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# TWO HORSE SKELETONS FROM THE CEMETERY OF KURRU, NORTHERN SUDAN

Not very much is known about the horses of northeast Africa, for example, those of the Egyptian and the Meroitic Kingdoms.

According to the most recent research, the wild horse was present in the Nile Valley during the Paleolithic (Gaillard, 1934, 23). Nevertheless, it died out there at the end of the Pleistocene and the domesticated horse arrived in Egypt with the Hyksos people, if not earlier (Clark, 1941, 56f; Lundholm, 1949, 159f). In fact, domesticated horses occurred there at the beginning of the 17th century B.C. The Hyksos themselves were successful horse breeders as well as charioteers (Habachi, 1972, 36, 53f; Littauer—Crouwel, 1985, 96), and it is possible that the Egyptians acquired chariotry from them. This is a rather late date since at that time, horses were known over all of Europe, Asia Minor, the Levant, Mesopotamia and Iran as well. From Egypt the horse went further south to the Sudan but even the approximate time of its arrival there is as yet unknown except in northern areas where they appeared by the 12th Dynasty (see later). In any case, horse skeletons do not commonly occur in excavation materials from Egypt or the Sudan. It is even rarer that they come into the hands of archaeozoologists for detailed study. For the time being, four horse skeletons have been described to date. In chronological order of publication they are as follow:

1. The Sakkara horse, dated somewhere between the 20th Dynasty and the Ptolemaic period (Quibell—Olver, 1926, 172ff).

2. The Thebes horse found in front of the tomb of Senmut and dated to the early 15th century B.C. (Chard, 1937, 317f; Boessneck, 1970, 43ff).

3. The Buhen horse found in a Middle Kingdom fortress near the second cataract of the Nile in Northern Sudan (Clutton-Brock, 1974, 89ff; 1981, 85). This seems to be the most ancient horse skeleton in northeast Africa dating back to the 12th Dynasty (ca. 1675 B.C.), thus far earlier than any artistic or written source on the horse in Egypt (Nibbi, 1979, 160).

4. The Soleb horse dates back to the reign of Amenophis III (Schiff Giorgini, 1971, 260f; Ducos, 1971, 260ff).

Unfortunately, the horse skeletons from famous Nubian cemeteries such as Ballana and Qustul have never been published, though it is more than probable that the skeletons of these horses can still be found in the storerooms of certain great museum(s), for example, obviously those of the Egyptian Museum in Cairo.

In 1986, I had the opportunity to study two horse skeletons in the Zooarchaeological Laboratory of the Museum of Comparative Zoology, Harvard University, Cambridge, Mass. I express here my gratitude to Dr. Richard Meadow, head of the above laboratory for placing the two skeletons at my disposal. He provided all necessary help in my work as well as provided photographs and even X-ray pictures of the most important specimens.

The two horse skeletons were unearthed during the course of excavations by the Harvard University — Museum of Fine Arts Expedition in one of the royal cemeteries of Kush, that of Kurru in 1919. Kurru lies in Northern Sudan, right below the 4th cataract of the Nile on the western side of the river. The excavation *(Fig. 1)* was led by Dr. G. A. Reisner who excavated — among other things — 24 horse graves (Reisner, 1919; Dunham, 1950, 109). Out of the 24 horse skeletons two were brought to the

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Fig. 1. Kurru, horse cemetery looking to the NW. May. 1919. Courtesy of the Museum of Fine Arts, Boston

(Boston) Museum of Fine Arts. This museum handed them over first as a loan and then in 1941 as a gift to the Museum of Comparative Zoology. Still in 1941, Professor Allen, Curator of Mammals, studied the two skeletons, although, as far as is known, results are still unpublished. The only statement concerning the results of this study occurs in a letter signed by Allen (Dunham, 1950, 111).

The two horse skeletons were found in two graves, in No. 211 (*Fig. 2;* Invent. No. 19—4—98) and No. 212 (*Fig. 3;* Invent. No. 19—4—61). They were the remains of two out of the eight chariot horses of King Shebitku (Reisner's Shabataka) dating between 701 and 690 B.C. (Dunham, 1950, 109). According to Dunham, the horses had been buried standing (in fact, lying on their bellies) and were probably decapitated because "in no case a skull was found" (Dunham, 1950, 111). In fact, the alleged decapitation of the horses proved to be untrue because in both cases, skull fragments and almost complete sets of teeth could be observed. The explanation for the supposed decapitation of the horses may be that since the funerary objects were concentrated at their heads and necks, later grave-robbers caused most damage in this region.

The two skeletons are not fully complete (the most problematic in this respect is the absence of the long bones of the forelegs — humeri, radii and metacarpi — of horse No. 212).

Another problem is that the bones of the two skeletons are mixed up. Although, as can be seen later, the two horses are practically identical in terms of size and constitution ("Wuchsform") but the various bones or even fragments from each individual have different colour so that their division was only impossible in a few cases. In this respect, the inventory numbers offer little help because they could naturally not be found on every little fragment.

