JAHRBUCH DER GEOLOGISCHEN BUNDESANSTALT

Jb. Geol. B.-A. | ISSN 0016-7800 | Band 137 | Heft 2 | S. 365–381 | Wien, November 1994

The Brachiopod Fauna of the Wetterstein Limestone of the Raxalpe (Austria)

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15 Text-Figures and 3 Plates

Niederösterreich
Nördliche Kalkalpen
Raxalpe
Wettersteinkalk
Trias
Brachiopoden

Österreichische Karte 1 : 50.000
Blatt 104

Contents

Die Brachiopodenfauna des Wettersteinkalks der Raxalpe (Österreich)

Zusammenfassung

Im Wettersteinkalk der Raxalpe stellen Brachiopoden einen signifikanten Anteil der Riffbewohner dar. Sämtliche 19 Brachiopoden-Taxa stammen aus dem Wetterstein-Riffkalk, der mit großer Wahrscheinlichkeit Cordevol-Alter aufweist. Im lagunären Wettersteinkalk scheinen Brachiopoden zu fehlen. Interessant ist der Erstnachweis von *Stolzenburgiella baloghi* außerhalb des Bereiches der Westkarpaten.

Abstract

19 taxa have been ascertained during the present study of brachiopods from the Wetterstein Limestone of Raxalpe. Brachiopods belong there to the most characteristic reef-dwellers and seem to be missing in lagoonal facies. Cordevolian age is presumed for the local brachiopod assemblages studied. *Stolzenburgiella baloghi* was ascertained on Raxalpe, known till the present time from the West Carpathians only.

1. Introduction

The finds of the macrofauna in the Wetterstein Limestone are usually not very frequent and the literary data on them are rather scarse. The brachiopod fauna coming from the Wetterstein Limestone of Raxalpe (Schneeberg nappe) has been well-known since the end of the last century, thanks to the publications by BITTNER (1891 and 1892).

This fauna – reported by BITTNER as coming from the "Korallenkalke der Raxalpe" – is significant for its relatively great number of species, most of them being new. BITTNER (1892) reported from Raxalpe the following brachiopods: *Terebratula praepunctata* m., *Terebratula euryglossa* n.sp. and var. *biplicata*, *Terebratula pleurocoela* n.sp., *Terebratula Raxana* n.sp., *Waldheimia (Aulacothyris) compressa* n.sp., *W. (A.) Zugmayeri* n.sp., *W. (A.) canaliculata* n.sp., *W. (A.) cinctella* n.sp., *Rhynchonella Seydelii* n.sp., *Rh. pumilio* n.sp., *Rh. Raxana* n.sp., *Rh. lycodon* n.sp., *Rh. vulnerata* n.sp., ?*Thecidium* (? *Thecospira*) spec. indet., *Retzia* cfr. *Schwageri* var. *fastosa* m., *Spiriferina Myrina* n. sp., *Spiriferina* 2 spec.indet., *Spiriferina orthorhyncha* n.sp., *Spirigera* cfr. *leptorhyncha* m., *Spirigera* cfr. *Wissmani* MÜNST. spec., *Spirigera dyactis* n.sp., *Amphiclina* spec.indet. (aff. *Lunzensis*) m.

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There is nearly nothing to be added to BITTNER's descriptions of the external characters, which are sufficiently accurate in most cases. The sites that delivered the original material cannot be exactly located basing on BITTNER's indications (the environs of the Preinerwand). It is clear, however, that the collection must have been made in the Wetterstein complex in the southernmost parts of the Rax plateau. Since BITTNER, there have not been any brachiopod species from the Rax mentioned in the geological literature, except for rare notes on the finds of smooth brachiopods reported as *"Terebratula" praepunctata* (e.g. in LOBITZER, 1986, p. 412).

The most recent geological data on Raxalpe can be found in the paper by LOBITZER, MANDL, MAZZULO & MELLO (1990) who focus their attention on sedimentology and microfacies of the Wettersteinkalk carbonate platform. They recognize in the Rax area two main types of the Wetterstein Limestone:

a) The reef facies forming in SW a platform edge reef (Heukuppe-Predigtstuhl reef complex) and
b) towards NE the near-reef lagoonal limestones (in part peritidal) – see the sketch!

According to the mentioned authors brachiopods belong to the most important reef-dwellers, whereas they are missing in lagoons. They could be found, however, in the patch-reefs that rarely occur in the lagoonal complex. This pattern of brachiopod distribution was confirmed by my field works on Raxalpe made in the years 1990–1993.

1.1. Material

The study was accomplished on my own finds made on Raxalpe within 1990–1993, and on BITTNER's figured specimens (1892). The latter make a part of the large BITTNER's type collection deposited in the Museum of the Geologische Bundesanstalt in Vienna. There is no trace of other BITTNER's material from Raxalpe in the depository of the GBA, with the only exception of a small lumachelle piece with *Lobothyris praepunctata*. It is of particular interest to notice that the *"praepunctata"* lumachelle which was reported but unprecisely localized by BITTNER:

„ ... *Diese Art ... erfüllt ganze Bänke* ... " (1892, p. 28.)

was later not mentioned by CORNELIUS (1936) or other geologists. This lumachelle has also not been ascertained – despite great efforts – during my field investigations on Raxalpe, and even the species itself appears not to be very frequent. Anyhow, a small loose sample of the smooth brachiopod lumachelle was found some years ago between the Rax chapel and the Karl Ludwig Haus by LOBITZER (personal communication).

My new collection consists of the following brachiopods: *Amoenirhynchia seydeli* (BITTNER), *Caucasorhynchia* aff. *altaplecta* (BÖCKH), *"Spiriferina" myrina* BITTNER, *"Spiriferina"* ex gr. *pectinata* BITTNER, *Mentzelia ampla* (BITTNER), *Mentzelia* aff. *fraasi (BITTNER), Schwagerispira fastosa* (BITTNER), *Dioristella* aff. *indistincta* (BEYRICH), *Stolzenburgiella baloghi* SIBLIK, *Tetractinella dyactis* (BITTNER), ?*Rhaetina* cf. *pyriformis* (SUESS), ?*Cruratula* sp., *"Terebratula"* aff. *raxana* BITTNER – juv., *Lobothyris praepunctata* (BITTNER), *Lobothyris* ex gr. *praepunctata* (BITTNER), *Lobothyris euryglossa* (BITTNER), *Aulacothyris compressa* BITTNER, *Aulacothyris* cf. *canaliculata* BITTNER, *Gemerithyris zugmayeri* (BITTNER).

The preservation of the material is in average unsatisfactory. Many of the brachiopods are fragmentary and incomplete. Recrystallization of the shell interiors has made it difficult, as a rule, to prepare serial sections. Consequently, only very limited information could be obtained on the internal characters of the specimens.

1.2. Age and Relations of the Fauna

The former uncertainty concerning the age of the Wetterstein Limestone complicated the considerations on the age of its fauna (shortly summarized by LEIN & SIBLIK, 1978). Also due to the fact that most of BITTNER's brachiopod species from Raxalpe were new and some of them have not been found since the ascertainment of the age of the assemblage rendered not easy. The associated macrofauna includes poorly preserved gastropods, pelecypods and small ammonites (e.g. obtained from the localities of Predigtstuhl), and also does not allow a definite stage assignment. The species *Terebratula praepunctata* had been described by BITTNER (1890) from the Dachstein Limestone of the Lechnergraben near Mariazell, Styria and found together with *Schwagerispira fastosa* that is also considered as a Norian species. According to MANDL, the blocks sampled there by BITTNER were most probably from the Dachstein Limestone. However, it cannot be completely ruled out that also Wetterstein Limestone was collected, as the locality shows limited outcrops of Wetterstein Limestone, too (MANDL, personal communication).

The age of the type locality of *Tetractinella dyactis*, that is the most characteristic species on Raxalpe (environs of the Preinerwand), was discussed in the paper by LEIN & SIBLIK (1978). Basing on the comparison of this type locality with the stratigraphically proved locality of *Tetractinella dyactis* at Spielkogel (Mürztaler Alpen), they assume that both these localities are of Cordevolian age. Because there have not appeared any new opinions on the age of the fauna of Raxalpe since, I may presuppose the Cordevolian age also for my localities on Raxalpe – at least for those that yielded *Tetractinella dyactis*. This view could be supported by the finds of the conodont *"Epigondollela" mungoensis*, a.o. proving a Langobardian to Cordevolian age, in the lenses of red limestone intercalations in the Heukuppe reef (det. MANDL, in LOBITZER, 1986, p. 413).

The occurrence of *Stolzenburgiella baloghi* on Raxalpe is rather surprising. This species has been known only from the West Carpathians, where it occurs in the reef Wetterstein Limestone in a relatively small area of the Slovak Karst. It is there sometimes accompanied by *Aulacothyris compressa*. The two species may point out both facial and stratigraphical similarity of the Wetterstein Limestone of both areas. On the other side, *Tetractinella dyactis*, quite common on Raxalpe has not yet been ascertained in the Slovak Karst.

1.3. Localities

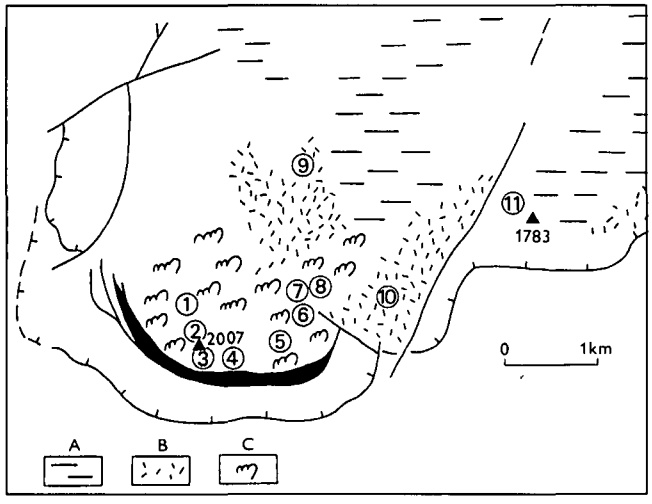
The indications of the brachiopod fragments were found on Raxalpe at many places within the reef domain. The following localities yielded determinable brachiopods (see the sketch!):

Locality 1

About 250 m NW of Heukuppe top (2007 m), near the red-marked path from Heukuppe towards Gamseck: *"Spiriferina" myrina*, *Dioristella* aff. *indistincta*.

