Eucricetodon and *Melissiodon* (Cricetidae, Rodentia) from the Ramblian and Lower Aragonian of the Calamocha area (Calatayud-Teruel Basin, Spain)

C. Sesé

Sesé, C. *Eucricetodon* and *Melissiodon* (Cricetidae, Rodentia) from the Ramblian and Lower Aragonian of the Calamocha area (Calatayud-Teruel Basin, Spain). — Scripta Geol., 83: 1-17, 4 figs., 2 pls, Leiden, May 1987.

This paper is one in a series of monographs on the mammal faunas from the type area of the Aragonian and adjacent areas (Calamocha area) in the provinces of Teruel and Zaragoza. It deals with the description and palaeoenvironmental interpretation of *Eucricetodon* and *Melissiodon* (Cricetidae; hamsters).

C. Sesé, Museo Nacional de Ciencias Naturales, C.S.I.C., José Gutiérrez Abascal 2, 28006 Madrid, Spain.

Introduction

In the summers of 1976-1983 extensive collections from micromammal-bearing deposits have been made in the type area of the Aragonian and adjacent areas in the provinces of Zaragoza and Teruel. Preliminary reports on these faunas have been published by Daams & Freudenthal (1981), Daams & van der Meulen (1984) and Daams (1985). This paper deals with the cricetid genera *Eucricetodon* and *Melissiodon*. Most other groups of micro- and macromammals are now under study by various students from Spain and The Netherlands. The first paper on the microfauna of one of the localities in the Calamocha area (Navarrete del Río) was published in 1978 by Adrover.

For the stratigraphic order of the studied localities and more complete information on the faunas, the reader is referred to the above-mentioned publications.

In the present paper 'lower Miocene' (with lower case 'l') is used in an informal way. At present a combined Spanish-Dutch research team is trying to define a new stage for the continental lower Miocene of Spain. The Oligocene-Miocene boundary is not yet clear, nor is the lower boundary of the Aragonian. In this paper 'lower Miocene' stands for the lower part of the Aragonian, plus a preceding stage, the lower limit of which should be the boundary between Oligocene and Miocene, not taking into account the discrepancy that may exist between continental and marine stratigraphy.

The nomenclature of the cheek teeth is after Mein & Freudenthal (1971). The teeth have been measured using an ocular micrometer on a Nikon SZ 10 microscope. The measurements are given in millimetres.

STORAGE OF THE MATERIAL

The material is stored in the following collections:
Rijksmuseum van Geologie en Mineralogie, Leiden, The Netherlands: Ramblar 1, La Dehesa, Bañon 2, Bañon 11 A.
Museo Nacional de Ciencias Naturales, Madrid, Spain: Navarrete del Río, Ramblar 3 B, Ramblar 7, Valhondo 1.

Acknowledgements

This study has been made possible by the cooperation of the following institutions and persons: the 'Comisión Nacional de Geología' (Spain), the 'Instituto Geológico y Minero de España (I.G.M.E.); Drs N. López Martínez (Madrid), M. Freudenthal (Leiden) and R. Daams (Groningen; now at the Museo Nacional de Ciencias Naturales, Madrid). The excavations have been financed by the Rijksmuseum van Geologie en Mineralogie (The Netherlands), the State University of Groningen (The Netherlands), The Netherlands Organization for the Advancement of Pure Research (Z.W.O.), and the I.G.M.E. We gratefully acknowledge these contributions. The plates have been drawn by the author, the text-figures have been made by J. Arroyo (Madrid). Many thanks are extended to Drs R. Daams and M. Freudenthal for helpful comments and critically reading the manuscript.

Systematic descriptions

Subfamily Eucricetodontinae Mein & Freudenthal, 1971
Genus *Eucricetodon* Thaler, 1966

Eucricetodon aff. *aquitanicus* Baudelot & de Bonis, 1968
Pl. 1, figs. 1-16.

LOCALITY NAVARRETE DEL RIO

Material and measurements — See Table 1; Figs. 1-3; Pl. 1, figs. 1-10.

Description — The length of the lower and upper cheek teeth decreases from M1 to M3.

Table 1. Measurements of the *Eucricetodon* teeth from Navarrete del Río, Ramblar 1, Ramblar 3 B, Ramblar 7, Valhondo 1, and La Dehesa.

Element	Localities	Length				Width			
		N	min.	mean	max.	N	min.	mean	max.
M_1	Valhondo 1	7	2.48	2.51	2.57	9	1.48	1.67	1.74
	Ramblar 7	2	2.22	2.25	2.28	2	1.62	1.63	1.65
	Ramblar 1	3	2.25	2.32	2.37	3	1.54	1.61	1.66
	Navarrete	31	2.00	2.16	2.37	32	1.28	1.45	1.68
M_2	Valhondo 1	10	1.91	2.10	2.20	8	1.71	1.81	1.88
	Ramblar 7	3	1.97	2.01	2.05	3	1.57	1.68	1.80
	Ramblar 1	8	1.85	1.96	2.08	8	1.51	1.62	1.68
	Navarrete	34	1.74	1.90	2.02	35	1.42	1.58	1.74
M_3	Valhondo 1	8	1.51	1.68	1.77	9	1.40	1.48	1.57
	Ramblar 7	2	1.54	1.59	1.65	4	1.31	1.42	1.48
	Navarrete	17	1.42	1.54	1.71	17	1.22	1.33	1.48
M^1	Valhondo 1	11	2.48	2.63	2.85	11	1.77	1.93	2.08
	Ramblar 7	5	2.45	2.63	2.77	5	1.80	1.88	1.94
	Ramblar 3 B	1	—	2.64	—	1	—	1.91	—
	Ramblar 1	3	2.31	2.34	2.37	3	1.65	1.71	1.80
	Navarrete	21	2.22	2.34	2.57	23	1.54	1.72	1.84
M^2	Valhondo 1	8	1.92	2.02	2.05	8	1.65	1.85	1.94
	Ramblar 7	1	—	2.00	—	1	—	1.85	—
	Ramblar 1	4	1.80	1.85	1.97	4	1.51	1.58	1.65
	Navarrete	19	1.60	1.79	1.94	19	1.42	1.57	1.77
M^3	La Dehesa	1	—	1.22	—	1	—	1.34	—
	Ramblar 1	4	1.48	1.52	1.62	4	1.40	1.48	1.51
	Ramblar 7	1	—	1.31	—	1	—	1.42	—
	Ramblar 1	2	1.34	1.34	1.34	2	1.37	1.38	1.40
	Navarrete	12	1.17	1.25	1.37	12	1.14	1.23	1.34

In the lower jaw the width of the M_2 is larger than that of M_1 and M_3. These characters are valid for all the *Eucricetodon* assemblages from the Calamocha area.