Fig. 2. Kurru, Grave 211, NE end, looking to the NE. Courtesy of the Museum of Fine Arts, Boston

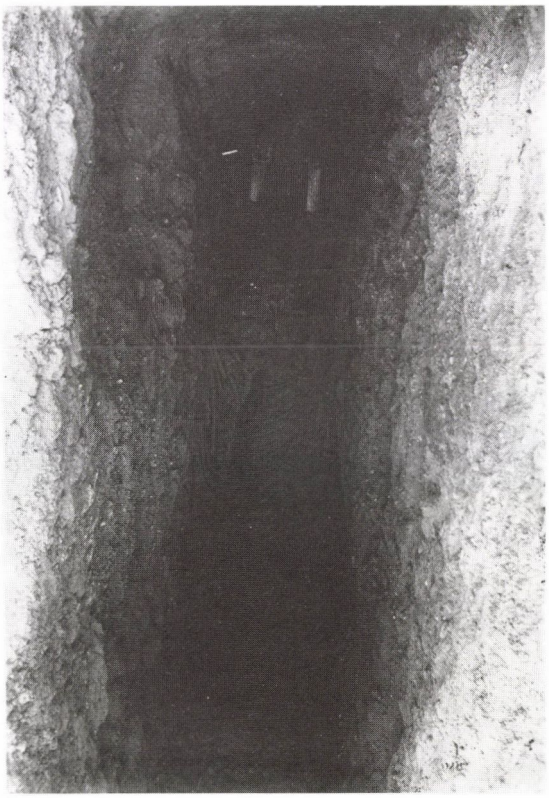

Fig. 3. Kurru, Grave 212, stage 1, looking to the NE. Courtesy of the Museum of Fine Arts, Boston

Both skulls are represented by very small fragments pointing to the excessive damage done by grave-robbers or unskilled excavation personnel on the skulls. A great part of the teeth are missing while the surviving ones are generally damaged. Most of the ribs are broken, some extremity bones are damaged, too.

The spinal processes of five thoracal vertebrae from the withers were broken about five cm from their ends in one of the horses (unfortunately, it is not possible to determine which of them) but the fractures bealed, leaving only some exostoses to show traces of the accident *(Figs 4—5)* which must have been a big fall. Nevertheless, the horse survived it, and being a draught horse, did not suffer any irreversible damage.

The metapodials also display some minor abnormities while the metatarsals or for example the medial splint bones ($mt_2$) are grown together with the main cannon bones ($mt_3$) in horse No. 212. Nevertheless, this can be considered physiological since it occurs in all workhorses after longer use. The exostoses on the anterior side of the proximal half, and even on the proximal epiphysis, are also the results of the long-term exploitation of the animal as a draught horse and probably caused no serious problems. At the same time, the osteoporosis on the distal half of the metapodials and on the anterior side of the proximal part of the metatarsals in horse No. 211 are results of the greater age of this individual.

As regards the description of the two horses, nothing can be said concerning their skulls because they had been broken into such small fragments that the reconstruction of the skulls proved impossible. They were probably large because their teeth were large too. The enamel patterns of the upper molars and praemolars were simple, their protoconi were long, and the caballine fold (pli caballin) was on every upper cheektooth present. The incisors were also large and the single canine that could be found was well developed. The extremity bones were long. Their shafts were rather slender *(Fig. 6)* with strong muscle insertion places at their ends. The bones of the feet were large *(Figs 7—8)* on both the fore and hind legs,

