N. Jb. Geol. Paläont. Abh. 258/2, 243–248
published online August 2010

Article

Earliest known Porcellanidae (Decapoda: Anomura: Galatheoidea) (Jurassic: Tithonian)

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With 1 figure and 1 table

Schweitzer, C. E. & Feldmann, R. M. (2010): Earliest known Porcellanidae (Decapoda: Anomura: Galatheoidea) (Jurassic: Tithonian). – N. Jb. Geol. Paläont. Abh., **258**: 243–248; Stuttgart.

Abstract: *Jurellana tithonia* n. sp. is the earliest known Porcellanidae, from the Tithonian Ernstbrunn Limestone, Austria. Porcellanids are well-known from the fossil record, already having been described from Cretaceous, Eocene, and Neogene rocks. Their occurrence in the Jurassic is not surprising, because the Infraorder Anomura, to which they belong, is the sister to the Brachyura, well known from Jurassic occurrences.

Key words: Porcellanidae, Anomura, Jurassic, Ernstbrunn Limestone, Tithonian, phylogeny.

1. Introduction

The Tithonian (Late Jurassic) Ernstbrunn Limestone has already yielded a wealth of brachyurans, many of which are earliest occurrences for their respective families (Schweitzer & Feldmann 2008 [imprint 2007], 2008, 2009a, b, c, d; Feldmann & Schweitzer 2009). The earliest known occurrence of the anomuran family Porcellanidae Haworth, 1825, is now known from this formation and is described here.

The Ernstbrunn Formation localities have been well-documented by Schweitzer & Feldmann in the works cited above. It is Tithonian in age and fossils from the unit are well-known.

Institutional abbreviations: KSU D, Decapod crustacean collections of the Department of Geology, Kent State University, Kent, Ohio, USA; NHMW, Naturhistorisches Museum Wien (Natural History Museum of Vienna), Austria.

2. Systematic Paleontology

Infraorder Anomura MacLeay, 1838
Superfamily Galatheoidea Samouelle, 1819
Family Porcellanidae Haworth, 1825

Included fossil genera: *Annieporcellana* Fraaije et al., 2008; *Beripetrolisthes* De Angeli & Garassino, 2002; *Eopetrolisthes* De Angeli & Garassino, 2002; *Jurellana* new genus; *Lobipetrolisthes* De Angeli & Garassino, 2002; *Longoporcellana* Müller & Collins, 1991; *Pachycheles* Stimpson, 1858 (also extant); *Petrolisthes* Stimpson, 1858 (also extant); *Pisidia* Leach, 1820 (also extant); *Polyonyx* Stimpson, 1858 (also extant); *Porcellana* Lamarck, 1801 (also extant).

Diagnosis: Carapace dorsoventrally flattened, ovate, wider than long or longer than wide, often widest in posterior half, carapace regions usually weakly defined; rostrum triangular, bilobed, trilobed, or quadrilobed, may be downturned, may be very short or extending moderately beyond orbits; orbits generally anterolaterally directed and

