Ann. Naturhist. Mus. Wien, Serie A	118	65–131	Wien, 15 Jan. 2016

New families Paragalatheidae and Catillogalatheidae (Decapoda: Anomura: Galatheoidea) from the Mesozoic, restriction of the genus *Paragalathea*, and establishment of 6 new genera and 20 new species

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(With 18 figures and 7 tables)

Manuscript submitted on October 1st 2014,
the revised manuscript on September 30th 2015.

Abstract

Two new families of Galatheoidea from the Mesozoic are described. Paragalatheidae encompasses members of *Paragalathea* and *Mesogalathea*, as well as two new genera: *Discutiolira* and *Lemacola*. The genus *Paragalathea* is herein restricted to its original definition. New species within the Paragalatheidae established in this paper are: *Paragalathea arcella*, *P. crenarvina*, *P. ternata*, *P. vultuosona*, *Lemacola jenniferae*, *L. rossi*, *L. salia*, *Mesogalathea macra*, *M. pyxis*, and *M. retusa*. The new family Catillogalatheidae is described to encompass species from the Late Jurassic and Cretaceous. New genera established within Catillogalatheidae include: *Catillogalathea*, *Tuberosagalathea*, *Serraphylctaena*, and *Vasconilia*. New species established within Catillogalatheidae are: *Catillogalathea falcula*, *Catillogalathea patruliusi*, *Catillogalathea purcarenensis*, *Galatheites aiola*, *G. diasema*, *G. obtecta*, *Hispanigalathea tithonia*, *Tuberosagalathea antefixa*, *T. tornatilis*, and *Vasconilia xystosa*. The genus *Galatheites* is redescribed. Some observations and remarks are made on the preservation of cuticle and ornamentation on galatheoid dorsal carapaces.

Keywords: Galatheoidea, Ernstbrunn Limestone, Tithonian, new taxa

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ZooBank LSID: urn:lsid:zoobank.org:pub:6A9EDC32-EEB8-4212-8E80-303F7D533734

Introduction

The Anomura H. Milne-Edwards, 1832 have seen numerous revisions within the last decade. The Chirostylidae Ortmann, 1892 was removed from the Galatheoidea to its own superfamily, Chirostyloidea, by Schnabel & Ahyong (2010) and Schnabel *et al*. (2011a). The subfamily Munidopsinae Ortmann, 1898 was elevated to family status, and the new family Munididae was established by Ahyong *et al*. (2010). Within the last few years, the Mesozoic fossil record of galatheoids was greatly expanded and revised, with numerous new genera and species (see De Angeli & Garassino 2002, 2006; Fraaije *et al*. 2008; Garassino *et al*. 2008; Klompmaker *et al*. 2012; Robins *et al*. 2012, 2013, 2015; among others). Although not yet approaching the level of diversity seen in the modern oceans, the Late Jurassic seems to have served as a crucible for anomuran evolution (Bracken-Grissom *et al*. 2013, Fraaije 2014, Klompmaker *et al*. 2013, Robins *et al*. 2013).

Robins *et al*. (2013) described and revised the diverse munidopsid fauna from Ernstbrunn, Austria. This paper describes and revises most of the remaining squat lobster faunas from Ernstbrunn, as well as the Tithonian age squat lobsters from Purcăreni, Romania, originally described by A. Shirk (now A. Bonde) in an unpublished Master of Science thesis from Kent State University.

In 1959, Patrulius erected *Paragalathea* as a subgenus of *Galathea* Fabricius, 1793, to contain *Galathea verrucosa* Moericke, 1889. In a subsequent paper, he added three species to the subgenus, *Galathea* (*Paragalathea*) *ornatissima* Patrulius, 1966; *Galathea* (*Paragalathea*) *striata* Remeš, 1895; and *Galathea* (*Paragalathea*) *substriata* Blaschke, 1911. All four species are from the Tithonian age Štramberk Limestones of the Czech Republic and Poland. In 1963, Houša erected a new genus, *Mesogalathea*, to encompass two species: *Galathea striata* and *Galathea ruizi* Van Straelen, 1940. Neither Patrulius, working in Romania and Poland, nor Houša, working in the former Czechoslovakia, indicated that they knew of the work of the other.

In 1981, Vía Boada elevated *Paragalathea* to full generic status, declared *Mesogalathea* the junior synonym, and placed the two species that were included within *Mesogalathea* by Houša (1963) into *Paragalathea*. He included in the newly elevated genus three species that he interpreted to be similar to *Mesogalathea*; *Galathea substriata* Blaschke, 1911; *Galathea straeleni* Ruiz de Gaona, 1943; and *Paragalathea multisquamata* Vía Boada, 1981. He also declared the members of *Paragalathea* to be outside of the parameters of Galatheinae Samouelle, 1819, and, in 1982, placed them within Munidopsinae Ortmann, 1898 (now Munidopsidae), as well as adding another species to *Paragalathea*: *Galatheites neocomiensis* Van Straelen, 1936. Subsequent authors maintained *Mesogalathea* and *Paragalathea* as distinct genera; however, all the species included in *Paragalathea* by Vía Boada (1981, 1982) except *M. striata* remained within *Paragalathea*.

Fig. 1. Geographic map showing the three main localities for the specimens described in this paper. E is Ernstbrunn, Austria; S is Štramberk, Czech Republic, with a shaded ellipse showing the range of area where outcrops of Štramberk Limestone can be found; P is Purcăreni, Romania. Map modified from d-maps.com.

After *Paragalathea* was redefined by Vía Boada (1981, 1982), several other authors added species to the genus, including *Paragalathea miyakoensis* Takeda & Fujiyama, 1983; *Paragalathea ubaghsi* (Pelseneer, 1886) by Collins, Fraaye & Jagt, 1995 (now *Gastrosacus ubaghsi*, according to Robins *et al*. 2013); and *Paragalathea africana* Garassino *et al*., 2008 (now *Muelleristhes africanus* according to Garassino *et al*. 2014). There has been no agreement within the literature as to the familial placement of *Paragalathea*; this is due in large part to the extreme heterogeneity of the genus and the characteristic traits of the genus not falling within the diagnosis of any current galatheoid family.

Upon studying the galatheoids that comprise *Paragalathea*, as well as other Mesozoic galatheoids from the Tithonian of Austria, Romania, Poland, and the Czech Republic, it is evident that the broad morphological range cannot be encompassed by the currently defined families, which contain mostly modern species. Thus, two distinct new families are defined as a reflection of the high degree of diversity.

Study Area

The new species established herein are mostly sourced from five quarries of the Tithonian age Ernstbrunn Limestones of Ernstbrunn, Austria, or the Tithonian age Purcăreni outcrops of Romania, all shown on the map in Fig. 1. The Austrian species are housed in the Friedrich Bachmayer Collection at the NHMW, Wien, Austria. Precise stratigraphic horizons and associations of the fauna are unknown. Information about the Bachmayer Collection can be found in Feldmann & Schweitzer (2009). The Romanian specimens are housed in the Laboratory of Paleontology, Department of Geology and Paleontology, University of Bucharest, Romania. Other faunas discussed within this paper are sourced from the Tithonian Štramberk Limestones of the Czech Republic and Poland and Cretaceous strata from northern Spain, northern France, southeast Morocco, and the Miyako Islands of Japan. Recent research completed by Fraaije *et al*. (2013) on the Štramberk Limestones of the Kotouč Quarry show some uncertainty in the exclusively Tithonian age; it is possible that the limestones found within the quarry are Lower Cretaceous.

Abbreviations and Notes

The specimens studied for this work are housed in the following repositories:

BSP – Bayerische Staatssammlung für Paläontologie und historische Geologie München (Munich), Germany

KSU – Kent State University, Kent, Ohio, USA

LPB – Laboratory of Paleontology, Department of Geology and Paleontology, University of Bucharest, Romania

MAB – Oertijdmuseum De Groene Poort, Boxtel, The Netherlands

MGSB – Museo Geólogico del Seminario de Barcelona

MHN-Auxerre – Muséum d'Histoire naturelle d'Auxerre, France

NHMW – Naturhistorisches Museum Wien, Austria

SOC – Slezskémuseum v Opavě, Coll. Palaeontologica; Opava, Czech Republic

UJ – Collections of the Geological Museum of the Institute of Geological Sciences, Jagiellonian University, Kraków, Poland

All genera and species described within this manuscript are exclusively fossil. In differential comparisons, modern genera are labeled as such. Unless otherwise noted, all specimens were dyed with removable blue dye and subsequently whitened with ammonium chloride sublimate. Photos were taken by C. Robins, unless otherwise noted. L refers to length, excluding rostrum; TW refers to width of anterior margins; MW is the maximum width of the specimen. Fig. 2 illustrates the galatheoid regions referred to in the descriptions, as well as the location of measurements.

Previous workers often listed the names of species as being present in various localities, but did not provide illustrations, photographs, or descriptions to substantiate their identifications. Synonymies are therefore limited to publications with illustrations or where the authors were able to visually confirm identifications from examination of original specimens.

A note about cuticle preservation and ornamentation on galatheoids: many of the galatheoids figured within this publication retain their cuticle. This is most commonly the case with individuals from the Ernstbrunn Limestones, which, on occasion, retain more than one layer of cuticle (see Waugh *et al*. 2009 for details of cuticle morphology). Individuals from the Štramberk Limestones tend to have deteriorating cuticle or no cuticle preserved on their carapaces, and the individuals from Romania tend to have carapaces with deteriorating cuticle, sometimes with crystalline overgrowth. Klompmaker *et al*. (2015) compiled a summary of various works that discuss the effect cuticle preservation has on the appearance of the specimen. Klompmaker *et al*. (2015) also refers to several publications where the presence or absence of cuticle did not affect the overall ornamentation or appearance of the species, including those of galatheoids (see De Angeli &

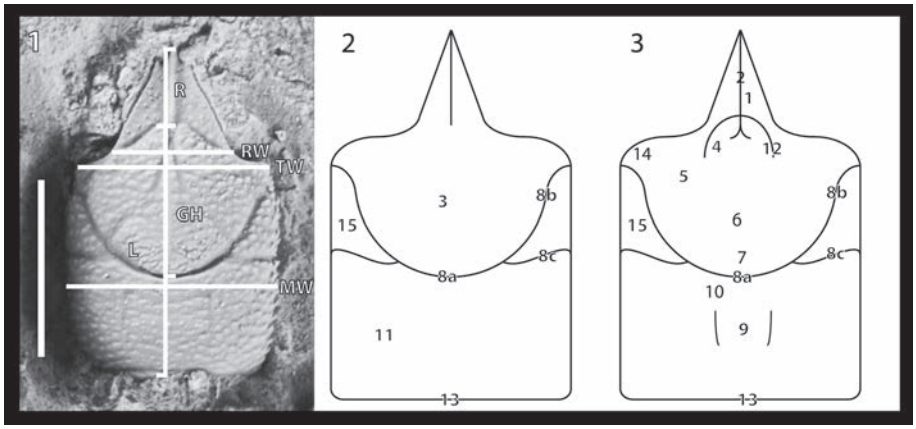


Fig. 2. **1**: *Galatheites diasema* nov. spec. (NHMW 2007z0149/0434), with measurement locations superimposed. L refers to length, excluding rostrum; R refers to rostrum length; RW refers to rostrum width; GH refers to length of gastric region from base of rostrum to instersection with cervical groove; TW refers to width of anterior margins; MW is the maximum width of the specimen. **2–3**: Idealized schematic diagram of a member of Paragalatheidae nov. fam. (2) and Catillogalatheidae nov. fam. (3) with regions numbered. 1. Rostrum; 2. Rostral keel; 3. Undifferentiated gastric area; 4. Epigastric area; 5. Protogastric; 6. Mesogastric; 7. Metagastric; 8a. Cervical groove; 8b. Hepatic branch of cervical groove; 8c. Epibranchial branch of cervical groove; 9. Cardiac; 10. Urogastric; 11. Undifferentiated branchial region; 1 Gastro-orbital groove; 13. Posterior margin; 14. Hepatic; 15. Epibranchial.

GARASSINO 2002: pl. 4, fig. 2 of *Palaeomunida defecta* LÖRENTHEY, 1902; KLOMPMAKER *et al*. 2012: fig. 7 of *Paragalathea ruizi* VAN STRAELEN, 1940 and fig. 10 of *Hispanigalathea tuberosa* KLOMPMAKER, FELDMANN, ROBINS & SCHWEITZER, 2012).

In terms of many of the species featured herein, where examples of specimens both with and without cuticle are preserved (Fig. 3.1 without cuticle, Figs 3.3–3.5 with cuticle; Fig. 8.1 with cuticle, Figs 8.3 and 8.4 without cuticle; Fig. 12.1 without cuticle, Figs 12.2–12.4 with cuticle), the ornamentation displayed is essentially the same with or without cuticle. The specimen featured in Fig. 7.4 retains cuticle without much, if any, deterioration apparent. Figures 7.5 and 7.6 clearly only have partial cuticle, but the ornamentation is still quite strong. The ornamentation is less well-defined where the cuticle is still present, but those specimens with pristine cuticle are almost identically ornamented in the area where the cuticle has been removed. Another example of this can be seen in Fig. 14. Fig. 14.1 has no cuticle; Figs 14.2–14.4 have partial cuticle preserved. The ornamentation on Fig. 14.1 appears crisper and more well-defined, but the same ornamentational patterns are present on the specimens photographed in Figs 14.2–14.4. If the cuticle is in the process of eroding from the carapace, or if there is damage to the exterior from abrasion, the ornamentation can look a bit different than that of a pristine specimen or a specimen without cuticle; however, underneath the deteriorating cuticle, there is almost always ornamentation present in the same pattern as would have been seen on a pristine

specimen. This change in ornamentational appearance during cuticle degradation is most apparent in the specimens that are ornamented with transverse ridges (Figs 7.1–7.13). The Romanian specimens also sometimes feature a crystalline overgrowth, obscuring some details of the specimens (notably Figs 11.6 and 12.11). Changes in cuticle were taken into account in the description of the species herein, and noted in the discussion sections when the cuticle on described specimens is deteriorating.

Systematic Paleontology

Order Decapoda Latreille, 1802

Infraorder Anomura H. Milne-Edwards, 1832

Superfamily Galatheoidea Samouelle, 1819

Included families: Catillogalatheidae nov. fam.; Galatheidae Samouelle, 1819; Munididae Ahyong, Baba, Macpherson & Poore 2010; Munidopsidae Ortmann, 1898; Paragalatheidae nov. fam.; Porcellanidae Haworth, 1825; Retrorsichelidae Feldmann, Tsudy & Thomson, 1993.

Family Paragalatheidae nov. fam.

Type genus: *Paragalathea* Patrulius, 1959.

Other included genera: *Discutiolira* nov. gen., *Lemacola* nov. gen., *Mesogalathea* Houša, 1963.

Diagnosis: Extremely strongly convex dorsal carapace. Rostrum extremely broad, downturned; spatulate to nearly rectangular in shape; width equal to or greater than two thirds of width of frontal margin; not differentiated to slightly differentiated by chevron pattern of ornamentation from main body of carapace. Carapace with weak to moderately strong concave forward cervical groove; regions not delimited or weakly delimited. Ornamentation consists of squamous or rounded tubercles or transverse ridges.

Discussion: As detailed earlier, *Paragalathea*, the type genus of this new family, has been considered a member of the Munidopsidae by some authors and as a member of Galatheidae by others. Part of this taxonomic problem stems from the expanded definition of the genus by Vía Boada (1981, 1982); part is due to the genus not conforming to the diagnosis of either a munidopsid or galatheid. A combination of factors including the general lack of regional definition, broad rostrum, and horizontally extending orbits separate this family from all others within the Galatheoidea. The members of Paragalatheidae nov. fam. are readily separated from the Retrorsichelidae, Munididae, Porcellanidae, Munidopsidae, and Catillogalatheidae nov. fam. The Retrosichelidae has

a different groove structure, with a sharp v-shape at the center of the cervical groove, and much narrower frontal margin. The Paragalatheidae nov. fam. do not have a circumgastric groove (groove encircling the gastric region) nor the extensive regional definition of the Munidopsidae. They are also much too transversely convex and are not crab-like in appearance, leaving them dissimilar from the Porcellanidae, and they do not have the trifid frontal margin characteristic of the Munididae. Members of Catillogalatheidae nov. fam. have much greater regional definition and more strongly developed gastro-orbital grooves. The closest morphological group to Paragalatheidae nov. fam. is the Galatheidae; however, the high degree of dorsal carapace convexity; extremely broad, spatulate rostrum; and lack of regional definition are inconsistent with the Galatheidae. Thus, a new family is erected to embrace these unique Jurassic galatheoids.

Genus *Paragalathea* Patrulius, 1959

Type species: *Galathea verrucosa* Moericke, 1889, by original designation.

Other species: *Paragalathea arcella* nov. spec.; *P. crenarvina* nov. spec.; *P. ornatissima* Patrulius, 1966; *P. ternata* nov. spec., *P. vultuosona* nov. spec.

Original diagnosis [translated from Patrulius 1959: p. 252]: *"Cephalothorax strongly convex; broad rostrum without sharp demarcation at the base, obtuse pronged tip, without median keel. Ornamentation consisting of mostly rounded granules."*

Discussion: All species added to *Paragalathea* by Vía Boada (1981, 1982), as well as all of the others added to *Paragalathea* since 1981, show marked differences between the originally named members of *Paragalathea* and the modern, extremely expanded interpretation. Those include *P. africana* Garassino, De Angeli & Pasini, 2008; *P. miyakoensis* Takeda & Fujiyama, 1983; *P. multisquamata* Vía Boada, 1981; *P. neocomiensis* (Van Straelen, 1936); *P. ruizi* (Van Straelen, 1940); *P. straeleni* (Ruiz de Gaona, 1943); and *P. ubaghsi* (Pelseneer, 1886).

Within the Munidopsidae, *Paragalathea ubaghsi* has already been reassigned to *Gastrosacus* von Meyer, 1851 (Robins *et al*. 2013). Within Catillogalatheidae, a new family detailed later in this paper, *Vasconilia* nov. gen. is erected to encompass the early Cretaceous species ?*Vasconilia miyakoensis* nov. comb., *Vasconilia ruizi* nov. comb., and *Vasconilia straeleni* nov. comb. The justifications for the reclassifications of species to *Vasconilia* are detailed under its genus heading. These reclassifications result in *Paragalathea* being exclusively Tithonian in age. *Paragalathea africana* was reassigned to the Porcellanidae as *Muelleristhes africanus* by Garassino *et al*. (2014). Although we support the new genus *Muelleristhes* Garassino, De Angeli & Pasini, 2014, we disagree with the assignment to the Porcellanidae. *Muelleristhes* is reassigned to the new family Catillogalatheidae, detailed later in this paper.

An unidentified species of *Paragalathea* was found in Romania by Muțiu & Bădăluță (1971: p. 248; pl. 1, fig. 1). They identified it as a species of *Gastrosacus*, but the photographic illustration shows characteristics typical of *Paragalathea*, including a lack of

regional definition and tuberculate ornamentation. Examination of the actual specimen is necessary for definitive placement; efforts to locate the specimen, believed to be in the museum of the Geological Institute of Romania, have been unsuccessful.

Discutiolira nov. gen. differs from *Paragalathea* by having ornamentation of interrupted transverse ridges, as opposed to tubercles, and more regional definition. *Mesogalathea* has strong, imbricated transverse ridges ornamenting the carapace, whereas *Paragalathea* has tuberculate ornamentation. Members of *Paragalathea* have been found in Tithonian age limestones of Austria, Czech Republic, Poland, and Romania.

Paragalathea verrucosa (Moericke, 1889)

Figs 3.1–3.5

1889 *Galathea verrucosa* Moericke: p. 55, taf. 6, fig. 9.
1959 *Galathea* (*Paragalathea*) *verrucosa* Patrulius: p. 252
1963 *Galatheites verrucosus* Moericke – Houša: pl. 2, figs 1–2.
1981 *Paragalathea verrucosa* Patrulius – Vía Boada: p. 249.

Emended diagnosis: Carapace widens posteriorly, maximum width roughly equal to length. Rostrum downturned, without keel. Base of rostrum differentiated from carapace by slight chevron shaped indent. Cervical groove moderately well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin. Regions undefined. Carapace, including rostrum, ornamented with rounded to slightly squamous tubercles; approaching center of carapace immediately posterior of the cervical groove to the posterior margin tubercles become slightly transversely elongated.

Measurements: See Table 1.

Lectotype: BSP AS III 313, designated by Robins *et al*. (2013), a cast of which is shown in Figs 3.1 and 3.3.

Material Examined: KSU D635 (cast of lectotype BSP AS III 313 from the Štramberk Limestones); NHMW 2007z0149/0067, NHMW 2007z0149/0071 from the Ernstbrunn Limestones.

Type locality: Moericke (1889) reported Willamowitz as the locality. This locality corresponds to the modern Wilamowice near Oświęcim (Auschwitz) in Poland.

Type stratum: Štramberk Limestones, Poland.

Occurrence: *Paragalathea verrucosa* has been found in the Tithonian limestones of Austria (herein) and Poland (Moericke 1889). Houša (1963) did not specify a locality other than Štramberk Limestones. It has also been reported from Romania by Patrulius (1966), but that occurrence has not been confirmed by the authors.

