177	60	50	162		235			190	
160	240	83	70	185		260			200	
160	162	54	47	155		220			180	
160	150	52	45	150		225	540	290		
160	165	57	47	164		215				
160	180	61	55	150		230	360	470	200	
160	155	54	47	155		220	520	320	195	
160	197	66	55	153			560	380		
160	184	62	51	162		230	610	390	200	140
160	200	65	62	158		230			180	
160	159	50	50	155		205	360	155	160	
160	204	66	61	155		240			190	
160	180	63	51	155		205	460	340	180	140
160	160	55	48	153		225	550	320	190	145
160	225	76	67	180		240	700	430		
160	235	76	70	165		250	600	350	190	
160	159	55	47	155		225	515	290	180	
160	184	67	55	162		235	660	350		
160	178	60	52	155		225	560	280	185	
160	175	56	50	155		225				
160	187	64	57	155		225	510	350		
160	182	61	54	160		230	560	310	200	150
160	241	81	73	190		240				
160	150	51	45	150		225	505	300	175	140
160	185	61	54	150		235	500	360		
160	248	85	71	185		245				

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania																						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
160	242	81	73	188			620	330	220			160	200	66	57	160		220			180	
160	230	82	65	188		240			210			160	160	55	44	160		225	520	260		
160	145	47	43	145			420	300				160	230	76	67	185	147	250	610	360		
160	175	60	53	150		230	540	320	190	145		160	180	59	55	155		235	560	280	180	140
160	168	55	51	155		225	440	220	180			160	150	50	45	155	122	220	580	340	180	140
160	174	60	51	160		230						160	253	84	75	185	150				220	180
160	180	61	53	153		230	520	280	190	150		160	155	46	42	150				280		
160	170	55	52	150			520	280				160	167	54	50	165	118	225	540	320		
160	142	50	42	145		210	460	255				160	150	46	45	155		210	560	340		
160	175	57	51	150		220						160	215	74	64	185	133	245				
160	145	47	42	155		210	440	220	180	140		160	185	63	55	160		230	540	270	200	150
160	189	63	55	160		235	540	300	200			160	140	47	43	150	109		510	250		
160	210	74	56	180		245			200			160	220	73	65	180		245	600	330		
160	180	63	52	163		225			190	140		160	230	76	72	175	144	260				
160	188	60	56	158		245			180	144		160	210	69	63	170		250			195	155
160	193	65	52	190		265						160	235	79	68	180	153	240				
160	247	79	70	175		295			200			160	240	84	70	190	151	240	660	400	220	160
160	200	62	54	160		225						160	260	86	75	195		260	720	400		
160	155	51	44	153		230	400		175			160	155	49	46	145		220	470	430		
160	190	64	57	160		235			200	160		160	210	71	64	170		225	600	330		
160	197	67	57	155		230		340	185			160	145	46	43	145			450	340		
160	170	54	48	155		230	620	350	200			160	155	54	45	145						
160	190	65	52	160		255						160	255	87	75	185		260				
160	173	60	47	155		240						160	170	55	50	155		220	460	240	185	
160	210	71	58	170		230						160	190	62	55	180			600	400		
160	170	57	50	150		225						160	243	80	71	190	155	260				
160	155	51	46	155		220	440	340				160	200	67	58	165	130	230	560	320	200	150
160	170	55	50	155		230	550	260	175			160	200	68	57	165	120	230				
160	142	48	42	150		215	520	290				160	178	59	51	160		230	500	280	210	150
160	235	79	68	195		255						160	180	60	55	160	124	230	570	330	185	145
160	215	72	64	180		230			200	160		160	160	53	49	155		215	480	390		
160	310	110	84	205		270	1260	680				160	170	57	49	160	129	225	600	390		
160	178	61	54	160		230						160	140	45	44	160		220				
160	170	58	47	160		225						160	165	54	51	150			680	450		
160	165	58	45	160								160	150	49	45	170		225	640	390		
160	180	63	52	160		230			200			160	215	70	62	170		240	600	340		
160	155	52	47	150		215						160	230	80	60	190		260	520	290		
160	240	79	70	185		245			210	170		160	175	57	52	170		235	580	300		
160	250	85	72	190		245						160	170	57	47	155			440	230	170	
160	187	61	55	175		235			195			160	145	48	42	145		235	440	280		
160	160	53	46	155		230	500	250	180			160	240	82	68	185		250	680	350		
160	155	51	46	150		215	460	240	190			160	183	61	55	160			560	310		
160	160	53	47	160								160	235	80	67	190		245				
160	160	52	47	150		220	480	280	165			160	160	53	51	160		225				
160	210	70	62	175		220	640	370	210			160	230	78	69	175	181	235			200	
160	190	66	55	160		250	560	280				160	180	61	53	170		240			180	
160	155	51	45	150		220	480	240	190	160		160	235	81	65	180		270			220	
160	180	58	56	170		220						160	162	52	51	155	144					
160	170	58	50	150			560	350				160	150	48	45	150			450	240		
160	175	61	50	170		240	560	310	200	140		160	215	69	64	180		230			205	
160	177	60	53	160		220						160	160	51	49	155		230				
160	185	63	53	155		220						164	192	65	57	175						

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
165	235	80	70	180		260			200	160
165	175	58	51	160		220	600	380		
165	160	52	46	160		210	560	330	180	
165	152	52	42	160		220	540	280		
165	152	50	46	150		220	510	290		
165	190	62	58	180		235	500	300		
165	250	84	75	185		255			210	160
165	175	55	52	160		230	670	430		
165	150	50	43	158		235	520	280	190	150
165	165	53	50	150		240	530	320	185	150
165	190	62	56	160		235	490	310		
165	260	86	76	195		240	700	450	240	180
165	180	61	52	145						
165	179	60	50	155		230			196	150
165	175	56	53	167			540	340		
165	292	101	89	200			790	485		
165	221	72	67	185		255			210	170
165	243	83	66	175		250	710	480		
165	220	72	66	188		240	680	430		
165	170	56	50	155		225	540	310	180	140
165	172	60	51	160		230			200	
165	176	59	51	163		230	560			
165	230	72	74	163		250			200	160
165	177	56	51	160		220			188	150
165	180	57	52	153		225				
165	175	58	53	152		235	530	250	180	
165	180	62	51	175		235			200	
165	245	83	70	190		260			210	
165	177	60	51	165		225	480	250		
165	172	56	51	155		220	530	340		
165	270	91	77	210	173	265	980	500		
165	250	84	75	195		260			210	180
165	180	59	52	160	132	230	540	300	190	
165	155	51	47	155	132	215	560	350	180	140
165	180	60	55	170						
165	240	78	72	175	159	250	700	420	210	160
165	175	60	53	165		230	680	350	190	150
165	217	72	63	180	148	235				
165	225	77	70	180	154	230				
165	210	70	62	175	140	240	580	330		
165	155	52	46	160	124		500	320		
165	230	77	67	190	123	250	700	440		
165	162	53	51	160		220	510	370		
165				160		240	560	290		
165	183	62	56	155		230	600	280		
165	250	87	68	180		225			220	190
165	165	53	48	155		230			180	
165	270	91	76	200		280				
165	250	84	71	185		245				
166	175	60	51	148		215				
166	165	54	46	150		225			190	130
170	155	52	48	160		225	600	330	185	150

1	2	3	4	5	6	7	8	9	10	11
170	195	66	55	170		230	600	360	190	
170	185	63	55	160			550	370		
170	225	75	65	175		240	760	440		
170	230	75	67	170		240	630	370		
170	210	70	62	170		240			200	
170	170	56	46	155		230	600	330	185	
170	210	70	63	180		250			190	
170	180	63	55	160		215	600	340		
170	165	57	47	160		220	550	310	190	
170	175	60	50	150		220	580	330	180	135
170	165	53	49	160		215	540	330		
170	180	62	54	160		230			180	
170	160	52	47	155		220	550	330		
170	160	52	46	150		210	520	290	170	130
170	160	55	47	160		210	600	290	190	150
170	240	80	68	175					210	160
170	160	54	47	150			480	270		
170	170	50	47	155		235			190	130
170	180	63	60	165		230			190	160
170	152	51	46	155		205	510	260	170	
170	195	63	59	160		230				
170	170	55	52	155		230	600	330	180	140
170	248	85	71	180					210	
170	170	54	52	160		240			175	150
170	143	46	41	150		225	560	300		
170	272	94	74	190		260	850	470	220	160
170	210	71	64	175		235	620	380	210	160
170	220	67	62			230				
170	200	65	58	160		250	640	400	190	150
170	190	63	52	170			540	390		
170	165	54	51	155		230				
170	180	62	53	160		225				
170	192	65	55	160		225	660	380		
170	171	57	50	160		235	480	320	190	
170	165	56	50	150		230	530	420	180	
170	137	42	41	150		220	480	250		
170	200	65	62	175		245				
170	190	62	56	160		240	600	410		
170	165	55	50	155		230	570	370	190	150
170	200	67	59	180		250				

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania																						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
170	178	59	52	165		220			185			170	195	65	55	160		225			200	140
170	201	64	59	165			740	440				170	242	82	72	190		250			220	180
170	160	55	45	163			560	340				170	170	55	47	155		220			185	140
170			45	150								170	179	62	50	160		215	610	370		
170	177	58	54	155		230	550	410	200	170		170	232	79	68	185		255	660	380	210	170
170	202	69	59	175		235	560	310				170	175	57	48	165	132	220	680	330	190	
170	180	60	54	160		235						170	205	71	60	180	144	230	840	460		
170	163	53	48	160		240			210	160		170	155	56	42	160			580	350		
170	210	70	64	180		260	680	380				170	158	53	46	155		230	500	250		
170	218	74	64	184		260	580	300	214			170	172	57	52	162	135	225	590	370	190	150
170	242	82	76	190		255			220	186		170	182	64	52	170		235	650	420	200	155
170	170	57	49	158		225	540	290	200	150		170	218	71	65	185		240				
170	158	51	48	150		225	600	350				170	210	71	63	160		230	680	380	180	
170	180	59	54	160		240			180			170				150		230	480	280		
170	150	47	47	143		215			170			170	220	75	63	179		215	800	420		
170	186	61	56	155		225						170	232	79	66	185		250	570	360	210	180
170	172	58	52	160		225	540	250	200			170	220	74	65	180	149	255	580	320		
170	210	68	62	173		260			210			170	160	51	50	155		230	480	270		
170			47	152		230						170	170	57	50	165		240	560	250	180	
170	230	76	72	155		260						170	155	49	48	145		220	540	320	180	135
170	222	78	62	165		255	540	350				170	260	84	76	205		260	740	400		
170	193	64	61	168		250	580	360				170				150		195			175	130
170	245	81	75	190		255						170	230	78	64	190	151	250	720	370		
170	162	55	48	163		230	540	270	190			170	197	69	57	170	130	225	660	400		
170	211	70	66	175			620					170	210	73	62	170	147	240	760	480		
170	175	59	52	157		230						170	190	62	55	160		215	600	370		
170	230	77	64	180		250						170	182	61	55	165	132		570	400	195	
170	185	57	50	160					190			170	174	58	50	160	115					
170	170	57	45	160		220			190			170				170		240			200	
170	170	56	50	155		235	540	340	180			170	150	51	43	150		230	520	280	175	
170	215	75	58	170		250			200			170	145	48	41	160		215			190	
170	163	56	47	160		215	540	320	180			170	220	74	65	185		230			205	
170	215	72	63	175		240			210			170	235	80	71	185		240				
170	188	60	56	165		230						170	220	73	65	180			640	330	200	
170	180	59	53	155		255	480	250	180			170	260	87	76	190		265				
170	180	64	54	160		240						170	170	58	47	160		240	540	270		
170	219	75	62	164		245						170	180	60	54	170		230				
170	200	65	58	163								170	165	55	48	155						
170	258	88	77	190		260	700	350				175	225	76	61	160		240	640	400		
170	178	57	54	160		215			185	155		175	170	58	51	145		230	600	370	180	150
170	175	60	52	155		205	620	280	180			175	190	68	58	165		240			180	
170	225	73	67	185								175	210	68	62	170		230			200	160
170	170	58	47	165		230	520	280	190	150		175	175	58	51	160		235			190	
170	260	88	77	190		260			210			175	192	65	57	170		245	500	220		
170	280	95	79	200		240			220			175	160	52	48	145		230	510	300	170	135
170	237	81	70	190		240						175	190	61	58	170		215	500	320		
170	247	83	74	190		260						175	182	61	53	160		225	500	310	180	
170	160	52	49	155		220	600	300				175	176	58	52	160		220			190	145
170	180	61	53			235						175	180	62	52	165		230				
170		92	75	185		250			210			175	188	62	54	160		230			190	140
170	270	90	75	200		260			220			175	164	52	49	155		230	560	320	190	160
170	240	82	68	180		260						175	235	77	71	170		235	590	330		

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
175	215	70	63	170		240				
175	178	60	51	160		230			184	150
175	197	67	56	168		225			200	
175	180	60	53	163		225			205	145
175	173	58	51	160		210	520	320		
175	220	72	65	170		255				
175		60	66	163		225	610	340		
175	174	58	52	165		230	680	370		
175	165	54	49	155		230	530	320		
175	170	55	53	163		220	660	310	190	
175	230	77	70	180			700	360		
175	195	66	56	160		230			185	
175	205	71	60	166		255				
175	230	83	67	190		265				
175	218	69	66	173		250			200	150
175	202	63	58	160		230			168	140
175	245	83	68	190		245	780	440		
175	262	90	77	195		275	680	360	220	
175	170	54	52	155		225	600	300	200	160
175	202	68	61	170						
175	250	82	76	190		275				
175	270	91	79	190		255	700	420		
175	228	75	67	190	156	220	720	350		
175	227	76	66	195	158	240	600	310	230	180
175	150	47	46	145		205	420	300	165	120
175	265	91	79	210	170	265			240	
175	175	61	51	155		240	580	310		
175	175	58	52	175		230	500	240	190	155
175	238	83	66	180	2	245				145
175	222	74	67	180	148	240	800	450	220	
175	235	81	67	170						
175	245	86	68	180		240				
175	145	48	42	160	119	210			180	
175	207	69	60	180		245			200	
175	230	80	62				580	280		
180	212	72	61	185		260			205	175
180	160	53	45	160		220			180	
180	200	65	60	175		250	460	230	195	
180				160		230			185	
180	185	63	57	170		245			190	140
180	160	53	47	155		230	530	300	170	130
180	240	78	73	195			720	430		
180	225	76	68	180		260				
180	185	61	56	160		235				
180	240	75	71	170		220	660	400		
180	235	80	67	175			650	430		
180	180	61	53	170		235			190	145
180	157	50	47	150		220			170	130
180	210	72	63	170		235			190	160
180	180	62	55	160		225				
180		80	70	180		250			210	
180	225	74	68	170		245				
180	240	85	65	185		270				
180			66	180		250				
180	180	60	50	155		230	550	410	180	140
180	220	75	63	175		245				
180	200	66	60	170		260	610	360	200	
180	200	67	56	175		255	650	310	210	160
180	220	75	64	175		250	560	320		
180	168	57	47	150		210	590	340	180	140
180	170	57	51	160			640	370		
180	180	61	51	163			600	370		
180	218	76	63	175		240	780	420		
180	210	70	61	170		255			205	150
180	200	70	59	170		260			200	160
180	200	70	58	175		250	640			
180	237	80	70	187		255	800	450		
180	244	81	74	210		255	680	420		
180	257	87	74	185						
180	212	74	62	174		250	640	410	210	160
180	208	67	59	175		255	600	370		
180	195	64	55	165		235			180	
180	195	65	61	160		230				
180	192	65	56	165		230				
180	223	78	68	180		260	560			
180	232	80	66	180		270	660	400		
180	215	73	65	183		235				
180	187	61	57	167		250	540	370		
180	212	70	61	165		245	560	350		
180	220	73	67	180			640	360		
180	205	71	57	165		240			180	150
180	210	65	61	180					190	
180		61	56	170		235	560	250		
180	210	70	62	190		255				
180	197	66	60	160		230			185	
180	240	80	67	180		260				
180	185	62	54	163		240				
180	182	57	54	162		220			200	150
180	227	70	62	173		260				
180	182	58	50	150		220	460			
180		77	68	174		230				
180	205	64	57	165		250			190	

