

Some new and poorly known Middle Miocene ostracods of Malta Isle

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ABSTRACT – The Upper Langhian - Early Serravallian ostracods of the section Ras-il Pellegrin (Malta Isle) have been studied from systematic point of view. The ostracod fauna is constituted by 78 species, 53 of which have been identified or doubtfully identified. Nineteen species are left in open nomenclature and 6 described and illustrated as new: *Australoecia posterocurva* n. sp., *Cytherella fovea* n. sp., *Eucytherura bicornuta* n. sp., *Monoceratina praeoblita* n. sp., *Ruggieria caudoflexa* n. sp. and *Trachyleberidea lanceolata* n. sp.

RIASSUNTO – [Alcune specie nuove e poco note di Ostracodi del Miocene medio dell'Isola di Malta] – È stata studiata l'ostracofauna della sezione Ras-il Pellegrin (Malta) nell'intervallo Langhiano superiore - Serravalliano inferiore. L'ostracofauna è costituita da 78 specie di cui 53 identificate o dubitativamente attribuite a specie note, 19 lasciate in nomenclatura aperta a causa della loro rarità e lo cattivo stato di conservazione. Sei specie, *Australoecia posterocurva* n. sp., *Cytherella fovea* n. sp., *Eucytherura bicornuta* n. sp., *Monoceratina praeoblita* n. sp., *Ruggieria caudoflexa* n. sp. e *Trachyleberidea lanceolata* n. sp., sono considerate nuove e vengono descritte ed illustrate.

INTRODUCTION

The present paper deals with the systematics of the ostracods of the Miocene section of Ras-il Pellegrin outcropping along the western coast of the Malta Isle (Text-fig. 1) and is part of a larger project which, on the basis of a detailed biostratigraphy, cyclostratigraphy and isotopic analyses, attempts a paleoceanographic interpretation of the Middle and Upper Miocene Mediterranean basin.

The section is constituted in the basal part by calcarenitic sediments of the Middle Miocene "Upper *Globigerina* Limestone" followed by the marls and clays of the "Blue Clays", sampled for a thickness of 22 and 70 m, respectively.

The interval studied ranges from the Late Langhian to the Early Serravallian. The biostratigraphy has been previously defined by Giannelli & Salvatorini (1972; 1974) based on planktonic foraminifers. Foresi *et al.*, (in progress) are presently revising it in greater detail which allowed to attribute to the *Orbulina universa* Zone the upper part of the "Upper *Globigerina* Limestone", to the *Globorotalia peripheroronda* Zone the sediments of the "Blue Clays" from the base up to 16.95 m, to the *Dentoglobigerina altispira* Zone those between 16.96 m and 52.81 m and to the *Paragloborotalia partimlabiata* Zone the sediments above. The Langhian - Serravallian boundary is closely approximate by the disappearance of *Sphenolitus heteromorphus* (Rio *et al.*, 1997) which occurs at 7.31 m above the "Blue Clays" base (in Barra *et al.*, 1999). A hiatus seems to occur in the Langhian at the boundary between the "Upper *Globigerina* Limestone" and the "Blue Clays" (Sprovieri, per. comm.).

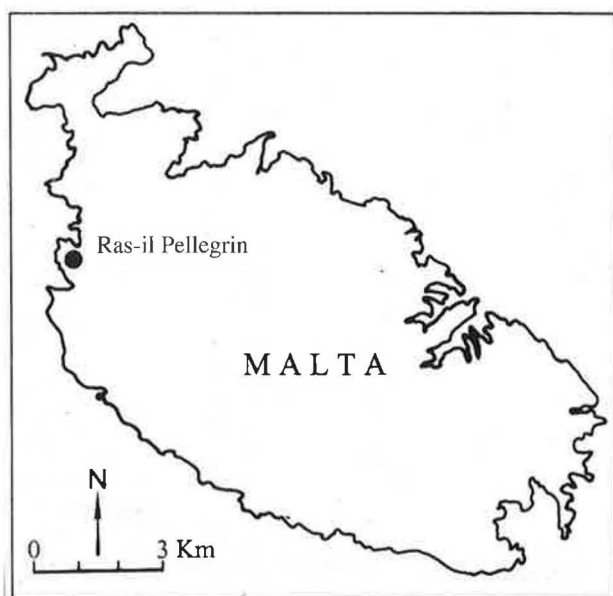
The previous studies on the systematics of the ostracod fauna of the Mediterranean area concerning this stratigraphic interval in deep-water environment are rather rare; among them we cite those of Oertli (1961) which deals with the type Langhian of Piedmont (Bricco della Croce), Russo (1966) for the Langhian of Pescale (Northern Apennines), Russo & Bossio (1976) for the interval from the Aquitanian to the Messinian of the Malta Isle, Ciampo (1981) for the Late Oligocene - Serravallian of Monte Cammarata and of the Ragusa area (Sicily) and Bonaduce & Russo (1985) for the Miocene of Sardinia. A short paper is dedicated by Ruggieri (1960) to the ostracode assemblage of a single sample collected in the Ragusa area doubtfully attributed to the Langhian.

Consequently before trying a paleoecological interpretation by a quantitative analysis of the ostracods assemblages we believed necessary to set up their systematics.

MATERIAL AND METHODS

A total of 103 samples, taken at about 1 m intervals, have been analyzed. Twenty samples pertain to the "Upper *Globigerina* Limestone" and 83 to the overlying "Blue Clays"; most of the samples have an original dry weight of 200 gr. The total picking of the ostracods has been realized from the residue > 125 µ and the quantitative results of smaller samples have been standardized to 200 gr.

The ostracod fauna is constituted by 78 species; 59 species have been identified or doubtfully identified and the remaining 19 left in open nomenclature because of the sparse or poorly preserved material.



Text-fig. 1 - Location of the section Ras-il Pellegrin (Malta Isle).

The species list is given in the systematic appendix. The specimens illustrated are housed in the Bonaduce Ostracod Collection (B.O.C.), Dipartimento di Scienze della Terra, Università di Napoli "Federico II".

SYSTEMATICS

In the following chapter only some previously poorly illustrated species, those proposed as new and few left in open nomenclature are reported in systematic order and illustrated in the enclosed plates. Their synonymies, distribution in the section and previously known occurrences, with age and location, are given.

The systematics followed is that of Hartmann & Puri (1974) with the contribution of Maddocks & Steineck (1987) for Eucytheruridae. The following 6 species,

Australoecia posterocurva n. sp., *Cytherella fovea* n. sp., *Eucytherura bicornuta* n. sp., *Monoceratina praeoblita* n. sp., *Ruggieria caudoflexa* n. sp. and *Trachyleberidea lanceolata* n. sp., are described and illustrated.

Subclass OSTRACODA Latreille, 1806
Order PODOCOPIDA G.W. Müller, 1894
Suborder PLATYCOPIA Sars, 1866
Family CYTHERELLIDAE Sars, 1866
Genus CYTHERELLA Jones, 1849

CYTHERELLA CIRCUMPUNCTATA Ciampo, 1976
Pl. 1, figs. 2-3

- 1976 *Cytherella circumpunctata* CIAMPO, pp. 6-7, pl. 1, figs. 1-6.
1996 *Cytherella circumpunctata* Ciampo - Aiello *et al.*, p. 178, pl. 4, figs. 9, 10, 12 (*cum syn.*).
1996 *Cytherella circumpunctata* Ciampo - Ruiz & Gonzalez-Regalado, pl. 1, fig. 2.

Remarks – Our specimens are attributable to the Ciampo's species even if some detail of the ornamentation appear variably developed especially in the size and distribution of the foveolae as previously pointed out by Aiello *et al.*, (1996). Moreover our specimens seem more truncated in dorsal view (Pl. 1, fig. 3).

Distribution – In the present section it occurs more commonly in the Langhian and in a scattered way in the Serravallian up to the *Paragloborotalia partimlabiata* Zone where it disappears.

The species, previously known from the Messinian to Recent (see Aiello *et al.*, 1996), with the present findings enlarges its stratigraphic distribution to the Middle Miocene.

Ruiz & Gonzalez-Regalado (1996): Gibrleon Clay Formation, Messinian and Huelva Sands Formation, Pliocene of Huelva (S.W. Spain).

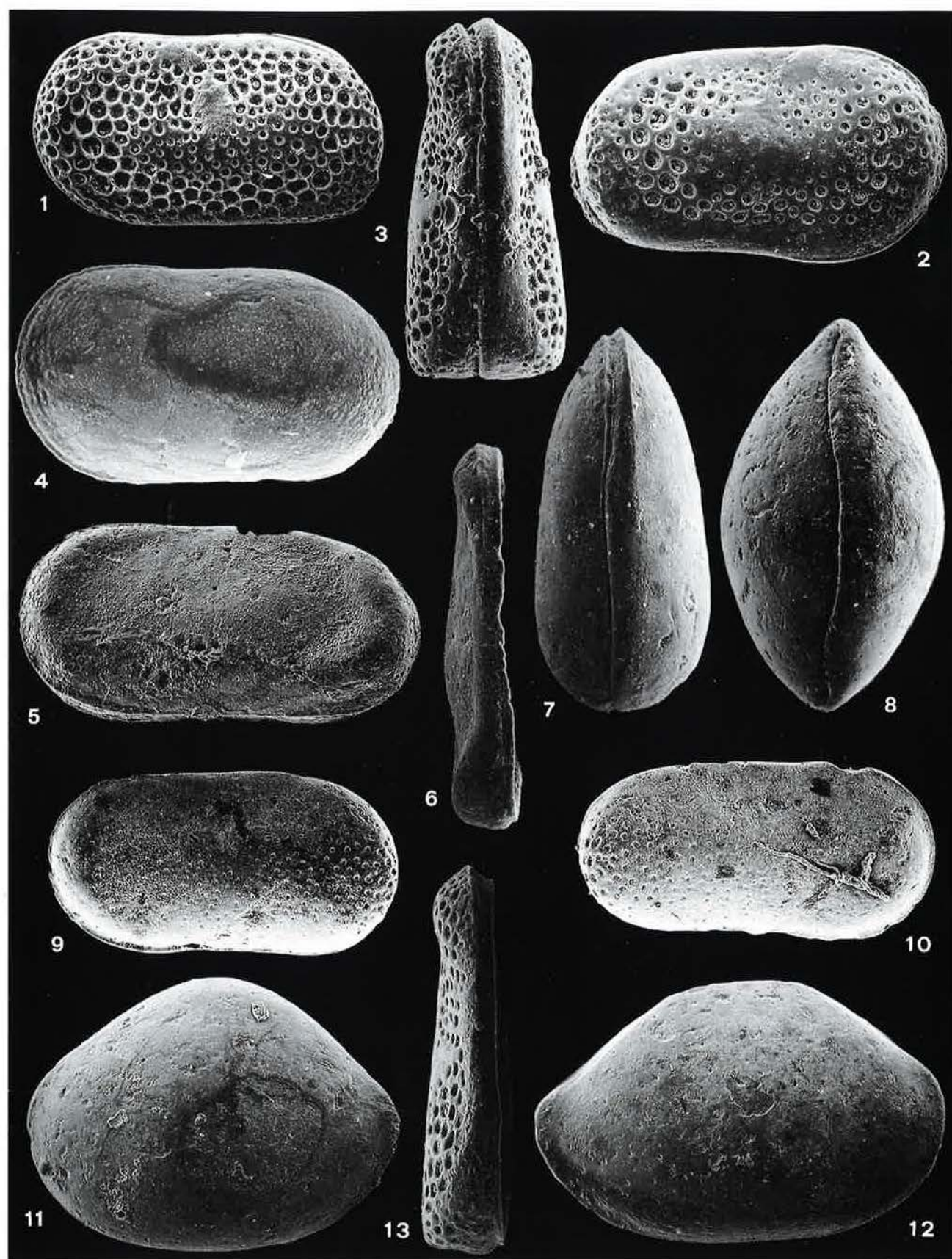
CYTHERELLA FOVEA n. sp.
Pl. 1, figs. 1, 13

Etymology – From Latin *fovea* = with foveolae.

