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LOWER PERMIAN FUSULINIDS FROM THE VICINITY OF ANKARA (TURKEY)

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Key-words: Permian, Fusulinida, Systematics, Turkey.

Riassunto. Nei dintorni di Ankara (Turchia) affiora una successione attribuita alla Serie di Karakaya entro cui si ha una sequenza carbonatica e dei blocchi contenenti fusulinidi. Vengono descritte 30 specie di fusulinidi appartenenti a 14 generi. In particolare a: *Pamirina, Boultonia, Quasifusulina, Darvasites, Rugosofusulina, Darvasella, Dutkevitchia, Robustoschwagerina, Zellia, Alpinoschwagerina, Chalaroschwagerina, Pseudofusulina, Chusenella* e *Rugosochusenella*. 7 delle 30 specie descritte sono nuove. I fusulinidi sono raggruppati in due associazioni, rispettivamente di età Sakmariana e Yahtashiana, descritti per la prima volta in Turchia.

Abstract. 30 species of fusulinids belonging to 14 genera: *Pamirina, Boultonia, Quasifusulina, Darvasites, Rugosofusulina, Darvasella, Dutkevitchia, Robustoschwagerina, Zellia, Alpinoschwagerina, Chalaroschwagerina, Pseudofusulina, Chusenella,* and *Rugosochusenella* are described from separate samples of carbonate rocks widely developed in the vicinity of Ankara. 7 species among them are new. Two fusulinid assemblages - Sakmarian and Yahtashian - were revealed and characterized for the first time for Turkey.

Introduction.

Numerous exposures of upper Paleozoic limestones have long been known in the vicinity of Ankara. So far they did not come to the attention of stratigraphers and paleontologists, despite the fact that a fine collection of Late Permian fusulinids originating from one of the exposures was already described in 1969 (Skinner,1969). The lack of interest may be related to the fact that Paleozoic limestones from the Ankara area are interpreted to occur as allochthonous blocks enclosed inside the thick volcanoclastic Karakaya Formation of Triassic age (Fig. 1A). The latter filled a depression between Gondwanland and the Sakarya microcontinent, which separated them in the latest Permian (Sengör & Yilmaz, 1981).

In Spring 1994, the present author had a chance to observe some exposures of Upper Paleozoic limestones during the excursion organized by the researchers M.Sengün and E. Catal of the Turkish Geological Survey (MTA). The exposures were inspected over a large area from the southwestern outskirts of Ankara to the Cerkezhoyük village, where the Midian fusulinids described by Skinner (1969) were collected from (Fig.1B). We get the impression that the limestones form a flat cover, on the high part of the relief, over the area of about 100 km^2. In some places, terrigenous rocks of uncertain age crop out under it, in other parts the Paleozoic limestones are overlapped by Mesozoic and Cenozoic deposits. A cursory inspection of some exposures and a field determination of fusulinids showed that the lower part of the cover comprised the deposits of Moscovian stage of the Middle Carboniferous. Upwards, fusulinids of Sakmarian and Yahtashian stages of Lower Permian were found, and in the uppermost part the Upper Permian (Midian) fusulinids were encountered.

The limestones seem to form a normal section, which can be reconstructed following the great amount of well-preserved fusulinids, which may be collected in detail. Unfortunately I failed to do it for the lack of time. So, below I shall characterize only the Lower Permian fusulinids found in some samples not referred to the section.

Sample T1 was recovered from the outcrop located about 2 km south of Tulumtash village (southwest of Gulbasi) (Fig. 1B). At some distance the Moscovian limestones crop out in the low parts of the relief, whereas the higher parts are composed of limestones with Murgabian-Midian *Neoschwagerina*. The limestones in the considered outcrop are grey, compact, with vague bedding, and are rich in algae and fusulinoids.

Samples T2-T5 were collected at the territory of the Geological Faculty of Hodjatepe University situated on the western slope of Beytepe Hills. They were recovered from partially rounded rock fragments and pebbles derived from the near top of the hills which consists of the Permian flat beds.

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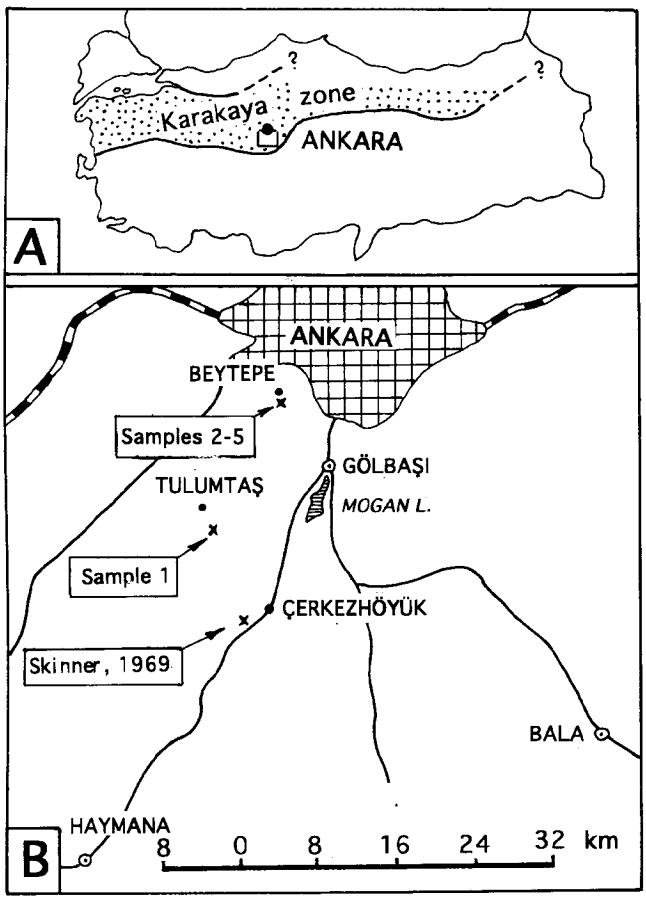


Fig. 1 - Index-map showing of fossil localities. 1) Beitepe (samples T2-T5); 2) Tulumtash (sample T1); 3) locality from where were described the fusulinids by J.W. Skinner (1969).

The rocks in the samples are represented by two varieties:

(1) - oolitic limestones with abundant fusulinids and rather rare algal remains; the matrix is clayey-carbonatic (sample T2);

(2) - fusulinid and algal-fusulinid limestones; the matrix is carbonatic and carbonatic-clayey (samples T3-T5). Fusulinids, rare small foraminifers and algae encountered in all samples are of good preservation. Redeposition traces are absent. A complete list of them is given in Table 1.

Analysis of fusulinids and their age.

I would like to begin the analysis of fusulinids with sample T5, because this assemblage differs substantially from the other four samples.