Discussion: The emended diagnosis above is based on examination of a mold of the lectotype (Figs 3.1, 3.2) as well as two additional specimens (Figs 3.3–3.5) found in Ernstbrunn, Austria. Patrulius (1959) characterized *Paragalathea* as possessing a

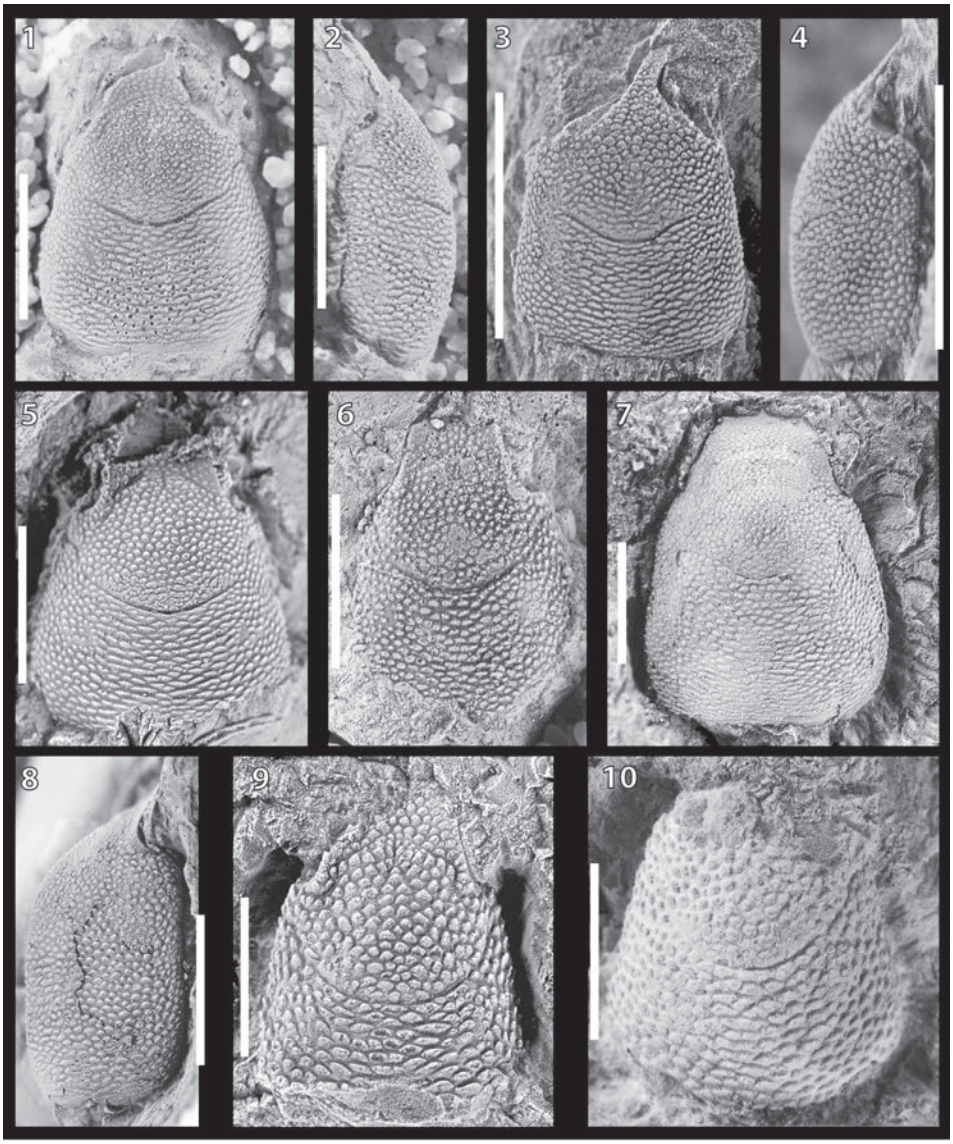


Fig. 3. **1–2**: Cast of the lectotype of *Paragalathea verrucosa* (MOERICKE, 1889) from the Štramberk Limestones of Wilamowice, Poland (KSU D635). 1: dorsal view; 2: side view. **3**: *Paragalathea verrucosa* (NHMW 2007z0149/0067) from the Ernstbrunn Limestones. **4–5**: Specimen of *Paragalathea verrucosa* (NHMW 2007z0149/0071) from the Ernstbrunn Limestones. 4: dorsal view; 5: side view. **6**: Cast of the holotype of *P. ornatissima* PATRULIUS, 1966 (KSU D472) from Woźniki, Poland. **7–8**: Holotype of *Paragalathea arcella* nov. spec. (NHMW 2007z0149/0072) from the Ernstbrunn Limestones. 7: dorsal view; 8: side view. **9**: Holotype of *Paragalathea crenarvina* nov. spec. (NHMW 2007z0149/0069) from the Ernstbrunn Limestones. **10**: Paratype of *Paragalathea crenarvina* nov. spec. (two numbers: P129/54 and 11866) from the Štramberk Limestones. This specimen was whitened, but not dyed, prior to the photograph. Scale bars for 1–3 and 6–10 equal 5 mm, those for 4–5 equal 2 mm.

tridentate rostrum. The lectotype of *P. verrucosa* does not have a preserved rostrum. An additional specimen found in Ernstbrunn, Austria, NHMW 2007z0149/0067, has the proximal portion of the rostrum preserved. It does indicate that the rostrum is broad with slightly narrowing sides; unfortunately, no member of *P. verrucosa* has yet been found with an intact rostrum. PATRULIUS (1966) reported an occurrence of *P. verrucosa* from Moroeni, Romania. He illustrated the specimen solely with a hand-drawn figure comparing the rostra of various decapods (PATRULIUS 1966: p. 503, fig. 3C). The rostrum he illustrated is not complete; however, he indicated that there is no division between the rostrum and the main carapace. While this is the case for *Paragalathea arcella* nov. spec., *P. verrucosa* has a very slight mark where the carapace ends and the rostrum begins. He may have found a member of the similar *P. arcella* as opposed to *P. verrucosa*. Unfortunately, his collection, believed to be housed in the museum of the Geological Institute of Romania, has not been available for study for confirmation.

Three species of *Paragalathea*, *P. verrucosa*, *P. ornatissima*, and *P. crenarvina* nov. spec., differ in the size of the tubercles on the dorsal carapace. *Paragalathea verrucosa* has the smallest, most transversely ovate ornamentation of the three. *Paragalathea arcella* nov. spec. is much more convex, with finer ornamentation and no discernable marking between the rostrum and main carapace. The cervical groove on *P. arcella* nov. spec. is also slightly more sinuous than that of *P. verrucosa*. In contrast, the cervical grooves of *Paragalathea ternata* nov. spec. and *P. vultuosona* nov. spec. is more rounded than that of *P. verrucosa*. *Paragalathea verrucosa* has been found in the Tithonian limestones of Austria and Poland. It has also been reported from Romania by PATRULIUS (1966), as discussed above, but that occurrence has not been confirmed by the authors.

Paragalathea ornatissima PATRULIUS, 1966

Fig. 3.6

1966 *Galathea* (*Paragalathea*) *ornatissima* PATRULIUS: p. 505, pl. 30, fig. 6.
1981 *Paragalathea ornatissima* PATRULIUS – VÍA BOADA: p. 249.

Diagnosis (translated and paraphrased from PATRULIUS 1966: p. 505): "Carapace trapezoidal in shape; cervical groove visible; only extends to the lateral edges of the cephalothorax by hepatic sulci (anterior transverse); epigastric regions barely distinct from the base of the rostrum, separated by a minor chevron-shaped groove surface; ornamentation consists of tightly spaced tubercles essentially equal in size, somewhat transversely elongated across cardiac region and posterior part of branchial regions. Ornamentation continues onto rostrum; middle portion of the rostrum they [tubercles] are more attenuated [weaker]."

Measurements: See Table 1.

Holotype by original designation: UJ 127P 9 (a plaster cast of the holotype, KSU D472, was studied).

Type locality: Woźniki, Western Carpathians, Poland.

Type stratum: Block of Štramberk Limestone (Tithonian) within a Hauterivian conglomerate.

Discussion: *Paragalathea ornatissima* has yet to be found in the collections of BACHMAYER, but is reported and illustrated (Fig. 3.6) here for completeness. *Paragalathea ornatissima*, as well as *Mesogalathea striata*, have been reported incorrectly by some authors as Hauterivian (Early Cretaceous) or Cretaceous instead of exclusively Tithonian in age (GARASSINO *et al*. 2008; SCHWEITZER & FELDMANN 2000; AHYONG *et al*. 2011). The confusion stems from the complex geologic history of the Polish Carpathians. Tithonian age limestone blocks are redeposited within a Hauterivian age conglomerate. The decapods found by PATRULIUS, including *P. ornatissima*, were found within a Tithonian limestone block, listed as Štramberk by PATRULIUS (1966), that had been redeposited within the Cretaceous conglomerate. The limestone containing the decapods was dated based on ammonite zones *Pseudovirgatites* and *Zaraiskites* (PATRULIUS 1966: p. 505). PATRULIUS (1966) also reported this species from the Tithonian rocks of Sinaia, Romania, but that has not been confirmed by the authors.

Paragalathea ornatissima possesses coarser ornamentation and has fewer transversely elongated tubercles than *P. verrucosa*. *Paragalathea ornatissima* has finer ornamentation than *P. crenarvina* nov. spec. *Paragalathea crenarvina* nov. spec. also appears to have more squamous ornamentation, whereas *P. ornatissima* has more tubercular ornamentation. *Paragalathea arcella* nov. spec. is much more convex, with finer ornamentation and no discernable marking between the rostrum and main carapace. The cervical groove on *P. arcella* nov. spec. is also slightly more sinuous than that of *P. ornatissima*. *Paragalathea ternata* nov. spec. and *P. vultuosona* nov. spec. both have more regional definition than *P. ornatissima*.

***Paragalathea arcella* nov. spec.**

Figs 3.7, 3.8

Diagnosis: Carapace average L/TW 1.1; L/MW 0.9. Rostrum without demarcation at its base, unkeeled, broadly rectangular, terminates in very broad tridentate tip. Cervical groove very weakly defined; diminishes in strength and nearly disappears upon approaching lateral margin. No regional definition present. Ornamentation consists of rounded to slightly squamous tubercles.

Etymology: From the Latin *arcella*, meaning box. The name refers to the extremely convex shape of the carapace.

Measurements: See Table 1.

Holotype: NHMW 2007z0149/0072.

Paratypes: NHMW 2007z0149/0073, NHMW 2007z0149/0074, NHMW 2007z0149/0075.

Other material examined: NHMW 2007z0149/0076, NHMW 2007z0149/0077.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Extremely strongly convex carapace; rostrum very broad without demarcation at its base, L/TW ranges 0.8–1.0; L/MW ranges 1.1 to 1.2. Rostrum unkeeled; broadly rectangular; terminates in very broad tridentate tip. Points on lateral edges of rostrum slightly more prominent than surrounding area; midpoint of rostrum much more prominent. Serrations present on anterior edge of rostrum between points. Cervical groove very weakly defined; arcs concave forward in middle third of carapace; arcs convex forward on left and right third of carapace; fades and nearly disappears upon approaching lateral margin. No regional definition present. Ornamentation consists of rounded to slightly squamous tubercles, with few tubercles laterally elongated posterior of cervical groove. Approaching posterior margin elongated tubercles occur more frequently. Ornamentation continues onto rostrum. Ventral surface and appendages not preserved.

Discussion: *Paragalathea arcella* nov. spec. possesses a weaker cervical groove, finer ornamentation, and is the most convex of all the known species within *Paragalathea*.

***Paragalathea crenarvina* nov. spec.**

Figs 3.9, 3.10

Diagnosis: Carapace widens posteriorly. Rostrum downturned, broad, without keel. Cervical groove moderately well defined; regions undefined. Carapace ornamented with large squamous tubercles.

Etymology: A combination of the Latin *arvina*, meaning fat, and *crena*, meaning projection, describing the coarse projections ornamenting the carapace.

Measurements: See Table 1.

Holotype: NHMW 2007z0149/0069.

Paratype: Located in the Slezskémuseum v Opavě Coll. Palaeontologica; Opava, Czech Republic; the specimen has two numbers written on the rock it is embedded within: P129/54 and 11866.

Type locality: Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Occurrence: Ernstbrunn Limestones and Štramberk Limestones of the Czech Republic and Poland.

Description: Carapace extremely convex; widens posteriorly. Rostrum downturned, without keel, broad, narrows anteriorly; rostral shape and termination unknown. Base of rostrum differentiated from carapace by slight chevron-shaped indent. Cervical groove

moderately well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin. Epibranchial region barely defined by ornamentation; other regions undefined. Carapace ornamented with large squamous tubercles; tubercles end in anteriorly directed rounded points. Tubercles rounded at lateral margins; approaching center of carapace immediately posterior of the cervical groove to the posterior margin tubercles become transversely elongated. Transversely elongated ornamentation not uniform. Ventral surface and appendages not preserved.

Discussion: Two individuals of this species are known; the paratype is from Štramberk, Czech Republic, and is housed in the local geology museum in Opava, Czech

Table 1. Measurements of studied *Paragalathea* specimens. Measurements are the same as marked on Fig. 2.1, abbreviations for the measurements are as follows: Length (L), length of carapace including rostrum (LR), length of rostrum (R), maximum width (MW), rostral width (RW), total width of anterior margin (TW), length of the gastric region (GH). The Fig. number refers to specimens illustrated in this paper. All measurements are given in mm.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Paragalathea verrucosa* (MOERICKE, 1889)**											
KSU D635 (cast of lectotype)	7.8	-	-	8.1	4.4	6.1	3.5	1	1.3	0.7	3.1-2
NHMW 2007z0149/0067	7.8	-	-	8.2	4.2	5.9	3.6	0.9	1.3	0.7	3.3
NHMW 2007z0149/0071	4.5	-	-	4.7		3.9	2.3	1	1.2		3.4-5
***Paragalathea ornatissima* (PATRULIUS, 1966)**											
KSU D472 (cast of holotype)	-	-	-	-	3.9	5.6	3	-	-	0.7	3.6
***Paragalathea arcella* nov. spec.**											
NHMW 2007z0149/0072 (holotype)	9.8	12.9	3.1	10	5.7	7.9		1	1.2	0.7	3.7-8
NHMW 2007z0149/0073 (paratype)	-	-	4.5		5.8	8.4	4.7	-	-	0.7	-
NHMW 2007z0149/0074 (paratype)	-	-	-	12.3	6.8	8.1	5.4	-	-	0.8	-
NHMW 2007z0149/0075 (paratype)	9.9	-	-	-	6.5	9.4	5.4	-	1.1	0.7	-
NHMW 2007z0149/0076	10.1	-	-	12.3	5.9	8.9	4.4	0.8	1.1	0.7	-
NHMW 2007z0149/0077	-	-	-	-	-	-	-	0.9	1.1	-	-
***Paragalathea crenarvina* nov. spec.**											
NHMW 2007z0149/0069 (holotype)	-	-	-	-	4.6	7.7	3.7	-	-	0.6	3.9
Opava P129/54 & 11866 (paratype)	-	-	-	9.7	-	7.2	-	-	-	-	3.10
***Paragalathea ternata* nov. spec.**											
NHMW 2007z0149/0078 (holotype)	11.2	14.8	3.6	11.1	5.2	7.7	5	1	1.5	0.7	4.1
NHMW 2007z0149/0079 (paratype)	11.7	15.8	4	12.1	5.4	9.1	5.8	1	1.3	0.6	4.2
***Paragalathea vultuosona* nov. spec.**											
NHMW 2007z0149/0080 (holotype)	10.1	14.3	4.2	12	6.7	9	5.3	0.8	1.1	0.7	4.3-5
NHMW 2007z0149/0081 (paratype)	10.9	14.5	3.6	12.7	7.1	8.6	6	0.9	1.3	0.8	-

Republic, the holotype is from Ernstbrunn, Austria, and is housed at the NHMW. Unfortunately, neither is completely preserved. The holotype possesses the basal part of the rostrum through the presumed posterior of the cardiac region; the paratype possesses the posterior margin forward to the mid-gastric region. The two individuals have identical patterns of tubercles; however, the paratype has much more closely spaced tubercles than the holotype. This shows some variation within the species. The specimens are very close to the same size, which seems to preclude an ontogenetic cause. More specimens are necessary to determine with greater certainty the nature of the variation. *Paragalathea crenarvina* nov. spec. has coarser ornamentation with rounded points not found on *P. verrucosa*, *P. ternata* nov. spec., *P. vultuosona* nov. spec., or *P. ornatissima*. *Paragalathea arcella* nov. spec. is much more convex, with finer ornamentation and no discernable marking between the rostrum and main carapace. The cervical groove on *P. arcella* nov. spec. is also slightly more sinuous than that of *P. crenarvina* nov. spec.

***Paragalathea ternata* nov. spec.**

Figs 4.1, 4.2

Diagnosis: Carapace widens posteriorly, average L/TW 1.4; L/MW 1.0. Rostrum broad, unkeeled, subrectangular; terminates in tridentate tip. Cervical groove smooth U-shape; epibranchial, branchial, and cardiac region extremely weakly defined. Ornamentation consists of rounded to slightly squamous tubercles.

Etymology: From the Latin *ternatus*, meaning three. The name refers to the tridentate rostrum found on this species. Although *Paragalathea arcella* nov. spec. has a tridentate rostrum with slight differentiation between the three terminal points, the tridentate nature of the rostrum of *P. ternata* nov. spec. is one of the more notable features of this species.

Measurements: See Table 1.

Holotype: NHMW 2007z0149/0078.

Paratype: NHMW 2007z0149/0079.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Strongly convex carapace; carapace widens posteriorly, L/TW ranges 1.3 to 1.5; L/MW 1.0. Rostrum broad with slight demarcation at its base. Rostrum unkeeled; subrectangular; terminates in tridentate tip, with central spine projecting slightly farther than other spines. Cervical groove moderately defined in smooth U-shape; fades upon approaching lateral margin. Very faint cervical groove branches below and above epibranchial region. Branchial and cardiac regions slightly defined. Ornamentation consists of rounded to slightly squamous tubercles; with very few tubercles slightly laterally elongated posterior of cervical groove; most laterally elongated tubercles concentrated in cardiac region. Approaching posterior margin tubercles return

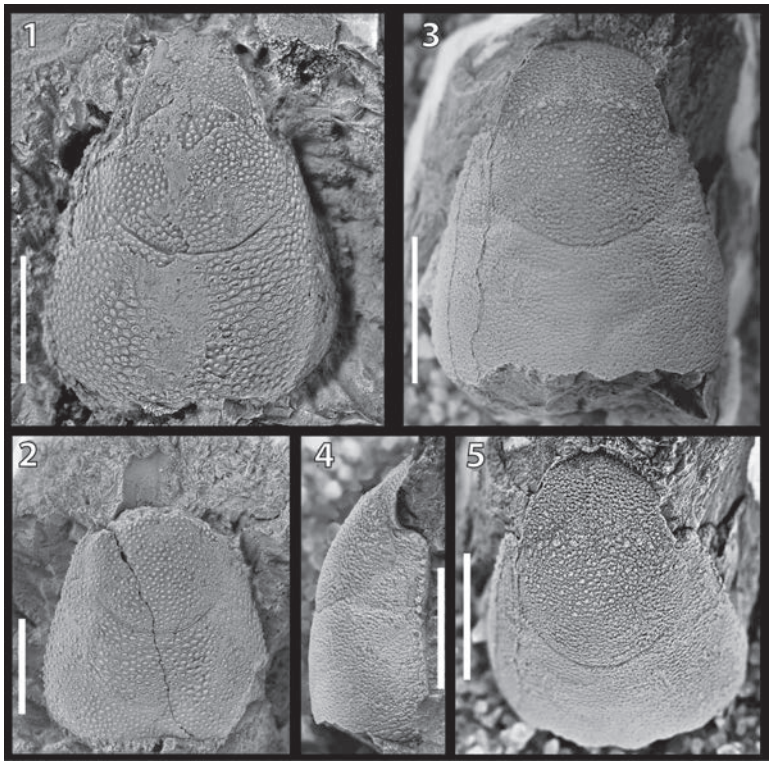


Fig. 4. **1**: Holotype (NHMW 2007z0149/0078) and 2 Paratype (NHMW 2007z0149/0079) of *Paragalathea ternata* nov. spec. from the Ernstbrunn Limestones. **3–5**: Holotype of *Paragalathea vultuosona* nov. spec. (NHMW 2007z0149/0080) from the Ernstbrunn Limestones; 3: dorsal view; 4: side view; 5: oblique frontal view. All scale bars equal 5 mm.

to rounded form. Ornamentation continues onto rostrum. Ventral surface and appendages not preserved.

Discussion: Two specimens of this species are known; the holotype has a preserved rostrum with a partially-obscured tip, whereas the paratype has the shape of the rostrum imprinted in the rock, but the rostrum itself is missing. *Paragalathea ternata* nov. spec. has a deeper, less sinuous cervical groove than other members of *Paragalathea* except *P. vultuosona*, as well as ornamentation that is less transversely ovate posteriorly. *Paragalathea ternata* nov. spec. has a tridentate rostrum, separating it from *P. vultuosona* nov. spec., which has a rounded rostrum with serrate edges.

***Paragalathea vultuosona* nov. spec.**

Figs 4.3–4.6

Diagnosis: Carapace widens posteriorly; average L/TW 1.2, L/MW 0.8. Rostrum extremely broad, deflected downward, unkeeled, broadly rectangular, with serrate edge. Cervical groove moderately defined in smooth U-shape. Epibranchial, branchial, and

cardiac regions slightly defined. Lateral margins bear anteriorly-directed spines. Ornamentation consists of rounded tubercles in varying sizes on gastric region.

Etymology: A combination of the Latin *vultuosus*, meaning full of expression, and *onus*, meaning heavy. The name refers to the well-developed rostrum and large carapace. Feminine gender.

Measurements: See Table 1.

Holotype: NHMW 2007z0149/0080.

Paratype: NHMW 2007z0149/0081.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Strongly convex carapace; carapace widens posteriorly, L/TW ranges 1.1 to 1.3; L/MW ranges 0.8 to 0.9. Rostrum extremely broad; deflected; without clear demarcation at its base. Rostrum unkeeled, broadly rectangular; terminates in rounded tip. Tip of rostrum serrate. Orbits present below rostrum, straight, oriented transversely. Cervical groove moderately defined in smooth U-shape; cervical groove branches below and above epibranchial region. Very weak regional definition; cardiac region slightly raised. Lateral margins bear anteriorly-directed spines. Ornamentation consists of rounded tubercles in varying sizes on gastric region. Ornamentation continues onto rostrum as smaller, uniform tubercles. Ornamentation posterior of cervical groove pitted. Ventral surface and appendages not preserved.

Discussion: The holotype and the paratype are nearly complete. Neither shows any evidence of ornamentation posterior to the cervical groove other than tiny, shallow pits, with tubercles reappearing at the posterior margin. The rostrum of the paratype is broken at the lateral edge, exposing part of the orbit, which is horizontal, in the same plane as the carapace. The cervical groove of *Paragalathea vultuosona* nov. spec. which extends in a broad U-shape without arcing when approaching the lateral margins, separates this genus from *Paragalathea arcella* nov. spec., *P. verrucosa*, *P. crenarvina* nov. spec., and *P. ornatissima*. This species is separated from *P. ternata* nov. spec. on the basis of the rostrum; the rostrum of *P. vultuosona* nov. spec. is rounded with a serrate edge; *P. ternata* nov. spec. has a tridentate rostrum.

Genus *Mesogalathea* Houša, 1963

Type species: *Galathea striata* Remeš, 1895; by original designation.

Other included species: *Mesogalathea macra* nov. spec., *Mesogalathea pyxis* nov. spec., *Mesogalathea retusa* nov. spec.

Emended diagnosis: Carapace sub-rectangular to sub-oval; strongly convex, maximum width roughly equal to length; ornamented exclusively with transverse striae.

Rostrum very broad, without keel; ends in broadly tridentate tip. Cervical groove weakly to moderately defined; regions usually undefined.

Discussion: The members of *Mesogalathea* are united by their broad rostrum, imbricated transverse ornamentation, convexity, and lack of regional definition. This genus is known exclusively from the Late Jurassic, and has been found in Austria, Czech Republic, Poland, and Romania. Reports of this genus from the Hauterivian are incorrect, as explained in the discussion section of *Paragalathea ornatissima*.

Mesogalathea striata (Remeš, 1895)

Figs 5.1–5.3

1895 *Galathea striata* Remeš: p. 200, pl. 1, fig. 3.
1929 *Galatheites striatus* Remeš – Lőrenthey in Lőrenthey & Beurlen: p. 77–78, pl. 30, fig. 14.
1963 *Mesogalathea striata* (Remeš, 1895) – Houša: pl. 1, fig. 2.
1966 *Galathea* (*Paragalathea*) *striata* (Remeš) – Patrulius: p. 504–505, pl. 30, fig. 5.
1971 *Galathea* (*Paragalathea*) *striata* Remeš – Mutiu & Bădăluță: p. 249–250, pl. 1, figs 5–7.

