Zitteliana

An International Journal
of Palaeontology and Geobiology

Series A/Reihe A
Mitteilungen der Bayerischen Staatssammlung
für Paläontologie und Geologie

53

München 2013

Bayerische Staatssammlung für Paläontologie und Geologie

- Zitteliana A 53, 77 – 83
- München, 31.12.2013
- Manuscript received 17.06.2013; revision accepted 20.10.2013
- ISSN 1612 - 412X

A new genus and species of caridean shrimps from the Upper Jurassic Solnhofen Lithographic Limestones of Schernfeld (S Germany)

Norbert Winkler

D-14532 Stahnsdorf, Germany

E-mail: norbert_winkler@t-online.de

Abstract

A new genus and species of caridean shrimps, *Schernfeldia schweigerti* nov. gen. nov. sp., is described from the Upper Jurassic Solnhofen Lithographic Limestones of Schernfeld near Eichstätt (Lower Tithonian, Hybonotum Zone). It differs from other genera of carideans primarily in the shape of the rostrum.

Key Words: Caridea, Solnhofen Lithographic Limestones, Tithonian.

Zusammenfassung

Eine neue Gattung und Art von Garnelen aus der Unterordnung Caridea, *Schernfeldia schweigerti* nov. gen. nov. sp., wird aus den oberjurassischen Solnhofener Plattenkalken von Schernfeld bei Eichstätt beschrieben (Unter-Tithonium, Hybonotum-Zone). Sie unterscheidet sich von anderen Gattungen der Caridea in erster Linie in der Gestalt des Rostrums.

Schlüsselwörter: Caridea, Solnhofener Plattenkalke, Tithonium

1. Introduction

The decapod infraorder Caridea Dana, 1852 is comprised of 3438 extant species in 389 genera (De Grave & Fransen 2011). Carideans are found widely distributed around the world, both in freshwater and marine environments. With regard to global shrimp production, some of these species such as *Crangon crangon* Linnaeus, 1758 are of great economic importance. Fifty-two fossil species of carideans in 33 genera listed (Schweizer et al. 2010) have been recorded to date from different geological ages and localities. Several of the groups date back to the Triassic; an important source is the Bergamo area in Northern Italy (Garassino & Teruzzi 1993). Further discoveries date from the Jurassic with sources from the region of Eichstätt (Schweigert 2011). The Upper Jurassic lithographic limestones of southern Germany represent an important source of information on fossil representatives of carideans. Apart from the well-known locations in the close vicinity of Solnhofen and Eichstätt, there are several other eminent lithographic limestone sites in southern Germany, including Brunn, Ettling, Schamhaupten, Nusplingen, Zandt and Painten (Röper et al. 1996; Ebert & Kölbl-Ebert 2008; Viohl & Zapp 2006; Dietl & Schweigert 2001). In addition to the long since known fossil caridean genera from this area, mainly described by Münster (1839) and Oppel (1862), several others have recently been added, including *Schmelingia wulfi* Schweigert, 2002, *Buergerocaris psittacoides* Schweigert & Garassino, 2004, *Udora koschnyi* Schweigert & Garassino, 2004, *Pleopteryx kuempeli* Schweigert & Garassino, 2004, *Hefriga proboscideawulfi* Schweigert & Garassino, 2004, *Harthofia blumenbergi* Polz, 2007, *Harthofia bergeri* Polz, 2007, *Alcmonacaris winkleri* Polz, 2008, *Hefriga rogerfrattigianii* Schweigert, 2011, *Hefriga norbertwinkleri* Schweigert, 2011, and *Harthofia polzi* Schweigert, 2011. This new material has been collected during scientific excavations and by a number of amateur collectors. Fossil carideans from the Cretaceous, mostly described by Garassino (Milan), have been reported from Lebanon and Italy (Bravi & Garassino 2000). Among Caridea there are no extant species that are also known as fossils (De Grave et al. 2009).

