

NEW REMAINS OF THE RHINOCEROTID HISPANOTHERIUM MATRITENSE AT LA RETAMA SITE : TAGUS BASIN, CUENCA, SPAIN

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ABSTRACT

The rhinocerotid remains from the Middle Miocene site of La Retama (Cuenca, Spain) are described. They have been identified as *Hispanotherium matritense* and compared with other known material of this species. Among the studied bones the humerus and femur can be detached since, up to now, they are the first well preserved ones of *H. matritense*. That increases the knowledge of the limb proportions of that species which correspond to a running- mediportal locomotor type, with long first and second segments. The presence of *H. matritense* in the faunal assemblage of La Retama implies a Middle Aragonian age and supports, together with other faunal elements, the younger age of La Retama with regard to the geographically near site of Loranca.

DÉCOUVERTE DU RHINOCÉROTIDÉ HISPANOTHERIUM MATRITENSE À LA RETAMA : BASSIN DU TAGE, CUENCA, ESPAGNE.

RÉSUMÉ

Le gisement du Miocène moyen de La Retama (Cuenca, Espagne) a livré d'intéressants restes de rhinocéros qui font l'objet de ce travail. Ils sont identifiés comme *Hispanotherium matritense* et comparés avec d'autres matériels connus de cette espèce. Parmi l'ensemble étudié, nous pouvons détacher les os longs, car ils sont les premiers exemplaires bien conservés d'*H. matritense*. Cela accroît notre connaissance des proportions des membres de l'espèce, qui correspondent au type locomoteur coureur-médiportal, avec un premier et deuxième segments longs. Du point de vue biostratigraphique, la présence d'*H. matritense* à La Retama indique un âge Aragonien moyen et conforte, associée à d'autres éléments fauniques, l'âge plus récent du gisement de La Retama par rapport à celui tout proche de Loranca.

KEY-WORDS : HISPANOTHERIUM MATRITENSE, RHINOCEROTIDAE, MIDDLE MIOCENE, SPAIN.

MOTS-CLÉS : HISPANOTHERIUM MATRITENSE, RHINOCEROTIDAE, MIOCÈNE MOYEN, ESPAGNE.

INTRODUCTION

La Retama site is placed in the "Depresión Intermedia", in the Cuenca province, in the rich fossiliferous area of Loranca del Campo (Daams *et al.* 1986 ; Morales 1989 ; Alcalá *et al.* 1990). The finding of the macromammal level so-called La Retama took place during the field season of 1988 in Loranca. Since then three systematic excavations have been carried out and yielded a great number of micro and macromammal fossils, as well as

some material of turtles and crocodiles (Morales 1989). Only the rhinocerotid remains have been studied in this paper. They are not very much abundant but they are interesting since they correspond to a species, *Hispanotherium matritense*, almost exclusive of the Iberian Peninsula and not well known yet. It was defined by Prado (1864) as *Rhinoceros matritensis* upon a few teeth from Puente de Toledo (Madrid). Many years later Crusafont & Villalta (1947) described the genus *Hispanotherium* based on that species which has been

after found in other Spanish and Portuguese localities (Hernández Pacheco & Crusafont 1960 ; Antunes 1979 ; Alférez *et al.* 1982 ; Cerdeño & Alberdi 1983 ; Antunes & Ginsburg 1983 ; Astibia 1985 ; Cerdeño 1989). Recently *Hispanotherium matritense* has been also recorded in France (Ginsburg *et al.* 1987).

