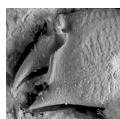


Taxonomy and palaeoecology of a decapod crustacean assemblage from the Oxfordian of Stránská skála (Southern Moravia, Czech Republic)

MATÚŠ HYŽNÝ, NATALIA STARZYK, CRISTINA M. ROBINS & MARTINA KOČOVÁ VESELSKÁ



Primitive brachyurans and other decapods have been extensively reported from deposits of Oxfordian age, often termed microbial-sponge and coral megafacies distributed across the entirety of Europe. During the Oxfordian, coral reefs were far less common than microbial-sponge build-ups. The occurrences of decapods associated with such coral facies include those in France, Romania and the Czech Republic. Regarding the Czech Republic, the assemblage from the Stránská skála Hill has been evaluated; it is composed of at least six species including *Gastrosacus wetzleri*, *Eomunidopsis* cf. *E. neojurensis*, *Longodromites angustus*, *Goniodromites narinusus*, *Goniodromites serratus* and *Eodromites grandis*. Besides the dorsal carapace material, isolated chelae are described as well. As they are not preserved in direct association with taxonomically significant carapaces, they are treated in open nomenclature. Differential diversity of decapods at Stránská skála is relatively low compared to slightly younger Tithonian coral-associated assemblages from Romania. Out of 36 studied specimens, three bear a swelling on the branchial region interpreted to be a result of an isopod infestation. The relatively high percentage of infestation (8.33%) can be explained by collection bias since carapaces with bopyriform swellings can be considered more attractive to collectors. • Key words: Oxfordian, Czech Republic, Decapoda, differential diversity, bopyrid infestation.

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Decapod crustaceans of the European Upper Jurassic reefal facies have recently received quite a bit of attention. This is especially true of the primitive brachyurans that have been extensively reported from the Oxfordian microbial-sponge and coral megafacies distributed across the entirety of Europe (e.g. Wehner 1988, Müller *et al.* 2000, Feldmann *et al.* 2006, Schweitzer *et al.* 2007a, b, Krobicki & Zatoń 2008, Franțescu 2011). During the Oxfordian, coral reefs were far less common than microbial-sponge build-ups. Coral reefs were dispersed across the carbonate platforms of the northern margin of the Tethys (Wierzbowski 2004, Krobicki & Zatoń 2008, Hyžný *et al.* 2011). The occurrences of decapods associated with such coral facies are known from the northern Paris Basin (Bertling & Insalaco 1998), Central Dobrogea of Romania (Schweitzer *et al.* 2007b, Franțescu 2011) and Stránská skála Hill near Brno in the

Moravian part of the Czech Republic (Oppenheimer 1926, Jaroš & Zapletal 1928).

With regard to decapod crustaceans, Stránská skála Hill has received only minor attention. In fact, since the work of Oppenheimer (1926), no evaluation of the decapod assemblage has been done, partly because the locality has been protected by law since 1978. In 1992 it became a national reserve; thus, no collecting at the locality is possible now.

From Stránská skála, Oppenheimer (1926) mentioned two primitive “crabs”: *Prosopon aculeatum* Quenstedt, 1858 (= *Gastrosacus wetzleri* von Meyer, 1851) and *Pithonoton rostratum* (von Meyer, 1840). He figured only the former taxon (Oppenheimer 1926, pl. 1, fig. 1). The latter species is currently classified within the genus *Eodromites* Patruilius, 1959; thus, it is possible that Oppenheimer (1926) reported on the occurrence of *Eodromites grandis* (von Meyer, 1857) as



Figure 1. Location of Stránská skála.

recognized herein. Later, Eliáš (1981) confirmed the presence of decapods at the locality, but with no identification at family (or lower) level.

The re-examination of older collections allows for a systematic description of the assemblage, which is one of the goals of the present study. The other goal is the evaluation of the assemblage in terms of differential diversity of coeval decapod assemblages.

Geological settings

The studied material comes from the Upper Jurassic rocks exposed at Stránská skála Hill in the eastern part of Brno (Brunn), Czech Republic (Fig. 1). Stránská skála is located in the borough Brno-Slatina (co-ordinates 49°11,458' N, 16°40,699' E). It is a natural elevation (310 m above sea level), about 1.5 km long and 0.5 km wide, and is one of the few localities in the Brno area where Jurassic sediments are exposed. In the past, several quarries operated here.

Geological studies of this area have a long history, starting in the 19th century with the work of Uhlig (1881), who described various rocks and fossils from the Stránská skála. Later, Oppenheimer (1926) provided an overview of the macrofauna. The geological settings and sedimentological conditions were described by Eliáš (1969, 1981), Eliáš & Eliášová (1984) and Adámek (2005). The palaeogeographic settings were outlined by Adámek (2005).

Jurassic deposits lie transgressively upon Upper Devonian and Lower Carboniferous rocks at Stránská skála Hill. The thickness of the Upper Jurassic limestone strata is approximately 50 m. The Upper Jurassic sequence exposed at Stránská skála can be divided into three parts (Oppenheimer 1926, Koutek 1926, Eliáš 1981): 1) the lower part is composed of massive, grey, cherty limestone with grey, finely-laminated limestone and pseudo-oolithic limestone with radiolarian and echinoderm remains in the uppermost portion of the layer; 2) the middle part consists of a 3–4 m thick sequence of white-grey, coarse, detritic, crinoidal limestone containing 80–90% of crinoid seg-

Table 1. Synopsis of studied material from the Oxfordian of Stránská skála.

Taxon	Number of specimens
Squat lobsters (Galatheaidea)	
<i>Gastrosacus wetzleri</i> von Meyer, 1854	3
<i>Eomunidopsis</i> cf. <i>Eomunidopsis neojurensis</i> (Patrullius, 1959)	2
Brachyuran crabs (Brachyura)	
<i>Longodromites angustus</i> (Reuss, 1858)	3
<i>Goniodromites narinosis</i> Frantescu 2011	3
<i>Goniodromites serratus</i> Beurlen, 1929	12
<i>Eodromites grandis</i> (von Meyer, 1857)	1
<i>Goniodromitidae</i> indet.	7
Indeterminate chela sp. 1	5
Total	36

ments, previously mentioned by Uhlig (1881); 3) the uppermost part represents an approximately 8 m thick well-bedded sequence consisting of fragments of coarse, bioclastic and pseudo-oolithic limestone with abundant remains of echinoderms, algae, bryozoans and other organisms including decapod crustaceans. The entire sequence is silicified with quartz and chalcedony.

According to Vašíček (1973), the lower part of the section at the Stránská skála Hill represents the Middle Oxfordian (*Plicatilis ammonite* Biozone *sensu* Cariou *et al.* 1997), whereas the upper parts extend to the Upper Oxfordian (Transversarium and Bimammatum ammonite biozones *sensu* Cariou *et al.* 1997).

Material and methods

The material consists of isolated carapaces or chelae typically preserved as internal moulds (Feldmann *et al.* 2006). All specimens are dissociated; *i.e.* no chela has been found directly associated with a dorsal carapace. Altogether 36 specimens were examined (Table 1).

For comparative reasons, material from different localities was studied as well; specifically, type specimens and additional specimens, mainly from Štramberg (Czech Republic) and Ernstbrunn (Austria), were studied. Details are given in the Systematic palaeontology chapter.

Terminology for the galatheid descriptions follows Robins *et al.* (2013). Terminology for brachyuran descriptions follows Schweitzer & Feldmann (2009) and Starzyk *et al.* (2012) except usage of the term “augenrest”. We prefer to use the term “false orbit” as used and depicted by Wright & Collins (1972, p. 44, text-fig. 8). The same structure is called “plage orbitaire” by Guinot & Richer de Forges (1995). Because the state of cuticle preservation may alter the appearance of some taxonomically important characters (Feldmann & Portell 2007, Waugh *et al.* 2009,

Fraaije *et al.* 2013a, Klompmaker *et al.* 2015) information on the presence or absence of cuticle is supplied for every studied specimen.

Synonymies are kept as brief as possible and include only works that markedly contributed to the knowledge of the respective taxon.

All measurements are in millimetres.

The fossils were studied using stereomicroscope Leica EZ4. They were photographed either dry or coated with ammonium chloride. Photographs were made with an Olympus SP-510UZ camera and Nikon Coolpix P7800.

Repositories: Bayerische Staatssammlung für Paläontologie und historische Geologie München, Germany (BSP); Chlupáčovo Muzeum historie Země, Charles University, Prague, Czech Republic (CHMHZ); Geologisches Bundesanstalt, Vienna, Austria (GBA); Naturhistorisches Museum Wien, Austria (NHMW); Slovenské národné múzeum – Prírodovedné múzeum, Bratislava, Slovakia (SNM-Z); Ústav geologických věd, Masarykova univerzita, Brno, Czech Republic (IGS-MJ).

Systematic palaeontology

Order Decapoda Latreille, 1802

Suborder Pleocyemata Burkenroad, 1963

Infraorder Anomura MacLeay, 1838

Superfamily Galatheaidea Samouelle, 1819

Family Munidopsidae Ortmann, 1898

Genus *Gastrosacus* von Meyer, 1851

Type species. – *Gastrosacus wetzleri* von Meyer, 1851, by monotypy.

