

THE DECAPOD CRUSTACEANS FROM THE UPPER EOCENE OF PARONA (VERONESE LESSINI - NE ITALY)

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ABSTRACT

Ten species of brachyuran decapod crustaceans are described from the upper Eocene levels of Parona (Verona - NE Italy). They are referred to *Kromtitis* Müller, 1984, *Noetlingia* Beurlen, 1928 (Dromiidae De Haan, 1833), *Lophoranina* Fabiani, 1910 (Raninidae De Haan, 1839), *Calappilia* A. Milne Edwards, 1873 (Calappidae De Haan, 1833), *Lobonotus* A. Milne Edwards, 1863 and *Paronacarcinus* gen. nov. (Tumidocarcinidae Schweitzer, 2005), *Mithracia* Bell, 1858 (Majidae Samouelle, 1819), *Phrynelambrus* Bittner, 1893 (Parthenopidae MacLeay, 1838), *Palaeograpsus* Bittner, 1875 (Panopeidae Ortmann, 1893), *Phlyctenodes* A. Milne Edwards, 1862 (Xanthidae MacLeay, 1838). Three new species have been recognized: *Kromtitis bicuspidatus* sp. nov. is a new representative of *Kromtitis*, a genus well known from the Eocene of Veneto; *Lobonotus sommarugai* sp. nov. confirms, together with *L. granosus* (Beschin, Busulini, De Angeli, Tessier, 2002) comb. nov., the presence of *Lobonotus* in Europe; *Paronacarcinus spinosus* sp. nov. is the sole species of a new genus of Tumidocarcinidae characterized by well defined regions bearing pointed tubercles. *Phrynelambrus corallinus* Bittner, 1893, for the first time discovered in Italy, proves to be a species spread in a wide portion of the Tethys basins. The unique propodus of the anomuran *Xylopagurus* sp. (Paguridae Latreille, 1802) here described represents probably the first report of the genus in the fossil record.

RIASSUNTO

I crostacei decapodi dell'Eocene superiore di Parona (Lessini veronesi - Italia nordorientale)

Viene analizzata e descritta una piccola fauna di decapodi fossili rinvenuta in livelli dell'Eocene superiore affioranti a Parona, località situata a Ovest di Verona, nell'ultima parte della valle di Negrar. I crostacei provengono da livelli marnosi grigio-verdastri o giallastri senza stratificazione evidente, ricchi anche di foraminiferi (abbondanti le discocicline), melobesie, molluschi (soprattutto ostreidi), briozoi, echinidi e frammenti di coralli; l'associazione fossile indica un ambiente neritico poco profondo. La conservazione dei resti in alcuni casi non è buona: il materiale studiato consiste in propodi di chelipedi e carapaci dalla cuticola talvolta alterata e incompleta o anche rappresentati solo dal modello interno. E' stata riconosciuta un'unica forma di anomuro attribuibile a *Xylopagurus* A. Milne Edwards, 1880 (Paguridae Latreille, 1802): probabilmente si tratta della prima segnalazione del genere allo stato fossile; è rappresentato da un propodo di chelipede nettamente più corto di quello delle forme attuali ma dotato della caratteristica spina sviluppata sull'angolo dorso-distale che doveva spingersi al di sopra della base del dattilo. Tra i brachiuri sono state identificate le seguenti specie: *Kromtitis bicuspidatus* sp. nov. e *Noetlingia veronensis* (Bittner, 1886) (Dromiidae De Haan, 1833), *Lophoranina laevifrons* (Bittner, 1875) (Raninidae De Haan, 1839), *Calappilia dacica* Bittner, 1893 (Calappidae De Haan, 1833), *Lobonotus sommarugai* sp. nov. e *Paronacarcinus spinosus* gen. nov., sp. nov. (Tumidocarcinidae Schweitzer, 2005), *Mithracia* sp. (Majidae Samouelle, 1819), *Phrynelambrus corallinus* Bittner, 1893 (Parthenopidae MacLeay, 1838), *Palaeograpsus inflatus* Bittner, 1875 (Panopeidae Ortmann, 1893), *Phlyctenodes tuberculatus* A. Milne Edwards, 1862 (Xanthidae MacLeay, 1838). La presenza di *Kromtitis bicuspidatus* sp. nov., caratterizzato dalla parziale fusione della coppia mediale di tubercoli epibranchiali, conferma la grande diffusione del genere nell'Eocene negli antichi mari del Veneto dove probabilmente è comparso e si è differenziato. La piccola specie *Lobonotus sommarugai* sp. nov. e *L. granosus* (Beschin, Busulini, De Angeli, Tessier, 2002) comb. nov. hanno permesso di confermare la presenza del genere *Lobonotus* A. Milne Edwards, 1863 in Europa. *Paronacarcinus* gen. nov., abbastanza simile a *Titanocarcinus* A. Milne Edwards, 1863, è caratterizzato da quattro denti sui margini anterolaterali, due fessure orbitali aperte, regione meso-metagastrica pentagonale molto allungata con tubercoli disposti a V, solco trasversale che separa le regioni gastriche ed epibranchiali da quelle cardiaca e branchiali posteriori, parte posteriore del carapace depressa e tubercoli appuntiti distribuiti sulle varie regioni. Accanto a forme descritte solo per l'Eocene dell'Italia nordorientale, all'interno della fauna di Parona sono presenti anche specie, come *Phrynelambrus corallinus* Bittner, 1893 e *Calappilia dacica* Bittner, 1893, reperite anche in Ungheria e Transilvania (Romania), che mostrano una maggiore diffusione all'interno della Tetide, e, per quanto riguarda la seconda che è nota pure in Inghilterra, anche in bacini dell'Europa settentrionale. Gli esemplari studiati sono conservati presso il Museo Civico "G. Zannato" di Montecchio Maggiore (Vicenza).



Fig. 1 - The upper Eocene marls cropping out at Parona.

INTRODUCTION

A small group of fossil decapods found in the upper Eocene levels cropping out at Parona (Verona - NE Italy) was reported in BESCHIN *et al.* (2007b) (Fig. 1). Even if the intense urbanization of this area makes very difficult the access to the estates where the outcrop is situated, recent inspections in the site allowed to increase the former nucleus of crustaceans housed in the Museo Civico "G. Zannato" at Montecchio Maggiore (Vicenza) and to complete the analysis of the Parona fauna.

The fossil remains consist of carapaces sometimes lacking part of the original cuticle, some internal moulds and some palms of claw. In spite of the bad conditions of some specimens, the fauna appeared at once interesting and very differentiated and so worthy of a study in depth.

Only one species of Anomura has been discovered: it was referred to ?*Xylopagurus* A. Milne Edwards, 1880 (Paguridae Latreille, 1802): this is probably the first report of the genus in the fossil record. Among the Brachyura, species were recognized within the following genera: *Kromtitis* Müller, 1984, *Noetlingia* Beurlen, 1928 (Dromiidae De Haan, 1833), *Lophoranina* Fabiani, 1910 (Raninidae De Haan, 1839), *Calappilia* A. Milne Edwards, 1873 (Calappidae De Haan, 1833), *Lobonotus* A. Milne Edwards, 1863, *Paronacarcinus* gen. nov. (Tumidocarcinidae Schweitzer, 2005), *Mithracia* Bell, 1858 (Majidae Samouelle, 1819), *Phrynosomus* Bittner, 1893 (Parthenopidae MacLeay, 1838), *Palaeograpsus* Bittner, 1875 (Panopeidae Ortmann, 1893), *Phlyctenodes* A. Milne Edwards, 1862 (Xanthidae MacLeay, 1838).

GEOLOGICAL SETTING

Parona is a little village located in the NW part of the Verona municipality, in the last part of the Negrar Val-

ley (Fig. 2). The succession cropping out in this area is from lower Eocene to middle Miocene in age (DE ZANCHE *et al.*, 1977). The lower Eocene rocks are represented by restricted outcrops of closely bedded whitish clayey limestones and marls, underlying wide middle Eocene deposits of Nummulite limestones ("pietra Gallina" and "pietra d'Avesa") forming a large part of the hilly range. The upper Eocene series ends with the Priabona Marls Formation. It is particularly fossiliferous and crops out exclusively at the top of the hills; its maximum thickness kept is about 80 m. At the top of the sequence there are calcarenites bearing pectinids and large coralline algae, biocalcarenes and sandstones Miocene in age: their contacts with the underlying layers are interested by a hiatus caused by erosion including part of the upper Eocene, all the Oligocene and part of the Miocene. The eruptive rocks are scantily represented; the Quaternary fluvial and fluvioglacial Adige deposits are widespread in the South of the hilly area. The rocks



Fig. 2 - General location of Parona.

present in this area are weakly dipped towards the plain and are intersected by faults with prevailing NNE-SSW direction arranged in terraces.

