

Rodents and lagomorphs from a lower Vallesian fissure filling near Molina de Aragón (prov. Guadalajara, Spain)

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A new lower Vallesian micromammalian fauna from a locality near Molina de Aragón is described. Five species of Cricetidae, three species of Sciuridae – including a new one (*Heteroxerus molinensis*) –, two species of Gliridae, and one lagomorph species are described. Also, the paleoecological implications of the lower Vallesian vertebrate faunas are discussed.

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Introduction

The fossiliferous karst fissure of Molina de Aragón was discovered during an excursion guided by P. Carls (Braunschweig, F. R. G.). Collecting of the samples has been carried out by R. Daams (Groningen) and M. Freudenthal (Leiden) in 1979 during the Spanish-Dutch co-operation project called 'Aragoniense'. The small-mammal remains are kept

in the collections of the Rijksmuseum van Geologie en Mineralogie at Leiden (RGM). The measurements have been taken by means of a Wild binocular microscope with measuring scale. Measurements are given in 0.1 mm units. The length is measured approximately through the middle of the teeth, and the largest width has been taken perpendicularly to the length.

GEOGRAPHIC SITUATION

The locality is situated at 2 km from Molina de Aragón in the top of a small karstic hill of Liassic limestone, alongside the road from Molina to Ventosa. The type locality of the mineral aragonite is at the base of the same hill.

Acknowledgements

The author expresses his gratitude to Dr Remmert Daams (Groningen) for the supervision of his 'tesis de Licenciatura' and his kind help. Sincere thanks are extended to Drs Matthijs Freudenthal (Leiden), Nieves López, Carmen Sesé and Jorge Morales (Madrid). The figures have been drawn by Menno Bijl (Groningen).

Systematic descriptions

Rodentia Bowdich, 1821
Family Sciuridae Gray, 1821

The nomenclature of the parts of the cheek teeth for this family is after de Bruijn, 1966 (see Fig. 2).

Heteroxerus cf. huerzeleri Stehlin & Schaub, 1951
Pl. 1, figs. 1-8.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
D ₄	7	13.0	15.1	18.5	7	10.0	12.1	14.5
P ₄	22	14.0	15.0	16.5	22	12.0	13.7	15.0
M _{1,2}	67	15.5	17.4	21.0	68	15.0	18.1	21.0
M ₃	27	16.5	19.2	21.0	26	16.5	17.9	19.0
D ⁴	6	13.5	14.6	15.5	6	12.5	14.7	16.0
P ⁴	25	13.0	14.2	15.0	25	15.0	16.6	18.0
M ^{1,2}	61	14.5	15.7	17.5	62	17.0	19.3	22.0
M ³	38	14.5	16.4	17.5	38	16.5	17.9	19.5

Discussion — The size of the teeth of the Molina de Aragón population is similar to that of *H. cf. H. huerzeleri* from Los Valles de Fuentidueña (Sesé & López, 1981). Measure-

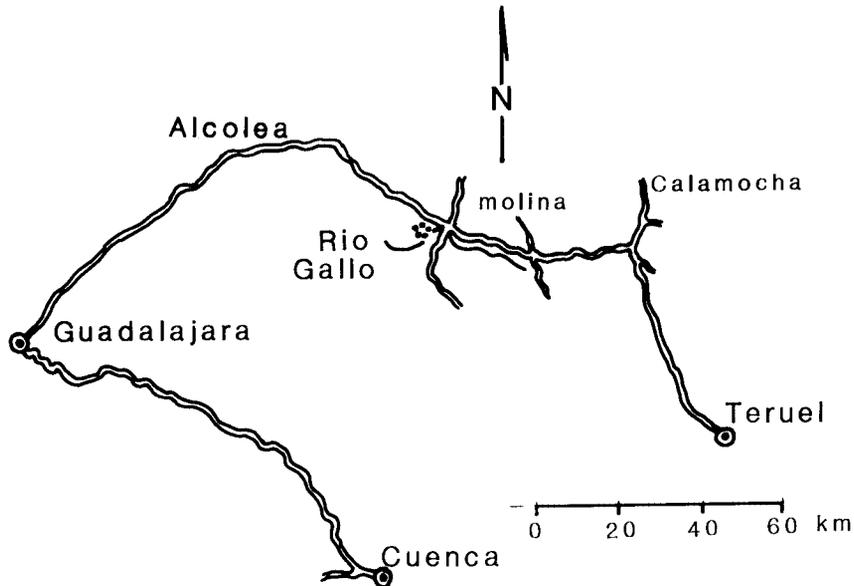


Fig. 1. Geographic situation of the locality of Molina de Aragón (the locality is marked by an asterisk).

ments are very close to those of the same species from Masia del Barbo 2A and 2B, and Pedregueras 1A (de Bruijn & Mein, 1968). All these assemblages have a small anteroconid and ectolophid in the P₄, and in Molina de Aragón and in Los Valles the P₄ presents a connection between metaconule and posteroloph and a well-developed hypocone. M^{1,2} presents an anterocone near to the protocone and in M³ the hypocone is reduced and the metacone and the metaconule are fused to the posteroloph.

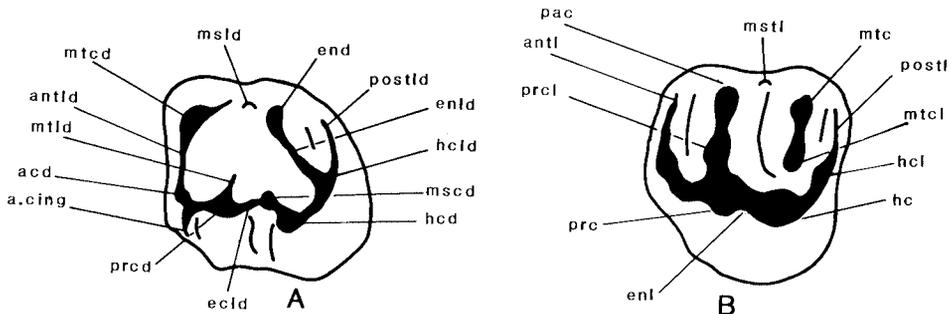


Fig. 2. Nomenclature of parts of the cheek teeth of the Sciuridae (after de Bruijn, 1966).

A: Lower molars: A.cing = anterior cingulum; Ac = anteroconid; Antld = anterolophid; Mtd = metaconid; Prcd = protoconid; Mtd = metalophid; Ecd = ectolophid; Msd = mesostylid; Mscd = mesoconid; End = entoconid; Hcd = hypoconid; Endl = endolophid; Hcd = hypoconulid; Postld = posterolophid.

B: Upper molars: Antl = anteroloph; Prc = protocone; Prcl = protoconule; Pac = paracone; Entl = endoloph; Mstl = mesostyle; Hc = hypocone; Hcl = hypoconule; Mtc = metacone; Mtcl = metaconule; Postl = posteroloph.

Heteroxerus molinensis sp. nov.

Pl. 1, figs. 9-16.

Holotype — M^{1,2} sin., RGM 337 407, Pl. 1, fig. 15.*Type locality* — Molina de Aragón.*Derivatio nominis* — The species is named after Molina de Aragón, the type locality.*Age* — Late Miocene.*Diagnosis* — *Heteroxerus* of large size and with a well-developed anterior cingulum in the lower molars.*Differential diagnosis* — *H. molinensis* differs from *H. paulhiacensis* and *H. lavocati* by its larger size and by the presence of the anterior cingulum.