SYSTEMATIC PALEONTOLOGY

Order PERISSODACTYLA Owen, 1845
Family RHINOCEROTIDAE Owen, 1845
Subfamily RHINOCEROTINAE Owen, 1845
Tribe ELASMOTHERINI Gill, 1872

Genus *Hispanotherium* Crusafont & Villalta, 1947

HISPANOTHERIUM MATRITENSE (PRADO, 1864)

Material - RET 1, left juvenile mandible with I₂ erupting, P₁-D₂-D₃-D₄-M₁ and M₂ erupting. RET 1 392 + 394, right mandibular fragments of the same individual than RET 1, with M₁ and fragments of P₂ and M₂ inside the ramus. RET 242, left mandibular fragment with P₄-M₃. RET 99, right mandibular fragment of the same individual with P₃-M₁. RET 243, right mandibular fragment with P₄-M₃. RET 6, left mandibular fragment with P₂-M₂. RET 218, right P¹. RET 474, ectoloph of a left M¹. RET 473, right M¹. RET 92, fragment of right M². RET 351, I₁. RET 48, left P₂. RET 54, fragment of lower molar. RET 705, right humerus. RET 310, left radius. RET-S, proximal fragment of left radius. RET 700 + 704, left femur without the distal epiphysis. RET 713, left scaphoid. RET 107, left semilunar. RET 702 and RET 703, left pyramidal. RET 402, right trapezoid. RET 701, right astragalus. RET-S, proximal fragment of left calcaneum. RET 507, left mesocuneiform. RET 188, right ectocuneiform. RET 393, distal fragment of MtIII. RET 105, right McIV. RET 21 and RET 120, first anterior central phalanges. RET 11, RET 19, RET 121 and RET 497, first posterior central phalanges. RET 189, second central phalange. RET 116, RET 153 and RET 492, first lateral phalanges. RET 17 and RET 517, second lateral phalanges.

These forty elements correspond to a minimum number of three individuals, of which one juvenile and two adults.

The measurements of teeth and bones are expressed in millimetres. The abbreviations used in tables are as follows : APD, anteroposterior diameter ; art., articulation ; d./dis., distal ; DL, transversal diameter between the crests of the astragalus trochlea ; ep., epiphysis ; H, height ; i., internal ; L, length ; max., maximal ; prox., proximal ; TD, transversal diameter ; W, width.

Description

Mandible - The juvenile fragment RET 1 (pl. 1, fig. 3) presents a low horizontal ramus with longitudinally

mandible	TD	H
RET 1		
level P1-D2	26.5	48.7
level D2-D3	28.6	55.0
level D3-D4	33.4	60.0
level D4-M1	36.3	63.7
level M1-M2	38.8	61.0
RET 392		
level D2-D3	28.7	(64.0)
level D3-D4	32.1	(62.5)
level D4-M1	35.4	(63.2)
RET 342		
level P3-P4	33.4	57.7
level P4-M1	38.7	61.7
level M1-M2	43.0	69.5
level M2-M3	45.2	71.3
behind M3	45.0	80.0
RET 243		
level P3-P4	32.8	54.7
level P4-M1	36.8	62.8
level M1-M2	40.7	67.4

Table 1 - Mandibular dimensions of *H. matritense* from La Retama. *Dimensions mandibulaires.*

	P1	M1	M1	M2
L	17.1	52.0	54.4	50.5
W	16.4	-	52.2	-

Table 2 - Dimensions of the upper teeth of *H. matritense* from La Retama. *Dimensions de la denture supérieure.*

convex ventral border. The ascending ramus is low ; the masseter fossa projects backwards, the condyle is broad and the coronoid apophysis is not complete.

The adult mandibular fragments (pl. 1, figs. 1-2) show the lower border less convex than the juvenile specimen and there is a labial point of inflexion just before the base of the ascending ramus, which lacks. The height of the horizontal ramus has been measured at the lingual side (Table 1).

Dentition - The upper rhinocerotid dentition (Table 2) from La Retama is represented by a P¹, an ectoloph of M¹, a complete M¹ (pl. 1, fig. 8), and a large fragment of M². The P¹ has no developed protoloph but the hypcone is stretched forwards. The ectoloph is undulated in all teeth, the molars with a strong paracone rib, smooth mesostyle and metacone rib, and a projecting metastyle. A labial cingulum is present in the M². The enamel is finely striate. A double crochet is present with a long

fold and a shorter second one. Cement fills in the median valley and the postfossette, and covers the ectoloph.

The lower milk dentition (Table 3) does not present particular characters. D₂ and D₃ are incomplete and worn. D₄ is not specially long and only shows the wide metaconid base backwards.