Two rocky units crop out at Parona highlighted by a clear lithological change: the uppermost middle Eocene Nummulite Limestone and the upper Eocene Priabona Marls. This second formation, bearing in its lower part the studied crustacean fauna, is very rich in fossils. Discocyclinids, nummulites, microforaminiferids, gastropods, bivalves (particularly ostreids and pectinids), bryozoans, echinids, the serpulid *Rotularia spirulacea* Lamarck, 1818, shark teeth and corals have been found. The fossil association indicates a neritic shallow marine environment probably not far from the coast and affected by significant terrigenous supplies. In the crustaceans bearing levels the presence of well crystallized limestone nodules is noteworthy; they have a diameter of about 20-30 cm; the specimen of *Phlyctenodes tuberculatus* A. Milne Edwards, 1862, here reported was found in one of these. Several authors dealt with the crustaceans of this part of the Veronese Lessini; we remember A. MILNE EDWARDS (1862), BITTNER (1883, 1884, 1886), DE GREGORIO (1895), VINASSA DE REGNY (1896), FABIANI (1910a) and recently DE ANGELI & BESCHIN (2006).

SYSTEMATIC PALEONTOLOGY

The systematic arrangements proposed by MARTIN & DAVIS (2001), NG *et al.* (2008) and DE GRAVE *et al.* (2009) are adopted.

Measurements in mm: L = maximum carapace length; W = maximum carapace width; FoW = fronto-orbital width; Lp = palm length; Ltp = propodus length; hp = palm height.

The specimens are deposited in the Museo Civico "G. Zannato" - Montecchio Maggiore, Vicenza (Italy) under acronym MCZ (I.G. = Catalogo Generale dello Stato Italiano).

Infraorder Anomura MacLeay, 1838
Superfamily Paguroidea Latreille, 1802
Family Paguridae Latreille, 1802

Genus *Xylopagurus* A. Milne Edwards, 1880

Type species: *Xylopagurus rectus* A. Milne Edwards, 1880

?*Xylopagurus* sp.

Pl. 1, fig. 1

Material and measurements: one right propodus (MCZ 3044 - I.G. 336823 Ltp: 13.0 Lp: 9.0 hp: 11.6).

Description - The propodus is subsquare in outline, with palm higher than long. It appears subtriangular in transverse section with the flat base below. Only the inner surface is observable: it is inflated with a weak longitudinal ridge on the lower part. The upper and outer margins of the hand are convex, sharp and beaded; a wide prominent spine is situated on the upper distal angle. The fixed fin-

ger is short but stout, gently curved inward. The original cuticle is only partially preserved; the ornamentation is made of tiny nodes on the upper half of the inner surface and of weak little transverse ridges in the lower half. Mobile finger not preserved.

Remarks - The prominent spine developed on the upper distal angle of the propodus that should partly stand above the mobile finger suggests that this sole specimen should be referred to *Xylopagurus* A. Milne Edwards, 1880. We decided not to define its specific attribution because of the strongly lacunose preservation of the propodus partly lacking in the external cuticle. *Xylopagurus* is represented by a few species living in the west tropical Pacific and the Caribbean inside tunnels drilled in small pieces of branches deposited on the sea floor (LEMAITRE, 1995; FOREST, 1997; McLAUGHLIN, 2003).? *Xylopagurus* sp. differs from the extant forms and above all from the type species *X. rectus* A. Milne Edwards, 1880, for the shorter palm and the convex upper and lower margins. This is probably the first report in the fossil record of the genus whose habitat appears so particular and very unsuited to preservation.

Infraorder Brachyura Linnaeus, 1758
Superfamily Dromioidea De Haan, 1833
Family Dromiidae De Haan, 1833
Subfamily Dromiinae De Haan, 1833
Genus *Kromtitis* Müller, 1984

Type species: *Dromilites koberi* Bachmayer & Tollmann, 1953

Kromtitis bicuspidatus sp. nov.

Pl. 1, figs. 3, 4

2007b *Kromtitis* sp. - Beschin *et al.*, 12, fig. 2C.

Holotype: MCZ 3052 - I.G. 336824.

Paratypes: MCZ 1346, MCZ 3047, MCZ 3048, MCZ 3049, MCZ 3050, MCZ 3051, MCZ 3053, MCZ 3054, MCZ 3055.

Type locality: Parona (Verona - NE Italy)

Geological age: late Eocene.

Etymology: *bi* = prefix for "double" and *cuspidatus* - *a* - *um* (lat.) = pointed: from the double apex of the medial epibranchial swelling.

Material: ten specimens represented by variously incomplete carapaces; the size of some of these is considerable. (MCZ 1346, MCZ 3047, MCZ 3048, MCZ 3049, MCZ 3050, MCZ 3051, MCZ 3052 - I.G. 336824, MCZ 3053, MCZ 3054, MCZ 3055).

Measurements

MCZ 3052	W: 26.5	FoW: 13.5	Holotype
MCZ 1346	W: 24.5	L: 25.6	
MCZ 3050	W: 36.0		
MCZ 3048	W: 42.0	L: 43.5	
MCZ 3047		L: 31.0	

Diagnosis - Carapace subcircular, moderately domed, with well defined swollen regions. Front narrow, bilamellar, with median notch and small triangular rostrum. Orbits large, ovate, with interrupted inferior margin and developed outer orbital spine. Lateral margins constitute a continuous arch. Five spines on anterolateral margins (excluded outer orbital spine), three large pointed tubercles on posterolateral ones. Posterior margin concave, weakly rimmed, depressed below the general surface of carapace. Dorsal surface with large tubercles surrounded by pointed granules. One tubercle on each epigastric lobe. Large tubercle at the base of each protogastric lobe. Three swellings forming a triangle on subpentagonal mesogastric lobe. Metagastric lobe narrow with two pointed swellings. Depressed urogastric lobe. Cardiac region triangular with two large swellings. Two couples of long and narrow swellings with a tubercle on the top of each epibranchial lobe; bulges of medial group fused forming a unique large swelling with two points. Row of at least three tubercles on each posterior branchial lobe. Four tubercles in a row flanking the posterior margin.

Description - The carapace is almost circular in outline, moderately domed. The front is narrow, made of two fringed lamellae divided by a median notch and a small triangular rostrum weakly bent downward. The orbits are large, ovate, with interrupted inferior margin and a developed outer orbital spine. The fronto-orbital margin occupies a little more than half the carapace width. The lateral margins constitute a continuous arch. The anterolateral parts are armed with five spines (the outer orbital one excluded) and three large pointed tubercles project from the posterolateral parts. The posterior margin is concave, weakly rimmed (bounded by a thin ridge) depressed below the general surface of the carapace.

The dorsal shield is clearly subdivided; the main regions are defined by quite deep and smooth furrows and are characterized by some swellings. The cervical furrow is apparent; near the midline it borders the mesogastric lobe and continues directed forward on both sides between the hepatic and branchial regions. Also the branchiocardiac furrows are clearly visible such as other branchial furrows concentric to the cervical one. Large tubercles surrounded by pointed granules are present on the dorsal regions.

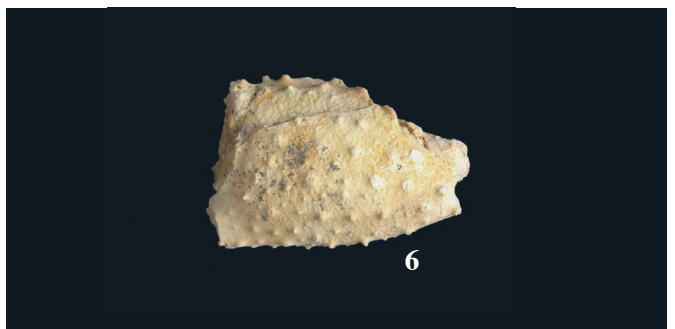
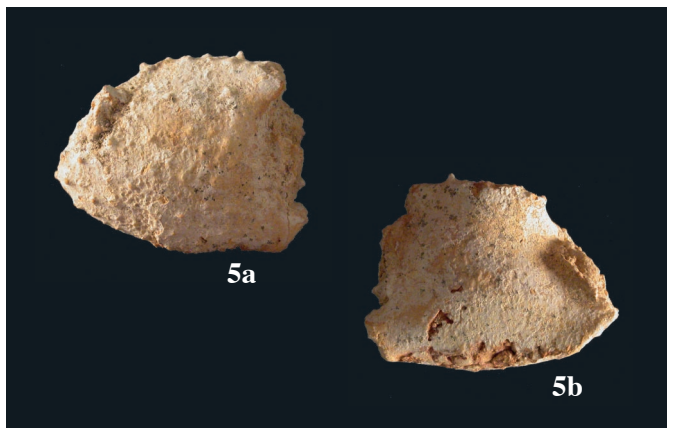
The anterolateral part of the shield is gently sloping downward and the hepatic regions are quite wide, flat but not well defined. Each epigastric lobe is occupied by one drop-shaped, long and narrow tubercle and there is a large tubercle at the base of each protogastric lobe. The other parts of the protogastric lobes and the hepatic regions are covered with numerous granules. The subpentagonal mesogastric lobe is particularly apparent for the presence of three swellings forming a triangle: the smallest one is on the anterior process and the other two, paired in the wider part of the lobe, are larger, pointed and divided by a median furrow. The metagastric lobe is narrower with two pointed lateral swellings. The urogastric lobe is represented by a flat depressed area. The cardiac region is

triangular in outside with the vertex directed to the posterior margin and the base characterized by two large swellings. The structure of the epibranchial lobes is typical for this genus: on each one there are two couples of long and narrow swellings with a tubercle on the top; the inflations of the medial group are almost fused to form a unique large swelling with two points, while the lateral ones are clearly distinct and pointed; on each posterior branchial lobe there is a row of at least three tubercles of growing size almost parallel to the lateral margins of the cardiac region. Four tubercles constitute a row flanking the posterior margin: as just described, the medial ones are on each side of the cardiac region while the lateral ones are the last tubercles of the posterolateral margins.

