

## DYNAMICS OF THE WESTERN MEDITERRANEAN MAMMALIAN FAUNA DURING THE QUATERNARY

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ABSTRACT: Palombo M.R., *Dynamics of the western Mediterranean mammalian fauna during the Quaternary*. (IT ISSN 0394-3356, 2011)

During the Quaternary, the dispersal in the North-western Mediterranean regions of several mammalian taxa modified the structure of pre-existing faunas, altering the internal equilibrium of palaeocommunities, perhaps removing keystone species and giving rise to new inter-guild and intra-guild dynamics. Diachroneity in local turnovers across the Western Mediterranean regions, probably relied on differences in local dynamic patterns, though the different manifestations of global climate changes in different geographic settings could have contributed to the scale of local bioevents.

RIASSUNTO: Palombo M.R., *Dinamica delle faune a grandi mammiferi del Mediterraneo occidentale durante il Quaternario*. (IT ISSN 0394-3356, 2011)

*Nel corso del Quaternario, la dispersione nel Mediterraneo nordoccidentale di vari grandi mammiferi modificò la composizione e la struttura delle faune preesistenti, alterando l'equilibrio delle "paleocomunità", a volte rimuovendo specie chiave, e dando origine a nuove dinamiche di competizione/coevoluzione tra e nell'ambito dei diversi gruppi ecologici. La diacronia nel rinnovo faunistico, sia tassonomico che funzionale, osservata tra le diverse regioni (Spagna, Francia, Italia), è da imputarsi a diversità nella dinamica biotica locale, anche se fattori geografici hanno indubbiamente favorito variazioni locali nel manifestarsi degli effetti dei cambiamenti globali del clima.*

Key words: Large mammals, Spain, France, Italy, Quaternary, Diversity, Turnover

Parole chiave: Grandi mammiferi, Spagna, Francia, Italia, Quaternario, Diversità, Rinnovi faunistici

### 1. INTRODUCTION

During the Quaternary, Earth's climate underwent a significant evolution: climatic oscillations were a recurring phenomenon, and took place on different temporal and geographic scales. Throughout the Pliocene–Pleistocene, large mammals, particularly from middle latitudes, are known to have more frequently reacted to climate shifts, not by evolving and producing new species, but by varying their range. This, in keeping with the vegetational cover and latitudinal displacement of biomes, as well as with changes in palaeogeographical setting, relate to both tectonics and climate forcing. Many evolutionary stages have been recognized in a number of phylogenetic mammal lineages, and a number of sequences of ecological and dispersal events have been seen as developing on a backdrop of a complex interplay of palaeogeographic reorganizations and climatic factors. Therefore, physical environmental modifications have often been regarded as the main factors in determining concurrent bioevents in multiple lineages, which in turn affected the taxonomic diversity and changed the structure of palaeocommunities.

Although global climatic changes undoubtedly altered existing habitats, giving rise to new environments for both indigenous and dispersing species,

the evolutionary dynamics of mammalian fauna are actually a high complex phenomenon. Therefore, it seems reasonable to suppose that both climate and intrinsic biotic controls could have contributed to regulate the composition and structure of regional faunas, albeit at a different temporal scale (see BARNOSKI, 2005; PALOMBO, 2007, 2010 and reference there in).

### 2. SOURCE OF DATA

The data base consists of taxonomically revised lists of large mammal species from selected Spanish, French and Italian local faunal assemblages (LFAs, i.e., a list of the species identified from the remains retrieved at a given fossil site, and recovered from the same stratigraphic horizon) ranging in age from the Early to the Middle Pleistocene (middle Villafranchian to early Aurelian European land mammal ages, ELMAs). The lists have been compiled from previous analysis on the Plio- Pleistocene mammals of the North-western Mediterranean region (see PALOMBO 2007, 2010 and references therein) adding some recently discovered and/or revised faunas (e.g. PASTRE, 2009; BOVIN *et al.* 2010; MARTINEZ *et al.*, 2010; TORO *et al.*, 2010; PALOMBO & MILLI in press).

