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A Contribution to the Brachiopod Fauna of the "Oberrhätkalk" (Northern Calcareous Alps, Tyrol-Salzburg)

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20 Text-Figures and 3 Plates

Tirol
Salzburg
Nördliche Kalkalpen
Oberrhätkalk
Brachiopoden
Taxonomie

Österreichische Karte 1 : 50.000
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Contents

Ein Beitrag zur Brachiopodenfauna des „Oberrhätkalkes" (Nördliche Kalkalpen, Tirol-Salzburg)

Zusammenfassung

Die Brachiopoden-Vergesellschaftungen des Oberrhätkalks mehrerer wohl bekannter Lokalitäten in Tirol und Salzburg erwiesen sich mit 16 Arten als ziemlich reichhaltig. Die Fauna zeigt keine nennenswerten Unterschiede zu jener der Kössener Schichten.

Abstract

The brachiopod fauna coming from the "Oberrhätkalk" of several known localities in Tyrol and Salzburg turned out varied and yielded 16 species. There is no remarkable difference between this fauna and that of the Kössen Formation.

1. Introduction

The Oberrhätkalk (Upper Rhaetian Limestone) represents end-Triassic shallow water carbonates, which are restricted in the area investigated to the Tyrolicum tectonic unit of the Northern Calcareous Alps. While in many places the intraplatform basin sediments of the Kössen Formation – which often show cyclic bedded carbonates with clayey/marly intercalations – are dominating the stratigraphic record, locally the upper part of the Kössen Fm. may be replaced by often thick-bedded or massive shallow water carbonates. These shallow water bodies are either developed within the Kössen intraplatform basin (e.g. Adnet, Feichtenstein, Gruberalm, Rötelwald) or

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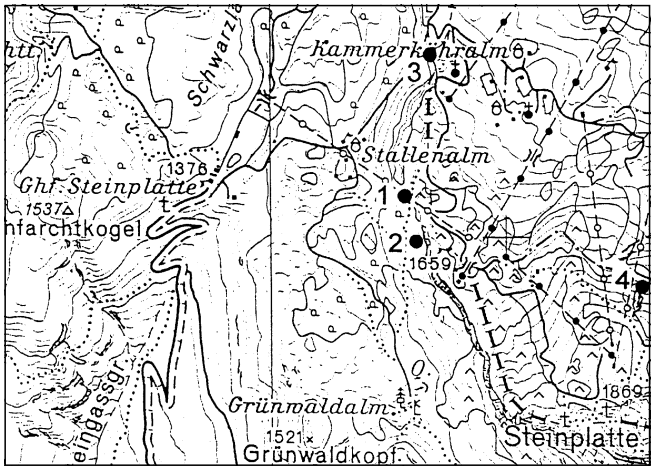
seem to mark the edge between the Dachstein Limestone lagoon northwards towards the Kössen Basin (Steinplatte). Generally speaking, towards the south of the Kössen intraplatform basin with local Oberrhätkalk swells, the carbonate platform of the Dachstein Limestone with cyclic bedded limestones follows. The Dachstein Limestone platforms in many places show reef development on their southern fringes and mark the transition to the open marine Tethyan ocean with various Hallstatt type sediments. In contrast to the Dachstein Limestone reefs, the biofacies of Oberrhätkalk reefs besides the reef builders is often dominated by megalodontids and dasycladaceans.

Abundant finds of brachiopods are mentioned in literature from the Kössen Beds. However, even if not so rich, brachiopods have been recognized as common dwelling organisms also in Upper Triassic reefs, in the Dachstein Limestone, as well as in the Oberrhätkalk. The present paper is focused on the brachiopod assemblages of the Oberrhätkalk with special emphasis on the patch reefs within the Kammerköhr – Kössen basin and on the Steinplatte capping facies. Special attention was paid also to some occurrences in Adnet and to the Rötelwand reef. Due to short visits only sporadic brachiopod finds can be reported so far from the Feichtenstein and Gruberalm Oberrhätkalk. Except for some specimens, the present study is based on my own collection at the mentioned localities. Infilling of crystalline calcite made it very difficult to trace internal characters of the specimens, and thus the study of their internal structures is unsatisfactory and possible in some species only. $\delta^{13}C$- and $\delta^{18}O$-isotopic composition was measured of *Oxycolpella oxycolpos* from Steinplatte-locality 4 (made by J. HLADÍKOVÁ, Czech Geological Survey, Prague), and gave $\delta^{13}C$ values of 2.8 ‰ PDB for shell and 3.4 ‰ PDB for sediment, and $\delta^{18}O$ values of –1.8 ‰ PDB for shell and –1.3 ‰ PDB for sediment.

The following species were ascertained and described in the systematic part: *Bactrynium bicarinatum* EMMRICH, *Thecospira haidingeri* (SUESS), *Fissirhynchia fissicostata* (SUESS), *Austrirhynchia cornigera* (SCHAFHÄUTL), "*Rhynchonella*" ex gr. *subrimosa* (SCHAFH.), *Zugmayerella koessenensis* (ZUGMAYER), *Zugmayerella uncinata* (SCHAFH.), *Laballa suessi* (ZUGM.), *Oxycolpella oxycolpos* (SUESS), *Rhaetina gregaria* (SUESS), *Rhaetina pyriformis* (SUESS), *Rhaetina* aff. *elliptica* DAGYS, *Triadithyris gregariaeformis* (ZUGM.), *Zeilleria austriaca* (ZUGM.), *Zeilleria elliptica* (ZUGM.) and *Zeilleria norica* (SUESS).



Text-Fig. 1.
Situation map of the Steinplatte area, with the sampling localities 1–4 (ÖK 91 St. Johann i.T.).

2. Steinplatte – Kammerköhralm

According to the model of PILLER & LOBITZER (1979), respectively PILLER (1981), an extensive carbonate platform was existing during the Norian/Rhaetian in the eastern part of the Salzburg Calcareous Alps. The Dachstein Limestone of the Hochkönig Massif in part shows reef development representing the transition to the Tethys open sea with characteristic rocks of Hallstatt facies. Towards the north a carbonate platform with more than 1000 m thick cyclic bedded lagoonal Dachstein Limestone follows, which shows the well-known loferites, described by FISCHER (1964). On one side of Steinplatte a transition between lagoonal Dachstein Limestone and the Oberrhätkalk "reef" is well exposed (OHLEN, 1959; PILLER, 1981; STANTON & FLÜGEL, 1989). Towards the north, however, it can be seen that the Steinplatte Oberrhätkalk interfingers with the intraplatform basin of the upper Kössen Formation. It is very characteristic of this Kössen basin that patch reefs of different size developed within the marginal shallow Kammerköhr Kössen basin. These patch reefs were already recognized by VORTISCH (1926) and later studied among others by the authors mentioned above.

The finds of Rhaetian brachiopods reported from Steinplatte by HAHN (1910), VORTISCH (1926), KUSS (1983), KRISTAN-TOLLMANN (1987) and GOLEBIOWSKI (1991) originated from the Kössen Beds only. During my recent samplings in the Steinplatte area (1992–1995) I found numerous brachiopod specimens not only in the Kössen Beds but also in the "Oberrhätkalk". They were collected at the following localities: in the patch-reefs A and B sensu OHLEN (1959) (= A and B mounds in PILLER, 1981) on the NW slopes of Steinplatte (1869 m), in a similar mud-mound near Köhrgatterl, and in the light massive limestones on the NE slope of Plattenkogel (see Text-Fig. 1). According to PILLER (1981) lower parts of both A- and B mounds are represented by terrigenous limestones with bivalve-coral-hydrozoan assemblages. In these grey, irregularly bedded limestones I ascertained the richest brachiopod fauna. It confirms also the knowledge of STANTON & FLÜGEL (1989, p. 17). Upper parts of the mounds are nearly perpendicular walls, differing from the underlier in their massive character and lesser terrigenous content only. The fact that till now they have yielded only rare brachiopod specimens may be caused by bad access resulting in difficult sampling.

2.1. Patch-reef A – Locality 1

Patch-reef A sensu OHLEN (1959) = locality 1 in STANTON & FLÜGEL (1989), SE of the Stallenalm (1422 m). Bedded limestones at the base yielded *Thecospira haidingeri*, *Fissirhynchia fissicostata*, *Austrirhynchia cornigera*, "*Rhynchonella*" ex gr. *subrimosa*, *Zugmayerella koessenensis*, *Zugmayerella uncinata*, *Rhaetina gregaria*, *Rhaetina pyriformis*, *Triadithyris gregariaeformis* and *Zeilleria norica*. In the massive limestones *"Rhynchonella"* ex gr. *subrimosa* was ascertained. The terebratulid forms predominate at this locality.

2.2. Patch-reef B – Locality 2

Patch-reef B sensu OHLEN (1959) = locality 7 in STANTON & FLÜGEL (1989), is situated SSE of the patch-reef A. It was shown by PILLER (1981) on Text-Fig. 15 A. Lower bedded limestones gave the following brachiopods: *Bactrynium bicarinatum*, *Fissirhynchia fissicostata*, *Austrirhynchia cornigera*, *Zugmayerella* sp., *Rhaetina pyriformis*, *Triadithyris gregariaeformis* and *Zeilleria austriaca*.

Text-Fig. 2.
Outcrop photograph of the middle part of locality 3 on Steinplatte.

Text-Fig. 3.
Detailed view showing irregularly bedded, fossiliferous limestones in the middle part of locality 3 on Steinplatte.

2.3. Patch-reef South of Köhrgatterl – Locality 3

A "new" patch-reef was ascertained 1994 about 150 m S of Köhrgatterl, and it is of the same character as the localities 1 and 2. Laterally, the passage to the typical Kössen Formation is well shown. Lower bedded limestones yielded: *Fissirhynchia fissicostata*, *Austrirhynchia cornigera*, *Zugmayerella uncinata*, *Rhaetina gregaria*, *Rhaetina pyriformis*, *Triadithyris gregariaeformis*, *Zeilleria austriaca* and *Zeilleria norica*. The massive limestones gave *Austrirhynchia cornigera* and *Zeilleria* sp.

2.4. Capping Facies of Plattenkogel NE-Slope – Locality 4

White to light grey massive organogenic limestones on the NE slope of Plattenkogel, NNW Steinplatte top (1869 m), above the marked tourist trail, resp. the downhill run. According to STANTON & FLÜGEL (1989) they represent the capping facies of the Oberrhätkalk. On the top of these limestones, the Upper Hettangian Adnet Limestone occurs, with rich ammonite and brachiopod fauna (for this profile see locality ST 90/2 in RAKUS & LOBITZER [1993, Text-Figs. 2 and 4]). The Oberrhätkalk there yielded following species: *Fissirhynchia fissicostata*, "*Rhynchonella*" ex gr. *subrimosa*, *Zugmayerella koessenensis*, *Zugmayerella uncinata*, *Laballa suessi*, *Oxycolpella oxycolpos*, *Rhaetina pyriformis*, *Rhaetina* aff. *elliptica*, *Zeilleria austriaca* and *Zeilleria norica*.

3. Adnet

A wooded hill called Kirchholz consists for most part of a pinnacle-shaped large patch-reef of Oberrhätkalk which is surrounded by Kössen basinal sediments. The drilled thickness of Oberrhätkalk amounts to more than 100 m. The top and the slopes of the Kirchholz Oberrhätkalk are covered by various facies of Liassic limestones, which are quarried for dimension stone (KIESLINGER, 1964; BÖHM, 1992). Also the Oberrhätkalk of Adnet was quarried extensively for polished decoration stone, the so-called "Tropf", which along with various Liassic limestones has been used since Roman time by sculptors and for inside decoration. At present, the following quarries show exposures of Oberrhätkalk: Kirchenbruch, Quarry "Am eisernen Geländer", Eisenmann Quarry (all abandoned), Lienbacher Quarry (abandoned in the Rhaetian part), Tropf Quarry (quarried in small scale) and Motzen Quarry (Rhaetian part opened in 1995; not yet investigated). The facies and palaeontological record of Adnet Oberrhätkalk was studied in detail by SCHÄFER (1979). The fauna coming from the Upper Rhaetian Reef Limestone and occurring in the quarries in vicinity of Adnet was dealt with by ZAPFE (1963) who based his study on the historic, large collection of WÄHNER. Within that material, ZAPFE determined the following brachiopods: *Rhynchonella* ex aff. *cartieri* OPPEL, *Rhynchonella* sp. I, *Rhynchonella* sp. II., *Amphiclinodonta adnethica* BITTNER and *Waldheimia mutabilis* OPPEL. They came from the quarries Kirchholz (Deisselbruch-Fabrik), Brunnauer-Tropfbruch and Kirchenbruch. These determinations were later revised by PEARSON (1977) as follows: *"Rhynchonella" cartieri* OPPEL, *Cirpa briseis* (GEMM.), *Fissirhynchia fissicostata* (SUESS), *Amphiclinodonta adnethica* BITTNER and *"Zeilleria" mutabilis* (OPPEL). According to PEARSON those brachiopod samples came most probably from the Liassic fissures because four of the brachiopod species determined by him were known till then from the Liassic only. FLÜGEL (1981) ascertained that the rhynchonellids in Adnet and

Rötelwand were concentrated in the interstices of the reef framework, whereas terebratulids occurred commonly at the tops of the Kössen biostromes.

3.1. Eisenmann Quarry

In the right (southern) part of quarry No. XXX white massive, partially recrystallized limestones occur. Some coral-rich layers show variegated (mostly green and red) colours due to the micritic resp. silty admixtures. The following species were found: *Austrirhynchia cornigera*, "*Rhynchonella*" ex gr. *subrimosa*, *Zugmayerella koessenensis*, *Zeilleria austriaca* and *Zeilleria norica*. Quite recently, one specimen of *Halorelloidea* sp. was ascertained in the quarry.

3.2. Lienbacher Quarry

Very limited occurrence of light Upper Rhaetian limestones in quarry No. XII shows according to SCHÄFER (1979) packstones of algal-foram-detritus facies. They contain "*Rhynchonella*" ex gr. *subrimosa*.