Remarks - The species attributed to *Kromtitis* Müller, 1984, known from lower Eocene to Miocene coral environments, constitute a homogeneous group and their number is increased in the late years above all for studies dealing with fossil faunas from Veneto (NE Italy) (BESCHIN *et al.*, 2002, 2007a, DE ANGELI & BESCHIN, 2008). The genus is strongly characterized by some swellings distributed on the median and epibranchial regions of the carapace while the species can be distinguished for the structure of the protogastric and posterior branchial lobes and for the abundance of granules on the shield. GUINOT (2008) points out the resemblance between *Kromtitis* and *Kierionopsis* Davidson, 1966, from the Paleocene of Texas (DAVIDSON, 1966) and the extant coral associated *Paradynomena* Sakai, 1963, from the seas of the Philippines and gather them together in the subfamily Paradynomeninae Guinot, 2008 among Dynomenidae Ortmann, 1892; in DE GRAVE *et al.* (2009) instead, *Kromtitis* is considered a member of Dromiidae De Haan, 1833. *Kromtitis* is spread in Eocene and Oligocene sediments of Veneto (NE Italy): the oldest species were collected in Ypresian levels of the Vicenza territory: they are *K. koberiformis* Beschin, Busulini, De Angeli, Tessier, 2007, *K. levigatus* Beschin, Busulini, De Angeli, Tessier, 2007, and *K. subovatus* Beschin, Busulini, De Angeli, Tessier, 2007, all of them from Contrada Gecchelina at Monte di Malo (Vicenza); *K. tetratuberculatus* Beschin, Busulini, De Angeli, Tessier, 2002, is known from the middle Eocene of "Main" quarry (Arzignano - Vicenza), *K. bicuspidatus* sp. nov. from the Priabonian of Parona (Verona) and *Kromtitis* sp. from the Oligocene of Soghe (Berici Hills, Vicenza) (BESCHIN *et al.*, 2002, 2007a, DE ANGELI & BESCHIN, 2008). From this part of the Tethys where this ge-

Plate 1 - 1. ? *Xylopagurus* sp., es. MCZ 3044, right propodus (x 2,8); 2. *Noellinia veronensis* (Bittner, 1886), es. MCZ 1343, dorsal view (x 4,7); 3. *Kromtitis bicuspidatus* sp. nov., holotype, es. MCZ 3052 - I.G. 336824, dorsal view (x 2,0); 4. *Kromtitis bicuspidatus* sp. nov., es. MCZ 3053, dorsal view (x 1,6); 5. Dromiidae gen. indet., sp. indet. Morphotype 1, es. MCZ 3056, a = external view of the chela; b = internal view of the chela (x 1,6); 6. Dromiidae gen. indet., sp. indet. Morphotype 2, es. MCZ 3060, external view of the chela (x 1,8); 7. *Lophoranina laevifrons* (Bittner, 1875), es. MCZ 3062, dorsal view (x 2,2).

PLATE 1



nus possibly originated and differentiated, it should have spread also in other basins: other species attributed to the genus have been discovered in Central Europe (*K. pentagonalis* Müller & Collins, 1991, from the upper Eocene of Hungary and the type species *K. koberi* (Bachmayer & Tollmann, 1953) from the Miocene of Austria, Hungary and Poland) and in Central America (*K. spinulata* Portell & Collins, 2004, from the lower Miocene of Jamaica) (BACHMAYER & TOLLMANN, 1953; MÜLLER, 1984, 1996; PORTELL & COLLINS, 2004).

Kromtitis koberiformis and *K. tetratuberculatus* are the most similar to *K. bicuspidatus* sp. nov. but the partial fusion of the medial pair of epibranchial swellings is absent in both. They also have definitely a richer ornamentation, even if different from each other, made of small granules covering the swellings and flanking some larger tubercles; moreover *K. koberiformis* has a broad crescent swelling on the posterior branchial lobes and *K. tetratuberculatus* a larger number of inflations on the protogas-tric lobes.

Genus *Noetlingia* Beurlen, 1928

Type species: *Dromia claudiopolitana* Bittner, 1893

***Noetlingia veronensis* (Bittner, 1886)**

Pl. 1, fig. 2

1886 *Dromia Veronensis* Bittner, 3, pl. 1, figs. 2a-c.

1928 *Noetlingia veronensis* (Bittner) - Beurlen, 166.

2006 *Noetlingia veronensis* (Bittner) - De Angeli & Garassino, 29.

2007b *Noetlingia veronensis* (Bittner) - Beschin *et al.*, 12, fig. 2B.

Material: three specimens: MCZ 1343 is quite well preserved, MCZ 3045 is incomplete and decorticated, MCZ3046 is only a fragment of carapace.

Measurements

MCZ 1343 W: 9.8 L: 13.2

MCZ 3045 W: 12.1

Description - Carapace ovate, longer than wide (W/L 0.74), largest width in the posterior half, strongly vaulted in transverse section. The frontal margin and the orbits of the specimens analyzed are damaged. Anyway, the fronto-orbital margin appears overall narrow and pointed. The lateral margins are long, continuous, strongly divergent in the anterior third, then gently convex with a few small blunt spines. The posterior margin is broad and weakly concave in the middle. The surface of the shield is altered, but on the whole smooth; probably only the axial portion of the cervical groove and part of the branchio-cardiac and branchial grooves were evident; on the posterior half of the carapace there is some little, scattered tubercles.

Remarks - The overall shape of the carapace, with an ovate, long and narrow outline, strongly vaulted in transverse section, regions not defined, a few blunt spines on the lateral margins, surface smooth on the anterior half

and rare tubercles on the posterior one allow to attribute the specimens from Parona to *Noetlingia veronensis* (Bittner, 1886). Up to now the species was known only for the holotype from the upper Eocene of San Giovanni in Valle (Verona) (BITTNER, 1886).

Three species were attributed by BEURLEN (1928) to *Noetlingia* that he created for species near to *Dromia* Weber, 1795, and *Dromilites* H. Milne Edwards, 1837, but with ovate carapace, longer than wide, with blunt little spines on the lateral margins, triangular rostrum, regions not defined, part of the transverse grooves weakly incised and precisely: *N. claudiopolitana* (Bittner, 1893), *N. succini* (Noetling, 1885) and *N. veronensis*, (Bittner, 1886). Also *N. claudiopolitana*, originally described for the upper Eocene of Romania (BITTNER, 1893), and then of Hungary (LÖRENTHEY & BEURLEN, 1929) for shallow water environments, is known from the Vicenza territory (BESCHIN *et al.*, 1994). *Noetlingia succini* (Noetling, 1885), comes from the Oligocene of the southeast shore of the Baltic Sea (Russia) (NOETLING, 1885). The carapace of *N. veronensis* is almost smooth, while the shield of the other two species shows an ornamentation a little more apparent.

Occurrence - The species is known for the upper Eocene of NE Italy.

***Dromiidae* gen. indet., sp. indet.**

Pl. 1, figs. 5 a, b, 6

Morphotype 1: three palms of right cheliped (MCZ 3056 - MCZ 3058).

Measurements

MCZ 3058 Lp: 14.0 hp: 11.0

MCZ 3056 Lp: 19.0 hp: 16.0

MCZ 3057 Lp: 19.5 hp: 16.3

Description - The palm is stout, weakly longer than high (hp/Lp about 0.83), carpo-propodial articulation oblique. Margins distally diverging, the upper one is the shorter, convex, weakly inner folded, sharp and serrated, the lower one is almost straight and distally bent downward at the base of the fixed finger. Outer surface convex with even small tubercles arranged in irregular rows and interested by weakly tiny transversal ridges probably generated by the alteration of the cuticle. Inner surface almost flat but weakly convex in the lower portion; the ornamentation is on the whole scanty. Fixed fingers not preserved.

Morphotype 2: one palm of right (MCZ 3059) and two of left (MCZ 3060, MCZ3061) cheliped.

Measurements

MCZ 3961 Lp: 16.0 hp: 9.3

MCZ 3059 Lp: 16.7 hp: 11.0

MCZ 3060 Lp: 17.0 hp: 11.7

Description - The palms of this group are very similar to the previous ones in the general outline and ornamenta-

tion but are smaller and longer (hp/Lp about 0.65): they come probably from younger individuals of the same species.