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11		1	2	3	4	5	6	7	8	9	10	11
180	200	70	63	175		235						185	226	76	66	185		250				
180	162	54	47	160		215	580	280	180			185	203	69	63	170		240			190	160
180	238	77	70	190		230						185	150	47	43	158		215	530	290	180	130
180	202	68	60	170		240						185	220	73	61	172		255	600	395		
180	203	70	60				680	300				185	150	50	41	170		225	550	265		
180	212	73	62	170								185	200	67	60	170		250	630	370		
180	250	85	73	190		250						185	207	69	59	165			610	370		
180	150	49	46	160		225	680	380	180			185	198	66	61	183		235			230	170
180	180	57	54	160		220			195			185	245	84	69	182		255	700	410		
180	250	89	68	170		260			190			185	205	71	60	170		245			200	150
180	230	83	68	200		255			210			185	180	60	55	165						
180	215	74	66	190		245			200			185	193	66	56	170		245			190	150
180	240	80	75	185		270	740	400				185	199	67	58	165		250	670	340	200	
180	210	71	65	175		250	680	310	205			185	175	57	52	165		215	620	330	190	150
180	175	55	54	150		225			175	140		185	175	59	49	162		220				
180	250	82	70	185		265						185	185	62	53	165		235			190	160
180	190	67	55	165		225	560	280				185	260	88	76	200		260	740	460		
180	170	59	49	165		215						185	192	63	57	170		220	560	240	180	140
180	210	69	62	165		235	610	330	200			185	216	71	64	175		250				
180	150	47	47	145		220	660	360				185	250	83	75	190	159	260	750	360		
180	235	81	71	190			730	470				185	195	62	61	170	141	240	910	470		
180	240	81	71	210	168	255			230			185	220	75	64	190	166	240				
180	215	73	66	175	170	250	670	410	210			185	195	66	57	180			700	420		
180	177	58	54	160	111	220			180	140		185	180	61	51	180		215	480	200		
180	235	80	69	195		255	750	460				185	245	85	70	180		255	620	350		
180	205	72	60	185		250	660	400				190	190	66	54	155		255	600	430	190	
180	197	66	58	170		240	560	280	190	150		190	210	71	62	180						
180	220	74	63	180	169	155						190	220		70	175					190	
180	230	75	65	185		250						190	232	80	64	190		245			210	
180	180	62	52	160	116	230	550	390				190	240	80	72	175		270			200	
180	235	78	70	195	162		660	330	210			190	210	70	66			235				
180	205	68	64	170		230	600	360				190	230	79	67	190		255	660			
180	150	50	44	170		230	500	250				190	240	79	71	195		270				
180	175	59	50	170	130	230						190	203	70	58				600	340		
180	195	67	57	160	140	245	570	300	180	140		190	290	97	85	145		270				
180	220	76	62	175		240						190	220	80	62	180		270			210	160
180	240	80	71	200		235	720	400	220	180		190	215	72	65	180		245			205	160
180				165		210			180			190	245	81	76	200		280				
180	232	76	70	185	155	240	700	370				190	170	56	50	160		220			190	140
180	195	66	57	160		230	640	310				190	200	67	58	170		230	630	370		
180	215	72	66	190		245			220			190	208	70	62	180		235	730	410		
180	260	90	72	190								190	220	75	62	175		250	600	290		
180	230	77	68	180								190	180	57	54	157			820	440		
180	217	73	64	175		240			190			190	215	72	64	170		250	800	480		
180	165	56	46	160		230	540	270	185			190	232	80	68	182		245	780	470		
180	215	73	60	175	132							190	182	62	54	164			630	430		
180	260	88	74	190		260						190	220	78	66	170		250	560	330	190	
185	225	77	65	180		250	700	360				190	230	79	64	168		245	680	410		
185	245	86	68	180		255	660	380				190	217	71	61	175		260			220	164
185	260	91	70	195		280						190	208	68	63	163		225			190	
185	215	70	65	170		240	720	360				190	230	75	70	183		250				
185	243	82	72	180		265						190	220	74	67	180		255				

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
190	210	68	62	175		240			215	160
190	255	88	79	200		260				
190	212	65	60	175		240				
190	217	62	58	170		230	560	310		
190	232	74	64	178		255				
190	205	58	53	165		225				
190	187	61	57	160		240	600	360	200	155
190	235	80	69	210		250			220	
190	230	80	69	185						
190	240	81	72	175		245	640	320		
190	230	82	67	200		260				
190	230	78	68	175						
190	260	90	70	195		250				
190	240	81	69	175	148	260	610	450	200	
190	210	73	63	170		240	620	360	200	
190	210	71	61	170		245	520	250	195	
190	205	68	60	165		240				
195	230	70	65	175		250				
195	200	66	58	180		230				
195	185	62	56	170		260	680	340	200	
195	170	60	48	180		235	660	310		
195	214	70	66	180		250				
195	230	78	70	185		250			210	170
195	193	66	57	180			600	350		
195	265	88	81	205			700	450		
195	222	72	65	178		245				
195	224	72	66	180		245	640	360		
195	225	73	67	190	157	275	620	300		
195	250	81	75	200	182	275	750	410	225	180
195	235	77	71	200		270	700	430		
195	220	75	62	190	167	260				
200	220	73	64	175			700	380		
200	230	75	65	180		250	660	350	200	
200	180	61	57	175		235				
200	215	71	64	185		260			220	180
200	260	90	72	170		240				
200	233	78	72	170		245	760	450		
200	245	87	62	190		265			220	165
200	195	62	60	170		240				
200	208	74	58	175		260				
200	199	68	57	175		250				
200	230	80	68	180		255				
200	208	68	64	175		230				
200	210	70	67	180			700	380	210	
200	228	77	60	170		250	640	300	190	150
200	239	77	72	195		270			225	180
200	245	85	70	200		245	800	460		
200	210	69	61	180			700	435		
200	235	81	66	185			800	460		
200	250	85	67	180		260				
200	210	67	62	178		255			210	165
200	235	77	66	180		300				

1	2	3	4	5	6	7	8	9	10	11
200	192	62	60	165		235				
200	220	80	67	178		260				
200		73	60	185		260			210	
200	280	96	82	190		290				
200	220	74	65	175		260				
200	175	55	51	155		230	500	220		
200	240	65	55	180		255	690	400		
200	240	79	69	190		260				
200	227	78	69	175		255				
200	230	70	66	180		240				
200	250	86	68	190			600	300		
200	190	65	55	175		255	700	350		
200	195	65	56	170		250	600	320		
200	230	77	71	185		270	660	310		
200		85	75	175					210	170
200	250	90	75	200		270				
200	220	73	67	190	156	265			190	
200	260	83	79	175					230	
200	220	74	66	185		255			205	
200	220	75	64	180	140	255	700	330		
200	202	66	63		153	255	840	560		
200				185			720	390		
200	230	78	69	195		275	710	360	130	
200	240	80	72	200	170	255			220	
205	280	96	79	190		280	740	440		
205	210	73	62	175		255	700	410	210	160
205	230	78	70	180		245	640	380		
205		68	57	165		220				
205	220	75	62	185		260	840	400		
205	210	69	63	180		260	700	450		
210	245	85	71	210		290	630	380	220	
210	230	77	69	190		280	800	450	215	
210		75		190						
210		72	62	175		220	680	330		
210	230	77	67	190					210	
210	208	67	63	175						
210	233	76	69	180		250	880	680		
210	215	71	67	180		255	700	440	210	160
210	230	74	69	185		260				
210	190	66	57	175		250	600	280	200	

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania																						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
210	250	81	72	180		265	730	450								160						
210	150	47	46	160		250	880	360								160					180	
210	232	79	70	175			700	450								180		235				
210	190	65	57	175		225	600	300	210							170		250			190	
210	256	82	77	195		270	840	480								170		235			200	
210	235	76	69	178		260			210	180						165		230				
210	255	84	76	180												170		225				
210	215	69	67	185		240	700	420								160						
210	220	72	65	190		250	600	250	220							160		240			200	160
210	230	76	68	180	143	280	700	330								150		215				
215	238	74	71	195		265			210							160						
220	225	73	69	200		255			210							152		220				
220	220	73	68	180		260	640	600								204						
220	255	83	77	200		270	760	450								182						
220	190	60	61	170		255	810	520								164						
220	265	83	80	195												160						
220	215	71	66	190		270	800	460	215							150					180	
220	250	79	75	200		270	740	370					195	67	59	175						
220	160	50	51	180		275							160	52	48	150		220				
220	250	85	73	210		270	800									170		250				
220	230	82	67	205		260								79		185		255			210	180
220	245	85	71	210		270	800	510							56	165					195	160
220	215	74	61	190	180	270									62	164		225				
225	220	74	64	180	145	230	860	510	200							152		215				
230	145	48	42	175		270	580	220					185	61	56	155		230			185	140
240	235	80	75	200		270										160		220				
240	260	86	79				1120	600								160		245				
240	265	89	77	220		250	1000	480								153		235				
	165	53	49	170				350						83		190		250			220	
			50	160										70		185		270				
				200									210	80	64	160		235	740			
			68	165					195	165				75	58	180						
		65		170		235									68	165		240			185	
				170									260	86	72	185		255			205	160
				170		235								67	64	168						
			68	180												150					180	140
				190					200	150						170		225				
			60	160												144		230				
			75	170										55	62	140						
				190					220	170						180						
				190					200	160						166					190	170
				184											64	178		235			190	
				150					185	150						155		230				
			66	155		245			180							160		235			185	140
	130	41	38	140					160	130						170						
			64	170									210	71	65	188						
			75	185									195	65	57	190					210	170
		72	67	185					210	170						180						
				170					210	160				69				230				
				155		230								83		190		260				
				167		220										170		225				
			61	180											53	165					190	

Table 13 (cont.)

GRAVE 253 (cont.) - Bucrania

1	2	3	4	5	6	7	8	9	10	11
				180						
			54	173						
	220	84	64	166						
	210	67	61	180						
		63	59	170						
				170		235			190	145
			59	168		235			190	
	250	85	75	195		310			220	
	215	74	67	175		245				
			66	180		240				
				180					200	
				194					210	170
				184						
				170		225			190	
			58	160		230			190	
				190		255			204	
			61	180		260			210	
			48	160						
				190						
				185						
	125	39	38	154		245			170	
		80	69			255			210	
				160		230				
			54	173						
				158		240				
			60	162		230			200	
			57	156					175	
			44	145					170	
			60	168						
				170						
				170						
			48							
				160						
				170		250				
		74	69	172						
				160					185	155

1	2	3	4	5	6	7	8	9	10	11
				160					190	152
			67	170		220				
				160					184	
	171	58	51	160		210			185	
	191	64	56	176						
				160						
				150		210				
	320	105	95	200						
		82	72							
				165					190	
				185					210	
				195					210	
				155		240				
	190	65	50	170		240			200	
				185		250			210	170
			51	150		220			190	150
	160	54	46					260		
	243	83	72							
	195	68	57							
	25	67	60							
				156		235				
	165	56	46	160			520	260		
	225	79	63	200						
	180	61	56							

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

Table 13 (cont.)

GRAVE B - Bucrania

1	2	3	4	5	6	8
91,5	52,0	18,2	16,0	94,0		
93,0	62,0	20,0	18,5	106,0		
96,0	66,0	20,0	20,0	97,0		170
116,0	77,0	24,0	23,5	123,0	94,5	165
129,0	172,0	59,8	46,5	149,0		205
141,0	161,0	55,0	45,5	156,5	118,0	
142,0	190,0	66,0	53,0	166,5		
144,0	106,0	33,5	32,3	141,0		
147,5	227,0	78,0	67,5	196,5	167,0	305
148,5	183,0	58,7	54,0	163,0		590
148,8	156,0	52,7	46,0	163,0	178,0	495
149,0	125,0	42,6	32,5	151,0		600
152,0	212,0	68,5	57,3	171,0	126,0	410
152,0	176,0	59,5	51,5	164,0		
153,5	250,0	84,5	73,5	192,5	180,0	
153,5	172,0	54,1	52,0	158,0	128,0	
156,0	302,0	100,0	86,0	210,0	209,0	570
156,0	250,0	83,0	74,0	188,0	174,0	800
156,5	216,0	71,0	62,2	172,0		680
158,0	270,5	89,0	74,0	191,0		
160,0	200,0	69,0	52,0	168,0	131,0	850
160,5	184,0	60,5	51,0	159,5		550
161,0	275,0	89,0	77,0	189,0	175,0	630
161,0	158,0	52,5	49,5	155,0	134,0	
163,0	273,0	93,0	76,5	204,0	184,0	
164,5	171,0	57,0	51,0	174,0	124,0	
165,5	192,0	66,0	50,0	168,0		590
166,0	253,0	83,7	75,5	205,0	161,0	600
168,0	257,0	84,0	74,8	207,0	172,0	
168,5		64,0		153,0		680
169,0	275,0	94,0	78,0	207,0	194,5	
169,0	280,0	92,5	82,5	220,0		
170,0		79,0	71,0			

1	2	3	4	5	6	8
170,0	193,0	64,0	56,0	168,0	120,0	530
170,0	205,0	71,0	55,0	161,0	130,0	650
174,0	200,5	65,0	63,0	182,0		600
174,0	180,0	60,0	57,0	159,0		
176,5	202,0	64,0	61,5	159,0		
178,5	190,0	62,2	56,1	182,0		680
179,0	220,0	66,0	58,0	156,0		650
179,0	180,0	58,0	48,0	178,0	126,0	600
180,0	215,0	75,0	59,0	170,0	128,0	
181,0	245,0	78,5	71,0		158,5	
183,0	190,0	66,0	55,5	172,0		
179,0	220,0	66,0	58,0	156,0		650
179,0	180,0	58,0	48,0	178,0	126,0	600
180,0	215,0	75,0	59,0	170,0	128,0	
181,0	245,0	78,5	71,0		158,5	
183,0	190,0	66,0	55,5	172,0		
184,0		53,0	42,0	151,0		
186,0	228,0	74,7	68,0	191,0		
186,0	240,0	81,4	65,0	190,0		
191,5	280,0	91,0	86,0	230,0	212,0	
195,0	207,0	68,4	59,5	189,0		
198,0		81,5	68,0	207,0	165,0	620
204,0	170,0	56,0	45,0	161,0		760
204,5	264,0	87,0	72,2	157,0		
208,0	230,0	80,0	61,0	167,0	128,0	660

