Permian Stratigraphy and Fusulinida of Afghanistan with Their Paleogeographic and Paleotectonic Implications

by
Ernst Ja. Leven
edited by
Calvin H. Stevens and Donald L. Baars

SPECIAL PAPER

316

Published by The Geological Society of America, Inc.
3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301

Printed in U.S.A.

GSA Books Science Editor Abhijit Basu

Library of Congress Cataloging-in-Publication Data
Leven, Ė. I͡A. (Ėrnst I͡Akovlevich)
Permian stratigraphy and Fusulinida of Afghanistan with their paleogeographic and paleotectonic implications / by Ernst Ja. Leven ; translated by Tatyana Yu. Shalishilina ; edited by Calvin H. Stevens and Donald L. Baars.
p. cm. -- (Special paper ; 316)
Includes bibliographical references.
ISBN 0-8137-2316-7
1. Geology, Stratigraphic--Permian. 2. Geology--Afghanistan. 3. Fusulinida--Afghanistan. 4. Paleontology--Permian. 5. Animals, Fossil--Afghanistan. I. Stevens, Calvin H. II. Baars, Donald L. III. Title. IV. Series: Special papers (Geological Society of America) ; 316.
QE674.L55 1997
551.7'56'09549--dc21 96-51130
CIP

Cover: Upper Carboniferous and Lower Permian rocks near Kwakhan village, Afghan Badakhshan.

10 9 8 7 6 5 4 3 2 1

Geological Society of America
Special Paper 316
1997

Permian Stratigraphy and Fusulinida of Afghanistan with Their Paleogeographic and Paleotectonic Implications

ABSTRACT

Permian rocks are widespread in Afghanistan and species of the Fusulinida show that all stages of this system from Asselian to Dorashamian are present. All of the species encountered in this study from almost all known Permian exposures in Afghanistan are herein described and figured, including one new genus, *Laosella* n. gen., and 41 new species and subspecies including *Neofusulinella callosa* n. sp., *N. magna* n. sp., *Codonofusiella simplex* n. sp., *Biwaella tumefacta* n. sp., *Zellia heritschi afghanica* n. subsp., *Rugososchwagerina altimurica* n. sp., *R. heratica* n. sp., *Darvasella ponderosa* n. sp., *D. cucumeriformis* n. sp., *Dutkevitchia sourkhobensis* n. sp., *Darvasites ordinatus longus* n. subsp., *D. afghanensis* n. sp., *Chalaroschwagerina bamianica* n. sp., *C. sourkhobensis* n. sp., *Pseudofusulina karapetovi* n. sp., *P. karapetovi gudriensis* n. sp. and n. subsp., *P. karapetovi tezakensis* n. sp. and n. subsp., *P. macilenta* n. sp., *P. peregrina* n. sp., *P. fabra grandiuscula* n. subsp., *P. acuminatula* n. sp., *P. hessensis orientalis* n. subsp., *P. heratica* n. sp., *P. sourkhobensis* n. sp., *P. priva* n. sp., *P. bulolensis* n. sp., *P. argandabensis* n. sp., *P. immensa* n. sp., *P. perspicua* n. sp., *P. haftkalensis* n. sp., *Praeskinnerella crassitectoria afghanensis* n.subsp., *Parafusulina uruzganensis* n. sp., *Chusenella subextensa* n. sp., *Rugosochusenella dialis* n. sp., *Verbeekina (Quasiverbeekina) altimurensis* n. sp., *Cancellina (Shengella) bamianica* n. sp., *Neoschwagerina bamianica* n. sp., *Colania altimurensis* n. sp., *Presumatrina uruzganensis* n. sp., *P. longa* n. sp., and *Sumatrina bulolensis* n. sp.

The current study shows that the fusulinid faunas in Afghanistan and adjacent Pamir can be used to compare and contrast the different tectonic zones present in these two regions. Four major conclusions regarding the geologic history of Afghanistan and surrounding territories follow:

1. The geology of Afghanistan and Pamir is complex, and the Permian rocks in the numerous tectonic zones are small relics of much larger depositional basins that were crushed during the collision of the Indostanian and Laurasian plates.

2. The carbonate facies and fusulinid assemblages of the Asselian and Sakmarian Stages in north Afghanistan and north Pamir, which apparently had marine connections with south Tien Shan and the southern Ural region, are characteristic of tropical shelves. Asselian and lower Sakmarian(?) rocks of south Afghanistan and south Pamir, however, are exclusively siliciclastic, lack fusulinids, but contain cold-water bryozoans, brachiopods, and bivalves typical of Perigondwanan seas. A fusulinid fauna that is endemic and quite different from coeval faunas in the northern areas appears only in the upper half of the Sakmarian Stage. This fusulinid assemblage suggests that the Lower Permian rocks in south Afghanistan were formed in cool- to moderately cold-water environments. Because the northern and southern areas of Afghanistan and Pamir that once were in different climatic belts are now essentially

Leven, E. Ja., 1997, Permian Stratigraphy and Fusulinida of Afghanistan with Their Paleogeographic and Paleotectonic Implications, Stevens, C. H., and Baars, D. L., eds., Shalashilina, T. Yu., translator: Boulder, Colorado, Geological Society of America Special Paper 316.

in contact, the distance of convergence must have been at least the width of one climatic belt.

3. A trend toward a milder climate in the southern Perigondwanan regions led to a complete replacement of the siliciclastic facies by carbonate rocks in Yahtashian-Bolorian time, and this trend toward a milder climate allowed expansion of the northern fusulinid assemblages to those regions. At that time, the distinction between southern and northern fusulinid assemblages disappeared.

4. Despite the fact that the sequences in different tectonic zones are dissimilar, most of them show similar large-scale transgressions and regressions. The Asselian Stage is restricted in extent and is closely allied with the Upper Carboniferous. A vast Sakmarian transgression was followed by a rapid regression. A new advance of the sea began in late Yahtashian and Bolorian time, with an abrupt enlargement of that transgression in early Kubergandian and again in early Midian times. At the end of the Midian, the sea retreated. This was followed by a minor transgressive episode in Dzhulfian time. These and other geologic events are recognizable in many Tethyan sequences beyond Afghanistan and Pamir.

INTRODUCTION

This study of the Permian stratigraphy, Fusulinida, and paleogeography of Afghanistan is an outgrowth of a joint Soviet-Afghan project, lasting from 1958–1977, aimed at deciphering the complex geology of Afghanistan. This work already has resulted in publication of a geological map of Afghanistan compiled at scale 1:500,000 and a definitive monograph on the geology and mineral resources of Afghanistan (Dronov, 1980).

Many of the paleontological materials used in the current study were provided by V. I. Dronov, S. S. Karapetov, A. Kh. Kafarskiy, and B. R. Pashkov. In 1971, I had an opportunity to visit the most important Permian sequences in north Afghanistan. In particular, I was able to see and collect fusulinid-bearing samples from the sequences at Bamian, Bulola, and Sourkhob.

I conceived the present study as a comprehensive overview of the Permian geology of Afghanistan based upon all of the materials I had at my disposal. A study of the Afghan fusulinids also was an original focus of this study because I have been interested in the Pamir Permian fusulinid faunas for many years, and the Afghan materials allowed a much broader appraisal of the geology of the region. In the process of this compilation, I have summarized all of the information available on the Permian of Afghanistan. Interpretation of the data on the two contiguous regions (Afghanistan and Pamir) from a single viewpoint provides a basis for understanding the character of the Permian sequences in Afghanistan and serves as background for making paleogeographic and paleotectonic interpretations. Examination of the Permian fusulinids was of primary importance in documenting that rocks of this age occur in most of the structural-facies regions in Afghanistan.

PREVIOUS STUDIES

Griesbach (1885, 1886) first mentioned the possible occurrence of Permian rocks in Afghanistan. Later Hayden (1909, 1911) confirmed this observation and distinguished a “Fusuline Limestone Series” at Shibar, Bulola, Ak Rabat, and other localities (Fig. 1) northwest of Kabul. He regarded the “Fusuline Limestone Series” as of Carboniferous-Permian age and he also recognized Permo-Carboniferous deposits at other localities in Afghanistan, particularly within the “Khingil Series” east of Kabul.

Later, a number of new Permian outcrops were discovered. Furon (1927) reported Permian fusulinids in the Sourkhob Valley near the village of Doshi; Hinze (1964) described a sequence of Sakmarian strata in the drainage basin of the Bangi River in northeast Afghanistan; Mennessier (1961) distinguished Permian rocks in the “Khingil Series” on the basis of fusulinids and brachiopods in the drainage basins of the Hilmand and Argandab Rivers; and Fesefeldt (1964) described a thick limestone unit containing Early Permian fusulinids that he correlated with Hayden’s “Fusuline Limestone Series.” Later, H. Bergman and G. Blummel (unpublished report, 1970) reported the presence of Permian rocks in west Afghanistan, south of Herat. Fossiliferous Permian sequences also were described at Jalalabad, Altimur, Qasim Khel, and Ali Khel in the eastern part of the country by Kaever (1965, 1967) and Weippert et al. (1970), and in the remote areas of Wahan and Afghan Badakhshan by Kafarskiy and Abdullah (1976) and Lapparent and Lys (1972). Therefore, by the early 1970s, Permian rocks of dominantly marine facies had been recognized in almost all of Afghanistan except for the northwestern part (Paropamiz) where continental red beds are exposed.

Information on the Permian sequences in different regions is highly variable. Most publications have dealt with the sections in the Bamian region and central and middle Afghanistan. Information regarding most other areas is inadequate but nevertheless indicates significant differences in rock types in different areas. This, in turn, suggests that the geological events that accompanied Permian sedimentation and those that followed were very complex.

The first general summary of the Permian of Afghanistan and reconstruction of paleobasins was attempted by Burrard and Hayden (1934). These workers divided the country into two “stratigraphic provinces”: western and eastern, separated by the

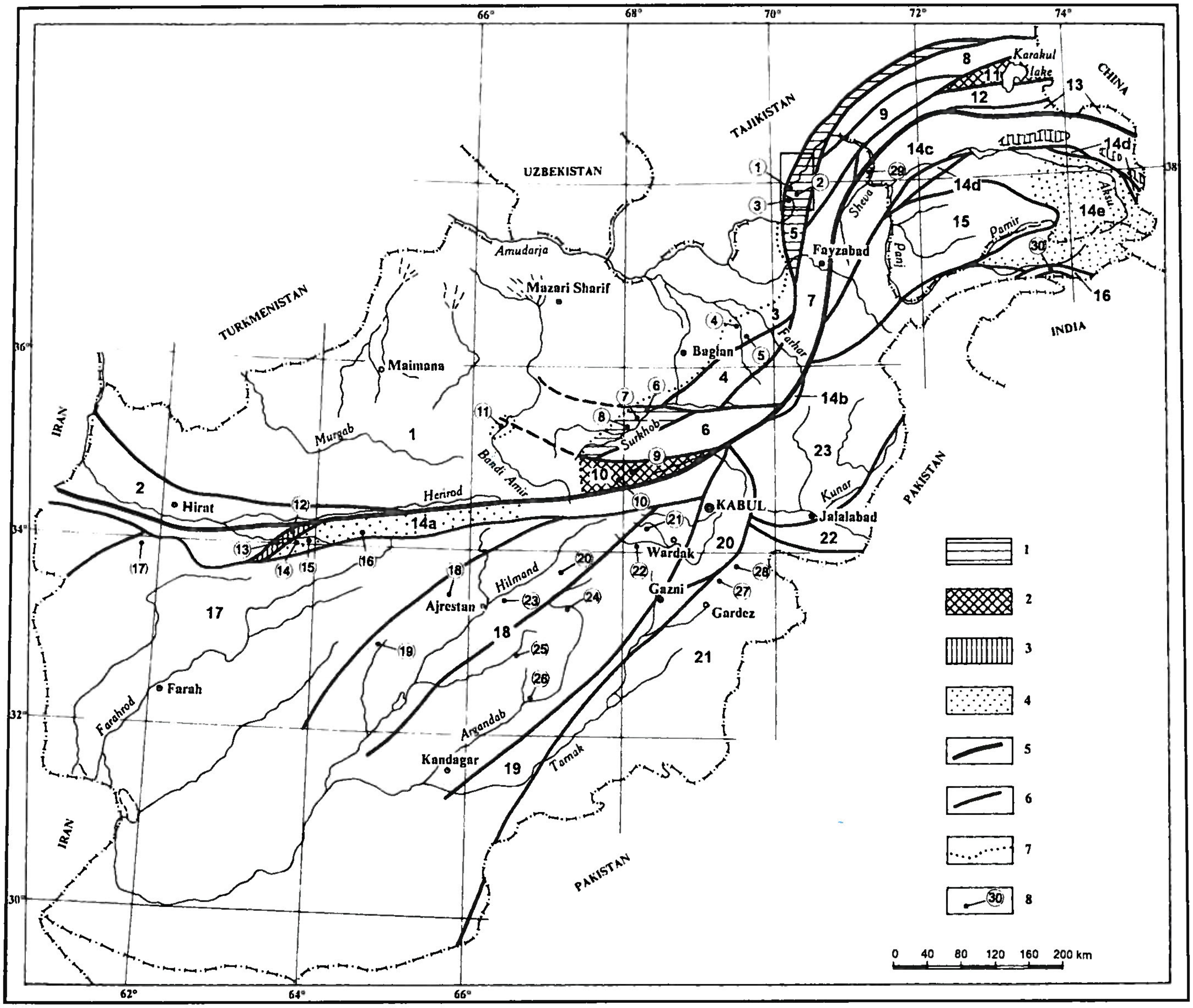


Figure 1. Tectonic zones of Afghanistan and Pamir. North Afghanistan–North Pamir: 1. Turan Plate; 2. Turkmenian-Khorasanian folded area. 3–13, structural-facies zones: 3. Rudi Tchal, 4. Sourkhob, 5. Darvaz-Transalay, 6. West Hindu Kush, 7. Faizabad–Khazret Sultan, 8. Kalaikhumb-Sauksai, 9. Jaway-Kurgovad, 10. Bamian, 11. Karakul, 12. Ak Jilga, 13. Darvaz-Sarykol. South Afghanistan– south Pamir: 14. Afghan–south Pamirian folded area: (a) middle Afghanistan, (b) Pahjsher block, (c) central Badakhshan–central Pamir, (d) Rushan-Pshart zone, (e) Wahan, southeast Pamir, 15. south Badakhshanian–south Pamirian massif, 16. Tash Kupruk zone, 17. Farahrud trough, 18. Hilmand-Argandab uplift (central Afghanistan), 19. Tarnak zone, 20. Kabul massif, 21. Suleiman-Kirthar area, 22. Kunar zone, 23. Nuristan massif.

Legend: 1–4. Fragments of the sedimentary paleobasins: 1. Sourkhob-Darvaz-Transalayan; 2. Bamian-Karakulian; 3. Khaftkala–central Pamirian; 4. Middle Afghanistan–southeast Pamirian. 5. Major suture line of Central Asia. 6. zone-controlling faults. 7. southeastern border of sedimentary cover of the Turan Plate. 8. localities of fusulinid collections (in circles): 1. Kwahan (loc. 119, 1155), 2. Obi Tang (loc. 1153), 3. Chosk (loc. D28), 4. Rudi Tchal (loc. 10686), 5. Namakab (loc. 12103), 6. Saidi Kajon (loc. A27-A40), 7. Chon and Vodu (loc. A22, A23), 8. Amir Omad (loc. A9, A10, A12), 9. Bulola (loc. A53–A59, A63), 10. Khojagor (loc. A47–A52; A65–A73), 11. Bandi Amir (loc. 1520, 1522, 1526, 1528, 1529), 12. Khaftkala (loc. 561, 563, 571, 573), 13. Khaftkala Zone, Kohe Pud (loc. 566, 575), 14. Sange Dushoh (loc. 628–633), 15. Djare Sebak (loc. 604, 606, 607), 16. Nilbandon (loc. 874), 17. Kohe Gulanji (loc. 1504, 5854), 18. Urkhon (loc. 1522), 19. Bashlang (loc. 470), 20. Gudri Mazar (loc. 85), 21. Tezak (loc. 222), 22. Sabzab-Adjar (loc. 209, 210), 23. Adjrestan (loc. 36, 46, 54, 57, 73), 24. Khargardan (loc. 8, 10, 12), 25. Uruzgan (loc. 238), 26. Shalkalay, 27. Altimur (loc. 284, T344, 1362); Abtchagan (loc. 175, 180, 181), 28. Quasim Khel, 29. Sheva, Varv (loc. 1669, 1671), 30. Tash Kupruk (loc. 1400). Outlined rectangular region on the map is shown on Figure 2.

Pagman and Kohe Bobo Ridges. In their opinion, the eastern province was defined by the areal extent of the Khingil Series and was closely associated with the Himalayan region. The western province adjacent to western Asia and Europe was characterized by continuous deposition of the Hojagak and Hilmand Groups and Permian limestones of the west Hindu Kush. This interesting speculation concerning paleogeographic links between the basins in different parts of Afghanistan, unfortunately, was too poorly substantiated to attract the immediate attention of other workers. The idea that the areas of Afghanistan that adjoined Gondwana could be separated from those associated with Laurasia, for instance, was not expressed again until the work of Petrushevskyi (1940) and Siehl (1967).

As knowledge of the stratigraphy of upper Paleozoic faunal groups of Afghanistan and conterminous regions expanded, Lapparent et al. (1970) pointed out the close facies and faunal similarities between central Afghanistan, India, and Australia. Based on this evidence, they concluded that Afghanistan had been connected with Gondwana and separated from Laurasia by the vast Tethys Sea. The territory of Afghanistan was considered as a single entity in that paper. In a later study, Termier et al. (1973) noted that the facies and faunal affinities of north Afghanistan are typical of warm seas and dissimilar to those of the Gondwana peripheries.

The concepts of the researchers noted above were advanced by subsequent workers (Karapetov and Leven, 1973; Leven et al., 1975; Leven and Scherbovich, 1978). These authors reported new information suggesting the proximity of south Afghanistan and south Pamir to Gondwana. At the same time they inferred an adjacent setting for north Afghanistan and north Pamir and pointed out close links between these areas and the northern regions of Tien Shan, which was part of the continent of Laurasia. The above observations have led me to conclude that in late Paleozoic time only the southern areas of Afghanistan were joined with Gondwana. The northern areas were located on the periphery of Laurasia and separated from the southern areas by the Paleotethys Ocean. Convergence of these areas took place along the major Hindu Kush fault and its continuation in the Pamir, the Vanch-Tanymas thrust.

Permian rocks are represented by platform facies in south Afghanistan and by geoclinal facies in north Afghanistan. North Afghanistan was located in the tropical north Tethyan biostratigraphic province, whereas south Afghanistan was located in the south Tethyan province in a temperate climatic zone.

These studies just noted provided the background for recognition of different types of Permian sequences in Afghanistan. More detailed descriptions and interpretations have been given by Siehl (1967), Kaever (1970), Lys and Lapparent (1971), Vachard (1980), and others. All of these ideas were considered thoroughly during the geologic survey of Afghanistan starting in 1958 and led by V. J. Dronov, S. S. Karapetov, A. Kh. Kafarskiy, Sh. Sh. Denikaev, I. V. Pyzhjanov, B. R. Pashkov, I. M. Sborschikov, and others. Numerous Permian sections from different parts of the country were distinguished during those studies. With the use of these and other data (Karapetov et al., 1973; Dronov et al., 1979; Pyzhjanov and Sonin, 1977; Kafarskiy and Abdullah, 1976), Dronov (1980) compiled a fairly detailed tectonostratigraphic map of Afghanistan and reconstructed the major Permian sedimentary basins. Knowledge of the Permian stratigraphy and biostratigraphy of Afghanistan, however, is still quite superficial.

The history of biostratigraphic assignments is long and complicated. Hayden (1909, 1911) regarded the “Fusuline Limestone Series” as Late Carboniferous to Late Permian in age. He considered the *Sphaeroschwagerina* beds, (i.e., the Asselian Stage), that in modern schemes is considered Permian, as Upper Carboniferous.

Thompson (1941, 1946) revised some of Hayden’s fusulinid determinations and concluded that the forms identified by Hayden as *“Schwagerina” princeps* belong to the Upper Permian genus *Verbeekina*. Hayden also described the species *“Fusulina” elongata* in association with these forms. Thompson (1946) reported the latter as a new species assignable to the genus *Polydiexodina*. Taking into account that in North America this genus occurs in the uppermost Guadalupian, the “Fusuline Limestone Series” from the Bamian sequence was dated as late Guadalupian.

Subsequently Hinze (1964) and Fesefeldt (1964) showed that Lower Permian deposits are present in northeastern Afghanistan and in the Hazaradjat province of central Afghanistan, respectively. Siehl (1967) divided the Permian of Afghanistan in accordance with the classification of Miklukho-Maclay (1963) and distinguished correlatives of the Karatchatyrian, Darvazian, Murgabian, and Pamirian Stages. In 1970, Bouyx et al., on the basis of fusulinid and ammonoid evidence, recognized the Kubergandian in the Permian sequence in the Bamian area and compared the older strata with the Artinskian. Ammonoids of Kubergandian age also have been collected in central Afghanistan (Termier et al., 1972).

Lys and Lapparent (1971) divided the Permian of Afghanistan in accordance with the scheme used by Leven (1967) in the Pamirian sequences. A lower series was divided into the Sakmarian and Artinskian and an upper series into the Kubergandian, Murgabian, and Pamirian. In 1975, Leven proposed a more detailed subdivision of the Tethyan Permian. According to this scheme, the Afghan Permian was divided into three series (Leven, et al., 1975). The lower series was further divided into the Asselian, Sakmarian, and Artinskian Stages on the basis of the fusulinid faunas. The middle series was divided into the Chihsianian, Kubergandian, and Murgabian Stages, with the Murgabian subdivided into two zones. Subdivision of the upper series is yet to be completed. The next modification of the Permian biostratigraphic scheme was attempted by Lys (1977), who after analyzing fusulinid lists, suggested a two- to three-member subdivision for all stages within both the lower and middle series.

In 1979, the Regional Tethyan Stratigraphic Scale was accepted in the former Soviet Union on the basis of the one proposed by Leven (1975). Stages and zones of this scale can be traced throughout north, south, and west Afghanistan, as shown in the correlation chart enclosed in the “Explanatory notes” of

Leven (1980b). Only the upper portion of the Permian succession remained undivided.

The Permian biostratigraphy of Afghanistan is presently understood in moderate detail based on evolutionary trends in the Afghan and Pamirian faunas, especially the fusulinids. The detailed subdivision of the Permian can be applied to the sections in Pamir, which have been studied more thoroughly than those of Afghanistan where, due to inadequate knowledge of different sections and faunal groups, few Permian sequences can be zoned. Even in the most completely studied parts of the section, however, subdivision of some units of the Standard Tethyan Scale, especially the Asselian Stage, should be better documented. In addition, the position of the Carboniferous-Permian boundary cannot be placed with certainty in the overwhelming majority of Afghan sequences. The same problem exists with respect to the Permian-Triassic boundary, which still defies recognition.

The Permian biostratigraphic scheme of Afghanistan is based almost exclusively on the distribution of fusulinids. Hayden (1909), who described several species from the Bamian "Fusuline Limestone Series," initiated examination of this fossil group. Thompson (1946) recognized some new fusulinid species from the same limestones. Later, Leven (1971) studied the Sakmarian fusulinids in north Afghanistan, and Lys and Lapparent (1971) described fusulinids and some of the smaller foraminiferans of Hazardjat and Bamian age. Later, Lapparent and Lys (1972) illustrated four fusulinid species from the Upper Carboniferous and Permian outcrops in Afghan Badakhshan. Finally, Vachard (1980) figured fusulinids from central Afghanistan and briefly commented on the faunas.

The works mentioned above are far from exhaustive with respect to the diversity of Permian fusulinid faunas in Afghanistan, and other fossil groups are even less completely studied. Brachiopods of central Afghanistan have been studied by Reed (1931), Legrand-Blain (1968), Plodowski (1970), and Termier et al. (1974). Bryozoans from central Afghanistan (Termier and Termier, 1971), rugosids from east Afghanistan (Flugel, 1965), and ammonids from the Bamian sequences (Termier and Termier, 1970) and from central Afghanistan (Termier et al., 1972) have been subjects of monographs.

In this work, I will describe the major sequences and exposures of Permian rocks in Afghanistan and report upon all of the fusulinids I have determined (about 282 species assigned to 58 genera and 22 families). In addition, the most complete lists of fusulinids published by different authors are brought into accordance with presently accepted nomenclature.

Biostratigraphic subdivision of the Afghan sequences is carried out on the basis of a somewhat modified and improved version of the scale developed by Leven (1980b). This scale is shown in Table 1. Some changes introduced into the scale, especially zonation of the Murgabian and the position of the boundary between this stage and the Midian, are based on the fact that index species within the two upper zones (Leven, 1993c, 1993d) are based on holotypes that occur at higher stratigraphic levels than the zones that bear their names. Hence,

TABLE 1. PERMIAN SCALE OF THE TETHYS

Series	Subseries	Stage	Zone
Upper	Upper	Dorashamian-P_2dr	*Pleuronodoceras, Rotodiscoceras*
			Dzhulfites, Paratirolites
			Phisonites, Iranites
		Dzhulfian-P_2d	*Vedioceras, Sanyangites*
			Araxoceras
	Lower	Midian-P_2md	*Eoaraxoceras, Anderssonoceras*
			L. kumaensis
			Yabeina globosa, Lepidolina multiseptata
			Afghanella robbinsae, Yabeina archaica
		Murgabian-P_2m	*Afghanella schencki*
			Afghanella tereshkovae
			Presumatrina neoschwagerinoides, P. schellwieni
		Kubergandian-P_2kb	*Cancellina cutaensis*
			Armenina, Misellina ovalis
Lower	Upper	Bolorian-P_1b	*Misellina parvicostata*
			Brevaxina dyhrenfurthi
		Yahtashian-P_1yh	*Chalaroschwagerina vulgaris, Pamirina darvasica*
			Chalaroschwagerina solita, Pamirina pulchra
	Lower	Sakmarian-P_1sk	*Robustoschwagerina schellwieni, Paraschwagerina mira*
		Asselian-P_1as	*Sphaeroschwagerina glomerosa*
			Paraschwagerina robusta, P. saibulakensis
			Sphaeroschwagerina vulgaris, S. fusiformis

Leven (1992, 1993b) proposed that developmental stages within the Family Sumatrinidae be the basis for zonation of the Murgabian. It is this zonation that is reflected in the version of the scale used herein.

The boundary between the Murgabian and Midian is placed below the *Yabeina-Lepidolina* genozone. The first occurrence of *Yabeina* is in beds usually considered to belong to the *N. margaritae* zone of the Murgabian. By placing the boundary of the Midian at the first appearance of *Yabeina*, I thus incorporate in this stage beds previously considered as uppermost Murgabian. The first appearance of *Yabeina*, however, is very important because it corresponds with the first appearance of many other typical Midian genera, including *Kahlerina*, *Lantchichites*, *Rauserella*, *Reichelina*, *Parareichelina*, *Sikhotenella*, and *Dunbarula*. In addition, *Codonofusiella*, *Metadoliolina*, and *Sumatrina* become much more abundant. At the same horizon, there is a marked renewal of smaller foraminifers including *Sphairionia*, *Abadehella*, *Neoendothyra*, *Paraglobivalvulina*, *Langella*, *Frondina*, *Partisania*, *Dagmarita*, *Hemigordiopsis*, *Kamurana*, *Baisalina*, and *Shanita*. This boundary also marks the beginning of a major Midian transgression that spanned the entire Tethyan region.

PERMIAN SEQUENCES AND EXPOSURES

Permian rocks presently crop out in most of the major tectonic zones in Afghanistan. Each tectonic zone has its own peculiar stratigraphic section and most zones are traceable into Pamir. Despite differences, the sequences in the different structural-facies zones of Afghanistan and Pamir can be grouped into two major types.

The first type of sequence is located in the southern parts of Afghanistan and Pamir. In these areas, the lower part of the section is composed of siliciclastic rocks whereas the upper part commonly is represented by transgressional carbonate rocks. Fossils in the lower part of the section are closely allied with Gondwanan assemblages, whereas those in the upper part compare favorably with Tethyan faunas.

North of the Major Suture Line of Afghanistan and Pamir that traverses the Herirud, Gorband, Pahjsher, and Sheva Valleys, and is traceable farther into Pamir along the Vanch-Tanymas fault, Permian sequences are lithologically more variable. Carbonate rocks, including Lower Permian reefal facies, are present, and fossils with Tethyan affinities occur throughout the section. All of the rocks in the western part of north Afghanistan and the upper part of the section in the eastern part, represent continental deposition. Thus, the Permian deposits of Afghanistan and Pamir can be subdivided into two parts: south Afghanistan and south Pamir on the one hand, and north Afghanistan and north Pamir on the other.

A complete treatment of the highly complicated tectonic framework of Afghanistan and Pamir is beyond the scope of the present study. Here, I will use the tectonic provinces employed in Dronov (1980).

North Afghanistan

In much of north Afghanistan, Permian rocks are concealed beneath a thick cover of Mesozoic and Cenozoic deposits. They are exposed only in the deepest part of the Bandi Amir Valley and in the uplifted Bandi Turkestan Ridge. In the eastern-northeastern part of north Afghanistan, the main Permian outcrops are within the north Afghan–north Pamirian folded area (Fig. 1). This area appears to be a projection of the north-Afghan basement platform that was uplifted during the Cenozoic. In the Turkmenian-Khorasanian folded area, Permian rocks also are confined to the basement that was uplifted in late Oligocene to Neogene time (Dronov, 1980).

North Afghan–north Pamirian folded area. Pre-Paleozoic and Paleozoic structures form a broad strip, extending from northern Badakhshan to the western slopes of the Hindu Kush in the north Afghan–north Pamirian folded area. The Permian deposits within this area are located in four regions: north Badakhshan, Farkhar, Sourkhob, and Bamian. These all belong to different structural-facies zones, each having its own individual Permian section.

North Badakhshan. The Permian rocks in this remote area (Fig. 1) are still poorly studied. However, detailed research on the rocks in the Darvaz-Transalay zone in north Pamir allows interpretation of the rocks in the western part of north Badakhshan, which constitutes a southern continuation of this zone. In Afghanistan, this zone is bordered on the west by the Kwahan fault and the east by the Laron fault, which are the southern extensions of the north Pamirian Darvaz-Karakul (north Pamirian) and Sauksai faults, respectively (Kafarskiy and Abdullah, 1976). East of the Darvaz-Transalay zone in north Badakhshan, the Jaway zone, recognized by Kafarskiy and Abdullah (1976), is a continuation of the Kalaikhumb-Sauksai and Kurgovad zones in north Pamir. The Jaway zone is bounded on the east by the Khejwand fault which is on strike with the Uibulak fault in north Pamir.

Darvaz-Transalay tectonic zone. Knowledge of the Permian System in the Afghan part of this region (Fig. 1, area 5) is fragmentary (Lapparent and Lys, 1972; Dronov, 1980). In the northern Pamirian part of the region (southwest Darvaz), Permian sequences have been studied by a number of geologists and stratigraphers (Vlasov, 1961; Vlasov and Miklukho-Maclay, 1959; Kalmykova, 1967; Leven 1974, 1980a, 1982b; Leven and Scherbovich, 1978; and Leven et al., 1992). In the author's opinion, two trends of Permian outcrops can be recognized here. The western strip of Permian deposits extends over the western limb of the Kuhi Frush-Kwahan anticline (Fig. 2). The eastern limb of this anticline is cut off by a fault beyond which Permian rocks of the eastern strip are exposed.

The Permian sequence of the western strip is well studied on the right bank of the Panj River, east of the village of Shagon. The lower part of the Permian sequence described by Leven and Scherbovich (1978, 1980b) is represented by the Sebisourkh Formation, which constitutes the upper half of the thick calcareous Shagon Group. The Carboniferous-Permian boundary is placed within a

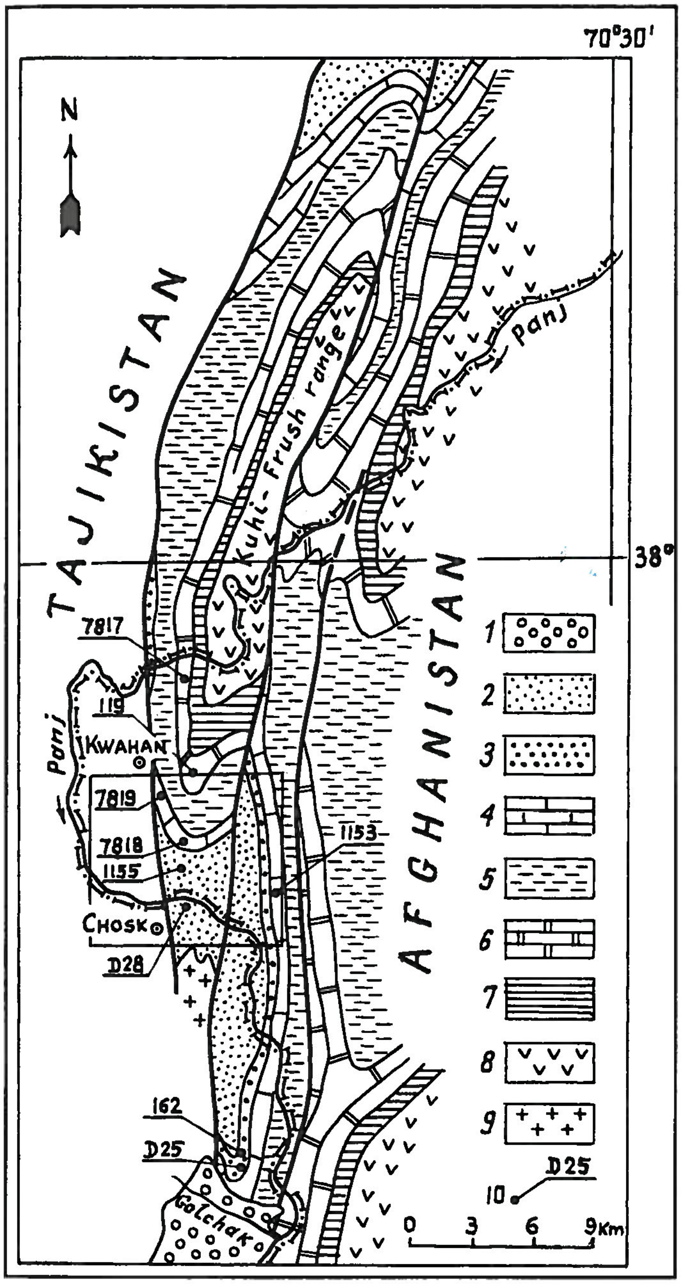


Figure 2. Map showing distribution of the Upper Paleozoic rocks in the Darvaz and Northern Badakhshan (see Fig. 1). 1. Neogene; 2. Jollihar Group; 3. Gundara Formation; 4. Safetdara Formation; 5. Tcharymdara Group; 6. Sebisourkh Formation; 7. Middle and Upper Carboniferous; 8. Lower Carboniferous; 9. granodiorite; 10. location of fusulinid collections. Geology of outlined area is shown on Figure 3.

dominantly limestone unit by the change upward from the *Daixina bosbytauensis–D. robusta* fusulinid Zone to the *Sphaeroschwagerina vulgaris–S. fusiformis* Zone. Near the Afghanistan border, the Sebisourkh Formation is about 400 m thick and is composed of a biogenic limestone with diverse fossils and argillite interbeds in the middle part. Fusulinids collected throughout the formation have allowed recognition of the same three zones of the Asselian present in the type sections of the Ural region. The top of the formation contains fusulinids of Sakmarian age.

The Sebisourkh Formation is overlain sharply, but probably conformably, by the Khoridje Formation. The latter formation, 300 m to 400 m thick, is a flyschoid sequence of argillite, siltstone, and sandstone. At the base of the section, the rocks contain Sakmarian fusulinids, including *Paraschwagerina mira, Robustoschwagerina schellwieni, Zellia heritshi,* and others. In the areas north of Darvaz, Sakmarian ammonoids occur in the argillites (Leven et al., 1992).

The Zygar Formation, 200 m to 300 m thick, is the next higher unit. It is represented by coarse-grained, thick-bedded, volcanomictic sandstone with argillite and intercalations of conglomerate and tuff. Here the formation is barren of fossils, but in the sections north of Darvaz this formation contains fusulinids compatible with the lower zone of the Yahtashian Stage.

The Zygar Formation grades upward into the Tchelamtchi Formation, which is composed of argillite, siltstone, and sandstone with conglomerate lenses and biohermal limestone. This formation is nearly 400 m thick. Here, limestone interbeds in the upper part of the Tchelamtchi Formation yield the upper Yahtashian fusulinids *Pamirina darvasica* Leven, *Darvasites ordinatus* (Chen), *Chalaroschwagerina vulgaris* (Schellwien and Dyhrenfurth), and others.

The Khoridje, Zygar, and Tchelamtchi Formations are combined into the Tcharymdara Group. This unit is overlain by massive reefal limestone of the Safetdara Formation, which attains thicknesses of 400 m to 500 m. Fusulinids typical of the upper zone of the Yahtashian are encountered throughout the section. These include *Pamirina darvasica* Leven, *Toriyamaia laxiseptata* Kanmera, *Darvasites ordinatus* (Chen), *Chalaroschwagerina globosa* (Schellwein), and *Pseudofusulina kraffti* (Schellwein and Dyhrenfurth). In the most complete sequences, *Misellina (Brevaxina) dyhrenfurthi* (Dutkevich), a guide species of the lower zone of Bolorian, appears near the top of the unit. The Safetdara Formation grades conformably upward into the Kuljaho Formation, which consists of red-purple, crimson, and lilac argillite, sandstone, conglomerate, and tuff. The Kuljaho Formation is 150 m thick near the north fold of the Kuhi Frush–Kwahan anticline, increasing in thickness southward. Simultaneously, the Safetdara Limestone is replaced laterally by clastic and volcanoclastic rocks, almost pinching out on the right bank of the Panj River near the village of Shagon.

A multicolored tuff unit called the Daraitang Formation, which ranges from 700 m to 800 m in thickness, overlies the Kuljaho with a gradational contact. The succeding Valvaljak Formation is made up of cherry-red, poly- and volcanomictic sandstone and conglomerate as much as 1,000 m thick. Three volcanogenic formations (the Kuljaho, Daraitang, and Valvaljak Formations) constitute the Jollihar Group, which ranges in age from the late Bolorian to probably early Midian. The Valvaljak Formation is overlain by the Khamtarma Formation, which consists of 30 m to 60 m of gray and green argillite and siltstone with sandstone and marlstone interbeds. This formation yields plant fossils of a Zechstein aspect (Leven and Davydov, 1979). In the northern parts of Darvaz, the Khamtarma Formation is overlain successively by the siliciclastic Kaftarmol Formation and carbonate Kafirbatcha Formation, the scoured upper surface of which is overlain by clastic rocks of Early Triassic age.

The Sebisourkh, Khoridje, Zygar, and Tchelamtchi Formations extend toward the Panj Valley to the Afghanistan border. On the right bank of the Panj River the upper part of the Permian sequence is cut off by the Kwahan fault, which juxtaposes Permian rocks against Jurassic continental rocks.

Permian formations across the Panj River extend southward to east of the village of Kwahan across the Panj River. Across a river-formed loop, these deposits reappear on the right bank near the village of Chosk at the northern termination of the Farkak Ridge. Their strike changes from north-south to east-west and then, to north-south again forming the southern limb of the Kuhi Frush–Kwahan anticline. Its core is composed of the Sebisourkh Limestone (Fig. 3). Two and one-half kilometers east of the village of Kwahan, N. G. Vlasov (1970, personal communication) collected middle Asselian fusulinids including *Quasifusulina* sp., *Pseudoschwagerina velebitica* Kochansky-Devidé, *P. turbida* Kahler and Kahler, *P. extensa* Kahler and Kahler, and *Rugosofusulina stabilis* (Rauser) (loc. 119) from limestones of the Sebisourkh Formation.

The fusulinids collected by Lapparent and Lys (1972) near the villages of Koldara and Pari Kam probably came from the same limestone unit. Judging by the specimens illustrated by these authors (their plate 2, fig. 2, and plate 3, fig. 4), both the Gzhelian and the uppermost zone of the Asselian are present. The former is indicated by the occurrence of *Ruzhezevites ferganensis* (Miklukho-Maclay) and *Pseudofusulina* aff. *P. sulcata* of Lapparent and Lys, a species common in the upper part of the Gzhelian sequence on the right bank of the Panj River. A late Asselian age is indicated by numerous specimens of *Dutkevitchia complicata* (Schellwien and Dyhrenfurth) incorrectly assigned to *Pseudoschwagerina inflata* Zhang by Lapparent and Lys (1972).

The Sebisourkh Limestone is stratigraphically overlain by dark-colored, siliciclastic rocks of the Tcharymdara Group and a thin band of bedded limestone, the stratigraphic position of which corresponds to that of the Safetdara Limestone. The fusulinids reported by Lapparent and Lys (1972) from the Bedi Khah and Khami Bahar localities (their loc. 7818–7819) probably came from these rocks. Their photographs of *Pseudofusulina* and *Darvasites* are of randomly oriented sections and are, therefore, indeterminable at the species level. The first closely resembles *Pseudofusulina neolata* (Thompson) and *P. gundarensis* Kalmykova, and the second, *Darvasites ordinatus* (Chen), all of which occur in the Safetdara Limestone. These fusulinids indicate an age of Yahtashian-Bolorian. Therefore, the report of the Tastubian fusulinid *Pseudofusulina moelleri* Rauser-Chernousova by Lapparent and Lys (1972) is considered to be erroneous.

Well exposed on the right bank of the Panj River, near the ruins of Chosk village, the limestones of the Safetdara are succeeded by the Jollihar Group, the lower part of which consists of 300 m to 400 m of bright-colored, red-violet, slaty rocks. These rocks are identical to, although thicker than, the volcanogenic argillites and siltstones present at the base of the Kuljaho Formation in the northern sequences of Darvaz.

The red-violet, slaty rocks are overlain by thick-bedded, massive, gray and greenish beds consisting of polymictic sandstone and conglomerate (Dronov, 1980). Thin limestone interbeds and lenses in these rocks from loc. 1155-3 contain fusulinids of the lower zone of the Bolorian, including *Pseudoendothyra* sp., *Nankinella* sp., *Pseudoreichelina* sp., *Schubertella giraudi* (Deprat), *Toriyamaia laxiseptata* Kanmera, *Darvasella vulgariformis* (Kalmykova), *D. compacta* (Leven), *Darvasites ordinatus* (Chen), *D. contractus* (Schellwien and Dyhrenfurth), *Rugosochusenella* sp., *Pseudofusulina cabudcuensis* Kalmykova, *P. zulumartensis* (Leven), *P. hessensis orientalis* n. subsp., *P. neolata* (Thompson), and *Misellina (Brevaxina) dyhrenfurthi* (Dutkevich). This unit ranges from 400 m to 500 m in thickness.

The succeeding unit is made up of a brighter red-violet

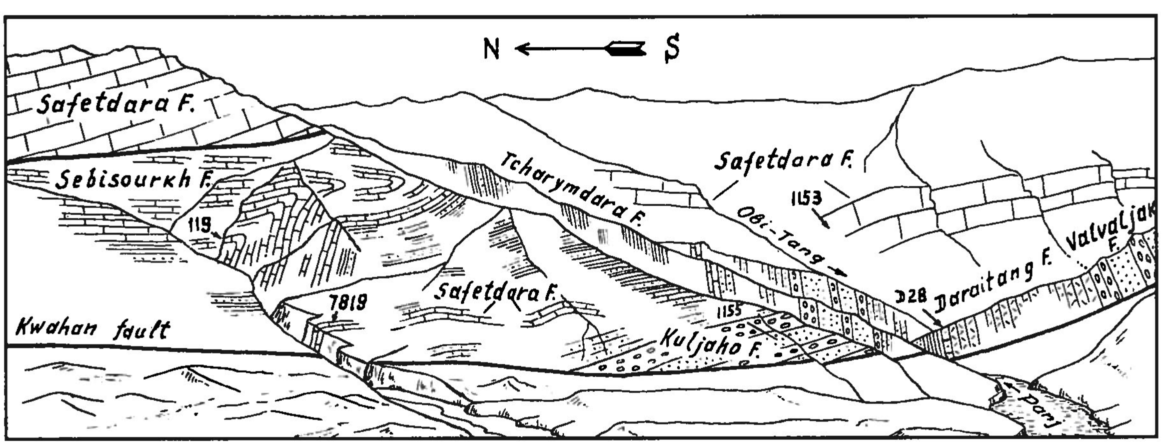


Figure 3. Sketch from a photograph of Permian outcrops of the southern end of the Kuhi Frush-Kwahan anticline (see Fig. 2). Numerals indicate locations of fusulinid collections (see Figs. 1 and 2).

polymictic and volcanomictic sandstone and conglomerate, 600 m to 700 m thick.

The three units above the Safetdara Limestone correspond to the Kuljaho Formation in Darvaz. This unit crops out on the right flank of Panj Valley two km downstream from the Chosk ruins (Figs. 2 and 3). The uppermost strata of the Kuljaho Formation at loc. D28 are composed of siliciclastic rocks with limestone interbeds containing the late Bolorian fusulinids *Schubertella* sp., *Darvasella* cf. *D. brevis* (Kalmykova), *Darvasites contractus* (Schellwein and Dyhrenfurth), *D. ordinatus* (Chen), *Pseudofusulina ambigua* (Deprat), *P. murotbekovi* (Leven), *P. dutkevitchi* (Leven), and *Misellina (Misellina) parvicostata* (Deprat).

Above the Kuljaho Formation, the Daraitang, Valvaljak, and Khamtarma Formations are exposed.

Exposures of Bolorian age reappear east of the western strip of the Permian outcrops discussed previously, beyond the fault cutting off the eastern limb of the Kuhi Frush–Kwahan anticline. The stratigraphic sequence is similar to that described above, but there are some differences. Outcrops of the Sebisourkh Formation on the Tadjik bank of the Panj River are thicker than those in the western strip and contain more massive limestone (Fig. 4). The Safetdara Formation also is markedly thicker, apparently the result of a rapid lateral change from the siliciclastic Tcharymdara Group to reefal limestone. In comparison to the western strips where the Safetdara Formation extends to the base of the Bolorian Stage, here it extends into the upper Bolorian or even lowermost Kubergandian. Thick, dominantly continental rocks of the Kuljaho Formation are lacking and their place in the section between the Safetdara Limestone and the Daraitang tuffs is occupied by the marine Gundara Formation (Fig. 4).

The only sequence studied within the eastern strip of Permian outcrops in Afghan territory is that described by A. Kh. Kafarskiy (personal communication, 1970) on the right bank of the Obi Tang River, a left tributary of Panj River (Fig. 3). This sequence (below) contains fusulinid assemblages characteristic of the Safetdara Formation.

Top of the Safetdara Formation Thickness (m)

9. Gray, thick-bedded limestone with *Pamirina* sp., *Pseudoendothyra* sp., *Nankinella hunanensis* (Chen), *Schubertella kingi* Dunbar and Skinner, *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth), *P. neolata* (Thompson), *P. fusiformis* (Schellwien) (loc. 1153-1-1) . . . . 175 m
8. Pink, massive limestone with *Nankinella hunanensis* (Chen), *Schubertella pseudogiraudi* Deprat, *Darvasites* sp., *Misellina (Brevaxina) otakiensis* (Fujimoto), *M. (Misellina) parvicostata* (Deprat) (loc. 1153-2). . . . . 45 m
7. Light-gray, massive limestone . . . . 10 m
6. Dark-gray, bedded limestone with *Pseudofusulina fusiformis* (Schellwien and Dyhrenfurth), *P.* cf. *P. kraffti* (Schellwien and Dyhrenfurth) (loc. 1153-2) . . . . 15 m
5. Bedded limestone with *Nankinella* sp., *Schubertella girandi* (Deprat), *Biwaella* sp., *Toriyamaia* sp., *Darvasites ordinatus* (Chen), *D. contractus* (Schellwien and Dyhrenfurth), *D. wissi* (Reichel), *Darvasella vulgariformis* (Kalmykova), *D. compacta* (Leven), *Pseudofusulina neolata* (Thompson), *Misellina (Brevaxina) dyhrenfurthi* (Dutkevich), *M. (Misellina) parvicostata* (Deprat) (loc. 1153-3). . . . . 10 m
4. Massive reefal limestone. . . . . 250 m
3. Medium-bedded marlstone with *Schubertella* sp., *Boultonia* sp., *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth) (loc. 1153-6) . . . . 50 m
2. Medium-bedded limestone with *Pamirina* sp., *Nankinella* sp., *Darvasites* sp., *Pseudofusulina fusiformis* (Schellwien and Dyhrenfurth), *P. kraffti* (Schellwien and Dyhrenfurth), *Misellina (Brevaxina) dyhrenfurthi* (Dutkevich) (loc. 1153-7) . . . . . . 50 m
1. Massive limestone with *Schubertella* sp., *Robustoschwagerina* sp., *Darvasites* sp., *Pseudofusulina* sp. (loc. 1153-8). . . . . 180 m

Total thickness of the Safetdara Formation . . . . 785 m

Tcharymdara Group

The presence of *Misellina* 180 m above the base of the Safetdara Formation indicates a Bolorian age for the upper part of the formation.

The Safetdara limestones extend southward from the mouth of the Obi Tang River along the left flank of Panj Valley, passing then to the right flank, where both underlying and overlying deposits are present (Fig. 2). Here, beneath the limestone, the siliciclastic Tcharymdara Group contains Yahtashian fusulinids. Below this unit the massive limestones of the Sebisourkh Formation are exposed.

The Safetdara Formation is overlapped by sandstone, siltstone, argillite, and limestone beds of the Gundara Formation, which contain a typically Kubergandian fusulinid assemblage. The Gundara Formation is overlain by the thick, red-colored Jollihar Group. Downstream from the mouth of the Golchak River, all of these units reappear in Afghan territory, although in a short distance they are concealed by clastic rocks of Neogene age.

Jaway tectonic zone. This zone (Fig. 1, area 9) encompasses an area in north Badakhshan bordered on the north by the Panj River, on the west by the Laron fault, and on the east by the Khojwand fault. Southward these faults terminate this zone before it reaches the town of Faizabad. The deposits characteristic of this area may crop out again farther south in west Hindu Kush. The Jaway region, an extension of the Kalaikhumb-Sauksai and Kurgovad areas in north Pamir, is extremely poorly studied. Unpublished reports of A. Kh. Kafarskiy, V. Averjanov, V. M. Moralev, and others, as well as the published papers of Dronov (1980) and Kafarskiy and Abdullah (1976) contain some information, however.

According to these studies, the base of the upper Paleozoic consists of bedded limestone correlative with the Kurgovad Formation of north Pamir, which is tentatively dated as Middle to Late Carboniferous. The limestones are succeeded by micaceous, carbonaceous schists and quartz-feldspathic sandstone as much as 2,500 m thick. Poorly preserved specimens of *Nankinella* sp. and *Pseudofusulina* sp. of an Early Permian aspect occur in the upper part of this sequence, which represents a direct continuation of the Pshiharv Formation on the right bank of the Panj River. The Pshiharv Formation commonly is considered entirely Early Permian based on its stratigraphic position above the Kurgovad Formation, which is regarded conventionally as Middle and Late Carboniferous, and on the presence of *Monodiexodina* cf. *M. ferganica* (Miklukho-Maclay) in its upper part.

Rudi Tchal tectonic zone. Much of the area between drainage basins of the Panj and Kokcha Rivers on the southern extension of the Paleozoic structures of north Badakhshan is covered by Neogene deposits. Upper Paleozoic rocks, including Permian ones, however, crop out in the Farkhar Valley and in its left tributaries, the Namakab and Bangi (Rudi Tchal) Valleys (Fig. 1, area 3). Permian deposits there were first recognized by Hinze (1964) and subsequently were examined by K. Ya. Mikhailov, B. R. Pashkov, V. P. Kolchanov and A. Kh. Kafarskiy (unpublished reports). Descriptions of the sections reported below are based on unpublished data collected by B. R. Pashkov (1966). Leven's (1971) monograph presented a study of the fusulinids from these sections based on samples collected by B. R. Pashkov and A. Kh. Kafarskiy.

The most representative sequence in the drainage basin of the Rudi Tchal River is exposed near the village of Tchashma Gavan, where it was described by Hinze (1964). The Permian beds there occur along a steeply dipping, north-facing monocline. These rocks are cut off by a fault in the south and are unconformably overlapped by Upper Triassic volcanic rocks in the north.

From south to north, in descending order, the following stratigraphic sequence is exposed:

Upper Triassic volcanic rocks Thickness(m)

20. Violet and greenish gray, arkosic and polymictic sandstone with an admixture of volcanics .... 3.5 m
19. Interbedded siltstone, argillite, and limestone with *Quasifusulina* aff. *Q. longissima* (Moeller), *Pseudoschwagerina* cf. *P. robusta* (Meek), *Paraschwagerina inflata* (Zhang), *Dutkevitchia complicata* (Schellwien and Dyhrenfurth), *Pseudofusulina hindukushiensis* Leven (loc. 10686-1, 10686-5, 10686-6) .... 15 m
18. Greenish gray, arkosic sandstone .... 12 m
17. Violet, polymictic sandstone with siltstone and argillite interbeds .... 12 m
16. Interbedded argillite and limestone with *Quasifusulina* sp., *Pseudoschwagerina parasphaerica* Zhang, *P. aff. P. inflata* Zhang, *Pseudofusulina hindukushiensis* Leven, *P. namakabensis* Leven (loc. 10686-10, 10686-11) .... ~14 m
15. Purple and greenish gray, thick-bedded sandstone with greenish gray siltstone................................ 50 m
14. Interbedded argillite, siltstone, and multicolored sandstone .... 60 m
13. Greenish gray, fine-grained, thin-bedded, lumpy sandstone. The upper part contains limestone interbeds with *Quasifusulina* sp., *Sphaeroschwagerina fusiformis* Krotow, *Paraschwagerina* aff. *P. tianshanensis* Zhang, *Pseudofusulina griesbachi* Leven (loc. 10686-14, 1086-16) .... 45 m

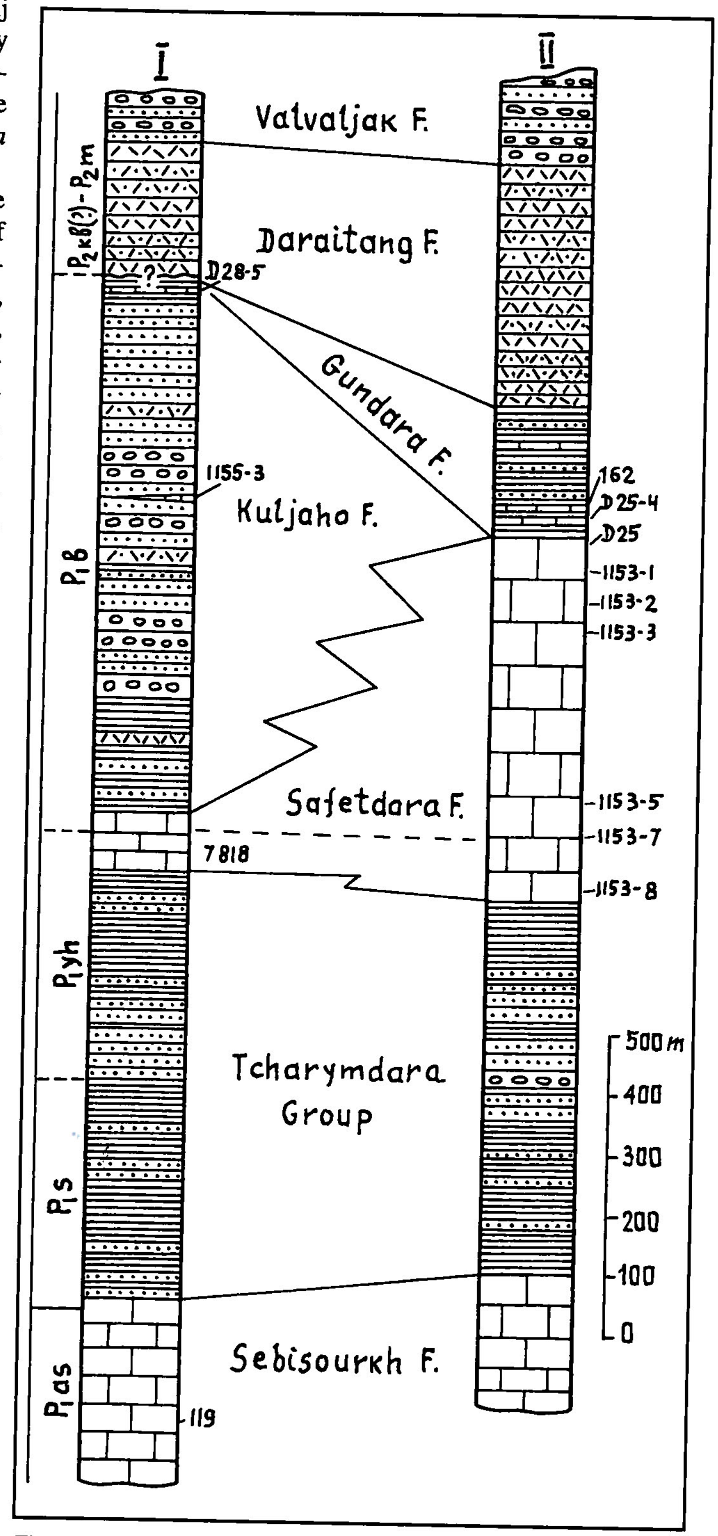
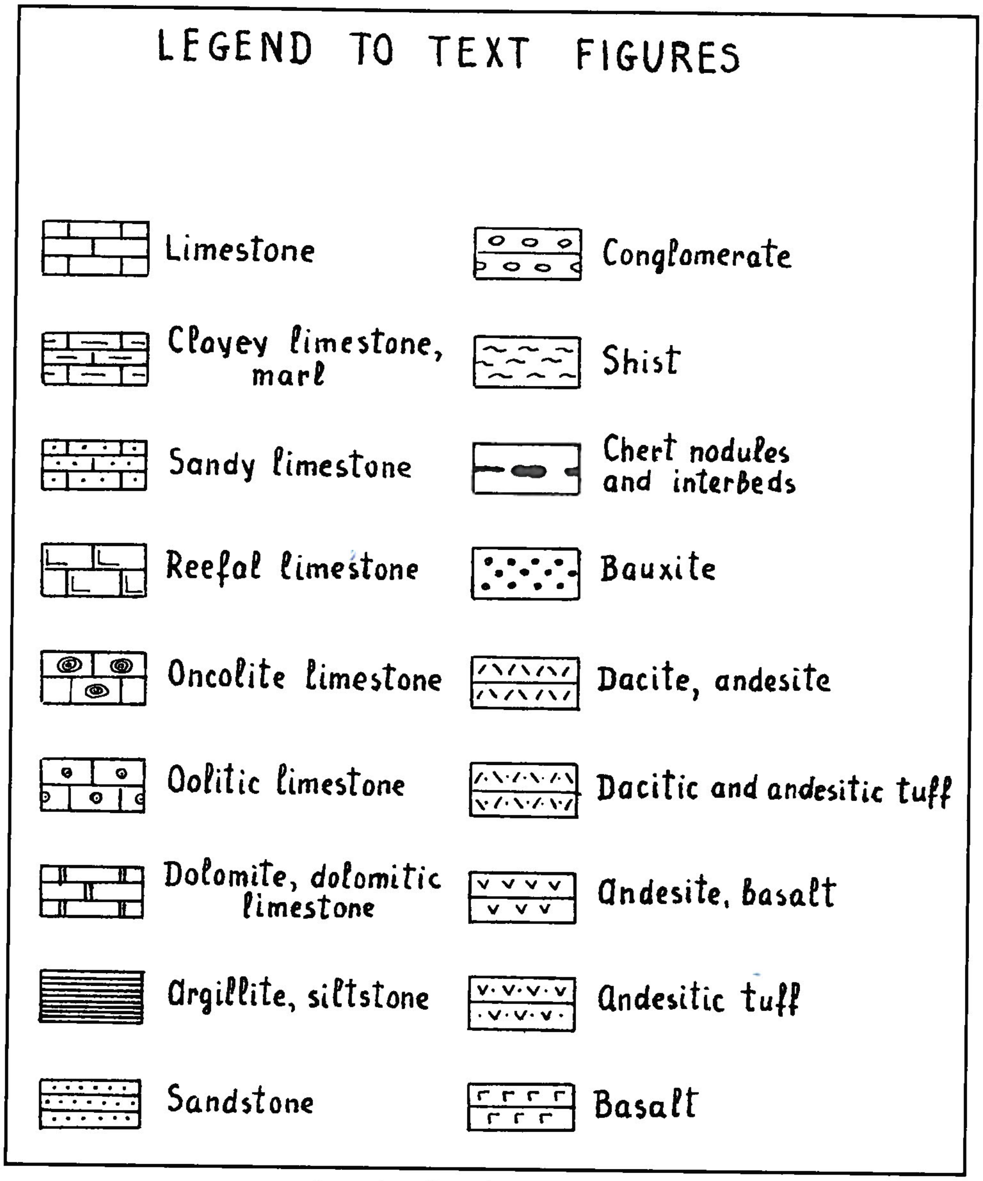


Figure 4. Comparison of western (I) and eastern (II) Permian sequences in the southern Darvaz-Transalay zone, southeast of the village of Kwahan. Numerals indicate fusulinid localities (see Figs. 1 and 2). For age designations, see Table 1.



Legend to all stratigraphic columns.

12. Dark-gray argillite with nodules and interbeds of limestone, bearing *Quasifusulina karawanensis* Miklukho-Maclay, *Paraschwagerina pashkovi* Leven, *Dutkevitchia complicata* (Schellwien), *D. splendida* (Bensh) (loc. 10686-17) .... 15 m
11. Sandstone, and violet and greenish-gray siltstone with argillite interbeds .... 25 m
10. Dark-gray, bedded limestone .... 1 m
9. Greenish gray siltstone with limestone interbeds and dark-gray to greenish gray siltstone. The limestone yields *Quasifusulina pseudoelongata* Miklukho-Maclay, *Q.* cf. *Q. karawanensis* Miklukho-Maclay, *Paraschwagerina pashkovi* Leven, *Robustoschwagerina* cf. *R. nucleolata* (Ciry), *Dutkevitchia* cf. *D. complicata* (Schellwien), *Pseudofusulina kattaganensis* Leven, *P. ellipsoides bangiensis* Leven, *P. ellipsoides afghanensis* Leven, *P. trompi* Leven (loc. 10686-18). The same strata are probably the source of *Sphaeroschwagerina glomerosa* (Schwager) and *Paraschwagerina pashkovi* Leven, which were found in the talus at loc. 10686-12.......................... 10 m
8. Greenish-gray, thin- and medium-bedded siltstone with thin gravelstone interbeds and fine-pebble conglomerate. Interbedded limestones contain abundant fusulinids including *Minojapanella* sp., *Quasifusulina pseudoelongata* Miklukho-Maclay, *Triticites* sp., *Paraschwagerina pashkovi* Leven, *Dutkevitchia complicata* (Schellwien and Dyhrenfurth), *Pseudofusulina kattaganensis* Leven (loc. 10686-19). At loc. 10684-6, on the left flank of the Bangi Valley the same strata contain *Pseudoschwagerina confinii* Kahler and Kahler and *Pseudofusulina mennessieri* Leven .... ~42 m
7. Interbedded limestone and siltstone .... 22 m
6. Greenish-gray, medium-bedded siltstone........... 13 m

5. Greenish-gray siltstone alternating with dark gray argillite . . . . 12 m
4. Violet-gray and greenish-gray, lumpy limestone interbedded with dark gray and violet siltstone . . . . 22 m
3. Violet-gray sandstone and siltstone with impure gravelstone interbeds . . . . 15 m
2. Greenish-gray siltstone . . . . 10 m
1. Violet gray, more rarely greenish gray, polymictic sandstone with frequent interbeds of gravelstone and fine-pebble conglomerate . . . . 21 m
Total thickness . . . . ~424.5 m

In a drainage basin of the Namakab River, the Permian is represented by rocks similar to those along the Bangi River except that siliciclastic rocks are more homogeneous in color (mainly black, dark gray, greenish gray) and finer grained, and limestones are more abundant.

Along the main Namakab River, the following sequence, faulted against Silurian-Devonian limestone, consists of the following:
Granite porphyry sill Thickness (m)
8. Greenish gray, polymictic sandstone with thin interbeds of pebble conglomerate and gray argillite. The upper part comprises limestone interbeds with *Pseudoschwagerina beedei afghanensis* Leven, *Robustoschwagerina* sp., *Rugosofusulina* cf. *R. alpina* (Schellwien) (loc. 12103-5) . . . . ~95 m
7. Black and dark-gray, thin- and medium-bedded limestone with *Minojapanella* sp., *Quasifusulina pseudoelongata* Miklukho-Maclay, *Paraschwagerina tinvenkiangi elongata* Leven, *Robustoschwagerina* cf. *R. geyeri* (Kahler and Kahler), *Dutkevitchia* cf. *D. complicata* (Schellwien and Dyhrenfurth), *Pseudofusulina namakabensis* Leven, *P. ellipsoides* Grozdilova (loc. 12103-7). . . ~90 m
6. Gray and dark-gray argillite interbedded with greenish gray, calcareous siltstone and limestone with *Quasifusulina longissima* (Moeller), *Q. pseudoelongata* Miklukho-Maclay, *Pseudoschwagerina* sp., *Paraschwagerina tinvenkiangi* Lee, *Dutkevitchia complicata* (Schellwien and Dyhrenfurth) (loc. 12103-8) . . . . . . 60 m
5. Medium-bedded, gray limestone with *Quasifusulina* cf. *Q. longissima* (Moeller), *Paraschwagerina* cf. *P. inflata* Zhang, *Pseudofusulina ellipsoides etypa* Leven (loc. 12103-10) . . . . ~12 m
4. Greenish gray siltstone with the brachiopods *Neochonetes* sp., *Choristites fritschi ferganensis* Licharew (loc. 12103-14) . . ~25 m
3. Greenish gray siltstone and dark-gray argillite. Rare, thin limestone interbeds with *Quasifusulina* cf. *Q. longissima* (Moeller), *Paraschwagerina pseudomira margelanica* Miklukho-Maclay, *P. koksarecensis* Bench, *P.* aff., *P. tianshanensis* Zhang (loc. 12103-14) . . . . 300 m
2. Albitic diabase and hornblendic porphyrite sill . . . . . . 50 m
1. Dark-gray, fine- and medium-bedded limestone with intercalations of dark-gray argillite and less common greenish gray siltstone, the basal part locally containing conglomerate interbedded with sandstone and siltstone. The limestone contains *Triticites haydeni* (Ozawa), *T. lucidus* Rauser, *T.* cf. *T. communis* Rozovskaya, *T.* cf. *T. postarcticus* Rozovskaya, *Daixina* aff. *D. baituganensis* (Rauser) (loc. 12107-1) . . . . 80 m
Total thickness . . . . ~712 m
Unconformity
Lower Carboniferous sandstone and shale

Bed 1 in the reported sequence represents the lower zone of the Gzhelian Stage (*Triticites rossicus–T. stuckenbergi* zone), whereas bed 3 contains Sakmarian fusulinids. The diabase sill (unit 2), therefore, may have been injected along the contact between the Carboniferous and Permian. If so, most of the Gzhelian and the entire Asselian are lacking in the sequence.

In addition to the just-described sequences, there are some isolated Permian exposures containing profuse fusulinids, brachiopods, and rugose corals. For instance, an isolated exposure of limestone, argillite, and siltstone in the headwaters of the Zamburak River, collected by K. Y. Mikhailov, yielded the following fusulinids: *Quasifusulina karawenensis* Miklukho-Maclay, *Q. pseudoelongata* Miklukho-Maclay, *Sphaeroschwagerina glomerosa* (Schwager), *Pseudoschwagerina* cf. *P. beedi* (Dunbar and Skinner), *Paraschwagerina koksarecensis* Bench, *Darvasites pusillus* (Schellwien and Dyhrenfurth), *Pseudofusulina haydeni* Leven, and *P. ovata* (Zhang). Rugosids include *Caninia mapingense* Lee and Gu, *C. kueichsinensis* Lee and Gu, *C. rhopaloseptata* Pyzhjanov, and *C.* cf. *C. yuii* Pyzhjanov.

In the collections made by A. Kh. Kafarskiy from several Bangi and Namakab exposures, the following fusulinids were recognized: *Quasifusulina cayeuxi* (Deprat), *Sphaeroschwagerina asiatica* Miklukho-Maclay, *Dutkevitchia ruzhenzevi* (Rauser), *Pseudofusulina mikhailovi* Leven, and *P. lapparenti* Leven.

All of these data suggest that Permian deposits in the Rudi Tchal region can be assigned to the Sakmarian Stage. *Paraschwagerina pseudomira, P. inflata P. tianshanensis, Robustoschwagerina geyeri, R. nucleolata* and others are typical of Sakmarian deposits in Tethyan sequences. *Pseudofusulina ellipsoides* Grozdilova is characteristic of the upper zone of the Asselian and lower zone of the Sakmarian Stages in the Ural region.

Pseudofusulina haydeni, P. namakabensis, and *P. kattaganensis,* which are abundantly represented in the Bangi and Namakab fusulinid assemblages, are nearly lacking in the Darvaz indicating a certain degree of endemism. This suggests that the Permian deposits of the Rudi Tchal type are not directly correlative with those in Darvaz and north Badakhshan, but belong to a different structural-facies zone. This is also indicated by the difference in lithology of the sequences in the two areas. Permian, siliciclastic rocks dominate in both the Rudi Tchal zone and the Khoridje Formation of Darvaz, but in the Namakab, and especially in the Bangi exposures, many beds have a red coloration.

Sourkhob tectonic zone. Permian deposits are moderately widespread on both flanks of Sourkhob Valley, upstream from the village of Doshi (Fig. 1, area 4). The principle data on these beds are contained in unpublished manuscripts of K. Ya. Mikhailov, A. Kh. Kafarskiy, and I. V. Pyzhjanov (1965–1973).

Some results have been reported in publications of Leven et al. (1975), Leven (1971), Pyzhjanov and Sonin (1977), and Dronov (1980). The sequences in this area are poorly known because of complex structural deformation and, in places, metamorphism caused by large intrusions. The authors of most of the herein-cited studies adhere to the concept that the structure of the Permian succession is homogeneous over the region concerned. I have observed, however, that in exposures near Doshi and Tala-Barfak the Permian rocks, commonly differing from one another in stratigraphic character, thickness, and fusulinid assemblages, occur in tectonic wedges. It is likely that the fragments of at least two structural-facies zones have been juxtaposed by faulting. The westernmost section I have studied (Fig. 5) is located on the left bank of the Amir Omad River in Amir Omad area (Fig. 1, locality 8). Permian rocks here make up almost all of the slope. They extend from here to the watershed of the Djari Estama Valley which descends to the Sourkhob River downstream from the mouth of the Amir Omad River.

On the left bank of the Djari Estama Valley near its mouth, a sequence of rocks (Fig. 5), from the top downward, consists of the following:

Thick-bedded, polymictic conglomerate, 25 m thick and a thick volcanic unit considered to be Late Triassic in age by K. Ya. Mikhailov.

An interbed of dense, gray, yellow-weathering, marly limestone containing poorly preserved crinoids, rugose corals, and goniatites. Below are beds equivalent to unit 7.

Fault Thickness (m)

8. Coarse-grained, greenish gray, polymictic sandstone. . 40 m
7. Black argillite intercalated with siltstone and fine-grained sandstone. . . . . 30 m
6. Thin-bedded, platy, arenaceous limestone showing gradational contacts with the underlying siliciclastic unit. Thirty meters below the top *Nankinella* sp., *Boultonia* sp., *Darvasites* aff. *D. zulumartensis* Leven, *Robustoschwagerina kahleri* Miklukho-Maclay, *Pseudoschwagerina* sp., *Zellia heritschi afghanica* n. subsp., *Rugosofusulina likana* Kochansky-Devidé, *R. mariae* Leven and Scherbovich, *Dutkevitchia sourkhobensis* n. sp., *D. ruzhenzevi* (Rauser), *D. bianpingensis* (Zhang and Dong), and *Pseudofusulina* sp. (loc. A-12-4) have been identified. Twenty-five meters below the top *Pseudoschwagerina* sp., *Darvasites simplex* (Schellwien and Dyhrenfurth), *Pseudofusulina fusiformis* (Schellwien and Dyhrenfurth) (loc. A-12-3) are present. Fifty meters below the top *Boultonia yukonensis* Ross and *Biwaella europae* Kochansky-Devidé (loc. A-12-2) are present. All of the fusulinids of unit 6 are characteristic of the Sakmarian stage . . . . 150 m
5. Interbedded black, laminated argillite, with a more dense, brown-weathering, greenish gray siltstone and fine-grained, polymictic sandstone. Near the base of the sequence calcareous sandstone interbeds contain the following fusulinids: *Quasifusulina* sp., *Triticites* sp., and Schwagerinidae gen. indet. (loc. A-10). The fusulinids indicate that the rocks are not older than Late Carboniferous in age. As underlying limestones contain early Bashkirian foraminifers, a concealed unconformity is inferred to lie between the limestones and the siliciclastic unit . . . . 800–1000 m
4. Sandy, clastic limestone with *Eostaffella* sp., *Ozawainella* sp., and *Pseudostaffella* sp. (loc. A-9), probably of early Bashkirian age . . . . 3 m
3. Micritic, lumpy, sandy limestone grading upward into conglomeratic limestone with fragments of tabulate corals. . . . 20 m
2. Black, locally ferruginous, micritic limestone with fine particles of organic debris . . . . 5 m
1. Gravelstone with quartz pebbles interbedded with coarse-grained sandstone . . . . 2 m

Total thickness . . . . >1,000 m

Unconformity

Volcanogenic rocks

Another sequence of Permian rocks is developed northeast of the exposure just described and separated from it by Triassic volcanic rocks and Jurassic limestones. It is reconstructed from several outcrops in the left tributaries of the Sourkhob-Vodu Rivers and Tormuz and Chon (Karemak) Creeks.

The lowermost parts of the succession were observed in the mouth of Chon Creek.

The sequence from younger to older units consists of the following:

Thickness (m)

5. Dark-gray with a brownish tint, well-bedded, fine-grained sandstone, locally interbedded with slate. Sandstone is well exposed on the left bank of the Sourkhob River downstream from the mouth of Chon Creek, where it is crumpled into a series of gentle folds and cut by a granite intrusion about 400 m wide. The upper part of the sequence is not exposed at this locality. On the right bank of the Sourkhob River the sandstone grades upward into limestone. . . . . ~175 m
4. Dark-gray and black, thin-bedded marlstone . . . . . . ~175 m
3. Light-gray shale interbedded with marlstone, one bearing *Rugosofusulina* sp., *Darvasites* sp., and *Pseudofusulina* sp. (loc. A-20). . . . . 80 m
2. Gray, platy marlstone with numerous, large, crushed, recrystallized fusulinids (*Pseudofusulina* sp.) of a Permian aspect near the base . . . . ~45 m
1. Bright-violet and light-green, slaty argillite, sandstone, and conglomerate with pebbles of volcanic rocks, chert, and limestone. These rocks form the base of a thick Permian succession that traverses the Sourkhob Valley. On the right flank of the valley, this unit is well marked by its color . . . . ~50 m

Total thickness . . . . ~525 m

Greenstone, probably Early Carboniferous

The limestone which overlies unit 5 also was recognized by the author in the left tributaries of the Vodu River (Fig. 5). Downstream, Triassic volcanics and Jurassic limestones are exposed. Upstream, beyond a fault, platy marlstone, slate, and sandstone, resembling those in Chon Creek, are overlain by intensely sheared

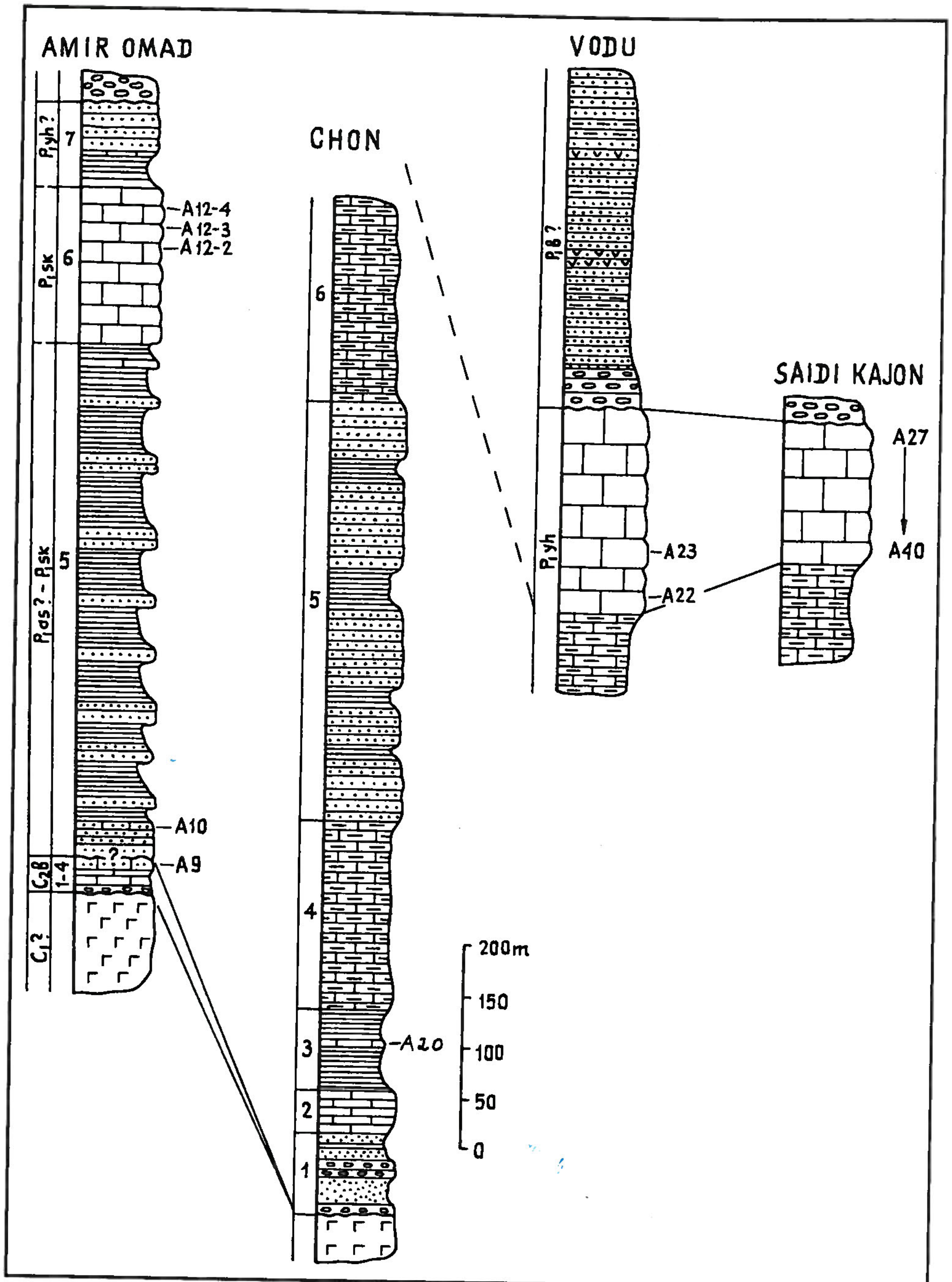


Figure 5. Permian sequences on the left bank of the Sourkhob River. Letters and numerals indicate fusulinid localities. C_1? = Lower Carboniferous (?); C_2B = Bashkirien. For other age designations, see Table 1.

pelitomorphic limestone. On the left flank of Vodu Valley, a 200 m thick, light-colored, massive limestone occurs above this limestone. From near the base of this limestone the following Yahtashian fusulinids were collected: *Robustoschwagerina* sp., *Darvasella vulgariformis* (Kalmykova), and *Pseudofusulina* sp. (loc. A-22 and A-23). The limestone is overlapped by coarse-grained, calcareous conglomerate, 30 m to 40 m thick, overlain by red and light-green sandstone and siltstone, 300 m to 400 m thick. A Permian age for this conglomerate and sandstone is interpreted by analogy with the sequences in Darvaz and north Badakhshan. In those areas, the Safetdara limestones, similar and compatible in age with the limestones considered here, are overlapped by red-colored siliciclastic rocks of the Permian Jollihar Group.