DOI: 10.1127/0077-7749/2010/0096

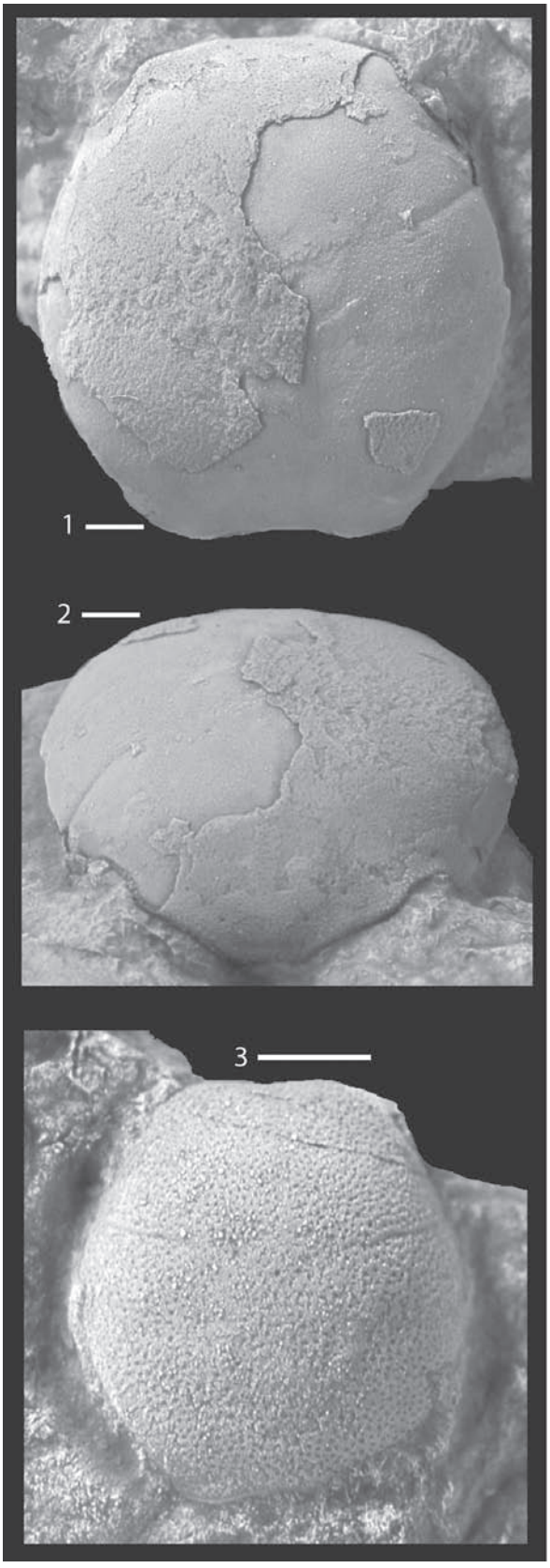

Fig. 1 (Legend see right)

situated on side of rostrum or at base of rostrum, outer-orbital spine or projection reduced but often present; antero-lateral and posterolateral margins confluent, may be entire or with spines, projections, tubercles, or granules, may be notched at intersection of cervical groove; pterygostomial region short, may be calcified, membranous, or composed of plates and membranes; entire dorsal carapace well-calcified; antenna with elongate flagellum, first pereiopods chelate, 2-4 pereiopods not chelate, pereiopod 5 greatly reduced and may rest on dorsal carapace; abdomen symmetrical, broad, folded under body but not closing sterno-abdominal cavity as in Brachyura, first segments visible dorsally; telson and uropods well-developed, telson divided into five or seven plates; female with uniramous pleopods on fourth, fifth and sometimes third abdominal somites; males with pleopods on second somite, male pleopods 3-5 absent (after Haig 1960, 1965; Osawa 1998; Harvey 1999; Poore 2004; McLaughlin et al. 2002, 2007; ABRS 2009).

Discussion: Finding a current diagnosis for the Porcellanidae proves to be somewhat difficult. Poore (2004: 242) stated that the family was so easy to recognize that it had not been diagnosed recently. The above diagnosis is a composite from multiple sources, some electronic. Indeed porcellanids are distinctive, but many of the features that make them so are not readily preservable as fossils. Thus, we provide several features of the dorsal carapace that will assist paleontologists in distinguishing porcellanids from brachyurans and other anomurans.

The new material is referred to the Porcellanidae because the specimens exhibit all of the diagnostic features of the dorsal carapace coded by McLaughlin et al. (2007) for the group, as well as several others observed in other works on extant taxa and included in the diagnosis above. The new material is easily distinguished from the most similar brachyurans from the same formation, members of the Goniodromitidae Beurlen, 1932. Goniodromitids have deep carapace grooves, augenrests, steep and high carapace flanks, vaulted dorsal carapaces, and inflated subhepatic regions. None of these are features seen either in extant porcellanids or the new material described here. Members of the Goniodromitidae have orbits and augenrests that occupy a substantial percentage of the frontal margin of the carapace, and those structures are located distal to the orbit. In living porcellanids and in the new material described here, the orbits are at the base of the rostrum or partially on the side of the rostrum.

A distinctive feature of porcellanids is the very short flank compared to brachyurans, and its composition of several plates in many forms. Examination of specimens in the KSU collection (KSU D325 and 349, *Petrolisthes* spp.)

Fig. 1. *Jurellana tithonia* n. g. n. sp. **1, 2** – NHMW 1990/0041/2518, holotype, dorsal view (1) and anterior view (2); **3** – NHMW 1990/0041/1445, paratype, dorsal view. Both specimens from Tithonian Ernstbrunn Limestone. Scale bars = 1 mm.

indicates that those plates appear to be somewhat less well calcified than the dorsal carapace and are held together by arthrodial membranes. They could easily disarticulate upon death of the animal. In the fossils described here, the flanks are very short, and there is no evidence of the flank or the pterygostomial plates or region.

