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LINGULATE BRACHIOPODS OF THE SILURIAN AND DEVONIAN OF THE BARRANDIAN (BOHEMIA, CZECH REPUBLIC)

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Abstract. Complete revision of all to present time described and recognised lingulate brachiopods in the Silurian and Devonian of the Barrandian is given, including revision of nearly all types of Joachim Barrande (1879). Of 63 identified species, 23 are new. Nine new genera are defined: *Careniellus* gen. n., *Kosagittella* gen. n., *Kacakiella* gen. n., *Prastavia* gen. n., *Barrandeoglossa* gen. n., *Sterbinella* gen. n., *Praeoehlertella* gen. n., *Opatrilkiella* gen. n., and *Havlicekion* gen. n. A new subfamily Ivanothelinae subfam. n. is erected.

■ Brachiopoda, Lingulata, taxonomy, palaeoecology, Silurian, Devonian, Barrandian, Bohemia

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Introduction

Lingulate brachiopods are a commonly overlooked group of animals in the Lower Palaeozoic marine benthic communities. Their phosphatic shells are inconspicuous, mostly small, simply shaped and generally are not very abundant. This group, rapidly evolving in late Cambrian and Early Ordovician time, decreases in diversity and abundance in the late Ordovician age (Wright and McClean 1991). To Silurian and Devonian periods, only a few families of lingulates survived, mainly Obolidae King, 1846, Pseudolingulidae Holmer, 1991 Paterulidae Cooper, 1956, Trematidae Schuchert, 1893 and Discinidae Gray, 1840. In the Middle and Upper Ordovician, dominant acrotretoids survived in a much restricted number, with a few genera (Holmer and Popov 1996). Siphonotretids, dysoristids and likely also paterinates are extremely rare and represent "living fossils" in Silurian and Devonian marine communities.

Lingulate brachiopods, as opposed to the bulk of another Lower Palaeozoic fossils, may be studied as free valves, with fascinating details of outer and inner shell morphology (Biernat 1973, Williams and Holmer 1992, Popov and Holmer 1994, Cusack et al. 1999 etc.). Organo-phosphatic shell may be loosed from calcareous rocks by dissolution of the calcite by a weak acetic acid. This method in combination with SEM study been widely used in recent decades; however, mainly Cambrian and Ordovician strata have been studied (Biernat 1973, Krause and Rowell 1975, Holmer 1986, 1989, Popov and Holmer 1994, etc.). The application of this method to the Silurian and Devonian rock is at very beginning, mainly due to general rarity of lingulates at this time (Ireland 1961, Ludvigsen 1974, Cocks 1979, Biernat 1984, and Brock et al. 1995).

Some limestone beds of the Silurian and Devonian age in the Barrandian yielded remarkably rich and diverse assemblages of lingulate brachiopods, in quantity and quality unrecovered in the foreign areas with the Silurian–Devonian strata. In combination with the material collected by hammering, a revision of all previously described species from the Barrandian and description of numerous newly discovered taxa have been possible. The present results indicate that some taxa have much longer stratigraphical range than suggested by former authors. Among them, lingulate genus *Paterula* and micromorphous siphonotretids and dysoristids surely survived to the early Middle Devonian.

Material and methods

A substantial part of material studied comes from the collection of Joachim Barrande, including nearly all his types (Barrande 1879); they are currently deposited in the collections of the Department of Palaeontology, National Museum, Prague (abbreviation NM). Many specimens come from the collection of Dr. Vladimír Havlíček, currently located in the palaeontological collections of the Museum of Dr. B. Horák, Rokycany (abbreviation MBHR). Several brachiopod specimens come from the material collected during 1940-1960 by Dr. Josef Bouška and professor Bedřich Bouček; these specimens are currently deposited in the palaeontological collection of the Czech Geological Survey, Prague (abbreviations JB and BB). All new material collected by the author is kept in the palaeontological collection of the Department of Biology, University of West Bohemia, Plzeň (abbreviation PCZCU).

Phosphatic microbrachiopods were collected by standard methods, described by Holmer (1989). Limestone samples (from roughly 1 to 15 kg) were dissolved in 10 % acetic acid for three to five days. The residues were sieved into two fractions and all microfossils were picked under the microscope. Neither heavy liquid nor any other method of microfossil concentration was used. Number of phosphatic brachiopods in residues vary significantly, from a few fragments to several hundred

specimens in a sample. Quality of their preservation depends on limestone composition; light-grey biodetritic and micritic limestones contain perfectly preserved shells, while dark-grey, bituminous limestones often yielded strongly carbonised, fragmentary and poorly preserved shells.

Historical overview

The first lingulate brachiopods of the Silurian and Devonian age of the Barrandian have been described by Joachim Barrande in 1848. He assigned all to him known specimens to two species of genera *Lingula* BRUGUIÈRE and four species to *Orbicula* LAMARCK, but no species was described as new by him. In his next brachiopod work (Barrande 1879), he referred 21 species to genus *Lingula* BRUGIÈRE, 34 species to *Discina* LAMARCK, 2 species to *Siphonotreta* DE VERNEUIL and a single species to *Trematis* SHARPE. However, Joachim Barrande in his *Système Silurien du centre de la Bohême* (1879) did not describe particular species and made only fine lithographical drawings of individual specimens (in natural sizes and generally also in moderate magnifications).

Next works about Silurian and Devonian lingulate brachiopods are of much younger data.

Mergl (1982) described a new biernatid *Caenotreta ephemera* sp. n. from the Kopanina Formation, Silurian. Havlíček and Mergl (1988) described two discinid species from the Silurian and early Devonian and erected two new genera: *Lochkothele* with the type species *L. intermedia* sp. n. from the Lochkov Formation, and *Kosoidea* with the type species *K. fissurella* sp. n. from the Kopanina Formation. Havlíček (1995) described new genus *Wadiglossella,* with the type species *W. odiosa* sp. n. from the Motol Formation, Silurian. A year later Havlíček and Vaněk (1996) erected new genus *Chynithele* with the type species *C. ventricona* sp. n., derived from the Chýnice Limestone, Emsian. In the same year, Mergl (1996) described several discinids from the tuffaceous limestones of the Kopanina Formation, Silurian, including a new genus *Ivanothele* (*Ivanothele mordor* sp. n., *Orbiculoidea karlstejnensis* sp. n., and *Orbiculoidea* ? spp.). Vladimír Havlíček, in Havlíček and Vaněk (1998a) gave short remarks and descriptions of Barrande's species *"Lingula" bohemica* BARRANDE, *Wadiglossa lingua* (BARRANDE) and *Orbiculoidea bohemica* (BARRANDE), all from the Koněprusy Limestone, Devonian. He also gave comments to other species of the Pragian age described by J. Barrande, but without descriptions and illustrations. In 1998b, Havlíček described Barrande's species *Chynithele fritschi* (BARRANDE) from the Zlíchov Formation, Devonian. In his last paper, Havlíček (1999) described species *Wadiglossella nigricula* sp. n., *Orbiculoidea* sp. n., *Kosoidea regalis* sp. n., and *Schizocrania* sp. from the Lochkov Formation, Lochkovian. Mergl (1999a) described the new species *Lingulops barrandei* sp. n. from the Kopanina Formation, and the only Silurian representative of the genus *Paterula* (species *P. argus* sp. n.) from the Želkovice Formation, Silurian at Hýskov (Mergl 1999b).

Shell morphology

Detailed morphology and chemico-structures of the lingulate shell are comprehensively known, especially due to works of the last decade (Williams and Mackay 1979, 1994, Curry and Williams 1983, Holmer 1989, Popov and Holmer 1994, Williams 1997, Williams et al. 1998, etc.). The interest is directed to morphological structures, which reflect soft anatomy, such as muscle scars, imprints of pedicle nerves and setal follicles, epithelial cell moulds and structure of the periostracum.

Of the internal features of lingulides, the shape of muscle scars and especially the posterior adductor is a significant feature, discriminating the early obolids from the Mesozoic and Cenozoic lingulates (Biernat and Emig 1993). Shape of the posterior adductor and lack of its paired character followed by an asymmetry is also reflected by the course of the pedicle nerves. Two diverging ridges or grooves on the interior of the ventral valve originate as imprints of the pedicle nerve as suggested by Broglio-Loriga (1968) and Holmer (1991). Silurian and Devonian obolids of the Barrandian invariably show weakly diverging imprints of pedicle nerves. These are poorly preserved in proximal part of lingullellines *Careniellus* and *Kosagittella*, and thin and longer in glossellines *Prastavia* and *Barrandeoglossa*. Genus *Paterula* has divergent and rather long imprints of pedicle nerves in its Ordovician and Llandoverian representatives; the latest known *Paterula* species from the early Middle Devonian has impression divided much more anteriorly; the posterior course of the groove is simple, straight and bisecting deep posterior adductor scars. Similar paired grooves are known in micromorphous trematids (Baliński and Holmer 1999) and were also found in the early Middle Devonian species *Opatrilkiella* sp. A (Pl. 24, fig. 12) in the Barrandian.

Setal follicles are well developed in *Paterula* near the contact of limbus and internal surface of the shell; however, these follicles are not so distinct as in Ordovician representatives of the genus (Pl. 11, fig. 8). Contrary to this, no discinid species have similarly shaped setal follicles around the valve periphery and number and density of setae may be only estimated by help of the fine radial ornamentation on partly exfoliated shells (Pl. 15, fig. 16). Some minute obolids (*Kosagittella*) and discinids (*Orbiculoidea karlstejnensis* and related, undescribed discinids) have several weak, radially disposed plications or rays around the anterior shell periphery (Pl. 1, figs 9, 11, 14; pl. 15, figs 5, 7, 8, 9, 15). They may correspond to more coarse setae or their bundles around the mantle periphery.

Epithelian cell moulds and similar pitted structures have been discovered in shell interior of numerous lingulate taxa in the Silurian and Devonian of the Barrandian. Among studied obolids, they are remarkably developed in the posterior part of dorsal valve of *Kosagittella pinguis*. Posterolateral part of the dorsal pseudointerarea bear fine pitting, while axial part of the pseudointerarea is smooth, with a few radiating striae. This probably corresponds to contact between outer epithelium and pedicle cuticle (Pl. 4, fig. 16).

Epithelian cell moulds are well preserved in some moderate thick-walled biernatids, where rather large pits are about 15 μm in diameter (e. g. in *Havlicekion splendidus*). Pits cover the valve floor adjacent to central muscle scars and also a foot and wall of the median septum. However, in the acrotretid *Acrotretella* the pits are never developed.

Remarkable pitting has been observed in the trematid *Opatrilkiella minuta* (Pl. 24, figs 1-3). There are two types of pits. Polygonal pits with indistinct margins are located in posterolateral part of the ventral valve, at the bottom of visceral area.

These pits are deep, with concave bottom, about 12-18 μm in diameter, slightly elongate in outline. Pits located in front of the visceral area are distinctly polygonal (pentagonal to hexagonal), shallow, flat-bottomed and isometric. Raised margins of pits are superimposed on one another, reflecting interruption of apatite secretion. The same observation is noted in acrotretoid shells by McClean (1988).

Internal surface of *Paterula* is devoid of any epithelial cell mould, with an exception of posterior slope of ventral visceral chamber. There are located shallow pits just in front of the pedicle groove, sized some 12-15 μm. Visceral field and anterior part of the shell bear no discrete pitting; obscure shallow elongate depressions some 20 μm long are present.

External microornamentation is highly variable among particular taxa of lingulates in the Barrandian, but remarkably uniform within species and higher taxonomic groups. Studied obolids have generally fine, straight, wavy or interrupted fila or folds (Pl. 6, fig. 15; pl. 7, figs 12, 13; pl. 8, figs 10, 13), sometimes with rows of minor pustules.

Microornamentation of *Paterula* is quite distinct. It consists of rhomboidal, shallow and flat-bottomed pits, which become more transverse, elongate toward the shell periphery (Pl. 11, figs 7, 8, 10, 11). Pits are 10 μm wide and 2 μm long near shell periphery of *Paterula holynensis*. Genus *Lingulops* has different microornamentation, with fine irregular folds, separated by deep and narrow interspaces (Pl. 9, figs 6, 7), both superimposed obliquely to much coarser concentric fila. Microornamentation of discinids is much more complex, with close-packed uniformly sized pits. This microornament is sometimes crossed by radially disposed, usually much large circular pits (their size is up to several times larger). These pits may constitute the simple row but double of multiple arrays of pits in a broad rows are more common (Pl. 19, figs 14, 16). The uniformly sized pits may be also arranged in radial rows, separated by narrower smooth interspaces; this type was observed in discinisine *Sterbinella daphne* (Pl. 22, fig. 12). The trematid *Opatrilkiella* has similar but slightly different microornamentation. Discrete long wavy radial rows of larger circular pits (1.5 – 2 μm) are surrounded by slightly smaller, transversely elongate shallower pits, arranged in divaricate pattern.

Microornamentation of post-larval shell of studied acrotretoids is rather simple, with concentric, often wavy fila and folds. Concentric microornament is crossed by radial, deeply curved lines (microfractures), along which the folds are curved backward (Pl. 30, figs 3, 14). These folds and radial lines are the result of individual growth (probably caused by injury of outer epithelium) because their number and location strongly vary among individuals in the same sample. They sometimes may look as regular radial ornamentation (Pl. 30, fig. 10). Narrow radial lines are often concentrated along the posterior margin of ventral valve, indicating the stress with the opening mechanism of the shell (Pl. 29, fig. 9).

Microornamentation of the larval shell has been studied by many authors (Biernat and Williams 1970), and new observations only support the known data. It is suggested that pitted ornament of acrotretoids reflect a phylogenetic affinity. Thit is documented by different pitting among an acrotretidide *Acrotretella* (very fine, obscure pitting diminishing toward periphery of the larval shell: Pl. 26, fig. 14), a scaphelasmatide *Artiotreta* (circular, non-overlapping pits surrounded by much fine pits: Pl. 28, figs 6-8), and biernatides *Opsiconidion* and *Havlicekion* (circular, overlapping to touching circular pits: Pl. 30, fig. 17; pl. 33, fig. 13; pl. 34, figs 4, 7, 14). Larval shell of discinids is smooth, without any pitting (Pl. 17, figs 9, 11, 13; pl. 21, figs 10, 11). A trematid *Opatrilkiella* has the same smooth larval shell (Pl. 23, fig. 13).

Juvenile shells of some studied obolids indicate rapid growth disturbance. It is evident from change of the ornamentation in *Kacakiella bouceki*. Its juvenile shell bears radial fila, all disappearing at the same concentric line. Similar rapid changes in the ornamentation are present in a glosselline *Prastavia distincta*. It has a smooth, almost circular juvenile shell, with concentric rows of small protuberances along the periphery (Pl. 6, figs 14, 16). There is a prominent disturbance in growth, followed by a shell bearing irregular concentric fila (Pl. 6, fig. 15). The genus *Lingulops* has similar smooth juvenile shell, also with distinct growth disturbance. Contrary to the juvenile shell of the obolids, the juvenile shell of *Paterula* bears pitted microornament with rhomboidal pits, similar to those of its adult shell.

Fig. 1: Schematic geological map of the Barrandian, with main localities examined.

Stratigraphical distribution of lingulates in the Silurian and Devonian of the Barrandian

The Silurian and Devonian lingulates in the Barrandian are known since Llandovery (Želkovice Formation) to the late Eifelian-Givetian (Srbsko Formation) (Figs 1, 2). Lingulates are locally rather common, but they are generally rarely encountered by field collecting; their commonest and the most famous occurrence is known in the black limestones of the Lochkov Formation (Radotín Limestone). However, brachiopod samples yielded by an etching of limestone blocks offer a different view. The commonest occurrence of lingulates is in platy limestones and calcareous shales of the Motol and Kopanina Formations (Wenlock-Ludlow), the top of the Požáry Formation (Přídolí) and the base of the Lochkov Formation

(Kotýs Limestone, Lochkovian). Abundant lingulates also occur in platy limestones and calcareous nodules of the Choteč Formation. Siliciclastic lithofacies are generally poor, with a few lingulates, of them mainly large discinids.

Llandovery

The Želkovice Formation contains rather diversified lingulate assemblage around the submarine volcanic elevation near Hýskov, north of Beroun. Tuffaceous and calcareous shales (Aeronian, *D. convolutus* to *M. sedgwicki* Biozones) contain rich non-graptolite fauna including lingulate brachiopods. Lower calcareous shales yielded acrotretoids *Acrotretella siluriana*, *Artiotreta krizi*, *Opsiconidion* sp. A, *O.* sp. B and a small obolid *Careniellus carens*. A slightly different assemblage is known several meters up, in the upward shallowing sequence. Tuffaceous and platy laminated limestones offered large discinids *Orbiculoidea snajdri* and *Praeoehlertella georgiana*, obolids *Kacakiella bouceki* and *Careniellus carens*, paterulid *Paterula argus* and minute fragments of pitted phosphatic shell, probably a paterinide; a quantity of acrotretoids is much lower.

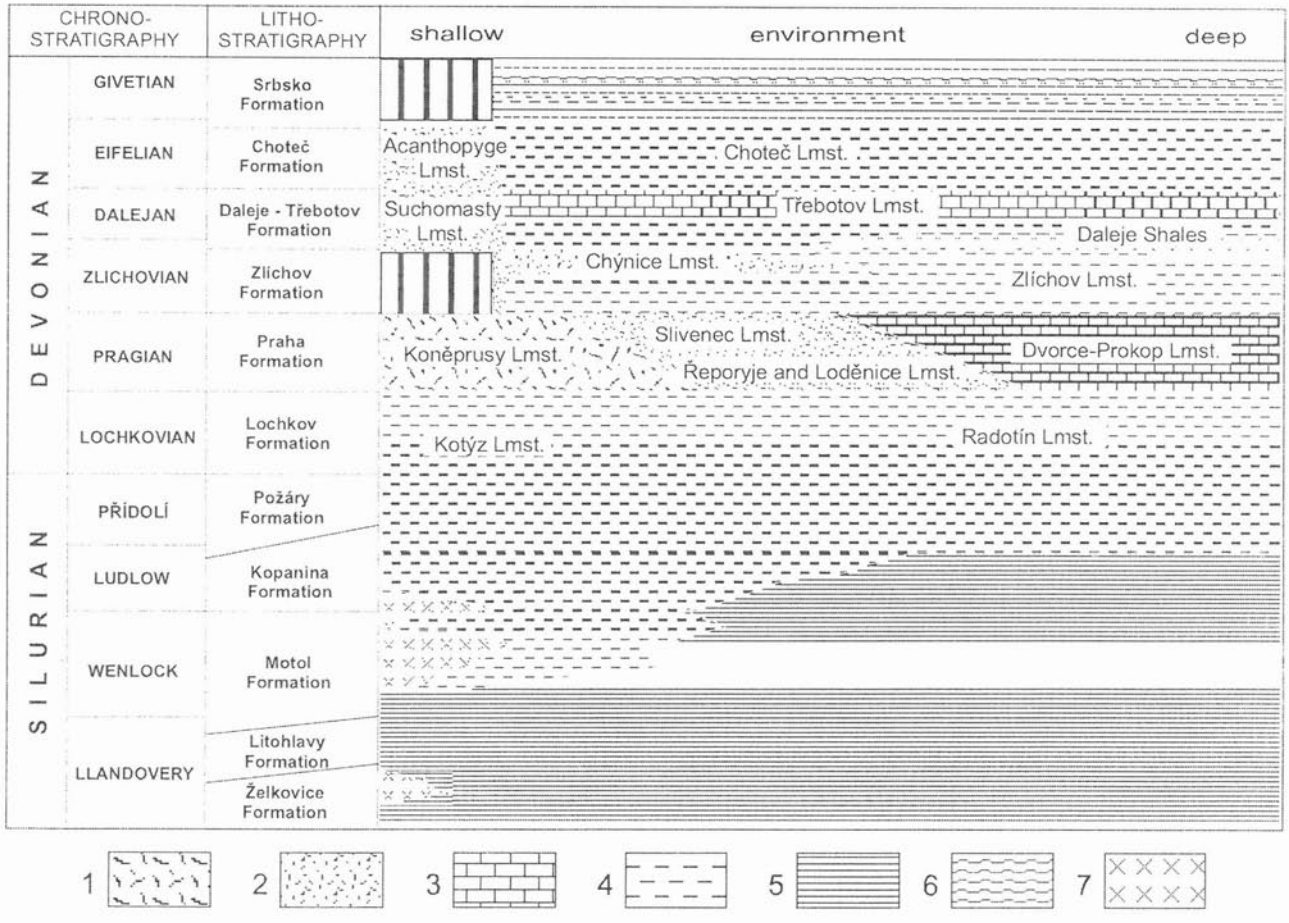
The fauna of the Litohlavy Formation is known mainly from the black shales; it consists almost exclusively of graptolites and dendroids. Brachiopods are represented by rare minute obolids probably referred to *Careniellus carens*; the same species is also known from graptolitic shales in the lower part of the Motol Formation (*O. spiralis* Biozone).

Wenlock

Lingulate brachiopod fauna of the Motol Formation is known from several horizons but peak of their diversity is in bioclastic limestones of the *M. belophorus* to *C. perneri/C. ramosus* Biozones. Lingulates are represented by the same obolids as in the Želkovice Formation, with the commonest *Careniellus carens* and *Kacakiella bouceki*, but associated with a large glosselline *Barrandeoglossa fissurata*. Discinids are diversified but not well studied due to scarce occurrences; there are large species *Orbiculoidea patelliformis*, *O. bubovicensis*, and much smaller ones *Orbiculoidea* cf. *karlstejnensis*, *Schizotreta rarissima*, *Acrosaccus vexatus*, and *Ivanothele* sp. Micromorphous brachiopods are generally abundant in calcareous shales and bioclastic limestones; there are mainly biernatids *Opsiconidion* sp. and *Havlicekion ivanensis* together with local *Lingulops fragilis*. A poorly known but undoubted siphonotretid is rare. A slightly deeper environment marginal to graptolitic shales bears typical deep-water element *Paterula argus*.

Ludlow

The Kopanina Formation is characterised by a prevalence of micromorphous brachiopods. There are rare and poorly known large obolids *Barrandeoglossa* sp. and *Pseudolingula*



1 – white reef limestones, 2 – red and grey perireef bioclastic limestones, 3 – micritic limestones, 4 – platy bioclastic and tuffaceous limestones, 5 – shales and calcareous shales, 6 – siltstones and sandstones, 7 – volcanites

Fig. 2: Stratigraphy of the Silurian and Devonin of the Barrandian (Chlupáč et al. 1998, simplified).

(?) *dilatata*, with a local occurrence of much smaller obolids *Kosagittella clara* and *Wadiglossa perlonga*. Acrotretoid assemblage is monotonous, being plentifully represented only by *Opsiconidion ephemerus*. With an exception of the local occurrence of large discinids *Ivanothele mordor*, *Kosoidea fissurata*, and *Acrosaccus vexatus*, other discinids are minute and poorly known. Locally, on the bottom rich in sorted crinoidal debris *Lingulops barrandei* is common. Fragmentary remains of a siphonotretid have been found in dark platy limestones in the upper part of the formation. A shallower environment with coral-crinoid dominated benthic communities occupied the calcareous-shelled craniopsid *Craniops vulcanus*, a homeomorph of the *Lingulops barrandei*.

Přídolí

The Požáry Formation bears generally uniform lingulate fauna of minute acrotretoids and discinids. The only exceptions are massive bioclastic limestones in Svatý Jan Volcano area. A medium sized discinid *Orbiculoidea karlstejnensis* is uncommon there and acrotretoids are lacking. Contrary to that, the deeper bioclastic and dark platy limestones are rich in acrotretoid *Opsiconidion ephemerus*, small, circular or elongate, more or less rugellate discinids and a rare, thin shelled glosselline. In addition, the lower part of the Požáry Formation near Kosov and Koledník (area south of Beroun) yielded a morphologically distinct, minute discinid *Sterbinella daphne* associated with a minute form of the species *Orbiculoidea* cf. *karlstejnensis*. Limestone beds at the top of the Požáry Formation rich in coarse crinoidal debris of *Scyphocrinites* bear different, rich lingulate fauna with small biernatid *Opsiconidion simplex*, acrotretid *Acrotretella spinosa*, poorly known minute discinids (two or three species) and a trematid *Opatrilkiella minuta*.

Lochkovian

The Lochkov Formation is developed as grey bioclastic crinoid limestone (Kotýs Limestone) and relatively deep-water black bituminous platy limestones and calcareous shales (Radotín Limestone). Lingulate fauna is quite different in both lithofacies. The Kotýs Limestone yielded abundant lingulate fauna dominant by obolids *Kosagittella pinguis* and *Barrandeoglossa perneri* in its lower part, while *Careniellus nigriculus* is the only obolid in the Radotín Limestone. Differences in discinid taxa distribution are even more prominent; the Kotýs Limestone bears only minute and imperfectly known discinids, but the Radotín Limestone is rich in medium-sized discinid *Lochkothele intermedia* and much rarer large *Orbiculoidea magnifica*. Obolids and minute discinids of the Lochkov Formation are phylogenetic successors of some Silurian evolutionary lineages (*Careniellus*, *Kosagittella*, *Barrandeoglossa*) but the discinid *Lochkothele* represents a quite new element. Acrotretoids are abundant in the fine crinoidal limestone in biodetritic limestones of the Kotýs Limestone, with *Havlicekion holynenis* and very rare *Acrotretella triseptata*. The later is the stratigraphically youngest and the first known Devonian member of the genus *Acrotretella*.

Pragian

The Praha Formation is the most complex lithostratigraphic unit of the Devonian of the Barrandian (Chlupáč 1998). It comprises reef Koněprusy Limestone ranging with depth gradient to micritic Dvorce-Prokop and Řeporyje Limestones. Intermediary members are biomicritic to bioclastic Loděnice, Slivenec, and Vinařice Limestones.

The lingulate fauna is generally rare and mainly represented by micromorphous brachiopods. Contrary to rhynchonellate brachiopods, corals, bryozoans, trilobites etc., the reef Koněprusy Limestone yielded only few lingulates. Both medium to large sized discinid *Orbiculoidea bohemica* and *O.* sp. A are rare, and an obolid *Barrandeoglossa* (?) *bohemica* are quite exceptional. The lingulates are slightly more frequent in the micritic or biomicritic Dvorce-Prokop Limestone. Acrotretids represent here a species *Havlicekion splendidus* and rarer *Opsiconidion* sp. C. Imperfectly known siphonotretids and a dysoristid are locally present, but never abundant. Discinids similar to *Lochkothele* are rare. The bioclastic Vinařice and Řeporyje Limestones rarely bear *Lochkothele* cf. *intermedia* and unusually small obolid *Kosagittella (?) lingua*.

Quite different composition of lingulate fauna occurs in intercalations of graptolitic shales in the Stydlé vody Quarry (near Svatý Jan pod Skalou). Dark shales abundantly bear a discinid *Praeoehlertella umbrosa* associated with the less common valves of a rather large obolid *Careniellus* aff. *nigriculus*.

Zlíchovian

The bulk of the Zlíchov Formation is represented by grey, finely bioclastic spary limestones, with rare lingulate fauna. A few indeterminable discinid valves are known, and micromorphous brachiopods are nearly absent (in etched samples). So called "Chapel Coral Horizon", the coarse perireef bioclastic limestone rarely yielded discinid *Lochkothele* sp. Contrary to prevalent part of the Zlíchov Formation, rose-coloured bioclastic and biomicritic Chýnice Limestone in the upper part of the unit contains much abundant and diversified lingulate fauna. It comprises discinids *Chynithele ventricona*, *Orbiculoidea* cf. *karlstejnensis* along with minute obolid *Kosagittella* (?) *lingua*. Acrotretoid brachiopods are unknown from the Chýnice Limestone.

Dalejan to lowest Eifelian

The Třebotov Limestone and Daleje Shales are generally poor in lingulates. Micritic up to biomicritic limestones, red and grey in colour rarely yielded a biernatid *Opsiconidion* sp. and minute discinids. A single valve of a siphonotretid was discovered some 4 m below the Lower-Middle Devonian boundary; that is the latest known representative of the siphonotretid brachiopod lineage.

The Suchomasty Limestone, restricted to the Koněprusy area, represents a shallow-water and high-energy equivalent of the Třebotov Limestone. The limestones are red and grey in colour, biomicritic and bioclastic, platy or massive. Skeletal fossils are very abundant and diversified, but lingulates are rare. There are common species with the Chýnice Limestone: discinids *Chynithele ventricona*, *Orbiculoidea* cf. *karlstejnensis*, thick-walled *Lochkothele* sp. and a minute obolid *Kosagittella* (?) *lingua*. Acrotretoid brachiopods are unknown in the Suchomasty Limestone.

Soft, calcareous greenish Daleje Shale bears mostly planktonic and nektonic fossils. Lingulates are uncommon, represented only by medium sized discinids *Orbiculoidea* sp. B and *Lochkothele* sp.

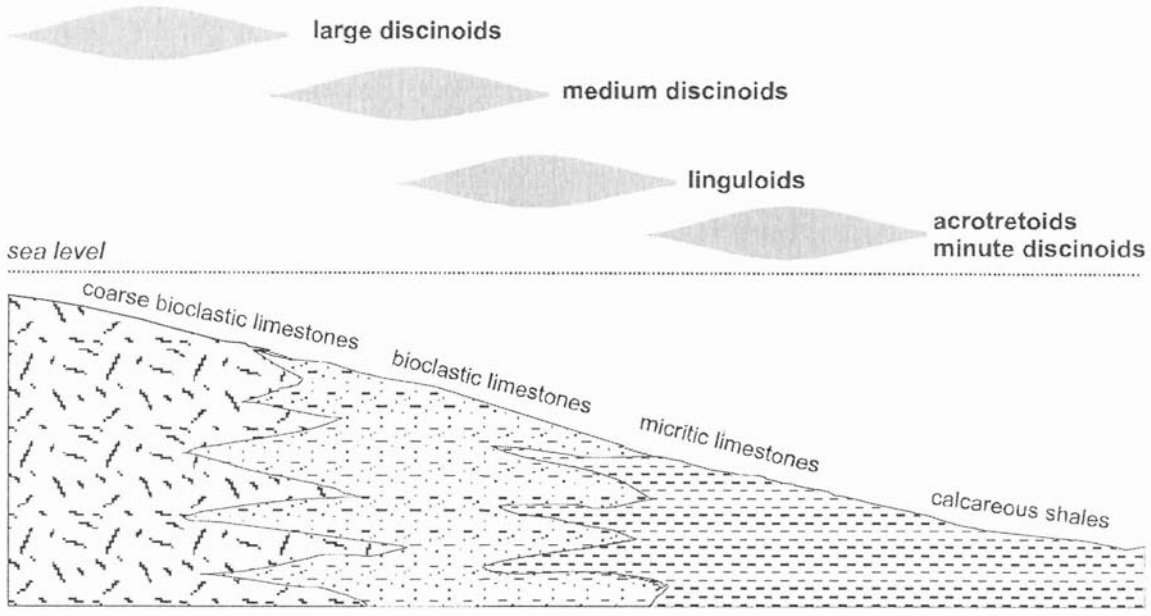


Fig. 3: Generalised ecological scheme of lingulide brachiopod distribution along the depth gradient, based on data from the Silurian and Devonian of the Barrandian.

Eifelian

The Choteč Formation represented by grey micritic and biomicritic limestones yielded mainly micromorphous brachiopods. Among them, a paterulid *Paterula holynensis* is remarkable; this is the latest member of the family Paterulidae yet known. Associated lingulates are diversified, distinct from the older lingulate fauna, but the whole assemblage is not well known due to rarity of fossils. There are obolids *Prastavia distincta*, *Bicarinatina* sp., three discinids including *Sterbinella* sp., and a biernatid *Opsiconidion decessus* in the lower part of the Choteč Limestone.

The Acanthopyge Limestone, light grey shallow-water limestones in the Koněprusy area, bears rarely the same lingulates as the stratigraphically older units in the area. Discinids *Chynithele ventricona* and *Lochkothele* sp. are known together with an obolid *Kosagittella* (?) *lingua*.

Late Eifelian to Givetian

The Srbsko Formation is represented by uniform facies development over the whole territory of the Barrandian, with the calcareous Kačák Shale and siliciclastic, flysch-like sedimentation of the Roblín Member. Known lingulates are represented only by abundant, medium size discinid *Orbiculoidea tarda* in the Kačák Member.

Remarks to evolution of lingulates in the Silurian and Lower-Middle Devonian of the Barrandian

Diversity of lingulate brachiopods dramatically decreased with the Upper Ordovician extinction (Holmer and Popov 1996). Paterinids, siphonotretids, obolids and especially acrotretids almost disappeared. Recovery of marine communities at the beginning of the Silurian did not result in renewed radiation of lingulates. A weak radiation of the discinid brachiopods appeared, while only four and taxonomically reduced acrotretid families persisted: Acrotretidae, Torynelasmatidae, Biernatidae and Scaphelasmatidae. The last family disappeared during the early Silurian, the three former families continued to the base or even higher part of the Devonian. Obolid brachiopods also decreased in number and richness, in contrast to the Ordovician of the Barrandian, but this may be due to changes of facies development; the siliciclastic and clayey sedimentation was substituted by carbonatic sedimentation, which is generally less favourable for this brachiopod group. Siphonotretids and similarly shaped dysoristids did not extinct before the end of the Ordovician, as suggested until now (Holmer and Popov 1996). They were dramatically reduced in number and abundance, but miniaturised and persisted into the latest Lower Devonian. Trematid lingulates underwent the same miniatu-risation.

The fate of genus *Paterula* is quite exceptional. This deep-water related minute brachiopod passed over the Ordovician-Silurian boundary without any morphological changes. This may be due to its deep water, stable, outer shelf habitat, generally poor in a shelly benthic fauna before the Ordovician extinction. Because no drastic environmental changes appears there, *Paterula* evolutionary lineage continued in environment marginal to dysaerobic or anoxic bottom waters (graptolitic shales) into the early Middle Devonian.

Several ambiguous pitted shell fragments from the Llandovery indicate possible persistence of the paterinide brachiopods into the beginning of the Silurian; this group was considered extinct before the end of the Ordovician (Holmer 1989, Williams et al. 1998).

Palaeoecology of lingulates in the Silurian and Lower-Middle Devonian of the Barrandian

Lingulate brachiopod associations of Silurian and Devonian of the Barrandian are not so diversified as associations of the early Ordovician age. They have uniform character, with a few large discinids and obolids, in association with the

micromorphous acrotretoids. Species diversity is low, generally with three to five species in a sample. In an ideal section along the depth gradient, the following distributional patterns of lingulate brachiopods may be distinguished (Text-fig. 3). The shallowest, high-energy reef environment is poor in lingulates. The crinoid-bryozoan-brachiopod biofacies of the reef Koněprusy Limestone is extremely rich in rhynchonellate brachiopods and craniids (Havlíček and Vaněk 1998) but lingulates are represented only by three rare species (two discinids and one obolid).

Slightly deeper and more calm environment is characteristic by minute sessile discinids and very small and rare obolids. The late Lower and early Middle Devonian Chýnice, Suchomasty and Acanthopyge Limestones are characterised by genera *Chynithele*, *Kosagittella*, small *Orbiculoidea* and *Lochkothele*. Coral-crinoid association at the elevated Svatý Jan Volcano area bears similar discinid *Ivanothele* and medium sized *Orbiculoidea* (Kopanina Formation, "Na rešnách" Quarry, Kozolupy). Abundant corals offered a hard substrate together with protected crevices and cryptic microenvironments, used by some discinids as good habitat.

Sea bottom with fine skeletal, mainly crinoid debris (bioclastic, thick bedded limestones: (e.g. Kotýs, Vinařice, and Slivenec Limestones) was occupied by uncommon micromorphous lingulates, mainly with small (to 5 mm in diameter) discinids. The increased amount of micritic material is reflected by higher amount of micromorphous lingulates; acrotretoids *Opsiconidion* and locally *Acrotretella* are present, minute discinids and small to medium sized obolids may be present.

Scattered fine skeletal debris in soft-muddy bottom represented the best habitat for micromorphous lingulates. The Silurian biodetrital platy limestones of the Motol, Kopanina and Požáry Formation have a rather diversified association of lingulates. Along with abundant acrotretoids *Opsiconidion*, *Acrotretella* and in the early Silurian also *Artiotreta*, other shallow semiinfaunal or epibenthic micromorphous lingulates are present (*Kosagittella*, *Careniellus*, *Lingulops*, *Acrosaccus*, *Sterbinella*, *Opatrilkiella*, siphonotretids). Relatively large, burrowing obolids may also be present (*Barrandeoglossa*, *Kacakiella*) together with the epibenthic discinid *Kosoidea*.

Environment marginal to graptolitic shales may be also rich in small lingulates, but diversity is low. Deep-water soft-bottom Silurian and early Devonian black biofacies bear minute to medium sized specimens of burrowing obolid *Careniellus* and micromorphous *Opsiconidion*. However, the Radotín Limestone commonly bears a moderate-sized discinid *Lochkothele intermedia*, and a giant *Orbiculoidea magnifica*; these taxa probably utilized substrate elevated above the soft sediment at sea bottom, such as dendroid graptoloids or empty and partly burried cephalopod shells; similar habitat is suggested also in the genus *Praeoehlertella*. In calcareous shales minute sessile lingulate *Paterula*, the characteristic element of the dysaerobic environment, may be present.

Contrary to the Cambrian and Ordovician shallow-water sediments, the Silurian and Devonian sequence yielded less burrowing forms of lingulates; crinoid and another fine skeletal debris was not a suitable substrate for a burrowing habitat, in contrary to siliciclastic sediments (Emig 1997). Nevertheless, the burrowing, deep to shallow infaunal habitat may be suggested in the Silurian glosselline *Barrandeoglossa*, a pseudolingulid *Pseudolingula* (?) *dilatata*, and minute obolid *Careniellus*. Burrowing habitat is genuine due terrace lines present in an obolid *Kacakiella bouceki*, known form the Llandovery to Wenlock. It is worth to note that even siliciclastic sedimentation in the Srbsko Formation did not bring true lingulid communities into the basin, although they are widely present in the intertidal to shallow subtidal environment in the Devonian seas (Boucot 1975).

Epibenthic, fixo-sessile habitat was the commonest habitat among the Silurian and Devonian lingulates of the Barrandian. It is well documented by a centrally located pedicle foramen in the ventral valves of discinids *Orbiculoidea, Lochkothele, Praeoehlertella, Sterbinella* and *Kosoidea*. Three distinct morphologies of their shell are developed. The first with moderately to gently conical ventral valve and conical to depressed dorsal one (*Orbiculoidea, Sterbinella, Lochkothele*), indicating fixation in firm but supple substrate, such as loose fine skeletal debris (Text-fig. 4). Stability was achieved by a shallow clinch of subconical ventral valve between debris and by comparatively long pedicle penetrating into sediment. The second morphological type is the flat ventral valve and conical dorsal ones, indicating the very close fixation to hard, larger substrate. Short and disc-shaped pedicle is sometimes accommodated in a shallow depression circled round the pedicle foramen. This type of shell morphology is present in *Orbiculoidea magnifica* and in the genera *Kosoidea* and *Praeoehlertella*. Extreme morphology is developed in *Ivanothele*, *Chynithele* and *Acrosaccus*. They have weakly asymmetrical, bent ventral valve with rather posterior foramen and very short listrium, and operculum-like dorsal valve. Their

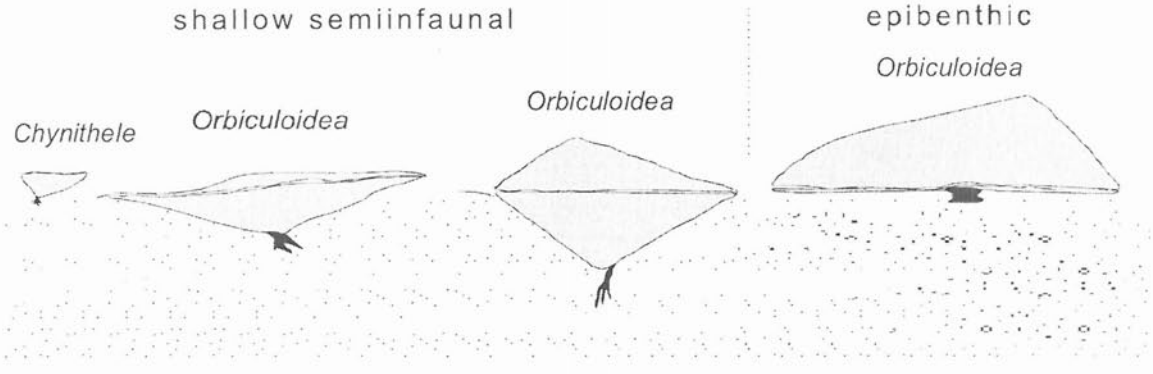


Fig. 4: Habitat of selected discinoid brachiopods, reflected by convexity of ventral valve. Pedicle in black.

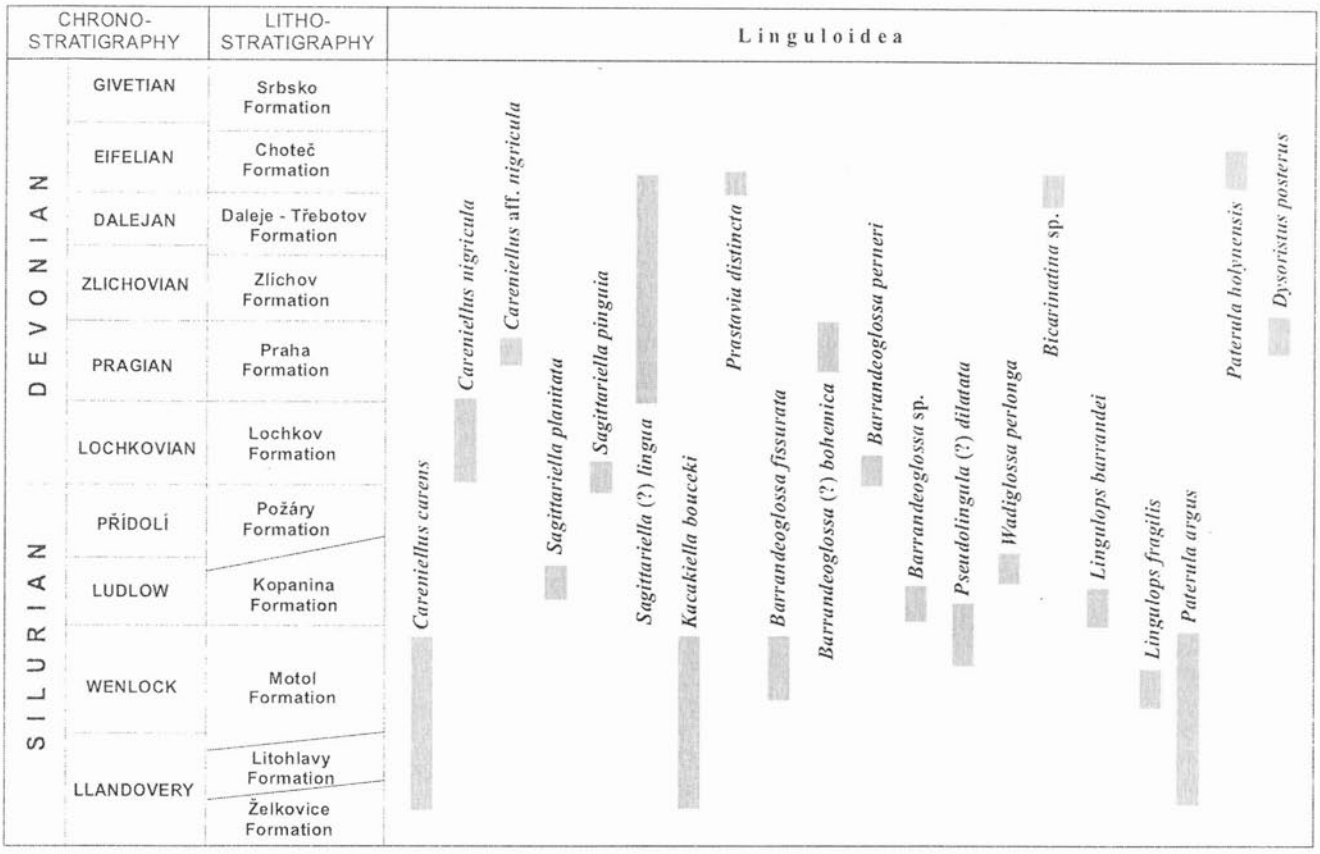


Fig. 6: Stratigraphical distribution of the linguloid brachiopods in the Barrandian.

morphology reflects a firm fixation and conforming the shell shape to the relief of the hard substrate.

Libero-sessile, free-lying lingulates are uncommon, represented only by a pedicle-lacking genus *Lingulops*. There are no lingulates fixed to substrate by a cementation, as it is common in some calcareous-shelled "inarticulates" (craniids, craniopsids).

Habitat of the genus *Paterula* was discussed by several authors (Percival 1978, Havlíček and Vaněk 1990, 1996, Havlíček et al. 1993, Mergl 1999b). Detailed morphology of pedicle groove indicates functional pedicle turned ventrally (Pl. 9, fig. 12). This may be explained by shell orientation with commissure vertical, when the specimen was attached to the subvertical substrate (? sponges, conulariids or dendroid graptolites; Lenz 1993) or by flat lying shell with the pedicle turned down and fixed to small particles of the sediment, as suggested by Mergl (1999b).

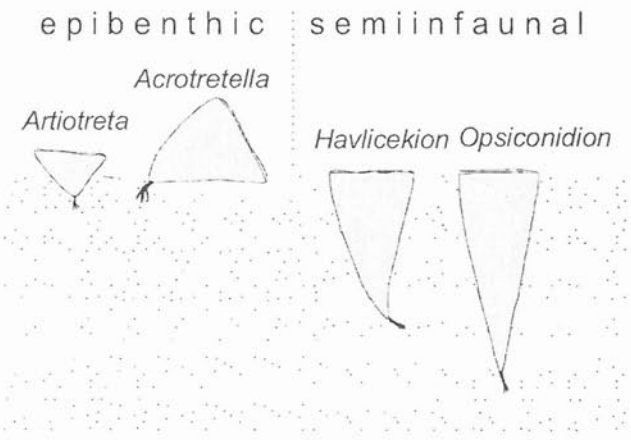


Fig. 5: Habitat of Silurian acrotretoid brachiopods. Pedicle in black.

Mode of life of the micromorphous Silurian acrotretoids was discussed by several authors (Cocks 1979, Bassett 1984), but interstitial habitat does not seem probable. The genus *Artiotreta* probably rested on the ventral pseudointerarea with the commissure subvertical (Chatterton and Whitehead 1987), the same orientation is probable in *Acrotretella*, which has even more extensive and depressed ventral pseudointerarea. Both genera have pedicle foramen posterior to the larval shell, as close to the substrate as possible (Text-fig. 5). High and acutely conical, sometimes slightly bent ventral valves with apical foramen and weakly depressed ventral pseudointerarea of genera *Opsiconidion* and *Havlicekion* indicate that their ventral valves deeply penetrate and rest almost vertically in the soft substrate. Although rather thin and fragile, the burrowed ventral valve was sufficiently protected while the dorsal valve operated as an operculum. Slightly more thick-walled and less conical ventral valve of *Havlicekion* reflects shallower burrowing, when rugellate sculpture offers the better stability in the coarser biomicritic substrate. Thin, fragile but longer ventral valve of *Opsiconidion* is nearly smooth and indicates a deep penetration of the ventral valve into unconsolidated and fine micritic substrate.

Mode of life of the micromorphous Silurian and Devonian siphonotretids is hypothetical, but they were probably epizoic like their Ordovician ancestors. A minute size and spinose surface is a good adaptation to fixation to soft surface or shallow subsurface of epibenthic sponges. It is in a good correlation with abundant presences of sponge spicules in the residues yielded by

limestone etching in the beds bearing siphonotretid fragments. Shape of siphonotretid spines sometimes indicates a firm fixation to any cylindrical objects (Wright and Nõlvak 1997).

Comparison of Czech Silurian and Devonian lingulate fauna with other areas

There are limited data about the Silurian and Devonian lingulate fauna in other parts of Europe and America. The only modern monographic elaboration is revision of inarticulate brachiopods of the Přídolí to Lochkovian of Artois, north France by Bassett (1986). Restricted new data about the Silurian lingulates presented Biernat (1984) from Poland. There is not any modern revision of lingulate fauna from classical Silurian areas as Gotland or the British Isles. Nevertheless, there are similar general aspects, e.g. prevalence of discinid brachiopods and restricted data about obolid and trematid brachiopods.

The Bohemian lingulate fauna of the Silurian and Devonian age (Old World Realm in the Devonian) is much similar to the Ordovician fauna of the North America than to the Ordovician fauna of the Barrandian. This reflects similar environment, with relative temperate to tropical climate and predominantly limy sedimentation. The Silurian and Devonian lingulates in the Barrandian area are mainly new immigrants instead of the descendant of the Ordovician ancestors derived from the same basin. The faunal uniformity and decrease of endemism during the Silurian is also distinct in the Barrandian, with present taxa common with other, even distant areas (Kazakhstan, Australia).