The only I₁ is a very worn piece whose dimensions are as follows :

	TD	APD
crown	12.4	9
root	7.9	10.7

The P₁ in the juvenile mandible is a small, short, biconvex tooth with a very little posterior valley.

The other lower cheek-teeth (Table 3) present a wide metaconid directed backwards ; the labial groove is well marked and the lobes are labially rounded. There is neither labial nor lingual cingula. Cement is present mainly in the valleys and the external groove.

Postcranial skeleton - The humerus (pl. 1, fig. 4) is something distorted, with the trochlea a little removed, and it seems shorter than it really would be. The diaphysis is short and it enlarges rapidly upwards. The deltoid tuberosity lacks. The proximal epiphysis is very large with widely developed trochanters.

The radius (pl. 2, fig. 1) is a slender bone with a great, rugged insertion area for the biceps. The proximal facets form a marked angle. The posterior facets for the ulna are well separated, the lateral one high and concave on the posterior tuberosity. The contact zone between the two bones is very well marked by a rugosity along the lateral margin of the diaphysis. The proximal and distal epiphysis are not large.

The femur (pl. 1, fig. 5) also presents a large and wide epiphysis. The femoral head is large and hardly detached from the diaphysis. The trochanter major is massive and rough ; it has a pronounced posterior fold that encloses a little, deep cavity. The third trochanter is not very developed ; its central point is about 205 mm from the proximal edge of the trochanter major. The height of the third trochanter is about 48.5 mm.

The dimensions of these three bones are detailed in Table 4.

The scaphoid (pl. 1, fig. 9) has a convex and little rugged medial face. The anterior apophysis is short and

RET 1	P1	D2	D3	D4	M1
L	12.5	-	(25)	(31)	37.5
W	7.5	-	16.0	19.0	23.0

	RET 342		RET 243	RET 6	RET 392
P2 L				(17.4)	
W				14.7	
P3 L	-	28.6	-	(23.2)	
W	-	18.2	-	18.3	
P4 L	29.4	25.7	28.9	(28.5)	
W	23.5	24.4	23.0	-	
M1 L	30.8	32.5	31.2	35.1	38.4
W	24.2	24.7	(26.8)	23.3	25.0
M2 L	40.0		41.2	(41.0)	
W	26.8		27.7	(25.7)	
M3 L	42.0		40.4		
W	27.0		25.1		

Table 3 - Dimensions of the lower teeth of *H. matriense* from La Retama. *Dimensions de la denture inférieure.*

Humerus						
L	prox.ep.		diaphysis		APDdis.	delt.
	TD	APD	TD	APD		TDtub.
>297	132	116	52.5	57.0	>96	>86

Radius										
L	prox.ep.		prox.art.		diaphysis		dis.ep.		dis.art.	
	TD	APD	TD	APD	TD	APD	TD	APD	TD	APD
298	81.2	58.7	78.9	46.0	45.0	31.3	(71)	52.4	64.0	(33)
-	(71)	(50.5)	-	-	41.8	28.8	-	-	-	-

Femur						
TD	head		prox.ep.		diaphysis	
	TD	APD	TD	APD	TD3tr.	APD
74.4	70.0	157	96.0	89.3	51.1	47.3

Table 4 - Dimensions of the long bones of *H. matriense* from La Retama. *Dimensions des os longs.*

curved. The posterior border is very convex and distally it does not surpass the distal facet. The proximal articulation has an anterior area quite convex. Laterally there is a large, fusiform, short proximal facet and a lesser distal one. Distally, the magnum-facet is short and wide and the trapezium-facet is very laterally placed.

The semilunar (pl. 1, fig. 7) has a wide posterior apophysis. The anterior face presents an angular distal border and the wide proximal facet has a differentiated lateral edge which would articulate with the ulna. The upper scaphoid-facet is large, the lower one smaller. Laterally, the upper pyramidal-facet is rather small and the lower one is long and little curved. Distally, both articular facets reach the same anterior level and form a marked crest between them.

