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EARLY PERMIAN FUSULINIDS FROM THE CENTRAL PAMIR

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Riassunto. Viene qui descritta per la prima volta una associazione endemica a Fusulinidi del Sakmariano del Pamir Centrale. Essa comprende 42 specie e sottospecie, di cui 24 nuove, appartenenti ai generi *Pseudofusulina, Sphaeroschwagerina, Paraschwagerina, Zellia, Robustoschwagerina, Eoparafusulina, Schubertella, Pseudoendothyra* e *Pseudoreichelina*. Il confronto di questa associazione a Fusulinidi con altre regioni indica che essa è tipica di un'area peri-Gondwaniana della Tetide nell'attuale Asia Centrale. Il maggiore controllo sull'endemismo sembra essere costituito dai fattori climatici.

Abstract. An endemic fusulinid assemblage is herein first described from Sakmarian rocks of the Central Pamir. It consists of 42 species and subspecies belonging to the genera *Pseudofusulina, Sphaeroschwagerina, Paraschwagerina, Zellia, Robustoschwagerina, Eoparafusulina, Schubertella, Pseudoendothyra* and *Pseudoreichelina*; 24 species and subspecies are newly named. Comparative studies of the above assemblage and the fusulinid fauna from other regions show that the former is characteristic of the peri-Gondwana area of the Tethys. The endemic elements recognized in the assemblage apparently are related to climatic factors.

Introduction.

Permian rocks in the Central Pamir were first recognized in the Kalaktash valley (Leven, 1959). Somewhat later these were distinguished in the Muzkol Range (West Pshart, Jilga Kul), and in the easternmost areas of the region in drainages of the Ak Jilga and Balgyn valleys (Leven, 1967; Dronov & Leven, in prep.). The Permian was also first described in several tectonic sheets of the so-called Ak Baital faulting zone (Karapetov & Miklukho-Maclay, 1964).

All the rocks of Permian age initially were merged in a single calcareous (Kalaktash) formation, divisible into two subformations (Dronov & Leven, 1961). Afterwards, when the two subformations were proved to be separated by a considerable stratigraphic unconformity, they were separated into discrete units, i.e. Dangikalon Formation, below, and Kyrkkotchu Formation, above (Leven et al., 1989). Initially,

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the thick terrigenous Sarez Formation, which underlies the Dangikalon Fm., was also ascribed to the Permian. However, at present it is referred to a much older, probably, Precambrian age.

Both, the Lower and Upper Permian rocks of the Central Pamir contain fusulinid and smaller foraminiferal fauna, attaining in places significant amounts. Bryozoans, brachiopods, corals, gastropods, algae and terrestrial plant remains occur as well. All the listed faunal and floristic finds still are to be described. This paper presents the first description of the Early Permian fusulinids. Late Permian fusulinids and smaller foraminifers will be considered in a next publication.

The fusulinids discussed herein were collected by the author and V.I. Dronov in the Kalaktash valley and in drainage of the West Pshart river. This collection includes more than 10.000 thin sections. Since most fusulinids are poorly preserved, deformed and recrystallized, only large material allowed to select the number of specimens required for the identification and description.

Main characters of the succession.

The most complete succession of Early and Late Permian age is exposed in the Kalaktash and also in the West Pshart valley, where the latter narrows in a gorge

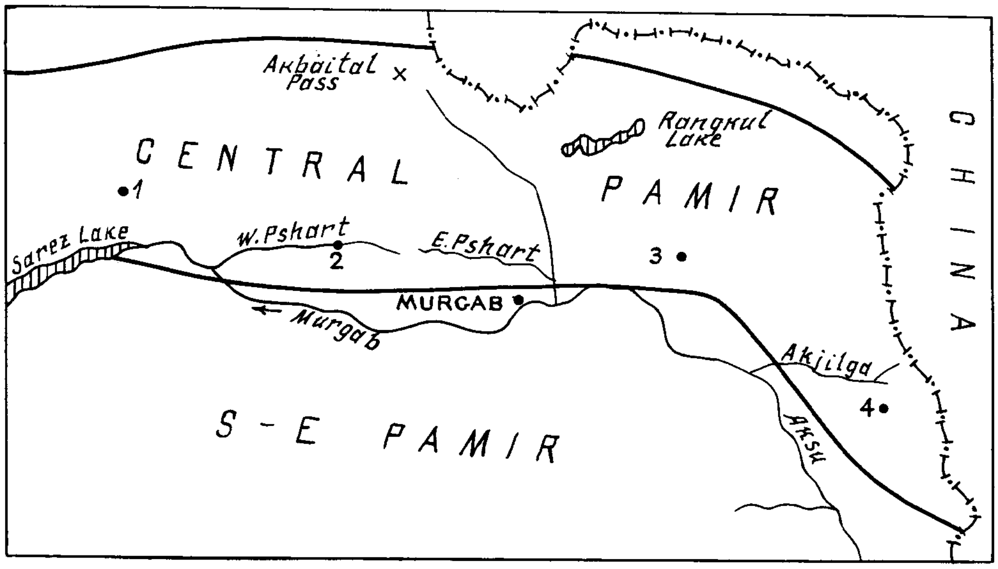

Fig. 1 - Main outcrop areas of Permian rocks in Central Pamir. 1) Jilga Kul; 2) West Pshart (Kyrkkotchu); 3) Kalaktash; 4) Akjilga.

called Kyrkkotchu (Fig. 1). It is worth noting that the successions here discussed show minor distinctions from one another. Since these will be thoroughly described elsewhere, we report herein their general characteristics, from bottom to the top.

Dangikalon Formation.

1. White, pink and multicoloured coarse-grained quartzarenites, sandstone, coarse- and fine-pebble conglomerate; siltstone interbeds containing plant fragments. 2-9 m.

2. Fine-detritic and, more seldom, oolitic limestone polluted by sandy material in lower part. This latter increases in amount in the West Pshart sequences and occurs there in isolated interbeds, alternating with siltstone interbeds and limestone strata. Organic detritus consists mostly of rolled crinoid ossicles with minor fragments of bryozoan skeletons, brachiopods, corals, gastropods as well as ostracods and echinoid needles. Some interbeds are rich in foraminifers, mainly ammodiscids (*Ammovertella*, *Ammodiscus*) and smaller foraminifers (*Globivalvulina*, *Pseudoglomospira*, *Nodosaria*). Fusulinids are represented by hardly identifiable, but locally abundant *Pseudoendothyra*, and small rare specimens of *Schubertella*. A few thin interbeds contain prolific but poorly preserved brachiopod and bryozoan remains. The top parts of fine-grained limestone yielded conodonts, indeterminable at the species level, such as *Streptognathodus* sp. 12-14 m.

3. Alternance of argillite and siltstone interbedded with fine-grained quartzarenite in the West Pshart sequences. Poorly preserved brachiopod, bivalve and gastropod remaines. 6-8 m.

4. Detritic and sandy-detritic limestone below and more fine-detritic above. In the West Pshart successions the limestone alternates with siltstone and argillite. Detrital bioclasts comprise crinoid, bryozoan, gastropod, brachiopod remains and rare solitary corals. 8-10 m.

5. Alternance of crinoid-bryozoan, detrital and marly limestone and marl, interbedded with argillite and fine-grained sandstone in the West Pshart sequences. A few cm at the base of this unit consists of calcareous conglomerate with pebbles composed of the underlying marly limestone in carbonate matrix. It is not improbable, then, that this bed lies on bed 4 with an insignificant stratigraphic unconformity. The lower part of this bed contains the conodont *Neogondolella bisseli* Clark & Behnken. Brachiopods, rugoses and gastropods wait for an identification. 17-20 m.

6. Dark-grey and black bedded organic-detrital limestone, largely packed with fusulinids, while bryozoans and brachiopods are subordinated.

All fusulinids herein described derive from this level. Their list and range within the succession is reported below. In addition to the fusulinids, rare smaller foraminifers are present, including *Nodosaria yishanensis* Lin, *N. sinensis* Xia & Zhang, *N. jaborovensis* Kosch., *Deckerella media* Morozova, *D. delicatula* Wang, *Palaeotextularia* ex gr. *longiseptata crassa* Lipina, *P. longissima* Reitl., *Climacammina huangjiangensis* Lin, *Tetrataxis nana* Morozova, *Endothyra soshkinae* Lipina, *E. beanscreenkensis* Reichel (determinations by G.P.Pronina). Some interbeds comprise brachiopods such as *Neospirifer* ex gr. *fasciger* (Keyserling) (determinations by T.A. Grunt) and corals *Caninia* ex gr. *mapingensis* Yu, *Caninophyllum* sp. (determinations by I.V. Pyzhjanov).

It is not unlikely that the fusulinid-bearing limestone lies on the underlying unit with an erosional surface as suggested by red coloured sandstone, siltstone and waterworn "bean-like" iron ores locally present in the contact zone. 20-28 m.

7. Grey, yellowish-brown thick-bedded and massive dolomite and pellitomorphic dolomitic limestone. The upper part contains calcareous interbeds with fusulinids, comprising *Pseudofusulina* sp., *Robustoschwagerina* sp. 10-20 m.

8. Reddish, lilac and yellowish carbonate-clay, locally kaolinized or replaced by limestone and quartzarenite. It lies on the uneven corroded dolomitic surface and occurs only in the West Pshart successions, varying there from 0 to 20 m in thickness.

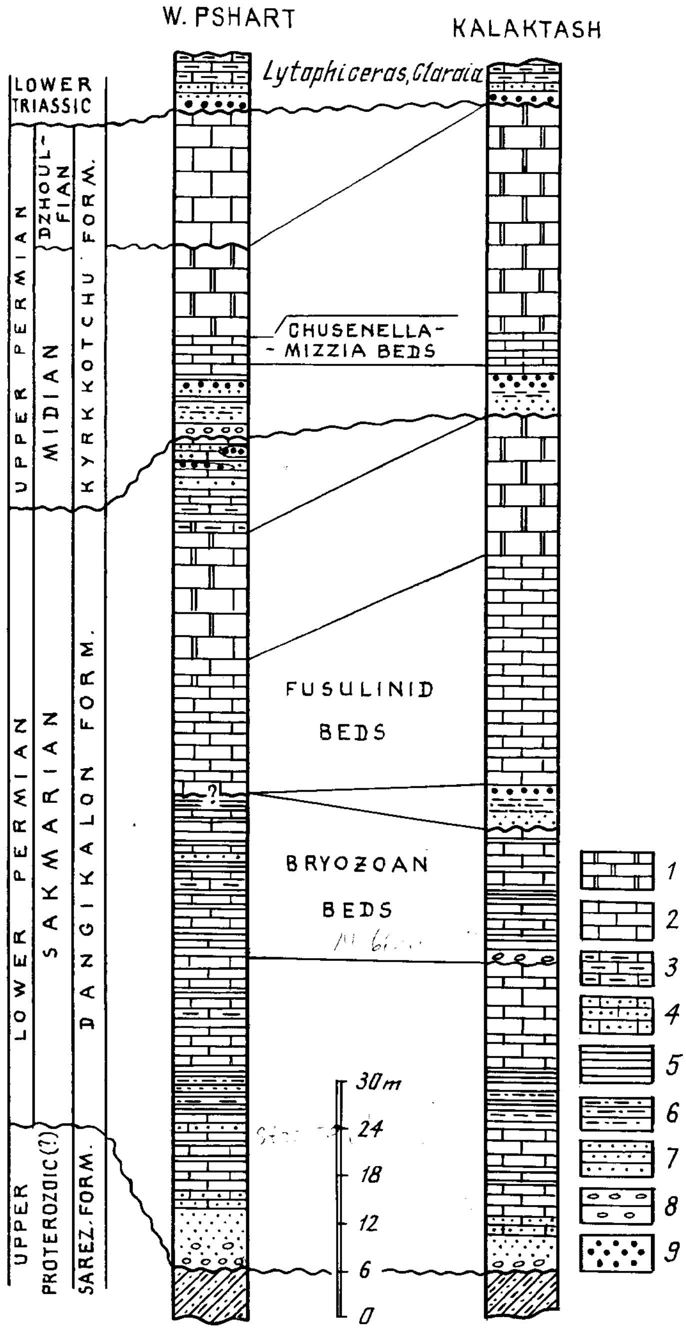

Fig. 2 - The most relevant sections of Central Pamir.
1) Dolomite and dolomitic limestone; 2) limestone; 3) marly limestone; 4) arenaceous limestone; 5) marl; 6) siltite; 7) sandstone; 8) quartzose conglomerate; 9) conglomerate with bauxite clasts.

Kyrkkotchu Formation.

9. Quartzose conglomerate grading into sandstone and siltstone and, further, into caolinized clayey rock containing bean-like bauxite. Lenses and linses of bauxite derive probably from volcanites. This level lies on the subjacent rocks with a distinct erosional surface. 5-10 m.

10. Fine detrital foraminiferal limestone packed by *Mizzia velebitana* remains which in places are rock-forming. Poorly preserved fusulinids are dominated by *Chusenella*. Besides, *Kahlerina*, *Pseudokahlerina*, *Yangchienia*, *Nankinella*, *Sphaerulina*, *Neoschwagerina*, *Pseudodoliolina* and others had been found.

The smaller foraminiferal assemblage is diverse in composition, with the following species being determined among its forms: *Langella cukurkoyi*, *Frondina permica*, *Colaniella minima*, *Dagmarita chanakchensis*, *Paradagmarita dubreuilli*, *Abadehella* sp., *Paraglobivalvulina* sp., *Globivalvulina vonderschmitti*, *Sphairionia sikuoides*, *Hemigordius changxingensis*, *Kamurana* sp. and many others.

The compound corals *Ipciphyllum* aff. *laosense*, *I.* ex gr. *persicum*, *Waagenophyllum* ex gr. *kueichowense* are present (determinations are by I.V. Pyzhjanov and G.S. Kropacheva). All the listed fossil faunas suggest an Early Midian age for the described level. 5-8 m.

11. Yellowish-grey massive dolomite. This unit may be deeply karstified with bauxite up to 5-10 m-thick. 15-30 m.

12. Light-grey and white foraminiferal and very fine grained limestone containing *Shanita amosi* and *Sh. pamirica* (Leven, 1991). Such a limestone occurs only in the West Pshart sequences. There, it appears to lie on the underlying rocks with an erosional surface indicated by conglomeratic breccia at its base that includes fragments of the subjacent dolomite. It is followed upward by multicoloured calcareous siltstone and marls with the Early Triassic forms *Lytophiceras* sp., *Claraia aurita*, *C. griesbachi*, *C. stachei*, *C.* aff. *tridentina*, *C.* aff. *australasiatica*.

As noted above, the Kalaktash and West Pshart successions have minor variations in lithology. In the Lower Permian formation, on which this study is focused, these are expressed by an increase of terrigenous input toward the West Pshart successions, suggesting a westward origin for the clastics. The carbonate component of the succession exposed in the proximity of the Jilga Lake is represented only by the Kyrkkotchu Formation. Its basal conglomerate lies on a multicoloured unit, sandy-schiststose at its top, that, in turn, overlaps the terrigenous Sarez Formation (Leven, 1967). The unit attains hundreds of meters in thickness, being apparently a source of the Lower Permian fossil plants sampled by V.I. Dronov (1964).

Characters and age of the Kalaktash fusulinid assemblage.

