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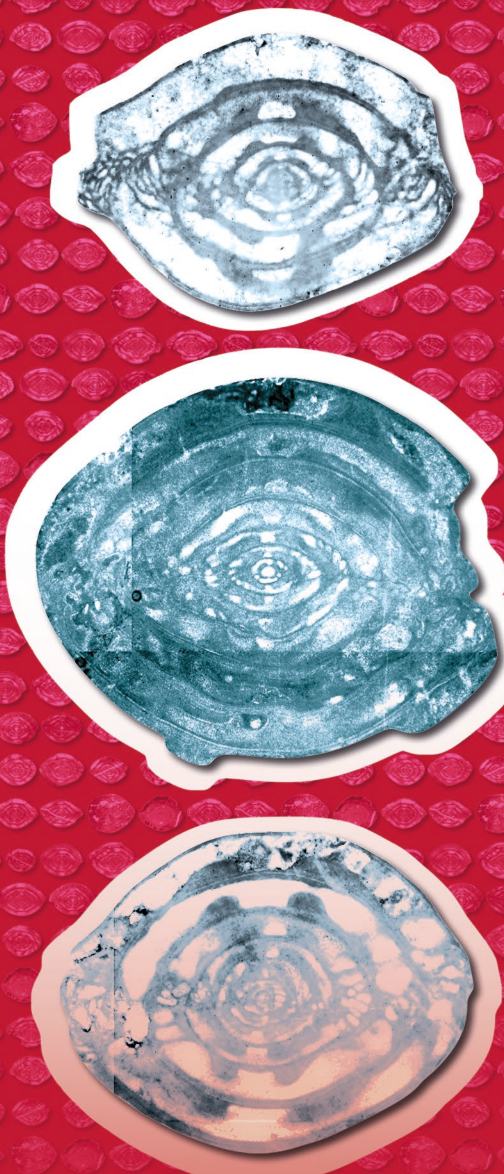

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Fusulinid Biostratigraphy of the Moscovian-Lower Kasimovian of Hadim Nappe, Central Taurides, southern Turkey

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ABSTRACT
The Hadim Nappe which is one of the allochthonous tectonic units in the Tauride Belt includes continuous stratigraphic successions from Middle(?)-Late Devonian to Late Cretaceous. The well exposed successions of the Moscovian to lower Kasimovian are selected for fusulinid biostratigraphy along three sections (Yassıpınar, Gölbelen and Bademli) in the Central Taurides. The Lower-Middle Pennsylvanian boundary was determined by the first appearance datum of the *Aljutovella aljutovica* (Rauzer-Chernousova, 1938) and *Solovievaia ovata ovata* (Rauzer-Chernousova, 1938). In this study, the Vereian, Kashirian, Podolskian and Myachkovian regional substages of the Moscovian stage were determined by *Aljutovella aljutovica-Solovievaia ovata ovata, Aljutovella priscoidea* (Rauzer-Chernousova, 1938), *Eofusulina triangula* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936), *Fusulinella vozhgalensis devexa* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, *Beedeina schellwieni* (Staff *in* Schellwien & Staff, 1912) and *Fusulinella bocki bocki* Möller, 1878 in ascending order. The base of the lower Kasimovian is represented by the occurrence of *Quasifusulinoides* Rauzer-Chernousova & Rozovskaya *in* Rauzer-Chernousova & Fursenko, 1959, *Protriticites* Putrya, 1948 and *Montiparus* Rozovskaya, 1948 taxa. A total of 106 fusulinid species belonging to 19 genera were determined. One genus and ten species are new: *Aljutovella typica* Akbaş, n. sp., *Beedeina minuta* Akbaş, n. sp., *Beedeina tauridiana* Akbaş, n. sp., *Praefusulinella guvenci* Akbaş, n. gen., n. sp., *Praefusulinella okuyucui* Akbaş, n. gen., n. sp., *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp., *Praefusulinella tekini* Akbaş, n. gen., n. sp., *Fusulinella absoluta* Akbaş, n. sp., *Fusulinella obtusa minuta* Akbaş, n. subsp. and *Fusulinella propriaforma* Akbaş, n. sp. The taxonomic positions of some fusulinids species (e.g., *Neostaffella larionovae polasnensis* (Rauzer-Chernousova & Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), *Depratina chernovi* (Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), *Solovievaia arta* (Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) and *Beedeina paradistenta* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) were revised. The fusulinid assemblages recovered in this study correlate well with the Russian Platform, Cantabrian Mountains, Central Iran, southern Urals, Donets Basin, and some other regions of the Tethyan Realm.

KEY WORDS
Fusulinid,
Moscovian,
Kasimovian,
Turkey,
new combinations,
new genus,
new species.

RÉSUMÉ

Biostratigraphie des fusulinidés du Moscovien-Kasimovien inférieur de la nappe de Hadim, Taurides centrales, sud de la Turquie.

La nappe de Hadim, qui est l'une des unités tectoniques allochtones de la ceinture des Taurides, comprend des successions stratigraphiques continues du Dévonien moyen(?)-supérieur au Crétacé supérieur. Les successions bien exposées du Moscovien au Kasimovien inférieur sont sélectionnées pour la biostratigraphie des fusulinidés le long de trois coupes (Yassıpınar, Gölbelen et Bademli) dans les Taurides centrales. La limite Pennsylvanien inférieur-moyen a été déterminée par la date de première apparition d'*Aljutovella aljutovica* (Rauzer-Chernousova, 1938) et de *Solovievaia ovata ovata* (Rauzer-Chernousova, 1938). Dans cette étude, les sous-étages régionaux véréien, kashirien, podolskien et myachkovien de l'étage moscovien ont été déterminés par *Aljutovella aljutovica-Solovievaia ovata ovata*, *Aljutovella priscoidea* (Rauzer-Chernousova, 1938), *Eofusulina triangula* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936), *Fusulinella vozhgalensis devexa* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, *Beedeina schellwieni* (Staff *in* Schellwien & Staff, 1912) et *Fusulinella bocki bocki* Möller, 1878 en ordre croissant. La base du Kasimovien inférieur est représentée par l'occurrence des taxons *Quasifusulinoides* Rauzer-Chernousova & Rozovskaya *in* Rauzer-Chernousova & Fursenko, 1959, *Protriticites* Putrya, 1948 et *Montiparus* Rozovskaya, 1948. Un total de 106 espèces de fusulinidés appartenant à 19 genres a été déterminé. Un genre et dix espèces sont nouveaux : *Aljutovella typica* Akbaş, n. sp., *Beedeina minuta* Akbaş, n. sp., *Beedeina tauridiana* Akbaş, n. sp., *Praefusulinella guvenci* Akbaş, n. gen., n. sp, *Praefusulinella okuyucui* Akbaş, n. gen., n. sp., *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp., *Praefusulinella tekini* Akbaş, n. gen., n. sp., *Fusulinella absoluta* Akbaş, n. sp, *Fusulinella obtusa minuta* Akbaş, n. subsp. et *Fusulinella propriaforma* Akbaş, n. sp. La position taxonomique de certaines espèces de fusulinidés (par exemple, *Neostaffella larionovae polasnensis* (Rauzer-Chernousova & Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), *Depratina chernovi* (Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), *Solovievaia arta* (Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) et *Beedeina paradistenta* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) a été révisée. Les assemblages de fusulinidés retrouvés dans cette étude sont bien corrélés avec la Plate-forme Russe, les Montagnes Cantabriques, l'Iran Central, le sud de l'Oural, le bassin de Donets et quelques autres régions de la Téthys.

MOTS CLÉS
Fusulinidés,
Moscovien,
Kasimovien,
Turquie,
combinaisons nouvelles,
genre nouveau,
espèces nouvelles.

INTRODUCTION

The Carboniferous system is formally subdivided into the Mississippian and Pennsylvanian subsystems, and the Tournaisian, Viséan, Serpukhovian, Bashkirian, Moscovian, Kasimovian and Gzhelian stages in ascending order by the International Commission on Stratigraphy (Richards 2013). In addition to the international chronostratigraphic subdivisions there are also many regional stages, substages and horizons (see Kagarmanov & Donakova 1990; Kulagina *et al.* 2001; Orlov-Labkovsky *et al.* 2003; Heckel & Clayton 2006; Richards 2013). The anticipated GSSP's of the Carboniferous stage boundaries are mainly determined by using the evolutionary lineage of certain conodont taxa. Fusulinids are also used extensively as index fossils for stage, substage and horizon boundaries, but they have provincial distributions, and so the more widespread conodonts are used for global correlations.

The Hadim Nappe has an almost continuous succession of shallow marine carbonates with some siliciclastic intercalations from the Middle(?)-Late Devonian to Late Cretaceous in the Central Taurides (Özgül 1976, 1997; Monod 1977; Turan 1990). Akbaş & Okuyucu (2021) recently subdivided the upper Serpukhovian-Bashkirian (middle Carboniferous) successions based on fusulinid assemblages. The present study documents the fusulinid biostratigraphy of the overlying Moscovian-Kasimovian section. For this purpose, samples have been collected from three outcropping stratigraphic sections (Yassıpınar, Gölbelen and Bademli) in southern Turkey (Fig. 1B-D).

A previous fusulinid study in the area by Dzenchuraeva & Okuyucu (2007) determined the Bashkirian-Moscovian boundary, but the fusulinid biostratigraphy of the overlying Moscovian section was not studied.

The goals of this study are to: 1) present the fusulinid biostratigraphy of the Moscovian-lower Kasimovian successions of the Hadim Nappe; 2) determine the Lower-Middle Pennsylvanian (Bashkirian-Moscovian) boundary based on the index fusulinid taxa in Central Taurides; and 3) compare the recovered fusulinid assemblages with coeval faunas in Turkey and other regions. In addition, four new species belonging to a newly established genera and six new species are described from the Moscovian succession of the Hadim Nappe.

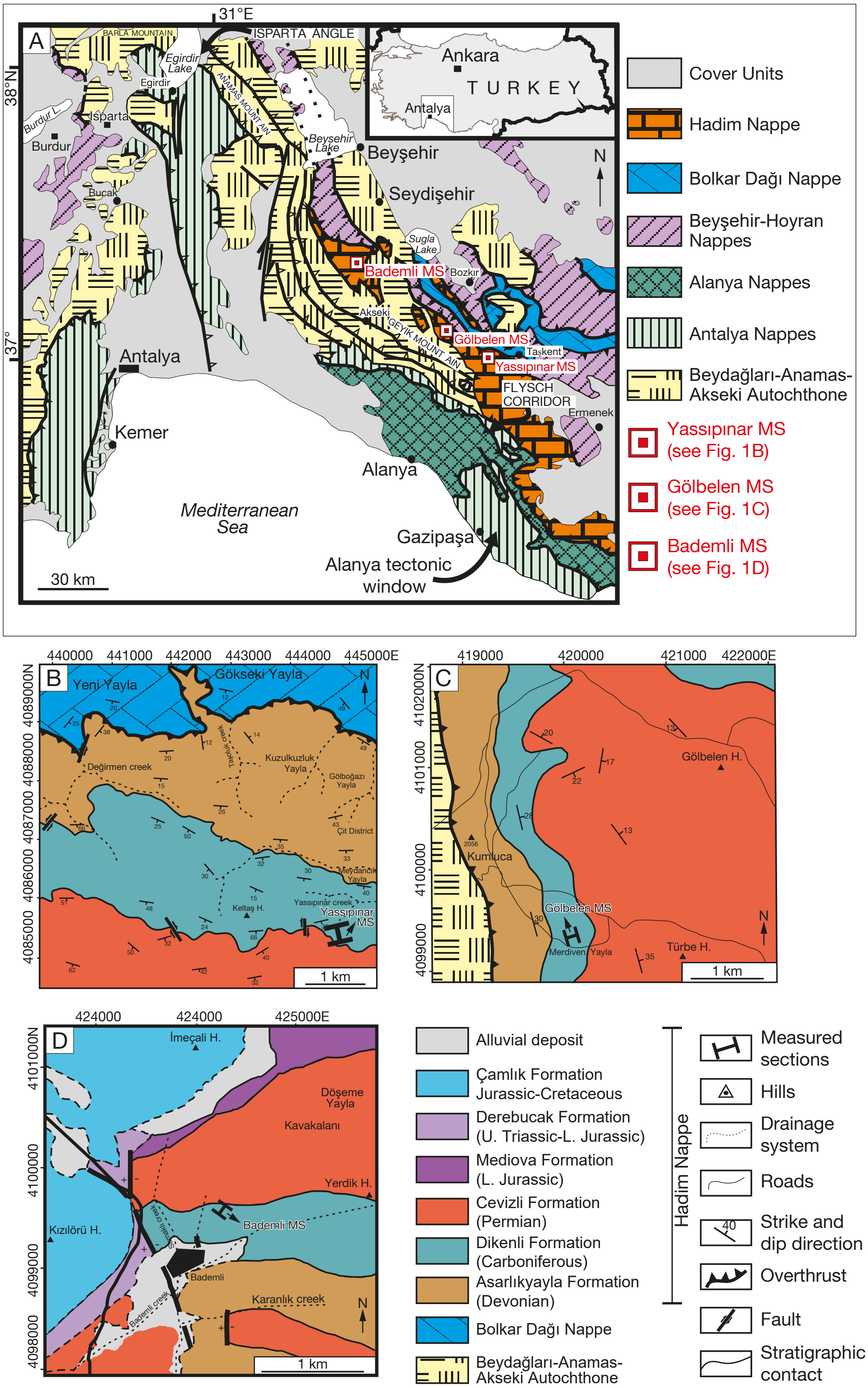


Fig. 1. — **A**, Schematic map showing the distribution of autochthonous and allochthonous sequences in the area between Western and Central Taurides (simplified and revised after Özgül 1984); **B**, geological map of the study area showing the location of the Yassıpınar measured section (simplified and revised after Turan 1990); **C**, geological map of the study area showing the location of the Gölbelen measured section (simplified and revised after Metin 1994); **D**, geological map of the study area showing the location of the Bademli measured section (simplified and revised after Monod 1977).

GEOLOGICAL SETTING

The Taurides, one of the major units of the Alpine-Himalayan Orogenic Belt, is geographically subdivided into three segments or parts by Özgül (1976, 1984) as: 1) the Eastern Taurides to the east of the Ecemiş fault; 2) the Central Taurides between the Kırkkavak and the Ecemiş faults; and 3) the Western Taurides from the Aegean coast to the Kırkkavak fault. The Taurides consists of one autochthonous/para-autochthonous (Anamas-Akseki-Beydağları autochthonous) and five allochthonous units (Hadim, Beyşehir-Hoyran, Bolkar Dağ, Alanya and Antalya Nappes) (Fig. 1A) (Blumenthal 1944, 1951; Gutnic *et al.* 1968, 1979; Brunn *et al.* 1970, 1971; Özgül 1976, 1984, 1997; Monod 1977; Turan 1990, 2000, 2010). The extensive outcrops of the Hadim Nappe in the eastern, central and western Taurides are mainly composed of platform type shallow-marine carbonates and siliciclastic rocks ranging from Middle(?)-Upper Devonian to Upper Cretaceous (Fig. 2) (Özgül 1971, 1997; Güvenç 1965, 1977a; Monod 1977; Turan 1990, 2000, 2010). In the Central Taurides, the Paleozoic units of the Hadim Nappe are represented by continuous and well exposed carbonates with rare siliciclastic interbeds.

Lithostratigraphy of the carboniferous successions of the Hadim Nappe

The Carboniferous successions of the Hadim Nappe mainly consist of shallow marine carbonates and siliciclastic rocks. In the Mississippian, the Tournaisian stage is represented by shale and siltstone intercalations, and the Viséan is dominantly represented by carbonates with shale interbeds. The Serpukhovian stage consists of mainly quartz arenite sandstones and rare carbonates (limestone, oolitic limestone). The Lower to Middle Pennsylvanian (from Bashkirian to Moscovian) interval is composed dominantly of carbonates rich in foraminifera and calcareous algae. The Kasimovin succession commonly has a basal sandstone overlain by a carbonate section. The Gzhelian stage corresponds to an alternation of sandstone and limestone with *Girvanella* limestone (*Calcaires à Girvanelles*) facies which was originally determined by Güvenç (1965) from the Carboniferous-Permian boundary sections of the Hadim Nappe.

The Viséan-upper Moscovian interval of the Carboniferous has been named as Dikenli Group, and Kasimovian-lower Permian units were named as Dikmen Group by Güvenç (1977a, 1980). Later Dikenli Formation is named as Korucuk Formation (Demirtaşlı 1984), Yarıcak Formation (Özgül 1997; Altıner & Özgül 2001) in Central Taurides, and Eksimelik, Aziziye Gediği and Oruçoğlu Formation (Altıner 1981), Siyah Aladağ Formation (Tekeli *et al.* 1984) and Köşkdere Formation (Ayhan & Lengeranlı 1986) in eastern Taurides. In this study, the Dikenli name is adopted as a formation name for the Carboniferous part of the Hadim Nappe units due to the priority of the nomenclature (Fig. 2).

Studied measured sections

The lithostratigraphic characteristics of the Yassıpınar, Gölbelen, and Bademli measured sections are described below. The features of the Carboniferous strata of these sections are generally similar except for the Serpukhovian(?)-Bashkirian part of the Bademli section.

Yassıpınar section

This section is located to the southwest of the Hadim province (Konya) (Fig. 1A, B) and named after Yassıpınar Creek situated to the north of the section (UTM coordinates on 1/25 000 scaled Alanya O28-b2 topographical map: between 36S 444875E/4085434N [36°54’47”N, 32°22’52”E] and 36S 444997E/4085048N [36°54’35”N, 32°22’57”E]). The total thickness of the section is 28 meters. The Yassıpınar is composed of a well-exposed Moscovian succession which consists of grey-colored, thick-bedded bioclastic limestone at the base and pink-colored, medium to thick-bedded bioclastic limestone with thick-bedded quartz arenite sandstone interlayers at the top. The uppermost part of the Moscovian stage includes yellow-colored, medium to thick-bedded bioclastic limestone (Fig. 3).

Gölbelen section

This section is located to the southwest of the Bozkır province (Konya) (UTM coordinates on 1/25 000 scaled Konya N28-d4 topographical map: between 36S 419453E/4100306N [37°2’43”N, 32°5’39”E] and 36S 419809E/4100450N [37°2’48”N, 32°5’53”E]) and named after the Gölbelen Hill to the northeast of the section (Fig. 1A, C). The total thickness of the section is 73 meters. The basal part of the Moscovian strata of the Gölbelen section is characterized by grey/beige-colored, middle to thick-bedded bioclastic limestone. The overlying part of the section is represented by grey-colored, iron-oxide bearing limestone and yellow-colored medium-bedded bioclastic limestone. The lower Kasimovian is composed of basal pink-colored, thin to medium-bedded quartz arenite sandstone overlain by yellow-colored, thick-bedded limestone (Fig. 4).

Bademli section

This section is located to the northeast of the Akseki province (Antalya) (UTM coordinates on 1/25 000 scaled Konya N27-a3 topographical map: between 36S 388776E/4130367N [37°18’47”N, 31°44’41”E] and 36S 388897E/4130590N [37°18’55”N, 31°44’46”E]) and named after the Bademli province (Fig. 1A, D). The total thickness of the section is 31 meters. The Bademli section is composed of grey/beige-colored, medium to thick-bedded bioclastic limestone at the base, and pink-colored, thick-bedded bioclastic limestone in the middle part of the section. The upper Moscovian part of the section is composed of grey-colored, thick-bedded bioclastic limestone. The lower Kasimovian part of the section has a basal quartz arenite sandstone that is overlain by yellow-colored, thick bedded limestone, similar to the lower Kasimovian of the Gölbelen section (Fig. 5).

