| Bollettino della Società Paleontologica Italiana | 23 (1) | 1984 | 131-136 | 2 pls. | Modena, Aprile 1985 |
|---|---|---|---|---|---|

# The appearance of *Cytheropteron testudo* Sars (Crustacea: Ostracoda) is a Pliocene event. Evidences from a sicilian sequence (Italy).

Gioacchino BONADUCE

Zoological Station
Naples

Rodolfo SPROVIERI

Geological Institute
University of Palermo

*KEY WORDS — Ostracoda, Foraminifera, Stratigraphy, Neogene-Quaternary boundary, Sicily (Italy).*

*SUMMARY — It has been demonstrated that* Cytheropteron testudo *first appeared in the Plio-Pleistocene section of Mount S. Nicola (Sicily) earlier before the N/Q boundary as based on the foraminiferal content. Therefore this ostracode species cannot be accepted as a marker for the N/Q boundary as previously stated.*

*RIASSUNTO* — [La comparsa di *Cytheropteron testudo* Sars (Crustacea: Ostracoda) è un evento pliocenico. Evidenza in una serie della Sicilia (Italia)] — *Si dimostra che la comparsa di* Cytheropteron testudo *è di età anteriore al limite Neogene-Quaternario nella serie plio-pleistocenica di Monte S. Nicola, controllata biostratigraficamente con i Foraminiferi. Questa specie di ostracode non può quindi essere accettata come marker del limite Neogene-Quaternario come precedentemente affermato.*

## INTRODUCTION

The presence of the ostracode species *Cytheropteron testudo* Sars (1869) in the Plio-Pleistocene section outcropping at le Castella (Southern Italy), lead Ruggieri (1971) to consider this species, which presently lives only north of the Biscay Bay (at temperatures between 2 and 10°C), as a « northern guest » of the Mediterranean. Consequently, this species was included in the large group of « northern guests » as the already known mollusks, foraminifers, and other ostracode species.

Since then many authors accepted *C. testudo* to represent the « cold » ecological indicator of the Mediterranean deep-waters as *Arctica islandica* is for shallow-water environment. Colalongo *et al.* (1980, fig. 1), even with some uncertainties, considered the first appearance of *C. testudo* in the Mediterranean to coincide with that of *A. islandica.* Consequently *C. testudo* was indentified as a marker of the N/Q boundary in the stratotype Vrica section (Pelosio *et al.*, 1980; Colalongo *et al.*, 1982). A detailed sampling (2 m interval) of a section outcropping along the southward slope of Mount S. Nicola (near Gela, Sicily) allowed us to demonstrate the presence of *C. testudo* in sediments older than the base of the Pleistocene. The present paper will deal only with the stratigraphical range of *C. testudo*, because of its implication for the Plio-Pleistocene boundary in the Mediterranean. All the other faunal and floral assemblages, including Foraminifers, Nannoplancton, Ostracodes, Mollusks, Otolites and Pollens, and already studied, will be described in a further paper.

## BIOSTRATIGRAPHY

The Mount S. Nicola section is continuous for a total thickness of about 170 m. Its lower part consists of 34 meters of « Trubi » Formation (white *Globigerina* marls). This lithotype is overlain by the blue-marls of the Mount Narbone formation. The transition between the two lithologies occurs over a thin interval in which the two lithotypes alternate several times. Most of the transitional layers up to the base of Mount Narbone formation for a thickness of 8 meters are rich in manganese concretions. These strata represent an excellent marker, which are easy to identify in the field because they give origin to a purple band laterally continuous that can be detected throughout the area.

Their lateral continuity demonstrates the absence of important tectonic phenomena affecting the studied sequence.

Towards the top of the section, the marls of Mount Narbone formation, often interbedded with thin diatomitic layers, become gradually more silty. The section ends with 2 sandy turbiditic graded layers, the lower of which is about 8 m thick.