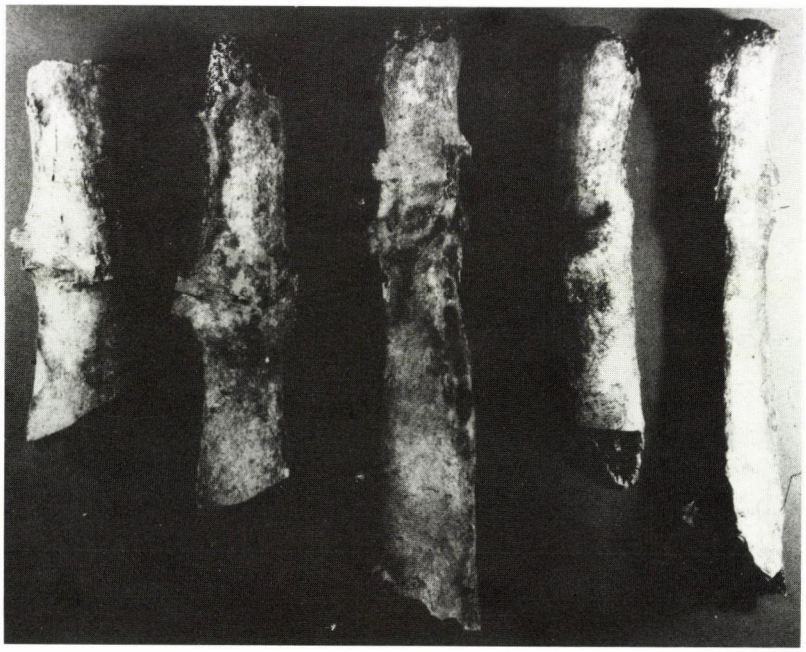

Fig. 4. Spinal process fragments of horse No. 211 with healed fractures

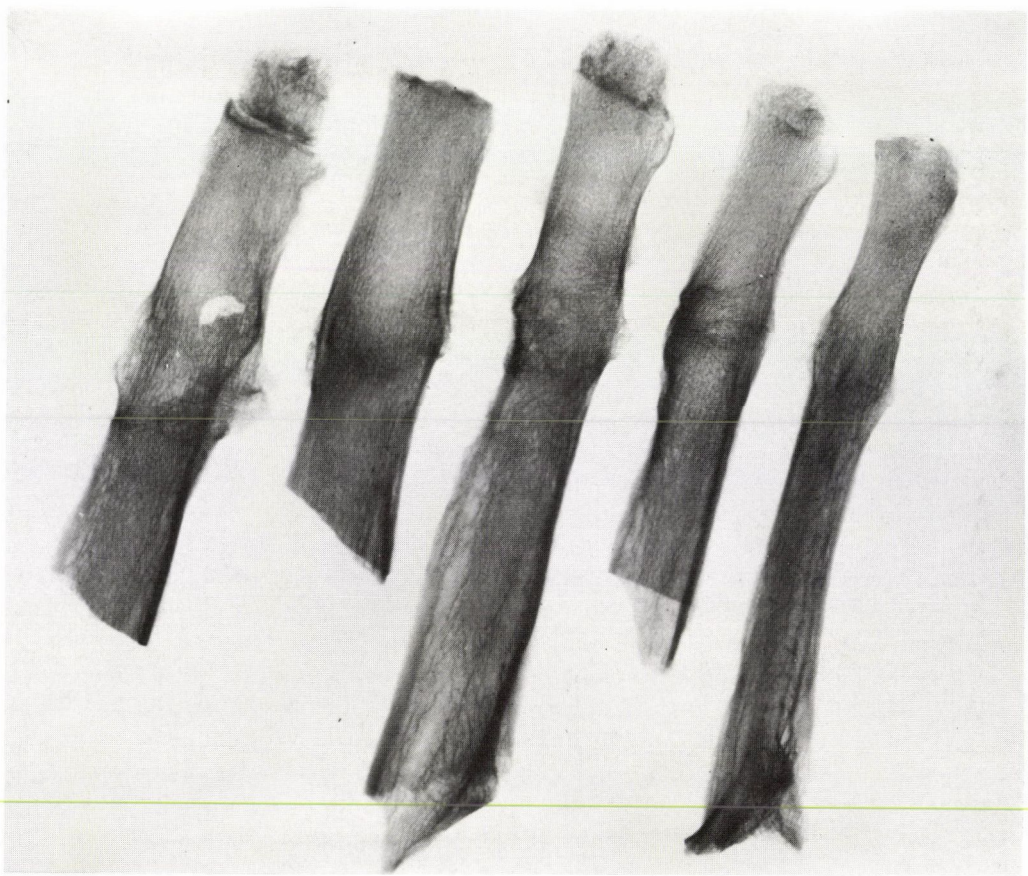

Fig. 5. X-ray picture of the spinal process fragments with healed fractures

Fig. 6. Horse No. 211 metacarpals and metatarsals

the hoof bones were conspicuously wide and flat *(Figs 8—10)*; this latter is important and will be referred to.

The exact age of the two horses cannot be determined because of the missing and damaged incisors. One can only say that horse No. 212 was adult and horse No. 211 adult-mature. One of them (one cannot say exactly which) was surely a stallion because one well-developed canine was found among the teeth. The other was, in all probability, also a stallion because its size, proportions and stature were similar to those of the former one. The possibility of these horses being castrates may be excluded on the basis that the metapodials were well balanced and not exceptionally long and/or slender.

The two horses were large animals that cannot be considered, even by modern standards, small. Their withers heights are 152.29 cm (No. 211) and 155.33 cm (No. 212), respectively, calculated with Vitt's method (Vitt, 1952, Table 1). The 3 cm height difference between the two horses can easily be the result of the fact that the long bones of the forelegs (humerus, radius and metacarpus) of horse No. 212 are missing and only the greatest length of the three long bones (femur, tibia and metatarsus) of the hind leg were used in the determination of withers height. This suspicion derives from the results of the withers height determination of horse No. 211: in that horse, withers height determined from the length of the long bones of the foreleg is only 150.42 cm while that determined from the length of the hind leg is 154.17 cm. The difference is, thus nearly 4 cm. This demonstrates that this horse was slightly overgrown in its croup which may easily have been a characteristic of the breed. And since the two horses are very similar in size, stature, body and limb proportions, it may rightly be supposed that the proportions of the forelegs to the hind legs were similar, too. Thus, the withers height determined from the foreleg was actually ca. 4 cm

Fig. 7. Horse No. 211, anterior (upper row) and posterior (lower row) first phalanges

lower than that based on the length of the long bones of the hind leg, while the average withers height was around 133 cm, in fact only cca. one cm higher than that of horse No. 211. This means that the two horses represented an ideal pair of draught horses which is what would be expected from the favourite chariot horses of a king.