All Early Permian fusulinids, except *Pseudoendothyra* and a few specimens of *Schubertella* encountered in the level No. 2 of the described succession, were found in the limestone level No. 6, where they are distributed more or less continuously. The microfauna sampling was made from each bed with an interval of 0.3 to 0.5 m. It is worth nothing that the Kalaktash succession was sampled for fusulinids more than once. The assemblage from level No. 6 consists of 7 genera and 43 species and subspecies, of which 42 are here described. The identified genera include *Pseudofusulina*, *Eoparafusulina*, *Robustoschwagerina*, *Sphaeroschwagerina*, *Zellia*, *Paraschwagerina*, *Schubertella*, *Pseudoendothyra* and *Pseudoreichelina*. The complete list of the identified species is as follows:

Pseudoendothyra sp.
Pseudoreichelina sp.
Schubertella sp.
Pseudofusulina pamirensis sp. n.
P. karapetovi karapetovi Leven
P. karapetovi tezakensis Leven
P. plena sp. n
P. curva sp. n.
P. kalaktashensis sp. n.
P. sulcata Korzhenevsky
P. psharti sp. n.
P. muzkolensis sp. n.
P. insignis sp. n.
P. curteum sp. n.
P. granuliformis sp. n.
P. memoralis sp. n.
P. tibetica maxima subsp. n.
P. neglectens sp. n.
P. incompta sp. n.
P. licis sp. n.
P. gravis sp. n.
P. inobservabilis sp. n.
P. macilenta Leven
P. minuscula sp. n.
P. tumidiscula sp. n.
P. curta sp. n.
P. perrara sp. n.
P. vulgara sp. n.
P. aff. *P. rara* Leven & Scherbovich
Paraschwagerina (?) *tianshanensis* (Chang)
Robustoschwagerina psharti sp. n.
R. aff. *R. kainsuensis* Miklukho-Maclay
Robustoschwagerina (?) sp. A
Zellia nunosei (Hanzawa)
Sphaeroschwagerina zhongzanica (Zhang)
Eoparafusulina tschernyschewi tschernyschewi (Schellwien)
E. tschernyschewi memoranda (Grozdilova & Lebedeva)
E. recondita (Grozdilova & Lebedeva)
E. laudoni (Skinner & Wilde)
E. aff. *E. mendenhalli* Petocz
E. weddelli Petocz
E. depressa Skinner & Wilde
E. regina Nie & Song
E. subrotunda sp. n.
E. pamirensis sp. n.

This list is far from being exhaustive due to the diversity of the assemblage, for poorly preserved specimens often defy determination. Since changes of the species through the sequence are not recognizable, that is why this assemblage is discussed as a whole. General character of the faunule called herein Kalaktash assemblage is defined first of all by *Pseudofusulina*, dominating both in abundance and diversity. This genus consists of 26 species, 21 of which are newly named. Most conspicuous of these are large and elongate shells such as *Pseudofusulina plena, P. curva, P. pamirensis, P. kalaktashensis* and some others.

The cited species group shows strong affinities to the assemblage of elongate fusulinids from the Ural region and the Timan-Pechoran area. Most typical forms described from the last mentioned area are *Pseudofusulina juresanensis* Rauser, *P. postpedissequa* Rauser, *P. luminosa* Konovalova and *P. nodosa* Konovalova. The newly erected species *P. psharti* resembles *P. zyganica* Vissarionova of Early Artinskian age.

Such a resemblance between Central Pamir and Ural *Pseudofusulina* suggests that both are of the same age. A more close comparison shows that the Pamir species attain, in general, a lower evolutional level than Ural fossils as assumed by a less intense fluting in the Pamirian specimens. This evidence suggests that here we deal with an older assemblage, probably of Sakmarian age. However, the elongate forms are less frequent among Sakmarian than among Artinskian fusulinids both of the Ural region and the Timan area. Yet some of them, such as *Pseudofusulina sertchejensis* Konovalova and others, are very similar to the Pamirian *P. curva* sp. n.

Sakmarian age for the Pamirian *Pseudofusulina* is supported by the presence among them of fairly abundant *P. sulcata* Korzhenevsky. This species is typical of Lower Sakmarian and more rarely of Upper Asselian rocks of the Bashkirian Fore-

Ural region. The loosely coiled specimens of the new species *P. neglectens* resemble some specimens of *P. moelleri* (Schellwien) described by Rauser-Chernousova (1965) from the stratotype of Sakmarian Stage. A certain resemblance also exists between *P. muzkolensis* sp. n. and *P. devexa* Rauser-Chernousova.

A comparison of the Central Pamir *Pseudofusulina* with their Ural counterpart shows several affinities, suggesting that the Pamirian forms are rather Sakmarian than Artinskian in age. Indeed, this inference is valid only in case the resemblance is not homologue, which is not improbable, taking into account a considerable, if not a complete isolation of the Uralian and Tethyan basins assumed during the Sakmarian age. It is interesting to note from one side that similarities exist between *Pseudofusulina* species from this assemblage and Uralian Pseudofusulinas. From the other side, nothing is in common with species of this genus described from well studied Sakmarian, and even Artinskian (Yahtashian) rocks, typical of the Tethyan regions such as Carnic Alps, Darvaz, Fergana, North Afghanistan, China, Japan and Indochina. Conversely, the Central Pamirian assemblage rich in *Pseudofusulina*, has been reported from South Afghanistan, and in recent years these were also recognized in East Hindu Kush (drainage of the Chitral River), in Karakorum (drainage of the Chapursan River) and in South Tibet (to the north of Rutog).

The analogous fossiliferous beds were studied in detail in South Afghanistan (Leven, 1993b), where they are widespread and underlying the beds containing fusulinids of Yahtashian - Bolorian age. These include Zone P2 in the Tezak sequence (Vachard, 1980), beds B2 in the Wardak succession (Lys & Lapparent, 1971) and the base of a limestone unit in the sequence outcropping near the village of Khaftkala (Abdullah & Chmyrev, 1980). *Pseudofusulina karapetovi* and *P. macilenta* identified in South Afghanistan are also present in the Central Pamir. Judging from the plates of the Vachard' Thesis (Vachard, 1980, plate 33, fig.1 and 6), *Monodiexodina ferganica* from the Tezak sequence rather resembles Central Pamirian species *Pseudofusulina plena* or *P. pamirensis.*

The present pseudofusulinid assemblage was recognized by the author while examining the fusulinid collection sampled by M. Gaetani from the Rosh Gol succession (drainage of the Chitral River). That sequence had been formerly described by Talent & Mawson (1979) who pointed out the presence of evoluted *Neoschwagerina* in its lower part and abundant *Parafusulina multiseptata* in its upper part. Yet the Talent's determinations are open to question. Based on the Gaetani's sampling, we may prove that the beds of that sequence are in a reversed occurrence (Gaetani & Leven, in prep.). Then, determinations of *Parafusulina* might have been erroneous. The latter is not improbable due to poor preservation of the material. Close analysis of the samples convinced us that fusulinids from Talent's "*Parafusulina*"-bearing beds consisted mostly of *Pseudofusulina*. Some of the latter forms show strong affinities to the equivalent species within the Kalaktash assemblage such as *Pseudofusulina psharti, P. plena, P. insignis, P. karapetovi* and *P. kalaktashensis.* This evidence enables a comparison with the level No. 6 of the Central Pamir sequence and their correlatives from South

Afghanistan. Such a correlation is favoured by the finding of Bolorian *Misellina parvicostata* and *Monodiexodina* aff. *shiptoni* in the stratigraphically overlying beds. In the Rosh Gol section, still above, fusulinids of the lower zone of Kubergandian were recovered. These include *Misellina claudiae, M. ovalis, Armenina* sp. and others.

Also similar to the Central Pamir assemblage are the fusulinids described by Premoli Silva (1965, pl. 10, 11, 13) from the drainage area of the Chapursan River in Karakorum. Some of the illustrated forms are very similar to *Pseudofusulina inobservabilis, P. karapetovi tezakensis* and *P. tumidiscula* from the Central Pamir and South Afghanistan.

Finally, *Pseudofusulina ultima, P. tibetica* and *P. "juresanensis"* were described from the top of the Qudi Formation, north to the town of Rutog, South Tibet (Nie & Song, 1983). These forms resemble, in general, the Central Pamir species with elongate shell.

The quoted data are certainly to be updated. Nevertheless, these allow to distinguish an entire bioprovince, closely allied to the southern peri-Gondwanan Tethyan regions (Fig. 3) with quite homogeneous and peculiar *Pseudofusulina* faunule.

The beds, comprising this faunule, occupie the same stratigraphic position below an unconformity, separating them from strata with Yahtashian-Bolorian fusulinids. This field observation supports the inference about Sakmarian age for *Pseudofusulina* in the Kalaktash assemblage drawn by comparison with Sakmarian and Artinskian fusulinids from the Ural region.

Another genus, abundant and diverse in the Kalaktash assemblage, is *Eoparafusulina*. It occurs throughout the level No. 6 being distributed unevenly. The specimens of *Eoparafusulina* are assigned here to 9 species, two of them new. The recognized species range from large subcylindric and elongate to small forms with ovoid shell. The first to be mentioned is *Eoparafusulina tschernyschewi* with two subspecies, and *E. recondita*, which are very important for dating, because they are most typical fossils of the Lower Sakmarian (Tastubian) rocks in the Pre-Uralian and Timan regions. It is also worth to note the presence of *Eoparafusulina laudoni, E.* aff. *E. mendenhalli* and *E. weddelli* described from Alaska, where they also characterize beds correlative to the Sakmarian. In addition to the noted forms, two other species are identified. One of these, *Eoparafusulina depressa*, is known from Zone E of the McCloud limestones, California (Skinner & Wilde, 1965). The other, *E. regina*, occurs in the top of the Qudi Formation in the South Tibet (Nie & Song, 1983). In both cases the host beds are seemingly Sakmarian in age. The two remainder species are new. One of them, *E. pamirensis*, is closely allied to *E. ferganica* from Sakmarian strata described in South Fergana (Miklukho-Maclay, 1949).

The analysis of the *Eoparafusulina* species assemblage suggests its strong affinities to the Boreal faunule, where similar forms are typical of the Sakmarian (Lower Sakmarian) deposits. *Eoparafusulina* is not common for the coeval rocks of the Tethyan region, although frequently quoted in the literature, especially by Chinese authors. A number of forms attributed to this genus belongs in our opinion to *Dar-*

vasites. These are distinguished by loose coiling, elliptic form of shell, generally more distinct chomata and more intense and regular septal fluting. The assignment of such forms to *Eoparafusulina* is often based on the appearance of cuniculi. The cuniculi were years ago defined in *Darvasites* too, and their presence alone cannot serve to attribute the forms possessing them to *Eoparafusulina*.

As we see from the foregoing discussion, *Pseudofusulina* and *Eoparafusulina* assemblages have more in common with the faunule of Boreal bioprovince, and its pertaining Uralian basins, than with their equivalents from the Tethys, excluding its southern peri-Gondwanan areas. This evidence highly complicates correlations between the studied interval of the Central Pamir with the sequences of Southern Europe, North Afghanistan, Darvaz and Japan. Correlations are however made

Fig. 3 - Distribution of the main fusulinid assemblages: a) Boreal assemblage; b) Tethyan assemblage; c) Kalaktash assemblage. 1 - ~~Darvaz~~; 2 - Central Afghanistan; 3 - Central Pamir; 4 - Chitral; 5 - Rutog.
Iran

possible by the presence of *Robustoschwagerina, Zellia* and *Sphaeroschwagerina* in the Kalaktash assemblage. These forms are uncommon in Sakmarian rocks of the Ural region. Indeed, their presence in Sakmarian rocks in the Tethyan region is proved by their occurrence with typical ammonoids in the Khoridje Formation distinguished in the Darvaz (Leven et al., 1992). *Sphaeroschwagerina* and *Zellia* do not reach up to Yahtashian stage. *Robustoschwagerina* ranges into Bolorian, however, being represented by different species from the Kalaktash assemblage.

Although the assemblage of sphaerical pseudoschwagerinids is not conspicuous, their presence helps to constrain the age of the fusulinid limestones of the Central Pamir. In addition, the beds containing these genera may be confidently traced through numerous Permian sequences of the Tethys. In the Carnic Alps and in the Karavanken Mountains, *Robustoschwagerina (R. geieri)*, closely allied to the Pamirian forms, characterizes the Trogkofel Stage recognized by Kahler & Kahler (1980), where these occur associated with *Zellia*. The latter ranges here from the underlying Rattendorf beds (Ebner & Kahler, 1989).

Primitive *Robustoschwagerina* in association with *Zellia* and *Sphaeroschwagerina* are recognized in the correlatives of Sakmarian rocks cropping out in drainages of the Bangi and Namakab Rivers, North Afghanistan (Leven, 1971) as well as in the Southwest Darvaz (Leven & Scherbovich, 1980 b) and Kelpin Mountains of Xinjiang (Chang, 1963). In the Darvaz the mentioned forms are confined to the Khorije Formation that is positioned between two well dated levels of Asselian and Yahtashian stages. Moreover, these occur in association with Sakmarian ammonoids (Leven et al., 1992).

Joint occurrence of *Robustoschwagerina, Zellia* and *Sphaeroschwagerina* is also pointed out in several successions, namely of the upper part, of the Mapin Formation, South China, below the beds containing Yahtashian *Pamirina* and *Chalaroschwagerina* (Zhang, 1984; Xiao et al., 1986; Zhou et al., 1987). The subjacent beds are well characterized by Asselian fusulinids, but a precise positioning of the boundary between Asselian and Sakmarian stages is still to be made.

Robustoschwagerina and *Zellia* are described as well from the Kitakami Mountains in Japan, where these fossils occur in the lower part of the Sakamotozawa Formation, lying with a erosional surface on the Upper Carboniferous. The base of the upper part of the formation contains Yahtashian *Chalaroschwagerina* and *Darvasites*, whilst the uppermost beds comprise Bolorian *Misellina (Brevaxina)* (Kanmera & Mikami, 1965; Choi, 1973). The genera discussed or some of them are recognized at the same stratigraphic level of Kitakami in the limestone sequences Atetsu and Akiyoshi (Nogami, 1961; Watanabe, 1991). Watanabe, who proposed a new scheme for zonation of the Late Carboniferous - Early Permian in Japan, distinguished the beds with *Robustoschwagerina* and *Zellia* within the zone *Robustoschwagerina shellwieni pamirica - Schwagerina krotowi*.

The genus completing our review of the Kalaktash fusulinid assemblage is *Paraschwagerina*. The single species in our collection occurs in Sakmarian rocks of Xinjiang

(Chang, 1963), in Fergana (Bensh, 1972) and North Afghanistan (Leven, 1971).

The remainder genera, or have a wide stratigraphic range, or are represented in our collection by a few poorly preserved specimens.

This exhuastive review indicates that the fusulinid assemblage of the level No. 6 of the Kalaktash section is Sakmarian in age. This conclusion should be more reliable if supported by ammonoid evidence, because it would enables direct correlation with the Uralian stratotypes. Ammonoids have been found in association with some of the Kalaktash fusulinids only in a locality of the Darvaz. The correlation based on fusulinids alone is rather approximate. But it is getting much more precise if some indirect indications are involved, even without taking into account ammonoids. As noted above, the correlatives of the discussed beds lie in many of the Tethyan sequences between well defined Asselian and Yahtashian rocks. Rich ammonoid samplings were made in the upper part of Yahtashian rocks in the Darvaz. They are closely allied to the Late Artinskian ammonoids from the Ural region (Leven et al., 1992).

The level No. 6 forms only the upper part of the Dangikalon Formation. The question arises if all this formation may be referred to Sakmarian age. No unequivocal answer exists, although, in our opinion it is possible. Bryozoans occurring through the sequence are represented by a more-or-less homogeneous assemblage. They do not suggest an older age for the lower part of the formation. As R.V.Gorjunova (1975) reports, the noted faunule is rather Artinskian than Asselian in age. The finding of *Neogondolella bisseli* in the lower part of the level No. 5 suggests also a Sakmarian age. As regards the level No. 7, the few fusulinid collected are closely allied to that of level No. 6.

Eventually, some provincialism may be identified in the Kalaktash assemblage. Its habitat is restricted by the South Tethyan region, called also peri-Gondwanan province (Fig. 3). As the author earlier stated (Leven & Scherbovich, 1978), distinctions in fusulinid biota between that provinces and the northerly part of the Tethys are related to climatic factors and to its paleoposition at higher and cooler latitudes. An indirect evidence is the resemblance between the Kalaktash fusulinid assemblage and Sakmarian faunule of the Boreal bioprovince. Their location was symmetric to the tropics.

