



Alessandro Garassino
Günter Schweigert
Giuseppe Muscio

**ACANTHOCHIRANA TRIASSICA N. SP.
AND ANTRIMPOS COLETTI N. SP.
(DECAPODA: AEGERIDAE, PENAEIDAE)
FROM THE UPPER TRIASSIC (NORIAN)
OF NORTHERN CARNIC PRE-ALPS
(UDINE, NORTHEASTERN ITALY)**

**ACANTHOCHIRANA TRIASSICA N. SP. E ANTRIMPOS
COLETTI N. SP. (DECAPODA: AEGERIDAE, PENAEIDAE) DAL
TRIASSICO SUPERIORE (NORICO) DELLA PREALPI CARNICHE
SETTENTRIONALI (UDINE, ITALIA NORDORIENTALE)**

Riassunto breve - I crostacei decapodi del Triassico superiore (Norico) della Dolomia di Forni sono stati descritti da GARASSINO et al. (1996). La recente scoperta di un piccolo campione, rivenuto nella Valle del Rio Seazza e in quella del Rio Rovadia, ha permesso un aggiornamento relativo ai crostacei decapodi delle Prealpi Carniche. Gli esemplari studiati sono stati assegnati a *Acanthochirana triassica* n. sp. (Aegeridae BURKENROAD, 1963) e *Antrimpos colettoi* n. sp. (Penaeidae RAFINESQUE, 1815). *Acanthochirana triassica* n. sp. estende il range stratigrafico di questo genere nel Triassico superiore, mentre *Antrimpos colettoi* n. sp. rappresenta la seconda specie di questo genere segnalata nel Triassico superiore d'Italia. La scoperta di queste due nuove specie incrementa il numero delle specie di peneidi conosciuti nel Norico dell'alta Val Tagliamento (Prealpi Carniche settentrionali).

Parole chiave: Crustacea, Decapoda, Aegeridae, Penaeidae, Triassico superiore, Prealpi Carniche.

Abstract - The decapod crustaceans from the Upper Triassic (Norian) of the Dolomia di Forni Formation were reported by GARASSINO et al. (1996). The recent discovery of a small sample from this Formation between Seazza and Rovadia brooks allowed updating the decapod assemblages from the Norian of Carnic Pre-Alps. The studied specimens have been assigned to *Acanthochirana triassica* n. sp. (Aegeridae BURKENROAD, 1963) and *Antrimpos colettoi* n. sp. (Penaeidae RAFINESQUE, 1815). *Acanthochirana triassica* n. sp. expands the stratigraphic range of this genus back to the Late Triassic, whereas *Antrimpos colettoi* n. sp. represents the second species of this genus from the Upper Triassic of Italy. The report of these new species increases the number of known penaeid species from the Norian of high Tagliamento Valley in the northern part of Carnic Pre-Alps.

Key words: Crustacea, Decapoda, Aegeridae, Penaeidae, Late Triassic, Carnic pre-Alps.

Introduction

The southern part of the high Valley of Tagliamento river, between Villa Santina and Forni di Sopra (Carnic Pre-Alps, Udine, Friuli-Venezia Giulia) is mainly constituted by the Dolomia di Forni (Forni Dolostone), an Upper Triassic (Norian) lithological unit. It is a geological formation rich in fossils of great scientific interest (DALLA VECCHIA 2012, cum bibl.), such as terrestrial and flying reptiles, fishes, decapod crustaceans, thylacocephalans, and plants remains. Other important but less abundant taxa have been found, i.e. a specimen of an arachnid (DALLA VECCHIA & SELDEN 2013).

Reptile remains - among them some of the most primitive pterosaurs - have been subject of numerous publications, but half of the more than 3,000 specimens coming from the Dolomia di Forni and stored in the Museo Friulano di Storia Naturale of Udine, are crustaceans (MUSCIO 2000, L. Simonetto pers. com.).