Remarks - The features of these propodi correspond to the ones of the chelipeds of some Dromiidae. Probably they could be palms of *Kromtitis* Müller 1984, genus abundant in Parona levels whose limbs are unknown.

Superfamily Raninoidea De Haan, 1839

Family Raninidae De Haan, 1839

Subfamily Ranininae De Haan, 1839

Genus *Lophoranina* Fabiani, 1910

Type species: *Ranina marestiana* König, 1825

***Lophoranina laevifrons* (Bittner, 1875)**

Pl. 1, fig. 7

1875 *Ranina laevifrons* Bittner, 68, pl.1, fig. 4.

1895 *Ranina laevifrons* Bittner - Bittner, 247, pl. 1, figs. 3, 4.

1910a *Ranina laevifrons* Bittner - Fabiani, 20 (list).

1910b *Ranina (Lophoranina) laevifrons* (Bittner) - Fabiani, 90 (list).

1966 *Ranina laevifrons* Bittner - Ancona, 406.

1969 *Lophoranina laevifrons* (Bittner) - Vía Boada, 120.

1983 *Lophoranina laevifrons* (Bittner) - Busulini *et al.*, 61, pl. 2, fig. 4.

1988 *Lophoranina laevifrons* (Bittner) - Beschin *et al.*, 181, textfig. 7(4-6), pl. 7, figs. 3-5.

1994 *Lophoranina laevifrons* (Bittner) - Beschin *et al.*, 174, pl. 3, fig. 3.

2001 *Lophoranina laevifrons* (Bittner) - De Angeli & Beschin, 18 (list), textfigs. 13(4a-b).

2004 *Lophoranina laevifrons* (Bittner) - Beschin *et al.*, 113 (list).

2005 *Lophoranina laevifrons* (Bittner) - Beschin *et al.*, 16, pl.3, fig.3.

2006 *Lophoranina laevifrons* (Bittner) - De Angeli & Garassino, 34 (list).

2007b *Lophoranina laevifrons* (Bittner) - Beschin *et al.*, 12.

Material: one fragment of dorsal carapace corresponding to the left anterolateral part (MCZ 3062).

Remarks - The transverse asymmetrical ridges visible on the fragment are subparallel, almost straight and regularly spaced, with packed small pointed tubercles: this arrangement is typical of *Lophoranina laevifrons* (Bittner, 1875). This allows us to refer the specimen to this species.

Occurrence - The species was found first in middle Eocene strata of Northern Italy at San Giovanni Ilarione (Verona) (BITTNER, 1875, 1895), and subsequently in coeval levels in various quarries in Vicenza and Verona territory all located in Chiampo and Agno Valleys (BUSULINI *et al.*, 1983; BESCHIN *et al.*, 1988, 1994, 2005). Now we report the species from the late Eocene, too.

Superfamily Calappoidea De Haan, 1833

Family Calappidae De Haan, 1833

Genus *Calappilia* A. Milne Edwards, 1873

Type species: *Calappilia verrucosa* A. Milne Edwards, 1873

***Calappilia dacica* Bittner, 1893**

Pl. 2, figs. 1-3

1893 *Calappilia dacica* Bittner, 16, pl. 2, fig. 1.

1929 *Calappilia dacica* Bittner - Lörenthey & Beurlen, 127, pl. 6, figs. 4-6.

1981 *Calappilia dacica* Bittner - Quayle & Collins, 739, pl. 104, figs. 6, 9.

1982 *Calappilia dacica* Bittner - Busulini *et al.*, 77.

2006 *Calappilia dacica* Bittner - De Angeli & Garassino, 41.

2007b *Calappilia dacica* Bittner - Beschin *et al.*, 12, fig. 2A.

Material: 24 carapaces (MCZ 1341, MCZ 1342, MCZ 3063 - MCZ 3084). Some of them are altered and incomplete.

Measurements

MCZ 3068 W: 12.2

MCZ 3073 W: 12.4

MCZ 3074 W: 14.5

MCZ 3064 W: 14.8

MCZ 3069 W: 15.0

MCZ 3071 W: 15.0 FoW: 7.5

MCZ 3063 W: 15.2

MCZ 1342 W: 15.5 L: 17.0

MCZ 3084 W: 16.0

MCZ 1341 W: 16.2 L: 15.5 FoW: 7.6

MCZ 3066 W: 16.3

MCZ 3076 W: 18.0

MCZ 3072 W: 18.7

MCZ 3080 L: 13.7

Description - The specimens here described are in complete agreement with the types found in the upper Eocene of Transylvania (Romania) (BITTNER, 1893).

The carapace is subcircular, vaulted in longitudinal and transverse sections, covered with many irregularly arranged tubercles; the median regions are quite apparent.

The frontal margin is very short with a little triangular rostrum and continues on both sides with the orbital margins. The orbits are close together, quite small and directed forward; the upper orbital margin is rimmed and interrupted by two little notches. The lateral margins are continuous, strongly convex, diverging in the anterior part, converging beyond the lateral angle and a little concave at the end. They are bordered by a little rib with sparse granules; the last six are pointed tubercles: the first four become stronger in size; the fifth one is the most developed and protruding; the sixth one is a little shorter. On the posterior angle, the margin has a recess for the articulation of the fifth pereopod; the posterior margin is rather narrow, convex with three tubercles: the median one is the largest. The median regions of the shield are defined by two subparallel longitudinal furrows extended on the whole carapace but more clear in the branchiocardiac portion. The protogastric regions are not clearly defined

by furrows but they are apparent; they are covered with numerous tubercles; a longitudinal row of three small pointed granules is particularly evident in medial position, at the side three little tubercles draw a small triangle near the orbital margin and a big tubercle occupies the posterior part of the region. The median gastric regions are narrow: the first portion is a little wider and has a big tubercle surrounded by little granules in a rosette-like arrangement; it is followed by a getting narrower part with other little tubercles. Two rows of small tubercles are visible on the long and narrow cardiac region; the intestinal region is quite apparent: it is posteriorly protruding and decorated by two rows of little tubercles. The subtriangular hepatic regions are covered with dense and small tubercles; the branchial regions are not subdivided into lobes: they are decorated with numerous tubercles becoming smaller posteriorly and laterally almost forming transverse curving rows.

Remarks - *Calappilia dacica* Bittner, 1893, reported from the upper Eocene of Romania, Hungary and England, is also known from the middle and upper Eocene of Veneto: the species was widely spread not only into the Tethys but also into the northern European basins.

Calappilia A. Milne Edwards, 1873, has a distribution ranging from Eocene to Miocene and is widespread in Europe, the Caribbean, North America and the Indo-Pacific; it shows an Atlantic and Tethyan distribution. The genus appears closely related to the recent *Paracyclois* Miers, 1886 (GLAESSNER, 1969, SCHWEITZER & FELDMANN, 2000, FELDMANN *et al.*, 2005). From the Eocene of Veneto the following species were found: *C. gemmata* Beschin, Busulini, De Angeli, Tessier, 1994, *C. incisa* Bittner, 1886, *C. subovata* Beschin, Busulini, De Angeli, Tessier, 2002, and recently *C. scopuli* Quayle & Collins, 1981 (BESCHIN *et al.*, 2009). The genus is known also from the lower Oligocene of Northern Italy with *C. mainii* Allasinaz, 1987 (Piemonte) (ALLASINAZ, 1987) and *C. vicetina* Fabiani, 1910 (Veneto).

Occurrence - The species is reported from the upper Eocene of Transylvania (Romania) (BITTNER, 1893), Hungary (LÖRENTHEY & BEURLEN, 1929), Great Britain (QUAYLE & COLLINS, 1981) and middle and upper Eocene of Veneto (NE Italy) (BUSULINI *et al.*, 1982).

Superfamily Carpilioidea Ortmann, 1893
Family Tumidocarcinidae Schweitzer, 2005
Genus *Lobonotus* A. Milne Edwards, 1863

Type species: *Lobonotus sculptus* A. Milne Edwards, 1863

***Lobonotus sommarugai* sp. nov.**

Pl. 3, figs. 1, 2

2007b *Lobonotus* cf. *L. sandersi* - Beschin *et al.*, 12, fig. 2E.

Holotype: MCZ 3092 - I.G. 336825

Paratypes: MCZ 1344, MCZ 3090, MCZ 3091, MCZ 3093, MCZ 3094, MCZ 3095, MCZ 3096, MCZ 3105.

Type locality: Parona (Verona - NE Italy)

Geological age: late Eocene.

Etymology: the species is named in honour of Michele Sommaruga, the geologist from Verona who found some of the studied specimens.

Material: nine carapaces (MCZ 1344, MCZ 3090 - MCZ 3096, MCZ 3105); the specimens MCZ 3093, MCZ 3094 and MCZ 3095 are fragments, while MCZ 3105 is a carapace lacking part of the margins.

