ZEITSCHRIFT FÜR SÄUGETIERKUNDE

INTERNATIONAL JOURNAL OF MAMMALIAN BIOLOGY

Organ der Deutschen Gesellschaft für Säugetierkunde

Volume 53, 1988 ISSN 0044-3468

Mit 176 Abbildungen

Verlag Paul Parey Hamburg und Berlin

Wissenschaftliche Originalarbeiten

Wissenschaftliche Kurzmitteilungen

Bekanntmachungen

Buchbesprechungen

Z. Säugetierkunde 53 (1988) 108–123

ISSN 0044-3468

Osteomorphological features of the appendicular skeleton of African buffalo, *Syncerus caffer* (Sparrman, 1779) and of domestic cattle, *Bos primigenius* f. taurus Bojanus, 1827

By J. PETERS

Laboratorium voor Paleontologie, Rijksuniversiteit Gent, Gent, Belgium

Receipt of Ms. 10. 11. 1986

Abstract

Studied the osteomorphological differences between the appendicular skeleton of African buffalo *(Syncerus caffer)* and domestic cattle (*Bos primigenius* f. taurus). Osseous remains derived from these large bovids, frequently found in African Holocene archaeological sites, can not be distinguished easily.

A key has been developed to meet this recurrent problem and a number of diagnostic, osteomorphological features are established, which allow a distinction between the two species. Only a few of the smaller carpal and tarsal bones can not be separated yet. In general, osteomorphological differences are more constant than osteometrical differences and therefore seem more useful. Most of the ostemorphological criteria, established for domestic cattle can also be used to identify remains of their wild ancestor, the aurochs *(Bos primigenius).*

Introduction

The following study was undertaken within the frame of our Ph. D. research on faunal remains from archaeological sites in Central and Eastern Sudan (cf. MARKS et al. 1985; PETERS 1986a, 1986b). During this archaeozoological analysis, we were confronted with the fact that the majority of our samples was dominated by osseous remains from members of the family Bovidae, ranging in size from the small oribi *(Ourebia ourebi)* up to the large buffalo *(Syncerus caffer).* Because of (1) the diversity of bovid species within these collections (up to 20 species or more), (2) their mixed composition with domesticated and wild bovids and (3) the pronounced fragmentation of the bone material, their identification presented considerable problems. The literature available on African bovid osteology focuses mainly on the morphology of the skull, including the teeth (e.g. ARAMBOURG 1947; GENTRY 1964, 1967, 1978; STÖCKMANN 1975; VAN NEER 1981 and others). Postcranial skeletons, however, are poorly known, for descriptions of their osteomorphological characteristics, useful to the archaeozoologist, are quite rare (ARAMBOURG 1947; GENTRY 1967; LEINDERS and SONDAAR 1974; OBOUSSIER and ERNST 1977; LEINDERS 1979; VAN NEER 1981; GABLER 1985; WALKER 1985). To solve partly our identification problems, we carried out a few osteomorphological studies on recent and fossil postcranial material of African and other bovids. The choice of the species considered in these contributions is conditioned by an important question concerning the life style of prehistoric man: are domesticated animals present in our collections or not? Therefore, this first analysis deals with the osteomorphology of two very large bovids, of which, until now, the postcranial skeleton could not be separated accurately: the African buffalo, *Syncerus caffer* and domestic cattle, *Bos primigenius* f. taurus.

Within the descriptive part, we include several distinctive features already recorded by other authors in earlier publications (DOTTRENS 1946; GENTRY 1967) or reports (PAYNE s.d.). To distinguish between the phalanges of the fore and hind limbs of cattle, we used

U.S. Copyright Clearance Center Code Statement: 0044-3468/88/5302-0108 $ 02.50/0

some of the criteria established by DOTTRENS (1946). As to the work by GENTRY (1967), we do not agree with the conclusions concerning the distinction between certain skeletal elements of *Bos* and *Syncerus*. We suspect that the small size of the sample used by this researcher may be responsible for our differences of opinion.

In the course of our study, we also collected an impressive amount of osteometrical data, which enabled us to calculate many indices. This information has not been included here for practical reasons, but it can be obtained from the author at the address listed below. Both these osteometrical data and the ones summarized here will be available soon in an extensive, technical paper (PETERS 1986c). This paper is distributed on a very limited scale; therefore we thought it useful to publish separately the following short article.

Material and methods

The following results are based on a detailed analysis of the appendicular skeleton of the two species involved. As to the African buffalo *(Syncerus caffer)*, 25 adults, including both sexes, were carefully examined. All three subspecies sensu HALTENORTH and DILLER (1979:95) are present: the forest buffalo *(S. c. nanus)*, the western savanna buffalo *(S. c. brachyceros)* and the savanna buffalo *(S. c. caffer)*. The specimens studied are collected from all over Africa, but mainly Zaire. They are stored in the Koninklijk Museum voor Midden-Afrika, Tervuren-Belgium; the Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels and the British Museum (Natural History), London.

From cattle (*Bos primigenius* f. taurus), 15 adults, including both sexes and hundreds of fossil specimens collected in archaeological sites of varying ages in Europe (Neolithic to Modern Times) were examined. The recent material consists of European as well as African specimens of extant breeds. This material is stored in the institutions already mentioned, and partly in the Laboratorium voor Paleontologie and the Laboratorium voor Anatomie van de Huisdieren, both at the Rijksuniversiteit Gent.

For the osteomorphological descriptions, we have followed strictly the nomenclature proposed by the International Committee on Veterinary Gross Anatomical Nomenclature in their 'Nomina Anatomica Veterinaria' (3rd. ed., 1983). The figures were drawn by Mrs. J. BAETENS from right limb bones with the light coming from the lefthand top corner; each scale bar represents 20 mm. Note that the first and second phalanges belong to the fourth digit; the third phalanges are taken from the third digit. We did not consider the dew claws in this study.

Results

Osteomorphological features of the appendicular skeleton of African buffalo and cattle

The relevant diagnostic features are indicated by a number between brackets, which is also given on the plates. Arrows on these plates indicate morphological differences, lines refer to general differences in proportions.

Scapula

1. The position of the spina scapulae differs in the two genera. In *Bos*, the spina scapulae is slightly curved so that the acromion projects across the line of the margo cranialis when the bone is laterally viewed (pl. 1, fig. 1, char. 1). In *Syncerus* the ventral portion of the spina scapulae appears to be rather straight, so that the acromion remains within the line of the margo cranialis (pl. 1, fig. 2). As a consequence, the width ratio fossa supraspinata: fossa infraspinata is circa 1 to 3 in *Bos*, in stead of 1 to 2 or 2.5 in *Syncerus*.

2. The lateral border of the cavitas glenoidalis exhibits a medial notch in *Bos* (pl. 1, fig. 3, char. 2). In *Syncerus*, a comparable notch has been observed only once; in all other specimens it was less pronounced or even absent (pl. 1, fig. 4).

3. In *Syncerus*, the incisura glenoidalis is well developed, while in *Bos* it is almost completely absent (pl. 1, figs. 3–4, char. 3).