Table 14

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth

KN 24 - Bucrania

1	2	3	4	5	7	8
110	195	67	55		118	540
120	140	44	35	130		340
120	232	77	69		127	570
125	235	78	69		120	500
130	170	57	48			420
130	155	52	42		120	410
130	160	56	45			240
130	215	71	62		120	
130	190	65	56			540
135	250	83	74			640
135	160	53	47			360
135	164	53	48	140	88	480
135	205	66	59	145	108	470
140	170	58	45			440
140	170	57	50	150		580

1	2	3	4	5	7	8
140	185	61	52			420
140	210	70	60	160		
140	215	69	65	155		720
140	215	71	61		180	440
140	170	57	49	155		460
140	130	45	37		160	200
140	190	64	56		100	540
140	175	57	50			660
140	255	87	70	180	135	680
140	185	63	54			480
140	165	54	49		110	450
140	195	64	57		103	515
140	190	62	54			620
140	168	56	50		98	400
140	175	60	48		140	555

Table 15

KN 24 (cont.) - Bucrania													
1	**2**	**3**	**4**	**5**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**7**	**8**
140	190	62	57	150	113	620	150	170	53	52		100	540
140	197	67	60	166		540	150	164	56	48	160		300
140	170	57	48		120	740	150	160	50	47	148	110	480
140	172	60	50			660	150	165	53	51	148	130	540
140	223	75	65	166		570	150	210	69	63		140	730
140	190	63	56			480	150	197	85	60			700
140	180	58	56			700	155	220	69	61	160		550
140	234	81	69	190		700	155	160	50	47			390
140	179	60	53	170		520	155	170	55	48			640
140	196	65	57	150	110	570	155	175	56	50		115	600
140	245	81	73	150		540	155	200	66	57		125	570
140	170	56	49	140		320	155	215	74	64			600
140	177	59	52	150	118	560	155	185	62	55	165	110	610
140	180	61	56	160	110	510	155	145	47	43	155		460
140	240	82	68		135	610	155	230	77	67	180	155	650
145	190	62	54		120	630	155	170	60	47		110	580
145	235	79	66		165	760	155	170	57	51		130	520
145	150	50	43		125	380	155	220	73	66		140	770
145	260	88	70	200	175	720	155	195	67	58	150	110	600
145	180	59	53			600	155	192	64	56		103	600
145	197	67	56			540	155	160	52	48		110	360
145	145	47	41	140	160	440	155	225	82	60			600
145	155	50	48	144	100	520	155	172	59	50		120	240
145	160	53	48	144	115	580	155	163	55	49			530
145	175	56	53				155	165	57	45	150		
145	190	66	51			800	155	280	94	78		160	820
145	225	76	66	180	150	600	156	180	59	51			540
145	225	76	64		134	600	160	170	53	52			500
146	170	55	51			420	160	180	83	47	170		
150	145	47	45			215	160	190	58	58	160		560
150	210	72	59				160	185	60	52	160		460
150	150	49	44			600	160	310	103	87		160	1400
150	245	77	70		150	740	160	168	55	49			660
150	215	71	61			460	160	165	55	46	160		620
150	225	75	65			530	160	182	62	53	160		610
150	210	71	60			750	160	230	73	68	180	140	820
150	210	71	62	180		640	160	220	71	65		140	750
150	205	66	57		130	640	160	245	86	64		142	800
150	214	72	62		110	800	160	235	79	74	184		760
150	210	70	59		120	580	160	248	83	72		170	780
150	215	70	64		108	730	160	210	72	61			820
150	175	79	48			640	160	215	71	64			700
150	260	88	75		155	650	160	240	80	68			700
150	230	79	65	180	120		160	208	71	60			700
150	230	80	67			570	160	182	63	52		130	640
150	195	64	56	170	120	600	160	175	79	50	210	130	600
150	188	63	54	150	104	640	160	172	59	48		130	690
150	160	51	49	162	122	500	160	190	64	56			650
150	178	58	53	150		540	160	175	57	52			490
150	173	55	52		110	540	160	174	58	50	170		
150	160	54	45	150			160	177	57	52			
150	170	57	49			480	160	140	46	43			540

Table 15 (cont.)

KN 24 (cont.) - Bucrania

1	2	3	4	5	7	8
160	170	57	50	160	120	600
160	160	54	45		118	520
160	170	55	52		105	520
160	205	65	58		132	630
160	158	53	47			670
160	185	62	52	166	130	590
160	144	49	42			420
160	235	76	67	180		
160	163	54	48		90	580
160	170	55	51			700
160	205	70	59			660
160	215	71	59			660
160	203	66	60	160		680
160	198	66	59		150	860
165	185	67	54			
165	180	59	54		120	820
165	260	89	71	200		760
165	235	78	71			420
165	150	51	44	164		510
165	176	58	53			700
165	170	54	50	150	120	680
165	160	53	47			480
165	150	49	47	150	100	460
165	220	74	62	180	144	
165	185	58	50	140		630
165	208	69	60		119	680
165	150	49	43	160		560
165	132	41	38		120	660
165	183	58	56			650
170	200	66	60			
170	215	69	64			620
170	200	68	58			640
170	155	49	45	160		500
170	265	90	76	195		1280
170	230	78	68	175	155	630
170	220	76	62	180		670
170	225	73	68	150		450
170	178	59	52			580
170	250	83	73		160	975
170	210	70	59		140	875
170	170	56	50	165	126	520
170	200	67	58		140	1000
170	187	62	55	164	120	630
170	163	54	48			560
170	230	80	66			710
170	138	45	41	150	124	540
170	235	78	70			690
170	232	76	68		125	580
170	178	60	48	150		660
170	245	85	65			720
170	210	69	65	170	124	700
170	217	73	62		125	830
170	202	69	60	180		610
170	265	88	79	196		740
170	245	79	74		180	500
175	235	76	69	170	130	990
175	230	78	69			750
175	178	59	53			
175	208	70	53		110	800
175	248	88	68	180	130	610
180	210	69	63		150	1020
180	310	102	83		170	1000
180	205	68	60			800
180	225	71	67		140	550
180	230	77	68			
180	175	57	48			800
180	210	71	62			700
180	225	74	67			620
185	240	72	68			850
190	232	76	72			640
190	250	83	71	164	192	750
195	220	74	63	180	150	750
205	321	106	92	224		1420
	180	58	54			
	235	77	69			
	184	63	51			
	220	75	60			
	165	55	48			
	175	57	51			
	170	56	51			
	215	68	64	160	130	620
	220	68	64			
	185	58	56	160		
	170	54	52			
	168	55	51			
	212	69	62			
	230	74	70			
	150	50	43			460
	205	68	60			
	240	85	66			860
	210	70	62			
	165	52	51			
	175	54	52			

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth

Table 15 (cont.)

MAXILLA				
L. P2-M3	**L. P2-P4**	**L. M1-M3**	**L. M3**	**B. M3**
			28.0	
137,9	53,0	82,0	30,4	22,6
			32,3	
			32,4	

Table 16

MANDIBLE				
L. P2-M3	**L. P2-P4**	**L. M1-M3**	**L. M3**	**B. M3**
			35,0	13,4
			35,2	13,3
			35,5	15,0
			35,5	14,5
			35,6	
			35,7	16,0
			36,5	13,0
			36,7	14,5
			36,9	
			37,0	14,8
			37,0	13,5
			37,2	
			37,3	14,3
			37,3	16,5
			37,5	14,3
			37,7	13,7
			37,9	14,2
			38,3	15,2
			38,3	15,2
			38,4	15,0
			38,7	14,5
144,0	55,0	90,5	38,7	14,0
			38,8	
			39,0	16,0
			39,1	13,5
			39,4	
			39,4	
			39,7	
			39,7	15,4
			40,0	15,1
			40,2	16,1
			40,3	16,2
138,2	53,5	85,5	40,5	17,0
			40,8	
			41,0	16,0
			41,3	14,6
			41,5	14,2

Table 17

ATLAS				
GB	**GL**	**BFcr**	**BFcd**	
153,0		106,7	99,0	
		95,2	89,8	juv.
165,0	95,0	120,0	115,0	

Table 18

SCAPULA							
GLP	**LG**	**BG**	**SLC**		**GLP**	**LG**	**BG**
54,6	46,5	37,5			67,3	58,8	47,1
55,0					67,4	54,3	39,3
55,0	46,0	37,5			67,5	57,5	45,5
56,5	47,5	46,0	35,7		69,0	56,5	50,5
57,0	49,8	40,1			69,0	62,0	48,0
57,8	51,0	36,0			69,0	59,0	46,0
58,7	48,3	44,1			70,0	60,1	46,8
58,9	50,0	40,0			70,5	61,5	52,2
59,0			49,4		71,3	58,5	48,5
59,2	52,0	42,5	42,8		71,5	61,5	52,5
59,2	52,3	40,0			71,5	58,0	51,0
59,4	51,0	38,6			72,1	57,0	45,0
59,5	50,4	43,3			72,8	52,5	48,6
59,5	51,2	41,0			73,0	59,0	51,2
59,5	49,8	42,3	48,8		73,2	60,5	53,0
59,5	46,5	35,5			73,4	66,0	54,0
59,5	53,0	43,8			75,0	70,0	57,0
59,6	50,7				75,5	64,0	54,0
59,9	53,0	46,2			76,0	63,9	53,0
60,0	45,0	44,5			76,4	66,0	47,8
60,0	49,9	42,0			76,5	64,5	54,0
60,7	51,5	42,5	45,7		78,1	63,2	53,6
61,0	50,0				78,5	63,5	58,7
61,3	49,0	43,0	43,5		79,0	67,0	
61,7	52,0	40,5			79,0	59,0	47,5
62,0	52,0	43,5			79,0	69,5	56,0
62,0	56,0	49,5	49,0		80,0		52,4
62,2	49,5	41,0			80,6	65,6	52,0
62,5	56,2	43,2			81,0	65,0	54,4
63,1	52,2	39,9				57,1	46,7
64,0	51,0	44,5				58,5	53,5
64,0		51,0	53,0			58,5	
64,2	53,5	44,2				51,0	39,8
64,5	50,0	45,0	50,2			56,3	45,3
64,5	55,5	46,0	57,0			68,2	59,0
64,5	55,0	43,0	52,5				59,1
65,5	55,5	53,0				58,7	51,8
65,5	56,6	44,5				54,5	
65,9	57,4	55,5	55,4				55,5
66,1						51,8	37,0
66,5		42,0				54,1	42,8
66,7	52,8						
66,9	57,2	43,0				60,4	51,0
67,0	53,8	42,5				63,0	54,5
67,0		42,2	49,0			59,5	54,7
67,0	57,4	43,0					

Table 20

AXIS	
BFcr	**B. dens**
81,0	40,0
86,5	45,6
87,0	40,6
87,5	47,6
88,0	45,0
89,5	44,0
90,5	48,5
91,0	42,0
92,0	42,0
94,1	40,0
95,0	42,8
97,0	42,0
101,0	41,8
101,0	47,0
101,0	45,0
103,5	38,2
	38,2
	42,3
	46,0

Table 19

HUMERUS					
Bd	**BT**		**Bp**	**Bd**	**BT**
58,2				88,8	78,0
68,2				89,0	
70,0	67,3			89,0	78,0
72,4				89,5	
72,5				90,5	
73,7				90,8	78,8
74,0				91,0	80,5
74,0				92,3	80,6
74,0	68,0			93,0	
74,2				93,0	
74,5	67,5			96,0	82,5
74,9	66,0			97,0	80,6
75,5	69,0			97,0	85,0
76,4				97,0	85,5
76,5	71,0			98,5	88,0
76,5	71,5			101,2	86,2
77,0					76,0
77,1					80,0
78,0					81,2
78,2	72,5				83,9
78,5	74,0				70,8
79,0	72,2				70,0
79,5					81,2
79,8	76,0				77,3
80,0	72,3				74,9
80,5	69,5				72,0
81,0	73,3				78,0
81,0					79,0
81,5	73,0				70,0
82,0					81,8
82,0	74,1				70,2
82,0	73,0				70,1
82,5					69,6
83,0					73,1
83,2	71,5				66,0
84,0					68,0
84,0	75,0				68,8
84,0	73,2				82,0
84,5	81,3				69,0
84,5	75,5				72,2
85,0					
85,0	77,0				68,0
85,7					77,0
86,0	82,1				71,8
86,3	78,3				70,6
86,5	80,0		92,5		
87,0	82,3				73,9
87,5	78,0				62,5
88,0	81,3		95,0		
88,2	78,2				78,1
88,5	82,0				73,8

Table 21

RADIUS			
BP	**BFp**	**Bd**	
74,8	69,0	63,0	juv.
75,0	69,0	63,1	
76,0	69,1	63,5	juv.
76,1	79,0	63,6	
78,5	81,0	64,0	
78,5		64,3	juv
87,5		64,4	juv.
91,1		65,0	
		65,5	juv.
		66,0	juv.
		68,0	juv.
		68,3	
		69,3	
		70,0	
		70,0	juv
		70,2	juv
		70,3	
		71,5	
		75,5	
		75,5	
		76,0	
		76,0	juv
		76,1	juv
		76,3	
		79,4	
		79,4	
		80,0	
		81,2	juv.
		81,5	
		82,4	
		83,7	
		85,5	

Table 22

ULNA		
LO	**SDO**	**DPA**
88,5	48,9	81,6
93,4		
95,0	50,3	
104,2	57,5	
117,5	57,0	
		60,5
		78,5
	56,0	74,5
	58,0	73,3
		55,4

Table 23

OS CARPI RADIALE				
L		L		L
34,2		42,2		46,5
35,0		42,2		46,5
36,1		42,2		46,6
37,8		42,3		46,6
37,8		42,5		46,9
38,0		42,5		46,9
38,3		42,7		47,0
38,7		42,8		47,0
39,0		42,9		47,0
39,0		43,0		47,1
39,0		43,0		47,2
39,2		43,6		47,2
39,4		44,0		47,2
39,9		44,0		47,6
39,9		44,0		48,0
40,0		44,0		48,0
40,0		44,0		48,0
40,1		44,0		48,0
40,2		44,0		48,0
40,4		44,2		48,0
40,4		44,3		48,0
40,4		44,5		48,2
40,6		44,5		48,2
40,6		44,6		48,5
40,8		45,0		48,6
40,9		45,0		48,7
41,0		45,0		48,9
41,0		45,0		49,0
41,0		45,0		49,0
41,0		45,0		49,0
41,1		45,1		49,0
41,1		45,1		49,1
41,1		45,1		49,5
41,1		45,2		49,5
41,2		45,5		50,0
41,3		46,0		50,6
41,3		46,0		51,0
41,5		46,0		51,0
42,0		46,0		51,0
42,0		46,2		51,1
42,1		46,3		51,3
42,1		46,3		52,8

