



Fig. 10 - Both complete and disarticulated decapod crustaceans on the surface of the laminae of Vesole Mount Plattenkalk. A wide part of the specimens is constituted by exuviae, but some laminae seems to represent real mass-mortality events, because a wide part of the specimens shows a darker colour than that of the exuviae, due to the soft-tissues that were still preserved. Magnification: about 1.5x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5).

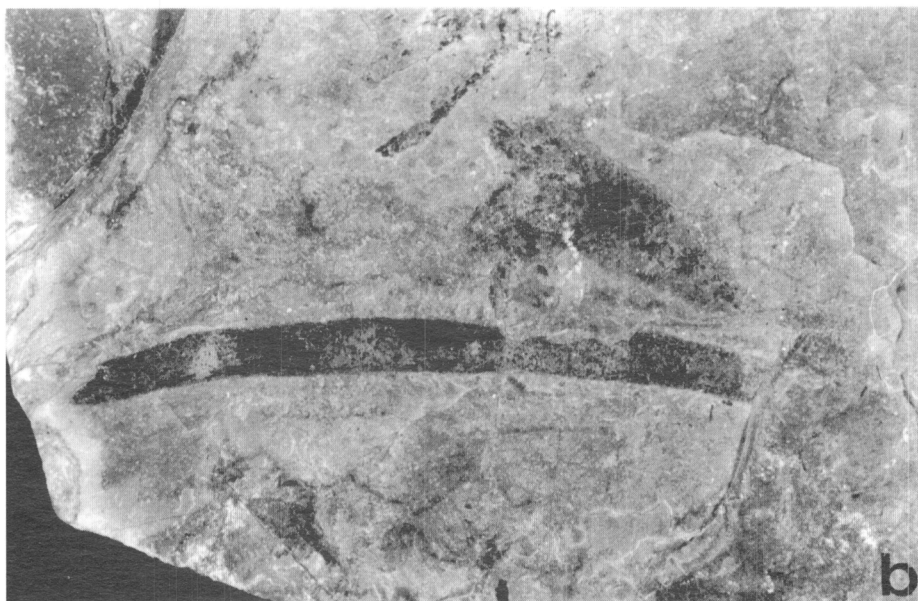


Fig. 11 - a) The typical fossil association of Vesole Mount Plattenkalk. It is constituted by decapod crustaceans and turruculated gastropods. The high number of monospecific specimens belonging to the two taxa is characteristic of high ecological stress environment, populated by oligotypic faunae.

b) Some layers of the Plattenkalk contain plant remains, at least in part belonging to land plants.

Magnification: 1.5x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5).

