Paguroid anomurans from the upper Tithonian–lower Berriasian of Štramberk, Moravia (Czech Republic)

Zgornjetitonijski–spodnjeberiasijski raki samotarji iz Štramberka, Moravska (Češka)

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Prejeto / Received 10. 8. 2019; Sprejeto / Accepted 26. 11. 2019; Objavljeno na spletu / Published online 30. 1. 2020

Key words: Paguroidea, upper Tithonian - lower Berriasian, Štramberk Limestone, Moravia, Czech Republic

Abstract

Subsequent to a preliminary report on a handful of paguroid remains from the Tithonian (uppermost Jurassic) to lower Berriasian (Lower Cretaceous) Štramberk Limestone in Moravia (eastern Czech Republic), published in 2013, several field campaigns were organised by our research team during the summers of 2012–2015 and 2018. These resulted in the recovery of additional paguroid shields (or, anterior carapaces) that form the basis of the present study. The currently available material documents a diverse paguroid fauna. In fact, it ranks amongst the most diverse fossil paguroid assemblages known, following faunas from the upper Kimeridgian of Nusplingen (southern Germany) and the Tithonian of Ernstbrunn (northeast Austria). New representatives of five families and five genera are described, named and illustrated, as follows: Annuntidiogenes sagittula sp. nov. (Diogenidae), Protopagurus cerebellum sp. nov. and Protopagurus duopupae sp. nov. (Paguridae), Mesoparapylocheles janetjacksonae sp. nov. (Parapylochelidae), Masticacheles septemgradu sp. nov. (Pilgrimchelidae) and Ammopylocheles romankijoki sp. nov. (Pylochelidae).

Izvleček

Po prvih poročilih o ostankih rakov samotarjev (Paguroidea) titonijske (zgornje jurske) do spodnje beriasijske (spodnje kredne) starosti iz apnencev v kamnolomu Štramberk na Moravskem (vzhodna Češka), ki so bila objavljena leta 2013, smo med leti 2012–2015 in poleti 2018 opravili več dodatnih terenskih raziskav. Pri raziskavah smo odkrili številne nove ščite (sprednje dele oklepa) rakov samotarjev, ki so predstavljeni v pričujočem članku. Opisan fosilni material predstavlja raznovrstno favno rakov samotarjev, ki se uvršča med najbolj raznolike znane fosilne paguroidne združbe, primerljive z zgornjo kimeridžijsko združbo regije Nusplingen (južna Nemčija) in titonijsko paguroidno združbo nahajališča Ernstbrunn (severovzhodna Avstrija). Opisani in predstavljeni so novi predstavniki petih družin in petih rodov rakov samotarjev: Annuntidiogenes sagittula sp. nov. (Diogenidae), Protopagurus cerebellum sp. nov. in Protopagurus duopupae sp. nov. (Paguridae), Mesoparapylocheles janetjacksonae sp. nov. (Parapylochelidae), Masticacheles septemgradu sp. nov. (Pilgrimchelidae) in Ammopylocheles romankijoki sp. nov. (Pylochelidae).
Introduction

The Štramberk Limestone, exposed along several exploitation levels at Kotouč quarry in the immediate vicinity of the town of Štramberk (Moravia, Czech Republic), comprises variably sized carbonate megablocks, breccias and conglomerates that represent deposition on a carbonate platform along the northern Tethyan margin in the area of the present-day Outer Western Carpathians during the latest Jurassic and earliest Cretaceous (Vašíček et al., 2018; Vaňková et al., 2019). In recent years, numerous macrofossils have been collected from this quarry thanks to an agreement between the VSB-Technical University of Ostrava and the management of Kotouč quarry. From about 1910 onwards, the quarry at Kotouč Hill has been the main source of macro- and microfossils that have been described in numerous palaeontological studies (see Vašíček & Skupien, 2004, 2005, 2019 for references). The reefal limestone facies at the quarry varies widely, ranging from very coarse-grained to gravelly layers or lenses, formed by e.g. molluscan shells and corals, to very fine-grained micritic limestones and (most commonly) fine-grained bioclastic limestones (e.g., Houša & Vašíček, 2005).