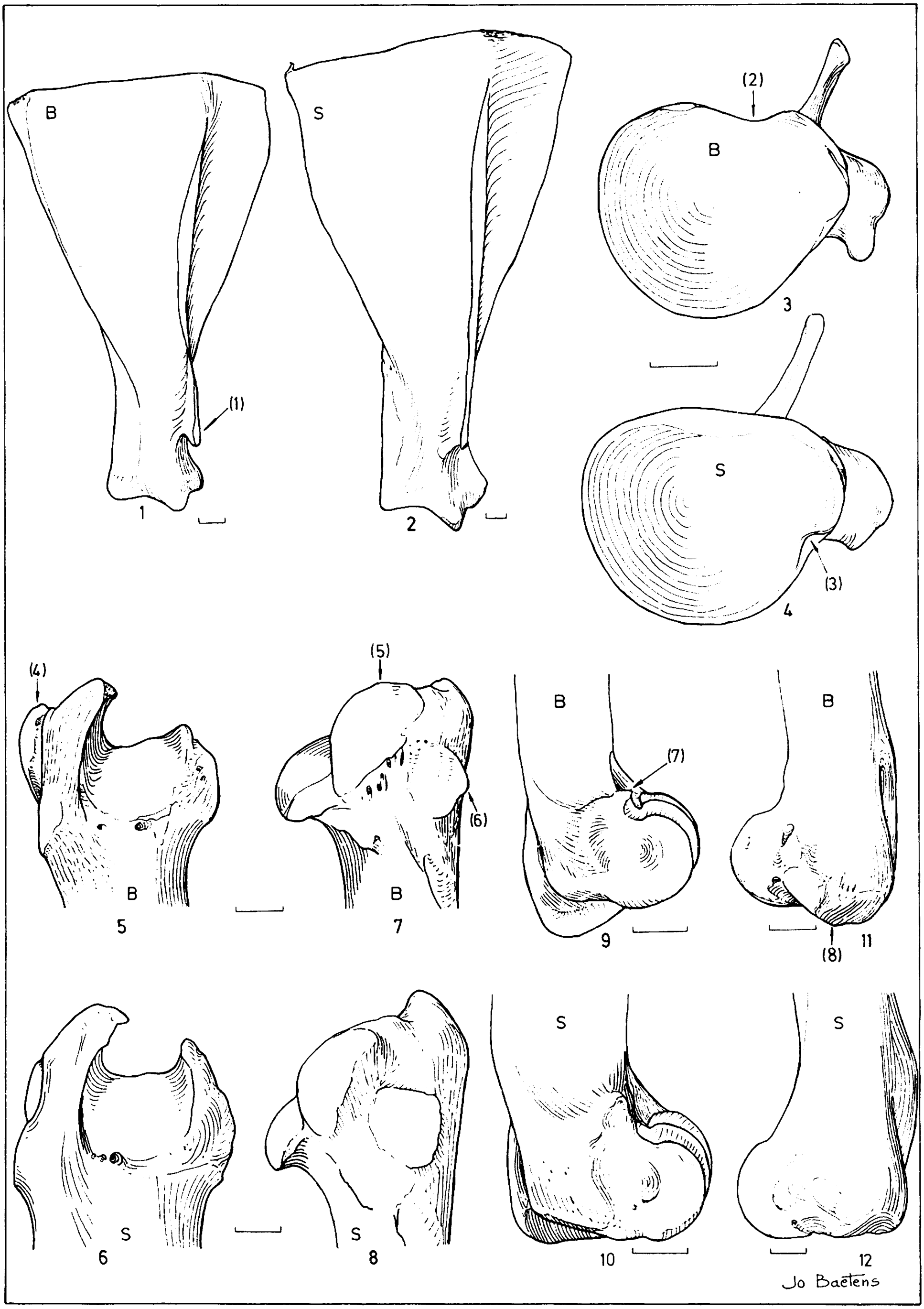

Plate 1. 1: Scapula, lateral view, *Bos primigenius* f. taurus, 2: Scapula, lateral view, *Syncerus caffer*, 3: Scapula, distal view, *Bos primigenius* f. taurus, 4: Scapula, distal view, *Syncerus caffer*, 5: Humerus, proximal extremity, cranial view, *Bos primigenius* f. taurus, 6: Humerus, proximal extremity, cranial view, *Syncerus caffer*, 7: Humerus, proximal extremity, lateral view, *Bos primigenius* f. taurus, 8: Humerus, proximal extremity, lateral view, *Syncerus caffer*, 9: Humerus, distal extremity, lateral view, *Bos primigenius* f. taurus, 10: Humerus, distal extremity, lateral view, *Syncerus caffer*, 11: Humerus, distal extremity, medial view, *Bos primigenius* f. taurus, 12: Humerus, distal extremity, medial view, *Syncerus caffer*

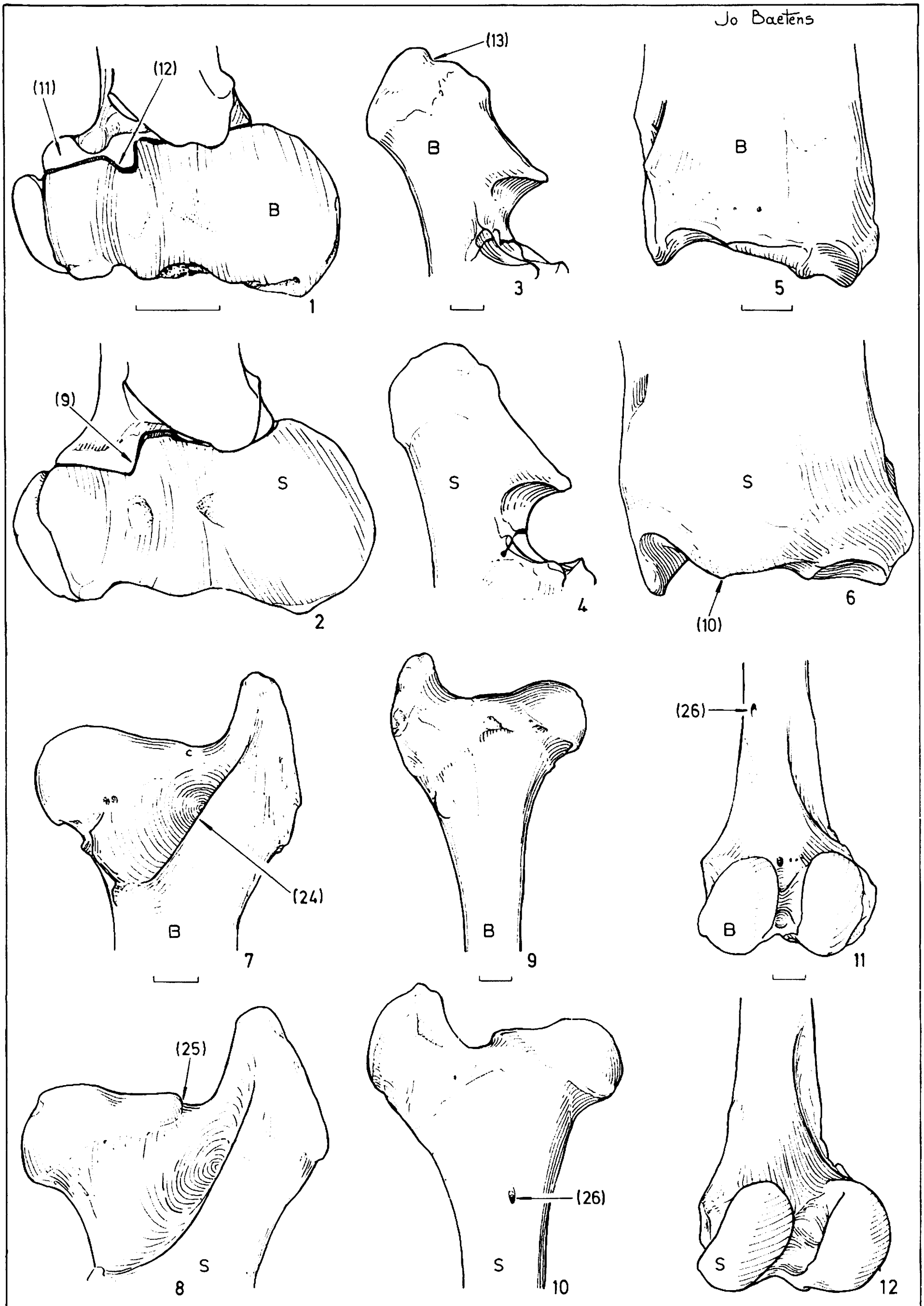

Plate 2. 1: Radius-Ulna, proximal extremity, proximal view, *Bos primigenius* f. taurus, 2: Radius-Ulna, proximal extremity, proximal view, *Syncerus caffer*, 3: Ulna, olecranon, lateral view, *Bos primigenius* f. taurus, 4: Ulna, olecranon, lateral view, *Syncerus caffer*, 5: Radius-Ulna, distal extremity, cranial view, *Bos primigenius* f. taurus, 6: Radius-Ulna, distal extremity, cranial view, *Syncerus caffer*, 7: Os femoris, proximal extremity, caudal view, *Bos primigenius* f. taurus, 8: Os femoris, proximal extremity, caudal view, *Syncerus caffer*, 9: Os femoris, proximal extremity, cranial view, *Bos primigenius* f. taurus, 10: Os femoris, proximal extremity, cranial view, *Syncerus caffer*, 11: Os femoris, distal extremity, caudal view, *Bos primigenius* f. taurus, 12: Os femoris, distal extremity, caudal view, *Syncerus caffer*

Humerus

1. The position of the pars caudalis of the tuberculum majus, relative to that of the pars cranialis differs in the two genera. In a cranial view, the pars caudalis projects more laterally compared with the pars cranialis in *Bos,* while in *Syncerus* both are lying more or less in the same plane (pl. 1, figs. 5–6, char. 4).