Robustoschwagerina and *Zellia* dominate in this complex. The first genus, while found also in Yahtashian and Bolorian deposits, is more characteristic of the Sakmarian stage (Leven et al., 1992). *Zellia* appears at the end of the Asselian, is abundant in the Sakmarian, and entirely disappears at the end of it (Kanmera & Mikami, 1965; Leven, 1971; Leven & Scherbovich, 1980a; Xiao et al., 1986; Watanabe, 1991). All together, these

Samples	1	2	3	4	5
Fusulinids:					
Pamirina (*Leveniella*) sp. ind.				x	
Pamirina (*Pamirina*) *nobilis* (Wang & Sun)	x				
Boultonia sp. ind.		x	x		
Boultonia cheni Ho				x	
Quasifusulina sp. ind.					x
Quasifusulina paracompacta Chang			x		
Darvasites sp. ind.					x
Darvasites sinensis (Chen)		x			
Darvasites ordinatus (Chen)			x	x	
Darvasites beitepensis n. sp.				x	
Darvasites cf. *contractus* (Schellwien)				x	
Darvasites aff. *vandae* Leven & Scherbovich				x	
Rugosofusulina sp. ind.		x	x		
Rugosofusulina latioralis Rauser-Chernousova			x		
Rugosofusulina aff. *latioralis* Rauser-Chernousova					x
Rugosofusulina anatoliensis n. sp.			x		x
Rugosofusulina sp. A		x			
Rugosofusulina aff. *likana* Kochansky-Devidé	x				
Darvasella vulgariformis (Kalmykova)	x				
Dutkevitchia jipuensis (Nie & Song)			x		
Robustoschwagerina fluxa Li					x
Robustoschwagerina beitepensis n. sp.					x
Robustoschwagerina cf. *tumida* (Licharew)			x		
Zellia nunosei Hanzawa					x
Alpinoschwagerina ankaraensis n.sp.			x		
Chalaroschwagerina vulgaris (Schellwien)			x	x	
Chalaroschwagerina globosaeformis (Leven)			x		
Chalaroschwagerina bamianica Leven				x	
Chalaroschwagerina darvasica Leven				x	
Chalaroschwagerina cf. *formosa* Skinner & Wilde			x		
Chalaroschwagerina crassitectoria n. sp.	x				
Chalaroschwagerina solita Skinner & Wilde			x		
Pseudofusulina sp. ind.	x				x
Pseudofusulina neolata (Thompson)	x				
Pseudofusulina aff. *lassula* Bensh	x				
Chusenella globulariformis (Dutkevitch)	x		x		
Rugosochusenella aff. *ibukiensis* (Kobayashi)					x
Small foraminifera:					
Eotuberitina sp. ind.	x		x	x	x
Nodosaria sp. ind.	x		x		
Globivalvulina sp. ind.	x				
Climacammina sp. ind.	x			x	
Tetrataxis sp. ind.		x	x	x	
Algae:					
Girvanella sp. ind.	x	x	x		x
Girvanella ex gr. *ducii* Wethered				x	
Tubiphytes obscurus Maslov	x	x		x	x
Anthracoporella sp. ind.	x				
Epimastopora sp. ind.	x				
Giroporella nipponica Endo & Hushimoto	x				
Vermiporella sp. ind.	x				
Ungdarella sp. ind.			x		
Pseudolithotuba gravata (Conil & Lys)					x
Selebra sp. ind.	x				

Tab. 1 - List of Lower Permian fossils from the neighbouring of Ankara.

data indicate a Sakmarian age, which is confirmed by the other genera of fusulinids. Except for *Darvasites*, they appear in the Asselian to end in the Yahtashian and Bolorian. The bloom of *Darvasites* falls into the Yahtashian and Bolorian, but they appear in Sakmarian (Leven & Scherbovich, 1980 a,b).

Outside Turkey, similar fusulinid associations are known in many regions of the Tethys. They are described from the upper part of Rattendorf Fm. and in Trogkofel Fm. of Carnic and Julian Alps, Karawanken Alps, Croatia (Kahler, 1983; Kochansky-Devidé, 1959, 1970; Ramovs & Kochansky-Devidé, 1981). In easterly regions of the Tethys, they were registered in Northern Afghanistan (Leven, 1971), Darvaz (Leven & Scherbovich, 1980a), Central Pamir (Leven, 1993a), Xinjiang (Chang, 1963a), Southern China (Xiao et al., 1986), Japan (Kanmera & Mikami, 1965; Watanabe, 1991). Everywhere the beds with fusulinids occupy the same stratigraphic level between the deposits known to be of Asselian age and Yahtashian deposits characterized by the appearance of *Pamirina* and *Chalaroschwagerina*. In Darvaz, Ammonoidea were encountered together with similar fusulinid assemblage, which allowed us to correlate these beds with the Sakmarian deposits of the Urals (Leven et al.,1992). Thus, the age of the fusulinid assemblage can be certainly assumed as Sakmarian. It is worthwhile to note that earlier in Turkey the Sakmarian and Asselian deposits were considered together.

Fusulinid assemblages found in samples T1-T4, though similar on the whole, differ in abundance and diversity. The similarity results from the presence of the genus *Chalaroschwagerina*, which characterize the Yahtashian and Bolorian stages of Lower Permian. Many associated forms, such as *Darvasites sinensis, D. ordinatus, Darvasella vulgariformis, Pseudofusulina neolata, Chusenella globulariformis* are of the same age. They all are well known in the type sections of these stages in Darvaz. Primitive *Pamirina* revealed in samples T1 and T4 make the dating more precise. With the absence of *Misellina* they clearly indicate the Yahtashian Stage. The other fusulinids are consistent with this conclusion. The genus *Alpinoschwagerina* known only from the Asselian deposits is an exception. Its occurrence together with Yahtashian fusulinids allows to redefine the range of this genus.

The Yahtashian fusulinids and, correspondingly, the deposits of this age are detected in Turkey for the first time. In the neighbouring Iran and Armenia, this fusulinid assemblage is encountered at the base of thick carbonate formations transgressively overlapping the older deposits (Leven, 1993b). The lack of *Pamirina* does not yet allow a separation of the Bolorian stage from Yahtashian or to prove the absence of the latter. We can say the same about the occurrence of the Yahtashian-Bolorian fusulinids that are known in the Mediterranean countries (Montenegro, Greece) (Kochansky-Devidé & Milanovich, 1962; Grant et al., 1991). According to Kahler's data (Kahler, 1983; Erben & Kahler, 1989), Yahtashian *Pamirina* are found in Carnic Alps in the Breccia of Tarvisio at Coccau. However, the concurrence of *Sphaeroschwagerina* would suggests an older, probably Sakmarian, age for these rocks.

A typically Yahtashian fusulinid assemblage similar to the described above is found in many easterly regions of the Tethys. Except for the type sections of Darvaz, it is recorded in Northern Afghanistan (Leven, in press), Tibet (Nie & Song, 1983), South China (Zhang Zugi, 1984; Xiao et al., 1986; Zhou Jianping, 1989), Japan (Ueno, 1991).

SYSTEMATICS

Class Foraminiferida

Superorder Fusulinoidea

Order Ozawainellida Solovieva, 1978

Family *Eostaffellidae* Mamet, 1968

Genus *Pamirina* Leven, 1970

Subgenus *Pamirina* Leven, 1970

Pamirina (Pamirina) cf. **nobilis** (Wang & Sun, 1973)

Pl. 1, fig. 1, 2

1973 *Chinlingella nobilis* Wang & Sun, p. 173, pl. 1, fig. 1-5, 9-11.