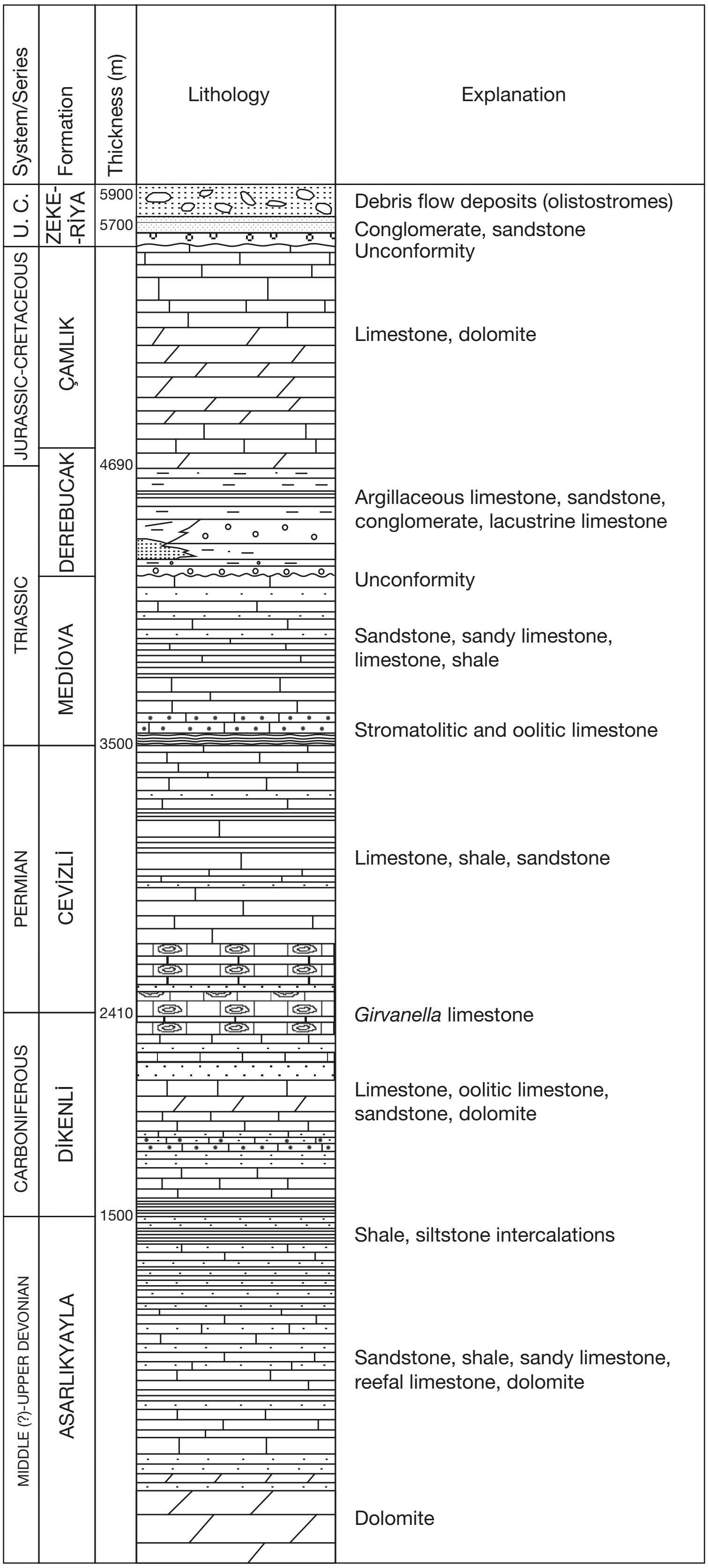


FIG. 2. — Generalized columnar section of the Hadim Nappe (modified after Güvenç 1977a, b; Monod 1977; Turan 1990; Okuyucu & Güvenç 1997; Özgül 1997). Abbreviation: **U.C.**, Upper Cretaceous.

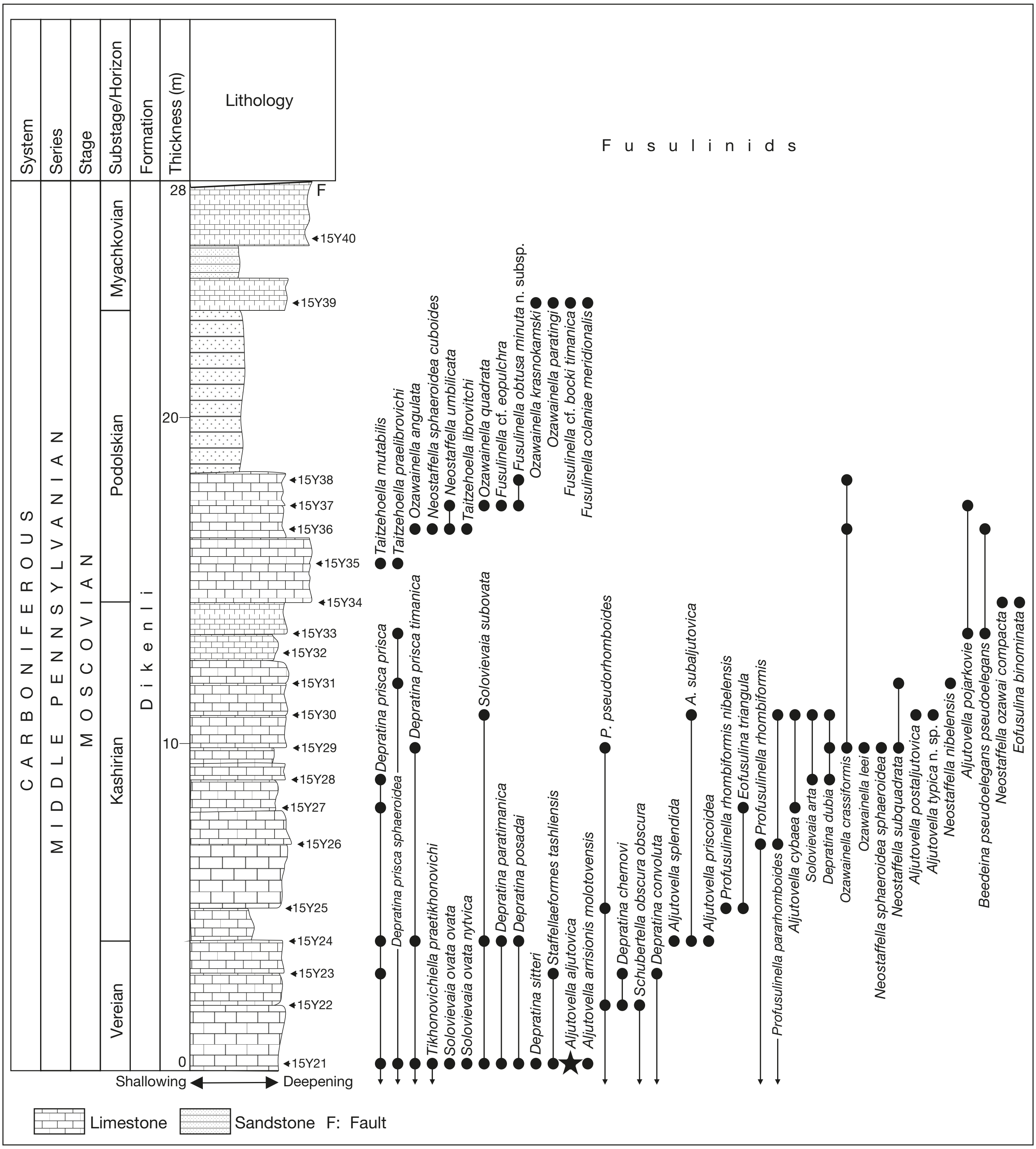


FIG. 3. — Lithostratigraphy and fusulinid distribution of the Yassıpınar section.

BIOSTRATIGRAPHY

The substages or horizons of the Moscovian stage defined in the Russian type sections are adopted in this study (Kagarmanov & Donakova 1990). The Moscovian stage was originally established by Nikitin (1890) in the Moscow Basin (Russia), and the section in the village of Myachkovo was selected as the stratotype of the Moscovian stage (Makhlina *et al.* 2001; Richards 2013). The base of the Moscovian stage, which originally described based on brachiopods, was defined by fusulinid species *Aljutovella aljutovica* (Rauzer-Chernousova, 1938) which occurs 3 meters above the occurrence of the conodont *Declinognathodus donetzianus* Nemirovskaya, 1990 within

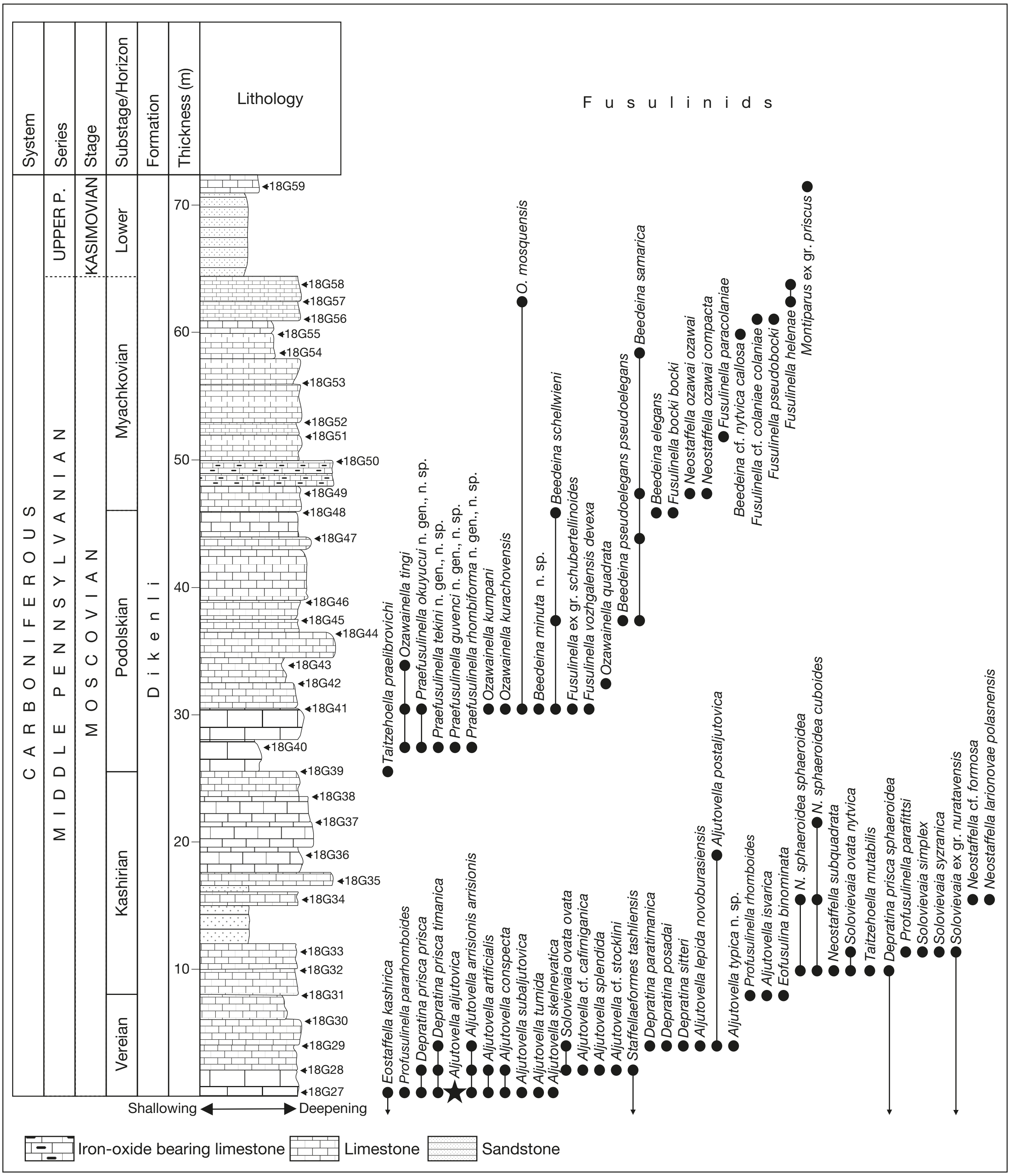


Fig. 4. — Lithostratigraphy and fusulinid distribution of the Gölbelen section.

the Aljutovskaya Formation in its stratotype (Makhlina *et al.* 2001). There are some marker fusulinid and conodont taxa to define the base of the Moscovian but there is no formal GSSP. The conodonts *Diplognathodus ellesmerensis* Bender, 1980 and *Declinognathodus donetzianus* have been proposed as potential index fossils for the base of Moscovian stage by SCCS task-group (Richards 2013; Alekseev 2017).

The Moscovian carbonate dominated succession of the Hadim Nappe contains a well-developed shallow marine

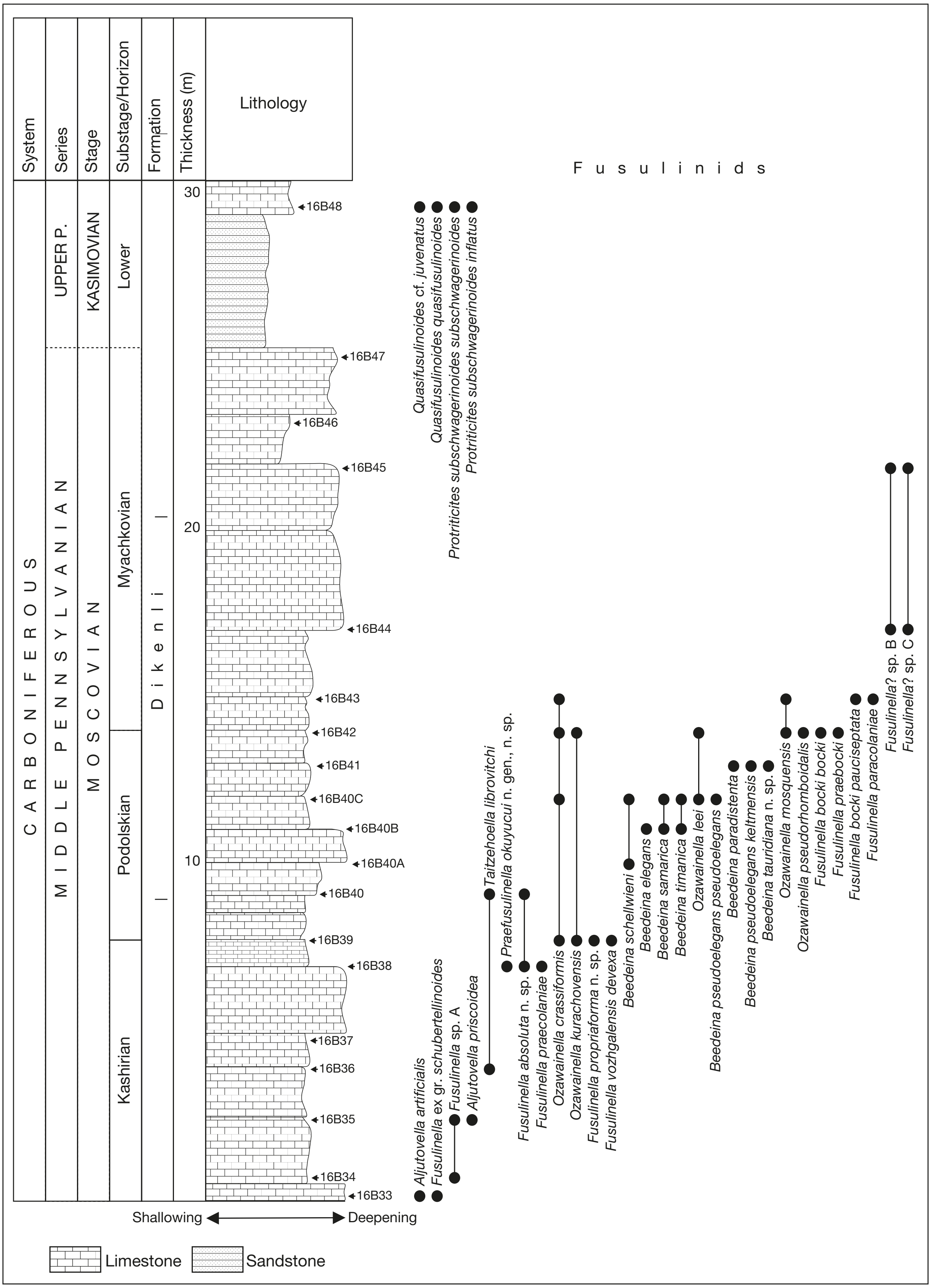


FIG. 5. — Lithostratigraphy and fusulinid distribution of the Bademli section.

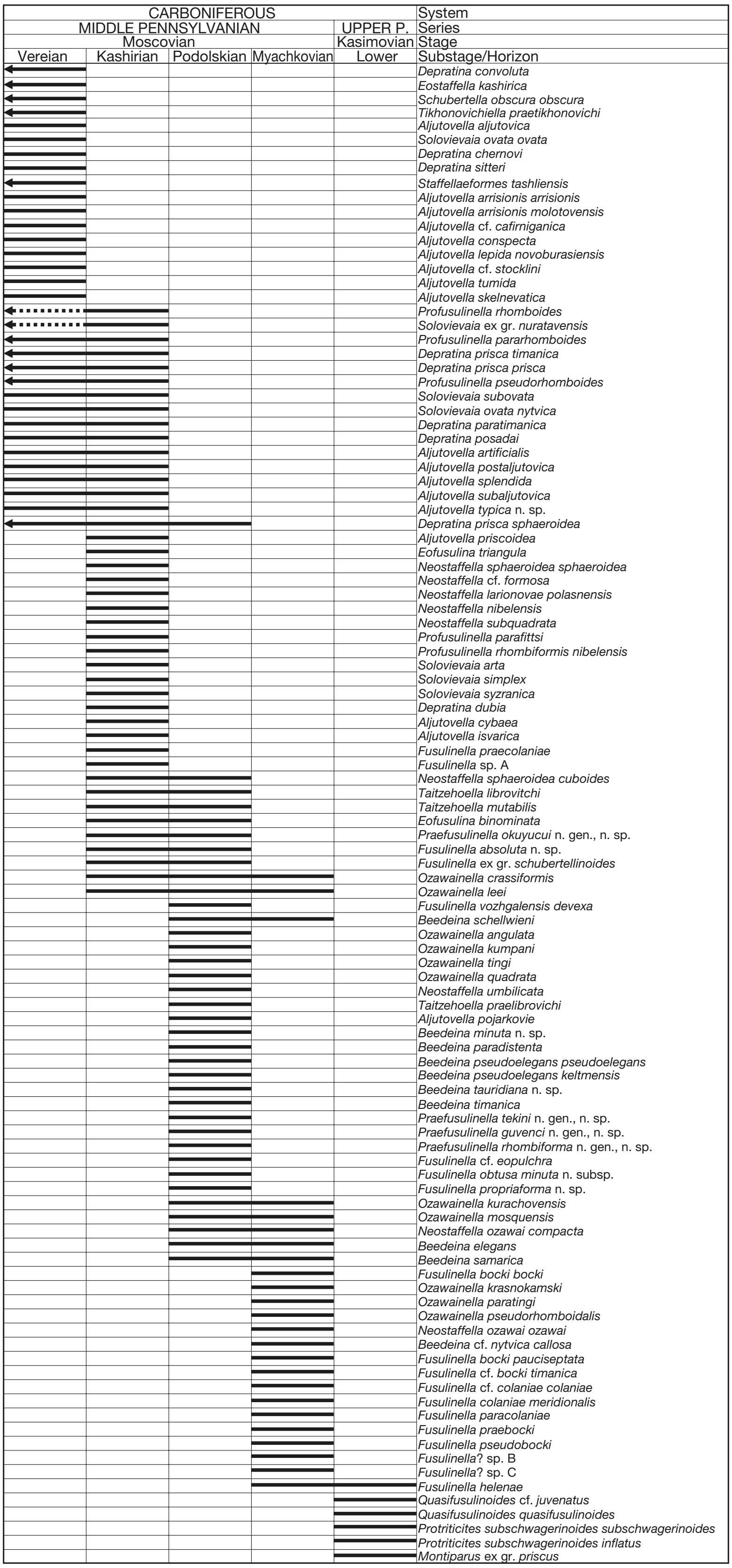


FIG. 6. — Total stratigraphic distribution of fusulinids from the Moscovian to lower Kasimovian in this study.

