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Globigerina-like foraminifera (Oberhauserellidae) from the Triassic (Ladinian-Carnian) of the San Cassiano Formation (Dolomites, Italy)

DONATO di BARI

1 Text-Figure and 6 Plates

Triassic
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Taxonomy
Alps
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"Trias-Globigerinen" (Oberhauserellidae) der ladinisch-karnischen San Cassiano-Formation (Dolomiten, Italien)

Zusammenfassung

Vorliegende Revision der sogenannten "Trias-Globigerinen" des locus classicus der karnischen San Cassiano Formation basiert sowohl auf dem Typusmaterial, als auch auf ergänzendem gut erhaltenem isolierten Material. Röntgendiffraktometrische Untersuchungen zeigen eine aragonitische Schalen-Zusammensetzung. Die Schalenoberfläche von *Oberhauserella mesotriassica* zeigt eine retikulate Struktur, die durch zahlreiche Erhebungen charakterisiert wird, die annähernd hexagonale Kammern bilden. Die Wandstruktur von *Oberhauserella* und *Kollmannita* ist durch einen lamellar-perforaten Aufbau gekennzeichnet, wobei die Lamellen aus Aragonitnadeln bestehen, deren c-Achsen annähernd senkrecht zur Wandoberfläche stehen. Außerdem wird ein neues Genus der Familie Oberhauserellidae FUCHS, 1970 beschrieben: *Pillerita* nov. gen. mit der Typusart *Pillerita tenonata.*

Abstract

The restudy of the so-called Triassic *Globigerina*-like foraminifers based both on well preserved isolated material from the Triassic (Carnian) San Cassiano Formation (Dolomites, Italy) and the type-material, leads to a description of their mineralogy, shell surface and test-wall structure. X-ray investigation has shown the aragonitic composition. The shell surface of the test of *Oberhauserella mesotriassica* has shown a reticulate structure characterised by many ridges that form nearly hexagonal cells. The wall structure of *Oberhauserella* and *Kollmannita* is characterised by a lamellar perforate wall made up of layers (lamellae) that consist of aragonite needles with the c-axis approximately perpendicular to the wall surface. The new genus *Pillerita* (type-species *Pillerita tenonata*), included in the family Oberhauserellidae FUCHS, 1970, is also described.

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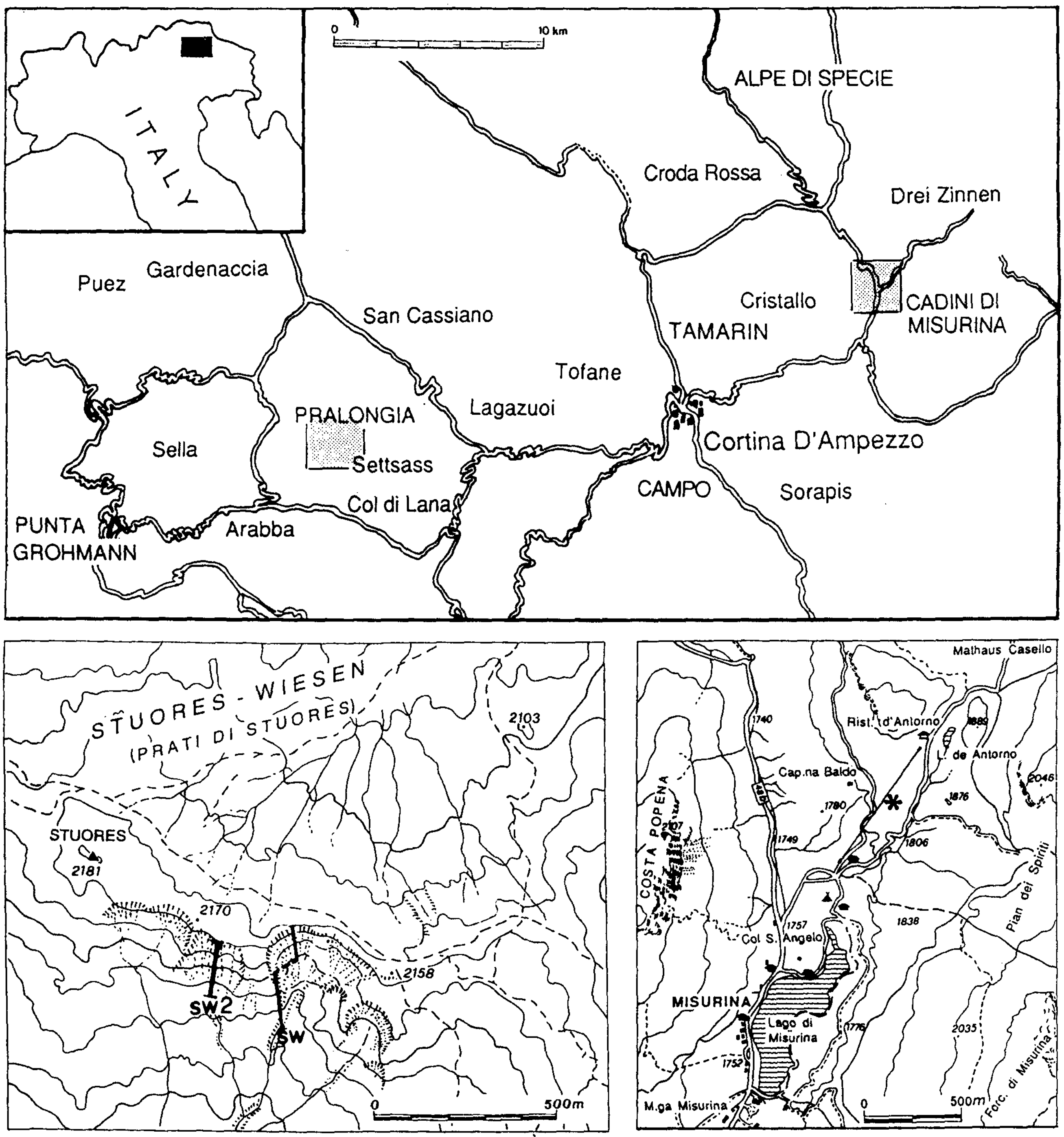
1. Introduction

In the course of a research program on Triassic *Globigerina*-like foraminifers (Oberauserellidae FUCHS, 1970), still in progress, supported by the CNR (Consiglio Nazionale delle Ricerche) and carried out in the Geological Survey of Austria (Geologische Bundesanstalt), a rich oberhauserellid assemblage from the San Cassiano Formation (Dolomites, Italy) has been found. It has offered the possibility to improve the knowledge on this group by providing new data on mineralogy, test structure and test-wall texture. It has been also possible to recognise one genus new. It is recorded herein.

During the last two decades few papers on the oberhauserellid foraminifers from the Triassic have been published. In fact, the knowledge on the Triassic oberhauserellids is mostly based on the papers of FUCHS (1967, 1969, 1975a, b), who established all the Triassic species belonging to the family Oberhauserellidae FUCHS, 1970. Nevertheless, in all but one case (FUCHS, 1975b), these papers showed only drawings of these species and their descriptions were based on studies with use of light microscope. This circumstance prevented the possibility to easily find out many important shell features that FUCHS described. As these features seem to be essential for the identification of the oberhauserellid foraminifers, a re-exa-



Text-Fig. 1.
Location map of Stuores Wiesen and Misurina areas, Dolomites, Italy. The map in low to the left show the location of the Prati di Stuores (Stuores Wiesen) sections; asterisk in low to the right map marks locality Misurina.

mination of the type-material using the electron microscope was done. This taxonomic revision is still in progress, but some results have been already obtained and they are partly showed herein.

2. Previous research

In 1967 FUCHS established five new genera, *Kollmannita, Oberhauserella, Schlagerina, Schmidita* and *Praegubkinella*, that he called Triassic *Globigerina*-like foraminifers because of the globular shape of their chambers. They belong to the family Oberauserellidae FUCHS, 1970 and were distinguished on the basis of the features of the umbilical area.

