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Loerenthopluma Beschin, Busulini, De Angeli & Tessier, 1996
(Decapoda, Brachyura, Retroplumidae)
from the Oligocene of Hungary

Abstract - New material of *Loerenthopluma lata* Beschin, Busulini, De Angeli & Tessier, 1996 (Retroplumidae Gill, 1894) is reported from Oligocene strata of Hungary, extending both the stratigraphic and geographical distribution of the genus. Preservation of pereopods and eye stalks provides new information on the appearance of the animal.

Key words: Decapoda, Retroplumidae, Oligocene, Hungary.

Riassunto - *Loerenthopluma* Beschin, Busulini, De Angeli, & Tessier, 1996 (Decapoda, Brachyura, Retroplumidae) dell'Oligocene dell'Ungheria.

Nuovo materiale di *Loerenthopluma lata* Beschin, Busulini, De Angeli & Tessier, 1996 (Retroplumidae Gill, 1894) è segnalato nell'Oligocene dell'Ungheria, incrementando la distribuzione stratigrafica e geografica del genere. La conservazione dei pereopodi e dei peduncoli oculari fornisce nuove informazioni sull'anatomia dell'animale.

Parole chiave: Decapoda, Retroplumidae, Oligocene, Ungheria.

Introduction

The Retroplumidae Gill, 1894 is a relatively small deep-water family of brachyuran crabs. The family consists of eight genera, of which six are exclusively fossil (De Grave *et al.*, 2009). A diagnosis of the family, including the fossil record, has been published by Schweitzer & Feldmann (2001). The taxonomic position to the extinct genera was discussed by de Saint Laurent (1989), Vega & Feldmann (1992), Beschin *et al.* (1996), Schweitzer & Feldmann (2001), McLay (2006), Feldmann & Portell (2007) and Armstrong *et al.* (2009). The oldest representative of the family is considered to be the genus *Archaeopus* Rathbun, 1908 known from Upper Cretaceous rocks of North America and Japan (Schweitzer &

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Feldmann, 2001). According to Vega & Feldmann (1992; p. 148) *Archaeopus* gave rise to *Costacopluma* Collins & Morris, 1975, whose stratigraphic span extends from the Upper Cretaceous to the Eocene. However, there is no general agreement about the placement of *Archaeopus* within Retroplumidae (see e.g. Glaessner, 1969; McLay, 2006).

From cenozoic strata of Europe, several fossil genera of retroplumid crabs are known namely *Loerenthopluma* Beschin, Busulini, De Angeli, & Tessier, 1996, *Loerentheyia*, Lörenthey in Lörenthey & Beurlen, 1929, *Retrocypoda* Vía Boada, 1959, and *Retropluma* Gill, 1894.

Today, the family is represented by only two genera occurring in the Indo-Pacific region, *Retropluma* and *Bathypluma* de Saint Laurent, 1989, which have been reported from muddy or sandy bottoms spanning the depth from 50 to 600 m (de Saint Laurent, 1989; McLay, 2006). The fossil record of Retroplumidae is similarly restricted to fine siliciclastic rocks (Schweitzer *et al.*, 2002; p. 30).

Geological setting

The material described here is recovered from a borehole Mány-115 (Má 115), obtained ca. 2 km northwest of the village Mány in northern Hungary (Fig. 1). The borehole is built on Mány Formation, which is covered discordantly by Miocene (Sarmatian) or younger sediments (Anonymous, 1977). The Mány Formation itself is comprised mainly of alternating calcareous silt, argillaceous silt, sand and sandstone, with conglomerate coal stringers and variegated clay intercalations (Nagymarosy & Gyalog in Császár, 1997). According to Báldi (1983) the Mány Formation is of lower Egerian age (upper Oligocene), however, the recent revisions (Gyalog & Budai, 2004) demonstrated both Egerian and Kiscellian age of the Mány Formation.

The borehole Má 115 was drilled to the depth of nearly 400 m. The cores were drilled from the depth 316.3 m. The strata of Oligocene age extending from the depth 110.8 to 393.6 m are overlaid by Sarmatian (upper Miocene) sediments. Below the depth 393.6 m deposits of Eocene age occur (Anonymous, 1977).