Taking into account that in recent palinspastic reconstructions the southern margin of the Tethys tends to be perpendicular in respect to the paleolatitudes, the biota character might have been changing accordingly, along its shore line. This implication is well illustrated by the distribution of Asselian and Sakmarian fusulinid assemblages and by their latitudinal changes. Asselian fusulinids are known in Turkey and Iran, yet these are lacking already in South Afghanistan and farther southeast. Instead, in these regions benthos fauna of so-called "Gondwana type" is widespread, including cold-water conularia, bivalves (*Eurydesma*), brachiopods (*Stepanoviella, Notospirifer, Taeniothaerus*), and corals (*Lytvolasma*).

As a result of the Sakmarian warming (Dickins, 1977, 1985), the area of dispersal of fusulinids advanced southeast, till to the Southwest Tibet. Yet, this faunule represents an endemic and relatively homogeneous assemblage of Kalaktash-type, and only in the northernmost and, hence, warmer regions such as the Central Pamir, warm-water *Robustoschwagerina*, *Zellia* and *Sphaeroschwagerina*, typical of the North Tethyan tropical province, appear in the assemblage. In Australia, that was located to the southernmost latitudes, Sakmarian fusulinid are lacking.

The wide latest Sakmarian regression which occurred in the whole Tethys (Leven, 1993 a), led to the extinction of the Kalaktash fusulinid assemblage. No lineage between this assemblage and the succeeding Yahtashian-Bolorian faunule may be established. The latter developed in connection with expansion of the warm-water forms from the north that followed the Yahtashian-Bolorian transgression accompanied by milder climate.

Systematic description

All the described material comes from the level No. 6 of the Dangikalon Fm., Kalaktash River and West Pshart sections. This is consequently also the stratum typicum for the new species. Repository of the material is the Geological Institute of the Academy of Sciences of the Russia, Moscow.

Order **Schwagerinida** Solovieva, 1978

Family *Pseudofusulinidae* Dutkevich, 1934

Genus *Pseudofusulina* Dunbar & Skinner, 1931

Pseudofusulina pamirensis sp. n.

Pl. 1, fig. 1-3, 6, 8

Holotype. GGM VI-229/1; subaxial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 25 axial sections.

Description. A large, fusiform shell of 5-6 volutions, subcylindrical in the middle part of some specimens and gently tapering toward sharpened or rounded poles. Length (L) = 10-12.5 mm; Diameter (D) = 2.5-3 mm; L:D = 4-4.8.

The proloculus is spherical with a diameter of 0.2 to 0.3 mm. Coiling is tight in the first two-three volutions, later the shell expands abruptly. The spirotheca is slightly wavy; it is thin in the inner volutions and thickens outwards up to the value of 0.1 mm after the abrupt increase in height of the whorls. Septa are thin and intensely fluted throughout the length. Folds are irregular, variable in shape and height, locally arranged in two stages and grading into complex axial reticulation. The tunnel is low and narrow in the inner volutions; later it is irregular and rapidly expands outwards. Axial filling is present only in the inner volutions.

Discussion. Some of these specimens, including the holotype, bear strong similarity to the *Psdeudofusulina paraconcinna* Bensh described from Sakmarian rocks of

South Fergana. The present specimens differ from *P. paraconcinna* by the abrupt uncoiling, higher and irregular septal fluting and lack of septal thickening at the sides of the tunnel. The present species also resembles *P. juresanensis* Rauser-Chernousova and *P. forakerensis uralensis* Rauser-Chernousova from Lower Artinskian rocks of the Ural region. However, the Ural species are more elongate and sharpened toward the poles and possess a more regular septal fluting.

Occurrence and age. Kalaktash, West Pshart, Early Permian, Sakmarian.

Pseudofusulina karapetovi Leven, 1993

Remarks. This species is described in the monograph "Permian of Afghanistan" which now is in press. The present paper may eventually to be published earlier than the study on biostratigraphy and fusulinid fauna of Afghanistan. That is why two subspecies of this species are described herein for the second time.

Pseudofusulina karapetovi karapetovi Leven, 1993

Pl. 1, fig. 4 , 9

Holotype. GGM VI-228/133; axial section; Tezak, Central Afghanistan; Early Permian, Sakmarian.
Material. Central Afghanistan: 15 axial sections; Central Pamir: 7 axial sections.

Description. A small, elongate to subcylindrical shell of 5 to 6 volutions. L = 6.5-7.7 mm; D = 1.7-2.2 mm; L:D = 3.5-4.4.

The proloculus is small, with diameter ranging from 0.14 to 0.16 mm. The coiling is tight with a small leap after the third or fourth whorl. The spirotheca is thin in the inner volutions, markedly thickening later and attaining 0.1 mm. Septa are thin, folded. Folding of a moderate intensity covers all septa. Arcs vary in form and height. Fairly simple septal reticulation is present in axial portion of the shell. The tunnel is not broad, low, more or less steady positioned in the whorls. Small chomata are seen in the first two to three volutions. Axial filling is lacking or slightly in the early volutions.

Discussion. The subspecies is most similar to *Pseudofusulina tastubensis* Vissarionova, 1949, but differs in having minor size, more sharpened shell and relatively more compact coiling.

Distribution and age. Central Afghanistan (Tezak, Gudri Mazar, Khargardan), Pamir (Kalaktash), East Hindu Kush (Rosh Gol); Early Permian, Sakmarian.

Pseudofusulina karapetovi tezakensis Leven, 1993

Pl. 1, fig. 5, 7

Holotype. GGM VI-228/143; axial section; Tezak, Central Afghanistan; Early Permian, Sakmarian.
Material. Central Afghanistan: 12 axial sections; Central Pamir: 6 axial sections.

Remarks. This subspecies differs from *Pseudofusulina karapetovi karapetovi* in being shorter, having inflated shell and a more distinct juvenarium with axial filling.

Distribution and age. Central Afghanistan (Tezak, Gudri Mazar, Khargardan), Central Pamir (Kalaktash, West Pshart); Early Permian, Sakmarian.

Pseudofusulina plena sp. n.

Pl. 2, fig. 1-3

Holotype. GGM VI-229/10; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 17 axial and 20 subaxial sections.

Description. A medium-sized shell of 5-5.5 volutions, fusiform to subcylindrical, bent in some specimens and sharply tapering toward the rounded poles. In the first two volutions the shell is fusiform, inflated in the middle portion and has sharply pointed poles. L = 8-9.5 mm; D = 1.8-2 mm; L:D = 4.2-4.7.

The proloculus is spherical with a diameter of 0.15-0.2 mm. Coiling is fairly tight and uniform with a gradual increase in height of the succeeding whorls. The spirotheca slowly thickens to the value of 0.1 mm in the outermost volution. Septa are moderate thick and fluted pole to pole. Folds are rounded and nearly regular, attaining half of the chamber height. The tunnel is low, irregular and expands gradually outwards. Axial filling is lacking. Small chomata are present on the proloculus and in the first volution.

Discussion. This species differs from *Pseudofusulina pamirensis* sp. n. in being smaller, having a more uniformly coiled and sharply tapering shell and a less intense septal fluting. Compared to *P. karapetovi*, the present species is more elongate and yields a more intense and regular septal fluting. This species bears a strong similarity to the Lower Artinskian *P. postpedissequa* Rauser from the Bashkirian Pred-Uralye, but differs for its tighter coiling and, hence, smaller size, and lack of axial filling in the inner volutions.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina curva sp. n.

Pl. 2, fig. 7, 8

Holotype. GGM VI-229/17; subaxial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 2 subaxial and several tangential sections.

Description. A large, elongate-fusiform shell of 5 volutions, commonly bent and sharply tapering to rounded poles. L = 9.5-14.5 mm; D = 1.45-2 mm; L:D = 6.5-7.2.

The proloculus is spherical with a diameter of 0.17-0.20 mm. Coiling is tight and uniform. The spirotheca is thin, attaining 0.17 mm in the final volution. Septa are thin and fluted throughout the length. Fluting is moderately intense. Folds are broad, irregular and loop-shaped, grading into the medium-sized complex axial reticulation. The tunnel is low, poorly defined and appears to be very broad in the last volutions. Axial filling is absent.

Discussion. This species resembles *Pseudofusulina nodosa* Konovalova, 1980 from Lower Artinskian beds of the Timan-Pechora province. It differs in having a bent shell, less regular and high septal fluting with more rounded and broad folds. This feature distinguishes the present species from another closely allied species, *P. sertchejuensis* Konovalova, 1991 which occurs in the topmost Tastubian of the mentioned province. In addition, unlike the present species, *P. sertchejuensis* yields an axial filling in the inner volutions.

Occurrence and age. Kalaktash, Early Permian, Sakmarian.

Pseudofusulina kalaktashensis sp. n.

Pl. 2, fig. 4-6

Holotype. GGM VI-229/15; nearly axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.

Material. 6 axial and subaxial sections.

Description. An inflated fusiform shell in the juvenarium; it rapidly elongates thereafter, resulting in the fusiform shell with sharply tapering rounded poles. L = 9-11 mm; D = 2.2-2.5 mm; L:D = 4-4.1.

The proloculus is spherical and large, attaining a diameter of 0.3 mm. Coiling is loose, with minor abrupt expansion after the second volution. The spirotheca is uneven and increasingly thickens to 0.1 mm in the final volution. Septa are thin and folded. Folds are rounded and variable in size, rapidly grading into the medium-sized axial reticulation polewards. The tunnel is rather narrow, low and irregular.

Discussion. This species differs from *Pseudofusulina pamirensis* sp. n. in having a large proloculus, inflated shell in the inner volutions, less intense and regular septal fluting. The form of the shell and character of coiling make this species similar to *P. pedissequa* Vissarionova, 1949 from Lower Artinskian beds of the Permian Pred-Uralye, but the present species commonly has thinner and more simple septal folds. This species also bears a resemblance with *P. rauserae praecursor* Kireeva, 1949 from Lower Tastubian beds of the Bashkirian Pred-Uralye, but differs in a less intense septal fluting.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina sulcata Korzhenevsky, 1940

Pl. 3, fig. 1-4

1940 *Pseudofusulina sulcata* Korzhenevsky, p. 5, fig. 1-13.

Material. 16 axial sections.

Distribution and age. Central Pamir, Bashkirian Pred-Uralye, South Ural, Precaspian; Early Permian, latest Asselian - earliest Sakmarian.

Occurrence. Kalaktash.

Pseudofusulina psharti sp. n.

Pl. 3, fig. 7; Pl. 4, fig. 1-4

Holotype. GGM VI-229/27; axial section; West Pshart, Central Pamir; Early Permian, Sakmarian.
Material. 5 axial sections.

Description. A fusiform shell of 5.5-6 volutions, slightly inflated in the middle portion and sharply narrowing toward rounded poles. The shell is short-fusiform with sharply pointed and somewhat elongated poles in the well-defined juvenarium of 3.5-4 volutions. L = 9-12 mm; D = 2.3-2.75 mm; L:D = 3.5-4.

The proloculus is spherical or subspherical, commonly small, and ranges in diameter from 0.15 to 0.17 mm, attaining in exceptional specimens the diameter of 0.35 mm. Coiling is tight in the juvenarium. The chamber height increases abruptly in the succeeding whorls with simultaneous elongation of the shell. The spirotheca increases gradually in thickness, resulting in maximum thickness of 0.1 mm in the final volution. Septa are fairly thick, fluted throughout the length and transforming into medium-sized axial meshwork. The tunnel is rather narrow and relatively straight. Heavy axial filling is present in the juvenarium.

Discussion. This species resembles *Pseudofusulina parasolida* Bensh, 1962 and *P. hindukushiensis* Leven, 1971, known to occur in Sakmarian beds of the South Fergana and North Afghanistan. It differs in having a distinct and more tightly coiled juvenarium. A shorter and more inflated juvenarium explains a convexity of the middle portion in the mature specimens.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina muzkolensis sp. n.

Pl. 3, fig. 5, 6

Holotype: GGM VI-229/23; subaxial section; West Pshart, Central Pamir; Early Permian, Sakmarian.
Material. 6 axial and subaxial sections.

Description. A fusiform shell of 5-5.5 volutions, slightly bent along the axis in most of the specimens and smoothly tapering toward sharply pointed, rarely elongated poles. L = 8-10 mm; D = 1.9-2.5 mm; L:D = 4-4.2.

The proloculus is spherical, with a diameter ranging from 0.2 to 0.3 mm. The shell is tightly coiled in the first 2.5-3 volutions; later it expands looser. The spirotheca thickens gradually, attaining the maximum of 0.1 mm in the final volution. Septa are moderate thick and fluted. Folds are rounded and high. The tunnel is low, narrow and irregular, expanding in the loosely coiled final volutions. Small chomata are present on the proloculus. Axial filling is prominent in the first two-three volutions.

Discussion. This species differs from *Pseudofusulina psharti* sp. n. in being more elongate in the juvenarium, which is less defined. The present species resembles as well specimens of *P. devexa* Rauser-Chernousova, 1949 from Lower Sakmarian of the

Pred-Uralye region. It is distinguished in having a less regular shape of the shell and less intense and regular septal fluting. This species also is similar to *P. ziganica* Vissarionova, 1949, from the Sakmarian rocks of the above-mentioned region. But the Pred-Uralye species is more uniformly coiled with its septa being more intensely and regularly folded; its axial filling is present in more volutions.

Occurrence and age. West Pshart; Early Permian, Sakmarian.

Pseudofusulina insignis sp. n.

Pl. 4, fig. 6, 8

Holotype. GGM VI-229/31; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 15 axial and subaxial sections.

Description. A large, short-fusiform shell of 5-7 volutions, slightly thickened and convex in the middle portion with narrowly rounded poles. L = 9-11.5 mm; D = 2.6-3.2 mm; L:D = 3-3.6.

The proloculus is spherical with a diameter ranging from 0.2 to 0.3 mm. A well defined and tightly coiled juvenarium of 2.5-3 volutions is followed by rather free coiling of the mature shell. The spirotheca thickens gradually to the value of 0.1 mm. Septa are moderate thick and folded. Folds commonly are high and rounded or narrowing to their tops and grading into moderate-sized axial meshwork. Axial filling is well developed in the juvenarium and lacking thereafter.

Discussion. This species is very similar to *Pseudofusulina psharti* sp. n., but has a shorter and heavier shell. It also bears an affinity to *P. parafranklinensis* Rauser-Chernousova, 1949, which occurs in Artinskian rocks of the Pred-Uralye region. This last is more regular in the shell shape, which is inflated in the middle portion and sharply pointed at the poles, and possesses more intensely and regularly fluted septa.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina curteum sp. n.

Pl. 4, fig. 5, 7; Pl. 5, fig. 1, 3

Holotype. GGM VI-229/34; subaxial section; West Pshart, Central Pamir; Early Permian, Sakmarian.
Material. 16 axial and subaxial sections.

Description. The shell is subspherical to inflated-fusiform in the juvenarium of 2.5-3 volutions. It elongates thereafter, resulting in a lemon-like form, inflated in the middle region and narrowly ending in rounded poles. The shell has 4.5-5 volutions. L = 6-7.5 mm; D = 2.4-3.4 mm; L:D = 2.2-2.9.

The proloculus is spherical with a diameter of 0.12 to 0.2 mm. The first 2-2.5 volutions are fairly tight coiled; later, the shell abruptly expands with simultaneous elongation of the shell toward its poles. The spirotheca is uneven and gradually thickens to 0.075 mm in the outermost volution. Septa are thin and irregularly fluted.

Fluting is most intense in the juvenarium. The tunnel is low and narrow in the innermost volutions and rapidly expandes outwards. Light chomata are present on the proloculus. Axial filling is prominent in the juvenarium.

Discussion. This species differs from *Pseudofusulina insignis* sp. n. in its lemon-like shape, more rapid expansion of the shell, smaller size and less regular septal fluting.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina granuliformis sp. n.

Pl. 5, fig. 4, 5

Holotype. GGM VI-229/37; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 3 axial and 5 tangential sections.

Description. A short-fusiform shell of 5 volutions, sharply tapering in the juvenarium and ending in rounded poles in mature specimens. L = 7.5 mm; D = 2.5-2.8 mm; L:D = 2.7-3.

