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# PENNSYLVANIAN STRATIGRAPHY AND FUSULINIDS OF CENTRAL AND EASTERN IRAN

E.Ja. Leven, V.I. Davydov, and M.N. Gorgij

## ABSTRACT

The Pennsylvanian succession of Central and Eastern Iran (Sardar Group) is studied in two key sections: Zaladu and Anarak. The Sardar Group (previously Sardar Formation) has been divided into two formations: the predominantly carbonate Ghaleh Formation and the predominantly siliciclastic or mixed carbonate-siliciclastic Absheni Formation. These two formations were earlier identified as Sardar 1 and Sardar 2 subformations. The Ghaleh Formation (formerly Sardar 1), of early Bashkirian age, is characterized by *Eostaffella*, *Eostaffellina*, *Millerella*, *Plectostaffella*, *Semistaffella*, primitive *Pseudostaffella,* and numerous archaediscids. The Absheni Formation (formerly Sardar 2) is upper lower Moscovian in age (late Vereian-early Kashirian) and is characterized by *Profusulinella, Aljutovella, Neostaffella*, *Putrella, Moellerites,* and *Fusiella* fusulinids. Poorly preserved upper Moscovian fusulinids (derived *Fusiella, Fusulina,* and *Beedeina*) occur at the top of this sequence. The hiatus between the Ghaleh and Absheni Formations corresponds to an interval from the upper Bashkirian, and probably to the lowermost Moscovian, and coincides with the replacement of predominantly carbonate sedimentation with mixed carbonate-siliciclastic sedimentation. The recently established late Gzhelian-Asselian Zaladu Formation unconformably overlies the Absheni Formation. The new data disagree with the previously proposed paleogeographic reconstruction of Central Iran and surrounding regions (including Iran-Afghanistan territory) during the Carboniferous-Early Permian. The foraminiferal assemblages from the Bashkirian-Moscovian sections of Alborz and Eastern Iran show a close resemblance in every respect. It is evident that these regions were located within a single basin connected with the basins of Taurus and Anatolia in the west and those of the Donets, Russian platform, and Urals in the north.

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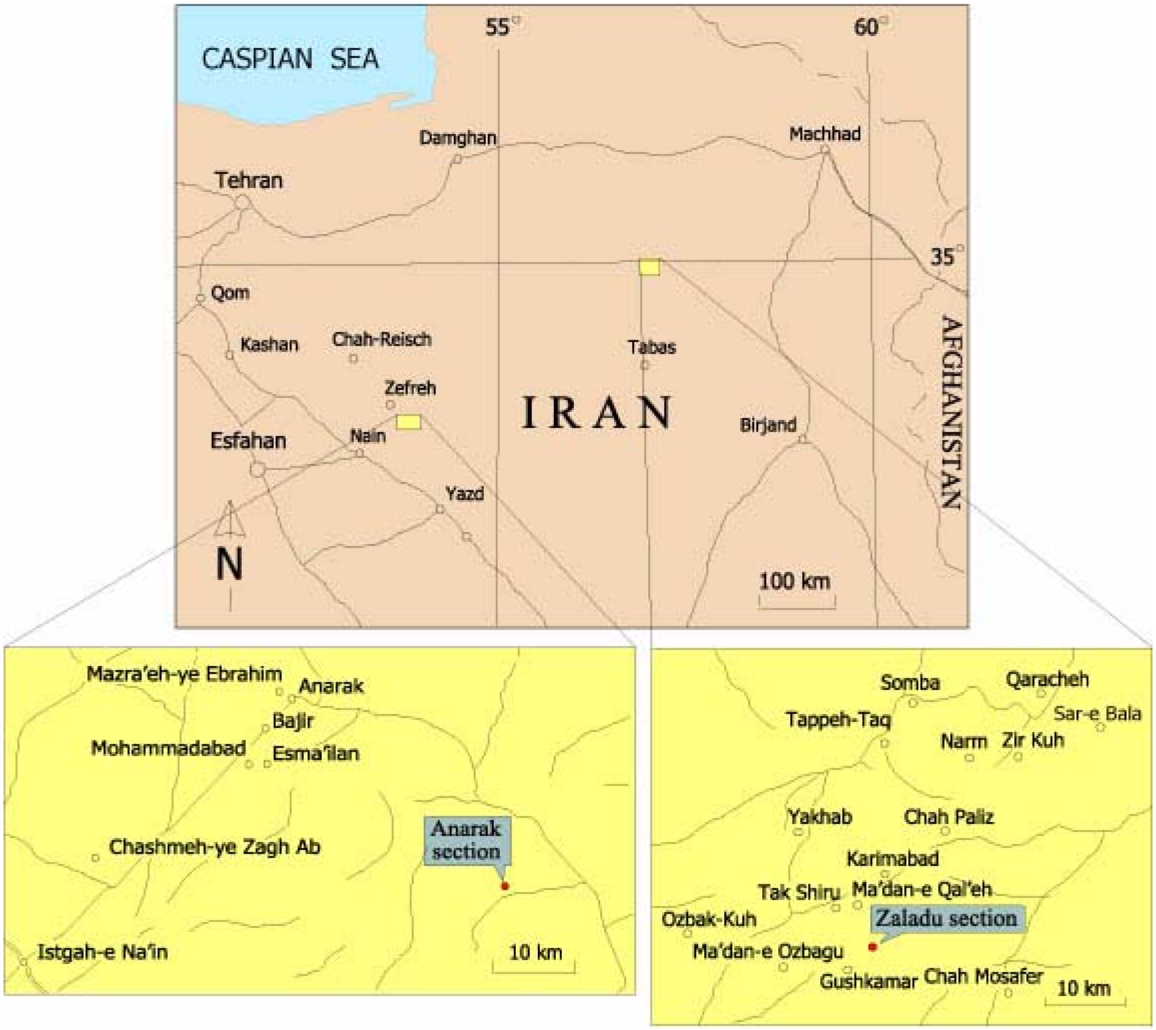


**Figure 1.** Location map of Anarak and Zaladu sections, Eastern and Central Iran.

## INTRODUCTION

Stöcklin et al. (1965) proposed that the present Carboniferous and Lower Permian strata in Central and Eastern Iran were recognized as a single Sardar Formation. Recently, Leven and Taheri (2003) distinguished Gzhelian-Asselian deposits from the uppermost Sardar Formation as a new Zaladu Member and described Gzhelian and Asselian foraminiferal fauna from these strata. We are proposing herein that this member be recognized as the Zaladu Formation. We also propose that the largest remaining portion of the Sardar "Formation" be raised to the rank of Group and that it be divided into two new formations, The Ghaleh and Absheni Formations. The Sardar Group at Zaladu contains an abundant and diverse foraminiferal fauna. The Sardar Group was also studied in a section in the Anarak region of Central Iran (Figure 1).

A total of 350 samples were obtained from the Zaladu and Anarak sections, and 2000 thin sections were made. Thin sections were prepared, photographed, and studied at the Geological Institute of the Russian Academy of Sciences, Moscow, and at Boise State University, Boise, Idaho, USA. The foraminiferal material described below are housed in the Geological Institute of the Russian Academy of Sciences, Moscow, collection no. GIN 4777. Supplemental material appearing in this report will be posted at http://www.paleostrat.org.

## PREVIOUS STUDIES OF THE UPPER CARBONIFEROUS (PENNSYLVANIAN) DEPOSITS OF EASTERN AND CENTRAL IRAN

Data on the Upper Carboniferous and Lower Permian sequences in Central and Eastern Iran were obtained in the 1960s in the course of the geological mapping of the Tabas area (Stöcklin et al. 1965; Ruttner and Stöcklin 1966; Ruttner et al. 1968). Stepanov (1971) and Stöcklin (1971) published comprehensive stratigraphic and paleontologic data about this region. The Devonian through Carboniferous deposits of this region include the Shishtu and Sardar Formations.The former spans the Upper Devonian through the lower half of the Visean. The type section of the Shishtu Formation is located in the Ozbak-Kuh Mountains, north of Tabas and consists of alternating shale, marl, and limestone. The Sardar “Formation” was established in the Shotori Mountains, east of Tabas city (Stöcklin et al. 1965). The lower portion of Sardar was described as sequences of interbedded shale, sandstone, and limestone and the upper portion as predominantly shale with sandstone (Stöcklin et al. 1965).

The thickness of the Sardar “Formation” varies from 280 to 660 m and unconformably overlies the limestone and shale of the Shishtu Formation, and is characterized by a 30 m thick basal conglomerate. The Sardar “Formation” is overlaid by massive beds of limestone and dolomite of the Jamal Formation. A thin coal bed occurs irregularly at the sharp contact between these two units. The presence of the coal bed and the difference in lithology suggest an unconformable contact between the Jamal and Sardar Formations.

The Sardar “Formation” was recognized in the Shirgesht area and in the Ozbak-Kuh Mountains and was divided into two sub-formations, (i.e., Sardar 1 and Sardar 2; Ruttner et al. 1968). In Shirgesht, it is represented by sequences more than 1000 m thick of shale, siltstone, and sandstone that contain infrequent thin interbeds of sandy and crinoidal limestone. The Sardar “Formation” in this area has no contact with the Shishtu Formation and is unconformably overlaid by Jurassic deposits (Ruttner et al. 1968). In the Ozbak-Kuh Mountain, the lower portion of the Sardar “Formation” is rich in carbonate rocks.

Geological mapping by Russian geologists revealed an analog of the Sardar “Formation” in the Anarak section (Sharkovski et al. 1984) with a thickness of up to 300 m of sandstone and shale, with highly fossiliferous limestone interbeds. The interrelationships of deposits lying above and below are unclear. The Sardar “Formation” was purportedly overlain by limestone with a basal horizon of pink sandstone. This limestone previously was assigned to the Jamal Formation. The Early Permian (Asselian-Sakmarian) fusulinids, bryozoans, and brachiopods occurring in the limestone, however, imply a relationship with the Late Pennsylvanian-Asselian Zaladu Formation rather than to the Upper Permian Jamal Formation (Leven and Taheri 2003).

The Sardar “Formation” was loosely dated as late Visean-Permian on the basis of ammonoids, brachiopods, and corals, which are occasionally preserved in the rocks (Stöcklin et al. 1965; Walliser 1966; Stepanov 1971). A confident late Visean age of the lower part of the formation was established exclusively by brachiopods in the type section at Shotori Mountain. Elsewhere, the age of Sadar is somewhat dubious. Stepanov (1971) referred Sardar 1 to the upper Visean-lower Namurian interval; the Namurian portion being unspecified. Therefore, in terms of the recent chronostratigraphic scale, the age of Sardar 1 could be interpreted as late Visean-early Bashkirian. Sardar 2 was assigned to the Upper Carboniferous (Silesian)-Lower Permian, or, Bashkirian-Lower Permian (Stepanov 1971) on the basis of the Early Pennsylvanian (Bashkirian) goniatite *Gastrioceras (Branneroceras)* cf. *branneri* in the lower part of the sub-formation (Walliser 1966) and Early Permian brachiopods near the top of the Sardar 2 (Stepanov 1971). Partoazar (1995) restricted the age for the Sardar 2 to Moscovian, however, no justification was given for this assignment.

It should be noted that before our investigation, age assignments of the Sardar “Formation” were based on limited, discrepant information. With few exceptions, most of the paleontological collections were never described, affecting the accuracy of dating. Samplings of micro-faunas were far from adequate. Conodonts from the underlying Devonian-Mississippian were described by Weddige (1984).

Pennsylvanian foraminifers in Iran were previously listed only from the eastern Alburz Mountains, near the Gorgan town area, northern Iran, (Bozorgnia 1973; Jenny et al. 1978; Lys 1986). Their occurrence in Eastern and Central Iran was reported but they were never described. Vachard (1996) figured few poorly oriented Moscovian fusulinids from J. Jenny’s collections of the Gheselghaleh area, northern Iran.

The common occurrences of foraminifers in the Zaladu section (at 53 stratigraphic levels) and Anarak section (at 60 levels) provide a solid basis for chronostratigraphic calibration of the Sardar “Formation” (Figure 2). Several stratigraphic unconformities were recognized, both within the formation and at their boundaries. For the first time, a significant gap can be well documented between Sardar 1 and Sardar 2, allowing for the establishment of those units as new formations. The type sections for the Formations occur at the western slope of Zaladu valley in the Ozbak-Kuh Mountains.

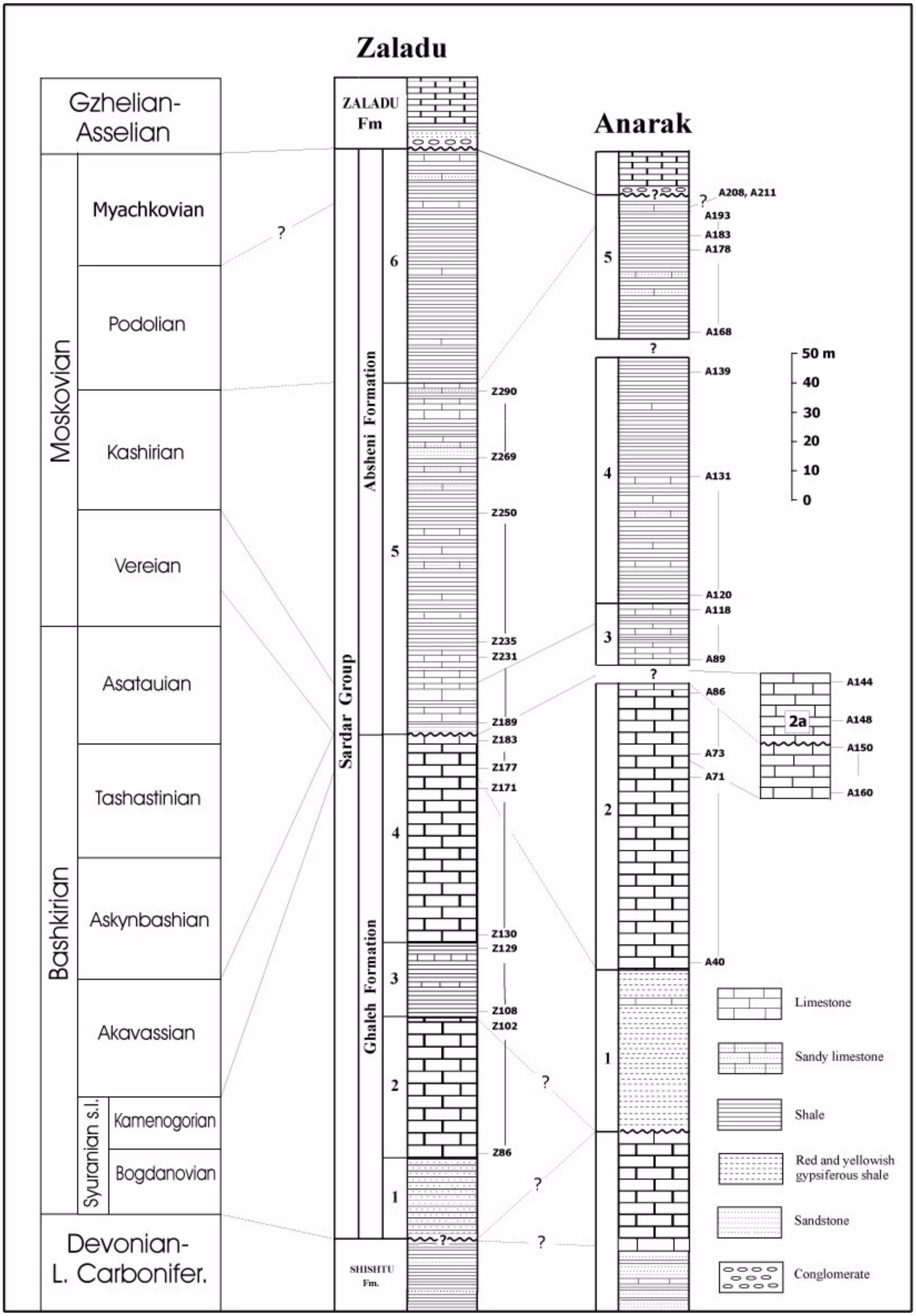


**Figure 2.** Stratigraphic columns of Anarak and Zaladu sections, Eastern and Central Iran. Because the samples are collected tightly, their position is shown within the from-to the range. **2a** – is a faulted block within the Anorak section (see Fig. 3 and section description for details).

## MATERIAL

### Zaladu Section (Ozbak-Kuh Mountains)

The Zaladu section is located on the slope of the mountain near the Gushkamar village (Figure 1). The Zaladu section continues below the interval described by Leven and Taheri (2003). The following successive beds are exposed from the base upwards (Figure 2):

**Ghaleh Formation**

1. White quartzite sandstone with interbeds of green platy shale in the middle. The sandstone occurs at the base of the Ghaleh Formation and rests along a sharp contact of shale with thin interbeds of sandstone and limestone of the Shishtu Formation. Approximately 75 m below the base of Ghaleh Formation, the limestone in the Shishtu Formation (sample Z69) contains *Eostaffella acuta*, *Archaediscus krestovnikovi*, *A.* aff. *A. globosus*, *Biseriella minima*, and *Endotaxis brazhnikovi* of supposed Serpukhovian age (Table 1, at end of article).

   **25 m**

2. Thinly to coarsely layered grainstone, locally sandy, dolomitized, and silicified with brachiopods, corals, bryozoans, crinoids, and foraminifers. The following foraminiferal species were identified: *Parastaffella* aff. *P. utkaensis Eostaffella ovoidea*, *E. pseudostruvei elongatissima*, *E. parastruvei* forma *recta*, *E. libera*, *E.* aff. *E. postmosquensis*, *E. acutiformis*, *E. designata*, *E. ovoidea*, *E. parastruvei*, *E. pseudostruvei elongatissima*, *E. pseudostruvei* cf. *E. chomatifera Plectostaffella (Plectostaffella) seslavica, Pl. (Pl.)* aff. *P. orbiculata*, *Millerella* aff. *excavata*, *Parastaffella* aff. *P. utkaensis*, *Biseriella minima*, *B. parva, Globivalvulina kamensis*, *Monotaxinoides* sp., *Deckerella* sp., *Archaediscus krestovnikovi*, *A. vischeriensis*, *Asteroarchaediscus* sp. (samples Z86-Z102).

   **45 m**

3. Gray, greenish shale with interbeds of thinly layered marls and medium layered fine to medium grainstone with corals, bryozoans, crinoids, and foraminifers *Eostaffella* cf. *E. mirifica*, *Plectostaffella (Plectostaffella) bogdanovkensis*, *Monotaxinoides convexus*, *Tetrataxis planocula*, *Neoarchaediscus* aff. *N. gregori acutiformis* (samples Z108-Z129).

   **25 m**

4. Dark gray, thinly to coarsely layered fine to coarse grainstone with cherty nodules. Bioturbation is prominent. Abundant corals and foraminifers occur. The following species are identified: *Eostaffella designata*, *E.* aff. *E. nalivkini*, *E. pseudostruvei angusta*, *E.* cf. *proikensis*, *E. designata*, *Plectostaffella (Plectostaffella) bogdanovkensis*, *Pl. (Pl.) jakhensis*, *Pl. (Pl.) varvariensis*, *Millerella mixta*, *M.* aff. *M. paraumbilicata*, *M. variabilis*, *M.* ex gr. *M. conica*, *Mediocris mediocris*, *Endothyra bowmani*, *Plectoendothyra spirilliniformis*, *Biseriella parva*, *Tetrataxis* aff. *T. acutiformis*, *Deckerella* sp., *Neoarchaediscus gregori gregori*, *N. parvus*, *N. postrugosus*, *N. latispiralis*, *N. incertus*, *N. probatus*, *Asteroarchaediscus* cf. *A. bashkiricus*, *A.* cf. *A. ovoides* (samples Z130-Z171). Up section, there occur *Eostaffella* ex gr. *E. ikensis*, *Millerella* cf. *M. variabilis*, *M.* cf. *M. uralic*a, *M.* ex gr. *M. marblensis*, *Mediocris mediocris*, *Pseudonovella irregularis*, *Plectostaffella (Plectostaffella) uzbekistanica*, *Semistaffella* cf. *S. variabilis*, *Pseudostaffella* ex gr. *P. antiqua*, *Planoendothyra aljutovica* (samples Z177-Z179). At the top of this unit *Eostaffella pseudostruvei chomatifera*, *Millerella* ex gr. *M. marblensis*, *Pseudonovella irregularis*, *Semistaffella* sp., *Pseudostaffella antiqua*, *P. paracompressa*, *P. composita*, *Biseriella* sp., *Neoarchaediscus postrugosus* were found (sample Z183).

   **67 m**

The total thickness of the Ghaleh Formation in this section is 162 m.