The **pyramidals** are wide bones (pl. 1, fig. 6) ; the anterior part forms an angular proximal border, wider than the posterior one. The pisiforme-facet is wide. Medially, the proximal semilunar-facet is hardly developed ; the distal one is slightly extended postero-laterally. The distal facet is triangular in shape.

The **trapezoid** (pl. 2, fig. 2) is a long and narrow bone. Table 5 shows the dimensions of these carpal bones.

The fragment of **calcaneum** shows an elevated proximal tuberosity, wide and rugged postero-laterally. There is a well developed tibial facet. Only the next dimensions can be obtained :

tuber.		
TD	APD	TDpost.
40	56.3	30.5

The **astragalus** (pl. 2, fig. 5) has a rather narrow and deep trochlea. The internal crest is very convex and the external one slopes smoothly. The trochlea and the distal articulation are separated by a short, shallow groove. The medial tuberosity is slightly pronounced. The two distal articular surfaces have a great antero-posterior diameter ; there is a marked crest between both facets. The posterior face shows a wide, quite concave facet-1 with a large distal extension. The facet-2 is elliptical, distally pointed, and united to the facet-3.

The **mesocuneiform** (pl. 2, fig. 4) is a small, triangular bone with little lateral and medial facets. This is the first one attributed to *H. matritense*.

The **ectocuneiform** (pl. 2, fig. 3) is slightly longer than wider. The proximal articular facet is markedly L-shaped. Medial and lateral facets are large.

Scaphoid							
TD	APD	H	prox. art.		dis. art.		
			TD	APD	TD	APD	
39	56.6	54.6	38.7	32.4	26.1	50.6	

Semilunar			
TD	APD	H	Hant.
41	57	38.6	41.8

Pyramidal			
TD	APD	H	APDprox.
38.2 (39)	34.6 33	40.6 >36	27.4 24.4

Trapezoid			
TD	APD	H	Hmin.
19.2	39.5	27.1	18.9

Table 5 - Dimensions of the carpal bones of *H. matritense* from La Retama. *Dimensions des os du carpe.*

Table 6 shows the dimensions of these tarsal bones.

The **McIV** (pl. 2, fig. 6) is a quite slender metapodial. The proximal epiphysis is triangular, stretched latero-anteriorly. The proximal articular facet is concave becoming convex at its lateral edge, forming a contact surface for the McV. The medial facets are large and separated each other ; the posterior one is also far from the proximal border. The diaphysis is narrow, markedly curved at its proximal third. Its dimensions are expressed in Table 7.

PLATE 1

Hispanotherium matritense. La Retama, Cuenca, Spain. M.N.C.N.
(Museo Nacional de Ciencias Naturales, Madrid).

Fig. 1 - RET 242, left mandibular fragment with P₄-M₃, occlusal view. *Fragment mandibulaire gauche. Vue occlusale.*

Fig. 2 - Idem, labial view. *Idem, vue labiale.*

Fig. 3 - RET 1, left juvenile mandible with P₁-D₂-D₃-D₄-M₁, I₂ and M₂ erupting, labial view. *Mandibule juvénile gauche. Vue labiale.*

Fig. 4 - RET 705, right humerus, posterior view. *Humérus droit, vue postérieure.*

Fig. 5 - RET 700, left femur fragment, anterior view. *Fragment de fémur gauche, vue antérieure.*

Hispanotherium matritense. La Retama, Cuenca, Spain. M.N.C.N.

Fig. 6 - RET 703, left pyramidal, anterior view. *Pyramidal gauche, vue antérieure.*

Fig. 7 - RET 107, left semilunar, medial view. *Semilunaire gauche, vue médiale.*

Fig. 8 - RET 473, right M¹, occlusal view. *M¹ droite, vue occlusale.*

Fig. 9 - RET 713, left scaphoid, lateral view. *Scaphoïde gauche, vue latérale.*

Fig. 1-5, x 1/3 ; fig. 6-9, x 1.



