

<i>Bollettino della Società Paleontologica Italiana</i>	35 (3), 1996	ISSN 0375-7633	277-280	–	Modena, Luglio 1997
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Lower Pleistocene record of the boreal guest *Macoma obliqua* (Sowerby, 1817) from the Romagna Apennine (N Italy)

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KEY WORDS – *Bivalvia* (Mollusca), *Macoma obliqua*, Boreal guest, Pleistocene, Apennine, N. Italy.

ABSTRACT – The boreal guest *Macoma obliqua* (Sowerby, 1817) is recorded for the first time in the Pleistocene of the Romagna Apennine where it occurs in clayey-silty sediments of the Lower Emilian. This finding considerably extends the Pleistocene geographic range of this taxon within the Mediterranean basin, previously known to be limited to southern Italy.

RIASSUNTO – [Segnalazione dell'ospite boreale *Macoma obliqua* nel Pleistocene inferiore dell'Appennino romagnolo (N. Italia)] – Viene segnalata la presenza dell'ospite boreale *Macoma obliqua* (Sowerby, 1817) nel Pleistocene (Emiliano inferiore) dell'Appennino romagnolo (Valle del F. Lamone). Questo ritrovamento estende al bacino padano l'areale di distribuzione pleistocenico di questa specie finora confermato, limitatamente al bacino del Mediterraneo, solo per giacimenti dell'Italia meridionale.

INTRODUCTION

Macoma obliqua (Sowerby, 1817) is a well known «boreal guest» of the Mediterranean Pleistocene (Raffi, 1986; Malatesta & Zarlenga, 1988). The taxonomic position and the chronostratigraphic range of this species have been critically reviewed by Bellomo & Raffi (1991) who also provided a comprehensive iconography of this taxon. This species got extinct sometimes during the Pleistocene, its latest known occurrence being related to upper Sicilian deposits of the Mediterranean basin (Bellomo & Raffi, 1991).

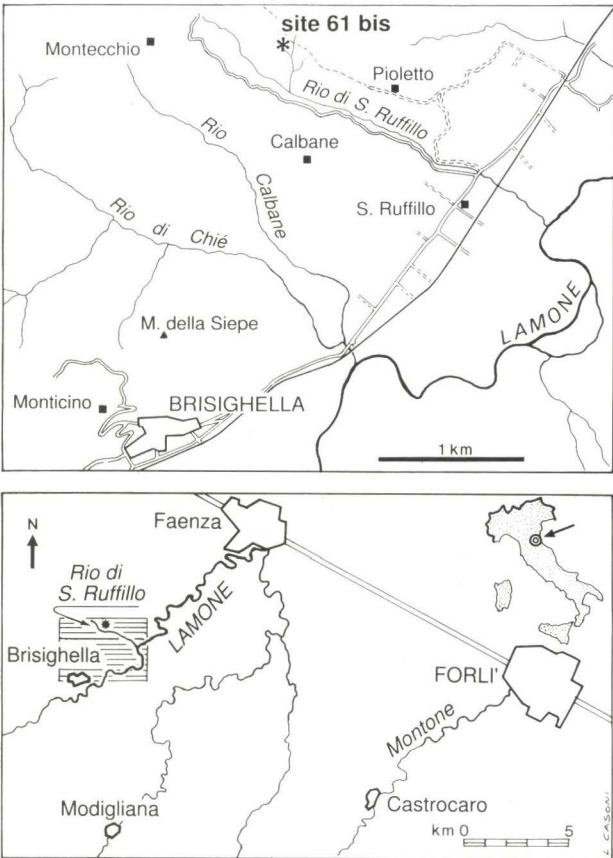
One question left open by these Authors concerns the paleobiogeographic distribution of *M. obliqua* within the Mediterranean basin. In fact, this taxon has been recorded from the Po valley (Padan) basin based on a single shell from Castell'Arquato, near Piacenza (Sacco, 1901, *sub M. lata*). Since this unique record has never been later confirmed by further findings, Bellomo & Raffi (1991) prudently consider rather doubtful the presence of *M. obliqua* in the Padan basin.