Systematic part

Order **Lingulida** WAAGEN, 1885

Superfamily **Linguloidea** MENKE, 1828

Family **Obolidae** KING, 1846

Remarks: In the Silurian and Devonian of the Barrandian, the family Obolidae KING is represented by numerous species, but particular levels bear a few, generally small shelled forms. Some of the species have been named and figured by Barrande (1879), but without formal description. However, some species, determined by J. Barrande are represented in his collection by one or two valves, with only poorly preserved internal and external features; these species cannot be reliably evaluated at present level of knowledge of the obolid fauna of the Silurian and Devonian age, because new material to these species is not available.

Almost all species from the Silurian and Devonian of the Barrandian cannot be referred to any known obolid genus. Obolid genera are restricted mainly to the Cambrian and Ordovician stata and taxonomy of the Silurian and Devonian obolids is at very beginning. Therefore, some species of J. Barrande and all newly described species are referred to newly erected genera.

Subfamily **Obolinae** KING, 1846

Genus *Careniellus* gen. n.

Type species: *Lingula carens* BARRANDE, 1879; Silurian, Wenlock; Barrandian, Bohemia.

Name: *Careniellus* (masculine). Derived from the type species name *carens*.

Diagnosis: Thin-walled, medium-sized, broadly oval and weakly convex oboline with rounded beaks. Dorsal pseudointerarea short, distinct, undivided, widely triangular plate, ventral pseudointerarea high, almost orthocline, very short, bisected by shallow and poorly defined pedicle groove, which continues as weak groove on posterior slope of the valve floor. Visceral area poorly defined, large in both valves. Dorsal vascula lateralia broadly arcuate, divergent, vascula media subparallel and well-impressed. Ornamentation of fine growth lines restricted to concentric bands between coarser and less numerous concentric fila.

Remarks: The type species *Lingula carens* BARRANDE (= *Wadiglossella odiosa* HAVLÍČEK) has been referred to Glossellinae COOPER by Havlíček (1995), but dorsal valve has well defined short apsacline pseudointerarea, which is gently but clearly raised above the valve floor and its surface bears fine transverse growth lines. Therefore, the genus *Careniellus* is better placed to the subfamily *Lingulellinae* SCHUCHERT. Internal morphology of the dorsal valve is similar to morphology of some early Ordovician species, namely *Ralfia? bryograptorum* (MOBERG et SEGERBERG) coming from the Dictyonema Shale of Scania. Popov and Holmer (1994) note its extremely short ventral pseudointerarea, narrow and well-impressed pallial markings and exterior with regular concentric bands of fine concentric fila, all features similar to shell morphology of the *Careniellus*.

The early Ordovician species *Ralfia? bryograptorum* derived from sediments of dysaerobic or anaerobic environment of the Dictyonema Shale. Species *Careniellus carens* (BARRANDE) and *C. nigriculus* (HAVLÍČEK) dwelt in the similar environment and are widespread in sediments marginal to graptolitic shales in the Silurian and early Devonian.

Occurrence: Upper Silurian to Lower Devonian (Llandovery to Pragian); Bohemia.

Species included: *Lingula carens* BARRANDE, 1879. Silurian, Llandovery to Wenlock; Barrandian, Bohemia

Wadiglossella nigricula HAVLÍČEK, 1999. Devonian, Lochkovian; Barrandian, Bohemia.

Careniellus aff. *nigriculus* (HAVLÍČEK, 1999). Devonian, Pragian; Barrandian, Bohemia.

Careniellus carens (BARRANDE, 1879)

Pl. 1, figs 1-15; text-fig. 7

1879 *Lingula carens* BARR.: Barrande, pl. 103, case V, figs 1, 2.
1879 *Lingula perlonga* BARR.: Barrande, pl. 103, case VI, fig. 1 (partim).
?1879 *Lingula nigricans* BARR.: Barrande, pl. 104, case VII, fig. 1 (partim).
1879 *Lingula comes* BARR.: Barrande, pl. 105, case II.
?1879 *Lingula comes* BARR.: Barrande, pl. 105, case III., figs 1, 2.
1995 *Wadiglossella odiosa* sp. n.: Havlíček, p. 55, pl. 1, figs 1-4.

Lectotype: Selected herein, ventral valve, figured by Barrande (1879) on pl. 103, case V, fig. 1, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 24458), re-figured herein on pl. 1, fig. 2.

Paralectotype: Dorsal valve figured by Barrande (1879) on pl. 103, case V, fig. 2 (NM L 24457).

Type horizon: Wenlock, Sheinwoodian, Motol Formation.

Type locality: Loděnice (in original spelling Lodenitz).

Material: Fifty isolated valves.

Description: Shell small to medium size, to 5 mm wide, subequally biconvex, thin-walled.

Dorsal valve broadly oval, evenly rounded, with rounded beak, widest in anterior third. The valve is weakly but more convex posteriorly than anteriorly in lateral profile and gently convex in transverse profile. Posterolateral periphery steeply sloping. Dorsal pseudointerarea minute but distinct, steeply apsacline, restricted to beak region. Its width equal 20 % of valve width, and its length reaches some 20 % of its width. Dorsal interior with rather small and poorly defined visceral area. Muscle scars poorly impressed, with discriminated anterior lateral, central and transmedian-outside lateral muscles, but their sizes are conspicuously minute. Vascula lateralia broadly divergent, narrow and parallel sided. Their impressions are restricted to posterolateral sector of valve floor. Vascula media narrow, long, and almost parallel.

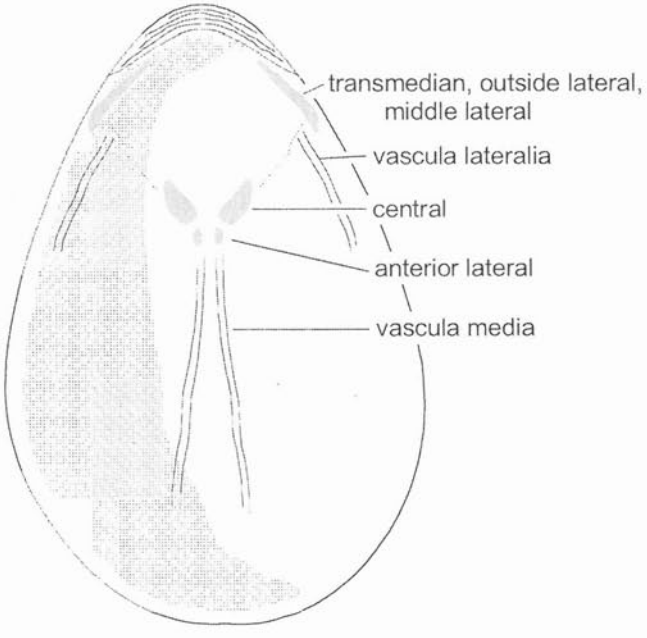


Fig. 7: *Careniellus carens* (BARRANDE, 1879). Dorsal valve interior with muscle scars.

Ventral valve roundly triangular in outline. Ventral beak much acuminate than dorsal beak. Ventral pseudointerarea short but distinct, almost orthocline, with minute propareas evenly sloping toward poorly defined, short pedicle groove. Pedicle groove continues anteriorly as distinct and broad groove sloping on posterior slope of the valve floor. Ventral visceral area poorly defined, muscle scars unknown. Vascula lateralia weakly divergent and narrow.

Ornamentation of both valves with fine, uniform and distinct concentric fila, arranged in regular intervals, with shell surface in interspaces covered by much finer and less regular growth lines. Some large valves have weak radial plications along anterolateral and anterior margins. There may be to 40 such plications, but they may be obscuring. Larval shell smooth, circular, weakly convex.

Remarks: The species has been incorrectly described by Havlíček (1995) as a new species of newly erected genus *Wadiglossella* HAVLÍČEK, 1995. This description was based on specimens yielded from tuffaceous limestone of the Motol Formation (Wenlock) at Praha-Řeporyje. The holotype of *Wadiglossella odiosa* HAVLÍČEK has the same shell morphology as characteristic valves of *Lingula carens* BARRANDE collected by Barrande (1879), the former being only somewhat smaller. However, Havlíček (1995) also referred (but not figured) to the species *W. odiosa* a few valves having quite different type of external ornamentation, derived from the same level and locality. He noted presence of fine radial fila at juvenile shell of *W. odiosa* but this ornamentation refers to the different genus and species (herein newly erected species *Kacakiella bouceki* sp. n.).

The dorsal valve, selected by Havlíček (1995) as the holotype of the species *Wadiglossella odiosa* HAVLÍČEK and figured by him on pl. I, fig. 4, is deposited in the collections of the Museum of Dr. B. Horák at Rokycany, MBHR 66996 (original signature VH 10565b). It is better considered *Wadiglossella odiosa* HAVLÍČEK as a subjective synonym of the *Careniellus carens* (BARRANDE). Therefore, generic name *Wadiglossella* HAVLÍČEK must be taken as invalid (*nomen vetitum*) because is based on an invalid species. Apart the lectotype, Barrande (1879) correctly referred to *Careniellus carens* a dorsal valve from the same locality (specimen NM L 24457; pl. 1 fig. 1). Dorsal valve referred to species *Lingula perlonga* BARRANDE, figured by Barrande (1879) in pl. 103, case VI, fig. 1 (not fig. 2) (specimen NM L 24459, pl. 1, fig. 1), and *Lingula comes* BARRANDE, figured by Barrande (1879) in pl. 105, case II (specimen NM L 24461) derived from Svatý Jan pod Skalou, and specimens figured by Barrande (1879) in pl. 105, case III (specimens NM L 24461 and NM L 24460; Pl. 1, fig. 4) derived from Králův Dvůr probably also belong to *Careniellus carens*.

Careniellus carens is a long-ranging and widespread species in the lower Silurian of the Prague Basin (from middle Llandovery to middle Wenlock). Unfavourably preserved, weathered and deformed linguline valves from Llandovery (Aeronian) limestone and calcareous shales from Hýskov (V Jakubinkách) are identical with the specimens from the type locality and they are referred herein to *C. carens*. Otherwise, the species is widespread in the lower part of the Motol Formation (*O. spiralis* to *C. perneri/C. ramosus* Biozones).

Bouček (1936, 1953, 1957) referred to *"Lingula" comes* BARRANDE some lingulids coming from *R. linnaei* and *S. turriculatus* Biozones (Llandovery, upper Aeronian to lower Telychian). Although this material was not available to the author, these obolids likely belong to species *Careniellus carens*.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone); Llandovery, Telychian, Motol Formation (*O. spiralis* Biozone); Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Hýskov (V Jakubinkách), Loděnice (Černidla), Praha-Řeporyje (Daleje Valley), Praha-Malá Chuchle, Svatý Jan pod Skalou (U elektrárny), Všeradice.

Careniellus nigriculus (HAVLÍČEK, 1999)

Pl. 2, figs 1-9

1999 *Wadiglossella nigricula* sp. n.: Havlíček, p. 305, pl. 1, figs 1-3, 7, 8, text-fig. 3.

Emended description: Shell equally biconvex, broadly oval, with moderately thick shell wall. Widths of the available shells

reach 5.5-6 mm, but there are fragments of slightly larger specimens, with widths to 7-8 mm.

Dorsal valve broadly oval, widest in anterior third, evenly rounded anteriorly and laterally. Posterior margin rounded, with angular apex. Valve gently convex in transverse and lateral profiles, with maximum depth at posterior third. Dorsal valve interior with low, broadly triangular apsacline pseudointerarea. Widely triangular median groove is 20 % as wide as the valve. Pseudointerarea with transversely striated surface is poorly raised above valve floor. Muscle scars obscure, with narrow, oblique central muscle scars located posterior to shell midlength. Vascula media narrow, straight, weakly diverging anteriorly and extending near to anterior margin of valve. Their canals are distinctly impressed along whole length, divided each another by weak median ridge. Vascula lateralia narrow, straight, broadly diverging from the umbonal chamber toward midlength.

Ventral valve more acuminate than dorsal valve, with acute beak, apical angle 80°-90°. Shell more convex posteriorly than anteriorly in transverse profile. The valve is poorly convex, in lateral profile with flattened anterior. Narrowly triangular median sector is feebly depressed. Ventral pseudointerarea small, orthocline, divided by very short, deep, and narrow pedicle groove. Impression of pedicle nerve long and weakly divergent. Valve floor with numerous radially arranged wavy ridges, probably impressions of vascular canals, but main canals of vascula media are obscure.

Exterior of the shell bears fine concentric growth fila, slightly varying in course and size.

Remarks: *Careniellus nigriculus* (HAVLÍČEK) differs from *C. carens* (BARRANDE) by wider shell, more curved lateral margins, and by absence of radial plications along the anterior margins of large valves.

Havlíček (1999) to stabilise brachiopod taxonomy, selected the lectotype of the original Barrande (1879) species *Lingula nigricans* BARRANDE to which an abundant oboline from the Radotín Limestone has previously been referred. The species *Lingula nigricans* is stratigraphically older and belongs to different, yet not well-defined taxon. The oboline from the Radotín Limestone has been by Havlíček (1999) referred to the genus *Wadiglossella* HAVLÍČEK (herein stated as invalid) and described as a new species *W. nigricula*.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Radotín Limestone.

Localities: Praha-Kosoř (Černá rokle), Karlík, Suchomasty (Klonk).

Careniellus aff. *nigriculus* (HAVLÍČEK, 1999)

Pl. 2, figs 10, 11

Material: Three ventral valves deformed in shales.

Remarks. The occurrence of *Careniellus nigriculus* (HAVLÍČEK) is restricted to black bitumenous limestone of the Lochkov Formation (Radotín Limestone). Shales of the Pragian age (shaly intercalations with *Monograptus atopus* BOUČEK, *M.* cf. *yukonensis* JACKSON et LENZ, and *M. aequabilis notaequabilis* JAEGER et STEIN) at Stydlé vody Quarry near Svatý Jan pod Skalou yielded flattened valves similar to *C. nigriculus*; the valves differ only in a larger size (up to 11 mm width), broader outline with the maximum width at midlength and in a less acuminate ventral beak. These valves probably represent a different but closely related species, and they are referred here to *Careniellus* aff. *nigriculus* (HAVLÍČEK).

Stratigraphical occurrence: Pragian, Praha Formation, black shale intercalations with *Monograptus atopus*.

Locality: Svatý Jan pod Skalou (Stydlé vody Quarry).

Genus *Kosagittella* gen. n.

Type species: *Kosagittella clara* sp. n.; Silurian, Ludlow; Barrandian, Bohemia.

Name: After Kosov hill near Beroun and *Sagittella* (feminine), *sagitta* (Lat.) - arrow, reminiscent to a shape of ventral pseudointerarea.

Diagnosis: Small, thick-walled, transversally highly convex elongate oboline, with a small, but distinct orthocline to apsacline ventral pseudointerarea, and propareas inclined laterally. Short, parallel sided pedicle groove sloping on posterior of valve floor as shallow groove. Dorsal valve with short, well defined pseudointerarea, wide median groove and incipient lateral propareas. Dorsal vascula media subparallel, long and distinctly impressed. Visceral area poorly defined. Exterior with fine concentric fila of uneven size.

Remarks: New genus differs from other described obolines by a small to medium sized, laterally inclined ventral propareas, which are not excavated anteriorly, and rest at the top of the conspicuously swollen posterior shell wall. New genus is closely related and probably derived from the genus *Careniellus*. The genus *Kosagittella* has also rather small ventral pseudointerarea and dorsal vascula lateralia are similarly shaped, but *Kosagittella* differs by short and differently shaped dorsal pseudointerarea, more elongate outline and by greater convexity of the shell; the latter genus was apparently better modified for infaunal habitat as evident from elongate, almost parallel-sided and nearly smooth shell.

Occurrence: Upper Silurian to Middle Devonian (Ludlow to Eifelian); Bohemia.

Species included: *Kosagittella clara* sp. n. Silurian, Ludlow; Barrandian, Bohemia.

Kosagittella pinguis sp. n. Devonian, Lochkovian; Barrandian, Bohemia.

Lingula lingua BARRANDE, 1879. Devonian, Pragian to Eifelian; Barrandian, Bohemia.

Kosagittella clara sp. n.

Pl. 3, figs 1-12

Holotype: Ventral valve figured on pl. 3, fig. 1, deposited in the collection of the Department of Palaeontology, National Museum, Prague (NM L 34253).

Paratype: Dorsal valve figured on pl. 3, fig. 2, deposited in the collection of the Department of Palaeontology, National Museum, Prague (NM L 34254).

Type horizon: Ludlow, Ludfordian, Kopanina Formation (probably horizon with *Ananaspis fecunda*).

Type locality: Králův Dvůr, Dlouhá hora Hill (Dlauha hora in original spelling).

Name: *clarus* (Lat.) - clear, bright.

Material: Ten ventral and four dorsal valves.

Description: Shell small, equally biconvex, moderate thick-walled, 7 mm long in adults.

Dorsal valve elongate elliptical, with evenly curved anterior

margin and weakly curved sides, posterior margin rounded. Dorsal apex marginal. Valve moderate convex with conspicuously convex apex in a transverse profile, and weakly convex in lateral profile. Dorsal pseudointerarea apsacline, short, divided by wide and short median groove. Median groove weakly raised above valve floor, axially with another shallow groove. Lateral propareas short, incipient. Surface of the pseudointerarea covered by fine, anteriorly arched fine growth lines. Visceral area poorly defined, with weak radial striation on surface. Vascula media weakly divergent, distinct near midlength of the valve.

Ventral valve elongate oval, about 180-190 % as long as wide, widest anterior to midlength, with attenuate, but at apically rounded beak. Especially in the posterior part, the valve is strongly convex in transverse profile, and moderate convex in lateral profile. Ventral pseudointerarea small but well developed, resting at the edge of the thickened posterior shell wall. Pseudointerarea is formed by small, transversely striated orthocline propareas, which are distinctly inclined laterally from the short but deep and parallel-sided pedicle groove. Pedicle groove continues as a shallow groove on the posterior slope of visceral area and gradually disappears anteriorly. Visceral area poorly impressed, muscle scars unknown.

Exterior of both valves with numerous, uneven concentric fila. Flanks of ventral valve with a few (six to eight) weak radial plications.

Remarks: This small species has not been figured by Joachim Barrande, but, as can be inferred from the labels attached to specimens from his collections, he knew this species and referred several valves to *Lingula attenuata* SOWERBY = *Palaeoglossa attenuata* (SOWERBY). However, the species *Palaeoglossa attenuata* (SOWERBY) is a typical oboline with large and distinct pseudointerareas in both valves and its occurrence is restricted to the early Ordovician (Williams 1974). Although the exact location of fossiliferous bed in Barrande´s locality Dlauha Hora (from which all his specimens derived) is unknown, all new available specimens derive from the horizon with trilobite *Ananaspis fecunda* in the area between Koněprusy and Beroun (Koledník, Koněprusy, Dlouhá hora Hill Hill, and Kosov Hill).

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation, upper part (horizon with *Ananaspis fecunda*).

Localities: Králův Dvůr (Dlouha hora in Barrande's collection), Jarov, Koledník, Koněprusy (Velký vrch), Králův Dvůr (Kosov Quarry).

Kosagittella pinguis sp. n.

Pl. 4, figs 1-17

Holotype: Ventral valve figured on pl. 4, figs 3, 6, 7, 10 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 161).

Paratype: Dorsal valve figured on pl. 4, figs 1, 4 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 174).

Type horizon: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part, *M. uniformis* Biozone.

Type locality: Praha-Holyně, Černý lom Quarry, east wall.

Name: *pinguis* (Lat.) – fat, thick.

Material: Ten incomplete ventral and five dorsal valves and numerous fragments.

Description: Shell minute, biconvex, thick-walled, in adults 6-8 mm long (judging from fragments).

Dorsal valve elongate elliptical, with rounded posterior margin and evenly curved anterior and lateral margins. Valve moderate to highly convex posteriorly in transverse profile and evenly convex in lateral profile. Dorsal pseudointerarea apsacline, rather large, weakly raised above valve floor. Pseudointerarea occupies some 30 % of valve width and less than 10 % of valve length. Surface of median groove bears fine striation paralleling margin of valve (Pl. 4, fig. 11). Posterolateral margins of the pseudointerarea (= propareas) are formed by swollen shell wall, gently tapering posteriorly. Superficial structure of the pseudointerarea bears three morphological elements. Axial part of median groove is smooth, covered by fine wavy ridges; lateral to smooth area are finely pitted areas gradually passing into nearly smooth valve exterior (Pl. 4, fig. 15). Interpretation of these structures is beyond the scope oh this paper. Visceral area weakly defined, with oblique, narrow scars of central muscles. Dorsal vascula media well-impressed, long, and gently diverging.

Ventral valve conspicuously acuminate, strongly convex posteriorly in transverse profile. The apex of the valve is rounded, passing into straight posterolateral margin. Lateral and anterior margins evenly rounded. Ventral pseudointerarea apsacline to almost orthocline, gently curved in lateral profile, well-defined, formed by strongly thickened posterior shell wall. Pedicle groove deep, rather narrow. It continues as shallow groove on the posterior slope of visceral area. Propareas large, inclined laterally, with surface covered by coarse growth lines.

Visceral area weakly defined, with shallow and narrow oblique impressions of central muscles.

Exterior of ventral valve with flattened subcircular larval shell. Its almost smooth surface gradually passes into post-larval shell by increasing size of growth fila. Surface of the shell covered by fine concentric fila of uniform size.

Remarks: The species *Kosagittella pinguis* sp. n. is distinct by remarkably acuminate ventral valve with rather large propareas from its stratigraphical forerunner *K. clara* sp. n.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Kotýs Limestone.

Locality: The type locality only.

Kosagittella (?) *lingua* (BARRANDE, 1879)

Pl. 3, figs 13-18

1879 *Lingula lingua* BARR.: Barrande, pl. 4, case IV, figs 1, 2.

1998 *Wadiglossa lingua* (BARRANDE, 1879): Havlíček and Vaněk, p. 57, pl. I, fig. 2

Lectotype: Selected by Havlíček and Vaněk (1995), the brachial valve figured by Barrande (1879), pl. 104, case IV, fig. 1, deposited in collections of the Department of Palaeontology, National Museum, Prague (NM L 25975), re-figured herein on pl. 3 as fig.13.

Material: In total ten valves.

Remarks: The species was defined by Barrande (1879) and for the first time described by Havlíček in Havlíček and Vaněk (1998). It is remarkable by small size (less than 4 mm) with thick-walled shell, elongate-oval outline, high convexity and rounded beaks of both valves.

The shell morphology is close to the genus *Kosagittella*,

including short orthocline ventral pseudointerarea and fine groove sloping on the posterior slope of visceral area as anterior extension of a short and deep pedicle groove. However, available material was restricted, mainly in free valves, and almost all available data are based on material yielded by hammering.

Stratigraphical occurrence: Pragian, Praha Formation, Dvorce-Prokop and Vinařice Limestones; Zlichovian (lower Emsian); Chýnice and Suchomasty Limestones; Dalejan (upper Emsian).

Occurrence: Lužce, Praha-Smíchov (Konvářka), Praha-Řeporyje (U kantiny), Měňany, Bubovice (Čeřinka Hill), Koněprusy (Voskop).

Genus ***Kacakiella*** gen. n.

Type species: *Kacakiella bouceki* sp. n.; Silurian, Wenlock; Barrandian, Bohemia.

Name: After the brook Kačák in the valley with the type locality.

Diagnosis: Minute to medium-sized obolid with distinct dorsal and ventral pseudointerareas, parallel-sided pedicle groove, broadly triangular dorsal median groove, weakly impressed visceral field and muscle scars. Exterior with shallow pits in divaricate pattern, forming oblique terrace lines on flanks of the shell. Ridges between adjacent pits never extended into spines. Larval and juvenile shell surface bears several radial ribs.

Remarks: New genus is similar and may be derived from the Lower to Middle Ordovician genus *Spinilingula* COOPER. The genus *Spinilingula* has similar ornamentation of superficial pits arranged in divaricate pattern, and shapes of both pseudointerareas are similar to that of *Kacakiella*. A new genus differs from *Spinilingula* by the presence of radial ridges in juvenile shells and an absence of prone spines. The exterior of *Kacakiella* with terrace lines recalls some Ordovician genera (*Libecoviella* MERGL, *Westonia* WALCOTT, *Agalatassia* POPOV et HOLMER) but the latter genera never have pitted surface. On the contrary, a superficial ornamentation of *Glyptoglossella* COOPER is similar, but this genus belongs to the subfamily Glossellinae COOPER.

Occurrence: Silurian (Llandovery to Wenlock); Bohemia.

Species included: *Kacakiella bouceki* sp. n. Silurian, Wenlock; Barrandian, Bohemia.

Kacakiella bouceki sp. n.

Pl. 5, figs 1-12

Holotype: Ventral valve, figured herein in pl. 5, fig. 1, deposited in the palaeontological collections of the Department of Palaeontology, National Museum, Prague (NM L 34252).

Type horizon: Wenlock, Sheinwoodian, Motol Formation.

Type locality: Svatý Jan pod Skalou (U elektrárny).

Name: After Prof. Bedřich Bouček, the prominent Czech palaeontologist in the 20th century.

Material: Seven ventral and two dorsal valves.

Description: Shell medium sized, thick-walled, 10 mm long, subequally biconvex.

Dorsal valve broadly and roundly triangular, with angular apex, beak angle some 120°. Margins evenly curved, less in posterior part and in front margin. Dorsal pseudointerarea well-developed, apsacline, broadly triangular, with large, transversely concave median groove bearing distinct growth lines. Anterior edge of the pseudointerarea straight.

Dorsal visceral field weakly defined, about 50 % as long as valve. Muscle scars shallow, posterolaterally with narrow, oblique imprints (= transmedian and outside lateral muscles) and posteromedianly with oblique and narrow central muscle scars. Pallial markings weakly impressed, with gently divergent and narrow vascula media. Vascula lateralia unknown.

Ventral valve broadly, roundly triangular in outline, 130 % as long as wide, widest anteriorly to midlength, with evenly curved anterolateral margins, slightly less curved at front margin. Valve acuminate, with beak angle 80°-90°, posterolateral margins almost straight. Valve strongly convex posteriorly and less anteriorly in transverse profile, moderate and evenly convex in lateral profile. Ventral pseudointerarea anacline, small but distinct, restricted to the top of the apex. Propareas gently raised above valve floor, sloping toward deep, parallel-sided pedicle groove. Muscle scars weakly impressed. Ventral visceral area poorly defined, 40 % as long as valve. Pallial marking not distinctly impressed.

Macroornamentation of generally fine, but in size variable triangular pits arranged in divaricate pattern, forming the *Westonia*-like type of ornamentation over the entire shell surface. Fine and low terrace lines are well developed in marginal and posterolateral parts of the shell, while median sector bears only shallow pits. Concentric bands and short lamellae are irregularly spaced. Larval shell is smooth, and anteriorly is covered by fine, radially arranged acute ribs, which increase in number by an intercalation, but all abruptly disappear at 1 mm distance from the apex.

Remarks: Species differs by pitted surface in a divaricate pattern from all other obolids known from the Silurian strata. Presence of the *Westonia*-like ornamentation indicates burrowing, infaunal mode of life in fine-grained sediment. Valves, often incomplete, are quite common in laminate calcareous shale and bioclastic limestone. Species has long stratigraphical range and is abundant from the Llandovery to Wenlock in the Barrandian. Available valves are generally small; specimens from Svatý Jan pod Skalou (U elektrárny) are two to three-times larger than specimens from calcareous shale at other localities; because, apart from the absolute size of the shells, other morphological features are constant, the small specimens are not separated as separate species.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone); Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Hýskov (V Jakubinkách), Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny).

Subfamily **Glossellinae** COOPER, 1956

Genus ***Prastavia*** gen. n.

Type species: *Prastavia distincta* sp. n.; Devonian, Eifelian; Barrandian, Bohemia.

Name: *Prastavia* (feminine). Derived from Prastav Quarry near Praha- Holyně, the type locality of the type species.

Diagnosis: Minute, broadly oval, thin-walled glosselline. Ventral pseudointerarea poorly developed, with propareas resting on the valve floor, pedicle groove shallow and extending anteriorly to narrowly triangular area bordered by thin impressions of pedicle nerves. Dorsal pseudointerarea substituted by laterally thickened posterior margin of valve. Visceral areas large, with conspicuously thickened surface. Pallial markings weakly impressed, but inner secondary branches of ventral vascula lateralia superimposed on anterior thickened border of visceral area. Ornamentation of very fine, interrupted, elevated concentric fila.

Remarks: New genus is distinguished mainly by thickened and raised anterior border of visceral area in both valves.

Occurrence: Middle Devonian (Eifelian); Bohemia.

Species referred: *Prastavia distincta* sp. n.: Devonian, Eifelian, Bohemia.

Prastavia distincta sp. n.

Pl. 6, figs 1-16

Holotype: Dorsal valve, figured on pl. 6, figs 3, 5, 7 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 237).

Paratype: Ventral valve, figured on pl. 6, figs 1, 2 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 238).

Type horizon: Eifelian, Choteč Formation, base of bed No. 13.

Type locality: Praha-Holyně, Prastav Quarry.

Name: *distinctus* (Lat.) – distinct.

Material: Ten more or less complete dorsal and five ventral valves, many fragments.

Description: Shell very small, biconvex, apart visceral area thin-walled.

Dorsal valve broadly oval, some 130 % as long as wide, widest at midlength, with less curved anterior margin and evenly curved lateral margins. Posterior margin rounded. Larval shell subcircular, well defined from post-larval shell. Valve is moderately convex transversely as well as longitudinally, with shell weakly flattened at anteromedian sector. Dorsal pseudointerarea absent, posterior shell wall gently thickened, but it does not form elevated shell as in other glossellines. Visceral area is broadly rhomboidal, nearly as long as wide, large, extending over the midlength of the valve. Anterolateral borders of visceral area strongly thickened. Muscle scars weakly impressed, with rather small central muscle scars and elongate small anterior lateral muscle impressions. Umbonal muscle scars weakly defined, small, additional muscle (transmedian, outside lateral and middle lateral muscles) scars located posterolaterally but poorly impressed. Vascula media parallel, short, vascula lateralia not impressed.

Ventral valve moderately convex in transverse profile, evenly convex in lateral profile, with nearly the same outline as dorsal valve, but with more acute beak. Ventral pseudointerarea anacline, resting on valve floor, with minute propareas sloping toward narrow, shallow and long pedicle groove. Impressions of pedicle nerve fine, distinct, gently diverging and rather short. Visceral area large, anteriorly rounded, about 40 % as long as valve, with distinctly raised anterior border. There are no distinct muscle impressions. Thickened anterior border of visceral area is crossed by deeply impressed, wide internal secondary canals of vascula lateralia. External secondary branches are finely impressed anterior to valve midlength. There are only 5 to 6 internal secondary canals.

Ornamentation of the larval shell consists of obscure concentric fila, near the contact with the post-larval shell passing into fine, raised nodes disposed in concentric rows (Pl. 6, figs 14, 16). Post-larval shell with numerous, densely packed fine concentric fila of uneven size, some of them slightly wavy or discontinuous.

Comparison: This new species has no related species among lingulates of the Devonian age. A combination of highly raised anterior border of visceral area in both valves, poorly impressed muscle scars and minute size are unique features among glossellines.

Stratigraphical occurrence: Eifelian, Choteč Limestone.

Locality: The type locality only.

Genus *Barrandeoglossa* gen. n.

Type species: *Lingula fissurata* BARRANDE, 1879. Silurian, Wenlock; Barrandian, Bohemia.

Name: *Barrandeoglossa* (feminine). After Joachim Barrande, the famous palaeontologist of the 19th century and suffix derived from *Glossella*.

Diagnosis: Thick-walled glosselline, with minute, well developed, divided ventral pseudointerarea and absent dorsal pseudointerarea, which is substituted by thickened posterior margin of valve. Visceral area poorly defined, large, with obolid-like arrangement of muscle impressions. Weak median septum in dorsal interior. Pallial markings, both vascula lateralia and media well-impressed, with vascula lateralia densely branched into numerous, almost transverse and additionally branched secondary canals. Ornamentation of fine, distinct, regular elevated concentric fila, separated by narrow and deep, acute interspaces. Fila become slightly wavy in posterior and posterolateral part of shell.

Comparison: The genus *Barrandeoglossa* gen. n. is rather similar to large pseudolingulines, but it has preserved dorsal vascula media and flexure lines on the ventral pseudointerarea which are absent in *Pseudolingula* MICKWITZ and other species referred to Pseudolingulinae HOLMER (Holmer 1991). The ventral valve of the new genus has weakly impressed visceral field, which is, on the other hand, thickened and well defined in the pseudolingulines.

Glossellines are known mainly from the Middle to Upper Ordovician (Cooper 1956, Krause and Rowell 1975, Holmer 1989), but they probably extended to the late Palaeozoic (Havlíček and Röhlich 1987). Most glosselline genera have external surface ornamentation of fine spines, pustules or wavy lines (Cooper 1956). Also some species of the Silurian and Devonian age, referred herein to Glossellinae COOPER have similar pustulose microornament superimposed on concentric growth lines. This type of the microornament may be considered as a diagnostic feature of the subfamily, because it is generally unknown in genera of Obolinae KING and Pseudolingulidae HOLMER. However, *Barrandeoglossa* has only concentric fila and lack any pustulose ornamentation. In this respect, it is similar to Middle Ordovician genus *Pachyglossella* COOPER, which

externally bears only concentric fila. The genus *Pachyglossella* differs from the new genus mainly by absence of dorsal median septum and only weakly impressed pallial markings.

Outline and exterior of *Barrandeoglossa* resemble genus *Rafanoglossella* HAVLÍČEK. The latter genus, described by Havlíček (1998a) from Upper Ordovician of Bohemia, clearly differs from the new genus by poorly developed ventral pseudointerarea (= internal area of Havlíček 1982) and by less convex transverse profile of both valves. In addition, *Rafanoglossa* Havlíček and other Ordovician glosselline genera have vascular canals weakly impressed, quite different from the deeply impressed and branched vascular canals of *Barrandeoglossa*.

Species included: *Lingula fissurata* BARRANDE, 1879. Silurian, Wenlock; Barrandian, Bohemia.

Lingula bohemica BARRANDE, 1879. Devonian, Pragian; Barrandian, Bohemia.

Barrandeoglossa perneri sp. n. Devonian, Lochkovian; Barrandian, Bohemia.

Barrandeoglossa sp. Silurian, Ludlow; Barrandian, Bohemia.

Barrandeoglossa fissurata (BARRANDE, 1879)

Pl. 7, figs 1-13

1879 *Lingula Leiskowiensis* BARR.: Barrande, pl. 103, case II, figs 6a, 8, (partim).

1879 *Lingula Leiskowiensis* BARR. = *fissurata*. BARR.: Barrande, pl. 103, case III, figs 1-4.

Lectotype: Selected here, the ventral valve figured by Barrande (1879) in pl. 103, case III, fig. 4, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 24454), re-figured herein on pl. 7, fig. 3.

Paralectotypes: Valves figured by Barrande (1879) in pl. 103, case III, figs 1, 2, 3 (NM L 24452, NM L 24453, NM L 24455), deposited in the collections of the Department of Palaeontology, National Museum, Prague.

Type horizon: Wenlock, Motol Formation.

Type locality: Sedlec (in original spelling Sedletz).

Material: Fifteen ventral and twenty dorsal valves.

Description: Shell large, equally biconvex, thick-walled, in average 12-13 mm long, but it may reach 20 mm.

Dorsal valve broadly oval, some 130-140 % as long as wide, widest in anterior one-fourth to one-fifth, without any sulcus or fold. Posterior margin rounded, lateral and anterior margins weakly curved, but anterolateral part of margin curved more strongly. Valve moderately convex in transverse profile, and more convex posteriorly than anteriorly in transverse profile. Dorsal pseudointerarea reduced to thickened posterior margin of valve, without any sign of median groove and propareas.

Dorsal interior with large visceral area, occupying more than 50 % of valve width and expanding over midlength of valve. Anterior half of visceral area is divided by weak, broad median ridge. Muscle scars not well-impressed, with submarginal pair of small umbonal muscle scars, oblique narrow central muscle scars near the centre, and minute elongate-oval scars of anterior lateral muscles near at centre of the valve. Other muscle scars located posterolaterally, but their outlines are obscure. Vascula lateralia deeply impressed, broad, paralleling valve margin. Main vascular canals branch into numerous, normally arranged much finer secondary canals along whole preserved length of primary canal. Vascula media narrow, diverging from anterior border of anterior lateral muscle scars.

Ventral valve with acute, weakly acuminate beak, with the apical angle about 90°. Margins evenly curved, with more curved anterolateral and nearly straight posterolateral parts. Valve widest in anterior one-fifth. Transverse profile gently convex, lateral profile weakly and evenly convex. Ventral pseudointerarea anacline, moderately raised above adjacent valve floor, short and some 30 % as wide as valve, sloping toward pedicle groove. Anterolateral edge of the pseudointerarea overhangs the valve floor. Weak flexure lines divide pseudointerarea into smaller internal and larger external propareas. Pedicle groove deep, narrow and weakly expanding anteriorly. Visceral area weakly impressed, large, with obscure muscle scars except of oblique, large central muscle scars. Vascula lateralia deeply impressed, similar to that of dorsal valve, with transverse secondary canals and numerous transverse, short and complexly branched terminal canals.

Ornamentation of concentric fila, being slightly wavy and irregular in posterior part of shell, but becoming more regular anteriorly. Ornamentation in anterior half of large shells of regular, rounded and densely packed fila of uniform size, separated by narrow and deeply incised interspaces. The width of fila ranges from 50 to 70 μm anteromedianly in large shells. Larval shell is smooth.

Remarks: Several specimens from the Ratinka locality (Motol Formation, Wenlock) were identified by Barrande (1879) as *Lingula leiskowiensis* BARR. (Pl. 103, case II, figs 6a, 8).

At explanation of case III, with original heading *Lingula Leiskowiensis* BARR., Joachim Barrande inscribed a new name (= *fissurata* BARR.) above an older name *Leiskowiensis* BARR. As the lectotype *L. leiskowiensis* originates from the late Ordovician Králův Dvůr Formation and was referred by Havlíček (1998a) to another species (*Rafanoglossella leiskowiensis* [BARRANDE, 1879]), the lectotype of *Lingula fissurata* BARRANDE is selected from case III.

All specimens from Barrande's and Havlíček's collections come from the Motol Formation (Wenlock). Barrande (1879) figured on pl. 103, case III, four specimens of the species *Lingulella leiskowiensis* BARR. = *fissurata* BARR.: the dorsal valve from the locality Dlouhá hora Hill (Fig. 1, specimen NM L 24452), two ventral valves from the locality Sedlec (Figs 2, 4, specimens NM L 24453, NM L 24454) and incomplete dorsal valve from Lužce - Loděnice (Fig. 3, specimen NM L 24455). In addition, two ventral valves referred by Barrande (1879) to *Lingula Leiskowiensis* BARR., both coming from the locality Ratinka (Pl. 103, case II, figs 6a and 8) belong to the same species. Unfigured specimens from the original Barrande's collection come also from the locality St. Iwan (= Svatý Jan pod Skalou).

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny), Beroun (Ratinka), Tachlovice, Lištice, Lužce, Sedlec.

Barrandeoglossa (?) ***bohemica*** (BARRANDE, 1879)

Pl. 8, fig. 8

1879 *Lingula Bohemica* BARR.: Barrande, pl. 105, case IX.

1998 *"Lingula" bohemica* BARRANDE, 1879: Havlíček and Vaněk, p. 57, pl. 1, fig. 1.

Holotype (by monotypy): Ventral valve figured by Barrande (1879) on pl. 105, case X, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 25993), re-figured herein on pl. 8, fig. 8.

Material: Only the holotype.

Remarks: The species was described by Havlíček in Havlíček and Vaněk (1998), but material is poor and its attribution to *Barrandeoglossa* is not definite. Shell is externally covered by concentric fila of uniform size, slightly wavy is some parts, but much finer than concentric fila of the type species *B. fissurata* (BARRANDE).

Stratigraphical occurrence: Pragian, Praha Formation, Koněprusy Limestone.

Locality: Koněprusy.

Barrandeoglossa perneri sp. n.

Pl. 8, figs 1-7

Holotype: Dorsal valve, figured on pl. 8, figs 4, 5, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 180).

Paratype: Ventral valve, figured on pl. 8, fig. 3, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 173).

Type horizon: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part, *M. uniformis* Biozone.

Type locality: Praha-Řeporyje, Černý lom Quarry, eastern wall.

Name: After Prof. Jaroslav Perner, the famous Czech palaeontologist of 19th and beginning of the 20th century.

Material: Five incomplete dorsal and three incomplete ventral valves, many fragments.

Description: Shell of medium to large in size, biconvex, with moderate thick shell, with poorly differentiated larval and post-larval shells.

Dorsal valve elongate oval, with weakly acuminate beak, which is posterolaterally bordered by elevated pad. Valve is gently convex in lateral profile, moderate convex in posterior part but flattened anteriorly in transverse profile. Dorsal pseudointerarea absent. It is substituted by thickened shell wall, forming elevated wide strip along inner posterior margin, inclined toward valve floor (= apsacline in position). This strip, in function homologous with the limbus of paterulids, bears fine incision paralleling the posterior margin of the valve. Dorsal valve interior with weakly impressed visceral area, having finely pitted surface. Muscle impressions weak.

Ventral valve with acute beak, rather strongly convex in transverse profile in posterior part of the valve, but flattened anteriorly. The valve is thick posteromedianly, but thin-walled apically and posterolaterally. Ventral pseudointerarea is small, anacline, gently raised above valve floor, with propareas sloping toward shallow and poorly defined pedicle groove. Impressions of pedicle nerve deeply incised, weakly divergent, extending rather far anteriorly. Muscle scars and pallial markings unknown.

External ornamentation of fine concentric fila, regularly spaced anteromedianly. Raised fila are separated by much broader interspaces. Fila in the posterolateral sector of the shell more densely crowded, tending to be slightly wavy and less regular.

Remarks: New species is internally similar to *Barrandeoglossa fissurata* (BARRANDE), but differs by a quite different external ornamentation without densely spaced concentric fila. Instead of it, an almost smooth shell surface is covered by fine, distantly spaced concentric fila separated by much broader and smooth interspaces. Another difference is an externally swollen posterolateral margin of dorsal valve in *B. perneri* sp. n., while *B. fissurata* has posterior margin entire, with simple acute edge. Attribution of the new species to the genus *Barrandeoglossa* is based on general morphology of shell interior, while external ornamentation of *B. perneri* is quite unlike *B. fissurata*.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Kotýs Limestone.

Locality: The type locality only.

Barrandeoglossa sp.

Pl. 8, figs 9, 11, 12

Material: One complete crushed shell, many small fragments.

Description: Shell gently biconvex, large, 17-18 mm long, parallel-sided, widest at midlength, with weakly rounded anterior as well as posterior margins. Posterior of dorsal valve without pseudointerarea, shell surface extended as a short acute edge along the posterior margin. Ornamentation of very fine, wavy concentric fila of uniform size, densely packed over whole shell surface.

Remarks: This large species in known after numerous fragments with characteristic microornamentation and a single but broken and deformed complete shell found in the lower part of the Kopanina Formation (Ludlow); outlines of pseudointerareas and visceral areas are unknown. However, thick-walled shell, fine wavy external ornamentation and broadly rounded posterior margin of dorsal valve are very similar to glossellines.

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation, horizon with *Encrinuraspis beaumonti*.

Localities: Králův Dvůr (Kosov Quarry), Kozoloupy (Kouřící lom Quarry), Tachlovice.

Family **Pseudolingulidae** HOLMER, 1991

Genus ***Pseudolingula*** MICKWITZ, 1909

Type species: *Crania quadrata* VON EICHWALD, 1829. Ordovician, Ashgill; Estonia.

Pseudolingula (?) ***dilatata*** (BARRANDE, 1879)

Pl. 8, figs 10, 13

1879 *Lingula dilatata* BARR.: Barrande, pl. 103, case VIII.
?1879 *Lingula zebra* BARR.: Barrande, pl. 105, case V.

Holotype (by monotypy): Dorsal valve figured by Barrande in pl. 103, case VIII, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 17828), re-figured herein on pl. 8, fig. 13.

Type horizon: Ludlow, Gorstian, Kopanina Formation (probably *C. colonus/N. nilssoni* Biozone).

Type locality: Praha-Butovice (in original spelling Butowitz).

Material: The holotype only.

Description: Shell large, thick-walled, 21 mm long,

subpentagonal in outline, 75 % as wide as long, widest nearly front margin. Beak angle 130°, lateral margins weakly divergent, almost straight, anterior margin gently curved. Valve rather convex in transverse profile and evenly, gently convex in lateral profile. Posteromedian part of the valve flattened. Interior poorly known, but absence, or prominent reduction of dorsal pseudointerarea is evident.

Umbonal muscle scars paired, deeply impressed. Visceral field expands almost to midlength of valve, vascula lateralia deeply impressed, with anterior part strongly curved medianly to almost touch each other. There is no space for dorsal vascula media.

Remarks: The only specimen does not allow exact generic attribution of the species, but absence of dorsal vascula media, depressed dorsal beak, divided umbonal scars and shell outline is strongly reminiscent of pseudolingulines. Barrande (1879) described from the Motol Formation much smaller and thin-walled species *Lingula zebra* BARRANDE (the holotype, probably dorsal valve, specimen NM L 24464). The single available specimen is almost flat, also subpentagonal in outline and bears conspicuously regular, gently curved transverse terrace lines facing anteriorly over the entire shell surface. It cannot be ruled out that species *Lingula zebra* is only an immature specimen of *Pseudolingula* (?) *dilatata*.

Stratigraphical occurrence: (?) Wenlock, Motol Formation; Ludlow, Gorstian, Kopanina Formation (*C. colonus /N. nilssoni* Biozone).

Localities: Loděnice (hills between Loděnice and Bubovice), Praha-Butovice.

Genus ***Wadiglossa*** HAVLÍČEK, 1984

Type species: *Wadiglossa supramarginalis* HAVLÍČEK, 1984; Carboniferous, Tournaisian; Libya.

Wadiglossa perlonga (BARRANDE, 1879)

Pl. 9, figs 1-4, 8

1879 *Lingula perlonga* BARR.; Barrande, pl. 103, case VI, fig. 2.

Lectotype: Selected here, the ventral valve figured by Barrande in pl. 103, case VI, fig. 2, deposited in the collection of the Department of Palaeontology, National Museum, Prague (NM L 24460), re-figured herein on pl. 9, fig. 1.

Type horizon: Ludlow, Ludfordian, Kopanina Formation.

Type locality: Králův Dvůr, Dlouhá hora Hill (in original spelling Dlauha Hora).

Material: Two valves, and several valves that probably belong to the same species.

Description: Shell moderate sized, elongate-oval, equally biconvex, thin-walled.

Dorsal valve elongate oval, almost parallel-sided, with evenly curved anterior margin. Valve is gently convex in transverse profile anteriorly but rather convex posteriorly. Interior with poorly defined visceral area. Morphology of dorsal pseudointerarea unknown.

Ventral valve with acute beak, which is rather erected above posterior margin. Morphology of ventral pseudointerarea unknown. Interior of ventral valve with rather narrowly triangular radially striated visceral area. Central muscle scars weakly impressed, oblique and rather rectangular. Short and weakly divergent impression of pedicle nerve is present in posterior third of visceral area.

Concentric ornamentation poorly developed, with weak and low concentric growth lines.

Remarks: This species has been defined by Barrande (1879) on two specimens from different stratigraphical horizons and localities. The first figured specimen from the Motol Formation, Svatý Jan pod Skalou locality (Pl. 103, case, VI, fig. 1, specimen NM L 24459) belongs to species *Careniellus carens* (BARRANDE); second specimen, the lectotype, is the ventral valve with exfoliated shell derives from the yellowish tuffaceous limestone of Dlouhá hora Hill near Králův Dvůr (probably lower part of the Kopanina Formation). There have been recognised several unfigured specimens of the same species in the collection of J. Barrande; all have attached label Dlauha Hora and are preserved in the same rock type as the lectotype. These specimens are figured herein on pl. 9 as figs 2-4, and 8. It is worthwhile to note that in the newly collected material no shell could be referred to this species.

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation (exact horizon unknown).

Locality: Dlouhá hora Hill near Králův Dvůr.

Genus ***Bicarinatina*** BATRUKOVA, 1969

Type species: *Lingula bicarinata* KUTORGA, 1837; Devonian, Eifelian; northwestern Russia.

Bicarinatina sp.

Pl. 9, figs 5-7

Material: Three fragments and one complete, probably ventral valve.