FUCHS (1969) described *Praegubkinella tugescens* FUCHS, 1967 as having every chamber characterised by an internal vault (*archus* of FUCHS) externally revealed as an umbilical furrow on each chamber. This internal vault divided the chamber into a proximal part and a distal one. The aperture, subcircular in shape, was considered opened at the base of the distal part and leading into the umbilicus. Based on the thin sections analysed by light microscopy, FUCHS (1969) also considered the test wall of this species calcareous composed of aragonite, non-lamellar, fibrous-radiate and questionably perforate.

WERNLI (1995), who studied the oberhauserellid group from Jurassic, has also described the same result.

In 1975a FUCHS emended all the five-oberhauserellid genera and considered the arrangement of the umbilical margin of the last chamber the most significant feature of the shell. This umbilical margin of the last chamber was considered characterised by some convex (flaps) and concave (arcs of FUCHS) folds along the radial direction. According to FUCHS (1975a) the arrangement of the umbilical margin of the last chamber changes during the evolution of the oberhauserellid foraminifers. From the older genus *Kollmannita*, which shows some folds forming the so-called proximal and distal arcs and the two connected flaps, derive *Schmidita* and *Oberhauserella*, in which the folds are attenuate. Particularly, in *Oberhauserella* the distal arch disappears and only the proximal arch followed by a wide flap is showed. From *Oberhauserella* originate both *Schlagerina* and *Praegubkinella*, the former differs in having a closed umbilicus, the latter in having a higher trochospiral enrolment and a more attenuate arch.

LOEBLICH & TAPPAN (1988) rejected this hypothetical evolutionary relationship. In their opinion *Kollmannita, Schlagerina* and *Praegubkinella* are synonym with *Oberhauserella* and the superfamily Oberhauserellacea FUCHS, 1975a is synonym with Duostominacea (suborder Robertinina) as well.

FUCHS (1975a) described the wall structure of the oberhauserellids as nonlamellar or mesolamellar. Particularly, he assumed *Kollmannita, Schmidita* and *Praegubkinella* as nonlamellar, while *Schlagerina* and *Oberhauserella* as nonlamellar or mesolamellar.

In the opinion of WERNLI (1995) the Jurassic oberhauserellids have a nonlamellar test-wall.

According to FUCHS (1975b) scheme, the aragonitic fibrous-radiate wall-texture of *Praegubkinella* start with the Carnian *Oberhauserella*, in which the radiate texture, is only hinted. This latter texture derived from the calcareous microgranular shells of *Variostoma* KRISTAN-TOLLMANN, 1960. The transition from calcareous microgranular to aragonitic radiate wall took place within the genus *Kollmannita*.

HOHENEGGER & PILLER (1975) considered *Praegubkinella tugescens* and *Schlagerina altispira* FUCHS, 1967 having respectively, a radial hyaline and a granular hyaline wall-texture. They also considered *Praegubkinella tugescens* as having a lamellar test-wall.

3. Material and methods

The material studied comes from the Ladinian-Carnian sediments of the San Cassiano Formation (Dolomites, Italy) that is a basinal unit mainly consisting of marl, marly to pure micrite and oolitic-bioclastic calciturbidites. These sediments are geometrically interfingered with the coeval prograding platforms (BOSELLINI, 1984, 1988, 1989; BOSELLINI & DOGLIONI, 1988; DE ZANGHE et al., 1993; NERI et al., 1994) that consist mainly of steeply clinostratified, strongly dolomitized, megabreccias deposited as talus beds prograding on the basinal sediments of the San Cassiano Fm. They are also defined "Cassian platforms" for this geometrical arrangement. According to quoted authors the Cassian platforms and their coeval San Cassiano deposits are organized in depositional sequences.

The material studied has been recorded in isolated specimens from two typical fossiliferous San Cassiano localities: Prati di Stuores (Stuores Wiesen) and Misurina (Text-Fig. 1).

The Prati di Stuores (Stuores Wiesen) lies in the neighbourhood of Pralongia, on the southwest of the village of San Cassiano (Text-Fig. 1) and may be considered the type-area of the San Cassiano Fm. The material studied comes from two stratigraphic sections, here called SW and SW2. They are located inside a vast gully-eroded ground depression, which deeply incises the slope from an altitude of 1980 m to about 2150 m in correspondence of the crest (Text-Fig. 1). These sections are both Ladinian-Carnian in age but they are not lithostratigraphically related. The section SW2, unless for the upper part where URLICHS (1994) recorded the lowest significant Carnian ammonoid species *(Trachyceras aon)* of this area, is Upper Ladinian (Regoledanus Zone) in age (NERI et al., 1994). Since the material studied comes from a sample (SW2-5bis) located below the layer where this specimen were found, it must be considered Upper Ladinian in age.

The section SW has been proposed by BROGLIO LORIGA et al. (in press) as a type section of the Ladinian-Carnian boundary. According to URLICHS (1974, 1994) and NERI et al. (1994) the above said section could be considered Ladinian (Regoledanus Zone) in age. In fact, the first appearance of Carnian ammonoid *(Trachyceras aon)* and conodont *(Gondonella polygnathiformis)* occur in an other overlying section. In the proposal of BROGLIO LORIGA et al. (in press) the Prati di

Species / Samples	*Kollmannita ladinica*	*Kollmannita* aff. *ladinica*	*Kollmannita diplotreminiformis*	*Pillerita tenonata* gen. et sp. nov.	*Oberhauserella mesotriassica*	*Oberhauserella ? karinthiaca*	*Oberhauserella* sp. A	*Oberhauserella* sp. B	*Schmidita* sp.
Mis. 13	*		*						
Mis. 11	*	*	*	*	*	*	*		*
Mis. 5	*	*	*	*	*		*		*
14SW1, 5	*	*		*	*			*	*
SW2-5bis								*	*

Stuores section SW is Ladinian only in the first 45 m. Since the layer 14SW1.5, from which the material studied comes from, is located near the top of the section it is Carnian in age (for further discussion see BROGLIO LORIGA et al. (in press)).

The locality Misurina indicates outcrops on the left side of the ski lift at a height of about 1820m east of the Lago di Misurina situated east of Cortina D'Ampezzo (Text-Fig. 1). According to di BARI & LAGHI (1994) the Misurina outcrops could be referred to the Carnian (Austriacum Zone) because of the strong similarity of its microfauna (foraminiferal and microcrinoid assemblage) with those from Alpe di Specie. The latter area, in fact, has been dated as Carnian (Austriacum Zone) on the basis of the microcrinoid assemblage (BIZZARINI et al., 1990) and ammonoids (BIZZARINI & BRAGA, 1987).

The material investigated consists of many well preserved isolated specimens collected from the washed residues of marls and shales. They have been referred to four genera, one of which is new. Some specimens have been considered as two possible new species but their scarce number has not allowed to formally establishing them. In other cases the species have been only dubitatively classify. This foraminiferal species are listed below.

In this paper are described the species *Kollmannita ladinica, Pillerita tenonata* gen. et sp. nov., *Oberhauserella mesotriassica, Oberhauserella* sp. A and *Oberhauserella* sp. B. In order to have a more precise classification the holotypes of these species have been also studied and illustrated.

The material studied was cleaned by ultrasonic treatment before being investigated with light and Scanning Electron Microscope (SEM). The following dimensions of the test of the holotype and the other studied samples have been measured: largest diameter (D) and height (H). The latter dimension refers to the distance, along the shell axis, between the apex of the test and the bottom of the umbilical region. The oil immersion technique has been also used to help elucidate chamber arrangement. The structure of the test was studied by SEM on broken shells as well as in thin sections. The mineralogical composition of the test of *Kollmannita ladinica* FUCHS, 1967, *Oberhauserella mesotriassica* FUCHS, 1967 and *Pillerita tenonata* gen. et sp. nov. has been investigated by GANDOLFI chamber method.