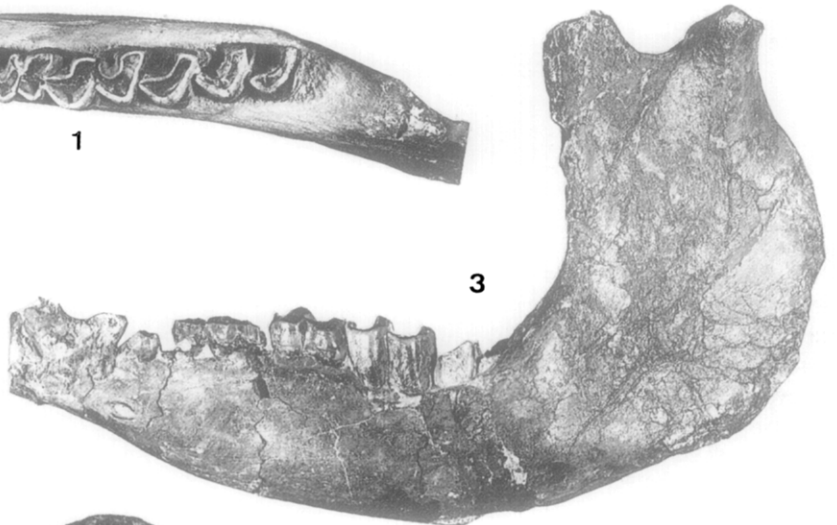
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2



1



3



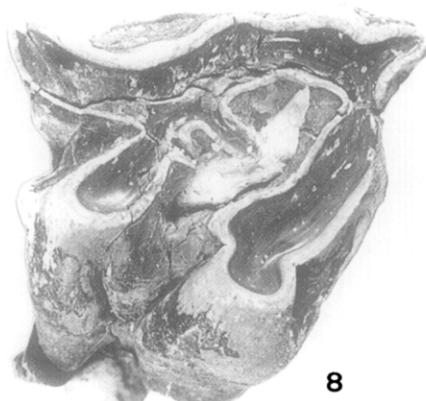
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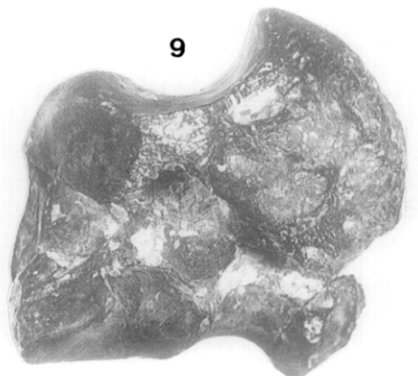
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7



8



9

Astragalus						
TD	H	Tdm.d.	dis.art.		APDi.	DL
			TD	APD		
74.8	69.3	62.3	59.6	42.2	49.4	47.8

Mesocuneiform		
TD	APD	H
18.3	32.1	14.7

Ectocuneiform			
TD	APD	H	Hmin.
41	43.2	23.4	16.5

Table 6 - Dimensions of the tarsal bones of *H. matritense* from La Retama. *Dimensions des os du tarse.*

The distal fragment of **MtIII** is narrow with little developed supraparticular tuberosities. Its diameters are also included in Table 7.

The **first central phalanges** show two different types attending to their proportions (pl. 2, figs. 7-8). RET 21 and RET 120 differ from the others by their greater height, deeper (APD) proximal face and the existence of a median posterior groove on the proximal facet ; the medial and lateral sides are less enlarged ; and finally the distal articulation is more concave. These differences are interpreted as corresponding to anterior (RET 21, RET 120) and posterior phalanges. Out of the posterior ones, RET 19 is something shorter (Table 8).

The **second central phalange** is wide and short (Table 8), with transversely convex proximal facet. This articulation seems to fit better with the central phalanges RET 21 and RET 120.

The **first lateral phalanges**, of which only one is complete, present the proximal facet with a flattened lateral part (Table 8).

The **second lateral phalanges** are small bones with the lateral part of the proximal facet thicker (APD) than the medial one (Table 8).