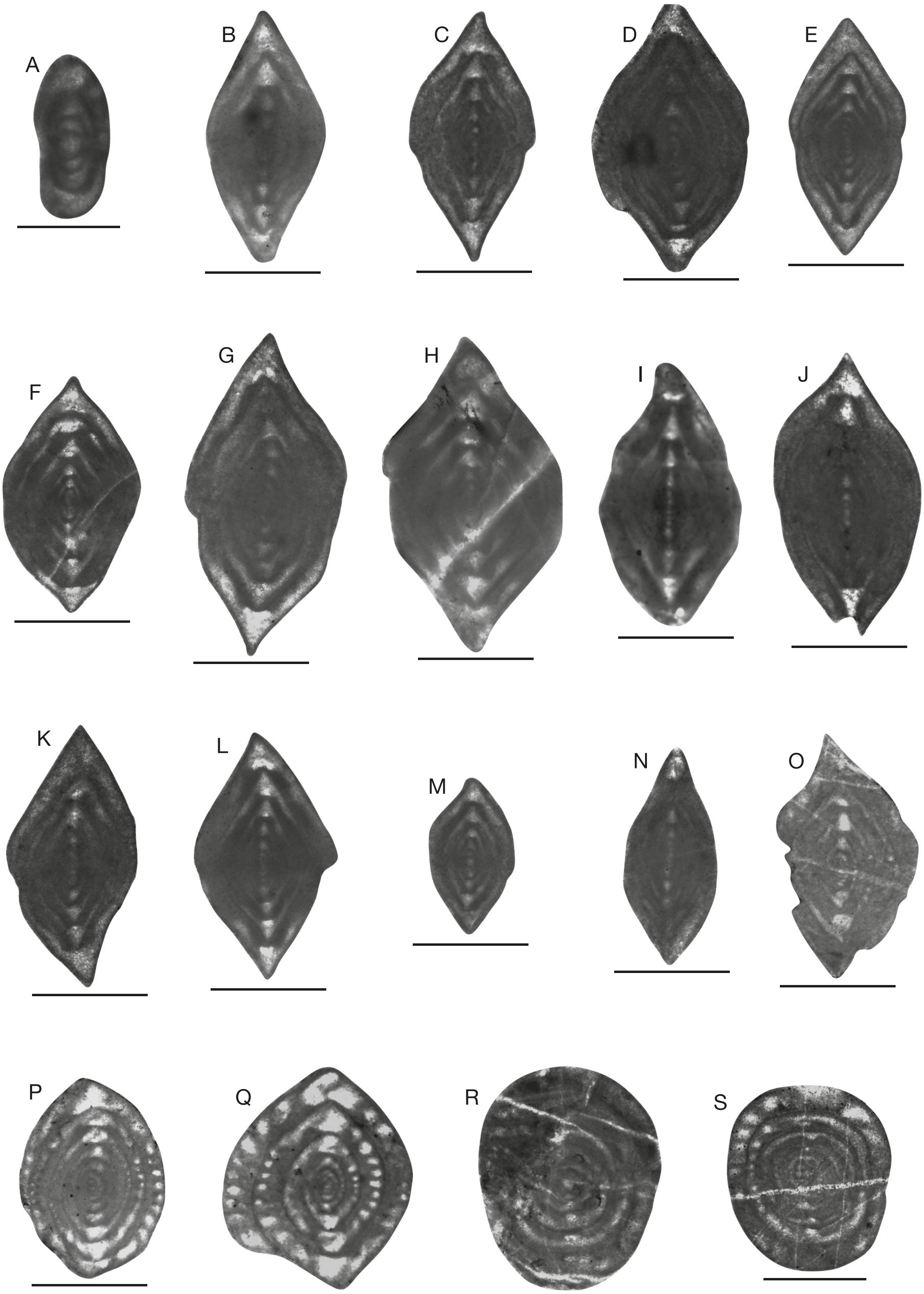
fossil biota (e.g., echinoids, bryozoans, bivalves, crinoids and calcareous algae) including a rich and diverse fusulinid fauna (Figs 6-18). The fusulinid assemblages of the Moscovian to lower Kasimovian strata enable a detailed biostratigraphic subdivision and correlation with coeval fusulinid assemblages of other regions of the Tethyan Realms such as the Russian Platform, Cantabrian Mountains (Spain), Iran and southern Urals.

Moscovian stage, Vereian substage

The basal Vereian substage of the Moscovian stage is characterized by the first appearance datum (FAD) of *Aljutovella aljutovica* and *Solovievaia ovata ovata* (Rauzer-Chernousova, 1938) in the Hadim Nappe sections (Figs 3; 4; 6). In addition to these index taxa, the Vereian substage is characterized by very abundant and diverse fusulinid assemblages including, *Eostaffella kashirica* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 7A), *Schubertella obscura obscura* Lee & Chen *in* Lee, Chen & Chu, 1930 (Fig. 9A), *Profusulinella rhomboides* (Lee & Chen *in* Lee, Chen & Chu, 1930) (Fig. 9H, I), *Profusulinella pararhomboides* Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936 (Fig. 9C, D), *Profusulinella pseudorhomboides* Putrya & Leontovich, 1948 (Fig. 9E, F), *Solovievaia* ex gr. *nuratavensis* (Solovieva, 1977) (Fig. 9K), *Solovievaia ovata nytvica* (Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 9N, O), *Solovievaia subovata* (Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 9Q), *Depratina chernovi* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 10A, B), *Depratina convoluta* (Lee & Chen *in* Lee, Chen & Chu, 1930) (Fig. 10C), *Depratina paratimanica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 10F, G), *Depratina posadai* (Villa, 1995) (Fig. 10H, I), *Depratina prisca prisca* (Deprat, 1912) (Fig. 10J-M), *Depratina prisca sphaeroidea* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 10N, O), *Depratina prisca timanica* (Kireeva in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 10P-S), *Depratina sitteri* (van Ginkel, 1987) (Fig. 10T, U), *Staffellaeformes tashliensis* (Lebedeva in Grozdilova, Lebedeva, Lipina, Malakhova, Mikhailova, Chermnykh, Postoyalko, Simonova, Sinitsyna, Krylova, Grozdilova, Pozner & Sultanaev, 1975) (Fig. 10V, W), *Aljutovella arrisionis arrisionis* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11H, I), *Aljutovella arrisionis molotovensis* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11J), *Aljutovella artificialis* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11K, L), *Aljutovella* cf. *cafirniganica* Bensh, 1969 (Fig. 11M), *Aljutovella conspecta* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11N), *Aljutovella lepida novoburasiensis* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11R), *Aljutovella postaljutovica* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 12C, D), *Aljutovella skelnevatica* (Putrya & Leontovich, 1948) (Fig. 12H, I), *Aljutovella splendida* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 12J, K), *Aljutovella* cf. *stocklini* Leven, Davydov & Gorgij, 2006 (Fig. 12L), *Aljutovella subaljutovica* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 12M, N), *Aljutovella tumida* Bensh, 1969 (Fig. 12O, P), *Aljutovella typica* Akbaş, n. sp. (Fig. 12Q, R) and *Tikhonovichiella praetikhonovichi* Akbaş *in* Akbaş & Okuyucu, 2021 (Fig. 12U). While most of the species in this assemblage first appear in the Moscovian stage, species that actually first appeared in the Bashkirian stage are *Eostaffella kashirica*, *Schubertella obscura obscura*, *Profusulinella rhomboides*, *Profusulinella pararhomboides*, *Solovievaia* ex gr. *nuratavensis*, *Depratina convoluta*, *Depratina prisca prisca*, *Depratina prisca sphaeroidea*, *Depratina prisca timanica* and *Tikhonovichiella praetikhonovichi* Akbaş in the Hadim Nappe (Akbaş & Okuyucu 2021) (Fig. 6).

Aljutovella aljutovica, which is one of the most characteristic fusulinids of the basal part of the Moscovian stage, was described for the first time by Rauzer-Chernousova (1938) within the Vereian succession of the Samara and Moscow Basins on the Russian Platform. Later, Rauzer-Chernousova *et al.* (1951) described this form at the lower Moscovian (Vereian-lower Kashirian?) succession of the Russian Platform. *Aljutovella aljutovica* has been described from Vereian succession of the southern Urals (Kulagina 2003, 2008), Urals (Grozdilova *et al.* 1975), Alai-Turkmenistan (Dzhenchuraeva 1979), Pamir Mountains (Leven 1998) and Hadim Nappe (Dzhenchuraeva & Okuyucu 2007; Kobayashi 2011). Several additional species of *Aljutovella* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 are also very common in lower Moscovian (Vereian-Kashirian) successions of the Russian Platform (Rauzer-Chernousova *et al.* 1951). Therefore, this interval correlates well with lower Moscovian succession of the Russian Platform based on diverse and rich *Aljutovella* assemblage in studied material.

Fig. 7. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Eostaffella kashirica* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 18G27.18, GS; **B**, *Ozawainella angulata* (Colani, 1924), subaxial section, 15Y36.18, YS; **C**, **D**, *Ozawainella crassiformis* Putrya, 1956; **C**, axial section, 15Y36.20, YS; **D**, axial section, 16B43.15, BS; **E**, *Ozawainella krasnokamski* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 15Y39.12, YS; **F**, *Ozawainella kumpani* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 18G41.12, GS; **G**, **H**, *Ozawainella kurachovensis* Manukalova, 1950; **G**, subaxial section, 16B42.09, BS; **H**, subaxial section, 18G41.05, GS; **J**, **K**, *Ozawainella leei* (Putrya, 1939);



J, subaxial section, 15Y29.09, YS; **K**, subaxial section, 16B42.26, BS; **L**, **M**, *Ozawainella mosquensis* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **L**, subaxial section, 16B43.11, BS; **M**, axial section, 18G41.16, GS; **N**, *Ozawainella paratingi* Manukalova, 1950, axial section, 15Y39.15, YS; **O**, *Ozawainella pseudorhomboidalis* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 16B42.08, BS; **P**, *Ozawainella tingi* (Lee, 1937), subaxial section, 18G40.08, GS; **Q**-**R**, *Ozawainella quadrata* Kireeva, 1949; **Q**, axial section, 15Y37.05, YS; **R**, axial section, 18G42.04, GS; **S**, *Neostaffella* cf. *formosa* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 18G34.03, GS; **T**, *Neostaffella larionovae polasnensis* (Rauzer-Chernousova & Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) subaxial section, 18G34.07.02, GS. Scale bar: 500 µm except A, 250 µm.

Moscovian stage, Kashirian substage

The Kashirian substage of the Moscovian stage is characterized by the occurrence of fusulinids developing four-layered wall which consists of tectum, diaphanotheca, lower and upper tectorium. The genus *Neostaffella* Miklukho-Maklay, 1959 with four-layered wall structure in its last volutions, also appears in this substage (Fig. 6). The base of the Kashirian substage is characterized by FAD of *Aljutovella priscoidea* (Rauzer-Chernousova, 1938) and *Eofusulina triangula* (Rauzer-Chernousova & Belyaev in Rauzer-Chernousova, Belyaev & Reitlinger, 1936) in the Hadim Nappe sections (Figs 3-6). The abundant and diverse fusulinid assemblages of this substage contain *Ozawainella crassiformis* Putrya, 1956 (Fig. 7C, D), *Ozawainella leei* (Putrya, 1939) (Fig. 7J, K), *Neostaffella* cf. *formosa* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 7S), *Neostaffella larionovae polasnensis* (Rauzer-Chernousova & Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 7T), *Neostaffella nibelensis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 8A), *Neostaffella sphaeroidea sphaeroidea* (Ehrenberg, 1842) (Fig. 8E, F), *Neostaffella sphaeroidea cuboides* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 8G, H), *Neostaffella subquadrata* (Grozdilova & Lebedeva, 1950) (Fig. 8I, J), *Profusulinella parafittsi* Rauzer-Chernousova & Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 9B), *Profusulinella pararhomboides* (Fig. 9C, D), *Profusulinella pseudorhomboides* (Fig. 9E, F), *Profusulinella rhombiformis nibelensis* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 9G), *Profusulinella rhomboides* (Fig. 9H, I), *Solovievaia arta* (Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 9J), *Solovievaia* ex gr. *nuratavensis* (Fig. 9K), *Solovievaia ovata nytvica* (Fig. 9N, O), *Solovievaia simplex* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), n. comb. (Fig. 9P), *Solovievaia subovata* (Fig. 9Q), *Solovievaia syzranica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), n. comb. (Fig. 9R, S), *Depratina dubia* (Villa, 1995) (Fig. 10D, E), *Depratina paratimanica* (Fig. 10F, G), *Depratina posadai* (Fig. 10H, I), *Depratina prisca prisca* (Fig. 10J-M), *Depratina prisca sphaeroidea* (Fig. 10N, O), *Depratina prisca timanica* (Fig. 10P-S), *Taitzehoella librovitchi* (Dutkevich, 1934) (Fig. 10 X-Z), *Taitzehoella mutabilis* (Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 11A, B), *Aljutovella artificialis* (Fig. 11K, L), *Aljutovella cybaea* Leontovich in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 11O, P), *Aljutovella isvarica* Putrya, 1956 (Fig. 11Q), *Aljutovella priscoidea* (Fig. 12E-G), *Aljutovella postaljutovica* (Fig. 12C, D), *Aljutovella splendida* (Fig. 12J, K), *Aljutovella subaljutovica* (Fig. 12M, N), *Aljutovella typica* Akbaş, n. sp. (Fig. 12Q, R), *Eofusulina binominata* Putrya, 1956 (Fig. 14J, K), *Eofusulina triangula* (Fig. 14L, M), *Praefusulinella okuyucui* Akbaş, n. gen., n. sp. (Fig. 15C-G), *Fusulinella absoluta* Akbaş, n. sp. (Fig. 17A-E), *Fusulinella praecolaniae* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 18B), *Fusulinella* ex gr. *schubertellinoides* Putrya, 1938 (Fig. 18G, H) and *Fusulinella* sp. A (Fig. 18K, L) taxa.

Aljutovella priscoidea, one of the most age-diagnostic species of this assemblage, was originally described by Rauzer-Chernousova (1938) from the lower Moscovian (Kashirian) sediments of the Samara region (Russian Platform), and it is known from coeval succession on the Russian Platform (Rauzer-Chernousova *et al.* 1951), southern Gissar-Tajikistan (Bensh 1969), Urals (Grozdilova *et al.* 1975), Alai-Turkmenistan (Dzhenchuraeva 1979), Cantabrian Mountains (Villa 1995) and Iran (Leven *et al.* 2006; Leven & Gorgij 2011).

The fusulinid taxa and their stratigraphic ranges in the sections studied herein provide a precise correlation with coeval sections in Russian Platform, Cantabrian Mountains and Iran.

Moscovian stage, Podolskian substage

The Podolskian substage is characterized by the occurrence of the genus *Beedeina* Galloway, 1933 which is characterized by a four layered wall and regularly folded septal structure (Figs 13C-P; 14A-I). The new genus *Praefusulinella* Akbaş, n. gen. which described herein, is also present in this substage with its four new species (Figs 14N, O; 15; 16). In the Hadim Nappe sections, the Podolskian substage is composed of very rich and diverse fusulinid assemblages including *Ozawainella angulata* (Colani, 1924) (Fig. 7B), *Ozawainella crassiformis* (Fig. 7C, D), *Ozawainella kumpani* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 7F), *Ozawainella kurachovensis* Manukalova, 1950 (Fig. 7G, H), *Ozawainella leei* (Fig. 7J, K), *Ozawainella mosquensis* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 7L, M), *Ozawainella tingi* (Lee, 1937) (Fig. 7P), *Ozawainella quadrata* Kireeva, 1949 (Fig. 7Q, R), *Neostaffella ozawai compacta* (Manukalova, 1950) (Fig. 8C, D), *Neostaffella sphaeroidea cuboides* (Fig. 8G, H), *Neostaffella umbilicata* (Putrya & Leontovich, 1948) (Fig. 8K, L), *Depratina prisca sphaeroidea* (Fig. 10N, O), *Taitzehoella librovitchi* (Fig. 10X-Z), *Taitzehoella mutabilis* (Fig. 11A, B), *Taitzehoella praelibrovichi* (Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 11C, D), *Aljutovella pojarkovie* Dzhenchuraeva, 1979 (Fig. 12A, B), *Beedeina elegans* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reytlinger, 1940) (Fig. 13C, D), *Beedeina minuta* Akbaş, n. sp. (Fig. 13E, F), *Beedeina paradistenta* (Safonova in Rauzer-Chernousova,

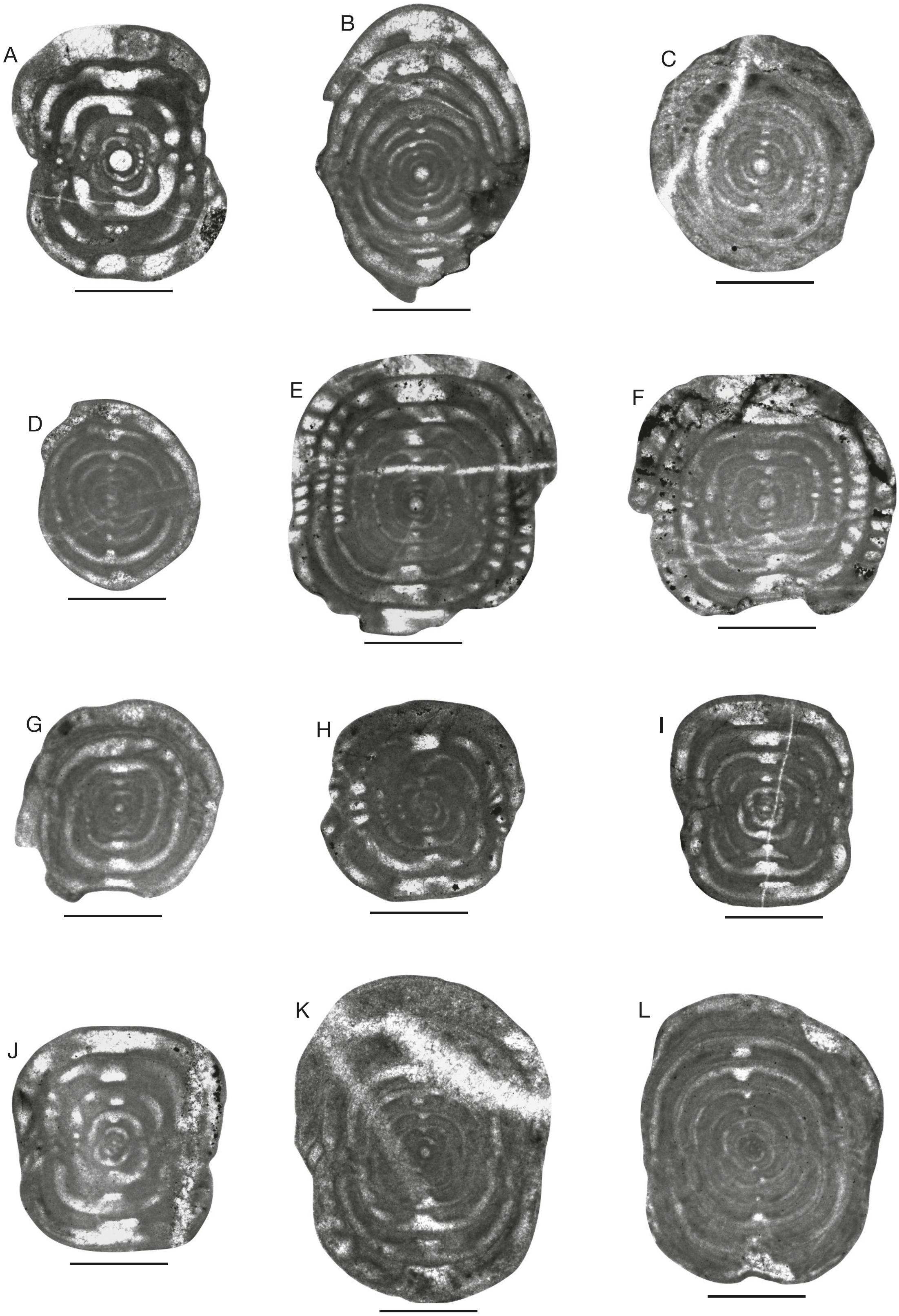


Fig. 8. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Neostaffella nibelensis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 15Y31.05, YS; **B**, *Neostaffella ozawai ozawai* (Lee & Chen *in* Lee, Chen & Chu, 1930), axial section, 18G49.03, GS; **C**, **D**, *Neostaffella ozawai compacta* (Manukalova, 1950); **C**, axial section, 15Y34.03, YS; **D**, subaxial section, 18G49.04, GS; **E**, **F**, *Neostaffella sphaeroidea sphaeroidea* (Ehrenberg, 1842); **E**, axial section, 15Y29.12, YS; **F**, axial section, 18G32.22, GS; **G**, **H**, *Neostaffella sphaeroidea cuboides* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **G**, axial section, 15Y36.07.01, YS; **H**, subaxial section, 18G32.09, GS; **I**, **J**, *Neostaffella subquadrata* (Grozdilova & Lebedeva, 1950); **I**, subaxial section, 15Y31.08, YS; **J**, axial section, 18G32.10, GS; **K**, **L**, *Neostaffella umbilicata* (Putrya & Leontovich, 1948); **K**, axial section, 15Y36.06, YS; **L**, subaxial section, 15Y36.15.01, YS. Scale bar: 500 µm.

Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 13I), *Beedeina pseudoelegans pseudoelegans* (Chernova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 13J-M), *Beedeina pseudoelegans keltmensis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 13N), *Beedeina samarica* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reytlinger, 1940) (Fig. 13O, P), *Beedeina schellwieni* (Staff *in* Schellwien & Staff, 1912) (Fig. 14A-D), *Beedeina tauridiana* Akbaş, n. sp. (Fig. 14E, F), *Beedeina timanica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 14H, I), *Eofusulina binominata* (Fig. 14J, K), *Praefusulinella guvenci* Akbaş, n. gen., n. sp. (Figs 14N, O; 15A), *Praefusulinella okuyucui* Akbaş, n. gen., n. sp. (Fig. 15C-G), *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp. (Fig. 16A-C), *Praefusulinella tekini* Akbaş, n. gen., n. sp. (Fig. 16E-I), *Fusulinella absoluta* Akbaş, n. sp. (Fig. 17A-E), *Fusulinella* cf. *eopulchra* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 17M), *Fusulinella obtusa minuta* Akbaş, n. subsp. (Fig. 17P-R), *Fusulinella propriaforma* Akbaş, n. sp. (Fig. 18C, D), *Fusulinella* ex gr. *schubertellinoides* (Fig. 18G, H) and *Fusulinella vozhgalensis devexa* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 18I, J) taxa. The base of Podolskian substage is marked by the FAD of *Fusulinella vozhgalensis devexa* and *Beedeina schellwieni* in the studied sections (Fig. 6).

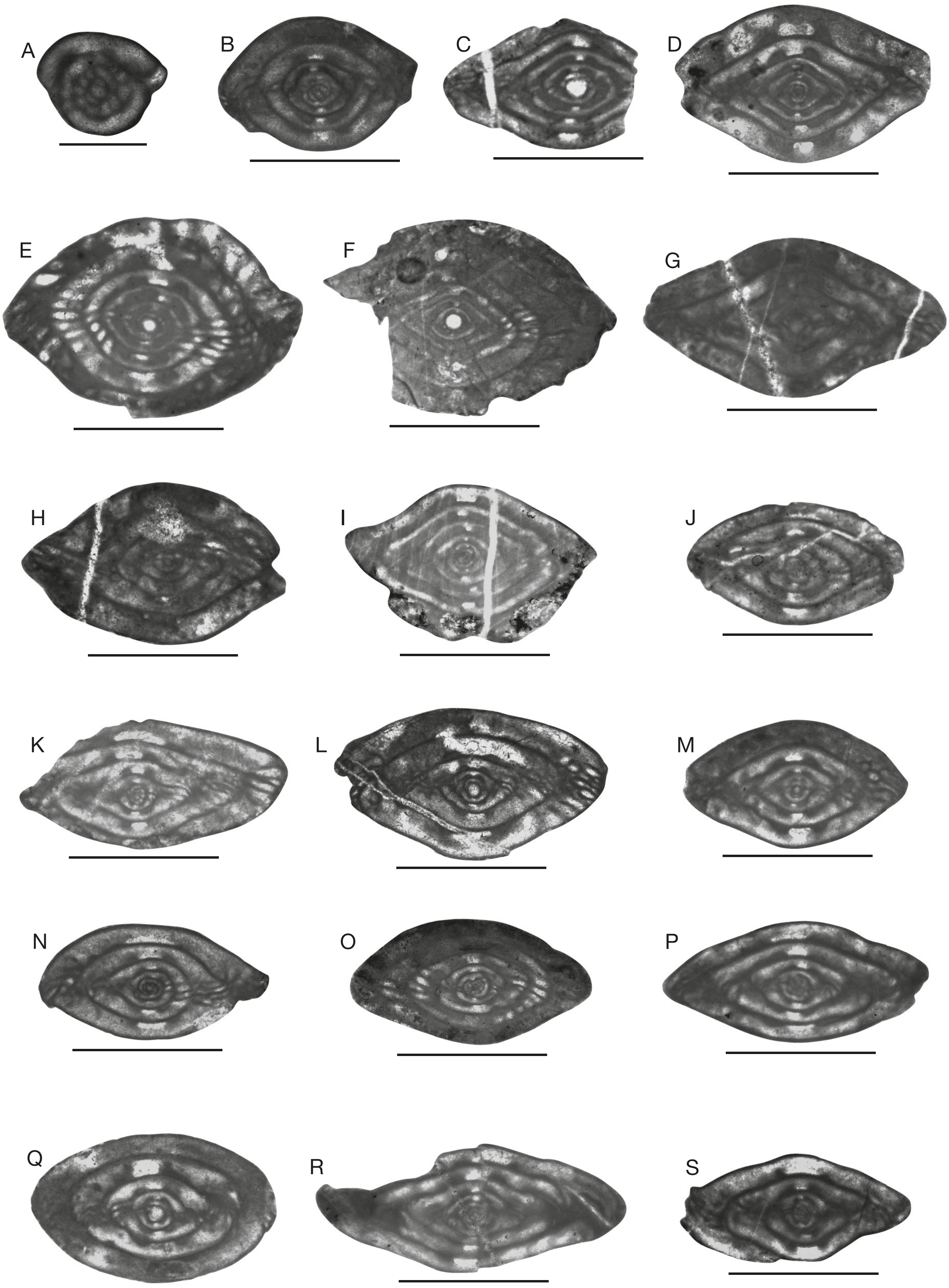
One of the index taxa of the Podolskian substage, *Fusulinella vozhgalensis devexa*, was originally described by Rauzer-Chernousova (in Rauzer-Chernousova *et al.* 1951) in the upper Moscovian (Podolskian) succession of the Russian Platform. The occurrence of this taxon in coeval succession from the northern Timan (Russia) is reported by Lebedeva (1966). *Beedeina schellwieni*, the other important taxon of this interval, was described for the first time by Staff (in Schellwien & Staff 1912) from the upper Moscovian of the Donets Basin (Ukraine). After its first description, *Beedeina schellwieni* is widely documented from the uppermost Kashirian(?) to upper Moscovian in many regions such as: the Russian Platform (Rauzer-Chernousova *et al.* 1951), Donets Basin (Ukraine) (Putrya 1956), Cantabrian Mountains (Spain) (Ginkel 1965; Villa 1995), Pamir Mountains (Tajikistan) (Leven 1998) and Hadim Nappe (Turkey) (Okuyucu 2002, 2009). Consequently, the fusulinid assemblages of this succession are correlative with the coeval succession of the Russian Platform and Cantabrian Mountains.

Moscovian Stage, Myachkovian Substage

The Myachkovian substage is notable for diversification of the genus *Fusulinella* Möller, 1877 and therefore its base is determined by the FAD of *Fusulinella bocki bocki* Möller, 1878 in the Hadim Nappe sections (Figs 4-6). The entire fusulinid assemblages of this interval are composed of *Ozawainella crassiformis* (Fig. 7C, D), *Ozawainella krasnokamski* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 7E), *Ozawainella kurachovensis* (Fig. 7G, H), *Ozawainella leei* (Fig. 7J, K), *Ozawainella mosquensis* (Fig. 7L, M), *Ozawainella paratingi* Manukalova, 1950 (Fig. 7N), *Ozawainella pseudorhomboidalis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 7O), *Neostaffella ozawai ozawai* (Lee & Chen *in* Lee, Chen & Chu, 1930) (Fig. 8B), *Neostaffella ozawai compacta* (Fig. 8C, D), *Beedeina elegans* (Fig. 13C, D), *Beedeina* cf. *nytvica callosa* (Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 13H), *Beedeina samarica* (Fig. 13O, P), *Beedeina schellwieni* (Fig. 14A-D), *Fusulinella bocki bocki* (Fig. 17G, H), *Fusulinella bocki pauciseptata* Rauzer-Chernousova & Belyaev in Rauzer-Chernousova, Belyaev & Reitlinger, 1936 (Fig. 17I), *Fusulinella* cf. *bocki timanica* Rauzer-Chernousova, 1951 (Fig. 17J), *Fusulinella* cf. *colaniae colaniae* Lee & Chen *in* Lee, Chen & Chu, 1930 (Fig. 17K), *Fusulinella colaniae meridionalis* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 17L), *Fusulinella helenae* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 17N, O), *Fusulinella paracolaniae* Safonova in Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 17T-V), *Fusulinella praebocki* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951 (Fig. 18A), *Fusulinella pseudobocki* Lee & Chen *in* Lee, Chen & Chu, 1930 (Fig. 18F), *Fusulinella*? sp. B (Fig. 18M-P) and *Fusulinella*? sp. C (Fig. 18Q-T).

Fusulinella bocki bocki was firstly described in the Novoarsk region (Kresty, Russia) by Möller (1878). It is also known to occur from the upper Moscovian succession in the Russian Platform (Rauzer-Chernousova *et al.* 1951), Cantabrian Mountains (Spain) (Ginkel 1965), northern Timan (Lebedeva 1966), Urals (Grozdilova *et al.* 1975), Pamir Mountains (Tajikistan) (Leven 1998) and Hadim Nappe (Okuyucu 2013). This interval can be correlated as well with the Russian Platform and Cantabrian Mountains based on the occurrence of rich and diverse *Fusulinella* assemblages and the index taxon.

Fig. 9. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Schubertella obscura obscura* Lee & Chen *in* Lee, Chen & Chu, 1930, axial section, 15Y22.03.02, YS; **B**, *Profusulinella parafittsi* Rauzer-Chernousova & Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 18G33.09, GS; **C**, **D**, *Profusulinella pararhomboides* Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936; **C**, axial section, 15Y30.09, YS; **D**, subaxial section, 18G27.12, GS; **E**, **F**, *Profusulinella pseudorhomboides* Putrya & Leontovich, 1948; **E**, oblique section, 15Y22.07, YS; **F**, axial section, 15Y25.14, YS; **G**, *Profusulinella rhombiformis nibelensis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 15Y25.04, YS; **H**, **I**, *Profusulinella rhomboides* (Lee & Chen *in* Lee, Chen & Chu, 1930); **H**, axial section, 15Y19.06, YS; **I**, subaxial section, 18G31.07, GS; **J**, *Solovievaia arta* (Leontovich *in* Rauzer-Chernousova, Gryzlova,



Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 15Y28.07.02, YS; **K**, *Solovievaia* ex gr. *nuratavensis* (Solovieva, 1977), axial section, 18G26.07, GS; **L**, **M**, *Solovievaia ovata ovata* (Rauzer-Chernousova, 1938); **L**, axial section, 15Y21.33.02, YS; **M**, axial section, 18G28.21, GS; **N**, **O**, *Solovievaia ovata nytvica* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **N**, axial section, 15Y21.28, YS; **O**, axial section, 18G32.16, GS; **P**, *Solovievaia simplex* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), n. comb., axial section, 18G33.14, GS; **Q**, *Solovievaia subovata* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 15Y24.20, YS; **R**, **S**, *Solovievaia syzranica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), n. comb.; **R**, axial section, 18G33.12, GS; **S**, axial section, 18G33.15, GS. Scale bar: 1 mm except A, 250 µm.

Lower Kasimovian

Due to extensive tectonic deformation, the top of the Yassıpınar section is bounded by faults and the lower Kasimovian succession could not be recognized (Fig. 3). In the Bademli and Gölbelen sections, however, limestones containing characteristic late Moscovian fusulinids are overlain by sandstones that are overlain by limestones containing the lower Kasimovian fusulinids *Quasifusulinoides* cf. *juvenatus* Kireeva in Bogush, 1963 (Fig. 13A), *Quasifusulinoides quasifusulinoides* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951) (Fig. 13B), *Fusulinella helenae* (Fig. 17N, O), *Protriticites subschwagerinoides subschwagerinoides* Rozovskaya, 1950 (Fig. 18U), *Protriticites subschwagerinoides inflatus* Bensh, 1972 (Fig. 18V, W) and *Montiparus* ex gr. *priscus* (Villa in Villa & Martinez-Garcia, 1989) (Fig. 18X) taxa. The fusulinid assemblages encountered in this interval indicate an early Kasimovian age (e.g., Davydov & Nilsson 1999; Forke & Samankassou 2000; Okuyucu 2009; Villa *et al.* 2015).

SYSTEMATIC PALAEONTOLOGY

In this study, the systematic and taxonomic descriptions of fusulinids follow the reference-book on taxonomy of Paleozoic foraminifera proposed by Rauzer-Chernousova *et al.* (1996). All holotypes and paratypes are reposited in the collection of the MA-HY15, MA-HB16/19 and MA-HG18 in the Konya Technical University, Turkey.

Class FORAMINIFERA d'Orbigny, 1826
Superorder FUSULINOIDEA Fursenko, 1958
Order OZAWAINELLIDA Solovieva, 1980
Family Pseudostaffellidae Putrya, 1956

Genus *Neostaffella* Miklukho-Maklay, 1959

Type species. — *Melonia* (*Borelis*) *sphaeroidea* Ehrenberg, 1842 subsequently designated by Rauzer-Chernousova *et al.* (1951).

Assemblage. —The *Neostaffella* species recognized in this study are: *Neostaffella* cf. *formosa* (Fig. 7S), *Neostaffella larionovae polasnensis* (Fig. 7T), *Neostaffella nibelensis* (Fig. 8A), *Neostaffella ozawai ozawai* (Fig. 8B), *Neostaffella ozawai compacta* (Fig. 8C, D), *Neostaffella sphaeroidea sphaeroidea* (Fig. 8E, F), *Neostaffella sphaeroidea cuboides* (Fig. 8G, H), *Neostaffella subquadrata* (Fig. 8I, J), *Neostaffella umbilicata* (Fig. 8K, L).

Description

Test moderate in size and subspherical to quadrate in shape. Three-layered wall composed of tectum, lower and upper tectorium, a weakly developed diaphanotheca can be observed only in outer volutions of some individuals. Septa plain and not fluted. Chomata massive and ribbon-like.

Remarks

The genus *Neostaffella* is similar to the genus *Pseudostaffella* Thompson, 1942 in terms of general characteristics, but differs by larger, mostly square test shape, ribbon-like chomata and weakly developed diaphanotheca in the outer volutions. In this sense, many species of the genus *Pseudostaffella* which show these structural features were replaced into the genus *Neostaffella* by some previous researchers (Dzhenchuraeva 1979; Leven 1998; Dzhenchuraeva & Okuyucu 2007; Fohrer *et al.* 2007; Leven & Gorgij 2008, 2011; Davydov 2009; Khodjanyazova & Davydov 2013) after its original description by Miklukho-Maklay (1959). In this study, *Neostaffella* cf. *formosa* and *Neostaffella larionovae polasnensis*, formerly described in the genus *Pseudostaffella* by Rauzer-Chernousova & Safonova (in Rauzer-Chernousova *et al.* 1951), are included in the genus *Neostaffella* due to their morphological features, reflecting their characteristics of this genus.

Order FUSULINIDA Fursenko, 1958
Family Profusulinellidae Solovieva, 1996

Genus *Solovievaia* Vachard & Le Coze, 2018

Ovatella Solovieva *in* Rauzer-Chernousova, Bensh, Vdovenko, Gibshman, Leven, Ya Lipina, Reitlinger, Solovieva & Chediya, 1996: 93.

Solovievaia Vachard & Le Coze, 2018: 1-6 (*nomen novum* for *Ovatella* Solovieva, 1996).

Type species. — *Profusulinella ovata* Rauzer-Chernousova, 1938 by original designation.

Assemblage. — The recovered *Solovievaia* assemblage in this study are as follows; *Solovievaia arta* (Fig. 9J), *Solovievaia* ex gr. *nuratavensis* (Fig. 9K), *Solovievaia ovata ovata* (Fig. 9L, M), *Solovievaia ovata nytvica* (Fig. 9N, O), *Solovievaia simplex* n. comb.(Fig. 9P), *Solovievaia subovata* (Fig. 9Q) and *Solovievaia syzranica* n. comb. (Fig. 9R, S).

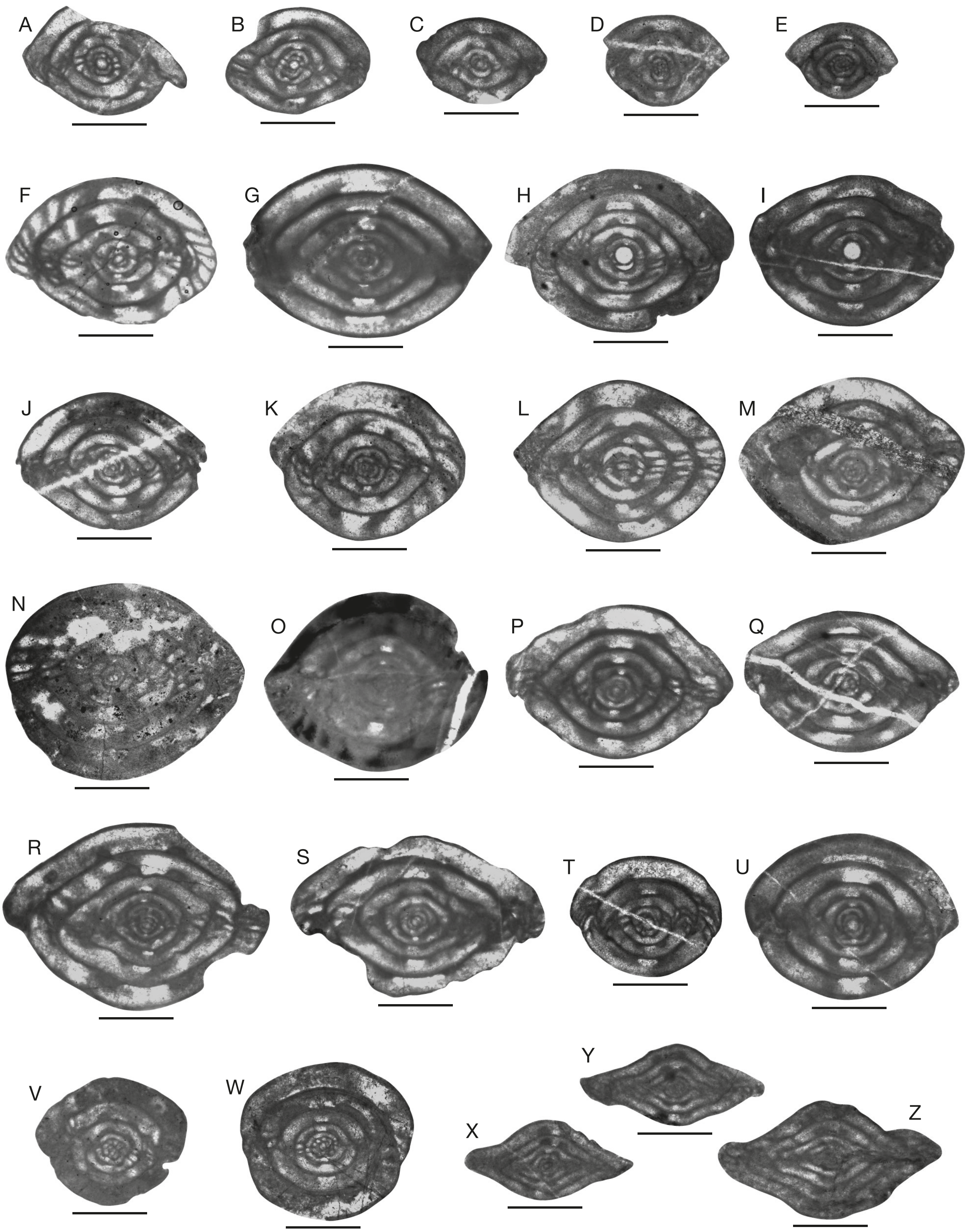
Description

Test small to moderately in size and elongate-ovoid or cylindrical in shape. Thin three-layered wall with tectum, lower and upper tectorium. Septa plain across the centre of the test and slightly folded at the end of the axis. Chomata massive, symmetrical and subquadrate in shape.

