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Oligohaline mollusc faunas of the Colombacci Formation (upper Messinian) from an exceptional fossil vertebrate site in the Romagna Apennines: Monticino Quarry (Brisighella, N Italy)

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ABSTRACT — Oligohaline mollusc faunas recovered in the Monticino Quarry (Brisighella, Italy) from the Colombacci Formation (upper Messinian) both in situ *and from sedimentary dikes infilling karst fissures within Messinian evaporites are briefly described. The assemblages are dominated by Dreissenidae* (Dreissena rostriformis) *and Limnocardiidae* (Plagiodacna *cfr.* carinata, ? Didacna *cfr.* bollenense, *and Limnocardiidae undetermined) associated with rare* Mactra *sp.; gastropoda are less frequent* (Neritina mutinensis, Saccoia *cfr.* fontannesi, *and* Melanopsis narzolina). *Preservation state is rather poor with the fossil remains being very often decalcified, gypsified and deformed. Species composition reveals the coexistence of elements of western Mediterranean paleobiogeographic affinity together with Paratethyan and Italian endemic ones. Terrestrial gastropods, belonging to theree different species of Pulmonates (cfr.* Oxychilus *sp.,* Rumina *cfr.* decollata, *cfr.* Helix *sp.) and one terrestrial Prosobranch* (Pomatias *sp.) have been also found in clayey sediments of the Colombacci Formation or in their dikes.*

RIASSUNTO — [Malacofaune oligoaline della Formazione a Colombacci (Messiniano superiore) associate a resti di vertebrati nella cava di Monticino] — *La Formazione a Colombacci (Messiniano superiore) affiorante nella cava di Monticino, presso Brisighella (Appennino romagnolo), è ricca di resti di malacofaune oligoaline, sebbene in modesto stato di conservazione. Tali associazioni sono state rinvenute sia* in situ *che all'interno dei filoni sedimentari noti in letteratura per la loro eccezionale ricchezza in resti di vertebrati. Dominano i bivalvi con Dreissenidae* (Dreissena rostriformis) *e Limnocardiidae* (Plagiodacna *cfr.* carinata, ? Didacna *cfr.* bollenense, *Limnocardiidae indeterminabili), con associate rare* Mactra *sp. I gasteropodi sono meno abbondanti* (Neritina mutinensis, Saccoia *cfr.* fontannesi, Melanopsis narzolina). *La composizione specifica di tali associazioni rivela la coesistenza di elementi a distribuzione paleobiogeografica tipicamente mediterranea occidentale, con elementi della Paratetide ed endemici alla penisola italiana. Sono stati inoltre rinvenuti alcuni gasteropodi terrestri (cfr.* Oxychilus *sp.,* Rumina *cfr.* decollata, *cfr.* Helix *sp.) in precario stato di conservazione ed alcuni opercoli calcarei di* Pomatias *sp.*

INTRODUCTION

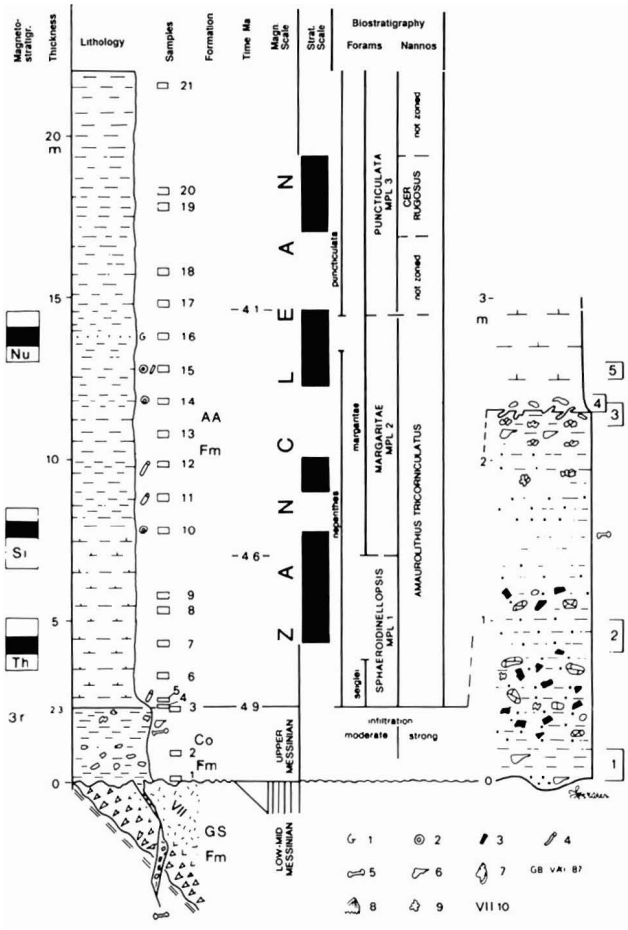
An exceptional vertebrate site has been very recently discovered in the Monticino Quarry of Brisighella (Faenza, N Italy) where gypsum is mined out from the Messinian evaporitic Gessoso-Solfifera Formation (Costa *et al.*, 1986). A wealth of mammal, bird, amphibian and reptile remains is concentrated within sedimentary dikes and pockets filling paleokarst fissures of the uppermost selenite banks (Costa *et al.*, 1986; De Giuli *et al.*, 1988; Kotsakis, 1989; Kotsakis & Masini, 1989). Infilling is represented by different lithotypes of the Colombacci Formation (upper Messinian) which unconformably overlies the Gessoso-solfifera Formation and underlays the Argille Azzurre Fm (Trubi-like clay of lower Pliocene age, *Sphaeroidinellopsis* Zone).