Material. 1 tangential and 1 sagittal sections.

Distribution and age. China, Pamir, Turkey; Early Permian, Yahtashian and lowermost Bolorian.

Occurrence. Tulumtash (sample T1).

Subgenus *Levenella* Ueno, 1991, emend Ueno, 1994

Pamirina (Levenella) cf. **pulchra** (Wang & Sun, 1973)

Pl. 1, fig. 3

1973 *Chinlingella pulchra* Wang & Sun, p. 172, pl. 1, fig. 6-8, 13-16.

Material. 1 oblique section.

Distribution and age. China, Japan, Pamir, Turkey; Early Permian,Yahtashian.

Occurrence. Beitepe (sample T4).

Order Schubertellida Skinner, 1931

Family *Boultoniidae* Skinner & Wilde, 1954

Genus *Boultonia* Lee,1927

Boultonia cheni Ho, 1956

Pl. 1, fig. 4

1956 *Boultonia cheni* Ho, p. 64, pl. 1, fig.1-7.

Material. 1 subaxial and 1 tangential sections.

Distribution and age. China, Pamir, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (samples T3 and T4).

Order Fusulinida Moeller, 1878

Family *Fusulinidae* Moeller, 1878

Genus *Quasifusulina* Chen, 1934

Quasifusulina paracompacta Chang, 1963a

Pl. 1, fig. 5,6

1963a *Quasifusulina paracompacta* Chang, p. 11, pl. 1, fig. 3, 5, 7, 8.

Material. 1 axial and 1 subaxial sections.

Distribution and age. China, Turkey; Early Permian, Sakmarian and Yahtashian.

Occurrence. Beitepe (sample T3).

Order Schwagerinida Solovieva, 1978

Family *Darvasitidae* Leven in Leven et al., 1992

Genus *Darvasites* Miklukho-Maclay, 1957

Darvasites sinensis (Chen, 1934)

Pl. 1, fig. 9

1934 *Triticites sinensis* Chen, p. 36-38, pl. 7, fig. 8, 12.

Material. 5 axial and subaxial sections.

Distribution and age. China, Pamir, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (sample T2).

Darvasites ordinatus (Chen, 1934)

Pl. 1, fig. 8

1934 *Triticites ordinatus* Chen, p. 38, pl. 7, fig. 5-7.

Material. 2 tangential sections.

Distribution and age. China, Japan, Pamir, Afghanistan, Transcaucasus,Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (samples T3 and T4).

Darvasites beitepensis n.sp.

Pl. 1, fig. 12, 13

Holotype. Pl. 1, fig. 13, GGM VI-230/11, axial section; Beitepe; Early Permian, Yahtashian.

Material. 1 axial section.

Description. Shell small, inflated fusiform, with bluntly pointed poles. Mature individuals have 8 to 9 volutions. L = 3.7-4.0 mm; D = 1.9-2.1 mm; L:D = 1.8-1.9. The proloculus is sphaerical and quite small. Coiling is uniform, tightly in the inner volutions, with gradual expansion of the shell. Spirotheca composed of tectum and keriotheca, its thickness in last whorl 0.05 mm. Septa fluted from pole to pole. Septal folds high about 0.5 of the total high of the chamber. Tunnel rather narrow and high about half of the chamber. Chomata narrow, present in early whorls but replaced by pseudochomata in later ones.

Discussion. The inflated fusiform shape and the small chomata of *Darvasites beitepensis* serves to distinguish it from any other known species.

Occurrence and age. Turkey, Beitepe (sample T4); Early Permian,Yahtashian.

PLATE 1

All figures, except 1-4, X 10. The acronym GGM is for Gosudarstvennyi Geologicheskyi Musei, intitled to V.I. Vernadskyi, Moskva.

Fig.1, 2 - *Pamirina* (*Pamirina*) cf. *nobilis* (Wang & Sun, 1973). Tulumtash, sample T1. 1) Tangential section, GGM VI-230/1; X 70; 2) sagittal section, GGM VI-230/2; X 35.

Fig. 3 - *Pamirina* (*Levenella*) cf. *P.*(*L.*) *pulchra* (Wang & Sun,1973). Beitepe, sample T4. Oblique section, GGM VI-230/3; X 100.

Fig. 4 - *Boultonia cheni* Ho, 1956. Beitepe, sample T4. Subaxial section, GGM VI-230/4; X 20.

Fig. 5, 6 - *Quasifusulina paracompacta* Chang, 1963. Beitepe, sample T3. 5) Axial section, GGM VI-230/6; 6) subaxial section, GGM VI-230/5.

Fig. 7 - *Quasifusulina* sp. ind. Beitepe, sample T5. Tangential section, GGM VI-230/7.

Fig. 8 - *Darvasites ordinatus* (Chen, 1934). Beitepe, sample T3. Subaxial section, GGM VI-230/9.

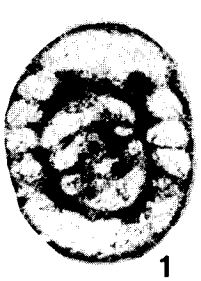
Fig. 9 - *Darvasites sinensis* (Chen, 1934). Beitepe, sample T2. Axial section, GGM VI-230/8.

Fig. 10 - *Darvasites* (?) aff. *vandae* Leven & Scherbovich, 1980b. Beitepe, sample T4. Axial section, GGM VI-230/12.

Fig. 11, 14-16 - *Rugosofusulina latioralis* Rauser-Chernousova, 1937. Beitepe, sample T3. 11) Axial section, GGM VI-230/15; 14) axial section, GGM VI-230/13; 15) axial section, GGM VI-230/16; 16) axial section, GGM VI-230/14.

Fig. 12, 13 - *Darvasites beitepensis* n. sp. Beitepe, sample T4. 12) Axial section, GGM VI-230/10; 13) axial section of the holotype, GGM VI-230/11.

