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BARNACLES (CRUSTACEA, CIRRIPEDIA, THORACICA) FROM THE BOHEMIAN CRETACEOUS BASIN DESCRIBED BY FRITSCH AND KAFKA (1887), WITH THE EXCLUSION OF THE FAMILY STRAMENTIDAE

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Abstract. The original types of seven cirripede taxa recorded between 1885 and 1887 by J. Kafka and A. Fritsch et J. Kafka are redescribed and reillustrated. These stalked (scalpellomorph) and sessile (brachylepadomorph) species include '*Scillaelepas*' *conica* (Reuss, 1844), *Titanolepas tuberculata* (Darwin, 1851), *Cretiscalpellum glabrum* (Roemer, 1841), *Cretiscalpellum striatum* (Darwin, 1851), *Arcoscalpellum angustatum* (Geinitz, 1843), *Arcoscalpellum maximum* (J. de C. Sowerby, 1829) and *Brachylepas fallax* (Darwin, 1851). Information on the palaeoecology and taphonomy of these cirripedes in the Bohemian Cretaceous Basin (the Czech Republic) has been added.

■ Scalpellomorpha, Brachylepadomorpha, Cretaceous, taxonomy

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Introduction

The first cirripedes to be recorded from the Bohemian Cretaceous Basin (BCB) in the Czech Republic are those recorded by Reuss (1844, 1845–1846, 1864), all were from the Ohře area of the basin. Later, both Kafka (1885) and Fritsch and Kafka (1887) provided detailed accounts of cirripedes from the same area, referring also to work by Darwin (1851, 1854), Reuss (1864) and Geinitz (1843, 1845, 1875a,b). A few decades later, Withers (1935) presented a modern revision of all Cretaceous cirripedes from Europe and elsewhere; he also studied and, in part, illustrated material recorded by authors such as A. Frič (Fritsch), J. Perner and J. Šulc. Withers (1935) examined material from the following Czech localities: Kaňk, Kamajka, Na Vinici, Kučlín u Bíliny, Koštice, Duchcov, Bílá Hora, Holice, Lhota Úhřetická and Choceň, recording eleven species of cirripede, inclusive of two stramentids, *viz*. (in original nomenclature): *Zeugmatolepas cretae* (Steenstrup, 1837), *Calantica* (*Scillaelepas*) *conica* (Reuss, 1844), *Calantica* (*Titanolepas*) *tuberculata* (Darwin, 1851), *Cretiscalpellum glabrum* (Roemer, 1841), *Cretiscalpellum striatum* (Darwin, 1851), *Scalpellum* (*Arcoscalpellum*) *angustatum* (Geinitz, 1850), *Scalpellum* (*Arcoscalpellum*) *maximum* (J. de C. Sowerby, 1829), *Loriculina laevissima* (von Zittel, 1884), *Stramentum pulchellum* (G. B. Sowerby, jun., 1843), *Proverruca vinculum* Withers, 1914 and *Brachylepas fallax* (Darwin, 1851). Of these, *Z. cretae* is housed in the collections of the Natural History Museum (Department of Palaeontology, London); *P. vinculum* was in the J. Šulc Collection, but has been lost. The most recent papers on dissociated cirripede valves from the BCB are those by Kočí and Kočová Veselská (2012, 2013) and Kočová Veselská *et al*. (in prep.).

Here we revise and reillustrate material first recorded by Kafka (1885) and Fritsch and Kafka (1887), and add notes on the palaeoecology and taphonomy of cirripedes from the BCB. Table 1 lists all cirripede taxa described by those authors, their status and their current names.

Interestingly, most illustrations of cirripedes provided by Kafka (1885) and Fritsch and Kafka (1887) are the same, the majority being idealised (e.g., *Brachylepas fallax*). Fortunately, figures of some species, such as *Cretiscalpellum striatum* and *Arcoscalpellum maximum*, match actual specimens.

Systematic palaeontology

With a few exceptions,the taxonomic assignments below mostly follow Withers (1935), Newman *et al*. (1969), Babinot *et al*. (1979), Buckeridge (1983), Viaud *et al*. (1983), Zullo and Sohl (1985), Jagt and Collins (1989, 1999), Collins and Jagt (1999) and Carriol and Collins (2000, 2002).

Table 1. Cirripede taxa recorded by Fritsch and Kafka (1887), indicating page numbers and illustrations; current names are shown in bold.

Pollicipes conicus Reuss (p. 11, fig. 21)	**'*Scillaelepas*' *conica* (Reuss)**
Scalpellum tuberculatum Darwin (p.6, fig. 9)	***Titanolepas tuberculata* (Darwin)**
Scalpellum nitens Kafka (p. 7, fig. 11)	***Cretiscalpellum glabrum* (Roemer)**
Pollicipes glaber Roemer (p. 8, fig. 13)	***Cretiscalpellum glabrum* (Roemer)**
Pollicipes bronnii Roemer (p. 9, fig. 14)	***Cretiscalpellum glabrum* (Roemer)**
Pollicipes cuspidatus Kafka (p. 11, fig. 18)	***Cretiscalpellum glabrum* (Roemer)**
Pollicipes unguis Sowerby (p. 12)	***Cretiscalpellum glabrum* (Roemer)**
Pollicipes costatus Kafka (p. 9, fig. 15)	***Cretiscalpellum striatum* (Darwin)**
Pollicipes košticensis Kafka (p. 11, fig. 19)	***Cretiscalpellum striatum* (Darwin)**
Pollicipes striatus Darwin (p. 9, fig. 16)	***Cretiscalpellum striatum* (Darwin)**
Scalpellum quadratum Darwin (p. 5, fig. 3)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum quadricarinatum Reuss (p. 5, fig. 4)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum kamajkense Kafka (p. 5, fig. 5)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum fossula Darwin (p. 5, fig. 6)	***Arcoscalpellum angustatum* (Geinitz).**
Scalpellum maximum (Sowerby) (p. 6, fig. 7)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum angustum Dixon (p. 6, fig. 8)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum crassum Kafka (p. 7, fig. 10)	***Arcoscalpellum angustatum* (Geinitz)**
Pollicipes elongatus Steenstrup (p. 11, fig. 20)	***Arcoscalpellum angustatum* (Geinitz)**
Scalpellum maximum var. *bohemica* Kafka (p. 6)	***A. maximum* (J. de C. Sowerby)**
Scalpellum maximum J. de C. Sowerby (p. 6, fig. 7)	***A. maximum* (J. de C. Sowerby)**
Pollicipes fallax Darwin (p. 10, fig. 17)	***Brachylepas fallax* (Darwin)**