The Dolomia di Forni crops out in an elongated east-west oriented area (40 km). There are a couple of different sites of great palaeontological interest. The main locality is Preone - Rio Seazza Valley; it includes several fossiliferous outcrops along the Seazza brook incision, south of Preone village (note: the name "Preone Valley"



Fig. 1 - Location map of the described site (in pink the Dolomia di Forni extension): 1 - Rio Forchiar; 2 - Rio Seazza Valley; 3 - Caprizzi; 4 - Rio di Purone; 5 - Rio Rovadia (from DALLA VECCHIA 2012, mod.).
- Inquadramento geografico delle località descritte (in rosa l'area di affioramento della Dolomia di Forni; da DALLA VECCHIA 2012, mod.).

is incorrect and indicates another locality of different age lacking fossils).

Other localities of palaeontological interest (Fig. 1) are Rio Forchiar (Enemonzo), Caprizzi (Socchieve), Rio di Purone and Rio Rovadia (between Forni di Sotto and Forni di Sopra). Sometimes in the literature, specimens coming from the whole Dolomia di Forni are indicated as “fossils from Preone”.

The crustaceans herein described have been collected either during the researches of the Museo Friulano di Storia Naturale of Udine or are reported by some collectors, i.e. Claudio Calligaris who prematurely died some years ago. Some of those crustaceans have been reported by DALLA VECCHIA (2012) who indicated the opportunity for more detailed studies.

Geological setting

The Dolomia di Forni is comprised of grey-brown thin laminated dolostones, often rich in organic matter. It is about 700-800 m thick in the section of Rio Seazza Valley. The lithology varies mainly from dolomiticrites to doloarenites, with presence of chert lenses or nodules, turbidites, etc.

This formation, which is more or less heteropic with the Dolomia Principale (Main Dolomite), represents a basin deposit (max depth of a few hundreds of meters), often with anoxic episodes. Anoxia has promoted the exceptional fossil preservation of this unit. A detailed analysis of the features, age, and palaeoenvironmental implications of the Dolomia di Forni has been recently proposed by DALLA VECCHIA (2014).

Concerning the described specimens, it is appropriate to recall that the fossiliferous sites, even though there may be some little differences between the various localities, are dated in to the Alaunian-Sevastian

(upper Norian, ROGHI et al. 1995, DALLA VECCHIA & SELDEN 2013, DALLA VECCHIA 2014). From the palaeoenvironmental point of view it is useful to note that, based upon the local differences, the benthic elements seems to be more common in the western part of the basin.

Previously recorded decapod crustaceans from Rio Seazza Valley

The rich decapod community from the Dolomia di Forni Formation (Norian, Upper Triassic) of Carnia (Udine, NE Italy) was reported by GARASSINO et al. (1996). The bulk of the studied specimens have been collected in the Rio Seazza Valley, the mostly fossiliferous interval within the lower member of the Dolomia di Forni. The remaining specimens come from the other above quoted sites. Penaeids, carideans, eryonids, palinurids, and glypheids have been reported from some localities of this Fm. (for a complete checklist of localities, see GARASSINO et al. 1996). Concerning the Rio Seazza Valley, the subject of this new study, two penaeids, *Dusa longipes* (PINNA, 1974) and *Antrimpos noricus* PINNA, 1974, one caridean, *Acanthinopus gibbosus* PINNA, 1974, one palinurid, *Archaeopalinurus levis* PINNA, 1974, and one glypheid, *Glyphea rigoi* GARASSINO, 2000, are reported to date.

Material

The studied specimens, preserved in thickly laminated levels, are flattened on the bedding planes. The specimens have been assigned to *Acanthochirana triassica* n. sp. (Aegeridae BURKENROAD, 1963) (4 specimens) and *Antrimpos colettoi* n. sp. (Penaeidae RAFINESQUE, 1815)

(6 specimens). The studied material is housed in the Museo Friulano di Storia Naturale, Udine (MFSN).

For the higher-level classification, we follow the recent arrangement proposed by DE GRAVE et al. (2009) and SCHWEITZER et al. (2010).

Abbreviations: al: antennulae; a2: antennae; lcxp: carapace length (excluding rostrum); mxp3: maxilliped 3; P1-P5: pereopods 1 to 5; s1-s6: pleomeres 1 to 6; tl: total length of the body; wxcp: carapace width.