**Absheni Formation**

5. Interbedded shale and siltstones with thin to medium layered sandy grainstone and oolitic, locally dolomitized limestone with cherty nodules, and with fine-grained quartz sandstone. The limestone dominates in the lower and upper parts of Unit 5 and contains numerous solitary corals, brachiopods, bryozoans, crinoids, and foraminifers. The lower part of the unit contains an abundant foraminiferal assemblage including *Eostaffella* sp., *Millerella* sp., *Seminovella nana, S. carbonica*, *S. aperta*, *Pseudostaffella subquadrata*, *Neostaffella* ex gr. *N. larionovae*, *Neostaffella* sp., *Ozawainella mosquensis*, *O. vozhgalica*, *Ozawainella* sp., *Eoshubertella obscura obscura*, *E. obscura mosquensis*, *Fusiella pulchella*, *F. praecursor paraventricosa*, *F.* aff. *longa*, *Profusulinella parva*, *P. staffellaeformis*, *P. omiensis*, *P. beppensis*, *P. pseudoparva* n. sp., *P.*

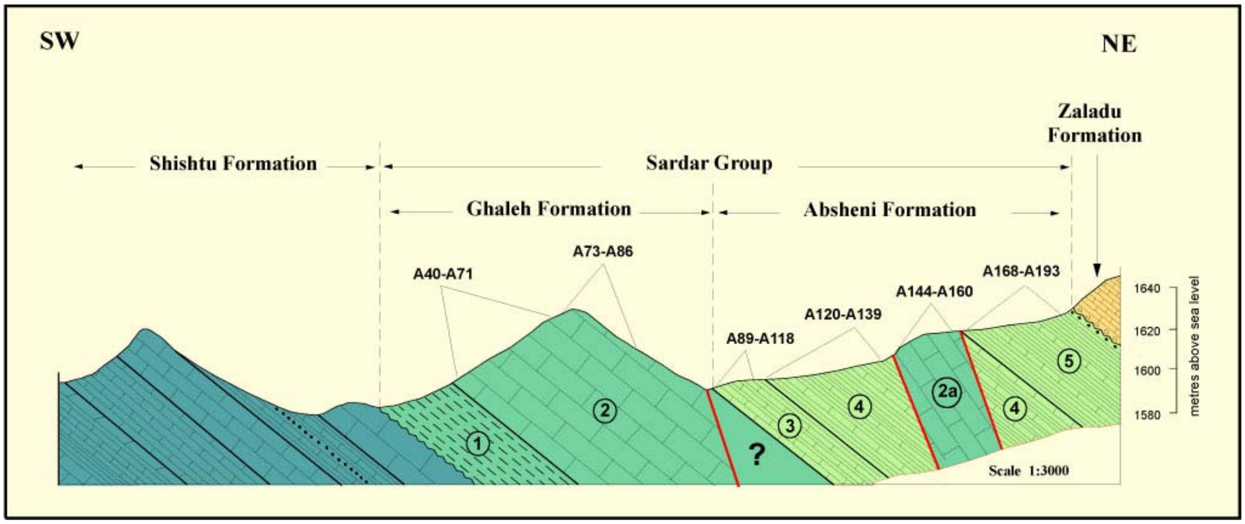


**Figure 3.** Cross section of the Anorak section. Position of the collected samples shown above the erosional profile.

*prisca prisca*, *P. convoluta*, *Taitzehoella* cf. *T. pseudolibrovichi*, *Aljutovella* sp. 1, *Al. stocklini* n. sp., *Al. iranica* n. sp., *Al. cafirniganica*, *Al. gorgiji* n. sp., *Al. artificialis*, *Al. conspecta*, *Al. priscoidea* , *Al.* aff. *Al. cybaea*, *Al.* aff. *Al. devexa*, *Al. complicata*, *Al. subaljutovica*, *Tetrataxis acutiformis*, *Howchinia gibba*, *Neoarchaediscus* sp., *Asteroarchaediscus* sp. (Table 1; samples Z189-Z231). The middle part of Unit 5, composed mainly of shale, yielded *Fusiella* aff. *F. paradoxa, Parastaffella* sp., *Ozawainella eoangulata*, *Pseudostaffella* ex gr. *P. subquadrata*, *Profusulinella omiensis*, *Putrella* aff. *P. donetziana*, *Putrella* sp. (samples Z235-Z250). The upper part of the formation contains *Fusiella* aff. *F. praetypica*, *F.* aff. *F. paradoxa*, *F. praecursor paraventricosa*, *Ozawainella* aff. *O. vozhgalica*, *Pseudostaffella* sp., *O.* ex gr. *O. mosquensis*, *Profusulinella omiensis*, *Aljutovella* ex gr. *Al. stocklini* n. sp., *Al.* ex gr. *Al. cafirniganica*, *Tetrataxis minima*, *T.* aff. *T. pusilla*, *Deckerella* sp. (samples Z262-Z290).

**110 m**

Greenish gray shale with thin interbeds of dolomitized sandy and bioclastic limestone and sandstone. The limestone includes fragments of brachiopod shells and bryozoan and pelmetazoan skeletons. At the top, the shale is red-colored and shows signs of intensive bioturbation.

**75 m**

The total thickness of the Absheni Formation is 185 m. Correspondingly, the thickness of the Sardar Group in this section is 347 m.

### Anarak Section

The section is located 25 km to the southeast of the town of Anarak (Figure 1) near the Kuh-e-Bande Abdulhussien Mountain (height 1625 m). We reconstructed the succession of displaced Shishtu and Sardar beds by means of foraminiferal data. The position of samples in this section is shown in Figures 2 and 3.

#### Ghaleh Formation

1. The Ghaleh Formation begins at the bottom with red and yellowish-brown gypsiferous shale. The upper part includes interbeds of thinly layered marly and sandy limestone. The deposits lie along a sharp contact with the eroded surface of the Shishtu limestone. This feature, and the presence of gypsum in the shale, implies a hiatus at the formation boundary. We observe no angular unconformity.

**51 m**

2. Coarsely layered dark gray massive grainstone with interbeds of dolomite and thinly layered marly wackstone with abundant corals, crinoids, fragments of brachiopod valves, and foraminifers.

   Samples were taken from several levels. Sample A40 was taken from the base and yielded *Eostaffella pseudostruvei pseudostruvei, Plectostaffella (Plectostaffella) seslavica Semistaffella variabilis*, *Pseudostaffella* cf. *P. antiqua*, *Monotaxinoides grandis*, *Globivalvulina bulloides*, *Tetrataxis* sp. (Table 2, at end of article). Higher in the sequence, sample

A71 contains few *Eostaffella* sp., *Semistaffella variabilis*, *Plectostaffella (Plectostaffella) bogdanovkensis*, *Pseudostaffella* cf. *P. antiqua*, *Globoendothyra* sp., Bradyinidae gen. indet, *Globivalvulina bulloides*, *Eolasiodiscus donbassicus, Monotaxinoides grandis*, *Tetrataxis conica*, *T. parviconica*, *T.* aff. *T. acuta*, *Deckerella composita*, *Neoarchaediscus* cf. *N. grandis*, *N. incertus*, *Tetrataxis* sp., *Biseriella parva*. The upper part of Unit 2 (samples A72-A86) contains more abundant and diverse foraminifers, including *Eostaffella* ex gr. *E. postmosquensis acutiformis*, *E.* aff. *E. ljudmilae*, *E. parastruvei chusovensis*, *E. ovoidea*, *E. raguschensis*, *E.* aff. *E. pseudostruvei chomatifera*, *Millerella pressa*, *M. variabilis*, *M. paraconica*, *Mediocris mediocris*, *M. brevisculus*, *Plectostaffella (Plectostaffella) bogdanovkensis*, *Pl. (Pl.) seslavica*, *Pl. (Pl.) jakhensis*, *Pl. (Varistaffella) varsanofievae*, *Pl. (V.) ziganica*, *Semistaffella variabilis*, *S. minuscilaria*, *Pseudostaffella antiqua*, *P. compressa*, *P. praegorskyi*, *P. paracompressa*, *P. nikolaevskiensis*, *P. composita*, *P. grandis*, *P.* aff. *P. gorskyi*, *Plectoendothyra*(*?*) sp., Bradyinidae gen. indet., *Eolasiodiscus donbassicus*, *Monotaxinoides grandis*, *M. convexus*, *Biseriella minima*, *Tetrataxis grandis*, *T. parviconica*, *T. quasiconica*, *T. planocula*, *T. minima*, *Cribrostomum posteximinium*, *Neoarchaediscus rugosimilis*, *N. postrugosus*, *N. latispiralis*, *Asteroarchaediscus subbashkiricus*, *A. bashkiricus* (Table 2).

**95 m**

Total thickness of the Ghaleh Formation in Anarak section is 146 m.

### Absheni Formation

3. Thinly layered fine to coarse grainstone with thin shale interbeds. A contact with the limestone of Unit 2 is complicated by a fault. Abundant foraminifers are represented by *Eostaffella acuta*, *Eostaffella* sp., *Millerella pressa*, *M.* ex gr. *M. marblensis*, *Novella primitiva*, *Mediocris brevisculus*, *Pseudostaffella antiqua*, *P.* aff. *P. paracompressa*, *Pseudostaffella subquadrata*, *Neostaffella pseudoquadrata*, *N. rotundata*, *Ozawainella mosquensis*, *O. paracompressa*, *O. vozhgalica*, *O. ferganensis*, *O.* aff. *O. paratingi O. kurakhovensis*, *Profusulinella* ex gr. *P. parva*, *P.* aff. *P. pseudorhomboides*, *P. prisca*, *Aljutovella* cf. *Al. cybaea*, *Al. tumida*, *Al. cafirniganica*, *Al. artificialis*, *Al. subaljutovica*, *Al. iranica* n. sp., *Al.* aff. *Al. stocklini* n. sp., *Endothyra bashkirica*, *Planoendothyra spirilliniformis*, *Endothyranella gracilis*, Bradyinidae gen. indet., *Globivalvulina* sp., *Tetrataxis parviconica*, *T. grandis*, *Palaeotextularia bruta*, *Neoarchaediscus incertus*, *N. gregori, Eolasiodiscus* sp. (samples A89-A118).

**22 m**

4. Shale, with thin wackstone-packstone interbeds (samples A120-A139). Limestone interbeds yield *Eostaffella exilis*, *E. acuta*, *Millerella variabilis*, *Novella primitiva*, *N. irregularis*, *Seminovella carbonica*, *Pseudostaffella* aff. *P. nikolaevskiensis*, *Pseudostaffella subquadrata*, *Neostaffella* sp., *Ozawainella eoangulata*, *O.* aff. *O. grandis*, *O.* aff. *O. paratingi*, *O. mosquensis*, *Profusulinella omiensis*, *Pr. staffellaeformis, Pr. prisca*, *Pr. pseudoparva* n. sp., *Ps.* aff. *Ps. pseudorhomboides*, *Aljutovella tumida*, *Al. cafirniganica*, *Endothyra* sp., Bradyinidae gen. indet., *Tetrataxis* sp., *Climacammina* sp. (sample A120-A127). At the top of the bed there are single *Ozawainella* ex gr. *O. paratingi*, ?*Putrella* sp. and *Palaeostaffella moellerites Retlingerina* sp. (sample A139).

**80 m**

The thickness of the Absheni Formation in this section is 102 m, however, it is incomplete. Although slightly displaced, the section seems to record a continuous stratigraphic succession as confirmed by the analysis of the foraminiferal assemblages. The shale of Unit 4 is separated by a fault from the coarsely layered massive grainstone within Unit 4 (Unit 2a in Figures 2 and 3). Unit 2a contains a foraminiferal assemblage similar to that of the upper part of Unit 2 of the Ghaleh Formation. The assemblage includes *Eostaffella postmosquensis*, *E. lepida*, *Plectostaffella (Plectostaffella) acuta*, *Pl. (Pl.) jakensis*, *Pl. (Pl.) quadrata*, *Pl. (Varistaffella) ziganica*, *Pseudostaffella antiqua*, *Ps. grandis*, *Ps. compressa*, *Ps. nikolaevskiensis*, *Ps. latispiralis*, *Biseriella* sp., *Tetrataxis angusta*, *T. planocula*, *Palaeotextularia* sp., *Neoarchaediscus* ex gr. *incertus*, *Asteroarchaediscus bashkiricus*, *A. ex. gr. A. subbashkiricus*, *Eosigmolina* sp. (samples A150-A160). The foraminiferal assemblage from higher levels (samples A144-A148) consists of *Ozawainella* sp., *Profusulinella parva*, *Pr.* aff. *ellipsoidalis*, *Pr.* aff. *Pr. bona sphaerica*, *Aljutovella pseudoaljutovica*, *Eoschubertella* sp., *Monotaxinoides* sp. According to these data, the limestone of Unit

2a is analogous of that of the upper part of Unit 2 and partially overlaps it. The estimated thickness of Unit 2a is 40 m.

5. Gray, locally plastered shale with thin interbeds of pink shale, sandstone, and thinly layered sandy grainstone with crinoids, corals, brachiopods, and foraminifers. Unit 5 is in tectonic contact with the underlying massive limestone of Unit 2a. Unit 5 is lithologically similar to Unit 4 but is distinguished by a younger foraminiferal assemblage. The lower and thicker part of the unit contains *Seminovella operta*, *Millerella* cf. *M. mixta*, *Pseudostaffella* aff. *P. subquadrata*, *Neostaffella rotundata*, *N. eoangulata*, *N.* aff. *N. syzranica*, *Ozawainella mosquensis*, *O. kurachovensis*, *O.* aff. *O. paratingi*, *O.* cf. *O. stellae*, *Reitlingerina bradyi*, *Eoschubertella obscura obscura*, *Profusulinella* (*?*) sp., and *Putrella* sp. near the top of this part (samples A168-A178). The upper part of Unit 5 includes *Eostaffella ex gr. mutabilis*, *E.* cf. *acutissima, Novella irregularis*, *Neostaffella rotundata*, *N. syzranica*, *Ozawainella eoelongata*, *Eoschubertella obscura obscura*, *E. obscura compressa*, *Schubertella* cf. *S. penchiensis* Sheng, *Fusiella typica ventricosa*, *F.* aff. *F. praetypica*, *F. praecursor praecursor*, *F. praecursor paraventricosa*, *Fusulinella (Moellerites) bockiformis*, *F. (M.) praebocki* , *F. (M.)* aff. *F. globulus*, *Fusulinella (Fusulinella)* aff. *subpulchra contracta*, *Fusulinella* sp. 1, *Putrella persica* n. sp., *Putrella* sp. 1 and 2, *Beedeina bona anarakensis* n. subsp. *Beedeina* sp., *Reitlingerina bradyi*, *R. timanica*, *Glomospira* sp., *Endothyra* sp., Bradyinidae gen. indet., *Endothyranella gracilis*, *Globivalvulina* sp., *Tetrataxis acutiformis*, *T.* aff. *paraconica*, *Deckerella* sp., *Climacammina* sp. (samples A183 - A193).

**45 m**

We acquired samples A208 and A211 from slightly adjacent to the line of the section studied, immediately below the base of the Zaladu Formation. Samples are related to the uppermost part of Unit 5. The following foraminifers were recovered: *Seminovella nana*, *Pseudostaffella* aff. *P. lomovatica*, *Eoschubertella obscura procera*, *Fusiella praecursor paraventricosa*, *F. typica*, *F.* aff. *F. longa*, *Fusulina?* sp. (Table 2). It is likely that Units 4 and 5 belong to a single, predominantly siliciclastic sequence that composes the upper half of the Sardar Group and is equivalent to the Absheni Formation of the Ozbak-Kuh section.

The shale of Unit 5 is overlain by a limestone sequence with Gzhelian (Orenburgian) *Ultradaixina, ?Rauserites, Schellwienia, Rugosofusulina, Occidentoschwagerina* (in the lower part), and Asselian *Pseudoschwagerina* (in the upper part) (Leven and Gorgij 2006). The sequence corresponds to the Zaladu Formation of the Ozbak-Kuh Mountain section. The contact between Unit 5 and the Zaladu Formation is indistinct. As in the Zaladu section, the Zaladu Formation in the Anarak section is preceded by dolomites of unknown (probably Sakmarian) age. (Leven and Taheri 2003). During fieldwork, the third author thought that these dolomites belonged to the Jamal Formation, however, the Jamal Formation is recognizable by Late Permian foraminifers previously reported in a different location (Sharkovski et al. 1965) and is characterized by a different lithology (grainstone, wackstone, and oolitic limestone). These dolomontes recently established as a new Tigh-Maadanou Foramation (Leven and Gorgil 2005).

## ANALYSIS

### Foraminiferal Assemblages and Age of the Sardar Group

**Zaladu section**. The oldest foraminiferal assemblage occurs in Unit 2 of the Zaladu section (Fig. 4-6). The majority of the species range widely from the Serpukhovian to lowermost Bashkirian. The presence of primitive *Plectostaffella (Plectostaffella) seslavica* of the *Pl. varvariensis* group (Fig. 7)*,* allows the correlation of the upper portion of this unit to the *Plectostaffella varvariensis* Zone of the basal Bashkirian in the stratotype region of the Urals (Kulagina et al. 2001). The age of this zone imn the Urals is confirmed as Bashkirian based on the occurrence of conodonts *Declinognathodus noduliferus* zone and ammonoids of the *Homoceras-Hudsonoceras* zone (Kulagina et al. 2000).

Unit 3 contains a sparse foraminiferal assemblage, which includes *Plectostaffella (Plectostaffella) bogdanovskensis*, an index-species of the lower subzone of the *Eostaffella pseudostruvei* Zone, established in the Urals above *Plectostaffella varvariensis* Zone (Kulagina et al. 2001). Based on the occurrence of characteristic species such as *Plectostaffella (Plectostaffella) bogdanovkensis*, *Pl. (Pl.) varvariensis*, *Eostaffella pseudostruvei angusta* and *E. designata* (Fig. 7), the greater part of Unit 4 (up to the level of sample Z171) can also be assigned to the *Eostaffella pseudostruvei* Zone. In general, Units 2 and 3, and most of Unit 4 are correlated with the Syuranian *sensu lato* (= Bogdanvian + Kamennogorian Regional Stages) substage of the Bashkirian Stage of the Urals (Kulagina et al. 2001) (Figure 2). The

