

# New localities with fossil micromammals in the Pliocene of the Granada Basin (Spain)

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Several new fossiliferous localities were found in the northern part of the Granada Basin. One of these, Purcal 4, yielded a rich fauna of micromammals, that clearly demonstrates an Early Pliocene age of the beds.

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## Introduction

The Granada Basin is situated in the central sector of the Betic Cordillera (Fig. 1). Its Neogene and Quaternary sediments are of considerable thickness, and cover the contact between the internal and external zones of the Cordillera. Like in other Betic basins the marine influence ends during the Late Tortonian (Rodríguez Fernández, 1982).

The construction of the new motorway Granada-Murcia exposed various good sections in continental deposits, 6 km N of Granada, due north of Pulianas. In this area Padial Ojeda (1986) described Turolian faunas from three levels in the clay-pit of Pulianas. Sheet 1009 (Granada) of the Geological Map of Spain describes the following situation: the Turolian

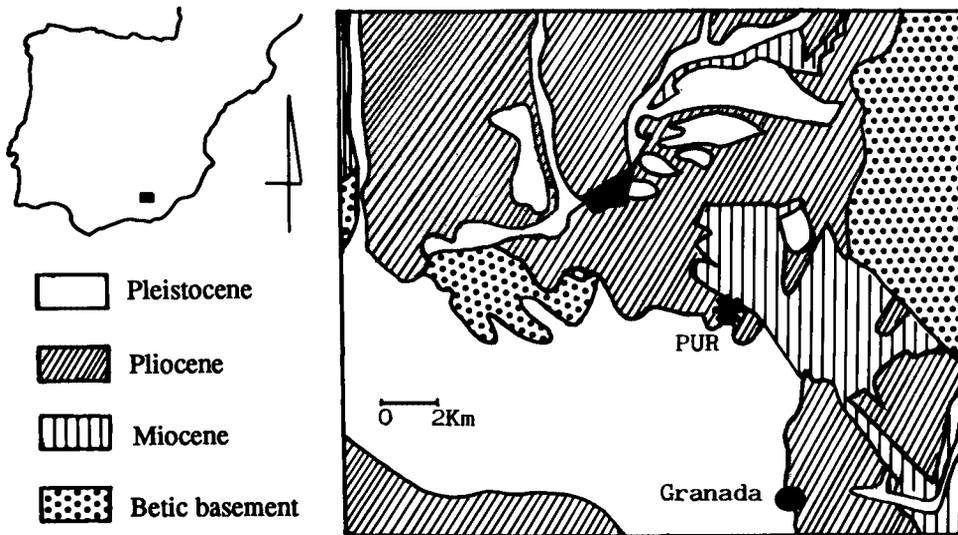


Fig. 1. Situation and geological scheme of the area studied. Geology after sheet 1009 (Granada) of the Geological Map of Spain, 1:50 000.

beds are grey clays, mudstones and sands (unit 43); south and west of these Turolian beds Pliocene is represented by clays, red mudstones and conglomerates (unit 48); the contact between the Turolian and Pliocene sediments is supposed to be a normal fault with a NW-SE direction.

The fresh sections visible today demonstrate that the contact is a big reverse fault, and that various contacts, interpreted in the Geological Map as concordant, in reality are tectonic contacts, linked to this reverse fault.

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## Description of the sections

The present paper is based on the study of several sections in the outer fan of the Alhambra Formation. In one of the sections (Fig. 2), in the east of the area studied, we found four localities with fossil micromammals. It lies between co-ordinates UTM 30 SVG 453218 and 30 SVG 460217. The total thickness of the sediments in the outcrop is c. 130 m; the beds are tectonically deformed, tilted about 26° N45E (in the middle of the section). At the base of the

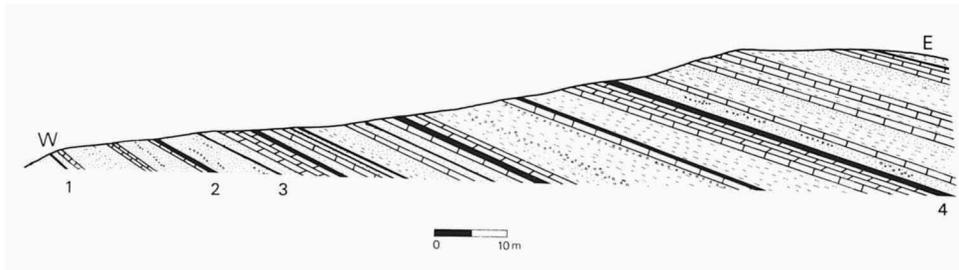


Fig. 2. Part of one of the sections of Purcal. The numbers 1 through 4 indicate the fossiliferous localities PUR 1, 2, 3, 4.

section we find an alternation of marly lutitic aluvial plain deposits, and lacustrine sediments that consist of carbonatic levels and carbonaceous lutites rich in organic material, typical of lake border conditions. The lacustrine intercalations diminish towards the top of the section that contains mainly detritic materials, predominantly fine-grained, mud- to sand-size, with lenses of microconglomerates of c. 50 cm thickness. The entire complex is a fan deposit, typical of wet climate, an interpretation also supported by the faunal associations found.