The basal part of the section, from sample 1 to 3 (thickness 0-4 m), can be attributed to the foraminiferal biozone M PL 3 due to the co-occurrence of *Globorotalia margaritae* and *G. puncticulata*. It follows consequently that almost all of the Lower Pliocene (defined as the interval between the basis of the Pliocene and the *G. margaritae* LAD) is absent in our section. Between sample 3 and 17 (thickness 28 m) the biozone M PL 4 is recognizable, based on the occurrence of *Sphaerodinellopsis seminulina* in the uppermost sample 17. The M PL 5 zone was recognized between sample 17 and 50 (thickness 66 m). Finally the M PL 6 zone has been found between samples 50 and 70 (thickness 49 m). In sample 70, the first occurrence of *Globigerina cariacoensis* associated with the first frequent occurrence of *Globigerina pachyderma* « left coiled » and *Uvigerina costata-caudata* was detected. Consequently the base of the Selinuntian stage (Lower Pleistocene), then the base of the Santernian substage, was plotted just below sample 70. The section ends 32 m above without reaching the first appearance of *H. baltica*, so that according to the foraminiferal and ostracode assemblages the Emilian substage is not represented in M. S. Nicola section. The entire section was deposited in a bathyal environment.

A more detailed discussion on the biostratigraphy and on the paleoenvironmental conclusions will be presented in a further paper.

## DISTRIBUTION OF *CYTHEROPTERON TESTUDO*

The first scattered appearance of *C. testudo* in the Mount S. Nicola section occurs in samples 35, 45 and 46, but *C. testudo* becomes regularly present only from samples 50 to 78. With reference to the Neogene-Quaternary boundary, as stratotypified in the Vrica section at the top of level « e », the N/Q boundary was placed just below our sample 70 (see below). Consequently, the first appearance of the ostracode *Cytheropteron testudo* pre-dates that from the Vrica section (Colalongo and Pasini, 1980) were its F.O. practically coincides with the N/Q boundary. At present we are not discussing in detail the ostracode fauna, that will be a part of a conclusive work, but we would like to point out that the Mediterranean F.O. of *C. testudo* cannot be used to mark the N/Q boundary.

The ostracode fauna shows that most of the sediments of Mount S. Nicola were deposited in deep-water environments with an estimated water-depth of about 1000 meters.

Only the topmost four samples yielded mixed ostracode assemblages: one assemblage consisting of near-shore species mainly belonging to the genera *Aurila, Callistocythere, Carinocythereis, Costa, Cytheretta, Eucytherura, Graptocythere, Hiltermannicythere, Leptocythere, Loxoconcha, Neocytherideis, Paradoxostoma, Paracytheridea, Pontocythere, Sagmatocythere, Semicytherura, Tenedocythere, Tetracytherura, Urocythereis* and *Xestoleberis*, and clearly transported. The second one consists mainly of species such as *Cytherella robusta, Cytheropteron alatum, Henryhowella asperrima, Krithe caudata, Parakrithe dactylomorpha* and *Bythoceratina scaberrima mediterranea*. They characterize still a deep environment with a water-depth not exceeding 400-500 m, that means an environment between the outer shelf and upper slope. Thus, a decrease in water-depth is proved to have occurred in the Early Pleistocene at M. S. Nicola location.