2. Material and methods

The fossil at hand (holotype) comes from the Upper Jurassic Solnhofen Lithographic Limestones (Eichstätt Formation; Lower Tithonian, Hybonotum Zone) of southern Germany. The specimen occurs on a limestone slab that is 10 mm thick. Specimen preparation was carried out with various needles and scrapers. Because the sclerotisation of the exoskeleton of crustaceans preserved in litographic limestone brightly fluoresces, fluorescence was used for the study of the fossil. In this way even the most delicate features, which otherwise would be barely discernible, can be observed and adequately documented photographically. To complement the analysis and documentation, other techniques were used. Three different documentation techniques were applied: 1) A Canon Rebel T3i camera with a MP-E 65mm macro lens was used for documentation under white light. Light was provided by a Canon Macro Twin Lite MT-24EX Flash. The flash was equipped with polarizer sheets; a cross-polarised filter was mounted onto the lens. The cross-polarised light minimizes reflections and enhances the colour contrast of the fossil against the matrix (see, e.g., Schaarschmidt 1973; Bengtson 2000; Kerp & Bomfleur 2011). The even lighting of the twin flash reduces shadows, and thus the negative effects of the preparation traces. Several images of different image details were stitched together using the Photomerge function of Adobe Photoshop CS3. 2) The same camera and lens were used for a macro-fluorescence set up (Haug et al. 2011). Light was provided by three evenly distributed LED torches equipped with cyan filters. A red filter was mounted onto the lens. With this, mainly light emitted from the fossil (roughly of orange colour) was detected by the camera. Processing followed (Haug & Haug 2011); only the red channel is informative (other channels originate from scattered light), the image is then desaturated and the histogram optimized. Also here several images were superimposed and merged into a high-resolution image. 3) Small details were documented on with Nikon Eclipse 90i fluorescence microscope. A 4x lens was used, resulting in a magnification of about 40x. An excitation wavelength of 488 nm (green) was used. To overcome the limited depth of field a stack of images was recorded and fused to a single sharp image. Several of these images (of different image details) were merged into a high-resolution image (for methodology, see Haug et al. 2008, 2009, 2011).

Abbreviations: SMNS = Staatliches Museum für Naturkunde Stuttgart, Germany

PI-PV: pereiopods I-V

3. Systematic palaeontology

Diagnostic characters of the Caridea: The classification of Caridea follows McLaughlin (1980) and is largely based on extant taxa. All members of Caridea exhibit the following complement of external features: (1) the second pleonal pleura overlap the pleura of both the first and the third pleomeres; (2) the first two pairs of pereiopods chelate (except in Procarididae); (3) pereiopods III, IV and V achelate; (4) the rostrum is extremely variable in both length and armature; (5) antennular peduncle with three articles; (6) the antennules possess a pair of flagella; (7) the antennal peduncle consists of a 2-segmented protopodite and a 3-segmented endopodite; (8) a telson bearing several small movable spines. Mouthpart morphology is usually difficult to assess in fossil shrimps and prawns from the Solnhofen Limestones due to the mostly lateral embedding of fossils.

Order Decapoda Latreille, 1803
Infraorder Caridea Dana, 1852
Superfamily and Family uncertain

Genus *Schernfeldia* nov. gen.

Type species: *Schernfeldia schweigerti* nov. sp.

Etymology: Nominated to the village Schernfeld, Eichstätt district, Bavaria, Germany.

Diagnosis: See diagnosis of the type species.

Included species: Monospecific.

Schernfeldia schweigerti nov. sp.
Pls 1, 2

Holotype: Specimen illustrated in Pl. 1, Fig. 1, deposited in the SMNS under accession number 70111 (ex coll. N. Winkler).

Etymology: The species name honors Günter Schweigert, who studied numerous fossil decapod crustaceans and considerably expanded the knowledge of Late Jurassic crustacean diversity.

Gender: Feminine.

Type locality: Vicinity of Eichstätt (Schernfeld); S Franconia, Bavaria, southern Germany.

Type horizon and age: Solnhofen Group, Upper Eichstätt Formation (after Zeiss 1977), Lower Tithonian, Hybonotum Zone.

Studied material: 1 specimen (holotype).

