

## THE MIOCENE RODENT SUCCESSION IN EASTERN SPAIN:

### A ZOOGEOGRAPHICAL APPRAISAL

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### INTRODUCTION

The first papers dealing with the paleomammalian biogeography of the Spanish Neogene were produced by Crusafont (1954, 1958, etc.), who emphasized the endemic character of most of the Iberian faunas. This endemic character was thought to be caused by the effects of the Pyrenees Range, which probably acted as a biogeographic filter, isolating the Iberian Peninsula from the rest of Europe.

The intensive work developed by de Bruijn (1967) and Freudenthal (1963) in the Calatayud-Daroca basin partially confirmed this view, since the rodent faunas of this basin showed a high number of endemic taxa (for instance, the glirids *Armantomys*, *Praearmantomys*, and *Tempestia*).

However, the analysis of the rodent faunas from the Vallesian of the Vallès-Penedès and other Catalanian basins revealed a rather different composition, much closer to that of other European localities and different from that of the Calatayud-Daroca and Duero basins (Agustí, 1978). The recognition of two biogeographic provinces -- Central and Levant -- was extended by Agustí (1981) to most of the Iberian Neogene. This subdivision of the Iberian Peninsula was lately confirmed in the Duero basin by Alberdi et al. (1981) and by García-Moreno (1987). These two bioprovinces, here called Ibero-Levant province and Ibero-Central province, show significant differences in the rodent content during most of the Miocene.

The exact limits of the two bioprovinces are difficult to establish. As a common feature, most of the basins assigned to the Ibero-Levant bioprovince were opened to the Mediterranean Sea and were affected by transgressive phases. A number of these basins, characterized by the presence of good exposures, have been chosen for the present paper: Seu d'Urgell, Cerdanya, Empordà, Vallès-Penedès, Araya, Mira, Crevillente, Fortuna, and Guadix-Baza. Besides, the late Miocene fissure infilling of Casablanca-M has been also taken into account.

### THE BASINS

#### Seu d'Urgell

Seu d'Urgell is a small intramountain basin which represents part of an assemblage of tectonic basins in the eastern part of the Pyrenees Range. Hartevelt (1979) subdivided the Miocene deposits of this basin into two stratigraphic units:

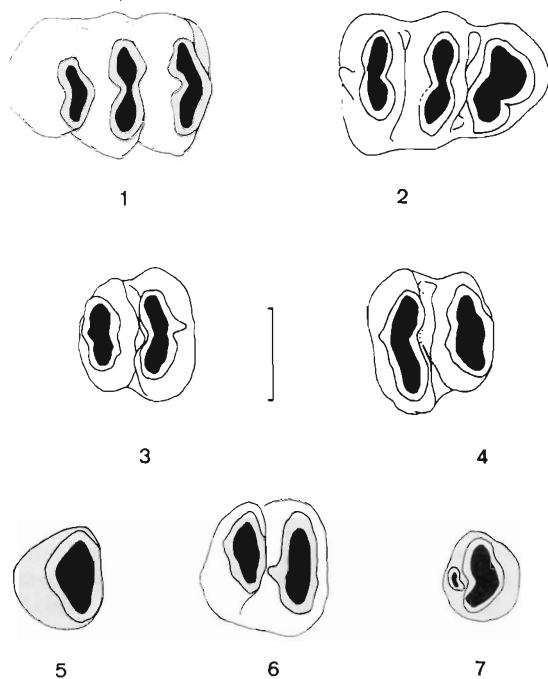


Fig. 4. Protatera almenarensis n. sp. from Casablanca-M. 1) Left M1/, ACS-M-11. 2) Right M/1, ACS-M-33. 3) Right M2/, ACS-M-06. 4) Left M2/, ACS-M-42. 5) Right M/3, ACS-M-37. 6) Right M/2, ACS-M-03. 7) Right M3/, ACS-M-02.

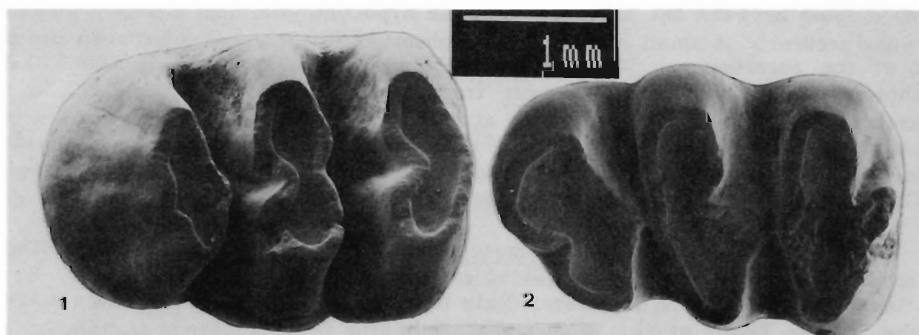


Plate 1. Protatera almenarensis n. sp. (Casablanca-M). 1) Left M1/, ACS-M-07. 2) Left M/1, ACS-M-15 (Holotype).

Protatera almenarensis n. sp.

Derivatio nominis: After Almenara (Castellón), the town where Casablanca-M is placed.

Type-locality: Casablanca-M (Almenara, Castellón).