Measurements

MCZ 3092	W: 16.5	L: 14.4	FoW: 11.9	Holotype
MCZ 3091	W: 14.4	L: 12.7		
MCZ 1344	W: 17.8	L: 15.1		
MCZ 3090	W: 18.0	L: 16.0	FoW: 12.0	
MCZ 3096	W: 20.0			

Diagnosis - Carapace small, subpentagonal, weakly wider than long, flattened. Region inflated, granulated, well defined by broad, deep and smooth grooves. Front slightly projecting, bilobate, truncate, with a wide axial incision. Orbits ovate with two wide fissures. Anterolateral margins strongly convex, with three stout rounded teeth (excluding outer orbital spine). Posterolateral margins longer with a small epibranchial tooth and a larger prominence adjacent the mesobranchial lobe. Epigastric lobes ovate, inflated; protogastric lobes broad, ovate, with a short longitudinal groove. Mesogastric and metagastric regions separated. Cardiac region broad and trilobed: Intestinal region depressed and flattened; on both sides narrow, granular transversely lengthened metabranchial swelling. The branchial regions are large and clearly subdivided into lobes. The dorsal regions and the lateral margins are covered with spaced and scattered tubercles.

Description - Carapace small, subpentagonal in outline, weakly wider than long (L/W 0.88), longitudinally and transversely flattened. Region inflated, granulated, well defined by broad, deep and smooth grooves. The fronto-orbital margin is not entirely preserved in the holotype. In MCZ 3091 the front is slightly projected beyond the orbits, bilobate, with a deep wide axial incision and anteriorly truncate; the margin is granular. The orbits are ovate, clearly separated from the front by a notch; the upper orbital margin is interested by two wide fissures producing a long inner orbital lobe, a stout upper orbital spine and a similar outer orbital one. The anterolateral margin is strongly convex, with three stout rounded teeth

Plate 2 - **1.** *Calappilia dacica* Bittner, 1893, es. MCZ 1342, dorsal view (x 2,8); **2.** *Calappilia dacica* Bittner, 1893, es. 1341, dorsal view (x 2,7); **3.** *Calappilia dacica* Bittner, 1893, es. MCZ 3072, dorsal view (x 2,6); **4.** *Mithracia* sp., es. MCZ 3086, dorsal view (x 2,0); **5.** *Phrynotambrus corallinus* Bittner, 1893, es. MCZ 1345, dorsal view (x 4,3); **6.** *Phrynotambrus corallinus* Bittner 1893, es. 3089, fronto-orbital region (x 2,0); **7.** *Phrynotambrus corallinus* Bittner, 1893, es. 3087, dorsal view (x 5,5).

PLATE 2



(excluding outer orbital spine); the first two are situated on the hepatic part of the margin, the third one that is the largest is on the lateral angle just posteriorly the cervical groove. The posterolateral margins are longer than the anterolateral ones, regularly convex, characterized by a small, narrow, epibranchial tooth and a larger flat prominence near the mesobranchial lobe. The posterior margin is broad, smooth, straight in the axial part, a little convex on both sides.

The epigastric lobes are axially ovate, inflated, weakly downfolded; protogastric lobes broad, ovate, partially subdivided into two lobes by a longitudinal groove extended in their anterior part. Mesogastric region with a long narrow anterior process and a broad, transversely ovate posterior portion with a couple of little tubercles on the furrow separating it from the curved metagastric lobe. The meso- and metagastric lobes form together a pentagonal swelling. The urogastric lobe is depressed. The cardiac region is typically trilobed: the axial part is heart-shaped with three obscure tubercles arranged to form a triangle with posterior apex; it is flanked posterolaterally on each metabranchial lobe by a round swelling. The intestinal region is depressed and flattened; on both sides there is a narrow, granular transversely lengthened metabranchial swelling. The hepatic regions are apparent, subtriangular in outline. The branchial regions are large and clearly subdivided into lobes. The epibranchial lobe is well developed and constituted by two oblique subrectangular swellings: the outer one, the larger, flanks the third anterolateral tooth, the hepatic region and the posterolateral tooth, the inner one is medially adjacent to the meso-metagastric lobe and laterally to the mesobranchial lobe. This one is a small subcircular swelling near the posterolateral prominence. The metabranchial lobe is characterized by the small subcircular node adjacent to the cardiac region and the transversely elongate swelling near the posterior margin. All the swellings of the dorsal regions and the lateral margins are covered with large, spaced and scattered tubercles; on the anterior regions the granules are concentrated above all on the hepatic and epi- and protogastric swellings.

Remarks - *Lobonotus* A. Milne Edwards, 1863, was erected on the basis of the study of a single specimen of *L. sculptus* A. Milne Edwards, 1863, collected in levels from the “middle Tertiary” of Santo Domingo (Haiti), afterwards indicated as Miocene in age (FRITSCH, 1875, SCHWEITZER *et al.*, 2002, 2004, 2007a, 2007b). GLAESSNER (1969) and then SCHWEITZER *et al.* (2007a, 2007b) considered *Archaeopilumnus caelatus* Rathbun, 1919, synonym of this species; this form was defined on the basis of five specimens (three males and two females) found again in Santo Domingo, in opinion of RATHBUN (1919) “probably lower Miocene” in age and are really very much similar to the drawing of *L. sculptus* by A. MILNE EDWARDS (1863).

Diagnostic features of the genus are: carapace almost equant but weakly wider than long, nearly flat, widest

in its anterior half, regions well defined and lobulate, anterolateral margins with some spines (usually four, excluding outer orbital spine, even if the last ones are often beyond the lateral angle), orbits broad with two fissures, front lamellar with a median notch; among the regions should be noted the epigastric lobes apparent, the cardiac region wide and trilobed, the branchial regions large and very subdivided. A. MILNE EDWARDS (1863) declared that it is unlikely that species attributable to *Lobonotus* will be found in Europe because during the “middle Tertiary” (Miocene) the American faunas were already differentiated from the European ones. A geographic criterion for the attribution of species to *Lobonotus* is re-proposed by COLLINS & MORRIS (1978) and SCHWEITZER *et al.* (2004) while in SCHWEITZER *et al.* (2002) it is partially ignored. In the last years several studies dealt with the revision of *Lobonotus* revealing some difficulties in attributing the species to the genus. (FELDMANN *et al.*, 1995, SCHWEITZER *et al.*, 2002, 2004, 2007a). Considering only the species whose carapace is known, in the latest quoted publication some forms, all Eocene in age, are referred to the genus, beyond *L. sculptus*, the type species that is characterized by a small ovate urogastric lobe and a continuous ridge flanking the posterior margin. In our opinion *L. bakeri* (Rathbun, 1935) from Texas (U.S.A.) (RATHBUN, 1935), *L. mexicanus* Rathbun, 1930, from Mexico (RATHBUN, 1930), *L. natchitochensis* Stenzel, 1935, from Louisiana (U.S.A.) (STENZEL, 1935), *L. purdyi* (Blow & Manning, 1996) and *L. sandersi* (Blow & Manning, 1997) from South Carolina (U.S.A.) can be referred to the same genus; *L. sturgeonii* (Feldmann, Bice, Schweitzer Hopkins, Salva, Pickford, 1998) from the Eocene of North Carolina (U.S.A.) that has weak subdivided regions and posterior part of the shield almost smooth (FELDMANN *et al.*, 1998) should be instead attributed to a different genus.

BESCHIN *et al.* (2002) erected *Eohalimede granosa* Beschin, Busulini, De Angeli, Tessier, 2002, from the middle Eocene of Vicenza territory (“Main” quarry - Arzignano); the species has the features of *Eohalimede* Blow & Manning, 1996, as indicated by the authors. The type species of this genus is *E. walleri* Blow & Manning, 1996, from the middle Eocene of South Carolina (U.S.A.) but it was originally described combining the characteristics of two extremely lacunose specimens (BLOW & MANNING, 1996); in BLOW & MANNING (1997) instead *E. saundersi* Blow & Manning, 1997 was erected - then correctly named *E. sandersi* (BLOW & MANNING, 1998) - and the authors declared that also the specimen previously attributed to *E. walleri* and used for the description of the anterior parts of the carapace had been included among the paratypes of the new taxon. SCHWEITZER *et al.* (2002, 2004, 2007a) referred *Eohalimede sandersi* to *Lobonotus* A. Milne Edwards, 1863. We agree with this choice and we think that also *Eohalimede granosa*, showing evident affinities with this species, must be considered as a member of the same genus. *Lobonotus sommarugai* sp. nov. has carapace a little less lengthened than *L. granosus*, anyway smaller, frontal lobes clearly separated by a

deep median notch, a smaller urogastric depression and a different structure of the protogastric regions that in *L. granosus* have a peculiar anterior depression. The new species can be differentiated also from *L. sandersi*: this last species has only two lobes on the anterolateral margins, epigastric regions lacking tubercles and anteriorly cut off; instead in the new form the epigastric regions are hemispherical in outline and decorated with some little granules; moreover the protogastric regions are anteriorly partially divided; the meso-metagastric regions are clearly wider; the epibranchial regions are more developed above all in the middle lobe. Therefore there are at least two species of *Lobonotus* A. Milne Edwards, 1863, from the Eocene of NE Italy: *L. granosus* (Beschlin, Busulini, De Angeli, Tessier, 2002) *comb. nov.* and *L. sommarugai* sp. nov. Moreover we think that also *Lobonotus* cf. *orientalis* (BUSULINI *et al.*, 1983) from the middle Eocene of “Main” quarry (Arzignano - Vicenza) could be a further species to refer to that genus (as considered also in DE ANGELI & GARASSINO, 2006).

