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Distribution of some species of fresh and brackish-water Ostracoda from the lower Pleistocene of SE Sicily

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SUMMARY

Lower Pleistocene marine sediments, evolving upwards to continental deposits, widely crop out along the south-western edge of the Hyblean Plateau in the Comiso-Vittoria area. This environmental transition is well recorded, along the right side of the Ippari river near "Cartiera Mulino" (Vittoria, Ragusa). Eight samples were collected in a geological section from this locality. The basal and middle layers contain abundant shallow-water marine ostracods whereas microfaunas from the top of the section only consist of ostracods which exclusively thrive in freshwater environments. Three among the brackish and freshwater species are recorded (*Aurila arborescens*, *Ilyocypris gibba* and *Candona neglecta*) with remarks on their geographical and stratigraphical distribution.

INTRODUCTION

Ostracods are the most common extant arthropod group with abundant and continuous fossil record, due to their usually mineralised, easily preservable exoskeletons. They are able to thrive in all aquatic environments, mostly in marine settings from the sea level to oceanic depths, but also in continental waters: lakes, rivers and even humid ephemeral ponds. Consequently, ostracods represent an useful tool for palaeoenvironmental reconstructions and palaeobiogeographical analyses (Ducasse and Peypouquet, 1979; Babinot and Lethiers, 1984; Guernet and Lethiers, 1984; Carbonel, 1987; Passlow, 1997; Martens et al., 2008).

The present analysis is a contribution to the knowledge of the palaeobiogeographic distribution of *Aurila arborescens* (Brady, 1865), *Ilyocypris gibba* (Ramdohr, 1808) and *Candona neglecta* Sars 1887, here first recorded from Lower Pleistocene sediments from SE Sicily.

MATERIALS AND METHODS

Lower Pleistocene marine sediments, locally passing upwards to continental deposits, widely crop out along the south-western edge of the Hyblean Plateau in the Comiso-Vittoria area. This regressive succession is known through geological studies by Conti et al. (1979) and palaeoecological analyses by Costa (1989) and Sciuto et al. (2008). The transition from the shallow marine to lacustrine environment is documented along a 6 m thick section, well exposed near the Cartiera Mulino (Vittoria) along the right side of the Ippari river (Figs. 1, 2), which deposited during the Early Pleistocene (Conti et al., 1979).

For the present analysis eight samples were collected (Fig. 2) and routinely treated. Ostracod specimens were picked out from the 63-500 μm fraction. Selected ostracod valves were observed under a LMU Tescan Vega II SEM.

The investigated material is housed in the Palaeontological Museum of Catania University (PMC S.O.Pl.1).