EXPLANATION OF PLATE 1

- Figs. 1, 13 - *Cytherella fovea* n. sp. 1) Holotype, LV, Stn. ML 296, B.O.C. 2411, (x 92); 13) Hypotype, LV in dorsal view, Stn. ML 33, B.O.C. 2412, (x 99).
Figs. 2-3 - *Cytherella circumpunctata* Ciampo, 1976. 2) RV from complete carapace, Stn. ML 065, B.O.C. 2413, (x 103); 3) CC in dorsal view, Stn. ML 033, B.O.C. 2414, (x 96).
Figs. 4, 7 - *Cytherella vulgatella* Aiello, Barra, Bonaduce & Russo, 1996. 4) LV, Stn. ML 059, B.O.C. 2415, (x 96); 7) CC in dorsal view, Stn. ML 059, B.O.C. 2416, (x 93).
Figs. 5-6 - *Cytherelloidea? creutzburgi* Sissingh, 1972. 5) LV, Stn. ML 059, B.O.C. 2417, (x 122); 6) LV in dorsal view, same specimens of fig. 5, (x 117).
Figs. 8, 11-12 - *Bairdoppilata conformis* (Terquem, 1878). 8) CC in dorsal view, Stn. ML 065, B.O.C. 2418, (x 47); 11) LV, Stn. ML 065, B.O.C. 2419, (x 44); 12) RV, Stn. ML 065, B.O.C. 2420, (x 50).
Figs. 9-10 - *Cytherella? vandenboldi* Sissingh, 1972. 9) LV, Stn. ML 055, B.O.C. 2421, (x 93); 10) RV, Stn. ML 027, B.O.C. 2422, (x 93).

LV = left valve; RV = right valve; CC = complete carapace.



Holotype – A LV (Pl. 1, fig. 1), Stn. ML 296, B.O.C. 2411.

Hypotypes – A LV (Pl. 1, fig. 13), Stn. ML 33, B.O.C. 2412.

Type-level – “Blue Clay” Formation, Serravallian, *Dentoglobigerina altispira* Zone, 45.15 m from the base.

Diagnosis – A species of *Cytherella* characterized by the subrectangular shape in lateral view, depressed near the periphery, lateral surface covered by large subpolygonal deep foveolae arranged in rows parallel to the margins in the peripheral areas except in the extreme dorsal and in the muscle-scars area which appears smooth. In dorsal view posteriorly truncated.

Description – This species shows valves clearly subrectangular with dorsal margin feebly inflexed, anterior almost regularly rounded, and ventral straight. The postero-dorsal margin slopes down almost abruptly (Pl. 1, fig. 1). In dorsal view carapace clearly truncated (Pl. 1, fig. 13).

Valves in lateral view depressed inside the margins and covered by subpolygonal foveolae very close each other in most part of the surface, while below the mid height in the central part a large area is ornamented by distinct well separated rounded foveolae of small size. The area corresponding to the muscle scars appears smooth as well as a small area in the antero-centro-dorsal part.

Size (mm) – *Holotype* (LV): $l = 0.69$; $h = 0.38$ (Pl. 1, fig. 1).

Hypotype (LV): $l = 0.70$; $h = 0.40$ (Pl. 1, fig. 13).

Affinities – This species is similar to numerous other ones previously described as *C. alvearium* Bonaduce, Ciampo & Masoli, 1976, *C. circumpunctata* Ciampo, 1976, *C. pulchella* Ruggieri, 1967, *C. scutulum* Ruggieri, 1976 and *C. ultima* Bonaduce, Ruggieri, Russo & Bismuth, 1992 from all of which it differs especially in the different distribution and the much larger foveolae which appear very tied each other. Moreover the valves of our species appear clearly more rectangular in lateral view in respect to the previously cited ones.

It appear also close to *C. hartmanni* Stambolidis, 1980, from which it differs due to the lack of the rim parallel to the anterior margin.

Distribution – It occurs in few samples of the Langhian and in the Serravallian where it is present exclusively and in scattered way in the *Dentoglobigerina altispira* Zone.

CYTHERELLA ? VANDENBOLDI Sissingh, 1972
Pl. 1, figs. 9-10; pl. 2, fig. 7

Remarks – The present species is doubtfully attributed to *C. vandenboldi* Sissingh, 1972 from the Late Miocene of Apostoli Formation (Crete) from which it differs chiefly in the regularly spaced medium sized deep foveolae concentrated at the posterior extremity which decrease in size and numbers towards the anterior, the presence of a thin anterior marginal rim which does not seem to occur in the nominate species and ventral margin feebly inflexed (Pl. 1, figs. 9, 10).

The sizes of our specimens are a little smaller [LV (Pl. 1, fig. 9): $l = 0.69$ mm, $h = 0.36$ mm; RV (Pl. 1, fig. 10): $l = 0.69$ mm, $h = 0.36$ mm].

The species is also close in shape and size in lateral view to *C. moyesi* Nascimento, 1988 described from the Serravallian of Portugal. It differs chiefly due to the occurrence of the ornamentation which seems lacking in the Nascimento's species. Moreover in dorsal view the shape of *C. moyesi* is different, showing a depression at about mid length, the anterior more acuminate and the lack of the posterior invagination.

Distribution – It occurs exclusively in the Langhian “Upper *Globigerina* Limestone”.

CYTHERELLA VULGATELLA Aiello, Barra,
Bonaduce & Russo, 1996
Pl. 1, figs. 4, 7

1996 *Cytherella vulgatella* AIELLO, BARRA, BONADUCE & RUSSO,
p. 187, pl. 1, figs. 1-14; pl. 2, figs. 1-3, 6, 7 (cum syn.).

Remarks – Our specimens corresponds well in shape, size and ornamentation to the species recently described by Aiello *et al.* (1996), especially due to the anterior striae parallel to the margin and to the posterior delicately tubercled. The relatively poor preservation's conditions did not allow the splitting of our specimens into the different forms described by Aiello *et al.* (1996).

Distribution – Present all along the section mostly with a relatively high number of specimens.

The present findings represent the oldest citation of the species which was previously found from Tortonian to Recent (see Aiello *et al.*, 1996).

GENUS CYTHERELLOIDEA Alexander, 1929

CYTHERELLOIDEA ? CREUTZBURGI Sissingh, 1972
Pl. 1, figs. 5-6

Remarks – The present species is doubtfully attributed to *Cytherelloidea* (*Cytherelloidea*) *creutzburgi* Sissingh, 1972, from the Lower – Middle Pliocene of the Asteri Formation (Crete) from which it differs especially due to the lack of the median longitudinal ridge.

Nachite (1993) described *C. tetuaniensis* from the Early Pliocene of Tetuán (N.W. Morocco) which

is so close to the Sissingh' species to allow the hypothesis to be considered a junior synonym of *C. creutzburgi*.

Distribution – Very rare and occurring only in the Langhian "Upper *Globigerina* Limestone".

Suborder PODOCOPINA Sars, 1866

Superfamily BAIRDIACEA Sars, 1866

Family BAIRDIIDAE Sars, 1888

Subfamily BAIRDIINAE Sars, 1888

Genus BAIRDOPILATA Coryell, Sample & Jennings, 1935

BAIRDOPILATA CONFORMIS (Terquem, 1878)

Pl. 1, figs. 8, 11-12

1878 *Bairdia subdeltoidea* var. *conformis* TERQUEM, p. 93, pl. 10, figs. 17 a-c.

2000 *Bairdopilata conformis* Terquem – AIELLO *et al.*, pp. 85-86, pl. 1, fig. 2 (*cum syn.*).

Distribution – In the present section very frequent in the Langhian and generally rare in the Serravallian.

This species has been previously cited from the Late Pliocene to the Holocene from different Mediterranean areas (see Aiello *et al.*, 2000). The present data demonstrate that its stratigraphic range is much wider than previously known.

BAIRDOPILATA PROFUNDA Aiello,

Barra & Bonaduce, 2000

Pl. 2, fig. 1

2000 *Bairdopilata profunda* AIELLO, BARRA & BONADUCE, pp. 86-88, pl. 1, figs. 3-6; pl. 6, fig. 1 (*cum syn.*).

Distribution – In the present section very rare and exclusive of the Langhian. Cited from the Middle Eocene to the Late Pliocene (see Aiello *et al.*, 2000).

Superfamily CYPRIDACEA Baird, 1845

Family PONTOCYPRIDIDAE G.W. Müller, 1894

Genus ARGILLOECIA Sars, 1866

ARGILLOECIA SPISSA Barra, Aiello & Bonaduce, 1996

Pl. 2, fig. 2

1996 *Argilloecia spissa* BARRA, AIELLO & BONADUCE, pp. 133-134, pl. 2, figs. 5-6.

Remarks – All the characters of our specimens fit perfectly with those of the cited taxon. The only difference lies in the smaller size of our specimens.

Distribution – In the present section it pertains only to the Langhian, very rare.

Barra *et al.* (1996): In the Monte San Nicola section (Gela, Sicily) from M Pl 5 biozone to the Early Pleistocene.

Genus AUSTRALOECCIA McKenzie, 1967

AUSTRALOECCIA POSTEROCURVA n. sp.

Pl. 2, figs. 3-6; text-fig. 2c

Etymology – From Latin *posterior* = posterior and *curvus* = inflected.

Holotype – A LV (Pl. 2, fig. 3), Stn. ML 096, B.O.C. 2425.

Hypotypes – 1 complete carapace (Pl. 2, fig. 4), Stn. ML075, B.O.C. 2426; 1RV (Pl. 2, fig. 5), Stn. ML 089, B.O.C. 2427; 1RV (Pl. 2, fig. 6), Stn. ML 059, B.O.C. 2428.

Type-level – "Upper *Globigerina* Limestone", Langhian, *Orbulina universa* Zone, 19.20 m from the base.

