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**PALAEOGEOGRAPHY AND MAMMAL FAUNAS
IN THE APULO-DALMATIC AREA**

by

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Three fossil mammal complexes have been preserved in the karst structures of the Gargano Peninsula (southern Italy). From the youngest one it can be recognized:

a) *Allocricetus* fauna, made up by horses, bovids, cervids and, among micro-mammals, *Allocricetus bursae* and *Microtus*. In one case the fauna has been recovered together with pre-Musterian artifacts. The age is Middle Pleistocene.

b) *Allophaiomys* fauna, an assemblage with typical villafranchian elements and some peculiar new species. *Allophaiomys pliocaenicus* is present. The age is late Early Pleistocene (DE GIULI et al., 1985a).

c) *Microtia* fauna, abundant endemic assemblages whose change can be followed over a geologically significant period. The age referred to is the Early Pliocene, but some genera show relationships with Late Miocene immigrants while others can be connected even with Early Miocene forms (DE GIULI et al., 1985b).

This work deals with the palaeogeographic evolution of the South Adriatic area during the Neogene in order to define the correlation between the geographic history of the area and the possible migration routes of the mammal faunas.

In the South Adriatic region it is possible to recognize different structural sectors from east to west:

- 1 the Dalmatic platform,
- 2 the meso-Adriatic basin,
- 3 the Apulian foreland,
- 4 the foredeep of the Apennines Range,
- 5 the Apenninic system.

These sectors formed a part of an emerged unit during the Neogene which existed in the South Adriatic area; present-day remnants are in the Balkanic and Italian Peninsulas. This unit has been defined as Apulo-Dalmatic Realm (DE GIULI et al., 1986). The main elements of this Realm were the whole Apulian region (Murge highlands, Salento Peninsula, the Tavoliere and Gargano Peninsula), with a northern extension in the Fortore—Sangro area and the shallow sea between the Gargano and the Split—Dubrovnik region (Mid-Adriatic Ridge). To the west and the northwest, no nearby continental area can be envisaged up to the Late Messinian. An emerged area was in existence to the north, made up by the Istria region and the facing part of the Adriatic Sea. Some authors envisage a NW—SE narrow ridge connecting this area with the Apulo-Dalmatic Realm. We are not yet able to define the eastern extension of the Realm in the Balkans and its relationship with other emerged units.

The endemic character of the *Microtia* fauna, namely the low number of supposed immigrants, suggests that the connection with the neighbouring continental areas has

never been easy. The low number of immigrants is in antithesis with the strong specific diversity in most assemblages from several fissures. As sister species are the rule in the *Microtia*, fauna an hypothesis of evolution in an archipelagus is highly probable. Thus the Apulo-Dalmatic Realm can be envisaged as formed by structural high blocks often emerged and discontinuously connected.

Palaeogeographic maps have been drawn concerning different geologic periods:

- 1 Early Miocene,
- 2 Middle Miocene—Tortonian,
- 3 Messinian,
- 4 Pliocene (*Sphaeroidinellopsis* and *Globorotalia margaritae* zones),
- 5 Pliocene (*Globorotalia puncticulata* zone),
- 6 Pliocene (*Globorotalia* gr. *crassaformis* zone),
- 7 Pliocene (*Globorotalia inflata* zone),
- 8 Early Pleistocene.

The Pliocene biostratigraphic zonation is according to COLALONGO and SARTONI, 1979. These subdivisions are those allowed by the available borehole stratigraphic data, published by Agip and Montedison oil companies.

On the base of the palaeogeographic sketches it is possible to recognize that an ingressive phase, flooding the Oligocene largely emerged lands, started in the Early Miocene (Fig. 1). Later in the Middle Miocene but mainly in the Tortonian (Fig. 2) the sea spread largely and caused a fragmentation of the emerged lands. Also in the Pannonian basin a distensive phase, correlating to the Tortonian, occurred during the Leithiaian orogenetic cycle (HÁMOR, 1984).