Description: Shell of medium size, at least 4-5 mm long (based on fragments), elongate oval, almost parallel-sided, with nearly flat ventral valve having weak median plication. Ventral valve interior with small, almost linear pseudointerarea and tiny minute pedicle groove. Ventral visceral area broadly triangular, anteriorly resting on a raised, transverse plate with trilobate anterior edge. Exterior with fine, irregular and wavy concentric fila.

Remarks: Material is extremely rare (two fragments derive from 10 kg limestone block) but morphology of fragments, mainly planar shell and rudimentary ventral pseudointerarea clearly distinguish this species from all known lingulates of the Barrandian. The type species *Bicarinatina bicarinata* (KUTORGA) differs by much larger size and more convex ventral valve.

Stratigraphical occurrence: Eifelian, Choteč Formation, Choteč Limestone.

Locality: Praha-Holyně (Prastav Quarry).

Family **Elliptoglossidae** POPOV et HOLMER, 1994

Genus ***Lingulops*** HALL, 1872

Type species: *Lingulops whitfieldi* HALL, 1872; Upper Ordovician; U.S.A.

Remarks: Genus *Lingulops* HALL is described from the Silurian of Central Bohemia for the first time. Genus is highly conservative in shell morphology, but the Silurian species seem to have less raised anterior border of dorsal visceral area than the Ordovician representatives of the genus. Soft body morphology and inferred mode of life has been summarized by Mergl (1999a).

Lingulops barrandei MERGL, 1999

Pl. 10, figs 1-16

1999a *Lingulops barrandei* sp. n.: Mergl, p. 155, pl. 1.

Description: See Mergl (1999a).

Remarks: The original material derived from the Kopanina Formation (horizon with *Encrinuraspis beaumonti*) in an association with chonetid *Shagamella margarita* (BARRANDE) and trilobite *Metacalymene baylei* (BARRANDE). Two valves, rather thick-walled, externally with fine growth fila and internally undistinguishable from *L. barrand*ei MERGL are known from the Silurian limestone at Železná (Farská Gorge), north of Beroun. One valve derives from an unfigured material of the collection of J. Barrande (Pl. 10, fig. 11), another valve has been collected by V. Havlíček (Pl. 10, fig. 10) at the same locality. These valves occur in association with trilobites *Aulacopleura* and *Dicranopeltis*; associated conodonts indicate lower Ludlow (Gorstian) age (Havlíček and Kříž 1973).

Stratigraphical occurrence: Ludlow, Gorstian, Kopanina Formation (*Encrinuraspis beaumonti* Horizon).

Localities: Železná near Beroun (Farská gorge), Králův Dvůr (Kosov Quarry).

Lingulops fragilis sp. n.

Pl. 9, figs 9-15

Holotype: Ventral valve, figured herein in pl. 9, figs 9, 13, 14, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 209).

Type horizon: Wenlock, Sheinwoodian, Motol Formation.

Type locality: Barrandian, Svatý Jan pod Skalou (U elektrárny).

Name: *fragilis* (Lat.) – fragile.

Material: Three valves in limestone, seven free valves and several fragments (only exterior does not enable differentiation of ventral and dorsal valves).

Description: Shell small, equally biconvex, elongate-elliptical, thin-walled, about 200 % as long as wide. Both valves are very similar in outline in convexity, being evenly convex in transverse and lateral profiles, with weakly flattened posterolateral margin of ventral valve, while opposite valve lacks this flattening.

Visceral area same as in *L. barrandei* MERGL, being only less distinctly impressed.

Exterior of very weak and low regular concentric fila over entire shell. Microornamentation of fine, oblique and irregular fila superimposed and crossing the coarser, regular concentric fila. Larval shell weakly convex, subcircular, 270 μm wide and 300 μm long, distinguishable from finely striated post-larval shell by smooth surface.

Remarks: New species differs from *L. barrandei* MERGL by thinner and more fragile shell wall and by finer and less numerous concentric fila.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Locality: Svatý Jan pod Skalou (U elektrárny), Tachlovice.

Family **Paterulidae** COOPER, 1956

Genus ***Paterula*** BARRANDE, 1879

Type species: *Paterula bohemica* BARRANDE, 1879; Ordovician, Caradoc; Barrandian, Bohemia.

Remarks: Bohemian paterulids of the Ordovician and early Silurian age have been revised just recently (Mergl 1999b). Up to now, the youngest member of genus *Paterula* has been known from the Pragian (Jaeger et al. 1969), but the species *P. holynensis* sp. n. extends the range of this genus at least to the early Middle Devonian (lower Eifelian).

Paterula argus MERGL, 1999

Pl. 11, figs 1-8

1999b *Paterula argus* sp. n.: Mergl, p. 359, fig. 10.

Holotype: Ventral valve figured Mergl (1999b) in fig. 10:1, refigured herein on pl. 11, fig. 1, deposited in the collection of the District Museum of Dr. B. Horák at Rokycany (MBHR 85196). The holotype came from limestone of *M. sedgwicki* Biozone, Želkovice Formation (Llandovery) at Hýskov near Beroun.

Description: Mergl (1999b).

Remarks: This species was described in detail by Mergl (1999b). He noted presence of this genus also in the part of the Motol Formation, but material is limited and not well preserved to identify available valves to species level.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* to *M. sedgwicki* Biozones); Wenlock, Homerian, Motol Formation.

Localities: Hýskov (V Jakubinkách), Koněprusy (Velký vrch).

Paterula holynensis sp. n.

Pl. 11, figs 9-13; pl. 12, figs 1-15

Holotype: Ventral valve, figured on pl. 11, fig. 13, and pl. 12, figs 6, 9, 13, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 239).

Paratype: Dorsal valve, figured on pl. 12, figs 1, 5 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 224).

Type horizon: Eifelian, Choteč Formation, base of bed No. 13.

Type locality: Praha-Holyně, Prastav Quarry.

Name: *holynensis* - after the village Holyně near the type locality.

Material: Ten dorsal and seven ventral valves, many fragments.

Description: Shell, thin-walled, dorsi-biconvex, with broadly oval outline, widest at posterior third, with evenly curved margins. Shell 112-120 % as long as wide, at maximum 3 mm long.

Dorsal valve weakly convex, with apex at posterior third.

Larval shell directed slightly posterodorsally. Dorsal valve interior with prominent, gently convex limbus of uniform width. Visceral area large, occupying almost 50 % of shell length, poorly impressed. Impressions of muscles weak, the same as in another members of the genus (Mergl 1999b).

Ventral valve less convex than the dorsal valve, with apex submarginal. Larval shell circular, gently raised above adjacent shell surface, directed posteroventrally. Posterior slope gently concave to flattened marginally. Ventral valve interior with prominent limbus, separated by deep groove from the raised perimarginal rim. Pedicle groove distinct, tapering posteriorly and turned ventrally. Externally, the pedicle groove is defined by low elevated ridge at posterior slope. There is no pedicle notch. Pedicle groove is deepest anteriorly, but is separated by raised transverse ridge from the shell interior. Ventral valve deepest posteriorly. Visceral area poorly defined, and extending to midlength of the valve. Muscle scars generally weakly impressed, only with deep umbonal scar in front of pedicle groove. Impression of pedicle nerve undivided along its posterior course; impression bifurcates at anterior third of visceral area. Impressions of vascula lateralia obscure, with centrally directed inner secondary canals.

Exterior with fine concentric growth fila. Microornamentation of shallow rhomboidal pits, showing regular changes in outline toward the shell periphery; pits taper in radial and elongate in concentrical directions.

Remarks: The new species distinguishes from all stratigraphically older species of the genus by undivided posterior margin of ventral valve devoid of any pedicle notch, and by impressions of pedicle nerve divided much more anteriorly than in any other known species.

Stratigraphical occurrence: Eifelian, Choteč Formation, basal layers.

Localities: Praha-Holyně (Prastav Quarry), Choteč.

Family **Dysoristidae** POPOV et USHATINSKAYA, 1992

Genus ***Dysoristus*** BELL, 1944

Type species: *Dysoristus lochmanae* BELL, 1944; Upper Cambrian; Nevada, U.S.A.

Dysoristus posterus sp. n.

Pl. 35, figs 4-13

Holotype: Incomplete ventral valve, figured on pl. 35 as figs 10, 14, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 064).

Paratypes: Dorsal valves figured on pl. 35 as fig. 8 (PCZCU 058), and figs 6, 7, 12 (PCZCU 056) deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň.

Type horizon: Pragian, Praha Formation, Dvorce-Prokop Limestone, limestone bed in graptolitic shales with *Monograptus atopus*.

Type locality: Svatý Jan pod Skalou, Stydlé vody Quarry.

Name: *posterus* (Lat.) – second, later.

Material: Ten dorsal valves, two fragmentary ventral valves, and numerous fragments.

Description: Shell minute, broadly subcircular, in adults some 2-3 mm wide, dorsi-biconvex.

Dorsal valve relatively thick-walled, with a marginal beak. Valve is moderately convex, in transverse and longitudinal profiles; with distinct, widely triangular flattened area extending from the apex toward the front margin. Dorsal pseudointerarea apsacline, widely triangular, deeply concave in transverse profile, with an extensive median depression and small but distinct propareas. Its surface bears fine transverse striations. Pseudointerarea is highly raised above valve floor, but not excavated, anteriorly supported by weak median ridge. Muscle scars poorly defined posterolaterally.

Ventral valve flattened, with conspicuous supramarginal apex. Posterior slope apsacline, anterior slope straight to weakly concave. Pedicle track prominent, narrowly triangular, and deeply concave along whole length, open by posteriorly acute pedicle foramen. Internally, the track has thickened margins, with a shallow depression along axis of the covering plate.

Posterior shell wall thickened, with orthocline, widely triangular pseudointerarea.

External ornamentation of dorsal valve with deep, subcircular pits (Pl. 35, figs 5-7, 12). They are deeper posteriorly than anteriorly. Pits are also superimposed on weakly elevated, irregularly spaced concentric bands. Ventral valve is nearly smooth, with only weak concentric bands.

Remarks: The family Dysoristidae POPOV et USHATINSKAYA is known from the Upper Cambrian to Lower Ordovician (Holmer and Popov 1996) and comprises only two genera (*Dysoristus* BELL and *Ferrobolus* HAVLÍČEK) (Popov and Holmer 1994). The total absence of dysoristids in the Upper Ordovician, Silurian and the early Devonian made occurrence of a dysoristid in the limestones of the Pragian age extremely surprising. However, the shell morphology of collected specimens is wholly consistent with their reference to the genus *Dysoristus* and the family Dysoristidae. There are a triangular pedicle track with a covering plate, large dorsal pseudointerarea with well-defined propareas, dorsi-biconvex to dorsi-planar shell, finely pitted surface of dorsal valve and less prominent surface ornamentation on the ventral valve. If the general trends of the evolution of benthic marine communities during the early Palaeozoic are taken into account (Sepkoski and Miller 1985), the occurrence of the new species in the deep-water environment marginal to graptolitic biofacies is not so surprising.

Stratigraphical occurrence: Pragian, Praha Formation, Dvorce-Prokop Limestone.

Localities: Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales bearing *Monograptus atopus*), Praha-Klukovice, Červený lom Quarry (top of the Praha Formation, interval 2.0 - 1.5 m below the Pragian-Zlíchovian boundary).

Superfamily **Discinoidea** GRAY, 1840
Family **Discinidae** GRAY, 1840
Subfamily **Orbiculoideinae** SCHUCHERT et LE VENE, 1929

Remarks: Genus *Orbiculoidea* D'ORBIGNY and phylogenetic relations within the family Discinidae GRAY are not well

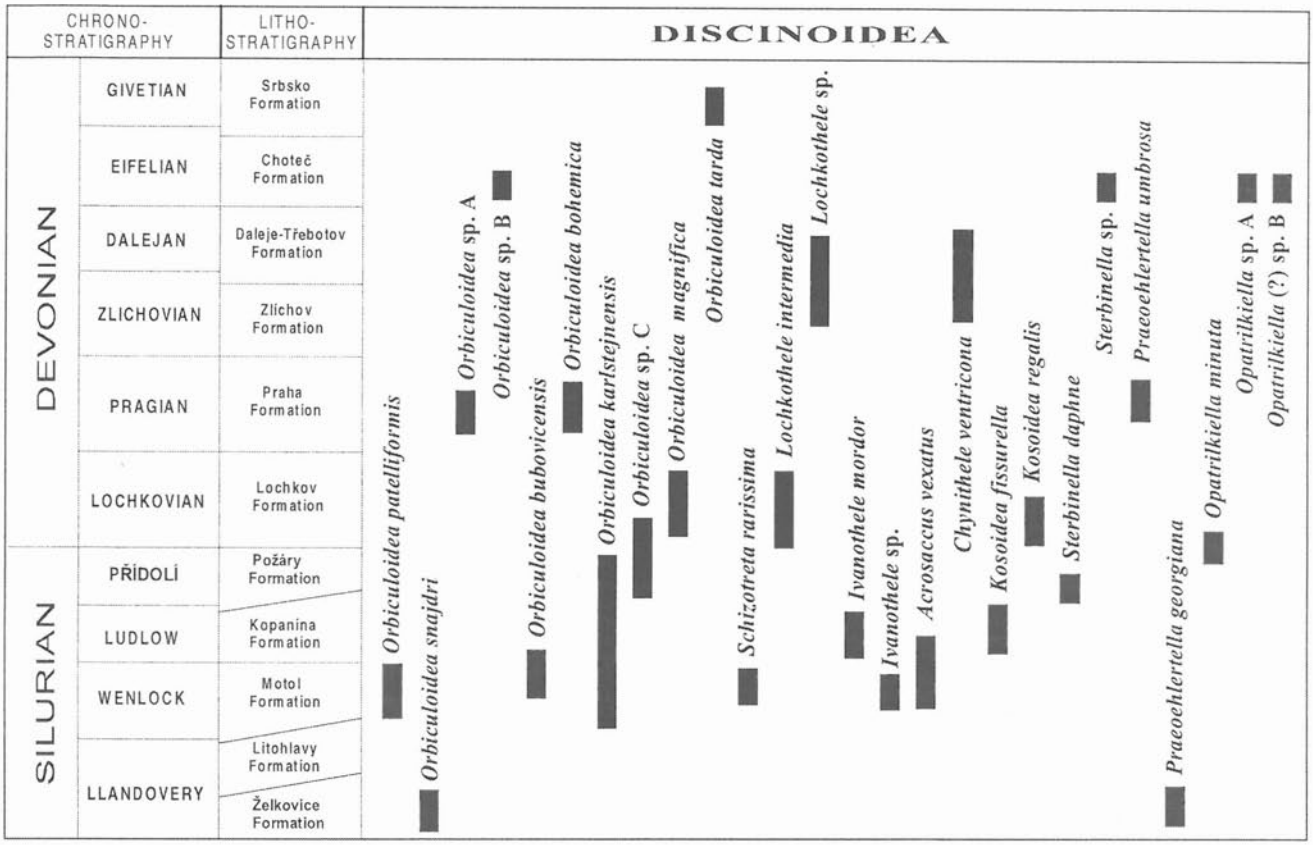


Fig. 8: Stratigraphical distribution of the discinoid brachiopods in the Barrandian.

enlightened. It is obvious that any careful study of this genus will split this and the related genus *Schizotreta* KUTORGA to more genera reflecting the real affinity and phylogeny within the group. Such splitting seems premature in consideration of the recent knowledge of the family. Otherwise, in the Silurian and Devonian of the Barrandian, several morphologic groups may be distinguished, each of them comprising phylo-genetically related species. Several species that do not fit in any known genus are assigned to newly defined genera, other species are referred to widely accepted taxa *Orbiculoidea* D'ORBIDNY and *Schizotreta* KUTORGA.

Genus ***Orbiculoidea*** D'ORBIGNY, 1847

Type species: *Orbicula forbesii* DAVIDSON, 1848; Silurian, Wenlock; England.

Remarks: Apart the type species *Orbiculoidea forbesi* (DAVIDSON) there are numerous species, often imperfectly known, poorly described or figured, which can be hardly compared with new material. It is especially true in types of many of Barrande's (1879) species, known after single or several specimens and by him invariably referred to the genus *Discina* LAMARCK. All known species of the Silurian and Devonian of the Barradnian referred to *Orbiculoidea* D'ORBIGNY may be divided into four evolutionary groups.

The first group comprises large biconvex species with subcircular shell, well developed internal pedicle tube, broadly V-shaped listrium, and shell ornamented by high, lamellose concentric rugellae; species *Orbiculoidea patelliformis* (BARRANDE), *O. snajdri* sp. n. and *O.* sp. A and *O.* sp. B belong to this group. The type species of the genus, *Orbiculoidea forbesi* (DAVIDSON) may be referred to this group, too.

Second group comprises similar, but smaller thick-walled shells, with central dorsal apex, short pedicle track and short internal tube; only species *O. bubovicensis* sp. n. belongs there.

Third group comprises medium sized, elongate-oval shells, having short, concave listrium, long internal pedicle tube and ornamentation of regular fine concentric rugellae; species *O. bohemica* (BARRANDE), *O. karlstejnensis* MERGL and *Orbiculoidea* sp. C.

Fourth group comprises large, convexo-planar shells, with deep subcircular depression around the pedicle track; species *O. magnifica* sp. n. may be referred there. Similar morphology of dorsal valve but with much larger pedicle tube in ventral valve has also the medium sized species *O. tarda* (BARRANDE).

Other subcircular discinid species from Silurian and Devonian of the Prague Basin, often referred by previous authors to genus *Orbiculoidea,* are referred to another genera: *Schizotreta* KUTORGA, *Lochkothele* HAVLÍČEK et MERGL, *Chynithele* HAVLÍČEK, and *Ivanothele* MERGL.

Orbiculoidea patelliformis (BARRANDE, 1879)

Pl. 13, figs 1-11, 14

1879 *Discina Maeotis* EICHW.: Barrande, pl. 100, case II, figs 9-11.
1879 *Discina patelliformis* BARR.: Barrande, pl. 110, case VI.

Holotype (by monotypy): Dorsal valve, figured by Barrande (1879) on pl. 110, case V, fig. 1, deposited in the collections of the Department of Palaeontology, National Museum, Prague, (NM L 26047), re-figured herein on pl. 13, fig. 1.

Type horizon: Wenlock, Sheinwoodian, Motol Formation, *C. perneri/C. ramosus* Biozone.

Type locality: Svatý Jan pod Skalou.

Material: Ten dorsal and two ventral valves.

Description: Shell large up to 25 mm long, thick-walled, 105-110 % as long as wide, circular in outline.

Dorsal valve depressed conical, about 20-25 % as high as long, with apex situated slightly posterior, at some 40 % of the valve length. Margins evenly curved. Valve with straight slopes in transverse and lateral profiles. Interior of the valve with thin median septum at the beak, extending into short distance anteriorly. Dorsal muscle scars minute, adjacent laterally to median septum near the apex. Vascula media incipient, gently diverging from the apex.

Ventral valve depressed conical, as high as dorsal valve, with straight posterior slope and anteriorly gently flattened anterior slope. Ventral apex located gently more posteriorly than dorsal apex. Pedicle opening spindle-shaped, deep, anteriorly covered with broadly V-shaped listrium, occupying 50 % of the posterior slope. Exact length of internal pedicle tube is unknown, but probably is short. Interior of both valves covered by radially disposed and generally coarse canals of pallial markings, uneven in size, and forming scalloped surface on partly exfoliated shell. Terminal vascular canals along shell periphery fine.

Exterior covered by conspicuous, high and thin concentric rugellae, with rounded crest, slightly inclined toward shell periphery. Rugellae are separated by uniformly broad interspaces with flat bottom, in some places bearing low concentric fila. Size and spacing of rugellae are uniform over whole shell surface. Growth lamellae crowded along shell periphery of large shells often superimposing one another, indicating vertical instead of lateral shell growth direction.

Remarks: One ventral and a few dorsal valves have been referred by Barrande (1879) to species *Discina maeotis* EICHWALD. Barrande's specimens derive from various stratigraphical levels and localities. The undeformed dorsal valve, the holotype of *Discina patelliformis* BARRANDE was described by Barrande (1879) from the same locality and stratigraphical level as three valves referred by him to *Discina maeotis* EICHWALD; the latter three specimens are referred herein to *O. patelliformis*. The species *Orbiculoidea patelliformis* is externally similar to *Orbiculoidea forbesi* (DAVIDSON) as figured by Davidson (1866), but the latter species has more conical dorsal valve.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny).

Orbiculoidea snajdri sp. n.

Pl. 14, figs 1-4

Holotype: Ventral valve, figured on pl. 14, fig. 4, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 510).

Type horizon: Llandovery, Aeronian, Želkovice Formation, *Monograptus sedgwicki* Biozone.

Type locality: Hýskov, V Jakubinkách.

Name: After Dr. M. Šnajdr, the prominent Czech palaeontologist of 20th century.

Material: Six ventral and two dorsal valves.

Description: Shell large, 20 mm long, thick-walled, with regularly circular outline, as long as wide.

Dorsal valve depressed conical, with raised, smooth brephic shell, dorsal apex located slightly posterior to midlength.

Ventral valve is depressed conical in brephic stage, becoming nearly flat in later growth stages. Ventral apex situated at posterior 25-30 %. Pedicle opening narrow, spindle-shaped, with large listrium, occupying some 50 % of the posterior slope. Internal pedicle tube with thickened wall, internal foramen at posterior 20 % of the posterior slope.

Ornamentation of coarse rugellae evenly spaced over whole shell surface. The size and height of rugellae and width of interspaces evenly increase toward shell periphery. There are 6 low rugellae per 2 mm in apical region but only 2-3 rugellae near shell periphery of large shells. Rugellae grow almost perpendicularly to shell surface and their rounded crests are not swollen (Pl. 14, fig. 4).

Remarks: This species was unknown to Joachim Barrande (1879). It is very close to *Orbiculoidea patelliformis* (BARRANDE), but the new species differs by more posteriorly located ventral apex, slightly thinner shells with more finely impressed vascular canals, and more robust concentric rugellae. Similar morphology, size and occurrence marginal in the same biofacies indicate that *O. snajdri* sp. n. is an evolutionary forerunner of the species *O. patelliformis*.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* to *M. sedgwicki* Biozones).

Locality: The type locality only.

Orbiculoidea sp. A

Pl. 13, figs 9, 12, 13

1879 *Discina Maeotis* EICHW.: Barrande, pl. 100, case II, figs 1, 2, 4.

Material: Three ventral valves.

Description: Ventral valve large, 23 mm long, circular, rather thin-walled. Anterior and lateral margins evenly curved, but posterolateral margins less so. Apex located at posterior third. Transverse profile gently convex, with acute apex. Transverse profile of posterior slope gently convex, anterior slope moderately concave. Pedicle opening spindle-shaped, occupying about one third of posterior slope. Ornamentation of regular concentric rugellae of uniform size that are evenly spaced over whole shell surface.

Remarks: This poorly known species is known only from three Barrande's types. Its morphology, ornamentation and pedicle opening are close to *Orbiculoidea patelliformis* (BARRANDE), but *Orbiculoidea*. sp. A clearly differs by concave anterior slope and less rounded posterolateral margins.

Stratigraphical occurrence: Pragian, Praha Formation, Koněprusy Limestone.

Locality: The type locality only.

Orbiculoidea sp. B

Pl. 16, figs 10, 11; pl. 17, fig. 9

1879 *Discina tarda* BARR.: Barrande, pl. 96, case V, fig. 2.

Material: Three dorsal and two ventral valves.

Description: This medium sized species has remarkably transverse outline, very low dorsal valve and depressed conical ventral valve. Favourably preserved dorsal valves have apex posterior to centre of valve, and gently concave profile of slopes. Ornamentation consists of regular low concentric fila, crossed by two gently curved radial plications. Ventral valve with similar ornamentation, with slightly posterior apex.

Remarks: This species was confused by Barrande (1879) with species *Discina tarda* BARR. (= *Orbiculoidea tarda* [BARRANDE]). The specimen figured by him on pl. 96, case V, fig. 2 was collected in the Daleje Shales, while the type specimens came from the Srbsko Formation.

Stratigraphical occurrence: Daleje-Třebotov Formation, Třebotov Limestone and Daleje Shale.

Localities: Praha-Hlubočepy (V háji Quarry), Choteč (east of the Vávrův mlýn).

Orbiculoidea bubovicensis sp. n.

Pl. 14, figs 5-12

1879 *Discina rugata* ? SOW.: Barrande, pl. 98, case I, figs 3, 6.
1879 *Discina Maeotis* EICHW.: Barrande, pl. 100, case II, fig. 5.

Holotype: Ventral valve figured on pl. 14, figs 10, 12, deposited in the collections of the Museum Dr. B. Horák, Rokycany (MBHR 73183).

Type horizon: Wenlock, Homerian, Motol Formation, *M. ludensis* Biozone.

Type locality: Kozolupy, excavations near the "Kouřící lom" Quarry.

Name: *bubovicensis* - after the village Bubovice near the type locality.

Material: One complete shell, two dorsal and three ventral valves.

Descriptions: Shell of medium size, 12 mm long, thin-walled near the apex but rapidly thickened toward the shell periphery, with subcircular outline, less than 110 % as long as wide.

Dorsal valve depressed symmetrically conical, 20 % as high as long, with acute apex directed dorsally and located slightly anterior to the centre of the valve. Margins of the valve evenly curved, with valve slopes remarkably straight, including the posterior one. Ventral valve depressed, asymmetrically conical. The apex directed anteroventrally, located slightly posterior to the centre of the valve. Posterior slope gently convex, anterior slope moderately concave, becoming less concave to almost flat anteriorly. Pedicle track well developed, large, 20-25 % as long as the posterior slope, broadly V-shaped in a cross section. Listrium divided into two flattened slopes by narrow axial plate. Interior of the ventral valve with short, posteriorly expanding pedicle tube, which is opened at about midlength of posterior slope.

Exterior with low concentric rugellae, fine near the beak but becoming coarser toward the shell periphery. Interspaces uneven in depth and width, at some places rugellae may be densely packed, but in other parts of the same shell the rugellae are distant and almost evenly spaced. Rugellae sometimes extend into overlapping growth lamellae.

Remarks: New species was confused by Barrande (1879) with *Discina rugata* J. de C. SOWERBY and *Discina maeotis* EICHWALD. However, an interrogation behind the specific name at Barrande's explanation of figures indicates his uncertainty as concerned the specific determination. The lectotype of *Orbiculoidea rugata* (J. de C. SOWERBY) as figured by Davidson (1866; pl. 5, figs 9, 10) derives from the Ludlow Series (Ludfordian Stage) (Cocks 1978) and its dorsal valve has more posteriorly located apex (Bassett 1986) than the new species.

The locality of the Barrande's bivalved specimen (Pl. 14, fig. 8 herein) is Lužce-Loděnice in original spelling "Collines entre Lužetz and Lodenitz", but additional material kept in Barrande's collection, both figured and unfigured, derived from the locality Bubowitz. Grey-green bioclastic limestone bearing nice specimens came probably from the upper part of the Motol Formation (*T. testis* Subzone), but the species is known also from the uppermost Motol Formation, in the yellowish crinoidal limestone of *M. ludensis* Biozone (Havlíček 1995, Kříž 1998).

Orbiculoidea bubovicensis sp. n. is externally similar to small individuals of *O. patelliformis* (BARRANDE) but the latter differs by posterocentral dorsal apex, much large size, longer pedicle track and internal pedicle tube. Significant differences are in the ornamentation; unlike the low rugellae covering the shell of *O. bubovicensis*, the species *O. patelliformis* and *O. snajdri* sp. n. have high lamellose rugellae.

Stratigraphical occurrence: Wenlock, Homerian, Motol Formation (*T. testis* Subzone to *M. ludensis* Biozone).

Localities: Bubovice, Loděnice ("Ischaditové jámy"), Kozulupy (excavations near "Kouřící lom Quarry").

Orbiculoidea bohemica (BARRANDE, 1879)

Pl. 15, figs 1-9

1879 *Discina bohemica* BARR.: Barrande, pl. 97, case V, figs 1-4.
1998 *Orbiculoidea bohemica* (BARRANDE, 1879): Havlíček and Vaněk, p. 57, pl. 1, figs 7, 17.

Lectotype: Ventral valve figured by Barrande on pl. 97, case V, fig. 1, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 16053), re-figured herein on pl. 15, fig. 9.

Paralectotypes: Ventral valve figured by Barrande on pl. 97, case V, fig. 2 (NM L 16052), fig. 3 (NM L 16054), fig. 4 (NM L 16055), deposited in the collections of the Department of Palaeontology, National Museum, Prague, re-figured herein on pl. 15, figs 3, 5, 4, respectively.

Type horizon: Pragian, Praha Formation, Koněprusy Limestone.

Type locality: Koněprusy (in original spelling Konieprus).

Material: Four dorsal and seven ventral valves.

Description: Shell elongate-oval, 15 mm long, 125-130 % as long as wide, thin-walled.

Dorsal valve is depressed asymmetrically conical, with apex at posterior one-fourth. Margins evenly rounded. Posterior slope weakly convex to straight, anterior slope with gently convex beak region passing forward into flattened or even weakly concave profile.

Ventral valve depressed and asymmetrically conical, with

the apex at posterior one-third to one-fourth. Posterior slope gently but distinctly convex, anterior slope finely concave, more umbonally than anteriorly. Lateral slopes weakly convex. Pedicle track deep and conspicuous. The track is 30 - 40 % as long as the posterior slope, covered by deeply concave undivided listrium. Pedicle foramen circular, internally continues into pedicle tube that is opened internally at 20 % of posterior slope length.

Shell covered by fine concentric rugellae of uniform size, separated by concave interspaces of the comparable size. Rugellae have rounded narrow crests and rest almost perpendicularly at shell surface, being gently inclined toward the beak in some parts. Rugellae are the same size but are more densely packed at the posterior slope. There are some 6-7 rugellae per 1 mm anteromedianly. Some ten irregular and weak plications extend from the apex toward the anterior margin.

Comparison: *Orbiculoidea bohemica* (BARRANDE) is a distinct species in the Lower Devonian of the Barrandian; its elongate-oval outline, deep pedicle track and finely rugellate ornamentation distinguish this species from other large Devonian species erected by Barrande (1879) from the Barrandian.

Stratigraphical occurrence: Pragian, Praha Formation, Koněprusy Limestone.

Locality: Koněprusy.

Orbiculoidea karlstejnensis MERGL, 1996

Pl. 15, figs 10-16

1879 *Discina propinqua* BARR. (partim): Barrande, pl. 98, case IV, figs 3, 4, 5, 6 (non figs 1, 2).
1879 *Discina propinqua* BARR.: Barrande, pl. 152, case IV.
1996 *Orbiculoidea karlstejnensis* sp. n.: Mergl, p. 122, pl. I.

Description: See Mergl (1996).

Remarks: This species has been described and discussed by Mergl (1996) but new differences may be pointed out. The species *Orbiculoidea karlstejnensis* MERGL has more centrally situated ventral apex, and has longer although similar, undivided pedicle track when compared with *O. bohemica* (BARRANDE). Shell outline of *O. karlstejnensis* is less elongate and its ornamentation consists of less densely packed concentric rugellae.

Barrande (1879) defined the new species *Discina propinqua* BARR. on six specimens. The lectotype of *D. propinqua* BARRANDE (pl. 98, case IV, fig. 1, selected herein) is the dorsal valve coming from the locality Sedlec (Sedletz in original spelling; probably from the Motol Formation, Sheinwoodian, Wenlock). This valve cannot be with certainty referred to any other known discinid from the Barrandian; its morphology is nearest to the dorsal valve of *Lochkothele* HAVLÍČEK et MERGL. Other specimens referred to *Discina propinqua* by Barrande (1879) may be accommodated in the species *O. karlstejnensis* MERGL. They have similar elongate outline, convexity and similarly shaped pedicle tube. Outer surfaces of these specimens are also covered by concentric rugellae. Barrande's material figured on pl. 98 came from localities Koledník and Dlauha Hora, both probably from the limestone of the Kopanina Formation. Ventral valve figured by him on pl. 152, case IV probably derived from the Motol Formation from the locality Svatý Jan pod Skalou (St. Iwan in original spelling). Similarly shaped but rare and generally smaller valves which may be referred to *O. karlstejnensis* are known also from the lower part of the Požáry Formation.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation; Ludlow, Kopanina Formation; Přídolí, Požáry Formation.

Localities: Svatý Jan pod Skalou, Karlštejn ("Na rešnách" Quarry), Koledník, Králův Dvůr (Dlouhá hora Hill, Kosov Quarry).

Orbiculoidea sp. C

Pl. 17, figs 7, 8, 10-12

Material: Ten dorsal valves, many fragments.

Remarks: The residues after dissolution of limestone block of the Požáry Formation abundantly yielded subcircular, low conical dorsal, rarely fragmentary ventral valves, with conspicuously regular rugellate ornamentation (Pl. 17, figs 8, 10, 12). Almost identical discinids are also known from the lower part of the Kotýs Limestone (Lochkov Formation). However, material is not sufficient enough for formal description and may be only roughly compared with some poorly known discinids figured by Barrande (1879). Valves from the upper part of the Kopanina Formation show great similarity to the lectotype of the species *Discina sequens* BARRANDE (the dorsal valve from the locality Dlouhá hora Hill, figured by Barrande in 1879 on pl. 100, case IV, fig. 1, specimen NM L 24431; selected herein). However, different modes of preservation do not allow satisfactory evaluation of their affinity.

Stratigraphic occurrence: Přídolí to Lower Lochkovian, Požáry and Lochkov Formations.

Localities: Praha-Holyně (Opatřilka Quarry); Praha-Řeporyje (Černý lom Quarry, Mušlovka Quarry), Králův Dvůr (Dlouhá hora Hill, Kosov Hill).

Orbiculoidea magnifica sp. n.

Pl. 16, figs 1-9, 12

1879 *Discina Maeotis* EICH.: Barrande, pl. 100, case II, fig. 3 (partim).
1999 *Orbiculoidea* sp. n.: Havlíček, p. 305, pl. IV, fig. 19.

Holotype: Ventral valve, figured herein on pl. 16, fig. 4, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 34434).

Type horizon: Lochkovian, Lochkov Formation, Radotín Limestone.

Type locality: Kosoř, Černá rokle.

Name: *magnificus* (Lat.) – splendid.

Material: Six dorsal and four ventral valves.

Description: Shell large, up to 32 mm wide, convexo-planar, thin-walled relative to shell size. Outline circular to broadly pyriform, 100-110 % as long as wide, with gently extended posterior margin. Anterior and posterior margins semicircular, but posterolateral margins less curved.

Dorsal valve asymmetrically conical, 25 % as high as wide, with apex at posterior third. Apex directed posterodorsally. Posterior and lateral slopes straight, anterior slope gently convex. Shell interior with fine radial lines, but there are no muscle impressions preserved.

Ventral valve flat, with a narrow band along posterior and

posterolateral margins that are gently curved dorsally, and with weakly raised shell surface near the central apex. Pedicle track occupies about half of space between the apex and posterior margin. The bottom of the pedicle track lies deeply below outer shell surface, and anteriorly is covered by a small listrium. Pedicle opening is surrounded by oval depression of valve surface. Internal pedicle tube thin and short.

Ornamentation of dorsal valve with fine and low, sometimes wavy concentric fila. Ventral valve covered by coarse concentric rugellae, low and more distant near apex but higher, coarser and more densely and regularly arranged on remaining shell surface; the ornamentation between posterior margin and pedicle track the same as on other parts of the valve. Rugellae continue also at the bottom of depressed area near the pedicle opening.

Remarks: New species attains size unusual in the Lower Palaeozoic discinids. Flat ventral valve and depressed area near pedicle foramen and gently extended posterior part of valve distinguish *O. magnifica* sp. n. from all other species of the genus. Large, similarly shaped shell and nearly the same morphology of ventral valve shows the closely related, but yet formally undescribed species from the Pragian of Central Sahara (Mergl and Massa, in prep.). New species distinctly differs from all other species of the genus *Orbiculoidea* present in the Silurian and Devonian of the Barrandian by a shell profile and morphology of the pedicle track. It probably represents a new genus; however, rarity and poor preservation of material does not enable definition of the new genus.

External morphology of the new species is very close to the extant discinid *Discinisca tenuis* (SOWERBY). Shared shell profiles and a depression around the pedicle track indicate, that also living specimen of *O. magnifica* had short, externally disc-like pedicle, filling the adjacent depression. The animal used such pedicle to close attachment to any hard substrate. However, *O. magnifica* has well mineralised shell behind the pedicle track, while *D. tenuis* has only thin periostracal sheet between the pedicle track and the posterior margin.

Barrande (1879) referred the juvenile ventral valve from white limestone from Vápenice near Železná, north of Beroun (outside of the main part of the Silurian and Devonian synclinorium of the Barrandian) to the species *Discina maeotis* EICHWALD. Although small, this may be referred to the newly described species (Pl. 16, fig. 3).

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Radotín Limestones.

Localities: Kosoř (Černá rokle), Praha-Podolí, Lejškov, Železná (Vápenice).

Orbiculoidea tarda (BARRANDE, 1879)

Pl. 17, figs 1-6

1879 *Discina tarda* BARR.: Barrande, pl. 96, case IV, figs 1-5.

Lectotype (here selected): Dorsal valve figured by Barrande on pl. 96, case IV, fig. 1, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 16066), re-figured herein on pl. 17 as fig. 1.

Type horizon: Late Eifelian, Srbsko Formation.

Type locality: Srbsko.

Material. Two ventral valves, ten dorsal valves poorly preserved in siltstone.

Description: Shell of medium size, 8 mm wide, dorsi-biconvex, thin-walled, with circular outline.

Dorsal valve with submarginal beak, gently convex in transverse and lateral profiles, with evenly curved margin. Ventral valve with apex at posterior third, with distinct pedicle track and long internal pedicle tube opened internally near the posterior margin. Ornamentation of dorsal valve with fine and low, slightly wavy concentric fila, ventral valve with densely packed fine concentric rugellae.

Remarks: This species is poorly known and may be compared with other discinids with difficulty. All better known discinids from the Barrandian differ only slightly, mainly by more prominent ornament on the dorsal valve or by more anteriorly located dorsal apex.

Stratigraphical occurrence: Upper Eifelian to lower Givetian, Srbsko Formation;

Localities: Srbsko, Hostim, Praha-Barrandov (highway cut).

Genus ***Schizotreta*** KUTORGA, 1848

Type species: *Orbicula elliptica* KUTORGA, 1846; Ordovician, Volkhovian or Kundan Stages; Russia.

Schizotreta rarissima (BARRANDE, 1879)

Pl. 17, fig. 13

1879 *Discina rarissima* BARR.: Barrande, pl. 102, case V.

Holotype (by monotypy): Valve, probably dorsal, figured by Barrande (1879), pl. 102, case V, deposited in the National Museum, Prague (NM L 24448), re-figured herein on pl. 17, fig. 13.

Type horizon: Wenlock, Sheinwoodian, Motol Formation.

Type locality: Loděnice (in original spelling Lodenitz).

Material: Apart the holotype, a single dorsal valve.

Description: Shell small (length of holotype 8 mm), elongate oval, with apex at posterior one-sixth, 125 % as long as wide. Margins evenly curved, posterior margin conspicuously extended. Dorsal valve weakly convex in transverse profile. Lateral profile weakly and evenly convex anterior to the apex, but posterior slope flattened and almost straight. Ornamentation of weak concentric fila.

Comparison: *Schizotreta rarissima* (BARRANDE) differs from other discinids of the Barrandian by conspicuously elongate outline and extended posterior slope.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Locality: Loděnice (Černidla).

Genus ***Lochkothele*** HAVLÍČEK et MERGL, 1988

Type species: *Discina intermedia* BARRANDE, 1879; Devonian, Lochkovian; Barrandian, Bohemia.

Emended diagnosis: Ventri-biconvex, medium-sized discinid, subcircular in outline, rather thick-walled. Ventral valve asymmetrically depressed conical, with convex posterior and

concave anterior slopes. Beak subcentral. Pedicle track through-like, short and deep, internally continuing as a long pedicle tube; that is open internally near the posterior margin. Dorsal valve planar to gently convex, with apex located close to posterior margin.

Ventral interior with deeply impressed muscle scars posterior to the apex, dorsal valve with raised anterior edge of the visceral area. Pallial markings deeply impressed, densely branched.

Macroornamentation of concentric rugellae, arranged in regular intervals, with much finer concentric fila in interspaces. No sign of radial ornamentation.

Remarks: When erected, the genus was considered monospecific, containing *Lochkothele intermedia* (BARRANDE) only. Recently, the valves that may be referred to this genus are also known from the Řeporyje Limestone (Pragian), and poor remains were collected in the lower part of the Zlíchov Formation (Zlíchovian). Similar and unusually thick-walled shells are rare in the Suchomasty Limestone at Koněprusy area (Dalejan) (Pl. 18, fig. 13). Two valves from the Daleje Shale, figured and referred by Barrande (1879) to *Discina tarda* BARRANDE (Pl. 96, case V, figs 1 and 3, specimens NM L 16033 and NM L 16031; re-figured herein on pl. 18, figs 5, 6) may be also referred to *Lochkothele* HAVLÍČEK et MERGL. The species *Orbiculoidea* sp. A from the Lochkovian of North France (Bassett 1986) may be referred to the *Lochkothele* HAVLÍČEK et MERGL.

Lochkothele intermedia (BARRANDE, 1879)

Pl. 18, figs 1-12

1879 *Discina intermedia* BARR.: Barrande, pl. 99, case V, case VI.
1879 *Discina signata* BARR.: Barrande, pl. 99, case II.
1879 *Discina triangularis* BARR.: Barrande, pl. 101, case I.
1988 *Lochkothele intermedia* (BARRANDE, 1879): Havlíček and Mergl, p. 170, pl. I, figs 1-8, pl. 2, figs 1-3, text-fig.1.
1999 *Lochkothele intermedia* (BARRANDE): Havlíček, pl. 2, figs 1-4, 18.

Lectotype: Selected by Havlíček and Mergl (1988), ventral valve figured by Barrande (1879), pl. 99, case VI, fig. 2, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 16268), re-figured herein on pl. 28, fig. 12.

Paralectotypes: Ventral valves figured by Barrande (1879), pl. 99, case VI, fig. 1 (NM L 16268), fig. 3 (NM L 16269), fig. 4 (NM L 16270), deposited in the collections of the Department of Palaeontology, National Museum, Prague.

Type horizon: Lochkovian, Lochkov Formation, Radotín Limestone.

Type locality: Kosoř (Černá rokle) (original label Lochkow).

Material: Twenty dorsal and thirty ventral valves.

Remarks: Barrande (1879) referred all available ventral valves to *Discina intermedia* BARRANDE except the large, fractured valve, the holotype (by monotypy) of invalid species *Discina triangularis* BARRANDE (Pl. 101, case I), which is the subjective synonym of *Lochkothele intermedia* (BARRANDE). All dorsal valves figured by Barrande (1879) as species *Discina signata* BARRANDE, including the lectotype (Lectotype: *Discina signata* BARR., the dorsal valve from locality Lochkow, figured by Barrande in 1879 on pl. 99, case II, fig. 1, specimen NM L 16059; selected herein) belong to the species *L. intermedia*.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Radotín Limestone.

Localities: Kosoř, Lochkov, Velká Chuchle, Suchomasty, Klonk, Karlík.

Subfamily **Ivanothelinae** subfam. n.

Diagnosis: Small to medium-sized discinids of acrotretoid shape, having thick-walled shell, medium to highly asymmetrically conical ventral valve and operculum-like, flat to concave dorsal valve having a large visceral area. Pedicle foramen small, circular, with rudimentary, short listrium. Pedicle opening internally continuing as broad pedicle tube, which may be slightly asymmetrical.

Remarks: This subfamily is characteristic by moderately to highly conical, moderately thick-walled ventral shell and more thick-walled, operculum-like dorsal valve having subcentral apex. Ornamentation of dorsal valve relatively coarse, but ventral valve may bear only fine concentric fila.

All three included genera *Ivanothele* MERGL, *Acrosaccus* WILLARD and *Chynithele* HAVLÍČEK are homoeomorphous with the large Ordovician acrotretids, such as *Spondylotreta* COOPER and *Acrotreta* KUTORGA. Species of the genera *Ivanothele* and *Chynithele* probably laid freely, partly buried in unconsolidated fine carbonate sand and fixed by pedicle to small sedimentary particle or any hard substrate. Asymmetry of their ventral valves is significant, and is marked by a bent of the ventral apex.

Genera included:

Ivanothele MERGL, 1996; Silurian, Wenlock to Ludlow; Barrandian, Bohemia

Acrosaccus WILLARD, 1928; Ordovician to Silurian, Llanvirn to Wenlock; USA, Sweden, Kazakhstan, Bohemia.

Chynithele HAVLÍČEK, 1996; Devonian, Emsian to Givetian; Barrandian, Bohemia.

Genus ***Ivanothele*** MERGL, 1996

Type species: *Ivanothele mordor* MERGL, 1996; Silurian, Ludlow; Barrandian, Bohemia.

Ivanothele mordor MERGL, 1996

Pl. 19, figs 1-13.

1996 *Ivanothele mordor* sp. n.: Mergl, p. 123, pls 2, 3 and pl. 4, figs 1-3.

Description: See Mergl (1996).

Stratigraphical occurrence: Ludlow, Kopanina Formation (tuffaceous limestones with *Encrinuraspis storchi*).

Locality: Karlštejn ("Na rešnách" Quarry).

Ivanothele sp.

Pl. 29, figs 14, 17

Material: One incomplete dorsal valve, several fragments.

Remarks: This poorly known species is characterised by coarse, high concentric rugellae on nearly flat, 2 mm across dorsal valve. The valve is similar to dorsal valve of *Ivanothele mordor* MERGL, but new material is necessary for better comparison.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Locality: Loděnice (Černidla).

Genus *Acrosaccus* WILLARD, 1928

Type species: *Acrosaccus shuleri* WILLARD, 1928; Ordovician, Caradoc; Virginia, U.S.A.

Acrosaccus vexatus (BARRANDE, 1879)

Pl. 19, figs 15, 16; pl. 20, figs 1-10

1879 Discina vexata BARR.: Barrande, pl. 100, case III, figs 1, 3, 4.
?1879 *Discina reversa* V. K.: Barrande, pl. 96, case I, fig. 6.
1879 *Discina planula* BARR.: Barrande, pl. 102, case III.
?1879 *Discina Fritschi* BARR.: Barrande, pl. 110, case 4.

Lectotype: Selected here, dorsal valve, figured by Barrande (1879) on pl. 100, case III, fig. 1, deposited in the collections of the Department of Palaeontology, National Museum, Prague (NM L 16065), re-figured herein on pl. 20, fig. 4.

Type horizon: Wenlock, Sheinwoodian, Motol Formation.

Type locality: Loděnice (in original spelling Lodenitz).

Material: Eleven dorsal and three ventral valves, many fragments.

Description: Shell small, 5 mm in diameter, plano-convex, rather thick-walled, circular in outline. Dorsal valve nearly flat, with weakly raised apex but concave shell periphery. The apex at posterior third. Margins evenly curved, but may be slightly less curved at posterior margin. Ventral valve asymmetrically conical, with apex at posterior third. Anterior slope gently concave, posterior slope nearly straight or gently convex. Pedicle foramen minute, located at the top of the valve. It continues into long and relatively massive internal pedicle tube.

Ornamentation of dorsal valve prominent, formed by densely crowded concentric rugellae separated by narrower deep interspaces. The crests of rugellae are strongly swollen. Rugellae appear immediately near the larval shell and steadily increase in size toward the valve periphery.

Remarks: *Acrosaccus vexatus* (BARRANDE) is the only representative of the genus in the Silurian of the Barrandian. Barrande (1879) used four specimens when erecting this taxon, but their mutual affinity is unclear; therefore, three specimens cannot be referred to *Acrosaccus vexatus* without doubts.

Barrande (1879) figured several species, which may be synonymous with *Acrosaccus vexatus*. *Discina planula* BARRANDE (holotype by monotypy, dorsal valve from the locality Loděnice, figured by Barrande in 1879 on pl. 102, case III, specimen NM L 24447) is exfolited valve bearing limited information about external ornamentation, but otherwise similar to the lectotype. Generic affilation of *Discina fritschi* BARRANDE is similarly intricate; a single dorsal valve, the holotype (by monotypy) was referred by Havlíček (1998b) to the genus *Chynithele* HAVLÍČEK, but its ventral valve is currently unknown. Barrande (1848: pl. 23, figs. 17) referred to the species *Orbicula reversa* M. V. K. specimens of Silurian age. In 1879, he referred to the same species, but under the generic name *Discina* LAMARCK the specimens of Silurian age. However, the species *Orbicula reversa* DE VERNEUIL is the type species of the genus *Keyserlingia* PANDER. Because *Keyserlingia reversa* (DE VERNEUIL) is Upper Cambrian in age and is known only in Baltoscandia, all Barrande's references of this species from the Barrandian area must be taken as incorrect.