M_1 — The anteroconid is a simple and transversely elongated cusp. The labial anterolophid is connected to the basis of the protoconid. The lingual anterolophid is connected to the metaconid. The anterolophulid is connected to the anterior part of the protoconid, and it is continuous in 11 specimens; in the other 19 specimens it is interrupted or absent. The anterior metalophulid is present in 16 out of 30 specimens and it points obliquely forward. The posterior metalophulid is present in 23 out of 30 specimens and it points obliquely backward. In some of these 23 specimens the posterior metalophulid is not connected to the posterior part of the protoconid, but it ends freely. The ectolophid is short, and it is interrupted in 5 specimens. The mesoconid is a well-developed cusp on the ectolophid in all specimens. A short mesolophid is present in 25 out of 30 specimens. The ectomesolophid is generally well developed. The connection between the hypoconid and the ectolophid is interrupted in 10 out of 30 specimens. The sinusid is labially closed by a low ridge, on which a small ectostylid is present in some specimens. The posterolophid is connected to the entoconid.

M_2 — The anteroconid is generally a distinct cusp. The lingual anterolophid is absent in 31 specimens, it is a reduced ridge on the anterior side of the metaconid in 5

specimens, and it is a short and low ridge, enclosing a small anterosinusid in 2 specimens. The long, labial anterolophid reaches the base of the protoconid. In 1 specimen the labial anterolophid is long, and it descends towards the posterior part of the tooth, thus separating the protoconid and hypoconid from the labial border. The mesolophid is absent in 11 specimens, and it is short in 27. The mesoconid is less developed than in M_1, and in some specimens it does not form a distinct cusp. The ectomesolophid is less developed than in M_1. It is generally absent, and if present, it is shorter except in one specimen in which it is very long, joining the labial ridge. In one specimen there is a short and reduced labial posterolophid.

M_3 — The lingual anterolophid is absent in 15 specimens, it is a reduced ridge in 2, and it is short and enclosing a small anterosinusid in 2 specimens. The mesolophid is absent in 15 specimens and it is very short in 4.

M^1 — The anterocone is a symmetrically split cusp in all specimens. A labial and a lingual ridge descend from the anterocone, reaching the basis of the paracone and protocone respectively. The anterolophule is a continuous ridge between the anterocone and protocone in 18 specimens, and it is interrupted in 3. The protolophule is connected to the entoloph, and it is more or less transverse or directed obliquely backward. The entoloph is short and disconnected from the protocone in 6 out of 21 specimens. The mesocone is generally present, although in worn specimens it is not a distinct cusp. The mesoloph is absent in 12 specimens, it is short in 8, and of medium length in 1 specimen. The sinus is more or less transverse or it points slightly forward. The metalophule points backward. The posteroloph and posterosinus are absent in 12 specimens, and there is a small posteroloph enclosing a posterosinus in 9 specimens. The teeth have three roots; the lingual one shows a longitudinal furrow in some specimens, thus marking a subdivision.

M^2 — The long labial anteroloph is generally connected to the basis of the paracone. The protolophule is connected to the entoloph in all specimens. The posterior ectoloph on the paracone is present in 23 specimens, and it is absent in 2. The mesoloph is better developed than in M^1; it is absent in 2 specimens. The sinus points strongly forward. The metalophule points obliquely backward, and it is connected to the posteroloph in 23 specimens; it is more or less transverse and connected to the hypocone in 5 specimens. The posteroloph and posterosinus are better developed than in M^1; they lack in 1 specimen, there is a short posteroloph enclosing a small posterosinus in 21 specimens, and a long one enclosing a relatively large posterosinus in 6.

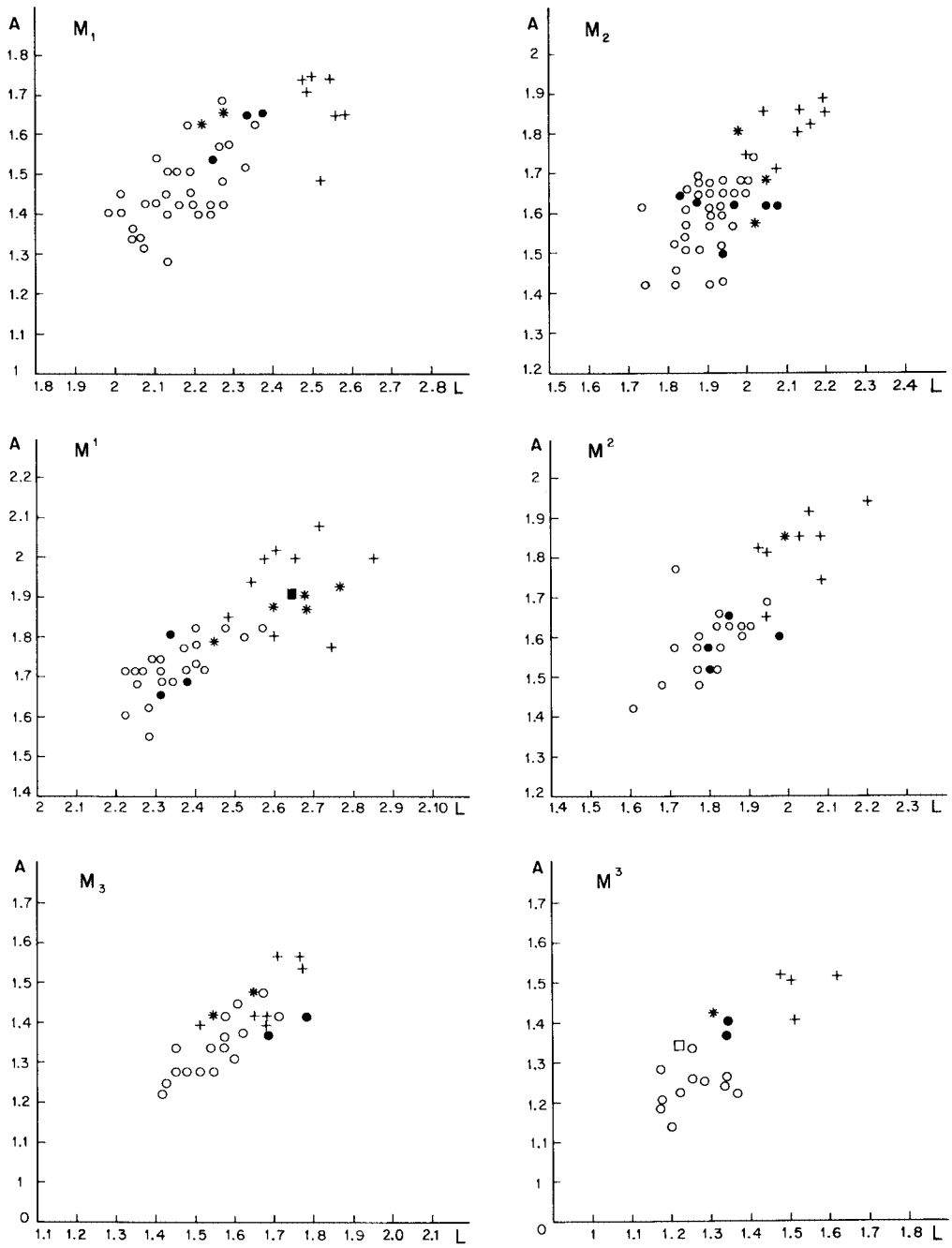
M^3 — The long labial anteroloph is connected to the basis of the paracone. The mesoloph is absent in 1 specimen, short in 2, of medium length in 2, and it reaches the labial border in 9 specimens. The posterior part of the tooth is reduced.