The proloculus is spherical or subspherical with a diameter ranging from 0.15 to 0.25 mm. The juvenarium of 2.5-3 volutions is coiled fairly tight and followed by much looser coiled whorls. The spirotheca is rather thick throughout, attaining the maximum value of 0.1 mm. Septa are thin and intensely fluted pole to pole. Folds are rounded, "multi-storeyed" and affect almost all the chamber space, transforming it into a complex fine meshwork. The tunnel is low and narrow. Chomata and pseudochomata are lacking. Axial filling is present in the juvenarium.

Discussion. This species resembles *Pseudofusulina insignis* sp. n., differing by the more regular, fusiform shell, looser coiled outer volutions and more intense and complex septal fluting.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina memoralis sp. n.

Pl. 5, fig. 9

Holotype. GGM VI-229/41; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. One axial and two tangential sections.

Description. A short-fusiform shell of 6 volutions, sharply pointed at the poles in the first four volutions and rapidly elongating toward rounded poles in the last two volutions. L = 11.5 mm; D = 2.9 mm; L:D = 4.

The proloculus is spherical, attaining a diameter of 0.2 mm. Coiling is moderate and relatively uniform. The spirotheca is even throughout, attaining 0.12 mm in thickness. Septa are thin and intensely folded pole to pole. The tunnel is low, narrow and straight, expanding gradually outwards. Light axial filling is present in the inner 3-4 volutions.

Discussion. The form of shell in the inner volutions, thick spirotheca and intense septal fluting make this species closely similar to *Pseudofusulina granuliformis* sp. n. It differs from the latter in being elongate, more uniformly coiled and in having different character of septal fluting.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina tibetica maxima subsp. n.

Pl. 5, fig. 6

Holotype. GGM VI-229/39; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. One axial section.

Description. A large shell of 5-6 volutions, fusiform and sharply tapering to the poles in the juvenarium and subcylindrical with rounded poles in mature specimens. L = 12.7 mm; D = 2.9 mm; L:D = 4.3.

The proloculus is spherical, attaining a diameter of 0.32 mm. Coiling is fairly tight and uniform. The spirotheca increases gradually to the value of 0.07 mm in the final volution. Septa are regularly fluted. Folds are low, even and rounded, grading into a broad region of axial reticulation. The tunnel is rather low and narrow in the first three volutions, rapidly expanding thereafter. Light chomata are present on the proloculus and the first volution. Axial filling is absent.

Discussion. This subspecies differs from *Pseudofusulina tibetica tibetica* (Nie & Song, 1983) known from Sakmarian (?) rocks of Tibet in being larger and having no axial filling.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina neglectens sp. n.

Pl. 5, fig. 8; Pl. 6, fig. 2, 5

Holotype. GGM VI-229/43; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 5 axial sections.

Description. A short-fusiform shell of 4.5-5.5 volutions, slightly inflated in the middle portion. L = 7.3-8.1 mm; D = 2.8 mm; L:D = 2.6-2.8.

The proloculus is spherical, attaining a diameter of 0.3 mm. Coiling is fairly free and uniform. The spirotheca is thick, up to 0.1 mm in the final volution. Septa are fairly thick and fluted pole to pole. Fluting is irregular and not very intense. Folds are rounded or irregular, attaining half of the chamber height and transform rapidly into large-sized reticulation towards the poles. Axial filling is absent.

Discussion. This species resembles some specimens described by Rauser-Chernousova as *Pseudofusulina moelleri* (Schellwien) from the lower part of the Sakmarian stratotype. Typical specimens of the latter are larger, sharply pointed at the poles, tighter coiled in the innermost volutions and possess a higher septal fluting.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina incompta sp. n.

Pl. 5, fig. 2, 7; Pl. 6, fig. 1

Holotype. GGM VI-229/42; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 5 axial sections.

Description. A fairly small shell of 4 to 5.5 volutions, inflated with sharply pointed poles in the first two volutions, and fusiform with narrowly rounded poles thereafter. L = 5.6-7.6 mm; D = 1.8-2 mm; L:D = 3-4.2.

The proloculus is spherical with a diameter ranging from 0.15 to 0.2 mm. The spirotheca is moderately thick, attaining 0.17 mm in thickness in the outermost volution. Septa are thin and folded. Folds are low and variable in height, which decreases toward the tunnel. Folds grade into medium-sized reticulation toward the poles. The tunnel is rather narrow, reaching half of the chamber height. Axial filling is absent.

Discussion. This species differs from typical forms of the most closely allied *Pseudofusulina karapetovi karapetovi* Leven, 1993 and *P. plena* sp. n. in being smaller and having the lesser form index. In addition, its juvenarium is shorter and inflated in shape.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina licis sp. n.

Pl. 6, fig. 3, 4

Holotype. GGM VI-229/45; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 2 axial and 3 tangential sections.

Description. A small, short-fusiform shell of 5 volutions with narrowly rounded ends. L = 5 mm; D = 2.4 mm; L:D = 2.1.

The proloculus is spherical, attaining a diameter of 0.2 mm. Coiling is rather loose, with a gradual expansion of the succeeding volutions. The spirotheca is moderate thick, attaining 0.07 mm in the outer volutions. Septa are thin and fluted throughout the length. Folds are rounded, variable in the height. The tunnel is rather narrow and straight, reaching almost a half of the height of volutions. Axial filling is absent.

Discussion. This species closely resembles *Pseudofusulina incompta* sp. n., differing in a shorter shell.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina gravis sp. n.

Pl. 6, fig. 6-8, 10

Holotype. GGM VI-229/47; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 4 axial sections.

Description. A fusiform shell of 4.5 to 5 volutions, gently sharpening polewards. L = 7.5-8 mm; D = 2.2-2.6 mm; L:D = 3-3.5.

The proloculus is spherical and subspherical, ranging from 0.2 to 0.3 mm in a diameter. Coiling is loose with a gradual expansion of volutions. The spirotheca is thick throughout the growth, attaining 0.12 mm in the final whorl. Septa are fluted. Folds are irregular in the form and transform into large-sized axial reticulation. The tunnel is fairly narrow in the first 2-3 volutions, rapidly expanding thereafter. Axial filling is either lacking or sparse in the second and third volution. Light chomata occur on the proloculus and in the first volution of some specimens.

Discussion. The species studied is most similar to *Pseudofusulina neglectens* sp. n. It resembles the latter in the character of fluting and, that is most important, its thick spirotheca. It differs from the latter in a more elongate and sharpened form of the shell.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina inobservabilis sp. n.

Pl. 6, fig. 9, 11, 12; Pl. 7, fig. 1, 2

Holotype. GGM VI-229/52; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 5 axial sections.

Description. A fairly small, fusiform shell of 4.5-5 volutions. L = 5.5-7 mm; D = 1.7-1.8 mm; L:D = 3.2-3.9.

The proloculus is spherical, with a diameter of 0.1 to 0.2 mm. The first two-three volutions are tightly coiled; then, the shell expands abruptly. The spirotheca is thin in the inner volutions and increases rapidly in thickness, attaining a thickness of 0.1 mm in the outermost volution. Fluting is rather moderate in the middle portion of the shell. Folds are low, rounded and uneven. The tunnel is low and expands gradually outwards. Small chomata are present on the proloculus and the first volution; pseudochomata occur on the succeeding 1-2 volutions. Septa are thicker in the juvenarium than in mature individuals at the expense of axial filling.

Discussion. The specimens studied most resemble *Pseudofusulina karapetovi* Leven, 1993, but differ in smaller size and less intense septal fluting. These are distinguished from *P. muzkolensis* sp. n. in the same characteristics. In addition, type specimens of the latter have a more distinct juvenarium.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina macilenta Leven, 1993

Pl. 7, fig. 3-7

Remark. Likewise *Pseudofusulina karapetovi*, this species is first described in monograph "Permian of Afghanistan" that is presently in press. This description is reproduced herein.

Holotype. GGM VI-228/147; axial section; Khaftkala, Afghanistan; Early Permian, Sakmarian.
Material. Afghanistan: 15 axial sections; Central Pamir: 6 axial and 15 subaxial sections.

Description. A medium size shell, elongate-fusiform to with subcylindrical in shape. L = 5-7 mm; D = 1.5-1.9 mm; L:D = 3-5.

The proloculus is small, spherical, a diameter ranging from 0.12 to 0.17 mm. The coiling is tight and uniform with a graduate increase in the height of the succeeding whorls. The spirotheca with hardly seen alveoli is thin in the inner volutions, rapidly thickening to 0.07 mm thereafter. Sometimes it is slightly wavy. Septa are thin, fluted. Fluting increases from the middle region of the shell polewards; arcs being rounded or irregular of a variable height. The tunnel is low, strongly expanded in the final volutions, unsteadily positioned. Small chomata are sometimes visible on the proloculus and in the first whorls. Axial filling is lacking or light in the third to fourth volutions.

Discussion. The species studied has most resemblance with *Pseudofusulina samjatini* Scherbovich, but is well distinguished from the latter in having a lesser size and more compact coiling. The same characteristics differ it from *P. karapetovi karapetovi* Leven, 1993.

Distribution and age. Khaftkala, Afghanistan; West Pshart, Central Pamir; Early Permian, Sakmarian.

Pseudofusulina minuscula sp. n.

Pl. 10, fig. 5, 6, 9, 10

Holotype. GGM VI-229/88; axial section; West Pshart, Central Pamir; Early Permian, Sakmarian.
Material. 3 axial and 5 subaxial sections.

Description. A fairly small, fusiform shell of 4.5-5 volutions with slightly inflated middle portion. L = 5-7 mm; D = 1.3-1.6 mm; L:D = 3.5-4.3.

The proloculus is spherical and ranges from 0.12 to 0.20 mm in a diameter. Coiling is rather tight and uniform, with slow expansion of the shell. The spirotheca increases gradually in thickness, attaining 0.07 mm in the final volution. Septa are strongly folded throughout the length. Folds are high, rounded and transform into a narrow region of axial reticulation. The tunnel is medium-broad and medium-high and expands gradually. Moderate axial filling is present.

Discussion. This species is closely similar to *Pseudofusulina macilenta* sp. n., differing by a more intense and regular septal fluting and the presence of axial filling.

Occurrence and age. West Pshart; Early Permian, Sakmarian.

Pseudofusulina tumidiscula sp. n.

Pl. 7, fig. 8, 10, 13

Holotype. GGM VI-229/63; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 6 axial and subaxial sections.

Description. A short-fusiform shell of 5.5 volutions slightly inflated in the middle portion. L = 5.5-7 mm; D = 2.4-2.5 mm; L:D = 2.4-2.8.

The proloculus is spherical, attaining a diameter of 0.2 mm. Coiling is uniform, with gradual expansion of the shell. The spirotheca increases slowly in thickness up to 0.07 mm in the outermost volution. Septa are thin and fluted throughout the length. Folds are rounded, transforming into a broad region of axial reticulation. The tunnel is rather narrow, attaining in height half of the chamber space. Pseudochomata are present in the inner volutions. Axial filling is present in the first three-four volutions.

Discussion. This species bears some similarity to *Pseudofusulina panjiensis* Leven & Scherbovich, 1978 described from Asselian beds of the Darvaz, but differs in the character of septal fluting, lighter axial fillings and a more elongate shell.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Pseudofusulina curta sp. n.

Pl. 7, fig. 12, 14

Holotype. GGM VI-229/66; axial section; West Pshart, Central Pamir; Early Permian, Sakmarian.
Material. 3 axial sections.

Description. A fairly small, short-fusiform shell of 5-6 volutions, slightly convex in the middle portion, with steep lateral slopes and somewhat elongated poles. L = 5-6 mm; D = 1.9-2.3 mm; L:D = 2.1-2.6.

The proloculus is spherical, attaining a diameter of 0.17 mm. Coiling is tight with gradual expansion of the shell. The spirotheca increases slowly in thickness, attaining 0.07 mm in the final volution. Septa are thin and intensely fluted throughout the length. Folds are high, narrow and more rarely rounded, and transform into the complex fine meshwork. The tunnel expands gradually, without attaining a half of the space between volutions and showing a stable position in the growth. Axial filling is present in the first 3-4 volutions, extending on to the folds at a distance from the tunnel.

Discussion. This species differs from *Pseudofusulina tumidiscula* sp. n. in having different shape of the shell, inflated in the middle portion and more tightly coiled, and in a more intense, regular septal fluting with narrow and high folds.

Occurrence and age. West Pshart; Early Permian, Sakmarian.

Pseudofusulina perrara sp. n.

Pl. 7, fig.11

Holotype. GGM VI-229/65; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. An axial and two tangential sections.

Description. A medium-sized shell of 5.5 volutions, fusiform and sharpened at the poles in the inner 3 volutions; subcylindrical with smoothly rounded poles thereafter. L = 8.6 mm; D = 2.5 mm; L:D = 3.3.

The proloculus is spherical, attaining 0.2 mm in a diameter. The shell is tightly and more-or-less uniformly coiled with gradual increase in the height of the succeeding volutions except the final whorl that is coiled much looser than the penultimate one. The spirotheca increases slowly in thickness up to 0.1 mm in the final whorl. Septa are thin and fluted. Fluting is broad, with rounded and low areas, transforming into the large-sized axial reticulation. The tunnel is low and broad. Axial filling is absent. Light chomata are present in the first two volutions.

Discussion. The species studied closely resembles *Pseudofusulina kiangsuensis* var. *occidentalis* Rauser-Chernousova, occurring in the Lower Artinskian rocks of the Bashkirian Pred-Uralye. It differs in having a less intense and more regular septal fluting and, in general, uniform coiling.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina vulgara sp. n.

Pl. 7, fig. 9

Holotype. GGM VI-229/64; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. A single axial section.

Description. A fusiform shell of 4.5 volutions with sharply rounded poles. L = 9.7 mm; D = 2.6 mm; L:D = 3.7.

The proloculus is spherical, attaining a diameter of 0.3 mm. The shell is tightly and uniformly coiled. The spirotheca is thin in the inner volutions, rapidly increasing in thickness thereafter to 0.12 mm. Septa are thin and fluted throughout the length. Fluting is irregular. Folds are uneven, rounded or narrowed and elongate in the height. The tunnel is narrow and low in the first volutions after which it expands rapidly. Pseudochomata are present in the first two volutions. Axial filling was not observed.

Discussion. The species studied bears some resemblance with *Pseudofusulina paraconcessa* Rauser-Chernousova that occurs in the Lower Artinskian substage of the Bashkirian Pred-Uralye. It differs in the more loosely coiled shell, especially in the inner volutions.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Pseudofusulina aff. **P. rara** Leven & Scherbovich, 1980

Pl. 7, fig. 15, 16

1980 b *Pseudofusulina rara* Leven & Scherbovich, p. 22, pl. 3, fig. 6, 7.

Material. 3 subaxial sections.

Remarks. The specimens discussed are very similar to the typical representatives of *Pseudofusulina rara*, which occurs in Sakmarian rocks of the Darvaz, as far as form of the shell, character of uncoiling and septal fluting. The only distinction, preventing their complete identification is the somewhat more massive axial filling present in the Darvasian specimens.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Family *Pseudoschwagerinidae* Chang, 1963

Genus *Paraschwagerina* Dunbar & Skinner, 1936

Paraschwagerina (?) **tianshanensis** (Chang, 1963)

Pl. 8, fig. 1-3

1963 *Pseudoschwagerina tianshanensis* Chang, p. 226, pl. 5, fig. 6, 7.

Material. 3 axial sections.

Distribution and age. China (Xinjiang), Fergana, Central Pamir (West Pshart); Early Permian, Sakmarian.

Genus *Robustoschwagerina* Miklukho-Maclay, 1956

Remarks. According to the original diagnosis, *Robustoschwagerina* is characterized by a spherical shell or compressed along the axis, with a distinct juvenarium and loose coiling in the succeeding whorls. The septa are straight at all stages of growth (Miklukho-Maclay, 1959). New informations about *Robustoschwagerina* enable to extend the diagnosis of this genus. (i) Septa in the juvenarium of most specimens of this genus are wavy or slightly folded. This concerns as well the type-species of this genus, *Robustoschwagerina tumida* (Licharev). (ii) The shell may vary from compressed to slightly elongate shape within the same species (Sheng et al., 1984).