Diagnosis – A species of *Australoeccia* characterized by a very thick carapace with LV suboval, with the maximum inflexion of the dorsal margin peculiarly located after the mid-length, RV smaller, more elongated and with dorsal margin regularly and more gently arched than LV.

Description – LV anterior margin subacutely rounded, posterior amply rounded, dorsal very arched with maximum height after the mid length in the LV, ventral feebly convex (Pl. 2, fig. 3). In dorsal view carapace elongated oval, anterior subacuminate and posterior subrounded with LV overlapping RV in the anterior part and RV overlapping LV posteriorly (Pl. 2, fig. 4). The valves appear completely smooth. The anterior margin of the LV is fringed by a delicate but consistent rim; LV more inflated than RV posteriorly.

Hinge: typical of the genus, with a very strong simple bar in the RV (Pl. 2, fig. 6).

Inner lamella: very well developed anteriorly with deep vestibule which disappears ventrally at about mid length.

Muscle scars: typical of the genus (Text-fig. 2c).

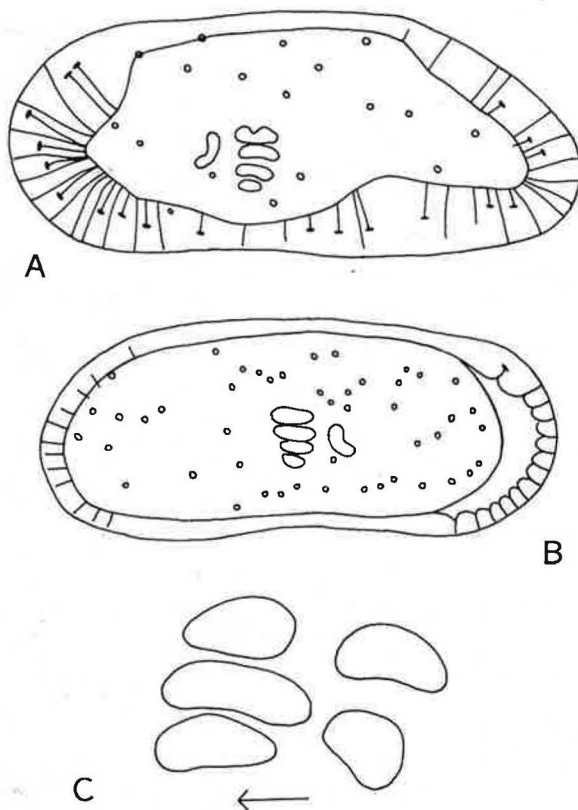
Size (mm) – Holotype (LV): l = 0.60; h = 0.36 (Pl. 2, fig. 3).

Hypotype (RV): l = 0.58; h = 0.29 (Pl. 2, fig. 5).

Hypotype (RV): l = 0.58; h = 0.29 (Pl. 2, fig. 6).

Affinities – The proposed n. sp. differs from *A. argilloeciaformis* Whatley & Downing, 1983 which shows a left valve (pl. 3, fig. 4) more rectangular and dorsal margin almost straight while the right valve (pl. 3, figs. 2-3) is more similar even if the posterior extremity in lateral view is more gently arched.

Distribution – Rather well represented and exclusive of the Langhian.



Text-fig. 2 - a) *Parakrithe dactylomorpha* Ruggieri, 1962, LV, Stn. ML 296, B.O.C. 2472, (x 134).
 b) *Pseudopsammocythere kollmanni* Carbonnel, 1966, RV, Stn. ML 33, B.O.C. 2473, (x 134).
 c) *Australoecia posterocurva* n. sp., RV muscle scars, hypotype, same specimens figured in Pl. 2, fig. 6, (x 335).

Superfamily CYTHERACEA Baird, 1850
 Family EUCYTHERIDAE Puri, 1954
 Genus EUCYTHERE Brady, 1868

EUCYTHERE CURTA Ruggieri, 1975
 Pl. 2, fig. 13

1975 *Eucythere curta* RUGGIERI, pp. 433-434, fig. 6 (cum syn.).
 1976 *Eucythere curta* Ruggieri - BONADUCE *et al.*, pp. 63-64, pl. 37, figs. 9-13.
 1981 *Eucythere curta* Ruggieri - CIAMPO, pl. 4, fig. 13.

Distribution - In the present section found only in two samples of the "Upper *Globigerina* Limestone".

Ruggieri (1975 with literature): Capocolle (Cesena), Castellarquato, from Middle-Late Pliocene; Imola (Bologna), Quaternary; Provence, Gulf of Naples, Adriatic Sea from 13 to 230 m, Recent.

Bonaduce *et al.* (1976): Northern Adriatic, more frequent between 70 and 90 m, represented always by few specimens, Recent.

Ciampo (1981): Aquitanian - Langhian of Monte Cammarata and Tellaro Formation (Sicily).

Genus PARAKRITHE van den Bold, 1958

PARAKRITHE DACTYLOMORPHA Ruggieri, 1962
 Text-fig. 2a

1962 *Parakrithe dactylomorpha* RUGGIERI, pp. 15-16, pl. 1, figs. 1-6.

1965 *Parakrithe dactylomorpha* Ruggieri - DIECI & RUSSO, p. 78, pl. 15, fig. 10.

1982 *Parakrithe dactylomorpha* Ruggieri - CIAMPO, pl. 1, fig. 13.

Distribution - From the base of the section up to the top part of the *Dentoglobigerina altispira* Zone, in reduced numbers.

Ruggieri (1962): Enna (Sicily), Tortonian.

Dieci & Russo (1965): Montegibbio, Tortona (Northern Appennines), Tortonian.

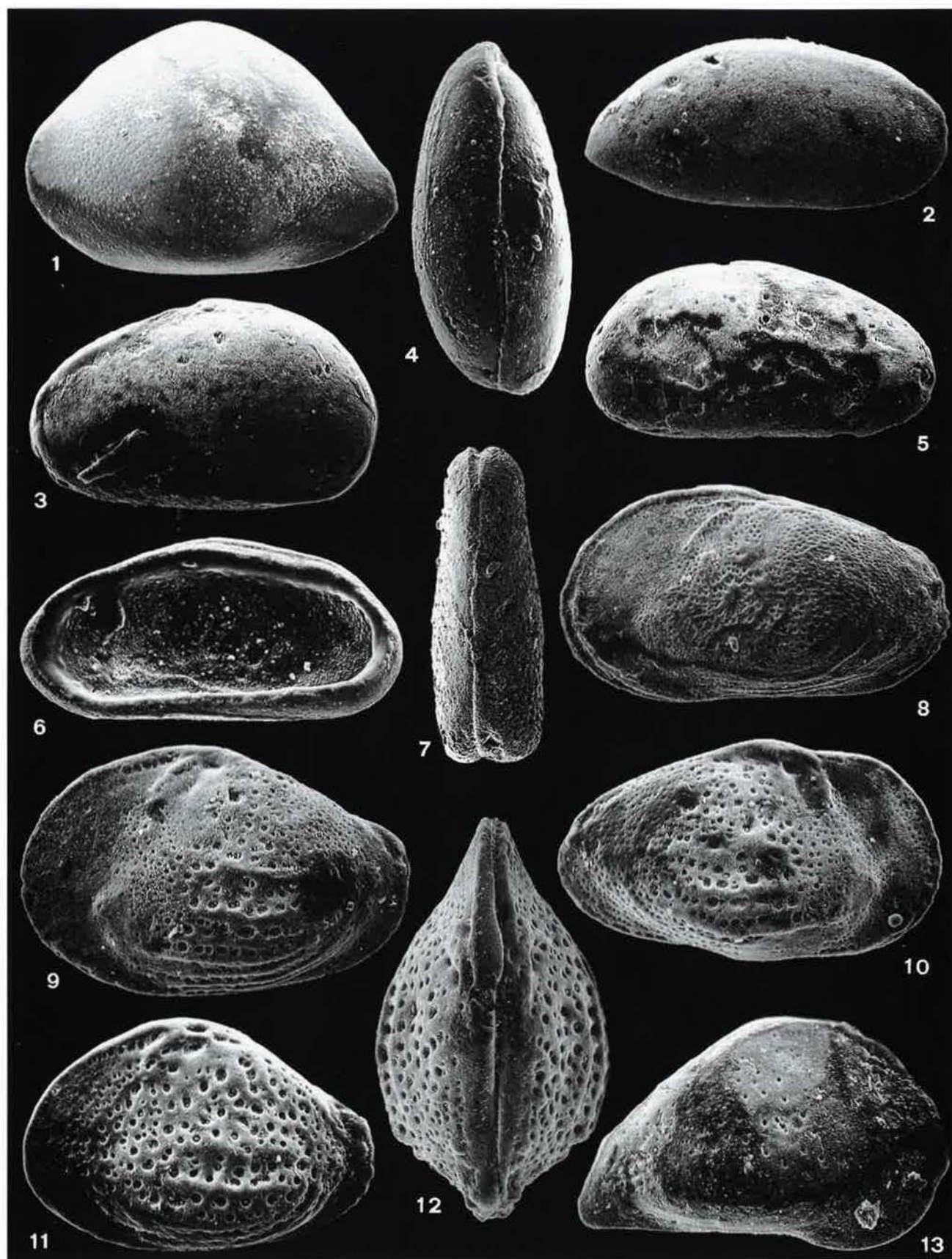
Ciampo (1982): Rio Mazzapiedi (Piedmont), Late Tortonian.

Genus PSEUDOPSAMMOCYTHERE Carbonnel, 1966

PSEUDOPSAMMOCYTHERE KOLLMANNI Carbonnel, 1966
 Text-fig. 2b

EXPLANATION OF PLATE 2

- Fig. 1 - *Bairdoppilata profunda* Aiello, Barra & Bonaduce, 2000, LV, Stn. ML 075, B.O.C. 2423, (x 62).
 Fig. 2 - *Argilloecia spisa* Barra, Aiello & Bonaduce, 1996, RV, Stn. ML 055, B.O.C. 2424, (x 159).
 Figs. 3-6 - *Australoecia posterocurva* n. sp. 3) Holotype, LV, Stn. ML 096, B.O.C. 2425, (x 105); 4) Hypotype, CC in dorsal view, Stn. ML 075, B.O.C. 2426, (x 106); 5) Hypotype, RV, Stn. ML 089, B.O.C. 2427, (x 109); 6) Hypotype, RV, internal view, Stn. ML 059, B.O.C. 2428, (x 118).
 Fig. 7 - *Cytherella? vandenboldi* Sissingh, 1972, CC in dorsal view, ML 075, B.O.C. 2429, (x 91).
 Fig. 8 - *Rectobuntonia hilaris* Ciampo, 1984, LV, Stn. ML 153, B.O.C. 2430, (x 137).
 Figs. 9-10 - *Buntonia dertonensis* Ruggieri, 1954. 9) LV, Stn. ML 055, B.O.C. 2431, (x 152); 10) RV, Stn. ML 055, B.O.C. 2432, (x 146).
 Figs. 11-12 - *Buntonia multicostata* Ruggieri, 1962. 11) LV, Stn. ML 059, B.O.C. 2433, (x 155); 12) CC in dorsal view, Stn. ML 055, B.O.C. 2434, (x 177).
 Fig. 13 - *Eucythere curta* Ruggieri, 1975, RV, Stn. ML 033, B.O.C. 2435, (x 131).



