Meded. Werkgr. Tert. Kwart. Geol. | vol. 21(2) | pp. 61-91 | 6 pls, 1 tab. | Leiden, juni 1984

TYPE SPECIMENS OF PTEROPOD SPECIES (MOLLUSCA, GASTROPODA) DESCRIBED BY ROLLE (1861), REUSS (1867) AND KITTL (1886), KEPT IN THE COLLECTION OF THE NATURHISTORISCHES MUSEUM AT VIENNA

by

A. W. Janssen
Rijksmuseum van Geologie en Mineralogie
Leiden

Janssen, A.W. Type specimens of pteropod species (Mollusca, Gastropoda) described by Rolle (1861), Reuss (1867) and Kittl (1886), kept in the collection of the Naturhistorisches Museum at Vienna. - Meded. Werkgr. Tert. Kwart. Geol., 21(2): 61-91, 6 pls, 1 tab. Leiden, June 1984.

The original material of 19 pteropod species described by Rolle (1861), Reuss (1867) and Kittl (1886), kept in the collection of the Naturhistorisches Museum at Vienna (Austria), was restudied. Thirteen of these species were introduced as new taxa. Type material is still available of 11 species, one of which was based on a single shell (*Limacina hospes* Rolle). Lectotypes are designated for 11 species (one of which is based on an illustration), viz. *Balantium bittneri* Kittl, *Balantium fallauxi* Kittl, *Cleodora spina* Reuss, *Creseis fuchsi* Kittl, *Hyalaea bisulcata* Kittl, *Spirialis andrussowi* Kittl, *Spirialis tarchanensis* Kittl, *Spirialis valvatina* Reuss, *Vaginella austriaca* Kittl, *Vaginella lapugyensis* Kittl and *Vaginella rzehaki* Kittl. The two syntypes of *Spirialis koeneni* Kittl are lost because of pyrite desintegration. New illustrations are given to enable correct interpretation of the species concerned. Opinions on validity and present day naming are avoided.

A.W. Janssen, Rijksmuseum van Geologie en Mineralogie, Hooglandse Kerkgracht 17, 2312 HS Leiden, The Netherlands.

Contents:

ZUSAMMENFASSUNG

Das Belegmaterial zu 19 Pteropoden-Arten beschrieben von Rolle (1861), Reuss (1867) und Kittl (1886), aufbewahrt im Naturhistorischen Museum in Wien, wurde erneut untersucht. Dreizehn davon beziehen sich auf Neubeschreibungen. Original-Material von 11 Arten liegt noch vor, eine davon wurde basiert auf einem Einzelstück (*Limacina hospes* Rolle). Für 11 Arten wurden Lectotypus-Bestimmungen durchgeführt (*Balantium bittneri* Kittl, *Balantium fallauxi* Kittl, *Cleodora spina* Reuss, *Creseis fuchsi* Kittl, *Hyalaea bisulcata* Kittl, *Spirialis andrussowi* Kittl, *Spirialis tarchanensis* Kittl, *Spirialis valvatina* Reuss, *Vaginella austriaca* Kittl, *Vaginella lapugyensis* Kittl und *Vaginella rzehaki* Kittl. Belegmaterial zu *Balantium fallauxi* ist leider verschollen, weshalb die Lectotypus-Bestimmung für diese Art gegründet wurde auf der Original-Abbildung. Beide Syntypen von *Spirialis koeneni* Kittl sind der Pyrit-Verwitterung zum Opfer gefallen. Neue, nicht-idealisierte Abbildungen ermöglichen eine einwandfreie Deutung der vorliegenden Arten. Aussagen über die Gültigkeit oder die heutige Benennung der Taxen wurden eine spätere Arbeit vorbehalten.

INTRODUCTION

During the last two or three years I have been increasingly interested in the study of cenozoic pteropods, mainly those of the North Sea Basin. This was initiated by the urgent need of marker fossils that can be used for long distance correlation of marine deposits. During the activities of the Subgroup "Mollusca and other invertebrate Mesofauna" of I.G.C.P. project 124 it became once more obvious that even within the North Sea Basin correlations by means of benthonic molluscs offers severe and apparently insuperable problems.

It was Mr Chris King (Watford, U.K) who suggested the use of planktonic gastropods, producing at the same time a first draft of a pteropod biozonation for the British and Belgian Paleogene. The present author elaborated this initiative, mainly restricting himself to the Oligocene and younger species. This resulted in a joint proposal for a pteropod biozonation valid all over the North Sea Basin, comprising 17 zones and covering the interval from latest Paleocene up to the youngest Pliocene. This zonation was one of the subgroup's contributions to Project 124 and will be published in the final report (Janssen & King, in press).

This study soon appeared to be more comprehensive than expected at first. Even a first attempt to concentrate pteropod material revealed the existence of several undescribed taxa. It was obvious also that pteropod material is poorly represented in most collections. Newly collected samples have to be treated in a special way to obtain the very fragile and minute pteropod shells. Once started, however, material became available in unexpected quantities, disproportionating the original concept. A purposeful search for pteropods in deposits in which such organisms had hardly ever been found before appeared to be highly successful in several cases. To give one example: Glibert (1957) in his monograph on the Rupelian and Chattian molluscs of Belgium did not mention the presence of even one pteropod shell in the Boom Clay. Recent sampling however revealed the presence of thousands of specimens in a variety of forms, offering good possibilities to recognize certain intervals of this deposit! These and other results will be published in a forthcoming paper.

In molluscan systematics the literature is polluted to a certain degree with misinterpretations, errors and unsatisfactory illustrations. This unfortunately is a normal phenomenon; hardly any taxonomist will be able to escape from this, as all depend on the availability of types and on subse-

quent interpretations of later workers. The fact however that a common Middle Miocene North Sea Basin species, that used to be indicated with the name *Vaginella depressa*, was found to belong to a quite different species, viz. *V. austriaca*, thus provoking a new idea on the interregional correlation of the deposits in which this species is present, made it painfully clear that a critical attitude towards all identifications in literature is absolutely desirable.

Therefore I eagerly took the occasion to study the pteropod collection of the Vienna museum, where the original material is kept of taxa introduced by Rolle (1861), Reuss (1867) and Kittl (1886). Though these authors mainly described material from the Paratethys several of their species are also present in the North Sea Basin, so a critical inventory and new non-idealized illustrations of the type specimens will be very valuable.

Although it was clear in advance that the drawings in the papers concerned were insufficient or idealized it was quite an experience to discover the differences between the illustrations and the actual specimens. I hope that the notes and new illustrations given here will be of use to other students of this very interesting and promising group of organisms as well.

In the present paper the species are listed in alphabetical order with the names used by the quoted author. Opinions on the present day naming and validity of the taxa are largely avoided. They will be discussed in one or more future papers. Younger references are not listed (except for those cases where type specimens are discussed), since they always require a judgement of the material involved. Generally the remarks are restricted to information about the presence or the condition of type specimens, descriptions are only given as a supplement to the original publication or in cases where significant differences were established between the material and the paper where the taxon was introduced. To prevent future errors as much as possible in advance lectotypes were designated whenever relevant. Practically all species described by the three authors are illustrated here, either in simple line drawings or by means of photographs. Altogether 19 species are discussed, 13 of which were first descriptions.

Ich danke besonders herzlich Herrn Dr. Ortwin Schultz, der mir in zuvorkommender Weise Gastfreiheit geboten hat in der Geologisch-Paläontologischen Abteilung des Naturhistorischen Museums in Wien und mir die Bearbeitung der wertvollen Pteropodensammlung überlassen hat.

All drawings were made by the author by means of a Wild M5 stereoloupe with camera lucida device. The photographs of pls 5 and 6 were made by Mr W.A.M. Devilé (RGM).

THE PAPER OF FRIEDRICH ROLLE (1861)

F. Rolle, who at the time of his publication was an assistant curator in the so-called "k.k. Hof-Mineralien-Cabinet" at Vienna (now the Naturhistorisches Museum), described in his 1861 paper 15 mollusc species (14 of which were new to science) from a variety of localities all over Europe. Among these new species is only one pteropod, *Limacina hospes*. The species was based on a single specimen, present in a shipment of Sternberger Gestein, received by the Museum. The collector of this material was not indicated.

THE PAPER OF A.E. REUSS (1867)

This paper was exclusively dedicated to the rich but predominantly ill-preserved fauna of the rock salt deposits of Wieliczka in Galicia, Poland. The greater part of the fossils described by Reuss are Foraminifera and other microfossils, but also several molluscs were encountered. Among them were three species of pteropods, two of which were introduced as new species, viz. *Cleodora spina* Reuss, *Cleodora subulata* Guoy & Gaimard and *Spirialis valvatina* Reuss. Though Reuss's material is now also kept in the Vienna museum he apparently had not the possibility to compare Rolle's type of *Limacina hospes*, as is obvious from a remark in his description of *S. valvatina*: "*Limacina hospes* Rolle aus dem Oberoligocän von Sternberg dürfte von unserer Art kaum verschieden sein" (Reuss, 1867, p. 146).

THE PAPER OF ERNST KITTL (1886)

Kittl was a curator of the K.-k. naturhistorisches Hofmuseum (earlier named the K.-k. naturhistorisches Hof-Cabinet, nowadays the Naturhistorisches Museum). He mainly described, in his 1886 paper, material collected by others, as specified on p. 47 of his paper. The following 18 species, 10 of which were introduced as new species, were treated by him: *Balantium bittneri* Kittl, *Balantium fallauxi* Kittl, *Balantium pedemontanum* (Mayer), *Cleodora spina* Reuss, *Creseis fuchsi* Kittl, *Hyalaea bisulcata* Kittl, *Spirialis andrussowi* Kittl, *Spirialis hospes* (Rolle), *Spirialis koeneni* Kittl, *Spirialis stenogyra* (Philippi), *Spirialis tarchanensis* Kittl, *Spirialis valvatina* Reuss, *Vaginella austriaca* Kittl, *Vaginella depressa* Daudon, *Vaginella lanceolata* von Koenen, *Vaginella lapugyensis* Kittl, *Vaginella rzehaki* Kittl and *Vaginella tenuistriata* Semper.