2. The pars caudalis of the tuberculum majus is proximally and caudally more developed in *Bos* compared with *Syncerus* (pl. 1, figs. 7–8, char. 5) (see also GENTRY 1967:284-char. 71).

3. A lateral view of the humerus of *Bos* shows that the facies musculi infraspinati is well developed cranially, through which it forms a projection at the cranial side of the humerus. In *Syncerus,* this rough prominence is less pronounced and less well developed cranially (pl. 1, figs. 7–8, char. 6) (see also GENTRY 1967: 284-char. 72).

4. The transition between the epicondylus lateralis humeri and the fossa radialis humeri is in *Bos* characterized by a cranioproximal, rather pointed attachment surface. In *Syncerus,* this attachment area is less pronounced (pl. 1, figs. 9–10, char. 7).

5. The epicondylus medialis is more developed distally in *Bos* compared with *Syncerus* (pl. 1, figs. 11–12, char. 8).

Radius

1. The margo caudalis of the proximal articular surface shows a different course in both genera. This is due to the differences in form and proportions of the lateral part of the incisura ulnaris (pl. 2, figs. 1–2, char. 9).

2. The portion of the margo cranialis of the facies articularis carpea, which corresponds with the dorsal border of the os carpi intermedium, extends more distally in *Syncerus* (pl. 2, figs. 5–6, char. 10).

Ulna

1. In *Bos,* the processus coronoideus lateralis is decidedly more developed laterally compared with *Syncerus* (pl. 2, figs. 1–2, char. 11).

2. In *Bos,* the incisura lateralis has a rectangular form, while in *Syncerus* this incisura is rather triangular and less well pronounced at both its dorsal and lateral side (pl. 2, figs. 1–2, char. 12).

3. The tuber olecrani exhibits in *Bos* a distinct proximal notch which is almost lacking in *Syncerus* (pl. 2, figs. 3–4, char. 13).

Ossa carpi

Os carpi radiale. 1. The ratio of the proximodistal versus dorsopalmar dimensions is different in the two genera (pl. 4, figs. 1–2, char. 14). 2. The margo medialis exhibits a slightly more angular course in *Bos* in comparison with *Syncerus* (pl. 4, figs. 3–4, char. 15) (see also GENTRY, 1967: 284-char. 83).

Os carpi intermedium. 1. The margo palmaris of the facies articularis proximalis is more developed proximally in *Bos* (pl. 4, figs. 5–6, char. 16). 2. The angle between the palmar border and the (oblique) medial border of the facies articularis distalis is about 45° in *Syncerus,* while in *Bos* this angle is about 30° (pl. 4, figs. 5–6, char. 17).

Os carpi ulnare. The facies articularis medialis of the os carpi ulnare is in *Bos* much more pronounced in comparison with *Syncerus* (pl. 4, figs. 7–10, char. 18).

Os carpi accessorium. No constant osteomorphological differences were found.

Os carpale II + III. 1. In a proximal view, the habitus of the os carpale II + III is rather squarish in *Syncerus,* while in *Bos* this carpal bone looks more rectangular because of an increased mediolateral distance (pl. 4, figs. 11–12, char. 19). 2. In *Bos,* the medial articular surface is cut into two parts by a distopalmar groove. In *Syncerus,* this medial articular surface remains uniform (pl. 4, figs. 13–14, char. 20).

Os carpale IV. No constant osteomorphological differences were found.

Os metacarpale III + IV

1. The habitus of the os metacarpale III + IV differs in the two genera: relatively slender in *Bos,* while shorter, broader and rather sturdy in *Syncerus* (pl. 4, figs. 15–16, char. 21) (see partly Gentry 1967: 282-char. 62).

2. The foramen nutricium at the palmar side of the distal extremity is well developed in *Bos,* while in *Syncerus* this foramen is reduced or even absent (pl. 4, figs. 15–16, char. 22) (see also Gentry 1967: 282-char. 66).

3. The tuberositas ossis metacarpalis III is more pronounced in *Bos* than in *Syncerus* (pl. 4, figs. 17–18, char. 23).

Os femoris

1. The central portion of the crista intertrochanterica has a minor mediodorsal fold, which is absent in *Syncerus* (pl. 2, figs. 7–8, char. 24).

2. The caput ossis femoris merges gradually into the trochanter major in *Bos,* while in *Syncerus* the edge of the caput ossis femoris forms a clear boundary between the medial and lateral parts of the proximal extremity (pl. 2, figs. 7–8, char. 25). We agree with Gentry (1967: 280-char. 49) that *Bos* tends to have a steeper slope on the top edge of the articular head in anterior view compared with *Syncerus,* although this feature is not distinguishable in every bone or bone fragment.

3. In *Syncerus,* a foramen nutricium is present near the proximal end of the femur. In *Bos,* a comparable foramen is located at the caudal side of the femur diaphysis near the distal end, slightly proximomedial of the fossa supracondylaris (pl. 2, figs. 9–12, char. 26).

4. The medial ridge of the trochlea ossis femoris extends more proximally in *Bos;* this trochlea is altogether more developed proximally compared with its analogue in *Syncerus* (pl. 3, figs. 1–2, char. 27).

5. The lateral ridge of the trochlea ossis femoris is more pronounced distally in *Syncerus* (pl. 3, figs. 3–4, char. 28).

Patella

The patella of *Bos* generally has, in comparison with *Syncerus,* a more slender habitus; this is partly due to a prolonged proximodistal axis (pl. 3, figs. 5–6, char. 29).

Tibia

The sulcus malleolaris lateralis is more pronounced in *Bos.* The morphology of the facies articularis malleoli is also different in the two genera (pl. 3, figs. 7–10, char. 30).

Os malleolare

The cranioproximal portion of the os malleolare of *Syncerus* is in most cases protruding proximally (pl. 4, figs. 11–12, char. 31).