- 1961 *Psammocythere* ? sp. 2 OERTLI, p. 32, pl. 5, fig. 54.
 1966 *Pseudopsammocythere kollmanni* CARBONNEL, pp. 50-54, pl. 1, figs. 1-8.
 1972 *Pseudopsammocythere kollmanni* Carbonnel - SISSINGH, p. 85, pl. 4, fig. 3.
 1985 *Pseudopsammocythere* sp. BONADUCE & RUSSO, p. 432, pl. 2, fig. 9.

Remarks – The specimens found by us correspond almost perfectly with the figures given by Carbonnel (1966). The only differences observed are in the number of the anterior marginal pore-canals which in the original description result in number of 13 while our specimens seems to show 14 of them and in the size which appear a little shorter ($l = 0.49$ mm) and relatively higher ($h = 0.30$ mm). We consider the cited differences within the variability of the species.

Distribution – Very rare and occurring only in 2 samples of the *Orbulina universa* and *Dentoglobigerina altispira* Zones.

Oertli (1961): Bricco della Croce (Asti), Langhian.
 Carbonnel (1966): Tortonian of the Valréas (Bassin Vacluse).

Sissingh (1972): Apostoli (Crete), Tortonian.

Bonaduce & Russo (1985): Marmilla region (Central - Southern Sardinia), Early - Middle Miocene.

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948
 Subfamily BUNTONINAE Apostolescu, 1961
 Genus BUNTONIA Howe, 1935

BUNTONIA DERTONENSIS Ruggieri, 1954
 Pl. 2, figs. 9-10

- 1954 *Buntonia sublatissima dertonensis* RUGGIERI, pp. 565, 568, figs. 25, 25a, 26, 32, 33.
 2000 *Buntonia dertonensis* Ruggieri - AIELLO *et al.*, p. 98, pl. 4, figs. 1-3, 5 (*cum syn.*).

Distribution – From the base of the section, rather well represented during Langhian and in scattered way up to the top part of the Serravallian *D. altispira* Zone.

Cited from Tortonian to Late Pliocene (see Aiello *et al.*, 2000).

BUNTONIA MULTICOSTATA Ruggieri, 1962
 Pl. 2, figs. 11-12

- 1962 *Buntonia sublatissima* (NEVIANI) *multicostata* RUGGIERI, pp. 50-52, pl. 6, fig. 14.
 1965 *Buntonia sublatissima multicostata* Ruggieri - DIECI & RUSSO, p. 75, pl. 12, fig. 13.
 ? 1980 *Buntonia multicostata* Ruggieri - CIAMPO, pl. 2, fig. 2.
 1996 *Buntonia multicostata* Ruggieri - RUIZ & GONZALEZ-REGALADO, pl. 2, fig. 4.

Remarks – The specimens identified by Ciampo (1980) are doubtfully attributed to this taxon due to

the fact that he represents only the RV which seems a little different in shape and ornamentation less evident from the LV figured by Ruggieri (1962).

Distribution – It occurs only from the base of the section up to high part of the *Orbulina universa* Zone, quite common.

Ruggieri (1962): Enna (Sicily), Tortonian.

Dieci & Russo (1965): Tortona, Montegibbio (Northern Appennines), Tortonian.

Ruiz & Gonzalez-Regalado (1996): Huelva (S.W. Spain) Tortonian - Messinian.

Genus RECTOBUNTONIA Sissingh, 1972

RECTOBUNTONIA HILARIS Ciampo, 1984
 Pl. 2, fig. 8

- 1980 *Buntonia* sp. CIAMPO, pl. 2, fig. 1.
 1984 *Rectobuntonia hilaris* CIAMPO, p. 257, pl. 2, figs. 3-4.

Distribution – It is very rare along the section up to *Dentoglobigerina altispira* Zone.

Ciampo (1980): Ragusa (Sicily), Tortonian - Messinian.

Ciampo (1984): Rio Mazzapiedi (Piedmont), Tortonian.

Subfamily CAMPYLOCYOTHERINAE Puri, 1960
 Genus RUGGIERIA Keij, 1957

RUGGIERIA CAUDOFLEXA n. sp.
 Pl. 3, figs. 1-2, 5

- 1976 *Ruggieria* sp. 3 RUSSO & BOSSIO, pl. 1, fig. 8; pl. 2, fig. 3.

Etymology – From Latin *cauda* = tail and *flexus* = inflected due to the shape of the caudal process.

Holotype – A LV (Pl. 3, fig. 1), Stn. ML 0100, B.O.C. 2436.

Paratype – 1 LV, B.O.C. 2474.

Hypotypes – 1RV (Pl. 3, fig. 2), Stn. ML 033, B.O.C. 2437 and 1 complete carapace (Pl. 3, fig. 5), Stn. ML 022, B.O.C. 2438.

Type-level – “Upper *Globigerina* Limestone”, Langhian, *Orbulina universa* Zone, 20 m from the base of the section.

Diagnosis – A species of *Ruggieria* characterized by a singular ventral ridge, by the caudal process peculiarly bent down and the valve surface of the valves covered by deep and tegminate foveolae.

Description – Valves in lateral view subtriangular with anterior margin obtusely rounded, dorsal almost

straight in the antero-central part and gently bent down posteriorly; ventral margin concave anteriorly and centrally, and convex at the posterior extremity (Pl. 3, figs. 1-2).

Antero-ventral and anterior margins ornamented by thick spines, more developed along the antero-ventral margin. Posterior extremity with a stocky well developed spinose caudal process which is characteristically curved downward. A singular cordiform ventral ridge runs from the anterior margin to the beginning of the caudal process, which ends abruptly with a strong spine in well preserved specimens.

The surface of the valves, with the exception of the ventral ridge which is smooth, is almost completely covered by equally spaced foveolae whose shape are anteriorly comma-shaped and irregularly oval elsewhere.

All the foveolae appear tegminate and tend to close at their top in the anterior area. Small anterodorsal and posterodorsal areas seem smooth or delicately pitted. The caudal process shows a particularly strong spine near the postero ventral extremity.

In dorsal view the carapace is very inflated with maximum width at about mid-length (Pl. 3, fig. 5). Eye-spot elongated but not strongly protruding.

Size (mm) – Holotype (LV): l = 0.90; h = 0.52 (Pl. 3, fig. 1).

RV: l = 0.95; h = 0.47 (Pl. 3, fig. 2).

Affinities – This species differs from most of the *Ruggieria* known to us in the shape of the posterior extremity and the foveolate ornamentation. *R. micheliniana* (Bosquet, 1852) as redescribed and illustrated by Keij, 1957 (pp. 112-113, pl. 15, figs. 5-6; pl. 20, figs. 1-3) from the Burdigalian of Belgium, is similar in shape to our species except for its upturning caudal process, the occurrence of 2-3 ridges above the ventral one and large part of the lateral surface smooth.

Our species is also similar to *R. micheliniana sensu* Moyes, 1965 as far as the single ventral ridge and the general ornamentation are concerned; it differs especially due to the different shape in lateral view particularly in the dorsal and posterior extremity which in the form figured by Moyes is upturning while in our species it is clearly bent down.

Another species similar to *R. caudoflexa* n. sp. is *R. micheliniana sensu* Nascimento, 1988 (Pl. 7, fig. 7) which shows a singular ventral ridge but a different shape in lateral view and surface smooth except for the occurrence of a horizontal alignment of foveolae along the base of the ventral ridge.

The species can be also compared with *R. indopacifica* Whatley & Zao (1988) in the general appearance in lateral view (Pl. 8, fig. 14) and in the ornamentation which shows oblong fossae with an evident celation. It differs for the caudal process less bent downward, the presence of a single ventral ridge

instead of four and a reduced number of foveolae. In dorsal view, the present species (Pl. 3, fig. 5) shows the maximum inflation at mid length while in *R. indopacifica* it appears to be located more backward (Pl. 8, fig. 18).

Distribution – Same area of the Maltese Archipelago, "Upper *Globigerina* Limestone", Langhian (Russo & Bossio, 1976); in the present section it occurs almost constantly up to the end of the Langhian.

RUGGIERIA TETRAPTERA (Seguenza, 1880) Pl. 3, figs. 3-4

- 1880 *Cythere tetraptera* SEGUENZA, p. 125, pl. 12, figs. 9, 9a.
- 1962 *Ruggieria tetraptera tetraptera* (Seguenza) - RUGGIERI, p. 47, pl. 5, figs. 11-13.
- 1963 *Cythere tetraptera* Seguenza - RUGGIERI, pp. 11-13, pls. 1, figs. 1, 1a, text-figs. 7-9 (*cum syn.*).
- 1965 *Ruggieria tetraptera tetraptera* (Seguenza) - MOYES, pp. 95-96, pl. 10, fig. 14.
- 1965 *Ruggieria tetraptera tetraptera* (Seguenza) - DIECI & RUSSO, pp. 68-69, pl. 11, fig. 6.
- 1967 *Ruggieria tetraptera* (Seguenza) - RUGGIERI, p. 361, figs. 17-20.
- 1969 *Ruggieria tetraptera* (Seguenza) - ULICZNY, p. 110, pl. 9, figs. 5-6; pl. 18, figs. 3-4.
- 1972b *Ruggieria tetraptera tetraptera* (Seguenza) - CIAMPO, pl. 4, figs. 1-4.
- 1979 *Ruggieria tetraptera tetraptera* (Seguenza) - BASSIOUNI, pp. 133-134, pl. 17, figs. 3-8.
- 1985 *Ruggieria tetraptera tetraptera* (Seguenza) - CARBONEL, pl. 95, figs. 4-5.
- 1990 *Ruggieria (R.) tetraptera tetraptera* (Seguenza) - NASCIMENTO, pl. 1, fig. 14.
- 1994 *Ruggieria tetraptera* (Seguenza) - BERTHOLON, pl. 10, figs. A-J.

Remarks – We attributed all the forms to *Ruggieria tetraptera* (Seguenza, 1880) because the systematics of this taxon, at subspecific level, is still unclear due probably to its large variability (Ruggieri, 1992).

Distribution – Well represented all along the section.

Seguenza (1880); Ruggieri (1963): Calabria, Tortonian.

Ruggieri (1962): Enna (Sicily), Tortonian.

Moyes (1965): Late Miocene - Pliocene of the Aquitanian Basin.

Dieci & Russo (1965): Rio Mazzapiedi Castellania (Northern Apennines), Tortonian.

Ruggieri (1967): Val Marecchia (North Apennines), Middle or Upper Miocene.