The specimens described herein correspond completely to such a diagnosis. They may be referred to the group of *Robustoschwagerina* that possesses a "juvenile *Triticites*-like" juvenarium (Yang, 1992). Such a juvenarium has fewer volutions (not more than 2-2.5) and is isolated from the mature portion of the shell not so distinctly as that in the other group of *Robustoschwagerina* with the "adult *Triticites*-like" juvenarium (Yang, 1992). Specimens of *Robustoschwagerina*, like the forms described, resemble some species of *Zellia*, such as *Z. nunosei* (Hanzawa, 1939) and *Z. colanii* Kahler & Kahler. A distinct limit hardly may be drawn between these genera. But the better separated juvenarium of *Robustoschwagerina* is lacking in *Zellia* of Central Pamir. It may serve as the main criterion to distinguish the forms here discussed.

Robustoschwagerina psharti sp. n.

Pl. 8, fig. 4-8; Pl. 9, fig. 1-3

Holotype. GGM VI-229/72; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 8 axial sections.

Description. A subspherical shell of 5.5-6.5 volutions, varying in shape from the slightly compressed along the axis to the short-ellipsoidal. L = 6-7.5 mm, D = 4.7-7 mm, L:D = 0.95-1.4. Coiling is irregular. A distinct juvenarium extends to 1.5-2.5 volutions which are relatively tightly coiled. The shell in the juvenarium is fusiform, and a more elongate in the ellipsoidal specimens. After the juvenarium, the chambers increase in height abruptly. The shell is coiled less loosely in the last than in the next to the last volution. The increase in the chamber height with the growth is as follows (in mm):

	volutions							
specimens	1	2	3	4	5	5.5	6	6.5
1022-5 (holotype)	0.52	1.00	2.00	3.95	5.00	7.00	-	-
1022-2	0.55	0.80	1.60	3.00	4.50	-	6.00	-
1022-7	0.75	1.40	2.95	4.75	6.40	7.00	-	-
1022-3	0.37	0.62	1.50	2.70	4.10	-	5.30	-
1022-1	0.42	0.72	1.70	3.05	4.25	4.65	-	-
22982-30-15	0.50	0.95	2.30	4.00	5.00	-	-	-
22982-35-11	0.60	1.25	2.60	4.00	5.50	-	-	-

The spirotheca is thin in the first volutions, but increases in thickness in the succeeding 1-2 volutions up to 0.12 mm. Septa are thin, wavy or gently folded in the juvenarium and straight or slightly wavy thereafter. High and fairly narrow chomata are present only on the proloculus and in one-two volutions of the juvenarium.

Discussion. This species most resembles primitive specimens of *Robustoschwagerina* known from the Maping Formation of South China such as *R. xiaodushanica* Sheng & Wang, but differs in having somewhat looser coiled, more inflated and shorter juvenarium. The same features distinguish this species from *R. geyeri* (Kahler & Kahler) and *R. kahleri* Miklukho-Maclay. In addition, the mentioned species has more intensely fluted septa in the juvenarium.

Occurrence and age. Kalaktash, West Pshart; Early Permian, Sakmarian.

Robustoschwagerina aff. **R. kainsuensis** (Miklukho-Maclay, 1949)

Pl. 10, fig. 4

1949 *Pseudoschwagerina tumida kainsuensis* Miklukho-Maclay, p. 74, pl. 4, fig. 2.

Material. One axial and several subaxial sections.

Description. A spherical shell of 5 volutions. L = 4 mm; D = 4 mm; L:D = 1.

The proloculus is spherical, with a diameter of 0.12 mm. Coiling is tight in the first two volutions. Later, the height of the volutions increases gradually. Starting with the fourth volution, the shell expands abruptly. The spirotheca increases gradually up to the value of 0.1 mm in the last whorl. Septa are thin and straight. Rounded chomata are distinctly observed in the first two volutions.

Discussion. The specimen described resembles *Robustoschwagerina kainsuensis* (Miklukho-Maclay, 1949) in the shape of the shell, small size of the proloculus and character of uncoiling. The smaller size of the present specimen, having however the same number of whorls of *R. kainsuensis*, prevents full identification.

Occurrence and age. West Pshart; Early Permian, Sakmarian.

Robustoschwagerina (?) sp. A

Pl. 9, fig. 6

Material. One axial section.

Description. A large, ellipsoidal shell of 6.5 volutions, fusiform in the juvenarium and slightly inflated in the middle portion. L = 3.5 mm; D = 7 mm; L:D = 1.7.

The proloculus is spherical, with a diameter of 0.35 mm. The juvenarium of 3.5 volutions is distinct and tightly coiled. Starting with the fourth volution, the shell expands abruptly. The last volution is lesser in height than the preceeding one. The spirotheca is fairly thick even in the juvenarium, not exceeding 0.12 mm. Septa are thin and wavy in the juvenarium and straight in the subsequent whorls. High and narrow chomata are well developed in the juvenarium, but lacking thereafter.

Discussion. A well defined *Triticites*-like juvenarium, abrupt expansion of the shell in the later whorls and straight septa suggest a close alliance of the form described with representatives of *Robustoschwagerina*. Nevertheless, this form differs from all known species of this genus in having an elongate shell. In this respect it bears a resemblance to the ellipsoidal varieties of *R. psharti* sp. n. with which it jointly occurs in thin sections. However, compared to *R. psharti* sp. n., the form described has a juvenarium of more volutions, and uncoils thereafter more abruptly.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Genus *Zellia* Kahler & Kahler, 1937

Zellia nunosei Hanzawa, 1939

Pl. 10, fig. 1, 2

1939 *Pseudoschwagerina (Zellia) nunosei* Hanzawa, p. 72, pl. 4, fig. 4-6.

Material. 2 axial sections.

Distribution and age. Japan, Central Pamir; Early Permian, Sakmarian.
Occurrence. West Pshart.

Genus *Sphaeroschwagerina* Miklukho-Maclay, 1956

Sphaeroschwagerina zhongzanica (Zhang, 1982)

Pl. 9, fig. 4, 5; Pl. 10, fig. 3

1982 *Pseudoschwagerina zhongzanica* Zhang, p. 193, pl. 9, fig. 1.
1984 *Pseudoschwagerina sphaerica* Zhao, Han & Wang, p. 91, pl. 12, fig. 26-30.

Material. 2 subaxial and 3 tangential sections.

Distribution and age. East Tibet, West Kunlun, Central Pamir; Early Permian, latest Asselian and Sakmarian.
Occurrence. West Pshart.

Family *D a r v a s i t i d a e* Leven, 1992

Genus *Eoparafusulina* Coogan, 1960

Eoparafusulina tschernyschewi tschernyschewi (Schellwien, 1909)

Pl. 10, fig. 7, 8, 11

1909 *Fusulina tschernyschewi* Schellwien, p. 168, pl. 45, fig. 8-12.
1961 *Pseudofusulina tschernyschewi tschernyschewi* - Grozdilova & Lebedeva, p. 220, pl. 13, fig. 2-4.

Material. 11 axial sections.

Distribution and age. Timan, Petchorian depression, Early Sakmarian (Tastubian); Central Pamir, Sakmarian.
Occurrence. Kalaktash, West Pshart.

Eoparafusulina tschernyschewi memoranda (Grozdilova & Lebedeva, 1961)

Pl. 11, fig. 2, 3, 6

1961 *Pseudofusulina tschernyschewi* forma *memoranda* Grozdilova & Lebedeva, p. 222, pl. 14, fig. 2, 3.

Material. 12 axial and subaxial sections.

Distribution and age. Timan, Early Sakmarian; Central Pamir, Sakmarian.
Occurrence. Kalaktash, West Pshart.

Eoparafusulina recondita (Grozdilova & Lebedeva, 1961)

Pl. 11, fig. 1, 4, 5, 7, 8

1961 *Pseudofusulina* (?) *recondita* Grozdilova & Lebedeva, p. 196, pl. 6, fig. 5, 6.

Material. 7 axial sections.

Distribution and age. North Timan, Early Sakmarian; Central Pamir, Sakmarian.
Occurrence. Kalaktash, West Pshart.

Eoparafusulina laudoni (Skinner & Wilde, 1966)

Pl. 11, fig. 9-13

1966 *Alaskanella laudoni* Skinner & Wilde, p. 57, pl. 48, fig. 1-13.

Material. 7 axial sections.

Distribution and age. Alaska, Central Pamir; Early Permian, Sakmarian.
Occurrence. West Pshart.

Eoparafusulina aff. **E. mendenhalli** Petocz, 1970

Pl. 11, fig. 14; Pl. 12, fig. 1

1970 *Eoparafusulina mendenhalli* Petocz, p.81, pl. 8, fig. 5-7; pl. 9, fig. 1-14.

Material. 2 axial sections.

Distribution and age. Alaska, Central Pamir; Early Permian, Sakmarian.
Occurrence. West Pshart.

Eoparafusulina weddelli Petocz, 1970

Pl. 12, fig. 2

1970 *Eoparafusulina weddelli* Petocz, p. 87, pl. 10, fig. 1-13.

Material. One axial section.

Distribution and age. Alaska, Central Pamir; Early Permian, Sakmarian.
Occurrence. West Pshart.

Eoparafusulina depressa Skinner & Wilde, 1965

Pl. 12, fig. 3-8

1965 *Eoparafusulina depressa* Skinner & Wilde, p. 76, pl. 34, fig. 12-16.

Material. 3 axial sections.

Distribution and age. California, Central Pamir; Early Permian, Sakmarian.
Occurrence. Kalaktash.

Eoparafusulina regina Nie & Song, 1983

Pl. 12, fig. 13, 14

1983 *Eoparafusulina regina* Nie & Song, p. 32, pl. 1, fig. 14, 17.

Material. 2 axial sections.

Distribution and age. South Tibet, Central Pamir; Early Permian, Sakmarian.
Occurrence. Kalaktash, West Pshart.

Eoparafusulina subrotunda sp. n.

Pl. 12, fig. 15, 16

Holotype. GGM VI-229/120; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 2 axial and several subaxial sections.

Description. A rather small and ellipsoidal throughout shell of 6-7 volutions. L = 3.3-4.3 mm; D = 1.9-2.1 mm; L:D = 1.7-2.

The proloculus is spherical with a diameter of 0.15-0.16 mm. Coiling is uniform and fairly tight. The spirotheca is medium-sized and increasingly thicking to 0.07 mm in the outermost volution. Septa are thin and slightly fluted. Fluting is minute and affects only the lower margin of the septa. Folds are rounded or rounded to triangular and uneven. The tunnel is low and expands gradually outwards. Low cuniculi are observed in the outer volutions of some specimens. Small pseudochomata are present almost in all volutions at the sides of the tunnel. Indistinct axial filling occurs throughout.

Discussion. This species most resembles the specimen identified as *Eoparafusulina rotunda* (Skinner & Wilde, 1965) from Sakmarian strata of the Chuanshan Formation, Fujiang, South China (Wu et al., 1986). The Chinese specimen is distinguished by abruptly expanding shell in the last two volutions and less developed axial filling. The species here described differs from typical *E. rotunda* by a more rounded shape of the shell in the inner volutions, less intense and regular septal fluting, thin spirotheca and the presence of axial filling.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

Eoparafusulina pamirensis sp. n.

Pl. 12, fig. 9-12

Holotype. GGM VI-229/115; axial section; Kalaktash, Central Pamir; Early Permian, Sakmarian.
Material. 8 axial sections.

Description. A shell of 6-7 volutions, fusiform in the inner whorls, then subcylindrical or elongate-fusiform and gradually ending in rounded poles. L = 6.5-7 mm; D = 1.6-1.8 mm; L:D = 3.8-4.7.

The proloculus is spherical and ranges in diameter from 0.15 to 0.17 mm. Coiling is tight and uniform. The spirotheca increasingly thickens up to 0.17 mm in the outermost volution. Septa are thin and fluted in their lower parts. Folds are rounded and regular in shape, getting higher from the tunnel to the ends and transforming into fine reticulation. A low tunnel is moderately broad in the first three volutions and rapidly expands thereafter. Low cuniculi are present in the final volutions. Light and discrete axial filling occurs in axial portion of the shell.

Discussion. Most elongate specimens of the present species are similar to *Eoparafusulina ferganica* Miklukho-Maclay, 1949 known from Sakmarian strata of the Southern Fergana. *E. ferganica* is distinguished by a more sharply tapering shell, especially in the first volutions. As compared to *E. laudoni* (Skinner & Wilde, 1966), *E. pamirica* has a more intense and regular septal fluting and a less developed axial filling.

Occurrence and age. Kalaktash; Early Permian, Sakmarian.

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PLATE 1

Fig. 1-3, 6, 8 -*Pseudofusulina pamirensis* sp. n. Kalaktash. 1) Axial section of the holotype, GGM VI-229/1; 2) axial section, GGM VI-229/2; 3) axial section, GGM VI-229/3; 6) axial section, GGM VI-229/4; 8) axial section, GGM VI-229/5.

Fig. 4, 9 - *Pseudofusulina karapetovi karapetovi* Leven, 1993. Kalaktash. 4) Axial section, GGM VI-229/6; 9) axial section, GGM VI-229/7.

Fig. 5, 7 - *Pseudofusulina karapetovi tezakensis* Leven, 1993. West Pshart. 5) Subaxial section, GGM VI-229/8; 7) axial section, GGM VI-229/9.

All figures x 10. The acronym GGM is for Gosudarvstrennyi Geologichevskyi Museui, intitled to V.I. Vernadskyi, Moskva.

PLATE 2

Fig. 1-3 - *Pseudofusulina plena* sp. n. Kalaktash. 1) Axial section of the holotype, GGM VI-229/10; 2) axial section, GGM VI-229/11; 3) axial section, GGM VI-229/12.

Fig. 4-6 - *Pseudofusulina kalaktashensis* sp. n. Kalaktash. 4) Subaxial section, GGM VI-229/13; 5) subaxial section, GGM VI-229/14; 6) axial section of the holotype, GGM VI-229/15.

Fig. 7, 8 - *Pseudofusulina curva* sp. n. Kalaktash. 7) Axial section, GGM VI-229/16; 8) subaxial section of the holotype, GGM VI-229/17.

(All figures x 10)

PLATE 3

Fig. 1-4 - *Pseudofusulina sulcata* Korzhenevsky. Kalaktash. 1) Axial section, GGM VI-229/18; 2) axial section, GGM VI-229/19; 3) axial section, GGM VI-229/20; 4) subaxial section, GGM VI-229/21.

Fig. 5, 6 - *Pseudofusulina muzkolensis* sp. n. West Pshart. 5) Axial section, GGM VI-229/22; 6) axial section of holotype, GGM VI-229/23.

Fig. 7 - *Pseudofusulina psharti* sp. n. West Pshart. Tangential section, GGM VI-229/24.

(All figures x 10)

PLATE 4

Fig. 1-4 - *Pseudofusulina psharti* sp. n. 1) Subaxial section, GGM VI-229/25, Kalaktash; 2) subaxial section, GGM VI-229/26, West Pshart; 3) axial section of the holotype, GGM VI-229/27, West Pshart; 4) axial section, GGM VI-229/28, West Pshart.

Fig. 5, 7 - *Pseudofusulina curteum* sp. n. West Pshart. 5) Subaxial section, GGM VI-229/29; 7) tangential section, GGM VI-229/30.

Fig. 6, 8 - *Pseudofusulina insignis* sp. n. Kalaktash. 6) Axial section of the holotype, GGM VI-229/31; 8) subaxial section, GGM VI-229/32.

(All figures x 10)

PLATE 5

Fig. 1, 3 - *Pseudofusulina curteum* n. sp. West Pshart.1) Axial section, GGM VI-229/33; 3) axial section of the holotype, GGM VI-229/34.

Fig. 2, 7 - *Pseudofusulina incompta* sp. n. Kalaktash. 2) Axial section, GGM VI-229/35; 7) axial section, GGM VI-229/36.

Fig. 4, 5 - *Pseudofusulina granuliformis* sp. n. Kalaktash. 4) Axial section of the holotype, GGM VI-229/37; 5) axial section, GGM VI-229/38.