It differs from *H. rubricati* by its larger size. Moreover, the M_{1,2} of *H. rubricati* are longer than wide, whereas this character is reversed in *H. molinensis*. The anterior cingulum is more developed in *H. molinensis* and the anteroconid of M_{1,2} is more developed in *H. rubricati*; the metalophid of M_{1,2} from Molina de Aragón is never connected to the anterolophid or to the metaconid, whereas the connection is usually present in *H. rubricati*. In the M₃ of *H. rubricati* there is a hypoconulid, whereas this cusp is always absent in *H. molinensis*. The posterolophid is better developed in *H. molinensis* than in *H. rubricati*.

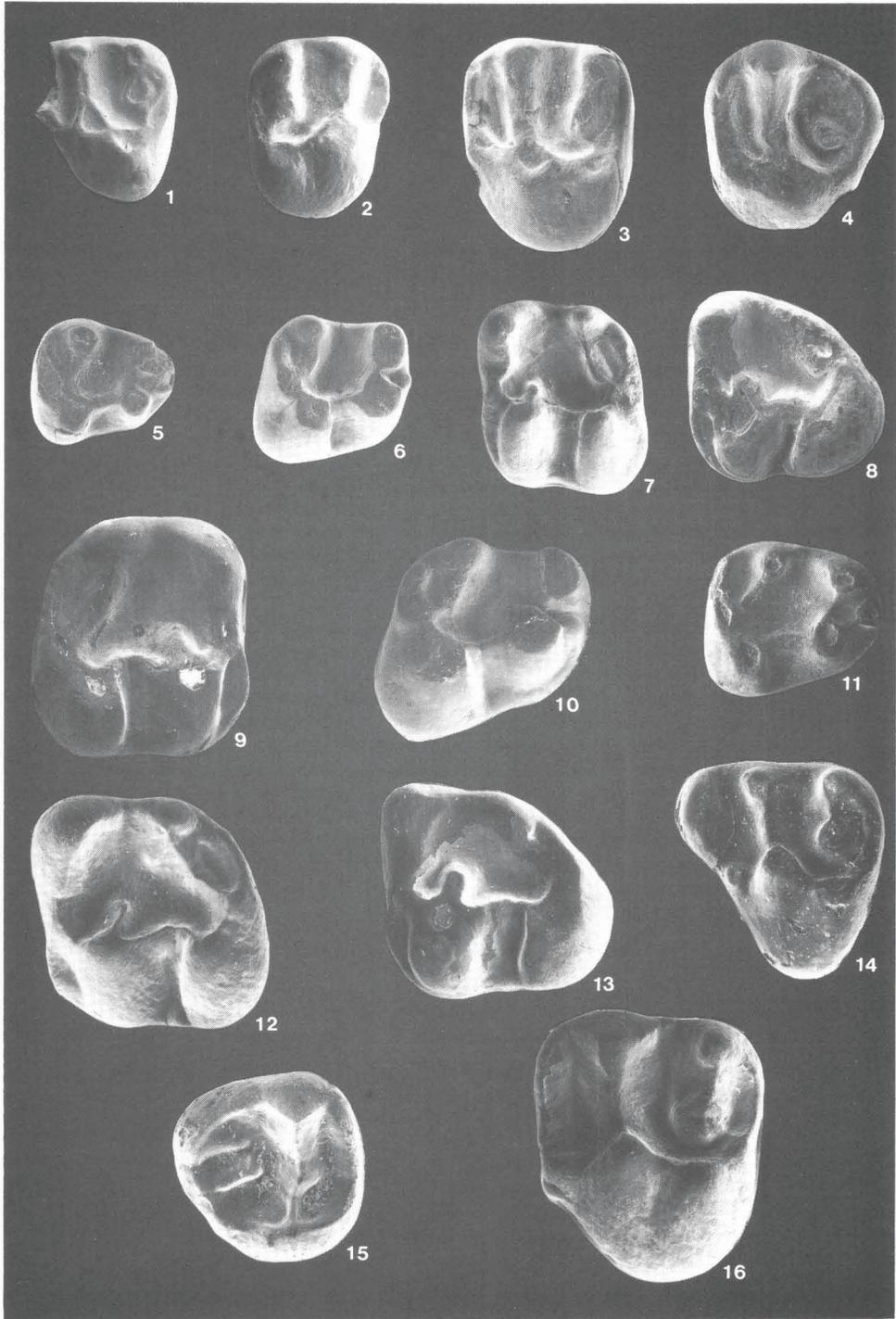
H. molinensis differs from *H. grivensis* by its larger size, its less-developed anteroconid of M_{1,2} and the absence of a connection between metalophid and anterolophid in all lower molars (always present in *H. grivensis*). Moreover, the hypoconid and the mesoconid are present in the M₃ of *H. grivensis* and always absent in *H. molinensis*. The M^{1,2} may have a mesostyle which is always absent in *H. molinensis*. The metacone of M³ is larger in *H. grivensis* than it is in *H. molinensis*. The M³ of *H. molinensis* have a longitudinal ridge connecting the metaconule to the posteroloph, whereas this longitudinal ridge is absent in *H. grivensis*.

 Plate 1

All figures × 15.

Heteroxerus cf. *H. huerzeleri* Stehlin & Schaub, 1951Fig. 1. D⁴ sin., RGM 337 100.Fig. 2. P⁴ dext., RGM 337 162.Fig. 3. M^{1,2} sin., RGM 337 230.Fig. 4. M³ sin., RGM 337 335.Fig. 5. D₄ sin., RGM 337 160. Fig. 6. P₄ dext., RGM 337 183.Fig. 7. M_{1,2} sin., RGM 337 286.Fig. 8. M₃ sin., RGM 337 354.*Heteroxerus molinensis* sp. nov.Fig. 9. M_{1,2} dext., RGM 337 366.Fig. 10. P₄ dext., RGM 337 390.Fig. 11. D₄ dext., RGM 337 360.Fig. 12. M_{1,2} sin., RGM 337 421.Fig. 13. M₃ sin., RGM 337 430.Fig. 14. D⁴ sin., RGM 337 373.Fig. 15. M³ dext., RGM 337 422.Fig. 16. Holotype, M^{1,2} sin., RGM 337 407.

Plate 1



H. molinensis differs from *H. huerzeleri* by its larger size, by the absence of a connection between endolophid and entoconid in D_4 and M_3 , by the more developed metalophid and posterolophid in $M_{1,2}$, by the extra cusp near the protocone in D^4 and by the absence of a connection between metacone and posteroloph. In the P^4 of *H. molinensis* the protocone is better developed and the metaconule is connected to the posteroloph. In $M^{1,2}$ of *H. molinensis* there is no connection between metaconule and posteroloph.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
D_4	4	17.5	17.9	18.5	4	13.5	14.1	14.5
P_4	10	17.5	19.1	21.5	11	16.0	16.9	18.0
$M_{1,2}$	15	20.0	20.8	21.5	15	22.0	22.5	22.5
M_3	7	23.5	24.6	26.5	7	20.5	21.9	23.0
D^4	1	—	21.5	—	1	—	20.0	—
P^4	13	16.0	17.1	19.0	13	18.5	20.2	22.0
$M^{1,2}$	11	19.0	20.5	22.5	11	24.0	25.2	26.5
M^3	8	19.0	20.6	21.0	8	20.5	21.8	23.0

Description

D_4 — There is a well-developed anteroconid which is connected to the protoconid; the protoconid is connected to the metaconid by a low mesolophid. The metaconid is the highest cusp of the tooth. The anterior cingulum and the mesostylid are always absent. The long ectolophid is very low and curved; in 1 of the 4 teeth there is a very small mesoconid. Hypoconid, hypoconulid and entoconid are well developed. The endolophid is connected to the entoconid and to the hypoconulid, and it is interrupted in the middle. The posterolophid is short and well developed and it is not connected to the entoconid.