A good section of massive, coarse-grained limestone is exposed in the Saidi Kajon River downstream from the point where the river abruptly veers southward cutting across the Permian section. South of a fault that separates the Permian sequence from metamorphosed schists of middle Paleozoic age, limestone conglomerate interbedded with red, violet and green argillite and siltstone is exposed. This conglomerate is correlative with the rocks capping the Permian sequence in Vodu Valley (Fig. 5).

South of the conglomerate and the fault contact, thick-bedded, massive, fossiliferous limestone about 150 m thick crops out. From north to south (i.e., stratigraphically from top, loc. A-27, to bottom, loc. A-40), beds contain the following fusulinids:

(Loc. A-27) *Pamirina (Pamirina) darvasica* Leven, *P. (P.) nobilis* (Wang and Sun), *P. (P.) chinlingensis* (Wang and Sun), *Biwaella ellipsoidalis* Leven, *B. omiensis* Morikawa and Isomi, *B. shiroishiensis* (Morikawa and Kobayashi), *Quasifusulina magnifica* Leven, *Robustoschwagerina* sp., *Rugosofusulina darvasica* Leven and Scherbovich, *Dutkevitchia sourkhobensis* n. sp., *Darvasella compacta* (Leven), *Pseudofusulina sourkhobensis* n. sp., *P. fusiformis* (Schellwien and Dyhrenfurth), *P. perspicua* n. sp., *Chusenella globulariformis* (Dutkevich).

(Loc. A-28) *Quasifusulina magnifica* Leven, *Robustoschwagerina tumida* (Licharew), *Darvasella cucumeriformis* n. sp., *D. ponderosa* n. sp.

(Loc. A-29) *Pamirina (Pamirina) darvasica* Leven, *P. (P.) chinlingensis* (Wang and Sun), *Mesoschubertella* sp., *Darvasella compacta* (Leven), *Darvasites simplex* (Schellwien and Dyhrenfurth), *Chalaroschwagerina* sp.

(Loc. A-30) *Pamirina* sp., *Minojapanella* (Wutuella) sp., *Mesoschubertella thompsoni* Sakagami, *Rugosofusulina mariae* Leven and Scherbovich, *Darvasella vulgariformis* (Kalmykova), *D. compacta* (Leven), *D. ponderosa* n. sp., *Darvasites pseudosimplex* (Chen), *D. vandae* Leven and Scherbovich, *Chalaroschwagerina tibetica* Nie and Song, *Pseudofusulina fusiformis* (Schellwien and Dyhrenfurth), *P. sourkhobensis* n. sp.

(Loc. A-31) *Pamirina* sp., *Mesoschubertella* sp., *Darvasella compacta* (Leven), *Darvasites pseudosimplex* (Chen), *D. vandae* Leven and Scherbovich, *Chalaroschwagerina sourkhobensis* n. sp., *Pseudofusulina sourkhobensis* n. sp.

(Loc. A-32) *Pamirina* sp., *Boultonia* cf. *B. willsi* Lee, *Darvasella ponderosa* n. sp., *D. compacta* (Leven), *D. cucumeriformis* n. sp., *Chalaroschwagerina* sp., *Pseudofusulina* cf. *P. kafarskyi* Leven and Scherbovich, *P. immensa* n. sp., *Chusenella* sp.

(Loc. A-33) *Pamirina (Pamirina) chinlingensis* (Wang and Sun), *Minojapanella* sp., *Biwaella* cf. *B. omiensis* Morikawa and Isomi, *B.* cf. *B. ellipsoidalis* Leven, *Pseudofusulina sourkhobensis* n. sp.

(Loc. A-34) *Pamirina (Levenella)* aff. *P. (L.) pulchra* (Wang and Sun), *P. (Pamirina) darvasica* Leven, *Biwaella shiroishiensis* (Morikawa and Kobayashi), *B. tumefacta* n. sp., *B. omiensis* Morikawa and Isomi, *Darvasella vulgariformis* (Kalmykova), *Darvasites contractus* (Schellwien and Dyhrenfurth), *D. vandae* Leven and Scherbovich, *Chalaroschwagerina tibetica* Nie and Song.

(Loc. A-38) *Darvasella compacta* (Leven), *Chalaroschwagerina formosa formosa* Skinner and Wilde, *Pseudofusulina* sp.

(Loc. A-39) *Rugosofusulina* sp., *Dutkevitchia jipuensis* (Nie and Song), *Chalaroschwagerina formosa* Skinner and Wilde.

(Loc. A-40) *Biwaella* sp., *Robustoschwagerina tumida* (Licharew), *Rugosofusulina* sp., *Chalaroschwagerina formosa* Skinner and Wilde.

To the south this massive limestone unit is overlain by light-gray, platy, pelitomorphic limestone, resembling that in the same stratigraphic position in the Vodu Valley. The upper part of the stratigraphic sequence is faulted, repeating outcrops of platy and massive limestone. Fusulinids from several of the limestone outcrops are as follows:

(Loc. A-44) *Quasifusulina* sp., *Pamirina* sp., *Biwaella omiensis* Morikawa and Isomi, *Rugosofusulina* sp., *Dutkevichia jipuensis* (Nie and Song), *Darvasites contractus* (Schellwien and Dyhrenfurth), *Pseudofusulina* sp.

(Loc. A-45) *Pamirina (Pamirina) darvasica* Leven, *Biwaella* sp., *Quasifusulina* sp., *Darvasella ponderosa* n. sp., *Darvasites ordinatus* (Chen), *Chalaroschwagerina vulgaris* (Schellwien and Dyhrenfurth).

These fusulinids and those from the massive limestone unit are assigned to the Yahtashian Stage because of the presence of *Pamirina*, *Chalaroschwagerina*, and *Darvasella*.

The material described above from Permian exposures on the left bank of the Sourkhob River suggests that the outcrops along the Vodu, Chon, and Saidi Kajon Valleys comprise a single succession, which is dissimilar to that near the mouth of the Amir Omad River. For instance, a red-colored, basal unit is lacking in the Amir Omad sequence and the succession appears to begin with beds older than those in other Sourkhobian sequences. This is supported by the fairly primitive aspect of the fusulinids occurring at the base of the Amir Omad sequence. *Triticites* indicates a Gzhelian or Asselian age, whereas large species of *Pseudofusulina* from the Chon Creek sequence are no older than Sakmarian.

The siliciclastic unit in the Amir Omad sequence is of a distinct flyschoid character, and carbonate rocks are lacking. In contrast, siliciclastic rocks in the eastern sequences of the Sourkhob are very calcareous and alternate with limestones, often grading into limestone along the strike. Medium- and thin-bedded, platy limestone of Sakmarian and possibly partly latest Asselian age dominates the upper part of the Amir Omad sequence. The uppermost limestone units in the Vodu and Saidi Kajon sequences have a reefal character and are dated as Yahtashian. These facts suggest that the Permian sequences of Amir Omad and the eastern sections of Sourkhob were deposited in different depositional environments and probably at a considerable distance from one another.

The Permian deposits in the Vodu, Chon, and Saidi Kajon Valleys closely resemble coeval units in north Badakhshan and southwest Darvaz. The red-colored unit unconformably capping the Permian sequence and the underlying limestone are identical with the Kuljaho and Safetdara Formations in the western strip of Darvaz. The strata underlying the limestone in the Sourkhob sequence may be, in general, correlative with the Tcharymdara Group. The unconformity that is so distinct in the Vodu, Chon, and Saidi Kajon Valleys has not been observed at the base of this group in north Badakhshan and the adjacent areas of the Darvaz. However, in the northern Darvaz, the Tcharymdara Group overlies the Upper Carboniferous with the absence of Asselian rocks in the sequence.

The deposits described above occur only in a narrow strip extending along the base of the slopes of the Sourkhob Valley. Nevertheless, Permian deposits of this type are much more widely developed. A. Kh. Kafarskiy, I. V. Pyzhjanov, Sh. Sh. Denikaev, and others reported (*in* Dronov, 1980) that these beds are widespread in the drainage basin of the Saigan River and along the right tributaries of the Sourkhob River (i.e., the Pojandeh, Valzhan, and Andarab Rivers). The materials collected in these areas are fragmentary, but still I am confident that the succession is everywhere similar to that in Sourkhob Valley. Fusulinids collected in different localities are assigned to the Lower Permian, mainly Sakmarian and Yahtashian. The presence of Asselian assemblages has not been proven, although Lys (1977) reported upper Asselian deposits in the right tributaries of the Sourkhob River.

West Hindu Kush tectonic zone. Kafarskiy (*in* Dronov, 1980) assigned a graphitic, biotite-bearing, micaceous-carbonate schist and quartz-feldspathic sandstone as much as 2,000 m thick in the northern part of west Hindu Kush Ridge, east of Salang Pass (Fig. 1, area 6), to the Permian. The age is based on its resemblance to a sandy-schistose sequence of Permian age in the Jaway area. In both areas, siliciclastic rocks are underlain by a limestone conventionally considered Middle and Late Carboniferous in age. This limestone overlaps Lower Proterozoic metamorphic rocks unconformably.

Bamian tectonic zone. Permian outcrops of the Bamian zone (Fig. 1, area 10), especially those located near the village of Bamian and in the Bulola Valley (Figs. 6–8), are comparatively well studied. The fusulinid and brachiopod-bearing limestones originally were considered Late Carboniferous to Permian in age (Hayden, 1911; Furon, 1927; Reed, 1931). Subsequent studies (Gubler, 1935; Thompson, 1941; Desio, 1960; Lapparent et al., 1965; Lapparent and Lys, 1966) have shown that these sequences are mostly assignable to the Late Permian. Siehl (1967) considered the lower part of a sequence in Khojagor Gorge (Figs. 6, 7) to be Middle Permian in age. West of the Khojagor, Bouyx et al. (1970), Termier and Termier (1970), and Lys et al. (1990) reported Bolorian ammonoids and assigned higher strata in the same sequence to the Kubergandian Stage on the basis of fusulinids of the *Cancellina* zone. In the Bamian type section, Lys and Lapparent (1971) recognized an "Artinskian" (Bolorian) age for the lower part of the series and Kubergandian and Murgabian ages for the upper part. Leven et al. (1975) and Leven (1982a) studied the sequence in the Khojagor Valley, in the Bamian Valley near the village of Bamian, and along a motor road passing through the Bulola Valley, presenting more accurate faunal data and a better description of the sequence.

In Khojagor Valley (Fig. 1, loc. 10), the Bamian sequence (Figs. 6, 7) crops out on the right bank of a unnamed creek immediately above the junction of the left tributary of the Khojagor River. This sequence was formerly described by Hayden (1911) and Lys and Lapparent (1971). In the headwaters of this creek, below Hindu Kush Ridge, exposures are poor. Downstream, the valley narrows into a gorge, the flanks of which are made up of Permian limestone (Fig. 7) with a steep southerly dip (Fig. 6). Locally, this limestone is underlain by bedded sandy limestone, sandstone, and siltstone. A complete section is not present because of tectonic complications (Fig. 6).

The reconstructed section from top to bottom consists of the following:

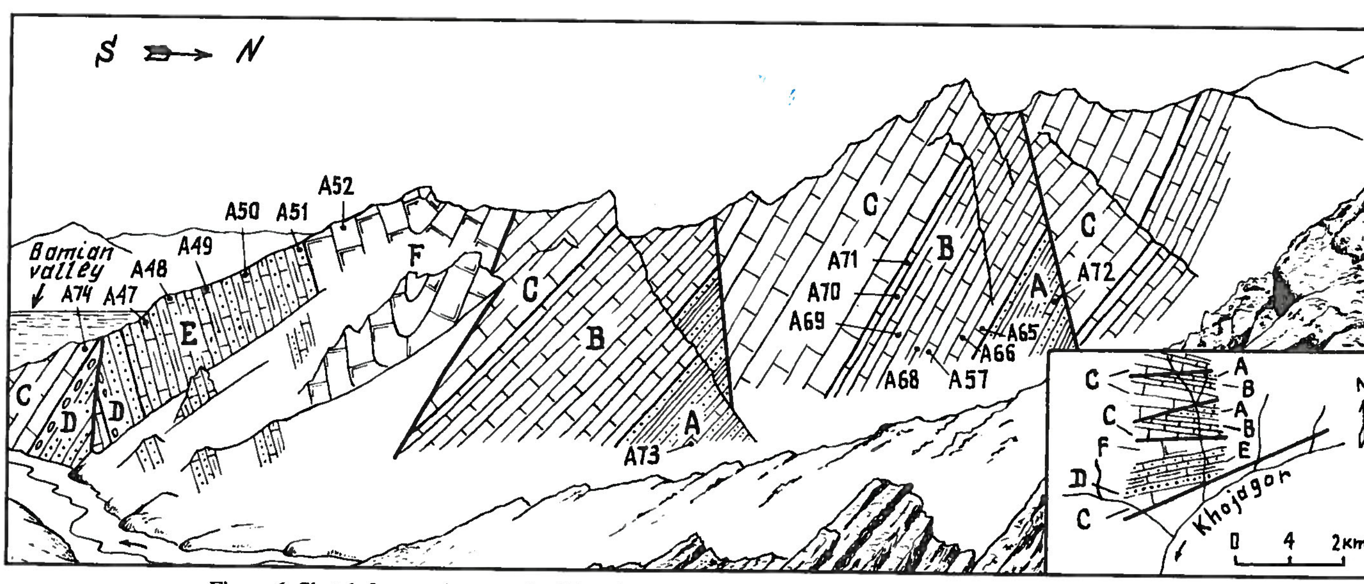


Figure 6. Sketch from a photograph of Permian outcrops on a right tributary of the Khojagor River. Letters A to F indicate formations described in the text. Letters and numerals indicate fusulinid localities.

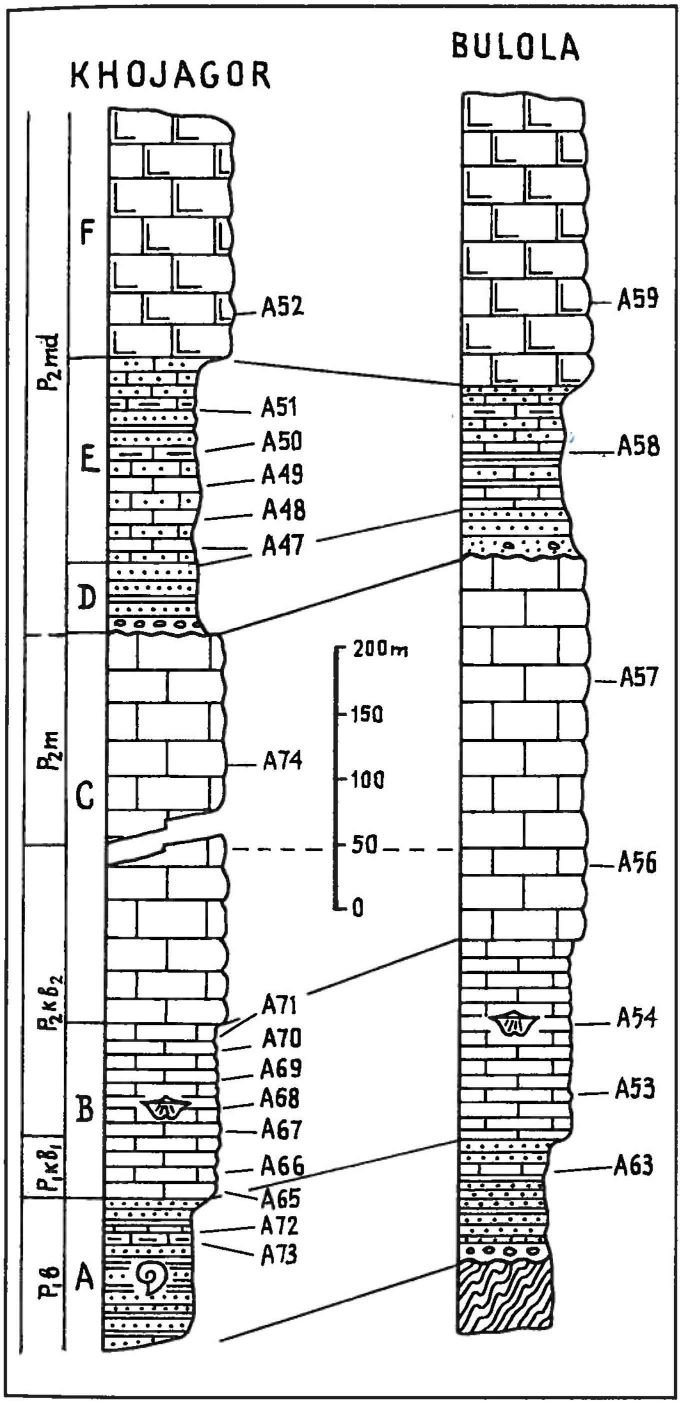


Figure 7. Permian sequences in the Bamian zone. Letters and numerals indicate fusulinid localities. Lettered formations are described in the text. P_1b = Bolorian; P_2kb_1 = lower Kubergandian; P_2kb_2 = upper Kubergandian; P_2m = Murgabian; P_2md = Midian.

Thickness (m)

UNIT F. Massive, light-gray, algal limestone, resembling that of unit C, but containing much more advanced fusulinids including *Laosella gigantea* (Deprat), *Neoschwagerina haydeni* (Dutkevich), *Afghanella tumida* Skinner and Wilde, *Sumatrina annae* Volz, and *S. bulolensis* n. sp. (loc. A-52). . . . . . >100 m

UNIT E. Limestone alternating with calcareous sandstone and siltstone.

6. A slope of poorly exposed slaty, siliciclastic rocks, about 30 m thick, underlain by yellowish brown, thin platy sandstone, 4 m thick . . . . 34 m

5. Platy, sandy limestone bearing the fusulinids *Eopolydiexodina (Eopolydiexodina)* cf. *E. megasphaerica* Leven, *Sumatrina* sp. (loc. A-51) . . . . 3 m

4. Thin-bedded limestone with slaty, calcareous sandstone containing the fusulinids *Dunbarula* sp., *Rugosofusulina furoni* (Thompson), *Pseudofusulina paralpina* (Chen), *Eopolydiexodina (Eopolydiexodina) bithynica* Erk (loc. A-50) . . . . . . 20 m

3. Medium-bedded, algal-fusulinid-bearing limestone with the following fusulinids: *Parafusulina* sp., *Chusenella* sp., *Eopolydiexodina* sp., and *Neoschwagerina* sp. (loc. A-49) . . . . . 10 m

2. Alternation of slaty sandstone with black, thin-bedded, fusulinid- and algal-bearing limestone, comprising *Dunbarula kitakamiensis* Choi, *Rugosofusulina furoni* (Thompson), *Chusenella* sp., *Laosella mathikuli* (Pitakpaivan), *Eopolydiexodina* sp., *Sumatrina bulolensis* n. sp., and *S. annae* Volz (loc. A-48) . . . . 10 m

1. Limestone, black and sandy below; lighter, thick bedded, and algal-fusulinid–bearing above, containing the following fusulinids: *Neofusulinella* sp., *Codonofusiella* sp., *Yangchienia haydeni* Thompson, *Chusenella* sp., *Neoschwagerina bamianica* n. sp., *N. haydeni* Dutkevich, *N. margaritae* Deprat, *Colania altimurensis* n. sp., *Afghanella tumida* Skinner and Wilde, *A. schencki* Thompson, *Sumatrina* cf. *S. anna* Volz, *Armenina crassispira* (Chen), *Verbeekina (Verbeekina) americana* Thompson, Wheeler, and Danner, and *Pseudodoliolina ozawai* Yabe and Hanzawa (loc. A-47) . . . . 14 m

Total thickness of Unit E. . . . . 91 m

UNIT D. Yellowish brown, thin-bedded, medium- and fine-grained sandstone and siltstone interbedded with quartzose conglomerate in the lower part. Above, thin interbeds of sandy limestone occur with *Eopolydiexodina* sp. The unit is complicated by a fault . . . . 40–50 m

UNIT C. Light-colored, massive, algal limestone, with a concealed base. The top of the limestone contains the fusulinids *Neofusulinella callosa* n. sp., *N. magna* n. sp., *N. tumida* Leven, *Yangchienia haydeni* Thompson, *Y. iniqua* Lee, *Parafusulina* sp., *Eopolydiexodina (Eopolydiexodina) afghanensis* (Thompson), *Armenina karinae* Miklukho-Maclay, *Verbeekina (Paraverbeekina) pontica* Miklukho-Maclay, *Neoschwagerina simplex tenuis* Toriyama and Kanmera, *Presumatrina schellwieni* (Deprat), *P. longa* n. sp. (loc. A-74). . . . . 60–70 m

Section transferred from creek mouth upstream to a broad fault zone outlined by ferrigenous dolomitic breccia.

UNIT B. Black, well-bedded, algal-fusulinid and brachiopod-

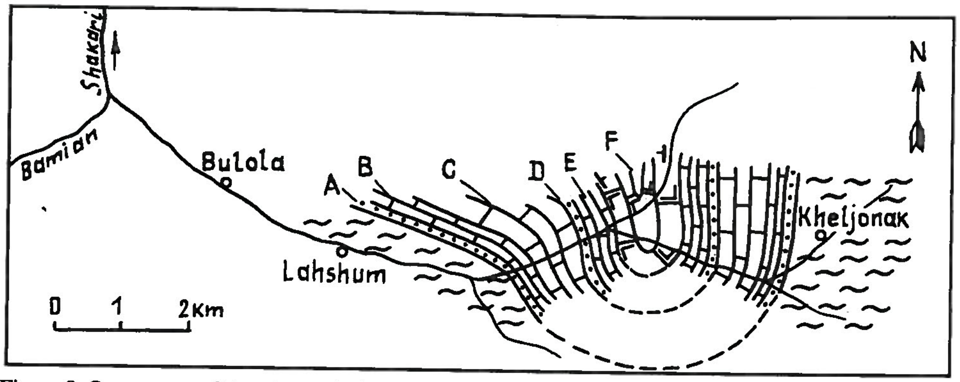


Figure 8. Occurrence of Permian rocks in a syncline in Bulola Valley. Beds A–F are described in the text.

bearing argillaceous limestone .... 120 m

The following fusulinids were collected in descending order:

7. Top of the unit: *Neofusulinella callosa* Leven, *N. lantenoisi* Deprat, *N. tumida* Leven, *Eopolydiexodina* sp., *Cancellina* sp. (loc. A-71)

6. 110 m above the base: *Eopolydiexodina* sp., *Cancellina* sp. (loc. A-70)

5. 80 m above the base: *Pseudoendothyra* sp., *Neofusulinella tumida* Leven, *N. callosa* Leven, *Chusenella chihsiaensis* (Lee), *C. brevis* (Chen), *C. tieni* (Chen), *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich), *E. (E.) zulumartensis* (Leven), *Armenina asiatica* Leven, *A. taurica* Miklukho-Maclay, *Cancellina (Cancellina)* cf. *C. primigena* Hayden, *C. (C.) pamirica* Leven, *C. (Shengella) bamianica* n. sp. (loc. A-69)

4. 60 m above the base: *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich), *Cancellina (Cancellina) primigena* Hayden (loc. A-68)

3. 25 m above the base: *Neofusulinella* sp., *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich), *E. (E.) zulumartensis* (Leven), *Armenina asiatica* Leven, *Cancellina (Cancellina) primigena* Hayden (loc. A-67)

2. 15 m above the base: *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich) (loc. A-66)

1. Base: *Pseudoendothyra* sp., *Pseudofusulina* sp., *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich) (loc. A-65).

UNIT A. Yellowish gray, bedded, calcareous sandstone, siltstone, and sandy limestone. Exposure is poor. Limestone yields poorly preserved ammonoids and fusulinids including *Pamirina* sp., *Biwaella* sp., *Darvasites* cf. *D. contractus* (Schellwien and Dyhrenfurth), *D. pseudosimplex* (Chen), *Praeskinnerella* cf. *P. cushmani* (Chen), *Chalaroschwagerina bamianica* n. sp., *Pseudofusulina* cf. *P. huecoensis* Dunbar and Skinner (loc. A-72).

In this measured section, only the lower part of unit F is exposed, the upper part having been removed by faulting. The total thickness exceeds several hundred meters as indicated by other outcrops in the drainage area of the Khojagor River.

Unit D of the section corresponds to bed 1 of Lys and Lapparent (1971), unit E correlates with beds 2 and 3, and unit F is compatible with bed 4 (outcrop N-8).

Fusulinids obtained from unit A occur both in upper Yahtashian and Bolorian rocks.

Unit B belongs entirely to the Kubergandian; beds 1 to 2 correspond with the lower zone of this stage and beds 3 to 7 are correlative with the upper zone. The lower part of unit C also may be Kubergandian in age, but fusulinids in its upper part are typical of the lower zone of the Murgabian. Unit D is poorly characterized by fusulinids, but its stratigraphic position suggests correlation with the uppermost Murgabian or the lowermost Midian. Unit E, according to the author's definition of the Midian Stage, belongs to the lower Midian (Leven, 1980b, 1993b, 1993c, 1993d) because of the presence *Codonofusiella, Dunbarula kitakamiensis, Colania altimurica, Afghanella tumida, Kahlerina pachitheca,* and *Pseudokahlerina compressa,* which also occur in the equivalent unit of the Bulola sequence.

A similar fusulinid assemblage was recovered from the lower part of unit F, which thus is also Midian. The upper part of unit F, however, may be Dzhulfian in age.

Recognition of a Midian age for unit D infers that the upper Murgabian is lacking and the presence of conglomerate in the basal part of Unit D further suggests the possibility of an unconformity.

Downstream, the floor of the right flank of Bulola Valley consists of light greenish gray, micaceous schists of uncertain age overlain by Permian rocks in the main valley downstream from the village of Lahshum.

From higher to lower, the following beds are exposed (Figs. 7, 8):

Thickness (m)

UNIT B. Black, bedded limestone with fusulinids and brachiopods

UNIT A.

4. Marl and marly slate with sandstone and limestone interbeds .... 70–80 m

3. Thin-platy, sandy, and marly limestone .... 10 m

2. Yellow-brown, calcareous sandstone with an impure limestone interbed containing the following fusulinids: *Pamirina* sp., *Yangchienia* sp., *Darvasella vulgariformis* (Kalmykova), *Darvasites ordinatus* (Chen), *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth), *Skinnerella* cf. *S. gruperaensis* (Thompson and Miller),

Misellina (Brevaxina) olgae Leven, *M. (B.) otakiensis* (Fujimoto), and *M. (Misellina) aliciae* (Deprat) (loc. A-63) . . . . 80–100 m
1. Conglomerate, containing well rounded pebbles with quartz and chert dominant . . . . 5–10 m
Unconformity with schist below

The entire sequence consists of 6 units (units A–F). The higher beds were observed on the Bulola Valley floor, where the Permian rocks descend from its right flank. The lower beds crop out at the entrance to a gorge cut by the river in the Permian limestone.

From younger to older the rocks consist of the following units:
Thickness (m)
UNIT F. Light-gray, thick-bedded and massive, algal limestone, comprising the fusulinids *Codonofusiella* sp., *Yangchienia* sp., *Kahlerina* sp., *Rugosofusulina furoni* (Thompson), *Pseudofusulina bulolensis* n. sp., *Chusenella sinensis* Sheng, *Laosella gigantea* (Deprat), *Verbeekina (Paraverbeekina) pontica* Miklukho- Maclay, *Neoschwagerina haydeni* Dutkevich, *N. kojensis* Toumanskaya, *Afghanella tumida* (Skinner and Wilde), *A. robbinsae* Skinner and Wilde, and *Sumatrina bulolensis* n. sp. (loc. A-59). *Codonofusiella* sp., *Chusenella* sp., *Neoschwagerina haydeni* (Dutkevich), *Verbeekina* sp., *Afghanella robbinsae* Skinner and Wilde, *A. sumatrinaeformis* (Gubler), and *Sumatrina* sp. are present in the sample from loc. A-59-1. The limestone unit is several hundred meters thick and forms a tight syncline (Fig. 8) traversed by the gorge. On the eastern limb of the fold near the village of Heljonak, the sequence is well exposed in reverse order.
Thickness (m)
UNIT E. Thin-bedded, fossiliferous, locally sandy and argillaceous limestone. Fusulinids include *Codonofusiella* sp., *Neofusulinella* sp., *Kahlerina* aff. *K. pachytheca* Kochansky-Devidé, *Pseudokahlerina compressa* Sosnina, *Rugosofusulina furoni* (Thompson), *Chusenella minuta* Skinner, *Rugosochusenella dialis* n. sp., *Laosella gigantea* (Deprat), *Eopolydiexodina (Eopolydiexodina) afghanensis* (Thompson), *Neoschwagerina occidentalis* Kochansky-Devidé and Ramovš, *Sumatrina bulolensis* n. sp., *S. annae* Volz. (loc. A-58) . . . . 100–120 m
UNIT D. Yellowish-brown, medium- and fine-grained sandstone with quartzose conglomerate intercalations . . . 30–40 m
UNIT C. Light-gray, massive, algal limestone exposed in the narrowest part of Bulola Gorge. The following fusulinids occur in the upper beds: *Neofusulinella* sp., *Yangchienia* sp., *Russiella pulchra* Miklukho-Maclay, *Eopolydiexodina (Eopolydiexodina) afghanensis* (Thompson), *Verbeekina (Verbeekina)* cf. *V. verbeeki* Geinitz, *V. (V.) americana* Thompson, *Presumatrina uruzganensis* n. sp. (loc. A-57).

Fusulinids in the lower part of Unit C include *Schubertella* sp., *Neofusulinella* sp., *Pseudofusulina* sp., *Chusenella chihsianensis* (Lee). *C. brevis* (Chen), *Eopolydiexodina* sp., *Armenina asiatica* Leven, *Cancellina (Cancellina) bella* (Zhang and Dong), *C. (C.) cutalensis* Leven, *C. (C.) sethaputi* (Kanmera and Toriyama), *C. (C.) primigena* Hayden, *C. (C.) pamirica* Leven, *Pseudodoliolina ozawai* (Yabe and Hanzawa) (loc. A-56) . . . . 300–400 m
UNIT B. Black, thin-bedded, fusulinid-bearing limestone with *Neofusulinella callosa* n. sp., *N. tumida* Leven, *Pseudofusulina priva* Leven, *Misellina (Misellina) termieri* (Deprat), *M. (M.) ovalis* Deprat, *M. (M.)* aff. *M. californica* Douglass, *Armenina pamirensis* (Dutkevich) (loc. A-54) . . . . 100 m

Black, medium-bedded limestone at loc. A-53 has yielded the fusulinids *Schubertella* sp., *Neofusulinella callosa* n. sp., *N. tumida* Leven, *Pseudofusulina priva* Leven, *P. fusiformis* (Schellwien and Dyhrenfurth), *Chusenella tieni* (Chen), *Misellina (Misellina)* cf. *M. claudiae* (Deprat), *M. (M.)* aff. *M. californica* Douglass, *M. (M.) megalocula* Wang and Sun, *Armenina pamirensis* (Dutkevich) . . . . 40–50 m
UNIT A. Yellowish brown, coarse-grained sandstone with gravelstone interbeds . . . . 70–100 m
Total thickness of Units A–E. . . . . 700–800 m

From the vicinity of Shibar Pass in the Bulola Valley, Permian rocks of the type in the sequence just described are traceable farther along the left bank of the Gorband River. Farther east, they are cut off by faults. The only known fusulinids are from outcrops near Shibar Pass where the assemblages are similar to those of Kubergandian-Murgabian age in the Bamian and Bulola sequences.

A Permian outcrop was described by Bouyx et al. (1970) west of the village of Bamian in the headwaters of the Darai Khaza River, which is a right tributary of the Bamian River. The lower part of that outcrop (beds 1 to 3) is composed mainly of calcareous argillite and sandstone, and the upper part (beds 4 to 5) is composed of black, laminated limestone. Beds 4 and 5 of the Darai Khaza sequence are correlative with unit B of the Khojagor sequence as indicated by the presence of Kubergandian fusulinids characteristic of unit B. Beds 1 to 3 are correlative with unit A. From bed 3 of the subjacent, mostly siliciclastic unit, the following ammonoids have been determined: *Bamianiceras bouyxi* Termier and Termier, *Prostacheoceras longi* Termier and Termier, *Agathiceras sundaicum* Haniel, and *Perrinites hilli* var. *afghana* Termier and Termier. Termier and Termier (1970) assigned these fossils to the Artinskian Stage, comparing them with the assemblage described by A. P. Karpinsky and O. G. Toumanskaya from Darvaz. The goniatite-bearing strata of Darvaz are assigned to the lower part of the Tchelamtchi Formation, which represents the upper zone of the Yahtashian Stage (Leven, 1982b), below beds where *Misellina* first appears (i.e., below the Bolorian). If this is correct, the Darvazian and Afghan ammonoids cannot be identical in age, because bed 3 is overlapped by Kubergandian deposits. The stratigraphic position of this bed suggests a Bolorian rather than a Yahtashian age. The same conclusion has been made by Leonova (1985) on the basis of the Pamirian and Darvazian ammonoid evidence. In the opinion of that author, the Bamian ammonoid assemblage correlates with the younger Boztere assemblage of southeast Pamir, which occurs in the Bolorian Stage.

Turan plate.

Bandi Amir. West of the described outcrops of west Hindu Kush, Permian deposits plunge under the Meso-Cenozoic cover of the Turan plate. Permian rocks are exposed, however, in a deep canyon of the Bandi Amir River northeast of the village of Dahani Kashan (Fig. 1, locality 11). The fusulinid-yielding samples were sent to the author for determination by A. Kh. Kafarskiy. Three of those (1520-I, 1526-I, and 1528) represent sandy limestone containing *Darvasites pseudosimplex* (Chen). The others (1520, 1522, 1526, 1529) are pure algal-fusulinid limestone bearing *Kahlerina* sp., *Nankinella* sp., *Schubertella* sp., *Yangchienia* sp., *Pseudofusulina* sp., *Chusenella* sp., *Parafusulina* sp., *Afghanella* sp., *Sumatrina* sp., *Neoschwagerina* cf. *N. haydeni* Dutkevich, *N.* cf. *N. margaritae* Deprat, *Pseudodoliolina* sp., *Verbeekina (Verbeekina) verbeeki* (Geinitz).

Darvasites from the first three samples also occurs in the Yahtashian outcrops on the left bank of the Sourkhob River. The same species has been determined in south Afghanistan from strata conventionally referred to the upper Sakmarian, so that species may be late Sakmarian to Yahtashian in age. The other samples are assigned to the uppermost Murgabian-lowermost Midian because of the presence of a highly characteristic fusulinid assemblage closely related to that in unit E of the Khojagor and Bulola sequences.

Bandi Turkestan. The cores of dome-shaped uplifts in the western part of Bandi Turkestan Ridge consist of as much as 1,000 m of red-colored, sandy siltstone. This formation correlates with the Sangi Surkh Formation of Firuzkoh Ridge (Dronov et al., 1979a). At the base of the formation, carbonate interbeds contain late Moscovian fusulinids including *Fusulina elshanica* Putrja and Leontovich, *Fusulinella helenae* Rauser, *Eofusulina* sp., and others. This formation is unconformably overlain by Triassic rocks. Therefore, the stratigraphically defined age of these red siltstones is late Carboniferous–Permian.

Turkmen-Khorasan area. The Turkmenian-Khorasanian fold belt in northwestern Afghanistan formed within Paleogene troughs that subsided along the southern pericratonal termination of the Turan plate (Dronov, 1980). The late Paleozoic folded basement is exposed in Firuzkoh Ridge. Lithologically, the rocks are identical with the red-colored unit in Bandi Turkestan. K. Ya. Mikhailov, B. R. Pashkov et al. (unpublished report, 1967) also have reported, a red-colored exposure identified as the Sangi Surkh Group in a drainage basin of the Karoh River in the western part of the area. This unit rests unconformably on rocks containing Early to Middle-Carboniferous foraminiferans and corals. The lower member is represented by red-brown argillite, siltstone, and sandstone with a basal conglomerate. Limestone and marl interbeds are present at the top. This member is 700 m to 800 m thick.

The middle part of the group, as much as 2,000 m thick, is composed of violet-gray sandstone, alternating with siltstone and argillite. Gravelstone and conglomerate interbeds and lenses are rare. The upper member of the Sangi Surkh sequence, 800 m to 1,000 m thick, is capped by an argillite and siltstone unit with minor sandstone, with red-brown gravelstone and conglomerate interbeds. Thin limestone and marl intercalations also are present.

The age of the Sangi Surkh Group is uncertain, but it is probably Permian. It occurs above beds containing Moscovian fossils and is unconformably overlain by Lower Triassic rocks. In the eastern portion of Firuzkoh, the Sangi Surkh Group is subdivided into two members. The lower member, 1,000 m thick, is composed of pale red and green sandstone and siltstone, with gravelstone conglomerate lenses and interbeds. The upper member is composed of 1,500 m of argillite and siltstone with rare sandstone intercalations.

South Afghanistan

South Afghanistan can be subdivided into several large tectonic wedges or zones (Fig. 1), in most of which Permian rocks occur. Structurally complex, narrow, lense-like outcrops commonly are present in north-trending overthrust sheets. Such blocks extend along the major suture line which separates south and north Afghanistan. Dronov (1980) combined all the tectonic blocks under a common name: “Middle Afghanistan” or the Afghan-Pamirian Folded Area. Here, these blocks are divided into a western part and an eastern part. The western blocks span Kasamurg, Bandi Bajan, and Kohe Bobo Ridges. The narrow Panjsher block, in which Permian rocks are not exposed, is located to the northeast. Farther northeast, the central Badakhshan blocks of the eastern part directly adjoin the central Pamirian structures. I also include the Wahan region in the eastern extremity of the Afghan–south Pamirian fold belt in these eastern blocks.

Middle Afghanistan (Afghan–south Pamirian fold belt). This area (Fig. 9) is dominated by tectonic lenses thrust over one another in a northerly direction. According to Dronov (1980), each lens represents a separate tectonic zone. The Permian rocks in most of the zones were studied by Dronov et al. (1979a) and the fossils by Leven (1983).

Khaftkala tectonic zone. This tectonic zone spans Kohe Safed and Kohe Pud Ridges. Permian rocks here are dominated by carbonate facies and range in thickness from 250 m to 300 m.

In Kohe Pud Ridge the sequence, from top to bottom (Fig. 10), consists of

Thickness (m)

Multicolored limestone and dolomite of Early Triassic age with bivalves including *Claraia aurita* (Hauer), *C.* cf. *C. stachei* (Bittner), *C.* cf. *C. australasiatica* Krumbein, and *Anodonotophora* sp.

9. Gray, milliolid-bearing, bedded limestone with profuse *Shanita* sp. (loc. 563) . . . . 40 m

8. Brown and green, oolitic, ferrugenous bauxite lenses lying on an uneven scoured limestone surface on bed 7 . . . . . 0–4 m

7. Light-colored, massive, algal-foraminiferal limestone with oolitic limestone interbeds. The following foraminiferal species are abun-

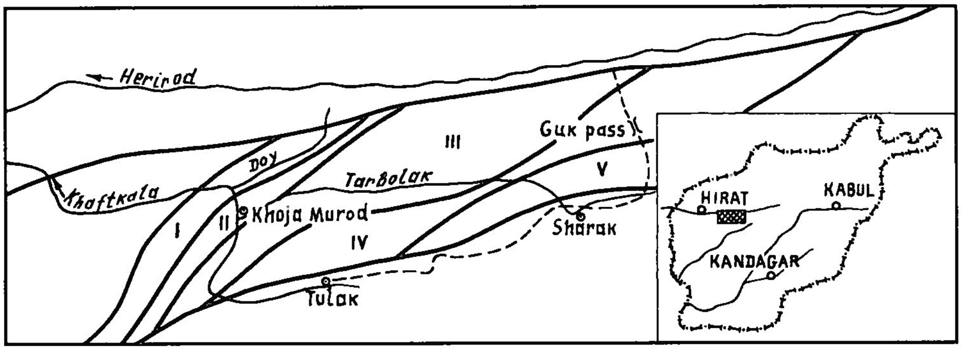


Figure 9. Structural-facies zones in western middle Afghanistan. I. Khaftkala; II. Sange Dushoh; III. Khoja Murod; IV. Nilbandon; V. Karganau (modified after Dronov, 1980). Cross-hatched rectangle on inset shows location of main figure on map of Afghanistan.

dant: *Rauserella sphaeroidea* Sosnina, *Pseudoendothyra* sp., *Staffella* sp., *Sphaerulina* sp., *Dunbarula* sp., *Neoschwagerina* cf. *N. haydeni* Dutkevitch, *Tuberitina* sp., *Eotuberitina* sp., *Glomospira* sp., *Globivalvulina* sp., *Glomospirella* sp., *Neoendothyra* sp., *Dagmarita chanakchensis* Reitlinger, *Hemigordiopsis renzi* Reichel, *Kamurana* sp., *Shanita* sp., *Baisalina* sp., *Nodosaria* sp., *Langella* sp., *Frondicularia tumida* Miklukho-Maclay, *Pachyphloia* sp., *Cribrogenerina* sp. (loc. 561-3, 573-1 to 573-24) . . . . 6–12 m

6. Dolomite and dolomitic limestone with the rare fusulinids including *Pseudoendothyra* sp. and *Staffella* sp., and the alga *Permocalcus* sp. (loc. 561-4, 575) . . . . 60–70 m

5. Dark-gray, medium- and thick-bedded, algal-foraminiferal limestone, overlying bed 4 disconformably. Fusulinids are represented by *Sphaerulina* sp., *Dunbarula* sp., *Schubertella* sp., *Rugososchwagerina geratica* n. sp., *Pseudofusulina haftkalensis* n. sp. (loc. 561-5, 571-1–571-4). Smaller foraminifers include *Eotuberitina, Climacammina, Cribrogenerina, Tetrataxis, Globivalvulina, Langella, Pachyphloia.* The tabulate corals, determined by V. A. Leleshus, are *Michelinopora* aff. *M. sigangensis* Reed, *M. grandispinosa* (Huang). . . . . 20 m

4. Light-colored, massive, organic limestone formed of fusulinids, crinoid ossicles, bryozoa, and algae. Foraminifers include *Pseudoendothyra* sp., *Pseudoreichelina darvasica* Leven, *Schubertella giraudi* (Deprat), *Rugosofusulina valida* (Lee), *Pseudofusulina macilenta* n. sp., *P.* cf. *P. karapetovi* n. sp., *P. fabra grandiuscula* n. subsp., *P. fabra fabra* Leven and Scherbovitch, *P. peregrina* n. sp., *P.* aff. *P. postpedissequa* Rauser, *P.* cf. *P. paraconcessa* Rauser, *P.* cf. *P. parasecalica* (Zhang) (loc. 566-1–566-12) . . . . 10 m

3. Massive, coarse-grained dolomite . . . . 15–20 m

2. Thin bedded, dark-gray marl and limestone with some siliciclastic material. Fossils include bryozoans and brachiopods such as *Permundaria* sp., *Globiella rossiae* (Fantini-Sestini), *Linoproductus cora* (d'Orbigny), *Marginifera typica* (Waagen) (determinations by T. Grunt), and the corals *Paracaninina* sp., *Bradyphyllum* sp., *Amplexus* sp., *Caninia* sp. (determinations by I. V. Pyzhjanov) . . . . 25–30 m

1. White, quartzose sandstone with well rounded grains. Conglomerate interbeds and lenses occur within the sandstone. The matrix is calcareous and locally dominates the rocks which grade into sandy limestone composed of moderately rounded fragments of bryozoans, algae, crinoid ossicles, echinoids, and brachiopod spines. Foraminifera are rare and poorly preserved; those present are represented by species of *Pseudoendothyra* and *Tetrataxis* . . . . 80 m

Total thickness . . . . 270–300 m

Unconformity

Limestone of the Kohe Pud Group (Lower Carboniferous) with *Gigantoproductus* sp.

Bed 1 in the just described sequence generally is considered Permian. Beds 2 to 4 are undoubtedly Permian as indicated by the fossils. A more precise dating is not possible because of both the scarcity of fossils and endemism of the fusulinid assemblage in bed 4. The most accurate age is provided by *Pseudofusulina postpedissequa* and *P. paraconcessa*, which are also present in Artinskian deposits in the Ural region. *Rugosofusulina valida* was described from the Konkrinskian limestones of Xinjiang province, northwest China (Zhang, 1963). In both cases, the age is limited to Sakmarian to early Yahtashian. The Sakmarian age is favored by the presence of *Pseudofusulina karapetovi*, which in the Dangi Kalon Formation in the central Pamir occurs directly below beds with *Robustoschwagerina* and *Zellia* (Leven, 1993a). Nevertheless, the species in the Afghan collection could not be determined exactly because of poor preservation. Thus, the above evidence suggests a Sakmarian age for beds 2 to the lower part of 4, and a lower Yahtashian age for beds of the upper part of unit 4.

Exact dating also is impossible for bed 5, which may be Murgabian or even Midian. If bed 5 is this young, beds corresponding to most of the Yahtashian, Bolorian, and possibly Kubergandian age would be lacking. V. A. Leleshus (1975, personal communication) reported that the tabulate corals obtained from bed 5 occur in the upper part of the Lower Permian rocks in China and the Gundara Formation in Darvaz. Strata including the *Misellina* to *Yabeina* zones, inclusively (i.e., from Bolorian to Midian), are regarded by some Chinese stratigraphers to be Lower Permian. The Gundara Formation in Darvaz com-

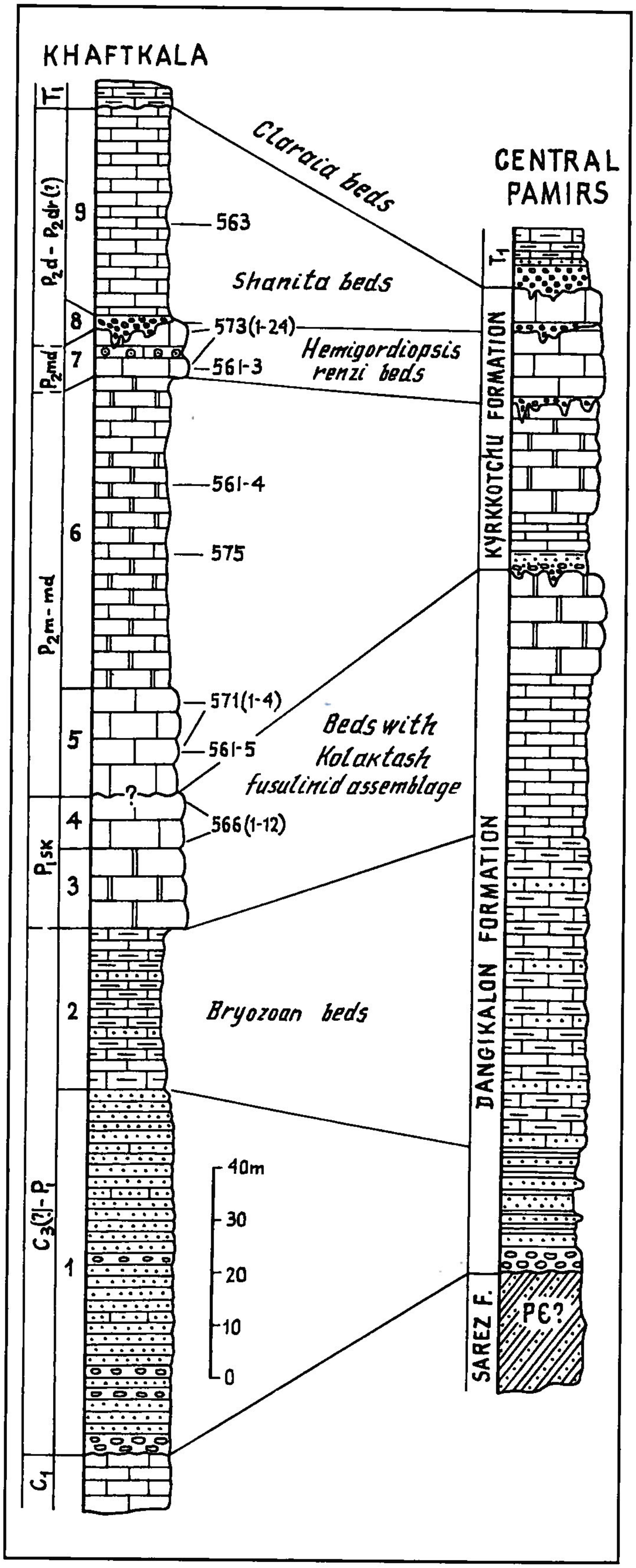


Figure 10. Correlation between Permian sequences of the Khaftkala zone and central Pamir. Numerals on right indicate fusulinid localities. Units 1–9 at Khaftkala are described in the text. PЄ? = Precambrian?; C_1 = Lower Carboniferous; C_3(?)–P_1 = Upper Carboniferous (?)–Lower Permian; P_1sk = Sakmarian; P_2m–md = Murgabian–Midian; P_2md = Midian; P_2d–P_2dr(?) = Dzhulfian–Dorashamian(?); T_1 = Lower Triassic.

monly is assigned to the top of the Lower Permian and the Upper Permian, with its lower part being assigned to the Bolorian and the upper part to the Kubergandian. A Late Permian age, however, is favored by the presence of *Sphaerulina* associated with the tabulate corals, and foraminifers resembling *Dunbarula*. *Rugososchwagerina geratica* and *Pseudofusulina haftkalensis* are new species, thus not good age indicators. However, it is noteworthy that *Rugososchwagerina* is a genus known mostly from rocks of the Murgabian and Midian Stages.

Bed 6 is not older than Murgabian as confirmed by occurrence of the alga *Permocalcus*, which is characteristic of the Midian and Dzhulfian Stages. Bed 7 definitely is Midian as is indicated by advanced *Neoschwagerina*, as well as *Rauserella sphaeroidea* Sosnina, *Neoendothyra* sp., *Dagmarita chanakchensis* Reitlinger, *Baisalina* sp., *Kamurana* sp., and especially *Hemigordiopsis renzi* Reichel, one of the most characteristic species of the Midian interval. Bed 9 probably is Dzhulfian in age.

Sange Dushoh tectonic zone. This zone extends as a narrow band southeast of the Khaftkala Tectonic Zone, being separated from it by faults (Fig. 9). Permian rocks of this zone (Fig. 11) are best exposed in the village of Dahani Shoh and in Sange Dushoh Gorge (Fig. 1, fusulinid location 14).

The section in descending order consists of the following units:

Thickness (m)

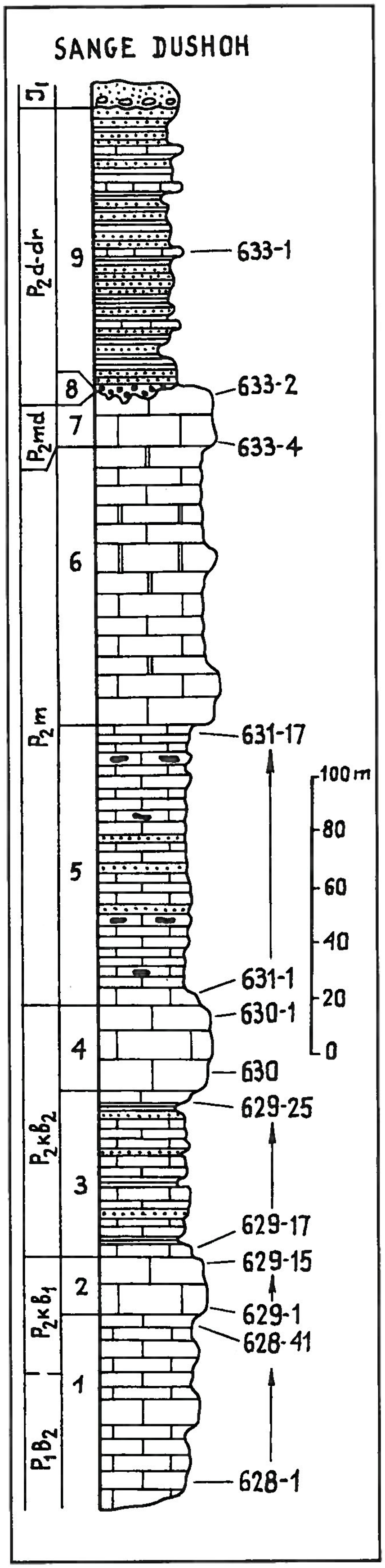
Jurassic rocks

Unconformity

9. Sandstone and siltstone intercalated with ferruginous, algal-fossiliferous limestone. Fusulinids and small foraminifers include *Reichelina* cf. *R. changhsingensis* Sheng and Chang, *Staffella* cf. *S. zisonzhengensis* (Sheng), *Codonofusiella* sp., *Globivalvulina* sp., *Paraglobivalvulina* sp., *Glomospira* sp., *Hemigordius reicheli sigmoidalis* Lys, *Baisalina* sp., *Dagmarita* sp., *Spirulina* sp., *Pachyphloia* sp., *Frondina* sp., *Partisania* sp., *Rectostipulina* sp. (loc. 633-1). The siltstone contains fossil leaf impressions which include *Pecopteris orientalis* and *P. nerinii* .... 100 m

8. Red and green, ferruginous, oolitic siliceous rocks . 0.5–5 m

7. Light-gray, massive, algal-fossiliferous limestone yielding the fusulinids *Kahlerina* sp., *Pseudokahlerina compressa* Sosnina, *Schubertella* cf. *S. silvestri* Skinner and Wilde, *Codonofusiella* sp., *Chusenella pseudocompacta* Sheng, *C. schwageriniformis* Sheng, *Neoschwagerina* sp., *Verbeekina* sp., and small foraminifers including *Neoendothyra parva* (Lange), *Abadehella biconvexa* Okimura and Tshii, *Dagmarita chanakchensis* Reitlinger, *Climacammina* sp., *Deckerella* sp., *Nodosaria* sp., *Pachyphloia*



sp., *Partisania* sp. (loc. 633-2 and 633-4) . . . . 20 m
6. Gray, massive, thick-bedded, fine, clastic, dolomitized limestone . . . . 100 m
5. Gray and black, bedded, detrital limestone with chalcedony nodules and lenses. Sandstone and siltstone interbeds occur in the middle portion of the unit. The notable fusulinids are *Nankinella* sp., *Staffella zisonzhengensis* (Sheng), *Dunbarula ardaglensis* (Chedija), *Boultonia* sp., *Skinnerella multiseptata* (Schwager), *Neoschwagerina simplex simplex* Ozawa, *N. simplex tenuis* Toriyama and Kanmera, *N. verae* Toumanskaya, *Presumatrina neoschwagerinoides* (Deprat), *Pseudodoliolina* aff. *P. oliviformis* Thompson, Wheeler and Danner. (loc. 631-1 to 631-17) . . 100 m
4. Gray, massive, clastic limestone containing *Boultonia ogbinensis* Chedija, *Pseudofusulina quasifusuliniformis* Leven, *Parafusulina* sp. (loc. 630, 630-1) . . . . 30 m
3. Medium- and dark-gray limestone interbedded with sandstone and siltstone. Fusulinids include *Schubertella kingi* Dunbar and Skinner, *Yangchienia* sp., *Parafusulina* sp., *Armenina* sp., *Cancellina* sp. (loc. 629-17 to 629-25). The brachiopod *Leptodus nobilis* (Waagen) also is present . . . . 60 m
2. Light gray, massive, clastic limestone bearing fusulinids including *Schubertella* sp., *Yangchienia* sp., *Skinnerella yabei asiatica* (Leven), *Skinnerella cincta* (Reichel), *Chusenella brevis* (Chen), *Armenina* sp. (loc. 629-1 to 629-15) . . . . 18 m
1. Gray, medium- and thick-bedded, clastic limestone. The clasts are composed of bryozoans, crinoids, algae, and fusulinids. From the upper part of the sequence, the fusulinids are *Schubertella* sp., *Kubergandella* cf. *K. sarykolensis* (Leven), *Pseudofusulina heratica* n. sp., *P. postkraffti* (Leven), *Misellina (Misellina) ovalis* (Deprat), *Armenina* cf. *A. pamirica* Leven (loc. 628-16 to 628-41). Fusulinids in the lower half of the sequence include *Schubertella giraudi* (Deprat), *S. kingi* Dunbar and Skinner, *S. longiuscula* n. sp., *Toriyamaia laxiseptata* Kanmera, *Chalaroschwagerina vulgariformis* (Morikawa), *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth), *P. postkraffti* (Leven), *Misellina (Brevaxina) dyhrenfurthi* (Dutkevitch), *M. (B.) olgae* Leven, *M. (Misellina) parvicostata* (Deprat) (loc. 628-1 to 628-15) . . . . 70 m
Total thickness . . . . 503 m

The presence of *Misellina* together with *Pseudofusulina kraffti* and *Chalaroschwagerina vulgariformis* in the lower part of bed 1 indicates the *Misellina parvicostata* zone of the Bolorian Stage. The upper part of the bed belongs to the *Armenina-Misellina ovalis* zone of the Kubergandian Stage, as indicated by the occurrence of the zone index and very characteristic species, *Kubergandella sarykolensis*. Bed 2 is also assignable to this zone because of the absence of *Cancellina*, although the lack of *Cancellina* could reflect incompleteness of sampling.

Figure 11. Permian sequence of the Sange Dushoh zone (modified after Dronov, 1980). Numerals on right indicate fusulinid localities. Ages are given in Table 1. Units 1–9 are indicated in the text. P_1b_2 = upper Bolerian; see figures 7 and 10 for other age designations.

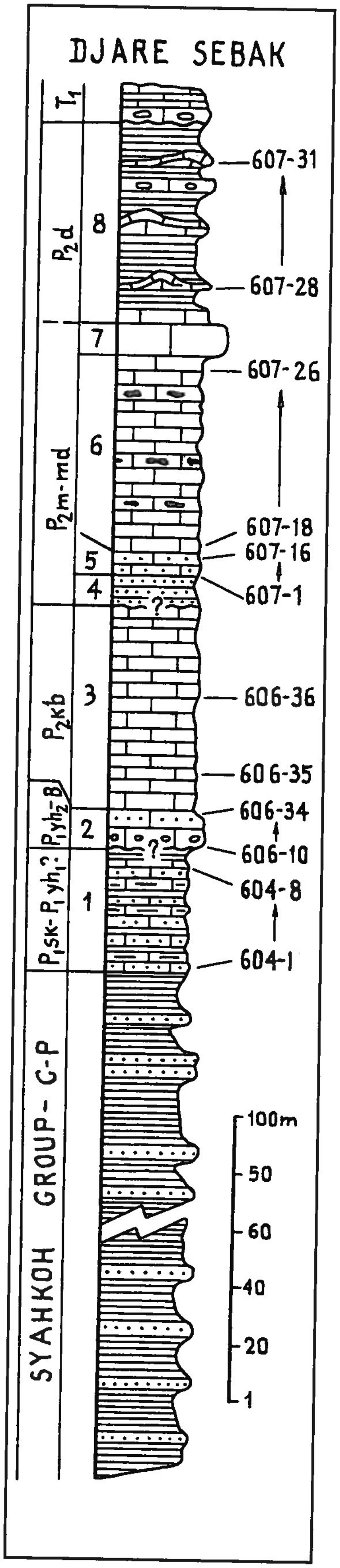


Figure 12. Permian sequence of the Khoja Murod zone, locality of Djare Sebak (modified after Dronov, 1980). Numerals on right indicate fusulinid localities. Ages are given in Table 1. Units 1–8 are described in the text. C–P = Carboniferous–Permian; P_1sk–P_1yh$_1$(?) = Sakmarian–lower Yahtashian (?); P_1yh$_2$–b = upper Yahtashian–Bolorian; P_2kb = Kubergandian; P_2m–md = Murgabian–Midian; P_2d = Dzhulfian; T_1 = Lower Triassic.

Bed 3 and probably bed 4 can be assigned to the *Cancellina cutalensis* zone of Kubergandian Stage because of the presence of *Cancellina* and *Armenina*. Bed 5 represents the lower zone of the Murgabian as indicated by primitive *Neoschwagerina* and *Presumatrina neoschwagerinoides*. Bed 6 may be upper Murgabian. The presence of *Kahlerina* in bed 7 suggests the Midian Stage. Smaller foraminifera and aberrant fusulinids from the uppermost beds of the sequence are typical of deposits of a post-Midian age.

Khoja Murod tectonic zone. This zone is located southeast of the Sange Dushoh Tectonic Zone (Fig. 9). Permian outcrops were studied in the Kohe Kamol Mountains and the Djare Sebak and Kohe Mushgol Valleys. The best studied section (Fig. 12) is situated near the village of Djare Sebak (Fig. 1, fusulinid location 14).

Here, as elsewhere within the region, the Upper Carboniferous–Lower Permian Syakhkoh Group, a thick, black slate and siltstone section, marks the base of the section. The presence of this Group makes the Khoja Murod sequence highly dissimilar to that in the Khaftkala region, where correlative deposits are represented by carbonate facies.

The section, from upper to lower includes the following units:

Thickness (m)

Limy conglomerate and limestone of Early Triassic age with bivalves such as *Eumorphotis* cf. *E. beneckei* (Bittner), *E. venetianus* (Hauer), *E.* cf. *E. kittli* (Bittner), *E.* cf. *E. tenuistriata* (Bittner), *Anodontophora* sp., *Velopecten* sp., and *Gervilia* sp.

Unconformity

8. Biohermal coral-sponge-algal limestone and argillite with limy conglomerate intercalations. The foraminiferal assemblage consists of *Reichelina* sp., *Pseudoendothyra* sp., *Schubertella* sp., *Glomospira* sp., *Agathammina* sp., *Paraglobivalvulina* sp., *Tetrataxis* sp., *Climacammina* sp., *Colaniella* cf. *C. cylindrica* K. Miklukho-Maclay, *Baisalina* sp. (loc. 607-28 to 607-31. Some of the limestone beds contain the brachiopods *Scacchinella* sp., *Alexenia* cf. *A. gratiodentalis* Licharew, *Krotovia jisuensiformis* Sarycheva, *Compressoproductus compressus* (Waagen), *Wellerella arthaberi* Tschernyschev, *Strophalosiina multicostata* Licharew, and *Martinia* sp. (determinations by T. A. Grunt, 1991, personal communication). . . . . 70 m

7. Massive reefal hydroid limestone . . . . 10–15 m

6. Detrital, algal limestone with small chert intercalations and nodules. The foraminiferal assemblage is represented by the following species: *Kahlerina* sp., *Schubertella silvestri* Skinner and Wilde, *Dunbarula kitakamiensis* Choi, *Boultonia* sp., *Codonofusiella erki* Rauser, *Yangchienia* sp., *Parafusulina* sp., *Neoschwagerina* sp., *Sumatrina annae* Volz, *Verbeekina (Verbeekina)*

verbeeki (Geinitz), *Tuberitina* sp., *Cribrogenerina* sp., *Tetrataxis* sp., *Globivalvulina* sp., *Dagmarita* sp., *Abadehella* sp., *Nodosaria* sp., *Pachyphloia* sp. (loc. 607-18 to 607-26) . . . . 70 m

5. Detrital limestone, locally with minor subangular and subrounded quartz grains. Fusulinids present are *Rauserella* sp., *Pseudoendothyra* sp., *Schubertella* sp., *Dunbarula nana* Kochansky-Devidé, *Codonofusiella* cf. *C. dzhulfensis* Rauser, *Neofusulinella* sp., *Parafusulina* sp., *Cancellina* cf. *C. cutalensis* Leven, *Armenina pamirensis* (Dutkevitch), and *A. salgirica* Miklukho-Maclay (loc. 607-1 to 607-16). . . . . 5 m

4. Laminated, quartzose sandstone interbedded with argillite and sandy limestone . . . . 12 m

3. Detrital limestone with *Pseudofusulina* aff. *P. fusiformis* (Schellwien and Dyhrenfurth), *Armenina* sp. and *Cancellina* sp. (loc. 606-35 to 606-36). . . . . 74 m

2. Dark-gray, thick-bedded and massive, sandy-clastic limestone; limy conglomerate often occurs in the basal 1 m to 3 m. The conglomerate matrix and the detrital limestone contain rare specimens of the fusulinids *Schubertella* sp., *Boultonia* sp., *Pseudofusulina* aff. *P. consobrina* Rauser, *P.* aff. *P. selencensis* Rauser, *P. kraffti* (Schellwien and Dyhrenfurth), *P. exigua* (Schellwien and Dyhrenfurth) (loc. 606-10 to 606-34). . . . . 12 m

1. Argillaceous, sandy and sandy-clastic limestone, alternating with marl and argillite; interbeds of quartzose sandstone contain small remains of bryozoans, crinoids, brachiopods, echinoids, and fusulinids. The sandstone and sandy-clastic limestone are similar to those at the base of the Khaftkala sequence. The resemblance is emphasized by the occurrence of *Pseudofusulina* aff. *P. karapetovi* in association with *Pseudofusulina peregrina* n. sp., *Pseudoendothyra* sp., *Pamirina* cf. *P. evoluta* Sheng and Sun (loc. 604-1 to 604-8). In the Khaftkala sequence *Pseudofusulina* aff *P. karapetovi* is prolific in bed 4. In the Kohe-Mushgol exposures equivalent beds contain ammonoids determined by V. E. Ruzhentsev as *Agathiceras* sp., *Eothinites* sp., and *Neocrimites* sp. . . . . 50 m

Total thickness . . . . 308 m

Syakhkoh Group

The total thickness of Permian deposits overlying the siliciclastic Syakhkoh(?) Group (beds 1–8) is 308 m. In other parts of this region, its thickness ranges from 70 m to 150 m as a result of pre-Triassic erosion and possible lack of certain intervals. Actually, several breaks of short-duration are indicated by changes in the fusulinid assemblages and by the presence of clastic limestone and limestone conglomerate in the sequence.

The paleontological material at hand suggests that bed 1 is Sakmarian to early Yahtashian. Fusulinids from bed 1 are represented by new species, but the occurrence of *Pseudofusulina* cf. *P. karapetovi* permits a comparison with a part of the Khaftkala sequence, assigned by us to the Sakmarian–early Yahtashian. Bed 2 contains fusulinids that are typical of the Yahtashian, but that also occur in the Bolorian Stage. Thus, the age of this bed is Yahtashian to Bolorian. *Cancellina* and *Armenina* in beds 3 to 5 suggest a Kubergandian age, but *Codonofusiella* and *Rauserella* in bed 5 do not occur commonly lower than the uppermost part of the Murgabian Stage. The age, therefore, is in doubt.

The foraminiferal assemblage (*Codonofusiella*, *Dagmarita*, *Abadahella*, and *Dunbarula*) in bed 6 is characteristic of the Midian Stage. This suggests that either bed 5 is at least partly Kubergandian and is separated from the overlying bed by a hiatus corresponding to the Murgabian, or that bed 5 is Murgabian and the Kubergandian fusulinids are reworked. The latter is quite possible because of the detrital character of the limestones, but the final solution of this problem requires supplementary investigation.

Some brachiopods suggest that Bed 8 is Dzhulfian, but other brachiopods and the foraminifers indicate an older (Midian) age. In the Kohe-Kamol sequence, bed 8 is overlain by a rather thick unit of limestone and dolomite.

Nilbandon tectonic zone. The Nilbandon Tectonic Zone, located southeast of the Khoja Murod Tectonic Zone (Figs. 1, 9), trends northeastward. The upper Paleozoic rocks described here differ from the Djare Sebak sequence in having a markedly thinner, upper carbonate part.

On the watershed of the Hasan-Sansalangey and Shehlovast Rivers the following Permian succession, from younger to older, is exposed (Fig. 13):

Thickness (m)

Limy conglomerate overlain by dolomite and cherty shale with bivalves of Karnian age.

Unconformity

8. Rust-brown, calcareous sandstone . . . . 5–6 m

7. Gray, massive, clastic limestone with lenses and thin interbeds of limestone conglomerate and sandy limestone. Rare fusulinids include *Kahlerina* sp., *Pseudofusulina* sp., and *Neoschwagerina* sp. (loc. 874-13) . . . . 2.5–3 m

6. Marl, lilac and greenish gray, calcareous, and lumpy slate with interbeds of calcarenite yielding indeterminable fusulinid species of *Codonofusiella*, *Kahlerina*, *Neoschwagerina* (loc. 874-11) . . . . 1 m

5. Gray, massive, clastic limestone with chert nodules. This unit rests on unit 4 disconformably. The limestone includes indeterminable species of *Pseudofusulina*, *Neoschwagerina* (loc. 874-10). . . . . 1–2.2 m

4. Fine- and medium-grained, clastic limestone with the fusulinids *Schubertella* sp., *Boultonia* sp., *Pseudofusulina* sp., *Skinnerella* sp., *Eopolydiexodina* sp. (loc. 874-3) . . . . 1–1.8 m

3. Marl and greenish gray, purple-lilac, and red slates with small lenses, nodules and fragments of detrital limestone bearing *Parafusulina* sp . . . . 5–7 m

2. Detrital, ferrugenous limestone, comprising the fusulinids *Pamirina* sp., *Neofusulinella* sp., *Pseudofusulina dzamantalensis* (Leven), and *Armenina* cf. *A. pamirensis* (Dutkevich) (loc. 874-1) . . . . 4 m

Total thickness . . . . 25 m

Unconformity

1. Thick, siliciclastic rocks of the Syakhkoh Group. The Artinskian

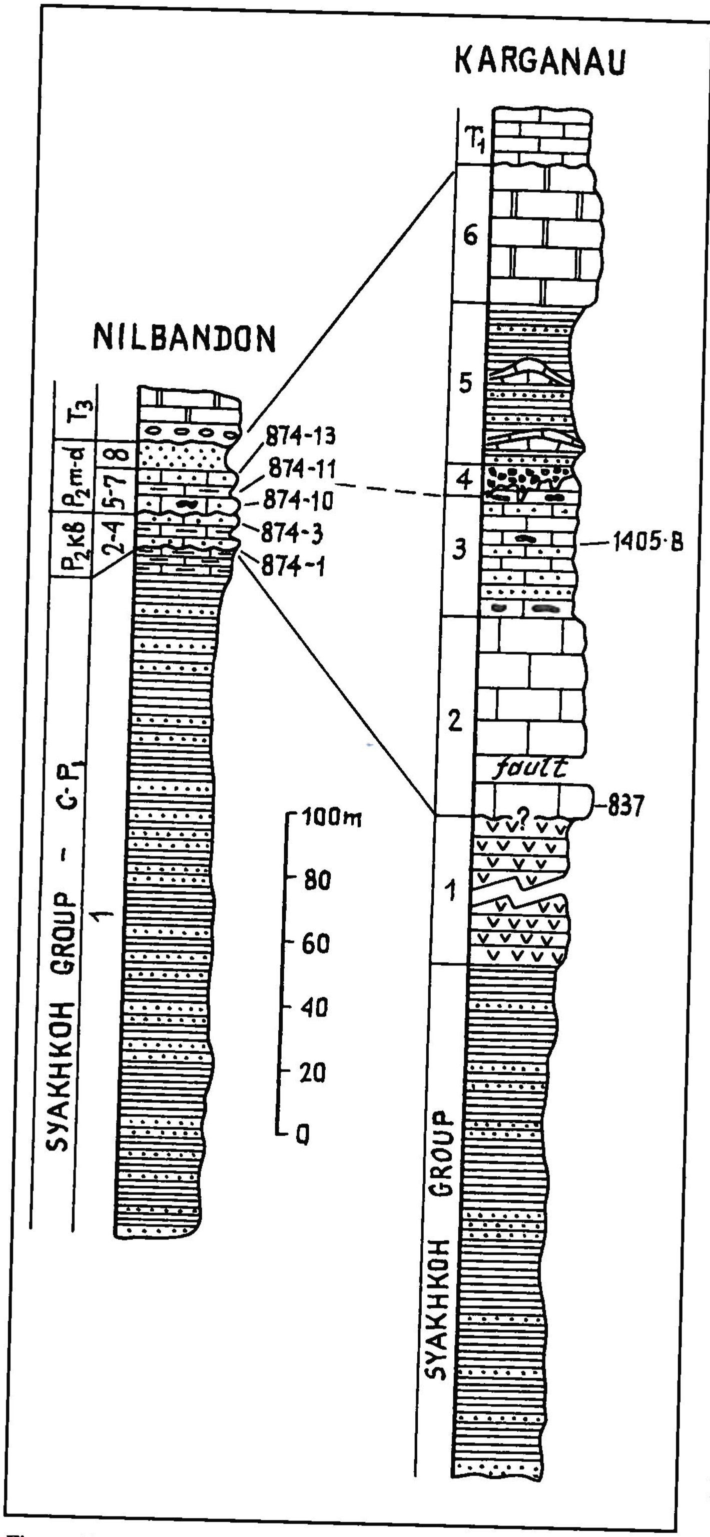


Figure 13. Permian sequences of the Nilbandon and Karganau zones (after Dronov, 1980). Numbered beds are described in the text. Numerals on right indicate fusulinid localities. C–P_1 = Carboniferous–Lower Permian; P_2kb = Kubergandian; P_2m–d = Murgabian–Dzhulfian; T_3 = Upper Triassic. Units are described in the text.

ammonoid *Metaperrinities* sp. (determination by V. E. Ruzhentsev and M. F. Bogoslovskaya) occurs at the top of a thin, isolated ochreous yellow-brown calcareous bed .... 1,000 m+

A single ammonoid in the top of Bed 1 is Artinskian (Yahtashian) in age. Bed 2 bears fusulinids characteristic of the lower zone of the Kubergandian, and bed 7 is assignable to the Midian Stage based on the presence of *Neoschwagerina* and *Kahlerina*. Bolorian and upper Kubergandian, as well as Dzhulfian and Dorashamian deposits, are either lacking or are represented by beds lacking fossils.

Karganau tectonic zone. The Permian sequence in the Karganau Tectonic Zone, located southeast of the Nilbandon Zone (Figs. 1, 9), is generally similar to others in western Middle Afghanistan. A minor difference is that the upper part of the siliciclastic Carboniferous–Lower Permian group comprises altered volcanics as much as 400 m thick (Fig. 13). The Permian age for this part of the sequence is questionable.

North of the village of Karganau in the Mene Bum Valley, the volcanics are overlain, apparently conformably, by the following sequence, from younger to older:

Lower Triassic limestone — Thickness (m)

Unconformity (obscure)

6. Thick-bedded dolomite........................ 40 m
5. Siltstone and limestone with hydroid-algal limestone bioherms and biostromes........................ 50 m
4. Dirty, green-gray, oolitic siliceous rocks lying on a rough limestone surface .... 10 m
3. Black, organic, detrital limestone with rare chert nodules and sandstone and siltstone interbeds. Limestone contains foraminifers including *Staffella* sp., *Nankinella* sp., *Pseudofusulina* aff. *P. solita* (Skinner), *Parafusulina* sp., *Neoschwagerina* sp., *Yabeina* sp., *Armenina* sp., *Pseudodoliolina* sp., and *Sumatrina* sp. (loc. 1405-8)...................................... 40 m
2. Thick-bedded, gray limestone .... 40 m

Fault

White, massive, reefal limestone with the foraminifers *Staffella zisongzhengensis* (Sheng), *Nankinella inflata* (Colani), Schwagerinidae gen. indet., *Hemigordiopsis* sp., and the algae *Mizzia velebitana* (Schubert), *Permocalcus tenellus* (Pia) (loc. 837 and 837-1) .... 100 m

Total thickness.......................... 280 m

Altered volcanic rocks

Both fusulinids and algae recovered from beds 1 and 3 indicate a latest Murgabian or Midian age. Part of the succession may have been removed by faulting.

Turkman tectonic zone. This tectonic zone is located in the drainage basin of the Turkman River that occupies the western part of the Kohe Bobo Ridge. It is bordered on the northwest by the Hajigak and Kalu tectonic blocks and on the southeast by the Pagman tectonic block. Similar to the Nilbandon region, faunally proven Permian deposits are very thin and represented mainly by detrital limestone, marl, and cherty slate. Permian rocks along with thin carbonate rocks of Early and Middle Triassic age occur between two thick siliciclastic units, the upper bearing Karnian bivalves and the lower corresponding to the Carboniferous to Early Permian Syakhkoh Group.

A detailed Permian succession of the Turkman region has not yet been compiled. The thickness of the upper, limestone-cherty portion of the succession immediately underlying Triassic rocks is tens of meters thick. The presence of *Codonofusiella* sp. and *Paradunbarula* sp. indicate a Midian to Dzulfian age for these strata. Blaise et al. (1978) reported Neoschwagerinidae and a goniatite, *Pseudogastrioceras roadense* (Bose), referable to a late Kubergandian or early Murgabian age, probably collected from the top of the Syakhkob Group.

Central Badakhshan. Remote central Badakhshan is still poorly studied. Permian deposits were recognized by Dronov (1980) who reported Permian rocks from the Varv and Sheva tectonic zones.

Varv tectonic zone. The Varv region occupies the drainage basins of the Darai Huf, Darai Begav, and Darai Gumai Rivers. Here, Permian rocks form a tectonic block 50 km long and 2 km to 7 km wide. The most complete sequence has been described along the Darai Begav River.