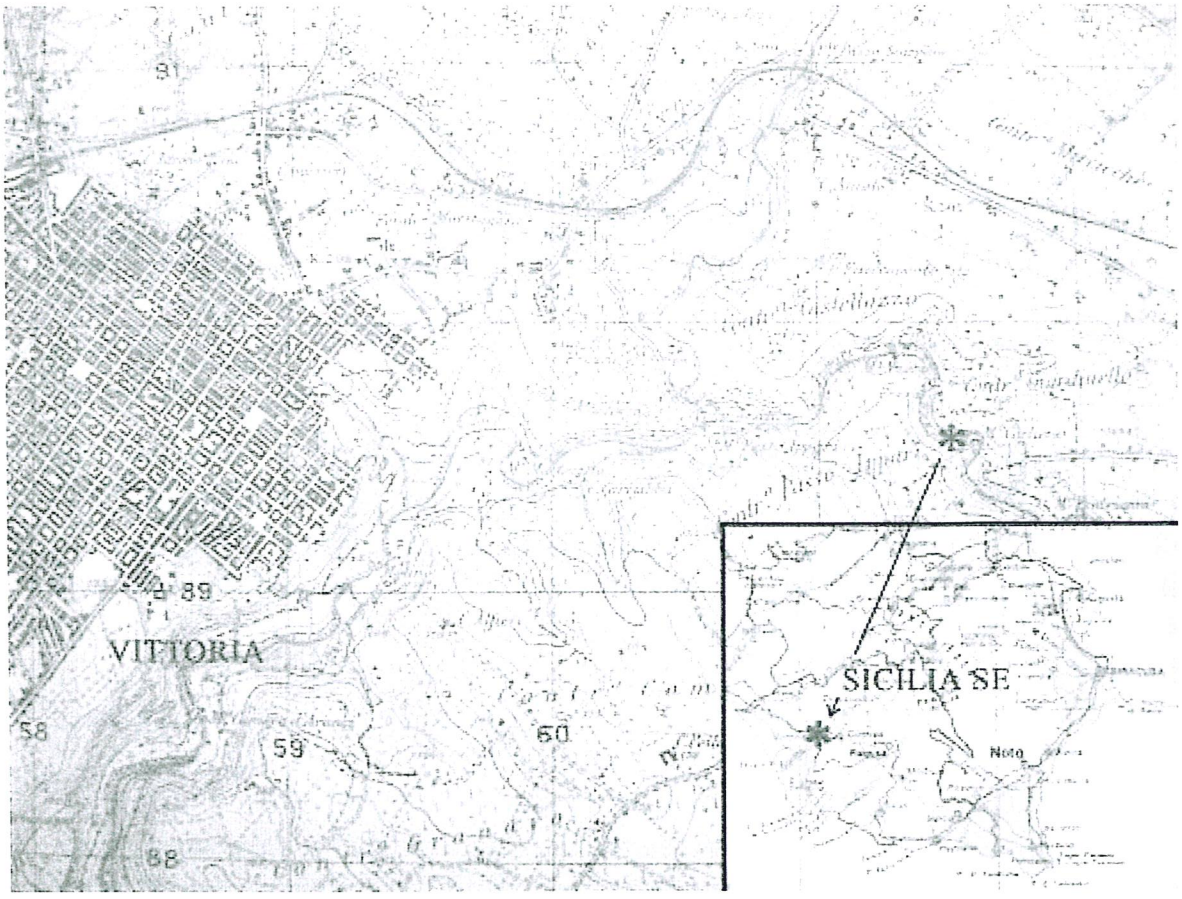

Fig. 1 - Geographical location (*) of the Cartiera Mulino section.