The Jurassic porcellanid described here differs in some regards from extant porcellanids. It has a sharply downturned rostrum, so that the tip is at a nearly 90° angle to the dorsal carapace. In extant forms, the rostrum usually seems to be in the same plane as the dorsal carapace. The rostrum and orbits occupy about 80 % of the maximum width of the carapace in the Jurassic form; in extant forms they seem to occupy more in the range of about half the maximum carapace width. Many extant species are maximally wide in the posterior portion of the carapace, not at about the midlength.

Despite these differences, however, the Jurassic form is remarkably similar to some species of *Petrolisthes* Stimpson, 1858, in its overall ovoid shape, possessing its maximum width at about the midlength, having a relatively simple rostrum, a well-defined cervical groove, and a cardiac region (Tirmizi et al. 1982; Haig 1965). Thus, the new material is placed within the Porcellanidae. Like the many brachyuran taxa from the same formation, the specimens lack abdominal or ventral aspects. Recovery of these could help to strengthen placement within the Porcellanidae.

Genus *Jurellana* nov.

Type species: *Jurellana tithonia* n. sp., by monotypy.

Etymology: The genus name is a combination of the words Jurassic and *Porcellana*, the nominal genus of the family. The gender is feminine.

Diagnosis: Carapace ovate, about as wide as long; rostrum wide, about 55 % maximum carapace width, strongly downturned at 90° angle to dorsal surface; orbits small, shallow, with small, forward-directed outer-orbital spine; fronto-orbital width about 80 % maximum carapace width; lateral margins convex; notch at intersection of cervical groove, notch followed by blunt projection; cervical groove moderately deep, post-cervical groove weak, branchiocardiac groove very weak.

Description: As for species.

Occurrence: The genus is thus far known only from the Tithonian Ernstbrunn Limestone.

Jurellana tithonia n. sp.
Fig. 1

Etymology: The trivial name is derived from Tithonian, the age of the specimens.

Types: The holotype is NHMW 1990/0041/2518, and the paratype is NHMW 1990/0041/1445.

Occurrence: Both specimens were collected from the Tithonian Ernstbrunn Formation, north from Vienna, Austria.

Diagnosis: As for genus.

Description: Carapace ovate, about as wide as long, maximum width about 95 % maximum length, widest about 55 % the distance posteriorly on carapace; weakly vaulted transversely and longitudinally; entire surface covered by tiny punctae; flanks very short, slightly higher at posterior corner.

Rostrum wide, about 55 % maximum carapace width, overall triangular, with beaded rim; lateral margins weakly sinuous, slightly concave at base and drawn into triangular tip, strongly downturned at 90° angle to dorsal surface (Fig. 1.2). Orbits small, directed anterolaterally, shallow; with small, forward-directed outer-orbital spine; fronto-orbital width about 80 % maximum carapace width. Lateral margins convex; notch at intersection of cervical groove, notch followed by blunt projection at intersection of very weak branchiocardiac groove; rimmed posterior to branchiocardiac groove, rim diminishing posteriorly. Posterior margin convex at lateral edges, concave axially, rimmed.

Regions very poorly defined. Mesogastric region triangular, with long anterior process, very weakly visible, with two pits along posterior margin; protogastric and hepatic regions confluent, not differentiated; cardiac region a weakly inflated triangle.

Cervical groove moderately developed laterally, initiating well-posterior to outer orbital spine, extending in oblique path toward axis, nearly disappearing at base of mesogastric region. Very weak trace of postcervical groove on mold of interior, not visible on cuticle. Branchiocardiac groove developed as very shallow depression extending more or less parallel to cervical groove, then arcing around cardiac region.

Remainder of carapace and appendages unknown.

Measurements: Carapace measurements (in mm) taken on the holotype and paratype (respectively) of *Jurellana tithonia* n. sp.: NHMW 1990/0041/2518, 1990/0041/1445, carapace length = 10.8, 4.0; maximum carapace width = 9.8, 4.0; fronto-orbital width = 7.8, 3.4; rostral width = 5.4, 2.2; length to position of maximum width = 5.3, 2.4.

Discussion: The new species is represented by two specimens. The smaller specimen is more equant than the larger (Fig. 1.3), perhaps an indication of allometric growth. However, a much more robust sample size would be necessary to test this hypothesis.