Mc IV									
L	prox.ep.		prox.art.		diaphysis		Tdm.d.	dis.art.	
	TD	APD	TD	APD	TD	APD		TD	APD
131.3	36.7	36.2	33.4	33.2	26.3	19.4	34.6	32.6	30.8
Mt III									
-	-	-	-	-	-	-	41.9	39.2	33.0

Table 7 - Dimensions of the metapodials of *H. matritense* from La Retama. *Dimensions du McIV et du MtIII.*

1st central phalange	TD	APD	H
RET 21	39.2	28.7	34.1
RET 120	40	27	31.9
RET 11	42.8	29.1	32.2
RET 19	40	20	21.4
RET 121	42.5	29.5	30.7
RET 497	45	29	30.4
2nd central phalange			
RET 189	41.8	25.4	27
1st lateral phalange			
RET 116	29.9	25.6	25
RET 153	-	26.6	27.4
RET 492	31.1	26.1	-
2nd lateral phalange			
RET 17	27.8	20	21.4
RET 517	23.6	18.4	19.9

Table 8 - Dimensions of the phalanges of *H. matritense* from La Retama. *Dimensions des phalanges.*

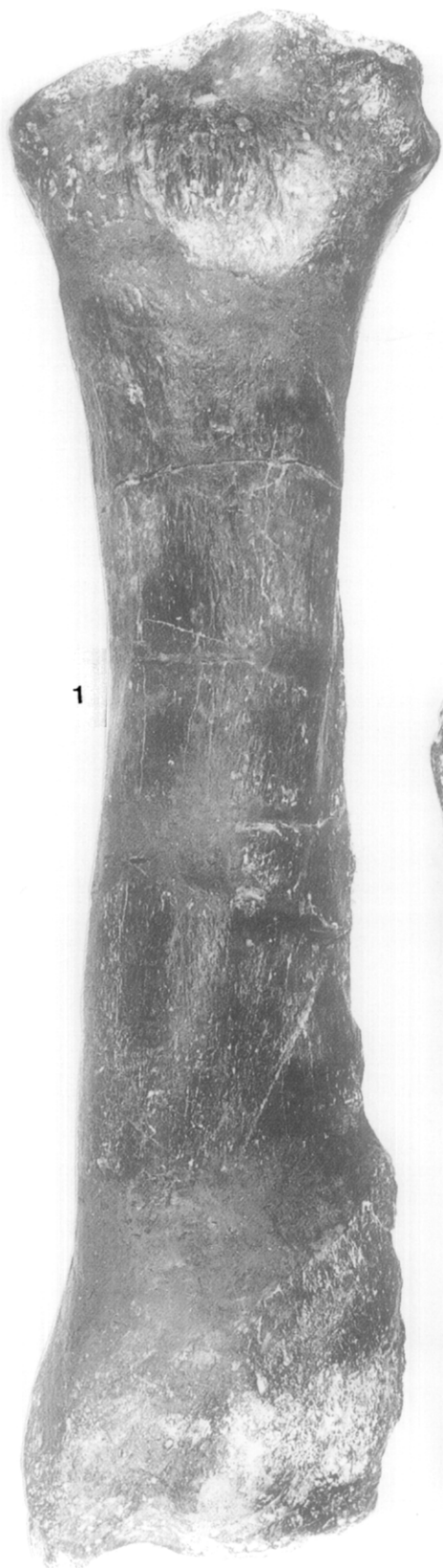
DISCUSSION

The features observed on the dentary remains here described, that is the ondulated ectoloph of the upper molar, the large metaconid of the lower cheek-teeth and the presence of much cement, are characteristics of *Hispanotherium matritense*.

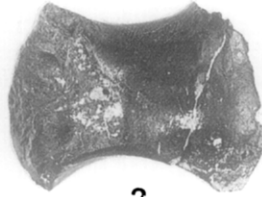
PLATE 2

Hispanotherium matritense. La Retama, Cuenca, Spain. M.N.C.N.

