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The Foraminiferal Genera Schackoina Thalmann, emended and Leupoldina, n. gen. in the Cretaceous of Trinidad B.W.I.

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With 1 figure in the text and 2 plates (I and II)

INTRODUCTION

Several years ago, Dr. A. WIRZ, then with the Trinidad Petroleum Development Company, Palo Seco, Trinidad, drew the author's attention to some specimens of planktonic Foraminifera of quite extraordinary shape. These forms which are here described as *Leupoldina*, n. gen., were found together with a rich benthonic and planktonic foraminiferal fauna that included *Schackoina* THALMANN. The fauna had been collected from a Lower Cretaceous shale believed to be of Aptian age and outcropping in the Piparo River of the Central Range. With a few exceptions (e. g. REICHEL, 1947; AUROUZE and DE KLASZ, 1954) *Schackoina* has always been described and figured with the chamber extensions broken off. Because of a morphology similar to that of *Hantkenina* and *Hastigerinoides*, it is generally assumed that the missing, broken off parts are invariably spines. The specimens described here demonstrate that this need not necessarily be so. Figures 1 and 6 of plate I illustrate *Schackoina* specimens with the peripheral chamber extensions broken off as they are usually found and described. Figures 2, 3, 4 and 7 of plate I show specimens from the same sample with one or more of the chamber extensions still attached. These extensions are all bulb-shaped. To include this type of chamber extensions it becomes necessary to emend the definition of the genus *Schackoina*.

The early stage of the specimens attributed to the new genus *Leupoldina* appears to be identical with that of *Schackoina*. In the last or last few chambers however there are two or occasionally even three bulb-shaped protuberances, symmetrically arranged on each side of the equatorial plane. The final chamber may occasionally become almost divided into two parts as in *Biglobigerinella* LALICKER. The aperture in the early *Schackoina* stage is interiomarginal, equatorial, whilst the ultimate chamber possesses two interiomarginal, umbilical apertures, one leading into each umbilicus.

ACKNOWLEDGMENTS

The writer is indebted to THE TRINIDAD OIL COMPANY for permission to publish this paper. Through the courtesy of DOMINION OIL LTD., Trinidad, who recently carried out field work in the area where the fauna was found, the author was able to re-collect from the original locality and obtain sufficient material to describe

this fauna. The author wishes to thank Prof. M. REICHEL, Basel and Mr. J.B. SAUNDERS, Paleontologist of THE TRINIDAD OIL COMPANY, for reading and dicussing the manuscript. Dr. K. ROHR of THE TRINIDAD OIL COMPANY kindly prepared the sketch map showing the locality of the described fauna. The plate illustrations are camera lucida drawings by PATRICIA and LAWRENCE JSHAM, Scientific Illustrators, U.S.National Museum, Washington.

SYSTEMATIC DESCRIPTIONS

Family **Hantkeninidae** CUSHMAN, 1927

Genus **Schackoina** THALMANN 1932, emended

Original reference. – Eclogae geol. Helv., vol. 25, p. 289, 1932.
Type species. – *Siderolina cenomana* SCHACKO, 1896.

Test free, early portion may be more or less trochospiral, later becoming nearly or completely planispiral; chambers elongate, with a hollow tubulospine or a bulb-shaped extension on the periphery; multiple, irregularly arranged tubulospines may also occur; sutures straight, radial, depressed; wall calcareous, perforate; surface smooth or finely hispid; primary aperture an interiomarginal arch, extraumbilical and tending to become equatorial, may be bordered above by a narrow lip.

Remarks. – *Schackoina* differs from *Hantkenina* CUSHMAN in being slightly trochospiral at least in its early stage and in having a simple interiomarginal arched aperture, whereas *Hantkenina* has a triradiate aperture with a high slit extending up the face of the final chamber.

It differs from *Hastigerinoides* BRÖNNIMANN in being slightly trochospiral at least in its early stage and in the absence of secondary relict apertures[1]). However, it appears possible that *Hastigerinoides* has developed from *Schackoina* by becoming more planispiral and by developing secondary relict apertures. Like *Schackoina*, *Hastigerinoides* is known to possess spine-shaped, e. g. *H. alexanderi* (CUSHMAN), or bulb-shaped, e. g. *H. watersi* (CUSHMAN), chamber extensions.