From top to bottom the sequence is as follows:
Early Triassic red marl bearing the brachiopod *Lingula tenuissima* Bron
Unconformity Thickness (m)
15. Gray, thick-bedded dolomite . . . . 70 m
14. Dark, marly limestone interbedded with polymictic sandstone. Both limestone and sandstone contain abundant foraminifers including *Staffella* sp., *Leella* sp., *Rauserella* sp., *Reichelina* sp., *Sichotenella* cf. *S. sutschanica* Toumanskaya, *Dagmarita* sp., *Baisalina* sp., *Globivalvulina* sp., *Nodosaria* sp., *Climacammina* sp., *Tetrataxis* sp., *Colaniella minima* Wang (loc. 1669-3, 1671-7) and rugosids which include *Waagenophyllum pulchrum* Ham (?), *W.* cf. *W. compactum* Minato and Kato, *W. virgalense* (Waagen and Wentzel), and *Iranophyllum* sp. 50 m
13. White, light-gray and creamy limestone. Lower part thick-bedded, upper part biogenic and massive. The upper 50 m comprise algae, crinoids, sponges, corals, gastropods, and foraminifers, including *Neoschwagerina* sp., *Yabeina* sp., *Hemigordiopsis* sp. (loc. 1669-1) . . . . 1,000 m
12. Dolomite and gray, white, and cream, laminated, dolomitic, sandy limestone . . . . 200 m
11. Andesitic and basaltic volcanic rocks . . . . 50 m
10. Yellowish brown dolomite with chert nodules . . . . .5 m
9. Andesitic and basaltic volcanic rocks . . . . 2 m
8. Green-gray, slaty limestone . . . . 3 m
7. Andesitic and basaltic volcanic rocks . . . . 10 m
6. Gray, thick-bedded dolomite . . . . 8 m
5. Argillite and shale . . . . 15 m
4. Yellowish brown, thick-bedded dolomite . . . . 5 m
3. An alternation of crinoid-algal limestone, sandstone, and slate . . . . 82 m
2. Black, phyllitic slate . . . . 150 m
1. Slaty, andesitic volcanics . . . . 100 m
Total thickness . . . . 1750 m

Only the upper part of the sequence is dated faunally. The association of advanced neoschwagerinids and hemigordiopsids in bed 13 is characteristic of the Midian Stage, and the assemblage of smaller foraminifers from bed 14 is Midian-Dzulfian. The Permian age for the lower part of the sequence, especially the lower volcanic sedimentary unit, is uncertain.

Sheva tectonic zone. Permian rocks crop out in a narrow tectonic block 13 km long in the Sheva and Darai Turgun watershed. Super- and subjacent deposits are lacking.

Dronov (1980) distinguished, from upper to lower, the following sequence:
Thickness (m)
5. Gray, medium-grained, detrital limestone with crinoids, bryozoans, and poorly preserved fusulinids of the Family Schwagerinidae. Incomplete thickness . . . . ~70 m
4. Rusty-red and green oolitic bauxite. Base is disconformable . . . . 0–2 m
3. Thick-bedded dolomite . . . . 10 m
2. Black siltstone interbedded with quartzose sandstone containing the Early Permian brachiopod *Reticularis* sp. . . . 60 m
1. Gray, brownish weathering, thick-bedded dolomite grading into limestone at the top . . . . 100 m
Total thickness . . . . 241 m

Nahchipar tectonic zone. The Nahchipar tectonic zone extends southeast of the two preceding areas. Permian rocks are exposed in the drainage basin of the Kokcha River south of the village of Djurm. According to Sh. Sh. Denikaev (*in* Dronov, 1980), the Permian is represented by a unit of dark-gray and black limestone interbedded with sericite- and biotitic-sericite-bearing schist. The thickness is 400 m. The fusulinids *Pseudofusulina bactriana* (Dutkevich) and *P. kraffti* (Schellwien and Dyhrenfurth) of Early Permian (Yahtashian) age occur in the lowest part, and corals of Triassic aspect are present in the upper part.

Wahan tectonic zone. The Wahan region is located adjacent to southeast Pamir (Fig. 1) and comprises part of the Afghan–south Pamirian fold belt. Until recently the only information on the geology of this remote area was that reported by Hayden (1915), who named the widespread slates "Wahanian." In adjacent southeast Pamir, Dutkevitch (1936) showed that the "Wahanian" slates include two terrigenous units interbedded ubiquitously with carbonate-cherty rocks of Late Permian and Early and Middle Triassic age. More detailed work was done by Dronov and Leven (1961), Kushlin (1973), and others. At present, the lower of the two terrigenous units, the Bazardara Group, is dated Carboniferous(?) to Sakmarian. The upper, siliciclastic unit, the Istyk Formation, is considered Upper Triassic. In the southeastern Pamir sequences, uppermost Permian and lowermost Triassic strata are missing along an unconformity. An unconformity also is recognized at the base of the Bolorian Stage, and other, minor, concealed unconformities are presumed to occur in the upper part of the Permian sequence.

The Wahan area was studied by Kafarskiy (*in* Kafarskiy and Abdullah, 1976), who confirmed that the "Wahanian slates," are traceable over much of this region. Kafarskiy reported that the lower part of these deposits, represented by more than 1,800 m of black siltstone and phyllitic slate with minor polymictic and quartz sandstone interbeds, overlie Archean gneisses with a sharp unconformity. The lower part of this unit contains the Visean coral *Barrandophyllum disunctus* Grabau and limestone interbeds near the top contain Permian microfossils.

A limestone, sandstone and cherty slate sequence, the base of which contains fusulinids, occurs above a low angle (10°–15°) unconformity. These strata are 300 m to 400 m thick and are comparable to equivalent rocks of Permian to Early and Middle Triassic age in southeastern Pamir. The Upper Triassic is represented by a thick flyschoid terrigenous unit.

The following general stratigraphic sequence is reported from outcrops in the Darai Surhad Valley (Dronov, 1980):

Thick, sandy-slaty unit of Late Triassic age	Thickness (m)
12. Cherty slate	7 m
11. Dark-gray limestone	13 m
10. Cherty slate	60 m
9. Dark-colored siltstone and sandstone	210 m
8. Limestone conglomerate with fusulinids	50 m
Unconformity	
7. Dark-gray limestone containing the Upper Permian fusulinids *Quasifusulina* sp., *Yangchienia* sp., *Pseudofusulina* sp.	10 m
6. Cherty slate	20 m
5. Thin-foliated phyllite with quartz sandstone interbeds in the upper part	480 m
4. Quartz sandstone in calcareous matrix	5 m
3. Thin-foliated slate	75 m
2. Medium-bedded sandstone	5 m
1. Black, slaty siltstone	960 m
Total thickness	**1,895 m**

Central Afghanistan. Central Afghanistan (Figs. 1, 14) spans the mountainous area of Hazarajat that extends throughout the drainage basins of the Hilmand, Argandab, and part of the Logar Rivers. This region includes the Hilmand-Argandab uplift which represents a part of the south-Afghan median massif. The uplift is separated from the Farahrud trough to the northwest by the Hilmand fault. On the southeast it is bounded by the Mukur-Tarnak fault that separates the uplift from the Dori Rud trough. The Precambian, Paleozoic, and Mesozoic rocks of the Hilmand-Argandab uplift plunge southwestward under Neogene and Quaternary deposits of the Seistan depression (Fig. 1).

Permian rocks were first recognized in this region by Fesefeldt (1964). Papers and monographs published by Sieh (1967), Lys and Lapparent (1971), Karapetov and Leve (1973), Wolfart and Wittekindt (1980), Vachard (1980), an Dronov (1980), as well as those of Termier et al. (1972, 1974 Legrand-Blain (1968), and Plodowski (1970) deal with descrip tions of the fossils or the generalized stratigraphy. The wel documented outcrops in the Logar drainage and on the Dasht Navar Plateau are relatively accessible.

Analysis of the available data suggests that Permian rock are most completely represented in the axial part of the Argandab trough that extends southeastward from the middle Argandab River to the upper Logar River (Fig. 14) (Karapetov and Leven, 1973). The lower, Asselian to Sakmarian, portion of the section here constitutes the upper half of a thick (as much as 1,200 m) siliciclastic unit called the Shalkalay Group (Karapetov and Leven, 1973). The higher, dominantly carbonate, part of the section is assigned to the transgressive Chohan Group.

The Hilmand trough extends along the drainage basin of the Hilmand River. During Paleozoic time, the Hilmand and Argandab troughs were separated by a narrow outcrop of basement that is now overlain by the Chohan Group (the Uruzgan sequence). Within the Hilmand trough, the Chohan Group is underlain by a siliciclastic unit called the Bed Formation (Karapetov and Leven, 1973). Unlike the Shalkalay Group, however, the Bed Formation is relatively thin (as much as 500 m thick) and probably belongs mainly to the Lower Permian. The subjacent rocks are either crystalline schists or thin sandstone beds of Late Devonian age.

Argandab trough. Permian rocks of the Argandab trough (Fig. 15) are best developed near the villages of Tezak and Wardak in the northeastern part of the area. Sequences at the Adjar, Khargardan, Shalkalay, Kundaljan localities and several outcrops on the Dashti Navar Plateau (Fig. 14) are less well studied.

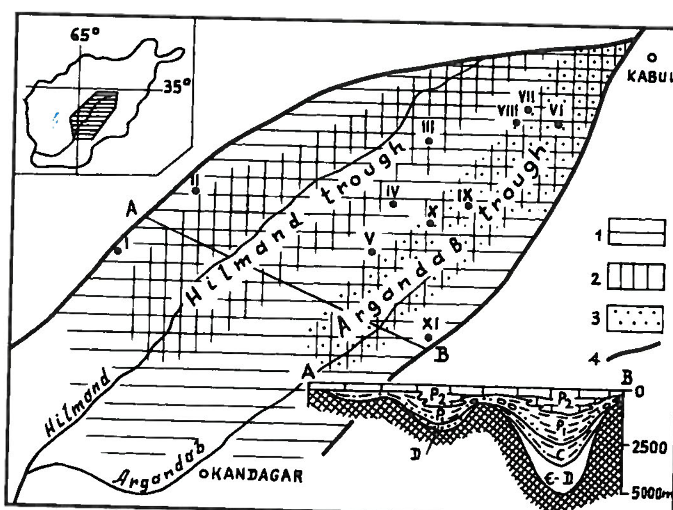


Figure 14. Distribution of Carboniferous and Permian rocks in Central Afghanistan. 1. Upper Permian; 2. Lower Permian; 3. Carboniferous; 4. faults bordering central Afghanistan. Roman numerals indicate locations of the sequences shown on Figure 15. Inset shows location of main figure on a map of Afghanistan.

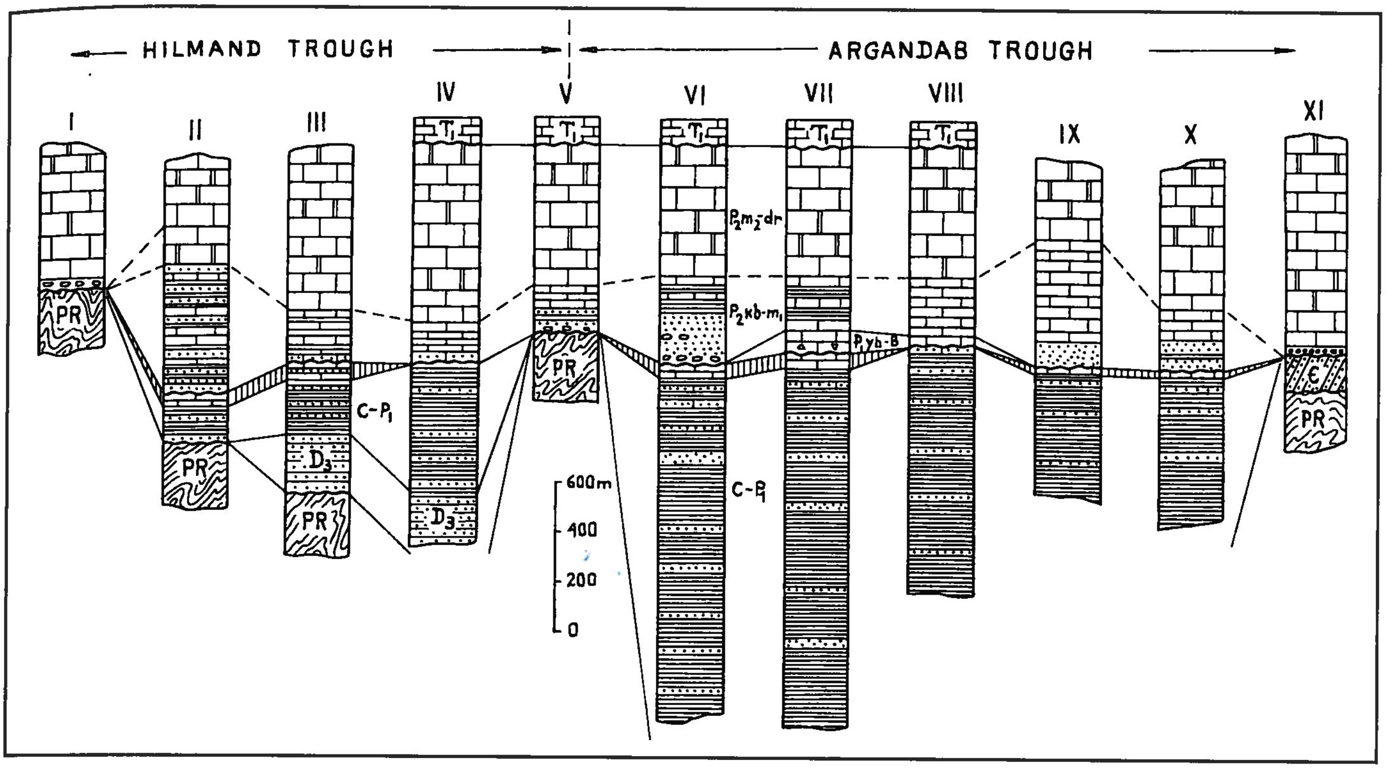


Figure 15. Permian sequences of Central Afghanistan; I. Bashlang; II. Urkhon; III. Gudri Mazar; IV. Adjrestan; V. Uruzgan; VI. Wardak; VII. Tezak; VIII. Sabzab-Adjar; IX. Chagna; X. Khargardan; XI. Sokhjoy. See Figure 14 for locations. See Table 1 for ages. PR = Proterozoic; € = Cambrian; D_3 = Upper Devonian; C–P_1 = Carboniferous–Lower Permian; P_1yh–b = Yahtashian–Bolorian; P_2kb–m_1 = Kubergandian–lower Murgabian; P_2m_2–dr = upper Murgabian–Dorashamian; T_1 = Lower Triassic.

Tezak. Stratigraphy of the Permian deposits exposed in the vicinity of Tezak village (Fig. 15, VII) was reported upon by Fesefeldt (1964), Lapparent et al. (1965), Siehl (1967), Termier and Termier (1970), Termier et al., (1972), Lys and Lapparent (1971), and Desparmet et al. (1972).

Vachard (1980) published a thorough and comprehensive summary of the succession at several exposures that were examined both by the present author and his predecesors. Vachard distinguished 10 beds in the succession dated by fusulinids, smaller foraminifers, brachiopods, ammonoids, bryozoans and algae (Figs. 16, 17).

Just as everywhere in Central Afghanistan, the Lower Permian Series is represented mainly by siliciclastic facies, indiscernible from Carboniferous rocks. Therefore, the boundary between the systems is placed conventionally.

The stratigraphic sequence (Fig. 16) reported from top to bottom is as follows:

Thickness (m)

Lower Triassic rocks overlying Permian rocks without a visible unconformity

ZONE P10. *Colaniella*

Dolomitic limestone, comprising the fusulinids *Staffella zisongzhengensis* (Sheng), *Reichelina minima* Erk, *Neofusulinella* sp. Other fossils include algae and the foraminifers *Dagmarita chanakchensis* Reitlinger, *Baisalina* sp., *Frondina permica* Civrieux and Dessauvagie, *Robuloides lens* Reichel, *Colaniella parva* (Colani). . . . . 250–500 m

ZONE P9. *Neoschwagerina margaritae*

Limestone, similar to that of Zone P8 and yielding corals, bryozoans, brachiopods, ostracods, trilobites, and algae. Small foraminifers and fusulinids determined are *Staffella sp., Kahlerina* sp., *Toriyamaia* sp., *Neofusulinella lantenoisi* Deprat, *Codonofusiella* spp., *Minojapanella* sp., *Yangchienia* sp., *Parafusulina* sp., *Verbeekina (Verbeekina) verbeeki* (Geinitz), *Pseudodoliolina* sp., *Neoschwagerina margaritae* Deprat, *Sumatrina annae* Volz . . . . 250–500 m

ZONE P8. *Neoschwagerina schuberti*

Limestone, closely resembling those of unit 7, with algae and the following foraminifers: *Neofusulinella lantenoisi* Deprat, *Minojapanella* sp., *Yangchienia haydeni* Thompson, *Parafusulina* spp., *Chusenella* sp., *Rugosochusenella yabei* (Staff), *Verbeekina (Verbeekina) verbeeki* (Geinitz), *Armenina* sp., *Pseudodoliolina* sp., *Neoschwagerina schuberti* Kochansky-Devidé, *Presumatrina schellwieni* (Deprat), *Afghanella* sp., *Sumatrina sp.* . . . . 100–350 m

ZONE P7. *Neoschwagerina simplex*

Limestone similar to that of Zone P6, containing corals, gastropods, bivalves, ostracods, trilobites and algae. Fusulinids include *Staffella* sp., *Kahlerina* sp., *Toriyamaia* sp., *Neofusulinella lantenoisi* Deprat, *Boultonia* sp., *Wutuella wutuensis* (Kuo), *Yangchienia tobleri* Thompson, *Pseudofusulina* spp., *Parafusulina* spp., *Verbeekina* sp., *Armenina* sp., *Pseudodoliolina* sp., *Cancellina (Shengella) praeneoschwagerinoides* Leven, *Neoschwagerina simplex* Ozawa, *Presumatrina schellwieni* (Deprat) . . . . 130–150 m

ZONE P6. *Cancellina*

Dark-gray, biohermal, detrital limestone with chert nodules, corals, goniatites and algae. Foraminifers recognized include *Staffella* sp., *Nankinella* sp., *Toriyamaia* sp., *Neofusulinella lantenoisi* Deprat, *Boultonia* sp., *Wutuella wutuensis* (Kuo), *Yangchienia compressa* (Ozawa), *Pseudofusulina sp.*, *Parafusulina* sp., *Armenina* sp., *Pseudodoliolina ozawai* Yabe and Hanzawa, *Cancellina (Cancellina) nipponica* Ozawa, *C. (C.) pamirica* Leven, *C. (C.) primigena* Hayden, *C. (Shengella) praeneoschwagerinoides* Leven . . . . 150 m

ZONE P5. *Parafusulina (Skinnerella) cincta*

Dark-gray and yellowish, marly slate with limestone lenses and scarce remains of corals, brachiopods, algae, small foraminifers and fusulinids such as *Wutuella wutuensis* (Kuo), *Parafusulina (Skinnerella) cincta* Reichel, *P. (S.) multiseptata* (Schellwien) . . . . 100–200 m

ZONE P4. *Parafusulina (Skinnerella) gruperaensis–Dzhulfanella gelatinosa*

Dark-gray limestone yielding gastropods, corals, small foraminifers and fusulinids which include *Parafusulina (Skinnerella) gruperaensis* (Thompson and Miller), *P. (S.) multiseptata* (Schellwien), *P. (S.) cincta* Reichel, *Boultonia sp.*, *Neofusulinella lantenoisi* Deprat, *Staffella sphaerica* (Abich), *Russiella pulchra* Miklukho-Maclay . . . . 50–150 m

ZONE P3. *Pseudoreichelina darvasica*

Dolomite followed by limestone breccia, and oolitic and oncolitic limestone with algae, small foraminifers, and the fusulinids *Pseudoreichelina darvasica* Leven, *Staffella* sp., *Neofusulinella lantenoisi* Deprat, *and Parafusulina (Skinnerella)* sp. . . . . . 50–300 m

ZONE P2. *Monodiexodina ferganica*

Gray, limy sandstone and sandy limestone with small lenses of biohermal limestone marking the base. Upward, these rocks grade into massive, dolomitic, detrital limestone, and dolomite. The limestone locally contains fusulinids such as *Ozawainella* sp., *Staffella* sp., *Boultonia* sp., "*Monodiexodina ferganica* (Miklukho-Maclay)" (=*Pseudofusulina karapetovi* n. sp.), *Pseudofusulina* spp. . . . . 50–75 m

ZONE P1. *Tezaquina clivuli*

Alternation of slate, quartzose sandstone, and to a lesser degree detrital and sandy-detrital limestone with algae and small foraminifers, the most typical being *Tezaquina clivuli* Vachard. Other fossils include the brachiopods *Spiriferella blainae* Termier, *Licharevia spinosa* (Plodowski), *Orthotichia bistriata*

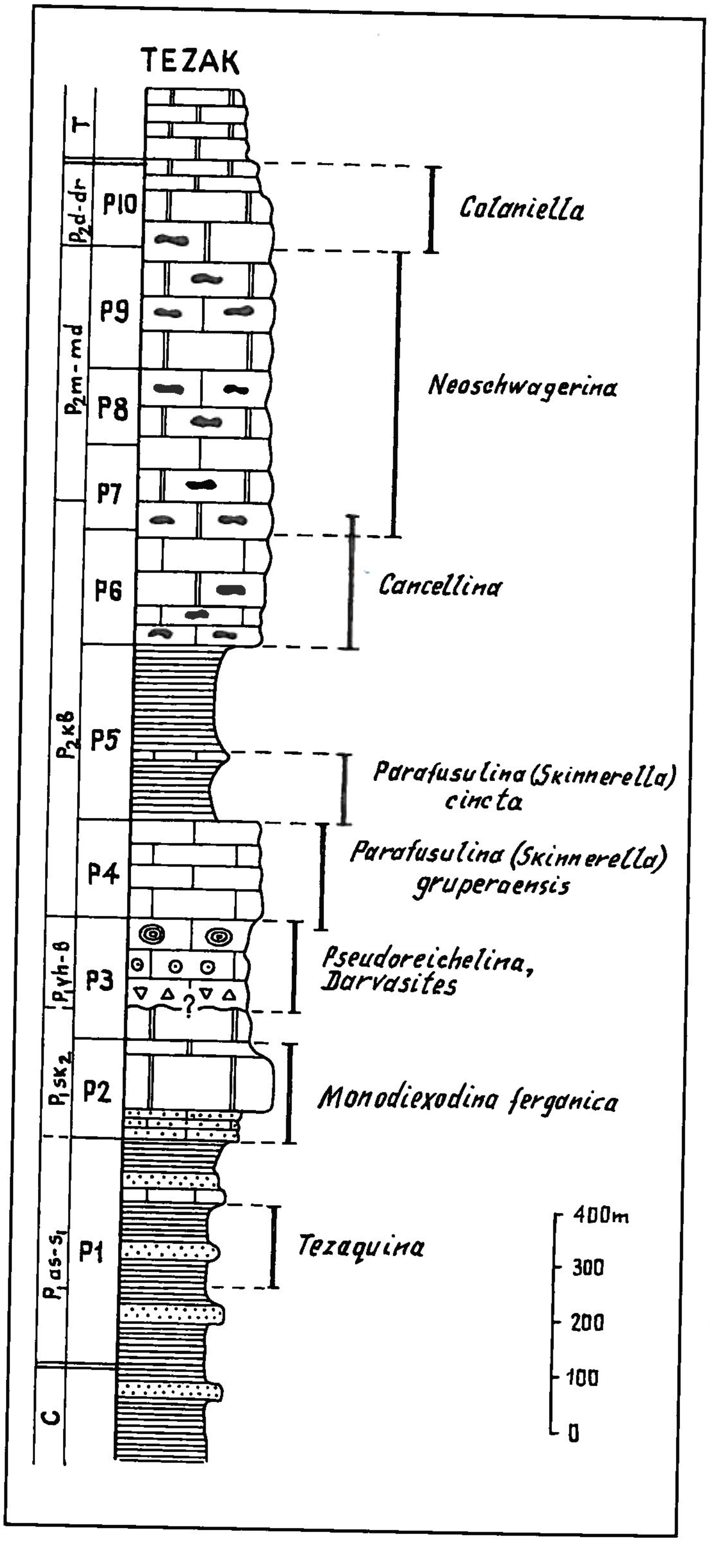


Figure 16. Permian sequence in the vicinity of the village of Tezak (Vachard, 1980; dating based on author's interpretation). See Table 1 for ages. For descriptions of zones P1–P10 see Figure 17 and the text. C = Carboniferous; P_1as–s_1 = Asselian–lower Sakmarian; P_1sk_2 = upper Sakmarian; P_1yh–b = Yahtashian–Bolorian; P_2kb = Kubergandian; P_2m–md = Murgabian–Midian; P_2d–dr = Dzhulfian–Dorashamian; T = Triassic. P1–P10, numbers of beds in Vachard (1980). Triangle pattern = breccia.

AGE	LYS, LAPPARENT, 1971	DESPARMET a.o. 1972 TERMIER a.o. 1972	VACHARD, 1980	KARAPETOV (Nº samples)
DORASHAMIAN DZHULFIAN	11	10	P10 *Colaniella parva, Reichelina*	
MIDIAN	10 *Reichelina, Laosella gigantea*	9	P9 *Kahlerina, Sumatrina, Neoschwag. margaritae*	
MURGABIAN	9 *Afghanella, Eopolydiex. afghanensis*	8 *Presumatrina grandis*	P8 *Neoschwag. schuberti, Afghanella*	
		7 *Neoschwag. simplex*	P7 *Neoschwag. simplex, Presumatrina*	
KUBERGANDIAN	8	7 *Cancellina, Ammonoids*	P6 *Cancellina primigena*	
	7 *Parafus. multiseptata*	6	P5 *Skinnerella cincta*	209 *Skinnerella*
	6 *Skinnerella cincta. Eopolidiex. praecursor*	5 *Neofusulinella tumida*	P4 *Skinnerella gruperaensis, Sk. multiseptata*	209a, 209б *Skinnerella*
BOLORIAN	5 *Staffella*	4 *Pseudofusul. kraffti*	P3 *Neofusul. lantenoisi, Pseudoreichel. darvasica*	210 *Darvasites*
YAHTASHIAN (?)	4	3		
SAKMARIAN	3 „*Pseudofus. ambigua*"	2 „*Pseudofus. ambigua*"	P2 „*Monodiex. ferganica*"	222б, 222a *Pseudofus. karapetovi*
	2	1	P1	
ASSELIAN	1			

Figure 17. Subdivisions of the Permian sequence in the vicinity of Tezak village. For description of zones see text.

Reed, *Aperispirifer naubauriensis* Plodowski, as well as numerous bryozoans . . . . 150–200 m

The above mentioned sequence is a summary of several outcrops in the Tezak vicinity (Fig. 17), some described by Lys and Lapparent (1971), Desparmet et al. (1972), and Termier et al. (1972). The results adduced by different authors permit compilation of a more precise and updated paleontological description of the beds recognized by Vachard (1980). Thus, along with the listed assemblage, additional fusulinids typical of Zone P2 are *Pseudofusulina ambigua* (Deprat) and *P. kalmykovae* Leven, determined by Lys and Lapparent (1971). According to Termier et al. (1972), Zone P3 contains *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth) and *P. magna* Toriyama. Zone P4 includes *Pseudofusulina quasifusuliniformis* Leven, *Skinnerella schucherti* (Dunbar and Skinner), and *Eopolydiexodina praecursor* (Lloyd) (Lys and Lapparent, 1971).

Zone P6 ammonoids and fusulinids were reported by Termier et al. (1972) and Desparmet et al. (1972). These beds, 700 m thick, locally consist of brecciated dolomitic and sandy limestone infrequently interbedded with argillite. Ammonoids were sampled from three levels near the base of the limestone. From the lowermost level *Stacheoceras rothi* Miller and Furnish, together with *Cancellina dutkevitchi* Leven, were found; from the middle and upper levels, *Daraelites meeki* Gemmellaro, *Paraceltites* cf. *P. haeferi* Gemmellaro, *Parapronorites konincki* Gemmellaro, *Propinacoceras beyrichi* Gemmellaro, *Epiglyphioceras meneghinii* Gemmellaro, *Agathiceras suessi* Gemmellaro, *Adrianites elegans* Gemmellaro, *Stacheoceras mediterraneum* Gemmellaro and *Popanoceras scrobiculatum* Gemmellaro were collected.

Ammonoids from the upper part of this unit are associated with the following fusulinids: *Neofusulinella lantenoisi* Deprat, *Cancellina dutkevitchi* Leven, *C.nipponica* (Ozawa), *C. pamirica* Leven, and *Armenina asiatica* Leven. The above-cited fusulinid list suggests that these beds belong to the *Cancellina cutalensis* zone of the Kubergandian Stage and correspond to Zone P6 of Vachard's (1980) sequence. This conclusion is confirmed by the appearance of the lower Murgabian fusulinids *Presumatrina neoschwagerinoides* (Deprat) and *Neoschwagerina simplex* (Ozawa) in the overlying sequence. The occurrence of ammonoids together with fusulinids enables a solution of some questions concerning correlation of fusulinid and ammonoid zones.

Karapetov and Leven (1973) reported fusulinids from several outcrops in the area (Fig. 17) that can be correlated quite precisely with the beds in Vachard's (1980) succession. The first outcrop is located near the village of Tezak. Limestone at this locality has yielded numerous specimens of *Pseudofusulina acuminulata*

n. sp. and *Pseudofusulina karapetovi* n. sp. and corresponds to Zone P2 of Vachard (1980). The latter species is represented by three subspecies, *P. karapetovi karapetovi, P. karapetovi tezakensis, P. karapetovi gudriensis* (loc. 222 a and b, Fig. 17).

A comparison of these subspecies with those figured by Lys and Lapparent (1971, their plate IX, fig. 1) and identified by them as *Pseudofusulina ambigua* (Deprat), shows them to be the same. These fusulinids differ from typical representatives of *Pseudofusulina ambiqua* from successions in Indochina in a number of features. Lys and Lapparent (1971) also mentioned *Pseudofusulina kalmykovae* Leven. However, in the author's collection no specimens resembling *P. kalmykovae* have been encountered, and this species is characteristic of a higher (Bolorian) stratigraphic level.

Also, I disagree with Vachard's (1980) determination of *Monodiexodina ferganensis* from Zone P2. The specimens figured by him (plate 33, fig. 1, 2, and 4–6 *in* Vachard, 1980) are represented by tangential sections which show more irregular septal fluting than is typical of *Monodiexodina*. In my opinion, these specimens and a better oriented section shown in figure 5 of Vachard (1980) could be assigned to *Pseudofusulina karapetovi*.

The second fusulinid collection of Karapetov and Leven (1973) is from an area approximately 20 km south of Tezak village in the Sabzab-Adjar watershed. Permian rocks are exposed on the northern slope of the limestone crest that extends along the watershed (Figs. 14, 15). Similar to the rocks at Tezak, the lower portion of the sequence here is made up of a slaty-sandstone unit. The upper portion is represented by the thick Chohan Group that consists of dark, well-bedded, fusulinid limestone (250 m) below, and thick-bedded, dolomitic limestone (600 m) above. Its uppermost strata contain sandy limestone with abundant brachiopods and bryozoans. Triassic limestone beds lie above without an apparent unconformity.

Samples yielding the oldest fusulinid assemblage (loc. 210 and 210a) were taken from an isolated limestone outcrop that may correspond to the basal carbonate unit of the Chohan Group. Fusulinids include *Darvasites ordinatus longus* n. subsp., *D. contractus* (Schellwien and Dyhrenfurth), *Chalaroschwagerina vulgaris* (Schellwien and Dyhrenfurth), *Pseudofusulina hessensis orientalis* n. subsp., *P. fusiformis* (Schellwien and Dyhrenfurth), *P. exigua* (Schellwien and Dyhrenfurth), *Praeskinnerella crassitectoria afghanica* n. subsp., and *P. guembeli pseudoregularis* (Dunbar and Skinner).

Fusulinids collected from the lower third of the dark, laminated limestone beds of the Chohan Group include *Boultonia* sp., *Codonofusiella simplex* n. sp., *Minojapanella (Wutuella) wutuensis* (Kuo), *Dutkevitchia jipuensis* (Nie and Song), *Kubergandella insolita* (Davydov), *Skinnerella undulata* (Chen), and *S. gundarensis* Leven (loc. 209b). *Skinnerella undulata* (Chen) (loc. 209a) was determined from the middle part of the laminated limestone. From the upper part of this limestone the fusulinids *Schubertella* sp., *Neofusulinella* sp., and *Skinnerella cincta* (Reichel) were recovered (loc. 209). The beds containing these fusulinid assemblages are compatible with Zones P3 to P5 of Vachard's (1980) succession, as suggested both by their faunal compositions and stratigraphic position.

The age of the lower subdivision of Tezak, the *Tezaquina* zone, is uncertain. It is in the same stratigraphic position as the brachiopod-bearing beds of the Wardak sequence (see later), where the lower beds could be Asselian and the upper probably Sakmarian. A precise position of the boundary with the Gzhelian Stage of the Upper Carboniferous also is uncertain.

I agree with Vachard (1980) who assigned the Zone P2 beds to the Sakmarian. In addition to Vachard's arguments, it is noteworthy that the fusulinids known to occur here have a close affinity to those which are abundant in the upper half of the Dangi Kalon Formation of the central Pamir (Leven et al., 1989; Leven, 1993a). There, abundant specimens of species such as *Pseudofusulina karapetovi*, are accompanied by the typically Sakmarian *Zellia* and *Robustoschwagerina*. Lys and Lapparent (1971) considered the beds Artinskian in age, which is not at all improbable. The upper beds, however, are lower Yahtashian in age.

Some questions arise in dating the beds of Zone P3. Vachard (1980) assigned them to the early Artinskian, chiefly based on their position above Sakmarian beds and below beds of Zone P4, which he assigned to the upper half of the Artinskian (Vachard's concept of the Artinskian corresponds to my Yahtashian and Bolorian Stages.) The fusulinids from the P3 beds are Yahtashian and (or) Bolorian. Such species as *Pseudoreichelina darvasica, Pseudofusulina kraffti* and *P. magna* are typical of both stages. However, the presence of *Neofusulinella* and *Skinnerella* favors the upper part of the Bolorian Stage. Sample 210 collected by S. S. Karapetov probably came from the same beds. Fusulinids determined from that sample are characteristic of the upper zone of the Yahtashian (*Pamirina–Chalaroschwagerina vulgaris* zone), although these species may range into the Bolorian. If unit P3 proves to be Bolorian or upper Yahtashian in age, an unconformity may be inferred between it and unit P2 which represents part or all of the Yahtashian Stage.

Zone P4 and the lower part of zone P5 are characterized by closely related fusulinid assemblages dominated by species of *Skinnerella* and *Parafusulina*, typical of the *Armenina–Misellina ovalis* zone of the Kubergandian Stage. From the same stratigraphic level, the common Kubergandian species, *Kubergandella sarykolensis* (sample 209b), which occurs in the lowermost Kubergandian in the sequences of Pamir and Darvaz, was recovered.

Zone P6 includes the index species, *C. cutalensis*, of the *Cancellina cutalensis* zone of the Kubergandian Stage. Following Vachard (1980) I confidently refer Zones P7 and P8 to the Murgabian Stage on the basis of typical Murgabian fusulinids. Zone P9 is likely correlative with the lower Midian, based on the presence of *Codonofusiella, Kahlerina,* and advanced *Neoschwagerina*. Zone P10 probably is Dzhulfian-Dorashamian in age, as indicated by the absence of fusulinids except for *Staffella* and the aberrant *Reichelina*, and by the occurrence of the Dorashamian foraminifer, *Colaniella parva.*

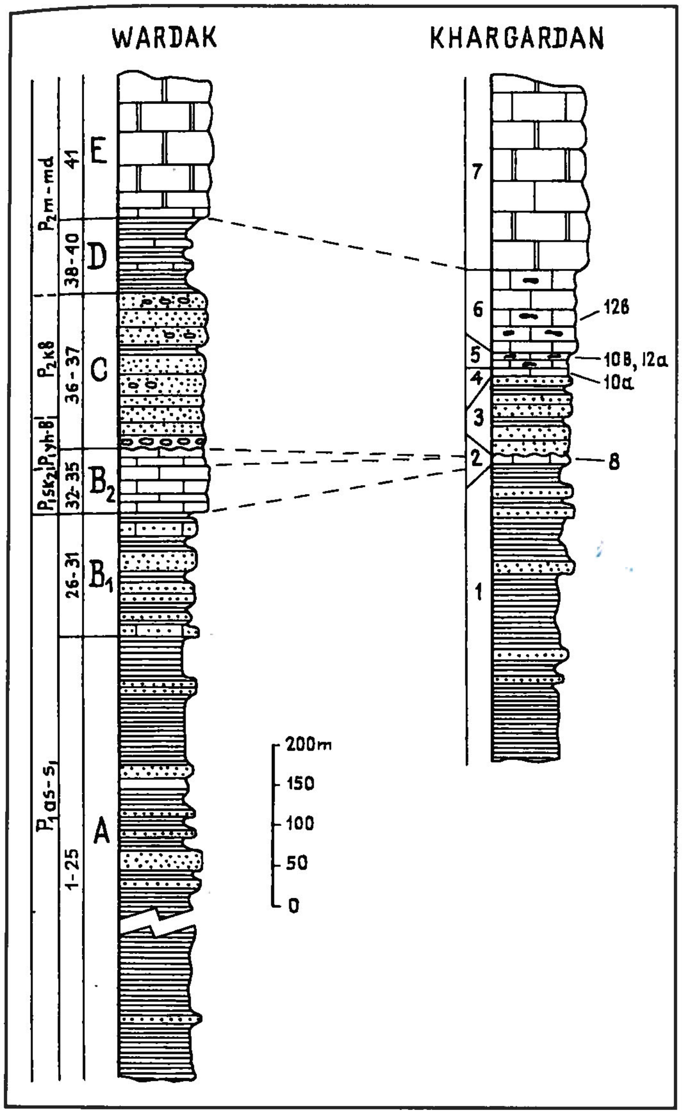


Figure 18. Permian sequences in the vicinity of the villages of Wardak (Lys and Lapparent, 1971; Termier et al., 1974) and Khargardan (after S. S. Karapetov, 1970, personal communication). See Figure 16 for ages. Numerals on right indicate fusulinid localities. Units are described in the text. A, B_1, B_2, C, D, E = formations and subformations of Lys and Lapparent (1971).

Wardak. The settlement of Chaki Wardak, like Tezak, is located in the Logar Valley, about 100 km southwest of Kabul (Figs. 1, 14). Permian deposits in this area (Fig. 18) were reported first by Lapparent and Lys (1965). Subsequent publications by Siehl (1967), Lys and Lapparent (1971), Blaise et al. (1971), Termier et al. (1973, 1974), and Vachard (1980) have given a complete concept of the succession and its important fossils. Especially important is the monograph of Termier et al. (1974), where detailed characteristics of the succession along with determinations of brachiopods, bivalves, bryozoans, and conularids were provided.

The most complete Permian successions described by Termier et al. (1974) are exposed on the northwestern slopes of the Kaparey Gar at an elevation of 2,772 m. Succession D of Termier et al. is equivalent to succession II earlier reported on by Lys and Lapparent (1971). A summary of this succession (Fig. 18) is based on the descriptions from those studies.

Lys and Lapparent (1971) subdivided the Kaparey Gar succession into 6 lithostratigraphic units, each corresponding approximately to a formation. The formational units are divided into 14 subunits of member status; a more detailed subdivision of the succession into 41 beds is contained in the monograph of Termier et al. (1974).

The Kaparay Gar section may be summarized in descending order as follows:

Thickness (m)

FORMATION E. Laminated, fusulinid-bearing limestone at the base, grading upward into massive and thick-bedded, dolomitic limestone. Fusulinids include *Laosella gigantea* (Deprat), *Rugosofusulina furoni* (Thompson), *Verbeekina (Paraverbeekina) pontica* (Miklukho-Maclay), *Cancellina* sp., *Neoschwagerina* aff. *N. schuberti* Kochansky-Devidé, *Pseudodoliolina ozawai* Yabe and Hanzawa . . . . >100 m

FORMATION D. Yellowish brown, sandy-detrital limestone at the base, grading into marl and marly slate upward. Limestone yields abundant fusulinids including *Laosella gigantea* (Deprat), *Skinnerella* aff. *S. cincta* Reichel, *S.* aff. *S. multiseptata* (Schellwien), *Rugosofusulina furoni* (Thompson), *Eopolydiexodina* sp., *Cancellina sp.*, *Neoschwagerina simplex* Ozawa, *Armenina sphaera* (Ozawa), *Pseudodoliolina ozawai* Yabe and Hanzawa. Occurring higher in the succession are the brachiopods *Enteletes conjunctus* Reed, *Uncinunellina timorensis* Beyrich, *Orthothetina pelita* Flugel, *Oldhamina decipicus* Koninck, *Leptodus trapezium* Termier and Termier. The cephalopod *Stacheoceras* sp., and corals and bryozoans also are present
60 m

FORMATION C. Conglomerate with quartz and calcareous pebbles, gray, coarse-grained sandstone, and red slate lying unconformably on the subjacent limestone with a distinct unconformity. . . . . 100–130 m

FORMATION B, SUBFORMATION B2. Black, bituminous, oölitic and biohermal limestone containing fusulinids in the lower part. Lys and Lapparent (1971) determined the following species: *Pseudofusulina ambigua* (Deprat), *P. kalmykovae* Leven, *Parafusulina dutkevitchi* Leven, *Schwagerina* sp. Termier et al. (1974) reported *Staffella sphaerica* (Abich), *Boultonia* sp., *Parafusulina ferganica* Miklukho-Maclay, *P. japonica* (Reichel), and *Pseudofusulina procera* Leven. In addition to fusulinids, the upper half of the formation contains brachiopods including *Karavankina wardakensis* Termier and Termier, *Rhynchopora winneri* Reed, *Spiriferellina bilotensis* Reed, *Notothyris acuta* Reed, and others. Bryozoans, small foraminifers, and algae also are present . . . . 30–40 m

FORMATION B, SUBFORMATION B1. Massive and cross-bedded quartz sandstone with lenses of greenstone, schist, limy sandstone, and sandy-detrital limestone. Bryozoans, foraminifers, and brachiopods are present; among the latter are *Wardakia grandis* (Waagen), *Taeniotherus permictus* Reed, *Licharevia spinosa* (Plodowski), and *Tomiopsis angulata* (Campbain) . . . . 59–90 m

FORMATION A. Green and greenish-gray slates intercalated with gray and yellowish brown quartzite, and rarely by limy, locally cross-bedded sandstone. In the upper half of the formation limy sandstone interbeds contain brachiopods including *Tomiopsis angulata* (Campbain), *T.* cf. *T mantuanensis* (Campbain), *Cyrtella nagmargensis* Bion, *Stepanoviella umariensis* (Reed), and others; bivalves, including *Atomodesma mytiloides* Beyrich, *Eurydesma mytiloides* Reed, *Heteropecten exemplaris* (Newell), and *Oriocrassatella lapidaria* Reed; the conularid *Calloconularia* sp.; and bryozoans . . . . 400–500 m

According to Siehl (1967), the dolomitic limestone of Formation E is overlain by a sequence of laminated limestone hundreds of meters thick. Foraminifers noted in the upper part of the unit include *Colaniella* sp., *Reichelina* sp., and *Nankinella* sp.

Termier et al. (1974) assigned the upper part of formation A to the upper Asselian and lower Sakmarian, whereas the upper zone of Sakmarian age was compared with the lower subformation (B1) of formation B. B2 was considered Artinskian. Age-diagnostic species that would permit a direct correlation with the type sections of the Asselian, Sakmarian, and Artinskian Stages in the Ural region are very rare in this interval.

As was clearly shown by Termier et al. (1974), the fossil assemblages in formations A and B1 are typical of the Gondwana region and have little in common with the coeval assemblages of the East European basin. The brachiopods, bivalves, conularids, and some bryozoans enable a confident comparison with the eurydesmo-conularia-bearing beds of the Salt Range, the Nagmarg beds of Kashmir, the Manendragar and Umaria beds in peninsular India, and Stages A and B in western Australia. According to recent concepts, these strata correspond to the Asselian and Sakmarian Stages in the Standard Scale, although these are only approximate age estimates.

The basal beds of subformation B2 are exactly comparable with zone P2 of the Tezak sequence of possible Sakmarian age, as has been discussed. The remaining greater part of the subformation may be comparable with zones P3 and P4, which correspond to the Yahtashian, Bolorian, and lowermost Kubergandian Stages. On the basis of these fossils Formation A was considered to be Asselian to early Sakmarian in age. The lower part of the formation probably is of Gzhelian age, but the exact position of the boundary between the stages and between the Carboniferous and Permian remains indefinable.

Formation C is barren of fossils, but its stratigraphic position suggests a Kubergandian age. Formation D belongs to the lower zone of the Murgabian Stage. The base of formation E is referable with some question to the middle zone of the Murgabian Stage, although the upper part of this formation is unfossiliferous. Siehl's (1967) data suggest that the entire Upper Permian, including the Dzhulfian and Dorashamian Stages, probably are present in the Wardak succession.

A section described by Lys and Lapparent (1971) west of Dashti Nawar Lake near the village of Chagna (below) closely resembles the sequence at Wardak.

Quartzite and slate of a Late Carboniferous to Early Permian age (Shalkalay Group) here are overlain by the following sequence, from upper to lower:

	Thickness (m)
7. Dark-gray dolomite	100 m
6. Black, cherty limestone with gastropods	400 m
5. Brachiopod-bearing limestone	100 m
4. Quartzite	70 m
3. Black, dense limestone	2 m
2. Limestone containing fusulinids and bryozoans	1 m
1. Sandy limestone with productids and spiriferids	10 m

Bed 1 of the above sequence is comparable with the upper part of formation A of the Wardak succession, whereas beds 2 and 3 correlate with formation B. The latter is indicated by its fusulinids, which are closely allied to those in the Wardak succession and determined by Lys and Lapparent (1971) as *Pseudofusulina ambigua* Deprat. I believe, however, that these fossils actually belong to a new species, *P. karapetovi* n. sp. An equivalent fusulinid assemblage occurs in Zone P2 of the Tezak section and probably indicates a Sakmarian age.

The quartzite of bed 4 is comparable with formation C of the Wardak sequence. Seemingly, there is an obscure unconformity at the base of the quartzite. Bed 5 is correlative with the lower Murgabian based on its stratigraphic position, and beds 6 and 7 correspond with formation E of the Wardak succession.

Only the top beds of the Shalkalay Group are present in the Chagna sequence. The Shalkalay Group is exposed more completely in another succession on the Dashti Nawar Plateau described by Lapparent et al. (1970). This succession contains goniatites, which enable more accurate dating for these siliciclastic rocks. The Wakak, Bokan and Doni Yarchi Formations are distinguished within the Shalkalay Group. The Wakak Formation is dominated by carbonate rocks of Early Carboniferous age; it is unconformably overlapped by black slate, with sandstone and limestone interbeds, of the Bokan Formation.

One bed in the middle of the formation contains the goniatites *"Glaphyrites" stenomphalum* Pareyn. This form closely resembles *Glaphyrites kansasensis* Plummer and Scott from the Gaptank Formation of North America, suggesting assignment to the upper Gzhelian. Somewhat higher in the succession the brachiopod *Cancrinella lyoni* (Prendergast), which is known from the Lyons Formation in western Australia and referred mostly to the Asselian Stage, is present. Thus, the fossils suggest that the Bokan Formation is Gzhelian to Asselian in age.

The Doni Yarchi Formation is composed of slate interbedded with quartzite and bryozoan-brachiopod limestone. Dating of Late Carboniferous to Artinskian based on different faunal groups makes a precise age determination impossible; generally it has been assigned to the Sakmarian.

Another sequence (Fig. 18) was examined by S. S. Karapetov (1970, personal communication) southwest of the Argandab trough near the village of Khargardan (Fig. 1, fusulinid locality 24). In general it resembles the Wardak succession, but it contains a more prolific fusulinid fauna.

The sequence observed from top to bottom is as follows:

Thickness (m)

7. Dolomitic limestone . . . . hundreds of meters thick
6. Thick-bedded, light-gray limestone with chert nodules. Some interbeds contain abundant rugosids and fusulinids including *Pseudoendothyra sp.*, *Nankinella inflata* (Colani), *Staffella* cf. *S. sphaerica* (Abich), *Sphaerulina* sp., *Pseudofusulina* ex gr. *nupera* Leven, *Chusenella* aff. *C. alpina* Kochansky-Devidé and Ramovš, C. *schwageriniformis* Sheng, *Cancellina (Cancellina) sethaputi* (Kanmera and Toriyama), *C. (C.) pamirica* Leven, *Armenina asiatica* Leven (loc. 12b). . . . . >100 m

These fusulinids are typical of the *Cancellina cutalensis* zone of the Kubergandian Stage, but they also may occur at the base of the Murgabian.

5. Dark-gray, dense, bedded limestone with nodules and lenticular interbeds of chert and scarce remains of brachiopods, rugosids and fusulinids including *Minojapanella* sp., *Nankinella inflata* (Colani), *Staffella sphaerica* (Abich), *Yangchienia iniqua* Lee, *Pseudofusulina pindingensis* (Sheng), *Chusenella subextensa* n. sp., *C.* aff. *C. alpina* Kochansky-Devidé and Ramovš, *Skinnerella speciosa* Skinner, *Misellina (Paramisellina) hauchangensis* Zhang and Dong (loc. 10b and 12a) . . . . 45 m
4. Brownish gray, well bedded, fine-detrital limestone, sandy at the base, with abundant brachiopods and rare ammonoids. Locally fusulinids including *Minojapanella (Wutuella)* sp., *Chusenella chihsiaensis* (Lee), *C. subextensa* n. sp. and *Skinnerella speciosa* Skinner (loc. 10a) are abundant . . . . 20 m

Skinnerella speciosa also occurs in upper Leonardian and Roadian beds of North America, which are approximately comparable with the Kubergandian.

3. Light-colored quartzose sandstone with siltstone interbeds . . . . 80–100 m

This bed is in the same stratigraphic position as formation C in the Wardak succession.

2. Limestone with bryozoans, echinoid spines, brachiopods, crinoids, and abundant fusulinids (loc. 8). The fusulinids include *Pseudoendothyra* sp., *Pseudofusulina karapetovi karapetovi* n. sp. and n. subsp., and *P. karapetovi tezakensis* n. sp. and n. subsp. On the basis of stratigraphic position and fusulinid species, these beds are correlated with subformation B2 of the Wardak and with limestone zone P2 of the Tezak succession . . . . 10 m
1. The Shalkalay Group: light-colored quartzose sandstone, quartzite, dark-gray siltstone and argillite.

Beds 4 to 6 occur immediately above quartzose sandstone, overlying the Lower Permian (Sakmarian) fusulinid-bearing limestone, and correspond to Formation D in the Wardak succession. Fusulinids in these beds are comparable with those in zones P4 to P6 in the Tezak sequence.

The settlement of Shalkalay is at the end of the Argandab trough, where the Permian succession by this name is located, nearly 120 km southwest of the village of Khargardan. Limestone beds yielding Tournasian corals are overlapped here by the Shalkalay siliciclastic rocks, which are 700 m to 800 m thick, and contain interbeds of limestone with the Sakmarian fusulinids *Pseudofusulina karapetovi* n. sp., and *Monodiexodina* cf. *M. ferganica* Miklukho-Maclay. The thick carbonate Chohan Group overlies the Shalkalay Group.

The Carboniferous–Lower Permian deposits of the Shalkalay Group are preserved only in the axial part of the Argandab trough; the deposits are wedged out on the northwestern and southeastern flanks where the Chohan Group directly overlies lower Paleozoic and Precambrian rocks. Near the village of Sokhjoy on the southeastern flank of the trough, where lower Paleozoic limestones are immediately overlain by limestone and dolomite of the Chohan Group, the base of the Chohan lies on a paleosol. A similar situation occurs on the northwestern flank of the trough near the village of Uruzgan (Fig. 1, fusulinid locality 25; Figs. 14, 15).

Lapparent (*in* Lys and Lapparent, 1971) described the sequence there as follows (from top to bottom):

Thickness (m)

6. Black limestone and dolomite overlain by gray, fusulinid-bearing limestone . . . . 70 m
5. Black, massive limestone containing fusulinids, brachiopods, and corals grading upward into limestone and marl . . . . . 44 m
4. Quartzite . . . . 10 m
3. Marl and yellowish limestone. 10 m
2. Light quartzite. . . . . 15 m
1. Conglomerate with quartz and chert pebbles lies with a sharp angular unconformity on Proterozoic or Lower Paleozoic schist . . . . 1–2 m

Fusulinids recovered from beds 5 and 6 include *Staffella* aff. *S. sphaerica* (Abich), *Boultonia* sp., *Minojapanella (Wutuella) wutuensis* (Kuo), *Yangchienia tobleri* Thompson, *Skinnerella multiseptata crassispira* Leven, *Laosella gigantea* (Deprat), *Eopolydiexodina (Eopolydiexodina) afghanensis* (Thompson), *Verbeekina (Paraverbeekina) pontica* (Miklukho-Maclay), *Afghanella schencki* Thompson, and *Pseudodoliolina ozawai* Yabe and Hanzawa. The presence of *Afghanella* and *Eopolydiexodina* indicates the top of the Murgabian. From the lowermost part of the limestone beds, S. S. Karapetov (1970, personal communication) collected fusulinids including *Staffella sphaerica* (Abich), *Nankinella hunanensis* (Chen), *Pisolina subsphaerica* Sheng, *Yangchienia tobleri* Thompson, *Y. haydeni* Thompson, *Pseudofusulina nupera* Leven, *Chusenella schwageriniformis* Sheng, *C. brevis* (Chen), *Parafusulina uruzganensis* n. sp., and

Presumatrina uruzganensis n. sp. (loc. 238).

Thus, the Uruzgan sequence starts with the top of the Murgabian Stage. Siehl (1967) reported fusulinid-bearing limestone overlain by several hundred meters of thick-bedded, unfossiliferous limestone. The latter is in turn overlain by carbonate rocks of Triassic age.

Hilmand trough. The Hilmand and Argandab troughs are parallel and are separated by an uplift characterized by the absence of Devonian, Carboniferous, and Lower Permian rocks. Siliciclastic rocks of Permian age in the Hilmand trough are correlated here with the Bed Formation. The Bed Formation, which does not exceed 500 m in thickness, is much thinner than the Shalkalay Group. The lower, more sandy portion of the Bed Formation probably is Carboniferous in age. This is suggested by the gradational contact between the Bed Formation and the subjacent quartzose sandstone (150 m to 200 m thick), containing brachiopods of Famennian age. The siliciclastic rocks are overlapped by thick carbonates of the Chohan Group; a ubiquitous, concealed unconformity is assumed to occur between the two sequences. The transgressive nature of the Chohan Group is well exposed around the periphery of the Hilmand trough, where different units lie on rocks as old as Precambrian.

The lower portion of the Permian sequence is best exposed near the village of Gudri Mazar (Fig. 1, fusulinid locality 20), where S. S. Karapetov (1970, personal communication) described the following stratigraphic sequence, from younger to older (Fig. 19):

Top not exposed — Thickness (m)

8. Gray, thick-bedded limestone .... 100 m

7. Alternation of dark-colored, bedded limestone and minor siltstone. Near the top is marlstone (8–10 m thick) with abundant brachiopods, rugosids, ammonoids, and crinoids . . 250 m

6. Limestone, similar to that in bed 4, containing the fusulinids *Eoparafusulina* sp., *Darvasites pseudosimplex* (Chen), *Pseudofusulina karapetovi gudriensis* n. sp. and n. subsp., *and P. karapetovi tezakensis* n. sp. and n. subsp. (loc. 85) .... 20 m

5. Dark-gray, well bedded sandstone .... 20 m

4. Detrital limestone with abundant fusulinids, bryozoans, and crinoid ossicles. Fusulinids recovered are *Darvasites pseudosimplex* (Chen), *D. afghanensis* n. sp., *Pseudofusulina karapetovi karapetovi* n. sp. and n. subsp., *P. karapetovi tezakensis* n. sp. and n. subsp., *P. karapetovi gudriensis* n. sp. and n. subsp. (loc. 85a and 85b) .... 25 m

3. Dark-gray siltstone, argillite and sandstone; indeterminable brachiopods occur at the base .... 80 m

2. Siltstone and sandstone resembling the subjacent beds but dominated by siltstone .... 120 m

Because the contact with the underlying rocks is gradational, unit 2 generally is assigned to the Carboniferous.

1. Light-colored, quartzose sandstone with dark-colored siltstone interbeds; a thin conglomerate bed marks its base. Brachiopods are Famennian in age .... 180–200 m

Intensely disrupted schist of Proterozoic age.

The fusulinids in beds 4 and 6 represent the same assemblage as in Zone P2, corresponding to subformation B2 in the Tezak and Wardak sequences. This suggests a Sakmarian age. Therefore, bed 3 may be of Asselian to early Sakmarian age. Beds 7 and 8 are unfossiliferous.

Similar rocks also were studied on the left bank of the

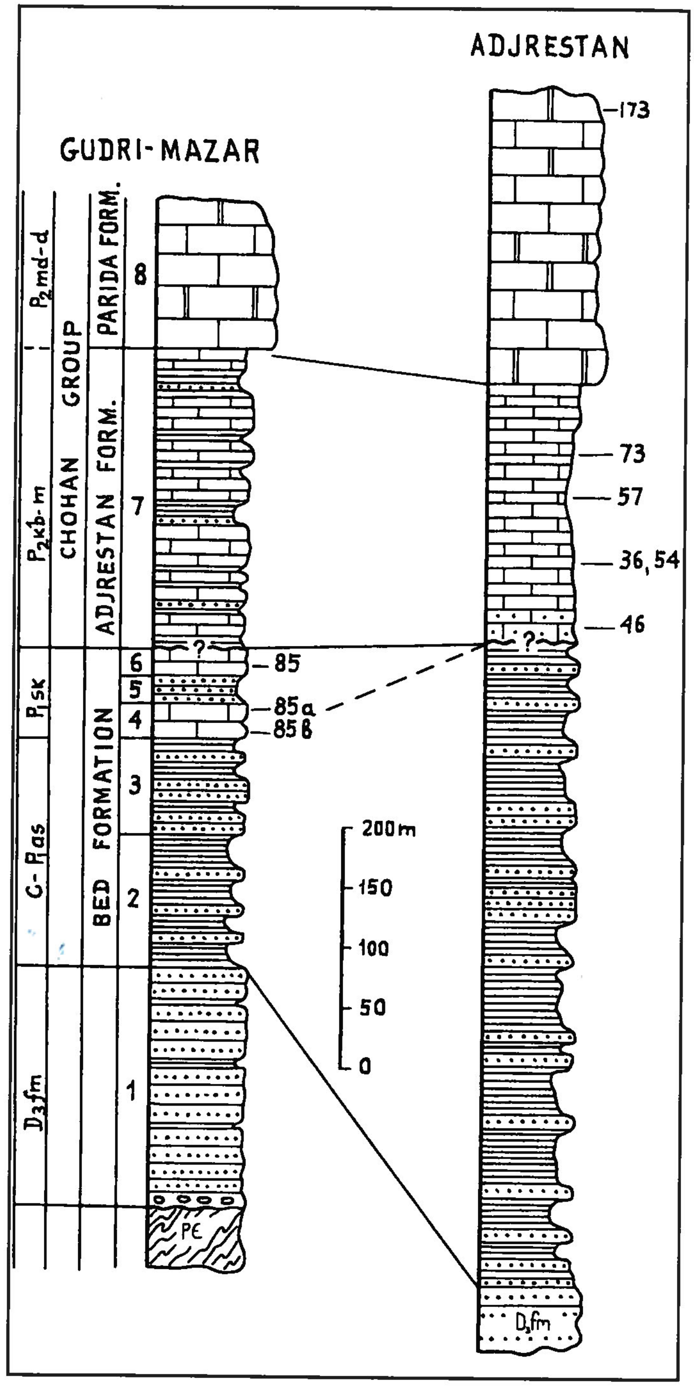


Figure 19. Permian sequences near the villages of Gudri Mazar and Adjrestan (after S. S. Karapetov, 1970, personal communication). Numerals on right indicate fusulinid localities. Units are described in the text. D_3fm = Famennian; C = Carboniferous. See Table 1 for other ages.

Adjrestan River, southeast of Gudri Mazar (Fig. 19). Intensely deformed phyllite and schistose strata of Precambrian age here are overlapped by Famennian quartzite and conglomerate that grade into the Bed Formation (500 m thick), apparently conformably. At 100 m below the top of the Bed Formation, thin interbeds of sandy limestone contain brachiopods of Late Carboniferous to Early Permian age including *Chonetes sp.*, *Neospirifer nitensis* (Diener), *Callispirina ornata* (Waagen) and *Cleiothyridina sp.*

The superjacent carbonate rocks of the Chohan Group are divided into two formations, the Adjrestan and Parida. The Adjrestan Formation, probably corresponding to bed 7 of the Gudri Mazar sequence, is composed of dark-colored, well bedded, organic limestone, locally sandy at the base, and 200 m to 250 m thick. Rugose corals and fusulinids including *Staffella sphaerica* (Abich), *Nankinella hunanensis* (Chen), and *Chusenella sp.* (loc. 46) are abundant. These fossils are regarded as Kubergandian to Murgabian in age. The upper beds of the succession yield lower Murgabian fusulinids including *Sphaerulina croatica* Kochansky-Devidé, *Pisolina subsphaerica* Sheng, *Nankinella inflata* (Colani), *N. orbicularia* Lee, *Yangchienia iniqua* Lee, *Schubertella sp.*, *Chusenella cheni* Skinner and Wilde, *C. pseudocompacta* Sheng, *C.* cf. *C. subextensa* n. sp., *Neoschwagerina simplex simplex* Ozawa, *Presumatrina neoschwagerinoides* (Deprat), *P. ozawai* (Hanzawa), and *P. schellwieni* (Deprat) (loc. 36, 54, 57, 73).

A Kubergandian to early Murgabian age of the Adjrestan Formation implies the presence of an unconformity between it and the subjacent siliciclastic rocks because Yahtashian and Bolorian fossils are lacking. A probable hiatus between the Sakmarian and Kubergandian Stages also has been pointed out in a number of sequences of the Argandab region such as Wardak, Khargardan, and Sabzab-Adjar.

The Parida Formation, which composes the thicker, upper portion of the Chohan Group, consists of thick-bedded, dolomitic limestone, and dolomite; fossils are rare. In the only outcrop near Chohan village, upper Midian-Dzhulfian smaller foraminifers and fusulinids, including *Hemigordiopsis renzi* Reichel, *Shanita amosi* Bronniman, Whittaker and Zaninetti, *Colaniella* cf. *C. cylindrica* Miklukho-Maclay, *Kahlerina sp.*, *Nankinella sp.*, *Reichelina changhsingensis* Sheng and Zhang, and *R.* cf. *R. media* Miklukho-Maclay, were recovered from near the top of the Parida Formation. Occurrences of *Colaniella sp.*, *Nankinella sp.*, and *Reichelina sp.* were reported by Siehl (1967) from the same stratigraphic interval of the Tangi Kautarga sequence near the village of Wardak. The presence of the Dorashamian Stage is questionable as is the case elsewhere in central Afghanistan.

The Bed Formation thins to the margins of the Hilmand trough where gritstone and conglomerate appear, and locally the rocks become red. Similar sequences occur at the southwest periphery of the trough near Urhon, Kedjran, and Murtch. Farther southwest, near the village of Bashlang, the siliciclastic Permian section pinches out, and a basal conglomerate (8–10 m thick) separates Upper Permian carbonate rocks from the underlying nearly vertical Precambrian schist (Dronov and Karapetov, 1970, personal communication) (Fig. 15). There the sequence starts with upper Murgabian or Midian rocks which accumulated during the maximum Late Permian transgression. Above, thick-bedded limestone and dolomite of the Chohan Group occurs; its base is marked by numerous fossils, including the fusulinids *Yangchienia sp.*, *Schubertella sp.*, *Chusenella sp.*, *Verbeekina (Verbeekina) verbeeki* (Geinitz), *and Sumatrina sp.* (loc. 470).

There are several observations that can be made concerning the geology of the Permian succession:

1. The sequences in the Argandab and Hilmand troughs are in general very similar, being distinguished only in stratigraphic completeness that depends on their position in the troughs. The most complete sections are in the centers of the troughs in their deepest, northeastern parts; on the peripheries and on intermediate uplifts, sections are incomplete.

2. In the centers of the troughs, sections consist of two nearly equal facies: siliciclastic below and carbonate above. Only the carbonate rocks are known outside the troughs.

3. The siliciclastic rocks belonging to the Shalkalay Group in the Argandab trough are Carboniferous and Permian in age. In the Hilmand trough the siliciclastic rocks composing the Bed Formation may be entirely Permian in age. This unit spans both the Asselian and Sakmarian Stages and the boundary between the Permian and Upper Carboniferous may be drawn only approximately. The Sakmarian fauna is endemic, being more closely related to the peri-Gondwanan than to the east European biota (Leven, 1993a).

4. The carbonate portion of the Permian succession is referred to as the Chohan Group. It transgressively overlies siliciclastic rocks, often with an unconformity. The group is overlain by thin-bedded limestone containing *Claraia aurita* (Hauer) of Early Triassic age. The Permian-Triassic boundary is distinct, owing to a probable short-term hiatus in sedimention.

5. The Chohan Group in the Hilmand trough commonly is divided into two parts that are named the Adjrestan and Parida Formations. Dark-colored, laminated, organic limestone dominates the Adjrestan Formation, and light-colored, thick-bedded dolomite and dolomitic limestone dominate the Parida. The lower part of the carbonate section is thick and variable. The subjacent siliciclastic unit nearly wedges out on the marginal uplift so that dolomite and dolomitic limestone overlie the Precambrian, with only a thin conglomerate at the base.

6. The entire Kubergandian and Murgabian Stages are recognized within the Chohan Group, but most of the sequences, except for the Tezak exposures, lack rocks of Yahtashian and Bolorian ages. The presence of *Shanita, Hemigordiopsis*, and *Reichelina* near the top of the Chohan Group indicates a Midian to Dzhulfian age. The presence of Dorashamian strata has not been established, and probably they are not present.

7. The Asselian-Sakmarian faunal assemblages in the region are endemic and closely related to the cold-water Gondwanan faunas. The succeeding faunas are of a more warm-water charac-

ter, because they are similar to assemblages widespread throughout the Tethys. The change in faunal assemblages coincides in time with the beginning of a trangression that advanced from the northeast, spanning both the Hilmand and Argandab troughs, and covering surrounding areas in late Murgabian-Midian time.

Kabul massif. Permian sections exposed within the Kabul Massif closely resemble those of central Afghanistan and those on the uplift rimming the Hilmand and Argandab troughs. Hayden (1911) first mentioned Permian rocks in this region, which he placed within his Khingil Group. Later the lower, Permian portion of the group, the Tangi Garu Formation, was described by Mennessier (1961, 1963, 1977), Siehl (1967), Fischer (1971), and others. The Khingil Group lies with a discordant contact on the Precambrian (or Vendian-Cambrian) Lataband Group. The Khingil Group is best represented on Khingil Ridge near the village of Dei Sabs northeast of Kabul.

The most complete description of the Permian portion of the group was made by Fischer (1971), who designated three units, from upper to lower:

Thickness (m)

3. A productid-bearing limestone (beds 7 to 27) generally thicker bedded than the underlying fusulinid-bearing rock and forming a well marked ledge on the slope. It consists of dolomitic, bituminous, sandy, and clayey limestone; some interbeds contain numerous chert nodules. Brachiopods, gastropods, and a few ammonoids, corals, and nautiloids occur throughout. Poor preservation renders some specimens unidentifiable. Corals, abundant in bed 16 and forming a traceable bed at about 100 m above the base of the unit, are represented by *Iranophyllum sp.* and *Waagenophyllum indicum* (Waagen and Wentzel). From bed 18, 40 m higher, *Pseudouddenites(?)* sp. is recognized. Species present in the succeeding bed are *Gyrtipecten sp.*, *Linoproductus sp.*, *Costiferina indica* (Waagen), and others. From bed 21, 66 m below the top of the unit, *Oldhamina decipiens* (Koninck) and *Keyserlingia sp.* are present . . . . 278 m
2. Fusulinid limestone (bed 1 to 6). The lower part of the unit is dolomitic limestone with recrystallized fusulinids (Schwagerinida) and gastropods. Bed 1 is 8 m thick. It is succeeded by reddish brown, locally cross-bedded quartzite, quartzose sandstone, phyllite, and slate. Bed 2 is 19.6 m thick. Above is a locally slaty dolomitic limestone (beds 3 to 6) with distinct hornfels intercalations. The limestone locally contains abundant fusulinids, and brachiopods and gastropods are common in the slaty intercalations. The intensely recrystallized fusulinids in bed 4 include *Pseudofusulina sp.*, *Parafusulina sp.*, and *Pseudodoliolina sp.*, and in bed 5, *Nankinella sp.* and *Neoschwagerina cf. N. craticulifera (Schwager)* . . . . 30 m
1. Basal conglomerate dominated by quartz pebbles grading upward into sandstone; the underlying Precambrian metamorphic rocks are represented in the pebbles. The basal rocks fill depressions on the surface of the subjacent beds . . . . . 0–85 m

The productid-bearing limestone (unit 3) is overlain by ceratitic beds with an abrupt contact. Yellowish gray, thin platy to slaty, marly limestone with *Eumorphotis sp.* and *Claraia sp.* occur at the base, and *Ophiceras* sp. occurs 1.5 m higher. According to Fischer (1971) the Permian productid-bearing limestone beds and Triassic ceratitic beds are apparently conformable, but Ishii et al. (1971) reported that the Triassic strata overlie an eroded burrowed surface of Permian limestone. Poor preservation of the fossils complicates dating of the beds in the sequence, but almost all of them may be assigned confidently to the Late Permian. Brachiopods from bed 21 may be regarded as Dzhulfian in age. Corals from bed 16 are most frequent in rocks of Midian age. *Neoschwagerina* from bed 5 indicates a Murgabian or Midian age, and *Pseudodoliolina* from bed 4 is common in Kubergandian to Midian deposits inclusively.

Fischer (1971) assumed an Artinskian age for the lower beds of the sequence, but provided no arguments favoring this assumption. N. G. Vlasov (1970 personal communication), however, collected a sample from immediately above the basal conglomerate and sandstone (seemingly from bed 1 of Unit 2 of Fischer's section) containing *Eoparafusulina*, a genus ranging into the Bolorian, but most characteristic of the Sakmarian Stage. In south Afghanistan, *Eoparafusulina* occurs in the first interbeds of Sakmarian fusulinid limestone overlying the thick siliciclastic Shalkalay Group. Therefore, bed 1 and the basal conglomerates are questionably regarded as Sakmarian in age. If this is true, an unconformity between Fischer's (1971) limestone bed 1 and sandstone bed 2 would be implied, because the Yahtashian and Bolorian Stages are missing. With this interpretation, the sequence is very similar to the Wardak succession with the only difference being that in the Wardak the Sakmarian beds are underlain by a thick siliciclastic unit (Shalkalay Group), whereas these beds are lacking on the Kabul Massif.

The suggestion that Late Permian carbonate deposition on the Kabul Massif was preceded by a regression is supported by the presence of terrestrial rocks in the vicinity of the village of Rajan. As Dronov and Scherbina (*in* Dronov, 1980) report, these rocks consist of sandstone, conglomerate, siltstone, and volcanic strata, attaining a total thickness of 200 m. A terrestrial flora includes *Pecopteris* sp., *Sphenopteris* sp., *Lobatennularia* sp., Pursongia(?) sp., *Cordaites* sp., *Taeniopteris* sp., *Phylladoderma* sp., and *Walchia* aff. *W. piniformis* (determinations by S. V. Meyen, *in* Dronov, 1980). According to Meyen, these forms closely resemble plants of the Kazanian Stage that is at least in part correlative with the Murgabian. Sandstone of bed 2 in the above sequence also has cross-bedding and commonly red coloration, so it probably belongs to this same terrigenous formation and probably is Murgabian in age.

Suleiman-Kirthar area. Outcrops of Permian rocks are mainly concentrated in the northwestern part of this area, being restricted to the fault zones and nappes which rim the Kabul Massif on the east. Permian rocks also are recognized in the northeastern part of the area, northeast of the town of Gardez (Fig. 1), and form a strip in the northwestern part of the area extending northeast from Altimur Pass along the road which connects Kabul and Gardez to the villages of Kazim Khel, Ali Khel, and Azrao. Permian rocks, represented by a limestone and dolomite unit commonly correlated with the Tangi Garu Formation of the Kabul Massif, overlie a siliciclastic unit. The carbonate unit is still poorly known, owing to the complexity of the structure. Sections have been studied by Siehl (1967), Kaever (1967, 1970), Mennessier (1970), Karapetov et al. (1973), Vachard (1980) and Sh. Sh. Denikaev (*in* Dronov, 1980).

The best studied section is exposed in the vicinity of the Altimur Pass. Siehl (1967) reported the presence of both siliciclastic and carbonate units. The former is composed of 110 m of phyllite, siltstone, and graywacke sandstone, with limestone lenses. It overlies volcanics of uncertain age with an obscure contact. Fossils were not recovered by Siehl (1967) from the terrigenous unit, but he assumed it to be Late Carboniferous to Early Permian in age. According to Siehl (1967), conglomerate and sandstone beds, which are overlain by sandy limestone, lie on a scoured surface of the lower terrigenous unit. These upper beds attain a thickness of 150 m. Fusulinids determined from the sandstone are *Minojapanella, Yangchienia,* and *Eopolydiexodina;* in the overlying sandy limestone large specimens of *Parafusulina* are referred to the "Darvazian Stage" which corresponds to the Yahtashian, Bolorian, and Kubergandian Stages in the recent Tethyan Scale. *Eopolydiexodina* and *Yangchienia* first appear in the Kubergandian, and become highly typical of Murgabian time.

As Siehl (1967) reported, the carbonate unit in the vicinity of Altimur Pass can be divided into three units. The base of the lowest of these units, which is 400 m thick, is represented by thick-bedded and massive, algal-fusulinid and reefal limestone, containing *Neoschwagerina* and *Colania;* beds above contain *Reichelina, Codonofusiella,* and *Lantschichites.* In Siehl's (1967) opinion this lower portion of the sequence is Murgabian, although now strata with these fusulinids would be considered Midian.

The highest unit is composed of 220 m of a better stratified limestone unit with chert nodules. Large fusulinids are lacking, but numerous, small aberrant fusulinids including *Codonofusiella, Lantschichites*, and *Reichelina*, and the lagenid *Colaniella* are present. All of these foraminifers except *Lantschichites*, which is known to range from the top of the Midian into the Dzhulfian Stage, are characteristic of the Dzhulfian and Dorashamian. The succession is capped by 120 m thick, almost fossil-barren dolomite, which is overlain by Lower Triassic rocks (zone of *Owenites*) with apparent conformity.

Paleontological characteristics of the upper portion of the succession described by Siehl (1967) were refined by Vachard (1980). In the stratified limestone with chert nodules, he indicated the presence of corals, bivalves, bryozoans, brachiopods, trilobites, gastropods, ostracods, radiolarians, algae, and foraminifers including *Nankinella* sp., *Reichelina cribroseptata* Erk, *R. minima* Erk, *Lantschichites elegans* Sosnina, *Endothyra sp., Neoendothyra sp., Colaniella parva* (Colani), *Langella conica* Civrieux and Dessauvagie, *Frondina* sp., *Dagmarita chanakchensis* Reitlinger, *Abadehella* sp., *Pachyphloia cukurkoyi* Civrieux and Dessauvagie, *Robuloides gourisiensis* Reichel, *R. lens* Reichel, *R. aequalis* Sosnina, *Globivalvulina vonderschmitti* Reichel, and others.

The upper dolomite contains *Colaniella, Reichelina, Pachyphloia*, and *Climacammina*, and rare brachiopods and corals (Vachard, 1980). Most of the foraminifers are typical of the Dzhulfian, with a Dorashamian age possible for the top of the sequence.

The paleontological characteristics of the Altimur sequence were updated by Karapetov et al. (1973). The fusulinids and corals in the siliciclastic unit show it to be Permian in age. S. S. Karapetov (1970, personal communication) collected prolific *Eopolydiexodina* from the fusulinid limestone bed in this unit (Fig. 20, loc. 285), indicating that the limestone is not older than Kubergandian. Higher in the sequence, a limestone (samples 284 and 284A, Fig. 20) has yielded the fusulinids *Reichelina* cf. *R. changhsingensis* Sheng and Zhang, *Kahlerina pachytheca pusilla* Kochansky-Devidé, *K. globiformis* Sosnina, *K. africana* Skinner, *Nankinella* sp., *Sphaerulina croatica* Kochansky-Devidé, *Dunbarula nana* Kochansky-Devidé and Ramovš, *Lantschichites minimus* (Chen), *Yangchienia thompsoni* Skinner and Wilde, *Rugososchwagerina altimurica* n. sp., *Pseudofusulina hupehensis* (Chen), *P. solita* (Skinner), *Verbeekina (Paraverbeekina) pontica* (Miklukho-Maclay), and *Colania altimurensis* n. sp. Sample 344, which was collected by V. I. Slavin, contains specimens of *Verbeekina (Verbeekina) verbeeki* Geinitz, *V. (Quasiverbeekina) altimurensis* n. sp., *Neoschwagerina haydeni* Dutkevich and Khabakov, and *N. margaritae* Deprat. The presence of *Lantschichites, Reichelina, Colania* and highly advanced species of *Neoschwagerina* indicate a Midian age for the strata.

Another sequence on strike with the sections north of Altimur Pass on the left bank of the Abtchagan River was observed by I. V. Pyzhjnov (*in* Karapetov et al., 1973). A siliciclastic unit within that sequence is 1,000 m thick. Siltstone and sandstone with minor limestone interbeds and lenses are folded here into a tight anticline (Fig. 21). From sample 180 from the core of the fold, *Skinnerella cincta* (Reichel), typical of the Kubergandian Stage, was determined. Somewhat higher in the sequence, Pyzhjanov (*in* Karapetov et al., 1973) identified the

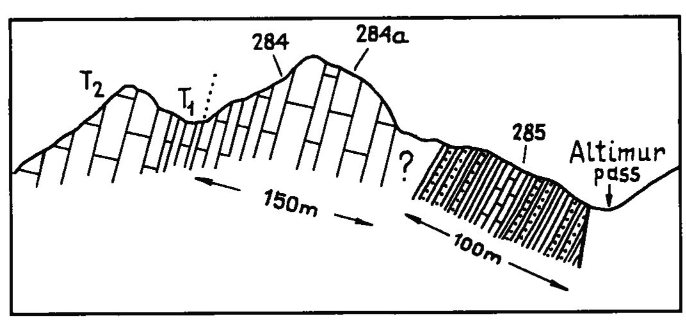


Figure 20. Permian sequence near Altimur Pass (after S. S. Karapetov, 1970, personal communication). T_1 = Lower Triassic; T_2 = Middle Triassic. Numerals indicate fusulinid localities.