Remarks

According to Rauzer-Chernousova *et al.* (1951), the species group of the *Profusulinella* Rauzer-Chernousova & Belyaev in Rauzer-Chernousova, Belyaev & Reitlinger, 1936, which predominantly characterized by elongate

Fig. 10. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, **B**, *Depratina chernovi* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **A**, axial section, 15Y22.06, YS; **B**, axial section, 15Y23.06, YS; **C**, *Depratina convoluta* (Lee & Chen *in* Lee, Chen & Chu, 1930), axial section, 15Y23.07.01, YS; **D**, **E**, *Depratina dubia* (Villa, 1995); **D**, axial section, 15Y28.12, YS; **E**, axial section, 15Y29.08.01, YS; **F**, **G**, *Depratina paratimanica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **F**, axial section, 15Y24.10, YS; **G**, axial section, 18G29.03, GS; **H**, **I**, *Depratina posadai* (Villa, 1995); **H**, axial section, 15Y24.04,



YS; **I**, axial section, 18G29.13, GS; **J**-**M**, *Depratina prisca prisca* (Deprat, 1912); **J**, axial section, 15Y23.08, YS; **K**, axial section, 15Y28.09.02, YS; **L**, axial section, 18G27.04, GS; **M**, axial section, 18G28.08.02, GS; **N**, **O**, *Depratina prisca sphaeroidea* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **N**, axial section, 15Y31.06, YS; **O**, subaxial section, 18G32.06.01, GS; **P**-**S**, *Depratina prisca timanica* (Kireeva *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **P**, axial section, 15Y21.13, YS; **Q**, axial section, 15Y24.11, YS; **R**, axial section, 18G27.19, GS; **S**, axial section, 18G28.14.01, GS; **T**, **U**, *Depratina sitteri* (van Ginkel, 1987); **T**, axial section, 15Y21.03, YS; **U**, axial section, 18G29.17, GS; **V**, **W**, *Staffellaeformes tashliensis* (Lebedeva *in* Grozdilova, Lebedeva, Lipina, Malakhova, Mikhailova, Chermnykh, Postoyalko, Simonova, Sinitsyna, Krylova, Grozdilova, Pozner & Sultanaev, 1975); **V**, axial section, 15Y23.03, YS; **W**, axial section, 18G23.12, GS; **X**-**Z**, *Taitzehoella librovitchi* (Dutkevich, 1934); **X**, axial section, 15Y36.17, YS; **Y**, subaxial section, 16B36.03, BS; **Z**, subaxial section, 16B40.05, BS. Scale bar: 500 μm.

test were classified under the "*ovata* group". Later, this group was transferred to the genus *Ovatella* Solovieva *in* Rauzer-Chernousova, Bensh, Vdovenko, Gibshman, Leven, Ya Lipina, Reitlinger, Solovieva & Chediya, 1996 by Rauzer-Chernousova *et al.* (1996) without any detailed taxonomic list. In recent studies, Vachard & Le Coze (2018) emended the name *Ovatella* as *Solovievaia* Vachard & Le Coze, 2018 because of the prior use of the name *Ovatella* for a gastropod genus *Ovatella* Bivona-Bernardi, 1832 by Bivona-Bernardi (1832). The identified species in this study, *Solovievaia arta*, *Solovievaia ovata ovata*, *Solovievaia simplex* n. comb. and *Solovievaia syzranica* n. comb., are included in the genus *Solovievaia* because of their morphologic features, particularly their elongate shells.

Genus *Depratina* Solovieva, 1996

Type species. — *Schwagerina prisca* Deprat, 1912 by original designation.

Assemblage. — The *Depratina* assemblage in this study are *Depratina chernovi* (Fig. 10A, B), *Depratina convoluta* (Fig. 10C), *Depratina dubia* (Fig. 10D, E), *Depratina paratimanica* (Fig. 10F, G), *Depratina posadai* (Fig. 10H, I), *Depratina prisca prisca* (Fig. 10J-M), *Depratina prisca sphaeroidea* (Fig. 10N, O), *Depratina prisca timanica* (Fig. 10P-S) and *Depratina sitteri* (Fig. 10T, U).

Description

Test small in size and short-inflated fusiform to subspherical in shape. The wall thin and three-layered, composed of tectum, thin lower and upper tectorium. Septa thin and plain across the centre of the test, slightly folded only in polar region of last one or two volutions. Chomata massive, symmetrical and rounded to subquadrate in shape.

Remarks

The dominantly small sized and nearly globular or short-inflated fusiform shaped *Profusulinella* species were referred to as the "*prisca* group" by Rauzer-Chernousova *et al.* (1951). Later, the "*prisca* group" was assigned to the genus *Depratina* Solovieva *in* Rauzer-Chernousova, Bensh, Vdovenko, Gibshman, Leven, Ya Lipina, Reitlinger, Solovieva & Chediya, 1996. The species belonging to the genus *Depratina* differ from other *Profusulinella* species by having relatively globular or short-inflated fusiform test, smaller L/D ratio and poorly developed chomata. Hence, in this study the species belonging to the "*prisca* group" (Rauzer-Chernousova *et al.* 1951) and the species which have same features such as *Depratina chernovi*, *Depratina convoluta*, *Depratina paratimanica*, *Depratina posadai*, *Depratina prisca sphaeroidea* and *Depratina dubia* are assembled in the genus *Depratina*.

Family Aljutovellidae Solovieva, 1996

Genus *Aljutovella* Rauzer-Chernousova, 1951

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Type species. — *Profusulinella aljutovica* Rauzer-Chernousova, 1938 by original designation.

Assemblage. — The described *Aljutovella* assemblage of this study is as follows; *Aljutovella aljutovica* (Fig. 11E-G), *Aljutovella arrisionis arrisionis* (Fig. 11H, I), *Aljutovella arrisionis molotovensis* (Fig. 11J), *Aljutovella artificialis* (Fig. 11K, L), *Aljutovella* cf. *cafirniganica* (Fig. 11M), *Aljutovella conspecta* (Fig. 11N), *Aljutovella cybaea* (Fig. 11O, P), *Aljutovella isvarica* (Fig. 11Q), *Aljutovella lepida novoburasiensis* (Fig. 11R), *Aljutovella pojarkovie* (Fig. 12A, B), *Aljutovella postaljutovica* (Fig. 12C, D), *Aljutovella priscoidea* (Fig. 12E-G), *Aljutovella skelnevatica* (Fig. 12H, I), *Aljutovella splendida* (Fig. 12J, K), *Aljutovella* cf. *stocklini* (Fig. 12L), *Aljutovella subaljutovica* (Fig. 12M, N), *Aljutovella tumida* (Fig. 12O, P) and *Aljutovella typica* Akbaş, n. sp. (Fig. 12Q, R).

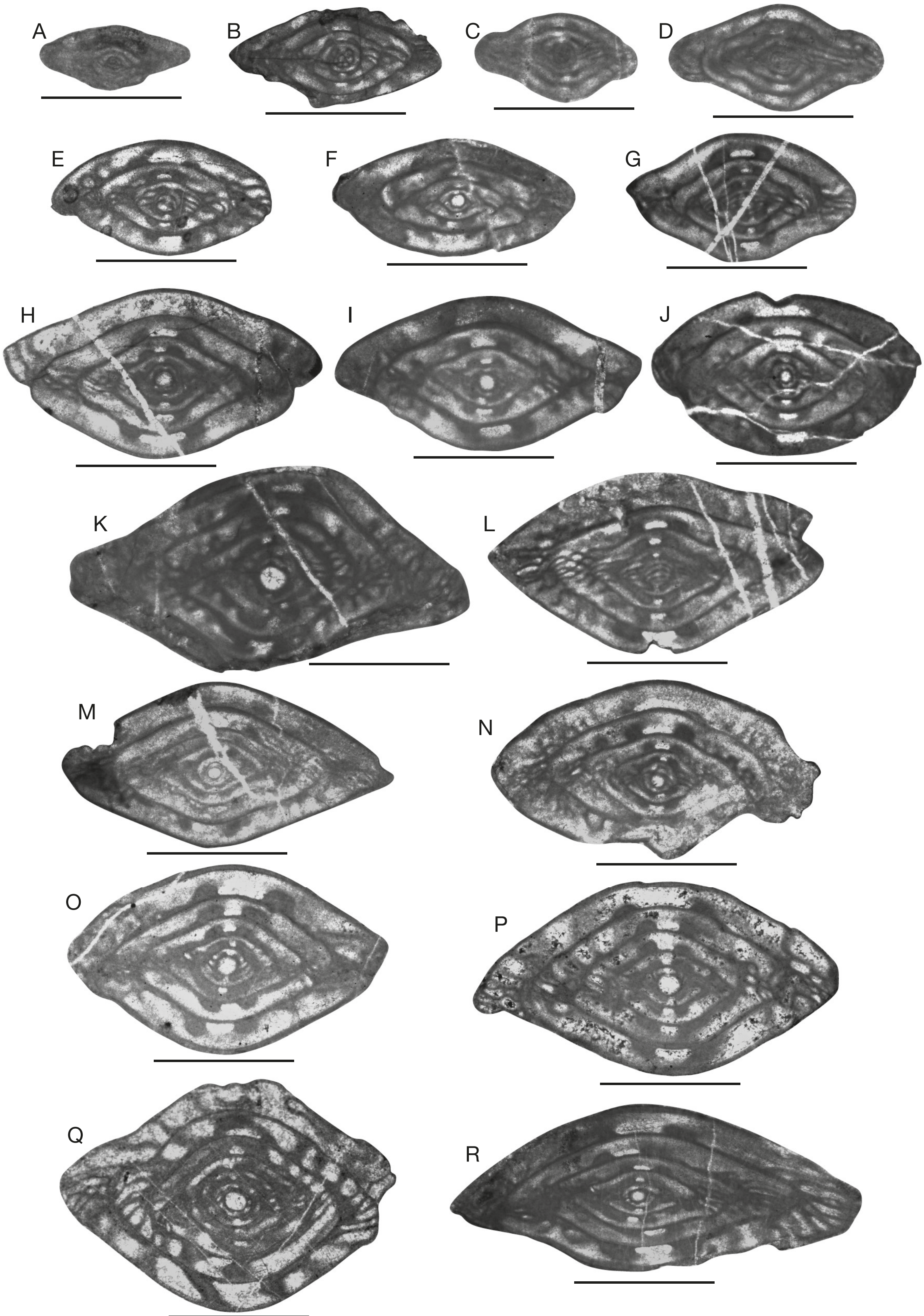
Description

Shell moderately large in size and fusiform in shape. The three-layered wall consists of the tectum, lower and upper tectorium, and poorly developed diaphanotheca in the last volutions of some individuals. Septa plain to slightly folded in the central part of the test and folded in polar regions. Chomata massive, commonly symmetrical and quadrate in shape.

Remarks

According to Rauzer-Chernousova *et al.* (1996), some species of the genus *Aljutovella* could be transferred to new genus such as *Skelnevatella* Solovieva in Rauzer-Chernousova, Bensh, Vdovenko, Gibshman, Leven, Ya Lipina, Reitlinger, Solovieva & Chediya, 1996 and *Priscoidella* Solovieva in Rauzer-Chernousova, Bensh, Vdovenko, Gibshman, Leven, Ya Lipina, Reitlinger, Solovieva & Chediya, 1996 without giving any species name except their type species, *Profusulinella skelnevatica* Putrya & Leontovich, 1948 and *Profusulinella priscoidea* Rauzer-Chernousova, 1938 respectively. These two species, which were described in the genus *Aljutovella* in the study of Rauzer-Chernousova *et al.* (1951), have been accepted by many authors (e.g., Putrya 1956; Bensh 1969; Grozdilova *et al.* 1975; Bogush & Yuferev 1976; Dzhenchuraeva 1979; Villa 1995; Leven *et al.* 2006; Fohrer *et al.* 2007; Davydov 2009; Leven & Gorgij 2011 and this study). One of the recent study of Kulagina (2008), the species *skelnevatica* is described under the genus *Skelnevatella*. The transfer of *P. skelnevatica* and *P. priscoidea* species to the new genus (*Skelnevatella* and *Priscoidella*) proposed by Solovieva (in Rauzer-Chernousova *et al.* 1996) is doubtful.

Fig. 11. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, **B**, *Taitzehoella mutabilis* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **A**, axial section, 15Y35.04, YS; **B**, axial section, 18G32.08, GS; **C**, **D**, *Taitzehoella praelibrovichi* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **C**, subaxial section, 15Y35.03, YS; **D**, subaxial section, 18G39.03, GS; **E**-**G**, *Aljutovella aljutovica* (Rauzer-Chernousova, 1938); **E**, subaxial section, 15Y21.16.01, YS; **F**, axial section, 15Y21.42, YS; **G**, axial section, 18G27.03, GS; **H**, **I**, *Aljutovella arrisionis arrisionis* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Cherno-



va, 1951; **H**, axial section, 18G27.20, GS; **I**, axial section, 18G28.07.02, GS; **J**, *Aljutovella arrisionis molotovensis* Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 15Y21.21, YS; **K**, **L**, *Aljutovella artificialis* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **K**, axial section, 16B33.06, BS; **L**, subaxial section, 18G28.06, GS; **M**, *Aljutovella* cf. *cafirniganica* Bensh 1969, axial section, 18G28.10, GS; **N**, *Aljutovella conspecta* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 18G28.23, GS; **O**, **P**, *Aljutovella cybaea* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **O**, axial section, 15Y27.06, YS; **P**, axial section, 15Y30.07, YS; **Q**, *Aljutovella isvarica* Putrya 1956, axial section, 18G31.03, GS; **R**, *Aljutovella lepida novoburasiensis* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 18G29.15, GS. Scale bar: 1 mm.

Aljutovella typica Akbaş, n. sp.
(Fig. 12Q, R)

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Holotype. — Specimen no. 15Y30.08.

Diagnosis. — A species of genus *Aljutovella* with inflated fusiform test, straight to convex lateral sides and distinct quadrate chomata shape.

Etymology. — Latin *typica*, meaning typical, named for its very characteristic shape that can be easily distinguished from other species of genus *Aljutovella*.

Material examined. — Two axial sections (specimen nos 15Y30.08 and 18G29.09) and one tangential section.

Type locality. — Yassıpınar and Gölbelen sections of Hadim Nappe (Hadim/Konya, Bozkır/Konya, Central Taurides, Turkey).

Stratigraphic range. — Carboniferous, Pennsylvanian, lower Moscovian, Vereian-Kashirian.

Occurrence. — Yassıpınar and Gölbelen sections of the Hadim Nappe (Hadim/Konya; Bozkır/Konya, Central Taurides, Turkey).

Description

Test small in size and inflated fusiform to subrhomboidal in shape with straight quite-sloping lateral sides and bluntly pointed to narrowly rounded and protuberant poles. All volutions coiled straight and relatively tight. The test of first one to two initial volutions spherical to subnautiloid in shape becoming the elongate towards the outer volutions. The outer shell shape is inflated fusiform. Proloculus is globular and small, with an outside diameter of 72 to 80 microns. The number of volutions is up to 4-5 in advanced specimens, and length ranges between 1.63 to 1.65 mm, diameters range between 0.94 to 0.97 mm and form ratios of 1.68 to 1.76. Wall is thin (0.02-0.035 mm in the outer volutions), three-layered and composed of a dark and thin tectum, dense and grey lower and upper tectorium (Fig. 12S, T). Septa plain in first one to two volutions while slightly folded in outer volutions. Chomata massive and quadrate in shape, their heights reach to half height of the chamber.

Remarks

Aljutovella typica Akbaş, n. sp. differs from the other species of genus *Aljutovella* by its typical shape of test while it is slightly similar to the *Aljutovella postaljutovica*, differings by having narrower chomata and weaker septal fluting.

Family Fusulinidae Möller, 1878
Subfamily Beedeininae Solovieva, 1996

Genus *Beedeina* Galloway, 1933

urn:lsid:zoobank.org:act:6A5DC70D-E063-4CED-90F2-51371460D34C

Type species. — *Fusulinella girtyi* Dunbar & Condra, 1927 by original designation.

Assemblage. — The *Beedeina* assemblage in this study includes: *Beedeina* cf. *nytvica callosa* (Fig. 13H), *Beedeina elegans* (Fig. 13C, D), *Beedeina minuta* Akbaş, n. sp. (Fig. 13E, F), *Beedeina paradistenta* (Fig. 13I), *Beedeina pseudoelegans pseudoelegans* (Fig. 13J-M), *Beedeina pseudoelegans keltmensis* (Fig. 13N), *Beedeina samarica* (Fig. 13O, P), *Beedeina schellwieni* (Fig. 14A-D), *Beedeina tauridiana* Akbaş, n. sp. (Fig. 14E, F) and *Beedeina timanica* (Fig. 14H, I).

Description

Test moderate to large in size and fusiform or relatively rhomboidal in shape. The four-layered wall has a tectum, lower and upper tectorium and diaphanotheca. Septa regularly to irregularly folded throughout the test. Chomata massive, symmetrical and quadrate in shape.

Remarks

In accordance with the generic definitions discussed by Ishii (1957, 1958), several species originally assigned to *Fusulina* were reassigned to the genus *Beedeina* in some recent studies (Villa 1995; Leven 1998; Leven & Gorgij 2008, 2011; and this study) based on their morphological features, such as the shell shape and lack of axial fillings. For this reason, *Beedeina paradistenta* which was originally described in the genus *Fusulina* by Safonova (in Rauzer-Chernousova *et al.* 1951) is considered as a species of the genus *Beedeina* in this study.

Beedeina minuta Akbaş, n. sp.
(Fig. 13E, F)

urn:lsid:zoobank.org:act:1E73CD2E-1886-47F8-BA1A-6C4294DAA3CC

Holotype. — Specimen no. 18G41.03.

Diagnosis. — A species of genus *Beedeina* with small and rhomboidal test, straight lateral sides and pointed poles.

Etymology. — Latin *minuta*, meaning small, named for its smaller size compare to the other species of the genus *Beedeina*.

Material examined. — Two axial sections (specimens nos 18G41.03 and 18G41.06).

Type locality. — Gölbelen section of Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

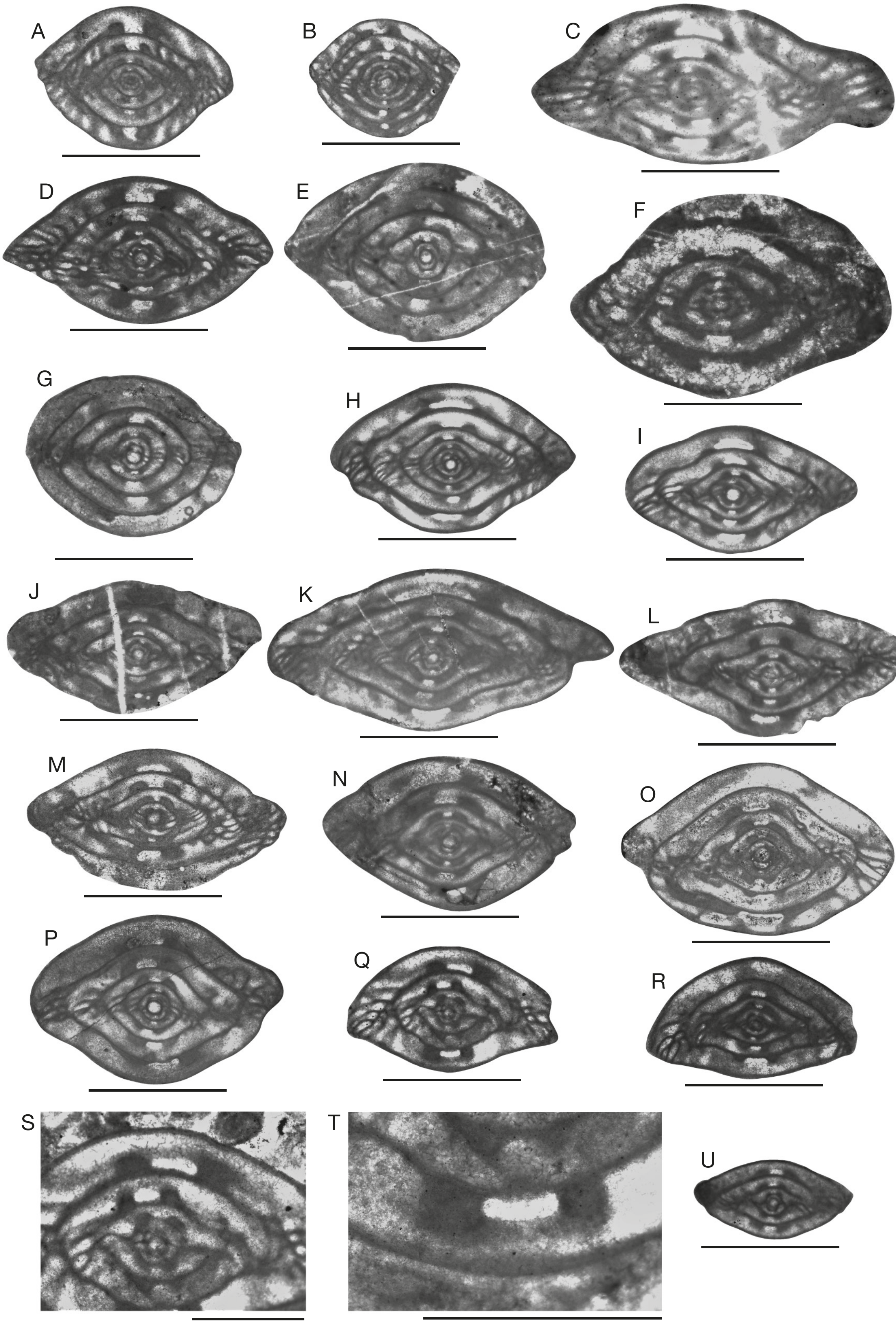
Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

Occurrence. — Gölbelen section of the Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

Description

Test small in size and rhomboidal in shape with lateral sides and pointed to bluntly pointed periphery and poles.