Acrosaccus vexatus has similar shape to *Chynithele ventricona* HAVLÍČEK, which is probably its descendant. Species *Acrosaccus shuleri* WILLARD and *A.* aff. *posteroconvexus* (COOPER) from the late Ordovician of Virginia and Kazakhstan, respectively (Holmer and Popov 2000, Nikitin et al. 1996) are remarkably similar to *A. vexatus* (BARRANDE), and indicate a long stratigraphic range and a morphological conservatism of this genus.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones); Ludlow, Ludfordian, Kopanina Formation.

Localities: Loděnice (Černidla), Koledník, Králův Dvůr (Dlouhá hora Hill).

Genus *Chynithele* HAVLÍČEK, 1996

Type species: *Chynithele ventricona* HAVLÍČEK, 1996; Devonian, Emsian; Barrandian, Bohemia.

Chynithele ventricona HAVLÍČEK, 1996

Pl. 20, figs 11-22; text-fig. 9

1879 *Discina surgens* BARR.: Barrande, pl. 101, case VIII, fig. 2.
1996 *Chynithele ventricona* sp. n.: Havlíček (in Havlíček and Vaněk 1996), p. 4, pl. 2, figs 5-8, text-fig. 1.

Material: Six dorsal and five ventral valves.

Emended description: Shell of medium size, plano-convex to concavo-convex, relatively thick-walled. Dorsal valve circular in outline, flat to weakly concave, with flat central disc and raised shell periphery. Dorsal apex at posterior 20 % of the length. Margins, including the posterior part, evenly curved,

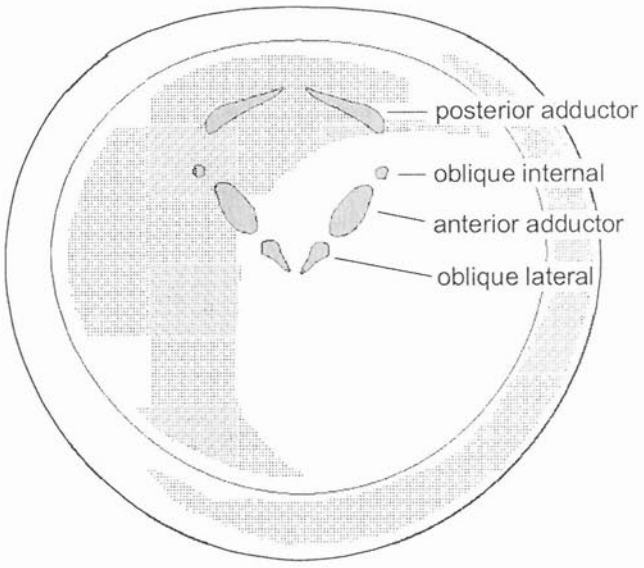


Fig. 9. *Chynithele ventricona* HAVLÍČEK, 1996. Dorsal valve interior with muscle scars.

maximum of shell width slightly posterior to midlength. Interior with widely rhomboidal visceral area which extends over midlength of valve. Visceral area bears distinct, but shallowly impressed muscle scars. There are oblique, fairly large central muscle scars at anterolateral border of the visceral area, smaller anterior lateral muscle scars at the centre of the valve and not well-impressed set of scars posterior and posterolateral to visceral area. A minute, pit-like scar, probably a site of middle lateral muscles lies lateral to visceral area. Posterior part of the visceral area forms distinct, circular and deep pit, with surface bearing epithelium cell moulds.

Ornamentation of dorsal valve with concentric, rather coarse, elevated rugellae, gently increasing in size toward the shell margin.

Ventral valve conical, about 60-80 % as high as wide, with apex gently posterior to midlength of the valve, sometimes with gently bent beak. Posterior slope slightly convex, anterior slope straight in lateral view, lateral margins poorly convex. Pedicle foramen at the top of valve. Minute, short pedicle track near beak continues internally into pedicle tube, which is opened posteriorly at 80 % of posterior slope. Muscle impressions on ventral valve interior poorly defined, with linear, oblique umbonal muscle scars impressed in the posterolateral slope of the valve. Exterior of ventral valve smoother than exterior of dorsal valve, with slightly weaker concentric fila.

Comparison: Havlíček (1996) suggested, that *Chynithele* HAVLÍČEK (Emsian age) has been derived from *Lochkothele* HAVLÍČEK et MERGL (Lochkovian age) by gradual elevation of ventral valve. However, there are significant differences, among others in the shape of the dorsal valve. Dorsal visceral area of *Lochkothele* is much smaller, highly raised anteriorly and muscle imprints are differently arranged. Moreover, dorsal valve of *Lochkothele* is convex and is not similar to an operculum. *Chynithele* is more probably derived from some small early Silurian species of *Acrosaccus* WILLARD. It is also worthwhile to note, that as well as the genus *Ivanothele* is known from biofacies rich in tabulates, rugose corals, crinoids, gastropods etc., the genus *Chynithele* occurs in reddish bioclastic limestones rich in corals, crinoids and locally also cystoids (Chýnice, Suchomasty, and Acanthopyge Limestones).

Stratigraphical occurrence: Lower Emsian, Zlíchov Formation, Chýnice Limestone; upper Emsian, Daleje–Třebotov Formation, Suchomasty Limestone; Eifelian, Choteč Formation, Acanthopyge Limestone.

Localities: Bubovice (Čeřinka Hill) and Koněprusy (Voskop, Zlatý kůň).

Subfamily **Disciniscinae** SCHUCHERT et LE VENE, 1929

Genus ***Kosoidea*** HAVLÍČEK et MERGL, 1988

Type species: *Kosoidea fissurella* HAVLÍČEK et MERGL, 1988; Silurian to Devonian, Ludlow to Lochkovian; Barrandian, Bohemia.

Kosoidea fissurella HAVLÍČEK et MERGL, 1988

Pl. 21, figs 16-19; text-fig. 10

?1879 *Discina incumbens* BARR.: Barrande, pl. 99, case IV, figs 1, 2.
1988 *Kosoidea fissurella* sp. n.: Havlíček and Mergl, p. 171, pl. 2, figs 4-8.

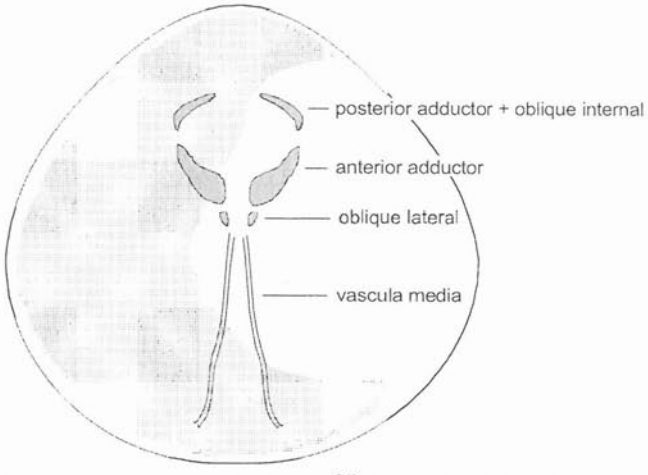


Fig. 10. *Kosoidea fissurella* HAVLÍČEK et MERGL, 1988. Dorsal valve interior with pallial markings and muscle scars.

Holotype: Ventral valve figured by Havlíček and Mergl (1988) on pl. 2, fig. 4 and 8, re-figured herein on pl. 21, fig. 16, deposited in the collection of the District Museum of Dr. B. Horák at Rokycany (MBHR 37893). The holotype comes from limestone of the *Encrinuraspis beaumonti* Horizon, Kopanina Formation at Kosov Quarry near Králův Dvůr.

Description: See Havlíček and Mergl (1988).

Remarks: This species was defined on rare material derived from single limestone bed at the Kosov Quarry near Králův Dvůr. A revision of the Barrande's material recovered, that several similar valves, unfortunately without fine morphological details preserved and without exact stratigraphical and locality data, may belong to this genus or even the same species. Of them, the dorsal valve, the lectotype of *Discina incumbens* BARRANDE (Pl. 99, case VI, fig. 1, re-figured herein on pl. 21, fig. 15) may belong to *Kosoidea fissurella* HAVLÍČEK et MERGL, but this cannot be confirmed with certainty.

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation.

Locality: The type locality only.

Kosoidea regalis HAVLÍČEK, 1999

1999 *Kosoidea regalis* sp. n.: Havlíček, p. 306, pl. 1, figs 4-6, 9, text-fig. 4.

Description: See Havlíček (1999).

Remarks: This quite recently defined species is lacking in the new material. Because the type material was not available to present author, the species is neither discussed nor figured herein.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Radotín and Kotýs Limestones.

Localities: Koněprusy (Čertovy schody), Řeporyje (Černý lom Quarry), Svatý Jan pod Skalou (Solway's Quarry), abandoned quarry between Karlštejn and Srbsko.

Genus ***Sterbinella*** gen. n.

Type species: *Sterbinella daphne* sp. n.; Silurian, Přídolí; Barrandian, Bohemia.

Name: *Sterbinella* (feminine), derived from a Czech word štěrbina - a narrow cut, concerning the shape of pedicle track.

Diagnosis: Minute disciniscine with depressed conical ventral valve and almost flat dorsal valve. Dorsal valve with submarginal apex, ventral apex subcentral. Pedicle track narrow, parallel-sided, emarginate at posterior end, by side with two parallel plates, open by narrow slit along whole length. Ornamentation of fine, wavy concentric fila.

Comparison: The new genus resembles *Praeoehlertella* gen. n. in similarly shaped pedicle track, but the former differs in depressed conical ventral valve, lack of concentric rugellae on the ventral valve surface and by more marginal dorsal apex. A pedicle track of the new genus is not completely closed and is opened by a narrow slit. The new genus represents evolutionary lineage distinct by ventri-biconvex shell, different from the *Kosoidea – Praeoehlertella* lineage, characterised by a convexo-planar shell.

Occurrence: Upper Silurian to Middle Devonian (Přídolí to Eifelian); Bohemia.

Species included: *Sterbinella daphne* sp. n. Silurian, Přídolí; Barrandian, Bohemia.

Sterbinella sp. Devonian, Eifelian; Barrandian, Bohemia.

Sterbinella daphne sp. n.

Pl. 21, figs 1-12

1879 *Discina reversa* V. K.: Barrande, pl. 96, case I, fig. 3.

Holotype: Ventral valve figured on pl. 21, fig. 8 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 526).

Type horizon: Přídolí, Požáry Formation, lower part.

Type locality: Králův Dvůr, Kosov Quarry, east wall.

Name: *daphne* (Greek) – after a Greek nymph (Daphne).

Material: Twenty ventral and 15 dorsal valves.

Description: Shell ventri-biconvex, thin-walled, circular in outline, small, with maximum width 3 mm.

Dorsal valve with submarginal beak, circular in outline, with maximum width at or slightly anterior to midlength. Dorsal apex distinctly and highly raised above adjacent surface of valve, with larval shell directed dorsally. Posterior slope gently inclined in medium and large sized specimens; juvenile specimens possess nearly marginal beak. Anterior slope poorly convex in lateral profile. Transverse profile of the valve weakly convex, with conspicuously pointed juvenile shell. Dorsal larval shell transversely oval, smooth. Dorsal valve interior with rather large, oblique central muscle scars and poorly defined other muscle scars

Ventral valve asymmetrically depressed conical, with apex posterior to the centre of valve and directed posteroventrally. Steeper posterior slope and weaker anterior slope straight, lateral slopes poorly convex. Pedicle track distinct, parallel-sided. Its side slopes are formed by two narrow, dorsally bent plates, almost united along axis of track, leaving only very narrow slit along whole length of the track. Posterior end of the pedicle track is deeply emarginate. Interior of ventral valve without any muscle impressions.

Ornamentation in the dorsal valve of fine, slightly wavy concentric fila. Ventral valve has slightly coarser concentric fila evenly spaced over anterior part of the valve. Concentric fila become coarser and bent anterior in the narrow area along the pedicle track, being crossed by several fine radial fila there. Surface of marginal plates in the pedicle track are covered by fine growth fila. Microornamentation consists of radial rows with shallow pits, entirely covering the post-larval shell. Surface of the larval shell is smooth.

Remarks: The ventral valve of this species was figured by Barrande (1879) on pl. 96, case I, fig. 3 and referred by him to the species *Discina reversa* VERNEUIL et KAYSERLING, with the locality name "Dlauha hora". Adjacent fragmentary pygidium of a proetide trilobite *Prionopeltis striata* present on the same slab corresponds with the new stratigraphical data, indicating the lower part of the Požáry Formation.

Stratigraphical occurrence: Přídolí, Přídolí Formation, lower part.

Localities: Králův Dvůr (Dlouhá hora Hill, Kosov Quarry), Koledník.

Sterbinella sp.

Pl. 21, figs 13, 14

Material: One ventral valve, several fragments.

Remarks: Occurrence of these specimens indicates a long stratigraphical range of the genus. Its slit-like pedicle track is similarly shaped as in the species *Sterbinella daphne* sp. n. together with the posteroventrally directed apex and fine concentric fila on outer shell surface.

Stratigraphical occurrence: Eifelian, Choteč Formation, Choteč Limestone.

Locality: Praha-Holyně (Prastav Quarry).

Genus ***Praeoehlertella*** gen. n.

Type species: *Praeoehlertella umbrosa* sp. n.; Devonian, Pragian; Barrandian, Bohemia.

Name: *Praeoehlertella* (feminine), derived from a brachiopod generic name *Oehlertella* and Latin prefix *prae* – pre – (preceding).

Diagnosis: Medium sized disciniscine with elongate oval outline, marginal pedicle opening located at the posterior emargination of subparallel-sided pedicle track, having acute edge at contact with adjacent shell surface; pedicle track almost completely covered by listrium. Listrium consists of two marginal bands, separated from each other by a thin axial groove. Dorsal valve with submarginal beak. Surface with fine concentric ornamentation of fine rugellae or fila in the dorsal valve and concentric fila passing in regular intervals into, coarser rugellae in the ventral valve.

Remarks: Shape of the pedicle track is reminiscent of narrow ventral pseudointerarea of lingulates. The listrium of *Praeoehlertella* consists of two narrow bands and axial narrow groove; two paired lateral, narrowly triangular bands along margins of the listrium are probably homologous to outer and inner propareas, and axial groove is homologous to the pedicle groove of obolids. This arrangement may be simply achieved by overturning of obolid-type pseudointerarea into the extreme procline position. Then, the emarginate posterior margin of pedicle track is homologous to the anterior edge of ventral pseudointerarea of obolids.

Comparison: The new genus is similar to *Oehlertella* HALL et CLARKE, but the latter has broader, subparallel pedicle track which is located in the depressed area of the valve. This depression is very weak and pedicle track remains triangular

in *Praeoehlertella* gen. n. In addition, *Oehlertella* is restricted to the Carboniferous strata. Genus *Kosoidea* HAVLÍČEK et MERGL, which is known from the Silurian and Lower Devonian of the Barrandian, differs from the new genus by a higher, subconical dorsal valve, and its pedicle opening is situated in the deep, slit-like, posteriorly nearly closed depression.

Occurrence: Lower Silurian to Lower Devonian (Llandovery to Pragian); Bohemia.

Species included: *Praeoehlertella umbrosa* sp. n. Devonian, Pragian; Barrandian, Bohemia.

Praeoehlertella georgiana sp. n. Silurian, Llandovery; Barrandian, Bohemia.

Praeohlertella umbrosa sp. n.

Pl. 22, figs 1-6

Holotype: Ventral valve figured on pl. 22 as fig. 4, deposited in the collections of the Museum of Dr. B. Horák, Rokycany (MBHR 49779).

Paratype: Dorsal valve figured on pl. 22 as fig. 1, deposited in the collections of the Museum of Dr. B. Horák, Rokycany (MBHR 49799).

Type horizon: Pragian, Praha Formation, black shale intercalation with *Monograptus atopus*.

Type locality: Svatý Jan pod Skalou, Stydlé vody Quarry.

Name: *umbrosus* (Lat.) – shady, dark.

Material: Ten ventral and fifteen dorsal valves.

Description: Shell weakly convexo-plane, thin-walled, 7 mm long in adult specimens.

Dorsal valve elongate oval, 110-115 % as long as wide, with submarginal beak. Maximum width at midlength. The valve is very low, asymmetrically conical, with straight, steep posterior slope and evenly sloping and slightly convex anterior slope. Transverse profile weakly convex at midlength, but apical region with larval shell is much raised. Larval shell circular, smooth, moderately convex, inclined posteriorly. Interior unknown.

Ornamentation of fine concentric fila of uniform size, with numerous concentric bands indicating the interruption of the shell growth. Microornamentation unknown.

Ventral valve nearly flat (all available specimens are depressed in shale and fractured along pedicle slit). Apex located in posterior 40 % of valve length. Pedicle track apically closed by a shallow listrium, which continues posteriorly and leaves only narrow pedicle slit near emarginate posterior margin of the valve. Contact of the listrium and adjacent shell surface is acute, with distinct edge. Sides of the listrium form two subparallel bands, concave in transverse profile, along the axis and along the whole length of pedicle track united by a prominent elevated pad. Ornamentation of ventral valve of concentric fila, which in regular intervals pass into slightly coarser concentric rugellae.

Stratigraphical occurrence: Pragian, Praha Formation, black shale intercalations with *Monograptus atopus*.

Locality: The type locality only.

Praeoehlertella georgiana sp. n.

Pl. 22, figs 7-13

Holotype: Ventral valve figured on pl. 22, figs 7, 9 deposited in the palaeontological collections of the Department of

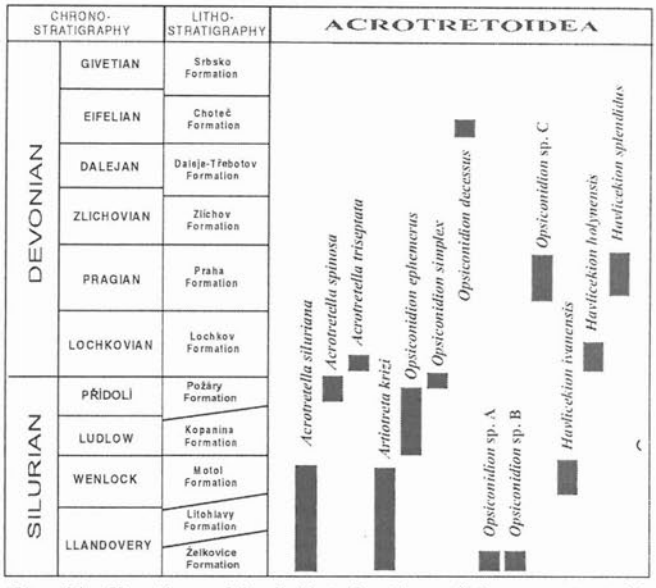


Fig. 11: Stratigraphical distribution of the acrotretoid brachiopods in the Barrandian.

Biology, University of West Bohemia, Plzeň (PCZCU 509).

Paratype: Dorsal valve figured on pl. 22, fig. 10 deposited in the collections of the Museum of Dr. B. Horák, Rokycany (MBHR 75662).

Type horizon: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone).

Type locality: Hýskov, V Jakubinkách.

Name: *georgiana*, derived from a name *Georgius* (Lat.) – George.

Material: Three dorsal and three ventral valves.

Description: Elongate elliptical to subcircular, 11 mm wide, convexo-plane, thin-walled shell.

Dorsal valve with apex at posterior third, gently convex in transverse and lateral profiles. Ventral valve flat, with the apex at posterior third. Pedicle track narrowly triangular, with narrowly triangular emargination at posterior margin. Side of pedicle track with paired plates of listrium similar to plates of the type species.

Ornamentation of dorsal valve of regularly spaced concentric rugellae, more distant anteriorly than apically. Ornamentation of ventral valve consists of densely arranged concentric rugellae, 9-10 in number per 2 mm anteromedianly.

Remarks: The species *Praeoehlertella georgiana* sp. n. differs from *P. umbrosa* sp. n. by coarser and more densely spaced rugellae.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone).

Locality: The type locality only.

Family **Trematidae** SCHUCHERT, 1893

Genus *Opatrilkiella* gen. n.

Type species: *Opatrilkiella minuta* sp. n.; Silurian, Přídolí; Barrandian, Bohemia.

Name: *Opatrilkiella* (feminine): After the type locality Opatřilka Quarry near Praha-Holyně.

Diagnosis: Minute trematid with elongate-oval outline,

submarginal ventral and marginal dorsal apex, minute and short pedicle track, closed by a pair of listrial plates almost along entire length. Pedicle opening forms short and narrow slit. Dorsal valve with minute pseudointerarea having preserved short, broadly triangular median groove. Exterior with weak concentric fila crossed by narrow wavy arrays of minute pits. Larval shell smooth, post-larval shell with very fine pitting. Interior with large visceral area and no traces of pallial markings.

Comparison: *Opatrilkiella* gen. n. differs from other trematids by marginal dorsal beak, unique arrangement of unusually short ventral pedicle track, which is bisected by short pedicle slit. A minute size may be also taken as a characteristic feature of the new genus. The genus *Opatrilkiella* is rather similar to genus *Schizobolus* ULRICH known from the Lower to Upper Devonian strata and recently revised by Baliński and Holmer (1999); the new genus, however, may be distinguished from type species by much shorter pedicle notch and well developed listrial plate. Baliński and Holmer (1999) described minute trematid *Schizobolus polonicus* BALIŃSKI et HOLMER from the late Devonian of Poland, which is externally very similar to the new genus. This species may be accommodated in *Opatrilkiella* gen. n. instead of *Schizobolus* ULRICH.

Occurrence: Upper Silurian to Upper Devonian (Přídolí to Famennian); Bohemia, Poland.

Species included: *Opatrilkiella minuta* sp. n. Silurian, Přidolí; Barrandian, Bohemia.

Opatrilkiella sp. A; Devonian, Eifelian; Barrandian, Bohemia.

Opatrilkiella (?) sp. B; Devonian, Eifelian; Barrandian, Bohemia.

Schizobolus polonicus BALIŃSKI et HOLMER, 1999; Devonian, Famennian; Holy Cross Mts, Poland.

Opatrilkiella minuta sp. n.

Pl. 23, figs 1-13; pl. 24, figs 1-5, 8

Holotype: Ventral valve, figured on pl. 23, figs 8, 10, 11, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 130).

Paratype: Dorsal valve, figured on pl. 23, figs 3, 7, 12, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 124).

Type horizon: Přídolí, Požáry Formation, upper part.

Type locality: Praha-Holyně, Opatřilka Quarry, east wall.

Name: *minutus* (Lat.) - small.

Material: Several dozen valves, both ventral and dorsal.

Description: Shell biconvex, thin-walled, minute, about 1.5 mm long in largest specimens available, 120 – 150 % as long as wide.

Dorsal valve with marginal apex, elongate oval, widest in anterior third, evenly convex in transverse profile and more convex posteriorly than anteriorly. Margins evenly curved. Smooth larval shell at the dorsal apex with imperfectly defined margins, slightly inclined posteriorly. Dorsal pseudointerarea is rudimentary, restricted to thickened posterior valve margin, with median groove steeply sloping at posterior valve floor, in steeply apsacline position.

Dorsal valve interior with large visceral area, roundly and broadly rhomboidal in outline, 50 % as long and 40 % as wide as valve. Surface of visceral area is not elevated above adjacent valve floor. Visceral area is anteromedianly halved by a low and narrow ridge, which bifurcates at anterior end. Centre of visceral area smooth, but its posterolateral part bears fine, deep imprints of epithelium cells. Valve floor anterior to visceral area bears finer and shallower pitting.

Ventral valve elongate oval, with submarginal apex and emarginate posterior margin. Lateral and anterior margins evenly curved. Valve moderately and evenly curved in transverse profile with gently convex anterior slope in lateral profile. Posterior margin with small, short, broadly triangular pedicle track, separated by sharp edge from adjacent surface of post-larval shell. Pedicle track almost completely covered by listrium, but it is halved posteromedianly by narrow pedicle slit. Larval shell poorly defined, smooth.

Ventral valve interior with thickened edge of pedicle slit. Visceral area shorter than dorsal visceral area, with obscure borders. There are oblique, narrow central muscle scars, defined by smooth surface of valve floor, separated from each another by small, subcircular area. Surface in the posterolateral part of visceral area bears subangular, concave pits, which correspond to moulds of visceral epithelium cells. Anterior to muscle scar is valve floor covered by shallow, pentagonal epithelium cell moulds. They are distinguished by flat bottoms.

Shell exterior bears low, poorly defined concentric fila, more distinct posterolaterally than anteriorly, 15-20 μm apart. Radial ornamentation is formed by irregular, narrow arrays of shallow circular pits, superimposed on concentric ornamentation. Some of the radial arrays run a long distance but others are much shorter. These arrays and adjacent radial folds are the same as described by Williams and Curry, 1991 in discinoid *Orbiculoidea nitida* (PHILLIPS), but arrays of the new species are not so broad. Microornamentation of discinid type, consists of fine shallow, transverse pits, arranged in divaricate pattern, 1.5 – 1.8 μm wide.

Stratigraphical occurrence: Přídolí, Požáry Formation, upper part.

Localities: Praha-Holyně (Opatřilka Quarry), Králův Dvůr (Kosov Hill).

Opatrilkiella sp. A

Pl. 24, figs 6, 7, 9, 11, 12

Material: Six ventral and four dorsal valves, many fragments.

Remarks: This species is externally and internally very near to *O. minuta* sp. n., but differs by ornamentation and its outline is somewhat broader. Its surface lacks well defined radial rows of circular pits that are distinct in *O. minuta*. Presence of this species in the Choteč Formation extends a range of the genus *Opatrilkiella* into the early Middle Devonian (Eifelian).

Stratigraphical occurrence: Eifelian, Choteč Formation, basal layers.

Localities: Praha-Holyně (Prastav Quarry), Choteč.

Opatrilkiella (?) sp. B

Pl. 24, fig. 10

Material: Two ventral valves.

Remark. This species differs from stratigraphically older species *O. minuta* sp. n. and from associated *O.* sp. A by more

circular shell outline, lack of radial rows of pits on shell exterior and by wavy course of concentric fila. Its pedicle track is broadly triangular, with a shallow emargination near posterior margin.

Stratigraphical occurrence: Eifelian, Choteč Formation, basal layers.

Localities: Praha-Holyně (Prastav Quarry), Choteč.

Order **Acrotretida** KUHN, 1949

Superfamily **Acrotretoidea** SCHUCHERT, 1893

Remarks: Members of the superfamily Acrotretoidea SCHUCHERT were diversified and abundant during the Cambrian and Ordovician periods, but since beginning of the Silurian, their diversity and abundance rapidly decreased. Currently, five acrotretoid genera are known from the Silurian and Devonian. Apart from the genus *Opsiconidion* LUDVIGSEN, all remaining genera have been described as monospecific: genera *Eschatelasma* POPOV, *Acrotretella* IRELAND and *Artiotreta* IRELAND are known from Llandovery to Wenlock, and *Concaviseptum* BROCK et al. from the Pragian.

Family **Acrotretidae** SCHUCHERT, 1893

Genus *Acrotretella* IRELAND, 1961

Type species: *Acrotretella siluriana* IRELAND, 1961; Upper Silurian; Oklahoma, U.S.A.

Remarks: The type species derived from the Lower Silurian of Oklahoma where it is not very common; Ireland's description is based on eight ventral and sixteen dorsal valves. Apart from the type locality, broken dorsal valves of *Acrotretella* have been reported by Ireland (1961) from the Wenlock limestones of Hereford, England. Further occurrence of *Acrotretella siluriana* IRELAND is noted, but not figured by Chatterton and Whitehead (1987) from the Silurian of Oklahoma. The only Ordovician representative of *Acrotretella* sp. has been reported from the Bestorp, Slandrom and Dalby Limestones of Southern Sweden (Holmer 1986, 1989).

In Central Bohemia, the genus *Acrotretella*, although generally uncommon, is represented by several distinct species, ranging from the Lower Silurian to Lower Devonian. The earliest known representative is known from the Želkovice Formation (Llandovery, Aeronian, *D. convolutus* Biozone), the latest species comes from the Kotýs Limestone (Lochkovian, Lochkov Formation, *M. uniformis* Biozone).

Acrotretella siluriana IRELAND, 1961

Pl. 25, figs 1-17

1961 *Acrotretella siluriana* IRELAND sp. n.: Ireland, p. 1140, pl. 137, figs 13-18.

Material: Ten dorsal and five ventral valves.

Description: Shell small, rather thick-walled, slightly over 1 mm wide in adults.

Dorsal valve generally transversely oval, 125-140 % as long as wide, but there are also much less transverse valves. Maximum width posterior to midlength. Posterior margin almost straight, with orthocline, slightly posteriorly extended pseudointerarea. Anterior edge of pseudointerarea may be weakly emarginate. The valve is flat or inconspicuously concave in side view with raised larval shell and a weak fold in posteromedian sector. Larval shell subcircular, 150 μm wide, with single, elongate oval and low, mound-shaped protegular node. Dorsal pseudointerarea about two-third of shell width, with broadly triangular and feebly concave median groove. Young valve has low, simple septum in anterior half of the valve, with pointed anterior; medium and large adult valves have higher, blade-like septum. The septum is elevated from anterior third of the valve with the top anterior to midlength and front edge nearby anterior valve margin. Septum is low, triangular in side view, about a half high as long. Proximal posteroventral crest of median septum bears short, concave surmounting plate. The length of surmounting plate is some 40 % of the septum. Cardinal muscle scars very large, but only weakly impressed.

Ventral valve broadly conical, with evenly convex anterior slope and steep, flattened and almost catacline ventral pseudointerarea. Larval shell distinctly subcircular, apically penetrated by circular pedicle foramen. Pedicle foramen rests at bottom of the moderately deep, anteriorly open depression of a larval shell. Pseudointerarea with obscure borders, distinctly depressed to gently concave without intertrough or interridge.

Ornamentation of ventral valve with concentric coarse rounded rugellae, some 5-7 μm wide, arranged in regular intervals over entire shell, except on surface of ventral pseudointerarea, where they disappear. Ornamentation of dorsal valve of concentric rugellae, nearly evenly spaced. Microornamentation of larval shell weak, consisting of densely packed minute, shallow circular pits.

Remarks: The material from the Želkovice and Motol Formations cannot be safely distinguished from the type material of Ireland (1961). Bohemian valves also have coarse concentric rugellae, as figured by Ireland (1961; pl. 137, figs 16, 17) and median septum is simple, with concave surmounting plate.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone); Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Hýskov (V Jakubinkách), Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny).

Acrotretella spinosa sp. n.

Pl. 26, figs 1-14; pl. 27, figs 1-8

Holotype: Dorsal valve, figured on pl. 16, figs 3, 6, 8, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 069).

Paratype: Ventral valve, figured on pl. 17, figs 1, 3, 5 deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 070).

Type horizon: Přídolí, Požáry Formation, upper part, *M. transgrediens* Interzone.

Type locality: Praha-Holyně, Opatřilka Quarry, east wall.

Name: *spinosus* (Lat.) – spinose.

Material: Twenty dorsal and six ventral valves.

Description: Shell small, rather thick-walled, 0.9 mm wide in adults.

Dorsal valve transversely oval to subrectangular, 110-120 % as wide as long, with straight posterior margin and slightly variable curvature of anterior margin. Maximum width in midlength. Valve flat or moderately concave, with raised larval shell and a weak fold in posteromedian sector. Larval shell subcircular, 150 μm wide, with single, elongate oval and low, mound-shaped protegular node. Junction between larval shell and brephic shell sharp. Dorsal pseudointerarea about two-third of shell width, with broadly triangular and feebly concave median groove. Shape of the median septum changes with ontogenetic stage. Young valve has low, simple septum in anterior half of the valve, but medium and large adult valves have higher, more complex septum. Their septum is elevated from anterior third of the valve with the top anterior to midlength and front edge near anterior valve margin. Septum is highly triangular in side view, as high as long. The crest of septum bears swollen, acutely pointed rod. Accessory, less massive rods, four to seven in number, are embedded into septal plate. All rods are pointed, and directed anteroventrally. Proximal posteroventral crest of median septum bears concave surmounting plate, which is formed by two ridges laterally adjacent to septum. The length of surmounting plate is some 40 % of the septum. Cardinal muscle scars large, but only weakly impressed. Epithelial cell moulds have not been observed in any valves examined.

Ventral valve broadly conical, with evenly convex anterior slope and steep, flattened almost catacline ventral pseudointerarea. Larval shell distinct, subcircular, with circular pedicle foramen located in its centre. Foramen is directed ventrally and lies at bottom of the deep, anteriorly open depression of larval shell. Pseudointerarea with obscure borders, weakly depressed, without intertrough and interridge. Its axis show a few, fine irregular nicks.

Dorsal valve exterior with concentric rugellae, more densely squeezed during later growth stages. Ornamentation of ventral valve with prominent rounded concentric rugellae, some 5-7 μm wide, arranged in regular intervals over entire shell, except on surface of ventral pseudointerarea, where some of them gradually disappear. Rugellae are 10-15 μm apart in anteromedian shell surface. Interspaces are flat, with numerous subcircular to elliptical holes of uneven size (Pl. 27, figs 6, 7). These empty places may be interpreted as the sites of unpreserved organic material. Microornament of larval shell weak, consisting of densely packed minute, shallow circular pits (Pl. 26, fig. 14).

Remarks: The new species differs from *Acrotretella siluriana* IRELAND by remarkably high and spinose median septum, but fine morphology of the type species has never been described. Paratypes of *A. siluriana*, figured by Ireland (1961) have much coarsely rugellate exterior than the new species. Ornamentation of species *Acrotretella* sp. reported by Holmer (1986, 1989) from the Upper Ordovician of Sweden is also much finer than in *A. spinosa*. The ventral valve figured by Holmer (1986, fig. 9: K-M) lacks median depression of ventral larval valve.

Stratigraphical occurrence: Přídolí, Přídolí Formation, upper part (*M. transgrediens* Interzone).

Localities: Praha-Holyně (Opatřilka Quarry, east wall), Koledník (Na čihadle).

Acrotretella triseptata sp. n.

Pl. 27, figs 9-11

Holotype: Dorsal valve, figured on pl. 27, figs 9-11, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 368).

Type horizon: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part, *M. uniformis* Biozone.

Type locality: Praha-Řeporyje, Černý lom Quarry, east wall.

Name: *triseptata*, derived from Latin *tres* – three, *septum* - ridge.

Material: Two dorsal valves.

Description: Dorsal valve subcircular, 115 % as long as wide, with evenly curved outline. Dorsal pseudointerarea short, with broadly triangular, transversely striated median groove. Interior with three septa. Median septum moderately high, with concave surmounting plate about 50 % long as the septum. Anterior edge of the septum bears four short, acute spines. A pair of short accessory septa is placed in anterolateral to visceral area. Septa bear two or three tumid spines along their anterior edge. Muscle scars obscure.

Remarks: This species is based on a single valve, but the original collection contained another shell fragment with the same paired accessory septa. Presence of accessory septa is an unique feature, unknown in any other species of *Acrotretella*. Moreover, the new species is the stratigraphically youngest occurrence of the genus. Therefore, an erection of the new species seems to be justified.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part, *M. uniformis* Biozone.

Locality: The type locality only.

Family **Scaphelasmatidae** ROWELL, 1965

Genus *Artiotreta* IRELAND, 1961

Type species: *Artiotreta parva* IRELAND, 1961; Upper Silurian; Oklahoma, U.S.A.

Artiotreta krizi sp. n.

Pl. 28, figs 1-11

Holotype: Complete shell, figured on pl. 28, figs 1, 2, 6, 7, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 427).

Type horizon: Llandovery, Aeronian, Želkovice Formation, *D. convolutus* Biozone.

Type locality: Hýskov, V Jakubinkách.

Name: After Dr. Jiří Kříž, the famous Czech palaeontologist.

Material: Two complete shells, three dorsal valves, several fragments.

Description: Shell thick-walled, 1.1 mm wide in the largest specimen.

Dorsal valve flat, with prominent mound-like larval shell, without any sign of sinus. Valve outline subrectangular, with evenly curved lateral margins but straight posterior margin and weakly curved front margin. Dorsal pseudointerarea small, with distinct, concave median groove. Dorsal interior with thick and high median septum. It appears just posterior to valve centre, and disappears immediately before thickened anterior marginal brim of the valve. Septum is very high, almost as high as long, roundly triangular in outline, with rounded edge, without any surmounting plate. Interior of valve with large, deeply embedded impressions of cardinal muscle scars. Periphery of the valve thickened.

Exterior of dorsal valve with subcircular, prominent larval shell, 200 μm wide. Larval shell strongly convex, steeply facing posteriorly, with thickened margins elevated above surface of juvenile shell. Microornamentation of circular, regular shallow pits 3-4 μm in diameter. Juvenile shell covered by prominent, raised, densely arranged rugellae, separated by deep and much narrower interspaces. Surface of rugellae bears fine concentric fila. There are 6 to 7 rugellae per 100 μm anteromedianly.

Ventral valve is lowly conical, about 40-50 % as high as wide, with rounded apex. Ventral pseudointerarea narrow, apsacline, parallel-sided and depressed below adjacent shell surface. Ornamentation of coarse rugellae, evenly covering entire shell surface.

Remarks: New species is similar to *Artiotreta parva* IRELAND from the Lower Silurian of Oklahoma (Ireland 1961, Chatterton and Whitehead 1987), but *A. krizi* sp. n. differs by much coarser ornamentation and subrectagular outline of dorsal valve.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone); Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Hýskov (V Jakubinkách), Loděnice (Černidla).

Family **Biernatidae** HOLMER, 1989

Genus ***Opsiconidion*** LUDVIGSEN, 1974

Type species: *Opsiconidion arcticon* LUDVIGSEN, 1974; Devonian, Emsian; Yukon, Canada.

Synonymy: *Caenotreta* COCKS, 1979

Remarks: Genus *Opsiconidion* LUDVIGSEN, 1974 has remarkably long stratigraphical range as well as wide geographical distribution. The earliest member of the genus is known from the late Ordovician of Estonia (Popov et al. 1994), the latest one in Givetian (Brock et al. 1995). All species referred to the genus and listed below have similar shell morphology; differences between particular species are very fine, mostly in outline of dorsal valve, height of ventral valve and nature of dorsal median septum.

Species referred to the genus: *Caenotreta aldridgei* COCKS, 1979; Silurian, Llandovery; Great Britain.

Opsiconidion aldridgei (COCKS, 1979); Silurian, Llandovery; Estonia.

Caenotreta sp. cf. *Caenotreta aldridgei* COCKS, 1979; Devonian, Lochkovian to Pragian; Australia, New South Wales.

Opsiconidion arcticon LUDVIGSEN, 1974; Devonian, Lochkovian to Emsian; Canada, Australia.

Caenotreta celloni COCKS, 1979; Silurian, Llandovery; Austria.

Opsiconidion aff. *celloni* (COCKS, 1979); Silurian, Wenlock; Poland.

Opsiconidion decessus sp. n.; Devonian, Eifelian; Bohemia.

Caenotreta ephemera MERGL, 1982; Silurian, Ludlow; Bohemia.

Opsiconidion minor POPOV, 1981; Devonian, Pragian to Givetian; Novaya Zemlya, Australia.

Opsiconidion podlasiensis BIERNAT, 1984; Silurian, Wenlock; Poland.

Opsiconidion praecursor POPOV et al. 1994; Ordovician, Harju; Estonia.

Opsiconidion simplex sp. n.; Silurian, Přídolí; Bohemia.

Opsiconidion sp.; Ordovician to Devonian, Ashgill to Pragian; Austria (Cocks, 1979), Canada (Von Bitter and Ludvigsen, 1979), Bohemia.

Opsiconidion ephemerus (Mergl, 1982)

Pl. 29, figs 1-9

1982 *Caenotreta ephemera* sp. n.: Mergl, p. 115, pl. 1, 2.

Neotype: Dorsal valve figured herein on pl. 29, figs 6, 7. The holotype and all original paratypes were lost (totally destroyed during SEM investigation). Therefore, the neotype was selected from the specimens derived from the same type horizon of the type locality: Ludfordian, Kopanina Formation, *Encrinuraspis beaumonti* Horizon (*M. fritschi linearis* Biozone) in the locality Praha-Řeporyje, Mušlovka Quarry. The neotype is deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 273).

Material: About one hundred valves, some of them conjoined.

Emended description: Detailed description has been given by Mergl (1982). New material recovers yet unknown microornamentation. Exterior of post-larval shell bears low growth fila of variable size, interrupted by fine, short folds disposed in radial rows. Surface of ventral pseudointerarea indicated by less prominent growth fila. Microornamentation of pseudointerarea with radial, sharply cut striae, superimposed on growth fila. Number and shape of striae are highly variable. In some valves (Pl. 29, fig. 9), striae are densely packed to form narrow radial area similar to intertrough, while other specimens have only a few, distant striae.

Remarks: Species *Opsiconidion ephemerus* (MERGL) is well characterised by large size; height of acutely conical ventral valve may reach 1.5 mm. Species is very close to *O. celloni* (COCKS), but *O. ephemerus* has less distinct lower rod in the septal plate. The species *O. ephemerus* (MERGL) has the most extensive stratigraphical range of all biernatids in the Barrandian with remarkably uniform morphology. It is present almost regularly in all samples derived from bioclastic platy and lenticular limestones of upper part of the Kopanina and lower and middle part of the Požáry Formations.

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation (upper part) to Přídolí, Požáry Formation (lower to middle part).

Localities: Species is widespread at Praha-Řeporyje (Mušlovka Quarry), Praha-Holyně (Opatřilka Quarry) and Králův Dvůr (Kosov Quarry).

Opsiconidion simplex sp. n.

Pl. 30, figs 1-17

Holotype: Dorsal valve, figured on pl. 30, figs 7, 12, 13, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 086).

Paratype: Ventral valve, figured on pl. 30, fig. 1, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 116).

Type horizon: Přídolí, Požáry Formation, upper part, *M. transgrediens* Interzone.

Type locality: Praha-Holyně, Opatřilka Quarry, east wall.

Name: *simplex* (Lat.) – simple, concerning dorsal septum morphology.

Material: Several hundred valves.

Description: Shell thin-walled, 0.5 mm wide, with conspicuously unisulcate commissure.

Dorsal valve weakly convex, circular in outline, 95-100 % as long as wide, widest at midlength. Valve margins evenly curved, posterolateral margin subtends 120-130° angle at dorsal apex. Weak and broad sulcus is well-developed in medium to large adult valves. Posterior margin with incipient, anacline, widely triangular and short pseudointerarea, its width equal to 30 % of shell width. Dorsal interior with delicate median septum originating immediately in front of pseudointerarea, and extending to 65-70 % of valve length. Septum low, 25-30 % high as long, formed by simple thickened and unflattened rod resting on crest of low and thin plate. Anterior edge of septal plate is concave in side view. Muscle scars weakly impressed on valve floor. Cardinal muscle scars obliquely oval, situated posterolaterally, rather close to each another. Central muscle scars weakly defined, of kidney-shaped outline, anteriorly extend to 40 % of valve length.

Larval shell bears two diverging and anteriorly widening ridges. Shell is distinctly separated by a raised edge from post-larval juvenile shell. Exterior of post-larval shell covered by weak concentric fila interrupted by frequent discrete folds.

Ventral valve acutely, asymmetrically conical, some 85-90 % wide as high, with steep, weakly convex anterior slope. Anterior slope much extended, attaining about 150-170 % of posterior slope length. Ventral pseudointerarea apsacline, with obscure boundary, narrowly triangular, unflattened, marked by weak changes in shell ornamentation. Larval shell pointed, asymmetrically conical, with distinct anterior border elevated above juvenile shell. Larval shell is penetrated by circular pedicle foramen of 200-250 μm diameter, situated at top of the acutely conical short pedicle tube. Apex is directed posteroventrally, covered by circular protegular pits. Vesicles were originally of uniform size, but corresponding protegular pits are densely overlapping and cross-hatched.

Ornamentation of ventral post-larval shell of fine concentric fila of uniform size, separated by wide interspaces. Fila are crossed by numerous discrete folds, arranged in radial rows on entire post-larval shell, but more densely present at anterior slope. The resulting ornamentation looks like radial fila under weaker magnification.

Comparison: New species differs from all yet described species of *Opsiconidion* LUDVIGSEN by low and simple morphology of dorsal septum, without flattened surmounting plate and accessory rod embedded in a septal plate. Ventral valve of *O. simplex* sp. n. is similar to *O. ephemerus* (MERGL), but the posterior slope of *O. simplex* sp. n. has more apsacline position than pseudointerarea of *O. ephemerus*.

Stratigraphical occurrence: Přídolí, Přídolí Formation, upper part (*M. transgrediens* Interzone).

Localities: Praha-Holyně, Opatřilka Quarry (east wall), Kolednik (Na čihadle).

Opsiconidion decessus sp. n.

Pl. 31, figs 4-16

Holotype: Dorsal valve, figured on pl. 31, figs 5, 6, 7, 16, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 216).

Paratype: Ventral valve, figured on pl. 31, figs 10, 11, 13, 14, 15, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 213).

Type horizon: Eifelian, Choteč Formation, base of bed no. 13.

Type locality: Praha-Holyně, Prastav Quarry.

Name: *decessus* (Lat.) - withdrawn, retreated, concerning the stratigraphical level of the species.

Material: Five dorsal and four ventral valves.

Description: Shell rather thick-walled, 0.5 mm wide, with poorly unisulcate commissure.

Dorsal valve weakly convex, subcircular in outline, widest slightly anteriorly to midlength. Valve margins evenly curved, slightly less anteromedianly. Valve poorly flattened medianly, but without distinct sulcus. Posterior margin with very short, steeply anacline, and almost linear pseudointerarea, medianly bearing shallow trace of median groove. Width of pseudointerarea equals about 30 % of the shell. Dorsal interior with strong, high and long median septum originating slightly anterior to the pseudointerarea, and extending to 80 % of the valve length. Septum high, formed by a thin septal plate, at crest having steeply posteriorly inclined, swollen surmounting ridge. Sides of surmounting plate form two weakly divergent rods, bluntly terminating and slightly overhanging the septal plate. Anterior terminations of the rods are at about midlength of the valve. A less swollen and less inclined accessory rod forms the edge of septal plate at its anterior half, apex of the rod ends bluntly and distinctly overhang the septal plate (Pl. 31, fig. 16). Muscle scars weakly defined, central and cardinal scars divided posteromedianly by a low oblique ridge. Exterior of the valve with fine concentric growth fila.

Ventral valve high, acute, and almost symmetrically conical. Maximum valve width is some 35-40 % of valve height. Larval shell acutely conical, perforated at apex by a circular pedicle foramen, directed ventrally. Anterior slope feebly convex, posterior slope straight. Ventral pseudointerarea catacline, very narrow, gently inflated and weakly defined from adjacent surface, marked by finer growth lines. Exterior of ventral valve with weak and slightly irregular concentric growth fila, crossed by fine radial striae and irregular drapes along their course. Protegular pitting of shallow, uniformly sized pits, often cross-hatched.

Remarks: The new species differs from yet described species of the genus by shape of dorsal septum; combination of two rather short divergent rods at surmounting plate and distinct single rod, all bluntly ended, is unknown in any described species of the genus. Species *O. podlasiensis* BIERNAT, described from the Wenlock of East Poland (Biernat 1984), has also tall conical ventral valve, but dorsal pseudointerarea is larger, and dorsal valve has simple, longer and differently shaped surmounting plate. Species *O. celloni* (COCKS) from Llandovery of the Carnic Alps (Cocks 1979) has similarly shaped septum at dorsal valve, but the septum of *O. decessus* is smaller and has a shorter and more inclined upper plate.

Stratigraphical occurrence: Eifelian, Choteč Formation, Choteč Limestone, basal layers.

Locality: The type locality only.

Opsiconidion sp. A

Pl. 29, figs 10-13, 15

Material: Four dorsal and three ventral valves.

Remarks: This species is characterised by thin shell, transversely elliptical outline of the dorsal valve and low, simple median septum. Dorsal pseudointerarea is very short, with larval shell conspicuously overhanging the posterior margin. Ventral valve broadly conical, with curved apex.

This species differs from other Bohemian members of the genus by transversely elliptical shell outline and simple median septum. By this features, it is rather similar to *O. praecursor* (POPOV et al.) from the Upper Ordovician of Estonia (Popov et al. 1994).

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone).

Locality: Hýskov (V Jakubinkách).

Opsiconidion sp. B

Pl. 29, fig. 14

Material: Three dorsal valves.

Remarks: Samples from limestones in Hýskov near Beroun (Želkovice Formation, Llandovery) contain together with *Opsiconidion* sp. A, also another species of this genus. Fragmentary material show relatively thick-walled shell with thick septum bearing distinct upper and lower rod. This morphology is similar to species *O. aldridgei* (COCKS) described from the Llandovery of Great Britain, but material is too restricted for reliable comparison.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*D. convolutus* Biozone).

Locality: Hýskov (V Jakubinkách).

Opsiconidion sp. C

Pl. 31, figs 1-3

Material: Three dorsal and two ventral valves.