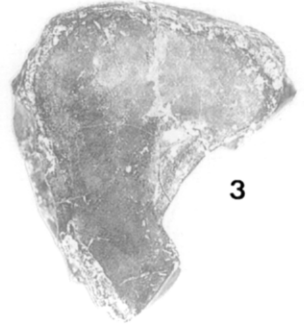
- Fig. 1 - RET 310, left radius, anterior view. *Radius gauche, vue antérieure.*
 Fig. 2 - RET 402, right trapezoid, medial view. *Trapézoïde droit, vue médiale.*
 Fig. 3 - RET 188, right ectocuneiform, proximal view. *Ectocunéiforme droit, vue proximale.*
 Fig. 4 - RET 507, left mesocuneiform, proximal view. *Mésocunéiforme gauche, vue proximale.*
 Fig. 5 - RET 701, right astragalus, anterior view. *Astragale droit, vue antérieure.*
 Fig. 6 - RET 105, right McIV, medial view. *McIV droit, vue médiale.*
 Fig. 7 - RET 11, first posterior central phalange, proximal (a) and anterior (b) views. *Première phalange postérieure centrale, vues proximale et antérieure.*
 Fig. 8 - RET 21, first anterior central phalange, proximal (a) and anterior (b) views. *Première phalange antérieure centrale, vues proximale et antérieure.*
 Fig. 1-8, x 1.



1



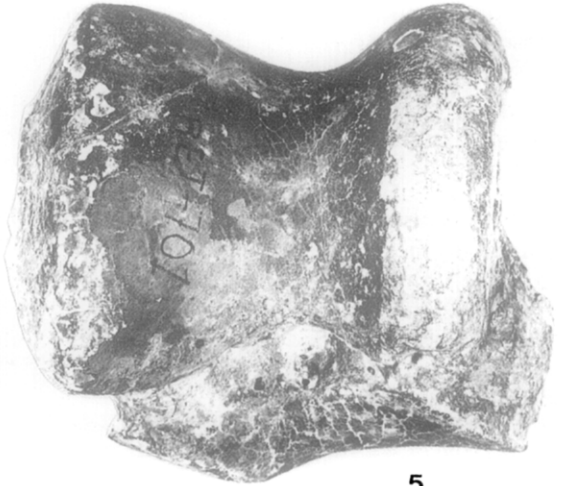
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3



4



5



6



7a



7b



8a



8b

The length of the upper molars is very close to the dimensions obtained from the Spanish remains from Puente de Toledo and Tarazona (Cerdeño 1989, table 41) as well as the Portuguese material from Lisbon and Quintanelas (Antunes & Ginsburg 1983 ; data from the author). Among the lower dentition the P₄ are a little wider than Puente de Toledo, Torrijos and Tarazona specimens. They are closer to that from Quintanelas. Molars are shorter than those from Puente de Toledo and closer again to the Portuguese remains (Cerdeño 1989, table 42).

Attending to the postcranial skeleton the humerus, radius and femur are the first Spanish long bones attributed to *H. matritense*, excepting the radius from Torralba V (Cerdeño 1989 : 239) which is slightly longer but with the same slenderness. In Portugal the humerus is represented by very incomplete remains, there is an almost complete radius and only a femur diaphysis from a young individual (Antunes & Ginsburg 1983).

Using those humerus and radius as well as the whole known central metapodials, the establishment of the foreleg proportions is attempted. Following the diagrams established by Eisenmann & Guérin (1984) it can be said that *H. matritense* corresponds to a running-mediportal locomotor type. The similar lengths of the humerus and radius agree with a running type but the metapodials happen to be shorter with regard to them and this fits better with the mediportal type. Comparing with other rhinoceroses the closer ratio 100 x humerus-L/radius-L is found in the so different species as the smaller, slender, Miocene *Protaceratherium minutum* and the Pleistocene *Stephanorhinus etruscus brachycephalus*, considered as a marked running rhinoceros (Guérin 1980 : 756).

Among the carpal bones, the piramydals from La Retama are little wider than these from Torrijos, Torralba V and Tarazona ; they are closer to the greatest specimen from Torrijos. The thickness (APD) is also greater than in the other Spanish piramydals but smaller than in the Portuguese one (Cerdeño 1989, table 44). The semilunar as well as the trapezoid are slightly longer (APD) and higher (H).

