

Hipparion primigenium melendezi Alberdi reconsidered

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Hipparion from Los Valles de Fuentidueñas, Segovia, Spain, described as *H. primigenium melendezi* Alberdi, is compared with *H. concudense* Pirlot and *H. sp.* from the Teruel area, Aragon, Spain, and with *H. depereti* Sondaar from Montredon, Herault, France. *Hipparion* from Los Valles is not closely related to *H. depereti*, but is, together with *H. sp.*, considered conspecific with typical *H. concudense*, the stratigraphic range of which is briefly discussed.

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1. Introduction

Alberdi (1974: 58–67), in her review of *Hipparion* in Spain, distinguished a new subspecies, *H. primigenium melendezi*, from the Vallesian of Los Valles de Fuentidueñas, which is also referred to from El Lugajero (Alvila), Relea (Palencia), and Pedregueras (Zaragoza). In her brief description, Alberdi pointed out some differences with respect to the nominate subspecies *H. p. primigenium* (v. Meyer): *Hipparion* from Los Valles is smaller, more slenderly built, and has more hypsodont teeth with fewer enamel plications. A notable similarity is the high proportion of MT III with no facet for the inner cuneiform (probably 18 out of a total of 22 MT III from Los Valles lack a facet). Forstén (1968) referred a left MT III (BMNH 16426) from Los Valles with no facet for the inner cuneiform to *H. primigenium*.

An excellent sample of bones and teeth from Los Valles is kept at the Geological Institute of the Museo de las Ciencias, Madrid. The sample allows for detailed analysis and comparison with similar forms from Spain and elsewhere. The aim of this paper is to compare *Hipparion* from Los Valles with Turolian *H. concudense* (localities Barranco and Cerro de la Garita = Concud s.l., Los Mansuetos, and Concud III) and *H. sp.* (locality Masía del Barbo) from the Teruel area, Spain, and with Vallesian *H. depereti* from Montredon, France. The latter represents the *H.*

primigenium superspecies (Forstén 1978). I sincerely thank the keepers of the collections studied.

2. Methods and abbreviations

I used standard statistical methods: scattergrams with 95 % equiprobability ellipses (Defrise-Gussenhoven 1955), phenograms of UPGMA clusterings (Sneath & Sokal 1973: 230–234, as applied to fossil horses in Forstén 1980), and triangular diagrams (Mayr et al. 1953).

Abbreviations of local sample names (Fig. 1) used in the diagrams:

LV = Los Valles de Fuentidueñas, Spain

H. primigenium

B = Baltavar, Hungary

Ch = Charmoille, Switzerland

Cz = Csakvar, Hungary

Ep = Eppelsheim, Federal Republic of Germany

Es = Esselborn, Federal Republic of Germany

G = Gaiselberg, Austria

GW = Gau Weinheim, Federal Republic of Germany

K = Kalfa, Moldavian SSR

Md = Montredon, France

N = Nombrevilla, Spain

P = Polgardi, Hungary

W = Westhofen, Federal Republic of Germany

H. concudense, Teruel area, Spain

Br = Barranco

C = Concud s.l.