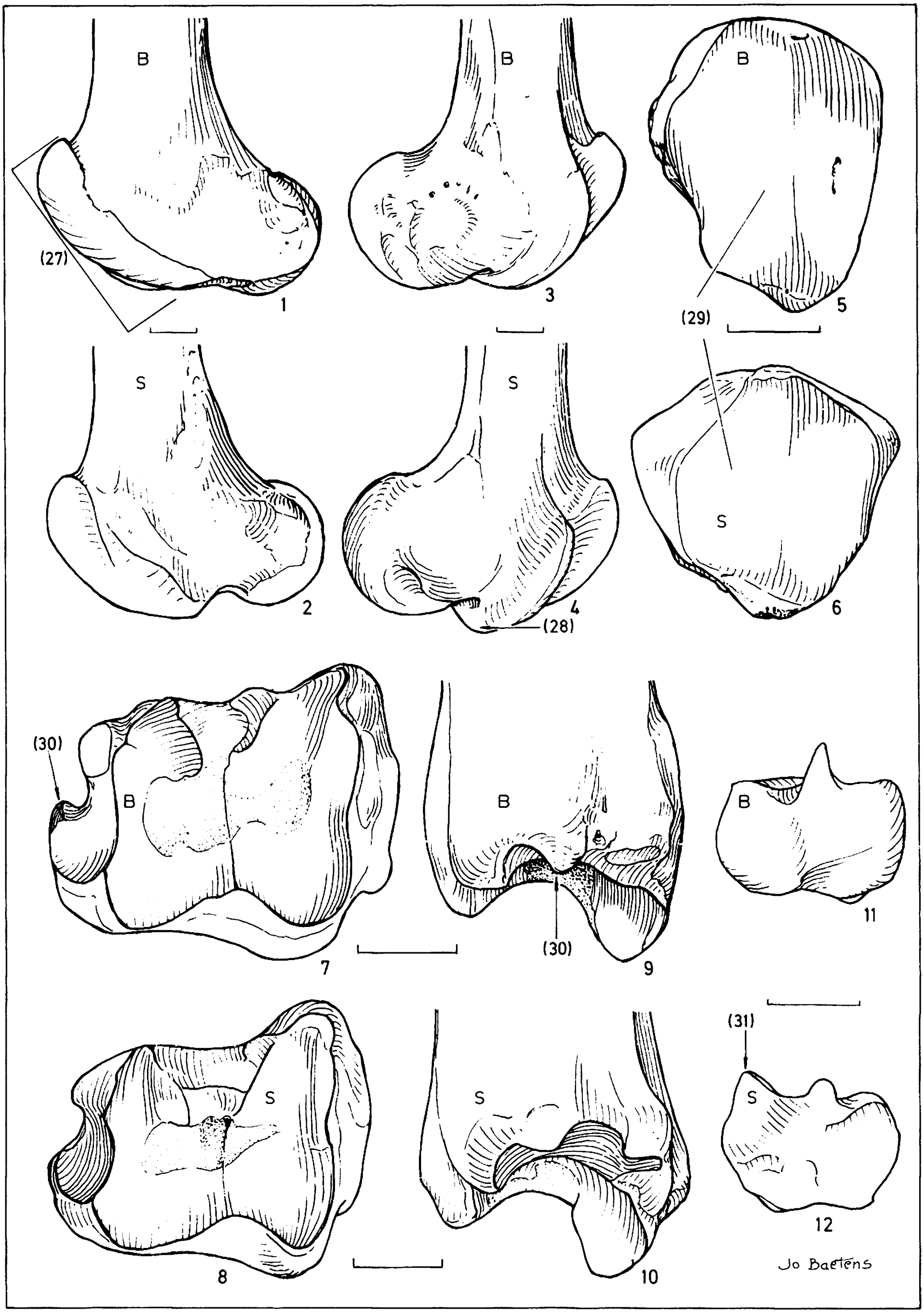

Plate 3. 1: Os femoris, distal extremity, medial view, *Bos primigenius* f. taurus, 2: Os femoris, distal extremity, medial view, *Syncerus caffer*, 3: Os femoris, distal extremity, lateral view, *Bos primigenius* f. taurus, 4: Os femoris, distal extremity, lateral view, *Syncerus caffer*, 5: Patella, caudal view, *Bos primigenius* f. taurus, 6: Patella, caudal view, *Syncerus caffer*, 7: Tibia, distal epiphysis, distal view, *Bos primigenius* f. taurus, 8: Tibia, distal epiphysis, distal view, *Syncerus caffer*, 9: Tibia, distal extremity, lateral view, *Bos primigenius* f. taurus, 10: Tibia, distal extremity, lateral view, *Syncerus caffer*, 11: Os malleolare, lateral view, *Bos primigenius* f. taurus, 12: Os malleolare, lateral view, *Syncerus caffer*

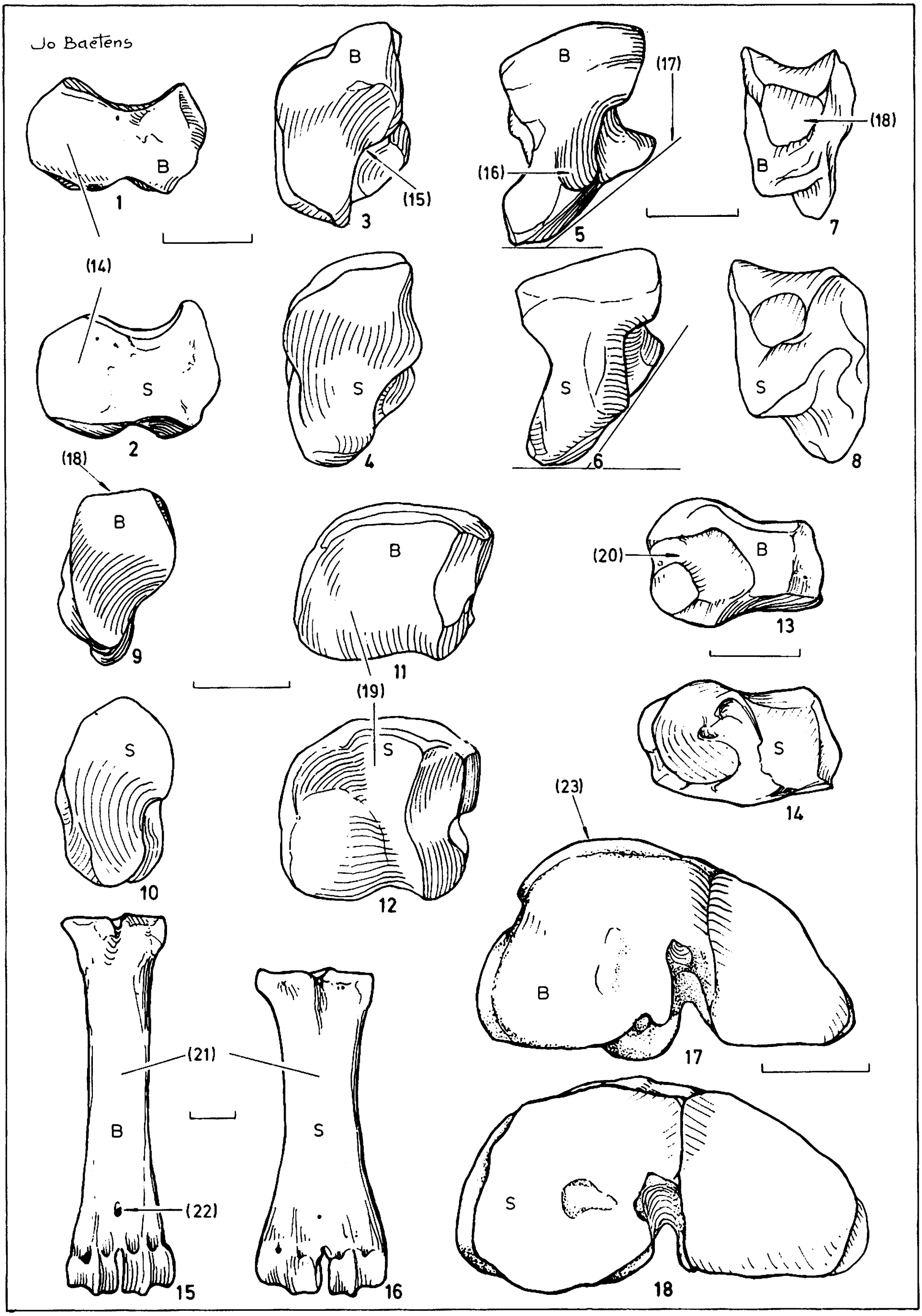

Plate 4. 1: Os carpi radiale, dorsomedial view, *Bos primigenius* f. taurus, 2: Os carpi radiale, dorsomedial view, *Syncerus caffer*, 3: Os carpi radiale, proximal view, *Bos primigenius* f. taurus, 4: Os carpi radiale, proximal view, *Syncerus caffer*, 5: Os carpi intermedium, proximal view, *Bos primigenius* f. taurus, 6: Os carpi intermedium, proximal view, *Syncerus caffer*, 7: Os carpi ulnare, dorsal view, *Bos primigenius* f. taurus, 8: Os carpi ulnare, dorsal view, *Syncerus caffer*, 9: Os carpi ulnare, proximal view, *Bos primigenius* f. taurus, 10: Os carpi ulnare, proximal view, *Syncerus caffer*, 11: Os carpale II + III, proximal view, *Bos primigenius* f. taurus, 12: Os carpale II + III, proximal view, *Syncerus caffer*, 13: Os carpale II + III, medial view, *Bos primigenius* f. taurus, 14: Os carpale II + III, medial view, *Syncerus caffer*, 15: Os metacarpale III + IV, palmar view, *Bos primigenius* f. taurus, 16: Os metacarpale III + IV, palmar view, *Syncerus caffer*, 17: Os metacarpale III + IV, proximal epiphysis, proximal view, *Bos primigenius* f. taurus, 18: Os metacarpale III + IV, proximal epiphysis, proximal view, *Syncerus caffer*