Remarks: This species is externally similar to *O. decessus* sp. n. It has the same tall conical ventral valve and similarly shaped, complex dorsal median septum, but surmounting plate is less distinctly divided into two diverging rods, lower rod in septal plate is less prominent and ridges between cardinal and central muscle scars are less divergent in *O.* sp. C. It is likely, that *Opsiconidion* sp. C is the phylogenetic forerunner of *O. decessus*.

Stratigraphical occurrence: Pragian, Praha Formation, Dvorce-Prokop and Řeporyje Limestones.

Localities: Stydlé vody Quarry (platy limestones with *Monograptus atopus*), Praha-Klukovice (Červený lom Quarry).

Genus ***Havlicekion*** gen. n.

Type species: *Havlicekion splendidus* sp. n.; Devonian, Pragian; Barrandian, Bohemia.

Name: *Havlicekion* (masculine). In honour of Dr. Vladimír Havlíček, the famous Czech brachiopodist, deceased in 1999.

Diagnosis: Minute, moderately thick-walled biernatid with highly conical ventral valve and shallowly sulcate, subpentagonal dorsal valve; dorsal pseudointerarea narrow, steeply anacline, median groove obscure; median septum rather low, with robust narrowly triangular to rod-like surmounting plate. Dorsal muscle scars deeply impressed, with accessory divergent ridge along anteromedian border of cardinal scars. Ornamentation of moderate to prominent, regular concentric rugellae. Microornamentation of larval shell flat, circular pits of nearly uniform size, about 5 μm in diameter, with weakly overlapping outlines.

Comparison: The new genus differs from *Opsiconidion* LUDVIGSEN in thicker shell-wall, regular and coarsely rugellate ornamentation and in rather low dorsal median septum covered by robust, narrowly triangular to rod-like surmounting plate. Ventral larval shell of all yet described species of *Opsiconidion* is more acute, with more pointed apical part. The only *Opsiconidion robustum* BROCK et al., described by Brock et al. (1995) from Pragian may be surely referred to *Havlicekion* gen. n.

Three Bohemian species referred to *Havlicekion* show gradual changes in shell morphology, mainly in the shape of the dorsal median septum. The oldest member of evolutionary lineage, *H. ivanensis* sp. n., has distinctly flattened, narrowly triangular surmounting plate, *H. holynensis* sp. n. has upper septal crest thickened into slightly flattened rod while the youngest representative, the species *H. splendidus* sp. n. has rod-like surmounting plate evenly wide along whole length, without any traces of flattening. Some analogous changes in shell morphology are apparent in Australian material (Brock et al. 1995). Specimen referred to *Opsiconidion robustum* BROCK, by Brock et al. (1995; fig. 6. C) from the Lower Lochkovian (*Icriodus woschmidti* Biozone) shows weakly flattened surmounting plate wholly similar to septum of *H. holynensis*, while the holotype of *O. robustum* of the Pragian age (*Eognathus kindlei* Biozone; fig. 6: G) has only unflattened rod along upper posteroventral edge of dorsal median septum.

Occurrence: Lower Silurian to Lower Devonian (Wenlock to Pragian); Bohemia, Australia.

Species included: *Havlicekion splendidus* sp. n.; Devonian, Pragian; Bohemia.

Havlicekion ivanensis sp. n.; Silurian, Wenlock; Bohemia.

Havlicekion holynensis sp. n.; Devonian, Lochkovian; Bohemia.

Opsiconidion robustum BROCK et al., 1995; Devonian, Lochkovian to Emsian, Australia.

Havlicekion splendidus sp. n.

Pl. 32, figs 1-13; pl. 35, figs 1-3

Holotype: Dorsal valve, figured on pl. 32, figs 9, 12, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 040).

Paratype: Ventral valve, figured on pl. 32, figs 1-5, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 036).

Type horizon: Pragian, Praha Formation, Dvorce-Prokop Limestone, platy limestone between black shales bearing *Monograptus atopus*.

Type locality: Svatý Jan pod Skalou, Stydlé vody Quarry.

Name: *splendidus* (Lat.) – splendid, shining.

Material: Twenty dorsal and ventral valves, often fragmentary.

Description: Shell minute, 1.1 mm wide, rather thick-walled.

Dorsal valve broadly subpentagonal, about 85-90 % as long as wide, widest in anterior third. Margins most curved anterolaterally, posterolateral and anterior margins less curved. A weak and broad sulcus is apparent at large valves. Posterior margin with large, anacline, rather large broadly triangular pseudointerarea, its width equal to 40% of shell width. Dorsal larval shell slightly overhangs the posterior margin. Dorsal interior with prominent, massive median septum originating just immediately in front of pseudointerarea, and extending nearly to front margin. Its length equal to about 70 % of the valve.

Septum rather high, with two robust rods. Upper rod, forming anteroventral crest of the septum, disappears at 70 % of septum length. Lower rod begins at mid-length of the septum and continues to its anterior edge. The ends of both rods are blunt, without spinose apex. Upper rod is circular in cross-section. Muscle scars deeply impressed on valve-floor. Cardinal muscle scars large, 30 % as long as valve, situated posterolaterally but not adjacent to posterolateral margins of valve. Central muscle scars smaller or nearly of the same size, but more elongate, bordering posterior half of the septum. Anterior border of central muscle scars extends almost to centre of the valve. Valve floor anterior to central muscle scars and anteromedian border of cardinal scars covered by deep and conspicuous pits of epithelium cells moulds. Dorsal larval shell distinctly separated by raised edge from juvenile shell. Two widely divergent low ridges are well developed. Exterior of post-larval shell covered by prominent rugellae of uniform size.

Ventral valve highly conical, some 85-90 % wide as high, with steep, almost straight anterior slope. Side profile and anterior slope in apical region weakly convex. Lateral slopes almost straight. Ventral pseudointerarea almost catacline, narrowly triangular, poorly flattened, marked by gradual change in the shell ornamentation. Apical angle some 60°. Larval shell pointed, with distinct border elevated above juvenile shell, covered by circular protegular pits of uniform size. At the top, the larval shell is penetrated by circular pedicle foramen of 350 μm diameter. Apex is directed posteroventrally. Interior of valve with two anteriorly weakly divergent ridges at posterior shell wall.

Ornamentation of ventral post-larval shell consists of conspicuous, coarse, continuous concentric rugellae of uniform size, separated by much narrower interspaces. Surface of ventral pseudointerarea bears less regular, discontinuous, but generally smaller rugellae.

Remarks: The new species is closely related to *H. robustum* (BROCK et al.) from the Coopers Creek limestone (Pragian) of New South Wales, Australia (Brock et al. 1995). Differences are delicate but distinct in all Bohemian specimens examined. *Havlicekion splendidus* sp. n. has less curved apex of ventral valve, with foramen directed posteroventrally while *H. robustum* has foramen directed more posteriorly. Dorsal valve of *H. splendidus* is more circular, with more curved posterolateral part of margin. The holotype of *H. robustum* (Brock et al.; fig. 6: G-I) show much shorter and smaller central muscle scars compared with *H. splendidus* and its outline is more transverse.

Stratigraphical occurrence: Pragian, Praha Formation, Dvorce-Prokop Limestone.

Localities: Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), Praha-Klukovice (Červený lom Quarry, top of Praha Formation, interval 2-1.5 m below the Pragian-Zlíchovian boundary).

Havlicekion ivanensis sp. n.

Pl. 33, figs 1-13

Holotype: Dorsal valve, figured on pl. 33, figs 5, 6, 9, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 344).

Paratype: Ventral valve, figured on pl. 33, figs 1, 2, 3, 10, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 332).

Type horizon: Wenlock, Sheinwoodian, Motol Formation (*C. perneri/C. ramosus* Biozone).

Type locality: Svatý Jan pod Skalou, U elektrárny.

Name: *ivanensis* - after the village Svatý Jan pod Skalou near the type locality.

Material: About twenty dorsal and ventral valves, many fragments.

Shell thick-walled, conspicuously large (width may exceed 1.5 mm), with weakly unisulcate anterior commissure.

Dorsal valve weakly convex, transverse oval to subpentagonal, about 80 % as long as wide, widest in midlength. Valve margins most curved anterolaterally, posterolateral and anterior margins less curved. A weak and broad sulcus is apparent in large valves. Posterior margin with large, steeply anacline, rather large broadly triangular pseudointerarea, its width equals to 40 % of shell width. Dorsal larval shell slightly overhangs the posterior margin. Dorsal interior with prominent, massive median septum originating immediately in front of pseudointerarea, and extending nearly to front margin. Its length equals about 70 % of the valve. Septum moderately high, with distinct surmounting plate and smaller lower rod. Surmounting plate swollen but narrow, flattened, triangular in cross-section, weakly concave in lateral view. Weak lower rod begins at mid-length of the septum and continues to its anterior edge. Muscle scars deeply impressed on valve-floor. Cardinal muscle scars large, 30 % as long as

valve, situated posterolaterally. Central muscle scars smaller or nearly of the same size, but more elongate, bordering posterior half of the septum. Anterior elevated borders of central muscle scars extend almost to centre of the valve. Prominent oblique ridge lies between central and cardinal muscle scars. Larval shell with two low diverging ridges is distinctly separated by raised edge from the juvenile shell. Exterior of post-larval shell covered by prominent rugellae of uniform size.

Ventral valve highly conical, some 85-90 % wide as high, with steep, almost straight anterior slope. Side profile and anterior slope in apical region weakly convex. Lateral slopes almost straight. Ventral pseudointerarea steeply apsacline, narrowly triangular, poorly flattened, marked by changes in shell ornamentation. Apical angle some 60°. Larval shell pointed, with distinct border elevated above juvenile shell, covered by circular protegular pits of uniform size. Apex is directed posteroventrally. At the top, the larval shell is penetrated by circular pedicle foramen of 350 μm diameter.

Ornamentation of ventral post-larval shell consists of conspicuous, coarse, continuous concentric rugellae of uniform size separated by much narrower interspaces. Rugellae at anterior slope weakly curved toward apex, large rugellae cross surface of the pseudointerarea without interruption. In addition, surface of the ventral pseudointerarea bears less regular, discontinuous, and generally smaller rugellae.

Comparison: The new species is related to *H. robustum* (BROCK et al.) from the Coopers Creek limestone (Pragian) of New South Wales, Australia (Brock et al. 1995), but Bohemian species has higher conical ventral valve. In addition, the surmounting plate of *H. ivanensis* sp. n. is distinctly flattened.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny).

Havlicekion holynensis sp. n.

Pl. 34, figs 1-14

Holotype: Dorsal valve, figured on pl. 34, figs 8, 11, 12, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 142).

Paratype: Ventral valve, figured on pl. 34, figs 1, 3, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 157).

Type horizon: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part (*M. uniformis* Biozone).

Type locality: Praha-Řeporyje, Černý lom Quarry, east wall.

Name: *holynensis* - after the village Holyně near the type locality.

Material: About hundred dorsal and ventral valves.

Description: Shell rather thick-walled, almost 0.9 mm wide, with poorly sulcate commissure, subcircular in outline.

Dorsal valve roundly subpentagonal, about 95-100 % as long as wide, widest in anterior third. Margins most curved anterolaterally; posterolateral and anterior margins less curved. A weak and broad sulcus is apparent at large valves. Posterior margin with large, anacline, rather large broadly triangular pseudointerarea, its width equals 40 % of shell width.

Dorsal interior with prominent, massive median septum originating just immediately in front of pseudointerarea, and extending to front margin. Its length equals about 70 % of the valve. Septum rather high, with two robust rods. Upper rod, forming anteroventral crest of the septum, disappears at 75-80 % of septum length. Lower rod begins at midlength of the septum and continues to its anterior edge. The end of lower rod is blunt, without spinose apex. Upper rod is slightly flattened in cross-section. Muscle scars deeply impressed on valve floor. Cardinal muscle scars large, 30 % as long as valve, situated posterolaterally but not adjacent to posterolateral margin. Central muscle scars, more elongate in outline, bordering posterior half of the septum and posterolaterally limited by cardinal scars. Border between cardinal and central scars is marked by narrow oblique ridge. Anterior border of central muscle scars extends almost to centre of the valve. Almost circular dorsal larval shell, 200 μm in diameter, distinctly separated by raised edge from juvenile shell. Two weakly divergent, low protegular ridges are well developed. Pits on the larval shell are 5 μm in diameter, of uniform size, weakly overlapping.

Ventral valve highly conical, some 85-90 % wide as high, with steep, almost straight anterior slope. Side profile and anterior slope in apical region almost straight. Lateral slopes almost straight. Ventral pseudointerarea catacline, narrowly triangular, weakly flattened, marked by changes in a shell ornamentation. Apical angle some 45°. Larval shell pointed, with distinct border elevated above juvenile shell, covered by circular pits of uniform size. Apex is directed almost ventrally. Larval shell is apically penetrated by circular pedicle foramen of 400 μm diameter.

Ornamentation of the post-larval dorsal valve consists of fine concentric rugellae, in some places extending to coarser concentric lamellae. Ventral post-larval shell bears weak, continuous concentric rugellae of uniform size. Surface of ventral pseudointerarea covered by less regular and generally finer rugellae.

Comparison: The new species differs from *H. robustum* (BROCK et al.) from the Coopers Creek Limestone (Pragian) of New South Wales (Brock et al. 1995) by ventrally directed foramen, straight anterior slope of ventral valve and finer concentric ornamentation. *H. splendidus* sp. n. differs by coarser ornamentation, more posteriorly directed pedicle foramen and more rounded posterolateral margin of dorsal valve.

Stratigraphical occurrence: Lochkovian, Lochkov Formation, Kotýs Limestone, lower part.

Locality: Praha-Řeporyje (Černý lom Quarry, east wall).

Order **Siphonotretida** KUHN, 1949

Superfamily **Siphonotretoidea** KUTORGA, 1848

Family **Siphonotretidae** KUTORGA, 1848

Remarks: To the present time, the family Siphonotretidae KUTORGA has been considered extinct at the end of the Ordovician (Popov and Holmer 1996). Very rare but distinct remains of several different siphonotretids have been discovered in the Silurian and Devonian deep-water carbonate lithofacies of the Barrandian. Remains are referred to all three subfamilies, but this cannot be definite, because detailed morphology of the shells is unknown.

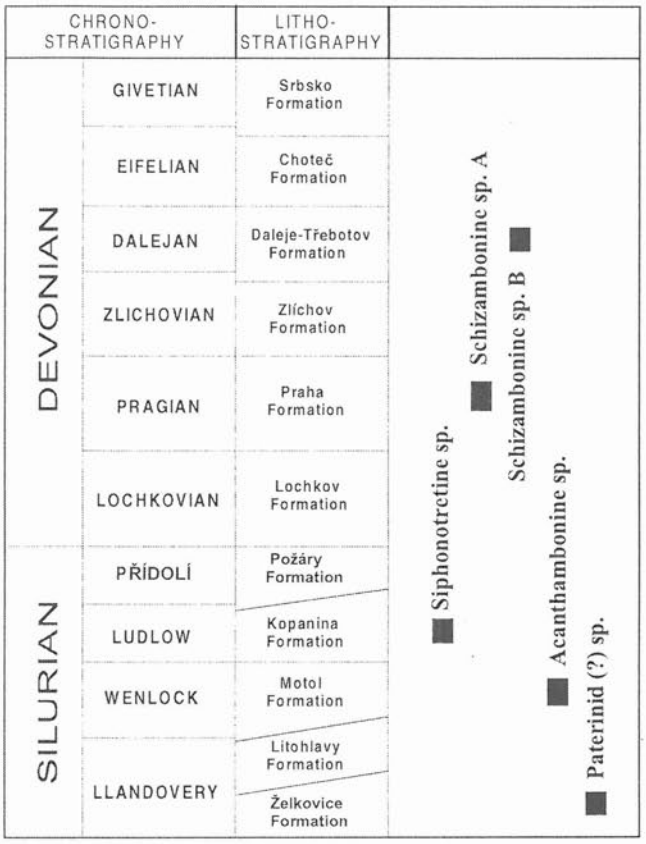


Fig. 12: Stratigraphical distribution of the siphonotretid and paterinid brachiopods in the Barrandian.

Subfamily **Siphonotretinae** KUTORGA, 1848

Siphonotretine sp.

Pl. 36, figs 8-10

Material: One shell fragment, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 247).

Remarks: Shell fragment is conspicuous by rather thick shell wall with coarse growth lamellae bearing densely crowded, anteriorly directed hollow spines. Rest of the valve bears deep, uneven pits. This valve differs distinctly from other siphonotretids of the Silurian and Devonian of the Barrandian by a deeply pitted surface.

Stratigraphical occurrence: Ludlow, Ludfordian, Kopanina Formation (*Prionopeltis archiaci* Horizon).

Locality: Praha-Řeporyje (Mušlovka Quarry).

Subfamily **Schizamboninae** HAVLÍČEK, 1982

Remarks: The subfamily Schizamboninae HAVLÍČEK is characterised by generally small and densely spinose siphonotretids. They are known mainly from the Lower to Middle Ordovician with five known genera (Popov and Holmer 1994), with only *Schizambon* WALCOTT extending into the Late Ordovician (Wright 1963). They are very rare in the Silurian and Devonian of the Barrandian, but there are two closely related species, both with depressed broadly triangular sector in the dorsal valve, similar to another minute schizambonines (e. g. *Nushbiella* POPOV, *Multispinula* ROWELL, *Karnotreta* WILLIAMS et CURRY, *Cyrbasiotreta* WILLIAMS et CURRY).

Schizambonine sp. A

Pl. 36, figs 15, 16

Material: Only one fragment of dorsal valve deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 192).

Remarks. The only fragment of rather thick-walled dorsal valve indicates strongly convex, in adult stage some 1.5 mm wide shell. The valve is gently flattened in median sector, otherwise is evenly convex. Surface bears minute prostrate spines scattered on finely pitted surface.

Stratigraphical occurrence: Pragian, Dvorce-Prokop Limestone, upper part, 2 m below the Pragian/Zlíchovian boundary.

Locality: Praha-Klukovice (Červený lom Quarry, east wall).

Schizambonine sp. B

Pl. 36, figs 11-14

Material: Incomplete dorsal valve, deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 191).

Remarks: The only valve is subcircular, 1 mm wide, thin-walled, evenly convex with narrowly triangular depressed median sector. Hollow prostrate spines are located at the anterior edge of fine concentric fila, some of them are directed posterolaterally.

Stratigraphical occurrence: Upper Dalejan, Daleje-Třebotov Formation, Třebotov Limestone, bed No. 5.

Locality: Praha-Holyně (Prastav Quarry).

Subfamily **Acanthamboninae** COOPER, 1956

Remarks: Published data indicate extension of the subfamily to the late Ordovician (Wright 1963, Wright and Nõlvak 1997). In the Barrandian, a single species has been recognised in material from the Motol Formation (Wenlock).

Acanthambonine sp.

Pl. 36, figs 1-7

Material: Two incomplete dorsal valves deposited in the palaeontological collections of the Department of Biology, University of West Bohemia, Plzeň (PCZCU 188 and PCZCU 202).

Description: Dorsal valve is relatively thin, in adult stage 3-4 mm wide with circular outline. Valve is strongly convex, with curved apex sunk into shell wall. A narrow brim builds up posterior periphery of the valve, behind the convex parts of the valve. Exterior of the valve is sparsely but regularly covered

by fine hollow spines. Spines are rather distant from each other and rest at about 20-40° angle to shell surface.

Stratigraphical occurrence: Wenlock, Sheinwoodian, Motol Formation (*M. belophorus* to *C. perneri/C. ramosus* Biozones).

Localities: Loděnice (Černidla), Svatý Jan pod Skalou (U elektrárny).

Order **Paterinida** ROWELL, 1965

Superfamily **Paterinoidea** SCHUCHERT, 1893

Family **Paterinidae** SCHUCHERT, 1893

Paterinid (?) sp. indet.
Pl. 35, figs 14, 15

Material: Four fragments deposited in the palaeontological collections of the Department of Biology, University of west Bohemia, Plzeň (PCZCU 189, PCZCU 190, PCZCU 410, PCZCU 419).

Remarks: Residues after etching tuffaceous limestones of the Želkovice Formation (Llandovery) contain very small, but characteristically pitted fragments of phosphatic shells. Gently to moderately transverse, uniformly sized pits are separated by smooth interspaces, devoid of any discrete microsculpture. Fragments are similar by pitting and their pattern indicates to external ornamentation of paterinid brachiopods (Wright 1981). The paterinide brachiopods are considered to be extinct before the end of Ordovician (Popov and Holmer 1996). If the shell fragments really belong to a paterinide (it seems likely, because no other group of organophosphatic brachiopods bears such ornamentation), these fragments extend the stratigraphical range of the order *Paterinida* ROWELL to the early Silurian. However, Popov (2000) figured fragmentary shells with similar ornamentation from the Late Ordovician (Ashgill) of Kazakhstan and referred them to trematid *Trematis* sp.

Stratigraphical occurrence: Llandovery, Aeronian, Želkovice Formation (*M. sedgwicki* Biozone).

Locality: Hýskov (V Jakubinkách).

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Explanation of plates

All photographs by author.

PLATE 1

Careniellus carens (BARRANDE, 1879)

1. Paralectotype, dorsal valve, NM L 24457, specimen figured by Barrande (1879) as *Lingula carens* BARR. on pl. 103, case V, fig. 2; Motol Formation; Loděnice, × 8.0.
2. Lectotype, ventral valve, NM L 24458, specimen figured by Barrande (1879) as *Lingula carens* BARR. on pl. 103, case V, fig. 1; Motol Formation; Loděnice, × 8.0.
3. Dorsal valve, NM L 25980, specimen figured by Barrande (1879) as *Lingula nigricans* BARR. on pl. 104, case VII, fig. 1; Motol Formation; Beroun, Ratinka, × 6.0.
4. Complete shell, NM L 25989, specimen figured by Barrande (1879) as *Lingula comes* BARR. on pl. 105, case III, fig. 1; Želkovice Formation; Králův Dvůr, × 9.0.
5. Ventral valve; Motol Formation; Loděnice, PCZCU 500, × 8.0.
6. Dorsal valve, NM L 24459, specimen figured by Barrande (1879) as *Lingula perlonga* BARR. on pl. 103, case VI, fig. 1; Motol Formation; Svatý Jan pod Skalou, U elektrárny, × 7.0.
7. Dorsal valve; Motol Formation; Svatý Jan pod Skalou, U elektrárny, NM L 34242, × 7.0.
8. Ventral valve; Motol Formation; Loděnice, MBHR 73388, × 8.0.
9. Dorsal valve; Motol Formation; Loděnice, NM L 34243, × 8.0.
10. Dorsal valve; Motol Formation; Svatý Jan pod Skalou, U elektrárny, NM L 34244, × 8.0.
11. Dorsal valve; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 501, × 7.0.
12. Dorsal valve; Motol Formation; Loděnice, NM L 34245, × 8.0.
13. Dorsal valve; Motol Formation; Sedlec, NM L 34246, × 8.0.
14. Dorsal valve; Želkovice Formation; Hýskov, V Jakubinkách, MBHR 75321, × 8.0.
15. Dorsal valve; Želkovice Formation; Hýskov, V Jakubinkách, MBHR 75229, × 8.0.

PLATE 2

Careniellus nigriculus (HAVLÍČEK, 1999); Lochkov Formation, Radotín Limestone

1. Dorsal valve interior; Kosoř, NM L 34236, × 8.0.
2. Dorsal valve interior; Kosoř, MBHR 73165, × 8.0.
3. Dorsal valve interior; Karlík, PCZCU 502, × 9.0.
4. Ventral valve interior; Kosoř, NM L 34237, × 8.0.
5. Dorsal valve interior; Kosoř, NM L 34238, × 8.0.
6. Dorsal valve exterior; Kosoř, NM L 34239, × 8.0.
7. Dorsal valve interior, NM L 25982, specimen figured by Barrande (1879) as *Lingula nigricans* BARR. on pl. 104, case VII, fig. 3; Kosoř, × 9.0.
8. Ventral valve exterior; Kosoř, NM L 34240, × 8.0.
9. Dorsal valve exterior; Kosoř, NM L 34241, × 8.0.

Careniellus aff. *nigriculus* (HAVLÍČEK, 1999); Praha Formation, black shales; Svatý Jan pod Skalou, Stydlé vody Quarry

10. Ventral valve interior, MBHR 49784, × 9.0.
11. Dorsal valve with preserved shell, MBHR 49788, × 9.0.

PLATE 3

Kosagittella clara sp. n.; Kopanina Formation, horizon with *Ananaspis fecunda*

1. Holotype, ventral valve exterior; Králův Dvůr, Dlouhá hora Hill, NM L 34253, × 8.0.
2. Paratype, ventral valve exterior; Králův Dvůr, Dlouhá hora Hill, NM L 34254, × 8.0.
3. Ventral valve interior; Praha-Jinonice, MBHR 73179, × 8.0.
4. Dorsal valve interior; Lochkov, Orthoceras Quarry, MBHR 73299, × 8.0.
5. Ventral valve interior; Koledník, MBHR 73348, × 8.0.

6, 8. Ventral valve interior and detail of pseudointerarea; Králův Dvůr, Kosov Quarry, PCZCU 182. 6 – × 30; 8 – × 105.

7. Dorsal valve pseudointerarea; Králův Dvůr, Kosov Quarry, PCZCU 181, × 70.

9, 11, 12. Ventral valve, internal mould and detail of pseudointerarea of the same valve; Králův Dvůr, Dlouhá hora Hill, NM L 34255 (mould) and PCZCU 193 (shell fragment). 9 – x 8; 11 – × 60; 12 – × 60.

10. Ventral valve, internal mould; Králův Dvůr, Dlouhá hora Hill, NM L 34256, × 8.0.

Kosagittella lingua (BARRANDE, 1879)

13. Lectotype, specimen figured by Barrande (1879) on pl. 104, case IV, fig. 1; Praha Formation, Dvorce-Prokop Limestone; Lužce, NM L 25975, × 10.
14. Ventral valve; Zlíchov Formation, Chýnice Limestone; Bubovice, Čeřinka Hill, MBHR 72558, × 8.5.
15. Dorsal valve; Praha Formation, Vinařice Limestone; Měňany, MBHR 67079, × 8.5.
16. Ventral valve; Daleje – Třebotov Formation, Suchomasty Limestone; Koněprusy, Voskop, PCZCU 507, × 8.5.

17. Dorsal valve; Choteč Formation, Acanthopyge Limestone; Koněprusy, small quarries in Acanthopyge Limestone, MBHR 84610, × 8.5.
18. Dorsal valve; Daleje – Třebotov Formation, Suchomasty Limestone; Koněprusy, Voskop, MBHR 84611, × 8.5.

PLATE 4

Kosagittella pinguis sp. n.; Lochkov Formation, Kotýs Limestone

1, 4. Paratype, dorsal valve interior; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 174. 1 – × 18, 2 – × 38.
2, 5, 11, 15. Incomplete dorsal valve; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 168. 2 – oblique view, × 45; 5 – internal view, × 45; 11 – posterior median groove, × 250; 15 – lateral part of dorsal pseudointerarea, × 250.
3, 6, 7, 10. Holotype, ventral valve interior; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 161. 3 – oblique view, × 23; 6 – internal view, × 19; 7 – posterior slope of visceral area, × 30; 10 – detail of ventral pseudointerarea, × 50.
8, 12. Ventral valve pseudointerarea; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 164. 8 – oblique view, × 24; 12 – internal view, × 30.
9. Ventral valve exterior, umbonal region; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 165, × 38.
13, 16. Ventral valve exterior; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 171. 13 – umbonal region, × 40; 16 – side view, × 40.
14, 17. Ventral valve pseudointerarea; Praha-Řeporyje, Černý lom Quarry, east wall, PCZCU 183. 14 – internal view, × 50; 17 – anterior view, × 40.

PLATE 5

Kacakiella bouceki sp. n.; Motol Formation

1. Holotype, ventral valve interior; Svatý Jan pod Skalou, U elektrárny, NM L 34252, × 5.5.
2. Ventral valve interior; Svatý Jan pod Skalou, U elektrárny, PCZCU 503, × 8.0.
3. Ventral valve exterior; Svatý Jan pod Skalou, U elektrárny, PCZCU 504, × 12.
4. Ventral valve interior; Praha-Řeporyje, MBHR 75226, × 8.0.
5. Ventral valve with remains of shell; Praha-Řeporyje, MBHR 73333, × 8.0.
6. Ventral valve interior; Svatý Jan pod Skalou, U elektrárny, MBHR 75248, × 55.
7. Ventral valve exterior; Svatý Jan pod Skalou, U elektrárny, PCZCU 505, × 8.0.
8. Ventral valve, apical part; Loděnice, Černidla, PCZCU 250, × 40.
9, 10. Ventral valve, larval shell, and lateral view; Loděnice, Černidla, PCZCU 249. 9 – × 40; 10 – × 40.
11. Detail of ornamentation; Loděnice, Černidla, PCZCU 466, × 45.
12. Dorsal valve exterior showing terrace lines; Svatý Jan pod Skalou, U elektrárny, PCZCU 253, × 24.

PLATE 6

Prastavia distincta sp. n.; Choteč Formation, Choteč Limestone, lower part; Praha-Holyně, Prastav Quarry, bed 13

1, 2. Paratype, ventral valve interior, PCZCU 238. 1 – × 30; 2 – × 30.
3, 5, 7. Holotype, dorsal valve interior, PCZCU 237. 3 – × 38; 5 – × 38; 7 – × 30.
4. Ventral valve interior, PCZCU 236, × 30.
6, 9. Ventral valve exterior, PCZCU 195. 6 – × 25; 9 – × 25.
8. Dorsal valve interior, PCZCU 235, × 50.
10, 12. Ventral valve exterior, PCZCU 197. 10 – × 30; 12 – × 35.
11, 15. Incomplete ventral valve exterior, and its detail, PCZCU 212. 11 – × 30; 15 – × 400.
13, 14, 16. Dorsal valve exterior PCZCU 198. 13 – × 50; 14 – detail of microornamentation along anterior margin of larval shell, × 560; 16 – detail of microornamentation along anterior margin of larval shell, × 170.

PLATE 7

Barrandeoglossa fissurata (BARRANDE, 1879); Motol Formation

1. Interior of ventral valve showing pseudointerarea; Svatý Jan pod Skalou, NM L 34247, × 8.0.
2. Interior of ventral valve showing pseudointerarea; Svatý Jan pod Skalou, NM L 34248, × 8.0.
3. Lectotype, ventral valve, NM L 24454, specimen figured by Barrande (1879) as *Lingula fissurata* BARR. on pl. 104, case III, fig. 4; Sedlec, × 3.5.
4. Internal mould of ventral valve; Svatý Jan pod Skalou, NM L 34257, × 5.0.
5. Internal mould of dorsal valve; Svatý Jan pod Skalou, MBHR 73197, × 5.5.
6. Ventral valve, NM L 25415, specimen figured by Barrande (1879) as *Lingula leiskowiensis* BARR. on pl. 103, case II, fig. 6a; Beroun, Ratinka, × 3.5.
7. Paralectotype, dorsal valve, NM L 24455, specimen figured by Barrande (1879) as *Lingula fissurata* BARR. on pl. 103, case III, fig. 3; Lužce, × 3.5.
8. Dorsal valve interior; Svatý Jan pod Skalou, MBHR 73198, × 5.5.
9. Ventral valve; Sedlec, NM L 34250, × 5.0.
10. Ventral valve, NM L 25415, specimen figured by Barrande (1879) as *Lingula leiskowiensis* BARR. on pl. 103, case II, fig. 8; Beroun, Ratinka, × 3.5.
11. Internal mould of ventral valve showing vascula lateralia; Beroun, Ratinka, NM L 34251, × 5.0.
12. External ornamentation; Svatý Jan pod Skalou, PCZCU 206, × 30.
13. Detail of external ornamentation; Svatý Jan pod Skalou, PCZCU 203, × 160.

PLATE 8

Barrandeoglossa perneri sp. n.; Lochkov Formation, Kotýs Limestone; Praha-Řeporyje, Černý lom Quarry, east wall

1, 2. Interior of dorsal valve, PCZCU 179. 1 – dorsal view, × 30; 2 – lateral view, × 38.
3. Paratype, ventral valve interior, PCZCU 173, × 35.
4, 5. Holotype, dorsal valve exterior, PCZCU 180. 4 – × 30; 5 – × 25.
6. Exterior of shell fragment, PCZCU 172, × 20.
7. Detail of ornamentation, PCZCU 178, × 65.

Barrandeoglossa (?) *bohemica* (BARRANDE, 1879); Praha Formation, Koněprusy Limestone; Koněprusy

8. Holotype, NM L 25993, specimen figured by Barrande (1879) as *Lingula bohemica* BARR. on pl. 105, case IX, × 3.0.

Barrandeoglossa sp.

9, 12. Detail of ornamentation and complete crushed shell, Kopanina Formation; Kozolupy Quarry, MBHR 74141. 9 – × 8, 12 – × 3.3.
11. Detail of microornamentation, Kopanina Formation, Kosov Quarry, PCZCU 185, × 130.

Pseudolingula (?) *dilatata* (BARRANDE, 1879)

10. Juvenile shell, NM L 24464, specimen figured by Barrande (1879) as *Lingula zebra* BARR. on pl. 105, case V; Motol Formation; Bubovice, × 8.0.
13. Holotype, dorsal valve, NM L 17828, figured by Barrande (1879) as *Lingula dilatata* BARR. on pl. 103, case VIII; Kopanina Formation; Butovice, × 2.5.

PLATE 9

Wadiglossa perlonga (BARRANDE, 1879); Kopanina Formation; Dlouhá hora Hill

1. Lectotype, ventral valve, NM L 24460, specimen figured by Barrande (1879) as *Lingula perlonga* BARR. on pl. 103, case VI, fig. 2, × 6.0.
2. Dorsal valve, NM L 34257, × 8.0.
3. Ventral valve, NM L 34258, × 8.0.
4. Dorsal valve, NM L 34249, × 8.0.
8. Ventral valve, NM L 34260, × 8.0.

Bicarinatina sp.; Choteč Formation, Choteč Limestone

5. Ventral valve; Praha-Hlubočepy, MBHR 85091, × 12.
6. Interior of ventral valve; Praha-Holyně, Prastav Quarry, PCZCU 199, × 30.
7. Shell fragment showing external ornamentation; Praha-Holyně, Prastav Quarry, PCZCU 200, × 50.

Lingulops fragilis sp. n.; Motol Formation; Svatý Jan pod Skalou, U elektrárny

9, 13, 14. Holotype, ventral valve, PCZCU 209. 9 – lateral view, × 50; 13 – ventral view, × 45; 14 – detail of microornamentation, × 1250.
10, 12. Ventral valve, PCZCU 201. 10 – × 50; 12 – its larval shell, x 130.
11, 15. Ventral valve, PCZCU 208. 10 – × 50; 15 – detail of microornamentation, × 350.

PLATE 10

Lingulops barrandei MERGL, 1999; Kopanina Formation

1, 3. Dorsal valve exterior; Králův Dvůr, Kosov Quarry, PCZCU 011. 1 – oblique view, × 30; 3 – dorsal view, × 30.
2. Ventral valve interior, oblique view; Králův Dvůr, Kosov Quarry, PCZCU 003, × 40.
4. Ventral valve interior, oblique view; Králův Dvůr, Kosov Quarry, PCZCU 004, × 40.
5. Dorsal valve interior, oblique view; Králův Dvůr, Kosov Quarry, PCZCU 017, × 38.
6. Dorsal valve exterior; Králův Dvůr, Kosov Quarry, PCZCU 010, × 23.
7. Dorsal valve interior, oblique view; Králův Dvůr, Kosov Quarry, PCZCU 006, × 40.
8. Ventral valve exterior; Králův Dvůr, Kosov Quarry, PCZCU 002, × 45.
9. Dorsal valve exterior; Králův Dvůr, Kosov Quarry, PCZCU 016, × 30.
10. Ventral valve; Hýskov, Farská rokle, MBHR 75218, × 8.0.
11. Dorsal valve, internal mould; Hýskov, Farská rokle, NM L 34261, × 8.8.
12, 15. Ventral valve interior; Králův Dvůr, Kosov Quarry, PCZCU 015. 15 – × 32; 12 – detail of ventral pseudointerarea, × 62.
13. Detail of microornamentation; Králův Dvůr, Kosov Quarry, PCZCU 002, × 270.
14. Dorsal valve interior; Králův Dvůr, Kosov Quarry, PCZCU 007, × 32.
16. Ventral valve interior; Králův Dvůr, Kosov Quarry, PCZCU 008, × 30.

PLATE 11

Paterula argus MERGL, 1999; Želkovice Formation; Hýskov, V Jakubinkách

1. Dorsal valve, internal mould, MBHR 85196, × 15.
2, 7, 8. Dorsal valve, PCZCU 318. 2 – × 60; 7 – detail of microornamentation near apex, × 2000; 8 – detail of microornamentation near shell margin, × 1000.
3, 4. Incomplete ventral valve interior, PCZCU 413. 3 – × 60; 4 – × 92.
5. Dorsal valve, MBHR 85201, × 15
6. Dorsal valve, MBHR 85199, × 15.

Paterula holynensis sp. n.; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry

9. Dorsal valve, internal mould, PCZCU 506, × 10.
10, 11. Ventral valve exterior, PCZCU 240. 10 – detail of larval shell, × 300; 11 – microornamentation, × 950.
12. Ventral valve, detail of pedicle groove in oblique view, PCZCU 241, × 350.
13. Ventral valve, detail of posterior margin, PCZCU 239, × 180.

PLATE 12

Paterula holynensis sp. n.; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry, bed No. 13

1, 5. Paratype, dorsal valve interior, PCZCU 224. 1 – oblique view, × 45; 5 – ventral view, × 32.
2. Ventral valve, PCZCU 240, × 45.
3, 4. Dorsal valve exterior, PCZCU 234. 3 – dorsal view, × 50; 4 – oblique view, × 60.
6, 9, 13. Holotype, ventral valve, PCZCU 239. 6 – oblique view, x 32; 9 – dorsal view, × 27; 13 – detail of posterior margin, × 75.
7, 10. Ventral valve, PCZCU 241. 7 – oblique view, × 45; 10 – dorsal view, × 40.
8, 12. Juvenile ventral valve, PCZCU 218. 8 – oblique view, x 70; 12 – dorsal view, × 60.
11, 14, 15. Ventral valve exterior, PCZCU 187. 11 – ventral view, × 20; 14 – oblique view, × 50; 15 – detail of posterior margin, × 75.

PLATE 13

Orbiculoidea patelliformis (BARRANDE, 1879); Motol Formation

1. Holotype, exfoliated dorsal valve, NM L 26047, specimen figured by Barrande (1879) as *Discina patelliformis* BARR. on pl. 110, case VI; Svatý Jan pod Skalou, U elektrárny, x 2.3.
2, 4. Ventral valve exterior, NM L 16276, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 10; Svatý Jan pod Skalou, U elektrárny. 2 – x 2.0; 4 – lateral view, x 2.0.
3. Dorsal valve, internal mould, NM L 24427, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 8; Sedlec, × 2.0.
5. Ventral valve, NM L 16278, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 11; Svatý Jan pod Skalou, U elektrárny, × 2.0.
6, 11. Dorsal valve; Loděnice, Černidla, MBHR 73187. 6 – internal mould, × 2.5; 11 – detail of apex showing vascula media, × 10.
7, 8. Dorsal valve, internal mould; Loděnice, Černidla, MBHR 73173. 7 – ventral view, × 2.5; 8 – oblique view, × 2.5.
10, 14. Ventral valve exterior; Svatý Jan pod Skalou, U elektrárny, PCZCU 508. 10 – × 2.5; 14 – detail of ornamentation, × 10.

Orbiculoidea sp. A; Praha Formation, Koněprusy Limestone; Koněprusy

9. Ventral valve, NM L 16273, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 4, × 2.5.
12. Fragment of ventral valve, NM L 16274, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 2, × 2.5.
13. Fragment of ventral valve, NM L 16275, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 1, × 2.5.

PLATE 14

Orbiculoidea snajdri sp. n.; Želkovice Formation; Hýskov, V Jakubinkách

1. Two ventral valves attached to shell of a sphenothallid, MBHR 75255, × 2.5.
2, 3. Ventral valve an detail of its ornamentation, MBHR 75662. 2 – × 6.0; 3 – × 2.6.
4. Holotype, ventral valve showing pedicle track, PCZCU 510, × 8.5.

Orbiculoidea bubovicensis sp. n.; Motol Formation

5, 6. Dorsal valve exterior, with anterior margin at right; Bubovice, NM L 34263. 5 – ventral view, × 3.6; 6 – lateral profile, × 3.6.
7, 9. Ventral valve, internal mould, NM L 24425, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 5; Bubovice. 7 – dorsal view, × 3.6; 9 – lateral view, × 3.6.
8. Ventral valve of complete shell, NM L 24411, specimen figured by Barrande (1879) as *Discina rugata* SOW. on pl. 98, case II, fig. 6; Lužce-Loděnice, × 5.5.
10, 12. Holotype, ventral valve with part of shell; Kozolupy, excavations east of the "Kouřící lom" Quarry, MBHR 73183. 10 – × 3.6; 12 – detail of ornamentation, × 6.0.
11. Dorsal valve with adjacent ventral valve; Bubovice, NM L 34262, × 3.6.

PLATE 15

Orbiculoidea bohemica (BARRANDE, 1879); Praha Formation, Koněprusy Limestone; Koněprusy

1. Ventral valve, NM L 34264, × 4.7.
2. Ventral valve, NM L 34265, × 4.7.
3. Paralectotype, ventral valve, internal mould, NM L 16052, specimen figured by Barrande (1879) as *Discina Bohemica* BARR. on pl. 97, case V, fig. 2, × 3.0.
4. Paralectotype, ventral valve, NM L 16055, specimen figured by Barrande (1879) as *Discina Bohemica* BARR. on pl. 97, case V, fig. 4, × 3.0.
5. Paralectotype, dorsal valve, NM L 16054, specimen figured by Barrande (1879) as *Discina Bohemica* BARR. on pl. 97, case V, fig. 3, × 3.0.
6. Dorsal valve, oblique view, MBHR 70490, × 3.7.
7. Ventral valve, NM L 34433, × 4.7.
8. Dorsal valve, lateral view, MBHR 67077, × 3.7.
9. Lectotype, dorsal valve, NM L 16053, specimen figured by Barrande (1879) as *Discina Bohemica* BARR. on pl. 97, case V, fig. 1, × 3.0.

Orbiculoidea karlstejnensis MERGL, 1996

10. Ventral valve, internal mould, NM L 26165, specimen figured by Barrande (1879) as *Discina propinqua* BARR. on pl. 152, case IV, fig. 1; Motol Formation; Svatý Jan pod Skalou, U elektrárny, × 7.0.
11-13. Complete shell; Kopanina Formation; Karlštejn, "Na

rešnách" Quarry, JB 18a. 11 –, ventral view, × 5.0; 12 – dorsal view. × 5.0; 13 – lateral view, × 5.0.

14. Ventral valve, internal mould, NM L 24415, specimen figured by Barrande (1879) as *Discina propinqua* BARR. on pl. 98, case VI, fig. 6; Kopanina Formation; Králův Dvůr, Dlouhá hora Hill, × 5.0.
15. Ventral valve, internal mould with remain of shell; Kopanina Formation; Karlštejn, "Na rešnách" Quarry, JB 18b, × 5.0.
16. Dorsal valve, internal mould with remain of shell, NM L 24416, specimen figured by Barrande (1879) as *Discina propinqua* BARR. on pl. 98, case VI, fig. 5; Kopanina Formation; Králův Dvůr, Dlouhá hora Hill, × 5.0.

PLATE 16

Orbiculoidea magnifica sp. n.; Lochkov Formation, Radotín Limestone

1. Ventral valve, external mould; Kosoř, Černá rokle, NM L 34435, × 2.8
2. Ventral valve; Lejškov, BB 464, × 1.9.
3. Juvenile ventral valve, internal mould, NM L 24414, specimen figured by Barrande (1879) as *Discina Maeotis* EICHW. on pl. 100, case II, fig. 3; Hýskov, Vápenice, × 9.0.
4. Holotype, ventral valve; Kosoř, Černá rokle, NM L 34434, × 1.9
5, 8. Ventral valve exterior; Praha-Podolí, NM L 34436. 5 – × 1.9; 8 – detail of ornamentation, × 8.0.
6, 7. Dorsal valve; Kosoř, Černá rokle, NM L 34437. 6 – ventral view, × 3.0; 7 – lateral view, × 3.0.
9, 12. Dorsal valve exterior; Kosoř, Černá rokle, NM L 34439. 9 – × 1.9; 12 – detail of ornamentation, × 8.0.

Orbiculoidea sp. B; Daleje-Třebotov Formation, Třebotov Limestone; Praha-Hlubočepy, V Háji Quarry

10. Dorsal valve exterior, MBHR 83877, × 6.0.
11. Dorsal valve exterior, MBHR 83876, × 6.0.

PLATE 17

Orbiculoidea tarda (BARRANDE, 1879); Srbsko Formation; Srbsko

1. Lectotype, dorsal valve, NM L 16066, specimen figured by Barrande (1879) as *Discina tarda* BARR. on pl. 96, case IV, fig. 1, × 6.6
2. Dorsal valve, NM L 16068, specimen figured by Barrande (1879) as *Discina tarda* BARR. on pl. 96, case IV, fig. 4, × 6.6
3. Dorsal valve, NM L 16067, specimen figured by Barrande (1879) as *Discina tarda* BARR. on pl. 96, case IV, fig. 2, × 6.6
4. Ventral valve, NM L 34438, × 6.6.

Lochkothele sp.; Daleje-Třebotov Formation, Daleje Shale; Choteč, Vávrův mlýn (former mill)

5, 6. Ventral valve, NM L 16033, specimen figured by Barrande (1879) as *Discina tarda* BARR. on pl. 96, case V, fig. 1. 5 – internal mould, × 6.6; 6 –external mould, × 6.6.

Orbiculoidea sp. C; Požáry Formation; Praha-Holyně, Opatřilka Quarry, east wall

7, 12. Dorsal valve exterior, PCZCU 275. 7 – × 33; 12 – × 40.
8. Dorsal valve exterior, PCZCU 274, × 40.
10, 11. Dorsal valve exterior, PCZCU 276. 10 – × 37; 11 – × 45.

Orbiculoidea sp. B; Daleje-Třebotov Formation, Daleje Shale; Choteč, Vávrův mlýn (former mill)

9. Deformed ventral valve, NM L 16032, specimen figured by Barrande (1879) as *Discina tarda* BARR. on pl. 96, case V, fig. 2, × 6.6

Schizotreta rarissima (BARRANDE, 1879); Motol Formation; Loděnice (Černidla)

13. Holotype, probably dorsal valve, NM L 24448, specimen figured by Barrande (1879) as *Discina rarissima* BARR. on pl. 102, case V, × 7.0.

PLATE 18

Lochkothele intermedia (BARRANDE, 1879); Lochkov Formation, Radotín Limestone

1. Dorsal valve, NM L 16063, specimen figured by Barrande (1879) as *Discina signata* BARR. on pl. 99, case II, fig. 5; Lochkov, × 8.0.
2. Dorsal valve, NM L 16060, specimen figured by Barrande (1879) as *Discina signata* BARR. on pl. 99, case II, fig. 4; Lochkov, × 8.0.
3. Dorsal valve, NM L 24420, specimen figured by Barrande (1879) as *Discina signata* BARR. on pl. 99, case II, fig. 2; Lužce-Loděnice, × 8.0.
4. Dorsal valve, NM L 16059, specimen figured by Barrande (1879) as *Discina signata* BARR. on pl. 99, case II, fig. 1; Lochkov, × 8.0.
5. Ventral valve exterior; Klonk, PCZCU 511, × 10.
6. Ventral valve exterior; Klonk, PCZCU 512, × 10.
7. Fragment of ventral valve showing pedicle track; Kosoř, PCZCU 246, × 50.
8. Dorsal valve exterior; Kosoř, NM L 34440, × 7.0.
9. Ventral valve, internal mould; Kosoř, NM L 34443, × 7.0.
10. Large ventral valve; Kosoř, NM L 34441, × 7.0.
11. Ventral valve with vascula lateralia; Kosoř, NM L 34442, × 8.5.
12. Lectotype, ventral valve, NM L 16268, specimen figured by Barrande (1879) as *Discina intermedia* BARR. on pl. 99, case VI, fig. 2; Lochkov, × 10.

Lochkothele sp.; Daleje-Třebotov Formation, Suchomasty Limestone; Koněprusy

13. Ventral valve, internal mould, PCZCU 513, × 6.6.

PLATE 19

Ivanothele mordor MERGL, 1996; Kopanina Formation; Karlštejn, "Na rešnách" Quarry

1, 5, 10. Holotype, complete shell, ventral valve lateral view, and dorsal valve, MBHR 66805, × 5.0.
2. Exfoliated dorsal valve, JB 06b, × 5.0.
3, 4. Ventral valve, JB 06d, × 5.0.
6, 7. Ventral valve, lateral and apical dorsal views, JB 14b, x 5.0, x 5.0.
8, 11. Ventral valve, posterior and lateral views, JB 16, × 5.0 × 5.0.
9. Dorsal valve exterior, JB 06c, × 5.0.
12. Dorsal valve exterior, JB 14a, × 5.0.
13. Dorsal valve, internal mould, JB 06a, × 5.0.