4. Rötelwand

Rötelwand (Lasswand, Looswand) Reef is situated on the southern end of the Mörtelbach valley near Gaissau. The structure and fauna of the reef were studied in detail by SIEBER (1937) and later by SCHÄFER (1979). Thanks to a large amount of raw material coming from new forestry roads, SIEBER made a large collection, and reported following brachiopods: *Spiriferina emmrichi, Spiriferina kössenensis*, *Rhynchonella fissicostata*, *Rhynchonella subrimosa*, *Waldheimia* (*Zeilleria*) *norica*, *Waldheimia* (*Zeilleria*) *elliptica*, *Waldheimia* (*Zeilleria*) *austriaca* and *Terebratula pyriformis*. I found following brachiopods in the white and pink organodetritic limestones below the NW part of the reef wall: *Fissirhynchia fissicostata*, *Austrirhynchia cornigera*, "*Rhynchonella*" ex gr. *subrimosa*, *Zeilleria austriaca* and *Zeilleria elliptica*. The rhynchonellids play a dominant role at the locality.

5. Feichtenstein and Gruberalm Reefs

Both reefs in the Hintersee valley near Hallein were visited only shortly and they did not yield any well-preserved, determinable brachiopod specimens. I found only 2 ribbed rhynchonellid fragments in the Gruberalm Reef. SENOWBARI-DARYAN (1980) published a very detailed study on both reefs and mentioned that brachiopods occurred very rarely, and that several rhynchonellid and terebratulid specimens had been found only.

6. Conclusions

The finds of the Rhaetian leading species *Austrirhynchia cornigera* in Adnet, Rötelwand and in the Oberrhätkalk of Steinplatte gave the first information on its occurrence at the localities mentioned. On the other hand, the robust *Oxycolpella oxycolpos* which occurs commonly in the Kössen Beds, was ascertained at the locality 4 on Steinplatte only, giving probably preference to living in deeper parts of the sea. The brachiopod fauna of the Oberrhätkalk from Steinplatte is the most diversified of all localities studied in the present paper, and characterizes well the shallow sea assemblage originated at the boundary of the Dachstein carbonate platform with a shallow intraplatform basin, where the Kössen Formation was deposited. *Fissirhynchia fissicostata*, *Rhaetina pyriformis* and *Zeilleria cornuta* are the most common species occurring in both these surroundings. According to FABRICIUS (1966), the similarity of their faunas proves the former neighbourhood of both facies. In accordance with this author, it seems that brachiopods inhabited the reefs mostly during the first phase of reef growth, whereas later, in the true reef complex they occurred occasionally only (Steinplatte-localities 1–3). Based on the localities studied in the present paper, it can be concluded that the brachiopod assemblages of the Oberrhätkalk show comparatively high diversity and resemble closely the Kössen fauna.

7. Systematic Descriptions

The synonymies include the original citations together with those not mentioned by PEARSON (1977) and SIBLIK (1988) only. Necessary information of the type specimens and distributions of the species was given by SIBLIK (1988).

Order: Strophomenida ÖPIK, 1934
Superfamily: Thecideacea GRAY, 1840
Family: Bactryniidae WILLIAMS in MOORE, 1965
Genus: *Bactrynium* EMMRICH, 1855

According to WILLIAMS & HURST (1977, p. 116) *Bactrynium* merits inclusion in the Thecideidina.

Bactrynium bicarinatum EMMRICH, 1855

1855 *Bactrynium bicarinatum* – EMMRICH, p. 449, 1 Text-Fig.
1917 *Thecidea (Pterophloeus) Emmrichi* GÜMB. sp. – GOETEL, p. 94.
1976 *Bactrynium bicarinatum* EMMRICH – MICHALÍK, p. 86, Fig. 7: 1–2.
1988 *Bactrynium bicarinatum* (EMMRICH) – SIBLÍK, p. 27 (cum syn.).

Material: 1 fragmentary brachial valve.

Remarks: Although poorly preserved, the specimen shows a part of the characteristic lobate apparatus with lateral lobes. There is no doubt that the specimen belongs to this unusual species.

Occurrence: Steinplatte – locality 2.

Superfamily: Thecospiracea BITTNER, 1890
Family: Thecospiridae BITTNER, 1890
Genus: *Thecospira* ZUGMAYER, 1880

WILLIAMS & HURST (1977) regarded thecospirids as Spiriferida.

Thecospira haidingeri (SUESS, 1854)

1854 *Thecidea Haidingeri* SUESS – SUESS, p. 43, Pl. 2, Figs. 16–17.
1917 *Thecospira Haidingeri* SUESS sp. – GOETEL, p. 95, Pl. 8, Fig. 1.
1974 *Thecospira haidingeri* – DAGYS, Text-Fig. 44, Pl. 26, Fig. 7.
1976 *Thecospira haidingeri* (SUESS) – MICHALÍK, p. 82, Fig. 1: 1–3, Fig. 2: 1–6, Fig. 3, Fig. 4: 1–5, Figs. 5–6, Fig. 7: 3–6, Figs. 8–9, Fig. 11.
1988 *Thecospira haidingeri* (SUESS) – SIBLÍK, p. 28 (cum syn.).
1989 *Thecospira haidingeri* (SUESS) – BENIGNI and FERLIGA, p. 547, Text-Figs. 6, 12–14, 17D, Pl. 57, Figs. 10–11; Pl. 58, Fig. 5, Pl. 63, Figs. 1–3.

Material: 2 fragmentary specimens with broken posterior parts. The better one measures ? × 6.4 × 4.5 mm.

Remarks: Due to the bad preservation, no new information could be obtained from the specimens. Detailed

studies of *haidingeri* (type-species of *Thecospira*) were made by MICHALÍK (1976) and by BENIGNI & FERLIGA (1989). The importance of internal characters of the brachial valve was stressed by the latter authors for the classification of Thecospiridae. Outline and profile of adductor muscle field, and morphology of median septum were mentioned in this respect. DAGYS (1974) treated *haidingeri* as punctate species. On the other hand, BENIGNI & FERLIGA (1989) did not ascertain any structure in *haidingeri* comparable to punctae and classified it as a pseudopunctate species. According to them, the perforation shown by SUESS (1854) was formed by solution of taleolae (?).

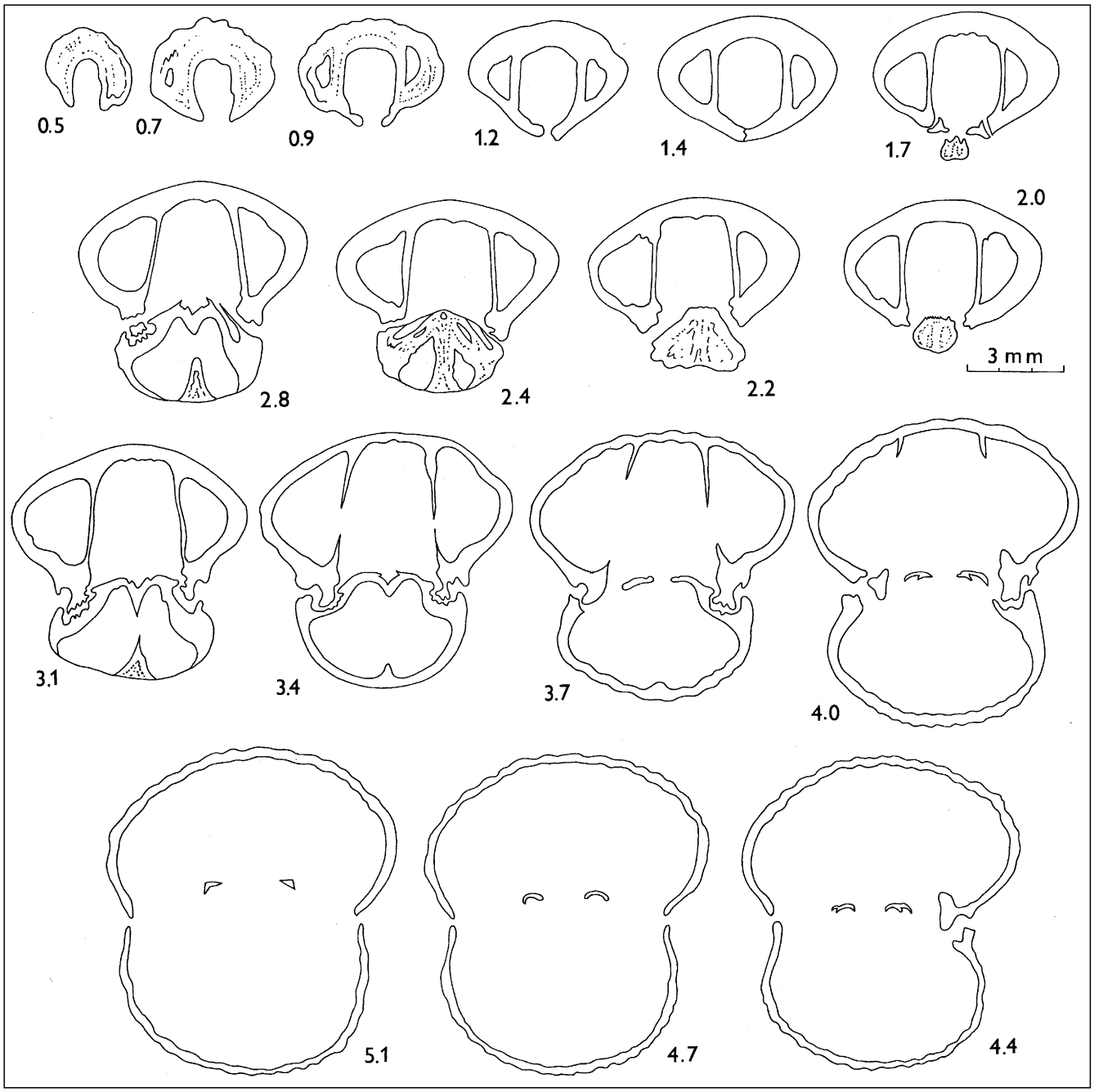
Occurrence: Steinplatte – locality 1. BENIGNI & FERLIGA (1989) reported this Rhaetian species also from several Carnian localities in Italy (San Cassiano Fm.).

Order: Rhynchonellida KUHN, 1949
Superfamily: Rhynchonellacea GRAY, 1848
Family: Praecyclothyrididae MAKRIDIN, 1964
Genus: *Fissirhynchia* PEARSON, 1977

Fissirhynchia fissicostata (SUESS, 1854)

(Pl. 1, Figs. 1, 4; Text-Fig. 4)

1854 *Rhynchonella fissicostata* SUESS – SUESS, p. 58, Pl. 4, Figs. 1–4.
1957 *Rhynchonella fissicostata* SUESS – MAHEL, p. 157, Pl. 3, Figs. 1–3.
1974 *Prionorhynchia* ? *fissicostata* (SUESS) – DAGYS and CERNOV, p. 68, Pl. 2, Fig. 5.



Text-Fig. 4.
Fissirhynchia fissicostata (SUESS). Serial transverse sections through the posterior part of shell.
Original length of specimen 18.6 mm. Steinplatte – locality 3. Magnified.

1977 *Fissirhynchia fissicostata* (SUESS) – PEARSON, p. 48, Pl. 6, Figs. 1–10, Text-Figs. 17–19 (cum syn.).

1978 *Fissirhynchia fissicostata* (SUESS) – AGER, GUTNIC, JUTEAU & MONOD, p. 67.

1978 *"Rhynchonella" fissicostata* SUESS – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 69, Pl. 1, Figs. 3–4.

1978a *"Rhynchonella" fissicostata* SUESS – IORDAN, Pl. 1, Figs. 7 & 9.

1978b *"Rhynchonella" fissicostata* SUESS – IORDAN, p. 49, Pl. 1, Fig. 1.

1979 *Fissirhynchia fissicostata* (SUESS) – KRISTAN-TOLLMANN, TOLLMANN & HAMEDANI, p. 145, Pl. 1, Fig. 5.

1988 *Fissirhynchia fissicostata* (SUESS) – SIBLÍK, p. 56, Pl. 2, Fig. 6/(SUESS), 1854, Pl. 4, Fig. 1/ (cum syn.).

?1993 *Fissirhynchia fissicostata* (SUESS) – IORDAN, Pl. 3, Fig. 1.

1993 *Fissirhynchia fissicostata* (SUESS) – MICHALÍK, p. 101, Pl. 1, Figs. 1–7.

Material: 39 fragmentary specimens with both valves, 7 brachial and 5 pedicle valves, ranging up to 24.0 mm in length, 28.0 mm in width and 14.5 mm in thickness. The figured specimens measure: 20.0 × 21.8 × 13.5 mm (Pl. 1, Fig. 1) and 14.8 × 14.8 × 9.4 mm (Pl. 1, Fig. 4).
Internal details are basically the same as those made known by PEARSON (1977) in the specimens coming from Lower Austria. The character of crura (canaliform in PEARSON) could not be compared as their terminations have not been preserved in my specimens.

Remarks: PEARSON (1977) gave a very detailed description of the species and discussed largely previous data; nothing is to be added. Despite their mostly bad preservation, my specimens show typical characters of this very variable species: steeply rising subangular plication, slightly sunken depressions on cardinal flanks of brachial valve, and sharp branching ribs up to umbos. They have 15–20 ribs on the anterior margin of shell, 5–8 of them in the fold.
The problem of generic appurtenance of *fissicostata* was clarified by MANCENIDO (1980). Up to then, the species was connected by various authors with *Costirhynchia* DAGYS, 1974, *Costirhynchopsis* DAGYS, 1977 (a replacement name for *Costirhynchia* DAGYS, not BUCKMAN, 1918), *Eoseptaliphoria* CHING & SUN, 1976 and *Fissirhynchia* PEARSON, 1977. The last name was accepted by MANCENIDO as the only valid one (including also *Costirhynchopsis* DAGYS, 1977 as a junior subjective synonym). Other genera close to *Fissirhynchia* were mentioned by RADULOVIC, UROSEVIC & BANJAC, 1992 (*Timorhynchia* AGER, 1964, *Excavatorhynchia* CHING & FENG, 1977, *Yidunella* CHING, SUN & YE, 1979 and *Dierisma* CHING, SUN & YE, 1979). They differ, however, from *Fissirhynchia* remarkably either externally or internally.

