Geobios 45 (2012) 387–396

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Original article

Eomyidae fauna turnover at the Early-Middle Miocene boundary in the Morteral section (Magro Basin, Valencia, Spain)☆

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ARTICLE INFO

Article history:
Received 31 March 2011
Accepted 6 October 2011
Available online 14 July 2012

Keywords:
Ligerimys
Eomyops
Eomyidae
Rodentia
Lower Miocene
Aragonian
Spain

ABSTRACT

The material of Eomyidae from three localities (Morteral 1, Morteral 20A and Morteral 22) of the Morteral section in the Magro Basin, eastern Spain, is described. These localities contain remains of *Ligerimys* and *Eomyops*. Morteral 1 is situated in the lowest part of the section and contains *Ligerimys ellipticus*, whereas Morteral 20A and Morteral 22 are situated in the middle part of the section and contain, among other rodent species, *Eomyops noeliae*. The youngest localities in the Morteral section (Morteral 41 and 44) record *Megacricetodon collongensis*, first representative of *Megacricetodon* in the Middle Miocene (MN5). The locality Morteral 20A contains *Megacricetodon primitivus*; Morteral 1 and Morteral 22 contain a form of *Megacricetodon* different from both *M. primitivus* and *M. collongensis*, therefore, these three localities are of lower Aragonian age (MN4). In the Aragonian type area, *L. ellipticus* is rare in zone B (lower part of MN4) and frequent in zone C (upper part of MN4). The first record of *Eomyops* in the Aragonian type area occurs in MN7/8 and in MN5 in Central Europe. The turnover of eomyid faunas in MN4 localities of the Morteral section clearly confirms the hypothesis of Engesser (1999) that *Eomyops* may have appeared earlier than supposed so far (MN5).

1. Introduction

The Magro Basin is an intramontane basin in eastern Spain, established in the Late Cretaceous (Fig. 1). The deposits of this basin have a continental character (Ruiz-Sánchez et al., 2003). The section at Barranco de Morteral is made up of 140 m of grey mudstones and white limestones, with two intercalations of sandstones, conglomerates and red clay. This unit lies unconformably on the red clays and gypsum of the Upper Triassic (facies Keuper). The upper part of the section is covered, and its deposits are affected by seven normal faults. The restoration of the materials affected by the faults (Ruiz-Sánchez, 1999) allows measuring a continuous section (Fig. 2) that consists of:

- 55 m of white micritic limestones and grey mudstones with organic matter;
- 8 m of intercalations of ochreous sandstones and grey mudstones with organic matter;
- 17 m of conglomerates, clays and red sandstones;
- 35 m of intercalations of ochreous clays, grey mudstones and nodular limestones;
- 28 m of intercalations of grey mudstones and bioturbated micritic limestones.

Twelve fossiliferous beds have been intensively sampled in the section of Morteral (Fig. 2), situated in the southeastern part of the Magro Basin: Morteral 1, 5, 5C, 11, 16, 17, 18, 19, 20A, 22, 31 and 41. About 3000 teeth of small mammals have been recovered in the twelve fossiliferous levels (Table 1; Ruiz-Sánchez, 1999). The age of these levels comprises the interval between Lower (zone C; Morteral 1) and Middle (lower part of zone D; Morteral 41) Aragonian (Ruiz-Sánchez, 1999; Ruiz-Sánchez et al., 2003). The presence of *Megacricetodon primitivus* in Morteral 20A allows its assignation to the Lower Miocene (Lower Aragonian, zone C). In Morteral 22, the presence of a *Megacricetodon* form, which is neither *M. primitivus* nor *M. collongensis*, leads us to place this locality at the boundary between Lower and Middle Miocene (boundary between Lower and Middle Aragonian, zones C–D). In Morteral 1, the scarce specimens of *Megacricetodon* do not allow a more specific determination. Nevertheless, the presence of a representative of *Megacricetodon* and the relative stratigraphic situation of Morteral 1, below Morteral 20A (*M. primitivus*), allows to consider a Lower Miocene age (Lower Aragonian, zone C) for this last locality too.

Eomyidae have been found in Morteral 1, Morteral 20A and Morteral 22, whose faunal lists are given in Table 2. In this paper,

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http://dx.doi.org/10.1016/j.geobios.2011.10.010