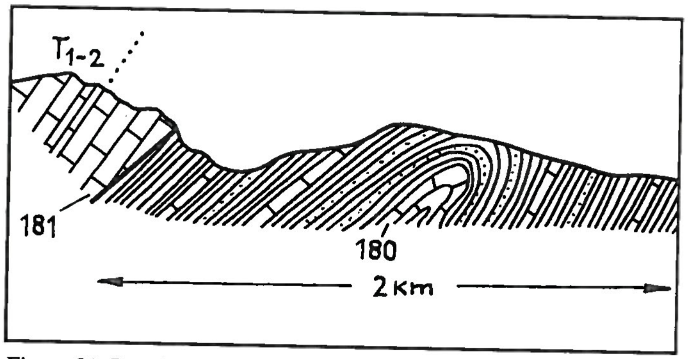


Figure 21. Permian terrigenous unit on the left bank of the Abtchagan River (after I. V. Pyzhjanov, 1970, personal communication). Numerals indicate fusulinid localities. T_1–T_2 = Lower and Middle Triassic.

following corals: *Sinophyllum lophophylloides* Pyzhjanov, *S.* cf. *S. amygdalophylloides* (Huang), *Lophophyllidium* sp., *Timorphyllum* sp., *Plerophyllum* sp., *Paracaninia liangschonensis* (Huang), and *Ufimia elongata* (Grabau).

Permian and Triassic limestones lie above the siliciclastic unit along a fault. Midian fusulinids recovered from the lower Permian part of the limestone include *Yangchienia thompsoni* Skinner and Wilde, *Pseudofusulina* sp., *Parafusulina* sp., *Neoschwagerina bamianica* n. sp. and *Colania altimurensis* n. sp. (loc. 181).

The siliciclastic unit was called the Abtchagan Formation and the carbonate unit the Altimur Formation (Karapetov et al., 1973). On the basis of the corals, Pyzhjanov (*in* Karapetov et al., 1973) considered most of the siliciclastic unit Lower Permian; the lowermost strata are Carboniferous in age. Pyzhjanov (1970, personal communication) included the Kubergandian Stage in the Lower Permian, thus explaining the apparent contradiction between the dating for the siliciclastic unit and the occurrences of typically Kubergandian *Skinnerella*. Because *Skinnerella* has been found in the lower part of the unit (see Fig. 2), the overlying part cannot be older than Kubergandian and it probably spans the Murgabian. This is not in conflict with the reported data of S. S. Karapetov (1970, personal communication) and the fusulinid samples of Pyzhjanov (1970, personal communication) in the section on the right bank of the Abtchagan River (Fig. 1, fusulinid locality 27; Fig. 22). The limestone there overlies the siliciclastic unit with a normal stratigraphic contact. Five m above the base of the limestone the following fusulinids were recovered: *Yangchienia tobleri* (Thompson), *Eopolydiexodina darvasica* (Dutkevich), and *Pseudofusulina* sp. (loc. 175-3). The two latter forms are characteristic of both the uppermost Kubergandian and the lower half of the Murgabian; *Yangchienia tobleri* has been described only from strata as old as the upper half of the Murgabian. *Eopolydiexodina afghanensis* Thompson 60 m higher in the sequence is known to be late Murgabian in age (loc. 175-7).

Thus, I conclude that the siliciclastic unit exposed near Altimur Pass, or at least its fossiliferous part, is referable to the Permian. *Skinnerella*-bearing beds about 1,000 m below the top of the unit are assigned to the Kubergandian. Hence, most of

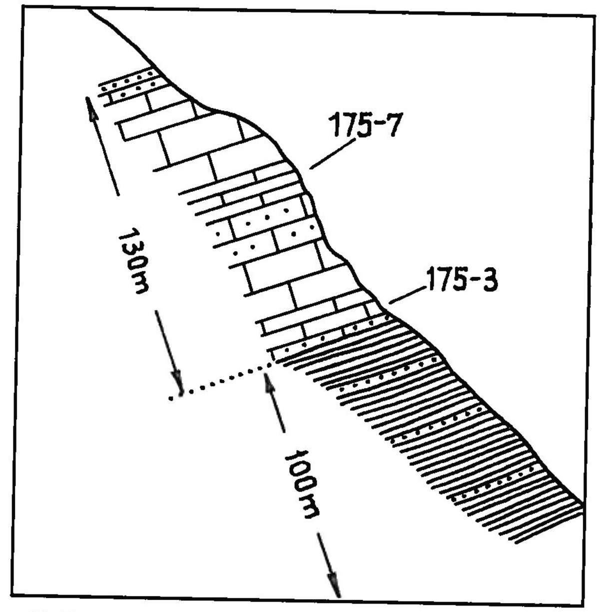


Figure 22. Permian sequence on the right bank of the Abtchagan River (after I. V. Pyzhjanov, 1970, personal communication). Numerals indicate fusulinid localities.

the unit ranges from Kubergandian to Murgabian. The siliciclastic composition of these Kubergandian and Murgabian deposits and their considerable thickness are quite dissimilar to those of the sequences in central Afghanistan, where the deposits of the same age are thin and consist mostly of carbonates. Previous correlations of the sequence near Altimur Pass with the Shalkalay Group, widespread in the Argandab and to a lesser degree in the Hilmand trough, are erroneous.

North of the sections described here, between the villages of Quazim Khel and Ali Khel, the Permian succession was studied by Kaever (1967). He reported the presence of marble of uncertain age unconformably overlain by a thick-bedded, massive, gray, limestone unit as much as 1,200 m thick containing oölitic limestone lenses with the following algae: *Gymnocodium* sp., *Permocalcus plumosus* Elliot, and *Mizzia velebitana* Schubert, *Pseudovermiporella sodalica* Elliot. These algae are common in the Upper Permian. Thick-bedded, dark-colored, fusulinid-bearing limestone 140 m to 200 m thick occurs higher in the section. In its upper portion the following late Murgabian species including *Yangchienia haydeni* Thompson, *Eopolydiexodina afghanensis* (Thompson), *Afghanella schencki* Thompson, and *Neoschwagerina craticulifera* (Schwager) are present. The Permian succession here is capped by a 50 m thick, dark-colored, bedded limestone with bryozoans and brachiopods, which is overlain by a cephalopod-bearing limestone of Early Triassic age.

Near the village of Azrao, Permian deposits are represented by thick limestone formations named the Sangae and Abtchagan Formations (Mennessier, 1970). The Sangae is 500 m thick and contains the fusulinids *Monodiexodina shiptoni* (Dunbar) and *M.* cf. *M. matsubaishi* (Fujimoto). Vachard (1980) correlated the *Monodiexodina* strata of the Azrao sequence with Zone P2 (Sakmarian Stage) in the Tezak sequence of central Afghanistan. Such a correlation, however, is impossible because the *Monodiexodina shiptoni* zone in southeast Pamir is early Bolorian or late Yahtashian and *Monodiexodina matsubaishi* occurs in the Kitakami sequence in Japan with *Codonofusiella* and *Rauserella*, indicating correlation with the top of the Murgabian or Midian Stages.

The Abtchagan Formation, which is 900 m thick, contains typical late Murgabian fusulinids in its lower portion including *Yangchienia haydeni* Thompson, *Rugosofusulina furoni* (Thompson), *Eopolydiexodina persica* (Kahler), and *E*. cf. *E. afghanensis* (Thompson). The contact between the Sangae and Abtchagan Formations is not apparent and some authors assume that these units are almost coeval.

The Permian rocks in the northeastern part of the Suleiman-Kirthar area are yet to be studied. As Sborschikov et al. (*in* Dronov, 1980) reported, they are represented by a very thick (>2,000 m) limestone sequence interbedded with phyllites and shales. The limestone contains indeterminable fusulinids and brachiopods having a Permian aspect. The contact with underlying rocks has not been detected. The superjacent rocks are Triassic in age and made up of a cyclic alternation of limestone and shale.

Nuristan. Permian rocks in this area have been recognized by Denikaev (*in* Dronov, 1980). Both Permian and Triassic formations here are represented by intensely altered carbonate-siliciclastic rocks exposed in faulted zones and in roof pendants in granitoid massifs. Permian fossils have been recovered at two localities. One of these is located on the left flank of the Munjan Valley, near its head. The middle part of the 600 m thick, thin-bedded, black, limestone unit, alternating with phyllitic slate, sandstone, and siltstone, contains *Codonofusiella*, which is characteristic of the Midian and Dzhulfian Stages. In addition, the Late Permian coral *Waagenophyllum* occurs in the Alingar River basin in a 400 m thick, gray and pink, massive limestone unit with quartzite and quartz-sericite schist interbeds. The upper part of the unit contains Triassic corals.

Kunar tectonic zone. Permian deposits are known to occur in a few isolated outcrops within the Kunar region in Kabul Valley, about 40 km east of Jalalabad. These rocks are represented by 300–350 m of light- and dark-gray, thick-bedded limestone and dolomite of the Khak Navar Formation, which unconformably overlies rocks that range in age from Ordovician to Carboniferous. The Permian rocks are overlain disconformably by Lower Triassic limestone (Dronov, 1980). The Khak Navar Formation is considered to be Late Permian in age on the basis of the following corals: *Waagenophyllum virgalense* Waagen and Wentzel, *W. wengchengense* Huang, *Yatsengia* cf. *Y. asiatica* Huang, and *Lonsdaleiastrea sp*. (Weippert et al., 1970; Slavin, 1976).

Tash Kupruk tectonic zone. The Tash Kupruk zone is located in a remote area on the northern slopes of the east Hindu Kush. Permian rocks were recognized by me on the basis of fusulinid samples collected by A. Kh. Kafarskiy in the headwaters of the Tash Kupruk (Baykara) Valley (Fig. 1, locality 30). These rocks lie conformably on coaly shale and sandstone regarded as Middle and Late Carboniferous in age (Kafarskiy and Abdullah, 1976). The Permian part of the succession is about 1,000 m thick and is composed of massive, medium- and light-gray, reefal limestone, containing a 30 to 40 m thick, bedded marlstone interval. The limestone, which is about 1,000 m thick, is overlain by red-colored clastic rocks of Early Cretaceous age.

The Permian faunas are represented by bryozoans, gastropods, corals, crinoids and fusulinids. Fusulinids have been collected from several levels. The oldest assemblage from near the middle part of the limestone unit contains *Schubertella* sp., *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth), *P. magna* Toriyama, *P. fusiformis* (Schellwien and Dyhrenfurth), and *Chalaroschwagerina kushlini* (Leven) (loc. 1400-1-20). These species are characteristic of the upper Yahtashian or lower Bolorian Stages. At several levels higher in the section, *Pseudofusulina* and *Skinnerella*, which commonly are indeterminable at the species level, are present. The only forms that I have identified with certainty are *Pseudofusulina fukasensis* (Suyari) (loc. 1400-1-8) and *Skinnerella yabei asiatica* (Leven) (loc. 1400-1-4). The first species is known from Bolorian deposits of Japan and the Darvaz area; the second is represented by a subspecies described from Kubergandian rocks of north Pamir. In addition to the cited forms, the following smaller foraminifers and fusulinids are recognized from different parts of the succession: *Globivalvulina sp.*, *Hemigordius* sp., *Nodosaria* sp., *Pachyphloia* sp., *Cribrogenerina* sp., Textularidae gen. and sp. unident., *Boultonia* sp., and *Minojapanella* sp.

Farahrud trough. The Farahrud trough is filled by several kilometers of Jurassic and Cretaceous volcanogenic rocks. Older deposits are restricted to fairly small tectonic wedges; their contacts with the superjacent Cretaceous rocks are uncertain.

Paleozoic outcrops were recognized by Dronov (1980) in the drainage areas of the Pushti Rug, Darjai Karajangal and Mene Bum Rivers. Here, beneath the Jurassic-Cretaceous rocks, a 4,000 to 5,000 m thick succession of black polymictic sandstone, siltstone, and argillite that is interbedded in the upper part with detrital limestone is exposed. The fusulinids are poorly preserved except those in large, redeposited, fusulinid-bearing limestone olistoliths.

Minor Permian exposures are known at the northwestern edge of the Farahrud trough on Kohe Gulanji, Kohe Guloga, and Salsella-Kohe-Bandi-Bedak Ridges. These were first recognized by H. Bergman (*in* Dronov, 1980), who encountered fusulinids of Murgabian age in limestone beds exposed on Kohe-Guloga Ridge. Later, occurrences of the Permian fossils were verified by Blummel and Dronov (*in* Dronov, 1980) who reported thickbedded fusulinid limestone surrounded by faults on Kohe Gulanji Ridge. I have identified the following fusulinids of late Murgabian to early Midian age from this 150 m thick limestone: *Nankinella sp.*, *Leella* sp., *Sumatrina annae* Volz, *Afghanella tumida* Skinner and Wilde, *Neoschwagerina sp.*, and *Verbeekina (Verbeekina)* cf. *V. verbeeki* (Geinitz) (loc. 5859-1, 1504-5). In Dronov's (1980) opinion these limestones are at the top of the succession that he observed on Salsella-Kohe-Bandi-Bedak Ridge. The base of that succession consists of dolomite as much as 100 m thick, partially replaced and interbedded with chert. Higher in the section there is multicolored, calcareous sandstone, slaty limestone, and marl, alternating with lenticular, basic volcanic rocks. The limestone contains indeterminable fusulinids and textulariids. The succession is capped by a 50 m thick, thick-bedded, gray limestone. Fusulinids indicate a PermianCarboniferous age for these units.

DISCUSSION AND ANALYSIS OF FUSULINID ASSEMBLAGES IN AFGHANISTAN AND THE PAMIRS

Fusulinids are present in most Permian rocks in Afghanistan, enabling very precise dating and correlation. Fusulinid collections made in Afghanistan for this study, which are the most extensive in existence, include 282 species and subspecies belonging to 58 genera, 22 families, and 7 orders. One family, 1 genus, and 41 species and subspecies are new (Table 2). The fusulinid species listed in Table 2 are all in the author's own material and represent almost all localities described previously as well as many new localities. Species listed in previous studies are not included here because it is not certain that the species concepts of the previous workers are the same as those of this writer.

Analysis of the dispersal of Early Permian fusulinids previously led Leven and Scherbovich (1978) to believe that north and south Afghanistan belonged to different biogeographic provinces: northern and southern Tethyan, located in different climatic belts. The new data, added to information from adjacent regions, especially the Pamirs, generally support this conclusion.

Asselian assemblage

Asselian fusulinids occur only in north Badakhshan where they are confined to the Sebisourkh Formation. Species of *Pseudoschwagerina, Rugosofusulina,* and *Quasifusulina* there are typical of the middle zone of the Asselian. This assemblage also is present in the Darvaz (Leven and Scherbovich, 1978), where it is extremely diverse and shows strong affinities to coeval assemblages from the Urals, south Fergana, and Kunlun.

Asselian fusulinids have not been recovered in south Afghanistan or in any other area regarded as southern Tethyan (Perigondwanan).

Sakmarian assemblage

Sakmarian fusulinids, present in carbonate rocks in the Rudi Tchal and Sourkhob zones of north Afghanistan, have been assigned to 50 species belonging to 17 genera. Species of the genus *Pseudofusulina* are the most numerous. *Quasifusulina, Paraschwagerina,* and *Rugosofusulina* occur frequently; *Sphaeroschwagerina, Pseudoschwagerina, Zellia, Darvasites,* and *Dutkevitchia* are less common; and the remaining genera are represented by single occurrences. All genera, except *Darvasites,* and most of the species in this assemblage occur also in Asselian rocks in the Darvaz, Tien Shan, and the Urals, thus linking the Asselian and Sakmarian assemblages regionally.

The Rudi Tchal and Sourkhob assemblages differ in that *Paraschwagerina* is important at Rudi Tchal and species of *Pseudofusulina*, including *P. haydeni, P. mikhailovi, P. menessieri, P. lapparenti, P. kattaganensis*, and *P. ellipsoides*, which have not been found in the Sourkhob assemblage, are abundant at Rudi Tchal.

The Rudi Tchal fusulinid assemblage shows affinities to the upper Asselian-Sakmarian faunas of southern Fergana (Uzbekistan) and the Kelpin Mountains of Xinjiang. The Sourkhob assemblage is most closely related to that of the south Darvaz.

In southern Afghanistan, fusulinids appear in the first carbonate rocks deposited upon a sequence of terrigenous rocks. The fossil-bearing beds are thought to be late Sakmarian, but they may be in part early Artinskian.

The Sakmarian fusulinid assemblage of south Afghanistan is quite dissimilar to that of north Afghanistan, the former consisting almost entirely of large numbers of only a few species of *Pseudofusulina*. Of the eight species from south Afghanistan, one occurs in the Darvaz, five are new, and two resemble forms from Artinskian rocks in the Urals. *Darvasites* and *Eoparafusulina* are notable but uncommon. *Nankinella, Pseudoendothyra, Pseudoreichelina, Schubertella, Boultonia,* and *Rugosofusulina* are all represented by single specimens. This assemblage, which occurs throughout south Afghanistan, also is present in the central Pamirs (Leven, 1993a) and in samples from Karakorum and east Hindu Kush collected by the Italian Research Group and recently studied by the author (Gaetani and Leven, 1993; Gaetani et al., 1995). These data suggest the existence of a single Perigondwanan Sakmarian fusulinid complex, here referred to as the Kalaktach assemblage after the Kalaktach exposure in the central Pamirs where it was first established (Leven, 1959; 1993a). This assemblage shows an exceptional consistency and is easily recognized. The only variation is the presence of *Zellia* and *Robustoschwagerina* in the Pamirian sequences, which supports a Sakmarian age and makes the assemblage more similar to that of the north Pamir and north Afghanistan. However, this assemblage still is more similar to coeval Boreal fusulinid faunas reported from northwestern Canada and Alaska (Ross, 1967; Skinner and Wilde, 1966a) than to the north Tethyan fauna. Species of *Pseudofusulina*, represented by *P. jenkinsi, P. hyperborea*, and other species from North America, are very closely allied with the Kalaktash assemblage, although more advanced. The resemblance between such distant regions of the Earth could be the result of similar, somewhat severe climatic environments.

Yahtashian assemblage

This assemblage is recognized in both the Sourkhob and Darvaz-Transalay zones in north Afghanistan where it is represented by 15 genera and 31 species. In the better studied

Pamirs, the diversity is much greater. This assemblage differs from the Sakmarian one in the appearance of *Pamirina, Mesoschubertella, Chalaroschwagerina,* and *Darvasella.* In addition, the typical Asselian-Sakmarian genera *Sphaeroschwagerina, Paraschwagerina, Zellia,* and *Pseudoschwagerina* are gone. Most abundant and diverse are species of *Pseudofusulina, Chalaroschwagerina, Darvasites, Darvasella, Pamirina,* and *Biwaella.* These genera are dominated by species such as *Pseudofusulina kraffti, P. fusiformis, Chalaroschwagerina vulgaris, Darvasites contractus, Darvasella vulgariformis, Pamirina darvasica,* and *Biwaella omiensis,* that occur widely in the Tethys. Most of these species range into the superjacent Bolorian rocks. The most diagnostic features of the Yahtashian Stage are the presence of *Pamirina* and the lack of the more advanced genus *Misellina*. In the adjacent Darvaz, ammonoids occurring with the fusulinids are closely allied to forms from the uppermost Artinskian beds of the Ural region (Leven et al., 1992).

In south Afghanistan, all species in possible Yahtashian strata, including *Chalaroschwagerina vulgaris, Darvasites ordinatus, Pseudofusulina kraffti*, and *Chalaroschwagerina kushlini*, range into the Bolorian, and so it is not known whether Yahtashian rocks are present in south Afghanistan or not. A lack of Yahtashian strata could be caused by the removal of such beds along a widespread hiatus recognized in the southeast Pamir and traced into some exposures of central Afghanistan.

Bolorian assemblage

In north Afghanistan fusulinids of Bolorian age occur in the Darvaz-Transalay (Obi Tang) and Bamian (Bulola and Khojagor) zones. Compared to the Yahtashian faunas, the Bolorian fusulinid assemblage is somewhat impoverished, represented by only 13 genera and 23 species. This may be the result of incomplete sampling, however, because the Bolorian fauna in the adjacent southwest Darvaz is rich and diverse.

With the addition of material from Darvaz, the Bolorian assemblage appears closely allied to Yahtashian faunas. Members of the *Pseudofusulina kraffti-fusiformis* group, *Darvasites, Chalaroschwagerina,* and *Darvasella* dominate; *Praeskinnerella, Rugosochusenella, Pamirina, Biwaella, Toriyamaia,* and *Pseudoendothyra* are common; and *Quasifusulina, Robustoschwagerina, Mesoschubertella*, and a few other forms are less common. All of these genera also occur in the Yahtashian assemblage, although in different proportions. The most distinctive feature of this assemblage is the first appearance of primitive species of *Misellina*, represented chiefly by the Subgenus *Brevaxina*.

In south Afghanistan, Bolorian fusulinids are represented only in the Sange Dushoh area, where there are a few species of *Misellina, Pseudofusulina, Chalaroschwagerina,* and *Toriyamaia.* In central Afghanistan, several species of *Pseudofusulina, Darvasites,* and *Chalaroschwagerina* are present between beds containing the Sakmarian Kalakhtash fusulinid assemblage and the lower Kubergandian. The species are equally typical of the Bolorian and Yahtashian Stages. Thus, the Yahtashian-Bolorian fusulinid assemblage here is not dissimilar to that occurring in all other areas of Afghanistan and the Pamirs.

In southeast Pamir Bolorian rocks contain typical species of *Misellina, Darvasites, Chalaroschwagerina, Pseudofusulina*, and *Monodiexodina.* The last genus, which is confined to siliciclastic facies, is characteristic of the Lower Permian rocks of the Perigondwanan province and is reported from the Salt Range, Karakorum, and south Tibet. In southeast Pamir, Bolorian fusulinids occur in association with conodonts and ammonoids of the Bostere assemblage; this places the Bolorian assemblage in the Standard Stratigraphic Scale at a level somewhat higher than the Artinskian. Thus, this Stage more of less corresponds to the Kungurian Stage (Leonova and Dmitriev, 1989).

There is a lack of distinction between fusulinid assemblages in south and north Afghanistan at this time in contrast to the Sakmarian assemblages that have almost nothing in common. This suggests an amelioration of the climate and subsequent migration of warm-water species to the southern Perigondwanan regions.

Kubergandian assemblage

Fusulinids of this age in both north and south Afghanistan are more abundant and better studied than those of the Yahtashian and Bolorian. This has allowed recognition of two zonal assemblages of the Kubergandian Stage: the lower, the *Armenina-Misellina ovalis* zone, and the upper, the *Cancellina cutalensis* zone.

The older assemblage occurs in the lower half of bed B in the sequences of Khojagor and Bulola in the Bamian tectonic zone. This low-diversity assemblage includes *Armenina*, the zone-species of *Misellina (M. ovalis)*, and the first occurrence of *Eopolydiexodina*. The upper zone is contained in the upper part of bed B and in the lower part of bed C, where some species of *Cancellina*, including the index species (*C. cutalensis*), appear.

The Kubergandian fusulinid assemblage of north Afghanistan is markedly richer than that of the Bolorian containing 16 genera and 34 species. *Neofusulinella, Yangchienia, Skinnerella, Parafusulina, Eopolydiexodina, Armenina*, and *Cancellina* first appear in this assemblage, and genera also occurring in the Bolorian are represented by new species. *Eopolydiexodina* permits a comparison with the sequences of the Karakul area, north Pamir (Leven, 1965, 1967).

The Kubergandian fusulinid assemblage of south Afghanistan, which includes 36 species assigned to 17 genera, has much in common with that of north Afghanistan. The major difference between them is the presence of primitive *Codonofusiella* and the absence of *Eopolydiexodina* which is typical of north Afghanistan and the Pamirs. Also, as in north Afghanistan, the Kubergandian fauna is much richer than that of the Bolorian. Almost all species are different as are 7 of 17 genera. In addition, many Yahtashian and Bolorian genera are missing

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN

Genera and Species of Fusulinids	Stages*								
	P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
Pamirina sp.		?	x	x	x				
P. (Levenella) pulchra (Wang and Sun)			aff.						
P. (L.) evoluta Sheng and Sun		cf.							
P. (Pamirina) darvasica Leven			x						
P. (P.) nobilis (Wang and Sun)			x						
P. (P.) chinlingensis (Wang and Sun)			x						
Rauserella sp.					?	x	x	?	
R. sphaeroidea Sosnina							x		
R. staffi Skinner and Wilde						x			
Riechelina sp.								x	x
R. changhsingensis Sheng and Zhang							x	x	
Sihotenella sutschanica Toumanskaya							x	x	
Kahlerina sp.							x		
K. pachytheca Kochansky-Devidé							x		
K. globiformis Sosnina							x		
K. africana Skinner and Wilde							x		
Pseudokahlerina compressa Sosnina							x		
Staffella sp.							x	x	x
S. sphaerica (Abich)					x	x			
S. zisonzhengensis (Sheng)						x	x	x	
Pisolina subsphaerica Sheng						x			
Sphaerulina croatica Kochansky-Devidé						x	x		
Leella sp.						x	x		
Nankinella sp.		x		x		x	x		
N. hunanensis (Chen)				g	x	x			
N. orbicularia Lee					x	x			
N. inflata (Colani)					x	x	g		
Pseudoendothyra sp.		x	x	x	?	x	x	x	x
Pseudoreichelina darvasica Leven		x							
Schubertella sp.			x	x	x	x			
S. giraudi (Deprat)		x	x	x	x				
S. silvestri Skinner and Wilde							x		
S. kingi Dunbar and Skinner				x	x				
S. longiuscula Leven				x					
Mesochubertella sp.			x						
M. thompsoni Sakagami			x						
Neofusulinella sp.					x		x		
N. lantenoisi Deprat					x				
N. tumida Leven					x	x			
N. callosa n. sp.					x	x			
N. magna n. sp.						x			
Boultonia sp.			x	x		x	x		
B. willsi Lee			cf.						
B. ogbinensis Chedija						x			
B. yukonensis Ross		cf.							
Russiella pulchra Miklukho-Maclay						x			
Minojapanella sp.		x							
M. (Wutuella) wutuensis (Kuo)					x	x			
Lantschichites minimus (Chen)							x		

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN (continued - page 2)

Genera and Species of Fusulinids	Stages* P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
Dunbarula sp.						x	x	?	
D. kitakamiensis Choi							x		
D. ardaglensis (Chedija)						x			
D. nana Kochansky-Devidé and Ramovš					?	x	x		
Paradunbarula sp.								x	
Codonofusiella sp.							x	x	
C. erki Rauser							x		
C. schubertelloides Sheng							x		
C. simplex n. sp.					x				
Yangchienia sp.				?	x	x	x		
Y. haydeni Thompson						x	x		
Y. thompsoni Skinner and Wilde							x		
Y. tobleri Thompson						x			
Y. iniqua Lee					x	x			
Biwaella sp.				x					
B. omiensis Morikawa and Isomi			x						
B. ellipsoidalis Leven			x						
B. tumefacta n. sp.			x						
B. shiroishiensis (Morikawa and Kobayashi)			x						
B. europae Kochansky-Devidé		x							
Toriyamaia sp.				x					
T. laxiseptata Kanmera				x	x				
Quasifusulina sp.	x								
Q. longissima (Moeller)		x							
Q. pseudoelongata Miklukho-Maclay		x							
Q. karawanensis Miklukho-Maclay		x							
Q. cayeuxi (Deprat)		x							
Q. magnifica Leven			x						
Pseudoschwagerina sp.		x							
P. velebitica Kochansky-Devidé	x								
P. turbida Kahler and Kahler	x								
P. extensa Kahler and Kahler	x								
P. robusta Meek		cf.							
P. confinii Kahler and Kahler		g							
P. parasphaerica Zhang		x							
P. beedei afghanensis Leven		x							
Sphaeroschwagerina glomerosa (Schwager)		x							
S. fusiformis (Krotow)		x							
S. asiatica (Miklukho-Maclay)		x							
Zellia heritschi afghanica n. subsp.		x							
Robustoschwagerina sp.		x	x						
R. tumida (Licharew)			x						
R. kahleri Miklukho-Maclay		x							
R. nucleolata (Ciry)		cf.							
R. geyeri (Kahler and Kahler)		x							
Paraschwagerina pashkovi Leven		x							
P. tianshanensis Zhang		x							
P. inflata Zhang		x							
P. pseudomira margelanica Miklukho-Maclay		x							

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN (continued - page 3)

Genera and Species of Fusulinids	Stages* P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
P. koksarekensis Bensh		x							
P. tinvenkiangi Lee		x							
Rugososchwagerina altimurica n. sp.							x		
R. heratica n. sp.						x			
Kubergandella sarykolensis (Leven)					cf.				
K. insolita (Davydov)					x				
Rugosofusulina sp.			x						
R. stabilis (Rauser)	x								
R. likana Kochansky-Devidé		x							
R. valida (Lee)		x							
R. mariae Leven and Scherbovich		x	g						
R. darvasica Leven and Scherbovich			x						
R. furoni (Thompson)							x		
Darvasella vulgariformis (Kalmykova)			x	x					
D. compacta (Leven)			x	x					
D. ponderosa n. sp.			x						
D. cucumeriformis n. sp.			x						
Dutkevitchia ruzhenzevi (Rauser)		x							
D. complicata (Schellwien and Dyhrenfurth)	x	x							
D. splendida (Bensh)		x							
D. pinyensis (Zhang and Dong)		x							
D. sourkhobensis n. sp.		x	x						
D. jipuensis (Nie and Song)			g		x				
Darvasites pusillus (Schellwien and Dyhrenfurth)		x							
D. contractus (Schellwien and Dyhrenfurth)			x	x					
D. ordinatus ordinatus (Chen)			x	x					
D. ordinatus longus n. subsp.			x	x					
D. wyssi (Reichel)				x					
D. simplex (Schellwien and Dyhrenfurth)		x							
D. pseudosimplex (Chen)		x	x						
D. vandae Leven and Scherbovich		x	x						
D. compactus Leven			aff.						
D. zulumartensis Leven		aff.							
D. afghanensis n. sp.		x							
Chalaroschwagerina vulgaris (Schellwien and Dyhrenfurth)			x	x					
C. vulgarisiformis (Morikawa)				x					
C. tibetica Nie and Song			x						
C. kushlini (Leven)			x	x					
C. bamianica n. sp.				x					
C. sourkhobensis n. sp.			x						
C. formosa Skinner and Wilde			x						
Pseudofusulina sp.			x						
P. karapetovi karapetovi n. sp. and subsp.		x							
P. karapetovi gudriensis n. sp. and subsp.		x							
P. karapetovi tezakensis n. sp. and subsp.		x							
P. macilenta n. sp.		x							
P. hordeola Nie and Song		x							
P. peregrina n. sp.		x							
P. parasecalica (Zhang)		x							
P. farba farba Leven and Scherbovich		x							

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN (continued - page 4)

Genera and Species of Fusulinids	Stages* P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
P. farba grandiuscula n. subsp.		x							
P. acuminatula n. sp.		x							
P. kattaganensis Leven		x							
P. mennessieri Leven		x							
P. ellipsoides bangiensis Leven		x							
P. ellilpsoides afghanensis Leven		x							
P. ellipsoides etypa Leven		x							
P. trompi Leven		x							
P. griesbachi Leven		x							
P. hindukushiensis Leven		x							
P. namakabensis Leven		x							
P. haydeni Leven		x							
P. ovata Zhang		g							
P. mikhailovi Leven		x							
P. lapparenti Leven		x							
P. sourkhobensis n. sp.			x						
P. hessensis orientalis n. subsp				x					
P. neolata (Thompson)				x					
P. fusiformis (Schellwien and Dyhrenfurth)			x	x					
P. kraffti (Schellwien and Dyhrenfurth)			x	x					
P. postkraffti (Leven)				x					
P. isomie Igo				x					
P. heratica n. sp.					x				
P. priva n. sp.					x				
P. numpera Leven						x			
P. hupehensis (Chen)							x		
P. solita (Skinner)							x		
P. bulolensis n. sp.							x		
P. paralpina (Chen)							x		
P. nishiwarensis Kanuma				x					
P. argandabensis n. sp.		x							
P. immensa n. sp.			x						
P. perspicua n. sp.			x						
P. haftkalensis n. sp.						x			
P. cabudcuensis Kalmykova				g					
P. zulumartensis (Leven)				x					
P. kafarskyi Leven and Scherbovich			cf.						
P. huecoensis Dunbar and Skinner				cf.					
P. magna Toriyama			x	x					
P. fukasensis (Suyari)			x	x					
P. paraconcessa Rauser		cf.							
P. quasifusuliniformis Leven					x				
P. consobrina Rauser			aff.	aff.					
P. selencensis Rauser			aff.	aff.					
P. exigua (Schellwien and Dyhrenfurth)			x	x					
P. dzamantalensis (Leven)					x				
P. bactriana Dutkevich			x						
P. pindingensis (Sheng)					x				
P. pseudocompacta Sheng						x			
Praeskinnerella cushmani (Chen)			x	cf.					
P. crassitectoria afghanensis n. subsp.				x					
P. guembeli pseudoregularis (Dunbar and Skinner)				x					
Skinnerella sp.					x				
S. gundarensis Leven					x				
S. undulata (Chen)					x				
S. speciosa Skinner					x				
S. yabei asiatica Leven					x				

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN (continued - page 5)

Genera and Species of Fusulinids	Stages* P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
S. cincta (Reichel)					x				
S. gruperaensis (Thompson and Miller)					x				
S. multiseptata (Schwager)						x			
Parafusulina sp.					x	x	x		
P. uruzganensis n. sp.						x			
Laosella gigantea (Deprat)							x		
L. methikuli (Pitakpaivan)						x	x		
Chusenella sp.					?	x	x		
C. schwageriniformis (Sheng)						x			
C. tieni (Chen)					x				
C. sinensis Sheng							x		
C. minuta Skinner							x		
C. chihsiaensis (Lee)					x	x			
C. brevis (Chen)					x	x			
C. alpina (Kochansky-Devidé and Ramovš)					aff.				
C. subextensa n. sp.					x	x			
C. globulariformis (Dutkevich)			x						
C. cheni Skinner and Wilde					x	x			
C. pseudocompacta (Sheng)							x		
Rugosochusenella sp.					x				
R. dialis n. sp.							x		
Eopolydiexodina (Eopolydiexodina) sp.						x			
E. darvasica (Dutkevich)					x	x			
E. afghanensis (Thompson)						x	x		
E. zulumartensis (Leven)					x				
E. bithinica (Erk)							x		
E. megasphaerica (Leven)							x		
Misellina (Brevaxina) otakiensis (Fujimoto)				x					
M. (B.) dyhrenfurthi (Dutkevich)				x					
M. (B.) olgae Leven				x					
M. (Misellina) ovalis (Deprat)					x				
M. (M.) termieri (Deprat)					x				
M. (M.) megalocula Wang and Sun					x				
M. (M.) aliciae (Deprat)				x	x				
M. (M.) claudiae (Deprat)					aff.				
M. (M.) californica Douglas					aff.				
M. (Paramisellina) houchangenesis Zhang and Dong					x				
Armenina sp					x	x			
A. asiatica Leven					x	x			
A. pamirensis (Dutkevich)					x		x		
A. taurica Mikulkho-Maclay					x				
A. karinae Miklukho-Maclay					x				
A. salgirica Miklukho-Maclay					?		x		
A. crassispira (Chen)							x		
Verbeekina (Verbeekina) sp.							x		
V. furnishi Skinner and Wilde						x	x		
V. americana Thompson et al.							x		
V. (Paraverbeekina) pontica Miklukho-Maclay						x	x		
V. (Quasiverbeekina) altimurensis n. sp.							x		

TABLE 2. STRATIGRAPHIC DISTRIBUTION OF FUSULINIDS IN PERMIAN SEQUENCES OF AFGHANISTAN (continued - page 6)

Genera and Species of Fusulinids	Stages*								
	P_1as	P_1sk	P_1yh	P_1b	P_2kb	P_2m	P_2md	P_2d	P_2dr
Cancellina sp.					x				
C. (Cancellina) primigena Hayden					x				
C. (C.) bella (Zhang and Dong)					x				
C. (C.) sethaputi (Kanmera and Toriyama)					x	?			
C. (C.) pamirica Leven					x	?			
C. (C.) cutalensis Leven					x		cf.		
C. (Shengella) bamianica n. sp.					x				
Neoschwagerina sp.						x	x		
N. simplex simplex Ozawa						x			
N. simplex tenuis Toriyama and Kanmera						x			
N. verae Toumanskaya						x			
N. bamianica n. sp.						?	x		
N. occidentalis Kochansky-Devidé and Ramovš							x		
N. haydeni Dutkevich and Khabakov							x		
N. margaritae Deprat						?	x		
N. kojensis Toumanskaya							x		
Colania altimurensis n. sp.							x		
Yabeina sp.							x		
Presumatrina sp.						x			
P. neoschwagerinoides (Deprat)						x			
P. schellwieni (Deprat)						x			
P. ozawai (Hanzawa)						x			
P. uruzganensis n. sp.						x			
P. longa n. sp.						x			
Afghanella sp.						x	x		
A. robbinsae Skinner and Wilde							x		
A. tumida Skinner and Wilde							x		
A. schencki Thompson						x			
Sumatrina sp.							x		
S. bulolensis n. sp.							x		
S. annae Volz							x		
Pseudodoliolina sp.						x	x		
P. ozawai Yabe and Hanzawa					x	x	x		
P. chinghaiensis Sheng						x	x		
P. oliviformis Thompson et al.						aff.			

*See Table 1 for stage names; g = ex gr.

including *Mesoschubertella, Biwaella, Quasifusulina, Robustoschwagerina, Rugosofusulina, Darvasella, Darvasites*, and *Chalaroschwagerina*. The older assemblages are dominated by *Pseudofusulina,* but in the Kubergandian, *Skinnerella* and *Parafusulina* are predominant.

In the south, as in the north, the Kubergandian assemblage consists of two subassemblages or zones. The upper zone differs from the lower in the appearance of *Cancellina* and the greater abundance of *Yangchienia* and *Armenina*, which are uncommon and are represented by more primitive species in the lower zone. The assemblage of the lower zone is recognized in the upper part of bed 1 and bed 2 of the Sange Dushoh sequence, middle Afghanistan, and Zones P4 and P5 of the Tezak sequence, central Afghanistan. Fusulinids of the upper zone are recognized in beds 3 and 4 of the Sange Dushoh and in Zone P6 of the Tezak sequence.

The fusulinid faunas in both southern and northern Afghanistan are closely related to those described from the type section of the Kubergandian Stage in the southeast Pamir (Leven, 1967, 1981c; Chedija et al., 1986). The only difference is the presence of *Eopolydiexodina* which is unknown in the type Kubergandian.

The composition of Kubergandian faunas and the faunal changes at the Bolorian-Kubergandian boundary in Afghanistan and Pamir also are similar to those in south China, Indochina, Japan, and the Transcaucasus. Evidence of provincialism is restricted to the occurrence of *Eopolydiexodina* which occurs in northern Afghanistan and northern Pamir but which has not been found in other regions.

Murgabian assemblage

In north Afghanistan, Murgabian fusulinids are recognized only in the Bamian sequences. Although only the lower part of the Stage is represented, there are 15 genera and 24 species. The assemblage, which is typical of other Tethyan regions, is dominated by the Neoschwagerinida including *Armenina, Pseudodoliolina, Cancellina, Neoschwagerina, Presumatrina, Afghanella*, and *Verbeekina*. The first three genera range into Kubergandian, but the others first appear in the Murgabian. Schwagerinids are only represented by *Chusenella* and *Eopolydiexodina.* The presence of the latter makes the Murgabian faunal assemblage of the Bamian zone closer to that of the Karakul area. The role of schubertellids, the most numerous being *Neofusulinella* and *Yangchienia*, increases in this zone.

In southern Afghanistan this assemblage is somewhat more varied than in the north, consisting of 19 genera and 38 species. The increased diversity, however, may rather reflect a more thorough sampling rather than an actual difference. Of 15 genera known in north Afghanistan only *Russiella* and *Neofusulinella* are lacking. In south Afghanistan 6 genera, *Staffella, Pisolina, Leella, Pseudofusulina, Parafusulina,* and *Skinnerella*, are lacking in the north although most of them are known from Murgabian rocks in the north Pamir. Similar to the north, fusulinids in the south are mainly lower Murgabian. At the generic level, at least, fusulinids of the southern and northern assemblages are closely allied, similar to those of north and south Pamir.

Midian assemblage

In north Afghanistan, Midian fusulinids have been recognized in beds E and F of the Bamian sequences. They belong to 21 genera and 31 species. *Neoschwagerina, Afghanella, Verbeekina*, and *Eopolydiexodina* are abundant, the latter often being rock forming. *Neoschwagerina* and *Afghanella* are represented by the most advanced species of their genera including *N. margaritae, N. occidentalis, N. kojensis, A. robbinsae,* and *A. sumatrinaeformis*. In many Tethyan successions these species occur in association with *Yabeina* and *Lepidolina* which are lacking here. *Yangchienia, Chusenella,* and *Laosella* are characteristic and very abundant. All of the above genera also occur in the Murgabian, but in the Midian they are represented by more advanced species.

A few genera including *Codonofusiella* and *Reichelina* are common to the Midian and the younger Dzhulfian-Dorashamian. As reported by Lys (1977) and supported by our material, smaller foraminifers of Midian-Dzhulfian age include *Hemigordius reicheli, Hemigordiopsis renzi, Langella conica, Pseudolangella fragilis, Frondina permica, Paraglobivalvulina* sp., *Abadehella conica*, and others.

The most striking feature of the Midian assemblage in the Bamian zone is the abundance of *Eopolydiexodina* in association with large, advanced forms of *Neoschwagerina, Sumatrina*, and *Afghanella*. The coeval assemblage of the Karakul area in north Pamir is identical suggesting that these areas might have been part of a single paleobasin with similar environments.

In most successions in south Afghanistan Midian fusulinids are poorly represented. An exception is the sequence near Altimur Pass in the Suleiman-Kirthar area, where the limestones are filled with well-preserved fusulinids.

Twenty-seven genera and 41 species occur in the Midian Stage of south Afghanistan. The most typical are advanced forms of *Neoschwagerina*. At some localities (Sange Dushoh, Varv), *Neoschwagerina* is accompanied by poorly preserved fusulinids resembling *Yabeina. Afghanella, Sumatrina, Eopolydiexodina,* and *Laosella*, which are very abundant in north Afghanistan, are scarce here. Advanced species of *Neoschwagerina* as well as *Colania* occur in the Altimur sequence in association with numerous specimens of *Dunbarula, Lantschichites*, and *Kahlerina*, and fewer representatives of *Codonofusiella, Reichelina, Yangchienia, Rugososchwagerina, Pseudofusulina*, and *Verbeekina.* Most of these genera occur with *Yabeina* and *Lepidolina*, the index genera for the Midian in many Tethyan sections. In southeast Pamir, *Yabeina, Lepidolina*, advanced species of *Neoschwagerina, Dunbarula, Lantschichites, Kahlerina, Reichelina, Yangchienia, Verbeekina*, and others have been reported (Kotlyar et al., 1989).

The south Afghanistan fusulinid assemblage is characteristic of the lower part of the Midian Stage and shows affinities to the faunas of coeval rocks in other Tethyan regions. Its major feature is the presence of advanced species of most Murgabian taxa, together with taxa typical of the Midian and, in part, of the Dzulfian and Dorashamian Stages.

Dzhulfian-Dorashamian assemblage

Although Dzhulfian and probably Dorashamian rocks occur in both north and south Afghanistan, the fusulinid assemblage is very meager. Only single specimens of *Reichelina, Codonofusiella, Paradunbarula,* and generalized species of Staffellida have been found.

OUTLINE OF THE STRATIGRAPHY AND MAJOR FEATURES OF PERMIAN SEDIMENTATION IN AFGHANISTAN AND THE PAMIRS

Much of the dating of strata, interpretation of the sequences, and the structural geology of the region is based on the author’s more complete knowledge of the adjacent Pamirs. In addition, because some structural-facies zones in Afghanistan extend into the Pamirs (Figs. 1, 2), it seems expedient to reconstruct the environments of Permian sedimentation over a much larger region than that of Afghanistan only. Characteristics of the Permian rocks of the Pamirs that follow here are brief because information on this subject has been published earlier (Leven, 1967; Leven and Scherbovich, 1978; Kotlyar et al., 1983, 1989; Leven et al., 1992).

Asselian Stage

In north Afghanistan and north Pamir, Asselian deposits are recognized only in the Darvaz-Transalay zone where they consist of algal- and fusulinid-bearing, locally biohermal limestone and to a lesser extent, argillite of the Sebisourkh Formation (Leven and Scherbovich, 1978). This unit overlies Gzhelian rocks conformably and attains a thickness of 600 m. In some sections of the southeast Darvaz, middle Asselian deposits unconformably overlie Gzhelian rocks, but in a number of sections the Asselian is lacking. The prevalence of carbonate rocks together with distinctive fusulinid and other fossil assemblages suggests sedimentation in a shallow, warm-water basin, freely connected with Asselian seas of the Kunlun, Tien Shan, south Urals, and southern part of the east European platform.

Outside the Darvaz-Transalay zone, Asselian rocks with *Sphaeroschwagerina* were reported by Lys (1977) in the Sourkhob zone. Also in this zone, the flyschoid unit at the base of the Amir Omad sequence may be Asselian in age. In the remainder of north Afghanistan and north Pamir, Asselian rocks have not been recognized. They were either not deposited or were removed during pre-Sakmarian erosion. Asselian rocks probably are present in south Afghanistan and the south Pamir although this has not been proven. In the central Afghanistan sequences, part of the siliciclastic Shalkalay Group probably is Asselian. In southeast Pamir, the upper part of the siliciclastic Bazar Dara Group (Tash Kozyk Formation) contains late Asselian ammonoids (Ruzhentsev, 1978; Leonova and Dmitriev, 1989).

Sakmarian Stage

A marine transgression led to more widespread deposition of Sakmarian than Asselian rocks in north Afghanistan and north Pamir. The Sakmarian beds rest unconformably on pre-Asselian strata in some of the Darvaz-Transalay sequences, and in the zone of Rudi Tchal, Sakmarian deposits overlie lower Gzhelian beds unconformably and Lower Carboniferous and older slates with angularity. The oldest Permian rocks in the Sourkhob zone, probably Sakmarian, rest on a widespread unconformity.

In the Farkhar drainage in the Rudi Tchal zone, the Sakmarian is represented by shallow-water, multicolored, terrigenous, and minor carbonate facies, whereas the Sakmarian deposits in the Darvaz-Transalay and Sourkhob zones are typically open-sea facies. In the first zone, the Sakmarian is represented by the uppermost limestones of the Sebisourkh Formation and the superjacent flyschoid Khoridje Formation. Where the Sebisourkh Formation wedges out locally, the Khoridje Formation rests on Upper Carboniferous limestone. The Sakmarian rocks attain a total thickness of 790 m. The Khoridje Formation may correspond to a carbonate-terrigenous unit at the base of the sequence traceable along Chon Creek in the Sourkhob zone. Fusulinid limestones of Sakmarian age may belong to the upper part of the underlying flyschoid unit in the Amir Omad sequence.

In the areas south of north Pamir and north Afghanistan, Sakmarian rocks are unknown. However, they probably are present in the siliciclastic Permian unit developed in the Jaway zone that extends into the zones of Kurgovad and Kalaikhumb-Sauksai (Pshiharv and schistose Beleulin Formations) in north Pamir.

In summary, the Sakmarian Stage in north Afghanistan and north Pamir is represented by marine facies overlying both Asselian and older rocks. The fragmentary nature of Sakmarian outcrops and an inadequate knowledge of the sequences prevents assessing the size of the paleobasin, distribution of lithofacies, and depositional environments. An area of erosion was located to the north and northwest, the Rudi Tchal zone was in a nearshore environment, and the zones of Sourkhob and Darvaz-Transalay were situated in more open marine settings. The Jaway-Kurgovad and Kalaikhumb-Sauksai zones represent deep-water settings far from the shore. These three strips of Sakmarian rocks are separated by large faults, and so the original relationships are unknown.

The Sakmarian fusulinid assemblage is diverse and closely allied with Asselian faunas; it also shows strong affinities with Sakmarian faunas of Fergana. The similarity with Uralian assemblages is less pronounced than that in the Asselian, indicating the initial stage of separation from the east European paleobasin.

The top of terrigenous units in the Lower Permian in most of the sequences of south Afghanistan and south Pamir are Sakmarian as indicated by prolific brachiopod and bryozoan faunas from the Doni Yarchi Formation, Dashti Navar sequence, and the lower member of the Wardak Formation B in central Afghanistan. An analogous fossil assemblage has been reported from the uppermost part of the Tash Kazyk Formation in the southeast Pamir (Grunt and Dmitriev, 1973; Gorjunova, 1975). Other deposits of the same age occur in the Khaftkala zone of middle Afghanistan, where they are represented by quartz sandstones (bed 1), unconformably overlying Lower Carboniferous rocks and sandy marlstones and limestones with brachiopods and corals (bed 2), and in the central Pamir.

In the central Pamir, a basal, Permian sandstone-conglomerate sequence followed by marls and limestones of the lower portion of the Dangi Kalon Formation, which contains bryozoans and corals (Dronov and Leven, 1971; Leven, 1993a), overlaps Precambrian(?) schists. These two units are comparable with beds 1 and 2 in the Khaftkala sequence, respectively (Fig. 10). Beds 3 and 4 in Khaftkala sequence and the upper part of the Dangi Kalon Formation in the central Pamir both contain limestones and dolomites with the Kalaktash fusulinid assemblage. Limestones yielding this fossil assemblage also are widespread in central Afghanistan. These include bed 2 in the Tezak succession, Member B2 of Formation B in the Wardak sequence, beds 4 to 6 in the Gudri Mazar, and others. This fossil assemblage occurs in the Khoja Murod zone (bed 1) of middle Afghanistan, but is lacking in the southernmost Pamir, probably because of erosion in post-Sakmarian time. Although the fusulinids indicate a Sakmarian age for these beds, the brachiopods and bryozoans suggest an Artinskian age. Probably part of the sequence belongs to the lowermost Artinskian (Yahtashian?).

Despite some uncertainly in dating, the Sakmarian deposits in south Afghanistan and in the south Pamir are part of a transgressive sequence that began near the end of the Asselian. Terrigenous deposits of an Asselian-Sakmarian age accumulated at shallow depths in Karakorum, Tibet, the Himalayas, Australia, and Iran, as well as Afghanistan. Thus, in the Early Permian, Gondwanaland apparently was rimmed along the north by a continuous terrigenous sheath.

The biota of cold-water bivalves and brachiopods (Termier et al., 1973) suggests that the almost total absence of carbonate deposits is a consequence of a cold climate. In addition, in the southern, high-latitudinal regions, the lower portion of the terrigenous rocks sequence is known to contain diamictites of glacial origin (Dickins, 1985).

The Sakmarian sequence becomes increasingly calcareous upward and limestone finally replaces terrigenous rocks. This trend is observed not only in south Afghanistan and Pamir, but also in the other south Tethyan regions, including Karakorum, Tibet, and Australia. This change, the appearance of the Kalaktach fusulinid assemblage, and the trangression in late Sakmarian time probably was linked to warming and reduction of the Gondwanan ice sheet (Dickins, 1985). Marked difference of the Kalaktash fusulinid assemblage from the Sakmarian fusulinids of north Afghanistan and north Pamir and the affinities of the former with Boreal faunas indicate that, despite warming, the climate in the southern, Perigondwanan regions of the Tethys remained more severe than that in the northern ones, which were conterminal to Laurasia.

Yahtashian Stage

Yahtashian deposits are well developed in the Darvaz-Transalay and Karakul zones of the north Pamir (Leven, 1967; Leven and Scherbovich, 1978; Leven, 1982b; Leven et al., 1992). The tuffaceous Zygar Formation as well as part of the terrigenous Tchelamtchi Formation and carbonate Safetdara Formation in the Darvaz-Transalay zone also belong to this stage. All three formations traverse the Panj River Valley at the frontier and pass into poorly studied areas of north Badakhshan. Nevertheless, the presence of deposits of this age is indicated by fusulinids in the vicinity of the villages of Bedi-Ka and Khami-Bahar (Lapparent and Lys, 1972) and at the base of the sequence exposed on the right bank of the Obi Tang River (Figs. 2–4). The fusulinids are confined to the biohermal and reefal Safetdara limestones. The Yahtashian rocks rest concordantly on the Sakmarian Khoridje Formation. The total thickness of Yahtashian rocks is variable, locally attaining hundreds of meters.

The Safetdara-type limestones and the underlying whitish, platy, argillaceous limestone containing Yahtashian fusulinids are exposed on the left bank of the Sourkhob River (sequences of Vodu and Saidi Kajon). The subjacent sandstones, slates, and argillaceous limestones probably belong to the Sakmarian Stage.

Despite some distinctions, the sequence on the whole, especially in the upper portion, is comparable to that of the Darvaz. Thus, the Sourkhob zone is regarded as a western extension of both the north Pamirian zone of Darvaz-Transalay and north Badakhshan.

The Yahtashian sediments in these zones might have accumulated in similar environments in a single basin with an upland situated to the north-northwest. Reef-forming activity started in the early Yahtashian and by the beginning of the Bolorian, reef massifs merged, forming a continuous band of barrier reefs. The enhanced reef formation and general character of faunas infer water of normal salinity in a tropical climate. Simultaneously, the terrigenous Pshiharv and slaty Beleulin Groups accumulated in the interior part of the basin. These groups are developed in the Jaway, Kurgovad, and Kalaikhumb-Sauksai zones of the north Pamir.

The rich Yahtashian fusulinid assemblage has nothing in common with that of the Artinskian Stage in the Ural region suggesting that complete separation of the east European and Tethyan basins started in the Sakmarian.

The Yahtashian Stage has not been recognized in the southern part of north Afghanistan, but it is represented by limestone in the reefal Zulumart Formation in the Karakul zone of the Pamir. Leven (1967) dated the lower part of the limestone as Sakmarian, but further observations suggest a Yahtashian age. In the Darvaz-Sarykol zone, southernmost north Pamir, Yahtashian fusulinids occur in a thick quartzose sandstone unit (Apac Formation) capping the Darvaz-Sarykol Group.

These data suggest that Yahtashian deposits are widespead in the southern part of the north Pamir. As no indication of the presence of Asselian or Sakmarian rocks in these areas exists, distribution of Yahtashian rocks there may have been linked to a transgressive episode. Similarity of the fusulinids to those from the Darvaz-Transalay zone suggest open marine connections between these areas and similar climates.

Yahtashian rocks have not been recognized in either south Pamir or south Afghanistan. Limestone and limestone conglomerate of bed 2 in the Khoja Murod sequence (Fig. 12) could be referable to this stage, but because Kubergandian fusulinids occur immediately above bed 2, they probably are Bolorian in age. A similar break also was observed in the southeast Pamir and the correlative sequence of the Khoja-Murod zone (Leonova and Dmitriev, 1989; Leven, et al., 1989). The presence of Yahashian rocks in central Afghanistan also is questionable. In the Tezak succession, the limestone Zone P3 (Fig. 16) may be Yahtashian, but fusulinids are lacking.

In summary, south Pamir and all or most of south Afghanistan were subject to erosion during Yahtashian time. Locally Yahtashian rocks composed of thin clastic and clastic-detrital limestone may occur at the base of the post-Sakmarian transgressive assemblage.

Bolorian Stage

The Bolorian Stage is well represented in north Afghanistan and north Pamir. In Afghanistan, deposits of this age are developed in north Badakhshan, in a zone extending into southwest Darvaz. In the Darvaz area this zone is represented in the carbonate Safetdara Formation and the lower, terrigenous part of the Gundara Formation (Leven, 1980a; Leven et al., 1989, 1992). As the lower contact of the Safetdara is of variable age, probably the top of the Tchelamtchi Formation locally is Bolorian in age. On the western limb of the Kuhi Frush–Kwahan anticline (Fig. 2), the uppermost Safetdata and the superjacent, tuff-conglomerate of the Kuljaho Formation, which replaces the Gundara Formation laterally (Figs. 3, 4), are Bolorian. The Kuljaho Formation is more than 1,000 m thick on the southern end of the anticline where it consists of gray and red sandstone, conglomerate and minor siltstone, and argillite with sparce fusulinid limestone interbeds. East of the fault cutting off the eastern limb of the Kuhi Frush-Kwahan anticline, much of the upper Safetdata Formation (Obi-Tang sequence) is Bolorian.

The available data show that marine facies of the Bolorian are replaced by continental ones northward and westward. Thus, Bolorian in the eastern limb of the Kuhi Frush–Kwahan anticline is mainly represented by limestone of the Safetdara Formation, whereas in the western limb only the upper portion of this formation belongs to the Bolorian. On the whole the latter is represented here by sandstone and conglomerate of the Kuljaho Formation. Southwestward in Afghanistan all the Bolorian is composed of red-colored continental rocks (the Vodu section). Still farther west all of the Permian rocks are continental. In the Karakul zone of north Pamir, Bolorian fusulinids occur in the upper part of the Zulumart Formation. The base of the formation belongs to the Yahtashian (Leven, 1967), and Yahtashian and Bolorian Stages appear to be in gradational contact. In the Bamian zone of Afghanistan, Bolorian rocks transgressively overlie Carboniferous or older rocks, being represented by sandstone, siltstone, argillite, and marlstone (unit A, Fig. 7). In the Akjilga zone, north Pamir, Bolorian rocks are composed of conglomerate and limestone unconformably overlapping volcanic rocks and limestones possibly Early Permian in age (Leven, 1967). Thus, in northernmost north Afghanistan and Pamir adjacent to south Tien Shan, Bolorian deposits accumulated in continental environments. In contrast, in southernmost north Afghanistan and Pamir the sea was submerging areas which had been at least partly exposed during all of Asselian and Sakmarian time.

In the southeast Pamir, terrigenous, carbonate, and volcanic Bolorian rocks of the Kotchusu and Shindi Formations overlie the terrigenous Tash Kazyk Formation of Asselian-Sakmarian age with a distinct unconformity (Leonova and Dmitriev, 1989), In central Afghanistan the limestone breccia and oolite- and oncolite-bearing limestone of P3 in the Tezak succession appears to belong entirely to the Bolorian. Thus, a late Sakmarian–early Yahtashian regression was succeeded by the Bolorian transgression in south Pamir and southern areas of north Pamir and Afghanistan during which a thin sequence of shallow-water facies accumulated. The transgression may have started in places in the late Yahtashian.

During the transgression and possibly related to it, warming occurred in both the southern and northern Tethys. This caused a large expansion of the area of warm-water fusulinids to Perigondwanan regions of the Tethys and complete extinction of the cold-water species of the Kalaktash assemblage that had inhabited those regions earlier.

Kubergandian Stage

In north Afghanistan the Kubergandian Stage has been recognized only in the Bamian and Bulola sequences. Deposits of this age also are present in north Badakhshan, beyond the fault cutting off the eastern limb of the Kuhi Frush–Kwahan anticline (Fig. 2). The Safetdara and Gundara Formations developed there continue into Tajikistan in the Siung and Golchak Valleys (Fig. 2). The Gundara Formation, which is composed of black, green, and violet argillite, siltstone, and more rarely by sandstone with algal-fusulinid limestone, is almost entirely Kubergandian in age. The total thickness is 120 m to 150 m. Limestone interbeds decrease upward, where red-violet argillite is dominant. These features suggest a regressive condition.

On the western limb of the Kuhi Frush–Kwahan anticline, the Kuljaho Formation corresponds to the Gundara Formation. However, fusulinids near the top belong to the Bolorian Stage. Therefore, the Kubergandian either is represented in the superjacent tuffaceous Darai-Tang Formation, or it is lacking (Fig. 4). In other areas of the Darvaz, Kubergandian fusulinids are reported only from the Gundara Formation.

The Gundara Formation is well developed north of the Kuhi Frush–Kwahan anticline, where it is represented by gray and multicolored terrigenous rocks. Its lower part, which is assignable to the Bolorian, contains interbeds of tuff and fusulinid limestone. The formation here is several hundred meters thick, increasing northwards in the Gundara drainage area to include reef massifs as much as a kilometer thick (Leven, 1981b).

To the northeast, the Gundara Formation exhibits facies variability and disappears on the northern slope of the Transalay Ridge, where it is either cut off or replaced by continental deposits.

Another section of the Kubergandian crops out in north Pamir and north Afghanistan in the Karakul and Bamian zones. In the first of these zones it starts with a multicolored sandstone and siltstone interbedded with conglomerate at the base and by fusulinid limestone in the upper part (Leven, 1967). The subjacent limestones contain late Bolorian fusulinids. The superjacent rocks are black, bituminous limestone of the Baljand Kiik Formation. The lower part of this formation comprises fusulinids of the upper zone of the Kubergandian Stage with the oldest specimens of *Eopolydiexodina*.

In the Bamian zone, the Kubergandian is composed of a lower black, bedded limestone that becomes lighter and more massive upward (units B and C, Fig. 7). As in the Karakul zone, *Eopolydiexodina* first occurs in these rocks.

In north Pamir and North Afghanistan, Kubergandian rocks are still unknown outside the tectonic zones under consideration. Apparently, the regression which started in Bolorian time continued through the Kubergandian in the Darvaz-Transalay zone. Sedimentation occurred in foreshore, shallow-water environments which were gradually replaced by continental ones toward Tien Shan where volcanic activity was occurring, as indicated by tuffaceous, andesitic, and dacitic interbeds. In the basin, which extended through the Karakul and Bamian zones, Kubergandian deposits that accumulated in open shallow-water shelf environments, are of a transgressive character. A broad strip of terrigenous rocks in the Kurgovad and Kalaikhumb-Sauksai zones separate the Karakul and Bamian zone from the Darvaz-Transalay area.

Kubergandian deposits are more widely developed in the south than in the north of Afghanistan and Pamir. This stage is represented in the Sange Dushoh sequence in middle Afghanistan by nearly 150 m of organic and organic-detrital limestones in the upper part of bed 1 and in beds 2 to 4 (Fig. 11). Fusulinids of Kubergandian age also occur in the Nilbandon zone in beds 2 and 4 (10 m thick). These beds unconformably overlie the terrigenous Syakhkoh Group. Dronov (1980) reported that these zones have much in common with coeval rocks in southeast Pamir. There, Kubergandian deposits are represented by interbedded argillite, siltstone and detrital limestone, ranging in thickness from several meters to 150 m (Leven, 1967; 1981c). The Permian rocks extend from southeastern Pamir to the edge of the Wahan zone. To the south, in the Tash Kupruk zone they are represented by thick reefal limestone. In the Argandab trough in central Afghanistan, the fusulinid limestone and marls of beds P4 to P6 in the Tezak succession (Fig. 16), which attain a thickness of about 400 m, are Kubergandian in age. The Kubergandian fusulinid limestones are underlain by quartz sandstone in the Khargardan sequence. The latter appears to lie unconformably on the terrigenous Shalkalay Group. That unconformity also is apparent in the Wardak succession where red sandstone and conglomerate of bed C overlie Sakmarian limestone. Basal Murgabian fusulinids occur immediately above the sandstone. This suggests that the upper part of the sandstone is assignable to the Kubergandian. In the Hilmand trough fusulinids of late Kubergandian–early Murgabian aspect are present at the base of the calcareous Adjrestan Formation in the Gudri Mazar and Adjrestan sections (Fig. 19). There, this formation lies unconformably on deposits of Sakmarian age.

The Kubergandian Stage of south Afghanistan and the south Pamir is represented in most areas by thin, shallow-water carbonates (tens to hundreds of meters thick). Kubergandian rocks of southeastern Pamir have a distinctive deep-water flyschoid character.

The Kubergandian lies either conformably on the Bolorian or unconformably on Sakmarian rocks. This suggests a continuation of the trangression which started in late Yahashian or Bolorian time. It affected all regions under review except the central Pamir and Khaftkala zone in middle Afghanistan, which remained emergent during the Yahtashian, Bolorian, and Kubergandian.

Fusulinid assemblages of both the southern and northern Pamir are typical of the entire Tethys except that *Eopolydiexodina*, which occurs in the Karakul and Bamian zones, is unknown to the south.

Murgabian Stage

In the Darvaz-Transalay zone in northernmost north Afghanistan and north Pamir, the Murgabian is represented by the thick, red and multicolored, tuffaceous Daraitang Formation and the terrigenous Valvaljak Formation (Leven and Scherbovich, 1978; Novikov et al., 1985). The age is considered Murgabian because this unit overlies the Kubergandian Gundara Formation.

To the south in the Jaway-Kurgovad and Kalaikhumb-Sauksai zones, the Pshiharv Formation and the slaty Beleula Formation apparently are partly Murgabian. Poorly preserved specimens of *Neoschwagerina* occur in the Beleula slates in the Uisu drainage area of the eastern north Pamir. The Kainda Formation, which overlies the Beleula Formation, also may be Murgabian. It is composed of red-violet argillite, siltstone, and sandstone. Large, light-colored limestone bodies with some terrigenous components contain the Murgabian fusulinids *Verbeekina* and *Neoschwagerina*. These rocks could be either reefal or olistoliths and the host rocks may be of Triassic age.

Farther south in the Karakul zone, the Murgabian upper Baljand Kiik Formation is composed of black, fusulinid-bearing limestone locally replaced by thick, massive, reefal limestone (Leven, 1967; Leven et al., 1989). The most typical feature of the Baljand Kiik limestone is the presence of specimens of *Eopolydiexodina* as much as 15 cm long, which in places are rock-forming. In the Bamian zone of north Afghanistan, Murgabian, and Midian limestones also contain prolific *Eopolydiexodina.* The light, thick-bedded limestone of the upper part of bed C and possibly the overlying sandstone and conglomerate of bed D are Murgabian. The latter, however, more likely is Midian. Bed C contains fusulinids indicative of the lower half of the Murgabian Stage, thus the upper part may be lacking.

In the Ak Jilga zone in the Pamir, which adjoins the Karakul zone to the south, the Murgabian sequence, known as the Karai Kashan, differs from those described above by the presence of thick basaltic and tuffaceous units interbedded with sandstone and slate and containing large reefal limestone bodies with fusulinids (Leven, 1981a). Part of this unit probably is Kubergandian and Midian in age.

In the Murgabian, the Darvaz-Transalay zone of north Afghanistan and north Pamir was elevated and converted into a piedmont plain onto which clastics, including products of explosive volcanic activity from the more northerly mountain ranges were deposited (Leven and Davydov, 1979; Novikov et al., 1985). In late Murgabian time, the change from the gray, slaty Beleula Formation to the violet Kainda Formation in the southerly areas suggests uplift. A shallow-water basin was located in the Karakul and Bamian zones farther south where large reef massifs were formed. Even farther south, algal reefs were built on the slopes of a volcanic arc.

Three types of Murgabian and Kubergandian rocks can be distinguished in south Pamir and south Afghanistan. In southeastern Pamir, there is a frequent alternation of clastic and pelitic limestone, marl, cherty-argillaceous slate not more than a few tens of meters thick. In central Afghanistan, the section is represented mainly by thick-bedded, biohermal, detrital, and clastic-detrital, chert nodule-bearing limestone several hundred meters thick. As in the southeast Pamir, Murgabian rocks grade downward into the Kubergandian. In the Suleiman-Kirthar sequence, the lower part is composed of a thick, terrigenous unit with Kubergandian and Murgabian fusulinids.

The sequences are not in contact; therefore, reconstructions of basins is impossible. The pattern of submergence in most of south Afghanistan and south Pamir, as outlined in the Kubergandian, continued into the Murgabian. In central Afghanistan there was deposition of rather thick, shallow-water, organic carbonate deposits. Deeper-water deposits accumulated in the southeast Pamirian trough as indicated by thin-bedded, pelitic carbonate and argillaceous-cherty rocks. Clastic, fusulinid-bearing limestone may have been deposited by sediment gravity flows. In the Suleiman-Kirthar area, Murgabian deposits of unknown thickness contain fusulinid limestone interbeds within terrigenous units, inferring rather shallow water. In at least the early Murgabian no sediment accumulated in the central Pamir or in the Khaftkala zone of middle Afghanistan. Beginning in Yahtashian time, these areas were uplifted.

Similarity of fusulinid assemblages in the northern and southern areas of Afghanistan and Pamir suggest similar climatic environments. Prolific *Eopolydiexodina* in Murgabian rocks of the Karakul and Bamian zones and their nearly complete absence in central Afghanistan and in the southeast Pamir is the result of facies controls rather than climatic ones.

Midian Stage

Midian deposits are of a transgressive character in the Darvaz-Transalay zone of northernmost north Pamir and north Afghanistan. Clastics of the Valvaljak Formation are overlain by gypsum that is succeeded by dark, terrigenous rocks of the Kaftarmol Formation. The latter contains plant, gastropod, and bivalve remains. This unit is overlain by the Kafirbatcha Formation which is composed of algal limestone with upper Midian conodonts (Leven and Scherbovich, 1978; Leven and Kozur, 1977). Its total thickness is 500 m. Midian rocks also are present in the Bamian and Karakul zones. In the former zone the sandy and clayey limestone E and the superjacent massive, biohermal limestone F are Midian. The conglomeratic and sandy unit D, which overlies the lower Murgabian limestone C unconformably, also appears to be assignable to the lower Midian. The successive change from clastics to carbonates suggests an episode of transgression similar to that in the Darvaz-Transalay zone. A similar situation is observed in the Upper Kara Jilga section of the Karakul zone. There, a Midian unit of black, bituminous, fusulinid-bearing limestone is underlain by conglomerate, containing pebbles from the subjacent reefal limestone of Murgabian age (Leven, 1967).

Midian rocks have not been recognized in northern Pamir and Afghanistan, other than in the areas mentioned. In the southern areas of the Pamir and Afghanistan, however, they are ubiquitous.

Everywhere the Midian is represented by limestone, commonly of biohermal and reefal origin. These rocks conformably overlie limestone of the Murgabian in Adjrestan, Tezak, and other sequences of central Afghanistan, but unconformably overlie them in Khoja Murod in middle Afghanistan. In a number of sections Midian units overlap rocks as old as Precambrian. In the central Pamir, limestone with *Codonofusiella, Dunbarula, Kahlerina,* and *Chusenella* rest on Sakmarian fusulinid-bearing limestone, being separated from the latter by a bauxite unit (Leven, 1993a). To the south, in the Rushan-Pshart zone, the Midian is represented by detrital limestone, argillite, cherty slate, basalt and tuff, which overlap a thick terrigenous unit containing early Bashkirian goniatites (Leven, 1995). In central Afghanistan (the Bashlang and Sokhjoy sequences) basal fusulinid-bearing limestones of late Murgabian-early Midian age rest on Precambrian schist (Fig. 15).

In southeastern Pamir, the Midian sequence begins with a coarse clastic limestone that unconformably overlies alternating fine-detrital, pelitic limestone and calcareous and cherty argillite of Murgabian age. Similar rocks also make up the upper half of the Midian Stage above the clastic limestone. Fragments in the limestone represent underlying rocks as old as Kubergandian. The origin of the clastic limestone is controversial. It may represent an erosional event and part of the Murgabian may be missing, or these beds may constitute olistostromal blocks of sediment-gravity-flow origin encased within deep-water beds.

Overall, Midian deposits are transgressive. Locally, both in the north (Karakul and Bamian zones) and, probably in the south (Khoja Murod zone, southeast Pamir), unconformities between Murgabian and Midian units suggest short-term exposure prior to the Midian transgression. Except perhaps in the southeast Pamir and Rushan-Pshart zone, deposition of Midian organic, particularly reefal limestones, occurred in shallow water. Basaltic volcanism was prominent in the Rushan-Pshart and apparently in the Ak Jilga zones. Thin, tuffaceous beds also are present in southeast Pamir. Fusulinid assemblages of northern and southern Pamir and Afghanistan are similar suggesting a similarity of climates and open marine connections between these regions.

Dzhulfian and Dorashamian Stages

Unequivocal Dorashamian faunas have been found only in southeast Pamir. In all other areas, ammonoid and conodonts are lacking and the deposits cannot be distinguished from the Dzhulfian. Therefore, the Dzhulfian-Dorashamian stratigraphic interval is considered together. Also in a number of areas, Dorashamian deposits evidently did not accumulate or they were eroded in pre-Triassic time. The upper member of the Kafirbatcha Formation in the Darvaz-Transalay zone, which overlies algal limestone beds with Midian conodonts (Leven and Scherbovich, 1978), is Dzhulfian-Dorashamian. This unit consists of olive-green argillite containing lenses of biohermal limestone composed primarily of Dzhulfian brachiopods. The olive-green argillite grades upward into red argillite that in turn is overlapped unconformably by Triassic conglomerate and sandstone.

In the southern areas of north Pamir, Dzulfian-Dorashamian deposits are present in the Karakul zone. In the Zulumart drainage area they are represented by the Baigashka Formation, which is composed of clayey shale and *Colaniella*-yielding sandstone. These rocks appear to overlap Midian limestone unconformably as a conglomerate marks its base (Leven, 1967). In the drainage of the Baigashka and Upper Kara Jilga Rivers, the thickness of conglomerate increases sharply. Fusulinids within sandstone interbeds from near the base indicate a lower Midian age (Leven, 1967). *Colaniella* in the upper part of limestone of unit F in the Bamian zone of north Afghanistan suggests a Dzhulfian-Dorashamian age.

In south Pamir and Afghanistan, Dzulfian-Dorashamian deposits apparently are widespread. The northernmost outcrops are in the central Pamir and in the Khaftkala zone in middle Afghanistan where this zone is represented by limestones with *Shanita* lying unconformably on limestone and dolomite of Midian age (Fig. 10; Leven, 1991,1993a). These rocks are overlain unconformably by bauxite at the base of the Lower Triassic section. To the south in southeastern Pamir, Dzhulfian conodonts occur in the upper half of the Kutal Patch and at the base of the unconformably overlying Tahta Bulak Formation. The former is composed of thin, platy, fine-detrital and pelitic limestone, calcareous shale, and cherty slate. The latter is composed of tuff with lesser amounts of argillite, siltstone, and biohermal limestone (Kotlyar et al., 1983). Conodonts in the middle and upper part of the Tahta Bulak Formation indicate a Dorashamian age and the formation is overlapped by Lower Triassic carbonate rocks. A crust of weathered material at the Permian-Triassic boundary suggests an erosional hiatus.

In the Sange-Dushon, Karganau, and Khoja Murod zones, middle Afghanistan, the Dzhulfian-Dorashamian is represented by terrigenous units with *Shanita, Rectostipulina, Paraglobivalvulina,* and *Reichelina*. These rocks unconformably overlie Midian limestone and dolomite, and are overlapped unconformably by Lower Triassic rocks (Figs. 11–13).

In central Afghanistan and the Suleiman-Kirthar area, unlike the northern areas, Dzhulfian-Dorashamian rocks occur in an undivided carbonate formation including Midian rocks. Late Dzhulfian and latest Dorashamian ages are indicated by rare foraminifera. The base of the superjacent Lower Triassic section is marked ubiquitously by an unconformity.

The Dzhulfian and Dorashamian rocks generally are of a regressive character throughout the region. In northern, southeastern, and central Pamir, as well as in middle Afghanistan, carbonate formations generally are replaced by terrigenous rocks upward, and in southeastern Pamir by tuffaceous rocks above an unconformity. This unconformity has not been recognized in central Afghanistan or the Suleiman-Kirthar area, where deposition continued from the Midian. At the end of the Permian the entire region was exposed to erosion.

PALEOGEOGRAPHIC AND PALEOTECTONIC IMPLICATIONS

Despite the fragmentary nature of data on Permian deposits and their fusulinids, generalizations concerning Permian history can be made. Those of special interest are the following:

1. Several structural-facies zones are very distinctive and different from adjacent zones, but are remarkably continuous along strike. The facies character may remain constant for a distance of hundreds of kilometers even if the zones are only tens of kilometers wide. A good example is the Darvaz-Transalay zone.

Some sequences located within separate, narrow, lenticular but aligned tectonic blocks, many hundreds of kilometers from one another, may be similar or identical (Fig. 1). The successions of central Pamir and the Khaftkala zone of middle Afghanistan are strikingly similar, having the same number of distinguishable strata, same lithology, same fossils, and the same unconformable characteristics, even with bauxite beds that do not occur in any of the other structural-facies zones (Fig. 10). A lesser, but still marked, resemblance exists between the zones of Darvaz-Transalay and Sourkhob; Karakul and Bamian; and between Sange-Dushoh, Khoja Murod, Karganau, and Nilbandon on the one hand, and southeast Pamir on the other. These comparable areas probably are relics of several paleobasins of which only separated fragments remain. An interpretative tectonic map (Fig. 1) shows that the present trend of these structural-facies belts is more northerly in the Pamir than in Afghanistan. This also is true of Kunlun and Karakorum, which are the eastern prolongations of the Pamirian structures. The arcuate bend of the latter areas probably is a consequence of the northward drift of the Pamirian sector of Central Asia.

2. The fusulinid assemblages give substantial information concerning the paleogeography and paleoclimatology. Analysis of the Asselian and Sakmarian fusulinid assemblages indicates that the rocks in north Pamir and Afghanistan were deposited in a tropical climate within a basin freely connected with basins in the Tien Shan, the Pre-Caspian Depression, and the southern

Urals. Closely allied faunas also are known from northern Kunlun. The Asselian rocks of the south Pamir and Afghanistan, as well as those of the eastern Hindu Kush, Karakorum, south Tibet, Australia, and peninsular India, lack fusulinids. Brachiopods, bivalves, and bryozoans in those regions, however, are abundant. This Gondwanan-type assemblage commonly is considered a cold-water phenomenon. The absence of fusulinids can be explained by unfavorable climatic environments.

In the southern region, the earliest Permian fusulinids are Sakmarian. They are represented by the endemic Kalaktash assemblage, which is widespread in Central Asia. It differs from Sakmarian faunas of the north Pamir and Afghanistan, but shows some affinities with those of the Boreal seas.

Because of differences in the faunas that inhabited the Early Permian seas washing Laurasia's shores in the north and Gondwanaland in the south, Leven and Scherbovich (1978) recognized northern and southern Tethyan (Perigondwanan) biogeographic provinces. The former was equatorial and tropical, and the second was cooler.

The fact that these regions are presently in contact along the major suture line of Central Asia indicates subsequent convergence. The space eliminated by the convergence of the plates is estimated to have been at least as wide as a climatic belt. By Yahtashian time, provincial distinctions between the northern and southern Tethys were essentially eliminated as a result of the expansion of warm-water fusulinids to the Perigondwanan region. This undoubtedly was linked to climatic amelioration first evident in the Sakmarian. Whether or not this was a consequence of global warming or a result of the northward drift of microplates toward lower latitudes is not known.

3. Post-Permian convergence of the southern and northern Tethys requires resolution of the following alternatives: (1) was the space between the Permian structural-facies zones occupied by an ocean or a system of more or less isolated troughs, and (2) did convergence occur because of subduction of oceanic crust or by folding and overthrusting?