Diagnosis: Slender caridean with smooth carapace; rostrum broad and forwardly directed, bearing 2 dorsal teeth and 1 ventral tooth; PI-PII chelate; PII

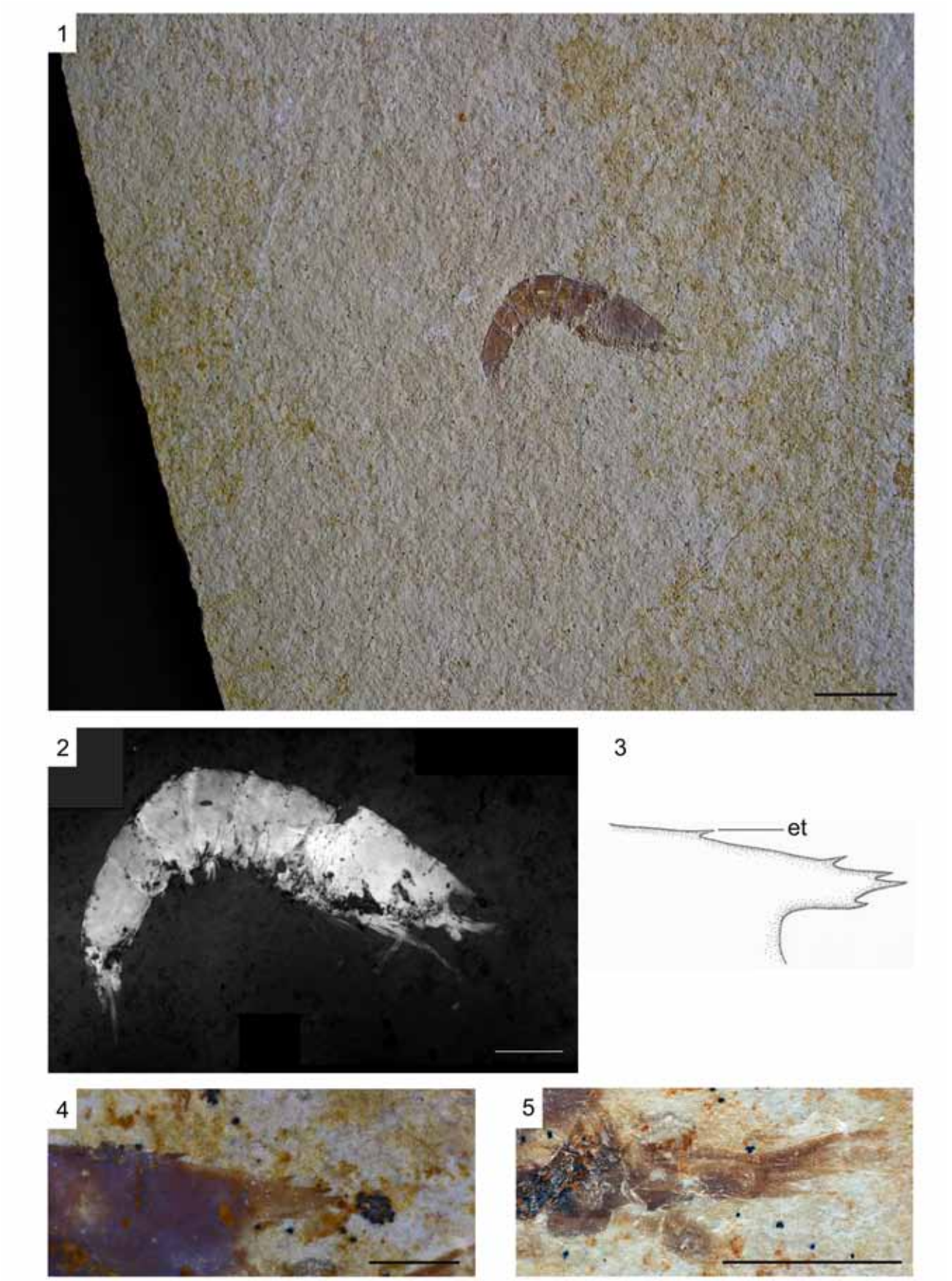

Plate 1: *Schernfeldia schweigerti* nov. gen. nov. sp. Quarry district of Eichstätt (Schernfeld); Solnhofen Lithographic Limestones (Upper Eichstätt Formation), Lower Tithonian, Hybonotum Zone. Holotype, SMNS 70111. **(1)** Overview; scale bar 12 mm. **(2)** Shape of carapace and rostrum; scale bar 4 mm. **(3)** Line-drawing of rostrum and epigastric tooth; et = epigastric tooth; not to scale. **(4)** Rostrum and epigastric tooth; scale bar 2 mm. **(5)** Scaphocerite and antennular peduncle; scale bar 3 mm.

longest; pleomere II with subrounded pleura partly covering those of pleomeres I and III.