Ivanothele sp.; Motol Formation; Loděnice (Černidla)

14, 17. Dorsal valve exterior, PCZCU 248. 14 – detail of microornamentation , × 400; 17 – entire valve, × 30.

Acrosaccus vexatus (BARRANDE, 1879); Motol Formation; Loděnice (Černidla)

15, 16. Fragment of ventral valve, PCZCU 243. 15 – × 30; 16 – detail of microornamentation, × 250.

PLATE 20

Acrosaccus vexatus (BARRANDE, 1879)

1. Dorsal valve; Kopanina Formation; Koněprusy, Tobolka, MBHR 73335, × 10.
2, 6. Ventral valve; Kopanina Formation; Koledník, MBHR 73382. 2 – posterior view to internal mould, × 10; 6 – interior in ventral view, × 10.
3. Exfoliated dorsal valve, NM L 16064, specimen figured by Barrande (1879) as *Discina vexata* BARR. on pl. 100, case III, fig. 3; Motol Formation; Loděnice, × 8.5.
4. Dorsal valve exterior, NM L 24412, specimen figured by Barrande (1879) as *Discina rugata* SOW. on pl. 98, case I, fig. 5; Motol Formation; Lužce-Loděnice, × 8.5.
5. Lectotype, dorsal valve interior, NM L 16065, specimen figured by Barrande (1879) as *Discina vexata* BARR. on pl. 100, case III, fig. 1; Motol Formation; Loděnice, × 8.5.
7. Exfoliated ventral valve, NM L 24401, specimen figured by Barrande (1879) as *Discina reversa* V. K. on pl. 96, case I, fig. 6; Kopanina Formation; Králův Dvůr, Dlouhá hora Hill, × 8.5.
8. Exfoliated dorsal valve, NM L 24498, specimen figured by Barrande (1879) as *Discina Fritschi* BARR. on pl. 110, case IV; Zlíchov Formation; Praha-Zlíchov, Švagerka, × 8.5.
9. Exfoliated dorsal valve, NM L 24447, specimen figured by Barrande (1879) as *Discina planula* BARR. on pl. 102, case III; Motol Formation; Loděnice, × 8.5.
10. Dorsal valve exterior; Motol Formation; Loděnice, PCZCU 514, × 13.

Chynithele ventricona HAVLÍČEK, 1996

11. Dorsal valve exterior; Daleje-Třebotov Formation, Suchomasty Limestone; Koněprusy, Voskop, PCZCU 515, × 10.
12, 15. Dorsal valve interior; Zlíchov Formation, Chýnice Limestone; Bubovice, Čeřinka Hill, MBHR 72704. 12 – × 10; 15 – internal mould, × 10.
13. Ventral valve exterior, NM L 24444, specimen figured by Barrande (1879) as *Discina surgens* BARR. on pl. 101, case VIII, fig. 2; Daleje-Třebotov Formation, Suchomasty Limestone; Měňany, × 10.
14, 17, 18. Ventral valve interior; Daleje-Třebotov Formation, Suchomasty Limestone; Koněprusy, Zlatý kůň, PCZCU 516. 14 – ventral view, × 10; 17 – lateral view, × 10; 18 – posterior view × 10.
16, 19, 20. Ventral valve exterior; Daleje-Třebotov Formation, Suchomasty Limestone; Koněprusy, Voskop, PCZCU 518. 16 – ventral view, × 10; 19 – posterior view, × 10; 20 – lateral view, × 10.
21. Ventral valve internal mould, posterior view; Daleje-Třebotov Formation, Suchomasty Limestone; Koněprusy, Zlatý kůň, PCZCU 517, × 10.
22. Ventral valve with remain of shell; Zlíchov Formation, Chýnice Limestone; Bubovice, Čeřinka Hill, MBHR 67654, × 10.

PLATE 21

Sterbinella daphne sp. n.; Požáry Formation; Králův Dvůr, Kosov Quarry

1. Dorsal valve, internal mould, PCZCU 519, × 13.
2. Dorsal valve interior, PCZCU 520, × 13.
3. Dorsal valve exterior, PCZCU 521, × 13.
4. Dorsal valve internal mould, PCZCU 522, × 13.
5. Dorsal valve, internal mould, PCZCU 523, × 13.
6. Ventral valve exterior, PCZCU 524, × 13.
7. Ventral valve exterior, PCZCU 525, × 13.
8. Holotype, ventral valve exterior, PCZCU 526, × 13.
9. Ventral valve exterior, PCZCU 527, × 13.
10 – 12. Dorsal valve exterior, PCZCU 186. 10 – × 30; 11 – detail of larval shell, × 210; 12 – post-larval shell microornamentation, × 690.

Sterbinella sp.; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry

13, 14. Ventral valve, PCZCU 227. 13 – × 42; 14 – × 50.

"Discina" incumbens BARRANDE, 1879; Kopanina Formation; Králův Dvůr, Dlouhá hora Hill

15. Dorsal valve, internal mould, NM L 24422, specimen figured by Barrande (1879) as *Discina incumbens* BARR. on pl. 99, case VI, fig. 1, × 10.

Kosoidea fissurella HAVLÍČEK et MERGL, 1988; Kopanina Formation; Králův Dvůr, Kosov Quarry

16. Ventral valve interior, MBHR 37894, × 9.0.
17, 18. Dorsal valve, internal mould, MBHR 37891. 17 – oblique viev, × 9.0; 18 – internal mould, x9.0.
19. Dorsal valve exterior, MBHR 37892, × 9.0.

PLATE 22

Praeoehlertella umbrosa sp. n.; Praha Formation, black shales; Svatý Jan pod Skalou, Stydlé vody Quarry

1. Paratype, dorsal valve, MBHR 49799, × 9.5.
2. Dorsal valve, MBHR 49765, × 9.5.
3. Dorsal valve, MBHR 49777, × 9.5.
4. Holotype, ventral valve, MBHR 49779, × 9.5.
5. Ventral valve, MBHR 49775, × 9.5.
6. Ventral valve, MBHR 49799, × 9.5.

Praeoehlertella georgiana sp. n.; Želkovice Formation; Hýskov, V Jakubinkách

7, 9. Holotype, ventral valve, PCZCU 509. 7 – entire shell, × 5.0; 9 – detail of pedicle track, × 10.
8. Ventral valve, MBHR 75258, × 5.0.
10. Paratype, dorsal valve, MBHR 75662, × 5.0.
11. Dorsal valve, MBHR 74137, × 5.0.
12. Dorsal valve, MBHR 75681, × 5.0.
13. Fragment of shell, PCZCU 420, × 40.

PLATE 23

Opatrilkiella minuta sp. n.; Přídolí Formation, upper part; Praha-Holyně, Opatřilka Quarry east wall

1. Ventral valve exterior, PCZCU 474, × 55.
2, 4, 13. Ventral valve exterior, PCZCU 472. 2 – dorsal view, × 50; 4 – oblique view, × 65; 13 – detail of posterior, × 200.
3, 7, 12. Paratype, dorsal valve exterior, PCZCU 124. 3 – ventral view, × 60; 7 – oblique view, × 65; 12 – detail of posterior part, × 200.
5. Dorsal valve interior, PCZCU 128, × 50.
6. Dorsal valve exterior, PCZCU 125, × 50.
8, 10, 11. Holotype, ventral valve interior, PCZCU 130. 8 – oblique view, × 70; 10 – anterior view, × 70; 11 – dorsal view, × 50.
9. Dorsal valve, interior in oblique view, PCZCU 129, × 65.

PLATE 24

Opatrilkiella minuta sp. n.; Přídolí Formation, upper part; Praha-Holyně, Opatřilka Quarry, east wall

1 – 3. Holotype, ventral valve, PCZCU 130. 1 – interior showing two types of epithelial cell moulds, × 130. 2 – moulds at visceral area, × 500; 3 – moulds anterior to central muscle scars, × 420.
4, 5, 8. Dorsal valve ornamentation, PCZCU 124. 4 – radial rows of pits, × 110; 5 – detail of microornamentation, × 900; 8 – fine microornamentation, × 1100.

Opatrilkiella sp. A; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry, bed 13

6, 9. Dorsal valve exterior, PCZCU 231. 6 – × 35; 9 – × 35.
7, 12. Ventral valve interior, PCZCU 232. 7 – dorsal view, × 40; 12 – oblique view, × 50.
11. Ventral valve interior, PCZCU 221, × 45.

Opatrilkiella (?) sp. B; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry, bed 13

10. Ventral valve in oblique view, PCZCU 233, × 35.

PLATE 25

Acrotretella siluriana IRELAND, 1961

1, 2, 8. Ventral valve; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 026. 1 – apical view, × 50; 2 – lateral view, × 55; 8 – oblique view, × 60.
3. Dorsal valve exterior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 029, × 60.
4, 6, 7, 17. – Dorsal valve exterior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 027. 4 – dorsal view, × 60; 6 – oblique view, × 60; 7 – anterior view, × 60; 17 – detail of ornamentation, × 350.
5. Dorsal valve exterior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 025, × 55.
9, 14. Dorsal valve interior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 339. 9 – oblique view, × 60; 14 – ventral view, × 60.
10, 13, 16. Dorsal valve interior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 024. 10 – oblique view, × 60; 13 – ventral view, × 50; 16 – detail of pseudointerarea, × 180.
11. Juvenile dorsal valve interior; Motol Formation; Svatý Jan pod Skalou, U elektrárny, PCZCU 024, × 80.
12, 15. Ventral valve; Želkovice Formation; Hýskov, V Jakubinkách, PCZCU 434. 12 – anterior view, × 65; 15 – apical view, × 60.

PLATE 26

Acrotretella spinosa sp. n.; Požáry Formation; Praha-Holyně, Opatřilka Quarry, east wall

1. Dorsal valve interior, PCZCU 076, × 60.
2, 7. Dorsal valve interior, PCZCU 075. 2 – ventral view, × 60; 7 – anterior view, × 65.
3, 6, 8. Holotype, dorsal valve interior of gerontic specimen, PCZCU 069. 3 – × 55; 6 – ventral view, × 62; 8 – oblique view, × 65.
5. Dorsal valve interior, oblique view, PCZCU 065, × 60.
9. Dorsal valve interior, PCZCU 066, × 60.
10. Dorsal valve exterior, PCZCU 081, × 60.
11, 13, 14. Dorsal valve exterior, PCZCU 072. 11 – oblique view, × 85; 13 – dorsal view, × 60; 14 – detail of larval shell, × 320.

PLATE 27

Acrotretella spinosa sp. n.; Požáry Formation; Praha-Holyně, Opatřilka Quarry, east wall

1, 3, 5. Paratype, ventral valve exterior, PCZCU 070. 1 – lateral view, × 72; 3 – apical view, × 65; 5 – oblique view, × 75.

2, 4, 7. Ventral valve exterior, PCZCU 077. 2 – apical view, × 65; 4 – oblique view, × 90. 7 – detail of ornamentation, × 210.
6, 8. Ventral valve exterior, PCZCU 071. 6 – oblique view, × 100; 8 – detail of ornamentation, × 500.

Acrotretella triseptata sp. n.; Lochkov Formation, Kotýs Limestone; Praha-Řeporyje, Černý lom Quarry, east wall

9–11. Holotype, dorsal valve interior, PCZCU 368. 9 – ventral view, × 60; 10 – oblique view, × 65; 11 – posterior view, × 65.

PLATE 28

Artiotreta krizi sp. n.

1, 2, 6, 7. Holotype, complete shell, dorsal valve; Želkovice Formation; Hýskov, V Jakubinkách, PCZCU 427. 1 – × 100; 2 – lateral view, × 100; 6 – detail of posterior margin, × 350; 7 – detail of larval shell, × 400.
3, 5. Dorsal valve interior; Želkovice Formation; Hýskov, V Jakubinkách, PCZCU 429. 3 – ventral view, × 80; 5 – oblique view, × 90.
4. Dorsal valve exterior, oblique view; Želkovice Formation; Hýskov, V Jakubinkách, PCZCU 423, × 90.
8, 9. Dorsal valve exterior; Motol Formation; Loděnice, Černidla, PCZCU 459. 8 – detail of larval shell, × 180; 9 – ventral view, × 55.
10, 11. Complete shell, ventral valve with broken apex, septum of dorsal valve visible; Motol Formation; Loděnice, Černidla, PCZCU 244. 10 – × 60; 11 – oblique views, × 70.

PLATE 29

Opsiconidion ephemerus (MERGL, 1982); Kopanina Formation; Praha-Řeporyje, Mušlovka Quarry

1, 9. Ventral valve exterior, PCZCU 443. 1 – posterior view, × 50; 9 – detail of pseudointerarea near anterior margin, × 500.
2, 3. Ventral valve exterior, PCZCU 442. 2 – lateral view, × 45; 3 – apical view, × 45.
4. Ventral valve exterior, anterior view, PCZCU 444, × 45.
5, 8. Dorsal valve exterior, PCZCU 451. 5 – ventral view, × 80; 8 – detail of larval shell, × 280.
6, 7. Neotype, dorsal valve interior, ventral and oblique views, PCZCU 273, × 70, × 80.

Opsiconidion sp. A; Želkovice Formation; Hýskov, V Jakubinkách

10. Dorsal valve interior, PCZCU 408, × 68
11, 13. Juvenile ventral valve, PCZCU 319. 11 – lateral view, x 80; 13 – apical view, × 80.
12. Dorsal valve exterior, PCZCU 437, × 100.
15. Juvenile ventral valve, posterior view, PCZCU 321, × 130.

14. *Opsiconidion* sp. B; Želkovice Formation; Hýskov, V Jakubinkách

14. Dorsal valve interior, oblique view, PCZCU 416, × 80.

PLATE 30

Opsiconidion simplex sp. n.; Přídolí Formation, upper part; Praha-Holyně, Opatřilka Quarry, east wall

1. Paratype, ventral valve exterior, lateral view, PCZCU 116, × 90.
2, 14. Ventral valve exterior, PCZCU 110. 2 – anterolateral view, × 90; 14 – detail of ornamentation, × 280.
3. Ventral valve exterior, dorsal view, PCZCU 117, × 80.
4. Ventral valve exterior, anterior view, PCZCU 103, × 80.
5. Ventral valve interior, PCZCU 107, × 95.
6. Dorsal valve interior, PCZCU 111, × 100.
7, 12, 13. Holotype, dorsal valve interior, PCZCU 086. 7 – ventral view, × 100; 12 – oblique view, × 100; 13 – oblique view, x 100.
8. Ventral valve exterior, lateral view, PCZCU 122, × 105.
9. Dorsal valve interior, PCZCU 093, × 100.
10. Dorsal valve interior, oblique view, PCZCU 099, × 115.
11. Dorsal valve interior, oblique view, PCZCU 096, × 115.
15, 17. Dorsal valve exterior, PCZCU 102. 15 – × 110; 17 – detail of larval shell, × 350.
16. Dorsal valve exterior, PCZCU 101, × 100.

PLATE 31

Opsiconidion sp. C; Praha Formation, Dvorce-Prokop Limestone (1-3); Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestones between black shales with *Monograptus atopus*)

1, 2. Incomplete dorsal valve, interior, PCZCU 049. 1 – oblique view, × 70; 2 – ventral view, × 70.
3. Incomplete ventral valve, PCZCU 048, × 70.

Opsiconidion decessus sp. n.; Choteč Formation, Choteč Limestone; Praha-Holyně, Prastav Quarry

4, 8. Dorsal valve interior, PCZCU 220. 4 – ventral view, × 45; 8 – oblique view, × 45.
5-7, 16. Holotype, dorsal valve interior, PCZCU 216. 5 – ventral view, × 45; 6 – oblique view, × 55; 7 – posterior view, × 48; 16 – detail of septum, × 122.
9. Ventral valve exterior, PCZCU 214, × 70.
10, 11, 13-15. Paratype, ventral valve exterior, PCZCU 213. 10 – lateral view, × 45; 11 – detail of larval shell, × 180; 13 – posterior view, × 55; 14 – oblique view, × 55; 15 – detail of pseudointerarea, × 180.
12. Dorsal valve exterior, oblique view, PCZCU 196, × 55.

PLATE 32

Havlicekion splendidus sp. n.; Praha Formation, Dvorce-Prokop Limestone; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*)

1-5. Paratype, ventral valve, PCZCU 036. 1 – anterior view, x 65; 2 – left lateral view, × 65; 3 – apical view, × 70; 4 – detail of larval shell, × 240; 5 – right lateral view, × 65.

6. Ventral valve, apical view, PCZCU 045, × 85.
7. Ventral valve, posterior view, PCZCU 046, × 130.
8, 11, 13. Dorsal valve interior, PCZCU 038. 8 – ventral view, x 55; 11 – oblique anterior view, × 55; 13 – anterior view, × 60.
9, 12. Holotype, dorsal valve interior, PCZCU 040. 9 – oblique view, × 68; 12 – ventral view, × 55.
10. Dorsal valve interior, PCZCU 039, × 55.

PLATE 33

Havlicekion ivanensis sp. n.; Motol Formation; Svatý Jan pod Skalou, U elektrárny

1-3, 10. Paratype, ventral valve exterior, PCZCU 332. 1 – lateral view, × 60; 2 – posterior view, × 70; 3 – apical view, × 55; 4 – detail of ornamentation, × 250.
4, 7. Dorsal valve interior, PCZCU 327. 4 – ventral view, × 70; 7 – oblique view, × 90.
5, 6, 9. Holotype, dorsal valve exterior, PCZCU 344. 5 – dorsal view, × 42; 6 – oblique view, × 50; 9 – detail of posterior, × 140.
8. Dorsal valve exterior, oblique view, PCZCU 345, × 62.
11. Dorsal valve interior, oblique view, PCZCU 469, × 75.
12. Dorsal valve interior, PCZCU 266, × 55.
13. Dorsal valve exterior, detail of larval shell, PCZCU 254, × 300.

PLATE 34

Havlicekion holynensis sp. n.; Lochkov Formation, Kotýs Limestone; Praha-Řeporyje, Černý lom Quarry, east wall

1, 3. Paratype, ventral valve, PCZCU 157. 1 – posterior view, x 80; 3 – lateral view, × 80.
2. Ventral valve, apical view, PCZCU 154, × 80.
4, 6. Ventral valve, PCZCU 155. 4 – detail of larval shell, × 260; 6 – posterior view, × 120.
5. Dorsal valve interior, PCZCU 135, × 55.
7, 14. Dorsal valve, PCZCU 141. 7 – larval shell pitting, × 1200; 14 – dorsal valve exterior, × 170.
8, 11, 12. Holotype, dorsal valve interior, PCZCU 142. 8 – dorsal view, × 70; 11 – anterior view, × 75; 12 – lateral view, × 75.
9, 13. Dorsal valve interior, PCZCU 137. 9 – lateral view, × 80; 13 – dorsal view, × 80.
10. Dorsal valve exterior, PCZCU 144, × 60.

PLATE 35

Havlicekion splendidus sp. n.; Praha Formation, Dvorce-Prokop Limestone; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*)

1-3. Dorsal valve exterior, PCZCU 042. 1 – detail of larval shell, × 300; 2 – ventral view, × 60; 3 – oblique view, × 85.

Dysoristus posterus sp. n.; Praha Formation, Dvorce-Prokop Limestone

4. Dorsal valve, oblique view; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), PCZCU 183, × 50.
5. Dorsal valve; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), PCZCU 055, × 60.
6, 7, 12. Paratype, dorsal valve; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), PCZCU 056. 6 – ventral view, x 60; 7 – oblique view, × 75; 12 – detail of ornamentation, × 300.
8. Paratype, dorsal valve interior; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), PCZCU 058, × 85.
9, 11. Fragment of ventral valve; Praha-Klukovice, Červený lom Quarry, PCZCU 194. 9 – interior, × 50; 11 – oblique view, × 60.
10, 13. Holotype, incomplete ventral valve, exterior; Svatý Jan pod Skalou, Stydlé vody Quarry (platy limestone between black shales with *Monograptus atopus*), PCZCU 064. 10 – dorsal view, × 50; 13 – oblique view, × 60.

Paterinid (?) sp. indet.; Želkovice Formation; Hýskov, V Jakubinkách

14. Fragment of valve, PCZCU 419, × 65.
15. Fragment of valve, PCZCU 189, × 65.

PLATE 36

Acanthambonine sp.; Motol Formation; Svatý Jan pod Skalou, U elektrárny

1, 4-7. Dorsal valve, PCZCU 202. 1 – ventral view, × 22; 4 – detail of posterior view, × 82; 5 – oblique view, × 28; 6 – details of surface with bases of spines, × 112; 7 – details of surface with bases of spines, × 85.
2, 3. Dorsal valve interior, PCZCU 188. 2 – in ventral view, × 52; 3 – oblique view, × 50.

Siphonotretine sp.; Kopanina Formation; Praha-Řeporyje, Mušlovka Quarry

8 – 10. Fragment of valve, PCZCU 247. 8 – right part of the valve, × 52; 9 – oblique view, × 63; 10 – detail of spines, × 300.

Schizambonine sp. B; Daleje-Třebotov Formation, Třebotov Limestone; Praha-Holyně, Prastav quarry, bed No. 5

11-14. Dorsal valve in oblique view, PCZCU 191. 11 – oblique view, × 65; 12 – posterior view, × 65; 13 – ventral view, × 55; 14 – detail of spines, × 750.

Schizambonine sp. A; Praha Formation, Dvorce-Prokop Limestone; Praha-Klukovice, Červený lom Quarry

15, 16. Dorsal valve, PCZCU 192. 15 – detail with spine bases, × 140; 16 – complete valve, × 50.

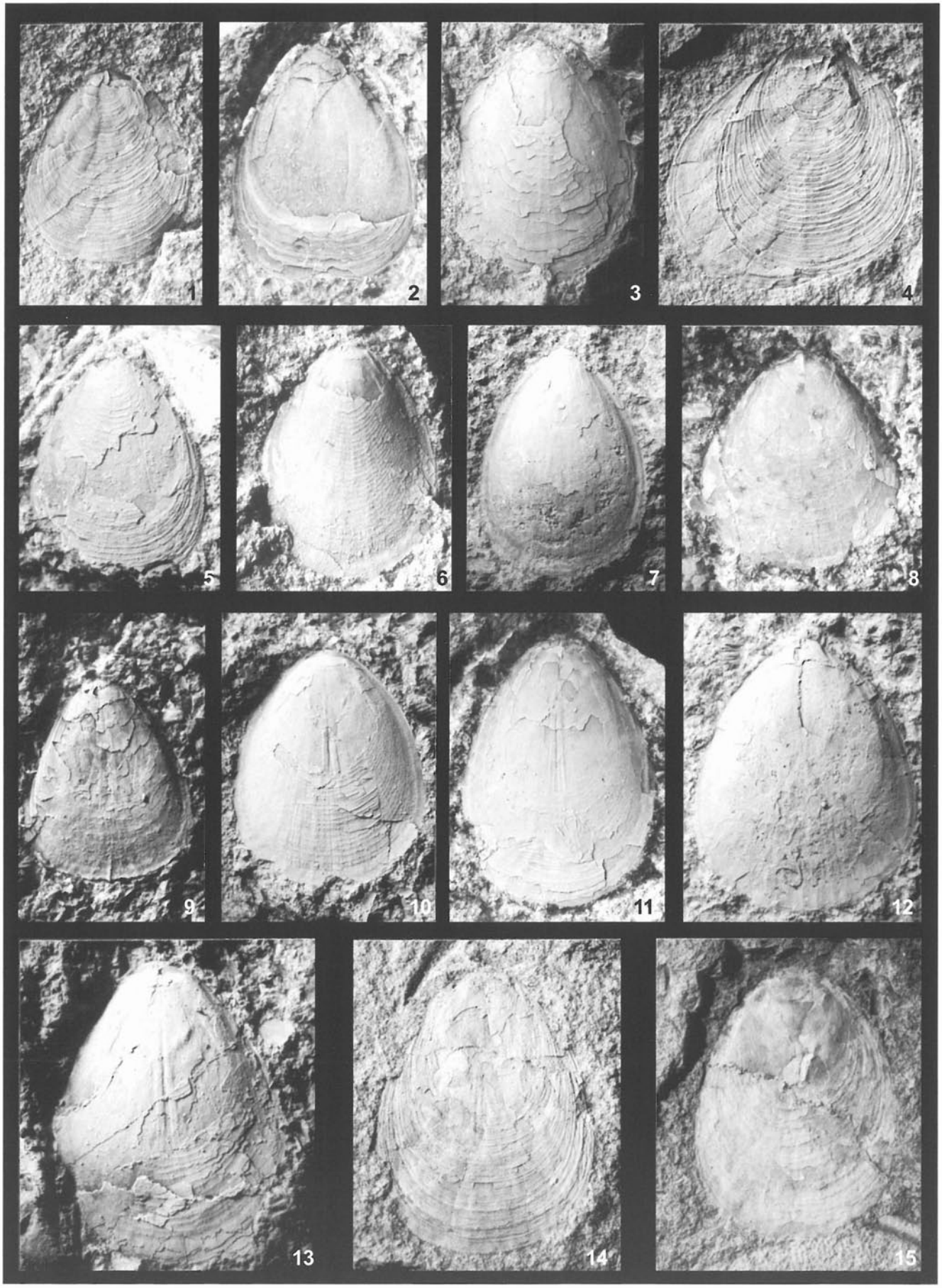
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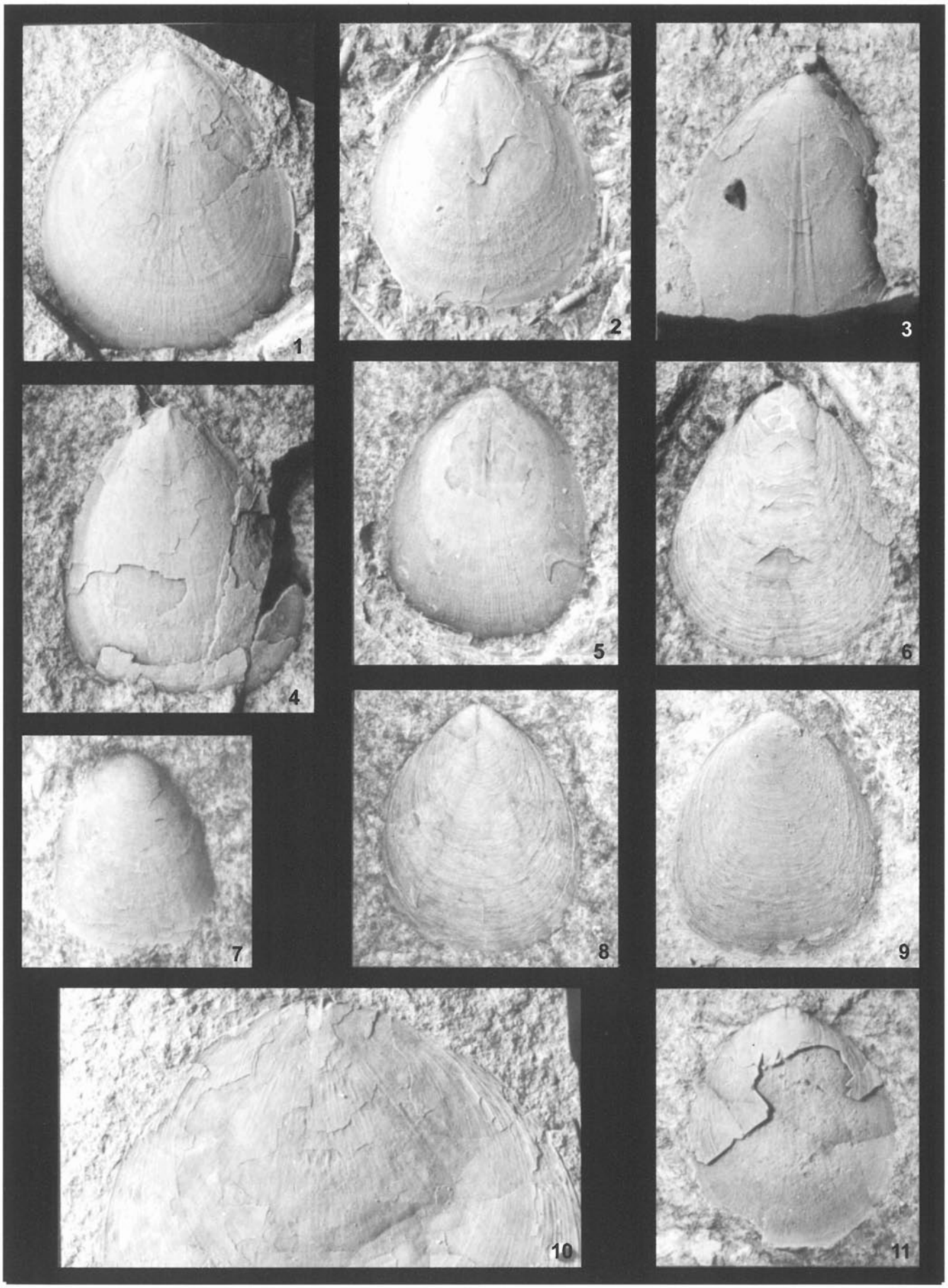
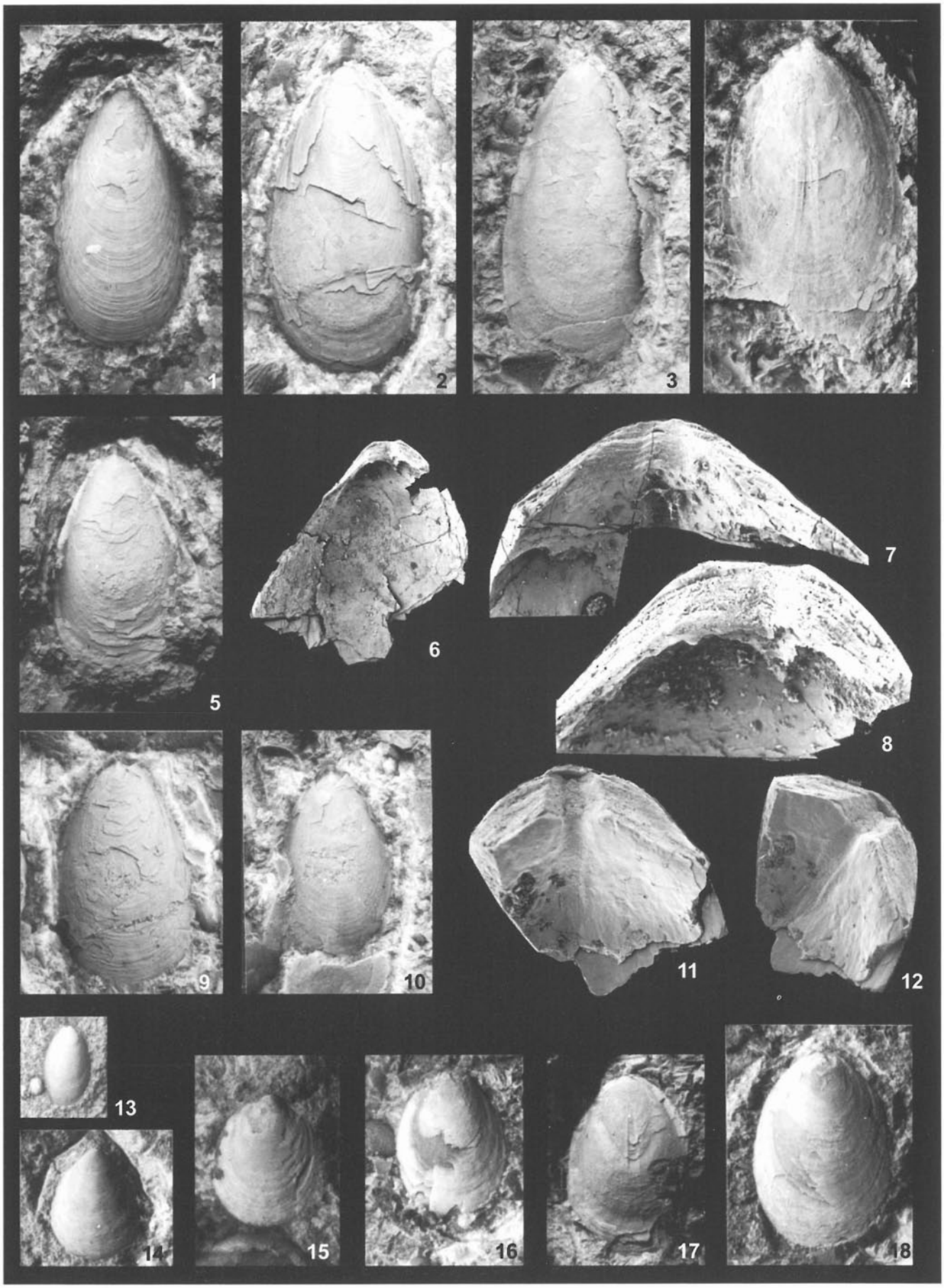
Plate 2

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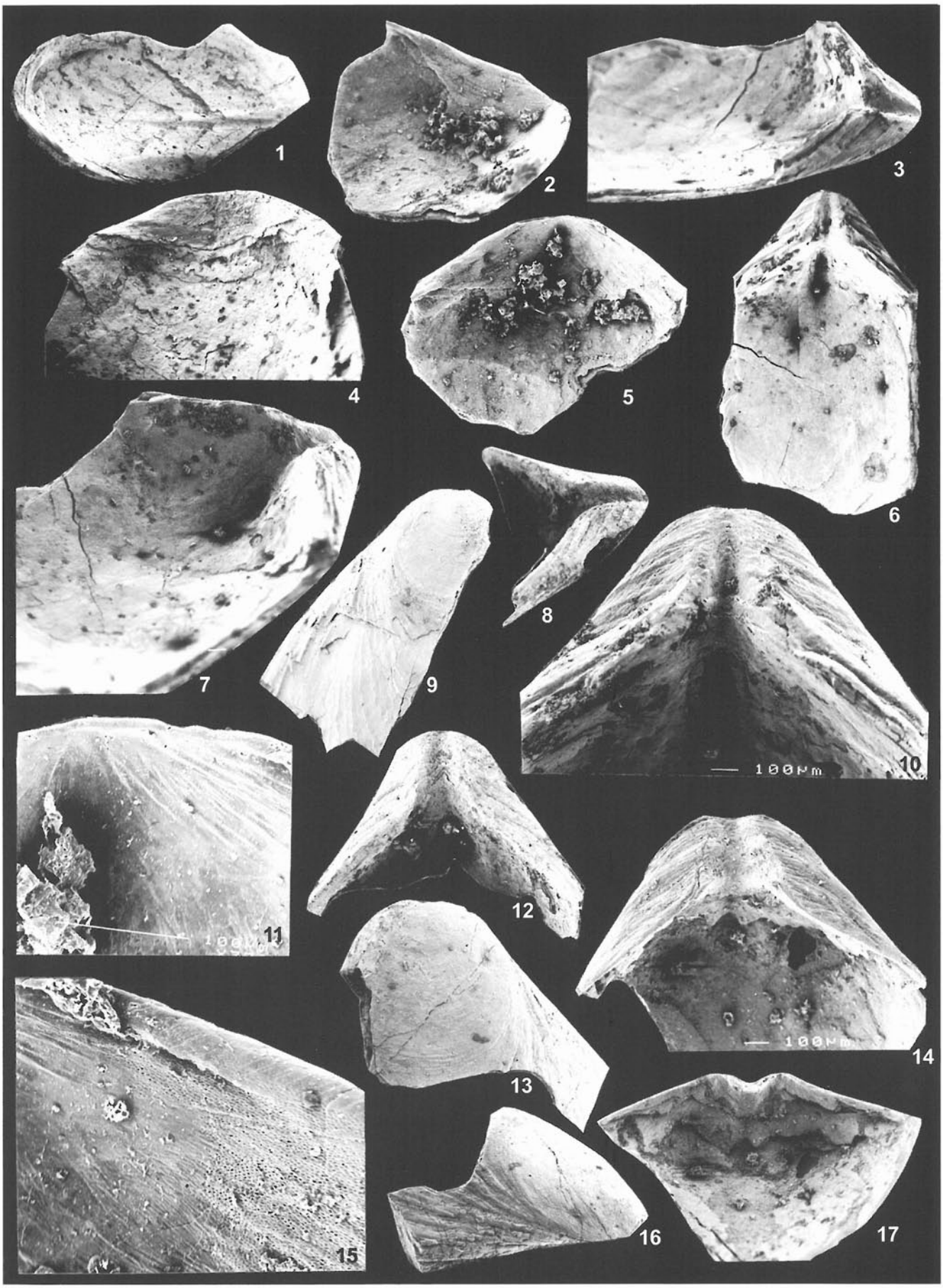

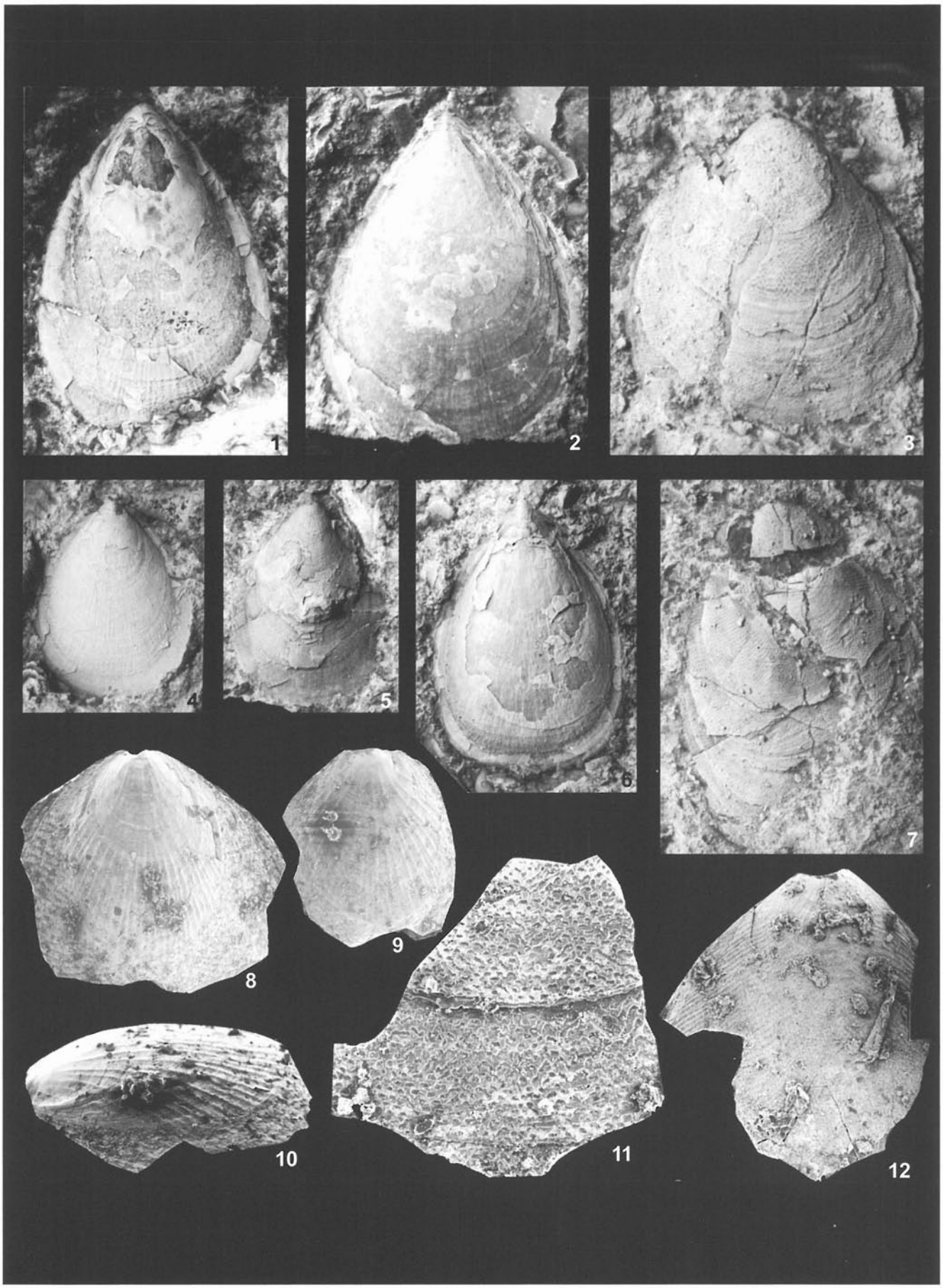
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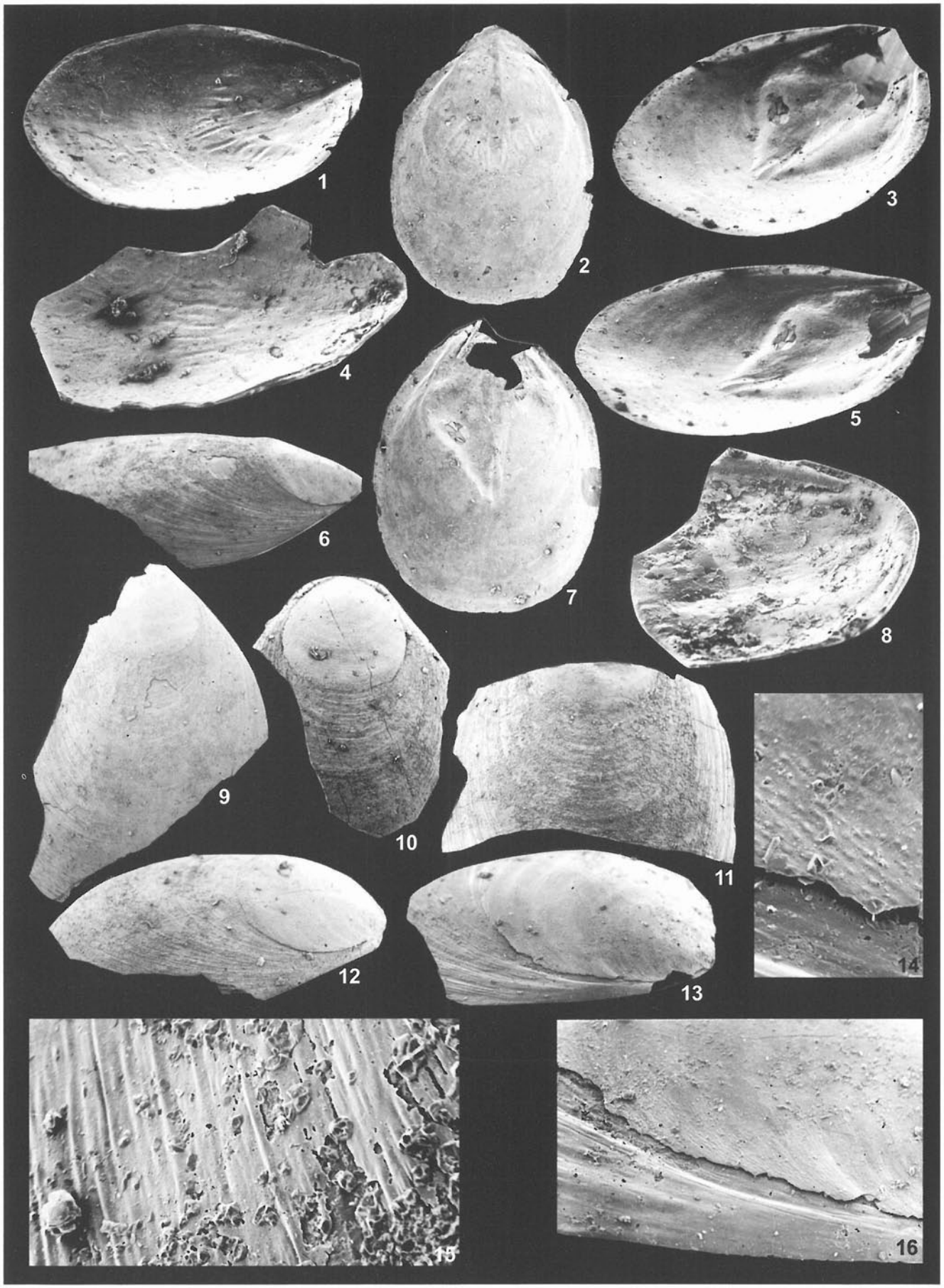

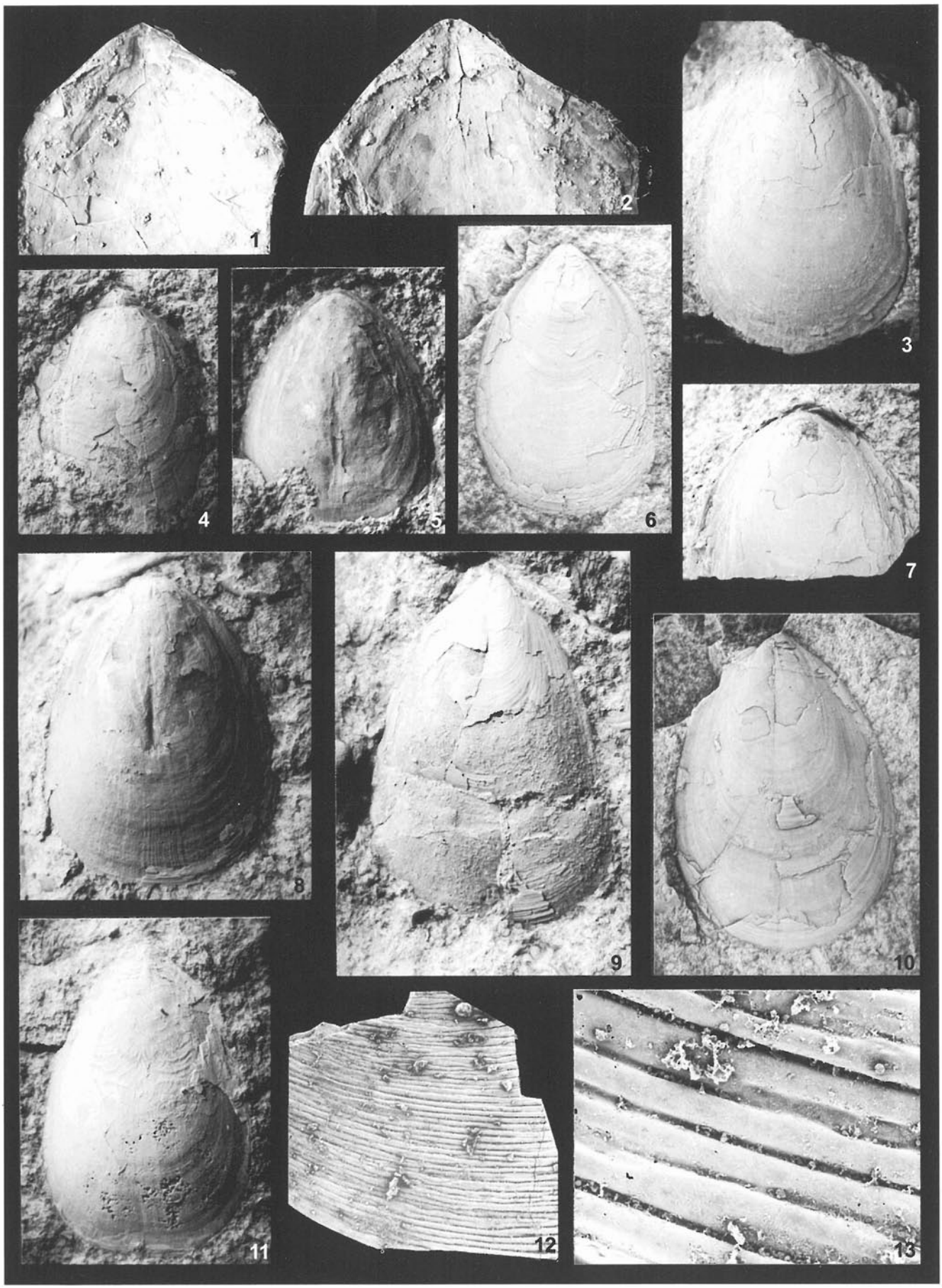
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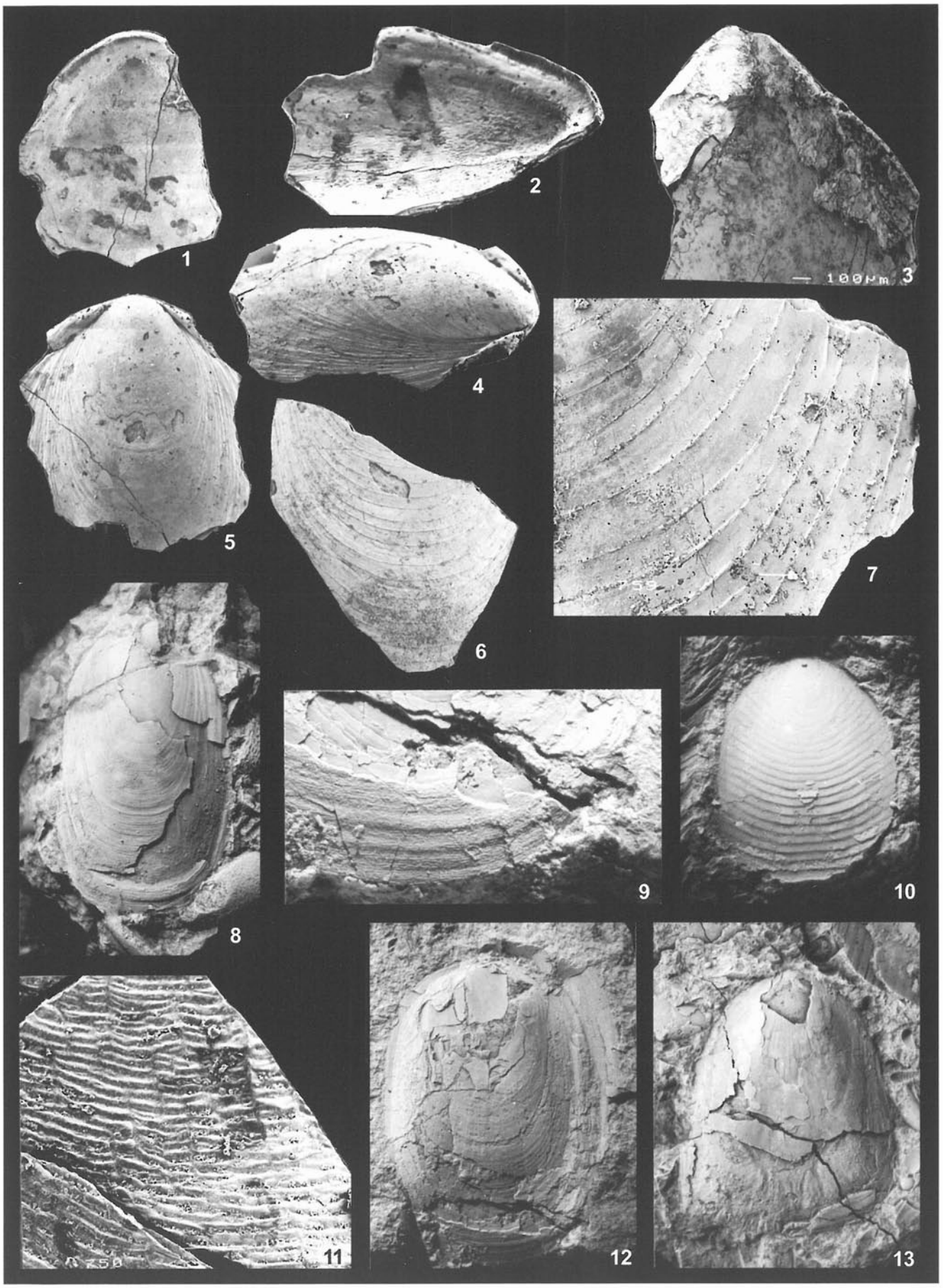