Systematic palaeontology

Order Decapoda LATREILLE, 1802

Suborder Dendrobranchiata BATE, 1888

Superfamily Penaeoidea RAFINESQUE, 1815

Family Aegeridae BURKENROAD, 1963

Genus *Acanthochirana* STRAND, 1928

Type species: *Udora cordata* MÜNSTER, 1839, by subsequent designation by GLAESSNER (1929).

Included fossil species: *Acanthochirana angulata* OPPEL, 1862; *A. cenomanica* GLAESSNER, 1946; *A. cordata* (MÜNSTER, 1839) (= *A. longipes* OPPEL, 1862); *A. krausei* FÖRSTER, 1967; *A. liburiaensis* GARASSINO, AUDO, CHARBONNIER & SCHWEIGERT, 2014; *A. smithwoodwardi* (VAN STRAELEN, 1940).

Remark: We point out that *Acanthochirana cenomanica* GLAESSNER, 1946, is considered as a subjective junior synonym of *A. smithwoodwardi* (VAN STRAELEN, 1940) (see GARASSINO 1994, for further discussion).

Acanthochirana triassica n. sp.

Figs. 2, 3

Etymology: after the Triassic, referring to the geological age of the studied specimens.



Fig. 2 - *Acanthochirana triassica* n. sp., holotype MFSN 40252.
- *Acanthochirana triassica* n. sp., olo tipo MFSN 40252.