Description of the holotype: The holotype of *Schernfeldia schweigerti* (Pl. 1, Fig. 1) is a moderately preserved moult embedded in lateral view. Its length amounts to 44.3 mm, measured from the tip of the rostrum to the end of the tail fan, along the dorsal axis. The body of the well-sklerotized shrimp is curved. The surface of the cephalothorax is smooth.

In lateral view the carapace is subrectangular in outline and narrows slightly along the anterior margin (Pl. 1, Fig. 2). The carapace (including rostrum) is 10.7 mm long and 7.9 mm high. There are no grooves visible. The ventral margin of the carapace is bent. The dorsal midline extends into the forwardly directed rostrum with a pointed distal extremity. On the dorsal margin of the rostrum 2 forwardly directed teeth occur. The rostrum is 1.9 mm long and 0.7 mm high, measured at the posterior dorsal tooth of the rostrum. The anteriorly directed short tip of the rostrum does not reach the end of the scaphocerite. The ventral margin of the rostrum bears 1 tooth, which is located oppositely and slightly posteriorly to the anterior dorsal tooth. The rostrum formula is 0 + 2 / 1. Posterior to the rostrum an epigastric tooth occurs at a distance of 1.7 mm (Pl. 1, Figs 3, 4). Ventrally from the rostrum the frontal margin of the carapace forms a relatively broad orbital margin.

In the anterior part of the carapace the antennal spine is present. In the hepatic region of the carapace the hepatic spine is visible. The eyestalk is hardly discernible due to the insufficient preservation of this area; both eyestalk and eye are somewhat displaced. The cephalic appendages are partly preserved. The three articles of the antennular peduncle are preserved intact; their surface is smooth. The two flagella are poorly preserved; the superior antennular flagellum is preserved up to 2.2 mm, the inferior one up to 1.2 mm. The flagella of the antennae are mostly well preserved, the superior one is preserved up to a length of 74 mm, the inferior one of 83 mm; the proximal portions of both structures are hardly discernible. Antennae are approximately twice as long as the entire body. The ischiocerite, the merocerite, and carpocerite are more or less equal in length. The lanceolate scaphocerite is 3.4 mm long, with a pointed distal extremity; the tip is somewhat longer than the distal end of the third segment of the antennular peduncle (Pl. 1, Fig. 5).The third maxillipeds are not preserved. Also the subsequent appendages appear to be not preserved: mandible, maxillula, maxilla, maxilliped 1 and maxilliped 2.

The pereiopods are partly preserved and partly either recognized by using fluorescence or by intense sidelight. PI-PII chelate. PI chela is broken and is incompletely preserved. Its distal part is somewhat dislocated and exhibits some setae. The carpus shows setae, too (Pl. 2, Figs 1, 2). PII chela is only preserved as a weak imprint. PII is the longest of all due to its notably elongate carpus. PIII-PIV are estimated being achelate, PV dactylus is preserved as a weak imprint (Pl. 2, Figs 3, 4). All pereiopods are thin and slender. The pleon shows a curvature, its surface is smooth. The pleomeres are subrectangular in outline in lateral view. The sixth pleomere is slightly longer than the others. The ventral margins of the pleurae are smooth. The pleura of the second pleomere overlap those of pleomeres I and III partly (Pl. 2, Fig. 5). The moderately preserved pleopods are biramous. The telson is partly preserved and shows at least two spines. Because of the poor preservation of the tail fan, a diaeresis of the uropodal exopodites is not discernible. For detailed information on measurements, see Table 1.

4. Comparisons

To distinguish the different genera and species of Caridea the number of rostral teeth is of great importance (Holthuis 1951). Moreover, possibly significant with regard to the identification of new fossil species or genera are other features, including the length of the rostrum in relation to the scaphocerite and the antennular peduncle (von Rintelen & Cai 2009). The existence of an epigastrical tooth, as well as the length and shape of the rostrum, may also be diagnostic.