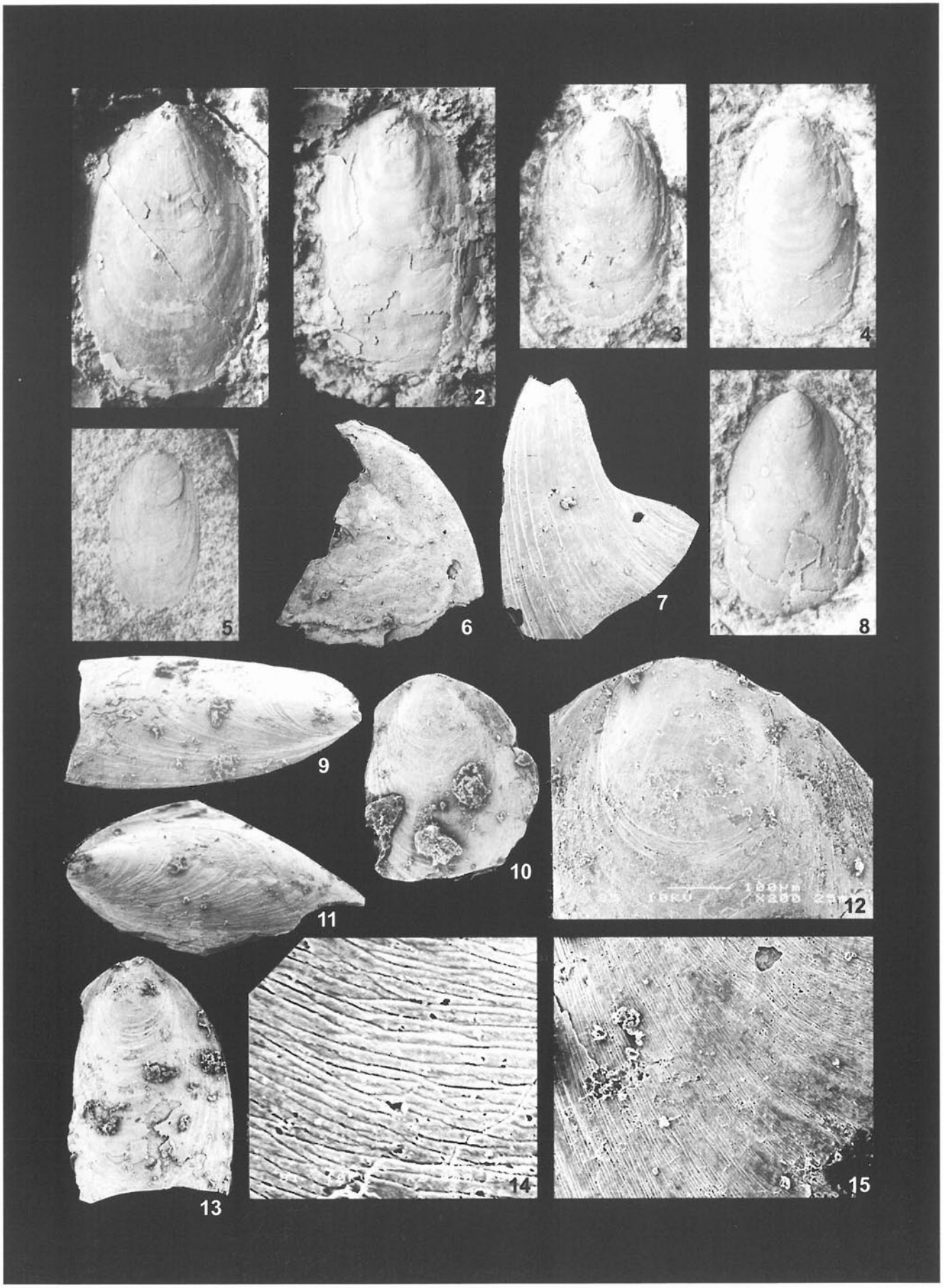
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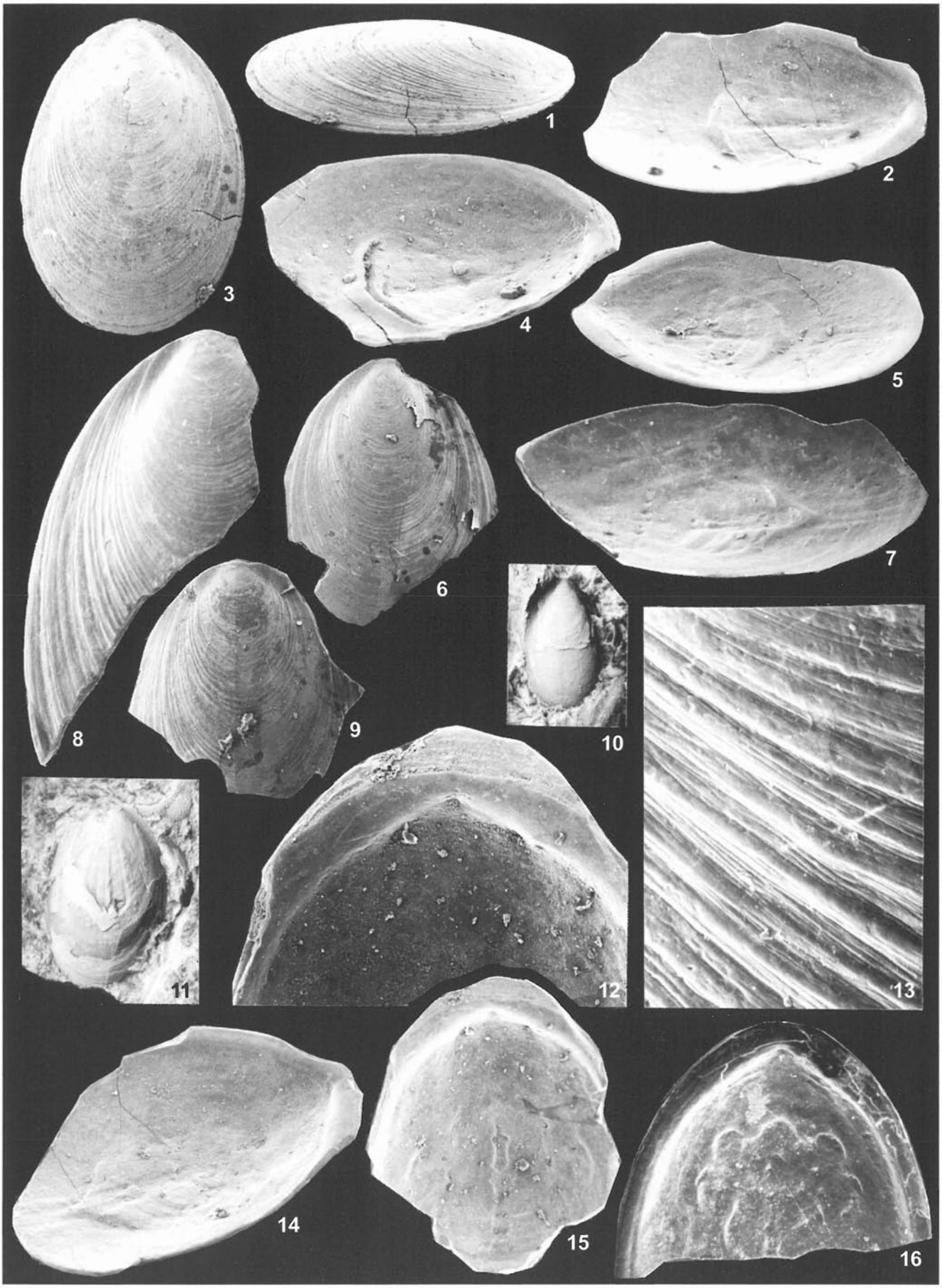
Plate 10



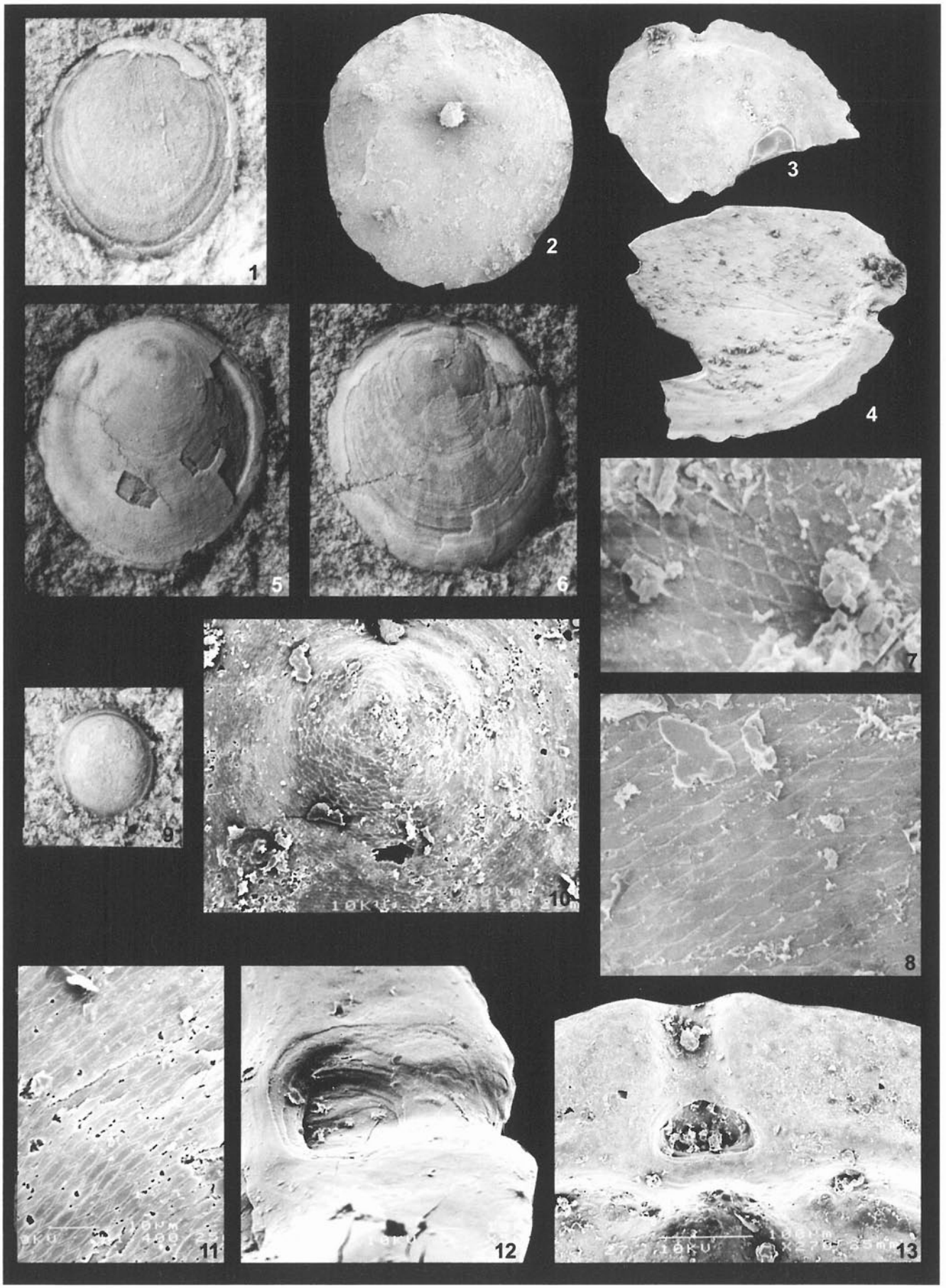

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Plate 12

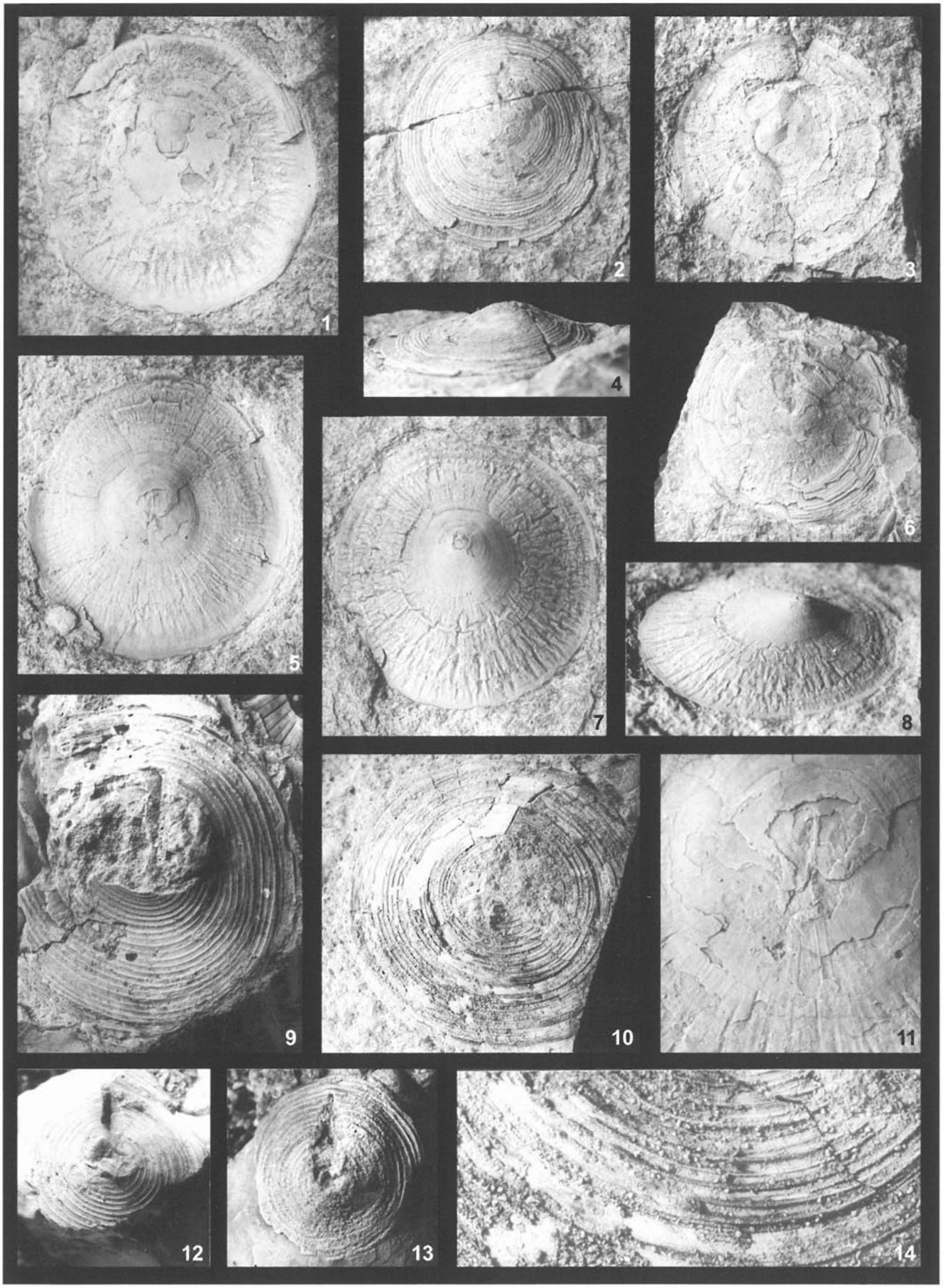
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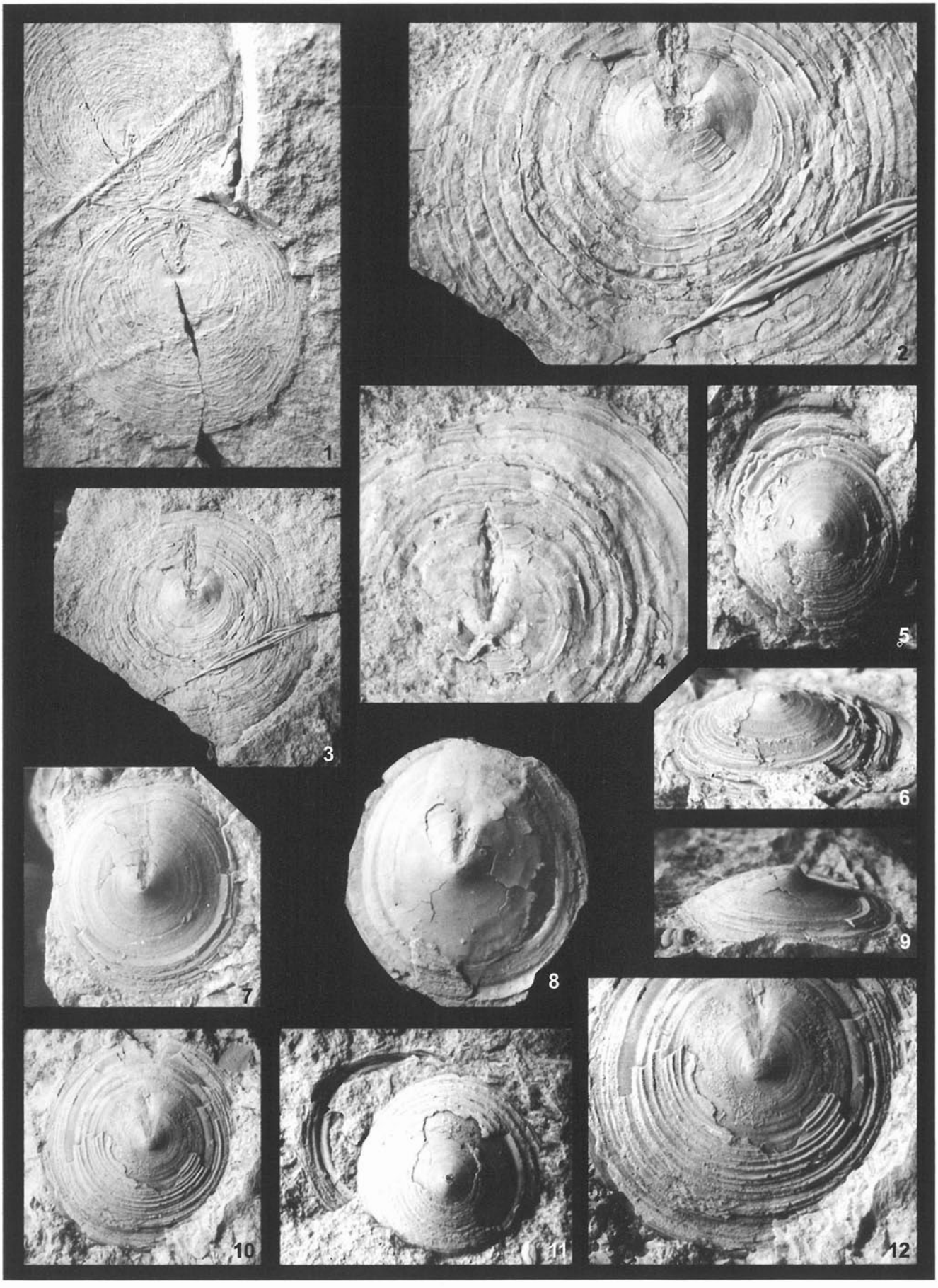
Plate 14



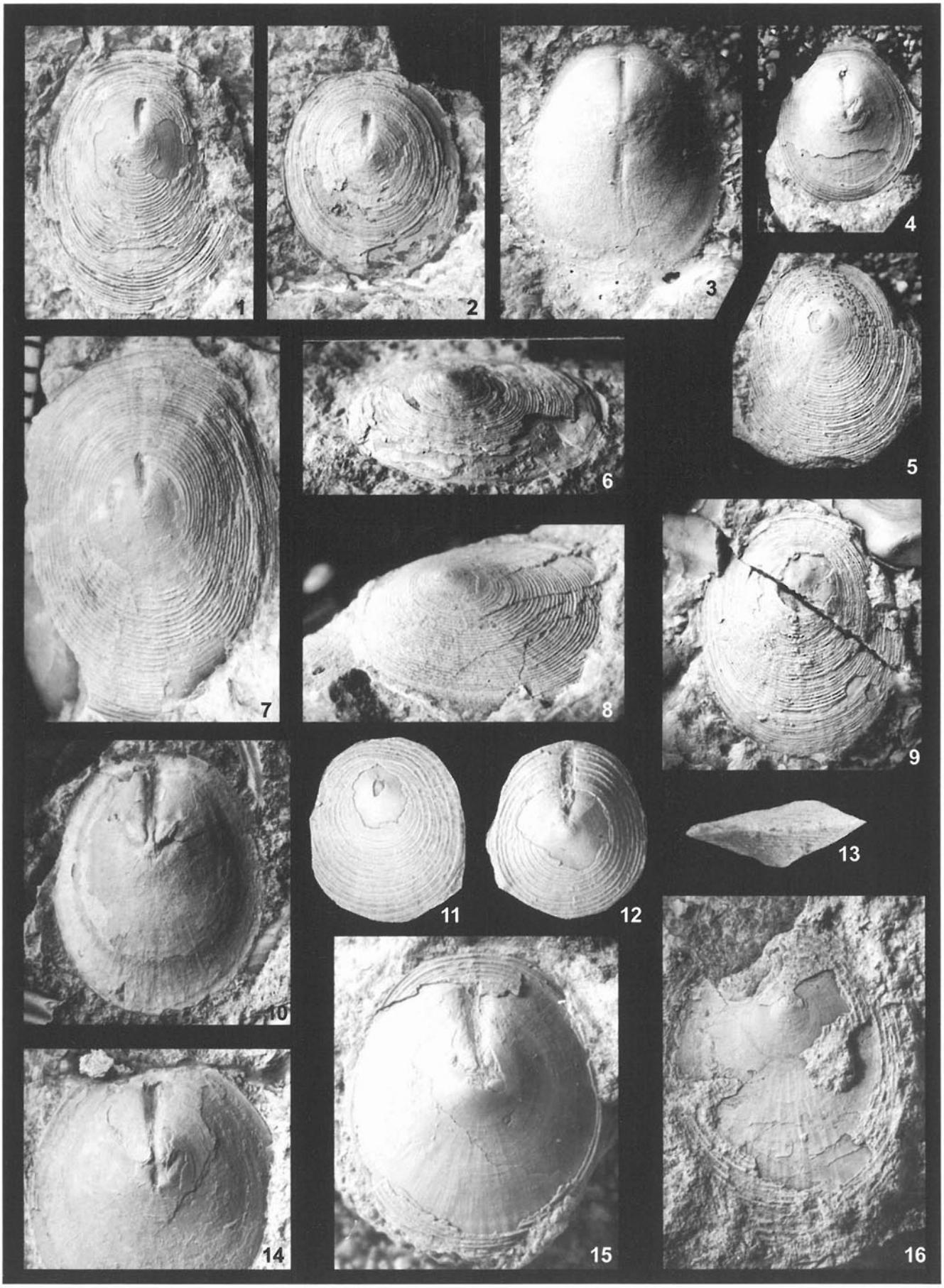

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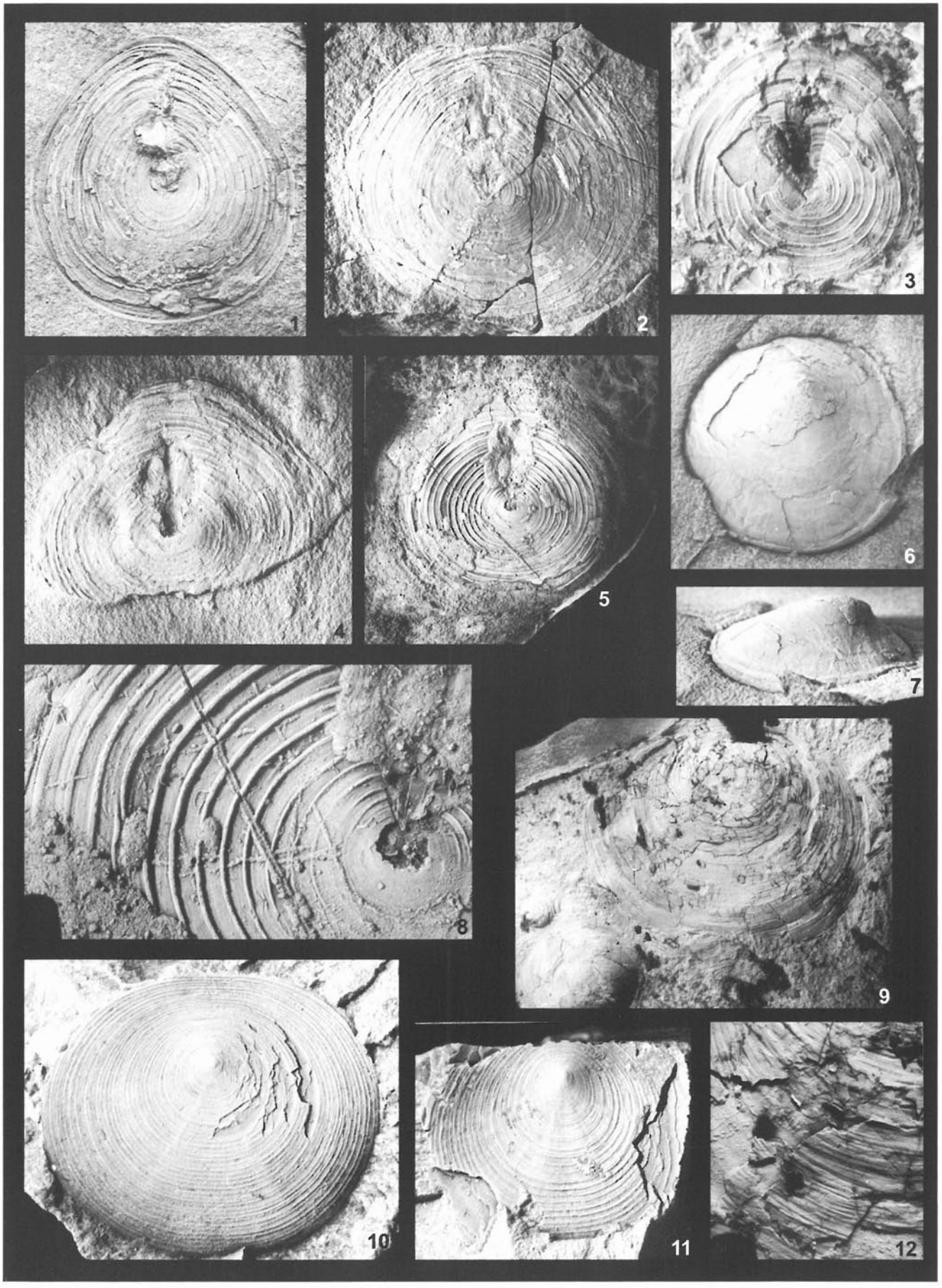
Plate 16



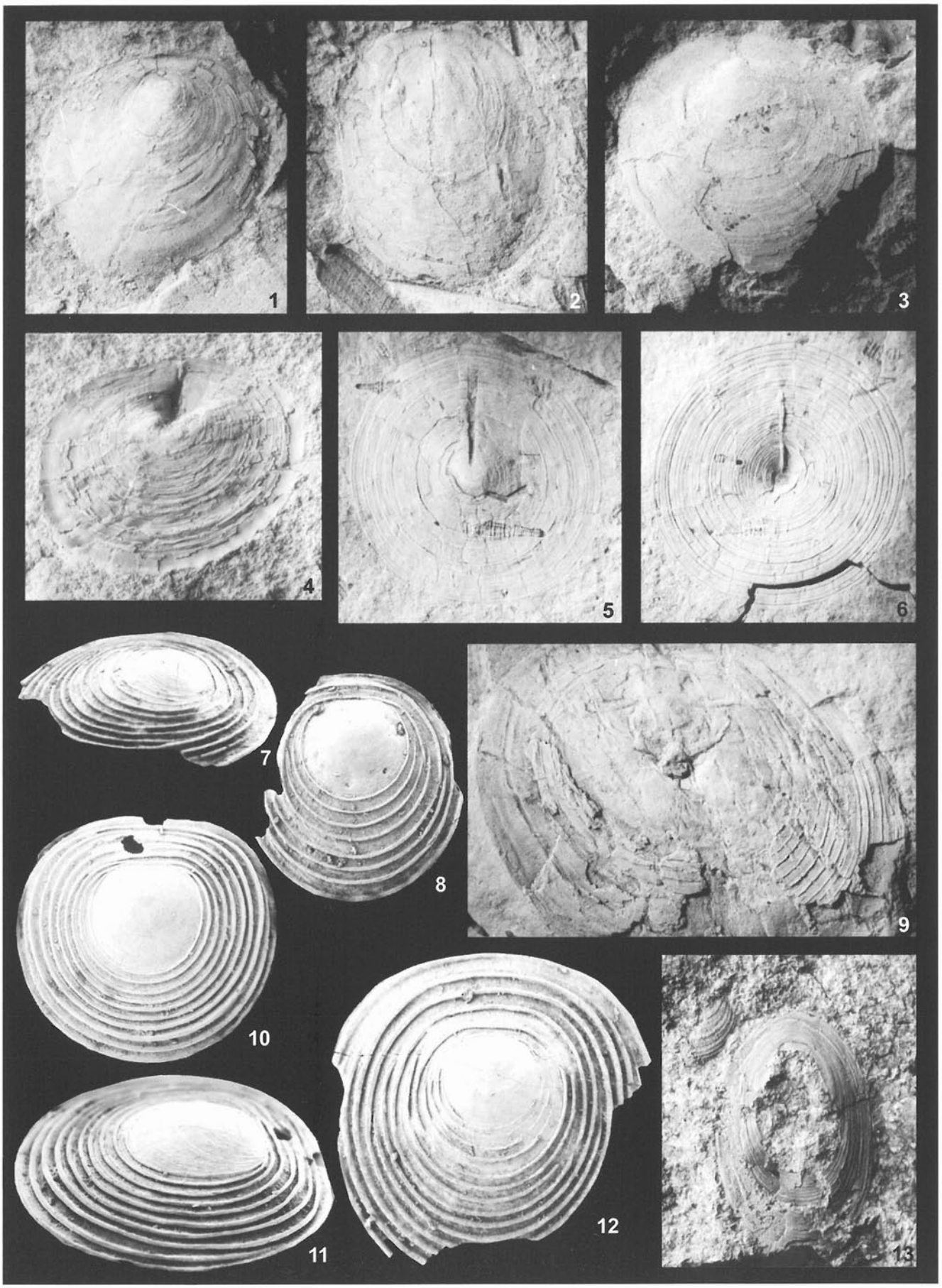

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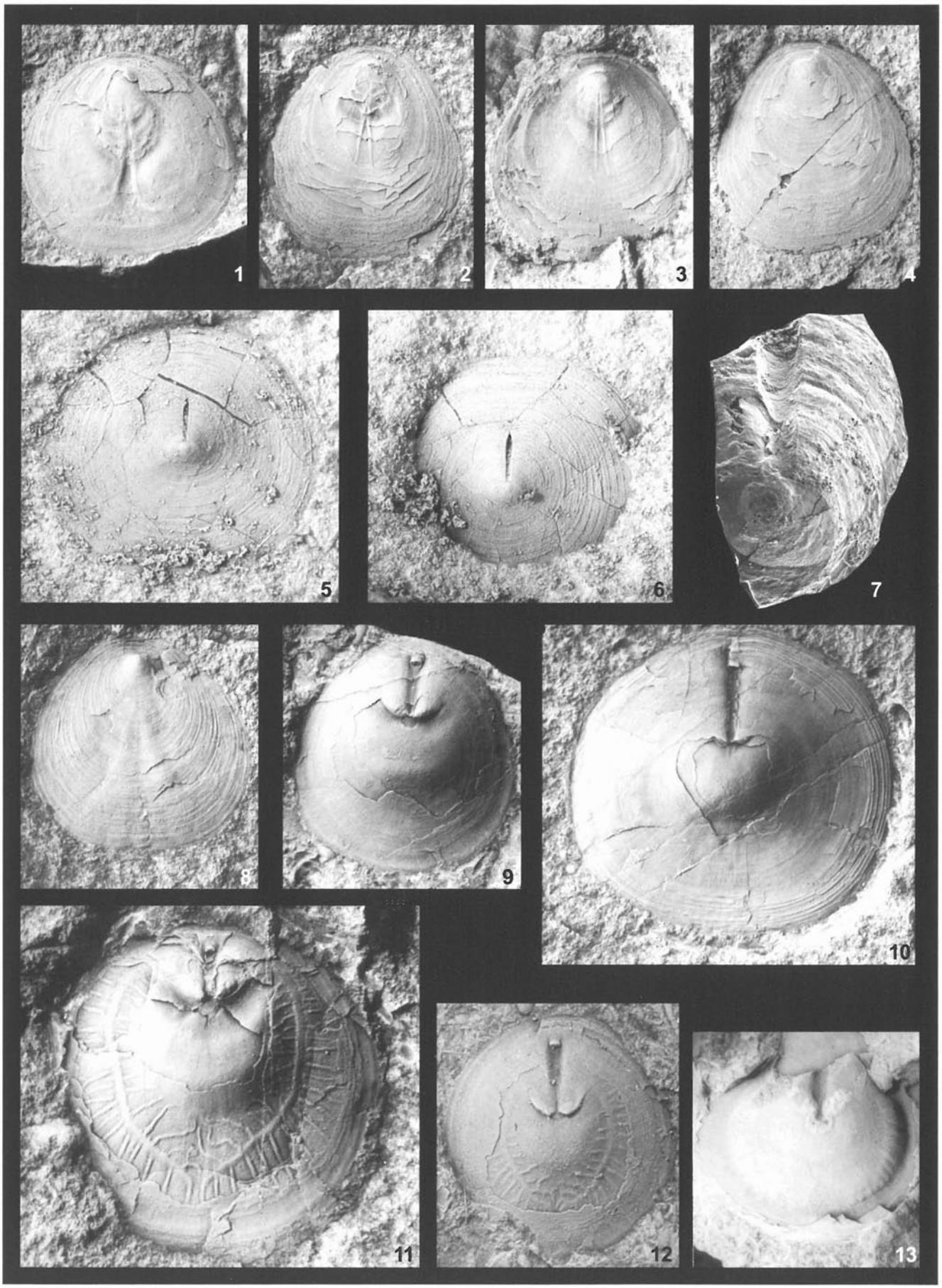
Plate 18



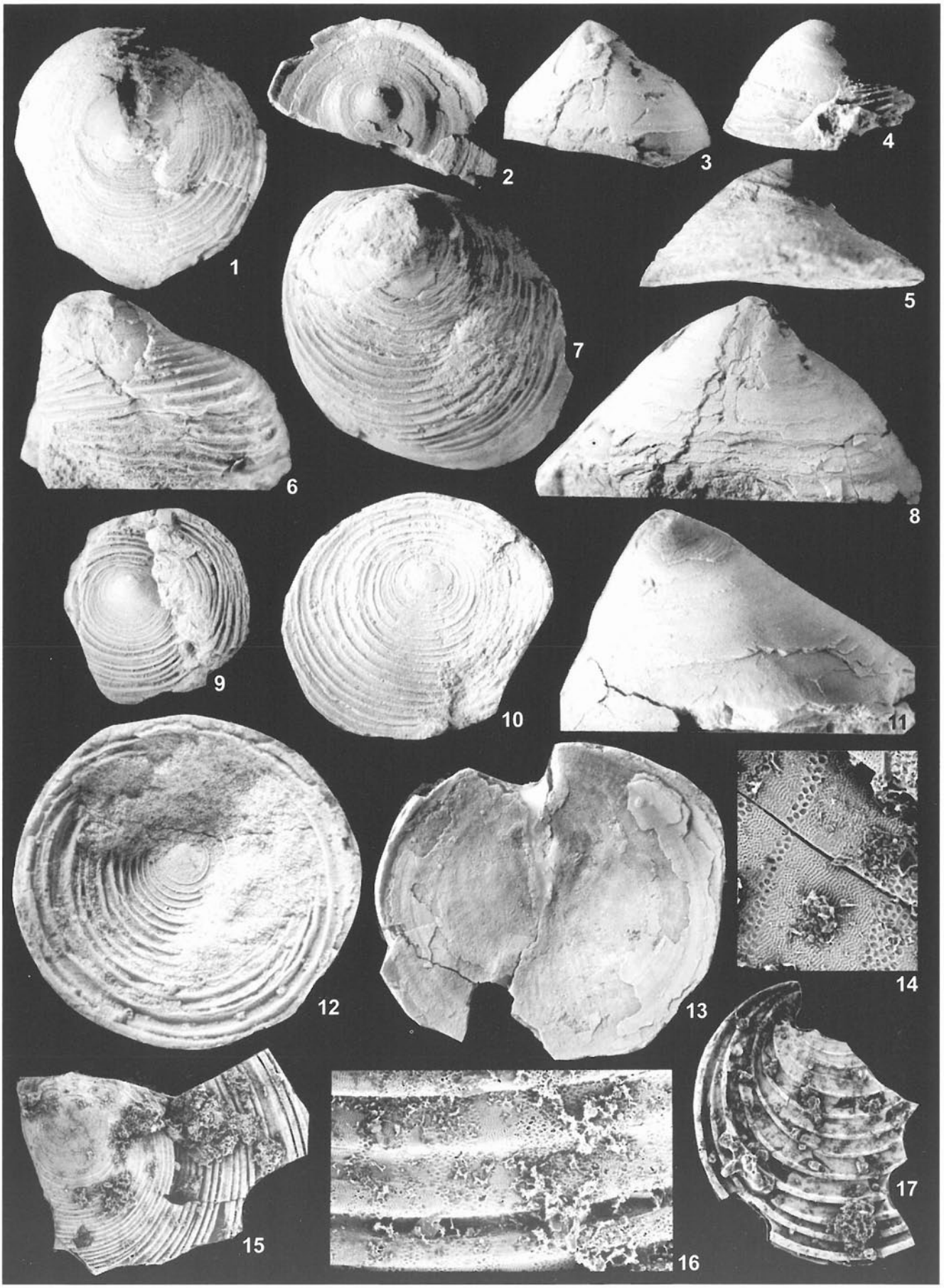

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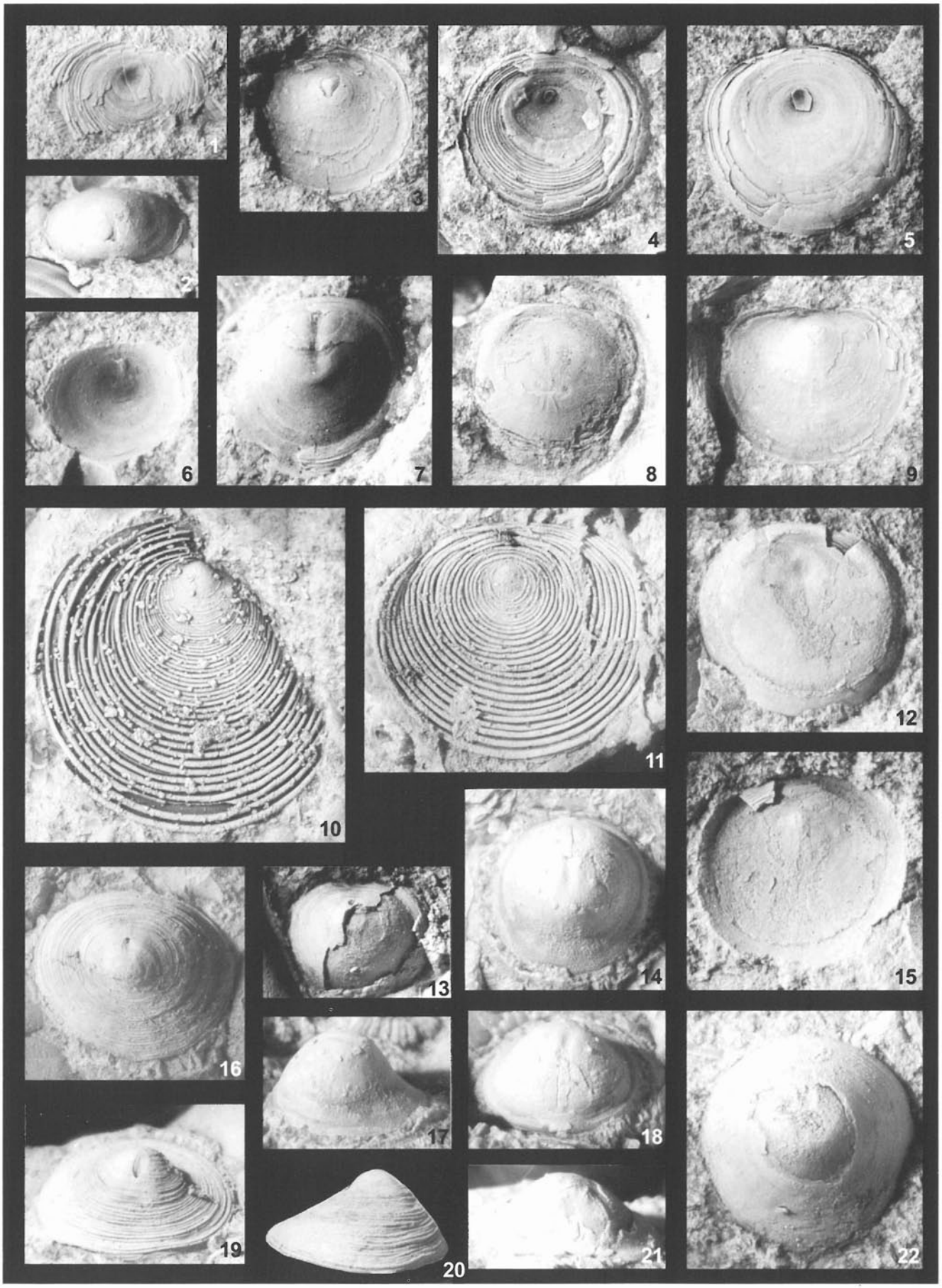
Plate 20