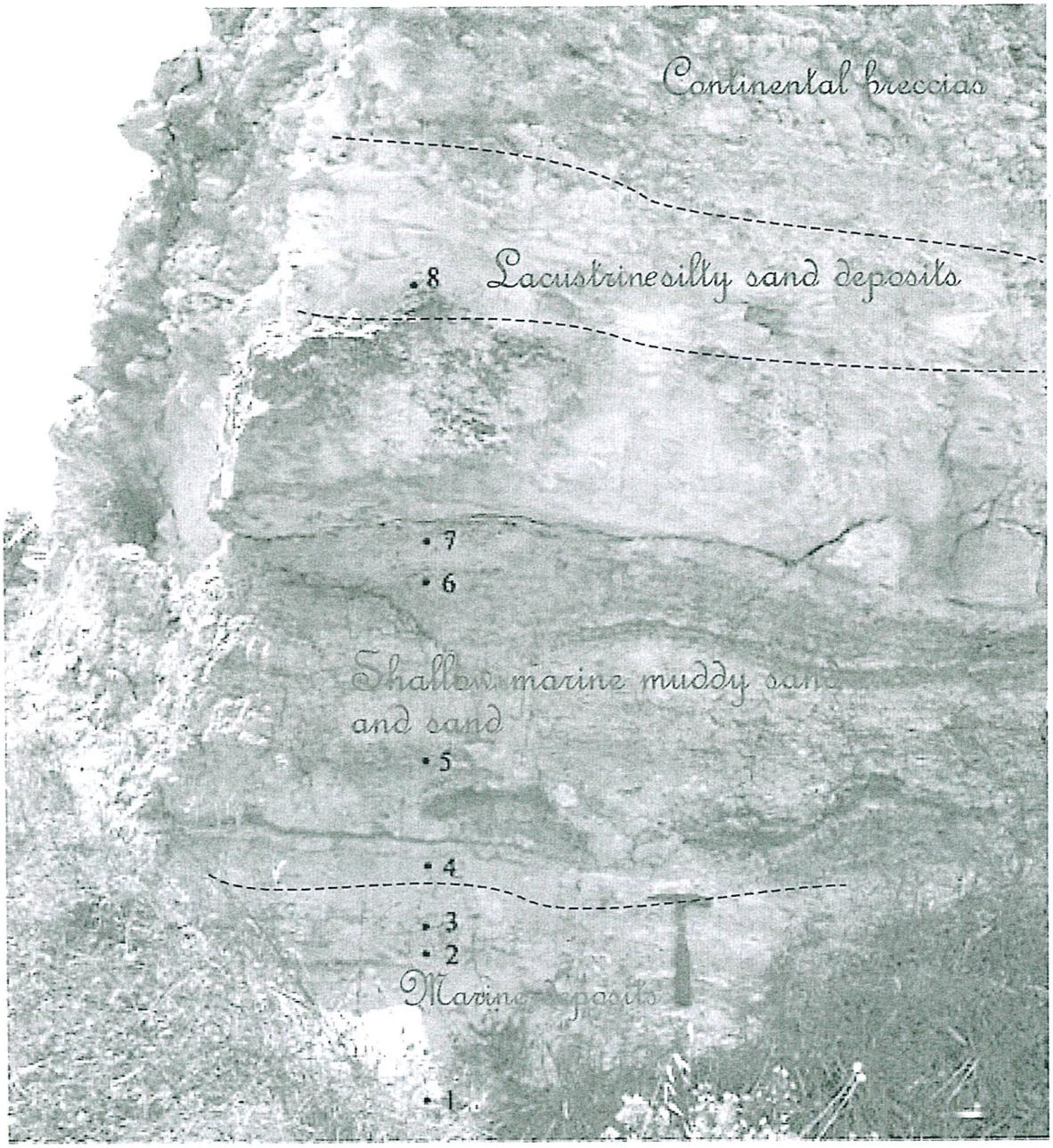

Fig. 2 - Geological outcrop of Cartiera Mulino (numbers indicate the position of the investigated samples).

RESULTS

Basal and middle layers (sample 1-7 in Fig. 2) from the Cartiera Mulino section contain abundant marine ostracods. Most species belong to the genera *Aurila*, *Loxoconcha*, *Bairdia*, *Urocythereis*, *Costa*, *Cytheretta*, *Cytherelloidea* and *Graptocythere*, which are typical of bottoms characterized by algal cover and/or algal debris and testify to a very shallow and sheltered marine environment which can be ascribed to the SVMC Biocoenosis with superimposed metaphytes (Sciuto et al., 2008).

Microfaunas from the top of the section (sample 8 in Fig. 2), only consist of *Ilyocypris gibba* (Ramdohr, 1808) and *Candona neglecta* Sars, 1887, which exclusively thrive in freshwater environments.

The present study focuses on the geographic distribution of the latter two species and the brackish-water dweller *Aurila arborescens* (Brady, 1865), recorded from the middle part of the section (samples 5-7 in Fig. 2).

Order PODOCOPIDA Müller, 1894
Suborder PODOCOPINA Sars, 1866
Superfamily CYTHERACEA Baird, 1850
Family HEMICYTHERIDAE Puri, 1953
Genus *Aurila* Pokorny, 1955
Aurila arborescens (Brady, 1865)
(Fig. 3)

1865 *Cythere arborescens* Brady: 190, pl. 9, figs. 5-8.
1868 *Cythere woodwardii* Brady: 93, pl. 10, figs. 19-21.