Uliczny (1969): Cefalonia, Pliocene.

Ciampo (1972b): Calvello (Potenza), Plio-Pleistocene.

Bassiouni (1979): Mio-Pliocene of Turkey.

Carbonel (1985): Aquitania, Neogene.

Nascimento (1990): Cacela (Portugal), Late Miocene.

Bertholon (1994): Dar Bel Hamri (Morocco), Messinian - Pliocene.

Subfamily TRACHYLEBERIDINAE Sylvester-Bradley, 1948

Genus ACANTHOCYHEREIS Howe, 1963

ACANTHOCYHEREIS HYSTRIX (Reuss, 1850)
Pl. 4, fig. 4.

- 1850 *Cypridina hystrix* REUSS, p. 47, pl. 10, fig. 6.
1972 *Acanthocythereis hystrix* (Reuss) - SISSINGH, pp. 92-93.
1979 *Acanthocythereis hystrix* (Reuss) - ATHERSUCH, pp. 133-140 (cum syn.).

Remarks – This species has been cited very frequently in the literature. We do not report the complete synonymy because the species is well defined and does not give problems of identifications.

Distribution – In the present section is very abundant all along the section.

It occurs commonly from Miocene to Recent (see Athersuch, 1979) mostly in relatively shallow environment.

Genus CHRYSOCYHERE Ruggieri, 1962

CHRYSOCYHERE PARADISUS Doruk, 1973
Pl. 3, figs. 11-12

- 1973 *Chrysocythere paradisus* DORUK, pp. 89-92.
1992 *Chrysocythere paradisus* Doruk - BONADUCE *et al.*, p. 52, pl. 14, figs. 12-14.

Remarks – The present species differs from *C. cataphracta* Ruggieri, 1962 refigured by Sylvester-Bradley & Ruggieri (1973) in the reduced development of the antero-dorsal lamella which runs parallel to the sub-peripheral ridge, in the ornamentation between the median and ventral ridge constituted by numerous disorganized foveolae which in *C. cataphracta* occur in a reduced number and are organized in subparallel vertical rows. Moreover in *C. paradisus* above the anterior part of the median ridge the foveolae are more numerous and of smaller size.

Distribution – It occurs only in the "Upper Globigerina Limestone", in a very restricted interval and most probably displaced from shallow – water environment.

Doruk (1973): Mersin and Adana areas (Turkey), Middle and Upper Miocene.

Bonaduce *et al.* (1992): Ashtart (Gulf of Gabès, Tunisia), Late Miocene.

Genus HENRYHOWELLA Puri, 1957

HENRYHOWELLA SARSII (G.W. Müller, 1894)
PROFUNDA Bonaduce, Barra & Aiello, 1999
Pl. 4, fig. 8

- 1999 *Henryhowella sarsii* (G. W. MÜLLER) *profunda* BONADUCE, BARRA & AIELLO, pag. 68, 70, pl. 1, figs. 5-12; pl. 4, figs. 1-8 (cum syn.).

Remarks – This recently described n. subspecies occurs in the Recent of the Mediterranean and Atlantic in epibathyal and deeper environment and is substituted in shallow waters (from 110 to 350 m depth) by *H. sarsii sarsii* (Bonaduce *et al.*, 1999). This is the only *Henryhowella* commonly occurring in the studied sections, fact which confirms its deep-water environment.

The cited subspecies shows some variability in the development of the tubercles which can be more or less obtuse and in the reticulation which appears more or less evident.

Distribution – This species is very common especially in the "Upper Globigerina Limestone" while it decreases in abundance during the Serravallian.

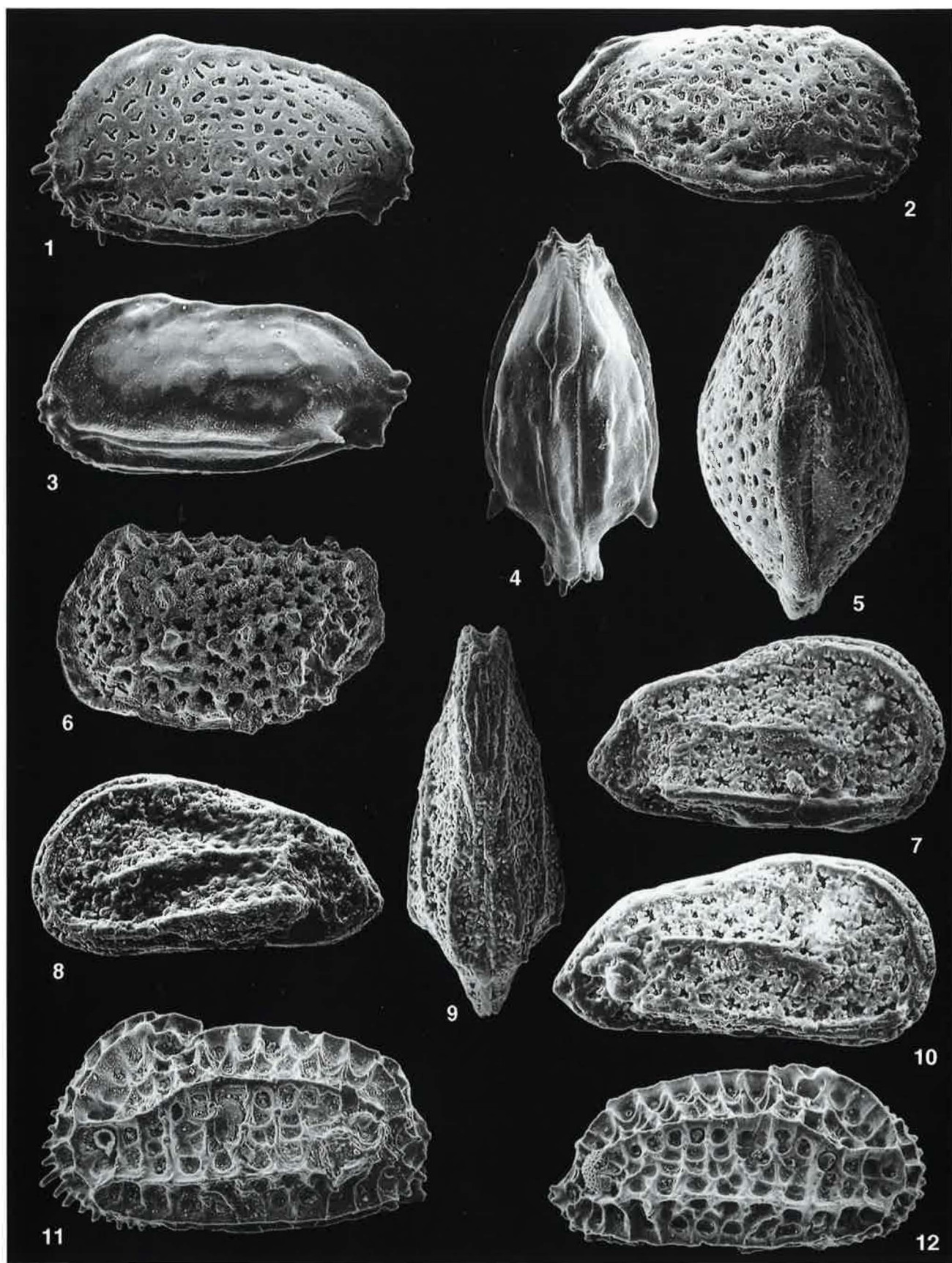
Widely distributed from Miocene to Recent of Mediterranean and Atlantic areas (see Bonaduce *et al.*, 1999).

Genus INCONGRUELLINA Ruggieri, 1958
Subgenus LIXOURIA Uliczny, 1969

INCONGRUELLINA (LIXOURIA) MARGINATA
(Terquem, 1878)
Pl. 4, figs. 5, 7

EXPLANATION OF PLATE 3

- Figs. 1-2, 5 - *Ruggieria caudoflexa* n. sp. 1) Holotype, LV, Stn. ML 0100, B.O.C. 2436, (x 81); 2) Hypotype, RV, Stn. ML 033, B.O.C. 2437, (x 75); 5) Hypotype, CC in dorsal view, Stn. ML 022, B.O.C. 2438, (x 80).
Figs. 3-4 - *Ruggieria tetraptera* (Seguenza, 1880). 3) LV, Stn. ML 82, B.O.C. 2439, (x 73); 4) CC in dorsal view, Stn. ML 82, B.O.C. 2440, (x 73).
Fig. 6 - *Typhloeocytherura* sp. 1, LV, Stn. ML 0110, B.O.C. 2441, (x 227).
Figs. 7-10 - *Trachyleberidea lanceolata* n. sp. 7) Holotype, RV female, Stn. ML 080, B.O.C. 2442, (x 103); 8) Hypotype, LV from complete carapace, Stn. ML 043, B.O.C. 2443, (x 99); 9) Hypotype, CC in dorsal view, Stn. ML 0100, B.O.C. 2445, (x 105); 10) Hypotype, RV male, Stn. ML 0100, B.O.C. 2446, (x 105).
Figs. 11-12 - *Chrysocythere paradisus* Doruk, 1973. 11) LV, Stn. ML 059, B.O.C. 2447, (x 78); 12) RV, Stn. ML 059, B.O.C. 2448, (x 75).



- 1878 *Cythere marginata* TERQUEM, p. 106, pl. 12, fig. 7.
 1972 *Incongruellina (Lixouria) marginata* (Terquem) - SISSINGH, pp. 109-110, pl. 5, figs. 11-13 (*cum syn.*).
 1978 *Incongruellina marginata* (Terquem) - BRESTENSKÁ & JIRÍČEK, pl. 4, fig. 11.
 1988 *Incongruellina (Lixouria) marginata* (Terquem) - NASCIMENTO, pp. 109-110, pl. 6, fig. 2.

Distribution – Very rare in the Langhian and Lower Serravallian and represented by very few specimens.

Moyes (1965): Aquitania, Late Miocene.

Carbonnel (1969): Rodano Basin, Late Miocene.

Uliczny (1969): Cephalonia (Greece), Pliocene.

Sissingh (1972): Crete, Rhodos (Greece), Late Cenozoic.

Brestenská & Jiríček (1978): Central Paratethys, Badenian.

Nascimento (1988): From Aquitanian to Serravallian of Tejo basin (Portugal).

Genus OBLITACYTHEREIS Benson, 1977

Subgenus PALEOBLITACYTHEREIS Benson, 1977

OBLITACYTHEREIS (PALEOBLITACYTHEREIS) BOSSIOI

Dall'Antonia, 2000

Pl. 4, figs. 11-13

- 1976 *Oblitacythereis* sp. 3 RUSSO & BOSSIO, p. 221, pl. 2, figs. 1-2.
 1977 *Oblitacythereis (Paleoblitacythereis) ruggierii* Russo - BENSON, p. 34, pl. 1, figs. 5-6, 8; pl. 2, figs. 5-7; pl. 3, figs. 2-3, 8; text-figs. 4 c-e, 6 a-c.
 2000 *Oblitacythereis (Paleoblitacythereis) bossioi* DALL'ANTONIA, p. 394, pl. 1, figs. 5-6, 8.