The following table demonstrates the withers height values of the two horses based on the length of their long bones:

| bone | withers No. 211 | height No. 212 |
|---|---|---|
| Humerus | 149.50 | — |
| Radius | 150.00 | — |
| Metacarpus | 151.75 | — |
| Femur | 152.50 | 155.00 |
| Tibia | 158.00 | 158.00 |
| Metatarsus | 152.00 | 153.00 |
| M | 152.29 | 155.33 |

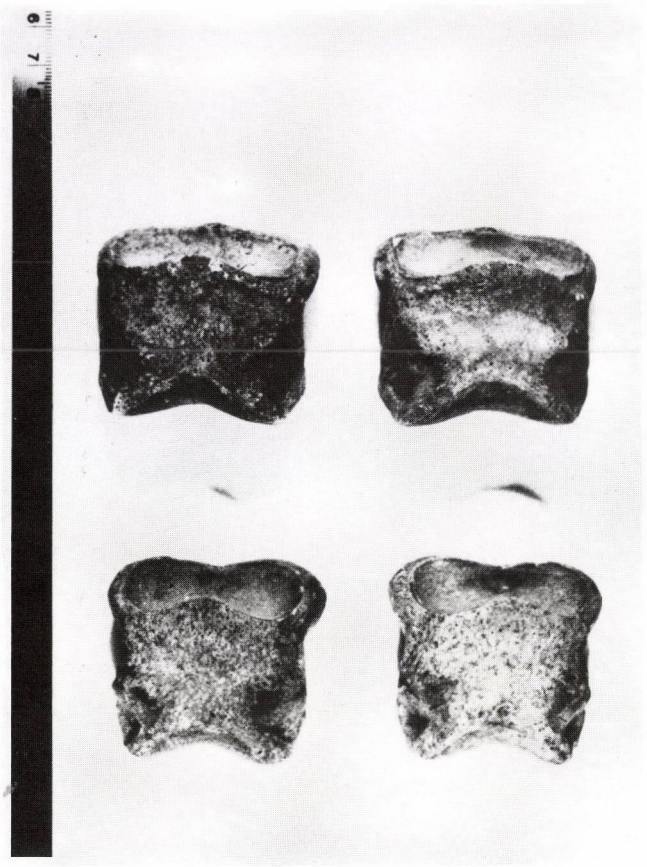

Fig. 8. Horse No. 211 anterior (upper row) and posterior (lower row) second phalanges

The next table shows the percentual ratios of the different limb bones in comparison to the whole length of the fore or hind leg. Unfortunately, only the bones of the hind legs of both horses can be compared. Nevertheless, the great similarity in their proportions can be seen even in this way:

| | Humerus | Radius | Metacarpus | Femur | Tibia | Metatarsus |
|---|---|---|---|---|---|---|
| horse No. 211 | 34.49% | 38.96% | 26.55% | 38.50% | 35.64% | 25.86% |
| horse No. 212 | — | — | — | 38.76% | 35.35% | 25.89% |

Both horses have very slender limbs, particularly the metapodials as well as wide, flat hooves. They represent a strange combination because slender metapodials usually go with narrow, well-arched hooves. However the above combination may be the result of purposeful horse breeding and, as such, a characteristic of the breed. At any rate, the 14.2 and 14.0 slenderness indexes of the metacarpals of horse No. 211 and the metatarsal slenderness indexes of 10.7 and 11.07 of horse No. 211 and 10.60 of horse No. 212 are certainly very low and fall well below the average for Iron Age horses of Eastern Europe and Middle Asia (Bökönyi, 1974, Table 4; Figs 94—95).

In summary, it may be said that the two horses from Kurru, were large animals, of a much greater size that the average oriental horses of their time. In fact, they can only be compared to large Assyrian,

Fig. 9. Anterior hoof bones (third phalanges), dorsal view. Horse No. 211 (upper row), horse No. 212 (lower row)

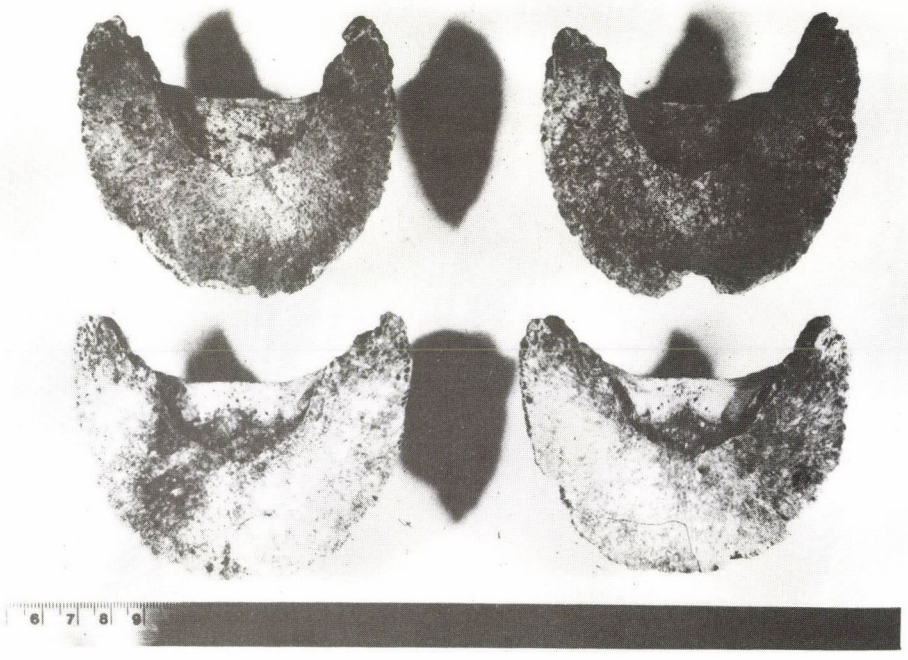

Fig. 10. Anterior hoof bones (third phalanges), volar view. Horse No. 211 (upper row), horse No. 212 (lower row)

Median and Parthian (Bökönyi, 1964, 236; 1968, 41; 1974, 255; 1988, 39) as well as later Roman (Hilzheimer, 1924, 151; Habermehl, 1958, 105; Bökönyi, 1974, 263; 1984, 62f; Azzaroli, 1985, 156) horses. It may be said that they represented a unique, outstanding quality at that time, horses which could only be the result of conscious breeding. Beside their large size, they were slender-legged. However, these horses were not castrates as is evidenced by the fact that their slender metapodials were conspicuously short.

