This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

GEOLOGICAL SURVEY OF CANADA
BULLETIN 418

UPPER MOSCOVIAN (DESMOINESIAN) FUSULINACEANS FROM THE TYPE SECTION OF THE NANSEN FORMATION, ELLESMERE ISLAND, ARCTIC ARCHIPELAGO

Rui Lin, C.A. Ross, and W.W. Nassichuk

1991

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Canada

THE ENERGY OF OUR RESOURCES

THE POWER OF OUR IDEAS

GEOLOGICAL SURVEY OF CANADA
BULLETIN 418

UPPER MOSCOVIAN (DESMOINESIAN) FUSULINACEANS FROM THE TYPE SECTION OF THE NANSEN FORMATION, ELLESMERE ISLAND, ARCTIC ARCHIPELAGO

Rui Lin, C.A. Ross, and W.W. Nassichuk

1991

©Minister of Supply and Services Canada 1991

Available in Canada through
authorized bookstore agents
and other bookstores

or by mail from

Canada Communication Group–Publishing
Ottawa, Canada K1A 0S9

and

Institute of Sedimentary and Petroleum Geology
Geological Survey of Canada
3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7

A deposit copy of this publication is also available
for reference in public libraries across Canada

Cat. No. M42-418E
ISBN 0-660-14055-1

Price subject to change without notice

Critical readers

G. Sanderson
J. Utting

Scientific editor

N.C. Ollerenshaw

Editor

L. Reynolds

Typesetting and layout

M.L. Jacobs
P.L. Greener

Cartography

Institute of Sedimentary and Petroleum Geology

Authors' addresses

Rui Lin
Nanjing Institute of Geology and Palaeontology
Academia Sinica, Chi-Ming-Ssu
Nanjing 210008
People's Republic of China

Charles A. Ross
Chevron U.S.A. Inc.
P.O. Box 1635
Houston, Texas 72251
U.S.A.

W.W. Nassichuk
Geological Survey of Canada
Institute of Sedimentary and Petroleum Geology
3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7

Manuscript submitted: 91.02.21
Approved for publication: 91.06.04

PREFACE

Fusulinaceans have been known from Carboniferous strata in the Sverdrup Basin since 1950. They were reported from the type area of the Canyon Fiord Formation on Ellesmere Island by J.C. Troelsen, geologists to "Danish Thule and Ellesmere Land Expedition 1939-41" under the leadership of James van Hauen. Since then, they have been collected throughout the Sverdrup Basin and have enabled geologists to correlate Carboniferous successions in the basin with sequences elsewhere in the circum-Arctic and around the world. Moreover, fusulinaceans have been of extraordinary importance in the development of the biostratigraphic framework of the Sverdrup Basin.

To meet one of its objectives — the estimation of the potential abundance and probable distribution of mineral and fuel resources in Canada — the Geological Survey requires extensive stratigraphic and paleontological data. This report presents information and interpretations that will be of considerable assistance in further understanding the geology of an important part of the Canadian Arctic.

E.A. Babcock
Assistant Deputy Minister
Geological Survey of Canada

PREFACÉ

Les Fusulinidé sont connus dans des strates carbonifères du bassin de Sverdrup depuis 1950. J.C. Troelsen, géologue de l'expédition de 1939-1941 aux terres danoises de Thule et d'Ellesmere, que dirigeait James van Hauen, a signalé la présence de ces fossiles dans la région type de la Formation de Canyon Fiord, dans l'île d'Ellesmere. Depuis, on en a retrouvés partout dans le bassin de Sverdrup; grâce à eux, les géologues ont réussi à établir une corrélation entre les successions carbonifères dans le bassin et des séquences ailleurs dans la zone circumarctique et partout au monde. En outre, les Fusulinidé ont contribué extraordinairement à la mise au point du cadre biostratigraphique du bassin de Sverdrup.

Afin de satisfaire à un de ses objectifs, soit l'estimation de l'abondance potentielle et de la répartition probable des ressources minérales et combustibles au Canada, la Commission géologique du Canada a besoin de vastes données stratigraphiques et paléontologiques. La présente étude fournit des renseignements et des interprétations qui aideront énormément à mieux comprendre la géologie d'une importante partie de l'Arctique canadien.

E.A. Babcock
Sous-ministre adjoint
Commission géologique du Canada

CONTENTS

1 Abstract/Résumé
2 Summary/Sommaire
5 Introduction
6 Acknowledgments
7 Nansen Formation
7 Regional setting
7 Stratigraphic relationships in the type area
9 Lithostratigraphy in the type area
10 Lithostratigraphy of the Desmoinesian interval in the type area
16 Paleoenvironment
17 Fusulinacean zones
17 *Wedekindellina lata–Wedekindellina uralica longa* zone
20 *Fuslinella eopulchra* zone
20 Biogeographic provinces
21 Arctic Province
21 Midcontinent–Andean Province
22 Tethyan Province
22 Ural Province
22 Correlation
22 Union of Soviet Socialist Republics
23 Canada
23 Greenland
23 Spitsbergen
25 United States of America
25 China
27 South Korea
27 Japan
27 Thailand
28 Spain
29 Systematic Paleontology
29 Order Fusulinida
29 Superfamily Fusulinacea
29 Family Ozawainellidae
29 Subfamily Ozawainellinae
29 Genus *Eostaffella*
30 Genus *Millerella*
30 Genus *Ozawainella*
32 Subfamily Pseudostaffellinae
32 Genus *Neostaffella*
34 Subfamily Staffellinae
34 Genus *Pseudoendothyra*
38 Genus *Staffella*
40 Family Schubertellidae
40 Subfamily Schubertellinae
40 Genus *Schubertella*
43 Family Fusulinidae
43 Subfamily Fusulinellinae
43 Genus *Wedekindellina*
48 Genus *Fusulinella*
65 Subfamily Fusulininae
65 Genus *Beedeina*
66 References

Illustrations

Figures

5 1. Map of the Canadian Arctic Archipelago showing the general outline of the Carboniferous to Tertiary Sverdrup Basin and the general position of the type section of the Nansen Formation

8 2. Index map showing the location of the type section and the distribution of the Nansen Formation in the Northwestern Carbonate Belt and Southeastern Carbonate Belt on Ellesmere and Axel Heiberg islands

11 3. Schematic lithostratigraphic summary of the type section of the Nansen Formation at Girty Creek on northern Ellesmere Island

12 4. Schematic restored section for Carboniferous to Lower Permian lithofacies across Sverdrup Basin in the vicinity of Hare Fiord, northern Ellesmere Island

14, 15 5. Range chart for upper Moscovian (Desmoinesian) fusulinaceans from the type area of the Nansen Formation on northern Ellesmere Island

21 6. Paleogeographic map showing the distribution of fusulinacean biogeographic provinces during late Middle Carboniferous (late Moscovian) time

24 7. Map of the world showing the distribution of upper Moscovian (Desmoinesian) fusulinacean-bearing strata

26 8. Geographic distribution of upper Moscovican fusulinaceans described from the type area of the Nansen Formation on northern Ellesmere Island

28, 29 9. Generalized correlation chart for upper Moscovian (Desmoinesian) fusulinacean-bearing strata in the world

73 Plates 1 to 24

UPPER MOSCOVIAN (DESMOINESIAN) FUSULINACEANS FROM THE TYPE SECTION OF THE NANSEN FORMATION, ELLESMERE ISLAND, ARCTIC ARCHIPELAGO

Abstract

The Nansen Formation in the type area ranges in age from Middle Carboniferous (late Serpukhovian) to Early Permian (Sakmarian) and contains a rhythmically bedded succession of limestones that are thick bedded at the base of the formation and thin to medium bedded elsewhere. Deposition occurred in a transitional "belt" between the shallow water shelf and the shelf slope in an environment characterized by strong and continued wave or current agitation. The upper Moscovian (Desmoinesian) fusulinaceans studied are from between 1105-1649 m (3625-5410 ft.) above the base of a section 1.6 km west of the type section.

The fauna in this interval contains 60 species belonging to *Beedeina, Eostaffella, Fusulinella, Millerella, Neostaffella, Ozawainella, Pseudoendothyra, Schubertella, Staffella,* and *Wedekindellina,* some of which have worldwide distribution. Six new species are described: *Fusulinella daviesi, F. subelliptica, F. thorsteinssoni, Pseudoendothyra ellesmerensis, Wedekindellina pulchra,* and *W. quasicylindrica.* Two informal range zones have been recognized, the lower of which is the *Wedekindellina lata–Wedekindellina uralica longa* zone and the upper, the *Fusulinella eopulchra* zone.

Fusulinaceans evolved rapidly during late Moscovian (Desmoinesian) time, and four biogeographic provinces have been identified: the Arctic, Midcontinent–Andean, Tethyan, and Ural provinces. The fauna from the Nansen Formation belongs to the Arctic Province. The pattern of distribution of the fusulinacean biogeographic provinces seems to be a reflection of the different geographic climatic zones. The Arctic Province represents a warm temperate climatic zone in the northern hemisphere.

Résumé

Dans la région type, la Formation de Nansen s'échelonne du Carbonifère moyen (Serpukhovien tardif) au Permien précoce (Sakmarien). Elle contient des séquences rythmiques de calcaires en couches épaisses à la base de la formation et en couches minces ou moyennes ailleurs. Elle s'est accumulée dans une "zone" de transition entre la plate-forme interne (en eau peu profonde) et le talus, dans un milieu caractérisé par l'action puissante et continue des vagues ou des courants. Les Fusulinidés de la partie supérieure du Moscovien (Desmoinésien) qui sont examinés dans la présente étude proviennent d'un intervalle situé entre 1 105 et 1 649 m (3 625 et 5 410 pi) au-dessus de la base d'une coupe, à 1,6 km à l'ouest de la coupe type.

La faune de cet intervalle comprend 60 espèces appartenant à *Beedeina*, à *Eostaffella*, à *Fusulinella*, à *Millerella*, à *Neostaffella*, à *Ozawainella*, à *Pseudoendothyra*, à *Schubertella*, à *Staffella* et à *Wedekindellina*, dont quelques-unes ont une répartition mondiale. Six nouvelles espèces sont décrites : *Fusulinella daviesi*, *F. subelliptica*, *F. thorsteinssoni*, *Pseudoendothyra ellesmerensis*, *Wedekindellina pulchra* et *W. quasicylindrica*. Deux zones d'extension informelles sont reconnues, la zone à *Wedekindellina lata–Wedekindellina uralica longa* (zone inférieure) et la zone à *Fusulinella eopulchra* (zone supérieure).

Les Fusulinidés ont évolué rapidement durant la fin de l'époque moscovienne (Desmoinésien), et quatre provinces biogéographiques sont reconnues : les provinces arctique, médio-continentale et andine, téthysienne et ouralienne. La faune de la Formation de Nansen appartient à la province arctique. La répartition des provinces biogéographiques à Fusulinidés semble refléter les différentes zones climatiques géographiques. La province arctique représente une zone climatique tempérée chaude dans l'hémisphère nord.

Summary

The Nansen Formation in the Sverdrup Basin of the Canadian Arctic Archipelago is widely distributed in both the Northwestern Carbonate Belt and the Southeastern Carbonate Belt. In the "Glacier Section" 1.6 km west of the type section, the Nansen Formation ranges in age from Middle Carboniferous (late Serpukhovian) to Early Permian (Asselian or possibly Sakmarian) and contains at least 2028 m (6654 ft.) of limestone with minor shale and anhydrite. Four main, albeit informal, lithostratigraphic units are recognized. The upper Moscovian (Desmoinesian) interval extends from 1105 m (3625 ft.) to 1649 m (5410 ft.) above the base of the section and is contained in Unit 4. This interval can be subdivided into twelve distinct lithological parasequences from Subunit "A" at the bottom to Subunit "L" at the top.

Desmoinesian carbonate strata in the type area were deposited between the shallow water shelf and the slightly deeper shelf slope. Changes in deposition from shelf to slope are indicated by changes in the character of the carbonate rocks. Carbonate rocks from the relatively shallow water shelf part of the succession are mainly grainstone with calcite spar cement, phylloid algal–foraminifer packstone, foraminifer–algal–crinoid–micritized grain packstone, foraminifer–bryozoan–crinoidal wackestone, and oolite. Carbonates from the shelf slope include wackestone, packstone, grainstone, rudstone, boundstone, and floatstone with spectacular submarine cement fabrics.

The fusulinacean faunas from the shelf proper are closely similar to those from the shelf slope and include representatives of *Beedeina, Eostaffella, Fusulinella, Millerella, Neostaffella, Ozawainella, Pseudoendothyra, Schubertella, Staffella,* and *Wedekindellina*. *Fusulinella, Pseudoendothyra* and *Wedekindellina* are the most common forms. *Beedeina* and *Fusulina*, which are abundant and diverse in tropical and subtropical areas, are of exceedingly low diversity in the type area. Only one species of *Beedeina* is known from the Desmoinesian interval of the Nansen Formation in the type area, and *Fusulina* is absent.

The study of rocks and faunas in the Nansen Formation indicates that the sedimentary environment changed continuously from early to late Desmoinesian time and repetitive cycles occurred as deposition shifted from the shallower water shelf, toward the shelf margin and onto the shelf slope.

During late Moscovian (Desmoinesian) time, a number of genera, including *Beedeina, Fusulina, Fusulinella, Neostaffella, Ozawainella, Pseudoendothyra, Staffella,* and *Wedekindellina* diversified rapidly and evolved into many specialized forms, some of which became distributed worldwide. Most, however, were restricted to specific geographic areas that had specific climatic control. Although the generic and specific composition of Middle Carboniferous fusulinaceans varied somewhat through episodes of faunal dispersion in different seaways, four biogeographic provinces have been identified: the Arctic, the Midcontinent–Andean, the Ural, and the Tethyan provinces.

The distinctive Desmoinesian fauna contains 60 species, belonging to *Beedeina, Eostaffella, Fusulinella, Millerella, Neostaffella, Ozawainella, Pseudoendothyra, Schubertella, Staffella,* and *Wedekindellina*. Species of special stratigraphic significance include *Beedeina elegans decurta, Fusulinella cabezasensis, F. devexa, F. eopulchra, F. jamesensis, F. nevadensis, F. pokojamiensis, F. pseudobocki, F. schwagerinoides, F. subcolaniae, F. subpulchra, F. taishakuensis, F. zelleri, Neostaffella sphaeroidea, Wedekindellina lata, W. matura, W. uralica,* and *W. uralica longa*, some of which have been identified from successions of comparable age elsewhere in the Canadian Arctic, as well as in Greenland, Spitsbergen, central British Columbia, the Midcontinent, Russian Platform, Urals, Donbass, Spain, North China, South China, Japan, South Korea and Thailand. Six species are new: *Fusulinella daviesi, F. subelliptica, F. thorsteinssoni, Pseudoendothyra ellesmerensis, Wedekindellina pulchra,* and *W. quasicylindrica*.

Two informal range zones are recognized: the *Wedekindellina lata–Wedekindellina uralica longa* zone (Podolian = lower Desmoinesian) and the *Fusulinella eopulchra* zone (Myachkovian = upper Desmoinesian).

The fauna from the type area of the Nansen Formation belongs to the Arctic Province. The generic and specific diversity in the Arctic Province is clearly lower than in the Midcontinent–Andean, Tethyan or Ural provinces, suggesting that the water temperature in the Arctic Province was slightly cooler than in the other three, or that the water chemistry in the Arctic Province was different from the other three. The pattern of distribution of these fusulinacean provinces seems to reflect the different geographic climatic zones. The Arctic Province represents a warm temperate climatic zone in the northern hemisphere. The Midcontinent–Andean Province belongs to tropical, and northern and southern subtropical climatic zones along the eastern side of Panthalassa. The Tethyan Province was probably confined to tropical and subtropical climatic zones in the vicinity of the Tethys Sea and the western Panthalassa Ocean. The Ural Province was located in the tropical and subtropical seaway that connected the Tethyan and Arctic provinces.

Sommaire

La Formation de Nansen, dans le bassin de Sverdrup de l'archipel arctique canadien, a une vaste répartition dans la zone carbonatée du nord-ouest et la zone carbonatée du sud-est. Dans la "coupe de glacier" située 1,6 km à l'ouest de la coupe type, la Formation de Nansen s'échelonne du Carbonifère moyen (fin du Serpukhovien) au Permien précoce (Asselien ou peut-être Sakmarien) et contient au moins 2 028 m (6 654 pi) de calcaire avec un peu de shale et d'anhydrite. On y reconnaît quatre unités lithostratigraphiques informelles. L'intervalle de la partie supérieure du Moscovien (Desmoinésien) s'étend de 1 105 m (3 625 pi) à 1 649 m (5 410 pi) au-dessus de la base de la coupe et fait partie de l'unité 4; on peut le subdiviser en 12 paraséquences lithologiques distinctes, depuis la sous-unité "A", à la base, jusqu'à la sous-unité "L", au sommet.

Dans la région type, les strates carbonatées du Desmoinésien se sont accumulées entre la plate-forme interne, peu profonde, et le talus, en eau légèrement plus profonde. Les changements constatés dans la nature des roches carbonatées témoignent de changements survenus dans la sédimentation depuis la plate-forme jusqu'au talus. Les roches carbonatées qui proviennent de la plate-forme interne se composent principalement de grainstones à ciment spathique, de packstones à algues foliacées et à foraminifères, de packstones à foraminifères, à algues, à crinoïdes et à grains micritisés, de wackestones à foraminifères, à bryozoaires et à crinodes, et d'oolites. Les roches carbonatées du talus comprennent des wackestones, des packstones, des grainstones, des rudstones, des boundstones et des floatstones qui comportent des ciments sous-marins spectaculaires.

Les faunes à Fusulinidés de la plate-forme proprement dite ressemblent étroitement à celles du talus et comprennent des représentants de *Beedeina*, d'*Eostaffella*, de *Fusulinella*, de *Millerella*, de *Neostaffella*, d'*Ozawainella*, de *Pseudoendothyra*, de *Schubertella*, de *Staffella* et de *Wedekindellina*. Les formes les plus abondantes sont *Fusulinella*, *Pseudoendothyra* et *Wedekindellina*. *Beedeina* et *Fusulina*, abondantes et variées dans les régions tropicales et subtropicales, ont une diversité extrêmement faible dans la région type. En effet, dans la région type, l'intervalle desmoinésien de la Formation de Nansen contient une seule espèce de *Beedeina* et aucun échantillon de *Fusulina*.

L'étude des roches et des faunes de la Formation de Nansen indique que le milieu sédimentaire a changé continuellement entre le début et la fin du Desmoinésien et qu'il y a eu production de cycles répétés à mesure que la zone de sédimentation s'est déplacée de la plate-forme interne vers la marge de la plate-forme, puis sur le talus.

À la fin du Moscovien (Desmoinésien), un certain nombre de genres, y compris *Beedeina*, *Fusulina*, *Fusulinella*, *Neostaffella*, *Ozawainella*, *Pseudoendothyra*, *Staffella* et *Wedekindellina*, se sont diversifiés rapidement et ont évolué en plusieurs formes spécialisées, certaines desquelles ont une répartition mondiale. Cependant, la plupart d'entre elles ont occupé des régions géographiques précises que caractérisait un climat particulier. Bien que la composition générique et spécifique des Fusulinidés du Carbonifère moyen ait varié quelque peu au cours des épisodes de migration des faunes dans diverses voies de communication océaniques, on a reconnu quatre provinces biogéographiques : les provinces arctique, médio-continentale et andine, ouralienne et téthysienne.

La faune desmoinésienne distinctive comprend 60 espèces appartenant à *Beedeina*, à *Eostaffella*, à *Fusulinella*, à *Millerella*, à *Neostaffella*, à *Ozawainella*, à *Pseudoendothyra*, à *Schubertella*, à *Staffella* et à *Wedekindellina*. Les espèces suivantes ont une importance stratigraphique particulière: *Beedeina elegans decurta*, *Fusulinella cabezasensis*, *F. devexa*, *F. eopulchra*, *F. jamesensis*, *F. nevadensis*, *F. pokojamiensis*, *F. pseudobocki*, *F. schwagerinoides*, *F. subcolaniae*, *F. subpulchra*, *F. taishakuensis*, *F. zelleri*, *Neostaffella sphaeroidea*, *Wedekindellina lata*, *W. matura*, *W. uralica* et *W. uralica longa*. Certaines de ces espèces sont connues dans des successions d'âge comparable qui se trouvent ailleurs dans l'Arctique canadien, ainsi qu'au Groenland, au Spitsberg, dans le centre de la Colombie-Britannique, dans la région médio-continentale, sur la plate-forme russe, dans la chaîne de l'Oural, dans le Donbass, en Espagne, dans la Chine du Nord, dans la Chine du Sud, au Japon, en Corée du Sud et en Thaïlande. Six espèces sont nouvelles : *Fusulinella daviesi*, *F. subelliptica*, *F. thorsteinssoni*, *Pseudoendothyra ellesmerensis*, *Wedekindellina pulchra* et *W. quasicylindrica*.

On reconnaît deux zones d'extension informelles: la zone à *Wedekindellina lata–Wedekindellina uralica longa* (Podolien = partie inférieure du Desmoinésien) et la zone à *Fusulinella eopulchra* (Myachkovien = partie supérieure du Desmoinésien).

La faune qui provient de la région type de la Formation de Nansen appartient à la province arctique. La diversité des genres et des espèces est manifestement moins élevée dans la province arctique que dans les provinces médio-continentale et andine, téthysienne ou ouralienne, ce qui porte à croire que l'eau était légèrement plus froide dans la province arctique que dans les trois autres provinces, ou que son chimisme y était différent. La répartition de ces provinces à Fusulinideś semble refléter les différentes zones climatiques géographiques. La province arctique représente une zone climatique tempérée chaude dans l'hémisphère nord. La province médio-continentale et andine englobe des zones climatiques tropicale, subtropicale septentrionale et subtropicale méridionale le long de la bordure est de l'océan Panthalassa. La province téthysienne se limitait vraisemblablement à des zones climatiques tropicale et subtropicale à proximité de la Téthys et de la partie ouest de l'océan Panthalassa. La province ouralienne était située dans le passage maritime tropical et subtropical qui reliait les provinces téthysienne et arctique.

INTRODUCTION

Upper Middle Pennsylvanian (Desmoinesian) fusulinaceans are widely distributed throughout the Sverdrup Basin from Melville Island in the south to tiny Ward Hunt Island, off the north coast of Ellesmere Island in the north (Fig. 1). J.C. Troelsen, geologist to the Danish Thule and Ellesmere Lands Expedition, 1930-41, was the first to identify Desmoinesian fusulinaceans in the basin. Troelsen (1950) listed *Fusulina* spp. from the type area of the Canyon Fiord Formation on the north side of Cañon Fiord, northern Ellesmere Island and because of that species suggested (ibid.) "... that at least Bed I belongs to the Desmoinesian ..." Several other species cited by Troelsen (ibid.) from his "Bed I" in the lower part of the Canyon Fiord Formation are of Desmoinesian age: *Fusulinella* n. spp., *Wedekindellina* n. sp., *Ozawainella* sp., and *Staffella* sp. Representatives of most of these genera were also identified by Thorsteinsson (1974) from Desmoinesian strata in several other sections of the Canyon Fiord Formation on Ellesmere Island, at Bjorne Peninsula, Blind Fiord, and Trold Fiord (Fig. 2). Moreover, Tozer and Thorsteinsson (1964) reported that part of the Canyon Fiord succession on Melville Island was possibly correlative with *Fusulina*-bearing Desmoinesian strata in the Canyon Fiord Formation on Ellesmere Island.

Thorsteinsson (1974, p. 46) also noted the occurrence of upper Moscovian (Desmoinesian) species from the lower part of a single section of the Antoinette Formation on southern Hamilton Peninsula on northern Ellesmere Island: *Fusulinella* sp., *Wedekindellina* sp., and *Neostaffella* sp. In a summary of Middle Pennsylvanian biostratigraphy in Western and Arctic Canada, Nassichuk and Bamber (1978) provided additional information on Desmoinesian fusulinacean occurrences on Ellesmere Island.

Although Troelsen (1950) was the first to identify Desmoinesian fusulinaceans from the Sverdrup Basin, he did not describe them; credit for the first description falls to the gifted American paleontologist, M.L. Thompson,

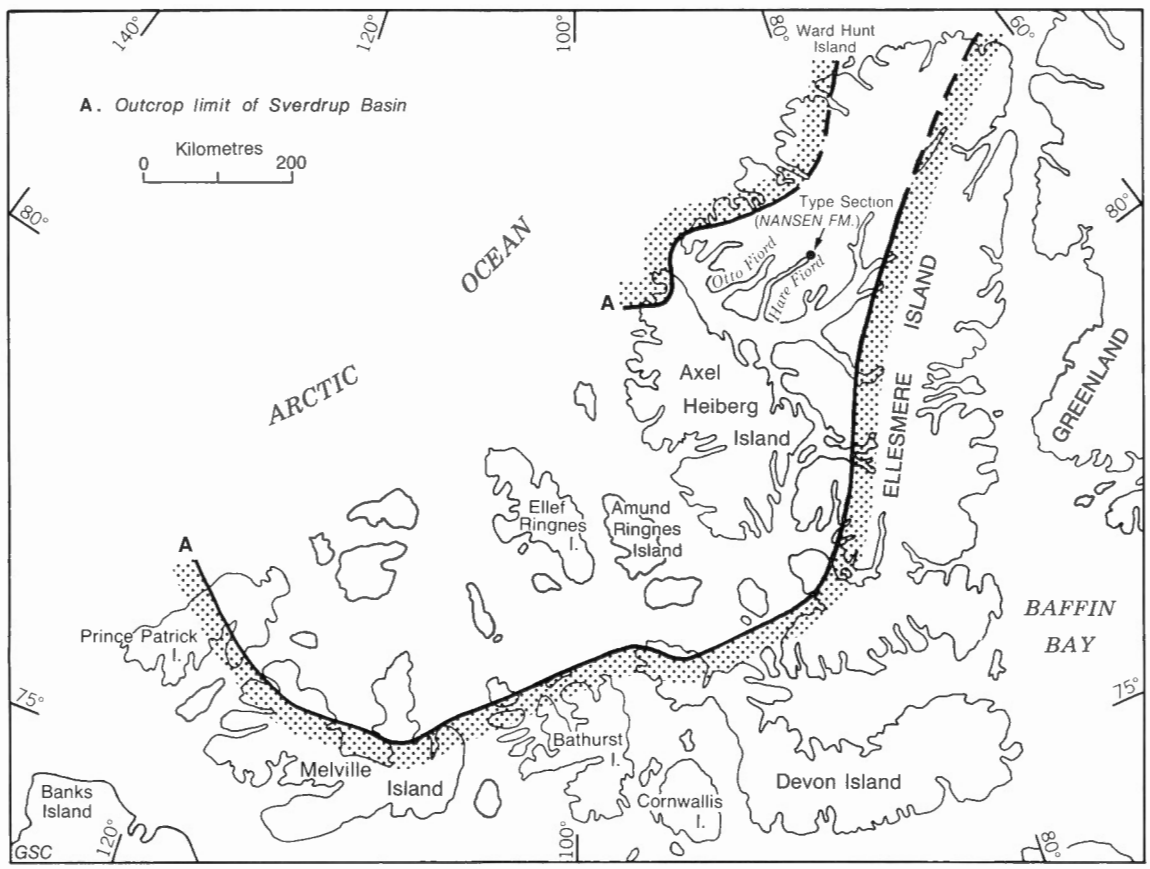


Figure 1. *Map of the Canadian Arctic Archipelago showing the general outline of the Carboniferous to Tertiary Sverdrup Basin and the general position of the type section of the Nansen Formation.*

who described five species from Ward Hunt Island in 1961. The fauna described by Thompson (1961), including *Beedeina huntensis* (Thompson), *Fusulinella zelleri* Thompson, *Neostaffella wardensis* (Thompson), *Ozawainella? arctica* Thompson, and *Wedekindellina lata* Thompson, was collected from a succession of limestones thought to belong to the Nansen Formation on the northwest side of the island. Thompson (op. cit., p. 1133) also reported *Eoschubertella*, but did not describe the species.