Distribution – Very scattered but sometimes consistently present all along the section.

Russo & Bossio (1976): Upper Langhian – Serravallian of the Maltese Archipelago.

Benson (1977): Lower Langhian – Tortonian of Sicily; Tortonian of Andalusia (Spain).

Dall'Antonia (2000): Lower Langhian (*Praeorbulina* Zone) of the Iblean Plateau.

Genus PALEOCOSTA Benson, 1977

PALEOCOSTA OCELLATA Ciampo, 1981

Pl. 4, figs. 1-3

1981 *Paleocosta ocellata* CIAMPO, pp. 62, 64, pl. 2, figs. 6-10.

Remarks – Our specimens fit perfectly with those described and figured by Ciampo from the Langhian of Monte Cammarata (South Western Sicily). We reillustrate the species because we had at disposal better preserved specimens, in which it is also possible to detect a small eye-tubercle which confirms the generic attribution of Ciampo.

Distribution – Very rare, present only in two samples of the "Upper *Globigerina* Limestone".

Ciampo(1981): Tellaro Formation (Southeastern Sicily), Langhian.

Genus TRACHYLEBERIDEA Bowen, 1953

TRACHYLEBERIDEA LANCEOLATA n. sp.

Pl. 3, figs. 7-10

Etymology – From Latin *lanceolatus* = arrow-shaped.

Holotype – A RV female (Pl. 3, fig. 7), Stn. ML 080, B.O.C. 2442.

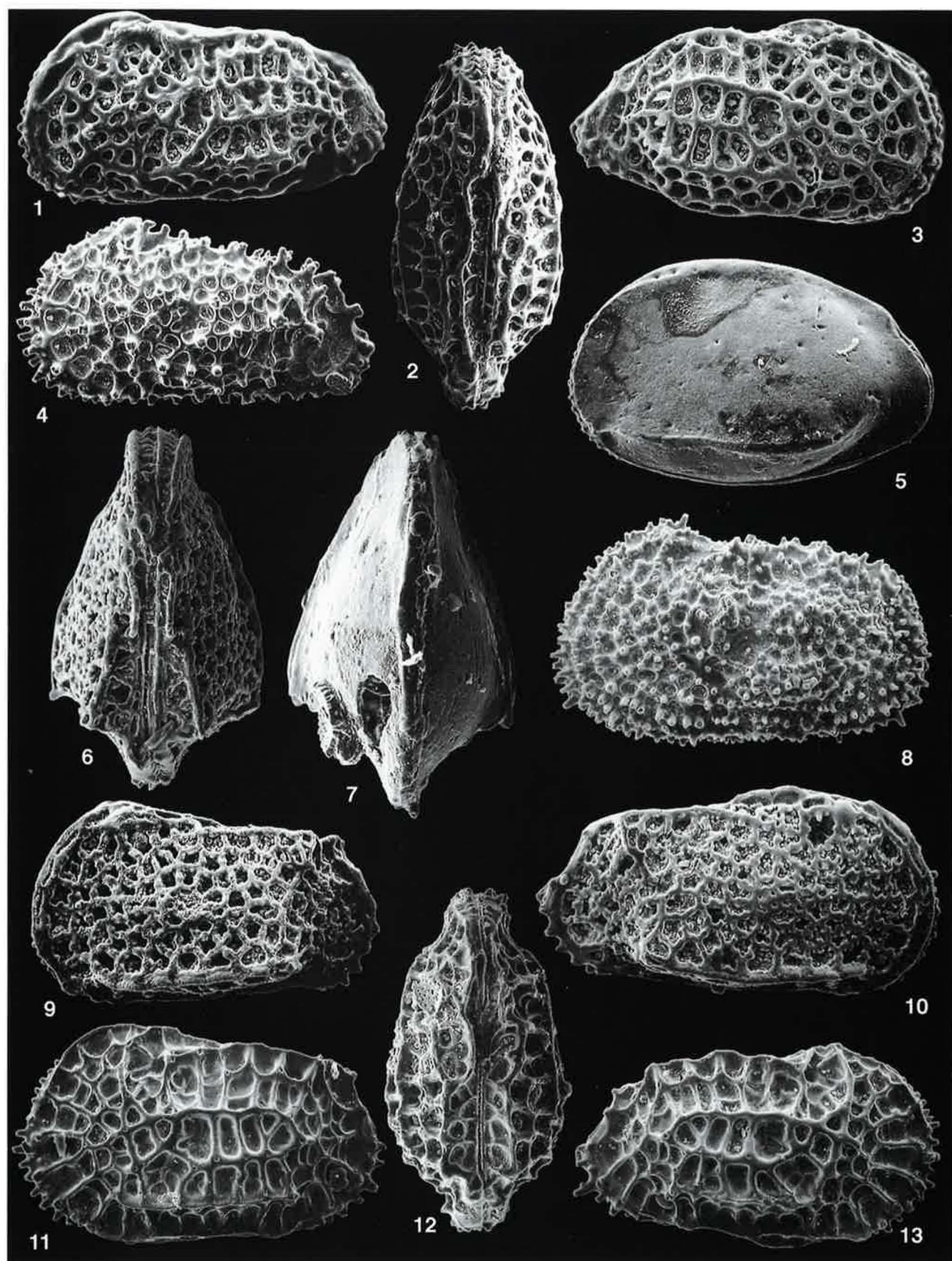
Hypotypes – 1 complete carapace (Pl. 3, fig. 8), Stn. ML 043, B.O.C. 2443; 1 RV, Stn. ML 0100, B.O.C. 2444; 1 complete carapace (Pl. 3, fig. 9), Stn. ML 0100, B.O.C. 2445; 1RV male (Pl. 3, fig. 10), Stn. ML 0100, B.O.C. 2446.

Type-level – Upper "*Globigerina* Limestone" Formation, Langhian, *Orbulina universa* Zone, 16 m from the base.

Diagnosis – Valves very elongated in lateral view characterized by very acuminate posterior margin, by three longitudinal ridges, the topmost two connected

EXPLANATION OF PLATE 4

- Figs. 1-3 - *Paleocosta ocellata* Ciampo, 1981. 1) LV, Stn. ML 043, B.O.C. 2449, (x 103); 2) CC in dorsal view, Stn. ML 055, B.O.C. 2450, (x 108); 3) RV, Stn. ML 055, B.O.C. 2451, (x 113).
 Fig. 4 - *Acantocythereis hystrix* (Reuss, 1850), LV, Stn. ML 306, B.O.C. 2452, (x 67).
 Figs. 5, 7 - *Incongruellina (Lixouria) marginata* (Terquem, 1878). 5) LV, Stn. ML 31, B.O.C. 2453, (x 88); 7) CC in dorsal view, Stn. ML 070, B.O.C. 2454, (x 93).
 Figs. 6, 9-10 - *Grinioneis pirata* (Ruggieri, 1960). 6) CC in dorsal view, Stn. ML 055, B.O.C. 2455, (x 88); 9) LV, Stn. ML 043, B.O.C. 2456, (x 85); 10) RV, Stn. ML 055, B.O.C. 2457, (x 93).
 Fig. 8 - *Henryhowella sarsii profunda* Bonaduce, Barra & Aiello, 1999, LV, Stn. ML 136, B.O.C. 2458, (x 88).
 Figs. 11-13 - *Oblitacythereis (Paleoblitacythereis) bossioi* Dall'Antonia, 2000. 11) LV, Stn. ML 306, B.O.C. 2459, (x 79); 12) CC in dorsal view, Stn. ML 017, B.O.C. 2460, (x 80); 13) RV, Stn. ML 286, B.O.C. 2461, (x 80).



posteriorly and by a flat anterior marginal ridge which from the eye region continue along the ventral margin ending before the well developed flattened caudal process.

Description – Valves in lateral view regularly rounded anteriorly and very acuminate posteriorly (Pl. 3, figs. 7, 8, 10). Dorsal margin almost straight bending abruptly at the posterior extremity in the caudal process. Ventral margin almost straight and feebly upturning at the posterior extremity. In dorsal view the carapace is lanceolate (Pl. 3, fig. 9).

The valves are ornamented by 3 longitudinal ridges. The dorsal ridge is poorly developed and continue in a flat ridge parallel to the anterior and to the ventral margins, ending abruptly before the caudal process. The median ridge appears almost straight and restricted to the central part of the valve and connected with the dorsal one, character more evident in the RV (Pl. 3, fig. 7).

The surface of the valves is completely and deeply ornamented by irregularly shaped foveolae which tend to become tegminated. The anterior extremity seems surrounded by separated small tubercles just before the anterior peripheral ridge.

Remarks – The genus *Trachyleberidea* (type-species *Cythereis prestwichiana* Jones & Sherbon, 1887) is characterized by a lanceolate shape in lateral and dorsal view, by an antero-marginal ridge and three longitudinal ones. The dorsal ridge generally is connected with the median one near the posterior cardinal angle.

The surface is generally reticulated or pitted.

The muscle-scars pattern is constituted by two anterior subdivided muscles and by a posterior row of four vertical scars.

Following Van Morkhoven (1963, vol. 2), *Trachyleberidea* is a junior synonym of *Costa* Neviani, 1928. Liebau (1975) stresses that *Trachyleberidea*, considered by him a valid genus, cannot pertain to the tribe ? Costaini Hartmann & Puri, 1974.

In our opinion due to the peculiar shape in lateral view, the characteristic muscle scars pattern and characters of the hinge, it cannot be considered anyway junior synonym of *Costa* and the genus should be considered valid.

Size (mm) – Holotype (RV female): $l = 0.66$; $h = 0.36$; $l/h = 1.83$ (Pl. 3, fig. 7).

RV male: $l = 0.72$; $h = 0.35$; $l/h = 2.06$ (Pl. 3, fig. 10).

LV: $l = 0.72$; $h = 0.37$; $l/h = 1.95$ (Pl. 3, fig. 8).

Affinities – This species is very similar in shape and ornamentation to *T. venusta* (Deltel, 1964) as figured by Ducasse *et al.* (1985) attributed to *Paracaudites* Deltel, 1964 described from the Eocene of the Aquitanian Basin which differs in the occurrence of two ventrolateral ridges instead of one and in the

anterior submarginal ridge which is more elongated into the dorsal margin. Moreover our species lacks the posterior submarginal ridge connected with the median one at its posterior extremity. It seems evident an evolutionary link between the two species.

Distribution – Occurring exclusively in the "Upper *Globigerina* Limestone".

Family HEMICYTHERIDAE Puri, 1953

Genus GRINIONEIS Liebau, 1975

GRINIONEIS PIRATA (Ruggieri, 1960)

Pl. 4, figs. 6, 9-10

1960 *Hermanites* (?) *pirata* RUGGIERI, p. 4, pl. 2, figs. 1a-1e.

