# EQUUS CAPENSIS (MAMMALIA, PERISSODACTYLA) FROM ELANDSFONTEIN 

by

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#### Abstract

The skull and limb bones collected at Elandsfontein, Cape indicate that E. capensis was different from a Grevy's zebra. The body proportions were similar to those of an extant draft horse (E. caballus) and the skull resembled those of true Cape quaggas and a fossil Algerian plains zebra, E. mauritanicus.


KEYWORDS: Pleistocene, Elandsfontein, Equus capensis, zebras.

## INTRODUCTION

Because Equus capensis is a large equid and because the Grevy's zebra is the largest of extant wild equids, it has sometimes been considered that they were conspecific (Churcher \& Richardson 1978; Churcher 1986, 1993). This preliminary paper intends to point out some of the general features of $E$. capensis which, as noted by Broom (1913) "was more powerfully built but did not stand so high" as "a modern horse 15 hands in high".

## Skull

There is a well preserved skull of E. capensis from Elandsfontein (Hendey \& Deacon 1977) in the South

African Museum Cape Town (E21025). It is very large, but quite unlike a Grevy's zebra skull. Grevy's zebras have very long distances between the posterior border of the palate and the posterior border of the vomer, and their muzzles are narrow (Eisenmann 1980 Plate 1). In the skull of E. capensis mentioned above, the muzzle is much wider and the distance between palate and vomer (vomerine length) is relatively short. A scatter diagram of these dimensions in Grevy's zebras, plains zebras, and true Cape quaggas (Figure 1) shows that the E.capensis skull has proportions similar to true Cape quaggas although it is larger. On the same diagram, E. mauritanicus from Tighenif (Ternifine), Algeria, plots between true quaggas and $E$. capensis.


Figure 1. Scatter diagram in millimeters of muzzle breadths versus vomerine lengths in skulls of fossil and extant species of Equus.

The middle Pleistocene (Geraads et al. 1986) E. mauritanicus is probably a close relative to quaggas and plains zebras (Eisenmann 1979). Not shown on the diagram, horses plot near true quaggas while mountain zebras plot near plains zebras.

## General body build

In cursorial animals, the proximal limb bones (humerus, femur, radius, tibia) tend to be relatively short while more distal limb bones, in particular metapodials, tend to be long (Gregory 1912; Osborn 1929).

Simpson's (1941) ratio diagrams of limb bone dimensions make comparisons of sizes and proportions very easy (Table 1). In Figure 2 the onager (Equus hemionus onager) - a very cursorial equid - is taken as the reference (horizontal line). Both mountain zebras and plains zebras have longer humeri and femora, but shorter third metacarpals and metatarsals since their body build is less cursorial. The mountain zebras, as usual in climbing animals, have narrower hooves than plains zebras, and even shorter third metapodials relative to the lengths of the tibia and radius. Moreover, mountain zebras and plains zebras have relatively long


Figure 2. Ratio diagram of limb bone proportions in fossil and extant species of Equus, relative to the onager (Equus hemionus).Lengths of humerus (H), femur (F), radius (R), tibia (T), third metacarpal (Mc), third metatarsal (Mt), first anterior phalanx (IA), first posterior phalanx (IP), and breadth of third anterior phalanx (III). For E. capensis, the continuous line corresponds to average values while the isolated spots correspond to associated bones of a front limb ( E 16659).
femora and tibiae. Grevy's zebras appear less cursorial than the onagers but more so than mountain and plains zebras.
An associated front limb of E. capensis was found at Elandsfontein (South African Museum, E16659). It
has a very long radius relative to the third metacarpal (Table 1). These proportions are unlike those of Grevy's zebras (Figure 2), and quite uncommon in extant equids. Unfortunately, there are not many entire proximal limb bones at Elandsfontein, but the

TABLE 1.
Limb bone dimensions in millimeters (all are maximal lengths except for the third anterior phalanx where the dimension is the maximal width). MC III = third metacarpal; MT III = third metatarsal; Ph I = first phalanx; Ph III = third phalanx; A = anterior; $\mathrm{P}=$ posterior. The numbers of specimens on which the means were calculated are in brackets. In the last column are the values concerning associated bones of a front limb (E 16659).