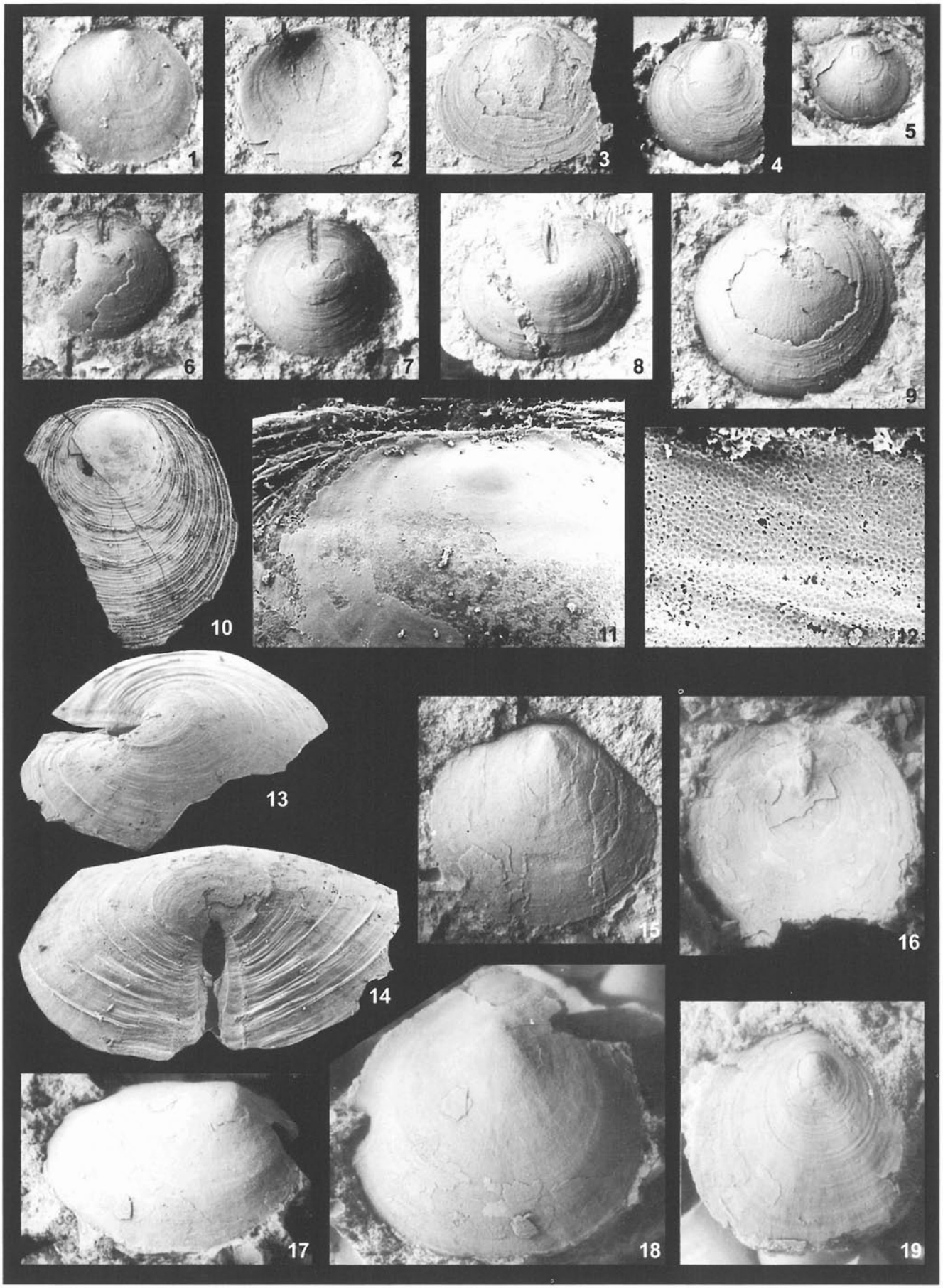

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Plate 22

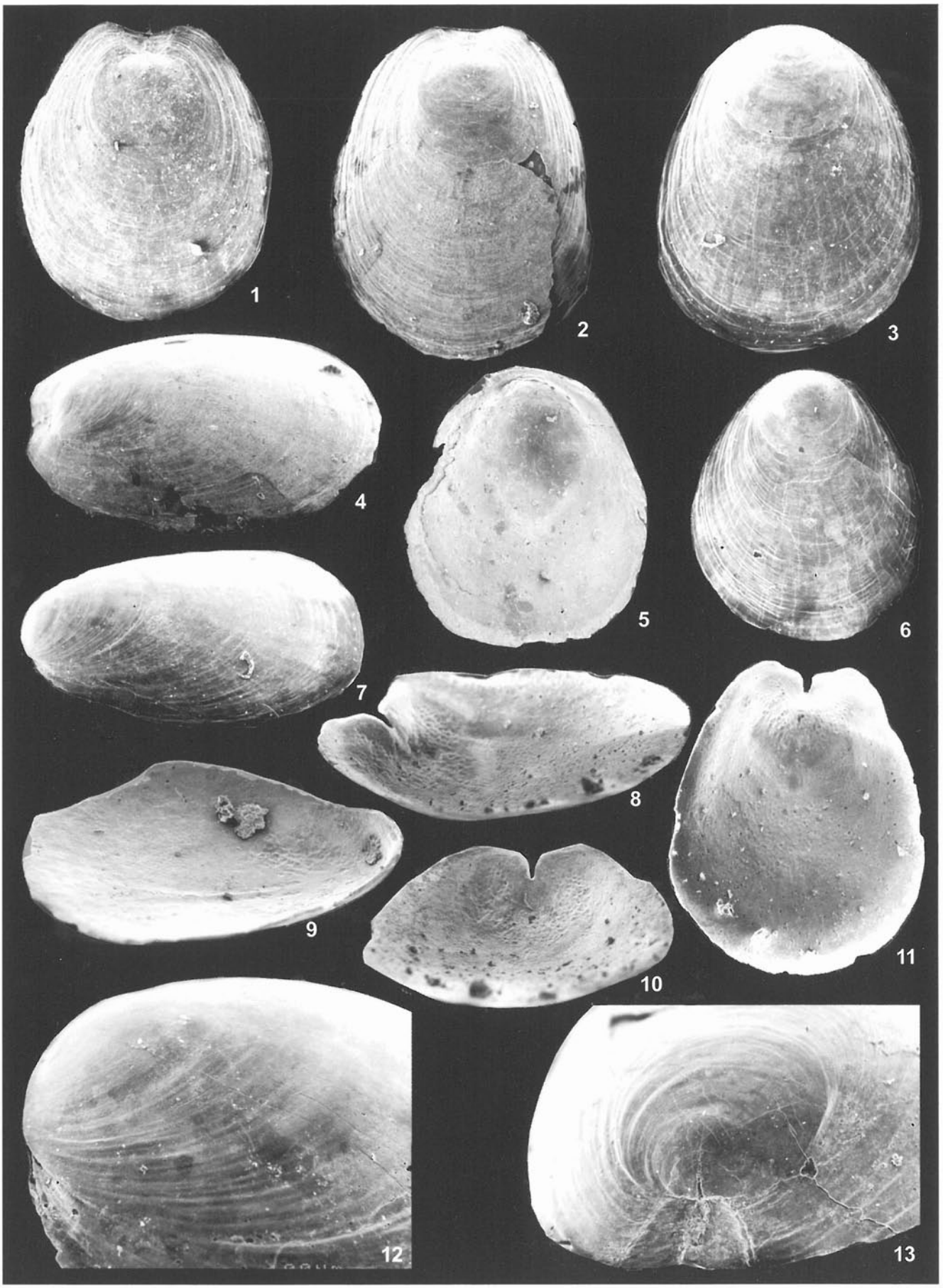
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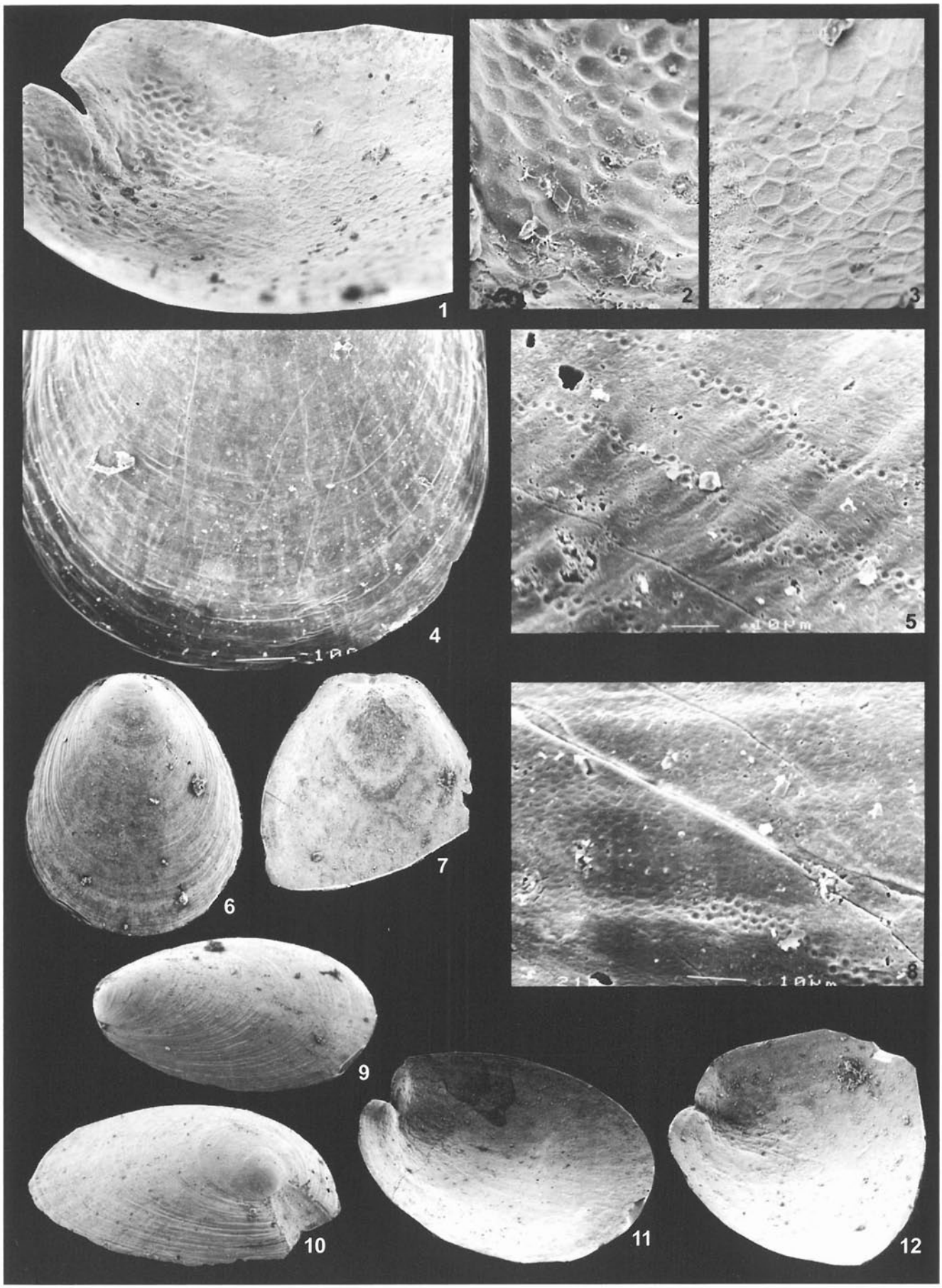
Plate 24



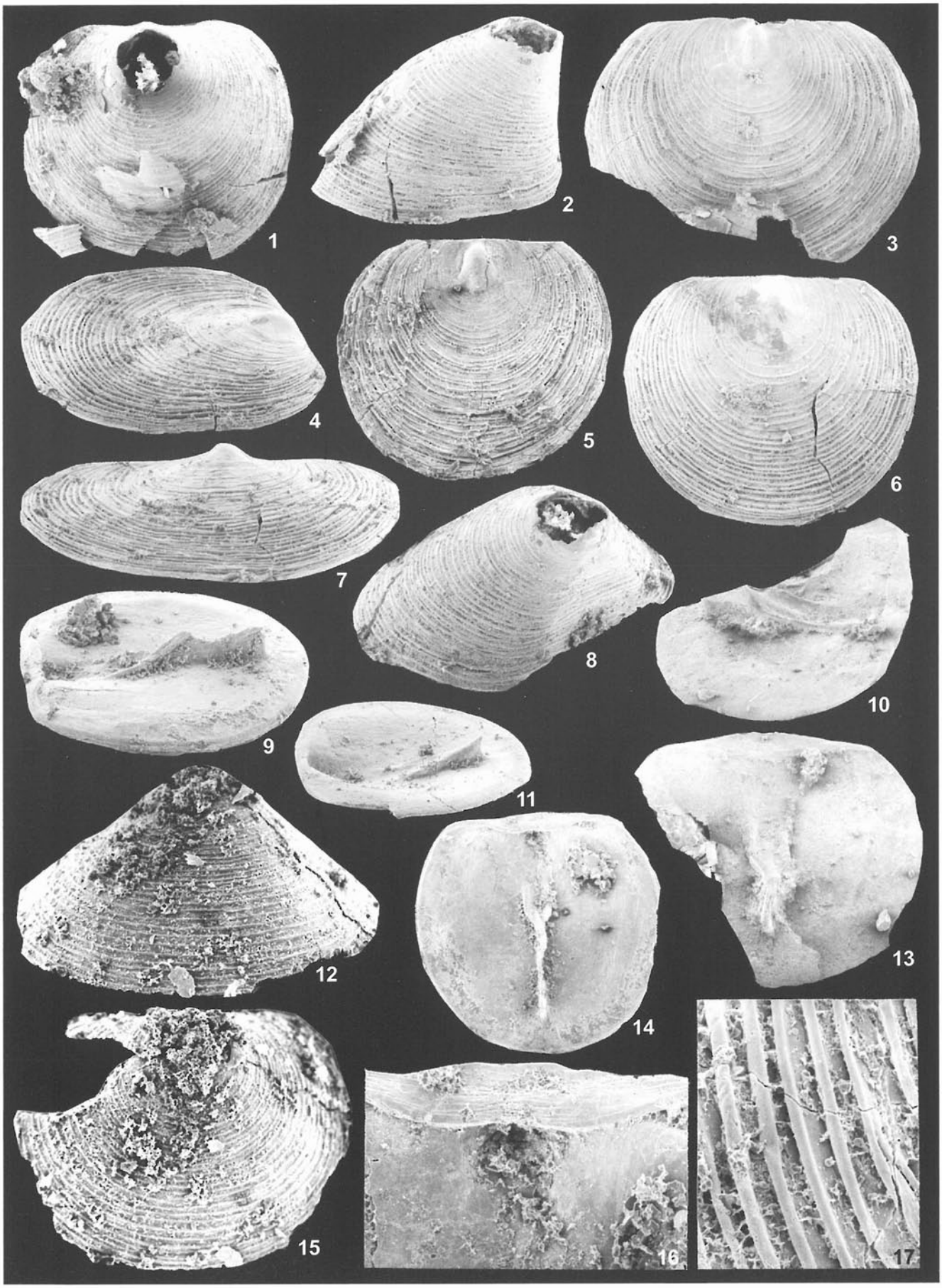

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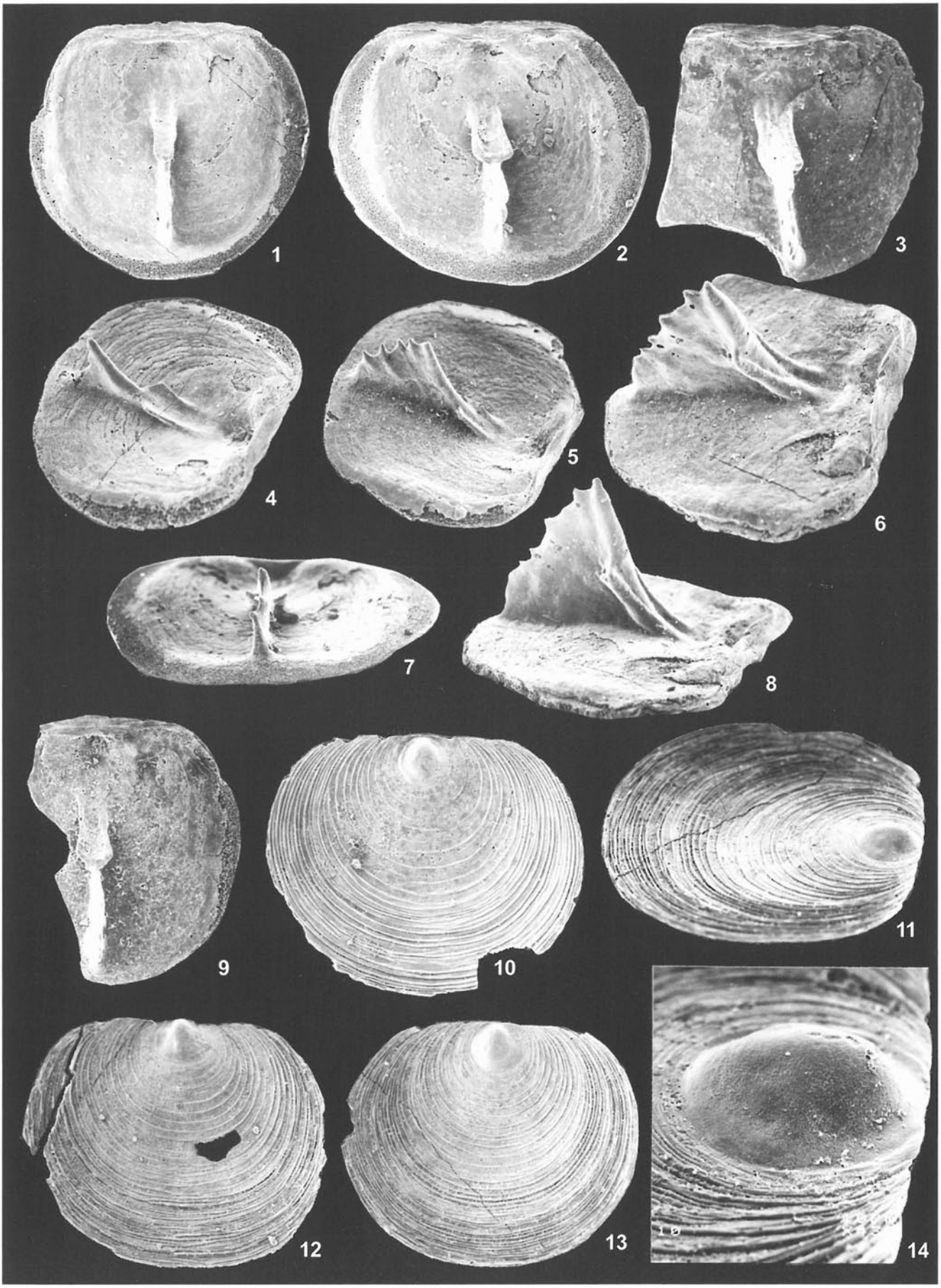
Plate 26



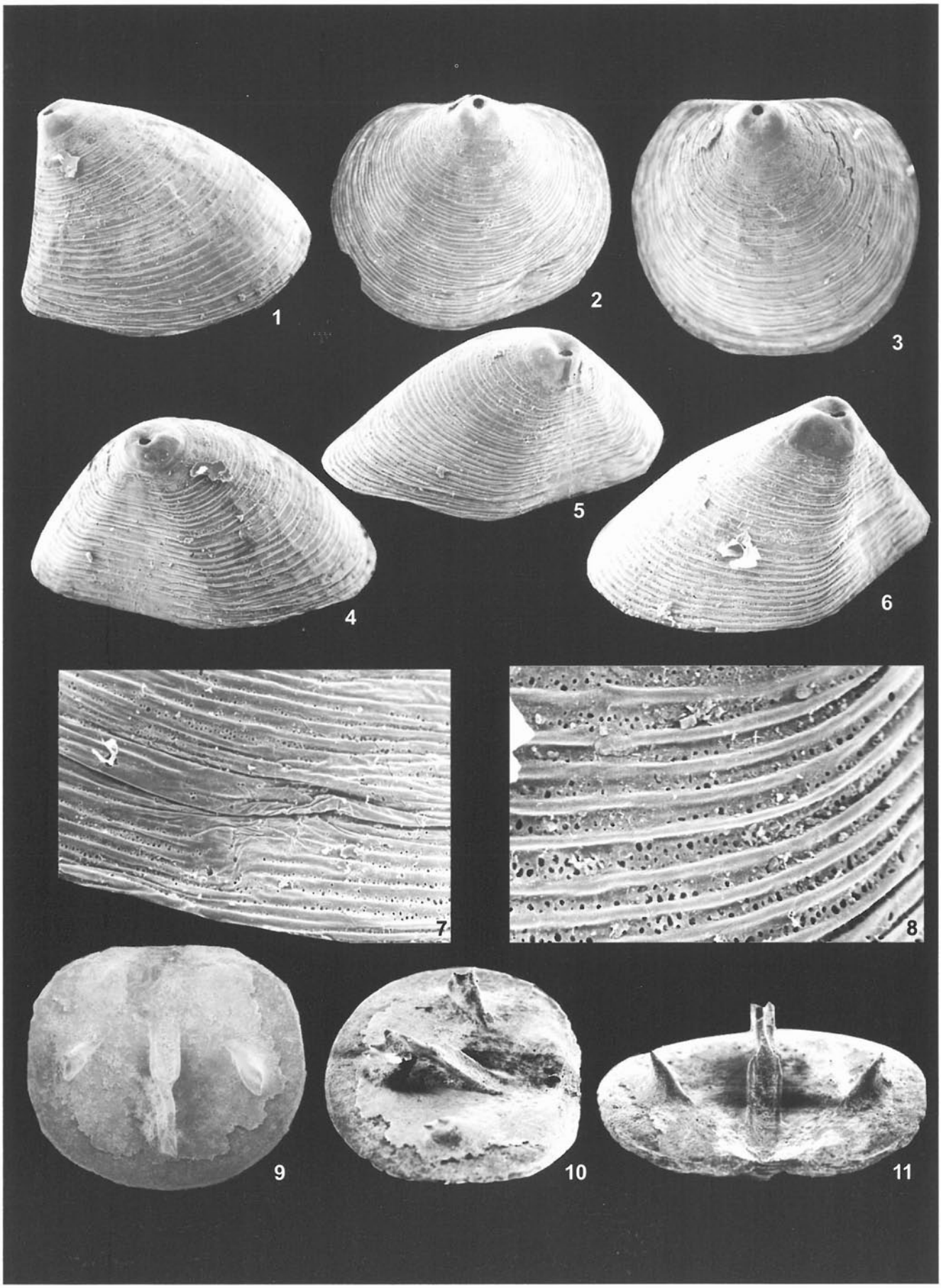

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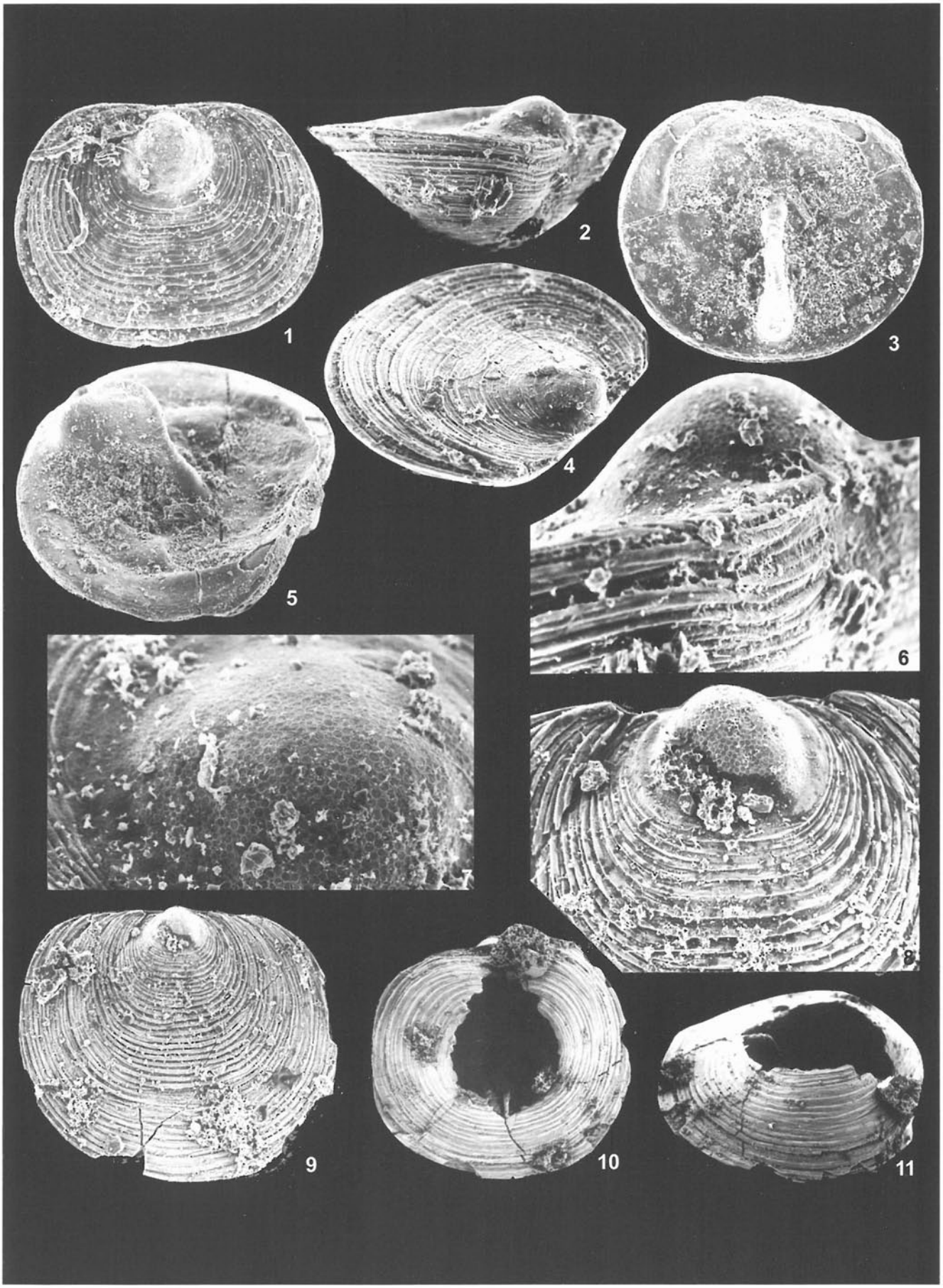
Plate 28



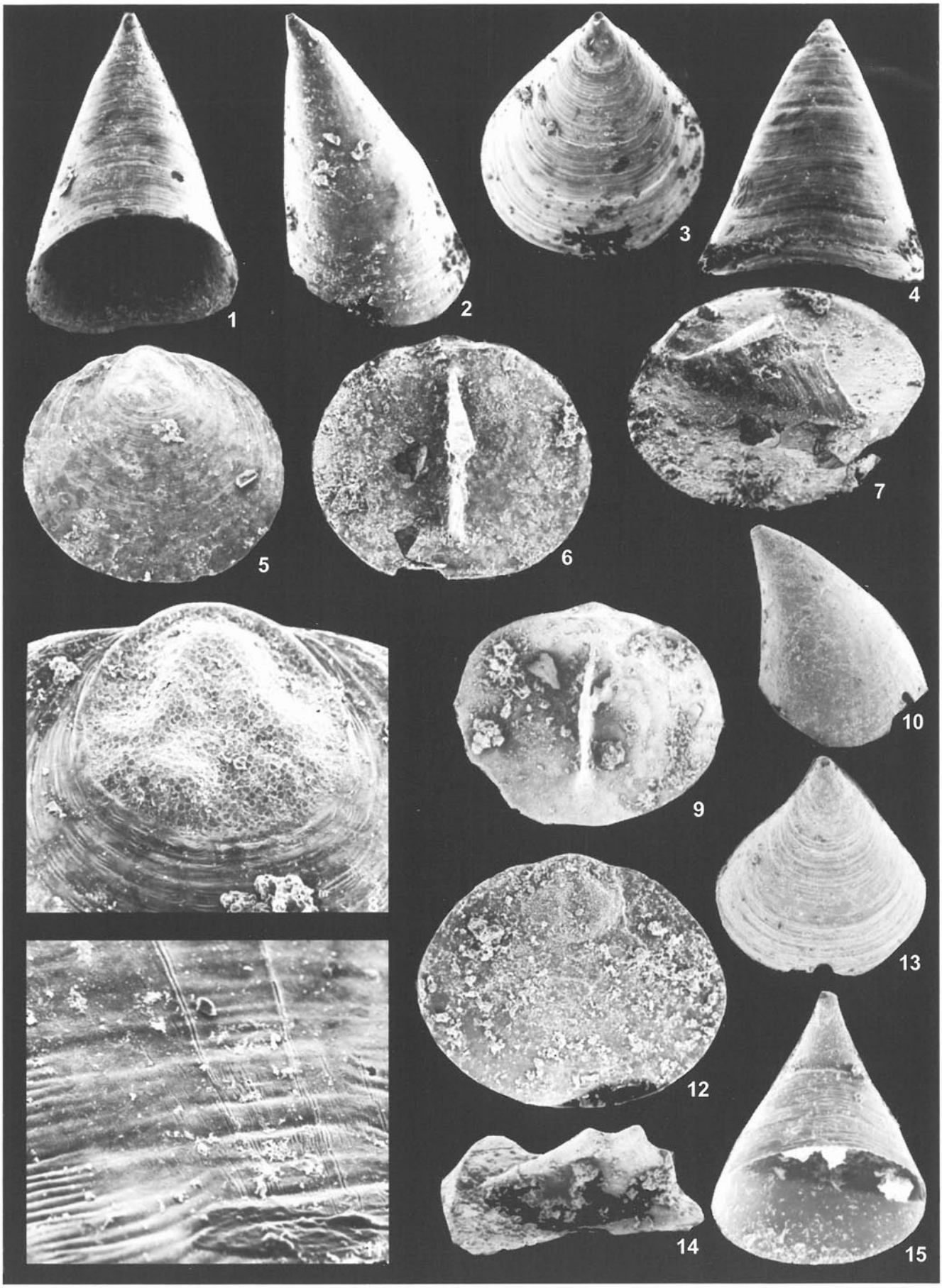

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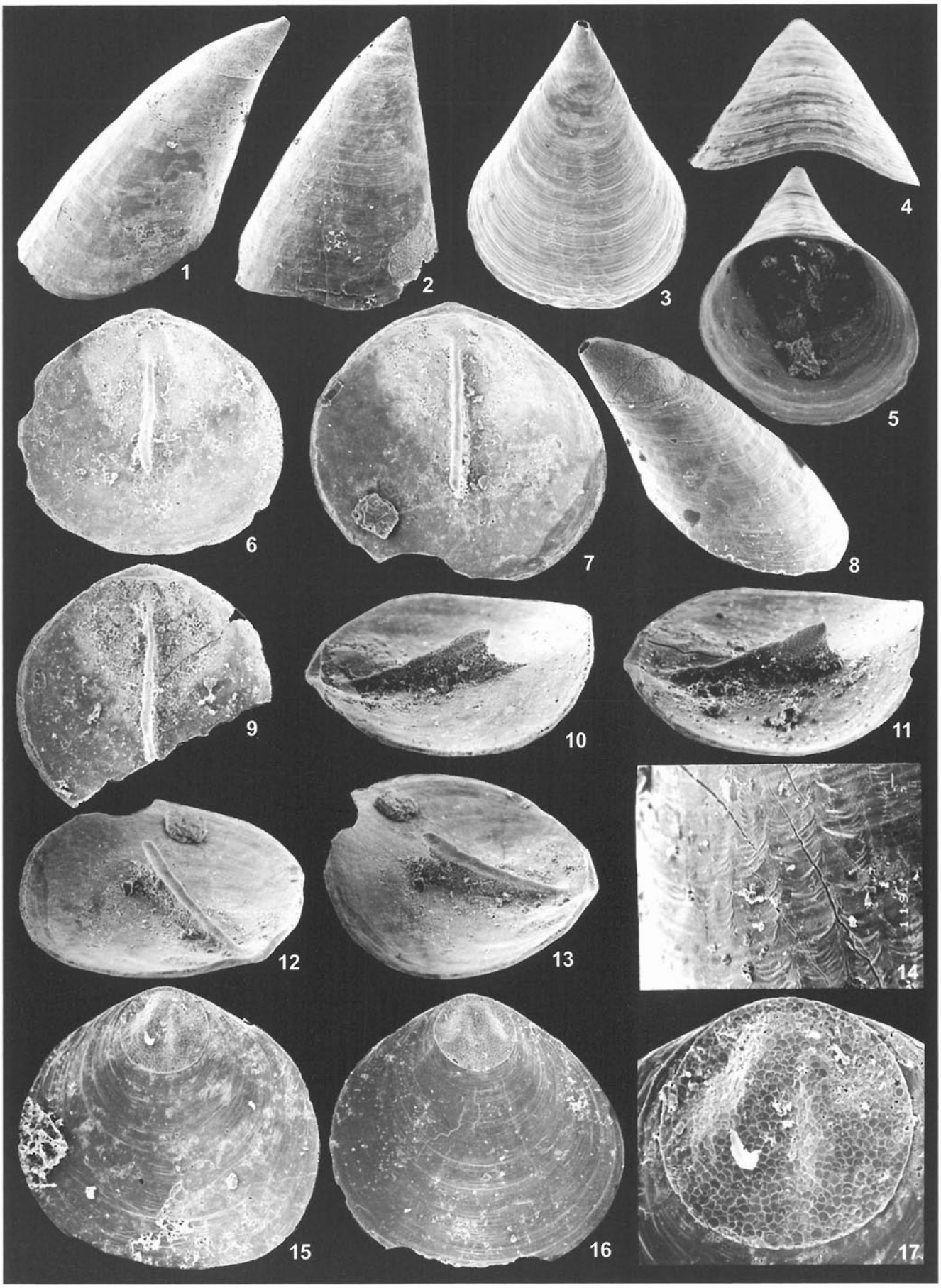
Plate 30



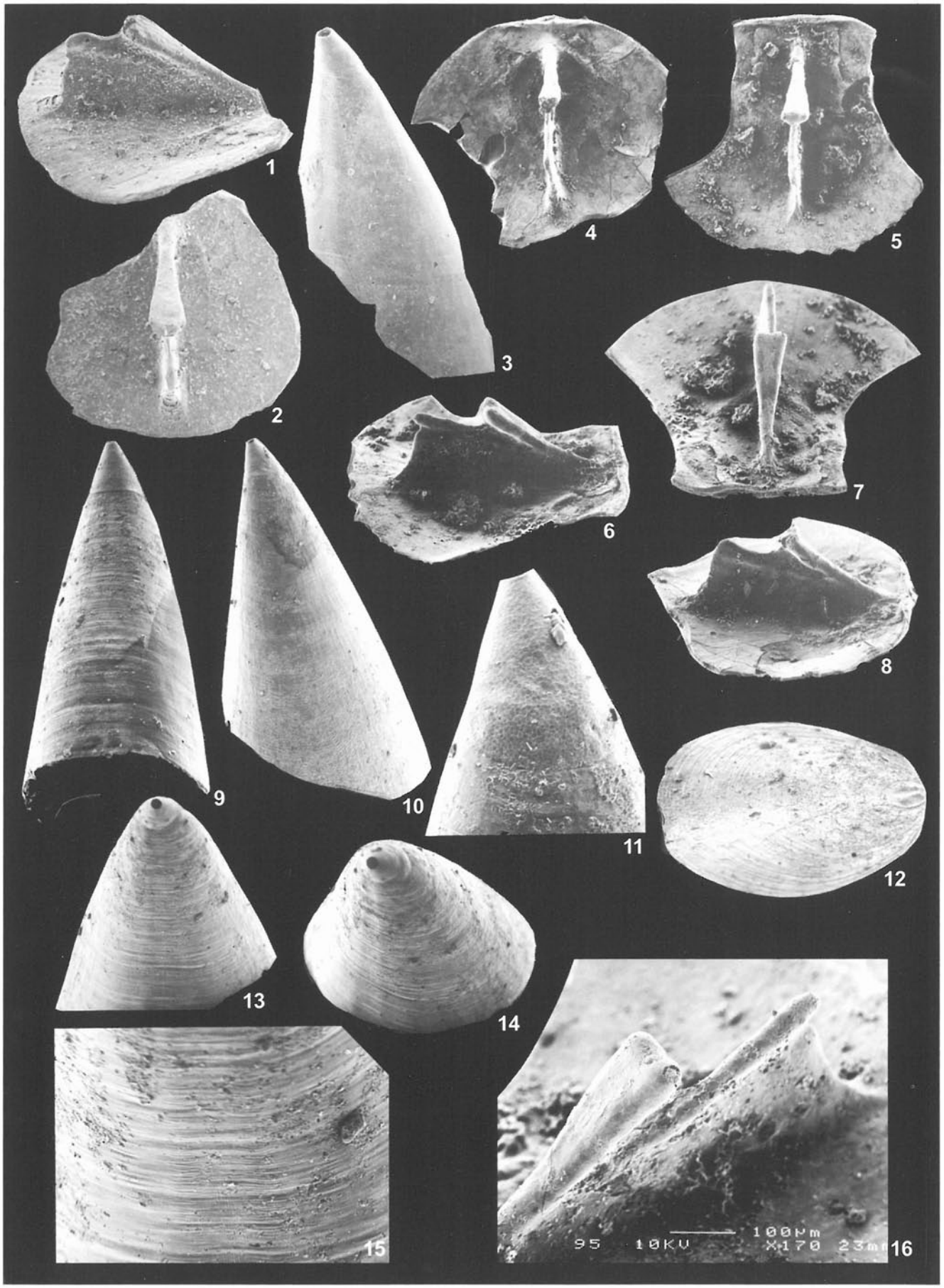

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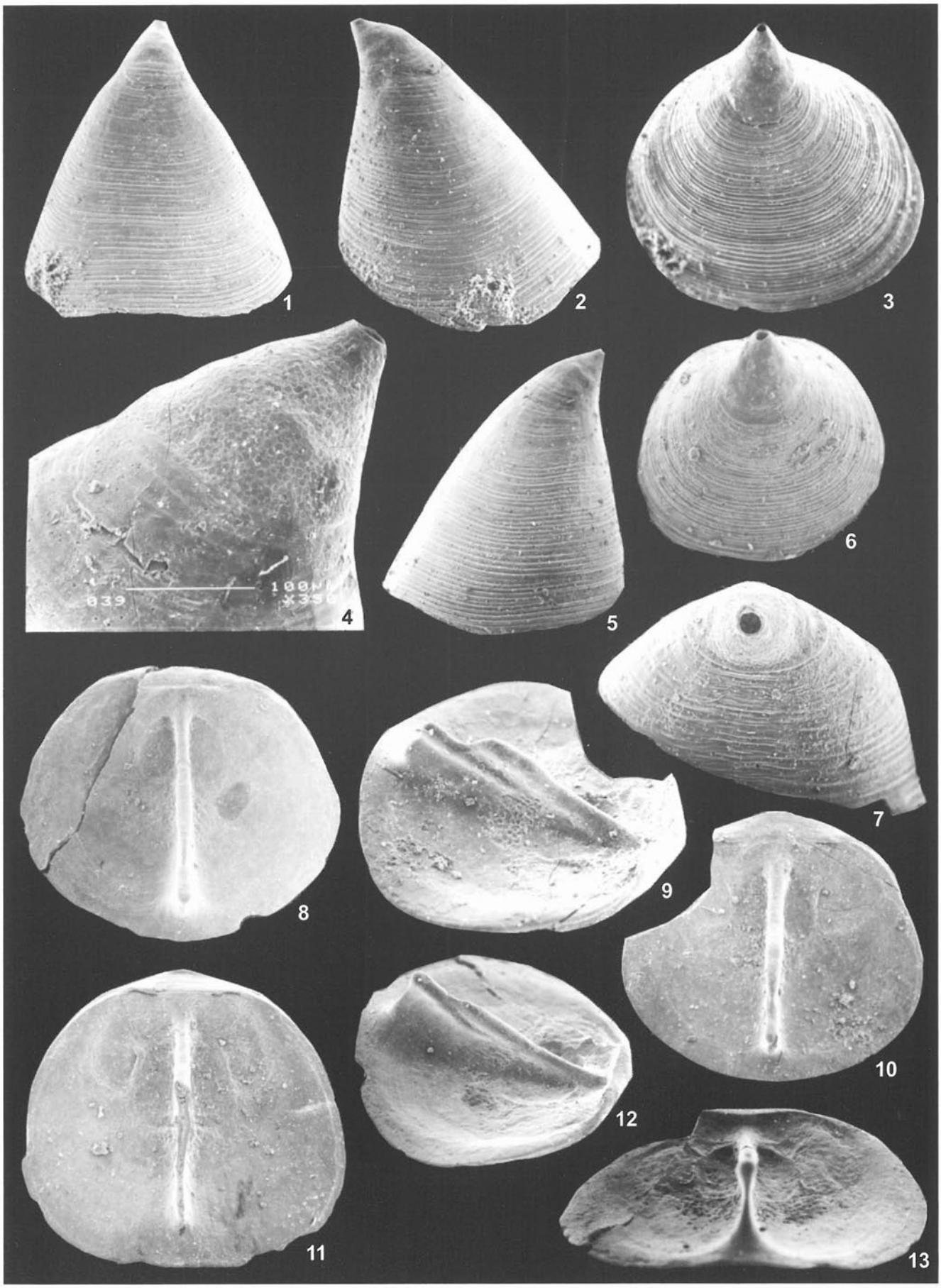
Plate 32



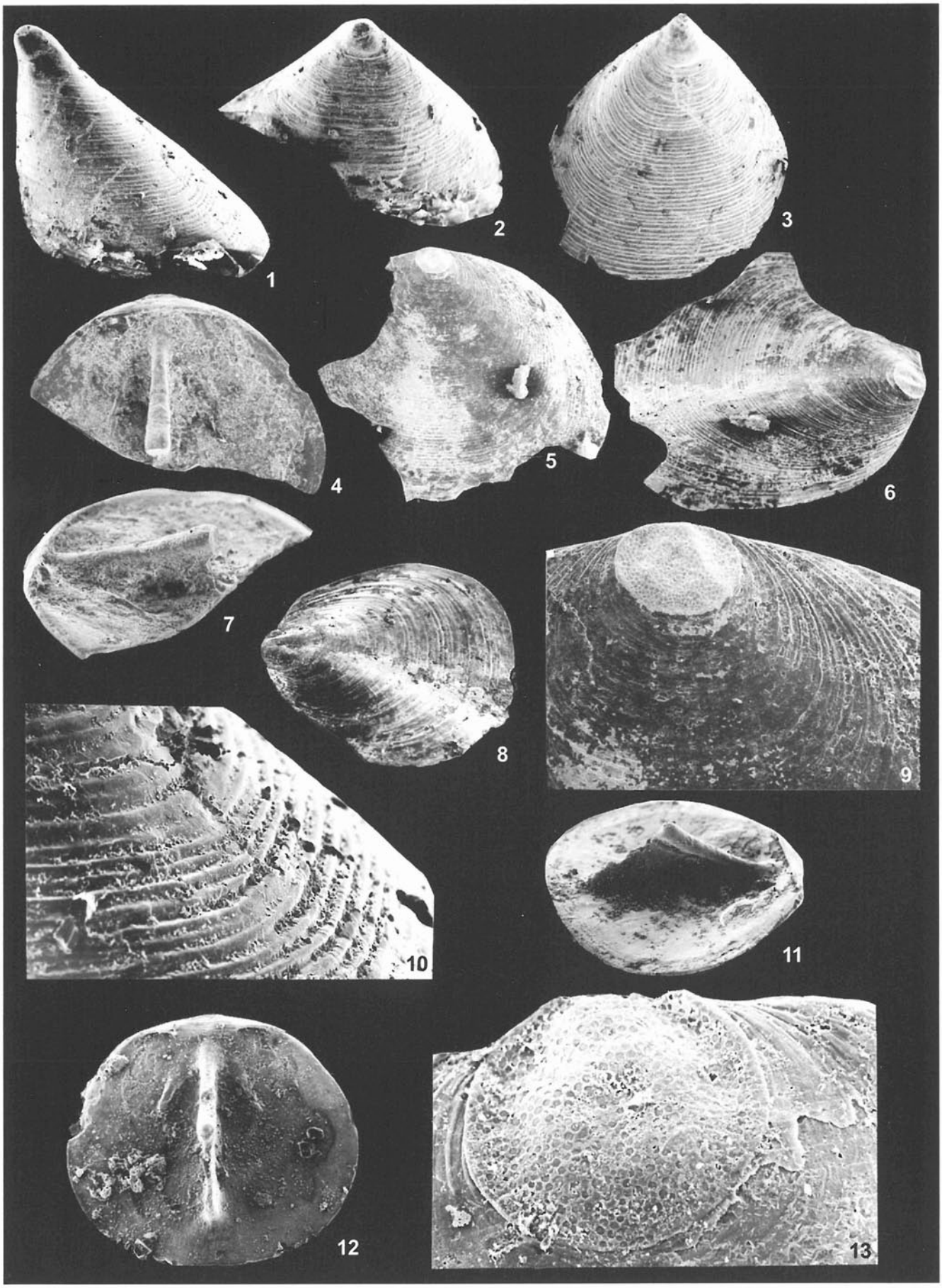

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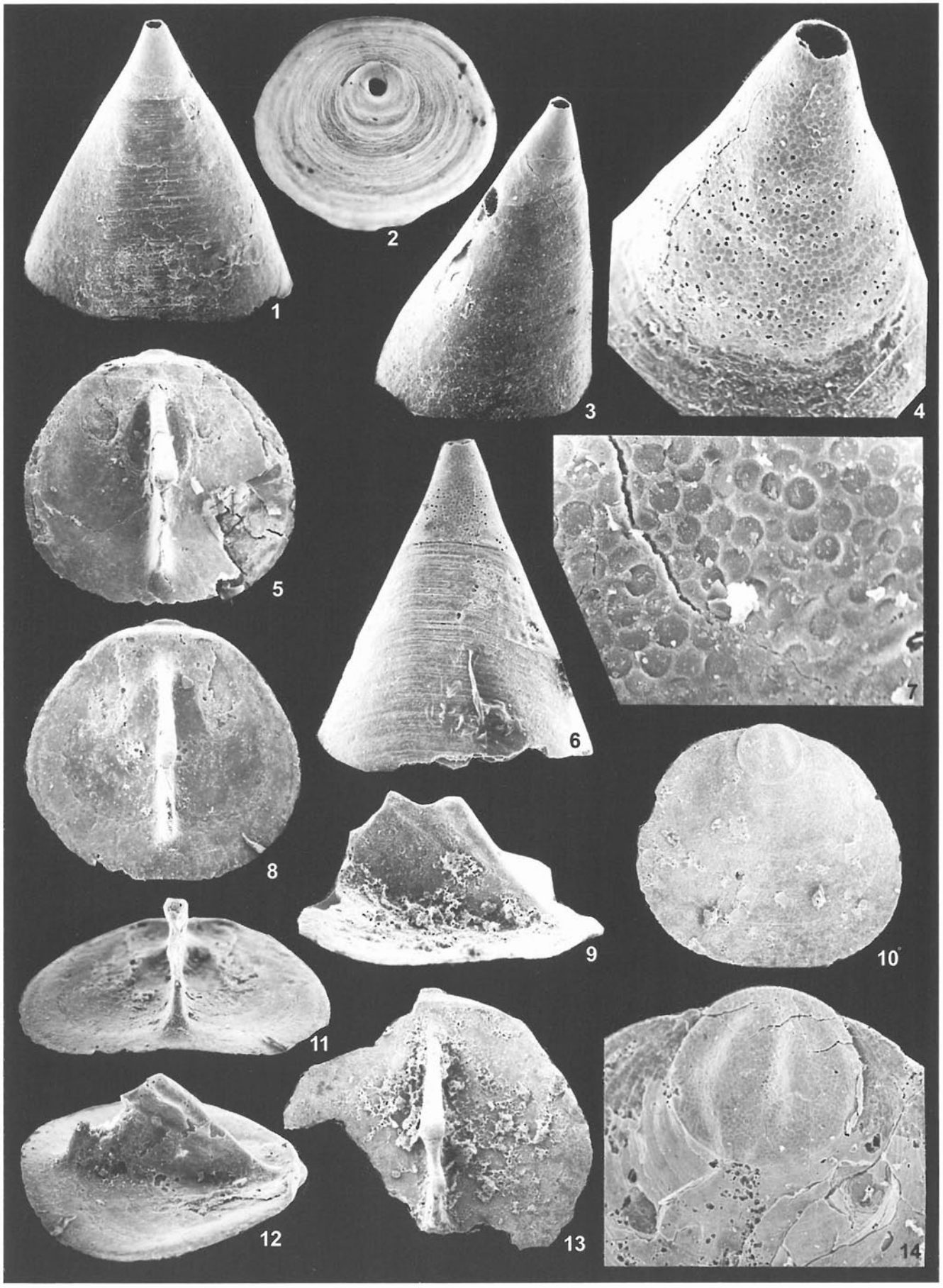
Plate 34



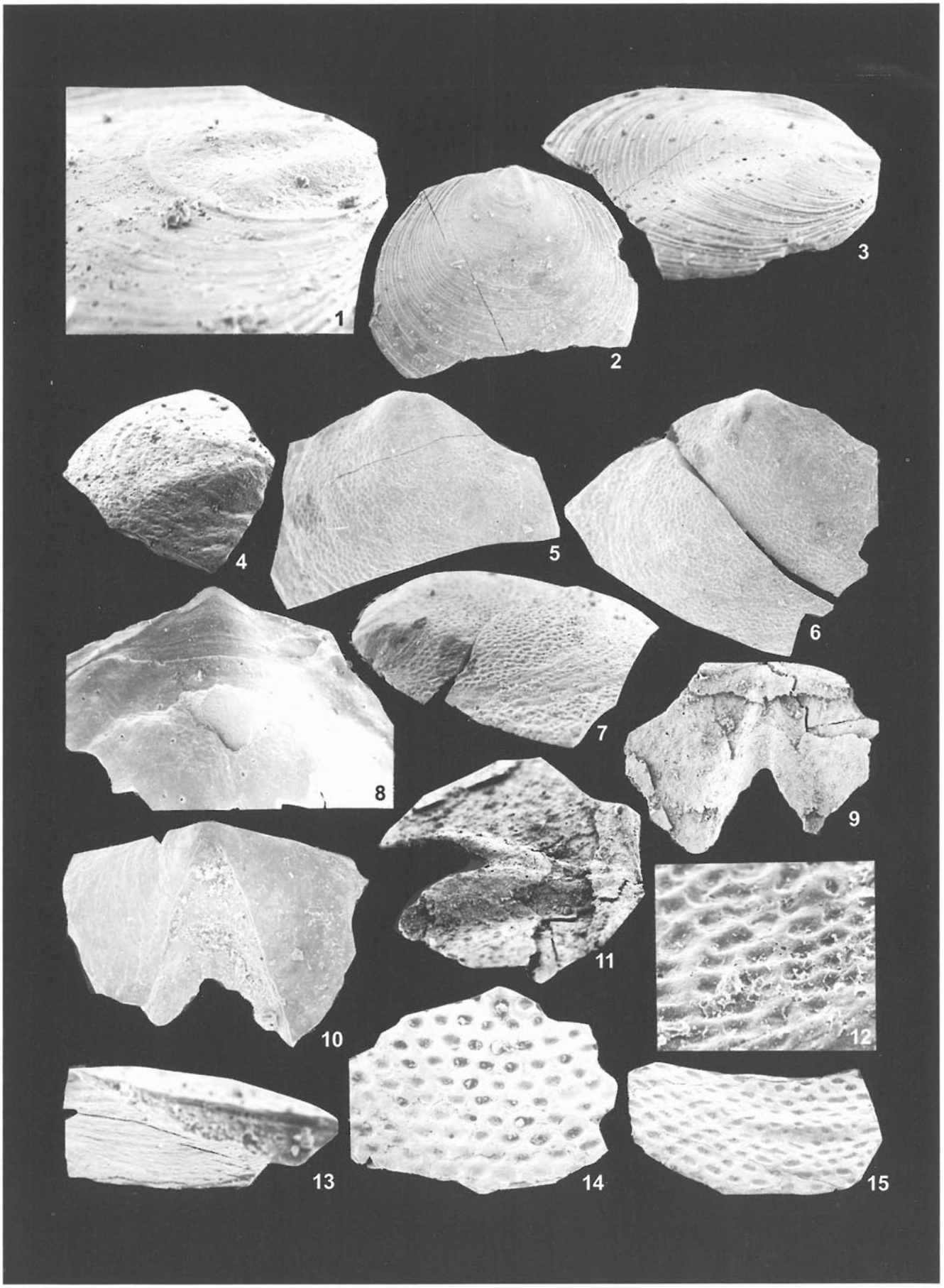

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Plate 36