In 1966, one of us (WWN) studied the Nansen Formation on Ward Hunt Island and assembled several collections of fusulinaceans that were listed by another one of us (CAR) in an unpublished report submitted to the Geological Survey of Canada in 1977. Two collections from the upper half of the 320 m (1050 ft.) thick Nansen succession at Walker Hill yielded the following upper Desmoinesian (upper Moscovian, i.e., Myachkovian) species: *Neostaffella* sp. cf. *P. sphaeroidea* (Moeller), *Neostaffella* sp. cf. *P. umbilicata* (Putrja and Leontovitch), *Wedekindellina* sp. cf. *W. uralica* Dutkevitch, *Wedekindellina* sp. cf. *W. dutkevitchi* Rauser, *Wedekindellina* sp. cf. *W. curta* Lebedeva, and *Endothyra* sp.

Other fusulinaceans collected from the lower part of the Walker Hill section (110–130 m above the base) include *Profusulinella* sp. cf. *P. paratimanica* Rauser, *Profusulinella* sp. cf. *P. prisca* (Deprat), and *Profusulinella* sp., which we consider to be of early Moscovian, that is, early Middle Pennsylvanian (Atokan) age.

Desmoinesian fusulinaceans were first identified from the Nansen Formation on Ellesmere Island by Thorsteinsson (1974), who reported *Fusulinella* sp. from the type section. In the same year (1974) extensive collections were assembled from the Nansen Formation in the type area and elsewhere on Ellesmere and Axel Heiberg islands by one of the authors (WWN) and G.R. Davies; those from the type area are described herein. Preliminary examination of fusulinaceans from Nansen sections north of Oobloyah Bay and north of Otto Fiord on northern Ellesmere Island and at Bunde Fiord on western Axel Heiberg Island (Fig. 2) indicate that Desmoinesian fusulinaceans are also abundant in those areas, but their inclusion is beyond the scope of the present study.

Fusulinaceans are poorly known from the type section of the Nansen Formation and only the post-Desmoinesian *Triticites* sp. and the Desmoinesian *Fusulinella* sp. have been reported (Thorsteinsson, 1974). However, analysis of the 1974 collections assembled by Nassichuk and Davies from only 1.6 km west of the type section (Fig. 3) shows that fusulinaceans are abundant throughout the section, from the Middle Carboniferous, Bashkirian Stage (*Eostaffella postmosquensis* Zone) at the base to at least the Lower Permian Asselian Stage, and possibly into the lower Sakmarian in the upper part of the section. Although younger Permian (Artinskian) fossils have been reported from the Nansen Formation elsewhere on Ellesmere Island (Thorsteinsson, 1974), we have no unequivocal data to suggest the presence of post-Sakmarian strata in the type Nansen. This report is one of several planned to describe the entire fusulinacean fauna from the type area of the Nansen Formation.

Fusulinaceans described in this report are of late Moscovian (Podolian and Myachkovian) age, and most of the species are also known from upper Moscovian strata of the Russian Platform. These fusulinaceans are equivalent in age to forms known from the Middle Pennsylvanian (Desmoinesian) Series in the Midcontinent. The fauna occurs in the interval 1105–1649 m (3625–5410 ft.) above the base of the 2028 m thick formation, in the "Glacier Section" 1.6 km west of the type section (Fig. 3), and includes 60 species belonging to 10 genera. Many of the Desmoinesian species in the Nansen are unique to the Arctic paleogeographic province, but others are more cosmopolitan; that is, with a global distribution. Accordingly, the latter are particularly significant for the correlation of Desmoinesian strata in the Nansen Formation with strata elsewhere in the world.

In addition to fusulinaceans, only a few other fossil groups have been reported from upper Moscovian (Desmoinesian) strata in the type area of the Nansen Formation. The enigmatic *Palaeoaplysina*, of uncertain hydrozoan or perhaps algal origin, and eight genera of algae were reported by Mamet et al. (1979, 1987); included are the phylloid algae *Eugonophyllum* Konishi and Wray, *Ivanovia* Khvorova, *Neoanchicodium* Endo, and representatives from other algal families including *Donezella* Maslov, *Dvinella* Khvorova, *Epimastopora* emend Roux, *Komia* Korde, and *Ungdarella* Korde.

ACKNOWLEDGMENTS

The authors are indebted to G.R. Davies who, in 1974, assisted in assembling the faunas described in this report when he was an officer of the Geological Survey of Canada. Moreover, G.R. Davies critically reviewed and provided important data for stratigraphic parts of this report. We especially want to thank E.W. Bamber, and R.D. Michie of the Geological Survey of Canada for technical advice and assistance in the preparation of photographic plates and thin sections. J. Utting of the

Geological Survey of Canada and G. Sanderson of Amoco Production Company in Tulsa critically reviewed the manuscript and provided important suggestions on the biostratigraphy and the taxonomy and relationships of Desmoinesian fusulinaceans. We also thank Chevron U.S.A. Inc. for supporting C.A. Ross in this research venture.

NANSEN FORMATION

Regional setting

All Carboniferous and Permian strata in the Canadian Arctic Archipelago are contained within the Sverdrup Basin, a major rift basin 1000 km long and 400 km wide, which underlies the northernmost islands in the archipelago (Fig. 1). The basin formed in Early Carboniferous time following extension, faulting, and collapse of Proterozoic to Devonian rocks in the underlying Franklinian Geosyncline during the latest Devonian to earliest Carboniferous Ellesmerian Orogeny (Thorsteinsson and Tozer, 1970; Davies and Nassichuk, 1990, in press). An essentially conformable succession of strata, with a cumulative thickness of at least 15 km and ranging in age from Early Carboniferous (Viséan) to early Tertiary (Eocene) is contained within the basin. Interestingly, the oldest strata (Viséan) in this well defined rift basin and in many other rift basins in the world are lacustrine oil shales (Davies and Nassichuk, 1988).

Thorsteinsson (1970, 1974) noted significant changes in the lithological character of the succession between the basin edge and the basin interior, while conducting field investigations (which began in 1956) that led to his initial establishment of the stratigraphic framework for Carboniferous and Permian strata in the Sverdrup Basin. The changes were particularly evident for the Lower Carboniferous (Serpukhovian) to Lower Permian (Artinskian) interval, which is represented mainly by carbonate strata. For this succession, Thorsteinsson (1970) established a series of facies belts, the areal distribution and vertical relationships of which are shown schematically in Figures 2 and 4.

The Nansen Formation, the major shelf-forming carbonate in the Sverdrup Basin, ranges in age from Early Carboniferous (Serpukhovian) to Early Permian (early Artinskian) and is the principal formation in both the Northwestern Carbonate Belt and the Southeastern Carbonate Belt (Thorsteinsson, 1970, 1974; Thorsteinsson, Tozer, and Kerr, 1972). Between these two belts (Fig. 2), which are parallel with the long axis of the Sverdrup Basin, is the Basinal Clastic and Evaporitic Belt. This belt contains the Otto Fiord Formation, which comprises evaporite, shale, and limestone of Serpukhovian to early Moscovian age, and which is overlain by the Hare Fiord Formation. The Hare Fiord Formation contains ammonoid-bearing limestone and shale that range in age from late Bashkirian (Atokan) to Artinskian (Nassichuk, Furnish, and Glenister, 1965; Nassichuk, 1975).

Repetitive depositional cycles or sequences occur within the Nansen Formation at different scales. At the lower end of the spectrum are shallowing-upward hemicycles or parasequences that vary from one metre or so in thickness to three or four metres. Many of these cycles are characterized by the development of micritized-grain lime grainstone, or coated-grain/oolitic grainstone at the top of the shallowing-upward units, although grainstones may also occur as basal transgressive beds. Phylloid algal floatstone with lime mudstone matrix, or submarine-cemented skeletal packstone, grainstone and floatstone are common within these parasequences in the upper, more massive limestone interval of the Nansen Formation. These thinner cycles probably are controlled by fifth- to sixth-order glacioeustatic sea level fluctuations. Beauchamp (1987) suggested that a few hundred shelf cycles of this type occur in Upper Carboniferous and Lower Permian carbonate successions in the Sverdrup Basin.

At the other end of the depositional spectrum, Beauchamp et al. (1989b) defined seven long term transgressive/regressive sequences bounded by major unconformities at the basin margin. The oldest of these sequences is Viséan in age, predating deposition of the Nansen. However, the second (Serpukhovian to basal Asselian) and the third (Asselian–Sakmarian) sequences correspond to deposition of the Nansen Formation in the type area.

Stratigraphic relationships in the type area

The type section of the Nansen Formation at Girty Creek on northwestern Ellesmere Island (Fig. 3) is in the Northwestern Carbonate Belt, on the north side of the Basinal Clastic and Evaporitic Belt. In the immediate vicinity of the type section, shelf carbonate in the Nansen Formation interfingers quite distinctly with basinal anhydrite and limestone in the basinal Otto Fiord and Hare Fiord formations. Lenticular and mound-like, "reefal" carbonate units of Carboniferous to Early Permian age are common near these facies transitions. Stratigraphic relationships between the three formations are clearly visible a few kilometres east of the type section.

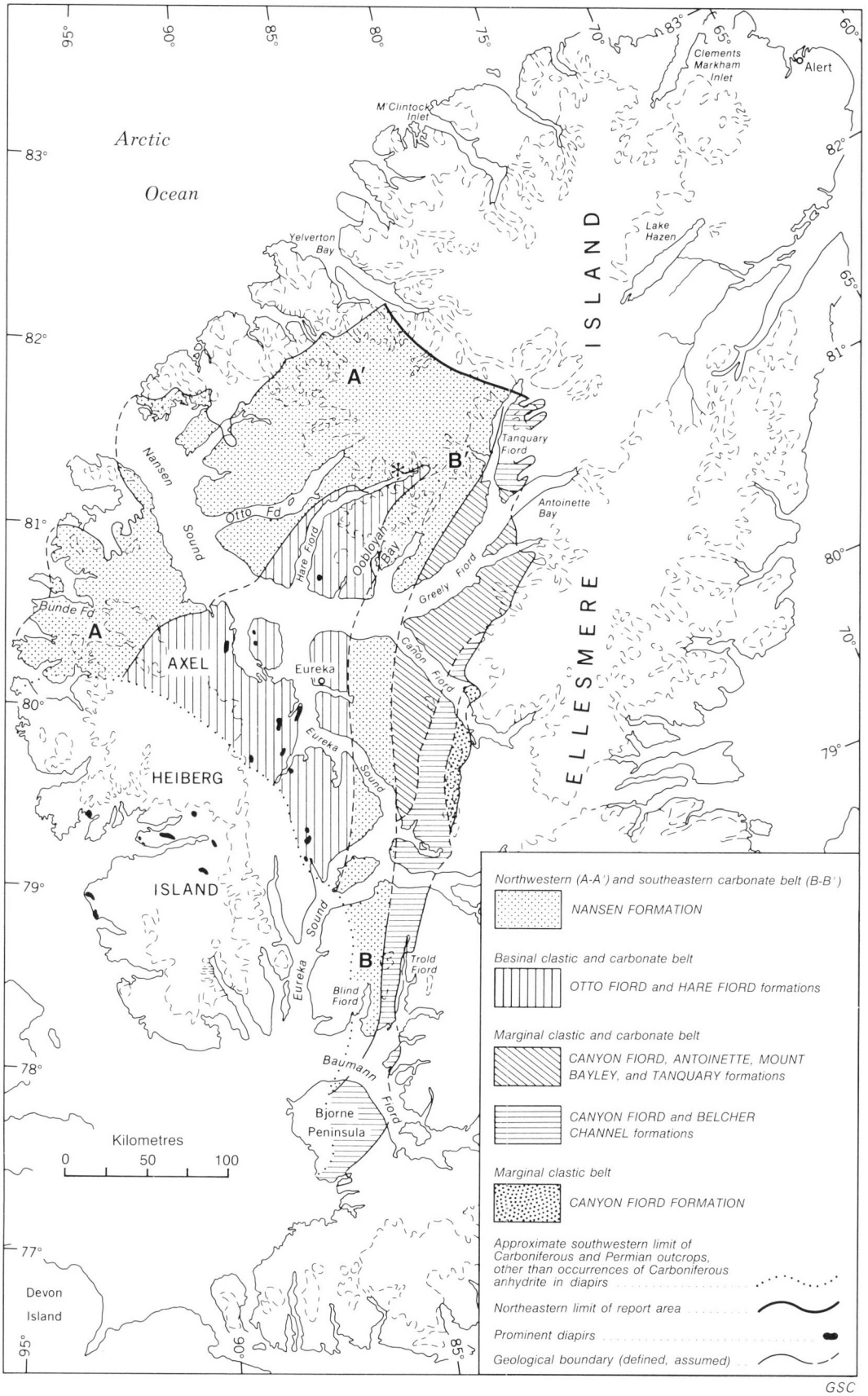


Figure 2. *Index map showing the location of the type section (*) and the distribution of the Nansen Formation in the Northwestern Carbonate Belt and the Southeastern Carbonate Belt on Elllesmere and Axel Heiberg islands. (Modified from Thorsteinsson, 1974.)*

Although the type section along Girty Creek is well exposed, with clearly visible lower and upper contacts, access to the type section is difficult. A narrow gorge in the lower part of the section, which contains deep rushing water during the summer, and steep cliffs in the upper part of the section, make access to all parts of the type section along Girty Creek nearly impossible. Fortunately, the entire section is exposed and easily accessible along the east side of a major south-flowing unnamed glacier 1.6 km west of Girty Creek. The terminus of the glacier is immediately east of the head of Hare Fiord. Thorsteinsson (1974) described *Triticites* sp. and *Fusulinella* sp. from the Girty Creek type section, but all the fusulinaceans described in this report are from the adjacent (glacier) section (Fig. 3).

The type section of the Nansen Formation at Girty Creek proper was reported to be at least 2372 m (7780 ft.) thick by Thorsteinsson (1974), but at the nearby "Glacier Section", the formation is 2028 m (6654 ft.) thick. In the type area, the Nansen section is replete with bryozoan reefs in the lower part and *Palaeoaplysina* reefs in the upper part. Thickness variations are probably dependent to some degree on minor faults in the lower part and the top of the section, and on the relative abundance of reefs in specific sections.

The Nansen Formation ranges from Serpukhovian to Asselian or possibly Sakmarian age in the type area, but elsewhere in Ellesmere Island it extends into the early Artinskian (Thorsteinsson, 1974). In the type area it overlies redbed conglomerate, sandstone and shale of the Borup Fiord Formation (Fig. 3). Fossils are extremely rare in the Borup Fiord formation, but foraminifers and algae collected from near the top of the type section at Stepanow Creek, 19 miles (30 km) west of Girty Creek, are indicative of a late Serpukhovian age (see faunal list of Mamet *in* Thorsteinsson, 1974). The contact between the two formations is marked by a distinctive erosional surface, but clastic rocks in the Borup Fiord Formation grade upward into carbonate rocks of the Nansen Formation. Considerable topographic relief is evident on the surface of the Borup Fiord Formation east of the head of Hare Fiord, that is, east of the "Glacier Section". In this area, the Borup Fiord Formation is overlain by carbonate mounds and evaporites of the Otto Fiord Formation. Locally, in the type area, the contact is further complicated by slippage along minor bedding plane faults.

Thorsteinsson (1974) indicated that the type section of the Nansen Formation at Girty Creek is overlain by a thin succession of basaltic flows and pyroclastic rocks belonging to the Lower Permian Esayoo Formation. The Esayoo is associated with the Nansen Formation only intermittently on northern Ellesmere Island and is absent from the "Glacier Section" described herein (Fig. 2). In the "Glacier Section", the Nansen Formation is overlain by a thin sequence of quartzite, sandstone, and conglomerate that most likely belong to the lowermost Upper Permian Trold Fiord Formation (Fig. 3).

Lithostratigraphy in the type area

The Nansen Formation contains a wide variety of light grey limestones that are generally thick bedded at the base and in the upper two thirds of the formation, and are thin bedded elsewhere. Minor amounts of black, shaly, quartzose sandstone and anhydrite occur in the lower half of the unit. Generally, the Nansen Formation is a shallow water shelf carbonate deposit composed commonly of rhythmically bedded to lenticular, light-coloured, bioclastic limestones. Toward the shelf interior, or shoreward, however, the Nansen Formation grades into parallel bedded dolomite (i.e., in the Krieger Mountains) and even farther shoreward, into anhydritic evaporite and carbonate. To illustrate the previous point, the Nansen Formation grades into the evaporitic Mount Bayley Formation in the vicinity of Tanquary Fiord.

The outer shelf edge lithofacies of the middle and upper (Moscovian and younger) part of the Nansen includes lenticular organic buildups and mounds characterized by the dominance of phylloid algae and the enigmatic organism *Palaeoaplysina* (Davies and Nassichuk, 1986; Beauchamp et al., 1989a).

Four main, albeit informal lithostratigraphic units (Units 1-4) are clearly displayed in the type area of the Nansen Formation and are depicted graphically in Figure 3.

Unit 1

Unit 1 is a basal lenticular carbonate unit, ranging in thickness from about 75 m (246 ft.) in the "Glacier Section" to 175 m (574 ft.) in the type section proper at Girty Creek. It is conformable with the underlying Borup Fiord Formation. This unit is resistant and cliff forming, and is composed mainly of multicyclic peloidal and algal limestone of restricted marine to metahaline aspect. It contains upper Serpukhovian and lower Bashkirian foraminifers and algae.

The high content of beresellid algae in Unit 1, typical of carbonate mounds in the evaporitic Otto Fiord Formation, suggests that this unit probably accumulated under variable marine to metahaline conditions during initial flooding of the Sverdrup Basin rift trough. The basal syntectonic redbeds indicate nonmarine to marginal marine deposition that was localized by erosion of major

fault blocks formed during initial extension and subsidence of the Sverdrup rift basin.

Unit 2

Argillaceous, thin bedded limestone, recessive weathering shale, and anhydrite characterize Unit 2. The anhydrite is exposed intermittently over a stratigraphic interval of about 45 m. Carbonate mounds are clearly visible in this interval on the east flank of the ridge between the "Glacier Section" and the type section. This interval is about 200 m (656 ft.) thick in the "Glacier Section", and 142 m (466 ft.) thick in the type section at Girty Creek. Overall, this interval is correlated at least in part with the Otto Fiord Formation, and represents a tongue of that facies extending into the type Nansen. This unit contains ammonoids and foraminifers of Bashkirian to early Moscovian (Atokan) age (Nassichuk, 1975).

Episodic deepening of the rift trough under arid to semiarid climatic conditions resulted in periodic evaporitic conditions and precipitation of subaqueous sulphate units of the Otto Fiord Formation. These sulphate units were cyclically interbedded with more open marine shale and argillaceous carbonate. The basin-margin equivalents of this succession were shallow water and metahaline limestone and dolomite.

Unit 3

Unit 3 is characterized by thin bedded, dark coloured, argillaceous limestone (spiculitic mudstone, wackestone), cherty limestone and shale. Crinoids, brachiopods, corals, and other biota are common components. The unit is 523 m (1716 ft.) thick in the "Glacier Section", and 610 m (2000 ft.) thick in the Girty Creek section. Within the type Nansen, Unit 3 is a lateral equivalent of the Hare Fiord basin-fill facies. Several kilometres east of the "Glacier Section", Units 2 and 3, which resemble strata in the Otto Fiord and Hare Fiord formations, respectively, grade by pinch-out and intertonguing into massive carbonates of the Nansen Formation. There, the entire Nansen Formation consists of resistant, shallow water shelf or slope carbonates. Unit 3 contains ammonoids and abundant foraminifers and is mainly of early Moscovian age (Nassichuk, 1975).

Progressive subsidence and extension of the Sverdrup rift resulted in more persistent deep, open marine conditions and the accumulation of thin bedded argillaceous and organic limestone and shale in the basin centre (Unit 3). Early diagenetic remobilization of opaline silica in sponge spicules resulted in extensive replacement of the limestone by chert. The basin margin or shallow water equivalent of this section was shoal limestone.

Unit 4

Unit 4 is a thick, resistant, light to medium grey limestone unit, which occurs in multiple shallowing-upward cycles or parasequences. It is thin bedded and cherty near its basal transition from Unit 3, and grades upward into thicker bedded to massive and lenticular carbonates. Thin, shaly, or recessive weathering, argillaceous carbonates mark the base of cycles or parasequences throughout the section. This unit forms the main cliff-forming massive carbonates of the Nansen Formation in the type area, and is 1230 m (4035 ft.) thick in the "Glacier Section".

Marginal filling of the rift trough allowed seaward progradation so that the upper massive shelf edge and slope carbonates of the upper Nansen (Unit 4) stepped out over basinal shales and carbonates of the Hare Fiord Formation. Behind the prograding shelf margin, evaporites—such as those apparent in the Lower Permian (Asselian) Mt. Bayley Formation near Tanquary Fiord—developed in localized inner, restricted shelf environments.

Lithostratigraphy of the Desmoinesian interval in the type area

Desmoinesian fusulinaceans described in this report are from 1105 to 1649 m (3625–5410 ft.) above the base of a succession 1.6 km west of the type section. The Desmoinesian interval is contained in Unit 4, which consists of shallow slope and shelf carbonates that are variously thick bedded to massive (Fig. 3). The lower limit of the Desmoinesian Stage cannot be identified precisely because of a paucity of diagnostic fossils immediately below the 1105 m level, and may include strata in the upper part of Unit 3. The carbonates in Unit 4 are internally multicyclic and those in the lower part of the unit in particular are indicative of a considerable depositional slope. This interpretation is supported by an abundance of submarine cement.