Species included. – *G. aequabus* Robins, Feldmann & Schweitzer, 2013; *G. eminens* (Blaschke, 1911); *G. ernstbrunnensis* Bachmayer, 1947; *G. ? latirostris* Beurlen, 1929; *G. levocardiacus* Robins, Feldmann & Schweitzer, 2013; *G. limacurvus* Robins, Feldmann & Schweitzer, 2013; *G. meyeri* (Moericke, 1889); *G. pisinnus* Robins, Feldmann & Schweitzer, 2013; *G. torosus* Robins, Feldmann & Schweitzer, 2013; *G. tuberosiformis* (Lörenthey in Lörenthey & Beurlen, 1929); *G. tuberosus* (Remeš, 1895); *G. ubaghsi* (Pelseneer, 1886); *G. wetzleri* von Meyer, 1851.

Diagnosis. – See Robins *et al.* (2013, p. 181).

Remarks. – *Gastrosacus* von Meyer, 1851 is the most speciose fossil munidopsid genus, found in strata ranging from the Upper Jurassic to Upper Cretaceous; geographically, the range of *Gastrosacus* extends from England to Romania (Robins *et al.* 2013, table 9). Recently, Ro-

bins *et al.* (2013) provided discussion on the taxonomy of the genus.

Gastrosacus wetzleri von Meyer, 1851

Figures 2A–C, 8A

1854 *Gastrosacus Wetzleri* von Meyer, p. 51, pl. 10, figs 3, 4.

1858 *Prosopon aculeatum* Quenstedt, p. 779, pl. 95, figs 46, 47.

1860 *Gastrosacus Wetzleri* von Meyer. – von Meyer, p. 219, pl. 23, fig. 34.

1926 *Prosopon aculeatum* Quenstedt. – Oppenheimer, p. 151, pl. 1, fig. 1.

?1963 *Gastroracis* (sic) n. sp. – Houša, table 3.

2013 *Gastrosacus carteri* Van Straelen. – Robins *et al.*, p. 184, figs 7.9.

2013 *Gastrosacus wetzleri* von Meyer. – Robins *et al.*, p. 181, figs 6.11, 7.1.

2015 *Gastrosacus wetzleri* von Meyer. – Robins *et al.*, pp. 87–89, figs 2A–O, 3A–K, 4.

(abbreviated synonymy)

Material. – Fragmentary specimens CHMHZ-DSS/0001 (max. carapace width = 7.4; length of gastric region = 4.6); SNM-Z 10299 (max. preserved carapace width = 4.3; length of gastric region = 3.8) and IGS-MJ-0040 (left posterolateral portion of the carapace). All specimens are preserved without any cuticular surfaces intact.

Diagnosis. – See Robins *et al.* (2015).

Description. – Carapace incomplete; lateral and posterior margins absent. Carapace longer than wide; rostrum axially keeled, narrowly triangular. Circumgastric groove well defined. Epigastric, protogastric, mesogastric, and metagastric regions well defined; each individual region bordered anteriorly by larger pustules. Cardiac region well defined; sub-pentagonal in shape, apex directed posteriorly. Ornamentation consists of larger pustules and smaller tubercles; pustules clustered at anterior of defined regions.

Remarks. – The description above was based on the specimen SNM-Z 10299 and CHMHZ-DSS/0001. Another more fragmentary specimen, consisting of the lower left quadrant of the carapace (IGS-MJ-0040), is also attributed to *Gastrosacus wetzleri* based on the overall similarities of the ornamentation and groove structure with SNM-Z 10299 and the neotype of *G. wetzleri* (Robins *et al.* 2013, fig. 7.1; Robins *et al.* 2015, fig. 2C).

Houša (1963), in his review of parasitized Tithonian decapods of the Czech Republic, listed *Gastroracis* (sic) n. sp. as a host of Bopyridae from Stránská skála near Brno.

It is possible that this occurrence actually represents *Gastrosacus wetzleri*, but as no figure was supplied by Houša (1963), and he did not report on this new species in his subsequent publications, it is difficult to judge the veracity of his new species.

Occurrence. – Upper Jurassic of Germany (localities Oerlinger Tal and Nieder-Stotzingen; see Quenstedt 1858 and von Meyer 1854, 1860); Czech Republic (Stránská skála; Oppenheimer 1926, herein); England (Upper Coral Rag at Upware; see Carter 1898 and Robins *et al.* 2015). The occurrences from Štramberg (Czech Republic), Ernstbrunn (Austria), and Romanian localities were not able to be verified by Robins *et al.* (2013) and probably represent *Craensigillatus acutirostris* (Moericke, 1889).

Family Galatheidæ Samouelle, 1819

Genus *Eomunidopsis* Vía Boada, 1981

Type species. – *Galathea orobensis* Ruiz de Gaona, 1943, by original designation.

Species included. – *Eomunidopsis aldoirarensis* Klompmaker, Feldmann, Robins & Schweitzer, 2012; *E. eutecta* (Moericke, 1889); *E. kinokunika* Karasawa, Ohara & Kato, 2008; *E. meerssensensis* Collins, Fraaye & Jagt, 1995; *E. neojurensis* (Patrulius, 1959) (= *Galathea antiqua* Moericke, 1889); *E. navarrensis* (Van Straelen, 1940); *E. orobensis* (Ruiz de Gaona, 1943); *E. portlandica* Fraaye & Collins, 1996.

Diagnosis. – Cephalothorax elongated, bearing protruding transverse ridges. Regions bounded by visible grooves. Rostrum characterized by tridentate tip, devoid of serration on its lateral edges and bearing a median keel. [Translated from Vía Boada (1982).]

Remarks. – *Eomunidopsis* Vía Boada, 1981, ranges from the Oxfordian to Maastrichtian, and has been found at many localities in Europe, Japan, and the United States (Vía Boada 1982, Collins *et al.* 1995, Fraaye & Collins 1996, Karasawa *et al.* 2008, Klompmaker *et al.* 2012a). The diagnosis allows for a wide variety of morphologies to be accommodated within the genus. *Eomunidopsis* is currently being revised by one of us (CMR).

***Eomunidopsis* sp. cf. *Eomunidopsis neojurensis* (Patrulius, 1959)** (= *Galathea antiqua* Moericke, 1889; nomen preoccupatum *Galathea antiqua* Risso, 1815) Figures 2D–F

1889 *Galathea antiqua* Moericke, p. 54, pl. 6, fig. 4.

1959 *Galathea neojurensis* Patrulius, pp. 250–252, fig. 2c.

1982 *Eomunidopsis neojurensis* (Patrulius). – Vía Boada, p. 122.

(abbreviated synonymy)

Material. – Fragmentary carapaces without cuticle IGS-MJ-0053 (max. preserved carapace width = 10.7; width of gastric region = 8.3) and CHMHZ-DSS/0002.

Description. – Specimens incomplete; posteriormost part of branchial regions absent. Carapace appears longer than wide; rostrum covers approximately half of the anterior margin. Rostrum incomplete, axially keeled, lateral margin appears straight; rostrum ornamented with weak tubercles. Rostral keel extends onto carapace. Cervical groove well defined, arcs across carapace in broad U shape; groove weakens slightly approaching lateral margin separating hepatic and epibranchial regions. Gastric region slightly inflated above rostrum and hepatic regions. Epigastric regions well defined by rostral keel axially, weak indentation posteriorly. Mesogastric and cardiac regions weakly defined. Ornamentation across carapace consists of uniformly spaced squamous tubercles. Tubercles appear slightly elongated across cardiac region.

Remarks. – These specimens bear remarkable resemblance to *Eomunidopsis neojurensis* (Patrulius, 1959; = *Galathea antiqua* Moericke, 1889) from the Tithonian Štramberg Limestones of the Czech Republic (Blaschke 1911), Poland (Moericke 1889), and Romania (Patrulius 1959). A syntype of *E. neojurensis* is shown in Fig. 2F (BSP AS III 323). Unfortunately, not enough of the carapace of the Stránská skála specimen is preserved for a definitive assignment.

Occurrence. – *Eomunidopsis neojurensis* has thus far been found only in strata of Tithonian age of Sinaia, Romania (Patrulius 1959), Radziechów, Poland (Moericke 1889), and Štramberg, Czech Republic (Blaschke 1911); this specimen would extend the range of this species into the Oxfordian.

Infraorder Brachyura Linnaeus, 1758

Section Dromiacea de Haan, 1833

Superfamily Homolodromioidea Alcock, 1900

Family Longodromitidae Schweitzer & Feldmann, 2009

Genus *Longodromites* Patrulius, 1959

Type species. – *Prosopon angustum* Reuss, 1858, by original designation.