The greater part of his material is still present in the collections of the Naturhistorisches Museum at Vienna. Kittl did not select holotypes for his new species, so all the specimens he had at his disposal have to be considered syntypes. Apparently he did not add new labels to the samples studied by him, consequently incorrect names are still to be found joining the syntypes. Only part of the material has registration numbers.

The 1886 paper is one of the very few publications written by Kittl on Tertiary molluscs. Later he became interested in the Triassic fauna of Yugoslavia, on which subject several important monographs were published (Trauth, 1913).

SYSTEMATICAL PART

Balantium bittneri Kittl, 1886
Pl. 1, fig. 5

1886 *Balantium Bittneri* n.f., Kittl, p. 63, pl. 2, fig. 27.

Syntypes - Kittl studied numerous specimens from Miocene marls in the overburden of Tagbau I at Trifail. Though Kittl stated that the specimens were kept in the collection of the "k.k. geologischen Reichsanstalt" a sample is present, indicated as the original of Kittl illustration, in the collection of the Naturhistorisches Museum at Vienna (not registered).

Remarks - The available piece of marl contains many fragmentary pteropods, but not one of the visible specimens even looks like Kittl's fig. 27. So it must be concluded that his drawing is a reconstruction. One of the better preserved specimens in this piece of sediment is represented here on pl. 1, fig. 5. It does not reach the dimensions given by Kittl and its concentric sculpture is much less regularly developed than suggested by the original drawing. In fact only some weak undulations are visible in the abapical half of the shell. In spite of these differences this specimen, being the most complete one is herewith chosen as the lectotype.

It is very difficult, if not impossible, to obtain a fair idea about the exact appearance of the aperture and the shell-form in lateral and apertural views. Therefore Kittl's right and lower drawings of his fig. 27 seem to be merely wishful thinking.

Type locality - Trifail, Tagbau I.

Stratum typicum - Miocene marl (but see table 1!).

Balantium fallauxi Kittl, 1886

1886 *Balantium Fallauxi* n.f., Kittl, p. 62, pl. 2, figs 23-25 (non fig. 26).

Syntypes - This species was based on the following material. From Peterswald (Albrecht Schacht) 2 specimens (one of which was indicated as the "Typus", viz. the one illustrated in Kittl's figs 23-25). From Dombrau (Eleonoren Schacht) 3 defective specimens belonging to the typical form. From Polnisch-Ostrau (Josef and Jacob Schacht) 4 specimens were conditionally included in *B. fallauxi*, as was a fragment in mould preservation from Pratzer Berg.

Unfortunately all syntypes of the typical form of this species are missing. So the species will have to be interpreted solely on the illustrations and the description. I herewith designate Kittl's fig. 23 as the lectotype of *B. fallauxi*.

All specimens from Polnisch-Ostrau, including the original of his fig. 26 and also the specimen from Pratzer Berg were considered by Kittl to represent most probably a "variety" of *B. fallauxi*. The Pratzer Berg specimen is also missing, but several specimens from Polnisch-Ostrau are still available (all labeled Josef Schacht). Registration number 1888.I.5 contains two pieces of clay (pl. 5, figs 2-3), each with an imprint with shell remnants. One of these is the supposed original of Kittl's fig. 26 (here represented on pl. 5, fig. 3). Another sample from the same locality (registration number 1888.I.70) consists of a clay piece with several more or less defective specimens (at least three, may be four). A photograph of this piece, also containing several other molluscs, among which a badly preserved specimen of *Hyalaea bisulcata*, is given here in pl. 5, fig. 2.

Remarks - Kittl's fig. 26 seems to be a fair representation. The fine concentric sculpture is exclusively present on the illustrated specimen, in all other specimens from Polnisch-Ostrau this sculpture is less distinct or absent. So I think it hardly possible that these specimens belong to the same taxon as typical *B. fallauxi*, which species has a much more accentuated concentric sculpture. Other differences are found in the outline. In *fallauxi* the lateral margins are flexuous, being convex in the upper shell part and concave close to the apex. In the other form these margins are close to the apex. In the other form these margins are straight or very slightly convex. The squeezed condition of the specimens prevents to observe the convexity of the shells, but according to Kittl the typical form is more swollen.

It should be noted here that a specimen from Pratzer Berg in the Vienna collection, which is the original of Kittl's fig. 28 and identified as the only "Austrian" (nowadays Czechoslovakian) specimen of *Balantium pedemontanum* (Mayer), differs markedly from the latter species and agrees closely, on the other hand, with the Polnisch-Ostrau form (see pl. 1, fig. 6). The only difference that I could observe is a somewhat less convex curvature of the growth-lines (which could be a difference in ventral and dorsal sides, actually!). This is the more probable as this very form was recognized from Pratzer Berg by Kittl himself. It is not possible that the specimens were confused, as Kittl stated that in the shell mentioned sub *B. fallauxi* the lower third part was missing.

I think it highly probable that the Polnisch-Ostrau and Pratzer Berg specimens in fact belong to an undescribed *Clio* species. This is not the place, however, to introduce a new species and also the material should be compared with other species (e.g. *Clio bellardii* Audenino, 1899 from the Italian Miocene).

Type locality - Peterswald (Albrecht Schacht).

Stratum typicum - Miocäner Tegel.

Balantium pedemontanum (Mayer, 1868)
Pl. 6, figs 1-4

1886 *Balantium pedemontanum* (Mayer). - Kittl, p. 64, pl. 2, fig. 22 (non fig. 28).

Remarks - In the Vienna collection a sample of four specimens from Serravalle is kept, which certainly are the specimens sent by Mayer as recorded by Kittl. The shells, that may be considered syntypes, are preserved as internal moulds on pieces of grey marl. They are slightly squeezed and sometimes have remnants of the shell material preserved. These four specimens are represented here on pl. 5, figs 1-4. One of the shells (fig. 4) differs from the other three by the fact that the concentric sculpture is almost flattened out.

Though these specimens are syntypes a lectotype should preferably be chosen among the specimens in the Mayer collection, kept in the Naturhistorisches Museum Basel (Switzerland), but at a pinch one of the Vienna specimens might do.

For remarks on the only ' Austrian" specimen of this species see the notes concerning *B. fallauxi* above.

Cleodora (Creseis) spina Reuss, 1867
Pl. 1, figs 1a-b, 2a-b

1867 *Cleodora (Creseis) spina* Rss., Reuss p. 145, pl. 6, fig. 9
1886 *Creseis* (?) *spina* (Reuss). - Kittl, p. 51 (pars).

Syntypes - Reuss didn't indicate the number of specimens available to him. The species is indicated (p. 32) as vary rare in the rock salt. Two specimens are kept in the Vienna collection (registration number 1867.VII.41), but they are erroneously labeled *Cleodora subulata* and as the originals of Reuss's fig. 10. Both syntypes are illustrated on pl. 1, figs 1 and 2. The larger one is selected here as the lectotype, the smaller specimen is a paralectotype.

Remarks - Kittl regarded these two specimens as embryonic shells and therefore unidentifiable. He presumed them to belong to the same species as described by Reuss sub nomen *C. subulata*.

Indeed the two Wieliczka shells are juveniles, but I think it impossible that they belong to the same form as Reuss's *C. subulata* (see below). They resemble somewhat the embryonic part of *Vaginella* but the shell-part above the subapical thickening is widened much more rapidly in e.g. *V. austriaca*. One could suppose that they are embryonic parts of *V. lapugyensis*, which species has a very slender shell and a still unknown embryonic part. In that case however at least an indication should have been visable of the lateral carinae of that species.

The two specimens agree much more with some probably undescribed species available to me from Oligocene and Miocene deposits in the Aquitaine Basin (SW France), though the Polish shells differ slightly by a somewhat wider apical angle.

Both species of Reuss (*C. spina* and *C. subulata*) were mentioned by Krach (1981, p. 123) sub *Vaginella lapugyensis*. Most probably (I don't read Polish!) he considered them either doubtful or identical with *lapugyensis* as in his column Wieliczka of table 1 he only listed *Spiratella valvatina* and *Vaginella lapugyensis*. These data however should be distrusted as Krach's concept of *V. lapugyensis* is apparently erroneous. His illustrations give little information, but among a shipment of Polish pteropods sent to me on loan by Prof Krach one specimen is identified *V. lapugyensis*, which it is certainly not. Its slightly curved shell and the absence of lateral carinae are significant differences. Almost certainly this specimen (from Koszyce Małe) belongs to an undescribed species.

Summarizing *Creseis spina* Reuss can not be related with certainty to any other known species for the time being and has to be regarded an available taxon.

Cleodora (Creseis) subulata Reuss, 1867, non Quoy & Gaimard, 1827
Pl. 1, fig. 3

1867 *Cleodora* (*Creseis*) *subulata* Q.G. - Reuss, p. 145, pl. 6, fig. 10 (non Quoy & Gaimard).
1886 *Creseis* (?) *spina* (Reuss). - Kittl, p. 51 (pars).

Remarks - Of this form, also indicated by Reuss as very rare in the rock salt of Wieliczka, only incomplete specimens were found. The material is kept in Vienna, but incorrectly labeled *Creseis spina* (apparently the samples were mixed up). The sample is not registered. Two very small specimens are present, one of which is almost entirely desintegrated. The other one, though severely damaged, is redrawn and represented here on pl. 1, fig. 3. It is obviously insufficient for a reliable identification. The specimen has no indication of a longitudinal groove as present in *Styliola subula* (Quoy & Gaimard, 1827) and also its apical angle is much wider than in the Recent species.

Kittl united this material with that described by Reuss as *C. spina*, as being presumably one and the same species. This seems unlikely though, as Reuss described the "*subulata*" specimens as having a regularly pointed apex. Also the apical angle of the only remaining shell is wider than that of *C. spina*.

Creseis fuchsi Kittl, 1886
Pl. 1, fig. 4a-d

1886 *Creseis Fuchsi* n f., Kittl, p. 50, pl. 2, figs 1-3.

Syntypes - The three specimens originally mentioned by Kittl from Forchtenau are still present in the Vienna collection (no registration number). The illustrated shell, herewith chosen as the lectotype, is the only more or less complete specimen, the two others are fragments.