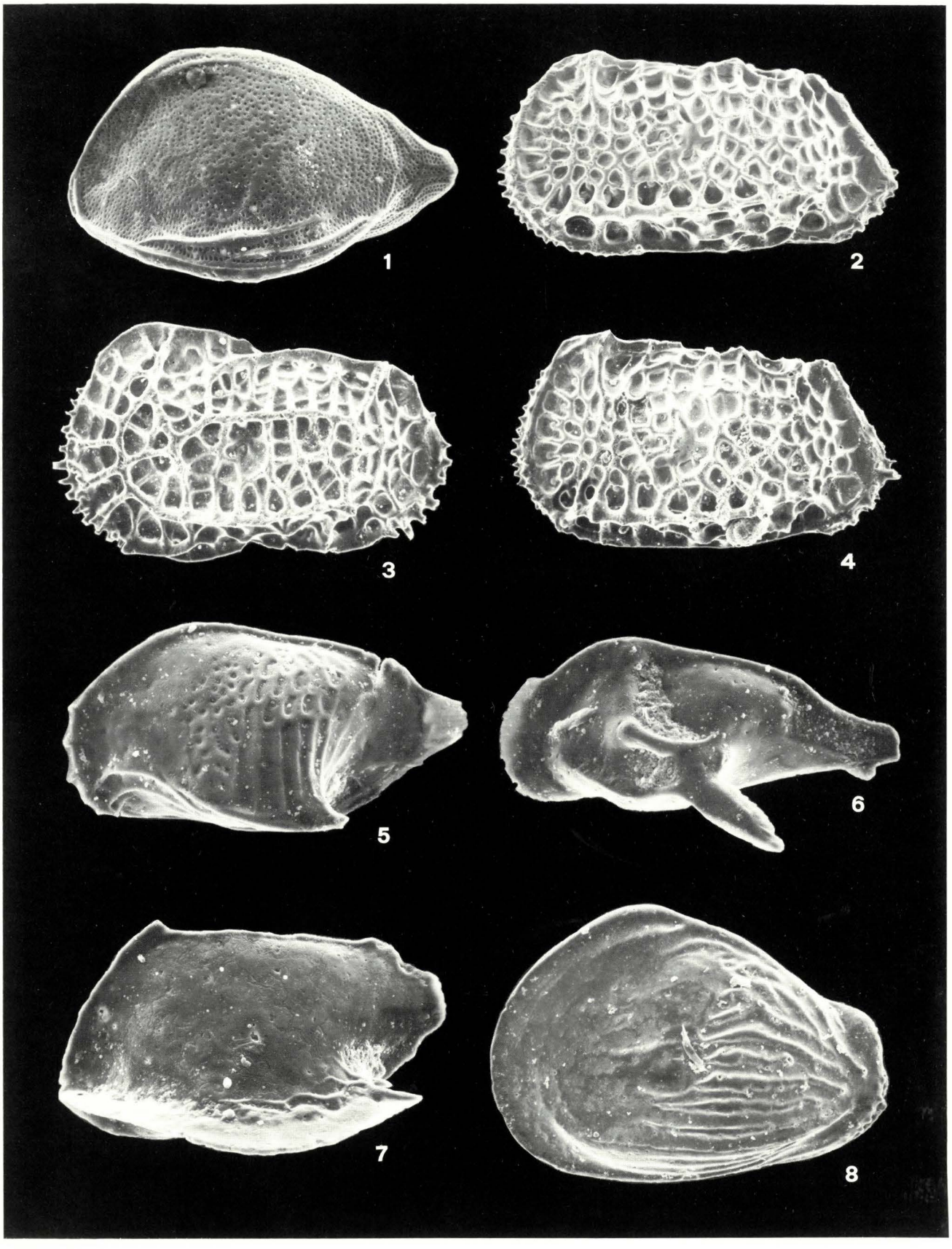
The appearance of *Cytheropteron testudo* in the Mediterranean basin is coeval with another remarkable event affecting the ostracode assemblage.