Table 24

OS CARPI INTERMEDIUM				
L		L		L
34,9		39,2		42,1
35,2		39,3		42,2
35,4		39,4		42,4
35,5		39,7		42,5
35,6		39,8		42,8
36,0		39,9		42,9
36,0		39,9		42,9
36,1		39,9		43,0
36,1		39,9		43,0
36,1		39,9		43,2
36,8		40,0		43,3
36,8		40,0		43,6
37,1		40,0		43,6
37,3		40,0		44,0
37,5		40,1		44,3
37,5		40,1		44,4
37,5		40,2		44,5
37,6		40,5		45,0
37,6		40,7		45,0
37,8		41,0		45,7
38,5		41,0		46,0
38,6		41,1		46,0
39,0		41,1		46,1
39,0		41,2		47,9
39,1		41,5		
39,2		42,1		

Table 25

METACARPUS III + IV				
Bp	Dp	SD	Bd	Dd
52,0			54,2	
54,5			55,0	28,5
56,0			55,7	
57,5		35,5	56,4	30,8
58,0		37,2	57,0	31,5
58,0		36,8	57,1	
58,2			57,2	
59,5		36,2	57,2	31,4
59,9	40,0		57,5	
62,0		39,5	57,8	
64,2			58,8	
66,0		42,2	59,0	30,3
67,2		41,8	59,1	
			60,0	32,2
			61,8	
			62,3	
			63,0	
			64,3	
			65,3	
			69,0	

Table 29

OS CARPI ULNARE				
L		L		L
31,6		36,9		41,0
32,0		37,0		41,0
32,3		37,0		41,0
33,3		37,0		41,1
33,5		37,1		41,2
33,7		37,1		41,3
34,0		37,1		41,3
34,1		37,1		41,4
34,2		37,2		41,4
34,6		37,2		41,5
35,0		37,8		41,5
35,0		38,0		41,7
35,0		38,0		41,8
35,0		38,1		41,8
35,0		38,1		41,8
35,0		38,1		41,8
35,1		38,2		42,0
35,1		38,2		42,1
35,1		38,5		42,1
35,2		38,5		42,3
35,4		38,6		42,5
35,5		38,8		42,6
35,5		39,1		42,8
35,6		39,1		42,9
35,6		39,2		43,0
35,7		39,5		43,0
36,0		39,8		43,5
36,0		39,9		43,9
36,0		40,0		44,0
36,0		40,3		44,2
36,1		40,3		44,4
36,1		40,3		44,9
36,2		40,4		45,0
36,3		40,5		45,0
36,5		40,6		47,9
36,5		40,6		49,3
36,6		40,9		
36,7		41,0		

Table 26

OS CARPALE II + III							
GB	**L**	**GB**	**L**	**GB**	**L**	**GB**	**L**
30,2	29,4	35,5	31,5	38,0	34,5	41,0	36,0
31,4		35,5		38,1	33,3	41,0	38,0
31,5	30,4	35,5		38,1	35,1	41,0	38,0
32,0		35,5	30,4	38,1	30,0	41,0	37,8
32,1	29,4	35,5	38,4	38,1	36,1	41,0	33,5
32,2		35,5	30,5	38,2		41,0	36,5
32,3	30,6	35,5	31,0	38,2	37,0	41,1	36,0
32,4		35,7	29,3	38,2	33,1	41,1	38,7
32,9		35,9		38,2	35,0	41,1	36,2
33,0		36,0	32,0	38,2	33,1	41,3	36,0
33,0	29,5	36,0	34,2	38,2	36,5	41,3	37,0
33,1	32,0	36,0	30,8	38,3	32,8	41,3	38,0
33,1	29,0	36,1	35,5	38,5		41,5	37,0
33,1	29,8	36,1	31,1	38,5	33,6	41,5	36,0
33,2	37,0	36,1	31,0	38,6	34,3	41,6	36,9
33,3		36,2		38,7		41,7	39,9
33,5	30,0	36,2	32,5	38,7	33,0	41,8	37,0
33,8	33,0	36,3		38,7	37,2	41,9	37,0
34,0	28,9	36,3	32,1	38,8	34,1	42,0	36,2
34,0		36,3	33,4	39,0		42,0	37,0
34,0		36,4		39,0	36,0	42,0	35,5
34,0		36,4	31,5	39,0	36,8	42,0	37,0
34,0	28,0	36,4	32,9	39,0	36,0	42,1	37,0
34,5	27,8	36,5	33,8	39,0	34,0	42,2	40,0
34,7		36,5		39,1	36,6	42,3	39,4
34,7	29,6	36,5	37,0	39,3	36,5	42,3	36,3
34,8		36,8	31,5	39,5	34,8	42,6	35,0
34,8	31,6	36,9	34,2	39,6	36,4	42,8	37,0
34,9	32,9	37,0	35,0	40,0	38,0	42,9	
34,9	32,0	37,0	31,2	40,0	34,8	43,0	37,0
34,9	31,0	37,0	34,0	40,0	35,5	43,0	37,9
35,0		37,1	35,2	40,0	37,0	43,0	36,0
35,0	33,7	37,1	30,0	40,1	35,8	43,3	36,8
35,0	31,2	37,1	34,0	40,1	38,0	44,0	37,0
35,0	30,5	37,1	32,0	40,1	36,1	44,1	37,2
35,0	32,5	37,2	38,1	40,1	36,5	44,1	38,6
35,0	31,9	37,2	35,0	40,2	37,1	44,6	36,4
35,0	30,0	37,3	34,0	40,2	35,0	45,0	35,0
35,1		37,4	29,5	40,5	39,2	45,0	37,9
35,1	32,6	37,6		40,5		45,0	39,2
35,1	29,6	37,9	35,4	40,5	35,7	45,5	41,0
35,1	33,1	38,0	35,0	40,5	38,0	46,0	40,0
35,1	31,2	38,0	33,2	40,5	37,0	46,3	40,2
35,2		38,0	36,8	40,6	38,2	48,9	40,6
35,3		38,0	34,1	40,7	38,2		
35,4	32,1	38,0	34,0	40,8	33,0		

Table 27

OS CARPALE IV					
GB	**L**	**GB**	**L**	**GB**	**L**
20,1	23,0	26,1	32,5	29,3	36,0
21,2	26,0	26,2	33,8	29,5	33,5
22,0	31,0	26,5	30,2	29,6	37,1
22,3	27,0	26,9	31,1	29,6	35,0
23,4	28,8	27,0		29,9	35,4
23,5	36,0	27,0	33,9	30,0	36,0
23,5	31,6	27,0	31,9	30,0	35,9
23,5	31,0	27,0		30,0	
23,6	27,6	27,0	32,8	30,0	
23,8	29,5	27,1	33,5	30,0	36,4
24,0	31,6	27,1	31,5	30,0	36,1
24,0	30,1	27,1	33,1	30,0	38,1
24,1	30,6	27,1	35,0	30,0	39,0
24,2	30,0	27,5	36,0	30,0	35,2
24,2	32,0	27,5		30,0	37,5
24,2	28,0	27,5	32,9	30,1	33,7
24,3	31,2	27,5	32,1	30,8	37,0
24,3	31,1	27,8	36,3	31,0	36,6
24,5		27,9	35,0	31,0	35,0
24,8	32,0	27,9	36,0	31,0	37,8
24,8	31,2	27,9	32,3	31,0	38,4
24,8	33,1	28,0	34,4	31,0	35,2
25,0		28,0	33,7	31,1	36,5
25,0	32,0	28,0	36,1	31,1	35,1
25,0	32,0	28,0	37,8	31,1	30,6
25,0	31,8	28,0	34,1	31,2	37,8
25,0	30,0	28,0		31,3	37,2
25,0	33,2	28,0	34,9	31,4	38,1
25,0	31,2	28,0	35,8	31,5	39,0
25,0	31,0	28,1	33,5	31,7	36,0
25,0	30,5	28,1	36,5	31,9	35,1
25,0	31,0	28,1	34,6	32,0	36,5
25,1	31,2	28,1	36,0	32,0	38,5
25,1	30,1	28,5	35,5	32,1	30,0
25,1	31,0	28,6	38,3	32,1	38,1
25,2	31,0	28,6	35,1	32,5	35,6
25,5	30,5	28,9	35,1	33,5	39,0
25,5	32,0	29,0	32,9	33,7	40,0
25,5	31,2	29,0	36,8	33,8	39,1
25,8		29,0	38,0	37,3	
25,8	28,0	29,0	33,0		35,0
25,8	28,9	29,1	38,1		36,1
26,0	31,7	29,1	36,0		35,8
26,0	30,5	29,1	38,8		33,5
26,1	34,5	29,1	35,5		30,2
26,1	36,0	29,3	29,9		34,6

Table 28

PHALANX 1 ANTERIOR

Glpe	Bp	SD	Bd	Glpe	Bp	SD	Bd	Glpe	Bp	SD	Bd	Glpe	Bp	SD	Bd
54,6	31,1	25,3	30,0	62,2	30,5	26,1	29,8	64,7	36,3	29,4	30,2	68,0	34,5	28,5	32,6
57,8	27,6	21,7	26,2	62,3	30,0	26,4	29,5	64,7	32,0	26,2	29,4	68,0	34,6	28,0	32,9
57,8	29,6	25,3	27,8	62,3	29,8	24,7	29,6	64,8	34,7	29,4	30,9	67,5	35,5	28,5	31,8
58,0	29,9	24,5	28,0	62,3	34,1	25,9	29,5	64,8	31,5	25,2	28,2	67,6	37,2	31,0	36,5
58,0	28,5	23,9	26,1	62,3	31,0	24,1	27,8	65,0	33,2	29,1	30,0	67,6	33,6	26,5	29,8
58,4	30,0	25,0	27,6	62,3	29,9	24,8	27,0	65,0	31,0	28,7	32,5	68,0	34,5	28,5	31,2
58,5	28,9	22,3	27,9	62,3	34,9	27,2	32,5	65,0	37,3	30,2	31,9	68,0	33,0	29,6	30,8
58,5	28,2	22,5	26,2	62,4	32,6	27,3	31,5	65,0	33,2	26,7	28,8	68,1	33,1	27,2	33,0
58,7	28,6	24,6	28,5	62,4	32,0	26,2	30,0	65,0	32,2	26,0	29,0	68,2	33,0	27,2	29,9
58,7	29,1	24,2	29,2	62,4	31,0	26,5	29,0	65,1	36,0	29,0	33,0	68,3	32,5	28,9	32,1
58,8	30,5	23,8	26,8	62,5	33,0	27,5	29,8	65,1	32,1	25,4		68,6	34,2	28,9	34,0
59,0	29,6	26,0	28,9	62,6	32,2	26,0	31,1	65,3	34,7	29,2	34,5	68,7	37,0	31,5	36,9
59,1	31,2	26,5	30,1	62,6	35,0	28,8	32,8	65,5	32,5	26,2	32,9	68,9	33,4	27,8	29,5
59,2	30,0	23,0	26,3	62,7	31,5	26,0	28,2	65,5	36,9	30,0	32,4	69,0	33,7	29,2	33,3
59,2	27,8	23,4	27,0	62,8	35,6	29,9	35,8	65,5				69,0	31,5	27,0	31,2
59,2	28,2	24,0	27,0	62,8	30,7	26,2	28,6	65,6	31,0	26,0	28,6	69,1	37,0	31,2	32,8
59,3	30,4	24,1	29,0	62,8	27,9	23,9	26,2	65,7	32,3	27,5	30,0	69,2	35,0	29,1	35,0
59,5	29,4	24,8		62,8	35,6	28,0	32,0	65,7	35,5	30,2	30,5	69,2	32,5	26,4	28,9
59,7	31,0	25,0	28,5	62,9	33,1	26,2	29,3	65,8	32,2	25,0		69,5	35,3	28,1	
59,8	31,6	28,9		63,0	31,4	25,3	29,0	65,8	37,3	29,8	34,7	69,5	35,2	28,0	32,6
60,1	29,9	25,0	29,0	63,0	31,6	24,9	30,0	65,9	33,2	28,0	30,4	69,5	31,2	25,0	28,7
60,1	30,0	23,6	26,7	63,0	29,8	24,5	27,8	66,0	30,5	25,8	30,4	69,8	34,5	26,8	31,7
60,1	28,6	23,0	26,1	63,0	33,6	28,5	31,5	66,1	37,1	30,0	32,6	70,0	32,5	27,0	30,6
60,1	29,1	23,0	26,8	63,1	32,2	29,4		66,1	34,0	27,9	31,8	70,1	35,5	28,8	32,0
60,4	28,0	23,3	26,6	63,2	32,7	27,8	30,4	66,2	30,5	26,0	31,0	70,1	38,0	32,6	33,8
60,5	28,5	24,3	27,2	63,4	34,5	29,0	32,0	66,2	33,2	26,9	31,2	70,3	37,3	31,2	33,3
60,6	30,5		29,3	63,5	34,5	27,2	31,6	66,2	34,5	28,8	28,5	70,6	36,5	30,0	33,2
61,0	29,1	24,3	28,2	63,5	32,4	26,5	28,9	66,3	34,2	26,1	29,2	70,6	36,8	32,2	32,6
61,0	35,0	27,5	31,0	63,6	34,0	27,6	32,6	66,4	35,3	26,0		70,8	31,9	26,0	29,2
61,0	29,4	24,1	26,5	63,6	33,4			66,5	35,5	29,5	32,2	71,1	35,0	29,0	31,0
61,1	30,0	25,3	30,5	63,6	33,8	28,7	31,0	66,7	35,0	31,0	36,8	71,2	35,6	29,2	32,9
61,2	35,9	31,2	39,4	64,0	34,8	27,5	31,4	66,8	36,2	29,2	35,1	71,9	37,0	31,5	35,7
61,2	32,8	27,1	29,7	64,0	32,3	27,5	33,5	66,8	37,8	32,3	32,0	72,0	37,8	29,3	31,5
61,2		24,5	29,5	64,0	33,2	28,0	35,0	66,8	30,8	24,2	29,0		34,0		
61,2	27,5	24,6	28,7	64,0	34,5	26,0	31,0	66,9	32,5	27,9	34,3		37,5	30,6	
61,3	31,2	25,7	27,8	64,0	33,5	24,2	28,7	66,9	35,8	30,1	32,0		31,2		
61,5	36,0	29,0	33,0	64,0	31,5	25,2	27,3	66,9			31,5		34,1		
61,7	31,0	26,5	28,9	64,2	35,5	28,5	33,0	67,0	35,6	29,9	36,0		29,0		
61,8	30,1	27,2	30,5	64,2	31,8	26,2	28,5	67,0					33,3		
61,8	27,2			64,3	34,0	29,2	32,9	67,0	29,5	25,2	29,6		34,5		
61,9	34,9	28,2	32,6	64,5	36,5	30,3	33,5	67,1	31,1	25,5	29,4		33,3		
61,9	29,0	25,0	29,4	64,5	32,0			67,2	34,0	27,5	32,0		33,6		
62,0	29,2	25,9	25,9	64,5	33,4	25,4	30,7	67,2	36,1				33,1		
62,0		22,5	25,9	64,5	35,0	27,0	32,5	67,2	34,7	28,0	30,2		37,4		
62,0	31,3	25,5	28,1	64,5	31,8	27,4	29,3	67,3	32,7	26,5	30,4			29,5	31,1
62,0	34,9	29,0		64,5	36,2	29,0	32,6	67,5	36,0	32,0	32,8				
62,1	30,8	24,5	29,8	64,5	34,5	28,7	32,0	67,5	37,4	30,6	32,0				
62,2	34,7	28,8	33,4	64,7	30,7	26,4	30,2	67,9	34,2	28,0	31,0				