In the Prati di Stuores section SW2 the oberhauserellids are associated with *Ammodiscus infimus* (STRICKLAND, 1846), *Ammobaculites hiberensis* MARQUEZ & TRIFONOVA, 1990, *Dentalina* ex gr. *subsiliqua* FRANKE, 1936, *Pseudonodosaria obconica, Kriptoseptida klebelsbergi* (OBERHAUSER, 1960), *Lenticulina excavata* (TERQUEM, 1864) and *Duostomina biconvexa* KRISTAN-TOLLMANN, 1960.

In the Prati di Stuores section SW the oberhauserellids are associated with *Aulotortus* ex gr. *sinuosus* WEYNSCHENK, 1956, *Lamelliconus multispirus* (OBERHAUSER, 1957), *Lamelliconus procerus*, (LIEBUS, 1942), *Duostomina biconvexa* KRISTAN-TOLLMANN, 1960, *Diplotremina astrofimbriata* KRISTAN-TOLLMANN, 1960, *Variostoma pralongense* KRISTAN-TOLLMANN, 1960, *Variostoma exile* KRISTAN-TOLLMANN, 1960, *Papillaria altoconica* (KRISTAN-TOLLMANN, 1973) and many other species referred to *Nodosaria* EHRENBERG, 1838 and *Lenticulina* LAMARK, 1804 as well described by the author in BROGLIO LORIGA et al. (in press).

The foraminiferal assemblage associated with the foraminifers oberhauserellid in the Misurina outcrops is rich and diversified. It consists of involutinids and duostominids mainly represented by the species *Aulotortus* ex gr. *sinuosus* WEYNSCHENK, 1956, *Lamelliconus* ex gr. *ventroplanus* (OBERHAUSER, 1957), *Lamelliconus artiskmorphos* di BARI & LAGHI, 1994, *Ornatoconus francorussoi* di BARI, 1998, *Prorakusia salaji* di BARI & LAGHI, 1994, *Triadodiscus inceptus* di BARI & LAGHI, 1994, *Duostomina biconvexa* KRISTAN-TOLLMANN, 1960, *Diplotremina astrofimbriata* KRISTAN-TOLLMANN, 1960, *Variostoma pralongense* KRISTAN-TOLLMANN, 1960, *Papillaria laghii* di BARI & RETTORI, 1996 and other species of the genera *Nodosaria* EHRENBERG, 1838, *Lenticulina* LAMARK, 1804 and *Reophax* DE MONTFORT, 1808.

4. Mineralogical analysis

As above mentioned the aragonitic composition of the oberhauserellid foraminifers were only hypothesized and deduced by the morphology of the needles constituting the wall-texture of *Praegubkinella* (FUCHS, 1969; HOHENEGGER & PILLER, 1975). In order to confirm this hypothesis for the species herein studied three x-ray diffraction analyses using the non-destructive technique of Gandolfi chamber (Diameter: 114,6 mm; Ni-filtered Cuα radiation: λ= 1,54178 A°) were done.

They showed the presence of both aragonite and calcite, but the latter one refers to the calcite cements filling the lumen of the chambers. Therefore the analyses indicate that *Oberhauserella mesotriassica, Kollmannita ladinica* and *Pillerita tenonata* gen. et sp. nov. possesses an aragonitic composition.

5. Systematic descriptions

Order Foraminiferida EICHWALD, 1830
Suborder Robertinina LOEBLICH & TAPPAN, 1984
Superfamily Duostominacea BROTZEN, 1963
Family Oberhauserellidae, FUCHS, 1970

Genus *Kollmannita* FUCHS, 1967

***Kollmannita ladinica* (OBERHAUSER, 1960)**
Pl. 1; Pl. 2, fig. 3

1960 *Globigerina ladinica* OBERHAUSER, p. 43, Pl. 5, fig. 12, 14, 16
1967 *Kollmannita ladinica* (OBERHAUSER), FUCHS, p.144–145, Pl.1, fig. 5, 6
1975a *Kollmannita ladinica* (OBERHAUSER), FUCHS, Pl. 1, 5; Pl. 2, fig. 1
1975b *Kollmannita tirolica* FUCHS, p. 238–239, Pl. 2, fig. 2

Description: The studied specimens of this species were found to have a small test constituted by a low trochospiral coil of three whorls composed by five chambers that rapidly enlarge their size. From the convex spiral side the coiling is dextral and all the chambers are visible. They are inflated and separated by depressed sutures slightly curved backward at the periphery of the spiral side. The periphery is rounded and the peripheral outline lobulate. The last whorl surrounds a slightly concave umbilical area. The umbilical margin of each last chamber shows a notch (arch sensu FUCHS, 1969) followed by an umbilical extension or flap that, except for the last chamber, is upon the preceding chamber. In the last chamber both arch and flap are turned toward the umbilicus (Pl. 1, figs. 2, 3). Wall calcareous, perforate, made up of aragonitic layers (lamellae) of about 1.7 microns thick (Pl. 2, fig. 3) that are constituted by aragonite needles with the c-axis approximately perpendicular to the wall surface (Pl. 1, fig. 8). The perforations have a diameter of approximately 0.5–0.8 microns (Pl. 1, figs. 7,

8) and are perpendicular to the test surface. The surface is smooth and the aperture opens beneath the flap of the last chamber and extends radially from the inner to the margin of the umbilical region (Pl. 1, fig. 1–3).

Dimensions of the test: The dimensions, in millimetres, of the test of the holotype and other studied samples are schematized as follow:

Holotype: Largest diameter (D) = 0.32 mm; Height (H) = = 0.083 mm; D/H = 3.85;

D	H	D/H
0.4	0.1	4
0.77	0.2	3.85
0.57	0.16	3.56
0.45	0.12	3.75
0.7	0.19	3.68

Remarks: Fuchs (1975b) distinguished *Kollmannita tirolica* from *Kollmannita ladinica* on the basis of the shell size, being the former species bigger. This criterion seems to be too subtle to use and the writer thinks it should be considered as a character of variability of the species. Therefore, they are herein considered synonymous.

The so-called proximal and distal arcs that in the opinion of Fuchs (1975a) are present on the umbilical margin of the last chamber of all the species belonging to *Kollmannita*, has not been observed in *Kollmannita ladinica*. In fact, even the analysis of the holotype has showed the presence of a single notch (Pl. 1, fig. 5c) that could be the proximal arch of Fuchs (1975a). As above mentioned, this proximal arch are present on each last five chambers that surrounds the umbilical region. A fold of the lamellae constituting the umbilical septal face of the chambers (Pl. 2, figs. 3b, c) forms each arch. Inside of the chamber this arch forms an internal vault that divide the chamber into a proximal part and a distal one (Pl. 1, fig. 6). The aperture is opened at the base of the distal part. Fuchs (1969) described the same test architecture for *Praegubkinella turgescens*. The lamellar structure of *Kollmannita ladinica* has been observed on a specimen with a partially cut-away surface (Pl. 2, fig. 3). It has showed a wall made up by at least two layers. Fig. 3c in Pl. 2 seems to show a three-layered wall. Unfortunately it was not possible to observe how this lamellae are arranged and the studied thin sections of this species examined with a light microscope did not show even the lamellar structure. Therefore, at present it is not possible to refer this lamellar structure to one of the main lamellar arrangement of the hyaline foraminifers (nonlamellar, monolamellar, multilamellar, bilamellar and bilamellar with septal flap).

Genus *Oberhauserella* Fuchs, 1967

Oberhauserella mesotriassica (Oberhauser, 1960)
Pl. 2, figs. 1, 2, 4; Pl. 3, figs. 1, 6, 7; Pl. 4; Pl. 5; Pl. 6, fig. 4

1960 *Globigerina mesotriassica*, Oberhauser, p. 42–43, Pl. 5, figs 18, 19

1967 *Oberhauserella mesotriassica* – Fuchs, p. 149, Pl., figs. 7–8

1975 *Oberhauserella mesotriassica* – Fuchs, Pl. 2, figs. 4, 5

Description: *Oberhauserella mesotriassica* has a small test with a trochospiral coil of three, four whorls in which the inflated and rapidly increasing in size chambers are visible from the convex spiral side. Five chambers compose each whorl and the coiling is always dextral as viewed from the spiral side. The umbilical side has a depressed articulated umbilicus; the periphery is rounded, while the peripheral outline lobulate. Sutures depressed, curved backward at the periphery on the spiral side. The umbilical margin of each last five chambers, that surround the umbilical region, show a proximal notch followed by a flap that is directed roughly toward the centre of the umbilicus (Pl. 2, figs. 1a, 4; Pl. 3, fig. 1; Pl. 4, fig. 2). In the last chamber this flap is bigger. Wall calcareous, perforate, made up of aragonitic layers (lamellae) of about 1.8 microns thick (Pl. 5, fig. 4) that are constituted by aragonite needles. The surface is reticulate and the aperture opens beneath the flap of the last chamber.