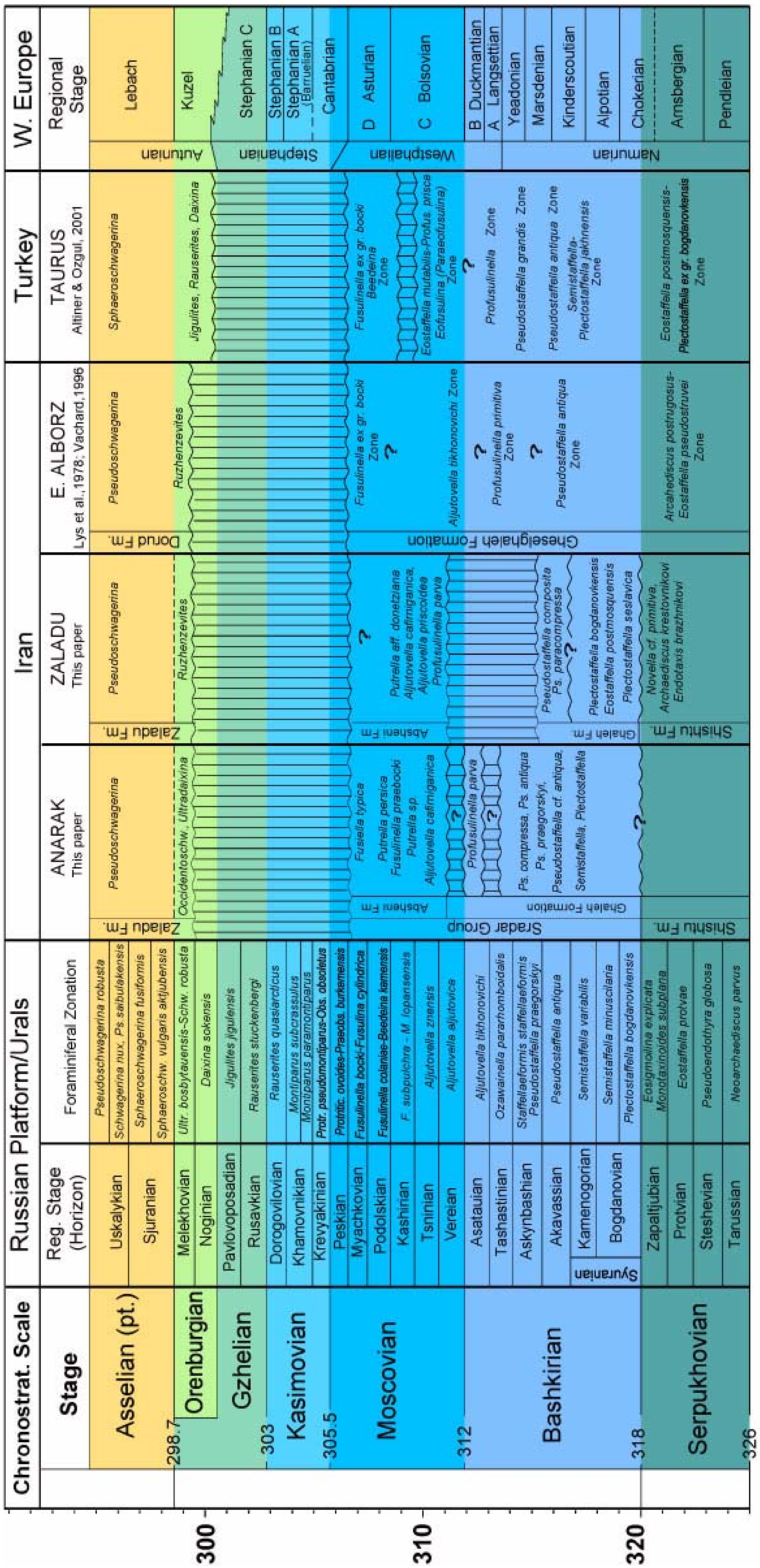


**Figure 4**. Correlation Pennsylvanian marine sediments in Central-Eastern Iran and surrounding regions.

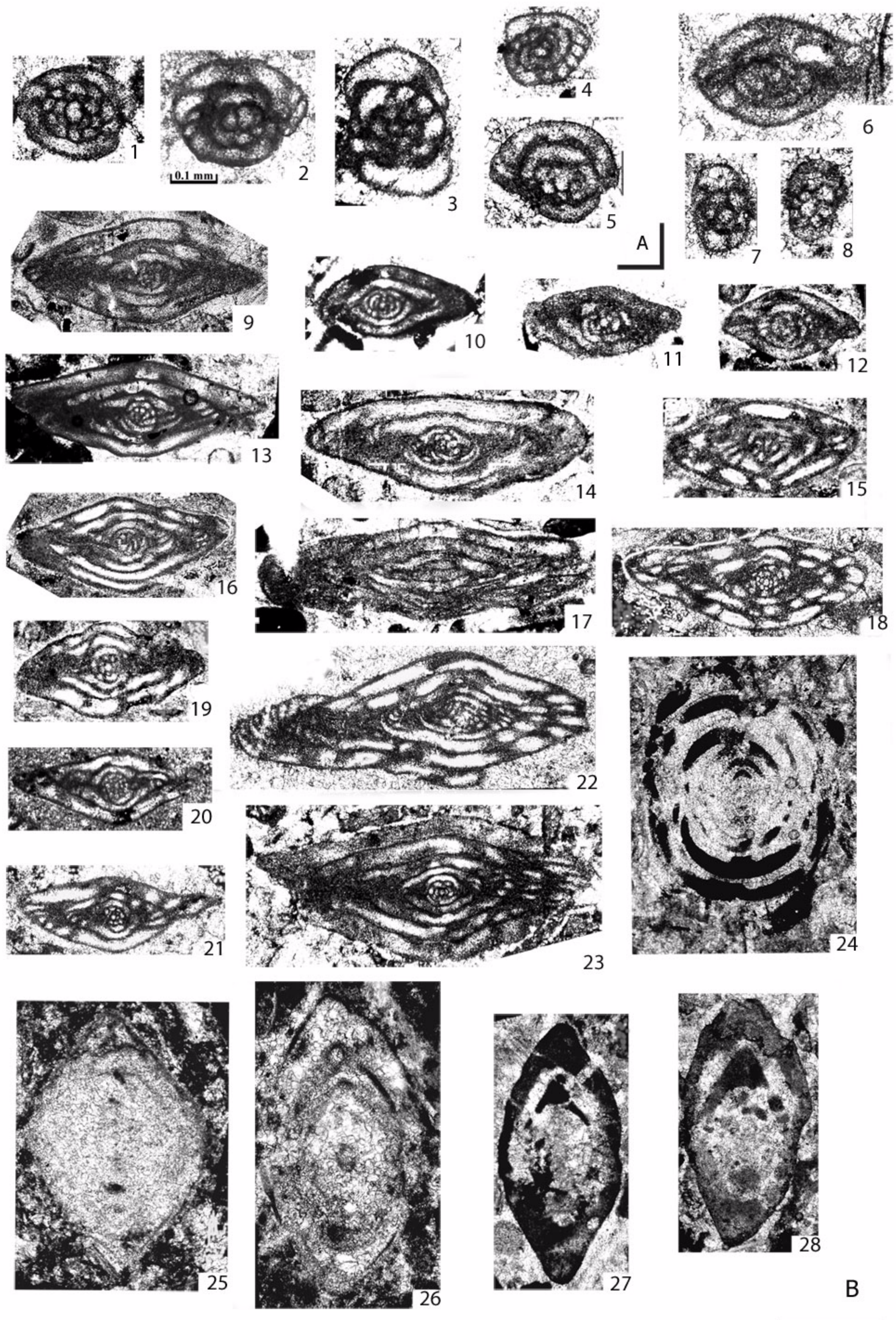


**Figure 5** (caption next page).

**Figure 5.** (figure previous page) **1-28.** Schubertellida and Staffellida species. This collection is housed in Micropaleontological Laboratory of Geological Institute, Russian Academy of Science, Pyzhevsky Pereulok 7, 109017, Moscow. Collection Number **4777**. **1.** *Eoschubertella obscura procera* (Rauser-Chernousova), scale-bar A = 0,1 mm; axial section, sample A211 (GIN 4777/1a); **2, 5.** *Eoschubertella obscura obscura* (Lee and Chen), scale-bar A = 0.1 mm; axial sections, samples A184 (GIN 4777/2a) and Z219 (GIN 4777/3a); **3.** *Eoschubertella obscura mosquensis* (Rauser-Chernousova), scale-bar A = 0,1 mm; axial section, sample Z219 (GIN 4777/4a); **4.** *Eoschubertella obscura compressa* (Rauser-Chernousova), scale-bar A = 0,1 mm, subaxial section, sample A184 (GIN 4777/5); **6.** *Schubertella* cf. *penchiensis* Sheng, scale-bar A = 0,1 mm; subaxial section, sample A183 (GIN 4777/6a); **7, 8.** *Eoschubertella* sp., scale-bar A = 0,1 mm; subaxial sections, sample Z219 (GIN 4777/7); **9, 13.** *Fusiella* aff. *praetypica* Safonova, scale-bar B = 0,5 mm; axial sections, samples Z262 (GIN 4777/8a) and A193 (GIN 4777/9); **10-12, 20, 21.** *Fusiella paraventricosa* Rauser-Chernousova, scale-bar B = 0,5 mm; 10 – subaxial section, sample Z201 (GIN 4777/10); 11,12 – subaxial sections; sample Z189 (GIN 4777/11a; GIN 4777/11b); 20 – axial section, sample A185 (GIN 4777/13); 21 – axial section, sample A208 (GIN 4777/14); **14,17.** *Fusiella* aff. *longa* Rumjanzeva, scale-bar B = 0,5 mm; 14 – axial section, sample A211-15-8a (GIN 4777/1b); 17 - tangential section, sample Z189 (GIN 4777/11c); **15.** *Fusiella* sp., scale-bar B = 0,5 mm; subaxial section, sample Z189 (GIN 4777/11d); **16.** *Fusiella* aff. *paradoxa* Lee and Chen, scale-bar B = 0,5 mm; subaxial section, sample Z262 (GIN 4777/8b); **18, 22.** *Fusiella typica* Lee and Chen, scale-bar B = 0,5 mm; subaxial sections, samples A208 (GIN 4777/19a) and A208-3-1a (GIN 4777/20); **19.** *Fusiella pulchella* Safonova, scale-bar B = 0,5 mm; axial section, sample Z189 (GIN 4777/11e); **23.** *Fusiella* ex gr. *typica* Lee and Chen, scale-bar B = 0,5 mm; subaxial section, sample A211 (GIN 4777/15); **24.** *Palaeostaffella moelleri* (Ozawa), scale-bar B = 0,5 mm, axial section, sample A139 (GIN 4777/22); **25.** *Reitlingerina bradyi* (Moeller), scale-bar B = 0,5 mm; axial section, sample A173 (GIN 4777/23); **26-28.** *Reitlingerina timanica* (Rauser-Chernousova), scale-bar B = 0,5 mm; 26 – subaxial section, sample A184 (GIN 4777/24a); 27 – subaxial section, sample A193 (GIN 4777/25); 28 – subaxial section, sample A193 (GIN 4777/26).

**Figure 6.** (figure next page) **1-44.** Endothyrida and Ozawainellida species. **1-3.** *Mediocris brevisculus* (Ganelina), scale-bar = 0,1 mm; 1 - axial section, sample A78 (GIN 4777/27a); 2 – axial section, sample A72 (GIN 4777/28a); 3 – axial section, sample A114 (GIN 4777/29); **4.** *Mediocris mediocris* (Vissarionova), scale bar = 0,1 mm; axial section, sample Z160 (GIN 4777/30a); **5-7.** *Eostaffella ovoidea* Rauser-Chernousova, scale-bar = 0,1 mm; 5 – axial section, sample A78 (GIN 4777/27b); 6 – axial section, sample Z86 (GIN 4777/47a); 7 – axial section, sample Z98 (GIN 4777/48a); **8, 9.** *Novella primitiva* (Dutkevich), scale-bar = 0,1 mm; 8 – axial section, sample A120 (GIN 4777/31a); 9 – axial section, sample A114 (GIN 4777/32a); **10, 17, 18.** *Seminovella nana* (Kireeva), scale-bar = 0,1 mm; 10 – axial section, sample Z231 (GIN 4777/33a); 17 – axial section, sample A208 (GIN 4777/19b); 18 – axial section, sample Z231 (GIN 4777/34); **11, 40.** *Millerrella* ex gr. marblensis Thompson, scale-bar = 0,1 mm; 11 – axial section, sample A108 (GIN 4777/35); 40 – axial section, sample Z183 (GIN 4777/74a); **12.** *Eostaffella* ex gr. *mutabilis* Kireeva, scale-bar = 0,1 mm; axial section, sample A183 (GIN 4777/37a); **13-15, 35.** *Novella irregularis* Kireeva, scale-bar = 0,1 mm; 13 – subaxial section, sample Z183 (GIN 4777/38); 14 – axial section, sample A118(GIN 4777/39a); 15 – axial section, sample A184 (GIN 4777/2b); 35 - axial section, sample A120 (GIN 4777/40); **16, 21, 22.** *Seminovella carbonica* (Grozdilova and Lebedeva), scale-bar = 0,1 mm; 16 – axial section, sample Z219 (GIN 4777/3b); 21 – axial section, sample Z226 (GIN 4777/41); 22 – axial section, sample A120 (GIN 4777/42); **19, 20.** *Seminovella operta* (Grozdilova and Lebedeva), scale-bar = 0,1 mm; 19 – axial section, sample A170 (GIN 4777/43); 20 – axial section, sample Z219 (GIN 4777/44); **23, 37.** *Millerella* aff. *paraumbilicata* Manukalova-Grebenjuk, Iljina and Serezhnikova, scale-bar = 0,1 mm; 23 – axial section, sample A82 (GIN 4777/16a); 37 – axial section, sample Z160 (GIN 4777/30b); **24, 25.** *Millerella mixta* (Rauser-Chernousova), scale-bar = 0,1 mm; 24 – axial section, sample Z162 (GIN 4777/46a); 25 – axial section, sample Z162 (GIN 4777/46b); **26.** *Millerella* aff. *excavata* Conil and Lys, scale-bar = 0,1 mm; axial section, sample Z98 (GIN 4777/48b); **27, 28.** *Millerella pressa* Thompson, scale-bar = 0,1 mm; 27 – axial section, sample A118 (GIN 4777/49); 28 – axial section, sample A89 (GIN 4777/50); **29.** Eostaffella exilis (Grozdilova and Lebedeva), scale-bar = 0,1 mm; axial section, sample A127 (GIN 4777/51); **30.** *Millerella paraconica* Manukalova-Grebenjuk, Iljina and Serezhnikova, scale-bar = 0,1 mm; subaxial section, sample A78 (GIN 4777/27c); **31-34,** *Eostaffella acuta* Grozdilova and Lebedeva, scale-bar = 0,1 mm; 31 – axial section, sample A114 (GIN 4777/32b); 32 – axial section, sample A114 (GIN 4777/52); 33 – axial section, sample A120 (GIN 4777/ 53); 34 – axial section, sample A120, (GIN 4777/40); **36.** *Millerella* (?) ex gr. *conica* Potievskaja, scale-bar = 0,1 mm; axial section, sample Z130 (GIN 4777/54); **38.** *Eostaffella* ex gr. *postmosquensis acutiformis* Kireeva, scale-bar = 0,1 mm; axial section, sample A82 (GIN 4777/16b); **39.** *Eostaffella pseudostruvei elongatissima* Manukalova-Grebenjuk, Iljina and Serezhnikova, scale-bar = 0,1 mm; axial section, sample A81(GIN 4777/48g); **41.** *Eostaffella parastruvei* Rauser-Chernousova, scale-bar = 0,1 mm; tangential section, sample Z98 (GIN 4777/48c); **42-44.** *Eostaffella designata* (D. Zeller), scale-bar = 0,1 mm; 42 – subaxial section, sample Z98 (GIN 4777/30c); 43 – axial section, sample Z160 (GIN 4777/30d); 44 – axial section, sample Z160 (GIN 4777/30e).

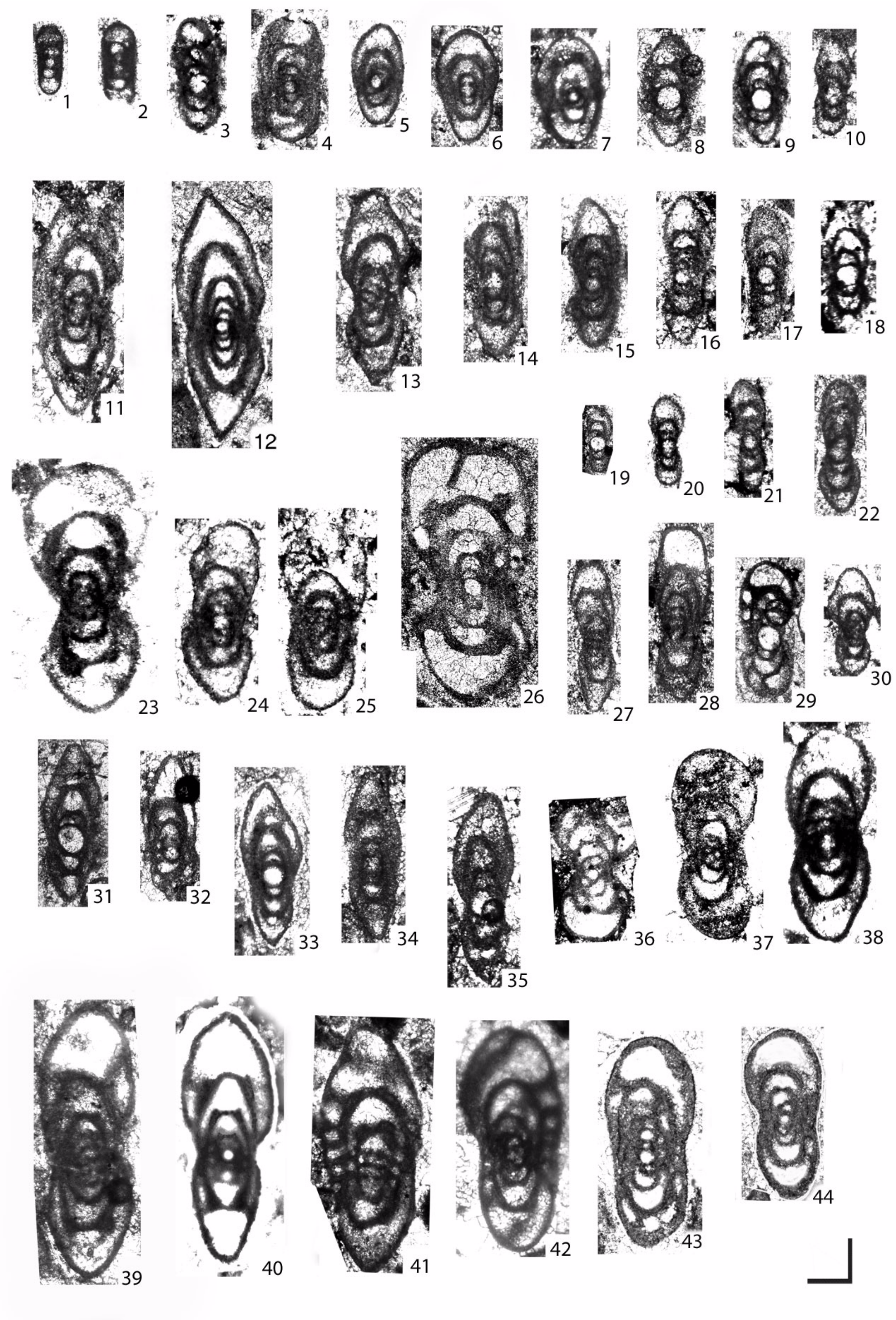


**Figure 6** (caption previous page).

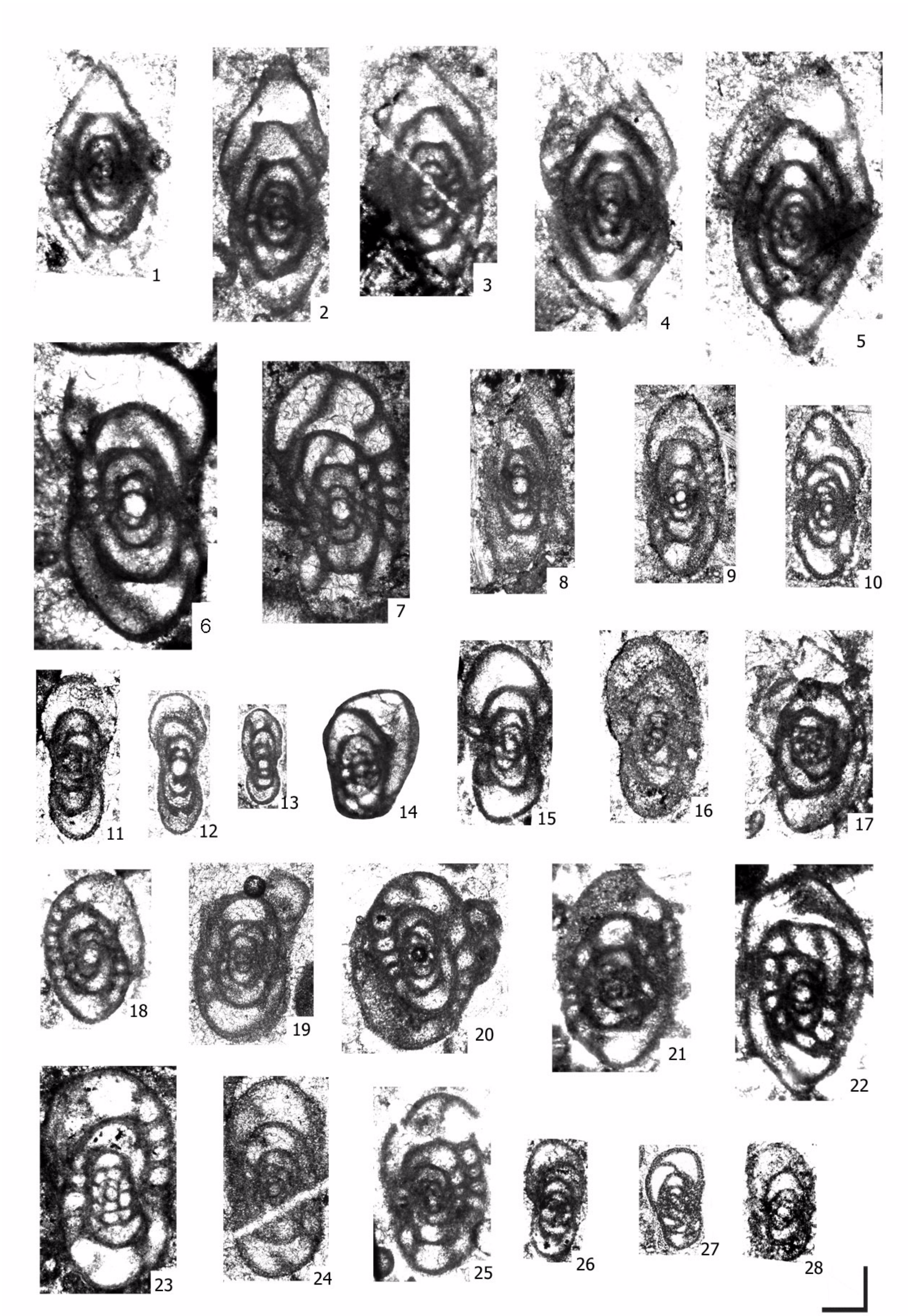


**Figure 7** (caption on next page).

**Figure 7.** (figure previous page) **1-28.** Ozawainellida species. **1-5.** *Eostaffella raguschensis* Ganelina, scale-bar = 0,1 mm; 1- axial section, sample A74 (GIN 4777/56a); 2 – axial section, sample A74 (GIN 4777/57); 3 – axial section, sample A74 (GIN 4777/58a); 4 – axial section, sample A74 (GIN 4777/58b); 5 – axial section, sample A74 (GIN 4777/56b); **6, 7.** *Eostaffella libera* Rumjanzeva, scale-bar = 0,1 mm; 6 – subaxial section, sample Z98 (GIN 4777/48d); 7 – subaxial section, sample Z86 (GIN 4777/47b); **8-10.** *Eostaffella pseudostruvei chomatifera* Kireeva, scale-bar = 0,1 mm; 8 – subaxial section, sample Z183 (GIN 4777/59a); 9 – subaxial section, sample Z183 (GIN 4777/59b); 10 – subaxial section, sample Z183 (GIN 4777/60); **11-13.** *Millerella variabilis* Rauser-Chernousova, scale-bar = 0,1 mm; 11 – axial section, sample Z160 (GIN 4777/30c); 12 – axial section, sample A120-8-4a (GIN 4777/42b); 13 – axial section, sample A78-1-7a (GIN 4777/27d); **14.** *Plectostaffella (Plectostaffella)* aff. *orbiculata* R. Ivanova, scale-bar = 0,1 mm; axial section, sample Z98 (GIN 4777/48e); **15.** *Eostaffella pseudostruvei angusta* (Rauser-Chernousova and Beljaev), scale-bar = 0,1 mm; axial section, sample Z147-1-4a (GIN 4777/61a); **16, 17, 25.** *Plectostaffella (Plectostaffella) jakhensis* Reitlinger, scale-bar = 0,1 mm; 16 – axial section, sample Z160-1-2a (GIN 4777/61b); 17 – axial section, sample A76-8-2a (GIN 4777/62); 25 – axial section, sample A156-5-5a (GIN 4777/83a); **18.** *Plectostaffella (Plectostaffella) acuta* (Manukalova-Grebenjuk, Iljina and Serezhnikova), scale-bar = 0,1 mm; subaxial section, sample A156-1-5a (GIN 4777/64); **19, 20, 23, 24.** *Plectostaffella (Plectostaffella) bogdanovkensis* Reitlinger, scale-bar = 0,1 mm; 19 – subaxial section, sample A71-2-2a (GIN 4777/65); 20 – subaxial section, sample A76-13-3a (GIN 4777/66a); 23 – subaxial section, sample Z129-1-2a (GIN 4777/67); 24 – subaxial section, sample Z160-2-2a (GIN 4777/45= GIN 4777/30); **21, 22.** *Plectostaffella (Plectostaffella) quadrata* Rumjanzeva, scale-bar = 0,1 mm; 21 – axial section, sample A160-12a (GIN 4777/68a); 22 – axial section, sample A160-8a (GIN 4777/68b); **26-28.** *Plectostaffella (Plectostaffella) varvariensis* (Brazhnikova and Potievskaja), scale-bar = 0,1 mm; 26 – subaxial section, sample Z171-2-1a (GIN 4777/70); 27 – axial section, sample Z159 (GIN 4777/71); 28 – axial section, sample Z159-1-2a (GIN 4777/72).