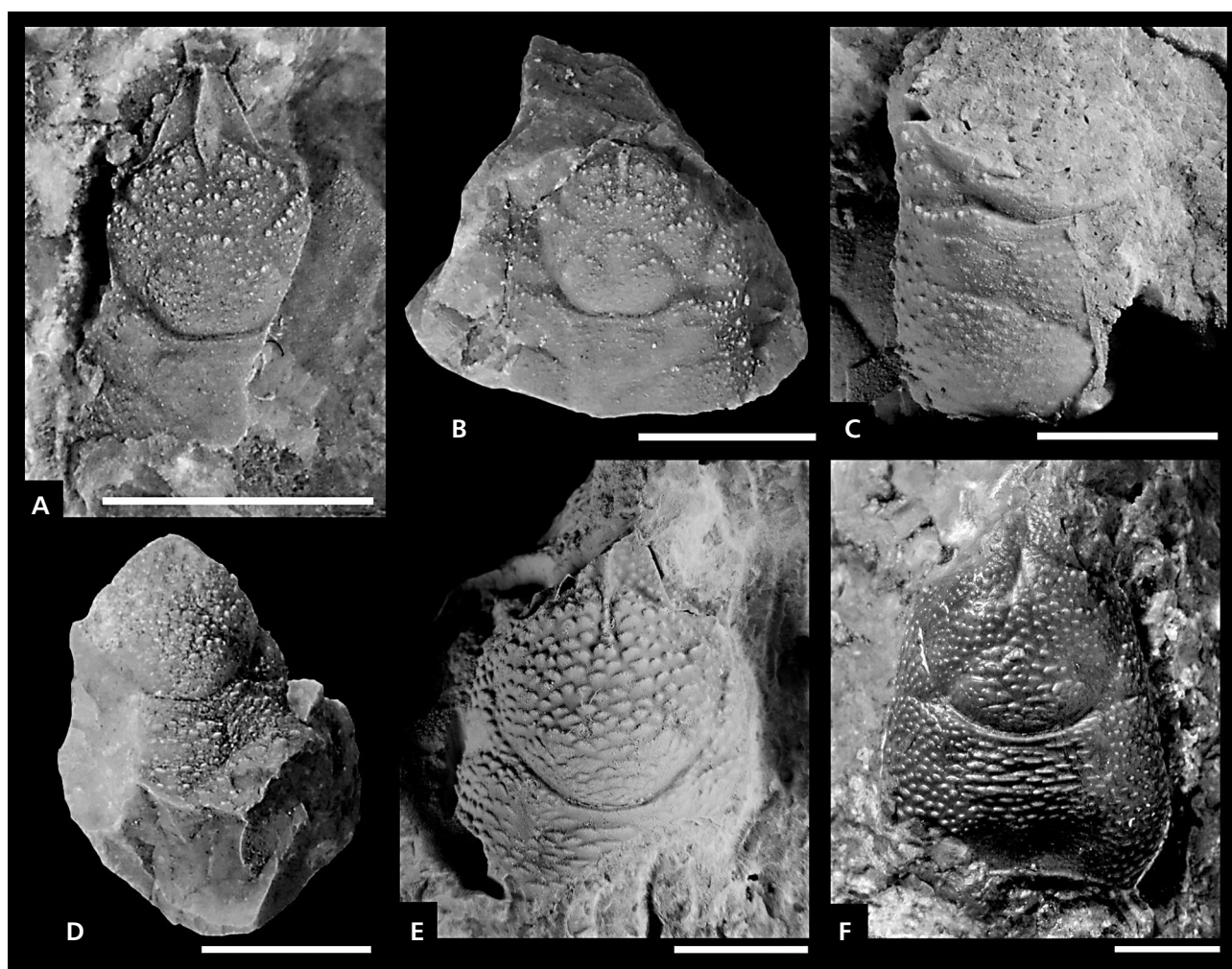


Figure 2. Galatheoid squat lobsters from the Oxfordian of Stránská skála. • A–C – *Gastrosacus wetzleri* von Meyer, 1854; A – SNM-Z 10299, B – CHMHZ-DSS/0001, C – IGS-MJ-0040. • D, E – *Eomunidopsis* sp. cf. *Eomunidopsis neojurensis* (Patrulius, 1959); D – CHMHZ-DSS/0001, E – IGS-MJ-0053. • F – syntype of *Eomunidopsis neojurensis*, BSP AS III 323. Specimens in A–E were covered with ammonium chloride prior to photography. Scale bar equals 5 mm.

Species included. – *L. angustus* (Reuss, 1858); *L. bicornutus* Muțiu & Bădăluță, 1971; *L. excisus* (von Meyer, 1857); *L. ovalis* (Moericke, 1889).

Diagnosis. – See Schweitzer & Feldmann (2009, p. 101).

Remarks. – The genus is well known from the Upper Jurassic of Central and Eastern Europe. It was recently revised by Schweitzer & Feldmann (2009).

***Longodromites angustus* (Reuss, 1858)**

Figures 3A–C, 8B

1858 *Pithonoton angustum* Reuss, p. 11.

1859 *Pithonoton angustum* Reuss. – Reuss, p. 72, pl. 24, fig. 3.

1895 *Prosopon angustum* (Reuss). – Remeš, p. 203, pl. 2, fig. 10.

1959 *Longodromites angustus* (Reuss). – Patrulius, p. 254, fig. 1a.

1966 *Longodromites angustus* (Reuss). – Patrulius, p. 514, pl. 31, figs 25, 26.

2009 *Longodromites angustus* (Reuss). – Schweitzer & Feldmann, p. 101, figs 1.6, 7.4–7.7.

2011 *Longodromites angustus* (Reuss). – Frăntescu, p. 292, fig. 15.

(abbreviated synonymy)

Material. – Three carapaces without cuticle: CHMHZ-DSS/0005 (well preserved; length excluding rostrum = 8.9; max. carapace width = 6.9; width at base of rostrum = 2.5; fronto-orbital width = 5.6), IGS-MJ-0051 (well preserved; length excluding rostrum = 6.5; max. carapace

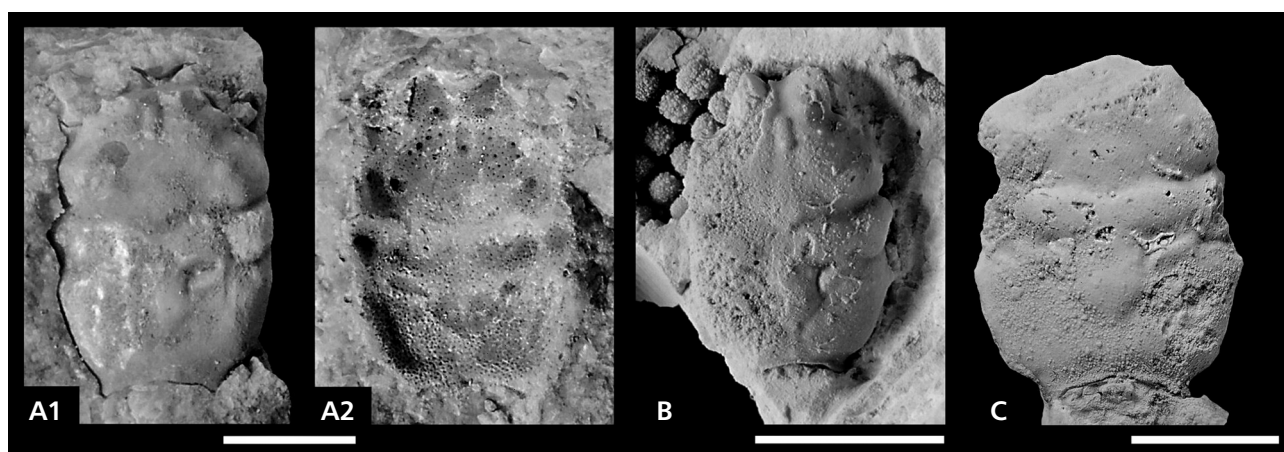


Figure 3. *Longodromites angustus* (Reuss, 1858) from the Oxfordian of Stránská skála. • A1, A2 – part and counterpart of CHMHZ-DSS/0005, B – IGS-MJ-0051, C – IGS-MJ-0052. All specimens were covered with ammonium chloride prior to photography. Scale bar equals 5 mm.

width = 5.0; width at base of rostrum = 2.5; fronto-orbital width = 4.1), IGS-MJ-0052 (without anterior portion; length excluding rostrum = 10.4; max. carapace width = 8.3).

Comparative material. – Holotype specimen from Štramberg, Czech Republic (GBA 2007/096/0005); note that Schweitzer & Feldmann (2009) erroneously listed the repository number of the holotype as GSA 2357. Additional specimens from Ernstbrunn, Austria (NHMW 1990/0041/3190) and Štramberg (NHMW 2007/0149/0001).

Diagnosis. – See Schweitzer & Feldmann (2009, p. 103).

Description. – Carapace longer than wide; width about 0.78 of length without rostrum. Maximum width at epibranchial regions; narrows slightly anteriorly and posteriorly. Anterior part of carapace (anterior to cervical groove) relatively long; more than half carapace length. Epibranchial regions very short, approximately 40% carapace length (Fig. 3A1). Rostrum broad, long, strongly deflected. Axial groove deep, broad, extends to anterior edge of carapace (Fig. 3B). False orbit deep, posteriorly directed, bounded with intra-orbital spine and outer-orbital spine. Mesogastric and epigastric regions not clearly differentiated. Anterior process of mesogastric region bears single tubercle. Cervical pits present on posterior of mesogastric region. One tubercle present in centre of each hepatic region (Fig. 3). Cardiac region triangular in shape, apex directed posteriorly, with two faint tubercles anteriorly and one, more distinct tubercle posteriorly. Cervical groove very broad and deep. Branchiocardiac groove also broad in lateral parts; the groove shallows and narrows approaching midpoint of carapace; extends to posterior margin of carapace. One large spine located along lateral margin posterior to cervical groove and one posterior to branchiocardiac groove (Fig. 3B, C). Posterior margin of carapace strongly inflected.