Dimensions of the test: The dimensions, in millimetres, of the test of the holotype and other studied samples are schematized as follow:

Holotype: Largest diameter (D) = 0.18mm; Height (H) = 0.1 mm; D/H = 1.8;

D	H	D/H
0.3	0.17	1.76
0.27	0.14	1.92
0.26	0.13	2
0.23	0.12	1.91
0.25	0.11	2.27
0.24	0.13	1.84

Remarks: The proximal notch observed on the umbilical margin of the last chamber has the same characteristic of the proximal arch described by Fuchs (1975a). Nevertheless the specimens analysed have not allowed to recognize if this notch internally forms a vault that divide the chamber into a proximal part and a distal one.

In spite of most of specimens studied have been showed a roughly smooth shell surface, some of them were found having a reticulate structure. Unfortunately this shell structure was not found well preserved in all its parts. Nevertheless it was possible to note that it consists of many ridges that form deep cells (Pl. 6, fig. 4). The length of these ridges is 1,87–2,5 microns, while the size of the cells in their largest diameter ranges from 1,56–3,12 microns. The shape of the cells seems nearly hexagonal (Pl. 6, figs. 4d, e). The regular geometry showed by this shell sculpture allows to say that it is not of secondary derivation. The fact that it was not observed in all the specimens studied, even in the holotype, could be related to its easily broken.

The test-wall of *Oberhauserella mesotriassica* has perforations of 0,6–0,9 microns in diameter. They were observed on the test surface of whole specimens (Pl. 4, figs. 1b, 4b; Pl. 6, fig. 4) as well as inside the chamber on broken specimens (Pl. 4, fig. 5b). They are perpendicular to the test surface of the wall and located at random. In the specimens that showed the above said reticulate structure, the density of the perforations seems to be independent of the sculpture of the test surface. They are located inside the cells and one perforation or more than one seems to be in each cell (Pl. 6, figs. 4d, e).

Test lamellar structure of the wall has been observed by SEM on fresh broken surfaces. These lamellae are about 1.8 microns in thickness and have a radial texture constituted by aragonitic needles perpendicular to the wall surface. Fresh broken surfaces, both roughly parallel and oblique to the shell axis (Pl. 5, figs. 2–4) showed that two layers form the septa. As far as the author knows, the wall structure in which the septa are two-layered should be considered bilamellar. By definition, bilamellar wall has a basic structure consisting of an outer and inner layer separated by a membranous median layer (or dark layer). The outer layer covers the outer surface of the new chamber as well as parts or all the outer surfaces of the pre-existing shell that become thicker (Smout, 1954; Reiss, 1957; Hansen & Reiss, 1971, 1972; Gronlund & Hansen, 1976). The inner layer cover the inside of the new chamber wall and may stops at the earlier formed septum or may coats it forming the septal flap that make it three-layered. The lamellar arrangement of the septa of *Oberhauserella mesotriassica*, except for the median layer, is similar to that of the bilamellar model without septal flap. Unfortunately it was not possible to observe the arrangement of these lamellae on the outer surface of the test. Therefore the author does not know if the outer layer covers the outer surfaces of the pre-existing chambers. As regards the median layer, it is difficult to detect a membranous layer in the material fossilized. Therefore it is not possible to compare entirely the lamellar structure of *Oberhauserella mesotriassica* with the bilamellar one. Nevertheless, the two-layered wall is typical of the bilamellar hyaline foraminifera and it can be only justify admitting the presence of the median layer calcifying both its sides. In this way the lamellar structure of *Oberhauserella mesotriassica* should be considered having a bilamellar wall.

Oberhauserella sp. A
Pl. 3, figs. 4, 5

Remarks: In the material studied some specimens have showed peculiar characteristics that have not allowed referring them to any known species. Since the number of the specimens is not so numerous, it does not allow establishing a new species.

They have a dome-shaped test characterised by a low trochospiral coil constituted by few whorls of inflated chambers. The coiling is dextral as viewed from the spiral side. The last whorls of four chambers surround the open umbilicus. The umbilical aperture is open beneath a distal flap that follow a notch (proximal arch) (Pl. 3, fig. 5a) and is located at the centre of the umbilicus. Wall probably aragonitic, densely perforate (Pl. 3, fig. 5b). The diameter of the perforation ranges from 0.31–0.47 microns.

Among the species described by Fuchs (1967) *Oberhau-serella quadrilobata* resemble this undetermined one. Never-theless, *Oberhauserella quadrilobata* has more inflated chambers that in the last whorl are characteristically arranged like a four-leaf clover. Moreover it has the proximal notch located at the centre of the last chamber and the aperture extends from the inner to the margin of the umbilical region.

Oberhauserella sp. B
Pl. 3, figs. 2, 3

Remarks: The specimens of this species have showed a cone-shaped test characterised by a trochospiral coil constituted by about five, six whorls. The coiling is both dextral and sinistrorsal. Sutures curved backward at the periphery on the spiral side. The last whorl of four chambers surrounds an articulated umbilicus. The umbilical margin of each last chambers shows a moderate notch (proximal arch) followed by a flap that is curved backward. Beneath each distal flaps of the last four chambers an aperture seems to be open (Pl. 3, fig. 3a).

The features of the umbilical region of this species resemble that of *Oberhauserella mesotriassica*. Nevertheless *Oberhauserella* sp. B differs by possessing a high cone-shaped test and four chambers surrounding the umbilical region. Moreover the chambers are not so inflated.

As far as the author knows this species could be the oldest oberhauserellid species.

Genus *Pillerita* gen. nov.
Type-species: *Pillerita tenonata* gen. et sp. nov.

Derivation of name: The new genus is named in honour of Professor Werner Piller, University of Graz (Austria), for his contribution to the knowledge of the Triassic foraminifers.

Diagnosis: Small test, free, constituted by a low trochospiral coil of few whorls in which the rapidly increasing in size chambers are visible from the convex spiral side. The chambers are moderately inflated and separated by depressed sutures slightly curved backward at the periphery on the spiral side and almost radial on the umbilical side. The periphery is ovoid to rounded, the peripheral outline from slightly lobulate to gently angled. The final whorl surrounds a depressed umbilicus. The umbilical margin of the last chamber shows two tenons (or chamber flaps) that extend toward the umbilicus partly covering it. These tenons are separated by an indentation. An indentation also precedes and follows the two tenons. Wall aragonitic, finely perforate, surface smooth, one or more openings probably beneath the indentations.

Remarks: The last chamber of the specimens of fig. 3, Pl. 6 shows a clear opening in extraumbilical position that herein is interpreted as septal foramen. It was not possible to observe directly the location of the aperture (or the apertures). Nevertheless, since the structure like tenon, toothplate etc. are always associated with the aperture it was assumed its (or their) presence beneath the indentations close to the tenons.

Stratigraphic distribution: Known only from the Upper Triassic (Carnian) of the Dolomites, Italy.

Distinction: *Pillerita* differs from all the other genera belonging to the family Oberhauserellidae in having tenons on the umbilical septal face of the last chamber. In particular the new genus differs from *Oberhauserella* because the latter has more inflated chambers and reticulate test surface. In *Oberhauserella* each whorl posseses less chambers than *Pillerita* and the trochospiral coil is also higher.

Superficial similarities exist to *Kollmannita*, but in this genus the more inflated chambers possess a notch (proximal arch) followed by a flap that make the genus characteristic.