Emended diagnosis: Carapace average L/TW 1.2; L/MW 0.9. Rostrum very large; covers more than half total width of anterior of dorsal carapace and comprises 1/3 total carapace length. Lateral edges of rostrum meet to form obtuse tridentate tip. Carapace, including rostrum, ornamented with long, transverse ridges. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; straightens across carapace and turns sharply anteriorly at lateral margins.

Measurements: See Table 2.

Types: The description given by Remeš (1895), as well as his drawing of *M. striata*, appear to match well with the illustrated specimens. Subsequent authors (Lőrenthey in Lőrenthey & Beurlen 1929; Houša 1963; Patrulius 1966; Mutiu & Bădăluță 1971) have been consistent in identifying specimens with identical morphology of *M. striata* illustrated in Figs 5.2 and 5.3. Unfortunately, Remeš' illustrated specimen of this species is presumed lost. None of the *M. striata* specimens examined for this work were from the Štramberk Limestones; thus, it is beyond the scope of this work to declare a neotype.

Material examined: NHMW 2007z0149/0260, NHMW 2007z0149/0263, NHMW 2007z0149/0265 to …/0267, from Ernstbrunn, Austria.

Type locality and strata: Remeš (1895) did not specify a particular Štramberk locality, and referred only to the "Stramberger Schichten" in his descriptions.

Occurrence: Ernstbrunn Limestones (herein); Moesian Platform, Romania (Mutiu & Bădăluță 1971); Nagy-Küküllő (now Comitatul Târnava-Mare, Transylvania, Romania; Lőrenthey in Lőrenthey & Beurlen 1929); Štramberk Limestones of Woźniki, Poland (Patrulius 1966); unspecified Štramberk Limestones of the Czech Republic and Poland (Houša 1963, Remeš 1895).

Description: Carapace sub-rectangular to sub-oval; may narrow slightly at extreme anterior and posterior. Carapace strongly convex transversely; moderately convex

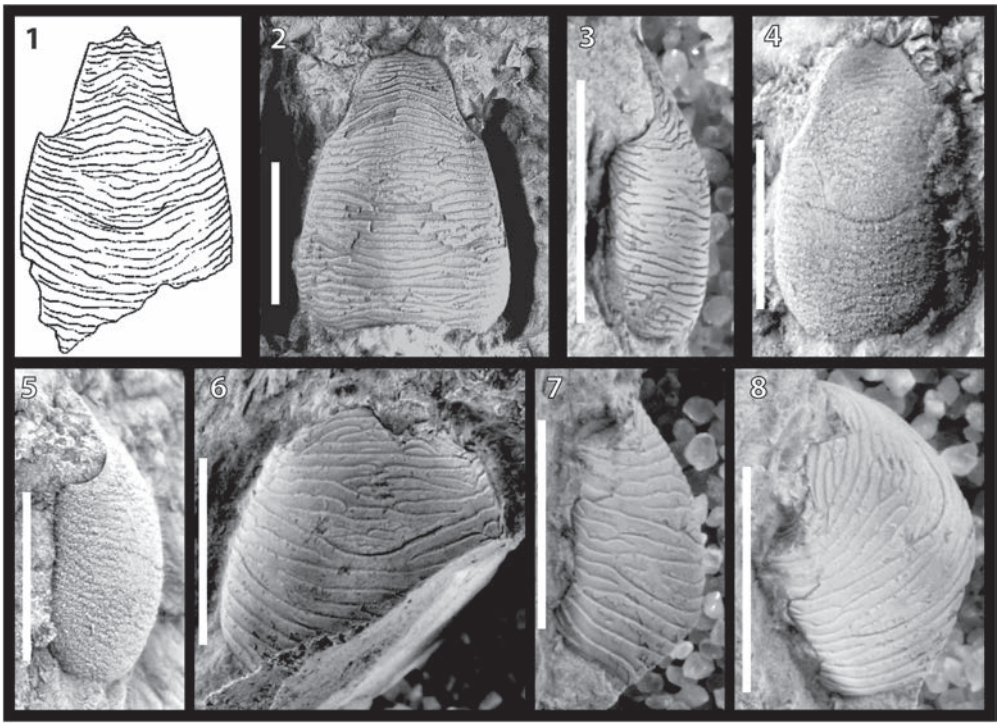


Fig. 5. **1**: Reprinted drawing of *Mesogalathea striata* (Remeš, 1895: pl. 1, fig. 3a) from the Štramberk Limestones. Remeš (1895) stated the rostrum was 4 mm long. **2**: *Mesogalathea striata* (NHMW 2007z0149/0260). **3**: Side view of *Mesogalathea striata* (NHMW 2007z0149/0265). **4–5**: Holotype of *Mesogalathea macra* nov. spec. (NHMW 2007z0149/0268). 4: dorsal view; 5: side view. **6–8**: Holotype of *Mesogalathea pyxis* nov. spec. (NHMW 2007z0149/0269). 6: dorsal view; 7: side view; 8: oblique view. Specimens featured in 2–8 are from the Ernstbrunn Limestones. Scale bars for 2–3 and 6–8 equal 5 mm, those for 4–5 equal 2 mm.

longitudinally, L/TW ranges 1.1 to 1.3, L/MW ranges 0.9 to 1.0. Rostrum very large; covers more than half anterior width of frontal margin of dorsal carapace and comprises 1/3 total carapace length. Rostrum spatulate with smooth lateral margins; strongly deflected; bears no keel. Lateral edges of rostrum sub-parallel, slightly angling toward axis; sides turn toward each other at tip of rostrum to form obtuse tridentate tip. Rostrum bears transverse ornamentation that follows general rostral shape; ornamentation of rostrum nearly indistinguishable from carapace ornamentation. Rostrum merges smoothly to carapace with no discernable border posteriorly and at rounded obtuse angle laterally. Orbit straight; extends transversely under rostrum in same plane as carapace.

Lateral margin straight; smoothly arcs inward both anteriorly and posteriorly. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; straightens across carapace and turns sharply anteriorly at lateral margins. Branchiocardiac groove not defined. Carapace ornamented with long transverse ridges. Regions

not defined. Anteriorly, ornamentation follows that of rostrum until lateral edges reach maximum width. Posterior to that point, transverse ridges cross majority of carapace, interspersed with smaller ridges. Most ridges bear slight concave forward inflection. All ornamentation extends to lateral edges and turns sharply anteriorly at lateral margins. Ventral surface and appendages not preserved.

Discussion: *Mesogalathea striata* has more prominent transverse ornamentation and a rostrum with an obtusely tridentate tip, in contrast to the weak transverse ornamentation and more prominent tridentate tip of *Mesogalathea macra* nov. spec. and *Mesogalathea retusa* nov. spec. *Mesogalathea pyxis* nov. spec. is much more convex than *M. striata* and has a broad-V shaped cervical groove, whereas *M. striata* has a mostly transverse, nearly straight cervical groove.

***Mesogalathea macra* nov. spec.**

Figs 5.4, 5.5

Diagnosis: Carapace L/TW 1.0; L/MW 1.0. Rostrum with tridentate tip. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; straightens across carapace. Carapace ornamented with fine, long transverse ridges; anterior edge of most ridges appears irregularly scalloped. Transverse ridges on anterior of gastric region become shorter when approaching rostrum.

Etymology: From the Latin *macer*, meaning thin or poor. This refers to the thin striations on the carapace.

Measurements: See Table 2.

Holotype by monotypy: NHMW 2007z0149/0268.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace sub-rectangular to sub-oval; may narrow slightly at extreme anterior and posterior. Carapace strongly convex transversely; moderately convex longitudinally L/TW 1.0; L/MW 1.0. Rostrum very large; covers more than half anterior of dorsal carapace. Rostrum spatulate with smooth lateral margins; strongly deflected; bears no keel. Lateral edges of rostrum sub-parallel, slightly angling toward center; sides turn toward each other at tip of rostrum to form tridentate tip. Center point of trident extends slightly farther than lateral tips. Rostrum bears weak transverse ornamentation; attaches smoothly to carapace with no discernable border posteriorly. Orbital margin not exposed. Lateral margin straight; smoothly arcs inward both anteriorly and posteriorly. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; straightens across carapace. Regions not defined. Carapace ornamented with long transverse ridges; anterior edges of most ridges appear irregularly scalloped. Fine, transverse ridges cross majority of carapace, interspersed with smaller ridges. Most ridges bear slight concave-forward inflection. All ornamentation extends to lateral edges

and turns sharply anteriorly at lateral margins. Transverse ridges on anterior of gastric region become shorter when approaching rostrum. Ventral surface and appendages not preserved.

Discussion: This species is most similar to *Mesogalathea striata*; however, the tip of the rostrum on *Mesogalathea macra* is more strongly tridentate, and the ornamentation is weaker, with scalloped edges, compared to the strong, straight ornamentation of *M. striata*. *Mesogalathea pyxis* is much more convex with a more V-shaped cervical groove than *M. macra*. *Mesogalathea retusa*, which also has a strongly tridentate rostrum, has a longer rostrum that is slightly narrower than that of *M. macra*.

***Mesogalathea pyxis* nov. spec.**

5.6–5.8

Diagnosis: Carapace widens posteriorly; narrows slightly at extreme anterior and posterior. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; forms extremely broad V-shape approaching lateral margin. Carapace ornamented with long transverse ridges.

Etymology: From the Latin *pyxis*, meaning box. The specific name references the convex appearance of the carapace.

Measurements: See Table 2.

Holotype by monotypy: NHMW 2007z0149/0269.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace incompletely preserved; majority of rostrum and right branchial region absent. Carapace widens posteriorly; narrows slightly at extreme anterior and posterior. Carapace extremely strongly convex both transversely and longitudinally. Carapace vaulted; highest point of carapace occurs at unmarked cardiac region; carapace markedly less vaulted approaching the posterior margin.

Rostrum incompletely preserved; appears very large; covers more than half of frontal margin of dorsal carapace. Rostrum attaches smoothly to carapace with no discernable border. Orbital margin partly obscured; appears to extend under rostrum horizontally in same plane as carapace; orbit ornamented in same manner as carapace.

Lateral margin straight; smoothly arcs inward both anteriorly and posteriorly. Weak cervical groove extends across carapace with a shallow inflection concave forward at center; forms extremely broad V-shape approaching lateral margin. Branchiocardiac groove not defined.

Carapace ornamented with long transverse ridges. Regions not defined. Transverse ridges cross majority of carapace, interspersed with smaller ridges. Ridges less continuous on gastric region; appear more continuous on preserved part of branchial region, with

smaller ridges occurring along lateral margin, not extending onto carapace. Most ridges bear slight concave-forward inflection. All ornamentation extends to lateral edges and turns sharply anteriorly at lateral margins. Ventral surface and appendages not preserved.

Discussion: This species differs from *Mesogalathea striata* by the shape of the cervical groove. The cervical groove of *M. striata* is straighter; on *M. pyxis* nov. spec. the groove has a very broad V-shape. *Mesogalathea pyxis* nov. spec. also has much stronger transverse ornamentation than *Mesogalathea macra* and *Mesogalathea retusa* nov. spec. The partial orbit, shown in Fig. 5.8, is very similar in shape to that of *Paragalathea vultuosona* nov. spec.

***Mesogalathea retusa* nov. spec.**

Figs 6.1, 6.2

Diagnosis: Carapace sub-rectangular; L/TW 1.2, L/MW 1.0. Rostrum obtusely tridentate. Weak cervical groove extends across carapace; weakens and terminates

Table 2. Measurements of studied *Mesogalathea* and *Discutiolira* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Mesogalathea striata* (REMEŠ, 1895)**											
NHMW 2007z0149/0260	6.7	9.7	3	7.4	4.4	5.6	2.8	0.9	1.2	0.8	5.2
NHMW 2007z0149/0263	-	-	-	-	-	-	3.3	-	-	-	-
NHMW 2007z0149/0265	4.6	6.7	2.1	4.6	3.4	4.3	2.1	1	1.1	0.8	5.3
NHMW 2007z0149/0266	6.5	-	-	7.2	3.9	5.1	2.7	0.9	1.3	0.8	-
NHMW 2007z0149/0267	-	-	-	5.1	2.7	3.9	1.9	-	-	0.7	-
***Mesogalathea macra* nov. spec.**											
NHMW 2007z0149/0268 (holotype)	2.3	3.5	1.2	2.4	1.8	2.2	-	1	1	0.8	5.4-5
***Mesogalathea pyxis* nov. spec.**											
NHMW 2007z0149/0269	-	-	-	8	4.4	5.6	3	-	-	0.8	5.6-8
***Mesogalathea retusa* nov. spec.**											
NHMW 2007z0149/0270 (holotype)	4.3	6.5	2.2	4.3	2.3	3.6	2.2	1	1.2	0.6	6.1-2
***Discutiolira eutecta* (MOERICKE, 1889) nov. comb.**											
BSP AS III 318	14	-	-	13.3	6.4	9.1	6.3	1.1	1.5	0.7	8.1
NHMW 1910/0005/0035	-	-	-	-	-	7	4.2	-	-	-	8.2
NHMW 2012/0129/0001	-	-	-	6.3	-	-	-	-	-	-	8.3
NHMW 2012/0129/0002	-	-	-	10.5	-	-	-	-	-	-	8.4
Discutiolira* cf. *eutecta											
NHMW 2012/0129/0003	-	-	4	-	6	8.1	-	-	-	-	9

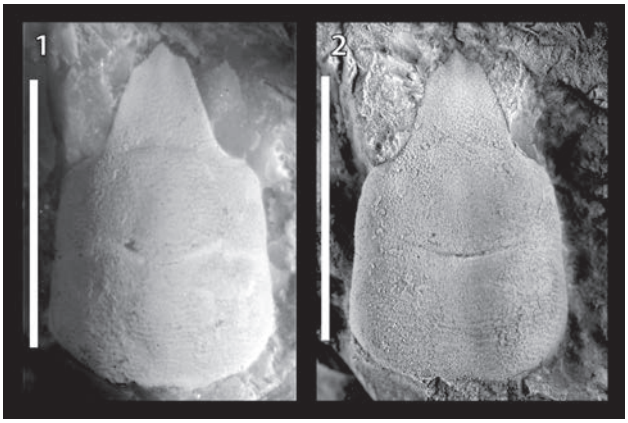


Fig. 6. **1**: Holotype of *Mesogalathea retusa* nov. spec. (NHMW 2007z0149/0270) from the Ernstbrunn Limestones. This specimen was neither whitened nor dyed prior to the photograph. **2**: Same specimen as Fig. 1, after specimen was dyed and whitened. Scale bars equal 5 mm.

approaching lateral margin. Cardiac region very weakly defined. Ornamentation consists of weak, narrow, long transverse ridges.

Etymology: From the Latin *retusus*, meaning rounded and notched at the apex. Refers to the bluntly rounded carapace with a blunted, tridentate rostrum.

Measurements: See Table 2.

Holotype by monotypy: NHMW 2007z0149/0270.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace sub-rectangular; narrows slightly at extreme anterior and posterior. Carapace strongly convex transversely; moderately convex longitudinally; L/TW 1.2, L/MW 1.0. Rostrum very large; covers more than half of width of frontal margin of dorsal carapace and comprises 1/3 total carapace length. Rostrum broadly triangular with smooth lateral margins; strongly deflected; bears no keel; attaches smoothly to carapace with no discernable border. Tip of rostrum tridentate; central tooth triangular, extends farther than lateral teeth. Lateral teeth not pointed; lateral edge of rostrum abruptly slopes inward approaching central tooth. Central tooth slightly raised above remainder of rostrum. Rostrum bears extremely weak, slightly squamous ornamentation. Rostrum merges smoothly to carapace. Orbital margin obscured.

Lateral margin straight, smoothly arcs inward both anteriorly and posteriorly. Weak cervical groove extends across carapace with inflection concave forward at center; continues across carapace in broad U-shape; weakens and terminates approaching lateral margin. Cervical groove branches at base of epigastric region; weak groove arcs slightly concave forward approaching lateral margin. Gastric region raised slightly above rostrum. Cardiac region very weakly defined. Ornamentation extremely weak; consists of narrow, long transverse ridges. Ornamentation mostly eroded from central portion of carapace. Ventral surface and appendages not preserved.

Discussion: *Mesogalathea retusa* nov. spec. differs from *M. striata* and *M. pyxis* nov. spec. due to its weaker ornamentation. *Mesogalathea striata* and *M. macra* nov. spec. have slightly wider rostra. The ornamentation on *M. macra* nov. spec. is stronger than that of *M. retusa* nov. spec. *Mesogalathea retusa* nov. spec. also has a longer rostrum than *M. macra*.

Genus *Discutiolira* nov. gen.

Type species: *Galathea eutecta* MOERICKE 1889 (=*Galathea substriata* BLASCHKE, 1911 nov. syn.).

Other included species: *Galathea moesica* – MUȚIU & BĂDĂLUȚĂ, 1971.

Diagnosis: Carapace moderately convex; widens posteriorly; maximum width roughly equal to length. Rostrum downturned, with or without keel, broadly triangular or pentagonal. Cervical groove well defined. Epigastric and mesogastric region slightly to moderately well defined by weak groove. Cardiac region slightly defined. Carapace, including rostrum, ornamented with transverse ridges.

Etymology: The generic name comes from the Latin *discutio*, meaning discontinuous or broken, and *lira*, meaning earthen ridges or furrows. This name refers to the interrupted transverse ridges ornamenting the carapace. The gender is feminine.

Discussion: This genus is placed within the Paragalatheidae nov. fam. based on the pattern of the cervical groove, which traverses the carapace and approaches the lateral margin at much the same angle as that of *Paragalathea verrucosa*. This similarity is especially apparent comparing Figs 3.5, 7.5, and 7.9. Members of the genus generally lack regional development, although this genus does have more regional development than others in the family. This regional definition is exhibited primarily across the gastric region. This genus differs from *Mesogalathea* by possessing interrupted transverse ridges, instead of the continous ridges found on members of *Mesogalathea*. There is a discernable area where the rostrum attaches in members of *Discutiolira* nov. gen., a feature absent in *Mesogalathea*. *Paragalathea* has squamous ornamentation with less regional development than *Discutiolira* nov. gen.

Discutiolira moesica (MUȚIU & BĂDĂLUȚĂ, 1971), nov. comb.

Figs 7.1–7.13

1895 *Galathea eutecta* MOERICKE – REMEŠ: p. 200, pl 1, fig. 2.
1911 *Galathea* aff. *eutecta* MOERICKE – BLASCHKE: p. 148–149.
1971 *Galathea* (*Palaeomunida*) *moesica* – MUȚIU & BĂDĂLUȚĂ: p. 249, pl. 1, figs 2, 3.
1971 *Galathea* (*Palaeomunida*) sp. – MUȚIU & BĂDĂLUȚĂ: p. 249, pl. 1, fig. 4.
2006 *Eomunidopsis eutecta* (MOERICKE) – SHIRK: p. 105–111, figs 27–28.

Diagnosis [translated from French, MUȚIU & BĂDĂLUȚĂ: p. 249]: *"Carapace trapezoidal, rectangular, oval in appearance. Cervical groove curved, deep and narrow, extended to the outer edge with the hepatic groove (transverse anterior). Branchio-hepatic grooves visible.*

Paragastric [mesogastric] *region separated from rest of gastric region by shallow grooves that converge in the middle of the anterior part of cephalothorax and then continues close to the fronto-orbital margin. The rostrum is not preserved. The area of rostral attachment is difficult to examine,* [it] *is similar to Palaeomunida zitteli* MOERICKE [*Galatheites zitteli*] *from which it differs in carapace shape and ornamentation. The ornamentation consists of narrow, raised, elongated, parallel bands, arranged in parallels or alternatively on the branchial, hepatic, and paragastric regions as slightly elongated squamous tubercles."*

Emended diagnosis: Carapace moderately convex; widens posteriorly, average L/TW 1.2, L/MW 0.9. Rostrum downturned, with or without keel, broadly triangular or pentagonal. Cervical groove well defined. Epigastric and mesogastric region slightly to moderately well defined by weak groove. Cardiac region weakly defined. Carapace, including rostrum, ornamented with short transverse ridges; ridges appear squamous across epigastric region, rostrum, and approaching lateral margins.

Measurements: See Table 3.

Holotype: The holotype is believed to be housed within the museum collections of the Geological Institute of Romania, in Bucharest. MUȚIU & BĂDĂLUȚĂ (1971) reported that it was deposited in the 'Collection du Laboratoire du Ministère du Pétrole' which was later assimilated into the Geological Institute of Romania. No specimen number was given. Inquiries about fossils within their collection have not been successful.

Material examined: From the Ernstbrunn Limestones: NHMW 2007z0149/0374 to NHMW 2007z0149/0381; NHMW 2007z0149/0383 to NHMW 2007z0149/0398; NHMW 2007z0149/0448; NHMW 2007z0149/0450; NHMW 2012/0129/0001; NHMW 2012/0129/0002. From Purcăreni, Romania: LPBIIIart111; LPBIIIart112; LPBIIIart115.

Type locality: Ghergheasa, Romania, northeast of the Moesian Platform (after MUȚIU & BĂDĂLUȚĂ 1971).

Type stratum: Štramberk type limestones from either the late early Tithonian or early late Tithonian. MUȚIU & BĂDĂLUȚĂ (1971) wrote at length about the overlapping ranges of comparative localities and the absence of ammonites to determine with certainty the exact stratigraphic level from which their fauna came.