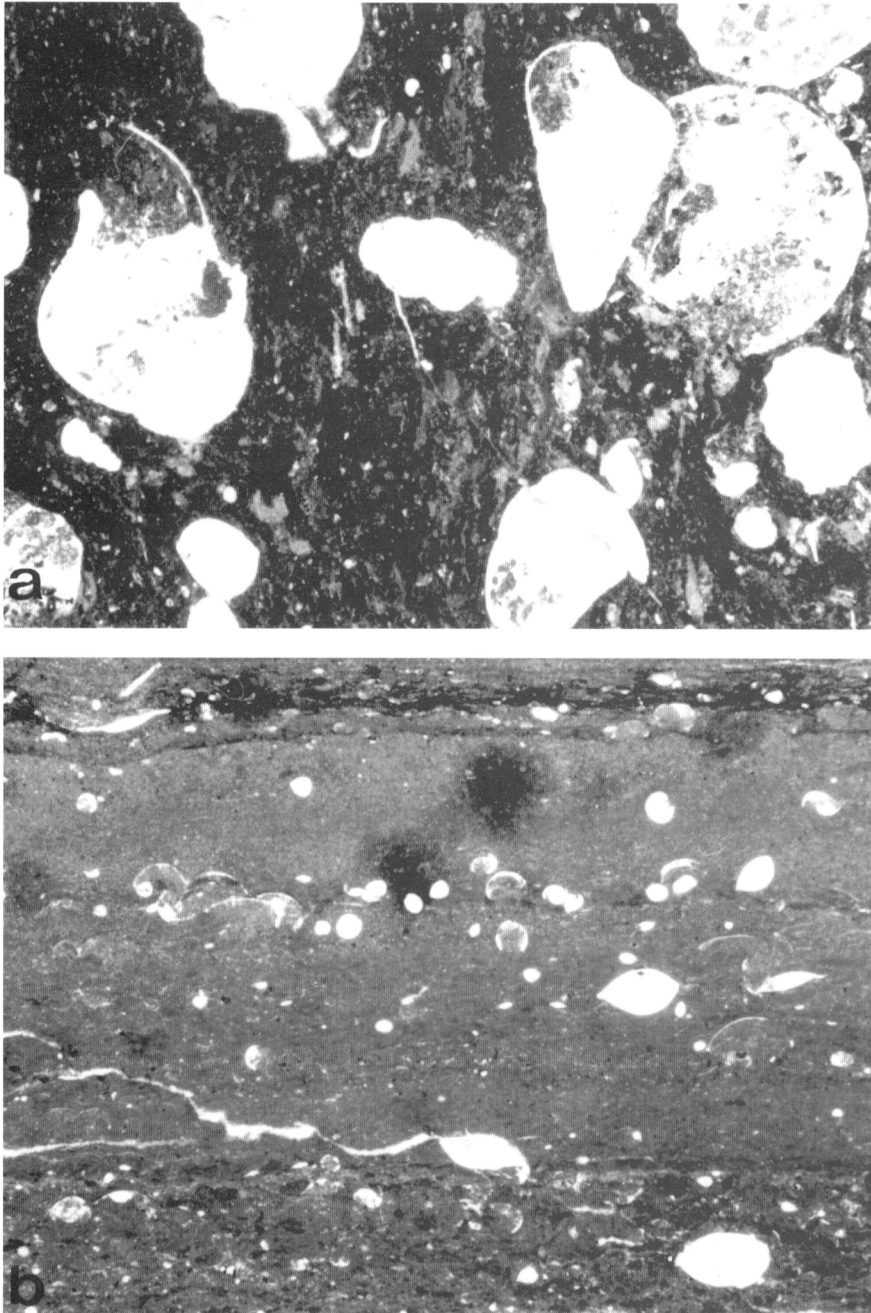


Fig. 12 - a) Thin section from a stratum with turruculated gastropods from Vesole Mount Plattenkalk. The gastropods are completely recrystallized and often filled by sparry calcite. Thin section: VES.g about 12x. b) A detail of the thin-laminated strata of Vesole Mount Plattenkalk. The laminae often contain abundant oysters with thin valves. A number of oysters in the photo show still articulated valves, filled by sparry calcite. Thin section: VES 5P about 10x. For both the figures - Age: Upper Cretaceous (Campanian- Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5).

In conclusion, the sedimentation environment of Vesole Mount Plattenkalk seems to represent a coastal lagoonal biotope with a scarce water-circulation and low oxygenation, rhythmic sedimentation mostly linked to tides, subject to storms, with a high ecological stress and populated by oligotypic faunae (we must point out the total absence of organisms such as fishes and echinoderms). Moreover, the presence of charophyta gyrogonites and carbonious plant remains should prove the presence of freshwater environments and lands nearby the lagoon.

### **Modes of preservation and materials**

The macruran decapod crustaceans of Vesole Mount are preserved in light-brown thin layers of marly lithographic limestone, flattened on the layer surface. The soft consistency of the surrounding rock makes their preparation easy.

The examined sample consists of 93 specimens so divided: 27 belong to De Castro's collection and 66 to the palaeontological collection of the Museo di Storia Naturale di Milano.