LOCALITY RAMBLAR 1

Material and measurements — See Table 1; Figs. 1-3; Pl. 1, figs. 11-16.

Description

M_1 — The variation of the anterolophid is of the same degree as that of the M_1 from Navarrete, with the exception of 1 specimen in which the labial anterolophid is long and descends towards the posterior part of the tooth, thus separating the protoconid and hypoconid from the labial border. The anterolophulid is continuous in 5 specimens, and it is interrupted in 3. The anterior metalophulid is present in 5, and lacks in 3 specimens. The posterior metalophulid is present in 6, and absent in 5 specimens. The mesoconid is



Figs. 1-3. Length (L) - width (A) scatter diagrams of respectively the M_1 and M_2, M^1 and M^2, M_3 and M^3 of the *Eucricetodon* assemblages from the Calamocha area. For an explanation of the symbols see Fig. 4.

a distinct cusp in all specimens. The ectomosolophid is absent in 5 and short in 6 specimens. The mesolophid is absent in 1 specimen, it is short in 10 and of medium length in 1.

M_2 — The lingual anterolophid is absent in 2 specimens, it is a reduced ridge in 3 and short but enclosing a small anterosinusid in 6. The mesolophid is absent in 4 specimens, short in 9 and of medium length in 1. The ectomesolophid is short in 3 specimens, and absent in 11. A trace of a labial posterolophid is present in 1 specimen.

M_3 — The lingual anterolophid is absent in 2 specimens, it is a very reduced ridge in 1, and short in 2 specimens. The mesolophid is absent.

M^1 — The anterocone is symmetrically split in all specimens, but as the majority of the M^1 from Ramblar are worn, this character is less distinct. The anterolophule is continuous and the mesoloph is short. The mesocone is a well-developed cusp. The posteroloph and posterosinus are absent in 1 specimen, and there is a short posteroloph enclosing a narrow posterosinus in 4 specimens. The three roots are similar to those from Navarrete.

M^2 — The lingual anteroloph is poorly developed, and it is only present as a reduced ridge at the anterior side of the protocone in 3 out of 10 specimens. The posterior ectoloph on the paracone is present in all specimens. The mesoloph is absent in 1, short in 6 and of medium length in 3 specimens. The metalophule is posterior in 9 specimens; another specimen shows an interrupted anterior metalophule, and the posteroloph presents a short and interrupted ridge pointing towards the metacone, indicating an incomplete posterior metalophule. The posteroloph is short and the posterosinus small in 7 specimens, and in 1 specimen the posteroloph is long, enclosing a wide posterosinus.

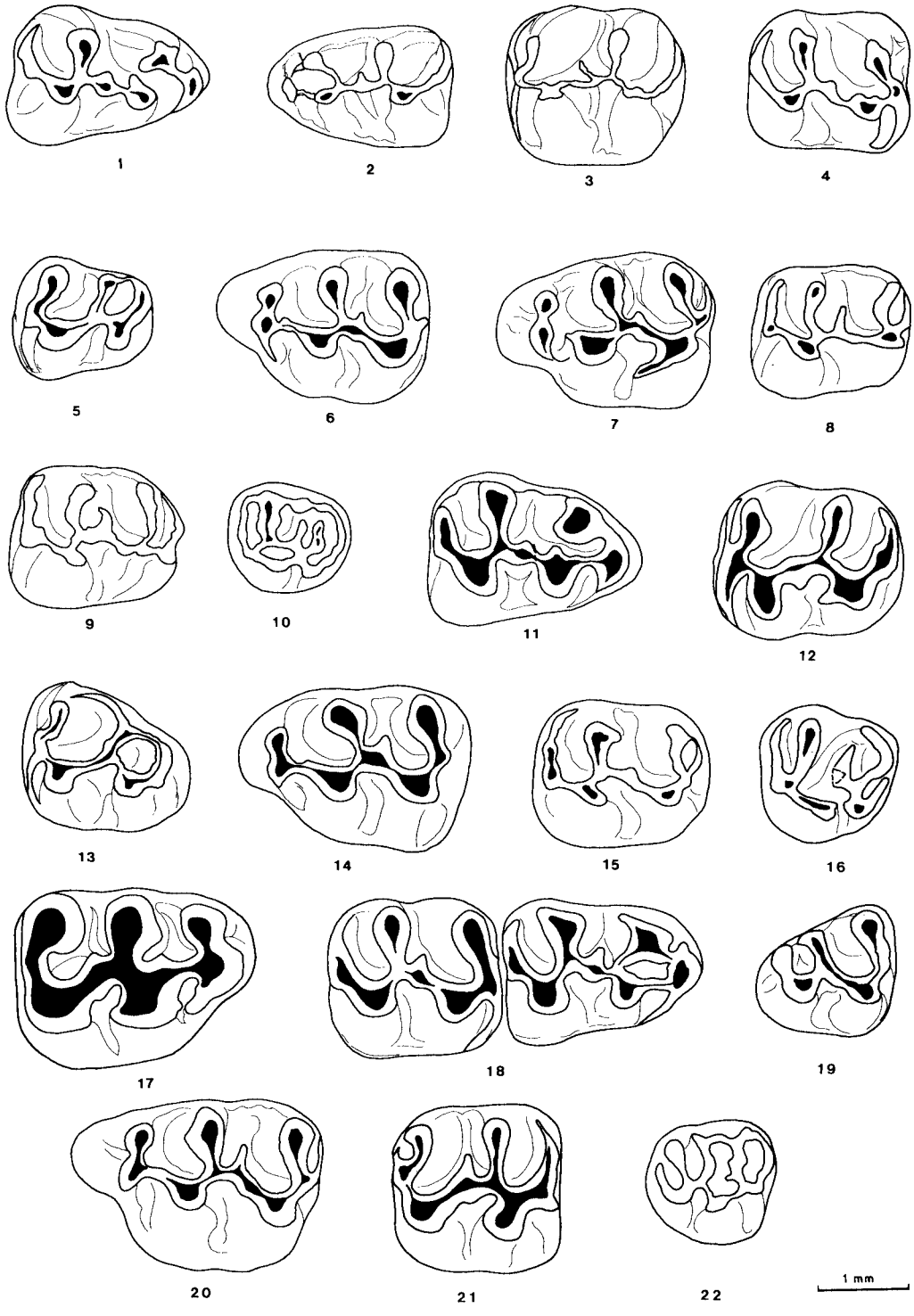
M^3 — The mesoloph is long and reaches the labial border in all 7 specimens.