|  | E. hemionus onager | Grevy's zebra | Plains zebra | Hartmann's zebra | Draft horse | Elandsfontein mean | $\begin{array}{\|c} \text { Elandsfontein } \\ 16659 \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Humerus | 241,3 (10) | 282 (19) | 247 (25) | 270 (12) | 356 (2) | 325 (1) |  |
| Femur | 329,7 (10) | 385.5 (19) | 349.2 (25) | 378.4 (12) | 467.5 (2) | 413 (2) |  |
| Radius | 293,5 (10) | 329 (20) | 280 (25) | 312 (12) | 387.5 (2) | 336 (3) | 360 |
| Tibia | 313 (10) | $342.9 \quad$ (20) | 305.3 (25) | 338.9 (12) | 425 (2) | 363.31 (10) |  |
| MC III | 214,1 (10) | 232 (21) | 201.7 (25) | 209 (14) | 263 (2) | 216.3 (47) | 219 |
| Mt III | 250,8 (10) | 266.5 (21) | 226.4 (25) | 235.1 (15) | 308 (2) | 253.9 (64) |  |
| Ph I A | 76,3 (10) | 86.4 (21) | 75.3 (21) | 80.6 (13) | 101.5 (2) | 83.6 (49) | 88 |
| Ph I P | 71,2 (10) | 81.5 (20) | 71.3 (21) | 75.6 (14) | $99 \quad$ (2) | 80.9 (58) |  |
| Ph III A | $54 \quad$ (8) | 65.3 (18) | 55.6 (13) | 51.6 (13) | $95 \quad$ (2) | 76.7 (19) | 79 |

TABLE 2.
Estimations of the height at the withers in centimeters in heavy horses and E. capensis and in the much more cursorial Grevy's zebra. Withers heights are obtained by multiplying the length of a limb bone (Table 1) by the corresponding 'index'. Indices differ in heavy and cursorial forms.

|  | Indices | Withers height | Withers height | Withers height |
| :--- | :---: | :---: | :---: | :---: |
|  | Draft horses | Elands. mean | Elands. 16659 | Grevy's zebras |
| Humerus | 4.80 | 156.0 |  | 135.4 |
| Femur | 3.60 | 148.7 |  | 138.8 |
| Radius | 4.30 | 144.5 | 154.8 | 141.5 |
| Tibia | 4.00 | 145.3 |  | 137.2 |
| MC III | 7.00 | 151.4 | 153.3 | 162.4 |
| MT III | 6.00 | 152,3 |  | 159.9 |
| Ph I A | 17.50 | 146,3 | 154.0 | 151.2 |
| Ph I P | 18.00 | 145,6 |  | 146.7 |
|  | Grevy's zebras | Elands. mean | Elands. 16659 | Grevy's zebras |
| Humerus | 5.14 | 167.1 |  | 145.0 |
| Femur | 3.76 | 155.3 |  | 145.0 |
| Radius | 4.41 | 148.2 | 158.8 | 145.0 |
| Tibia | 4.23 | 153.7 |  | 145.0 |
| MC III | 6.25 | 135.2 | 136.9 | 145.0 |
| MT III | 5.43 | 137.9 |  | 145.0 |
| Ph I A | 16.86 | 140.9 | 148,4 | 145.0 |
| Ph I P | 17.68 | 143.0 |  | 145.0 |

available data (Table 1) indicate that E.capensis was rather like a draft horse in its general build, although smaller (Figure 2).

## Estimation of the height at the withers

The height at the withers of a horse used to be expressed in "hands" (one hand $=4$ inches) or in "inches" (one inch $=25,4$ millimeters). Thus, a horse " 15 hands high" measures $152,4 \mathrm{~cm}$ at the withers. The height at the withers can be estimated by multiplying the length of a limb bone by an adequate number. The best known numbers for horses (average and range of variation) are those proposed by Kiesewalter in 1889 ('Kiesewalter's indices' of Gromova, 1949, p.14). However, as already pointed by Gromova and by Mourer-Chauviré (1980), the estimations based on the average indices are often not concordant, while the use of the range of variation makes them so approximate that they become useless. It is indeed natural that numbers adequate for a cursorial form will not give a correct estimation for a draft horse. Using my own data on limb bone lengths of heavy horses, and previously published average heights, I have calculated 'indices' (Table 2) that may reasonably be applied to E. capensis. At least, they give relatively concordant indications, whatever the bone used. The estimated heights range between 144 and 156 cm , confirming Broom's (1913) opinion: on average, E. capensis'did not stand so high as a modern horse 15 hands high'. The same table shows the indices calculated for Grevy's zebra, assuming an average withers height of 145 cm (Kingdon 1979).