1962 *Hermanites haidingerii* (Reuss) *rectangularis* RUGGIERI, pp. 23-25, pl. 12, figs. 1-5, tf. 10.

1976 *Cleocythereis pirata* (Ruggieri) - RUSSO & BOSSIO, pl. 1, fig. 5.

1985 *Hermanites rectangularis* Ruggieri - BONADUCE & RUSSO, p. 432, pl. 5, fig. 8.

1992 *Grinioneis pirata* (Ruggieri) - RUGGIERI, p. 185.

1992 *Grinioneis rectangularis* (Ruggieri) - RUGGIERI, p. 186.

Distribution – Exclusive of the "Upper *Globigerina* Limestone" where it is very common in most of the samples.

Ruggieri (1960): basal part of the Tellaro Formation, Ragusa (Southwestern Sicily), Early Middle Miocene.

Ruggieri (1962): Enna (Sicily), Tortonian.

Russo & Bossio (1976): Maltese Archipelago, "Upper *Globigerina* Limestone", Langhian.

Bonaduce & Russo (1985): Capo S. Marco section (Sardinia), Late Tortonian - Early Messinian.

Family CYTHERETTIDAE Triebel, 1972

Genus PURICYTHERETTA Russo & Bossio, 1975

PURICYTHERETTA MELITENSIS Russo & Bossio, 1975

Pl. 5, figs. 1-2

1975 *Puricytheretta melitensis* RUSSO & BOSSIO, pp. 148-149, pl. 54, figs. 1-12.

Distribution – Rather common in the "Upper *Globigerina* Limestone" and very rare and scattered in the "Blue Clays" up to the middle of the *Dentoglobigerina altispina* Zone.

Russo & Bossio (1975; 1976): Maltese Archipelago, from Upper Burdigalian to Lower Serravallian.

Family MICROCYTHERIDAE G.W. Müller, 1894

Genus MICROCYTHERE G.W. Müller, 1894

MICROCYTHERE (?) sp. 1

Pl. 5, fig. 8

Remarks – The extreme rarity of the species and bad preservation of the material does not allow a more precise even generic attribution; in fact also the internal characters are not detectable.

Distribution – Only two valves of this taxon have been found in the "Upper *Globigerina* Limestone".

Family CYTHERURIDAE G.W. Müller, 1894
Subfamily EUCYTHERURINAE Puri, 1974
Genus EUCYTHERURA G.W. Müller, 1893

EUCYTHERURA BICORNUTA n. sp.
Pl. 5, figs. 3-7

Etymology – From Latin *bi* = twice and *cornutus* = horned.

Holotype – A LV (Pl. 5, fig. 3), Stn. ML 82, B.O.C. 2464.

Paratypes – 2 valves, 1RV (Pl. 5, figs. 4-6), B.O.C. 2465 and 1LV (Pl. 5, fig. 7), B.O.C. 2466.

Type-level – "Blue Clay" Formation, Serravallian, *Globorotalia peripheroronda* Zone, 12.37 m from the base.

Diagnosis – A species of *Eucytherura* characterized by a subrectangular shape in lateral view, posterior extremity acuminate and ventral subhorizontal ridge limited to the anterior and antero-ventral part. Surface reticulate. Postero-dorsal area characterized by two elongated subvertical tubercles which overlap the margin.

Description – In lateral view valves with dorsal margin straight, anterior almost regularly rounded, posterior extremity depressed and acuminate, ventral feebly concave. The valves are ventrally inflated and surrounded along the ventral margin by a smooth ridge which from the anteroventral reaches the base of the caudal process. An anterior ridge inside the margin runs from the evident eye-tubercle to the antero-ventral where it disappears. Two elongated and vertically disposed protrusions, parallel each other ornament the postero-dorsal submarginal area, separated by two large foveolae. All the valve surface is reticulated mostly with celate elements more rare in the caudal process area (Pl. 5, figs. 3-4).

The reticulation is constituted by irregularly shaped elements, generally horizontally elongated in the central area. Small rounded foveolae occur near the posterodorsal margin, aligned into 2 rows parallel to the margin itself.

Internal characters typical of the genus with large inner lamella both anteriorly and posteriorly where it upturns decreasing in size toward the posterior hinge element (Pl. 5, fig. 5).

Hinge constituted in the RV (Pl. 5, fig. 6) by an anterior elongated smooth tooth, a bar apparently smooth and a posterior elongated crenulate tooth, whose characters do not seem typical of the genus. LV hinge sockets open to the interior (Pl. 5, fig. 7).

Size (mm) – Holotype (LV): $l = 0.35$; $h = 0.18$ (Pl. 5, fig. 3).
RV: $l = 0.34$; $h = 0.17$ (Pl. 5, fig. 4).

Affinities – This species cannot be compared with any other species known to us because of the peculiar shape and ornamentation.

Distribution – It occurs in only three samples of the section, in both the "Upper *Globigerina* Limestone" and the "Blue Clays".

Genus TYPHLOEUCYTHERURA Colalongo & Pasini, 1980

TYPHLOEUCYTHERURA sp. 1
Pl. 3, fig. 6

Remarks – This species is represented in our material only two valves and consequently it does not allow a sure determination.

It seems vaguely similar to *T. hirsuta* (Ciampo, 1980) in the general shape but differs due to the shape of the caudal process which in our species appears truncated. Moreover the ornamentation of the two species differs in the foveolae, star-shaped in our species and more irregular in the Ciampo's species. It is also similar to *T. calabra* Colalongo & Pasini, 1980 in the general characters but it differs in the shape of caudal process, in the straight dorsal margin and in the less inflated carapace.

Distribution – Very rare and exclusively represented in the "Upper *Globigerina* Limestone".

Family XESTOLEBERIDIDAE Sars, 1866
Genus XESTOLEBERIS Sars, 1866

XESTOLEBERIS ? GLABRESCENS (Reuss, 1850)
Pl. 5, fig. 9

? 1850 *Cytherina glabrescens* REUSS, p. 59, pl. 10, fig. 27.

Remarks – The attribution to *X. glabrescens* of the present species is due principally to the stratigraphic age of our section. In fact *X. communis* G.W. Müller, 1894, does not seem to differ significantly from the present species for which we have not been able to separate them. In our opinion *X. communis* could be considered a junior synonym of the Reuss's species, up to when more detailed studied are accomplished.

Distribution – Only one valve of this species has been found at the base of the *Dentoglobigerina altispi-*

ra Zone, possibly reworked from shallow environment.

XESTOLEBERIS PROGDATA Bonaduce & Danielopol,
1988
Pl. 5, fig. 11

1988 *Xestoleberis prognata* BONADUCE & DANIELOPOL, p. 381,
pl. 3, figs. A, B, C; pl. 1, figs. G, H.

1994 *Xestoleberis prognata* Bonaduce & Danielopol - ABATE *et al.*, pp. 208-209, pl. 2, figs. 1-10.

1996 *Xestoleberis prognata* Bonaduce & Danielopol - RUIZ & GONZALEZ-REGALADO, pl. 2, fig. 14.

Distribution – This species occurs almost continuously in the “Upper *Globigerina* Limestone” with reduced number of specimens and in a scattered way in the lower part of the *Dentoglobigerina altispira* Zone.

Cited from the Late Miocene and Pliocene of Spain (Ruiz & Gonzalez Regalado, 1996) and Pliocene of Sicily (Bonaduce & Danielopol, 1988; Abate *et al.*, 1994; Barra *et al.*, 1998).

Family BYTHOCYTHERIDAE Sars, 1866
Genus MONOCERATINA Roth, 1928

MONOCERATINA PRAEOBLITA n. sp.
Pl. 5, fig. 10

Etymology – From Latin *prae* = before and *oblitus* = forgotten.

Holotype – A LV (Pl. 5, fig. 10), Stn. ML 091, B.O.C. 2469.

Paratype – A LV, B.O.C. 2475.

Type-level – “Upper *Globigerina* Limestone”, Langhian, *Orbulina universa* Zone, 18.20 m from the base.

Diagnosis – A species of *Monoceratina*, characterized by the defined reticulation in the swelling area before the median sulcus and by 3 thin ridges below the wing projection.

Description – The general characters of the present species are not described because of their almost identical features with *M. oblita* Bonaduce, Ciampo & Masoli, 1976 (Pl. 70, figs. 1-8). The character which allows to separate the two species are treated below. The swelling before the median sulcus is completely covered by a rather large reticulation. The antero-dorsal and anterior areas are completely smooth. The protruding wing-like process is ornamented in the ventral area by 3 delicate longitudinal ridges parallel each other.

Size (mm) – Holotype (LV): l = 0.61; h = 0.35 (Pl. 5, fig. 10).

Affinities – One of the species which can be compared with the present one is *Bythoceratina orientalis* (Brady) as figured by Whatley & Zhao (1987) and Zhao & Whatley (1988) from the Recent of Hong Kong in the revision of Brady's Ostracoda of the area. The ornamentation of the dorso-ventral anterior swelling is very similar but it differs in the presence of the more developed ventral wing projection which reaches the anterior part of the valve (pl.1, fig. 11).

The nearest species which at our knowledge can be compared with the present one, as previously stressed, is *M. oblita* described from the Recent of the Adriatic Sea. Our species chiefly differs due to presence of the reticulation of the anterior swelling, to the absence of the S-shaped riblet which from the anterodorsal margin reaches the wing-like process and to the occurrence of 3 ventral longitudinal riblets. In our opinion *M. praeoblita* n. sp. can be considered the ancestor of *M. oblita*.