All the specimens have been ascribed to *Palaemon vesolensis* n. sp. (infraorder Caridea Dana, 1852, family Palaemonidae Rafinesque, 1815). A so abundant sample induced us, in a first time, to divide the specimens in different dimensional classes, but after a deeper analysis we have considered it as different ontogenetic stages of the same species.

The study of decapod crustaceans of the Upper Cretaceous of Vesole Mount (Salerno, S Italy) is part of a research programme on lithographic limestones of Campania that the Palaeontology Department of the Università di Napoli has been carrying out for many years; moreover, this study is part of a research programme on Mesozoic macruran decapod crustaceans that the Invertebrate Palaeontology Department of the Museo di Storia Naturale di Milano has been carrying out for many years on materials from its own and other Museums' collections. Up to now this programme brought to the description of important Italian and foreign Mesozoic faunistic assemblages, such as the Triassic association of the Ambilobè region (NW Madagascar) (Garassino & Teruzzi, 1995a), of Cene (Seriana Valley, Bergamo – N Italy) (Pinna, 1974), of Prati di Rest (Valvestino, Brescia – N Italy) (Pinna, 1976), of Ponte Giurino (Imagna Valley, Bergamo – N Italy) (Garassino & Teruzzi, 1993), of Carnia (Udine, NE Italy) (Garassino *et al.*, 1996b, Garassino, in press) and of the Muschelkalk (Anisian-Ladinian) of Germany (Garassino *et al.*, work in progress); the Lower Jurassic fauna of Osteno (Lugano Lake, Como – N Italy) (Pinna, 1968, 1969; Garassino & Teruzzi, 1990; Teruzzi, 1990; Garassino, 1996) and the Cretaceous assemblages of Trebiciano (Trieste, NE Italy) (Garassino & Ferrari, 1992), of Lebanese outcrops (Garassino, 1994), of Vernasso (Udine, NE Italy) (Garassino & Teruzzi, 1995b, Garassino, in press), of Las Hoyas (Cuenca, Spain) (Garassino, 1997a), of Pietrarroia (Benevento, S Italy) and Petina (Salerno, S Italy) (Bravi & Garassino, 1998 a,b) and of Torrente Cornappo Valley (Udine, NE Italy) (Garassino, 1997b, 1998).

Acronyms: A: Collezione Prof. P. De Castro; MSNM: Museo di Storia Naturale di Milano.

## Abbreviations

pt - protopodite      en - endopodite      ex - exopodite      t - telson  
 di - diaeresis      c - carina      s - spine

**Systematic Palaeontology**

Infraorder Caridea Dana, 1852  
 Family Palaemonidae, Rafinesque, 1815  
 Genus *Palaemon* Weber, 1795

*Palaemon vesolensis* n. sp.  
 Figs. 13, 14, 15, 16, 17

Diagnosis: subrectangular carapace; long rostrum with 7 suprarostal teeth forwards protuded and 3 subrostral teeth; somite II with subround pleura partly overlapping that of somite I and III; three-flagellate antennulae; pereopods I-II chelate with elongate merus and carpus; telson with two pairs of spines on dorsal surface and one pair of spine to the distal extremity; exopodite with diaeresis.

Derivatio nominis: referring to Vesole Mount where the specimens were discovered.

Holotype: A4491/8.

Paratypes: A4491/1; A4491/19; MSNM i24780, i24785.

Type locality: Vesole Mount (Salerno, S Italy).

Geological age: Upper Cretaceous.

Materials. 93 complete and fragmentary specimens, in lateral and dorsal view and in good state of preservation.

A4491/1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 34, 41.

MSNM: from i24731 to i24796.

Description. It is a medium-sized caridean with thin and smooth exoskeleton, 1 to 5 cm in length.