In general, the Desmoinesian interval is characterized by an abundance of foraminifers including fusulinaceans, the presence of submarine cements in many samples, occurrence of phylloid algae, particularly in abraded and micritized plates in the upper part of sample sequences (or as algal-plate, mould-collapse fabrics in wackestone to floatstone textures), and the common occurrence of micritized bioclasts (algae, foraminifers, molluscs) in grainstone fabrics at the top of subunits. Encrusting

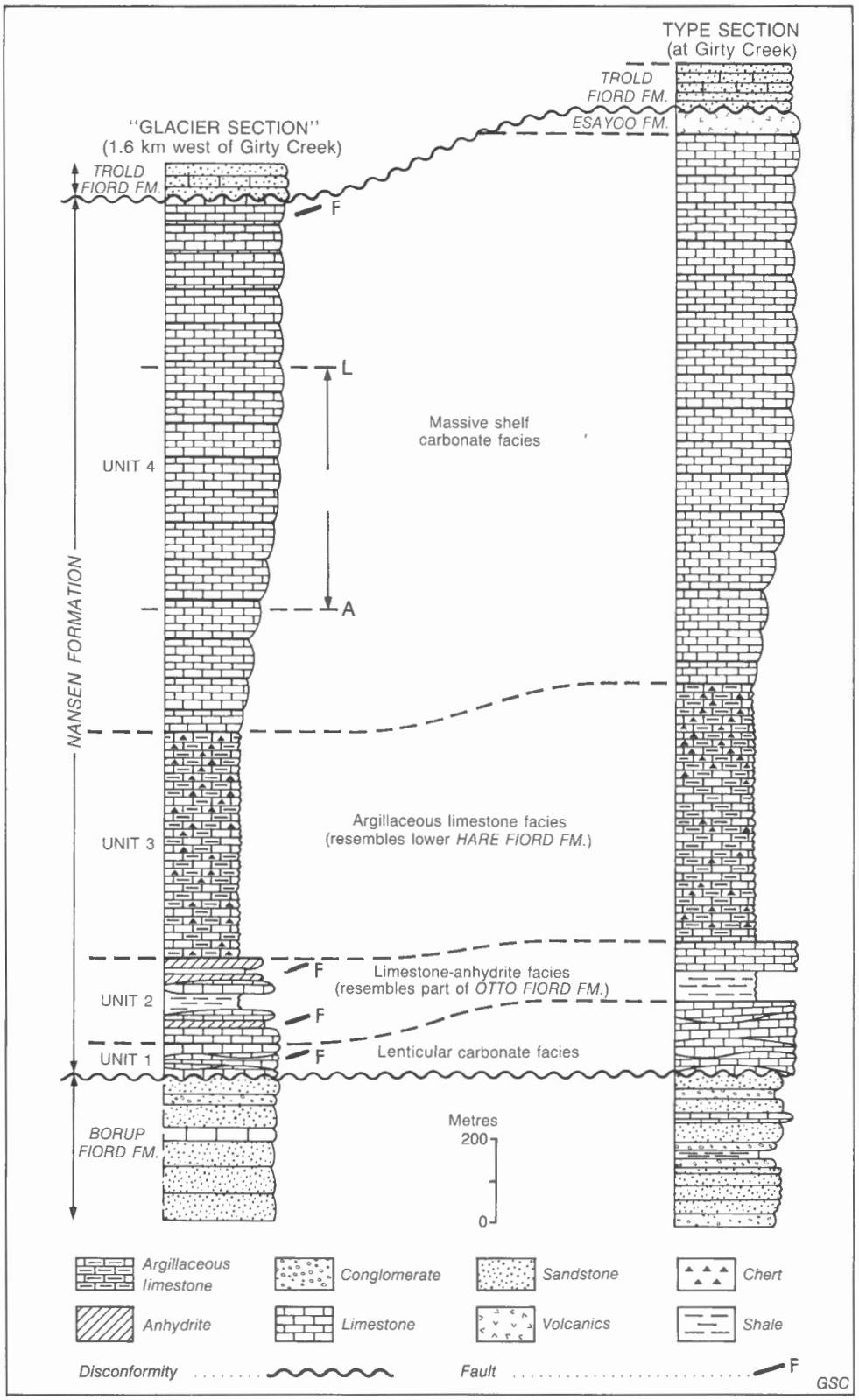


Figure 3. *Schematic lithostratigraphic summary of the type section of the Nansen Formation at Girty Creek on northern Ellesmere Island and a standard reference section, informally referred to as the "Glacier Section" 1.6 km to the west. For location of type section see Figures 1, 2. All fusulinaceans described in this report are from sequences "A to L" in Unit 4 in the "Glacier Section", 1105–1649 m above the base of the Nansen Formation. Thorsteinsson (1974) reported* ***Triticites*** *sp. and* ***Fusulinella*** *sp. from the type section.*

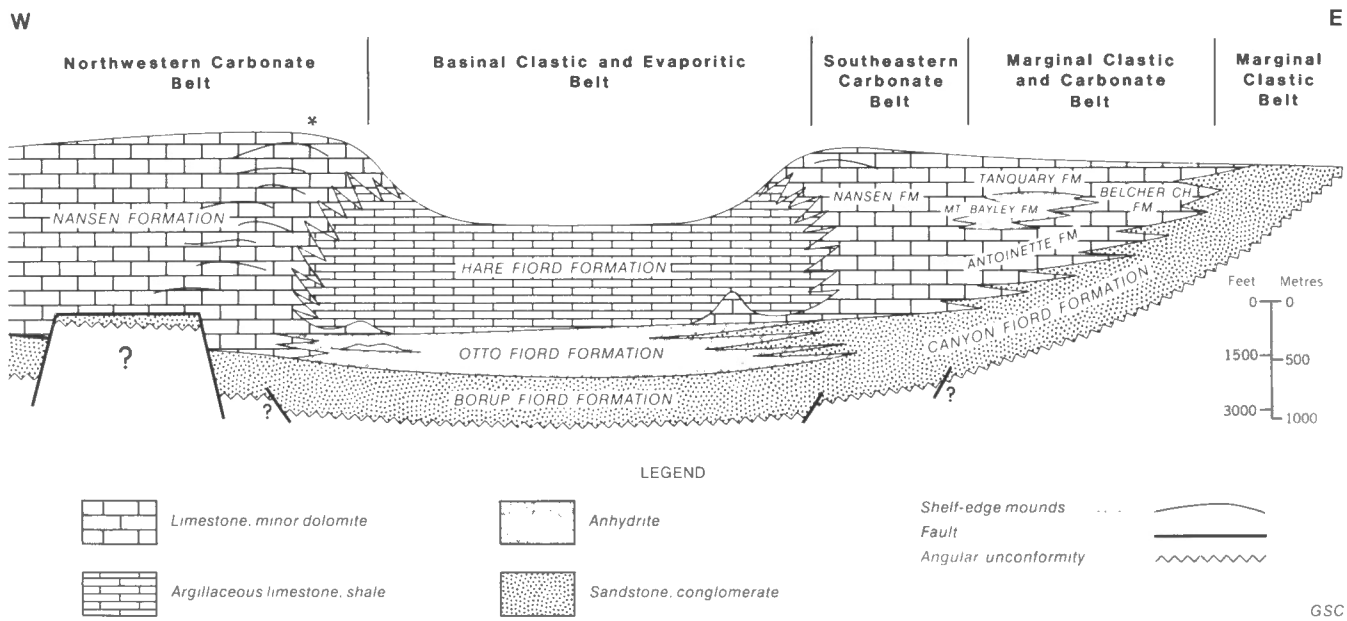


Figure 4. Schematic restored section for Carboniferous to Lower Permian lithofacies across Sverdrup Basin in the vincinity of Hare Fiord, northern Ellesmere Island. Section length (from W to E) approximates 160 km. The Nansen Formation is the sole formation in the Northwestern and Southeastern Carbonate belts. Location of the type section of the Nansen Formation is marked by an asterisk (*).

foraminifers and algae, and the enigmatic encruster *Tubiphytes*, present in most of the samples, are detached from an uncalcified or poorly calcified component of the benthonic biota. *Palaeoaplysina* is recorded in the Desmoinesian succession as strongly abraded and micritized plate fragments.

Twelve distinctive lithological subunits are apparent in this thick to massively bedded Desmoinesian interval in Unit 4 and these, identified from Subunit "A" at the bottom of the interval to Subunit "L" at the top (Figs. 3, 5) are summarized in the following. The lowest subunit (A) conformably overlies probable lower Moscovian (Atokan) strata. As also indicated under the heading "Fusulinacean zones", which follows, our collections are sparse directly beneath Subunit A and, accordingly, the presence of Desmoinesian strata below Subunit A cannot be precluded. The highest subunit (L) is conformably overlain by post-Moscovian Upper Carboniferous (Kasimovian, Missourian) strata.

Subunit L (37 m/121 ft. thick)

The lower part of this sequence consists of abraded, micritized, phylloid algal and foraminiferal packstone to grainstone, grading up into the middle part of the succession with an increase in fusulinaceans in a foraminiferal packstone, followed by increased phylloid algal plates in mould-collapse fabrics, with associated *Tubiphytes* and foraminifers. The top of the sequence is characterized by foraminiferal, abraded and micritized algal plate, crinoidal packstone, with some submarine cement (GSC locs. C-31780–C-31792). The following fusulinaceans were found: *Beedeina elegans decurta* Rauser and Safonova, *Fusulinella cabezasensis* Ross and Sabins, *F. eopulchra* Rauser, *F. fugax* Thompson, *F. nevadensis* Verville, Thompson, and Lokke, *F. pokojamiensis* Lebedeva, *F. subpulchra* Putrja, *F. subpulchra submesopachis* Putrja, *F. zelleri* Thompson, *F.* sp. A, *F.* sp B, and *Pseudoendothyra preobrajenskyi* (Dutkevich), *P.* sp. A.

Subunit K (49 m/161 ft. thick)

Light grey weathering packstone. Interval rather poorly sampled; no fusulinaceans found.

Subunit J (64 m/210 ft. thick)

The lower part of this sequence is characterized by submarine-cemented, abraded and micritized-rim, coarse phylloid algal and foraminiferal grainstone to boundstone, grading up through a similarly textured packstone, and capped by a finer, less submarine-cemented, fusulinacean, small foraminiferal crinoid, and micritic peloid packstone (GSC locs. C-31744–C-31759). The following fusulinaceans were found: *Fusulinella*

cabezasensis Ross and Sabins, *F. famula* Thompson, *F. nevadensis* Verville, Thompson, and Lokke, *F. subpulchra submesopachis* Putrja, and *F. zelleri* Thompson.

Subunit I (66 m/216 ft. thick)

The lower part of this sequence is characterized by submarine-cemented, fusulinacean and bioclastic wackestone to algal plate and foraminifer cemented boundstone, with a few abraded and micritized phylloid algal plates (GSC locs. C-31713–C-31727). The following fusulinaceans were found: *Fusulinella cabezasensis* Ross and Sabins, *F. devexa* Thompson, *F. eopulchra* Rauser, *F. famula* Thompson, *F. fugax* Thompson, *F. nevadensis* Verville, Thompson, and Lokke, *F. subcolaniae decurta* Reitlinger, *F. subpulchra* Putrja, *F. subpulchra submesopachis* Putrja, and *F. taishakuensis* Sada.

Subunit H (56 m/184 ft. thick)

The base of this sequence is characterized by foraminiferal, bryozoan, and crinoidal wackestone to packstone with minor submarine cement, grading up into fusulinacean grainstone to wackestone, and then into submarine-cemented boundstone where the volume of submarine cement is a significant percentage of the rock. The sequence is capped by foraminiferal, algal, crinoid, and micritized grain packstone, with micritized algal plates as a common component (GSC locs. C-31680–C-31701). The following fusulinaceans were found: *Fusulinella cabezasensis* Ross and Sabins, *F. daviesi* n. sp., *F. devexa* Thompson, *F. eopulchra* Rauser, *F. mosquensis* Rauser and Safonova, *F. nevadensis* Verville, Thompson, and Lokke, *F. praecolaniae* Safonova, *F. pseudobocki* Lee and Chen, *F. pseudobocki ovoides* Rauser, *F. rara* Schlykova, *F. subelliptica* n. sp., *F. subpulchra submesopachis* Putrja, *F. taishakuensis* Sada, *F. thorsteinssoni* n. sp., *F. zelleri* Thompson, *Schubertella gracilis* Rauser, and *S. lata elliptica* Sheng.

Subunit G (38 m/125 ft. thick)

The lower part of this sequence is a coarse, micritized algal plate, bioclastic, and submarine rim-cemented rudstone with large, dark, micritized grains. This fabric grades up into a slightly silty, very fine, sandy fusulinacean, peloidal, and fine bioclastic wackestone (GSC locs. C-31671–C-31676). The following fusulinaceans were found: *Fusulinella jamesensis* Thompson, Pitrat, and Sanderson, *F. subpulchra submesopachis* Putrja, *F. thorsteinssoni* n. sp., *Neostaffella sphaeroidea* (Ehrenberg), *Ozawainella pseudoangulata* (Putrja), *O. turgida Sheng, Staffella pseudosphaeroidea* Dutkevich, *Wedekindellina uralica longa* (Dutkevich), and *W.* sp. A.

Subunit F (69 m/226 ft. thick)

The lower part of this sequence is composed of recrystallized, probably submarine-cemented foraminifers, fine micritic grain, *Tubiphytes*-encrusting grain, algal packstone, grading up into massively submarine-cemented foraminiferal, phylloid algal plate floatstone. Foraminifers, including fusulinaceans, brachiopods, fenestellid bryozoans, and crinoids also are present in the mid-part of this succession. The top is characterized by phylloid algal floatstone with algal-plate, mould-collapse fabrics. Some recrystallized submarine cement may be present. This subunit appears to be a shallowing-upward sequence with an increasing abundance of phylloid algae toward the top, but possibly without the uppermost capping units of micritized grain grainstone at the top (GSC locs. C-31647–C-31669). The following fusulinaceans were found: *Fusulinella devexa* Thompson, *F. fugax* Thompson, *F. jamesensis* Thompson, Pitrat and Sanderson, *F. rara* Schlykova, *F. schwagerinoides* (Deprat), *F. subelliptica* n. sp., *F. subpulchra submesopachis* Putrja, *F. taishakuensis* Sada, *F. thorsteinssoni* n. sp., *F. zelleri* Thompson, *Millerella* sp. cf. *M. porcupinensis* Ross, *Neostaffella khotunensis* Rauser, *N. subquadrata* Grozdilova and Lebedeva, *N. sphaeroidea* (Ehrenberg), *Ozawainella mosquensis* Rauser, *O. turgida* Sheng, *Schubertella obscura mosquensis* Rauser, *Staffella mochaensis* van Ginkel, *Wedekindellina lata* Thompson, *W. matura* Thompson, *W. pulchra* n. sp., *W. uralica longa* (Dutkevich), and *W.* sp. A.

Subunit E (53 m/174 ft. thick)

This sequence includes very coarse, abraded, and micritized phylloid algal rudstone with submarine cement. The clasts include a few abraded and micritized *Palaeoaplysina* plates. Poorly preserved representatives of *Fusulinella* sp. indet., *Ozawainella* sp. indet., and *Wedekindellina* sp. indet were found in this interval, but have not been described in this report.

Subunit D (35 m/115 ft. thick)

The base of this sequence is characterized by a foraminiferal, micritized grain, and crinoidal packstone, which grades up into a foraminiferal, phylloid algal, and *Tubiphytes* packstone. The top is a foraminiferal, phylloid algal floatstone with a subpeloidal micritic

SYSTEM
MIDDLE CARBONIFEROUS
STAGE
UPPER MOSCOVIAN (DESMOINESIAN)
SUBSTAGE
MYACHKOVIAN
ZONE
Fusulinella eopulchra Zone
PARA-SEQUENCE
L
K
J
I
H
C 31792(1647 9)
C 31790(1635.7)
C 31789(1632 6)
C 31788(1629.6)
C 31787(1628 7)
C 31786(1628 0)
C 31784(1620 4)
C 31783(1617.4)
C 31780(1613 1)
C 31759(1548.8)
C 31757(1542.7)
C 31746(1529.0)
C 31745(1527.4)
C 31744(1523.9)
C 31727(1484.8)
C 31726(1481.7)
C 31721(C 31722)(1475.6)
C 31715(1461.9)
C 31713(1455.5)
C 31701(1434.5)
C 31697(1428.7)
C 31696(1426.2)
C 31695(1422.2)
C 31694(1422.0)
C 31693(1420.7)
C 31692(1416.2)
C 31689(1401.5)
C 31688(1398.8)
C 31687(1396.3)
C 31685(1390.2)
C 31683(1387.2)
C 31681(1381.1)
C 31680(1379.3)

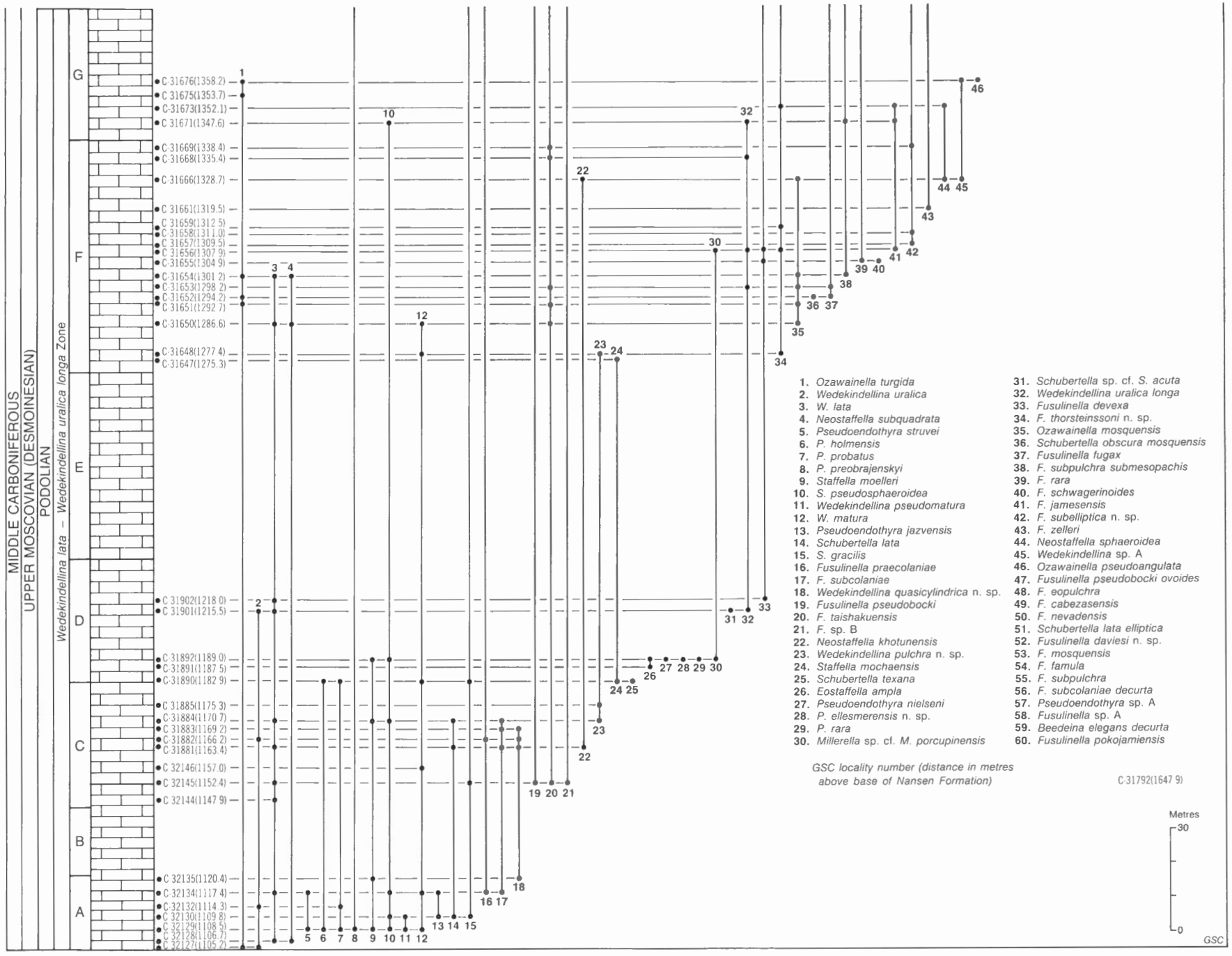


Figure 5. Range chart for upper Moscovian (Desmoinesian) fusulinaceans from the type area of the Nansen Formation on northern Ellesmere Island.

matrix characterized by phylloid algal, mould-collapse fabrics. Some submarine cement may be present. Overall, this succession is similar to others where phylloid algal plates are more common in the upper part, but may not represent a complete shallowing-upward succession, because it lacks the upper grainstone (GSC locs. C-31890–C-31902). The following fusulinaceans were found: *Eostaffella ampla* (Thompson), *Fusulinella devexa* Thompson, *Millerella* sp. cf. *M. porcupinensis* Ross, *Pseudoendothyra ellesmerensis* n. sp., *P. holmensis* (Ross and Dunbar), *P. nielsoni* (Ross and Dunbar), *P. probatus* (Durkina), *P. rara* (Grozdilova), *Schubertella gracilis* Rauser, *S. texana* (Thompson), *S.* sp. cf. *S. acuta* Rauser, *Staffella mochanensis* van Ginkel, *S. moelleri* Ozawa, *S. pseudosphaeroidea* Dutkevich, *Wedekindellina lata* Thompson, *W. matura* Thompson, *W. uralica* (Dutkevich), and *W. uralica longa* (Dutkevich).

Subunit C (36 m/(117 ft. thick)

The lower part of this sequence is composed of abraded algal bioclasts, *Tubiphytes*, and crinoidal and foraminiferal grainstones, with calcite spar cement. The most common abraded grains include phylloid algal plates. This lower interval grades up into a submarine-cemented foraminiferal packstone to wackestone with phylloid algal mould-collapse fabrics. The top of the sequence is a recrystallized (and possibly an originally submarine-cemented) coarse, micritized bioclastic, crinoidal, algal, foraminiferal grainstone to packstone. Overall, this succession closely resembles a relatively shallow, but shallowing-upward or shoaling parasequence (GSC locs. C-32144–C-31885). The following fusulinaceans were found: *Fusulinella praecolaniae* Safonova, *F. pseudobocki* Lee and Chen, *F. subcolaniae* Reitlinger, *F. taishakuensis* Sada, *F.* sp. B., *Neostaffella khotunensis* Rauser, *Schubertella gracilis* Rauser, *S. lata* Lee and Chen, *Staffella moelleri* Ozawa, *S. pseudosphaeroidea* Dutkevich, *Wedekindellina lata* Thompson, *W. matura* Thompson, *W. pulchra* n. sp., *W. quasicylindrica* n. sp., and *W. uralica* (Dutkevich).

Subunit B (21 m/69 ft. thick)

No fusulinaceans were collected from this sequence, which contains submarine-cemented, subpeloidal, phylloid algal, foraminiferal wackestone to floatstone, with submarine cement infilling phylloid algal moulds.

Subunit A (20.7 m/68 ft. thick)

This sequence includes a variably submarine-cemented, foraminiferal, algal wackestone to packstone (to cement boundstone) at the base, grading up through crinoidal, foraminiferal packstone, to a micritized bioclast (mollusc, algal plate), foraminiferal grainstone to submarine-cemented boundstone. Micritized grains and grainstone textures are consistent with the upper part of shallowing-upward sequences (GSC locs. C-32121–C-32135). The following fusulinaceans were found: *Fusulinella praecolaniae* Safonova, *F. subcolaniae* Reitlinger, *Neostaffella subquadrata* Grozdilova and Lebedeva, *Ozawainella turgida* Sheng, *Pseudoendothyra holmensis* (Ross and Dunbar), *P. jazvensis* (Grozdilova and Lebedeva), *P. preobrajenskyi* (Dutkevich), *P. probatus* (Durkina), *P. struvei* (Moeller), *Schubertella gracilis* Rauser, *S. lata* Lee and Chen, *Staffella moelleri* Ozawa, *S. pseudosphaeroidea* Dutkevich, *Wedekindellina lata* Thompson, *W. matura* Thompson, *W. pseudomatura* Ross and Tyrrell, *W. uralica* (Dutkevich), and *W. quasicylindrica* n. sp.

PALEOENVIRONMENT

During Desmoinesian time, carbonate strata in the Nansen type area were deposited between a shallow water shelf to the north and a slightly deeper shelf slope to the south. Changes in deposition from shelf to slope are clearly indicated by changes in the character of carbonate rocks and their fossils.

Carbonates from the relatively shallow water shelf are mainly grainstone with calcite spar cement, phylloid algal–foraminiferal packstone, foraminiferal–algal–crinoidal–micritized grain packstone, foraminiferal–bryozoan–crinoidal wackestone and oolite. In general, oolites are deposited in shallow water environments under high energy conditions, such as strong and continued wave action. Grainstone with calcite spar cement, foraminiferal–algal–crinoidal–micritized grain packstone and phylloid algal–foraminiferal packstone are formed in shallow water in a moderately high to high energy environment.

Carbonates from the shelf slope include wackestone, packstone, grainstone, rudstone, boundstone, and floatstone, with spectacular submarine cement fabrics. Submarine diagenetic fabrics are preferentially developed in shelf margin, reefal, and shelf foreslope to toe-of-slope environments. It is worth noting that reefs and mounds are common in shelf margin and shelf slope positions in the Desmoinesian interval. They were constructed mainly of phylloid algae and plates of *Palaeoaplysina*, and are characterized by pervasive submarine cements in platestone textures.

The fusulinacean faunas in the shallow water shelf environment are similar to those in the slightly deeper shelf slope and include representatives of *Beedeina*, *Eostaffella*, *Fusulinella*, *Millerella*, *Neostaffella*, *Ozawainella*, *Schubertella*, *Staffella*, and *Wedekindellina*. *Fusulinella* is the most common form; at least 25 species and subspecies of the genus (41.7% of the total fusulinacean fauna) have been recovered. Conversely, *Beedeina* is rare and only one species is known from the Desmoinesian succession.

It is of particular interest that *Beedeina* and *Fusulina*, which are abundant and diverse in tropical and subtropical areas characterized by warm, shallow, and open marine conditions, are of exceedingly low diversity in Arctic areas such as Ellesmere Island, Ward Hunt Island, Greenland, Spitsbergen, and probably Alaska, as well as the Yukon Territory and central British Columbia. As far as we know, upper Moscovian (Desmoinesian) strata are known to contain only two species of *Beedeina* in central British Columbia and Greenland, and only one species on Ellesmere and Ward Hunt islands. Moreover, only one species of *Fusulina* is known from Alaska and only a few species from Ellesmere Island. Neither *Beedeina* nor *Fusulina* has been reported from upper Moscovian strata in Spitsbergen.

During Desmoinesian time the paleolatitudes for the present Arctic area (Fig. 6) may have been between 25 to 40 north (Smith et al., 1981; Ross and Ross, 1985; Lin, 1987). It appears that the relatively cool temperature of sea water in the Arctic area was not favourable for the general dispersal of species of *Fusulina* and *Beedeina*. Evidently, representatives of *Fusulinella*, *Wedekindellina*, *Pseudoendothyra*, *Schubertella*, *Neostaffella*, *Ozawainella*, and *Staffella* were better adapted than other genera to the warm temperature, latitudinal climatic zone that characterized the Arctic at that time.

To conclude, the lithological and paleontological character of Desmoinesian strata in the type area of the Nansen Formation suggest deposition in a transitional "belt" between shallow water shelf and shelf slope. As a result of eustatic sea-level fluctuations, the sedimentary environment changed continuously from early to late Desmoinesian time, and repetitive depositional cycles occurred as deposition shifted from the shallower water shelf, toward the shelf margin, and onto the shelf slope. The temperature of the water was probably slightly cooler than that of the Tethys, Ural, and Midcontinent seaways; perhaps warm temperate in contrast to tropical and subtropical (Fig. 6).

FUSULINACEAN ZONES

Fusulinaceans are abundant and widely distributed throughout the Desmoinesian (upper Moscovian) interval of the Nansen Formation in the type area. The fauna is characterized by numerous species of *Fusulinella*, *Pseudoendothyra*, and *Wedekindellina*, and a species of *Beedeina*; *Fusulina* is absent. Two informal range zones can be distinguished. In ascending order, they are the *Wedekindellina lata–Wedekindellina uralica longa* zone, and the *Fusulinella eopulchra* zone.

Wedekindellina lata–Wedekindellina uralica longa zone

This zone includes Subunits A through G in the type area of the Nansen Formation (Fig. 5). Its base is determined by the first occurrence of *Wedekindellina lata* and/or *W. uralica*, and its top by the first occurrence of *Fusulinella eopulchra*. It is characterized by a diverse and abundant assemblage of fusulinaceans, including 46 species, subspecies, and unnamed species of 9 genera, in which 33 species and subspecies are restricted to the present zone and 13 species, subspecies, and unnamed species extend into the upper zone. The underlying zone in the Nansen type section has not yet been studied in detail.

The genus *Wedekindellina* is the most important taxon in this zone, and is represented by eight species and subspecies. The dominant species, *Wedekindellina lata* Thompson, is a highly significant form originally described from the middle Desmoinesian succession on Ward Hunt Island by Thompson (1961). *Wedekindellina uralica longa* (Dutkevich), another dominant form, was first described by Dutkevich (1934) from the upper part of the Moscovian succession on the western slope of the Middle Urals, U.S.S.R. Since then, it has been reported from the following localities and horizons: the Podolsky to Myachkovsky horizons on the Russian Platform (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a), the Sulsky Horizon (Myachkovian) in northern Timan (Lebedeva, 1966a), the *Fusulina* Zone of the Passage Beds in Spitsbergen (Forbes, 1960), and the *Wedekindellina* Zone in northeast Greenland (Ross and Dunbar, 1962). *Wedekindellina uralica* (Dutkevich) is a common species in the Podolsky to Myachkovsky horizons in the Russian Platform (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a; Lebedeva, 1966a) and in the Podolsky horizon in the Urals (Chuvashov et al., 1984). *Wedekindellina matura* Thompson was reported by Thompson (1945a) from the *Fusulina* Zone of the Younghall Formation in northwestern Colorado. According to Ross and Tyrrell (1965), *W. pseudomatura*

Ross and Tyrrell is known to occur in the *Fusulina–Beedeina* Range Zone in Arizona where it is associated with *Wedekindellina euthysepta* (Henbest), *Beedeina pattoni* Needham, and *B. mescalensis* Ross and Tyrrell.