Pillerita differs from *Praegubkinella* because the latter has higher trochospiral test and more inflated chamber.

According to di Bari (in preparation) the genus *Schlagerina* is synonymous with *Oberhauserella*.

Pillerita tenonata gen. et sp. nov.
Pl. 6, fig. 1-3, 5, 6

Derivation of name: After the presence of tenons on the umbilical septal face of the last chamber.

Holotype: The specimen illustrated in Pl. 6, fig. 5.

Paratypes: The specimens illustrated in Pl. 6, fig. 1–3, 6.

Locality and horizon: Prati di Stuores (Stuores Wiesen), Dolomites, Italy. San Cassiano Formation, Carnian (Daxatina subzone).

Material: 16 isolated specimens from Prati di Stuores (14SW1,5) and Misurina (M11, M5). The holotype and the paratypes are deposited at Geological Survey of Austria (Geologische Bundesanstalt).

Diagnosis: See generic diagnosis.

Description: Small test, free, with a low trochospiral coil of three whorls in which the moderately inflated and rapidly increasing in size chambers are visible from the convex spiral side. Six chambers compose each whorl and the coiling is always dextral as viewed from the spiral side. The umbilical side has a depressed umbilicus surrounded by the last whorl of six chambers; the periphery is ovoid to rounded, the peripheral outline from slightly lobulate to gently angled. Sutures depressed curved backward at the periphery on the spiral side and almost radial on the umbilical side. The umbilical septal face of the last chamber shows two tenons and three indentations. The tenons extend toward the umbilicus partly covering it. The distal tenon is sometimes branched out. The length of the tenons ranges from 41.1–60.6 microns and the diameter from 11.8–29.4 microns. Wall aragonitic, finely perforate, surface smooth, one or more openings probably beneath the indentations.

Dimensions of the test

Holotype: Largest diameter (D) = 0.33 mm; Height (H) = 0.09 mm; D/H = 3.6. The dimensions, in millimetres, of the test of the paratypes and other samples are schematized as follows:

D	H	D/H
0.35	0.07	5
0.34	0.09	3.8
0.32	0.08	4
0.26	0.06	4.3
0.3	0.06	5

Stratigraphic distribution: The same as the genus.

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Plate 1

***Kollmannita ladinica* (Oberhauser, 1960)**

Figs. 1, 4: Exterior, umbilical view of a specimen with a partially cut-away surface. SEM pictures, Fig. 1, x 90, M11; Fig. 4, x 110, M5.
Fig. 2: Exterior, umbilical view of a specimen showing the notch (proximal arch) followed by a flap of each last chambers; the aperture is also visible. SEM picture, x 230, M11.
Fig. 3: Exterior, umbilical view. SEM picture, x 120, M11.
Fig. 5: Exterior of the Holotype, material Oberhauser (1960), specimen stored in the Geological Survey of Austria. SEM pictures, 5a oblique spiral view, x 210; 5b exterior, peripheral view, x 260; 5c exterior, oblique umbilical view, x 200.
Fig. 6: Oblique equatorial section of a specimen showing the arch inside of the chamber. Optical microscope photograph, x 250, M11.
Fig. 7: Enlarged detail of Fig. 4 showing external pore mouths at shell surface. SEM picture, x 2100.
Fig. 8: Enlarged detail of Fig. 1 showing the perforation and the aragonitic needles. SEM picture, x 1200.

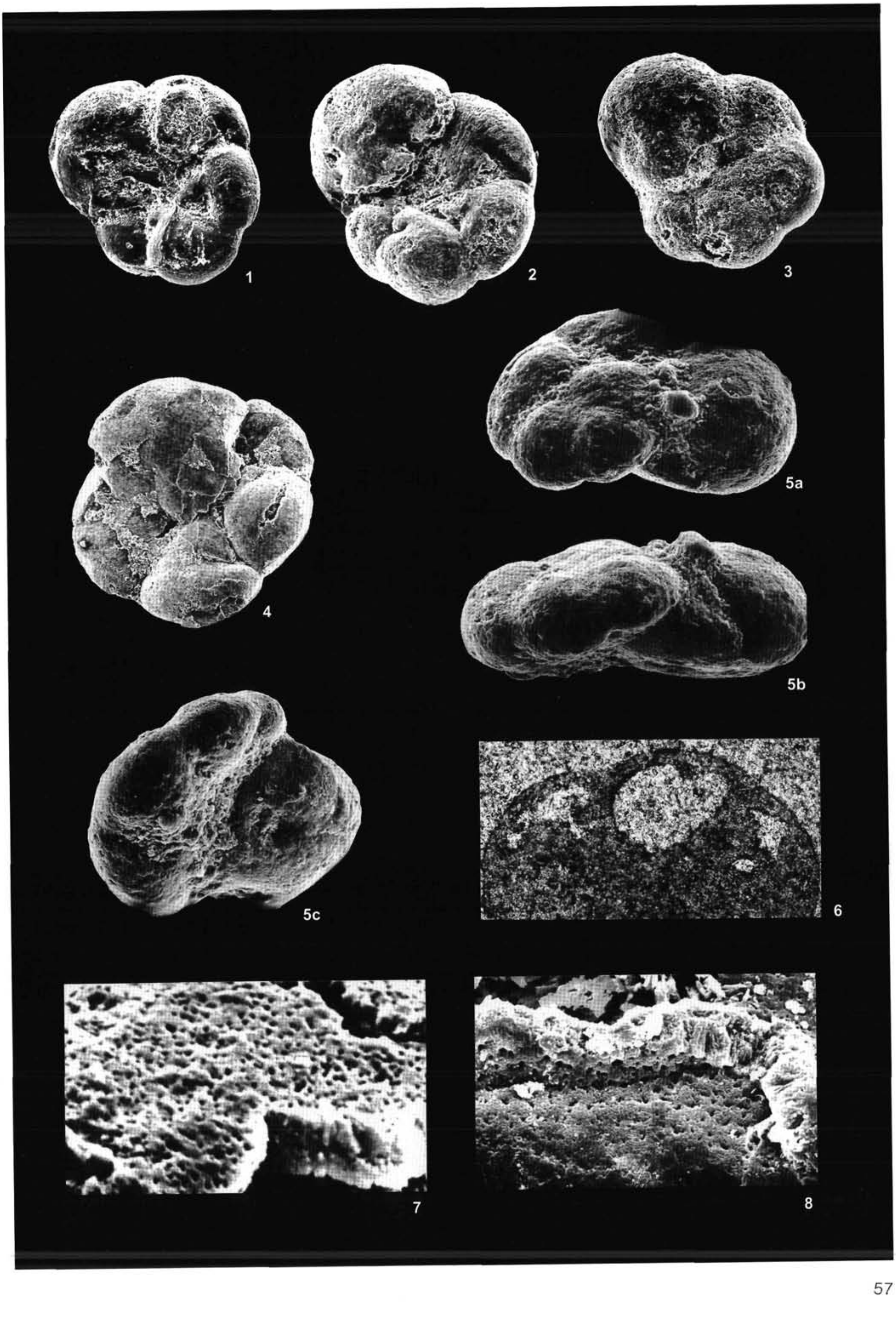

1
2
3
4
5a
5b
5c
6
7
8

Plate 2

Oberhauserella mesotriassica **(Oberhauser, 1960)**

Fig. 1a: Exterior, umbilical view. SEM picture, x 200, M5.
Fig. 1b: Exterior, lateral view. SEM picture, x 270.
Fig. 2: Exterior of the holotype, material Oberhauser (1960), specimen stored in the Geological Survey of Austria. SEM pictures, 2a umbilical view, x 250; 2b spiral view, x 220; 2c lateral view, x 350; 2d oblique lateral view, x 290.
Fig. 4: Exterior, umbilical view, SEM pictures, x 190, 14SW1,5.

Kollmannita ladinica **(Oberhauser, 1960)**

Fig. 3a: Exterior, umbilical view of a specimens with a partially cut-away surface. SEM picture, x 80, M5.
Fig. 3b, c: Enlarged detail of Fig. 3a showing the lamellar structure of the wall and the fold that forms the proximal arch, SEM picture, 3b, x 580; 3c, x 1300.