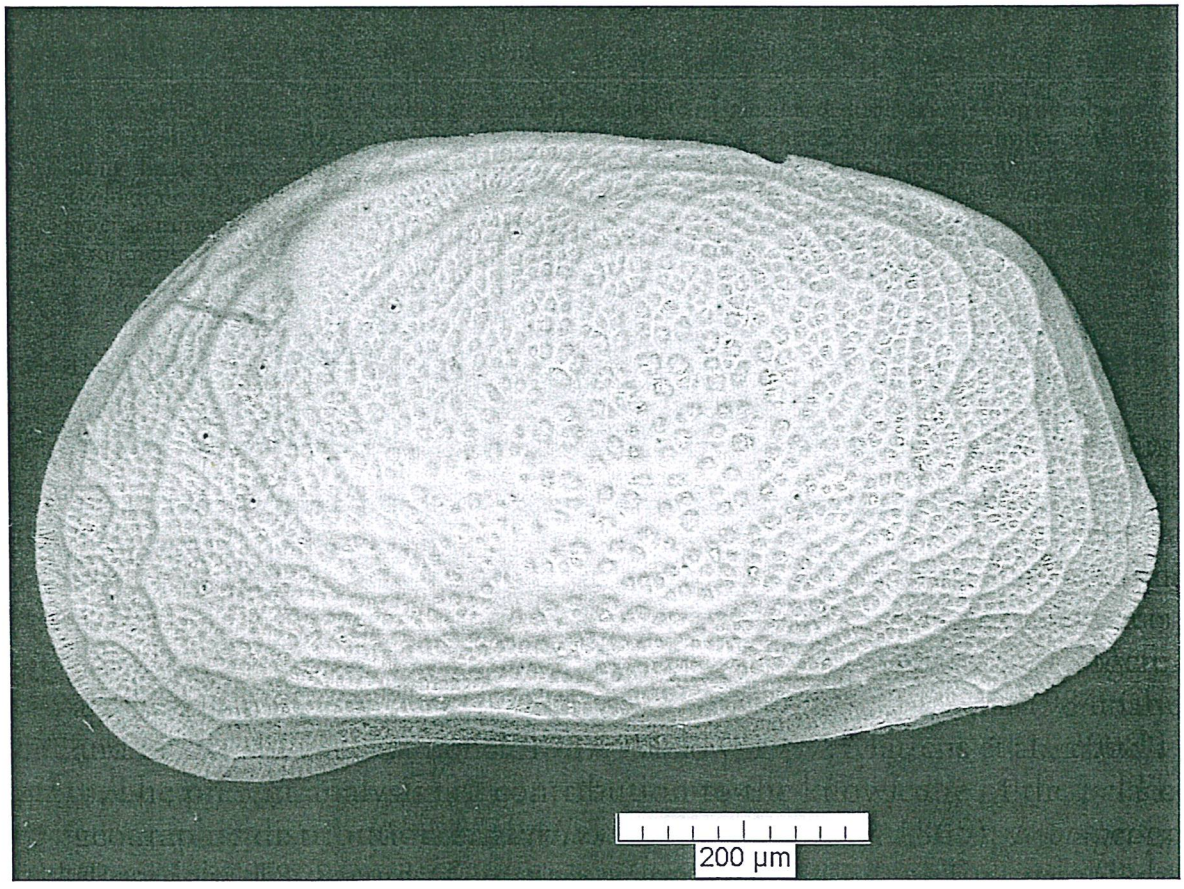

Fig. 3 - *Aurila arborescens* (Brady, 1865): left valve, external view.

1963 *Aurila woodwardii* (Brady): McKenzie: 8, pl. 1, figs. 1-3.
1975 *Aurila woodwardii* (Brady): Bonaduce, Ciampo & Masoli: 44, pl. 20, figs. 8-11.
1975 *Aurila woodwardii* (Brady): Ruggieri: 30.
1985 *Aurila arborescens* (Brady): Athersuch, Horne & Whittaker: 156, pl. 1, figs. 5-8; pl. 2, figs. 1-4.
1989 *Aurila arborescens* (Brady): Athersuch, Horne & Whittaker: 158, fig. 63; pl. 4, fig. 10.

GEOGRAPHIC DISTRIBUTION: *A. arborescens* is a Mediterranean species (Bonaduce et al., 1975), which has been recorded also from SW Wales and the Thames estuary (Athersuch et al., 1989).

STRATIGRAPHIC DISTRIBUTION: This species was previously known as fossil only from the Late Pliocene of Forlì (Ruggieri, 1975) and NW France and Cornwall (Athersuch et al., 1985). The present record from Sicily, partly fills the gap in distribution, including the Late Pleistocene.

ECOLOGY: *A. arborescens* is a phytal shallow marine species, found also in brackish lagoonal environments.