Both the lower and the upper limit of the exposed sequence are defined by faults. In a first compression phase its base was pushed up against the red beds of the latest Pliocene (and possibly Quaternary). A second compression phase is demonstrated by a reverse fault with a very low inclination, at the contact between the gypsum-bearing beds of the Turolian and the upper part of our sequence; this second fault affects the first one.

## The fossiliferous localities

During our first prospection of the area we observed three sections, and sampled 8 different levels, identified as PUR 1, 2, 3, 4, 10, 11, 12, and 13, that have yielded Pliocene micro-mammal faunas. The youngest of these, PUR 13, contains a faunal association with *Paraethomys jaegeri*.

One of the others, PUR 4, seemed very promising, since many bone fragments were seen during the sampling. The site is located at co-ordinates 30 SVG 457217. The fossiliferous bed is 25 cm thick, and consists of dark greyish-brown carbonaceous lutites, very rich in gastropods, especially at its base. It is underlain by a light-coloured marly limestone and overlain by a sequence of sands with intercalated lenses of microconglomerates.

In our sample of over 100 kg we found about 70 dental elements, that can be attributed to the following taxa:

Insectivora: *Dibolia* cf. *dekkersi* Rümke, 1985

*Sorex praeearaneus* Kormos, 1934

*Galerix* sp.

Cricetidae: *Ruscinomys lasallei* Adrover, 1969

*Cricetus* sp.

Muridae: *Occitanomys alcalai* Adrover, Mein & Moissenet, in press

*Stephanomys ramblensis* van de Weerd, 1976

*Stephanomys donnezani* Depéret, 1890

*Paraethomys meini* (Michaux, 1969)

*Apodemus gorafensis* Ruiz Bustos, Sesé, Dabrio, Peña & Padial, 1984

Sciuridae: *Atlantoxerus* sp.

Gliridae: *Eliomys intermedius* Friant, 1953

*Muscardinus* sp.

Lagomorpha: *Prolagus michauxi* López Martínez, 1977

## Comparisons

The remains of Desmaninae are very abundant (20 % of the specimens, not counting the lagomorphs), and belong to a species of *Dibolia*. The P<sup>4</sup> is molarized, with a protocone well-individualized by the concave shape of the lingual border on both sides. Morphologically this form is highly similar to *Dibolia dekkersi*, but it is slightly larger (Rümke, 1985).

Our material of *Ruscinomys lasallei* is very similar to the specimens from La Dehesa and from the type-locality Alcoy (Adrover, 1969).

*Occitanomys alcalai* from PUR 4 resembles the material from other localities in the Granada Basin. It seems to be the only *Occitanomys* species present in the more than 30 fossiliferous sites sampled in this basin. It is a very small *Occitanomys* with high tooth crowns. The type-locality of *Occitanomys alcalai* is Peralejos E, dated as earliest Pliocene.

*Paraethomys meini* is a medium-sized species, with teeth relatively broader than in Orrios (van de Weerd, 1976), Peralejos E and Villalba Alta Río (Adrover et al., in press). In M<sup>2</sup> the t<sub>9</sub> is reduced to a narrow cingulum, that connects t<sub>6</sub> and t<sub>8</sub>.

In PUR 4 we find an association of two species of *Stephanomys*. *S. ramblensis* is of small size, with t<sub>1</sub> placed backwards and isolated; our specimens are larger than the ones from Valdecebro 3 (Van de Weerd, 1976). The other species, *S. donnezani*, is medium-sized, it shows well-differentiated t<sub>1bis</sub> and t<sub>2bis</sub>, and the longitudinal crests in M<sub>1</sub> and M<sup>1</sup> are complete.

The *Eliomys* material shows the morphology of *E. intermedius*, but has smaller dimensions.

## Discussion

Thanks to the kindness of Dr P. Mein we had the opportunity to compare the fauna of PUR 4 with collections from various Spanish and French localities in the Department of Earth Sciences of the University of Lyon. This made it clear that we are dealing with a faunal association typical of the Pliocene, Early Alfambrian (continental Stage, defined by Moissenet et al., 1990), correlatable with Peralejos E, older than Alcoy, Caravaca, Gorafe 1, Gorafe 4, etc.

Within the Granada Basin it may be correlated with localities in the sections of La Dehesa and La Mina (Arenas del Rey), near the SW border of the basin, and with those of Cerro del Aguila in the central sector. These localities were studied by Padial Ojeda (1986), who attributed them a Late Turolian age. Since it was impossible to study the original collections from these localities, we carried out large scale sampling campaigns in the