For a better understanding of this outcrop, which appears of paramount importance for a clearer definition of time-correlation between continental and marine Neogene domains (Costa *et al.*, 1986), a complete inventory of the fossil content has been undertaken by many specialists. Here we refer to the oligohaline mollusc remains belonging to the Colombacci Formation.

Preliminary information on these same faunas was presented by Marabini & Vai (1988) and Taviani (1988). In this article a more accurate systematic description is given also in light of new findings done in the summer-fall 1988.

STRATIGRAPHIC POSITION AND TAPHONOMIC ASPECTS OF OLIGOHALINE MOLLUSC FAUNAS RECOVERED AT MONTICINO QUARRY

It seems unnecessary to discuss again the geological and stratigraphical framework of this site which has been thoroughly detailed elsewhere (Vai & Ricci Lucchi, 1976; Marabini & Vai, 1985, 1988; Vai, 1988). For our purposes, it is sufficient to recall that our faunas were collected within the Colombacci Fm and from the infilling of sedimentary dikes (Taviani, 1989).



Text-fig. 1 - Stratigraphic column of Monticino Section 1987. 1, glauconite; 2, marcasite nodules; 3, wood fragments; 4, bioturbation; 5, bones; 6, molluscs (*Dreissena*); 7, *Melanopsis;* 8, *Limnocardium;* 9, Ca concretions; VII, evaporite cycle. (from Marabini & Vai, 1988).

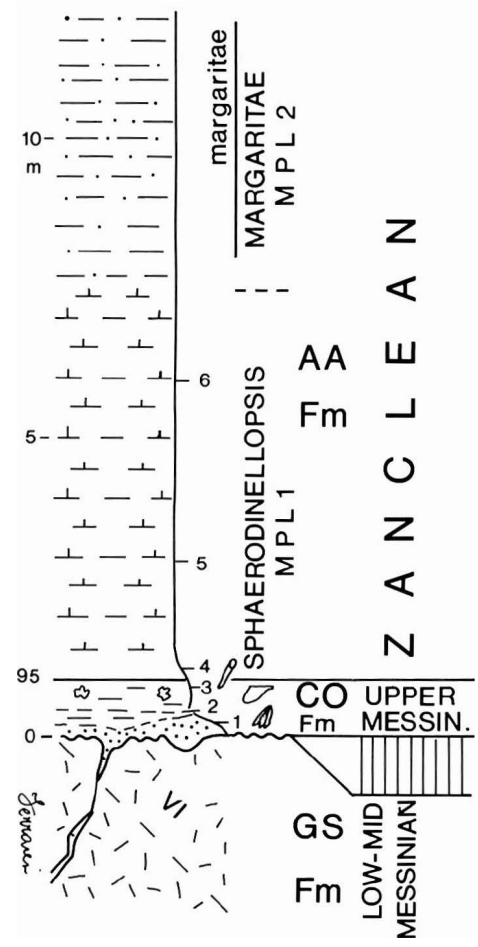
For the lithology of the Colombacci Fm in the studied quarry, the reader has to refer mostly to the Monticino 1987 Section described by Marabini & Vai (1988) which quote:

Colombacci Fm. It is represented by 2.3 metres of alternating dark-grey to green, brown and black brackish clays and fine grained, silt to fine sand-supported rudite, including green-gray to brackish ripped-up angular clayey clasts, mollusc fragments, small possibly reworked concretions and well-rounded lithic pebbles (mainly carbonates up to 5-6 cm of size). A *caliche* horizon is almost developed in the uppermost blackish clay. *Limnocardium* sp. was found at the very silty-sandy base. Rich, small mollusc assemblages of brackish-oligohaline water *(Dreissena, Limnocardium, Melanopsis,* etc.) are common in the upper part, where a few loose bones occur. The transition to the overlying Fm is sharp (particularly due to the color change)".