Fieldwork carried out by our research team in the Upper Jurassic–Lower Cretaceous reefal limestones at Kotouč quarry during the summers of 2012–2015 and 2018, has provided a highly diverse decapod crustacean fauna comprising remains of isopods, macrurans, anomurans, and brachyurans. Paguroid material collected during the first campaign was recorded in a preliminary paper; this included a handful of shields (or, portions of anterior carapaces) and a single sixth abdominal tergite (Fraaije et al., 2013). In 2015, Gašparič et al. described the galatheoid Galaetheites zitteli (Moericke, 1889) from the infill of a test of a nucleolitid echinoid, collected in June 2014.

With at least 18 species, in eight families, the Tithonian (Late Jurassic) paguroid fauna from Ernstbrunn (Austria) is by far the most diverse decapod crustacean fauna comprising remains of isopods, macrurans, anomurans, and brachyurans. Paguroid material collected during the first campaign was recorded in a preliminary paper; this included a handful of shields (or, portions of anterior carapaces) and a single sixth abdominal tergite (Fraaije et al., 2013). In 2015, Gašparič et al. described the galatheoid Galaetheites zitteli (Moericke, 1889) from the infill of a test of a nucleolitid echinoid, collected in June 2014.

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Material and methods

Specimens, usually only partially exposed, were mechanically prepared under a LOMO MBS-10 stereomicroscope, using needles and pneumatic airscribes of the types Hardy Winkler HW-1 and HW-70/3. Accidentally chipped pieces were glued back by Starbond super fast thin CA glue.

For photography, specimens were first dyed with black water colour, and when dry, coated with ammonium chloride, in order to gain maximum contrast of fine details. Specimens were photographed using a Canon digital SLR in aperture priority, Zeiss Luminar 100 mm and 63 mm macro lenses on a Nikon PB-4 bellows unit. A copy stand was used, and a Euromex coldlight source for illumination. Post-processing was done in GIMP 10.0; levels and curves were adjusted for white balance and contrast, the sharpness slightly enhanced with an ‘unsharp mask’.

Systematic palaeontology

We here adopt the carapace-based classification and descriptive terminology of extinct paguroids proposed by Fraaije (2014) and Fraaije et al. (2019). All material is contained in the collections of the Oertijdmuseum, Boxtel (the Netherlands; abbreviation: MAB).

Order Decapoda Latreille, 1802
Infraorder Anomura H. Milne Edwards, 1832
Superfamily Paguroidea Latreille, 1802
Family Annuntidiogenidae Fraaije, 2014
Genus Annuntidiogenes Fraaije, Van Bakel, Jagt & Artal, 2008

Type species: Annuntidiogenes ruizdegaonai Fraaije, Van Bakel, Jagt & Artal, 2008, by original designation.

Included species: Annuntidiogenes sagittula sp. nov., An. elongatus Fraaije, Robins, Van Bakel, Jagt & Bachmayer, 2019, An. hoelderi Fraaije, Robins, Van Bakel, Jagt & Bachmayer, 2019, An. jurassicus Fraaije, 2014, An. massetispinus Fraaije, Van Bakel & Jagt, 2017, An. sunucium Fraaije, Van Bakel, Jagt & Artal, 2008, An. ruizdegaonai and An. worfi Fraaije, Van Bakel, Jagt, Klompmaker & Artal, 2009.

Annuntidiogenes sagittula sp. nov. (Pl. 1.1)

Diagnosis: Shield longer than wide, divided into distinct regions by grooves; long triangular rostrum extending beyond postocular and
postantennal spines; convex postrostral ridge; scabrous ornament on anterior gastric region; long and wide central gastric groove forming arrow-shaped figure in conjunction with rostrum; elongated, bipartite massetic region; pronounced triangular anterior branchial area; posterior intragastric grooves parallel to cervical groove.

**Derivation of name:** Latin *sagittula*, meaning small arrow, in reference to the typical arrowhead shape of the central anterior groove in conjunction with the triangular rostrum.