Genus *Paronacarcinus* gen. nov.

Type species: *Paronacarcinus spinosus* sp. nov.

Etymology: *Paronacarcinus* (m.) from Parona, the village near Verona where the type material was discovered, and *carcinus* (lat.) = crab.

Diagnosis: as for type species.

***Paronacarcinus spinosus* sp. nov.**

Pl. 3, figs. 3-5

Holotype: MCZ 3097 - I.G. 336826

Paratypes: MCZ 3098, MCZ 3099, MCZ 3100, MCZ 3101, MCZ 3102, MCZ 3103, MCZ 3104, MCZ 3106.

Type locality: Parona (Verona - NE Italy)

Geological age: late Eocene.

Etymology: *spinosus* - a - um (lat.) = spiny, for the abundance of pointed tubercles on the carapace.

Material: the holotype MCZ 3097- I.G. 336826 is a carapace lacking the intestinal region. There are eight further incomplete and partially decorticated specimens (MCZ 3098 - MCZ 3104, MCZ 3106).

Measurements

MCZ 3097	W: 42.0		Holotype
MCZ 3104	W: 32,4	L: 27,4	
MCZ 3101	W: 36.2		
MCZ 3100	W: 37.0		
MCZ 3098	W: 40.0	FoW: 24.0	

Diagnosis - Carapace subhexagonal, wider than long; transversely almost flat, longitudinally weakly convex, widest in anterior half of carapace, regions well defined, dorsal surface granular. Front weakly projected, bilobed, with axial U-shaped notch. Orbits ovate, large, rimmed, with two broad, shallow notches defining a pointed upper orbital spine. Anterolateral margins convex, shorter than

posterolateral ones with four laminar sharp spines (excluding outer orbital one). Posterolateral margins gradually converging; posterior margin wide, convex, defined by a ridge.

Inflated epigastric lobes with a pointed node. Protogastric lobes broad, longitudinally incised, with two rows of spiny granules. Mesogastric region with some spiny granules in a V-shaped arrangement. Meso-metagastric region forming a lengthened subpentagonal swelling. Subpentagonal cardiac region swollen with lateral nodes. Intestinal region wide, depressed, with a weak beaded ridge. Epibranchial regions broad and swollen, with some spiny tubercles, with triangular lobe. Transverse groove dividing gastric and anterior branchial regions from cardiac and posterior branchial ones.

Description - Carapace subhexagonal in outline, wider than long, W/L about 0.80; transversely almost flat, longitudinally weakly convex; widest in anterior half of carapace, between the forth anterolateral spines; dorsal surface granular. Front weakly projected beyond orbits, divided into two lobes by an axial U-shaped notch. Orbits ovate, large, almost forward directed, rimmed, with two broad, shallow notches that define a pointed upper orbital spine and a slightly larger outer orbital one. Fronto-orbital margin about 62 - 64 per cent largest carapace width. Anterolateral margins convex, shorter than posterolateral ones with four laminar sharp spines (excluding outer orbital one); the first two are small, the third the largest, and the forth is more lengthened on the posterolateral margin. The posterolateral margins are gradually converging; posterior margin about 40 per cent maximum carapace width, convex, defined by a ridge.

Regions well defined by grooves and decorated with granules and pointed tubercles, particular evident in specimens lacking the original cuticle. Inflated epigastric lobes with a pointed node. Protogastric lobes broad, longitudinally incised with two rows of spiny granules. Mesogastric region with a narrow granular anterior process that continues to the epigastric lobes; some spiny granules in a V-shaped arrangement are present on base of the region. The meso- and the metagastric region form a lengthened subpentagonal swelling. Urogastric region depressed. Subpentagonal cardiac region swollen with lateral nodes. Intestinal region wide, depressed, with a weak beaded ridge. Hepatic region subtriangular, well defined, with some pointed tubercles. Branchial regions divided into lobes: the epibranchial one is broad and swollen, with some spiny tubercles, with a triangular lobe with base adjacent the axial gastric regions; meso-branchial lobe transversely lengthened and granular. A transverse groove across the carapace divides the gastric and anterior branchial regions from the cardiac and posterior branchial ones.

Remarks - Many brachyurans are characterized by subhexagonal carapace, wider than long, weakly vaulted, with well defined regions, wide front with median notch,

broad orbits with two fissures, anterolateral margins with spines or teeth, but the new species shows a combination of other features not observable all together in a single known genus: four pointed teeth on the anterolateral margins and protogastric regions with a longitudinal groove resemble *Titanocarcinus* A. Milne Edwards, 1863, but the pentagonal and lengthened meso-metagastric region, with a group of spiny granules in a V-shaped arrangement, a transverse groove across the carapace dividing the gastric and anterior branchial regions from the cardiac and posterior branchial ones and posterior part of the carapace depressed with a marginal ridge are similar to *Glyphithyreus* Reuss, 1859, and above all to *G. ellipticus* Bittner, 1875. So we thought to erect the new genus *Paronacarcinus* (type species *P. spinosus* sp. nov.) that has as further peculiarities the broad orbital fissures and the pointed tubercles distributed on the regions. The general outline of carapace and its features certainly resemble the Xanthoidea MacLeay, 1838, but it is difficult to refer the genus to a family because the complicated task of redefinition of the families that is carried out in the last years is based on features of sternum and abdomen, parts that are not preserved in our specimens. For its resemblance with *Titanocarcinus* we refer for the moment the genus *Paronacarcinus* gen. nov. to the Tumidocarcinidae Schweitzer, 2005, within the Carpilioidea Ortmann, 1893.

Superfamily Majoidea Samouelle, 1819
Family Majidae Samouelle, 1819
Subfamily Micromaiinae Beurlen, 1930
Genus *Mithracia* Bell, 1858

Type species: *Mithracia libinioides* Bell, 1858

***Mithracia* sp.**

Pl. 2, fig. 4

Material: one specimen (MCZ 3086) altered and lacking the front.

Remarks - The studied specimen can be referred to *Mithracia* Bell, 1858, as it has the typical features of this genus: carapace pear-shaped in outline, very convex, regions defined by grooves, the protogastric ones confluent, urogastric region narrow, cardiac region gibbous in the middle, hepatic regions projecting, branchial regions very large, rounded, dorsal ornamentation constituted of globular granules.

Only four species of *Mithracia* are known: *M. libinioides* Bell, 1858 (early Eocene - South England) (BELL, 1858); *M. hollandi* Förster & Mundlos, 1982 (late Eocene - Germany) (FÖRSTER & MUNDLOS, 1982); *M. margaritifera* Beschin, Busulini, De Angeli, Tessier, 1994 and *M. oppionii* Larghi, 2002 (middle Eocene - NE Italy). BESCHIN *et al.* (1998) besides described ?*Mithracia* sp. from the middle Lutetian of “Rossi” quarry in Monte di Malo (Vicenza - NE Italy).

The carapace from Parona is very damaged and lacks the anteriormost parts so we prefer not to define its specific

placement; anyway it resembles *M. libinioides* but above all *M. oppionii*, collected in the Lessini area as well (“Lovara” quarry of Chiampo - Vicenza) (LARGHI, 2002). In fact, apart from the not preserved frontal region, it has: carapace subcircular in outline, finely granular; well developed mesobranchial lobes and broad cardiac region; epibranchial lobes weakly defined.

The report of this specimen is a certain confirmation of the diffusion of the Majoidea Samouelle, 1819, in the area of the Lessini Mountains. In fact they are here represented by at least six species of *Micromaia* Bittner, 1875, one species of *Micippa* Leach, 1817, and two species of *Mithracia* Bell, 1858 (Majidae Samouelle, 1819), one species of *Hyastenus* White, 1847, and two species of *Periacanthus* Bittner, 1875 (Epialtidae MacLeay, 1838) (DE ANGELI & GARASSINO, 2006; DE ANGELI & BESCHIN, 2008).

Superfamily Parthenopoidea MacLeay, 1838

Family Parthenopidae MacLeay, 1838

Subfamily Parthenopinae MacLeay, 1838

Genus *Phrynotambrus* Bittner, 1893

Type species: *Phrynotambrus corallinus* Bittner, 1893

***Phrynotambrus corallinus* Bittner, 1893**

Pl. 2, figs. 5-7

1893 *Phrynotambrus corallinus* Bittner, 19, pl. 2, figs. 3.

