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Original article

Latest Messinian "Lago-Mare" Lymnocardiinae from Italy: Close relations with the Pontian fauna from the Dacic Basin

Lymnocardiinae du Messinien terminal (faciès « Lago Mare ») d'Italie : relations étroites avec la faune pontienne du bassin Dacique

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Abstract

Rich hypo- to mesohaline molluscan assemblages characterising the latest Messinian "Lago-Mare" biofacies, composed of prosobranch gastropods (Neritidae, Thiaridae, Melanopsidae, Hydrobiidae) and bivalves of the families Cardiidae (subfamily Lymnocardiinae) and Dreissenidae, are widespread in shallow water basins characterized by low salinities within the Mediterranean realm, during the post-evaporitic phase in the time-span 5.5–5.3 Ma. Several genera and species are recorded in the Italian uppermost Messinian sediments. While the gastropods show endemic character being linked to continental water-systems, Lymnocardiinae and Dreissenidae have strong Paratethyan affinity. New records of significant species of Lymnocardiinae from the uppermost Messinian sediments of Tuscany, Marches and Sicily and the systematic review of the old literature data point out close relations of the Italian fauna with that from the Pontian sediments of the Dacic Basin. The palaeobiogeographical data referred to Messinian and Pontian Lymnocardiinae suggest that the Aegean Basin could be an intermediate basin from whence the Pontian Paratethyan-type fauna migrated into the Mediterranean area during the latest Messinian. Since the ecology of Lymnocardiinae is mainly tied to oligo- and mesohaline water, spreading of suitable habitats in depositional systems of marginal settings characterized by increasing freshwater influx after the "salinity crisis" favoured their dispersal into the Mediterranean area from the Paratethys realm.

Résumé

Les associations de mollusques hypo- oligo- et mésohalins (biofaciès du « Lago Mare »), constituées par des bivalves des familles des Cardiidae (sous-famille de Lymnocardiinae) et des Dreissenidae et des gastropodes prosobranches des familles des Neritidae, Thiaridae, Melanopsidae, Hydrobiidae, sont très répandues dans les bassins périméditerranéens, peu profonds et à salinité réduite, pendant la phase post-évaporitique du Messinien terminal, entre 5,5 et 5,3 Ma. Des associations de ce type, constituées par de nombreux genres et espèces, sont connues dans les sédiments du Messinien terminal d'Italie. Les gastropodes, liés au système des eaux continentales, montrent des caractères endémiques tandis que les Lymnocardiinae et les Dreissenidae présentent de fortes affinités avec les faunes de la Paratéthys. La découverte d'espèces caractéristiques de Lymnocardiinae dans les sédiments du Messinien terminal de Toscane, Marche et Sicile, ainsi que la révision systématique des faunes déjà connues dans la littérature scientifique indiquent des affinités très proches entre les faunes italiennes et celles du Pontien du bassin Dacique. Les données paléobiogéographiques qui concernent les Lymnocardiinae du Messinien et du Pontien montrent que le bassin égéen a constitué une étape intermédiaire de la migration de ces faunes paratéthysiennes du Pontien vers le bassin méditerranéen pendant le Messinien terminal. Après la « crise de salinité », la formation des bassins marginaux caractérisés par des eaux hypo- oligo- ou mésohalines, environnements qu'affectionnent les Lymnocardiinae, a permis la dispersion de nombreux éléments paratéthysiens de cette sous-famille dans la région de la Méditerranée.

Keywords: Late Messinian; Lymnocardiinae; Palaeobiogeography; Italy; Paratethys; Lago-Mare

Mots clés : Messinien supérieur ; Lymnocardiinae ; Paléobiogéographie ; Italie ; Paratethys ; Lago Mare

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1. Introduction

Rich molluscan assemblages of hypo- and oligohaline gastropods and bivalves characterising the ''Lago-Mare'' biofacies are recorded from sediments of non-marine environment laid down within the Mediterranean Basin during the uppermost Messinian post-evaporitic phase ranging from about 5.5 Ma to 5.33 Ma (Odin et al., 1997; Vai, 1997; Krijgsman et al., 1999; Roveri et al., 2001; Ricci Lucchi et al., 2002). During this time-span several species of non-marine gastropods belonging to the prosobranch families Neritidae, Thiaridae, Melanopsidae, Hydrobiidae and bivalves of the families Cardiidae (subfamily Lymnocardiinae) and Dreissenidae, colonised various shallow marginal basins of the Western Mediterranean area. The best-known molluscan assemblages are recorded from Eastern Spain (Papiol, Castellbisbal, Llobregat valley), Southern France (Bollène, Rhône valley), Corse (Aleria), Italian peninsula and Sicily (Esu and Girotti, 1989). While the most of the gastropods occurring in the uppermost Messinian sediments from Italy, such as *Theodoxus mutinensis* D'Ancona, *Melanospis fusulatina* Sacco, *Melanopsis narzolina* D'Archiac, *Saccoia etrusca* (Capellini), *Saccoia fontannesi* (Capellini), *Saccoia oryza* (Sismonda), reveal strong endemic character since they are present in the Italian non-marine basins from Middle–Late Tortonian or Early Messinian (Ghetti et al., 2002), the Lymnocardiinae occurring in the same layers are of special palaeobiogeographical interest because of their Paratethyan origin.