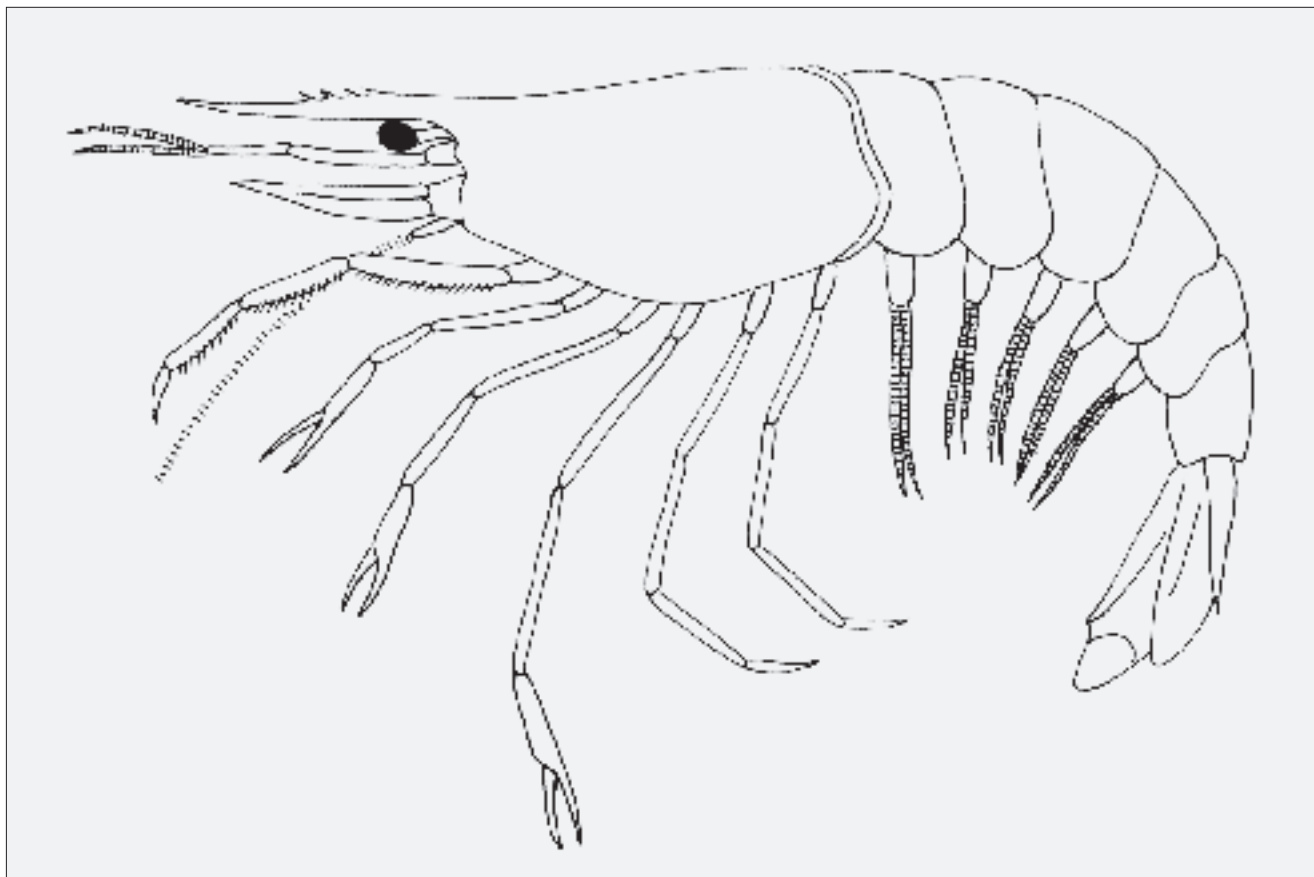


Fig. 3 - *Acanthochirana triassica* n. sp., reconstruction.
- *Acanthochirana triassica* n. sp., ricostruzione.

Holotype: MFSN 40252 (Rio Seazza Valley, Preone).

Paratypes: MFSN 36578 (Rio Seazza Valley, Preone), 44473 (Rio Rovadia, Forni di Sopra), 44474 (Rio Rovadia, Forni di Sopra).

Material and measurements: four specimens in lateral view (MFSN 36578 - lcxp: 17 mm; tl: ca. 70 mm; wcxp: 8 mm; MFSN 40252 - lcxp: 17 mm; tl: ca. 70 mm; wcxp: 8 mm; MFSN 44473 - lcxp: 15 mm; tl: ca. 55 mm; wcxp: 6 mm; MFSN 44474 - incomplete).

Diagnosis: carapace subrectangular, laterally flattened; rostrum elongate with four proximal dorsal teeth and distal tip upward-incurved; mx3 elongate, well developed with a row of setae along the inferior margin of each element; uropodal exopod with a subrounded diaeresis.

Description

Carapace: carapace subrectangular, ventro-posteriorly curved backward; rostrum elongate with four dorsal proximal forward-pointing teeth and rostral distal tip upward-incurved; grooves and spines not visible; all regions apparently smooth.

Pleon: s1-s5 subrectangular equal in size; s6 longer than s1-s5; terga and pleura in s1-s6 smooth; telson smooth triangular with a pointed tip.

Cephalic appendages: well-developed, remarkable large cornea, with short eyestalk; a1 bi-flagellate; a2 very long; scaphocerite very elongate slender with a pointed tip.

Thoracic appendages: mxp3 elongate with four segments narrowing slightly toward the distal extremity; merus long, subrectangular with smooth lateral margins; carpus short; propodus ovate with narrow proximal articulation with carpus; dactylus short, thin; inferior margin of all elements with a row of small setae; P1-P3 increasing in size, with thin elongate chelae; occlusal margins of chelae edentulous; P4-P5 achelate; P4-P5 very elongate about one third longer than P1-P3.

Pleonal appendages: Pleopods well developed with a subrectangular basal segment and very elongate biramous flagellae; uropodal endopod and exopod slightly longer than telson; uropodal exopod with a curved diaeresis.

Discussion

As reported by DE GRAVE et al. (2009) and later by SCHWEITZER et al. (2014) Aegeridae BURKENROAD, 1963 includes four genera, *Acanthochirana* STRAND, 1928, *Aeger* MÜNSTER, 1839, *Anisaeger* SCHWEITZER, FELDMANN, HU, HUANG, ZHOU, ZHANG, WEN & XIE, 2014, and *Distaeger* SCHWEITZER, FELDMANN, HU,