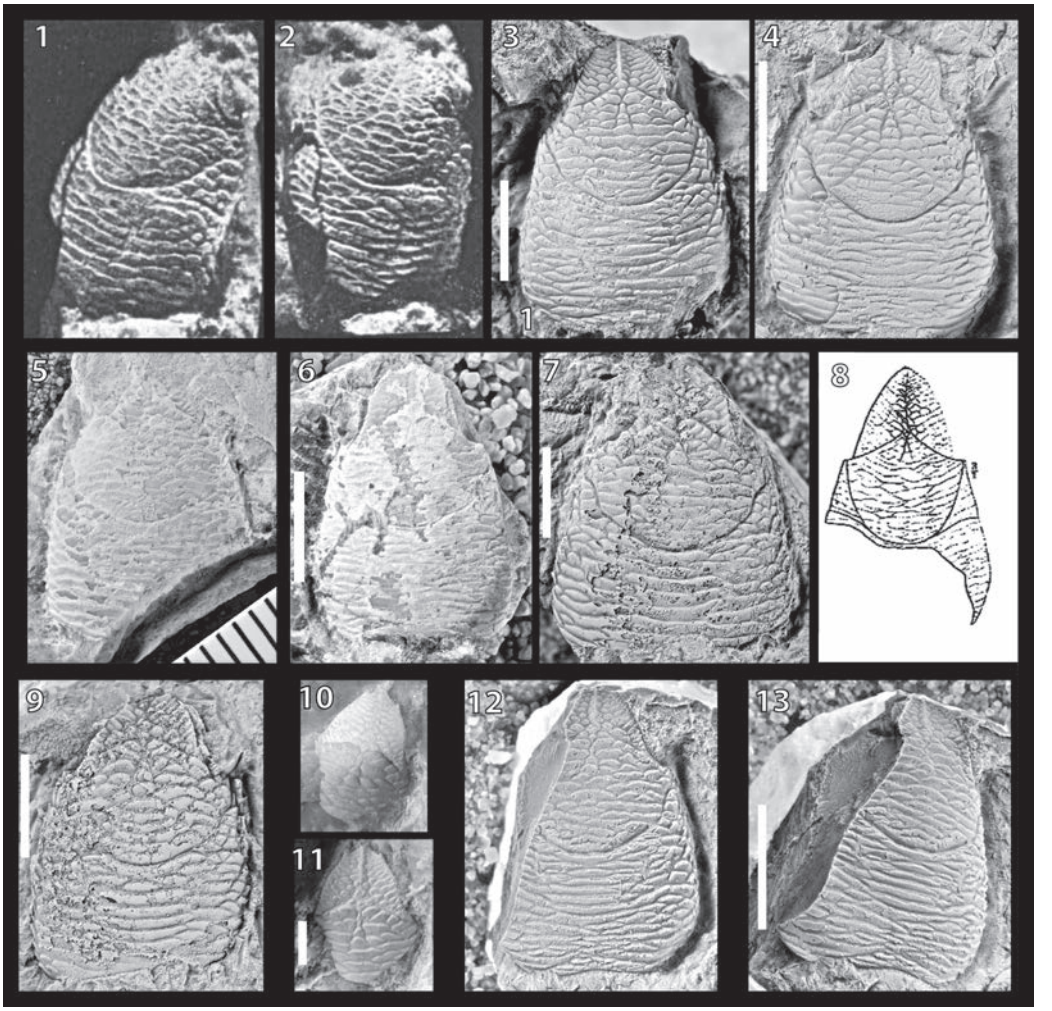
Occurrence: Ernstbrunn Limestones (herein) and Štramberk Limestones (herein; BLASCHKE 1911; REMEŠ 1895); Moesian Platform, Romania (MUȚIU & BĂDĂLUȚĂ 1971); Purcăreni, Romania (herein; SHIRK 2006).

DESCRIPTION: Carapace moderately convex especially anteriorly; widens and decreases in transverse convexity posteriorly; L/TW ranges 1.0 to 1.4; L/MW ranges 0.7 to 1.0. Rostrum downturned, with or without medial marking of keel, crease, or aligned ornamentation; rostral shape broadly triangular or pentagonal, narrows anteriorly; anteriormost part of rostrum serrate. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin. Epigastric region moderately defined; mesogastric region slightly defined by shallow groove posteriorly. Cardiac region slightly defined

by ornamentational differences, typically includes three similar sized transverse ridges. Carapace, including rostrum, ornamented with short transverse ridges; ridges appear squamous across epibranchial and epigastric regions, rostrum, and approaching lateral margins of carapace. Posterior margin rimmed, slightly indented; ornamentation continues onto rim. Ventral surface and appendages not preserved.

Table 3. Measurements of studied *Discutiolira moesica* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Discutiolira moesica* (MUŢIU & BĂDĂLUŢĂ, 1971) nov. comb.**											
NHMW 2007z0149/0375	11.4	15.6	4.2	12.6	5.4	9	5.3	0.9	1.3	0.6	7.3
NHMW 2007z0149/0376	9.7	14.3	4.6	11.8	6.3	8.1	4.4	0.8	1.2	0.8	-
NHMW 2007z0149/0377	8	11.3	3.3	9.6	4.6	7.2	3.9	0.8	1.1	0.6	7.4
NHMW 2007z0149/0378	4.3	6	1.7	4.4	2.1	3.7	2.1	1	1.2	0.6	-
NHMW 2007z0149/0379	7.9	-	-	9.7	-	8	4.4	0.8	1	-	-
NHMW 2007z0149/0380	9.6	12.9	3.3	11.1	4.3	7.8	4.7	0.9	1.2	0.6	7.12-13
NHMW 2007z0149/0381	-	-	2	-	2.7	4.6	2.5	-	-	0.6	
NHMW 2007z0149/0383	-	-	3.6	-	4.5	-	-	-	-	-	7.10-11
NHMW 2007z0149/0384	10.2	13.5	3.3	11	5.1	9.2	5.6	0.9	1.1	0.6	-
NHMW 2007z0149/0385	6.8	-	-	7	-	6	3.3	1	1.1	-	-
NHMW 2007z0149/0386	10.4	-	-	11.4	-	7.7	5.4	0.9	1.4	-	-
NHMW 2007z0149/0387	11.3	15.6	4.3	11.1	4.7	8.2	5	1	1.4	0.6	-
NHMW 2007z0149/0388	7.6	-	-	10.2	4.7	7.2	3.8	0.7	1.1	0.7	-
NHMW 2007z0149/0389	-	-	4.1	-	5.8	8.8	3.8	-	-	0.7	-
NHMW 2007z0149/0390	-	-	3.2	-	-	-	-	-	-	-	-
NHMW 2007z0149/0391	-	-	4	-	4.8	7.7	-	-	-	0.6	-
NHMW 2007z0149/0392	8.2	11.3	3.1	-	4.2	6.4	3.9	-	1.3	0.7	-
NHMW 2007z0149/0393	-	-	-	-	5.1	10	5.6			0.5	-
NHMW 2007z0149/0394	-	-	-	10.9	-	-	-	-	-	-	-
NHMW 2007z0149/0395	-	-	3.6	-	4.7	8.4	4.7	-	-	0.6	-
NHMW 2007z0149/0396	8.6	12.2	3.6	8.9	3.8	7.6	4.7	1	1.1	0.5	-
NHMW 2007z0149/0397	-	-	-	-	-	-	2.8	-	-	-	-
NHMW 2007z0149/0398	8.5	-	-	10.2	-	-	4.4	0.8	-	-	-
NHMW 2007z0149/0445	-	-	2	5.5	2.6	4.6	2.3	-	-	0.6	-
NHMW 2007z0149/0448	6.9	-	-	7.3	-	5.9	3	0.9	1.2	-	-
NHMW 2007z0162/0012	9.8	14	4.2	12.6	4.8	8.3	4.4	0.8	1.2	0.6	7.5
NHMW 2007z0162/0013	11.4	-	-	12.4	-	9.8	4.9	0.9	1.2	-	-
NHMW 2007z0162/0014	10	13.9	3.9	10.2	5.3	8.6	4.5	1	1.2	0.6	-
LPBIIIart111	12	-	-	12.3	6.1	8.1	6	1	1.5	0.8	7.9
LPBIIIart112	13.6	-	-	13.8	6.8	10.3	7.4	1	1.3	0.7	7.7
LPBIIIart115	-	-	-	-	5.6	-	6.3	-	-	-	-



Discussion: The above description was based on NHMW 2007z0149/0375 from the Ernstbrunn quarries. *Discutiolira moesica* nov. comb. is a widely distributed Tithonian species, prevalent in multiple localities in Romania, as well as Ernstbrunn, Austria, and Štramberk, Czech Republic. This species is somewhat similar to the better known but much less commonly occurring *Discutiolira eutecta* nov. comb., and has previously been mistaken for *D. eutecta* nov. comb. The most obvious difference between the two species is in their ornamentation. *Discutiolira moesica* nov. comb. has ornamentation of short, interrupted transverse ridges, which become squamous on the lateral edges of the carapace and approaching the rostrum, whereas *D. eutecta* nov. comb. has continuous transverse ridges. Differences between *D. eutecta* nov. comb. and the specimens found by both Remeš (1895) and Blaschke (1911) were noted in their reports of the species from Štramberk, with Remeš (1895) illustrating the species he found as possessing short, interrupted transverse ridges. Blaschke (1911) indicated that he found a species similar to *D. eutecta* nov. comb., and stated that it was similar to the one illustrated by Remeš (1895).

There seems to be a substantial amount of variation exhibited by individuals within this species. The transverse ridge pattern exhibited by *Discutiolira moesica* nov. comb. shows variation from individual to individual. This species is also susceptible to cuticle degradation and preservational problems, further elaborated upon in the notes and abbreviations section of this paper. If the cuticle on the carapace is partially degraded or broken, the transverse ridge pattern can appear very different than that of a pristine sample. The width of the anteriormost, serrate part of the rostrum also varies, with some individuals bearing a rostrum that is more pentagonal in shape than subtriangular. The development of the rostral keel is also quite varied. Most individuals exhibit some form of medial marking of the rostrum, often with a crease. In some individuals, the crease is raised, whereas in others the medial marking is exhibited by aligned squamous tubercles. Other individuals show only a partial medial marking, which is not apparent at the base of the rostrum but develops towards the tip. The visibility of the keel also depends on the angle of viewing, as shown in Figs 7.10 and 7.11, which illustrate the same specimen, one with the rostral keel visible, the other with no discernable keel. These differences do not seem to be consistent enough to merit separate species descriptions. The specimen *Galathea* (*Palaeomunida*) sp. (MUȚIU & BĂDĂLUȚĂ 1971; pl. 1, fig. 4) also displays an ornamentational pattern within the bounds of intraspecific variation of *Discutiolira moesica* nov. comb. and is therefore considered to be a specimen of *D. moesica* nov. comb.

Discutiolira eutecta (MOERICKE, 1889) nov. comb.

Figs 8.1–8.4

1889 *Galathea eutecta* – MOERICKE: p. 54, pl. 6, fig. 5.
1911 *Galathea substriata* – BLASCHKE: p. 149, pl. 5, fig. 10. nov. syn. herein.

◀ Fig. 7. **1–2**: Reprinted illustration of *Discutiolira moesica* (MUȚIU & BĂDĂLUȚĂ, 1971; 1: reprint of pl. 1, fig. 2; 2: reprint of pl. 1, fig. 3) nov. comb from Ghergheasa, Romania. Same specimen is shown in both reprinted photos. Specimen number unknown; length without rostrum listed as 8.5 mm. **3**: Example of *Discutiolira moesica* nov. comb. (NHMW 2007z0149/0375) from the Ernstbrunn Limestones. **4**: Example of *Discutiolira moesica* nov. comb. (NHMW 2007z0149/0377) from the Ernstbrunn Limestones. **5**: Example of *Discutiolira moesica* nov. comb. (NHMW 2007z0162/0012) from the Štramberk Limestones. **6**: Example of *Discutiolira moesica* nov. comb. (NHMW 2007z0162/0011) from the Štramberk Limestones. **7**: Example of *Discutiolira moesica* nov. comb. (LPBIIIart112) from Purcăreni, Romania. **8**: Illustration of *Galathea eutecta* reproduced from REMEŠ, 1895: pl. 1, fig 2, from the Štramberk Limestones, presumed to be *Discutiolira moesica* nov. comb. **9**: Example of *Discutiolira moesica* nov. comb. (LPBIIIart111) from Purcăreni, Romania. **10**: Specimen of *Discutiolira moesica* nov. comb. from the Ernstbrunn Limestones showing the development of the rostral keel (NHMW 2007z0149/0383). The keel is not apparent in this photograph. This specimen was neither whitened nor dyed prior to photography. **11**: Same specimen as in 11, this time whitened, but not dyed, and photographed at a slightly different angle to show the rostral keel. **12**: Example of *Discutiolira moesica* nov. comb. (NHMW 2007z0149/0380) from the Ernstbrunn Limestones with ichnospecies *Kanthyloma crusta* KLOMPMAKER *et al.*, 2015 swelling in the left branchial region. **13**: Oblique view of same specimen in Fig. 7.12. Scale bars for 3–7, 9 and 12–13 equal 5 mm, those for 10 and 11 equal 2 mm.

Diagnosis [translated from German, Moericke 1889: p. 54; brackets indicate clarifications by the authors]: *"The cephalothorax is an elongated square* [shape]*, the corners of the anterior margin seem rather blunted. The margins of the carapace are folded, they can even clearly show a suture, equivalent of the linea anomurica. The rostrum is flat and at the base quite broad, the tip of which is unfortunately broken. Near the anterior margin, directly before the start of the rostrum, rise two small cusps, which were probably occupied earlier with spines. The cervical groove is located slightly above the middle of the carapace; a semicircular arc to the corners of the anterior margin. The transverse groove is indistinct, which is related to the ornamentation of the carapace. Anterior to the cervical groove is the gastric region; however only the narrow front end is visible* [only epigastric region defined]*. The cardiac region in this species is scarcely hinted at. The posterior margin is not indented. The surface of the steinkern is densely covered with long lateral ridges. These transverse ridges are in the posterior part of the carapace very long, but the more they approach the anterior margin, the shorter they are, until they finally reach the rostrum* [and] *take a rounded, scaly shape.*

"Comparisons and remarks: This species comprises [corresponds]*, in the ornamentation of the carpace, closely to the living representatives of the genus Galathea. Particularly with young individuals of the living species Galathea strigosa, in which the grooves of the carapace are not so sharply pronounced, show striking resemblance to Galathea eutecta."*

Emended diagnosis: Carapace widens posteriorly, L/TW 1.5; L/MW 1.1. Cervical groove moderately well defined; epigastric region slightly to moderately well defined by weak groove. Cardiac region weakly defined. Carapace, including rostrum, ornamented with pronounced, long transverse ridges often extending across greater than half the carapace.

Measurements: See Table 2.

Lectotype: Moericke (1889) examined four individuals of this species. Since he did not declare a holotype, BSP AS III 318 is considered a syntype from Mischlowitz. BSP AS III 318 is herein declared the lectotype. Moericke reported that this species also was found in Wischlitz.

Other material examined: NHMW 2012/0129/0001 and NHMW 2012/0129/0002 from the Štramberk Limestones.

Type locality: Mischlowitz (Mysłowice), Poland.

Type stratum: Štramberk Limestones, Tithonian, Upper Jurassic.

Occurrence: Endemic to the Štramberk Limestones of the Czech Republic and Poland (Blaschke 1911; Moericke 1889).

Description: Carapace widens posteriorly, L/TW 1.5; L/MW 1.1. Rostrum termination unknown; appears unkeeled. Cervical groove moderately well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin. Epigastric slightly defined by shallow groove. Cardiac region slightly defined by ornamentational differences, typically includes three

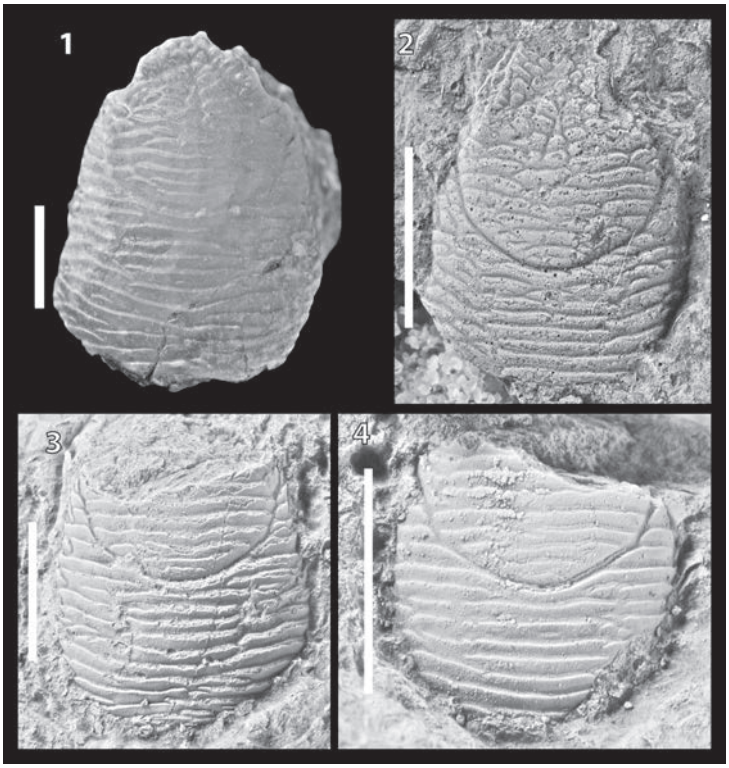


Fig. 8. **1**: Lectotype of *Discutiolira eutecta* (Moericke, 1889) nov. comb. (BSP AS III 318) from the Štramberk Limestones of Mysłowice, Poland. **2**: Holotype of *Galathea substriata* Blaschke, 1911 nov. syn. (NHMW 1910/0005/0035) from the Štramberk Limestones, which should be considered the junior synonym of *Discutiolira eutecta* nov. comb. **3–4**: Examples of *Discutiolira eutecta* nov. comb. from the Štramberk Limestones of the Kotouč Quarry in Štramberk, Czech Republic (3: NHMW 2012/0129/0001; 4: NHMW 2012/0129/0002). All scale bars equal 5 mm.

similar sized transverse ridges. Carapace ornamented with long transverse ridges; ridges appear squamous across epigastric region, rostrum, and approaching lateral margins of carapace. Longest ridges extend across more than half carapace width. Posterior margin rimmed, slightly indented; ornamentation continues onto rim. Ventral surface and appendages not preserved.

D i s c u s s i o n : There do not seem to be two cusps immediately posterior to the rostrum on *Discutiolira eutecta* nov. comb., as the lectotype shown in Fig. 8.1 does not seem to have a pronounced epigastric area, so Moericke (1889) may have been referring to another specimen. That characteristic has been omitted from the emended diagnosis. Two additional, incomplete specimens of *D. eutecta* nov. comb. were found by the authors during collections at the Kotouč Quarry in Štramberk, Czech Republic (Figs 8.3 and 8.4). This species has not been found within any of the Ernstbrunn material in the Bachmayer Collection at the NHMW.

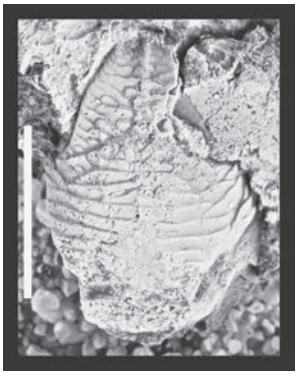


Fig. 9. *Discutiolira* cf. *D. eutecta* (NHMW 2012/0129/0003) from the Štramberk Limestones of the Kotouč Quarry in Štramberk, Czech Republic. Scale bar equals 5 mm.

Upon comparing photos of *D. eutecta* nov. comb. as identified by Moericke (1889) with a cast of *Galathea substriata* Blaschke, 1911, it was determined that they are synonymous. Both have nearly identical groove and ornamentational patterns, and there is not enough variation to justify a separate species. *Galathea substriata* should be considered the junior synonym of *Discutiolira eutecta* nov. comb.

This species differs from *Discutiolira moesica* nov. comb. by having long, continuous ridges ornamenting the majority of the carapace, with squamous ornamentation present only on the protogastric and epigastric regions. *Discutiolira moesica* nov. comb. has short, transverse ridges covering both the anterior and posterior regions of the carapace.

Discutiolira* cf. *D. eutecta

Fig. 9

Measurements: See Table 2.

Material examined: NHMW 2012/0129/0003.

Locality: Kotouč Quarry, Štramberk, Czech Republic.

Stratum: Štramberk Limestones, Štramberk, Czech Republic, Tithonian, Upper Jurassic.

Description: Carapace incomplete; gastric regions and rostrum preserved. Rostrum broad with weak keel; sub-pentagonal to trapezoidal; serrate at tip. Rostrum narrows slightly anteriorly until reaching midlength, following midlength rostrum narrows until reaching approximately 30% original width, continues subhorizontally until reaching midpoint of rostrum. Anterior of carapace ornamented with long transverse ridges extending across center of carapace; long ridges interfinger with shorter, imbricated ridges approaching lateral margin. Ornamentation on rostrum composed of short ridges and scales.

Discussion: Although this specimen is incomplete, it is not an exact match to *Discutiolira eutecta* nov. comb. *Discutiolira eutecta* nov. comb. has squamous ornamentation across the protogastric region, whereas *D.* cf. *D. eutecta* does not. No complete specimens of *D. eutecta* nov. comb. have been found, and not enough incomplete specimens have been found to be certain that this specimen does not fall within the bounds of variation within the species.

Genus *Lemacola* nov. gen.

Type species: *Lemacola jenniferae* nov. spec.

Other included species: *Lemacola rossi* nov. spec., *Lemacola salia* nov. spec.

Diagnosis: Carapace moderately convex; subrectangular in shape. Rostrum sub-triangular to sub-pentagonal with weak medial keel; tip of rostrum tridentate. Cervical groove moderately defined; regional definition poor. Carapace, including rostrum, ornamented with short transversely ovate tubercles or faint ridges.

Etymology: The generic name is a combination of the Greek *lema*, meaning bold, and *akolos*, meaning mouthful. The name refers to the diminutive size of the species in comparison to many of the other, larger species known from the type strata. Feminine gender.

Discussion: Members of *Lemacola* nov. gen. have a subtle rostral keel, separating them from *Paragalathea* and *Mesogalathea*. Their carapaces do not widen significantly posteriorly and are sub-rectangular in shape, separating them from *Paragalathea*, *Mesogalathea*, and *Discutiolira* nov. gen. Further separating them from other genera, the ornamentation of their carapaces is not as strong as members of *Paragalathea* and *Discutiolira*.

Lemacola jenniferae nov. spec.

Figs 10.1, 10.2

Diagnosis: Carapace L/TW 1.3, L/MW 1.2. Rostrum sub-pentagonal with weak medial keel. Cervical groove moderately well defined; weak epibranchial branch defines base of epibranchial reagion. Cardiac region very slightly marked. Carapace, including rostrum, ornamented with short transversely ovate tubercles.

Etymology: The name honors Jennifer ROBINS, the mother of the first author (CMR).

Measurements: See Table 4.

Holotype: NHMW 2007z0149/0425.

Paratype: NHMW 2007z0149/0426.