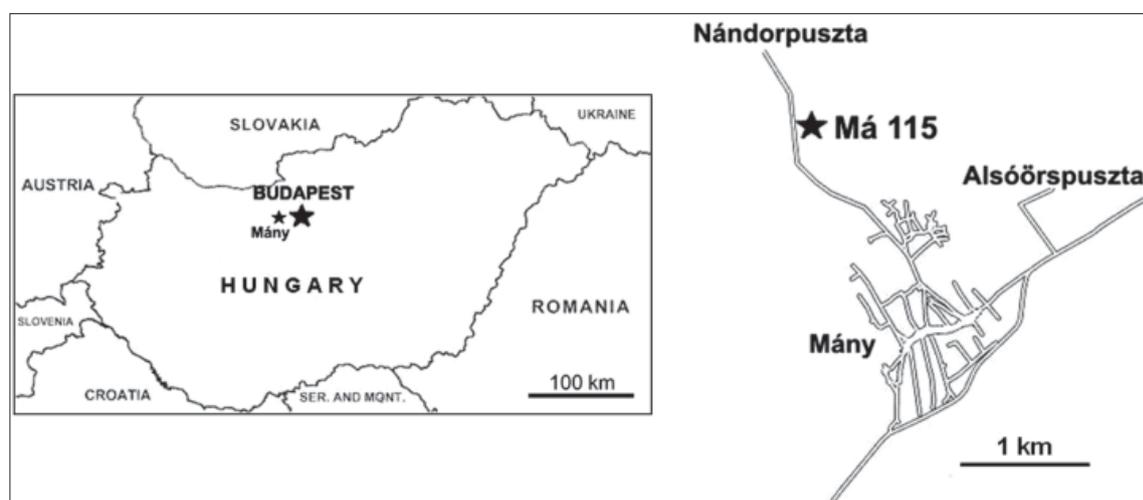


Fig. 1 - Geographic position of the bore-hole Má 115. / Posizione geografica del pozzo di trivellazione Má 115.

The studied specimen was recovered in the depth interval of 372.5 - 375.8 m, thus, it is of Oligocene age. It comes from the strata where also large milioline foraminifera occur. This part of the section is very close to the Eocene succession, but there may be unconformity between the Eocene and Oligocene strata (I. Selmeczi, pers. comm. 2010), therefore more data are needed for the precise age determination.

Systematic Palaeontology

Order Decapoda Latreille, 1802
 Infraorder Brachyura Linnaeus, 1758
 Section Eubrachyura de Saint Laurent, 1980
 Superfamily Retroplumoidea Gill, 1894
 Family Retroplumidae Gill, 1894

Type Genus: *Retropluma* Gill, 1894

According De Grave *et al.* (2009) there are eight genera of the family Retroplumidae known. Their stratigraphic range and geographical distribution is summarized in Table 1.

De Saint Laurent (1989) argued for the distinction between two lineages of retroplumid crabs, elevating Retroplumidae to superfamilial level and designating a separate family Costacoplumidae to embrace *Costacopluma*, *Retrocypoda* and other Western Hemisphere genera described before the year 1989. She con-

Table 1 - Genera of the Retroplumidae Gill, 1894: their stratigraphic range and geographical distribution. / Generi appartenenti a Retroplumidae Gill, 1894: distribuzione stratigrafica e geografica.

Genus	Stratigraphic range	Geographic occurrences
<i>Archaeopus</i> Rathbun, 1908	Turonian - late Eocene	Canada, USA, Japan
<i>Costacopluma</i> Collins & Morris, 1975	Coniacian - early/middle Eocene	both Americas, W. Africa, India
<i>Cristipluma</i> Bishop, 1983	Maastrichtian	USA
<i>Retropluma</i> Gill, 1894	early Eocene - Holocene	Europe; Japan, Indo-Pacific
<i>Retrocypoda</i> Via Boada, 1959	middle Eocene	Spain, Italy
<i>Loerentheyia</i> Lörenthey in Lörenthey & Beurlen, 1929	middle Eocene	Hungary
<i>Loerenthopluma</i> Beschin <i>et al.</i> , 1996	early Eocene - Oligocene	Belgium, Italy, Hungary (this paper)
<i>Bathypluma</i> de Saint Laurent, 1989	Holocene	Indo-Pacific