Occurrence: Rötelwand (24 specimens); Steinplatte – locality 1 (9 specimens), loc. 2 (5 specimens), loc. 3 (12 specimens) and loc. 4 (1 specimen).

Genus: *Austrirhynchia* AGER, 1959

Austrirhynchia cornigera (SCHAFHÄUTL, 1851)

(Pl. 1, Fig. 8)

1851 *Terebratula cornigera mihi* – SCHAFHÄUTL, p. 408, Pl. 7, Fig. 1.

1974 *Austrirhynchia cornigera* (SCHAFHÄUTL) – DAGYS & CERNOV, p. 67, Pl. 2, Fig. 6, Text-Fig. 1.

1977 *Austrirhynchia cornigera* (SCHAFHÄUTL) – PEARSON, p. 54, Pl. 7, Figs. 1–8, Text-Figs. 20–21 (cum syn.).

1977 *Austrirhynchia cornigera* (SCHAFH.) – MISIK, MOCK & SYKORA, Pl. 5, Fig. 3.

1978 *Austrirhynchia cornigera* (SCHAFHÄUTL) – AGER, GUTNIC, JUTEAU & MONOD, p. 67.

1978 *Austrirhynchia cornigera* (SCHAFHÄUTL) – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 70, Pl. 1, Figs. 6–7.

1978a *Austrirhynchia cornigera* (SCHAFH.) – IORDAN, Pl. 1, Fig. 12.

1978b *Austrirhynchia cornigera* (SCHAFHÄUTL) – IORDAN, p. 50, Pl. 1, Fig. 2.

1988 *Austrirhynchia cornigera* (SCHAFHÄUTL) – SIBLÍK, p. 53, Pl. 5, Fig. 3/SCHAFHÄUTL, 1851, Pl. 7, Fig. 1/ (cum syn.).

1993 *Austrirhynchia cornigera* (SCHAFH.) – IORDAN, Pl. 3, Figs. 3–4.

1993 *Austrirhynchia cornigera* (SCHAFHÄUTL) – MICHALÍK, p. 101, Pl. 2, Figs. 3–4.

Material: 132 mostly incomplete internal moulds with shell remains, ranging up to 12.5 mm in length, 22.3 mm in width and 8.7 mm in thickness. The figured specimen measures ?11.5 × ?21.6 × 7.5 mm.

Internal characters: The sections made by PEARSON, 1977 (of the material from Axelstein at Jochenau and of the topotypical one from Koth-Alpe, both Bavaria) and by DAGYS, 1974 (specimen from Kitzberg, Austria) showed characteristic features of the species: quadrate delthyrial cavity limited by subparallel dental lamellae, narrow lateral umbonal cavities, no inner hinge plates, very low and short dorsal septum, and raduliform crura.

Remarks: Nothing is to be added to the very detailed description of this peculiar and highly variable species given by PEARSON (1977).
My material corresponds well to ZUGMAYER's "Kössener Form" of *cornigera* (1880). However, the bizzare anterolateral wings are broken in most of my specimens. Their ribs number between 7–13, 5–8 of them being confined to the fold. *Cornigera* has been recognized as the only Upper Triassic brachiopod characteristic of Rhaetian. Its distribution in various facies is caused according to PEARSON by its unusual morphology facilitating dispersal of the valves by currents. The frequent association of *cornigera* with corals is according to PEARSON unusual. He ascertained and discussed populations of small specimens at the localities Koth-Alpe (type-locality) and Fonsjoch. According to him, two explications could exist for such an occurrence: either relatively unfavourable environmental conditions at the localities, or the adaptation of the individuals for attachment between stems of the dendritic corals (these corals were the chief associates at both localities mentioned).
Nothing certain can be said about the relation of my brachiopods to the coral associates; both dendritic and cerioid coral types are present at the localities.
The specimens from Steinplatte are in the average of smaller dimensions, the specimens from Rötelwand medium-sized.
In this connection, it is interesting to mention that I ascertained 18 comparably small specimens of *cornigera* in the upper parts of the Kössen Beds near Gaissau associated with tiny cerioid corals, and with no other fauna. In that case the mutual relation seemed to be clear.

Occurrence: Rötelwand (115 specimens), Adnet – Eisenmann Quarry (3 specimens), Steinplatte – locality 1 (7 specimens), locality 2 (1 specimen), locality 3: massive limestones (1 specimen), basal bedded limestones (5 specimens).
It is interesting that SIEBER (1937) did not ascertain *cornigera* during his intensive collecting at Rötelwand. The species was not reported from Steinplatte, either.

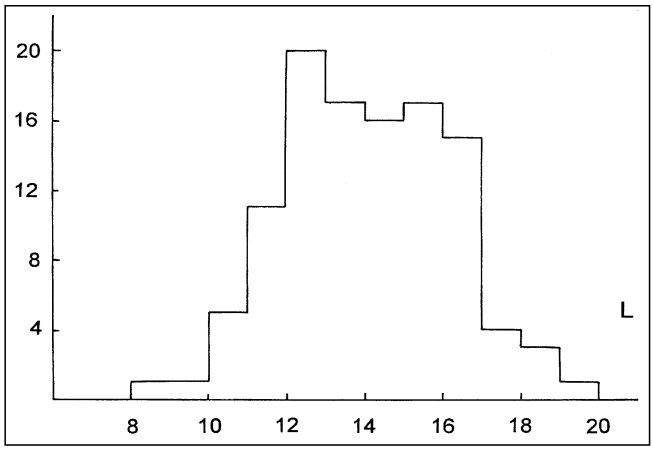
Family: Rhynchonellidae GRAY, 1848
Genus: *Rhynchonella* FISCHER, 1809, s.l.

"Rhynchonella" ex gr. *subrimosa* (SCHAFHÄUTL, 1851)

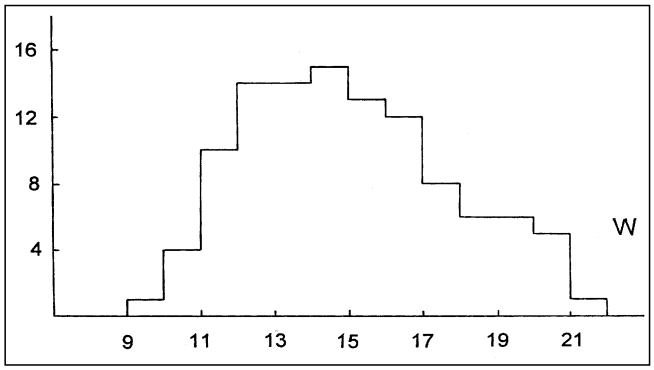
(Pl. 1, Figs. 2–3, 5–7; Text-Figs. 5–12)

1851 *Terebratula subrimosa* mihi – SCHAFHÄUTL, p. 412, Pl. 7, Figs. 3–4.
1854 *Rhynchonella subrimosa* SCHAFHÄUTL spec. – SUESS, p. 54, Pl. 4, Figs. 5–11.
1917 *Rhynchonella subrimosa* SCHAFH. sp. – GOETEL, p. 107, Pl. 7, Figs. 3–4.
1957 *Rhynchonella subrimosa* (SCHAFHÄUTL) – MAHEL, p. 160, Pl. 4, Figs. 1–4.
1964 *"Rhynchonella" subrimosa* (SCHAFHÄUTL) – PEVNY, p. 164.
1974 *Euxinella subrimosa* (SCHAFHÄUTL) – DAGYS and CERNOV, p. 65, Pl. 2, Fig. 4.
1978 *"Rhynchonella" subrimosa* (SCHAFHÄUTL) – BORDEA J., IORDAN, TOMESCU and BORDEA S., p. 69, Pl. 1, Fig. 5.
1988 *"Rhynchonella" subrimosa* (SCHAFHÄUTL) – SIBLÍK, p. 50 (cum syn.).
1993 *Euxinella subrimosa* (SCHAFH.) – IORDAN, Pl. 3, Fig. 2.
1993 *"Rhynchonella" subrimosa* SCHAFHÄUTL – MICHALÍK, p. 101, Pl. 2, Figs. 1–2.
1994 *"Rhynchonella" subrimosa* (SCHAFH.) – SIBLÍK in LOBITZER et al., Pl. 1, Fig. 6.

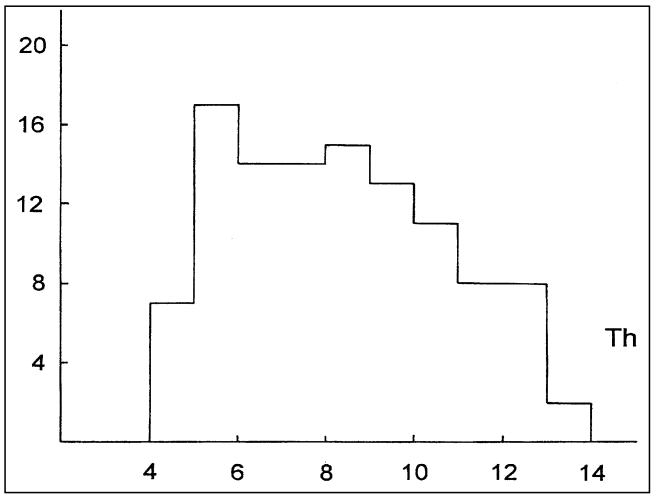
Material: 273 semicostate specimens and 4 specimens with completely ribbed shells, up to 19.0 mm long, 22.0 mm wide and 14.0 mm thick. Figured specimens are of the following dimensions: 17.2 × 17.9 × 13.6 mm (Pl. 1, Fig. 2), 15.6 × 16.7 × 10.4 mm (Pl. 1, Fig. 3),



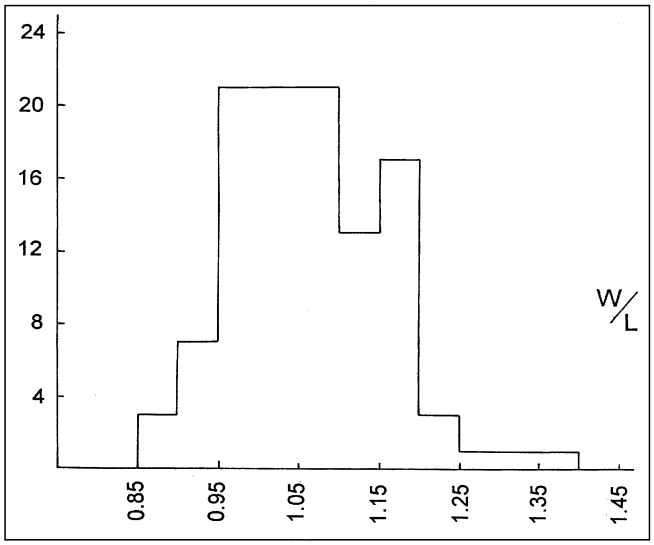
Text-Fig. 5.
Length frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.), in mm.
Vertically number of specimens. Rötelwand.



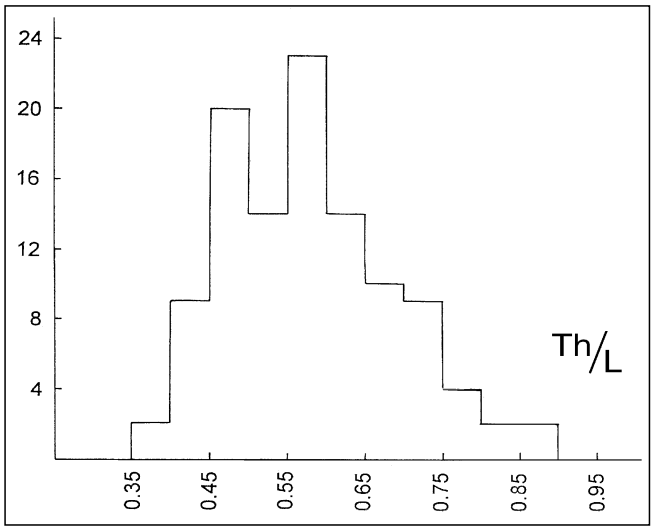
Text-Fig. 6.
Width frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.). Rötelwand.



Text-Fig. 7.
Thickness frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.). Rötelwand.

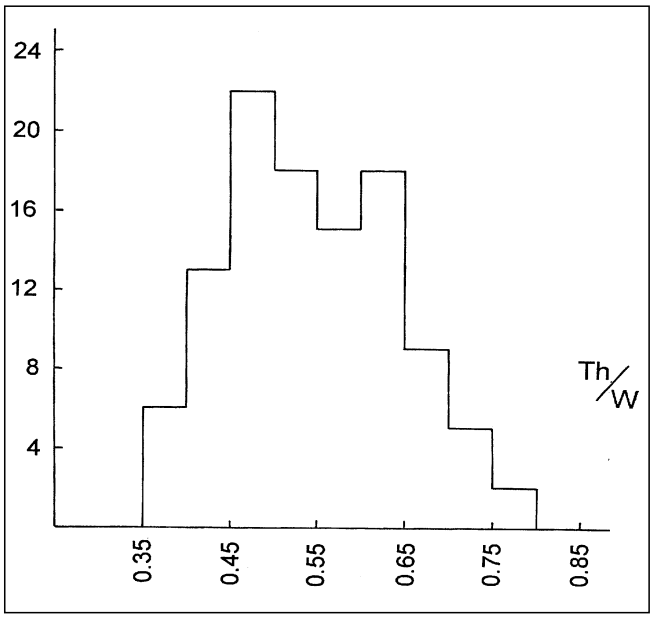


Text-Fig. 8.
Width/length frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.). Rötelwand.



Text-Fig. 9.
Thickness/length frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.). Rötelwand.