Thus, Reisner was not correct in writing that "the horses were clearly of a short, rather small breed" (Reisner, 1919, 253). Being well-built, large horses, they could easily pull a royal chariot with the king and its driver at a higher speed or could carry the weight of any rider while maintaining a great velocity. This was important at that time when the horses were so small that they could hardly carry a rider, particularly not in gallop, and when every breeder or tribal chief or king tried to acquire the comparatively larger "eastern" horses (Bökönyi, 1964, 239; 1968, 41; 1974, 254; 1988, 39f; Harmatta, 1968, 156). Using of the study of Tut Ankhamon's chariots by Littauer and Crouwell (Littauer—Crouwel, 1985, 70ff; Pl. LXXVII) as a starting point, they would even have been too large for a light chariot. One could consider them more riding horses capable of carrying a lot of weight.

Comparing these two horses to the Egyptian—Nubian horses listed in the introductory part of this paper, it can immediately be seen that the two horses from the royal cemetery of Kush near Kurru are larger than any of them.

The Sakkara horse's withers height was given apparently by Olver as 14 hands and 1 1/2 inches, thus, about 143—144 cm (Quibell—Olver, 1926, 174) although dorsal spines were mentioned as being noticeably high. In any case, the Sakkara horse was about 10 cm smaller in the withers than the Kurru horses.

The Thebes horse's withers height was estimated for Thornton Chard by Dr. D. E. Derry as 12 1/2 hands thus, 50 inches (Chard, 1937, 137). This was too small and has already been disputed by Boessneck (1970, 47) who properly measured it and stated that it was 14 hands high at the withers and resembled the Hittite horses of Osmankayashi in Central Anatolia (Herre—Röhrs, 1958, 63f).

Clutton-Brock found the Buhen horse very similar in size to the Thebes horse though a little larger and heavier (Clutton-Brock, 1960, 1974, 90f). As a matter of fact, both Boessneck and Clutton-Brock emphasized that their horses were larger and more slender than their Western European counterparts. Both placed his/her horse within the oriental group. This was not surprising because it has been known since 1962 and 1968 that eastern prehistoric horses were larger than the horses of the Western European group (Bökönyi, 1962, 234ff; 1968, 19ff).

Finally, the Soleb horse was truely a small animal. Ducos (1971, 261) grave its wither height as 134—138 cm, but in correctly used the greatest lengths and not the lateral dimensions with the Kiesewalter indexes. In reality his horse was 3—5 cm smaller. Thus, this is the smallest of all known Egyptian horses.

After all of these complications one has the right to ask what an early Egyptian or Nubian horse was like? First it must have been of eastern origin. This is so obvious that it does not need a detailed explanation. Since from the time of earliest domestication of the horse until the beginning of conscious horse breeding in the Persian and the Roman Empires, eastern horses had been larger and, from the breeder's viewpoint, better than the western ones (see earlier), the Egyptians acquired the superior eastern horses. They did it not just because being a rich empire they could afford it but also because of their geographical position. They were closer to great eastern horse breeding centres. It is true, horse breeding did not yet exist in Arabia (their next-door neighbour to the east) when the first domestic horses reached Egypt. Nevertheless, such horses did exist in the Levant, Anatolia and Iran. The first domestic horses arrived in Anatolia in the Late Chalcolithic, in the second half of the 4th mill. B.C. through the Caucasus and started an uninterrupted breeding of good Eastern horses there (Bökönyi, 1978, 54f; 1988, 38). From Mesopotamia there is artistic evidence from the middle of the 3rd mill. B.C. (Bökönyi, 1972, 35ff), while at about the same time, domestic horses also occurred in Iran either through the Anatolian–Mesopotamian connection or — which is now more plausible — directly from the newly discovered Siberian horse domestication centres (Narumov—Makarova, 1988, 7ff; Bökönyi in print) through the Transcaspian steppes.

For the importation of these horses, the Levant was an evident land route that was secured by smaller vassal states of the Egyptian Empire. When the supposedly fine eastern horses arrived in Egypt, they found there an environment unsuitable for horses. Horses do not like extreme heat, particularly if it is connected with humidity. In Egypt, the Nile delta was warm and humid while the irrigated belt where agriculture, stockbreeding and, in general, human settlement was possible was not dry either. The most obvious response of the imported horses to this stress would have been a general size decrease caused by this environmental situation. In fact, this certainly happened to some of them as is clearly shown by the Soleb horse.