Cd = Concud III

Cr = Cerro de la Garita

L = Los Mansuetos

M = Masía del Barbo

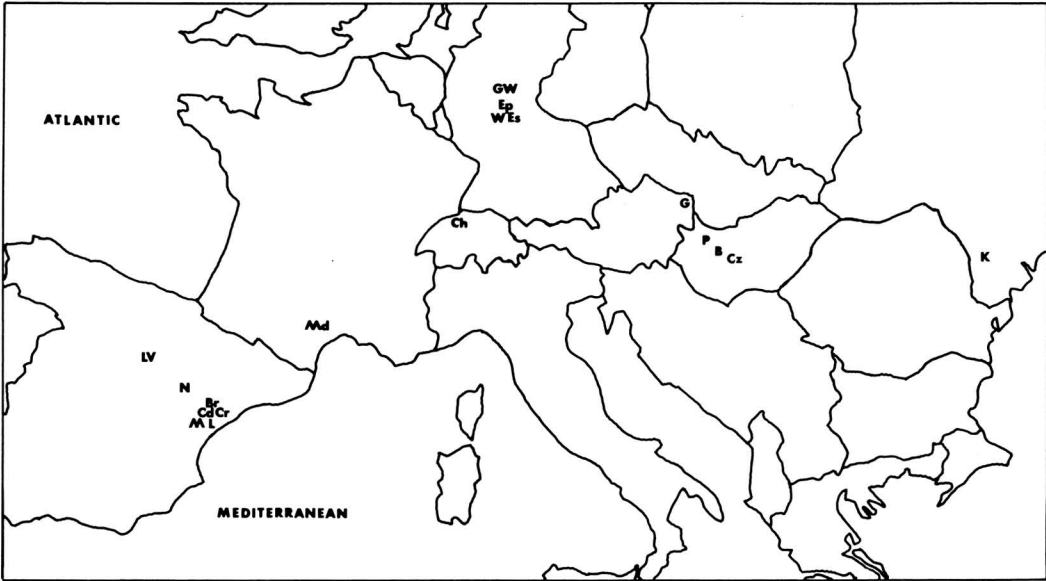


Fig. 1. Map of central and southern Europe, showing localities from which samples have been used in analyses (see text for abbreviations).

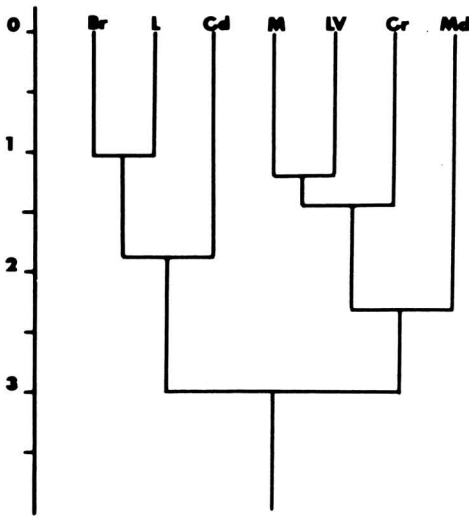


Fig. 2. Phenogram of UPGMA clustering constructed from the sample means of 10 tooth measurements (Table 3). Distance scale in standard deviation (*s*) units.

3. Description and comparison

3.1. Teeth

I used a phenogram (Fig. 2) to compare 10 different tooth variables in the sample from Los

Table 1. Statistics on teeth, Los Valles de Fuentidueñas. *N* = number of observations, *SE* = standard error, *SD* = standard deviation, *V* = coefficient of variation.

	<i>N</i>	Range	Mean ± <i>SE</i>	<i>SD</i>	<i>V</i>
<i>M</i> ¹⁻² length	140	1.74—2.23	1.96±0.008	0.09	4.61
breadth	134	1.93—2.48	2.23±0.01	0.11	5.01
<i>P</i> ³⁻⁴ length	119	1.98—2.46	2.18±0.01	0.096	4.39
breadth	103	2.04—2.53	2.29±0.01	0.11	4.61
<i>M</i> ₁₋₂ length	143	1.77—2.88	2.02±0.008	0.096	4.75
breadth	136	1.06—1.45	1.26±0.007	0.08	6.44
<i>P</i> ₃₋₄ length	108	2.06—2.65	2.27±0.01	0.106	4.66
breadth	88	1.26—1.66	1.42±0.008	0.07	5.08
protocone length	260	0.54—1.02	0.77±0.005	0.076	9.95
plication count	237	3 —31	14.74±0.37	5.72	38.79

Valles de Fuentidueñas (Table 1) with corresponding data in local samples from the Teruel area (data in Forstén 1979: table 1) and from Montredon (data in Forstén 1978: figs. 2—6). The phenogram resembles fig. 1 in Forstén (1979) in that the localities Barranco, Los Mansuetos, and Concud III cluster together, as do Cerro de la Garita and Masía del Barbo. Los Valles and Montredon join the latter cluster.