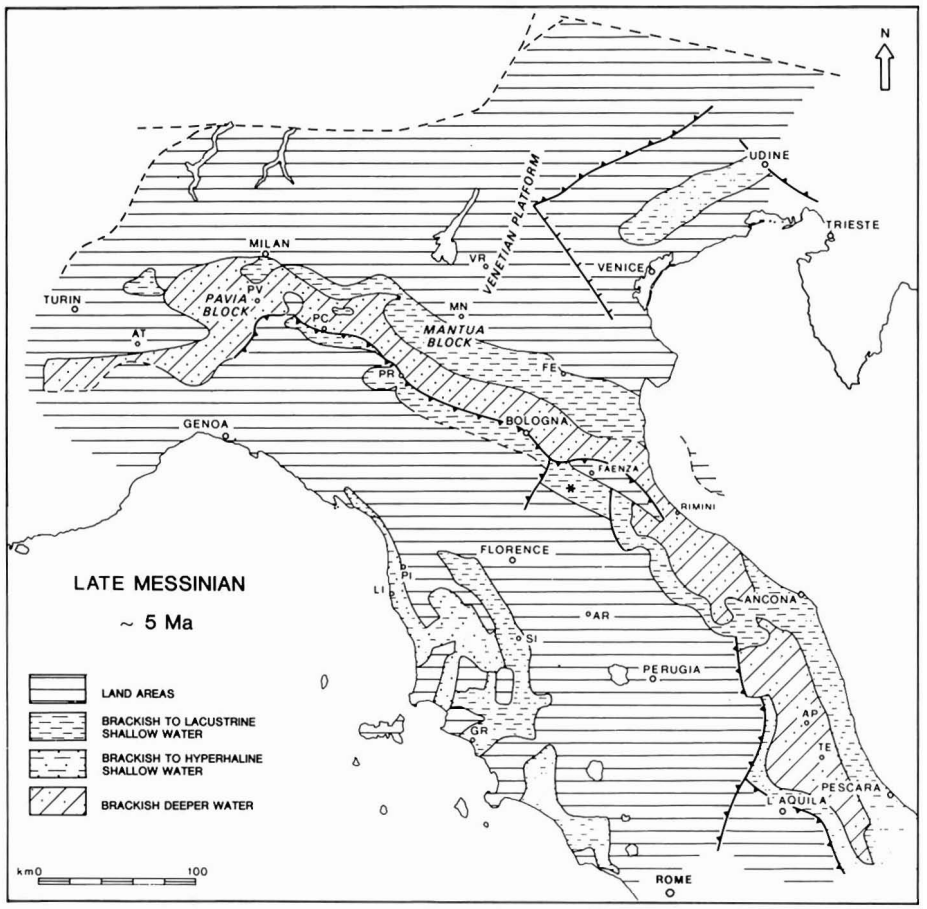
As it is well known from the literature, such formation represents brackish-freshwater environments (Ruggieri, 1967; Casati *et al.,* 1978; Colalongo *et al.,* 1978a) which succeeded the end of the evaporitic regime within the Mediterranean basin (see paleogeographic map of Text-fig. 3).

Faunal samples from *in situ* Colombacci Fm observed by us are represented by Limnocardiid-greyish silty-marls and by gastropod-rich *(Melanopsis)* olive-green marls; these two major lithotypes however support a fauna substantially identical although differences can be noticed in the relative number of individuals: in fact, the Limnocardiid silty marls are exceedingly rich in bivalves while they are scarce in the *Melanopsis* marls (see also Taviani, 1988). The matrix from karst infilling is made up by both types although dominant is a *Melanopsis*-rich pebbly greenish pebbly mudstone.

Preservation state of mollusc faunas is generally rather poor with advanced decalcification and gypsification being the most evident taphonomic bias togeth-



Text-fig. 2 - Stratigraphic column of Monticino Section 1985 (legend to symbols as in text-fig. 1. (from Marabini & Vai, 1988).



Text-fig. 3 - Late Messinian (5 Ma) palaeogeography of northern Italy. (from Vai, 1988).

er with a more or less important deformation of the shell remains. Most bivalves are disarticulated and often fragmented.

The material was collected along the Section 1985 and 1987 of Marabini & Vai (1988): see stratigraphic logs of Text-fig. 1.