**Type material:** The holotype, and sole specimen known to date (MAB k.3631), is a near-complete shield; as preserved, maximum carapace length measures 4.0 mm, maximum shield width is 3.0 mm.

**Type locality and type level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 5; lower Berriasian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Type material:** The holotype, and sole specimen known to date (MAB k.3631), is a near-complete shield; as preserved, maximum carapace length measures 4.0 mm, maximum shield width is 3.0 mm.

**Remarks:** For a detailed description, reference is made to Fraaije et al. (2013).

**Family Diogenidae Ortmann, 1892**

**Genus Bachmayerus Fraaije, Van Bakel, Jagt & Skupien, 2013**

Type locality and type level: Kotouč quarry (Štramberk, Moravia, Czech Republic), level 7; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Type material:** The holotype, and sole specimen known to date (MAB k.3631), is a near-complete shield; as preserved, maximum carapace length measures 4.0 mm, maximum shield width is 3.0 mm.

**Remarks:** For a detailed description, reference is made to Fraaije et al. (2013).

**Genus Eopaguropsis Van Bakel, Fraaije, Jagt & Artal, 2008**

**Type species:** *Eopaguropsis loercheri* Van Bakel, Fraaije, Jagt & Artal, 2008, by original designation.

**Locality and level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 6; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3, locality 3).

**Material:** The specimen (MAB k.3759), is an incomplete shield; as preserved, maximum carapace length measures 7.0 mm, maximum shield width is 5.0 mm.

**Remarks:** For a detailed description, reference is made to Fraaije et al. (2012c).

**Family Gastrodoridae Van Bakel, Fraaije, Jagt & Artal, 2008**

**Genus Gastrodorus von Meyer, 1864**

Type species: *Gastrodorus neuhausensis* von Meyer, 1864, by monotypy.

**Included species:** *Gastrodorus bozowiensis* Krzemińska, Krzemiński, Fraaije, Van Bakel & Jagt, 2015, *G. cretahispanicus* Klompmaker, Artal, Fraaije & Jagt, 2011, *G. kotoucensis* Fraaije, Van Bakel, Jagt & Skupien, 2013 and *G. neuhausensis* von Meyer, 1864.
**Gastrodorus kotoucensis** Fraaije, Van Bakel, Jagt & Skupien, 2013  
(Pl. 1.4)

**Type locality and type level:** Kotouč quarry (Stramberk, Moravia, Czech Republic), level 7; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Remarks:** For a detailed description, reference is made to Fraaije et al. (2013).

**Family Paguridae** Latreille, 1802

**Genus** Protopagurus Fraaije, Robins, Van Bakel, Jagt & Bachmayer, 2019

**Type species:** Protopagurus janoscheki Fraaije, Robins, Van Bakel, Jagt & Bachmayer, 2019, by original designation.

**Included species:** Protopagurus janoscheki, Protopagurus cerebellum sp. nov. and Protopagurus duopupae sp. nov.

**Remarks:** To date, we are unaware of any representative of the family Paguridae from Oxfordian and Kimmeridgian strata, in spite of intensive fieldwork in southern Germany and southern Poland over several years. The oldest known pagurid has recently been described from the middle to lower upper Tithonian of Ernstbrunn (Austria; see Fraaije et al., 2019). The new taxa from the lower Berriasian of Moravia appear to substantiate the notion that this group rose to dominance during the latest Jurassic (and up to the present day) and ousted the more ancient groups of symmetrical hermit crabs.

**Protopagurus duopupae** sp. nov.  
(Pl. 1.5)

**Diagnosis:** Well-areolated shield, slightly longer than wide; large, elongated massetic region, anteriorly covered with scale-like ornamentation; shallow central gastric groove centrally indenting convex postfrontal ridge; anterior part of gastric region covered with scale-like ornamentation; posteriorly a row of large pits is forming subtransverse furrow; thin, elongated anterior branchial area; well-delineated, reniform keraial region; shield irregularly covered with (setal) pores. Frontal area and posteriormost part of shield not preserved.