Carapace. In lateral view in nearly all specimens, the carapace has a subrectangular shape and gets slightly narrow the anterior margin for the slight curvature of the ventral margin. The dorsal margin is straight, while the posterior margin, strengthened by a thin marginal carina, is slightly sinuous, with a slight concavity in the lower third, partially covering somite I. The ventral margin has a curvilinear trend. The dorsal margin extends into an extremely long rostrum, with pointed distal extremity and strengthened by a thin longitudinal median carina that extends for its whole length. The rostrum bears 7 identical and forwards protruded suprarostal teeth and 3 subrostral teeth. The ocular incision is narrow and shallow and the antennal and pterygostomial angles are not very marked. No traces of grooves, carinae and spines can be observed on the surface of the carapace.

Abdomen. The abdomen shows the typical, almost right-angle curvature of carideans between somites III-IV. Somites I, III and IV have a subrectangular shape and uniform length. Somite II has a subround pleura partly overlapping that of somites I and III. Somite VI has a subrectangular

shape and it is slightly longer than the others. The posterior margin of somites III is slightly sinuous, while that of somites IV-V is posteriorly projecting. The telson has a triangular shape (Fig. 13), pointed distal extremity and bears one pair of long and thin spines at the distal extremity. One pair of thin and longitudinal carinae in the upper part and two pairs of small-sized and equidistant spines in the median and the lower part are present on the dorsal surface of the telson. The uropods are about 1/3 longer than the telson (Fig. 13). The protopodite, subrectangular in outline, supports the exopodite. The exopodite, with rounded diaeresis, has crossed by a thin longitudinal carina running parallel to the outside lateral margin and ending with a small spine. The endopodite lacks any ornamentation.

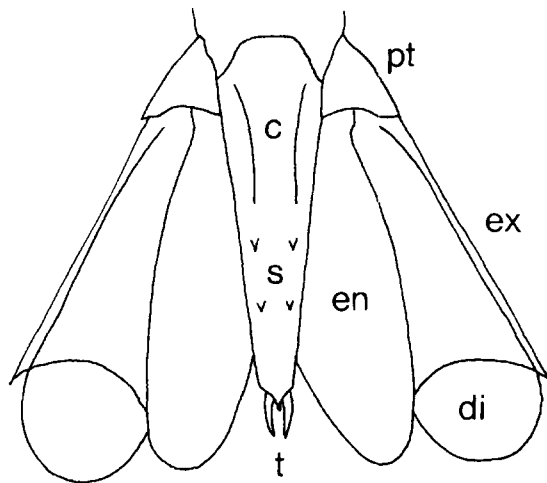


Fig. 13 - *Palaemon vesolensis* n. sp., tail fan, line drawing.

**Cephalic appendages.** They are well preserved not only in all complete specimens, but also in the incomplete specimens. The eye is supported by a short eye-stalk. The antennulae consist of three articula: the 1<sup>st</sup> thin and elongate, the 2<sup>nd</sup> not much elongate and the 3<sup>rd</sup> short and stocky to which three flagella are articulated (one short and two of the same length, about 1/3 the body length). The scaphocerite has a laminar shape and pointed distal extremity. A flagellum, twice the body length, is articulated to the sub-rectangular carpopercite of the antennae.

**Thoracic appendages.** Well preserved in almost all specimens. Thin, elongate and spineless articles form the 3<sup>rd</sup> maxilliped. The merus and carpus of the chelate pereopods I-II are thin and elongate. The propodus and index of the chelae have the distal extremity slightly curved. Pereiopods III-V have a terminal dactylus and their articles are thin and strongly elongate.

**Abdominal appendages.** The pleopods consist of a subrectangular sympodite to which two elongate multiarticulate flagella are articulated.