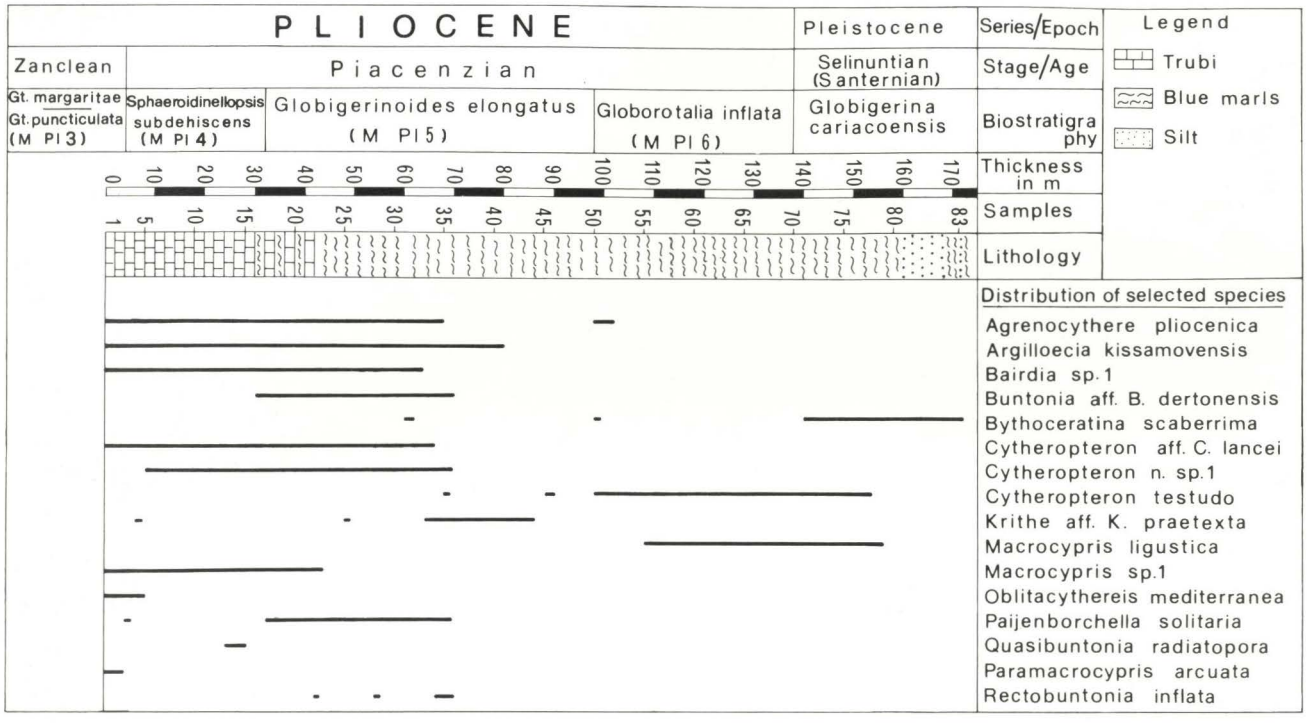
As reported in text-fig. 1, in the interval between samples 32-42, some species, recorded from the base of the section, definitively disappear; some other species disappear only temporary for reappearing later

---

## EXPLANATION OF PLATE 1

Fig. 1 - *Cytheropteron testudo*. LV - Sample 51 (x 127).
Fig. 2 - *Agrenocythere pliocenica* ♂ - LV - Sample 3 (x 56).
Fig. 3 - *Oblitacythereis mediterranea*. LV - Sample 4 (x 82).
Fig. 4 - *Agrenocythere pliocenica* ♀ - LV - Sample 3 (x 58).
Fig. 5 - *Cytheropteron* n. sp. 1. - LV - Sample 30 (x 196).
Fig. 6 - *Paijenborchella solitaria*. LV - Sample 21 (x 151).
Fig. 7 - *Cytheropteron* aff. *C. lancei*. LV - Sample 26 (x 196).
Fig. 8 - *Quasibuntonia radiatopora*. LV - Sample 14 (x 56).


1
2
3
4
5
6
7
8




Text-fig. 1 - Biostratigraphy of the Mount S. Nicola section, and distribution of selected species of Ostracoda.

after some but short interval of eclipse. This is contained within a thin sediment sequence and occurs according to the biochronological data based on calcareous plankton over a very short time-span from 2.4 to 2.3 MY (Rio *et al.* in progress.) Such event is slightly younger than the well known onset of the Pliocene glaciation in the Northern Hemisphere dated at about 2.5-2.4 MY (Shackleton and Opdike, 1977; Thunnel and Williams, 1983).