Locality 2

70 m NNW of Heukuppe top (2007 m): *Amoenirhynchia seydeli*, *"Spiriferina" myrina*, *Lobothyris praepunctata*, *Gemerithyris zugmayeri*.



Text-Fig. 1.
Sketch map of the SW Rax Plateau, with the position of the brachiopod localities (1–11) – Adapted after LOBITZER, MANDL, MAZZULLO & MELLO (1990).
A = lagoonal facies, B = dolomitized Wetterstein Limestone, C = "reef" and reef debris.

Locality 3
100 m SE of Heukuppe top (2007 m): *Caucasorhynchia* aff. *altaplecta*, *Mentzelia* aff. *fraasi*, *Tetractinella dyactis*.

Locality 4
About 500 m SE of Heukuppe top, near the junction of the red- and yellow-marked paths: *"Spiriferina" myrina*, *Lobothyris* ex gr. praepunctata.

Locality 5
In the karst depressions "Schneegruben" (W of Karl-Ludwig-Haus) crossed by the blue-marked path from Karl-Ludwig-Haus towards Gamseck.

5a) In the nearest depression on the left, above the path: *Mentzelia ampla*, *Tetractinella dyactis*; partially dark grey limestones: *Tetractinella dyactis*, *Aulacothyris compressa*, *Gemerithyris zugmayeri*.

5b) In the nearest depression on the right, below the path: *"Spiriferina" myrina*, *Tetractinella dyactis*, *Lobothyris praepunctata*, *Lobothyris* ex gr. *praepunctata*, *Lobothyris euryglossa*.

Locality 6
On the path "Bismarcksteig", at about 200 m distance from its beginning nearer to Karl-Ludwig-Haus: *Lobothyris praepunctata*, *Lobothyris* ex gr. *praepunctata*.

Locality 7
On the marked path from Karl-Ludwig-Haus to Predigtstuhl (1902 m), about 50 m above the beginning of the path "Bismarcksteig": *Stolzenburgiella baloghi*, *Lobothyris* ex gr. *praepunctata*.

Locality 8
Predigtstuhl top (1902 m). The collection was mostly made in 2 places not far from each other.

8a) In the sinkhole close by the crossing of 2 red-marked paths, E of the elevation point 1902 m: *Caucasorhynchia* aff. *altaplecta*, *"Spiriferina" myrina*, *"Spiriferina"* ex gr. *pectinata*, *Mentzelia ampla*, *Mentzelia* aff. *fraasi*, *Tetractinella dyactis*, *?Rhaetina* cf. *pyriformis*, *?Cruratula* sp., *"Terebratula"* aff. *raxana* - juv., *Lobothyris praepunctata*, *Aulacothyris compressa*, *Aulacothyris* cf. *canaliculata*.

8b) In the sinkhole about 50 m from 8a, nearer to the elevation point 1902 m: *Caucasorhynchia* aff. *altaplecta*, *"Spiriferina" myrina*, *Mentzelia* aff. *fraasi*, *Schwagerispira fastosa*, *Stolzenburgiella baloghi*, *Tetractinella dyactis*, *Lobothyris praepunctata*, *Aulacothyris compressa*.

Locality 9
On the track from Karl-Ludwig-Haus to Habsburg-Haus, in the turnings SW of Dreimarkstein (1984 m): *Mentzelia* aff. *fraasi*, *Lobothyris praepunctata*, *Lobothyris* cf. *euryglossa*.

Locality 10
On the red-marked path from Waxriegel-Haus towards Trinksteinsattel, about 100 m above the junction with the subhorizontal unmarked path towards Schlangenweg. Partly dark grey dolomitized limestone with hollow brachiopod shells: *Amoenirhynchia seydeli*, *"Spiriferina"* cf. *myrina*, *Schwagerispira fastosa*, *Lobothyris praepunctata*.

Locality 11
Near the blue-marked trail from Preiner Wand (1783 m) to Neue See-Hütte, about 250 m SE of the junction with the yellow-marked track from Neue See-Hütte towards Otto-Haus: *Stolzenburgiella baloghi*, *Aulacothyris* cf. *compressa*.

Localities 1–10 show mostly medium grey Wetterstein Limestone with abundant reef detritus, locality 11 is a coral patch-reef situated in the lagoonal Wetterstein Limestone.

2. Systematic Descriptions

Order: Rhynchonellida KUHN, 1949
Superfamily: Rhynchonellacea GRAY, 1848
Family: Wellerellidae LIKHAREV in RZHONSNITSKAYA, 1956

Amoenirhynchia SIBLIK, 1964

Amoenirhynchia seydeli (BITTNER, 1891)

(Pl. 1, Figs. 1, 3–4)

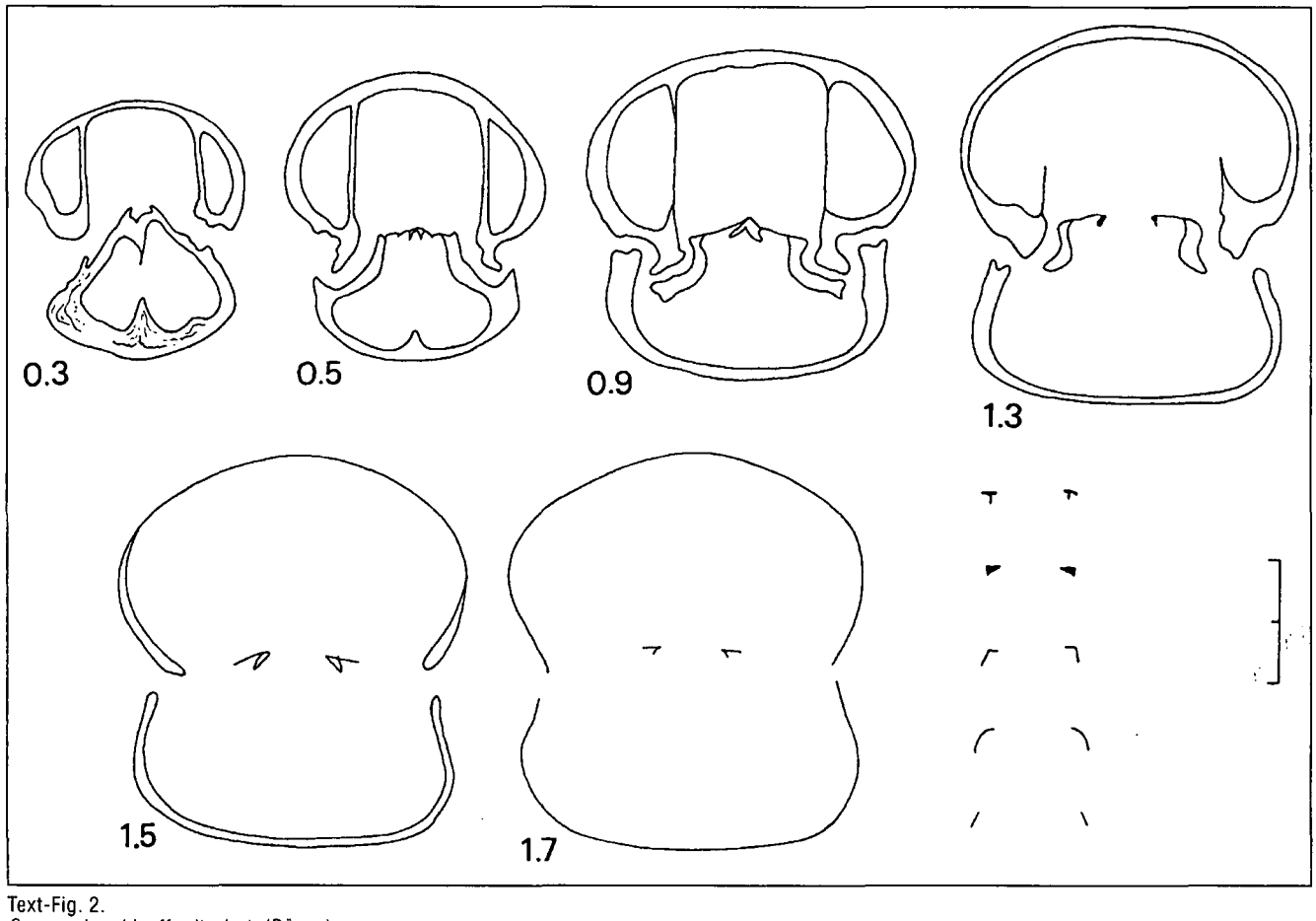
1891 *Rhynchonella Seydelii* nov.spec. – BITTNER, p. 56.
1892 *Rhynchonella Seydelii* nov.spec. – BITTNER, p. 30, Pl. 4, Figs. 6–15.
1892 *Rhynchonella pumilio* nov.spec. – BITTNER, p. 31, Pl. 4, Figs. 16–17.
1986 *Amoenirhynchia seydeli* (BITTNER) – SIBLIK, p. 24, Text-Fig. 17, Pl. 1, Figs. 5–6.

Lectotype (selected by SIBLIK, 1986): The specimen derived from Raxalpe and figured by BITTNER, 1892 on Pl. 4, Fig. 9 (GBA no. 1892/1/81).

Material: 9 specimens. Dimensions of the better preserved specimens in mm: 8.9 × 6.5 × 5.6 (Pl. 1, Fig. 4), 8.7 × 8.4 × 5.1 (Pl. 1, Fig. 3), 8.3 × 8.7 × 5.7, 8.0 × 7.1 × 4.3.

Remarks: Characteristically trigonal, smooth to semicostate shells with well-developed lateral planareas reveal the same variability as the specimens figured by BITTNER (1892) except for his Fig. 10, showing a relatively thick specimen with longer ribblets. Somehow stronger, sharper and longer ribbing near the anterior commissure was ascertained in *Amoenirhynchia seydeli* coming from the Tuvalian of the Slovak Karst (SIBLIK, 1986).

Occurrence: Raxalpe – locality 2 (2 specimens) and locality 10 (7 specimens). Styria (Neun Kögerln near Gusswerk-Mariazell). Tuvalian of Slovakia.



Text-Fig. 2.
Caucasorhynchia aff. *altaplecta* (BÖCKH).
Transverse sections through the posterior part of the shell; measured from dorsal umbo. Original length of specimen 14.0 mm. Crura distally recurving into the cavity of pedicle valve.
Locality 8b. Enlarged, scale bar equals 2 mm.