Subclass: **Cirripedia Burmeister, 1834**

Superorder: **Thoracica Darwin, 1854**

Order: **Scalpelliformes Buckeridge et Newman, 2006**

Family: **Calanticidae Zevina, 1978**

Genus: ***Scillaelepas* Seguenza, 1876 (*s. lat.*)**

'*Scillaelepas*' *conica* (Reuss, 1844)

Pl. 1, figs 1–9

*1844 *Pollicipes conicus* Reuss, p. 216.
1887 *Pollicipes conicus* Reuss: Fritsch and Kafka, p. 11, fig. 21.
1889 *Pollicipes conicus* Reuss: Fritsch, p. 95, text-fig. 119.
1911 *Pollicipes conicus* Reuss: Frič, p. 69.
1935 *Calantica* (*Scillaelepas*) *conica* (Reuss): Withers, p. 120, pl. 8, figs. 1–7 (with synonymy).

Material. Studied specimens from the locality of Kaňk, sold by Fritsch in 1897, and deposited in the collections of the Natural History Museum (London) comprise five scuta (NHM In. 16739-40, In. 16742-45, one carina (NHM In. 16746), one rostrum (NHM In. 16747) and four terga (NHM In. 16753-56). In addition, we also examined all material which is deposited in NHM (London) which consists of a total of 84 plates sold by Fritsch (coll. numbers are mentioned by Withers (1935, pp. 120–122)). Unfortunately, the collections of the National Museum (Prague) do not contain any material from Fritsch and Kafka's (1887) original collection.

Description. For a full description, please refer to Withers (1935, pp. 120–122).

Remarks. In his account of the 'Teplitzer Schichten' (= current Teplice Formation), Fritsch (1889) used Reuss's type specimen (1844, p. 216) from Sauerbrunnberg bei Bilina (= Kyselka u Bíliny). Fritsch and Kafka (1887) recorded the present species from the 'Priesener Schichten' (= current Březno Formation) from the locality of Luschitz, while Frič (1911) merely noted a single occurrence from Cenomanian strata (current Korycany Member) at Bílina and Kyselka u Bíliny, but did not provide an illustration. From the locality Kaňk – Na Vrších more than 500 articulated capitular plates were recently obtained from fieldwork during 2014 (T. K. and M. K. V.) and the new material pertaining to this species has recently been studied (Kočí, Kočová Veselská, Buckeridge, Jagt, Collins, Gale *in prep*.). It is probable that this new material represents a new genus (Gale, personal communication) and species based on the study of the holotype (T. K. and M. K. V., August 2014) which is deposited in NHMW in Vienna.

Occurrence (BCB). Upper Cenomanian (Kaňk); upper Turonian (Kyselka u Bílliny, Lužice; Březno Formation).

Overall range. Upper Cenomanian to ? Upper Turonian (or ? Coniacian; Březno Formation).

Genus: ***Titanolepas* Withers, 1913**

***Titanolepas tuberculata* (Darwin, 1851)**

Pl. 2, fig. 1

*1851 *Scalpellum tuberculatum* Darwin, p. 43, pl. 1, fig. 10.
1887 *Scalpellum tuberculatum* Darwin: Fritsch and Kafka, p. 6, fig. 9.
1935 *Calantica* (*Titanolepas*) *tuberculata* (Darwin); Withers, p. 130, pl. 11, figs. 1–10; pl. 12, figs. 1–3.

M a t e r i a l. A single, rather poorly preserved tergum from Kamajka (National Museum, NM O3407), Kafka's original (1885, p. 14, pl. 1, fig. 7; see also Fritsch and Kafka, 1887, p. 6, fig. 9).

D e s c r i p t i o n. Tergum diamond shaped, elongated; apicobasal ridge almost straight, prominent, thickening towards acute basal angle; conspicuous ornamentation, longitudinal ridges crossed by transverse ridges, creating short, blunt spines.

R e m a r k s. *Titanolepas tuberculata* can be differentiated from the younger *T. subtuberculata* (Withers, 1935) by its straight apicobasal ridge, the latter having a sigmoidally curved apicobasal ridge on the tergum. In addition, the coarse, close-set ridges are fewer and finer. *Titanolepas martini* (Withers, 1926), from the Late Cretaceous Niobrara Group, has a subrhomboidal tergum and lacks the blunt spines on the valve surface.

O c c u r r e n c e (B C B). Kamajka. Withers (1935) also listed this species from the upper Turonian of Na Vinici, northeast of Kolín, a locality now defunct, on the basis of the J. Šulc Collection held at the Natural History Museum (London). This lot comprises six carinae, five scuta, six terga and two lower latera. The remainder of this collection was lost during the turmoil of the Second World War. Unfortunately, the original locality is lost so we cannot determine whether a nearshore or pelagic facies was once exposed; the age has recently been documented as Middle Turonian (Zelenka *et al*. 2011).

O v e r a l l r a n g e. Cenomanian to Upper Turonian.

Genus: ***Cretiscalpellum* Withers, 1922**

***Cretiscalpellum glabrum* (Roemer, 1841)**

Pl. 2, fig. 2

*1841 *Pollicipes glaber* Roemer, p. 104, pl. 16, fig. 11a-c.
1887 *Scalpellum nitens* Kafka.: Fritsch and Kafka, p. 7, fig. 11a, b.
1887 *Pollicipes glaber* Roemer: Fritsch and Kafka, p. 8, fig. 13.
1887 *Pollicipes Bronnii* Roemer: Fritsch and Kafka, p. 9, fig. 14a-c.
1887 *Pollicipes fallax* Darwin: Fritsch and Kafka, p. 10, fig. 17 (*partim*).
1887 *Pollicipes cuspidatus* Kafka: Fritsch and Kafka, p. 11, fig. 18.
1887 *Pollicipes unguis* Sowerby: Fritsch and Kafka, p. 12.
1889 *Pollicipes glaber* Roemer: Fritsch, p. 95, fig. 117.
1887 *Pollicipes bronni* Roemer: Fritsch, p. 95, fig. 118.
1893 *Pollicipes glaber* Roemer: Fritsch, p. 109.
1897 *Pollicipes glaber* Roemer: Fritsch, p. 70.
1935 *Cretiscalpellum glabrum* (F. A. Roemer): Withers, p. 161, pl. 15, figs. 8–17; pl. 16, figs. 1–10; pl. 17, figs. 1–21; pl. 18, figs. 1–5.