1929 *Phrynotambrus corallinus* Bittner - Lörentz & Beurlen, 154, pl. 7, figs. 6, 7, 9, 10.

2007b “*Phrynotambrus*” *corallinus* Bittner - Beschin *et al.*, 12, fig. 2D.

Material: two quite well preserved carapaces (MCZ 1345, MCZ 3087), one fragment of the right lateral part of carapace (MCZ 3088) and one fragment corresponding to a front of large dimensions (MCZ 3089).

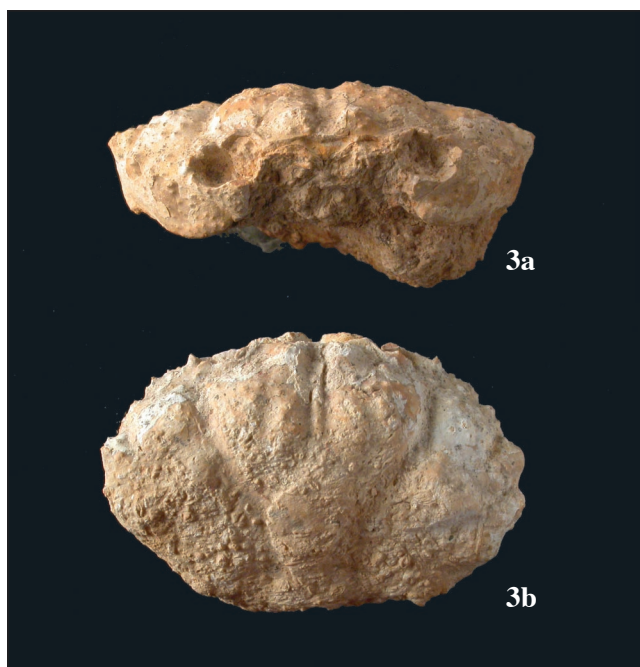
Measurements

MCZ 1345 W: 11.6 L: 10.6

Description - The carapace is small and subtriangular in outline. The dorsal regions are well defined and strongly convex. The surface is almost completely covered with little tubercles uniform in size, well distinct from each other: they appear like small pipes; a few larger tubercles are also present. The fronto-orbital margin is preserved in MCZ 3089, that represents the front of a large specimen: the frontal margin is broad and triangular, the orbital margins are longitudinal, straight and the orbits are laterally directed, semicircular, beaded; therefore the front is strongly protruding and has an almost smooth median

Plate 3 - 1. *Lobonotus sommarugai* sp. nov., es. MCZ 1344, dorsal view (x 3,2); **2.** *Lobonotus sommarugai* sp. nov., holotype, es. MCZ 3092 - I.G. 336825, dorsal view (x 2,5); **3.** *Paronacarcinus spinosus* gen. nov., sp. nov., es. 3098; a = frontal view; b = dorsal view (x 1,4); **4.** *Paronacarcinus spinosus* gen. nov., sp. nov., es. MCZ 3104, dorsal view (x 1,7); **5.** *Paronacarcinus spinosus* gen. nov., sp. nov., holotype, es. MCZ 3097 - I.G. 336826, dorsal view (x 1,4); **6.** *Phlyctenodes tuberculatus* A. Milne Edwards, 1862, es. MCZ 3107, dorsal view (x 3,2); **7.** *Palaeograpsus inflatus* Bittner, 1875, es. MCZ 2522, dorsal view (x 1,7).

PLATE 3



large depression. The anterolateral margins are strongly diverging and longer than the posterolateral ones; on each lateral angles, situated on the posterior third of carapace, there is a large projecting epibranchial spine, laterally directed. The posterior margin is broad, concave and beaded; it occupies about half the carapace greatest width. The regions are clearly defined by wide furrows and the most of them are strongly swollen. The small epigastric lobes are very apparent: they are inflated at the base of the front; the protogastric regions are large, vaulted and separated by the anterior process of the mesogastric region, whose basal width is about one ninth of the greatest carapace width: it appears flattened on the central part of the shield. The cardiac region is large, widening posteriorly, strongly convex and prominent. The hepatic regions are small, triangular, depressed. The epibranchial regions are very large, swollen and laterally developed; they bear a central large grained tubercle and a strong spine protruding from the lateral angle. The mesobranchial regions, laterally surrounding the cardiac region, are not very developed, depressed and subtriangular in shape. The posterior part of the carapace is subrectangular, wide and depressed. The inferior parts of the carapace are not preserved.

Remarks - BITTNER (1893) erected *Phrynomambrus corallinus* on the basis of the study of three specimens from the upper Eocene of Transylvania (Romania). Because of the bad preservation of the type material, the original description and the reconstructed drawing of the carapace were not completely corresponding with the true features of the species above all in the frontal and orbital regions, as pointed out afterwards by LÖRENTHEY & BEURLEN (1929) analyzing other carapaces collected in Budapest (Hungary) from levels a little older; they particularly noticed that the orbits are not opened upward, but are covered by the frontal margin and opened only sideward, as it is also in MCZ 3089.

A peculiarity that made a deep impression on the authors who dealt with this species, besides the lengthening of the branchial regions with two “lateral horns”, is the ornamentation of the shield.

As pointed out by BITTNER (1893), it is made of irregularly hexagonal small patches with diameter of about 2 mm, with lateral folds going into every patch forming small pores; therefore the carapace appears “covered with a colony of bryozoans”; where the cuticle is lacking, the shield is covered with “cylindrical bodies” erect and short or with dense “small sticks” whose vertical sides are folded in little grooves. The specimens from Parona don’t preserve the original cuticle but the tubercles covering the carapace look like partly empty small cylinders that fit with the described ornamentation pattern.

BITTNER (1893) referred this species to the Parthenopidae MacLeay, 1838, underlining its similarity with the recent genera *Parthenope* Weber, 1795, and *Lambrus* Leach, 1815 (the last one now considered synonym of *Parthenope*). LÖRENTHEY & BEURLEN (1929) noted its resemblance to *Aulacolambrus diacanthus* (De Haan,

1837), living in the seas of Japan, in the Indian Ocean and in the Red Sea but this form has frontal region more pointed and a different orbital structure. Because of the peculiarities of the ornamentation, GUINOT (1967, 1978, 1979) pointed out the presumed relationship between *Phrynomambrus* and the genus *Dairoides* Stebbing, 1920 (STEBBING, 1920), that has also similar shape of the shield and course of the longitudinal grooves, and with *Daira* De Haan, 1833, too. In the living *Dairoides margaritatus* Stebbing, 1920, *Daira perlata* (Herbst, 1790) (HERBST, 1782-1804) and *D. americana* Stimpson, 1860, the outer surface of the carapace is made of patches more or less conical, subhexagonal in shape with pores: each patch is sustained by a stalk and remembers a mushroom with petaloid cap. Guinot thinks that the ornamentation observed in *P. corallinus* could have had similar features and that the stick-shaped structures described by Bittner should be related to the stalk of the “mushrooms” whose tops had been abraded. As in the recent species these structures should have been related with the circulation of the water entering through the pores in little ducts among the stalks to the base of the pereopods and the branchial openings; so they shouldn’t be associated with camouflage or with bristles as LÖRENTHEY & BEURLEN (1929) supposed. In Guinot’s opinion, different evolutionary branches would be developed and differentiated from a common ancestor: one branch is represented by the recent Parthenopidae and would be related also to *Phrynomambrus* and *Dairoides*; the second one, already differentiated during Eocene, would be associated to *Daira*; the third one would have originated some group within the Xanthoidea.

GLAESSNER (1969) considered *Phrynomambrus* synonym of *Parthenope* (*Pseudolambrus*) Paulson, 1875, but the structure of the fronto-orbital margin and the peculiarity of the ornamentation and the consequent phylogenetic relationships as expressed by Guinot induce us to consider *Phrynomambrus* as a valid genus.

Another species of *Phrynomambrus* has been recently reported from outcrops of NE Italy: it is *P. italicus* De Angeli & Beschin, 2008, from the lower Oligocene of the Berici Hills (Vicenza): its peculiarities are the very broad and smooth grooves defining the mesogastric, cardiac and intestinal regions.

One third form was referred to *Phrynomambrus*: we are speaking about *P. weinfurteri* Bachmayer, 1953 from Miocene of Austria (BACHMAYER, 1953); this small species is very different from the type species in outline, subdivision and ornamentation of the shield; so we agree with GUINOT (1979) in thinking that it should be ascribed to a different genus. MÜLLER (1984) considers *P. weinfurteri* synonym of *Micippa hungarica* (Lörenthey & Beurlen, 1929) but the preservation of the holotype makes it difficult to accept this choice.

Occurrences - *Phrynomambrus corallinus* is reported from the upper Eocene of Romania, Hungary and Veneto (NE Italy) (BITTNER, 1893, LÖRENTHEY & BEURLEN, 1929).