**Protopagurus cerebellum** sp. nov.  
(Pl. 2.1)

**Diagnosis:** Well-areolated shield, slightly longer than wide; large, elongated massetic region, anteriorly covered with scale-like ornamentation, posteriorly covered with broad, shallow, pitted furrow slightly curving from anteriormost keraial region to mid-massetic edge; shallow central gastric groove centrally indenting convex postfrontal ridge; anterior part of gastric region covered with scale-like ornamentation; posteriorly a row of large pits is forming subtransverse furrow; thin, elongated anterior branchial area; well-delineated, reniform keraial region; shield irregularly covered with (setal) pores. Frontal area and posteriormost part of shield not preserved.

**Type locality and type level:** Kotouč quarry (Stramberk, Moravia, Czech Republic), level 5; lower Berriasian (see Vašíček & Skupien, 2019, p. 39, fig. 3, locality 10; Vaňková et al., 2019, section B, layer B22).

**Description:** Well-areolated shield, slightly longer than wide; large, elongated massetic region, anteriorly covered with scale-like ornamentation; shallow central gastric groove centrally indenting convex postfrontal ridge; anterior part of gastric region covered with scale-like ornamentation; posteriorly a row of large pits is forming subtransverse furrow; thin, elongated anterior branchial area; well-delineated, reniform keraial region; shield irregularly covered with (setal) pores. Frontal area and posteriormost part of shield not preserved.
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PLATE 1

1 - *Annuntidiogenes sagittula* sp. nov.;
2 - *Bachmayerus cavus* Fraaije, Van Bakel, Jagt & Skupien, 2013;
3 - *Eopaguropsis cf. nidiaquilae* Fraaije, Krzemiński, Van Bakel, Krzemińska and Jagt, 2012, original (left), composite (right);
4 - *Gastrodorus kotoucensis* Fraaije, Van Bakel, Jagt & Skupien, 2013;
5 - *Protopagurus duopupae* sp. nov., original (left), composite (right); all scale bars 2 mm.
terior part of gastric region covered with brain-like ornamentation, posteriorly ending convexly; thin, elongated anterior branchial area; small, reniform keraial region; shield irregularly covered with (setal) pores.

Family Parapylochelidae Fraaije, Klompmaker & Artal, 2012a
Genus *Housacheles* Fraaije, Van Bakel, Jagt & Skupien, 2013

**Type species:** *Housacheles timidus* Fraaije, Van Bakel, Jagt & Skupien, 2013, by original designation.

*Housacheles timidus* Fraaije, Van Bakel, Jagt & Skupien, 2013 (Pl. 2.2)

**Type locality and type level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 5 (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Remarks:** For a detailed description, reference is made to Fraaije et al. (2013).

Genus *Mesoparapylocheles* Fraaije, Klompmaker & Artal, 2012a

**Type species:** *Mesoparapylocheles michaeljacksoni* Fraaije, Klompmaker & Artal, 2012a, by original diagnosis.

*Mesoparapylocheles janetjacksonae* sp. nov. (Pl. 2.3)

**Diagnosis:** Shield well calcified, longer than wide, well areolated; globose massectic region; prominent triangular rostrum; triangular postocular spines. Gastric region of arrowhead shape, pointing posteriorly. Distinct and complete U-shaped branchiocardiaca groove, parallel to V-shaped cervical groove.

**Derivation of name:** Named after Janet (Damita Jo) Jackson, well-known American singer, songwriter, actress, dancer and sister of the late Michael Jackson after whom the first member of this genus was named.

**Type material:** The holotype, and sole specimen known to date (MAB k.3623a, b), is a near-complete carapace of a maximum carapace length, as preserved, of 5.0 mm; the maximum shield width is 3.5 mm.