Fig. 12. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, **B**, *Aljutovella pojarkovie* Dzhenchuraeva 1979; **A**, axial section, 15Y33.08, YS; **B**, axial section, 15Y37.09, YS; **C**, **D**, *Aljutovella postaljutovica* Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **C**, subaxial section, 15Y30.04, YS; **D** axial section, 18G29.04, GS; **E**-**G**, *Aljutovella priscoidea* (Rauzer-Chernousova, 1938); **E**, axial section, 15Y24.19, YS; **F**, axial section, 16B35.04, BS; **G**, axial section, 15Y24.25, YS; **H**, **I**, *Aljutovella skelnevatica* (Putrya & Leon-



tovich, 1948); **H**, axial section, 18G27.11, GS; **I**, axial section, 18G27.16, GS; **J**, **K**, *Aljutovella splendida* Leontovich *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **J**, axial section, 15Y24.17, YS; **K**, axial section, 18G28.16, GS; **L**, *Aljutovella* cf. *stocklini* Leven, Davydov & Gorgij, 2006, axial section, 18G28.14.02, GS; **M**, **N**, *Aljutovella subaljutovica* Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **M**, axial section, 15Y24.23, YS; **N**, axial section, 18G27.14, GS; **O**, **P**, *Aljutovella tumida* Bensh, 1969; **O**, axial section, 18G27.13, GS; **P**, axial section, 18G27.21, GS; **Q**, **R**, *Aljutovella typica* Akbaş, n. sp.; **Q**, axial section, 15Y30.08 (Holotype), YS; **R**, axial section, 18G29.09, GS; **S**, **T**, detailed view of the wall structure of the *Aljutovella typica* Akbaş, n. sp., 15Y30.08 (Holotype) (Three layered wall including tectum, lower and upper tectorium); **U**, *Tikhonovichiella praetikhonovichi* Akbaş, axial section, 15Y21.38, YS. Scale bar: 1 mm except S, T, 500 µm.

All volutions coiled tightly, and the rhomboidal shape of the test is preserved from the first volutions to the last one. Proloculus globular and large, with an outside diameter of 180-210 µm. The number of volutions is up to 4½-5 in advanced specimens and length ranges between 1.70 to 1.85 mm, diameters range between 1.18 to 1.30 mm and form ratios of 1.31 to 1.57. Wall is thin (0.025-0.035 mm in the outer volutions), four-layered and composed of a distinct tectum, a diaphanotheca which thickness gradually increases towards outer volutions, and relatively thick lower and upper tectorium (Fig. 13G). Septa regularly folded throughout the test. Chomata are massive, symmetrical and rounded.

Remarks

Beedeina minuta Akbaş, n. sp. differs easily from the other species of genus *Beedeina* by its smaller test size.

Beedeina tauridiana Akbaş, n. sp.
(Fig. 14E, F)

urn:lsid:zoobank.org:act:820DB710-024D-4E9D-8BC2-A79EF15646A8

Holotype. — Specimen no. 16B41.07.

Diagnosis. — A species of genus *Beedeina* with inflated ovoid test, convex lateral sides and rounded poles.

Etymology. — This new species is named after its type location in the Taurides.

Material. — Two axial sections (specimen nos 16B41.07 and 16B41.08), one oblique section.

Type locality. — Bademli section of Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

Occurrence. — Bademli section of the Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test large in size and ovoid in shape with convex lateral sides and rounded poles. The initial first to second volutions coiled tightly and spherical in shape, but in the succeeding volutions the test loosely coiled and after a rapid elongation the outer shape of the test become ovoid. Proloculus globular and relatively large, with an outside diameter of 182-190 microns. The number of volutions is up to 6-6½ in advanced specimens, and length ranges between 3.15 to 3.98 mm, diameters range between 2.03 to 2.10 mm and form ratios of 1.50 to 1.96. Wall is relatively thick (0.045-0.050 mm in the outer volutions), four-layered and composed of a tectum, a well-developed diaphanotheca and dark-dense lower and upper tectorium (Fig. 14G). Septa regularly folded throughout the test. Chomata are massive, symmetrical and quadrate in shape, and their heights reach to half height of chamber.

Remarks

Beedeina tauridiana Akbaş, n. sp. differs easily from the other species of genus *Beedeina* by its characteristic ovoid test shape.

Family Fusulinellidae Staff & Wedekind, 1910
Subfamily Fusulinellinae Staff & Wedekind, 1910

Genus *Praefusulinella* Akbaş, n. gen.

urn:lsid:zoobank.org:act:2971ADCE-8942-4F7D-AD06-E8902541AC2B

Type species. — *Praefusulinella okuyucui* Akbaş, n. sp.

Diagnosis. — Test large, subspherical to ovoid and planispiral. Wall is four-layered. Septa slightly folded. Chomata massive, spherical to subquadrate in shape.

Etymology. — Latin *prae*, previous, because of the similarity and a possible ancestor of the genus *Fusulinella* Möller.

Included taxa. — *Praefusulinella guvenci* Akbaş, n. gen., n. sp. (Figs 14N, O; 15A), *Praefusulinella okuyucui* Akbaş, n. gen., n. sp. (Fig. 15C-G), *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp. (Fig. 16A-C) and *Praefusulinella tekini* Akbaş, n. gen., n. sp. (Fig. 16E-I).

Stratigraphic range. — Upper Moscovian.

Occurrence. — Gölbelen and Bademli sections of the Hadim Nappe (Bozkır/Konya; Bademli-Akseki/Antalya, Central Taurides, Turkey).

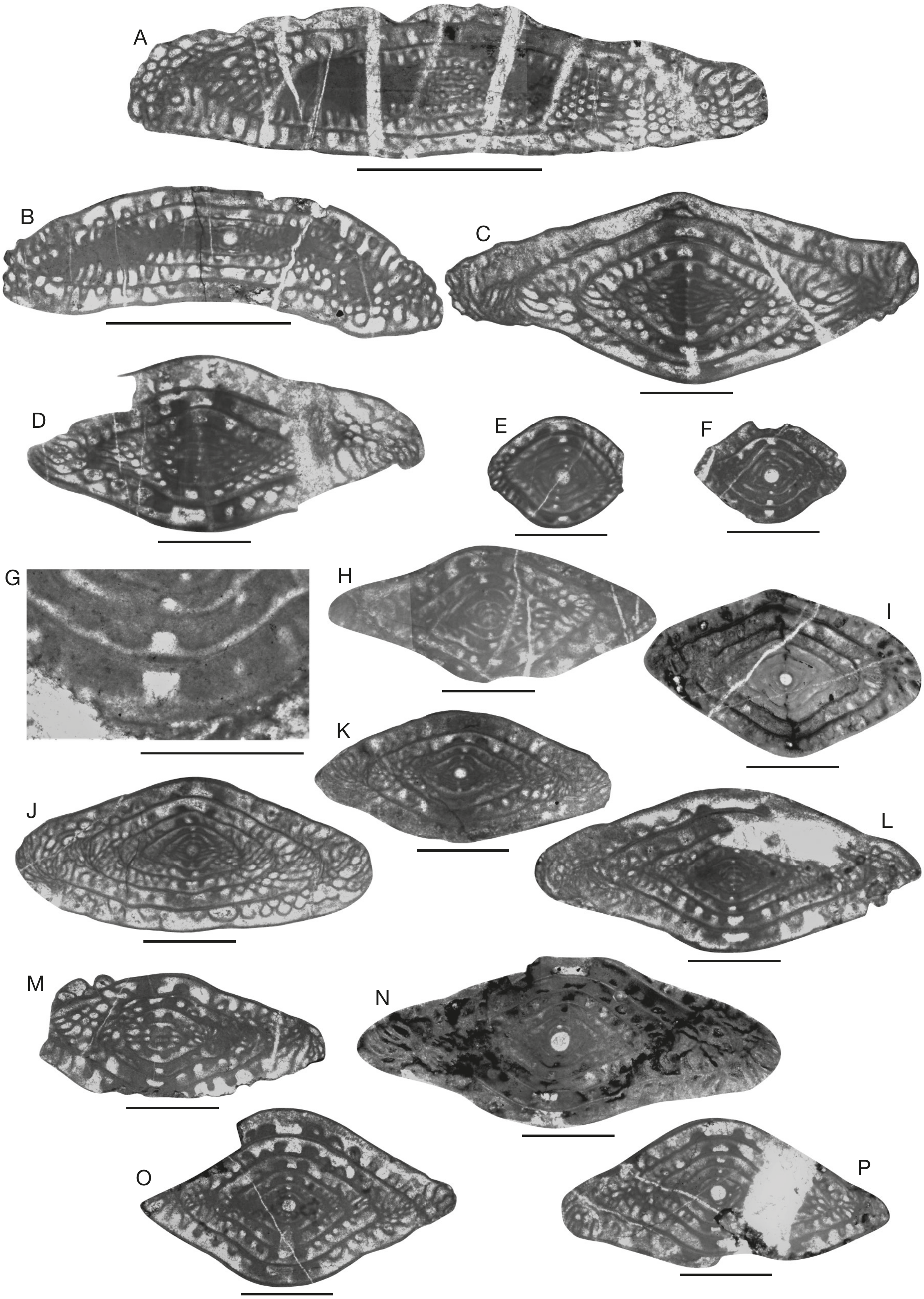
Description

Test large in size, entirely planispiral and involute, subspherical to ovoid in shape, or subrhomboidal in some specimens with spherical initial volutions. The coiling of the spiral is moderately tight and followed by some loosely coiled last volution in some adult forms. Wall is thick and four-layered including tectum, diaphanotheca, lower and upper tectorium. Septa regularly and slightly folded across the centre of the test and folded near the polar extremities. Chomata are massive, symmetrical and rounded to subquadrate or short ribbon-like in some specimens.

Remarks

Praefusulinella Akbaş, n. gen. is similar to the genus *Fusulinella* concerning the wall structure and septal fluting. However, the new genus differs by its thick wall, inflated subspherical to ovoid test shape and spherical initial volutions.

Fig. 13. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Quasifusulinoides* cf. *juvenatus* Kireeva *in* Bogush, 1963, subaxial section, 19B48.08, BS; **B**, *Quasifusulinoides quasifusulinoides* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 19B48.06, BS; **C**, **D**, *Beedeina elegans* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reytlinger, 1940); **C**, subaxial section, 16B40B.08, BS; **D**, subaxial section, 18G48.03, GS; **E**, **F**, *Beedeina minuta* Akbaş, n. sp.; **E**, axial section, 18G41.03 (Holotype), GS; **F**, axial section, 18G41.06, GS; **G**, detailed view of the wall structure of the *Beedeina minuta* Akbaş, n. sp., 18G41.06 (Four layered wall including tectum, diaphanotheca, lower and upper tectorium); **H**, *Beedeina* cf. *nytvica callosa* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva,



Leontovich, Safonova & Chernova, 1951), axial section, 18G55.03, GS; **I**, *Beedeina paradistenta* (Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 16B41.16, BS; **J**-**M**, *Beedeina pseudoelegans pseudoelegans* (Chernova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **J**, axial section, 15Y36.04, YS; **K**, axial section, 15Y36.09, YS; **L**, subaxial section, 16B40C19.01, BS; **M**, subaxial section, 18G45.06.02, GS; **N**, *Beedeina pseudoelegans keltmensis* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951), axial section, 16B41.11, BS; **O**, **P**, *Beedeina samarica* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reytlinger, 1940); **O**, axial section, 16B40B.05, BS; **P**, axial section, 18G45.03, GS. Scale bar: 1 mm except A, B, 2 mm; G, 500 µm.

Praefusulinella guvenci Akbaş, n. gen., n. sp. (Figs 14N, O; 15A)

urn:lsid:zoobank.org:act:6FD7FF4D-CCA5-4188-AD20-903641460250

Holotype. — Specimens nos 18G40.14.

Diagnosis. — A species of *Praefusulinella* Akbaş, n. gen. with inflated short-fusiform test, slightly straight to convex lateral sides and narrowly rounded poles.

Etymology. — This species is named after Prof. Dr. Tuncer Güvenç, in honour of his contributions to the Paleozoic foraminifera and fossil algae biostratigraphy.

Material examined. — Three axial sections (specimens nos 18G40.14, 18G40.16 and 18G40.20).

Type locality. — Gölbelen section of Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

Occurrence. — Gölbelen section of the Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

Description

Test large in size and inflated short-fusiform test with slightly straight to convex lateral sides and narrowly rounded poles. All volutions are coiled loosely. The initial first to second volutions are slightly spherical but the nautiloid shell shape is reached in the successive volutions. The last one or two volutions are short-fusiform in shape. Proloculus globular and relatively large, with an outside diameter of 140-180 microns. The number of volutions is up to 5 in advance specimens, and length ranges between 2.58 to 2.65 mm, diameters range between 1.75 to 1.90 mm and form ratios of 1.36 to 1.51. Four-layered wall is thick (0.045-0.070 mm in the outer volutions), and composed of a tectum, a well-developed and distinct diaphanotheca and dark-thin lower and dark-dense upper tectorium (Fig. 15B). Septa regularly folded throughout the coiling axis. Chomata are massive, symmetrical and rounded in shape which present a ridge on the tunnel sides and sloping to the axis. They are subribbon-like in earlier volutions and their heights reach to nearly height of chamber in outermost volutions.

Remarks

Praefusulinella guvenci Akbaş, n. gen., n. sp. is similar to *Praefusulinella okuyucui* Akbaş, n. gen., n. sp. and *Praefusulinella tekini* Akbaş, n. gen., n. sp., but differs from the former by smaller test, loose coiling and nautiloid initial volutions and from the latter by shorter test, nautiloid initial volutions and shape of the chomata.

Praefusulinella okuyucui Akbaş, n. gen., n. sp. (Fig. 15C-G)

urn:lsid:zoobank.org:act:B5C029FC-4729-4E42-BAE7-7AC0B952CF1B

Holotype. — Specimen no. 18G40.07.

Diagnosis. — A species of *Praefusulinella* Akbaş, n. gen. with very large and inflated short-fusiform to subspherical test, convex lateral sides and widely rounded poles.

Etymology. — This species is named after Prof. Dr. Cengiz Okuyucu, Konya Technical University, Konya, Turkey, in honour of his contributions to the knowledge of Carboniferous-Permian fusulinids biostratigraphy.

Material examined. — Four axial sections (specimens nos 18G40.03, 18G40.07, 18G40.18 and 18G41.10), one subaxial section (specimens no. 16B38.13).

Type locality. — Gölbelen and Bademli sections of Hadim Nappe (Hadim/Konya, Bademli-Akseki/Antalya, Central Taurides, Turkey).

Stratigraphic range. — Carboniferous, Pennsylvanian, Upper Moscovian, Kashirian-Podolskian.

Occurrence. — Gölbelen and Bademli Sections of the Hadim Nappe (Bozkır/Konya; Bademli-Akseki/Antalya, Central Taurides, Turkey).

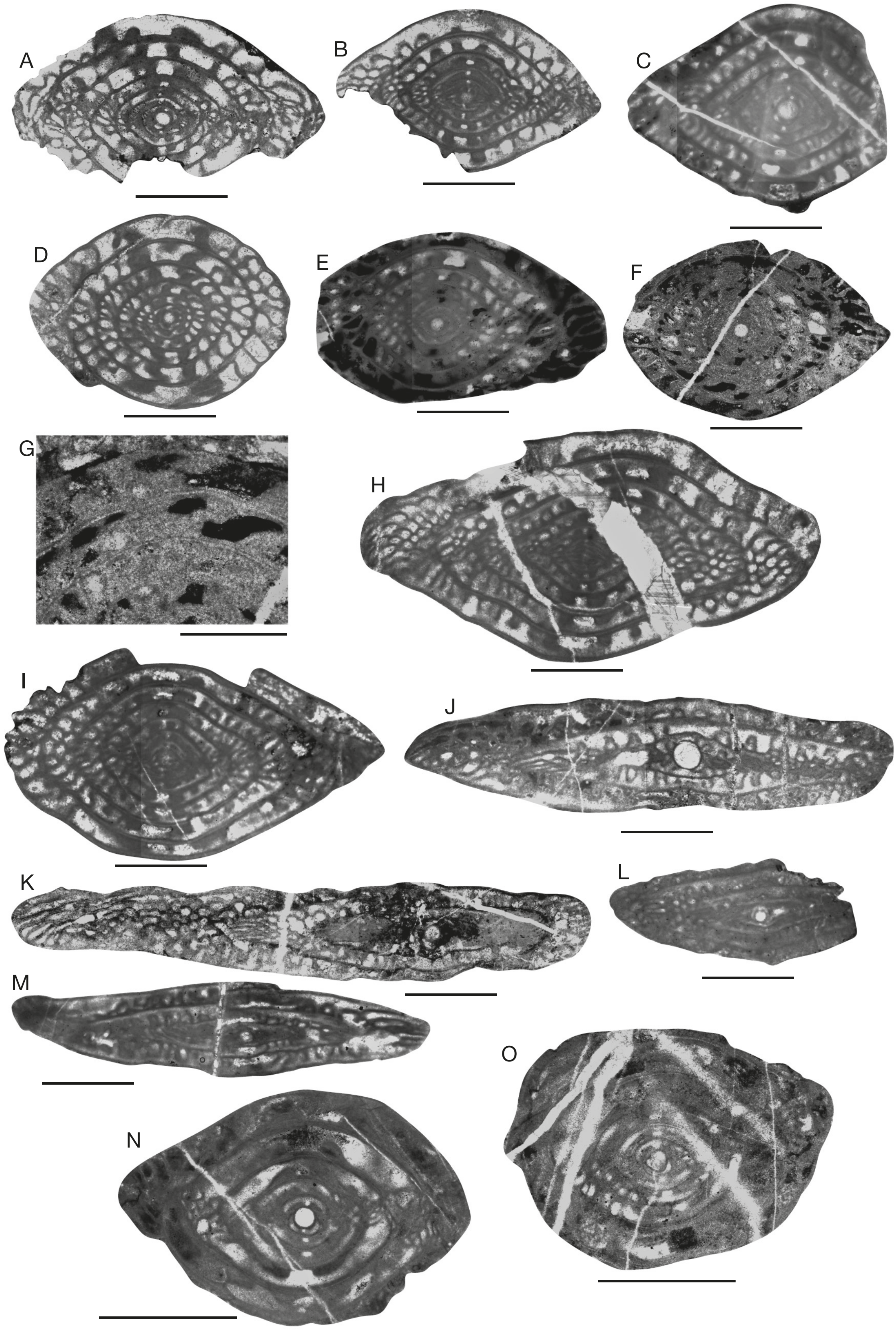
Description

Test large in size and more-inflated short-fusiform to subspherical in shape with convex lateral sides and widely rounded poles. The coiling of the spiral is relatively irregular. The initial volutions are tight and short-fusiform in shape, succeeding volutions loosely coiled. Proloculus globular and moderately in size, with an outside diameter of 100-190 microns. The number of volutions is up to 5-7 in advance specimens, and length ranges between 2.78 to 3.55 mm, diameters range between 1.98 to 2.73 mm and form ratios of 1.30 to 1.46. Four-layered wall is thick (0.045-0.090 mm in the outer volutions) and composed of a tectum, a well-developed and prominent diaphanotheca and dark lower and upper tectorium (Fig. 15H). Septa plain to slightly folded in initial volutions and folded in outer volutions across the centre of the test. Chomata are massive, symmetrical and rounded in shape and their heights reach to nearly height of chamber.