Other material examined: NHMW 2007z0149/0427 and NHMW 2007z0149/0429 from the Ernstbrunn Limestones.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex; subrectangular in shape, L/TW 1.3, L/MW 1.2. Rostrum downturned, with weak medial keel, rostral shape sub-pentagonal, narrows anteriorly; tip of rostrum tridentate with central spine extending very slightly beyond outer pair of spines. Lateral margin appears to have weak spines. Cervical groove moderately defined; extends in smooth semicircle concave forward across center

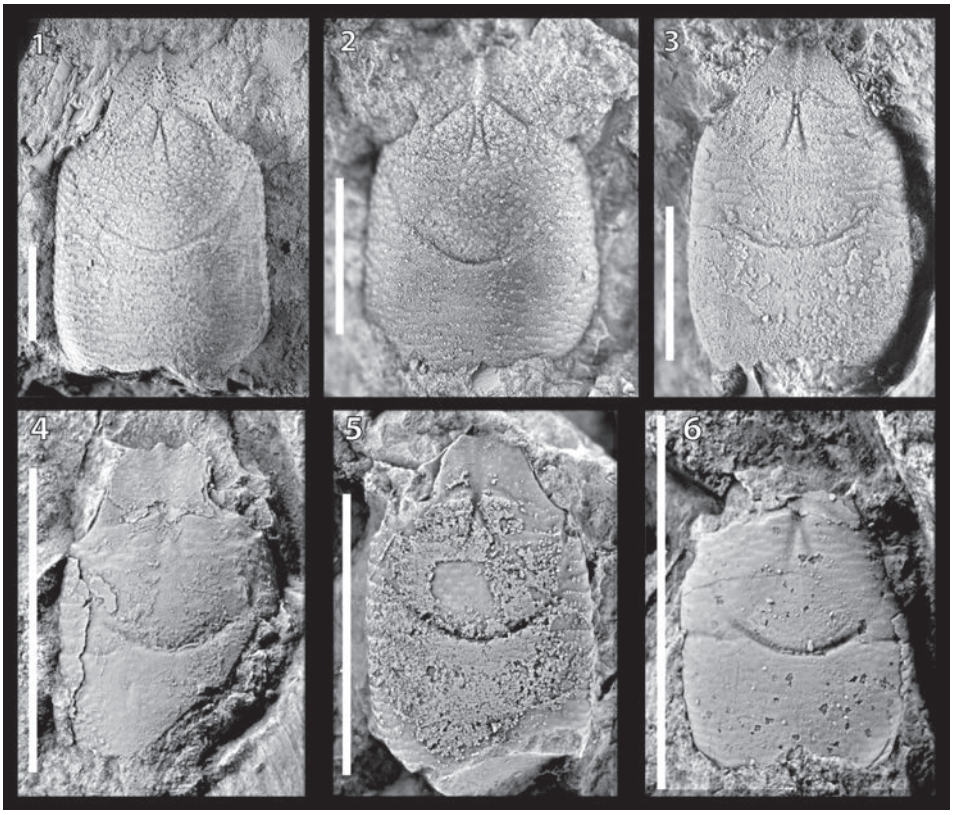


Fig. 10. **1**: Holotype (NHMW 2007z0149/0425) and **2**: Paratype of *Lemacola jenniferae* nov. spec. (NHMW 2007z0149/0426) from the Ernstbrunn Limestones. **3**: Holotype of *Lemacola rossi* nov. spec. (NHMW 2007z0149/0428) from the Ernstbrunn Limestones. **4**: Holotype of *Lemacola salia* nov. spec. (LPBIIIart138) from Purcăreni, Romania. **5**: Paratype of *Lemacola salia* nov. spec. (LPBIIIart135) from Purcăreni, Romania. **6**: Example of *Lemacola salia* nov. spec. (LPBIIIart139) from Purcăreni, Romania. Scale bars for 1–3 equal 2 mm, those for 4–6 equal 5 mm.

of carapace before arcing convex forward as groove approaches anterolateral margin. Very weak epibranchial branch defines base of epibranchial region. Epigastric region weakly defined; mesogastric region slightly defined by shallow groove. Cardiac region very slightly swollen in comparison to surrounding areas. Carapace, including rostrum, ornamented with short transversely ovate tubercles. Ventral surface and appendages not preserved.

Discussion: All four individuals within this species have extremely poorly preserved cuticle. *Lemacola rossi* nov. spec. has ornamentation of transverse ridges, as opposed to *L. jenniferae* nov. spec., which has ornamentation of tubercles. *Lemacola salia* nov. spec. has a much weaker rostral keel with a wider rostral termination, and ornamentation of tubercles that are more transversely ovate than that of *L. jenniferae* nov. spec.

***Lemacola rossi* nov. spec.**
Fig. 10.3

Diagnosis: Carapace L/TW 1.3, L/MW 1.1. Rostrum sub-triangular. Epigastric region moderately defined; mesogastric region slightly defined. Anterior portion of carapace, including rostrum, ornamented with short, imbricated transverse ridges.

Etymology: The name honors Ross ROBINS, the father of the first author (CMR).

Measurements: See Table 4.

Holotype by monotypy: NHMW 2007z0149/0428.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex, subrectangular in shape, narrows slightly at extreme posterior, L/TW 1.3, L/MW 1.1. Rostrum downturned, with weak medial keel, rostral shape sub-triangular, narrows anteriorly; tip of rostrum horizontal, tridentate with three equally sized spines. Cervical groove moderately defined; extends in smooth semi-circle concave forward across center of carapace before arcing convex forward as groove approaches anterolateral margin. Very weak epibranchial branch defines base of epibranchial region. Epigastric region moderately defined; mesogastric region slightly defined by very shallow groove. Anterior portion of carapace, including rostrum, ornamented with short, imbricated transverse ridges. Regions appear undefined posterior to cervical groove; ornamentation obscured except for lateral margins where faint imbricated transverse ridges apparent. Posterior margin weakly rimmed. Ventral surface and appendages not preserved.

Discussion: This species differs from *Lemacola jenniferae* nov. spec. by possessing ornamentation of transverse ridges instead of squamous tubercles. *Lemacola salia* nov. spec. has a much weaker rostral keel with a wider rostral termination, as well as ornamentation of transversely ovate tubercles as opposed to transverse ridges.

Table 4. Measurements of studied *Lemacola* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Lemacola jenniferae* nov. spec.**											
NHMW 2007z0149/0425	5.4	7	1.6	4.5	2.5	4.1	2.7	1.2	1.3	0.6	10.1
NHMW 2007z0149/0426	-	-	-	3	1.7	2.7	1.8	-	-	0.6	10.2
***Lemacola rossi* nov. spec.**											
NHMW 2007z0149/0428	3	3.8	0.8	2.6	1.6	2.4	1.7	1.1	1.3	0.7	10.3
***Lemacola salia* nov. spec.**											
LPBIIIart138	4.1	5.2	1.1	3.9	2.5	3.3	2.3	1.1	1.3	0.8	10.4
LPBIIIart135	4.8	6.1	1.3	4.2	2.8	3.6	2.4	1.1	1.3	0.8	10.5
LPBIIIart139	3.5	-	-	3.1	2.1	2.7	1.9	1.1	1.3	0.8	10.6

***Lemacola salia* nov. spec.**
Figs 10.4–10.6

2006 *Paragalathea* n. sp. 1–Shirk: p. 133–138, figs 35–36.

Diagnosis: Carapace subrectangular in shape. Rostrum subtriangular. Cervical groove well defined at center; weakens as groove extends anteriorly. Mesogastric region weakly defined by very shallow groove. Anterior portion of carapace, including rostrum, ornamented with interrupted, elongated transverse tubercles.

Etymology: The species name is derived from the Latin *salio*, meaning to jump or dance. The name refers to the ornamentation that jumps, or dances, across the carapace in an interrupted fashion.

Measurements: See Table 4.

Holotype: LPBIIIart138.

Paratype: LPBIIIart135.

Other material examined: LPBIIIart139.

Type locality: Endemic to Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″

Type stratum: Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace weakly convex transversely, subrectangular in shape, narrows slightly at extreme posterior. Rostrum wide, downturned, with weak medial keel, rostral shape sub-rectangular, narrows slightly anteriorly; tip of rostrum horizontal, tridentate with three equally sized weak spines. Cervical groove moderately defined at center; extends in smooth semicircle concave forward across center of carapace before weakening, arcing convex forward as groove approaches anterolateral margin. Very weak epibranchial branch defines base of epibranchial region. Epigastric region weakly defined; mesogastric region slightly defined by very shallow groove. Anterior portion of carapace, including rostrum, ornamented with short, imbricated transverse ridges. Ridges absent or appear squamous when cuticle absent. Regions undefined posterior to cervical groove. Posterior margin weakly rimmed. Ventral surface and appendages not preserved.

Discussion: The breadth of the rostrum, as well as the extremely weak rostral keel, separates this species from the others known from Ernstbrunn, Austria. This species extends the geographic range of the genus from Austria to Romania.

Family Catillogalatheidae nov. fam.

Type genus: *Catillogalathea* nov. gen.

Other included genera: *Annieporcellana* Fraaije, van Bakel, Jagt & Artal, 2008; *Galatheites* Balss, 1913; *Hispanigalathea* Klompmaker, Feldmann, Robins & Schweitzer,

2012; *Muelleristhes* Garassino, De Angeli & Pasini, 2014; *Nykteripteryx* Klompmaker, Feldmann, Robins & Schweitzer, 2012; *Serraphylctaena* nov. gen., *Tuberosagalathea* nov gen.; *Vasconilia* nov. gen.

Diagnosis: Carapace longer than wide; moderately convex transversely. Rostrum triangular, rectangular, or spatulate in shape; medially marked with groove or keel. Epigastric region markedly elevated above rostrum; rostrum borders epigastric region anteriorly and laterally. Gastro-orbital groove extremely strong; separates epigastric region from rostrum and extends posterolaterally from orbital area. Cervical groove deeply incised; mesogastric region well defined. Ornamentation usually consists of tubercles or short, squamous ridges.

Discussion: This new family differs from the others within Galatheoidea primarily due to its epigastric region. The two rounded, forward directed epigastric lobes, marked by gastro-orbital grooves, separate the genera within this family from all others. Munidopsidae have a circumgastric groove, which is a circular groove surrounding the gastric region (see Robins *et al*. 2013: p. 170, fig. 2.4). While the circumgastric groove is similar to the gastro-orbital grooves exhibited by members of Catillogalatheidae nov. fam., the grooves of Catillogalatheidae nov. fam. do not travel in a circular path. Members of Catillogalatheidae nov. fam. have the traditional cervical groove. Munidopsids also have a branchiocardiac groove, which traverses the posterior half of the carapace separating the metabranchial and cardiac regions. This groove is absent from members of Catillogalatheidae nov. fam. Catillogalatheidae nov. fam. differs from Paragalatheidae nov. fam. due to the deep cervical groove and higher degree of regional definition shown by members of Catillogalatheidae nov. fam., especially in the gastric region. Catillogalatheidae nov. fam. differs from Munididae due to its general lack of transverse ridge ornamentation and lack of a needle-like rostrum. Catillogalatheidae nov. fam. differs from Galatheidae due to its general lack of transverse ridge ornamentation, and well defined gastric regions. Catillogalatheidae nov. fam. differs from Retrosichelidae in overall dorsal carapace shape; Retrorsichelidae has an egg-shaped carapace, and Catillogalatheidae nov. fam. has a rectangular to sub-rectangular shaped carapace. Porcellanidae has a carcinized (crab-like) carapace, which is not shared by members of Catillogalatheidae nov. fam.

We propose that *Annieporcellana* be transferred from Porcellanidae to Catillogalatheidae nov. fam. Although the carapace of the monospecific *Annieporcellana dhondtae* Fraaije *et al*., 2008, does narrow slightly posteriorly, giving a sub-ovate shape to the carapace, the overall characteristics of this genus better align with those of Catillogalatheidae nov. fam. The deeply incised grooves and longer than wide proportions are atypical of the Porcellanidae. *Annieporcellana* also exhibits a high degree of similarity with *Hispanigalathea* both in carapace shape, rostral shape, and groove structure. Both *Annieporcellana* and *Hispanigalathea* are Cretaceous (Albian) genera from patch reefs in northern Spain.

Muelleristhes africanus is from the Upper Cretaceous strata at Gara Sbaa (Kem Kem) in Morocco. It is a flattened specimen missing the central portion of the dorsal carapace and the tip of the rostrum. From the preserved portions, this galatheoid does resemble

Vasconilia ruizi. Garassino *et al*. (2014) transferred the species from *Paragalathea* into its own genus in the Porcellanidae. This family assignment does not seem to be supported by the morphology of the specimen. The abdomen of this species is exposed in the photograph (Garassino *et al*. 2008, p. 56, fig. 14; Garassino *et al*. 2014: pl. 1, figs 2–4) as extending posteriorly from the carapace, not tucked underneath the body as is more common with the porcellanids.

This new family, like Paragalatheidae nov. fam., encompasses genera that did not readily fit in existing families. They are aligned closest with members of Munidopsidae; *Nykteripteryx* was most recently considered a munidopsid. The late Cretaceous munidopsid *Calteagalathea* De Angeli & Garassino, 2006, is very similar to both *Nykteripteryx* and *Serraphylctaena* nov. gen. Although it may indeed belong to this family, its epigastric regions are not preserved well enough to make that determination. The presence of the branchiocardiac groove on *Calteagalathea friulana* De Angeli & Garassino, 2006 indicates it is better placed within Munidopsidae.

Genus *Catillogalathea* nov. gen.

Type species: *Catillogalathea falcula* nov. spec.

Other included species: *Catillogalathea patruliusi* nov. spec., *Catillogalathea purcarenensis* nov. spec.

Diagnosis: Carapace moderately convex; subrectangular in shape. Rostrum broadly triangular. Cervical groove well defined. Gastro-orbital grooves strong; epigastric region well defined, separated from protogastric region by gastro-orbital groove, extending posterolaterally from orbital area. Epigastric area raised above rostrum. Urogastric and cardiac regions weakly defined. Carapace, including rostrum, ornamented with squamous tubercles or ridges.

Etymology: The name is derived from a combination of the the Latin *catillo*, meaning gourmand, referring to the large epigastric regions, and *galathea*, referring to the superfamily Galatheoidea.

Discussion: *Tuberosagalathea* nov. gen. has an indentation just anterior of the center of the posterior margin with ornamentation of setal pits, a trait absent from *Catillogalathea* nov. gen. The gastro-orbital grooves are also not as well marked in *Tuberosagalathea* nov. gen. *Annieporcellana* and *Hispanigalathea* have a more rounded, spatulate rostrum, and less definition of the gastric region than *Catillogalathea* nov. gen. *Serraphylctaena* nov. gen. and *Nykteripteryx* have smaller L/W ratios and much broader rostra than *Catillogalathea* nov. gen. *Vasconilia* nov. gen. and *Muelleristhes* have much less regional definition than *Catillogalathea* nov. gen. The gastro-orbital grooves of *Galatheites* are not as well definited as those on *Catillogalathea* nov. gen. One species of *Catillogalathea* nov. gen. has been found in Ernstbrunn, and two additional species from Romania can also be attributed to the genus.

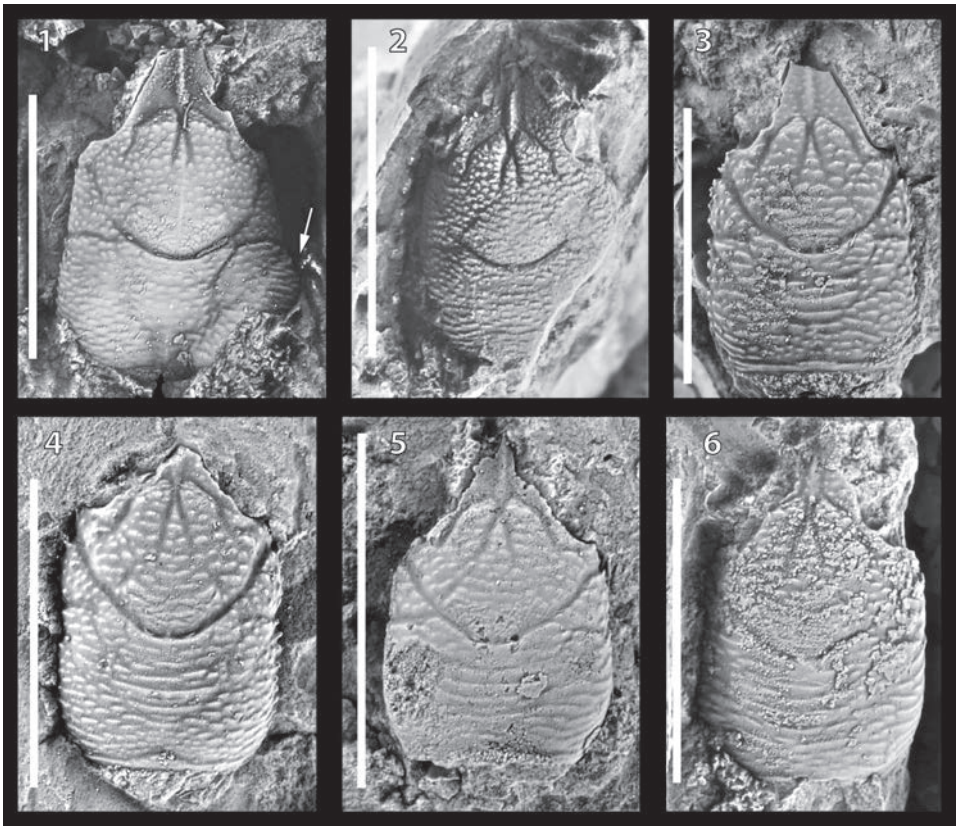


Fig. 11. **1**: Holotype of *Catillogalathea falcula* nov. spec. (NHMW 2007z0149/0435a) from the Ernstbrunn Limestone with ichnospecies *Kanthyloma crusta* KLOMPMAKER *et al*., 2015 swelling in the right branchial region, indicated with an arrow. **2**: Paratype of *Catillogalathea falcula* nov. spec. (NHMW 2007z0149/0436) from the Ernstbrunn Limestones. **3**: Holotype (LPBIIIart141) and **4**: Paratype (LPBIIIart119) of *Catillogalathea patruliusi* nov. spec. from Purcăreni, Romania. **5**: Holotype (LPBIIIart147) and **6**: Paratype (LPBIIIart143) of *Catillogalathea purcarenensis* nov. spec. from Purcăreni, Romania. All scale bars equal 5 mm.

***Catillogalathea falcula* nov. spec.**

Figs 11.1, 11.2

Diagnosis: Rostrum broadly triangular, tapering to tridentate tip. Carapace, including rostrum, ornamented with slightly squamous tubercles.

Etymology: From the Latin *falcula* meaning sickle; refers to the curved gastro-orbital grooves.

Measurements: See Table 5.

Holotype: NHMW 2007z0149/0435a.

Paratype: NHMW 2007z0149/0436.

Type locality: Endemic to the Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex especially anteriorly; widens and decreases in transverse convexity posteriorly. Rostrum slightly downturned, sulcate, with medial keel; rostral shape broadly triangular, narrows anteriorly; terminates in tridentate tip. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before fading and arcing convex forward as groove approaches lateral margin. Deep groove defines base of epibranchial region. Gastro-orbital grooves strong; epigastric region well defined, separated from protogastric region by gastro-orbital groove, extending posterolaterally from orbital area. Epigastric region raised above rostral surface. Mesogastric and metagastric regions weakly defined by shallow grooves. Urogastric and cardiac regions defined by weak grooves or indentations. Carapace, including rostrum, ornamented with small, squamous tubercles; tubercles elongated slightly on posterior of carapace. Posterior margin weakly rimmed, slightly indented. Ventral surface and appendages not preserved.

Discussion: Although the tips of both rostra are slightly broken on both the holotype and paratype, indentations left in the rock of the holotype clearly indicate a tridentate tip. The grooves on *Catillogalathea patruliusi* nov. spec. are much deeper, and the ornamentation much more transversely ovate on the posterior part of the carapace than that of *Catillogalathea falcula* nov. spec. *Catillogalathea purcarenensis* nov. spec. has short, transverse ridges ornamenting the carapace in contrast to the tubercular ornamentation of *Catillogalathea falcula* nov. spec.

***Catillogalathea patruliusi* nov. spec.**

Figs 11.3, 11.4

2006 *Paragalathea* n. sp. 2 – Shirk: p. 139–144, figs 37–38. [pars.]

Diagnosis: Rostrum broadly triangular; terminates in tridentate tip. Lateral margins spined. Carapace, including rostrum, ornamented with squamous tubercles; tubercles elongated on posterior of carapace; three squamous ridges ornament cardiac region.

Etymology: The species name is in honor of Dan Patrulius, who, among many other pursuits, studied fossil decapods of Romania.

Measurements: See Table 5.

Holotype: LPBIIIart141.

Paratype: LPBIIIart119.

Type locality: Endemic to Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″

Type stratum: Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace subrectangular; moderately convex especially anteriorly, decreases in transverse convexity posteriorly. Rostrum downturned, with weak medial keel; rostral shape broadly triangular, narrows anteriorly; terminates in tridentate tip; central spine longest. Lateral margins spined. Cervical groove deepest groove on carapace; extends in smooth semicircle concave forward across center of carapace before fading and arcing convex forward as groove approaches lateral margin at anterior of epibranchial region. Gastro-orbital grooves strong; epigastric region well defined, separated from protogastric region by gastro-orbital groove, extending posterolaterally from orbital area. Epigastric region raised above rostral surface. Mesogastric and metagastric regions weakly defined by shallow grooves. Urogastric and cardiac region well-defined by weak grooves or indentations. Carapace, including rostrum, ornamented with squamous tubercles; tubercles elongated on posterior of carapace, especially across cardiac region. Posterior margin rimmed. Ventral surface and appendages not preserved.

Discussion: *Catillogalathea patruliusi* nov. spec. has larger, more squamous and transversely ovate ornamentation, and better defined regions than *Catillogalathea falcula* nov. spec. *Catillogalathea purcarenensis* nov. spec. has ornamentation of transverse ridges on the posterior of the carapace, as opposed to squamous tubercles found on *Catillogalathea patruliusi* nov. spec. *Catillogalathea patruliusi* nov. spec. also has better defined regions than *Catillogalathea purcarenensis* nov. spec.

***Catillogalathea purcarenensis* nov. spec.**

Figs 11.5, 11.6

2006 *Paragalathea* n. sp. 2 – SHIRK: p. 139–144, figs 37–38. [pars.]
2006 *Paragalathea ruizi* (VAN STRAELEN, 1940) – SHIRK: p. 145–151, figs 39.1, 40. [pars.]

Diagnosis: Carapace subrectangular; moderately convex especially anteriorly, decreases in transverse convexity posteriorly. Lateral margins of carapace spined

Table 5. Measurements of studied *Catillogalathea* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Catillogalathea falcula* nov. spec.**											
NHMW 2007z0149/0435a	4.5	6.1	1.6	4.8	2.3	4	2.5	0.9	1.1	0.6	11.1
NHMW 2007z0149/0436	3.4	4.8	1.4	-	1.8	2.8	1.8	-	1.2	0.6	11.2
***Catillogalathea patruliusi* nov. spec.**											
LPBIIIart141	4.6	-	-	3.6	2.1	3.2	2.6	1.3	1.4	0.7	11.3
LPBIIIart119	4.5	6	1.5	3.8	2.2	3.3	2.4	1.2	1.4	0.7	11.4
***Catillogalathea purcarenensis* nov. spec.**											
LPBIIIart147	4.6	-	-	4	2.5	3.5	2.6	1.2	1.3	0.7	11.5
LPBIIIart143	3.8	4.8	1	3.2	2.1	2.8	-	1.2	1.3	0.7	11.6

anteriorly. Carapace, including rostrum, ornamented with squamous tubercles anteriorly; raised, slightly flexuous transverse ridges posteriorly.

Etymology: The species name is derived from the type locality, Purcăreni, Romania.

Measurements: See Table 5.

Holotype: LPBIIIart147.

Paratype: LPBIIIart143.