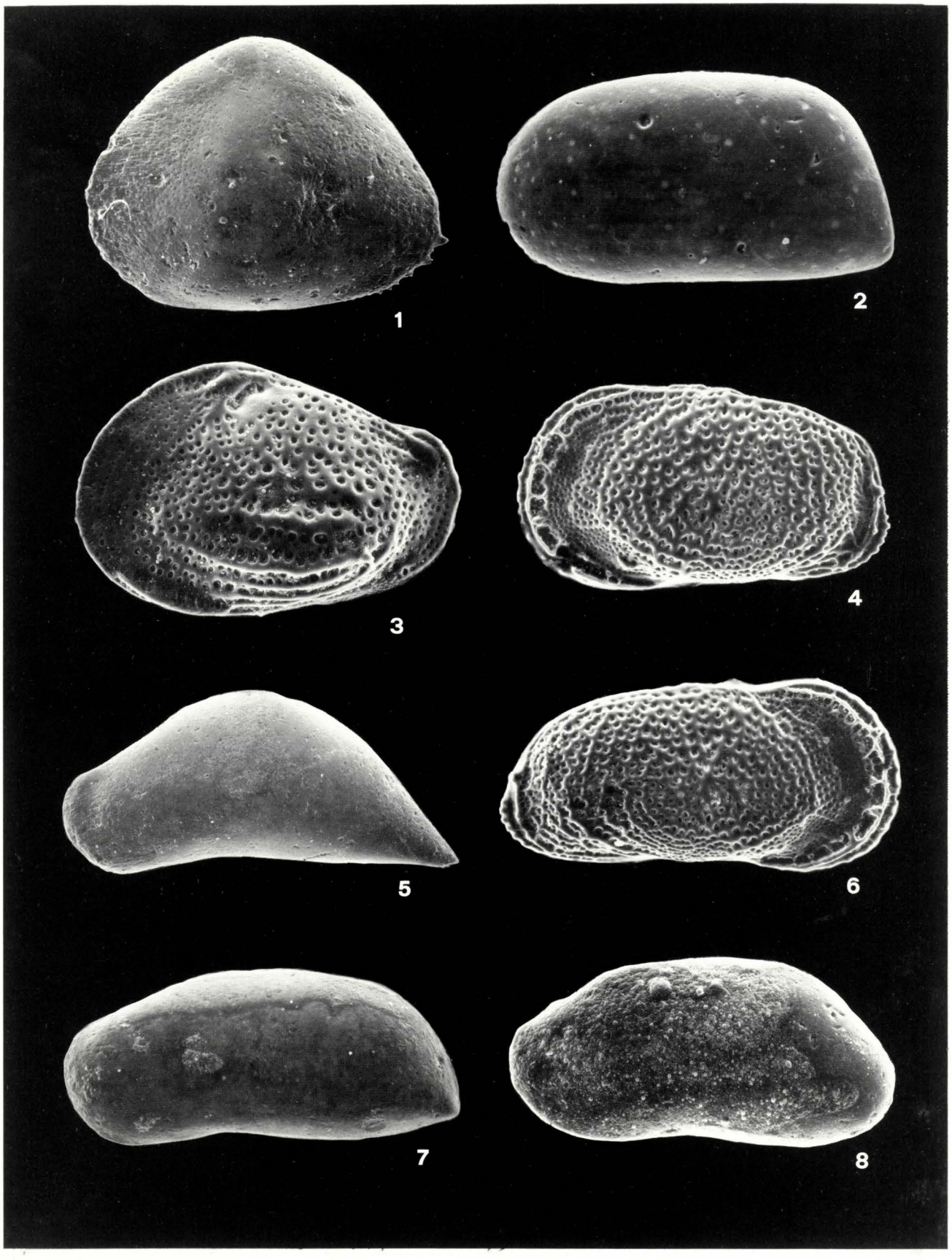
In a paper in press Sprovieri (1984), demonstrated that a major extinction 2.5 to 2.4 MY event involving at least 22 species of benthic foraminifers, also occurred. Such event was second to an even more massive species extinction which occurred at 3.1 to 3.0 MY; this older event is considered the first Pliocene severe climatic deterioration as demonstrated by oxygen isotope values (Thunnel, 1979; Keigwin and Thunnel, 1979; Thunnel and Williams, 1984, *inter alios*).