Suborder CYPRIDOCOPINA Jones, 1901
Superfamily CYPRIDOIDEA Baird, 1845
Family CANDONIDAE Kaufmann, 1900
Subfamily CANDONINAE Kaufmann, 1900
Genus *Candona* Baird, 1845
Candona neglecta Sars, 1887
(Fig. 4)

1887 *Candona neglecta* Sars: 279, pl. 15, figs. 5-7; pl. 19.
1900 *Candona neglecta* Sars: Müller: 17.
1957 *Candona neglecta* Sars: Wagner: 21, pl. 3, figs. 1-5.
1998 *Candona (Candona) neglecta* Sars: Gliozzi & Mazzini: 78, pl. 1, fig. E.
2000 *Candona neglecta* Sars: Meisch: 77, fig. 26.
2003 *Candona neglecta* Sars: Meisch & Wouters: 15, fig. 2.
2008 *Candona neglecta* Sars: Beker et al.: 13, pl. 2, fig. 1.

GEOGRAPHIC DISTRIBUTION: *C. neglecta* is distributed throughout the Holarctic region (Meisch, 2000; Meisch and Wouters, 2003) but it has not been found in Sicily until now. Nevertheless, Pieri et al. (2006) recorded in this region living specimens of *Candona lindneri* Petkovski, 1969, a species which has been sometimes distinguished from *C. neglecta*, owing to the presence of tu-

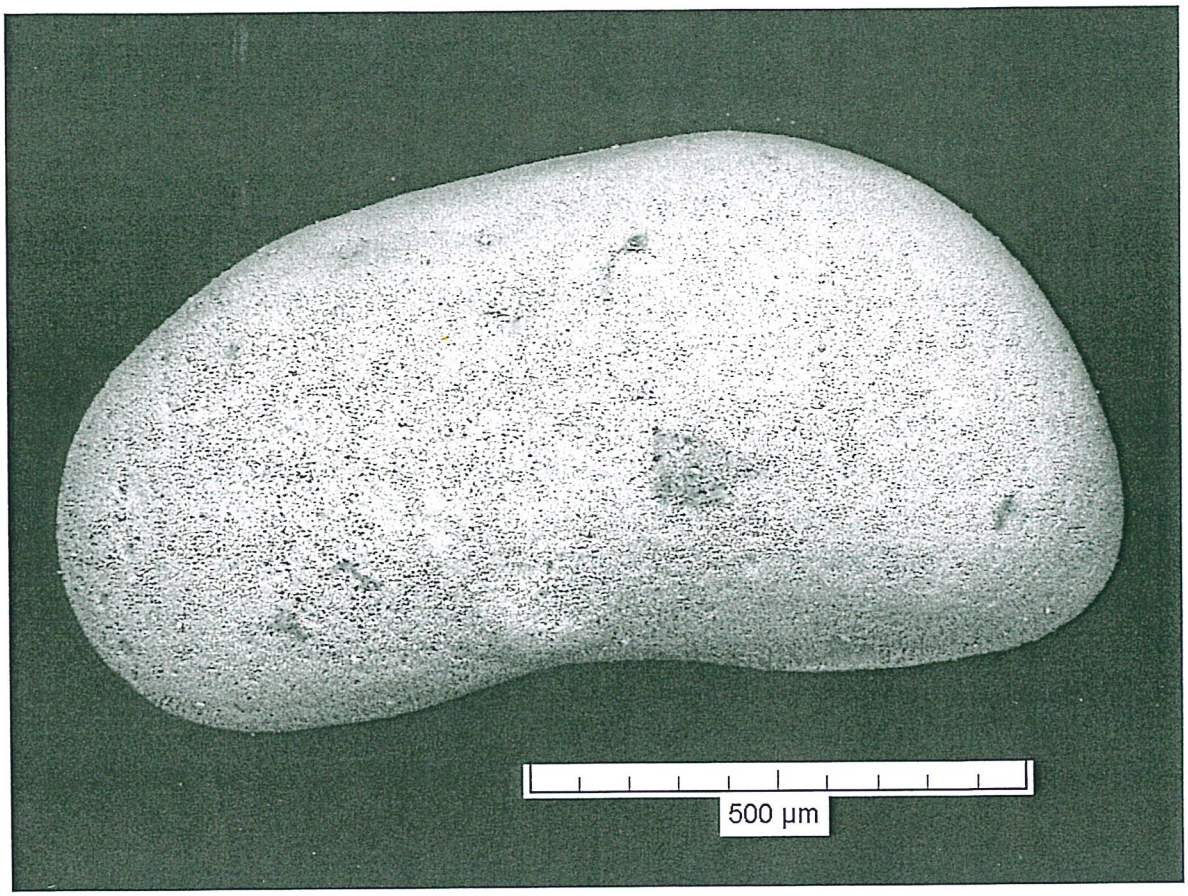

Fig. 4 - *Candona neglecta* Sars, 1887: left valve, external view.

bercles and spines. The validity and distinction of this species has been, nevertheless, questioned by Meisch and Wouters (2003).