sidered Retroplumidae *s.s.* as embracing only the extant genera *Retropluma* and *Bathypluma*. Feldmann *et al.* (2006) re-examined all fossil genera referred to Retroplumoidea together with extant *Retropluma* and through documenting characters of the dorsal and ventral carapace and the abdomen, they concluded that no clear familial distinctions could be made. Their opinion in retaining the Retroplumidae as a discrete taxon embracing all eight genera was followed by De Grave *et al.* (2009) and is followed here as well. It should be mentioned, however, that McLay (2006) suggested *Archaeopus* might be a member of Palicidae Bouvier, 1898 (McLay, 2006; tab. 3) or a new family (McLay, 2006; p. 387). McLay also contested the placement of members of *Costacopluma* within Retroplumidae, arguing that not all of them comply with the definition of the Retroplumidae *sensu* de Saint Laurent (1989). Considering these inconsistencies in the opinions is beyond the scope of this paper.

Genus *Loerenthopluma* Beschin, Busulini, De Angeli, & Tessier, 1996

Type species: *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996, p. 89, fig. 3; T. 1, fig. 1, by original designation.

Included other species: *Loerenthopluma* sp. nov. van Bakel, Artal, Fraaije, & Jagt, in press.

Diagnosis: The diagnosis of the genus was recently emended by van Bakel *et al.* (in press).

Remarks: The species *Loerenthopluma lata* was described for the first time from the middle Eocene (Lutetian) of northern Italy ("Rossi" quarry of Monte di Malo, Vicenza) on the basis of two specimens; features of the dorsal carapace, venter, and chelipeds were described (Beschin *et al.*, 1996). These authors noted its superficial similarity to *Loerentheyia carinata* Beurlen in Lörenthey and Beurlen, 1929, known only from a single specimen from Hungary, which is considered to be lost (for details see Beschin *et al.*, 1996; p. 89). *Loerenthopluma* shows morphological affinities to the extant genera *Retropluma* and *Bathypluma* (Beschin *et al.*, 1996; van Bakel *et al.*, in press). *Loerenthopluma* has, however, long ocular peduncles (this paper) unlike the short ones in *Retropluma* and *Bathypluma*.

The presence of the genus *Loerenthopluma* in the Oligocene strata of Hungary (this paper) could speak for synonymization of the genera *Loerentheyia* and *Loerenthopluma*. One should be aware of the incongruence between the description of *Loerentheyia carinata* and its figure (Lörenthey and Beurlen, 1929; p. 388, fig. 49); therefore, the conclusions made upon the figured sketch, which is of poor quality, should be considered as doubtful. For example, the frontal margin mentioned in the description as slightly S-shaped (characteristic also for *Loerenthopluma*) is figured as almost straight. However, without reexamination of the lost type material of *Loerentheyia* further conclusions are not possible, and therefore retaining both above mentioned genera seems to be the wisest at the moment.

Recently the second species of *Loerenthopluma* was described as *L.* sp. nov. from lower Eocene (Ypresian) strata of northwest Belgium (van Bakel *et al.*, in press).

The genus *Loerenthopluma* is known from the early Eocene to Oligocene of Europe.

Loerenthopluma lata Beschin, Busulini, De Angeli, & Tessier, 1996
Figs. 2-6

- 1996 *Loerenthopluma lata* – Beschin, Busulini, De Angeli, & Tessier, p. 89, text-fig. 3, Pl. 1 (Fig. 1)
 1998 *Loerenthopluma lata* – Beschin, Busulini, De Angeli, Tessier, & Ungaro, p. 31, text-figs 15 (4), 17
 2000 *Loerenthopluma lata* – Beschin, De Angeli & Alberti, p. 15
 2001 *Loerenthopluma lata* – De Angeli & Beschin, p. 28, text-fig. 21 (1)
 2006 *Loerenthopluma lata* – De Angeli & Garassino, p. 52
 2006 *Loerenthopluma lata* – McLay, p. 387, 388
 in press *Loerenthopluma lata* – van Bakel, Artal, Fraaije, & Jagt