M a t e r i a l. The original carina collected by Fritsch and Kafka (1887, fig. 13), from Koštice, NM O4375 (no. 6532) in the collections of the National Museum (Prague); it measures 14.6 mm in length and 6.3 mm in basal width. *Pollicipes* sp./*Scalpellum* Frič A.,- carina and two fragments of a left tergum from Měcholupy railway station - this material was collected by Antonín Frič in 1901, unpublished data., and deposited in collection of NM, without an inventary number.

D e s c r i p t i o n. Carina with broken apex, lacking parietes and intraparietes; median ridge distinct; lateral margins slightly rounded inwards; surface of carina apparently smooth, but at higher magnification distinct sharp lines parallel to basal margin become visible.

R e m a r k s. The present species bears the closest resemblance to *C. striatum*, the carina of which has a stronger apicobasal ridge than other longitudinal lines and strongly developed transverse lines. The carina of *C. bronni* (Roemer, 1841), from the Cenomanian of Germany and northwest France, has no transverse lines and the apicobasal keel is less prominent, while that of *C. unguis* (J. de C. Sowerby, 1829), from the Albian of England and France, is wider, has slightly rounded parietes and the most strongly developed transverse lines within the genus *Cretiscalpellum*. The early Campanian *C. obtusum* Jagt et Collins, 1999 has a trapezoidal scutum that is more convex than that of *C. glabrum*.

O c c u r r e n c e (B C B). Upper Cenomanian (Velim, Přemyšlany [Přemyšlení is now part of the hamlet of Zdiby near Prague), Černovičky; Lower Turonian (Velim, Kamajka, Turkaňk, Karlov, Odolena Voda, Běstvina u Ronova nad Doubravou, Chrtníky); Middle Turonian (Semice, Bousov, Všetaty, Mikulovice near Pardubice); Upper Turonian (Koštice, Úpohlavy, Čížkovice, Želenice near Bílina, Kostomlaty, Radim u Luže, Teplice, Kystrá, Měcholupy); Upper Turonian – Lower Coniacian (Lužice, Lány na Důlku near Pardubice, Úhřetická Lhota); Lower – Middle Coniacian (Litomyšl).

O v e r a l l r a n g e. Upper Albian – Upper Maastrichtian.

***Cretiscalpellum striatum* (Darwin, 1851)**

Pl. 2, fig. 3

*1851 *Pollicipes striatus* Darwin, p. 70, pl. 4, fig. 5a-c.
1887 *Pollicipes costatus* Kafka: Fritsch and Kafka, p. 9, fig. 15.
1887 *Pollicipes striatus* Darwin: Fritsch and Kafka, p. 9, fig. 16.
1887 *Pollicipes košticensis* Kafka: Fritsch and Kafka, p. 11, fig. 19.
1889 *Pollicipes košticensis* Kafka: Fritsch, p. 95, fig. 116.
1935 *Cretiscalpellum striatum* (Darwin): Withers, p. 183, pl. 20, figs. 1–5, 15-21; pls. 21, 22.

M a t e r i a l. NM O4027 (no. 6531), the original tergum described by Kafka (1889, pl. 2, fig. 4).

D e s c r i p t i o n. Tergum elongated, irregularly rhomboidal; apical umbo acute; apicobasal ridge distinct and sharply rounded; occludent margin straight; scutal margin forming angle of 50 degrees with occludent margin; longitudinal lines on carinal part of tergum clear and distinct; scutal margin formed by apicoscutal groove, ending at scutal

margin, 2 mm from occludent margin; distinct transverse lines parallel to scutal margin; inner part smooth and with distinct growth lines of carinal fold near carinal margin.

R e m a r k s. The present species has a more elongated tergum than *C. glabrum*. The main distinguishing features are the sharp longitudinal and transverse lines; these are absent in *C. glabrum*. *Cretiscalpellum paucistriatum* (Woodward, 1901) has an elongated tergum, which is much less clearly longitudinally striated (almost smooth in some cases) and with a peculiar transverse convexity, while *C. naidini* Alekseev, 2009 has a strongly convex tergum with a very thick axial portion and a wide occludent rib. The carina of *C. sharapovi* Alekseev, 2009 has a thick-set apical part which is covered by narrow ribs which are curved into the outer side.

O c c u r r e n c e (B C B). Lower Turonian (Velim, Karlov [recorded by Žítt and Nekvasilová, 1989, p. 86, as *Pollicipes costatus* Kafka], Běstvina u Ronova nad Doubravou [recorded by Žítt and Nekvasilová, 1994, p. 26, as *Pollicipes costatus* Kafka]; Upper Turonian (Koštice).

O v e r a l l r a n g e. Lower Cenomanian – Upper Maastrichtian.

Family: **Scalpellidae Pilsbry, 1916**

Subfamily: **Arcoscalpellinae Zevina, 1978**

Genus: ***Arcoscalpellum* Hoek, 1907**

***Arcoscalpellum angustatum* (Geinitz, 1843)**

Pl. 2, fig. 4

*1843 *Pollicipes angustatus* Geinitz, p. 7, pl. 4, fig. 10.
1885 *Scalpellum quadratum* Darwin: Kafka, pl. 1, fig. 1d.
1887 *Scalpellum quadratum*, Darwin: Fritsch and Kafka, p. 5, fig. 3a-d.
1887 *Scalpellum quadricarinatum* Reuss: Fritsch and Kafka, p. 5, fig. 4a-c.
1887 *Scalpellum kamajkense* Kafka: Fritsch and Kafka, p. 5, fig. 5a, b.
1887 *Scalpellum fossula* Darwin: Fritsch and Kafka, p. 5, fig. 6a, b.
1887 *Scalpellum maximum* Sowerby sp.: Fritsch and Kafka, p. 6, fig. 7c (*non* 7a, b).
1887 *Scalpellum angustum* Dixon sp.: Fritsch and Kafka, p. 6, fig. 8a-d.
1887 *Scalpellum crassum* Kafka: Fritsch and Kafka, p. 7, fig. 10.
1887 *Pollicipes elongatus* Steenstrup: Fritsch and Kafka, p. 11, fig. 20a, b.
1889 *Scalpellum angustatum* Dixon: Fritsch, pp. 95, 96, fig. 120.
1893 *Scalpellum quadratum* Darwin: Fritsch, pp. 108, 109, fig. 142.
1935 *Scalpellum* (*Arcoscalpellum*) *angustatum* (Geinitz): Withers, p. 215, pl. 25, figs. 2–20; pl. 26, fig. 1.