SYSTEMATICS

The mollusc faunas collected in the Monticino Quarry comprehend the following species:

Class BIVALVIA
Family DREISSENIDAE

DREISSENA ROSTRIFORMIS Deshayes (ssp.?) (= *D. simplex* Auct. it., not Barbot = *D. mayeri* Sacco)

This species, represented by numerous and fairly preserved specimens (cited by Taviani, 1988: fig. 1, under the name of *D. simplex* Barbot), is rather variable and is widely distributed in the upper Messinian of the Mediterranean basin (e.g., Capellini, 1879, 1880; Cafici, 1880, 1883; Gillet, 1963; Gillet *et al.*, 1965; Devoto, 1969; Colalongo *et al.*, 1978a, 1978b; Esu & Kotsakis, 1983).According to Archambault-Guezou (1976) the Mediterranean populations would represent a local 'variety' of typical *D. rostriformis* which is distributed in the Dacian basin.

Family LIMNOCARDIIDAE

PLAGIODACNA cfr. CARINATA (Deshayes)
Text-fig. 4

A few disarticulated valves appear to be likely referable to this species which shows a highly variability with respect to the carina, which is more or less developed depending upon individual variations.

It is of paratethyan affinity (Crimea, Dacian basin) and it has been reported from some Messinian localities along the Italian peninsula (Piedmont, Tuscany, Marches: Capellini, 1879, 1880; Sacco, 1899).

In the past, the generic attribution has been very controversial with the species being included in *Cardium, Adacna, Pontalmyra,* but modern authors have included *carinata* within the paratethyan genus *Plagiodacna* (e.g., Andreescu, 1977; Papaianopol, 1981).

? DIDACNA cfr. BOLLENENSE (Mayer)
Text-fig. 5

Some disarticulated, rather decalcified valves whose hinge area is not visible, are tentatively attributed to this species of Mediterranean affinity whose exact generic collocation needs to be verified. *D. bollenense* has been cited for the Mio-Pliocene of central-western Mediterranean (Rhone, Papiol, Castellbisbal, Corsica: Gillet, 1965) and, occasionally, for the Messinian of central and northern Italy (Capellini, 1879; Pantanelli, 1886). Old records, however, require taxonomic revision.

LIMNOCARDIIDAE genera and species undet.

We have observed many fragments of Limnocardiids which cannot be determined with accuracy but that belong to other species.

Family MACTRIDAE

MACTRA sp.

Two small valves appear to belong to an undetermined species of this eurihaline bivalvia.

Class GASTROPODA
Family NERITIDAE

NERITINA MUTINENSIS D'Ancona

This species, widely distributed in the Messinian of peninsular Italy and Sicily (Capellini, 1874, 1880; Cafici, 1880, 1883; Pantanelli, 1886; Gillet *et al.*, 1965; Colalongo *et al.*, 1978a; Iaccarino & Papani, 1979), is represented in our site by a few, poorly preserved shells. Recorded from the site by Taviani (1988, fig. 2b).

Family HYDROBIIDAE

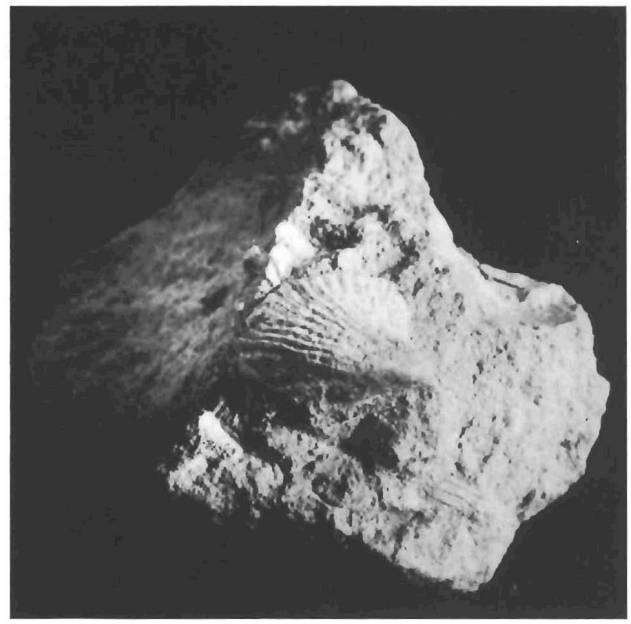
SACCOIA cfr. FONTANNESI (Capellini)

Almost completely decalcified, deformed and incomplete specimens, occurring very rarely in our samples, probably belong to this Messinian species, which is distributed along the Italian peninsula (e.g., Sacco, 1880, 1895; Sangiorgi, 1906; Gillet, 1963; Gillet *et al.*, 1965).