Fig. 6 - *Pseudofusulina tibetica maxima* subsp. n. Kalaktash, axial section of the holotype, GGM VI-229/39.
Fig. 8 - *Pseudofusulina neglectens* sp. n. Kalaktash, axial section, GGM VI-229/40.
Fig. 9 - *Pseudofusulina memoralis* sp. n. Kalaktash, axial section of the holotype, GGM VI-229/41.

(All figures x 10)

PLATE 6

Fig. 1 - *Pseudofusulina incompta* sp. n. Kalaktash, axial section of the holotype, GGM VI-229/42.
Fig. 2, 5 - *Pseudofusulina neglectens* sp. n. Kalaktash. 2) Axial section of the holotype, GGM VI-229/43; 5) tangential section, GGM VI-229/44.
Fig. 3, 4 - *Pseudofusulina licis* sp. n. Kalaktash. 3) Axial section of the holotype, GGM VI-229/45; 4) subaxial section, GGM VI-229/46.
Fig. 6-8, 10-*Pseudofusulina gravis* sp. n. 6) Axial section of the holotype, GGM VI-229/47, Kalaktash; 7) axial section, GGM VI-229/48, West Pshart; 8) axial section, GGM VI-229/49, Kalaktash; 10) subaxial section, GGM VI-229/50, Kalaktash.
Fig. 9, 11, 12 -*Pseudofusulina inobservabilis* sp. n. Kalaktash. 9) Tangential section, GGM VI-229/51; 11) axial section of the holotype, GGM VI-229/52; 12) axial section, GGM VI-229/53.

(All figures x 10)

PLATE 7

Fig. 1, 2 - *Pseudofusulina inobservabilis* sp. n. Kalaktash. 1) Axial section, GGM VI-229/54; 2) axial section, GGM VI-229/55.
Fig. 3-7 - *Pseudofusulina macilenta* Leven, 1993. West Pshart. 3) Axial section, GGM VI-229/56; 4) tangential section, GGM VI-229/57; 5) axial section, GGM VI-229/58; 6) axial section, GGM VI-229/59; 7) tangential section, GGM VI-229/60.
Fig. 8, 10, 13 -*Pseudofusulina tumidiscula* sp. n. 8) Axial section, GGM VI-229/61, West Pshart; 10) axial section, GGM VI-229/62, Kalaktash; 13) axial section of the holotype, GGM VI-229/63, Kalaktash.
Fig. 9 - *Pseudofusulina vulgara* sp. n. Kalaktash, axial section of the holotype, GGM VI-229/64.
Fig. 11 - *Pseudofusulina perrara* sp. n. Kalaktash, axial section of the holotype, GGM VI-229/65.
Fig. 12, 14 -*Pseudofusulina curta* sp. n. West Pshart. 12) Axial section of the holotype, GGM VI-229/66; 14) axial section, GGM VI-229/67.
Fig. 15, 16 -*Pseudofusulina* aff. *P. rara* Leven & Scherbovich, 1980. 15) Subaxial section, GGM VI-229/68, Kalaktash; 16) subaxial section, GGM VI-229/69, West Pshart.

(All figures x 10)

PLATE 8

Fig. 1-3 - *Paraschwagerina* (?) *tianshanensis* (Chang). West Pshart. 1) Subaxial section, GGM VI-229/70; 2) axial section, GGM VI-229/70; 3) subaxial section, GGM VI-229/71.
Fig. 4-8 - *Robustoschwagerina psharti* sp. n. 4) Axial section of the holotype, GGM VI-229/72, Kalaktash; 5) axial section, GGM VI-229/73, West Pshart; 6) axial section, GGM VI-229/74, Kalaktash; 7) axial section, GGM VI-229/75, Kalaktash; 8) subaxial section, GGM VI-229/76, Kalaktash.

(All figures x 10)

PLATE 9

Fig. 1-3 - *Robustoschwagerina psharti* sp. n. 1) Axial section, GGM VI-229/77, Kalaktash; 2) axial section, GGM VI-229/78, West Pshart; 3) axial section, GGM VI-229/79, Kalaktash.

Fig. 4, 5 - *Sphaeroschwagerina zhongzanica* (Zhang). West Pshart. 4) Tangential section, GGM VI-229/80; 5) subaxial section, GGM VI-229/81.

Fig. 6 - *Robustoschwagerina* (?) sp. A. Axial section, GGM VI-229/82, Kalaktash.

(All figures x 10)

PLATE 10

Fig. 1, 2 - *Zellia nunosei* (Hanzawa). West Pshart. 1) Axial section, GGM VI-229/83; 2) axial section, GGM VI-229/84.

Fig. 3 - *Sphaeroschwagerina zhongzanica* (Zhang). West Pshart, sagittal section, GGM VI-229/85.

Fig. 4 - *Robustoschwagerina* aff. *R. kainsuensis* (Miklukho-Maclay, 1949). West Pshart, subaxial section, GGM VI-229/86.

Fig. 5, 6, 9, 10-*Pseudofusulina minuscula* sp. n. West Pshart. 5) Tangential section, GGM VI-229/60; 6) axial section, GGM VI-229/87; 9) axial section, GGM VI-229/58; 10) axial section of the holotype, GGM VI-229/88.

Fig. 7, 8, 11 -*Eoparafusulina tschernyschewi tschernyschewi* (Schellwien, 1909). Kalaktash. 7) Axial section, GGM VI-229/89; 8) axial section, GGM VI-229/90; 11) subaxial section, GGM VI-229/91.

(All figures x 10)

PLATE 11

Fig. 1,4,5,7,8-*Eoparafusulina recondita* (Grozdilova & Lebedeva, 1961). 1) Axial section, GGM VI-229/92, Kalaktash; 4) axial section, GGM VI-229/93, West Pshart; 5) axial section, GGM VI-229/94, West Pshart; 7) axial section, GGM VI-229/95, West Pshart; 8) axial section, GGM VI-229/96, West Pshart.

Fig. 2, 3, 6 -*Eoparafusulina tschernyschewi memoranda* (Grozdilova & Lebedeva, 1961), Kalaktash. 2) Axial section, GGM VI-229/97; 3) axial section, GGM VI-229/98; 6) axial section, GGM VI-229/99.

Fig. 9-13 - *Eoparafusulina laudoni* (Skinner & Wilde, 1966). West Pshart. 9) Axial section, GGM VI-229/100; 10) subaxial section, GGM VI-229/101; 11) subaxial section, GGM VI-229/102; 12) subaxial section, GGM VI-229/103; 13) tangential section, GGM VI-229/104.

Fig. 14 - *Eoparafusulina* aff. *E. mendenhalli* Petocz, 1970. West Pshart, subaxial section, GGM VI-229/105.

(All figures x 10)

PLATE 12

Fig. 1 - *Eoparafusulina* aff. *E. mendenhalli* Petocz, 1970. West Pshart, axial section, GGM VI-229/106.

Fig. 2 - *Eoparafusulina weddelli* Petocz, 1970. West Pshart, axial section, GGM VI-229/107.

Fig. 3-8 - *Eoparafusulina depressa* Skinner & Wilde, 1965. Kalaktash. 3) Axial section, GGM VI-229/108; 4) axial section, GGM VI-229/109; 5) tangential section, GGM VI-229/110; 6) subaxial section, GGM VI-229/111; 7) axial section, GGM VI-229/112; 8) axial section, GGM VI-229/113.

Fig. 9-12 - *Eoparafusulina pamirensis* sp.n. Kalaktash. 9) Axial section, GGM VI-229/114; 10) axial section, GGM VI-229/114; 11) axial section of the holotype, GGM VI-229/115; 12) subaxial section, GGM VI-229/116.

Fig. 13, 14 -*Eoparafusulina regina* Nie & Song, 1983. 13) Subaxial section, GGM VI-229/117, West Pshart; 14) axial section, GGM VI-229/118, Kalaktash.

Fig. 15, 16 -*Eoparafusulina subrotunda* sp. n. Kalaktash. 15) Axial section, GGM VI-229/119; 16) axial section of the holotype, GGM VI-229/120.

