A Late Pliocene rodent fauna from Alozaina (Malaga, Spain)

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Aguilar, J.P., J. Michaux, J.J. Delannoy & J.L. Guendon. A Late Pliocene rodent fauna from Alozaina (Malaga, Spain). — Scripta Geol., 103: 1-22, 11 figs., 2 pls, Leiden, April 1993.

In this paper 11 species of rodents are described, that have been found in the fossiliferous karst fissure of Alozaina (Malaga, Spain). Three species of *Stephanomys* (Murinae) are present in this fauna: *S. thaleri*, *S. minor*, and the new species *S. prietaensis*. The latter exhibits a lesser degree of evolution than *Stephanomys balcellsi* from Valdeganga 7 and Islas Medas. The association of rodents from Alozaina is a new one for the Upper Pliocene in Spain. It indicates that the locality of Alozaina is younger than Moreda 1B and Rambla Seca Ab, and older than Valdeganga 7.

Key words: rodents, Pliocene, Spain.

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Introduction

The Alozaina site (co-ordinates UTM: 333.75 - 4070; height 820 m, military map Ronda 15 - 41 (1051)) was discovered by two of the authors (J.L. G. and J.J. D.) in the autumn of 1991. It is located (Fig. 1) on the eastern slope of the Sierra Prieta (Malaga, Spain). It is the filling of one of the many caves that erosion has produced in that area. The filling can be seen over a length of some ten metres along a forest track between two talwegs named Arroyo de Pina and Arroyo de la Fabrica (Fig. 2). The fossil remains were found in a reddish sandy clay which locally exhibits horizontal bedding; at some points it is hardened.

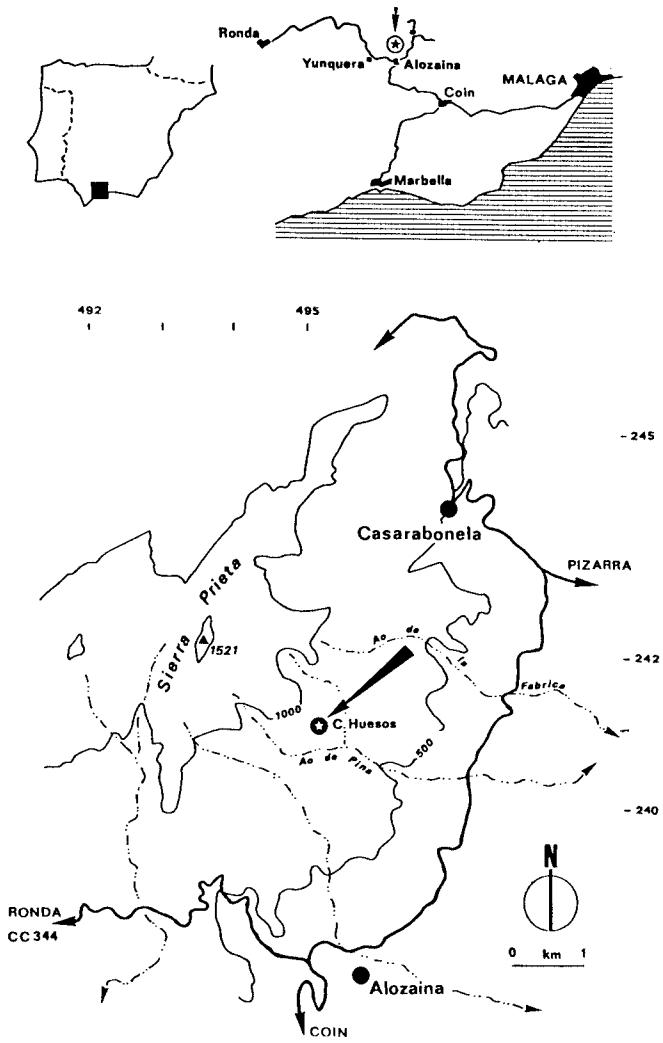


Fig. 1. Location of the mammal-bearing locality of Alozaina (Malaga, Spain).

The micromammal fauna is older than the erosion surface that has truncated the cavities. The fossil assemblage has been extracted from several blocks of hardened sediment, and from unhardened sediment. These samples have yielded the same list of species and a similar relative abundance of species. Most of the tooth material is in a good state of preservation and if some teeth are worn due to transportation, none of the species is more affected than any other one. All the species recognized are compatible with a Late Pliocene age. Not a single tooth belongs to a species significantly older or younger. Only the occurrence of three species of *Stephanomys* was unexpected because so far only two species of this genus had been recorded from Iberian localities: Moreda 1A, Belmez, Moreda 2, Moreda 1B, Rambla Seca Ab (references in Castillo Ruiz, 1990).

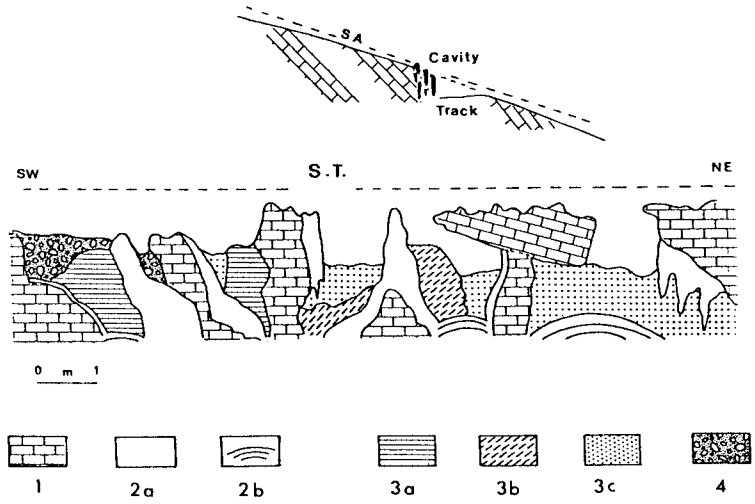


Fig. 2. Section of the fossiliferous filling at Alozaina (Malaga, Spain).
1: substratum; 2: calcitic deposit, 2a: stalagmitic wall, 2b: stalagmitic floor; 3: argilloarenaceous deposit: 3a: hardened and bedded, 3b: hardened and non-bedded, 3c: unhardened and non-bedded; 4: breccia younger than the erosion phase which has truncated the cavity and its filling.

MATERIAL AND METHODS

More than one thousand isolated cheek teeth have been collected in 1991 by dissolution of the breccia in water with 10% of formic acid. The material is stored in the two following collections: University of Montpellier II (Laboratory of Paleontology: ALZ) and Nationaal Natuurhistorisch Museum (RGM), Leiden (The Netherlands).

The teeth were measured using a Wild stereoscopic microscope and a Leitz stage for measurements. Measurements are given in millimetres. Terminology for the murid teeth is after Michaux (1971).

Systematic descriptions

Family MURIDAE Gray, 1821
Subfamily MURINAE Gray, 1821

Genus *Stephanomys* Schaub, 1938

Discussion — A rich sample of *Stephanomys* has been collected in Alozaina. A few specimens of lower molars can easily be isolated on the basis of their morphology. They belong to a species very similar to *Stephanomys thaleri.* The rest of the sample is large, morphologically homogeneous, and shows a great size range (Figs. 3-8).