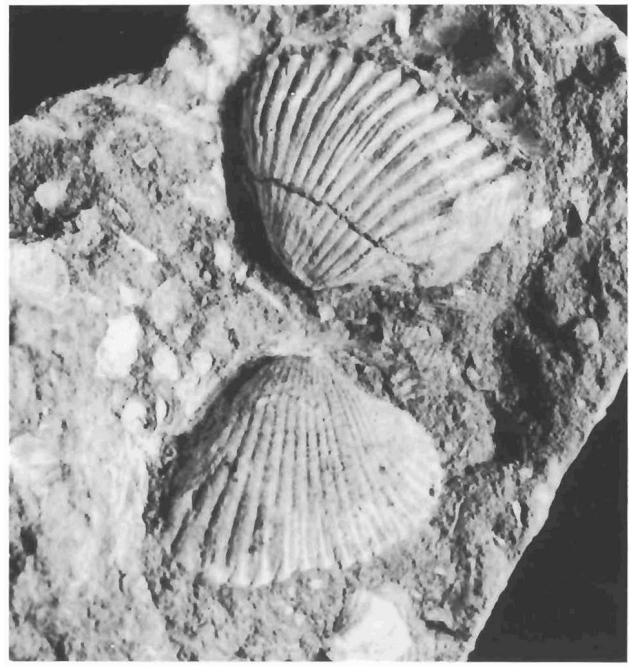
Family THIARIDAE

MELANOPSIS NARZOLINA Archiac

This species is relatively frequent in the Monticino Quarry (Taviani, 1988: fig. 2a) where is mostly represented by highly decalcified shells or by internal molds. *M. narzolina* is a species of western European affinity and it is widely distributed in central western Mediterranean, Italian peninsula and Sicily (e.g., Capellini, 1880; Cafici, 1880, 1883; Pantanelli, 1886; Sacco, 1895; Gillet, 1963; Devoto, 1969; Truc, 1971; Colalongo *et al.*,



Text-fig. 4 - *Plagiodacna* cfr. *carinata* (Deshayes), ×1,5



Text-fig. 5 - *? Didacna* cfr. *bollenense* (Mayer), ×1,2.

1978a, 1978b; Iaccarino & Papani, 1979; Esu & Kotsakis, 1983; Esu *et al.*, 1986).

PALEOBIOGEOGRAPHIC REMARKS

The oligohaline mollusc faunas of Monticino Quarry show the coexistence of elements considered of western Mediterranean affinity *(D.* cfr. *bollenense, M. narzolina)* together with Paratethyan *(D. rostriformis, P. carinata)* and Italian endemic species *(N. mutinensis, S. fontannesi)*. For major details and for comparisons with other occurrences of analogous faunas in the Mediterranean basin, the reader may refer to Esu & Girotti (1989).

APPENDIX: TERRESTRIAL MOLLUSCS

Within some clayey levels we have osberved the presence of terrestrial gastropods. Only a few are the upper Miocene records of terrestrial mollusc faunas in the Mediterranean basin (Esu & Girotti, 1989). Our material is in a rather poor preservation state so that it is not simple to ascertain the taxonomic position at specific level. Within the sedimentary dikes, are extremely abundant the shells of pulmonate slugs (Taviani, 1988) to which it is reported in a separate article (Taviani, 1989).

Class GASTROPODA
Subclass PROSOBRANCHIA
Family POMATIASIDAE

POMATIAS sp.

A few opercula unquestionably belonging to this genus (F. Giusti and G. Manganelli, pers. comm.) have been found in the sedimentary dikes mixed with small vertebrate bones and slug shelled remains (see Taviani, 1988). The absence of either whole shells or fragments of *Pomatias* may be due to selective dissolution of the thin shell *vs* the rather harder operculum; such a phenomenon has been observed in the nearby Pleistocene continental deposits of Olmatello (Vai, 1984; Taviani, unpubl. data), at the expsenses of the extant taxon *Pomatias elegans* (Müller). Alternatively, it may be supposed that opercula behaved differently from shells and mechanically accumulated separately.

Subclass PULMONATA
Family ZONITIDAE

cfr. OXYCHILUS sp.

A single, rather damaged shell is tentatively attributed to this genus.

Family SUBULINIDAE

RUMINA cfr. DECOLLATA (Linne')

We found one incomplete and strongly fragmented shell tentatively assigned to this common species widely distributed in the temperate Mediterranean region since the Miocene, although only rarely occuring in Messinian strata (D. Esu, pers. unpubl. data).

Family HELICIDAE

cfr. HELIX sp.

A rather large Helicid is represented by five deformed shells whose aperture is not visible since embedded in the sediment.

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