Nevertheless, this size decrease did not occur in most of the imported horses for two main reasons. One is that the Egyptians were already good animal breeders in dynastic times and as a result, they handled these newcomers very carefully. These animals were possibly accompanied by professional personnel, grooms, trainers, etc. (The other reason is that according to Alessandra Nibbi's article (1979, 162f) horses in general or at least most of them belonged to the Pharaoh and were treated accordingly. Here one must point out that A. Nibbi's article, in spite of the fact that a) one feels that the writer has no real zoological background and therefore cannot judge zoological statements properly and b) that her final conclusions are not always exactly correct, is a valuable contribution to our knowledge of early Egyptian horse breeding because it contains a large amount of philological evidence which would have been inaccessible to an archaeozoologist.)

Nibbi's suspicion was awakened by the strange fact that Janssen (1975, 161—179) found no mention of the price of a horse in Egyptian texts from the Ramesside period (Nibbi, 1979, 162). This seemed to indicate to her that horses were very rarely traded and in all probability they were a strictly supervised royal monopoly and used as precious gifts or barter articles as well as for military purposes. She feels this supposition of hers was confirmed by a passage in Papyrus Lansing (2, 6—9) which concerns the training of horses in the field that as foals were taken away from their mothers in order to learn a noble bearing worthy of their master.

There is no doubt that the pharaohs had their own stables; texts and representations prove it. And it is also natural that both the pharaohs and their sons were devoted not only to horse breeding and training but also to using horses as draught animals for their chariots on hunting excursions and in wars as well. One may again refer to representations and texts. The exact study by Littauer and Crouwel clearly shows the various uses the pharaohs kept chariots for (Littauer—Crouwel, 1985, 99f). Out of the six chariots found in Tutankhamun's grave three were finely decorated and thus, they were certainly used for parade and ceremonial purposes. One was constructed for hard wear and rough terrain and might have been used as a travelling chariot on campaign. And the last two had a less sturdy construction and probably served as hunting chariots.

Nevertheless, the overwhelming majority of horses was owned and their breeding was controlled by the Egyptian state. It is also obvious that pharaoh and state could not be precisely distinguished in every small aspect of everyday life. In fact, the Pharaoh as the absolute ruler of the country, possessed everything in Egypt. Thus, in a wider sense, he controlled the horse stock and directed horse breeding as well although all the horses did not necessarily have to be his personal property.

The Buhen horse (Clutton-Brock, 1974) has already drawn attention to the high quality of horses in Upper Egypt and ancient Meroe. This area (today's Nubia) was known by the name of Kush. This was the best horse country in Africa. As Dunham points out (Dunham, 1968, 121) Northern Sudan was virtually rainless and uninhabitable except where the Nile provided water for irrigation along its banks. But at approximately the level of the Fifth Cataract one comes into country where there is an annual summer raining season, where grass will grow after the rains, where cattle (and seemingly horses too) can be grazed and crops grown back from the river and where, above all, thorn trees can grow.

These large horses could have been developed in that area and quickly have become well known in the ancient Near East. Na'aman was the first who pointed out (Na'aman, 1976, 89ff) that the Kushite horses, famous for their size, were imported from Egypt to Assyria according to the inscriptions of Tiglat-Pileser III where there are two references to horses from Egypt as tribute to Assyria from rulers in the west. Na'aman also mentioned that the King of Egypt, Shilkenni (Osarkon IV) sent 12 large horses

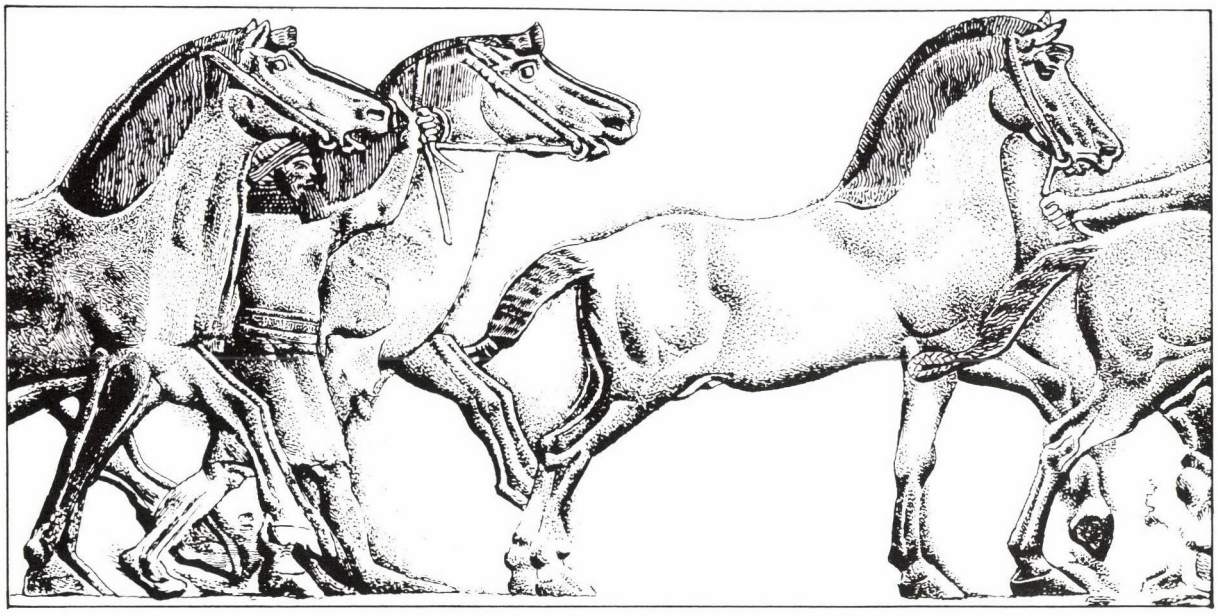

Fig. 11. Representation of large Assyrian horses with slender legs and wide hooves on a stone relief of Ashurbanipal, Niniveh (668—630 B.C.) I thank to Mrs. Mary A. Littauer who kindly called my attention to this piece