M a t e r i a l. A single left scutum only (NM O 4021) survives from Fritsch and Kafka's (1887) original collection; it measures 7.7 mm in length and 4 mm in basal width.

D e s c r i p t i o n. Scutum trapezoidal, elongated; cross section slightly convex; length about twice the width; occludent margin straight or slightly curved and basal margin at right angles; edge of occludent margin bending inwards; basal margin slightly concave to straight; lateral margin extending to about two-thirds of scutal height and tergal margin to one third of scutal height; apicobasal margin distinct and rounded; towards lateral and tergal margins, area of scutum slightly sloping; lateral margin convex; tergolateral angle distinct.

R e m a r k s. The present species resembles *A. fossula* (Darwin, 1851), but differs from it in the scutal construction (see also Collins in Viaud *et al*. 1983). *Arcoscalpellum lineatum* (Darwin, 1851), from the Upper Albian to ?Lower Santonian of England, France and Germany, differs in having longitudinal lines on the carinal tectum, narrower terga and wider scuta. The scutum of *A. maximum* (J. de C. Sowerby, 1829) (see below) has a less pronounced apicobasal ridge and generally shows finer transverse and longitudinal ornamentation.

O c c u r r e n c e (B C B). Upper Cenomanian (Předboj, Černovičky [recorded by Žítt *et al*., 1999, p. 112, as *Scalpellum* sp.); Lower Turonian (Velim, Kamajka, Turkaňk, Kněžívka [recorded by Žítt *et al*., 1999, as *Scalpellum crassum*], Odolena Voda [recorded by Hradecká *et al*., 1994, p. 19, as *Scalpellum crassum*], Chrtníky [recorded by Žítt *et al*., 2006, unit 7, 8f as Scalpellid gen. et sp. indet.], Běstvina u Ronova nad Doubravou [recorded as *Scalpellum* sp. by Žítt and Nekvasilová, 1994, p. 26]; Middle Turonian (Všetaty); Upper Turonian (Úpohlavy, Novosedlice, Stradouň); Upper Turonian – Lower Coniacian (Lány na Důlku near Pardubice).

O v e r a l l r a n g e. Albian – Lower Santonian.

***Arcoscalpellum maximum* (J. de C. Sowerby, 1829)**

Pl. 2, figs. 5–7

1829 *Pollicipes maximus* J. de C. Sowerby, p. 222, pl. 606, figs. 4, 6 (*non* figs. 3, 5).
1885 *Scalpellum maximum* (Sowerby): Kafka, p. 12, pl. 1, fig. Aa-c (*non* fig. 5B, C).
1886 *Scalpellum maximum*, var. *bohemica* Kafka: Kafka, p. 564, pl. 1, fig. A (*non* fig. B, C).
1887 *Scalpellum maximum*, var. *bohemica* Kafka: Fritsch and Kafka, p. 6, fig. 7a (*non* fig. 7b, c).
1893 *Scalpellum maximum* (Sowerby): Fritsch, p. 109, text-fig. 141 (incl. var. *bohemica*).
1935 *Scalpellum* (*Arcoscalpellum*) *maximum* (Sowerby): Withers, p. 239, pl. 29, figs. 2-10; pl. 30, figs. 1–12; pl. 31, figs. 1–19.

M a t e r i a l. The lectotype carina of var. *bohemicum,* NM O4022, is from Holice. Another specimen from Kunětická Hora was collected by Jan Jiljí Jahn (see Fritsch and Kafka, 1887, p. 6).

D e s c r i p t i o n. Carina with moderately to strongly convex tectum and moderately transversely arched, subcarinated and with prominent distinct narrow ridge on both sides; ridges separate tectum from parietes; parietes narrow, equalling about half tectal width, inclined outwards

and sligthly concave; intraparietes slightly wider than the entire side of the valve side, set slightly inwards; intraparietes divided from parietes by strong distinctly rounded ridge; tectum length ranging from five to three times its width and moderately bowed inwards; wall very thin and widening gradually from apex; depth of valve approximately half width of tectum; basal margin acutely angular and inner margin almost straight.

R e m a r k s. It is interesting to note that all illustrations in the papers listed above (synonymy) are the same and all repeat the incorrect identification, as outlined by Withers (1935, p. 243). *Arcoscalpellum angustatum* (see above) develops only very fine apicobasal lines on the tectum and the carina is of smaller size.

O c c u r r e n c e (B C B). Holice.

O v e r a l l r a n g e. Lower Santonian – Upper Maastrichtian.

Order: **Sessilia Lamarck, 1818**

Suborder: **Brachylepadomorpha Withers, 1923**

Genus: ***Brachylepas* Woodward, 1901**

***Brachylepas fallax* (Darwin, 1851)**

Pl. 3, figs. 1a–m, 2a–g; Pl. 4, figs. 1–8

1851 *Pollicipes fallax* Darwin, p. 75, pl. 4, fig. 8a, b.
1885 *Pollicipes fallax* Darwin: Kafka, p. 19, pl. 3, figs. 2r (*non* fig. 2l), 3a, b (*non* fig. 3sl, l′).
1887 *Pollicipes fallax* Darwin: Fritsch and Kafka, p. 10, fig. 17 (*non* l′, sl).
1893 *Pollicipes fallax* Darwin: Fritsch, p. 309.
1935 *Brachylepas fallax* (Darwin): Withers, p. 367, pl. 48, figs. 1–24.