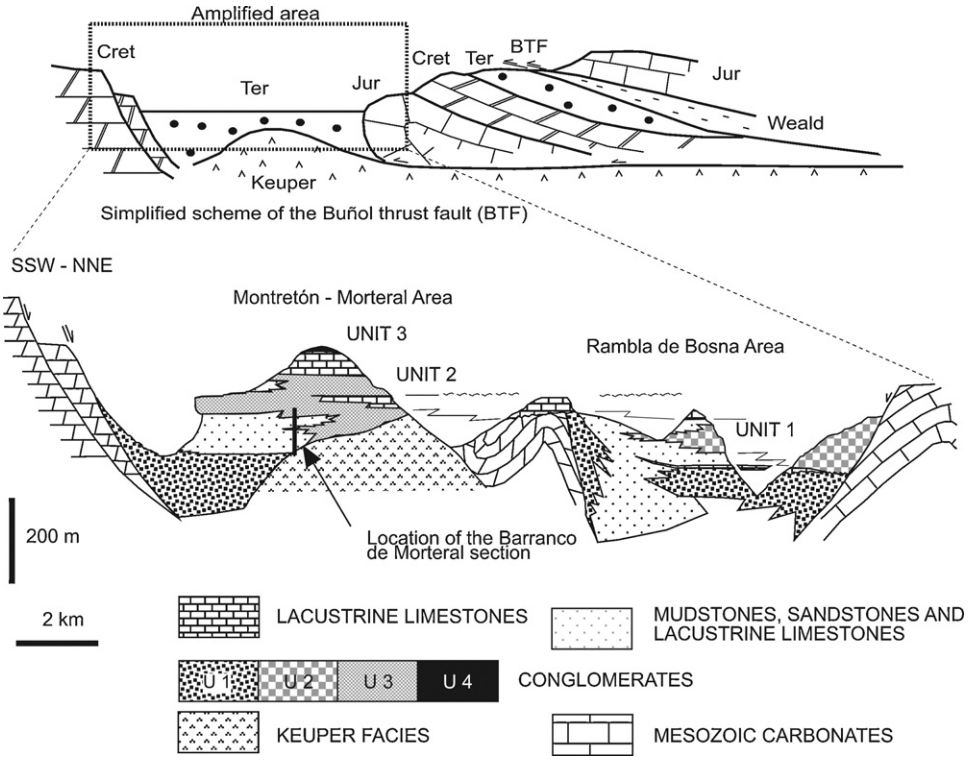

Fig. 1. Cross-section of the Rio Magro Miocene Basin (after Ruiz-Sánchez et al., 2003). BTF: Buñol thrust fault; Cret: Cretaceous; Jur: Jurassic; Ter: Tertiary.

we describe *Ligerimys ellipticus* from Morteral 1, *Eomyops noeliae* from Morteral 20A and *Eomyops* cf. *noeliae* from Morteral 22 and we discuss the biochronological, paleobiogeographical and paleoecological implications of these new data.

The Eomyidae Winge, 1887 is an extinct family with a widespread register throughout the Tertiary. Its origin seems to be located either in America (Storer, 1987) or in Asia (Emry et al., 1997; Engesser, 1999). The eomyid record in Europe starts in the earliest Oligocene, reference level MP 21 (Fahlbusch, 1973, 1979) and continues until the Pliocene (Dehm, 1962; Engesser, 1999). In the European Late Oligocene and Early Miocene, the eomyids were very abundant. In many European fossil associations of this age, they are the main component of the rodent fauna (Engesser, 1999). The European fossil record from MN4 (Lower Miocene) comprises at least six genera: *Pseudotheridomys*, *Ligerimys*, *Apeomys*, *Megapeomys*, *Pentabuneomys* and *Eomyops* (Stehlin and Schaub, 1951; Hugueney and Mein, 1968; Daams, 1976; Álvarez-Sierra, 1988; Fejfar et al., 1998; Engesser, 1999; Ruiz-Sánchez et al., 2009). At the transition MN4-MN5, the composition of Eomyidae assemblages changes substantially: all eomyid species from MN4 are replaced by *Eomyops* and *Keramidomys* (Engesser, 1999). However, some data confirm the presence, in Central Europe (Moayedpour, 1977) and Spain (Ruiz-Sánchez et al., 2009), of *Eomyops* assemblages in the time span between MN2 and MN4.

The age range of *Ligerimys* comprises the interval MN3-MN4 with a maximum abundance and diversity in MN3, disappearing from the fossil record in the upper part of MN4 (Engesser, 1999). There are five *Ligerimys* species in MN3: *L. oberlii* Engesser 1990, *L. lophidens* (Dehm 1950), *L. fahlbuschi* Álvarez-Sierra, 1988, *L. magnus* Álvarez-Sierra, 1988 and *L. freudenthali* Álvarez-Sierra, 1988. Only one species, *L. antiquus* Fahlbusch, 1970, has records in MN3 and MN4 (Fahlbusch, 1970). In MN4, three species have been cited: *L. palomae* Álvarez-Sierra, 1988, *Ligerimys florancei* Stehlin and Schaub, 1951 and *L. ellipticus* Daams, 1976 (Stehlin and Schaub, 1951; Hugueney and Mein, 1968; Baudelot, 1969; Fahlbusch, 1970; Cicha et al., 1972; Fejfar, 1974; Daams, 1976; Agustí, 1981, 1983; Álvarez-Sierra, 1988).

Eomyops is a rather uncommon eomyid. It appears in some European localities from MN4/5 to MN17 and comprises five species: *E. catalaunicus* Hartenberger, 1966, *E. bodvanus* Jánossy, 1972, *E. oppligeri* Engesser, 1972, *E. hebeiseni* Kälin, 1997 and *E. noeliae* Ruiz-Sánchez et al., 2009.

2. Material and methods

This study is based on the specimens from Morteral 1 (MT1-), Morteral 20A (MT20A-) and Morteral 22 (MT22-), kept in the Museu de Geologia de la Universitat de València. The nomenclature used in the descriptions of the teeth follows Fahlbusch (1970). Lengths and widths have been measured as defined by Álvarez-Sierra (1988). Measurements are in tenths of millimetres and were taken on a Leica $MZ7_5$ binocular microscope, by means of displacement of a mechanical slab, connected to a Sony Magnescale measuring equipment. First, second, and third lower molars are named as m1, m2, and m3, whereas first, second, and third upper molars as M1, M2, and M3. We use the MN (European Neogene land mammal) units as defined/updated by Mein (1990), Daams et al. (1999a) and local zones of Daams and Freudenthal (1988) and/or Daams et al. (1999a).

Institutional Abbreviations: MGUV; Museu de Geologia de la Universitat de València; SCSIE; Servei Central de Suport a la Investigació Experimental; UV; University of Valencia; Spain.

3. Systematic paleontology

Order RODENTIA Bowdich, 1821
Family EOMYIDAE Winge, 1887
Genus **Ligerimys** Stehlin and Schaub, 1951
Ligerimys ellipticus Daams, 1976