**Figure 8.** (figure on next page) **1-30.** Ozawainellida species. **1-3.** *Plectostaffella (Plectostaffella) seslavica* (Rumjanzeva), scale-bar A = 0,1 mm; 1 – axial section, sample Z40 (GIN 4777/73); 2 – axial section, sample A72-1-4 (GIN 28b); 3 – axial section, sample Z98-1-1b (GIN 4777/48f); **4.** *Semistaffella* sp., scale-bar A = 0,1 mm; axial section, sample Z183-4a (GIN 4777/74b); **5, 6, 11.** *Plectostaffella (Varistaffella) ziganica* (Sinitsyna), scale-bar A = 0,1 mm; 5 – axial section, sample A58-1-2 (GIN 4777/75); 6 – axial section, sample A76-1-2a (GIN 4777/17); 11 – axial section, sample A76-12-6a (GIN 4777/76); **7, 8.** *Plectostaffella (Varistaffella) varsanofievae* (Rauser-Chernousova), scale-bar A = 0,1 mm; 7 – axial section, sample A74-14 (GIN 4777/83b); 8 – axial section, sample A76-13-4a (GIN 4777/66b); **9.** *Semistaffella minuscularia* Reitlinger, scale-bar A = 0,1 mm; subaxial section, sample A76-13-2 (GIN 4777/66c); **10.** *Semistaffella variabilis* Reitlinger, scale-bar A = 0,1 mm, subaxial section, sample A72-2-3a (GIN 4777/78a); **12-16.** *Pseudostaffella antiqua* (Dutkevich), scale-bar B = 0,5 mm; 12 – axial section, sample A74-13-1a (GIN 4777/79); 13 – axial section, sample Z183-6a (GIN 4777/74c); 14 – axial section, sample A150-7-1a (GIN 4777/80); 15 – axial section, sample A150-9-1a (GIN 4777/81); 16 – axial section, sample Z183-1-1a (GIN 4777/36); **17-19.** *Pseudostaffella nikolaevskiensis* Manukalova-Grebenjuk, Iljina and Serezhnikova, scale-bar B = 0,5 mm; 17 - axial section, sample A76-4-1a (GIN 4777/82); 18 – axial section, sample A156-5-1a (GIN 4777/83); 19 – axial section, sample A156-2-1a (GIN 4777/84); **20.** *Pseudostaffella* aff. *compressa* Rauser-Chernousova, scale-bar B = 0,5 mm; axial section, sample A82-2-9a (GIN 4777/85); **21.** *Pseudostaffella grandis* Schlykova, scale-bar B = 0,5 mm; subaxial section, sample A82-1-1a (GIN 4777/55); **22.** *Pseudostaffella praegorskyi* Rauser-Chernousova, scale-bar B = 0,5 mm; axial section, sample A74-4-1a (GIN 4777.86); **23-25.** *Pseudostaffella paracompressa* Safonova, scale-bar B = 0,5mm; 23 – axial section, sample Z183-3-1a (GIN 4777/38); 24 – axial section, sample A76-7-1a (GIN 4777/87); 25 – axial section, sample A76 (GIN 4777/88); **26-28.** *Pseudostaffella compressa* Rauser-Chernousova, scale-bar B = 0,5 mm; 26 – axial section, sample A74 (GIN 4777/89); 27 – axial section, sample A74 (GIN 4777/90); 28 – axial section, sample A74 (GIN 4777/91); **29, 30.** *Pseudostaffella subquadrata* Grozdilova and Lebedeva**,** scale-bar B = 0,5 mm; 29 – subaxial section, sample Z226 (GIN 4777/93); 30 – subaxial section, sample A114 (GIN 4777/92).

first appearance of *Pseudostaffella – Ps. antiqua* – in this section occurs at the level of sample Z177*)*. At the top of Unit 4 this species is associated with more derived and abundant forms of *Pseudostaffella,* such as *Ps. paracompressa* and *Ps. composita* (Fig. 8). The presence of primitive but diverse *Pseudostaffella,* abundant *Semistaffella, Plectostaffella (Plectostaffella),* and *Plectostaffella (Varistaffella),* and the absence of *Profusulinella* and *Ozawainella* permits a reliable correlation of the upper part of Unit 4 to the Akavassian regional Stage of Bashkirian of the Urals and to the Severokeltmenian regional stage of Bashkirian in the East-European Platform (Kulagina et al. 2001).

The fusulinid assemblage of Unit 5 (samples Z189-231) contains abundant *Aljutovella* and *Profusulinella, Pseudostaffella subquadrata,* and *Ozawainella* of early Moscovian age (Fig.9 and Fig. 10). At the top of Unit 4, fusulinids are represented mainly by *Eostaffella* and primitive *Pseudostaffella,* which are probably early Bashkirian or later. This suggests the existence of a hiatus between Units 4

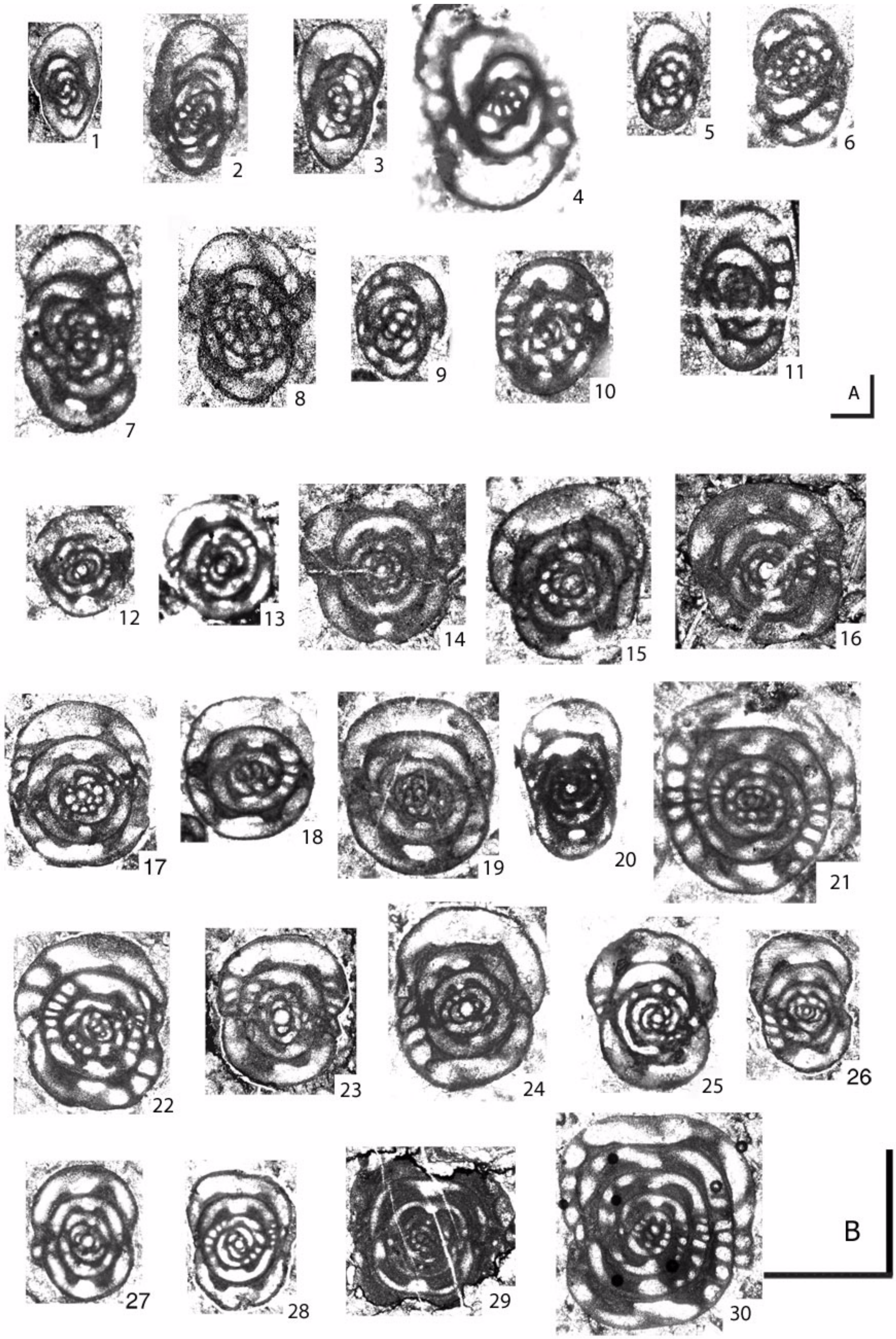


**Figure 8** (caption on previous page).

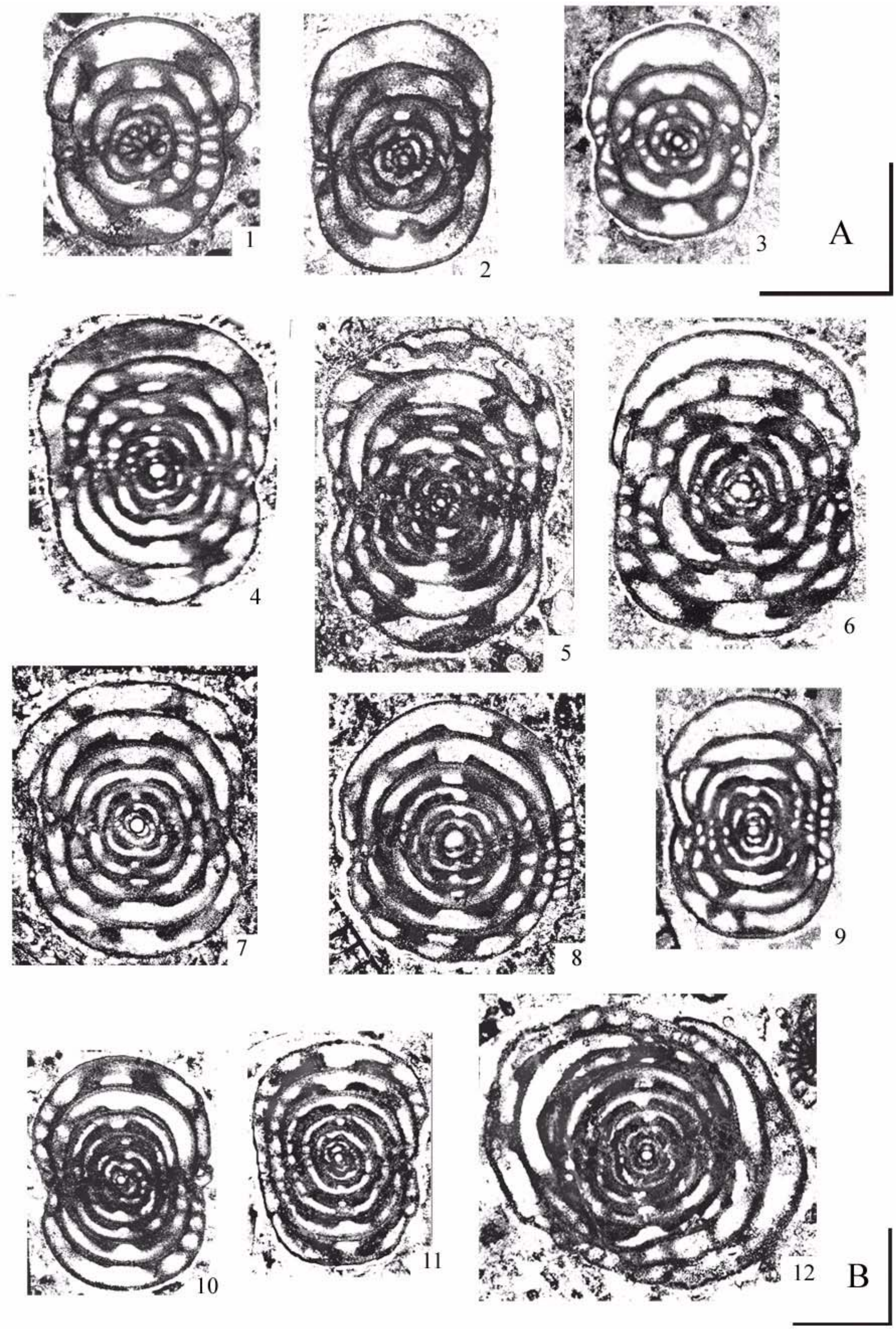


**Figure 9** (caption next page).

**Figure 9.** (figure previous page) **1-12.** Ozawainellida species. **1-3.** *Pseudostaffella composita* Grozdilova and Lebedeva, scale-bar A = 0,5 mm; 1 – axial section, sample A72 (GIN 4777/78b); 2 – axial section, sample A76 (GIN 4777/94); 3 – axial section, sample Z183 (GIN 4777/95); **4-8.** *Neostaffella rotundata* (Bensh), scale-bar B = 0,5 mm; 4 – axial section, sample A171 (GIN 4777/78c); 5 – axial section, sample A170 (GIN 4777/97); 6 – axial section, sample A177 (GIN 4777/98); 7 – axial section, sample A174 (GIN 4777/99); 8 – axial section, sample A174 (GIN 4777/100); **9-12.** *Neostaffella syzranica* (Rauser-Chernousova and Safonova), scale-bar B = 0,5 mm; 9 – axial section A184 (GIN 4777/101a); 10 – axial section, sample A183 (GIN 4777/102); 11 – axial section, sample A183 (GIN 4777/103); 12 – axial section, sample A184 (GIN4777/104).

**Figure 10.** (figure next page) **1-22.** Ozawainellida and Fusulinida species. **1, 2.** *Ozawainella* aff. *paratingi* Manukalova, scale-bar A = 0,5 mm; 1 – axial section, sample A108 (GIN 4777/105); 2 – axial section, sample A108 (GIN 4777/106); **3, 4.** *Ozawainella ferganensis* Dzhentchuraeva, scale-bar A= 0,5 mm; 3 – axial section, sample A108 (GIN 4777/35a); 4 – axial section, sample A107 (GIN 4777/107); **5, 6.** *Ozawainella vozhgalica* Safonova, scale-bar A= 0,5 mm; 5 – axial section, sample A107 (GIN 4777/108); 6 – axial section, sample Z220 (GIN 4777/109); **7, 8.** *Ozawainella eoangulata* Manukalova, scale bar A = 0,5 mm; 7 – axial section, sample A120 (GIN 4777/110); 8 – axial section, sample A120 (GIN 4777/111); **9, 10.** *Ozawainella* aff. *grandis* Potievskaja, scale-bar A = 0,5 mm; 9 – axial section, sample A120 (GIN 4777/112a); 10 - axial section, sample A120 (GIN 4777/113); **11.** *Ozawainella kurakhovensis* Manukalova, scale-bar A= 0,5 mm; axial section, sample A117 (GIN 4777/114); **12-14.** *Ozawainella paracompressa* Grozdilova and Lebedeva, scale-bar A = 0,5 mm; 12 – axial section, sample A107 (GIN 4777/115); 13 – axial section, sample A108 (GIN 4777/116); 14 – axial section, sample A110 (GIN 4777/117); **15-19.** *Ozawainella mosquensis* Rauser-Chernousova, scale-bar A = 0,5 mm; 15 – axial section, sampleA113 (GIN 4777/118); 16 - axial section, sample A171 (GIN 4777/119); 17 - axial section, sample A174 (GIN 4777/120); 18 – axial section, sample A174 (GIN 4777/121); 19 – axial section, sample A174 (GIN 4777/122); **20, 21.** *Profusulinella staffellaeformis* Kireeva, scale-bar B = 0,5 mm; subaxial sections, sample Z193 (GIN 4777/123a); **22.** *Profusulinella* ex gr. *parva* (Lee and Chen), scale-bar B = 0,5 mm; axial section, sample A108 (GIN 4777/35b).

and 5. The fusulinids of the lower part of Unit 5 are dominated by *Profusulinella parva*, *Pr. staffellaeformis*, *Pr. convoluta*, *Aljutovella* sp. 1 (ex gr. *Al. subaljutovica* ), *Al. artificialis*, that are typical for the Vereian regional Stage of the East-European Platform. Persistent Archaediscida and earliest primitive *Fusiella* also occur in Unit 5.

Starting with sample Z220, the lowermost Kashirian species present are *Ozawainella vozhgalica*, *Pseudostaffella subquadrata*, *Profusulinella ovata*, *P. polasnensis*, *Aljutovella complicata, Al. priscoidea*, *Al. cafirniganica*, *Al.* aff. *devexa,* and others (Figs. 10-12). Their occurrences suggest a late Vereian-early Kashirian age for the lower part of Unit 5 or the basal part of Absheni Formation. The upper part of Ghaleh Formation is Akavassian in age. Therefore, the hiatus between the formations encompasses the upper half of the Bashkirian Stage (Askynbashian-Asatauian regional Stages) and, probably, the lowermost Moscovian.

The middle and upper parts of Unit 5 of the Zaladu section are referred to the Kashirian by the occurrence of *Putrella* aff. *donetziana* (samples Z235 and Z244). In the Moscow Basin, *Putrella* has been found recovered from the upper Moscovian. Putrya (1956) also considered *Putrella donetziana* to be of late Moscovian (Myachkovian) age. The forms he attributed to this species, however, seem to differ from the type species of *Putrella* described from Donets Basin by Lee (1937). Our assessment that the upper part of Unit 5 is Kashirian in age is based on the fact that the entire assemblage of the fusulinids, excluding *Putrella,* is similar to that found in the lower part of Unit 5. Secondly, the pre-Podolian age of this portion of the Zaladu section is also confirmed by the absence of fusulinids typical of the transitional beds between the lower and upper Moscovian substages. These fusulinids include, but are not limited to, the earliest *Fusulinella, Beedeina, Citronites, and Paraeofusulina.* Unit 6 lacks fusulinids and is assigned to the upper Moscovian (most likely Podolian) by its stratigraphic position.

Based on these observations in the Zaladu section, the type section of the Ghaleh and Absheni Formations, we conclude that the Ghaleh Formation is lower Bashkirian in age. The data presented here do not confirm that Ghaleh Formation includes Lower Carboniferous deposits, as previously proposed (Stöcklin et al. 1965; Stepanov 1971). Because the lowermost beds were not collected, however, we cannot at present, exclude the possibility that these beds may belong to the Serpukhovian Stage.

We also consider the entire Absheni Formation to be of Moscovian age. It rests on the Ghaleh Formation with a stratigraphic hiatus corresponding to the greatest part of the Bashkirian Age and probably the basal most beds of the lower Moscovian. It is quite possible that the upper half, and most likely the lower part, of the Absheni Formation