Emended diagnosis: Carapace subrectangular in outline, flat; front very narrow with a small triangular rostrum; orbitofrontal margin very wide, distinctly sinuous, ending with a tooth directed forward; ocular peduncles long; carapace with three transverse ridges: two ridges almost parallel, and one in median position, oblique, sinuous, and divided into three parts; sternum wide; female abdomen triangular, with all segments free, carinate in median part, sixth with concave lateral margins,

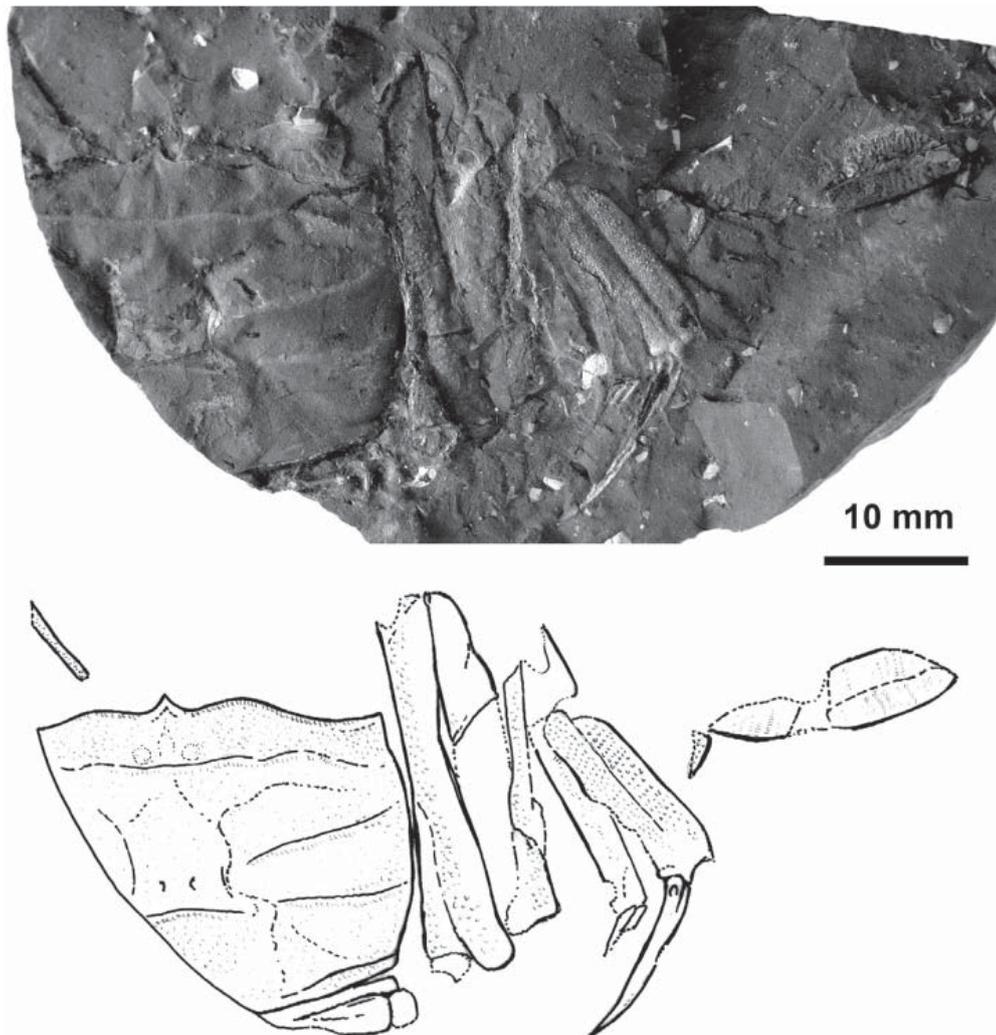


Fig. 2 - *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; part of M 2010.1.1: photo and line drawing. The specimen was whitened with ammonium chloride. / *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; parte di M 2010.1.1: foto e disegno al tratto. L'esemplare è stato trattato con cloride d'ammonio.

enlarging posteriorly, telson rounded; merus of first pereopod elongate, cylindrical; carpus small, rounded; propodus elongate, compressed laterally, fixed finger well developed; dactylus elongate; walking pereopods long and slender; meri very long; dactyli slender with pointed tips.