Remarks - Kittl's drawings give a rather good impression of this species. The apertural characteristics are slightly incorrect and incomplete. The abapical convexity of the ventral apertural margin is absent in the lectotype. This part of the shell has two weak internal thickenings, as can be observed in an apertural view (pl. 1, fig. 4a). In a lateral view (pl. 1, fig. 4c) the dorsal side of the shell shows a slight but regular convexity, whereas the ventral side is almost straight. The surface of the shell has irregular growth-lines, much more so than suggested in Kittl's fig. 3 where a regularly concentric sculpture is drawn. The apical part of the shell is corroded, the protoconch is missing.

Type locality - Forchtenau.

Stratum typicum - Zweite Mediterranstufe.

Hyalaea bisulcata Kittl, 1886
Pl. 5, figs 4-5

1886 *Hyalaea bisulcata* n.f., Kittl, p. 65, pl. 2, figs 29-32.

Syntypes - This species was based on two squeezed specimens and a fragment from Polnisch-Ostrau (Josef Schacht). This material is still present. Registration number 1888.I.6 comprises two clay casts and their imprints in pieces of clay, all with some shell remnants. The fragmentary specimen is an imprint with shell remnants in registration number 1888.I.70 also containing the specimens discussed sub *Balantium fallauxi*. This latter fragment is so badly preserved that it hardly contributes to the knowledge of the species, if indeed it belongs to the same form.

Remarks - The two more or less complete shells are badly squeezed. On pl. 5, figs. 4-5 these specimens are represented from both sides, also their imprints. They were photographed in low-angle light to show at least the most important sculpture elements.

It is difficult to imagine that Kittl's fine drawings were based on this poor material. The presence and configuration of the basal spines, the surface ornamentation and the differentiation of the ventral and dorsal shell parts, all so clearly indicated by Kittl, are hardly or not justified by the actual syntypes. It may be clear that Kittl's illustrations are no more than a suggestion of how the species might have looked when fresh!

The larger specimen is herewith chosen as the lectotype, as it approaches Kittl's drawing to some extend. The other shell may be considered a paralectotype.

Type locality - Polnisch-Ostrau (Josef Schacht).

Stratum typicum - Miocäner Tegel.

Limacina hospes Rolle, 1861
Pl. 2, fig. 1a-d

1861 *Limacina hospes* Rolle, Rolle, p. 4, pl. 1, fig. 1, 1a-b.
1886 *Spirialis hospes* (Rolle). - Kittl, p. 69, pl. 2, fig. 39.

Holotype - This taxon was founded on a single specimen from the Sternberger Gestein collected in the Mecklenburg area (G.D.R.). The specimen fortunately is still present in the Vienna collection (registration number 1859.XIV.233).

Remarks - The holotype is represented here on pl. 2, fig. 1a-d. As is obvious from these drawings there are marked differences with respect to the original publication and also with the illustration given by Kittl. Especially the widening of the apertural margin is striking. This was not indicated in the original drawing of Rolle, though it was mentioned in the description ("*apertura ... superne paullulum expansa ...*").

Several authors subsequently considered *L. hospes* to be closely related or even identical with *valvatina* Reuss. This latter form, however, never has a widened apertural margin and also there are differences in the general shell form, together distinctly contradicting such a close relationship.

A much closer resemblance exists between *L. hospes* and a species described by von Koenen (1892, p. 995, pl. 62, figs 3a-b, 4a-c), viz. *Spirialis dilatata*. Though having a more elevated spira this species approaches *hospes* by its apertural characteristics. It was also recognized in Rupelian deposits in the meantime, so Rolle's species could be a member of the same lineage. It is difficult to estimate whether or not they belong to one and the same species, with only one specimen at hand.

Type locality - Mecklenburg area.

Stratum typicum - Sternberger Gestein.

Spirialis andrussowi Kittl, 1886
Pl. 2, figs 2-9

1886 *Spirialis Andrussowi* n.f., Kittl, p. 71, pl. 2, fig. 41.

Syntypes - The original sample from Kop-Kotschegen is still available (no registration number). It consists of a small quantity of limestone grit, containing numerous specimens. None of these, however, was isolated from the main sample as being the type or the illustrated specimen, so all the material has to be regarded as syntypes.

Apart from pteropods this sample also contains 17 internal moulds of a small bivalve (? *Spaniodontella*) and one internal mould of a small dextral gastropod.

Remarks - There is a discrepancy between Kittl's text and drawings, concerning the dimensions of the illustrated specimen. This specimen is stated to have a height of 0.9 mm and a width of 0.8 mm. The drawing on the contrary shows a shell being distinctly wider than high. In this respect the illustration agrees with the bulk of the material, so apparently the dimensions are erroneous.

The fossils in this sample are all preserved as internal moulds, also some fragmentary external moulds are present. The former ones invariably have their sutures and umbilical regions concealed by sediment particles or matrix remnants. Some of the specimens could be nicely cleaned by ultrasonic treatment.

The greater part of the specimens agree with Kittl's concise description in having a completely flat or only very slightly elevated spira. Indeed in some larger specimens the body whorls meets the preceding whorl somewhat lower (pl. 2, fig. 3a-b). The original description is quite incorrect, however, in stating that this species is not umbilicated. All cleaned specimens demonstrate the presence of an umbilicus and it is assumed that the sample is uniform in this respect. The diameter of the umbilicus is roughly one seventh of the basal shell diameter. One should realize of course that these are internal moulds, but in such very thin-shelled gastropods dimensions of specimens in shell preservation may not be expected to differ significantly.

From the raw sample 570 specimens were isolated. One of these is chosen as the lectotype (pl. 2, fig. 2a-e), all other specimens are paralectotypes. Some of them have been drawn to demonstrate variability (pl. 2, figs 3-8). In the remaining residue only irrecognizable fragments are left.

The paralectotypes include nine internal moulds that have a more elevated spira than the typical form. One of these is represented here on pl. 2, fig. 9. Such shells in my opinion still belong to *andrussowi*, though they strongly remind of *Spirialis tarchanensis*. Their relatively high and somewhat inflated whorls differ however from those of *tarchanensis*.

Type locality - Near the village of Kop-Kotschegen, Kertsch Peninsula, Crimea.

Stratum typicum - Gypsiferous, sandy limestone.

Spirialis koeneni Kittl, 1886
Pl. 1, fig. 7

1886 *Spirialis Koeneni* n.f., Kittl, p. 68, pl. 2, fig. 37.

Syntypes - Two "silicified" internal moulds with defective apertural margins from Langenfelde (NW Germany) formed the material on which the species *koeneni* was based.

Remarks - The two specimens were kept in the Vienna collection (registration number 1872.IV.36). I borrowed them in 1981 and they were sent to me by post, together with some other pteropod specimens. Both syntypes appeared to consist of pyrite (as could be expected for Langenfelde specimens), that had severely suffered from desintegration. In spite of careful packing one of the specimens had fallen to pieces during the transportation and only irrecognizable crumbles were left. The other specimen is still unimpaired. It is represented here on pl. 1, fig. 7. It is obvious that its present condition prevents recognition entirely. Progressing pyrite desintegration has obscured all shell details. The general shell form is only vaguely visible, but still disagrees with Kittl's drawing. The separate whorls seem to be less numerous than indicated by Kittl. In general this specimen reminds strongly of *S. valvatina* Reuss, a species indeed known from Langenfelde.

It must be concluded that *S. koeneni* is a nomen dubium and I strongly recommend to abandon the application of this name to any other specimen.

Type locality - Langenfelde (NW Germany, Lower Saxony).

Stratum typicum - Miocene.

Spirialis stenogyra (Philippi, 1844)
Pl. 3, figs 1-2

1867 *Spirialis ventricosa* Sowby. - Reuss, p. 61 (non Sowerby).
1886 *Spirialis stenogyra* (Philippi). - Kittl, p. 67, pl. 2, figs 35-36 (non Philippi?).

Remarks - *Scaea stenogyra* Philippi is nowadays regarded to be a junior synonym of *Limacina retroversa* (Fleming) (compare van der Spoel, 1967, p. 43). It seems not very likely that *retroversa* was extant already in Miocene times. Kittl recorded a sample from Ronaszék, collected from Miocene salt clays. The same locality was mentioned already by Reuss. Contrary to Kittl's information some 125 specimens are present, the two illustrated specimens are kept apart. They were redrawn and are represented here on pl. 3, figs 1-2.

The other localities mentioned by Kittl are Palermo (4 specimens), Milazzo near Messina (4 specimens) and Rhodus (5 specimens). The former sample is absent in the Vienna collection, the two others are still there and contain *L. retroversa*. The sample from Rhodus is indicated "Neogen" and the Milazzo sample is said to be of Pleistocene age.

A further sample of this "*stenogyra*" was published by Krach (1981, p. 126) from Krywald, Poland. This sample was sent to me on loan and it agrees almost completely with Recent *retroversa*. This sample is of Badenian age, as is probably the sample from Ronaszék. Further study of this material will be necessary for a reliable evaluation.

Spirialis tarchanensis Kittl, 1886
Pl. 2, figs 10-15

1886 *Spirialis tarchanensis* n.f., Kittl, p 70, pl. 2, fig. 40.

Syntypes - This species was based on two samples from the Kertsh Peninsula, Crimea, on the bank of the Azow Lake. The first of these was collected between Cap Tarchan and Cap Chronevi (indicated as Cap Chroni in the collection). The second sample originates from Cap Tarchan.

Remarks - Both samples are still at hand in the Vienna collection. From the first mentioned locality two containers are present, in one of which lies a copy of Kittl's fig. 40. The labels bear the identification *Spirialis hospes* (Rolle), later changed into *S. tarchanensis*. This agrees with Kittl's text. Both labels in this sample bear the indication "Orig.". Seven specimens (calcitic internal moulds or shells completely filled with calcitic matrix) are present. The larger one of these looks exactly like Kittl's drawing and also has the correct dimensions. This shell is herewith chosen as the lectotype (see pl. 2, fig. 10). The other six shells are to be considered paralectotypes.

In the second container (from the same locality) 5 glass tubes are kept. One of these contains a *Chrysallida* shell, two tubes contain respectively one umbilicated and two non-umbilicated specimens (labeled as such). In a further tube several hundreds of specimens filled with calcitic matrix are present (their exact number could not be counted as many specimens are agglomerated). From this material three specimens are illustrated here (pl. 2, figs 11-13). The above mentioned seven specimens in the first container were apparently isolated from this sample. The last tube contains a washing residue with many, mainly juvenile specimens in shell preservation. Of these also two specimens are represented here (pl. 2, figs 14-15). The shells in this residue are relatively higher than the juvenile specimens in the earlier mentioned samples, so these may not be considered

paralectotypes. I suppose them to originate from a different stratigraphic level, as is also suggested by their state of preservation.