The distribution of length and width for the different categories of teeth is extremely varied: either bimodal or of random shape. Once the teeth attributed to

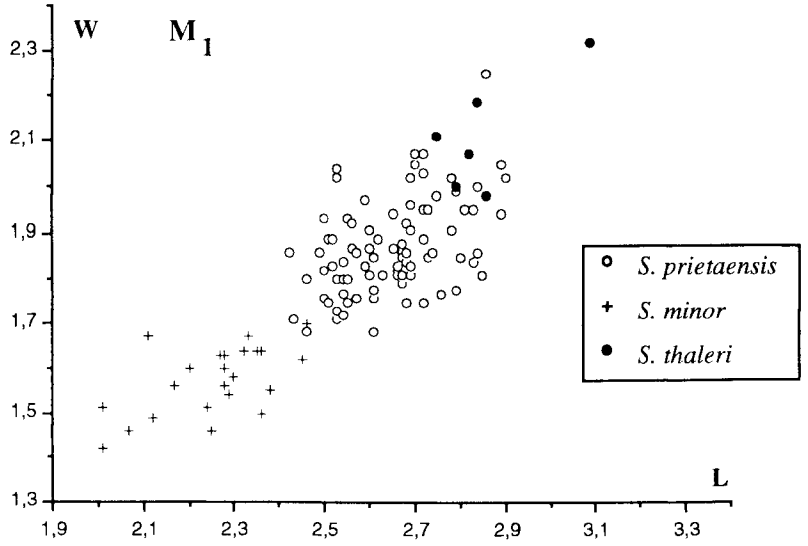


Fig. 3. Length/width diagram of M_1 of *Stephanomys* from Alozaina.

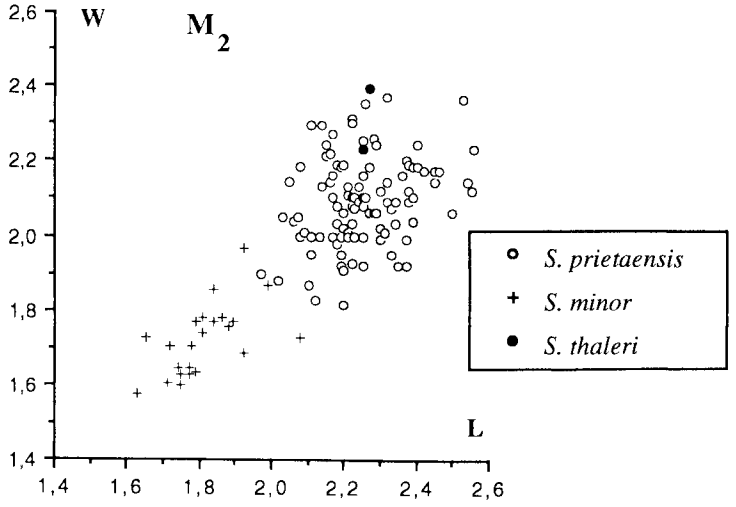


Fig. 4. Length/width diagram of M_2 of *Stephanomys* from Alozaina.

Stephanomys thaleri have been eliminated, values for the coefficient of variation V (Table 1) are nearly double the ones calculated for monospecific populations of *Stephanomys* from French and Spanish Pliocene localities. Values for the coefficient of variation V' defined by Freudenthal & Cuenca Bescos (1984) are equally very high for the upper teeth.

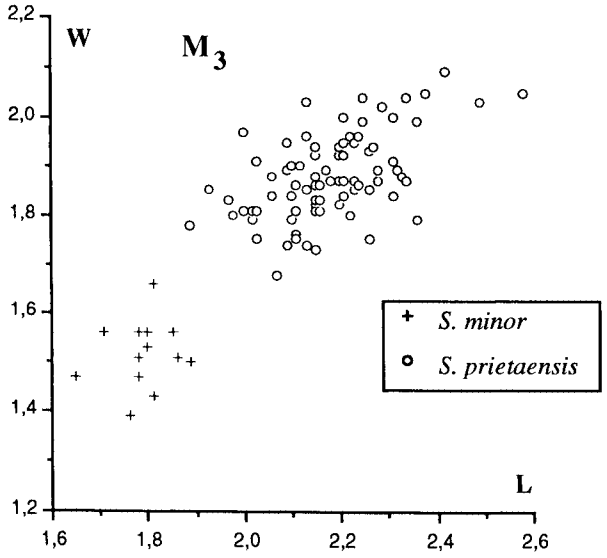


Fig. 5. Length/width diagram of M_3 of *Stephanomys* from Alozaina.

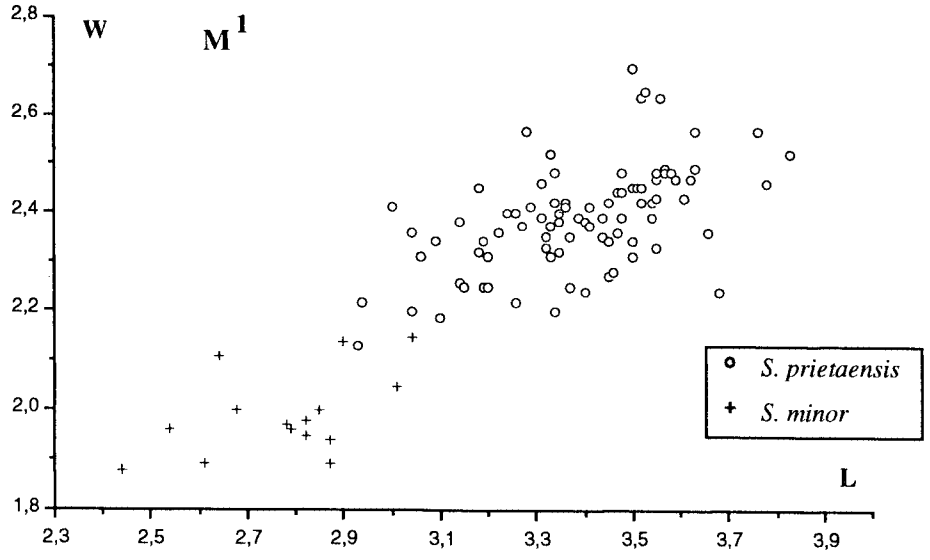


Fig. 6. Length/width diagram of M^1 of *Stephanomys* from Alozaina.

Comparison with reference populations of *Stephanomys minor* and *S. balcellsi* (Figs. 9-10) permits to divide the Alozaina sample into two groups. All values of V' are then similar to the values given by Freudenthal & Martín Suárez (1990) for monospecific samples of *Stephanomys* from various localities. So, apart from *S. thaleri*

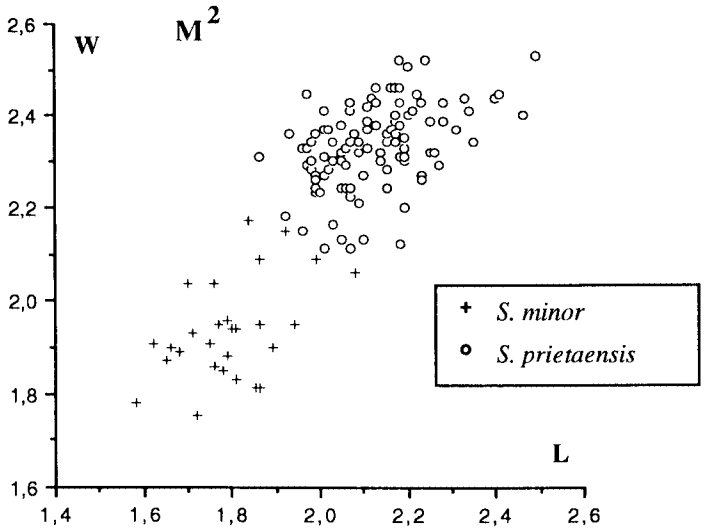


Fig. 7. Length/width diagram of M^2 of *Stephanomys* from Alozaina.