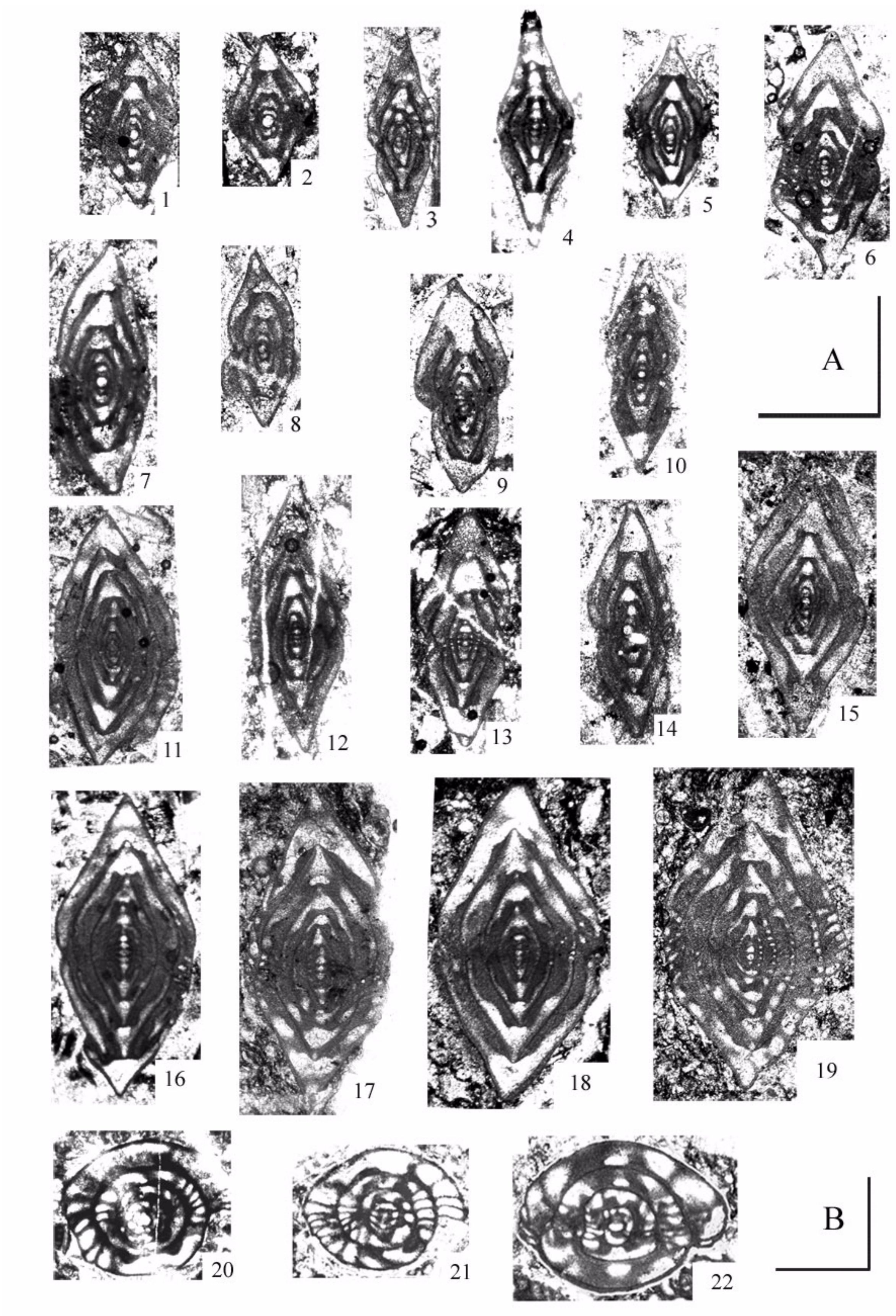


**Figure 10** (caption previous page).

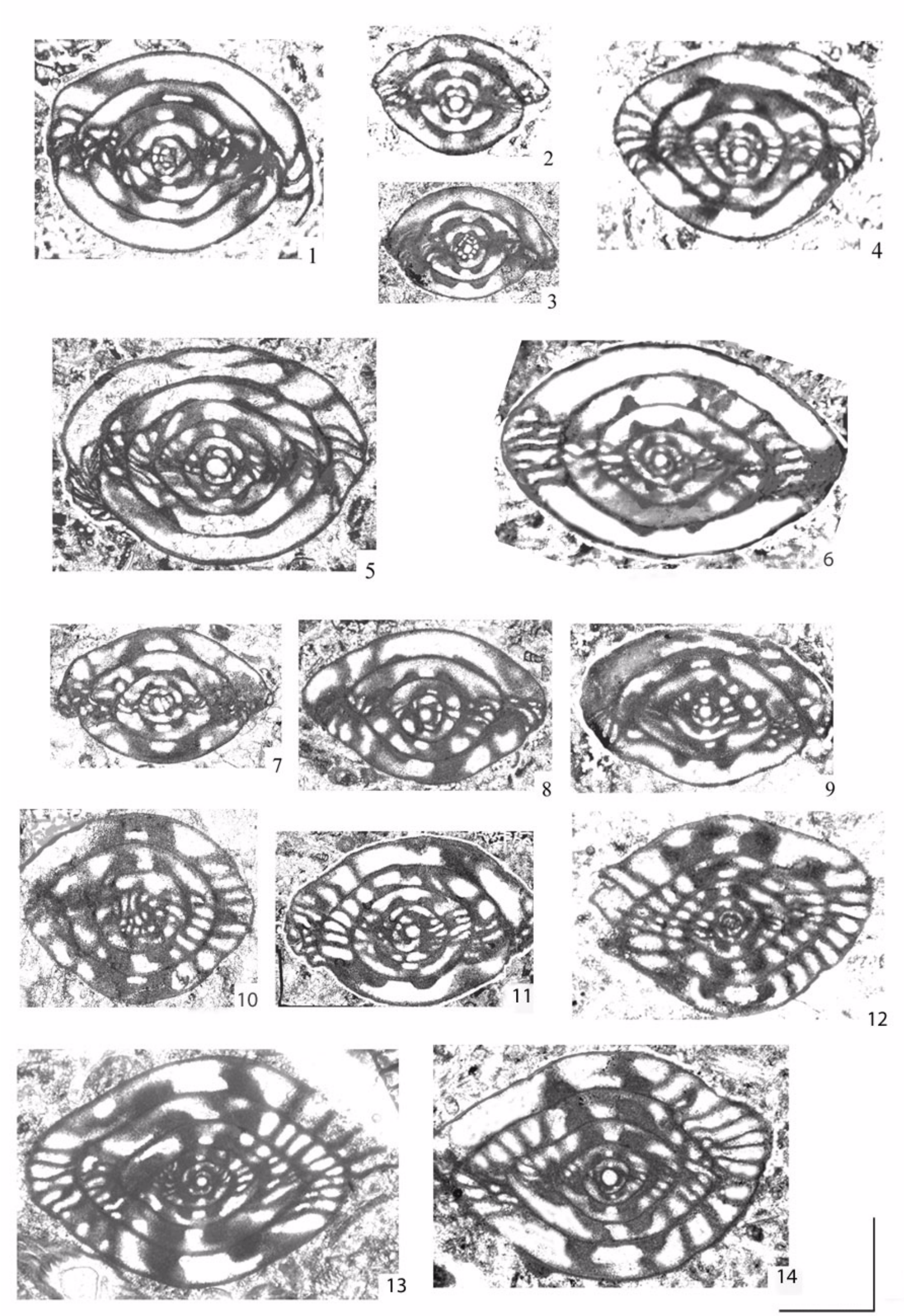


**Figure 11. 1-14.** *Profusulinella* species. **1, 4, 5.** *Profusulinella beppensis* Toriyama, scale-bar = 0,5 mm; 1 – axial section, sample Z220 (GIN 4777/124); 4 – axial section, sample Z209 (GIN 4777/125); 5 – axial section, sample Z220 (GUN 4777/126); **2, 3.** *Profusulinella pseudoparva* Leven and Davydov, n. sp., scale-bar = 0,5 mm; 2- axial section, sample Z209 (GIN 4777/127); 3 – axial section (holotype), sample A120 (GIN 4777/128); **6.** *Profusulinella* ex gr. prisca (Deprat), scale-bar = 0,5 mm; axial section, sample Z223 (GIN 4777/132a); **7-9.** *Profusulinella omiensis* Watanabe, scale-bar = 0,5 mm; 7 – axial section, sample Z202 (GIN 4777/156); 8 – axial section, sample Z220 (GIN 4777/ 130); 9 – axial section, sample Z288 (GIN 4777/131a); **10, 11.** *Profusulinella prisca* (Deprat), scale-bar = 0,5 mm; 10 – oblique section, sample A120 (GIN 4777/31b); 11- axial section, sample Z220 (GIN 4777/186); **12-14.** *Profusulinella* aff. *pseudorhomboidea* Putrja, scale-bar = 0,5 mm; 12 – subaxial section, sample A107 (GIN 4777/134); 13 – subaxial section, sample A107 (GIN 4777/135); 14 – subaxial section, sample A100 (GIN 4777/136).

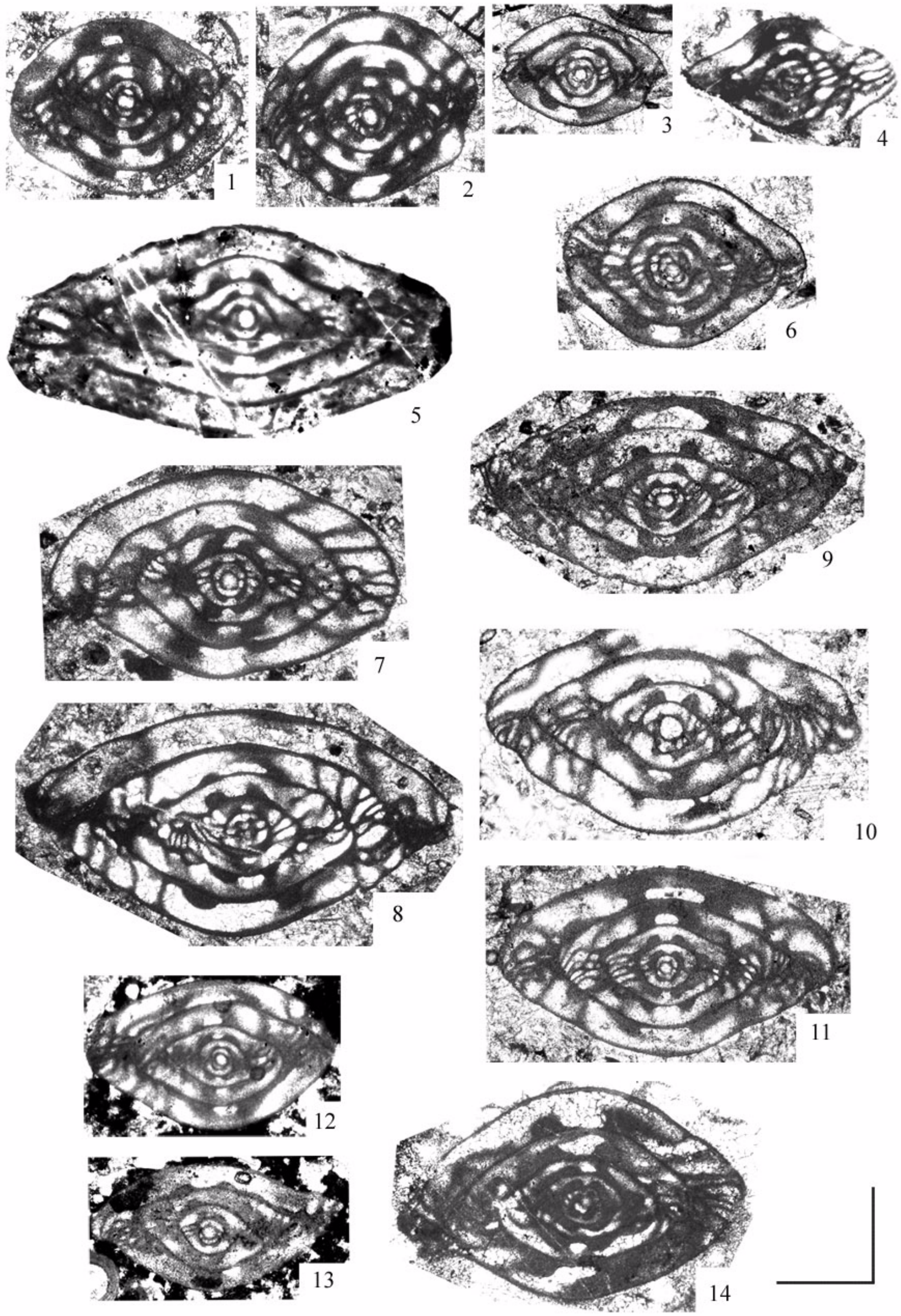


**Figure 12. 1-14.** *Profusulinella* and *Aljutovella* species. **1, 2.** *Profusulinella prisca* (Deprat), scale-bar = 0,5 mm; 1 – axial section, sample A107 (GIN 4777/12); 2 – axial section, sample Z288 (GIN 4777/131b); **3.** *Profusulinella pseudoparva* Leven and Davydov, n. sp., scale-bar = 0,5 mm; axial section, sample Z219 (GIN 4777/18); **4.** *Taitzehoella* cf. *pseudolibrovichi* (Safonova), scale-bar = 0,5 mm; subaxial section, sample Z193 (GIN 4777/123b); **5.** *Aljutovella conspecta* Leontovich, scale-bar = 0,5 mm, axial section, sample Z223 (GIN 4777/132b); **6.** *Profusulinella convoluta* (Lee and Chen), scale-bar == 0,5 mm; subaxial section, sample Z219 (GIN 4777/21); **7-11.** *Aljutovella subaljutovica* Safonova, scale-bar = 0,5 mm; 7 - axial section, sample Z231 (GIN 4777/137); 8 – subaxial section, sample Z231 (GIN 4777/33b); 9 – axial section, sample Z231 (GIN 4777/138); 10 – axial section, sample Z231 (GIN 4777/139); 11 – axial section, sample Z231 (GIN 4777/140); **12, 13.** *Aljutovella pseudoaljutovica* Rauser-Chernousova, scale-bar = 0,5 mm; 12 – axial section, sample A148 (GIN 4777/141); 13 – axial section, sample A148 (GIN 4777/142); **14.** *Profusulinella* ex gr. *convoluta* (Lee and Chen), scale-bar = 0,5 mm, axial section, sample Z191 (GIN 4777/143).

includes the upper Moscovian. The uppermost part of the Moscovian, as well as the Kasimovian and most probably the greatest part of Gzhelian stages, are absent from this section.

**Anarak section.** Foraminiferal assemblages, more abundant than in the Zaladu section, are present in the Anarak section. The section consists of separate, frequently displaced blocks (Figure 3), the initial succession of which can be reconstructed with much confidence. The shale of Unit 1 that lies below the foraminifer-rich limestone of Unit 2 and is devoid of foraminifers, was referred to as the lower Bashkirian. Primitive *Pseudostaffella (Ps.* cf. *Ps. antiqua)* are associated with *Eostaffella, Semistaffella, Plectostaffella,* and abundant Archaediscidea span the lower half of Unit 2 (samples A40-A71). Accordingly, most of the lower half of Unit 2 can be correlated to the *Varistaffella ziganica-Pseudostaffella antiqua* Zone (Kulagina et al. 2001). This zone is the lowest Akavassian regional stage of the Bashkirian of the Urals (Figure 2).

*Pseudostaffella* are abundant and diverse in Unit 2, whereas *Profusulinella* and *Ozawainella* are absent (samples A72-A86). These fauna allow the assignment of the upper portion of Unit 2 to the upper half of the Akavassian regional stage and probably the basal portion of the Askynbashian regional stage. The same assemblage is present in the displaced limestone block of Unit 2a, which occurs higher in the sections than the shale of Unit 4 (Figure 3). The block includes a diverse sample of species of *Pseudostaffella* and abundant *Eostaffella* and *Archaediscidae* (samples A150-A160). The lower portion of the block (samples A144 and A148) contains a younger foraminiferal assemblage, in which *Pseudostaffella* is associated with a new occurrence of *Profusulinella, Ozawainella,* and early species of *Aljutovella.* This assemblage is characteristic of the uppermost Bashkirian and implies that the overturned position of the limestone block of Unit 2a originated between Units 4 and 5. The fusulinid assemblages in the lower and upper portions of the limestone block of Unit 2a suggest a hiatus that corresponds to the Tashastinian regional stage of the Urals. Because of the tectonic nature of this block, however, we cannot exclude additional complications within it. A stratigraphic unconformity between Unit 2 and Unit 3 is quite possible, as the upper Bashkirian is missing. However, the possibility of tectonic contact between Units 2 and 3 cannot be excluded.

The presence of *Neostaffella* and the relatively derived *Ozawainella, Aljutovella, Profusulinella* indicates a Moscovian age of Unit 3. The species composition within this unit is characteristic of the upper Vereian-lower Kashirian of the lower Moscovian in the East European platform. Similar assemblages occur in the lower portion of Unit 4 (samples A120 and A121) of the Anarak section and the lower half of Unit 5 of the Zaladu section. The upper part of Unit 4 is correlated to the Kashirian Regional stage by the presence of the earliest *Putrella* (sample A139).

Abundant *Putrella* were also found in Unit 5 (samples A175, A183, and A184). More derived forms of the genus suggest a younger age of the enclosing deposits. *Putrella* is associated with the earliest *Fusulinella*, i.e., the subgenus *F. (Moellerites)* (sample A184), earliest *Beedeina*, and highly derived *Neostaffella* (*N. syzranica* type). The entire set of genera and species is characteristic of the interval from the upper Kashirian Regional stage of the lower Moscovian through lower Podolian Regional stage of upper Moscovian. The uppermost part of Unit 5 contains sparse foraminifers. Derived forms of *Fusiella,* such as *F. typica* and *F. paradoxa,* as well as poorly preserved specimens resembling *Fusulina*, are typical of the Myachkovian Regional stage of the Moscovian Stage, but an older age cannot be excluded.

In summary, we recognize a great similarity between the Zaladu and Anarak sections. Both sections of the Sardar Group consist predominantly of carbonate in the lower Ghaleh Formation and of siliciclasts in the upper part Absheni Formation. The Ghaleh Formation is restricted to the Bashkirian and the Absheni Formation to the Moscovian. The Sardar Group is bounded by unconformities in both Ozbak-Kuh and Anarak areas. An indication of unconformity between Ghaleh and Absheni Formations, however, was not documented in the field.

Although similar in several ways, the two formations differ in certain details, especially those concerning the age of the Ghaleh Formation (Figure 2). In the Zaladu section, the uppermost part of Unit 4, is correlated with the Akavassian Regional stage of the Urals. In the Anarak section, however, the Akavassian fusulinids appear at the base of limestone of Unit 2. This implies a possible correlation of Unit 1 and the underlying limestone of the Anarak section and Units 1,2,3 and major part of 4 of the Ghaleh Formation in the Zaladu section to the lower Bashkirian (Syuranian *s.l.* Substage). There is no paleontological evidence, however, to confirm this suggestion.

The data presented above show that the uppermost portion of Unit 2 in the Anarak section is related to the lower portion of the Askynbashian Regional stage of the Bashkirian. If our hypothesis that the displaced limestone block 2a belongs to Unit 2 is correct, then the top of the Ghaleh Formation in the Anarak section, where the upper half of the Bashkirian falls into the hiatus between Ghaleh and Absheni Formations, is younger than in the Zaladu section.

The Absheni Formation in both sections is Moscovian in age. The lower part of the Formation in both sections includes beds attributable to the upper Vereian-Kashirian of the lower Moscovian. The topmost part of the shale (i.e., the upper part of the formation) can be assigned to the upper Moscovian. However, this assignment has not been confirmed by reliable paleontological evidence.

## CORRELATION AND PALEOGEOGRAPHIC INFERENCES

Until now Bashkirian and Moscovian deposits had been recognized in Eastern Iran, the eastern part of Central Iran, and eastern Alborz (Figure 4). Beyond these regions, these rock units were either not deposited or were eroded away during the Late Pennsylvanian (Kasimovian-early-middle Gzhelian) and Early Permian (late Sakmarian) marine regressions (Leven and Taheri 2003). Bashkirian-Moscovian strata also occur in other areas of Central Iran (Abadeh area) where they underlie the Asselian-Sakmarian Vazhnan Formation and contain the Moscovian fusulinid *Ozawainella mosquensis* (Baghbani 1993). Although no details on the Moscovian in the Abadeh area are known.

The Bashkirian and Moscovian deposits of eastern Alborz have received thorough biostratigraphic characterization (Jenny et al. 1978; Lys et al. 1978; Varchard 1996). The deposits constitute the Bagherabad and Gheselghaleh formations. The former is mainly composed of varying limestone up to 260 m thick. Only the upper 30-40 m of the limestone is related to the Bashkirian. Laterally, this portion is substituted by the lower beds of the Gheselghaleh Formation (G1) and overlain by higher beds of this formation (G2). The Gheselghaleh formation is 242 m thick and consists of bioclastic limestone, sandstone, and marl. Upwards in the section, Gheselghaleh Formation is replaced by sandstone and limestone of the Dorud Formation (Asselian in age, although the basal most strata of Dorud Formation could be late Gzhelian).

Comparative analysis of the sections reported here and the eastern Alborz section shows their great similarity. The Sardar Group and Gheselghaleh formations both are represented by shallow-water carbonate and carbonate-siliciclastic deposits of approximately equal thicknesses. They lie on predominantly Devonian-Lower Carboniferous, carbonate deposits and below the uppermost Gzhelian-Asselian transgressive deposits (the Zaladu and Dorud formations). A significant stratigragraphic hiatus exists between the Moscovian and the latest Gzhelian-Asselian. In all three regions the Bashkirian-Moscovian sequences are well characterized by foraminifers, including fusulinids, the fossil group that provides precise interregional correlations. The eastern Alborz foraminiferal biostratigraphy was reported by Bozorgnia (1973), Lys et al. (1978), and Vachard (1996). In the Bashkirian through the Moscovian interval, Lys et al. (1978) established several foraminiferal zones, which were slightly modified by Vachard (1996). Figure 4 shows the strong correlation of these zones to the foraminiferal zones in the Zaladu and Anarak sections. Some discrepancies exist because the eastern Alborz section is not known as well as the others. Another feature common to all sections in these regions is the poor foraminiferal content of upper Moscovian deposits.

Well-exposed Bashkirian and Moscovian sequences in the regions bordering Iran on the west occur only in Turkey. In eastern Taurus, there is a para-autochthonous occurrence represented by sandstone and bioclastic foraminiferal limestone blocks nearly 100 m thick. Seven fusulinid zones were established for this interval (Altiner 1981). In western Taurus, in the Hadim-Tashkent area, Bashkirian-Moscovian deposits occur in the Aladag and Bolkar Dagi nappes. Here they are represented by Mantar Tepe Beds (quartzitic sandstone and bioclastic, oolitic and micritic limestone, 250 m thick) of the Yaricak Formation where eight fusulinid zones were established (Altiner and Özgül 2001). The highly fossiliferous Taurus sections can readily be correlated with the Iranian sections (Figure 4). The Bashkirian-Moscovian deposits are likely widespread in the Anatolia region of Turkey, as suggested by the occurrence of corresponding foraminifers in limestone blocks of the Karakaya Complex (Leven and Okay 1996), however, no sections suitable for study have been discovered there.

In Afghanistan, just east of the Iranian border, Bashkirian-Moscovian deposits have a restricted distribution and are poorly studied. Reliably dated foraminiferal facies are only known in northern Afghanistan. In the province, Fariab, in the Maimana area and in Firuzkoh Ridge, north of the Herirud River, Pennsylvanian strata are exposed below thick red deposits from the Upper Carboniferous-Permian. Bashkirian-Moscovian strata also occur on the northern slope of western Hindu-Kush in the Sourkhob River basins (Dronov 1980). These strata are represented by a 200 m limestone sequence that unconformably overlies pre-Carboniferous deposits and is overlaid by a lower Permian flysch. These exposures have not been studied and therefore cannot be correlated.

Vachard (1980, 1996) correlated the Carboniferous sequences of the Tabas area to those of Central Afghanistan and the eastern Alborz section to the Band-e-Bayan Ridge sequences in the north Afghanistan. These correlations are problematic, however, because they are not substantiated by direct evidence. The Serpukhovian-Gzhelian deposits of the Tabas section were correlated to those of the Bokan section of Central Afghanistan on the basis of their siliciclastic lithology and almost absolute absence of fossils. Vachard's correlations seemed to be valid because the Sardar Group had not received adequate paleontological characterization. Presently, rich foraminiferal assemblages are known to occur throughout the Sardar Group; these occurrences lend no support to Vachard's hypothesis. There is less evidence to correlate the Alborz section to the Band-e-Bayan sections. In these locations the Bashkirian-Moscovian deposits either cannot be distinguished from the virtually barren, thick shaly Siakhkoh Formation (as in the Khodja Murod and Karganau tectonic zones) or they are completely missing as in the Khaftkala tectonic zone (Dronov 1980; Leven 1997).

The statement above contradicts the paleoreconstruction of the Iran-Afghanistan territory of Central Asia proposed by Vachard (1980, figure 56; and 1996). According to this reconstruction, Eastern Iran was confined to the western part of a narrow "Sinus Tezakien" bay, which was connected somewhere in the east of the Pamirs with the Sinus Tethysien parallel basin in the southern margin of which existed the Alborz Basin. This supports the hypothesis that Eastern Iran was isolated from Alborz by a wide stretch of land in Central Iran. In light of the new data presented in this paper, Vachard's reconstruction is likely no longer correct. The Bashkirian-Moscovian sections of Alborz and Eastern Iran are in every respect alike. It is evident that these regions were located within a single basin. This basin can also be correlated with the Taurus and Anatolia basins in the west, Central Asia in the east, and basins of the Donets, Russian platform, and Urals in the north (Davoudzadeh and Weber-Diefenbach 1987). This hypothesis is supported by the non-endemic character of the Iranian foraminiferal assemblages throughout Bashkirian-Asselian time. The differences in diversity can be attributed to more complete taxonomic studies in the Russian sections. The Eastern Iranian basins might have been connected with basins that existed in Afghanistan territory, but additional studies are required to confirm this linkage.

## SYSTEMATIC PALEONTOLOGY

Genus *PROFUSULINELLA* Rauser-Chernousova and Beljaev 1936

*Profusulinella pseudoparva* n. sp.