None of the many *Schackoina* specimens examined from the Piparo River locality were found to have spines instead of the bulb-shaped chamber extensions. It seems possible that in the early stages of evolution of *Schackoina* in the Lower Cretaceous, the chamber extensions are always bulb-shaped and only later, in the Upper Cretaceous, do forms with spines develop (e. g. *Schackoina gandolfii* REICHEL). It is of interest to note that together with the Cenomanian specimens with long, thin spines, REICHEL also figures a form (textfig. 10, no. 14; pl. 8, fig. 5) where the end of the spine of the ultimate chamber shows a slight bulb-shaped swelling. This might be a form transitional between *Schackoina reicheli* n. sp. and *Schackoina gandolfii*, but the possibility of a tangential section through a bent spine can not entirely be ruled out.

REICHEL (1947) suggests that during the evolution of *Schackoina* the number of chambers in the last whorl becomes gradually reduced from five to four and

[1]) Relict apertures are the umbilical portions of the equatorial apertures not covered by succeeding chambers and thus open as short radial slits (BOLLI, LOEBLICH and TAPPAN, 1957).

eventually to three. It is mainly for this reason that in the present study the four and five-chambered forms of *Schackoina* are each given subspecific rank. The sample studied is considered to be of Aptian age and thus contains some of the earliest examples of *Schackoina*. In it the five-chambered forms are quite frequent (*Schackoina reicheli*, n. sp., *Schackoina pustulans quinquecamerata* n. sp., n. subsp.) but are outnumbered by the more common four-chambered *Schackoina pustulans pustulans* n. sp., n. subsp. indicating that four-chambered forms do already occur in an early evolutionary stage.

A few specimens of the *Schackoina* species and subspecies described here have also been observed in the Maridale formation where they occur together with

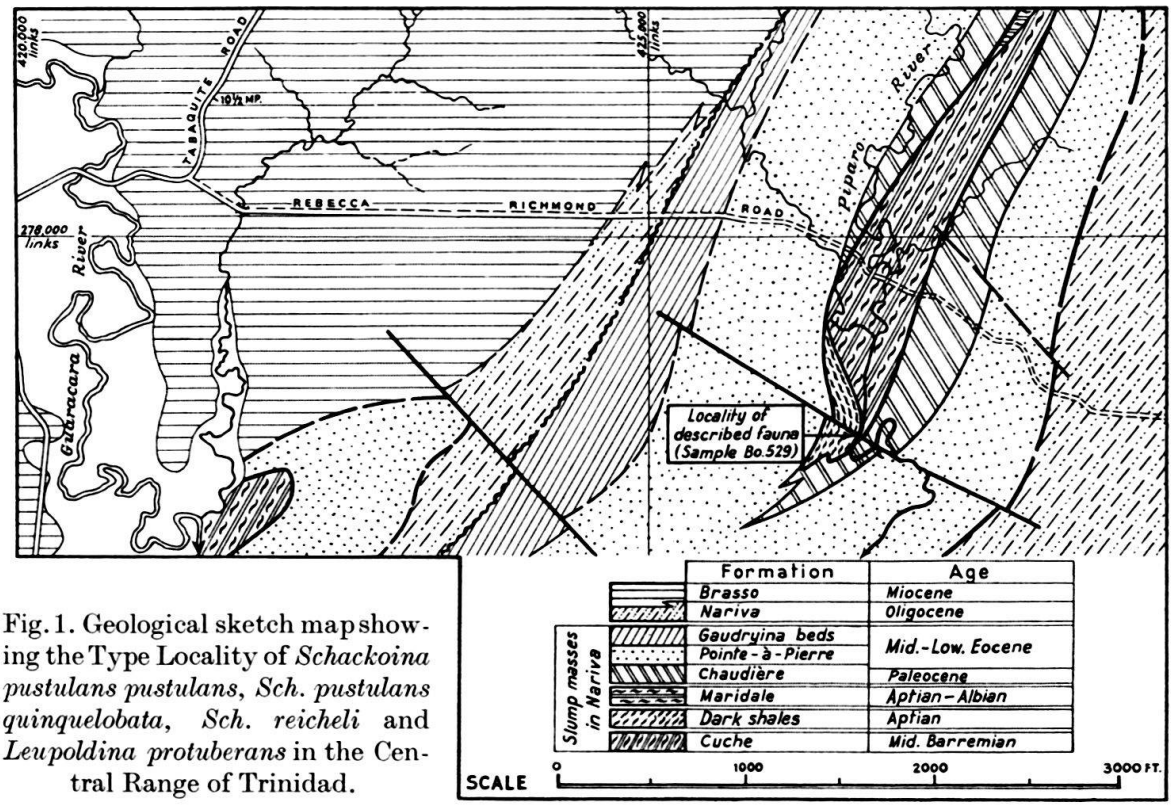

Fig. 1. Geological sketch map showing the Type Locality of *Schackoina pustulans pustulans*, *Sch. pustulans quinquelobata*, *Sch. reicheli* and *Leupoldina protuberans* in the Central Range of Trinidad.