Caucasorhynchia DAGYS, 1963

Caucasorhynchia aff. *altaplecta* (BÖCKH, 1873)

(Pl. 1, Fig. 6, Text-Fig. 2)

1978 *Caucasorhynchia* aff. *altaplecta* (BÖCKH) – LEIN & SIBLIK, p. 217, Text-Fig. 6, Pl. 31, Fig. 6.

Material: 12 specimens. Dimensions of the better preserved ones: 15.5 × 17.5 × 9.8 mm, 14.5 × 15.1 × 7.0 mm, ?14 × 18.8 × ?9.0 mm (Pl. 1, Fig. 6), 12.0 × 15.5 × 6.8 mm, ?12.0 × 14.8 × 6.5 mm.

Remarks: The unexpected identity of the Rax specimens with those described in detail and figured by LEIN & SIBLIK (1978) from Spielkogel is of considerable interest. They are accompanied by common *Tetractinella dyactis* in both areas, and seem to be typical of a certain level near the Ladinian/Carnian boundary.

The internal characters of the Rax material agree well with those figured by LEIN & SIBLIK (1978), inclusive parallel dental lamellae, fused subhorizontal hinge plates and absence of any septalium.

It seems that the species under consideration could make it possible to improve the correlation of monotonous Wetterstein Limestone, even if not definitely determined.

Occurrence: Raxalpe – locality 3 (1 specimen), locality 8a (2 specimens) and locality 8b (9 specimens). Styria (Spielkogel in the Mürztaler Alpen).

Order: Spiriferida WAAGEN, 1883
Superfamily: Spiriferinacea DAVIDSON, 1884
Family: Spiriferinidae DAVIDSON, 1884

Spiriferina D'ORBIGNY, 1847; s.l.

"Spiriferina" myrina BITTNER, 1891

(Pl. 1, Figs. 5, 7, 10)

1891 *Spiriferina Myrina* nov.spec. – BITTNER, p. 56.
1892 *Spiriferina Myrina* nov.spec. – BITTNER, p. 32, Pl. 1, Figs. 1–6.
?1913 *Spiriferina* cf. *Myrina* BITTNER-TOULA, p. 94.

Lectotype (selected by SIBLIK, 1988): The specimen figured by BITTNER, 1892 on Pl. 1, Fig. 6 (GBA no. 1892/1/88). It comes from Raxalpe.

Material: 13 mostly fragmentary specimens, the best ones measure: ?15.0 × 16.0 × 9.8 mm, 12.0 × ?13.5 × 7.5 mm, 9.8 × 10.8 × 6.7 mm (Pl. 1, Fig. 7), 9.0 × ? × 6.3 mm, 8.5 × 9.4 × 5.9 mm (Pl. 1, Fig. 10).

Remarks: The specimens agree in all observed external features and their variability with the material figured and described in detail by BITTNER (1892). Some pedicle valves have, however, higher and less curved interareas if compared to those of the BITTNER's specimens.

DAGYS (1974, p. 131) tentatively referred *"myrina"* to his *Mentzelioides* gen.nov. mainly on external features. I do not think there are sufficient reasons for this assignment and I prefer to use temporarily the traditional generic name.

Occurrence: Raxalpe – locality 1 (3 specimens), locality 2 (1 specimen), locality 4 (1 specimen), locality 5b (1 specimen), locality 8a (4 specimens) and 8b (3 specimens). One specimen determined as *"Spiriferina"* cf. *myrina* was found at the locality 10. The occurrence near Baden (TOULA, 1913) is supposed here not to be sufficiently documented.

"Spiriferina" ex gr. *pectinata* BITTNER, 1890

Material: 1 fragmentary specimen with both valves measuring ca. 5.0 x 6.5 x 4.0 mm.

Remarks: Very small, moderately biconvex specimen showing long hinge line, no folding, low beak, and 15 faint plications on the brachial valve. Some similarity to *"Spiriferina" pectinata* BITTNER seems apparent, but more exact determination of our certainly juvenile specimen awaits the discovery of additional material.

Occurrence: Raxalpe – locality 8a.

Mentzelia QUENSTEDT, 1870

Mentzelia ampla (BITTNER, 1890)

1890 *Spiriferina ampla* nov.spec. – BITTNER, p. 165, 1 Text-Fig., Pl. 41, Figs. 10–11.
?1892 *Spiriferina* spec.indet. – BITTNER, p. 33.
1945 *Spiriferina (Mentzelia) ampla* BITTNER – BEŠIĆ, p. 11, Pl. 1, Fig. 6.
1958 *Mentzelia ampla* BITTNER – PANTIĆ, p. 63, Pl. 1, Fig. 4.
?1985 *Mentzelia ampla* BITTNER – JING et al., p. 222, Pl. 18, Figs. 13–16, 24–27.
?1989 *Mentzelia* sp., aff. *ampla* (BITTNER) – VÖRÖS & PALFY, p. 25, Pl. 4, Fig. 7.

Lectotype: has not been selected yet. Both specimens figured by BITTNER (1890) are deposited in the Bayerische Staatssammlung für Paläontologie und historische Geologie in Munich (No. 1890. VIII. 39 and 1890. VIII. 1003). They derive from the "Cassianer Schichten" of the Wendelstein, Bavaria.

Material: 6 brachial and 7 pedicle mostly fragmentary, large valves of maximum width about 31.0 mm.

Remarks: 4 of the valves are very well comparable to those of the BITTNER's specimen (1890) figured on Pl. 41, Fig. 10 by the characters of their shape, folding and/or by the high linguiform extension of the pedicle valve. Other valves in our material show only very low uniplication or poorly developed sulci. Different narrower outline, incipient sulcation of the pedicle valve and lower, incurved beak are the main characters distinguishing very similar *Mentzelia fraasi* (BITTNER, 1890) from *"ampla"*. Both species may, however, prove to be synonymous when more material of *"ampla"* becomes available. Considerable resemblances to our material can be observed in the specimen determined as *Mentzelia* sp., aff. *ampla* by VÖRÖS & PALFY (1989), and coming from the Anisian/Ladinian boundary in Váczoly, Hungary. This *Mentzelia* would fit – according to these authors – into the evolutionary lineage between *Mentzelia mentzeli* and *M. ampla*.

Occurrence: Raxalpe – locality 5a (1 specimen), loc. 8a (12 specimens). The species was reported also from the Middle Triassic of Yugoslavia and Italy.

Mentzelia aff. *fraasi* (BITTNER, 1890)

(Pl. 1, Figs. 2, 8; Pl. 2, Fig. 5; Text-Fig. 3)

Material: 3 fragmentary specimens with both valves, 2 brachial and 26 mostly incomplete pedicle valves, not exceeding 23.0 mm in length and 18.0 mm in width.

Remarks: Due to bad preservation the definitive determination is not possible. The material shows a considerable resemblance to *Spiriferina [= Mentzelia] fraasi* described by BITTNER (1890) from the "Cassianer Schichten" of the Wendelstein. Our specimens differ, however, from the Bavarian specimens in higher beak and interarea, in maximum width situated anterior of mid-length, and in absent or only incipient sulcation of the pedicle valve. Internally a very strong median septum was ascertained in the pedicle valve interior of the Rax specimens.

Occurrence: Raxalpe – locality 3 (1 specimen), locality 8a (2 specimens), locality 8b (27 specimens), locality 9 (1 specimen).

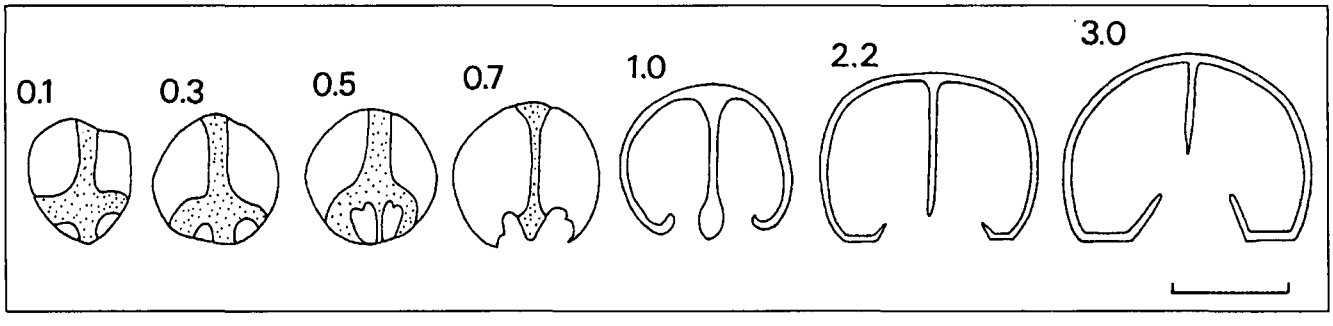
Superfamily: Retziacea WAAGEN, 1883
Family: Neoretziidae DAGYS, 1972

Schwagerispira DAGYS, 1972

Schwagerispira fastosa (BITTNER, 1890)

(Pl. 1, Fig. 9)

1890 *Retzia Schwageri* m.var. *fastosa* – BITTNER, p. 274, Pl. 29, Figs. 17–20.
1891 *Retzia Schwageri* m.var. *fastosa* – BITTNER, p. 57.
1892 *Retzia* cfr. *Schwageri* var. *fastosa* m. – BITTNER, p. 32.
1957 *Retzia schwageri fastosa* BITTNER – MAHEL, p. 171, Pl. 5, Figs. 8–10.



Text-Fig. 3.
Mentzelia aff. *fraasi* (BITTNER).
Transverse sections through the posterior part of pedicle valve. Original length of specimen 19.1 mm.
Locality 8 b. Enlarged, bar equals 3 mm.

1965 *Retzia schwageri fastosa* BITTNER – ZAPFE, p. 286.
1993 *Schwagerispira fastosa* (BITTNER) – IORDAN, p. 52, Pl. 2, Fig. 7.
non1977 *Neoretzia fastosa* BITTNER – JING & FANG, p. 54, Pl. 5, Figs. 13–16.

Lectotype (selected by SIBLIK, 1988): The specimen figured in BITTNER, 1890, Pl. 29, Fig. 20 (GBA no. 1890/2/380a). It derives from the "Dachsteinkalk" of the Tristelwand, Hagengebirge in Salzburg.