Plate 1

Figs. 1-16. *Eucricetodon* aff. *aquitanicus* Baudelot & de Bonis, 1968
1. M_1 dext. (N 5); Navarrete del Río.
2. M_1 sin. (N 103); Navarrete del Río.
3. M_2 sin. (N 104); Navarrete del Río.
4. M_2 dext. (N 52); Navarrete del Río.
5. M_3 sin. (N 105); Navarrete del Río.
6. M^1 sin. (N 34); Navarrete del Río.
7. M^1 sin. (N 26); Navarrete del Río.
8. M^2 sin. (N 39); Navarrete del Río.
9. M^2 sin. (N 101); Navarrete del Río.
10. M^3 sin. (N 102); Navarrete del Río.
11. M_1 dext. (RGM 333 979); Ramblar 1.
12. M_2 sin. (RGM 333 960); Ramblar 1.
13. M_3 sin. (RGM 333 967); Ramblar 1.
14. M^1 sin. (RGM 334 005); Ramblar 1.
15. M^2 sin. (RGM 333 983); Ramblar 1.
16. M^3 sin. (RGM 334 011); Ramblar 1.

Figs. 17-22. *Eucricetodon* sp. ex gr. *aquitanicus-infralactorensis*
17. M^1 dext. (R3 B 1); Ramblar 3 B.
18. M_1-M_2 dext. of the same individual (R7 1); Ramblar 7.
19. M_3 dext. (R7 11); Ramblar 7.
20. M^1 sin. (R7 15); Ramblar 7.
21. M^2 dext. (R7 19); Ramblar 7.
22. M^3 dext. (R7 33); Ramblar 7.

Plate 1



Eucricetodon sp. (ex gr. *aquitanicus-infralactorensis*)
Pl. 1, figs. 17-22.

LOCALITY RAMBLAR 3 B

Material and measurements — See Table 1; Fig. 2; Pl. 1, fig. 17.

Description

M^1 — The anterocone is a symmetrically split cusp. The anteroplophule is continuous. The mesoloph is short in both specimens. The posteroloph and posterosinus are absent in both specimens.

LOCALITY RAMBLAR 7

Material and measurements — See Table 1; Figs. 1-3; Pl. 1, figs. 18-22.

Description

M_1 — The anteroconid is elongated and the labial anterolophid is connected to the base of the protoconid. The lingual anterolophid is connected to the metaconid. The anterolophulid is continuous and the metalophulid is double in both specimens. The mesoconid is a distinct cusp. The mesolophid is short in 1 specimen, an ectomesolophid is present in the other one.

M_2 — The lingual anterolophid is absent in 3 specimens, it is a small reduced ridge in 1, and short in 2 specimens. The mesoconid is a distinct cusp. There is no ectomesolophid. The mesolophid is short in 3 specimens and absent in the other 3.

M_3 — The lingual anterolophid is absent in all 5 specimens. The mesolophid is absent in 3 and short in 2 specimens.

M^1 — The anterocone is a symmetrically split cusp. A labial and a lingual ridge descend from the anterocone reaching the basis of the paracone and protocone respectively. The anterolophule is continuous in all 6 specimens. The mesoloph is absent in 2 specimens, it is short in 3 and of medium length in 1. The sinus points slightly forward. The posteroloph and posterosinus are absent in 3 specimens and there is a small posteroloph enclosing a narrow posterosinus in 2. The roots are similar to those of the assemblage from Navarrete.

M^2 — The posterior ectoloph on the paracone is present in 5 specimens and absent in 2. The mesoloph is short in 2 specimens, of medium length in 4 and long, reaching the paracone near the labial border of the tooth, in 1 specimen. There is a posterior metalophule in all 6 specimens. There is a short posteroloph enclosing a narrow posterosinus in all 5 specimens in which these structures are visible.

M^3 — The mesoloph is long and it reaches the low ridge, that closes the mesosinus at the labial border, in both specimens.

Eucricetodon aff. *infralactorensis* (Viret, 1929)
Pl. 2, figs. 2-7.

LOCALITY VALHONDO 1

Material and measurements — See Table 1; Figs. 1-3; Pl. 2, figs. 2-7.

Description

M_1 — This element presents various characters which differ from those of the above described *Eucricetodon* assemblages. The anteroconid is elongated in all 6 specimens, and in 3 of these this cusp is slightly split into two lobes (see Pl. 2, fig. 2). The lingual and labial anterolophids are also different. In the assemblages described above they are robust and long, but in Valhondo 1 the lingual anterolopid is absent in 2 specimens and it is low and narrow in the other 4. The labial anterolophid is absent in 1 specimen and it is a narrow ridge in the other 3. The anterolophulid is continuous in 3 specimens and it is interrupted in 6. The anterior metalophulid is present in 7, and absent in 2 specimens. The ectolophid is connected to the protoconid in 7 specimens, and interrupted in 3. The ectolophid is connected to the hypoconid in 8 specimens and interrupted in 2. The mesoconid is a well-developed cusp. The mesolophid is absent in 7 specimens and short in 10. The ectomesolophid is present in 10 out of 12 specimens. The posterolophid is long in some specimens, and it joins the entoconid.

M_2 — The lingual anterolophid is absent in 10 specimens, it is a reduced ridge in 3 and short in 2. The mesoconid is a well-developed cusp. The mesolophid is absent in 4 specimens, and short in 12. M_3 — The lingual anterolophid is absent in 10 specimens, and a reduced ridge in 5. The mesolophid is absent in 12 specimens and short in 4.

M^1 — The anterocone is a symmetrically split cusp. The anterolophule is continuous in all 12 specimens. The mesocone is a well-developed cusp. The mesoloph is absent in 4 specimens, short in 7 and of medium length in 1. The posteroloph and posterosinus are absent in 4 specimens and there is a short posteroloph enclosing a small posterosinus in 7. The M^1 has three roots. The furrow of the lingual root, indicating a beginning subdivision, is better developed than it is in the assemblages described above.