Remarks

Praefusulinella okuyucui Akbaş, n. gen., n. sp. is partly similar to some specimens of genus *Fusulinella* concerning the four-layered wall and septal fluting, but it easily differs from them by more large and nearly spherical test shape.

Fig. 14. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**-**D**, *Beedeina schellwieni* (Staff *in* Schellwien & Staff, 1912); **A**, axial section, 16B40A.09, BS; **B**, axial section, 16B40C.11, BS; **C**, axial section, 18G41.15, GS; **D**, oblique section, 18G45.07, GS; **E**, **F**, *Beedeina tauridiana* Akbaş, n. sp.; **E**, axial section, 16B41.07 (Holotype), BS; **F**, axial section, 16B41.08, BS; **G**, detailed view of the wall



structure of the *Beedeina tauridiana* Akbaş, n. sp., 16B41.08 (Four layered wall including tectum, diaphanotheca, lower and upper tectorium); **H**, **I**, *Beedeina timanica* (Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951); **H**, subaxial section, 16B40C.06, BS; **I**, axial section, 16B40C.18, BS; **J**, **K**, *Eofusulina binominata* Putrya, 1956; **J**, axial section, 15Y34.04, YS; **K**, subaxial section, 18G31.06, GS; **L**, **M**, *Eofusulina triangula* (Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936); **L**, axial section, 15Y25.06, YS; **M**, axial section, 15Y27.04, YS; **N**, **O**, *Praefusulinella guvenci* Akbaş, n. gen., n. sp.; **N**, axial section, 18G40.14 (holotype), GS; **O**, axial section, 18G40.16, GS. Scale bar: 1 mm except G, 500 µm.

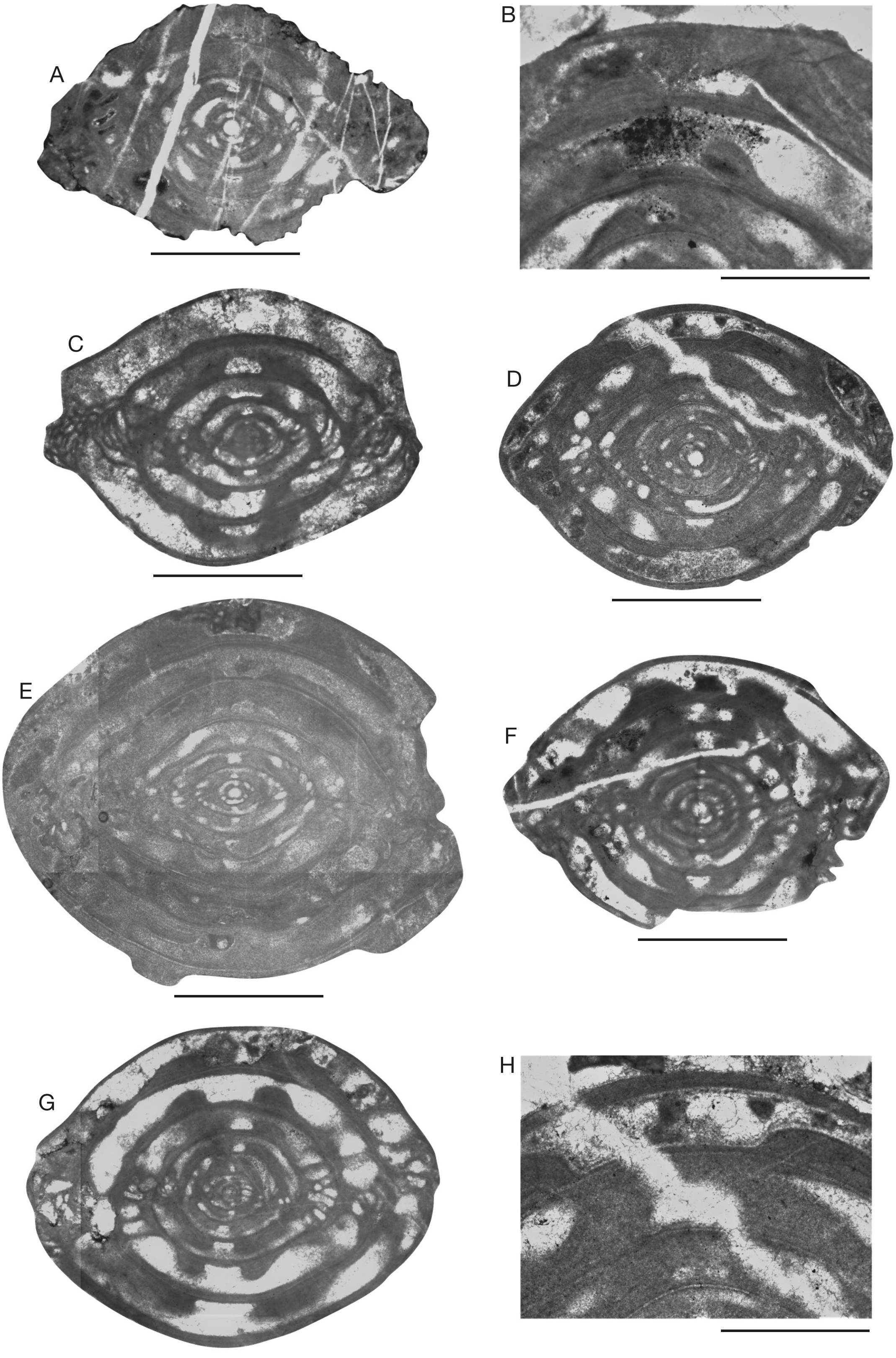


Fig. 15. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Praefusulinella guvenci* Akbaş, n. gen., n. sp., axial section, 18G40.20, GS; **B**, detailed view of the wall structure of the *Praefusulinella guvenci* Akbaş, n. gen., n. sp., 18G40.16 (four-layered wall including tectum, diaphanotheca, lower and upper tectorium); **C**-**G**, *Praefusulinella okuyucui* Akbaş, n. gen., n. sp.; **C**, subaxial section, 16B38.13, BS; **D**, axial section, 18G40.03, GS; **E**, axial section, 18G40.07 (Holotype), GS; **F**, axial section, 18G40.18, GS; **G**, axial section, 18G41.10, GS; **H**, detailed view of the wall structure of the *Praefusulinella okuyucui* Akbaş, n. gen., n. sp., 18G40.03 (four-layered wall including tectum, diaphanotheca, lower and upper tectorium). Scale bar: 1 mm except B, H, 500 µm.

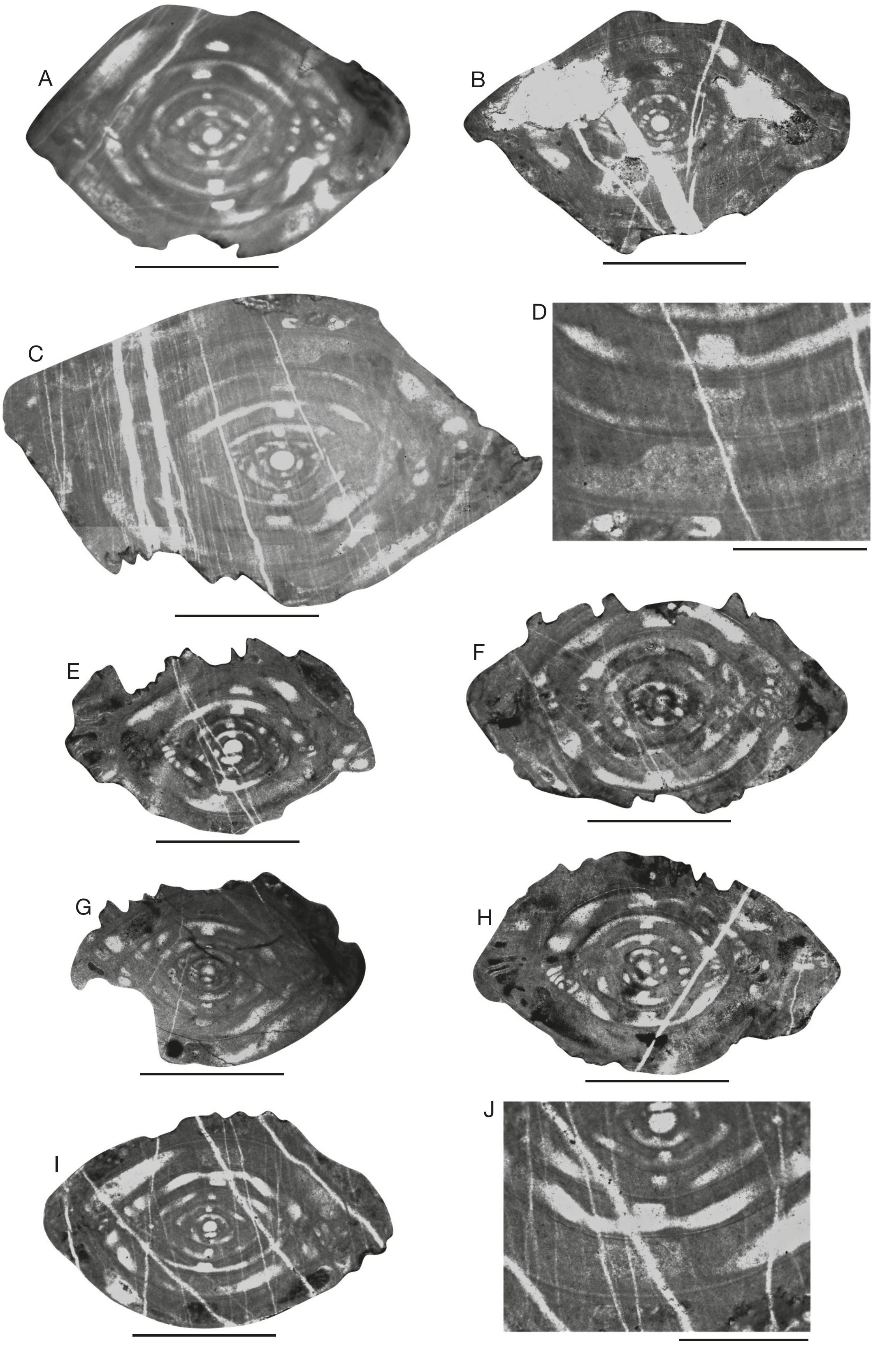


Fig. 16. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**-**C**, *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp.; **A**, axial section, 18G40.06, GS; **B**, axial section, 18G40.10, GS; **C**, axial section, 18G40.11 (Holotype), GS; **D**, detailed view of the wall structure of the *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp., 18G40.11 (holotype) (four-layered wall including tectum, diaphanotheca, lower and upper tectorium); **E**-**I**, *Praefusulinella tekini* Akbaş, n. gen., n. sp.; **E**, axial section, 18G40.12, GS; **F**, axial section, 18G40.13, GS; **G**, axial section, 18G40.15, GS; **H**, axial section, 18G40.17.01, GS; **I**, axial section, 18G40.21 (holotype), GS; **J**, detailed view of the wall structure of the *Praefusulinella tekini* Akbaş, n. gen., n. sp., 18G40.21 (holotype) (four-layered wall including tectum, diaphanotheca, lower and upper tectorium). Scale bar: 1 mm except D, J, 500 µm.

Praefusulinella rhombiforma Akbaş, n. gen., n. sp. (Fig. 16A-C)

urn:lsid:zoobank.org:act:21A32D06-9595-4D05-849A-5AE675339331

HOLOTYPE. — Specimen no. 18G40.11.

DIAGNOSIS. — A species of *Praefusulinella* Akbaş, n. gen. with very large and rhomboidal test, straight lateral sides and pointed poles.

ETYMOLOGY. — This new species is named for its rhomboidal test.

MATERIAL EXAMINED. — Three axial sections (specimens nos 18G40.06, 18G40.10 and 18G40.11).

TYPE LOCALITY. — Gölbelen section of Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

STRATIGRAPHIC RANGE. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

OCCURRENCE. — Gölbelen section of the Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

DESCRIPTION

Test very large in size and rhomboidal in shape with straight lateral sides and pointed poles. The test is tightly coiled. All initial volutions are ovoid in shape, but the outermost whorl is rhomboidal in shape. Proloculus globular and relatively large, with an outside diameter of 150-210 microns. The number of volutions is up to 5-6 in advance specimens, and length ranges between 2.93 to 4.13 mm, diameters range between 1.75 to 2.38 mm and form ratios of 1.60 to 1.74. Four-layered wall is moderately thick (0.045-0.050 mm in the outer volutions), and composed of a tectum, a prominent diaphanotheca and dark-dense lower and upper tectorium (Fig. 16D). Septa folded across the coiling axis. Chomata are massive, symmetrical and subribbon-like in shape and their heights reach to half height of chamber.

REMARKS

Praefusulinella rhombiforma Akbaş, n. gen., n. sp. shows similarity with *Fusulinella bocki bocki* and *Fusulinella bocki timanica*, but it easily differs from them by ovoid initial volutions and subribbon-like chomata.

Praefusulinella tekini Akbaş, n. gen., n. sp. (Fig. 16E-I)

urn:lsid:zoobank.org:act:36640616-8101-4D4C-A86E-971D6CA2F68A

HOLOTYPE. — Specimen no. 18G40.21.

ETYMOLOGY. — This species is named after Prof. Dr. Uğur Kağan Tekin, Hacettepe University, Ankara, Turkey, in honour of his contributions to the knowledge of Mesozoic Radiolarians taxonomy.

MATERIAL EXAMINED. — Five axial sections (specimens nos 18G40.12, 18G40.13, 18G40.15, 18G40.17.01 and 18G40.21).

TYPE LOCALITY. — Gölbelen section of Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

DIAGNOSIS. — A species of *Praefusulinella* Akbaş, n. gen. with large and inflated short-fusiform test, convex lateral sides and pointed poles.

STRATIGRAPHIC RANGE. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

OCCURRENCE. — Gölbelen section of the Hadim Nappe (Bozkır/Konya, Central Taurides, Turkey).

DESCRIPTION

Test relatively large in size and inflated short-fusiform in shape with convex lateral sides and narrowly rounded to pointed poles. The test takes its shape with first volutions and preserved throughout its evolution. The initial volutions are coiled tightly, but latters loosely. Proloculus globular and moderately in size, with an outside diameter of 130-190 microns. The number of volutions is up to 4½-5½ in advanced specimens, and length ranges between 2.15 to 2.90 mm, diameters range between 1.35 to 1.85 mm and form ratios of 1.48 to 1.59 (mostly 1.57-1.59). Four-layered wall is moderately thick (0.035-0.070 mm in the outer volutions), and composed of a prominent tectum, a very distinct diaphanotheca, thin-dark lower and thick-dark upper tectorium (Fig. 16J). Septa folded across the coiling axis. Chomata are massive, symmetrical and subribbon-like to rounded in shape and their heights reach to half height of chamber or pass it.

REMARKS

Praefusulinella tekini Akbaş, n. gen., n. sp. is similar to *Fusulinella bocki bocki* and *Fusulinella bocki timanica*, but it differs from them by smaller test and low L/D (L/D ratio of *Fusulinella bocki bocki* is 2.00 and L/D ratio of *Fusulinella bocki timanica* is range between 1.70 to 1.80), ovoid initial volutions and subribbon-like chomata.

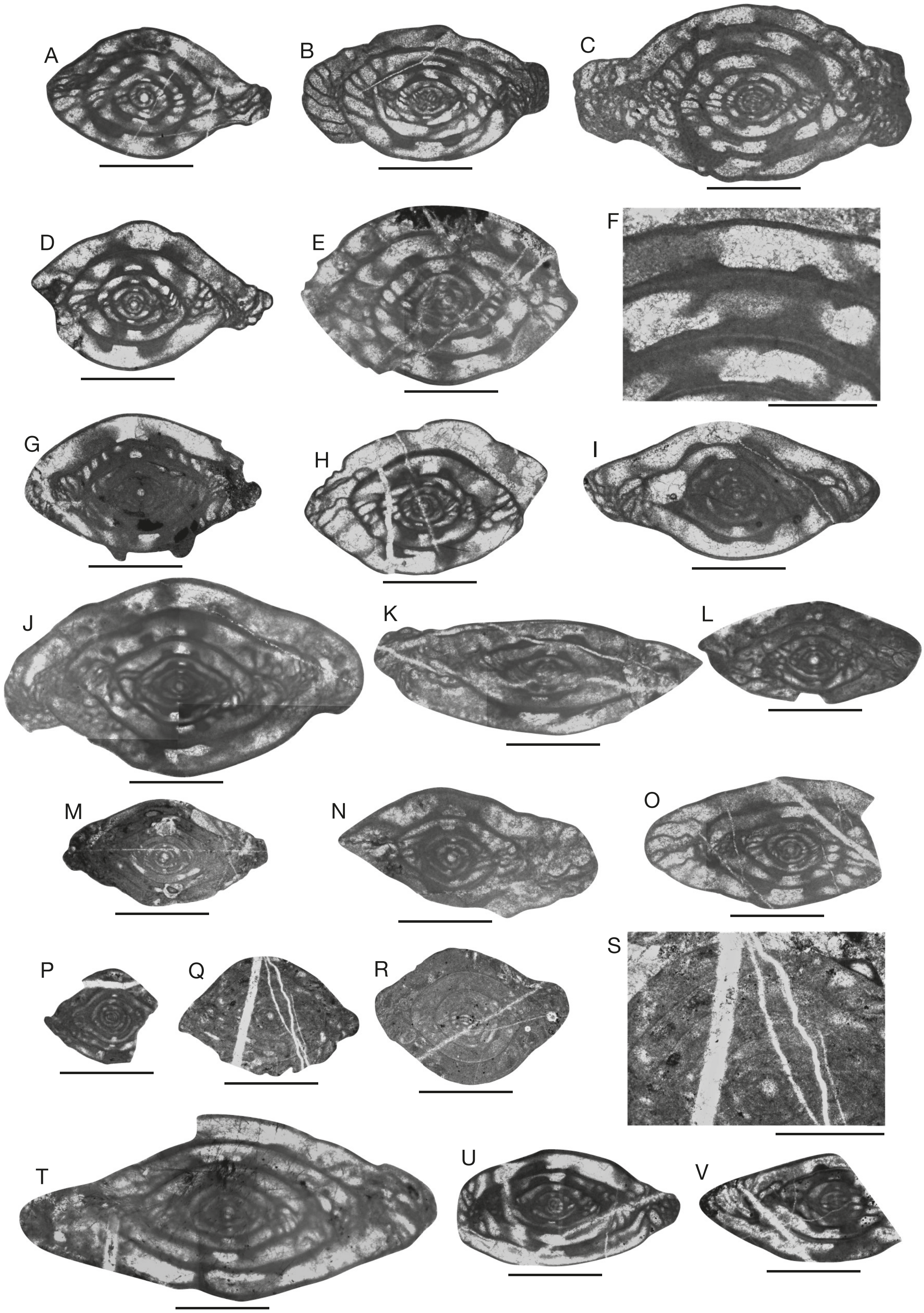
Genus *Fusulinella* Möller, 1877

urn:lsid:zoobank.org:act:7610EA99-7FF2-4005-B9B4-5BFEE4BE0F81

TYPE SPECIES. — *Fusulinella bocki*, subsequent designation by Möller (1878).