Based on a comparison of the new fossil with fossil caridean genera described in the literature, the new species difters from others in the following: 1) *Schernfeldia schweigerti* is equipped with an epigastrical tooth, which rarely occurs in other taxa. In fact, only the genus *Tonellocaris* Garassino, 1998 from the Lower Cretaceous (Garassino 1998) shows such a tooth. This fossil, however, clearly differs from *S. schweigerti* in the absence of a ventral rostral tooth and by the existence of 4 dorsal teeth on the rostrum. Moreover, pereiopods I-V are achelate in *Tonellocaris*, thus indicating its systematic affinities with the Procarididae. 2) Apart from *S. schweigerti* several other genera of Caridea have at least one tooth on the ventral margin of the rostrum, including *Harthofia bergeri* Polz, 2007, *H. blumenbergi* Polz, 2007, and *H. polzi* Schweigert, 2011 (Polz 2007; Schweigert 2011) from the Upper Jurassic as well as *Palaemon antonellae* Garassino & Bravi, 2003 from the Lower Cretaceous (Garassino & Bravi 2003). However, all of these taxa differ from *S. schweigerti* in the dorsal armature and overall outline of the rostrum. 3) In *S. schweigerti* all dorsal teeth of the rostrum are positioned distally from the orbital margin. This feature only rarely occurs, e.g., in *Delclosia roselli* Rabadà, 1993 from the Lower Cretaceous of Spain (Rabadà 1993). The other rostral features in these cases do not correspond with *S. schweigerti*. 4) The rostrum of *S.schweigerti* is short, approaching at most the end of the second article of the antennular peduncle and appears rather broad and stocky. A similar