In all facies-structural zones of the Pamir, Afghanistan, and adjacent regions, Permian deposits are shallow-water type, except perhaps the Kubergandian-Dzhulfian carbonate-argillite-cherty rocks of the southeast Pamir and their correlatives in middle Afghanistan that may be of a rather deep-water origin. However, even if the water was deep, the sediment could have been deposited in narrow troughs rather than in the deep ocean.

No evidence has been provided for the existence of a deep-water Permian ocean in the Pamir and Afghanistan regions, and because no traces of oceanic floor are known, it is unlikely that any of the Permian rocks in this region accumulated on oceanic crust. Where subjacent rocks are exposed, they consist of thick, shallow-water facies separated by many unconformities, and commonly the Permian rocks are discordant with them. This suggests deposition on continental crust. Thick Late Permian basaltic flows are known in the Ak Jilga zone of the north Pamir, but the setting there was not oceanic.

The available data thus suggest that no ocean lay between the southern and northern Tethys. Instead, a system of troughs separated by uplifts and median massifs may have characterized at least the Central Asian segment of the Tethys under review here in Permian time. Convergence of the northern and southern peripheries of the Tethys could have occurred at the expense of crushing and thrusting. Relics of such blocks presently crop out along the suture zones; the major suture line that divides the Pamirs and Afghanistan into northern and southern parts is the most important.

4. Examination of the sequences in numerous structural-facies zones have shown that with all the differences which exist between them, still there are general similarities in the timing of transgression and regression. Disparities are seen only in the Darvaz-Transalay and Sourkhob sequences.

Two major transgressive-regressive cycles are especially significant (Leven, 1993b). The first transgression started in the Carboniferous and terminated at or shortly after the end of the Sakmarian (Leven, 1994). The second began in the late Yahtashian or Bolorian and ended in the Dorashamian (Fig. 23). Each of the major cycles is subdivided into second-order ones. Thus, unconformities occur at the base of the Sakmarian (possibly upper Asselian-Sakmarian) Tash Kozyk Formation of the southeast Pamir and at the base of the correlative Bokan Formation of central Afghanistan, and between the Kubergandian and subjacent rocks in central and middle Afghanistan and in the Karakul zone of the Pamir. The Midian transgression is well displayed in the central Pamir and in the southern part of the Rushan-Pshart zone. It also spans the Khaftkala zone of middle Afghanistan and part of central

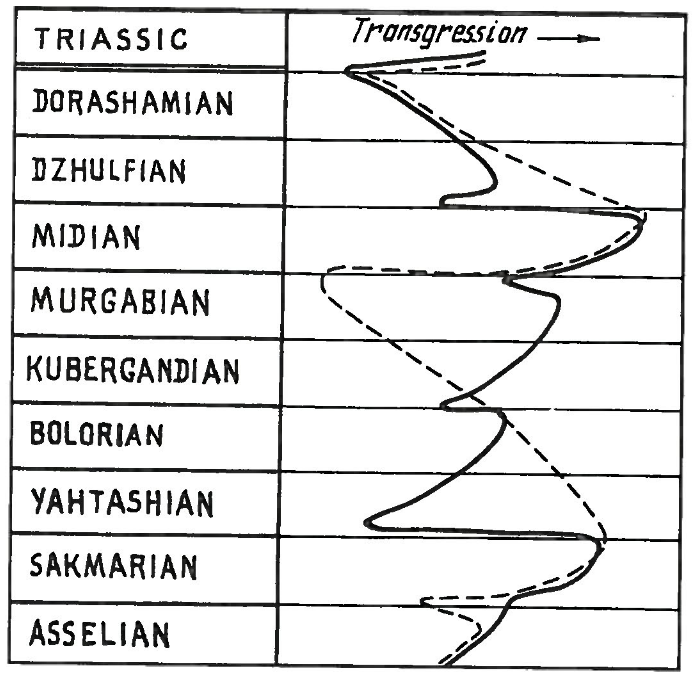


Figure 23. Permian transgressive-regressive curve based on the sequences of the Darvaz-Transalay zone (dashed line) and other regions of Afghanistan and Pamir (solid line).

Afghanistan and probably is present in the Bamian and Karakul zones. A Dzulfian transgression is recognized in middle Afghanistan, central and southeast Pamir, and in the Karakul zone. Because the same transgressions are recognizable in different structural-facies zones, they must have been controlled by factors of regional significance. Actually, a curve of the transgressive-regressive cycles in this region (Fig. 23) coincides entirely with that drawn by the author based on data on the entire Tethys (Leven, 1993d).

It is uncertain whether the transgressions and regressions were associated with eustatic fluctuations or other factors, but it is most probable that superposition of both eustatic and tectonic events resulted in the mentioned cycles. The successions in the northernmost zones of the north Pamir and north Afghanistan (Darvaz-Transalay, Sourkhob, Rudi Tchal) tend to confirm this idea. Post-Sakmarian erosion caused by uplifts associated with the Hercynian orogeny, which spanned this time in south Tien Shan, occurred only in the Rudi Tchal zone. In the other two zones, marine environments continued. In south Pamir and Afghanistan, as well as in the southern Transcaucasus, Iran, south China, Japan, and the other Tethyan regions, post-Sakmarian regression was quite rapidly followed by the Yahtashian-Bolorian transgression that became more widespread in the Kubergandian and Murgabian. In north Pamir and north Afghanistan, however, the transgressive trend was terminated by a series of uplifts that extended from Tien Shan southward, progressively affecting more and more area. In the early Murgabian, continental conditions were established in the northern part of north Pamir and north Afghanistan. The ubiquitous red-colored molasse is composed of clastics and volcanics derived from a mountainous terrain in the south Tien Shan. Further tectonic stabilization led to the reduction in relief that enabled penetration of the sea into the Darvaz-Transalay zone during a widespread Midian transgression. As is seen everywhere, a regression marks the end of the Permian. Similar events occurred in southern Europe and the northern Caucasus where the influence of the Hercynian Orogeny is prominently exhibited.

Despite the apparent breaks marking the Permian-Triassic boundary within the entire region under study and beyond, Triassic rocks are known to overlie Upper Permian rocks only. Seemingly, the Triassic transgression was restricted exactly by the limits of basins that existed before the Late Permian regression. In contrast, each Permian transgression spanned more and more space. As a result, Permian transgressive units overlie rocks of different ages, down to the Precambrian. The question then arises: could not the importance of the pre-Triassic regression be overrated? I cannot deny that in a number of cases uplift preceding the Triassic transgression is quite apparent. The sequences in central Pamir with the Triassic underlain by the bauxite beds and some sections in middle Afghanistan and southwestern Darvaz are examples. In many places, however, a regression is postulated only because one or more conodont or cephalopod zones apparently are missing.

SYSTEMATIC PALEONTOLOGY

Superorder Fusulinoida Fursenko, 1958
Order Staffellida A. Miklukho-Maclay, 1949
Family Staffellidae A. Miklukho-Maclay, 1949
Genus *Staffella* Ozawa, 1925
***Staffella sphaerica* (Abich, 1858)**
Plate I, Fig. 1

Fusulina sphaerica: Abich, 1858, p. 439, 528, plate 3, figs. 13a–13c.
Locality. Khargardan (loc. 12a), Adjrestan (loc. 46), Uruzgan (loc. 238), central Afghanistan.
Distribution. South Afghanistan, north Pamir, Transcaucasus, southern Europe, Iran, China, Indochina.
Age. Late Permian.
Material studied. Six axial and several subaxial sections.

Genus *Pisolina* Lee, 1933
***Pisolina subsphaerica* Sheng, 1956**
Plate I, Figs. 2, 3

Pisolina subsphaerica: Sheng, 1956, p. 205, plate 2, fig. 6.
Locality. Uruzgan (loc. 238), Adjrestan (loc. 54), central Afghanistan.
Distribution. South Afghanistan, south China.
Age. Late Permian.
Material studied. Two axial sections.

Genus *Sphaerulina* Lee, 1933
***Sphaerulina croatica* Kochansky-Devidé, 1965**
Plate I, Figs. 4, 14

Sphaerulina croatica: Kochansky-Devidé, 1965, p. 143–144, plate 5, fig. 9; plate 6, figs. 1–14; plate 7, figs. 1–8; plate 8, fig. 1.
Locality. Urkhon (loc. 1522-4), central Afghanistan; Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Croatia, Transcaucasus.
Age. Late Permian, Murgabian to Midian.
Material studied. Seven axial and several subaxial sections.

***Sphaerulina* cf. *S. ogbinensis* Rozovskaya, 1965**
Plate I, Fig. 8

Sphaerulina ogbinensis: in Ruzhentsev and Sarycheva, 1965, p. 139, 148, plate 1, figs. 1–17.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Transcaucasus.
Age. Late Permian, Murgabian to Midian.
Material studied. Several subaxial and tangential sections.

Family Nankinellidae A. Miklukho-Maclay, 1963
Genus *Nankinella* Lee, 1933
***Nankinella hunanensis* (Chen, 1956)**
Plate I, Figs. 5–7

Ozawainella hunanensis: Chen, 1956, p. 18, plate 1, figs. 1–3.
Locality. Uruzgan (loc. 238), Adjrestan (loc. 46), Bad Olum (loc. 3), central Afghanistan; Obi Tang (loc. 1153), zone of Darvaz-Transalay, north Afghanistan.
Distribution. Afghanistan, Darvaz, China, Indochina.
Age. Early and Late Permian, Sakmarian to Murgabian.
Material studied. Five axial sections.

***Nankinella orbicularia* Lee, 1933**
Plate I, Figs. 12, 13

Nankinella orbicularia: Lee, 1933, p. 16, plate 2, fig. 4; plate 3, figs. 1, 2.
Locality. Adjrestan (loc. 57, 73), central Afghanistan.

Distribution. South Afghanistan, south China, Japan.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Three axial sections.

Family Pseudoendothyridae Mamet, 1979
Genus *Pseudoreichelina* Leven, 1970
***Pseudoreichelina darvasica* Leven, 1970**
Plate I, Fig. 15

Pseudoreichelina darvasica: Leven, 1970a, p. 19, plate 1, figs. 6–13.
Locality. Zone of Khaftkala (loc. 566), central Afghanistan; Urkhon (loc. 1522-2), central Afghanistan.
Distribution. South Afghanistan, Darvaz, Slovenia.
Age. Early and Late Permian, Sakmarian to Murgabian.
Material studied. Three subaxial sections.

Order Schubertellida Skinner, 1931
Family Schubertellidae Skinner, 1931
Genus *Schubertella* Staff and Wedekind, 1910
***Schubertella giraudi* (Deprat, 1915)**
Plate I, Figs. 9–11

Neofusulinella giraudi: Deprat, 1915, p. 11, plate 1, figs. 6–11.
Locality. Zone of Khaftkala (loc. 566), zone of Khoja Murod (loc. 620-5), zone of Sange Dushoh (loc. 628-6), middle Afghanistan; Obi Tang (loc. 1153-1, 2, 3), zone of Darvaz-Transalay, north Afghanistan.
Distribution. Afghanistan, Darvaz, southeast Pamir, China, Indochina, Japan, Carnic Alps, USA.
Age. Permian, Yahtashian to Murgabian.
Material studied. Nine axial sections.

***Schubertella longiuscula* Leven, 1992**
Plate I, Figs. 16, 17

Schubertella longiuscula: in Leven et al., 1992, p. 65, pl. 1, figs. 17, 18.
Locality. Zone of Sange Dushoh (loc. 628-11), central Afghanistan.
Distribution. South Afghanistan, Darvaz.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Three axial and eight subaxial sections.

Genus *Neofusulinella* Deprat, 1912

Remarks. Deprat (1912), who erected the genus *Neofusulinella*, gave no information on the spirothecal structure of its representatives. Subsequent studies by Thompson and Foster (1937) have shown that the spirotheca of *Neofusulinella* consists of a tectum and a lighter, inner layer called the protheca or primatheca. In some forms the porous structure of the inner layer is marked, and in the work on fusulinids from Thailand, Toriyama et al. (1969) mentioned alveoli and trabeculi, which allowed comparison of the spirotheca of *Neofusulinella* with that of representatives of the Order Schwagerinida.

Numerous specimens of *Neofusulinella* from the Transcaucasus, Pamir, and Afghanistan, in the author's possession, suggest that the spirotheca of *Neofusulinella* is more complicated than commonly thought. Many samples reveal a thin, light-colored layer between the tectum and a wide, porous, inner layer, identical with the diaphanotheca of representatives of the Order Fusulinida such as *Fusulinella* and *Fusulina.* This thin intermediate layer, which may have either distinct or obscure margins (plate I, fig. 19; plate II, fig. 3), is most often visible in the middle volutions of the shell. In some cases a thin outer tectorium also is visible.

***Neofusulinella lantenoisi* Deprat, 1913**
Plate II, Fig. 1

Neofusulinella lantenoisi: Deprat, 1913, p. 41–42, plate 7, figs. 23–25.
Locality. Khojagor (loc. A71), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, north and south Pamir, Crimea, Transcaucasus, south China, Indochina, Japan, Turkey.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Seven axial sections.

***Neofusulinella tumida* Leven, 1965**
Plate I, Figs. 18, 19

Neofusulinella tumida: Leven, 1965, p. 134–135, plate 4, fig. 6.
Locality. Khojagor (loc. A69, A71, A74), Bulola (loc. A53, A54), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, north and south Pamir, south China, Thailand.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Six axial sections.

***Neofusulinella callosa* Leven, n. sp.**
Plate II, Figs. 2–4

Neofusulinella phairayensis: Colani (part), 1924, p. 104–105, plate 16, fig. 5.
Neofusulinella lantenoisi: Leven (part), 1967, p. 126, plate 1, fig. 10.
Neofusulinella praecursor: Toriyama et al. (part), 1969, p. 23–28, plate 3, figs. 11, 13.
Holotype: GGM VI-228/20—axial section; zone of Bamian, Khojagor, north Afghanistan; Upper Permian, upper Kubergandian.
Description. A short, fusiform shell, convex in the middle portion with sharply terminated poles. Specimens of six to seven volutions have an average L = 2.3 mm, D = 1.4 mm, L:D = 1.6. The proloculus is spherical and small, with a diameter as much as 0.04 mm. The axis of coiling of the first one to one and one-half volutions is at an angle to that of the succeeding whorls. The coiling is rather loose, the height of volutions increasing gradually. The spirotheca is thick (0.07–0.1 mm) and consists of a tectum; a wide, more transparent, porous inner layer; and a thin, light, intermediate layer resembling diaphanotheca. The intermediate layer is not present in the outer volutions. Septa are thin and straight, have large pores, and form a complicated fine meshwork in the axial portion of the shell. The tunnel is fairly low, narrow, and straight. In all volutions the chomata are asymmetric and rounded to triangular in shape.
Discussion. This species differs from *N. lantenoisi* Deprat in having a thicker spirotheca and a subrhombic shell. The inflated, relatively short shell and looser coiling distinguishes *N. callosa* from *N. phairayensis* Colani. The less rounded form of the shell of *N. callosa* distinguishes it from *N. tumida* Leven.
Locality. Khojagor (loc. A69, A71, A74), Bulola (loc. A53), zone of Bamian.
Distribution. North Afghanistan, Pamir, Indochina.
Age. Late Permian, Kubergandian to lower Murgabian.
Material studied. Four axial sections.

***Neofusulinella magna* Leven, n. sp.**
Plate I, Fig. 20

Holotype: GGM VI-228/18—axial section; north Afghanistan, zone of Bamian, Khojagor; Upper Permian, Murgabian.
Description. A large, fusiform shell of eight volutions with gradually rounded poles. L = 4 mm, D = 2.2 mm, L:D = 1.8. The proloculus is spherical and small (0.08 mm). The axis of coiling of the first volutions is at an angle to that of the succeeding whorls. Coiling is relatively loose, resulting in a gradual increase in height of the volutions with growth. The spirotheca consists of a tectum and a wide, gray, thin-porous inner layer, which is light near the tectum. This porous layer occurs throughout, except for the last two volutions and the juvenarium. Septa are thin and form a wide zone of fine meshwork in the axial portion of the shell. The tunnel expands moderately with growth and is straight. Low,

rounded chomata are present in all volutions after the juvenarium.
Discussion. This species resembles *N. callosa* n. sp., but differs in its larger size and more smoothly rounded poles.
Locality and age. The same as for the holotype (loc. A74).
Material studied. One axial and two saggital sections.

Family Boultoniidae Skinner and Wilde, 1954
Genus *Boultonia* Lee, 1927
***Boultonia ogbinensis* Chedija, 1983**
Plate II, Fig. 5

Boultonia ogbinensis: in Kotlyar et al., 1983, p. 129–130, plate 2, figs.1–3, 15.
Locality. Zone of Sange Dushoh (loc. 630), central Afghanistan.
Distribution. Central Afghanistan, Transcaucasus.
Age. Late Permian, Murgabian.
Material studied. One axial section.

Genus *Russiella* A. Miklukho-Maclay, 1957
***Russiella pulchra* A. Miklukho-Maclay, 1957**
Plate II, Fig. 6

Russiella pulchra: Miklukho-Maclay, 1957, p. 101, plate 1, fig. 3.
Locality. Bulola (loc. A57), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Pamir, Crimea, south China.
Age. Late Permian, Murgabian.
Material studied. One axial and several subaxial sections.

Genus *Minojapanella* Fujimoto and Kanuma, 1953
Subgenus *Wutuella* Sheng, 1963
***Minojapanella (Wutuella) wutuensis* (Kuo, 1948)**
Plate II, Fig. 7

Gallowaiinella wutuensis: Kuo, 1948, p. 233–234, plate 1, figs. 1–3.
Locality. Sabzab-Adjar (loc. 209b), central Afghanistan.
Distribution. South Afghanistan, south Pamir, south China, Iran, Turkey.
Age. Late Permian, Kubergandian to Midian.
Material studied. One subaxial and several tangential sections.

Genus *Lantschichites* Toumanskaya, 1953
***Lantschichites minimus* (Chen, 1956)**
Plate II, Figs. 8–13

Gallowaiinella minima: Chen, 1956, p. 21, plate 1, figs. 22–24.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, south China, Tibet.
Age. Late Permian, Midian.
Material studied. Four axial and three sagittal sections.

Family Palaeofusulinidae A. Miklukho-Maclay, 1963
Genus *Dunbarula* Ciry, 1948
***Dunbarula kitakamiensis* Choi, 1970**
Plate II, Figs. 14–18

Dunbarula kitakamiensis: Choi, 1970, p. 314–316, plate 8, figs. 1–6.
Locality. Zone of Khoja Murod (loc. 607-18, 607-21), middle Afghanistan; Khojagor (loc. A48) and Bulola (loc. 5737), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, Japan.
Age. Late Permian, Midian.
Material studied. Five axial sections.

***Dunbarula ardaglensis* (Chedija, 1983)**
Plate III, Fig. 1

Nanlingella? ardaglensis: in Kotlyar et al., 1983, p. 131–132, plate 3, figs. 1–6.
Locality. Zone of Sange Dushoh (loc. 631-5), middle Afghanistan.
Distribution. Afghanistan, Transcaucasus.
Age. Late Permian, Murgabian to Midian.
Material studied. Three axial and two subaxial sections.

***Dunbarula nana* Kochansky-Devidé and Ramovš, 1955**
Plate III, Fig. 2

Dunbarula nana: Kochansky-Devidé and Ramovš, 1955, p. 409, plate 1, figs. 3–5, 7; plate 8, fig. 1.
Locality. Zone of Khoja Murod (loc. 607-11), middle Afghanistan.
Distribution. South Afghanistan, Transcaucasus, Slovenia, Tunisia, Tibet, Cambodia.
Age. Late Permian, Midian.
Material studied. One axial section.

Genus *Codonofusiella* Dunbar and Skinner, 1937
***Codonofusiella erki* Rauser-Chernousova, 1965**
Plate III, Figs. 3, 7

Codonofusiella erki: in Ruzhentsev and Sarycheva, 1965, p. 141–142, plate 3, figs. 16, 17; plate 5, figs. 3–5.
Locality. Zone of Khoja Murod (loc. 607-22, 607-25), middle Afghanistan.
Distribution. South Afghanistan, Transcaucasus, Turkey.
Age. Late Permian, Midian.
Material studied. Two axial and several sagittal and tangential sections.

***Codonofusiella schubertelloides* Sheng, 1956**
Plate III, Fig. 5

Codonofusiella schubertelloides: Sheng, 1956, p. 185, 208, plate 3, figs. 1–14; Sheng, 1963, p. 170, plate 6, figs. 16–20.
Locality. Zone of Khoja Murod (loc. 607-22), middle Afghanistan.
Distribution. Afghanistan, Pamir, south China, Transcaucasus.
Age. Late Permian, Midian to Dzhulfian.
Material studied. One axial section.

***Codonofusiella simplex* Leven, n. sp.**
Plate III, Figs. 4, 6, 8, 9, 11

Holotype: GGM VI-228/40—axial section; central Afghanistan, Sabzab-Adjar; Upper Permian, lower Kubergandian.
Description. A small, inflated, fusiform shell, uncoiled in the last volution. In the penultimate volution, L = 0.4–0.5 mm, D = 0.19–0.3 mm, L:D = 1.8–2.1. The proloculus is spherical with a diameter as much as 0.02 mm. The coiling is loose for the first one to two volutions, forming a juvenarium coiled at an angle to succeeding volutions. The height of the final volution increases sharply, attaining a trumpet-like form. The spirotheca is thin and without visible differentiation. Septa are thin and slightly wavy in the axial portion of shell and in the final, uncoiled volution. The tunnel is wide and rimmed by large, distinct chomata.
Discussion. This species differs from other known species of *Codonofusiella* in being small, and possessing a thin, nondifferentiated spirotheca, and having nearly straight septa.
Locality and age. The same as for the holotype (loc. 209b).
Material studied. One axial and six equatorial and oblique sections.

Family Yangchienidae Leven, 1987
Genus *Yangchienia* Lee, 1933
***Yangchienia haydeni* Thompson, 1946**
Plate III, Fig. 12

Yangchienia haydeni: Thompson, 1946, p. 146–147, plate 23, figs. 5–11.
Locality. Uruzgan (loc. 238a), central Afghanistan; Khojagor (loc. A47, A74), zone of Bamian, north Afghanistan; Abtchagan (loc. 175-3), Suleiman-Kirthar area.
Distribution. Afghanistan, south China, Indochina.
Age. Late Permian, Murgabian to Midian.
Material studied. Three axial and seven subaxial and tangential sections.

***Yangchienia thompsoni* Skinner and Wilde, 1966**
Plate III, Fig. 10

Yangchienia thompsoni: Skinner and Wilde, 1966b, p. 7–8, plate 4, figs. 1–4.
Locality. Altimur (loc. 284, 181), Suleiman-Kirthar area.
Distribution. South Afghanistan, Sicily, Thailand.
Age. Late Permian, Midian.
Material studied. Seven axial sections.

***Yangchienia tobleri* Thompson, 1935**
Plate III, Fig. 14

Yangchienia tobleri: Thompson (part), 1935, p. 516–517, plate 17, fig. 7.
Locality. Abtchagan (loc. 175-3), Suleiman-Kirthar area.
Distribution. Afghanistan, Pamir, China, Indochina, Greece.
Age. Late Permian, Murgabian.
Material studied. Four axial and eight subaxial sections.

Family Biwaellidae Davydov, 1984
Genus *Biwaella* Morikawa and Isomi, 1960
***Biwaella omiensis* Morikawa and Isomi, 1960**
Plate III, Figs.13, 15

Biwaella omiensis: Morikawa and Isomi, 1960, p. 302–305, plate 54, fig. 1–5.
Locality. Saidi Kajon (loc. A27; A34, A44), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, south China, Japan, Croatia.
Age. Permian, Sakmarian to Bolorian.
Material studied. Four axial and five subaxial sections.

***Biwaella ellipsoidalis* Leven, 1992**
Plate III, Figs. 16, 21

Biwaella ellipsoidalis: in Leven et al., 1992, p. 70, pl. 2, figs. 10, 11.
Locality. Saidi Kajon (loc. A27, 393), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz.
Age. Early Permian, Yahtashian.
Material studied. Two axial and several tangential sections.

Biwaella shiroishiensis
(Morikawa and Kobayashi, 1960)
Plate III, Figs. 18–20, 22

Oketaella shiroishiensis: Morikawa and Kobayashi, 1960, p. 310–312, plate 55, figs. 12–18.
Locality. Saidi Kajon (loc. A27, A34, 393), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Japan.
Age. Early Permian, Yahtashian.
Material studied. Four axial and a few subaxial sections.

***Biwaella tumefacta* Leven, n. sp.**
Plate III, Fig. 17

Holotype: GGM VI-228/48—axial section, Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A moderate sized, nearly spherical shell with slightly prominent poles, L = 2.15 mm, D = 1.85 mm, L:D = 1.16. The form of the shell changes during growth; in the first volution, L:D = 0.8; in the fourth, L:D = 1.0; and in the final, sixth volution, L:D = 1.16. The proloculus is spherical and attains a diameter of 0.11 mm. The coiling is tight and rather uniform before the fourth whorl; later the height of whorls increases sharply. The spirotheca, which is thick throughout the length of the shell (as much as 0.07 mm), is composed of a tectum and a broad, poorly defined keriotheca. Septa are straight, forming simple reticulation in the axial portion of the shell. The tunnel is narrow in the first three whorls, rapidly expanding thereafter. Chomata are high, narrow, and rounded to triangular in shape.
Discussion. This species differs from all other known species of this genus in the strong inflation of shell, the change of form of the shell with growth, the uneven expansion during coiling, and the thick spirotheca.
Locality and age. The same as for the holotype (loc. A34-3).
Material studied. One axial section.

Genus *Toriyamaia* Kanmera, 1956
***Toriyamaia laxiseptata* Kanmera, 1956**
Plate IV, Fig. 1

Toriyamaia laxiseptata: Kanmera, 1956, p. 252-255, plate 36, figs. 1–14.
Locality. Zone of Sange Dushoh (loc. 628-11), middle Afghanistan; Kwahan (loc. 1153-3), zone of Darvaz-Transalay, north Afghanistan.
Distribution. Afghanistan, Darvaz, south China, Indochina, Japan, Iran, Turkey.
Age. Early Permian, Yahtashian to Bolorian; Late Permian, Kubergandian.
Material studied. One axial section and five subaxial and tangential sections.

Order Ozawainellida Solovieva, 1978
Family Ozawainellidae Thompson and Foster, 1937
Genus *Pamirina* Leven, 1970
Subgenus *Levenella* Ueno, 1991, emend Ueno, 1994
***Pamirina (Levenella)* aff. P. *pulchra* (Wang and Sun, 1973)**
Plate IV, Fig. 2

Chinlingella pulchra: Wang and Sun, 1973, p. 153–154, pl. 1, figs. 6–8, 13–16.
Remarks. The specimen described is similar to *P. (Levenella) pulchra* (Wang and Sun) and *P. (Levenella) leveni* Kobayashi, but the former is more loosely coiled and the chomata are better developed in the inner whorls.
Locality. Saidi Kajon (loc. A34), zone of Sourkhob, North Afghanistan.
Distribution. North Afghanistan, Darvaz, China, Japan.
Age. Early Permian, Yahtashian.
Material studied. One axial section.

Subgenus *Pamirina* Leven, 1970
***Pamirina (Pamirina) darvasica* Leven, 1970**
Plate IV, Figs. 3–5

Pamirina darvasica: Leven, 1970b, p. 23–24, plate 1, figs. 1–12.
Locality. Saidi Kajon (A27, A29, A34, A45, 393), zone of Sourkhob, north Afghanistan; zone of Khoja Murod (loc. 606-10), middle Afghanistan.
Distribution. North and south Afghanistan, Darvaz, Carnic Alps, Thai-

land, Japan, south China.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Four axial and several subaxial sections.

Genus *Rauserella* Dunbar, 1944
***Rauserella sphaeroidea* Sosnina, 1968**
Plate IV, Fig. 6

Rauserella sphaeroidea: Sosnina, 1968, p. 117–118, plate 28, figs. 12–15.
Locality. Zone of Khaftkala (loc. 573-14), middle Afghanistan.
Distribution. South Afghanistan, Sikhote-Alin.
Age. Late Permian, Midian.
Material studied. One subaxial section.

***Rauserella staffi* Skinner and Wilde, 1966**
Plate IV, Fig. 7

Rauserella staffi: Skinner and Wilde, 1966b, p. 5, 6, pl. 2, figs. 2–7.
Locality. Zone of Khoja Murod (loc. 627-1), middle Afghanistan.
Distribution. South Afghanistan, Sicily.
Age. Late Permian, Murgabian and Midian.
Material studied. One axial section.

Genus *Reichelina* Erk, 1941
***Reichelina changhsingensis* Sheng and Zhang, 1958**
Plate IV, Fig. 8

Reichelina changhsingensis: Sheng and Zhang, 1958, p. 207, 211, plate 1, figs. 1–11.
Locality. Chohan (loc. 173), central Afghanistan.
Distribution. Central Afghanistan, Pamir, south China, Japan.
Age. Late Permian, Midian to Dorashamian.
Material studied. Two subaxial sections.

Order Endothyrida Brady, 1884
Family Kahlerinidae Leven, 1963
Genus *Kahlerina* Kochansky-Devidé, 1955
***Kahlerina pachytheca pusilla* Kochansky-Devidé and Ramovš, 1955**
Plate IV, Fig. 9

Kahlerina pachytheca pusilla: Kochansky-Devidé and Ramovš, 1955, p. 338, plate 3, figs. 7, 8.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Slovenia.
Age. Late Permian, Midian.
Material studied. One axial section.

***Kahlerina globiformis* Sosnina, 1968**
Plate IV, Fig. 10

Kahlerina globiformis: Sosnina, 1968, p. 100–101, plate 25, figs. 4–6.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Slovenia.
Age. Late Permian, Midian.
Material studied. One axial and several tangential sections.

***Kahlerina africana* Skinner and Wilde, 1967**
Plate IV, Fig. 11

Kahlerina africana: Skinner and Wilde, 1967, p. 7, plate 1, figs. 1–7.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Tunisia.
Age. Late Permian, Midian.
Material studied. One axial, five tangential and one saggital section.

Genus *Pseudokahlerina* Sosnina, 1968
***Pseudokahlerina compressa* Sosnina, 1968**
Plate IV, Fig. 12

Pseudokahlerina compressa: Sosnina, 1968, p. 105, plate 27, figs. 7, 8.
Locality. Bulola (loc. A58-1), zone of Bamian, north Afghanistan; zone of Sange Dushoh (loc. 633-2), middle Afghanistan.
Distribution. North Afghanistan, Sikhote-Alin.
Age. Late Permian, Midian.
Material studied. One axial section.

Order Fusulinida Moller, 1878
Family Fusulinidae Moller, 1878
Genus *Quasifusulina* Chen, 1934
***Quasifusulina magnifica* Leven, 1992**
Plate IV, Fig. 13

Quasifusulina magnifica: in Leven et al., 1992, p. 77, pl. 4, figs. 9, 10.
Locality. Saidi Kajon (loc. A27, A28), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Three axial and four tangential sections.

Order Schwagerinida Solovieva, 1978
Family Pseudoschwagerinidae Chang, 1963
Genus *Pseudoschwagerina* Dunbar and Skinner, 1936
***Pseudoschwagerina velebitica* Kochansky-Devidé, 1959**
Plate IV, Fig. 14

Pseudoschwagerina velebitica: Kochansky-Devidé, 1959, p. 55–56, plate 6, figs. 2–8.
Locality. Kwahan (loc. 119-4), zone of Darvaz-Transalay, north Afghanistan.
Distribution. North Afghanistan, Croatia.
Age. Early Permian, Asselian.
Material studied. One axial section.

***Pseudoschwagerina turbida* F. Kahler and G. Kahler, 1937**
Plate IV, Fig. 15

Pseudoschwagerina turbida: F. Kahler and G. Kahler, 1937, p. 16–17, plate 1, figs. 5, 6.
Locality. Kwahan (loc. 119-4), zone of Darvaz-Transalay, north Afghanistan.
Distribution. North Afghanistan, southern Fergana, Carnic Alps.
Age. Early Permian, Asselian to Sakmarian.
Material studied. One axial section.

***Pseudoschwagerina extensa* F. Kahler and G. Kahler, 1937**
Plate IV, Fig. 16

Pseudoschwagerina extensa: F. Kahler and G. Kahler, 1937, p. 17–19, plate 1, figs. 7, 8.
Locality. Kwahan (loc. 119-4), zone of Darvaz-Transalay, north Afghanistan.
Distribution. North Afghanistan, Carnic Alps, Croatia.
Age. Early Permian, Asselian.
Material studied. One axial section.

Genus *Zellia* F. Kahler and G. Kahler, 1937
***Zellia heritschi afghanica* Leven, n. subsp.**
Plate IV, Figs. 17, 18

Holotype: GGM VI-228/67—axial section, north Afghanistan, Amir Omad; Lower Permian, Sakmarian.
Description. A large, subspherical shell of five and one-half to six and one-half volutions, slightly elongate along the axis. L = 6.2–7.5 mm, D = 5.3–6.12 mm, L:D = 1.1–1.25. The proloculus is spherical and large, with a diameter ranging from 0.3 to 0.47 mm. The coiling is tight in the first one to two volutions, followed by a sharp increase in height of the succeeding volutions which increase uniformly thereafter. The spirotheca, moderately thick in the inner volutions, thickens to 0.15 mm in the outer volutions. Septa are porous, much thinner than the spirotheca, slightly wavy, and form fairly simple reticulation in the axial region of some specimens. Small chomata commonly are present on the proloculus and the first volutions. The tunnel is fairly low, broad, and straight.
Discussion. This form differs from other subspecies of *Z. heritschi* Kahler and Kahler, including *Z. heritschi colaniae* Kahler and Kahler, by its considerably larger size.
Locality and age. The same as for the holotype (loc. A12-4).
Material studied. Three axial sections.

Genus *Robustoschwagerina* A. Miklukho-Maclay, 1956
***Robustoschwagerina tumida* (Likharew, 1939)**
Plate V, Figs. 1, 2

Pseudoschwagerina tumida: Likharew, 1939, p. 41–42, plate 4, fig. 1.
Locality. Saidi Kajon (loc. A28, A40), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, north Pamir, south China, northwest China (Xinjiang).
Age. Early Permian, Yahtashian.
Material studied. Two axial sections.

Robustoschwagerina kahleri
(A. Miklukho-Maclay, 1949)
Plate V, Fig. 3

Pseudoschwagerina tumidiformis var. *kahleri:* Miklukho-Maclay, 1949, p. 77–78, plate 3, figs. 3, 4.
Locality. Amir Omad (loc. A12-4), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Tianshan (Kokshaal, Fergana), south China.
Age. Early Permian, Sakmarian.
Material studied. One axial section.

Genus *Rugososchwagerina* A. Miklukho-Maclay, 1959
***Rugososchwagerina altimurica* Leven, n. sp.**
Plate V, Figs. 4–8

Holotype: GGM VI-228/72—axial section; Altimur, Suleiman-Kirthar area, south Afghanistan; Upper Permian, Midian.
Description. An inflated fusiform shell with elongated poles and eight to ten volutions in mature specimens. L = 5.8–8.5 mm, D = 3.4–5.5 mm, L:D = 1.2–1.4. The juvenarium, consisting of the first three and one-half to six volutions, is fusiform to elongate fusiform and is well defined. The proloculus is spherical and small, ranging from 0.12 mm to 0.17 mm. The coiling in the juvenarium is tight, but very loose in the final three to four volutions. The increase in the diameter of the shell of typical specimens is shown in the table.

Shell Diameter (mm) Growth in *Rugososchwagerina altimurica* Leven, n. sp.

NN specimen	Volutions									
	1	2	3	4	5	6	7	8	8.5	9
284-2 (holotype)	0.27	0.40	0.55	0.77	1.1	1.9	3.07	4.1	4.35	
284-9	0.27	0.35	0.47	0.72	1.37	2.2	3.12	3.95		
284-16	0.22	0.3	0.45	0.62	1.1	1.87	2.75	3.4		
284-17	0.22	0.3	0.4	0.6	1.17	2.17	3.2	3.95		
284-19	0.27	0.4	0.55	0.72	1.1	1.8	3.1	4.4		5.5
284-23	0.22	0.32	0.45	0.51	0.92	1.5	2.37	3.17	3.4	

The spirotheca is thin (0.02–0.04 mm) in the juvenarium. Thereafter it thickens rapidly, attaining a maximum thickness of 0.12 mm. Septa are thin, wavy in the first two volutions, and fluted later. The fluting becomes increasingly intense and regular. In the free volutions of the mature shell the fluting decreases, so that it affects only the lower part of the septa. In the axial portion, especially in the outer volutions, complex reticulation is developed. Distinct, small chomata are present in the juvenarium and occur locally in the loosely coiled portion of the shell. Axial filling is developed in the juvenarium. The tunnel is low, expands with growth, and is irregular.
Variability. Essential features of the shell are rather constant. The specimens differ primarily in the number of volutions in the juvenarium, which ranges from three and one-half to six, and the form of the juvenarium which ranges from short-fusiform with rounded poles to elongate-fusiform with sharpened poles.
Discussion. R. altimurica differs from other known species of *Rugososchwagerina* in its more elongate shell and strongly elongated poles.
Remarks. The character of the juvenarium leaves no doubt that *Rugososchwagerina altimurica* is closely allied with *Pseudofusulina solita* (Skinner), with which it occurs. The materials at hand clearly show that at a certain stage of growth the coiling of some specimens begins to expand unevenly and more rapidly. A corresponding decrease in intensity and regularity of septal fluting appears to correlate with this expansion. Similarly, the juvenarium of the Sicilian fossil *Rugososchwagerina yabei* (Staff) compares closely with the inner volutions of *Chusenella (Sisoella) intermedia* Skinner and Wilde, both of which occur together. There is a similar relationship between *Rugososchwagerina xanzensis* Wang, Sheng, and Zhang and *Chusenella urulungensis* Wang, Sheng, and Zhang, which occur together in Tibet. This suggests that the ancestors of the morphologically close forms, which are commonly united within the genus of *Rugososchwagerina,* belong to different species, and, perhaps even to different genera. Because features of the species ancestors of *Rugososchwagerina* are similar, separation of *Chusenella* from *Pseudofusulina* may not be warranted.
Locality and age. The same as for the holotype (loc. 284).
Material studied. Six axial and several tangential sections.

***Rugososchwagerina heratica* Leven, n. sp.**
Plate VI, Figs. 1–6

Holotype: GGM 228/77—subaxial section; Kohe Pud Ridge, zone of Khaftkala; Upper Permian, Murgabian.
Description. A spherical shell of seven and one-half to eight volutions with slightly elongated poles. L = 4.5–5.2 mm, D = 3.3–3.8 mm, L:D = 1.2–1.4. The juvenarium of four to four and one-half volutions is well defined and sharply fusiform. The proloculus is spherical in shape, with a diameter of 0.05 mm to 0.07 mm. The coiling in the juvenarium is very tight. Later, the height of the volutions increases rapidly and unevenly,

attaining a maximum height in the penultimate volution. Increase in the diameter of the shell with the coiling is shown in the table.

Shell Diameter (mm) Growth in *Rugososchwagerina heratica* Leven, n. sp.

NN specimen	Volutions 1	2	3	4	5	6	7	7.5	8.5
561-5a-1 (holotype)	0.08	0.14	0.24	0.42	1.05	2.05	3.00	-	3.8
561-5a-2	0.11	0.21	0.35	0.65	1.36	2.2	3.00	3.3	-
561-5a-5	0.11	0.18	0.28	0.47	0.93	2.2	3.3	3.9	-

The spirotheca in the juvenarium is very thin (0.015 mm), with a gradual increase to as much as 0.12 mm in the two outer volutions. Septa in the juvenarium also are thin and slightly fluted near the poles. In the succeeding volutions, fluting is almost lacking. Slight reticulation is present in axial region of the shell. Deep septal furrows are prominent. The tunnel is fairly low and narrow, but is observable only in the juvenarium where there is light axial filling and small chomata.
Discussion. This species differs from *R. yabei* (Staff) and *R. xanzensis* Wang, Sheng, and Zhang in having tighter coiling, fewer volutions, a smaller size, and less septal fluting. Compared to *R. altimurica*, this species has a more rounded shell, a more primitive juvenarium, and a lack of complex axial reticulation.
Locality and age. The same as for the holotype (loc. 561-5).
Material studied. Several subaxial, tangential, and saggital sections.

Genus *Kubergandella* Leven, 1992
***Kubergandella insolita* (Davydov, 1986)**
Plate VI, Figs. 7, 8

Rugososchwagerina insolita: in Chedija et al., 1986, p. 45, plate 1, fig. 19; plate 2, fig. 6.
Locality. Sabzab-Adjar (loc. 209b), central Afghanistan.
Distribution. South Afghanistan, Darvaz, southeast Pamir.
Age. Late Permian, early Kubergandian.
Material studied. Two axial sections.

Family Rugosofusulinidae Davydov, 1982
Genus *Rugosofusulina* Rauser-Chernousova, 1937
***Rugosofusulina likana* Kochansky-Devidé, 1959**
Plate VI, Figs. 9, 10

Rugosofusulina likana: Kochansky-Devidé, 1959, p. 52–53, plate 4, figs. 1–8.
Locality. Amir Omad (loc., 12-4), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, Croatia.
Age. Early Permian, Sakmarian.
Material studied. Two axial sections.

***Rugosofusulina valida* (Lee, 1927)**
Plate VI, Fig. 11

Schellwienia valida: Lee, 1927, p. 69–70, plate 8, figs. 1–3, 10.
Remarks. The present species is nearly identical with the specimens described by Lee from north China as *Schellwienia valida.* It is difficult to compare the finely rugose spirotheca in the Afghan form with Lee's description, however, because Lee did not note this feature in his specimens. Bensh (1962) pointed out that photographs of the specimens figured by Lee showed a slight rugosity; if this is correct, the Afghan specimen undoubtedly belongs to *R. valida* (Lee).
Locality. Zone of Khaftkala (loc. 566-3), middle Afghanistan.
Distribution. South Afghanistan, north China.
Age. Early Permian, Asselian to Sakmarian.
Material studied. One axial section.

***Rugosofusulina furoni* (Thompson, 1946)**
Plate VI, Figs. 12–16

Schwagerina furoni: Thompson, 1946, p. 147–149, plate 23, figs. 1–4, plate 24, figs. 7–10.
Remarks. The numerous specimens available provide grounds to ascertain the variability of this species and to make an accurate diagnosis. Almost all features of this species are variable. Specimens of six to seven volutions range from 4.5 mm to 7 mm in length, 3.2 mm to 4 mm in diameter, and 1.3 to 2 in form ratio. Thus, the shape of the shell ranges from inflated fusiform to subspherical. The proloculus is 0.2 mm to 0.5 mm in diameter. The intensity of septal fluting also is variable, and the shapes of folds in axial sections range from narrow and high to low and rounded. Axial filling, although present in almost every specimen, is developed unequally. The only constant and most recognizable feature of this species appears to be the thick spirotheca (as much as 0.14 mm) composed of a finely rugose tectum and a coarse keriotheca throughout growth. Rugosity of the tectum, which allows assignment to the genus *Rugosofusulina*, was not pointed out in the original description. However, it is perceptible on some of the photographs presented by Thompson (1946).
Locality. Khojagor (loc. A48, A50), Bulola (loc. A58, A59), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Turkey(?).
Age. Late Permian, Murgabian to Midian.
Material studied. Twenty-five axial sections.

Genus *Darvasella* Leven, 1992
***Darvasella vulgariformis* (Kalmykova, 1960)**
Plate VII, Fig. 1

Rugosofusulina vulgariformis: Kalmykova, 1960, p. 126, plate 26, figs. 1, 2.
Locality. Obi Tang (loc. 1153-3), Kwahan (loc. 1155), zone of Darvaz-Transalay; Khojagor (loc. A63), zone of Bamian; Saidi Kajon (loc. A22, A23, A29, A30, A34, A35), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, north Pamir, Darvaz.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. One axial and numerous tangential sections.

***Darvasella compacta* (Leven, 1967)**
Plate VII, Figs. 3, 4

Rugosofusulina compacta: Leven, 1967, p. 139, plate 6, figs. 1, 4, 5.
Locality. Kwahan (loc. 1155-3), Obi Tang (loc. 1155-3), zone of Darvaz Transalay; Saidi Kajon (loc. A30, A31, A32, A38, 393-3), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, north Pamir, Darvaz.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Three axial and five tangential sections.

***Darvasella ponderosa* Leven, n. sp.**
Plate VII, Figs. 2, 5, 6

Holotype: GGM VI-228/97—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A large, short-fusiform shell of four and one-half to five volutions, with smoothly sharpened poles. L = 8.5–10 mm, D = 3.8–4 mm, L:D = 2.2–2.5. The proloculus is spherical to irregular and large, ranging from 0.35 mm to 0.55 mm. The coiling is loose and not

quite uniform. The spirotheca is thick, attaining a maximum value of 0.2 mm in the penultimate whorl. The tectum is finely rugose. Septa are thin and fluted throughout their length. Fluting, which increases poleward, is irregular and involves all of the septa. Phrenothecae are present. The tunnel, which is irregular, is narrow in the first two volutions, rapidly expanding with growth. Small chomata occur on the proloculus. Pseudochomata are present, but axial filling is lacking.
Discussion. This species resembles *D. vulgariformis* (Kalmykova), but differs in having a more regular, fusiform shape that appears at an earlier stage of ontogenesis, and by less intense septal fluting in the middle part of the shell.
Locality and age. The same as for the holotype (loc. A30, A32, A45).
Material studied. Three axial sections.

Darvasella cucumeriformis Leven, n. sp.
Plate VII, Fig. 7; Plate VIII, Fig. 1

Holotype: GGM VI-228/99—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A large, subcylindrical shell of six volutions, flattened to concave in the middle portion. The poles of the shell are sharply terminated in the inner volutions and more rounded in the outer ones. L = 16–18 mm, D = 3.5–3.7 mm, L:D = 4.7–4.8. The proloculus is spherical, with a diameter ranging from 0.7 mm to 0.75 mm. The coiling is tight in the first three to four volutions, becoming more loose with growth. The increase in the diameter of the shell with the growth is shown in the table.

Shell Diameter (mm) Growth in _Darvasella cucumeriformis_ Leven, n. sp.

NN specimen	Volutions						
	1	2	3	4	5	5.5	6
A28-6 (holotype)	0.6	1.0	1.55	2.2	3.15	3.5	
A28-2	0.5	0.75	1.25	2.0	2.9	-	3.7

The spirotheca is moderately thick (as much as 0.11 mm in the outermost volutions), with a finely alveolar keriotheca and a finely rugose tectum. Septa are thin and fluted. The fluting is irregular to cancellate, weakening in the middle part of the shell. Phrenothecae are present. The tunnel is low, fairly narrow in the first three to four volutions, rapidly and abruptly expanding thereafter. Chomata are present only on the proloculus. Axial filling is lacking.
Discussion. D. cucumeriformis n. sp. differs from all other species of this genus in having a larger, more subcylindrical shell. In this respect it resembles *D. compacta* Leven, which, however, is less uniformly and more loosely coiled. The most distinctive feature of this species is the sharpened form of the shell in the inner volutions.
Locality and age. The same as for the holotype (loc. A28).
Material studied. Two axial sections.

Genus _Dutkevitchia_ Leven and Scherbovich, 1978
Dutkevitchia ruzhenzevi (Rauser-Chernousova, 1937)
Plate VIII, Fig. 2

Rugosofusulina ruzhenzevi: Rauser-Chernousova, 1937, p. 20-21, plate 3, figs. 8–10.
Locality. Amir Omad (loc. A12-4), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, Fergana, Pre-Caspian depression, south Ural, north China.
Age. Early Permian, Asselian to Sakmarian.
Material studied. One axial section.

Dutkevitchia jipuensis (Nie and Song, 1983)
Plate VIII, Figs. 3–7

Pseudofusulina jipuensis: Nie and Song, 1983, p. 45–46, plate 3, figs. 6, 7.
Locality. Saidi Kajon (loc. A39, A44), zone of Sourkhob, north Afghanistan, Sabzab-Adjar (loc. 209a, b), central Afghanistan.
Distribution. South Afghanistan, Tibet, south China, Japan.
Age. Late Permian, early Kubergandian.
Material studied. Twenty axial sections.

Dutkevitchia bianpingensis (Zhang and Dong, 1986)
Plate IX, Fig. 1

Rugosofusulina bianpingensis: in Xiao et al., 1986, p. 96, plate 4, figs. 2, 5.
Locality. Amir Omad (loc. A12-4), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, south China.
Age. Early Permian, Sakmarian to Yahtashian.
Material studied. One axial section.

Dutkevitchia sourkhobensis Leven, n. sp.
Plate IX, Fig. 2

Holotype: GGM VI-228/106—axial section; north Afghanistan, zone of Sourkhob, Saidi Kajon; Lower Permian, Yahtashian.
Description. A medium-sized shell, inflated fusiform with slightly elongated poles. L = 8 mm, D = 4 mm, L:D = 2. The proloculus is spherical with a diameter of 0.28 mm. The first volution of the shell is tightly coiled, whereas the succeeding ones are loosely coiled. Diameters of the shell in succeeding whorls of the holotype are as follows: (1) 0.6 mm, (2) 1.9 mm, (3) 3.55 mm, (3.5) 4 mm. The spirotheca is as thin as 0.05 mm in all volutions and composed of a finely rugose tectum and a rather narrow, finely alveolar keriotheca. Septa are very thin and intensely and chaotically fluted; the complex, lace-like axial reticulation fills all the space between whorls. The tunnel is obscure. Chomata and axial filling are absent.
Discussion. D. sourkhobensis resembles advanced representatives of *D. splendida* (Bensh), a species that is widespread in the upper Asselian and lower Sakmarian deposits of Darvaz, Fergana, and north Afghanistan, but it is much more loosely coiled and has more complex and irregular septal fluting. In this respect *D. sourkhobensis* is similar to *Acervoschwagerina;* it cannot be referred to this genus, however, because of the character of the juvenarium and the rugosity of the spirotheca.
Locality. Amir Omad (loc. A12-4), Saidi Kajon (loc. A27), zone of Sourkhob, north Afghanistan.
Age. Early Permian, Sakmarian to Yahtashian.
Material studied. One axial section.

Family Darvasitidae Leven, 1992
Genus _Darvasites_ A. Miklukho-Maclay, 1959

Remarks. Some authors (e.g., F. Kahler and G. Kahler, 1980; Xiao et al., 1986; Nie and Song, 1983) have assigned species from several different regions of the Tethys to the genus *Eoparafusulina* Coogan, 1960, and its subgenera *Eoparafusulina* and *Mccloudia.* They considered the latter to differ from *Darvasites* in having cuniculi, which, according to Coogan (1960) and Skinner and Wilde (1965), are an important characteristic of the genus *Eoparafusulina.* Cuniculi, however, also are present in type species of *Darvasites* (Leven, 1967), and this feature occurs in all or almost all species of *Darvasites.* Thus, the presence of cuniculi in *Darvasites* makes the diagnosis identical with that of *Eoparafusulina.* This leads to the conclusion that there is either a single genus, in which case the name *Eoparafusulina* is a junior synonym of *Darvasites,* or that there are two different homeomorphic genera, spanning two distinct biogeographic provinces: Tethyan (*Dar-*

vasites) and Boreal (*Eoparafusulina*). The author is inclined to favor the second hypothesis. In either case, however, the name *Eoparafusulina* is not an advisable designation for Tethyan species.

***Darvasites contractus* (Schellwien and Dyhrenfurth, 1909)**
Plate IX, Figs. 3–5

Fusulina contracta: Schellwien and Dyhrenfurth, 1909, p. 159–163, plate 13, figs. 9–12.
Locality. Saidi Kajon (loc. A34, A44), zone of Sourkhob, Kwahan (loc. 1155-3), Obi Tang (loc. 1153-3), zone of Darvaz-Transalay; Bulola (loc. A63), zone of Bamian, north Afghanistan; Sabzab-Adjar (loc. 210a), central Afghanistan.
Distribution. Afghanistan, Darvaz, southeast Pamir, China.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Seven axial and five tangential sections.

***Darvasites ordinatus ordinatus* (Chen, 1934)**
Plate IX, Figs. 6, 7

Triticites ordinatus: Chen, 1934, p. 38–39, plate 7, figs. 5–7.
Locality. Saidi Kajon (loc. A45), zone of Sourkhob; Kwahan (loc. 1155-3), Obi Tang (loc. 1153-3), zone of Darvaz-Transalay; Bulola (loc. A63), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Darvaz, north and southeast Pamir, Transcaucasus, south China, Japan.
Age. Lower Permian, Yahtashian to Bolorian.
Material studied. Four axial sections.

***Darvasites ordinatus longus* Leven, n. subsp.**
Plate IX, Figs. 8, 9

Holotype: GGM VI-228/112—axial section; Sabzab-djar, central Afghanistan, Lower Permian, Yahtashian or Bolorian.
Description. An elongate, ellipsoidal shell of eight to nine volutions. L = 6–3 mm, D = 2–1 mm, L:D = 3. The proloculus is spherical and small, attaining a diameter of 0.12 mm. The coiling is tight and uniform. The axis of the coiling of the first volution may be turned at an obtuse angle to the axis of the succeeding ones. The spirotheca is thin, not more than 0.05 mm thick. Fluting is characterized by low, rounded folds. The tunnel is broad, uniformly expanding, and straight. Broad, massive chomata fill two to three folds adjacent to the tunnel.
Discussion. The subspecies described here differs from *D. ordinatus ordinatus* in being somewhat more tightly coiled and having a more elongate shell. It differs from *D. darvasicus* Leven in having broad, massive chomata.
Locality and age. The same as for the holotype (loc. 210a).
Material studied. Four axial sections.

***Darvasites wyssi* (Reichel, 1940)**
Plate IX, Fig. 10

Triticites wyssi: Reichel, 1940, p. 98, plate 19, figs. 1–6.
Locality. Obi Tang (loc. 1153), zone of Darvaz-Transalay; north Afghanistan.
Distribution. North Afghanistan, north Pamir, Darvaz, Karakorum.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. One axial section.

***Darvasites pseudosimplex* (Chen, 1934)**
Plate IX, Fig. 11

Triticites pseudosimplex: Chen, 1934, p. 25, plate 1, figs. 19, 20.
Locality. Gudri Mazar (loc. 85, 85a), central Afghanistan; Saidi Kajon (loc. A30, A31), zone of Sourkhob, north Afghanistan.
Distribution. Afghanistan, Darvaz, China, Japan, Carnic Alps.
Age. Early Permian, Sakmarian to Yahtashian.
Material studied. Three axial and five tangential sections.

***Darvasites vandae* Leven and Scherbovich, 1980**
Plate IX, Figs. 13–15

Darvasites vandae: Leven and Scherbovich, 1980a, p. 27, plate 4, figs. 7–9.
Locality. Gudri Mazar (loc. 85, 85a), central Afghanistan; Saidi Kajon (loc. A30, A31, A34), zone of Sourkhob, north Afghanistan.
Distribution. Afghanistan, Darvaz, Croatia.
Age. Early Permian, Sakmarian to Yahtashian.
Material studied. Two axial and three tangential sections.

***Darvasites* aff. *D. compactus* Leven, 1992**
Plate IX, Fig. 12

Darvasites compactus: in Leven et al., 1992, p. 83, pl. 12, figs. 10, 11.
Remarks. The specimen at hand resembles *D. compactus* Leven from Sakmarian deposits of southwestern Darvaz in having a very small proloculus and tight coiling. However, the more intense and regular septal fluting of the Afghan form indicates that it is not conspecific with the Darvazian species.
Locality. Saidi Kajon (loc. A30, A31, A34), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz.
Age. Early Permian, Yahtashian.
Material studied. One axial section.

***Darvasites* aff. *D. zulumartensis* Leven, 1967**
Plate IX, Fig. 16

Darvasites zulumartensis: Leven, 1967, p. 137, plate 4, fig. 8; plate 5, fig. 1.
Remarks. This species closely resembles *D. zulumartensis* Leven from Yahtashian and Bolorian rocks of north Pamir and Darvaz, but differs in having less intense septal fluting and less massive chomata.
Locality. Amir Omad (loc. A12-4), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, north Pamir.
Age. Early Permian, Sakmarian.
Material studied. One axial section.

***Darvasites afghanensis* Leven, n. sp.**
Plate IX, Figs. 17, 18

Eoparafusulina pusilla: Wang et al., 1981, p. 35, plate 2, fig. 6, not Schellwien, 1898.
Holotype: GGM VI-228/121—axial section; Gudri Mazar, central Afghanistan; Lower Permian, Sakmarian.
Description. A medium-sized, elongate-ellipsoidal shell of six and one-half to seven volutions. L = 5.5–6 mm, D = 2 mm, L:D = 2.7–3. The proloculus is spherical and small, attaining a diameter of 0.2 mm. The coiling is tight with a uniform increase in height of chambers with growth. The spirotheca has a finely alveolar keriotheca about 0.09 mm thick in the outermost whorl. Septa are regular, and the folds are low and rounded, forming an axial reticulation. The tunnel is rather narrow, gradually expanding, and more or less straight. Chomata are small and rounded to triangular, present in all volutions. Light axial filling is present.
Discussion. This species differs from *D. pseudosimplex* (Chen) in being more tightly coiled. In this respect the species closely resembles *D. subashiensis* (Chang), but the latter has a more elongate, subcylindrical shell and less intense and more irregular septal fluting.

Locality. Gudri Mazar (loc. 85a, 85b), central Afghanistan.
Distribution. South Afghanistan, central Pamir, Tibet.
Age. Early Permian, Sakmarian.
Material studied. Three axial sections.

Family Pseudofusulinidae Dutkevich, 1934
Genus *Chalaroschwagerina* Skinner and Wilde, 1965
***Chalaroschwagerina vulgaris* (Schellwien and Dyhrenfurth, 1909)**
Plate X, Figs. 1, 2

Fusulina vulgaris: Schellwien and Dyhrenfurth, 1909, p. 163, plate 14, figs. 1, 2.
Locality. Saidi Kajon (loc. A45), zone of Sourkhob, north Afghanistan; Sabzab-Adjar (loc. 210a), central Afghanistan.
Distribution. Afghanistan, Darvaz, China, Japan.
Age. Early Permian, Yahtashian.
Material studied. Three axial sections.

***Chalaroschwagerina vulgarisiformis* (Morikawa, 1952)**
Plate X, Fig. 3

Parafusulina vulgarisiformis: Morikawa, 1952, p. 31, plate 1, figs.1–4.
Locality. Zone of Khoja Murod (loc. 628-6), middle Afghanistan.
Distribution. South Afghanistan, Darvaz, southeast Pamir, China, Japan, Iran.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. One axial section.

***Chalaroschwagerina tibetica* Nie and Song, 1983**
Plate X, Figs. 5, 6

Chalaroschwagerina tibetica: Nie and Song, 1983, p. 36, plate 1, figs. 15–16.
Locality. Saidi Kajon (loc. A30, A34, A35), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, Darvaz, Tibet.
Age. Early Permian, Yahtashian.
Material studied. Five axial sections.

***Chalaroschwagerina kushlini* (Leven, 1967)**
Plate X, Fig. 4

Parafusulina kushlini: Leven, 1967, p. 177, plate 27, fig. 4; plate 28, fig. 2.
Locality. Zone of Tash Kupruk (loc. 1400-1-20), south Afghanistan.
Distribution. South Afghanistan, Darvaz, southeast Pamir.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. One axial section.

***Chalaroschwagerina bamianica* Leven, n. sp.**
Plate X, Figs. 7, 8

Pseudofusulina vulgaris var. *globosa:* Igo (part), 1959, p. 240–242, plate 1, fig. 5; plate 3, fig. 4.
Holotype: GGM VI-228/131—axial section; Khojagor, zone of Bamian, north Afghanistan; Lower Permian, Yahtashian or Bolorian.
Description. An inflated fusiform to subspherical shell with slightly elongated poles. L = 5.2–5.7 mm, D = 2.9–4 mm, L:D = 1.4–1.7. The proloculus is spherical, with a diameter of 0.22 mm to 0.4 mm. The coiling is rather tight and uniform as compared with other species of *Chalaroschwagerina*. The increase of the shell diameter with the coiling is shown in the table.

Shell Diameter (mm) Growth in
***Chalaroschwagerina bamianica* Leven, n. sp.**

NN specimen	Volutions 1	2	3	4	5	5.5	6	6.5
A72-6 (holotype)	0.47	0.85	1.35	2.1	2.85	-	3.5	4.5
A73-3	0.52	0.85	1.3	1.9	2.6	2.9		

The spirotheca is thick throughout growth (as much as 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 *C. globosa* (Schellwien and Dyhrenfurth), differing in being more tightly coiled, having a very thick spirotheca, and having more regular septal fluting.
Locality. Khojagor (loc. A72, A73), zone of Bamian.
Distribution. North Afghanistan, Japan, China.
Age. Early Permian, Yahtashian or Bolorian.
Material studied. Two axial sections.

***Chalaroschwagerina sourkhobensis* Leven, n. sp.**
Plate X, Fig. 9

Holotype: GGM VI-228/132—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A large, short uniform shell of six and one-half volutions with narrowly rounded poles. L = 10.5 mm, D = 4.9 mm, L:D = 2.1. The proloculus is obscure, but appears to be small (not more than 0.1 mm) and spherical. The first two whorls are tightly coiled, the shell then rapidly expanding with very loose coiling. The diameter of the shell in the first to seventh whorls in mm is: 0.2, 0.4, 0.7, 1.3, 2.3, 3.8, and 4.9. The spirotheca is slightly wavy and thick (0.12 mm in the outermost volution). Septa are thin and fluted throughout the length of the shell. Complex septal reticulation is present in the axial portion of the shell, and phrenothecae are present. The tunnel in the first three to four whorls is narrow and high; later it is not distinct. Pseudochomata are present in the inner volutions at the edges of tunnel. Axial filling is absent.
Discussion. This species differs from most known species of *Chalaroschwagerina* in having a small proloculus and tight coiling in the first whorls. In this respect it is similar only to *C. eximia* Skinner and Wilde; it is distinguished from the latter in having a thickened spirotheca, less intense septal fluting, and a shorter shell, especially in the inner volutions.
Locality and age. The same as for the holotype (loc. A31).
Material studied. One axial section.

Genus *Pseudofusulina* Dunbar and Skinner, 1931
***Pseudofusulina karapetovi* Leven, n. sp.**

Remarks. This species is abundant in the oldest fusulinid-bearing beds of south Afghanistan and includes forms from the Wardak and Tezak sequences erroneously referred to *Pseudofusulina ambigua* Deprat by Lys and Lapparent (1971) on pl. 9, fig. 1 and pl. 16. Judging by these figures, the specimens closely resemble the species described here. Three more or less stable varieties are distinguished within the species. These are described as subspecies.

***Pseudofusulina karapetovi karapetovi* Leven, n. sp. and n. subsp.**
Plate XI, Figs. 1–5

Holotype: GGM VI-228/133—axial section; central Afghanistan, Tezak; Lower Permian, Sakmarian.

Description. A small, elongate to subcylindrical shell of five to six volutions. L = 6.5–7.7 mm, D = 1.7–2.2 mm, L:D = 3.5–4.4. The proloculus is small, the diameter ranging from 0.14 mm to 0.16 mm. Coiling is tight with a small amount of loosening after the third or forth whorl. The table shows the increase in diameter of the shell of typical specimens.

Shell Diameter (mm) Growth in *Pseudofusulina karapetovi karapetovi* Leven, n. sp. and n. subsp.

NN specimen	Volutions						
	1	2	3	4	5	5.5	6
222b-13 (holotype)	0.25	0.4	0.7	1.1	1.7		
222b-1	0.22	0.42	0.52	1.1	1.57		2.2
222b-10	0.35	0.57	0.87	1.4	1.8	2.1	
222b-20	0.27	0.42	0.67	1.1	1.6	1.8	

The spirotheca is thin in the inner volutions, but markedly thickened later, attaining a maximum thickness of 0.1 mm. Septa are thin. Folding of moderate intensity involves all septa. Folds vary in form and height, and fairly simple septal reticulation is present in the axial portion of the shell. The tunnel is narrow, low, and more or less straight. Small chomata are present in the first two to three volutions. Axial filling is lacking or sparse in the inner volutions.
Discussion. This subspecies is similar to *Pseudofusulina tastubensis* Vissarionova, but differs in its smaller size, more sharply elongated shell, and tighter coiling.
Locality. Tezak (loc. 222b), Gudri Mazar (loc. 85a), Khargardan (loc.8), central Afghanistan.
Distribution. Afghanistan, central Pamir, Karakorum, east Hindu Kush.
Age. Early Permian, Sakmarian.
Material studied. Fifteen axial sections.

***Pseudofusulina karapetovi gudriensis* Leven, n. sp. and n. subsp.**
Plate XI, Figs. 6–8

Holotype: GGM VI-228/140—an axial section; central Afghanistan, Gudri Mazar; Lower Permian, Sakmarian.
Discussion. This subspecies differs from *P. karapetovi karapetovi* by the incongruity of the form of the early volutions, which is subrhombic, to that later where the shell is subcylindrical. The peculiarity of the form in the inner volutions is accentuated by more intense septal fluting and the presence of secondary calcite. This subspecies is allied with *P. karapetovi karapetovi* by transitional forms. It resembles *P. postpedissequa* Vissarionova, but can be distinguished from the latter in its smaller size, a shorter shell, and better defined juvenarium.
Locality. Gudri Mazar (loc. 85, 85a), Tezak (loc. 222a), central Afghanistan.
Age. Early Permian, Sakmarian.
Material studied. Nine axial sections.

***Pseudofusulina karapetovi tezakensis* Leven, n. sp. and n. subsp.**
Plate XI, Figs. 9–11

Holotype: GGM VI-228/143—axial section; Tezak, central Afghanistan; Lower Permian, Sakmarian.
Discussion. As in the subspecies *P. karapetovi gudriensis,* this subspecies has a well defined juvenarium filled with secondary calcite, but the shell uncoils from the juvenarium less rapidly. It remains inflated fusiform with sharpened poles in mature individuals with the form ratio never exceeding 3:1. The well defined juvenarium differentiates this subspecies from *P. karapetovi karapetovi.*
Locality and age. The same as for the former subspecies of *P. karapetovi.*
Material studied. Twelve axial sections.

***Pseudofusulina macilenta* Leven, n. sp.**
Plate XI, Figs. 12–19

Holotype: GGM VI-228/147—axial section; zone of Khaftkala, middle Afghanistan; Lower Permian, Sakmarian.
Description. A medium-sized shell, elongate-fusiform to subcylindrical in shape. L = 5–7 mm, D = 1.5–1.9 mm, L:D = 3–5. The proloculus is spherical and small, with a diameter of 0.12 mm to 0.17 mm. The coiling is tight and uniform with a gradual increase in the height of the succeeding whorls. The increase in diameter with growth in typical specimens is shown in the table.

Shell Diameter (mm) Growth in *Pseudofusulina macilenta* Leven, n. sp.

NN specimen	Volutions						
	1	2	3	4	5	5.5	6
566-4-1 (holotype)	0.22	0.4	0.62	0.9	1.25		1.6
566-7-4	0.3	0.47	0.7	0.93	1.3		
566-2-3	0.22	0.37	0.57	0.83	1.1	1.33	

The spirotheca, locally slightly wavy and with obscure alveoli, is thin in the inner volutions, rapidly thickening to 0.07 mm thereafter. Septa are thin. Fluting increases from the middle polewards; folds are rounded or irregular, and of a variable height. The tunnel is low, strongly expanded in the final volutions, and irregular. Small chomata locally are visible on the proloculus and in the first whorls. Axial filling is lacking or light in the third to fourth volution.
Discussion. The specimens studied most resemble *P. samjatini* Scherbovich and *P. karapetovi karapetovi,* n.sp., but they are distinguished by their smaller size and tighter coiling.
Locality. Kohe Pud (loc. 566), zone of Khaftkala, middle Afghanistan.
Distribution. South Afghanistan and the Bartang-Rangkul zone in the south Pamir.
Age. Early Permian, Sakmarian.
Material studied. Fifteen axial sections.

***Pseudofusulina hordeola* Nie and Song, 1983**
Plate XII, Figs. 1, 2

Pseudofusulina hordeola: Nie and Song, 1983, p. 46–47, plate 3, figs. 8, 14.
Locality. Zone of Khoja Murod (loc. 604-6), middle Afghanistan.
Distribution. South Afghanistan, China.
Age. Early Permian, Sakmarian.
Material studied. Five axial sections.

***Pseudofusulina peregrina* Leven, n. sp.**
Plate XII, Figs. 3–5

Holotype: GGM VI-228/154—axial section; middle Afghanistan, Kohe Pud, zone of Khaftkala; Lower Permian, Sakmarian.
Description. A medium-sized fusiform shell of five and one-half to six volutions, somewhat inflated in the middle portion and smoothly tapering toward the poles. L = 6–7.5 mm, D = 1.7 mm, L:D = 3.4–4.4. The proloculus is spherical, ranging in diameter from 0.15 mm to 0.25 mm. Diameters of the shell in the whorls of typical specimens are shown in the table.

Shell Diameter (mm) Growth in
***Pseudofusilina peregrina* Leven, n. sp.**

	Volutions					
NN specimen	1	2	3	4	5	6
566-3-3 (holotype)	0.4	0.6	1.0	1.4	1.7	
566-3-6	0.3	0.4	0.6	0.8	1.25	1.7

The spirotheca is moderately thick, 0.07 mm in the final volution. Septa are thin. Fluting involves the septa throughout their length, although it is weaker in the middle portion of the shell. The folds are rounded to triangular. The tunnel is irregular and rather narrow in the first three to four whorls, but strongly expanding outward.
Discussion. This species closely resembles *P. macilenta* n. sp., differing from the latter in its larger shell and bulbous middle portion, and in possessing axial filling in the inner whorls. This species resembles *P. hordeola* Nie and Song, but is distinguished by its smaller size, the form of the shell, and less intense septal fluting.
Locality. Zone of Khaftkala (loc. 566), zone of Khoja Murod (loc. 604-6, 604-8), middle Afghanistan.
Distribution. Afghanistan.
Material studied. Three axial and five tangential sections.

Pseudofusulina parasecalica (Zhang, 1963)
Plate XII, Fig. 6

Triticites parasecalicus: Zhang, 1963, p. 63, plate 3, fig. 18.
Remarks. This species is similar to *P. parasecalica* (Zhang) in the nature of the expansion of the shell, its size, and the septal fluting; it differs in the fusiform shape of the shell in the inner volutions and the more intense septal fluting.
Locality. Zone of Khaftkala (loc. 566), middle Afghanistan.
Distribution. Afghanistan, China.
Age. Early Permian.
Material studied. One subaxial section.

Pseudofusulina fabra Leven and Scherbovich, 1980
Pseudofusulina fabra fabra Leven and Scherbovich, 1980
Plate XII, Figs. 8, 9

Pseudofusulina fabra: Leven and Scherbovich, 1980a, p. 21–22, plate 3, fig. 5.
Locality. Zone of Khaftkala (loc. 566-3, 566-4), middle Afghanistan.
Distribution. Afghanistan, Darvaz.
Age. Early Permian, Sakmarian.
Material studied. One axial and one tangential section.

Pseudofusulina fabra grandiuscula Leven, n. subsp.
Plate XII, Fig. 7

Holotype: GGM VI-228/158—axial section; Kohe Pud, zone of Khaftkala, middle Afghanistan; Lower Permian, Sakmarian.
Description. A large, inflated fusiform shell of seven volutions. L = 10 mm, D = 3.5 mm, L:D = 3. The proloculus is spherical, with a diameter of 0.25 mm. The coiling is rather loose and uniform. The spirotheca attains a thickness of 0.15 mm. Septa are thin and fluted throughout their length. Folds increase moderately in height toward the poles, transforming into septal reticulation. The tunnel is irregular and expands gradually with growth. Axial filling is light.
Discussion. P. fabra fabra Leven and Scherbovich is considerably larger than *P. fabra grandiuscula* at the same stage of growth.
Locality and age. The same as for the holotype (loc. 566).
Material studied. One axial section.

Pseudofusulina acuminatula Leven, n. sp.
Plate XII, Figs. 10, 11

Holotype: GGM VI-228/161—axial section, Tezak, central Afghanistan; Lower Permian, Sakmarian.
Description. A medium-sized shell of six to seven volutions. It is short and fusiform, gradually tapering to sharpened poles in all whorls. L = 6.3 mm, D = 2.1-2.4 mm, L:D = 2.5–3.5. The proloculus is spherical and ranges from 0.02 mm to 0.025 mm in diameter. The coiling is tight and uniform. The spirotheca is moderately thick, reaching 0.07 mm in the final volution. Septa are quite thick and fluted throughout their length, forming rounded and rather low folds. The tunnel is narrow, moderately expanding, and more or less straight. Small chomata are present on the proloculus and on the first volution; the two or three succeeding whorls have pseudochomata. Poorly developed axial filling is present in the first four to five volutions.
Discussion. The present species resembles *P. kalamulunica* (Wang, Sheng, and Zhang) from Midian deposits of Tibet. It differs from the latter in being more inflated in the middle portion and having lower folds. In the character of septal fluting, *P. acuminatula* somewhat resembles some varieties of *P. tschernyschewi* (Schellwien) from Sakmarian deposits of Tibet, but the subcylindrical shape combined with the broadly rounded poles of the latter serves to distinguish it from the former.
Locality and age. The same as for the holotype (loc. 222a and 222b).
Material studied. Three axial sections.

Pseudofusulina hessensis orientalis Leven, n. subsp.
Plate XII, Figs. 12, 13

Holotype: GGM VI-228/162—axial section; Sabzab-Adjar, central Afghanistan; Lower Permian, Bolorian.
Description. A fusiform shell of five and one-half to six volutions, slightly inflated in the middle portion and gently tapering poleward. L = 5.4–8.5 mm, D = 2–3 mm, L:D = 2.0 to 2.8. The proloculus is spherical with a diameter of 0.25 mm to 0.35 mm. The coiling is tight and uniform. The spirotheca attains a thickness of 0.12 mm. Septa are thin and fluted throughout the shell. The folds are high and narrow and transform into a fine cancellate meshwork. The tunnel is of moderate width, irregular, and it expands in the penultimate volution. Weak pseudochomata and axial filling are present in the inner volutions.
Discussion. This subspecies differs from *P. hessensis hessensis* (Dunbar and Skinner) in its smaller size and less intense septal fluting.
Locality. Sabzab-Adjar (loc. 210a), central Afghanistan; Kwahan (loc. 1155–3), zone of Darvaz-Transalay, north Afghanistan.
Age. Early Permian, Bolorian.
Material studied. Twenty-eight axial sections.

Pseudofusulina neolata (Thompson, 1954)
Plate XII, Fig. 15

Schwagerina neolata: Thompson, 1954, p. 65, plate 36, figs. 9–15.
Locality. Kwahan (loc. 1155-3), Obi Tang (loc. 1153-1, 1153-3), zone of Darvaz-Transalay, north Afghanistan.
Distribution. North Afghanistan, Darvaz, USA.
Age. Early Permian, Bolorian.
Material studied. One axial and three tangential sections.

Pseudofusulina fusiformis (Schellwien and Dyhrenfurth, 1909)
Plate XII, Fig. 14

Fusulina vulgaris var. *fusiformis:* Schellwien and Dyhrenfurth, 1909, p. 165, plate 15, figs. 1–4.
Locality. Saidi Kajon (loc. A28, A30), zone of Sourkhob; Obi Tang (loc. 1153-1, 1153-2), zone of Darvaz-Transalay, north Afghanistan;

zone of Khoja Murod (loc. 606-14), middle Afghanistan; Sabzab-Adjar (loc. 210), central Afghanistan; zone of Tash Kupruk (loc. 1400-1-20).
Distribution. Afghanistan, Darvaz, China, Indochina, Japan.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Five axial and four tangential sections.

***Pseudofusulina kraffti* (Schellwien and Dyhrenfurth, 1909)**
Plate XII, Fig. 16

Fusulina kraffti: Schellwien and Dyhrenfurth, 1909, p. 169, plate 16, figs. 1–9.
Locality. Khojagor (loc. A63), zone of Bamian; Obi Tang (loc. 1153-1, 1153-6, 1153-7), zone of Darvaz-Transalay, north Afghanistan; zone of Khoja Murod (loc. 606-7, 606-16), middle Afghanistan; zone of Tash Kupruk (loc. 1400-1-20).
Distribution. Afghanistan, Darvaz, China, north Pamir, Transcaucasus, Turkey, China, Indochina, Japan.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Eight axial sections.

***Pseudofusulina postkraffti* (Leven, 1967)**
Plate XIII, Fig. 1

Parafusulina postkraffti: Leven, 1967, p. 157–158, plate 15, figs. 4–5.
Locality. Zone of Sange Dushoh (loc. 628-3, 628-29), middle Afghanistan.
Distribution. Afghanistan, Darvaz, China, southeast Pamir.
Age. Early Permian, Bolorian.
Material studied. Three axial sections.

***Pseudofusulina isomie* Igo, 1965**
Plate XIII, Fig. 2

Pseudofusulina isomie: Igo, 1965, p. 219, plate 29, fig. 6; plate 30, figs. 5, 6; plate 31, figs. 6, 7.
Locality. Chon (loc. A19), zone of Sourkhob, north Afghanistan; zone of Khoja Murod, (loc. 625-19), middle Afghanistan.
Distribution. Afghanistan, Darvaz, Koryakian Mountains, Japan, China.
Age. Early Permian, Yahtashian to Bolorian.
Material studied. Four axial sections.

***Pseudofusulina heratica* Leven, n. sp.**
Plate XIII, Figs. 3, 4

Parafusulina edoensis: Sheng, 1962, p. 428, plate 1, fig. 1–7; not Ozawa, 1925.
Holotype: GGM VI-228/168—axial section; zone of Sange Dushoh, middle Afghanistan; Upper Permian, Kubergandian.
Description. A large, elongate-fusiform shell of six and one-half to seven volutions, inflated in the middle portion and with broadly rounded poles. L = 12–14 mm, D = 3.2–3.5 mm, L:D = 3.6–4.3. The proloculus is spherical and 0.2 mm to 0.4 mm in diameter. The coiling is tight and uniform. The spirotheca is moderately thick and finely alveolar. The tectum is slightly wavy. Septa are thick. Fluting, which involves the entire septa, decreases gradually toward the tunnel. Phrenothecae are present. The tunnel is irregular and narrow to the fourth volution, rapidly expanding thereafter. Chomata are lacking. Axial filling covers a broad area.
Discussion. This species is most similar to *P. dzamantalensis* (Leven), but differs in its tighter coiling and somewhat more regular and more highly developed septal fluting.
Locality and age. The same as for the holotype (loc. 628-25, 628-26).
Distribution. Afghanistan, south China.
Material studied. Two axial sections.