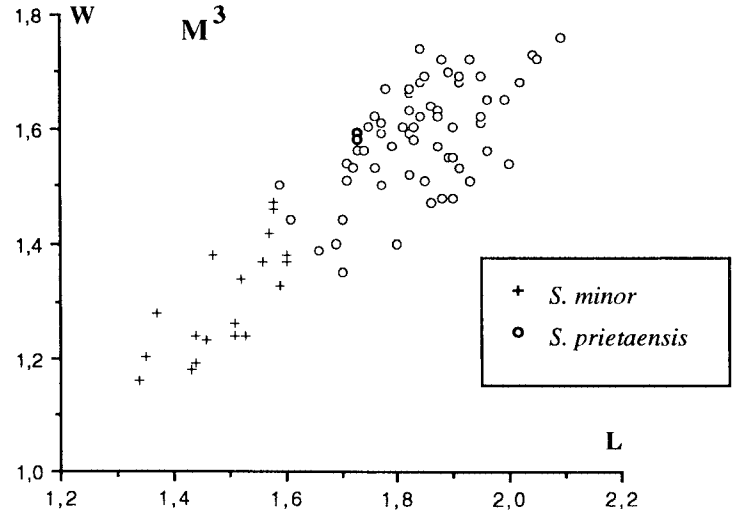


Fig. 8. Length/width diagram of M^3 of *Stephanomys* from Alozaina.

there are two species of *Stephanomys* of similar morphology in the Alozaina fauna: one can be referred to *S. minor*, the other one is a species smaller than *S. balcellsi*.

Table 1. Measurements of *Stephanomys* of Alozaina.

		Length							Width						
	n	min.	mean	max.	Sm	s	V	V'/√logN	min.	mean	max.	Sm	s	V	V'/√logN
M_1	111	2.01	2.57	2.90	0.019	0.20	7.77	25.35	1.42	1.81	2.25	0.015	0.15	8.62	31.63
M_2	127	1.63	2.17	2.56	0.018	0.20	9.47	30.57	1.58	2.03	2.37	0.016	0.18	8.98	27.58
M_3	97	1.65	2.13	2.58	0.018	0.17	8.28	31.21	1.39	1.83	2.09	0.015	0.15	8.22	28.55
M^1	105	2.44	3.30	3.83	0.027	0.28	8.56	31.13	1.88	2.33	2.70	0.017	0.17	7.48	25.20
M^2	134	1.58	2.05	2.49	0.015	0.18	8.74	30.67	1.58	2.03	2.37	0.016	0.18	8.98	27.58
M^3	82	1.34	1.76	2.09	0.019	0.18	10.00	31.62	1.16	1.52	1.76	0.017	0.15	10.00	29.72

Stephanomys thaleri Cordy, 1976
Pl. 1, figs. 13-14.

Type locality — Seynes (Gard, France).

Material and measurements — Isolated teeth ALZ 527-531 and RGM 389 373 - 389 376, Table 2.

Description

M_1 — The antero-central cusp or tma is well developed in most of the specimens. The labial cingulum is of variable length and size. Cusplet C1 is always present and is comma-shaped. C3, at the level of cusp tC, is usually small. A small ridge starting from the C3 is sometimes present on the flank of tC. Cusplet C4 is of variable size.

M_2 — In comparison with M_1, cusplet C1 is smaller and the posterior heel is of similar size.

Discussion — The lower molars are morphologically similar to specimens from the localities of Seynes, Balaruc 6, and Lo Fournas 4, described by Bachelet (1990), but they are larger. They also differ from the lower molars found in these localities in having a tubercular-shaped posterior heel (cp) and a more tuberculate labial cingulum. It should be noted, that the largest M_1 from Sarrion has a similar posterior heel (Adrover, 1983). This tooth may well belong to *Stephanomys thaleri*. It has not been possible to assign any upper molars from Alozaina to this species.

Table 2. Measurements of *Stephanomys thaleri* of Alozaina.

		Length			Width		
	n	min.	mean	max.	min.	mean	max.
M_1	7	2.55	2.81	3.09	1.89	2.08	2.32
M_2	2	2.25	2.26	2.27	2.23	2.31	2.39

Stephanomys minor Gmelig Meyling & Michaux, 1973
Pl.1, figs. 9-12.

Type locality — Moreda 1B (Granada, Spain).

Material and measurements — Isolated teeth ALZ 426-526 and RGM 389 348 - 389 372, Table 3.

Table 3. Measurements of *Stephanomys minor* of Alozaina.

		Length							Width						
	n	min.	mean	max.	Sm	s	V	V'/√logN	min.	mean	max.	Sm	s	V	V'/√logN
M_1	23	2.01	2.26	2.46	0.026	0.12	5.56	17.25	1.42	1.57	1.70	0.016	0.07	4.88	15.38
M_2	23	1.63	1.81	2.08	0.022	0.10	5.74	20.79	1.58	1.72	1.97	0.019	0.09	5.55	18.84
M_3	13	1.65	1.79	1.89	0.017	0.06	3.48	12.85	1.39	1.52	1.66	0.019	0.07	4.53	16.77
M^1	15	2.44	2.78	3.04	0.043	0.16	6.02	17.25	1.88	1.99	2.15	0.022	0.08	4.34	15.38
M^2	29	1.58	1.79	2.08	0.020	0.11	6.15	22.60	1.75	1.93	2.17	0.020	0.10	5.53	17.72
M^3	19	1.34	1.50	1.60	0.019	0.08	5.68	15.62	1.16	1.30	1.47	0.022	0.10	7.41	20.86

Description

M_1 — Only two specimens exhibit a very small tma in an almost central position. The anterior half of the molar is strongly asymmetric because of the anterior position of cusp tF. The labial cingulum is usually restricted to the interval between cusps tA and tC. Cusplet C1 is of variable size and cusplet C3 is connected to cusp tC. These two cusplets are included in the labial cingulum which is continuous from tA to tC. Four molars show a small cusplet C4 at the base of cusp tE. The posterior heel is low and mesio-distally reduced. It is lamelliform.

M_2 — Cusplet C1 is very much reduced. The labial cingulum is a ridge of enamel of varying width linking tA to tC. The posterior heel is even smaller than in M_1 and may be completely absent.