Figures 11.2, 11.3, 12.3

**Holotype.** GIN 4777/128. Axial section; Anarak, Absheni Formation, Unit 4; Carboniferous, Pennsylvanian, lower Moscovian.

**Material.** 6 axial and 5 tangential sections.

**Description.** Shell minute, inflated fusiform to subellipsoidal, with bluntly rounded poles. Mature specimens possess 4 to 6 volutions and measure from 0.9 to 1.25 mm in length and from 0.63 to 0.8 mm in diameter; form ratio 1.43-1.56. Early 1-1.5 volutions subdiscoidal to spherical and occasionally coiled at large angles to the coiling axis of following volutions. Coiling uniform but rather loose. Spirotheca composed of tectum, lower tectorium and indistinct upper tectorium 0.015 mm thick in outermost volution. Septa are thin. Septal fluting poorly developed in polar regions. Proloculus spherical, its outer diameter 0.07 mm. Tunnel rather narrow, about half as high as chambers. Chomata massive and wide.

**Discussion.** The species described closely resembles *Profusulinella parva* (Lee et al. 1930) but differs from the latter in having a more elongate shell and a more massive chomata. It is similar to *P. copiosa* (Thompson 1948) but differs from the latter in having a narrower tunnel and a more massive chomata.

**Stratigraphic range**. Carboniferous, Pennsylvanian, lower Moscovian.

**Occurrence.** Iran, Zaladu section, Absheni Formation, Unit 5, samples Z209, Z249; Anarak section, Absheni Formation, Unit 4, sample A120.

Genus *ALJUTOVELLA* Rauser-Chernousova 1951

*Aljutovella stocklini* n. sp.

Figures 13.5, 13.6, 14.4, 14.5

**Etymology.** The species named in honor of the outstanding investigator of Iranian geology Professor J. Stöcklin.

**Holotype.** GIN 4777/147. Axial section; Iran, Zaladu section, Absheni Formation, Unit 5; Carboniferous, Pennsylvanian, lower Moscovian.

**Material.** 8 axial and subaxial sections.

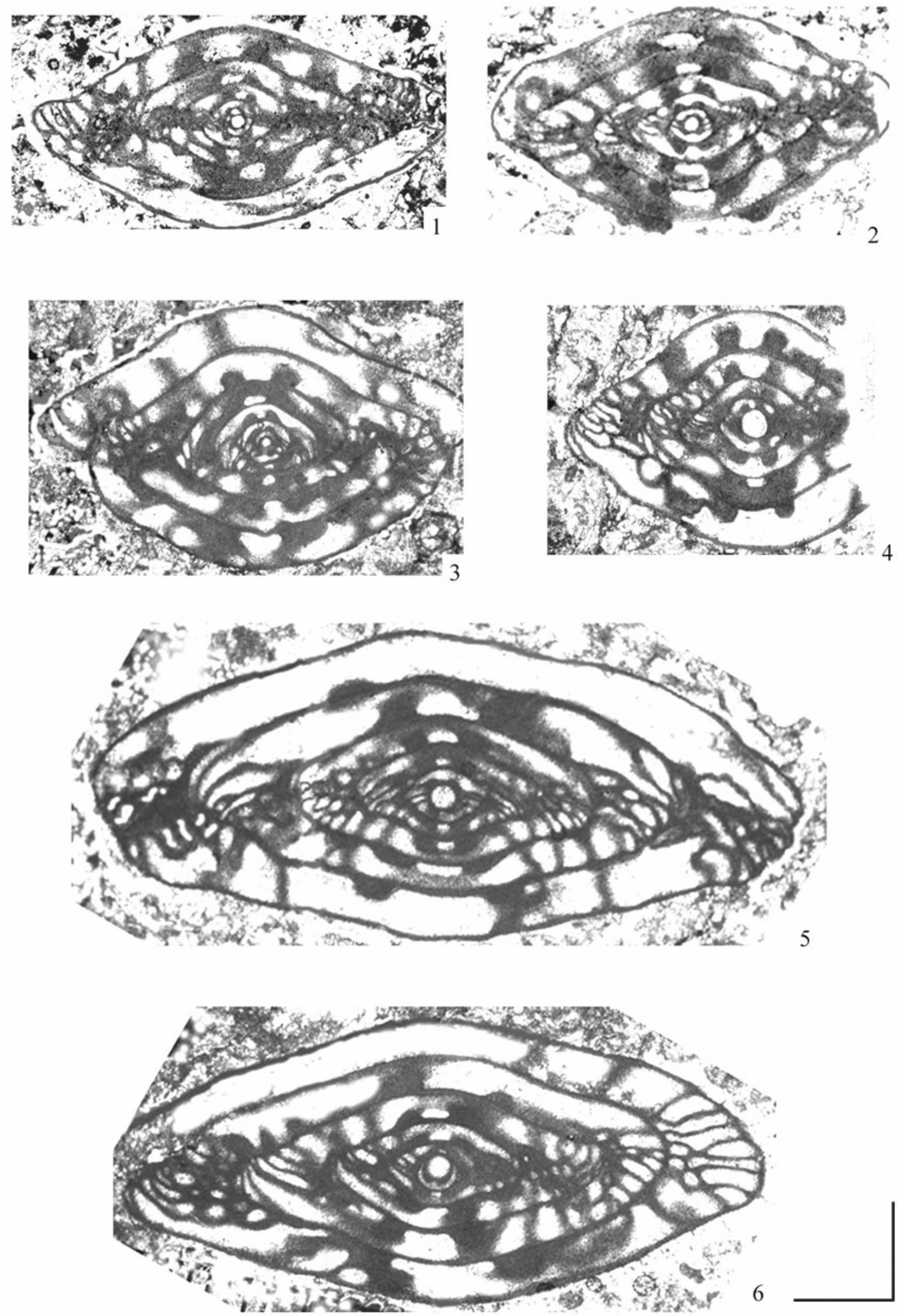


**Figure 13. 1-6.** *Aljutovella* species. **1, 2.** *Aljutovella artificialis* Leontovich, scale-bar == 0,5 mm; 1 – axial section, sample Z220 (GIN 4777/144); 2 – axial section, sample A108 (GIN 4777/145); **3, 4.** *Aljutovella tumida* Bensh, scale-bar = 0,5 mm; 3 – axial section, sample A120 (GIN 4777/112b); 4 – axial section, sample A108 (GIN 4777/146); **5, 6.** *Aljutovella stocklini* Leven and Davydov, n. sp., scale-bar = 0,5 mm; 5 – axial section (holotype), sample Z227 (GIN 4777/147); 6 – axial section, sample Z227 (GIN 4777/148).

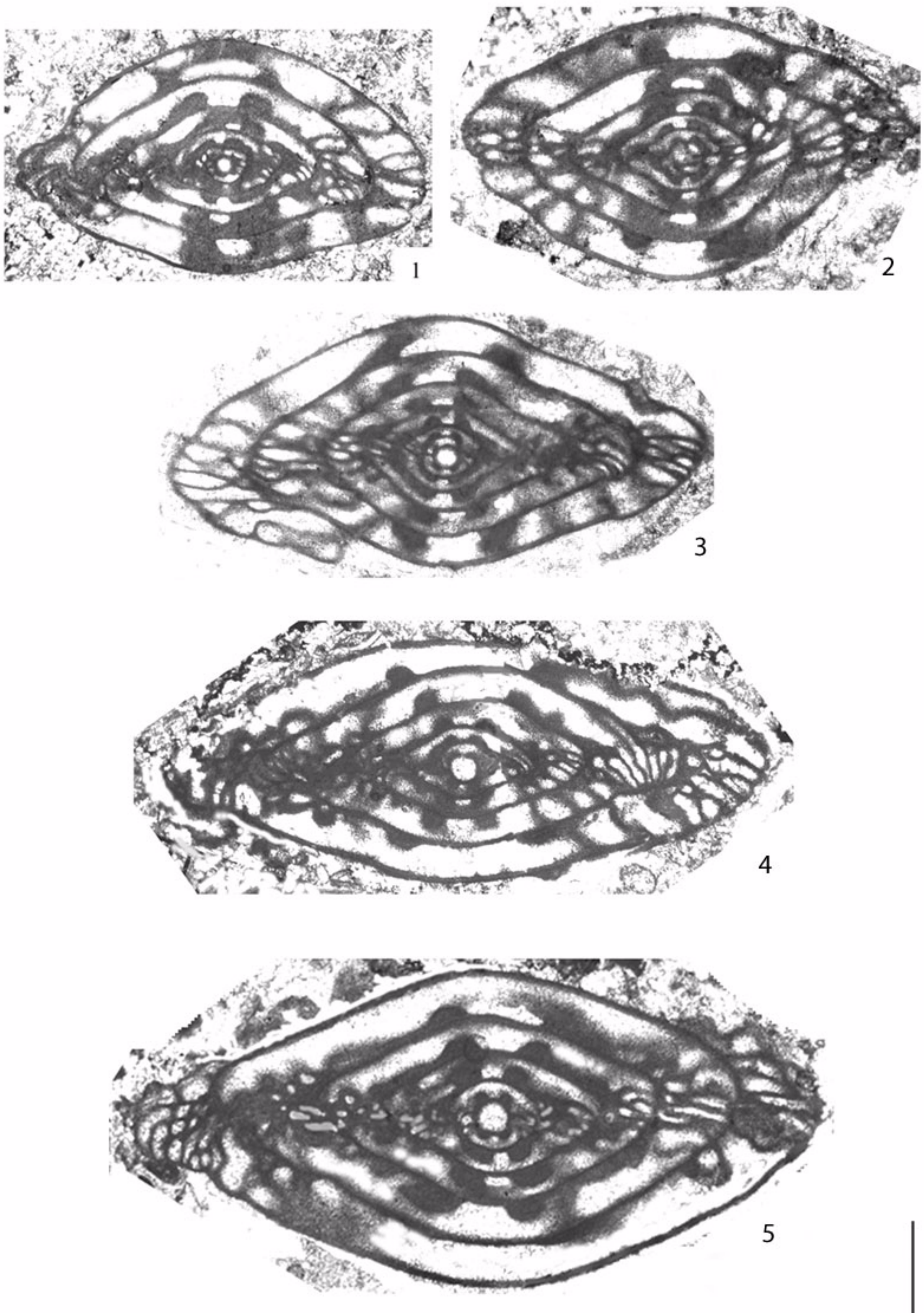


**Figure 14. 1-5.** Fusulinida species. **1-3.** *Aljutovella cafirniganica* Bensh, scale-bar = 0,5 mm; 1 – axial section, sample A120 (GIN 4777/149); 2, 3 – subaxial sections, sample Z227 (GIN 4777/150); **4, 5.** *Aljutovella stocklini* Leven and Davydov, scale-bar = 0,5 mm; 4 – axial section, sample Z227 (GIN 4777/151); 5 – axial section, sample Z227 (GIN 4777/152).

**Description.** Shell moderate in size, fusiform to inflate fusiform with straight to slightly convex lateral slopes and bluntly pointed poles. Mature specimens of 4.5 to 5 volutions and measure 3.0 to 3.6 mm in length and 1.3 to 1.6 mm in diameter; form ratio 2.15 to 2.4. Spirotheca composed of tectum and protheca (lower tectorium); poorly developed upper tectorium occurs only in the two early volutions. Septa thin, nearly plain, except for slight folding near the poles. Proloculus moderate in size; its outer diameter 0.10 to 0.17 mm. Tunnel moderately wide, except the last volution where it is very wide, about half as high as corresponding chambers. Chomata narrow, rounded, about half as high of chambers.

**Discussion.** *Aljutovella stocklini* most closely resembles *Al. cafirniganica* (Bensh 1969) but differs from the latter in fewer, but larger volutions, more rounded poles, and a less well developed upper tectorium in the early volutions. *Aljutovella stocklini* also possess slightly convex lateral slopes, whereas the lateral slopes of *Al. cafirniganica* are straight or slightly concave.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower Moscovian.

**Occurrence.** Iran, Zaladu section, Absheni Formation, Unit 5, sample Z227.

*Aljutovella iranica* n. sp.
Figures 15.4, 16.1, 16.2

**Etymology.** The species name is derived from Iran.

**Holotype.** GIN 4777/157. Axial section. Iran, Zaladu section, Absheni Formation, Unit 5; Carboniferous, Pennsylvanian, lower Moscovian.

**Material.** 4 axial sections.

**Description.** Shell moderate in size possesses inflated fusiform shape, with straight to slightly convex lateral slopes and bluntly pointed poles. Mature specimens of 5 to 6 volutions measured 2.5 to 3.1 mm in length and 1.45 to 1.75 mm in diameter; form ratio 1.65 to 1.7. Spirotheca composed of tectum and protheca; poorly developed upper tectorium occurs only in two early volutions. Septa thin, wavy across length of shell and gently folded near the poles. Proloculus of medium size; its outer diameter 0.08 to 0.10 mm. Tunnel narrow in the early volutions and wide in the outer ones. Chomata narrow and low.

**Discussion.** *Aljutovella iranica* is most like *Aljutovella postaljutovica* (Safonova 1951; Rauser-Chernousova et al. 1951) but differs from the latter in having a less well- developed chomata, loosely coiled volutions, and a larger size of corresponding volutions. *Aljutovella iranica* differs from *Al. cafirniganica* (Bensh 1969) and *Al. stocklini* in having a more inflated and rounded shell, a less well-developed chomata, and more folded septa.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower Moscovian.

**Occurrence.** Iran, Zaladu section, Absheni Formation, Unit 5, samples Z219 and Z220.

*Aljutovella gorgiji* n. sp.
Figures 16.3, 16.4

**Etymology.** The species is named in honor of Dr. M.N. Gorgij, who studied the Zaladu section and collected fusulinid samples there.

**Holotype.** GIN 4777/157. Axial section. Iran, Zaladu section, Absheni Formation, Unit 5; Carboniferous, Pennsylvanian, lower Moscovian.

**Material.** 3 axial and 4 subaxial and tangential sections.

**Description.** Shell moderate in size, fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles. Mature shells of 4.5 to 5 volutions are measured as 2.6 to 2.75 mm in length and 1.2 to 1.25 mm in diameter; form ratio of 2.1 to 2.25. Spirotheca are composed of tectum, lower and upper tectoria in the early volutions and tectum and protheca in the late ones. Septa are thin and nearly in one plane across the middle of the shell or gently folded near poles. Proloculus is relatively large, its outer diameter 0.08 to 0.125 mm. Tunnel is wide and low throughout. Chomata are small and rounded.

**Discussion.** The species described is greatly similar to the forms reported as *Aljutovella* ex gr. *Al. distorta* (Leontovich 1951) from the Bashkirian-Moscovian boundary beds of Asturias, Spain (Granados et al. 1985). It is distinguished from *Al. distorta* by having an inflated shell, larger shell dimensions, less pronounced chomata, and a wider tunnel. *Aljutovella gorgiji* differs from *Al. iranica* in having a more elongate shell and straighter septa in the middle part of the shell. Unlike *Al. stocklini*, *Al. gorgiji* is smaller, more elongate, has a less massive chomata, and wavier septa.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower Moscovian.

**Occurrence.** Iran, Zaladu section, Absheni Formation, Unit 5, sample Z220.

*Aljutovella* sp. 1
Figures 16.5-16.8

**Material.** 18 axial and subaxial sections.

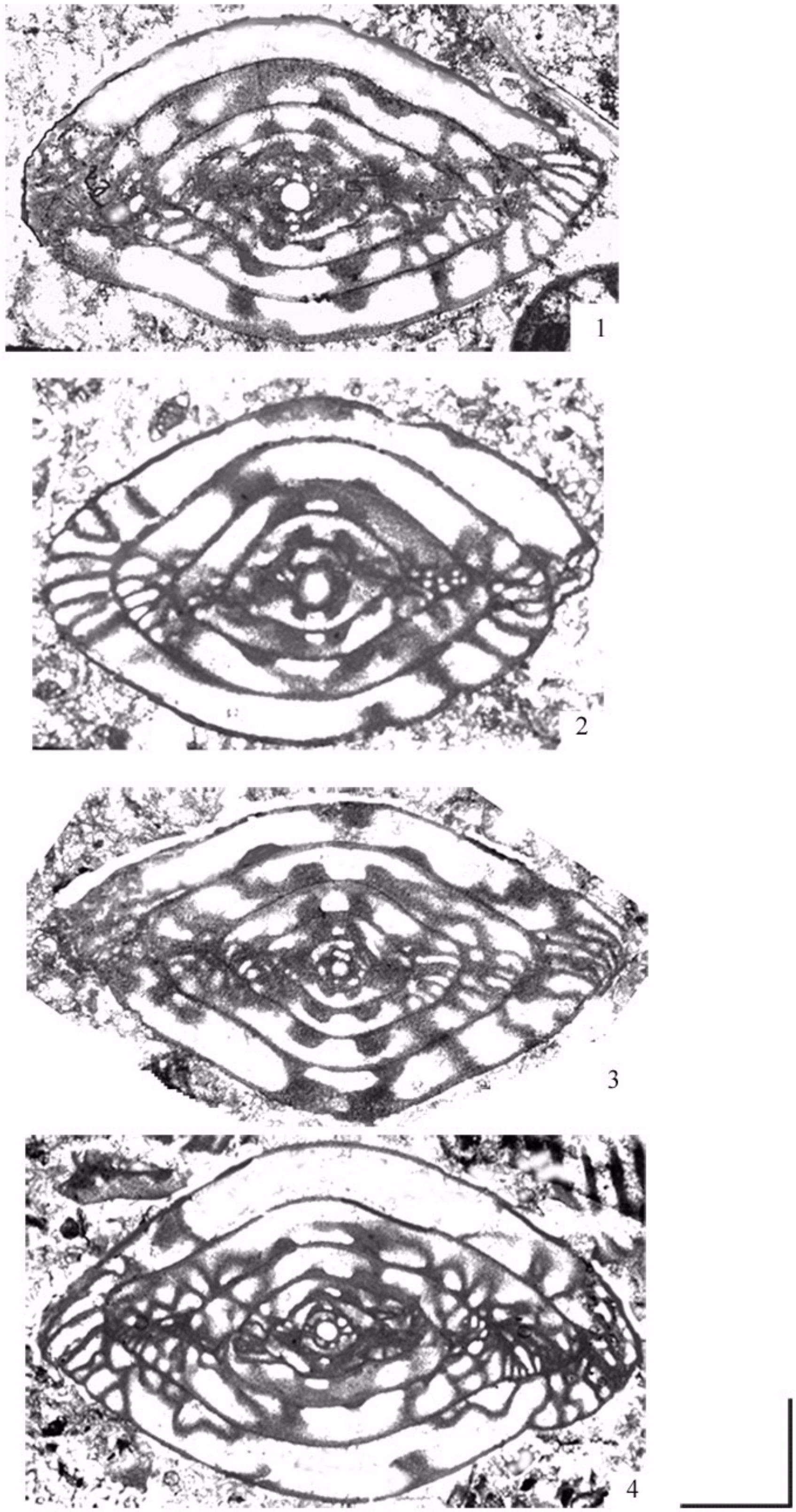

**Figure 15. 1-4.** *Aljutovella* species. **1, 2.** *Aljutovella priscoidea* (Rauser-Chernousova), scale-bar = 0,5 mm; 1 – axial section, sample Z209 (GIN 4777/153); 2 – axial section, sample Z227 (GIN 4777/154); **3.** *Aljutovella cybaea* Leontovich, scale-bar == 0,5 mm; axial section, sample Z288 (GIN 4777/155); **4.** *Aljutovella iranica* Leven and Davydov, n. sp., scale-bar = 0,5 mm; axial section, sample Z220 (GIN 4777/129).

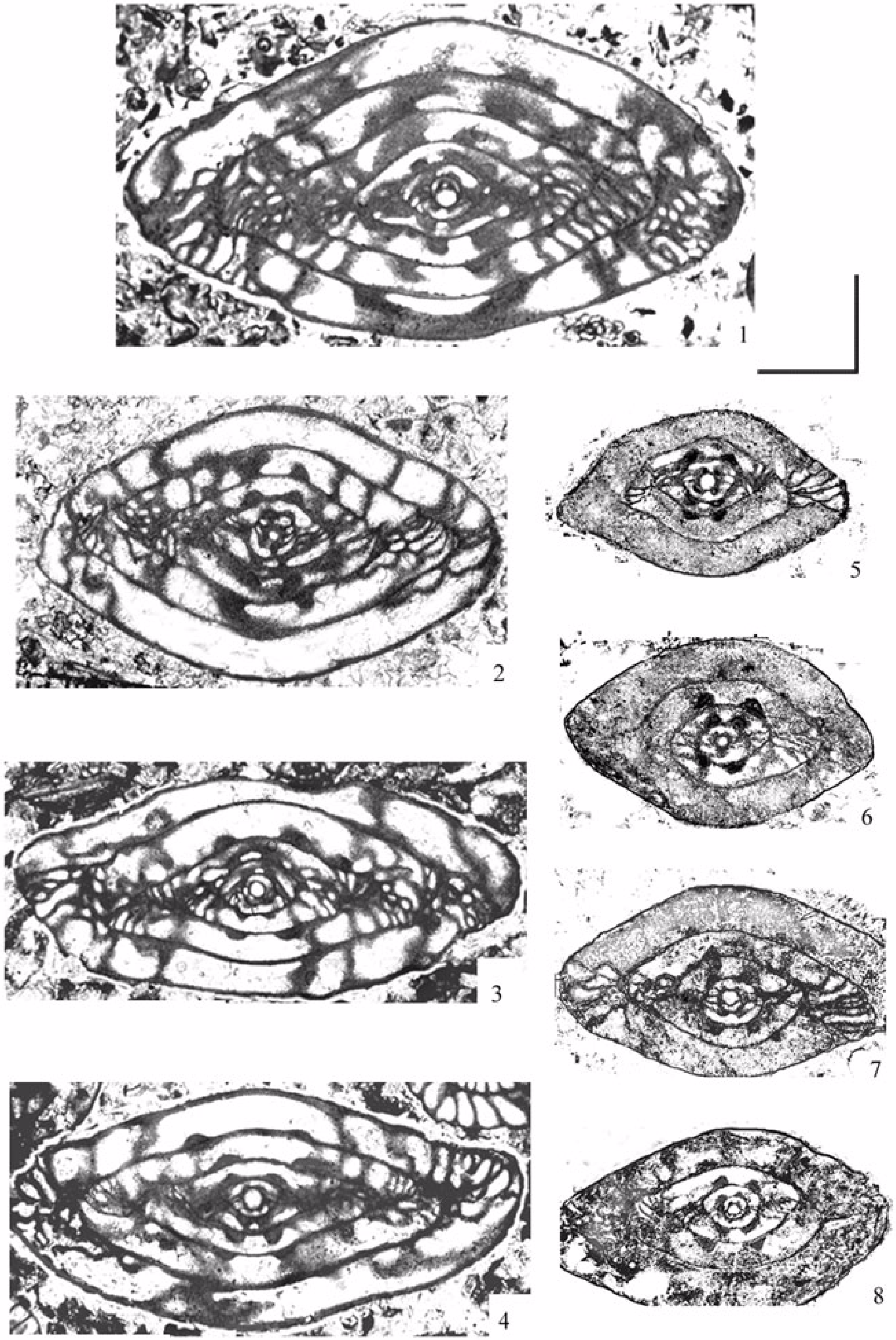


**Figure 16. 1-8.** *Aljutovella* species. **1, 2.** *Aljutovella iranica* Leven and Davydov, scale-bar = 0,5 mm; axial section (holotype), sample Z220 (GIN 4777/157); 2 – axial section, sample Z219 (GIN 4777/4b); **3, 4.** *Aljutovella gorgiji* Leven and Davydov, n. sp., scale-bar = 0,5 mm; 3 – axial section (holotype), sample Z220 (GIN 4777/158); 4 – axial section, sample Z220 (GIN 4777/159); **5-8.** *Aljutovella* sp. **1,** scale-bar = 0,5 mm; 5 – axial section, sample Z191 (GIN 4777/160); 6 – axial section, sample Z191 (GIN 4777/161); 7 – axial section, sample Z191 (GIN 4777/162); 8 – axial section, sample Z191 (GIN 4777/163).