***Pseudofusulina sourkhobensis* Leven, n. sp.**
Plate XIII, Figs. 5, 6

Holotype: GGM VI-228/170—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A fusiform shell of six to seven volutions, with regular coiling throughout and sharply tapering poles. L = 9.5–13 mm, D = 3.1–4.3 mm, L:D = 2.9–3.4. The proloculus is spherical to subspherical with a diameter of 0.2 mm to 0.4 mm. The coiling is uniform with a very gradual increase in height in succeeding whorls. The spirotheca attains a thickness of 0.2 mm and is finely alveolar. Septa are thin and fluted throughout their length. Folds are rounded or irregular and commonly are thickened in the upper part where they transform to an area of narrow and rather simple septal reticulation. The tunnel is low, gradually expanding, and irregular. Chomata are lacking. Light secondary deposits occur in the axial portion of the shell.
Discussion. This species most resembles *P. huecoensis* Dunbar and Skinner, but the more sharply terminating poles, the more uniform growth pattern, the smaller size, and the relatively thicker spirotheca serve to distinguish the former from the latter.
Locality and age. The same as for the holotype (loc. A27, A30, A33).
Material studied. Five axial sections.

***Pseudofusulina priva* Leven, n. sp.**
Plate XIII, Fig. 7

Holotype: GGM VI-228/172—an axial section; Bulola, zone of Bamian, north Afghanistan; Upper Permian, lower Kubergandian.
Description. A medium-sized shell of eight volutions, elongate-fusiform with narrowly rounded poles. L = 9.5 mm, D = 2.25 mm, L:D = 4.2. The proloculus is spherical, attaining a diameter of 0.28 mm. The shell is tightly coiled with a gradual increase in height of chambers with growth. The spirotheca is very thin (not more than 0.045 mm) with finely alveolar keriotheca. Septa also are thin. Fluting involves only the lower part of the septa; folds are fairly low, nearly regular, and rounded, not joining the basal part. The tunnel is narrow and irregular. Chomata are absent, but pseudochomata are present in the inner volutions. Axial filling occurs in the first six whorls, the region of development expanding markedly in the fourth to fifth whorl.
Discussion. This species resembles representatives of the *P. kraffti* (Schellwien and Dyhrenfurth) group in the character of fluting and the presence of heavy axial filling, but differs in being more tightly coiled and having a thinner spirotheca and an almost fusiform shape.
Locality and age. The same as for the holotype (loc. A53, A54).
Material studied. Two axial sections.

***Pseudofusulina nupera* Leven, 1965**
Plate XIV, Fig. 1

Pseudofusulina nupera: Leven, 1965, p. 136–137, plate 5, figs. 3–4.
Locality. Khojagor (loc. 446-2), zone of Bamian, north Afghanistan; Uruzgan (loc. 238), central Afghanistan.
Distribution. Afghanistan, north Pamir.
Age. Late Permian, Murgabian.
Material studied. Three axial sections.

***Pseudofusulina hupehensis* (Chen, 1956)**
Plate XIV, Figs. 3–5

Schwagerina hupehensis: Chen, 1956, p. 38–39, plate 8, figs. 1–3.
Locality. Altimur (loc. 284, 1362), Suleiman-Kirthar area.
Distribution. South Afghanistan, south China.
Age. Late Permian, Midian.
Material studied. Five axial and four tangential sections.

***Pseudofusulina solita* (Skinner, 1969)**
Plate XIV, Figs. 6–8

Schwagerina solita: Skinner, 1969, p. 9, plate 12, figs. 5–12.
Locality. Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. South Afghanistan, Turkey.
Age. Late Permian, Midian.
Material studied. Five axial and two subaxial sections.

***Pseudofusulina bulolensis* Leven, n. sp.**
Plate XIV, Figs. 2, 9, 10

Holotype: GGM VI-228/181—axial section; Bulola, zone of Bamian, north Afghanistan; Upper Permian, Midian.
Description. A fusiform shell of six to seven volutions, with strongly inflated axial portion and elongate poles. L = 5–6.3 mm, D = 2.5–3.1 mm, L:D = 1.6–2.2. The proloculus is spherical with a diameter of 0.2 mm to 0.25 mm. The coiling is more or less uniform, with visible, but moderate increase in the height of succeeding volutions. The spirotheca is thin in the innermost whorls, rapidly thickening to 0.15 mm. Septa are rather thick and fluted pole to pole. Fluting is irregular, folds being variable in size and form. The tunnel is narrow and irregular. Axial deposits fill some folds on both sides of the tunnel throughout growth.
Discussion. In the elongation of the poles and development of axial filling, this species is comparable with *P. crassa* (Deprat); it differs from the latter, however, in having a thick spirotheca, less intense septal fluting, and looser coiling.
Locality and age. The same as for the holotype (loc. A59).
Material studied. Three axial sections.

***Pseudofusulina paralpina* (Chen, 1956)**
Plate XV, Figs. 1, 3, 4

Schwagerina paralpina: Chen, 1956, p. 26, plate 2, figs. 9–11.
Locality. Khojagor (loc. A50), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, south China.
Age. Late Permian, Midian.
Material studied. Two axial sections.

***Pseudofusulina nishiwarensis* Kanuma, 1959**
Plate XV, Fig. 6

Pseudofusulina nishiwarensis: Kanuma, 1959, p. 66, plate 6, fig. 1–3.
Locality. Zone of Khoja Murod (loc. 625-17), middle Afghanistan.
Distribution. South Afghanistan, southeast Pamir, Darvaz, Japan.
Age. Early Permian, Bolorian.
Material studied. One axial section.

***Pseudofusulina argandabensis* Leven, n. sp.**
Plate XV, Fig. 5

Holotype: GGM VI-228/186—axial section; Khargardan, central Afghanistan; Lower Permian, Sakmarian.
Description. A fairly large, fusiform to subcylindrical shell with rounded poles. L = 11 mm, D = 2.8 mm, L:D = 4. The proloculus is spherical, attaining a diameter of 0.3 mm. The shell is quite loosely and uniformly coiled. The spirotheca is finely alveolar, reaching a thickness of 0.07 mm. Septa are relatively thick. Folding is minor, especially in the middle portion of the shell. Folds are low and rounded, transforming into fine septal reticulation at the poles. The tunnel is narrow in the first whorls, but it expands rapidly in the two final whorls. Chomata are present only on the proloculus. Heavy axial filling, extending into the septa, are developed in the first four volutions.
Discussion. This species closely resembles *P. fusiformis* (Schellwien and Dyhrenfurth), but differs in having less intense septal fluting and heavier axial filling in the inner volutions.
Locality and age. The same as for the holotype (loc. 8).
Material studied. One axial section.

***Pseudofusulina immensa* Leven, n. sp.**
Plate XV, Fig. 7

Holotype: GGM VI-228/188—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A large shell of seven and one-half volutions, fusiform with gradually tapering poles throughout growth. L = 19 mm, D = 5 mm, L:D = 3.8. The proloculus is spherical, attaining a diameter of 0.3 mm. The coiling is loose and uniform. The spirotheca is slightly wavy and very thick (as much as 0.17 mm), with finely alveolar keriotheca. Septa are thin, fluted the entire length. Fluting is moderate and increases toward the poles, forming complex septal reticulation. Folds are low near the tunnel, not joining one another. Closer to the poles these are arranged in two stages. Phrenothecae are present. Light axial filling is visible in the first three volutions.
Discussion. The combination of a large shell and a thick spirotheca serve to distinguish this species from all other known species of *Pseudofusulina.*
Locality and age. The same as for the holotype (loc. A32).
Material studied. One axial section.

***Pseudofusulina perspicua* Leven, n. sp.**
Plate XV, Fig. 8

Holotype: GGM VI-228/189—axial section; Saidi Kajon, zone of Sourkhob, north Afghanistan; Lower Permian, Yahtashian.
Description. A large shell of five volutions, inflated fusiform in the inner whorls, elongate-fusiform to subcylindrical later, with bulbous middle portion and broad tapering toward rounded poles. L = 16 mm, D = 3.5 mm, L:D = 4.6. The proloculus is spherical and large, attaining a diameter of 0.35 mm. The shell is loosely and evenly coiled. The spirotheca is thin, as much as 0.1 mm thick, and smooth with a finely alveolar keriotheca. Septa are thin and folded. Folds are rounded near the tunnel, but rapidly transform into cancellate septal reticulation especially in the inner whorls. Phrenothecae are present. The tunnel is low and narrow in the early whorls, expanding rapidly thereafter. Axial filling is sparse in the inner volutions.
Discussion. This species differs from all other known species of *Pseudofusulina* in having very loose coiling and unusual septal fluting. In these features, it resembles *Chalaroschwagerina,* but the strongly elongate form of the shell does not permit assignment to that genus.
Locality and age. The same as for the holotype (loc. A27).
Material studied. One axial section.

***Pseudofusulina haftkalensis* Leven, n. sp.**
Plate XV, Figs. 2, 9, 10

Holotype: GGM VI-228/183—axial section; Kohe Pud, zone of Khaftkala, middle Afghanistan; Upper Permian, Murgabian.
Description. A short, fusiform shell of seven to eight and one-half volutions with a flattened middle portion. L = 7–9 mm, D = 3.3–4 mm; L:D = 1.9–2.8. The proloculus is spherical and fairly small, not exceeding 0.3 mm in diameter. The shell is quite tightly and uniformly coiled with a very gradual increase in height in succeeding volutions. The spirotheca is coarsely alveolar, moderately thickening as much as 0.11 mm in the outermost whorl. Septa are thin, but thicken near the tunnel at the expense of secondary calcite. Fluting is intense and regular. The folds are large but do not reach chamber height. They often are rounded and flattened with thickened tops. The tunnel is narrow in the inner four to five whorls, rapidly expanding thereafter. Chomata are lacking.

Discussion. This species most resembles *P. pursatensis* (Gubler), especially to the specimen figured by Tien (1979, plate 19, fig. 1). *P. haftkalensis*, however, is distinguished by its more elongate shell, tighter coiling, and lower and more regular septal fluting. The present species also resembles *P. gundarensi* Kalmykova, but it differs in having a larger shell, which is flattened in the middle portion, having more regular septal fluting, and in having an expansion of the septa at both sides of the tunnel.
Locality and age. The same as for the holotype (loc. 561-5, 571-2).
Material studied. Eight axial sections.

Genus *Praeskinnerella* Bensh, 1987
***Praeskinnerella crassitectoria afghanensis* Leven, n. subsp.**
Plate XVI, Figs.1, 2

Holotype: GGM VI-228/192—axial section; Sabzab-Adjar, central Afghanistan; Lower Permian, Bolorian.
Description. A fairly small, fusiform shell of six to seven volutions, some specimens of which are slightly flattened in the middle portion. The poles commonly are tapered in the inner volutions, being more rounded in the final one or two. L = 6–10 mm, D = 2–2.7 mm, L:D = 3–4. The proloculus is spherical with a diameter ranging from 0.17 mm to 0.27 mm. The shell is tightly and more or less uniformly coiled. The spirotheca is moderately thick, as much as 0.07 mm. Septa are thin and intensely folded. Folds are high and rounded to triangular in shape. The tunnel is narrow and irregular. Axial filling is present in the inner volutions, covering almost all of the shell near the tunnel. In succeeding volutions axial filling is discontinuous and then disappears. Septal thickening occurs only adjacent to the tunnel.
Discussion. The Afghan subspecies differs from the typical representatives of *P. crassitectoria* Dunbar and Skinner from the Leonard Formation in the Glass Mountains, Texas, in its smaller size, tighter coiling, and the more elongate form of the shell; the last features of which serve to distinguish the present species from the latter.
Locality and age. The same as for the holotype (loc. 210a).
Material studied. Twenty-three axial sections.

***Praeskinnerella cushmani* (Chen, 1934)**
Plate XVI, Fig. 6

Pseudofusulina cushmani: Chen, 1934, p. 72, plate 6, figs. 4–6.
Locality. Saidi Kajon (loc. A35), zone of Sourkhob, north Afghanistan.
Distribution. North Afghanistan, China, Indochina, Japan.
Age. Early Permian, Yahtashian.
Material studied. One axial and two subaxial sections.

Praeskinnerella guembeli pseudoregularis
(Dunbar and Skinner), 1937
Plate XVI, Figs. 3–5

Schwagerina guembeli pseudoregularis: Dunbar and Skinner, 1937, p. 640–641, plate 61, figs. 14–24.
Locality. Sabzab-Adjar (loc. 210a), central Afghanistan.
Distribution. South Afghanistan, Darvaz, China, United States.
Age. Early Permian, Sakmarian to Bolorian.
Material studied. Five axial sections.

Genus *Skinnerella* Coogan, 1960
***Skinnerella gundarensis* Leven, 1992**
Plate XVI, Figs. 7–9

Skinnerella gundarensis: Leven et al., 1992, p. 108, pl. 25, figs. 6, 9.
Locality. Sabzab-Adjar (loc. 209b), central Afghanistan.
Distribution. South Afghanistan, Darvaz.
Age. Late Permian, early Kubergandian.
Material studied. Seventeen axial sections.

***Skinnerella undulata* (Chen, 1934)**
Plate XVI, Figs. 10, 11

Parafusulina undulata: Chen, 1934, P. 82–84, plate 12, fig. 5.
Locality. Sabzab-Adjar (loc. 209a, b), central Afghanistan.
Distribution. South Afghanistan, south China.
Age. Late Permian, Kubergandian.
Material studied. Nine axial sections.

***Skinnerella speciosa* (Skinner, 1971)**
Plate XVII, Figs. 1, 2

Parafusulina speciosa: Skinner, 1971, p. 8, plate 13, fig. 4; plate 14, figs. 1–4; plate 15, figs. 1–4; plate 16, figs. 1–3.
Locality. Khargardan (loc. 10a), central Afghanistan.
Distribution. Afghanistan, USA.
Age. Late Permian, Kubergandian.
Material studied. Twelve axial sections.

***Skinnerella yabei asiatica* (Leven, 1967)**
Plate XVII, Fig. 3

Parafusulina yabei asiatica: Leven, 1967, p. 163–164, plate 19, figs. 1, 4.
Locality. Zone of Sange Dushoh, (loc. 629-5), middle Afghanistan.
Distribution. South Afghanistan, north Pamir.
Age. Late Permian, Kubergandian.
Material studied. One axial section.

***Skinnerella cincta* (Reichel, 1940)**
Plate XVII, Figs. 4, 5

Parafusulina japonica cincta: Reichel, 1940, p. 106, plate 22, figs. 1, 2, 5–7.
Locality. Sabzab-Adjar (loc. 209), Khargardan (loc. 12a, b), central Afghanistan; zone of Sange Dushoh (loc. 639-1), middle Afghanistan; Abtchagan, (loc. 180), Suleiman-Kirthar area.
Distribution. South Afghanistan, Pamir, Karakorum, Japan.
Age. Late Permian, Kubergandian.
Material studied. Sixteen axial sections.

Genus *Parafusulina* Dunbar and Skinner, 1931
***Parafusulina uruzganensis* Leven, n. sp.**
Plate XVIII, Figs. 2, 3

Holotype: GGM VI-228/208—axial section; Uruzgan, central Afghanistan; Upper Permian, Murgabian.
Description. A medium-size to large, fusiform to subcylindrical shell of seven and one-half to eight volutions. L = 8–12 mm, D = 2.2–3.3 mm, L:D = 3.3–4.4. The proloculus is spherical with a diameter of 0.3 mm to 0.45 mm. The coiling is relatively tight and uniform, with a very slow increase in chamber height with growth. The spirotheca is moderately thick, attaining a thickness of 0.07 mm in the final volutions. Septa are thin and intensely fluted pole to pole. Folds are high, narrow, and rounded, grading into axial reticulation. The tunnel is narrow and irregular. Septa are thickened at the expense of the axial filling. Cuniculi appear in the early volutions.
Discussion. The present species resembles *P. tomeganensis* Morikawa from the Murgabian limestone of the Akasaka section, Japan. The essential difference is that the former has somewhat less developed axial filling, fewer volutions, and a smaller size. *P. uruzganensis* is also similar to *P. bakeri* Dunbar and Skinner from the Leonard Formation in the Glass Mountains, Texas, but the former differs in having a

shorter and more pointed form in the inner volutions.
Locality and age. The same as for the holotype (loc. 238).
Material studied. Twenty-four axial sections.

Genus *Laosella* Leven, n. gen.

Fusulina: Hayden, 1909, p. 244 (part); Deprat, 1913, p. 9, (part); *Schellwienia:* Ozawa, 1925, p. 32 (part); *Parafusulina:* Toriyama, 1958, p. 192 (part); Toriyama and Sugi, 1959, p. 19 (part); Sheng, 1963, p. 196 (part); Pitakpaivan, 1965, p. 43 (part); Leven, 1967, p. 15 (part); Toriyama and Pitakpaivan, 1973, p. 48; Toriyama and Kanmera, 1979, p. 44 (part); Xiao et al., 1986, p. 108 (part).
Type species: Fusulina gigantea Deprat; Upper Permian, late Murgabian to Midian; Laos.
Diagnosis. Shell moderately large to large with a short-fusiform to subcylindrical shape. The proloculus is spherical and medium to large. Coiling is fairly loose. The spirotheca is very thick and the septa are thin and intensely fluted throughout the length. Septa are thickened in the inner whorls and on both sides of the tunnel. Axial filling is lacking or poorly developed. Cuniculi occur throughout, except for the innermost volution.
Assigned species. Laosella gigantea (Deprat), Laos, Thailand, Japan, China, north Pamir, north Afghanistan; *Laosella methikuli* (Pitakpaivan), Thailand; *Laosella parva* (Pitakpaivan), Thailand.
Discussion. Laosella is similar to *Parafusulina* and *Skinnerella* but differs in having a very thick spirotheca, loose coiling, and a near absence of axial filling.

***Laosella gigantea* (Deprat, 1913)**
Plate XVIII, Figs. 5–7

Fusulina gigantea: Deprat, 1913, p. 29, plate 1, figs. 1–6.
Locality. Bulola (loc. A58-1, A59), Khojagor (loc. A52), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, north Pamir, south China, Laos, Thailand, Japan.
Age. Late Permian, late Murgabian to Midian.
Material studied. Eight axial sections.

***Laosella methikuli* (Pitakpaivan, 1965)**
Plate XVIII, Fig. 8

Parafusulina methikuli: Pitakpaivan, 1965, p. 43–49, plate 4, figs. 1–4; plate 5, figs. 1–4.
Locality. Khojagor (loc. A48), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Thailand.
Age. Late Permian, Midian.
Material studied. Two axial sections.

Family Chusenellidae F. Kahler and G. Kahler, 1966
Genus *Chusenella* Hsü, 1942
***Chusenella schwagerinaeformis* Sheng, 1963**
Plate XVIII, Figs. 9, 10

Chusenella schwagerinaeformis: Sheng, 1963, p. 211, plate 23, figs. 1–6.
Locality. Khargardan, (loc. 12a), Uruzgan (loc. 238), Bad Olum (loc. 3), central Afghanistan.
Distribution. South Afghanistan, Darvaz, southeast Pamir, China.
Age. Late Permian, Kubergandian to Midian.
Material studied. Four axial and subaxial sections.

***Chusenella tieni* (Chen, 1956)**
Plate XVIII, Figs. 1, 4

Schwagerina tieni: Chen, 1956, p. 23, plate 1, figs. 13–16.
Locality. Bulola (loc. A53), Khojagor (loc. A69), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, north and southeast Pamir, China.
Age. Late Permian, Kubergandian to Midian.
Material studied. Two axial sections.

***Chusenella sinensis* Sheng, 1963**
Plate XIX, Fig. 8

Chusenella sinensis: Sheng, 1963, p. 209, plate 23, figs. 7–18.
Locality. Bulola (loc. A59), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, China.
Age. Late Permian, Kubergandian to Midian.
Material studied. Four axial sections.

***Chusenella minuta* Skinner, 1969**
Plate XVIII, Figs. 11, 12

Chusenella minuta: Skinner, 1969, p. 11, plate 19, figs. 5–9.
Locality. Bulola (loc. A58), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Turkey.
Age. Late Permian, Midian.
Material studied. Five axial sections.

***Chusenella chihsiaensis* (Lee, 1931)**
Plate XIX, Fig. 1

Schellwienia chihsiaensis: Lee, 1931, p. 287, plate 1, figs. 2, 2a.
Locality. Khargardan (loc. 10a), central Afghanistan; Khojagor (loc. A69), Bulola (loc. A56), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, Pamir, China, Indochina.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Five axial sections.

***Chusenella brevis* (Chen, 1934)**
Plate XIX, Figs. 2–4

Pseudofusulina chihsiaensis brevis: Chen, 1934, p. 77–78, plate 9, fig. 9.
Locality. Bulola (loc. A56), Khojagor (loc. A69), zone of Bamian, north Afghanistan; Sange Dushoh (loc. 629-12), middle Afghanistan; Adjrestan (loc. 36), Uruzgan (loc. 238a), central Afghanistan.
Distribution. Afghanistan, China.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Ten axial sections.

Chusenella* aff. *C. alpina
(Kochansky-Devidé and Ramovš, 1955)
Plate XIX, Fig. 6

Dunbarinella alpina: Kochansky-Devidé and Ramovš, 1955, p. 410, plate 1, figs. 9–10; plate 2, figs. 1–6.
Remarks. The forms from Afghanistan are identical to *C. alpina* from upper Murgabian rocks of the Julian Alps in all essential characteristics, differing only in having less intense septal fluting. This suggests that the Afghan forms are older than those from the Alps.
Locality. Khargardan, central Afghanistan (loc. 10b and 12a).
Distribution. South Afghanistan, Julian Alps, Iran, China, Indochina.
Age. Late Permian, Kubergandian to Midian.
Material studied. Two axial sections.

Chusenella subextensa Leven, n. sp.
Plate XIX, Fig. 5

Holotype: GGM VI-228/222—axial section, Khargardan, central Afghanistan; Upper Permian, Kubergandian.
Description. A fusiform to elongate-fusiform shell of six and one-half to eight and one-half volutions, commonly with slightly elongated poles. L = 7–12 mm, D = 2–3 mm, L:D = 3–4. The proloculus is spherical and small, with a diameter of 0.1 mm to 0.2 mm. The first three to three and one-half volutions are coiled very tightly; succeeding whorls are somewhat looser and the chambers increase gradually in height. The spirotheca is very thin in the juvenarium, thickening thereafter as much as 0.1 mm. Septa are thin and strongly fluted throughout. Fluting is high and regular. Folds are rounded and high, and commonly do not join one another. The tunnel is narrow, low, and irregular. Small chomata are present in the juvenarium only. Axial filling is moderately to well developed.
Discussion. This species closely resembles *C. extensa* Skinner, differing from the latter mainly in having fewer volutions, a smaller size, a narrower tunnel, and somewhat more intense septal fluting.
Locality and age. The same as for the holotype (loc. 10a).
Material studied. One axial section.

Genus _Rugosochusenella_ Skinner and Wilde, 1965
Rugosochusenella dialis Leven, n. sp.
Plate XIX, Fig. 7

Holotype: GGM VI-228/224—axial section; north Afghanistan, Bulola, zone of Bamian; Upper Permian, Midian.
Description. A short, fusiform, nearly oval shell of eight and one-half volutions with slightly pointed poles. L = 8 mm, D = 3.7 mm, L:D = 2.1. The proloculus is obscure, but evidently very small, not exceeding 0.05 mm in diameter. The inner four volutions are tightly coiled; then there is some loosening and a small increase in chamber height after the sixth whorl. Diameters of volutions (in mm) in the holotype are as follows: (1) 0.12, (2) 0.2, (3) 0.27, (4) 0.45, (5) 0.83, (6) 1.45, (7) 2.25, (8) 3.25, (8.5) 3.7. The spirotheca is thin in the juvenarium, but it thickens rapidly to as much as 0.4 mm in the penultimate volution. It consists of a finely rugose tectum and a coarsely alveolar keriotheca. Septa are fairly thick, slightly wavy in the juvenarium, and intensely fluted throughout the length in the succeeding whorls. Fluting is complex and cancellate. The tunnel is of moderate width and is irregular. Weak chomata are present in the early volutions. Axial filling expands toward the poles in the first six volutions.
Discussion. This species differs from all other known species of *Rugosochusenella* in the shortened form of the shell, the intense septal fluting, and a very thick spirotheca. In essential characteristics it is similar to representatives of *Chusenella,* but it possesses a rugose tectum, which is not typical of the latter.
Locality and age. The same as for the holotype (loc. A58).
Material studied. One axial and one tangential section.

Family Polydiexodinidae A. Miklukho-Maclay, 1953
Genus _Eopolydiexodina_ Wilde, 1975
Subgenus _Eopolydiexodina_ Wilde, 1975
Eopolydiexodina (Eopolydiexodina) darvasica (Dutkevich, 1939)
Plate XIX, Fig. 9–11

Polydiexodina darvasica: in Likharew, 1939, p. 40, plate 3, figs. 9, 10; Kalmykova, 1967, p. 212, plate 29, figs. 1–5.
Locality. Khojagor (loc. A65, A66, A68, 441/6), Bulola (loc. A57), zone of Bamian; Abtchagan (loc. 175-3), Suleiman-Kirthar area.
Distribution. Afghanistan, Darvaz, Turkey.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. Eight axial sections.

Eopolydiexodina (Eopolydiexodina) afghanensis (Thompson, 1946)
Plate XX, Fig. 4

Polydiexodina afghanensis: Thompson, 1946, p. 150, plate 24, figs. 1–6; plate 26, figs. 1–7.
Locality. Khojagor (loc. A74, 461), Bulola (loc. A57, A58), zone of Bamian; Abtchagan (loc. 175-7), Suleiman-Kirthar area.
Distribution. Afghanistan, north Pamir.
Age. Late Permian, Murgabian to Midian.
Material studied. Six axial sections.

Eopolydiexodina (Eopolydiexodina) zulumartensis (Leven, 1967)
Plate XX, Figs. 1, 2

Polydiexodina zulumartensis: Leven, 1967, p. 179, pl. 30, figs. 1, 6.
Locality. Khojagor (loc. A67, A69, 451), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan and north Pamir.
Age. Late Permian. Kubergandian.
Material studied. Four axial sections.

Eopolydiexodina (Eopolydiexodina) bithinica (Erk, 1942)
Plate XX, Fig. 3

Polydiexodina bithinica: Erk, 1942, p. 264, plate 23, figs. 1–8; plate 24, fig. 1.
Locality. Khojagor (loc. A48, A50), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Turkey.
Age. Late Permian, Midian.
Material studied. Four axial sections.

Order Neoschwagerinida Minato and Honjo, 1966
Family Misellinidae A. Miklukho-Maclay, 1958
Genus _Misellina_ Schenck and Thompson, 1940
Subgenus _Brevaxina_ Schenck and Thompson, 1940
Misellina (Brevaxina) otakiensis (Fujimoto, 1936)
Plate XX, Figs. 5–7

Pseudodoliolina otakiensis: Fujimoto, 1936, p. 110, plate 22, fig. 1–5.
Locality. Bulola (loc. A63), Khojagor (loc. 451), zone of Bamian; Obi Tang (loc. 1153-1, 2), Kwahan (loc. 1155), zone of Darvaz-Transalay; north Afghanistan.
Distribution. North Afghanistan, Darvaz, southeast Pamir, China, Japan.
Age. Early Permian, Bolorian.
Material studied. Seven subaxial sections.

Misellina (Brevaxina) dyhrenfurthi (Dutkevich, 1939)
Plate XX, Figs. 8, 9

Doliolina dyhrenfurthi: in Likharew, 1939, p. 42, plate 4, figs. 3–5.
Locality. Zone of Sange Dushoh (loc. 628-11), middle Afghanistan; Obi Tang (loc. 1153-3, 7), Kwahan (loc. 1155-3), zone of Darvaz-Transalay, north Afghanistan.
Distribution. Afghanistan, Darvaz, southeast Pamir, China, Japan.
Age. Early Permian, Bolorian.
Material studied. Five axial sections.

Misellina (Brevaxina) olgae Leven, 1967
Plate XX, Fig. 10

Misellina olgae: Leven, 1967, p. 183, plate 30, figs. 2–4.
Locality. Bulola (loc. A63), zone of Bamian, north Afghanistan; zone

of Sange Dushoh (loc. 628-12), middle Afghanistan.
Distribution. Afghanistan, Darvaz, north Pamir, China.
Age. Early Permian, Bolorian to Late Permian, Kubergandian.
Material studied. Two axial sections.

Subgenus *Misellina* Schenck and Thompson, 1940
***Misellina (Misellina) ovalis* (Deprat, 1915)**
Plate XX, Figs. 11, 12

Doliolina ovalis: Deprat, 1915, p. 15, plate 3, figs. 1–4.
Locality. Bulola (loc. A53, A54), zone of Bamian, north Afghanistan; zone of Sange Dushoh (loc. 628-17), middle Afghanistan.
Distribution. Afghanistan, north and southeast Pamir, Transcaucasus, China, Japan, Indochina.
Age. Late Permian, Kubergandian.
Material studied. Two axial and one subaxial section.

***Misellina (Misellina) termieri* (Deprat, 1915)**
Plate XX, Figs. 14, 15

Doliolina termieri: Deprat, 1915, p. 17, plate 3, figs. 15–20.
Locality. Bulola (loc. A53, A54), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, southeast Pamir, Transcaucasus, Turkey, China, Indochina, Japan.
Age. Early Permian, Bolorian to Late Permian, Kubergandian.
Material studied. Six axial sections.

***Misellina (Misellina) megalocula* Wang and Sun, 1973**
Plate XX, Fig. 13

Misellina megalocula: Wang and Sun, 1973, p. 174, plate 2, figs. 11, 12, 14, 16–19; plate 3, figs. 12–14.
Locality. Bulola (loc. A53), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, southeast Pamir, Transcaucasus, China, Indochina.
Age. Late Permian, Kubergandian.
Material studied. Two axial sections.

Subgenus *Paramisellina* Zhang and Dong, 1986
***Misellina (Paramisellina) houchangensis* Zhang and Dong, 1986**
Plate XX, Fig. 16

Paramisellina houchangensis: in Xiao et al., 1986, p. 146, plate 19, figs. 1–4, 10.
Locality. Khargardan (loc. 12a), central Afghanistan.
Distribution. South Afghanistan, China.
Age. Late Permian, Kubergandian.
Material studied. One axial section.

Genus *Armenina* A. Miklukho-Maclay, 1955
***Armenina pamirensis* (Dutkevich, 1934)**
Plate XXI, Figs. 1–3

Doliolina termieri var. *pamirensis: in* Dutkevich and Khabakov, 1934, p. 83, plate 1, fig. 10.
Locality. Bulola (loc. A54), zone of Bamian, north Afghanistan; Djare Sebak (loc. 607-12), zone of Khoja Murod, middle Afghanistan.
Distribution. Afghanistan, southeast Pamir, China, Indochina, Japan, Turkey.
Age. Late Permian, Kubergandian.
Material studied. Four axial sections.

***Armenina taurica* (Toumanskaya, 1950)**
Plate XXI, Fig. 4

Doliolina taurica: Toumanskaya, 1950, p. 95, plate 7, figs. 6–8.
Locality. Khojagor (loc. A69), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Crimea.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. One axial section.

***Armenina karinae* A. Miklukho-Maclay, 1955**
Plate XXI, Fig. 5

Armenina karinae: A. Miklukho-Maclay, 1957, p. 120, plate 4, fig. 3.
Locality. Bulola (loc. A56), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, north and southeast Pamir, China, Indochina.
Age. Late Permian, Kubergandian to Murgabian.
Material studied. One axial section.

***Armenina asiatica* Leven, 1967**
Plate XXI, Figs. 6, 7

Armenina asiatica: Leven, 1967, p. 204, plate 38, fig. 3; plate 39, figs. 2, 3.
Locality. Khojagor (loc. A67, A69), Bulola (loc. A56), zone of Bamian, north Afghanistan; Khargardan (loc. 12b), central Afghanistan.
Distribution. Afghanistan, southeast Pamir.
Age. Upper Permian, Kubergandian.
Material studied. Nine axial and subaxial sections.

***Armenina crassispira* (Chen, 1956)**
Plate XXI, Fig. 9

Verbeekina crassispira: Chen, 1956, p. 49, plate 9, figs. 7–10.
Locality. Khojagor (loc. A47), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, southeast Pamir, China.
Age. Late Permian, Murgabian to Midian.
Material studied. Two axial sections.

Family Verbeekinidae Staff and Wedekind, 1910
Genus *Verbeekina* Staff, 1909
Subgenus *Verbeekina* Staff, 1909
***Verbeekina (Verbeekina) furnishi* Skinner and Wilde, 1966**
Plate XXI, Fig. 8

Verbeekina furnishi: Skinner and Wilde, 1966b, p. 14, plate 17, figs. 3–5; plate 18, figs. 1–4.
Locality. Altimur (loc. T344), Suleiman-Kirthar area; Djare Sebak (loc. 607-21), zone of Khoja Murod, middle Afghanistan.
Distribution. South Afghanistan, Sicily.
Age. Late Permian, Murgabian to Midian.
Material studied. Three axial sections.

Verbeekina (Verbeekina) americana
Thompson, Wheeler and Danner, 1950
Plate XXI, Fig. 10

Verbeekina (Verbeekina) americana: Thompson, Wheeler, and Danner, 1950, p. 57, plate 5, figs. 1–6.
Locality. Khojagor (loc. A47), Bulola (loc. A57), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Canada.
Age. Late Permian, Murgabian to Midian.
Material studied. One axial section.

Subgenus *Paraverbeekina* A. Miklukho-Maclay, 1955
***Verbeekina (Paraverbeekina) pontica* A. Miklukho-Maclay, 1955**
Plate XXI, Fig. 11

Paraverbeekina pontica: Miklukho-Maclay, 1955, p. 574–575, fig. 1b.
Locality. Khojagor (loc. A74), Bulola (loc. A59), zone of Bamian, north Afghanistan; Altimur (loc. 284), Suleiman-Kirthar area.
Distribution. Afghanistan, southeast and north Pamir, Crimea, China, Indochina.
Age. Late Permian, Murgabian and Midian.
Material studied. Three axial sections.

Subgenus *Quasiverbeekina* Wang, Sheng and Zhang, 1981
***Verbeekina (Quasiverbeekina) altimurensis* Leven, n. sp.**
Plate XXI, Fig. 12

Verbeekina sp.: Wang et al., 1981, p. 59, plate 14, figs. 8, 9, 13.
Holotype: GGM VI-228/255—axial section; Altimur, Suleiman-Kirthar area, south Afghanistan; Upper Permian, Midian.
Description. A large, subspherical shell of fourteen and one-half volutions, slightly compressed along the axis. L = 6.5 mm, D = 7.5 mm, L:D = 0.86. The inner four volutions are discoidal, strongly constricted along the axis, and have a broadly tapered and rounded periphery. The transition to a subspherical form in mature individuals is gradual. The proloculus is obscure, but it appears to be very small. The coiling is tight in juvenarium, becoming more loose thereafter. The spirotheca is thin in the inner volutions, thickening to 0.06 mm later. It consists of a tectum, a broad, finely porous layer (keriotheca?), and a dense inner layer. Septa are flat. Parachomata are small and developed mostly in the final five to six whorls. The tunnels are small, ellipsoidal, and variable in size.
Discussion. This species is similar to *V. (Q.) pedashanika* Wang, Sheng, and Zhang, but it differs in having a more constricted shell and lacking parachomata in the juvenarium.
Locality and age. The same as for the holotype (loc. 284, T344).
Distribution. Afghanistan, Tibet.
Material studied. Two axial and three tangential sections.

Family Neoschwagerinidae Dunbar and Condra, 1928
Genus *Cancellina* Hayden, 1909

Remarks. The genus *Cancellina* was established by Hayden (1909). Imperfect preservation of the type specimens and the absence of a comprehensive diagnosis resulted in a lack of understanding of both the generic characteristics and family-group assignment of *Cancellina.* Kanmera (1957) revised the *Cancellina* and *Neoschwagerina* systematics, assigning *Cancellina* to the Subfamily Sumatrininae Kahler and Kahler. He considered it to have been an ancestor of the genus *Afghanella* Thompson and placed it with the genus *Presumatrina* Toumanskaya. At present this viewpoint is supported by many Chinese and Japanese workers. Hayden (1909), however, regarded *Cancellina* as an ancestor of *Neoschwagerina* as have Dutkevich and Khabakov (1934), Thompson (1946), Miklukho-Maclay (1963), Leven (1967) and Rozovskaya (1975), who assigned *Cancellina* to the Family Neoschwagerinidae Dunbar and Condra.

Kanmera and Toriyama (1968) distinguished the genus *Maclaya,* suggesting that it rather than *Cancellina* was the ancestor of *Neoschwagerina.* An essential feature differentiating *Maclaya* from *Cancellina* is the thick spirotheca of the former. Finally, Yang (1985) erected a new genus *Shengella* within the Family Sumatrinidae, interpreting it to have been an ancestor of *Cancellina* that had evolved into *Presumatrina.*

Representatives of the three genera (*Maclaya, Cancellina,* and *Shengella*) are closely allied and bear many of the same characteristics. The presence of spiral septula differentiates them from *Misellina,* their common ancestor. Further subdivision of this group seems unnecessary because all three genera reached the same evolutionary level. The author prefers to regard all of these forms to belong to a single genus, *Cancellina,* which may be divided into two groups or subgenera. Representatives of the first group are more tightly coiled, have a thinner spirotheca, and have more narrow spiral septula than those of the second. *Shengella* Yang (1985) is the most appropriate name for this second subgenus.

The genus *Presumatrina,* first in the lineage of the family Sumatrinidae, descended from *Shengella.* The second group gave rise to the genus *Neoschwagerina* of the Family Neoschwagerinidae (Leven, 1982a). Besides the type species of the genus *Cancellina,* this subgenus comprises other forms with relatively thick spirotheca, including those separated into the genus *Maclaya,* which should be abolished as a junior synonym.

The subgenus *Cancellina* comprises the following species:
Cancellina primigena Hayden, 1909,
Cancellina nipponica Ozawa, 1927,
Cancellina cutalensis Leven, 1967,
Cancellina dutkevitchi Leven, 1967,
Cancellina pamirica Leven, 1967,
Maclaya sethaputi Kanmera and Toriyama, 1968,
Maclaya saraburiensis Kanmera and Toriyama, 1968,
Maclaya elliptica Zhang and Dong, 1986,
Maclaya bella Zhang and Dong, 1986,
Neoschwagerina haitongica Zhang, 1982.

The subgenus Shengella comprises the following:
Cancellina tenuitesta Kanmera, 1963,
Cancellina praeneoschwagerinoides Leven, 1967,
Cancellina phlongphrabensis Toriyama and Kanmera, 1975,
Cancellina tobensis Wang, Sheng and Zhang, 1981,
Shengella elliptica Yang, 1985,
Shengella datieguanensis Yang, 1982,
Shengella simplex Zhang and Dong, 1986,
Cancellina houchangensis Zhang and Dong, 1986,
Cancellina liuzhinensis Zhang and Dong, 1986,
Maclaya pulchella Zhang and Dong, 1986.

The two subgenera of the genus *Cancellina* gave rise to the families Neoschwagerinidae and Sumatrinidae. The genus *Cancellina* itself is assigned to the Neoschwagerinidae because Hayden, who established this genus, emphasized a close alliance between it and *Neoschwagerina* and considered it as a subgenus of the latter.

Subgenus *Cancellina* Hayden, 1909
***Cancellina (Cancellina) primigena* Hayden, 1909**
Plate XXII, Figs. 1, 2

Neoschwagerina (Cancellina) primigena: Hayden, 1909, p. 249, plate 22, fig. 1; Leven, 1982a, p. 49, plate 1, figs. 1–10.
Locality. Khojagor (loc. A68), Bulola (loc. A56), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, Pamir.
Age. Late Permian, Kubergandian.
Material studied. Five axial and seven subaxial sections.

***Cancellina (Cancellina) bella* (Zhang and Dong, 1986)**
Plate XXII, Figs. 3, 6

Maclaya bella: in Xiao et al., 1986, p. 168, plate 24, figs. 22, 25.
Locality. Bulola (loc. A56), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, China.

Age. Late Permian, Kubergandian.
Material studied. Three axial sections.

Cancellina (Cancellina) sethaputi (Kanmera and Toriyama, 1968)
Plate XXII, Figs. 4, 5

Maclaya sethaputi: Kanmera and Toriyama, 1968, p. 37, plate 5, figs. 1–17.
Locality. Bulola (loc. A56), zone of Bamian, north Afghanistan; Khargardan (loc. 12b), central Afghanistan.
Distribution. Afghanistan, China, Thailand.
Age. Late Permian, Kubergandian.
Material studied. Three subaxial sections.

Cancellina (Cancellina) pamirica Leven, 1967
Plate XXII, Fig. 7

Cancellina pamirica: Leven, 1967, p. 186, plate 22, figs. 1, 3.
Locality. Khojagor (loc. A69), Bulola (loc. A56), zone of Bamian, north Afghanistan; Khargardan (loc. 12b), central Afghanistan.
Distribution. Afghanistan, China, Thailand, Japan.
Age. Late Permian, Kubergandian.
Material studied. Two axial and four subaxial sections.

Subgenus _Shengella_ Yang, 1985
Cancellina (Shengella) bamianica Leven, n. sp.
Plate XXII, Fig. 8

Holotype: GGM VI-183/16—axial section; Khojagor, zone of Bamian, north Afghanistan; Upper Permian, Kubergandian.
Description. A medium-sized, elliptical shell of eight volutions, with sharply terminated poles in the inner volutions. L = 3 mm, D = 1.4 mm, L:D = 2.1. The proloculus is spherical with a diameter of 0.1 mm. The shell is tightly and uniformly coiled with a slight increase in height in the later whorls. The spirotheca is thin, as much as 0.025 mm thick. Septa are straight. Short, narrow primary septula, mostly not reaching the parachomata, are present in all volutions, starting with the third. Minute rounded tunnels are numerous. Parachomata are low and rounded to triangular in shape.
Discussion. This species differs from *C. (S.) praeneoschwagerinoides* Leven in its more elongate shell, the sharply terminated inner whorls, a thinner spirotheca, and the absence of axial filling. The present species closely resembles *C. (S.) tenuitesta* Kanmera, but in *C. (S.) tenuitesta* the spiral septula are less developed and more commonly join the parachomata. Compared to other subspecies of *Shengella*, *C.(S.) bamianica* has a more elongate and elliptical shell that is distinguished by low parachomata.
Locality and age. The same as for the holotype (loc. A69).
Material studied. One axial and two subaxial sections.

Genus _Neoschwagerina_ Yabe, 1903
Neoschwagerina simplex tenuis
Toriyama and Kanmera, 1975
Plate XXII, Fig. 9

Neoschwagerina simplex tenuis: in Toriyama, 1975, p. 97, plate 19, figs. 14–24.
Locality. Khojagor (loc. A74), zone of Bamian, north Afghanistan; zone of Sange Dushoh (loc. 631-4), middle Afghanistan.
Distribution. Afghanistan, Thailand.
Age. Late Permian, Murgabian.
Material studied. One axial and a one subaxial section.

Neoschwagerina verae (Toumanskaya, 1953)
Plate XXII, Fig. 11

Crimellina verae: Toumanskaya, 1953, plate 13, fig. 5.
Locality. Zone of Sange Dushoh (loc. 631-4), middle Afghanistan.
Distribution. South Afghanistan, Crimea.
Age. Late Permian, Murgabian.
Material studied. Two axial sections.

Neoschwagerina bamianica Leven, n. sp.
Plate XXII, Figs. 12, 13

Neoschwagerina craticulifera: Deprat, 1912, p. 47–49, plate 2, figs. 1, 2.
Holotype: GGM VI-228/264—axial section, Khojagor, north Afghanistan; Upper Permian, Midian.
Description. A short, fusiform shell of eleven to twelve volutions. L = 3–4.5 mm, D = 1.4–2.5 mm, L:D = 1.9–2.1. The proloculus is spherical, with a diameter ranging from 0.05 mm to 0.15 mm. The first three to four volutions form an angle with the axis of coiling of the succeeding whorls. The spirotheca is moderately thick, as much as 0.04 mm. Septa and axial septula are not observed. Spiral septula are wide at the base, but gradually narrow to the tops, which is commonly slightly condensed and rounded. In most cases spiral septula join (inosculate with) the low and rounded parachomata. Tunnels are numerous, very small, and rounded. Secondary spiral septula are not fixed.
Discussion. This species is similar to *N. craticulifera* (Schwager), but differs in having a regular fusiform shell, whereas the type forms of *N. craticulifera* are almost biconical. *N. bamianica* closely resembles *N. simplex tenuis* Ozawa, but the former has a thinner spirotheca, narrower spiral septula, and complete inosculation with the parachomata.
Locality. Khojagor (loc. A47), zone of Bamian, north Afghanistan; Altimur, (loc. 284), Suleiman-Kirthar area.
Distribution. Afghanistan, China.
Age. The same as for the holotype.
Material studied. Five axial sections.

Neoschwagerina occidentalis Kochansky-Devidé and Ramovš, 1955
Plate XXII, Fig. 10; Plate XXIII, Figs. 1, 4

Neoschwagerina craticulifera occidentalis: Kochansky-Devidé and Ramovš, 1955, p. 418–419, plate 7, figs. 1–6.
Neoschwagerina socioensis: Skinner and Wilde, 1966b, p. 14–15, plate 19, figs. 1–8; plate 20, figs. 1, 2.
Neoschwagerina pinguis: Skinner, 1969, p. 12, 13; plate 24, figs. 1–6; plate 25, figs. 1–4; plate 26, figs. 1, 2; plate 27, figs. 1, 2; plate 28, figs. 1, 2.
Locality. Bulola (loc. A58-1), zone of Bamian.
Distribution. Afghanistan, Mediterranian area.
Age. Late Permian, latest Murgabian to early Midian.
Material studied. Thirteen axial sections.

Neoschwagerina haydeni Dutkevich and Khabakov, 1934
Plate XXIII, Fig. 2

Neoschwagerina craticulifera var. *haydeni:* Dutkevitch and Khabakov, 1934, p. 94, plate 2, figs. 6–8; plate 3, figs. 1, 2.
Locality. Altimur (loc. T344), Suleiman-Kirthar area.
Distribution. Afghanistan, southeast Pamir, China, Japan.
Age. Late Permian, Midian.
Material studied. One subaxial section.

Neoschwagerina margaritae Deprat, 1913
Plate XXIII, Figs. 3, 6

Neoschwagerina margaritae: Deprat, 1913, p. 58, plate 8, fig. 10; plate 9, figs. 1, 2.

Locality. Khojagor (loc. A47), zone of Bamian, north Afghanistan; Altimur (loc. T344), Suleiman-Kirthar area.
Distribution. Afghanistan, Pamir, Iran, China, Indochina, Japan.
Age. Late Permian, latest Murgabian to Midian.
Material studied. Three axial sections.

Neoschwagerina kojensis Toumanskaya, 1950
Plate XXIII, Fig. 5

Neoschwagerina kojensis: Toumanskaya, 1950, p. 84, plate 6, figs. 1–3.
Locality. Bulola (loc. A59), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Crimea.
Age. Late Permian, Midian.
Material studied. One axial section.

Genus _Colania_ Lee, 1933

Remarks. When Lee (1933) established the genus *Colania,* he assigned it to the Neoschwagerinidae because at an early stage of ontogeny it has distinctly keriothecal spirotheca and septula similar to that in the genus *Neoschwagerina* Yabe. In mature stages both the spirotheca and septula become thinner and more dense, similar to that in species of the genus *Yabeina* Deprat. Based on this, Lee regarded *Colania* as a transitional form between *Neoschwagerina* and *Yabeina.* Ozawa (1970), on the other hand, referred all forms with thinner and more dense spirotheca and septula than those of *Neoschwagerina* to *Colania.* In his opinion, *Colania* descended from the genus *Cancellina* Hayden and developed parallel to *Neoschwagerina. Colania* then evolved into the genus *Lepidolina* Lee, whereas *Neoschwagerina* evolved into the genus *Yabeina.* Ozawa considered the two parallel branches of Neoschwagerinidae as separate subfamilies: the Neoschwagerininae Dunbar and Condra and the Lepidolininae Miklukho-Maclay.

The material at hand shows that in many advanced forms of the genus *Neoschwagerina* both the spirotheca and septula tend to thin and become compacted in the final volutions. These changes occur at progressively earlier stages of ontogenesis, giving rise to forms compatible with the type species of the genus *Colania.* The new species, *C. altimurensis,* is regarded as being identical with *C.* sp. indet. figured by Lee (plate 5, fig. 2). *C. leei* Chen, 1934 also belongs to the genus *Colania,* but in it thinning of the spirotheca and septula is more advanced, affecting almost all whorls. A greater number of volutions also infers an advanced level of the development of *C. leei.* The same also probably is true of *C. kwangsiana* Lee, the type species of the genus, but poor preservation of the holotype leaves some uncertainty.

Other forms of Neoschwagerinidae with thin spirotheca, assigned by Ozawa (1970) to the Subfamily Lepidolininae and considered ancestral to the genus *Lepidolina* by him, were placed in the genus *Gifuella* by Honjo (1959).

Colania altimurensis Leven, n. sp.
Plate XXIV, Fig. 1, 5

Colania sp. indet.: Lee, 1933, plate 5, fig. 2.
Holotype: GGM VI-228/272—axial section; Altimur, Suleiman-Kirthar area, south Afghanistan; Upper Permian, Midian.
Description. A large shell of as much as eighteen volutions with a biconical form, especially noticeable in the inner volutions. L = 5.5–7.2 mm, D = 3–5 mm, L:D = 1.2–1.8. The proloculus is spherical with a diameter ranging from 0.08 mm to 0.15 mm. The first two to three volutions are plectogyroid. The coiling is tight and uniform. The spirotheca is thin, ranging from 0.015 mm to 0.02 mm in the outer five to nine volutions. It is composed of a well defined tectum and an inner, gray layer with barely visible keriotheca. In the early volutions the spirothecal thickness is as much as 0.03 mm. Septa and axial septula are thin and three axial septula are present between adjacent septa in the outer volutions. Primary spiral septula, which join the parachomata, are present throughout growth. They are long, narrow, and more compact at the ends, especially in the last volutions. In the inner six to eight whorls their width ranges from 0.04 mm to 0.05 mm, decreasing to 0.03 mm in the succeeding whorls. Parachomata are neither high nor broad; inosculation with the spiral septula affects the lower third of the chamber height. Beginning with the tenth whorl, sparse secondary spiral septula are present.
Discussion. This species differs from *C. ungariensis* Nie and Song in its biconical and more elongated shell. The former is distinguished from *C. leei* Chen in its fewer volutions and looser coiling. Moreover, in *C. altimurensis* septal and spirothecal thinning starts at an earlier stage of ontogenesis. The most elongate specimens of *C. altimurensis* closely resemble *C. kwangsiana* Lee, but the former has broader septula in the inner volutions than the latter.
Locality. Altimur (loc. 284 and 181), Suleiman-Kirthar area, south Afghanistan; Khojagor (loc. A47), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, China.
Age. The same as for the holotype.
Material studied. Fifteen axial and subaxial sections.

Family Sumatrinidae Silvestri, 1933

Remarks. Leven (1982a, p. 47) has indicated the possibility of subdividing the Family Sumatrininae into two subfamilies, the Sumatrininae and the Afghanellinae. Representatives of these subfamilies are distinguishable in the form of the shell, which is elongate-fusiform to subcylindrical in the Sumatrininae and short-fusiform and subrhombic to subspherical in the Afghanellinae. Moreover, the Sumatrininae reveal a distinct developmental trend to elongation of the shell. The form ratio in the most advanced form, *S. longissima* Deprat, is 1:5, whereas in the Afganellinae the trend is opposite and the latest representatives of that subfamily have form ratios ranging from 1:1.2 to 1:1.5. Evolutionary changes are expressed in both subfamilies in an increase in the number of secondary axial and spiral septula, but in the Sumatrininae the process goes farther than in the Afghanellinae. Thus, in the most advanced Afghanellinae a number of secondary spiral septula between the pair of primary spiral septula generally is less than three, whereas in the Sumatrininae, at about the same stratigraphic level, it attains a value of four to five.

The Family Sumatrinidae probably diverged into two parallel branches from the genus *Presumatrina,* some species of the latter (e.g., *P. longa* n. sp.) having a shell form typical of the Sumatrininae. It is possible that the Sumatrininae separated from the Afghanellinae considerably later, but this question cannot be solved on the basis of the material at hand.

Subfamily Afghanellinae Leven, 1982
Genus _Presumatrina_ Toumanskaya, 1950
Presumatrina neoschwagerinoides (Deprat, 1913)
Plate XXIV, Fig. 2

Doliolina neoschwagerinoides: Deprat, 1913, p. 52, plate 10. figs. 1–7.
Locality. Adjrestan (loc. 36b), central Afghanistan; zone of Sange Dushoh (loc. 631-2), middle Afghanistan.
Distribution. Afghanistan, southeast Pamir, Transcaucasus, Crimea, Mediterranean area, China, Indochina, Japan.
Age. Late Permian, Early Murgabian.
Material studied. Five axial sections.

Presumatrina schellwieni (Deprat, 1913)
Plate XXIV, Figs. 3, 4

Doliolina schellwieni : Deprat, 1913, p. 51, plate VIII, figs. 4, 9.
Locality. Bulola (loc. A57), Khojagor (loc. A74), zone of Bamian, north Afghanistan; Adjrestan (loc. 36a, 36b), central Afghanistan.

Distribution. Afghanistan, China, Indochina, Japan.
Age. Late Permian, early Murgabian.
Material studied. Six axial sections.

Presumatrina ozawai (Hanzawa, 1954)
Plate XXIV, Figs. 6–8

Afghanella ozawai: Hanzawa, 1954, p. 3–7, plate 1; plate 2, figs. 1–3.
Remarks. Hanzawa (1954) referred the present species to the genus *Afghanella.* However, the late appearance of secondary spiral septula and their character infer a lower developmental level of the species as compared to type species of *Afghanella.* Based on this fact, this species is placed in the genus *Presumatrina.*
Locality. Uruzgan (loc. 238), Adjrestan (loc. 36), central Afghanistan.
Distribution. Afghanistan, China, Japan.
Age. Late Permian, early Murgabian.
Material studied. Five axial sections.

Presumatrina uruzganensis Leven, n. sp.
Plate XXIV, Figs. 9, 12, 13

Holotype: GGM 228/280—axial section; Uruzgan, central Afghanistan; Upper Permian, Lower Murgabian.
Description. An elliptical shell of nine to ten volutions, slightly inflated in the middle portion. L = 3.2–4 mm, D = 7–2 mm, L:D = 1.8–2. The proloculus is spherical with a diameter of 0.18 mm to 0.2 mm. The coiling is tight and uniform. The spirotheca with an outer tectorium is thin and dense. Keriotheca is only locally preserved. Axial septula were not observed. Short, pendant shaped primary spiral septula join the parachomata. Secondary spiral septula, also pendant-shaped, occur sparcely in the final two to three volutions. They may appear as small swellings on inner surface of the spirotheca, beginning with the fourth whorl. Numerous, small tunnels are rounded in section. Parachomata are large, high, and triangular with sharpened tops.
Discussion. This species differs from *P. ozawai* (Hanzawa) in having an elliptical form with more rounded poles, tighter coiling, a thinner spirotheca, and higher parachomata. As compared with *P. schellwieni* (Deprat) this species has more volutions, is larger at the same stage of growth, and has higher and heavier parachomata.
Locality. Bulola (loc. A57), zone of Bamian, north Afghanistan; Uruzgan (loc. 238), central Afghanistan.
Age. Late Permian, early Murgabian.
Material studied. Six axial sections.

Presumatrina longa Leven, n. sp.
Plate XXIV, Fig. 11

Holotype: GGM VI-228/282—axial section; Khojagor, zone of Bamian, north Afghanistan; Upper Permian, Murgabian.
Description. An elongate shell of eight and one-half volutions. L = 8.3 mm, D = 2.7 mm, L:D = 3. The proloculus is spherical and attains a diameter of 0.12 mm. The coiling is tight and uniform with a gradual increase in height of the whorls with growth. The spirotheca is thin and dense with poorly developed keriotheca. Primary spiral septula are pendant shaped; they join the parachomata at about midway between adjacent whorls. Secondary spiral septula of the same form as the primary appear in the last three volutions between the primary spiral septula. Parachomata are rounded to triangular and massive. Light filling of secondary calcite occurs in axial portion of the shell.
Discussion. This species differs from all species of the genus *Presumatrina* in the elongate form of the shell.
Locality and age. The same as for the holotype (loc. A74).
Material studied. One axial and several tangential sections.

Genus _Afghanella_ Thompson, 1946
Afghanella robbinsae Skinner and Wilde, 1967
Plate XXIV, Figs. 10, 14

Afghanella robbinsae: Skinner and Wilde, 1967, p. 16, plate 20, 21.
Locality. Bulola (loc. A59, A59-1), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Tunisia.
Age. Late Permian, Midian.
Material studied. Five axial sections.

Afghanella tumida Skinner and Wilde, 1967
Plate XXV, Figs. 1, 2

Afghanella tumida: Skinner and Wilde, 1967, p. 18, plate 23, figs. 3–5; plates 24, 25.
Locality. Khojagor (loc. A47, A52, 464), Bulola (loc. A59), zone of Bamian, north Afghanistan; Kohe Gulandji (loc. 5859), Farahrud trough, south Afghanistan.
Distribution. Afghanistan, Tunisia.
Age. Late Permian, latest Murgabian to early Midian.
Material studied. Fourteen axial sections.

Subfamily Sumatrininae Silvestri, 1933
Genus _Sumatrina_ Volz, 1904
Sumatrina annae Volz, 1904
Plate XXV, Figs. 3–6

Sumatrina annae: Volz, 1904, p. 182, fig. 28.
Locality. Kohe Gulandji (loc. 5859-1), Farahrud trough, south Afghanistan; Bulola (loc. A48, A52, A58), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, China, Indochina, Japan, Sumatra, Iran, Turkey.
Age. Late Permian, early Midian.
Material studied. Three axial sections.

Sumatrina bulolensis Leven, n. sp.
Plate XXV, Figs. 7, 8

Holotype: GGM VI-228/291—axial section; North Afghanistan, Bulola, zone of Bamian; Upper Permian, Midian.
Description. A large shell of eight to ten volutions, short to elongate-fusiform, rounded at the poles. L = 5.7–6.6 mm, D = 2.6–2.8 mm, L:D = 2.1–2.5. The proloculus is spherical to subspherical with a diameter of 0.2 mm to 0.32 mm. The coiling is tight and uniform. The spirotheca is thin and dense. Keriotheca is obscure, probably because of poor preservation. Three or less commonly four axial septula occur in the outermost whorl. Secondary spiral septula are present in the first volution; there are two between each pair of primary spiral septula in the third and fourth volutions and three thereafter. Light deposits of secondary calcite are present along the axis of the shell.
Discussion. This species resembles *S. annae* Volz, differing by being shorter and more inflated and having less pointed poles.
Locality. Bulola (A58, A59), Khojagor (loc. A48, A52), zone of Bamian, north Afghanistan.
Distribution. Afghanistan, Transcaucasus, and perhaps Japan, China, Indochina.
Age. Late Permian, Midian.
Material studied. Ten axial and more than twenty diverse sections.

Family Pseudodoliolinidae Leven, 1963
Genus _Pseudodoliolina_ Yabe and Hanzawa, 1932
Pseudodoliolina ozawai Yabe and Hanzawa, 1932
Plate XXV, Figs. 9, 10

Pseudodoliolina ozawai: Yabe and Hanzawa, 1932, p. 41.
Doliolina lepida: Deprat, 1914, p. 22, plate 3, figs. 12–14.

Locality. Bulola (loc. A56), Khojagor (loc. A47), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, Pamir, China, Indochina, Japan, Iran, Mediterranean area.
Age. Late Permian, late Kubergandian to Murgabian.
Material studied. Two axial and several subaxial sections.

Pseudodoliolina chinghaiensis Sheng, 1958
Plate XXV, Fig. 11

Pseudodoliolina chinghaiensis: Sheng, 1958, p. 286, plate 3, figs. 1–3.
Locality. Khojagor (loc. 464), zone of Bamian, north Afghanistan.
Distribution. North Afghanistan, China.
Age. Late Permian, Murgabian to lower Midian.
Material studied. One axial section.

PLATE I

Figure 1. *Staffella sphaerica* (Abich) (p. 58), from locality 46, Adjrestan, central Afghanistan, axial section, GGM VI-228/1, ×15.
Figures 2, 3. *Pisolina subsphaerica* Sheng (p. 58).
2. From locality 54, Adjrestan, central Afghanistan, axial section, GGM VI-228/2, ×15.
3. From locality 238, Uruzgan, central Afghanistan, axial section, GGM VI-228/3, ×15.
Figures 4, 14. *Sphaerulina croatica* Kochansky-Devidé (p. 58), from locality 1522-4, Urkhon, central Afghanistan.
4. Axial section, GGM VI-228/4, ×20.
14. Axial section GGM VI-222/5, ×20.
Figures 5, 6, 7. *Nankinella hunanensis* (Chen) (p. 58).
5. From locality 238, Uruzgan, central Afghanistan, axial section, GGM VI-228/6, ×20.
6. From locality 46, Adjrestan, central Afghanistan, subaxial section, GGM VI-228/7, ×20.
7. From locality 1153, Obi Tang, north Badakhshan, axial section, GGM VI-228/8, ×20.
Figure 8. *Sphaerulina* cf. *S. ogbinensis* Rozovskaya (p. 58), from locality 284, Altimur, Suleiman-Kirthar area, subaxial section, GGM VI-228/9, ×20.
Figures 9, 10, 11. *Schubertella giraudi* (Deprat) (p. 59).
9. From locality 620, Mushgol, zone of Khoja Murod, axial section, GGM VI-228/10, ×20.
10, 11. From locality 1153, Obi Tang, zone of Darvaz-Transalay, axial sections, GGM VI-228/11, ×20.
Figures 12, 13. *Nankinella orbicularia* Lee (p. 58), from locality 73, Adjrestan, central Afghanistan.
12. Axial section of a megalospheric form, GGM VI-228/12, ×15.
13. Axial section of a microspheric form, GGM VI-228/13, ×15.
Figure 15. *Pseudoreichelina darvasica* Leven (p. 59), from locality 566, zone of Khaftkala, tangential section, GGM 228/14, ×20.
Figures 16, 17. *Schubertella longiuscula* Leven (p. 59), from locality 628, zone of Sange Dushoh.
16. Axial section, GGM VI-228/15, ×20.
17. Axial section, GGM VI-228/16, ×20.
Figures 18, 19. *Neofusulinella tumida* Leven (p. 59), from locality A69, Khojagor, zone of Bamian.
18. Axial section, GGM VI-228/17, ×20.
19. Part of Figure 18 showing diaphanotheca, ×40.
20. *Neofusulinella magna* Leven, n. sp. (p. 59), from locality A74, Khojagor, zone of Bamian, axial section of the holotype, GGM VI-228/18, ×20.

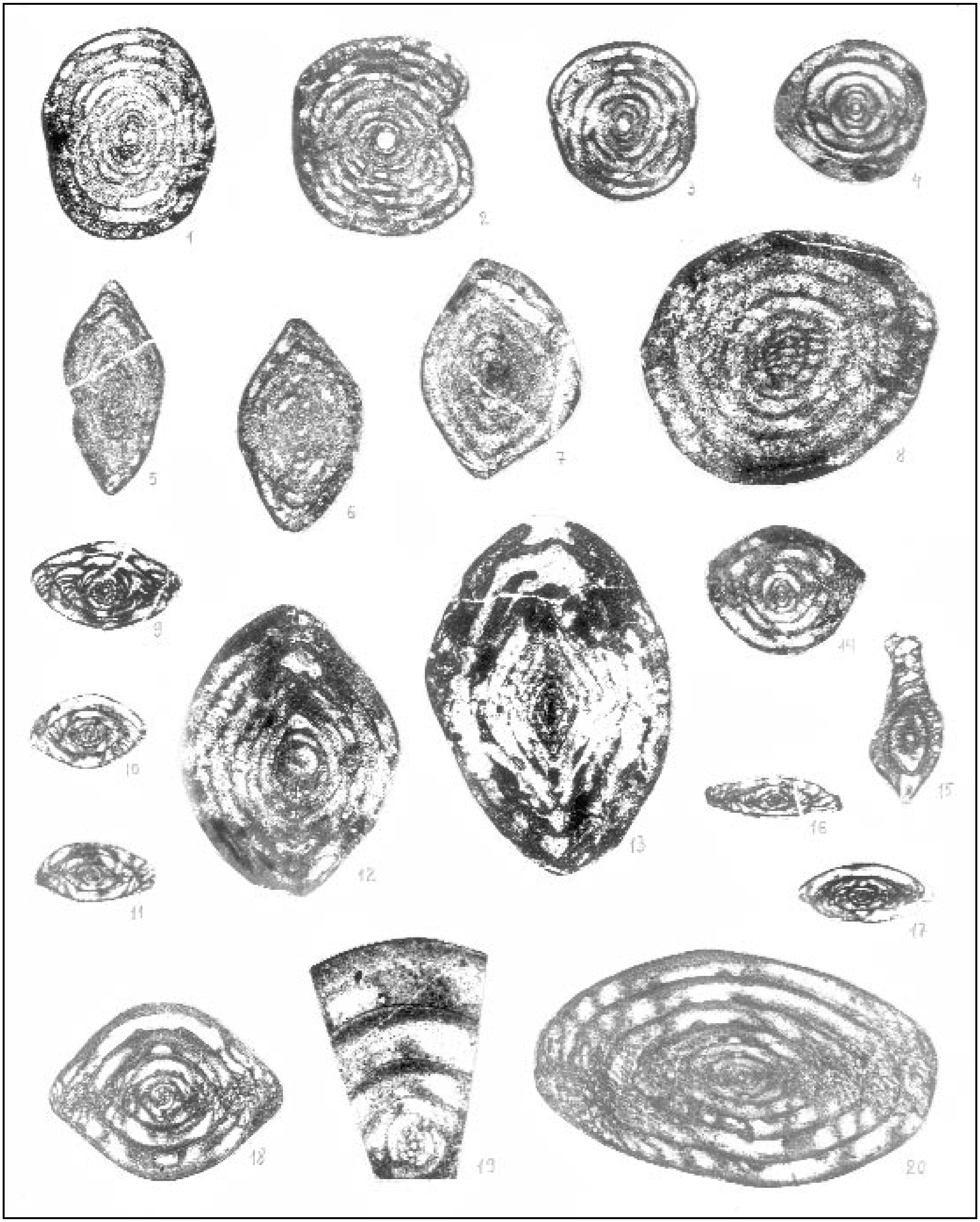

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

PLATE II

Figure 1. *Neofusulinella lantenoisi* Deprat (p. 59), from locality A71, Khojagor, zone of Bamian, tangential section, GGM VI-228/19, ×20.

Figures 2, 3, 4. *Neofusulinella callosa* Leven, n. sp. (p. 59), from locality A69, Khojagor, zone of Bamian.

2. Axial section of the holotype, GGM VI-228/20, ×20.
3. Part of Figure 2 showing diaphanotheca, ×40.
4. From locality A54, Bulola, zone of Bamian, axial section, GGM VI-228/21, ×20.

Figure 5. *Boultonia ogbinensis* Chedija (p. 60), from locality 630, zone of Sange Dushoh, axial section, GGM VI-228/22, ×50.

Figure 6. *Russiella pulchra* A. Miklukho-Maclay (p. 60), from locality A57, Bulola, zone of Bamian, axial section GGM VI-228/23, ×20.

Figure 7. *Minojapanella (Wutuella) wutuensis* (Kuo) (p. 60), from locality 209b, Sabzab-Adjar, central Afghanistan, subaxial section GGM VI-228/24, ×20.

Figures 8, 9, 10, 11, 12, 13. *Lantschichites minimus* (Chen) (p. 60), from locality 284, Altimur, Suleiman-Kirthar area.

8. Near-equatorial section, GGM VI-228/25, ×40.
9. Axial section, GGM VI-228/26, ×40.
10. Axial section, GGM VI-228/27, ×40.
11. Axial section, GGM VI-228/28, ×40.
12. Subaxial section, GGM VI-228/29, ×40.
13. Equatorial section, GGM VI-228/30, ×40.

Figures 14, 15, 16, 17, 18. *Dunbarula kitakamiensis* Choi (p. 60).

14. From locality 5737, Bulola, zone of Bamian, axial section, GGM VI-228/31, ×50.
15. From locality A 48, Khojagor, zone of Bamian, subaxial section, GGM VI-228/32, ×50.
16. From locality 607-21, zone of Khoja Murod, axial section, GGM VI-228/33, ×50.
17. From locality 5737, Bulola, zone of Bamian, subaxial section, GGM VI-228/34, ×50.
18. From locality A 48, Khojagor, zone of Bamian, axial section, GGM VI-228/34, ×50.

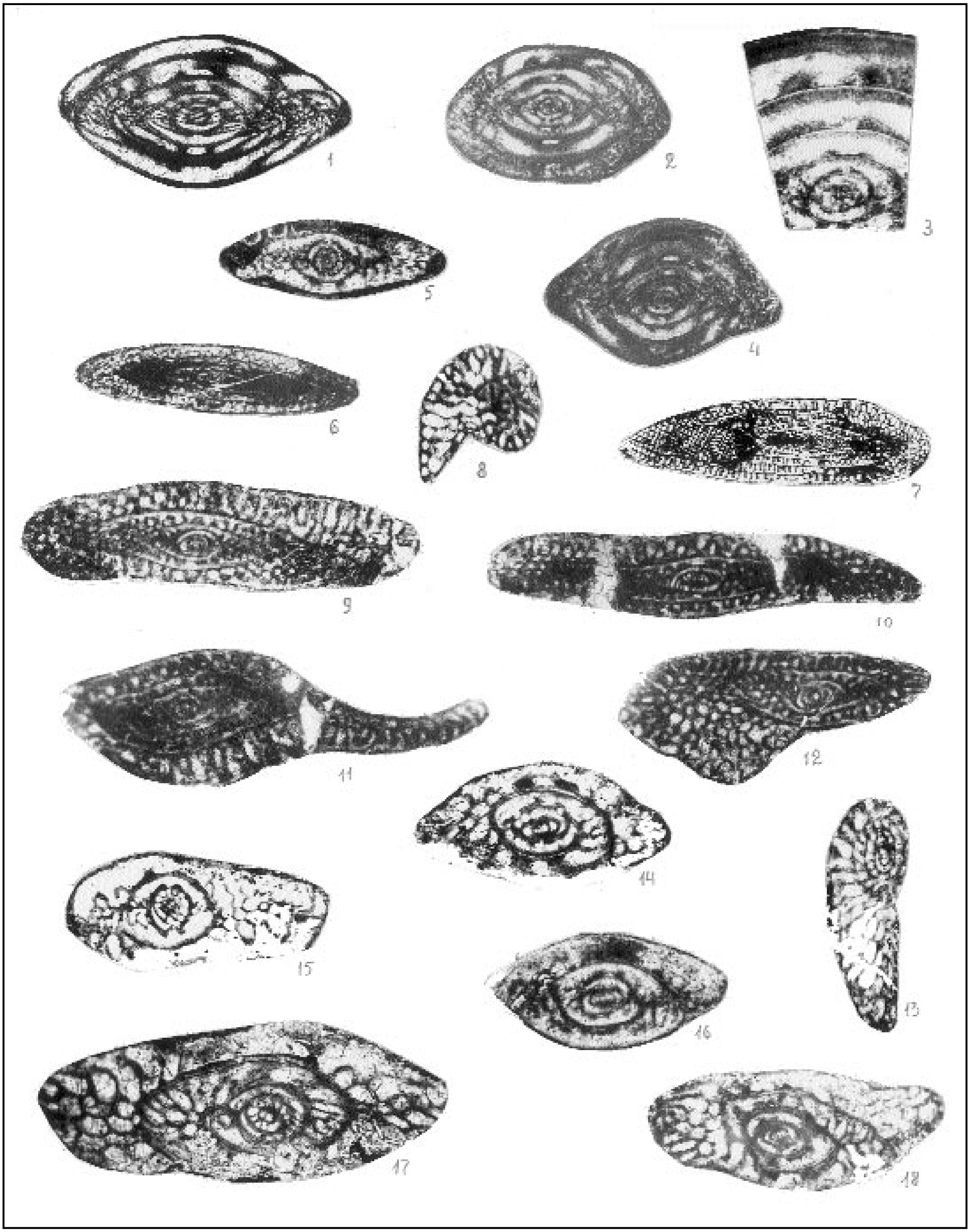

1
2
3
5
4
6
8
7
9
10
11
12
14
15
13
16
17
18

PLATE III

Figure 1. *Dunbarula ardaglensis* (Chedija) (p. 60), from locality 631-5, zone of Sange Dushoh, subaxial section, GGM VI-228/35, ×50.

Figure 2. *Dunbarula nana* Kochansky-Devidé and Ramovš (p. 60), from locality 607-11, zone of Khoja Murod, axial section, GGM VI-228/36, ×50.

Figures 3, 7. *Codonofusiella erki* Rauser-Chernousova (p. 60), from locality 607-25, zone of Khoja Murod.

3. Oblique section, GGM VI-228/37, ×50.
7. Axial section, GGM VI-228/37, ×50.

Figures 4, 6, 8, 9, 11. *Codonofusiella simplex* Leven n. sp. (p. 60), from locality 209b, Sabzab-Adjar, central Afghanistan.

4. Oblique section, GGM VI-228/38, ×50.
6. Axial section of the holotype, GGM VI-228/40, ×50.
8. Near-equatorial section, GGM VI-228/41, ×50.
9. Equatorial section, GGM VI-228/42, ×50.
11. Oblique section, GGM VI-228/38, ×50.

Figure 5. *Codonofusiella schubertelloides* Sheng (p. 60), from locality 607-22, zone of Khoja Murod, axial section GGM VI-228/39, ×50.

Figure 10. *Yangchienia thompsoni* Skinner and Wilde (p. 61), from locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-162/1, ×20.

Figure 12. *Yangchienia haydeni* Thompson (p. 61), from locality 238a, Uruzgan, central Afghanistan, axial section, GGM VI-228/43, ×20.

Figures 13, 15. *Biwaella omiensis* Morikawa and Isomi (p. 61).

13. From locality A34, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/44, ×20.
15. From locality A27, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/26, ×30.

Figure 14. *Yangchienia tobleri* Thompson (p. 61), from locality 175-3, Abtchagan, Suleiman-Kirthar area, axial section GGM VI-228/45, ×20.

Figure 16, 21. *Biwaella ellipsoidalis* Leven (p. 61).

16. From locality A27, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/47, ×20.
21. From locality 393, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/52, ×20.

Figure 17. *Biwaella tumefacta* Leven, n. sp. (p. 61), from locality A34-3, Saidi Kajon, zone of Sourkhob, axial section of the holotype, GGM VI-228/48, ×20.

Figures 18, 19, 20, 22. *Biwaella shiroishiensis* (Morikawa and Kobayashi) (p. 61).

18. From locality A34, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/49, ×20.
19. From locality A27, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/50, ×20.
20. From the same locality as figure 19, axial section, GGM VI-228/51, ×20.
22. From locality 393, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/53, ×20.

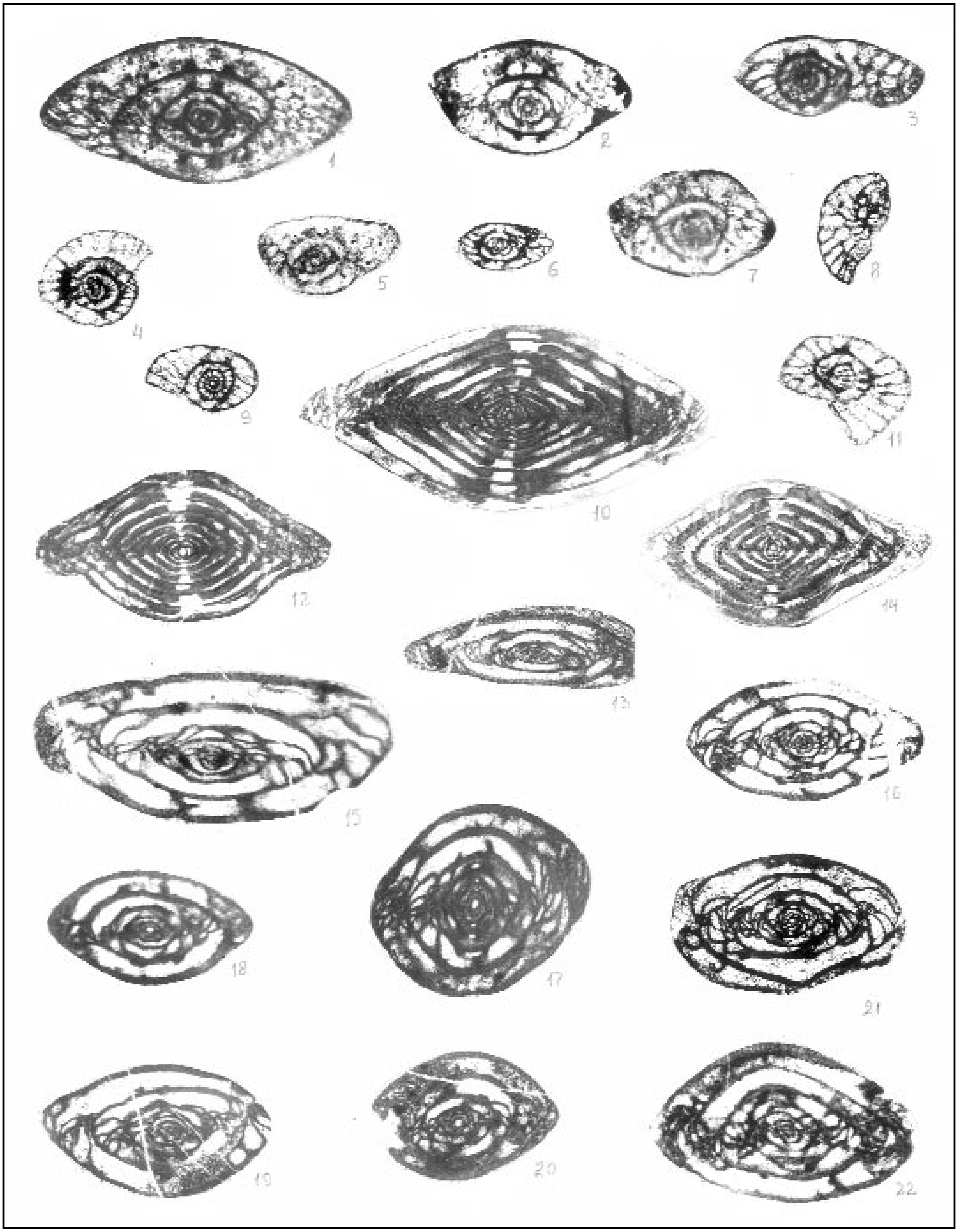

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE IV

Figure 1. *Toriyamaia laxiseptata* Kanmera (p. 61), from locality 628-11, zone of Sange Dushoh, axial section, GGM VI-228/15, ×20.