M^2 — The posterior ectoloph on the paracone is present in 15 out of 17 specimens. The mesoloph is short in 12 specimens and of medium length in 6. A short posteroloph enclosing a small posterosinus is present in 13 specimens, and a long posteroloph enclosing a wide and long posterosinus is present in 2.

M^3 — The mesoloph is short in 2 specimens and it is long, reaching the low labial ridge, in 3.

Eucricetodon sp.
Pl. 2, fig. 1.

LOCALITY LA DEHESA

Material and measurements — See Table 1; Fig. 3; Pl. 2, fig. 1.

Description

M^2 — The single tooth present, is a fragment of which the anterior and posterior part are missing. The paracone shows a posterior ectoloph. The mesocone is a well-developed cusp. The mesoloph is of medium length. There is a posterior metalophule. There is a short posteroloph enclosing a small posterosinus.

M^3 — The only tooth available displays a morphology similar to that of assemblages described above. The mesoloph is long, and it reaches the low ridge closing the mesosinus labially.

DISCUSSION

Vianey-Liaud (1972, 1974) studied European *Eucricetodon* assemblages and demonstrated that there are two lineages during the Oligocene which continue into the early Miocene. These two lineages differ from one another in size and morphology. The lineage of larger size has only been found in Central Europe, and is represented in the Middle and Upper Oligocene by *E. huerzeleri* Vianey-Liaud, 1972 and in the lower Miocene by *E. hochheimensis* (Schaub, 1925) and *E. haslachensis* (Schaub, 1925) successively. The representatives of the other lineage, of smaller size, have a larger area of dispersal: they have also been found in Western and Southwestern Europe. In the Oligocene this lineage is successively represented by the following species: *E. atavus* (Misonne, 1957) – *E. huberi* (Schaub, 1925) – *E. quercyi* Vianey-Liaud, 1972 – *E. praecursor* (Schaub, 1925). In the lower Miocene this lineage is successively known by *E. collatus* (Schaub, 1925) – *E. gerandianus* (Gervais, 1848) – *E. aquitanicus* Baudelot & de Bonis, 1968 – *E. infralactorensis* (Viret, 1930). The lineage of smaller species is characterized by the following trends during the early Miocene (Vianey-Liaud, 1972, 1974; Aguilar, 1974):
increase in size of the M1 and M2;
disappearance of the posterior branch of the protocone and protoconid, and that of the hypocone and hypoconid;
reduction of the mesoloph and mesolophid;
reduction of the posterosinus in M^2 and M^3;
reduction of the lingual anterolophid in M_2 and M_3;
more oblique ectolophids and ectolophs;
a change of the orientation of the ridges from pointing obliquely forward to pointing backward in the upper molars, and from transverse to forward in the lower molars;
progressive development of the posterior ectoloph of the paracone in M^2 (Daams, 1976).
These trends indicate that the *Eucricetodon* assemblages from the Calamocha area are in a progressive stage.

Hitherto, this lineage was known in the lower Miocene of Spain by *E. collatus* from Huete (Loranca Basin, Cuenca; Diaz Molina & López Martínez, 1979), *E.* cf. *collatus*

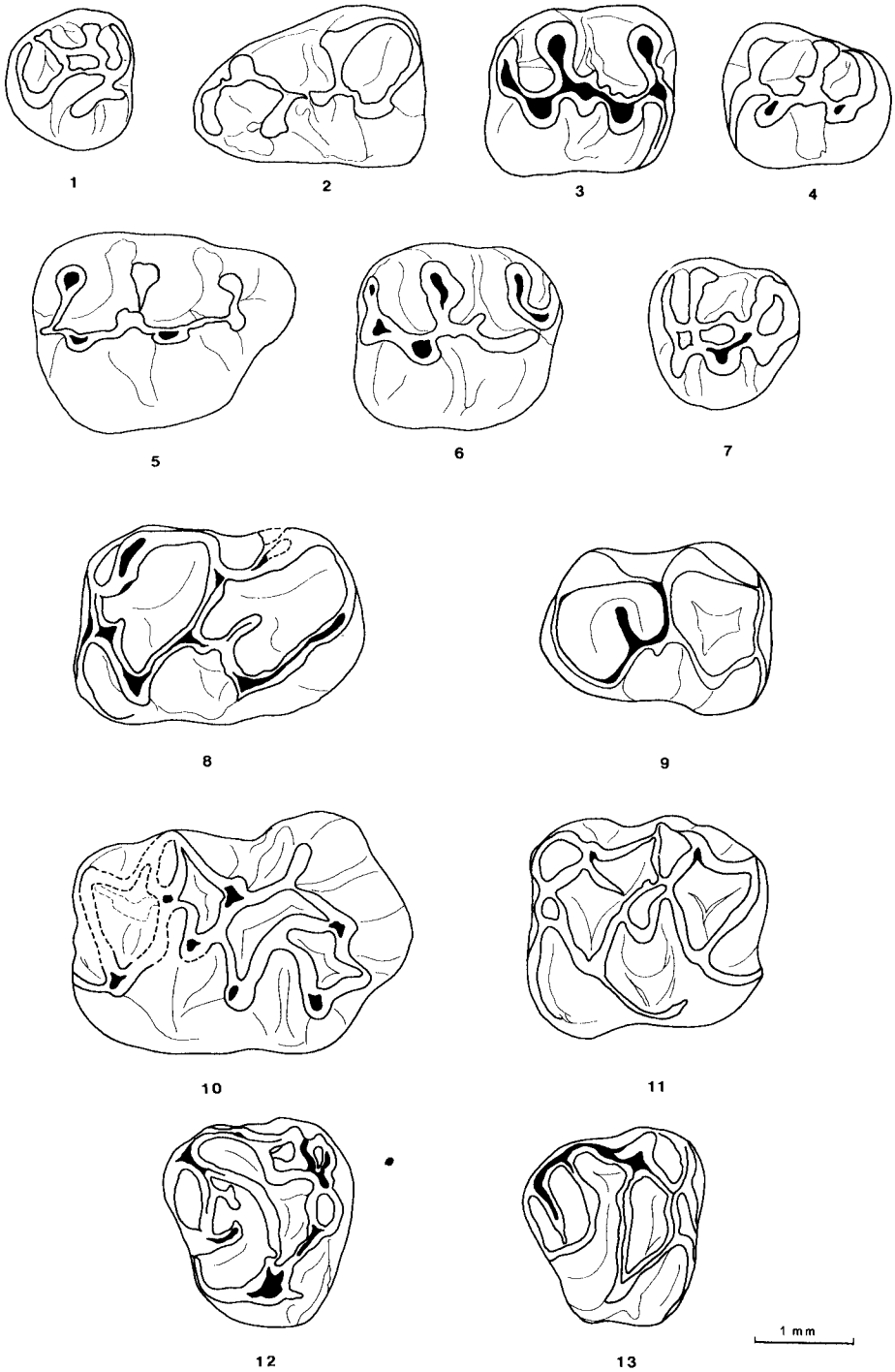
Plate 2

Fig. 1. *Eucricetodon* sp.
M^3 dext. (D 1); La Dehesa.