Fusulinella dominates the *Wedekindellina lata–Wedekindellina uralica longa* zone, where it is represented by 14 species, subspecies, and unnamed species. Most of these forms extend upward into the overlying *Fusulinella eopulchra* zone, and only the three following species are restricted to this lower zone. *Fusulinella subcolaniae* Reitlinger occurs in the uppermost part of the Kashirsky horizon in the Russian Platform (Reitlinger, 1961). *Fusulinella schwagerinoides* (Deprat) is a widespread species in the Ural and Tethyan realms and occurs in the upper part of Huanglong and Penchi formations, the upper part of the Podolsky and Myachkovsky horizons and their corresponding horizons in China, the Soviet Union, and northern Vietnam (Deprat, 1913; Lee, 1927; Lee et al., 1930; Reitlinger, 1961; Sheng et al., 1976; Chuvashov et al., 1984). *Fusulinella jamesensis* Thompson, Pitrat and Sanderson was originally reported from the Cache Creek Group in central British Columbia (Thompson et al., 1953). Later, it was found in the upper part of the *Fusulinella* Zone of the Hida Massif, Japan (Igo, 1957).

The other species of *Fusulinella* in this zone are distributed throughout the Desmoinesian (upper Moscovian) interval of the Nansen Formation in the type area, and most of them are also common species in upper Moscovian or Desmoinesian successions elsewhere in the Soviet Union, the United States, Canada, China, and Japan. For instance, *Fusulinella praecolaniae* Safonova (=*F. vozhgalensis* Safonova) is a zonal guide fossil for the *Fusulinella colaniae–F. vozhgalensis–Fusulina kamuensis* Zone from the Podolsky horizon in the Soviet Union (Ivanova et al., 1979). It also occurs in the Aoqu Group of the Middle Carboniferous in Tibet (Wang et al., 1981). *Fusulinella pseudobocki* Lee and Chen is widely distributed in the upper part of the Huanglong Formation, and in the lower part of the Myachkovsky horizon and equivalent beds in China, Japan, and the Soviet Union (Lee et al., 1930; Toriyama, 1947; Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Sheng, 1958; Grozdilova and Lebedeva, 1960; Bogush, 1963; Sheng et al., 1976; Lin et al., 1977). *Fusulinella rara* Schlykova has been reported from the Podolsky to Myachkovsky horizons in the Russian Platform (Schlykova, 1948; Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b), the Sulsky horizon (Myachkovian) in northern Timan (Lebedeva, 1966a, b) and the Podolsky horizon in the Urals (Chuvashov et al., 1984). *Fusulinella subpulchra submesopachis* Putrja was described from the "L5" to "L6" units in the upper Moscovian sequence in the Donbass in the Soviet Union.

Fusulinella taishakuensis Sada also occurs in the *Fusulinella* Zone of the Taishaku Limestone in western Japan (Sada and Yokoyama, 1970). *Fusulinella devexa* Thompson was first described from the Cuchillo Negro Formation in southern New Mexico (Thompson, 1948), and, later, it was regarded as an assemblage subzonal fossil in the lowermost part of the Assemblage Zone in Arizona by Ross and Sabins (1965).

Fusulinella zelleri Thompson is another important species described by Thompson (1961) from the middle Desmoinesian succession on Ward Hunt Island, where it occurs in association with *Wedekindellina lata, Neostaffella wardensis*, and *Beedeina huntensis*. *Fusulinella fugax* Thompson is one of the oldest known species of the genus and it ranges upward from the lower part of Middle Pennsylvanian (Thompson, 1948).

Neostaffella is represented by three species in the *Wedekindellina lata–Wedekindellina uralica longa* zone. Among them, *Neostaffella sphaeroidea* is a particularly important form. It has a rather limited stratigraphic range within the Podolsky and Myachkovsky horizons and correlative beds, but it has a wide geographic distribution in the Soviet Union, China, Japan, Greenland, Spitsbergen, and Spain (Lee, 1927, Lee and Chen, 1930; Grozdilova and Lebedeva, 1950; Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Igo, 1957; Sheng, 1958; Forbes, 1960; Ross and Dunbar, 1962; Ginkel, 1965; Lebedeva, 1966a; Chuvashov et al., 1984). The two others are long-ranging species; *N. subquadrata* Grozdilova and Lebedeva is known from the Vereisky and Kashirsky horizons (Grozdilova and Lebedeva, 1950; Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Chuvashov et al., 1984) and *N. khotuensis* Rauser from the Kashirsky and Podolsky horizons in the Soviet Union (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Chuvashov et al., 1984) and equivalent strata in North China (Sheng, 1958).

In addition to the four genera mentioned above, eight species of *Pseudoendothyra*, three species of *Staffella*, three species of *Ozawainella,* and five species of *Schubertella* also occur in this zone. Most of these species, however, are long ranging and are only of minor value for age determination. For instance, *Pseudoendothyra probatus* (Durkina), *P. jazvensis* (Grozdilova and Lebedeva), *P. rara* (Grozdilova), and *P. struvei* (Moeller) are known from strata as old as late Early Carboniferous or early Middle Carboniferous in the Soviet Union (Moeller, 1879; Grozdilova and Lebedeva, 1950; Rauser-Chernoussova et al., 1951; Durkina, 1959;

Rosovskaya, 1963). *Pseudoendothyra preobrajenskyi* (Dutkevich) has been reported from the Kashirsky to Myachkovsky horizons in the Russian Platform and in the Urals (Dutkevich, 1934; Rauser-Chernoussova et al., 1951; Grozdilova and Lebedeva, 1954, 1961). *Pseudoendothyra nielseni* (Ross and Dunbar) and *P. holmensis* (Ross and Dunbar) were described from the *Profusulinella priscoidea* Zone in Greenland (Ross and Dunbar, 1962). Moreover, *Eostaffella ampla* (Thompson) and *Millerella porcupinensis* Ross have been reported from the *Millerella* Zone in Kansas, and from the *Pseudostaffella yukonensis* Assemblage Zone in northern Yukon Territory, respectively (Thompson, 1944, 1948; Ross, 1967b).

Staffella pseudosphaeroidea Dutkevich was originally described from the Upper Carboniferous in the western slope of the Middle Urals (Dutkevich, 1934). It also occurs in Bashkirian strata in the Russian Platform (Rauser-Chernoussova et al., 1951) and in the Myachkovsky horizon in the Urals (Chuvashov et al., 1984), from the *Profusulinella priscoidea* Zone to the *Wedekindellina* Zone of the Lower Marine Group in Greenland (Ross and Dunbar, 1962), and from the *Profusulinella* Zone to the base of B subzone of the *Fusulinella* Zone in Spain (van Ginkel, 1965). *Staffella mochaensis* van Ginkel occurs in the *Protriticites* Zone of the Cristobal Formation in Spain (van Ginkel, 1965). *Staffella moelleri* Ozawa was first reported from the Akiyoshi Limestone at Akiyoshi, Japan (Ozawa, 1925), and subsequently, from the Bashkirian to Myachkovian horizons in the Soviet Union (Rauser-Chernoussova et al., 1951; Chuvashov et al., 1984) and in pebbles from the Upper Permian conglomerates of the northern part of Itsnkaichi, Tokyo, Japan (Toriyama, 1958).

Ozawainella pseudoangulata (Putrja) was first reported from the Kashirsky to Myachkovsky horizons in the Russian Platform and the Urals (Putrja 1939, 1956; Rauser-Chernoussova et al., 1951) but it also occurs in the *Fusulinella–Fusulina* Zone of Sinkiang, China (Chang, 1961). *Ozawainella mosquensis* (= *O. vozhgalica* Safonova) is a widespread species; it occurs from the Vereisky to Myachkovsky horizons in the Russian Platform (Rauser-Chernoussova et al., 1951), in the *Fusulina quasicylindrica* Subzone of the *Fusulinella–Beedeina* Zone near Nanjing in South China (Sheng et al., 1976), in the Penchi Formation in North China (Sheng, 1958) and from the *Profusulinella priscoidea* Zone to *Wedekindellina* Zone in Greenland (Ross and Dunbar, 1962). *Ozawainella turgida* Sheng (= *O*? *arctica* Thompson) is a common species in the Penchi Formation of North China (Sheng, 1958), and is also known from the middle Desmoinesian succession on Ward Hunt Island (Thompson, 1961) and from the *Profusulinella prisca timanica* Zone in North Thailand (Igo, 1972).

Schubertella texana (Thompson) and *S. lata* Lee and Chen are long-ranging and widespread species. The former occurs in the upper part of the Marble Falls Limestone in Texas (Thompson, 1947), in the Kashirsky horizon in Russian Platform (Rauser-Chernoussova et al., 1951), and at the top of subzone B of the *Profusulinella* Zone in Spain (van Ginkel, 1965). The latter occurs in the Huanglong Limestone and in the Penchi Formation in China (Lee and Chen, 1930; Sheng, 1958), from the Kashirsky to the Myachkovsky horizons in the Russian Platform and the Donetz Basin (Rauser-Chernoussova et al., 1951; Putrja, 1956), from the *Profusulinella* Zone to the B subzone of the *Fusulinella* Zone in Spain (van Ginkel, 1965), and from the upper part of the *Fusulinella* Zone of the Hida Massif and from the "It 1" to "It 2" zones of western Shikoku in Japan (Igo, 1957; Ishii, 1962). *Schubertella gracilis* Rauser and *S. acuta* Rauser range from the Vereisky to Podolsky horizons in the Russian Platform (Rauser-Chernoussova et al., 1951), but *S. acuta* is also known in the Penchi Formation in North China (Han, 1980). *Schubertella obscura mosquensis* Rauser was first reported from the Bashkirian to Kashirian succession in the Russian Platform (Rauser-Chernoussova et al., 1951), and subsequently from the top of subzone A in the *Profusulinella* Zone in Spain (van Ginkel, 1965).

Although this zone contains some species that flourished in early Moscovian or even earlier, in Bashkirian or possibly in Early Carboniferous time, the majority of species are Podolian to early Myachkovian; that is, early Desmoinesian species. Therefore, the *Wedekindellina lata–Wedekindellina uralica longa* zone is correlated with the upper Moscovian (Podolian), which is equivalent to the lower Desmoinesian.

It is worth noting that directly below the *Wedekindellina lata–Wedekindellina uralica longa* zone; that is, for a few hundred metres below the 1105 m level in the "Glacier Section" of the Nansen Formation (Fig. 3), our fusulinacean collections are sparse. Nevertheless, a few scattered, rather primitive representatives of *Wedekindellina* occur in that interval. Because *Wedekindellina* does not occur in pre-Podolian strata in the Soviet Union, it is entirely possible that future studies will show that Podolian, and therefore Desmoinesian, strata might extend a considerable stratigraphic distance, perhaps a few hundred metres below the 1105 m limit suggested in this report. Nevertheless, we are of the opinion that primitive forms of *Wedekindellina* occur in the lower Moscovian (that is, pre-Podolian strata in the Nansen Formation), and that the lowest Podolian strata in the Nansen Formation are recognized by abundant and diverse *Wedekindellina*, particularly abundant *W. lata, W. uralica,* and *W. uralica longa*.

Fusulinella eopulchra zone

This zone is equivalent to beds H through L in the type area of the Nansen Formation (Fig. 5), with the lower boundary marked by the first occurrence of *Fusulinella eopulchra* and the upper boundary by the first occurrence of *Pseudofusulinella*. It is characterized by the occurrence of various species of *Fusulinella*, abundant both in numbers of individuals and variety of species, and a few species of *Beedeina, Pseudoendothyra*, and *Staffella*. *Wedekindellina, Neostaffella*, and *Fusulina* are exceedingly rare or absent. There are 27 species and subspecies belonging to four genera in this zone, of which 13 species and subspecies range up from the underlying *Wedekindellina lata–Wedekindellina uralica longa* zone. The *Fusulinella eopulchra* zone comformably overlies the *Wedekindellina lata–Wedekindellina uralica longa* zone and is conformably overlain by beds of Kasimovian age containing *Pseudofusulinella*.

Fusulinella is the predominant genus in the zone and it includes 22 species, subspecies, and unnamed species (about 81.5% of the total species composition of the entire zone). Eleven species and subspecies, however, extend upward from the underlying *Wedekindellina lata–Wedekindellina uralica longa* zone. The most common species, *Fusulinella eopulchra* Rauser, is well known from the Arctic, Ural, and Tethyan provinces, and occurs in the *Fusulinella bocki–Fusulinella eopulchra–Fusulina subcylindrica* Zone of the Myachkovsky horizon in the Russian Platform and in the Urals (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Chuvashov et al., 1984), from the Sulsky to Burkemsky horizons (Myachkovian) in central Timan (Lebedeva, 1966a, b), the Middle Carboniferous of Qinghai and Hubei provinces, China (Sheng and Sun, 1975; Lin et al., 1977), from the *Profusulinella priscoidea* Zone to the *Wedekindellina* Zone of the Lower Marine Group in northeastern Greenland (Ross and Dunbar, 1962), and the *Fusulina* Zone of the Passage Beds in Spitsbergen (Forbes, 1960). *Fusulinella pokojamiensis* Lebedeva is also a very important form and occurs at the top of the zone. In central Timan and the Urals, this species together with *F. bocki*, *F. eopulchra*, *F. praebocki*, *F. pseudobocki*, *F. pulchra*, *F. rara*, and *F. subpulchra*, form a distinctive fusulinacean fauna, representing the Myachkovian (Sulsky and Burkemsky horizons) (Lebedeva, 1966b; Chuvashov et al., 1984). *Fusulinella pseudobocki ovoides* Rauser and *F. mosquensis* Rauser are common species in the Ural and Tethyan provinces and occur in the Myachkovsky horizon of the Russian Platform, the Urals and Central Asia in the Soviet Union (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b; Bogush, 1963; Chuvashov et al., 1984), and in the upper part of the Huanglong Formation in south China (Sheng et al., 1976). *Fusulinella subcolaniae decurta* Reitlinger has been described from the Kashirsky to Podolsky horizons in the Russian Platform and the eastern slope of the Urals (Reitlinger, 1961; Chuvashov et al., 1984). *Fusulinella subpulchra* Putrja occurs from the Kashirsky to the Podolsky horizons in the eastern Donbas (Putrja, 1956), but it is restricted to the Sulsky and Burkemsky horizons (Myachkovian) in central Timan (Lebedeva, 1966b). *Fusulinella nevadensis* Verville, Thompson, and Lokke has been recorded from the middle Desmoinesian in Nevada. *Fusulinella famula* Thompson is known from the Cuchillo Negro Formation in southern New Mexico and from the *Beedeina hayensis* Subzone of the Horquilla Formation in the Gila Mountains of Arizona (Thompson, 1948; Ross et al., 1965; Ross, 1969a). *Fusulinella cabezasensis* Ross and Sabins has been reported from the upper part of the *Fusulinella* Zone in the Horquilla Limestone in southeastern Arizona (Ross and Tyrrell, 1965).

Beedeina is one of the stratigraphically and environmentally most important upper Moscovian (Desmoinesian) forms in the world, but in the type area of the Nansen Formation, only one species is known: *Beedeina elegans decurta* (Rauser and Safonova), which was originally described from the Myachkovsky horizon in the Russian Platform (Rauser-Chernoussova et al., 1951; Rauser-Chernoussova, 1961a, b).

In addition to these predominant forms, the *Fusulinella eopulchra* zone contains a few species of the long-ranging *Schubertella* and *Pseudoendothyra*. *Schubertella lata elliptica* Sheng occurs in the Penchi Formation of North China (Sheng, 1958). *Schubertella gracilis* Rauser and *Pseudoendothyra preobrajenskyi* (Dutkevich) range from the *Wedekindellina lata–Wedekindellina uralica longa* zone to the *Fusulinella eopulchra* zone.

According to the data mentioned above, it is clear that the most important forms in the *Fusulinella eopulchra* zone are common in Myachkovian (middle and upper Desmoinesian) strata in the Soviet Union, the United States of America, Greenland, Spitsbergen, China, and elsewhere. Accordingly, the age of the *Fusulinella eopulchra* zone should be considered equivalent to the Myachkovian substage (Figs. 5, 9, and Ivanova et al., 1979).

BIOGEOGRAPHIC PROVINCES

Upper Moscovian (Desmoinesian) fusulinaceans rapidly evolved and diversified into many specialized

genera and species. Many of these genera and species are restricted to specific geographic areas and formed several distinctive fusulinacean faunas (Ross, 1967a); indeed, we recognize four fusulinacean biogeographic provinces for Desmoinesian time (Fig. 6).

Arctic Province

The Arctic Province (Fig. 6) includes the Canadian Arctic Archipelago, Greenland, Spitsbergen, and possibly also the Yukon Territory and central British Columbia, although data from the last two regions are sparse. This province extends from the northern part of the Cordilleran Geosycline on the Canadian mainland northward through the Innuitian Orogen in the Canadian Arctic Islands to Spitsbergen on the Barents Shelf. The fusulinacean fauna is characterized by abundant species of *Fusulinella, Wedekindellina, Pseudoendothyra*, and *Neostaffella*. It is obvious that conditions at the time were not favourable for dispersal of *Fusulina* and *Beedeina*, and, accordingly, most species of these genera failed to reach this province. The fauna in this province could be termed the *Fusulinella–Wedekindellina–Neostaffella–Pseudoendothyra* provincial fauna. Desmoinesian fusulinaceans in this province were reduced in generic diversity and had relatively long-ranging species. Many of the species were closely related and form what may be considered species complexes.

Midcontinent–Andean Province

The Midcontinent–Andean Province has four distinct Middle Pennsylvanian fusulineacean zones based on the stratigraphic ranges of *Profusulinella*, *Fusulinella*, *Beedeina*, and, at the top, *Fusulina*, which in this province have only a slight overlap in their ranges. In other provinces, these genera are added consecutively to the faunal assemblage so that there, these genera have progressively overlapping ranges.

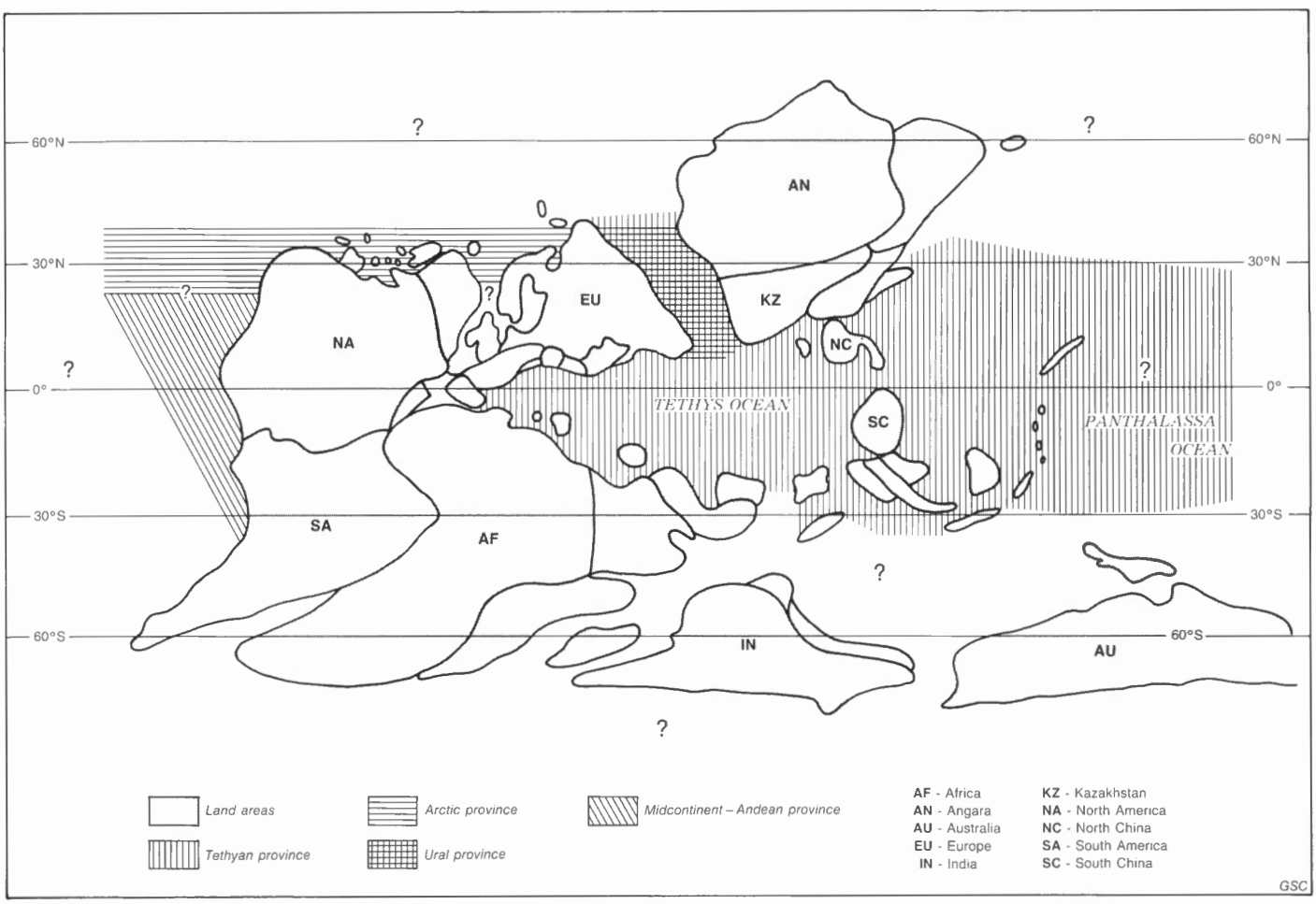


Figure 6. *Paleogeographic map showing the distribution of fusulinacean biogeographic provinces during late Middle Carboniferous (late Moscovian) time.*

In this province (Fig. 6), a distinctive fusulinacean fauna is represented by highly diverse and abundant *Fusulinella, Wedekindellina, Beedeina*, and *Fusulina*; however, *Neostaffella* and *Pseudoendothyra* are almost entirely lacking. This fauna is generally known as the *Fusulinella–Wedekindellina–Beedeina–Fusulina* provincial fauna. It is considered to be related to the *Fusulinella–Wedekindellina–Neostaffella–Pseudoendothyra* fauna in the Arctic Province, because a number of similar species, including *Fusulinella alta, F. cabezasensis, F. famula, F. nevadensis, Eostaffella ampla, Wedekindellina matura, W. pseudomatura*, and others occur in both. This province seems to be restricted to central North America and the Andean Mountain region, corresponding approximately to the southern part of the Cordilleran and Andean geosynclines.

Tethyan Province

This province (Fig. 6) is situated from 15°S to 15°N of the paleoequator and occupies a large territory in southern Europe, Central Asia, East Asia, and Southeast Asia, corresponding approximately to the Tethyan and Cathaysian geosynclines. The fusulinacean fauna in this province is marked by diverse and abundant *Fusulinella, Neostaffella, Beedeina*, and *Fusulina*, and by rare *Pseudoendothyra*; hence, the designation *Fusulinella–Neostaffella–Beedeina–Fusulina* provincial fauna. In the northern margin of the province, however, a few representatives of *Wedekindellina* occur. It is worth noting that some species in this fauna, such as *Fusulinella eopulchra, F. pseudobocki, F. schwagerinoides, F. taishakuensis, Neostaffella sphaeroidea, Ozawainella turgida, Schubertella lata, S. lata elliptica*, and others, also occur in the Arctic Province, suggesting that the Arctic and Tethyan provinces were connected during late Moscovian (Desmoinesian) time.

Ural Province

This province (Fig. 6) is situated between the Arctic and Tethyan provinces, embracing the Russian Platform, the Urals, and the Donetz Basin, and coincides approximately with the Uralian Geosycline. This remarkably diverse and abundant fauna is referred to as the *Fusulinella–Wedekindellina–Neostaffella–Pseudoendothyra–Beedeina–Fusulina* provincial fauna. With the exception of *Fusulinella, Ozawainella*, and *Schubertella*, typical Arctic genera such as *Wedekindellina* and *Pseudoendothyra*, and Tethyan genera such as *Beedeina, Fusulina*, and *Neostaffella* are included, indicating that this fauna is closely related to both the Arctic and Tethyan faunas. Thus, the faunas in the Ural Province indicate a transition between Arctic and Tethyan faunas. Accordingly, this province can be considered transitional between the Arctic and Tethyan provinces.

The distribution of fusulinaceans in the Nansen Formation shows that the four fusulinacean provinces were not completely isolated during late Moscovian (Desmoinesian) time; their patterns seem to reflect differentiation on the basis of geographic climatic zones. Accordingly, the Arctic Province probably represents the warm temperate latitudinal climatic zone; the Midcontinent–Andean Province, a western tropical zone; the Ural Province, a subtropical climatic zone; and the Tethyan Province, an eastern tropical and subtropical climatic zone.

CORRELATION

Union of Soviet Socialist Republics (Figs. 7-9)

Upper Moscovian strata are well developed and widely distributed in the Russian Platform, the Donetz Basin, the Urals, and Middle Asia. The Moscovian stratotype occurs in the Moscow Basin, where the upper Moscovian substage was subdivided by Ivanova (1926) into the Podolsky horizon below and the Myachkovsky horizon above. The Podolsky horizon corresponds to the *Fusulinella colaniae–Fusulinella vozhgalensis–Fusulina kamensis* fusulinacean Zone. *Fusulinella vozhgalensis* Safonova (=*F. praecolaniae* Safonova) was also found in the type area of the Nansen Formation. In addition to these species, *Neostaffella sphaeroidea* (Ehrenberg), *Wedekindellina uralica longa* (Dutkevich), *W. uralica* (Dutkevich), *Fusulinella schwagerinoides* Deprat, and others were also described from the Podolsky horizon in the U.S.S.R. (Rauser-Chernoussova et al., 1951; Reitlinger, 1961; Chuvashov et al., 1984).

The Myachkovsky horizon is characterized by the fusulinacean zone of *Fusulinella bocki–Fusulinella eopulchra–Fusulina cylindrica. Fusulinella eopulchra* Rauser, *F. pseudobocki* Lee and Chen, *F. rara* Schlykova, and *Beedeina elegans decurta* (Rauser and Safonova) are the most important elements of this zone (Rauser-Chernoussova et al., 1951; Lebedeva, 1966a, b; Chuvashov et al., 1984) and all occur in the Nansen Formation in the type area. In addition, other Myachkovian forms that have been reported from northern Timan, the Urals, and middle Asia, including *Fusulinella pokojamensis* Lebedeva and *F. mosquensis* Rauser and Safonova (Rauser-Chernoussova et al., 1951; Bogush, 1963; Lebedeva, 1966a, b), also occur in the type Nansen.