- Reference level: Late Turolian.
- Holotype: Lower M1, ACS-M-15, deposited in the Institut de Paleontologia "M. Crusafont" (Sabadell, Spain).
- Diagnosis: Species of Protatera with flat or concave anterior side of the anterocone in the upper M1 and very broad anteroconid in the lower M1. M3 strongly reduced.

Differential diagnosis:

Protatera almenarensis differs from the type-species of the genus, P. algeriensis, by its triangular shaped anterocone and by the degree of reduction of the upper and lower M3 (see table 3).

This species also differs from P. kabulense from the late Miocene of Pul-e Charki (Sen, 1983) because of the shape of the first lower M1, much more elongated, and by its very broad anteroconid.

Finally, P. almenarensis differs from the extant Tatera indica since this species still retains the posteroloph in the upper molars and the M3 are not so much reduced.

Measurements: see Table 3.

Description:

M1/: The anterocone is more or less triangular, its anterior side being flat or even concave in most of the specimens. A small enamel ring within this is observed in one specimen. In some specimens, a posterior spur connecting the anterocone with the protocone/paracone complex is present. This kind of longitudinal spur does not exist between the protocone/paracone and the metacone/hypocone complexes.

M2/: This tooth follows the morphology seen in the upper M1. Nevertheless, the medial constriction between the labial and lingual cusps is less developed than in the M1.

M3/: The upper M3 is strongly reduced, with a transverse crest (protocone/paracone complex) and an extremely reduced metacone/hypocone complex, which quickly disappears with wear.

M/1: This tooth is characterized by a very broad anteroconid with a labial anterolophid attaining the same size as the anteroconid. A very low longitudinal spur is present between the transverse ridges in the base of the sinusids. The posterolophid is very reduced.

Table 3. Measurements (in mm) of the teeth of Protatera almenarensis n. sp. from Casablanca-M (Almenara, eastern Spain).

	Length			Width			N
	min.	x	max.	min.	x	max.	
M1/	2.85	2.93	3.09	2.00	2.10	2.22	3/6
M2/	1.71	1.75	1.83	1.86	1.97	2.06	4
M3/	1.01	1.11	1.19	1.39	1.42	1.44	4
M/1	2.91	2.97	3.03	1.77	1.89	1.99	3/4
M/2	1.76	1.81	1.88	1.81	1.86	1.92	3
M/3	1.23	1.34	1.43	1.35	1.45	1.52	5

Table 4. Upper M1/Upper M3 ratios for different species of Protatera from Eurasia. (1) after Sen (1983). (2) after Jaeger (1977).

Casablanca-M	2.63
Pul-e Charki (1)	2.70
Amama-2 (2)	2.33
Ses Fontanelles	2.74

M/2: This tooth follows the same pattern as the lower M1. However, a longitudinal spur is present in most of the specimens.

M/3: This tooth displays an extremely simplified pattern, without distinguishable cusps or ridges.

#### Discussion:

The upper molars of P. almenarensis seem rather close to those of P. kabulense from Pul-e Charki, Afghanistan (Sen, op. cit.). They share a triangular shaped anterocone and a strongly reduced M3. Both are very different from P. algeriensis from the type-locality of the genus Amama-2. However, the lower molars of P. almenarensis are very different from those of P. kabulense, with elongated M/1 displaying a very broad anteroconid which resembles that of the extant Tatera indica. Nevertheless, a relationship between the Iberian species and the last species seems not to be very probable (the third molars of Tatera are not so much reduced as in P. almenarensis and the upper molars still retain the posteroloph).

A close comparison with other finds of Protatera in Spain is truly difficult, given the scarce representation of this genus. Besides the Iberian finds, Protatera has been also recorded in Ibiza, in the Balearic islands (Moya-Solà et al., 1984). The Ibiza Protatera already displays a size larger than that of the continent, although the M1/M3 relation is roughly similar. Protatera probably settled on this island during the Messinian salinity crisis.

Besides Protatera, a second gerbil, Pseudomeriones, has been recorded in the Casablanca-M fissure filling. This is a surprising find, since this genus had never been recorded in western Europe. Curiously, the scarce material of Pseudomeriones from Almenara exactly fits within the size and morphology of the type-species P. abbreviatus Teilhard from King-yan-fou (Kansu, China). On the other hand, the Casablanca-M form is very different from the eastern Mediterranean species P. rhodius from Maritsa (de Bruijn et al., 1970) and P. tchaltaensis from Calta, Turkey (Sen, 1977), which were already very specialized. While the find of Protatera could maintain the doubts on the Asiatic or African character of the Casablanca-M fauna, the presence of Pseudomeriones abbreviatus in this locality strongly suggest an Asiatic origin.

A third supposed gerbil species, Epimeriones aff. austriacus Daxner-Höck is also present in the late Turolian of Can Vilella, in the Cerdanya basin. Epimeriones has a completely different biogeographic character, its presence being restricted to central and eastern Europe. This is the case, for instance, of the type-species E. austriacus (early Turolian of Eichkögel), E. progressus Kowalski from Podlesize (Poland), and the poorly known E. dacicus Terzea from the early Pleistocene of Betfia-XIII. Epimeriones aff. austriacus from Can Vilella seems very close to the Eichkögel species, although it shows some advanced characters such as a higher hypsodonty and a more simplified dental pattern. Therefore, two very different kinds of gerbil-like forms settled the Iberian Peninsula in the late Turolian, one of central or eastern European character (Epimeriones) and the other of African or Asiatic character (Protatera).