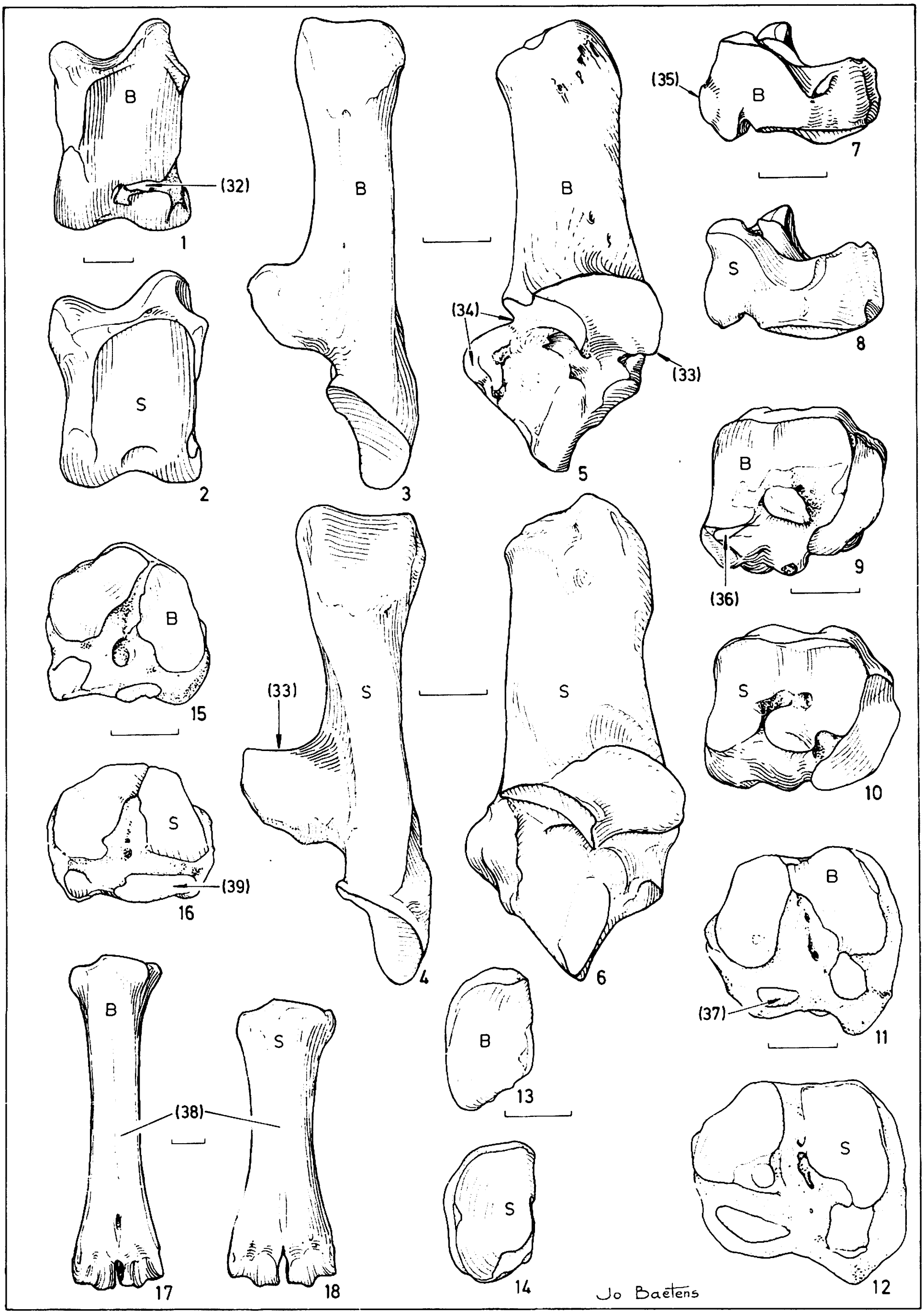

Plate 5. 1: Talus, plantar view, *Bos primigenius* f. taurus, 2: Talus, plantar view, *Syncerus caffer*, 3: Calcaneus, plantar view, *Bos primigenius* f. taurus, 4: Calcaneus, plantar view, *Syncerus caffer*, 5: Calcaneus, medial view, *Bos primigenius* f. taurus, 6: Calcaneus, medial view, *Syncerus caffer*, 7: Os centroquartale, lateral view, *Bos primigenius* f. taurus, 8: Os centroquartale, lateral view, *Syncerus caffer*, 9: Os centroquartale, proximal view, *Bos primigenius* f. taurus, 10: Os centroquartale, proximal view, *Syncerus caffer*, 11: Os centroquartale, distal view, *Bos primigenius* f. taurus, 12: Os centroquartale, distal view, *Syncerus caffer*, 13: Os tarsale II + III, proximal view, *Bos primigenius* f. taurus, 14: Os tarsale II + III, proximal view, *Syncerus caffer*, 15: Os metatarsale III + IV, proximal epiphysis, proximal view, *Bos primigenius* f. taurus, 16: Os metatarsale III + IV, proximal epiphysis, proximal view, *Syncerus caffer*, 17: Os metatarsale III + IV, dorsal view, *Bos primigenius* f. taurus, 18: Os metatarsale III + IV, dorsal view, *Syncerus caffer*