P_4 — There is a small anteroconid in 1 tooth. In 3 teeth there is a protuberance near the protoconid and in 3 others there is no anteroconid. The anterior cingulum is always absent. Protoconid and metaconid are situated close to each other. Metaconid, mesoconid and mesostylid are always absent. The ectolophid is very low. The hypoconid is well developed. The hypoconulid is small and it is connected to the entoconid by a curved endolophid. The posterolophid is well developed and it is connected to the base of the entoconid.

$M_{1,2}$ — The anteroconid is small and the anterolophid is low. The metaconid is the highest cusp. The anterior cingulum is well developed. The metalophid, which is directed towards the deep central valley, is short or of medium length. The ectolophid is low and curved. Mesoconid and mesostylid are always absent. The hypoconulid, always present, is small and connected to the entoconid by a well-developed endolophid. The posterolophid is well developed and it is connected to the base of the entoconid.

M_3 — The anteroconid is smaller than in $M_{1,2}$. The anterolophid is low and the anterior cingulum is well developed. The metaconid is the highest cusp. The metalophid is short and directed towards the central valley. The ectolophid is low, long and curved. Mesoconid and mesostylid are always absent. The hypoconid is well developed. The hypoconulid and the entoconid are fused in the posterolophid.

D^4 — The anteroloph is well developed and not connected to the protocone. Next to the protocone there is a small isolated cusp. There is no protoconule. The protocone is the highest cusp and it is connected to the paracone by a low ridge. The endoloph is low

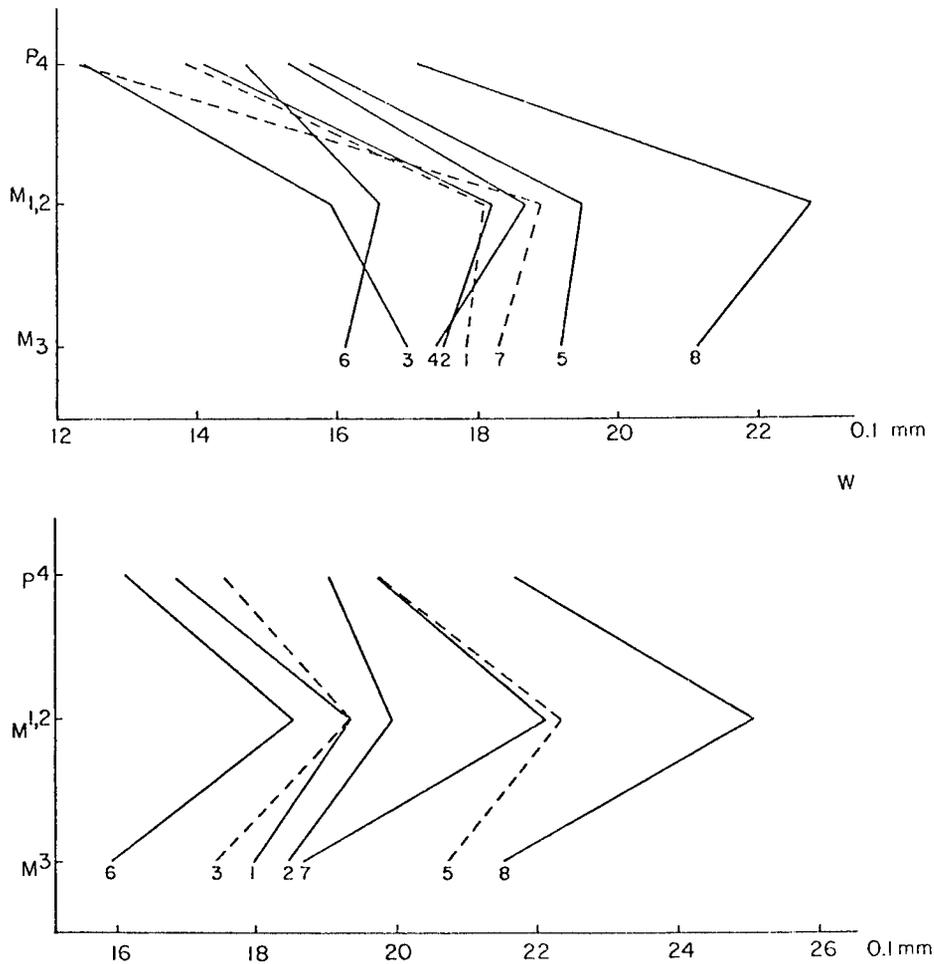


Fig. 3. Average width of cheek teeth of some *Heteroxerus* species.

- 1 - *Heteroxerus* cf. *H. huerzeleri*, Molina de Aragón;
- 2 - *Heteroxerus* cf. *H. huerzeleri*, Los Valles de Fuentidueña;
- 3 - *Heteroxerus* cf. *H. huerzeleri*, Masia del Barbo 2;
- 4 - *Heteroxerus* cf. *H. rubricati*, Nombrevilla;
- 5 - *H. grivensis*, Armantes 7;
- 6 - *H. rubricati*, Valdemoros 3B;
- 7 - *H. grivensis*, Manchones;
- 8 - *H. molinensis*, Molina de Aragón.

and short. The mesostyle is always absent, and the well-developed posteroloph is connected to the metacone.

P⁴ — The anteroloph is rather low and it is connected to the base of the paracone. The protocone is the largest cusp. There is no protoconule. Protocone and hypocone are situated close to each other; the mesostyle is always absent. In 5 out of 9 teeth the metaconule is larger than the metacone. The hypoconule is very small and it is connected to the metaconule in 3 out of 8 teeth. The posteroloph is very low and connected to the base of the metacone.

$M^{1,2}$ — The long and well-developed anteroloph is connected to the base of the paracone. There is a small extra cusp near the protocone which is part of the anteroloph. There is a very small protoconule in 5 out of 11 teeth. The endoloph is low and short due to the fact that the protocone and the hypocone are situated close to each other. A very small hypoconule is present in 3 out of 11 teeth. The metaconule is not connected to the posteroloph. The posteroloph is low and connected to the base of the metacone.

M^3 — M^3 has a rounded shape. The anteroloph is connected to the base of the paracone. There is a very small protoconule in 3 out of 5 teeth. The hypocone, hypoconule and metacone are fused in the posteroloph, which is connected to the base of the metacone. There is a short longitudinal ridge connecting the metaconule to the posteroloph.

Discussion — *H. molinensis* is larger than all other species of the genus. The size is similar to some species of *Atlantoxerus*, but, morphologically, *H. molinensis* cannot be confused with any *Atlantoxerus* species known because of the presence of the anterior cingulum in $M_{1,2}$. The well-developed anterior cingulum of *H. molinensis* is a feature which distinguishes it clearly from all other *Heteroxerus* species.