Figure 2. *Pamirina (Levenella)* aff. *P. pulchra* Wang and Sun (p. 61), from locality A34, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/54, ×15.

Figures 3, 4, 5. *Pamirina (Pamirina) darvasica* Leven (p. 61).

3, 4. From locality 393, Saidi Kajon, zone of Sourkhob, axial sections, GGM VI-228/55, ×30.

5. From locality A27, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-628/56, ×30.

Figure 6. *Rauserella sphaeroidea* Sosnina (p. 62), from locality 573-14, zone of Khaftkala, axial section, GGM VI-228/57, ×50.

Figure 7. *Rauserella staffi* Skinner and Wilde (p. 62), from locality 627-7, zone of Khoja Murod, axial section, GGM VI-228/58, ×25.

Figure 8. *Reichelina changhsingensis* Sheng and Zhang (p. 62), from locality 173, Chohan, central Afghanistan, tangential section, GGM VI-228/59, ×50.

Figure 9. *Kahlerina pachytheca pusilla* Kochansky-Devidé and Ramovš (p. 62), from locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/60, ×50.

Figure 10. *Kahlerina globiformis* Sosnina (p. 62), from locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/61, ×20.

Figure 11. *Kahlerina africana* Skinner and Wilde (p. 62), from locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/62, ×20.

Figure 12. *Pseudokahlerina compressa* Sosnina (p. 62), from locality A58-1, Bulola, zone of Bamian, axial section GGM VI-228/63, ×20.

Figure 13. *Quasifusulina magnifica* Leven (p. 62), from locality A28, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/64, ×10.

Figure 14. *Pseudoschwagerina velebitica* Kochansky-Devidé (p. 62), from locality 119-4, Kwahan, north Badakshan, axial section, GGM VI-228/65, ×10.

Figure 15. *Pseudoschwagerina turbida* F. and G. Kahler (p. 62), from locality 119-4, Kwahan, north Badakhshan, axial section, GGM VI-228/66, ×10.

Figure 16. *Pseudoschwagerina extensa* F. and G. Kahler (p. 62), from locality 119-4, Kwahan, north Badakhshan, axial section, GGM VI-228/66, ×10.

Figures 17, 18. *Zellia heritschi afghanica* Leven, n. subsp., (p. 63), from locality A12-4, Amir Omad, zone of Sourkhob, ×10.

17. Axial section of the holotype, GGM VI-228/67.

18. Axial section, GGM VI-228/68.

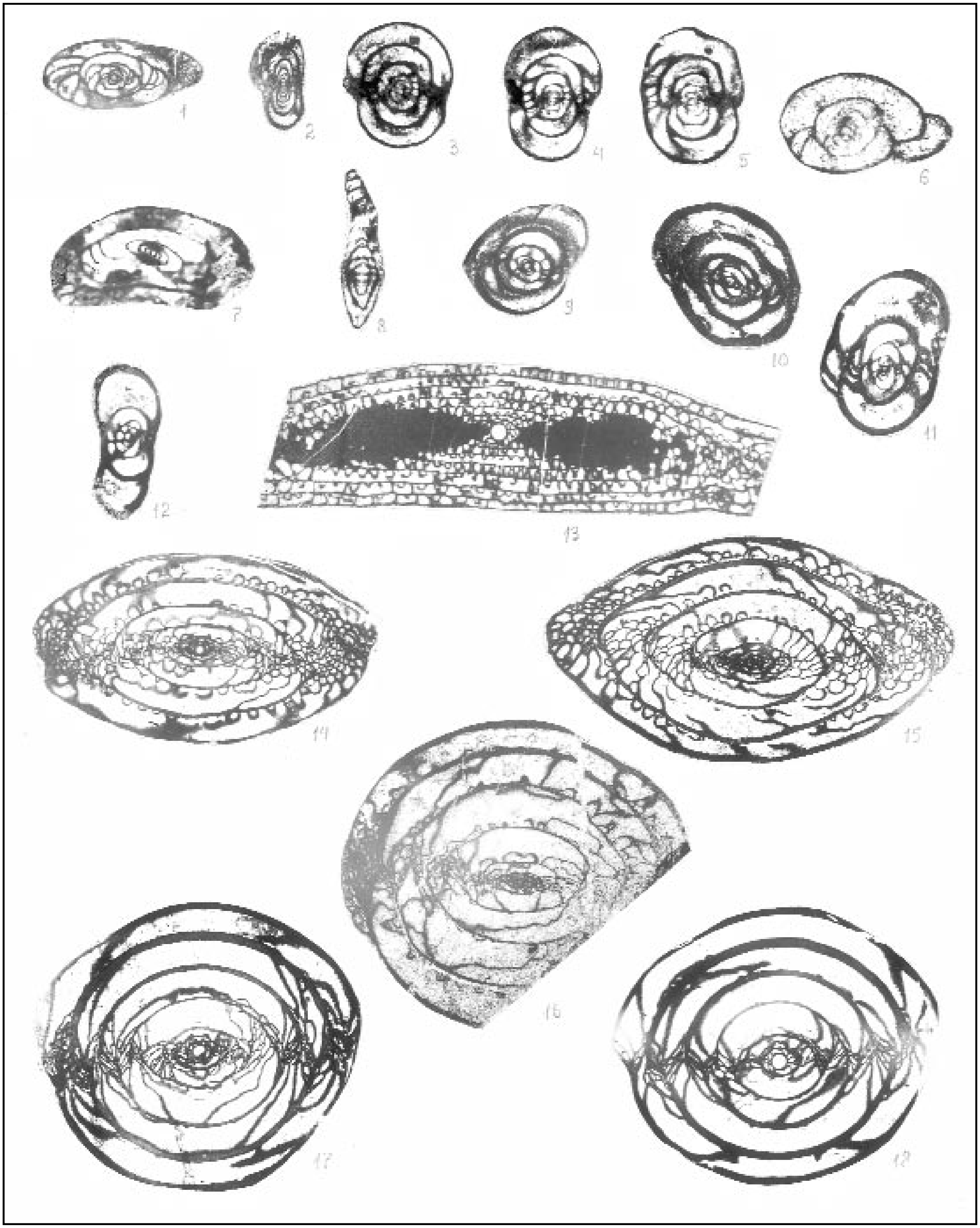

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

PLATE V

(All figures ×10)

Figures 1, 2. *Robustoschwagerina tumida* (Likharew) (p. 63), from locality A28, Saidi Kajon, zone of Sourkhob.

1. Axial section, GGM VI-228/69.
2. Axial section, GGM VI-228/70.

Figure 3. *Robustoschwagerina kahleri* (A. Miklukho-Maclay) (p. 63), from locality A12-4, Amir Omad, zone of Sourkhob, axial section, GGM VI-228/71.

Figures 4, 5, 6, 7, 8. *Rugososchwagerina altimurica* Leven, n. sp. (p. 63), from locality 284, Altimur, Suleiman-Kirthar area.

4. Axial section of the holotype, GGM VI-228/72.
5. Axial section, GGM VI-228/73.
6. Axial section, GGM VI-228/74.
7. Axial section, GGM VI-228/75.
8. Axial section, GGM VI-228/76.

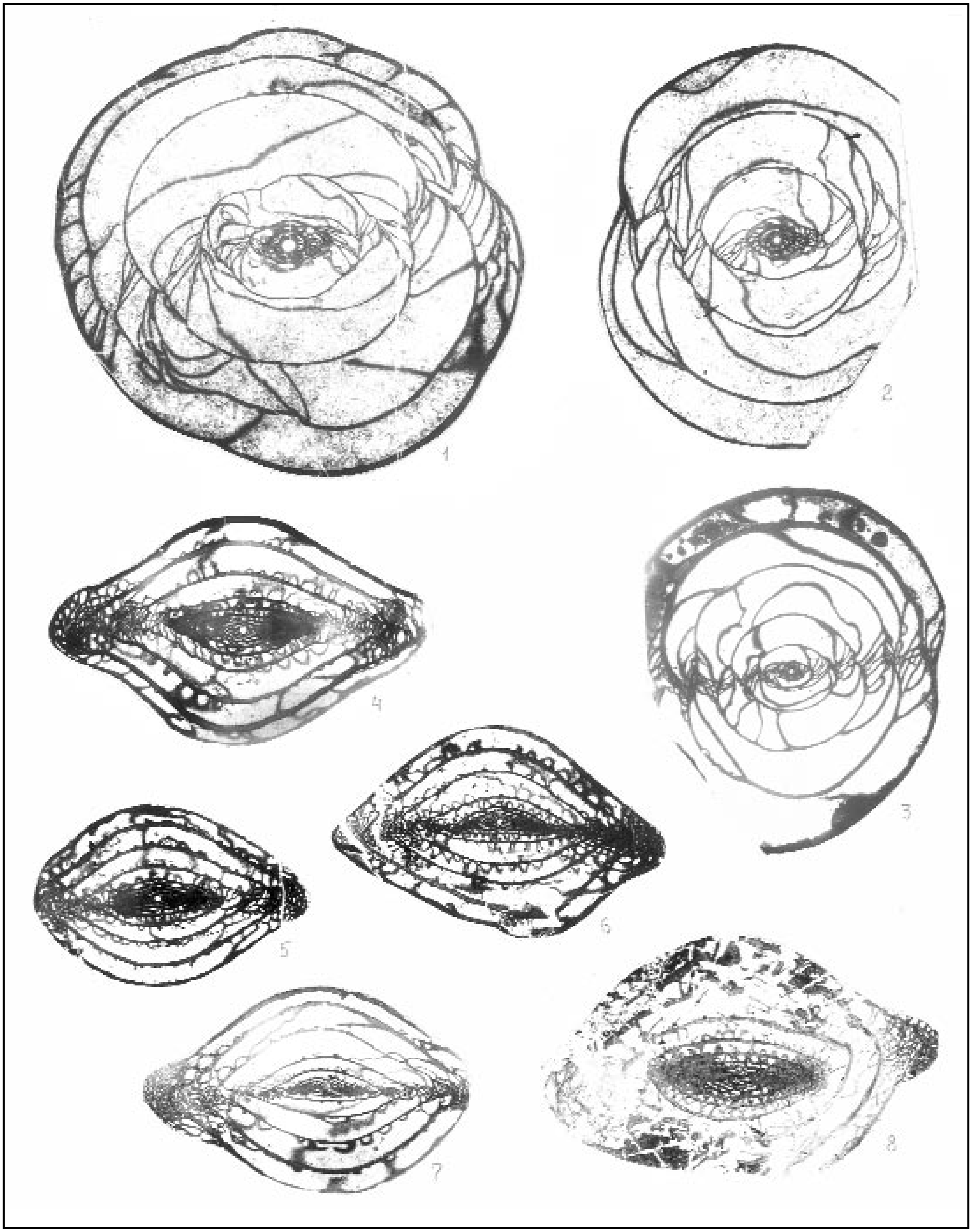

1
2
3
4
5
6
7
8

PLATE VI
(All figures ×10)

Figures 1, 2, 3, 4, 5, 6. *Rugososchwagerina heratica* Leven, n. sp. (p. 63), from locality 561-5, zone of Khaftkala.
1. Subaxial section of the holotype, GGM VI-228/77.
2. Equatorial section, GGM VI-228/78.
3. Tangential section, GGM VI-228/79.
4. Subaxial section, GGM VI-228/80.
5. Subaxial section, GGM VI-228/81.
6. Axial section of a juvenarium, GGM VI-228/81.

Figures 7, 8. *Kubergandella insolita* (Davydov) (p. 64), from locality 209b, Sabzab-Adjar, central Afghanistan.
7. Axial section, GGM VI-228/82.
8. Axial section, GGM VI-228/83.

Figures 9, 10. *Rugosofusulina likana* Kochansky-Devidé (p. 64), from locality A12-4, Amir Omad, zone of Sourkhob.
9. Axial section, GGM VI-228/84.
10. Axial section, GGM VI-228/85.

Figure 11. *Rugosofusulina valida* (Lee) (p. 64), from locality 566-3, zone of Khaftkala, axial section, GGM VI-228/86.

Figures 12, 13, 14, 15, 16. *Rugosofusulina furoni* (Thompson), (p. 64), from locality A58, Bulola, zone of Bamian.
12. Axial section, GGM VI-228/87.
13. Axial section, GGM VI-228/88.
14. Axial section, GGM VI-228/89.
15. Axial section, GGM VI-228/90.
16. Axial section, GGM VI-228/91.

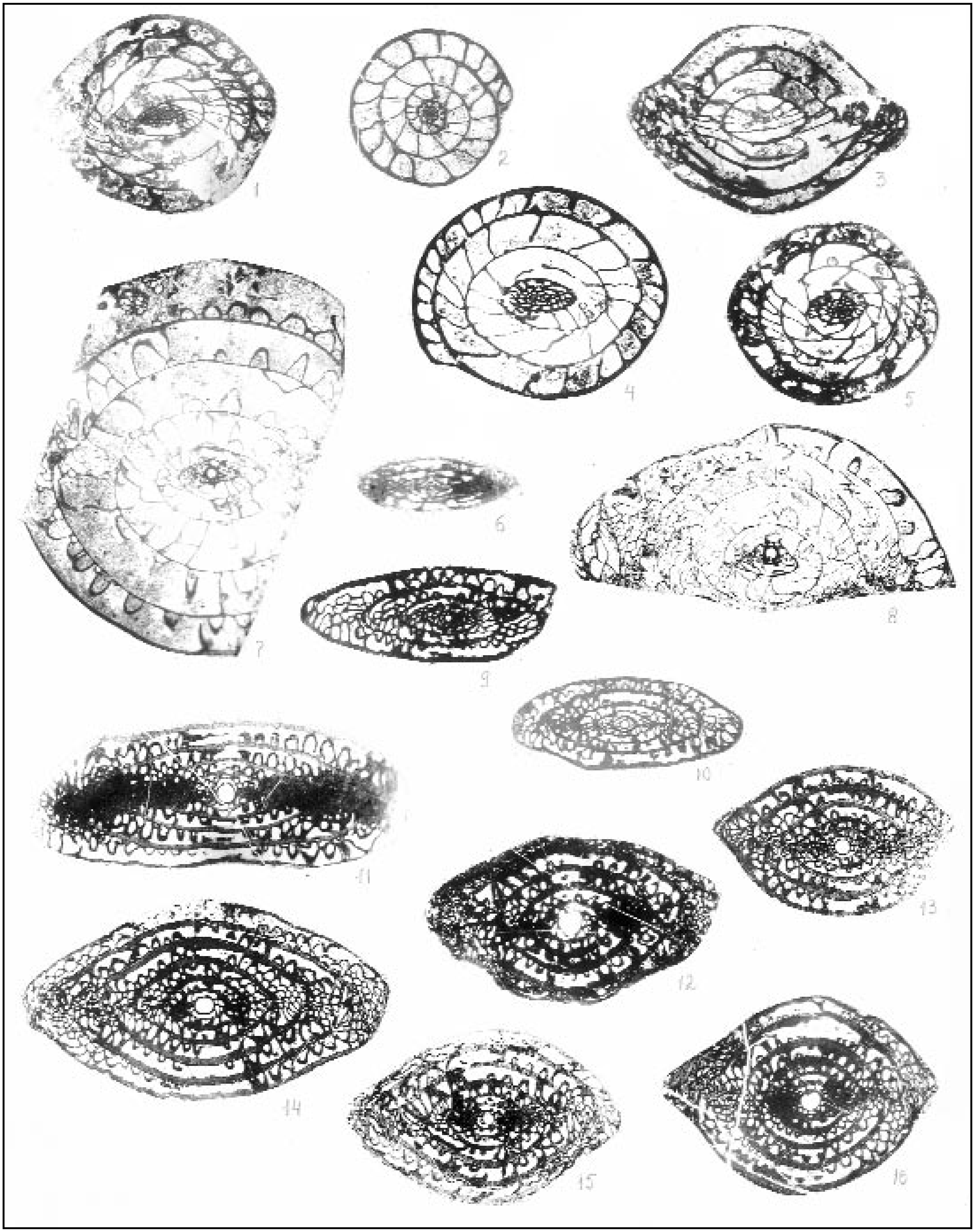

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

PLATE VII

(All figures ×10)

Figure 1. *Darvasella vulgariformis* (Kalmykova) (p. 64), From locality A 63, Khojagor, zone of Bamian, axial section, GGM VI-228/92.

Figures 2, 5, 6. *Darvasella ponderosa* Leven, n. sp. (p. 64), from locality A45, Saidi Kajon, zone of Sourkhob.

2. Axial section, GGM VI-228/93.
5. Axial section, GGM VI-228/96.
6. Axial section of the holotype, GGM VI-228/97.

Figures 3, 4. *Darvasella compacta* (Leven) (p. 64).

3. From locality A32, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/94.
4. From locality A38, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/95.

Figure 7. *Darvasella cucumeriformis* Leven, n. sp. (p. 65), from locality A28, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/98.

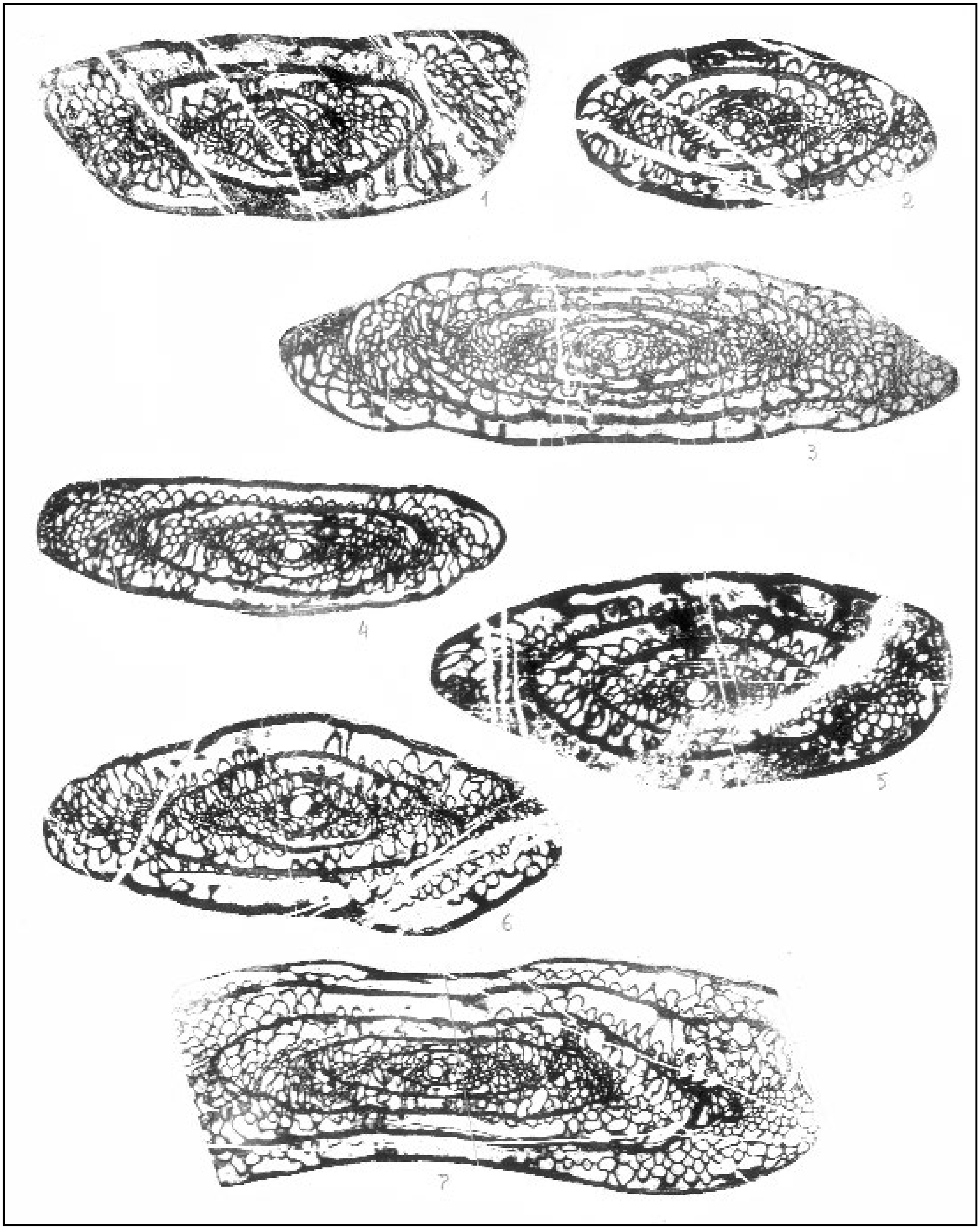

1
2
3
4
5
6
7

PLATE VIII
(All figures ×10)

Figure 1. *Darvasella cucumeriformis* Leven, n. sp. (p. 65), from locality A28, Saidi Kajon, zone of Sourkhob, axial section of the holotype, GGM VI-228/99.
Figure 2. *Dutkevitchia ruzhenzevi* (Rauser-Chernousova) (p. 65), from locality A12-4, Amir Omad, zone of the Sourkhob, axial section, GGM VI-228/100.
Figures 3, 4, 5, 6, 7. *Dutkevitchia jipuensis* (Nie and Song) (p. 65), from locality 209, Sabzab-Adjar, central Afghanistan.
3. Axial section, GGM VI-228/101.
4. Axial section, GGM VI-228/102.
5. Axial section, GGM VI-228/103.
6. Axial section, GGM VI-228/102.
7. Axial section, GGM VI-228/104.

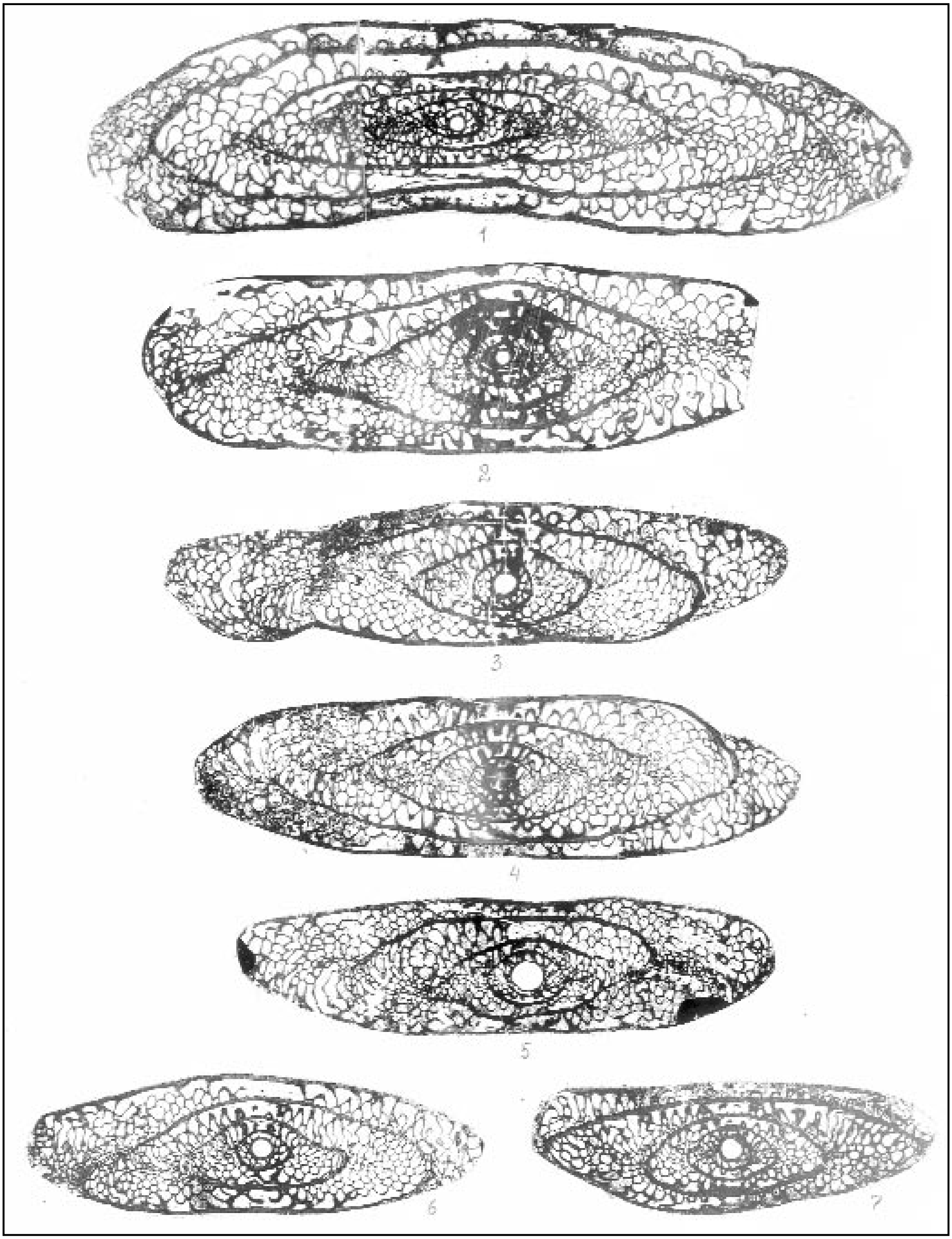

1
2
3
4
5
6
7

PLATE IX

(All figures ×10)

Figure 1. *Dutkevitchia bianpingensis* (Zhang and Dong) (p. 65), from locality A12-4, Amir Omad, zone of Sourkhob, axial section, GGM VI-228/105.

Figure 2. *Dutkevitchia sourkhobensis* Leven, n. sp. (p. 65), from locality A27, Saidi Kajon, zone of Sourkhob, axial section of the holotype, GGM VI-228/106.

Figures 3, 4, 5. *Darvasites contractus* (Schellwien and Dyhrenfurth) (p. 66).

3. From locality A63, Khojagor, zone of Bamian, axial section, GGM VI-228/107.
4. From locality 1153-3, Obi Tang, north Badakhshan, axial section, GGM VI-228/108.
5. From the same locality as figure 4, axial section, GGM VI-228/109.

Figures 6, 7. *Darvasites ordinatus ordinatus* (Chen) (p. 66).

6. From locality 1155, Kwahan, north Badakhshan, axial section, GGM VI-228/110.
7. From locality 1153, Obi Tang, north Badakhshan, axial section, GGM VI-228/111.

Figures 8, 9. *Darvasites ordinatus longus* Leven, n. subsp. (p. 66), from locality 210a, Sabzab-Adjaz, central Afghanistan.

8. Axial section of the holotype, GGM VI-228/112.
9. Axial section, GGM VI-228/113.

Figure 10. *Darvasites wyssi* (Reichel) (p. 66), from locality 1153, Obi Tang, north Badakhshan, axial section, GGM VI-228/114.

Figure 11. *Darvasites pseudosimplex* (Chen) (p. 66) from locality A30, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/115.

Figure 12. *Darvasites* aff. *D. compactus* Leven (p. 66), from locality A30, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/116.

Figures 13, 14, 15. *Darvasites vandae* Leven and Scherbovich (p. 66), from locality A31, Saidi Kajon, zone of Sourkhob.

13. Axial section GGM VI-228/117.
14. Axial section, GGM VI-228/118.
15. Axial section, GGM VI-228/119.

Figure 16. *Darvasites* aff. *D. zulumartensis* Leven (p. 66), from locality A12-4, Amir Omad, zone of Sourkhob, axial section, GGM VI-228/120.

Figures 17, 18. *Darvasites afghanensis* Leven, n. sp. (p. 66), from locality 85, Gudri Mazar, central Afghanistan.

17. Axial section of the holotype, GGM VI-228/121.
18. Axial section, GGM VI-228/122.

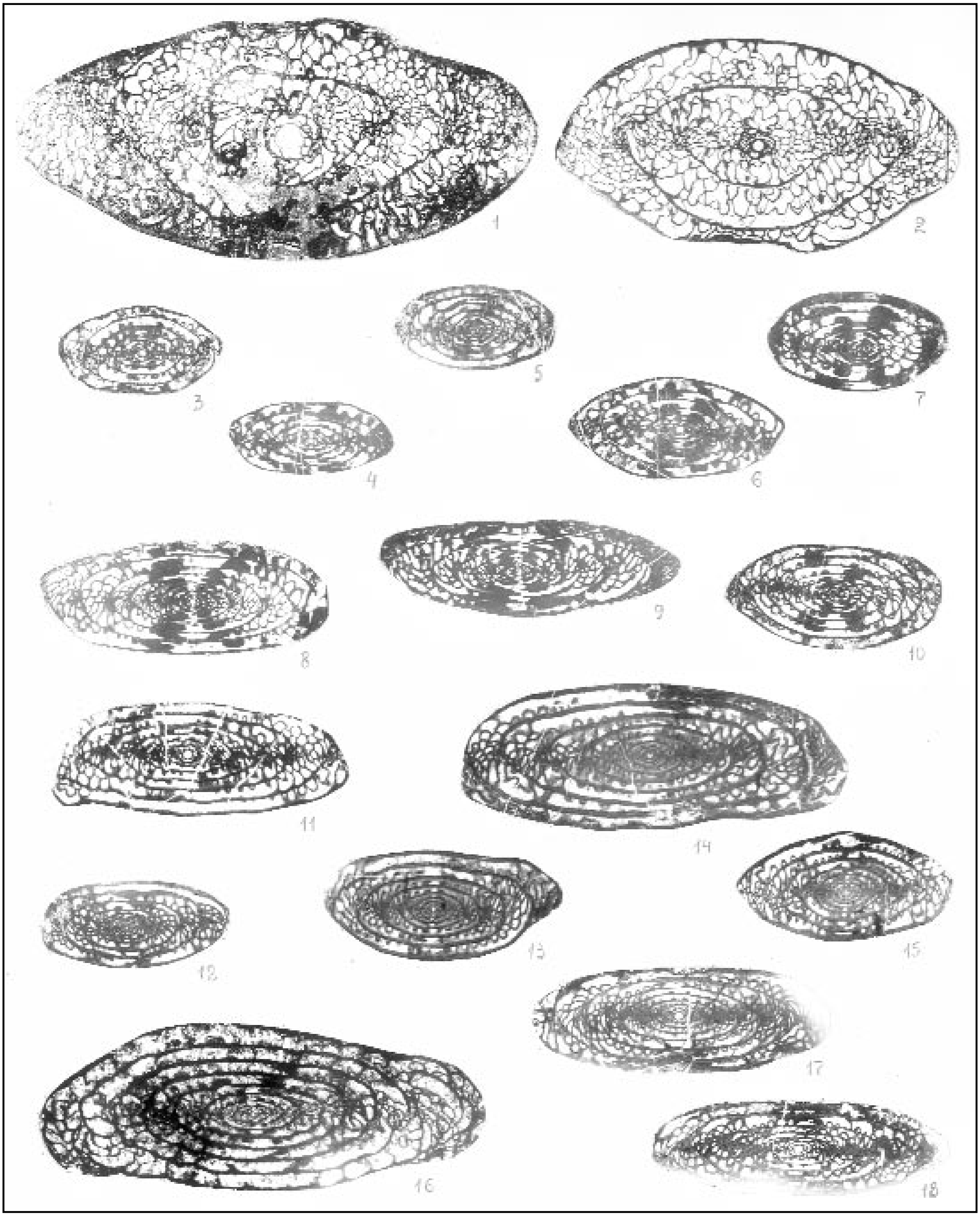

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

PLATE X

(All figures ×10)

Figures 1, 2. *Chalaroschwagerina vulgaris* (Schellwien and Dyhrenfurth) (p. 67), from locality 210a, Sabzab-Adjar, central Afghanistan.

1. Axial section, GGM VI-228/123.
2. Axial section, GGM VI-228/124.

Figure 3. *Chalaroschwagerina vulgarisiformis* (Morikawa) (p. 67), from locality 628-6, zone of Khoja Murod, axial section, GGM VI-228/125.

Figure 4. *Chalaroschwagerina kushlini* (Leven) (p. 67), from locality 1400-1-20, zone of Tash Kupruk, subaxial section, GGM VI-228/126.

Figures 5, 6. *Chalaroschwagerina tibetica* Nie and Song (p. 67), from locality A30, Saidi Kajon, zone of Sourkhob.

5. Axial section, GGM VI-228/127.
6. Axial section, GGM VI-228/128.

Figures 7, 8. *Chalaroschwagerina bamianica* Leven, n. sp. (p. 67).

7. From locality A73, Khojagor, zone of Bamian, axial section, GGM VI-228/190.
8. From locality A72, Khojagor, zone of Bamian, axial section of the holotype, GGM VI-228/131.

Figure 9. *Chalaroschwagerina sourkhobensis* Leven, n. sp. (p. 67), from locality A31, Saidi Kajon, axial section of the holotype, GGM VI-228/132.

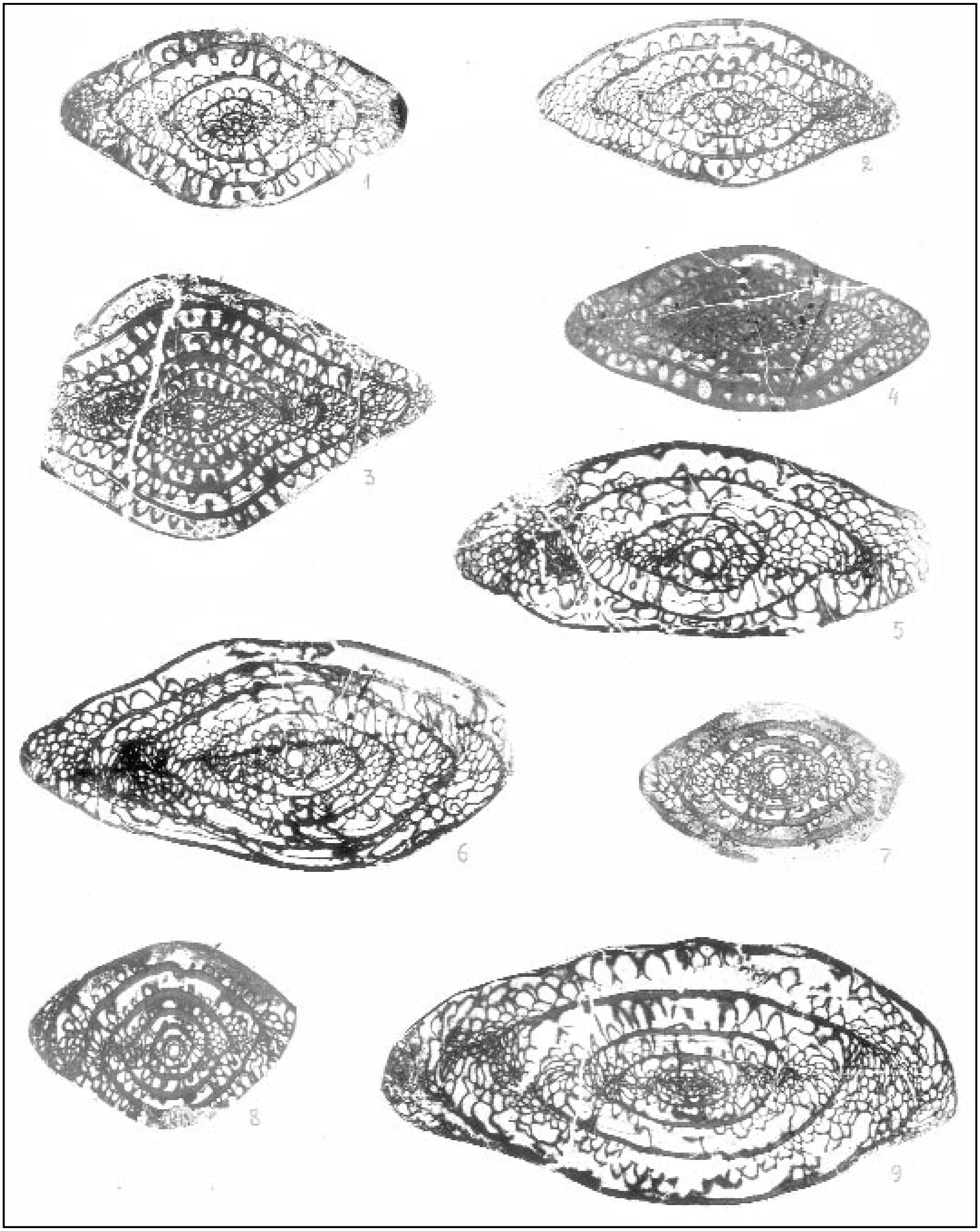

1
2
3
4
5
6
7
8
9

PLATE XI

(All figures ×10)

Figures 1, 2, 3, 4, 5. *Pseudofusulina karapetovi karapetovi* Leven, n. sp. and subsp (p. 67).
1. From locality 222b, Tezak, central Afghanistan, axial section of the holotype, GGM VI-228/133.
2. From the same locality as figure 1, axial section, GGM VI-228/134.
3. From the same locality as figure 1, axial section, GGM VI-228/135.
4. From locality 85, Gudri Mazar, central Afghanistan, axial section, GGM VI-228/136.
5. From locality 222, Tezak, central Afghanistan, axial section, GGM VI-228/137.

Figures 6, 7, 8. *Pseudofusulina karapetovi gudriensis* Leven, n. sp. and subsp. (p. 68).
6. From locality 85, Gudri Mazar, central Afghanistan, axial section, GGM VI 228/138.
7. From locality 222a, Tezak, central Afghanistan, axial section, GGM VI-228/139.
8. From locality 85, Gudri Mazar, central Afghanistan, axial section of the holotype, GGM VI-228/140.

Figures 9, 10, 11. *Pseudofusulina karapetovi tezakensis* Leven n. sp. and subsp. (p. 68).
9. From locality 222a, Tezak, central Afghanistan, axial section, GGM VI-228/139.
10. From locality 85, Gudri Mazar, central Afghanistan, axial section, GGM VI-228/142.
11. From locality 222a, Tezak, central Afghanistan, axial section of the holotype, GGM VI-228/139.

Figures 12, 13, 14, 15, 16, 17, 18, 19. *Pseudofusulina macilenta* Leven, n. sp. (p. 68), from locality 566, Kohe Pud, zone of Khaftkala.
12. Axial section, GGM VI-228/144.
13. Axial section, GGM VI-228/145.
14. Axial section, GGM VI-228/146.
15. Axial section of the holotype, GGM VI-228/147.
16. Axial section, GGM VI-228/148.
17. Axial section, GGM VI-228/149.
18. Axial section, GGM VI-228/150.
19. Axial section, GGM VI-228/151.

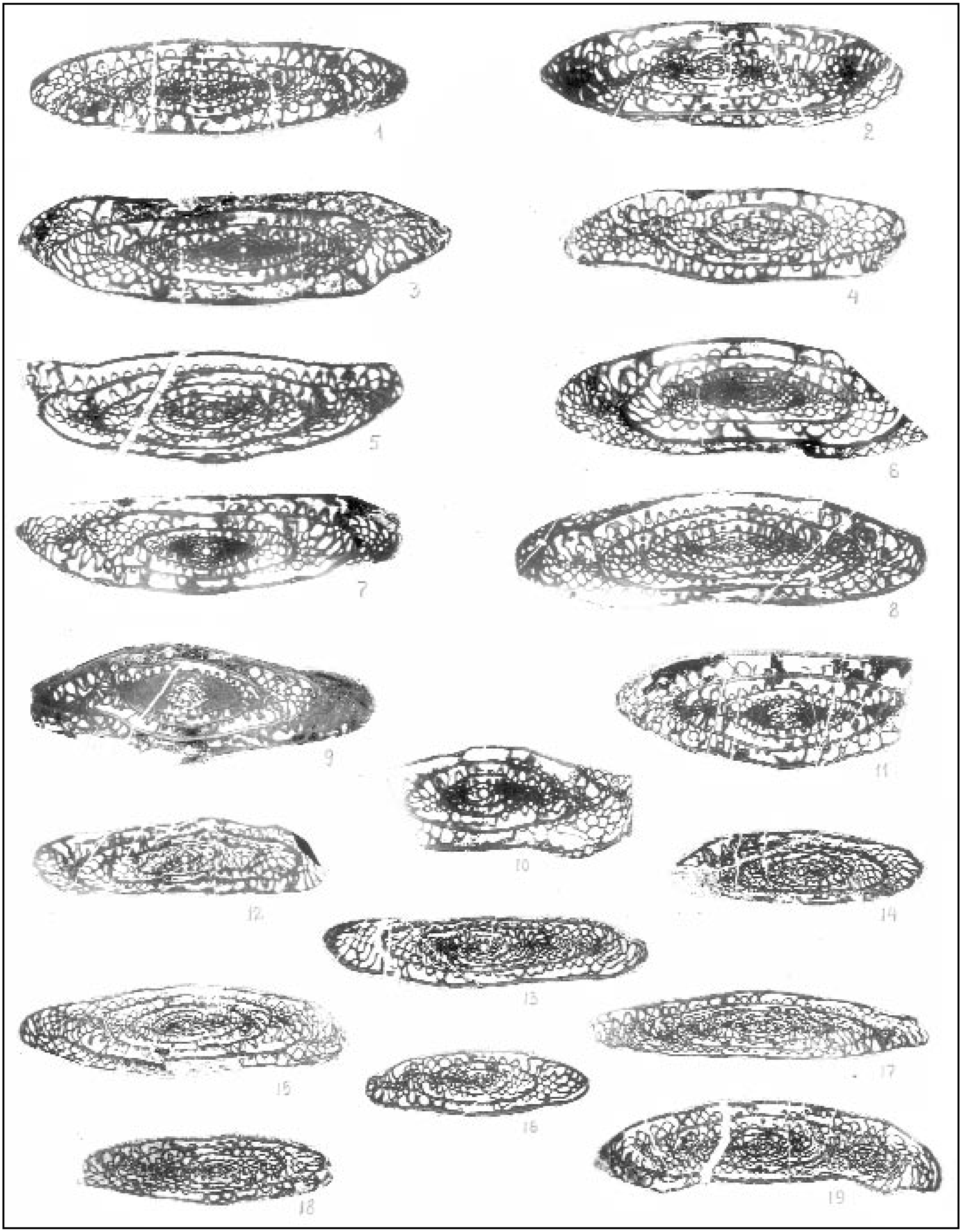

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

PLATE XII

(All figures ×10)

Figures 1, 2. *Pseudofusulina hordeola* Nie and Song (p. 68), from locality 604-6, zone of Khoja Murod.
1. Axial section, GGM VI-228/152.
2. Axial section, GGM VI-228/153.

Figures 3, 4, 5. *Pseudofusulina peregrina* Leven, n. sp. (p. 68), from locality 566, zone of Khaftkala.
3. Axial section of the holotype, GGM VI-228/154.
4. Axial section, GGM VI-228/155.
5. Axial section, GGM VI-228/156.

Figure 6. *Pseudofusulina parasecalica* (Zhang) (p. 69), from locality 566, zone of Khaftkala, axial section, GGM VI-228/158.

Figure 7. *Pseudofusulina fabra grandiuscula* Leven, n. subsp. (p. 69), from locality 566, zone of Khaftkala, axial section of the holotype, GGM VI-228/158.

Figures 8, 9. *Pseudofusulina fabra fabra* Leven and Scherbovich (p. 69), from locality 566, zone of Khaftkala.
8. Axial section, GGM VI-228/159.
9. Subaxial section, GGM VI-228/155.

Figures 10, 11. *Pseudofusulina acuminatula* Leven, n. sp. (p. 69), from locality 222a and 222b, Tezak, central Afghanistan.
10. Axial section, GGM VI-228/160.
11. Axial section of the holotype, GGM VI-228/161.

Figures 12, 13. *Pseudofusulina hessensis orientalis* Leven, n. subsp. (p. 69), from locality 210, Sabzab-Adjar, central Afghanistan.
12. Axial section, GGM VI-228/162.
13. Axial section of the holotype, GGM VI-228/162.

Figure 14. *Pseudofusulina fusiformis* (Schellwien and Dyhrenfurth) (p. 69), from locality A30, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/163.

Figure 15. *Pseudofusulina neolata* (Thompson) (p. 69), from locality 1155-3, Kwahan, north Badakhshan, axial section, GGM VI-228/164.

Figure 16. *Pseudofusulina kraffti* (Schellwien and Dyhrenfurth) (p. 70), from locality 606-7, zone of Khoja Murod, axial section, GGM VI-228/165.

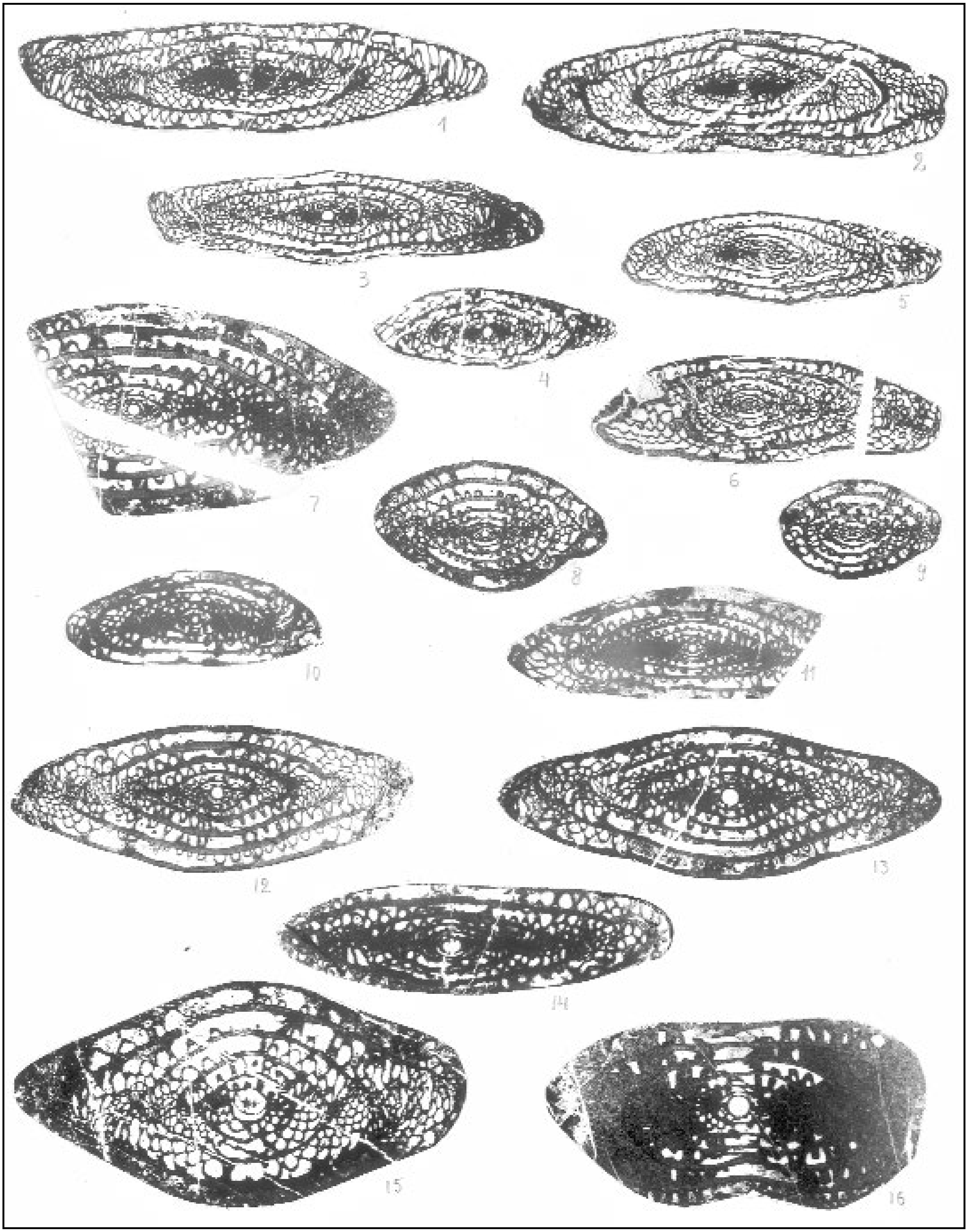

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

PLATE XIII
(All figures $\times 10$)

Figure 1. *Pseudofusulina postkraffti* (Leven) (p. 70), from locality 628-29, zone of Sange Dushoh, axial section, GGM VI-228/166.
Figure 2. *Pseudofusulina isomie* Igo (p. 70), from locality 625-19, zone of Khoja Murod, axial section, GGM VI-228/167.
Figures 3, 4. *Pseudofusulina heratica* Leven, n. sp. (p. 70), from locality 628-25, zone of Sange Dushoh.
3. Axial section of the holotype, GGM VI-228/168.
4. Axial section, GGM VI-228/169.
Figures 5, 6. *Pseudofusulina sourkhobensis* Leven, n. sp. (p. 70), from locality A27, Saidi Kajon, zone of Sourkhob.
5. Axial section of the holotype, GGM VI-228/170.
6. Axial section, GGM VI-228/171.
Figure 7. *Pseudofusulina priva* Leven, n. sp. (p. 70), from locality A53, Bulola, zone of Bamian, axial section of the holotype, GGM VI-228/172.

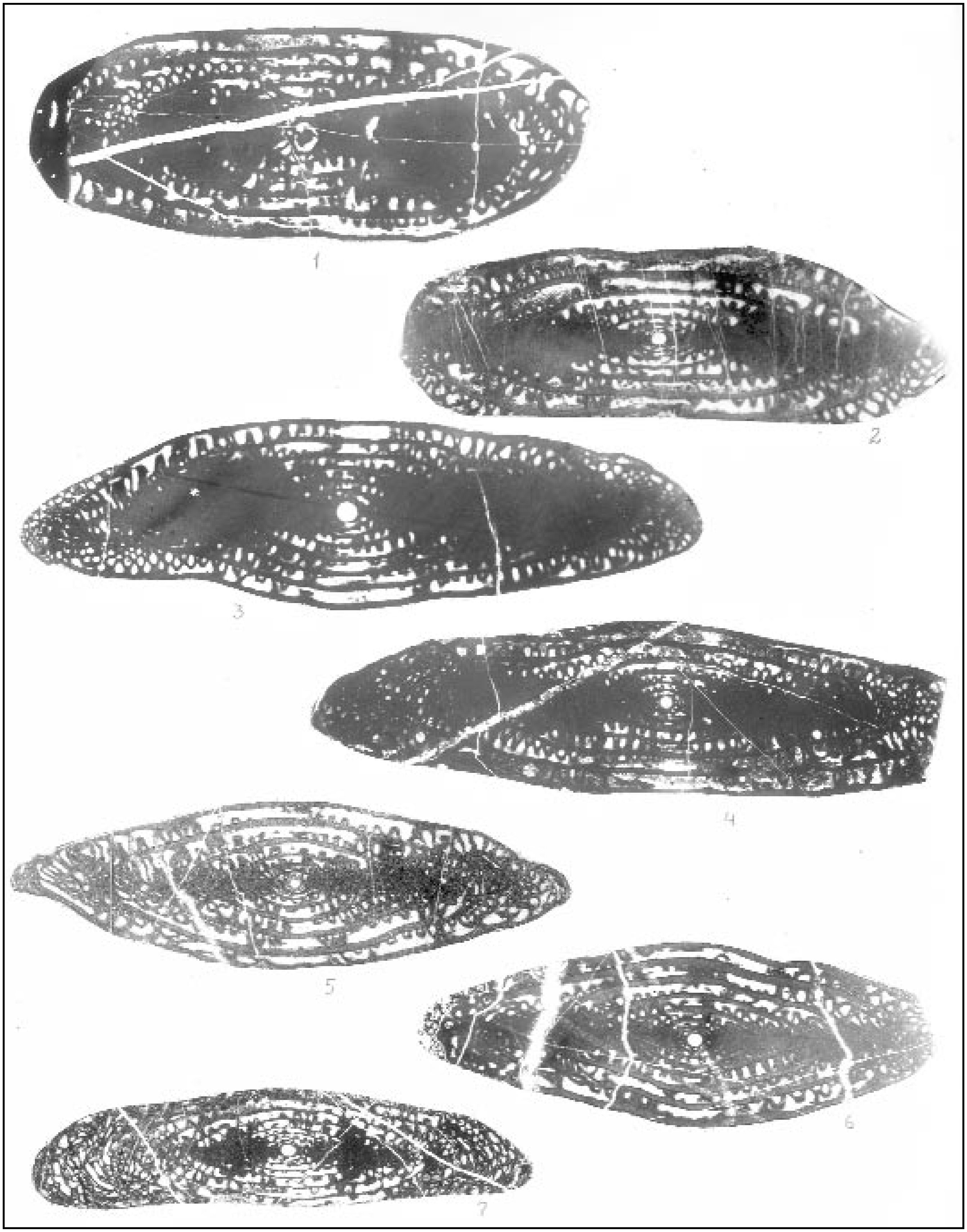

1
2
3
4
5
6
7

PLATE XIV

(All figures ×10)

Figure 1. *Pseudofusulina nupera* Leven (p. 70), from locality 446-2, Khojagor, zone of Bamian, axial section, GGM VI-228/173.

Figures 2, 9, 10. *Pseudofusulina bulolensis* Leven, n. sp. (p. 71), from locality A59, Bulola, zone of Bamian.

2. Axial section, GGM VI-228/174.
9. Axial section, GGM VI-228/180.
10. Axial section of the holotype, GGM VI-228/181.

Figures 3, 4, 5. *Pseudofusulina hupehensis* (Chen) (p. 70).

3. From locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/175.
4. From locality 1362, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/176.
5. From locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/177.

Figures 6, 7, 8. *Pseudofusulina solita* (Skinner) (p. 71), from locality 284, Altimur, Suleiman-Kirthar area.

6. Axial section, GGM VI-228/178.
7. Axial section, GGM VI-228/179.
8. Axial section, GGM VI-228/181.

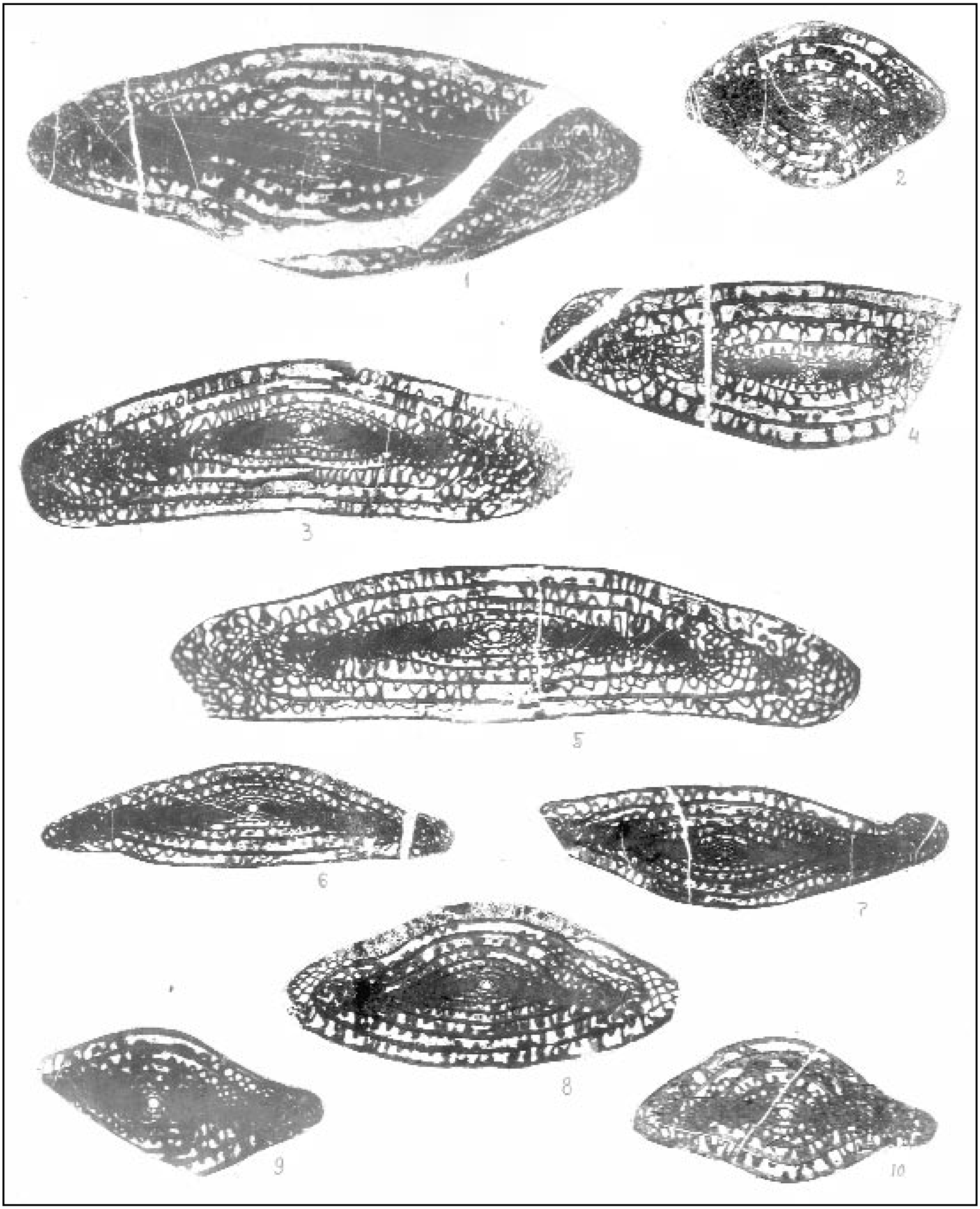

1
2
3
4
5
6
7
8
9
10

PLATE XV

(All figures ×10)

Figures 1, 3, 4. *Pseudofusulina paralpina* (Chen) (p. 71), from locality A50, Khojagor, zone of Bamian.
1. Axial section, GGM VI-228/182.
3. Axial section, GGM VI-228/184.
4. Axial section, GGM VI-228/185.

Figures 2, 9, 10. *Pseudofusulina haftkalensis* Leven, n. sp. (p. 71), from locality 561-5, zone of Khaftkala.
2. Axial section of the holotype, GGM VI-228/183.
9. Axial section, GGM VI-228/190.
10. Axial section, GGM VI-228/191.

Figure 5. *Pseudofusulina argandabensis* Leven, n. sp. (p. 71), from locality 8, Khargardan, central Afghanistan, axial section of the holotype, GGM VI-228/186.

Figure 6. *Pseudofusulina nishiwarensis* Kanuma (p. 71), from locality 625-17, zone of Khoja Murod, axial section, GGM VI 228/187.

Figure 7. *Pseudofusulina immensa* Leven, n. sp. (p. 71), from locality A32, Saidi Kajon, zone of Sourkhob, axial section of the holotype, GGM VI-228/188.

Figure 8. *Pseudofusulina perspicua* Leven, n.sp. (p. 71), from locality A27, Saidi Kajon, zone of Sourkhob, axial section of the holotype, GGM VI-228/189.

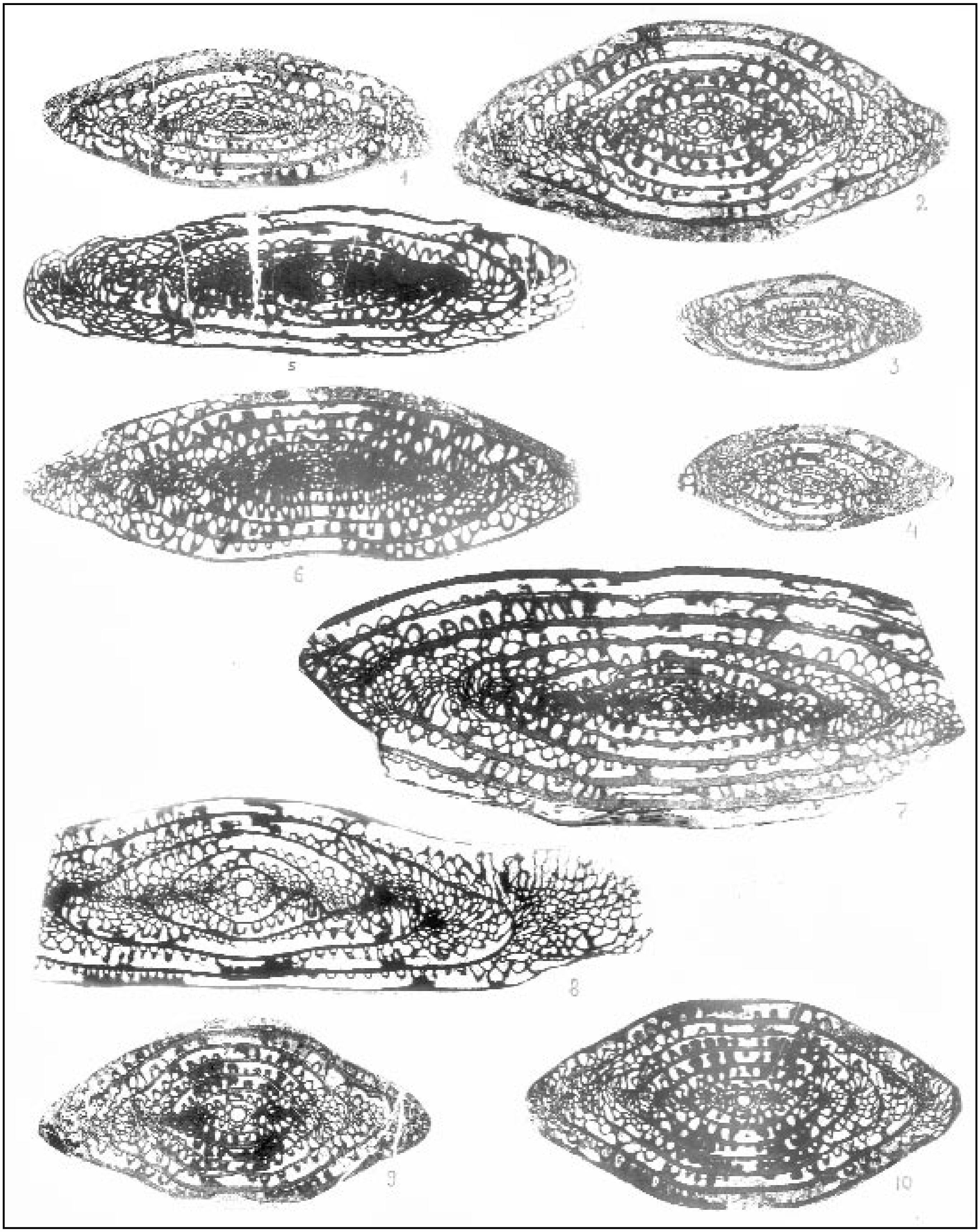

1
2
5
3
6
4
7
8
9
10

PLATE XVI

(All figures ×10)

Figures 1, 2. *Praeskinnerella crassitectoria afghanensis* Leven, n. subsp. (p. 72), from locality 210a, Sabzab-Adjar, central Afghanistan.

1. Axial section of the holotype, GGM VI-228/192.
2. Axial section, GGM VI-228/193.

Figures 3, 4, 5. *Praeskinnerella guembeli pseudoregularis* (Dunbar and Skinner) (p. 72), from locality 210a, Sabzab-Adjar, central Afghanistan.

3. Axial section, GGM VI-228/194.
4. Axial section, GGM VI-228/195.
5. Axial section, GGM VI-228/196.

Figure 6. *Praeskinnerella cushmani* (Chen) (p. 72), from locality A35, Saidi Kajon, zone of Sourkhob, axial section, GGM VI-228/197.

Figures 7, 8, 9. *Skinnerella gundarensis* Leven (p. 72), from locality 209b, Sabzab-Adjar, central Afghanistan.

7. Axial section, GGM VI-228/38.
8. Axial section, GGM VI-228/24.
9. Axial section, GGM VI-228/198.

Figures 10, 11. *Skinnerella undulata* (Chen) (p. 72), from locality 209a, Sabzab-Adjar, central Afghanistan.

10. Axial section, GGM VI-228/199.
11. Axial section, GGM VI-228/200.

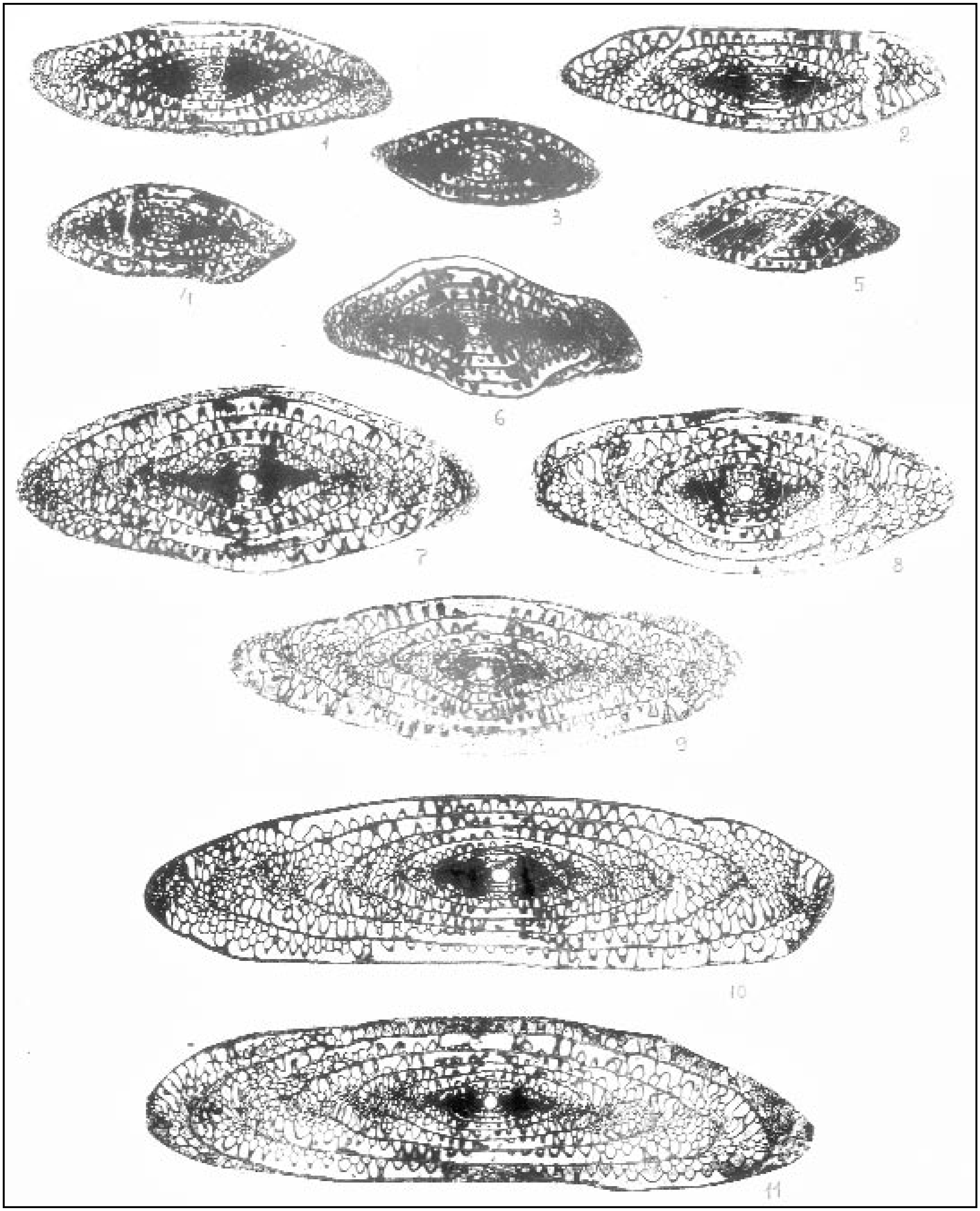

1
2
3
4
5
6
7
8
9
10
11

PLATE XVII

(All figures ×10)

Figures 1, 2. *Skinnerella speciosa* (Skinner) (p. 72), from locality 10a, Khargardan, central Afghanistan.
1. Axial section, GGM VI-228/201.
2. Axial section, GGM VI-228/202.

Figure 3. *Skinnerella yabei asiatica* (Leven) (p. 72), from locality 629-5, zone of Sange Dushoh, axial section, GGM VI-228/203.

Figures 4, 5. *Skinnerella cincta* (Reichel) (p. 72), from locality 209, Sabzab-Adjar, central Afghanistan.
4. Axial section, GGM VI-228/204.
5. Axial section, GGM VI-228/205.

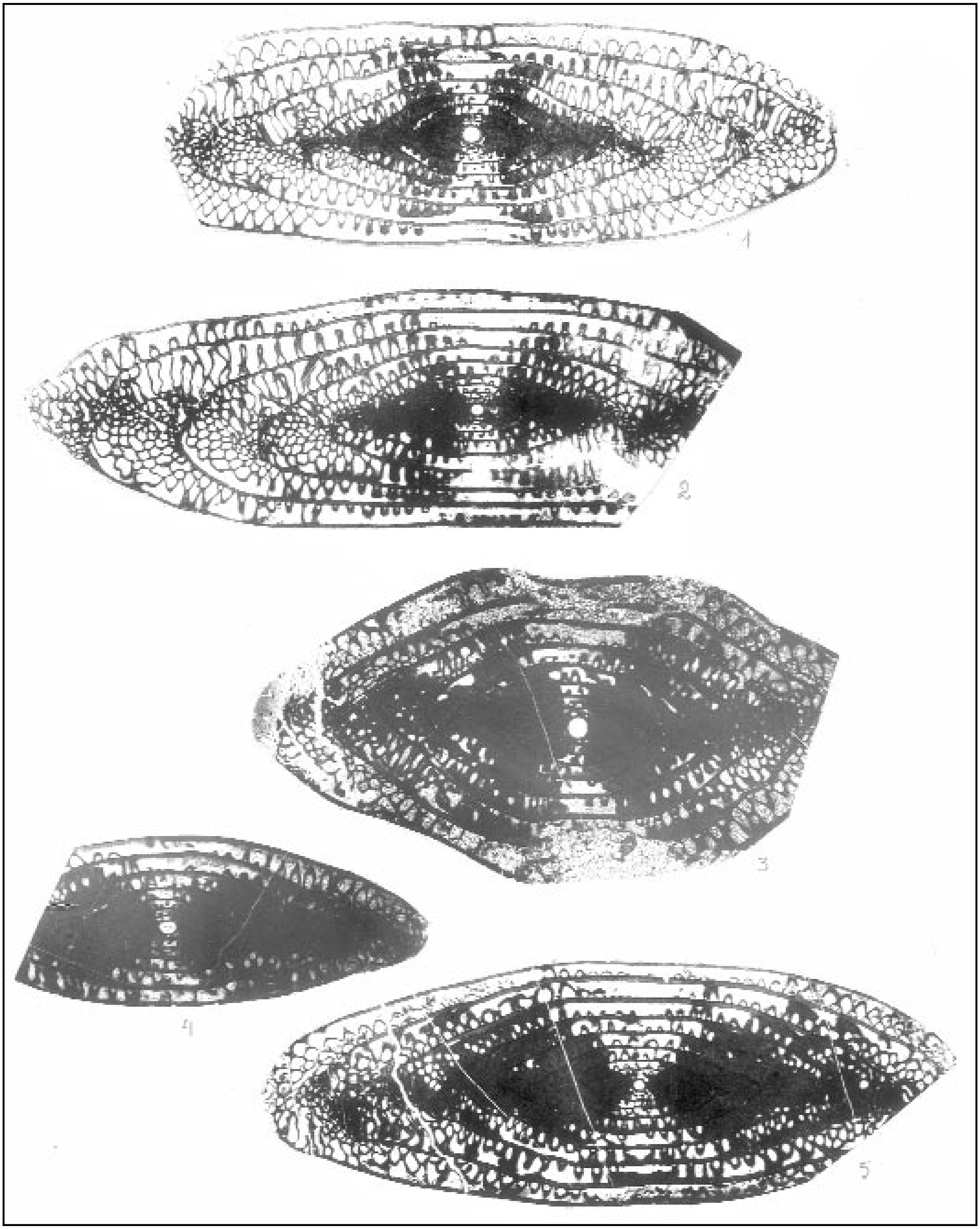

1
2
3
4
5

PLATE XVIII
(All figures ×10)

Figures 1, 4. *Chusenella tieni* (Chen) (p. 73).

1. From locality A69, Khojagor, zone of Bamian, axial section, GGM VI-228/206.
4. From locality A53, Bulola, zone of Bamian, axial section, GGM VI-228/209.

Figures 2, 3. *Parafusulina uruzganensis* Leven, n. sp. (p. 72), from locality 238, Uruzgan, central Afghanistan.

2. Axial section, GGM VI-228/207.
3. Axial section of the holotype, GGM VI-228/208.

Figures 5, 6, 7. *Laosella gigantea* (Deprat) (p. 73).

5. From locality A59 Bulola, zone of Bamian, axial section, GGM VI-228/210.
6. From locality A58-1 Bulola, zone of Bamian, axial section, GGM VI-228/211.
7. From the same locality as figure 6, axial section, GGM VI-228/212.

Figure 8. *Laosella methikuli* (Pitakpaivan) (p. 73), from locality A 48, Khojagor, zone of Bamian, axial section, GGM VI-228/213.

Figures 9, 10. *Chusenella schwagerinaeformis* Sheng (p. 73), from locality 12a, Khargardan, central Afghanistan.

9. Axial section, GGM VI-228/214.
10. Axial section, GGM VI-228/215.

Figures 11, 12. *Chusenella minuta* Skinner (p. 73), from locality A 58, Khojagor, zone of Bamian.

11. Axial section, GGM VI-228/216.
12. Axial section, GGM VI-228/217.

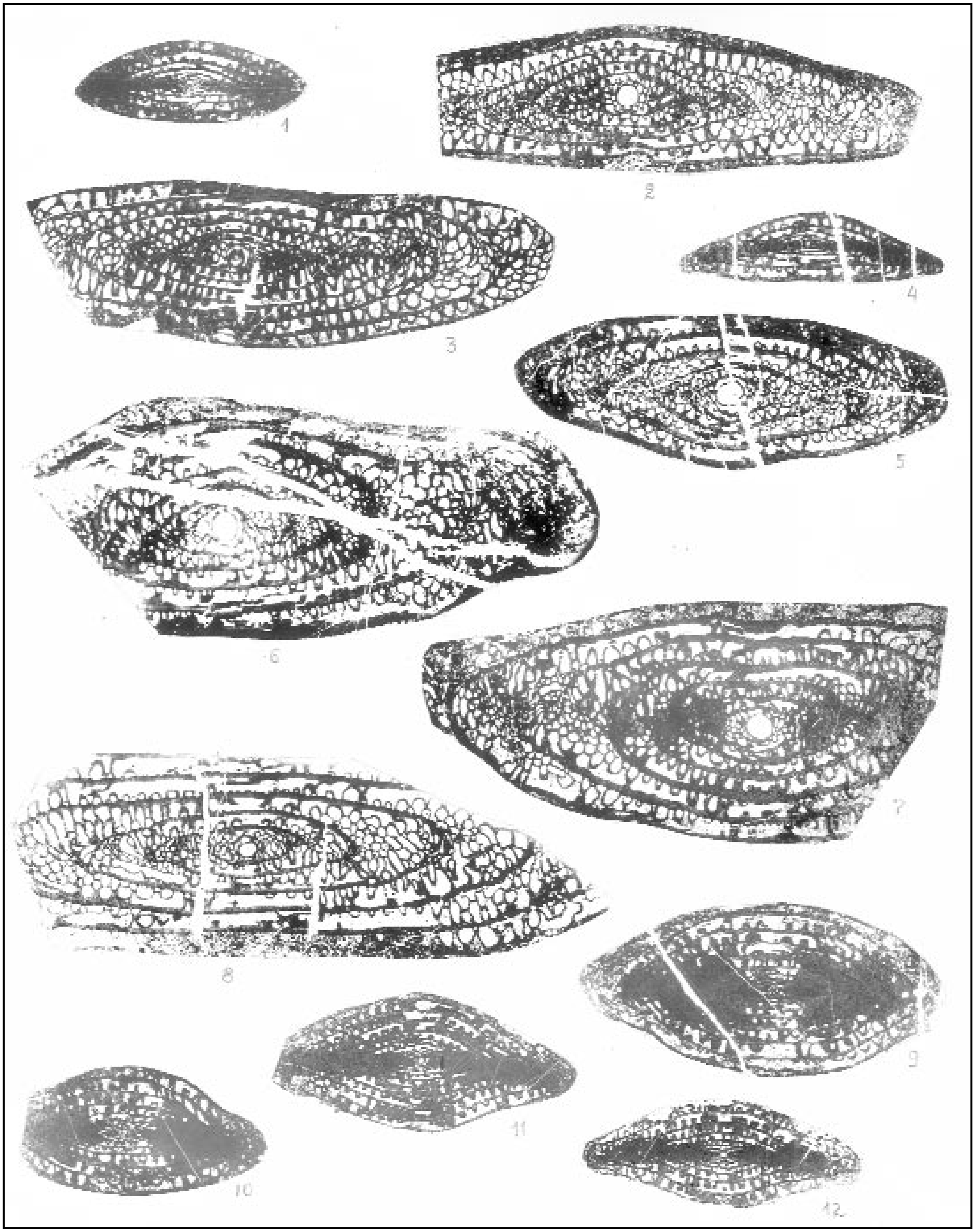

1
2
3
4
5
6
7
8
9
10
11
12

PLATE XIX

(All figures ×10)

Figure 1. *Chusenella chihsiaensis* (Lee) (p. 73), from locality 10a, Khargardan, central Afghanistan, axial section, GGM VI-228/218.

Figures 2, 3, 4. *Chusenella brevis* (Chen) (p. 73).

2. From locality 238a, Uruzgan, central Afghanistan, axial section, GGM VI-228/219.
3. From locality 1095, Shikari, zone of Bamian, axial section, GGM VI-228/220.
4. From locality A69, Khojagor, zone of Bamian, axial section, GGM VI-228/221.

Figure 5. *Chusenella subextensa* Leven, n. sp. (p. 74), from locality 10a, Khargardan, central Afghanistan, axial section of the holotype, GGM VI-228/222.

Figure 6. *Chusenella* aff. *C. alpina* (Kochansky-Devidé and Ramovš) (p. 73), from locality 12b, Khargardan, central Afghanistan, axial section, GGM VI-228/223.

Figure 7. *Rugosochusenella dialis* Leven, n. sp. (p. 74), from locality A58, Bulola, zone of Bamian, axial section of the holotype, GGM VI-228/224.

Figure 8. *Chusenella sinensis* Sheng (p. 73), from locality A59, Bulola, zone of Bamian, axial section, GGM VI-228/225.

Figures 9, 10, 11. *Eopolydiexodina (Eopolydiexodina) darvasica* (Dutkevich) (p. 74).

9. From locality 441-6, Khojagor, zone of Bamian, axial section, GGM VI-228/226.
10. From locality A65, Khojagor, zone of Bamian, axial section, GGM VI-228/296.
11. From locality A57, Bulola, zone of Bamian, axial section, GGM VI-228/247.