**Type locality and type level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 7; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Description:** Well-calcified, smooth, areolated shield, subcylindrical transversely, slightly convex longitudinally; pronounced, slightly downarched triangular rostrum, base wider than long, slender spinose tip; ocular-frontal area exceeding half of total maximum width; orbital cavity subcircular, bounded by distinct triangular postocular spines; thin, central gastric groove centrally indenting convex postfrontal ridge; gastric region of arrowhead shape, pointing posteriorly with a pair of gastric pits close to keraial region; elongated keraial region with straight lateral margin; prominent, reniform, globose massectic region; cardiac region anteriorly not delineated; elongated mesobranchial region with deep incision centrally running parallel to cervical groove; distinct U-shaped branchiocardiaca groove, parallel to deep, V-shaped cervical groove.

**Remarks:** *Mesoparapylocheles janetjacksonae* sp. nov. differs from all other Jurassic paguroids in the combination of an elongated keraial region with a straight, rather than convex, lateral margin; a narrower reniform, rather than broader, trapezoidal, massectic region, as well as a very convex postfrontal ridge. The new species differs from the mid-Cretaceous *M. michaeljacksoni* in having elongated keraial and massectic regions (rather than globose ones) and a cardiac region that is not posteriorly delineated as in *M. michaeljacksoni*.

Family Pilgrimchelidae Fraaije, 2014
Genus *Masticacheles* Fraaije, Krzemiński, Van Bakel, Krzemińska & Jagt, 2014

**Type species:** *Masticacheles longirostris* Fraaije, Krzemiński, Van Bakel, Krzemińska & Jagt, 2014, by original diagnosis.

*Masticacheles septemgradus* sp. nov. (Pl. 2.4)

**Diagnosis:** Shield well calcified, well areolated, with distinct regions; convex orbital cav-
1 - Protopagurus cerebellum sp. nov., original (right), composite (left);
2 - Housacheles timidus Fraaije, Van Bakel, Jagt & Skupien, 2013;
3 - Mesoparapylocheles janetjacksonae sp. nov.;
4 - Masticacheles septemgradu sp. nov.;
5 - Ammopylocheles mclaughlinae Van Bakel, Fraaije, Jagt & Artal, 2008, original (left), composite (right);
6 - Ammopylocheles romankijoki n. sp.; all scale bars 2 mm.
ity with sharp postocellar projection, convex post-rostral ridge centrally indented by long central groove; anterior part of gastric region crenulated; large, elongated massetic region; crescent keraial region; narrow anterior branchial area.

**Derivation of name:** Named after ‘Level 7’ at Kotouč quarry (see e.g., Vašíček & Skupien, 2019, fig. 3); Latin *septem* and *gradu*, noun used in apposition.

**Type material:** The holotype, and sole specimen known to date (MAB k.3757), is an incomplete shield of a maximum carapace length, as preserved, of 2.5 mm; the maximum shield width is 2.5 mm.

**Type locality and type level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 7; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Description:** Well-calciﬁed and clearly areolated shield, convex transversely, slightly convex longitudinally; convex orbital cavity bordered with sharp postocellar projection; ocular-frontal area equalling about 60 per cent of total maximum width; convex post-rostral ridge centrally indented by long central groove; anterior part of gastric region crenulated; prominent, globose and elongated massetic region; crescent keraial region laterally convex with its anterior tip centrally/forwardly directed; relatively narrow anterior branchial area; rostrum and posterior part of carapace not preserved.

**Remarks:** Until now, the family Pilgrimchelidae appeared to be conﬁned to the Jurassic, to be replaced subsequently by, for instance, annuntidiogenids. *Masticacheles septemgradu* sp. nov. can be differentiated from congeners by the typical crescentic morphology of the keraial region, with its anterior tip directed centrally/forwardly rather than laterally/forwardly, as well as a narrower anterior branchial area.

**Family Pylochelidae Bate, 1888**

**Subfamily Trizochelinae Forest, 1987**

**Genus Ammopylocheles Van Bakel, Fraaije, Jagt & Artal, 2008**

**Type species:** *Ammopylocheles mclaughlinae* Van Bakel, Fraaije, Jagt & Artal, 2008, by original designation.

**Included species:** *Ammopylocheles mclaughlinae*, *Am. petersi* Fraaije, 2014, *Am. robertboreki* Fraaije, Krzemiński, Van Bakel, Krzemińska & Jagt, 2012b and *Am. romankijoki* sp. nov.