Biglobigerinella barri BOLLI, LOEBLICH and TAPPAN. The Maridale formation which is of Aptian to Lower Albian age is considered to be slightly younger than the shales from which the present fauna is described.

Another probable occurrence of *Schackoina* in Trinidad is in the Middle-Lower Cenomanian part of the Gautier formation (*Rotalipora appenninica appenninica* zone). The forms described by BRÖNNIMANN (1952) as *Hastigerinoides rohri* (his pl. 1, figs. 8,9) do not possess the gradually tapering chambers of the typical *Hastigerinoides*. Due to the poor preservation of the Gautier material it has so far not been possible to observe the chamber extensions or to see whether or not relict apertures, characteristic of the genus *Hastigerinoides*, do exist. Thus, it is probable that *H. rohri* is in fact a *Schackoina*.

Although planktonic Foraminifera are often abundant in the higher Upper Cretaceous of Trinidad (Naparima Hill and Guayaguayare formations) no Schak-

koinas have so far been observed, with the only exception of scarce specimens of *Schackoina multispinata* (CUSHMAN and WICKENDEN) which occur in the upper part of the Maestrichtian Guayaguyare formation.

Schackoina pustulans pustulans, n. sp., n. subsp.

Pl. I, figs. 1–4

Shape of test. – Early stage possibly very slightly trochospiral (usually not recognizable), later becoming planispiral, stellate. Wall. – Calcareous, finely perforate. Chambers. – Early chambers globular to subglobular, becoming more and more elongated; the four chambers of the last whorl each with a bulb-or bubble-shaped extension (often broken off). Sutures. – Radial, depressed. Aperture. – An interiomarginal, equatorial arch bordered by a lip; in position often slightly asymmetrical to the equatorial plane. Largest diameter of holotype. – 0,41 mm.

Observed stratigraphic range. – Aptian to Albian.

Locality. – Holotype (pl. I, figs. 3,3a) and figured paratypes (pl. I, figs. 1, 2, 4) from sample Bo. 529 in dark grey shale of probable Aptian age exposed in the Piparo River, Central Range, Trinidad, B.W.I. (see textfig. 1). Very scarce specimens have also been found in the type locality material of the Aptian to Albian Maridale formation. Figured specimens deposited in the Museum of Natural History, Basel (Holotype C 2423, paratypes C 2421, C 2422, C 2424). Unfigured paratypes deposited in the U.S. National Museum, Washington.

Remarks. – *Schackoina pustulans pustulans*, n. sp., n. subsp., differs from *Schackoina pustulans quinquecamerata*, n. sp., n. subsp., and *Schackoina pentagonalis* REICHEL in possessing four instead of five chambers in the final whorl. From *Schackoina gandolfii* REICHEL and other four-chambered *Schackoina* species it differs in having bulb-shaped instead of spinose chamber extensions.

Schackoina pustulans quinquecamerata, n. sp., n. subsp.

Pl. I, figs. 6,7

Shape of test. – Early stage possibly very slightly trochospiral (usually not recognizable) later becoming planispiral, stellate. Wall. – Calcareous, finely perforate. Chambers. – Early chambers globular to subglobular, becoming more and more elongated; the five chambers of the last whorl each with a bulb-shaped extension (often broken off). Sutures. – Radial, depressed. Aperture. – An interiomarginal, equatorial arch, bordered by a lip; in position often slightly asymmetrical to the equatorial plane. Largest diameter of holotype. – 0.37 mm.

Observed stratigraphic range. – Aptian to Albian.

Locality. – Holotype (pl. I, figs. 7, 7a) and figured paratype (pl. I, fig. 6) from sample Bo. 529 in dark grey shale of probable Aptian age, exposed in the Piparo River, Central Range, Trinidad, B.W.I. (see textfig. 1). Very scarce specimens have also been found in the type locality material of the Aptian to Albian Maridale formation. Figured specimens deposited in the Museum of Natural History, Basel

(holotype C 2427, paratype C 2426). Unfigured paratypes deposited in the U.S. National Museum, Washington.