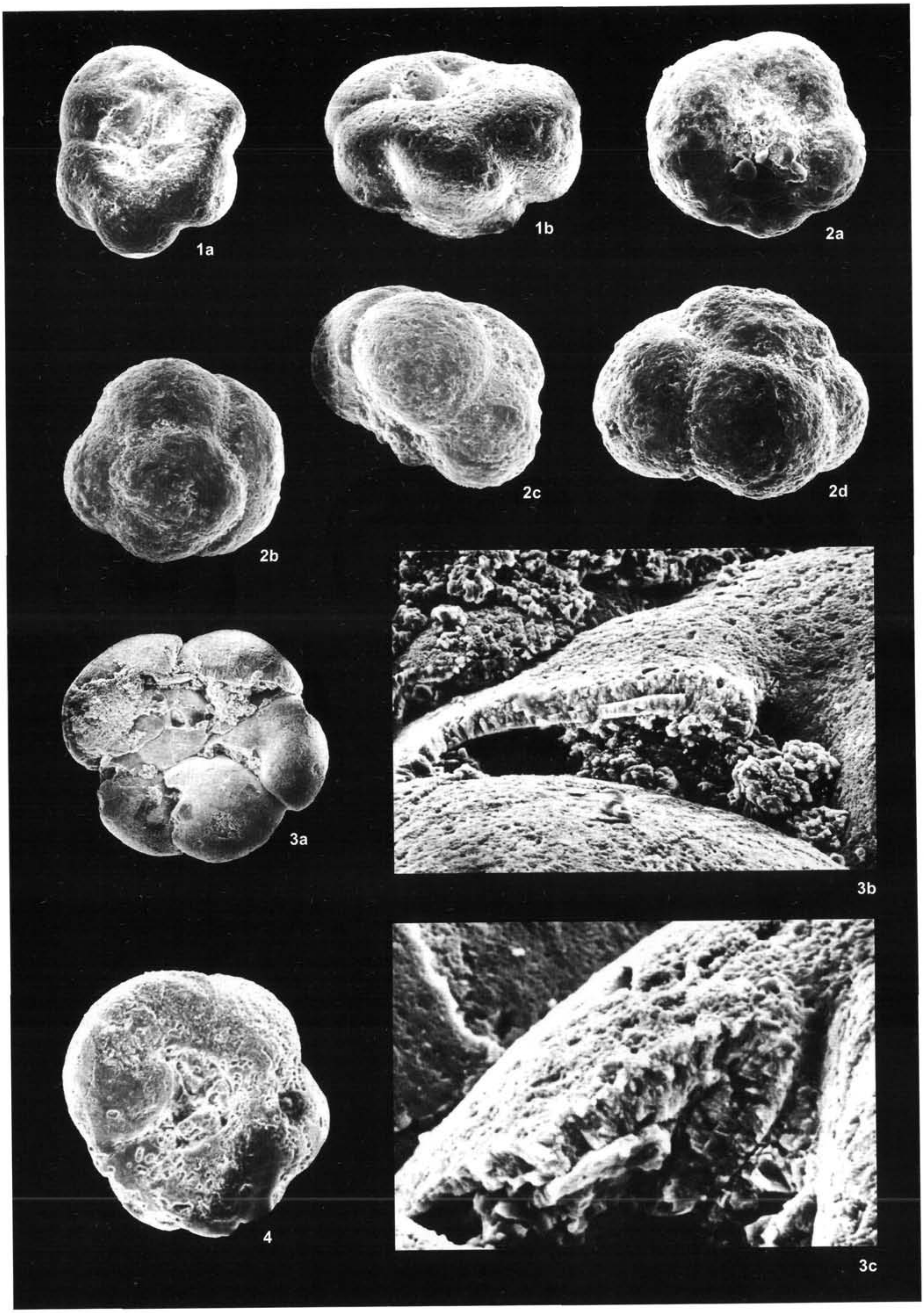

1a
1b
2a
2b
2c
2d
3a
3b
4
3c

Plate 3

Oberhauserella mesotriassica **(OBERHAUSER, 1960)**

Fig. 1a: Exterior, umbilical view, SEM picture, x 190, M5.
Fig. 1b: Exterior, oblique lateral view, SEM picture, x 240.
Fig. 6: Exterior, lateral view, SEM picture, x 230, M11.
Fig. 7: Exterior, oblique umbilical view, SEM picture, x 380, 14SW1,5.

Oberhauserella **sp. B**

Fig. 2a: Exterior, umbilical view, SEM picture, x 150, 14SW1,5.
Fig. 2b: Exterior, oblique lateral view, SEM picture, x 150.
Fig. 3a: Exterior, oblique lateral view of a specimen showing the apertural notch beneath the flap of the penultimate chamber, SEM picture, x 165, 14SW1,5.
Fig. 3b: Exterior, umbilical view, SEM picture, x 170, 14SW1,5.

Oberhauserella **sp. A**

Fig. 4: Exterior, umbilical view, SEM picture, x 240, M5.
Fig. 5a: Exterior, umbilical view of a specimen showing the aperture beneath the flap of the last chamber, SEM picture, x 240, M11.
Fig. 5b: Enlarged detail of Fig. 5a showing external pore mouths at shell surface. SEM picture, x 2100.