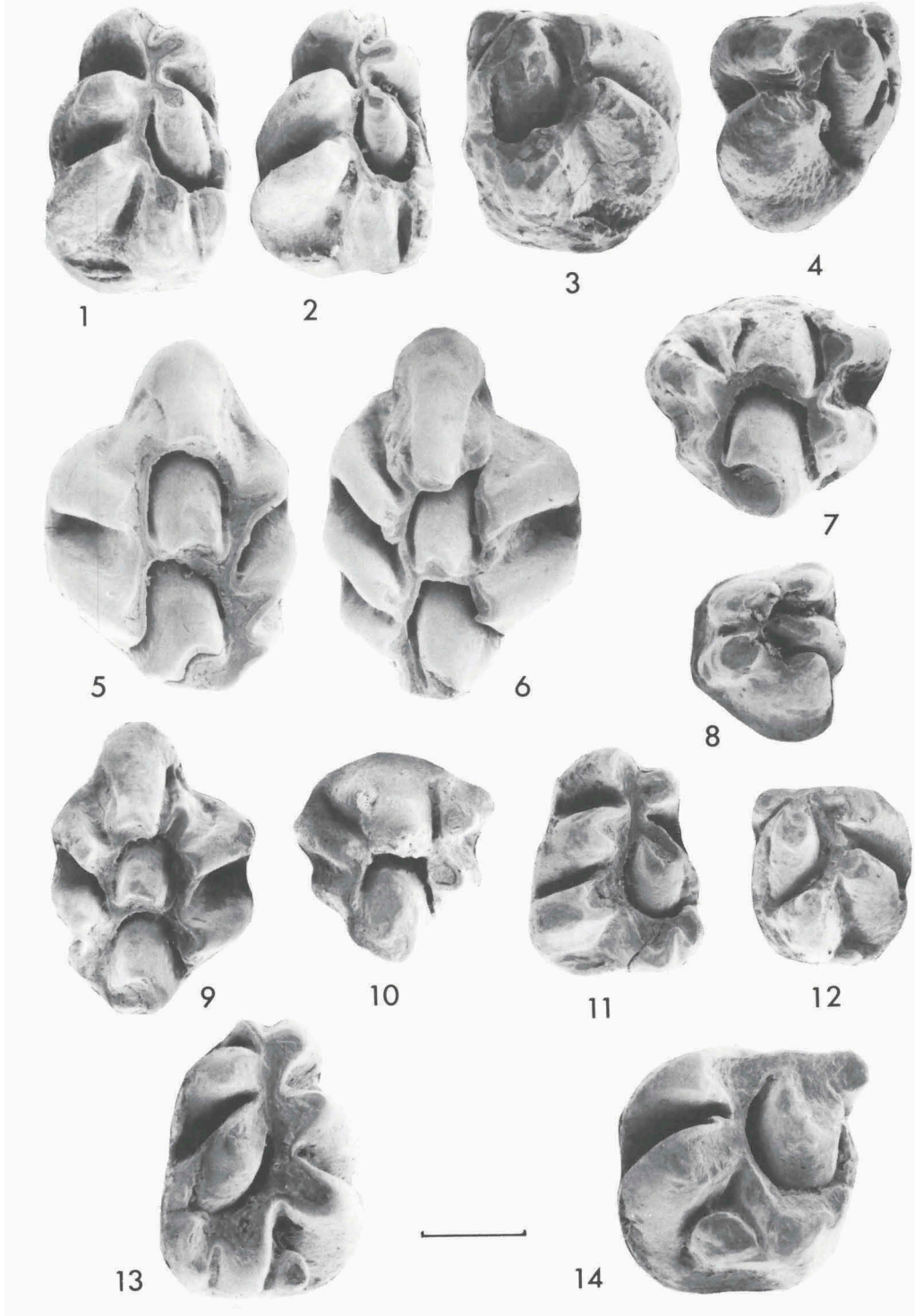
Plate 1

Stephanomys prietaensis sp. nov.
Fig. 1. M_1 dext., ALZ 3, holotype.
Fig. 2. M_1 dext., ALZ 9.
Fig. 3. M_2 sin., ALZ 155.
Fig. 4. M_3 dext., ALZ 171.
Fig. 5. M^1 sin., ALZ 253.
Fig. 6. M^1 dext., ALZ 236.
Fig. 7. M^2 dext., ALZ 308.
Fig. 8. M^3 dext., ALZ 379.

Stephanomys minor Gmelig Meyling & Michaux, 1973
Fig. 9. M^1 dext., ALZ 483.
Fig. 10. M^2 dext., ALZ 502.
Fig. 11. M_1 dext., ALZ 443.
Fig. 12. M_2 sin., ALZ. 452.

Stephanomys thaleri Cordy, 1976
Fig. 13. M_1 sin., ALZ 528.
Fig. 14. M_2 dext., ALZ 531.

Negatives have been taken by Mr L. Datas and positives have been made by Mr J. Martin.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M_3 — Cusp tE is always well differentiated. It is small and located against the crown below cusp tC. Cusp tB dips strongly backwards and leans against the posterior side of cusp tD.

M^1 — Cusplet t1bis is always well differentiated, contrary to cusplet t2bis which may be missing or very much reduced. All major cusps slope down forwards. In lateral view cusps t3, t6 and t9 are parallel. A deep groove separates cusps t4 and t8.

M^2 — Cusp t1bis is usually absent. Nevertheless, some specimens show an enamel swelling on the front face of cusp t1. The latter cusp is well developed. Cusp t3 is of variable size, usually small and leaning against cusp t5. Cusp t9 can be very small or missing.

Discussion — The specimens from Alozaina are morphologically similar to the teeth up to now identified as belonging to *Stephanomys minor*. They are smaller than those from Sarrion (Adrover, 1983) and from Rambla Seca Ab (Castillo Ruiz, 1990). They are very similar in size to those of *S. minor* from Moreda 1B, with the exception of the M_1, which are both longer and wider.

Stephanomys prietaensis sp. nov.
Pl. 1, figs. 1-8.

Type locality — Alozaina (Malaga, Spain).

Holotype — M_1 dext. ALZ 1, U.S.T.L., Montpellier, Pl. 1, fig. 1.

Derivatio nominis — The species is named after the Sierra de Prieta, where the type-locality is situated.

Diagnosis — *Stephanomys* morphologically similar to *S. minor* and *S. balcellsi*. Size larger than *S. minor* but smaller than *S. balcellsi*; cusplet t1bis and t2bis not as well developed as in the latter.

Material and measurements — Mandibles, maxillas, and isolated teeth, ALZ 1-425 and RGM 389 237 - 389 347, Table 4.

Table 4. Measurements of *Stephanomys prietaensis* of Alozaina.

		Length							Width						
	n	min.	mean	max.	Sm	s	V	V'/√logN	min.	mean	max.	Sm	s	V	V'/√logN
M_1	88	2.42	2.65	2.90	0.012	0.11	4.39	12.95	2.13	2.39	2.70	0.011	0.10	4.46	16.88
M_2	104	1.97	2.25	2.56	0.011	0.12	5.34	18.59	1.82	2.09	2.37	0.011	0.11	5.55	18.48
M_3	84	1.89	2.18	2.58	0.013	0.12	5.64	22.25	1.68	1.88	2.09	0.009	0.08	4.59	15.68
M^1	90	2.93	3.39	3.83	0.019	0.18	5.51	19.04	2.13	2.39	2.70	0.012	0.10	4.46	16.88
M^2	105	1.86	2.12	2.49	0.011	0.11	5.60	20.38	2.11	2.33	2.53	0.008	0.09	3.94	12.74
M^3	63	1.59	1.84	2.09	0.013	0.10	5.76	20.26	1.35	1.59	1.76	0.012	0.09	5.88	19.66

Description

M_1 — Half the teeth exhibit a tma of variable size that lies asymmetrically between tE and tF. It lies on the flank of cusp tF. Cusp tF has a more mesial position than cusp tE. The strong labial cingulum is high and composed of a C1 cusplet and a well-differentiated ridge linking the cusplet to tC. A C4 cusplet at the base of cusp tE can be observed in a few molars. The posterior heel (cp) is very low and mesio-distally compressed. It sometimes is a thin lamella of enamel.