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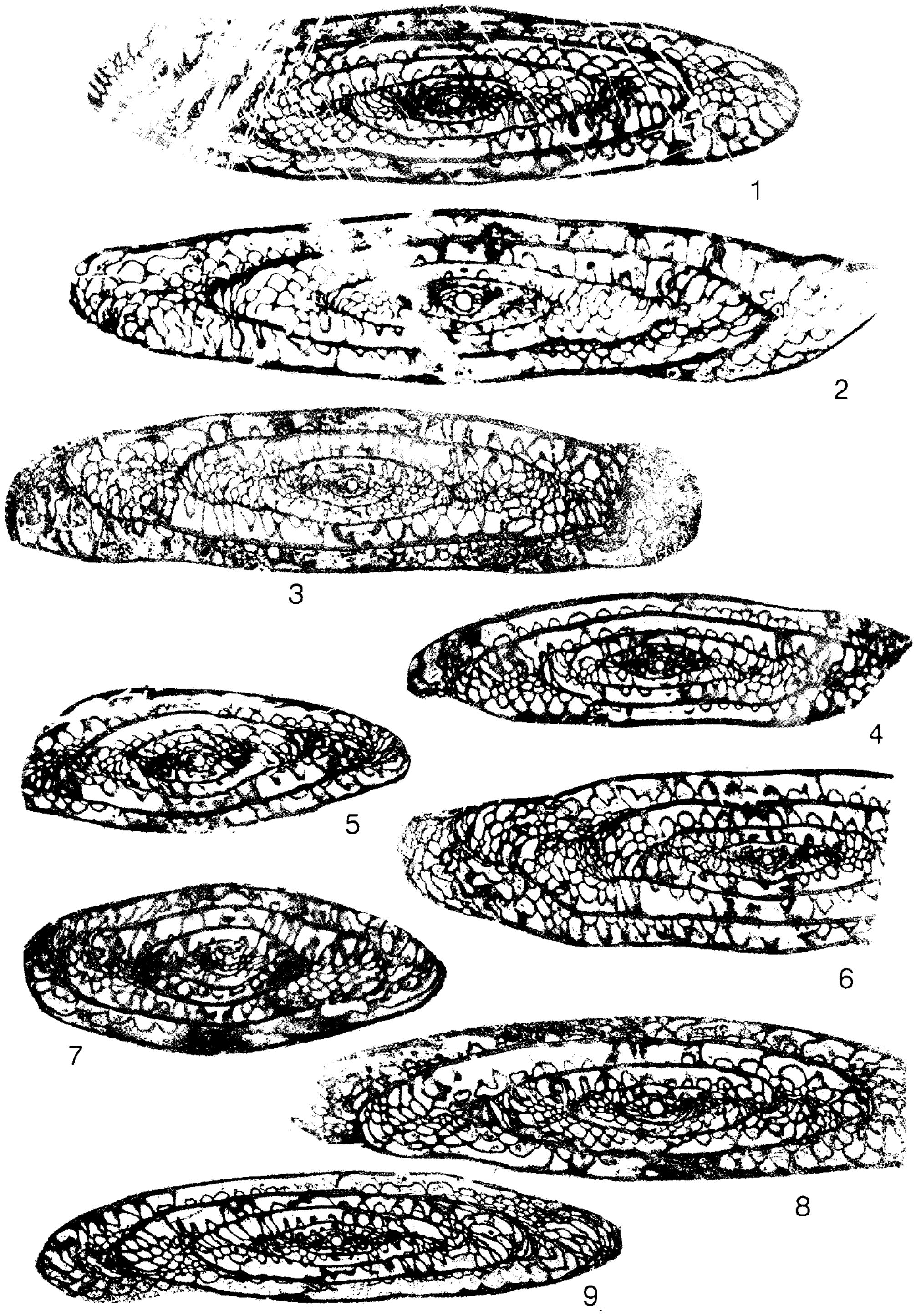
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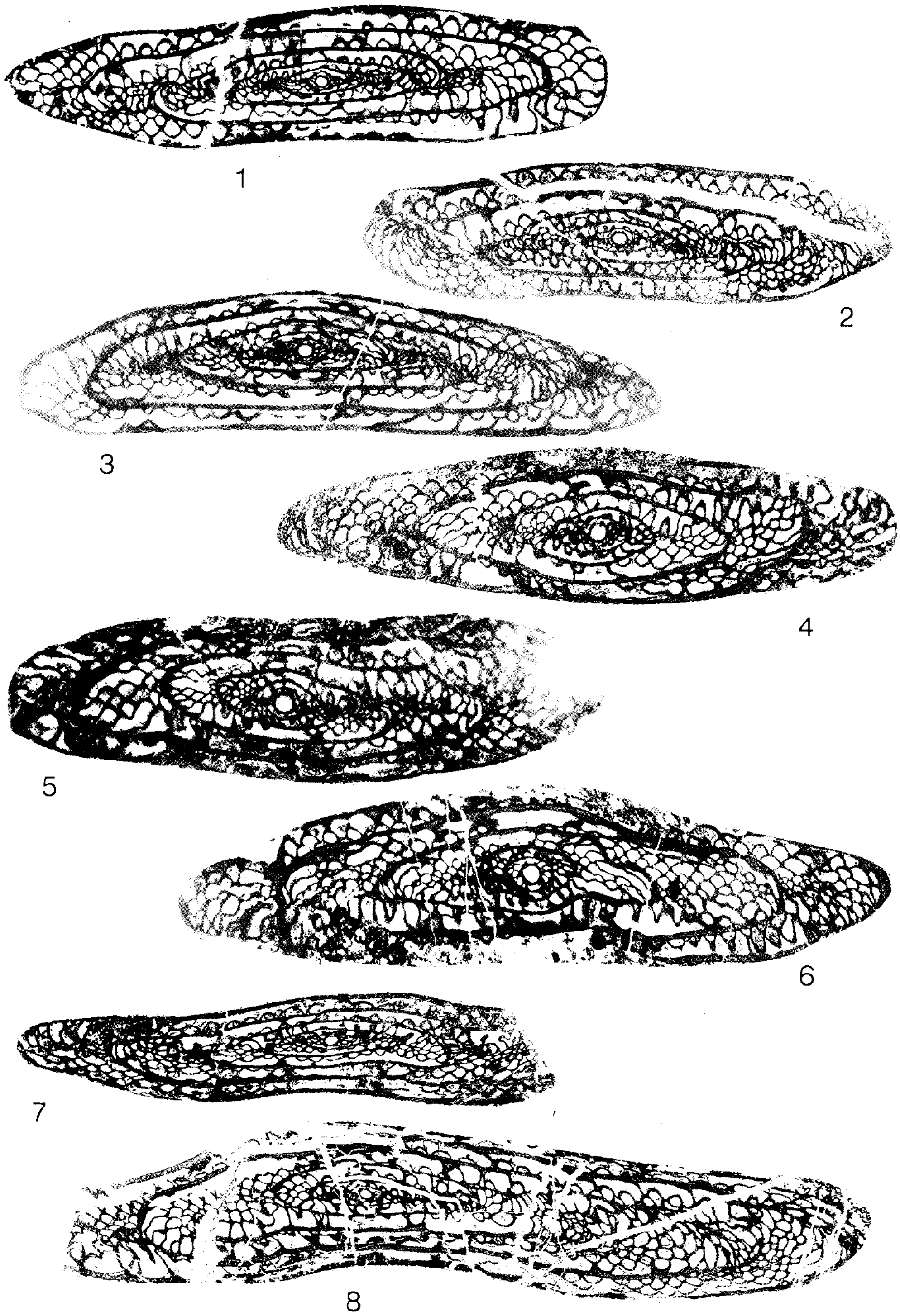
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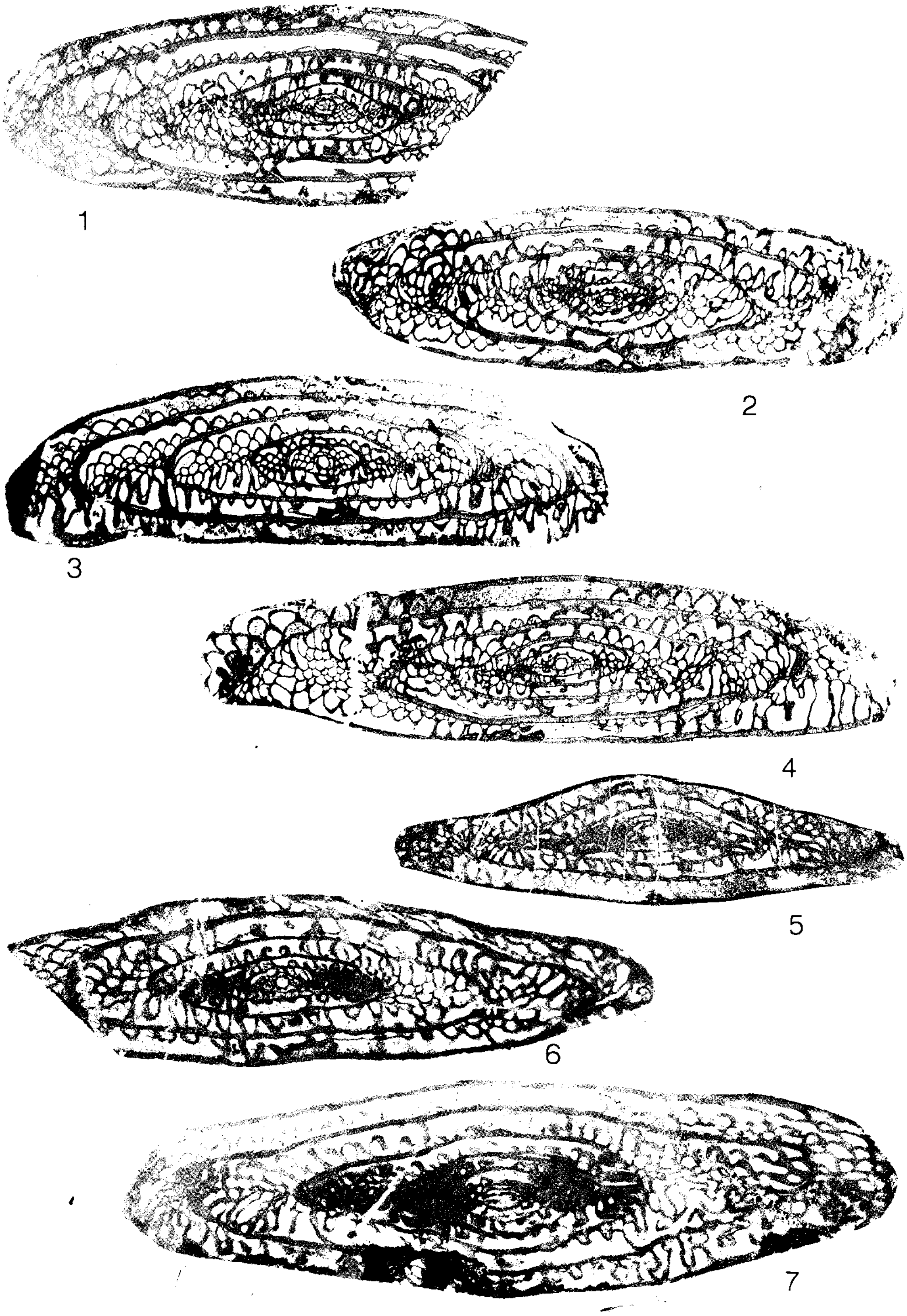
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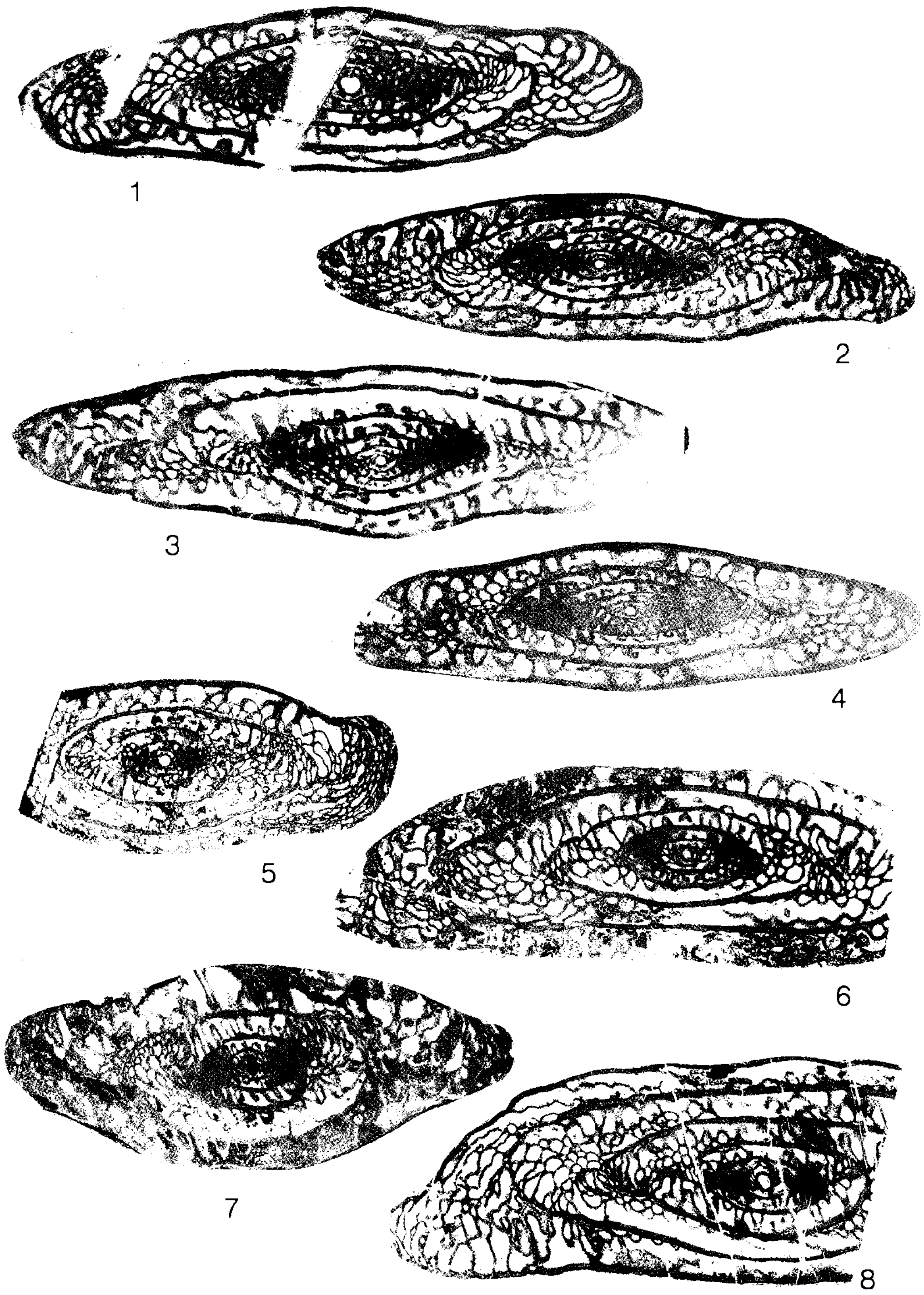
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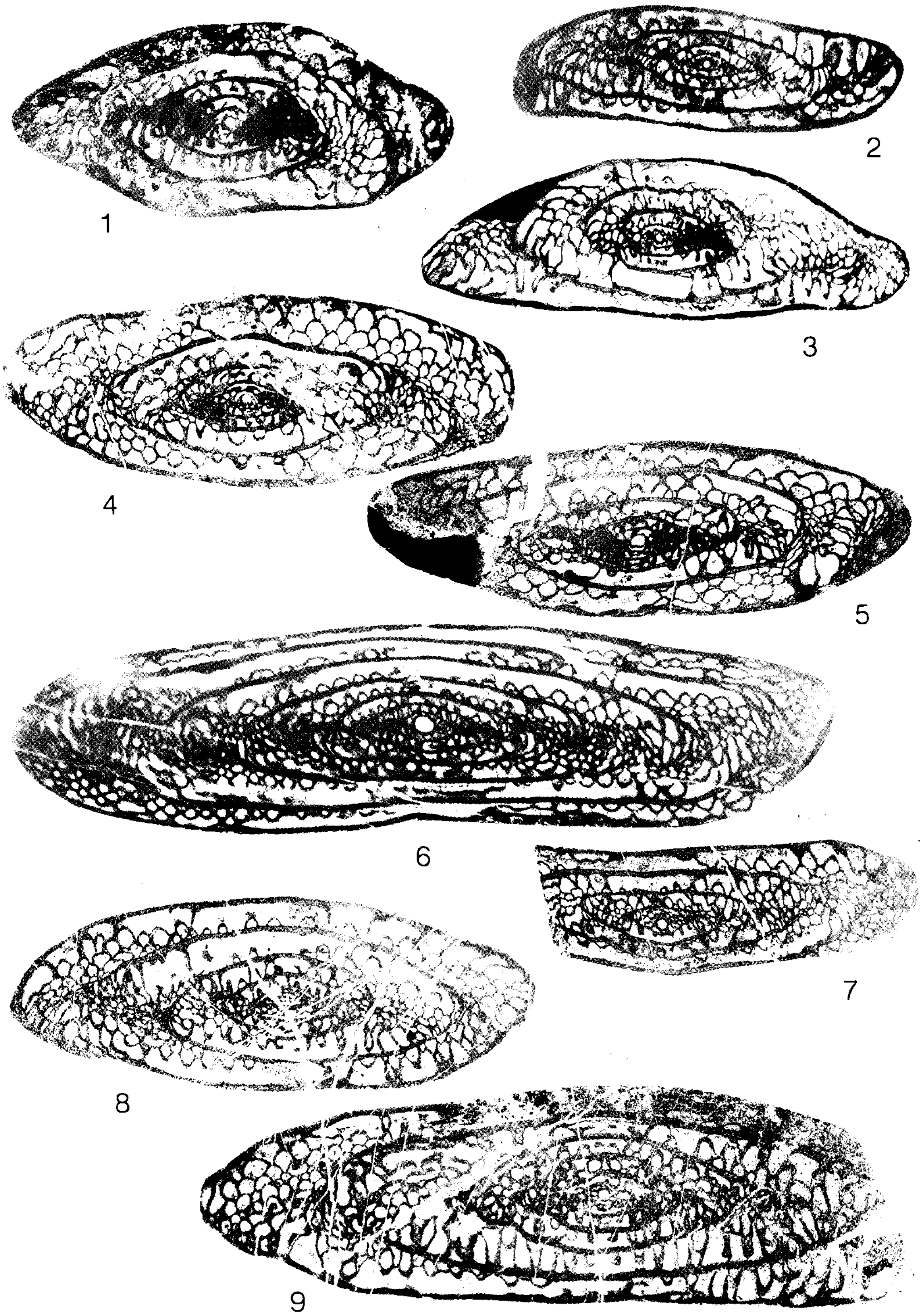
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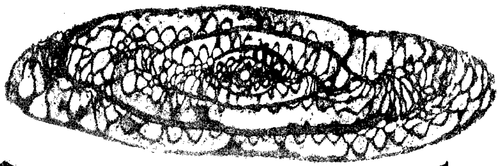

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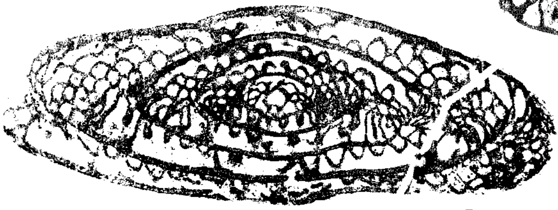

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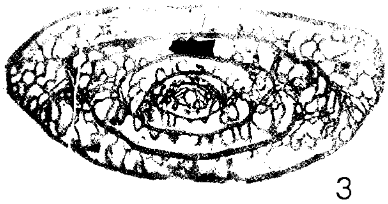

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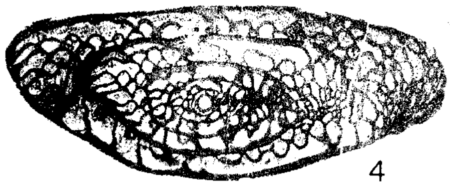

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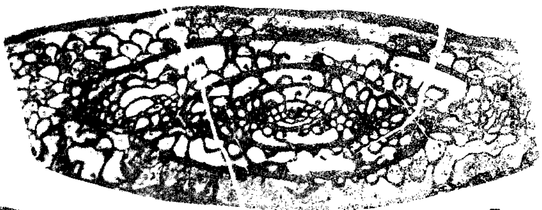

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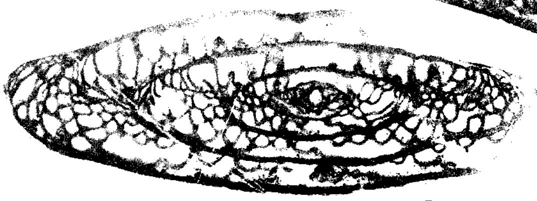

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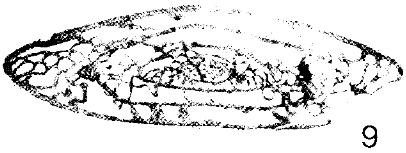

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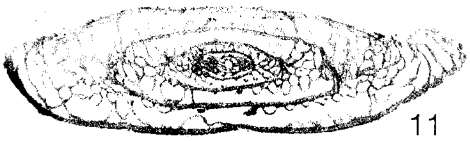