Table 30

PHALANX 2 ANTERIOR

GL	Bp	SD	Bd	GL	Bp	SD	Bd	GL	Bp	SD	Bd	GL	Bp	SD	Bd
35,5	26,3	22,5	24,1	41,2	28,5	23,3	24,1	43,0	34,0	27,0	30,0	45,3	36,4	31,4	32,5
36,6	28,2	22,2		41,2	27,4	21,7	23,2	43,0	32,0	24,4		45,5	34,0	28,9	29,4
36,7	26,4	21,0		41,3	30,9	26,4	27,0	43,0	38,1	29,9	31,6	45,5	33,4	27,7	30,7
36,9	28,7	23,0	25,5	41,3	20,2	23,4	25,9	43,1	32,9	26,6	29,2	45,7	34,0	30,0	32,7
37,2	37,0	22,5	25,0	41,3	28,8	24,0	25,1	43,2	29,7	24,9	27,2	45,8	32,7	30,1	30,9
37,3	28,7	22,2	24,7	41,3	28,7	22,2	24,9	43,2	32,0	27,8	30,1	46,0	34,5	27,6	30,8
37,7	27,8	23,6	23,0	41,3	33,9	26,6	28,9	43,2	32,0	26,0	27,1	46,0	34,4	29,1	30,4
38,0	28,5	24,3	26,0	41,4	31,3	25,7	29,7	43,3	35,5	31,0	30,5	46,2	32,5	27,2	30,3
38,4	30,0	25,0	27,0	41,5	30,9	24,7	26,2	43,4	33,3	27,4	26,5	46,3	32,4	27,2	30,9
38,6	27,7	21,3	23,1	41,5	29,3	23,8	30,2	43,4	32,0	26,4	28,2	46,4	32,0	26,2	27,8
38,8	31,3	24,5	27,0	41,5	38,8	24,1	24,6	43,4	31,2	26,0	27,8	46,5	33,7	27,8	28,2
39,0	31,5	25,2	28,2	41,6	31,6	26,8	25,7	43,5	32,5	27,4	28,2	46,5	35,7	30,8	31,0
39,0	30,8	26,6	25,5	41,6	28,2	21,9	23,6	43,6	30,0	26,2	24,5	46,5	33,9	26,8	28,3
39,1	30,0		28,9	41,7	34,8	27,3	29,5	43,7		27,0	30,0	46,5	31,4	27,2	28,0
39,2	30,1	25,3	29,0	41,7	28,9	25,3	27,1	43,8	32,3	28,0		46,6	34,2	29,3	32,7
39,5	36,1	29,0	31,9	41,9	29,9	25,5	26,1	43,8	33,3	28,1	30,2	46,6	35,2	28,6	30,8
39,5	31,0	27,7	27,3	41,9	27,8	23,3	25,4	43,8	32,0	26,1	28,1	46,6	32,2	26,1	28,9
39,8	31,3	24,5	27,0	41,9	30,2	26,1	27,5	44,0			28,0	46,7	34,3	30,5	29,4
39,9	32,2	27,6	30,7	42,0	33,0	28,8	32,6	44,0	31,0	28,0	31,0	46,8	33,7	26,8	29,2
40,0	28,0	24,2	31,8	42,0	28,1	23,0	24,2	44,0	33,5	26,9	27,9	46,8	33,2	27,1	30,1
40,0	29,8	24,2	27,8	42,0	28,3	24,9		44,0	33,5	26,5	28,0	47,0	34,0	29,5	30,5
40,0	33,5	27,3	26,5	42,0	30,4	26,0	28,2	44,0	31,5	26,3	28,5	47,0	33,0	27,0	30,0
40,0	28,2	23,0	24,8	42,0	31,0	26,0	28,9	44,1	34,0	26,2	29,2	47,0	36,2	32,0	35,9
40,0	29,2	24,0	25,1	42,2	32,4	25,8	28,0	44,2	33,0	27,6	27,7	47,0	33,6	26,2	28,2
40,0	28,8	23,5	25,4	42,2	34,9	28,7	29,2	44,2	32,5	26,2	29,3	47,0	34,9	27,1	28,0
40,0	28,0	22,2	23,0	42,2	30,7	25,5	28,1	44,2	33,6	28,5	31,2	47,1	33,7	28,0	29,1
40,1	28,8	24,8	26,3	42,2	29,0	23,0	25,0	44,2	31,7	25,0	25,6	47,2	34,0	29,2	30,0
40,3	30,2	25,2	27,2	42,3	29,9	25,9	28,3	44,2	33,0	28,0	30,8	47,3	34,2	30,1	31,3
40,3	31,0	26,1	26,2	42,5	32,3	27,6	29,3	44,5	34,0	30,4	34,0	47,5	35,5	30,0	33,3
40,5	30,2	24,0	26,9	42,5	33,2	27,1	28,0	44,6	34,4	27,8	30,3	47,5	33,2	28,1	31,5
40,5	28,4	23,1	24,5	42,6	33,5	28,0	29,0	44,6	29,2	25,0	29,6	47,6	35,5	31,6	32,8
40,5	28,0	23,6	22,5	42,6	32,0	27,3	27,6	44,6	32,5	26,0	27,1	47,7	35,2	29,0	32,5
40,6	29,7	24,8	26,0	42,7	29,3	24,6	25,0	44,7	34,9	30,4	32,9	47,8	34,8	30,0	31,2
40,7	30,0	27,0	26,8	42,7	32,4	24,5	27,6	44,8	32,3	28,4	26,3	47,9	33,9	27,3	29,4
40,7	29,2	24,1	26,1	42,8	34,5	27,8	29,2	44,8	33,3	28,7	31,6	48,0	34,5	27,0	29,0
40,9	32,0	26,1		42,9	36,0	26,7	27,6	44,8	32,5	27,1	30,0	48,3	35,6	30,2	34,5
41,0	32,3	27,7	27,5	42,9	30,7	24,4	25,0	44,9	33,9	28,0	30,0	49,0	35,3	28,3	31,4
41,0	32,3	26,0	27,1	43,0	31,0	26,6	27,1	45,0	31,3	26,2	27,4	49,1	35,8	29,3	34,0
41,0	33,7	27,6	29,3	43,0	30,0	24,5	25,3	45,1	32,3	28,0	31,3	49,4	37,0	33,1	33,8
41,1	32,6	27,1	27,2	43,0	32,6	27,0	27,7	45,2	32,8	28,8	31,0	50,9	34,8	30,2	34,8
41,2	29,0	23,8	24,9	43,0	33,0	27,4	28,8	45,2	32,2	25,9	29,2				
41,2	30,3	23,7	25,8	43,0	31,8	25,5	27,2	45,2	35,1	29,0	30,5				
41,2	27,1	24,5	24,0	43,0	33,8	27,5	29,5	45,3	34,2	27,0	29,5				

Table 31

PELVIS
LA
57,5
59,0
60,5
61,5
62,6
67,3
68,5
68,5
68,7
69,2
76,4
76,9

Table 32

FEMUR
Bd
102,5
108,1
100,7
103,0
106,5
85,0
98,8
100,5
98,0
102,5
103,8
88,5
105,0
105,0
86,0
90,0
100,0
100,0
84,8
101,5

Table 33b

FEMUR									
Bp	DC			Bp	DC			DC	
	37,0	juv.			43,2	juv.		47,5	
	37,8	juv.			43,4			47,5	juv.
	38,0				43,7			47,5	
	39,2				43,9			47,5	
	39,3				44,0	juv.		47,5	
	40,0				44,0			47,5	
	40,2				44,0			47,6	
	40,2				44,0	juv.		47,6	
	40,3				44,0			47,7	
	40,4				44,0	juv.		47,9	
	40,5				44,0	juv.		48,0	
	40,5				44,2			48,0	
	41,0				44,2			48,0	
	41,0				44,3			48,0	
	41,0				44,5	juv.		48,0	
	41,0				44,5	juv.		48,2	
	41,0				44,5	juv.		48,2	
	41,0				44,5			48,3	
	41,2				44,5			48,4	
	41,3				44,6			48,5	
	41,3				44,7			48,5	
	41,4	juv.			44,7			48,6	
	41,5				44,8			48,6	
	41,6				45,0			48,7	
110,0	41,6				45,0	juv.		48,8	
	41,8	juv.			45,0			48,9	
	41,8				45,2			48,9	
	41,8				45,2			49,0	
	42,0	juv.			45,2			49,0	
105,5	42,0				45,5			49,2	
	42,0				45,6			49,3	
	42,0				45,6			49,3	
	42,0				45,6			49,5	
	42,0			114,0				50,1	juv.
	42,1			127,0	46,3			50,2	
	42,2				46,3			50,5	
	42,3				46,5			52,0	
	42,3				46,5			52,5	
	42,4				46,5	juv.			
	42,4				46,6				
	42,4				46,7	juv.			
	42,6				46,7	juv.			
	42,6				46,7				
	42,8				46,8				
	42,8				46,8	juv.			
	42,9	juv.			46,8				
	43,0				46,8				
	43,0				47,0	juv.			
	43,0				47,1				
	43,0	juv.			47,2				
	43,1	juv.			47,2	juv.			
	43,2				47,2				
	43,2				47,3				

Table 33a

PATELLA					
GL	GB			GL	GB
52,4	39,5			67,0	50,6
52,6	36,7	juv.		67,0	52,0
54,5	50,5			67,0	59,0
54,7	44,8	juv.		68,1	54,0
58,0	45,0			68,3	55,1
58,5	47,6			68,4	52,5
58,8	45,6			68,5	
59,0				68,5	59,0
59,3				68,5	58,0
60,0	49,0			68,5	56,2
60,0				68,8	
60,7				69,2	55,0
61,0	45,0			70,0	62,5
61,0	53,0			70,0	62,0
61,3	45,4			70,3	56,1
61,8	49,0			70,6	57,3
62,0				71,0	61,0
62,0	48,3			71,0	
62,0	49,8			71,2	
62,2	51,8			71,5	
62,2	51,1			71,5	60,0
62,2	49,0			71,5	63,0
62,6	49,0			71,7	
62,8	46,0			72,0	69,9
62,8	47,0			72,0	53,0
63,0	48,6			72,1	
63,0				72,2	57,0
63,0	51,0			72,5	
63,3	48,0			73,5	
63,5	49,0			73,5	55,0
63,7				74,0	
64,0				74,5	
64,0				74,5	
65,0	54,0			76,0	
65,0	46,0			76,4	
65,5	50,6			76,5	66,0
65,6				77,0	60,3
66,0				79,5	62,0
66,5	59,1			85,0	60,0
66,5					61,8
66,5	55,0				62,2
66,7	51,0				57,0
66,8	45,4				57,2
67,0					43,0

Table 34

TIBIA								
Bp	**Bd**	**Dd**			**Bp**	**Bd**	**Dd**	
	55,3					61,8	46,0	
	56,5					62,0	46,6	
	57,0	41,0	juv.			62,0	46,2	
	57,5					62,4		
	58,0					63,0	43,2	
	58,0	42,5				63,0	43,5	
	58,1	42,0				65,0		juv.
	58,2					65,3	50,5	
	58,7	44,2	juv.			65,5		juv.
	59,0					66,5		
	59,0	46,0				67,4	49,3	
	59,4	44,5				68,0		
	60,0	49,0				68,0		juv.
	60,2	45,5				68,2		
	60,6					68,4	52,0	
	60,6					68,5	58,0	
	60,7		juv.			69,1	54,0	
	61,0					70,2	52,0	
	61,3		juv.		92,0			

Table 35

OS MALLEOLARE						
GD		**GD**		**GD**		**GD**
29,2		32,2		33,7		36,6
29,4		32,2		33,8		36,8
29,5		32,3		34,0		37,0
30,0		32,7		34,0		37,0
30,1		32,8		34,0		37,2
30,2		32,9		34,1		37,3
30,3		32,9		34,3		37,5
30,5		32,9		34,8		37,5
31,0		32,9		35,1		37,6
31,0		33,0		35,2		37,6
31,1		33,0		35,9		37,8
31,4		33,0		36,0		38,5
32,0		33,0		36,0		38,5
32,0		33,0		36,0		38,8
32,0		33,0		36,0		38,8
32,1		33,1		36,2		39,2
32,1		33,3		36,3		40,1
32,1		33,5		36,3		40,2
32,2		33,5		36,4		41,1
32,2		33,6		36,5		41,9
32,2		33,6				

Table 36

TALUS																
GLl	**GLm**	**Dl**	**Dm**	**Bd**		**GLl**	**GLm**	**Dl**	**Dm**	**Bd**		**GLl**	**GLm**	**Dl**	**Dm**	**Bd**
59,0	52,9	33,5	32,8	39,3		66,5	61,2	36,1	37,8	45,5		70,3	64,5		40,2	46,3
59,2		33,1		37,4		66,6	62,0			49,0		70,4	63,7	37,2	38,5	47,9
59,3	54,8	31,7	30,2	34,6		66,6						70,5	63,4	39,2	40,8	49,4
59,7	55,0	31,8	29,7	34,9		66,7	60,4	36,2	37,5			70,5				
60,0	54,0	32,8	33,5	38,0		66,8	60,0	37,0	36,3	40,6		70,5	64,5	38,0	40,9	48,4
60,1	56,5	33,0		37,3		66,8		35,0				70,6	65,4	40,2	38,6	47,9
60,3	55,9	33,0		40,2		66,9	60,9	37,3	36,2	40,2		70,6		38,3		45,2
60,7	56,3	33,8	32,9	37,7		66,9	61,9	36,5	37,0	44,0		70,6	63,7	39,6	38,4	46,0
60,8		33,4		37,0		67,0	61,2	36,9	37,3	41,5		70,6	64,0	37,9	35,8	41,5
61,0	56,2	34,6	34,5	38,5		67,0			41,0	46,7		70,7	62,5	37,3	37,9	44,8
61,0	55,7	34,2	33,3	37,8		67,0	62,0	37,3	39,0	43,7		70,7		39,0	39,6	47,0
61,1	56,8	34,7	33,8	41,5		67,0		37,0	36,3	42,0		70,8	65,3	39,0	39,5	46,8
61,1	53,6	34,1	33,1	40,0		67,1	58,5	36,2	36,5	43,4		70,8	64,5	40,6	40,5	46,9
61,2	54,7	33,6	31,6	38,5		67,2	61,3	37,7	36,7	44,9		70,8	61,8	38,0	37,8	44,2
61,2	56,3	33,1	32,3	38,0		67,2	61,8	37,6	37,4	43,8		70,8		40,0	39,8	48,0
61,8	54,8	34,0	33,3	38,2		67,3	61,1	38,0	36,4	43,0		70,8	64,5	37,5	38,3	43,3
61,8	58,5			39,3		67,3	61,8	35,9	34,9	43,2		70,9	66,6	41,1	41,0	47,6
61,8	57,0	32,4	33,1	38,7		67,3	65,1	38,6	40,3	48,8		70,9	63,6	38,7	38,8	46,2
62,0	55,8	34,4	32,5	40,9		67,3	61,9	36,2	38,3	45,1		71,0	65,1	40,0	39,9	44,1
62,0	56,5	32,7	30,3	37,7		67,4	61,8	38,5	37,6	44,5		71,0	64,0		39,2	46,7
62,1	57,9	34,3	32,8	37,5		67,5	67,3	37,2	37,6	41,0		71,0	67,0	39,4	40,3	48,1
62,2	57,2	34,3	34,2	38,5		67,5		38,0		48,7		71,0	66,7	39,5	41,2	48,8
62,5	55,4	35,3	35,2	42,3		67,5	62,8	36,6	35,0	41,7		71,0	64,5		38,2	45,6
62,5	58,7	33,8	34,0	39,2		67,6	63,4	35,5	37,3	42,2		71,0	63,0	38,5	38,7	44,5
62,7		35,3				67,6		37,0		44,6		71,1		38,5	37,4	43,2
62,7	57,4	34,5	35,7	41,8		67,8	61,4	38,8	39,2	46,8		71,2	65,1	38,4	40,8	46,3