The teeth from Los Valles resemble those from the Teruel area in size, plication count, and protoconal length, but are slightly less hypsodont: the Los Valles index of hypsodonty of *M*¹⁻² is 26.12 (*N* = 15), and of *M*₁₋₂ 25.24 (*N* = 4). The teeth

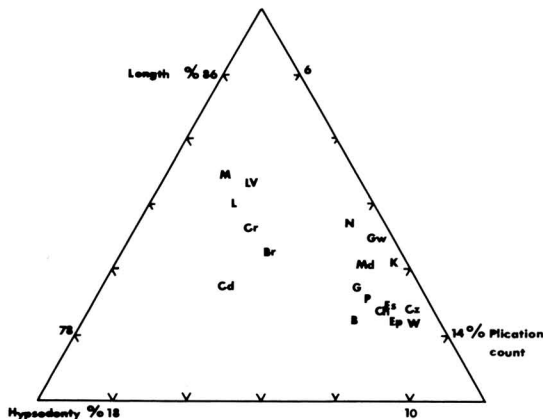


Fig. 3. Triangular diagram in which are plotted M_{1-2} mean length, M_{1-2} mean hypsodonty index, and sample mean plication count. See text for explanations.

from Montredon differ in having more complex enamel and lower tooth crowns: the index of hypsodonty of M_{1-2} is 22.66 ($N = 2$), and of M_{1-2} ($N = 8$). In a triangular diagram (Fig. 3) with M_{1-2} mean length and mean hypsodonty index, and sample mean plication count plotted against each other, Los Valles falls among the local samples from the Teruel area, and is well separated from local samples of the *H. primigenium* superspecies. The position of the *primigenium* cluster in Fig. 3 is decided by the plication count having more weight, and the hypsodonty less weight, than in the Teruel samples.

The frequency of ectostylids and protostylids in P_3-M_2 from Los Valles is the same as in the Teruel samples (Table 2).

3.2. Limbs

Measurements of the limb bones were plotted in bivariate scatter diagrams (Figs. 4–6). At a

Table 2. Frequency of cingular stylids of P_{3-4} and M_{1-2} in total number of teeth studied.

Locality	Protostylid absent		Ectostylid present	
	P_{3-4}	M_{1-2}	P_{3-4}	M_{1-2}
Cerro	3/46	3/55	5/46	17/55
Barranco	1/17	0/18	1/17	4/18
Concud III	2/22	0/22	1/22	2/22
Los Mansuetos	4/27	0/25	0/27	1/25
Masia	1/17	0/21	1/17	2/21
Los Valles	15/98	1/122	4/98	5/122

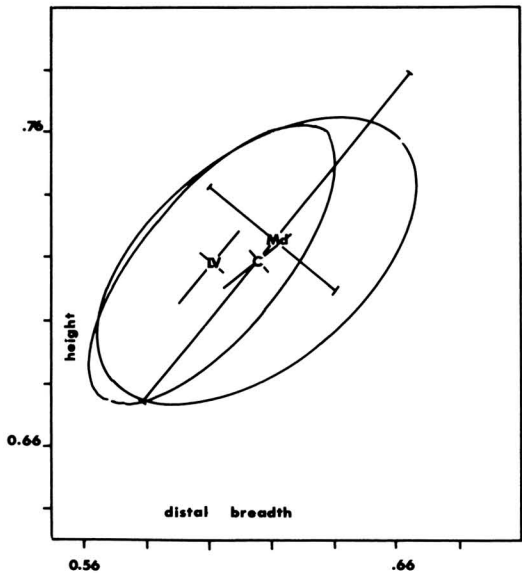


Fig. 4. Astragalus height (ordinate) plotted against distal breadth (abscissa). 95 % equiprobability ellipses drawn for samples from Concud s.l. and Los Valles; major and minor axes fitted to sample from Montredon. Log data.