HUANG, ZHOU, ZHANG, WEN & XIE, 2014. FÖRSTER (1967) and SCHWEITZER et al. (2014) pointed out the main differences among these genera: *Acanthochirana* exhibits a rostrum with a row of dorsal teeth, spiny mxp3 and P1, absence of a postorbital spine, and a smooth carapace; *Aeger* exhibits a dorsally toothless rostrum, spiny mxp3 and P1-P2, presence of a postorbital spine, and a carapace with a punctate ornamentation; *Anisaeger* exhibits a dorsally ventrally toothless rostrum, spiny mpx3, well-developed postorbital and hepatic spines, short P1-P3, and smooth carapace; *Distaeger* exhibits a rostrum one dorsal and one ventral tooth, spiny mxp3, short P1-P2, longer P3, and smooth carapace. The study of the specimens from the northern Carnic Pre-Alps permits assigning them to *Acanthochirana* due to their rostrum with dorsal teeth and the absence of a postorbital spine. As reported by SCHWEITZER et al. (2010) and BRAVI et al. (2014), *Acanthochirana* includes four species, ranging from Early to Late Jurassic of Germany and Italy, respectively: *A. krausei* FÖRSTER, 1967, from the Toarcian Posidonia Shale of Germany, *A. liburiaensis* GARASSINO, AUDO, CHARBONNIER & SCHWEIGERT, 2014, from the Bajocian/Bathonian of the Monte Fallano Plattenkalk of Italy, *A. angulata* OPPEL, 1862, and *A. cordata* (MÜNSTER, 1839) (= *A. longipes* OPPEL, 1862, as suggested by VAN STREALEN 1925 and FÖRSTER 1967), the latter both from the Tithonian Solnhofen Limestones of Germany. The elongate rostrum bearing four dorsal proximal forwardly-pointing teeth distinguishes *A. triassica* n. sp. from the other species of the genus: *A. liburiaensis* has a rostrum with ten dorsal teeth, whereas *A. krausei*, *A. cordata*, and *A. angulata* have

rostra with 6-7 dorsal teeth respectively. The assignment of the studied specimens to a new species within *Acanthochirana* extends the stratigraphic range of this genus back to the Late Triassic.

Family Penaeidae RAFINESQUE-SCHMALTZ, 1815

Genus *Antrimpos* MÜNSTER, 1839

Type species: *Antrimpos speciosus* MÜNSTER, 1839, subsequent designation by GLAESSNER (1929).

Included fossil species: See SCHWEITZER et al. (2010) and BRANDT & SCHULZ (2013).

Antrimpos colettoi n. sp.

Figs. 4-6

Etymology: after Alberto and Alessandro Coletto (Udine) who collected some of the described specimens.

Holotype: MFSN 40250 (Rio Seazza Valley, Preone).

Paratypes: MFSN 40241 (Rio Seazza Valley, Preone), 44412 (Caprizzi, Socchieve), 44465 (Rio Rovadia, Forni di Sopra), 44469 (Rio Rovadia, Forni di Sopra), 44476 (Rio Forchiar, Enemonzo).

Material and measurements: six specimens in lateral view (MFSN 40241 - incomplete; MFSN 40250 - lcxp: 18 mm; tl: ca. 55 mm; wcxp: 10 mm; MFSN 44412 - lcxp: 12 mm; tl: ca. 30 mm; wcxp: 6 mm; MFSN 44465 - lcxp: 10 mm; tl: ca. 35 mm; wcxp: 6 mm; MFSN 44469 - incomplete; MFSN 44476 - lcxp: 10 mm; tl: ca. 35 mm; wcxp: 6 mm).