Remarks. – The specimens from Stránská skála have two pairs of large spines along the lateral margins; one is behind the cervical groove and one is behind the branchiocardiac groove. Spines on the holotype (GBA 2007/096/0005) and additional specimens from Štramberg and Ernstbrunn (NHMW 2007/0149/0001; NHMW 1990/0041/3190; also published in Schweitzer & Feldmann 2009, figs 7.4 and 7.6, respectively) are small. The specimens from Štramberg (NHMW 2007/0149/0001) and Ernstbrunn (NHMW 1990/0041/3190) studied for this work have spines of similar size; however, the Štramberg specimen has its cuticle preserved, while the Ernstbrunn specimen is without cuticle. The majority of specimens studied from Stránská skála do not have cuticle preserved. The spines on the Stránská skála specimens are well developed and large, similar to the spines of Romanian specimens, similarly without cuticle, studied by Franțescu (2011, fig. 15). Despite these differences in the size of the spines, which is considered a matter of intraspecific variation, all discussed specimens are close to each other in other morphological aspects.

Occurrence. – This species is known from the Tithonian of Štramberg, Czech Republic and Ernstbrunn, Austria (Schweitzer & Feldmann 2009), the upper Oxfordian–lower Kimmeridgian of Dobrogea, Romania (Franțescu 2011), and the Oxfordian of Stránská skála (herein).

Family Goniodromitidae Beurlen, 1932

Genus *Goniodromites* Reuss, 1858
(= *Iberihomola* Van Straelen, 1940)

Type species. – *Goniodromites bidentatus* Reuss, 1858, by original designation.

Table 2. Measurements (in mm) of studied brachyuran specimens from the Oxfordian of Stránská skála.

Taxon	specimen	W	WR	WM	L	LPM	MtF	MtC	CtE	CtBc	BCtE
<i>Goniodromites narinosus</i>	IGS-MJ-043	12	5.3	4.4	–	3.1	7.3	–	–	–	–
<i>G. narinosus</i>	IGS-MJ-049	1.0	–	3.2	10.2	2.0	5.7	2.2	2.3	2.1	4.5
<i>G. narinosus</i>	SNM-Z 10297 (1)	9.2	4.4	3.4	–	3.0	–	–	–	1.7	–
<i>Goniodromites serratus</i>	CHMHZ-DSS/0003	9.6	–	3.8	–	2.1	–	2.4	–	2.0	–
<i>G. serratus</i>	CHMHZ-DSS/0004	4.4	2.6	–	8.5	–	–	–	–	2.1	2.7
<i>G. serratus</i>	IGS-MJ-040	8.5	–	3.3	–	2.2	–	–	–	1.5	–
<i>G. serratus</i>	IGS-MJ-041	7.7	–	2.9	–	1.5	–	–	–	1.3	–
<i>G. serratus</i>	IGS-MJ-042	4.1	2.4	1.4	4.6	0.6	2.5	1.1	1.0	0.6	1.0
<i>G. serratus</i>	IGS-MJ-044	8.4	4.1	3.2	9.5	2.2	5.6	2.3	1.6	1.5	3.5
<i>G. serratus</i>	IGS-MJ-045	8.0	4.0	2.8	9.0	1.6	5.2	2.1	1.7	1.7	4.2
<i>G. serratus</i>	IGS-MJ-046	7.4	3.5	3.1	9.0	1.7	4.6	2.2	2.2	1.5	–
<i>G. serratus</i>	IGS-MJ-050	6.7	–	2.5	–	1.4	–	1.8	1.4	1.2	2.5
<i>G. serratus</i>	SNM-Z 10296	6.3	–	2.3	6.4	1.6	–	1.6	1.2	1.1	2.3
<i>G. serratus</i>	SNM-Z 16019	6.6	3.5	2.5	~7.7	2.1	4.3	–	–	1.4	2.6
<i>Eodromites grandis</i>	IGS-MJ-047	8.1	–	3.6	–	–	–	–	–	–	–

Species included. – *Goniodromites aliquantulus* Schweitzer, Feldmann & Lazăr, 2007a; *G. bidentatus* Reuss, 1858; *G. cenomanensis* (Wright & Collins, 1972); *G. dentatus* Lörenthey in Lörenthey & Beurlen, 1929; *G. hirotai* Karasawa & Kato, 2007; *G. kubai* Starzyk, Krzemińska & Krzemiński, 2012; *G. laevis* (Van Straelen, 1940); *G. narinosus* Frantescu, 2011; *G. polyodon* Reuss, 1858; *G. serratus* Beurlen, 1929; *G. sakawense* Karasawa & Kato, 2007; *G. transylvanicus* Lörenthey in Lörenthey & Beurlen, 1929.

Diagnosis. – See Schweitzer & Feldmann (2008, p. 123).

Remarks. – *Goniodromites* is one of the best known and most widespread, but also has the most convoluted systematic history of the Jurassic homolodromioid crabs. As noted by Schweitzer & Feldmann (2008) the concept of the genus has expanded significantly since Reuss (1858). Detailed discussion on its taxonomy and occurrence has been presented by Schweitzer & Feldmann (2008).

Goniodromites narinosus Frantescu, 2011

Figures 4E, H, 8C

2011 *Goniodromites narinosus* Frantescu, p. 280, fig. 8.

2012 *Goniodromites narinosus* Frantescu. – Starzyk et al., pp. 147–148, figs 2, 6, 9b.

Material. – Partially incomplete carapaces without cuticle IGS-MJ-0043, IGS-MJ-0049 and SNM-Z 10297 (1). For measurements see Table 2.

Diagnosis. – See Starzyk et al. (2012, p. 147).

Description. – Rostrum broad and very short. Anterior margin of rostrum medially incised at anterior groove, where posterior margin of the rostrum and upper orbital margin meet (Fig. 4H). False orbit long; approximately 20% of frontal margin length. Upper and lower margins of false orbit finely serrated (preserved on specimen IGS-MJ-0049; Fig. 4E). Epigastric regions swollen, rounded and closely positioned anterior to mesogastric region. Mesogastric region clearly defined anteriorly by hepatic grooves and posteriorly by the cervical groove; pyriform in shape with anterior (narrow) and posterior (broad) parts approximately equivalent in length. Midpoint of posterior part of mesogastric region bears small incision directed axially with pair of cervical pits on each side (Fig. 4E). Cardiac region triangular in shape with apex directed posteriorly, faintly visible. Single spine on posterior part of cardiac region and two nodes on anterior part. Lateral margins possess two spines anterior to cervical groove, four spines between cervical and branchiocardiac grooves and two spines posterior to branchiocardiac groove (Fig. 4E). Posterior margin of carapace long and distinctly concave posteriorly. Carapace ornamented with granules. Cervical groove strongly concave forward. Branchiocardiac groove weaker than the cervical groove, especially in medial part. Postcervical groove interrupted at midpoint.

Remarks. – Differences between *Goniodromites narinosus* and its morphologically closest congeners are discussed under remarks of *G. serratus*.

Occurrence. – The species is known from the Oxfordian of Romania (Frantescu 2011), Poland (Starzyk et al. 2012) and Czech Republic (herein).

Goniodromites serratus Beurlen, 1929

Figures 4A–D, G, F, I, 8D

- 1929 *Goniodromites serratus* Beurlen, p. 130, fig. 4.
 - 1985 *Pithonoton serratum* (Beurlen). – Collins & Wierzbowski, p. 84, pl. 3, figs 2–4, pl. 4, figs 1, 2.
 - 2008 *Goniodromites serratus* Beurlen. – Schweitzer & Feldmann, p. 128, pl. 2, fig. f.
 - 2012 *Goniodromites serratus* Beurlen. – Starzyk *et al.*, pp. 148–149, figs 3, 7, 9a.
- (abbreviated synonymy)

Material. – Carapaces CHMHZ-DSS/0003–0004, IGS-MJ-0040–0042, IGS-MJ-0044–0046, IGS-MJ-0050, SNM-Z 10296, SNM-Z 16017, SNM-Z 16019; specimens CHMHZ-DSS/0003, IGS-MJ-0044 and IGS-MJ-0046 exhibit bopyriform swellings. Specimens IGS-MJ-0041, 0046 and SNM-Z 10296 are preserved with cuticle partly intact. All cuticular surfaces are preserved on IGS-MJ-0044; all other specimens are preserved as internal moulds. The carapace width ranges from 4.1 to 8.5 mm (Fig. 5), length from 4.6 to 9.5 mm. For measurements see Table 2.