Recent research on the Plio-Pleistocene deposits of the Romagna Apennine (Sami, 1992) has led to the finding of *M. obliqua* in lower Pleistocene deposits of the Lamone river valley, between Faenza and Brisighella (Text-fig. 1). This species is not recorded in the faunal lists of the Romagna Apennine (e.g., Ruggieri, 1962, 1975). The present record is based on two valves in excellent preservation conditions (Text-fig. 2).

THE RIO DI SAN RUFFILLO (RIO PIOLO) SECTION

GENERAL GEOLOGIC SETTING

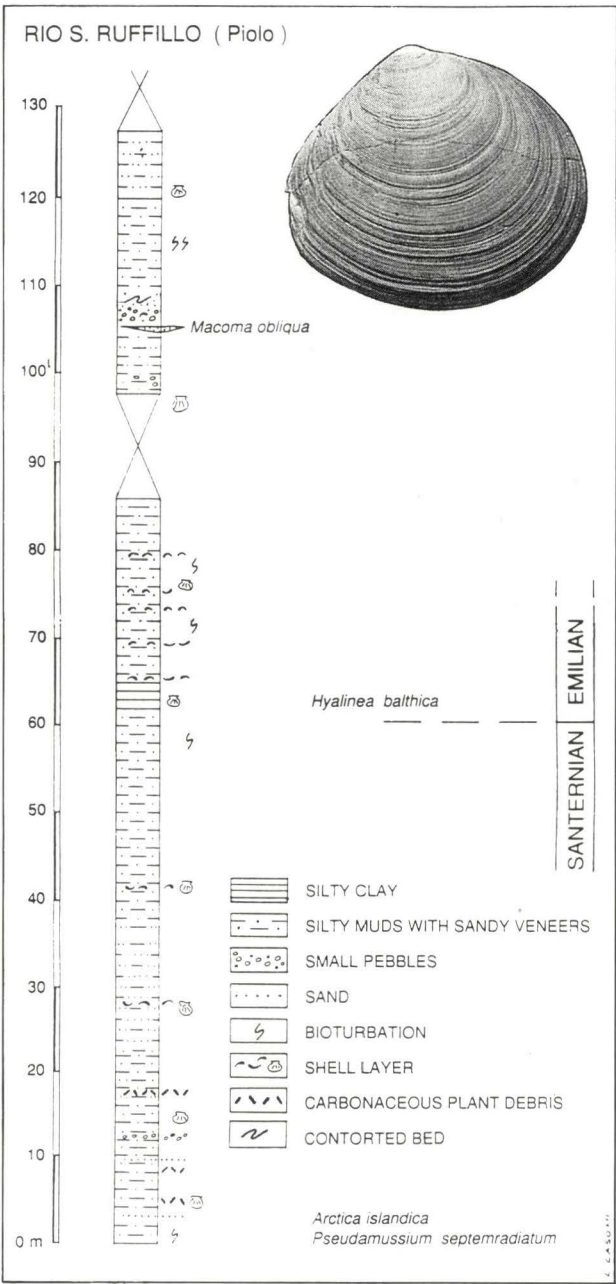
The lower Lamone Valley is lithostratigraphically characterized by the widespread occurrence of excellent outcrops of Plio-Pleistocene sedimentary units, mostly belonging to the «Argille Azzurre» Formation. According to Sami (1992), the Lamone marine series comprehends all foraminiferal biozones as defined by Colalongo *et al.* (1982), from the lowermost Pliocene *Sphaeroidinellopsis* zone to the lower Pleistocene (Emilian, FO of *Hyalinea balthica*). The Lamone marine series overlies a condensed terrestrial/paralic sedimentary sequence (up to 2 m, Monticino quarry) belonging to the «Colombacci» Formation (Vai, 1988). The whole thickness of the «Argille Azzurre» Fm. is ca. 2200 m, although series repetitions cannot be ruled out (Sami, 1992). Overall, this formation represents a regressive trend with bathyal environments predominating for most of the Pliocene and a gradual bathymetric shallowing during the Pleistocene. The «Argille Azzurre» are unconformably and erosionally truncated by marine littoral sands («Sabbie Gialle» of the authors) whose precise age is still matter of debate, with propositions ranging from Emilian to Crotonian (e.g., Viaggi, 1991, Marabini *et al.*, 1996). The sequence ends with continental sediments pertaining to the «Olmattello» Formation and unconformably truncating the marine series and by later alluvial sediments (Vai, 1988).