**Ammopylocheles mclaughlinae** Van Bakel, Fraaije, Jagt & Artal, 2008 (Pl. 2.5)

**Locality and level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 8; upper Tithonian (see Vašíček & Skupien, 2019, p. 39, fig. 3).

**Material:** The specimen (MAB k.3760) is an incomplete shield with part of the posterior carapace; as preserved, maximum carapace length measures 7.0 mm, maximum shield width is 5.5 mm.

**Remarks:** For a detailed description, reference is made to Van Bakel et al. (2008). Members of the genus *Ammopylocheles* range from the middle Oxfordian (Fraaije et al., 2012b) to the lower Berriasian (the present study). *Ammopylocheles mclaughlinae* is by far the commonest element in Kimmeridgian deposits at Nusplingen (Fraaije, 2014) and at Geisingen (Van Bakel et al., 2008) in southern Germany, but it is rather uncommon to rare at Ernstbrunn (Austria). The same appears to hold true for Štramberk.

**Ammopylocheles romankijoki** n. sp. (Pl. 2.6)

**Diagnosis:** Typical smooth carapace of pylochelid; carapace longer than broad, shield of equal width and length; broad rostrum and convex, rimmed orbital cavity; pronounced postfrontal ridge, centrally indented by deep, short central gastric groove; elongated massetic region; reniform keraial region, distinct V-shaped cervical groove.

**Derivation of name:** Named after Roman Ki- jok (Poland), who collected the specimen and kindly donated it to the Oertijdmuseum, Boxtel.

**Type material:** The holotype, and sole specimen known to date (MAB k.3758), is a near-complete shield with part of the posterior carapace, measuring 10.0 mm in maximum total length and 7.0 mm in width.

**Type locality and type level:** Kotouč quarry (Štramberk, Moravia, Czech Republic), level 5; lower Berriasian (see Vašíček & Skupien, 2019, p. 39, fig. 3, locality 10; Vaňková et al., 2019, section B, layer B22).

**Description:** Carapace longer than broad, shield as wide as long, strongly convex in transverse section, slightly convex in longitudinal section; broad rostrum posteriorly extending into pronounced central ridge, effacing towards central gastric groove; broad and convex, rimmed orbital cavity; postantennal projections obtuse;
transverse, convex, post-rostral ridge, with few large pores, medially subdivided by a short, deep, central gastric groove; elongated, more or less oval massetic region; subrounded keralial region not well delineated, about one third size of massetic region; deep V-shaped cervical groove, posterior part of carapace less well calcified (partially preserved), smooth with irregularly distributed large (setal) pores.

**Remarks:** This new species, of early Berriasian age, is the youngest member of the genus. It differs from its middle Oxfordian congener *A. robertboreki* in having a larger, wider rostrum, a shorter central gastric groove and a more clearly V-shaped cervical groove. *Ammopylocheles romankijoki* sp. nov. differs from *A. mclaughlinae* in having a much larger massetic region, a wider and more pronounced rostrum and a more angular V-shaped cervical groove. The new species differs from *Am. petersi* in having a much smaller and more subrounded keralial region, in lacking ornament on the anterior and posterior gastric regions and in having a more angular V-shaped cervical groove.

**Acknowledgements**

We wish to thank Dr Ewa Krzemińska (Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland) for bringing the specimen collected by Roman Kijok to our attention, Roman himself for kindly donating it to the Oertijdmuseum, Boxtel, and Yvonne Coole for collecting and donating the new species of *Masticacheles*. We are very grateful to the management of Kotouč quarry for access to all levels in their quarry over recent years and the journal reviewers, Rok Gašparič (Ljubljana) and Guenter Schweigert (Stuttgart), for pertinent comments on an earlier version of the typescript.

**References**

Bate, C. S. 1888: Report on the Crustacea Macrura collected by the H.M.S. Challenger during the years 1873–1876. In: Report on the scientific results of the voyage of H.M.S. Challenger during the years 1873-76, Zoology 24: 1–942.