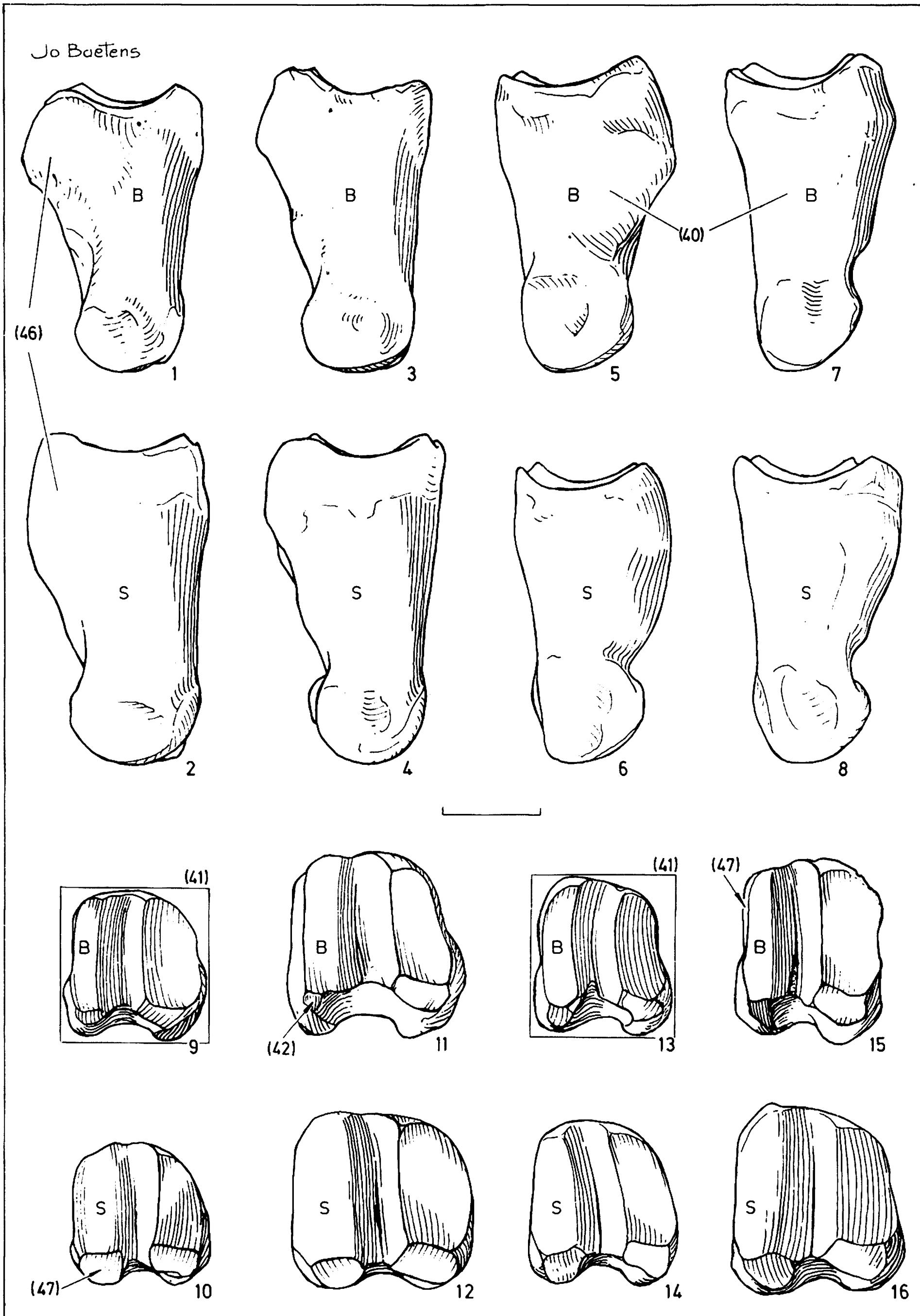

Plate 6. 1: P. proximalis manus, abaxial view, *Bos primigenius* f. taurus, 2: P. proximalis manus, abaxial view, *Syncerus caffer*, 3: P. proximalis pedis, abaxial view, *Bos primigenius* f. taurus, 4: P. proximalis pedis, abaxial view, *Syncerus caffer*, 5: P. proximalis manus, axial view, *Bos primigenius* f. taurus, 6: P. proximalis manus, axial view, *Syncerus caffer*, 7: proximalis pedis, axial view, *Bos primigenius* f. taurus, 8: P. proximalis pedis, axial view, *Syncerus caffer*, 9: P. proximalis manus (♀), proximal view, *Bos primigenius* f. taurus, 10: P. proximalis manus (♀), proximal view, *Syncerus caffer*, 11: P. proximalis manus (♂), proximal view, *Bos primigenius* f. taurus, 12: P. proximalis manus (♂), proximal view, *Syncerus caffer*, 13: P. proximalis pedis (♀), proximal view, *Bos primigenius* f. taurus, 14: P. proximalis pedis (♀), proximal view, *Syncerus caffer*, 15: P. proximalis pedis (♂), proximal view, *Bos primigenius* f. taurus, 16: P. proximalis pedis (♂), proximal view, *Syncerus caffer*

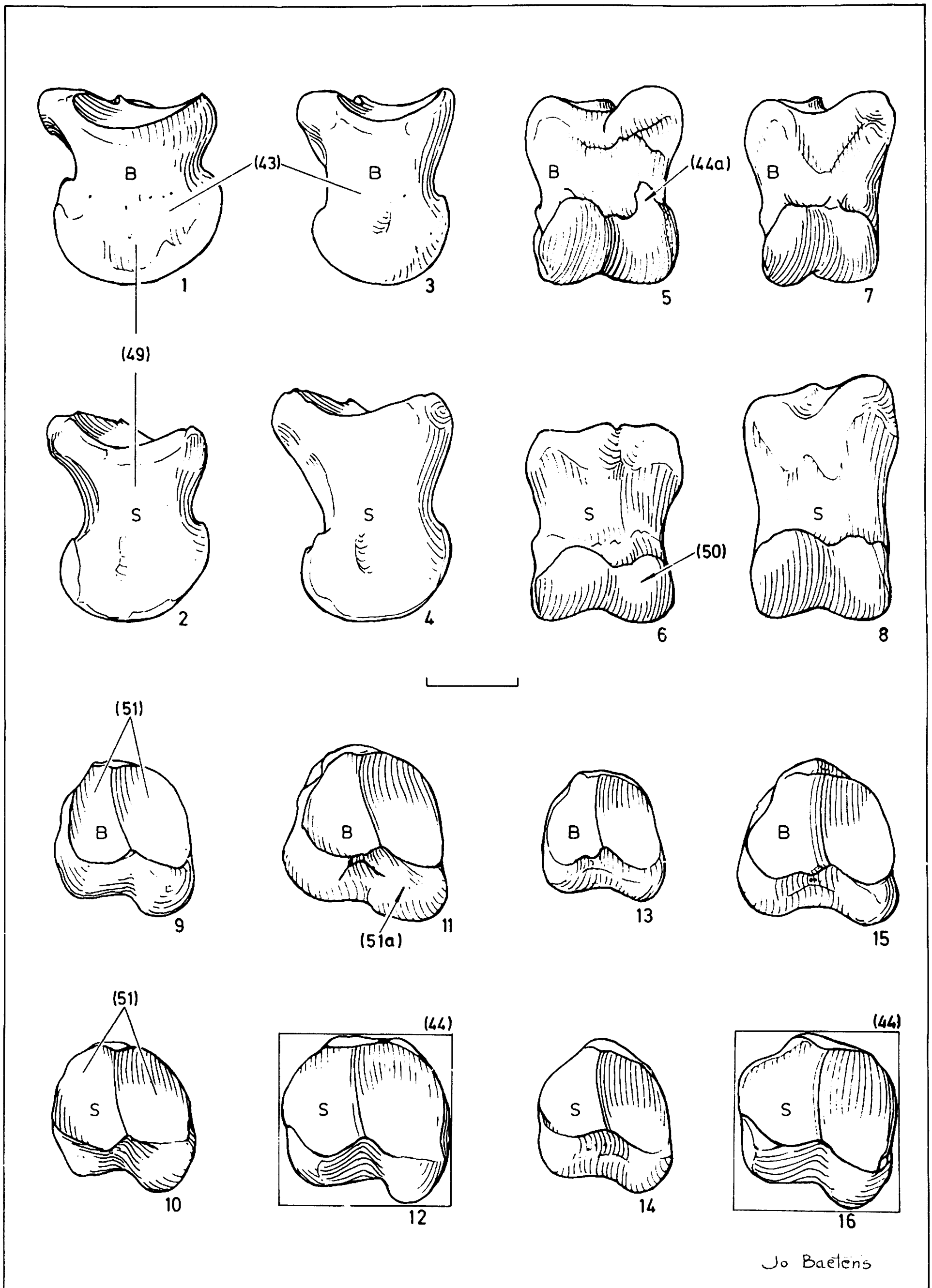

Plate 7. 1: P. media manus, abaxial view, *Bos primigenius* f. taurus, 2: P. media manus, abaxial view, *Syncerus caffer*, 3: P. media pedis, abaxial view, *Bos primigenius* f. taurus, 4: P. media pedis, abaxial view, *Syncerus caffer*, 5: P. media manus, palmar view, *Bos primigenius* f. taurus, 6: P. media manus, palmar view, *Syncerus caffer*, 7: P. media pedis, plantar view, *Bos primigenius* f. taurus, 8: P. media pedis, plantar view, *Syncerus caffer*, 9: P. media manus (♀), proximal view, *Bos primigenius* f. taurus, 10: P. media manus (♀), proximal view, *Syncerus caffer*, 11: P. media manus (♂), proximal view, *Bos primigenius* f. taurus, 12: P. media manus (♂), proximal view, *Syncerus caffer*, 13: P. media pedis (♀), proximal view, *Bos primigenius* f. taurus, 14: P. media pedis (♀), proximal view, *Syncerus caffer*, 15: P. media pedis (♂), proximal view, *Bos primigenius* f. taurus, 16: P. media pedis (♂), proximal view, *Syncerus caffer*