Type locality: Endemic to Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″

Type stratum: Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace subrectangular; moderately convex especially anteriorly, decreases in transverse convexity posteriorly. Rostrum downturned, with weak medial keel; rostral shape broadly triangular, narrows anteriorly; termination unknown. Lateral margins spined anteriorly. Cervical groove deepest groove on carapace; extends in smooth semicircle concave forward across center of carapace before fading and arcing convex forward as groove approaches lateral margin at anterior of epibranchial region. Gastro-orbital grooves strong; epigastric region well defined, separated from protogastric region by gastro-orbital groove, extending posterolaterally from orbital area. Epigastric region raised above rostral surface. Mesogastric and metagastric regions weakly defined by shallow grooves. Urogastric and cardiac region weakly defined by weak grooves or indentations. Carapace, including rostrum, ornamented with squamous tubercles anteriorly; raised, slightly flexuous transverse ridges posteriorly. Posterior margin rimmed. Ventral surface and appendages not preserved.

Discussion: Of the two incomplete specimens of this species were found, neither possesses an intact rostrum. The other two species within the genus have tridentate rostra; however, the rostral termination is unknown for this species. *Catillogalathea purcarenensis* nov. spec. has ornamentation posteriorly consisting of squamous ridges, which are absent on *Catillogalathea falcula* nov. spec. and only on the cardiac region of *Catillogalathea patruliusi* nov. spec.

Genus *Galatheites* Balss, 1913

Type species: *Galathea zitteli* Moericke, 1889, by original designation.

Other included species: *Galatheites aiola* nov. spec.; *Galatheites obtecta* nov. spec.; *Galatheites royoi* Van Straelen, 1936.

Diagnosis: Rostrum subrectangular, keel or medial rostral marking usually present. Cardiac area weakly indicated. Ornamentation consists of transverse, squamous ridges or squamous tubercles.

Discussion: Balss (1913) originally defined *Galatheites* in an effort to separate the modern genus *Galathea* from the fossil forms. He chose *Galatheites zitteli* as the type species, and was of the opinion that members of the fossil genus were closely related to the modern genus *Munidopsis* Whiteaves, 1874. The description of *Galatheites* was extremely broad as originally defined and was later synonymized with *Gastrosacus*. Robins *et al*. (2013), after separating the type species, *Galatheites zitteli*, from the remainder of *Gastrosacus*, re-instated the genus, and placed it within the Galatheidae due to a lack of circumgastric groove. *Galatheites* still encompasses a wide variety of forms, with many of the individual species showing considerable intraspecific variation. All species within the genus are Late Jurassic in age. Since *Galatheites* has had such a varied classification history, an elaboration of its differences from other genera is necessary.

Almost all modern galatheid genera possess transverse ornamentation. Half of the species within *Galatheites* have squamous ornamentation, half have transverse ridges. None of the modern galatheid genera have a keel extending the length of the dorsal surface of the rostrum, which is almost always present on species of *Galatheites*. Members of *Galatheites* also do not have a rostrum with lateral spines or serrations, which are present on all modern galatheid genera, including *Alainius* Baba, 1991; *Allogalathea* Baba, 1969; *Allomunida* Baba, 1988; *Coralliogalathea* Baba & Javed, 1974; *Fennerogalathea* Baba, 1988; *Galathea* Fabricius, 1793; *Janetogalathea* Baba & Wicksten, 1997; *Lauriea* Baba, 1971; *Macrothea* Macpherson & Cleva, 2010; *Nanogalathea* Tirmizi & Javed, 1980; *Phylladiorhynchus* Baba, 1969; and the fossil genera *Acanthogalathea* Müller & Collins, 1991 and *Palaeomunida* Lőrenthey, 1902. *Galatheites* also does not have supraocular spines, which are present on most modern galatheid genera. *Galatheites* differs from *Annieporcellana* by possessing a carapace that widens posteriorly instead of narrowing posteriorly. *Galatheites* has smaller epibranchial regions than *Hispanigalathea*. *Eomunidopsis* Vía Boada, 1981 and *Luisogalathea* Karasawa & Hayakawa, 2000, have a much narrower rostral base and much thicker, more developed transverse ridge ornamentation, and clearer regional definition than *Galatheites*. *Lessinigalathea* De Angeli & Garassino, 2002, also has better developed transverse ridge ornamentation and clearer regional definition than *Galatheites*. *Spathagalathea* De Angeli & Garassino, 2002, has much more developed transverse ridges and a rostrum that widens distally, unlike *Galatheites*. The carapaces of members of *Tuberosagalathea* widen significantly posteriorly, much more than *Galatheites*. *Vasconilia* nov. gen. and *Muelleristhes* have a narrower rostrum and less regional definition than *Galatheites*. *Catillogalathea* nov. gen. has much better defined epigastric regions than *Galatheites*. *Serraphylctaena* nov. gen. and *Nykteripteryx* have much better regional definition and a shorter L/W ratio than *Galatheites*. The regional definition and gastro-orbital grooves place *Galatheites* within the Catillogalatheidae nov. fam. All members of Paragalatheidae nov. fam. have less regional definition than *Galatheites*.

Galatheites zitteli (Moericke, 1889)

Figs 12.1–12.4

1889 *Galathea zitteli* – Moericke: p. 52–53, pl. 6, fig. 6.

Diagnosis [translated from German, Moericke 1889: p. 52–53; brackets indicate clarifications by the authors]: "The carapace of this species is much smaller than that of the previous one [*Discutiolira eutecta*], but the ratio of length to width remains the same. The flat, slightly curved rostrum is very broad and triangular in shape, with fine pointed teeth at the front end. Right in the middle of the rostrum, a narrow longitudinal keel runs down to the ultimate tip. Before the very well-developed cervical groove is the space in which lies the gastric region. The latter is a sharply defined triangle with the longer tip pointing upwards. The gastric region is slightly raised; adjacent on both sides of the gastric region are what is interpreted to be the hepatic regions. In the middle of the cervical groove, the bordering transverse groove [groove at base of epibranchial region] is clear. A strong definition of the cardiac area is not present in this species. Posterior margin with a rather wide rim. The ornamentation of the steinkerns is elongated transverse ridges posteriorly. In the anterior region of the cephalothorax the transverse ridges take on a more circular shape, continuing to the outermost tip of the rostrum, where they are very fine."

Emended diagnosis: Carapace average L/TW 1.2, L/MW 1.0. Rostrum downturned, keeled; terminates in three or five spines. Cardiac region slightly defined by ornamentational differences, weakly tumid. Carapace, including rostrum, ornamented with short transverse ridges; ridges appear squamous across gastric and epibranchial regions, rostrum, and approaching lateral margins of carapace.

Measurements: See Table 6.

Lectotype: BSP AS III 308, designated by Robins *et al*. (2013).

Type locality: Wischlitz (Wiślica), Poland.

Type stratum: Štramberk Limestones, Tithonian, Upper Jurassic.

Other material examined: From the Ernsbrunn Limestones: NHMW 2007z0149/0415 to NHMW 2007z0149/0424. From the Štramberk Limestones: NHMW 1910/0005/0035.

Occurrence: The Ernstbrunn Limestones (herein); the Štramberk Limestones of Wiślica, Poland (Moericke 1889); from unspecified Štramberk Limestones of the Czech Republic and Poland (herein).

Description: Carapace moderately convex; widens slightly posteriorly, L/TW ranges 1.1 to 1.5; L/MW ranges 0.9 to 1.2. Rostrum downturned, keeled; rostral shape broadly triangular to sub-rectangular, narrows anteriorly; rostrum terminates in three or five spines; central spine longest. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove

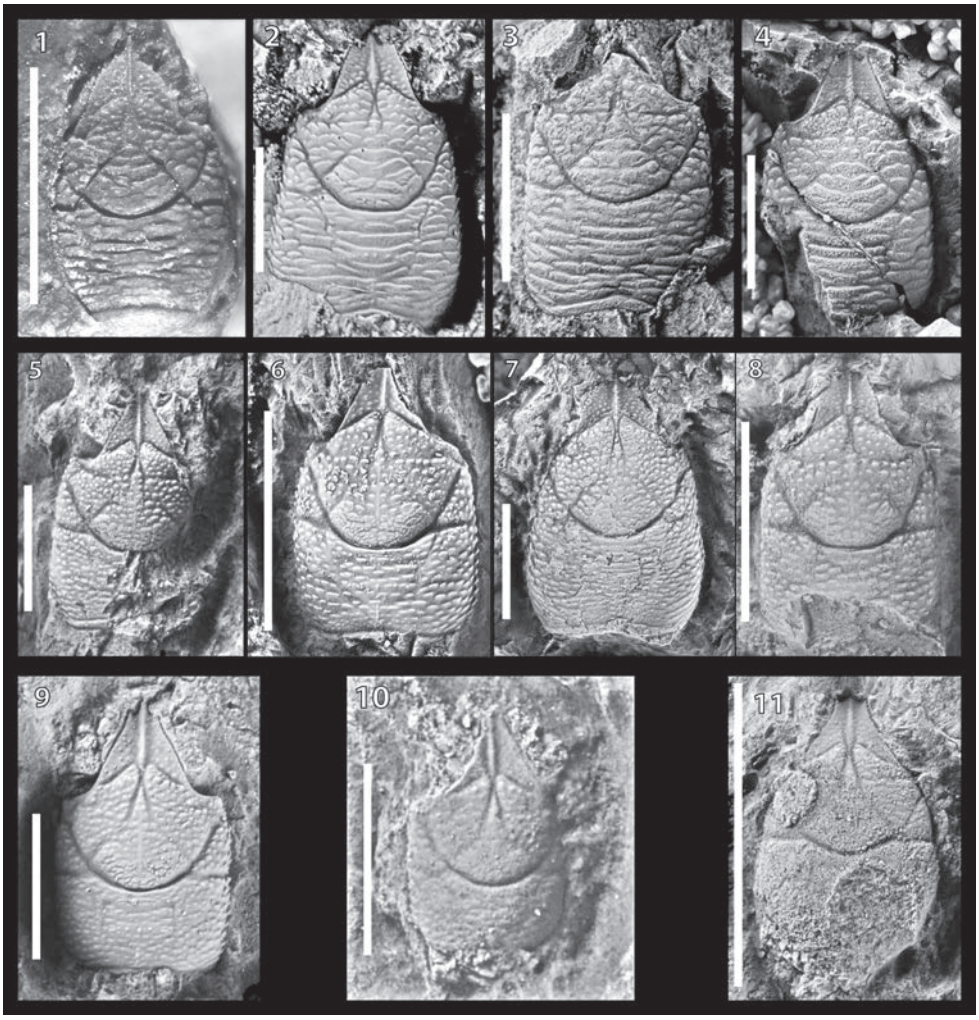


Fig. 12. **1**: Lectotype of *Galatheites zitteli* (MOERICKE, 1889; BSP ASIII308) from the Štramberk Limestones of Wiślica, Poland. Photo courtesy of A. KLOMPMAKER. **2**: Example of *Galatheites zitteli* (NHMW 2007z0149/0414). **3**: Example of *Galatheites zitteli* (NHMW 2007z0149/0416). **4**: Example of *Galatheites zitteli* (NHMW 2007z0149/0415). **5**: Paratype of *Galatheites aiola* nov. spec. (NHMW 2007z0149/0440), showing strong groove structure and a three-pronged rostrum. **6**: Paratype of *Galatheites aiola* nov. spec. (NHMW 2007z0149/0441), showing a presumed three-prong rostrum, well-developed groove structure, and a well preserved posterior carapace. **7**: Paratype of *Galatheites aiola* nov. spec. (NHMW 2007z0149/0412), showing weak groove structure and a five-prong rostrum. **8**: Holotype of *Galatheites aiola* nov. spec. (NHMW 2007z0149/0437), showing strong groove structure and a five-pronged rostrum. **9**: Holotype (NHMW 2007z0149/0434) and **10**: Paratype (NHMW 2007z0149/0163) of *Galatheites diasema* nov. spec. **11**: Holotype of *Galatheites obtecta* nov. spec. (LPBIIIart134) from Purcăreni, Romania. All figured specimens except 1 and 11 are from the Ernstbrunn Limestones. Scale bars for 1–4, 6–8, and 11 equal 5 mm, those for 5 and 9–10 equal 2 mm.

approaches lateral margin. Epigastric, mesogastric, and metagastric regions well-defined by shallow grooves. Cardiac region weakly defined by slight break in transverse ridges, slightly tumid. Carapace, including rostrum, ornamented with short transverse ridges; ridges appear squamous across gastric and epibranchial regions, rostrum, and approaching lateral margins of carapace. Posterior margin rimmed, indented; ornamentation continues onto rim. Ventral surface and appendages not preserved.

Discussion: As with many species within this genus, *Galatheites zitteli* exhibits a high degree of intraspecific variation. Depth of grooves, number of rostral spines, and the prevalence of squamous tubercles or ridges present on the anterior portion of the carapace seem to vary considerably from specimen to specimen. Cuticular preservation is also a factor in the appearance of the ornamentation. The cuticle is absent on the lectotype (Fig. 12.1), the right branchial region is broken, the left branchial region of the lectotype is still within the rock, and the rostrum is partially broken. This gives the impression the specimen is narrower than it would be if complete. NHMW 2007z0149/0414 (Fig. 12.2) was used in the emended diagnosis. This specimen has well preserved cuticle and a complete rostrum, although the left branchial region is incomplete. Various examples of the different morphologies of *G. zitteli* have been illustrated (Figs 12.1–12.4).

Galatheites zitteli differs from *G. royoi*, *G. aiola* nov. spec., and *G. diasema* nov. spec. by possessing ornamentation that is predominantly composed of transverse ridges instead of squamous tubercles. *Galatheites obtecta* nov. spec. has a rostrum that narrows sinuously, in contrast to the linear narrowing of *G. zitteli*.

Galatheites aiola **nov. spec.**

Figs 12.5–12.8

2015 *Galatheites zitteli* – Gašparič *et al.*: p. 5, figs 3D, 3F.

Diagnosis: Carapace average L/TW 1.3; L/MW 1.1. Rostrum downturned, sulcate, with medial keel; terminates in three or five pronged tip. Carapace, including rostrum, ornamented with slightly squamous tubercles; tubercles slightly elongated on posterior of carapace.

Etymology: From the Greek *aiolos*, meaning variable or changeable, referring to the three- or five-pronged rostrum and variable groove depth on carapace.

Measurements: See Table 6.

Holotype: NHMW 2007z0149/0437

Paratypes: NHMW 2007z0149/0412, NHMW 2007z0149/0413, NHMW 2007z0149/0440, NHMW 2007z0149/0441.

Other material examined: NHMW 2007z0149/0408, NHMW 2007z0149/0439, NHMW 2007z0149/0442, NHMW 2007z0149/0443, NHMW 2007z0149/0453, from the Ernstbrunn Limestones.

Type locality: Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Occurrence: Ernstbrunn Limestones, Ernstbrunn, Austria (herein); Štramberk Limestones of Kotouč, Czech Republic (GAŠPARIČ *et al*. 2015).

Description: Carapace moderately convex; widens slightly posteriorly, L/TW ranges 1.2 to 1.5; L/MW ranges 1.0 to 1.1. Rostrum downturned, sulcate, with medial keel;

Table 6. Measurements of studied *Galatheites* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Galatheites zitteli* (MOERICKE, 1889)**											
BSP AS III 308	4.6	6.3	1.7	-	2	3.5	2.3	-	1.3	0.6	12.1
NHMW 2007z0149/0414	8.7	11.3	2.6	7.7	3.5	5.9	4.4	1.1	1.5	0.6	12.2
NHMW 2007z0149/0415	7.5	10.1	2.6	8	3.4	6	3.8	0.9	1.3	0.6	12.4
NHMW 2007z0149/0416	6.2	-	-	5.8	-	5	3.2	1.1	1.2	-	12.3
NHMW 2007z0149/0417	2.3	3.2	0.9	2.1	1.2	2	1.3	1.1	1.2	0.6	-
NHMW 2007z0149/0418	-	-	2.7	-	3.1	6.6	3.9	-	-	0.5	-
NHMW 2007z0149/0419	-	-	2.5	-	3.2	6.6	5.3	-	-	0.5	-
NHMW 2007z0149/0420	7.1	10	2.9	8	3.2	6	3.4	0.9	1.2	0.5	-
NHMW 2007z0149/0421	-	-	-	6	-	-	-	-	-	-	-
NHMW 2007z0149/0422	-	-	2.6	7.2	3.1	6.2	3.3	-	-	0.5	-
NHMW 2007z0149/0423	6.3	8.1	1.8	6	3.8	5.4	2.6	1.1	1.2	0.7	-
NHMW 2007z0149/0424	3.6	5	1.4	-	1.7	3.4	2	-	1.1	0.5	-
NHMW 2007z0149/0430	4.8	6.7	1.9	4.6	2.2	4.2	-	1	1.1	0.5	-
NHMW 2007z0149/0431	9.3	12.1	2.8	7.9	4.2	6.8	4.9	1.2	1.4	0.6	-
***Galatheites aiola* nov. spec.**											
NHMW 2007z0149/0440	2.7	3.8	1.1	2.8	1.2	2.2	1.5	1	1.2	0.5	12.5
NHMW 2007z0149/0441	4.7	6.4	1.7	4.1	2.1	3.7	2.6	1.1	1.3	0.6	12.6
NHMW 2007z0149/0442	7.3	9.6	2.3	6.5	2.9	5.5	4	1.1	1.3	0.5	-
NHMW 2007z0149/0443	-	-	-	5.6	3	5.4	3.6	-	-	0.6	-
NHMW 2007z0149/0408	-	-	1.9	-	2.6	-	3.1	-	-	-	-
NHMW 2007z0149/0412	8.6	11.2	2.6	7.6	3.8	5.8	4.4	1.1	1.5	0.7	12.7
NHMW 2007z0149/0437	-	-	1.7	4.9	2.2	4	2.6	-	-	0.6	12.8
NHMW 2007z0149/0413	7.2	9.3	2.1	6.3	3.4	6.2	3.8	1.1	1.2	0.5	-
***Galatheites diasema* nov. spec.**											
NHMW 2007z0149/0434	2.7	3.8	1.1	2.4	1.3	2.3	1.6	1.1	1.2	0.6	12.9
NHMW 2007z0149/0163	1.7	2.5	0.8	1.8	1	1.8	1	0.9	1	0.5	12.10
***Galatheites obtecta* nov. spec.**											
LPBIIIart134	-	-	0.8	-	1.7	2.6	1.8	-	-	0.6	12.11

rostral shape broadly triangular, narrows anteriorly; terminates in three or five pronged tip. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin. Deep groove defines base of epibranchial region. Epigastric region well defined, separated from protogastric region by short groove perpendicular to lateral margin. Epigastric region slightly depressed relative to remainder of carapace. Mesogastric and metagastric regions well defined by shallow grooves. Urogastric and cardiac region weakly defined by weak grooves or indentations. Carapace, including rostrum, ornamented with weak squamous tubercles; tubercles slightly elongated on posterior of carapace. Posterior margin strongly rimmed, weakly indented; ornamentation continues onto rim. Ventral surface and appendages not preserved.

Discussion: This species shows some variability in the number of spines adorning the rostrum, as well as depth of grooves. Weaker groove structure tends to be coupled with a five-pronged rostrum, and stronger groove structure usually is coupled with a three-pronged rostrum; however, this difference is not always consistent, as seen in the illustration of the holotype, NHMW 2007z0149/0437, Fig. 12.8. *Galatheites aiola* nov. spec. differs from *G. zitteli* and *G. royoi* by possessing squamous ornamentation, whereas the aforementioned species have more transverse ornamentation than squamous. *Galatheites aiola* nov. spec. differs from *G. diasema* nov. spec. by having stronger epigastric region definition and more transversely ovate tubercles present posteriorly.

Galatheites diasema **nov. spec.**

Figs 12.9, 12.10

Diagnosis: Carapace average L/TW 1.1; L/MW 1.0. Rostrum ends in tridentate tip. Lateral margins of carapace spined. Carapace, including rostrum, ornamented with squamous tubercles; tubercles transversely elongated on cardiac region.

Etymology: The species name is derived from the Greek *diasemos*, meaning clear or distinct. This species has very clear grooves and ornamentation in comparison to the other species within the genus.

Measurements: See Table 6.

Holotype: NHMW 2007z0149/0434.

Paratype: NHMW 2007z0149/0163.

Type locality: Ernstbrunn quarries, Ernstbrunn, Austria.

Type stratum: Endemic to the Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex, subrectangular in shape, narrows very slightly at extreme posterior; L/TW ranges from 1.0 to 1.2; L/MW ranges from 0.9 to 1.1. Rostrum downturned, with medial keel, rostral shape sub-triangular, narrows anteriorly; terminates in tridentate tip, central spine longer than outer spines. Lateral margins spined. Cervical groove deep, well defined; extends in smooth semicircle concave

forward across center of carapace before arcing convex forward as groove approaches anterolateral margin. Moderately strong epibranchial branch defines base of epibranchial region. Epigastric region weakly defined; mesogastric region defined by shallow groove; metagastric region weakly defined by weak indentation. Carapace, including rostrum, ornamented with squamous tubercles; tubercles transversely elongated on cardiac region. Cardiac region weakly defined by very slight swelling, ornamentational difference, and slight indentational outline in carapace. Posterior margin weakly rimmed. Ventral surface and appendages not preserved.

Discussion: *Galatheites diasema* nov. spec. is morphologically closest to *G. aiola* nov. spec.; *G. diasema* nov. spec. has fewer transversely ovate tubercles and a more poorly defined epigastric region than *G. aiola* nov. spec. *Galatheites zitteli* and *G. royoi* have transverse ornamentation, which is absent from *G. diasema* nov. spec. *Galatheites diasema* nov. spec. has a subtriangular rostrum with straight, linear sides, whereas *G. obtecta* nov. spec. has a rostrum with sinuous lateral sides.

***Galatheites obtecta* nov. spec.**

Fig. 12.11

2006 *Paragalathea ruizi* (VAN STRAELEN, 1940) – SHIRK: p. 145–151, figs 39.2, 40. [pars.]

Diagnosis: Carapace moderately convex longitudinally and transversely; widens slightly posteriorly. Rostrum downturned, sulcate, with medial keel; rostral shape broadly triangular at base, narrows anteriorly along a sinuous arc; tridentate. Lateral margin spined. Carapace, including rostrum, ornamented with transversely elongated squamous tubercles.

Etymology: The Latin *obtecta*, meaning covered over, refers to the obscured and unpreserved portions of the carapace of the holotype and sole specimen.

Measurements: See Table 6.

Holotype by monotypy: LPBIIIart134.

Type locality: Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″.

Type stratum: Endemic to the Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace moderately convex longitudinally and transversely; widens slightly posteriorly. Rostrum downturned, sulcate, with medial keel; rostral shape broadly triangular at base, narrows anteriorly along a sinuous arc; terminates in horizontal tridentate tip with central spine wider than outer pair of spines. Lateral margin spined. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin at anterior of epibranchial region. Deep groove defines base of epibranchial region. Epigastric region well defined, separated from protogastric region by short, strong groove perpendicular to lateral margin. Mesogastric and metagastric regions well defined by shallow grooves.

Urogastric region weakly defined by weak grooves or indentations. Anterior of carapace, including rostrum, ornamented with transversely elongated squamous tubercles. Posterior of carpace ornamented with elongated squamous ridges along lateral margin; central portion not preserved. Ventral surface and appendages not preserved.

