

Proposed methods of measurements of carpal and tarsal bones in the genus *Equus*

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ABSTRACT – *Carpal and tarsal bones of equids are known in some fossiliferous sites and especially in prehistoric localities. The reference papers used by vertebrate paleontologists and archeozoologists among which the paper published after the "New York International Hipparion Conference, 1981", are incomplete, because with the exception of the calcaneum and astragalus, the measurements of carpals and other tarsals have been disregarded. For these reasons, the aim of the present paper is to standardize the measurements of the carpal and tarsal bones in the genus Equus.*

RIASSUNTO – [Metodi proposti per le misure delle ossa carpali e tarsali nel genere *Equus*] – *Le ossa carpali e tarsali degli equidi sono conosciute nei siti fossiliferi e specialmente nelle località preistoriche. I lavori di riferimento usati dai paleontologi dei vertebrati e dagli archeozoologi fra i quali il lavoro pubblicato dopo la "New York International Hipparion Conference, 1981", sono incompleti poiché, se si escludono il calcagno e l'astragalo, le misure delle ossa carpali e del resto delle tarsali sono trascurate. Per queste ragioni, l'intento del presente lavoro è quello di standardizzare le misure delle ossa carpali e tarsali nel genere Equus.*

INTRODUCTION

Researchers need to standardize the methods of anatomical measurement to make comparisons precise and coherent. The biometrical literature in this field is relatively rich. Vertebrate paleontologists and archeozoologists who work on animal bones use a number of reference papers such as Schmid (1972), von den Driesch (1976), Desse *et al.* (1986), etc. Despite this, a common practice is to use newly introduced measurements, which sometimes create a considerable confusion, often preventing comparisons.

In 1981 the "New York International Hipparion Conference" stirred up a considerable debate among specialists of equids. This debate produced an important reference manual (Eisenmann *et al.*, 1988). However, in spite of the detail and the high number of measurements proposed for the single bone elements, the paper is incomplete, because with the exception of the calcaneum and astragalus, the carpal bones and the other tarsal bones have been disregarded. The small size and the sturdiness of the latter generally prevent them from breakage and they are thus often found complete. They are also often spared by human dismembering and butchering activities, since they are usually complete in archaeological sites. In general terms, carpal and tarsal bones are between the most common skeletal elements among the few complete bones found in archaeological sites, leaving aside isolated teeth and sesamoid bones.

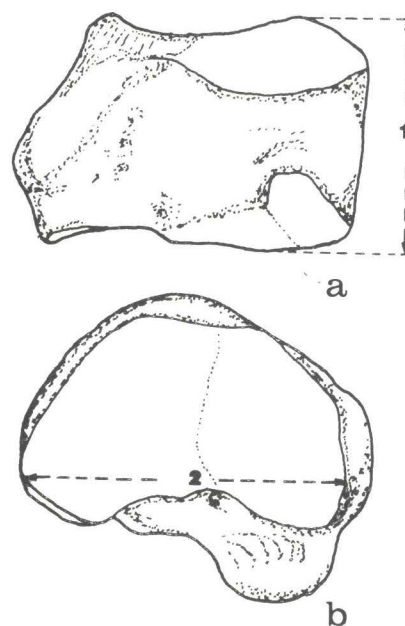
On the basis of these brief considerations, a scheme of measurements is proposed here for the carpal and tarsal bones of the genus *Equus*. A noteworthy property of carpal and tarsal bones is that they

may provide information on the character of the proximal articulations of the metapodial bones.

MEASUREMENTS PROPOSED

PROXIMAL ROW OF THE CARPUS

Radial carpal bone (Scaphoid):

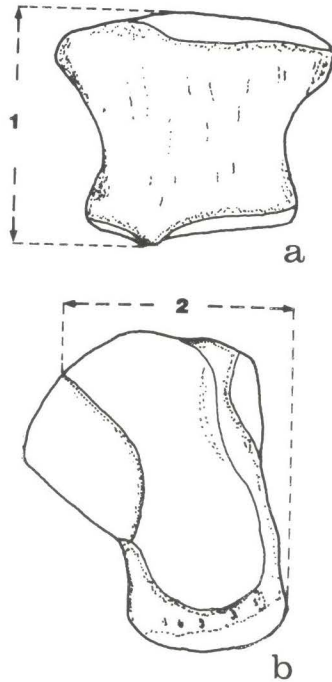


Text-fig. 1 - Right scaphoid: a) medial view, b) distal view.