Material: The described specimen is preserved within a well core and consists of a nearly complete dorsal carapace, whose left posterolateral margin is sawn off, and remains of the pereopods and eye stalks (Figs. 2-4). The specimen is deposited in the Hungarian Natural History Museum in Budapest under the catalogue number M 2010.1.1.

Description: Carapace rectangular, wider than long, width equals 1.36 times the length including rostrum, weakly convex longitudinally, almost flat in transverse section; carapace with three transverse ridges, the maximum width situated at the medial ridge. Rostrum short, narrow, and triangular. Anterior margin very wide, sinuous, with broad, rounded supra-orbital projection. Anterolateral tooth well developed. Anterolateral margin slightly concave, posterolateral margin weakly convex. Frontal margin and lateral margins with fine denticulation. Posterior margin as wide as orbitofrontal margin, rimmed, convex.

Dorsal surface of carapace dominated by three sharp-crested, finely granulated transverse ridges. Anterior ridge almost parallel to the anterior margin, crossing the entire dorsal surface. Median ridge oblique, slightly sinuous, well developed at the lateral flanks only. Posterior ridge almost parallel to the anterior one, located in the

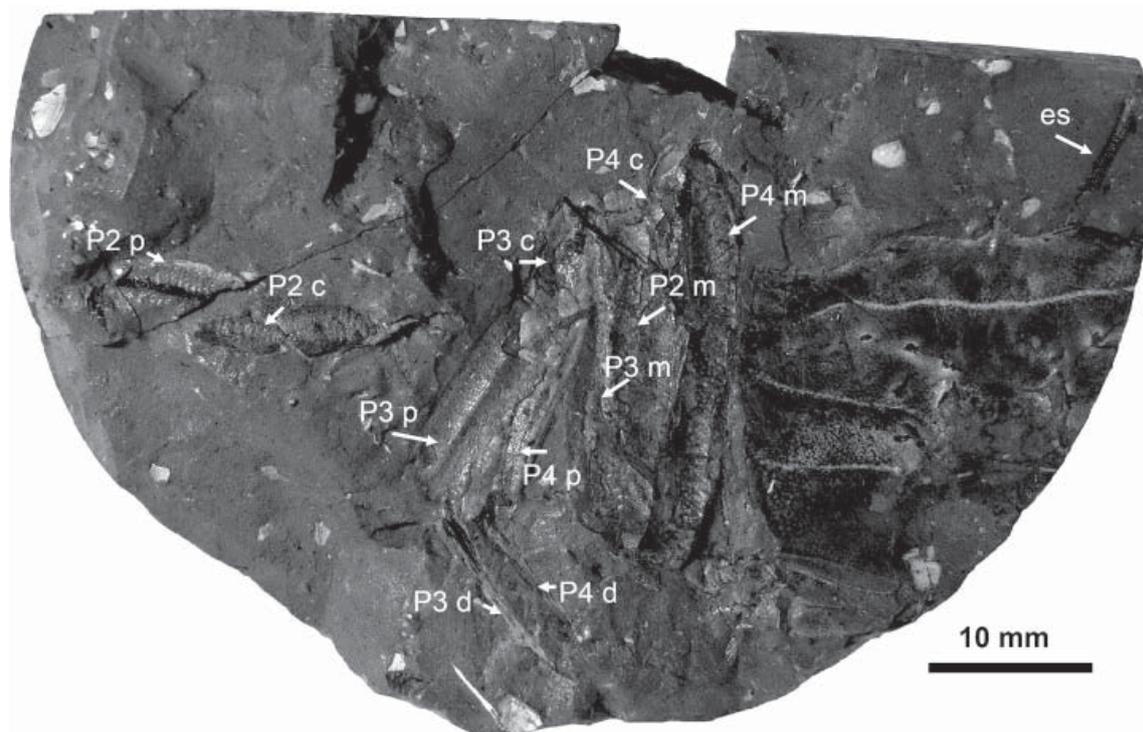


Fig. 3 - *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; counterpart of M 2010.1.1, note the eye stalk (es) in upper right corner of the fossil. / *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; controimpronta di M 2010.1.1, si noti il peduncolo oculare (es) nell'angolo superiore destro del fossile.