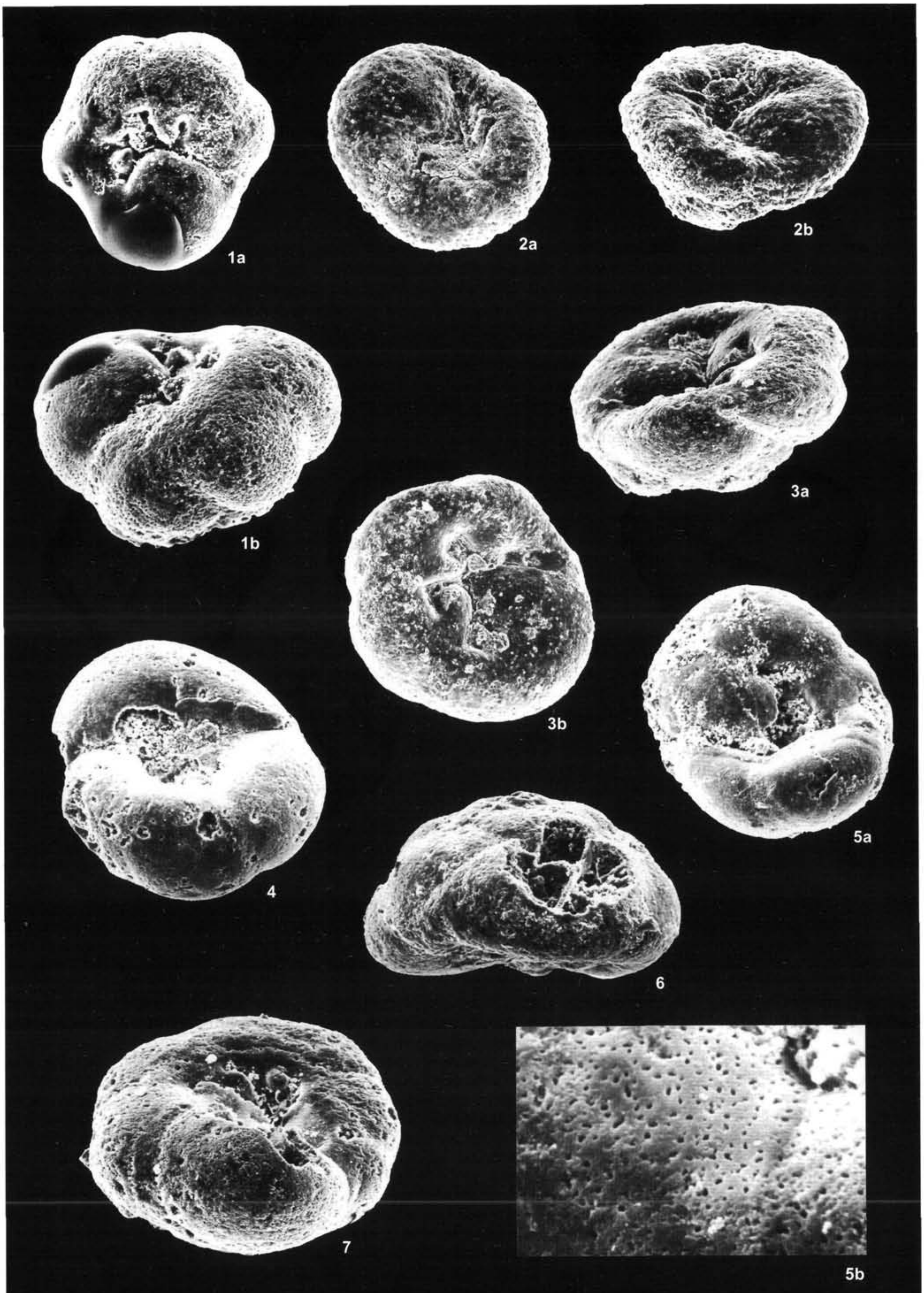
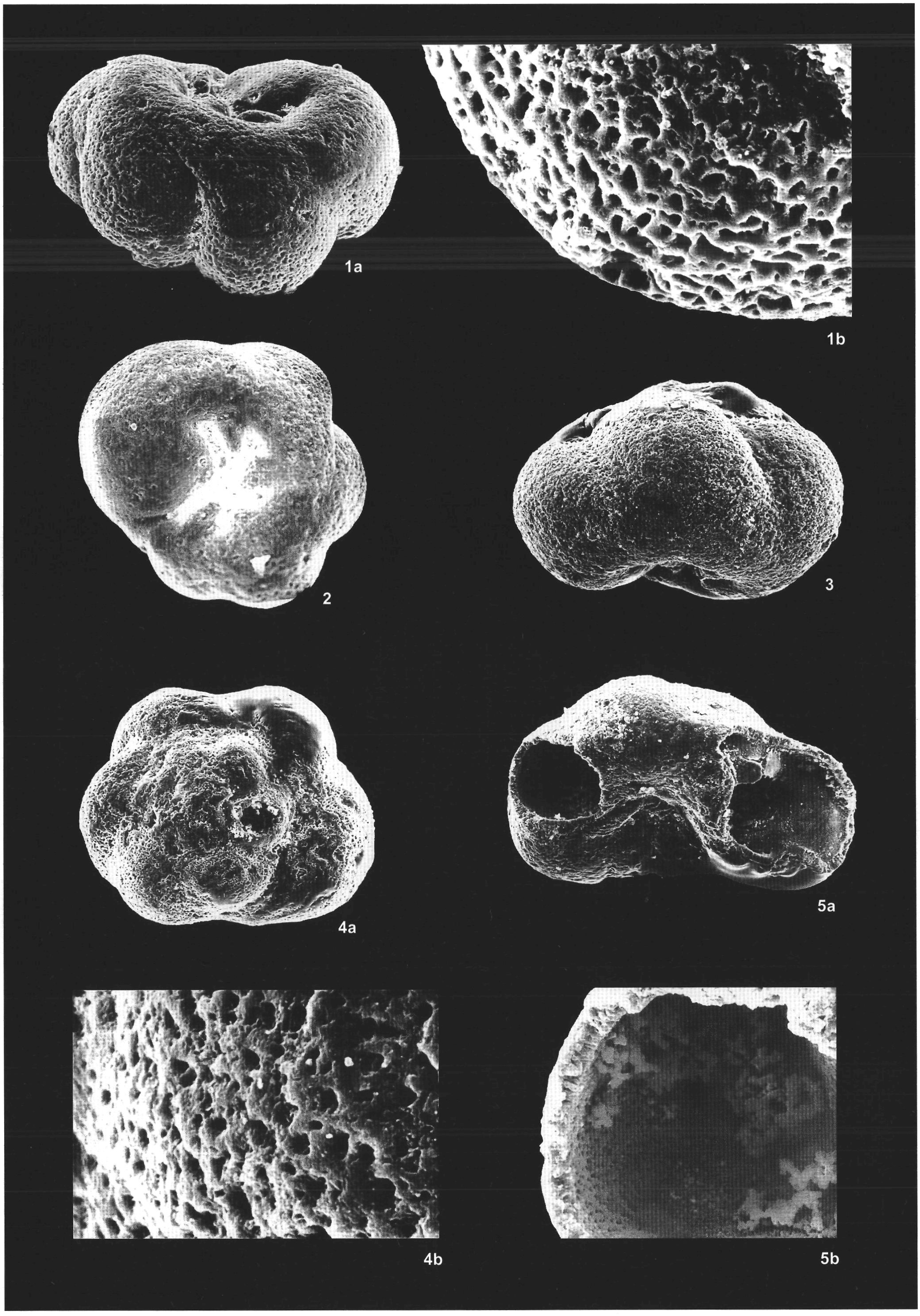

1a
2a
2b
1b
3a
3b
4
5a
6
7
5b

Plate 4

Oberhauserella mesotriassica **(Oberhauser, 1960)**

Fig. 1a: Exterior, lateral view, SEM picture, x 290, M11.
Fig. 1b: Enlarged detail of Fig. 1a showing a worn reticulate structure at shell surface, SEM pictures, x 900.
Fig. 2: Exterior, umbilical view, SEM picture, x 250, 14SW1,5.
Fig. 3: Exterior, lateral view, SEM picture, 210, M11.
Fig. 4a: Exterior, spiral view, SEM picture, x 190, M5.
Fig. 4b: Enlarged detail of Fig. 4a showing a worn reticulate structure at shell surface, SEM pictures, x 1600
Fig. 5a: Exterior, oblique lateral view, SEM picture, x 260, M5.
Fig. 5b: Detail showing the perforation and the aragonitic needles of the chamber-wall from the broken chamber of the specimen of Fig. 5a, SEM picture, x 1100.


1a
1b
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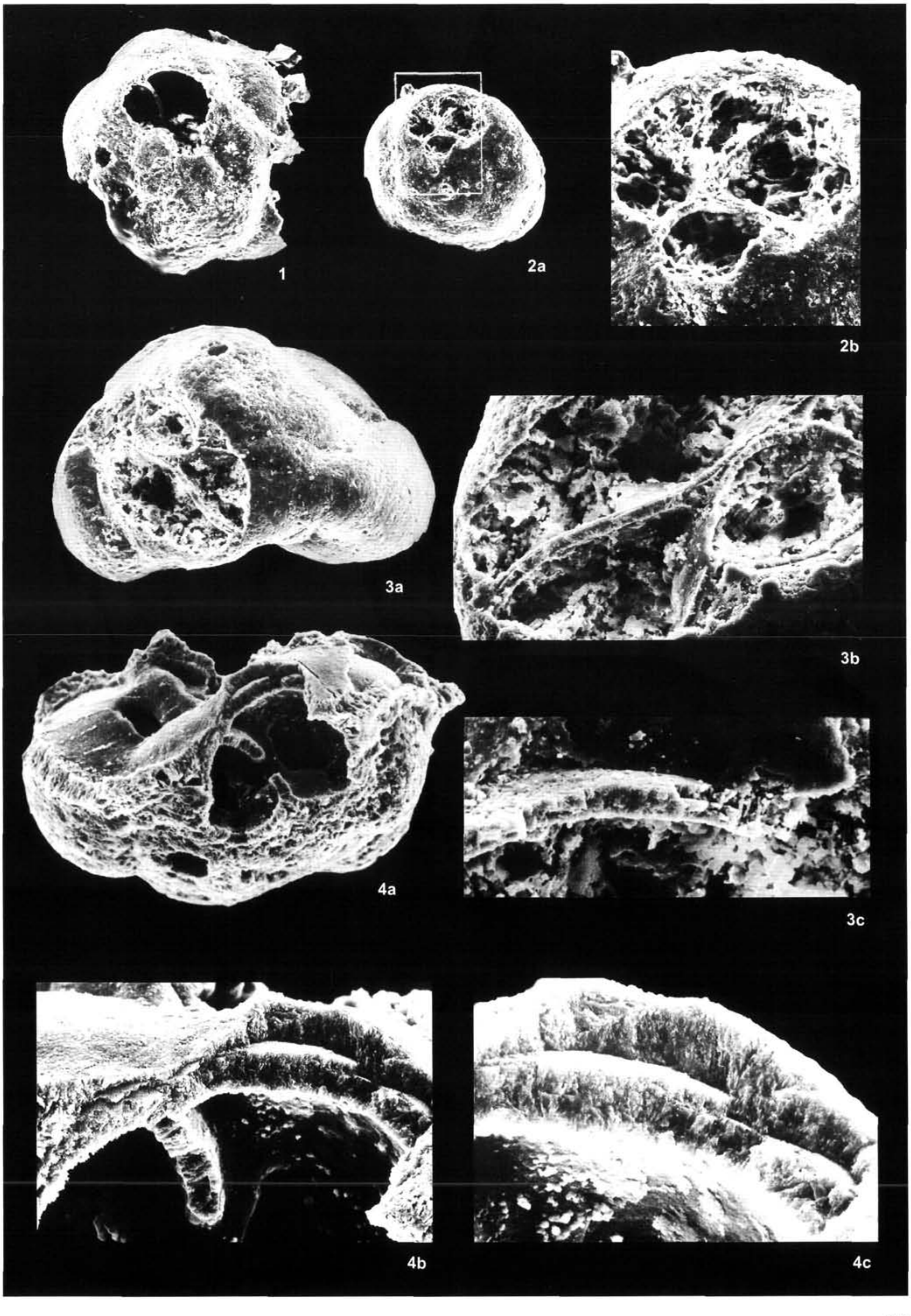
5a
4b
5b