During the Messinian (Fig. 3) the domain of the sea reduced and many formerly isolated areas were again connected. To the north the emerging Apennines, already uplifting since the Tortonian, approached the western border of the Fortore—Sangro area. During the earliest Pliocene (*Sphaeroidinellopsis* and *Globorotalia margaritae* zones) emerged land conditions still persisted (Fig. 4). A new ingressive phase started during *Globorotalia puncticulata* time and progressively advanced southwards even during later periods. In the infra-Pliocene basins of the foredeep the sediments, often turbiditic, were continuously deposited on the Messinian ones only to the north. While

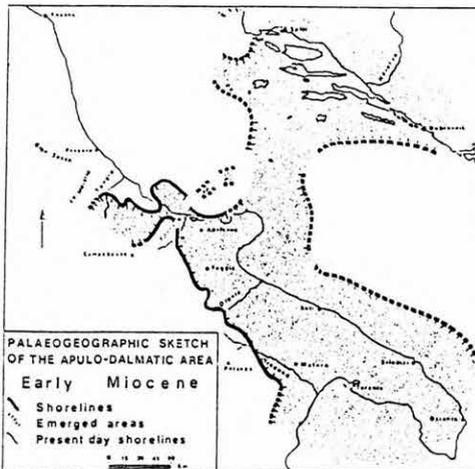


Fig. 1.



Fig. 2.

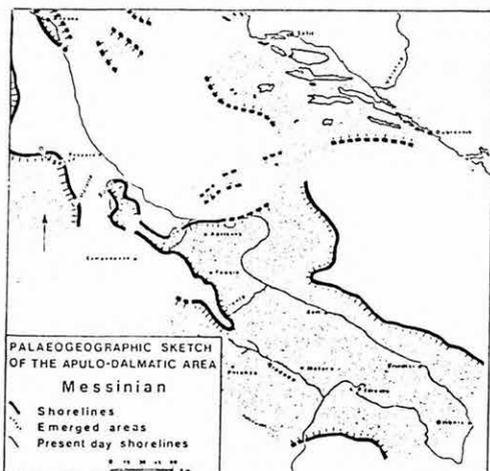


Fig. 3.

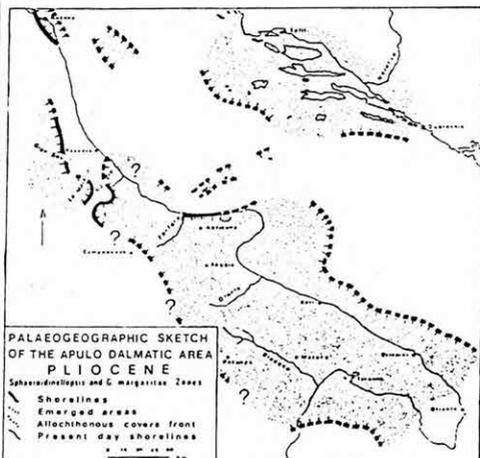


Fig. 4.

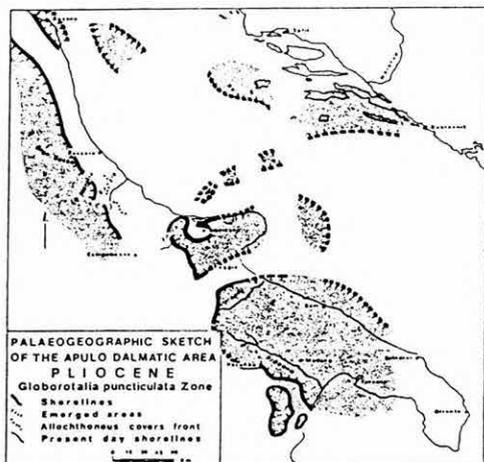


Fig. 5.

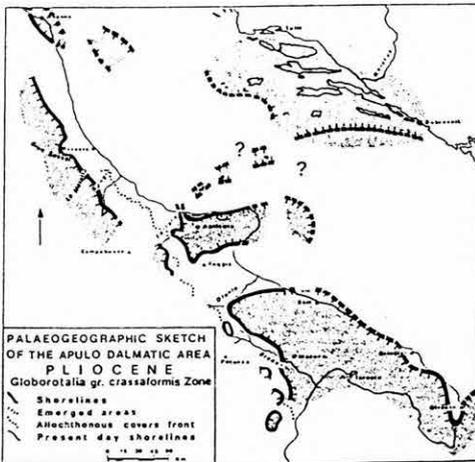


Fig. 6.