Remarks. – *Schackoina pustulans quinquecamerata*, n. sp., n. subsp., differs from *Schackoina pustulans pustulans*, n. sp., n. subsp., and other four-chambered *Schackoina* species in possessing five instead of four chambers in the final whorl. From *Schackoina pentagonalis* REICHEL it differs in having bulb-shaped instead of the assumed spinose chamber extensions. *Schackoina pustulans quinquecamerata* differs from *Schackoina reicheli*, n. sp., in having less elongated chambers and in being smaller in size.

Schackoina reicheli n. sp.

Pl. I, figs. 8–10

Shape of test. – Early stage possibly very slightly trochospiral (usually not recognizable), later becoming planispiral, strongly stellate. Wall. – Calcareous, finely perforate. Chambers. – Early chambers globular to subglobular; the four and a half to five chambers in the last whorl very strongly elongated, each with a bulb-shaped end (very often broken off). Sutures. – Radial, depressed. Aperture. – An interiomarginal, equatorial arch, bordered by a lip; in position often slightly asymmetrical to the equatorial plane. Largest diameter of holotype. – 0.52 mm.

Observed stratigraphic range. – Aptian to Albian.

Locality. – Holotype (pl. I, figs. 10, 10a) and figured paratypes (pl. I, figs. 8, 9) from sample Bo. 529 in dark grey shale of probably Aptian age, in the Piparo River, Central Range, Trinidad, B.W.I. (see textfig. 1). Very scarce specimens have also been found in the type locality material of the Aptian to Albian Maridale formation. Figured specimens deposited in the Museum of Natural History, Basel (holotype C 2430, paratypes C 2428, C 2429). Unfigured paratypes deposited in the U. S. National Museum, Washington.

Remarks. – *Schackoina reicheli*, n. sp., differs from *Schackoina gandolfii* REICHEL in possessing greatly elongated chambers with a bulb-shaped extension instead of a long, tapering spine. It possesses four and a half to five chambers in the final whorl instead of four in *Schackoina gandolfii*. Compared with *Schackoina pustulans quinquecamerata*, n. sp., n. subsp., *Schackoina reicheli* posessses more elongated chambers.

The species is named for Prof. M. REICHEL, Basel.

Genus **Leupoldina** n. gen.

Type species. – *Leupoldina protuberans*, n. sp.

Test free, early stage possibly slightly trochospiral, later planispiral, stellate, biumbilicate; early chambers globular to subglobular, chambers of last whorl elongate; some or all chambers of the last whorl with two or occasionally more long, tapering spines or bulb-shaped extensions symmetrically arranged on each side of the equatorial plane. Sutures depressed, radial; wall calcareous, perforate; surface smooth, pitted or hispid; aperture an interiomarginal, equatorial arch in the early stage, ultimate chamber with two interiomarginal, umbilical apertures,

one on each side of the chamber. There are indications that in some specimens relict apertures may exist in the penultimate and possibly in earlier chambers of the last whorl.

Observed stratigraphic range. – Aptian to Albian, probably Cenomanian.

Remarks. – *Leupoldina* differs from *Hastigerinoides* BRÖNNIMANN in having two or more symmetrically arranged bulb-shaped chamber extensions (protuberances) in some or all of the chambers of the last whorl. During a study of topotypes of *Hastigerinoides watersi* (CUSHMAN), a few specimens with two symmetrically arranged, bulb-shaped extensions on the ultimate chambers, similar to those in *Leupoldina*, were found, however, no divided aperture could be seen in these specimens. *H. watersi* differs further from the *Schackoina* and *Leupoldina* species described here in that the bulb-shaped extensions are restricted to the ultimate and occasionally penultimate chamber, while in *Schackoina* and *Leupoldina* they are present in all chambers of the last whorl. Secondary relict apertures, characteristic of *Hastigerinoides*, do not usually exist in *Leupoldina*. However, in some rare specimens they may probably be present, as is shown on figures 9 and 11 of plate II.

The new genus differs from *Biglobigerinella* LALICKER in having elongate chambers, the last ones with two or more symmetrically arranged spines or bulb-shaped protuberances.