Forest, J. 1987: Les Pylochelidae ou «Pagures symétriques» (Crustacea Coenobitoidea). In: Crosnier, A. (ed.): Résultats des Campagnes MUSORSTOM, Volume 3. Mémoires du Muséum national d’Histoire naturelle, Série A137: 1–254.

Fraaije, R. H. B. 2014: Diverse Late Jurassic anomuran assemblages from the Swabian Alb and evolutionary history of paguroids based on carapace morphology. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 273: 121–145.

Fraaije, R. H. B., Klompmaker, A. A. & Artal, P. 2012a: New species, genera and a family of hermit crabs (Crustacea, Anomura, Paguroidea) from a mid-Cretaceous reef of Navarra, northern Spain. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 263: 85–92.

Fraaije, R. H. B., Krzemiński, W., Van Bakel, B. W. M., Krzemińska, E. & Jagt, J. W. M. 2012b: The earliest record of pylochelid hermit crabs from the Late Jurassic of southern Poland, with notes on paguroid carapace terminology. Acta Palaeontologica Polonica, 57: 647–654.

Fraaije, R. H. B., Krzemiński, W., Van Bakel, B. W. M., Krzemińska, E. & Jagt, J. W. M. 2012c: The earliest record of a diogenid hermit crab from the Late Jurassic of the southern Polish Uplands, with notes on paguroid carapace terminology. Acta Palaeontologica Polonica, 57: 655–660.

Fraaije, R. H. B., Krzemiński, W., Van Bakel, B. W. M., Krzemińska, E. & Jagt, J. W. M. 2014: New Late Jurassic symmetrical hermit crabs from the southern Polish Uplands and early paguroid diversification. Acta Palaeontologica Polonica, 59: 681–688. https://doi.org/10.4202/app.2012.0022

Fraaije, R. H. B., Van Bakel, B. W. M. & Jagt, J. W. M. 2017: A new paguroid from the type Maastrichtian (Upper Cretaceous, the Netherlands) and erection of a new family. Bulletin de la Société géologique de France, 188/3. https://doi.org/10.1051/bsgf/2017185.

Fraaije, R. H. B., Van Bakel, B. W. M., Jagt, J. W. M. & Artal, P. 2008: New decapod crustaceans (Anomura, Brachyura) from mid-Cretaceous reefal deposits at Monte Orobe (Navarra, northern Spain), and comments on related type-Maastrichtian material. In: Steurbaut, E., Jagt, J. W. M. & Jagt-Yazykova, E. A. (eds.): Annie V. Dhondt Memorial Volume. Bulletin de l’Institut royal des Sciences naturelles de Belgique, Sciences de la Terre 78: 193–208.

Fraaije, R. H. B., Van Bakel, B. W. M., Jagt, J. W. M., Klompmaker, A. A. & Artal, P. 2009: A new hermit crab (Crustacea, Anomura, Paguroidea) from the mid-Cretaceous of Navarra, northern Spain. Boletín de la Sociedad Geológica Mexicana, 61/2: 211–214.
Fraaije, R. H. B., Van Bakel, B. W. M., Jagt, J. W. M. & Skupien, P. 2013: First record of paguroid anomurans (Crustacea) from the Tithonian-lower Berriasian of Štramberk, Moravia (Czech Republic). Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 269/3: 251–259. https://doi.org/10.1127/0077-7749/2013/0348.

Fraaije, R. H. B., Robins, C., Van Bakel, B. W. M., Jagt, J. W. M. & Bachmayer, F. 2019: Paguroid anomurans from the Tithonian Ernstbrunn Limestone, Austria – the most diverse extinct paguroid assemblage on record. Annalen des Naturhistorischen Museums in Wien, 121: 257–289.

Gašparič, R., Fraaije, R. H. B., Van Bakel, B. W. M., Jagt, J. W. M. & Skupien, P. 2015: Mesozoic–Cenozoic crustaceans preserved within echinoid tests and bivalve shells. Bulletin of Geosciences, 90/3: 601–611.