Table 37

TALUS

GLl	GLm	Dl	Dm	Bd	GLl	GLm	Dl	Dm	Bd	GLl	GLm	Dl	Dm	Bd
62,8	57,5	33,7	31,5	37,5	67,8	63,2	37,7	39,4	43,5	71,2				
62,8	57,8	34,0	33,8	41,2	67,8	62,0	36,2	36,7	42,0	71,2	64,9	39,0	41,8	47,1
62,9	56,2	34,8	32,0	41,3	67,8		37,6	39,5	48,3	71,2		37,5	35,5	43,0
63,0	59,2	34,2	35,6	38,6	67,8	62,3	37,5	40,7	45,4	71,2	65,6	40,1	41,0	48,3
63,0	57,3	35,4	35,5	41,0	67,8	61,8	35,6	36,4	42,0	71,3	64,0	39,5	39,4	47,0
63,0	57,9	35,3		42,0	67,8	60,4	36,3	35,9	45,0	71,3	67,0	41,5	42,4	48,0
63,0	59,8	36,7	37,2	41,3	67,9					71,3	65,0	39,0	41,0	48,0
63,1	58,5	34,2	33,7	43,0	68,0	61,5	36,7	33,0	41,8	71,3	64,7	39,1	38,4	44,7
63,2	56,8	34,2	33,0	38,4	68,0	63,5	35,0	36,5	40,1	71,3	65,6	38,7	39,1	50,4
63,4	58,6	35,4	36,0	39,8	68,3	62,6	37,5	37,6	45,3	71,5	65,9	40,0	42,0	45,8
63,6	57,8	34,3	34,8	38,5	68,3	64,0	38,2	37,1	44,1	71,5	64,6	39,1	40,7	43,0
63,9	59,3	35,5	35,0	41,6	68,4	63,2	37,8	38,4	44,4	71,5		39,6		48,2
64,0	56,3	35,0	33,5	40,5	68,5	63,8				71,6	65,1	39,3	39,0	48,2
64,0	60,0	37,0		41,0	68,5	61,5	37,5	37,5	40,8	71,7				
64,2	60,3	36,3	39,0	44,7	68,6	61,1	37,3		42,2	72,0	64,2	40,7	39,0	50,4
64,2	57,7	35,1	33,4	38,5	68,6	62,9	37,5	39,3	45,1	72,0		39,0		47,5
64,4	57,3	33,5	36,7	46,5	68,7	63,5	37,8	39,2	46,7	72,0	68,0		42,3	49,1
64,4	58,7	36,1	36,7	42,0	68,7	65,5	37,8	38,4	45,0	72,0	64,0	39,0		45,0
64,5	61,3	35,3	34,2	38,2	68,8	63,5	35,4	36,7	42,0	72,1	66,3	39,3	40,7	50,0
64,5	58,7	35,0	35,0	41,0	68,8	62,0	37,5		42,0	72,2		38,8	39,0	46,2
64,6					68,9	62,5	36,5	37,0	40,9	72,3	65,3	41,1	41,0	48,3
64,7	58,6	36,6	37,5	41,3	69,0	62,7	38,2	40,1	45,0	72,5	66,8	39,3	38,4	46,8
64,7	58,2	35,8	36,3	41,2	69,0	61,6	38,7	38,6	45,3	72,5		40,7	40,5	47,3
64,8		35,9			69,0	63,7	37,3	36,4	44,1	72,5	66,3	38,5	39,0	48,8
65,0	59,1	35,6	35,3	41,0	69,0	64,7	37,9	37,2		72,6	65,5	41,7	41,8	49,0
65,0		35,9	36,2	40,0	69,0	64,6	36,5	37,9	42,8	72,9	68,0	39,8	38,8	47,2
65,0	60,0	34,9	35,0	42,0	69,0	65,5	37,9	40,0	49,0	73,1	65,5	39,8	37,0	46,2
65,0	59,5	35,7	36,2	41,2	69,0	64,3	36,0	39,5		73,3	67,0	41,2	44,2	52,0
65,0	59,2	37,0	36,6	42,1	69,2	62,8	39,0	38,9	44,5	73,7	69,5	43,2	44,5	53,8
65,2					69,2	62,7	37,8	38,4	46,4	73,8	67,0	40,6	41,7	49,6
65,2	59,1	36,5	36,0	43,2	69,3	63,3	36,6	38,4	46,4	74,2	67,4	41,4	44,0	52,0
65,3	60,2	36,2	37,2	43,5	69,3	64,7	39,8	40,9	48,2	74,6		41,8		
65,4	61,7	35,5	36,9	43,0	69,5	63,3	38,1	39,0	44,3	75,0	69,3	39,2	40,5	46,5
65,5	63,2			41,8	69,5	64,0	38,9	39,5	46,2	75,4	66,0		41,6	49,0
65,5	60,3	37,2	36,7	40,3	69,6	63,3	36,6	38,4	46,4	77,0	71,5	42,1	43,0	49,5
65,5	62,0	35,4	34,6	41,3	69,6	63,2	36,4	36,8	45,0	77,5		42,5		51,1
65,5	59,3	35,5		42,2	69,6	64,1	39,0	37,5	46,2		60,5	39,4	39,1	47,1
65,5	60,2	38,1	38,2	45,1	69,7	64,4	37,2	39,5	42,2		63,9	36,8	38,2	44,9
65,6		36,0		41,0	69,7	62,9	38,7	36,5	43,7		59,4	35,6	35,8	40,9
65,7	61,0	35,5	34,0	42,0	69,7	63,2	39,0	39,0	46,3		66,2		40,8	
66,0	62,0			37,0	69,7	64,5	38,2	38,7	43,0		62,7		38,9	44,9
66,0	61,8	38,5	34,7	41,0	69,8	63,5	39,5		46,8		64,1	40,6		48,4
66,1	60,5	36,8	37,0	42,0	70,0	64,8	40,9	38,2	47,7		58,4		36,3	39,5
66,3	63,0	36,9	38,6	44,8	70,0	62,3	38,0	37,8	45,7		56,4		33,8	39,1
66,4		36,0			70,0	63,0	40,2	40,4	47,2					50,0
66,4	60,1	37,5	36,4	44,0	70,1	62,9	39,3	38,6	45,2		68,9	40,3	41,0	48,7
66,5	60,1	37,7	38,1	47,0	70,1			38,8	50,7		64,1		38,4	
66,5	61,8	36,3	36,9	42,0	70,1	65,5	38,8	39,0	44,0		69,0	42,3	42,9	53,5
66,5		37,0		41,5	70,2	62,2	40,7	39,6	48,7		59,3			42,0
66,5	60,5	36,3	37,0	43,8	70,2	65,5	40,5	41,9	44,6		63,2	37,0	36,7	44,1
66,5	61,2	36,5	37,1	43,6	70,3	64,3	38,7	36,4	48,2					

Table 37 (cont.)

OS CENTROQUARTALE

GB	GB	GB	GB	GB	GB	GB	GB	GB
44,2	48,5	50,2	51,8	52,4	54,9	56,5	59,7	62,4
44,2	48,5	50,3	51,9	52,7	54,9	56,5	60,0	62,5
45,2	49,3	50,4	52,0	53,0	55,0	56,6	60,0	62,5
46,0	49,5	50,4	52,0	53,0	55,0	56,8	60,0	62,5
46,6	49,5	50,4	52,0	53,0	55,0	56,8	60,0	62,5
47,2	49,7	50,5	52,0	53,1	55,1	57,0	60,1	63,0
47,8	49,8	50,5	52,0	53,2	55,2	57,1	60,5	63,1
47,9	49,9	51,0	52,0	53,6	55,3	57,3	60,5	63,2
48,0	49,9	51,2	52,1	53,7	55,5	57,5	60,5	64,0
48,0	49,9	51,2	52,2	53,7	55,5	57,5	60,9	64,0
48,1	50,0	51,2	52,2	53,8	55,5	57,5	61,0	64,2
48,5	50,0	51,8	52,3	53,9	55,7	57,8	61,0	64,7
48,5	50,0	51,8	52,4	53,9	55,7	58,0	61,0	65,0
				54,0	56,0	58,2	61,1	65,2
				54,0	56,0	58,7	61,2	66,0
				54,0	56,0	58,8	61,2	67,0
				54,0	56,0	59,0	61,4	67,4
				54,1	56,1	59,0	61,5	68,0
				54,2	56,2	59,0	61,9	68,2
				54,2	56,2	59,0	62,0	69,0
				54,3	56,3	59,2	62,2	70,5
				54,6	56,5	59,2		
				54,8	56,5	59,5		
				54,9	56,5	59,5		

Table 39

METATARSUS III + IV

GL	Bp	Dp	SD	Bd	Dd
	43,0		23,6	48,5	
	43,2	40,3		50,0	28,4
	45,5	44,5		51,5	
	46,1			52,0	28,5
	47,5	46,4		52,8	
	50,0	49,0		54,0	31,0
257,0	52,0	51,0	30,7	62,6	33,9
	52,0			54,0	
	52,0	47,5		54,5	
	53,0			54,7	
	53,0	50,8		55,2	30,5
	54,0			55,3	
	54,2	53,5		55,5	
	56,0			55,6	
	56,2	54,0		56,0	
		49,2		57,1	30,1
		48,3		57,5	
		48,0		58,0	31,5
				58,2	
				59,2	
				59,9	
				60,0	32,0
				60,0	32,0
				60,2	
				62,2	34,5
				63,0	
				63,0	33,1
				64,6	33,9
				66,0	
				67,9	
				73,9	
				84,9	

Table 41

OS TARSALE II + III

GB	GL		GB	GL
19,8	30,0		23,1	33,2
20,0	30,7		23,6	35,1
20,1	33,0		24,0	39,1
20,2	33,7		24,0	41,0
20,2	33,0		24,0	41,1
20,2	34,5		24,3	37,5
21,0	39,5		24,4	40,0
21,0	33,4		24,5	38,1
21,1	35,9		24,6	35,2
21,5	32,3		24,7	35,5
22,0	34,0		25,0	40,8
22,2	32,3		25,0	42,0
22,9	38,2		25,2	39,1
22,9	37,2		25,2	39,4
22,9	39,9		25,6	38,7
23,0	33,6		26,0	38,1
23,0	35,0		26,1	38,8
23,0	34,2			

Table 40

CALCANEUS

GL	GB	
124,8	38,4	
125,5		subad.
126,0		
128,0		
128,5		
132,0		
134,0		
134,0	43,5	
135,5		
136,0		
136,0		
136,2		
136,8		
139,5		
141,2		
144,0		
144,9		
149,9		
150,0		
150,0		
151,2		subad.
152,2		
153,5		
154,0		
156,0		

Table 38

PHALANX 1 POSTERIOR															
Glpe	**Bp**	**SD**	**Bd**	**Glpe**	**Bp**	**SD**	**Bd**	**Glpe**	**Bp**	**SD**	**Bd**	**Glpe**	**Bp**	**SD**	**Bd**
45,0	31,4	24,1	26,2	61,5	26,1	21,6	28,2	63,6	30,1	25,0	30,8	66,0	32,6	29,2	33,0
53,2	24,2	21,1	22,4	61,5	28,4	22,5	25,0	63,6	28,2	21,3	27,0	66,1	31,8	28,0	33,3
56,2	24,7	20,0	25,2	61,6	27,0	21,5	24,2	63,9	30,8	26,5	30,2	66,6	29,2	24,0	27,3
57,0		22,5	25,3	61,7	27,0	22,3	25,8	64,0	27,4	23,0	27,0	66,8	32,2	26,5	29,7
58,0	27,0	24,9	29,9	61,7	26,3	22,5	25,0	64,0	28,2	23,7	26,5	66,9	29,0	27,8	31,1
58,5	26,1	23,0	25,7	61,8	29,0	24,0	29,4	64,0	30,0	26,6	30,1	67,0	28,6	23,1	25,1
58,6	28,8	23,4	26,2	61,9	32,7	26,0	33,0	64,0	32,2			67,4	31,7	25,1	29,1
59,0	28,8	22,5	26,7	62,0	27,4	22,5	27,6	64,0	33,0	26,5	30,0	67,4	34,6	29,0	33,0
59,5	27,1	22,1	24,5	62,0	28,0			64,0	27,0	21,2	22,1	67,9	32,5	24,9	29,9
59,7	27,2	23,5	26,9	62,1	27,0	22,2	24,5	64,1	30,0	26,4	29,2	68,0	29,0	24,7	29,9
59,9	23,6	21,8	22,9	62,2	26,5	23,2	26,1	64,2	31,0	25,2	29,1	68,0	32,2	29,5	34,0
60,0	27,1	22,4	26,2	62,2	28,3	24,2	28,4	64,5	26,5	23,2	26,1	68,0	31,5	25,0	30,0
60,1	24,5	20,7	24,3	62,2	26,7	24,3	26,5	65,0	30,4	27,7	29,1	68,2	32,8	26,5	30,5
60,1	27,6	21,2	26,4	62,4	25,4	23,6	26,8	65,0	30,5	25,5	29,2	68,4	31,8	26,6	30,5
60,1	28,2	24,2	27,8	62,5	29,5	25,6	27,8	65,0	28,8	24,1	27,9	68,7	33,9		
60,2	27,0	22,9	26,0	62,5	29,0	24,3	27,1	65,0	30,8	25,8	30,0	69,0	32,5	27,5	32,2
60,2	28,8	27,8	26,7	62,6	30,6	26,2	27,2	65,1	29,0	24,3	25,0	69,1			28,2
60,3	26,0	22,0	25,4	62,7	26,7	22,6	28,1	65,2	30,6	24,3	29,4	69,9	32,5	26,9	29,3
60,4	26,3	21,9	26,1	62,7	31,7	25,8	29,9	65,5	33,0			70,0	34,0	27,2	33,0
60,5	27,5	21,5	25,3	62,9	28,1	23,0	26,2	65,6	27,0	22,9	25,6	70,4	34,0	26,0	29,0
60,5	27,4	24,1	28,0	63,0	29,9	25,0	27,5	65,6	27,8	23,2	26,5	70,5	34,0	30,1	32,2
60,8		23,4	25,5	63,0	26,4	22,0	27,8	65,7	32,8	28,0	30,4	71,5	33,5	27,2	31,5
61,2	29,6	25,8	29,3	63,0	28,6	23,3	27,5	65,8	32,2	27,2	31,9	71,6	33,9	26,5	28,7
61,2	25,3	22,0	25,0	63,2	28,8	24,3	27,6	65,9	30,9	24,0	31,4	71,8	33,0	28,0	33,0
61,2	26,5	24,0	26,8	63,4	27,4	23,2	27,4	66,0	31,3	24,6	28,5	72,5	33,0	27,9	30,4
61,5	28,9	22,5	26,2	63,5	31,9	25,0	29,5	66,0	32,0	28,5	31,0	73,7	33,0	28,7	31,8