Climatic changes and striking modification of ocean currents are expected to take place at the time of the onset of the Pliocene glaciation in the Northern Hemisphere (Berggren, 1972; Berggren and Hollister, 1974). Deep-water changes affected the ostracode faunas which became less diversified. Since about 2.2 MY, however, a progressive and slow increase in species diversity can be detected among the ostracode fauna resulting in the appearance or immigration of new species.

Most of the ostracod species reported in text-fig. 1 are figured in Plates 1 and 2.

## EXPLANATION OF PLATE 2

Fig. 1 - *Bairdia* sp. 1 LV - Sample 10 (x 60).
Fig. 2 - *Krithe* aff. *K. praetexta.* LV - Sample 40 (x 122).
Fig. 3 - *Buntonia* aff. *B. dertonensis.* LV - Sample 36 (x 111).
Fig. 4 - *Rectobuntonia inflata* ♀. LV - Sample 35 (x 139).
Fig. 5 - *Macrocypris* sp. 1. LV ♀ - Sample 3 (x 34.5).
Fig. 6 - *Rectobuntonia inflata* ♂. RV - Sample 35 (x 127).
Fig. 7 - *Macrocypris ligustica.* LV - Sample 77 (x 63).
Fig. 8 - *Argilloecia kissamovensis.* LV - Sample 18 (x 151).


1
2
3
4
5
6
7
8

## CONCLUSIONS

Recently the Vrica section (Crotone, Southern Italy) has been proposed as the N/Q boundary stratotype (Colalongo *et al.*, 1982). Biochronologic (Rio and Raffi, *in* Pasini and Colalongo, 1982), paleomagnetic (Tauxe *et al.*, 1983), and radiometric (Obradovich *et al.*, 1982) data suggest that the possible age of the N/Q boundary is of about 1.65 MYBP.

In the Mount S. Nicola section, the N/Q boundary was placed just below sample 70 through biostratigraphic correlation with the Vrica section. Here *C. testudo,* recorded from sample 35, occurs about 70 meters below the base of the Pleistocene and about 30 meters below the appearance level of *Globorotalia inflata* (and *Globorotalia truncatulinoides*). The *Globorotalia inflata* appearance in the Mediterranean was recently dated at about 2.05 MYBP (Rio *et al.*, in press; Rio *et al.*, in preparation). The curve for sediment accumulation rates of the Mount S. Nicola section (Rio *et al.*, in preparation) allowed us to estimate an age of about 2.35 MYBP for the appearance level of *C. testudo.* Therefore it becomes evident that the appearance of *C. testudo* in the Mediterranean basin cannot be equated to the N/Q boundary; it is, instead, possibly a consequence of the sharp cooling at about 2.5 MYBP (see Thunnel and Williams, 1983). According to many Authors, such a cooling should be interpreted as the response of the Mediterranean to the beginning of the Pliocene glaciation in the Northern Hemisphere (Blanc *et al.*, 1982). By about the same time, a faunistic change was observed even among the benthic foraminifers (Sprovieri, in press) as evidenced by a decrease in diversity (at least 22 species disappear). Such an event was followed, from about 2.3 MYBP upwards, by a slow, gradual appearance of a few new species. The ostracodes seem to have been affected by the same evolutionary phenomenon.

## REFERENCES


Berggren, W.A., 1972, Late Pliocene-Pleistocene glaciation. *In* Langhton A.S. *et al.*, Initial Report of the DSDP v. 12, pp. 953-963.

—, and Hollister, C.D., 1974, Plate tectonics and paleocirculation. Commotion in the Ocean: Tectonophysics, v. 38, pp. 11-48.