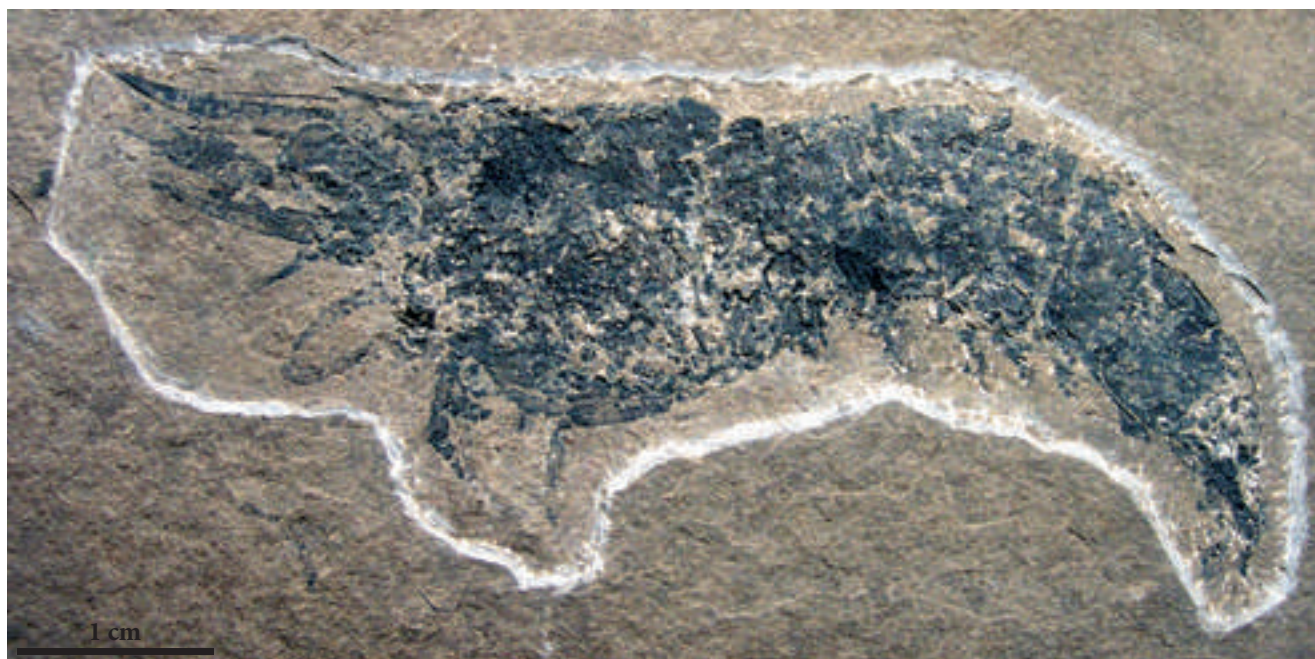


Fig. 4 - *Antrimpos colettoi* n. sp., holotype MFSN 40250.
- *Antrimpos colettoi* n. sp., olotipo MFSN 40250.



Fig. 5 - *Antrimpos colettoi* n. sp., MFSN 44469, detail of the trifold tip of the telson.

- *Antrimpos colettoi* n. sp., MFSN 44469, dettaglio dell'estremità trifida del telson.