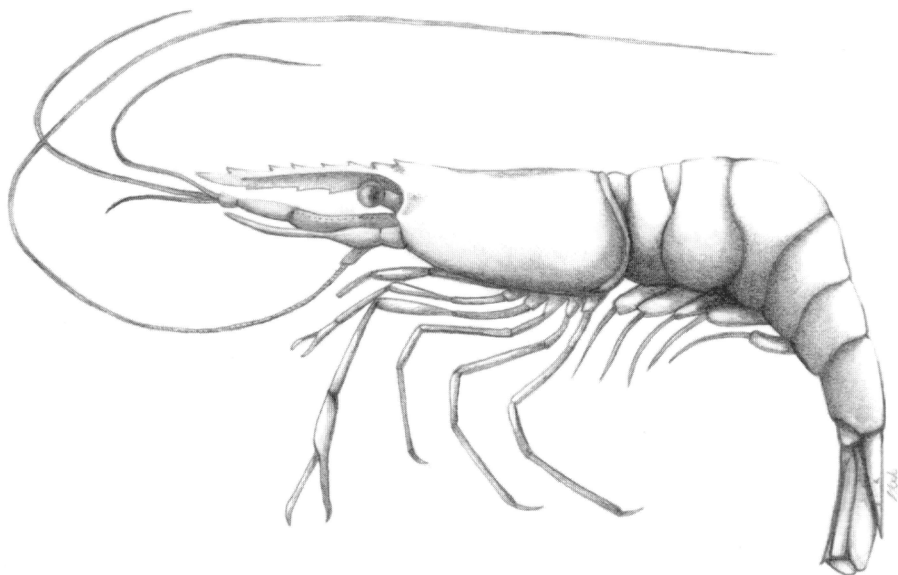


Fig. 14 - *Palaemon vesolensis* n. sp., reconstruction.

### Observations

Carideans are very rare in the fossil record and their morphological features are not well known because of their poor state of preservation.

The most ancient genera known to date, *Acanthinopus* Pinna, 1974 and *Leiothorax* Pinna, 1974, were discovered in the Calcare di Zorzino (Norian, Upper Triassic) of Bergamo Prealps (Cene, Seriana Valley - Bergamo, N Italy) (Pinna, 1974). Another form, *Pinnacaris* Garassino & Teruzzi, 1993, was described in the Argilliti di Riva di Solto (Sevatian, Upper Norian-Lower Rhaetian, Upper Triassic - depending on the authors) of Ponte Giurino (Imagna Valley - Bergamo, N Italy) (Garassino & Teruzzi, 1993).

Glaessner (1969) ascribed to Jurassic only *Udorella* Oppel, 1862 (family Udorellidae Van Straelen, 1924). The same author ascribed also three *incertae sedis* Jurassic genera to carideans: *Blaculla* Münster, 1839, *Hefriga* Münster, 1839 and *Udora* Münster, 1839.

We presently know six genera of Cretaceous carideans.

Martins-Neto & Mezzalana (1991a) found a few specimens of carideans in the Crato Member of Santana Formation (Lower Cretaceous) of Brazil. The perfect state of preservation of these specimens allowed the authors to describe *Beurlenia* (Family Palaemonidae Rafinesque, 1815) with *B. araripensis*.

Roger (1946) described *Notostomus cretaceus* n. sp. on a sample of five specimens found in the Santonian (Upper Cretaceous) of Sahel Alma (Lebanon). This species was the subject of a recent review by Garassino (1994), who ascribed the species by Roger to *Odontochelion* nov. (family Oplophoridae Dana, 1852).

Rabadà (1993) described *Delclosia* nov. with *D. martinelli* n. sp. on a sample of 60 specimens of the Lower Barremian (Lower Cretaceous) of

Las Hoyas (Cuenca, Spain). This genus was the subject of a recent review by Garassino (1997).

Bravi & Garassino (1998a, b) recently described *Parvocaris* nov. with *P. samnitica* n. sp. (indeterminate family) on a sample of 14 specimens of the Lower Albian (Lower Cretaceous) of Pietraroia (Benevento, S Italy) and *Alburnia* nov. with *A. petinensis* n. sp. (family Palaemonidae Rafinesque, 1815) on a sample of 3 specimens of the Middle Albian (Lower Cretaceous) of Petina (Salerno, S Italy).

Garassino (1998) have described on a sample of three specimens from the Lower Cretaceous of the Valley of Cornappo River (Udine, NE Italy), *Tonellocaris* nov. with *T. brevirostrata* n. sp. (family Ophlophoridae Dana, 1852).