Figs. 2-7. *Eucricetodon* aff. *infralactorensis* Viret, 1929
2. M_1 sin. (V1 1); Valhondo 1.
3. M_2 dext. (V1 11); Valhondo 1.
4. M_3 sin. (V1 15); Valhondo 1.
5. M^1 dext. (V1 26); Valhondo 1.
6. M^2 sin. (V1 33); Valhondo 1.
7. M^3 sin. (V1 43); Valhondo 1.

Figs. 8-13. *Melissiodon* aff. *dominans* Dehm, 1950
8. M_2 sin. (RGM 334 043); Bañon 2.
9. M_3 dext. (R3 B 1); Ramblar 3 B.
10. M^1 dext. (R7 1); Ramblar 7.
11. M^2 sin. (RGM 334 026); Ramblar 1.
12. M^3 dext. (RGM 334 021); Ramblar 1.
13. M^3 dext. (RGM 334 038); Bañon 11.

Plate 2



from Autol (Ebro Basin, La Rioja; Cuenca, 1983), *E. gerandianus* from Cetina de Aragón (Almazán Basin, Zaragoza; Daams, 1976), *E.* cf. *aquitanicus* from Loranca (Loranca Basin, Cuenca; Diaz Molina & López Martínez, 1979), and *E.* aff. *aquitanicus* from Navarrete del Río (Calatayud-Teruel Basin, Teruel; Adrover, 1978).

Cetina de Aragón is the only Spanish lower Miocene locality in which two *Eucricetodon* species are present: *E. gerandianus* and *E. cetinensis* Daams, 1976. The latter species is of larger size than found in any of the other *Eucricetodon* assemblages from Spain. Moreover, it differs from the various *Eucricetodon* species from the Calamocha area by the very long labial anterolophid of the M_1 and the simple bean-shaped anterocone of M^1 (Daams, 1976). Therefore, *E. cetinensis* is thought not to be related to any of the species described in this paper.

The *Eucricetodon* assemblages from the Calamocha area are more evolved than *E. gerandianus* from Cetina de Aragón (Daams, 1976) as is evidenced by the following features:
the larger size;
the split anterocone in all the M^1;
the more reduced mesoloph and mesolophid;
the more reduced posterosinus in the upper molars;
the better development of the posterior ectoloph on the paracone in M^2.

In the successive localities from the Calamocha area a trend can be seen in *Eucricetodon* towards size increase of the M1 and M2 (see Fig. 4). The same trend is present in *Eucricetodon* from the lower Miocene of France (de Bonis, 1973).

The *Eucricetodon* assemblage from Valhondo 1 is more evolved than the other assemblages from the Calamocha area in the following features:
the larger tooth size;
the more deeply split anterocone of the M^1;
the elongated anteroconid of the M_1, which is even slightly split in some specimens;
the lingual root of the M^1 has a more conspicuous longitudinal furrow.

Compared to the *Eucricetodon* species from the lower Miocene of France, the assemblages from Navarrete, Ramblar 1, Ramblar 3 B, and Ramblar 7 present a major resemblance with *E. aquitanicus*. But some differences can be mentioned as progressive features of the assemblages from the Calamocha area, as compared with *E. aquitanicus* from Laugnac (after de Bonis, 1973):
the larger tooth size of the Spanish assemblages;
the split anterocone of the M^1 (in *E. aquitanicus* from Laugnac the anterocone is only split in 3 out of 9 specimens, whereas in the Spanish assemblages all M^1 have subdivided anterocones);
the mesoloph and posterosinus are more reduced in the Spanish assemblages (even in *E. infralactorensis* from Estrepouy these two features are less reduced).

E. aquitanicus from Bouzigues (after Adrover, 1978) is similar in size to the species from Navarrete and Ramblar 1, and also presents the split anterocone of the M^1 in all specimens, as can be seen in the assemblage from the Calamocha area. Nevertheless, the assemblages from Ramblar 3 B and Ramblar 7 have a tooth size intermediate between that of *E. aquitanicus* from Bouzigues and that of *E. infralactorensis* from Estrepouy (Adrover, 1978).

Because of its size and morphology, the assemblage from Valhondo 1 resembles most that of *E. infralactorensis* (Adrover, 1978; de Bonis, 1973). It differs, however, from that species by the following features:
the more reduced mesoloph and posterosinus in the M^1 and M^2;
the elongated anteroconid of the M_1 which is even slightly split in some specimens.

Table 2. Frequency of variation of some morphological characters of the *Eucricetodon* teeth from Navarrete (N), Ramblar 1 (R1), Ramblar 3 B (R3B), Ramblar 7 (R7), Valhondo 1 (V1), and La Dehesa (LD).

			N	R1	R3B	R7	V1	LD
M_1	anterolophulid	interrupted	19	3	-	0	6	-
		continuous	11	5	-	2	3	-
	anterior metalophulid	absent	14	3	-	0	5	-
		present	16	5	-	2	2	-
	posterior metalophulid	absent	7	5	-	0	2	-
		present	23	6	-	2	7	-
	mesolophid	absent	5	1	-	1	7	-
		short	25	20	-	2	10	-
		medium	0	1	-	0	0	-
M_2	lingual anterolophid	absent	31	2	-	3	10	-
		residual	5	3	-	1	3	-
		short	2	6	-	2	2	-
	mesolophid	absent	11	4	-	3	4	-
		short	27	9	-	3	12	-
		medium	0	1	-	0	0	-
M_3	lingual anterolophid	absent	15	2	-	5	10	-
		residual	2	1	-	0	5	-
		short	2	2	-	0	0	-
	mesolophid	absent	15	5	-	3	12	-
		short	4	0	-	2	4	-
M^1	anterocone	single	0	0	0	0	0	-
		double	21	5	2	6	13	-
	anterolophule	interupted	3	0	0	0	0	-
		continuous	18	6	2	6	12	-
	mesoloph	absent	12	0	0	2	4	-
		short	8	5	2	3	7	-
		medium	1	0	0	1	1	-
	posterosinus/posteroloph	absent	12	1	2	3	4	-
		small	9	4	0	2	7	-
		medium	0	0	0	0	0	-
M^2	posterior ectoloph	absent	5	0	-	2	2	0
	of paracone	present	23	10	-	5	15	1
	mesoloph	absent	2	1	-	0	0	0
		short	19	6	-	2	12	0
		medium	6	3	-	4	6	1
		long	1	0	-	1	0	0
	metalophule	anterior	0	1	-	0	0	0
		transversal	5	0	-	0	0	0
		posterior	23	9	-	6	17	1
	posterosinus/posteroloph	absent	1	0	-	0	0	0
		small	21	7	-	5	13	1
		large	6	1	-	0	2	0
M^3	mesoloph	absent	1	0	-	0	0	0
		short	2	0	-	0	2	0
		medium	2	0	-	0	0	0
		long	9	7	-	2	3	1