M_2 — Cusp tE is small, the labial cingulum is more reduced than in M_1 and the posterior heel has nearly disappeared, being merged into the cusp tA.

M_3 — Cusp tE is always present but is more reduced in size than in M_2. Cusp tB leans against cusp tD in little-worn teeth.

M^1 — Cusplet t1bis is well developed in most of the molars (64). It is ridge-shaped in 29 specimens and swollen in the others. It is very small in 19 teeth and missing in 7. Cusplet t2bis is well developed in 51 molars and ridge-shaped in 28 of them. It is small in 30 teeth and missing in 9. In lateral view cusps t3, t6 and t9 are nearly parallel and slope forwards and downwards; cusp t9 sometimes has a vertical tip. In occlusal view cusps t3 and t1 lie at the same transverse level, as do cusps t4 and t6. Sometimes, cusp t4 may have a more distal position. The connection between t4 and t8 is present in 18 teeth. In the other cases t4 is isolated from t8. It possesses a small posterior spur. In unworn teeth a very small posterior cingulum is present.

M^2 — Cusp t1 has a well-differentiated anterior spur in nearly half the specimens. On the other teeth there is a ridge linking cusps t1 and t5. Cusp t3 is clearly smaller than cusp t1. It may be well separated from cusp t5, or it is coupled with t5. Its size is variable. Cusp t9 is smaller than cusp t6. On some specimens it is very small, and it may be a mere swelling on the side of the crown between t6 and t8.

M^3 — There are five cusps, t5 and t6 being well differentiated.

Discussion — The tooth morphology of *Stephanomys prietaensis* sp. nov. is shared by two other species, *S. minor* and *S. balcellsi*. *S. prietaensis* is clearly larger than *S. minor* from Moreda 1B (Castillo Ruiz, 1990) and from Sarrion (Adrover, 1983), and it is smaller than *S. balcellsi* from the Islas Medas locality. It was previously assumed that *S. minor* and *S. balcellsi* belong to a single lineage, the two successive species being separated by a great difference of size (Cordy, 1976; Gmelig Meyling & Michaux, 1973; Adrover, 1983; Castillo Ruiz, 1990).

Stephanomys prietaensis sp. nov. might be an intermediate stage between *S. minor* and *S. balcellsi* (Figs. 9-10). This lineage, starting with *S. minor* from Moreda 1B, would then have a more gradual evolution. Possible intermediate populations may be the ones from Rambla Seca Ab and Sarrion. The latter two populations are characterized by larger teeth than in Moreda 1B. The *S. prietaensis* - *S. balcellsi* lineage ends with the Cordoba *Stephanomys progressus* described by Cordy (1976).

The situation is, however, more complex since the fauna of Alozaina includes *Stephanomys minor* besides *Stephanomys prietaensis*. The populations from Alozaina referred to *S. minor* and *S. prietaensis* belong to independent lineages, differentiated before the time of the Alozaina fauna. The one leading to *Stephanomys balcellsi* is characterized by a size increase, the other one exhibits no size increase. The third species of *Stephanomys* found in the Alozaina fauna belongs to another lineage, the one

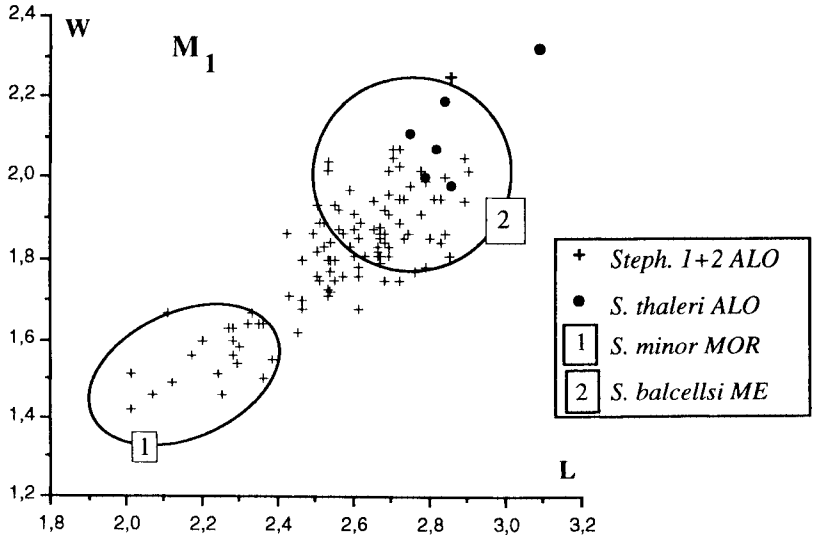


Fig. 9. Length/width diagram of M_1 of *Stephanomys* from Alozaina, *S. minor* from Moreda (1), and *S. balcellsi* from Islas Medas (2).

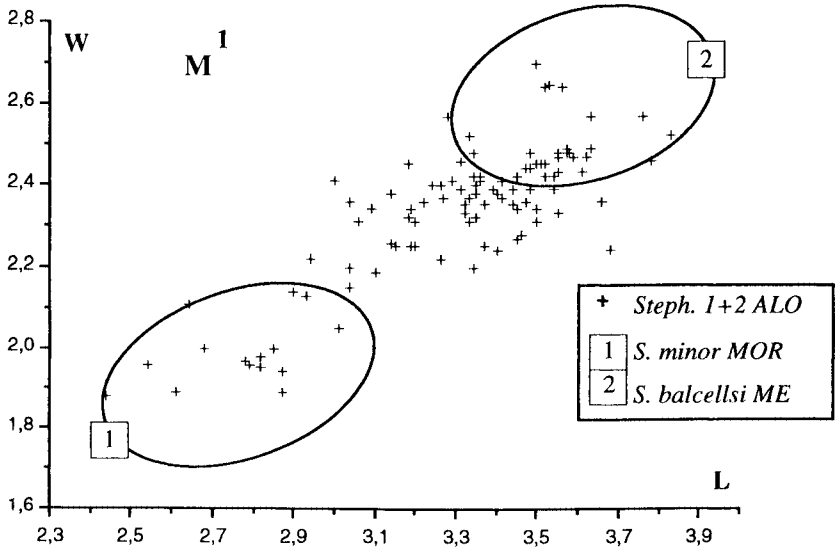


Fig. 10. Length/width diagram of M^1 of *Stephanomys* from Alozaina, *S. minor* from Moreda (1), and *S. balcellsi* from Islas Medas (2).

of *S. thaleri*, differentiated at the time of Moreda 1B (Fig. 11). Conclusively, the fauna of Alozaina provides additional support for Bachelet & Castillo Ruiz's theory (1990), that the Iberian Peninsula was an evolutionary centre for the genus *Stephanomys* in Pliocene times.