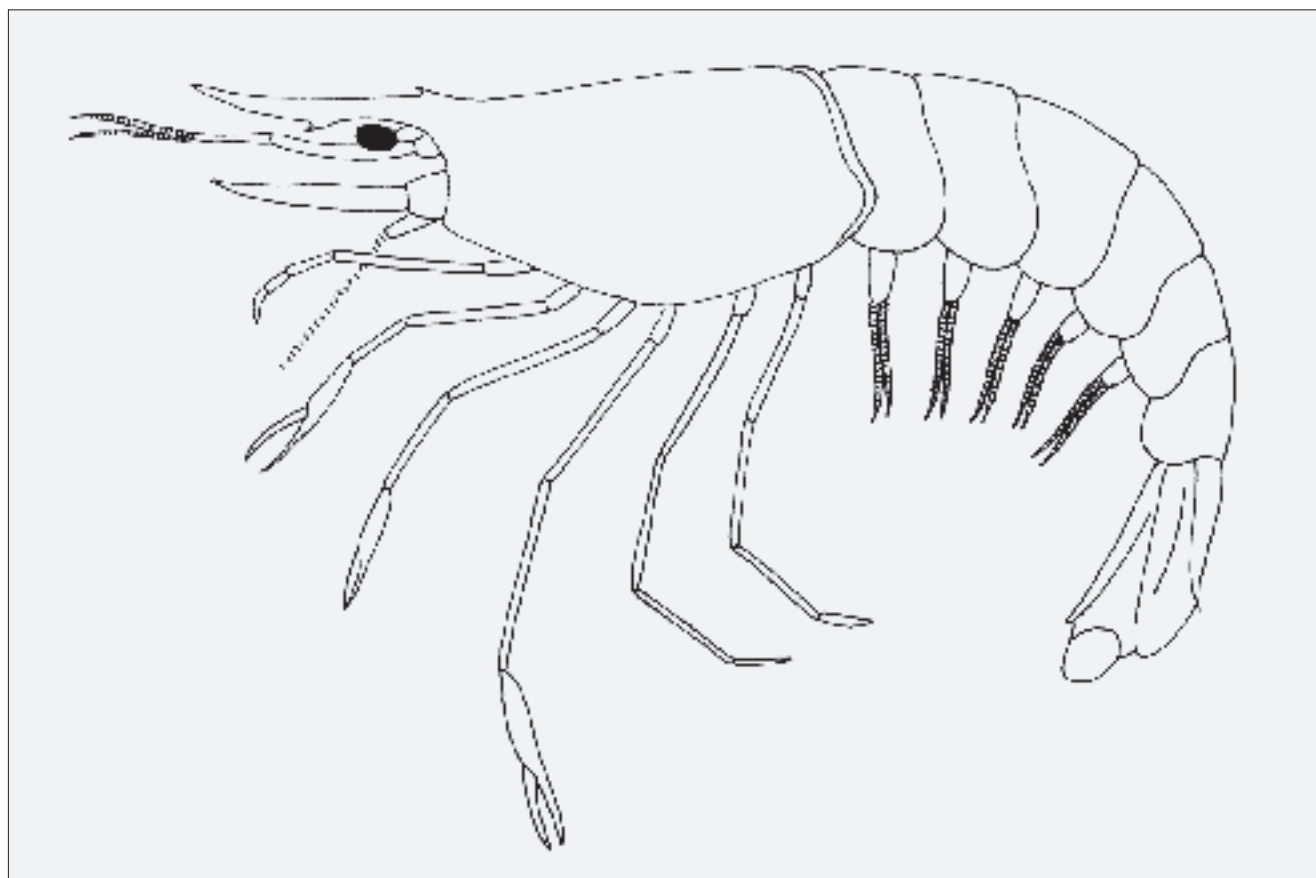


Fig. 6 - *Antrimpos colettoi* n. sp., reconstruction.

- *Antrimpos colettoi* n. sp., ricostruzione.

Diagnosis: carapace subrectangular, laterally flattened; rostrum elongated with one basal dorsal tooth and one median ventral tooth; P1-P3 chelate increasing in length from P1 to P3; P4-P5 achelate; distal tip of telson with two lateral flexible spines; uropodal exopod with a subrounded diaeresis.

Description

Carapace: carapace subrectangular, ventro-posteriorly curved backward; elongated thick rostrum, with one basal dorsal tooth, one median ventral tooth and rostral distal tip upward-incurved; grooves and spines not visible; all regions apparently smooth.

Pleon: s1-s5 subrectangular equal in size; s6 longer than s1-s5; terga and pleura in s1-s6 smooth; telson smooth triangular with distal tip having two lateral flexible spines.

Cephalic appendages: large cornea well developed with a short eyestalk; a1 bi-flagellate; a2 very long; scaphocerite very elongated, slender with a pointed tip.

Thoracic appendages: mxp3 short with four segments narrowing slightly toward the distal extremity; merus long, subrectangular with smooth lateral margins; carpus short; propodus ovate with narrow proximal articulation with carpus; dactylus short, thin; P1-P3 increasing in length, with thin elongated chelae; occlusal margins of chelae edentulous; P4-P5 elongated achelate.

Pleonal appendages: pleopods well developed with a subrectangular basal segment and short biramous flagella; uropodal endopod and exopod slightly longer than telson; uropodal exopod with a curved diaeresis.