$1 = H$, greatest height.

$2 = DDa$, greatest depth of the distal articular face (measure taken from the dorsal point of the edge between the articular surface for the third carpal bone to the articular surface for the intermediate carpal bone).

Intermediate carpal bone (Semilunar):

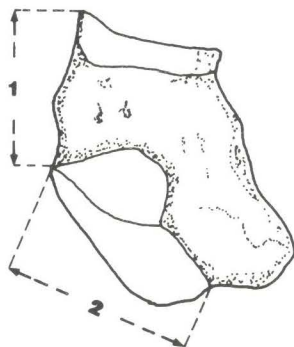


Text-fig. 2 - Right semilunar: a) dorsal view; b) distal view.

$1 = Hd$, height of the dorsal side (measure taken from the origin of the ridge between the articular surface for the third carpal bone to the articular surface for the fourth carpal bone).

$2 = DDa$, greatest depth of the distal face (measure taken from the origin of the ridge between the articular surface for the third carpal bone to the articular surface for the fourth carpal bone).

Ulnar carpal bone (Pyramidal):



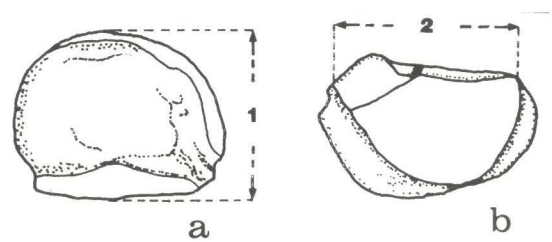
Text-fig. 3 - Right pyramidal: medial view.

$1 = Hd$, height of the dorsal side (measure taken from the dorsal origin of the edge between the articular surface for the fourth carpal bone and the articular surface of the intermediate carpal bone to the dorsal origin of the edge between the articular surface for the intermediate carpal bone and the articular surface with the radius).

$2 = DDa$, greatest depth of the distal articular face (measurements taken from the edge between the articular surface for the third carpal bone to the articular surface for the intermediate carpal bone).

DISTAL ROW OF THE CARPUS

Second carpal bone (Trapezoid):

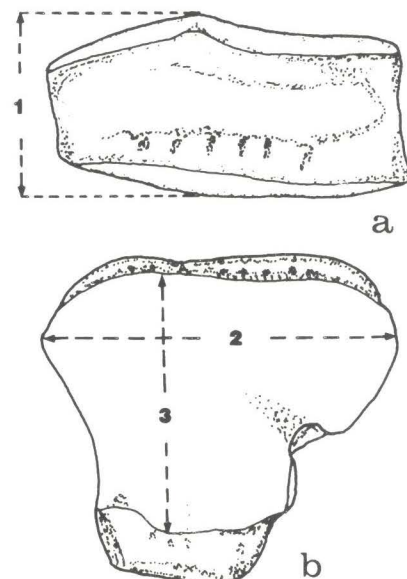


Text-fig. 4 - Right trapezoid: a) medial view; b) distal view.

$1 = H$, greatest height.

$2 = DDa$ depth of the distal articular surface (measure taken from the dihedral corner between the articular surface for the third carpal bone and the articular surface for the second metacarpal),

Third carpal bone (Magnum):



Text-fig. 5 - Right magnum: a) dorsal view; b) distal view.

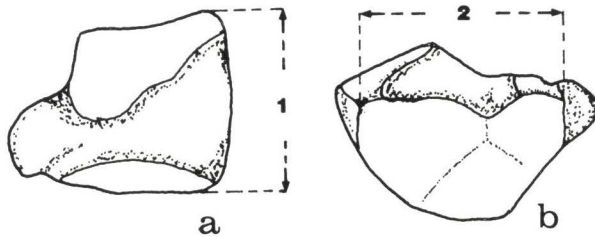
$1 = Hd$, height of the dorsal side (measure taken from the ridge between the articular surface for the

radial carpal bone and the articular surface for the intermediate carpal bone).