M a t e r i a l. Specimens from Uhřetická Lhota are as follows: a right scutum (NM O4023; the original from Fritsch and Kafka, 1887, fig. 17b (s), collected by J. J. Jahn), a rostrum (NM O4024; the original from Fritsch and Kafka, 1887, fig. 17r); a right scutum (NM O4025); a left scutum (NM O4026). Lot NM O4093 comprises a right tergum and four lower latera, the originals from Fritsch and Kafka, 1887, fig. 17. Lot NM-ČL6989 (nos 387, 388, 390) represents the originals from Fritsch and Kafka (1887, fig. 17t, t, c), while lot NM-ČL6990 (no. 879) comprises a scutum, a rostrum and a carina. Specimen NM-ČL6992 (Os 292), from Choceň (Sutiny), is also the original from Kafka (1885, pl. 3, 2 r).

D e s c r i p t i o n. Carina semiconical, slightly bowed inwards, strongly convex transversely, yet not carinate; basal margin slightly concave; outer surface with a number of strong distinct flattened transverse ridges, regularly spaced; longitudinal ornamentation of very fine distinct longitudinal lines, preserved only in NM-ČL6989 (no. 390). The carina from Úhřetická Lhota measures 5.85 mm in length, while NM-ČL6989 (no. 390), which lacks the apex, measures 5 mm in length and 2.35 mm in basal width. NM-ČL6992 (Os 292), from Choceň (Sutiny), measures 5.6 mm in length and 2.6 mm in basal width. Rostrum semiconical, wider than carina, bowed inwards and strongly convex transversely; transverse ornamentation resembles that of the carina, but less pronounced. Distinct longitudinal apicobasal ridge developed. NM-ČL6990 measures *c.* 6 mm in length and *c.* 4.64 mm in basal width. Measurements (estimated because matrix partially covered) of NM O4024 are: length *c.* 4.5 mm and width *c.* 7 mm. Scutum elongated triangular in outline, moderately convex transversely. Rounded, strongly convex occludent margin with acuminate apex. Apex strongly bowed towards tergum. Tergo-lateral margin slightly concave, mainly in upper part, near apex. Edge of basilateral margin protruding sharply; basilateral angle 100° (NM O4025); basal margin almost straight. Rostral angle 130° (NM O4025). Apicobasal ridge significantly pronounced , broad and curved convexly. Broad apicobasal ridge in NM O4026 measuring 0.45 mm in width. Transverse ridges significantly pronounced, equally spaced and thickened at occludent margin, narrowing near upper part of tergal margin. Overall length of right scutum NM O4023 *c.* 5 mm, basal width 3.4 mm, that of another right scutum, NM O4025, *c.* 6.4 mm, basal width 5 mm. Left scutum (NM O4026) *c.* 5.9 mm, basal width 3.7 mm. Tergum (NM-ČL6989, no. 388) subrhomboidal in outline, moderately convex transversely with prominent broad apicobasal ridge, curved towards carino-lateral margin and concave towards occludent and scutal margin. Apex acuminate, slightly bowed inwards towards occludent margin. In upper third of valve a distinct sharp concave apico-scutal ridge, parallel to apicobasal ridge. Transverse ridges prominent and equally spaced, as in scutum. Longitudinal ornamentation consisting of very fine lines. Basal angle between lateral and scutal margin 70°. Carinal angle between lateral and carinal margin 60°. Overall length 5.95 mm.

R e m a r k s. *Brachylepas* has carinae, rostra, scuta, terga and upper latera that closely resemble those of *Pycnolepas* Withers, 1914. In fact, Withers (1914) included *B. fallax* in *Pycnolepas*. However, the latter can be differentiated by the more prominent transverse and longitudinal ridges on the carina, rostrum and upper latus, with the exception of *B. naissanti* (Hébert, 1855), which has lower L/W ratios, a semicircular basal outline and thickened inner margine (Jagt, 2007). The scutum of *Pycnolepas* is more elongate and the apex more acute. *Brachylepas naissanti* has a wide semi-conical carina and rostrum with significantly raised longitudinal ribs. The terga and scuta of *B. naissanti* have less prominent transverse sculpture than *B. fallax*. The imbricating plates of the latter lack longitudinal ribs and differ from those of *B. naissanti* in being more rounded at the apex. The longitudinal ribs of the imbricating plates of *B. fallax* are developed as furrows. *Brachylepas guascoi* (Bosquet, 1857) has a wider carina with more prominent transverse ridges, a scutum with very pronounced transverse ridges and tergum with a straight apicobasal ridge nearer the scutal margin than in *B. fallax*. More details on the relationships between species of *Brachylepas* can be found in Jagt (2007). *Brachylepas nervosa* Alekseev, 2009, from the upper Lower Maastrichtian of Crimea (Ukraine) has a straighter carina and rostrum and the ridge on the scutum divides the valve into two unequal parts. Alekseev (2009, p. 34) considered some western European records of *B. fallax* to pertain to *B. nervosa.*

Occurrence (BCB). Upper Turonian – Lower Coniacian (Úhřetická Lhota, Choceň (Sutiny).

Overall range. Upper Turonian – uppermost Maastrichtian.

Palaeoecology and palaeogeography

Stalked cirripedes are relatively common faunal elements in nearshore/shallow-water facies in the BCB, but are rare constituents of hemipelagical deposits in the area. Species lived attached to substrates in high-energy settings, near the storm wave base, an environment similar to that of representatives of the recent genus *Pollicipes* which occur on wave-exposed rocky shores and which are mostly intertidal in distribution (Fernandes *et al*., 2010).

Bathymetric records of extant members of the genus *Arcoscalpellum*, as mentioned by Pilsbry (1907), range between 46 and 5.365 m. Weisbord (1977) indicated 1.555–3.028 m. Preservation of shallow water taxa is inhibited by a higher energy environment, thus completely preserved capitula of cirripedes are rare. In nearshore/shallow-water and hemipelagic facies in the BCB, ciripedes occur exclusively as disarticulated valves, the commonest being carinae, scuta, rostra and terga. Upper latera, carinal latera and rostral latera are rare. A single exception is *Brachylepas fallax* (see Pl. 3a; NM-ČL6990, no. 879) which comprises a number of plates that probably belonged to three separate individuals. These capitular plates were not displaced after decomposition of the capitula and covered by sediment immediately afterwards as was more usual. This kind of preservation is recorded here for the first time from the BCB. For specimens with strongly connected (articulated) capitular plates to be preserved more or less intact, tranquil environments, rapid burial and absence of subsequent scavenging/burrowing would be required. With the exception of the genus *Stramentum*, cirripedes from the BCB have never been found as articulated capitula, in contrast to occurrences in the Upper Cretaceous in northwest Europe, e.g., of *Arcoscalpellum unguis*, *A. fossula*, *A. maximum*, *Zeugmatolepas mockleri*, *Brachylepas naissanti* and others (see e.g., Withers, 1935).