Abbreviations: P2-P4, second to fourth pereopods; m, merus; c, carpus; p, propodus; d, dactylus; es, eyestalk. / Abbreviazioni: P2-P4, dal secondo al quarto pereopode; m, merus; c, carpus; p, propodus; d, dactylus; es, peduncolo oculare.

posterior regions, divided by cardio-branchial grooves into three parts, the middle one being oriented more posteriorly.

Entire surface of carapace finely granulated, regions weakly marked; cervical groove located in the depression between anterior ridge and median ridge, dividing the gastric regions from branchial ones. Mesogastric region with two blunt tubercles; urogastric region with two parallel gastric pits.

Eye stalks very long, the preserved portion being one fourth of the carapace width, finely granulated. No other details discernible.

All pereopod segments granulated, merus of 2nd to 4th pereopods being the longest, dactyli long, slender and sharp-tipped.

Chelipeds, venter, and abdomen unknown in present specimen.

Measurements: Maximum carapace width of the specimen: 24.5 mm (33.2 mm after reconstruction; see Fig. 5); maximum carapace length: 23 mm (24 mm after reconstruction); length of the preserved part of the eye stalk: 8 mm.

Occurrence: The species was known only from the middle Eocene (Lutetian) of northern Italy (Beschin *et al.*, 1996). The present report from Hungary extends slightly the geographic distribution and stratigraphic range of the species as well. Thus, the species is known from the middle Eocene to Oligocene of Europe.

Discussion: There is a minor difference between the material from Italy (Beschin *et al.*, 1996) and material presented herein: The W/L (without rostrum) ratio in the Hungarian specimen is 1.48, in the Italian 1.53. The Italian specimen is relatively wider. The arrangement of ridges and form of the fronto-orbital margin in the present material are the same as in the Italian specimens. We consider the differences as intraspecific variation.