Fig. 17, 18 - *Rugosofusulina anatoliensis* n. sp. Beitepe, sample T3. 17) Subaxial section, GGM VI-230/16; 18) Axial section, GGM VI-230/9.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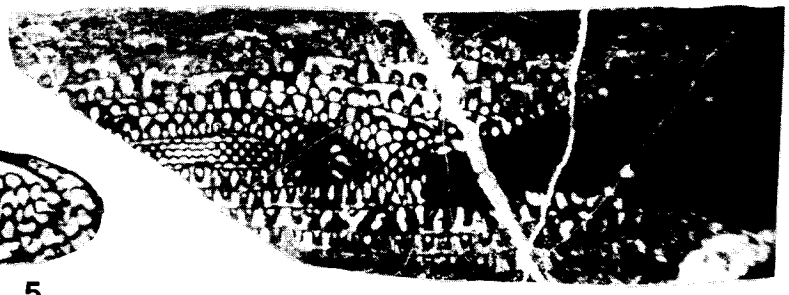
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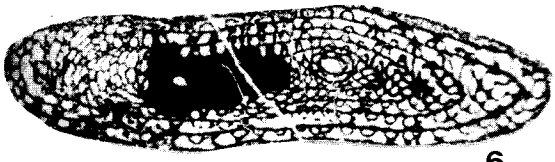
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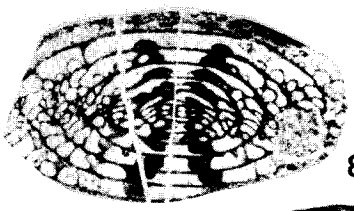
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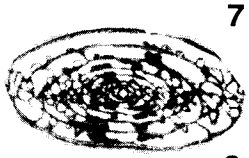
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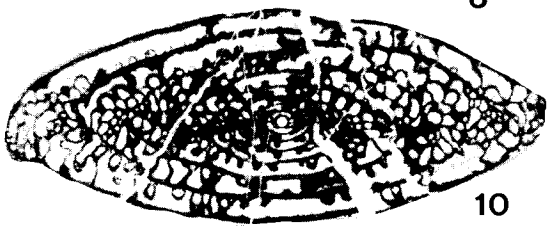
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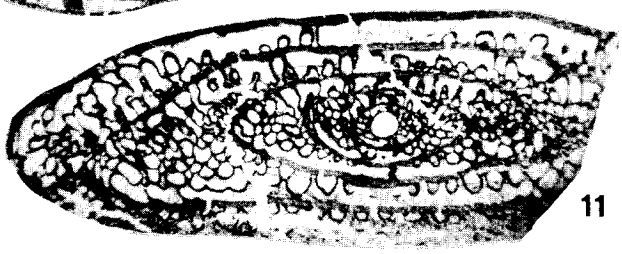
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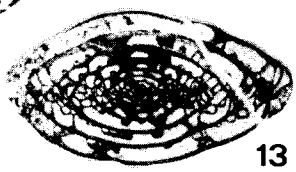
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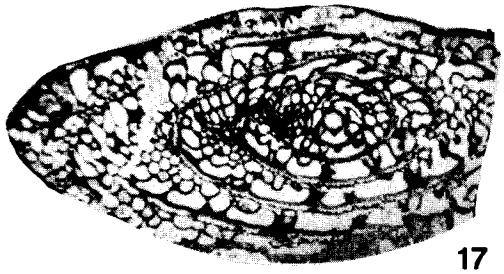
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Darvasites (?) aff. **vandae** Leven & Scherbovich, 1980b

Pl. 1, fig. 10

1980b *Darvasites vandae* Leven & Scherbovich, p. 27, pl. 4, fig. 7-9.

Material. 1 axial section.

Remarks. The specimen discussed differs from the *Darvasites vandae* in fusiform shell.

Occurrence and age. Beitepe (sample T4); Early Permian, Yahtashian.

Family *Rugosofusulinidae* Davydov, 1982

Genus *Rugosofusulina* Rauser-Chernousova, 1937

Rugosofusulina latioralis Rauser-Chernousova, 1937

Pl. 1, fig. 11, 14-16

1937 *Rugosofusulina latioralis* Rauser-Chernousova, p. 15, pl. 2, fig. 3-6.

Material. 4 axial sections.

Distribution and age. South Ural, Northern Afghanistan, Turkey; Early Permian, from uppermost Asselian to Yahtashian.

Occurrence. Beitepe (sample T3).

Rugosofusulina anatoliensis n.sp.

Pl. 1, fig. 17, 18; Pl. 2, fig. 1, 2

Holotype. Pl. 2, fig. 1, 2; GGM VI-230/17, axial section; Beitepe; Early Permian,Yahtashian.

Material. 4 axial sections.

Description. A fairly large, fusiform shell of 5.5-6.0 volutions. L = 9.0-11.5 mm; D = 3.5-4.0 mm; L:D = 2.7-2.8. The proloculus is sphaerical or subsphaerical, attaining a diameter of 0.4 mm. Coiling is uniform, with gradual expansion of the shell. Spirotheca composed of "rugose" tectum and keriotheca 0.13-0.17 mm thick in the fifth volution. Tectum exfoliate from keriotheca in last three or four volutions. Septa are thin and strongly fluted throughout the shell; phrenothecae are present. Septal folds high, extending to top of septa, and transforming into broad region of axial reticulation. Tunnel about 40% of the chamber height and not very wide. The axial filling is absent.

Discussion. *Rugosofusulina anatoliensis* differs from the other rugosofusulinas by the exfoliation of tectum from keriotheca.

Occurrence and age. Beitepe (samples T3 and T5); Early Permian, Sakmarian and Yahtashian.

Rugosofusulina sp. A

Pl. 2, fig. 6

Material. 1 axial section.

Description. Shell moderate large, elongate subcylindrical, with bluntly rounded poles. Mature specimen of 7 volutions; first 4 volutions very tightly coiled, followed by loosely coiled, rapidly elongating adult stage. L = 11.5 mm; D = 2.1 mm; L:D = 5.5.

Wavy spirotheca composed of "rugose" tectum and keriotheca; thickness variable, thicker areas measure 0.1 mm in sixth volution. Septa strongly but irregularly fluted from pole to pole; phrenothecae are present. Septal folds are broad and high. Proloculus tiny. Tunnel low and wide. Chomata weak, present in juvenarium. Axial fillings are absent.

Discussion. *Rugosofusulina* sp. A resembles *R. cylindrica* (Sosnina in Bensh, 1962) from North Fergana (Uzbekistan), but can be distinguished from that species by its minute proloculus, tightly coiled juvenarium, and presence of phrenothecae.

Occurrence and age. Beitepe (sample T2); Early Permian, Yahtashian.

Rugosofusulina aff. **likana** Kochansky-Devidé, 1959

Pl. 2, fig.5

1959 *Rugosofusulina likana* Kochansky-Devidé, p. 52, pl. 4, fig. 1-8.

Material. 1 axial section.

Remarks. The specimen discussed differs from the *Rugosofusulina likana* in smaller form ratio.

PLATE 2

All figures X10

Fig. 1, 2 - *Rugosofusulina anatoliensis* n. sp. Beitepe. 1) Axial section of the holotype, GGM VI-230/17; sample T3; 2) subaxial section, GGM VI-230/18; sample T5.

Fig. 3, 4 - *Darvasella vulgariformis* (Kalmykova, 1960). Tulumtash, sample T1. 3) Axial section, GGM VI-230/21; 4) subaxial section, GGM VI-230/22.

Fig. 5 - *Rugosofusulina* aff. *likana* Kochansky-Devidé, 1959. Tulumtash, sample T1. Axial section, GGM VI-230/20.