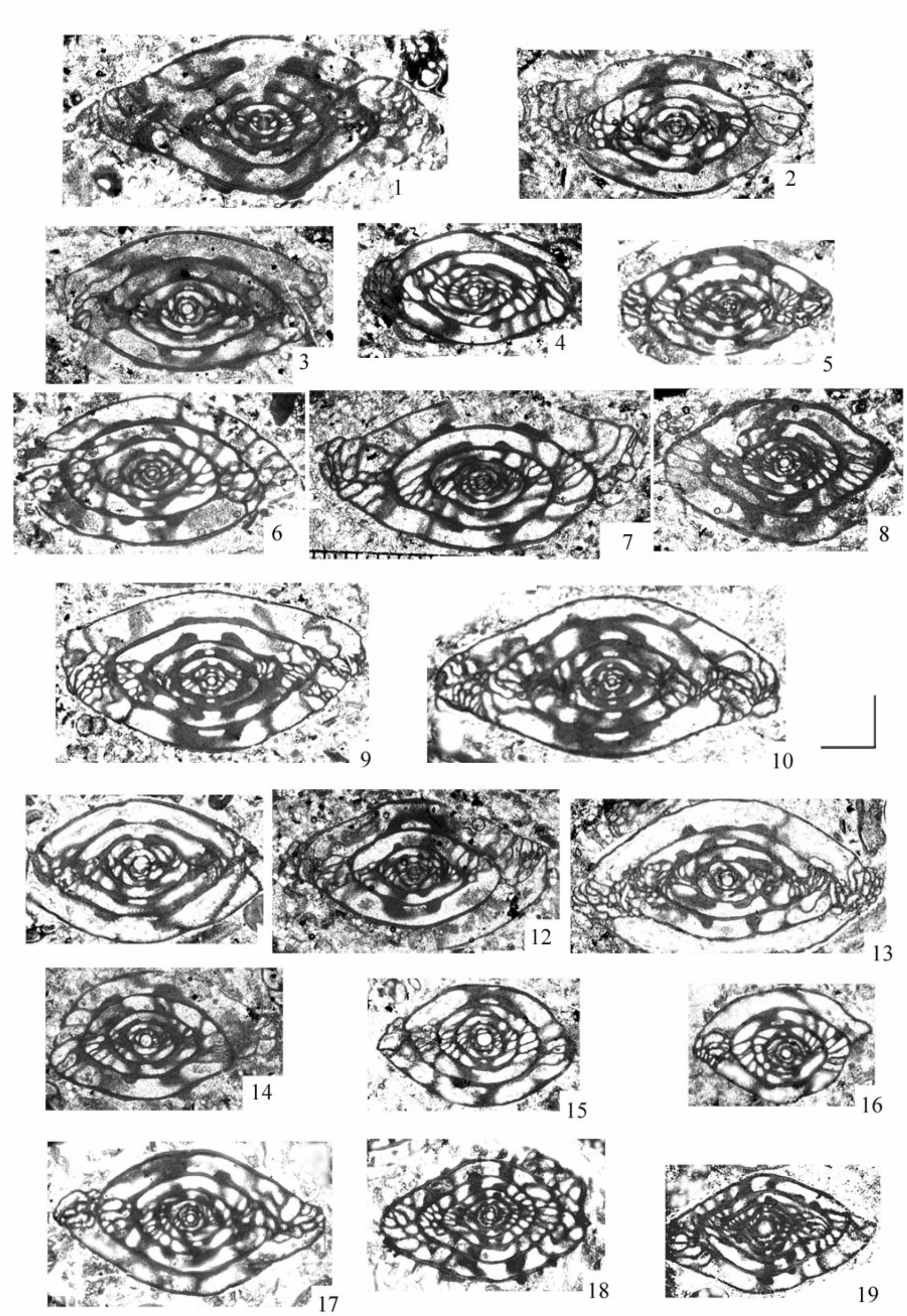


**Figure 17. 1-19.** *Fusulinella* species. **1, 8-13.** *Fusulinella (Moellerites) bockiformis* Bogush, scale-bar = 0,5 mm; 1 – axial section, sample A183 (GIN 4777/164); 8 – sudaxial section, sample A183 (GIN 4777/165a); 9 – axial section, sample A183 (GIN 4777/166); 10 – axial section, sample A183 (GIN 4777/167); 11 – axial section, sample A183 (GIN 4777/168); 12 – axial section, sample A183 (GIN 4777/169); 13 – axial section, sample A183 (GIN 4777/170); **2-7.** *Fusulinella (Moellerites) praebocki* Rauser-Chernousova, scale-bar = 0,5 mm; 2 – subaxial section, sample A183 (GIN 4777/171); 3 – axial section, sample A183 (GIN 4777/37b); 4 – axial section, sample A183 (GIN 4777/172), 5 – axial section, sample A184 (GIN 4777/24b); 6 – axial section, sample A183 (GIN 4777/173a); 7 – axial section, sample A183 (GIN 4777/174); **14-16.** *Fusulinella (Moellerites)* aff. *globulse* (?) Sosnina, scale-bar = 0,5 mm; 14 – subaxial section, sample A183 (GIN 4777/175); 15 – subaxial section, sample A183 (GIN 4777/165b); 16 - subaxial section, sample A184 (GIN 4777/176); **17.** *Fusulinella (Fusulinella)* sp. **1**, scale-bar = 0,5 mm; axial section, sample A184 (GIN 4777/133); **18, 19.** *Fusulinella (Fusulinella)* aff. *subpulchra contracta* Villa, scale-bar = 0,5 mm; 18 – subaxial section, sample A184 (GIN 4777/177); 19 – subaxial section, sample A184 (GIN 4777/101b).

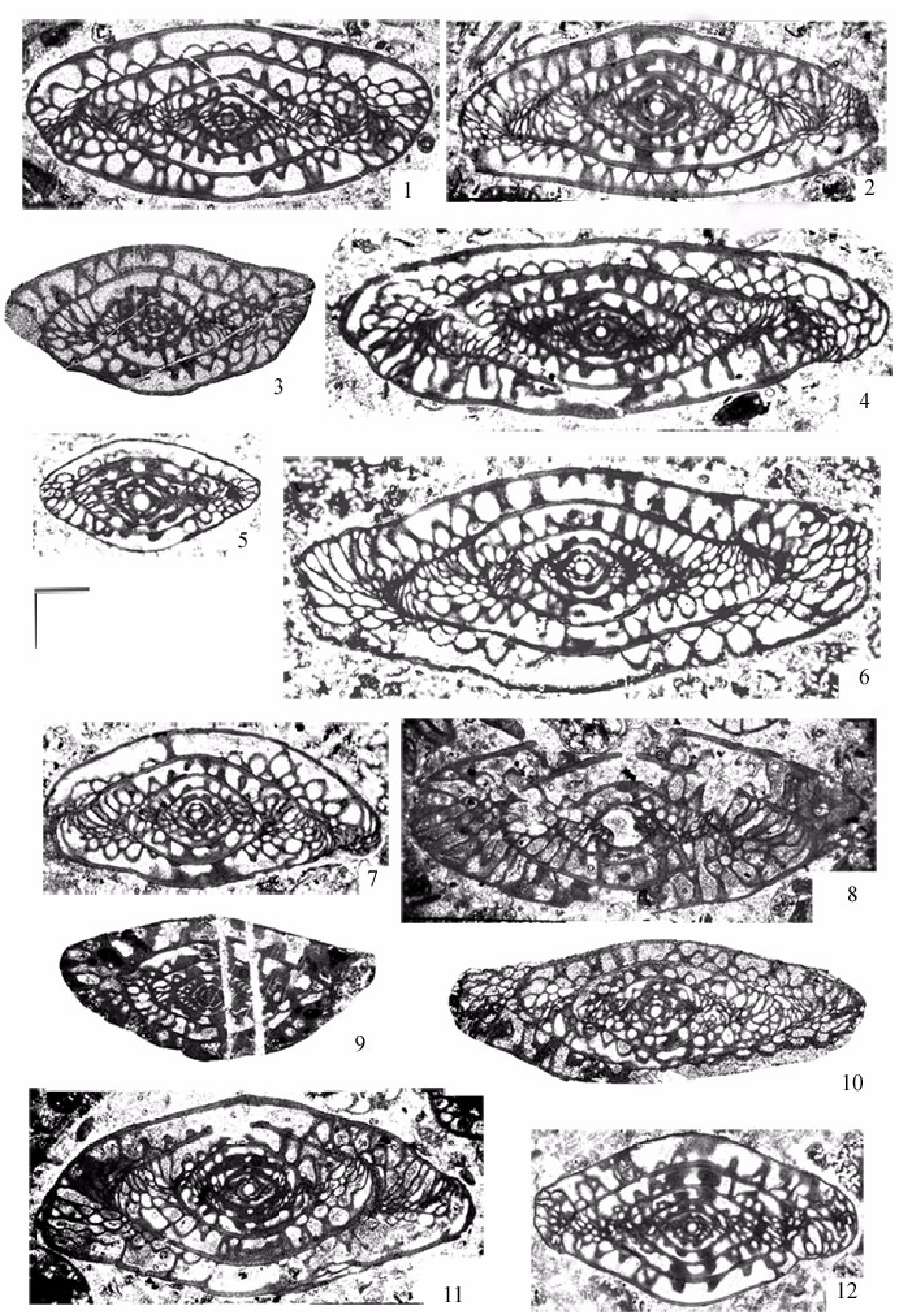

**Figure 18. 1-11.** *Putrella* and *Beedeina* species. **1, 2, 4, 6, 7.** *Putrella persica* Leven and Davydov, n. sp., scale-bar = 0,5 mm; 1 – axial section, sample A183 (GIN 4777/6b); 2 – axial section (holotype), sample A183 (GIN 4777/39b); 4 – axial section, sample A183 (GIN 4777/178); 6 – axial section, sample A183 (GIN 4777/173b); 7 – axial section, sample A183 (GIN 4777/179); **3, 10.** *Putrella* aff. *donetziana* (Lee), scale-bar = 0,5 mm; 3 – axial section, sample Z244 (GIN 4777/181); 10 – axial section, sample Z244 (GIN 4777/183); **5, 12.** *Beedeina bona anarakensis* Leven and Davydov, n. subsp., scale-bar = 0,5 mm; 5 – axial section, sample A184 (GIN 4777/2e); 12 – axial section (holotype), sample A184 (GIN 4777/184); **8.** *Putrella* sp.**1**, scale-bar = 0,5 mm; axial section, sample A183 (GIN 4777/180; **9,** *Putrella* ? sp., scale-bar = 0,5 mm; 9 – axial section, sample A-139 (GIN 4777/182); **11.** *Putrella* sp. **2**, scale-bar = 0,5 mm; axial section, sample A183 (GIN 4777/185).

**Description.** Shell fusiform to inflated fusiform, with slightly convex to slightly concave lateral slopes and bluntly pointed poles. Mature specimens of 4 to 5 volutions measured as 1.72 to 2.87 mm in length and 1.0 to 1.43 mm in diameter; form ratio 1.66 to 2.2. Volutions coiled loosely throughout beginning from the second volution. Spirotheca thin, its outermost volution reaches 0.02 to 0.03 mm. Septa is thin, nearly in one plane across the middle of shell, and gently folded near poles. Proloculus relatively large, its outer diameter 0.08 to 0.25 mm. Tunnel is moderately wide, about half as high as chambers. Chomata is narrow, about half as high as chambers.

**Remark.** Due to poor preservation, we hesitate to consider specimens to represent a new species. These specimens are distinguished from all known *Aljutovella* species, by a very loose, irregular spiral coiling and variable shape of the shell. They are most like *Aljutovella subaljutovica* (Rauser-Chernousova et al. 1951) but differ from the latter in having a more rounded shell, fewer volutions, and an irregular spiral coiling.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower Moscovian.

**Occurrence.** Iran, Zaladu section Absheni Formation, Unit 5, sample Z191.

Genus *FUSULINELLA* Möeller 1877
Fusulinella (*Fusulinella*) sp. 1
Figure 17.17

**Remarks.** The single specimen described is close to *Fusulinella (Moellerites) bockiformis* (Bogush 1963), but a greater developed diaphanotheca allows it to be attributed to the subgenus *Fusulinella (Fusulinella)* (Möeller 1877). In addition, this specimen has a more inflated shell than *Fusulinella (M.) bockiformis*, which is nearly spherical in the early volutions. This fusilinid may represent a new species, however, limited material prevents us from naming it at this time.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower part of the upper Moscovian.

**Occurrence.** Iran, Anarak section, Absheni Formation, Unit 5, sample A184.

Genus *PUTRELLA* Rauser-Chernousova 1951
*Putrella persica* n. sp.
Figures 18.1, 18.2, 18.4, 18.6, 18.7.

**Etymology.** The species name derived from ancient name of Iran – Persia.

**Holotype.** GIN 4777/39. Axial section; Iran, Anarak section, Absheni Formation, Unit 5; Carboniferous, Pennsylvanian, lowermost part of upper Moscovian.

**Material.** 14 axial sections.

**Description.** Shell large, inflated fusiform to elongate fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles; first one or twovolutions often subrhomboidal. Mature specimens of 5 volutions measured as 3.5 to 5.5 mm in length and 1.4 to 2.0 mm in diameter; form ratio 2 to 2.94. Thick spirotheca composed of tectum and protheca; wall penetrated by very fine, but prominent pores; upper tectorium occasionally present in one or two early volutions. Thickness of the spirotheca in two late volutions varies from 0.04 to 0.06 mm. Thin septa intensely and relatively regularly fluted from pole to pole. Proloculus spherical; its outer diameter 0.1 to 0.17 mm. Tunnel narrow in the early volutions and wide in the ones that follow. Massive chomata present in two early volutions.

**Discussion.** *Putrella persica* closely resembles *Putrella brazhnikovae fusiformis* (Putrja 1948) but is distinguished from the latter by having more inflated early volutions, less regular septal fluting, and more massive and wider chomata in the early volutions. The most elongate specimens of *Putrella persica* sp. nov. resemble *P. brazhnikovae brazhnikovae* (Putrja 1948), but differ from the latter in a slower rate of shell lengthening throughout the shell, more regular coiling of volutions, and stronger, more regular septal fluting. The other difference is that *Putrella persica* possess three-layered spirotheca in the early volutions, in contrast to four-layered spirotheca with diaphanotheca in the early volutions of *P. brazhnikovae. Putrella persica* differs from *P. admiranda* (Leven 1998) by less regular septal fluting and more compact coiling of the early volutions.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower part of upper Moscovian.

**Occurrence.** Iran, Anarak section, Sardar 2 Subformation, Unit 5, samples A183 and A184.

*Putrella* sp. 1
Figure 18.8

**Material.** 1 axial section.

**Description.** Shell moderately large, inflate fusiform, with slightly convex lateral slopes and bluntly rounded poles. Mature shells have only 3.5 loosely coiled volutions and measure 4.5 mm in length and 1.85 mm in diameter; form ratio 2.4. Spirotheca composed of tectum and thick (0.4 mm) protheca. Septa thin and very irregularly fluted from pole to pole except for the tunnel area. Septal folds are high. Proloculus is very large, its outer diameter

0.06 mm. Tunnel low and wide throughout. Very small chomata present only on proloculus.

**Discussion.** *Putrella* sp. 1 differs from all known *Putrella* species in large proloculus and loosely coiled volutions. The specimen most probably represents a new species, but due to limited material we cannot diagnose it at this time.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower part of upper Moscovian.

**Occurrence.** Iran, Anarak section, Absheni Formation, Unit 5, sample A183.

*Putrella* sp. 2
Figure 18.11

**Material.** 1 axial section.

**Description.** Shell is large, inflated fusiform, with straight or slightly convex lateral slopes and bluntly pointed poles. Mature specimens have six volutions, the early four of which are tightly coiled; coiling of last two volutions looser. Spirotheca composed of tectum and thick protheca; thickness of spirotheca in outer volution 0.056 mm. Septa thin, irregularly fluted from pole to pole except for the tunnel area. Septal folds low to very low. Proloculus of moderate size; its outside diameter 0.125 mm. Tunnel very narrow and high in tightly coiled early volutions and wide and low in the loosely coiled ones.

**Discussion.** *Putrella* sp. 2 differs from other *Putrella* species in strongly irregular coiling of volutions and in relatively weak and low septal fluting. Similarly to the previous specimens, *Putrella* sp. 1, we cannot establish new species due to limited material.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower part of upper Moscovian.

**Occurrence.** Iran, Anarak section, Absheni Formation, Unit 5, sample A183.

Genus *BEEDEINA* Galloway 1933
*Beedeina bona* Chernova and Rauser-Chernousova in Rauser-Chernousova1951
Subspecies *B. b. anarakensis* n. subsp.
Figures 18.5, 18.12

**Etymology.** The species is named for the Anarak section where it was found.

**Holotype.** GIN 4777/184. Axial section; Iran, Anarak section, Absheni Formation, Unit 5; Carboniferous, Pennsylvanian, lowermost part of the upper Moscovian.

**Material.** 2 axial and 3 subaxial and tangential sections.

**Description.** Shell small, inflated fusiform to subrhomboidal, with straight to slightly concave lateral slopes and bluntly rounded poles. Mature shells possess 5.5 to 6 volutions and measure 2.3 to 3.1 mm in length and 1.25 to 1.65 mm in diameter; form ratio 1.87 to 2.0. Spirotheca composed of tectum, lower and upper tectoria in the early three volutions; distinct diaphanotheca appear at the fourth volution. Thickness of spirotheca in two outer volutions varies from 0.03 to 0.04 mm. Septa thin, moderately and irregularly fluted from pole to pole except for the tunnel area where septa weakly fluted or even straight. Proloculus is of moderate size; its outside diameter 0.14 to 0.2 mm. Tunnel narrow and high. Chomata high and massive.

**Discussion.** The weakly developed diaphanotheca of the *Beedeina bona anarakensis* n. subsp. suggests that this subspecies is a primitive *Beedeina.* The subspecies described resembles, in many respects, the nominative subspecies, but differs from the latter in having weaker septal fluting. This feature makes it similar to some forms of ancestral genus *Citronites*, such as *C. citronoides* (Manukalova 1948). However, the presence of pronounced diaphanotheca prevents assigning the species to this genus.