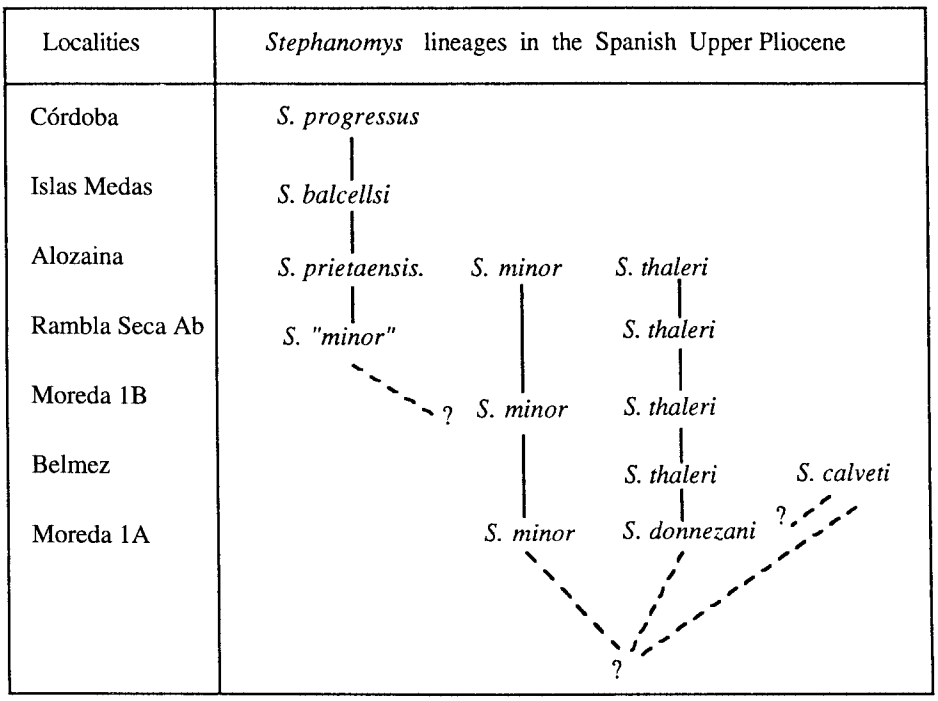


Fig. 11. Scheme of the evolution of the genus *Stephanomys* in the Spanish Upper Pliocene.

Genus *Castillomys* Michaux, 1969

Castillomys crusafonti Michaux, 1969
Pl. 2, fig. 7-11.

Type locality — Layna (Soria, Spain).

Material and measurements — Fragments of jaws and isolated teeth, ALZ 532-610 and RGM 389 377 - 389 387.

		Length				Width			
	n	min.	mean	max.	V'/√logN	min.	mean	max.	V'/√logN
M_1	20/22	1.42	1.52	1.64	12.61	0.92	0.98	1.07	13.00
M_2	25/26	1.00	1.11	1.26	19.45	0.92	1.03	1.16	19.40
M_3	2	0.81		0.88		0.76		0.85	
M^1	15/25	1.50	1.74	1.84	18.78	1.11	1.21	1.29	12.69
M^2	12/14	1.03	1.14	1.19	13.88	1.08	1.12	1.21	10.60
M^3	3	0.73	0.80	0.86		0.77	0.79	0.83	

Description

M_1 — In some specimens the longitudinal ridge is low, but it is always conspicuous.

One specimen exhibits a lengthened antero-central cusp (tma), and another one a small bud of enamel between tE and tF. On the other specimens there is no tma. The labial cingulum is always present and well developed. The posterior heel is of variable size, cusp-shaped and large in 2 specimens, lengthened and of variable size in the others.

M_2 — The longitudinal ridge is always present and it is more pronounced than in M_1. The posterior heel is well developed in 17 specimens (65%).

M_3 — This element exhibits a conspicuous longitudinal ridge.

M^1 — Cusp t1 lies far behind cusp t2. Cusplet t1bis is quite large in 8 teeth (35%), appears as a small bulge in 10 teeth (43%), and is absent in 5 (22%). Cusplet t2bis is lengthened and is prominent to a greater or lesser degree. The ridge linking t1 and t5 is present in 80% of the specimens, and absent or very small in 20%. The ridge between t3 and t5 is present in 92% of the specimens and absent in 8%. The connection between t4 and t8 is not always complete but wear makes it difficult to give percentages.

M^2 — Cusplet t1bis is always present, and it is linked to cusp t1 in all specimens. The connection between t1 and t3 is low, absent in one specimen only. Cusp t3 is generally small and it is connected to t5 in only 4 specimens (33%). As in M^1, wear makes it difficult to quantify percentages for the connection between t4 and t8.

Discussion — On the basis of tooth size the *Castillomys* population from Alozaina is very similar to the Iberian populations of Layna, Moreda 1B and Rambla Seca Ab. In comparison with the population from Seynes (France) only the length of M_1 is similar, all other measurements being smaller. The Alozaina population is morphologically similar to *Castillomys crusafonti* from Moreda 1B (Castillo Ruiz, 1990; Martín Suárez & Mein, 1991). It is noteworthy that in both the Alozaina and Mas Rambault *Castillomys* t2bis is always present in M^1 (Bachelet, 1990).

Plate 2

Apodemus jeanteti Michaux, 1967
Fig. 1. M_1 dext., ALZ 623.
Fig. 2. M_2 sin., ALZ 624.
Fig. 3. M^1 sin., ALZ 613.
Fig. 4. M^2 dext. ALZ 619.

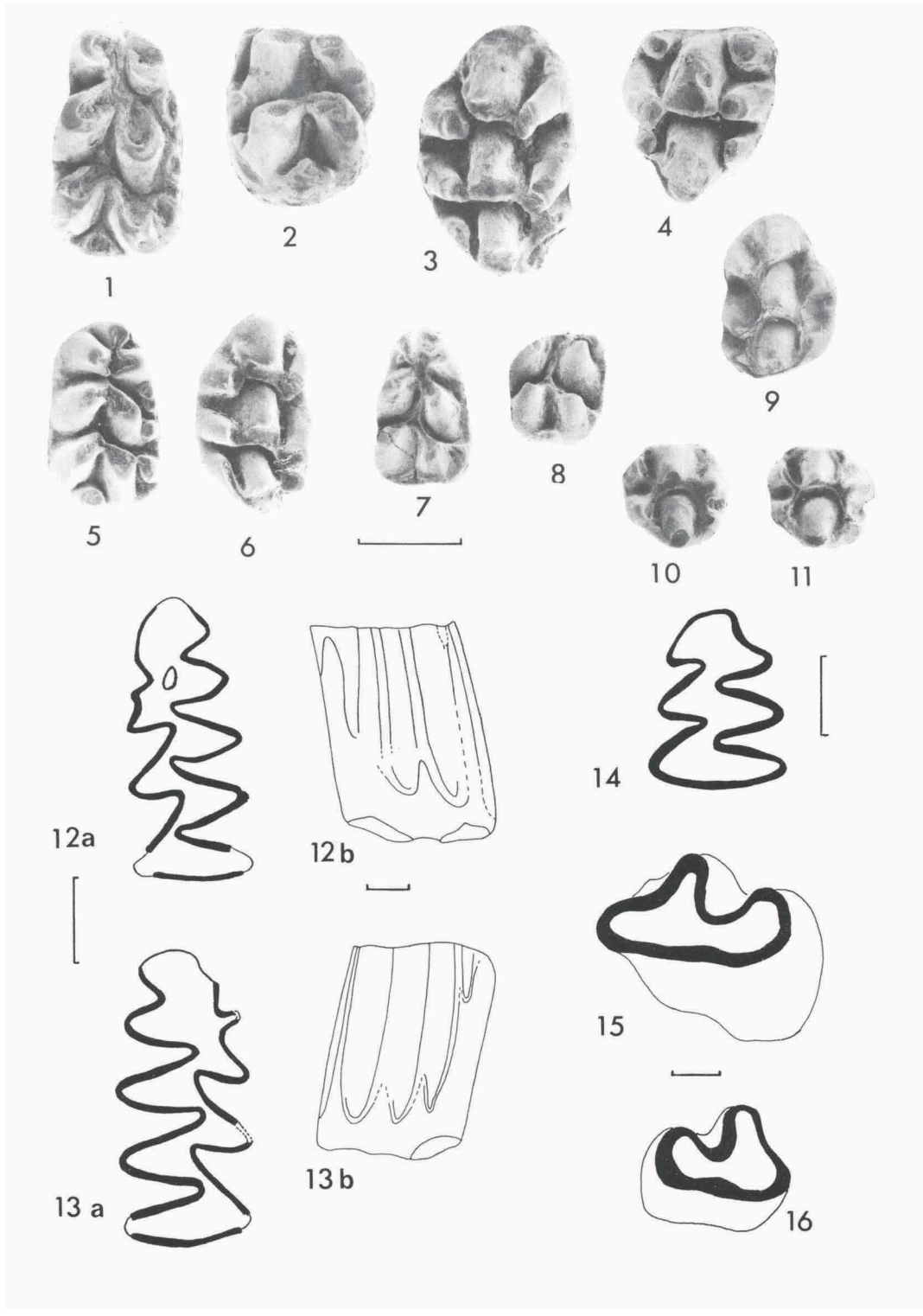
Apodemus dominans Kretzoi, 1959
Fig. 5. M_1 dext., ALZ 701.
Fig. 6. M^1 sin., ALZ 642.