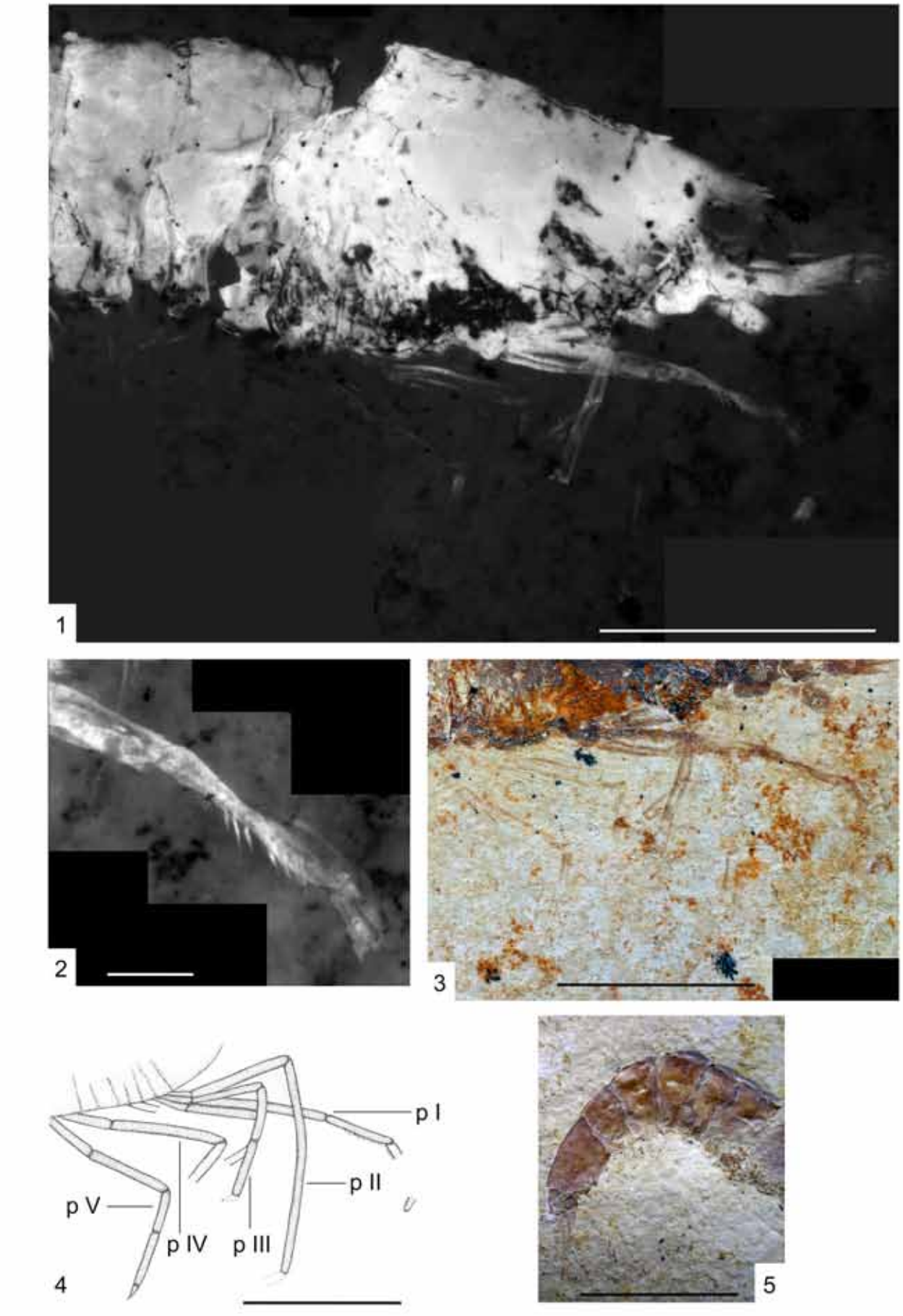

Plate 2: *Schernfeldia schweigerti* nov. gen. nov. sp. Quarry district of Eichstätt (Schernfeld); Solnhofen Lithographic Limestones (Upper Eichstätt Formation), Lower Tithonian, Hybonotum Zone. Holotype, SMNS 70111. **(1)** Carapace and pereiopods under fluorescence; scale bar 7 mm. **(2)** Carpus of pereiopod I; scale bar 1 mm. **(3)** Pereiopods I-V; scale bar 6 mm. **(4)** Line-drawing of pereiopods I-V; p = pereiopod; scale bar approximately 6 mm. **(5)** Abdomen; scale bar 13 mm.

Table 1: Measurements of the holotype specimen of *Schernfeldia schweigerti* nov. gen. et sp.

Schernfeldia schweigerti nov. gen. et sp. (holotype)	Measurements (in mm)
Antennular peduncle, first	1.2
Antennular peduncle, second	1.0
Antennular peduncle, third	1.3
Carpocerit	1.0
Merocerit	0.9
Ischiocerit	1.0
Scaphocerit	3.4
P I carpus	2.5
P I merus	4.8
P II carpus	12.9
P II merus	3.8
P III propodus	2.0
P III carpus	1.8
P III merus	2.7
P IV carpus, visible part	1.6
P IV merus	3.3
P IV ischium	1.7
P V dactylus	0.5
P V propodus	2.6
P V carpus	1.5
P V merus	3.5
P V ischium	1.6
Pereiopods, width approximately	0.4
Pleomere 1	3.8
Pleomere 2	3.2
Pleomere 3	4.5
Pleomere 4	4.5
Pleomere 5	3.3
Pleomere 6	6.7
Tail fan, visible part	7.6
Telson	6.0

combination of length and shape is not found in any other fossil caridean. 5) The second pereiopods of *S. schweigerti* are considerably elongated. This feature occasionally occurs, e.g., in representatives of the Late Jurassic genus *Blaculla* Oppel, 1862, as well as in *Palaemon antonellae* Garassino & Bravi, 2003. However, in all these fossils the rostrum is different. Moreover, the carpus of the second pereiopods of the representatives of *Blaculla* is annulated.

S. schweigerti also differs from other fossil carideans described to date, e.g., *Schmelingia wulfi* Schweigert, 2002, *Udora koschnyi* Schweigert & Garassino, 2004, and *Hefriga proboscideawulfi* Schweigert & Garassino, 2004, with regard to the morphology of the armature and the shape of the rostrum, as well as in the shape of the pereiopods (Schweigert 2002; Schweigert & Garassino 2004). *S. schweigerti* exhibits several morphological details that clearly distinguish this taxon from all earlier described fossil caridean genera, and thus a new genus and species is necessary to include the sole specimen with its unique combination of characters. Although this new genus, for which the name *Schernfeldia* is proposed, is characterized by a sound complement of diagnostic features, it is impossible at present to assign it with certainty to a family or superfamily.