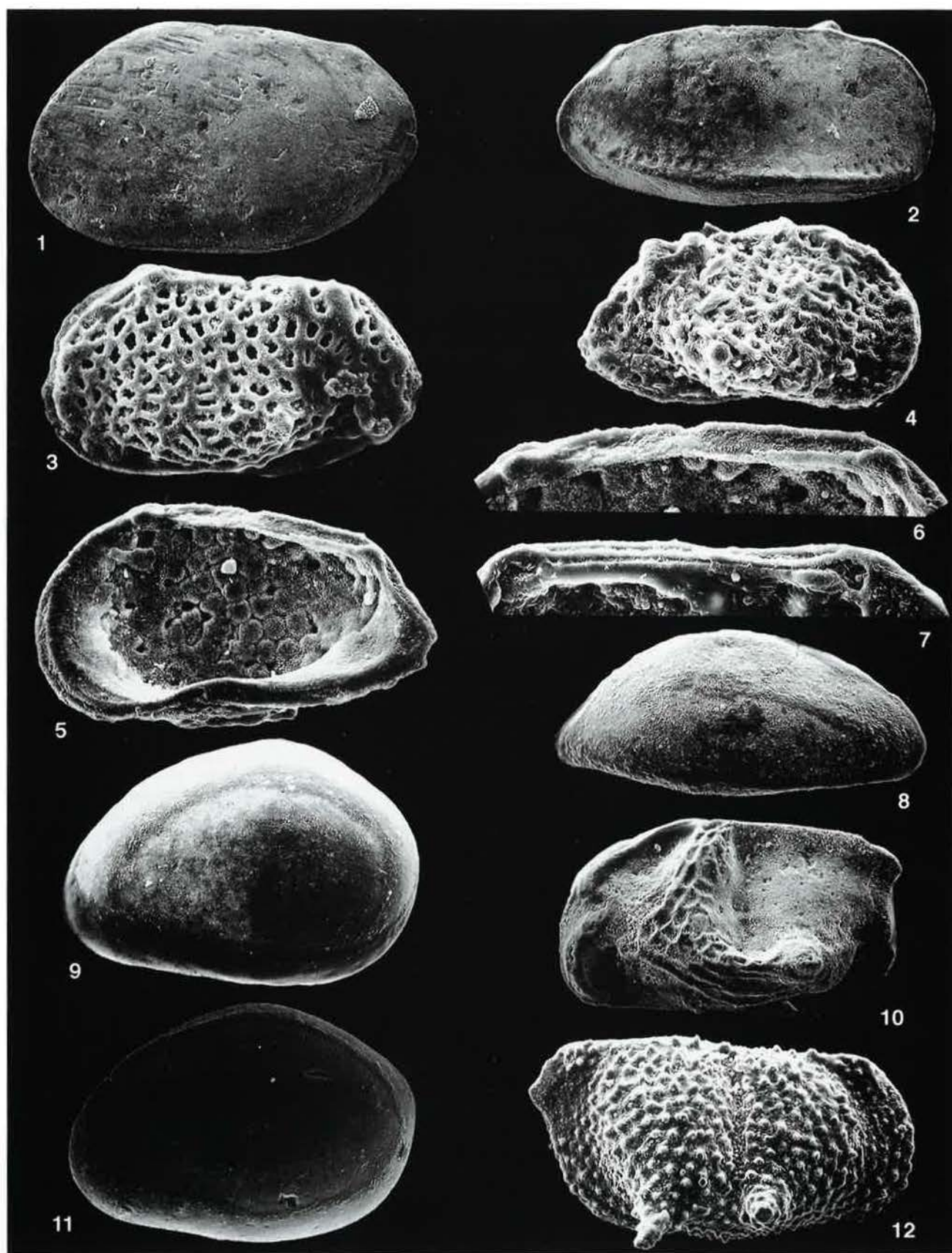
Distribution – This species is represented in the section by only two valves pertaining to “Upper *Globigerina* Limestone”.

Genus RETIBY THERE Schornikov, 1981
Subgenus BATHYBY THERE Schornikov, 1987

RETIBY THERE (BATHYBY THERE) VANDENBOLDI
Ruggieri, 1960
Pl. 5, fig. 12

EXPLANATION OF PLATE 5

- Figs. 1-2 - *Puricytheretta melitensis* Russo & Bossio, 1975. 1) LV, Stn. ML 070, B.O.C. 2462, (x 72); 2) RV ? male, Stn. ML 0100, B.O.C. 2463, (x 75).
Figs. 3-7 - *Eucytherura bicornuta* n. sp. 3) Holotype, LV, Stn. ML 82, B.O.C. 2464, (x 224); 4) Paratype, RV, B.O.C. 2465, (x 200); 5) same specimen of fig. 4 and fig. 6, internal view, (x 232); 6) same specimen of fig. 4 and fig. 5, hinge, (x 308); 7) Paratype, LV, hinge, B.O.C. 2466, (x 295).
Fig. 8 - *Microcythere* (?) sp. 1, RV, Stn. ML 055, B.O.C. 2467, (x 180).
Fig. 9 - *Xestoleberis* ? *glabrescens* (Reuss, 1850), LV, Stn. ML 153, B.O.C. 2468, (x 175).
Fig. 10 - *Monoceratina praeoblita* n. sp., Holotype, LV, Stn. ML 091, B.O.C. 2469, (x 107).
Fig. 11 - *Xestoleberis prognata* Bonaduce & Danielopol, 1988, LV, Stn. ML 070, B.O.C. 2470, (x 173).
Fig. 12 - *Retibythere* (*Bathybythere*) *vandenboldi* Ruggieri, 1960, RV, Stn. ML 055, B.O.C. 2471, (x 95).



- 1960 *Bythoceratina* (?) *vandenboldi* RUGGIERI, pp. 6-7, pl. 1, figs. 6-7; pl. 2, fig. 3.
 1972a *Bythoceratina vandenboldi* Ruggieri - CIAMPO, pl. 6, fig. 4.
 1976 *Bythoceratina vandenboldi* Ruggieri - RUSSO & BOSSIO, pl. 1, fig. 6.
 1976 *Bythoceratina* aff. *vandenboldi* Ruggieri - RUSSO & BOSSIO, pl. 1, fig. 3.

Remarks – The two forms figured by Russo & Bossio (1976) are in our opinion conspecific because the only differences lie in the little variability in shape in lateral view, possibly due to sexual dimorphism.

Distribution – It occurs, not rare, exclusively in the “Upper *Globigerina* Limestone”.

Ruggieri (1960): Ragusa (Sicily), Middle Miocene.
 Ciampo (1972a): Mar Piccolo area (Taranto), Pleistocene.

Russo & Bossio (1976): Burdigalian – Langhian of the Maltese Archipelago.

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APPENDIX

COMPLETE SPECIES LIST IN THE SECTION STUDIED

All the ostracod species are listed below in alphabetical order for genera and species. When figured, the related data are reported.

- Acantocythereis hystrix* (Reuss, 1850) [Pl. 4, fig. 4]
Anchistrocheles (?) sp.
Argilloecia acuminata G.W. Müller, 1894
Argilloecia kissamovensis Sissingh, 1972
Argilloecia micra Bonaduce, Ciampo & Masoli, 1976
Argilloecia spissa Barra, Aiello & Bonaduce, 1996 [Pl. 2, fig. 2]
Argilloecia sp.
Australoecia posterocurva n. sp. [Pl. 2, figs. 3-6; text-fig. 2c]
Bairdoppilata conformis (Terquem, 1878) [Pl. 1, figs. 8, 11-12]
Bairdoppilata profunda Aiello, Barra & Bonaduce, 2000 [Pl. 2, fig. 1]
Buntonia dertonensis Ruggieri, 1954 [Pl. 2, figs. 9-10]
Buntonia multicostata Ruggieri, 1962 [Pl. 2, figs. 11-12]
Bythocypris obtusata (Sars, 1866) *producta* (Seguenza, 1880)
Chrysocythere paradisi Doruk, 1973 [Pl. 3, figs. 11-12]
Cytherella cercinata Aiello, Barra, Bonaduce & Russo, 1996
Cytherella circumpunctata Ciampo, 1976 [Pl. 1, figs. 2-3]
Cytherella fovea n. sp. [Pl. 1, figs. 1, 13]
Cytherella postdenticulata Oertli, 1961
Cytherella robusta Colalongo & Pasini, 1980
Cytherella vandenboldi Sissingh, 1972
Cytherella ? vandenboldi Sissingh, 1972 [Pl. 1, figs. 9-10; pl. 2, fig. 7]
Cytherella vulgata Ruggieri, 1962
Cytherella vulgatella Aiello, Barra, Bonaduce & Russo, 1996 [Pl. 1, figs. 4, 7]
Cytherelloidea ? creutzburgi Sissingh, 1972 [Pl. 1, figs. 5-6]
Eucytheron rectum Colalongo & Pasini, 1980
Eucythere curta Ruggieri, 1975 [Pl. 2, fig. 13]
Eucytherura bicornuta n. sp. [Pl. 5, figs. 3-7]
Grinioneis pinata (Ruggieri, 1960) [Pl. 4, figs. 6, 9-10]
Henryhowella sarsii profunda Bonaduce, Barra & Aiello, 1999 [Pl. 4, fig. 8]
Incongruella (*Lixouria*) *marginata* (Terquem, 1878) [Pl. 4, figs. 5, 7]
Incongruella (*Lixouria*) *keiji* Sissingh, 1972
Krithe compressa (Seguenza, 1880)
Krithe iniqua Abate, Barra, Aiello & Bonaduce, 1993
Krithe keyi Breman, 1978
Krithe undecimradiata Ruggieri, 1974
Krithe sp. 1
Krithe sp. 2
Krithe sp.
Lixouria sp.
Macrocypris sp. 1
Macrocypris sp. 2
Microcythere (?) sp. 1 [Pl. 5, fig. 8]
Microcythere (?) sp. 2
Monoceratina praeoblita n. sp. [Pl. 5, fig. 10]
Oblitacythereis (*Paleoblitacythereis*) *bossioi* Dall'Antonia, 2000 [Pl. 4, figs. 11-13]
Occultocythereis ? dohrni (Puri, 1963)
Patjenborchella iocosa Kingma, 1948
Patjenborchella solitaria Ruggieri, 1962
Paleocosta ocellata Ciampo, 1981 [Pl. 4, figs. 1-3]
Palmococoncha sp. 1
Paracypris sp. 1
Paracypris sp. 2
Parakrithe ambigua Ciampo, 1980
Parakrithe ariminensis (Ruggieri, 1967)
Parakrithe dactylomorpha Ruggieri, 1962 [Text-fig. 2a]
Parakrithe dimorpha Bonaduce, Ciampo & Masoli, 1976
Parakrithe ? iuliani Aiello, Barra, Abate & Bonaduce, 1993
Parakrithe lamellosa Aiello, Barra, Abate & Bonaduce, 1993
Parakrithe rotundata Aiello, Barra, Abate & Bonaduce, 1993
Parakrithe sp. 1
Parakrithe sp. 2
Parakrithe sp. 3
Parakrithe sp.
Platyleberis profunda (Breman, 1975)
Propontocypris solida Ruggieri, 1952
Pseudosammocythere kollmanni Carbonnel, 1966 [Text-fig. 2b]
Pterygocythere (?) *iblea* Ruggieri, 1960
Pterygocythereis siveteri Athersuch, 1978
Pterygocythereis sp.
Puricytheretta melitensis Russo & Bossio, 1975 [Pl. 5, figs. 1-2]
Rectobuntonia hilaris Ciampo, 1984 [Pl. 2, fig. 8]
Retibythere (*Batibythere*) *vandendoldi* (Ruggieri, 1960) [Pl. 5, fig. 12]
Ruggieria caudoflexa n. sp. [Pl. 3, figs. 1-2, 5]
Ruggieria tetraptera (Seguenza, 1880) [Pl. 3, figs. 3-4]
Trachyleberidea lanceolata n. sp. [Pl. 3, figs. 7-10]
Typhlocytherura sp. 1 [Pl. 3, fig. 6]
Xestoleberis ? glabrescens (Reuss, 1850) [Pl. 5, fig. 9]
Xestoleberis prognata Bonaduce & Danielopol, 1988 [Pl. 5, fig. 11]

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