In summary, 31 species and subspecies from the upper Moscovian (Desmoinesian) part of the type Nansen section are widespread in the Russian Platform, which includes the Moscow Syneclise, the Volga-Ural region and northern Timan, Donbas, Donetz Basin, and the Urals. Accordingly, the late Moscovian fusulinacean fauna described herein from the type area of the Nansen Formation is more closely related to that of the Ural province than to any of the other fusulinacean provinces. The *Wedekindellina lata-W. uralica longa* zone in the Nansen type area can be correlated with the *Fusulinella colaniae-Fusulinella vozhgalensis* (=*F. praecolaniae*)-*Fusulina kamensis* Zone of the Podolsky horizon. Similarly, the *Fusulinellina eopulchra* zone in the type area can be correlated with the *Fusulinella bocki-Fusulinella eopulchra-Fusulina cylindrica* Zone of the Myachkovsky horizon in the Moscovian stratotype in the Soviet Union.

Canada (Figs. 7-9)

Upper Moscovian (Desmoinesian) fusulinacean fauna are known from central British Columbia, the northern part of the Yukon Territory, and the Canadian Arctic Archipelago.

In central British Columbia, Thompson et al. (1953) and Thompson (1965) suggested that the fusulinacean fauna from the Cache Creek Limestone—including *Fusulinella jamesensis* Thompson, Pitrat, and Sanderson (also known from the type area of the Nansen Formation), *Akiyoshiella toriyamai* Thompson, Pitrat, and Sanderson, *Staffella* sp., *Nankinella* sp., and *Millerella*? sp.—is of Middle Pennsylvanian age. This stratigraphic unit was derived from an accreted terrane and is tentatively correlated with the *Wedekindellina lata-Wedekindellina uralica longa* zone.

The fusulinacean fauna from the northern part of the Yukon is represented by the *Fusulinella crowensis* assemblage. According to Ross (1967b), *Fusulinella crowensis* is of middle and late Derryan age. Therefore, the *Fusulinella crowensis* assemblage may correspond to the *Wedekindellina lata-Wedekindellina uralica longa* zone.

As indicated earlier, upper Moscovian fusulinacean faunas are widely distributed in the Sverdrup Basin, in which we include Ward Hunt Island. According to Thorsteinsson (1970, 1974), Nassichuk (1975), and Nassichuk and Bamber (1978), unnamed species of *Beedeina*, *Fusulina*, *Fusulinella*, *Neostaffella*, and *Wedekindellina* have been reported from the Hare Fiord, Antoinette, Otto Fiord, and Canyon Fiord formations. These faunas probably indicate a correlation with the *Wedekindellina lata-Wedekindellina uralica longa* zone in the type area of the Nansen Formation.

The fusulinacean fauna from Ward Hunt Island, described by Thompson (1961), contains *Beedeina huntensis* (Thompson) (i.e., *Fusulina huntensis* Thompson), *Fusulinella zelleri* Thompson, *Ozawainella*? *arctica* Thompson (i.e., *Ozawainella turgida* Sheng), *Neostaffella wardensis* (Thompson), and *Wedekindellina lata* Thompson. Three of these species also occur in the type area of the Nansen Formation (*Fusulinella zelleri, Ozawainella*? *arctica*, and *Wedekindellina lata*). *Neostaffella wardensis* (Thompson) is similar to *Neostaffella sphaeroidea* (Ehrenberg) from the type area. Thus, we believe that the Ward Hunt Island fauna might be equivalent to the *Wedekindellina lata-Wedekindellina uralica longa* zone in the type area of the Nansen Formation.

Greenland (Figs. 7-9)

The Middle Carboniferous Lower Marine Group in northeast Greenland is fully exposed in Holm Land, where it consists mainly of alternating units of sandstone and limestone. The upper part of the Lower Marine Group contains late Moscovian fusulinaceans, including *Wedekindellina uralica longa* (Dutkevich) (=*W. dutkevichi* Rauser and Beljaev), *Beedeina paradistensa* Safonova, *Fusulinella eopulchra* Rauser, *Neostaffello greenlandica* Ross and Dunbar, *N. sphaeroidea* (Ehrenberg), *Ozawainella mosquensis* Rauser, and *Taitzehoella librovitchi* (Dutkevich). It was termed the *Wedekindellina* Zone by Dunbar et al. (1962) and considered to be equivalent to the Podolsky horizon of the upper Moscovian in the Russian Platform. The Podolsky horizon includes species such as *Fusulinella eopulchra, Wedekindellina uralica longa,* and *Neostaffella sphaeroidea,* and is similar to the *Wedekindellina lata-Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone in the type area of the Nansen Formation.

Spitsbergen (Figs. 7-9)

Carboniferous fusulinaceans in Spitsbergen occur in the Passage Beds of the Campbellryggen Group and in the Black Crag Limestone of the Wordiekammen Group (Forbes, 1960; Dunbar et al. 1962). The Passage Beds contain *Eofusulina* sp. cf. *E. triangula* (Rauser and Beljaev), *Fusulinella eopulchra* Rauser, *Neostaffella sphaeroidea* (Ehrenberg), *Ozawainella* sp., *Profusulinella pararhomboides* Rauser and Beljaev, *Pseudostaffella* sp.

Figure 7. *Map of the world showing the distribution of upper Moscovian (Desmoinesian) fusulinacean-bearing strata. Species that occur in the Nansen Formation that also occur at the locations marked 1-15 on this map are listed in Figure 8.*

cf. *P. antiqua* (Dutkevich), and *Wedekindellina* sp. This fauna was assigned to the *Fusulina* Zone by Forbes (1960). The Black Crag Limestone yields *Fusulinella eopulchra* Rauser, *Neostaffella sphaeroidea* (Ehrenberg), and *Wedekindellina* sp. In 1962, Dunbar et al. stated that the Passage Beds correlate approximately with the *Profusulinella priscoidea* Zone of the Lower Marine Group, and that the Black Crag Limestone at the base of the Wordiekammen Group, containing *Wedekindellina*, correlates with the upper part of the Lower Marine Group in Greenland. On the basis of the vertical distribution of *Neostaffella sphaeroidea* (Ehrenberg), *Fusulinella eopulchra* Rauser, and *Wedekindellina* sp., it is likely that the Black Crag Limestone and a part of the Passage Beds correlate with the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone in the type area of the Nansen Formation.

United States of America (Figs. 7-9)

Desmoinesian strata containing abundant fusulinaceans are well known from the U.S.A. and many authors have described the fusulinaceans. The type Desmoinesian section in Iowa (Thompson, 1934) has yielded *Beedeina euryteines* (Thompson), *B. girtyi* (Dunbar and Condra), *B. kayi* (Thompson), *B. leei* (Skinner), *B. lucasensis* (Thompson), *B. megista* (Thompson), *B. problematica* (Thompson), *B. pumila* (Thompson), *B. stookeyi* (Thompson), *Fusulina eximia* Thompson, *F. iowensis* Thompson, *F. mysticensis* Thompson, *Wedekindellina dunbari* Thompson, *W. elfina* Thompson, *W. euthysepta* (Henbest), and *W. uniformis* Thompson. Most of these are restricted to the middle and upper parts of the Desmoinesian succession. A number of the same species are known from elsewhere in Arizona, Illinois, Iowa, Kansas, Missouri, New Mexico, Oklahoma, Utah, and Wyoming. Dunbar and Henbest (1942) suggested that Desmoinesian fusulinaceans can be divided into three zones and five subzones in Illinois. The lower, *Fusulinella* Zone, includes the *Fusulinella iowensis* Subzone. The middle, *Wedekindellina* Zone, contains the *Wedekindellina euthysepta* Subzone, which overlaps the *Fusulina–Beedeina* Zone above. The upper, *Fusulina–Beedeina* Zone, includes the *Beedeina leei* Subzone, the *Beedeina girtyi* Subzone, and the *Fusulina eximia* Subzone, in ascending order. The lower limit of the *Fusulina–Beedeina* zone corresponds approximately with the base of the *Wedekindellina* Zone and its upper limit does not overlap the *Triticites* Zone.

In southeastern Arizona, Ross (1973) divided the Horquilla Limestone into fourteen "formats". Formats B through G are of Derryan or Desmoinesian age. Format B contains middle Derryan species of *Fusulinella*, such as *F. cochisensis*, *F. devexa*, *F. protensa*, and *F. velmae*, and species of *Pseudostaffella*. Format C contains upper Derryan species of *Fusulinella*, including *F. cabezasensis*, *F. dosensis*, *F. famula*, and *F. nipperensis*, in its lower part and lowest Desmoinesian species of *Beedeina*, such as *B. arizonensis* and *B. portalensis*, and *Wedekindellina*, such as *W. cabezasensis*, *W. euthysepta*, and *W. pseudomatura* in its upper part. Format D has more advanced species of *Wedekindellina*, such as *W. henbesti*, and several species of *Beedeina*; e.g., *B. apachensis*, *B. cedarensis* and *B. leei*. Format E includes a thickly fusiform species of *Wedekindellina, W. ellipsoides*, and several species of *Beedeina* including *B. bowensis*, *B. euryteines*, and *B. novamexicana*. Format F contains *Fusulina haworthi, F.* sp. cf. *F. weintzi,* and a small species of *Wedekindellina*. In eastern Nevada, *Beedeina euryteines* and *Fusulina weintzi* are associated with *Fusulinella alta* and *F. nevadensis*. Verville et al. (1956) suggested that this fusulinacean assemblage could be correlated with middle Desmoinesian rocks from Iowa to New Mexico. On the basis of the presence of *Beedeina euryteines, B.* sp. cf. *B. weintzi*, and *B. haworthi*, the fusulinacean assemblage zones in formats F and G may correspond to the *Beedeina girtyi* Subzone in Illinois. The highest strata containing *Fusulina* are in format G and have large subcylindrical and advanced species such as *F. sulphurensis*, which appears to be equivalent in age to the highest Desmoinesian Subzone of Iowa and Illinois, the *Fusulina eximia* Subzone.

The *Wedekindellina euthysepta* Subzone and the *Beedeina leei* Subzone in Arizona are probably equivalent to the *Wedekindellina lata–Wedekindellina uralica longa* zone of the Nansen Formation on Ellesmere Island. Similarly, the *Beedeina girtyi* Subzone of Illinois and the *Fusulina eximia* Subzone in Iowa and Illinois likely correspond to the *Fusulinella eopulchra* zone of the Nansen Formation.

China (Figs. 7-9)

Upper Moscovian fusulinaceans are diversified and widespread in China. In North China, Middle Carboniferous strata are contained in the Penchi Formation. Sheng (1958) assigned the fusulinacean fauna in the type section of the Penchi Formation to two zones, the lower *Eostaffella subsolana* Zone and the upper *Fusulina–Fusulinella* Zone. The *Fusulina–Fusulinella* Zone is further subdivided into the following five subzones, in ascending order: *Beedeina schellwieni* Subzone, *Beedeina konnoi* Subzone, *Neostaffella sphaeroidea* Subzone, *Fusulinella provecta* Subzone, and *Fusulina cylindrica–Fusulina quasicylindrica* Subzone. Sheng (1958) suggested that the *Beedeina konnoi* Subzone

and the *Neostaffella sphaeroidea* Subzone correspond to the Podolsky horizon and the lower part of the Myachkovsky horizon in the Russian Platform, and that the *Fusulinella provecta* Subzone and the *Fusulina cylindrica–Fusulina quasicylindrica* Subzone are equivalent to the upper part of the Myachkovsky horizon. Based on species such as *Fusulinella helenae* Rauser (= *F. rara* Schlykova), *Neostaffella sphaeroidea* (Ehrenberg),

	CANADA							U.S.S.R.									
	1 NORTHWESTERN ELLESMERE ISLAND	1A WARD HUNT ISLAND	2 YUKON TERR.	2A CENTRAL BRITISH COLUMBIA	3 U.S.A.	4 NORTHEASTERN GREENLAND	5 SPITSBERGEN	6 SPAIN	7 RUSSIAN PLATFORM	8 DONETZ BASIN	9 URALS	10 CENTRAL ASIA	11 NORTH THAILAND	12 SOUTH CHINA	13 NORTH CHINA	14 SOUTH KOREA	15 JAPAN
Eostaffella ampla	•				•												
Millerella sp. cf. *M. porcupinensis*	•		•														
Pseudoendothyra ellesmerensis n. sp.	•																
P. holmensis	•					•											
P. jazvensis	•								•								
P. nielseni	•					•											
P. preobrajenskyi	•								•								
P. probatus	•								•								
P. rara	•											•					
P. struvei	•								•		•						
P. sp. A	•																
Staffella mochaensis	•							•									
S. moelleri	•								•								•
S. pseudosphaeroidea	•					•		•	•	•	•		•		•		•
Ozawainella mosquensis	•					•			•					•	•		
O. pseudoangulata	•								•	•					•		
O. turgida	•	•													•		
Neostaffella khotunensis	•								•						•		
N. sphaeroidea	•					•	•	•	•	•	•	•	•	•	•		•
N. subquadrata	•								•	•	•						
Schubertella sp. cf. *S. acuta*	•								•								
S. gracilis	•								•								
S. lata	•								•	•				•	•		•
S. lata elliptica	•														•		
S. obscura mosquensis	•							•	•								
S. texana	•				•			•	•								
Wedekindellina lata	•	•															
W. matura	•				•												
W. pseudomatura	•				•												
W. pulchra n. sp.	•																
W. quasicylindrica n. sp.	•																
W. uralica	•								•		•						
W. uralica longa	•					•	•		•		•						
W. sp. A	•																
Fusulinella cabezasensis	•				•												
F. daviesi n. sp.	•																
F. devexa	•				•												
F. eopulchra	•					•	•		•					•	•		•
F. famula	•				•												
F. fugax	•				•												
F. jamesensis	•		•														•
F. mosquensis	•								•			•		•			
F. nevadensis	•				•												
F. pokojamiensis	•								•								
F. praecolaniae	•								•						•		
F. pseudobocki	•								•	•		•		•	•	•	•
F. pseudobocki ovoides	•								•			•					
F. rara	•								•			•			•		
F. schwagerinoides	•								•					•	•		
F. subcolaniae	•								•								
F. subcolaniae decurta	•								•								
F. subelliptica n. sp.	•																
F. subpulchra	•								•	•		•					
F. subpulchra submesopachis	•									•							
F. taishakuensis	•																•
F. thorsteinssoni n. sp.	•																
F. zelleri	•	•															
F. sp. A	•																
F. sp. B	•																
Beedeina elegans decurta	•								•								

GSC

Figure 8. *Geographic distribution of upper Moscovian fusulinaceans described from the type area of the Nansen Formation on northern Ellesmere Island. The location numbers (1-15) shown in this figure correspond to the numbers shown on the world map in Figure 7.*

Ozawainella vozhgalica Safonova (= *O. mosquensis* Rauser), *O. turgida* Sheng, *Schubertella lata* Lee and Chen, and *S. lata elliptica* Sheng, which occur both in North China and in the type area of the Nansen Formation, the *Neostaffella sphaeroidea* Subzone, the *Fusulinella provecta* Subzone and the *Fusulina cylindrica–Fusulina quasicylindrica* Subzone in the Penchi Formation of North China may correlate approximately with the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone in the Nansen Formation.

Middle Carboniferous strata in South China are contained either in the Huanglong Limestone or in the Weining Formation. The fusulinacean fauna of the Huanglong Limestone was restudied by Sheng et al. (1976). They divided the Huanglong Limestone into two fusulinacean zones, the lower, *Profusulinella* Zone and the upper, *Fusulinella–Beedeina* Zone. The *Fusulinella–Beedeina* Zone can be subdivided into three subzones, in ascending order: *Fusulinella praebocki* Subzone, *Beedeina cheni* Subzone, and *Fusulina quasicylindrica* Subzone. The presence of some species, such as *Fusulinella mosquensis* Rauser and Safonova, *F. pseudobocki* Lee and Chen, *F. schwagerinoides* Deprat, *Neostaffella sphaeroidea* (Ehrenberg), *Ozawainella vozhgalica* Safonova (= *O. mosquensis* Rauser), and *Schubertella lata* Lee and Chen, which occur in both South China and the type area of the Nansen Formation, suggest that the *Beedeina cheni* Subzone and *Fusulina quasicylindrica* Subzone in the Huanglong Limestone are probably correlative with the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone in the Nansen Formation.

South Korea (Figs. 7-9)

Moscovian strata in the Samcheog coalfield, Grangweon-do, South Korea, were divided into two formations, the Manhang Formation and the overlying Geumcheon Formation by Cheong (1974a). The Manhang Formation, which has yielded 13 fusulinacean species, can be subdivided in ascending order into the *Eostaffella subsolana* Zone, the *Beedeina mayiensis* Subzone and the *Neostaffella kimi* Subzone. The Geumcheon Formation, which has 40 species, can be subdivided in ascending order into the *Neostaffella sphaeroidea cuboides* Subzone, the *Neostaffella papitioformis* Subzone, and the *Fusulina cylindrica domodedovi* Subzone. On the bases of species such as *Ozawainella vozhgalica* Safonova (= *O. mosquensis* Rauser), *Schubertella* sp. cf. *S. lata* Lee and Chen, and *Wedekindellina uralica longa* (Dutkevich) (= *W. dutkevitchi* Rauser and Beljaev), which have also been found in the upper Moscovian part of the Nansen Formation, and on the basis of some species of *Neostaffella* in the *Neostaffella sphaeroidea cuboides* Subzone, the *Neostaffella papilioformis* Subzone and the *Fusulina cylindrica domodedovi* Subzone in South Korea are tentatively correlated with the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone of the Nansen Formation.

Japan (Figs. 7-9)

According to Toriyama (1967), upper Moscovian strata in Japan are referred to as the Kurikian "Series". The late Moscovian fusulinacean fauna in the Yayamadake Limestone, the type locality of the Kurikian "Series", was called the *Fusulina* Zone, which was divided by Kanmera (1954) into three subzones, the lower, *Staffella pseudosphaeroidea* Subzone, the middle, *Beedeina higoensis* Subzone, and the upper, *Beedeina ohtanii* Subzone. Kanmera (op. cit.) suggested that the *Fusulina* Zone of the Yayamadake Limestone is equivalent to the upper part of the Desmoinesian of North America and to the upper Moscovian of the Soviet Union.

In the Fukuji area of the Hida Massif, Igo (1957) also named the upper Moscovian fusulinacean fauna the *Fusulina* Zone and subdivided it into two subzones, the lower of which is the *Beedeina fujimotoi* Subzone and the upper the *Beedeina lanceolata–Beedeina ichinotaniensis* Subzone. Igo (op. cit.) suggested that although the faunas in the *Fusulina* Zone of the Hida Massif and in the Yayamadake Limestone of South Kyushu differ greatly in species composition, the *Fusulina* zones of both areas are equivalent in age, and may be referred to the Kurikian "Series", which corresponds approximately to the Desmoinesian Series of midcontinental North America, or to the upper part of the Moscovian of the Russian Platform.

On the basis of the common occurrence of some species such as *Fusulinella eopulchra*, *F. jamesensis*, *F. pseudobocki*, *F. taishakuensis*, *Neostaffella sphaeroidea*, and *Staffella pseudosphaeroidea*, the *Fusulina* Zone of the Japanese Kurikian "Series" may correlate with both the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone of the Nansen Formation.

Thailand (Figs. 7-9)

Middle Carboniferous fusulinacean-bearing strata occur in North Thailand. Igo (1972) recognized three late Moscovian fusulinacean faunal zones. The lower, *Beedeina paradistenta* Zone, is characterized by abundant *Beedeina paradistenta* (Safonova) and *Hemifusulina*(?)

	Type area of the Nansen Formation, northwestern Ellesmere Island (Present paper)	Moscow Basin U.S.S.R. (Ivanova et al., 1979)	Central British Columbia, Canada (Thompson et al., 1953; Thompson, 1965)	Ward Hunt Island and Sverdrup Basin, Canadian Archipelago (Thompson, 1961; Thorsteinsson, 1974; Nassichuk and Bamber, 1978)	Northeastern Greenland (Dunbar and Ross, 1962)	Spitsbergen (Forbes, 1960; Dunbar and Ross, 1962)	Arizona, U.S.A. (Ross, 1969a, 1973)
UPPER MOSCOVIAN (DESMOINESIAN)	*Fusulinella eopulchra* Zone	Myachkovsky Horizon *Fusulinella bocki–Fusulinella eopulchra–Fusulina cylindrica* Zone	Cache Creek Limestone (part)	*Fusulina* spp. *Fusulinella zelleri Beedeina huntensis Wedekindellina lata Neostaffella wardensis*	Lower Marine Group *Fusulinella eopulchra Wedekindellina uralica longa Neostaffella sphaeroidea*	Black Crag Limestone and uppermost part of the Passage Beds	Horquilla Limestone Formats E – G *Fusulina eximia* Subzone *Beedeina girtyi* Subzone
	Wedekindellina lata–Wedekindellina uralica longa Zone	Podolsky Horizon *Fusulinella colaniae–Fusulinella vozhgalensis–Fusulina kamensis* Zone	*Fusulinella jamesensis Staffella* sp.			*Fusulinella eopulchra Neostaffella sphaeroidea Wedekindellina* sp.	Formats C and D *Wedekindellina euthysepta* Subzone

Figure 9. *Generalized correlation chart for upper Moscovian (Desmoinesian) fusulinacean-bearing strata in the world.*

hamadai Igo and is tentatively correlated with the Podolsky horizon in the Soviet Union. The middle, *Hemifusulina*(?) *thaiensis* Zone, is marked by abundant *Hemifusulina*(?) *thaiensis* Igo and by the rich association of *Ozawainella turgida* Sheng, *Neostaffella larinovae* Rauser and Safonova, and the less common *Staffella pseudosphaeroidea* Dutkevich; it also correlates with the Podolsky horizon. The upper, *Fusulina pulchella* Zone, yields abundant *Fusulina pulchella* Grozdilova and *Fusulinella gracilis* Kanmera, as well as *F. fluxa* Lee and Chen, *Neostaffella sphaeroidea* (Ehrenberg), and *Ozawainella angulata* (Colani), and correlates with the Myachkovsky horizon in the Russian Platform, and the *Fusulina* Zone or Kurikian "Series" in Japan.

Although typical Canadian Arctic species of late Moscovian age are rather sparse in North Thailand, a few common species, such as *Neostaffella sphaeroidea* (Ehrenberg), *Ozawainella turgida* Sheng, and *Staffella pseudosphaeroidea* Dutkevich indicate that the *Beedeina paradistenta* Zone, *Hemifusulina*(?) *thaiensis* Zone, and *Fusulina pulchella* Zone can be approximately correlated with the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone in the type area of the Nansen Formation.

Spain (Figs. 7-9)

Upper Moscovian fusulinacean-bearing strata are widely distributed in the upper Rio Pisuerga area, Palencia province, northwestern Spain, and have been called the B subzone by van Ginkel (1965), who further subdivided the B subzone, in ascending order, into the B1, B2, and B3 levels, corresponding respectively to the former subzones B, C, and D (Brouwer and van Ginkel, 1964).

The B1 level contains *Beedeina*? ex gr. *B. ozawai* (Rauser and Beljaev), *Fusulina agujasensis* van Ginkel, *Fusulinella pandae* van Ginkel, *F.* ex gr. *F. bocki* Moeller, *F.* sp., *Hemifusulina* ex gr. *H. moelleri* Rauser, *Neostafella parasphaeroidea* (Lee and Chen), *N.* ex gr. *N. sphaeroidea* (Ehrenberg), *Ozawainella adducta* Manukalova, *Profusulinella* sp. cf. *P. librovitchi* (Dutkevich), and *Schubertella* sp. cf. *S. pseudoobscura* Chen.

The B2 level contains *Fusiella* ex gr. *F. typica* Lee and Chen, *Fusulina agujasensis* van Ginkel, *F. cotarazoe* van Ginkel, *Fusulinella maldrigensis* van Ginkel, *F. mosquensis adismie* van Ginkel, *F.* ex gr. *F. colaniae* Lee and Chen, *F.* ex gr. *F. mosquensis* Rauser and Safonova, *Neostaffella* ex gr. *N. sphaeroidea* (Ehrenberg), *Profusulinella* ex gr. *P. librovitchi* (Dutkevich), *Schubertella lata* Lee and Chen, and *S.* ex gr. *S. obscura* Lee and Chen.

The B3 level contains the following species: *Beedeina* ex gr. *B. elegans* (Rauser and Safonova), *Eostaffella* sp. cf. *E. acuta nana* Kireeva, *Fusiella praelancetiformis* Safonova, *F.* sp. cf. *F. pulchala* Safonova, *Fusulinella branoserae* van Ginkel, *F. lorease* van Ginkel, *F. soligalichi archedensis* Semikhatova and Melnikova, *F.* ex

North China (Sheng, 1958)	South China (Sheng et al., 1976)	Samcheog Coalfield, South Korea (Cheong, 1974a)	Kyushu Massif, southwestern Japan (Kanmera, 1954; Toriyama, 1967)	Hida Massif, Central Japan (Igo, 1957; Toriyama, 1967)	North Thailand (Igo, 1972)	Upper Rio Pisuerga area, northwestern Spain (van Ginkel, 1965)
Penchi Formation	Upper part of the Huanglong Limestone	Geumchon Formation	Kurikian	Ichinotani Formation	Rat Buri Limestone	B Subzone
			Fusulina Zone	*Fusulina* Zone		B 3
Fusulina cylindrica–Fusulina subcylindrica Subzone	*Fusulina quasicylindrica* Subzone	*Fusulina cylindrica domodedovi* Subzone	*Beedeina ohtanii* Subzone		*Fusulina pulchra* Zone	*Fusulinella soligalichi archedensis* *Beedeina* ex gr. *elegans*
				Beedeina lanceolata–Beedeina ichinotani Subzone		B 2
Fusulinella provecta Subzone		*Neostaffella papilioformis* Subzone			*Hemifusulina(?) kamadai* Zone	*Fusulinella* ex gr. *colaniae* *Fusulinella* ex gr. *mosquensis* *Neostaffella* ex gr. *sphaeroidea*
			Staffella pseudosphaeroidea Subzone			
Neostaffella pseudosphaeroidea Subzone	*Beedeina cheni* Subzone	*Neostaffella pseudosphaeroidea cuboides* Subzone		*Beedeina fujimotoi* Subzone	*Beedeina paradistenta* Zone	B 1
						Neostataffella ex gr. *sphaeroidea* *Fusulinella* ex gr *bocki*
						GSC

gr. *F. schwagerinoides* (Deprat), *Ozawainella leei* Putrja, *Profusulinella* ex gr. *P. librovitchi* (Dutkevich), *Pseudoendothyra* sp., and *Schubertella* ex gr. *S. kingi* Dunbar and Skinner.