STRATIGRAPHIC DISTRIBUTION: *C. neglecta* has a long and nearly continuous stratigraphic distribution from the Late Miocene to the Recent in the Holarctic biogeographical region. The earliest occurrence of the *C. neglecta* group is from the Late Cretaceus of Mongolia (Meisch and Wouters 2003).

ECOLOGY: *C. neglecta* is widespread in all permanent or temporary freshwater habitats, such as lakes, rivers, deltaic settings, springs and streams but it is rare in brackish waters. It prefers cool water and tolerates low oxygen content.

Family ILYOCYPRIDIDAE Kaufmann, 1900

Subfamily ILYOCYPRIDINAE Kaufmann, 1900

Genus *Ilyocypris* Brady & Norman, 1889

Ilyocypris gibba (Ramdohr, 1808)

(Fig. 5)

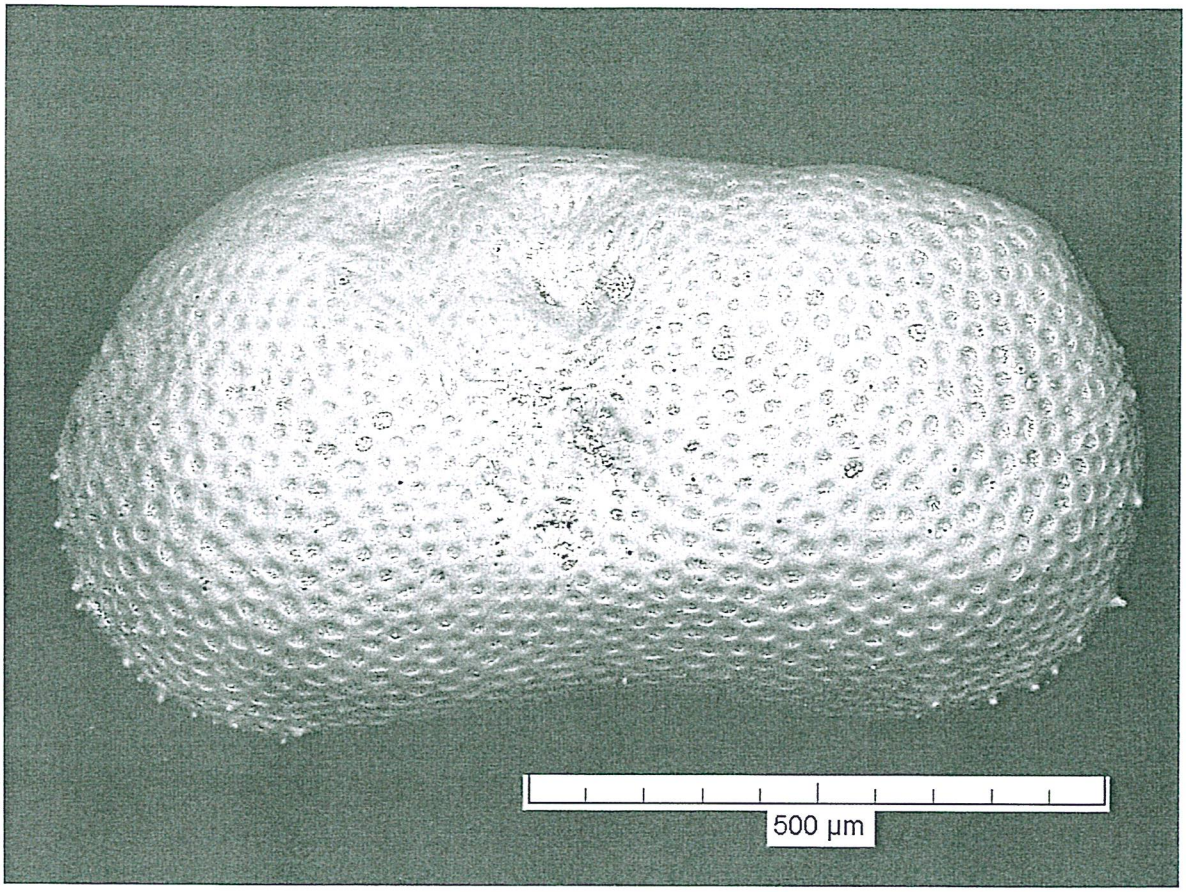

Fig. 5 - *Ilyocypris gibba* (Ramdohr, 1808): left valve, external view.

1808 *Cypris gibba* Ramdohr: 91, pl. 3, figs. 13-14, 17.
1979 *Ilyocypris gibba* (Ramdohr): Carbonnel & Peypouquet: 195, pl. 1, fig. 2.
1998 *Ilyocypris gibba* (Ramdohr): Gliozzi & Mazzini: 80, pl. 2, fig. A.
1999 *Ilyocypris gibba* (Ramdohr): Mazzini et al.: 297, pl. 2, fig. 5.
2000 *Ilyocypris gibba* (Ramdohr): Meisch: 245, fig. 104.
2005 *Ilyocypris gibba* (Ramdohr): Rodriguez-Làzaro and Martin-Rubio: 40, pl. 1, figs. 1-3, 7.
2006 *Ilyocypris gibba* (Ramdohr): Rossetti et al.: 124, fig. 2 (I-K).
2008 *Ilyocypris gibba* (Ramdohr): Akdemir: 109, fig. 2.
2008 *Ilyocypris gibba* (Ramdohr): Beker et al.: 12, pl. 1, figs. 10-11.

GEOGRAPHIC DISTRIBUTION: *I. gibba* is a Holarctic species, known from a very wide area in Europe and Asia, but also from East Africa and North America (Henderson, 1990). In Sicily it has been recently recorded by Pieri et al. (2006).

STRATIGRAPHIC DISTRIBUTION: the stratigraphical distribution of *I. gibba* is wide, ranging from the Tortonian to the Recent (Beker et al., 2008).

ECOLOGY: *I. gibba* is widespread in all freshwater environments, in a wide temperature range.

DISCUSSION AND CONCLUSIONS