From Cap Tarchan two fragments of rather tough, blackish concretions are present (not registered). Both contain numerous small spiratellids One of these samples is labeled "untere dunkle Thone" (= lower dark clays), whereas the other one is indicated "findling bei Cap Tarchan" (= foundling near Cap Tarchan). The latter apparently was not collected from sediments *in situ*. It is not possible, in both cases, to isolate the pteropods from the rock, but judging from what is visible on the outside the shells have a distinctly more elevated spira than typical *tarchanensis*. In fact they closely resemble *valvatina*! Therefore these samples may not be considered paralectotypes.

A further sample from Cap Tarchan is a sieving residue with the indication "from the greenish-grey clays being an intercalation in the sandy-limy layers of the II. Mediterran-Stufe". This residue contains hundreds of mainly juvenile specimens of typical *tarchanensis*. The sample was not mentioned by Kittl, so these specimens may not be considered as syntypes.

Furthermore the Vienna collection contains four samples from the Kertsch Peninsula labeled Čumnaja-balke (or Tschumnaja-balka). Two of these consists of pieces of light brownish limestone practically exclusively built up from *S. tarchanensis* shells. The two other samples contain similar but not consolidated material. Thousands of specimens are present in these four samples.

Finally a sieving residue is at hand from Orta-eli, also Kertsch Peninsula likewise containing a very large number of mainly juvenile *S. tarchanensis* in shell preservation. These latter five samples were not mentioned by Kittl, so they can not be considered syntypes. This material seems to be collected also by Andrussow.

Spirialis valvatina Reuss, 1867

1867 *Spirialis valvatina* Rss., Reuss, p. 146, pl 6, fig. 11a-b.
1886 *Spirialis valvatina* Reuss. - Kittl, p. 69, pl 2, fig. 38.
1972 *Spiratella valvatina* (Reuss, 1867) - Janssen, p. 61, text-figs 31-37.

Syntypes - Reuss did not indicate the number of specimens available to him but stated this species to be not very rare in the rock salt of Wieliczka, Galicia, Poland. Kittl studied the same sample and mentioned the presence of 8 specimens. He illustrated the same shell as Reuss.

Remarks - Nowadays only seven specimens are left of this sample in the Vienna collection (registration number 1867.VII.42). Drawings of all shells were given by Janssen (1972). The shell represented in text-fig. 32 is herewith selected as the lectotype. Its dimensions are H 0.82 mm and W 0.92 mm. The other six shells are paralectotypes.

Reuss considered his new species to be identical with *Valvatina umbilicata* Bornemann, a species of Middle Oligocene (Rupelian) age. Already von Koenen (1882, p. 358) disputed this point of view, and quite rightly so. It remains incomprehensible why Reuss introduced a new name and did not apply Bornemann's name to his material.

Kittl restudied the syntypes and had no additional material available, except for a piece of sediment from Nusslau near Seelowitz with squeezed *Spirialis*-specimens which he suspected to belong to *valvatina*. This sample is still available at Vienna (not registered). The species can not be

recognized and it was impossible for me to decide whether or not this sample consists of two species (see Kittl, p. 69, footnote 3).

Type locality - Wieliczka, Galicia, Poland.

Stratum typicum - Miocene rock salt.

Vaginella austriaca Kittl, 1886
Pl. 4, figs 1-8

1886 *Vaginella austriaca* n.f., Kittl, p. 54, pl. 2, figs 8-12.

Syntypes - Kittl based his species on the following material: Baden (11 specimens), Vöslau (15 specimens), Sóos (5 specimens), Forchtenau (1 specimen), Kostej (15 specimens), Lapugy (40 specimens, the best preserved material), Ruditz (4 specimens), Dombrau (7 specimens), Polnisch-Ostrau (11 specimens), Laa (1 specimen) and Nusslau near Seelowitz (16 specimens). An unknown number of badly preserved specimens from Pratzer Berg near Brünn was doubtfully assigned to this species.

Remarks - The following material could be located in the Vienna collection. From Baden a sample with several labels (registration numbers 1864.I.122 and 1869.I.233) consisting of 10 shells and a clay cast. One of these seems to be the shell illustrated by Hoernes (1856, p. 663, pl. 50, fig. 42a-b). It is here represented on pl. 4, fig. 2. Another sample from Baden (not registered) contains one shell, labeled "Kittl Pterop. fig. 11". This specimen (pl. 1, fig. 3) however, is distinctly smaller than indicated by Kittl (length according to him 7.7 mm, length of the shell 6.4 mm). A third sample from Baden is labeled *V. depressa* (without registration number) and contains a tube with one specimen of *V. austriaca*, the original of Kittl's fig. 8. This shell is here represented on pl. 4, fig. 1. The box in which the last mentioned specimen is stored contains a second glass tube with a label "Orig.v.Lapugy. *V. austriaca*". Three fragments of *V. austriaca* are present in this tube, which apparently are the remains of the shell pictured by Kittl in his figs 9 and 10. This is the more pityful as this shell was the only complete one available to Kittl. Finally a further sample is present from Baden, with the indication "Kittl. Pteropoden, fig. 12". This is quite puzzling, as the information given by Kittl (p. 55) suggests that his figs 8 and 12 were based on the same specimen. This latter shell is also considerably smaller than the original of fig. 8. It is illustrated here on pl. 4, fig. 4.

From Vöslau material is available (labeled *V. depressa*) with the following registration numbers: 1851.XIII.17, 1863.XV.1234, 1864.I.141, 1866.I.596, 1869.I.54 and 1874.XXIX.53. Three tubes are present with respectively 11 defective shells, 2 shells and 2 fragments, and 2 shells. Apparently these are the Vöslau syntypes of *V. austriaca*. The last mentioned two shells are represented here on pl. 4, figs 5-6.

From Sóos near Baden 5 defective shells and a clay cast are at hand, labeled *V. depressa*, registration numbers 1863.XV.1199, 1869.I.148 and 1872.XXX.87. This sample was relabeled *V. austrica* by Robba in 1973.

The syntype from Forchtenau is kept with the registration number 1869.I.606, labeled *V. depressa*.

I have not been able to trace the sample of 15 specimens from Kostej mentioned by Kittl, so it must be feared that this material is lost.

From Lapugy two samples are still present. The first of these contains three specimens, indicated as "Originale' and labeled *V. austriaca* Kittl. Among them is not the shell figured by Kittl (see above among the notes concerning the specimens from Baden!). The second sample (from which the three specimens were presumably isolated) is indicated *V. depressa* and bears the following registration numbers: 1854.XXXV.408, 1863.XV.252, 1865.I.272, 1868.I.630 and 1876.XI.173. Altogether 36 specimens and fragments are available in this sample. Together with the three specimens mentioned above and the broken original of figs 9 and 10 this matches exactly the number of specimens cited by Kittl. The 36 specimens can be divided in three forms: two specimens belong beyond any doubt to *V. lapugyensis* (both without protoconchs and apertural parts). Nine apical fragments, all without protoconchs, belong to typical *austriaca*, whereas the remaining 25 specimens and fragments belong to a small and slender form, closely resembling *V. austriaca*, but possibly representing a local forma. Three of these latter specimens have regularly accentuated growth-lines. Two specimens are illustrated here on pl. 4, figs 7-8.

The four syntypes from Ruditz are labeled *V. depressa* Daud. and have registration number 1862.XXIX.97. These specimens have suffered from crystal growth, only one of them is still recognizable as *V. austriaca*.

Six defective specimens from Dombrau (' Eleonora Schacht"), labeled *Vaginella* n.f. *austriaca* are most probably Kittl's syntypes. Though badly preserved they look like *austriaca* indeed. The seventh shell is apparently missing.

From Polnisch-Ostrau eleven specimens were available. Nowadays the sample consists of a glass tube with crumbled shell material and a piece of clay with one fragmentary cast of an irrecognizable vaginellid.

The syntype from Laa is still there, registration number 1870.I-IV.9. Though this specimen has the general outline of *V. austriaca* it must be considered unidentifiable.

Three samples are available from Nusslau, all without registration numbers. One of these consists of a piece of clay in which about 12 squeezed specimens are preserved, labeled *Vaginella* cf. *austriaca*. It is a slender vaginellid, but it is difficult to decide whether or not it belongs to *austriaca*. A further sample contains 3 squeezed specimens and a fragment on a piece of clay. The third sample contains two pieces of clay with about four specimens in a similar state of preservation. All these specimens can only doubtfully be assigned to *V. austriaca*.

Finally from Pratzer Berg two pieces of limestone are available (no registration number) containing quite irrecognizable pteropod remains. I suppose that these are the specimens mentioned by Kittl sub *V. austriaca*.

The differences between Kittl's drawings and the actual specimens in their present state are clearly demonstrated by the drawings given here. Kittl stated that the embryonic shell part was only preserved in the illustrated shell from Lapugy (figs 9 and 10). Nevertheless this shell part is also illustrated in fig. 8, which apparently is a reconstruction.

The specimen from Baden, indicated as the original of Kittl's fig. 8, is herewith chosen as the lectotype. Only the following syntypes may be considered paralectotypes: 10 shells from Baden among which presumably Hoernes' original, one shell from Baden indicated as the original of Kittl's fig. 11 and a further shell from Baden indicated as the original of Kittl's fig. 12. Furthermore from Lapugy three fragments labeled "Orig. v. Lapugy", three specimens labeled "Originale" and nine

apical fragments belonging to the sample of 36 specimens. Also the 25 shells and fragments probably representing a local forma may be considered paralectotypes. Furthermore from Vöslau 15 shells, from Sóos 5 defective shells, from Forchtenau one shell. From Ruditz only one of four specimens may be considered a paralectotype. All further syntypes can only doubtfully be assigned to *V. austriaca* and are not to be regarded as paralectotypes.

Type locality - Baden near Vienna, Austria.

Stratum typicum - Pleurotomen-Tegel der zweiten Mediterranstufe.

Vaginella depressa Daudon, 1800
Pl. 3, fig. 11; pl. 4, figs 9-13

1886 *Vaginella depressa* Daudon. - Kittl, p. 57, pl. 2, figs 17-22.