Van Ginkel (1965, 1971) regarded the B1 level as Podolian, B2 as latest Podolian to early Myachkovian, and B3 as late Myachkovian. The B1, B2, and B3 levels of the B subzone in northwestern Spain are difficult to correlate in detail with zones in the Nansen Formation because the genera and species of these two areas are quite different. However, the B subzone in Spain may be equivalent to parts of both the *Wedekindellina lata–Wedekindellina uralica longa* zone and the *Fusulinella eopulchra* zone of the Nansen Formation on the basis of data from a limited number of species, such as *Neostaffella* ex gr. *N. sphaeroidea* (Ehrenberg), *Fusulinella* ex gr. *F. schwagerinoides* (Deprat), *F.* ex gr. *mosquensis* Rauser and Safonova, and *Schubertella lata* Lee and Chen, which occur in both areas.

SYSTEMATIC PALEONTOLOGY

Order FUSULINIDA Fursenko, 1958

Superfamily FUSULINACEA Moeller, 1878

Family OZAWAINELLIDAE Thompson and Foster, 1937

Subfamily OZAWAINELLINAE Thompson and Foster, 1937

Genus *Eostaffella* Rauser, 1948

Type species. Staffella (*Eostaffella*) *parastruvei* Rauser, 1949.

Eostaffella ampla (Thompson)

Plate 1, figures 1, 2

Millerella? *advena* var. *ampla* Thompson, 1944, p. 429, 430, Pl. 1, figs. 15, 21, 22; Thompson, 1948, Pl. 2, fig. 3.

Material. Two axial sections: hypotypes GSC 73847, 73848.

Description. Test small and lenticular with narrowly rounded periphery and slightly inflated poles. Adult test contains 4 volutions and reaches 0.33 to 0.36 mm in length, 0.56 to 0.72 mm in width, and has a form ratio of 0.5 to 0.59. Proloculus minute, spherical, with an outside diameter of 0.04 to 0.07 mm. First two volutions closely coiled, discoidal with narrowly rounded periphery; succeeding volutions rapidly and uniformly expanded. Third volution with broadly rounded periphery, fourth one with narrowly rounded periphery. Spirotheca thin, composed of a less dense layer, about 0.01 mm thick in outer volutions. Septa unfluted. Chomata low and asymmetrical, extended nearly to poles. Tunnel narrow and low, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73847	0.36	0.72	0.50	0.07
73848	0.33	0.56	0.59	0.04

	Width of Volution (mm)			
GSC no.	1	2	3	4
73847	0.18	0.28	0.47	0.72
73848	0.10	0.19	0.31	0.56

Remarks. The illustrated specimens (Pl. 1, figs. 1, 2) agree in shape and internal characters with type specimens of *Eostaffella ampla* (Thompson) from the Kearny Formation of Kansas. In general shape, this species is comparable to *Eostaffella ikensis ventricosa* Rosovskaya; the latter, however, has fewer volutions, longer axis of coiling, larger form ratio and smaller test. *Eostaffella ampla* differs from *Eostaffella reguschensis* Ganelina in having inflated poles, a rounded periphery in the inner three volutions, and a blunt periphery in the last volution. *Eostaffella ampla* also resembles *E. advena* (Thompson), but that species has a narrowly rounded periphery and is much smaller.

Occurrence. *Eostaffella ampla* (Thompson) is rare at GSC loc. C-31891, 1187.5 m (3896 ft.), and GSC loc. C-31892, 1189 m (3901 ft.), above the base of the Nansen Formation.

Genus *Millerella* Thompson, 1942

Type species. *Millerella marblensis* Thompson, 1942.

Millerella sp. cf. *M. porcupinensis* Ross

Plate 1, figures 3-5

Millerella porcupinensis Ross, 1967b, p. 715, Pl. 79, figs. 19, 20; Pl. 80, fig. 17; Pl. 83, fig. 16.

Material. Three axial sections: hypotypes GSC 73849–73851.

Description. Test small, discoidal with narrowly rounded periphery, lateral slopes slightly convex, poles broadly umbilicate. Two mature specimens have 4 to 4½ volutions, are 0.23 to 0.27 mm long, 0.6 to 0.67 mm wide, and have a form ratio of 0.34 to 0.45. Proloculi small, spherical, and 0.04 to 0.06 mm in outside diameter. First and last (or last half) volution slightly evolute; remaining volutions involute. Spirotheca thin, composed of a less dense layer, about 0.01 mm thick in outer volutions. Septa unfluted. Chomata low and asymmetrical. Tunnel low with regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73849	0.19	0.47	0.40	0.06
73850	0.23	0.67	0.34	0.05
73851	0.27	0.60	0.45	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	4½
73849	0.14	0.27	0.47	–	–
73850	0.11	0.22	0.44	0.67	–
73851	0.08	0.17	0.30	0.58	0.60

Remarks. Specimens from the Nansen Formation of Ellesmere Island compare in general to *Millerella porcupinensis* Ross, but are not as strongly evolute as the holotype. They are also somewhat similar to *Millerella kanmerai* (Igo), but differ in having a larger shell and more volutions, as well as by having a smaller form ratio.

Occurrence. *Millerella* sp. cf. *M porcupinensis* Ross was collected from two levels within the Nansen Formation; GSC loc. C-31892, 1189 m (3901 ft.), and GSC loc. C-31656, 1307.9 m (4291 ft.), above the base.

Genus *Ozawainella* Thompson, 1935

Type species. *Fusulinella angulata* Colani, 1924.

Ozawainella mosquensis Rauser

Plate 5, figures 13-23

Ozawainella mosquensis Rauser. Rauser-Chernoussova et al., 1951, p. 136, 137, Pl. 10, figs. 14-16; Grozdilova and Lebedeva, 1960, p. 121, 122, Pl. 14, fig. 12; Ross and Dunbar, 1962, p. 8, 9, Pl. 1, figs. 1-7.

Ozawainella vozhgalica Safonova. Rauser-Chernoussova et al., 1951, p. 138, 139, Pl. 11, figs. 3, 4; Sheng, 1958, p. 15, 73, 74, Pl. 1, figs. 30-34; Sheng et al., 1976, p. 202, 203, Pl. 1, figs. 1-4.

Material. Ten axial sections and one near-central tangential section: hypotypes GSC 73927–73937.

Description. Shell large for genus, lenticular with sharply angular periphery, rather concave lateral slopes, and deeply umbilicate poles. Mature specimens of 5 to 6 volutions are 0.37 to 0.6 mm long and 0.93 to 1.52 mm wide, with form ratio of 0.32 to 0.42. Proloculus minute, with 0.03 to 0.06 mm outside diameter. First volution tightly coiled and discoidal with narrowly rounded periphery, succeeding volutions expand rapidly. Spirotheca thin, composed of a tectum, a heavy upper

tectorium, and a lower tectorium. Thickness of spirotheca about 0.01 mm in outer volutions. Septa unfluted throughout. Chomata small and symmetrical, nearly extending to poles. Tunnel rather narrow, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73927	0.41	1.28	0.32	0.04
73928	0.50	1.38	0.36	0.04
73929	0.39	1.13	0.35	0.04
73930	0.39	1.03	0.38	0.06
73931	0.37	0.93	0.37	0.05
73932	0.41	1.08	0.38	0.03
73933	0.60	1.52	0.38	0.02
73934	0.52	1.44	0.36	0.04
73935	0.45	1.14	0.39	0.05
73936	0.47	1.13	0.42	-
73937	0.47	1.30	0.36	0.04

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	5½	6
73927	0.08	0.23	0.42	0.67	1.03	1.28	-
73928	0.10	0.21	0.37	0.60	0.93	-	1.38
73929	0.12	0.25	0.43	0.70	1.13	-	-
73930	0.16	0.32	0.50	0.70	1.03	-	-
73931	0.10	0.19	0.37	0.60	0.93	-	-
73932	0.14	0.23	0.42	0.70	1.08	-	-
73933	0.10	0.25	0.43	0.78	1.13	-	-
73934	0.10	0.22	0.41	0.66	0.99	-	1.44
73935	0.12	0.23	0.39	0.64	0.99	1.14	-
73936	-	0.25	0.43	0.78	1.13	-	-
73937	0.10	0.21	0.35	0.58	0.87	-	1.30

Remarks. The Nansen specimens are virtually identical to *Ozawainella mosquensis* Rauser in shape, size, and other internal characters. This species is closely related to *Ozawainella vozhgalica* Safonova in the most important features. The only difference is that it is slightly smaller per volution than *O. vozhgalica* Safonova, and therefore, *O. vozhgalica* should be a synonym of *O. mosquensis* Rauser. This species is similar to *O. magana* Sheng in some respects, but differs in having deeply umbilicate poles and a sharply acute, angular periphery.

Occurrence. Ozawainella mosquensis Rauser is abundant in the Nansen Formation of Ellesmere Island and occurs at GSC loc. C-31650, 1286.6 m (4221 ft.) above the base, GSC loc. C-31651, 1292.7 m (4241 ft.), GSC loc. C-31653, 1298.2 m (4259 ft.), GSC loc. C-31654, 1301.2 m (4269 ft.), and GSC loc. C-31666, 1328.7 m (4359 ft.).

Ozawainella pseudoangulata (Putrja)

Plate 6, figure 19

Orobias pseudoangulata Putrja, 1939, p. 179-181, Pl. 2-5.

Ozawainella pseudoangulata Rauser. Rauser-Chernoussova et al., 1951, p. 135, Pl. 10, fig. 10; Putrja, 1956, p. 389, Pl. 3, figs. 22, 23; Chang, 1961, p. 152, Pl. 1, fig. 1.

Material. Only one axial section has been found in the section: hypotype GSC 73956.

Description. Shell large for genus, thickly lenticular; periphery bluntly pointed, lateral slopes convex, and poles narrowly umbilicate. One mature specimen with 7 volutions is 0.66 mm long, and 1.36 mm wide, and has form ratio of 0.49. Proloculus small, spherical, and 0.04 mm in outside diameter. First volution closely coiled, succeeding volutions slowly and uniformly expanding. Spirotheca, which has a thin tectum, a rather thick upper tectorium, and a lower tectorium, is about 0.02 to 0.04 mm thick in outer volutions. Septa unfluted throughout shell. Chomata massive, low, highly asymmetrical, and extending to poles. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73956	0.66	1.36	0.49	0.04

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	6	7
73956	0.12	0.22	0.41	0.60	0.89	1.13	1.36

Remarks. The single specimen recovered from the Nansen Formation of Ellesmere Island is closely similar in shape, size, and internal features to *Ozawainella pseudoangulata* (Putrja) described by Putrja in 1939. This species is related to *Ozawainella kurachovensis* Manukalora and *O. umbonata* Putrja and Leontovich in some respects; however, the first of these species has more volutions and a much smaller size and the second has a narrowly rounded periphery. *Ozawainella pseudoangulara* also resembles *Ozawainella kumpani* Sosnina, but differs in that the former has narrowly umbilicate poles and convex lateral slopes.

Occurrence. Ozawainella pseudoangulata (Putrja) has been found only at GSC loc. C-31676, 1358.2 m (4456 ft.) above the base of the Nansen Formation.

Ozawainella turgida Sheng

Plate 6, figures 10-18

Ozawainella turgida Sheng, 1958, p. 14, 72, 73, Pl. 1, figs. 25-28.

Ozawainella? *arctica* Thompson, 1961, p. 1132, Pl. 135, figs. 1-8.

Material. Six axial sections and three near-central tangential sections: hypotypes GSC 73947–73955.

Description. Shell small, thickly lenticular; periphery sharply pointed, lateral slopes slightly concave, and poles highly convex. Mature shells contain 5 to 6 volutions, and reach 0.43 to 0.68 mm in length, 1.07 to 1.46 mm in width and have form ratio of 0.36 to 0.51. Proloculus small and spherical, 0.04 to 0.06 mm in outside diameter. Shell closely coiled, slowly and uniformly expanding. Spirotheca thick, measuring about 0.01 to 0.02 mm, and composed of a tectum, a rather thick upper tectorium, and a lower tectorium. Septa unfluted. Chomata massive, low, and asymmetrical. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73947	0.56	1.06	0.53	0.05
73948	0.54	1.07	0.50	0.05
73949	0.54	1.28	0.42	–
73950	0.43	1.19	0.36	0.04
73951	0.62	1.22	0.51	–
73952	0.49	1.01	0.49	0.04
73953	0.68	1.46	0.47	0.06
73954	0.58	1.30	0.45	0.06
73955	0.56	1.32	0.42	–

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	5½	6	6½
73947	0.10	0.21	0.37	0.60	0.87	–	1.06	–
73948	0.16	0.35	0.58	0.78	1.07	–	–	–
73949	0.14	0.23	0.49	0.74	1.28	–	–	–
73950	0.16	0.35	0.58	0.84	1.19	–	–	–
73951	–	–	–	–	–	–	–	–
73952	0.12	0.23	0.39	0.58	0.89	1.01	–	–
73953	0.14	0.27	0.45	0.62	0.89	–	1.24	1.46
73954	0.13	0.26	0.40	0.64	0.99	–	1.30	–
73955	0.14	0.31	0.53	0.82	1.32	–	–	–

Remarks. The type specimens show some internal variation in shape, size, and form ratio, and the Nansen specimens fall within that range. Also, the specimens from Ward Hunt Island, Canadian Arctic, identified by Thompson (1961) as *Ozawainella*? *arctica* Thompson fall within the range of variation of the type specimens, and accordingly we refer them to *Ozawainella turgida* Sheng. In general shape, this species is closely similar to *Ozawainella tingi* Lee and Chen and *O. paratingi* Manukalora. It differs from those forms, however, in that it has a much larger shell and is larger per volution. It also resembles *O. crassiformis* Putrja, but that species is thicker and has a larger form ratio and smaller size per volution.

Occurrence. Ozawainella turgida Sheng occurs commonly at GSC loc. C-32127, 1105.2 m (3626 ft.) above the base of the Nansen Formation, GSC loc. C-31651, 1292.7 m (4241 ft.), GSC loc. C-31652, 1294.2 m (4246 ft.), GSC loc. C-31654, 1301.2 m (4269 ft.), GSC loc. C-31675, 1353.7 m (4441 ft.), and GSC loc. C-31676, 1358.2 m (4456 ft.).

Subfamily PSEUDOSTAFFELLINAE Putrja, 1956

Genus *Neostaffella* Miklucho-Maclay, 1959

Type species. Pseudostaffella sphaeroidea Ehrenberg. Rauser *in* Rauser-Chernoussova et al., 1951.

Neostaffella subquadrata (Grozdilova and Lebedeva)

Plate 6, figures 1-3

Pseudostaffella subquadrata Grozdilova and Lebedeva, 1950, p. 38, 39, Pl. 4, figs. 9, 10; Rauser *in* Rauser-Chernoussova et al., 1951, p. 109-111, Pl. 6, figs. 10, 11; Lebedeva, 1966a, p. 181, Pl. 1, fig. 7.

Material. Three axial sections: hypotypes GSC 73938–73940.

Description. Shell small, subquadrate in axial section. One mature specimen with 5 volutions is 0.86 mm long and 0.99 mm wide, with a form ratio of 0.87. Proloculus small and spherical, 0.04 to 0.08 mm in outside diameter. Shell regularly coiled, gradually and uniformly expanding. Spirotheca in inner volutions composed of tectum, and upper and lower tectoria, about 0.01 to 0.02 mm thick, and in outer volutions composed of tectum, diaphanotheca, and upper and lower tectoria, about 0.02 to 0.03 mm thick. Septa planar throughout. Chomata massive, highly asymmetrical, tunnel side slopes rather steep, poleward slopes more gradual, extending to poles. Tunnel high and narrow, with a somewhat irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73938	0.86	0.99	0.87	0.04
73939	0.66	0.78	0.85	0.08
73940	0.62	0.72	0.86	0.10

	Width of Volution (mm)				
GSC no.	1	2	3	4	5
73938	0.19	0.31	0.49	0.72	0.99
73939	0.19	0.37	0.58	0.78	–
73940	0.25	0.38	0.55	0.72	–

Remarks. Specimens from the Nansen Formation of Ellesmere Island are identical to *Neostaffella subquadrata* (Grozdilova and Lebedeva) in shape, size, and internal features. In general shape, this species is similar to some other species from the Soviet Union, Greenland, and Asia. However, some of the Asian species, such as *Neostaffella quadrata* (Deprat) from Vietnam, have a larger size, more volutions, and lower chomata. *Neostafella kremsi* Rauser from the Russian Platform and northern China is longer and has stronger chomata, and *N. greenlandi* (Ross and Dunbar) is much larger per volution and in prolocular diameter than *N. subquadrata*.

Occurrence. *Neostaffella subquadrata* Grozdilova and Lebedeva is common in the Nansen Formation and occurs at GSC loc. C-32128, 1106.7 m (3631 ft.) above the base, GSC loc. C-31650, 1286.6 m (4221 ft.), and GSC loc. C-31654, 1301.2 m (4269 ft.).

Neostaffella khotunensis (Rauser)

Plate 6, figures 4, 5

Pseudostaffella khotunensis Rauser. Rauser-Chernoussova et al., 1951, p. 119, Pl. 7, figs. 13, 14; Sheng, 1958, p. 76, 77, Pl. 4, figs. 19-23.

Material. Two axial sections: hypotypes GSC 73941, 73942.

Description. Shell small, subspherical, periphery broadly rounded, and poles depressed. One adult specimen with 4½ volutions is 0.52 mm long and 0.62 mm wide, with a form ratio of 0.84. Proloculus minute, spherical, and 0.05 to 0.06 mm in outside diameter. Shell closely coiled, first volution coiled at high angle to axis of outer ones, succeeding volutions slowly and uniformly expanding. Spirotheca thin, about 0.01 to 0.02 mm thick, composed of a tectum and upper and lower tectoria. Septa unfluted. Chomata low, asymmetrical, and extending to polar regions. Tunnel narrow, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73941	0.39	0.52	0.75	0.06
73942	0.52	0.62	0.84	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	4½
73941	0.12	0.21	0.31	0.52	–
73942	0.12	0.22	0.33	0.53	0.62

Remarks. The specimens studied herein from the Nansen Formation agree closely in all important characters with the holotype of *Neostaffella khotunensis* (Rauser). This species is closely similar in general shape, size, and internal features to *Neostaffella ivanovi* Rauser. The principal difference is that the periphery is more rounded in *N. khotunensis* than in *N. ivanovi* Rauser. It also resembles *N. subquadrata vozhgalica* Safonova, but differs in having a larger shell, fewer volutions, and more developed chomata.

Occurrence. *Neostaffella khotunensis* Rauser only occurs at GSC loc. C-31666, 1328.7 m (4359 ft.) above the base of the Nansen Formation, and at GSC loc. C-31881, 1163.4 m (3817 ft.).

Neostaffella sphaeroidea (Ehrenberg)

Plate 6, figures 6-9

Fusulinella (*Staffella*) *sphaeroidea* Lee, 1927, p. 13-16, Pl. 2, figs. 8-11.

Staffella sphaeroidea Lee and Chen, 1930, p. 114, 115, Pl. 6, fig. 26; Dutkevich, 1934, Pl. 2, fig. 12.

Pseudostaffella sphaeroidea Grozdilova and Lebedeva, 1950, p. 35, 36, Pl. 5, fig. 4; Rauser *in* Rauser-Chernoussova et al., 1951, p. 128, Pl. 9, figs. 3-5; Igo, 1957, p. 197-199, Pl. 5, figs. 9-18; Sheng, 1958, p. 16, 17, 75, Pl. 3, figs. 16-22, Pl. 4, figs. 1, 2; Forbes, 1960, p. 212, 213, Pl. 30, figs. 10-13; Chang, 1961, p. 153, Pl. 1, figs. 5-7; Ross and Dunbar, 1962, p. 13-15, Pl. 2, figs. 9-12; Lebedeva, 1966a, p. 186, 187, Pl. 3, fig. 3.

Pseudostaffella sp. cf. *P. sphaeroidea*, van Ginkel, 1965, p. 77, 78, Pl. 18, figs. 3-7, Pl. 19, figs. 1, 2.

Material. One axial section and three near-central tangential sections: hypotypes GSC 73943–73946.

Description. Shell large for the genus, subspherical with broadly rounded periphery, and slightly umbilicate poles. Mature shells of 7 volutions are 1.34 to 1.75 mm long, 1.67 to 1.81 mm wide, with form ratio of 0.79 to 1. Proloculus small, spherical, and 0.04 to 0.06 mm in outside diameter. Shell regularly coiled, slowly and uniformly expanding. Spirotheca composed of a tectum and upper and lower tectoria in inner volutions, and four layers (tectum, diaphanotheca, upper and lower tectoria) in outer volutions. Thickness of spirotheca about 0.03 mm in the inner volutions and 0.03 to 0.04 mm in the outer volutions. Septa planar in all volutions. Chomata well developed, massive, and highly asymmetrical, tunnel side slope nearly vertical, poleward

side slopes very gradual, extending to poles. Tunnel is low and broad, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73943	1.46	1.81	0.81	–
73944	1.59	1.67	0.95	0.06
73945	1.34	1.69	0.79	–
73946	1.75	1.75	1.00	–

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	6	7	7½
73943	–	0.21	0.41	0.62	0.91	1.27	1.63	1.81
73944	0.21	0.35	0.54	0.76	1.05	1.32	1.67	–
73945	0.12	0.29	0.49	0.74	1.01	–	–	–
73946	0.21	0.37	0.58	0.78	1.11	1.43	1.75	–

Remarks. Although most specimens from the Nansen Formation are near-central tangential sections, the important characteristics observed agree closely with those of typical *Neostaffella sphaeroidea* (Ehrenberg).

Occurrence. Neostaffella sphaeroidea (Ehrenberg) occurs commonly at GSC loc. C-31666, 1328.7 m (4359 ft.) above the base of the Nansen Formation, and at GSC loc. C-31673, 1352.1 m (4436 ft.).

Subfamily STAFFELLINAE M.-Maclay, 1949

Genus *Pseudoendothyra* Mikhailov, 1939

Type species. Fusulinella struvei Moeller, 1880.

Pseudoendothyra nielseni (Ross and Dunbar)

Plate 1, figures 6-8

Parastaffella nielseni Ross and Dunbar, 1962, p. 20, 21, Pl. 3, figs. 7a-c.

Material. Three axial sections: hypotypes GSC 73852–73854.

Description. Test small, lenticular, with pointed periphery, convex lateral slopes, and dimpled poles. Mature tests of 4 to 5 volutions measured 0.23 to 0.29 mm long and 0.6 to 0.72 mm wide, with form ratio of 0.38 to 0.4. Proloculus about 0.04 to 0.06 mm in outside diameter. Test planispirally coiled throughout and completely involute. First volution closely coiled, succeeding volutions rapidly expanded outward. Spirotheca composed of a tectum, a diaphanotheca, and a lower tectorium, but tectum is indistinct and lower tectorium is sometimes lacking in some volutions. Thickness of spirotheca about 0.015 mm in the fourth volution. Septa planar throughout; chomata low and asymmetrical and extend to polar regions. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73852	0.23	0.60	0.38	0.04
73853	0.29	0.72	0.40	0.06
73854	0.25	0.66	0.38	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	5
73852	0.09	0.16	0.31	0.60	–
73853	0.10	0.19	0.30	0.57	0.72
73854	0.10	0.21	0.37	0.66	–

Remarks. Pseudoendothyra nielseni (Ross and Dunbar) shows a wide variation in the type specimens. The present specimens are similar in all important features to the type specimens. This species is allied to *Pseudoendothyra struvei suppressa* (Schlykova), but the latter has distinctively umbilicate poles and slightly evolute last volution. *Pseudoendothyra nielseni* can be distinguished from *Pseudoendothyra bona bona* Rosovskaya by the slightly convex lateral slopes and slightly dimpled poles of the former species.

Occurrence. Pseudoendothyra nielseni (Ross and Dunbar) is rare at GSC loc. C-31892, 1189 m (3901 ft.) above the base of the Nansen Formation.

Pseudoendothyra struvei (Moeller)

Plate 1, figures 9-11

Fusulinella struvei Moeller, 1879, p. 22, Pl. 2, figs. 1a-c, Pl. 5, figs. 4a-c.

Parastaffella struvei Grozdilova and Lebedeva, 1950, p. 22, 23, Pl. 3, fig. 1.

Pseudoendothyra struvei struvei Rosovskaya, 1963, p. 71, 72, Pl. 12, figs. 21-24.

Material. Three axial sections: hypotypes GSC 73855–73857.

Description. Test small, lenticular, with blunt periphery, somewhat convex lateral slopes, and slightly umbilicate poles. Two mature specimens with 4 to 5 volutions are 0.35 to 0.47 mm long and 0.64 to 0.87 mm wide, with a form ratio of 0.54 to 0.55. Proloculi small, spherical, with 0.04 mm outside diameter. Inner three to four

volutions have narrowly rounded periphery, outer volution has blunt periphery. First volution closely coiled, succeeding volutions uniformly expanded outward. Spirotheca is composed of a tectum, a thick diaphanotheca, and a lower tectorium; tectum and lower tectorium sometimes missing in some volutions, thickness in outer volution about 0.02 mm. Septa unfluted. Chomata low, extend to near poles. Tunnel low, increasing in width from narrow to wide, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73855	0.43	0.79	0.54	0.07
73856	0.46	0.86	0.53	–
73857	0.34	0.87	0.54	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	5
73855	0.13	0.25	0.47	0.79	–
73886	0.15	0.25	0.53	0.86	–
73887	0.10	0.15	0.32	0.56	0.87

Remarks. In shape and most internal features, the specimens from the Nansen Formation of Ellesmere Island are closely similar to the type specimens of *Pseudoendothyra struvei* (Moeller). The only difference is that the width per volution ratio of Nansen specimens is larger than that of the holotype.

Occurrence. Pseudoendothyra struvei (Moeller) was found at two levels within the Nansen Formation: rarely at GSC loc. C-32130, 1108.5 m (3637 ft.) above the base, and GSC loc. C-32134, 1117.4 m (3666 ft.).

Pseudoendothyra preobrajenskyi (Dutkevich)

Plate 1, figures 12-18

Staffella preobrajenskyi Dutkevich, 1934, p. 30-34, 73-75, Pl. 4, figs. 3-8.