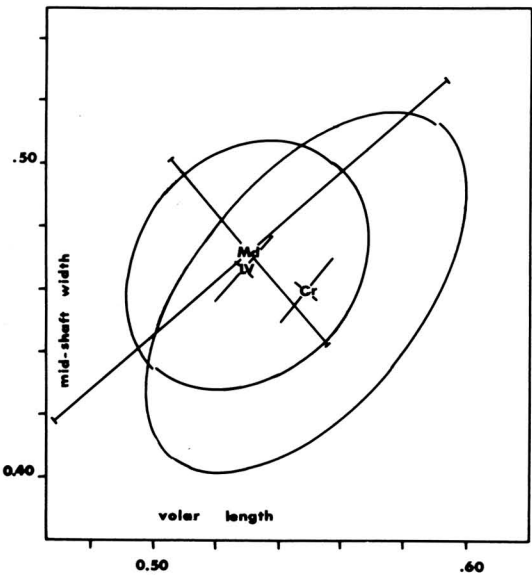


Fig. 5. Phalanx 2 mid-shaft width (ordinate) plotted against volar length (abscissa). 95 % equiprobability ellipses drawn from samples from Cerro de la Garita and Los Valles; major and minor axes fitted to sample from Montredon. Log data.

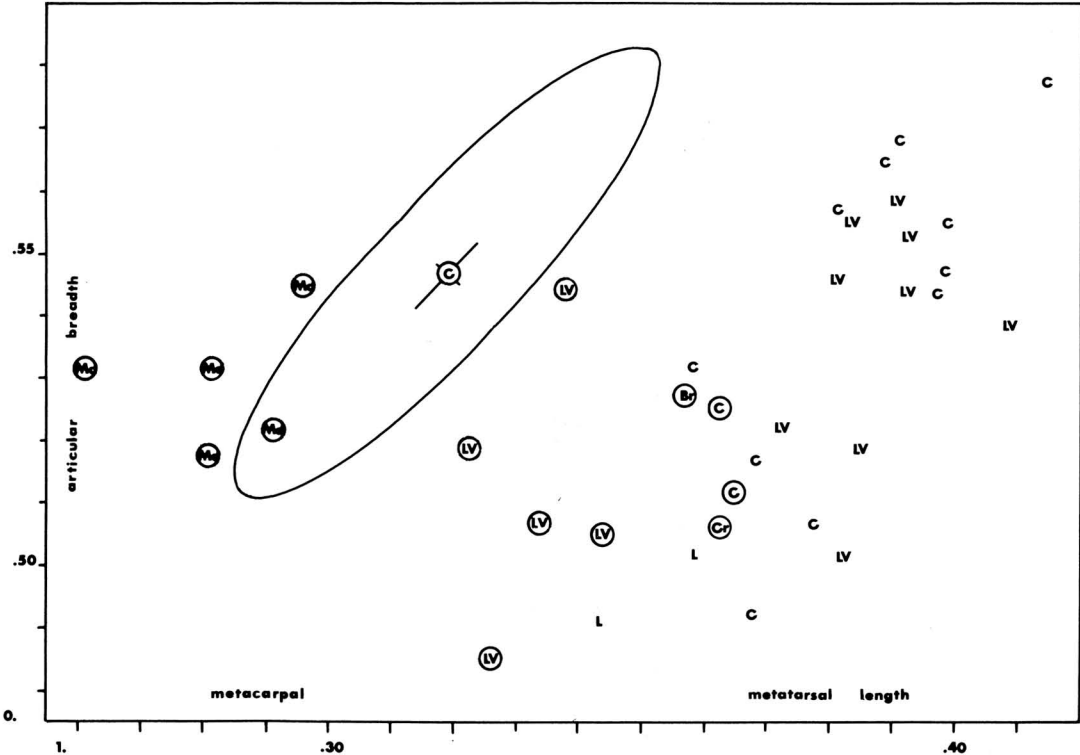


Fig. 6. MC III (in circles) and MT III distal breadth (ordinate) plotted against total length (abscissa). 95 % equiprobability ellipse drawn for sample from Concud s.l., compared with single observations from the sites indicated. Log data.

comparable height, astragali (Fig. 4) from Los Valles are more narrow distally than are astragali from Concud s.l., and astragali from Montredon are similar to the latter. Phalanx 2 (Fig. 5) and phalanx 1 from Los Valles are slightly shorter (phalanx 2 also broader) than those from Concud s.l. and Cerro. Phalanx 1 are also shorter than those from Montredon, but phalanx 2 are similar. The MT III (Fig. 6) from Los Valles are similar to those from the Teruel area, while the MC III (Fig. 6) are intermediate between the “long” and the “short” specimens from Teruel (see discussion in Forstén 1979: 287, fig. 5). The MC III specimens from Montredon (no complete MT III known) differ in being even shorter than the “short” specimens from Teruel.