Remarks - This species was rather extensively described by Kittl. There is only one basic error in this description, viz. the part concerning the apex, which is described as "einfach ausgezogen und zugeschärft" (= simply elongated and pointed). In reality the protoconch of *depressa* looks very much like that of *austriaca*, but in adult specimens it is always missing. The place where it was broken off is always visible as a small opening and the shell is never sharply pointed.

All the original specimens on which Kittl's drawings were based are still available in the Vienna collection. They were all redrawn and illustrated here. It may be noticed again that apparently some reconstruction has taken place in every case, but some of the differences may be the result, of course, of later damage done to the specimens. All illustrated specimens from Léognan in France (Aquitaine Basin) indeed belong to *V. depressa*, which is a very common species in the older Burdigalian deposits there.

The specimen from Forchtenau (Kittl's fig. 22, see pl. 4, fig. 13) is very small, but still it seems to belong to *depressa*, judging from its wide apical angle and the obvious constriction below the apertura.

Quite interesting are the two specimens from Kiel (Holsteiner Gestein), kept with registration number 1857.VI.62. They belong to the very few specimens of *V. depressa* that I know from the North Sea Basin (see pl. 3, fig. 11).

Vaginella lanceolata (Boll, 1846)
Pl. 3, fig. 5

1886 *Vaginella lanceolata* v. Koenen. - Kittl, p. 60, pl. 2, fig. 34.

Remarks - Kittl presumably listed this species under the authorship of von Koenen because of the fact that Boll's name (*Belemnites lanceolatus*) is repeatedly preoccupied. This preoccupation lead R. Janssen (1979, p. 351) to the introduction of a new name, *Vaginella chattica*, to replace Boll's *lanceolatus*.

Kittl's sample from the Sternberger Gestein is still present. The illustrated specimen is indicated as such. The registration number of this sample is 1859.XII.234. The original of Kittl's fig. 34 was redrawn and is here represented on pl. 3, fig. 5. Kittl's description and illustrations match this material quite well, the only difference being the fact that weak folds are present on both the ventral and the dorsal sides of the shell, whereas they are indicated by Kittl on one side only.

Vaginella lapugyensis Kittl, 1886
Pl. 3, figs 6-10

1886 *Vaginella Lapugyensis* n.f., Kittl., p. 52, pl. 2, figs 4-5.

Syntypes - This species was founded on three specimens from Lapugy and three specimens from Nusslau near Seelowitz.

In the Vienna collection I found two specimens from Lapugy, indicated as the originals of Kittl's figs 4 and 5. The former is a defective shell in which the apical and apertural parts are missing. It is represented here on pl. 3, fig. 7. The shell agrees with Kittl's description and shows distinctly the weak lateral carinae in its apical half. The latter specimen (see pl. 3, fig. 6) is an apical fragment with protoconch, not showing the lateral carinae, though its maximum diameter exceeds the smallest diameter of the first mentioned specimen where the carinae are already visible. This juvenile shell closely resembles *Creseis spina* Reuss (see above) in its general outline, but the Lapugy specimen has a slightly more voluminous protoconch.

The third original from Lapugy could be a specimen present in the Vienna collection under the designation "*Styliola* indet.". It is represented here on pl. 3, fig. 8. There is no indication whatsoever that Kittl indeed studied this sample.

Furthermore there are two specimens of *V. lapugyensis* among the syntypes of *Vaginella austriaca* (see above).

From Nusslau two pieces of clayey sediment are available with very badly preserved clay casts of vaginellids. One of these more or less distinctly shows the outline of the apertura while in another one a lateral carina is visible as a result of oblique bedding of the specimen (see pl. 3, figs 9-10).

Remarks - The specimen from Lapugy (Kittl's fig. 4) is herewith chosen as the lectotype. It reveals sufficient details to recognize the species. I'm not certain about the identity of the juvenile specimen from Lapugy, so it may not be considered a paralectotype. The same unfortunately is true for the Nusslau specimens.

Type locality - Lapugy, Rumania.

Stratum typicum - Pleurotomen-Tegel der zweiten Mediterranstufe.

Vaginella rzehaki Kittl, 1886
Pl. 3, figs 3-4; pl. 6, figs 5a-d

1886 *Vaginella Rzehaki* n.f., Kittl, p. 56, pl. 2, figs 13-16.
1980 *Vaginella rzehaki* Kittl - d'Alessandro & Robba, p. 632, pl. 67, fig. 5.

Syntypes - According to Kittl the following syntypes were available to him. From Seelowitz 1 specimen (said to be kept in the collection of the K.-k. technische Hochschule in Brünn), from Polnisch-Ostrau (Josef Schacht) 7 specimens, from Poremba (Bohrloch II) 1 specimen, from Poremba (Bohrloch III) 4 specimens, from Dombrau (Eleonoren Schacht) 5 fragmentary specimens, from Turin 1 specimen and finally from Serravalle di Scrivia 6 specimens.

Remarks - Nowadays no specimens are present in the Vienna collection with the indication Seelowitz (as could be expected considering Kittl's notes). Surprisingly enough, there is an unlabeled sample

to which a copy of Kittl's fig. 16 (the specimen from Seelowitz!) is added. This sample contains two pieces of clay, each containing partially oxidized clay casts of vaginellids, not being each others counterparts and therefore belonging to two individuals. The larger one of these is also the best preserved one (here represented pl. 3, fig. 3). This very specimen was also illustrated by d'Alessandro & Robba (1980). This specimen may be compared with Kittl's fig. 16. This drawing shows a specimen the facing side of which is largely missing. Only the basal part of this side of the shell is preserved. The fracture line runs from upper left to lower right. A closer view to the specimen in the Vienna collection demonstrates that it is apparently the counterpart of the fig. 16 specimen. Its basal part is missing and the fracture line runs exactly opposite. This specimen also demonstrates the fine radial sculpture mentioned in Kittl's description. The conclusion seems to be that the actually illustrated specimen is not in the Vienna collection, but presumably in Brno (Czechoslovakia). The counterpart of that specimen is apparently kept in Vienna. According to Dr. Jaroslav Řiha, Brno (in litt.) the collection of the K.K. Technical University at Brno was put partly into the Moravské Muzeum at Brno. Unfortunately Dr. Řiha has not been able to locate the specimen mentioned by Kittl.

The second specimen in the same container (pl. 3, fig. 4) can not originate from Seelowitz, as only one specimen was available. It could be one of the missing Poremba specimens.

Two samples are present from Polnisch-Ostrau. One of these (registration number 1888.I.1) is the specimen illustrated by Kittl in his fig. 13. The other sample (registration number 1888.I.60) contains six badly preserved pyritized specimens. The original of fig. 13 consists of a piece of clay with an imprint of the shell and some adhering shell remnants, also the pyritic internal mould is present (see pl. 6, figs 5a-d). The specimen is somewhat squeezed but still gives a fair idea of the general shell-form. The outer cast distinctly demonstrates the presence of fine radial lines when seen in low-angle light.

The Poremba II material is absent. Only an empty container is present with the indication Poremba, Bohrloch III. Perhaps the specimen in the piece of clay joining the Seelowitz sample originally belonged in this container?

All the specimens from Dombrau are missing The two Italian samples however, are still extant. From Serravalle there are three pieces of clay (not registered), indicated *Vaginella depressa*. They contain six casts of shells with a length to over 12 mm. They presumably are the *rzehaki* syntypes. The general shell form is in agreement with this, but no radial sculpture is visible.

Registration number 1851.XVII.320 from Turin has three identification labels, viz. *Cleodora strangulata* Deshayes, *Vaginella depressa* Daudon and *V. rzehaki* Kittl. It contains one specimen and a small piece of clay with a defective vaginellid cast. The latter one could be the syntype mentioned by Kittl. It is fairly irrecognizable; to me it looks more like *V. austriaca*.

Remarks - The Seelowitz syntype, in spite of its squeezed condition, undoubtedly offers the best possibilities to recognize the species, so I herewith select it as the lectotype. Should its counterpart ever be found in Brno, then it likewise is a lectotype as both pieces belong to one and the same specimen.

The existing specimen from Polnisch-Ostrau being the original of Kittl's fig. 13 has to be regarded a paralectotype, as is also the case for the six Serravalle specimens.

Unfortunately none of the available specimens gives information about the apertural characteristics or the protoconch. The ratios of the dimensions are obscured by the squeezed condition of the available material.

Type locality - Seelowitz.

Stratum typicum - Schlierton.

Vaginella tenuistriata Semper, 1861

1886 *Vaginella tenuistriata* Semper. - Kittl, p. 53, pl. 2, figs 6-7.

Remarks - In the collection of the Naturhistorisches Museum at Vienna two samples labeled *Vaginella tenuistriata* are present. One of them (registration number 1859.XIII.235) consists of two specimens in matrix and four isolated internal moulds with shell remnants. Two of these could be the originals of Kittl's figs 6 and 7, though this is not indicated on the labels The second sample (registration number 1868.XI.VIII.26) comprises three pieces of matrix with respectively one, three and four specimens and seven isolated internal moulds with remnants of the shells. This latter sample, though comprising exactly the number of specimens mentioned by Kittl, does most probably not contain the represented shells.

The drawings given by Kittl are slightly incorrect. They seem to be reconstructions, as none of the available specimens reaches the completeness suggested by the illustrations. The lateral expansion of the apertura, as indicated in figs 6 and 7, is absent in the specimens and the same is true for the contraction in the basal part of the shell. The real shells are much more regularly conical and less "vaginella-like" than suggested by Kittl. The radial striation of the shell, although very slightly indicated in the drawings, still is much to coarse. This sculpture is invisible at such low magnifications.

NOTES ON THE LOCALITIES AND THE AGE OF THE MATERIAL

In the above notes I quoted the localities and the stratigraphical origin of the material as given by (or translated from) the respective authors. It may be expected that several of the E. European localities have changed their name now. In table 1 I have listed all localities mentioned in this paper, giving the country in which they are situated nowadays and their stratigraphical position in modern nomenclature. Most of the stratigraphical data were supplied by Dr O. Schultz, Wien (in litt.) for which I am very grateful. Also I thank Dr J. Řiha at Brno for information concerning the Seelowitz locality.