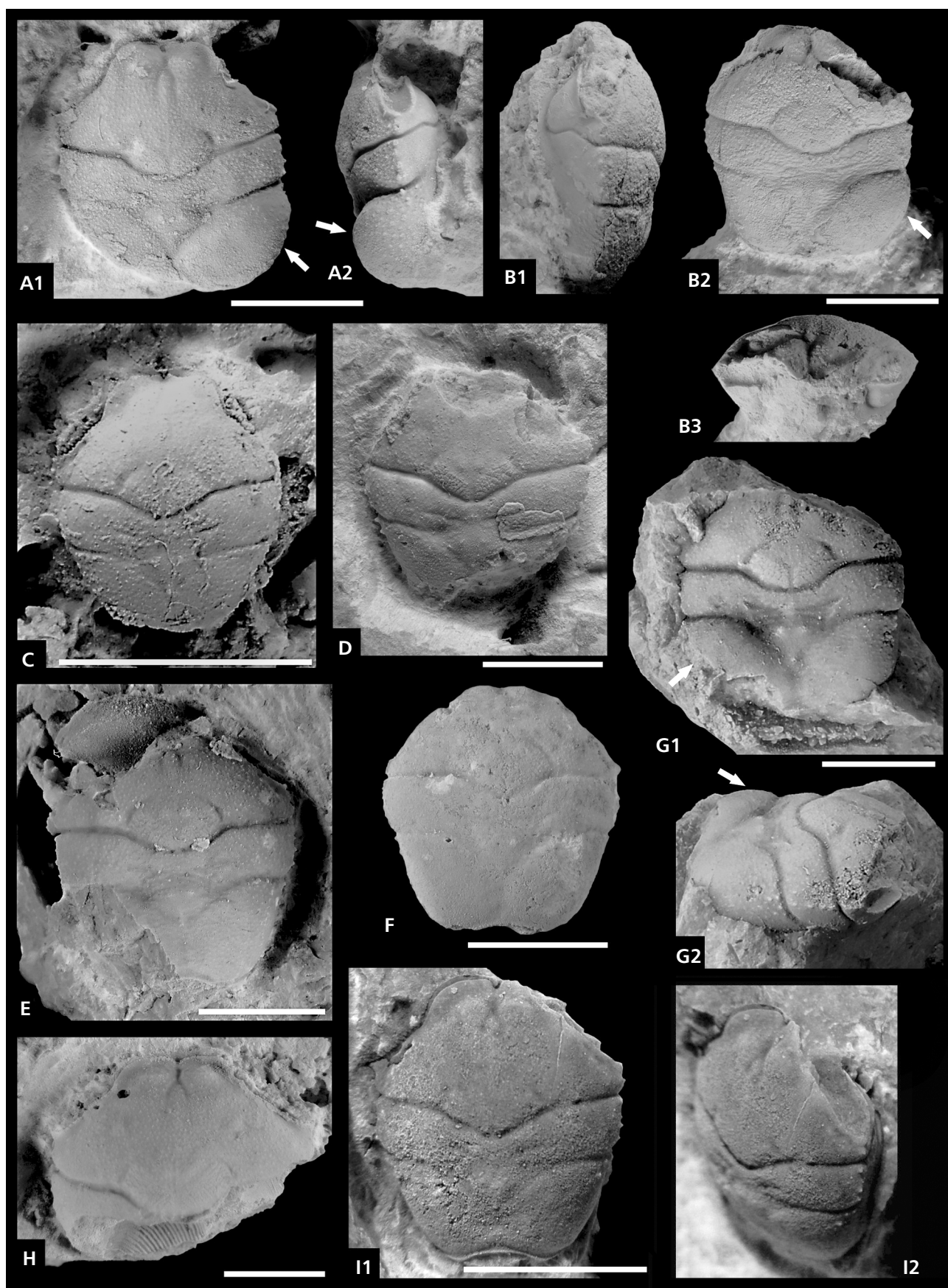
Diagnosis. – See Starzyk *et al.* (2012, p. 149).

Description. – Carapace longer than wide, pentagonal, dorsally convex. Rostrum deflected downward, medially incised by groove dividing it into two rounded lobes (Figs 4A1, B2, I2). Upper orbital margin of false orbit finely serrated; serration visible only on best-preserved specimens: IGS-MJ-042 (Fig. 4C), IGS-MJ-046 (Fig. 4A), IGS-MJ-050, and SNM-Z 16019 (Fig. 4I). In lateral view, false orbit comparatively narrow, approximately 1.45 times longer than wide, with upper and lower margins parallel to each other (Fig. 4I2). Epigastric regions swollen and slightly elongated anteriorly. Mesogastric region pyriform, with anterior (narrow) part longer than posterior (broad) part. Anterior-most portion protrudes anteriorly between epigastric regions. Axial incision visible in middle of posterior border. Cardiac region weakly delimited; triangular in shape, apex directed posteriorly. Single spine on posterior angle of cardiac region and two nodes located in both anterior angles. Posterior border of carapace wide and convex-forward. Center of cervical groove marked with pair of pores. Postcervical groove medially interrupted. Branchio-cardiac groove deep laterally; groove shallows approaching mid-point, almost disappears in posteriormost part.

Remarks. – The arrangement of spines on the lateral border, *i.e.* 2 spines in front of the cervical groove, 4 spines between the cervical and branchiocardiac grooves and 2 spines posterior to the branchiocardiac groove (Figs 4D, I1), is characteristic for *Goniodromites kubai*, *G. narinosus*, and *G. serratus*. The differences are in the proportions of the whole dorsal carapace and the development of particular carapace regions. *Goniodromites kubai* and *G. serratus* are proportionally longer than *G. narinosus*. Rostra of *G. narinosus* and *G. serratus* are incised in the middle, while the anterior outline of *G. kubai* is rounded without any incision. Differences are also visible in the shape and position of the epigastric regions. In *G. narinosus* the epigastric regions are rounded and close to each other, whereas in *G. serratus*, the epigastric regions are slightly elongated and partially separated by the anterior part of the mesogastric region. In *G. kubai*, the epigastric regions are distinctly elongated and positioned more laterally with respect to the mesogastric region. The false orbits are proportionally the longest in *G. narinosus* ($L/W = ca\ 1.9$) and shortest in *G. kubai* ($L/W = ca\ 1.1$); in *G. serratus* they attain ratio of 1.3.

The dimensions of representatives of *Goniodromites serratus* and *G. narinosus* from different localities were consistent with one another. The width range of all measured specimens is 3.7–12.8 mm. Specimens from Stránská skála are in the middle of the size range. Their width ranges from 6.3 to 8.5 mm. Specimen IGS-MJ-0042, one of the smallest of all analyzed specimens, is a bit of an outlier – it is 1.4 mm wide (Fig. 5). The morphometrics of *Goniodromites narinosus*, although distinguished morphologically from its congeners by Frăntescu (2011) and Starzyk *et al.* (2012), show strong overlap with *G. serratus* (Starzyk *et al.* 2012, fig. 10; Figs 5, 8C, D herein). Interestingly, at Kraków-Częstochowa Upland (Poland) and Stránská skála, the specimens of *G. narinosus* are almost always larger than *G. serratus*, and all specimens of both species appear to represent a single assemblage from each locality (Fig. 5). In other words, no specimen of *G. narinosus* with carapace width less than 5 mm is known. Assuming that both species had larvae of comparable size, juvenile specimens with carapace widths of several millimetres should be present at the studied localities, similar to the goniodromitids at the Koskobilo quarry in Spain (Klompaker *et al.* 2012b). The expression of taxonomically important characters on the species level may be linked to some environmental factor,

Figure 4. Goniodromitid crabs from the Oxfordian of Stránská skála, *Goniodromites serratus* Beurlen, 1929 (A–D, F, G, I) and *G. narinosus* Frăntescu, 2011 (E, H). • A – IGS-MJ-0046 in dorsal (A1) and lateral view (A2). • B – IGS-MJ-044 in lateral (B1), dorsal (B2) and frontal view (B3). • C – IGS-MJ-0042. • D – IGS-MJ-0041. • E – IGS-MJ-0049. • F – IGS-MJ-0045. • G – CHMHZ-DSS/0003 in dorsal (G1) and lateral view (G2). • H – IGS-MJ-0043. • I – SNM-Z 16019 in dorsal (I1) and dorsolateral view (I2). Specimens depicted in A, B and G bear swellings (arrows). All specimens were covered with ammonium chloride prior to photography. Scale bar equals 5 mm.