Houša, V. & Vašíček, Z. 2005: Ammonoidea of the Lower Cretaceous deposits (Late Berriasian, Valanginian, Early Hauterivian) from Štramberk, Czech Republic. GeoLines, 18 (for 2004): 7–57.

Krzemińska, E., Krzemiński, W., Fraaije, R. H. B., Van Bakel, B. W. M. & Jagt, J. W. M. 2015: Allometric ontogenetic changes in two Late Jurassic gastrodorid hermit crabs (Crustacea, Decapoda, Anomura) from central Europe. Journal of Systematic Palaeontology, 14/2: 139–148. https://doi.org/10.1080/14772019.2015.1018968.

Latreille, P. A. 1802–1803: Histoire naturelle, générale et particulièe, des Crustacés et des Insectes 3. F. Dufart, Paris: 1–467.

Meyer, H. von. 1864: Briefliche Mittheilungen an Prof. H. B. Geinitz. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, 1864: 206–211.

Milne Edwards, H. 1832: Extrait d’une lettre sur les caractères des Crustacés Anomures, adressée à M. Audouin. Annales des Sciences naturelles, Zoologie et Biologie Animale, 26: 255–256.

Moericke, W. 1889: Die Crustaceen der Stramberger Schichten. Palaeontologische Mitteilungen aus dem Museum des königlich Bayerischen Staates, 3: 43–72.

Ortmann, A. E. 1892: Die Decapoden-Krebse des Strassburger Museums, mit besonderer Berücksichtigung der von Herrn Dr. Döderlein bei Japan und bei den Liu-Kiu-Inseln gesammelten und zur Zeit im Strassburger Museum aufbewahrten Formen, IV. Theil. Die Abtheilungen Galatheidea und Paguridea. Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere, 6: 241–325.

Van Bakel, B. W. M., Fraaije, R. H. B., Jagt, J. W. M. & Artal, P. 2008: An unexpected diversity of Late Jurassic hermit crabs (Crustacea, Decapoda, Anomura) in Central Europe. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 250: 137–156.

Vaňková, L., Elbra, T., Pruner, P., Vašíček, Z., Skupien, P., Reháková, D., Schnabl, P., Košťák, M., Švábenická, L., Svobodová, A., Bubík, M., Mazuch, M., Čížková, K., & Kdýr, Š. 2019: Integrated stratigraphy and palaeoenvironment of the Berriasian peri-reefal limestones at Štramberk (Outer Western Carpathians, Czech Republic). Palaeoecology, Palaeoclimatology, Palaeogeography, 532: 109256. https://doi.org/10.1016/j.palaeo.2019.109256.

Vašíček, Z. & Skupien, P. 2004: Historie geologických a paleontologických výzkumů svrchnojuřských a spodnokřídových sedimentů na Štramberku [The Štramberk fossil site (uppermost Jurassic/Lower Cretaceous, outer Western Carpathians, Czech Republic) – two centuries of the geological and paleontological research]. Sborník vědeckých prací Vysoké školy báňské, Technické univerzity Ostrava Řada hornicko-geologická, 50: 83–102.

Vašíček, Z. & Skupien, P. 2005: Doplňky k historii geologických a paleontologických výzkumů na Štramberku [Supplements to history of geological and paleontological research of Štramberk territory]. Sborník vědeckých prací Vysoké školy báňské Technické univerzity Ostrava, Řada hornicko-geologická, 51: 1–6.

Vašíček, Z. & Skupien, P. 2019: New Tithonian and Lower Berriasian aptychi of Štramberk Limestone from the Kotouč Quarry (Outer Western Carpathians, Czech Republic). Paläontologische Zeitschrift, 93: 37–48.

Vašíček, Z., Skupien, P. & Jagt, J. W. M. 2018: Current knowledge of ammonite assemblages from the Štramberk Limestone (Tithonian-Lower Berriasian) at Kotouč Quarry, Outer Western Carpathians (Czech Republic). Cretaceous Research, 90: 185–203.