LITERATURE

Alessandro, Assunta d', & Elio Robba, 1980. Pteropodi neogenici della Puglia (Italia meridionale). - Riv. Ital. Paleont., 86 (3): 605-698, pl. 61-77, 14 figs.

Glibert, M., 1957. Pélécypodes et gastropodes du Rupélien supérieur et du Chattien de la Belgique. - Mém. Inst. r. Sc. nat. Belgique, 137: 1-98, pl 1-6.

Hoernes, M., 1851-1856. Die fossilen Mollusken des Tertiärbeckens von Wien. - Abhandl. k.k. geol. Reichsanst., 3: 1-736, 52 pl.

Table 1. List of localities mentioned in this paper

name	country	stratigraphy
Baden	Austria	Miocene, Early Badenian, Obere Lagenidenzone
Brünn (now Brno)	Czechoslovakia	see Pratzer Berg
Cap Chronevi (or Chroni)	U.S.S.R., Crimea	Miocene, Badenian?
Cap Tarchan	U.S.S.R., Crimea	Miocene, Early Badenian, Obere Lagenidenzone
Cumnaja-balke	U.S.S.R., Crimea	Miocene, Badenian?
Dombrau	Rumania	Miocene, Early Badenian?, Lagenidenzone?
Forchtenau	Austria	Miocene, Early Badenian, Obere Lagenidenzone
Kiel	F.R.G., Schleswig-Holstein	Miocene, Vierlandian, Holsteiner Gestein
Kop Kotschegen	U.S.S.R., Crimea	Miocene, Badenian?
Kostej	Rumania	Miocene, Early Badenian, Obere Lagenidenzone
Krywald	Poland	Miocene, Badenian
Laa a.d. Thaya	Austria	Miocene, Karpatian
Langenfelde	F.R.G., Lower Saxony	Miocene, Middle to Late Miocene
Lapugy	Rumania	Miocene, Early Badenian, Obere Lagenidenzone
Léognan	France, Gironde	Miocene, Burdigalian
Mecklenburg	D.R.G.	Oligocene, Chattian, Sternberger Gestein
Milazzo near Messina	Italy, Sicily	?Pliocene
Nusslau near Seelowitz	Czechoslovakia	Miocene, Early Badenian, Obere Lagenidenzone
Orta-eli	U.S.S.R., Crimea	Miocene, ?Badenian
Palermo	Italy, Sicily	?Pliocene
Peterswald	Czechoslovakia	Miocene, Early Badenian, Lagenidenzone
Polnisch-Ostrau	Czechoslovakia	Miocene, Early Badenian, Lagenidenzone
Poremba	?	?
Pratzer Berg near Brünn (now Brno)	Czechoslovakia	Miocene, Early Badenian, ?Lagenidenzone
Rhodus	Greece	Neogene
Ronaszék	Rumania	?Miocene, Badenian
Ruditz	Czechoslovakia	Miocene, Early Badenian, Obere Lagenidenzone
Seelowitz (now Židlochovice)	Czechoslovakia	Miocene, Early Badenian, Obere Lagenidenzone
Serravalle (di Scrivia)	Italy	Miocene, Serravallian?
Sóos	Austria	Miocene, Early Badenian, Obere Lagenidenzone
Trifail (now Trbovlje)	Yugoslavia	Oligocene, Egerian
Tschumnaja-balke	U.S.S.R., Crimea	Miocene, Badenian?
Turin	Italy	Miocene
Vöslau	Austria	Miocene, Early Badenian, Obere Lagenidenzone
Wielickzka	Poland	Miocene, Early Badenian, Kosovian

Janssen, A. W., 1972. Die Mollusken-Fauna der Twistringer Schichten (Miocän) von Norddeutschland. - Scripta Geol., 10, 1-96, 42 figs, 11 pl.

Janssen, A. W., & C. King, in press. Pteropoda. In: Final report I.G.C.P.-project 124 The NW European Tertiary Basin.

Janssen, R., 1979. Die Mollusken des Oberoligozäns (Chattium) im Nordsee-Becken, 2. Neogastropoda, Euthyneura, Cephalopoda - Archiv f. Molluskenk., 109 (4/6): 277-376, pl. 15-18, 18a.

Kittl, E., 1886. Ueber die miocenen Pteropoden von Oesterreich-Ungarn, mit Berücksichtigung verwandter Vorkommnisse der Nachbarländer. - Ann. k.k naturhist. Hofmuseum Wien, 1: 47-74, pl. 2.

Koenen, A. von, 1882. Gastropoda holostomata und tectibranchiata, Cephalopoda und Pteropoda des norddeutschen Miocän. - N. Jb. Min. Geol. Paläont., 2: 223-263, pl. 5-7.

Koenen, A. von, 1892. Das norddeutsche Unter-Oligocän und seine Mollusken-Fauna, 4. - Abhandl. geol Spezialkarte Preuss., 10 (4): 819-1004, pl 53-62.

Krach, W., 1981. Ślimaki skrzydłonogi (Pteropoda) w Miocenie Polski i ich znaczenie stratygraficzne. - Prace Geol. Polska Akad. Nauk, 121: 116-140. pl. 1-6.

Reuss, A. E., 1867. Die fossile Fauna der Steinsalzablagerung von Wieliczka in Galizien. - Sitzungsber. math.-naturwissensch. Cl. k. Akad. Wissensch. Wien, 55 (1): 17-182, pl. 1-8.

Rolle, F., 1861. Über einige neue oder wenig gekannte Mollusken-Arten aus Tertiär-Ablagerungen. - Sitzungsber. math.-naturwissensch. Cl. k. Akad. Wien, 44: 3-21, pl. 1-2.

Spoel, S. van der, 1967. Euthecosomata, a group with remarkable developmental stages (Gastropoda, Pteropoda). Gorinchem (thesis, Univ. Amsterdam), 375 pp., 366 figs.

Trauth, F., 1913. Ernst Kittl †. - Mitt. geol. Gesellsch. Wien, 6: 358-362.

EXPLANATION OF PLATE 1

1-2. *Cleodora* (*Creseis*) *spina* Reuss, 1867; x 25.
1. Lectotype; 2. Paralectotype. Wieliczka, Galicia.
Coll. Naturhist. Museum, Vienna (not registered).
a: Ventral views; b: lateral views.

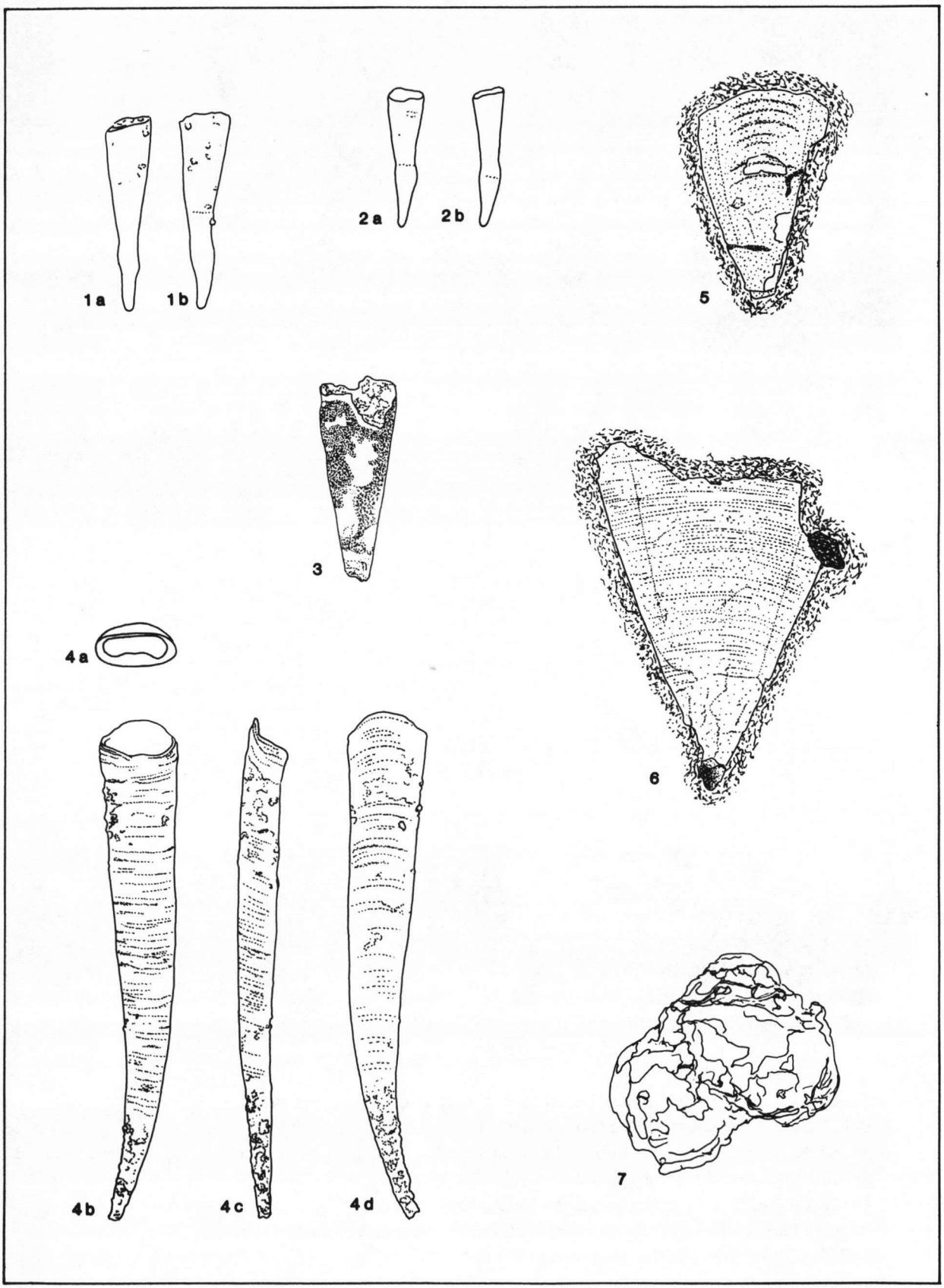
3. *Cleodora* (*Creseis*) *subulata* Reuss, 1867 non Quoy & Gaimard; x 25.
Wieliczka, Galicia.
Coll. Naturhist. Museum, Vienna (reg. 1867.VII.41).