Material: 1 partly damaged specimen with dimensions 10.7 × ?9.5 × 7.1 mm, and 4 fragments of single valves.

Remarks: The specimen corresponds well to the figures and description given by BITTNER (1890). There are 9 sharp ribs in the brachial valve of our specimen, the middle one being the strongest. The latter character differentiates *"fastosa"* from very similar *Schwagerispira schwageri media* (BITTNER, 1890) coming from the "Cassianer Schichten" of the Wendelstein. The Bavarian subspecies has that middle rib lower in comparison with the neighbouring ones. The specimen figured by JING & FANG (1977) with quite different shaping of beak does not seem to belong to the species under consideration.

Occurrence: Raxalpe – locality 8b (4 specimens), locality 10 (1 specimen). Salzburg (Locus typicus, Putzenköpfl near Dürrnberg), Upper Austria (Falmbergalm near Gosau), Styria (Lechnergraben near Mariazell). Norian of Slovakia, Carnian and Norian of Roumania.

Superfamily: Athyridacea DAVIDSON, 1881
Family: Spirigerellidae GRUNT, 1965

Dioristella BITTNER, 1890

Dioristella aff. *indistincta* (BEYRICH, 1863)

1981 *Dioristella* aff. *indistincta* (BEYRICH) – SIBLIK, p. 16, Pl. 9, Fig. 6.

Material: 1 specimen with dimensions of 5.5 × 4.9 × 3.0 mm.

Remarks: An athyridid shell – most probably a juvenile – of circular outline and straight anterior commissure shows a considerable resemblance to the specimen figured by SIBLIK (1981) from the type locality of *Stolzenburgiella baloghi* in the Slovak Karst. The absence of an incipient sulcation in the anterior part of brachial valve in the Raxalpe specimen could be caused by its juvenile character. BITTNER (1892, p. 33) reported but did not figure the finds of "spirigerids" of circular outline from Raxalpe under *Spirigera* cfr. *Wissmanni* MÜNST. spec. The possible identity of his finds with our specimen is not excluded but absence of more material precludes any comparison.

Occurrence: Raxalpe – locality 1.

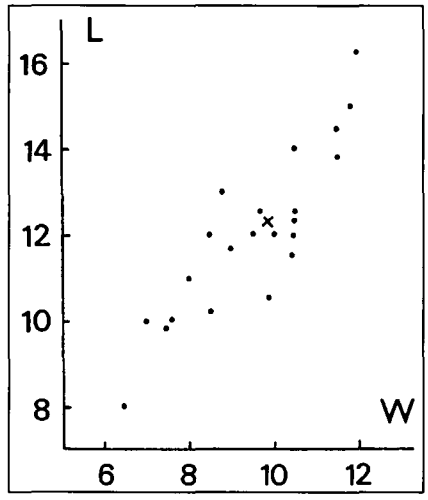
Stolzenburgiella BITTNER, 1903

Stolzenburgiella baloghi SIBLIK, 1981

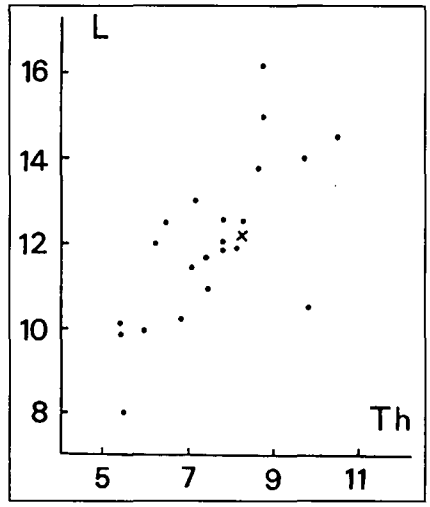
(Pl. 3, Figs. 5–6, 9; Text-Figs. 4–7)

1981 *Stolzenburgiella baloghi* sp.n. – SIBLIK, p. 16, Text-Figs. 1–9; Pl. 10, Figs. 1–5; Pl. 11, Figs. 1, 5–6.

Holotype: The specimen figured by SIBLIK, 1981 on Pl. 10, Fig. 3 and deposited in the Slovak National Museum in Bratislava (SNM Z 13285). It came from the reef Wetterstein Limestone of the locality Jablonov nad Turnou in the Slovak Karst. The age was reported as Ladinian and has not been revised since (Cordevolian ?).



Text-Fig. 4.
Length/width scattergram for 22 specimens of *Stolzenburgiella baloghi* SIBLIK, in mm.
× = lectotype.
Locality 8b.

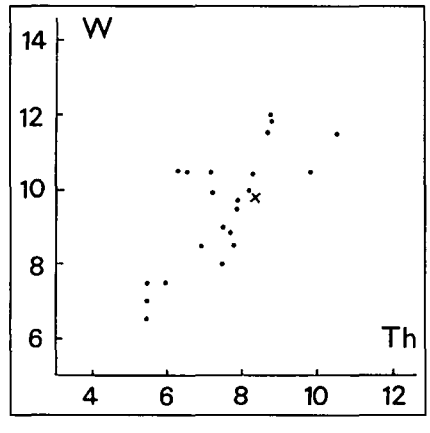


Text-Fig. 5.
Length/thickness scattergram for *Stolzenburgiella baloghi* SIBLIK.
For explanations see Text-Fig. 4.

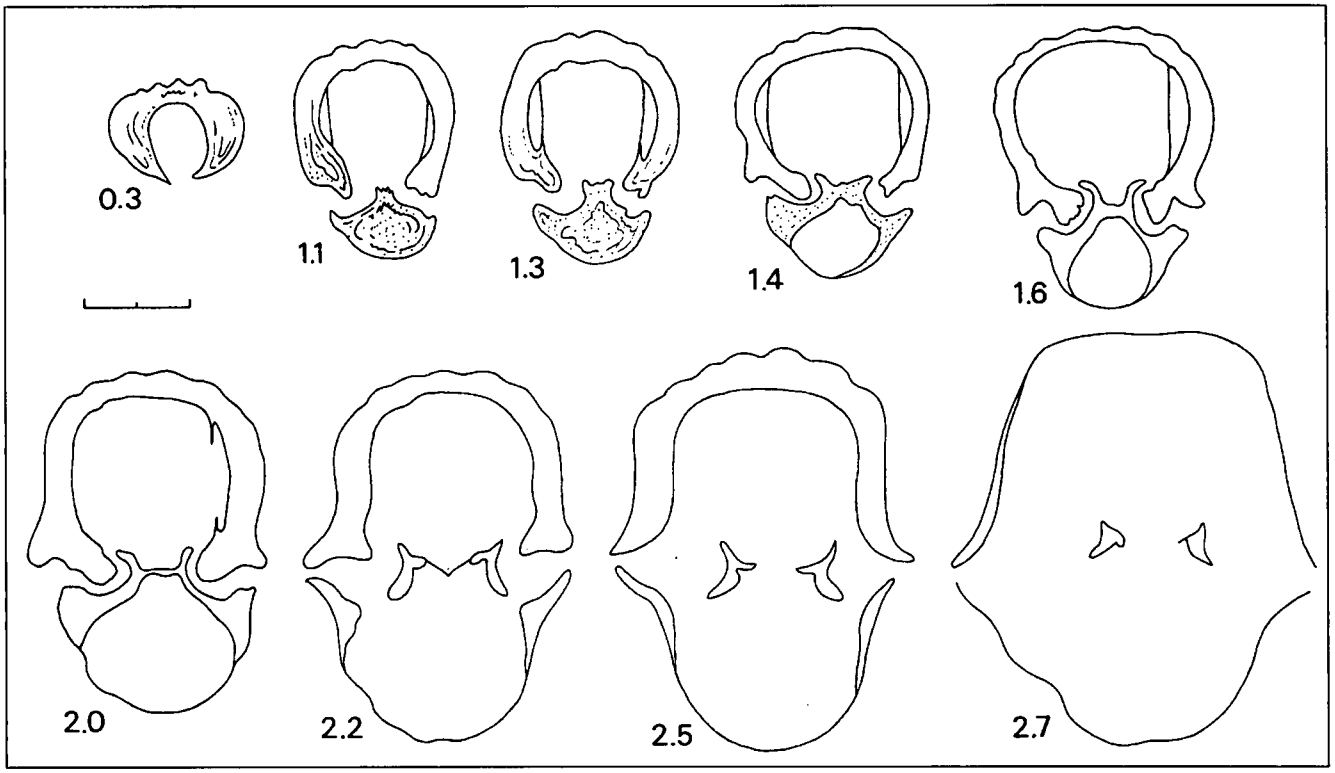
Material: 51 specimens. The figured specimens measure: 13.0 x 8.9 x 7.2 mm (Pl. 3, Fig. 6), 12.5 x 9.7 x 7.9 mm (Pl. 3, Fig. 9) and ?10.5 x 9.9 x 7.2 mm (Pl. 3, Fig. 5).

Remarks: The material agrees in all observed features with the original specimens as described by SIBLIK (1981). The only difference in external features is that the Rax shells have, on the average, less conspicuous posterior ribbing. Serial transverse sections are very well comparable to those of Slovak specimens, but only very short and poorly developed dental lamellae were ascertained in the Rax material.

The generic identification of *"baloghi"* may give rise to some doubts. It was affiliated to the rare *Stolzenburgiella* from the Dalmatian Anisian mainly on the basis of similar inequality of ribs and simple spiralia. It is of particular interest to notice that the internal characters



Text-Fig. 6.
Width/thickness scattergram for *Stolzenburgiella baloghi* SIBLIK.
For explanations see Text-Fig. 4.



Text-Fig. 7.
Stolzenburgiella baloghi SIBLIK.
Serial transverse sections. Total length of specimen 14.0 mm.
Locality 8b. Enlarged, bar equals 2 mm.

of *"baloghi"* show considerable resemblances to those of *Tetractinella*. However, the present incomplete knowledge of the internal structures of *"baloghi"* and *Stolzenburgiella* does not warrant well a detailed discussion of the problem.

Occurrence: Raxalpe – locality 7 (2 specimens), locality 8b (44 specimens) and locality 11 (5 specimens). Wetterstein Limestone of the type-locality in Slovakia.