prograding to the south, the sea transgressed a progressively aging substratum, from the Middle Miocene to the Cretaceous. In the palaeogeographic sketch concerning *Globorotalia puncticulata* zone (Fig. 5) one may notice the northern Apennines moving eastward. To the south it is possible to appreciate the Apennines, emerging from the time of the Early Pliocene, approaching the Gargano area and the allochthonous covers to prograde from the west. During the later period, *Globorotalia* gr. *crassaformis* zone (Fig. 6), the general ingressive phase progressed and the basins of the fore-deep subsided and spread eastwards. However local tectonics caused a reduction of the sea on the western border of the foredeep, due to the compression generating from the Apennine movement. Meanwhile, to the eastern border, a distensive tectonics renewed the horst-graben structures with fragmentation of the foreland: extremely

variable local conditions occurred. Sedimentary gaps or reduced series took place on structurally high blocks which were isolated by sea branches. This situation is sketched in the *Globorotalia* gr. *crassaformis* zone map in which the maximal narrowing of the foredeep is in evidence.

In the Val Marecchia, a locality to the north out of the Apulo-Dalmatic Realm, fishes with some endemic characteristics have been found in Pliocene sapropelitic sediments whose age is referred to *Globorotalia* gr. *crassaformis* zone (SORBINI, 1982). Sapropels imply anoxic conditions in the northern Adriatic sea. The limited water circulation to the west has already been demonstrated from the emerging Apennines, thus we have to believe that to the east the limited circulation in the northern Adriatic basin was produced by the emerging Mid Adriatic Ridge.

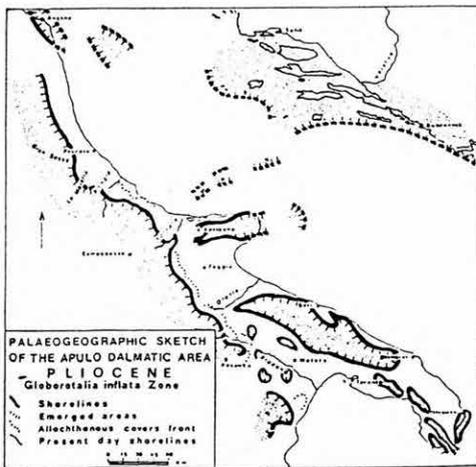


Fig. 7.

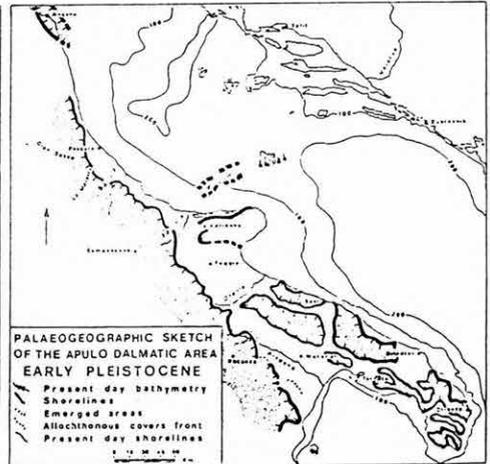


Fig. 8.

During the time of *Globorotalia inflata* zone (Fig. 7) and the Early Pleistocene (Fig. 8), the foredeep basins were still subsiding and sea domain was spreading. A contemporary high rate of sedimentation maintained neritic conditions. At the end of the Early Pleistocene a regressive phase started and the coastlines progressively approached the present day ones. No sufficient data are available at the moment to sketch palaeogeographic evolution during the whole Pleistocene.

The reconstruction of palaeogeographic maps thus confirms the existence of two regressive phases during the Miocene which could allow immigration: an Early/Middle Miocene one and a Messinian/earliest Pliocene one. In the *Microtia* fauna two groups can be recognized whose migration could be correlated to these phases.

The first group, including the erinaceids, glirids, ochotonids and cervoids, was derived from colonizers who immigrated during the first part of the Miocene. The Mid-Adriatic Ridge continuously connected the Apulian platform to the Dalmatic one and could allow mammal arrivals from the east (Fig. 1).

The features of cricetids, *Eliomys*, *Apodemus* and *Microtia* require a younger colonization phase corresponding to the Messinian regression and to the following earliest Pliocene emerged land condition (Figs. 3, 4). Also these migrations were possible only with an eastern provenance.

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