4. *Creseis fuchsi* Kittl, 1886; x 12.
Lectotype. Forchtenau.
Coll. Naturhist. Museum, Vienna (not registered).
a: apertural; b: ventral; c: lateral and d: dorsal views.

5. *Balantium bittneri* Kittl, 1886; x 6.
Lectotype. Trifail, Tagbau I.
Coll. Naturhist. Museum, Vienna (not registered).
(?) dorsal view.

6. *Clio* sp. ? nov.; x 6.
Original of Kittl's fig. 28 as *Balantium pedemontanum*. Pratzer Berg.
Coll. Naturhist. Museum, Vienna (not registered).
? ventral view.

7. *Spirialis koeneni* Kittl, 1886 (nomen dubium); x 25.
Syntype. Langenfelde, NW Germany.
Coll. Naturhist. Museum, Vienna (reg. 1872.IV.36).

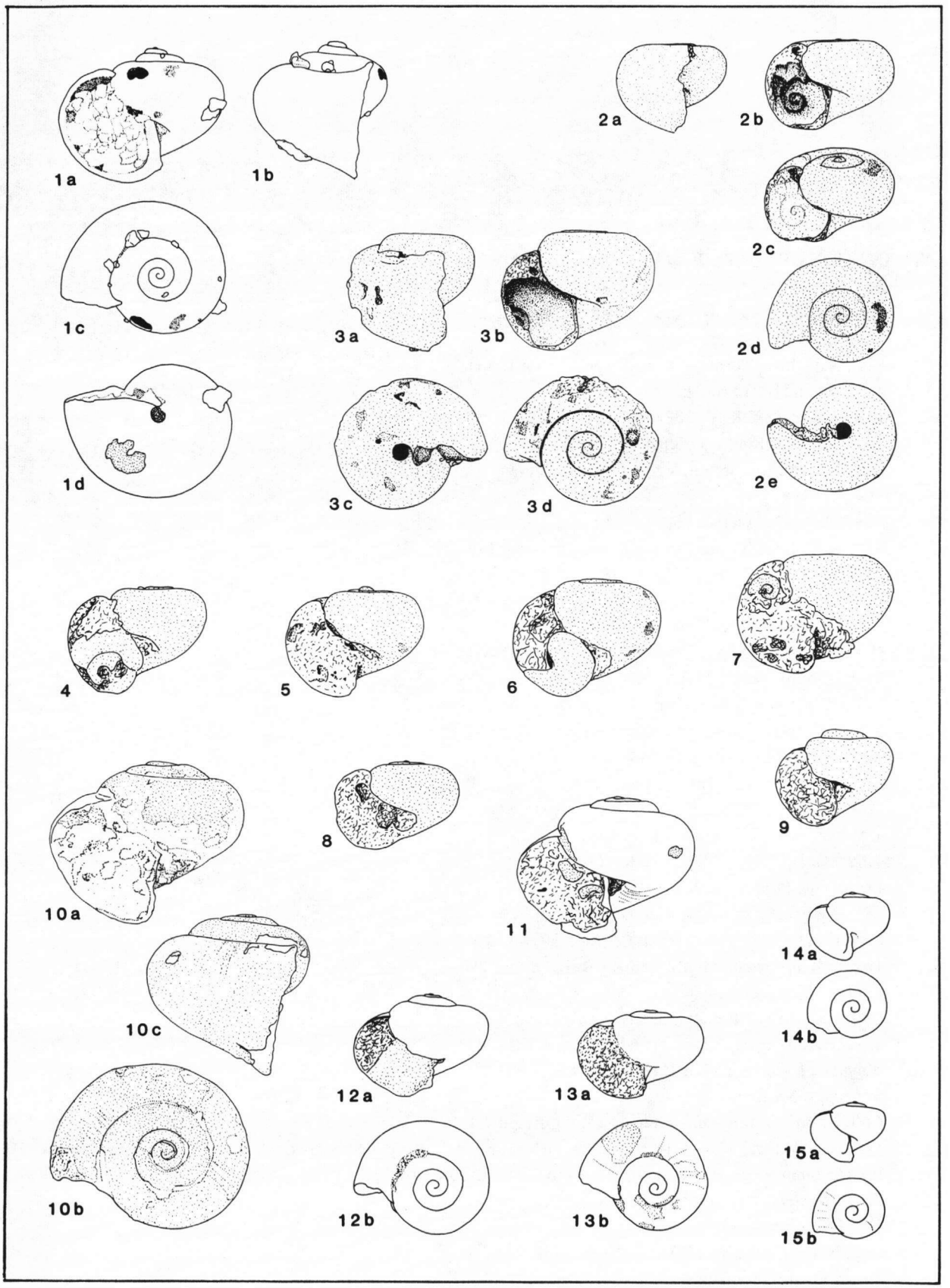

1a
1b
2a
2b
5
3
6
4a
4b
4c
4d
7

EXPLANATION OF PLATE 2

1. *Limacina hospes* Rolle, 1861; x 25.
Holotype. Mecklenburg area.
Coll. Naturhist. Museum, Vienna (reg. 1859.XIV.233).
a: frontal; b: lateral; c: apical and d: basal views.

2-9 *Spirialis andrussowi* Kittl, 1886; x 25.
2. Lectotype; 3-9. paralectotypes. Kop Kotschegen, Kertsch Peninsula, Crimea.
Coll. Naturhist. Museum, Vienna (not registered).
2a and 3a: lateral, 2b and 3b: frontal, 2c: oblique apical, 2d and 3c: basal, 2e and 3d: apical views.

10-15. *Spirialis tarchanensis* Kittl, 1886, x 25.
10. Lectotype, 11-13. paralectotypes, 14-15. syntypes.
Between Cap Tarchan and Cap Chronevi (or Chroni?), Kertsch Peninsula, Crimea.
Coll. Naturhist. Museum, Vienna (not registered).
a: frontal; b: apical and c: lateral views.


1a
1b
2a
2b
2c
1c
3a
3b
2d
1d
3c
3d
2e
4
5
6
7
10a
8
9
11
14a
10c
14b
12a
13a
15a
10b
12b
13b
15b

EXPLANATION OF PLATE 3

1-2. *Spirialis stenogyra* Kittl, 1886 (non Philippi?); x 25.
Originals to Kittl's figs 35 and 36. Ronaszék.
Coll. Naturhist. Museum, Vienna (reg. 1867.VII.43).
a: apical and b: frontal views.

3. *Vaginella rzehaki* Kittl, 1886; x 3.
Lectotype. Seelowitz. Original to Kittl's fig. 16.
Coll. Naturhist. Museum, Vienna (not registered).
? Dorsal view.

4. *Vaginella rzehaki* Kittl, 1886; x 3.
? Syntype. Locality unknown, may be Poremba, Bohrloch III.
Coll. Naturhist. Museum, Vienna (not registered).
Dorsal or ventral view.

5. *Vaginella chattica* R. Janssen, 1979; x 6.
Original to Kittl's fig. 34 (as *Vaginella lanceolata* v. Koenen).
Mecklenburg area (G.D.R.).
Coll. Naturhist. Museum, Vienna (reg. 1859.XIII.234).
a: left lateral; b: dorsal; c: apertural and d: ventral views.

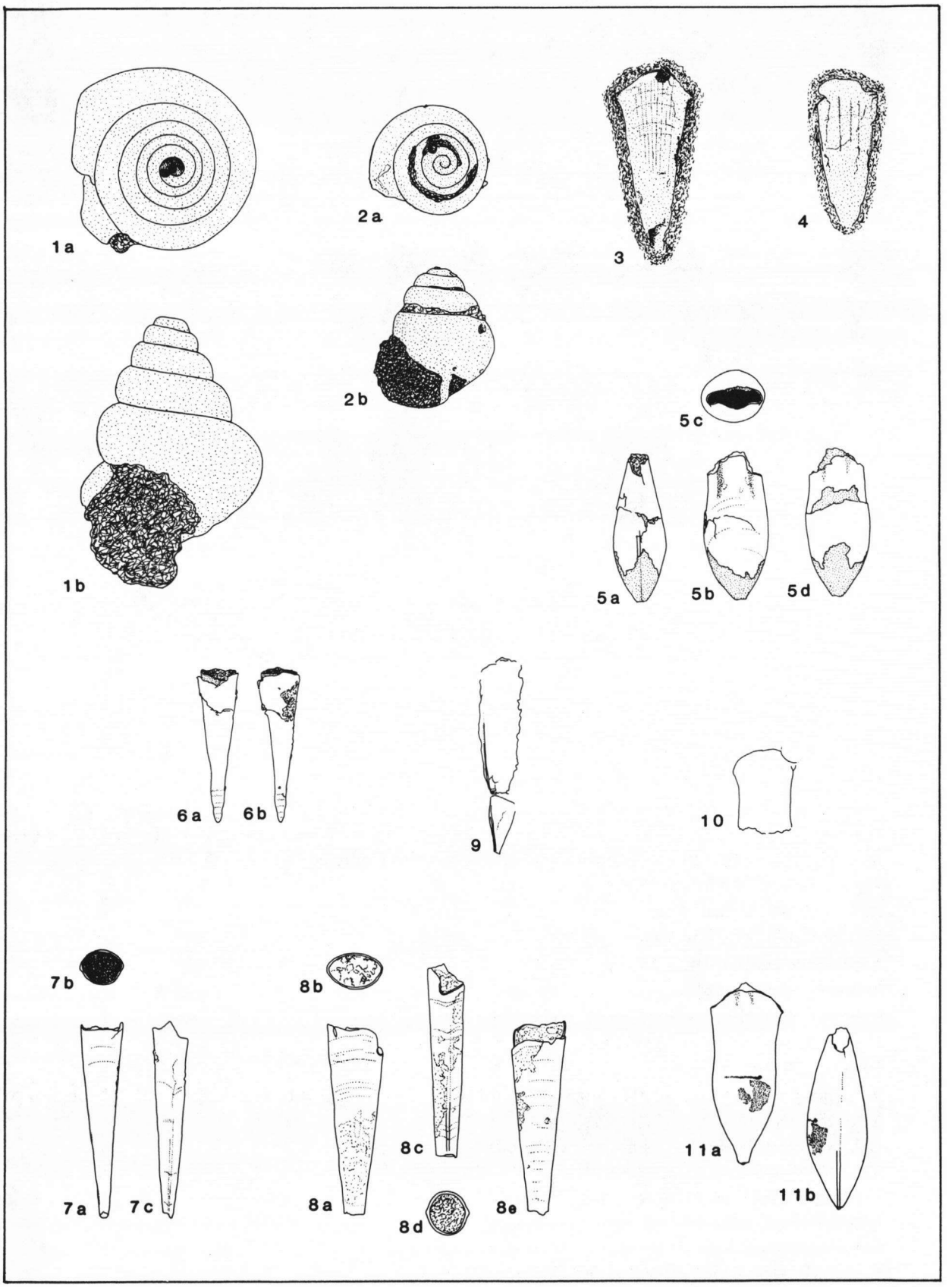
6. *Vaginella lapugyensis* Kittl, 1886 (?); x 12½.
Syntype. Original to Kittl's fig. 5. Lapugy;
Coll. Naturhist. Museum, Vienna (not registered).
a: ventral or dorsal view; b: lateral view.