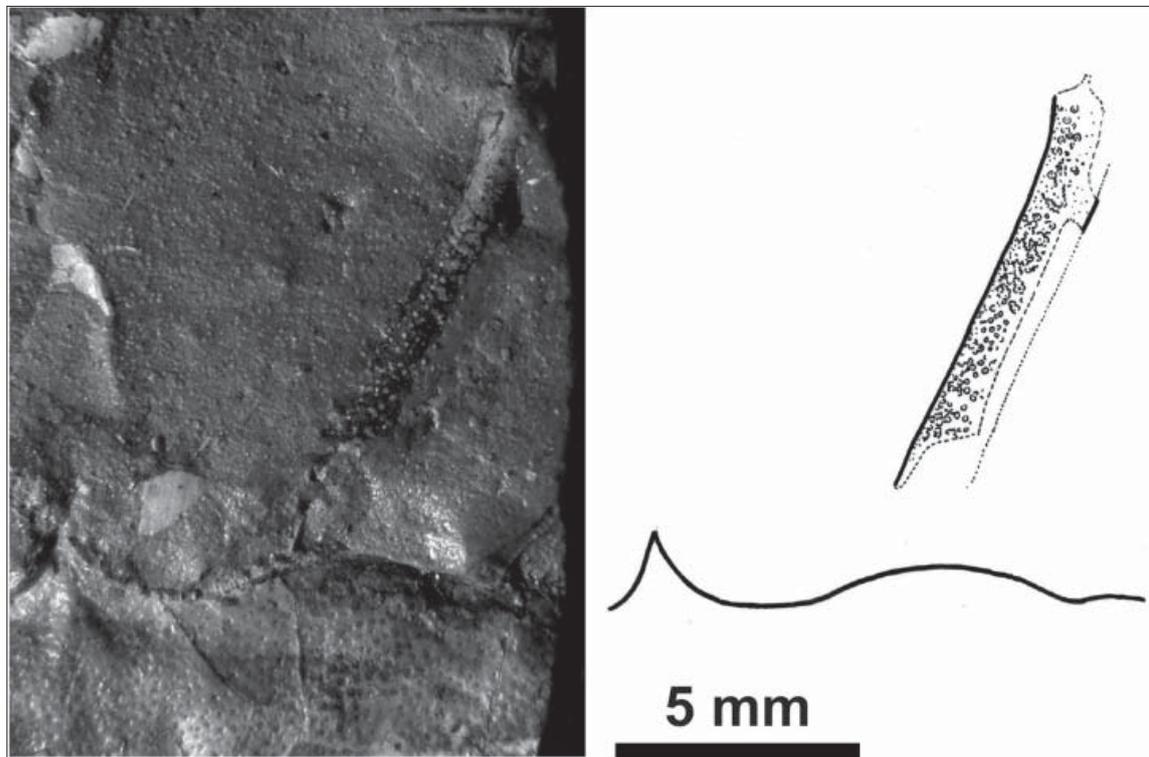


Fig. 4 - Detail of the eye stalk of *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; counterpart of M 2010.1.1. / Dettaglio del peduncolo oculare di *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; controimpronta di M 2010.1.1.

Loerenthopluma lata can be differentiated from *Loerenthopluma* sp. nov. mainly in having the greatest carapace width more anteriorly, less prominent outer orbital corners and a narrower base of the rostrum (van Bakel *et al.*, in press). The rostrum of *L. lata* is triangular in shape, whereas that of *L. sp. nov.* is distinctly spatulate. van Bakel *et al.* (in press) mentioned also the presence of gastric pits in *L. sp. nov.* as a possible additional differentiating character. The gastric pits are, however, present in the Hungarian material.

The present material exhibits some features of the genus *Loerenthopluma* which were previously unknown, namely the eye stalks and walking pereopods. The type material (holotype MCZ 1476 and paratype MCZ 1477) exhibits the chelipeds and venter (Beschin *et al.*, 1996; fig. 3). The material of *Loerenthopluma* sp. nov. exhibits proximal parts of walking pereopods and also portions of the fifth pair of pereopods (van Bakel *et al.*, in press).

Based on the material from Italy and Hungary, it is possible to reconstruct the overall morphology of *Loerenthopluma lata* (Fig. 6).

The resemblance of some carapace features of *Loerenthopluma* to *Retropluma* was previously mentioned by Beschin *et al.* (1996) and van Bakel *et al.* (in press). Present material gives some more evidence for close morphological relationship between these two genera. The morphology of pereopods of *Loerenthopluma* is very similar to that of *Retropluma*. Therefore, the unknown fifth pair of pereopods of *Loerenthopluma lata* in Fig. 6 is reconstructed mostly on the basis of the genus *Retropluma*.



Fig. 5 - The carapace of *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; left part of the reconstruction is mirror image. / Carapace di *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; la parte sinistra del carapace è un'immagine speculare.