2 = BDa greatest breadth of the distal articular surface (corresponds to the seventh measure of the third metacarpal after Eisenmann *et al.*, 1988).

3 = DDa depth of the distal articular surface (corresponds to the sixth measure of the third metacarpal after Eisenmann *et al.*, 1988).

Fourth carpal bone (Uncinate):



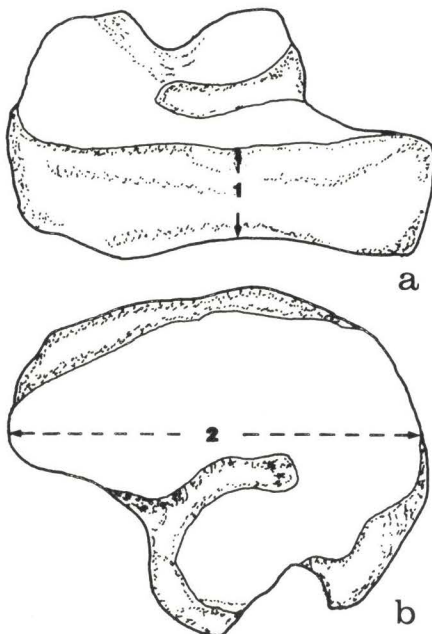
Text-fig. 6 - Right uncinate: a) lateral view; b) distal view.

1 = H , greatest height.

2 = DDa , greatest depth of the articular distal face (measurements taken from the dorsal origin of the edge between the articular surfaces for the third carpal bone and the third metacarpal to the ventral origin of the edge between the articular surfaces for the third metacarpal and the fourth metacarpal).

MEDIAL ROW OF THE TARSUS

Central tarsal bone (Navicular):



Text-fig. 7 - Left navicular: a) dorsal view; b) proximal view; c) distal view.

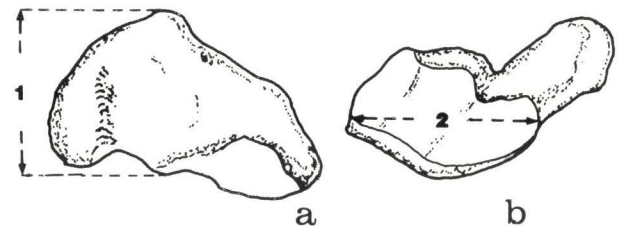
1 = Hsd , smallest dorsal height.

2 = BPa , greatest breadth of the proximal articular surface (corresponds to the fifth measure suggested by Eisenmann *et al.* (1988) for the astragalus).

3 = BDa , greatest breadth of the distal articular surface (corresponds to the second measure of the third tarsal bone).

DISTAL ROW OF THE TARSUS

First and second tarsal bones (fused) (First-Second Cuneiform):

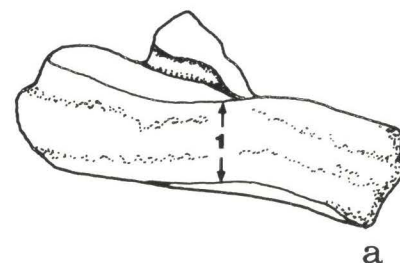


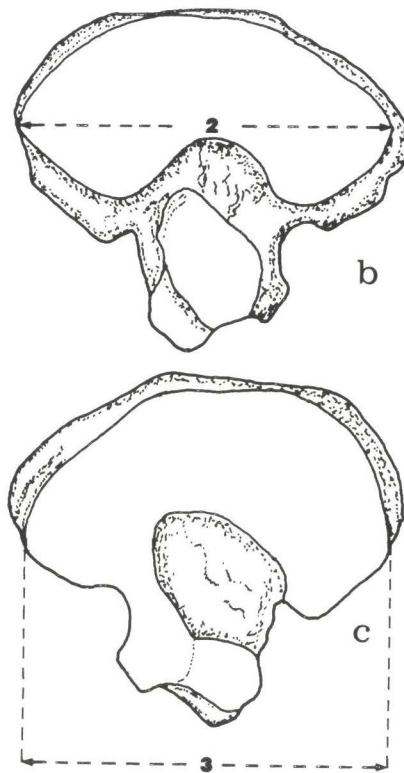
Text-fig. 8 - Left first-second cuneiform: a) ventral view; b) distal view.