Sciuridae gen. et sp. indet.

Material and measurements — 1 M_3 sin. (20.5 × 15.0).

Description — The anterolophid is well developed and there is no anteroconid. The metaconid is the highest cusp; it is much higher than the other cusps. The anterior cingulum is small. The metalophid is small and it is situated at the anterior border of the tooth. The well-developed protoconid is pointed and lies at the labial border of the tooth. The mesostylid is absent. The ectolophid is very short. There is no mesoconid. The hypoconid is as large as the protoconid and has a rounded shape. The endolophid is absent. The entoconid is small and is part of the well-developed posterolophid. The hypoconulid is also part of the posterolophid. The central valley is very deep.

Discussion — This tooth belongs to a medium-sized sciurid, the morphology is very different from any *Heteroxerus* species known; the dental pattern is similar to that of some Petauristinae (e. g. *Blackia miocaenica* Mein, 1970), but the central valley does not have the characteristic rugose pattern of that species. This single tooth does not permit a more precise generic or specific designation.

Plate 2

All figures × 15.

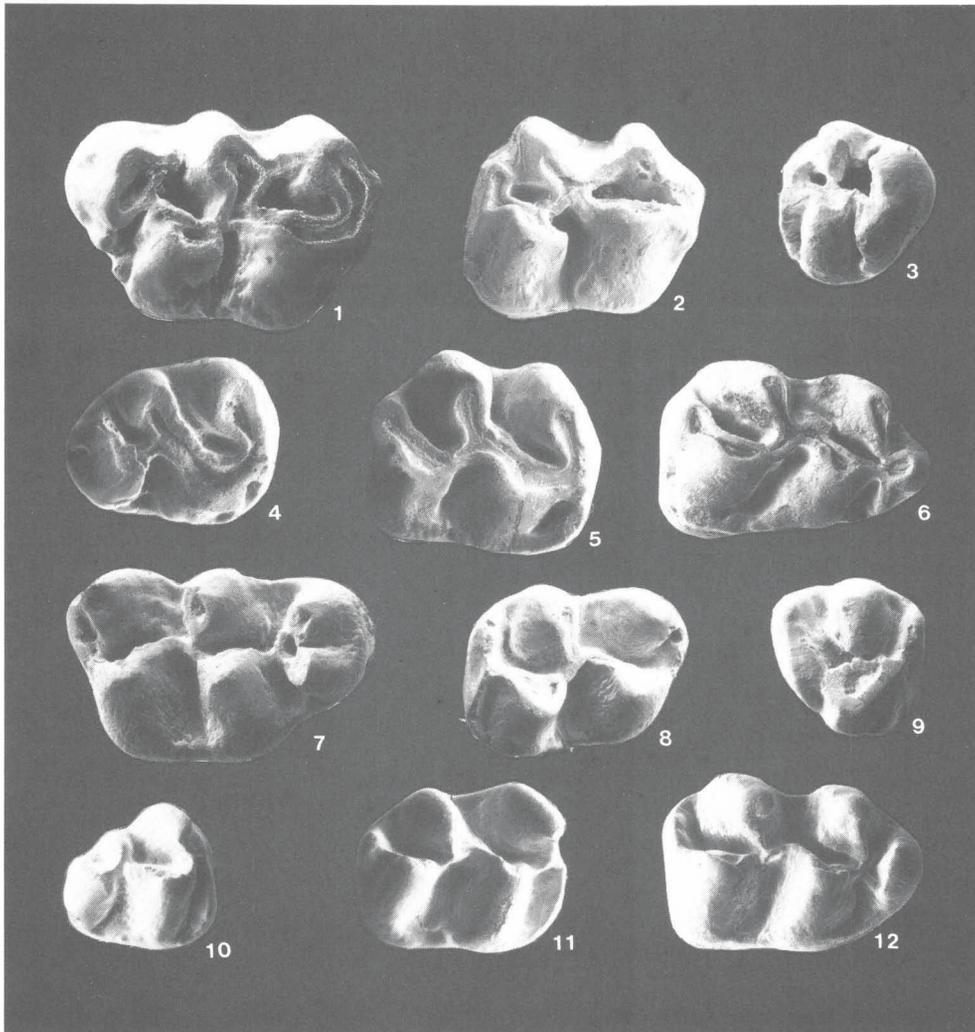
Hispanomys nombrevillae (Freudenthal, 1966)

- Fig. 1. M^1 sin., RGM 336 697.
- Fig. 2. M^2 sin., RGM 336 727.
- Fig. 3. M^3 sin., RGM 336 731.
- Fig. 4. M_3 dext., RGM 336 738.
- Fig. 5. M_2 dext., RGM 336 716.
- Fig. 6. M_1 dext., RGM 336 703.

Renzimys bilobatus Lacomba, 1983

- Fig. 7. Holotype, M^1 dext., RGM 336 906.
- Fig. 8. M^2 sin., RGM 336 924.
- Fig. 9. M^3 dext., RGM 336 948.
- Fig. 10. M_3 dext., RGM 336 957.
- Fig. 11. M_2 dext., RGM 336 934.
- Fig. 12. M_1 dext., RGM 336 866.

Plate 2



Family Gliridae Thomas, 1897

The nomenclature of parts of the cheek teeth for this family is after de Bruijn, 1966.

Myomimus dehmi (de Bruijn, 1966)

Pl. 3, figs. 10-11.

Material and measurements — 2 M_1 (10.0 × 10.0, 10.5 × 10.0), 1 M_2 (10.0 × 10.0), 1 M_3 (9.0 × 8.5), 1 P^4 (6.0 × 7.5), 1 M^1 (9.5 × 11.0), 1 M^2 (9.5 × 10.5).

Discussion — The assemblage from Molina de Aragón has been compared with the morphotypes described by Daams (1981) from several localities of the Calatayud-Teruel Basin (Nombrevilla, Pedregueras 1A, 2A and 2C, and Peralejos 4 and D). M_1 , M_2 and P^4 agree with the morphotypes 2, 1 and C, respectively. On the other hand there are some morphological differences between the M^1 and M^2 from Molina de Aragón and the assemblages from the Calatayud-Teruel Basin. In the M^1 and M^2 from Molina de Aragón the posteroloph is connected to the metacone and in the M^2 the anteroloph is connected to the paracone; in the Calatayud-Teruel assemblages these connections are absent. There are also some differences with respect to *M. dehmi* from Los Valles de Fuentidueña (Sesé & López, 1981), where the posterior centroloph and the connections posteroloph-paracone and posteroloph-metacone are always absent. The size of *M. dehmi* from Molina de Aragón is similar to that of *M. dehmi* from Nombrevilla and Pedregueras 2A and 2C.

Tempestia hartenbergeri (de Bruijn, 1966)

Pl. 3, fig. 12.

Material and measurements — 1 M_2 dext. (13.5 × 13.5).

Discussion — The size and dental pattern of the tooth from Molina de Aragón agree with those of the same species from Escobosa de Calatañazor (López et al., 1977). *T. hartenbergeri* from Masia del Barbo 2A (de Bruijn, 1967) is of larger size and has a longer centrolophid.

Plate 3

All figures × 15.