Table 42

PHALANX 2 POSTERIOR															
GL	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**
35,0	26,0	21,0	22,6	40,9	28,2	34,5	23,2	43,0	30,7	25,5	25,2	45,2	29,8	23,0	23,5
35,7	24,5	19,6	20,3	41,0	30,6	25,0	28,2	43,0	30,2	25,1	25,9	45,3	34,2	27,0	29,5
36,1	27,0	22,4	22,8	41,0	25,2	21,0	19,8	43,0	28,0	22,9	22,0	45,3	31,8	26,4	25,3
36,5	24,2	21,0	18,0	41,0	28,5	23,3	26,1	43,1	31,3	25,0	21,2	45,4	29,9	24,8	25,7
37,1	24,0	19,5	20,4	41,0	26,0	21,3	24,2	43,1	30,0	23,2	25,0	45,5	32,0	26,1	26,9
37,2	28,0	21,8	21,0	41,1	28,0	23,5	24,0	43,2	28,4	23,7	23,9	45,6	30,7		
37,8	26,1	22,4	21,0	41,1	28,0	23,0	24,1	43,2	30,9	24,2	25,1	45,7	29,2	24,2	25,6
38,0	27,0	21,6	23,5	41,2	26,2	21,8	22,2	43,2	26,5	23,3	22,6	45,7	28,3	24,0	24,5
38,1	25,0	21,6	20,8	41,2	25,9	21,0	22,4	43,2	28,0	23,5	24,8	45,7	28,6	24,5	24,4
38,2	26,4	21,7	23,0	41,2	28,8	23,7	25,0	43,3	29,0	24,2	25,5	45,7	29,0	24,7	25,6
38,3	36,8	22,0	22,6	41,3	29,8	24,5	24,0	43,3	31,0	24,7	25,5	45,9	27,8	23,4	25,5
38,3	24,0	20,0	20,5	41,4	26,4	21,4	23,0	43,3	31,2	26,2	26,0	46,0	31,9	25,8	25,7
38,3	25,5	22,0	20,2	41,5	29,5	24,2	23,7	43,4	29,9	24,9	27,2	46,0	27,6	22,0	
38,4	25,2	20,5	21,0	41,5	26,2	21,0	21,3	43,4	32,5	26,5	25,8	46,0	30,5	24,0	27,2
38,6	25,4	21,4	22,5	41,5	27,4	22,6	24,3	43,4	27,1	22,2	23,1	46,0	30,3	26,3	27,5
38,8	27,9	21,7	22,1	41,5	26,3	22,0	22,5	43,5	27,5	22,0	23,7	46,2		25,3	26,8
39,0	27,0	22,0	22,9	41,5	31,4	26,4	26,4	43,5	28,4	23,6	23,0	46,2	30,1	25,0	25,3
39,0	28,4	21,6	23,3	41,5	29,2	24,5	26,3	43,5	31,6	24,5	26,3	46,2	32,2	27,0	28,7
39,0	30,4	25,0	26,5	41,6	27,8	20,7	22,6	43,7	27,6	22,2	23,9	46,2	32,3	26,3	28,1
39,1	24,4	19,5	19,0	41,7	27,2	22,0	23,4	43,7	30,9	25,3	26,2	46,2	29,1	25,0	25,2
39,2	24,6	20,4	21,3	41,8	26,9	22,5	22,3	43,8	31,7	26,0	26,5	46,3	30,5	25,5	29,4
39,3	26,5	22,2	24,0	41,8	26,8	22,1	22,7	43,8	28,0	22,5	27,0	46,4	30,1	26,5	26,8
39,4	29,8	23,8	23,9	41,8	29,0	25,8	24,3	43,8	28,3	24,1	23,3	46,5	29,8	26,3	27,9

Table 43

PHALANX 2 POSTERIOR															
GL	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**	**GL**	**Bp**	**SD**	**Bd**
39,5	26,2	22,5	23,2	41,8	27,2	22,3	21,0	43,8	31,0	26,0	27,6	46,5	31,0	26,0	28,7
39,5	27,4	22,7	23,0	41,9	26,3	22,0	22,5	43,8	30,0	23,8	27,1	46,5	27,1	23,0	24,5
39,5	27,0	22,0	24,3	42,0	28,9	23,7	25,5	43,8	29,5	25,1	25,2	46,5	32,1	26,0	27,0
39,6	30,3	24,2		42,0	29,7	25,7	25,3	43,9	28,5	23,8	24,2	46,5	31,2	25,1	28,7
39,7	27,3	22,4	23,8	42,0	26,5	20,2	22,8	44,0	28,1	23,8	22,0	46,7	34,0	28,0	27,7
39,8	28,1	22,8	24,2	42,0	29,0	25,2	26,3	44,0	30,3	25,1	25,0	46,8	30,1	24,0	27,7
39,9	28,0	22,7	23,9	42,0	28,1	21,5	25,2	44,0	30,0	26,0	25,5	47,0			
40,0	27,8	22,0	21,9	42,1	26,0	20,6	22,6	44,0	29,0	25,7	26,2	47,0	31,4	25,0	27,0
40,0	25,2	20,9	19,5	42,1	25,9	21,0	21,3	44,0	27,0	22,5	23,5	47,0	32,1	27,5	27,0
40,0	28,4	23,2	25,5	42,2	29,9	25,0	27,8	44,0	33,5	28,0	30,3	47,1	34,0	27,3	28,5
40,0	28,2	25,0	23,8	42,2	26,0	21,2	21,5	44,2	29,4	24,9		47,1	32,1	25,5	28,9
40,0	27,2	27,2	24,9	42,3	31,8	26,9	27,7	44,2	28,4	25,0	22,7	47,2	31,3	24,6	26,1
40,0	27,0	23,0	23,6	42,3	30,0	24,3	26,6	44,2	32,1	25,7	27,0	47,4	30,7	25,6	25,4
40,1	27,9	23,0	21,5	42,3	29,7	25,5	26,2	44,2	30,5	25,5	25,5	47,4	31,9	26,5	27,6
40,2	30,0	24,0	27,6	42,3	28,7	23,7	25,0	44,2	28,9	24,0	23,8	47,5	29,6	25,2	26,5
40,2	27,8	22,2	22,9	42,3	27,7	24,8	25,4	44,3	27,4	21,3	22,7	47,6	33,0	26,8	27,2
40,2	27,0	21,0	23,2	42,4	30,0	25,0	26,3	44,4	29,0	24,1	22,9	47,6	31,8	25,3	27,0
40,2	26,5	22,0	22,5	42,5	28,4	23,6	25,2	44,5	33,0	28,2	31,7	47,8	30,6	26,2	28,5
40,3		23,0	26,1	42,5	26,0	23,0		44,5	32,9	27,3	29,6	47,9	28,1	23,5	24,4
40,3	27,5	21,8	24,4	42,6	27,2	21,8	23,0	44,5	32,4	26,6	26,2	48,0	31,0	25,3	26,1
40,3	27,3	23,7	25,1	42,7	28,8	23,2	25,0	44,5	29,8	25,0	27,3	48,0	32,5	26,0	28,3
40,4	24,9	20,0	21,9	42,8	31,2	26,0	27,3	44,5	32,2	27,8	27,9	48,0	32,8	27,1	27,2
40,4	27,5	22,0	20,5	42,8	27,3	23,0	22,3	44,6	29,6	25,1	23,0	48,0	30,5	26,5	29,2
40,5	25,0	21,0	22,8	42,8	31,5	24,4	24,8	44,7	28,6	24,7	25,4	48,2	31,1	26,3	28,6
40,5	27,8	23,4	22,0	42,8	29,4		24,6	44,7				48,2	33,0	26,0	27,7
40,5	27,4	22,1	22,6	42,8	30,0	24,6	25,7	44,8	30,2	26,9	27,7	48,5	33,5	27,0	26,4
40,5	31,7	26,0	27,0	42,8	27,2	22,2	23,4	44,8	28,3	25,2	25,1	48,7	32,0	26,3	26,2
40,6	27,5	22,6	23,9	42,8	29,2	23,8	24,3	44,8	31,3	26,7	27,6	48,9	30,2	25,3	24,8
40,6	26,8	22,8	23,8	42,9	27,4	23,0	23,3	44,9	30,5	25,0	23,7	49,0	32,7	27,0	28,0
40,6	27,5	23,4	22,4	42,9	27,3	24,5	25,0	44,9	32,5	27,1	29,0	49,2	36,2	29,3	30,5
40,6	26,1	21,8	23,0	42,9	27,6	23,0	26,0	45,0	30,8	25,2	26,3	49,3	33,0	28,2	27,0
40,7	27,0	24,2	26,1	42,9	26,8	22,3	23,6	45,0	28,9	24,0	23,4	49,3	34,1	27,6	28,9
40,8	28,1	23,8	24,5	42,9	27,0	21,1	22,9	45,0	33,0	27,5	29,5	49,7	33,3	25,5	28,0
40,8	26,0	21,2	23,6	43,0	28,0	22,0	22,1	45,0	33,0	25,2	27,0	50,1	33,0	27,2	27,5
40,8	26,9	22,2	22,6	43,0	29,2	24,4	23,8	45,1	30,1	26,2	25,0	50,2	33,6	27,4	27,8
40,8	28,4	22,5	24,5	43,0	29,4	25,5	23,5	45,1	30,7	25,1	27,5				

Table 43 (cont.)

PHALANX 3									
DLS	**DLS**	**DLS**	**DLS**	**DLS**	**DLS**	**DLS**	**DLS**	**DLS**	**DLS**
55,0	62,0	65,0	67,0	69,5	72,1	75,2	77,4	80,2	86,1
56,0	62,0	65,0	67,0	69,6	72,3	75,2	77,8	80,4	87,6
56,8	62,7	65,0	67,0	69,8	72,5	75,5	78,0	81,8	88,2
57,0	63,0	65,0	67,2	70,0	73,0	75,5	78,1	82,1	88,6
59,5	63,0	65,5	67,2	70,0	73,0	76,0	78,9	82,3	89,6
59,7	63,0	65,5	67,3	70,4	73,0	76,3	79,0	82,6	92,0
60,2	63,0	65,5	67,6	71,0	74,0	76,5	79,2	82,8	95,0
60,5	63,1	65,5	68,2	71,0	74,3	76,5	79,6	83,0	95,0
61,0	63,2	66,0	68,3	71,0	74,4	76,9	79,0	83,5	96,7
61,0	63,5	66,3	68,6	71,2	75,0	77,0	79,2	83,8	98,0
61,0	64,0	66,5	69,0	71,4	75,0	77,0	79,6	84,5	
61,5	64,3	66,8	69,2	71,6	75,0	77,0	79,9	84,5	
62,0	64,5	67,0	69,4	72,0	75,1	77,2	80,0	85,0	

Table 44

Appendix 2:
Statistical parameters for the different skeletal elements

GRAVE 115					
	N	mean	min	max	Std dev.
1	46	164,0	119,5	216,5	18,1
2	27	191,7	152,0	260,0	31,9
3	35	68,5	54,5	104,5	12,1
4	31	56,7	44,5	77,5	7,7
5	46	166,6	121,5	194,5	15,6

Table 1.1

GRAVE 119					
	N	mean	min	max	Std dev.
1	25	160,0	132,0	200,0	16,8
2	24	184,2	140,5	290,0	35,0
3	25	60,4	47,3	87,0	10,1
4	25	53,1	43,0	74,0	7,9
5	23	162,8	147,0	195,0	12,1
8	9	563,7	505,0	610,0	42,1

Table 1.2

GRAVE 156					
	N	mean	min	max	Std dev.
1	25	163,5	130,0	200,0	14,8
2	28	213,7	145,0	275,0	36,8
3	30	72,3	46,0	95,0	12,2
4	28	61,9	43,5	83,0	11,0
6	13	137,8	114,0	180,0	19,3
8	20	723,8	380,0	1460,0	233,5

Table 1.3

GRAVE 175					
	N	mean	min	max	Std dev.
1	27	151,8	115,0	180,0	14,0
2	36	189,7	120,0	265,0	29,6
3	36	63,4	39,0	92,0	10,6
4	36	55,4	36,0	78,0	8,8
6	21	119,9	95,0	150,0	16,6
8	24	617,5	420,0	940,0	114,4

Table 1.4

GRAVE 181					
	N	mean	min	max	Std dev.
1	28	161,0	124,0	220,0	22,4
2	46	212,1	140,0	275,0	33,3
3	46	71,9	47,0	94,0	12,1
4	47	62,0	38,5	80,0	10,2
6	9	139,4	100,0	168,0	21,4

Table 1.5

GRAVE 182					
	N	mean	min	max	Std dev.
1	14	149,4	110,0	180,0	17,1
2	13	182,8	90,0	266,0	42,5
3	14	61,0	29,0	89,0	15,5
4	13	52,8	26,5	79,5	12,5
5	14	156,1	106,0	196,0	23,3
6	4	129,0	110,0	140,0	14,3

Table 1.6

GRAVE 185					
	N	mean	min	max	Std dev.
1	27	163,8	125,0	195,0	19,1
2	28	189,1	145,0	240,0	23,8
3	28	63,5	46,5	85,0	9,1
4	28	54,5	42,5	71,5	6,5
5	26	165,1	136,0	200,0	14,6
6	19	127,6	110,0	155,0	14,0
8	12	565,8	390,0	680,0	74,2

Table 1.7

GRAVE 186					
	N	mean	min	max	Std dev.
1	12	163,8	138,0	188,0	15,0
2	12	189,6	158,0	240,0	26,1
3	12	62,5	52,0	78,0	9,1
4	12	54,8	46,0	65,0	6,5
5	12	165,3	145,0	185,0	11,7
6	8	137,3	125,0	154,0	11,3
8	7	557,1	400,0	800,0	135,0

Table 1.8

GRAVE 189					
	N	mean	min	max	Std dev.
1	16	158,3	140,0	180,0	12,7
2	16	189,6	144,0	240,0	28,3
3	17	63,4	48,5	83,5	10,4
4	17	55,0	41,5	68,0	7,7
5	16	165,6	142,0	185,0	12,1
8	2	500,0	480,0	520,0	28,3

Table 1.9

1 = Least breadth between bases of horn cores
2 = Horn core basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

GRAVE 190					
	N	**mean**	**min**	**max**	**Std dev.**
1	31	166,1	135,0	200,0	17,0
2	24	188,1	148,0	260,0	31,8
3	32	62,4	47,0	88,0	11,0
4	31	54,2	40,0	78,0	9,5
5	33	163,7	135,0	190,0	14,8
6	48	137,1	110,0	180,0	20,9
7	189	231,2	195,0	275,0	16,0
8	58	568,7	320,0	860,0	95,6
9	57	330,0	230,0	440,0	49,0
10	141	192,2	150,0	225,0	13,9
11	48	155,8	130,0	190,0	11,8