Text-fig. 1 - Location map of the fossiliferous outcrop in the Romagna Apennine where *Macoma obliqua* has been found.

LITHOSTRATIGRAPHY

The Rio di San Ruffillo (= Rio Piolo in the 1:5000 C.T.R. map) section crops out along this small tributary in the badlands of the Lamone river catchment and consists of a *ca.* 130 m-thick, 135N/15-dipping sequence entirely belonging to the «Argille Azzurre» Fm. (Text-fig. 2). The prevalent lithology is a structureless gray silty-clay, with frequent mm-thick silty-sand veneers and sparse lenticular sandy layers and shell lags. Two distinct, 30-cm thick pebbly mudstones occur near the base and in the upper part of the section. Pebbles are ovoidal-shaped, 1-12 cm in size and their main lithologies are carbonates, cherts and, subordinately, sandstones. A sandy horizon, showing small-scale disturbances (contorted bedding), is interpreted as a slump deposit. It overlies the uppermost pebbly mudstone and the lenticular layer containing a shallowmarine reworked macrofauna with *Macoma obliqua*. The massive gray silty clay contains an *in situ* macrofauna dominated by deep-sea protobranch bivalves, e.g., *Neilo isseli* Bellardi, 1875, *Neilonella pusio* (Philippi, 1844) and



Text-fig. 2 - Simplified lithostratigraphic log of the Pleistocene section of Rio di San Ruffillo. The photographed shell of *Macoma obliqua* is the best preserved actual sample discussed in this paper.

Spinula excisa (Philippi, 1844) and scaphopods, e.g., *Fustiaria triquetra* (Brocchi, 1814). The depositional environment of the section under scrutiny is interpretable as a relatively deep muddy slope fed by intermittent gravity deposits (Sami, 1992). A similar depositional style has been recognized also in the lower Pleistocene deposits of the Santerno valley, further to the northwest of the study area (Ruggieri, 1975). Tur-

bidites and slumpings are responsible to convey down-basin mixed shallow-marine faunas belonging to different inner-middle shelf environments (e.g., coastal muds rich in *Turritella tricarinata pliorecens*, inner shoreface sands with *Chamelea gallina* etc.).

AGE

According to its microfaunal content, this section belongs to the Lower Pleistocene (Colalongo in Sami, 1992). Based on the F.O. of the marker *Hyalinea balthica*, the Santerian-Emilian boundary is found ca. 45 m below the occurrence of *M. obliqua* layer which is, therefore, attributable to the Lower Emilian.

THE MOLLUSK FAUNA ASSOCIATED TO *MACOMA OBLIQUA*

Overall we have identified 37 species of mollusks (14 gastropods and 23 bivalves). The fossil fauna is mostly deposited in the Natural History Museum of the town of Faenza; a small voucher collection is stored in the Malacological collections of the Zoological Museum of the University of Bologna.

The malacofauna of the resedimented bed containing *M. obliqua* is represented by the following taxa:

GASTROPODA

Monodonta mutabilis (Philippi, 1846)
Turritella tricarinata pliorecens Crema in Monterosato, 1900
Aporrhais pespelecani (Linné, 1758)
Neverita josephina Risso, 1826
Euspira helicina (Brocchi, 1814)
Euspira guillemini (Payraudeau, 1826)
Nassarius cabrierensis (Fontannes, 1878)
Nassarius incrassatus (Stroem, 1768)
Nassarius reticulatus (Linné, 1758)
Nassarius circumcinctus (Adams, A., 1852)
Nassarius mutabilis (Linné, 1758)
Mitrella nassoides (Grateloup, 1827)
Bela nebula (Montagu, 1803)
Ringicula auriculata (Ménard de la Groye, 1811)