ASSEMBLAGE. — The recovered *Fusulinella* assemblage in this study includes: *Fusulinella absoluta* Akbaş, n. sp. (Fig. 17A-E), *Fusulinella*

FIG. 17. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**-**E**, *Fusulinella absoluta* Akbaş, n. sp.; **A**, axial section, 16B38.04, BS; **B**, subaxial section, 16B38.09, BS; **C**, subaxial section, 16B38.10 (Holotype), BS; **D**, axial section, 16B38.11, BS; **E**, axial section, 16B40.07, BS; **F**, detailed view of the wall structure of the *Fusulinella absoluta* Akbaş, n. sp., 16B38.10 (holotype) (four-layered wall including tectum, diaphanotheca, lower and upper tectorium); **G**, **H**, *Fusulinella bocki bocki* Möller, 1878; **G**, axial section, 16B42.03, BS; **H**, axial section, 18G48.06, GS; **I**, *Fusulinella bocki pauciseptata* Rauzer-Chernousova & Belyaev *in* Rauzer-Chernousova, Belyaev & Reitlinger, 1936, axial section, 16B43.22, BS; **J**, *Fusulinella* cf. *bocki timanica* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 15Y39.05, YS; **K**, *Fusulinella* cf. *colaniae colaniae* Lee & Chen *in* Lee, Chen & Chu, 1930, axial section, 18G56.04, GS; **L**, *Fusulinella colaniae meridionalis* Rauzer-Chernousova *in*



Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 15Y39.11, YS; **M**, *Fusulinella* cf. *eopulchra* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 15Y37.03, YS; **N**, **O**, *Fusulinella helenae* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **N**, axial section, 18G57.06, GS; **O**, axial section, 18G58.03, GS; **P**-**R**, *Fusulinella obtusa minuta* Akbaş, n. subsp.; **P**, axial section, 15Y37.07, YS; **Q**, axial section, 15Y37.08.01 (Holotype), YS; **R**, axial section, 15Y38.04, YS; **S**, detailed view of the wall structure of the *Fusulinella obtusa minuta* Akbaş, n. subsp., 15Y37.08.01 (holotype) (four-layered wall including tectum, diaphanotheca, lower and upper tectorium); **T**-**V**, *Fusulinella paracolaniae* Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **T**, axial section, 16B43.07, BS; **U**, axial section, 18G51.06, GS; **V**, axial section, 18G51.09, GS. Scale bar: 1 mm except F, S, 500 μm.

bocki bocki (Fig. 17G, H), *Fusulinella bocki pauciseptata* (Fig. 17I), *Fusulinella* cf. *bocki timanica* (Fig. 17J), *Fusulinella* cf. *colaniae colaniae* (Fig. 17K), *Fusulinella colaniae meridionalis* (Fig. 17L), *Fusulinella* cf. *eopulchra* (Fig. 17M), *Fusulinella helenae* (Fig. 17N, O), *Fusulinella obtusa minuta* Akbaş, n. subsp. (Fig. 17P-R), *Fusulinella paracolaniae* (Fig. 17T-V), *Fusulinella praebocki* (Fig. 18A), *Fusulinella praecolaniae* (Fig. 18B), *Fusulinella propriaforma* Akbaş, n. sp. (Fig. 18C, D), *Fusulinella pseudobocki* (Fig. 18F), *Fusulinella* ex gr. *schubertellinoides* (Fig. 18G, H), *Fusulinella vozhgalensis devexa* (Fig. 18I, J), *Fusulinella* sp. A (Fig. 18K, L), *Fusulinella*? sp. B (Fig. 18M-P) and *Fusulinella*? sp. C (Fig. 18Q-T).

Description

Test moderately to large in size and fusiform to inflated-fusiform in shape. The wall is four-layered which includes tectum, lower and upper tectorium and diaphanotheca. Septa regularly and slightly folded across the centre of the test and folded in the axis ends. Chomata massive, symmetrical and quadrate in shape.

Fusulinella absoluta Akbaş, n. sp.
(Fig. 17A-E)

urn:lsid:zoobank.org:act:AE1C84CE-556D-45A8-A852-507BA4248D6F

Holotype. — Specimen no. 16B38.10.

Diagnosis. — A species of genus *Fusulinella* with large and inflated cylindrical test, convex lateral sides and irregularly developed knob-like poles.

Etymology. — Latin *absoluta*, meaning advanced, named for its well-developed and large test.

Material examined. — Three axial sections (specimens nos 16B38.04, 16B38.11 and 16B40.07), two subaxial sections (specimens nos 16B38.09 and 16B38.10).

Type locality. — Bademli section of Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Stratigraphic range. — Carboniferous, Pennsylvanian, Moscovian, Kashirian-Podolskian.

Occurrence. — Bademli section of Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test large in size and inflated cylindrical in shape with convex lateral sides and rounded poles in initial volutions, but irregularly developed knob-like poles in outermost volutions. All volutions are coiled loosely. Proloculus globular and moderately in size, with an outside diameter of 112-160 microns. The number of volutions is up to 4½-6½ in advance specimens, and length ranges between 2.55 to 3.98 mm, diameters range between 1.50 to 2.03 mm and form ratios of 1.64 to 1.96. Four-layered wall is moderately thick (0.025-0.080 mm in the outer volutions), and composed of a thin tectum, a prominent and thick diaphanotheca, thick-dark lower and upper tectorium (Fig. 17F). Septa plain in initial volutions but folded in outermost one to two volutions. Chomata are massive, asymmetrical and rounded to subquadrate in shape.

Remarks

Fusulinella absoluta Akbaş, n. sp. shows similarity with *Fusulinella helenae* by its elongate test and knob-like polar regions but differs by having ovoid initial volutions and more inflated test.

Fusulinella obtusa minuta Akbaş, n. subsp.
(Fig. 17P-R)

urn:lsid:zoobank.org:act:1FA05BA1-6DE1-487B-BB69-D334BFF7AE19

Holotype. — Specimen no. 15Y37.08.01.

Diagnosis. — A species of genus *Fusulinella* with small and short-fusiform test, straight lateral sides and pointed poles.

Etymology. — Latin *minuta*, meaning small, named for its smaller test size.

Material examined. — Three axial sections (specimens nos 15Y37.07, 15Y37.08.01 and 15Y38.04).

Type locality. — Yassıpınar section of Hadim Nappe (Hadim/Konya, Central Taurides, Turkey).

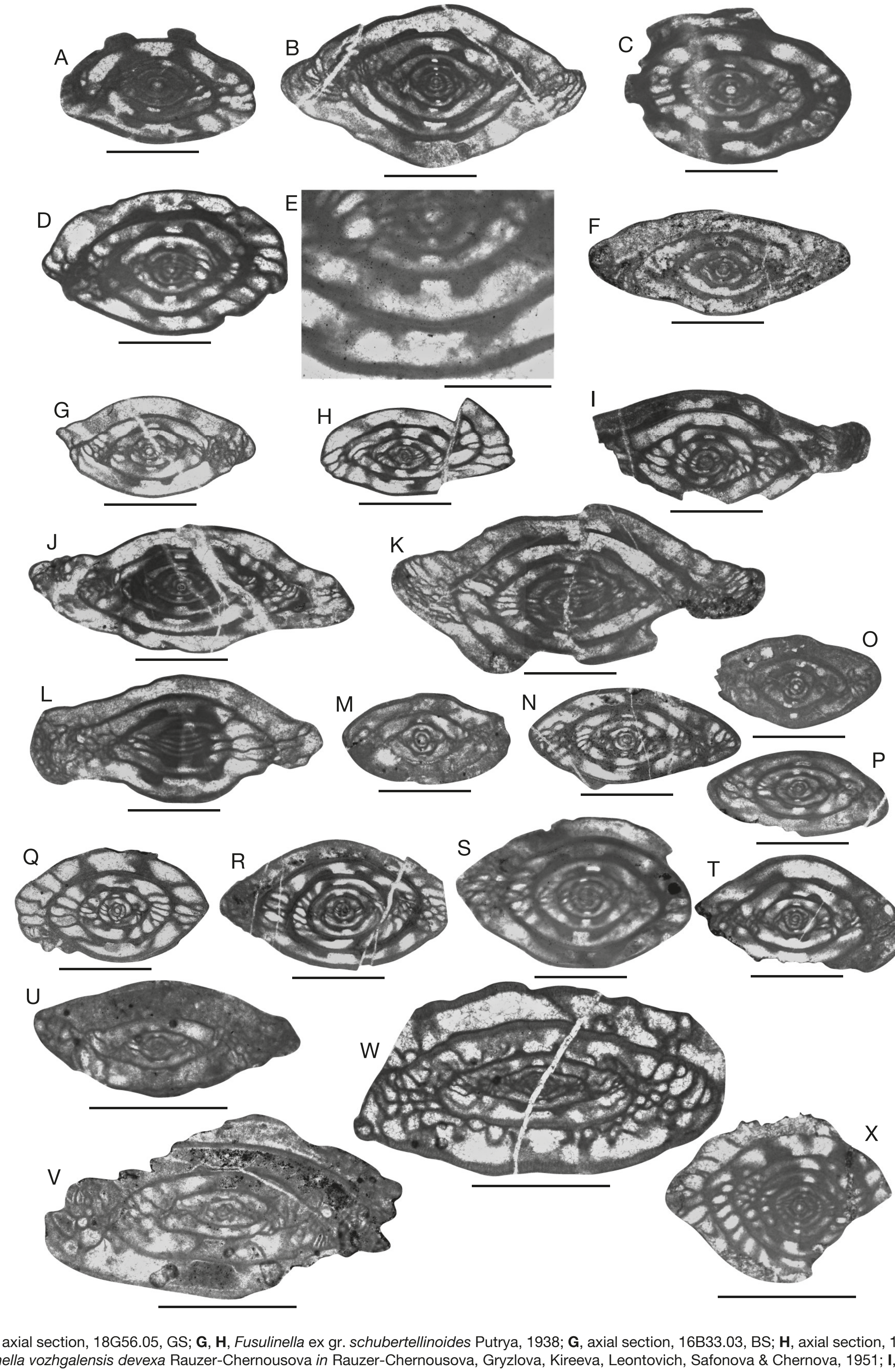
Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

Occurrence. — Yassıpınar section of the Hadim Nappe (Hadim/Konya, Central Taurides, Turkey).

Description

Test small to moderate in size and inflated short-fusiform in shape with straight lateral sides and pointed poles. All volutions are coiled relatively tight. The initial volutions are spherical in shape while test elongates in last one or two volutions. Proloculus globular and small, with an outside diameter of 20-70 microns. The number of volutions is up to 6-6½ in advance specimens, and length ranges between 1.54 to 2.12 mm, diameters range between 1.06 to 1.50 mm and form ratios of 1.41 to 1.50. Thin wall (0.025-0.080 mm in the outer volutions) is not well differentiated, but is composed of tectum, diaphanotheca, lower and upper tectorium (Fig. 17S). The diaphanotheca is very thin and not separate from lower tectorium in some specimens. Septa slightly folded throughout to the coiling axis of the test. Chomata are rounded to short ribbon-like in shape.

Fig. 18. — Thin-section photomicrographs of the fusulinid assemblages of the Yassıpınar (YS), Bademli (BS) and Gölbelen (GS) sections: **A**, *Fusulinella praebocki* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 16B42.18.02, BS; **B**, *Fusulinella praecolaniae* Safonova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951, axial section, 16B38.03, BS; **C**, **D**, *Fusulinella propriaforma* Akbaş, n. sp.; **C**, subaxial section, 16B39.03 (holotype), BS; **D**, axial section, 16B39.08, BS; **E**, detailed view of the wall structure of the *Fusulinella propriaforma* Akbaş, n. sp., 16B39.08 (four-layered wall including tectum, diaphanotheca, lower and upper tectorium); **F**, *Fusulinella pseudobocki* Lee & Chen *in* Lee, Chen &



Chu, 1930, axial section, 18G56.05, GS; **G**, **H**, *Fusulinella* ex gr. *schubertellinoides* Putrya, 1938; **G**, axial section, 16B33.03, BS; **H**, axial section, 18G41.09, GS; **I**, **J**, *Fusulinella vozhgalensis devexa* Rauzer-Chernousova *in* Rauzer-Chernousova, Gryzlova, Kireeva, Leontovich, Safonova & Chernova, 1951; **I**, axial section, 16B39.07, BS; **J**, axial section, 18G41.11, GS; **K**, **L**, *Fusulinella* sp. A; **K**, subaxial section, 16B34.03, BS; **L**, tangentially section, 16B35.05, BS; **M**-**P**, *Fusulinella* ? sp. B; **M**, axial section, 16B44.03, BS; **N**, axial section, 16B44.04, BS; **O**, axial section, 16B45.03, BS; **P**, axial section, 16B45.08, BS; **Q**-**T**, *Fusulinella* ? sp. C; **Q**, axial section, 16B44.08, BS; **R**, axial section, 16B44.09, BS; **S**, axial section, 16B44.13, BS; **T**, axial section, 16B45.04, BS; **U**, *Protriticites subschwagerinoides subschwagerinoides* Rozovskaya, 1950, axial section, 19B48.03, BS; **V**, **W**, *Protriticites subschwagerinoides inflatus* Bensh, 1972; **V**, axial section, 19B48.10, BS; **W**, axial section, 19B50.04, BS; **X**, *Montiparus* ex gr. *priscus* (Villa *in* Villa & Martinez-Garcia, 1989), axial section, 18G59.03, GS. Scale bar: 1 mm except E, 500 µm.

Remarks

Fusulinella obtusa minuta Akbaş, n. subsp. is most similar to *Fusulinella obtusa obtusa* Grozdilova, 1966 concerning the shape of the test, relatively tight coiling and the shape of chomata, but differs by smaller size of the test.

Fusulinella propriaforma Akbaş, n. sp. (Fig. 18C, D)

urn:lsid:zoobank.org:act:37639912-FEA9-4EE2-9F23-75130BEEDD5B

Holotype. — Specimen no. 16B39.03.

Etymology. — This new species is named for its similarity to the *Fusulinella propria* Ivanova, 1980.

Material examined. — Two axial sections (specimens nos 16B39.03 and 16B39.08).

Type locality. — Bademli section of Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Diagnosis. — A species of genus *Fusulinella* with cylindrical to ovoid test, convex lateral sides and rounded poles.

Stratigtaphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Podolskian.

Occurrence. — Bademli section of the Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test relatively large in size and inflated cylindrical to ovoid in shape with convex lateral sides and rounded poles. All volutions are loosely coiled. The initial first volution is spherical in shape and in succeeding volutions test begin to elongation and ovoid in shape in the outer volutions. Proloculus globular and moderately in size, with an outside diameter of 100-150 microns. The number of volutions is up to commonly 5 in advance specimens, and length ranges between 2.80 to 2.90 mm, diameters range between 1.70 to 1.80 mm and form ratios of 1.56 to 1.71. The four-layered wall is thick (0.045-0.060 mm in the outer volutions), and is composed of a thin tectum, a prominent and thick diaphanotheca, dark lower and upper tectorium (Fig. 18E). Septa intense and folded throughout to the coiling axis of the test. Chomata are massive, symmetrical and rounded in shape.

Remarks

Fusulinella propriaforma Akbaş, n. sp. is similar to *Fusulinella propria* but differs by more rounded poles.

Fusulinella sp. A (Fig. 18K, L)

Stratigraphic range. — Carboniferous, Pennsylvanian, lower Moscovian, Kashirian.

Occurrence. — Bademli section of the Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test large in size and inflated fusiform in shape with convex lateral sides and rounded and knob-like poles. All volutions are coiled loosely. Proloculus could not be measured from the obtained specimens. The number of volutions is mean 5-6 in an advanced specimen, and length ranges between 3.33 to 4.33 mm, diameters range between 1.50 to 2.13 mm and form ratios of 2.04 to 2.22. The four-layered wall is relatively thick (0.035-0.050 mm in the outer volutions), and is composed of a thin-dark tectum, a thin diaphanotheca, dark lower and upper tectorium. The diaphanotheca is not clearly observed in initial volutions or absent. Septa plain in initial volutions and folded in outer volutions. Chomata are massive, symmetrical and rounded in shape and their heights reach to half height of chamber.

Remarks

This species is closely similar to some species of *Fusulinella* concerning the shape of the test, coiling type, septal fluting and wall structure, but because of the absence of ideal sections for better identification, they are determined as *Fusulinella* sp. A.

Fusulinella ? sp. B (Fig. 18M-P)

Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Myachkovian.

Occurrence. — Bademli section of the Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test moderately in size and ovoid to cylindrical in shape with straight to slightly convex lateral sides and narrowly rounded to pointed poles. All volutions are coiled loosely. Proloculus irregularly globular and small to moderate in size, with an outside diameter of 60-120 microns. The number of volutions is up to 4-5½ in advance specimens, and length ranges between 1.88 to 2.40 mm, diameters range between 0.98 to 1.10 mm and form ratios of 1.82 to 2.18. The four-layered wall is relatively thick (0.035-0.050 mm in the outer volutions), and is composed of a thin-dark tectum, a prominent diaphanotheca, thin lower and upper tectorium. Septa folded across the centre of the test. Chomata are massive, asymmetrical and rounded in shape.

Remarks

This species shows similarity to some species of the genus *Fusulinella* concerning the wall structure and septal fluting, but based on its smaller sizes and shape of test and absence of ideal sections for better identification, they are determined as *Fusulinella* ? sp. B.

Fusulinella ? sp. C (Fig. 18Q-T)

Stratigraphic range. — Carboniferous, Pennsylvanian, upper Moscovian, Myachkovian.

Occurrence. — Bademli section of the Hadim Nappe (Bademli-Akseki/Antalya, Central Taurides, Turkey).

Description

Test moderately in size and inflated ovoid to cylindrical in shape with convex lateral sides and narrowly rounded to pointed poles. All volutions are coiled loosely. Proloculus globular and small, with an outside diameter of 70-90 microns. The number of volutions is up to 5-6 in advance specimens, and length ranges between 2.20 to 2.63 mm, diameters range between 1.34 to 1.50 mm and form ratios of 1.63 to 1.75. The four-layered wall is relatively thick (0.030-0.060 mm in the outer volutions), and is composed of a thin-dark tectum, a prominent diaphanotheca, thin lower and upper tectorium. Septa folded across the centre of the test. Chomata are massive, symmetrical and rounded in shape.

Remarks

This species shows similarity to some species of the genus *Fusulinella* concerning the wall structure and septal fluting, but based on its smaller sizes and shape of test and absence of ideal sections for better identification, they are determined as *Fusulinella*? sp. C. On the other hand, *Fusulinella*? sp. B and *Fusulinella*? sp. C are similar to each other in many respects but differentiated by having different form ratios (L/D).

CONCLUSION

This study concerns three measured sections (Yassıpınar, Bademli and Gölbelen) of the Hadim Nappe in the Central Taurides. The studied sections encompassing the Moscovian-lower Kasimovian succession of the Hadim Nappe are commonly composed of bioclastic grainstone/packstone with a diverse and rich fusulinid assemblage.

The Moscovian substages (Vereian, Kashirian, Podolskian and Myachkovian) of the regional Russian chronostratigraphic scale were precisely established based on fusulinid assemblages in the Hadim Nappe sections. The base of the Vereian substage across the Lower-Middle Pennsylvanian (Bashkirian-Moscovian) boundary is delineated by the first appearance of the *Aljutovella aljutovica* in the Yassıpınar and Gölbelen sections. Due to extensive dolomitization corresponding to late Serpukhovian, Bashkirian and lowermost Moscovian (Vereian substage) interval this boundary could not be determined in the Bademli section. The described fusulinid assemblages from the Moscovian stage in the Hadim Nappe show a high similarity with the Russian Platform, Donets Basin, Spain, Central Iran and southern Urals.

Taxonomic position of some fusulinid species such as *Neostaffella* cf. *formosa*, *Neostaffella larionovae polasnensis*, *Beedeina paradistenta*, *Solovievaia arta*, *Solovievaia ovata ovata*, *Solovievaia simplex* n. comb., *Solovievaia syzranica* n. comb., *Depratina chernovi*, *Depratina convoluta*, *Depratina dubia*, *Depratina paratimanica*, *Depratina posadai*, *Depratina prisca sphaeroidea*, has been revised based on the systematics proposed by Rauzer-Chernousova *et al.* (1996).

Fusulinid assemblages consisting of 19 genera and 106 species, including one new genus, *Praefusulinella* Akbaş, n. gen., nine new species including *Aljutovella typica* Akbaş, n. sp., *Beedeina minuta* Akbaş, n. sp., *Beedeina tauridiana* Akbaş, n. sp., *Praefusulinella guvenci* Akbaş, n. gen., n. sp., *Praefusulinella okuyucui* Akbaş, n. gen., n. sp., *Praefusulinella rhombiforma* Akbaş, n. gen., n. sp., *Praefusulinella tekini* Akbaş, n. gen., n. sp., *Fusulinella absoluta* Akbaş, n. sp. and *Fusulinella propriaforma* Akbaş, n. sp. and one new subspecies, *Fusulinella obtusa minuta* Akbaş, n. subsp. were recognized in the studied Hadim Nappe sections.

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