If applied to the associated front limb of E.capensis, the Grevy's indices would provide estimations of

137 cm (using the third metacarpal) to 159 cm (using the radius) Conversely, if $E$. capensis indices were applied to the average Grevey's zebra, the estimations would range from 135 to 162 cm (Table 2). These discordances are another expression of the fact that $E$. capensis was not a kind of Grevy's zebra.

## Estimation of weight

Several ways have been proposed to estimate the body weight of an equid (Alberdi et al. 1995). For instance, the occlusal surface of an upper cheek tooth can be taken as a base (Figure 3). Unfortunately, some equids ( $E$. caballus in particular) have relatively larger teeth than others. Thus, the occlusal surface of an upper first molar (M1) measures about 500 square millimeters in a horse which weighed about 150 kilos, but about the same surface is the minimum for Grevy's zebras whose minimal weight is about 350 kilos (Kingdon 1979). Obviously, the relationship between tooth surface and body weight is not the same in all equids. It is possible, however, to determine a relationship using regression analyses (Eisenmann \& Sondaar 1998): Ln of the weight $=-6.388+1.873$ (Ln surface M1). For E. capensis of Elandsfontein, the average upper molar occlusal surface area of M1 is 796 square millimeters ( $\mathrm{n}=50$ ) and the average weight can be estimated at 450 kg .

A better way is to use the product of a limb bone depth (antero-posterior diameter) by its width (transverse diameter). For instance, using the distal end of the third metacarpal, Ln of the weight $=-4.525+$ 1.434 ( Ln of the product of articular width by minimal depth of the medial condyle). In E. capensis of Elandsfontein, the average distal depth for 47 third metacarpals is 30.2 (maximum 32 mm ); the average


Figure 3. Scatter diagram of weights versus occlusal surfaces of upper M1 of extant Equus. The weight of E. capensis was calculated according to the regression: Ln of the weight $=-6.388+1.873$ (Ln product occlusal length by occlusal width of M1).


Figure 4. Scatter diagram of weights versus sections of third metacarpals of extant Equus. The average and maximal weights of $E$. capensis were calculated according to the regression: Ln of the weight $=-4.525+1.434$ ( Ln product of articular width by minimal depth of the medial condyle).
distal width is 51.4 (maximum 57 mm ); the product of average distal depth by distal width is 1552.3 (maximum 1824). These parameters indicate (Figure 4) an average weight of about 400 kg , and a maximum weight of about 500 kg .

## CONCLUSIONS

On the basis of fossils of $E$. capensis collected at Elandsfontein, one can conclude that this species resembled, in its general body build, a heavy horse ( $E$. caballus) more than any other extant equid. By comparison with extant heavy horses, the height at the withers of $E$. capensis can be estimated at about 150 cm , which is in accordance with Broom's estimation. Judging by the width and depth of its third metacarpals, the average weight would have been about 400 kg . Skull proportions resemble true Cape quaggas more than any other extant species, and also E. mauritanicus, a probable relative of plains zebras, represented in the Middle Pleistocene of Tighenif, Algeria.

## ACKNOWLEDGEMENTS

My first thanks are for all the curators who gave me access to their collections and helped me in many ways, in particular in South Africa, at Florisbad (Bloemfontein National Museum) from where comes the sample of skulls of plains zebras, and at Cape Town (South African Museum) where is preserved the material of Elandsfontein, but also in Ethiopia, at Addis Abeba (Natural History Museum); France (Laboratoires d'Anatomie Comparee et de Mammalogie du MNHN); Germany, at Berlin (Zoologisches Museum der Humboldt Universitat), Frankfurt (Naturmuseum Senckenberg), Halle (Museum für Haustierkunde), Hamburg (Zoologisches Museum), Kiel (Institut für Haustierkunde), Münich (Zoologisches Sammlung), Stuttgart (Staatliches Museum für Naturkunde); Great Britain, at London (British Museum and University College); Italy, at Torino (Istituto di Anatomia Comparata); Netherlands, at Amsterdam (Zöologisch Museum) and Leiden (Rijksmuseum van Natuurlijke Historie); Kenya, at Nairobi (National Museums); Russia, at Sankt Petersburg (Zoological Institute); Switzerland, at Basel and Bern (Naturhistorisches Museums), and Zurich (Zoologisches Museum); the United States, at New Haven (Yale Peabody Museum), New York (American Museum of Natural History) and Philadelphia (Laboratories of Anatomy). Particular thanks to James Brink who introduced me to $E$. capensis and helped in every possible way. The artistic touch in the diagrams is due to the skill of Henri Lavina.

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