Megacricetodon ibericus (Schaub, 1944)

- Fig. 1. M^1 sin., RGM 337 015.
 Fig. 2. M^2 sin., RGM 337 041.
 Fig. 3. M^1 dext., RGM 336 979.
 Fig. 4. M_1 sin., RGM 336 994.
 Fig. 5. M_3 sin., RGM 337 073.
 Fig. 6. M_1 dext., RGM 337 000.

Democricetodon sulcatus Freudenthal, 1967

- Fig. 7. M^1 sin., RGM 337 081.
 Fig. 8. M_2 sin., RGM 337 093.
 Fig. 9. M_1 dext., RGM 337 085.

Myomimus dehmi (de Bruijn, 1966)

- Fig. 10. P^4 , M^1 dext., RGM 337 434-435.
 Fig. 11. M^2 sin., RGM 337 436.

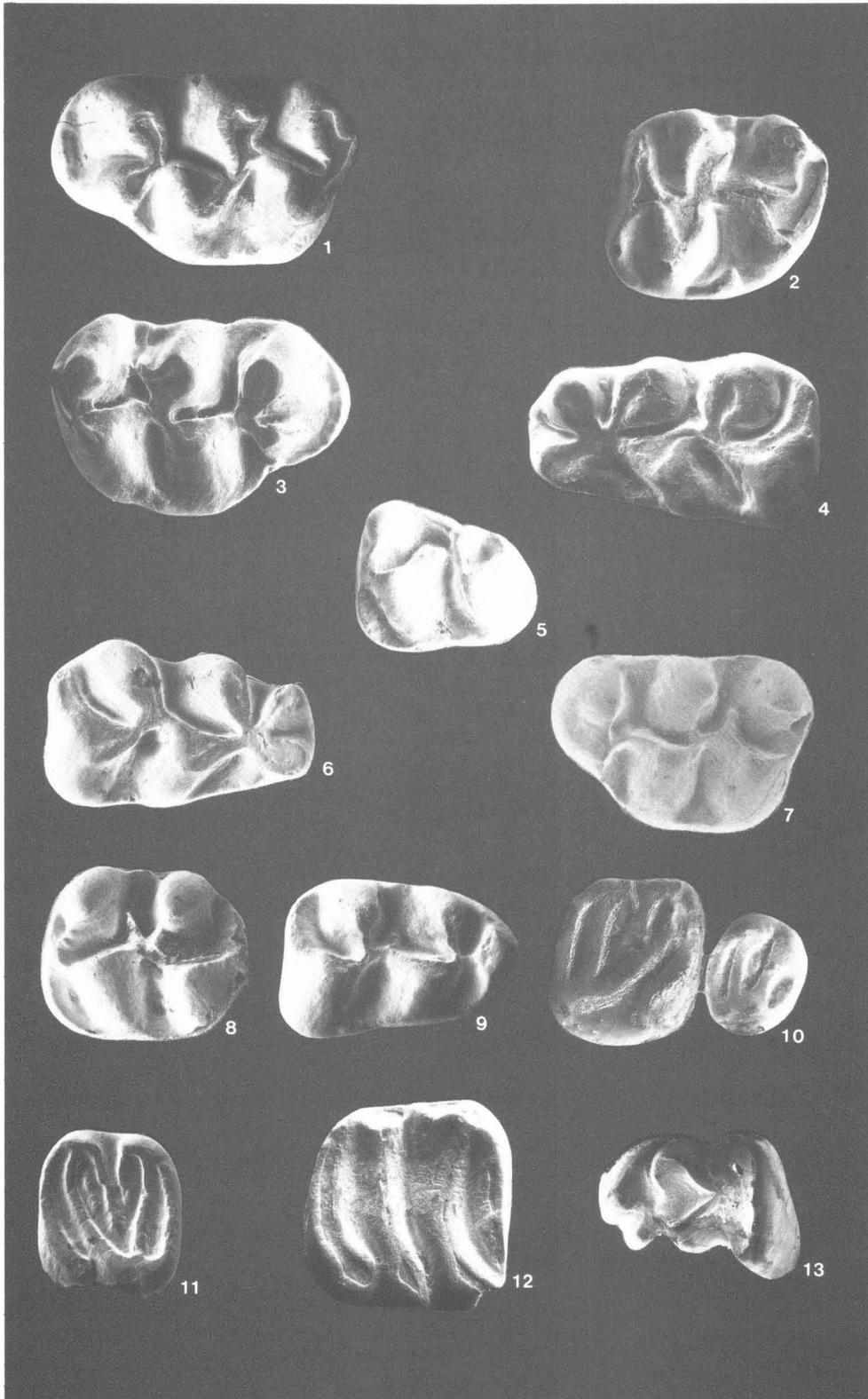
Tempestia hartenbergeri (de Bruijn, 1966)

- Fig. 12. M_2 dext., RGM 337 441.

Prolagus crusafonti López, 1975

- Fig. 13. D_3 sin., RGM 337 442.

Plate 3



Family Cricetidae Rochebrune, 1883
Subfamily Cricetodontinae Stehlin & Schaub, 1951

The nomenclature of the parts of the cheek teeth for this group is after Mein & Freudenthal, 1971.

Hispanomys nombrevillae (Freudenthal, 1966)
Pl. 2, figs. 1-6.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
M ₁	18	21.5	24.7	27.0	18	15.0	16.3	18.0
M ₂	26	20.5	23.0	27.0	26	16.5	17.8	18.5
M ₃	37	17.5	20.4	22.5	36	14.0	15.6	17.5
M ¹	29	26.5	29.4	34.5	29	17.5	19.1	21.0
M ²	35	20.0	22.5	25.0	35	15.5	17.2	18.5
M ³	31	14.0	15.7	18.5	32	11.0	14.4	17.0

Discussion — The species from Molina de Aragón has the same size as *H. nombrevillae* from Nombrevilla and *H. aragonensis* from Pedregueras 2C (Freudenthal, 1966).

H. nombrevillae from Molina de Aragón is more hypsodont than the populations mentioned in Table 1, but the values are closest to the Nombrevilla assemblage. It is also more hypsodont than *Cricetodon aguirrei* from Escobosa de Calatañazor (López et al., 1977), which in turn is more brachyodont than the assemblages from Nombrevilla and Pedregueras 2C.

The values of the ratios of mean length M¹/mean length M³ and mean length M₁/mean length M₃ of the assemblage from Molina de Aragón are between those of *H. nombrevillae* from Nombrevilla and *H. aragonensis* from Pedregueras 2C (taken from van de Weerd, 1976). The ratio LM₁/LM₃ coincides with *Hispanomys* sp. from Los Valles de Fuentidueña (Sesé & López, 1981). *H. aragonensis* from Pedregueras 2C and *H. nombrevillae* from Nombrevilla resemble each other morphologically, but Freudenthal (1966) gives some discriminating criteria. According to these criteria the Molina de Aragón assemblage is more similar to *H. nombrevillae* and it differs from *H. aragonensis*. The anterolophid of M₃, the mesolophids and the ectolophids are less-developed in *H. nombrevillae* from Molina de Aragón than they are in *H. aragonensis*, and M₃ is more reduced. Other resemblances with *H. nombrevillae* from Nombrevilla are the divided posterior root in M₂, the relative height of the anterior and posterior ectoloph in M¹ and M², the always absent mesoloph of M², and the reduction of M³.