Garassino & Ferrari (1992) reported the presence of only one specimen of caridean in the Senonian (Upper Cretaceous) of Trebiciano (Trieste, NE Italy) without ascribing it to a known family, genus and species. Garassino & Teruzzi (1995b) reported the probable presence of a new caridean form in the Upper Hauterivian-Lower Barremian (Lower Cretaceous) of Vernasso (Udine, NE Italy).

Only four genera of carideans are presently known in the Tertiary deposits.

Four species belong to *Bechleja* Hořsa, 1956, a typical form of freshwater deposits: *B. rostrata* Feldmann *et al.*, 1981 from the Eocene of the Green River Formation (Wyoming, USA); *B. inopinata* Hořsa, 1956 from the Oligocene of the Czechoslovakia; *B. bahiaensis* (Beurlen, 1950) and *B. robusta* Martins-Neto & Mezzalana, 1991 from the Oligocene of Brazil (Beurlen, 1950, Hořsa, 1956, Feldmann *et al.*, 1981, Martins-Neto & Mezzalana, 1991b).

In the Miocene deposits of N Caucasus (Russia) *Palaemon* Weber, 1795, *Pasiphaea* Savigny, 1816 and *Bannikovia* Garassino & Teruzzi, 1996 have been described with *P. mortuus* Smirnov, 1929, *P. mortua* Smirnov, 1929 and *B. maikopensis* Garassino & Teruzzi, 1996 respectively (Smirnov, 1929, Garassino & Teruzzi, 1996a).

On the grounds of what described, *Palaemon vesolensis* n. sp., *Alburnia petinensis* Bravi & Garassino, 1998, *Parvocaris samnitica* Bravi & Garassino, 1998 and *Tonellocaris brevirostrata* Garassino, 1998 represent the only four species of Italian Cretaceous carideans known to date of which *P. vesolensis* n. sp. and *A. petinensis* Bravi & Garassino, 1998 belonging to the same family Palaemonidae Rafinesque, 1815. Moreover, *P. vesolensis* n. sp. is one of the few fossil species of carideans known to date that can be ascribed with certainty to a known family by some definite characters. In fact the study of this species has pointed out some characters, such as the rostrum with many suprarostal teeth and some subrostral teeth, pereopods I-II with merus and carpus strongly elongate and pereopod II with a chela stronger and longer than that of pereopod I. These characters allow to ascribe *P. vesolensis* n. sp. to the family Palaemonidae Rafinesque, 1815. Moreover, the perfect state of preservation of the examined specimens have allowed surely to ascribe them to the genus *Palaemon* Weber, 1795 thanks to some typical characters of this genus pointed out by Zariquiey Alvarez (1968): rostrum with many suprarostal teeth and some subrostral teeth, telson with



one pair of long and thin spines at the distal extremity and two pairs of small-sized spines in the median and in the lower part on the dorsal surface and three-flagellate antennulae.

The ascription of the examined specimens to *Palaemon* Weber, 1795 pulls back the stratigraphical range of this genus known to date, even though in dubitative form, in the Oligocene of Europe.

### Conclusions

The geological and palaeontological observations carried out on the Plattenkalk with decapod crustaceans of Vesole Mount have allowed to point out:

1 - the Plattenkalk age is the Upper Cretaceous, probably Campanian-Maastrichtian;

2 - the Plattenkalk represents a coastal lagoonal biotope, with a scarce water-circulation and low oxygenation, high ecological stress, sedimentation mainly linked to tide contributions, subject to storms, populated by strongly oligotypic faunae and probably close to freshwater environments and land masses;

3 - decapod crustaceans are ascribed to *Palaemon* Weber, 1795 with *P. vesolensis* n. sp.. The presence of *Palaemon* Weber, 1795 in the Plattenkalk of Vesole Mount pulls back the stratigraphical range of this genus known to date, even though in dubitative form, in the Oligocene of Europe.

### Acknowledgements

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Iconographic material by Franco Nodo.

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