as a gift to Sargon II and that Ashurbanipal also took unusually large horses as booty from Egypt (Na'aman, 1976, 101). In fact, Fig. 11 might easily represent such horses. This strenghtens Postgate's horse reports (Postgate, 1974, 13f) in which large horses were called in the Assyrian records *mat Kusayn* and supposed to be a special breed, in all probability from Nubia, *mat Kusi*. It is also the opinion of Dalley (1985, 43) that the Kushite horses imported by the Assyrians from Nubia were large chariot horses. Interestingly enough, the horses represented on some Assyrian reliefs *(Fig. 11)* clearly show the main characteristics of the Kushite horses: the large size, slender limbs and conspicuously wide hooves. Besides the philological evidence, this is another proof that Kushite horses were imported by the Assyrians. It would be extremely exciting once to find Assyrian horse skeletons which might provide first-hand biological evidence in this respect.

According to Dalley, a special type of harness were also imported by the Assyrians along with these Kushite horses. This is highly probable because these horses were much larger than typical chariot horses whose usual height was around 125 cm at the withers (Spruytte, 1983, 40). Solomon and Sargon acquired such horses through Egypt, and Sargon's annals mention that these horses were especially trained to a particular type of yoke. This yoke might possibly have been for horses which were much higher at the withers than the usual Egyptian chariot horses. In this way, these horses were able to pull the Assyrian chariots that were in fact heavier than the Egyptian ones (Littauer—Crouwel, 1979, 101f).

Thus, these horses must have represented a really good breed if a world power such as Assyria imported them. Their development can mainly be attributed to a high degree of breeding and horsemanship in addition to a special climate and enviroment. It remains an open question whether the horse breeding techniques of Kush derived from Egypt or were of local origin. Nevertheless, there is a strong probability that they arrived along with the domestic horse in Kush. It is also true that the Nubian kings themselves were devoted to horses. For example, for King Piye the most urgent task after the siege and surrender of Hermopolis was to visit the sanctuaries and subjugate the royal stables. In peace treaties and as tributes he often recieved horses. Horses thus seem to have meant a lot to him (I express my thanks to Dr. L. Török of the Archaeological Institute of the Hungarian Academy of Sciences who called my attention to these facts and put the manuscript of the chapter "Piye's horses" of his work under

preparation "Iconography and mentality. Three remarks on the Kushite way of thinking" at my disposal).

The horse was mainly used as a chariot horse by the Nubians (just as in Egypt), although cavalry also existed but certainly in lower numbers (Kendall, 1986, Fig. 10; Wenig, 1978, Fig. 36).

An important point is the question of the origin of these excellent horses. Vitt (1972, 203) has already suggested a Scythian origin for the Saqqara horse based on skull form and stature and corrected its withers height to 148 cm instead of 12 1/2 hands (127 cm). Clutton-Brock placed her Buhen horse into my Eastern group (Clutton-Brock, 1960), Boessneck also compared the Thebes horse to the Hittite horses of Anatolia (Boessneck, 1970, 43ff).

Nevertheless, the problem is very simple: The ancient Egyptians had the opportunity to acquire *only* horses of the Eastern group because only these horses existed in the areas with which they had direct contacts although it is not possible to determine if these horses came from the East European or the Central Asian centre of horse domestication. They had nothing to do with the region of distribution of the Western horse group, thus west of the Vienna—Venice line, or at least there was a one-way traffic of goods, in a south to north direction. In this way, the Kurru horses must also have an oriental origin, while their development was the result of Nubian conscious horse breeding practices. Thus, in scatter-diagrams, their measurements would lie in the uppermost region of range of size variation. This means that they would have been among the finest horses of that time and their master, King Shebitku, would have been rightly proud of them.

## MEASUREMENTS

Lower row of teeth

| grave | length of $M_3$ | |
|---|---|---|
| No. ? | 32.5 | |

Scapula

Measurements: 1. greatest length
2. greatest width
3. smallest width of collum scapulae
4. width of angulus articularis
5. diameter of facies articularis

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| | 392[x] | 193 | 66 | 98[x] | 52.5 | s |
| No. 211 | | | | | | |
| | 393 | 194[x] | 67 | 98 | 51 | d |

Humerus

Measurements: 1. greatest length
2. proximal width
3. smallest width
4. distal width
5. proximal diameter
6. smallest diameter
7. distal diameter

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 322 | 103 | 37.5 | 85 | 106[x] | 47 | 86 | s |
| No. 211 | | | | | | | | |
| | 326 | 105 | 38 | 84 | 105 | 47 | 89 | d |
| | — | — | — | 87[x] | — | — | 92 | s |
| No. 212 | | | | | | | | |
| | — | — | — | 87,5 | — | — | 92[x] | d |

Radius

Measurements: the same as those of the humerus

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 366[x] | 91.5 | 43 | 86 | 55.5 | 32 | 52 | s |
| No. 211 | | | | | | | | |
| | 366[x] | 90 | 43 | 86.5 | 52 | 30 | 50 | d |