The number of roots of M¹ resembles that of the Nombrevilla assemblage. Out of 3 M¹ in Nombrevilla (van de Weerd, 1976) 1 specimen has four roots, whereas the other 2 specimens have an accessory small fifth root below the paracone. In Molina de Aragón 13 out of 16 specimens have the accessory fifth root. On the other hand all 13 M¹ from Pedregueras 2C lack the fifth root.

The criteria to distinguish *H. nombrevillae* from *H. aragonensis* are not very clear because of the great variability and the overlapping values of both species.

Table 1. Hypsodonty and length ratios of various species of *Hispanomys* and *Cricetodon*.

Species	Loc.	L/H M ¹				L/H M ²			
		min.	mean	max.	n	min.	mean	max.	n
<i>H. peralensis</i>	PER C	—	1.92	—	1	—	—	—	—
<i>H. peralensis</i>	MB B	1.65	1.77	1.85	5	1.56	1.70	1.81	5
<i>H. peralensis</i>	MB A	1.93	2.03	2.14	3	1.57	1.58	1.60	3
<i>H. thaleri</i>	CL	1.52	1.74	1.85	3	—	—	—	—
<i>H. aragonensis</i>	PE 2C	1.99	2.26	2.59	14	1.44	1.64	1.84	16
<i>H. nombrevillae</i>	MOL	1.75	2.01	2.11	4	1.45	1.56	1.61	5
<i>H. nombrevillae</i>	NO	1.83	1.97	2.21	4	1.61	1.64	1.66	7
<i>C. aguirrei</i>	ESC	1.86	2.07	2.21	4	1.70	1.72	1.79	4

Species	Loc.	L/H M ³				LM ₁ /LM ₃ n	LM ¹ /LM ³ n		
		min.	mean	max.	n				
<i>H. peralensis</i>	PER C	1.12	1.17	1.32	4	1.20	4/5	1.78	7/10
<i>H. peralensis</i>	MB B	1.03	1.20	1.35	11	1.24	21/29	1.93	16/20
<i>H. peralensis</i>	MB A	1.14	1.18	1.21	3	1.32	5/7	1.92	5/7
<i>H. thaleri</i>	CL	—	1.02	—	1	1.25	7/5	—	—
<i>H. aragonensis</i>	PE 2C	1.15	1.29	1.48	14	1.17	46/38	1.78	37/39
<i>H. nombrevillae</i>	MOL	1.36	1.38	1.39	3	1.21	21/30	1.87	29/32
<i>H. nombrevillae</i>	NO	1.33	1.37	1.41	3	1.26	10/19	1.93	14/11
<i>C. aguirrei</i>	ESC	1.50	1.52	1.54	2	—	—	—	—

PER C = Peralejos C, MB A = Masia del Barbo 2A, MB B = Masia del Barbo 2B, CL = Can Llobateres, PE 2C = Pedregueras 2C, MOL = Molina de Aragón, NO = Nombrevilla, ESC = Escobosa de Calatañazor.

Megacricetodon ibericus (Schaub, 1944)

Pl. 3, figs. 1-6.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
M ₁	22	16.5	17.5	19.0	22	9.5	10.9	12.5
M ₂	21	13.0	14.0	15.0	21	10.5	11.5	12.0
M ₃	3	11.5	12.2	12.5	3	9.0	9.0	9.0
M ¹	26	17.5	18.7	20.0	26	10.5	12.1	13.5
M ²	15	13.5	13.8	15.0	15	10.0	11.4	12.0
M ³	4	10.0	10.4	10.5	4	9.5	9.9	10.0

Discussion — The assemblage from Molina de Aragón is highly similar to the Nombrevilla assemblage, on the basis of the reduction of mesolophid and mesoloph, the deeply split anteroconid of M₁, the connection between the posteroloph and the metacone, the absence of the lingual anterolophid, the basal ridge in front of the anterocone of M¹, and the styles.

M. ibericus from Molina de Aragón is slightly larger than the population from Nombrevilla (Freudenthal, 1968), and slightly smaller than *M. ibericus* from the lower Vallesian of Hostalets de Pierola (Agustí, 1980).

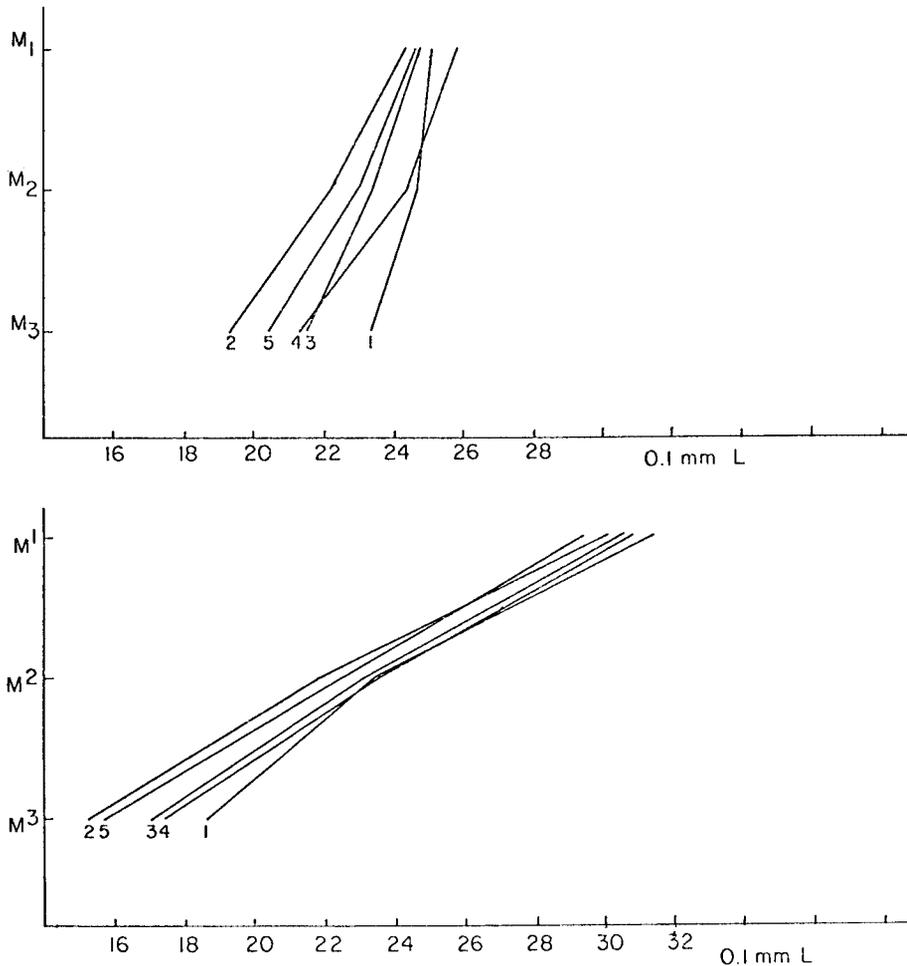


Fig. 4. Average length of the cheek teeth of some *Hispanomys* and *Cricetodon* species.

- 1 – *Cricetodon jotae*, Manchones;
 2 – *Hispanomys nombrevillae*, Nombrevilla;
 3 – *Hispanomys aragonensis*, Pedregueras 2C;
 4 – *Cricetodon aguirrei*, Escobosa de Calatañazor;
 5 – *Hispanomys nombrevillae*, Molina de Aragón.