The ecological distribution of marine ostracods is regulated by biotic factors, climatic and physical and chemical parameters, such as water salinity, temperature, dissolved O_2, type of substratum, food availability, turbidity and environmental energy (e.g. Carbonel, 1987; Montenegro et al., 1998; Correge, 1993; Hoibian et al., 2000). Marine ostracods are usually stenoecious. Consequently, different marine environments exhibit ostracod associations characterised by distinct taxa. Furthermore, the present-day and past geographical distribution of marine ostracods, is usually more or less restricted, mostly affected by general oceanic and local water-masses circulation, the presence of physical and ecological barriers, and their complex interactions.

In contrast, the geographical distribution of most non marine ostracods is wide, as the result of: 1) species behaviour and life histories, including resistance of eggs to dry conditions, different and, sometimes, alternating reproduction strategies, among which parthenogenesis, brooding capabilities; 2) tolerance to wide ranges of environmental conditions and to long and even short term environmental changes; and 3) passive transport by physical (winds) and biotic agents (e.g. birds and humans) which are thought to facilitate long distance dispersal (Martens et al., 2008). As a result, most continental ostracod species show wide distributions, sometimes tracing the main intercontinental bird migration routes, paralleling other fresh water taxa such as phylactolaematous bryozoans (Wood, 2001).

On the contrary, the restricted distributions known for some species are probably strongly affected by research efforts. Comparatively little information is presently available about the diffusion of non-marine species in the Austral hemisphere.

Further difficulties arise in the investigation and recognition of the palaeogeographical distributions of the treated species. Fresh water settings are usually small sized and ephemeral from a geological point of view, their potential preservation is low in a prevailingly erosional context. Finally, the reliable dating of continental sediments is difficult.

In this context, the record of *Candona neglecta* and *Ilyocypris gibba* from the Early Pleistocene of Sicily, contribute a small piece in the highly incomplete mosaic of the palaeogeographical distribution of these fresh water ostracod species.

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