Table 1.10

GRAVE 238					
	N	**mean**	**min**	**max**	**Std dev.**
1	224	161,1	120,0	240,0	19,4
2	222	193,3	140,0	262,0	29,0
3	223	64,5	46,0	89,0	10,5
4	223	56,1	41,0	88,0	8,2
5	240	165,8	130,0	210,0	14,2
6	48	137,1	110,0	180,0	20,9
7	189	231,2	195,0	275,0	16,0
8	58	568,7	320,0	860,0	95,6
9	57	330,0	230,0	440,0	49,0
10	141	192,2	150,0	225,0	13,9
11	48	155,8	130,0	190,0	11,8

Table 1.11

GRAVE 241					
	N	**mean**	**min**	**max**	**Std dev.**
1	22	162,5	135,0	210,0	18,9
2	22	189,1	148,0	255,0	33,3
3	22	61,9	49,0	87,0	11,4
4	22	54,8	42,0	74,0	9,1
5	22	164,5	148,0	200,0	15,5
6	7	132,0	104,0	175,0	28,7
7	19	232,1	210,0	270,0	16,0
8	6	546,7	460,0	760,0	112,0
9	6	273,3	230,0	380,0	54,3
10	11	184,8	174,0	200,0	8,8
11	6	142,5	130,0	160,0	9,9

Table 1.12

GRAVE 253					
	N	**mean**	**min**	**max**	**Std dev.**
1	1102	165,1	110,0	240,0	19,7
2	1097	194,5	25,0	320,0	33,0
3	1124	65,3	35,0	110,0	11,4
4	1149	57,2	38,0	95,0	9,5
5	1217	166,1	135,0	220,0	15,1
6	103	135,5	100,0	182,0	2,0
7	1012	234,6	155,0	310,0	17,1
8	594	573,2	295,0	1260,0	112,3
9	582	339,6	145,0	680,0	20,8
10	562	191,6	130,0	240,0	14,8
11	285	151,6	120,0	190,0	13,5

Table 1.13

GRAVE B					
	N	**mean**	**min**	**max**	**Std dev.**
1	54	163,0	91,5	208,0	25,0
2	50	199,7	52,0	302,0	58,3
3	54	66,5	18,2	100,0	19,1
4	53	57,3	16,0	86,0	16,5
5	14	156,1	106,0	196,0	23,3
6	4	129,0	110,0	140,0	14,3

Table 1.14

GRAVE KN24					
	N	**mean**	**min**	**max**	**Std dev.**
1	207	155,5	110,0	205,0	14,3
2	227	196,8	130,0	321,0	33,7
3	227	65,7	41,0	106,0	11,8
4	227	57,1	35,0	92,0	9,6
5	78	164,2	130,0	224,0	17,4
7	98	128,8	88,0	192,0	21,3
8	194	617,6	200,0	1420,0	171,3

Table 1.15

1 = Least breadth between bases of horncores
2 = Horncore basal circumference
3 = Greatest basal diameter
4 = Least basal diameter
5 = Least frontal breadth
6 = Least occipital breadth
7 = Length acrocranion-nasion
8 = Intertips breadth
9 = Length outer curvature
10 = Breadth ectorbitale-ectorbitale
11 = Breadth entorbitale-entorbitale

MANDIBLE					
	N	**mean**	**min**	**max**	**St.dev.**
L. P2-M3	2	141,1	138,2	144,0	4,1
L. P2-P4	2	54,3	53,5	55,0	1,1
L. M1-M3	2	88,0	85,5	90,5	3,5
L. M3	37	38,2	35,0	41,5	1,8
B. M3	29	14,8	13,0	17,0	1,0

Table 2

AXIS	N	m	min	max	St.dev.
Breadth of dens	19	43,1	38,2	48,5	3,0
BFcr	16	92,8	81,0	103,5	6,5

Table 3

HUMERUS	N	m	min	max	St.dev.
Bp	2	93,8	92,5	95,0	1,8
Bd	67	83,0	58,2	101,2	8,1
BT	74	75,3	62,5	88,0	5,6
DdT	5	82,1	76,2	86,5	4,0

Table 5

ULNA	N	m	min	max	St.dev.
LO	5	99,7	88,5	117,5	11,4
DPA	6	70,6	55,4	81,6	10,4
SDO	6	54,6	48,9	58,0	4,0

Table 8

RADIALE	N	m	min	max	St.dev.
GL	126	44,3	34,2	52,8	3,8

Table 9

INTERMEDIUM	N	m	min	max	St.dev.
GL	76	40,4	34,9	47,9	3,1

Table 10

ULNARE	N	m	min	max	St.dev.
L	112	38,8	31,6	49,3	3,5

Table 11

CARPALE II+III	N	m	min	max	St.dev.
GB	182	38,1	30,2	48,9	3,5
GL	152	34,6	27,8	41,0	3,0

Table 12

CARPALE IV	N	m	min	max	St.dev.
GB	132	27,7	20,1	37,3	2,9
GL	128	33,8	23,0	40,0	3,2

Table 13

METACARPUS	N	m	min	max	St.dev.
Bp	13	59,5	52,0	67,2	4,4
Dp	1	40,0			
SD	7	38,5	35,5	42,2	2,7
Bd	20	59,4	54,2	69,0	3,8
Dd	6	30,8	28,5	32,2	1,3

Table 14

PHAL. 2 ANTERIOR	N	m	min	max	St.dev.
GL	169	43,1	35,5	50,9	2,9
Bp	167	32,0	20,2	30,8	2,7
SD	167	26,5	21,0	33,1	2,4
Bd	163	28,4	22,5	35,9	2,7

Table 17

SCAPULA	N	m	min	max	St.dev.
GLP	75	66,4	54,6	81,0	7,1
LG	81	56,1	45,0	70,0	5,9
BG	81	46,8	35,5	59,1	6,0
SLC	24	52,0	35,7	69,2	7,4

Table 4

HUMERUS - BT	N	m	min	max	St. dev.
Kerma	28	75,2	66,0	83,9	5,1
Predynastic	16	72,8	65,0	82,0	4,5
Neolithic	11	72,7	67,0	79,5	4,3
Ptolemaïc	38	76,4	62,0	89,0	5,0

Table 6

RADIUS	N	m	min	max	St.dev.
Bp	8	79,7	74,8	91,1	6,2
Dp	3	42,4	38,0	48,6	5,5
BFp	5	73,4	69,0	81,0	6,0
Bd	32	72,1	63,0	85,5	7,0

Table 7

PHAL. 1 ANTERIOR	N	m	min	max	St.dev.
Glpe	177	64,3	54,6	72,0	3,5
Bp	183	32,9	27,2	38,0	2,6
SD	171	24,1	21,7	32,6	2,3
Bd	164	30,6	25,9	39,4	2,5

Table 15

PHALANX 1 ANTERIOR					
Glpe	**N**	**m**	**min**	**max**	**St. Dev.**
Kerma	177	64,3	54,6	72,0	3,5
Predynastic	9	60,7	54,5	70,0	5,7
Neolithic	14	61,2	56,0	71,0	3,7
Ptolemaïc	110	66,0	55,0	74,0	4,1
Bp	**N**	**m**	**min**	**max**	**St. Dev.**
Kerma	183	32,9	27,2	38,0	2,7
Predynastic	8	31,2	26,5	36,0	3,1
Neolithic	13	30,3	26,0	39,0	3,5
Ptolemaïc	96	33,4	26,5	40,0	2,8
SD	**N**	**m**	**min**	**max**	**St. Dev.**
Kerma	171	24,1	21,7	32,6	2,3
Predynastic	9	25,5	21,8	29,3	2,4
Neolithic	12	25,5	22,0	29,0	2,3
Ptolemaïc	96	28,7	22,8	35,5	2,3
Bd	**N**	**m**	**min**	**max**	**St. Dev.**
Kerma	164	30,6	25,9	39,4	2,5
Predynastic	9	27,5	22,4	31,3	3,0
Neolithic	10	29,4	26,0	33,0	2,5
Ptolemaïc	95	31,9	25,5	39,0	2,6

Table 16

PELVIS - LA	N	m	min	max	St.dev.
Ancient Kerma cattle	12	66,4	57,5	76,9	6,3
Kerma modern cattle	5	71,9	70,0	76,5	2,7
Predynastic cattle	3	70,5	65,0	77,5	6,4
African Neolithic cattle	1	71,9			
Ptolemaic cattle	9	75,6	65,0	81,0	5,3
Neolithic Europ. cattle	54	63,2	53,5	70,8	3,3
Europ. Iron Age cattle	140	61,5	53,0	78,0	4,1
African aurochs	3	92,5	90,0	94,0	2,2
European aurochs	15	79,1	73,0	91,0	5,0

Table 18

TIBIA	N	m	min	max	St.dev.
Bp	1	92,0			
Bd	37	62,3	55,3	70,2	4,2
Dd	19	47,2	41,0	58,0	4,5

Table 22

MALLEOLARE	N	m	min	max	St.dev.
GD	82	34,3	29,2	41,9	2,9

Table 23

TALUS	N	m	min	max	St.dev.
GLl	216	67,7	59,0	77,5	3,7
GLm	196	62,0	52,9	71,5	3,5
Dl	204	37,3	31,7	43,2	2,3
Dm	191	37,6	29,7	44,5	2,8
Bd	212	44,0	34,6	53,8	3,7

Table 24

TARSALE II + III	N	m	min	max	St.dev.
GB	35	23,0	19,8	26,1	1,9
GL	35	36,4	30,0	42,0	3,3

Table 28

METATARSUS	N	m	min	max	St.dev.
GL	1	257,0			
Bp	15	50,5	43,0	56,2	4,4
Dp	12	48,5	40,3	54,0	3,8
SD	2	27,1	23,6	30,7	5,0
Bd	32	59,0	48,5	84,9	7,2
Dd	12	31,6	28,4	34,5	2,0

Table 29

PHAL. 1 POSTERIOR	N	m	min	max	St.dev.
Glpe	104	63,8	45,0	73,7	4,2
Bp	102	29,4	23,6	34,6	2,7
SD	99	24,6	20,0	30,1	2,3
Bd	100	28,1	22,1	34,0	2,6

Table 30

OS FEMORIS	N	m	min	max	St.dev.
Bp	4	114,1	105,5	127,0	9,3
DC	143	44,8	37,0	52,5	3,1
Bd	20	98,5	84,8	108,1	7,4

Table 19

PATELLA - GB	N	m	min	max	St. Dev.
Kerma cattle	61	53,1	36,7	69,9	6,7
African Neolithic cattle	1	53,0			
Ptolemaic cattle	3	56,7	54,5	60,0	2,9
Europ. Iron Age cattle	17	46,2	38,0	53,0	4,8
European aurochs	5	69,8	65,0	78,0	5,1

Table 20

PATELLA - GL	N	m	min	max	St. Dev.
Kerma cattle	83	66,6	52,4	85,0	6,1
African Neolithic cattle	2	73,5	62,0	85,0	16,3
Ptolemaic cattle	4	66,6	65,0	68,0	1,4
Europ. Iron Age cattle	20	58,6	50,5	67,0	4,8
European aurochs	6	82,2	75,0	95,0	7,3

Table 21

CALCANEUS	N	m	min	max	St.dev.
GL	25	140,0	124,8	156,0	9,9
GB	2	41,0	38,4	43,5	3,6

Table 25

CALCANEUS GL	N	m	min	max	St. dev.
Kerma cattle	24	140,0	124,8	156,0	9,9
Maadi cattle	7	138,1	130,0	150,0	6,1
Tell el Dab'a cattle	27	146,3	117,0	159,0	9,3
Neolithic Europ. cattle	97	124,9	113,8	137,5	4,8
Iron Age cattle	397	117,9	103,0	150,0	7,2
African aurochs	4	181,3	170,0	193,0	13,0
Europ. male aurochs	12	185,2	177,0	192,0	5,6
Europ. female aurochs	10	157,6	133,0	167,0	12,0

Table 26

CENTROQUARTALE	N	m	min	max	St.dev.
GB	166	55,7	44,2	70,5	5,4

Table 27

PHALANX 3 - DLS	N	m	min	max	St.dev.
Ancient Kerma cattle	124	72,4	55,0	98,0	9,1
Kerma modern cattle	4	66,3	65,0	67,5	1,4
Predynastic cattle	1	80,0			
African aurochs	10	91,0	64,0	110,0	15,0
Scandinavian aurochs	10	91,9	86,0	104,0	5,5
Swiss aurochs	23	80,1	73,0	93,0	5,7
Neolithic Europ. cattle	176	69,1	54,2	84,3	6,1

Table 32

PHALANX 2 POSTERIOR					
GL	**N**	**m**	**min**	**max**	**St.dev**
Kerma	235	43,1	35,0	50,2	3,0
Kerma modern	9	44,3	39,2	48,1	3,4
Adaïma (Predynastic)	12	40,0	35,1	45,5	3,1
Maadi III (Predynastic)	27	46,1	41,5	51,0	2,8
Merimde (Neolithic)	11	42,4	39,0	49,5	3,1
Tell El-Dab'a(Ptolemaïc)	153	46,3	36,5	54,0	2,8
Euopean Iron Age	239	34,6	30,5	40,0	1,8
European aurochs	25	48,7	45,0	53,0	1,8
Bp	**N**	**m**	**min**	**max**	**St.dev**
Kerma	231	29,1	24,0	36,8	2,4
Kerma modern	9	28,2	23,8	33,7	3,5
Adaïma (Predynastic)	12	28,3	22,2	35,1	3,2
Maadi III (Predynastic)	25	31,7	26,5	39,5	3,5
Merimde (Neolithic)	11	29,3	26,0	34,5	2,5
Tell El-Dab'a(Ptolemaïc)	145	31,4	25,0	38,0	2,3
Euopean Iron Age	239	25,1	20,0	34,0	2,3
European aurochs	25	32,4	30,0	35,0	1,4
SD	**N**	**m**	**min**	**max**	**St.dev**
Kerma	231	24,1	19,5	34,5	2,2
Kerma modern	9	22,8	18,9	28,1	3,3
Adaïma (Predynastic)	12	23,0	17,9	29,7	2,8
Maadi III (Predynastic)	24	24,7	20,0	28,0	2,6
Merimde (Neolithic)	10	24,0	22,0	28,5	2,0
Tell El-Dab'a(Ptolemaïc)	146	25,7	19,5	31,5	2,2
European aurochs	24	25,3	21,5	29,0	2,1
Bd	**N**	**m**	**min**	**max**	**St.dev**
Kerma	228	24,9	18,0	31,7	2,4
Kerma modern	9	24,4	20,3	28,3	2,9
Adaïma (Predynastic)	11	23,7	19,1	28,0	2,6
Maadi III (Predynastic)	20	26,1	22,5	30,0	2,1
Merimde (Neolithic)	7	25,3	23,5	29,5	2,1
Tell El-Dab'a(Ptolemaïc)	128	26,7	20,7	34,3	2,0

Table 31