Superfamily Xanthoidea MacLeay, 1838
Family Panopeidae Ortmann, 1893
Subfamily Eucratopsinae Stimpson, 1871
Genus *Palaeograpsus* Bittner, 1875
Type species: *Palaeograpsus inflatus* Bittner, 1875

***Palaeograpsus inflatus* Bittner, 1875**
Pl. 3, fig. 7

1875 *Palaeograpsus inflatus* Bittner, 100, pl. 2, figs. 11 a,b.
1910a *Palaeograpsus inflatus* Bittner - Fabiani, 12, 28, pl. 2, figs. 5, 6.
1929 *Palaeograpsus inflatus* Bittner - Lörenthey & Beurlen, 254, pl. 16, fig. 2.
1994 *Palaeograpsus inflatus* Bittner - Beschin *et al.*, 194, pl. 9, fig. 5.
1995 *Palaeograpsus inflatus* Bittner - De Angeli, 16, text fig. 3(2-4), pl. 2, figs. 2-4.
1998 *Palaeograpsus inflatus* Bittner - Beschin *et al.*, 30, text fig. 16.1.
2001 *Palaeograpsus inflatus* Bittner - De Angeli & Beschin, 38.
2004 *Palaeograpsus inflatus* Bittner - Beschin & De Angeli, 21.
2004 *Palaeograpsus inflatus* Bittner - Schweitzer & Karasawa, 80.
2006 *Palaeograpsus inflatus* Bittner - De Angeli & Garassino, 69.
2007b *Palaeograpsus inflatus* Bittner - Beschin *et al.*, 12, fig. 2F.

Material and measurements: one carapace (MCZ 2522 W: 25.7 L: 22.4 FoW: 15.7).

Remarks - The sole specimen is only partially preserved but the equant carapace, with little spines on the antero-lateral margins, epibranchial lobes swollen forming with part of the metagastric region a continuous ridge across the shield, protogastric, cardiac and mesobranchial regions inflated, intestinal region flattened, allow to refer it to *Palaeograpsus inflatus* Bittner, 1875.

BITTNER (1875) included *Palaeograpsus* within the Grapsidae MacLeay, 1838, for its similarity with the extant *Varuna* H. Milne Edwards, 1830, and *Pseudograpsus* H. Milne Edwards, 1837; KARASAWA & KATO (2001, 2003) and SCHWEITZER & KARASAWA (2004) discussed the systematic position of the genus: now it is attributed to the Panopeidae Ortmann, 1893, subfamily Eucratopsinae Stimpson, 1871 (STIMPSON, 1871) for the male abdominal somites 1 and 2 not covering the entire space between the fifth pereopod as visible in specimens described by DE ANGELI (1995).

Occurrences - The species is known from the middle and upper Eocene of Veneto (Vicenza and Verona territory) (BITTNER, 1875, FABIANI, 1910a, BESCHIN *et al.*, 1994, 1998, DE ANGELI, 1995) and Hungary (LÖRENTHEY & BEURLIN, 1929).

Family Xanthidae MacLeay, 1838
Subfamily Actaeinae Alcock, 1898
Genus *Phlyctenodes* A. Milne Edwards, 1862
Type species: *Phlyctenodes tuberculosus* A. Milne Edwards, 1862

***Phlyctenodes tuberculosus* A. Milne Edwards, 1862**
Pl. 3, fig. 6

1862 *Phlyctenodes tuberculosus* A. Milne Edwards, 193, pl. 7, fig. 2.
2006 *Phlyctenodes tuberculosus* A. Milne Edwards - Busulini *et al.*, 353, figs. 2.1 - 2.3.

Material and measurements: one well preserved carapace (MCZ 3107 W: 12.0 L: 8.0).

Remarks - *Phlyctenodes tuberculosus* A. Milne Edwards, 1862, type species of the genus, is characterized by an ovate carapace longitudinally vaulted with hardly defined regions and isolated large tubercles on the anterior and lateral parts, smaller on the axial ones; wide frontal margin with four tubercle-like teeth (excluding inner orbital spines); orbits rimmed without upper orbital fissures; anterolateral margins with five tubercle-like spines; four longitudinally subparallel rows of four tubercles on the intraorbital regions; one small tubercle on each antero-lateral angle of the mesogastric region; two series of four tubercles concentric to the anterolateral margins; lateral angle situated on the posterior quarter of the shield; transverse rows of small tubercles forming a little lateral dorsal ridge beginning from the lateral angles; posterior branchial and cardiac regions almost smooth.

The systematic position of the genus *Phlyctenodes* A. Milne Edwards, 1862, has been recently discussed in BUSULINI *et al.* (2006). In the same work *P. tuberculosus* A. Milne Edwards, 1862, was recorded from upper Eocene levels in Veneto for the first time (San Feliciano - Vicenza). It was previously known only with the holotype discovered near Hastings (Landes - France) in "terrain nummulitique" (probably middle Eocene) (A. MILNE EDWARDS, 1862).

The genus *Phlyctenodes* in Veneto levels is represented also by: *P. nicolisi* Bittner, 1884 of middle Eocene, *P. steinmanni* Lörenthey, 1902, of middle and late Eocene (LÖRENTHEY, 1902), *P. dalpiazzi* Fabiani, 1911, and *P. krenneri* Lörenthey, 1898, of late Eocene (LÖRENTHEY, 1898).

Occurrence - The species is known from the middle Eocene of SW France and the upper Eocene of Veneto - NE Italy (A. MILNE EDWARDS, 1862, BUSULINI *et al.*, 2006).

DISCUSSION

The studied crustacean fauna found in the Priabonan levels at Parona (Verona) consist of 64 carapaces and 7 propodi of chelipeds. Only one species within the anomurans has been found: *?Xylopagurus* sp. (Paguridae Latreille, 1802) is probably the first report in the fossil record of this genus whose representatives live in the west tropical Pacific and the Caribbean inside tunnels drilled in small branches deposited on the sea floor, a habitat unsuited to preservation. Ten genera and species within eight brachyuran families have been recognized: *Kromtitis bicuspidatus* sp.

nov., *Noetlingia veronensis* (Bittner, 1886) (Dromiidae De Haan, 1833), *Lophoranina laevifrons* (Bittner, 1875) (Raninidae de Haan, 1839); *Calappilia dacica* Bittner, 1893 (Calappidae De Haan, 1833), *Lobonotus sommarugai* sp. nov., *Paronacarcinus spinosus* gen. nov., sp. nov. (Tumidocarcinidae Schweitzer, 2005), *Mithracia* sp. (Majidae Samouelle, 1819), *Phrynolambrus corallinus* Bittner, 1893 (Parthenopidae MacLeay, 1838), *Palaeograpsus inflatus* Bittner, 1875 (Panopeidae, Ortmann 1893), *Phlyctenodes tuberculosus* A. Milne Edwards, 1863 (Xanthidae MacLeay, 1838).

Species with different habits are present in this fossil association and probably some specimens were carried to the deposition basin from the surrounding areas together with significant terrigenous supplies and limestone nodules; this dynamic situation can partially justify the bad state of preservation of the fossil remains whose original cuticle is often altered and appears dusty.

The most abundant species, represented by even 24 carapaces, is *Calappilia dacica*. *Calappilia dacica* and *Phrynolambrus corallinus* were found together also in the Bryozoan Marls of Transylvania (Romania) and these two species and representatives of the burial *Lophoranina* Fabiani, 1910, are important members of the decapod assemblage of the Discocyclinid Limestone of the upper Eocene of Budapest (Hungary) (BITTNER, 1893, LÖRENTHEY & BEURLIN, 1929, MÜLLER & COLLINS, 1991); the wide spread of these species is a consequence of the connection between the western seas of the Northern Peri-Tethys and the Carpatho-Pannonian basin during the late Eocene; moreover the presence of *Calappilia dacica* in coeval sediments of the Great Britain too (QUAYLE & COLLINS, 1981) testifies a connection also between the Tethys and the North Sea

basin (DERCOURT *et al.*, 2000). At the same time it is probable the presence of endemism such as *Noetlingia veronensis*, a species known only for the upper Eocene of Veneto. The presence of representatives of *Kromtitis* Müller, 1984, *Lobonotus* A. Milne Edwards, 1863, *Paronacarcinus* gen. nov. and *Phlyctenodes* A. Milne Edwards, 1862, some of them with a relevant number of specimens, appears typical of coral-associated faunas. *Kromtitis bicuspidatus* sp. nov. confirms the wide spread of the genus in Eocene sediments of Veneto suggesting that this taxon could have been appeared and differentiated in coral bearing reef-like communities of the western Peri-Tethys. The presence of this kind of environment in the studied area during the Priabonian is corroborated by the discovery of a carapace of *Phlyctenodes tuberculosus* in one of the well crystallized limestone nodules constituting part of the fossil bearing Parona level. *Lobonotus sommarugai* sp. nov. and also *L. granosus* (Beschin, Busulini, De Angeli, Tessier, 2002) comb. nov., confirm the presence of *Lobonotus*, usually considered an American taxon, in European outcrops during the Eocene.

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