Tetractinella BITTNER, 1890

Tetractinella dyactis (BITTNER, 1892)

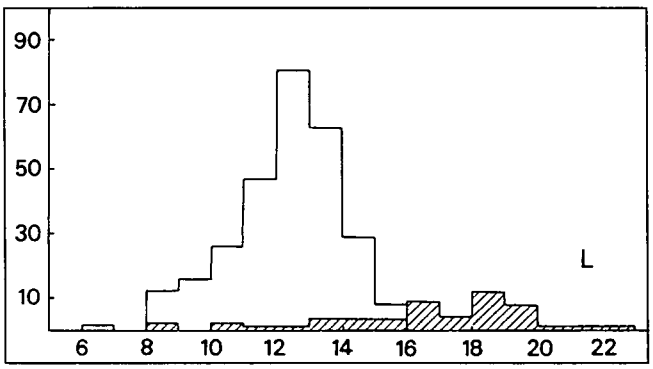
(Pl. 3, Figs. 1–4, 10; Text-Figs. 8–14)

1891 *Spirigera* spec. ? – BITTNER, p. 57.
1892 *Spirigera dyactis* nov.spec. – BITTNER, p. 33, Pl. 2, Figs. 8–11.
1962 *Athyris dyactis* BITTNER – ENTSCHEVA & KANCEV, p. 62, Pl. 10, Fig. 7.
1972 *Athyris dyactis* (BITTNER) – ENTCHEVA, p. 25, Pl. 7, Figs. 3–7; Pl. 10, Fig. 9.
1978 *Tetractinella* (?) *dyactis* (BITTNER) – LEIN & SIBLIK, p. 214, Pl. 3, Figs. 1–5; Text-Figs. 3–5.
1988 *Tetractinella* (?) *dyactis* (BITTNER – SIBLIK, p. 85.
1993 *Tetractinella dyactis* (BITTNER) – IORDAN, p. 52, Pl. 2, Fig. 6.

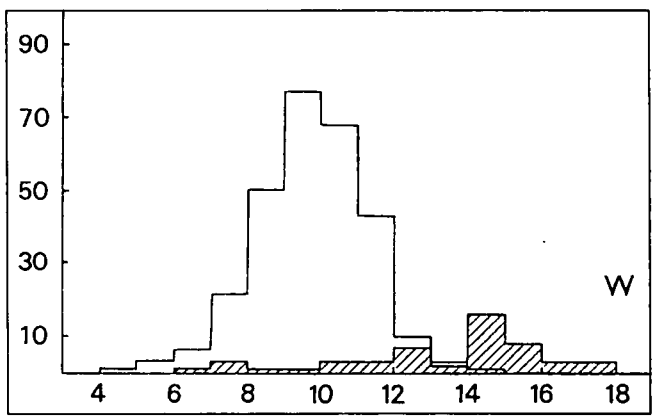
Lectotype (selected by SIBLIK in LEIN & SIBLIK, 1978): The specimen depicted by BITTNER, 1892 on Pl. 2, Fig. 10 (GBA no. 1892/1/93) and refigured in the present paper on Pl. 3, Fig. 3. It derives from Raxalpe.

Material: 820 specimens. The figured ones measure: 12.6 × 12.5 × 8.4 mm (Pl. 3, Fig. 1), 12.0 × 9.8 × 6.5 mm (Pl. 3, Fig. 2), 13.1 × 10.9 × 7.4 mm (lectotype; Pl. 3, Fig. 3), 13.8 × 10.4 × 8.8 mm (Pl. 3, Fig. 4), 18.6 × ?17.5 × 12.2 mm (Pl. 3, Fig. 10).

Remarks: This is the commonest species in the material from Raxalpe. Its external variability is well documented

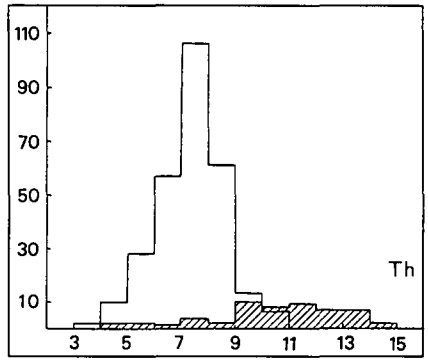


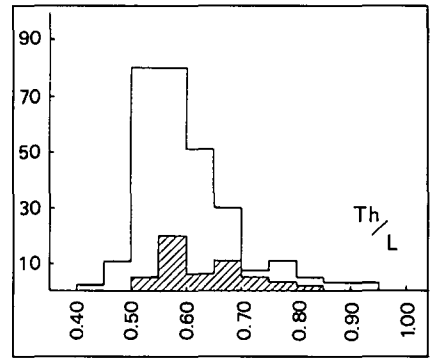
Text-Fig. 8.
Length frequency histogram for *Tetractinella dyactis* (BITTNER), in mm. Vertically number of specimens. Locality 5a (283 specimens), locality 8b – hatched (51 specimens).



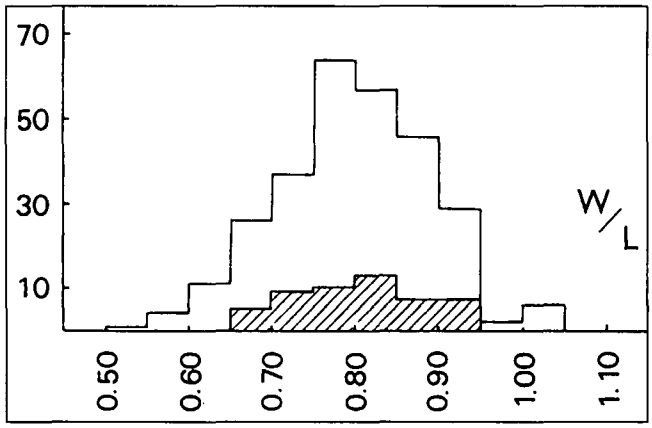
Text-Fig. 9.
Width frequency histogram for *Tetractinella dyactis* (BITTNER).
Explanation as Text-Fig. 8.

Text-Fig. 10.
Thickness frequency histogram for *Tetractinella dyactis* (BITTNER).
For explanation see Text-Fig. 8.

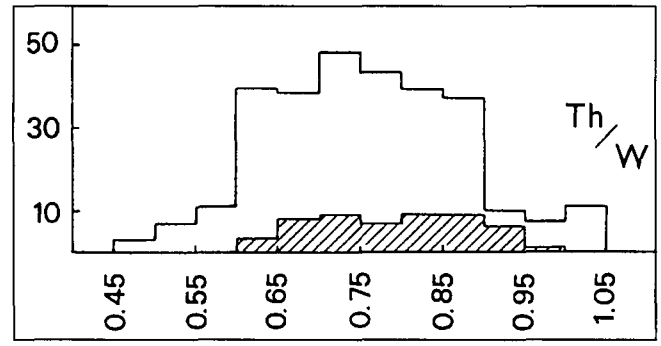




Text-Fig. 12.
Thickness/length frequency histogram for *Tetractinella dyactis* (BITTNER).
For explanation see Text-Fig. 8.



Text-Fig. 11.
Width/length frequency histogram for *Tetractinella dyactis* (BITTNER).
For explanation see Text-Fig. 8.

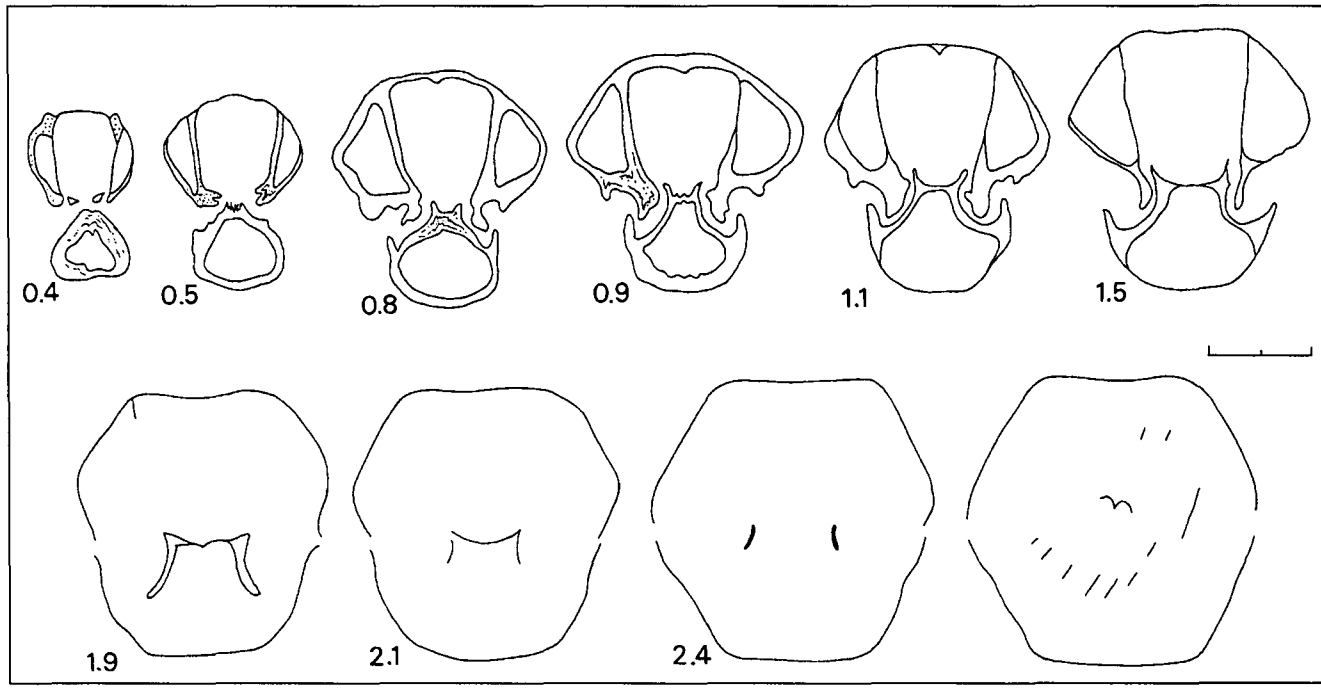


Text-Fig. 13.
Thickness/width frequency histogram for *Tetractinella dyactis* (BITTNER).
For explanation see Text-Fig. 8.

in the Text-Figs. 8–13. It is peculiar that the subpentagonal, more rounded smooth variants that were quite numerous within the *"dyactis"* material from Spielkogel (see LEIN & SIBLIK, 1978) have not been ascertained on Raxalpe. On the contrary, very rare specimens with 3–4 irregular ribs on the valve occur here (Pl. 3, Fig. 10).