Megacricetodon ex gr. *minor-debruijini*

Material and measurements — 1 M_1 sin. (13.5 × 8.5).

Discussion — The anteroconid of the single M_1 from Molina de Aragón is simple and the mesolophid is absent. In *M. debruijini* (Freudenthal, 1968) from Pedregueras 2C 77 % of the M_1 have a slightly split anteroconid and short mesolophids are frequent. In *M. minor* (Lartet, 1851) from Escobosa de Calatañazor a short mesolophid is present in 1 tooth and the mesolophid is absent in the other (Sesé & López, 1981). The size of the M_1 from Molina de Aragón agrees with the size of *M. minor* and *M. debruijini* from the above mentioned localities. This single M_1 does not justify a more precise determination.

Renzimys Lacomba, 1983

Derivatio nominis — The genus is named after Dr Miguel de Renzi.

Type species — *Renzimys bilobatus* Lacomba, 1983.

Remark — *Renzimys bilobatus* was described by Lacomba (1983) in a paper that was not widely distributed. Therefore the diagnosis and full description are given here.

Diagnosis — A large cricetid, with the anterocone of M¹ completely divided, with a double anterolophule in M¹, generally a single protolophule in M² and relatively narrow molars with respect to their length.

Differential diagnosis — *Renzimys* differs from *Fahlbuschia* Mein & Freudenthal, 1971 by: the split anterocone of M¹; the double anterolophule of M¹; the generally single protolophule in M²; the relatively narrow molars.

It differs from *Democricetodon* Fahlbusch, 1964 by: its larger size; its split anterocone (though more evolved species of *Democricetodon* may have a subdivided anterocone too); the absence of the anterior protolophule of M¹, which may be present in *Democricetodon*; the less-developed mesolophis in M¹ and M²; the very short mesolophids in M₁ and M₂; the transverse sinusid in M₃.

Renzimys differs from *Megacricetodon* Fahlbusch, 1964 by: its larger size; the simple anteroconid of M₁ (though *M. primitivus* has a simple anteroconid too); the exclusively posterior protolophule of M¹ and M²; the absence of a posterior spur on the paracone of M¹ and M².

Renzimys differs from *Cricetodon* Lartet, 1851 by: the simple posterior root of M₂; the absence of ectolophis in M¹ and M²; the general absence of protostyle and parastyle in M¹ and of the stylids in the lower molars.

Renzimys bilobatus Lacomba, 1983

Pl. 2, figs. 7-12.

Holotype — M¹ dext., RGM 336 906, Pl. 2, fig. 7.

Type locality — Molina de Aragón.

Derivatio nominis — the species name refers to the two lobes of the anterocone of M¹.

Age — Early Vallesian.

Diagnosis — For diagnosis and differential diagnosis see the description of the genus.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
M ₁	21	21.5	23.2	26.0	21	13.5	15.0	17.0
M ₂	21	19.0	20.7	23.0	21	15.0	15.9	17.5
M ₃	21	15.0	16.1	17.5	21	12.0	13.6	14.5
M ¹	16	25.5	27.5	28.5	15	15.0	16.8	18.0
M ²	20	18.8	20.2	22.0	20	14.8	15.6	16.8
M ³	10	12.5	14.4	16.0	10	10.5	13.4	14.5

Description

M_1 — Two cingulums descend from the simple anteroconid, the labial one of which is the better developed. The anterolophid is short and it is connected to the anteroconid by two branches. The metalophulid points obliquely forward. There is a very short mesolophid. The mesosinusid is short, narrow and transverse; a small mesostylid is observed in 4 out of 23 teeth. The sinusid is wide, deep, and it points obliquely forward; it is closed at its base by a very low ridge and a small ectostylid is observed in 2 out of 23 teeth. The short and transverse hypolophulid is connected to the posterolophid. The well-developed posterolophid is connected to the base of the entoconid and it closes the reduced posterosinusid.

M_2 — The labial anterolophid is well developed and it is connected to the base of the protoconid, thus closing the protosinusid. The long and narrow protosinusid points obliquely forward. The short metalophulid points obliquely forward. A very short mesolophid is present. The mesosinusid is short and transverse. A mesostylid is present in 5 out of 17 specimens. The wide sinusid points forward and it is closed at its base by a low cingulum; a small ectostylid is present in 5 out of 17 teeth. The hypolophulid is short and transverse. The ectolophid is long, narrow and points forward. The well-developed posterolophid closes the long posterosinusid.

M_3 — The M_3 has a triangular shape. The labial anterolophid is well developed and it closes the deep and narrow protosinusid. The lingual anterolophid is reduced and it is connected to the metaconid. The short and wide metalophulid is transverse and it is connected to the anterior part of the protoconid. The mesolophid is absent. The sinusid is transverse and closed by a low ridge, originating from the base of the protoconid; a small ectostylid is present in 2 out of 18 teeth. The reduced entoconid is always connected to the base of the metaconid along the border of the molar, thus closing the mesosinusid. The hypolophulid is short and wide. The ectolophid points obliquely forward. The well-developed posterolophid is connected to the entoconid, thus closing the reduced posterosinusid.

M^1 — The anterocone is completely divided into two lobes by a deep furrow. The anterolophule is divided into two branches connecting both lobes of the anterocone. The protosinus and the anterosinus are closed by small cingulums descending from the anterocone; the lingual one is larger and the labial one may be absent. Protolophule and metalophule are short and point obliquely forward. The sinus is transverse and it is longer than the wide mesosinus. Entostyle and mesostyle are always absent. A very short mesoloph is present in 9 out of 16 teeth. The short and narrow metalophule points backward and is connected to the posteroloph. The short and wide posteroloph is connected to the metacone, thus closing the reduced posterosinus.

M^2 — The lingual and labial anterolophs are both well developed, closing the protosinus and the anterosinus. The protolophule is single in 17 out of 19 teeth; in 2 teeth it is double. The mesoloph is present in 1 out of 20 specimens and it is connected to the base of the metacone. The wide and transverse sinus is closed at its base by a low cingulum; an ectostyle is present in 4 out of 20 teeth. The metalophule is connected to the posteroloph. The well-developed posteroloph is connected to the base of the metacone, thus enclosing the reduced posterosinus.

M^3 — The well-developed labial anteroloph is connected to the base of the paracone, closing the anterosinus. The lingual anteroloph is less developed. The metalophule points obliquely forward. The paracone is large. The reduced sinus is short and wide. The mesosinus is long, deep, and directed forward. The mesoloph and the styles are absent. The hypocone is reduced. The posteroloph is completely fused to the

metacone, except in 1 tooth; in this specimen the protolophule is double and the posteroloph is separated from the metacone. The M^3 is longer than wide.

Discussion — The dental pattern of *Renzimys* reveals its relationship with *Fahlbuschia* Mein & Freudenthal, 1971; nevertheless, some of the characters mentioned in the differential diagnosis prove it to be a separate genus.

The size of *R. bilobatus* is similar to that of the largest species of the genus *Fahlbuschia*, *F. crusafonti* Agustí, 1978, but the split anterocone of M^1 and the reduced M_3 of *R. bilobatus* indicate a more evolved morphology.