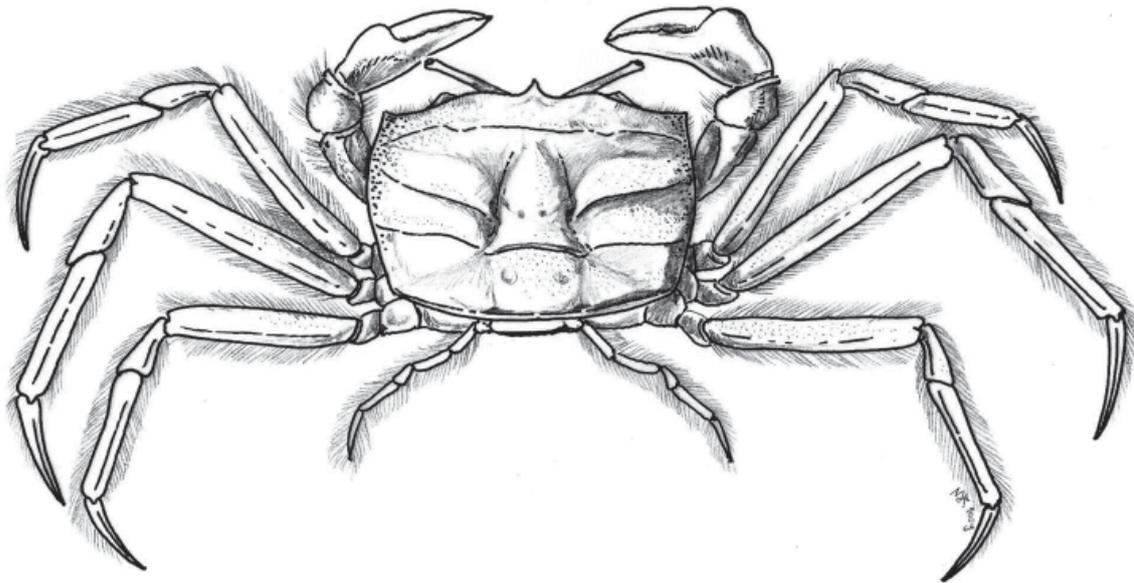


Fig. 6 - Reconstruction of *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; the fifth pair of pereiopods is reconstructed on the basis of the genus *Retropluma* Gill, 1847. / Ricostruzione di *Loerenthopluma lata* Beschin, Busulini, De Angeli, & Tessier, 1996; il quinto paio di pereiopodi è stato ricostruito basandosi sul genere *Retropluma* Gill, 1847.

Notes on palaeobiogeography and palaeoecology of retroplumids

The retroplumids known from Eocene strata show considerable generic diversity. From eight known genera, five have Eocene occurrences: *Costacopluma*, *Loerentheyia*, *Loerenthopluma*, *Retrocypoda* and *Retropluma*. The Eocene has been considered as a time of high evolution and low extinction rates within the Decapoda (Schweitzer, 2001; Feldmann & Schweitzer, 2006). It is also significant that many taxa which evolved during this period were endemic to their regions of origin (Feldmann & Schweitzer, 2006). This can be postulated also for the retroplumids *Retrocypoda*, *Loerentheyia* and *Loerenthopluma*, which are genera known exclusively from Eocene or Oligocene strata of Spain, Hungary, Italy, and Belgium (Vía Boada, 1959; Lörenthey & Beurlen, 1929; Beschin *et al.*, 1996; van Bakel *et al.*, in press; this paper).

The genera *Loerenthopluma* and *Retropluma* appear to have originated at the beginning of the Eocene in southern Europe. The genus *Loerenthopluma* with its oldest occurrence from the Ypresian (lower Eocene) of northwest Belgium (van Bakel *et al.*, in press) persisted in Europe at least until Oligocene time (this paper). The oldest known occurrence of *Retropluma* is *R. gallica* Artal, van Bakel, & Castillo, 2006, reported from the Ilerdian (lower Eocene) of southern France (Artal *et al.*, 2006). The genus persisted in Europe at least until the late Miocene (Fraaije *et al.*, 2005). The genus is today represented by seven species (Ng *et al.*, 2008) of Indo-Pacific and North-Western Pacific distribution (McLay, 2006).

Concerning the presence of *Costacopluma* in the rocks of Eocene age, it is the youngest record of the otherwise quite well known genus occurring during the Upper Cretaceous and Paleocene times (Feldmann & Portell, 2007; Armstrong *et al.*, 2009).

Considering the palaeobiogeography of the entire Retroplumidae is beyond the scope of this paper and will be discussed elsewhere.

Artal *et al.* (2006) discussed ecological preferences of both fossil and extant members of *Retropluma* and concluded they have always been adapted to the soft bottoms on inner to outer continental shelves. It seems that *Loerenthopluma* had similar preferences. Beschin *et al.* (1996) reported two specimens from Cava Rossi di Monte di Malo (NE Italy), which is considered to represent rather shallow water facies with soft muddy/sandy bottom (Beschin *et al.*, 1998). Present material of *L. lata* is preserved within the layer of fine clay material with presence of bivalves and large foraminifers.

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