1 = H , greatest height.

2 = DDa , greatest depth of the distal articular surface (measure taken from the dihedral edge formed by the articular surface for the third tarsal bone and by the articular surface with the third metatarsal to the posterior end of the facet for the second metatarsal).

Third tarsal bone (Third Cuneiform):





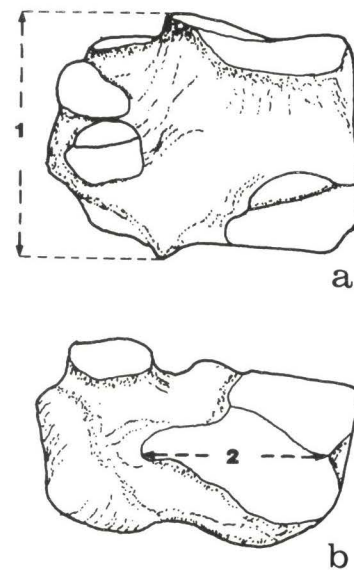
Text-fig. 9 - Left third cuneiform: a) dorsal view; b) proximal view; c) distal view.

1 = *Hsd*, smallest dorsal height.

2 = *BPa*, greatest breadth of the proximal articular surface (corresponds to the third measure of the central tarsal bone).

3 = *BDa*, greatest breadth of the distal articular surface (measure taken from the dorsal origin of the dihedral edges formed by the articular surfaces with the fourth tarsal bone on the one hand, and by the first and second tarsal bone (fused) on the other hand. This measure corresponds to the seventh for the third metatarsal proposed by Eisenmann *et al.*, 1988).

Fourth tarsal bone (Cuboid):



Text-fig. 10 - Left cuboid: a) medial view; b) distal view.

	Grotta delle Mura		Grotta Paglicci	
	<i>Equus caballus</i>	<i>Equus hydruntinus</i>	<i>Equus caballus</i>	<i>Equus hydruntinus</i>
Total postcranial elements	43	58	168	114
Complete bones and epiphyses				
Scapula (articular fragments)	—	—	1	—
Radius (distal epiphyses)	—	—	—	1
Tibia (proximal and distal epiphyses)	1	1	—	3
Rotula	—	—	1	—
Metapodial bones (proximal and distal epiphyses)	5	9	8	6
Carpal and tarsal bones	8	14	21	4
First phalanx	1	—	1	—
Second phalanx	—	1	1	1
Third phalanx	—	—	5	2
Sesamoid bones	3	7	18	16

Tab. 1 - Only complete bones and epiphyses from some levels of Grotta delle Mura (Monopoli, Bari, Apulia) and Grotta Paglicci (Rignano Garganico, Foggia, Apulia) are reported. Carpal and tarsal bones are the most represented bones in the caves.

$1 = H$, greatest height between proximal and distal articular surfaces.

$2 = DDa$, depth of the distal articular surface (measure taken from the dihedral edge formed by the articular surface for the third metatarsal and the articular surface for the fourth metatarsal to the end of the facet for the third metatarsal).

OBSERVATIONS

As an example of the frequency of carpal and tarsal bones of equids in prehistoric deposits, the data of the strata 2 and 3 of the "Grotta delle Mura" (Monopoli, Bari, Apulia) (Bon & Boscato, 1993) with Mesolithic human remains and the data of the strata 22, 23 and 24 of "Grotta Paglicci" (Rignano Garganico, Foggia, Apulia) (Boscato, 1994) referred to ancient Gravettian and Aurignacian cultural facies are reported.

Only complete bones and epiphyses are considered (Tab. 1). Table 1 shows that carpal and tarsal bones of *E. caballus* and *E. hydruntinus* are the most abundant in the caves mentioned above. However, the basipodials of *E. hydruntinus* from "Grotta Paglicci" are less frequent than the sesamoid bones and the proximal and distal metapodial fragments.

In prehistoric sites the measurable postcranial elements are often very few. Therefore, the available biometric data are meaningfully enriched by the morphometry of carpal and tarsal bones. Some of these bones, because of the direct relation that they have with the proximal articular surfaces, provide precious information on the main character of the metapodial bones.

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