'*Scillaelepas*' *conica*, *Titanolepas tuberculata*, *Cretiscalpellum striatum*, *Arcoscalpellum maximum* and *Brachylepas fallax* are comparatively rare in the BCB, while *C. glabrum* and *A. angustatum* are more abundant. All of these species occur widely across Europe.

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Explanation of the plates

PLATE 1

'*Scillaelepas*' *conica* (Reuss), Kaňk, collection of the Natural History Museum, London.

1a. Scutum (external part, NHM In. 16742); **1b.** Scutum (inner part, NHM In. 16742); **2a.** Scutum (external part, NHM In. 16743); **2b.** Scutum (inner part, NHM In. 16743); **3a.** Scutum (external part, NHM In. 16744); **3b.** Scutum (inner part, NHM In. 16744); **4a.** Scutum (external part, NHM In. 16745); **4b.** Scutum (inner part, NHM In. 16745); **5a.** Scutum (external part, NHM In. 16739); **5b.** Scutum (inner part, NHM In. 16740); **6.** Tergum (external part, NHM In. 16753); **7.** Tergum (external part, NHM In. 16754); **8a.** Carina (external part, NHM In. 16746); **8b.** Carina (inner part, NHM In. 16746); **9a.** Rostrum (inner part, NHM In. 16747); **9b.** Rostrum (external part, NHM In. 16747). All scale bars equal 1 mm. Photographs by H. Taylor (Natural History Museum, London).

PLATE 2

1. *Titanolepas tuberculata* (Darwin), Kamajka (NM O3407), partial tergum. Scale bar = 0.5 mm.

2. *Cretiscalpellum glabrum* (Roemer), Koštice (NM O4375, no. 6532), carina. Scale bar = 5 mm.

3. *Cretiscalpellum striatum* (Darwin), Koštice (NM O4027), tergum. Scale bar = 1 mm.

4. *Arcoscalpellum angustatum* (Geinitz), Lány na Důlku near Pardubice (collected by Jan J. Jahn; NM O4021), left scutum. Scale bar = 5 mm.

5–7. *Arcoscalpellum maximum* var. *bohemicum* Kafka, from Holice (NM O4022), carina. Scale bar = 1 mm.

(Figs 2–7 photographed by Jan Sklenář and Martina Aubrechtová, 2014; all others by the authors)

PLATE 3

1. *Brachylepas fallax* (Darwin), figured specimen from Fritsch and Kafka (1887, p. 10, fig. 17), Úhřetická Lhota (NM-ČL6990, no. 879). Scale bar = 5 mm.

a. Carina; **b.** Right tergum; **c.** Fragmentary right scutum; **d.** Left scutum; **e.** Fragmentary indeterminate valve; **f.** Left tergum (imprint); **g.** Right tergum (imprint); **h.** Right scutum; **ch.** ?Upper latus (imprint); **i.** Right tergum; **j.** Left scutum; **k.** Fragmentary ?rostrum; **l.** Fragmentary ?left tergum.

2. *Brachylepas fallax*, (Darwin), NM O4893. Scale bar = 1 mm.

a. Fragmentary right scutum; **b.** Fragmentary scutum; **c.** Rostrum; **d.** Right scutum; **e.** Indeterminate valve (imprint).

(Fig. A photographed by Jan Sklenář, 2013; Fig. B by the authors)

PLATE 4

Brachylepas fallax (Darwin), Úhřetická Lhota.

1. Right sputum, NM O4023;
2. Rostrum and left sputum, NM O4024;
3. Left sputum, NM O4025;
4. Right sputum, NM O4026;
5. Carina, NM-ČL6989, no. 390;
6. Left tergum with crushed apex, NM-ČL6989, no. 387;
7. Carina, NM-ČL6990, no. 879;
8. Right tergum, NM- ČL6989, no. 388.

All scale bars equal 1 mm.
(Photographs by Jan Sklenář and Martina Aubrechtová, 2014)