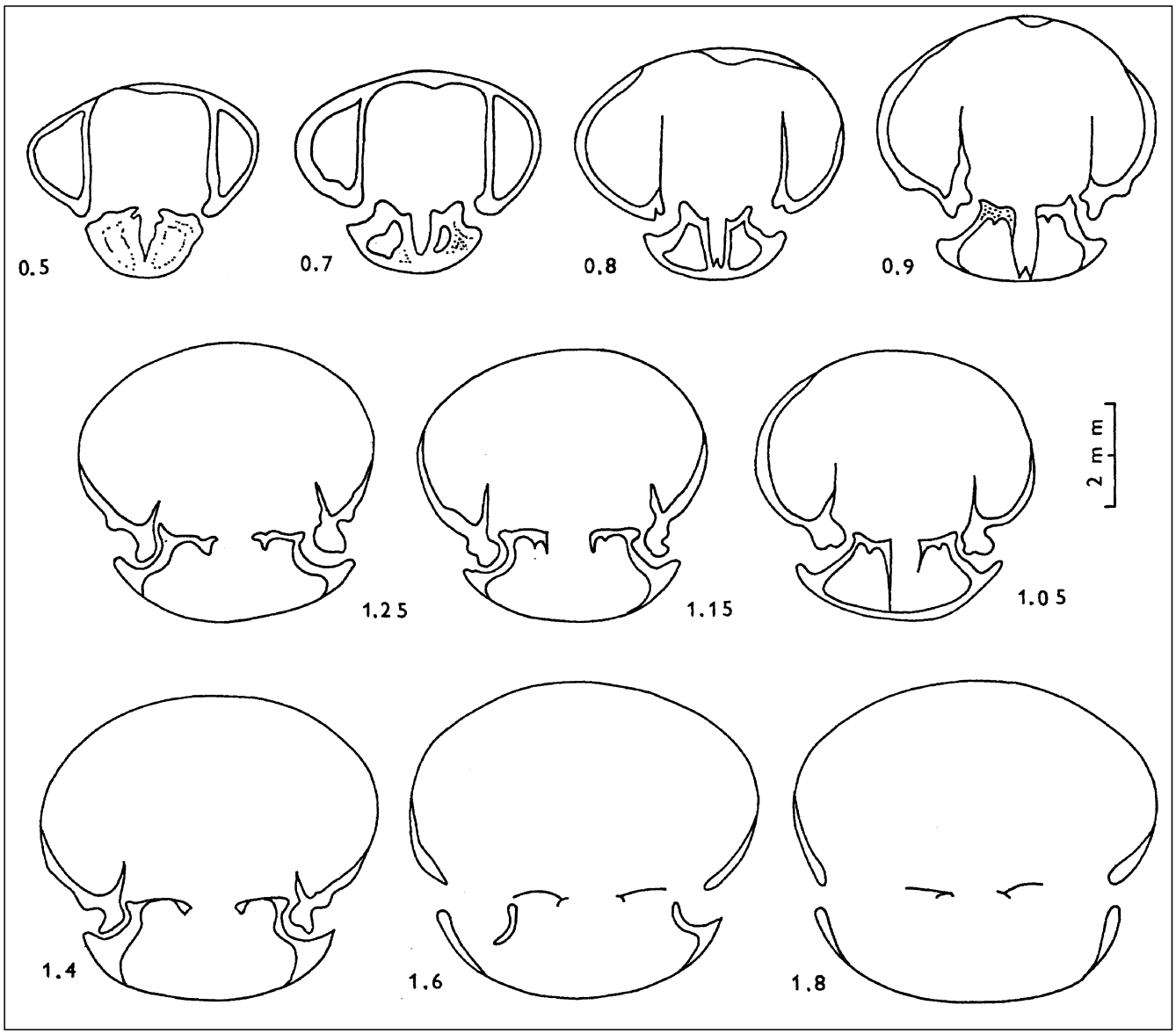
Text-Fig. 10.
Thickness/width frequency histogram for 109 specimens of *"Rhynchonella"* ex gr. *subrimosa* (SCHAFH.). Rötelwand.



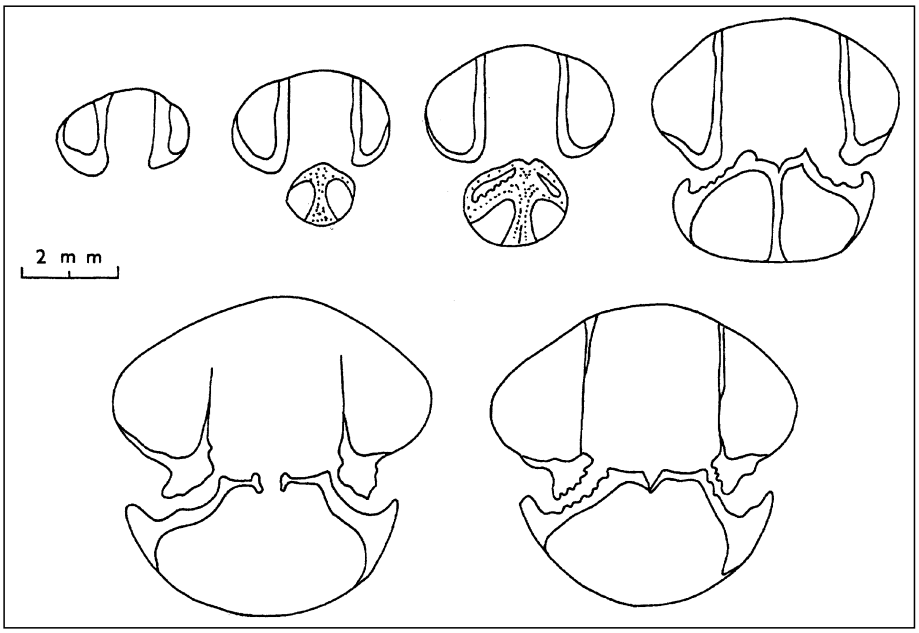
12.2 × 12.6 × 5.6 mm (Pl. 1, Fig. 5), 16.0 × 17.6 × 12.5 mm (Pl. 1, Fig. 6), 12.6 × 12.4 × 6.9 mm (Pl. 1, Fig. 7).

Description: Dorsibiconvex, mostly globulous specimens with poorly developed sulcation of the pedicle valve, and with steeply rising uniplication in the anterior commissure. There are up to 20 subrounded ribs near the anterior margin of shell, 2–7 of them in the fold.

Remarks: Starting with SUESS, 1854, most authors have understood under *"subrimosa"* a smooth to semicostate globulous rhynchonellid. The absolute majority of my present material is of the same character. However, SCHAFHÄUTL's both figured specimens (1851) were entirely ribbed. Thanks to the late Prof. D.V. AGER, I was shown many years ago a part of PEARSON's PhDr thesis



Text-Fig. 11.
"Rhynchonella" ex gr. *subrimosa* (SCHAFH.), sensu SUESS.
Semicostate specimen, measured from dorsal umbo. Length of specimen ?13.0 mm. Rötelwand. Magnified.



Text-Fig. 12.
"Rhynchonella" ex gr. *subrimosa* (SCHAFH.). Six transverse sections through nearly fully ribbed specimen. Original length of specimen 14.7 mm. Magnified.
Adnet. Eisenmann Quarry.

on "Rhaetian articulate brachiopods of Europe" (Imperial College of Science and Technology, London 1967) dealing with *subrimosa*. This species was later omitted in PEARSON's monograph (1977). In this thesis PEARSON chose SCHAFHÄUTL's specimen figured 1851 on Pl. 7, Fig. 3 as lectotype, and after the study of the internal characters of the topotypes he associated *subrimosa* with *Calcirhynchia*. According to him, *subrimosa* occurs in the neighbourhood of the type locality (Reit im Winkel) only. On the other hand, PEARSON designated specimens of smooth *"subrimosa"* (= *subrimosa* sensu SUESS, 1854) deposited in the collections of the Natural History Museum and of the Geologische Bundesanstalt in Vienna as *Vindobonella katzeri* gen.nov., sp.nov. (= nom.nuda), and thus pointed out their distinctness.

The material both from Rötelwand and Adnet shows considerable variability in character of ribbing. There are specimens with shells varying from completely smooth to completely ribbed ones. The specimens are not suitably preserved for sectioning, being fragmentary and much recrystallized. Nevertheless, 2 different types of internal structures could be recognized within the material. The satisfactory correlation of the interior structures to the character of ribbing could not be made on the present collection. The definitive determination needs more suitable material, possibly from the Kössen Beds. Four smooth to semicostate specimens showed (Text-Fig. 11) subquadrate delthyrial cavity, almost parallel dental lamellae, short and blunt denticula, large sockets, subhorizontal hinge plates, and outer hinge plates connected with floor of brachial valve by crural plates flanking sometimes a low, short median septum. Serial sections (Text-Fig. 12) of another, only posteriorly smooth specimen showed subparallel dental lamellae, very shallow septalium connected with short septum, and subhorizontal hinge plates. These latter characters might remind one of the internal structures of *Calcirhynchia* BUCKMAN, 1917, where *subrimosa* was placed by PEARSON.

Occurrence: Adnet-Lienbacher Quarry (4 specimens) and Eisenmann Quarry (43 specimens), Rötelwand (217 specimens), Steinplatte-locality 1: basal bedded limestones (2 specimens), massive limestones (1 specimen), and locality 4 (10 specimens).

Order: Spiriferida WAAGEN, 1883
Genus: *Zugmayerella* DAGYS, 1963

In the new classification of the spiriferid brachiopods (CARTER et al., 1994), *Zugmayerella* is placed in order Spiriferinida IVANOVA, 1972, suborder Cyrtinidina CARTER and JOHNSON, 1994, superfamily Spondylospiroidea HOOVER, 1991 and family Spondylospiridae HOOVER, 1991.

Zugmayerella koessenensis (ZUGMAYER, 1880)

(Pl. 2, Fig. 2)

1880 *Spiriferina Kössenensis* n.f. – ZUGMAYER, p. 28, Pl. 3, Figs. 2–3, Text-Figs. 2–3, 5, 13.
1974 *Zugmayerella koessenensis* – DAGYS, Text-Fig. 99.
1974 *Zugmayerella koessenensis* (ZUGMAYER) – DAGYS and CERNOV, p. 68, Pl. 2, Figs. 2–3.
1976 *Zugmayerella kössenensis* (ZUGM.) – TURCULET, p. 160, Pl. 1, Fig. 3 (cf. *koessenensis*).
1977 *Zugmayerella koessenensis* (ZUGMAYER) – PEARSON, p. 27, Pl. 2, Figs. 1–2, Text-Figs. 6–7 (cum syn.).
1978 *Zugmayerella koessenensis* (ZUGMAYER) – BORDEA J., IORDAN, TOMESCU and BORDEA S., p. 70, Pl. 1, Fig. 9; Pl. 4, Fig. 3.
1978a *Zugmayerella koessenensis* (ZUGM.) – IORDAN, Pl. 3, Fig. 3.
1978b *Zugmayerella* cf. *koessenensis* (ZUGMAYER) – IORDAN, p. 52, Pl. 1, Fig. 3.
1988 *Zugmayerella koessenensis* (ZUGMAYER) – SIBLÍK, p. 75 (cum syn.).

Material: 3 specimens with both valves, 1 brachial and 2 pedicle valves. The dimensions of better preserved specimens: 14.3 × 13.2 × 10.0 mm and 12.0 × 12.5 × 8.8 mm (figured).

Remarks: The description given by PEARSON (1977) of both external and internal characters is sufficiently complete. Medianly flattened folds and sulci are accompanied with 4–6 lateral ribs in my specimens, too. Owing to the limited number of specimens available, it was not possible to study their internal structures.

Occurrence: Adnet. Eisenmann Quarry (2 specimens), Steinplatte-locality 1 (3 specimens) and locality 4 (1 specimen).

Zugmayerella uncinata (SCHAFHÄUTL, 1851)

(Pl. 2, Figs. 4, 6)

1851 *Spirifer uncinatus* – SCHAFHÄUTL, p. 135, Pl. 24, Fig. 33.
1917 *Spiriferina austriaca* SUESS – GOETEL, p. 101, Pl. 8, Fig. 4.
1934 *Cyrtina uncinata* SCHAFH. Üb. zu *austriaca* SUESS – BERNDT, p. 57, Pl. 3, Fig. 11.
1954 *Spiriferina (Cyrtina) uncinata* SCHAFHÄUTL – CONTI, p. 154, Pl. 5, Fig. 11.
1974 *Lepismatina austriaca* – DAGYS, Text-Fig. 98.
1977 *Zugmayerella uncinata* (SCHAFHÄUTL) – PEARSON, p. 23, Pl. 2, Figs. 6–10, Text-Figs. 3–5 (cum syn.).

1978a *"Psioidea" uncinata* (SCHAFH.) – IORDAN, P. 2, Fig. 8.
1978a *Lepismatina austriaca* (SUESS) – IORDAN, Pl. 3, Fig. 5.
1988 *Zugmayerella uncinata* (SCHAFHÄUTL) – SIBLÍK, p. 75 (cum syn.).
1993 *Zugmayerella uncinata* (SCHAFHAEUTL) – SANDY & STANLEY, p. 455, Pl. 1, Figs. 11–20; Pl. 3, Figs. 1–4, Text-Figs. 8–10A.

Material: 23 mostly damaged specimens (8 specimens with both valves, 11 brachial and 4 pedicle valves). The best specimens measure: cca 22.0 (length of brachial valve 16.0) × 19.0 × 10.8 mm (Pl. 2, Fig. 6), 21.5 × 22.2 × 16.2 mm, 14.2 × 16.9 × 12.4 mm (Pl. 2, Fig. 2) and ?11.5 × 12.9 × 9.2 mm.

Remarks: PEARSON (1977) gave a thorough description and discussed the species in detail. The material from Steinplatte fits PEARSON's specimens and description well. There are 3–4 (in one specimen 5) ribs on lateral slopes of brachial valve of my specimens. Large material of *uncinata* from the Late Triassic Luning Formation of Nevada was studied recently by SANDY & STANLEY (1993). The authors did not consider the difference in surface microornaments serious, and synonymized HOOVER's new genus and species *Phenacozugmayerella mimuncinata* (HOOVER, 1991) with *Zugmayerella uncinata*.

Occurrence: Steinplatte – locality 1 (11 specimens), locality 3 (6 specimens) and locality 4 (4 specimens).