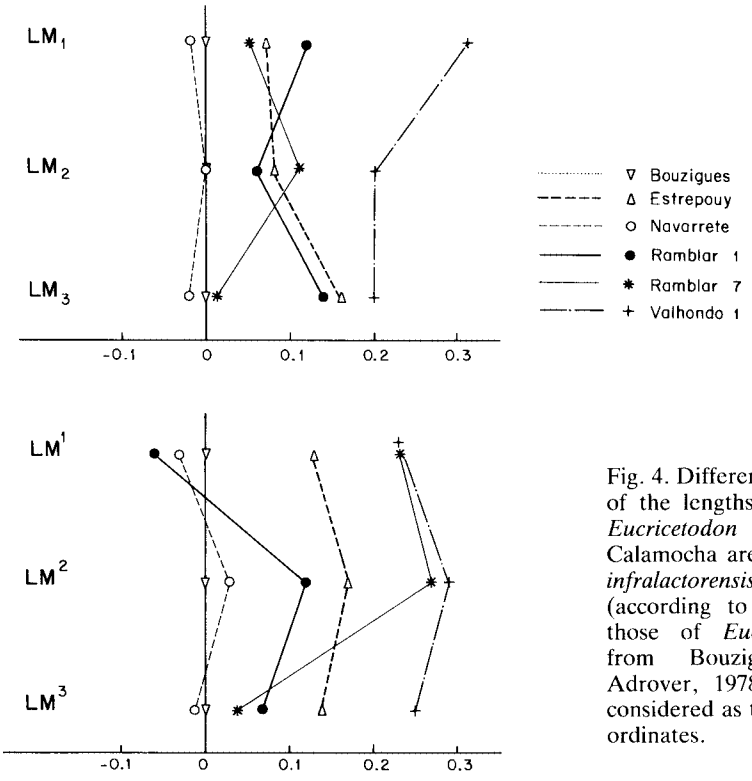


Fig. 4. Differences between the means of the lengths of the molars of the *Eucricetodon* assemblages from the Calamocha area and of *Eucricetodon infralactorensis* from Estrepouy (according to Adrover, 1978), and those of *Eucricetodon aquitanicus* from Bouzigues (according to Adrover, 1978). The last ones are considered as the 'zero' values on the ordinates.

Eucricetodon sp. from La Dehesa is so poorly represented that this material does not allow a specific identification.

Subfamily Melissiodontinae Stehlin & Schaub, 1951
Genus *Melissiodon* Schaub, 1920

Melissiodon aff. *dominans* Dehm, 1950
Pl. 2, figs. 8-13.

Localities — Ramblar 1, Ramblar 3 B, Ramblar 7, Bañon 2, and Bañon 11 A.

Material and measurements — See Table 3; Pl. 2, figs. 8-13. Ramblar 1: 2 damaged M_1, 2 damaged M_2, 1 M^2 and 1 damaged M^2, 2 M^3 and 1 damaged M^3, 9 fragments of indetermined molars. Ramblar 3 B: 1 damaged M_2 and 1 M_3. Ramblar 7: 1 M^1 and 1 molar fragment. Bañon 2: 1 M_2, and 1 molar fragment. Bañon 11 A: 1 damaged M_1, 2 damaged M_3, 1 damaged M^1, 1 damaged M^2, 1 M^3, and 1 molar fragment.

Description — The morphology and size of the molars in these small Spanish assemblages agree in most features with those of *M. dominans* from Wintershof-West (Dehm, 1950). Some differences can be mentioned, however.

In the M^1 from Ramblar 7 the two posterior cingulums of the labial and lingual lobes of the anterocone do not connect at one point, but at separate places. The ridge

Table 3. Measurements of the *Melissiodon* teeth from Ramblar 1, Ramblar 3 B, Ramblar 7, Bañon 2, and Bañon 11 A.

Elements	Localities	Length				Width			
		N	min.	mean	max.	N	min.	mean	max.
M_2	Bañon 11 A	0	—	—	—	1	—	1.90	—
	Bañon 2	1	—	2.80	—	1	—	2.00	—
M_3	Ramblar 3 B	1	—	2.34	—	1	—	1.72	—
	Ramblar 1	1	—	2.55	—	0	—	—	—
M^1	Ramblar 7	1	—	3.40	—	1	—	2.32	—
M^2	Bañon 11 A	0	—	—	—	1	—	1.83	—
	Ramblar 1	1	—	2.23	—	1	—	2.13	—
M^3	Bañon 11 A	1	—	1.70	—	1	—	1.90	—
	Ramblar 1	3	1.86	1.89	1.90	2	2.05	2.08	2.10

that connects the posterior cingulum of the lingual lobe of the anterocone to the anterior arm of the protocone is strongly oblique, and not longitudinal as in *M. dominans* from Wintershof-West. The cusp of the same lingual cingulum of M^1 of Ramblar 7 is well-developed.

In the M^2 from Ramblar 1 and Bañon 11 A the postero-lingual arm of the paracone is not connected to the labial extreme of the protocone, but to the basis of the mesoloph. The posterior arm of the protocone and the mesoloph form one ridge.

The M^2 from Bañon 11 A is of slightly smaller size than those from Ramblar 1. Moreover, the M^2 from Bañon 11 A has poorly developed anterior and posterior cingulums, thus giving the tooth a more simple aspect.

The morphology of M_2 and M_3 is similar to that of *M. dominans* from Wintershof-West.

Discussion — *M.* aff. *dominans* from the Calamocha area is similar to *M. dominans* from Moli Calopa, Sant Andreu de la Barca and El Fallol in the Vallés-Penedés Basin (Agustí, 1981). The few features of the – very scarce – Spanish material that differ from the Wintershof-West material are not sufficient to warrant a specific separation.

In France and Central Europe the fossil record of *Melissiodon* ranges from Middle Oligocene to Middle Miocene. In Spain, this taxon has been found in small numbers in the lower Miocene of the Calamocha area, in the Lower Aragonian of Sant Andreu de la Barca and Moli Calopa (Agusti, 1981), in the Middle Aragonian of El Fallol (Agustí, 1981), and in the Middle Aragonian of Buñol (van de Weerd & Daams, 1978).

