

Late Turolian slugs (Gastropoda: Pulmonata) from vertebrate-rich sedimentary dikes in the Monticino Quarry (Brisighella, Northern Italy)

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ABSTRACT — The sedimentary dikes within the uppermost evaporitic banks of the Gessoso-solfifera Fm. outcropping in the Monticino Quarry (Brisighella, Romagna Apennines) held an unusual concentration of shells of Late Turolian land slugs (Gastropoda: Pulmonata). Three families at least are represented in the dike-fauna, i.e., Limacidae, Milacidae and Parmacellidae. These shells were concentrated mechanically and trapped within karst fissures of subaerially exposed late Messinian evaporites.

RIASSUNTO — [Lumache (Gastropoda: Pulmonata) provenienti dai filoni sedimentari a vertebrati di cava Monticino (Brisighella, Italia settentrionale) — I filoni sedimentari presenti nella parte alta della Formazione Gessoso-solfifera affiorante nella cava Monticino, presso Brisighella (Appennino romagnolo), hanno fornito una ricchissima fauna di conchiglie rudimentali di lumache (Gastropoda: Pulmonata) appartenenti ad almeno tre famiglie (Limacidae, Milacidae e Parmacellidae). È probabile che la loro elevata concentrazione sia dovuta ad accumulo meccanico e selettivo in fessure carsiche nei gessi messiniani durante una fase di esposizione subaerea degli stessi. In seguito, con la formazione di filoni sedimentari, si avrebbe avuto mescolamento di queste malacofaune continentali turoliche con coeve o più recenti faune oligoaline della Formazione a Colombacci.

INTRODUCTION

The recent discovery of a very rich vertebrate fauna within sedimentary dikes infilling the evaporitic banks of the Gessoso-solfifera Fm. in the Monticino Quarry, near Brisighella (Romagna Apennines) has called the attention of many paleontologists to thoroughly study this important site (Costa *et al.*, 1986; De Giuli & Vai, 1988).

Among the commonest fossils found in the coarse fraction of some vertebrate-bearing sedimentary dikes, there are the internal shells of terrestrial pulmonate gastropods (slugs) only rarely encountered in the fossil record.

Their presence in the Monticino Quarry has been already reported by the writer (Taviani, 1988). The present article updates the information now available on these upper Miocene (Late Turolian) slugs.

MATERIAL

The residues of large sediment samples washed for searching vertebrate bones held many hundreds of reasonably well preserved slug shells, yellowish in co-

lor and ranging from ca. 1 to 15 mm in size. Besides slugs and vertebrate bones, recurrent biogenic components of the coarse fraction are other molluscs (see Taviani, 1988; Esu & Taviani, 1989), i.e., oligohaline fragmented bivalves (mostly Dreissenidae and Limnocardiiidae) and gastropods (often as internal molds) from the Colombacci Formation, internal molds of land snails, calcareous opercula of *Pomatias*, together with reworked benthic foraminifera.

The samples which resulted rich in slug remains are BRS3, 5, 5 (T1 bis), 14, and 24.

SYSTEMATICS

In my previous article (Taviani, 1988, p. 60), I tentatively assigned the fossil slugs from Monticino Quarry to three different families of Pulmonate gastropods (i.e., Limacidae, Arionidae?, Testacellidae?), being well aware of the almost unsurmountable problem to classify slugs based on the characters of their rudimentary shells only (e.g., Kerney & Cameron, 1979; Cambridge, 1981).

In order to assess better the systematic position of the Turolian slugs under study, I have submitted part of

this material to the much more expert eyes of F. Giusti and G. Manganelli, from the University of Siena (Italy).

These specialists were able to confirm the presence of three families *at least*, which are:

LIMACIDAE

(see Taviani, 1988, fig. 2d-e)

Material — A few tens of shells, up to 15 mm in size.

MILACIDAE

(= Arionidae? of Taviani, 1988, fig. 2f)

Material — A few hundred shells of small size.

PARMACELLIDAE

(= Testacellidae? of Taviani, 1988, fig. 2c)

Material — Many hundreds shells; this is by far the commonest slug at Monticino although it is mostly represented by the juvenile, coiled part of the shell the rest being very often fragmented.

According to G. Manganelli (writt. com.) "It is not case to propose generic determinations for Limacidae and Milacidae since their shell characteristics have no taxonomic meaning" (translated from the Italian original text). Concerning the Parmacellidae, it was not possible to ascertain their generic position because of the fragmentary state of the material. Nonetheless, such finding is important to trace the evolutionary history of this family which has left a very incomplete fossil record: under such respect, it is worth mentioning that the nominal genus *Parmacella* has been recorded from the early Pleistocene of Hungary (Krolopp, 1973), lower Pleistocene of Britain (Cambridge, 1981) and it has been recently found in the Pleistocene of Italy (Manganelli & Giusti, in press).

DISCUSSION

The Messinian was a crucial moment of the geological history of the Mediterranean basin and relative land faunas have witnessed important climatic and geographic changes (Azzaroli & Guazzone, 1980). Accordingly, it was hoped that the abundant slug material from Monticino Quarry could allow to derive some new paleobiogeographic information on the affinity of Mediterranean upper Miocene land faunas which is not, however, possible because of the impossibility, at the present state of our knowledge, to go behind a simple familiar attribution of our fossil slugs.

On the other hand, the finding of such material allows some paleoenvironmental speculations. These slugs are truly terrestrial gastropods normally encountered in vegetated areas. Therefore, their presence at Monticino points to the existence of subaerially exposed land where these gastropods could thrive. Considering that the concentration of slug shells found in the sedimentary dikes is unusually high, it is hypothesizable that their accumulation was mechanical. It is likely that they concentrated (flood?, biogenic activity?) close to or within open fissures within subaerially exposed evaporites (karstic traps); somewhat later these same fissures were plugged with Colombacci-derived material as well, which resulted in the final taphonomic mixing of land and oligohaline faunas.

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