Leupoldina has obviously developed from *Schackoina* THALMANN, from which it differs in possessing two or more symmetrically arranged extensions in the last chamber and a double aperture in the ultimate chamber. Forms morphologically very similar to the new genus have been previously described under *Schackoina* by REICHEL (1947) (*Schackoina cenomana bicornis*, *Schackoina moliniensis*) and by SIGAL (1952) (*Schackoina cabri*). In *Schackoina cenomana bicornis* the last or the last few chambers possess two symmetrically arranged, long spines (fig. 8,b), in *Schackoina moliniensis* (fig. 8,c) the chambers possessing two spines are, in addition, almost severed along the equatorial plane. The preservation of REICHEL's specimens made it impossible to see the apertures. Should future studies on more complete material show that these forms do not possess an interiomarginal, equatorial aperture typical of *Schackoina*, but instead have a double aperture typical of *Leupoldina*, then REICHEL's species would have to be placed in this genus.[2])

Schackoina cabri SIGAL, reported from the Aptian of Tunisia, is likely to be a *Leupoldina*. It seems to come from approximately the same stratigraphic level as do the Trinidad specimens. The paired extensions of the last two chambers in SIGAL's figured type are broken off. It looks very much like the *Leupoldina protuberans*, n. gen., n. sp., specimen figured here on plate II, fig. 2. Better preserved Tunisian material will be needed to determine whether the chamber extensions of

[2]) After completion of the manuscript a sample of the Middle to Lower Cenomanian Gautier formation from a borehole in south Trinidad was found to contain a few specimens which closely resemble *Schackoina cenomana bicornis* REICHEL and *Schackoina moliniensis* REICHEL. Although there are some indications of *Leupoldina*-type apertures, the poor preservation of the specimens does not allow a reliable observation. A rich planktonic foraminiferal fauna, consisting of such characteristic species as *Rotalipora appenninica appenninica* (O. RENZ), *Globigerina washitensis* CARSEY, four- and a few five-chambered *Schackoina* sp. accompany these specimens.

Schackoina cabri are spines as SIGAL assumes or are bulb-shaped and whether the ultimate chamber possesses a double aperture as does *Leupoldina protuberans*.

The genus is named for Prof. W. LEUPOLD, Zürich.

Leupoldina protuberans, n. sp.

Pl. II, figs. 1–13

Shape of test. – Early stage possibly very slightly trochospiral (usually not recognizable), later becoming planispiral, stellate. Wall. – Calcareous, finely perforate. Chambers. – Early chambers globular to subglobular, becoming more and more elongated; the early chambers of the last whorl each with a bulb- or bubble-shaped extension (often broken off). The final chamber, often also the penultimate and occasionally earlier chambers of the last whorl, with two, seldom three bulb-shaped extensions or protuberances, arranged symmetrically on each side of the equatorial plane. The final chamber with two protuberances may be almost severed along the equatorial plane (see pl. II, figs. 7, 9, 10). The last whorl consists of four to five chambers. Sutures. – Radial, depressed. Aperture. – In the early stage an interiomarginal, equatorial arch bordered by a thin lip. Ultimate chamber with two interiomarginal, umbilical apertures, one on each side of the chamber. Traces of probable relict apertures can occasionally be seen (pl. II, figs. 9, 11) but as a rule seem to be absent. In some specimens the interiomarginal, equatorial aperture persists to the ultimate chamber (pl. II, figs. 1, 3, 12), these might be taken as immature forms. Largest diameter of holotype. – 0,29 mm.

Observed stratigraphic range. – Aptian to Albian, ?Cenomanian.

Locality. – Holotype (pl. II, figs. 7, 7a) and figured paratypes (pl. II, figs. 1–6, 8–13a) from sample Bo. 529 in dark grey shale of probably Aptian age, exposed in the Piparo River, Central Range, Trinidad, B.W.I. (see textfig. 1). Figured specimens deposited in the Museum of Natural History, Basel (holotype C 2437, paratypes C 2431–C 2436, C 2438–C 2443). Unfigured paratypes deposited in the U. S. National Museum, Washington.

Remarks – The forms included here in *Leupoldina protuberans* display considerable variation. The last whorl consists of four to five chambers. Although two is the usual number of protuberances per chamber, specimens with three (pl. II, figs. 12, 13) do occasionally occur. The multiple protuberances are in many specimens restricted to the ultimate chamber but they are often also present in the penultimate and even earlier chambers. Such differences might appear a sufficient basis for the establishment of a number of subspecies. However, to justify such a subdivision it will have to be shown first that some or all of these features are not merely mutations which occur throughout the range of the species, but instead reflect evolutionary trends within the genus.

REFERENCES

AUROUZE, G., & KLASZ, I. DE (1954): *Sur la présence de Schackoines dans le Crétacé supérieur de France, de Bavière et de Tunisie.* Soc. Géol. France, Bull. [sér. 6] *4*, fasc. 1–3.

BOLLI, H. M. (1957), *The genera Praeglobotruncana, Rotalipora, Globotruncana and Abathomphalus in the Upper Cretaceous of Trinidad, B.W.I.* U.S. Nat. Mus., Bull. 215.