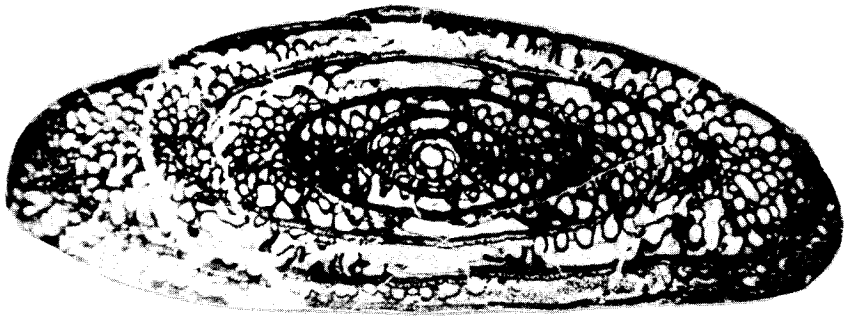
Fig. 6 - *Rugosofusulina* sp. A. Beitepe, sample T2. Axial section, GGM VI-230/19.

Fig. 7 - *Zellia nunosei* Hanzawa, 1939. Beitepe, sample T5. Axial section of a young form, GGM VI-230/28.

Fig. 8 - *Robustoschwagerina fluxa* (Li, 1977). Beitepe, sample T5. Axial section, GGM VI-230/27.

Fig. 9 - *Robustoschwagerina* cf. *tumida* (Licharew, 1939). Beitepe, sample T3. Oblique section, GGM VI-230/29.

Fig. 10-13 -*Dutkevitchia jipuensis* (Nie & Song, 1983). Beitepe, sample T3. 10) Axial section, GGM VI-230/24; 11) axial section, GGM VI-230/26; 12) axial section, GGM VI-230/23; 13) axial section, GGM VI-230/25.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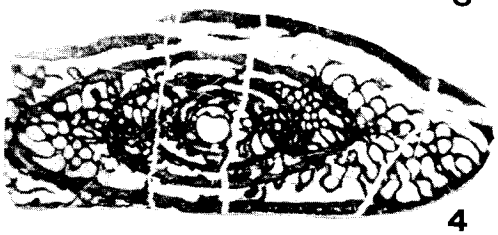
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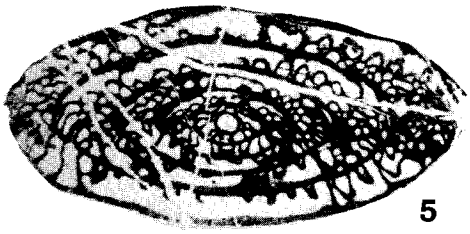
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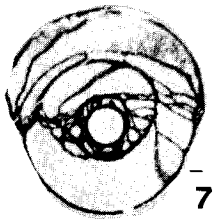
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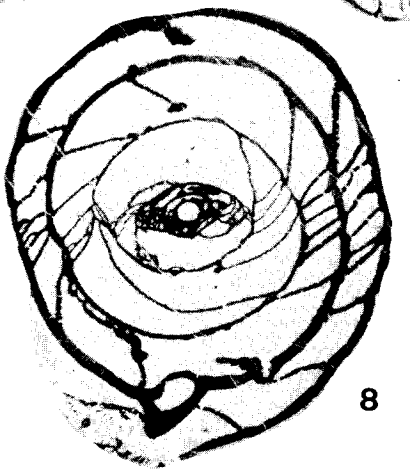
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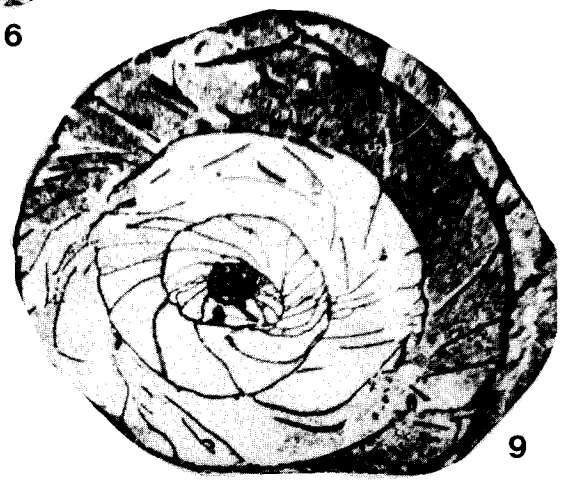
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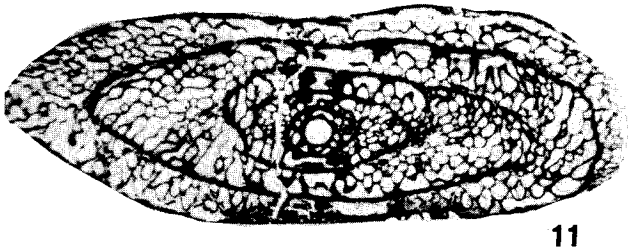
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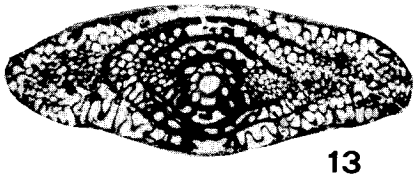
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Occurence and age. Tulumtash (sample T1); Early Permian, Yahtashian.

Genus *Darvasella* Leven in Leven et al., 1992

Darvasella vulgariformis (Kalmykova, 1960)

Pl. 2, fig. 3, 4

1960 *Rugosofusulina vulgariformis* Kalmykova, p. 126, pl. 26, fig.1, 2.

Material. 4 axial sections.

Distribution and age. Pamir, Afghanistan, China, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Tulumtash (sample T1).

Genus *Dutkevitchia* Leven & Scherbovich, 1978

Dutkevitchia jipuensis (Nie & Song, 1983)

Pl. 2, fig. 10-13

1983 *Pseudofusulina jipuensis* Nie & Song, p. 45, pl. 3, fig. 6, 7.

Material. 7 axial and subaxial sections.

Distribution and age. South Tibet, Turkey; Early Permian, Sakmarian; Late Permian, Early Kubergandian.

Occurrence. Beitepe (sample T3).

Family *Pseudoschwagerinidae* Chang, 1963

Genus *Robustoschwagerina* Miklukho-Maclay, 1956

Robustoschwagerina fluxa (Li, 1977)

Pl. 2, fig. 8

1977 *Pseudoschwagerina fluxa* Li, p. 76, pl. 22, fig. 4,5.

Material. 1 axial section.

Distribution and age. China, Turkey; Early Permian, Sakmarian.

Occurrence. Beitepe (sample T5).

Robustoschwagerina beitepensis n. sp.

Pl. 3, fig. 1, 6

Holotype. Pl. 3, fig. 6; GGM VI-230/28, axial section; Beitepe; Early Permian, Sakmarian.

Material. 2 axial sections.

Description. A subsphaerical shell of 7.5 volutions, slightly compressed along the axis. L = 6.25-6.75 mm; D = 6.75-7.35 mm; L:D = 0.9. The proloculus is sphaerical, with a diameter of 0.2 mm. Coiling is irregular. A distinct juvenarium extends of 3.0-3.5 volutions which are tightly coiled. The shell in the juvenarium is short fusiform. After the juvenarium, the chambers increase in height abruptly. The spirotheca is thin in the first volutions, but increases in thickness in the succeeding 2-3 volutions up to 0.15-0.17 mm. Septa are thin, wavy or gently folded in the juvenarium and straight thereafter. Chomata are present in the juvenarium.