Genus: *Laballa* MOISSEIEV in DAGYS, 1962

In the classification by CARTER et al. (1994), *Laballa* is placed in suborder Cyrtinidina CARTER & JOHNSON, 1994, superfamily Suessioidea WAAGEN, 1883 and family Laballidae DAGYS, 1962.

Laballa suessi (ZUGMAYER, 1880)

1880 *Spiriferina Suessi* – ZUGMAYER, p. 29, Pl. 3, Figs. 12, 14–19.
1974 *Laballa suessi* – DAGYS, Text-Fig. 97.
1976 *Laballa suessi* (WINKLER) – CHING, SUN & RONG, p. 315, Pl. 7, Figs. 19–22, Text-Fig. 22.
1977 *Laballa suessi* (ZUGMAYER) – PEARSON, p. 21, Pl. 2, Figs. 3–5, Text-Fig. 2 (cum syn.).
1977 *Laballa suessi* (WINKLER) – CHING & FENG, p. 47, Pl. 5, Figs. 1–4, Text-Fig. 3.
1978a *Laballa suessi* (WINKL.) – IORDAN, Pl. 2, Fig. 13; Pl. 3, Fig. 1.
1985 *Laballa suessi* (WINKLER) – CHING et al., p. 223, Pl. 17, Text-Figs. 24–27.
1988 *Laballa suessi* (ZUGMAYER) – SIBLÍK, p. 74 (cum syn.).
1983 *Laballa suessi* (ZUGMAYER) – IORDAN, Pl. 2, Fig. 11.

Material: 1 fragmentary pedicle valve.

Remarks: Nothing is to be added to the detailed descriptions by ZUGMAYER (1880) and PEARSON (1977) who discussed also the authorship of the species. The occurrence of *Laballa suessi* in the Karnian of the Slovak Karst seems to be well-documented, and the separation of the Slovak material from the ZUGMAYER's species was according to PEARSON not practicable.

Occurrence: Steinplatte – locality 4.

Order: Athyridida BOUCOT, JOHNSON and STATON, 1964
Suborder: Athyrididina BOUCOT, JOHNSON and STATON, 1964
Superfamily: Athyridacea DAVIDSON, 1881
Family: Spirigerellidae GRUNT, 1965
Genus: *Oxycolpella* DAGYS, 1962

Oxycolpella oxycolpos (SUESS, 1854)

(Pl. 2, Fig. 1)

1854 *Spirigera oxycolpos* EMMR. sp. – SUESS, p. 45, Pl. 1, Figs. 1–20.
?1974 *Oxycolpella oxycolpos* (EMMRICH), 1853 – DAGYS & CERNOV, p. 69, Pl. 2, Fig. 1.
1976 *Oxycolpella oxycolpos* (EMMR.) – TURCULET, p. 161, Pl. 1, Figs. 8–10; Pl. 2, Fig. 1.
1976 *Oxycolpella oxycolpos* (EMMRICH) – CHING, SUN & RONG, p. 310, Pl. 5, Figs. 27–32; Pl. 6, Figs. 1–14, Text-Fig. 18.
1977 *Oxycolpella oxycolpos* (SUESS) – PEARSON, p. 32, Pl. 3, Figs. 1–6, Text-Fig. 9 (cum syn.).
1978a *Oxycolpella oxycolpos* (EMMR.) – IORDAN, Pl. 4, Fig. 1.
1979 *Oxycolpella oxycolpos* (SUESS) – KRISTAN-TOLLMANN, TOLLMANN & HAMEDANI, p. 143, Pl. 3, Figs. 1–7; Pl. 4, Figs. 1–8.
1986 *Oxycolpella oxycolpos* (SUESS) – KRISTAN-TOLLMANN, p. 215, Text-Figs. 6–7.
1987 *Oxycolpella oxycolpos* (SUESS) – KRISTAN-TOLLMANN, p. 181, Pl. 3, Figs. 1–13, Text-Fig. 2.
1988 *Oxycolpella oxycolpos* (SUESS) – SIBLÍK, p. 80, Pl. 1, Fig. 2 /= SUESS, 1854, Pl. 1, Figs. 1–4/ (cum syn.).
1993 *Oxycolpella oxycolpos* (SUESS) – IORDAN, Pl. 2, Fig. 13.
1994 *Oxycolpella oxycolpos* (SUESS) – SIBLÍK in LOBITZER et al., Pl. 1, Fig. 3.

Material: 40 mostly fragmentary internal moulds with remains of shell, ranging up to 56.0 mm in length, 62.0 mm in width and 35.5 mm in thickness. The figured specimen measures 48.0 × 49.0 × 30.2 mm.

Remarks: My material corresponds well to the original specimens of SUESS deposited in the collections of the Geologische Bundesanstalt in Vienna. It concerns above all the shell outline and the character of the linguiform extension in the anterior commissure. Extreme thickness of the shell towards the umbos is well ascertainable in the specimens from Steinplatte, too. Their interiors are usually recrystallized, nevertheless the remains of spires are to be seen in some individuals. The lectotype was selected and refigured by PEARSON (1977) who also discussed the authorship of the species. He gave a detailed description of both external and internal characters of its shells based on the topotypical material from the Kössen Beds of the Lofer Graben. Nothing is to be added to this very detailed description, the same variability is shown also in my specimens from Steinplatte. KRISTAN-TOLLMANN (1986, 1987) showed extremely large variability of *oxycolpos* basing on the material from Persia and from some other localities of the Tethys and Panthalassa realm, including specimens coming out from the Kössen Fm. of Steinplatte (1986, Fig. 7, and 1987, Pl. 3, Figs. 8 and 13). Similar *Oxycolpella eurycolpos* (BITTNER) differs from *oxycolpos* esp. in its narrower outline, broader uniplication and in sulcated brachial valve.

Occurrence: Steinplatte – locality 4 only. According to FABRICIUS (1966), the species always occurs in the upper parts of Oberrhätkalk.

Order: Terebratulida WAAGEN, 1883
Superfamily: Dielasmatacea SCHUCHERT, 1913
Family: Dielasmatidae SCHUCHERT, 1913
Genus: *Rhaetina* WAAGEN, 1882

Rhaetina gregaria (SUESS, 1854)

(Pl. 3, Fig. 4)

1854 *Terebratula gregaria* SUESS – SUESS, p. 42, Pl. 2, Figs. 14–15 only.
1934 *Rhaetina gregaria* SUESS – BERNDT, p. 59, Pl. 3, Fig. 16.
1972 *Rhaetina gregaria* (SUESS) – ENCHEVA, p. 29, Pl. 10, Fig. 2.
1974 *Rhaetina gregaria* (SUESS), 1853 – DAGYS & CERNOV, p. 70, Pl. 1, Fig. 2.
1977 *Rhaetina gregaria* (SUESS) – PEARSON, p. 35, Pl. 4, Figs. 1–13, Text-Figs. 10–11 (cum syn.).
?1977 *Rhaetina gregaria* (SUESS) – MIETTO, Pl. 32, Fig. 1.
1978 *Rhaetina gregaria* (SUESS) – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 71, Pl. 4, Fig. 1.
1978a *Rhaetina gregaria* (SUESS) – IORDAN, Pl. 4, Fig. 4.
1978b *Rhaetina gregaria* (SUESS) – IORDAN, p. 52, Pl. 2, Fig. 2.
?1979 *Rhaetina gregaria* (SUESS) – KRISTAN-TOLLMANN, TOLLMANN & HAMEDANI, p. 114, Pl. 5, Fig. 1.
1988 *Rhaetina gregaria* (SUESS) – SIBLÍK, p. 97, Pl. 2, Fig. 3/SUESS, 1854, Pl. 2, Fig. 14/(cum syn.).
1993 *Rhaetina gregaria* (SUESS) – IORDAN, Pl. 3, Fig. 7.
1993 *Rhaetina gregaria* (SUESS) – SANDY & STANLEY, p. 468, Pl. 3, Figs. 7–22, Text-Figs. 15–16.

Material: 4 internal moulds with shell remains. The best preserved specimens measure: 22.4 × 17.4 × 12.6 mm and 19.3 × 17.2 × 10.3 mm (figured).

Internal characters: Serial sections showed a strong pedicle collar, cardinal process and inner hinge plates extending obliquely to the floor. A low median ridge may be present. The mode of preservation precluded study of the loop.

Remarks: *Gregaria* is a rare species in the area of Steinplatte, and this is valid also in the case of occurrence in the Kössen Formation. Owing to the limited number of specimens available, it is not possible to add something to the very detailed description of the species given by MICHALÍK (1975), and PEARSON (1977). Judging from the illustrations by SANDY & STANLEY (1993), there is every reason to believe that also the specimens from Nevada should belong to *gregaria* despite some minor differences in their external features (ovate, prolongated outline of shell and different character of beak and beak ridges in some specimens).

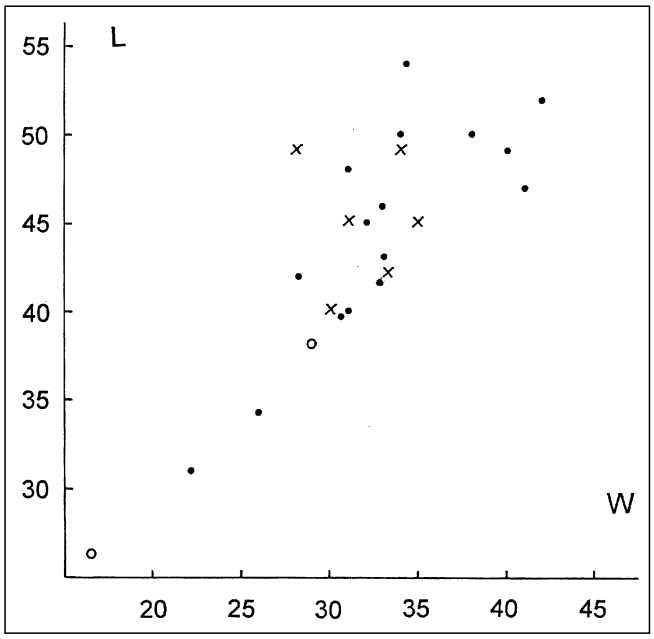
Occurrence: Steinplatte – locality 1 (2 specimens), locality 3 (2 specimens).

Rhaetina pyriformis (SUESS, 1854)

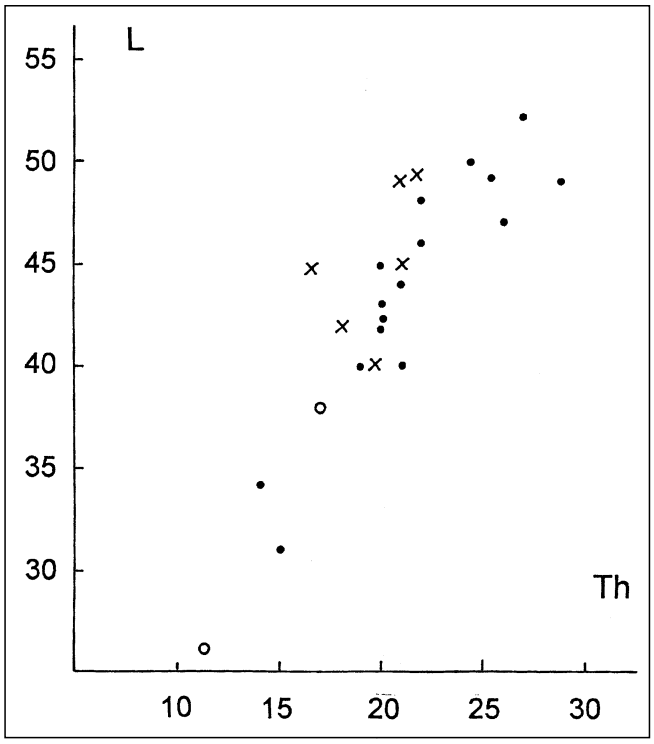
(Pl. 3, Figs. 2–3; Text-Figs. 13–15)

1854 *Terebratula pyriformis* SUESS – SUESS, p. 41, Pl. 3, Figs. 6–7.
1957 *Terebratula pyriformis* SUESS – MAHEL, p. 173, Pl. 6, Figs. 1–2.
1967 *Rhaetina pyriformis* (SUESS) – SIBLÍK, p. 84, Pl. 1, Fig. 3, Text-Fig. 2.
1974 *Rhaetina pyriformis* (SUESS), 1853 – DAGYS & CERNOV, p. 70, Pl. 1, Fig. 1.
1975 *Rhaetina pyriformis* (SUESS) – MICHALÍK, p. 62, Pl. 3, Figs. 2–5; Pl. 4, Figs. 6–7, Text-Figs. 13–20.
1977 *Rhaetina pyriformis* (SUESS) – PEARSON, p. 39, Pl. 5, Figs. 1–7, Text-Fig. 12 (cum syn.).
1977 *Rhaetina pyriformis* (SUESS) – MICHALÍK, Fig. 12.
1978 *Rhaetina pyriformis* (SUESS) – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 71, Pl. 2, Fig. 1; Pl. 3, Fig. 1.
1978b *Rhaetina pyriformis* (SUESS) – IORDAN, p. 54, Pl. 2, Fig. 1.
?1979 *Rhaetina pyriformis* (SUESS) – KRISTAN-TOLLMANN, TOLLMANN & HAMEDANI, p. 145, Pl. 5, Fig. 2.
1988 *Rhaetina pyriformis* (SUESS) – SIBLÍK, p. 99, Pl. 2, Fig. 2/SUESS, 1854, Pl. 3, Fig. 7/(cum syn.).
1993 *Rhaetina pyriformis* (SUESS) – IORDAN, Pl. 3, Fig. 9.

Material: 44 mostly fragmentary specimens with both valves and 2 damaged pedicle valves, up to 52.0 mm long, 43.0 mm wide and 30.0 mm thick. The figured specimens measure 45.6 × 32.8 × 20.7 mm (Pl. 3, Fig. 2) and ?26.3 × 16.2 × 11.0 mm (Pl. 3, Fig. 3).