BOLLI, H. M., LOEBLICH, A.R., & TAPPAN, H. (1957): *The planktonic foraminiferal families Hantkeninidae, Orbulinidae, Globorotaliidae and Globotruncaniidae.* U. S. Nat. Mus., Bull. 215.

BRÖNNIMANN, P. (1952): *Globigerinidae from the Upper Cretaceous (Cenomanian-Maestrichtian) of Trinidad, B.W.I.* Bull. Amer. Paleontol., *34*, no. 140.

CUSHMAN, J. A. (1931): *Hastigerinella and other interesting Foraminifera from the Upper Cretaceous of Texas.* Contr. Cushman Lab. Foram. Res., *7*, no. 4.

CUSHMAN, J. A., & WICKENDEN, R. T. D. (1930): *The development of Hantkenina in the Cretaceous with a description of a new species.* Contr. Cushman Lab. Foram. Res., *6*, no. 2.

MONTANARO GALLITELLI, E. (1955): *Schackoina from the Upper Cretaceous of the northern Apennines, Italy.* Micropaleontology, *1*, no. 2.

REICHEL, M. (1948): *Les Hantkéninidés de la Scaglia et les Couches Rouges (Crétacé-supérieur).* Eclogae geol. Helv., *40*, no. 2.

SCHACKO, G. (1897): *Beitrag über Foraminiferen aus der Cenoman-Kreide von Moltzow in Mecklenburg.* Ver. Freunde Naturg. Mecklenburg, Arch., *50* (1896).

SIGAL, J. (1952): *Aperçu stratigraphique sur la micropaléontologie du Crétacé.* XIX^{e} Congr. géol. internat., Algers. Monogr. rég., sér. 1, no. 26.

THALMANN, H. E. (1932): *Die Foraminiferen-Gattung Hantkenina Cushman 1925 und ihre regionalstratigraphische Verbreitung.* Eclogae geol. Helv., *25*, no. 2.

Plate I. Schackoina

All figures × 110

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Figs. 1–4. *Schackoina pustulans pustulans* n. sp., n. subsp. 274
1, Side view of paratype with all bulb-shaped extensions broken off. 2, Side view of paratype with bulb-shaped extension of ultimate chamber preserved. 3, Side view of holotype with bulb-shaped extensions preserved on two chamber of final whorl. 3a, Edge view, showing position of the slightly excentrical aperture. 4, Side view of fully preserved paratype.

Fig. 5. Side view of a specimen close to *Schackoina pustulans pustulans*, n. sp., n. subsp. with two apertures in the final chamber, one on each side. The ultimate chamber partly embraces the 5th last chamber. This specimen indicates the close relationship of *Schackoina* and *Leupoldina* n. gen. It might in fact be regarded as an immature specimen of *Leupoldina* where the multiple extensions are not developed in the last chamber.

Figs. 6–7. *Schackoina pustulans quinquecamerata* n. sp., n. subsp. 274
6, Side view of paratype with all bulb-shaped extensions broken off. 7, Side view of holotype with bulb-shaped extensions preserved in the 3 last chambers. 7a, Edge view, showing slightly excentrical position of aperture.

Figs. 8–10. *Schackoina reicheli* n. sp. 275
8, Side view of paratype showing the bulb-shaped extension preserved in the ultimate chamber. 9, Side view of paratype showing the strongly elongated, tapering chambers with all bulb-shaped extensions broken off. 10, Side view of holotype with bulb-shaped extension on the penultimate chamber preserved. 10a, Edge view, showing slightly excentrical position of aperture.