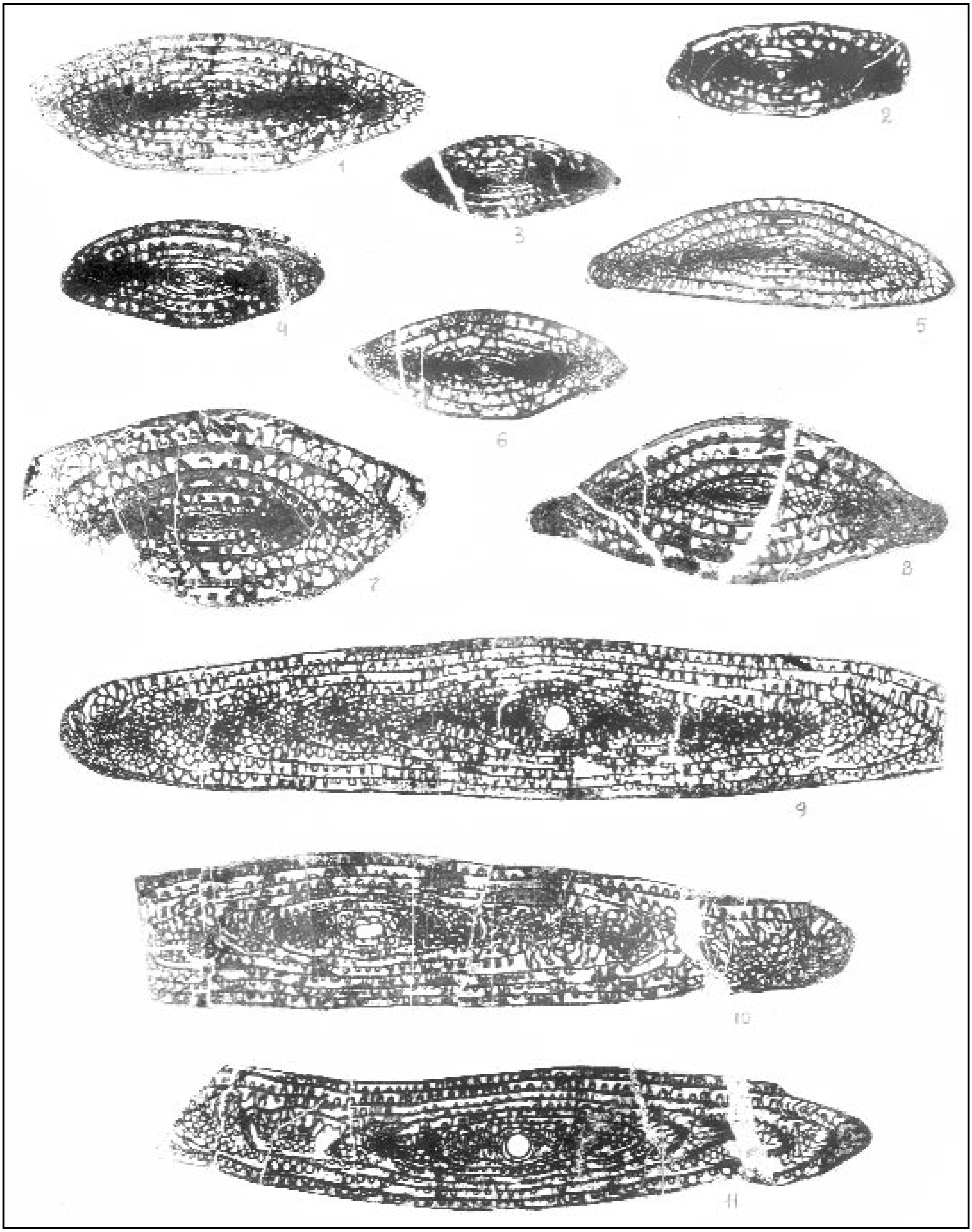

1
2
3
4
5
6
7
8
9
10
11

PLATE XX

Figures 1, 2. *Eopolydiexodina (Eopolydiexodina) zulumartensis* (Leven) (p. 74).
1. From locality 451, Khojagor, zone of Bamian, axial section, GGM VI-228/227, ×10.
2. From locality A69, Khojagor, zone of Bamian, axial section, GGM VI-228/228, ×10.

Figure 3. *Eopolydiexodina (Eopolydiexodina) bithinica* (Erk) (p. 74), from locality A50, zone of Bamian, axial section, GGM VI-228/229, ×10.

Figure 4. *Eopolydiexodina (Eopolydiexodina) afghanensis* (Thompson) (p. 74), from locality A58, Bulola, zone of Bamian, axial section, GGM VI-228/230, ×10.

Figures 5, 6, 7. *Misellina (Brevaxina) otakiensis* (Fujimoto) (p. 74).
5. From locality 451, Khojagor, zone of Bamian, subaxial section, GGM VI-228/231, ×15.
6. From locality 1153-1, Obi Tang, north Badakhshan, axial section, GGM VI-228/232, ×15.
7. From locality 1155, Kwahan, north Badakhshan, axial section, GGM VI-228/233, ×15.

Figures 8, 9. *Misellina (Brevaxina) dyhrefurthi* (Dutkevich) (p. 74), from locality 628-11, zone of Sange Dushoh.
8. Axial section, GGM VI-228/234, ×15.
9. Axial section, GGM VI-228/235, ×15.

Figure 10. *Misellina (Brevaxina) olgae* Leven, (p. 74), from locality A63, Khojagor, zone of Bamian, axial section, GGM VI-228/236, ×15.

Figures 11, 12. *Misellina (Brevaxina) ovalis* (Deprat) (p. 75).
11. From locality A54, Bulola, zone of Bamian, axial section, GGM VI-228/237, ×15.
12. From locality A53, Bulola, zone of Bamian, axial section, GGM VI-228/238, ×15.

Figure 13. *Misellina (Misellina) megalocula* Wang and Sun (p. 75), from locality A53, Bulola, zone of Bamian, axial section, GGM VI-228/239, ×15.

Figures 14, 15. *Misellina (Misellina) termieri* (Deprat) (p. 75).
14. From locality A53, Bulola, zone of Bamian, axial section, GGM VI-228/240, ×15.
15. From locality A54, Bulola, zone of Bamian, axial section, GGM VI-228/241, ×15.

Figure 16. *Misellina (Paramisellina) houchangensis* Zhang and Dong (p. 75), from locality 12a, Khargardan, central Afghanistan, axial section, GGM VI-228/242 ×15.

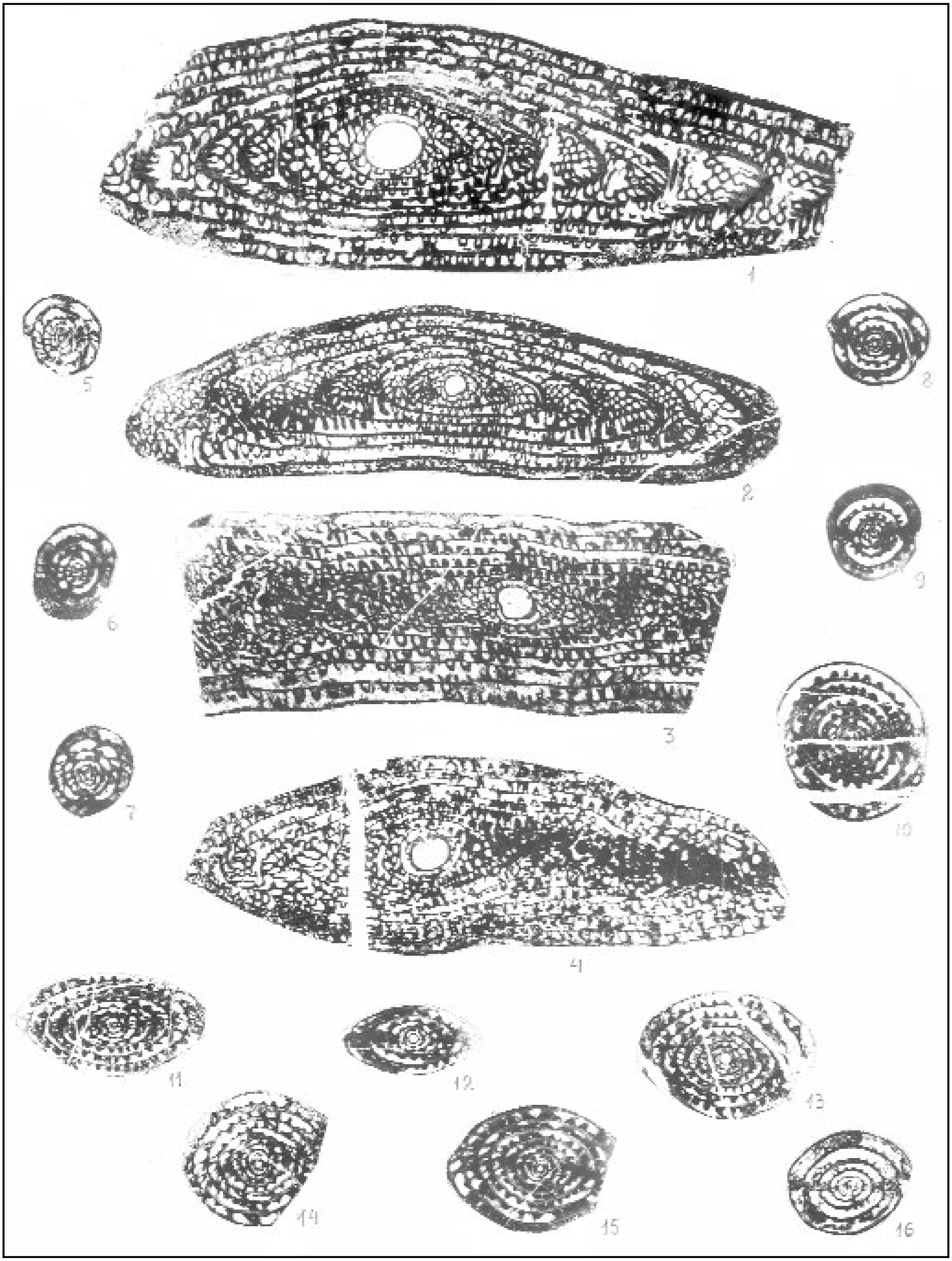

1
5
8
2
6
9
3
7
10
4
11
12
13
14
15
16

PLATE XXI

Figures 1, 2, 3. *Armenina pamirensis* (Dutkevich) (p. 75).

1. From locality A54, Bulola, zone of Bamian, axial section, GGM VI-228/243, ×15.
2. From the same locality as Figure 1, axial section, GGM VI-228/244, ×15.
3. From locality 607-12, zone of Khoja Murod, subaxial section, GGM VI-228/245, ×15.

Figure 4. *Armenina taurica* (Toumanskaya) (p. 75), from locality A69, Khojagor, zone of Bamian, axial section, GGM VI-228/246, ×15.

Figure 5. *Armenina karinae* A. Miklukho-Maclay (p. 75), from locality A56, Bulola, zone of Bamian, subaxial section, GGM VI-228/248, ×10.

Figures 6, 7. *Armenina asiatica* Leven (p. 75).

6. From locality A56, Bulola, zone of Bamian, axial section, GGM VI-228/249, ×10.
7. From locality A69, Khojagor, zone of Bamian, axial section, GGM VI-228/250, ×15.

Figure 8. *Verbeekina (Verbeekina) furnishi* Skinner and Wilde (p. 75), from locality 607-21, zone of Khoja Murod, axial section, GGM VI-228/251, ×10.

Figure 9. *Armenina crassispira* (Chen) (p. 75), from locality A47, Khojagor, zone of Bamian, axial section, GGM VI-228/252, ×10.

Figure 10. *Verbeekina (Verbeekina) americana* Thompson, Wheeler and Danner (p. 75), from locality A47, Khojagor, zone of Bamian, axial section, GGM VI-228/253, ×10.

Figure 11. *Verbeekina (Paraverbeekina) pontica* A. Miklukho-Maclay (p. 76), from locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/254, ×10.

Figure 12. *Verbeekina (Quasiverbeekina) altimurensis* Leven, n. sp. (p. 76), from locality T344, Altimur, Suleiman-Kirthar area, axial section of the holotype, GGM VI-228/255, ×10.

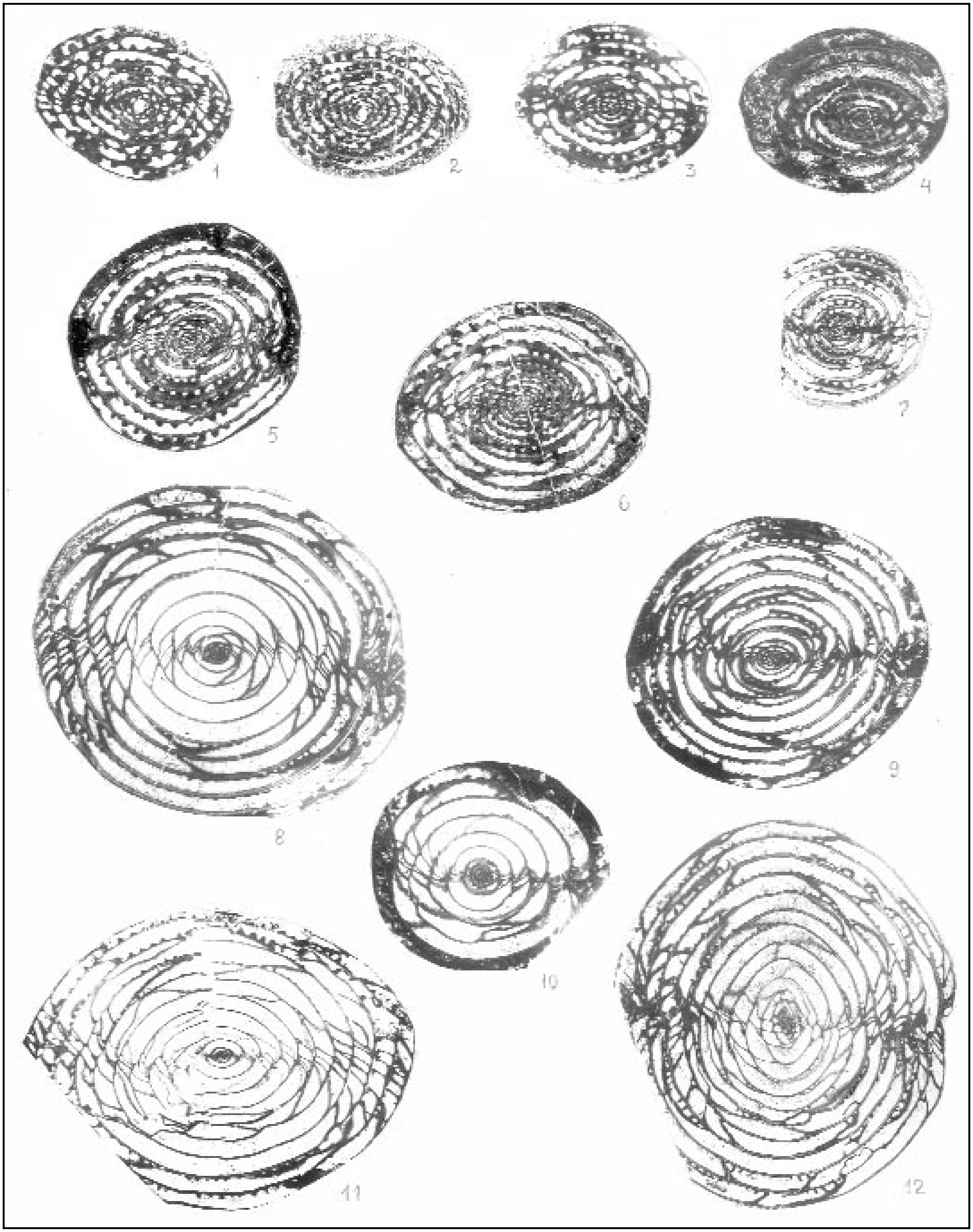

1
2
3
4
5
6
7
8
9
10
11
12

PLATE XXII

(All figures ×15 except Fig. 1)

Figures 1, 2. *Cancellina (Cancellina) primigena* Hayden (p. 76), from locality A68, Khojagor, zone of Bamian.

1. Axial section of the neotype, GGM VI-183/1, ×17.
2. Axial section, GGM VI-183/2.

Figures 3, 6. *Cancellina (Cancellina) bella* (Zhang and Dong) (p. 76), from locality A56, Bulola, zone of Bamian.

3. Axial section, GGM VI-228/256.
6. Axial section, GGM VI-228/259.

Figures 4, 5. *Cancellina (Cancellina) sethaputi* (Kanmera and Toriyama) (p. 77), from locality A56, Bulola, zone of Bamian.

4. Axial section, GGM VI-228/257.
5. Axial section, GGM VI-228/258.

Figure 7. *Cancellina (Cancellina) pamirica* Leven (p. 77), from locality 12b, Khargardan, central Afghanistan, axial section, GGM VI-228/260.

Figure 8. *Cancellina (Shengella) bamianica* Leven, n. sp. (p. 77), from locality A69, Khojagor, zone of Bamian, axial section of the holotype, GGM VI-183/16.

Figure 9. *Neoschwagerina simplex tenuis* Toriyama and Kanmera (p. 77), from locality A74, Khojagor, zone of Bamian, axial section, GGM VI-228/261.

Figure 10. *Neoschwagerina occidentalis* Kochansky-Devidé and Ramovš (p. 77), from locality A58, Bulola, zone of Bamian, axial section, GGM VI-228/262.

Figure 11. *Neoschwagerina verae* (Toumanskaya), (p. 77), from locality 631-4, zone of Sange Dushoh, axial section, GGM VI-228/263.

Figures 12, 13. *Neoschwagerina bamianica* Leven, n. sp. (p. 77).

12. From locality A47, Khojagor, zone of Bamian, axial section of the holotype, GGM VI-228/264.
13. From locality 284, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/265.

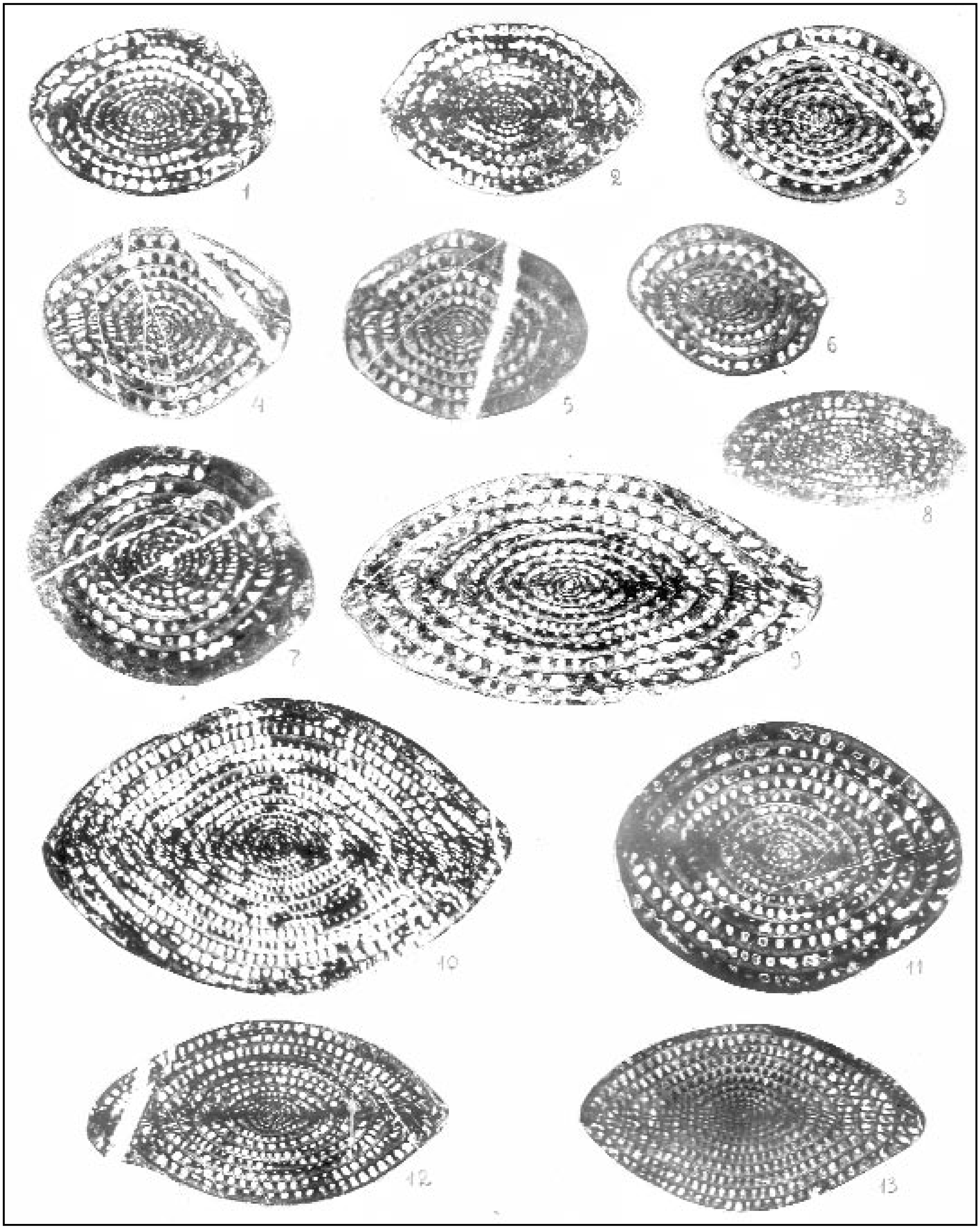

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE XXIII

(All figures ×15 except Fig. 2)

Figures 1, 4. *Neoschwagerina occidentalis* Kochansky-Devidé and Ramovš (p. 77), from locality A58-1, Bulola, zone of Bamian.

1. Subaxial section, GGM VI-228/266.
4. Axial section, GGM VI-228/269.

Figure 2. *Neoschwagerina haydeni* Dutkevich (p. 77), from locality T344, Altimur, Suleiman-Kirthar area, axial section, GGM VI-228/267, ×10.

Figures 3, 6. *Neoschwagerina margaritae* Deprat (p. 77), from locality T344, Altimur, Suleiman-Kirthar area.

3. Axial section, GGM VI-228/268.
6. Axial section, GGM VI-228/271.

Figure 5. *Neoschwagerina kojensis* Toumanskaya (p. 78), from locality A59, Bulola, zone of Bamian, axial section, GGM VI-228/270.

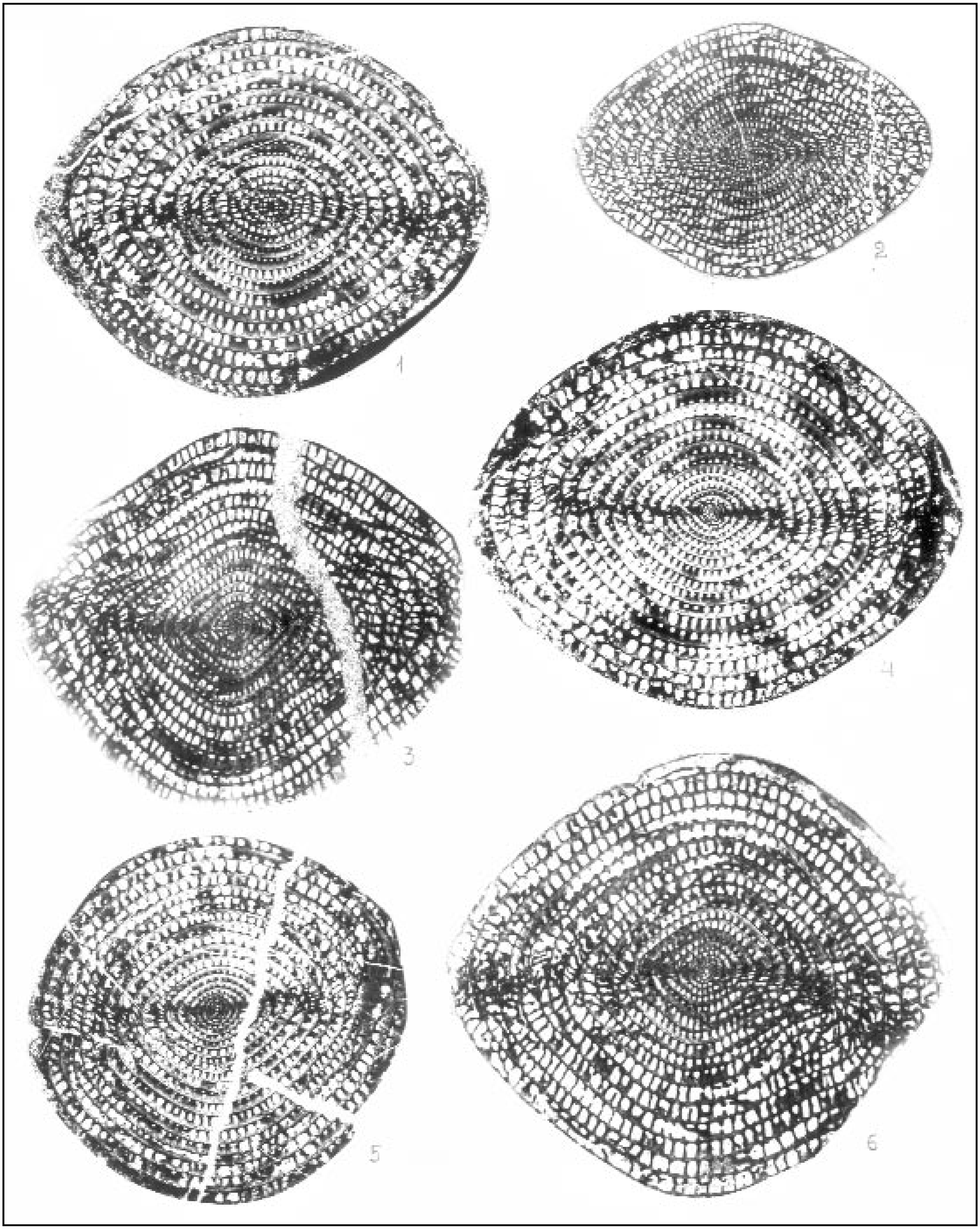

1
2
3
4
5
6

PLATE XXIV

(All figures ×15)

Figures 1, 5. *Colania altimurensis* Leven, n. sp. (p. 78), from locality 284, Altimur, Suleiman-Kirthar area.

1. Axial section of the holotype, GGM VI-228/272.
5. Axial section, GGM VI-228/276.

Figure 2. *Presumatrina neoschwagerinoides* (Deprat) (p. 78), from locality 36b, Adjrestan, central Afghanistan, axial section, GGM VI-228/273.

Figures 3, 4. *Presumatrina schellwieni* (Deprat) (p. 78), from locality 36b, Adjrestan, central Afghanistan.

3. Axial section, GGM VI-228/274.
4. Axial section, GGM VI-228/275.

Figures 6, 7, 8. *Presumatrina ozawai* (Hanzawa) (p. 79).

6. From locality 238, Uruzgan, central Afghanistan, axial section, GGM VI-228/277.
7. From locality 36, Adjrestan, central Afghanistan, axial section, GGM VI-228/278.
8. From the same locality as figure 7, axial section, GGM VI-228/279.

Figures 9, 12, 13. *Presumatrina uruzganensis* Leven, n. sp. (p. 79).

9. From locality 238, Uruzgan, central Afghanistan, axial section of the holotype, GGM VI-228/280.
12. From locality A57, Bulola, zone of Bamian, axial section, GGM VI-228/283.
13. From locality 238, Uruzgan, central Afghanistan, axial section, GGM VI-228/284.

Figures 10, 14. *Afghanella robbinsae* Skinner and Wilde (p. 79), from locality A59, Bulola, zone of Bamian.

10. Axial section, GGM VI-228/281.
14. Axial section, GGM VI-228/285.

Figure 11. *Presumatrina longa* Leven, n. sp. (p. 79), from locality A74, Khojagor, zone of Bamian, axial section of the holotype, GGM VI-228/282.

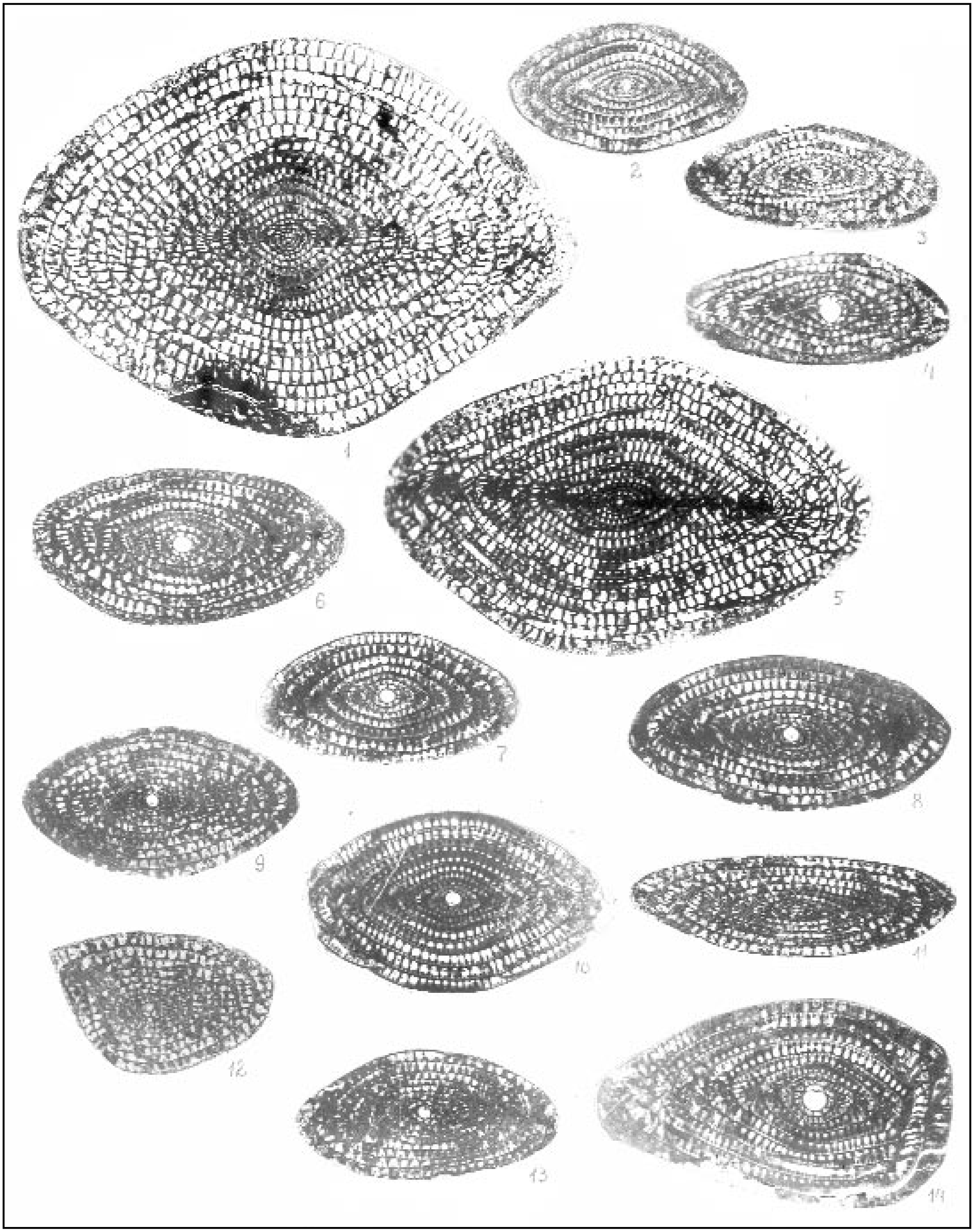

1
2
3
4
5
6
7
8
9
10
11
12
13
14

PLATE XXV

(All figures ×15)

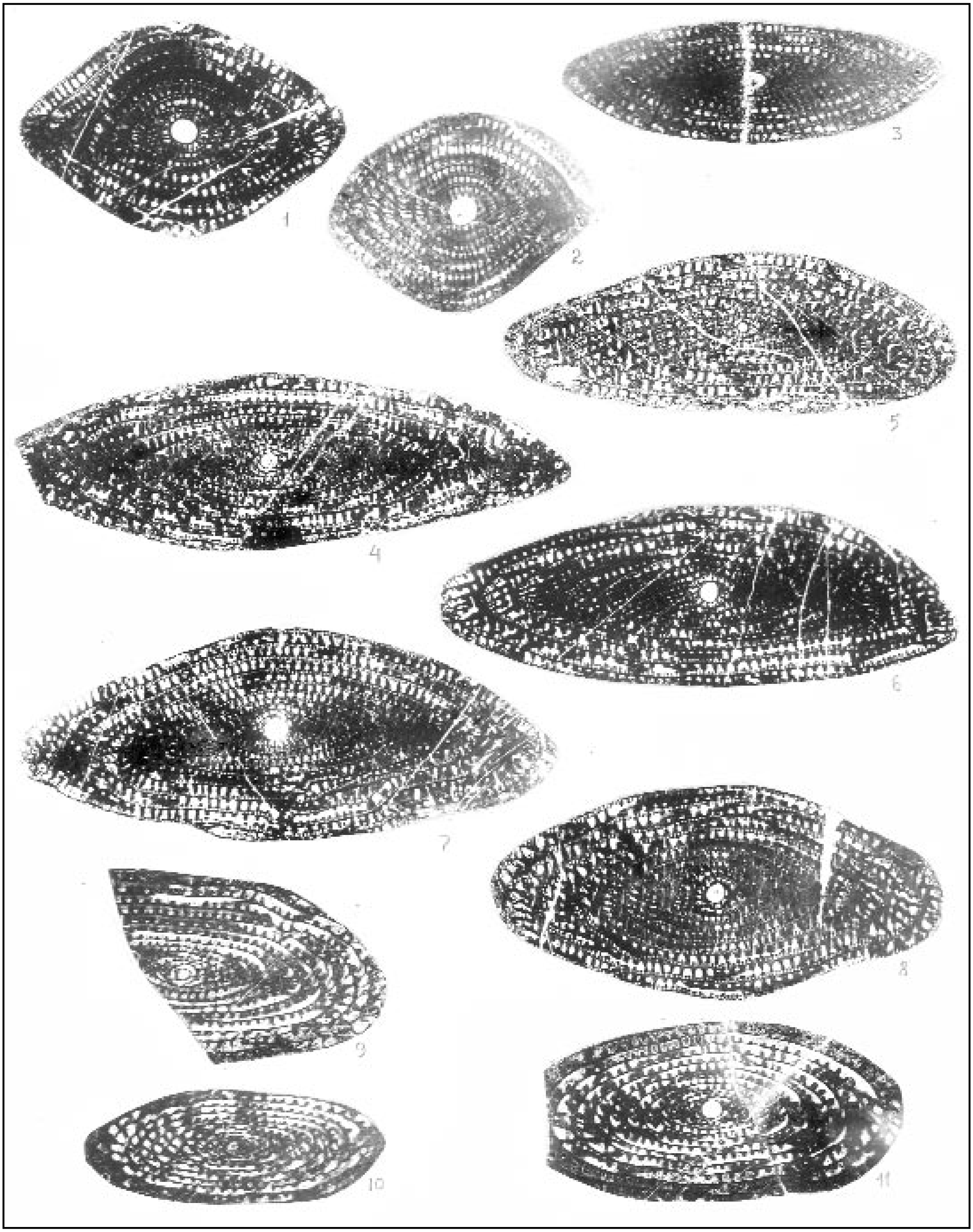
Figures 1, 2. *Afghanella tumida* Skinner and Wilde (p. 79).
1. From locality 464, Khojagor, zone of Bamian, axial section, GGM VI-228/286.
2. From locality 5859, Kohe Gulanji, Farahrud trough, axial section, GGM VI-228/287.

Figures 3, 4, 5, 6. *Sumatrina annae* Volz (p. 79).
3. From locality 5859, Kohe Gulanji, Farahrud trough, axial section, GGM VI-228/287.
4. From locality A58, Bulola, zone of Bamian, axial section, GGM VI-228/288.
5. From the same locality as Figure 4, axial section, GGM VI-228/289.
6. From the same locality as Figure 4, axial section, GGM VI-228/290.

Figures 7, 8. *Sumatrina bulolensis* Leven, n. sp. (p. 79).
7. From locality A58, Bulola, zone of Bamian, axial section of the holotype, GGM VI-228/291.
8. From locality A48, Khojagor, zone of Bamian, axial section GGM VI-228/292.

Figures 9, 10. *Pseudodoliolina ozawi* Yabe and Hanzawa (p. 79).
9. From locality A47, Khojagor, zone of Bamian, axial section, GGM VI-228/293.
10. From locality A56, Bulola, zone of Bamian, axial section, GGM VI-228/294.

Figure 11. *Pseudodoliolina chinghaiensis* Sheng (p. 80), from locality 464, Khojagor, zone of Bamian, axial section, GGM VI-228/295.


1
2
3
4
5
6
7
8
9
10
11

ACKNOWLEDGMENTS

I am grateful to all the geologists who provided paleontologic materials on the Permian of Afghanistan, especially V. I. Dronov, S. S. Karapetov, A. Kh. Kafarskiy, and B. R. Pashov. I am also highly indebted to C. H. Stevens, San José State University, for completely rewriting the entire manuscript, and to Stevens and D. L. Baars, University of Kansas, for their work editing the manuscript, their interest in this monograph, and some financial support which enabled this publication. The efforts of Tatyana Yu. Shalashilina in translating the original manuscript from Russian into English were indispensable. Review of the manuscript by Charles Ross is greatly appreciated.

REFERENCES CITED

Abich, H., 1858, Vergleichende geologische Grundzüge der Kaukusischen, Armenischen und Nordpersischen Gebierge: Academie Impériale Sciences de St.-Petersbourg, Mémoire, ser.6, v.7, p.359-534.

Bensh, F. R., 1962, Late Carboniferous and Early Permian fusulinids of the North Fergana and neighboring areas: Tashkent, Uzbekistan, Publishing Office of the Academy of Science of Uzbekistan, SSR, p. 187–252.

Blaise, J., Desparmet, R., and Lapparent, A. F., 1971, Stratigraphie et structure du Paléozoïque de la région de Wardak, en Afghanistan: Société Géologique de France, Bulletin, v. 13, no. 3–4, p. 420–429.

Blaise, J., Boulin, J., Bouyx, E., Lys, M., Termier, G., and Vachard, D., 1978; Découverte de Permien dans la "série des schistes et quartzites du Haut-Helmend," dans les Monts de Turkman, en Afghanistan central, et incidences paléogeographiques: Société Géologique de France, Bulletin, v. 20, no. 1, p. 109–113.

Bouyx, E., Lapparent, A. F., Termier, H., and Termier, G., 1970, Découverte de Goniatites dans le Permien inférieur de Montagne de Bamyan (Hindou Kouch occidental, Afghanistan): Comptes rendus des séances de l'Académie de Sciences, Paris, sér. D., v. 270, p. 1441–1444.

Burrard, S. G., and Hayden, A. M., 1933, A sketch of the geography and geology of the Himalaya Mountains and Tibet: Delhi, Government of India Press, 359 p.

Chedija, I. O., Bogoslovskaya, M. F., Davydov,V. I., and Dmitriev,V. Yu., 1986, Fusulinids and ammonoids in the stratotype of the Kubergandian Stage: Leningrad, Publishing office "Nauka," Annual of the All-Union Paleontological Society, v. 29, p.28–53 (in Russian).

Chen Shu, 1934, Fusulinidae of South China, Part 1: Paleontologia Sinica, ser. B, v. 4, fasc. 2, 185 p.

Chen Shu, 1956, The Fusulinidae of South China, Part 22: Palaeontologia Sinica, new ser. B, no. 6, p. 17–71.

Choi, D. R., 1970, On some Permian Fusulinids from Iwaizaki, N. E. Japan: Journal of the Faculty of Science, Hokkaido University, ser. 4, Geology and Mineralogy, v. 14, no. 3, p. 313–325.

Colani, M., 1924, Nouvelle Contribution à l'étude des Fusulinidés de l'Extrême-Orient: Service Géologique de l'Indochine, Mémoire, v. 11, fasc. 1, 191 p.

Coogan, A. H., 1960, Stratigraphy and paleontology of the Permian Nosoni and Dekkas formations (Bollibokka Group): Berkeley, University of California, Publications in the Geological Sciences, v. 36, no. 5, p. 243–316.

Deprat, J., 1912, Étude des Fusulinidés de Chine et d'Indochine et classification des calcaires à fusulines: Service Géologique de l'Indochine, Mémoires, v. 1, fasc. 3, 76 p.

Deprat, J., 1913, Étude des Fusulinidés de Chine et d'Indochine et classification des calcaires à fusulines (II-e Mémoire). Les Fusulinidés des calcaires carbonifèriens et permiens du Tonkin, du Laos et du Nord-Annam: Service Géologique de l'Indochine, Mémoires, v. 2, fasc. 1, 74 p.

Deprat, J., 1914, Étude des Fusulinidés du Japon, de Chine, et d'Indochine et classification des calcaires à fusulines (III-e Mémoire). Étude comparative des Fusulinidés d'Akasaka (Japon) et des Fusulinidés de Chine et d'Indochine: Service Géologique de l'Indochine, Mémoires, v. 3, fasc. 1, 45 p.

Deprat, J., 1915, Étude des Fusulinidés de Chine et d'Indochine et classification des calcaires à fusulines (IV-e Mémoire). Les Fusulinidés des calcaires carbonifériens et permiens du Tonkin, du Laos et du Nord-Annam: Service Géologique de Indochine, Mémoires, v. 4, fasc. 1, 30 p.

Desio, A., 1960, Ricognizioni Geologiche nell'Afghanistan: Bolletino della Societa Geologica Italiana, v. 79, fasc. 3, p. 99–170.

Desparmet, R., Montenat, Ch., Termier, H., and Termier, G., 1972, Découverte d'une faune d'Ammonoids (Goniatites) dans le Permien de Tezak (Afghanistan central): Comptes rendus des séances de l'Académie des Sciences, Paris, sér. D, v. 274, p. 3508–3510.

Dickins, J. M., 1985, Late Palaeozoic glaciation: BMR Journal of Australian Geology and Geophysics, no. 9, p. 163–169.

Dronov, V. I., editor, 1980, Geology and mineral resources of Afghanistan, v. 1, Geology: Moscow, Publishing Office "Nedra," 535 p. (in Russian).

Dronov, V. I., Kalimulin, S. M., Kotchetkov, A. Ja., Gretchishnikova, I. A., Leven, E. Ja., Pyzhjanov, I. V., and Saltovskaya, V. D., 1979a, The Carboniferous deposits of the Middle and North-West Afghanistan: Huitieme Congress International de Stratigraphie et de Geologie Carbonifère, Moscow, September 8–13, 1975: Compte Rendu, v. 2, p. 167–174 (in Russian with English summary).

Dronov, V. I., and Leven, E. Ja., 1961, On geology of the Southeast Pamir, Sovietskaia Geologia, no. 11, p. 21–36 (in Russian).

Dronov, V. I., and Leven, E. Ja., 1971, New data on the Permian deposits of the Central Pamir: Izvestija vuzov, Geologia i razvedka no. 3, p. 10–15 (in Russian).

Dronov, V. I., and Leven, E. Ja., 1993, Upper Paleozoic deposits of the southeastern Central Pamir (in Russian).

Dronov, V. I., Leven, E. Ja., and Kalimulin, S. M., 1979b, Permian deposits in the Khaftkala drainage basin (western Afghanistan), *in* Geology and mineral resources of Asia's, Africa's and Latin America's countries: Moscow, Interuniversity Annual Report, v. 1, p. 49–58 (in Russian).

Dunbar, C. O., and Skinner, J. W., 1937, Permian Fusulinidae of Texas: Geology of Texas, v. 3, p. 517–825.

Dutkevich, G. A., 1936, The main traits of the Upper Paleozoic deposits in the East Pamir, *in* The scientific results of the Tajik-Pamirian Expedition: Moscow-Leningrad, Publishing Office of the Academy of Sciences of USSR, p. 87–171 (in Russian).

Dutkevich, G. A., and Khabakov, A. V., 1934, Permian deposits of the Eastern Pamir and paleogeography of the Late Paleozoic of Central Asia: Transactions of Tajik Complex Expedition in 1932, v. 8, Moscow-Leningrad, Publishing Office of the Academy of Sciences of USSR, 112 p. (in Russian).

Erk, A. S., 1942, Étude géologique de la région entre Gemlik et Bursa (Turquie): Ankara, Institutes für Lagerstaettenforschung der Turkei, ser. B, no. 9, 295 p.

Fesefeldt, K., 1964, Das Paläozoikum im Gebiet Oberen Logar und im ostlichen Hazarajat sudwestlich Kabul, Afghanistan: Hannover, Geologische Jahrbuch Beihefte, v. 70, p. 185–227.

Fischer, J., 1971, Zur Geologie des Koh-e-Safi bei Kabul (Afghanistan): Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen, v. 139, no. 3, p. 267–315.

Flugel, E., 1965, Rugosa aus dem Perm Afghanistan (Altimur Pass): Neues Jahrbuch für Geologie und Paläontologie, Monats hefte, no. 1, p. 6–17.

Fujimoto, H. (Huzimoto, H.), 1936, Stratigraphical and palaeontological studies of the Titibu System of the Kwanto-Mountain, Part 2: Palaeontology, sec. C, v. 1, no. 2, p. 29–125.

Furon, R., 1927, L'Hundou-Kouch et le Kaboulistan. Contribution à l'étude géologique et géomorphogenique de l'Afghanistan: 23 Abb., Paris, 170 p.

Gaetani, M., Angiolini, L., Garzanti, E., Jadoul, F., Leven, E. Ja., Nicora, A., and Sciunnach, D., 1995, Permian stratigraphy in the Northern Karakorum, Pakistan: Rivista Italiana di Paleontologia e Stratigrafia, v. 101, no. 2,

p. 112–158.

Gaetani, M. and Leven, E. Ja., 1993, Permian stratigraphy and fusulinids from Rosh Gol (Chitral, east Hindu Kush): Rivista Italiana di Paleontologia e Stratigrafia, v. 99, no. 3, p. 307–326.

Gorjunova, R. V., 1975, Permian Bryozoa of the Pamir, *in* Transactions, Academy of Sciences of the USSR, Paleontological Institute: Moscow, Publishing Office "Nauka," v. 148, 127 p. (in Russian).

Griesbach, C. L., 1885, Afghan Field-Notes: Records of the Geological Survey of India, Calcutta, v. 18, no. 1, p. 57–64.

Griesbach, C. L., 1886, Afghan and Persian field-notes: Records of the Geological Survey of India, Calcutta, v. 19, no. 1, p. 48–65.

Grunt, T. A., and Dmitriev, V. Yu., 1973, Permian brachiopods of the Pamir, *in* Transactions, Academy of Sciences of the USSR, Paleontological Institute: Moscow, Publishing Office "Nauka," v. 136, 211 p.(in Russian).

Gubler, J., 1935, Les Fusulinidés du Permien de l'Indochine: Société Géologique de France, Mémoire, nou. sér., v. 11, fasc. 4, no. 26, 173 p.

Hanzawa, S., 1954, Notes on *Afghanella* and *Sumatrina* from Japan: Japan Journal of Geology and Geography, v. 24, p. 1–14.

Hayden, H. H., 1909, Fusulinidae from Afghanistan: Records of the Geological Survey of India, Calcutta, v. 38, no. 3, p. 230–256.

Hayden, H. H., 1911, The geology of northern Afghanistan: Geological Survey of India, Memoirs, v. 39, no. 12, p. 1–97.

Hayden, H. H., 1915, Notes on the geology of Chitral, Gilgit and Pamirs: Records of the Geological Survey of India, Calcutta, v. 45, no. 4, p. 271–335.

Hinze, C., 1964, Die geologische Entwicklung der ostlichen Hindukusch-Nord flanke (Nordost Afghanistan): Hannover, Geologische Jahrbuch, Beihefte, v. 70, p. 19–76.

Honjo, S., 1959, Neoschwagerinids from the Akasaka Limestone: Journal of the Faculty of Science, Hokkaido University, v. 10, no. 1, p. 1–12.

Igo, H., 1959, Some Permian Fusulinids from the Hirayu district southern part of the Hida Massif, Central Japan: Science Reports of the Tokyo Kyoiku Daigaku, Section C, no. 59, p. 231–254.

Igo, H., 1965, Permian Fusulinids of Nyukawa, Central Japan, Part 2: Some Fusulinids from the lower part of the Sote Formation: Journal of Paleontology, v. 39, no. 2, p. 210–223.

Ishii, K. I., Fischer, J., and Bando, Y., 1971, Notes on the Permian-Triassic boundary in Eastern Afghanistan, with systematic descriptions of Lower Triassic ammonoids: Journal of Geosciences, Osaka City University, v. 14, art. 1, p. 1–18.

Kaever, M., 1965, Mikropalaontologische Untersuchungen zur Stratigraphie Afghanistans: Erdol und Kohle, v. 18, p. 678–684.

Kaever, M., 1967, Untersuchungen zur Schichtenfolge im Gebiet Qasim Khel–Ali Khel, E. Afghanistan: Neues Jahrbuch für Geologie und Paläontologie, v. 5, p. 284–304.

Kaever, M., 1970, Das Permokarbon Afghanistans: Stuttgart, Zentralblatt für Geologie und Paläontologie, Teil 1, no. 4, p. 622–660.

Kafarskiy, A. Kh., and Abdullah, J., 1976, Tectonics of North-East Afghanistan (Badakhshan, Wakhan, Nurestan) and relationship with the adjacent territories, *in* Geotectonica delle zone orogeniche del Kashmir Himalaya-Karakorum-Hindu Kush-Pamir: Atti Convegni Lincei, v. 21, p. 87–113.

Kahler, F., and Kahler, G., 1937, Beitrage zur Kenntnis der Fusuliniden der Ostalpen: Pseudoschwagerinen der Grenzlandbanke und des Oberen Pseudoschwagerinen-Kalkes: Palaeontographica, v. 87, Abt. A, p. 1–44.

Kahler, F., and Kahler, G., 1980, Fusuliniden aus den Kalken der Trogkofel-Schichten der Karnischen Alpen. "Carinthia II," *in* Flugel, E., ed., Die Trogkofel-Stufe im Unterperm der Karnischen-Alpen: Klagenfurt, Sonderheft 36, p. 183–254.

Kalmykova, M. A., 1960, New Early Permian fusulinids of the Darvaz, *in* New species of ancient plants and invertebrates of the USSR, no. 1: Moscow, Publishing Office "Gosgeoltehizdat," p. 146–148 (in Russian).

Kalmykova, M. A., 1967, Permian fusulinids of Darvaz: *in* Transactions, Leningrad, All-Union Geological Institute, v. 116, no. 2, p. 116–285 (in Russian).

Kanmera, K., 1956, *Toriymaia*, a new Permian fusulinid genus from the Kuma Massif, Kyushu, Japan: Palaeontological Society of Japan, Transactions and Proceedings, new ser., no. 24, p. 251–257.

Kanmera, K., 1957, Revised classification on *Cancellina* and *Neoschwagerina*, and evolution of Sumatrininae and Neoschwagerininae: Memoirs of the Faculty of Science, Kyushu University, ser. D, v. 6, no. 1, p. 47–64.

Kanmera, K., and Toriyama, R., 1968, *Maklaya*, new generic designation for Neoschwagerinids of the group of *Cancellina pamirica* Leven: Geology and Palaeontology of Southeast Asia, v. 5, p. 31–46.

Kanuma, M., 1959, Stratigraphical and paleontological studies of the southern part of the Hida Plateau and the northeastern part of the Mino mountainland, central Japan, Part 2, Paleontology, no. 3: *Pseudoschwagerina, Pseudofusulina, Parafusulina*: Tokyo Gakugei University, Bulletin, v. 10, p. 59–83.

Karapetov, S. S., and Leven, E. Ja., 1973, Upper Paleozoic deposits of Central Afghanistan (Hilmand drainage basin): Moscow Society of Naturalists, Geological series, Bulletin, v. 48, no. 1, p. 30–40 (in Russian).

Karapetov, S. S., Pyzhjanov, I. V.,Sonin, I. I., and Demin, A. I., 1973, Upper Paleozoic and Mesozoic stratigraphy of Central and East Afghanistan, *in* New data on Geology of Tajikistan: Publishing Office "Donish", Dushanbe, no. 2, p. 74–88 (in Russian).

Kochansky-Devidé, V., 1959, Die Fusuliniden Foraminiferen aus dem Karbon und Perm im Velebit und in der Lika (Kroatien). Unteres Perm: Palaeontologia Jugoslavica, v. 3, p. 1–62.

Kochansky-Devidé, V., 1965, Die Fusuliniden Foraminiferen aus dem Karbon und Perm im Velebit und in der Lika (Kroatien). Mittleres und oberes Perm: Zagreb, Acta geologica, v. 5, p. 101–150.

Kochansky-Devidé,V., and Ramovš, A., 1955, Neoschwagerinski Skladi in njih fusulinidna Fauna pri Bohinjski Beli in Bledu: Razprave Slovenska Akademija, v. 3, p. 361–424.

Kotlyar, G. V., Zakharov, Yu. D., Koczyrkevich, B. V., Kropatcheva, G. S., Rostovcev, K. O., Chedija, I. O., Vuks, G. P., and Guseva, E. A., 1983, Evolution of the latest Permian biota; Dzhulfian and Dorashamian regional stages in the USSR: Leningrad, Publishing Office "Nauka," 200 p. (in Russian).

Kotlyar, G. V., Zakharov, Yu. D., Kropatcheva, G. S., Pronina, I. O., Chedija, I. O., and Burago, V. I., 1989, Evolution of the latest Permian biota; Midian regional stage in the USSR: Leningrad, Publishing Office "Nauka," 185 p. (in Russian with English summary).

Kuo, T. S., 1948, On a new form of Fusulinid: Geological Society of China, Bulletin, v. 28, no. 3–4, p. 233–234.

Kushlin, B. K. 1973, Pamirian geosincline, *in* Stratigraphy USSR. Triassic System: Moscow, Publishing Office "Nedra," p. 374–394.

Lapparent, A. F., Lavigne, J., Blaise, J., and Lys, M., 1965, Sur les gisements à Fusulines de l'Afghanistan central: Comptes rendus des séances de l'Académie des Sciences, Paris, v. 260, no. 9, p. 5073–5075.

Lapparent, A. F., and Lys, M., 1965, Le Permien à Fusulines en Afghanistan: Paris, Comptes rendus des séances de l'Académie des Sciences, v. 260, no. 9, p. 5313–5315.

Lapparent, A. F., and Lys, M., 1966, Attribution au Permien supérieur gisement à Fusulinidés et Brachiopodés de Kwaja Gar (Bamian, Afghanistan): Comptes rendus des séances de l'Académie des Sciences, Paris, sér. D, v. 262, p. 2138–2140.

Lapparent, A. F., and Lys, M., 1972, Étude du Permien et esquisse géologique de la région de Khwahan (Province du Badakhshan, Afghanistan septentrional): Annales de la Société Géologique du Nord, v. 92, p. 13–22.

Lapparent, A. F., Termier, H., and Termier, G., 1970, Sur la stratigraphie et la paléobiologie de la série permo-carbonifère du Dacht-e-Nawar (Afghanistan): Société Géologique de France, Bulletin, v. 12, no. 3, p. 565–572.

Lee, J. S., 1927, Fusulinidae of North China: Paleontologica Sinica, ser. B, v. 4, fasc. 1, 172 p.

Lee, J. S., 1931, Distribution of the dominant types of Fusulinid Foraminifera in the Chinese Seas: Geological Society of China, v. 10, p. 273–290.

Lee, J.S., 1933, Taxonomic criteria of Fusulinidae with notes on seven new Permian genera: National Research Institute of Geology, Memoirs, no. 14, p. 1–32.

Legrand-Blain, M., 1968, Spiriferacea carbonifères et permiens d'Afghanistan central: Notes et Mémoires sur le Moyen-Orient, v. 9, p. 187–253.

Leonova, T. B., 1985, Early Permian ammonoids of the Tethyan region [Ph.D.thesis]: Moscow, Russia, Paleontological Institute, 232 p. (in Russian).

Leonova, T. B., and Dmitriev, V. Yu., 1989, Early Permian ammonoids of the Southeast Pamir, *in* Transactions, Academy of Sciences of the USSR, Paleontological Institute: Moscow, Publishing Office "Nauka," v. 235, 198 p. (in Russian).

Leven, E. Ja., 1959, Permian deposits of the Central Pamir: Doklady, Akademya Nauk SSSR, v. 128, no. 2, p. 369–371 (in Russian).

Leven, E. Ja., 1963, On the phylogeny of higher fusulinids and subdivision of the Upper Permian rocks of the Tethys: Moscow, Voprosy mikropaleontologyi, no. 7, Publishing Office "Nauka," p. 57–70 (in Russian).

Leven, E. Ja., 1965, On stratigraphic implications of the genus *Polydiexodina* Dunbar and Skinner: Moscow, Voprosy micropaleontologyi, no. 9, Publishing Office "Nauka," p. 129–146 (in Russian).

Leven, E. Ja., 1967, Stratigraphy and fusulinids of the Pamir's Permian deposits, *in* Transactions, Academy of Sciences of the USSR, Geological Institute: Moscow, Publishing Office "Nauka," v. 167, 224 p. (in Russian).

Leven, E. Ja., 1970a, A new genus of the aberrant Permian fusulinids: Paleontologicheskyi zhurnal, no. 3, p. 18–25 (in Russian).

Leven, E. Ja., 1970b, On the origin of higher fusulinids: Paleontologicheskyi zhurnal, no. 3, p. 18–25 (in Russian).

Leven, E. Ja., 1971, Les gisements Permiens et les Fusulinidés de l'Afghanistan du Nord: Notes et Mémoires sur le Moyen-Orient, v. 12, p. 1–46.

Leven, E. Ja., 1974, Biostratigraphy of the Upper Paleozoic of the southwest Darvaz: Izvestyia Akademii Nauk SSSR,Geological Series, no. 3, p. 55–62 (in Russian).

Leven, E. Ja., 1975, Stage-scale of the Permian deposits of Tethys: Moscow Society of Naturalists, Geological Series, Bulletin, v. 50, no. 1, p. 5–21 (in Russian).

Leven, E. Ja., 1980a, The Bolorian Stage of the Permian System: establishment, characteristic and correlation: International Geological Review, v. 22, no. 5, p. 587–597.

Leven, E. Ja., 1980b, Explanatory note on the Stratigraphic Scale of the Tethyan Permian: *in* Transactions, Leningrad, All-Union Geological Institute, 51 p. (in Russian).

Leven, E. Ja., 1981a, The age of the Upper Paleozoic volcanic formations of the North Pamir: Izvestyia, Akademii Nauk SSSR, Geological Series, no. 9, p. 137–140 (in Russian).

Leven, E. Ja., 1981b, Upper Paleozoic of the Tcharymdara, Gundara and Zydadara drainage basins (Southwest Darvaz): Moscow Society of Naturalists, Geological Series, Bulletin, v. 56, no. 4, p. 40–52 (in Russian).

Leven, E. Ja., 1981c, Volume and characteristics of the Kubergandian Stage of the Permian (Pamir): Izvestyia Akademii Nauk SSSR, Geological Series, no. 4, p. 79–90 (in Russian).

Leven, E. Ja., 1982a, Genus *Cancellina* Hayden and its position in the system of higher fusulinids: Voprosy mikropaleontologyi no. 25, Moscow, Publishing Office "Nauka," p. 40–51 (in Russian).

Leven, E. Ja., 1982b, The Permian Yahtashian Stage: Its basis, characteristics and correlation: International Geological Review, v. 24, no. 8, p. 945–954.

Leven, E. Ja., 1983, Comparative characteristics of the Permian and Triassic deposits of the South Pamir and Middle Afghanistan: Izvestyia vuzov, Geologia i Razvedka, no. 12, p. 20–29 (in Russian).

Leven, E. Ja., 1991, First occurrence of the genus *Shanita* (Fam. Hemigordiopsidae): Paleontologicheskyi zhurnal, no. 2, p. 102–104 (in Russian).

Leven, E. Ja., 1992, Problems of Tethyan Permian stratigraphy: International Geological Review, v. 34, no. 10, p. 976–985 (in Russian).

Leven, E. Ja., 1993a, Early Permian fusulinids from the Central Pamir: Rivista Italiana di Paleontologia e Stratigrafia, v. 90, no. 2, p. 151–198.

Leven, E. Ja., 1993b, Main events of Tethyan Permian history and fusulinids: Stratigraphy and Geological Correlation, v. 1, no. 1, p. 59–79.

Leven, E. Ja., 1993c, Phylogeny of sumatrinids and zonation of the Permian Murgabian and Midian Stages: Paleontologicheskyi Zhurnal, no. 3, p. 23–29 (in Russian).

Leven, E. Ja., 1993d, The volume and diagnostic features of the species *Neoschwagerina craticulifera* (Schwager, 1883) (fusulinids): Paleontologicheskyi Zhurnal no. 2, p. 127–129 (in Russian).

Leven, E. Ja., 1994, The Mid-Lower Permian regression-transgression of the Tethys, Pangea: Canadian Society of Petroleum Geologists, Memoir 17, p. 232–239.

Leven, E. Ja., 1995, Permian and Triassic of the Rushan-Pshart zone (Pamir): Rivista Italiana di Paleontologia e Stratigrafia, v. 101, no. 1, p. 3–16.

Leven, E. Ja., and Davydov, V. I., 1979, New data on stratigraphy of the red colored rocks of the southwest Darvaz: Izvestia vuzov, Geologia i Razvedka, no. 8, p. 13–20 (in Russian).

Leven, E. Ja., and Kozur, H., 1977, First occurrence of the Upper Permian conodonts in the Darvaz: Doklady, Akademyia Nauk SSSR, v. 234, no. 1, p. 145–147 (in Russian).

Leven, E. Ja., and Scherbovich, S. F., 1978, Fusulinids and stratigraphy of the Asselian Stage of the Darvaz: Moscow, Publishing Office "Nauka," 162 p. (in Russian).

Leven, E. Ja., and Scherbovich, S. F., 1980a, New fusulinid species from the Sakmarian rocks of the Darvaz: Paleontologicheskyi zhurnal, no. 3, p. 19–27 (in Russian).

Leven, E. Ja., and Scherbovich, S. F., 1980b, Sakmarian fusulinid assemblage of Darvaz: Voprosy mikropaleontologyi, no. 23, Moscow, Publishing Office "Nauka," p. 71–85 (in Russian).

Leven, E. Ja., Pashkov, B. R., and Mirzod, S. Kh., 1975, Permian deposits of Afghanistan: Moscow Society of Naturalists, Geological Series, Bulletin, v. 50, no. 5, p. 8–27 (in Russian).

Leven, E. Ja., Dmitriev, V. Yu., and Novikov, V. P., 1989, Explanatory note to the Permian Regional Stratigraphic Scheme of Middle Asia (Pamirian subregion): Dushanbe, Tajikistan, Publishing Office "Donish," 60 p. (in Russian).

Leven, E. Ja., Leonova, T. B., and Dmitriev, V. Yu., 1992, Permian of the Darvaz-Transalay zone of the Pamir (fusulinids, ammonoids, stratigraphy): *in* Transactions, Russian Academy of Sciences, Paleontological Institute, v. 253, 250 p. (in Russian).

Likharew, B. K., editor, 1939, The altas of the leading forms of the fossil fauna of the USSR, v. 6, Permian: Leningrad-Moscow, State amalgamation of the scientific-technical publishing houses, Ministry of Heavy Industry, 269 p. (in Russian).

Lys, M., 1977, Biostratigraphie du carbonifère et du Permien d'Afghanistan (Micropaleontologie): Mémoire hors-série de la Société Géologique de France, no. 8, p. 291–308.

Lys, M., and Lapparent, A. F., 1971, Foraminifères et microfacies du Permien de l'Afghanistan Central: Notes et Mémoires sur le Moyen-Orient, v. 12, p. 47–166.

Lys, M., Bouyx, E., and Boulin, J., 1990, The *Cancellina* biozone (Middle Permian, Kubergandian) at the southern flank of the Western Hindu Kush (Afghanistan): Facies, v. 23, p. 37–56.

Mennessier, G., 1961, Sur l'extension verticale de la série de Khinguil, Afghanistan: Comptes rendus des séances de l'Académie des Sciences, Paris, v. 252, p. 2424–2426.

Mennessier, G., 1963, Geological observations in the Kabul mountains (Afghanistan): Sovetskaya Geologia, no. 7, p. 105–126 (in Russian).

Mennessier, G., 1970, Sur la stratigraphie de la série calcaire d'Altimour, provinces du Logar et de Paktia, Afghanistan oriental: Comptes rendus des séances de l'Académie des Sciences, Paris, sér. D, v. 270, p. 2521–2523.

Mennessier, G., 1977, Stratigraphie, tectonique et évolution du fossé de Kaboul (Afghanistan): Société Géologique de France, Mémoire hors-série, no. 8, p. 153–168.

Miklukho-Maclay, A. D., 1949, Upper Paleozoic fusulinids of Middle Asia—Darvaz, Fergana, Pamir: Leningrad, Publishing House of Leningrad State University, 126 p.

Miklukho-Maclay, A. D., 1955, New data on the Permian fusulinids from the southern regions of the USSR: Akademya Nauk SSSR Doklady, v. 105, no. 3, p. 573–576 (in Russian).

Miklukho-Maclay, A. D., 1957, Some Permian fusulinids of the Crimea: Leningrad State University, Scientific Reports, Geological Series, v. 225, no. 9, p. 96–157 (in Russian).

Miklukho-Maclay, A. D., 1963, Upper Paleozoic of Middle Asia: Leningrad, Publishing Office of Leningrad State University, 328 p. (in Russian).

Morikawa, R., 1952, Some *Schwagerina*-like *Parafusulina*: Science Reports of Saitama University, Ser.B, v. 1, no. 1, p. 28–34.

Morikawa, R., and Isomi, H., 1960, A new genus *Biwaella*, *Schwagerina*-like *Schubertella*: Science Reports of Saitama University, Ser. B, v. 3, no. 3, p. 301–305.

Morikawa, R., and Kobayashi, M., 1960, Two new species of *Oketaella* from Kanto Massif, Japan: Sciences Reports of Saitama University., Ser. B, v. 3, no. 3, p. 307–312.

Nie Zetong, and Song Zhimin, 1983, Fusulinids of Lower Permian Tunlonggonba Formation from Rutog of Xizang: Journal of the Wuhan College of Geology, no. 1, p. 43–55.

Novikov, V. P., Volodin, P. K., and Suprytchev, V. V., 1985, On the origin of the Permian red-colored molasse of the Southwest Darvaz: Geologia i Geophisica Tajikistana, Publishing Office "Donish", no. 1, p. 190–204 (in Russian).

Ozawa, T., 1970, Notes on the phylogeny and classification of the superfamily Verbeekinoidea (Studies of the Permian Verbeekinoidean Foraminifera—1): Memoirs of the Faculty of Science, Kyushu University, Ser. D, Geology, v. 20, no. 1, p. 17–58.

Ozawa, Y., 1925, Palaeontological and stratigraphical studies on the Permo-Carboniferous limestone of Nagato, Part 2, Palaeontology: Journal of the College of Science, Tokyo Imperial University, v. 45, no. 6, p. 1–90.

Petrushevskyi, B. A., 1940, Paleogeography and tectonics of Afghanistan and Tajikistan: *in* Transactions, Academy of Sciences of the USSR, Geological Institute, Geological Series, v. 8, no. 3, 68 p. (in Russian).

Pitakpaivan, K., 1965, Fusulinids of the Rat Buri Limestone of Thailand: Memoirs of the Faculty of Science, Kyushu University, ser. D, v. 17, no. 1, p. 1–69.

Plodowski, G., 1970, Stratigraphie und Spiriferen (Brachiopoda) des Palaozoikums der Dascht-e-Nawar (Afghanistan): Stuttgart, Palaeontographica, Bd. 134, Alt. A, 132 p.

Pyzhjanov, I. V., and Sonin, I. I., 1977, Outline of the Late Paleozoic and Early Mesozoic stratigraphy of Afghanistan: Izvestia vuzov, Geologia i Razvedka, no. 12, p. 30–39 (in Russian).

Rauser-Chernousova, D. M., 1937, *Rugosofusulina*, a new genus of fusulinids, *in* Essays on micropaleontology: Moscow State University Transactions, n. 1, p. 10–26 (in Russian).

Reed, F. R. C., 1931, Upper Carboniferous fossils from Afghanistan: Palaeontologia Indica, New ser., no. 19, p. 1–39.

Reichel, M., 1940, Unterpermische Fusuliniden aus dem Karakorum und dem Aghil-Gebirge, *in* Visser, P. C., Wissenschaftliche Ergebnisse der niederlandischen Expeditionen in den Karakorum in den Jahren 1927–1935: Leiden B, v. 3, p. 89–281.

Ross, C. A., 1967, Late Paleozoic Fusulinacea from Northern Yukon territory: Journal of Paleontology, v. 41, no. 3, p. 709–725.

Rozovskaya, S. E., 1975, Composition, phylogeny and system of the Order Fusulinida: Academy of Sciences of the USSR, Paleontological Institute, Transactions, v. 149, 267 p. (in Russian).

Ruzhentsev, V. E., 1978, Asselian ammonoids in the Pamir: Paleontologicheskyi Zhurnal, no. 1, p. 36–68 (in Russian).

Ruzhentsev, V. E., and Sarycheva, T. G., editors, 1965, Evolution and change of marine organisms at the boundary between the Paleozoic and Mesozoic: *in* Transactions, Academy of Sciences of the USSR, Paleontological Institute, v. 108, 312 p. (in Russian).

Schellwien, E., and Dyhrenfurth, G., 1909, Monographie der Fusulinen, Teil 2: Die asiatischen Fusulinen: A. Die Fusulinen von Darvas: Palaeontografica, v. 56, p. 135–176.

Sheng, Jinzhang, 1956, Permian fusulinids from Liangshan, Hanchung, Southern Shensi: Acta Palaeontologia Sinica, v. 4, no. 12, p. 175–228.

Sheng, Jinzhang, 1958, Some fusulinids from the Maokou Limestone of Chingha Province, Northwestern China: Acta Palaeontologia Sinica, v. 6, no. 3, p. 268–291.

Sheng, Jinzhang, 1962, Some Fusulinids of the Chihsia Stage, Northern Hopei: Acta Palaeontologia Sinica, v. 10, no. 4, p. 426–432.

Sheng, Jinzhang, 1963, Permian fusulinids of Kwangsi, Kueichow and Szechuan: Palaeontologia Sinica, New ser. B, no. 10, 247 p.

Sheng, Jinzhang, and Zhang Linxin, 1958, Fusulinids from the type-locality of the Changhsing Limestone: Acta Palaeontologia Sinica, v. 6, no. 2, p. 211–214.

Siehl, A., 1967, Zur Stratigraphie und Palaeogeographie des Perm in Afghanistan: Sonderdruck Geologische Rundschau, Band 54, p. 795–812.

Skinner, J. W., 1969, Permian Foraminifera from Turkey: The University of Kansas, Paleontological Contributions, Paper 36, p. 1–14.

Skinner, J. W., 1971, New Lower Permian Fusulinids from Culberson County, Texas: The University of Kansas, Paleontological Contributions, Paper 53, p. 1–10.

Skinner, J. W., and Wilde, G. L., 1965, Permian biostratigraphy and fusulinid faunas of the Shasta Lake area, Northern California: The University of Kansas, Paleontological Contributions, Protozoa,.article 6, 98 p.

Skinner, J. W., and Wilde, G. L., 1966a, Permian Fusulinids from Pacific Northwest and Alaska: The University of Kansas, Paleontological Contributions, paper 4, p. 55–58.

Skinner, J. W., and Wilde, G. L., 1966b, Permian fusulinids from Sicily: The University of Kansas, Paleontological Contributions, paper 8, p. 1–16.

Skinner, J. W., and Wilde, G. L., 1967, Permian Foraminifera from Tunisia: The University of Kansas, Paleontological Contributions, paper 30, p. 1–22.

Slavin, V. I., 1976, Tectonics of Afghanistan: Moscow, Publishing Office "Nedra," 204 p. (in Russian).

Sosnina, M. I., 1968, New Late Permian fusulinids of Sikhote Alin, *in* New species of ancient plants and invertebrates of the USSR: Moscow, Publishing Office "Nedra," no. 2, Part 1, p. 99–128 (in Russian).

Termier, H., and Termier, G., 1970, Ammonoidés de l'Artinskien (=Zygarien) dans la montagne de Bamyan (Afghanistan): Annales de la Société Géologique du Nord, v. 90, no. 2, p. 93–100.

Termier, H., and Termier, G., 1971, Bryozoaires du Paléozoïque Supérieur de l'Afghanistan: Documents des Laboratoires de Géologie de la Faculté des Sciences, Lyon, no. 47, p. 1–52.

Termier, H., Termier, G., Desparmet, R., and Montenat, C., 1972, Les Ammonoidés du Permien (Kubergandien) de Tezak (Afghanistan central): Annales de la Société Géologique du Nord, v. 92, p. 105–115.

Termier, G., Termier, H., Marin, Ph., Desparmet, R., and Lapparent, A. F., 1973, Données nouvelles sur la transgression glacio-eustatique permo-carbonifère (Gzhélien-Sakmarien) en Afghanistan central: Comptes rendus des séances de l'Académie des Sciences, Paris, v. 276, p. 943–947.

Termier, G., Termier, H., Lapparent, A. F., and Marin, Ph., 1974, Monographie du Permo-Carbonifère de Wardak (Afghanistan central): Documents des Laboratoires de Géologie de la Faculté des Sciences, Lyon, H.S. 2, 167 p.

Thompson, M. L., 1935, The fusulinid genus *Yangchienia* Lee: Eclogae Geologicae Helvetiae, v. 28, no. 2, p. 511–517.

Thompson, M. L., 1941, Upper Permian Fusulinid Foraminifera from Afghanistan: Geology Society of America Bulletin, v. 52, no. 12, Part 2, p. 1984.

Thompson, M. L., 1946, Permian fusulinids from Afghanistan: Journal of Paleontology, v. 20, no. 2, p. 140–157.

Thompson, M. L., 1954, American Wolfcampian fusulinids: University of Kansas, Paleontological Contributions, Protozoa, article 5, 226 p.

Thompson, M. L., and Foster, C. L., 1937, Middle Permian fusulinids from Szechuan, China: Journal of Paleontology, v. 11, no. 2, p. 126–144.

Thompson, M. L., Wheeler, H. E., and Danner, W. R., 1950, Middle and Upper Permian fusulinids of Washington and British Columbia: Cushman Foundation for Foraminiferal Research, Contributions, v. 1, 77 p.

Tien, N. D., 1979, Étude micropaleontologique (Foraminifères) de matériaux du Permien du Cambodge [thèse]: Université de Paris Sud, Centre d'Orsay, 167 p.

Toriyama, R., 1958, Geology of Akiyoshi. Part 3: Fusulinids of Akiyoshi: Memoirs of the Faculty of Science, Kyushu University, ser. D, v. 7, 264 p.

Toriyama, R., 1975, Permian fusulines from the Rat Buri Limestone in the Khao Phlong Phrab area, Sara Buri, Central Thailand: Memoirs of the Faculty of Science of Kyushu University, ser. D, v. 23, no. 1, p. 1–116.

Toriyama, R., and Kanmera, K., 1979, Permian Fusulines from the Rat Buri Lime-

stone in the Khao Khao area, Sara Buri, Central Thailand: Geology and Palaeontology of Southeast Asia, v. 20, p. 23–93.
Toriyama, R., and Pitakpaivan, K., 1973, Middle Permian Fusulines from Wat Kirinakratanaram, Central Thailand: Geology and Palaeontology of Southeast Asia, v. 12, p. 43–61.
Toriyama, R., and Sugi, T., 1959, Permian Fusulinids from Central Thailand: Memoirs of the Faculty of Science, Kyushu University, ser. D, v. 9, no. 1, p. 17–32.
Toriyama, R., Kanmera, K., and Ingavat, R., 1969, *Neofusulinella* from Thailand: Geology and Paleontology of Southeast Asia, v. 7, p. 15–32.
Toumanskaya, O. G., 1950, On higher fusulinids from the Upper Permian deposits of the USSR: Moscow Society of Naturalists, Geological series, Bulletin, v. 25, no. 4, p. 77–97 (in Russian).
Toumanskaya, O. G., 1953, On the Late Permian fusulinids of the Southern Ussury region: Moscow, All-Union Geological Institute, Publishing Office "Gosgeolizdat," 25 p. (in Russian).
Vachard, D., 1980, Tethys et Gondwana au Paléozoïque supérieur les données Afghanes [Ph.D. thesis]: Institut Géologique Albert Lapparent, Documents et Travaux, Paris, no. 2, 463 p.
Vlasov, N. G., 1961, Outline of the pre-Jurassic history of the southwest Darvaz, *in* Geology of Middle Asia: Leningrad, Publishing Office of Leningrad State University, p. 89–102 (in Russian).
Vlasov, N. G., and Miklukho-Maclay, A. D., 1959, New data on the Permian stratigraphy on the Southwest Darvaz: Akademya Nauk USSR, Doklady, v. 129, no. 4, p. 876–879 (in Russian).
Volz, W., 1904, Zur Geologie von Sumatra: Geologie und Palaontologie, Abhandelungen, new ser., v. 6, no. 2, p. 87–196.
Wang Kuolien, and Sun Xinfeng, 1973, Carboniferous and Permian foraminifera of the Chinling Range and its geologic significance: Acta Geologia Sinica, v. 2, p. 171–178.
Wang Yujing, Sheng Jinzhang, and Zhang Linxin, 1981, Fusulinids from Xizang of China: Paleontology of Xizang, Book 3: Academy of Sinica, Science Press, 80 p.
Weippert, D., Wittekindt, H., and Wolfart, R., 1970, Zur geologischen Entwicklung von Zentral- und Sudafghanistan: Hannover, Geologische Jahrbuch Beihefte, v. 92, 99 p.
Wolfart, R., and Wittekindt, H., 1980, Geologie von Afghanistan: Berlin-Stuttgart, Gebruder Borntraeger, 500 p.
Xiao Weimin, Zhang Linxin, Wang Hongdi, and Dong Wenlan, 1986, Early Permian stratigraphy and faunas in Southern Guizhou: People's Publishing House of Guizhou, 364 p.
Yabe, H., and Hanzawa, S., 1932, Tentative classification of the Foraminifera from the Fusulinidae: Proceedings of the Japan Imperial Academy, v. 8, no. 2, p. 40–43.
Yang Zhengdong, 1985, Restudy of fusulinids from the "Maokou Limestone" (Permian) at Datieguan, Langdai Guizhou: Acta Micropaleontologia Sinica, v. 2, no. 4, p. 307–338.
Zhang Linxin, 1963, Upper Carboniferous Fusulinids from Kelping and adjacent regions of Xinjiang: Acta Palaeontologia Sinica, v. 11, no. 1, p. 55–63.

Manuscript Accepted by the Society May 22, 1996

The Geological Society of America
3300 Penrose Place • P.O. Box 9140 • Boulder, Colorado 80301

Permian Stratigraphy and Fusulinida of Afghanistan with Their Paleogeographic and Paleotectonic Implications

CONTENTS

ISBN 0-8137-2316-7
9 780813 723167