Parastaffella preobrajenskyi Rauser. Rauser-Chernoussova et al., 1951, p. 149, 150, Pl. 12, figs. 14, 15; Grozdilova and Lebedeva, 1954, p. 136, 137, Pl. 15, fig. 5; Grozdilova and Lebedeva, 1961, p. 167, 168, Pl. 1, figs. 1-3.

Material. Seven axial sections: hypotypes GSC 73858–73864.

Description. Shell medium in size, thickly lenticular with acutely rounded periphery, generally convex lateral slopes, and narrowly umbilicate poles. Adult shells of 4 volutions have lengths of 0.36 to 0.47 mm, widths of 0.62 to 0.82 mm, and form ratios of 0.47 to 0.59. Proloculi small, spherical, with 0.03 to 0.08 mm outside diameter. Shell planispirally coiled throughout; first volution discoidal and closely coiled, succeeding volutions rapidly and uniformly expanding. Spirotheca, with tectum, diaphanotheca, and lower tectorium, is about 0.01 to 0.02 mm thick in outer volutions. Septa planar throughout. Chomata low and asymmetrical. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73858	0.45	0.76	0.49	0.06
73859	0.47	0.80	0.59	0.08
73860	0.37	0.64	0.58	0.03
73861	0.36	0.76	0.47	0.06
73862	0.47	0.91	0.52	0.07
73863	0.45	0.82	0.55	0.07
73864	0.36	0.61	0.59	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	4½
73858	0.19	0.27	0.49	0.76	–
73859	0.21	0.33	0.50	0.80	–
73960	0.10	0.23	0.39	0.64	–
73961	0.12	0.25	0.43	0.76	–
73962	0.14	0.25	0.54	0.73	0.91
73963	0.16	0.28	0.52	0.82	–
73964	0.16	0.36	0.61	–	–

Remarks. Specimens from the type area of the Nansen Formation on Ellesmere Island agree closely with the type specimens of *Pseudoendothyra preobrajenskyi* in size, shape, and internal characters. The species is also similar to *Pseudoendothyra crassa crassa* Rosovskaya in shape, but differs in having a much larger shell size and in each volution being larger.

Occurrence. Pseudoendothyra preobrajenskyi (Dutkevich) has been recovered from two levels in the Nansen Formation: GSC loc. C-32130, 1108.5 m (3637 ft.) above the base, and GSC loc. C-31780, 1613.1 m (5292 ft.).

Pseudoendothyra jazvensis (Grozdilova and Lebedeva)

Plate 1, figures 21, 22

Parastaffella bradyi Rauser. Rauser-Chernoussova et al., 1951, p. 148, Pl. 12, fig. 11.

Parastaffella jazvensis Grozdilova and Lebedeva, 1954, p. 134, Pl. 15, fig. 7.

Material. Two axial sections: hypotypes GSC 73867, 73868.

Description. Shell large for the genus, thickly lenticular, periphery blunt, lateral slopes almost straight, and poles highly inflated. The mature shell of 5 volutions is 0.87 mm long and 1.28 mm wide, with form ratio of 0.68. Proloculus small, spherical, and 0.04 to 0.06 mm in outer diameter. Shell planispirally coiled throughout and completely involute. Spirotheca thick, 0.01 to 0.03 mm thick in outer volutions, and composed of a tectum, a thick diaphanotheca, and a lower tectorium. Septa planar. Chomata low and asymmetrical. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73867	0.87	1.28	0.68	0.06
73868	0.42	0.70	0.60	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	5
73867	0.21	0.35	0.66	0.68	1.28
73868	0.16	0.37	0.70	–	–

Remarks. The present specimens agree closely in all important characters with the holotype of *Pseudoendothyra jazvensis*. In general shape, the Nansen species is similar to *Pseudoendothyra subrhomboides* (Rauser), but the latter species has a more acutely pointed periphery and deeply concave lateral slopes. It differs from *P. bradyi* (Moeller) in having an acutely pointed periphery, inflated poles, and a longer axis of coiling.

Occurrence. Pseudoendothyra jazvensis (Grozdilova and Lebedeva) has been recovered from two levels within the Nansen Formation, at GSC loc. C-32131, 1112.8 m (3651 ft.) above the base, and at GSC loc. C-32134, 1117.4 m (3666 ft.).

Pseudoendothyra sp. A

Plate 1, figures 19, 20

Material. Two axial sections: hypotypes GSC 73865, 73866.

Description. Shell medium size, thickly lenticular, periphery pointed, lateral slopes slightly concave, and poles inflated. Mature shells of 3½ volutions are 0.46 to 0.6 mm long and 0.7 to 0.81 mm wide, giving form ratios of 0.66 to 0.74. Proloculus small, almost spherical, about 0.04 mm in outside diameter. Shell planispirally coiled throughout; first volution tightly coiled, succeeding volutions increase markedly in width. Spirotheca, which has a tectum, a diaphanotheca, and a lower tectorium, is about 0.02 mm thick in outer volutions. Septa planar. Chomata low and asymmetrical. Tunnel low and narrow, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73865	0.46	0.70	0.66	0.04
73866	0.60	0.81	0.74	–

	Width of Volution (mm)			
GSC no.	1	2	3	3½
73865	0.10	0.26	0.92	0.70
73866	0.19	0.37	0.64	0.81

Remarks. Pseudoendothyra sp. A is similar to *Pseudoendothyra jazvensis* (Grozdilova and Lebedeva) and *P. subrhomboides* (Rauser) in general shape. It differs from these two species in being much smaller in size and having fewer volutions.

Occurrence. Pseudoendothyra sp. A occurs at GSC loc. C-31780, 1613.1 m (5292 ft.), and GSC loc. C-31784, 1620.4 m (5316 ft.) above the base of the Nansen Formation.

Pseudoendothyra ellesmerensis n. sp.

Plate 2, figures 1-3

Material. Three axial sections: holotype GSC 73869, paratypes GSC 73870, 73871.

Etymology. Named after Ellesmere Island, the general area of the type locality.

Description. Shell medium size, subdiscoidal with broadly rounded periphery and slightly umbilicate poles. Adult shells of 4 to 4½ volutions have lengths of 0.41 to 0.64 mm, widths of 0.8 to 1.01 mm, and form ratios of 0.51 to 0.66. Proloculus small, subspherical, and 0.04 to 0.06 mm in outside diameter. Shell planispirally coiled throughout; first volution evolute and discoidal, with narrowly rounded periphery; remaining volutions involute and rapidly and uniformly expanded. Spirotheca is composed of a tectum, a diaphanotheca, and upper and lower tectoria; upper tectorium usually missing in last volution and above tunnel; thickness in outer volutions about 0.02 to 0.04 mm. Septa unfluted throughout. Chomata massive and highly asymmetrical, extending to near poles. Tunnel low, narrow to broad from inside to outside, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73869	0.62	0.94	0.66	0.04
73870	0.64	1.01	0.63	0.06
73871	0.41	0.80	0.51	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	4½
73869	0.14	0.31	0.54	0.83	0.94
73870	0.21	0.39	0.62	1.01	–
73871	0.16	0.29	0.49	0.80	–

Remarks. This species is characterized by a subdiscoidal shell with rounded periphery, slightly umbilicate poles, and massive chomata. It is similar to *Pseudoendothyra volimiensis* (Grozdilova) in some features, but differs from that species in having slightly umbilicate poles and massive chomata. It also resembles *P. ermakiensis* Lebedeva, which, however, has heavier secondary deposits in the axial areas.

Occurrence. Pseudoendothyra ellesmerensis n. sp. was only found at GSC loc. C-31892, 1189 m (3901 ft.) above the base of the Nansen Formation.

Pseudoendothyra holmensis
(Ross and Dunbar)

Plate 2, figures 4-11

Parastaffella holmensis Ross and Dunbar, 1962, p. 18-20, Pl. 3, figs. 1-6.

Material. Seven axial sections and one sagittal section: hypotypes GSC 73872-73879.

Description. Test small, thickly lenticular with generally sharp angular periphery, slightly convex laterally and with narrowly umbilicate poles. Four adult specimens of 5 volutions measure 0.41 to 0.49 mm in length, are 1.03 to 1.13 mm wide, and have form ratios of 0.39 to 0.44. Proloculus small and spherical, 0.03 to 0.06 mm in outer diameter. Test is planispirally coiled throughout, first two volutions nautiliform with narrowly rounded periphery. Periphery of succeeding volutions becomes subacute to generally sharply angular. Spirotheca composed of tectum, diaphanotheca, and lower tectum and reaches 0.02 to 0.03 mm in thickness in the outer volution. Septa planar. Chomata low, broad, and extend near poles. Tunnel narrow and low, with regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73872	0.34	0.74	0.46	0.04
73873	0.43	0.91	0.47	0.04
73874	0.49	1.13	0.43	–
73875	0.43	1.09	0.39	0.04
73876	0.41	0.9	0.46	0.06
73877	0.41	1.19	0.34	0.04
73878	0.45	1.03	0.44	0.03
73879	–	0.91	–	0.06

	Width of Volution (mm)					
GSC no.	1	2	3	4	4½	5
73872	0.12	0.25	0.46	0.74	–	–
73873	0.12	0.43	0.76	0.76	0.91	–
73874	0.04	0.19	0.37	0.66	–	1.13
73875	0.08	0.23	0.37	0.64	–	1.09
73876	0.16	0.33	0.52	0.90	–	–
73877	0.16	0.31	0.49	0.82	–	1.19
73878	0.08	0.19	0.33	0.58	–	1.03
73879	0.14	0.29	0.49	0.68	–	0.91

Remarks. The present specimens fall within the range of variability of type specimens of *Pseudoendothyra holmensis* (Ross and Dunbar) from Greenland. The species is similar to *Pseudoendothyra luminosa* Ganelina; however, that species has deeply umbilicate poles, shorter axis of coiling, and smaller form ratio. It differs from *Pseudoendothyra kyrtajolis* (Durkina) in having narrowly umbilicate poles and sharply angular periphery.

Occurrence. Pseudoendothyra holmensis (Ross and Dunbar) has been found in the Nansen Formation at GSC loc. C-32130, 1108.5 m (3637 ft.) above the base, and GSC loc. C-31890, 1182.9 m (3881 ft.) above the base.

Pseudoendothyra probatus (Durkina)

Plate 2, figures 12-20

Parastaffella probatus Durkina, 1959, p. 214, 215, Pl. 22, figs. 15, 16.

Material. Nine axial sections: hypotypes GSC 73880–73888.

Description. Shell small, inflated, lenticular, with acutely rounded periphery and slightly umbilicate poles. Adult specimens of 5 to 6 volutions are 0.49 to 0.63 mm long and 0.87 to 1.26 mm wide, with form ratio of 0.5 to 0.6. Proloculus is small and spherical, with outside diameter of 0.06 mm. First volution closely coiled. Succeeding volutions gradually and uniformly expand outward. Spirotheca is composed of tectum, thick diaphanotheca, and lower tectoria, and is about 0.01 to 0.02 mm thick in outer volutions. Septa planar. Chomata are low and extend to the poles. Tunnel is narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73880	0.52	0.87	0.60	–
73881	0.41	0.84	0.49	0.04
73882	0.35	0.76	0.46	0.08
73883	0.31	0.76	0.41	0.06
73884	0.36	0.68	0.53	0.08
73885	0.33	0.72	0.46	–
73886	0.46	0.86	0.52	0.06
73887	0.49	0.97	0.50	0.06
73888	0.63	1.26	0.50	–

	Width of Volution (mm)						
GSC no.	1	2	3	3½	4	5	6
73880	0.06	0.19	0.33	–	0.54	0.84	–
73881	0.14	0.31	0.54	–	0.84	–	–
73882	0.19	0.33	0.52	–	0.76	–	–
73883	0.12	0.25	0.43	–	0.76	–	–
73884	0.18	0.36	0.61	0.68	–	–	–
73885	0.10	0.25	0.41	–	0.72	–	–
73886	0.21	0.39	0.57	–	0.86	–	–
73887	0.12	0.25	0.39	–	0.64	0.99	–
73888	0.11	0.18	0.32	–	0.54	0.82	1.26

Remarks. Specimens from the Nansen Formation are closely similar in shape, size, and internal characters to the type specimens from the U.S.S.R. *Pseudoendothyra probatus* (Durkina) resembles *Pseudoendothyra kremenskensis* Rosovskaya and *P. plummeri* (Thompson), but those species have a more acutely pointed periphery.

Occurrence. Pseudoendothyra probatus (Durkina) is common at GSC loc. C-32130, 1108.5 m (3637 ft.) above the base of the Nansen Formation, GSC loc. C-32132, 1114.3 m (3655 ft.), and GSC loc. C-31890, 1182.9 m (3881 ft.).

Pseudoendothyra rara (Grozdilova)

Plate 3, figures 1-6

Parastaffella rara Grozdilova. Lebedeva, 1954, p. 275, 276, Pl. 10, figs. 6, 7.

Material. Six axial sections: hypotypes GSC 73889–73894.

Description. Shell small, discoidal, with broadly rounded periphery, and broadly umbilicate poles. Mature specimens of 4 to 4½ volutions are 0.29 to 0.35 mm long and 0.62 to 0.78 mm wide, with form ratio of 0.4 to 0.47. Proloculus small, spherical, and 0.03 to 0.05 mm in outside diameter. First two volutions have narrowly rounded periphery and are closely coiled; succeeding volutions expand rapidly. Spirotheca, which has a tectum, a thick diaphanotheca, and a lower tectorium, is about 0.01 to 0.02 mm thick in outer volutions. Septa unfluted throughout. Chomata low, highly asymmetrical, and extend to polar regions. Tunnel low, narrow to broad from inside to outside, and has a regular path. Secondary deposits developed in polar regions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73889	0.33	0.78	0.42	0.04
73890	0.33	0.76	0.43	0.03
73891	0.29	0.62	0.47	0.04
73892	0.35	0.81	0.43	–
73893	0.31	0.78	0.40	0.05
73894	0.25	0.64	0.39	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	4	5
73889	0.10	0.21	0.39	0.63	0.78
73890	0.12	0.25	0.43	0.76	–
73891	0.12	0.19	0.35	0.62	–
73892	0.10	0.25	0.48	0.81	–
73893	0.14	0.27	0.47	0.78	–
73894	0.12	0.21	0.39	0.64	–

Remarks. Specimens from the Nansen Formation are identical to typical representatives of *Pseudoendothyra rara* (Grozdilova) in shape, size, and internal characters. This species is closely similar in shape, size, and internal features to *Pseudoendothyra arcuata* (Durkina). The principal difference is that *P. arcuata* lacks secondary deposits. It also resembles *Pseudoendothyra pressa* (Grozdilova) and *P. triznae* Lebedeva. Both of the latter, however, have more broadly umbilicate poles and evolute outer volutions.

Occurrence. Pseudoendothyra rara (Grozdilova) is abundant at GSC loc. C-31892, 1189 m (3901 ft.) above the base of the Nansen Formation.

Genus *Staffella* Ozawa, 1925

Type species. Fusulinella sphaerica Moeller, 1878.

Staffella pseudosphaeroidea Dutkevich

Plate 4, figures 1-7

Staffella pseudosphaeroidea Dutkevich, 1934, p. 17-22, Pl. 3, figs. 2-10; Kanmera, 1954, p. 123-126, Pl. 12, figs. 1-12; Putrja, 1956, p. 394, 395, Pl. 4, figs. 11, 12.

Parastaffella pseudosphaeroidea Rauser. Rauser-Chernoussova et al., 1951, p. 152, 153, Pl. 13, figs. 1, 2.

Pseudostaffella? pseudosphaeroidea Ross and Dunbar, 1962, p. 15-17, Pl. 2, figs. 1-8.

Staffella cf. *pseudosphaeroidea* van Ginkel, 1965, p. 14, 15, Pl. 5, figs. 8-11.

Material. Four axial sections and three near-central tangential sections: hypotypes GSC 73905–73911.

Description. Shell is large for the genus, subspherical, periphery broadly rounded, poles broadly umbilicate. A mature specimen of 5½ volutions has a length of 1.44 mm, width of 1.9 mm, and form ratio of 0.76. Proloculus is small, spherical, 0.08 mm in outside diameter. Shell planispirally coiled throughout, inner two volutions closely coiled, discoidal with narrowly rounded periphery; succeeding volutions rapidly and uniformly expanding and subsperical with broadly rounded periphery. Spirotheca is composed of a tectum, a thick diaphanotheca, and upper and lower tectoria, but upper tectorium usually lacking in most volutions; thickness about 0.04 to 0.06 mm in outer volutions. Septa unfluted. Chomata low and asymmetrical. Tunnel low and broad, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73905	1.05	1.36	0.77	0.12
73906	1.17	1.40	0.84	–
73907	1.44	1.90	0.76	0.08
73908	0.80	1.01	0.79	–
73909	0.76	0.91	0.84	–
73910	0.68	0.77	0.88	0.08
73911	0.64	0.68	0.94	0.08

	Width of Volution (mm)							
GSC no.	1	2	3	3½	4	4½	5	5½
73905	0.23	0.37	0.54	–	0.78	–	1.17	1.36
73906	–	0.28	0.60	–	0.93	–	1.40	–
73907	0.23	0.41	0.70	–	1.07	–	1.59	1.9
73908	0.23	0.37	0.57	–	0.82	1.01	–	–
73909	0.29	0.47	0.72	–	0.91	–	–	–
73910	0.19	0.33	0.53	–	0.77	–	–	–
73911	0.19	0.33	0.50	0.68	–	–	–	–

Remarks. The type specimens of *Staffella pseudosphaeroidea* Dutkevich show some variations in shell size, size per volution, and shape. The specimens from the Nansen Formation of Ellesmere Island fall within the range of variability of those type specimens. This species is closely similar in general shape to *Staffella moelleri* Ozawa and *S. continens* Rosovskaya. It differs from those species by having a larger size, both per volution and for the entire shell. It resembles *S. variabilis* (Rauser), but the latter has fewer volutions and much smaller size.

Occurrence. Staffella pseudosphaeroidea Dutkevich has been recovered from the Nansen Formation and is common at GSC loc. C-32130, 1108.5 m (3637 ft.) above the base, GSC loc. C-32131, 1112.8 m (3651 ft.), GSC loc. C-32134, 1117.4 m (3666 ft.), GSC loc. C-31884 1170.7 m (3841 ft.), GSC loc. C-31892, 1189 m (3901 ft.), and GSC loc. C-31671, 1347.6 m (4421 ft.).

Staffella moelleri Ozawa

Plate 3, figures 11-16

Staffella moelleri Ozawa, 1925, p. 19, 20, Pl. 2, fig. 9; Thompson, 1935a, Pl. 13, fig. 18; Toriyama, 1958, p. 71, 73, Pl. 6, figs. 29-34.

Parastaffella moelleri Rauser. Rauser-Chernoussova et al., 1951, p. 104, 105, Pl. 2, fig. 12.

Material. Six axial sections: hypotypes GSC 73899–73904.

Description. Shell small, subspherical, periphery broadly rounded, poles broadly umbilicate. Mature specimens containing 6 volutions are 0.76 to 0.87 mm long and 1.19 to 1.42 mm wide, with form ratios of 0.6 to 0.64. Proloculus small, spherical, and 0.04 to 0.08 mm in outer diameter. Shell planispirally coiled and completely involute throughout, inner three volutions discoidal with narrowly rounded periphery, closely coiled; succeeding volutions subspherical and expanded rapidly outward. Spirotheca composed of a tectum, a thick diaphanotheca, and upper and lower tectoria, but upper tectorium usually lacking in some volutions. Thickness of spirotheca about 0.03 to 0.09 mm in outer volutions. Septa planar. Chomata low and highly asymmetrical, extended to near poles. Tunnel low, with slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73899	0.76	1.07	0.71	0.07
73900	0.76	1.19	0.64	0.08
73901	0.67	1.22	0.54	0.06
73902	0.76	1.07	0.71	0.06
73903	0.82	1.11	0.61	0.06
73904	0.87	1.42	0.60	0.04

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	5½	6
73899	0.14	0.34	0.47	0.74	1.07	–	–
73900	0.16	0.27	0.41	0.60	0.84	–	1.19
73901	0.16	0.31	0.57	0.76	1.07	1.22	–
73902	0.16	0.31	0.52	0.74	1.07	–	–
73903	0.14	0.27	0.47	0.76	1.11	–	–
73904	0.16	0.31	0.45	0.66	0.99	–	1.42

Remarks. The specimens from the Nansen Formation of Ellesmere Island are similar to the holotype of *Staffella moelleri* Ozawa in shape, size, and internal features. This species is closely similar to *Staffella breimeri* van Ginkel, but the latter has flattened or broadly convex periphery and deeply umbilicate poles.

Occurrence. Staffella moelleri Ozawa is common at GSC loc. C-32130, 1108.5 m (3636 ft.) above the base of the Nansen Formation, GSC loc. C-32135, 1120.4 m (3675 ft.), GSC loc. C-31884, 1170.7 m (3840 ft.), and GSC loc. C-31892, 1189 m (3900 ft.).

Staffella mochaensis van Ginkel

Plate 4, figures 8-10

Staffella mochaensis van Ginkel, 1965, p. 17, 18, Pl. 7, figs. 1-7, Pl. 8, figs. 1-9, Pl. 9, fig. 1; van Ginkel, 1971, Pl. 1, fig. 8.

Material. Three axial sections: hypotypes GSC 73912–73914.

Description. Shell large for the genus, subquadrate, with nearly flat periphery, highly and broadly convex lateral slopes, and broadly umbilicate poles. Mature specimens with 5½ to 6 volutions are 1.13 to 1.6 mm long and 1.57 to 2.29 mm wide, with form ratio of 0.72. Proloculus small, subspherical, and 0.06 to 0.1 mm in outside diameter. Shell planispirally coiled throughout and uniformly expanded outward. Spirotheca, composed of a tectum, and a thicker, less dense layer, probably a diaphanotheca, has thickness of 0.02 to 0.06 mm in outer volutions. Septa planar. Chomata low, asymmetrical, extending to near poles. Tunnel low, narrow in inner volutions, becoming broad in outer volutions, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73912	1.13	1.57	0.72	0.06
73913	0.68	0.99	0.69	0.06
73914	1.60	2.29	0.72	0.10

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	5½	6
73912	0.19	0.39	0.62	0.97	1.34	1.57	–
73913	0.21	0.41	0.64	0.99	–	–	–
73914	0.18	0.40	0.59	1.12	1.48	–	2.29

Remarks. The Nansen specimens compare favourably with the holotype of *Staffella mochaensis* van Ginkel in size, shape, and internal features. Kanmera (1954, p. 123-126, Pl. 12, figs. 1-13) has identified some specimens from Japan as *Staffella? pseudosphaeroidea* Dutkevich, which, as Kanmera pointed out, differ from the type specimens in having a larger shell, more numerous volutions, smaller form ratio at maturity, and a nearly flattened periphery. On the basis of their shape and nearly flattened periphery, the Japanese specimens may belong to *Staffella mochaensis* van Ginkel. This species is closely similar to *Staffella pseudosphaeroidea* Dutkevich and *S. moelleri* Ozawa, but differs from those species in having a subquadrangular shape and nearly flat periphery.

Occurrence. Staffella mochaensis van Ginkel occurs at GSC loc. C-31890, 1182.9 m (3881 ft.) above the base of the Nansen Formation, and GSC loc. C-31647, 1275.3 m (4184 ft.).

Family SCHUBERTELLIDAE Skinner, 1931

Subfamily SCHUBERTELLINAE Skinner, 1931

Genus *Schubertella* Staff and Wedekind, 1910

Type species. Schubertella transitoria Staff and Wedekind, 1910.

Schubertella gracilis Rauser

Plate 5, figures 1-8

Schubertella gracilis Rauser. Rauser-Chernoussova et al., 1951, p. 74, Pl. 2, figs. 29, 30.

Schubertella gracilis znensis Rauser. Rauser-Chernoussova et al., 1951, p. 74, 75, Pl. 2, figs. 31, 32.

Material. Seven axial sections and one sagittal section: hypotypes GSC 73915–73922.

Description. Test minute, subellipsoidal, medium part slightly vaulted, lateral slopes convex, and poles acutely rounded. Mature specimens of 4 volutions are 0.58 to 0.66 mm long and 0.43 to 0.47 mm wide, with form ratio of 1.34 to 1.4. Proloculus spherical, 0.04 to 0.1 mm in outside diameter. Test gradually and uniformly expanding. First volution coiled at large angle to outer volutions. Spirotheca thin, composed of an undifferentiated layer, but in some outer volutions this layer sometimes differentiates into a tectum and a slightly transparent layer. Thickness of spirotheca about 0.01 mm in outer volutions. Septa unfluted throughout. Chomata rather low and asymmetrical, and missing in several volutions. Tunnel narrow, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73915	0.66	0.47	1.40	0.04
73916	0.56	0.39	1.44	0.08
73917	0.45	0.33	1.36	0.10
73918	–	0.37	–	0.08
73919	0.58	0.43	1.34	0.04
73920	0.44	0.37	1.19	0.05
73921	0.37	0.27	1.37	0.07
73922	0.41	0.31	1.32	0.08

	Width of Volution (mm)					
GSC no.	1	2	2½	3	3½	4
73915	0.08	0.16	–	0.29	–	0.47
73916	0.16	0.26	–	0.39	–	–
73917	0.16	0.27	–	0.33	–	–
73918	0.14	0.23	–	0.37	–	–
73919	0.11	0.17	–	0.28	–	0.43
73920	0.10	0.19	–	0.29	0.37	–
73921	0.14	0.23	0.27	–	–	–
73922	0.15	0.23	0.27	–	–	–

Remarks. The holotype of *Schubertella gracilis* Rauser is a poorly preserved specimen, but the paratype is well preserved. The Nansen specimen is identical to Rauser-Chernoussova's paratype (Rauser-Chernoussova et al., 1951, Pl. 2, fig. 30). This species is most closely similar in shape and internal characters to *Schubertella polymorpha* Safonova, but the latter has a more loosely coiled shell, a much larger test, and is relatively larger per volution.

Occurrence. Schubertella gracilis Rauser commonly occurs at GSC loc. C-32131, 1112.8 m (3651 ft.) above the base of the Nansen Formation, GSC loc. C-32145, 1152.4 m (3781 ft.), GSC loc. C-31890, 1182.9 m (3880 ft.), and GSC loc. C-31689, 1401.5 m (4598 ft.).

Schubertella lata elliptica Sheng

Plate 3, figures 8, 9

Schubertella lata elliptica Sheng, 1958, p. 20, 87, Pl. 2, figs. 13-20.

Material. Two axial sections: hypotypes GSC 73896, 73897.