Due to the bad preservation of the interiors of all the specimens sectioned, only incomplete information could be gained on the internal characters. They agree well with those found in the Spielkogel specimens (LEIN & SIBLIK, 1978, Text-Fig. 5). However, the dental lamellae converge dorsally in most Raxalpe specimens.

Occurrence: Raxalpe – locality 3 (18 specimens), locality 5a (682 specimens), locality 5 b (1 specimen), local-



Text-Fig. 14.
Tetractinella dyactis (BITTNER).
Serial transverse sections; measured from dorsal umbo. Total length of specimen 11.5 mm. Some specimens showed very short and thin dental lamellae. Locality 5a. Enlarged, bar equals 2 mm.

8a (65 specimens) and locality 8b (54 specimens). Styria (Spielkogel). Carnian of Bulgaria and Romania.

Order: Terebratulida WAAGEN, 1883
Superfamily: Dielasmatacea SCHUCHERT, 1913
Family: Dielasmatidae SCHUCHERT, 1913

Rhaetina WAAGEN, 1882

? Rhaetina cf. *pyriformis* (SUESS, 1854)

Material: 2 fragmentary specimens.

Remarks: There are not enough external characters preserved in these damaged punctate shells to enable their specific determination. Broadly and flatly plicate anterior commissures and shallow median grooves in the posterior parts of brachial valves remind one of *Rhaetina pyriformis* (SUESS), frequent species of the Kössen Beds.

Occurrence: Raxalpe – locality 8a.

Cruratula BITTNER, 1890

? Cruratula sp.

Material: 1 damaged specimen with dimensions ?18.5 × ca. 16.0 × ?7.0 mm.

Remarks: Punctate rectimarginate shell of subcircular outline, unequally convex. Flat brachial valve with shallow sulcus posteriorly. Beak massive, slightly incurved, beak ridges ill-defined. Dorsal median septum present. Judging from the most characters mentioned, there is every reason to believe that this specimen should be placed under *Cruratula*. However, it differs in subcircular outline and in relatively small thickness of pedicle valve from all the known *Cruratula* species.

Occurrence: Raxalpe – locality 8a.

Superfamily: Terebratulacea GRAY, 1840
Family: Terebratulidae GRAY, 1840

Terebratula MÜLLER, 1776; s.l.

"Terebratula" aff. *raxana* BITTNER, 1892; juv.

(Pl. 2, Fig. 2)

Material: 2 specimens with dimensions 7.2 × 5.5 × 4.2 mm (figured) and 6.4 × ?5.5 × 3.7 mm.

Remarks: Most probably juvenile specimens showing considerable resemblances to *"Terebratula" raxana* described from Raxalpe by BITTNER (1892): same shaping of the cardinal margin resulting in the characteristic outline of the brachial valve, and a low beak (for comparison see the lectotype of *"Terebratula" raxana* BITTNER on Pl. 2, Fig. 1). Our specimens have, however, a more globulous profile than *"raxana"* which is characterized by its rather flat brachial valve.

Occurrence: Raxalpe – locality 8a.

Lobothyris BUCKMAN, 1917

Lobothyris praepunctata (BITTNER, 1890)

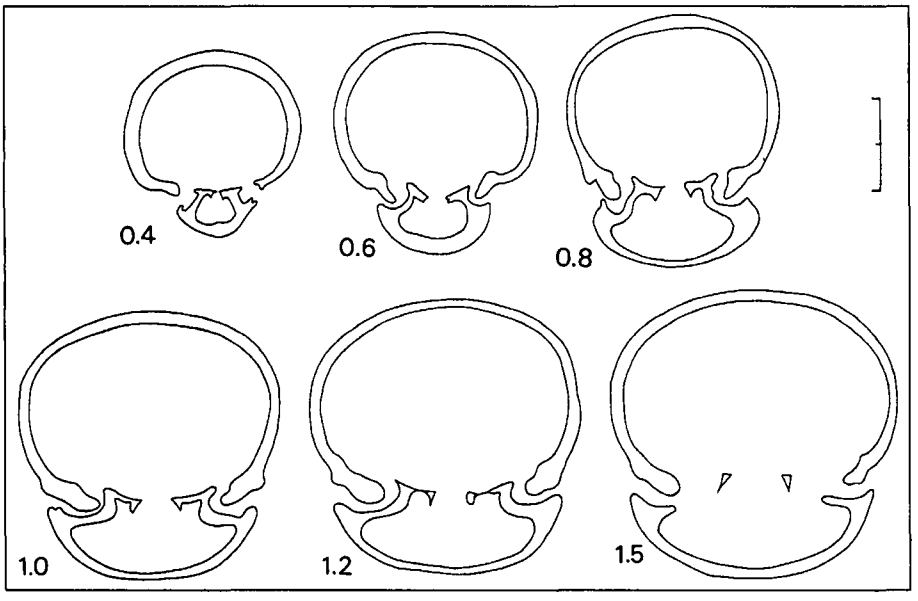
(Pl. 2, Figs. 3–4, 7, 9; Text-Fig. 15)

1890 *Terebratula praepunctata* nov.spec. – BITTNER, p. 257, Pl. 28, Figs. 2–5.
1891 *Terebratula praepunctata* m. – BITTNER, p. 55.
1892 *Terebratula praepunctata* m. – BITTNER, p. 28, Pl. 3, Figs. 16–20.
?1892 *Terebratula pleurocoela* nov.spec. – BITTNER, p. 28, Pl. 3, Fig. 15.
1963 *Lobothyris praepunctata* (BITTNER) – DAGYS, p. 180, Pl. 27, Figs. 1–3, Text-Fig. 87.
?1972 *Rhaetina praepunctata* (BITTNER, 1888) – ENTCHEVA, p. 30, Pl. 7, Figs. 1–2.

Lectotype (selected by SIBLIK, 1988): The specimen figured by BITTNER, 1890 on Pl. 28, Fig. 4 (GBA no. 1890/2/335) and refigured herein on Pl. 2, Fig. 9. It comes from the Dachstein Limestone of the Lechnergraben (Tonionalpe) near Mariazell, Styria.

Material: 27 specimens. The best preserved specimens measure: 15.0 × 10.1 × 8.4 mm; 13.7 × 11.2 × 7.8 mm (Pl. 2, Fig. 7); 13.5 × 10.0 × 6.2 mm; 12.5 × 10.0 × 8.2 mm; 12.1 × 8.4 × 7.3 (Pl. 2, Fig. 4); 9.7 × 7.7 × 5.8 mm.

Remarks: *"Terebratula praepunctata"* was according to BITTNER the commonest species on Raxalpe. After him it was identical with the material from the type locality of Lechnergraben (Tonionalpe) in Styria. This statement is probably correct, a smaller average size of the Rax specimens seems to be the only apparent difference. BITTNER reported, however, certain variability in width and thickness of shells from the Raxalpe and the



Text-Fig. 15.
Lobothyris praepunctata (BITTNER).
Transverse sections of a specimen from the small piece of original BITTNER's brachiopod lumachelle deposited in the Museum of the GBA; measured from dorsal umbo. Total length of specimen 15.3 mm. "Raxalpe". Enlarged, bar equals 2 mm.

same has been confirmed in our new material. Due to certain different characters, some variants of *"praepunctata"* plexus from the new material are for the moment provisionally determined herein as "ex gr. *praepunctata*" (e.g. the specimen with subcircular brachial valve on Pl. 2, Fig. 6).

The internal structure of *Lobothyris praepunctata* was studied in detail and figured by DAGYS (1963). Bad preservation precluded the complete study of the internal parts of the Rax material. However, subhorizontal orientation of the hinge plates and dorsally situated crural bases differ from those figured by DAGYS.

Occurrence: Raxalpe – locality 2 (3 specimens), locality 5b (2 specimens), locality 6 (4 specimens), locality 8a (4 specimens), locality 8b (2 specimens), locality 9 (5 specimens), locality 10 (7 specimens). Variants determined as "ex gr. *praepunctata*" were found at the localities 4, 5b, 6 and 7. Norian: Styria (Lechnergraben near Mariazell), Salzburg (Dopplersteig). Slovakia, Norian reefs of Caucasus.

Lobothyris euryglossa (BITTNER, 1892)

(Pl. 2, Fig. 8)

1892 *Terebratula euryglossa* nov.spec. – BITTNER, p. 28, Pl. 3, Fig. 21.
1981 *"Terebratula"* aff. *euryglossa* BITTNER – SIBLIK, p. 22, Pl. 9, Fig. 5, Text-Fig. 10.

Lectotype: (selected by SIBLIK, 1988): The specimen figured by BITTNER, 1892 and deposited in the GBA (no. 1892/1/75). It derives from Raxalpe.

Material: 1 specimen with dimensions 13.7 × 8.8 × 6.3 mm.

Remarks: The species belongs to the *"praepunctata"* group and was distinguished by BITTNER mainly on the ground of the uniplicate character of its shell. A low and broad deflection of the anterior commissure is clearly developed in our specimen. It differs in its relatively narrower and thicker shell with sharpened commissural margin from the lectotype.

Occurrence: Raxalpe – locality 5 b. Two fragments determined as *L.* cf. *euryglossa* were found at the locality 9. Slovakia (?Carnian).

Superfamily: Zeilleriacea ALLAN, 1940
Family: Zeilleriidae ALLAN, 1940

Aulacothyris DOUVILLE, 1879

Aulacothyris compressa BITTNER, 1891

(Pl. 3, Figs. 7–8)

1891 *Waldheimia (Aulacothyris) compressa* nov.spec. – BITTNER, p. 56.
1892 *Waldheimia (Aulacothyris) compressa* nov.spec. – BITTNER, p. 29, Pl. 3, Figs. 24–25, ?26.
1990 *Aulacothyris compressa* BITTNER – SIBLIK, p. 134, Pl. 9, Fig. 6.
non 1979 *Aulacothyris compressa* (BITTNER – PEVNY, p. 73, Pl. 39, Fig. 2; Text-Fig. 5 [= *Gemerithyris copiosa copiosa* SIBLIK, 1990].

Lectotype (selected by SIBLIK, 1988): The specimen derived from Raxalpe and was figured by BITTNER, 1892 on Pl. 3, Fig. 24 (GBA no. 1892/1/77).