Castillomys crusafonti Michaux, 1969
Fig. 7. M_1 dext., ALZ 537.
Fig. 8. M_2 dext., ALZ 569.
Fig. 9. M^1 dext., ALZ 577.
Fig. 10. M^2 sin., ALZ 600.
Fig. 11. M^2 dext., ALZ 602

Mimomys medasensis Michaux, 1971
Fig. 12. M_1 sin., ALZ 774; a) occlusal view; b) labial view.
Fig. 13. M_1 dext., ALZ 775; a) occlusal view; b) labial view.

Trilophomys vandeweerdi Brandy, 1979
Fig. 14. M_1 sin., ALZ 834.

Blancomys cf. *meini* Adrover, 1983
Fig. 15. M_1 sin., ALZ 772.
Fig. 16. M_3 dext., ALZ 773.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Genus *Apodemus* Kaup, 1926

Apodemus dominans Kretzoi,1959
Pl. 2, figs. 5-6.

Type locality — Csarnota 2 (Hungary).

Material and measurements — Isolated teeth, ALZ 626-757, and RGM 389 388 - 389 413.

		Length			Width		
	n	min.	mean	max.	min.	mean	max.
M_1	24	1.75	1.93	2.10	1.00	1.16	1.32
M_2	34/33	1.23	1.33	1.47	1.10	1.21	1.33
M_3	11	1.03	1.18	1.27	1.01	1.06	1.10
M^1	34	1.88	2.07	2.23	1.22	1.34	1.46
M^2	41/42	1.12	1.36	1.50	1.13	1.29	1.44
M^3	8/7	0.85	0.95	1.03	0.91	0.99	1.08

Description

M_1 — The antero-central cusp always has a central position between tE and tF, and its size varies from considerably to moderately developed. Cusp tE and tF occupy symmetrical positions with regard to the mid-line. The labial cingulum is well developed, and bears 3 to 4 cusplets. C1 is always the biggest of the cusplets. The form of the posterior heel is variable, either cusp-shaped and sizeable, or ovoid and to a greater or lesser extent elongated.

M_2 — The labial cingulum is not as well developed as in M_1, and it may be completely absent; it is always weaker than in M_1. It bears one or two cusplets, C1, and another one at the level of tC. C1 may be absent, reduced in size or well developed. Cusp tE is small to moderately developed. It may be either separated from tC or connected to tE by its anterior tip. The posterior heel is ovoid and low.

M_3 — Cusp tE is absent or poorly developed.

M^1 — Cusp t1 usually lies behind t2 and t3. It is always connected to t2. Most specimens exhibit a t3 with a small posterior spur directed towards t5. The position of t4 in relation to t6 is variable: it may be anterior, at the same level, or posterior to it. A deep valley usually separates t4 from t7, but in a few specimens the two cusps are linked together. There is always a connection between t6 and t9. Cusp t9 is more or less individualized and sometimes as big as t6. The t12 is well developed and directed towards t9. There are three roots.

M^2 — Cusp t1 is well developed, t3 is small. Both are leaning against t5. A connection with this cusp can be observed in worn teeth. Cusp t7 is either lengthened or tubercular; it is always well differentiated. There is no connection with t4. The t12 is absent, very small or slightly developed. There are three or four roots.

M^3 — In three teeth t1 is isolated. Cusp t8 is lengthened in six specimens and round in two.

Discussion — The tooth morphology is similar to that of *Apodemus dominans* . But the measurements are distinctly greater than those of most samples of *A. dominans* described either from France (Pasquier, 1974; Bachelet, 1990) or from the Iberian Peninsula (Adrover, 1983; Castillo Ruiz, 1990). On the other hand, the measurements for Alozaina are a little greater than those of the populations from Mas Rambault 2, a locality younger than Seynes, Balaruc 6 and Lo Fournas 4, that are assigned to the Late Pliocene (Bachelet, 1990). Measurements are smaller than those of *Apodemus* aff. *flavicollis* from Trassanel (Southern France) described by Bachelet (1990).

Apodemus jeanteti Michaux, 1967
Pl. 2, figs. 1-4.

Type locality — Seynes (Gard, France)

Material and measurements — Isolated teeth ALZ 611-625, and RGM 389 414 - 389 418.

		Length			Width		
	n	min.	mean	max.	min.	mean	max.
M_1	1		2.37			1.35	
M_2	2	1.70		1.72	1.47		1.50
M_3	1		1.53			1.29	
M^1	7/9	2.33	2.41	2.54	1.33	1.55	1.66
M^2	5/6	1.59	1.65	1.75	1.48	1.56	1.65
M^3	1		1.27			1.18	

Description

M_1 — There is no tma. The labial cingulum is well developed and bears three cusplets.

M_2 — The cingular ridge is faint. Cusplet C1 is reduced.

M^1 — Cusp t1 lies slightly backwards of t2 and t3. It is either connected to t2 or separated from it. A posterior spur directed towards t5 is present in t3. Cusp t4 usually lies at the same transverse level as t6 and is well separated from t7. This cusp is either lengthened or tubercular. Cusp t6 is bigger than cusp t9; the t12 is developed to a greater or lesser extent.

M^2 — Cusp t4 lies at the same level as t6. The t12 is absent or small.

Discussion — These few specimens are similar to the teeth described by Bachelet (1990) from French Pliocene localities. *Apodemus jeanteti* is clearly larger than *A. dominans*.

Family GLIRIDAE Thomas, 1897
Genus *Eliomys* Wagner, 1843

Eliomys intermedius Friant, 1953

Type locality — Sète (Hérault, France).

Material and measurements — Isolated teeth, ALZ 758-770, and RGM 389 419 389 421.

		Length			Width		
	n	min.	mean	max.	min.	mean	max.
P_4	2	1.51		1.62	1.42		1.52
M_1	2	1.38		1.65	1.68		1.85
M_2	5	1.61	1.73	1.84	1.84	1.99	2.10
M_3	2	1.43		1.50	1.62		1.64
P^4	1		1.08			1.60	
M^1	1		1.37			1.86	
M^2	2/1	1.49		1.56		2.01	
M^3	1		1.46				

Description — In one M_1 and one M_2, an extra ridge is present in the talonid. In one M^2, the posterior centroloph is small and in the other specimen it is absent.