5. Palaeoecology of *Schernfeldia schweigerti*

The markely elongate second pereiopods of *Schernfeldia schweigerti* may represent adaptations to a detritus-feeding lifestyle (cf. Schweigert & Garassino 2004). The limited number of fossils discovered to date suggest that this taxon may have lived outside the lithographic limestone basins, and its record within this Fossillagerstätte depends on lucky circumstances (Schweigert 2007).

Acknowledgements

My sincere thanks go to G. Schweigert (Stuttgart) for his careful proof-reading of the manuscript and valuable comments. Additionally, he kindly improved the English version. I also sincerely thank C. Haug and J. T. Haug (both Munich) for providing excellent images and a detailed report. I am much obliged to A. Winkler (Stahnsdorf) for the skilful preparation as well as for detailed line-drawings, and to J. Winkler for assembling the artwork.

6. References

Bengtson S. 2000. Teasing fossils out of shales with cameras and computers. Palaeontologia Electronica, 3(1), 14, art. 4.

Bravi S, Garassino A. 2000. The profeti platy dolomite and its decapod crustacean assemblage. 1st workshop on Mesozoic and Tertiary decapod crustaceans. Associacione Amici del Museo – Museo Civico „G. Zannato“. Montecchio Maggiore (Vicenza), 11–13.

De Grave S, Fransen CHJM. 2011. Carideorum Catalogus: The Recent Species of the Dendrobranchiate, Stenopodidean, Procarididean and Caridean Shrimps (Crustacea: Decapoda). Zoologische Mededelingen 85, 195–589.

De Grave S, Pentcheff ND, Ahyong ST, Chan T-Y, Crandall KA, Dworschak PC, Felder DL, Feldmann RM, Fransen CHJM,

Goulding LYD, Lemaitre R, Low MEY, Martin JW, Ng PKL, Schweitzer CE, Tan SH, Tshudy D, Wetzer R. 2009. A Classification of living and fossil genera of Decapod Crustaceans. Raffles Bulletin of Zoology, Supplements, 21, 1–109.

Dietl G, Schweigert G. 2001. Im Reich der Meerengel. München, Pfeil, 144 pp.

Ebert M, Kölbl-Ebert M. 2008. Steinbruch Ettling (Markt Pförring) – eine neue wissenschaftliche Grabungsstelle des Jura-Museums Eichstätt. Archaeopteryx 26, 61–74.

Garassino A. 1998. Nuovo studio sui crostacei Decapodi del Cretacico Inferiore (Barremiano-Aptiano) della valle del Torrente Cornappo (Udine, NE Italia).Gortania-Atti del Museo Friulano di Storia naturale 20, 59–73.

Garassino A, Teruzzi G. 1993. A new decapod crustacean assemblage from the Upper Triassic of Lombardy (N. Italy). Paleontologia Lombarda, Nuova serie Volume I. Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano, 27 pp.

Garassino A, Bravi S. 2003. *Palaemon antonellae* new species (Crustacea, Decapoda, Caridea) from the Lower Cretaceous "Platydolomite" of Profeti (Caserta, Italy). Journal of Paleontology 77, 589–592.

Haug JT, Haug C. 2011. Fossilien unter langwelligem Licht: Grün-Orange-Fluoreszenz an makroskopischen Objekten. Archaeopteryx 29, 20–23.

Haug JT, Haug C, Ehrlich M. 2008. First fossil stomatopod larva (Arthropoda: Crustacea) and a new way of documenting Solnhofen fossils (Upper Jurassic, Southern Germany). Palaeodiversity 1, 103–109.

Haug C, Haug JT, Waloszek D, Maas A, Frattigiani R, Liebau S. 2009. New methods to document fossils from lithographic limestones of southern Germany and Lebanon. Palaeontologia Electronica 12(3), 12, 6T.

