

Quaternary fauna of bats in Spain: Paleoecologic and biogeographic interest

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Abstract: The study of fossil bat material collected in Quaternary localities in Spain has yielded interesting information on the characteristics of this fauna during the Pleistocene and Holocene in Spain. Out of the 25 species of Chiroptera actually living in Spain, 15 have been detected from the Middle Pleistocene onwards: *Rhinolophus ferrumequinum*, *R. euryale*, *R. mehelyi*, *R. hipposideros*, *Myotis myotis*, *M. bechsteini*, *M. nattereri*, *M. emarginatus*, *Plecotus austriacus*, *Eptesicus serotinus*, *Barbastella barbastellus*, *Nyctalus leisleri*, *N. lasiopterus*, *Pipistrellus pipistrellus*, and *Miniopterus schreibersi*. The presence of *Myotis blythi* and *Plecotus auritus*, quite common in the rest of Europe during the Pleistocene, and actually present in Spain, cannot be ascertained up to the Holocene.

No important morphologic or metric differences with the corresponding extant species have been observed; thus we conclude that the use of bats for biostratigraphical purposes during the Quaternary is very limited. On the other hand, important changes have been observed in the geographical distribution of some species in the Quaternary, compared to the present one; these changes can be interpreted in paleoecological terms. The study of the association of bat species present in a locality can provide important paleoclimatic information as well.

Introduction

Up to very recently, the fossil fauna of bats from Spain has remained practically unknown. The scarce data of this fauna in the Quaternary came most frequently from archaeological excavations, and seldom contained further information than the name of the species represented in the locality, included in

[illegible]

a faunal list. Here we shall present a summary of what is known up to the moment of the Quaternary bat fauna of Spain. Our data come either from the literature (see Table 1) or from localities recently studied by the author (Sevilla, 1986). The geographical situation of the localities is shown in Figure 1, and the bat species identified in each are shown in Table 1. All localities except one, Aridos, consist of cave deposits or fissure fillings; Aridos is a fluvialite locality. The bat species have been identified from their humera, mandibles, maxillae, or isolated teeth.



Fig. 1. Spanish Quaternary localities with bat remains: 1—2 Lower Pleistocene, 3—10 Middle Pleistocene, 11—14 Upper Pleistocene, 15—16 Holocene.

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|----------------|---------------------|--------------------|
| 1 — La Union | 7 — Atapuerca | 13 — El Reguerillo |
| 2 — Las Yedras | 8 — Son Bou | 14 — Gibraltar |
| 3 — Pradena | 9 — Aridos | 15 — La Sarsa |
| 4 — Guardo | 10 — Cueva del Agua | 16 — El Congosto |
| 5 — El Higuero | 11 — La Carihuela | |
| 6 — Las Grajas | 12 — Cova Negra | |

Biostratigraphic interest

The Quaternary bat fauna of Spain seems to be of rather low biostratigraphic interest. Indeed, all bat remains present in the localities mentioned, including those from the Lower Pleistocene, are morphologically identical to the recent species and, allowing them a slightly wider range of variability in size, no

significant differences are observed when compared with the size of their living representatives. There is only one exception to this, the fossils of the *Eptesicus serotinus* group, which seem to be larger in size than the recent members of this species during the Pleistocene, most probably due to their phylogenetic relationship with *E. praeglacialis*, from the Lower Pleistocene, described by Kormos in 1930. Unluckily, and perhaps because they are not cave-dwelling bats, remains of this group are rather rare. In Spain only one locality, Las Grajas, has yielded remains of *E. aff. serotinus*, viz., several teeth with morphology identical to that of recent *E. serotinus*, but clearly larger in size (Figure 2).