Hitherto no conclusions can be drawn about a possible ancestor of *R. bilobatus*. At present *Fahlbuschia* and *Democricetodon* from the Aragonian and Lower Vallesian of Spain are under study by M. Freudenthal, and will be published in this volume.

Subfamily Cricetinae Murray, 1866

Democricetodon sulcatus Freudenthal, 1967

Pl. 3, figs. 7-9.

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
M_1	6	15.0	15.5	16.5	6	10.0	10.5	11.0
M_2	3	13.0	13.3	14.0	2	10.5	10.5	10.5
M_3	2	10.5	11.1	11.5	2	8.5	9.1	9.5
M^1	5	16.0	16.9	18.0	5	10.5	11.2	12.0
M^2	2	14.5	14.5	14.5	2	10.0	10.5	11.0

Discussion — The size and the reduction of M_3 of *D. sulcatus* from Molina de Aragón are similar to those of the same species from Nombrevilla (Freudenthal, 1967). In *D. hispanicus* from Villafeliche 2A M_3 is more reduced. Other resemblances between *D. sulcatus* from Molina de Aragón and from Nombrevilla are the short mesolophs in M^1 and M^2 , and the short or absent mesolophids in M_1 and M_2 . The small and subtriangular anteroconid, the convergence of the borders of M_1 and the slightly subdivided anterocone of M^1 are identical in both assemblages.

Lagomorpha Brandt, 1855

Family Ochotonidae Thomas, 1897

Prolagus crusafonti López, 1975

Pl. 3, fig. 13.

Discussion — *P. crusafonti* from Molina de Aragón is smaller than *P. oeningensis* Koenig, 1825 from La Grive-St. Alban and Sansan (López, 1974) and similar to *P. crusafonti* from the Calatayud-Teruel Basin. The first two lobes of 2 D_3 of *P. crusafonti* from Molina de Aragón point at a little-evolved stage of the population, though a third specimen has more evolved characters. The size of the entoconid and the relative sizes of

Material and measurements

	Length				Width			
	n	min.	mean	max.	n	min.	mean	max.
D ₃	1	12.0	12.0	12.0	0	—	—	—
P ₃	2	15.0	15.0	15.0	0	—	—	—
M ₁	1	12.5	12.5	12.5	0	—	—	—
M ₂	2	14.5	14.8	15.0	2	14.5	14.7	15.0
M ₃	2	21.0	21.5	22.0	2	15.5	15.5	15.5
P ²	6	6.0	8.6	12.0	6	15.0	16.1	17.5
P ³	5	14.5	14.9	15.5	5	18.5	21.5	23.0
P ⁴	2	12.5	12.7	13.0	2	24.0	24.0	24.0
M ¹	1	12.0	12.0	12.0	1	19.0	19.0	19.0
M ²	2	12.5	12.5	12.5	2	22.5	24.2	26.0

the protoconulid and protoconid of the P₃ indicate a primitive evolutionary stage of the Molina de Aragón material as well (López, 1978). The size of the anteroconid and of the metaconid also agree with those of *P. crusafonti*. In more evolved assemblages of *P. crusafonti* the crochet is absent in 50 % of the specimens (López & Thaler, 1975), but in Molina de Aragón the crochet is always present, being reduced and displaced towards the metacone in 40 % of the specimens. The connection between the protoconid and the talonid, the absence of fossets in the lower molars, the shape of the hypercone of P² and the shape of the hyperloph of P³ are all typical of *P. crusafonti*.

All the above-mentioned features point at a little-evolved stage of *P. crusafonti*, as some characters agree with those of its Aragonian ancestor *P. oeningensis*.

Biostratigraphy and paleoecological analysis

The presence of *Hipparion* in the fauna of Molina de Aragón (personal communication J. Morales, Madrid) determines the lower limit of its age as Vallesian.

The upper age limit is determined by the presence of *Megacricetodon ibericus*. According to Daams & Freudenthal (1981) this species is restricted to biozone H (lower Vallesian).

The most abundant rodent in Molina de Aragón is *Heteroxerus* cf. *H. huerzeleri* (28 %) followed by *Hispanomys nombrevillae* (24 %). On the other hand, the glirids only constitute 1 % of the total of the rodents. Percentages of glirids under 5 % have been observed too in Masia del Barbo 2A and 2B, Peralejos 4 and Peralejos D. The most abundant larger mammal in Molina de Aragón is a medium-sized Caprinae (personal communication J. Morales, Madrid). Both the medium-sized Caprinae and the ground-squirrel *H. cf. H. huerzeleri* are characteristic for a semiarid climate and an open landscape. On the other hand, *Democricetodon sulcatus*, although scarcely represented, seems to be characteristic for a more wet biotope (van de Weerd & Daams, 1978).

These authors suggest, that the Aragonian-Vallesian boundary in the Calatayud-Teruel Basin represents a more humid climate than that of the Middle Aragonian because of the observed decrease of the number of ground squirrels and the appearance of beavers. However, their localities are situated in the lower parts of the basin (a common feature in sedimentary localities) and the fissure filling of Molina de Aragón is

The relative abundance of the species has been calculated as a percentage of the sum of all M1 and M2.

<i>Hispanomys nombrevillae</i>	24 %
<i>Megacricetodon ibericus</i>	18 %
<i>Megacricetodon</i> ex gr. <i>minor-debruijni</i>	< 1 %
<i>Renzimys bilobatus</i>	18 %
<i>Democricetodon sulcatus</i>	4 %
<i>Heteroxerus</i> cf. <i>H. huerzeleri</i>	28 %
<i>Heteroxerus molinensis</i>	6 %
Sciuridae gen. et sp. indet.	< 1 %
<i>Myomimus dehmi</i>	1 %
<i>Tempestia hartenbergeri</i>	< 1 %

situated in a higher and well-drained zone (a normal situation for fissure fillings), and these differences might influence the faunal composition.

Alberdi et al. (1981) point out, that not a single species from Nombrevilla is characteristic for a wet biotope and favour the assumption that the Aragonian-Vallesian boundary period has been relatively dry. Their main reason for this assumption is the predominance of *Heteroxerus* in the fauna of Los Valles de Fuentidueña, a ground squirrel preferring a dry biotope. However, Sesé & López (1981) state that by far the most abundant rodent is *Chalicomys jaegeri*, a beaver preferring permanent rivers or lakes. Moreover, the presence of *Dorcattherium*, a semiaquatic animal (Alberdi, 1981), in the fauna of Los Valles de Fuentidueña supports the hypothesis of a relatively wet period. In this way the wet phase of the Aragonian-Vallesian boundary interval, as suggested by van de Weerd & Daams (1978), may be extended to the Duero Basin.

Daams & Freudenthal (1981) observed that the Gliridae are highly diversified during the Late Oligocene and Early Miocene, and that they become the second most abundant group in the Spanish localities of the Early Vallesian; afterwards they decrease in number of species and specimens. The fauna of Molina de Aragón does not fit very well into this picture, because the Molina assemblage is characteristic of a semiarid biotope (the scarcity of glirids is obvious) and open landscapes.

Arboreal cover must have been less than in the Vallés-Penedés Basin during the second part of the Early Vallesian, because in that region the faunas are characteristic of wet biotopes (Agustí, 1982). Obviously, the faunal differences in the known Spanish localities of Early Vallesian age indicate the existence of different biotopes.

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