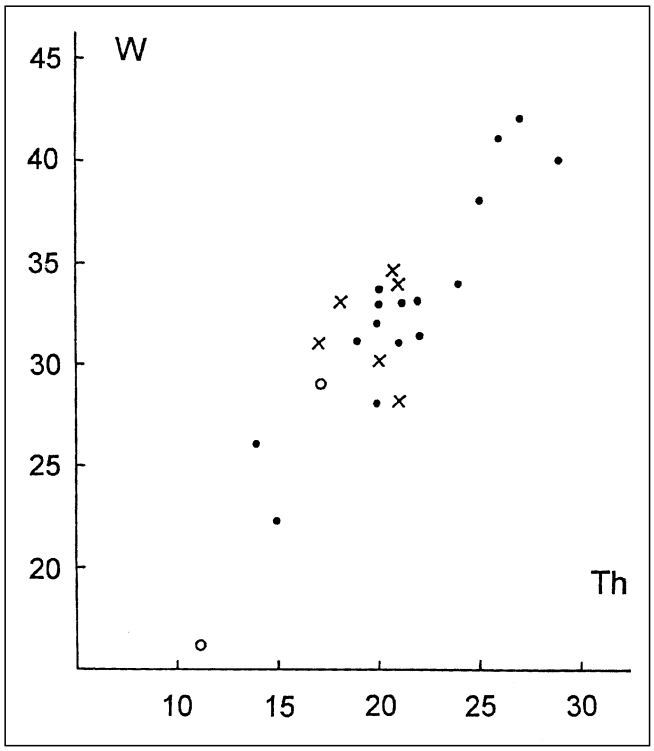


Text-Fig. 13.
Length/width scattergram for *Rhaetina pyriformis* (SUESS), in mm.
Steinplatte: **x** = locality 1 (6 specimens); • = locality 3 (16 specimens); ° = locality 4 (2 specimens).



Text-Fig. 14.
Length/thickness scattergram for *Rhaetina pyriformis* (SUESS).
Explanations as Text-Fig. 13.

Remarks: The specimens correspond well to the thorough description of PEARSON (1977) who selected also the lectotype and discussed variability of *pyriformis* at localities of different conditions. A shallow sulciplication of anterior commissure is developed in only 3 specimens from Steinplatte. According to MICHALÍK (1975) who based his study on very large material, the sulcipli-



Text-Fig. 15.
Width/thickness scattergram for *Rhaetina pyriformis* (SUESS).
Explanations as Text-Fig. 13.

cation was developed in large specimens coming from the Hybe Beds where they occurred very commonly, whereas in the Fatra Beds where *pyriformis* occurred sporadically and in specimens of small dimensions, only simple uniplication developed in the shells.

Occurrence: Steinplatte – locality 1 (12 specimens), locality 2 (3 specimens), locality 3 (25 specimens) and locality 4 (6 specimens).

Rhaetina aff. *elliptica* DAGYS, 1963

(Pl. 3, Fig. 1)

aff. 1963 *Rhaetina elliptica* DAGYS, sp.nov. – DAGYS, p. 155, Pl. 24, Figs. 1–5.

Material: 9 partly incomplete specimens. The figured one measures ?21.0 × 16.5 × 11.7 mm. The dimensions of the other better preserved specimens: 22.5 × 18.4 × 14.3 mm, 21.2 × 18.5 × 12.5 mm and 19.5 × 16.5 × 10.2 mm.

Description: Medium-sized, equi- to dorsibiconvex shells of ovate outline, some specimens nearly globose. Lateral commissure straight. Maximum-width situated in mid-length. Brachial valve nearly circular in some specimens. Usually neither fold nor sulcus developed, but a very low folding resp. sulcation may be noticed in globose specimens near the anterior margin of shell. Anterior plication broad and variably high. Linguiform extension subangular, and straightly limited on its dorsal side in one globose specimen. Beak strong and low, with rounded beak ridges. Concentric growth lamellae visible anteriorly in some specimens. Transverse sections – similar to those of other *Rhaetina* species – showed well-developed inner hinge plates extending obliquely and fusing with valve floor. Dental lamellae absent.

Remarks: The specimens seem to be close to Norian *Rhaetina elliptica* DAGYS. They have ovate outline with subcircular brachial valve and the same convexity of valves. They may be distinguished from DAGYS' species by their remarkably smaller size. It should be noted that also PEARSON described 3 specimens differing from "average" material of *pyriformis* in similar features as my specimens do, under *Rhaetina* sp. cf. *R. elliptica* DAGIS (PEARSON, 1977, p. 41). In connection with the present study, I ascertained recently 8 specimens completely identical with the material determined here as *Rh.* aff. *elliptica*, in my old collection coming from the Norian of Drnava (SE Slovakia). Those specimens did not seem then to be easily distinguishable from the variable material of *Rh. pyriformis* and were not treated separately in SIBLÍK, 1967.

Occurrence: Steinplatte – locality 4.

Superfamily: Loboidothyridacea MAKRIDIN, 1964
Family: Loboidothyrididae MAKRIDIN, 1964
Genus: *Triadithyris* DAGYS, 1963

Triadithyris gregariaeformis (ZUGMAYER, 1880)

(Pl. 3, Fig. 5)

1880 *Terebratula gregariaeformis* n.f. – ZUGMAYER, p. 13, Pl. 1, Figs. 22, 26–29.
1965 *Terebratula (Rhaetina) gregariaeformis* ZUGM. – ZAPFE, p. 285.
1976 *Triadithyris gregariaformis (ZUGM.) – TURCULET, p. 162, Pl. 2, Fig. 9.*
1977 Triadithyris gregariaeformis (ZUGMAYER) – PEARSON, p. 44, Text-Figs. 14–16, Pl. 7, Figs. 11–14 (cum syn.).
1978a *Triadithyris gregariaeformis* (ZUGM.) – IORDAN, Pl. 4, Fig. 5.
?1985 *Triadithyris gragariaformis* (ZUGMAYER) – CHING, WANG, SUN & SHI, p. 231, Text-Fig. 14, Pl. 19, Figs. 30–33.
1988 *Triadithyris gregariaeformis* (ZUGMAYER) – SIBLÍK, p. 103.

Material: 6 slightly damaged specimens. The better preserved specimens measure 18.3 × 18.2 × 10.8 mm, 18.2 × 15.2 × 10.8 mm (figured) and 14.5 × 13.4 × 8.8 mm.

Internal characters: Transverse sections showed a massive bilobed cardinal process and narrow, subhorizontal hinge plates. Other features were not ascertainable in specimens examined.

Remarks: The specimens agree in all observed external features with those described and figured by PEARSON (1977). Some specimens only show clearly an episulcate character of the anterior commissure. With "average" specimens, *gregariaeformis* may be recognized and distinguished externally from certain specimens of *Rhaetina gregaria* by its smaller size and by relatively broader shells with intensive anterior biplication. In comparison with its abundance e.g. at the locality Drnava (SIBLIK, 1967), *gregariaeformis* seems to be rare in the Northern Calcareous Alps (see also PEARSON, 1977, p. 44).

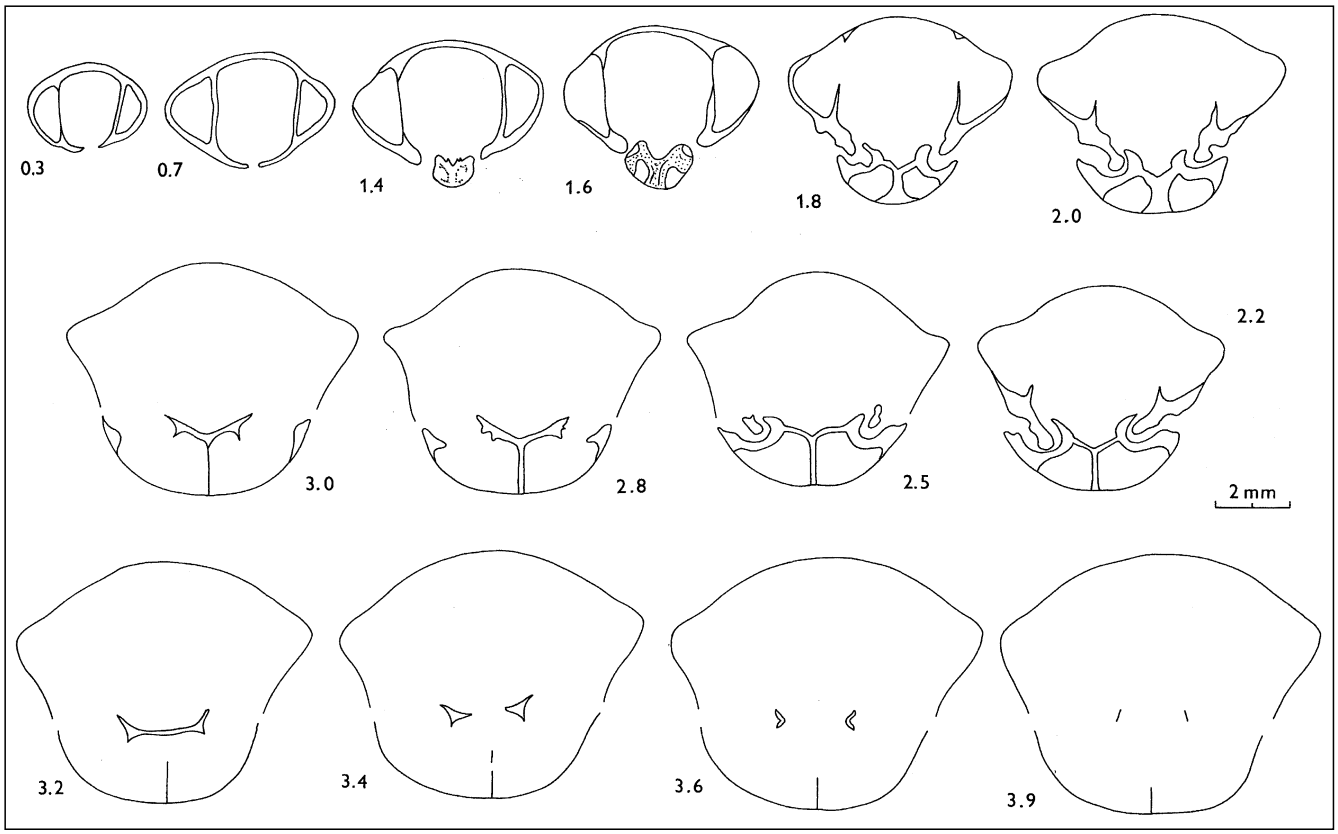
Occurrence: Steinplatte – locality 1 (4 specimens), locality 2 (1 specimen) and locality 3 (1 specimen).

Superfamily: Zeilleriacea ALLAN, 1940
Family: Zeilleriidae ALLAN, 1940
Genus: *Zeilleria* BAYLE, 1878

Zeilleria austriaca (ZUGMAYER, 1880)

(Pl. 3, Fig. 6; Text-Fig. 16)

1880 *Waldheimia austriaca* n.f. – ZUGMAYER, p. 17, Pl. 2, Figs. 12–14.



Text-Fig. 16.
Zeilleria austriaca (ZUGMAYER).
Original length of specimen 17.5 mm. Steinplatte, locality 4. Magnified.

1917 *Waldheimia (Zeilleria)* cf. *austriaca* ZUGM. – GOETEL, p. 121.
1937 *Waldheimia (Zeilleria) austriaca* ZUGM. – SIEBER, p. 158.
1957 *Waldheimia (Zeilleria) austriaca* ZUGMAYER – MAHEL, p. 177.
1967 *Zeilleria austriaca* (ZUGMAYER) – SIBLÍK, p. 84, Pl. 4, Fig. 4.
1977 *Zeilleria austriaca* (ZUGMAYER) – MICHALÍK, p. 336, Fig. 7/3.
1978 *Zeilleria austriaca* (ZUGM.) – BORDEA J., IORDAN, TOMESCU & BORDEA S., Pl. 4, Fig. 4.
1978a *Zeilleria austriaca* (ZUGM.) – IORDAN, Pl. 4, Fig. 6.
1988 *Zeilleria austriaca* (ZUGMAYER) – SIBLÍK, p. 109, Pl. 3, Fig. 4 /= ZUGMAYER, 1880, Pl. 2, Fig. 13/.
1993 *Zeilleria austriaca* (ZUGMAYER) – IORDAN, Pl. 3, Fig. 10.

Material: 18 partially damaged specimens. The best preserved specimens measure: 24.0 × 20.5 × 10.1 mm, 20.0 × 16.8 × 9.7 mm, 19.8 × 15.0 × 9.2 mm (figured) and 19.5 × 15.0 × 7.7 mm.

Internal characters: Pedicle collar not ascertained. Dental lamellae short, almost parallel (strongly converging near umbo in 1 specimen). Septalium well-developed. Hinge plates very clearly delimited from the inner socket ridges. Sockets large. Dorsal septum long but low. Loop not preserved.

Remarks: Nothing is to be added to the original description by ZUGMAYER (1880) and to that by MICHALÍK (1977). However, the maximum-width is situated more anteriorly in most of my specimens.

Occurrence: Adnet-Eisenmann Quarry (6 specimens), Rötelwand (3 specimens), Steinplatte – locality 2 (2 specimens), locality 3 (1 specimen) and locality 4 (6 specimens).