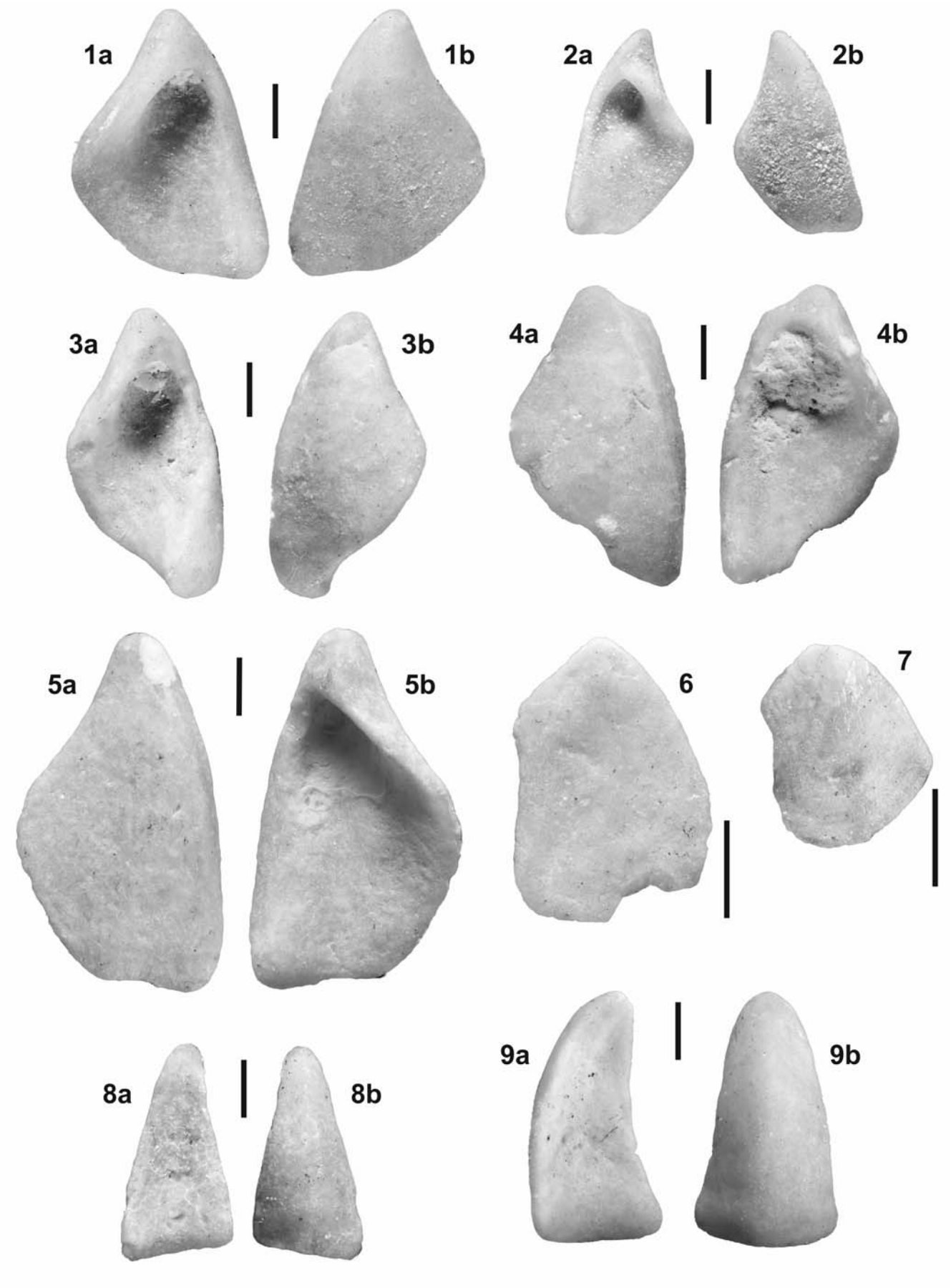
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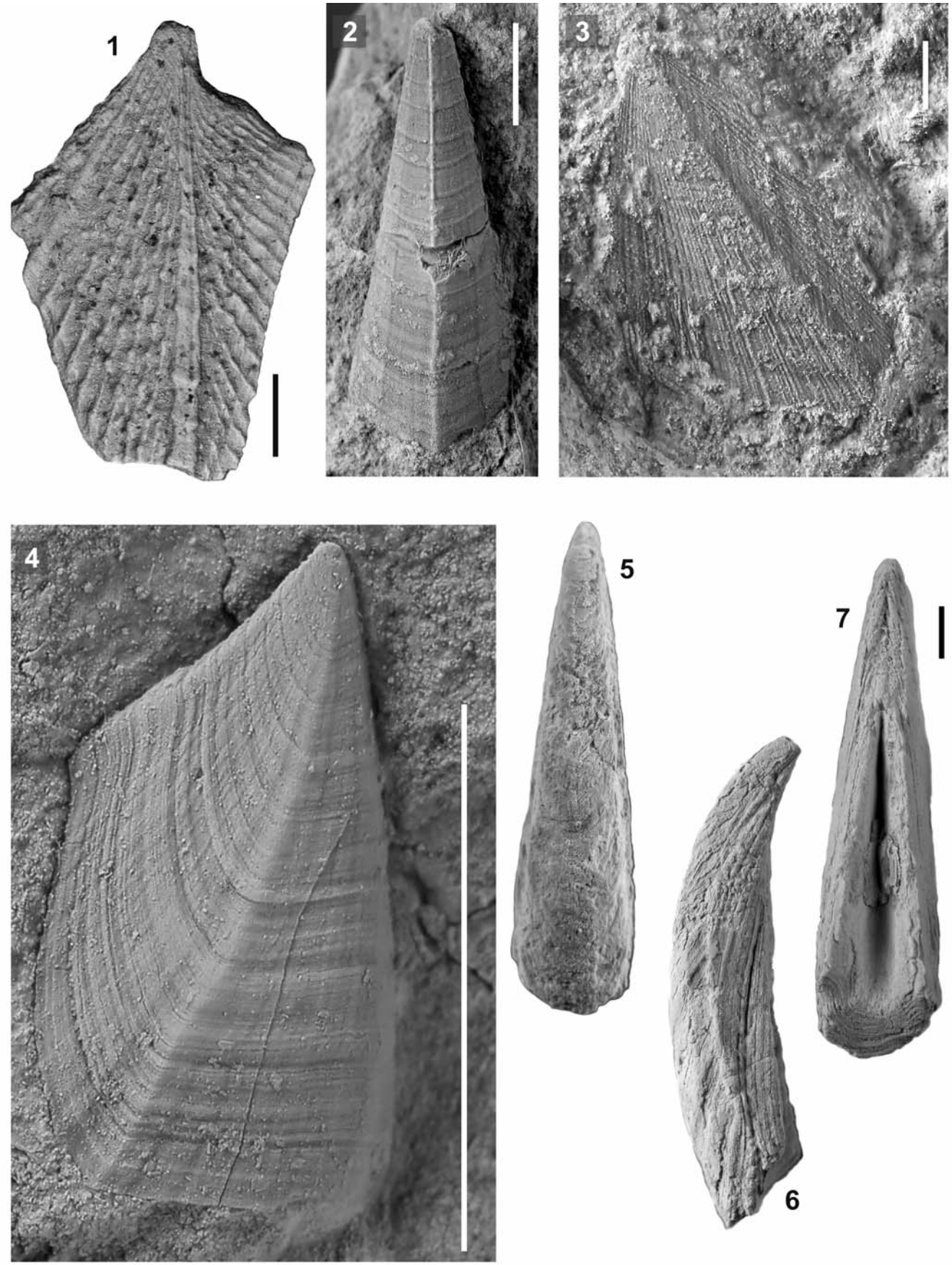
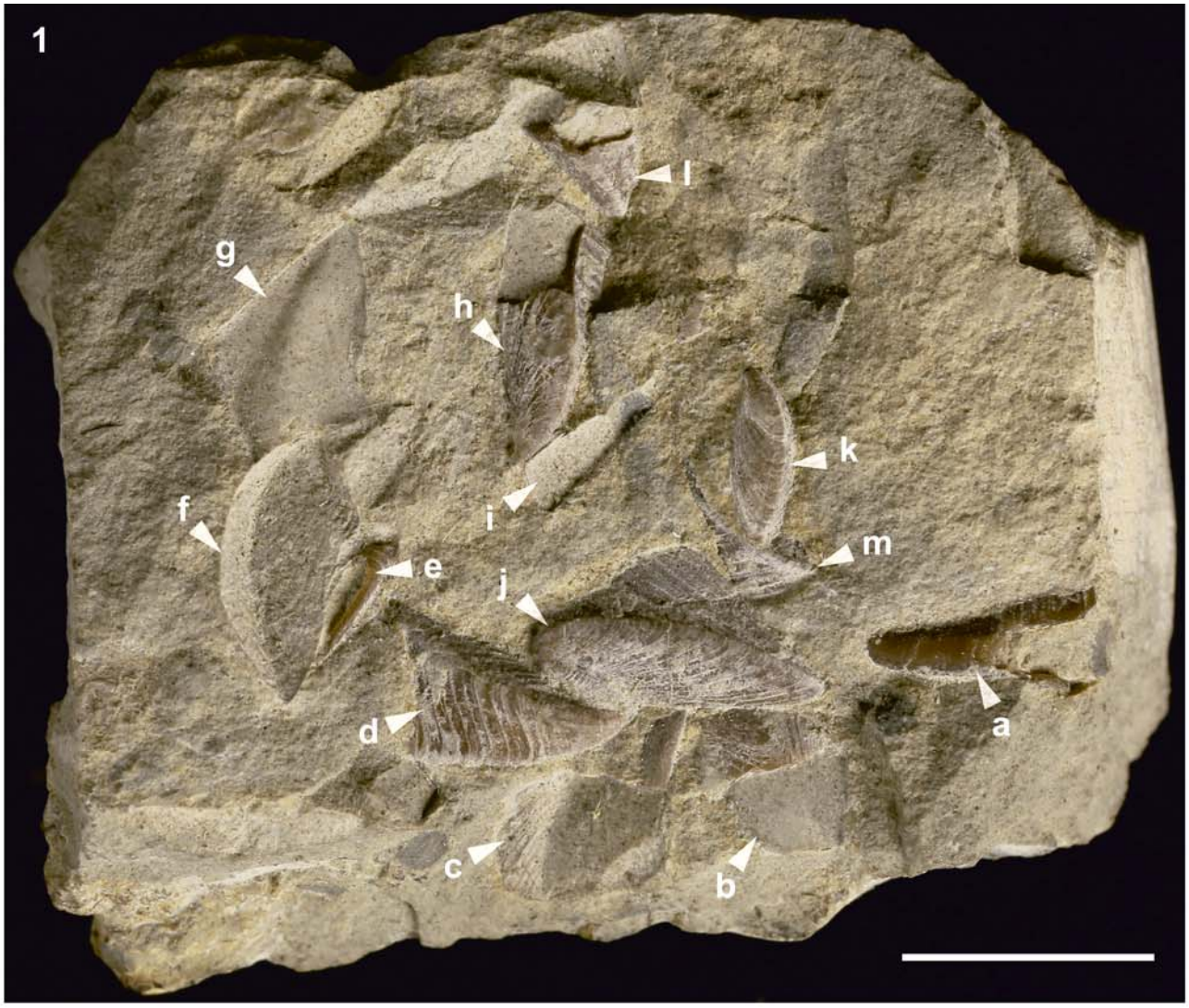
PLATE 2