7. *Vaginella lapugyensis* Kittl, 1886; x 6.
Lectotype. Original to Kittl's fig. 4. Lapugy.
Coll. Naturhist. Museum, Vienna (not registered).
a: ventral view; b: apertural and c: right lateral view.

8. *Vaginella lapugyensis* Kittl, 1886; x 6 (fig. 8d x 12½).
Syntype? Lapugy.
Coll. Naturhist. Museum, Vienna (not registered).
a: ventral; b: apertural; c: left lateral; d: apical and e: dorsal view.

9-10. *Vaginella lapugyensis* Kittl, 1886 (?); x 6.
Syntypes. Nusslau.
Coll. Naturhist. Museum, Vienna (not registered).
Dorsal or ventral views; fig. 9 is a somewhat obliquely bedded specimen, showing its lateral carina; fig. 10 is a fragment more or less showing the outline of the apertural part.

11. *Vaginella depressa* Daudon, 1800; x 6.
Kiel (NW Germany).
Coll. Naturhist. Museum, Vienna (reg. 1857.VI.62).
a: ventral and b: left lateral view.


1a
2a
3
4
2b
1b
5c
5a
5b
5d
6a
6b
9
10
7b
8b
7a
7c
8a
8c
8d
8e
11a
11b

EXPLANATION OF PLATE 4

1-4. *Vaginella austriaca* Kittl, 1886; x 6.
Baden, Austria. Coll. Naturh. Museum, Vienna.
1. Lectotype, original to Kittl's fig. 8 (not registered); 2. paralectotype, original to Hoernes' pl. 50, fig. 42a-b (as *Vaginella depressa*) (reg. 1864.I.122 etc.); 3. paralectotype, original to Kittl's fig. 11 (?) (not registered); 4. paralectotype, original to Kittl's fig. 12(?) (not registered).

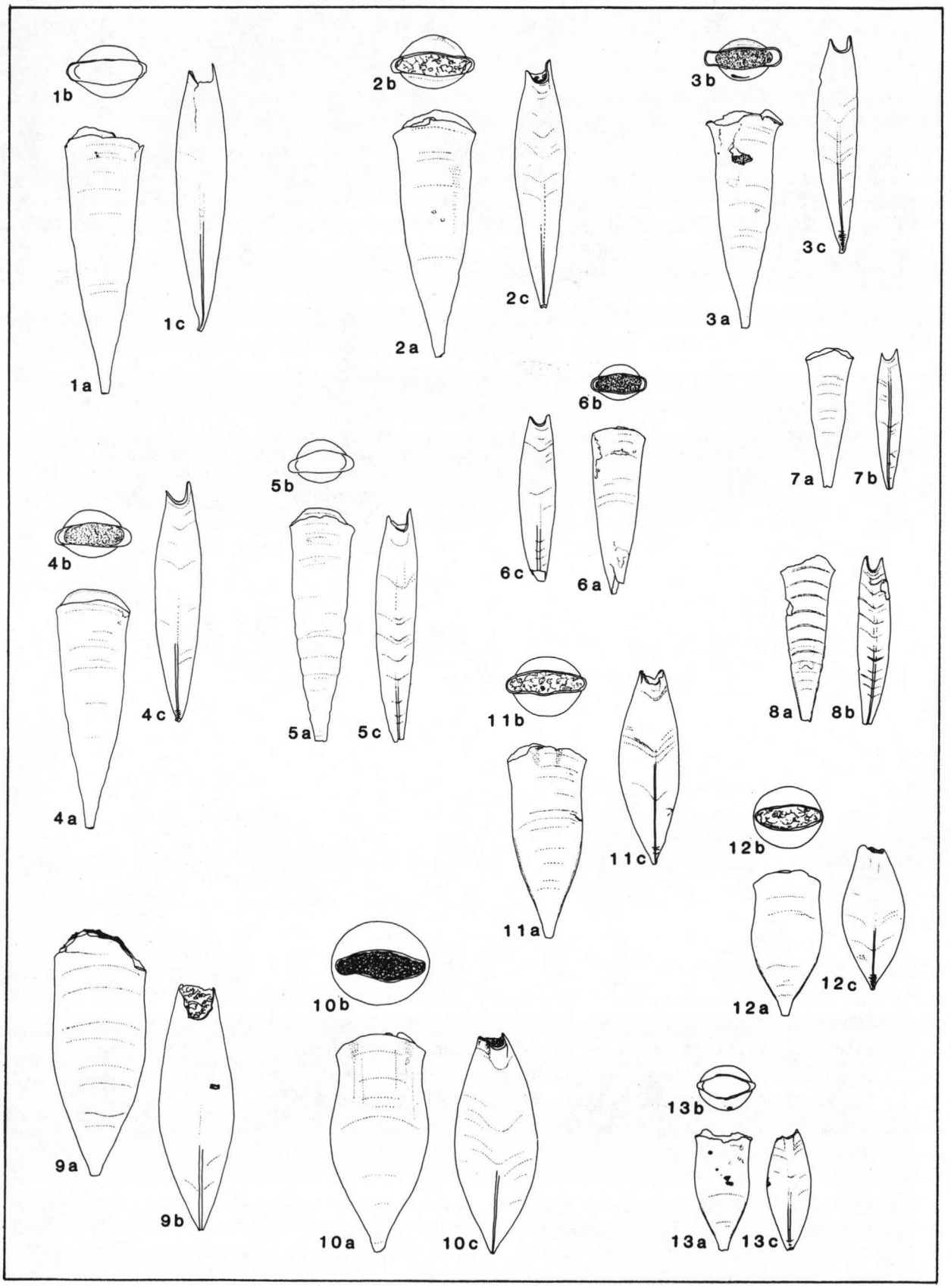
5-6. *Vaginella austriaca* Kittl, 1886, x 6.
Paralectotypes. Vöslau, Austria.
Coll. Naturhist. Museum, Vienna (reg. 1851.XIII.17 etc.).

7-8. *Vaginella austriaca* Kittl, 1886; x 6.
Paralectotypes. Lapugy.
Coll. Naturhist. Museum, Vienna (reg. 1854.XXXV.408 etc.).

9-12. *Vaginella depressa* Daudin, 1800; x 6.
Léognan, SW France.
9. Original to Kittl's fig. 17; 10. original to Kittl's fig. 19; 11. original to Kittl's figs 20-21; 12. original to Kittl's fig. 18.
Coll. Naturhist. Museum, Vienna (not registered).

13. *Vaginella depressa* Daudon, 1800; x 6.
Original to Kittl's fig. 22. Forchtenau.
Coll. Naturhist. Museum, Vienna (not registered).

a: dorsal or ventral view; b: lateral view; c: apertural view.


1b
1c
1a
2b
2c
2a
3b
3c
3a
6b
7a
7b
5b
4b
6c
6a
4c
5a
5c
8a
8b
11b
4a
11c
12b
11a
12c
12a
10b
9a
9b
13b
10a
10c
13a
13c

EXPLANATION OF PLATE 5

1-3. *Clio* sp. ? nov.; x 4.
Polnisch-Ostrau (Josef Schacht). Coll. Naturhistorisches Museum, Vienna.
Considered by Kittl to be a variety of his *Balantium Fallauxi*.
1-2. Specimens not illustrated by Kittl, resp. reg. 1888.I.5 and 1888.I.70.
3. Original to Kittl's fig. 26, reg. nr. 1888.I.5.

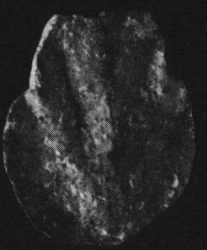
4-5. *Hyalaea bisulcata* Kittl, 1886; x 4.
Polnisch-Ostrau (Josef Schacht).
4. Lectotype; 5. Paralectotype. Both figs 4 and 5 are originals to Kittl's figs 29-32.
Coll. Naturhistorisches Museum, Vienna (reg. 1888.I.6).

a and b: both sides of internal mould; c: external mould.

1

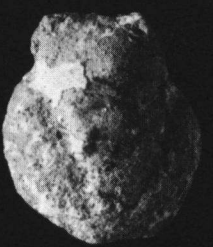
2

3



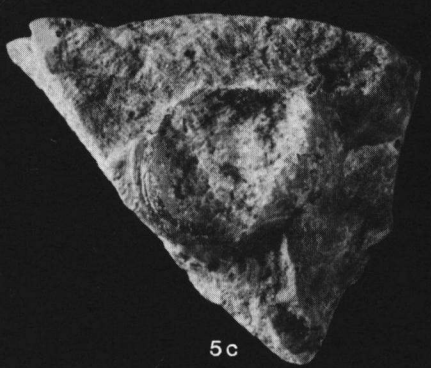
4a

4c



4b

5b



5c

5a

EXPLANATION OF PLATE 6

1-4. *Balantium pedemontanum* (Mayer, 1868); x 4.
Serravalle, Italy.
Syntypes. Coll. Naturhistorisches Museum, Vienna (not registered).

5. *Vaginella rzehaki* Kittl, 1886; x 4.
Polnisch-Ostrau (Josef Schacht).
Paralectotype. Original to Kittl's fig. 13.
Coll. Naturhistorisches Museum, Wien (reg. 1888.I.1).

a: dorsal; b: ventral and c: left lateral view of internal mould; d: external mould of ventral side.

1

2

5a

5b

5c

3

4

5d