Zeilleria elliptica (ZUGMAYER, 1880)

1880 *Waldheimia elliptica* n.f. – ZUGMAYER, p. 17, Pl. 2, Figs. 6–8, 10.
1917 *Waldheimia (Zeilleria) elliptica* ZUGM. – GOETEL, p. 120, Pl. 7, Fig. 12.
1937 *Waldheimia (Zeilleria) elliptica* ZUGM. – SIEBER, p. 158.
1957 *Waldheimia (Zeilleria) elliptica* ZUGMAYER – MAHEL, p. 178.
1963 *Zeilleria elliptica* (ZUGMAYER), 1882–DAGYS, p. 192, Pl. 28, Figs. 10–13, Text-Fig. 92.
1967 *Zeilleria elliptica* (ZUGMAYER) – SIBLÍK, p. 83, Pl. 1, Fig. 1.
1977 *Zeilleria elliptica* (ZUGMAYER 1882) – MICHALÍK, p. 339, Fig. 7/2, 8, 9/2, 10.
1978 *Zeilleria elliptica* (ZUGMAYER) – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 72, Pl. 4, Fig. 2.
1978a *Zeilleria elliptica* (ZUGM.) – IORDAN, Pl. 5, Fig. 4.
1978b *Zeilleria elliptica* (ZUGMAYER) – IORDAN, p. 55, Pl. 1, Figs. 4–5?.
?1979 *Zeilleria elliptica* (ZUGMAYER) – CHING, SUN & YE, p. 211, Pl. 53, Figs. 5–8.
1988 *Zeilleria elliptica* (ZUGMAYER) – SIBLÍK, p. 109, Pl. 3, Fig. 2 / = ZUGMAYER, 1880, Pl. 2, Fig. 8/.
1993 *Zeilleria elliptica* (ZUGMAYER) – IORDAN, Pl. 3, Fig. 8.

Material: 1 fragmentary specimen with both valves.

Remarks: A detailed description of the species was given by MICHALÍK (1977). *Zeilleria elliptica* differs from *Z. austriaca* above all in the subrounded anterior profile and in a stronger and narrower beak. My specimen has a rectimarginate anterior commissure, and its maximum-width is situated in the anterior half of shell. The specimen figured by IORDAN (1978b) on Pl. 1, Fig. 5 as *elliptica* seems – despite its strong beak – to be rather *austriaca*, basing on its outline and anterior profile. Considerable variation of zeilleriid brachiopods was pointed out recently also by SANDY & STANLEY jr. (1993) who reported *Zeilleria* cf. *elliptica* from Nevada.

Occurrence: Rötelwand.

Zeilleria norica (SUESS, 1859)

(Pl. 2, Figs. 3, 5; Text-Figs. 17–20)

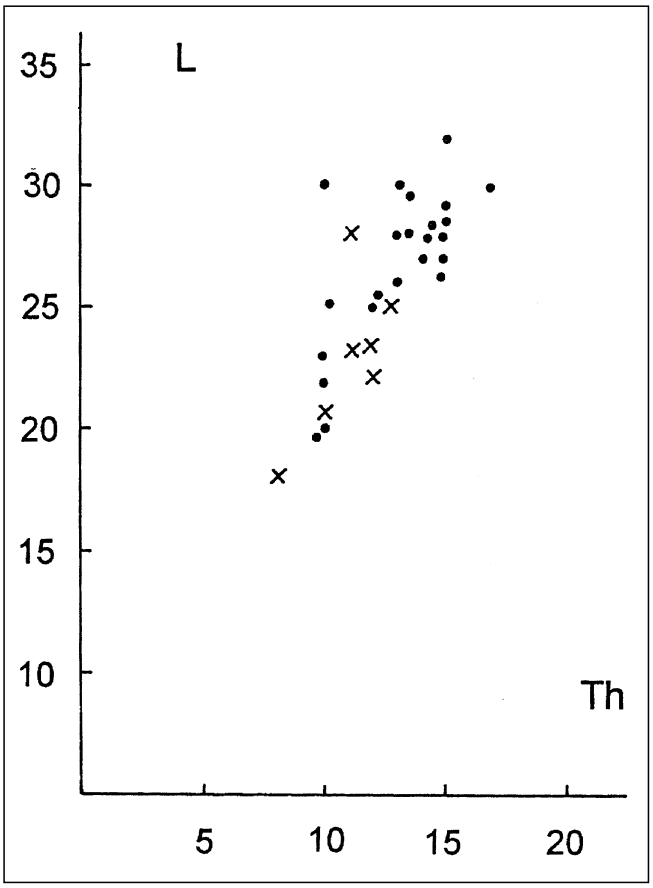
1854 *Terebratula cornuta* SOWERBY – SUESS, p. 38, Pl. 3, Figs. 1–5.
1859 *Waldheimia norica* SUESS (*T. cornuta* SOW. SUESS) – SUESS in HAUER, p. 46.
1890 *Waldheimia norica* SUESS – BITTNER, p. 279.
1917 *Waldheimia (Zeilleria) norica* SUESS – GOETEL, p. 119.
1963 *Zeilleria norica* (SUESS) – DAGYS, p. 197, Pl. 29, Figs. 9–10.
1967 *Zeilleria norica* (SUESS) – SIBLÍK, p. 82, Text-Fig. 1, Pl. 1, Fig. 2.
1974 *Zeilleria norica* (SUESS), 1853 – DAGYS & CERNOV, p. 71, Pl. 1, Fig. 3.
1977 *Zeilleria norica* (SUESS) – MICHALÍK, p. 324, Text-Figs. 2–6, 7/1, 9/1.
1978 *Zeilleria norica* (SUESS) – BORDEA J., IORDAN, TOMESCU & BORDEA S., p. 72, Pl. 3, Fig. 2.
1988 *Zeilleria norica* (SUESS) – SIBLÍK, p. 109 (cum syn.).

Material: 50 specimens, up to 32.2 mm in length, 26.8 mm in width and 18.0 mm in thickness. The figured specimens measure 29.3 × 22.7 × 13.6 mm (Pl. 2, Fig. 5) and 24.5 × 19.6 × 12.4 mm (Pl. 2, Fig. 3).

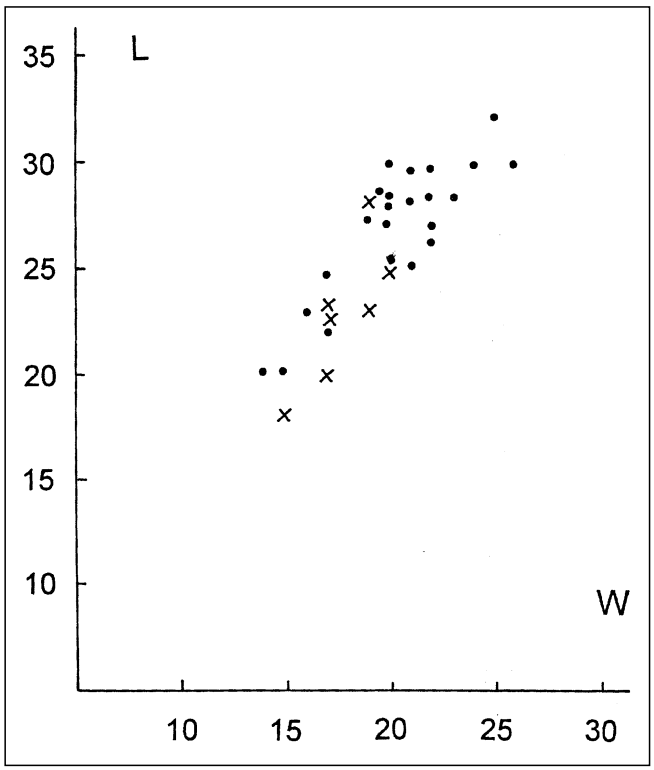
Internal characters: Short, subparallel dental lamellae. Very broad but shallow septalium formed by united inner socket ridges and hinge plates. Large sockets present. Dorsal septum very long. Loop not preserved.

Remarks: PEARSON in his monograph on Rhaetian brachiopods (1977) unaccountably omitted the part treating zeilleriid brachiopods. MICHALÍK (1977) dealt with the Carpathian *norica* in detail, including even ontogeny and anatomy of soft parts. The external variability of my specimens is well comparable to that of ZUGMAYER's material from Kössen Fm. (1880).

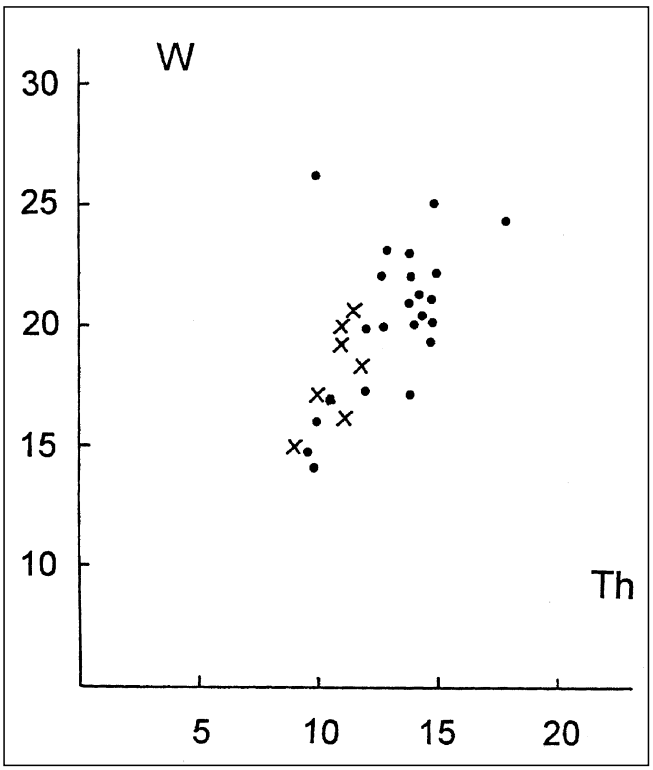
Occurrence: Steinplatte – locality 1 (12 specimens), locality 3 (34 specimens), locality 4 (3 specimens), Adnet-Eisenmann Quarry (1 specimen).



Text-Fig. 18.
Length/thickness scattergram for *Zeilleria norica* (SUESS).
Explanations as Text-Fig. 17.

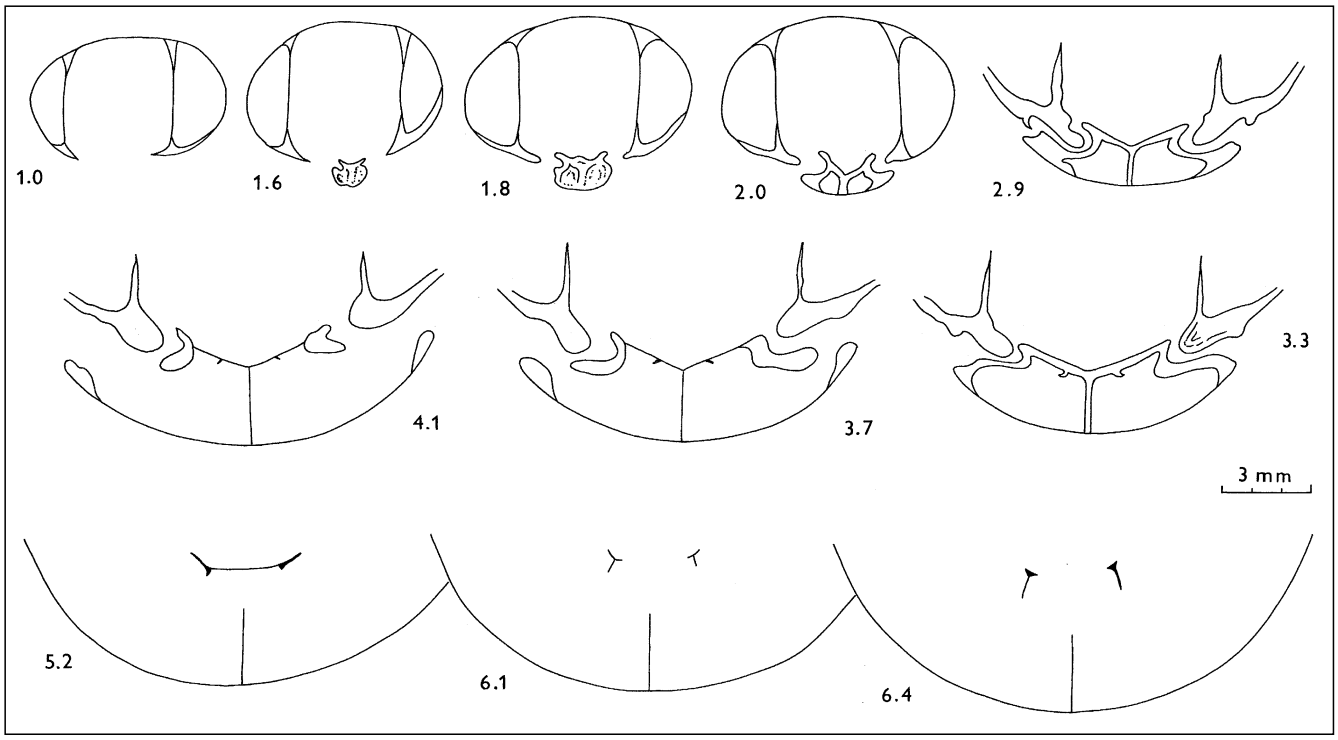


Text-Fig. 17.
Length/width scattergram for *Zeilleria norica* (SUESS), in mm.
Steinplatte: **x** = locality 1 (7 specimens); • = locality 3 (23 specimens).



Text-Fig. 19.
Width/thickness scattergram for *Zeilleria norica* (SUESS).

Explanations as Text-Fig. 17.



Text-Fig. 20.
Zeilleria norica (SUESS).
Due to bad preservation, incomplete series of transverse sections could be made only. Original length of specimen 28.0 mm.
Dorsal septum persisted to 13.5 mm. Steinplatte – locality 3. Magnified.

Acknowledgements

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Plate 1

Fig. 1: ***Fissirhynchia fissicostata* (Suess).**
Steinplatte, locality 1.
GBA no. 1996/1/1.
× 2.

Fig. 2: ***"Rhynchonella"* ex gr. *subrimosa* (Schafhäutl).**
Completely ribbed specimen, figured in Lobitzer et al. (1994, Pl. 1, Fig. 6).
Adnet, Eisenmann Quarry.
GBA no. 1996/1/2.
× 1.5.

Fig. 3: ***"Rhynchonella"* ex gr. *subrimosa* (Schafhäutl), sensu Suess.**
Rötelwand.
GBA no. 1996/1/3.
× 2.

Fig. 4: ***Fissirhynchia fissicostata* (Suess).**
Steinplatte, locality 1.
GBA no. 1996/1/4.
× 2.

Fig. 5: ***"Rhynchonella"* ex gr. *subrimosa* (Schafhäutl), sensu Suess.**
Young specimen.
Adnet, Eisenmann Quarry.
GBA no. 1996/1/5.
× 2.