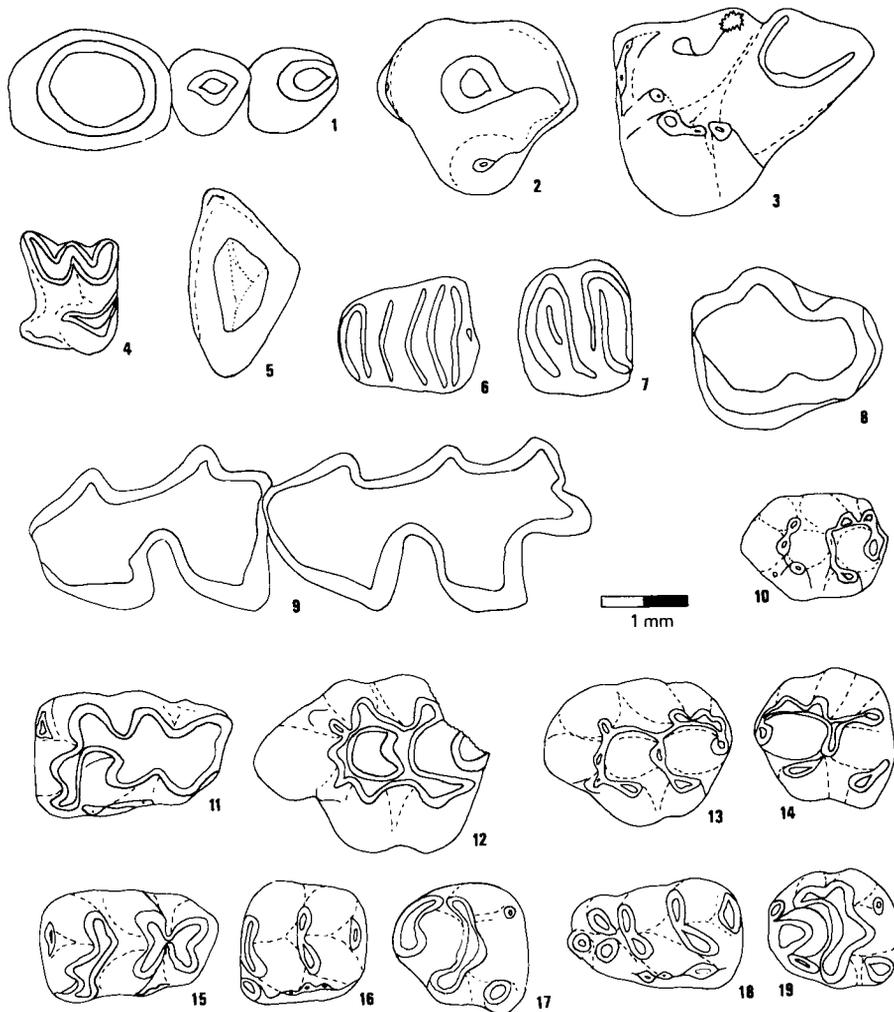


Fig. 3. Dental elements from PUR 4:

- Dibolia* cf. *dekkersi* Rümke, 1985 — 1: P<sub>2</sub>, P<sub>1</sub>, and C dext.; 2: P<sup>4</sup> sin.; 3: M<sup>1</sup> sin.  
*Sorex praeareaneus* Kormos, 1934 — 4: M<sup>1</sup> dext.  
*Galerix* sp. — 5: M<sup>3</sup> sin.  
*Muscardinus* sp. — 6: M<sub>1</sub> sin.  
*Eliomys intermedius* Friant, 1953 — 7: M<sub>1</sub> dext.  
*Ruscinomys lasallei* Adrover, 1969 — 8: M<sub>3</sub> sin.; 9: M<sup>1</sup>, M<sup>2</sup> dext.  
*Occitanomys alcalai* Adrover, Mein & Moissenet, in press — 10: M<sup>1</sup> sin.  
*Stephanomys donnezani* Depéret, 1890 — 11: M<sub>1</sub> dext.; 12: M<sup>1</sup> sin.  
*Stephanomys ramblensis* van de Weerd, 1976 — 13: M<sup>1</sup> sin.; 14: M<sup>2</sup> dext.  
*Paraethomys meini* (Michaux, 1969) — 15: M<sub>1</sub> dext.; 16: M<sub>2</sub> sin.; 17: M<sup>2</sup> dext.  
*Apodemus gorafensis* Ruiz Bustos, Sesé, Dabrio, Peña & Padial, 1984 — 18: M<sub>1</sub> sin.; 19: M<sup>2</sup> dext.

mentioned areas, that yielded larger collections than the ones studied before. In our opinion the localities of La Dehesa, La Mina, and Cerro del Aguila are of Early Pliocene age (Alfambrian), and not Late Turolian. The locality of La Dehesa D4 has yielded a "Cricetidae microtoide indet." (Boné et al., 1978), which is kept at the University of Montpellier. This specimen is a *Celadensia*, a fact that confirms the Pliocene age of the locality (Moissenet et al., 1990).

The association of two species of *Stephanomys* is remarkable, since it has only once before been observed in stratified deposits (Agustí et al., 1990). Until now, *S. ramblensis* had only been found in Turolian localities. Its unexpected presence in PUR 4 indicates that it persisted in the Granada Basin during the Early Pliocene, and, for that matter, at least in this area, its biostratigraphic value is reduced. *S. donnezani*, on the other hand, is considered to be a good marker for the Pliocene, as reconfirmed in the recent revision of the MN zonation (Mein, 1990).

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