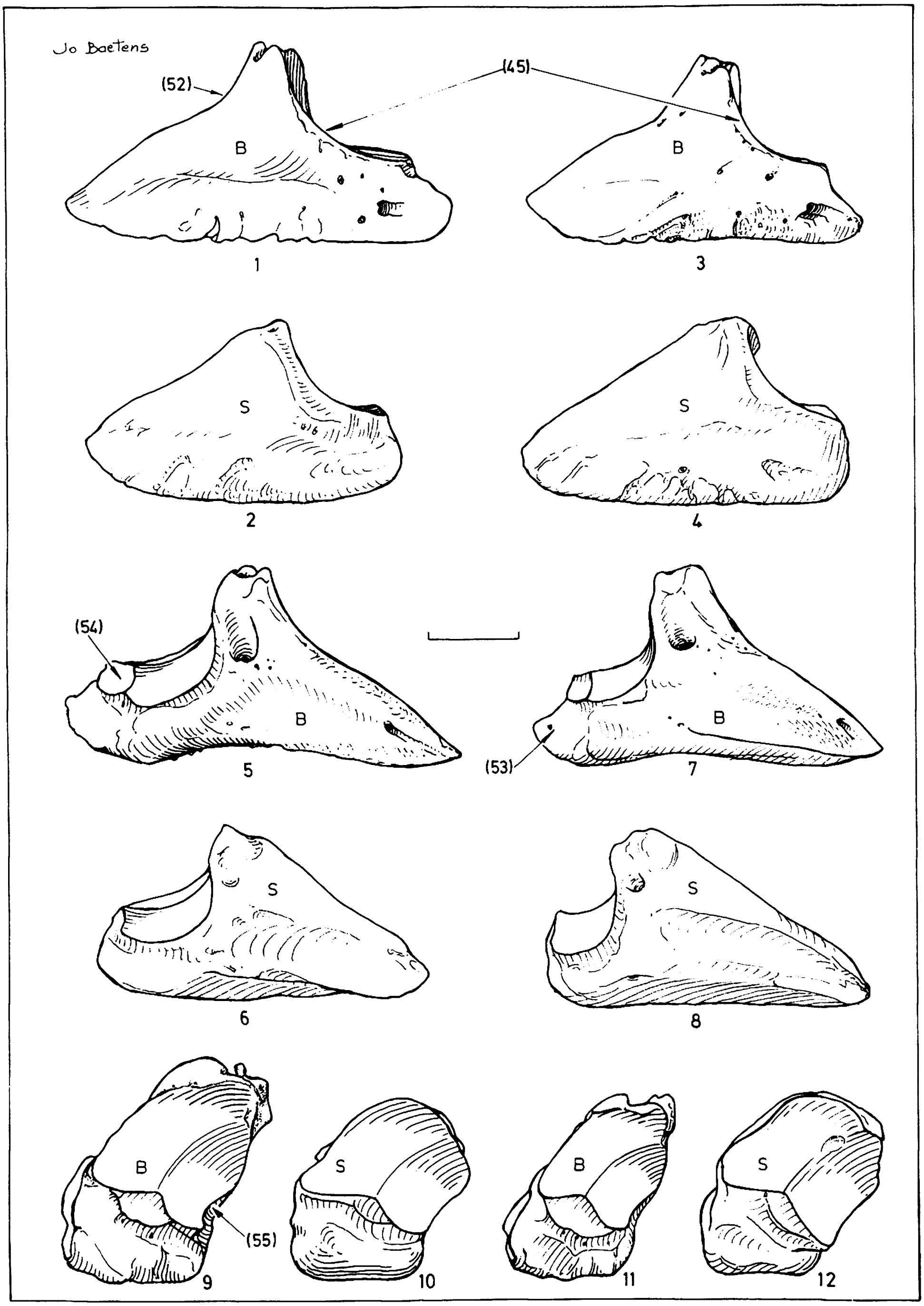

Plate 8. 1: P. distalis manus, abaxial view, *Bos primigenius* f. taurus, 2: P. distalis manus, abaxial view, *Syncerus caffer*, 3: P. distalis pedis, abaxial view, *Bos primigenius* f. taurus, 4: P. distalis pedis, abaxial view, *Syncerus caffer*, 5: P. distalis manus, axial view, *Bos primigenius* f. taurus, 6: P. distalis manus, axial view, *Syncerus caffer*, 7: P. distalis pedis, axial view, *Bos primigenius* f. taurus, 8: P. distalis pedis, axial view, *Syncerus caffer*, 9: P. distalis manus, proximal view, *Bos primigenius* f. taurus, 10: P. distalis manus, proximal view, *Syncerus caffer*, 11: P. distalis pedis, proximal view, *Bos primigenius* f. taurus, 12: P. distalis pedis, proximal view, *Syncerus caffer*

Ossa tarsi

Talus. In many cases, the caput tali exhibits in *Bos* at its facies articularis ossis centroquartalis a lateral groove, which is absent in *Syncerus* (pl. 5, figs. 1–2, char. 32).

Calcaneus. 1. In *Syncerus,* the sustentaculum tali is more pronounced medially (pl. 5, fig. 4) while in *Bos* it is more developed in a plantar direction (pl. 5, fig. 5, char. 33). 2. The proximal portion of the processus coracoideus is better developed dorsally in *Bos;* the transition towards the proximal part of the calcaneus lies more plantarly compared with *Syncerus* (pl. 5, fig. 5, char. 34).

Os centroquartale. 1. The plantar side of the lateral half of the os centroquartale exhibits in *Bos* a well pronounced plantar prominence, which is nearly absent in *Syncerus* (pl. 5, figs. 7–8, char. 35). 2. In *Bos,* the medioplantar portion of the proximal articular surface of the os centroquartale, which articulates with the caput tali, shows an extra articular surface laterally (pl. 5, figs. 9–10, char. 36). 3. The small, distal, lateroplantar articular surface, which articulates with a corresponding surface at the proximal extremity of the os metatarsale III + IV is in *Bos* generally smaller than in *Syncerus* (pl. 5, figs. 11–12, char. 37).

Os tarsale I. No constant osteomorphological differences were found.

Os tarsale II + III. No constant osteomorphological differences were found.

Os metatarsale III+IV

1. The habitus of the os metatarsale III+IV differs in the two genera: relatively slender in *Bos*, while shorter, broader and rather sturdy in *Syncerus* (pl. 5, figs. 17–18, char. 38).

2. The lateroplantar articular surface of the proximal epiphysis is much more developed laterally in *Syncerus* (pl. 5, figs. 15–16, char. 39).

Ossa digitorum

Criteria to distinguish the ossa digitorum manus from the ossa digitorum pedis in *Bos* and *Syncerus*

Phalanges proximales. 1. The habitus of the P. proximales pedis is more slender compared with that of the P. proximales manus (pl. 6, figs. 1–8, char. 40) (see also Dottrens, 1946:764). 2. The general appearance of the proximal end of the first phalanges is rather squarish for those of the fore limb and rather rectangular for those of the hind limb (pl. 6, figs. 9–16, char. 41) (see also Dottrens 1946:765). 3. In *Bos*, the articular surface for the axial os sesamoideum proximale of the P. proximales manus is reduced in size compared with that of the P. proximales pedis (pl. 6, figs. 9–16, char. 42) (see also Dottrens 1946:765).

Phalanges mediae. 1. The habitus of the P. mediae pedis of *Bos* and *Syncerus* is more slender compared with that of the P. mediae manus (pl. 7, figs. 1–8, char. 43) (see also Dottrens 1946:753). 2. The general appearance of the proximal end of the phalanges mediae is rather squarish for those of the fore limb, and rather rectangular for those of the hind limb (pl. 7, figs. 9–16, char. 44). 3. In *Bos*, the abaxiopalmar part of the trochlea phalangis mediae manus is more developed proximally compared with its analogue in the P. mediae pedis (pl. 7, figs. 5 and 7, char. 44a) (see also Dottrens, 1946:753).

Phalanges distales. In axial view, it becomes obvious that the margo coronalis of the distal phalanges of the hind limb exhibits a steeper course than that of the distal phalanges of the fore limb (pl. 8, figs. 5–8, char. 45) (see also DOTTRENS 1946:743).

Criteria to distinguish between the ossa digitorum from *Bos* and *Syncerus*

Phalanges proximales. 1. In both axial and abaxial view, one notices the angular aspect of the phalanges proximales in *Bos*, while in *Syncerus* these phalanges are more rounded (pl. 6, figs. 1–8, char. 46). We nevertheless agree with S. PAYNE (in litt.) that this criterium cannot always be used. 2. The proximal fovea articularis is well delineated in *Syncerus*, which is not the case in *Bos* (pl. 6, figs. 9–16, char. 47). 3. The facies articulares for the ossa sesamoidea proximalia are more pronounced in *Syncerus* compared with *Bos* (pl. 6, figs. 9–16, char. 48).