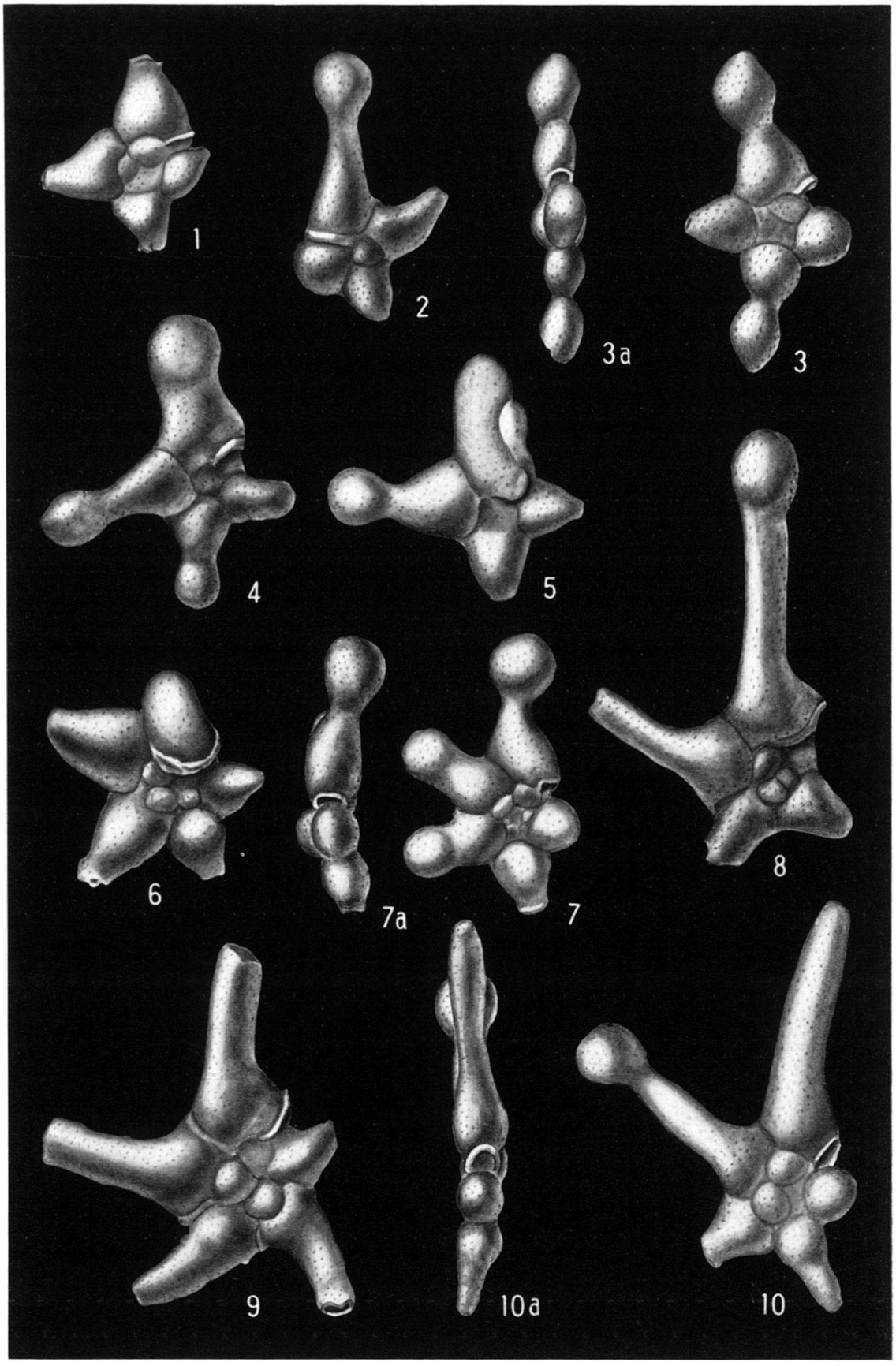
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Plate II. Leupoldina n. gen.