The astragalus is absolutely comparable to the pieces from Torrijos. Its general size is greater (Cerdeño 1989, table 45) but keeping the same ratio TD/H. The calcaneum fragment is also very similar to the previous known exemplaries of the species.

The ectocuneiform is closer to that from Tarazona than those from Torrijos (Cerdeño 1989, table 46).

The McIV is greater than the other Spanish and Portuguese metapodials (Cerdeño 1989, table 47) ; its robustness is also greater than in Torrijos and closer to the Lisbon McIV.

The similarity is also evident for the phalanges from La Retama, Torrijos, Torralba V and Tarazona, showing some greater height several specimens from La Retama. It has been difficult to take the anterior phalanges from the posterior ones from these other Spanish sites but the clear distinction observed in La Retama could help to do it. Santafé (1978 : 146) observed some general differences between anterior and posterior phalanges in rhinocerotids; what refers to the proximal posterior median groove in the posterior phalanges agrees with that exposed before for RET 21 and RET 120 ; however, the author also stated a greater transversal diameter which is not observed here, rather the opposite. On the other hand, these two phalanges present their lateral and median sides quite right, more concave in the other first phalanges, and this agree with what is stated for the anterior phalanges of equids (Prat 1957). This author also points out the lesser proximal thickness (APD) in the anterior ones but the differences observed in La Retama first phalanges are insignificant. Another feature that can be used to assign RET 21 and RET 120 to the anterior limb is the more transversely concave distal facet, according with Santafé (1978). Anyway, I do this assignment with certain reticence taking into account the great variation that rhinoceroses present and the lacking of well stated features for separating anterior and posterior phalanges. What is really clear is the different morphology observed in the sample from La Retama corresponding to fore and hind limbs.

CONCLUSIONS

The rhinocerotid remains from La Retama site (Cuenca, Spain) correspond to the elasmotherine species *Hispanotherium matritense*.

The studied material is widely similar to other known Iberian (Spanish and Portuguese) remains of this species, mainly to those from the Spanish site of Torrijos (Toledo). The general size of the bones from La Retama is slightly greater and the only complete metapodial shows some lesser slenderness than its homologous from Torrijos, being closer to the Lisbon one. The knowledge of the extremities of *H. matritense* has been completed specially from the long bones found at La Retama. The foreleg proportions correspond to a rather running locomotor type, comparable to other rhinocerotid species so different as *Protaceratherium minutum* (Lower Miocene) or *Stephanorhinus etruscus brachycephalus* (Middle Pleistocene).

The presence of *H. matritense* in the faunal assemblage of La Retama has both biostratigraphical and paleo-environmental important consequences. In the first case, *Hispanotherium matritense* is a species only known in the Middle Miocene (Fig. 1). It corresponds to the Middle Aragonian. In Spain it has been mainly reported in

	(1)	(2)	SPAIN	PORTUGAL	FRANCE
Middle	5	E		Quintanelas Lisbon	Hommes
Miocene	4b	D	Retama Torrijos Tarazona Pte. Toledo		
	4a	C B	Córcoles		
Lower Miocene	3b 3a	A Z	Loranca		

Figure 1 - Biostratigraphical distribution of European localities with *Hispanotherium matritense* (excepting Loranca which is included for reference ; see the text). (1) Mein (1975). (2) Daams & Van der Meulen (1984). *Distribution biostratigraphique des localités européennes (sauf Loranca qui est incluse pour référence).*

sites of the MN 4b or D biozone, excepting the Corcoles locality which seems to correspond to the C biozone. In Portugal and France *H. matritense* has been found in higher levels, corresponding to the E biozone, within the Middle Aragonian. This age is corroborated by other faunal elements (*Anchitherium*, *Gomphotherium*) and confirms the younger biostratigraphical position of La Retama with regard to the very near site of Loranca del Campo (MN 3 or Z biozone).

According to the paleoenvironment, the presence of *Hispanotherium matritense* in La Retama suggests the existence of open areas and rather arid conditions.

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