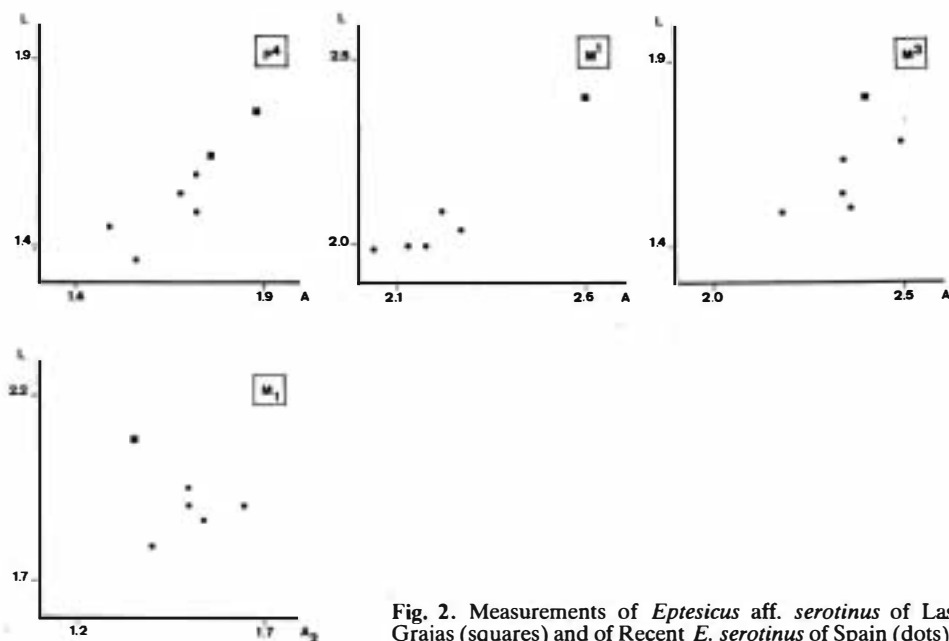


Fig. 2. Measurements of *Eptesicus aff. serotinus* of Las Grajas (squares) and of Recent *E. serotinus* of Spain (dots).

Paleobiogeographic interest

The Quaternary bats of Spain have been found to provide interesting data for studies of the history of their distribution from two different points of view. One of them regards the study of the "recent intruders" of *Myotis myotis* and *Plecotus austriacus* within the fauna of Europe. *M. myotis*, known from the middle Pleistocene in France (*M. cf. myotis* from La Fage, Mein, 1975) and certainly from the upper Pleistocene in numerous localities, is present in Spain at least from the lower Pleistocene onwards, as evidenced by its remains collected in the locality of La Unión. A similar situation is found with *P. austriacus*:

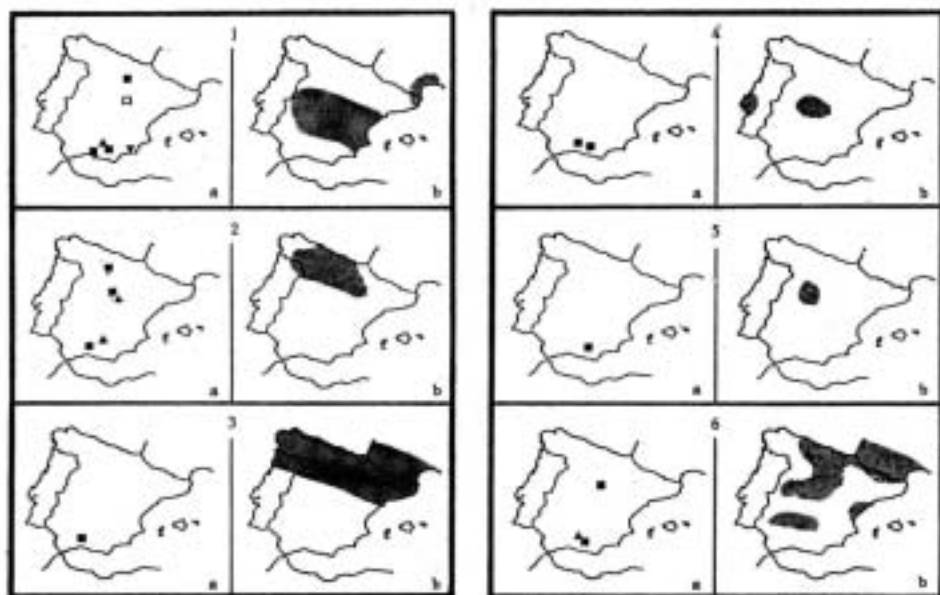


Fig. 3. Distribution patterns in Pleistocene (a) and Recent (b) of:

1 — *Rhinolophus mehelyi*

2 — *Myotis bechsteini*

3 — *Myotis emarginatus*

4 — *Nyctalus leisleri*

5 — *Nyctalus lasiopterus*

6 — *Barbastella barbastellus*

whereas no remains belonging to this species have been found in Europe earlier than the upper Pleistocene, it is certainly already present in Spain in the middle Pleistocene (e.g., Las Grajas). This might be indicative of the expansion of certain species along the Pleistocene from the south of Europe towards more northern regions.