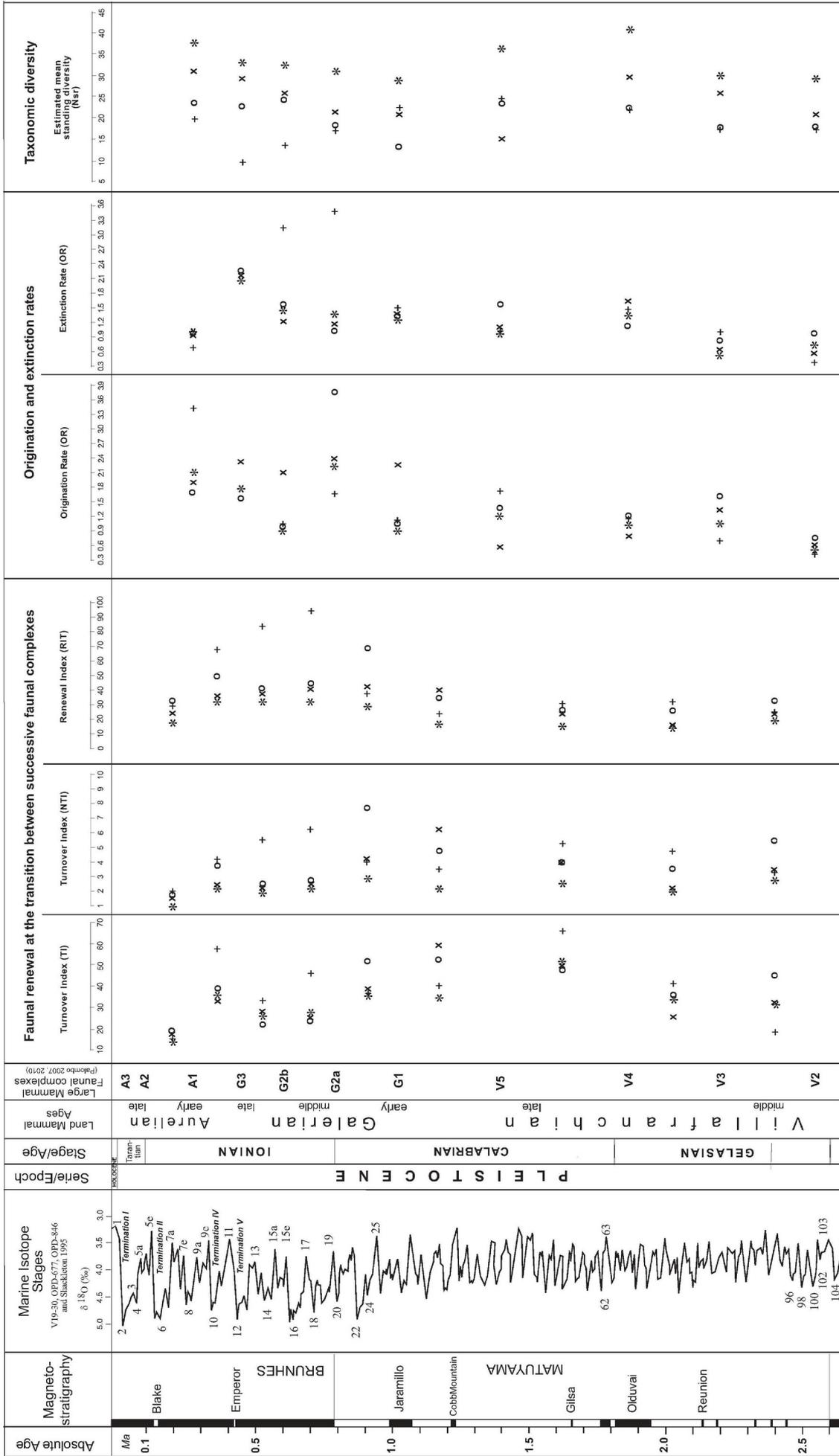


Table 1, Integrated chronological scheme and trends of faunal renewal, origination and extinction rates and taxonomic diversity in the western Mediterranean (French ( + ), Italian ( o ), Spanish ( + + ), French ( x ) and Italian ( o ) faunal complexes. Schema cronologico integrato ed andamento degli indici di rinnovo faunistico, dei tassi di comparsa e scomparsa e delle diversità nei complessi faunistici della Spagna ( + ), Francia ( x ), Italia ( o ) e del Mediterraneo occidentale nel suo insieme ( + ).

### 3. DIVERSITY AND TURNOVER

Dispersal events likely modified the structure of the pre-existing mammalian faunas, merging previously independently evolved taxa into new palaeocommunities, leading to dynamic shifts in community structure and promoting biotic and functional turnovers. As a result, dispersal events undoubtedly contributed to regulate both regional and local faunal renewals as well as diversity trends. Diversity itself is indeed regulated by the opposing forces of extinction and origination, the latter actually depending on both in situ evolution of new species, and dispersal of taxa from adjacent areas. This is because of the extension of their range, promoted by either environmental changes or disappearance of ecological/ geographical barriers. Accordingly, the study of the nature of turnover (e.g. comparing each other the perdispersal and per-origination indexes, see below) as well as of trends in faunal diversity, is an important aspect of evolutionary biology.

Understanding diversity and turnover dynamics through time and space, has important implications in correctly assessing the influence of both climate changes and intrinsic biotic factors on the evolution of mammal fauna.

Herein, taxonomical diversity was estimated as "Estimated mean standing Diversity" (Nsd) as in FOOTE (2000). Faunal renewal was estimated both as a change in the taxonomic composition at the transition between two faunal complexes belonging two successive biochrons (turnover index), as well as by the number of taxa which appeared/ disappeared during the time slice of a single biochron (origination and extinction rates).

Three turnover indexes were calculated: the Global "per dispersal" (TI-M) and the "per speciation" (TI-O) Turnover Index (TI-G) as in PALOMBO (2010). Origination (OR) and extinction (ER) rates within each biochron were calculated following FOOTE (2000). Main results are summarized in Table 1.

### 4. REMARKS

The main bioevents in the dispersal of taxa of both African and Asian origin, were mostly triggered by major global climatic changes (noticeably cold-shift oscillations around 2.6 and 1.0 Ma), to which large mammals more frequently reacted, not by evolving and producing new species, but by varying their range, in keeping with the vegetation cover and

latitudinal displacement of biomes. Over time, the appearance of such newcomers in the North-western Mediterranean regions modified the structure of the pre-existing mammalian faunas, altering the internal equilibrium of palaeocommunities, perhaps removing keystone species and giving rise to new inter-guild and intra-guild dynamics. Diachroneity in local turnover across the North-western Mediterranean regions, probably have relied on the differences in local dynamic patterns of competition/coevolution, even if the different manifestations of global climate changes in different geographic settings could have contributed to the scale of local bioevents.

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