Discussion. This species most resembles *Robustoschwagerina junnanensis* Sheng & Wang (1984) from the Maping Formation of South China, but differs in having more thick spirotheca.

Occurrence and age. Beitepe (sample T5); Early Permian, Sakmarian

Robustoschwagerina cf. **tumida** (Licharew, 1939)

Pl. 2, fig. 9

1939 *Pseudoschwagerina tumida* Licharew (in Licharew, Ed.), p. 41, pl. 4, fig. 6.

Material. 1 oblique section.

Distribution and age. Darvaz, Pamir, Turkey; Early Permian, Yahtashian and Bolorian. Other quotations westwards in Italy, Austria and former Yugoslavia possibly do not belong to *R. tumida*.

Occurrence. Beitepe (sample T3).

Genus *Zellia* Kahler & Kahler, 1937

Zellia nunosei Hanzawa, 1939

Pl. 2, fig. 7; Pl. 3, fig. 2, 3

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

Material. 3 axial sections.

Distribution and age. Japan, Pamir, Turkey; Early Permian, Sakmarian.

Occurrence. Beitepe (sample T5).

PLATE 3

All figures X10

Fig. 1, 6 - *Robustoschwagerina beitepensis* n.sp. Beitepe, sample T5. 1) Subaxial section, GGM VI-230/30; 6) axial section of the holotype, GGM VI-230/28.

Fig. 2, 3 - *Zellia nunosei* Hanzawa, 1939. Beitepe, sample T5. 2) Axial section, GGM VI 230/31; 3) axial section, GGM VI-230/32.

Fig. 4, 5 - *Alpinoschwagerina ankaraensis* n.sp. Beitepe, sample T3. 4) Axial section of the holotype, GGM VI-230/33; 5) subaxial section, GGM VI-230/16.

Fig. 7-10 - *Chalaroschwagerina vulgaris* (Schellwien, 1909). Beitepe. 7) Axial section, GGM VI-230/34, sample T3; 8) subaxial section, GGM VI-230/37, sample T4; 9) subaxial section, GGM VI-230/35, sample T4; 10) subaxial section, GGM VI-230/36, sample T3.


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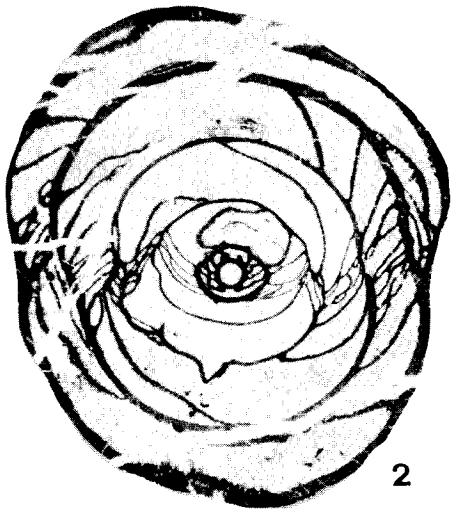
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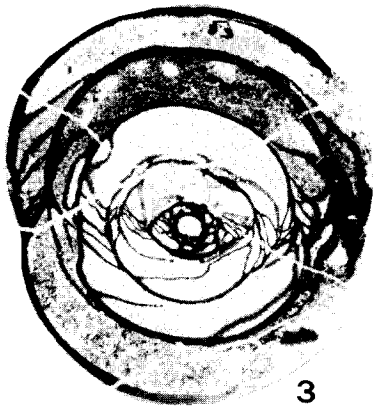
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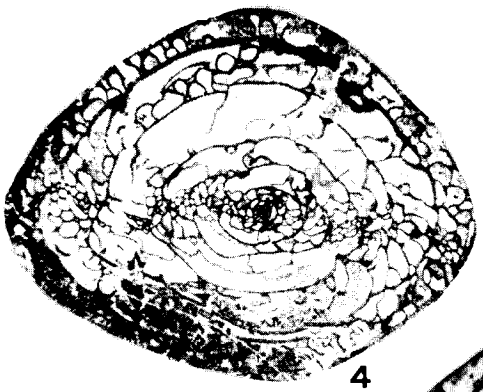
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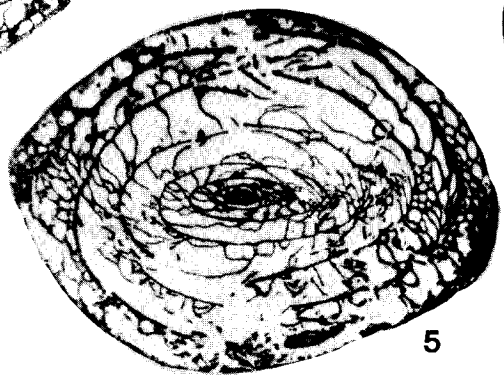
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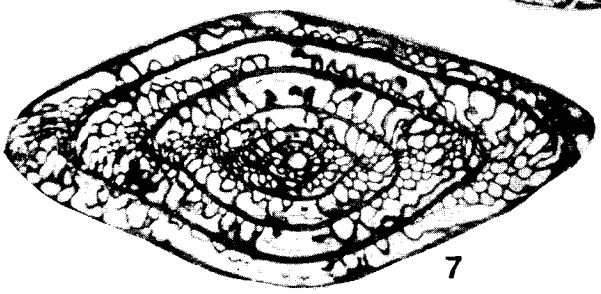
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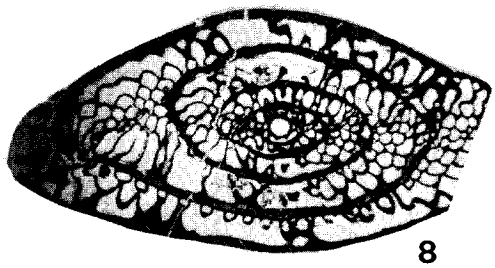
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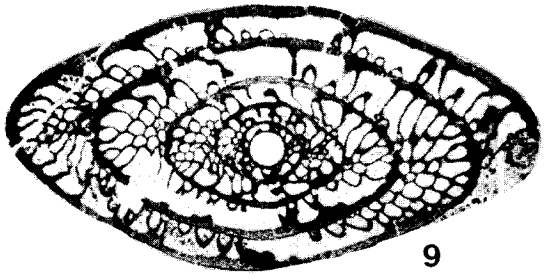
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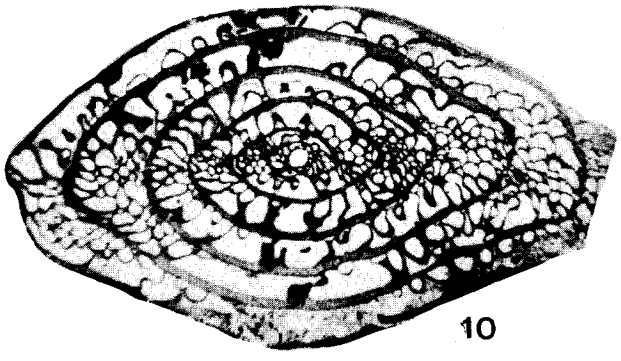
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Genus *Alpinoschwagerina* Bensh, 1972

Alpinoschwagerina ankaraensis n. sp.