Fig. 6: "***Rhynchonella*" ex gr. *subrimosa* (Schafhäutl), sensu Suess.**
Semicostate specimen.
Rötelwand.
GBA no. 1996/1/6.
× 2.

Fig. 7: ***"Rhynchonella"* ex gr. *subrimosa* (Schafhäutl), sensu Suess.**
Young specimen.
Adnet, Eisenmann Quarry.
GBA no. 1996/1/7.
× 2.

Fig. 8: ***Austrirhynchia cornigera* (Schafhäutl).**
Rötelwand.
GBA no. 1996/1/8.
× 2.

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).

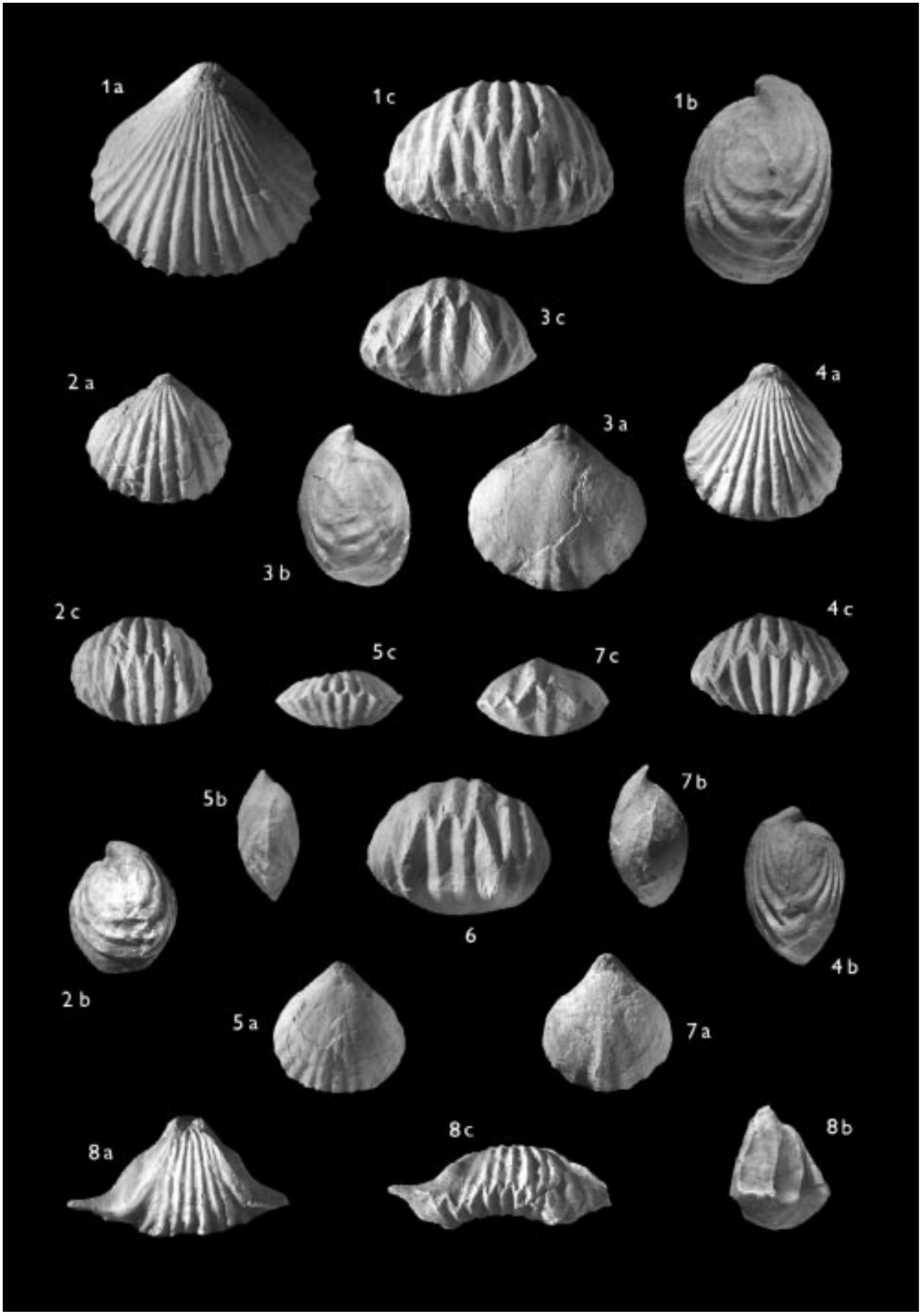
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Plate 2

Fig. 1: ***Oxycolpella oxycolpos* (SUESS).**
Steinplatte, locality 4.
GBA no. 1996/1/9.
× 1.

Fig. 2: ***Zugmayerella koessenensis* (ZUGMAYER).**
Steinplatte, locality 1.
GBA no. 1996/1/10.
× 3.

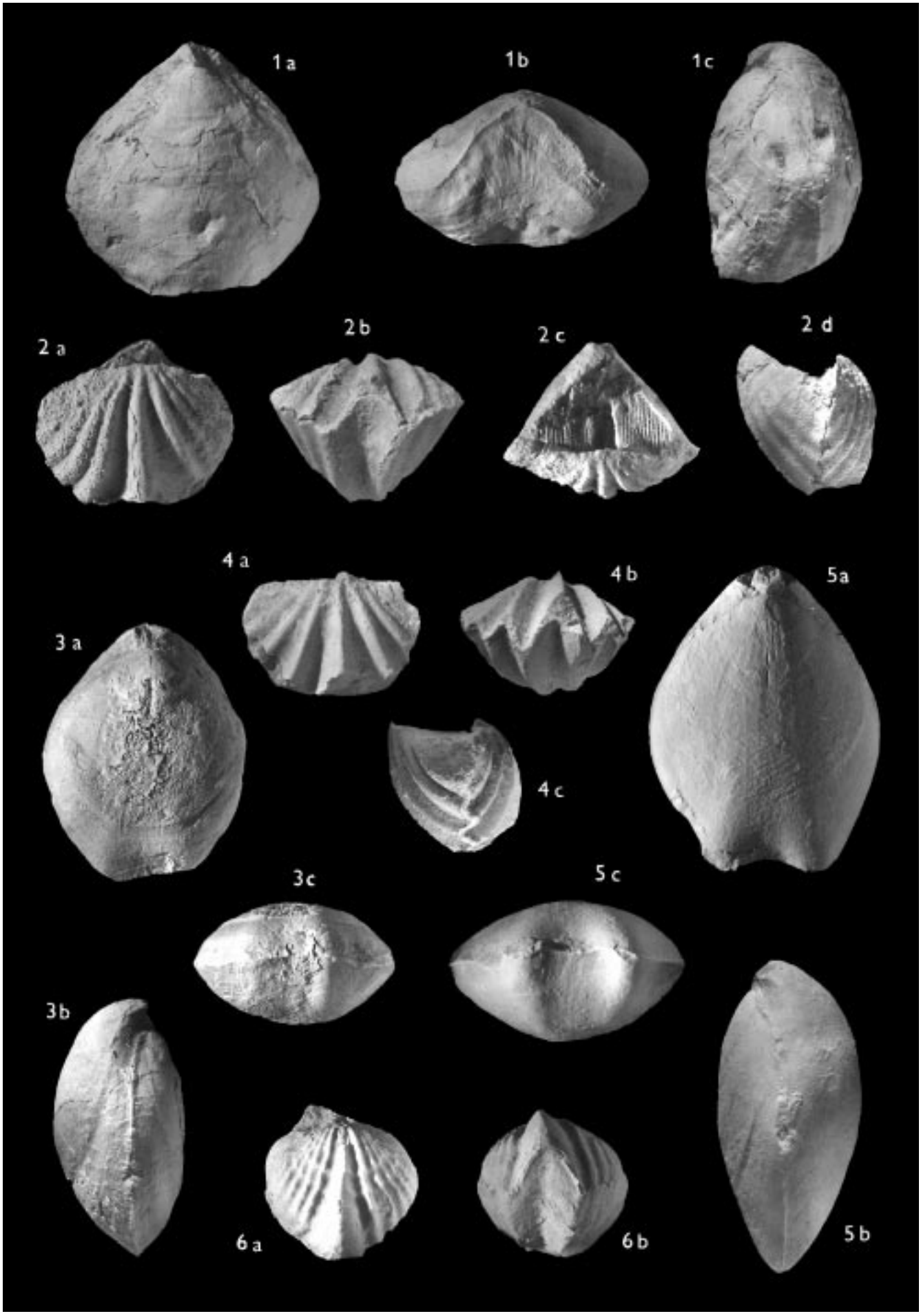
Fig. 3: ***Zeilleria norica* (SUESS).**
Steinplatte, locality 4.
GBA no. 1996/1/11.
× 2.

Fig. 4: ***Zugmayerella uncinata* (SCHAFHÄUTL).**
Steinplatte, locality 3.
GBA no. 1996/1/12.
× 2.

Fig. 5: ***Zeilleria norica* (SUESS).**
Steinplatte, locality 3.
GBA no. 1996/1/13.
× 2.

Fig. 6: ***Zugmayerella uncinata* (SCHAFHÄUTL).**
Figured in LOBITZER et al. (1994, Pl. 1, Fig. 2).
Steinplatte, locality 4.
GBA no. 1996/1/14.
× 1.5.

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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5b

Plate 3

Fig. 1: ***Rhaetina* aff. *elliptica* DAGYS.**
Steinplatte, locality 4.
GBA no. 1996/1/15.
× 2.

Fig. 2: ***Rhaetina pyriformis* (SUESS).**
Steinplatte, locality 3.
GBA no. 1996/1/16.
× 1.5.

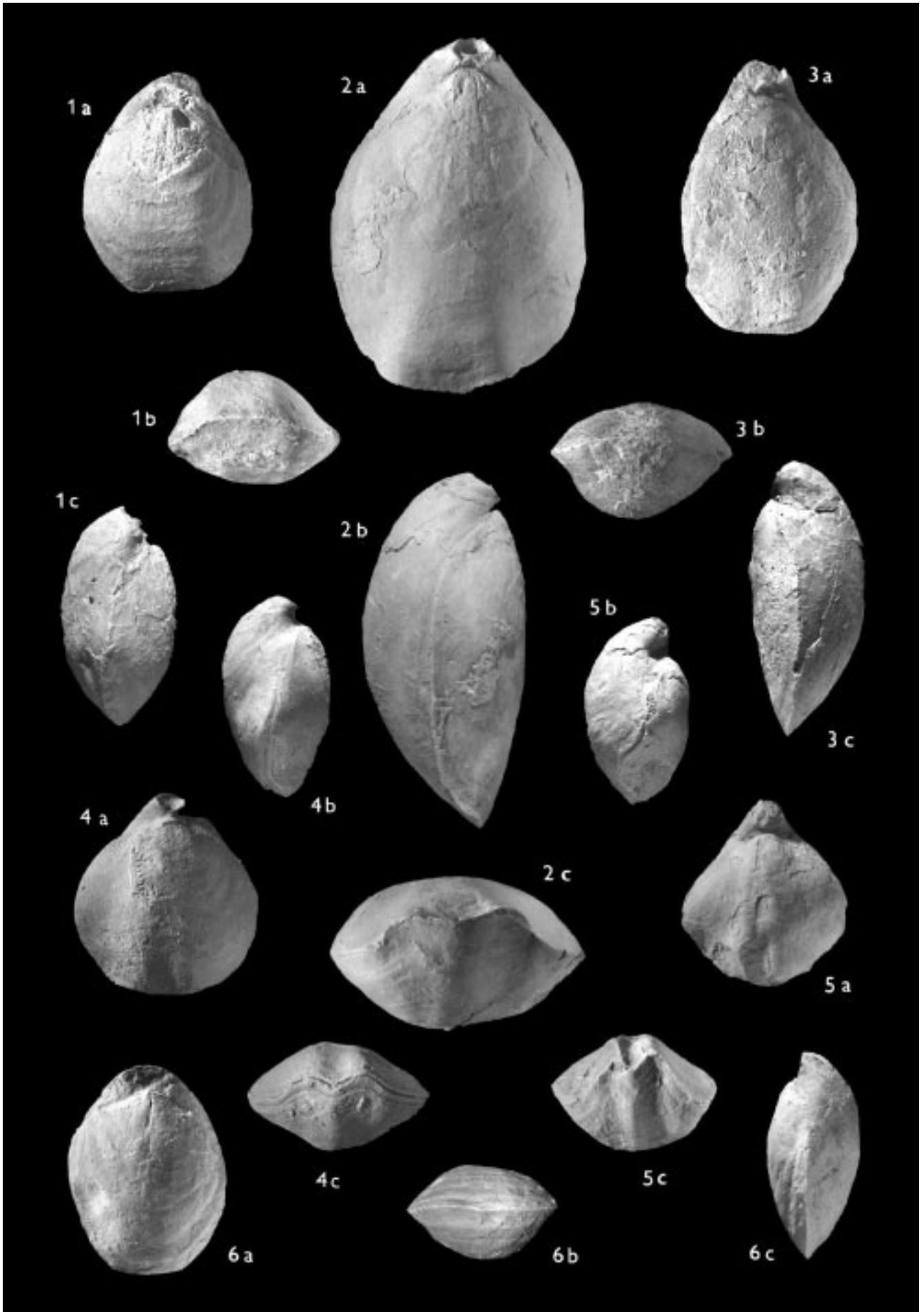
Fig. 3: ***Rhaetina pyriformis* (SUESS).**
Steinplatte, locality 4.
GBA no. 1996/1/17.
× 2.

Fig. 4: ***Rhaetina gregaria* (SUESS).**
Steinplatte, locality 3.
GBA no. 1996/1/18.
× 2.

Fig. 5: ***Triadithyris gregariaeformis* (ZUGMAYER).**
Steinplatte, locality 1.
GBA no. 1996/1/19.
× 2.

Fig. 6: ***Zeilleria austriaca* (ZUGMAYER).**
Adnet, Eisenmann Quarry.
GBA no. 1996/1/20.
× 2.

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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