Plate 5

Oberhauserella mesotriassica **(OBERHAUSER, 1960)**

Fig. 1: Exterior, spiral view, SEM picture, x 210, M11.
Fig. 2a: Exterior, oblique spiral view of a specimen showing the outline of Fig. 2b, SEM picture, x 120, 14SW1,5.
Fig. 2b: Enlarged detail of Fig. 2a showing some septa separating adjacent chambers, SEM picture, x 360.
Fig. 3a: Exterior, lateral view of a specimen with a partially cut-away surface. SEM picture, x 270, M5.
Fig. 3b: Enlarged detail of Fig. 3a showing some septa separating adjacent chambers, SEM picture, x 620.
Fig. 3c: Enlarged detail of Fig. 3a showing the lamellar wall structure, SEM picture, x 1100.
Fig. 4a: Exterior, lateral view of a specimens with a fresh fracture. SEM picture, x 330, M11.
Fig. 4b, c: Enlarged details of Fig. 3a showing the lamellar wall structure, SEM picture, 4b, x 900, 4c, x 1500.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2a
2b
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3b
4a
3c
4b
4c

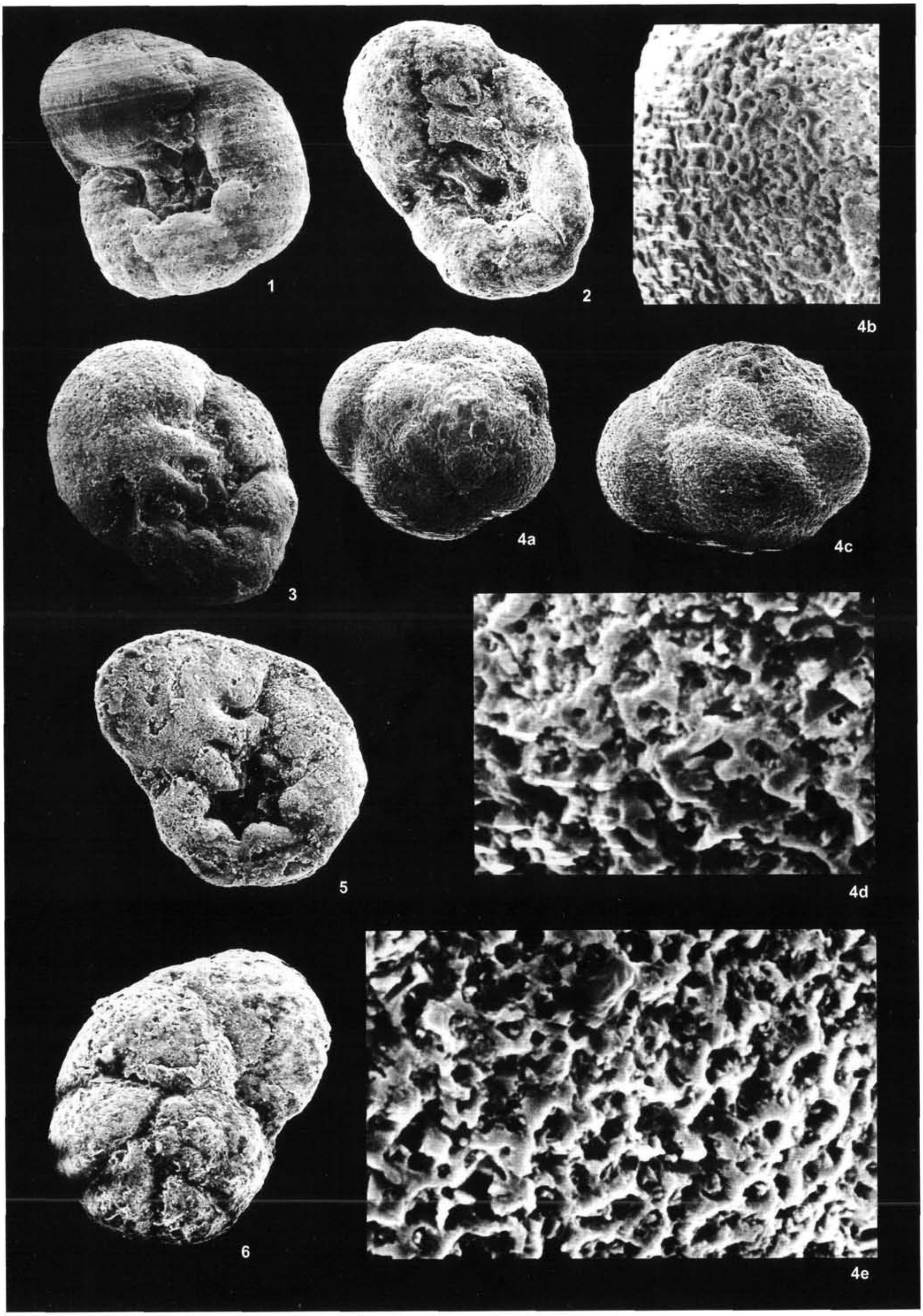
Plate 6

***Pillerita tenonata* gen. et sp. nov.**

Fig. 1, 2: Paratypes, exterior, umbilical view of a specimens showing the branching of the distal tenon, SEM pictures, Fig. 1, x 170, Fig. 2, x 165, 14SW1,5.
Fig. 3: Paratype, exterior, umbilical view of a specimen showing the foramen, SEM picture, x 165, M5.
Fig. 5: Holotype, exterior, umbilical view showing the two typical tenon that characterised the last chamber, SEM picture, x 220, 14SW1,5.
Fig. 6: Paratype, exterior, spiral view, SEM picture, x 280, M11.

***Oberhauserella mesotriassica* (OBERHAUSER, 1960)**

Fig. 4a: Exterior, spiral view of a specimen with the reticulate structure at shell surface, SEM picture, x 140, M5.
Fig. 4b: Enlarged detail of Fig. 4a showing the reticulate structure at shell surface of one chamber, SEM picture, x 760.
Fig. 4c: Exterior, oblique spiral view of the specimen of Fig. 4a, SEM picture, x 140.
Fig. 4d, e: Enlarged details of Fig. 4c showing the reticulate structure at shell surface, SEM pictures, 4d, x 1600, 4e, x1300.


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