**Stratigraphic range.** Carboniferous, Pennsylvanian, lower part of upper Moscovian.

**Occurrence.** Iran, Anarak section**,** Absheni Formation, Unit 5, samples A184 and A193.

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**Tab. 1 - Distribution of fusulinids in Zaladu section**

SAMPLES

| | Genus/species | Author | Year | Z86 | Z95 | Z97 | Z98 | Z102 | Z108 | Z129 | Z130 | Z131 | Z147 | Z158 | Z159 | Z160 | Z162 | Z171 | Z177 | Z178 | Z179 | Z183 | Z189 | Z191 | Z193 | Z194 | Z200 | Z201 | Z202 | Z204 | Z205 | Z206 | Z207 | Z208 | Z209 | Z210 | Z212 | Z216 | Z219 | Z220 | Z222 | Z223 | Z226 | Z227 | Z231 | Z235 | Z240 | Z243 | Z244 | Z249 | Z250 | Z262 | Z288 | Z290 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Eoschubertella** | Thompson | 1937 |||||||||||||||||||||||||||||||||||||sp.||||||||||||||||
| 2 | obscura obscura | (Lee et Chen) | 1930 |||||||||||||||||||||||||||||||||||||x||||||||||||||||
| 3 | obscura mosquensis | (Rauser-Chernousova) | 1951 |||||||||||||||||||||||||||||||||||||x||||||||||||||||
| 4 | **Fusiella** | Lee et Chen | 1930 ||||||||||||||||||||sp.|||||||||||||||||||||||||||||||
| 5 | praetypica | Safonova | 1951 |||||||||||||||||||||||||||||||||||||||||||||||||aff.|||
| 6 | praecursor paraventricosa | Rauser-Chernousova | 1951 ||||||||||||||||||||x|||||x|||cf.|||||||||||||||||||||x|||
| 7 | longa | Rumjanzeva | 1974 ||||||||||||||||||||aff.|||||||||||||||||||||||||||||||
| 8 | paradoxa | Lee et Chen | 1930 |||||||||||||||||||||||||||||||||||||||||||||||||aff.|||
| 9 | pulchella | Safonova | 1951 ||||||||||||||||||||x|||||||||||||||||||||||||||||||
| 10 | **Mediocris** | Rozovskaya | 1961 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 11 | brevisculus | (Ganelina) | 1951 ||||||||||x|||||||||||||||||||||||||||||||||||||||||
| 12 | mediocris | (Vissarionova) | 1948 |||||||||||||x|||||x|||||||||||||||||||||||||||||||||
| 13 | **Eostaffella** | Rauser-Chernousova | 1948 |||||sp.|sp.|||||sp.|sp.|sp.||||||||sp.||||sp.|sp.|sp.|||sp.|sp.||||||sp.|sp.||||||||||||||
| 14 | ovoidea | Rauser-Chernousova | 1948 |x|||x|||||||||x||||||||||||||||||||||||||||||||||||||
| 15 | postmosquensis | Kireeva | 1951 |||aff.||||||||||||||||||||||||||||||||||||||||||||||||
| 16 | pseudostruvei elongatissima | Manuk.-Greb.,Iljina et Serezhn. | 1969 ||||x|||||||||||||||||||||||||||||||||||||||||||||||
| 17 | pseudostruvei chomatifera | Kireeva | 1951 ||cf.|||||||||||||||||x||||||||||||||||||||||||||||||||
| 18 | pseudostruvei angusta | Kireeva | 1951 |||||||||x|x||||||||||||||||||||||||||||||||||||||||||
| 19 | parastruvei recta | Rumjanzeva | 1970 ||||x|cf.||||||||||||||||||||||||||||||||||||||||||||||
| 20 | designata | (D. Zeller) | 1953 ||||x||||||||cf.|x||||||||||||||||||||||||||||||||||||||
| 21 | libera | Rumjanzeva | 1970 |x|||x|||||||||||||||||||||||||||||||||||||||||||||||
| | nalivkini | Malachova | 1957 |||||||||||cf.||||||||||||||||||||||||||||||||||||||||
| 22 | raguschensis | Ganelina | 1951 |||||||||||||||||aff.||||||||||||||||||||||||||||||||||
| 23 | **Plectostaffella (Plectostaffella)** | Reitlinher | 1971 ||sp.||||||||||sp.|sp.||sp.|sp.|||||||||||||||||||||sp.|||||||||||||||
| 24 | orbiculata | R. Ivanova | 1988 ||||aff.|||||||||||||||||||||||||||||||||||||||||||||||
| 25 | jakensis | Reitlinger | 1971 ||||||||||x|||x||||||||||||||||||||||||||||||||||||||
| 26 | bogdanovkensis | Reitlinger | 1980 |||||||x||||||x||||||||||||||||||||||||||||||||||||||
| 27 | uzbekistanica | Rumjanzeva | 1992 ||||||||||||||||||x|||||||||||||||||||||||||||||||||
| 28 | varvariensis | Brazhnikova et Potievskaya | 1948 ||||||||||||x|||x||||||||||||||||||||||||||||||||||||
| 29 | seslavica | (Rumjanzeva) | 1970 ||||x|||||||||||||||||||||||||||||||||||||||||||||||
| 33 | **Millerella** | **Thompson** | 1942 |||||||||||||||||||||||||||sp.||sp.|||||||||||||||||||||||
| 34 | marblensis | Thompson | 1942 ||||||||||||||||||e.g.|e.g.||||||||||||||||||||||||||||||||
| 35 | paraumbilicata | Manuk.-Greb.,Iljina et Serezhn. | 1969 |||||||||||||aff.||||||||||||||||||||||||||||||||||||||
| 36 | mixta | (Rauser-Chernousova) | 1951 ||||||||||||||x|||||||||||||||||||||||||||||||||||||
| 37 | excavata | Conil et Lys | 1964 ||||aff.||||aff.|||||||||||||||||||||||||||||||||||||||||||
| 38 | conica | Potievskaya | 1964 ||||||||e.g.|||||||||||||||||||||||||||||||||||||||||||
| | variabilis | Rauser-Chernousova | 1951 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 39 | umbilicata | Kireeva | 1951 |||||||||||||||||||||||||||||e.g.||||||||||||||||||||||
| 40 | **Seminovella** | Rauser-Chernousova | 1951 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 41 | nana | (Kireeva) | 1949 ||||||||||||||||||||||||||||||||||||||||||x|||||||||
| 42 | carbonica | (Grozdilova et Lebedeva) | 1950 ||||||||||||||||||||||||||||||||||||x||||x|||||||||||
| 43 | aperta | Grozdilova et Lebedeva | 1950 ||||||||||||||||||||||||||||||||||||x|||||||||||||||
| 44 | **Novella** | Grozdilova et Lebedeva | 1950 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 45 | primitiva | (Dutkevich) | 1934 |||||||||||||||||||||||||||||x||||||||||||||||||||||
| 46 | irregularis | (Kireeva) | 1949 |||||||||||||||||||x||||||||||||||||||||||||||||||||
| 47 | **Ozawainella** | Thompson | 1935 ||||||||||||||||||||||sp.||||||sp.||||||||sp.||||||sp.|||||sp.|||||
| 48 | vozhgalica | Safonova | 1951 |||||||||||||||||||||||||||||||||||||x||||||||||aff.|||aff.||
| 49 | mosquensis | Rauser-Chernousova | 1951 |||||||||||||||||||||||cf.||||||||||||||x|x||||||||||cf.||e.g.||
| 50 | eoangulata | Manukalova | 1950 |||||||||||||||||||||||||||||||||||x|||||||||||||x||||
| 51 | ferganensis | Dzhentchuraeva | 1979 ||||||||||||||||||||||||||||||||||||x|x|||||||||||||||
| 52 | paracompressa | Grozdilova et Lebedeva | 1960 |||||||||||||||||||||||||||||||||||||||cf.|||||||||||||
| | **Semistaffella** | Reitlinger | 1971 |||||||||||||||||||sp.||||||||||||||||||||||||||||||||
| 53 | **Pseudostaffella** | Thompson | 1942 ||||||||||||||||?||||||||||sp.||sp.|||?||||sp.||||||sp.|||?||||||||
| 54 | antiqua | (Dutkevich) | 1934 ||||||||||||||||||e.g.|x||||||||||||||||||||||||||||||||
| 55 | paracompressa | Safonova | 1951 |||||||||||||||||||x||||||||||||||||||||||x||||||e.g.||||
| 56 | subquadrata | Grozdilova et Lebedeva | 1950 ||||||||||||||||||||||||||||cf.||||||||||||x||||||||||x|
| 57 | composita | Grozdilova et Lebedeva | 1950 |||||||||||||||||||x||||||||||||||||||||x|||||||||||
| 58 | **Neostaffella** | Miklukho-Maclay | 1959 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 59 | larionovae | (Rauser-Chernousova et Safonova) | 1951 |||||||||||||||||||||||||||||||||||||||||e.g.||||||||||
| 60 | **Profusulinella** | Rauser et Beljaev | 1936 ||||||||||||||||||||||||sp.|||sp.||||||sp.||||||||||||?|||||||
| 61 | staffellaeformis | Kireeva | 1951 ||||||||||||||||||||||x||||||||||||aff.|||||||||||||||||
| 62 | beppensis | Toriyama | 1958 ||||||||||||||||||||||||||||||||x|||||x||||||||||||||
| 63 | pseudoparva | Leven et Davydov | n.sp. ||||||||||||||||||||||||||||||||x|||cf.|x|||x||||||||x|||||
| 64 | prisca | (Deprat) | 1912 ||||||||||||||||||||||||||||||||cf.|||||x||e.g.|||||||||||x||
| 65 | omiensis | Watanabe | 1973 ||||||||||||||||||||||||||x||||||||||||x||||||||||x|||x||
| 66 | convoluta | (Lee et Chen) | 1930 |||||||||||||||||||||e.g.|||||||||||||||x|||||||||||||||
| 67 | bona | Grozdilova et Lebedeva | 1954 |||||||||||||||||||||cf.||||||||||||||||||||||||||||||
| 68 | pseudorhomboidea | Putrja | 1948 ||||||||||||||||||||||||||||||||||||||||||||||x||||||
| 69 | **Taitzehoella** | Sheng | 1951 |||||||||||||||||||||||||||||||||||||||||||||||||||
| 70 | pseudolibrovichi | (Safonova) | 1951 ||||||||||||||||||||||cf.|||||||||||||||||||||||||||||
| 71 | **Aljutovella** | Rauser-Chernousova | 1951 |||||||||||||||||||||sp.1||||||||||||sp.|sp.|sp.|||sp.|||||||||||||sp.|
| 72 | conspecta | Leontovich | 1951 |||||||||||||||||||||||||||||||||||||||x|aff.||||||||||||
| 73 | subaljutovica | Safonova | 1951 ||||||||||||||||||||||||||||||||||||||||||x|||||||||
| 74 | artificialis | Leontovich | 1951 |||||||||||||||||||||||||||||||||||||x||||||||||||||
| 75 | stocklini | Leven et Davydov | n.sp. |||||||||||||||||||||||||||||||||||||||||x|||||||||e.g.||
| 76 | cafirniganica | Bensh | 1969 |||||||||||||||||||||||||||||||||||||||||x|||||||||e.g.||
| 77 | priscoidea | (Rauser-Chernousova) | 1948 ||||||||||||||||||||||||||||||||x|||||||||x||||||||||
| 78 | cybaea | Leontovich | 1951 |||||||||||||||||||||||||||||||||||||||||aff.|||||||||x||
| 79 | iranica | Leven et Davydov | n.sp. ||||||||||||||||||||||||||||||||||||x|x|||||||||||||||
| 80 | gorgiji | Leven et Davydov | n.sp. |||||||||||||||||||||||||||||||||||||x||||||||||||||
| 81 | **Putrella** | **Rauser-Chernousova** | 1951 |||||||||||||||||||||||||||||||||||||||||||sp.|||||||||
| 82 | donetziana | (Lee) | 1936 ||||||||||||||||||||||||||||||||||||||||||||||aff.||||||
| 83 | **Parastaffella** | **Rauser-Chernousova** | 1948 ||||||||||||||||||||||||||||||sp.||||||||||||||||||||||
| | utkaensis | Postojalko | 1990 |||||aff.|||||||||||||||||||||||||||||||||||||||||||||||
| 84 | umbonata | Rauser-Chernousova | 1951 ||||||||||||||||||||||||||||||aff.||||||||||||||||||||||

Table 2 - Distribution of fusulinids in Anarak section.

SAMPLES

| | Genus/species | Author | Year | A40 | A51 | A58 | A69 | A70 | A71 | A72 | A74 | A75 | A76 | A78 | A79 | A81 | A82 | A84 | A86 | A89 | A93 | A99 | A100 | A107 | A108 | A110 | A112 | A113 | A114 | A117 | A118 | A120 | A121 | A127 | A139 | A144 | A148 | A150 | A156 | A160 | A168 | A170 | A171 | A173 | A174 | A175 | A177 | A178 | A183 | A184 | A185 | A193 | A208 | A211 | A214 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Eoschubertella** | Thompson | 1937 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | | | | |
| 2 | obscura obscura | (Lee et Chen) | 1930 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | x | | | | | |
| 3 | obscura compressa | (Rauser-Chernousova) | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | |
| 4 | obscura procera | (Rauser-Chernousova) | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | |
| 5 | **Schubertella** | Staff et Wedekind | 1912 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | penchiensis | Sheng | 1958 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | cf. | | | | | | |
| 7 | **Fusiella** | Lee et Chen | 1930 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | praetypica | Safonova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | aff. | x | | |
| 9 | praecursor praecursor | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | | | | |
| 10 | praecursor paraventricosa | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | x | aff. | |
| 11 | longa | Rumjanzeva | 1974 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | aff. | aff. | |
| 12 | typica typica | Lee et Chen | 1930 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | |
| 13 | typica ventricosa | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | |
| 14 | **Mediocris** | Rozovskaya | 1961 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | mediocris | (Vissarionova) | 1948 | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | brevisculus | (Ganelina) | 1951 | | | | | | | x | | | x | x | | | | | x | | | | | | | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | | | |
| 17 | **Eostaffella** | Rauser-Chernousova | 1948 | | | | sp. | | | sp. | | | | | | | | sp. | | | | | | sp. | | sp. | | | | | | | | | | | | | | sp. | | | | | | | | sp. | | sp. | | sp. | | | |
| 18 | pseudostruvei pseudostruvei | Rauser-Chernousova et Beljaev | 1951 | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | pseudostruvei chomatifera | Kireeva | 1951 | | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | pseudostruvei elongatissima | Manuk.-Greb.,Iljina et Serezhn. | 1969 | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | ovoidea | Rauser-Chernousova | 1948 | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | exilis | Grozdilova et Lebedeva | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | |
| 23 | acuta | Grozdilova et Lebedeva | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | acutissima | Kireeva | 1949 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | cf. | | | | | | |
| 25 | postmosquensis acutiformis | Kireeva | 1951 | | | | | | | | | | | | | e.g. | e.g. | | | | | | | | | | | | | | | | | | | | | e.g. | x | | | | | | | | | | | | | | | | |
| 26 | mutabilis | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | cf. | | | | | | e.g. | | | | | | | | | | | | | | | | | | | | | | | | e.g. | | | | | | |
| 27 | raguschensis | Ganelina | 1951 | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | lepida | Grozdilova et Lebedeva | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | |
| 29 | parastruvei chusovensis | Kireeva | 1951 | | | | | | | | x | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | kashirika rhomboides | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | |
| 31 | **Plectostaffella (Plectostaffella)** | Reitlinger | 1971 | | sp. | | | | sp. | | | | sp. | | sp. | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | | | |
| 32 | jakensis | Reitlinger | 1971 | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | |
| 33 | bogdanovkensis | Reitlinger | 1980 | | | | | | x | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | seslavica | (Rumjanzeva) | 1970 | x | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | quadrata | Rumjanzeva | 1992 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | |
| 36 | acuta | Manuk.-Greb.,Iljina et Serezhn. | 1969 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | |
| 37 | **Plectostaffella (Varistaffella)** | Kulagina et Sinitsyna | 2003 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38 | ziganica | (Sinitsyna) | 1975 | | | x | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | |
| 39 | varsanofievae | (Rauser-Chernousova) | 1951 | | | | | | | | x | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | eostaffelaeformis | (Rumjanzeva) | 1970 | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41 | **Millerella** | Thompson | 1942 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | |
| 42 | marblensis | Thompson | 1942 | | | | | | | | | | | | | | | | | | | | | | e.g. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | pressa | Thompson | 1944 | | | | | | | | | | | | | | | | | x | x | | | | | cf. | | | | | x | | | | | | | | | | | | | | | | | | | | | | cf. | | |
| 44 | paraconica | Manuk.-Greb.,Iljina et Serezhn. | 1969 | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 | variabilis | Rauser-Chernousova | 1951 | | | | | | | | | | x | x | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 46 | paraumbilicata | M.-G., Iljina et Serezh. | 1969 | | | | | | | | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 47 | **Seminovella** | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 48 | nana | Kireeva | 1949 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | |
| 49 | carbonica | (Grozdilova et Lebedeva) | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | aperta | (Grozdilova et Lebedeva) | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | |
| 51 | **Novella** | Grozdilova et Lebedeva | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 52 | primitiva | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | x | | | | | | | | | | | x | | | | | | | | | | aff. | | |
| 53 | irregularis | (Kireeva) | 1949 | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | | | | | x | x | | | | | |
| 54 | **Ozawainella** | Thompson | 1935 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | sp. | | | | | | | | | sp. | | | sp. | | | | | | sp. |
| 55 | paratingi | Manukalova | 1950 | | | | | | | | | | | | | | | | | | | | | | aff. | | | | | | | | | | e.g. | | | | | | aff. | | | | | | | | | | | | | | |
| 56 | ferganensis | Dzhentchuraeva | 1979 | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | |
| 57 | vozhgalica | Safonova | 1951 | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 58 | eoangulata | Manukalova | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | x | x | | | |
| 59 | grandis | Potievskaja | 1958 | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | | aff. | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | kurachovensis | Manukalova | 1950 | | | | | | | | | | | | | | | | | | | | | aff. | | | | | | x | | | | | | | | | | | x | | | | | | | | | | | | | | |
| 61 | paracompressa | Grozdilova et Lebedeva | 1960 | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 62 | mosquensis | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | cf. | | | | aff. | | x | x | x | x | x | | | | | cf. | | | | | cf. | x | x | x | | | | | | | | | | |
| 63 | stellae | Manukalova | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | cf. | | | | | | | | | | |
| 64 | **Semistaffella** | Reitlinger | 1971 | | | sp. | | sp. | | | | sp. | sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 65 | minuscularia | Reitlinger | 1971 | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 66 | variabilis | Reitlinger | 1961 | x | | | | x | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 67 | **Pseudostaffella** | Thompson | 1942 | | | | | | sp. | | sp. | | | | | | | | | | | | | sp. | | | | | | | | sp. | | | | | sp. | | | sp. | | | sp. | | | | | | | | | | sp. | | |
| 68 | antiqua | (Dutkevich) | 1934 | cf. | | | cf. | | | | x | cf. | x | x | | | x | | | | | | | x | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | | | | |
| 69 | nikolajevkiensis | Manuk.-Greb.,Iljina et Serezhn. | 1969 | | | | | | | | | x | x | | cf. | | | x | | | | | cf. | | | | | | | | | | aff. | | | | | | x | | | | | | | | | | | | | | | | |
| 70 | compressa | Rauser-Chernousova | 1938 | | | | | | | | x | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | |
| 71 | grandis | Schlykova | 1950 | | | | | | | | | | | | | | x | | cf. | | | | | | | | cf. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 72 | gorskyi | (Dutkevich) | 1934 | | | | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 73 | praegorskyi | Rauser-Chernousova | 1949 | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 74 | paracompressa | Safonova | 1951 | | | | | | | | | | x | | | | | | aff. | | | | | aff. | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | |
| 75 | latispiralis | Kireeva | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | | | | |
| 76 | subquadrata | Grozdilova et Lebedeva | 1950 | | | | | | | | | | | | | | | | | x | | | | | | | | | x | | | x | | | | | | | | | | aff. | | | | | | | | | | | | | |
| 77 | composita | Grozdilova et Lebedeva | 1950 | | | | | | | x | | x | x | | | x | | x | | x | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 78 | proozawai | Kireeva | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 79 | lomovatica | Manuk.-Greb.,Iljina et Serezhn. | 1969 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | |
| 80 | **Neostaffella** | A. Miklukho-Maclay | 1959 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | | | sp. | | | | ? | | | |
| 81 | rotundata | (Bensh) | 1969 | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | | | x | x | x | x | cf. | x | | x | | | | | | |
| 82 | syzranica | (Rauser et Safonova) | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | | | x | x | x | | | | |
| 83 | eoangulata | Manukalova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | |
| 84 | **Profusulinella** | Rauser-Chernousova et Beljaev | 1936 | | | | | | | | | | | | | | | | ? | | | | | | | | | | sp. | | | | | | | | | | | | | | | sp. | | | | | | | | | | | |
| 85 | parva | (Lee et Chen) | 1930 | | | | | | | | | | | | | | | | | | | | | | e.g. | cf. | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | |
| 86 | pseudoparva | Leven et Davydov | n.sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 87 | primitiva | Sosnina | 1954 | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | | |
| 88 | prisca | (Deprat) | 1912 | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 89 | pseudorhomboidea | Putrja | 1948 | | | | | | | | | | | | | | | | | | | aff. | aff. | | aff. | | aff. | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | |
| 90 | staffellaeformis | Kireeva | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 91 | subovata | Safonova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | | | | | | | | | | | | | | | | | |
| 92 | omiensis | Watanabe | 1973 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | |
| 93 | ellipsoidalis | Rumjanzeva | 1974 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 94 | **Aljutovella** | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | | | | | | |
| 95 | pseudoaljutovica | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | |
| 96 | paraaljutovica | Safonova | 1951 | | | | | | | | | | | | | | | | | | | | | aff. | | | | | aff. | | | aff. | | | | | | | | | | | | | | | | | | | | | | | |
| 97 | artificialis | Leontovich | 1951 | | | | | | | | | | | | | | | | | | | | | | x | | | | x | | | | e.g. | | | | | | | | | | | | | | | | | | | | | | |
| 98 | tumida | Bensh | 1969 | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 99 | subaljutovica | Safonova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 | cybaea | Leontovich | 1951 | | | | | | | | | | | | | | | | | | | cf. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 101 | cafirniganica | Bensh | 1969 | | | | | | | | | | | | | | | | | | | | | x | | | | | cf. | | | x | | | | | | | | | | | | | | | | | | | | | | | |
| 102 | stocklini | Leven et Davydov | n. sp. | | | | | | | | | | | | | | | | | | | | | aff. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 103 | iranica | Leven et Davydov | n. sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | | |
| 104 | **Fusulinella (Moellerites)** | Solovieva | 1986 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 105 | bockiniformis | Bogush | 1963 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | |
| 106 | praebocki | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | | | | |
| 107 | **Fusulinella (Fusulinella)** | Moeller | 1878 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp.1 | | | | | |
| 108 | subpulchra contracta | Villa | 1995 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aff. | | | | | |
| 109 | **Putrella** | Rauser-Chernousova | 1951 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ? | | | | | | | | | | | sp. | | | sp.1,2 | | | sp. | | | |
| 110 | persica | Leven et Davydov | n sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | |
| 111 | **Beedeina** | Galloway | 1933 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 112 | bona anarakensis | Leven et Davydov | n.sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | |
| 113 | **Fusulina** | Fischer de Waldheim | 1829 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ? | |
| 114 | **Palaeostaffella** | Liem | 1966 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | |
| 115 | moelleri | (Ozawa) | 1925 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | |
| 116 | **Reitlingerina** | Rauser-Chernousova | 1985 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | sp. | | | | | | | | | | | | | | | | | | | | |
| 117 | bradyi | (Moeller) | 1878 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | x | | | | | |
| 118 | timanica | (Rauser-Chernousova) | 1950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | | x | | | |