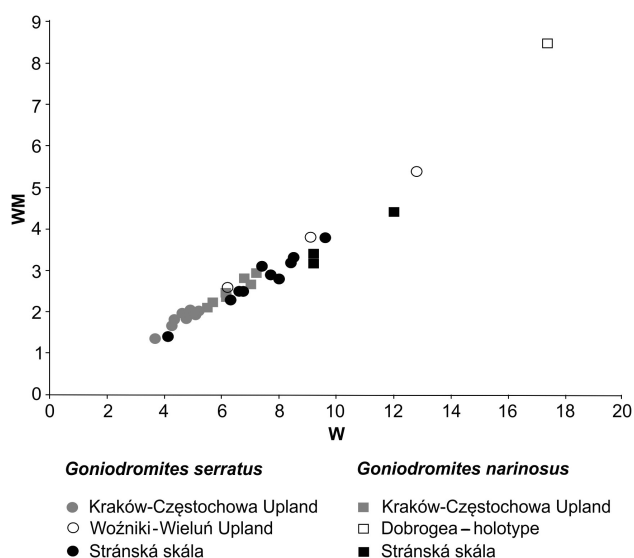


Figure 5. *Goniodromites narinosus* Franțescu, 2011 and *G. serratus* Beurlen, 1929. Variation in the carapace width (W) and mesogastric region width (WM) in different localities. Values are in millimetres.

which could explain the size differences of *G. serratus* and *G. narinosus* at respective localities (Fig. 5). Collecting bias may be another explanation; at least in the case of Stránská skála, only a limited number of specimens were gathered for the study herein. Additionally, at the type locality of *G. narinosus* in Romania, no specimen of *G. serratus* was recorded (Franțescu 2011). Differences between *G. narinosus* and *G. serratus* deserve more attention in future studies.

Occurrence. – *Goniodromites serratus* is one of the most common brachyurans at European Oxfordian localities. It is known from France, Germany, Poland, Romania, Switzerland and the Czech Republic (Beurlen 1929, Collins & Wierzbowski 1985, Wehner 1988, Feldmann *et al.* 2006, Starzyk *et al.* 2012).

Genus *Eodromites* Patručius, 1959

(= pars *Prosopon* von Meyer, 1835;
Ogydromites A. Milne-Edwards, 1865)

Type species. – *Prosopon grande* von Meyer, 1857, by original designation.

Species included. – *Eodromites aequilatus* (von Meyer, 1857); *E. depressus* (von Meyer, 1860); *E. dobrogea* (Feldmann, Lazar & Schweitzer, 2006); *E. grandis* (von Meyer, 1857); *E. nitidus* (A. Milne-Edwards, 1865); *E. polyphemi* (Gemmellaro, 1869); *E. rostratus* (von Meyer, 1840).

Diagnosis. – See Klompmaker *et al.* (2012b, p. 790).

Remarks. – The genus was revised by Schweitzer & Feldmann (2008) and Klompmaker *et al.* (2012b). For details on the taxonomy and occurrences see those works.

Eodromites grandis (von Meyer, 1857)

Figures 6A–C, 8E

- 1857 *Prosopon grande* von Meyer, p. 556.
- 1857 *Prosopon grande* von Meyer. – Quenstedt, pl. 95, figs 41, 43, 44.
- 1860 *Prosopon grande* von Meyer. – von Meyer, p. 202, pl. 23, figs 1–3.
- 1895 *Prosopon grande* von Meyer. – Remeš, p. 203, pl. 2, fig. 12.
- 1966 *Eodromites grandis* (von Meyer). – Patručius, p. 509, pl. 30, figs 10–14.
- 2008 *Eodromites grandis* (von Meyer). – Schweitzer & Feldmann, p. 134, pl. 4, figs a–g.
- 2011 *Eodromites grandis* (von Meyer). – Franțescu, p. 283, fig. 9.
- 2012 *Eodromites grandis* (von Meyer). – Klompmaker *et al.*, p. 790, figs 5a–k.
(abbreviated synonymy)

Diagnosis. – “Subovoid carapace varying from longer than wide to as long as wide, widest just posterior to intersection of cervical groove with lateral margin. Rostrum triangular, downturned. Orbits elongate. Orbital rim with axial indent, and outer orbital projection directed forward. Mesogastric region only defined anteriorly and posteriorly. Cardiac region does not reach posterior margin. Cervical groove generally broadly V-shaped. Branchiocardiac groove only defined laterally. Posterior margin accompanied by groove.” Excerpted from Klompmaker *et al.* (2012b, p. 790).

Material. – Partially incomplete carapace IGS-MJ-0047 without cuticle. For measurements see Table 2.

Description. – Carapace approximately as long as wide, strongly convex transversely, especially anteriorly. Branchial region comparatively flattened. Carapace narrows posteriorly, widest point posterior to intersection of cervical groove and lateral margin (Fig. 6C). Outer-orbital spine sharp and well defined. Distance between outer-orbital spine and cervical groove long. Rostrum not preserved. False orbit long, deep and distinctly bordered. Lower margin protrudes further anteriorly than upper margin (white arrow in Fig. 6C). Epigastric regions not preserved. Mesogastric region pyriform, weakly defined. Small, poorly developed incision at mid-point of posterior part of mesogastric region (Fig. 6C). One group of hepatic pits present in middle of each hepatic region (Fig. 6C). Cardiac region undifferentiated. Posterior border of carapace and branchial

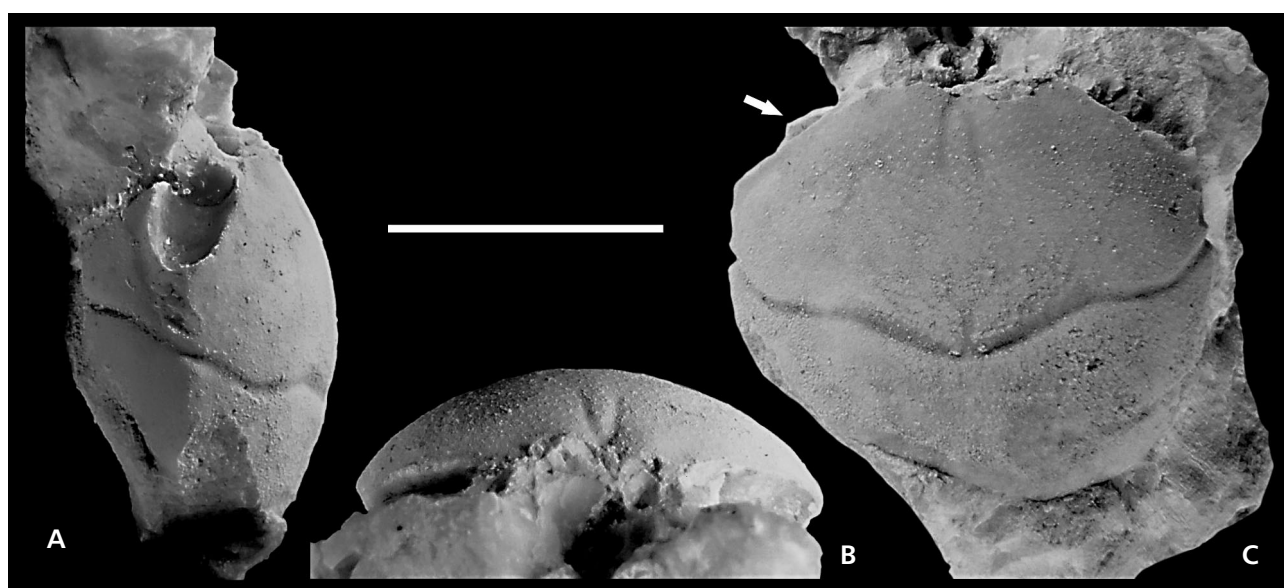


Figure 6. *Eodromites grandis* (von Meyer, 1857) from the Oxfordian of Stránská skála. Partial dorsal carapace IGS-MJ-0047 in lateral (A), frontal (B) and dorsal view (C). Note the protruded suborbital margin in C (arrow). Specimen was covered with ammonium chloride prior to photography. Scale bar equals 5 mm.

regions not preserved. Carapace surface smooth with shallow grooves. Cervical groove deepest, strongly arched posteriorly. Postcervical groove not visible; branchiocardiac groove faintly visible.

Occurrence. – *Eodromites grandis* was reported from the Oxfordian of Portugal (Wehner 1988), the Oxfordian–Tithonian of Germany, Poland and Romania (von Meyer 1860, Patruşius 1966, Wehner 1988, Frăţescu 2011), and the Tithonian of Austria and the Czech Republic (Moericke 1889, Remeš 1895, Blaschke 1911, Bachmayer 1947). It has been reported also from the Albian/Cenomanian patch reef of Koskobilo, Spain (Klompaker *et al.* 2012b).

Family Goniidromitidae Beurlen, 1932

Gen. et sp. indet.

Material. – Carapace fragments without cuticle CHMHZ-DSS/0007–0010, IGS-MJ-048, SNM-Z 13893, and SNM-Z 13895.

Remarks. – The preserved carapace fragments (no margins preserved) indicate affinities to Goniidromitidae. Closer identification, however, is not possible.

Isolated cheliped elements

Remarks. – The classification of isolated cheliped fragments is difficult, mainly because chelae are prone to con-

vergences, and thus offer only a few taxonomically important characters for closer identification. Nevertheless, isolated chelae, namely propodi (sometimes articulated with dactyli), are present at Jurassic localities where dorsal carapaces of primitive brachyurans occur, and they are not scarce (MH, personal communication to Andreas Kroh and Petr Skupien as cited in Hyžný *et al.* 2011). Only limited attention has been paid to isolated chelae loosely associated with Upper Jurassic primitive brachyurans (von Meyer 1860, Feldmann *et al.* 2006, Crônier & Boursicot 2009, Hyžný *et al.* 2011).