4. Discussion

Hipparion from Los Valles de Fuentidueñas was identified as a subspecies *melendezi* of *H. primigenium* (Alberdi 1974: 58—67). Comparison with

a member of the *H. primigenium* superspecies shows both similarities and differences, as also pointed out by Alberdi. *Hipparion* from Los Valles shows decided similarities with *H. concudense* and *H. sp* from the Teruel area, however.

In a phenogram of the teeth (Fig. 2), Los Valles clusters together with Masía at the s 1.23 level and

Table 3. Euclidean distance between local tooth samples of *Hipparion* (see text for abbreviations). Ten variables of the teeth are used in the analysis.

	Cr	Br	Cd	L	M	LV
Br	2.42					
Cd	2.87	2.17				
L	2.37	1.05	1.59			
M	1.62	3.26	3.92	3.28		
LV	1.37	2.77	3.22	2.70	1.23	
Md	1.96	2.55	3.69	3.08	2.58	2.50

with Cerro at the s 1.37 level (Table 3). Los Valles clusters together with Montredon at the s 2.50 level. The cluster comprising *Hipparion* from Los Valles, *H. concudense* from Cerro, and *H. sp* from Masía, in addition to *H. depereti* from Montredon, differs in over-all larger size of the teeth from the cluster of *H. concudense* from Barranco, Los Mansuetos, and Concud III.

In the case of the limb bones, *Hipparion* from Los Valles resembles *H. concudense* in metapodial size and proportions, and *H. depereti* in proportions of the phalanges (Figs. 5 and 6). MT III with no facet for the inner cuneiform is considered primitive (Pirlot 1952), and characteristic of members of the *H. primigenium* superspecies (Forstén 1978). However, local samples of Eurasian *Hipparion* from the Turolian may show high frequencies of MT III with no facet (Sondaar 1961, Forstén 1980); single specimens of such metapodials have been observed from the localities discussed here.

5. Conclusions

Hipparion from Los Valles is closer to *H. concudense* from Cerro and *H. sp* from Masía than to *H. depereti* from Montredon. *Hipparion sp* from Masía was considered intermediate between *H. primigenium* "truyolsi" and *H. concudense* (Alberdi 1974: 94, Cuadro V), but, although probably closely related to the latter, *H. sp* does not seem to be particularly closely related to *H. primigenium* (Forstén 1979: 287—289). On the basis of the teeth, *Hipparion* from Masía and Los Valles cluster

together with *H. concudense* from Cerro, with which I believe they are conspecific.

Hipparion concudense was originally defined from material from Concud s.l., comprising Cerro de la Garita and Barranco. The lectotype, Sabadell P 40-1960 (Sondaar 1961: fig. 7a), is from either one or the other of these localities, but its exact provenance is unknown. Tooth samples from these two localities compared separately by *t*-test differ in six out of ten variables (Forstén 1979: fig. 1). In the phenogram (Fig. 2) they differ in over-all tooth size and morphology. *Hipparion concudense* should be revised and redefined on homogeneous sample material.

The presence of a *Hipparion* similar to *H. concudense* in the Vallesian of Los Valles may indicate that this species differentiated earlier and persisted longer than so far suspected. Alternatively, the fauna of Los Valles is considerably younger than the lower Vallesian age proposed originally by Thaler and Crusafont (Alberdi 1974: 58). On the basis of the morphology of *Hipparion* from Los Valles, Alberdi seems to think that the age of the fauna is upper, rather than lower, Vallesian (Alberdi 1974: 58, Cuadro V). Early differentiation of *H. concudense* is also indicated by the presence of a very similar form at Masía del Barbo, the fauna of which is possibly transitional between the Vallesian and Turolian (Alberdi 1974: 94, Cuadro V). A detailed comparison of the faunas of Los Valles, Masía, and Cerro de la Garita may solve the age problem. Until then, the value of *H. concudense* as a stratigraphic marker of the Turolian (Alberdi 1974: Cuadro VI, Alberdi 1978: fig. 1) is questionable.

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