Material: 7 specimens. The better preserved specimens measure: 11.1 × 7.3 × 5.7 mm (Pl. 3, Fig. 8), 9.5 × 7.2 × 5.2 mm, 9.0 × 6.5 × 4.3 mm and ?7.5 × 6.6 × 4.5 (Pl. 3, Fig. 7).

Remarks: The specimens agree well with the description and figures by BITTNER. They correspond mostly to the specimen figured by him (1892) on Pl. 3, Fig. 25 in outline, but have shallower sinuation of the anterior commissure approaching thus to that of the lectotype, figured on Plate 3, Fig. 24. Extremely large external variability of the aulacothyridid species is well-known bringing certain difficulties if the material is determined. There has been described a series of other Middle-Upper Triassic species of strong affinities; at least *Aulacothyris ruedti* BITTNER, 1892 and *Aulacothyris rupicola* BITTNER, 1892 should be mentioned in connection with our material.

Occurrence: Raxalpe – locality 5a (1 specimen), locality 8a (5 specimens), locality 8b (1 specimen). *Aulacothyris* cf. *compressa* was found at the locality 11.

Aulacothyris cf. *canaliculata* BITTNER, 1892

Material: 1 damaged specimen with missing posterior part measures ?5.0 × 4.8 × 3.0 mm.

Remarks: This probably juvenile specimen shows characteristic features of *"canaliculata"*: length and width of outline approximately equal, strong sinuation of the anterior commissure and unusually deep sulcation of the brachial valve. The present material does not warrant a discussion of the other possible synonymies involved.

Occurrence: Raxalpe – locality 8a.

Gemerithyris SIBLIK, 1977

Gemerithyris zugmayeri (BITTNER, 1891)

(Pl. 3, Fig. 11)

1891 *Waldheimia (Aulacothyris) Zugmayeri* nov.spec. – BITTNER, p. 55, 57.
1892 *Waldheimia (Aulacothyris) Zugmayeri* nov.spec. – BITTNER, p. 29, Pl. 3, Figs. 27–29.
1936 *Waldheimia zugmayeri* BITTNER – JEKELIUS, p. 69, Pl. 5, Figs. 24–27.
1988 *Gemerithyris zugmayeri* (BITTNER) – SIBLIK, p. 107.
non 1940 *Waldheimia (Aulacothyris) Zugmayeri* BITTNER – BALOGH, p. 174, 197, Pl. 1, Figs. 9–10 [= *Gemerithyris hungarica* (BALOGH, 1940)].
non 1979 *Aulacothyris zugmayeri* (BITTNER) – PEVNY, p. 75, Pl. 39, Fig. 3, Text-Fig. 6 [= *Gemerithyris hungarica* (BALOGH)].

Lectotype selected by SIBLIK (1977, p. 210, 219): The specimen figured by BITTNER, 1892 on Pl. 3, Fig. 29 (GBA no. 1892/1/78) and refigured in the present paper. It comes from Raxalpe.

Material: Fragments of 2 specimens.

Remarks: This very characteristic species is easily recognizable by its intraplicate anterior commissure. According to BITTNER (1892, p. 29), it is not clearly delimited from his *Waldheimia (Aulacothyris) compressa*. Not enough specimens are available to say more to BITTNER's presumption and to the possible relationship to the very similar Tuvalian *Gemerithyris hungarica* (BALOGH, 1940) from the Slovak Karst. This latter species could be distinguished by its different outline and greater dimensions of shell, by flat posterior part of brachial valve and by much longer dorsal septum.

Occurrence: Raxalpe – locality 2 (1 specimen) and 5a (1 specimen). Hungary, Romania.

Acknowledgements

I am indebted to Dr. H. LOBITZER – who initiated the study – for his continual support, to Dr. F. STOJASPAL for access to the collections and for loans of some specimens, and to Dr. G.W. MANDL for providing useful informations (all from the Geologische B.-A., Vienna). I acknowledge the financial support of the Geologische Bundesanstalt in Vienna and the Grant Agency of the Czech Academy of Sciences in Prague that made my field work possible.

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Manuskript bei der Schriftleitung eingelangt am 13. März 1994

Plate 1

Fig. 1: ***Amoenirhynchia seydeli*** **(BITTNER).**
Lectotype. "Raxalpe". GBA no. 1892/1/81.
× 3.

Fig. 2: ***Mentzelia*** **aff.** ***fraasi*** **(BITTNER).**
Locality 8b. GBA no. 1994/3/1.
× 3.

Fig. 3: ***Amoenirhynchia seydeli*** **(BITTNER).**
Locality 2. GBA no. 1994/3/4.
× 3.

Fig. 4: ***Amoenirhynchia seydeli*** **(BITTNER).**
Locality 2. GBA no. 1994/3/5.
× 4.

Fig. 5: ***"Spiriferina" myrina*** **BITTNER.**
Lectotype. "Raxalpe". GBA no. 1892/1/88.
× 2.

Fig. 6: ***Caucasorhynchia*** **aff.** ***altaplecta*** **(BÖCKH).**
Locality 8a. GBA no. 1994/3/6.
× 2.5.

Fig. 7: ***"Spiriferina" myrina*** **BITTNER.**
Locality 8a. GBA no. 1994/3/7.
× 3.

Fig. 8: ***Mentzelia*** **aff.** ***fraasi*** **(BITTNER).**
Locality 8b. GBA no. 1994/3/2.
× 2.5.

Fig. 9: ***Schwagerispira fastosa*** **(BITTNER).**
Locality 8b. GBA no. 1994/3/9.
× 3.

Fig. 10: ***"Spiriferina" myrina*** **BITTNER.**
Locality 1. GBA no. 1994/3/8.
× 4.

All specimens were coated with ammonium chloride before photographing. They are deposited in the collections of the Geologische Bundesanstalt (Museum) in Vienna (GBA).
Photographs by Mr. J. BROZEK (Prague).

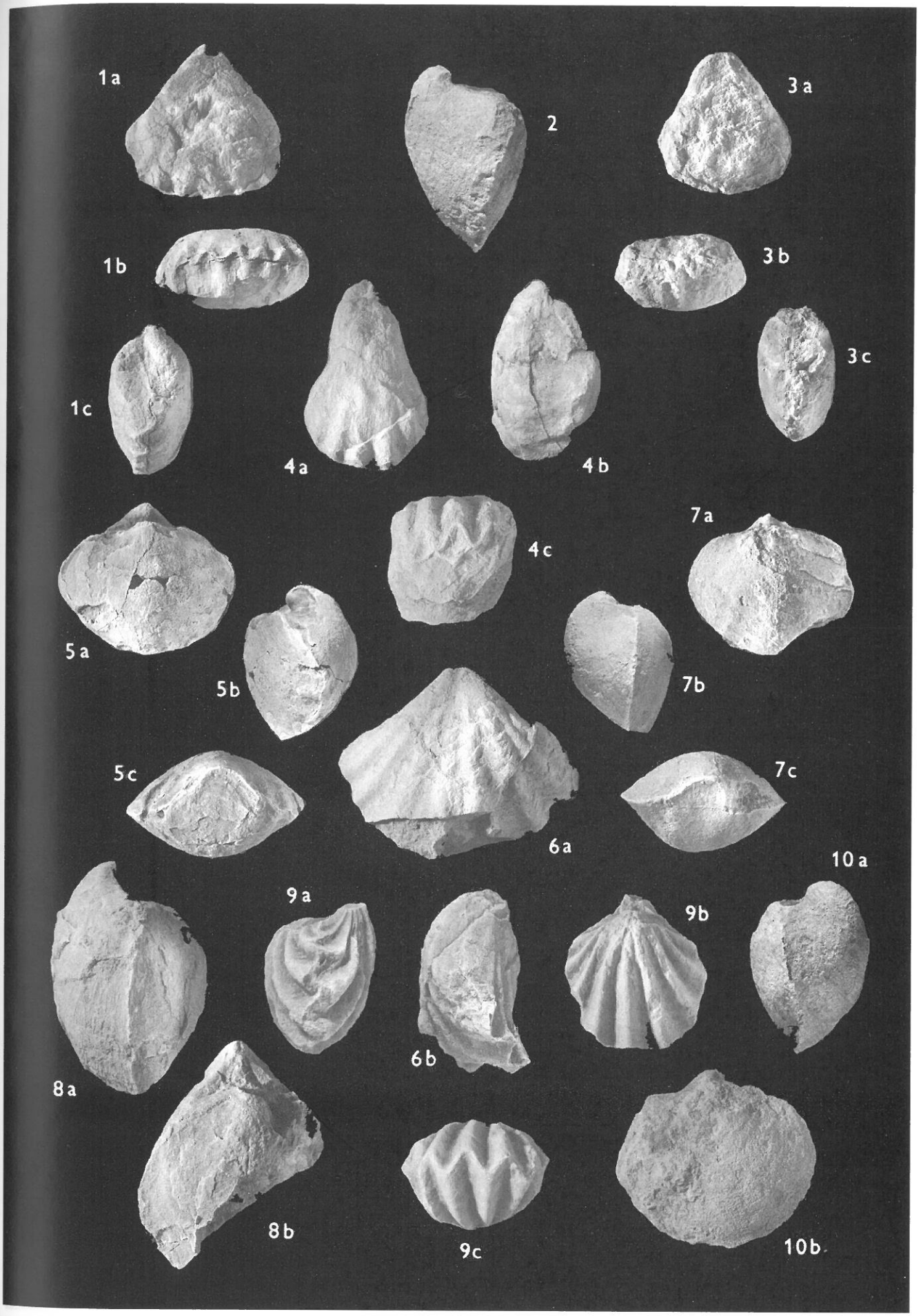
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Plate 2

Fig. 1: ***"Terebratula" raxana* BITTNER.**
Lectotype. "Raxalpe". GBA no. 1892/1/76.
× 3.

Fig. 2: ***"Terebratula" aff. raxana* BITTNER – juv.**
Locality 8a. GBA no. 1994/3/10.
× 4.

Fig. 3: ***Lobothyris praepunctata* (BITTNER).**
Figured by BITTNER, 1892, Pl. 3, Fig. 18. "Raxalpe". GBA.
× 2.

Fig. 4: ***Lobothyris praepunctata* (BITTNER).**
Locality 9. GBA no. 1994/3/11.
× 3.

Fig. 5: ***Mentzelia* aff. *fraasi* (BITTNER).**
Locality 9. GBA no. 1994/3/3.
× 3.