Discussion: The rostral shape of *Galatheites diasema* nov. spec., with the sinuous lateral margin and tridentate tip, separate it from all other species within the genus.

Genus *Hispanigalathea* Klompmaker, Feldmann, Robins & Schweitzer, 2012

Type species: *Hispanigalathea pseudolaevis* Klompmaker, Feldmann, Robins & Schweitzer, 2012, by original designation.

Other included species: *Hispanigalathea tithonia* nov. spec., *Hispanigalathea tuberosa* Klompmaker, Feldmann, Robins & Schweitzer, 2012.

Diagnosis: See Klompmaker *et al*. (2012, p. 138).

Discussion: *Hispanigalathea* is very similar to *Annieporcellana* from the Albian of Spain, and both are transferred into Catillogalatheidae nov. fam. herein. The strong gastro-orbital groove and epigastric region elevated above the rostrum, as well as the lack of transverse ornamentation indicate that *Hispanigalathea* is better placed within Catillogalatheidae nov. fam. than its current family, the Galatheidae. The absence of a circumgastric groove precludes placement within Munidopsidae, and the strong groove structure and L/W ratio are incompatible with Porcellanidae. This genus previously was only known from the Albian of Spain. The new species described here extends its range to the Tithonian of Austria.

***Hispanigalathea tithonia* nov. spec.**
Fig. 13

Diagnosis: Carapace sub-rectangular in shape. Rostrum slightly downturned, sulcate, without medial keel, proximal end of rostrum has parallel lateral margins. Carapace lateral margin spined. Cervical groove well defined; two deep pits situated at base of groove in center of carapace. Epigastric region well defined, raised above rostral surface. Cardiac region moderately defined by weak grooves or indentations. Ornamentation only apparent on metabranchial regions; ornamented with transversely elongated squamous tubercles; tubercles elongated slightly on posterior of carapace.

Etymology: The species name is derived from Tithonian, as this species is the only member of the genus thus far to be found in Tithonian age strata.

Measurements: See Table 7.

Holotype by monotypy: NHMW 2007z0149/0438.

Type locality: Ernstbrunn quarries, Ernstbrunn, Austria.

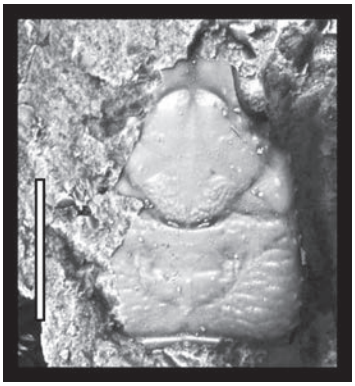


Fig. 13. Holotype of *Hispanigalathea tithonia* (NHMW 2007z0149/0438) from the Ernstbrunn Limestones. Scale bar equals 5 mm.

Type stratum: Endemic to the Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex transversely, sub-rectangular in shape. Rostrum slightly downturned, sulcate, without medial keel; rostral shape and termination unknown; proximally rectangular in shape with parallel sides. Carapace lateral margin spined. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before fading slightly. Two deep pits situated on cervical groove in center of carapace. Deep groove defines base of epibranchial region. Epigastric region well defined, separated from protogastric by slight continuation of gastro-orbital groove extending posterolaterally from orbital area. Epigastric region raised above rostral surface. Mesogastric and metagastric regions weakly defined by shallow grooves. Cardiac region weakly defined by weak grooves or indentations. Ornamentation only apparent on metabranchial regions; ornamented with transversely elongated squamous tubercles; tubercles elongated on posterior of carapace. Posterior margin moderately rimmed; indented. Ventral surface and appendages not preserved.

Discussion: The holotype is unfortunately incomplete but does show strong similarities with the type species of *Hispanigalathea*, *H. pseudolaevis*, and is therefore placed within this genus. The general lack of ornamentation is also found on *H. pseudolaevis*, as is the elevated epigastric region and rostrum without a keel. The broad, U shaped cervical groove with two deep pits also matches well between *H. pseudolaevis* and *H. tithonia* nov. spec. *Hispanigalathea tithonia* nov. spec. has more clearly defined regions on the posterior portions of the carapace than the other species within the genus, with a clearly outlined cardiac region.

Genus *Tuberosagalathea* nov. gen.

Type species: *Galathea neojurensis* PATRULIUS, 1959 nov. comb. (= *Galathea antiqua* MOERICKE, 1889; nomen preoccupatum *Galathea antiqua* RISSO, 1816).

Other included species: *Galatheites neocomiensis* Van Straelen, 1936; *Eomunidopsis portlandica* Fraaye & Collins, 1996; *Tuberosagalathea tornatilis* nov. spec.; *Tuberosagalathea antefixa* nov. spec.

Diagnosis: Carapace moderately convex; widens slightly posteriorly. Rostrum subtriangular to spatulate in shape, with or without median keel. Epigastric region very well defined; cardiac region moderately defined. Carapace, including rostrum, ornamented with slightly squamous tubercles or flexuous transverse ridges; Posterior to cardiac region middle portion of carapace anterior to posterior margin strongly indented; ornamented with setal pits.

Etymology: The name is derived from the combination of the Latin *tuberosus*, meaning full of lumps or protuberances, and *galathea*, from the superfamily Galatheoidea.

Discussion: This genus is erected and placed within Catillogalatheidae nov. fam. due to the extremely well defined epigastric region and triangular rostra possessed by the members. This genus differs from *Catillogalathea* nov. gen. by the epigastric regions. The gastro-orbital grooves on *Tuberosagalathea* nov. gen. traverse the lateral edges of the gastric area, whereas on *Catillogalathea* nov. gen., the grooves traverse through the gastric region. *Tuberosagalathea* nov. gen. differs from *Nykteripteryx* and *Serraphylctaena* nov. gen. by having a larger L/W ratio and weaker grooves. *Tuberosagalathea* nov. gen. differs from *Annieporcellana*, *Hispanigalathea*, *Muelleristhes*, and *Vasconilia* nov. gen. by having stronger regional definition, especially in the gastric region, and stronger ornamentation. *Tuberosagalathea* nov. gen. differs from *Galatheites* by widening posteriorly, having a wider, more spatulate rostrum, and having a deeper gastro-orbital groove.

Tuberosagalathea portlandica nov. comb. was originally assigned to *Eomunidopsis* by Fraaye & Collins (1996). The squamous ornamentation; carapace that widens posteriorly; broad, downturned, triangular rostrum with a keel; and well-defined epigastric regions align it more with *Tuberosagalathea* nov. gen. than *Eomunidopsis*, a genus with a narrow rostrum and strong, transverse ridges. Thus, it should be transferred to *Tuberosagalathea* nov. gen.

Tuberosagalathea neojurensis (Patrulius, 1959) nov. comb.

Figs 14.1–14.4

1889 *Galathea antiqua* Moericke: p. 54–55, pl. 6, fig. 4.
1959 *Palaeomunida neojurensis* Patrulius: p. 252.
1981 *Eomunidopsis neojurensis* Vía Boada: p. 249.

Diagnosis [translated from German, Moericke 1889: p. 54–55; clarifications added in brackets by the authors]: *"The greatest width is in the posterior half of the cephalothorax. The rostrum is very flat and triangular in shape, but with all specimens collectively available to me there is some defect. Prior to the deeply incised cervical groove is the gastric boundary* [mesogastric region] *which represents a distinct triangle. On both sides of the narrow anterior end of the gastric region are two humps which belong to the*

hepatic region, and probably previously were occupied with small spines. The transverse furrow is also well marked, it separates, as in all galatheids, on the sides of the cervical groove to extend out to the margins of the cephalothorax [defines base of epibranchial region]. *The ornamentation of the carapace is composed of strong tubercles, all are rounded, only where the cardiac region is located they are oblong. Anterior to the rear edge of the cephalothorax is a relatively broad, seemingly smooth seam, which, however, under the microscope small round dimples can be seen* [setal pits]. *The spines with which the margins of the carapace were filled, are almost all broken."*

Emended diagnosis: Carapace moderately convex; widens posteriorly, average L/TW 1.3, L/MW 1.0. Rostrum with medial keel; triangular with 3 pairs of short spines along lateral margins of rostrum. Carapace, including rostrum, ornamented with squamous tubercles; tubercles elongated on posterior of carapace, especially on cardiac region. Posterior to cardiac region middle half of carapace indented; ornamented with setal pits.

Measurements: See Table 7.

Lectotype: PATRULIUS (1959) proposed *Galathea neojurensis* as a replacement name for *Galathea antiqua* MOERICKE (1889), as *Galathea antiqua* was previously established by RISSO (1816). The original type series, however, remains the same. MOERICKE (1889) examined three individuals of this species from two localities, Mosty (near Český Těšín, Czech Republic) and Raczhichow (now Radziechów, Poland). Since he did not declare a holotype, BSP AS III 323 is herein declared the lectotype. The label at the BSP indicates that the specimen (BSP AS III 323) was illustrated by MOERICKE as *Galathea antiqua*; however, the label incorrectly states that the species is *Galathea zitteli*. The true *Galathea zitteli* lectotype is BSP AS III 308, which is correctly labeled as *Galathea zitteli*.

Other material examined: NHMW 2007z0149/0406; NHMW 2007z0149/0407; NHMW 2007z0149/0409 to NHMW 2007z0149/0411, all from the Ernstbrunn Limestones.

Type locality: Mosty, Czech Republic. Mosty is the name of two localities near Český Těšín, Czech Republic, and the correct locality is unclear. The two possibilities are Mosty u Českého Těšína and Mosty u Jablonkova, which are approximately 25 km apart.

Type stratum: Štramberk Limestones, Tithonian, Upper Jurassic.

Occurrence: Ernstbrunn Limestones, Ernstbrunn, Austria (herein); Radziechów, Poland (MOERICKE 1889); Mosty, near Český Těšín, Czech Republic (MOERICKE 1889).

Description: Carapace moderately convex; most convex anteriorly, widens and flattens posteriorly; L/TW ranges 1.2 to 1.4; L/MW ranges 1.0 to 1.1. Rostrum downturned, sulcate, with medial keel; rostral shape triangular with three pairs of short spines along lateral margins of rostrum. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove

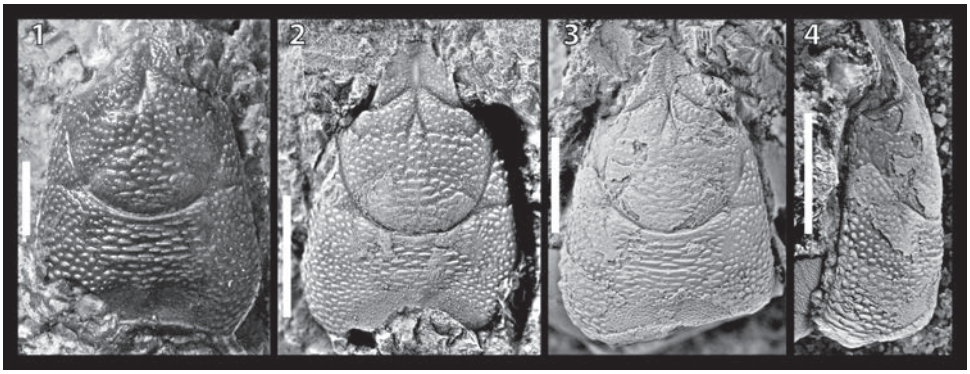


Fig. 14. **1**: Lectotype of *Tuberosagalathea neojurensis* (Patrulius, 1959; BSP AS III 323) from the Štramberk Limestones of Mosty, Czech Republic. **2**: Example of *Tuberosagalathea neojurensis* (NHMW 2007z0149/0406). **3–4**: Example of *Tuberosagalathea neojurensis* nov. comb. (NHMW 2007z0149/0407); 3: dorsal view; 4: side view. All figured specimens except 1 are from the Ernstbrunn Limestones; all scale bars are 5 mm.

approaches lateral margin. Deep groove defines base of epibranchial region. Epigastric region well defined, separated from protogastric region by short, strong groove perpendicular to lateral margin. Epigastric region weakly depressed relative to remainder of carapace. Mesogastric and metagastric regions well defined by shallow grooves. Urogastric and cardiac region weakly defined by weak grooves or indentations. Carapace, including rostrum, ornamented with slightly squamous tubercles; tubercles elongated on posterior of carapace, especially on cardiac region. Posterior to cardiac region middle half of carapace indented; ornamentation composed solely of setal pits. Posterior margin strongly rimmed and inflected concave posterior; ornamentation continues onto rim. Ventral surface and appendages not preserved.

Discussion: This species differs from *Tuberosagalathea tornatilis* nov. spec. and *Tuberosagalathea antefixa* nov. spec. by having all tubercular and transversely ovate tubercular ornamentation, whereas the Romanian species both have ornamentation of at least partial flexuous ridges. The Romanian species also have many more spines on the lateral sides of the rostrum. *Tuberosagalathea neojurensis* nov. spec. has a better defined epigastric region and less defined urogastric region than *Tuberosagalathea neocomiensis* nov. comb. (Fig. 15.1). *Tuberosagalathea neocomiensis* nov. comb. also does not have a median rostral keel, a feature present on *Tuberosagalathea neojurensis* nov. comb. *Tubersosagalathea portlandica* nov. comb. (Fig. 15.2) does not appear to have a serrate rostrum; additionally, the posterior portion of the carapace appears to be ornamented with more ridge like ornamentation instead of tubercular ornamentation. Hyžný *et al*. (2015) reported *Eomunidopsis* cf. *neojurensis* from the Oxfordian of Stránská Skála, Czech Republic. Unfortunately it is not well preserved enough to definitively attribute the specimen to *Tuberosagalathea neojurensis*; however, it certainly seems to belong to the genus *Tuberosagalathea*.

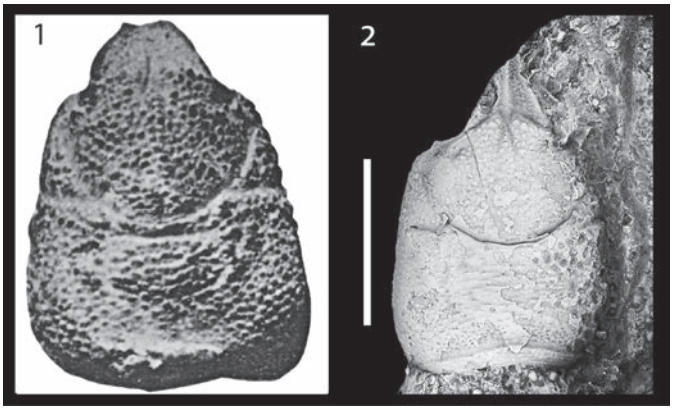


Fig. 15. **1**: Reprinted illustration of the holotype of *Tuberosagalathea neocomiensis* (Van Straelen, 1936) nov. comb. Originally published with a magnification factor in Van Straelen, 1936 (pl. 3, fig. 6, MNH-Auxerre 802); approximately 10 mm in length excluding rostrum. **2**: Holotype of *Tuberosagalathea portlandica* nov. comb. (Fraaye & Collins, 1996; specimen MAB K1695). Photo by BWM van Bakel, courtesy of RHB Fraaije. Scale bar equals 5 mm.

Tuberosagalathea neocomiensis (Van Straelen, 1936) nov. comb.

Fig. 15.1

1936 *Galatheites neocomiensis* – Van Straelen: p. 24–25, pl. 3, fig. 5, 6.
1981 *Paragalathea neocomiensis* – Vía Boada: p. 249.

Diagnosis [Van Straelen 1936: p. 24–25; translated from French]: Cephalothorax widens posteriorly, strongly convex, anterolateral angles almost right angles, posterolateral angles rounded, posterior edge slightly indented by the pleon. Rostrum very broad at the base, without median keel, occupies half the frontal margin, curved downward. Cervical groove deep, forms almost a half circle in outline. Gastro-orbital grooves weakly marked except in the middle of the base of the rostrum where they meet, gastric region occupies a total area roughly equal to one third of the cephalic area. Hepatic grooves very pronounced, approaching the lateral keel [la carène latérale] at almost a right angle. Brachiocardiac groove weakly indicated. Rostrum covered with very fine granulations, appears smooth. Cephalothorax, except cardiac area, covered with irregularly placed tubercles; cardiac area lined with very closely spaced tubercles placed in rows, forming flexuous parallel ridges.

Measurements: L/MW 1.15; L/TW 1.7, RW/TW 0.7.

Holotype by monotypy: NHM-Aux 802.

Type locality: Auxerre (Yonne), France.

Type stratum: Hauterivian; strata not indicated by Van Straelen (1936).

Discussion: Neither the holotype nor a cast of the holotype was available to the authors for examination; therefore, a detailed description is not possible at this time. This

species was originally described as a member of *Galatheites* by Van Straelen (1936), and was subsequently transferred to *Paragalathea* by Vía Boada (1982). The absence of a rostral keel distinguishes this species from the others within the genus. The amount of regional definition exhibited by *T. neocomiensis* nov. comb. indicates that it does not fall within the scope of *Paragalathea*. Unfortunately, the most diagnostic characteristic of setal pits along the posterior margin is obscured on the available photo of *Tuberosagalathea neocomiensis* nov. comb., but the rostral shape, carapace shape, and groove structure all align well with the type species *T. neojurensis* nov. comb. *Tuberosagalathea neocomiensis* nov. comb. also appears to have a more strongly defined cardiac region, as well as deeper grooves than the other species within this genus. It is also the only species from the Early Cretaceous, as all other species within this genus are Late Jurassic in age.

Tuberosagalathea tornatilis nov. spec.

Figs 16.1–16.4

1966 *Galathea* (*Palaeomunida*) n. sp. – Patrulius: p. 503, fig. 3B.
2006 *Palaeomunida* n. sp. 1 – Shirk: p. 121–126, figs 31–32.
2006 *Palaeomunida* n. sp. 2 – Shirk: p. 127–131, figs 33.1, 34. [pars.]

Diagnosis: Rostrum weakly keeled proximally; rounded with 6 pairs of lateral spines. Carapace ornamented anteriorly with short, interrupted transverse ridges; posterior of carapace ornamented with more continuous transverse ridges.

Etymology: The name is derived from the Latin *tornatilis*, meaning beautifully rounded. The name is in reference to this species' beautifully rounded rostrum.

Measurements: See Table 7.

Holotype: LPBIIIart128.

Paratypes: LPBIIIart127, LPBIIIart120, LPBIIIart113.

Type locality: Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″.

Type stratum: Endemic to the Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace weakly convex transversely; widens slightly posteriorly, increases convexity longitudinally posteriorly. Rostrum downturned, sulcate, weakly keeled with aligned scales proximally, scales not aligned distally. Rostral shape spatulate to subpentagonal, rounded with 6 pairs of lateral spines; ornamentation squamous. First pair of rostral spines laterally equivalent to anteriormost extension of epigastric region. Proximal four pairs of spines strong, approximately equal in size; distal most spines weak, much smaller. Terminal rostral point equal in size to proximal-most spines. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin at anterior of epibranchial region. Epigastric, mesogastric, and metagastric regions well-defined by grooves. Cardiac region weakly defined by four aligned transverse ridges, slightly

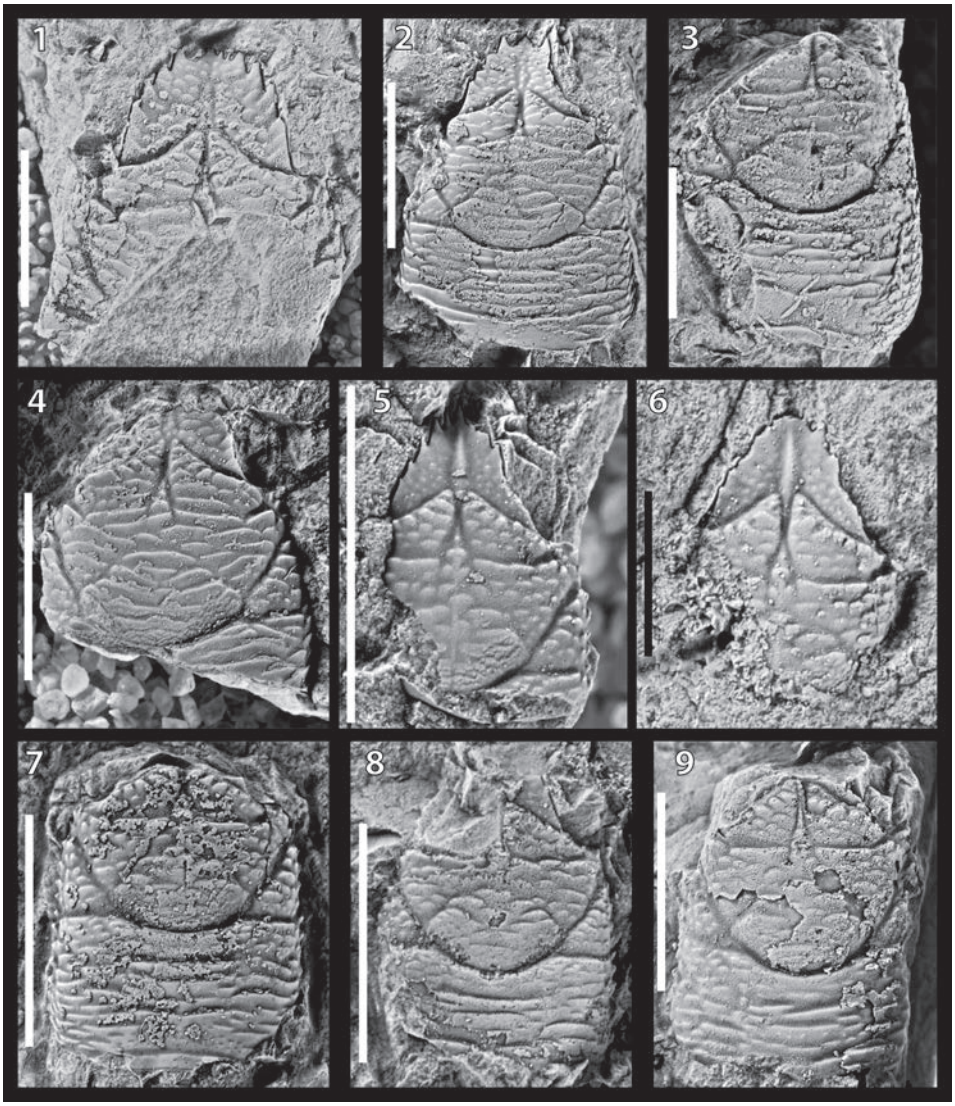


Fig. 16. **1**: Holotype of *Tuberosagalathea tornatilis* nov. spec. (LPBIIIart128). **2**: Paratype of *Tuberosagalathea tornatilis* nov. spec. (LPBIIIart127). **3**: Paratype of *Tuberosagalathea tornatilis* nov. spec. (LPBIIIart120). **4**: Paratype of *Tuberosagalathea tornatilis* nov. spec. (LPBIIIart113). **5**: Holotype of *Tuberosagalathea antefixa* nov. spec. (LPBIIIart131). **6**: Paratype of *Tuberosagalathea antefixa* nov. spec. (LPBIIIart133). **7**: Paratype of *Tuberosagalathea antefixa* nov. spec. (LPBIIIart142). **8**: Example of *Tuberosagalathea antefixa* nov. spec. (LPBIIIart121). **9**: Example of *Tuberosagalathea antefixa* nov. spec. (LPBIIIart122). All scale bars except for 6 equal 5 mm; for 6 scale equals 2 mm; all specimens are from Purcăreni, Romania.

tumid. Carapace ornamented anteriorly with short, interrupted transverse ridges; ridges appear squamous across gastric and epibranchial regions, and approaching lateral margins of carapace. Posterior of carapace ornamented with more continuous transverse

ridges. Posterior margin strongly rimmed, indented. Ventral surface and appendages not preserved.