Phalanges mediae. 1. In *Syncerus*, the phalanges mediae generally show a more slender habitus compared with those from *Bos* (pl. 7, figs. 1–8, char. 49). 2. In *Syncerus*, the abaxiopalmar part of the trochlea phalangis mediae manus is less developed proximally compared with its analogue in *Bos* (pl. 7, figs. 5–6, char. 50). 3. The articular surface is divided into two glenoid cavities by a crista sagittalis. In *Bos*, the difference in size between the abaxial and axial glenoid cavities is much larger compared with *Syncerus* (pl. 7, figs. 9–16, char. 51). 4. In many cases, the abaxial tuberosity of the torus palmaris/plantaris is less pronounced in *Bos* (pl. 7, figs. 9–16, char. 51a) (see also PAYNE, unpublished report).

Phalanges distales. 1. The processus extensorius is more developed in *Bos* (pl. 8, figs. 1–8, char. 52). 2. The tuberculum flexorium is in *Bos* more pronounced in the palmar (P. distales manus) and plantar (P. distales pedis) direction (pl. 8, figs. 1–8, char. 53). 3. The facies articularis sesamoidea for the os sesamoideum distale is larger and lies more plantarly in *Bos* (pl. 8, figs. 9–12, char. 54). 4. In *Bos*, the axial border of the facies articularis is indented, which is not the case in *Syncerus* (pl. 8, figs. 9–12, char. 55).

Concluding remarks

From the foregoing, it should be clear that a number of diagnostic osteomorphological features exist which allow a distinction between African buffalo and cattle. Only a few smaller carpal and tarsal bones such as the os carpi accessorium, the os carpale IV, the os tarsale I and the os tarsale II+III cannot be separated yet morphologically. Due to the fact that many features are located near the articular surfaces of the bones, even incomplete bones – in casu fossil specimens – can now in many cases be identified to the species level.

During our analysis, we also found out that measurements, and the indices based on them, proved to be a less useful tool for the distinction between the skeletal elements of the two species, because of the large overlap.

We furthermore were able to check whether the osteomorphological characteristics, established for domestic cattle, were also applicable to its wild ancestor, the aurochs *(Bos primigenius)*. It is known that the domestication process causes morphological changes but, from our observations, we can conclude that most of the features of domestic cattle described above can also be used to identify its wild ancestor.

Acknowledgements

The author is indebted to Drs. A. GAUTIER, P. SIMOENS, Rijksuniversiteit Gent, and S. PAYNE, Cambridge University, for reading the manuscript and discussing the subject; to Drs. W. VAN NEER, Katholieke Universiteit Leuven, and J.-P. BRUGAL, C.N.R.S., Marseille, for their valuable comments;

to Drs. X. Misonne, Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, D. Thijs van den Audenaerde, D. Meirte, Koninklijk Museum voor Midden-Afrika, Tervuren, and J. Clutton-Brock and K. Bryan, British Museum Natural History, London, for the permission to study museum material; to J. Baetens for the drawings and to N. Reynaert for typing the manuscript. This study has been financed by the I.W.O.N.L., Brussels; a travel grant was provided by the Vlaamse Wetenschappelijke Stichting, Leuven.

Zusammenfassung

Osteomorphologische Unterscheidungsmerkmale am Gliedmaßenskelett vom afrikanischen Büffel (Syncerus caffer) und vom Hausrind (Bos primigenius f. taurus)

Knochenresten von diesen großen Boviden werden oft gefunden an afrikanischen holozänen archaeologischen Fundorten, aber ihre Bestimmung schafft manches Problem.

Ein Bestimmungsschlüssel wurde entwickelt, um dieses immer wiederkehrende Problem zu lösen; die diagnostischen, osteomorphologischen Merkmale, welche eine Unterscheidung beider Tierarten voneinander ermöglichen, werden festgelegt. Nur einige kleine Karpal- und Tarsalknochen können noch nicht unterschieden werden.

Im allgemeinen sind die osteomorphologischen Unterscheidungsmerkmale beständiger als die osteometrischen. Den größeren Teil dieser osteomorphologischen Charakteristiken, festgelegt für das Hausrind, kann man auch anwenden, um Knochenreste ihres Vorfahren, des Ur, zu bestimmen.

References

Arambourg, C. (1947): Contribution à l'étude géologique et paléontologique du Bassin du Lac Rodolphe et de la Basse Vallée de l'Omo. 2e partie: Paléontologie. Mission scientifique de l'Omo 1932–1933, Tome I (Géologie et Anthropologie), Fascicule III. Ed. Mus. Nat. d'Hist. Nat. Paris.

Boessneck, J.; Müller, H.-H.; Teichert, M. (1964): Osteologische Unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Ziege (*Capra hircus* Linné). Kühn-Archiv **78**, 1–129.

Dottrens, E. (1946): 1. Etude préliminaire: Les phalanges osseuses de *Bos Taurus domesticus*. Rev. Suisse de Zool. **53**(33), 739–774.

Gabler, K.-O. (1985): Osteologische Unterscheidungsmerkmale am postkranialen Skelett zwischen Mähnenspringer *(Ammotragus lervia)*, Hausschaf *(Ovis aries)* und Hausziege *(Capra hircus)*. München: Diss.- u. Fotodruck Frank GmbH.

Gentry, A. W. (1964): Skull characters of African gazelles. Ann. and Mag. Nat. Hist. Ser. **13**, 7, 353–382.

— (1967): *Pelorovis oldowayensis* Reck, an extinct bovid from East Africa. Bull. Brit. Mus. (Nat. Hist.), Geol. **14**(7).

— (1978): Bovidae. In: Evolution of African Mammals. Ed. by Maglio, V. J.; Cooke, H. B. S. Cambridge, Mass. and London: Harvard Univ. Press. 539–572.

Haltenorth, Th.; Diller, H. (1979): Elseviers Gids van de Afrikaanse zoogdieren. Amsterdam and Brussel: Elsevier.

Leinders, J. J. M. (1979): On the osteology and function of the digits of some ruminants and their bearing on taxonomy. Z. Säugetierkunde **44**, 305–319.

Leinders, J. J. M.; Sondaar, P. Y. (1974): On functional fusions in footbones of Ungulates. Z. Säugetierkunde **39**, 109–115.

Marks, A. E.; Mohammed-Ali, A.; Peters, J.; Robertson, R. (1985): The Prehistory of the Central Nile Valley as Seen from Its Eastern Hinterlands: Excavations at Shaqadud, Sudan. J. Field Archaeology **12**, 261–278.

Nomina Anatomica Veterinaria, 3rd ed., Nomina Histologica, 2nd. ed. (1983): Published by the International Committee on Veterinary Gross Anatomical Nomenclature under the financial responsibility of the World Assocation of Veterinary Anatomists. Ithaca, N. Y.

Oboussier, H.; Ernst, D. (1977): Der formative Einfluß des Lebensraumes auf das postcraniale Skelett der Tragelaphinen (Tribus Tragelaphini Sokolov, 1953 – Bovidae, Mammalia). Zool. Jb. Syst. **104**, 203–238.

Peters, J. (1986a): Bijdrage tot de archeozoölogie van Soedan en Egypte. Ph. D. Diss., Rijksuniversiteit Gent.

— (1986b): A revision of the faunal remains from two Central Sudanese sites: Khartoum Hospital and Esh Shaheinab. Archaeozoologia, Mélanges publiés à l'occassion du 5e Congrès international d'Archéozoologie, Bordeaux-août 1986, 11–35.

— (1986c): Osteomorphology and osteometry of the appendicular skeleton of African Buffalo, *Syncerus caffer* (Sparrman, 1779) and cattle, *Bos primigenius* f. taurus Bojanus, 1827. Ghent: Occasional papers, Laboratorium voor Paleontologie, Rijksuniversiteit Gent, No. 1.

STÖCKMANN, W. (1975): Die Form der Mandibel Afrikanischer Bovidae (Mammalia) und ihre Beeinflussung durch die Ernährung. Ph. D. Diss., Universität Hamburg.

VAN NEER, W. (1981): Archeozoölogische studie van Matupi (Ijzertijd en Late Steentijd) en Kiantapo (Ijzertijd) in Zaïre. Ph. D. Diss., Katholieke Universiteit Leuven.

WALKER, R. (1985): A Guide to the post-cranial bones of East African animals. Norwich, England: Hylochoerus Press.

Author's address: Dr. JORIS PETERS, Institut für Palaeoanatomie, Domestikationsforschung und Geschichte der Tiermedizin, Schellingstraße 10/II, D-8000 München 40