Another group of paleobiogeographical data of interest yielded by the bat fauna of Spain refers to changes in the geographic distribution of certain species during the Pleistocene. Figure 3 shows that six species have been recorded in the middle Pleistocene, and in some cases in the upper Pleistocene, too, beyond their recent range of distribution. Being these species linked to a certain extent to forested areas, these records might indicate a reduction of initially wider ranges caused by the reduction of forests in the Iberian Peninsula during the Holocene.

Paleoecological interest

Quaternary bat remains have appeared to be interesting paleoecological indicators as well, mainly for paleoclimatic interpretations in fossil localities. These can be deduced from the study of the association of bat species found in

a locality. Table 2 shows that practically all cave-dwelling bats have been recorded in some locality or other from the Pleistocene. Several species, such as *Rhinolophus euryale/mehelyi*, *Myotis myotis/blythi* and *Miniopterus schreibersi*, have been found in almost every locality. The absence, or a low representation of these frequent species, when accompanied by relatively high representation of tree-dwelling or rarely cave-dwelling bats, can be interpreted as indicating cold conditions. Such is the case of the localities of Las Grajas, Cueva del Agua and La Carihuela, which, by means of other methods (sedimentology, palynology, other vertebrate fossils), have given place to a similar interpretation.

Another clue to paleoclimatic interpretations is given by the presence of certain species linked to a specific type of environment, most especially if it is combined with a different distribution from the recent one. Such may be the

TABLE 2 — Ecology of recent bat fauna from Spain and their representation (in %) in several localities. ▽ — isolated individuals, □ — small sized colonies, △ — large sized colonies.

In white, when rare; in black when frequent.

	CAVES	TREES	HUMAN CONSTRUCTIONS	PELLETS	GUARDO	EL HIGUERON	LAS GRAJAS	ATAPUERCA	C. DEL AGUA	LA CARIHUELA	EL REGUERILLO
<i>Rhinolophus ferrumequinum</i>	■				7.69	26.08	8.09			1.57	
<i>Rhinolophus hipposideros</i>	▼		▼	▽						2.15	
<i>Rhinolophus euryale/mehelyi</i>	■		■			26.08	0.47	3.01	3.33	3.44	22.22
<i>Myotis myotis/blythi</i>	▲		▲	△	28.28	26.06	59.52	84.93	50.00	77.61	70.70
<i>Myotis bechsteini</i>	▽	□		▽	5.12		1.42			0.14	2.02
<i>Myotis nattereri</i>	■			□	2.56		6.19		10.00	4.44	
<i>Myotis emarginatus</i>	▽			▽		4.34	0.47			0.14	
<i>Myotis capaccinii</i>	△										
<i>Myotis daubentoni</i>	▼	▼		□							
<i>Myotis mystacinus</i>	□	□	□	▽							
<i>Plecotus auritus/austriacus</i>	■	■	■	△			9.04		13.33	5.73	
<i>Eptesicus serotinus</i>	▼		▲	△			2.38				
<i>Barbastella bastastellus</i>	▼	▲	■	■	▽				3.33	1.14	
<i>Nyctalus noctula</i>			△	□							
<i>Nyctalus lasiopterus</i>			△	▽					3.33		
<i>Nyctalus leisleri</i>			△	▽			1.90		3.33		
<i>Pipistrellus pipistrellus</i>	▼			▲	□		9.04		3.33		
<i>Pipistrellus savii</i>				■							
<i>Pipistrellus nathusii</i>		▼	▼	□							
<i>Pipistrellus kuhli</i>				△							
<i>Miniopterus schreibersi</i>	▲				56.41	34.78	0.95	11.44	10.00	3.44	5.05
<i>Tadarida teniotis</i>				▽							

case, for instance, of *B. barbastellus*, which has been found in localities deposited during cold phases, such as Cueva del Agua and La Carihuela.

Finally, the value of bat diversity can sometimes be useful for this sort of interpretations. This index has been found to be generally higher in southern localities than in the northern ones. An unexpectedly low value was obtained for la Carihuela, in spite of its geographic situation, supporting thus the idea that it was deposited during a cold phase.

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