Pl. 3, fig. 4, 5

Holotype. Pl. 3, fig. 4; GGM VI-230/33, axial section; Beitepe; Early Permian, Yahtashian.

Material. 2 axial sections.

Description. A subsphaerical, short-ellipsoidal shell of 9 volutions. L = 6.1-6.3 mm; D = 4.75-4.8 mm; L:D = 1.2-1.3. The proloculus is sphaerical, minute, with a diameter of 0.12 mm. Coiling is irregular. A juvenarium extends to 3.5 volutions. The shell in the juvenarium is fusiform and tightly coiled, sometimes at large angle to outer volutions. The juvenarium is followed by much looser coiled whorls. The spirotheca is rather thin throughout, attaining the maximum value of 0.07 mm. Septa thin, irregularly and broadly fluted or only gently wavy. Narrow chomata are present only on the proloculus and in one-two volutions of the juvenarium.

Discussion. This species slightly resembles *Pseudoschwagerina turbida* Kahler & Kahler, 1937, from the Asselian of the Carnic Alps. It differs in having a more irregular septal fluting and thin spirotheca.

Occurrence and age. Beitepe (sample T3); Early Permian, Yahtashian.

Family *Pseudofusulinidae* Dutkevich, 1934

Genus *Chalaroschwagerina* Skinner & Wilde, 1965

Chalaroschwagerina vulgaris (Schellwien, 1909)

Pl. 3, fig. 7-10

1909 *Fusulina vulgaris* Schellwien in Dyhrenfurth, p. 163, pl. 14, fig. 1, 2.

Material. 5 axial and subaxial sections.

Distribution and age. Darvaz, Pamir, China, Indochina, Japan, Afghanistan, Iran, Armenia, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (samples T3 and T4).

Chalaroschwagerina globosaeformis (Leven, 1967)

Pl. 4, fig. 2

1967 *Parafusulina globosaeformis* Leven, p. 176, pl. 27, fig. 2, 3, 5.

Material. 1 subaxial section.

Distribution and age. Pamir, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (sample T3).

Chalaroschwagerina bamianica, Leven

Pl. 4, fig. 3, 4

Holotype. GGM VI-228/131, axial section; Khojagor, zone of Bamian, north Afghanistan; Early Permian, Yahtashian or Bolorian.

Material. Afghanistan: 2 axial sections; Turkey: 2 axial sections.

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

Description. An inflated fusiform to subsphaerical shell with slightly elongated poles. L = 4.5-5.7 mm; D = 2.9-4.0 mm; L:D = 1.4-1.7. The proloculus is sphaerical, with a diameter of 0.15 to 4.0 mm. The coiling is rather tight and uniform as compared with other species of *Chalaroschwagerina*. The spirotheca is thick throughout the growth (up to 0.17 mm in the outermost volution) and finely alveolar. Septa are thin and fluted. Fluting is moderate, quite regular, and does not involve the upper part of the septa. Axial septal reticulation is rather narrow and quite simple. The tunnel is rather narrow and irregular. Chomata and axial filling are absent.

Discussion. This species most resembles *Chalaroschwagerina globosa* (Schellwien), but differs in being more tightly coiled, having a very thick spirotheca, and having more regular septal fluting.

PLATE 4

All figures X10

Fig. 1 - *Chalaroschwagerina darvasica* Leven in Leven et al.,1992. Beitepe, sample T4. Subaxial section, GGM VI-230/4.

Fig. 2 - *Chalaroschwagerina globosaeformis* (Leven, 1967). Beitepe, sample T3. Subaxial section, GGM VI-230/38.

Fig. 3, 4 - *Chalaroschwagerina bamianica* Leven. Beitepe, sample T4. 3) Axial section, GGM VI-230/39; 4) subaxial section, GGM VI-230/3.

Fig. 5, 7 - *Chalaroschwagerina crassitectoria* n.sp. Tulumtash, sample T1. 5) Axial section, GGM VI-230/42; 7) axial section of the holotype, GGM VI-230/43.

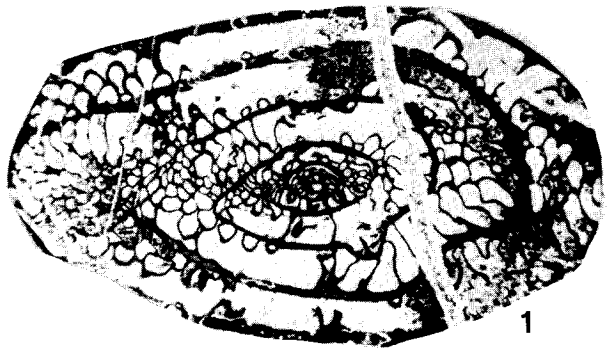
Fig. 6 - *Chalaroschwagerina solita* Skinner & Wilde, 1966. Beitepe, sample T3. Axial section, GGM VI-230/40.

Fig. 8 - *Pseudofusulina* aff. *lassula* Bensh, 1962. Tulumtash, sample T1. Axial section, GGM VI-230/44.

Fig. 9, 10, 15 - *Chusenella globulariformis* (Dutkevich, 1939). 9) Subaxial section, GGM VI-230/25, Beitepe, sample T3; 10) axial section, GGM VI-230/1, Tulumtash, sample T1; 15) axial section,GGM VI-230/29, Beitepe, sample T3.

Fig. 11 - *Pseudofusulina neolata* (Thompson, 1954). Tulumtash, sample T1. Subaxial section, GGM VI-230/41.