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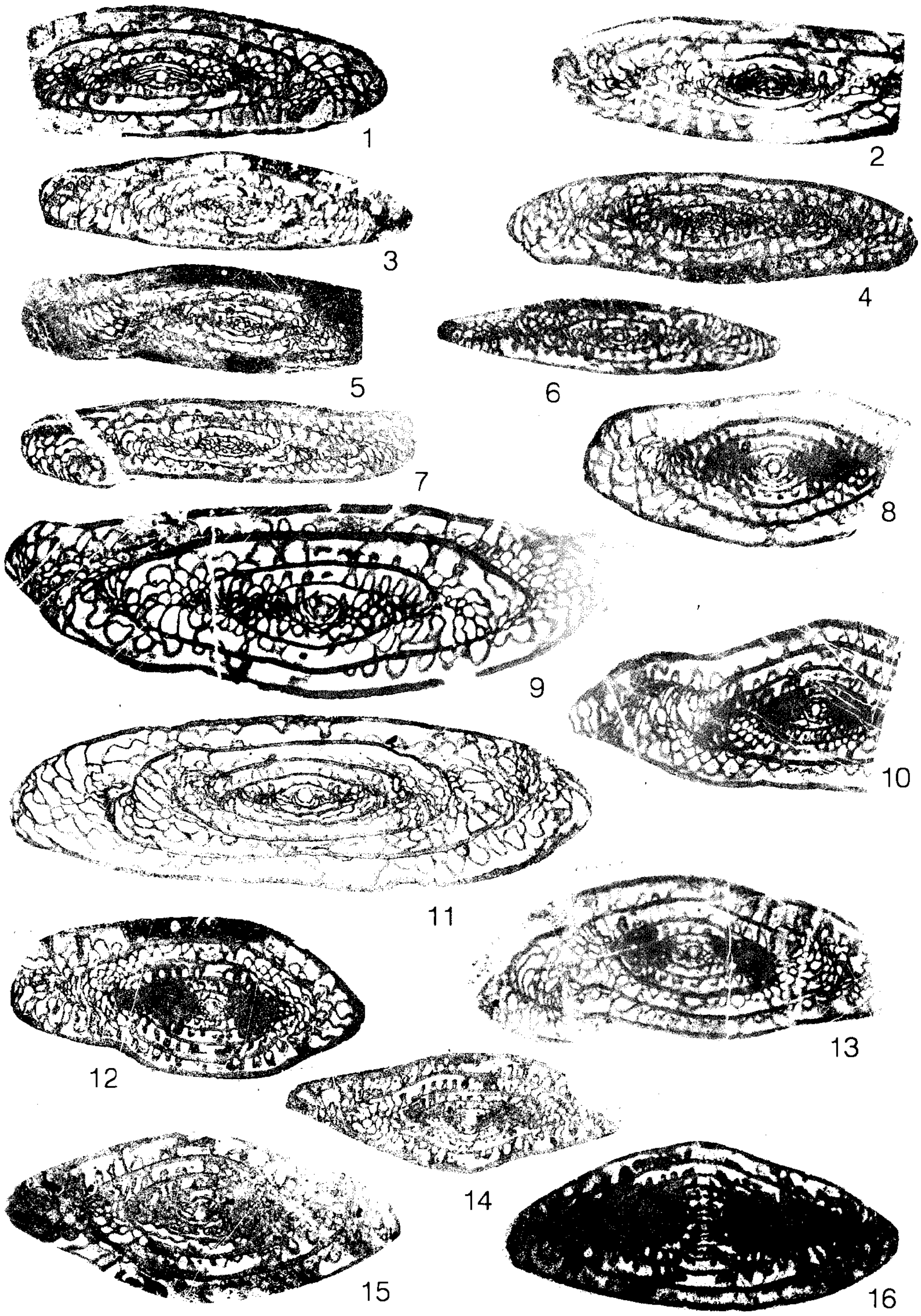
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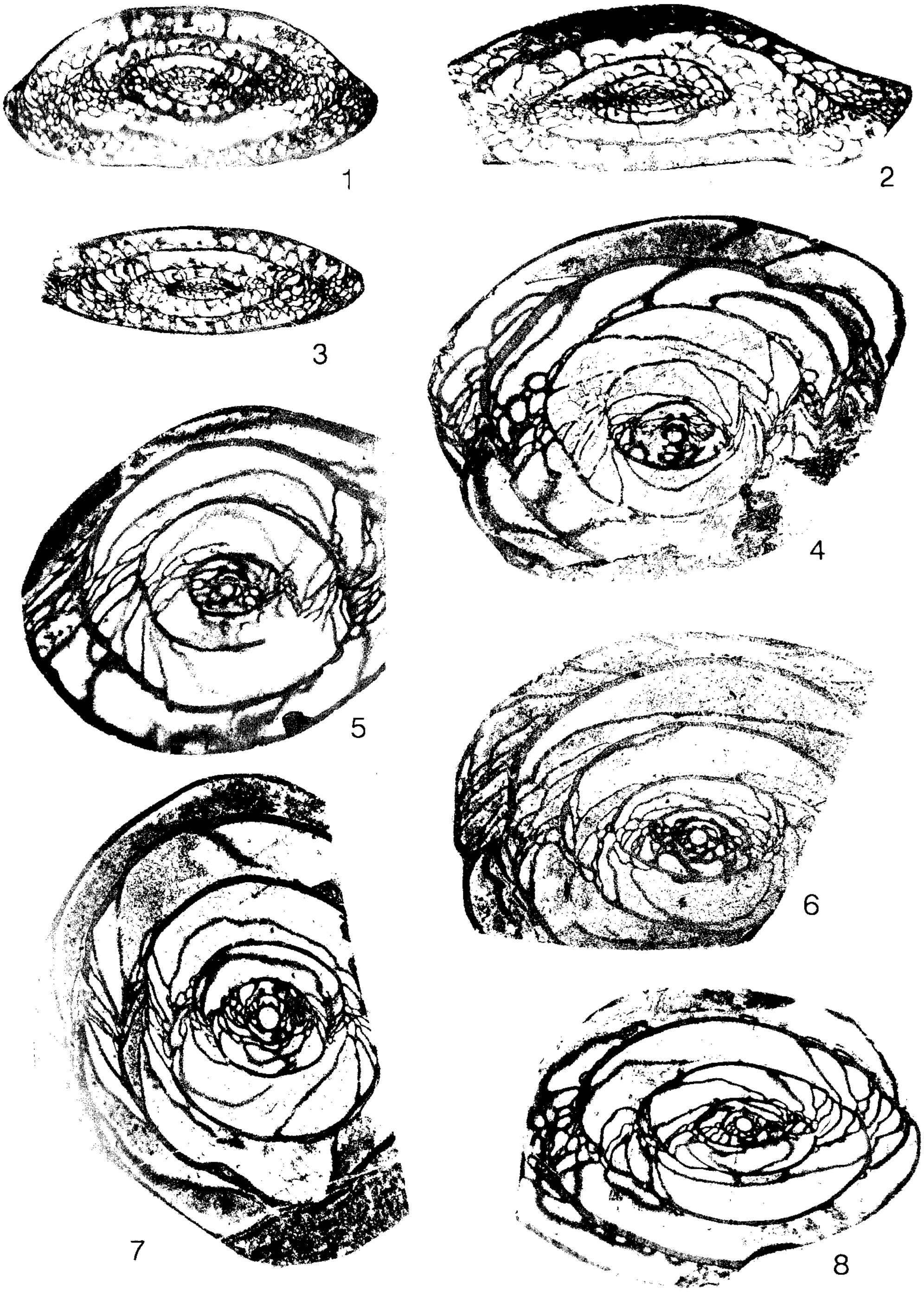
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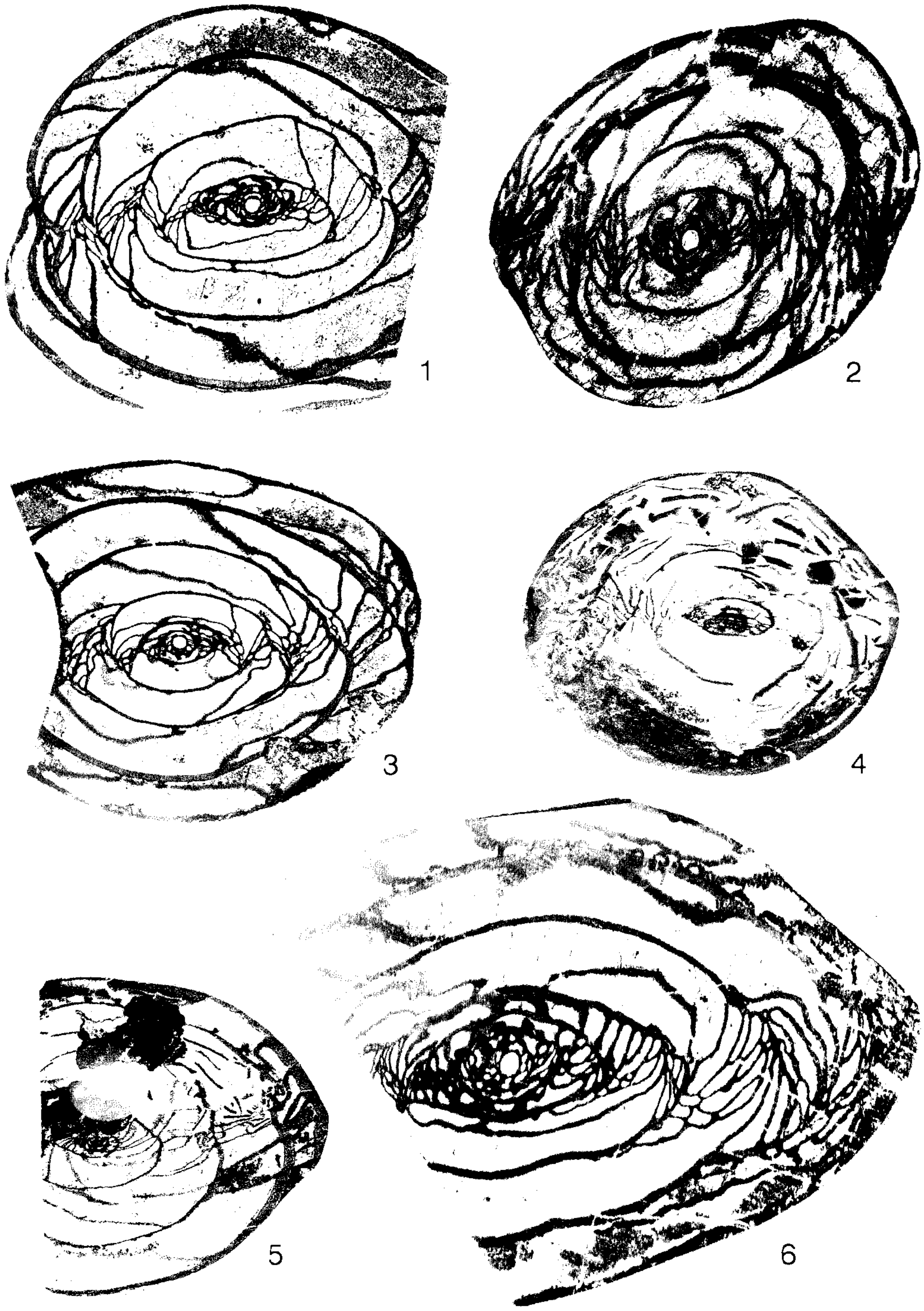
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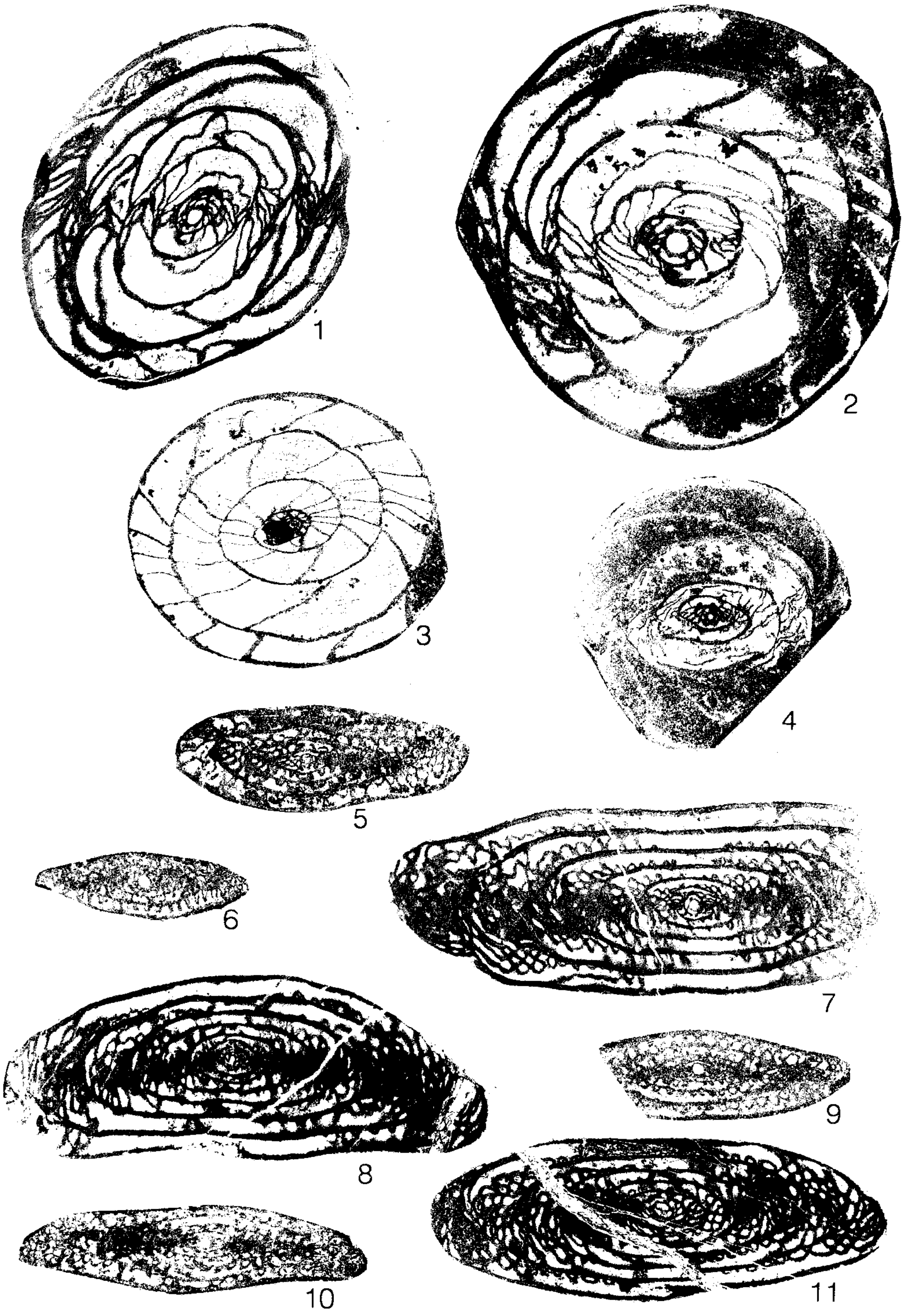
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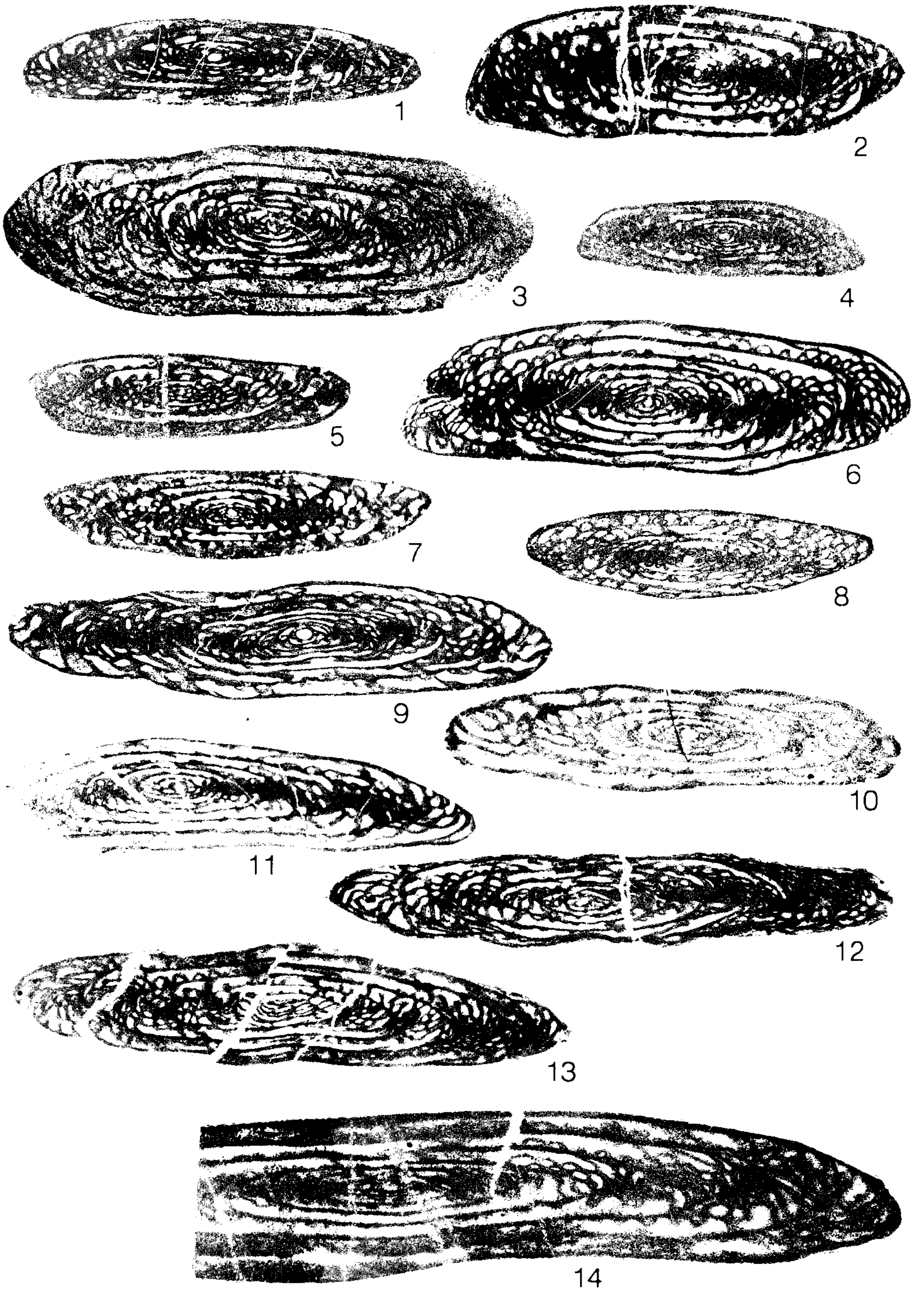
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