Discussion

According to GLAESSNER (1969) and ETTER (1994), it is difficult to establish the true morphological characters of *Antrimpos*, known to date from the Early Triassic to the Late Jurassic. Indeed, even though fifteen species have been described so far (for complete references, see SCHWEITZER et al. 2010), most taxa are based on poorly preserved material and the few species, based on well-preserved material, hardly allow recognising significant diagnostic characters useful for a distinction of this genus from the other genera within the Penaeidae, mainly from *Penaeus* FABRICIUS, 1798. However, even though *Antrimpos* is considered as a “basket” genus, according to VAN STRAELEN (1925, 1928) and GLAESSNER (1969), VAN STRAELEN (1925) tentatively pointed out the main morphological characters of the genus, as follows: carapace with short/elongate rostrum with dorsal/ventral teeth; a1 with flagella of different length; a2 longer than a1; P1-P3 chelate; P4-P5 achelate. These characters are not, however, really diagnostic for *Antrimpos*, since they are common in all genera within the Penaeidae.

Hence we point out the real need to review the genus in order to establish its true diagnostic characters based upon the study of type species of the genus, *A. speciosus* MÜNSTER, 1839 from the Late Jurassic (SCHWEIGERT & GARASSINO in press).

According to SCHWEITZER et al. (2010), just two species of *Antrimpos* are known to date from the Late Triassic, *A. crassipes* (BRONN, 1858) from the Carnian of Raibl (= Cave del Predil, Udine, Friuli-Venezia Giulia, northeastern Italy) and *A. noricus* PINNA, 1974, from the Norian of Cene (Val Seriana, Bergamo, northern Italy) and the Dolomia di Forni (Rio Seazza, Caprizzi and Forni di Sopra localities; Udine, Friuli-Venezia Giulia, northeastern Italy) (BRONN 1858; PINNA 1974; GARASSINO et al. 1996).

Antrimpos crassipes was described based upon four specimens, mostly incomplete. Indeed, just one specimen figured by BRONN (1858, pl. 4, fig. 5) appears to be quite complete, preserving the carapace partially. Unfortunately, even though BRONN (1858) gave a detailed analysis of this species, it is impossible to identify the main morphological characters of this species, making any comparisons with *A. colettoi* n. sp. impossible. Moreover, we tried to check Bronn's original sample of *A. crassipes* in the collections of the Geologisches Bundesanstalt (GBA) and Naturhistorisches Museum (NHMW) in Vienna. Some specimens, labelled as belonging to this species, have been found in the palaeontological collections of both institutes, but none of them corresponds to Bronn's original sample which is probably lost (M. Hyžný, pers. comm. 2014).

Antrimpos noricus was described based upon 149 complete and incomplete specimens. The high number of the studied specimens allowed a detailed description of this species in which even ontogenetic stages were recognised. The adults of this species are characterised as having an elongate rostrum with just two basal teeth, lacking ventral teeth, and an incurved distal tip. Even though this species shares with the new species P1-P3 increasing in length, *A. colettoi* n. sp. differs from *A. noricus* in having an elongate rostrum with just one basal dorsal tooth and one median ventral tooth and a telson with a trifid tip.

Antrimpos colettoi n. sp. represents the second report of this genus from the Late Triassic of Italy.

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Some of the described specimens were collected by Claudio Calligaris (Udine), an enthusiastic naturalist who died few years ago: his contribution to the knowledge of palaeontology of Friuli Venezia Giulia is particularly relevant. A special thank to Alberto and Alessandro Coletto (Udine) and Enrico Iodice (Maniago, Pordenone) for their kind cooperation.

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Authors' addresses - Indirizzi degli Autori:

- Alessandro GARASSINO
Sezione di Paleontologia degli Invertebrati
Museo Civico di Storia Naturale
Corso Venezia 55, I-20121 MILANO
e-mail: alegarassino@gmail.com
- Günter SCHWEIGERT
Staatliches Museum für Naturkunde
Rosenstein 1, D-70191 STUTTGART
e-mail: guenter.schweigert@smns-bw.de
- Giuseppe MUSCIO
Museo Friulano di Storia Naturale
Via Marangoni 39-41, I-33100 UDINE
e-mail: giuseppe.muscio@comune.udine.it