Colalongo, M.L. and Pasini, G., 1980, La Ostracofauna pliopleistocenica della Sezione Vrica in Calabria (con considerazioni sul limite Neogene/Quaternario): Boll. Soc. Paleont. Ital., v. 19 (1), pp. 44-126.

—, —, Pelosio, G., Raffi, S., Rio, D., Ruggieri, G., Sartoni, S., Selli, R. and Sprovieri, R., 1982, The Neogene/Quaternary boundary definition: a review and proposal: Geogr. Fis. Dinam. Quat., v. 5, pp. 59-68, 3 figg.

Keigwin, L.D. and Thunnel, R.C., 1979, Middle Pliocene climatic change in the Western Mediterranean from faunal and oxygen isotopic trends: Nature, v. 282, pp. 292-296.

Obradovich, J.D., Naeser, C.A., Izett, G.A., Pasini, G., Bigazzi, G., 1982, Age constraints on the proposed Plio-Pleistocene Boundary Stratotype at Vrica, Italy: Nature, v. 298, pp. 55-59.

Pasini, G. and Colalongo, M.L., 1982, Status of research on Vrica Section (Calabria, Italy), the proposed Neogene/Quaternary Boundary stratotype section in 1982. RPT Report at the XI INQUA Congress Mosca.

Pelosio, G., Raffi, S. and Rio, D., 1980, The Plio-Pleistocene Boundary Controversy. Status in 1979 at the light of International Stratigraphic Guide. Vol. speciale in memoria di S. Venzo, pp. 131-140.

Rio, D., Sprovieri, R., Di Stefano, E. and Raffi, I., 1984, *Globorotalia truncatulinoides* (d'Orbigny) in the Mediterranean Upper Pliocene geologic Record: Micropaleontology, v. 30 (2), pp. 121-137.

Ruggieri, G., 1971, Ostracoda as cold climate indicators in the Italian Quaternary. *In* Oertly H.J. (Editor). Paléoécologie des Ostracodes, pp. 285-293.

—, and Sprovieri, R., 1977, Revision of the Italian Pleistocene Stratigraphy: Geologica Romana, v. 16, pp. 131-139.

Sars, G.O., 1869, Nye dybvands crustacéer fra Lofoten: Förhandl. Vidensk, Selkskab Christiania, v. 7, pp. 170-174.

Shackleton, N.J. and Opdyke, N.D., 1977, Oxygen isotope and paleomagnetic evidence for early northern hemisphere glaciation: Nature, v. 270, pp. 216-219.

Sprovieri, R., 1978, I Foraminiferi bentonici della Sezione plio-pleistocenica di Capo Rossello (Agrigento, Sicilia): Boll. Soc. Paleont. Ital., v. 17, pp. 68-97.

—, 1984, Paleotemperature changes and speciation among benthic Foraminifera in the Mediterranean Pliocene: Boll. Soc. Paleont. Ital., v. 23 (2) (in press).

Tauxe, L., Opdyke, N.D., Pasini, G. and Elmi, C., 1983, Age of the Plio-Pleistocene boundary in the Vrica Section, Southern Italy: Nature, v. 304, pp. 125-129.

Thunnel, R.C., 1979, Pliocene-Pleistocene paleotemperature and paleosalinity history of the Mediterranean Sea: results from DSDP Sites 125 and 132: Marine Micropaleontology, v. 4, pp. 173-187.

—, and Williams, D.F., 1984, The stepwise development of Pliocene-Pleistocene paleoclimatic and paleoceanographic conditions in the Mediterranean: oxygen isotopic studies of the DSDP Sites 125 and 132: Utrecht Micropal. Bull. (in press.).


*(manuscript received April 2, 1984*
*accepted June 20, 1984)*

Gioacchino Bonaduce
Stazione Zoologica
Villa Comunale - 80121 Napoli - Italia

Rodolfo Sprovieri
Istituto di Geologia
Corso Tuköry, 131 - 90134 Palermo - Italia