Discussion: PATRULIUS (1966) first noted this species, from the same locality as the one described above. Although he did not offer a formal description, he illustrated the rostrum of a species he called *Galathea* (*Palaeomunida*) n. sp. (PATRULIUS 1966: p. 503, fig. 3B). The rostrum of this species is so distinctive that it can confidently be matched to the one described here, despite his collection being unavailable for study. The setal pits present along the posterior margin of this species, along with the general rostral and carapace shape, as well as the groove structure, place this species within *Tuberosagalathea* nov. gen.

Table 7. Measurements of studied *Hispanigalathea*, *Tuberosagalathea*, and *Vasconilia* specimens. Abbreviations as in Tab. 1.

Number	L	LR	R	MW	RW	TW	GH	L/MW	L/TW	RW/TW	FIG.
***Hispanigalathea tithonia* nov. spec**											
NHMW 2007z0149/0438	9.05	-	-	8.2	3.5	7	4.4	1.1	1.3	-	13
***Tuberosagalathea neojurensis* (PATRULIUS, 1959) nov. comb.**											
BSP AS III 323	16.1	-	-	16.2	7.2	11.4	8.6	1	1.4	0.6	14.1
NHMW 2007z0149/0406	9.9	13.8	3.9	9.2	4.3	7.3	5	1.1	1.4	0.6	14.2
NHMW 2007z0149/0407	13.3	18.5	5.2	13.8	6.2	10.8	6	1	1.2	0.6	14.3-4
NHMW 2007z0149/0409	10.3	13.8	3.5	10.8	4.1	8.6	5.5	1	1.2	0.5	-
NHMW 2007z0149/0410	10.3	-	-	9.6	-	7.7	4.8	1.1	1.3	-	-
NHMW 2007z0149/0411	13	-	-	13.3	-	10.5	7	1	1.2	-	-
***Tuberosagalathea tornatilis* nov. spec.**											
LPBIIIart128	-	-	3	-	5.8	8.1	-	-	-	0.7	16.1
LPBIIIart127	7.8	9.6	1.8	6.9	3.8	5.9	4.7	1.1	1.3	0.6	16.2
LPBIIIart120	10.3	-	-	7.3	-	6	5.8	-	-	-	16.3
LPBIIIart113	-	-	-	-	-	6.8	5.4	-	-	-	16.4
***Tuberosagalathea antefixa* nov. spec.**											
LPBIIIart131	-	-	1.3	-	2.4	3.4	2.9	-	-	0.7	16.5
LPBIIIart132	-	-	-	-	-	3.2	2.6	-	-	-	-
LPBIIIart133	-	-	2.2	-	3.8	-	-	-	-	-	16.6
LPBIIIart142	6.5	-	-	5.4	-	4.8	3.5	1.2	1.4	-	16.7
LPBIIIart121	-	-	-	-	-	-	-	-	-	-	16.8
LPBIIIart122	-	-	-	5.9	-	-	4.8	-	-	-	16.9
LPBIIIart144	-	-	-	-	-	-	-	-	-	-	-
***Vasconilia xystosa* nov. spec.**											
NHMW 2007z0149/0433	3	4.4	1.4	3	1.5	2.7	1.6	1	1.1	0.6	17.1

The six pairs of lateral spines on the rostrum separate this species from all others within the genus. There are two other species with spines along the lateral margins of the rostrum, *Tuberosagalathea neojurensis* nov. comb. and *Tuberosagalathea antefixa* nov. spec. *Tuberosagalathea neojurensis* nov. comb. has three pairs of spines on the lateral margin of the rostrum, and squamous ornamentation. *Tuberosagalathea tornatilis* nov. spec. has transverse ornamentation. *Tuberosagalathea antefixa* nov. spec., with similar ornamentation to *Tuberosagalathea tornatilis* nov. spec., is a much closer morphological match; however, *Tuberosagalathea antefixa* nov. spec. has only 5 pairs of rostral spines and a more triangularly shaped rostrum than *Tuberosagalathea tornatilis* nov. spec. *Tuberosagalathea antefixa* nov. spec. also has much more squamous ornamentation than *Tuberosagalathea tornatilis* nov. spec. Although it is easiest to separate the species based on the rostrum, the rostrum is often broken. The ornamentation of the dorsal carapace is also different from all others within the genus. *Tuberosagalathea tornatilis* nov. spec. has ornamentation of flexuous transverse ridges, covering both the anterior and posterior parts of the carapace. This differs from all others, which have tuberculate or squamous tubercles ornamenting at least the anterior portion of the carapace.

Tuberosagalathea antefixa nov. spec.

Figs 16.5–16.9

2006 *Eomunidopsis navarrensis* (Van Straelen, 1940) – Shirk: p. 112–119, figs 29–30.
2006 *Palaeomunida* n. sp. 2 – Shirk: p. 127–131, figs 33.2, 34. [pars.]

Diagnosis: Rostrum keeled, with 5 pairs of lateral spines. Lateral margin of carapace spined. Carapace ornamented anteriorly with short, squamous ridges; posterior of carapace ornamented with more continuous, squamous ridges. Immediately anterior of posterior margin, middle half of carapace ornamented exclusively with setal pits.

Etymology: The species name is derived from the Latin *antefixum*, meaning a little ornament for roofs of houses and temples. The species name refers to the ornate, steeple-shaped rostrum.

Measurements: See Table 7.

Holotype: LPBIIIart131.

Paratypes: LPBIIIart132, LPBIIIart133, LPBIIIart142.

Other material examined: LPBIIIart121, LPBIIIart122, LPBIIIart144, from Purcăreni, Romania.

Type locality: Purcăreni, Romania. GPS N 45° 38′ 14.5″ and E 25° 48′ 14.7″.

Type stratum: Endemic to the Tithonian coral reef limestone olistolith within the Piscul cu Brazi Formation (Cretaceous).

Description: Carapace moderately convex transversely; subrectangular in shape; widens slightly posteriorly. Rostrum downturned, slightly sulcate, keeled. Rostral shape subtriangular, with 5 pairs of lateral spines; ornamentation squamous. First pair of rostral

spines approximately laterally equivalent to anteriormost extension of epigastric region. First four pairs of spines increase in size distally; fourth pair of spines largest; fifth pair of spines narrower, smaller than preceding spine. Terminal rostral point slightly larger than fifth pair of spines. Lateral margin spined. Cervical groove well defined; extends in smooth semicircle concave forward across center of carapace before arcing convex forward as groove approaches lateral margin at anterior of epibranchial region. Epigastric, mesogastric, and metagastric regions well-defined by weak grooves. Cardiac region slightly defined by aligned transverse ridges, slightly tumid. Carapace ornamented anteriorly with short, squamous ridges; posterior of carapace ornamented with more continuous, flexuous squamous ridges. Posterior margin strongly rimmed, indented. Immediately anterior of posterior margin, middle half of carapace ornamented exclusively with setal pits. Ventral surface and appendages not preserved.

Discussion: The presence of setal pits, the basic groove structure, and the carapace and rostral shape place this species within *Tuberosagalathea* nov. gen. This species, like *Tuberosagalathea tornatilis* nov. spec., can be separated from all others on the basis of its rostrum. The 5 pairs of rostral spines are unique to this species. However, the ornamentation of the dorsal carapace is also a distinguishing feature. This species has squamous tubercles ornamenting the anterior regions of the carapace, and flexuous ridges ornamenting the posterior regions. *Tuberosagalathea neojurensis* nov. comb. and *Tuberosagalathea neocomiensis* nov. comb. have tubercles ornamenting the entire carapace, *Tuberosagalathea portlandica* nov. comb. has tubercles anteriorly and transversely elongate tubercles posteriorly, and *Tuberosagalathea tornatilis* nov. spec. has flexuous ridges ornamenting the entire carapace.

Genus *Vasconilia* nov. gen.

Type species: *Galathea ruizi* Van Straelen, 1940.

Other included species: ?*Vasconilia miyakoensis* (Takeda & Fujiyama, 1983) nov. comb.; *Galatheites straeleni* (Ruiz de Gaona, 1943; = *Galathea alsuasensis* Van Straelen, 1944) nov. comb.; *Vasconilia xystosa* nov. spec.

Diagnosis: Dorsal carapace subrectangular to subsquare in shape. U-shaped cervical groove deep at base; weakens slightly anteriorly. Rostrum triangular; often tridentate. Epigastric region very well defined; cardiac region weakly to moderately well defined. Posterior margin clearly rimmed. Ornamentation consists of tubercles, transversely elongate tubercles, or weak ridges.

Etymology: The generic name comes from the historical name of the Basque region in Spain. The type locality of two of the species, including the type species, is in the historical Duchy of Vasconia. Gender is feminine.

Discussion: The ratio for L/MW was taken from published data within Klompmaker *et al*. (2012) for *Vasconilia ruizi* nov. comb. and *Vasconilia straeleni* nov. comb.

Annieporcellana and *Hispanigalathea* have broad rostra and carapaces that narrow posteriorly, unlike *Vasconilia* nov. gen. *Galatheites*, *Muelleristhes*, and *Tuberosagalathea* nov. gen. have weaker groove structure and wider rostra than *Vasconilia* nov. gen.

Vasconilia ruizi nov. comb. and *Vasconilia straeleni* nov. comb. were recently redescribed and illustrated by KLOMPMAKER *et al*. (2012, figs 7 and 8). These two are the best known members of the new genus, with each represented by multiple well-preserved individuals. ?*Vasconilia miyakoensis* nov. comb., an Aptian species from the Riyaku Islands of Japan, was originally placed within the genus *Paragalathea* with some hesitation by TAKEDA & FUJIYAMA (1983) due to its morphological similarity to *Vasconilia ruizi* nov. comb. (TAKEDA & FUJIYAMA 1983; GARASSINO *et al*. 2008). It is too fragmentary for identification with any degree of confidence. Enough of the carapace is preserved to conclude that it does not belong within the genus *Paragalathea*. It has a strong cervical groove, very well defined epibranchial regions, and the cardiac region is elevated above the remainder of the carapace. TAKEDA & FUJIYAMA (1983) commented on the similarities between *Vasconilia ruizi* (then *Paragalathea*) and ?*Vasconilia miyakoensis* nov. comb. in terms of carapace shape and ornamentation. The rostrum and anterior margin of ?*Vasconilia miyakoensis* nov. comb. is unknown. Since the Japanese species was originally placed in *Paragalathea* due to its visual similarity to *Vasconilia ruizi* nov. comb., it is kept with *Vasconilia ruizi* nov. comb. until an additional, better preserved specimen allows for a better comparison and placement.

***Vasconilia xystosa* nov. spec.**

Fig. 17.1

Diagnosis: Carapace subrectangular in shape, L/TW 1.1, L/MW 1.0. Rostrum without medial keel, rostral shape sub-triangular to sub-rectangular, narrows slightly anteriorly. Anterolateral margin has anteriorly directed spine at anterior of hepatic region. Carapace ornamented with equal sized tubercles and elongated transverse tubercles.

Etymology: The species name comes from the Greek *xystos*, meaning scraped or shaved. The ornamentation on this species has been mostly lost.

Measurements: See Table 7.

Holotype by monotypy: NHMW 2007z0149/0433.

Type locality: Ernstbrunn Quarries, Ernstbrunn, Austria.

Type stratum: Endemic to the Ernstbrunn Limestones, Tithonian, Upper Jurassic.

Description: Carapace moderately convex, subrectangular in shape, widest part equivalent with base of cardiac region; narrows slightly at extreme posterior; L/TW 1.1, L/MW 1.0. Rostrum downturned, without medial keel, rostral shape sub-triangular to sub-rectangular, narrows slightly anteriorly; tip of rostrum unknown. Rostrum attaches to carapace with chevron shaped indent. Cervical groove well defined centrally; fades as it extends in smooth semicircle concave forward across center of carapace before arcing

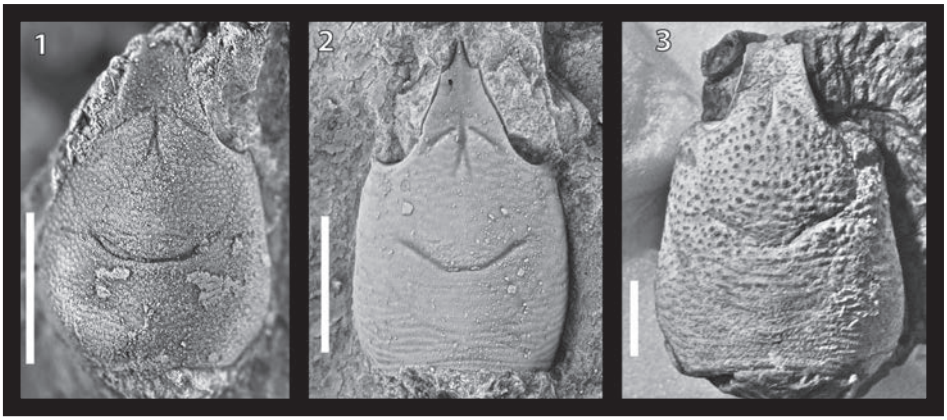


Fig. 17. **1**: Holotype of *Vasconilia xystosa* (NHMW 2007z0149/0433) from the Ernstbrunn Limestones. Scale bar equals 5 mm. **2**: Specimen of *Vasconilia ruizi* (Van Straelen, 1940) nov. comb. This specimen was also illustrated in Klompmaker *et al*. (2012: p. 136 fig. 7D; MAB k2972). **3**: Specimen of *Vasconilia straeleni* (Ruiz da Gaona, 1943) nov. comb (MGSB 11519.2). Photo provided by A. Klompmaker. All scale bar equals 5 mm.

convex forward as groove approaches anterolateral margin. Very weak epibranchial branch defines base of epibranchial region. Anterolateral margin has anteriorly directed spine at anterior of hepatic region. Epigastric region moderately defined; mesogastric region slightly defined by very shallow groove. Carapace ornamented with equal sized tubercles and ornamentation of elongated transverse tubercles. Regions appear undefined posterior to cervical groove. Posterior margin weakly rimmed. Ventral surface and appendages not preserved.

Discussion: This genus is very similar to *Vasconilia ruizi* nov. comb. (Fig. 17.2). The strongest difference is in the shape of the cervical groove. The cervical groove is more rounded at the base on *Vasconilia xystosa* nov. spec. The same difference is true for *Vasconilia straeleni* nov. comb. (Fig. 17.3), which has an identical cervical groove to *Vasconilia ruizi* nov. comb. ?*Vasconilia miyakoensis* nov. comb. has regions that are slightly tumid, a feature absent on *Vasconilia xystosa* nov. spec.

Genus *Serraphylctaena* nov. gen.
Figs 18.1, 18.2

Type and sole species: *Paragalathea multisquamata* Vía Boada, 1982.

Diagnosis: From Klompmaker *et al*. (2012: p. 134): *"Small carapace, excluding rostrum, 11–16% longer than wide. Rostrum broad at base, rounded to triangular in outline, margins bearing forwardly directed spines that diminish in size posteriorly; tiny spines cover lateral borders; has a median groove that diminishes toward tip. Epigastric regions raised and relatively narrow. Pronounced cervical groove broadly concave forward, with two branches on lateral part* [of] *carapace. Carapace, except rostrum,*

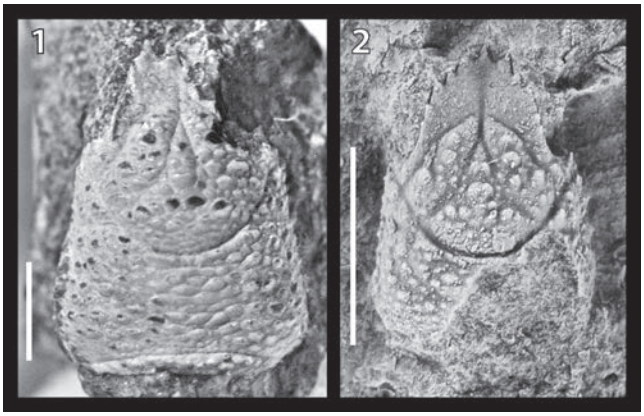


Fig. 18. **1**: Holotype (MGSB 28118) and **2**: an additional individual (MAB k2977) of *Serraphylctaena multisquamata* (VÍA BOADA, 1981) nov. gen. The individual shown in 2 was also illustrated in KLOMPMAKER *et al*. (2012: p. 135, fig. 6A). Scale bars equal 2 mm.

covered with rounded tubercles, seemingly more elongated transversely around cardiac region, largest tubercle on axis of mesogastric region."

Etymology: The name is derived from a combination of the Latin *serra*, referring to the serrate rostrum, and *phylctaena*, referring to the bulbous ornamentation of the sole member of the genus. Gender is feminine.

Discussion: This monospecific genus is erected to house *Paragalathea multisquamata*. The diagnosis quoted above from KLOMPMAKER *et al*. (2012) was originally for the species. Until other species within this genus are found, the diagnosis for the species and the genus are the same. The deep groove structure and well-defined epigastric regions separate it from other members of *Paragalathea*, and place it in strong similarity with *Nykteripteryx*, another Albian genus included within this family. This species, however, merits its own genus due to its numerous differences with other included genera. The spatulate, broad rostrum separates this genus from *Galatheites*, *Tuberosagalathea* nov. gen., *Catillogalathea* nov. gen., *Annieporcellana*, *Hispanigalathea*, and *Vasconilia* nov. gen. *Nykteripteryx* does not have the strong, U shaped cervical groove found on *Paragalathea multisquamata*. Hence, it belongs in its own genus.

CONCLUSIONS

The fossil specimens detailed herein did not line up well with the modern concepts of the morphology of galatheoids, and a new classification scheme was needed. Previously, not enough specimens were known to support such large divisions within the Galatheoidea. The rediscovery of the extensive FRIEDRICH BACHMAYER collection in the NHMW, plus extensive collecting done in Romania, including that by R. FELDMANN, A. & O. FRANTESCU, I. LAZAR, C. ROBINS, M. SANDY, C. SCHWEITZER, A. BONDE (née SHIRK), and J. VERHOFF, have greatly added to the number of specimens and diversity of species from the Tithonian.

From Ernstbrunn alone, 46 species of squat lobsters have been reported. This is a high level of diversity, but is not unheard of in squat lobster communities within the modern

oceans (Schnabel *et al*. 2011b). The Tethys was truly a crucible of anomuran biodiversity (Klompmaker *et al*. 2013). The species from Ernstbrunn represent approximately one-third of known fossil species of squat lobsters, excluding porcellanids (De Grave *et al*. 2009; Klompmaker *et al*. 2012; Robins *et al*. 2013), which indicates that quite a few more species should be found in the rock record between the Late Jurassic and the present.

This work, along with Robins *et al*. (2013), shows the enormous diversity of galatheoids 150 million years ago. The present oceans have nearly 1,000 species of galatheoids (De Grave *et al*. 2009); the Late Jurassic, by comparison, has approximately 60 galatheoid species. However, the Late Jurassic holds over half of the known fossil record for these creatures. Their diversity clearly did not start in the modern ocean environment.

The munidopsids were already remarkably diverse by the Tithonian (Robins *et al*. 2013). The first munidopsid, and oldest member of the Galatheoidea, *Palaeomunidopsis* Van Straelen, 1925, is from the Bathonian of the Middle Jurassic of France. By the Late Jurassic the munidopsids had diversified into 30 species, and four other galatheoid families made an appearance: Catillogalatheidae nov. fam. (13 species), Munididae (2 species; *Juracrista costaspinosa* Robins, Feldmann & Schweitzer, 2012; *Juracrista perculta* Robins, Feldmann & Schweitzer 2012), Paragalatheidae nov. fam. (15 species), and Porcellanidae (1 species; *Jurellana tithonia* Schweitzer & Feldmann, 2010). The Galatheidae have been restricted herein to a first appearance in the Early Cretaceous, with species formerly considered galatheids reclassified to Paragalatheidae nov. fam. and Catillogalatheidae nov. fam.

Today, the extant families of galatheoids are found in all modern oceans, at all latitudes, with multiple new species being discovered every year (Schnabel *et al*. 2011b). However, all the Jurassic species are thus far restricted to the shallow Tethyan Seas of Europe, with Tithonian species represented as far west as England (*Tuberosagalathea portlandia* nov. comb.) and as far east as Romania (multiple species described herein). By the Cretaceous, galatheoids enjoyed a cosmopolitan distribution: they are found not only across Europe, but in multiple locales within North America along the former Cretaceous interior seaway (Bishop 1985; Franțescu 2014); South America, in Brazil (Martins-Neto 2001); Japan (Karasawa & Hayakawa 2000); and Antarctica (Feldmann *et al*. 1993). It is possible that they have spread further; however, lack of collecting or collecting biases may have impacted reported occurrences. Despite the diverse locations, it is not enough to determine a path of distribution, as they all seem to appear in the fossil record contemporaneously.

The phylogeny of the modern galatheoids is anchored to the fossil record. The first occurrence of all modern galatheoid families, with the exception of Galatheidae, is tied to the Late Jurassic diversity explosion of Ernstbrunn and other Tethys reefs documented by this work. As the higher order classifications of the always problematic Anomura are continually refined, the strength of the fossil record can only aid in deciphering branching and speciation events. An issue raised within this work that has particular bearing

on the modern phylogeny of galatheoids concerns the Porcellanidae and Galatheidae. The conventional interpretation, supported by molecular studies, shows Porcellanidae as nesting within Galatheidae (Schnabel *et al*. 2011a; Ahyong *et al*. 2011). Porcellanidae is present in the Late Jurassic (Schweitzer & Feldmann 2010), with Galatheidae restricted to an earliest occurrence in the Cretaceous. More fossils are certainly needed to refine and complete the phylogenetic picture.

ACKNOWLEDGEMENTS

Funds for museum work was from NSF grant EF-0531670 to Feldmann and Schweitzer. We thank M. Harzhauser, A. Kroh, and O. Schultz (Geological and Paleontological Department of the Naturhistorisches Museum-Wien) for allowing extended study of the specimens, as well as information on the history of the collection and the source area. B. van Bakel and R. Fraaije provided the photo of *Tuberosagalathea portlandica* (Fig. 15.2). A. Klompmaker provided the photo for *Vasconilia straeleni* (Fig. 17.3). A. Klompmaker also assisted with photographic editing of figures within this paper. P. Skupien assisted CMR, RMF, and CES in the field in the Czech Republic. S. Charbonnier and R. Fraaije are thanked for thorough reviews which improved the manuscript.

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