3. Porcellanidae in the fossil record

Jurellana tithonia is the oldest known porcellanid (Table 1). Fraaije et al. (2008) described a Creta-

Table 1. Porcellanidae with fossil records, arranged in order of reported appearance and by geographic occurrence. Data from generic sources cited above and Glaessner (1929), Müller (1984), Bishop & Portell (1989), Fraaije et al. (2008), and Beschin et al. (2007). E = Europe, CAM = Central Americas, IPAC = Indo-Pacific, X = extant occurrences.

	Jurassic	Cretaceous	Eocene	Post-Eocene	Holocene
Jurellana	E				
Annieporcellana		E			
Beripetrolisthes			E		
Eopetrolisthes			E		
Lobipetrolisthes			E		
Longoporcellana			E		
Petrolisthes		E?	E	CAM, E, IPAC	X
Porcellana		E?			X
Pachycheles			E	CAM, IPAC	X
Pisidia			E	E	X
Polyonyx			E?		X

ceous porcellanid from Europe, *Annieporcellana dhondtae* Fraaije et al., 2008. They also reassigned *Glyptodynomene inornatus* Collins et al., 1995 to *Petrolisthes*. Examination of type material of the latter will confirm whether that genus extends from the Holocene into the Cretaceous. Although it may be a porcellanid, it likely belongs to an extinct genus. A. Milne-Edwards (1862) described *Porcellana antiqua* from the Cenomanian of France (Glaessner 1929). Breton & Collins (2007) and Fraaije et al. (2008) considered this taxon a nomen dubium. However, as recent work has yielded some success in locating a number of missing decapod types, we recognize this species. Although many species described in the 1800's were not illustrated, it seems possible that the type might be possible to trace. The International Code of Zoological Nomenclature recommends, for example, designating a neotype in the instance of a *nomen dubium* only if stability is threatened (Article 75.5). Because this is not the case, and because *P. antiqua* is an available name, it seems best to retain the name in our lists of taxa at this time. It is quite possible that it may not be a member of the extant genus *Porcellana* but that decision will have to await recovery of the type or neotype material.

Porcellanids were abundant by the Eocene (Müller & Collins 1991; De Angeli & Garassino 2002). Fossil records for this family appear to be concentrated in southern Europe, but more broadly, the family exhibits a Tethyan distribution over time, reaching the Indo-Pacific by the Miocene (Rathbun 1945; Karasawa 1993, 1997) and Central America by the Pliocene (Rathbun 1918; Bishop & Portell 1989).

Porcellanoidea Hu & Tao, 1996, from the Miocene of Taiwan was originally placed within the Porcellanidae but that placement was later questioned (Ng 1999). Boyko (2004) suggested that the genus was most likely a member of the Raninidae de Haan, 1839. The elongate shape, smooth carapace, and post-frontal ridge of specimens of *Porcellanoidea* suggest placement within the Raninoidinae Lőrenthey in Lőrenthey & Beurlen, 1929; synonymy with *Raninoides* H. Milne Edwards, 1837 [in 1834-1840] must await examination of specimens.

Discovery of Porcellanidae in the Jurassic is not surprising. Most recent phylogenies show the Anomura, which includes the Porcellanidae, as sister to the Brachyura (Dixon et al. 2003; Ahyong & O'Meally 2004; Ahyong et al. 2007). The earliest confirmed Brachyura are Jurassic in age (Schweitzer & Feldmann 2005). Thus, members of the Anomura, which includes the Porcellanidae, must have arisen by the Jurassic or earlier. Paguroidea were already known from the Jurassic (Van Bakel et al. 2008), so the Jurassic occurrence of Porcellanidae corroborates the Jurassic occurrence of the entire Infraorder Anomura. It also illustrates once again that nearly all decapod families existing prior to the K/T boundary survived the K/T event(s) (Schweitzer & Feldmann 2005).

Acknowledgements

NSF grant EF-0531670 to Feldmann and Schweitzer funded field and museum work. Extant specimens of *Petrolisthes* spp. were provided by H. Karasawa, Mizunami Fossil Museum, Japan. A. Kroh and O. Schultz facilitated our visits to the Naturhistorisches Museum Wien (Natural History Museum of Vienna), Austria, and loans of material

from that institution. Karasawa and G. Schweigert of the Staatliches Museum für Naturkunde, Stuttgart, Germany reviewed the manuscript. Our thanks go to all of these individuals.

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Manuscript received: September 14th, 2009.
Revised version accepted by the Stuttgart editor: September 22nd, 2009.

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