Discussion — The glirid found at Alozaina is morphologically similar to the Sète *Eliomys intermedius*. Specimens are as large as the ones from Seynes.

Family CRICETIDAE Rochebrune, 1883
Genus *Blancomys* van de Weerd, Adrover, Mein & Soria, 1977

Blancomys cf. *meini* Adrover, 1983
Pl. 2, figs. 15-16.

Type locality — Sarrion (Teruel, Spain).

Material and measurements — M_1 (4.14 × 3.37) ALZ 772, M_3 (2.92 × 2.63) ALZ 773.

Description

M_1 shows a deep lingual groove and a very faint labial one. The labial faces of the anteroconid, protoconid, and hypoconid are in a line. There is no inflection between the protoconid and the anteroconid as in the sample from Sarrion, the type locality of the species.

M_3 is made up of two lobes, the anterior one being wider than the posterior one. A deep groove is present on the lingual side of the crown. No groove is present on the labial one.

Discussion — Both specimens differ from the ones found at Sarrion in their lack of labial grooves. The M_1 is clearly wider than its equivalents from Sarrion.

Family SCIURIDAE Gray, 1821
Genus *Pliopetaurista* Kretzoi, 1962

?*Pliopetaurista* sp.

Material and measurements — One fragmentary M^3 (3.30 × –), ALZ 771.

Comments — The size and the granulated occlusal surface indicate a *Pliopetaurista*-like flying squirrel.

Family ARVICOLIDAE Gray, 1821
Genus *Mimomys* Forsyth Major, 1889

Mimomys medasensis Michaux, 1971
Pl. 2, figs. 12-13.

Type locality — Islas Medas (Gerona, Spain).

Material and measurements — Isolated teeth (12 M_1, 6 M_2, 14 M_3, 17 M^1, 9 M^2, 5 M^3), ALZ 74-833, and RGM 389 424 - 389 426. Mean length of 6 M_1: 3.46 mm.

Description

M_1 — The occlusal pattern includes a posterior lobe, three triangles and an anterior complex. A little-worn specimen exhibits a mimomys ring. Other characteristics of the mimomys pattern are present: a mimomys ridge separating two synclines, namely a shallow mimomys fold and a rather deep anterior reentrant angle. The mimomys ridge can be traced along the entire height of the crown. The linea sinuosa which determines enamel-free areas on the labial side of the molars is very irregular and the areas present at the posterior lobe and the anterior complex are very high. The M_1 have two roots: one large antero-external root and a rather small posterior one.

M^3 — There is an anterior lobe, one triangle and a posterior complex with an enamel ring. On the labial side, there are three synclines: two deep anterior ones and a shallow posterior one. A faint deflection may be seen behind this syncline of the posterior complex. On the lingual side, there are two synclines. These molars have two roots. An enamel-free area is clearly visible on the lingual side of the anterior lobe.

Other molars exhibit no particular characteristics. The enamel thickness is clearly differentiated in all specimens. Cement is usually present in the deep folds.

Discussion — The small sample found at Alozaina is mostly composed of poorly preserved teeth. They are morphologically similar to the specimens from Islas Medas, the type locality of *Mimomys medasensis* . Several dental features of the single well preserved first lower molar nevertheless indicate the lesser degree of evolution of the Alozaina population: it exhibits more juvenile features than teeth from Islas Medas with a similar amount of wear. On the other hand, *Mimomys stehlini* from Seynes and *M. minor* from Lo Fournas 4 (Bachelet, 1990) are clearly less advanced.

Family TRILOPHOMYIDAE Kretzoi, 1969
Genus *Trilophomys* Depéret, 1892

Trilophomys vandeweerdi Brandy, 1979
Pl. 2, fig. 14.

Type locality — Seynes (Gard, France).

Material and measurements — 1 M_1 (2.11 × 1.65); 3 M_2 (1.62 × 1.38; 1.96 × 1.47); 1 M^1 (2.12 × 1.54); 2 M^2 (1.57 × 1.37; 1.54 × 1.24), ALZ 834-840, and RGM 389 422 - 389 423.

Mean values for several populations of *T. vandeweerdi* including the type-population from Seynes are:

	Seynes		Plà de la Ville		Lo Fournas 4	
	n	means	n	means	n	means
M_1	5	1.96 × 1.78	11	1.99 × 1.50	2	1.94 × 1.44
M_2	16	1.93 × 1.74	2	1.90 × 1.60	1	1.82 × 1.58
M^1	15	2.34 × 1.70	6	2.24 × 1.69	1	1.65 × 1.42
M^2	15	1.67 × 1.67	9	1.60 × 1.60		

Description — The sample is composed of rather poorly preserved teeth. Measurements and morphological observations (occlusal surface and enamel-free areas) consequently lack precision.

M_1 — There are two labial and three lingual folds, the anterior one being shallow. Enamel-free areas are wide. The tips of enamel triangles are round and the synclines narrow. The enamel-dentine border at the base of the crown is irregular on the labial side. These morphological features indicate *Trilophomys vandeweerdi* Brandy, 1979.

Conclusions

The species of rodents found at Alozaina are thus:
Stephanomys prietaensis sp. nov.
Stephanomys thaleri Cordy, 1976
Stephanomys minor Gmelig Meyling & Michaux, 1973
Castillomys crusafonti Michaux, 1969
Apodemus jeanteti Michaux, 1967
Apodemus dominans Kretzoi,1959
Trilophomys cf. *vandeweerdi* Brandy, 1979
Mimomys medasensis Michaux, 1971
Blancomys cf. *meini* Adrover, 1983
Eliomys intermedius Friant, 1953
?*Pliopetaurista* sp.

The locality of Alozaina is younger than Moreda 1B. The presence of *Mimomys medasensis* indicates a later stage of the Pliocene, this species being identified in the sites Valdeganga 3 (called Valdeganga 7 in Martín Suárez & Mein, 1991) and Islas Medas. The Alozaina population of *M. medasensis* is slightly less advanced than that of the Islas Medas. This suggests that the site is a little older. The discovery of *Stephanomys prietaensis* also indicates that the Alozaina site is younger than Moreda 1B and Rambla Seca Ab, and older than the Valdeganga 7 and Islas Medas localities. Alozaina reveals an association of species so far unknown for the Late Pliocene in Spain.

A correlation of the Spanish localities here studied with the French ones can be based on the *Mimomys* species. If one accepts Chaline's hypothesis (1987) that *M. medasensis* is the descendant of *M. minor* , Alozaina would be more recent than the localities of Lo Fournas 4 and Balaruc 6 in the South of France. If, on the other hand, this hypothesis is rejected (Bachelet, 1990), there is no basis on which comparisons can be made with the faunas from southern France.

On the basis of the accepted correlations between the mammals of the Moreda 1B and Rambla Seca Ab sites on the one hand, and those of the Seynes and Balaruc sites on the other hand (Castillo Ruiz, 1990; Bachelet, 1990), it would therefore be possible to locate the Alozaina site between -2.4 and -2.0 Ma according to the time scale proposed by Aguilar et al. in Clauzon et al. (1990).

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Manuscript received 27 November 1992.

Publication no. 93 009 de l'Institut des Sciences de l'Evolution (URA 327 C.N.R.S.).