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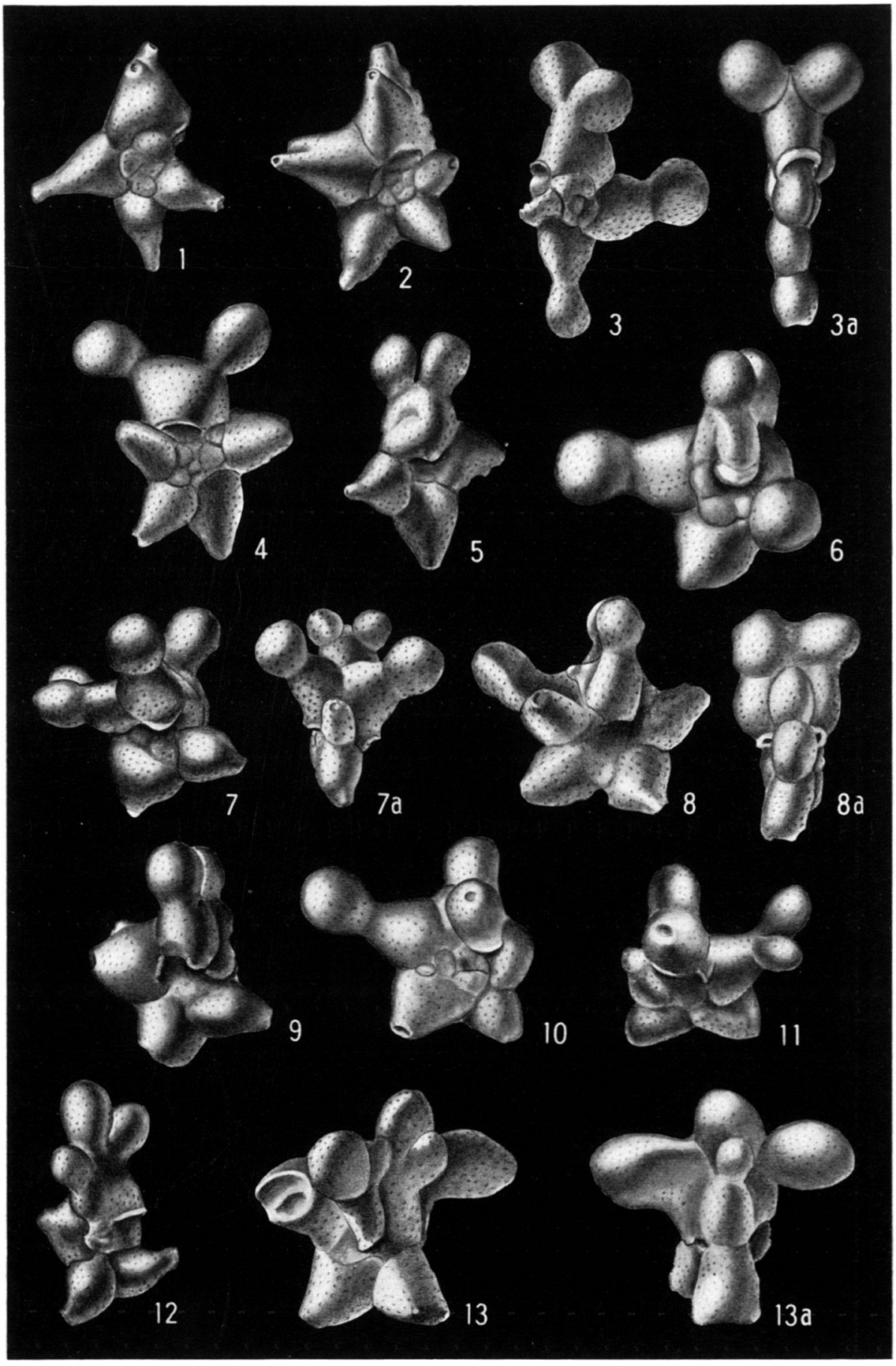
Figs. 1–13. *Leupoldina protuberans*, n. gen., n. sp. 277

1, Side view of paratype with the paired extensions of the ultimate chamber broken off. The aperture of the last chamber is still undivided and equatorial in position, which indicates an immature specimen. 2, Side view of paratype with the paired extensions of the last two chambers broken off. 3, Side view of paratype showing paired bulb-shaped extensions of ultimate chamber and single ones in earlier chambers preserved. 3a, Edge view, showing *Schackoina*-like aperture in a slightly excentrical position; the double aperture characteristic for *Leupoldina* is not yet developed in the final chamber, it might therefore be regarded as a juvenile specimen. 4–6, 10, Side views of paratypes with paired bulb-shaped extensions restricted to the final chamber; one of the two extraumbilical apertures of the final chamber is visible. 7, Side view of holotype showing paired bulb-shaped extensions in the two last chambers. The single bulb-shaped extensions of the two carlier chambers of the last whorl are broken off. One of the two interiomarginal, umbilical apertures of the ultimate chamber is visible. 7a, Edge view of holotype, showing the almost completely divided ultimate chamber with the two bulb-shaped extensions and the two interiomarginal, umbilical apertures. 8, 8a, Side and edge views of paratype showing similar features as holotype (figs. 7, 7a). 9, 11, Side view of paratypes showing probable relict apertures in the penultimate chambers. 12, Side view of paratype with three bulb-shaped extensions in the last chamber. The single extensions in the three earlier chambers of the last whorl are broken off. The equatorial aperture of the ultimate chamber indicates that the specimen is immature. 13, Side view of paratype showing three bulb-shaped extensions in the last chamber. The paired extensions in the three earlier chambers of the last whorl are broken off. The first chamber of the last whorl, partly embraced by the ultimate chamber and its central protuberance, has the single bulb-shaped extension preserved. One of the two interiomarginal, extraumbilical apertures is visible. 13a, Edge view, showing the three bulb-shaped extensions and the two interiomarginal, umbilical apertures of the ultimate chamber.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