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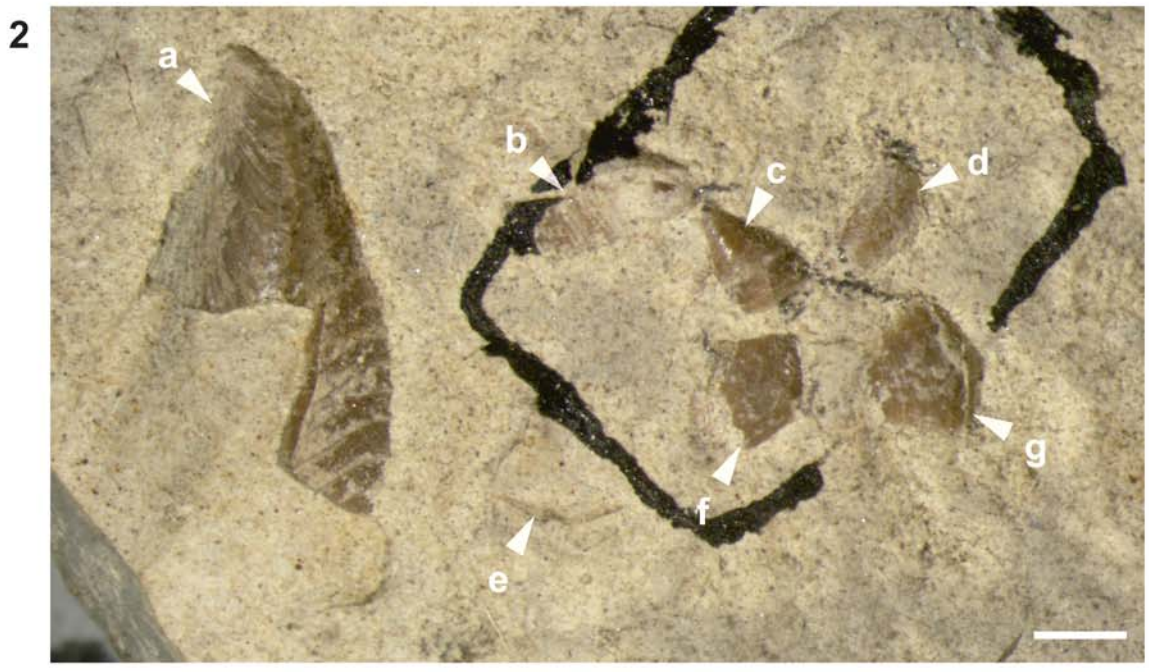
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PLATE 4