Indeterminate chela sp. 1

Figures 7A–D

?2006 indeterminate chela sp. 1: Feldmann *et al.*, p. 17, figs 3.7–3.9.

?2011 indeterminate chela sp. 1: Hyžný *et al.*, p. 219, fig. 3.

Material. – Four right fragmentary chelae consisting of articulated propodi and dactyli (IGS-MJ-042, IGS-MJ-054, IGS-MJ-055 – two chelae in close proximity to each other; Figs 7C, D and A, respectively) and one fragmentary left propodus (IGS-MJ-058; Fig. 7B). Only one of the specimens, IGS-MJ-055, partially retains original cuticle, all other specimens are preserved as internal moulds without any original cuticle.

Description. – Manus of chela longer than high (L/H ~ 1.15), convex on lateral surfaces (more convex on outer

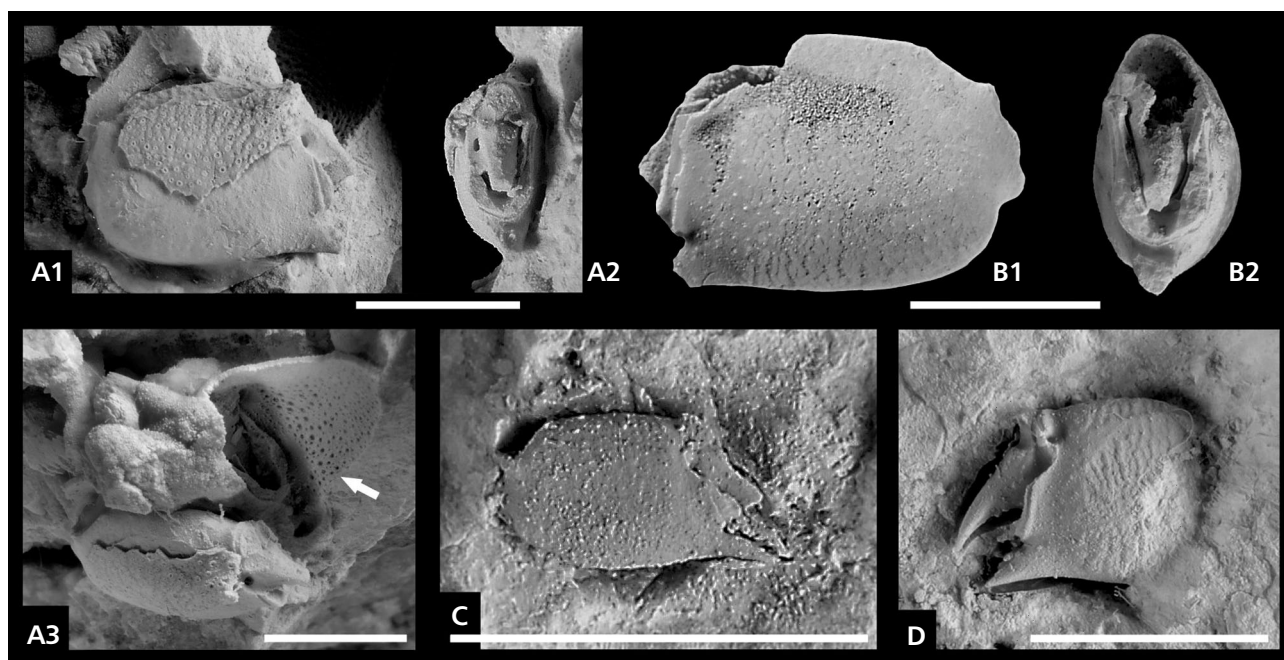


Figure 7. Isolated crab chelae (propodi with articulated dactyli) from the Oxfordian of Stránská skála. • A – right chela IGS-MJ-0055 in lateral (A1) and frontal view (A2). Note the presence of another chela associated with this specimen in A3 (arrow). • B – left chela IGS-MJ-0058 in lateral (B1) and frontal view (B2). • C – right chela IGS-MJ-0042. • D – right chela IGS-MJ-0054. All specimens were covered with ammonium chloride prior to photography. Scale bar equals 5 mm.

surface); proximal articulation slightly oblique to long axis of manus. Distal margin with swellings at articulation with dactylus. Fixed finger short, straight and pointed. Dactylus short and robust, highest proximally, without any apparent armature. Lateral propodal surfaces, without cuticle, show fine, scabrous ornamentation; cuticular surface is covered also with numerous, uniformly arranged tubercles.

Remarks. – The chelae are superficially similar to those found in the Oxfordian sponge bioherms of Dobrogea, Romania (Feldmann *et al.* 2006) and non-biohermal facies of the Pieniny Klippen Belt, Slovakia (Hyžný *et al.* 2011). Feldmann *et al.* (2006) described the upper margin of their “indeterminate chela sp. 1” as having three tiny spines; these are not present/preserved in the material of Stránská skála.

In contrast to the occurrences discussed above, the Czech material exhibit propodi articulated with dactyli, a condition which has so far not been mentioned in any published report on the Upper Jurassic reefal facies decapod assemblages. Unfortunately, the specimens are not preserved in direct association with carapaces; thus, closer identification is not possible. We can only speculate on the identity of the chelae as belonging to some species of *Goniodromites*, as the majority of specimens of primitive brachyurans recovered from Stránská skála are goniodromitids and the same is true for the sponge bioherms of Dobrogea (Feldmann *et al.* 2006, Frăntescu 2011).

Quenstedt (1858, pl. 95, figs 49–51) illustrated three

claws associated with primitive crabs; one of them (Quenstedt 1858, pl. 95, fig. 50) bears strong resemblance to the chelae from Stránská skála.

Étallon (1859, pl. 3, figs 3, 9) depicted two claws; he assigned them to *Pithonoton meyeri* Étallon, 1859 (= *Longodromites meyeri*) and *P. quadratum*, respectively. None of them fits the morphotype from Stránská skála.

Von Meyer (1860, pl. 23, fig. 16) figured two chelae as belonging to *Prosopon elongatum* von Meyer, 1860 (= *Pithonoton elongatum*) and three additional chelae without assignment to any crab species. All of them differ from the Stránská skála material in possessing proportionally longer fingers.

Discussion

Differential decapod diversity. – Oppenheimer (1926) mentioned more than 90 species of macrofauna from the Oxfordian of Stránská skála, including corals, cephalopods, bivalves, gastropods, brachiopods, polychaetes, crustaceans, and echinoderms. According to a microfacies analysis conducted by Eliáš (1981), the environment of the Stránská skála was very shallow marine and represents the transition between the carbonate platform and the shelf lagoon. The exposed carbonate breccias represent the margins of the carbonate platform and separated the platform from the shelf lagoon.

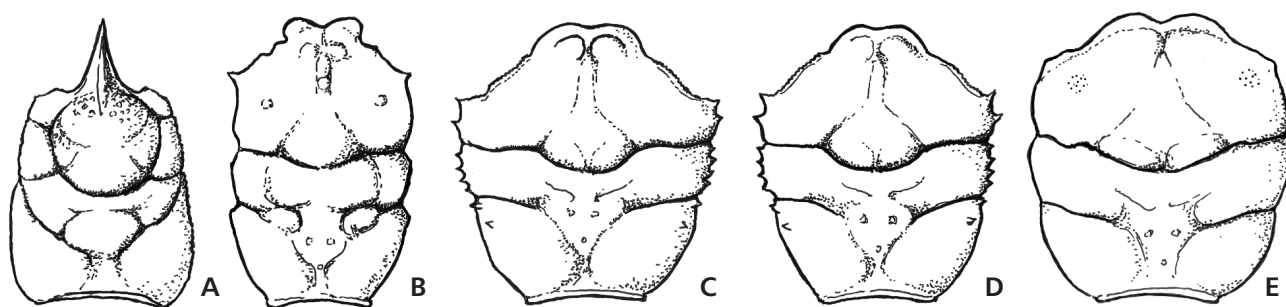


Figure 8. Schematic reconstructions of decapod carapaces from the Oxfordian of Stránská skála. Carapace ornamentation is largely omitted. • A – *Gastrosacus wetzleri* von Meyer, 1854. • B – *Longodromites angustus* (Reuss, 1858). • C – *Goniidromites narinosus* Frantescu, 2011. • D – *Goniidromites serratus* Beurlen, 1929. • E – *Eodromites grandis* (von Meyer, 1857). Reconstructions are based on the material from Stránská skála and the figured type material. Due to incompleteness of the material, the reconstruction of *Eomunidopsis* cf. *E. neojurensis* (Patrulus, 1959) has not been included.

The corals occurring at the Stránská skála are not very diverse; Eliášová (1994) reported only 11 taxa, of which two are in open nomenclature. The assemblage is dominated by *Isastrea helianthoides* (Goldfuss, 1826), which is characteristic for the Upper Jurassic (Oxfordian–Kimmeridgian) coral build-ups (e.g. Turnšek 1997, Pandey et al. 2009). According to Eliášová (1994) the corals in the Brno vicinity constituted a simple lenticular biostrome, whereas the plateau was a part of a vast shallow marine carbonate platform on the southern (passive) margin of the Western European platform (Eliáš 1981, Eliášová 1994, Adámek 2005). Later, after the deposition of the Stránská skála coral buildup, the sediment prograded into the lagoon.