Crusafont et al. (1955) described *M. arambourgi* from El Fallol on the basis of a lower jaw with M_1 and M_2 (op. cit., fig. 26). In the figures it appears that the mesolophid and anterior arm of the hypoconid are in a different position than in *M. dominans*. Subsequent observations of the type material of *M. arambourgi* by Agustí (1981) revealed that the figures do not agree with the material. On the contrary, the lower jaw from El Fallol falls within the variation of *M. dominans* and thus *M. arambourgi* is considered to be a junior synonym of *M. dominans*.

Conclusions

There are two lineages of *Eucricetodon* in the lower Miocene of Spain. One of them, of large size, is represented by *E. cetinensis* in Cetina de Aragón. The other lineage has, at present, its last representatives in the Calamocha area, and it shows resemblances with the lineage of small size described by Vianey-Liaud (1972, 1974), but in the Spanish localities that lineage has some particular features. *Eucricetodon.* aff. *aquitanicus* from Navarrete del Río and Ramblar 1 is of larger size than *E. aquitanicus* from Laugnac and it is more or less of the same size as *E. aquitanicus* from Bouzigues. *E.* aff. *aquitanicus* from Spain has a more evolved dental pattern than these two French assemblages. *E.* aff. *infralactorensis* from Valhondo 1 is larger and has a more evolved dental pattern than any other assemblages from the Calamocha area. Its size agrees with that of *E. infralactorensis* from Estrepouy, but in some features the Spanish material is more evolved. The assemblages from Ramblar 3 B and Ramblar 7 (*Eucricetodon* sp. ex gr. *aquitanicus-infralactorensis*) have a morphology similar to that of the assemblages from Navarrete and Ramblar 1, but those have an intermediate size between *E. aquitanicus* from Bouzigues and *E. infralactorensis* from Estrepouy.

The few features of the – very scarce – Spanish material of *Melissiodon* that differ from *M. dominans* from the Wintershof-West material are not sufficient to warrant any specific separation.

As for the palaeoecological and palaeoclimatological interpretation of the taxons described above, the information is scarce. It is yet unknown for what habitat *Eucricetodon* had a preference, but *Melissiodon* seems to have preferred relatively wet and wooded biotopes (van de Weerd & Daams, 1978). *Melissiodon* enters into Spain during a change from a relatively dry to a relatively wet climate (zone Z, Daams & van der Meulen, 1983), and it is not present in the Calamocha area beyond zone A, when the climate becomes relatively dry again.

References

Adrover, R., 1978. Les Rongeurs et Lagomorphes (Mammalia) du Miocène inférieur continental de Navarrete del Río (province de Teruel, Espagne). — Docum. Lab. Géol. Fac. Sci. Lyon, 72: 3-47, 5 pls.

Aguilar, J.P., 1974. Les Rongeurs du Miocène inférieur en Bas-Languedoc et les corrélations entre échelles stratigraphiques marine et continentale. — Géobios, 7, 4: 345-398.

Agustí, J., 1981. Roedores miomorfos del Neógeno de Cataluña. — Doctor's Thesis Univ. Barcelona: 1-293, 3 pls.

Baudelot, S. & L. de Bonis, 1968. Contribution à l'étude des Rongeurs de l'Aquitanien moyen et supérieur de l'Agenais. — Bull. Soc. Hist. Nat. Toulouse, 104, 1-2: 160-164.

Bonis, L. de, 1973. Contribution à l'étude des Mammifères de l'Aquitanien de l'Agenais. Rongeurs, Carnivores, Perissodactyles. — Mém. Mus. Natl. Hist. Nat., N. S., C, 28; 1-192, 14 pls.

Crusafont, M., J.F. Villalta & J. Truyols, 1955. El Burdigaliense continental de la cuenca del Vallés-Penedés. — Mem. Com. Inst. Geol. Barcelona, 12; 1-273, 11 pls.

Cuenca, G., 1983. Nuevo yacimiento de vertebrados del Mioceno inferior del borde meridional de la cuenca del Ebro. — Estudios Geol., 39: 217-224.

Daams, R., 1976. Miocene Rodents (Mammalia) from Cetina de Aragon (Prov. Zaragoza) and Buñol (Prov. Valencia), Spain. — Proc. Kon. Ned. Akad. Wet., B, 79, 3: 152-182, 5 pls.

Daams, R., 1985. Glirinae (Gliridae, Rodentia) from the type area of the Aragonian and adjacent areas (provinces of Teruel and Zaragoza, Spain). — Scripta Geol., 77: 1-20, 2 pls.

Daams, R. & M. Freudenthal, 1981. Aragonian: the Stage concept versus Neogene Mammal Zones. — Scripta Geol., 62: 1-17.

Daams, R. & A.J. van der Meulen, 1984. Paleoenvironmental and paleoclimatic interpretation of micromammal faunal successions in the Upper Oligocene and Miocene of north-central Spain. — Paléobiol. continent., 14, 2: 241-257.

Dehm, R., 1950. Die Nagetiere aus dem Mittel-Miozän (Burdigalium) von Wintershof-West bei Eichstätt in Bayern. — N. Jb. Miner. Geol. Paläont., Abh., B, 91: 321-428.

Diaz Molina, M. & N. López Martínez, 1979. El Terciario continental de la Depresión Intermedia (Cuenca). Bioestratigrafía y Paleogeografía. — Estudios Geol., 35: 149-167.

Mein, P. & M. Freudenthal, 1971. Une nouvelle classification des Cricetidae (Mammalia, Rodentia) du Tertiaire de l'Europe. — Scripta Geol., 2: 1-37, 2 pls.

Vianey-Liaud, M., 1972. Contribution à l'étude des Cricétidés oligocènes d'Europe occidentale. — Palaeovertebrata, 5, 1: 1-44, 5 pls.

Vianey-Liaud, M., 1974. L'anatomie crânienne des genres *Eucricetodon* et *Pseudocricetodon* (Cricetidae, Rodentia, Mammalia); essai de systématique des Cricétidés oligocènes d'Europe occidentale. — Géol. Méditerranéenne, 1, 3: 111-132, 1 pl.

Viret, J., 1929. Les faunes des Mammifères de l'Oligocène supérieur de la Limagne bourbonnaise. — Ann. Univ. Lyon, N.S., 47: 1-328, 31 pls.

Weerd, A. van de & R. Daams, 1978. Quantitative composition of rodent faunes in the Spanish Neogene and paleoecological implications. — Proc. Kon. Ned. Akad. Wet., B, 81, 4: 448-473.

Manuscript received 6 February 1985.