BIVALVIA

Nuculana commutata (Philippi, 1844)
Glycymeris insubrica (Brocchi, 1814)
Aequipecten opercularis (Linné, 1758)
Acanthocardia tuberculata (Linné, 1758)
Acanthocardia paucicostata (Sowerby G.B.II, 1841)

Macra stultorum (Linné, 1758)
Spisula subtruncata (Da Costa, 1778)
Solen marginatus Pulteney, 1799
Ensis ensis (Linné, 1758)
Tellina nitida Poli, 1791
Tellina pulchella Lamarck, 1818
Psammobia fervensis (Gmelin, 1791)
Donax venustus Poli, 1795
Donax trunculus (Linné, 1758)
Arctica islandica (Linné, 1758)
Solecurtus scopula (Turton, 1822)
Solecurtus strigilatus (Linné, 1758)
Azorinus chamasolen (Da Costa, 1778)
Venus nux Gmelin, 1791
Chamelea gallina (Linné, 1758)
Dosinia lupinus (Linné, 1758)
Venerupis senescens (Doderlein in Cocconi, 1873)
Pandora pinna (Montagu, 1803)

DISCUSSION AND CONCLUSIONS

In consideration of the absolute dominance of extant taxa, it appears legit to compare our fossil assemblage to modern biocoenoses living in the Atlantic ocean and Mediterranean sea. From such a comparison some ecological inferences can be derived. Overall this fauna clearly points out a neritic, shallow-marine environment. However, it is evident that the taphocoenosis was fed by multiple sources. Most taxa appear exclusive or preferential of well sorted shoreface sands (e.g., *Neverita josephina*, *Nassarius mutabilis*, *Macra stultorum*, *Solen marginatus*, *Spisula subtruncata*, *Chamelea gallina*, *Dosinia lupinus*, and, probably, *Acanthocardia paucicostata* and *Ensis ensis*). Others are typical of intertidal rocky environments (*Monodonta mutabilis*) or coastal muds and muddy-sands (e.g., *Turritella tricarinata pliorecens*, *Trophon muricatus*, *Nassarius cabrierensis* etc.). Finally, some species may indicate a certain lowering of salinity (*Venerupis senescens*, *Nassarius reticulatus*).

The fossil assemblage also shows the puzzling co-occurrence of species with apparent opposite climatic significance. Overall the fauna is clearly of «cold» affinity as proven by the presence of *M. obliqua* and *A. islandica* but also by morphotypes of *A. echinata*, *C. gallina*, *D. lupinus* etc. with very thickened shells. However, the gastropod *N. circumcinctus* is not rare. This taxon is normally considered a warm-temperate species because of its present-day Mediterranean distribution, virtually confined to the Levantine basin (Sabelli & Spada, 1977). We consider highly unlikely the mixing of cold and warm species to justify this incongruence. Instead we

postulate that the taxon *N. circumcinctus* has a wider ecologic valence for temperature than the one we can deduce by looking at its modern geographic range alone. In fact, shells belonging to *N. circumcinctus* attributable to a mild interstadial of the Würm glaciation, have been found associated to a Paleolithic culture of the Lessini mountains (Fiocchi, 1994). Because of the coexistence in this same unit of taxa originary pertaining to distinct neritic biocoenoses, the existence of *post-mortem* mixing is obvious. In summary, the taphocoenosis is the result of significant mixing of shells originated from different infralittoral environments, some of them echoing the sedimentary and salinity influence of a fluvial entry point. As discussed above, mass gravity transport is significant in the Pleistocene of the study area (Sami, 1992). In fact, the clayey part of the Rio di San Ruffillo section (containing epybathyal macrofauna) points out a monotonous deep-sea sedimentation which has been occasionally interrupted by risedimentation of neritic deposits enriched in shallow-marine fossils, including the assemblage containing *Macoma obliqua*.

ACKNOWLEDGEMENTS

We thank S. Raffi, G. B. Vai and G. Pelosio for critical suggestions. Drawing by L. Casoni and photograph by P. Ferrieri. This is IGM scientific contribution n. 1077.

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(manuscript received January 30, 1996
accepted April 22, 1997)

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