Metacarpus

Measurements: the same as those of the humerus

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 250 | 56 | 35.5 | 52 | 41 | 24 | 39.5 | s |
| No. 211 | | | | | | | | |
| | 249 | 56 | 35 | 52.5 | 39 | 24 | 39.5 | d |

Femur

Measurements: 1. length to trochanter major
2. length to caput femoris
3. proximal width
4. smallest width
5. distal width
6. proximal diameter
7. smallest diameter
8. distal diameter

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
|---|---|---|---|---|---|---|---|---|---|
| | — | 388[x] | 130[x] | 41 | 113[x] | — | 50 | 126 | s |
| No. 211 | | | | | | | | | |
| | 431 | 388 | 128 | 42.5 | 108[x] | — | 50 | 125 | d |
| | 438 | 390 | 130 | 39.5 | — | 93 | 53 | 130 | s |
| No. 212 | | | | | | | | | |
| | — | — | — | 40 | — | — | 50 | — | f |

Tibia

Measurements: the same as those of humerus

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 399[x] | 105[x] | 43 | 81 | — | 33 | 48.5 | s |
| No. 211 | | | | | | | | |
| | 399 | 103 | 43.5 | 80[x] | 98 | 32 | 50 | d |
| | 400[x] | 103 | 43 | 82.5 | — | 32 | 49.5 | s |
| No. 212 | | | | | | | | |
| | 399 | 103[x] | 42.5 | 82 | — | 31 | 51 | d |

Astragalus

Measurements: 1. greatest length
2. greatest width
3. greatest diameter

| 1 | 2 | 3 | |
|---|---|---|---|
| 71.5 | 67 | 69 | s |

| | | | | |
|---|---|---|---|---|
| No. 211 | | | | |
| | 70 | 67 | 69 | d |
| | 69.5 | 68 | 67 | s |
| No. 212 | | | | |
| | 68 | 68 | — | d |

Calcaneus

Measurements: the same as those of the calcaneus

| | 1 | 2 | 3 | |
|---|---|---|---|---|
| | 120 | 55 | 58 | s |
| No. 211 | | | | |
| | 121 | 57 | 60 | d |
| No. 212 | | | | |
| | 120[x] | 55 | 57 | d |

Metatarsus

Measurements: the same as those of the humerus

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 290 | 53 | 31 | 52 | 51 | 26 | 40 | s |
| No. 211 | | | | | | | | |
| | 289 | 53 | 32 | 51 | 51 | 27 | 39 | d |
| | 292.5 | 53 | 31 | 50 | 49 | 26 | 40 | s |
| No. 212 | | | | | | | | |
| | 292.5 | 53 | 31 | 50 | 52.5 | 26 | 40 | d |

Os phalangis I (ant.)

Measurements: 1. sagittal length
2—7. the same as those of the humerus

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 86 | 61 | 38 | 48 | 41.5 | 22 | 28 | s |
| No. 211 | | | | | | | | |
| | 85 | 60 | 37 | 46 | 42 | 21 | 27 | d |
| | 88.5 | 59.5 | 37 | 48 | 41.6 | 21 | 27.5 | s |
| No. 212 | | | | | | | | |
| | 89 | 59.5 | 37 | 46 | 41 | 21 | 27[x] | d |

Os phalangis I (post.)

Measurement: the same as those of the os phalangis I (ant.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 80 | 58.5 | 35 | 43.5 | 44 | 20 | 26 | d |
| No. 211 | | | | | | | | |
| | 86 | 58 | 34 | 43 | 42.5 | 21 | 26 | s |
| No. 212 | | | | | | | | |
| | 85 | 58 | 33 | 43.5 | 42 | 21 | 25.5 | d |

Os phalangis II (ant.)

Measurements: the same as those of the os phalangis I (ant.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 45.5 | 58 | 51 | 55 | 37 | 26 | 27.5 | s |
| No. 211 | | | | | | | | |
| | 47 | 57.5 | 51 | 54 | 35 | 25 | 27 | d |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. 212 | 46 | 58.5 | 50 | 55 | 34 | 26 | 29 | s |
| | 46 | 59 | 51 | 55 | 34 | 26 | 29 | d |

Os phalangis II (post.)

Measurements: the same as those of the os phalangis I (ant.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| | 45 | 56 | 46 | 49 | 35 | 25 | 27.5 | s |
| No. 211 | | | | | | | | |
| | 45 | 56 | 46 | 49.5 | 35.5 | 24 | 28 | d |
| | 46 | 56 | 44.5 | 50.5 | 34 | 24.5 | 28 | s |
| No. 212 | | | | | | | | |
| | 45 | 56 | 45 | 51[x] | 34 | 24 | 29 | d |

Os phalangis III (ant.)

Measurements: the same as those of the astragulus

| | 1 | 2 | 3 | |
|---|---|---|---|---|
| | 76 | 94 | 44 | s |
| No. 211 | | | | |
| | 78 | 96 | 45 | d |
| | 83 | 91 | 45 | s |
| No. 212 | | | | |
| | 82 | 90 | 46 | d |

Os phalangis III (post.)

Measurements: the same as those of the astragalus

| | | | | |
|---|---|---|---|---|
| No. 212 | 78 | 81 | 42 | d |

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