New discoveries of Lymnocardiinae assemblages in Italy containing taxa not mentioned till now for Italy permit to outline a more detailed palaeobiogeographical picture of the Italian latest Messinian ''Lago-Mare'' bivalves.

2. Previous studies

The oligohaline latest Messinian molluscan faunas from Italy have been studied since the 19th century by Capellini (1860, 1868, 1874, 1879, 1880) who first recognized the Eastern European affinity of the cardiids recorded in Tuscany (SE of Livorno) from the uppermost Miocene deposits called ''strati a Congerie'' laying on gypsiferous strata and overlain by lower Pliocene marine deposits: ''...strati a piccoli Cardi, Dreissene e Neritine che nella Valle del Marmolaio a Cerretello terminano superiormente la serie dei gessi di Castellina marittima... Fra i piccoli cardi raccolti a Cerretello vi si riscontrano certi tipi che ricordano le specie di Valacchia, Kertsch e Taman..., questi strati a Cerretello sono ricoperti dalle argille plioceniche'' (Capellini, 1868: 35, 36) (''strata with small cardiids, dreissenids and neritinids which overlie the gypsiferous strata of Castellina Marittima at Cerretello in the Marmolaio valley. Among the small cardiids recorded at Cerretello some types resembling species from Valacchia, Kertsch and Taman occur..., at Cerretello these strata are overlain by Pliocene clays''). His observations were confirmed by T. Fuchs from Wien who visited the Capellini's material in Bologna and the Tuscan palaeontological sites described by the Italian author pointing out the strong similarity of the Tuscan faunas with those from the Pontian ''Odessa limestone'' consisting of little forms of cardiidae, such as ''*Cardium littorale* Eichwald, *C. odessae* Barbot de Marny, *C. pseudocatillus* Barbot de Marny, *C. novaerossicum* Barbot de Marny and others'' (Fuchs, 1874: 228). Later Capellini (1879) studied the richly fossiliferous ''strati a Congerie'' from ''il Trave'' and Monte Acuto nearby Ancona (Marches), lying on gypsiferous strata and overlain by lower Pliocene marine sediments, pointing out the similarity of the Ancona molluscan faunas with the Tuscan ones.

In the same years Cafici (1880, 1883) recognized the typical ''*Congeria* and small cardiidae beds'' on gypsiferous horizons at Licodia-Eubea (Catania, Sicily) where lower Pliocene marine clays cover the fossiliferous Messinian marls. Several gastropods and lymnocardiids common to the deposits of Tuscany (Farsica, Cerretello) and Marches (Ancona), such as ''*T. mutinensis, Melanoides curvicosta* (Deshayes), *Melanopsis bonellii* Sismonda, *Cardium odessae, C. littorale, C. novarossicum, C. pseudocatillus, C. plicatum* Eichwald, *C. semisulcatum* Rousseau, *C. spratti* Fuchs and others'', are listed by Cafici calling it a ''Caspic-type fauna''.

Sacco (1886, 1888, 1899) described upper Messinian marly and organic sediments laying between gypsiferous strata and marine Pliocene (''Piacentino'') blue clays in the Tertiary Piedmont Basin. Such sediments yielded the typical brackish Messinian fauna with abundant specimens of dreissenids and cardiids, such as ''*Dreissena mayeri* Sacco, *Limnocardium banaticum* (Fuchs), *L. secans* (Fuchs), *L. bollenense* (Mayer), *L. spratti, Pontalmyra carinata* (Deshayes), *P. simplex* (Fuchs), *P. castellinensis* (Capellini), *P. novarossica, P. partschi* (Mayer), *Prosodacna semisulcata*'' and endemic gastropods, such as ''*T. mutinensis, M. narzolina, S. etrusca, S. fontannesi, S. oryza*'' pointing out the Eastern European affinity of the cardiids.

At the end of the 19th century some other papers on the latest Messinian ''*Congeria* and small cardiid marls'' laying on gypsiferous strata from the Romagna-Marche Apennines have been published (Scarabelli, 1864; Cardinali, 1880; Sangiorgi, 1906).

Then the analytical studies on the Italian molluscan faunas from the Messinian ''Lago-Mare'' underwent a stasis and only after the sixties have been carried on. A systematic review of the significant Capellini's mollusc collection stored in the Geological Museum ''G. Capellini'' in Bologna is given by Gillet (1963) who compared the specimens of Lymnocardiinae from various localities of Marches and Tuscany to the Eastern European ones underlying their Paratethyan affinity. Later Gillet (1969) also collected and described the rich Lymnocardiinae fauna from the Messinian marly deposits nearby Ancona (Monte dei Corvi and ''il Trave''), pointing out both endemic and Eastern European character of this fauna.

Similarly Kojumdgieva (1981) considered the Mediterranean Lymnocardiinae fauna partly endemic and partly similar to the Pontian fauna.

In the following years several ''Lago-Mare'' molluscan assemblages from the uppermost Messinian deposits of Italy