Previous investigations have shown that Upper Jurassic coral reef faunas, in terms of decapods, were generally diverse and robust (Schweitzer et al. 2007b, Frantescu 2011). Schweitzer et al. (2007b) compared the differential diversity among the Upper Jurassic sponge-algal and coralline decapod assemblages in Romania and concluded that many more genera had been specialized for coral reef habitats than for sponge ones. This was perhaps due to the shallower, better oxygenated and better illuminated environment of coral reefs as well as the wide variety of coral morphologies and the presence of more niches and physical spaces there. In this respect, the rather low decapod diversity of Stránská skála compared to other Upper Jurassic localities with preserved coral reefs (Table 3) may look surprising. In terms of diversity it is comparable to the roughly coeval sponge-algal environments of Romania (Feldmann et al. 2006, Schweitzer et al. 2007a; see Table 3). This discrepancy may be explained by collecting bias at Stránská skála. The material studied herein represents old collections; the exact position of specimens within the section cannot be traced, nor can be determined the specific place at the locality. Further collecting at Stránská skála is not possible anymore (see above) and, thus, only the discovery of other old collections can add more data about the true diversity of decapod crustaceans

there. Potentially, surveys of similar Polish and Romanian localities could be a nice comparative example in this respect.

Older studies (e.g. Collins & Wierzbowski 1985) underestimated the diversity of decapods compared to the most-recent research (Feldmann et al. 2006; Schweitzer et al. 2007a, b; Frantescu 2011; Fraaije et al. 2012a–c, 2014; Starzyk et al. 2011, 2012; Starzyk 2013), mostly because new insights into the systematics of paguroids, galatheoids and primitive brachyurans called for major taxonomic revisions. These revisions significantly influenced the number of observed species of fossil decapods. Thus, it is not surprising that the diversity of decapods at Ghergheasa (Muşiu & Bădăluţă 1971) and Stránská skála (herein) is rather low, because Ghergheasa has not been restudied in light of the new taxonomic revisions (e.g. Feldmann et al. 2006; Schweitzer et al. 2007a; Schweitzer & Feldmann 2008, 2009; Frantescu 2011; Robins et al. 2012; Starzyk et al. 2012). Additionally, only limited attention has been paid to Stránská skála in terms of decapod identification. In fact, since Oppenheimer (1926), no systematic treatment of the Oxfordian decapods of Stránská skála has been published. The species composition of Stránská skála is very close to that of the lower Tithonian of Woźniki, Poland (Patrulus 1966), although the latter association is more diverse. This may also indicate strong collecting bias in the case of Stránská skála.

More precise stratigraphic data on studied faunas appear to be crucial in resolving the true diversity of localities. Unrelated assemblages from different time horizons can be mixed when collecting within debris, especially when the studied sections span more than one ammonite zone (Starzyk et al. 2011, 2012; Starzyk 2013). Since many known decapod localities are now inaccessible or demolished, the true diversity of some localities, such as Stránská skála may never be known. This is also a reason why we did not compare the Stránská skála assemblage with the Tithonian-Berriasian assemblages of Ernstbrunn

Table 3. Differential diversity of decapod crustacean taxa at selected Upper Jurassic localities.

Locality	Age	Genera/species	Reference
Coral environment			
Stránská skála (CZ)	Oxfordian	5/6	herein
Ghergheasa (RO)	Tithonian	6/7	Muțiu & Bădăluță (1971)
Topalu/Piatra (RO)	Oxfordian/Kimmerdigian	7/10	Franțescu (2011)
Purcareni (RO)	Tithonian	16/24	Patrulus (1966), Shirk (2006)
Sinaia/Moroeni (RO)	Tithonian	20/38	Patrulus (1959, 1966), Schweitzer <i>et al.</i> (2007b)
Sponge-algal environment			
Gura Dobrogei (RO)	Oxfordian	4/4	Schweitzer <i>et al.</i> (2007a)
Cheia (RO)	Oxfordian	3/5	Feldmann <i>et al.</i> (2006)
Kroczyce (PL)	Oxfordian	3/5	Głowniak & Wierzbowski (2007)
Grabowa (PL)	Oxfordian	5/9	Głowniak & Wierzbowski (2007)
Wysoka (PL)	Oxfordian	8/13	Przybylski <i>et al.</i> (2010)
Niegowonice (PL)	Oxfordian	9/22	Głowniak (2006)
Bzów (PL)	Oxfordian	12/24	Matyja & Wierzbowski (1994)
Ogrodzieniec (PL)	Oxfordian	13/24	Głowniak (2006)

and Štramberg, which are extremely rich but their stratigraphic span is not limited to a single stage (Houša *et al.* 1996; Vašíček & Skupien 2004, 2005; Schneider *et al.* 2013).

Parasitized decapods. – Bopyriform swellings (as termed by Wienberg Rasmussen *et al.* 2008), which typically occur on the branchial regions, were recently named *Kanthyloma crusta* by Klompmaker *et al.* (2014). These swellings are known from many Upper Jurassic decapod assemblages (Bachmayer 1948, Houša 1963, Radwański 1972, Wienberg Rasmussen *et al.* 2008, Robins *et al.* 2012, Klompmaker *et al.* 2014).

The studied material from Stránská skála contains three infested specimens (out of 36); two of them were infested on the right side, and one specimen was infested on the left side. The sample, however, is too small to draw any conclusions regarding the preference for the left or right branchial side for infestation. Based on statistical data from the Albian of Koskobilo, Spain, Klompmaker *et al.* (2014) concluded that there is no statistical preference for either the left or right branchial side for infestation on the assemblage level.

Interestingly, the rate of infestation seems rather high in the Stránská skála assemblage, reaching 8.33%. For comparison, Bachmayer (1955) reported the rate of infestation to be 2% out of 3 000 decapod specimens from the Tithonian of Ernstbrunn (Austria), Houša (1963) reported 3.82% out of 890 specimens from the Tithonian of Štramberg (Czech Republic) and Radwański (1972) reported less than 1.4% out of more than 500 specimens. For Cretaceous assemblages the rate of infestation seems to be comparable; for instance Klompmaker *et al.* (2014) noted that 4.2% out of 874 decapod specimens from the Albian of

Koskobilo quarry (Spain) were infected. It should, however, be noted that not all species from the studied assemblages possess swellings, but rather there is a preference for certain taxa. At the higher taxonomic level, galatheid specimens usually are more afflicted than brachyuran families (Klompmaker *et al.* 2014). From Stránská skála, however, no infested galatheids are known. This can be explained with the small study sample. A relatively high percentage of infestation may be a consequence of collecting bias; carapaces with swellings are presumably more attractive to collectors. Although larger sample sizes may represent more accurate proportions of infested taxa, it is highly dependent upon the methodology of the collectors. If all decapod specimens regardless of species and condition were collected (*i.e.* no collecting bias), a truer picture of infestation level may be gleaned. With most museum-based research, data like this is not possible.

Taxonomy of isolated chelipeds. – Isolated cheliped elements are virtually always present together with carapaces at Upper Jurassic localities, but so far they have not been reported in close association with each other; thus, the identification of the chelipeds remains obscure. Feldmann *et al.* (2006) considered the association of chelae with carapaces reported by Quenstedt (1858), Étallon (1859) and von Meyer (1860) as circumstantial, *i.e.* their closer identification is not possible. We concur with Feldmann *et al.* (2006), but add that describing and depicting cheliped elements is a crucial step in understanding their taxonomic significance. In fact, only a few authors have depicted the isolated chelae from Jurassic localities (von Meyer 1860, Feldmann *et al.* 2006, Crônier & Boursicot 2009, Hyžný *et al.* 2011), although tens of publications on Jurassic brachyurans exist. In this respect, for the brachyurans of the Lower

and Upper Cretaceous the knowledge of cheliped morphology is more advanced and several claw types have been successfully matched to the carapaces (Jagt *et al.* 2010, Kočová Veselská *et al.* 2014, Hyžný & Kroh 2015).

Isolated cheliped elements, although difficult to treat taxonomically, exhibit characters that can be matched to a certain mode of life (*e.g.* armature of fingers, finger length, spatulate tips, *etc.*) and can thus say something about the ecological niches the decapods occupied within the ancient ecosystems. Robust propodi with short fingers in goniodromitid crabs may indicate feeding habits that involved scraping algal surfaces or detritus feeding.

Parataxonomy (*i.e.* usage of “form” taxa) is another way to deal with cheliped fragments, but due to widespread convergence in shape of decapod chelae and without more comparative studies using Upper Jurassic material it is difficult to propose characters of taxonomic importance. Parataxonomy has been recently proposed for sixth abdominal tergites of pylochelid hermit crabs (Fraaije *et al.* 2012a, 2013b); however, for isolated brachyuran chelae, the parataxonomy is seemingly avoided (see discussions in Jagt *et al.* 2010, Kočová Veselská *et al.* 2014, Hyžný & Kroh 2015).

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