Fig. 6: ***Lobothyris ex gr. praepunctata* (BITTNER).**
Locality 5b. GBA no. 1994/3/13.
× 3.

Fig. 7: ***Lobothyris praepunctata* (BITTNER).**
Locality 2. GBA no. 1994/3/12.
× 3.

Fig. 8: ***Lobothyris euryglossa* (BITTNER).**
Locality 5b. GBA 1994/3/14.
× 2.5.

Fig. 9: ***Lobothyris praepunctata* (BITTNER).**
Lectotype. Lechnergraben near Mariazell, Styria. GBA no. 1890/2/335.
× 3.

All specimens were coated with ammonium chloride before photographing. They are deposited in the collections of the Geologische Bundesanstalt (Museum) in Vienna (GBA).
Photographs by Mr. J. BROZEK (Prague).

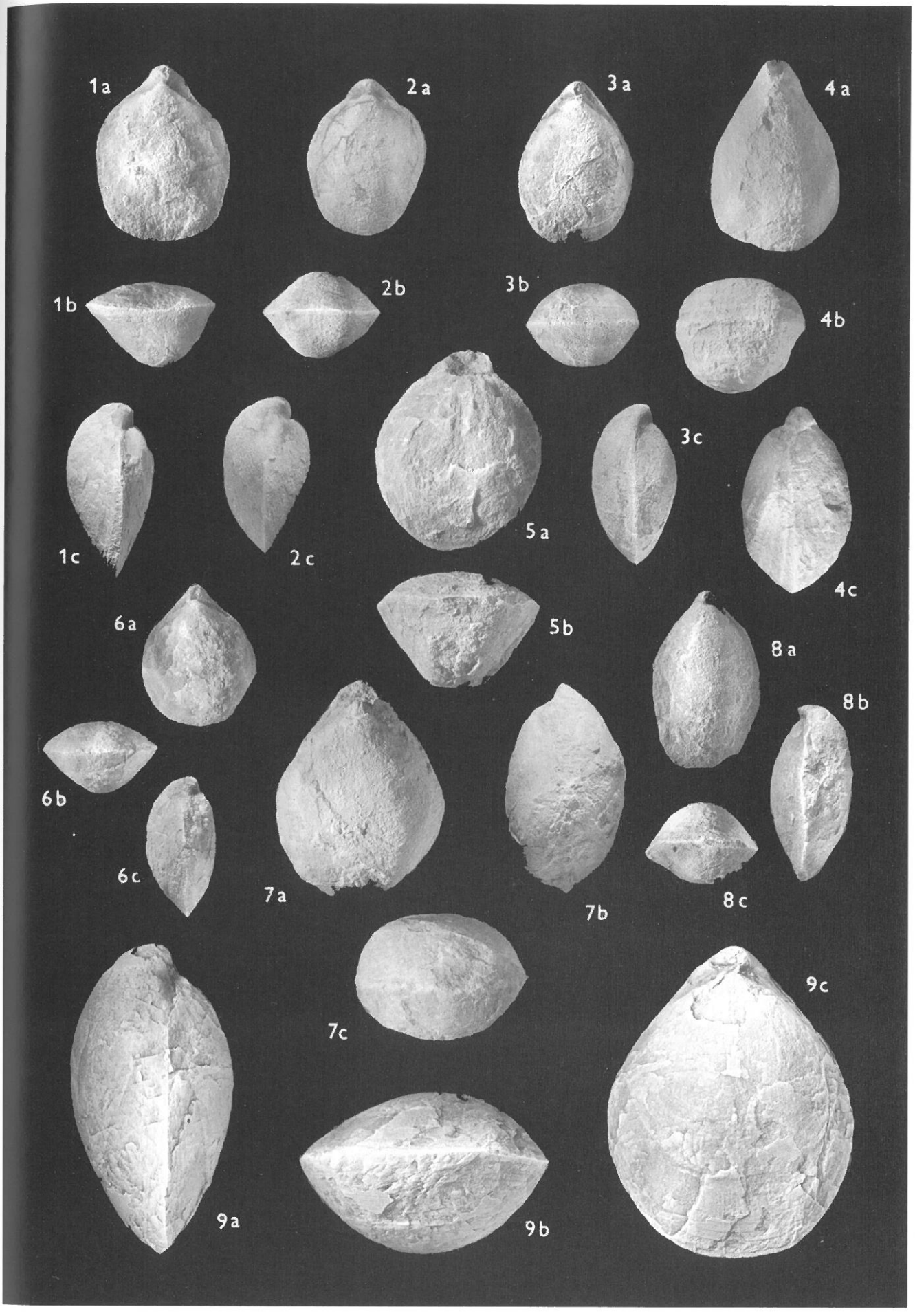
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Plate 3

Fig. 1: ***Tetractinella dyactis*** **(BITTNER).**
Locality 5a. GBA no. 1994/3/15.
× 2.5.

Fig. 2: ***Tetractinella dyactis*** **(BITTNER).**
Locality 8a. GBA no. 1994/3/16.
× 3.

Fig. 3: ***Tetractinella dyactis*** **(BITTNER).**
Lectotype. "Raxalpe". GBA no. 1892/1/93.
× 2.5.

Fig. 4: ***Tetractinella dyactis*** **(BITTNER).**
Locality 5a. GBA no. 1994/3/17.
× 2.5.

Fig. 5: ***Stolzenburgiella baloghi*** **SIBLIK.**
Locality 8b. GBA no. 1994/3/19.
× 3.

Fig. 6: ***Stolzenburgiella baloghi*** **SIBLIK.**
Locality 8b. GBA no. 1994/3/20.
× 3.

Fig. 7: ***Aulacothyris compressa*** **BITTNER.**
Locality 8a. GBA no. 1994/3/22.
× 4.

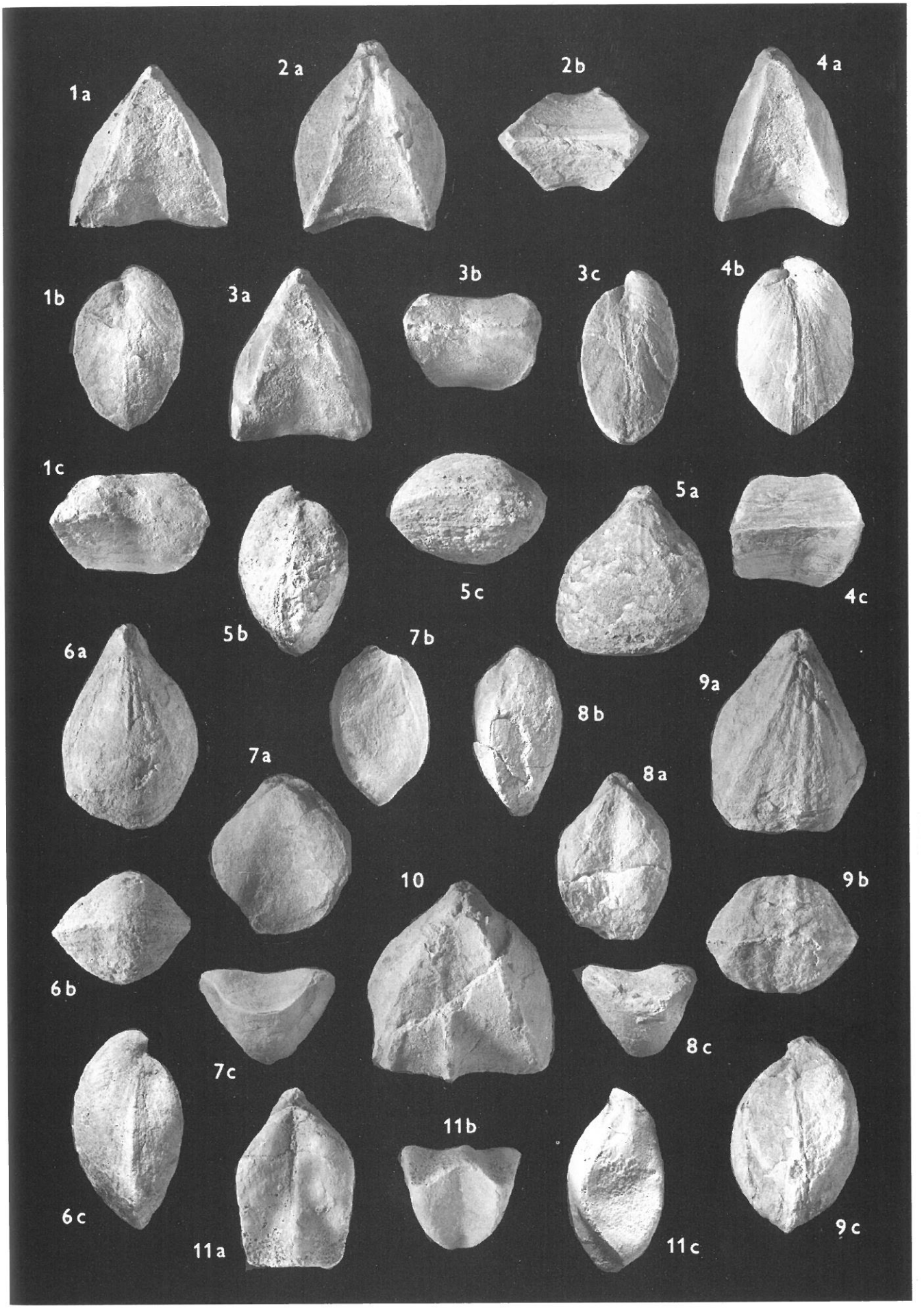
Fig. 8: ***Aulacothyris compressa*** **BITTNER.**
Locality 8a. GBA no. 1994/3/23.
× 3.

Fig. 9: ***Stolzenburgiella baloghi*** **SIBLIK.**
Locality 8b. GBA no. 1994/3/21.
× 3.

Fig. 10: ***Tetractinella dyactis*** **(BITTNER).**
Locality 8a. GBA no. 1994/3/18.
× 2.

Fig. 11: ***Gemerithyris zugmayeri*** **(BITTNER).**
Lectotype. "Raxalpe". GBA no. 1892/1/78.
× 3.

All specimens were coated with ammonium chloride before photographing. They are deposited in the collections of the Geologische Bundesanstalt (Museum) in Vienna (GBA).
Photographs by Mr. J. BROZEK (Prague).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