Fig. 12-14, 16 - *Rugosochusenella* aff. *ibukiensis* (Kobayashi, 1957). Beitepe, sample T5. 12) Axial section, GGM VI-230/45; 13) oblique section, GGM VI-230/46; 14) oblique section, GGM VI-230/45; 16) oblique section, GGM VI-230/46.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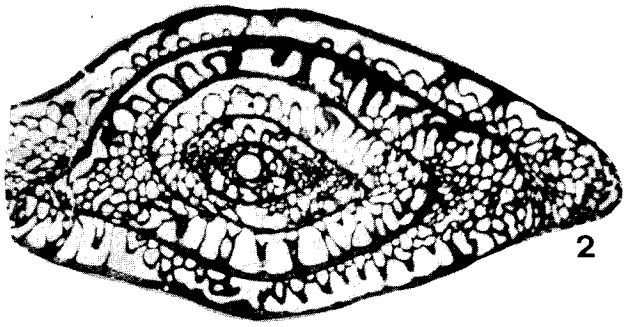
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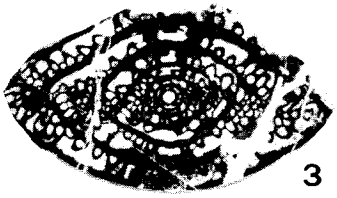
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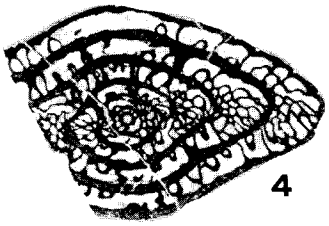
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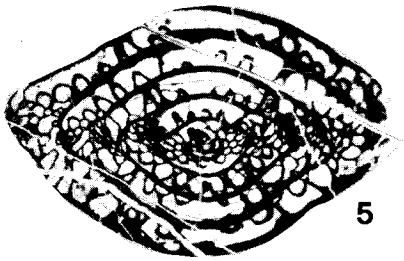
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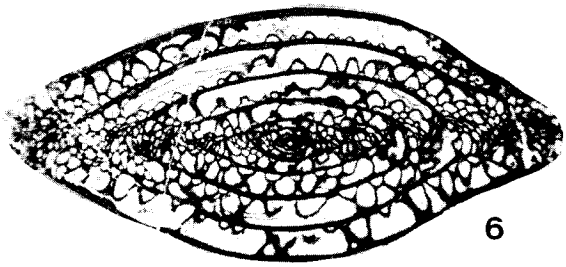
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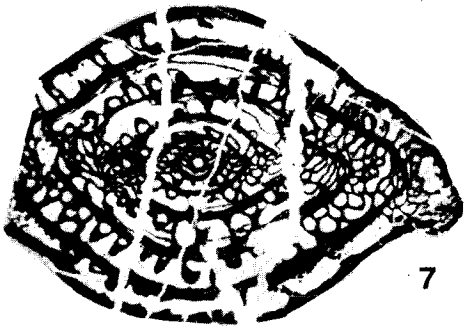
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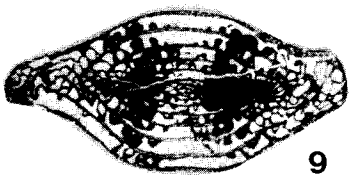
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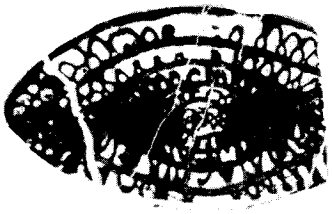
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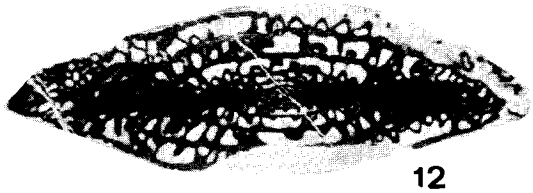
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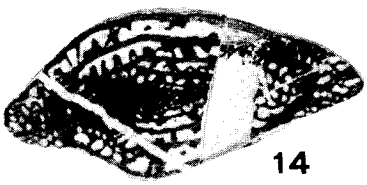
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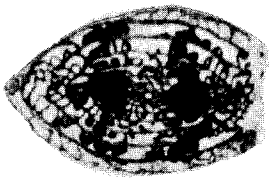
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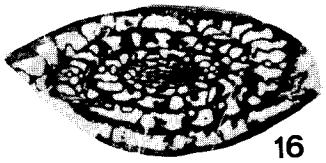
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Distribution and age. Northern Afghanistan, Japan, China, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Beitepe (sample T4).

Chalaroschwagerina darvasica Leven in Leven et al., 1992

Pl. 4, fig. 1

1992 *Chalaroschwagerina darvasica* Leven (in Leven et al.), p. 92, pl. 13, fig. 5, 6.

Material. 1 subaxial section.

Distribution and age. Pamir, Turkey; Early Permian, Yahtashian.

Occurrence. Beitepe (sample T4).

Chalaroschwagerina crassitectoria n.sp.

Pl. 4, fig. 5, 7

Holotype. Pl. 4, fig. 7; GGM VI-230/43, axial section; Tulumtash; Early Permian, Yahtashian.

Material. 2 axial sections.

Description. An inflated fusiform shell with slightly elongated poles. L = 5.25-6.5 mm; D = 3.5-4.25 mm; L:D = 1.5. The proloculus is sphaerical, with diameter of 0.2 mm. Coiling is loose, minor expansion after the first or second volution. The spirotheca is very thick, attaining 0.15 mm in the final volution. Septa are thin and irregularly folded from pole to pole. Folding being mainly confined to lower half of each septum while upper half is only wavy. Axial septal reticulation is rather narrow and quite simple. The tunnel is narrow, low and irregular. Chomata and axial filling are absent.

Discussion. This species most resembles *Chalaroschwagerina bamianica* Leven, differing in being less tightly coiled, and for larger size of shell. Thick spirotheca serves to distinguish the present species from all other known species of *Chalaroschwagerina*.

Occurrence and age. Tulumtash (sample T1); Early Permian, Yahtashian.

Chalaroschwagerina solita Skinner & Wilde, 1966

Pl. 4, fig. 6

1966 *Chalaroschwagerina solita* Skinner & Wilde, p. 9, pl. 5, fig. 2, 3.

Material. 1 axial section.

Distribution and age. North America (Nevada), Pamir, Turkey; Early Permian, Sakmarian (?) and Yahtashian.

Occurrence. Beitepe (sample T3).

Genus *Pseudofusulina* Dunbar & Skinner,1931

Pseudofusulina neolata (Thompson,1954)

Pl. 4, fig. 11

1954 *Schwagerina neolata* Thompson, p. 65, pl. 36, fig. 9-15.

Material. 1 subaxial section.

Distribution and age. North America (Texas), Pamir, Turkey; Early Permian, Sakmarian (?) and Yahtashian.

Occurrence. Tulumtash (sample T1).

Pseudofusulina aff. **lassula** Bensh, 1962

Pl. 4, fig. 8

1962 *Pseudofusulina lassula* Bensh, p. 245, pl. 22, fig. 7,8.

Material. 1 axial section.

Remarks. The specimen discussed differs from the *Pseudofusulina lassula* in smaller form ratio and smaller axial fillings.

Occurrence and age. Tulumtash (sample T1); Early Permian, Yahtashian.

Family *Chusenellidae* Kahler & Kahler, 1966

Genus *Chusenella* Hsu, 1942

Chusenella globulariformis (Dutkevich, 1939)

Pl. 4, fig. 9, 10, 15

1939 *Schwagerina globulariformis* Dutkevich (in Licharew, Ed.), pp. 31, 38, pl. 1, fig. 27; pl. 2, fig. 1, 2.

Material. 3 axial sections.

Distribution and age. Pamir, China, Turkey; Early Permian, Yahtashian and Bolorian.

Occurrence. Tulumtash (sample T1), Beitepe (sample T3).

Genus *Rugosochusenella* Skinner & Wilde, 1965

Rugosochusenella aff. **ibukiensis** (Kobayashi, 1957)

Pl. 4, fig. 12-14, 16

1957 *Rugosofusulina ibukiensis* Kobayashi, p. 103, pl. 15, fig. 1-12.

Material. 1 axial and 3 oblique sections.

Remarks. The specimen discussed differs from *Rugosochusenella ibukiensis* for a more elongate shell.

Occurrence and age. Beitepe (sample T5); Early Permian, Sakmarian.

Acknowledgments.

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