Haug JT, Haug C, Kutschera V, Mayer G, Maas A, Liebau S, Castellani C, Wolfram U, Clarkson ENK, Waloszek D. 2011. Autofluorescence imaging, an excellent tool for comparative morphology. Journal of Microscopy 244, 259–272.

Holthuis LB. 1951. A general revision of the Palaemonidae (Crustacea, Decapoda, Natantia) of the Américas. I – The subfamilies Euryrhynchinae and Potoniinae. Occasional Papers of the Allan Hancock Foundation 11, 1–322.

Kerp H, Bomfleur B. 2011. Photography of plant fossils – new techniques, old tricks. Review of Palaeobotany and Palynology 166, 117–151.

McLaughlin PA. 1980. Comparative morphology of recent crustacean, part I Crustacea – Anatomy. San Francisco, CA, W.H. Freeman and Company, 175 pp.

Münster G. Graf zu 1839. Decapoda Macroura. Abbildung und Beschreibung der fossilen langschwänzigen Krebse in den Kalkschiefern von Bayern. Beiträge zur Petrefacten-Kunde 2, 1–88. Oppel A. 1862. Ueber jurassische Crustaceen. Palaeontologische Mittheilungen aus dem Museum des koeniglich Bayerischen Staates 1, 1–120.

Polz H. 2007. Die Garnelengattung *Harthofia* g. nov. (Crustacea: Pleocyemata: Caridea) mit zwei neuen Arten aus den Solnhofener Plattenkalken von Eichstätt. Archaeopteryx 25, 1–13.

Rabadà D. 1993. Crustáceos decápodos lacustres de las calizas litográficas del Cretácico inferior de España: Las Hoyas (Cuenca) y el Montsec de Rúbies (Lleida). Cuardernos de Geoligía Ibérica 17, 345–370.

von Rintelen K, Cai Y. 2009. Radiation of endemic species flocks in ancient lakes: Systematic revision of the freshwater shrimp *Caridina* H. Milne Edwards, 1837 (Crustacea: Decapoda: Atyidae) from the ancient lakes of Sulawesi, Indonesia, with the description of eight new species. The Raffles Bulletin of Zoology 57, 343–452.

Röper M, Rothgaenger M, Rothgaenger K. 1996. Die Plattenkalke von Brunn. Eichendorf, Eichendorf, 102 pp.

Schaarschmidt F. 1973. Pflanzenfossilien in ungewöhnlichem Licht. Natur und Museum 103, 247–253.

Schweigert G. 2002. Zwei neue Garnelen (Decapoda: Dendrobranchiata, Eukyphida) aus oberjurassischen Plattenkalken Süddeutschlands. Stuttgarter Beiträge zur Naturkunde, Serie B, 323, 1–11.

Schweigert G. 2007. Preservation of decapod crustaceans in the Upper Jurassic lithographic limestones of southern Germany. In: A Garassino, RM Feldmann, G Teruzzi (eds), 3rd Symposium on Mesozoic and Cenozoic Decapod Crustaceans, Milano, May 23–25, 2007. Memorie della Società Italiana di Scienze Naturali e del Museo Civico di Storia naturale in Milano 35, 87–90.

Schweigert G. 2011. The decapod crustaceans of the Upper Jurassic Solnhofen Limestones: A historical review and some recent discoveries. Neues Jahrbuch für Geologie und Paläontologie Abhandlungen 260, 131–140.

Schweigert G, Garassino A. 2004. New genera and species of shrimps (Crustacea: Decapoda: Dendrobranchiata, Caridea) from the Upper Jurassic lithographic limestones of S Germany. Stuttgarter Beiträge zur Naturkunde, Serie B, 350, 1–33.

Schweitzer CE, Feldmann RM, Garassino A, Karasawa H, Schweigert G. 2010. Systematic list of fossil decapod crustacean species. Crustaceana Monographs 10, 1–222.

Viohl G, Zapp M. 2006. Die Fossil-Lagerstätte Schamhaupten (oberstes Kimmeridgium, Südliche Frankenalb, Bayern). Archaeopteryx 24, 27–78.

Zeiss A. 1977. Jurassic stratigraphy of Franconia. Stuttgarter Beiträge zur Naturkunde, Serie B, 31, 1–32.