Description. Test minute, ellipsoidal, with slightly vaulted central part and broadly rounded poles. Mature specimens having 3 volutions are 0.62 to 0.76 mm long and 0.33 to 0.43 mm wide, with form ratio of 1.77 to 1.88. Proloculus small, about 0.04 to 0.05 mm in outside diameter. First volution closely coiled, succeeding volutions rapidly and uniformly expanding. Spirotheca composed of a less dense layer in most volutions, but in outer volutions it is sometimes differentiated into a tectum, a diaphanotheca-like layer, and a tectorium-like layer; thickness in outer volutions about 0.01 to 0.015 mm. Septa unfluted. Chomata low and asymmetrical. Tunnel narrow and low, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73896	0.76	0.43	1.77	0.04
73897	0.62	0.33	1.88	0.05

	Width of Volution (mm)		
GSC no.	1	2	3
73896	0.14	0.27	0.43
73897	0.11	0.21	0.33

Remarks. The Arctic specimens herein are closely similar to the holotype of *Schubertella lata elliptica* Sheng in all important features. This subspecies can be distinguished from *Schubertella obscura* Lee and Chen by its ellipsoidal shape, greater size per volution, and form ratio. It also resembles *Schubertella simplex* Lange, but the latter has a larger shell, is larger per volution, and has more volutions.

Occurrence. Schubertella lata elliptica Sheng occurs at GSC loc. C-31688, 1398.8 m (4589 ft.) above the base of the Nansen Formation, and GSC loc. C-31696, 1426.2 m (4679 ft.).

Schubertella texana (Thompson)

Plate 3, figure 10

Eoschubertella texana Thompson, 1947, p. 161, 162, Pl. 31, figs. 1-8.

Schubertella pseudoglobulosa Safonova. Rauser-Chernoussova et al., 1951, p. 77, 78, Pl. 4, figs. 3, 4.

Schubertella cf. *pseudoglobulosa* van Ginkel, 1965, p. 89, 90, Pl. 22, figs. 21-23, Pl. 23, fig. 1.

Material. Only one axial section of a specimen has been found in the type area of the Nansen Formation on northern Ellesmere Island: hypotype GSC 73898.

Description. Test small, subspherical, central part broadly rounded, lateral slopes convex, and poles slightly umbilicate. A mature specimen of 3 volutions is 0.64 mm long, 0.44 mm wide, with a form ratio of 1.16. Widths of the first to third volutions are 0.19, 0.33, and 0.55 mm. Proloculus large for shell, spherical, about 0.1 mm in outside diameter. Test rapidly and uniformly expanding outward. Spirotheca thin, composed of an undiffer-

entiated layer in inner volutions and a tectum and a less dense layer in outer volutions; thickness of spirotheca about 0.01 to 0.02 mm in outer volutions. Septa planar throughout. Chomata low and asymmetrical. Tunnel low and broad, with a slightly irregular path.

Remarks. The Nansen specimen is identical to *Schubertella texana* (Thompson) in shape, size, and internal characteristics. In 1951, Safonova described some specimens from the Kashirsky horizon of the Russian Platform as *Schubertella pseudoglobulosa* Safonova. However, those Russian specimens are closely similar in shape and overall size and have a large proloculus, like the type specimens of *Schubertella texana* (Thompson); therefore, we refer *Schubertella pseudoglobulosa Safonova* to *Schubertella texana* (Thompson).

Occurrence. Schubertella texana (Thompson) occurs only at GSC loc. C-31890, 1213.4 m (3981 ft.) above the base of the Nansen Formation.

Schubertella sp. cf. *S. acuta* Rauser

Plate 3, figure 7

cf. *Schubertella acuta* Rauser. Rauser-Chernoussova et al., 1951, p. 79, 80, Pl. 3, figs. 8, 9.

Schubertella acuta forma *callosa* Rauser. Rauser-Chernoussova et al., 1951, p. 80, Pl. 3, figs. 10, 11.

Schubertella acuta callosa Han, 1980, p. 29, Pl. 2, figs. 26, 27.

Material. One axial section of a specimen has been found: hypotype GSC 73895.

Description. Test minute, fusiform, medium part vaulted, lateral slopes slightly concave or straight, and poles blunt. One mature specimen having 3½ volutions is 0.74 mm long and 0.35 mm wide, with a form ratio of 2.11. Widths of the first to the third and one half volutions are 0.1, 0.19, 0.29, and 0.35 mm. Proloculus small and spherical, about 0.04 mm in outside diameter. First volution endothyrid, coiled at right angles to outer volutions and closely coiled; succeeding volutions slowly and uniformly expanding outward. Spirotheca thin, composed of an undifferentiated and less dense layer, about 0.005 to 0.01 mm thick in outer volution. Septa planar throughout. Chomata low and asymmetrical. Tunnel rather narrow, with a regular path.

Remarks. The Nansen specimen is closely similar to *Schubertella acuta* Rauser in size and internal features. It differs from the holotype, however, in that it has a slightly concave lateral slope and developed chomata.

Occurrence. Schubertella sp. cf. *S. acuta* Rauser is very rare in the Nansen Formation and occurs only at GSC loc. C-31901, 1215.5 m (3988 ft.).

Schubertella lata Lee and Chen

Plate 5, figures 10-12

Schubertella lata Lee and Chen, 1930, p. 111, Pl. 6, figs. 9-11; Rauser *in* Rauser-Chernoussova et al., 1951, p. 81, Pl. 3, fig. 14; Putrja, 1956, p. 410, 411, Pl. 6, fig. 9; Sheng, 1958, p. 19, 20, 77, Pl. 2, figs. 7-12.

Schubertella sp. cf. *S. lata* Lin et al., 1977, p. 32, Pl. 6, fig. 13.

Eoschubertella lata Thompson, 1948, p. 33, Pl. 4, figs. 1, 2; Igo, 1957, p. 186, 187, Pl. 3 figs. 6-8.

Eoschubertella sp. cf. *E. lata* Ishii, 1962, p. 6-8, Pl. 6, figs. 38-40.

Material. Three axial sections: hypotypes GSC 73924–73926.

Description. Shell minute, subellipsoidal with slightly vaulted or flattened medium part, and broadly rounded poles. A mature specimen having 4 volutions is 0.81 mm long and 0.42 mm wide, with a form ratio of 1.94. Proloculus small, spherical, and 0.04 mm in outside diameter. First volution coiled at large angle to axis of outer ones, closely coiled, succeeding volutions rapidly and uniformly expanding. Spirotheca thin, composed of a tectum and a thick, less dense layer, but in outer volutions less dense layer is sometimes differentiated into a thin diaphanotheca and a lower tectorium. Thickness of spirotheca about 0.01 to 0.015 mm in outer volutions. Septa unfluted throughout. Chomata low and asymmetrical. Tunnel low and narrow in inner volutions, becomes broad in outer volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73924	0.81	0.42	1.94	0.04
73925	0.91	0.44	2.07	0.04
73926	0.82	0.37	2.22	0.04

	Width of Volution (mm)				
GSC no.	1	2	3	3½	4
73924	0.10	0.16	0.27	–	0.42
73925	0.14	0.23	0.36	0.44	–
73926	0.10	0.19	0.29	0.37	–

Remarks. The Nansen specimens are closely similar to the holotype of *Schubertella lata* Lee and Chen in shape and internal characters. The only difference is that the form ratio is slightly larger than that of the holotype. In general shape, this species is similar to *Schubertella pseudosimplex* Sheng, but the latter has a loosely coiled shell.

Occurrence. Schubertella lata Lee and Chen occurs at GSC loc. C-32131, 1112.8 m (3651 ft.) above the base of the Nansen Formation, GSC loc. C-31881, 1163.4 m (3817 ft.), and GSC loc. C-31884, 1170.7 m (3841 ft.).

Schubertella obscura mosquensis Rauser

Plate 5, figure 9

Schubertella obscura mosquensis Rauser. Rauser-Chernoussova et al., 1951, p. 72, 73, Pl. 3, figs. 23, 24.

Schubertella sp. cf. *S. obscura mosquensis* van Ginkel, 1965, p. 86, 87, Pl. 22, figs. 1-4.

Material. One axial section of a single specimen: hypotype GSC 73923.

Description. Test minute, spherical, with broadly rounded central portion and broadly rounded poles. One mature specimen with 3 volutions is 0.27 mm long and 0.26 mm wide, with a form ratio of 1.04. Widths of the first to third volutions are 0.08, 0.16, and 0.26 mm, respectively. Proloculus about 0.03 mm in outside diameter. Test closely coiled and uniformly expanding. Spirotheca composed of an undifferentiated layer, about 0.007 to 0.01 mm in outer volutions. Septa planar throughout. Chomata poorly developed, usually absent in most volutions. Tunnel narrow.

Remarks. The Nansen specimen is identical to typical representatives of *Schubertella obscura mosquensis* Rauser in most of the important features. The only difference is that the holotype has an endothyrid juvenarium. This subspecies is closely similar to *Schubertella obscura* Lee and Chen. It differs from the latter, however, by having a spherical test and a smaller form ratio. It also resembles *Schubertella*? *borealis* Rauser and *S. pauciseptata globulosa* Safonova, but those species and subspecies have more volutions and a much larger size of shell per volution.

Occurrence. Schubertella obscura mosquensis Rauser occurs at GSC loc. C-31652, 1294.2 m (4246 ft.) above the base of the Nansen Formation.

Family FUSULINIDAE Moeller, 1878

Subfamily FUSULINELLINAE Staff and Wedekind, 1910

Genus *Wedekindellina* Dunbar and Skinner

Type species. Fusulinella euthysepta Henbest, 1928.

Wedekindellina pseudomatura Ross and Tyrrell

Plate 8, figures 1-11

Wedekindellina pseudomatura Ross and Tyrrell, 1965, p. 628, Pl. 75, figs. 11-13; Ross, 1969a, p. 1411, Pl. 171, figs. 32-38.

Material. Eleven axial sections: hypotypes GSC 73975–73985.

Description. Shell small, elongate fusiform, one side of the central part vaulted and the opposite side slightly depressed, lateral slopes nearly straight, and poles bluntly pointed. Adult shells have 5 to 6½ volutions and reach 1.83 to 2.43 mm in length and 0.7 to 0.8 mm in width, with form ratio of 2.61 to 3.04. Proloculus minute and spherical, 0.04 to 0.09 mm in outside diameter. First two volutions tightly coiled and subspherical; succeeding volutions increase markedly in length and are fusiform to elongate fusiform. Spirotheca thin, composed of a tectum, a diaphanotheca, and upper and lower tectoria, but upper tectorium discontinuous and sporadically lacking in some volutions; thickness of spirotheca about 0.005 mm in inner volutions and 0.01 to 0.015 mm in outer volutions. Septa gently folded in extreme polar regions and nearly planar in other parts of shell. Chomata small, low, and slight asymmetrical, tunnel side slope steep and poleward slope low. Tunnel narrow and low, with a slightly irregular path. Axial fillings light, occurring in poles of most outer volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73975	2.10	0.70	3.00	0.08
73976	1.83	0.70	2.61	0.04
73977	2.16	0.76	2.84	0.04
73978	1.24	0.43	2.88	0.09
73979	1.17	0.45	2.60	0.08
73980	2.29	0.93	2.46	0.12
73981	1.17	0.45	2.60	0.10
73982	2.15	0.80	2.69	0.04
73983	2.29	0.99	2.31	0.08
73984	2.25	0.84	2.68	0.10
73985	2.43	0.80	3.04	0.08

GSC no.	Width of Volution (mm) 1	2	3	4	5	6	6½
73975	0.14	0.25	0.33	0.49	0.70	–	–
73976	0.08	0.13	0.21	0.31	0.45	0.62	0.70
73977	0.10	0.17	0.27	0.41	0.64	0.76	–
73978	0.14	0.21	0.29	0.43	–	–	–
78979	0.14	0.23	0.34	0.45	–	–	–
78980	0.19	0.29	0.43	0.66	0.93	–	–
78981	0.14	0.21	0.31	0.45	–	–	–
78982	0.10	0.15	0.25	0.39	0.59	0.80	–
78983	0.16	0.27	0.41	0.66	0.99	–	–
78984	0.19	0.29	0.38	0.60	0.84	–	–
78985	0.14	0.23	0.35	0.47	0.68	0.80	–

Remarks. The specimens from the type section of the Nansen Formation are identical to typical *Wedekindellina pseudomatura* Ross and Tyrrell in shape, size, and internal features. This species can be distinguished from *Wedekindellina matura* Thompson by its smaller shell and dimensions per volution, and its smaller chomata. Also, the general shape of the shell of those two species is different.

Occurrence. Wedekindellina pseudomatura Ross and Tyrrell has been found at two levels in the type area of the Nansen Formation: GSC loc. C-32130, 1108.5 m (3637 ft.) above the base and GSC loc. C-32131, 1112.8 m (3651 ft.).

Wedekindellina matura Thompson

Plate 9, figures 14-22

Wedekindellina matura Thompson, 1945a, p. 56-58, Pl. 4, figs. 1-12, Pl. 5, fig. 5.

Material. Nine axial sections: hypotypes GSC 74010–74018.

Description. Shell small, thickly fusiform, with vaulted central part, straight lateral slopes, and sharply pointed poles. Adult shells of 6 volutions are 1.86 to 2.68 mm long and 0.84 to 1.17 mm wide, with form ratio from 2.11 to 2.82. Proloculus small, spherical, and 0.06 to 0.09 mm in outer diameter. Shell compactly coiled, expanding uniformly; first volution spherical, second volution ellipsoidal, succeeding volutions fusiform. Spirotheca thin, composed of a thin tectum, a rather thick diaphanotheca, and a lower tectorium. Thickness of spirotheca about 0.007 to 0.01 mm in inner volutions and 0.015 to 0.02 mm in outer ones. Septa almost unfluted throughout length of shell. Chomata broad and highly asymmetrical, with vertical sides adjacent to tunnel and low poleward slope in inner volutions. Chomata become narrow, high, and slightly asymmetrical; both tunnel-side slopes and poleward slopes steep in the outer volutions. Tunnel narrow in inner volutions, becoming slightly broad in outer volutions, with a slightly irregular path. Axial fillings very thin, restricted to the polar areas of fourth and fifth volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74010	2.37	0.84	2.82	0.08
74011	2.51	1.01	2.48	0.08
74012	2.22	1.05	2.11	0.06
74013	2.55	0.95	2.58	0.08
74014	1.86	0.84	2.20	–
74015	2.06	0.87	2.37	0.09
74016	2.68	1.17	2.29	0.07
74017	2.02	0.87	2.32	0.06
74018	2.12	0.87	2.44	0.06

GSC no.	Width of Volution (mm) 1	2	3	4	5	6	7
74010	0.12	0.19	0.29	0.41	0.60	0.84	–
74011	0.19	0.27	0.39	0.54	0.75	1.01	–
74012	0.12	0.23	0.35	0.56	0.84	1.05	–
74013	0.19	0.33	0.49	0.72	0.95	–	–
74014	0.10	0.16	0.26	0.39	0.58	0.84	–
74015	0.14	0.21	0.29	0.45	0.64	0.87	–
74016	0.12	0.21	0.35	0.49	0.70	1.00	1.17
74017	0.16	0.27	0.43	0.62	0.87	–	–
74108	0.12	0.19	0.29	0.40	0.60	0.87	–

Remarks. The specimens from the type area of the Nansen Formation are closely similar to type specimens of *Wedekindellina matura* Thompson in shape, size, and development of chomata. The only difference is that the axial fillings in the Arctic specimens are less extensive than in the holotype. In general shape, this species resembles *Wedekindellina prolifica* Kanmera. It differs from that species, however, in being much smaller and having fewer volutions and rather thin axial fillings.

Occurrence. Wedekindellina matura Thompson occurs at GSC loc. C-32130, 1108.5 m (3637 ft.) above the base of the Nansen Formation, GSC loc. C-32134, 1117.4 m (3666 ft.), GSC loc. C-32146, 1157 m (3796 ft.), GSC loc. C-31890, 1182.9 m (3881 ft.), GSC loc. C-31648, 1277.4 m (4191 ft.), and GSC loc. C-31650, 1286.6 m (4221 ft.).

Wedekindellina uralica longa (Dutkevich)

Plate 7, figures 8-18

Fusulinella uralica var. *longa* Dutkevich, 1934, p. 47-52, 84-87, Pl. 5, figs. 6, 12.

Wedekindellina dutkevichi Rauser and Beljaev. Rauser-Chernoussova et al., 1936, p. 183-185; Rauser-Chernoussova et al., 1940, p. 21-23, 72, Pl. 4, figs. 4-7;

Rauser-Chernoussova et al., 1951, p. 239, Pl. 36, figs. 8, 9; Forbes, 1960, p. 215, Pl. 30, figs. 14, 15; Ross and Dunbar, 1962, p. 31-33, Pl. 4, figs. 6-12; Lebedeva, 1966a, Pl. 9, fig. 9.

Material. Eleven axial sections: hypotypes GSC 73964–73974.

Description. Shell large for genus, elongate fusiform, central part vaulted, lateral slopes slightly convex or straight, poles blunt. Mature specimens of 7 to 8 volutions are 3.54 to 4.61 mm long and 1.15 to 1.32 mm wide, with form ratio of 2.77 to 3.58. Proloculus small and spherical, with 0.04 to 0.08 mm outside diameter. Inner two volutions closely coiled, succeeding volutions slowly and uniformly expanding in height, but rapidly increasing in length. Spirotheca thin, composed of a tectum, a diaphanotheca, and upper and lower tectoria, about 0.01 mm thick in inner volutions and 0.015 to 0.02 mm thick in outer ones. Septa weakly fluted in the extreme polar regions, and almost planar elsewhere. Chomata broad and highly asymmetrical in inner volutions, but narrow, low, and slightly asymmetrical, about one third as high as chamber in outer volutions, and sometimes missing in last volution. Tunnel narrow in inner volutions, becoming broad in outer ones, with a slightly irregular path. Axial fillings markedly heavy, occurring in most volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73964	3.21	0.95	3.38	0.08
73965	4.08	1.24	3.29	0.04
73966	2.80	0.91	3.08	0.08
73967	3.54	1.28	2.77	0.04
73968	4.12	1.27	3.24	0.06
73969	3.87	1.17	3.31	–
73970	4.12	1.15	3.58	–
73971	3.67	1.07	3.43	0.04
73972	4.16	1.22	3.41	0.08
73973	4.61	1.32	3.49	–
73974	4.12	1.32	3.12	0.06

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	6	7	8
73964	0.14	0.25	0.37	0.57	0.76	0.95	–	–
73965	0.10	0.19	0.27	0.39	0.58	0.80	–	–
73966	0.12	0.20	0.28	0.39	0.54	0.76	0.91	–
73967	0.14	0.23	0.35	0.49	0.69	0.97	1.28	–
73968	0.11	0.20	0.31	0.43	0.61	0.81	1.09	1.27
73969	0.10	0.16	0.25	0.37	0.52	0.74	1.01	1.17
73970	0.09	0.16	0.27	0.41	0.61	0.82	1.15	–
73971	0.12	0.21	0.32	0.47	0.68	0.93	1.07	–
73972	0.12	0.19	0.31	0.43	0.62	0.98	1.22	–
73973	0.08	0.16	0.27	0.43	0.64	0.87	1.19	1.32
73974	0.11	0.19	0.27	0.42	0.61	0.84	1.13	1.32

Remarks. In shape, size, and inner characters, the specimens from the type area of the Nansen Formation compare closely with the type specimens of *Wedekindellina uralica longa* (Dutkevich) from the middle Urals, U.S.S.R. In 1936, Rauser and Beljaev (*in* Rauser-Chernoussova et al., 1936, p. 185) stated that *Fusulinella uralica* var. *longa* (Dutkevich, 1934, Pl. 5, figs. 6, 12) might be an another species of *Wedekindellina* and named it *Wedekindellina dutkevichi* Rauser and Beljaev, which was formally described and published in 1940 (Rauser-Chernoussova et al., 1940). Meanwhile, Rauser and Beljaev placed the specimens illustrated in Dutkevich (1934, Pl. 5, figs. 6, 12), the type specimens of *W. uralica longa* (Dutkevich), in synonymy with *W. dutkevichi* Rauser and Beljaev. On the basis of priority, the writers consider that *Wedekindellina dutkevichi* Rauser and Beljaev should be a synonym of *Wedekindellina uralica longa* (Dutkevich). This species is similar to *Wedekindellina henbesti* (Skinner) in several features. The latter species, however, has sharply pointed poles, more volutions, much smaller size per volution, and a narrow tunnel. It also resembles *W. longissima* Dalmatskaya (= *W. dutkevichi longissima*), but that species is more slender, has a much longer axis of coiling, a larger form ratio, and is smaller per volution.

Occurrence. Wedekindellina uralica longa (Dutkevich) is abundant in the type Nansen Formation and occurs at GSC loc. C-31901, 1215.5 m (3988 ft.) above the base, GSC loc. C-31653, 1298.2 m (4259 ft.), GSC loc. C-31656, 1307.9 m (4291 ft.), GSC loc. C-31668, 1335.4 m (4381 ft.), and GSC loc. C-31671, 1347.6 m (4421 ft.).

Wedekindellina lata Thompson

Plate 10, figures 1-22

Wedekindellina lata Thompson, 1961, p. 1134, Pl. 136, figs. 1-7.

Material. Twenty-two axial sections: hypotypes GSC 74019–74040.

Description. Shell of medium size for genus, elongate fusiform with vaulted central portion, slightly convex or straight lateral slopes, and blunt poles. Mature shells have 6½ to 7 volutions, are 2.86 to 4.4 mm long and 0.98 to 1.24 mm wide, with form ratio of 2.6 to 3.55. Proloculus small and spherical, 0.04 to 0.1 mm in outer diameter. Inner two volutions tightly coiled and ellipsoidal, succeeding volutions increase markedly in length and are elongate fusiform in shape. Spirotheca thin, composed of a tectum, a rather thin diaphanotheca, and upper and lower tectoria. Septa slightly folded near poles and almost planar in central regions. Chomata low and highly

asymmetrical, with steep tunnel sides and low, broad, lateral slopes; sometimes missing in outer volutions. Tunnel relatively wide, with an almost straight path. Axial fillings thin, developed in the polar areas of most volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74019	3.34	1.11	3.01	0.08
74020	2.47	0.89	2.78	0.09
74021	3.01	1.09	2.76	0.04
74022	2.93	0.93	3.15	0.07
74023	1.57	0.57	2.75	0.08
74024	3.01	0.98	3.07	0.09
74025	3.25	1.03	3.16	0.08
74026	1.96	0.60	3.27	0.09
74027	3.54	1.08	3.37	0.04
74028	3.30	1.24	2.66	0.08
74029	2.68	0.78	3.43	0.06
74030	3.25	1.09	2.98	0.06
74031	2.68	1.03	2.60	0.06
74032	3.50	1.19	2.94	0.06
74033	2.93	0.97	3.02	0.04
74034	3.42	0.93	3.68	0.08
74035	4.14	1.38	2.99	0.12
74036	2.02	0.82	2.46	0.11
74037	3.54	1.11	3.19	–
74038	4.40	1.24	3.55	0.10
74039	2.97	1.07	2.76	0.09
74040	3.31	1.13	2.93	0.10

	Width of Volution (mm)								
GSC no.	1	2	3	4	5	5½	6	6½	7
74019	0.14	0.23	0.31	0.46	0.76	–	0.97	1.11	–
74020	0.16	0.25	0.35	0.54	0.76	0.89	–	–	–
74921	0.08	0.15	0.25	0.37	0.54	–	0.81	–	–
74922	0.12	0.21	0.31	0.43	0.68	–	0.93	–	–
74923	0.16	0.25	0.39	0.57	–	–	–	–	–
74924	0.15	0.23	0.31	0.42	0.59	–	0.82	–	0.98
74925	0.19	0.29	0.43	0.64	0.84	–	1.03	–	–
74926	0.19	0.28	0.41	0.60	–	–	–	–	–
74927	0.10	0.22	0.35	0.52	0.74	–	1.08		
74928	0.12	0.21	0.29	0.45	0.66	–	0.91	–	1.24
74929	0.14	0.24	0.37	0.54	0.78	–	–	–	–
74930	0.14	0.23	0.33	0.47	0.68	–	0.93	–	1.09
74931	0.13	0.19	0.29	0.41	0.62	–	0.91	1.09	–
74932	0.12	0.21	0.31	0.45	0.66	–	0.91	–	1.19
74933	0.10	0.16	0.25	0.41	0.60	–	0.97	–	–
74934	0.14	0.24	0.37	0.56	0.78	0.93	–	–	–
74935	0.19	0.28	0.38	0.53	0.74	–	1.05	–	1.38
74936	0.19	0.27	0.38	0.58	0.82	–	–	–	–
74937	0.10	0.16	0.27	0.41	0.58	–	0.80	–	1.11
74938	0.16	0.25	0.38	0.57	0.78	–	1.05	–	1.24
74939	0.14	0.23	0.33	0.47	0.66	–	0.93	–	1.07
74940	0.19	0.29	0.42	0.60	0.82	–	1.13		

Remarks. The type specimens of *Wedekindellina lata* Thompson from Ward Hunt Island show some variability in shape, size, number of volutions, and proloculus. The Ellesmere Island specimens fall within the range of variation of the type specimens. This species is similar in general shape to *Wedekindellina ardmorensis* Thompson, Verville and Lokke. The latter species, however, has sharply pointed poles, more volutions, tightly coiled shell, and fewer axial fillings.

Occurrence. Wedekindellina lata Thompson is abundant in the type Nansen Formation and occurs at GSC loc. C-32128, 1106.7 m (3631 ft.) above the base, GSC loc. C-32134, 1117.4 m (3666 ft.), GSC loc. C-32144, 1147.9 m (3766 ft.), GSC loc. C-32145, 1152.4 m (3781 ft.), GSC loc. C-31881, 1163.4 m (3817 ft.), GSC loc. C-31884, 1170.7 m (3841 ft.), GSC loc. C-31901, 1215.5 m (3988 ft.), GSC loc. C-31902, 1218 m (3996 ft.), GSC loc. C-31650, 1286.6 m (4221 ft.), and GSC loc. C-31654, 1301.2 m (4269 ft.).

Wedekindellina uralica (Dutkevich)

Plate 7, figures 1-7

Fusulinella uralica Dutkevich, 1934, p. 47-52, 84-87, Pl. 5, fig. 7.

Wedekindellina uralica Safonova and Rauser. Rauser-Chernoussova et al., 1951, p. 237, 238, Pl. 36, fig. 1, 2; Lebedeva, 1966a, p. 201, 202, Pl. 9, fig. 6.

Material. Five axial sections and two tangential sections: hypotypes GSC 73957–73963.

Description. Shell small, fusiform, with slightly vaulted central portion, slightly convex lateral slopes, and pointed poles. Mature shells with 5½ to 7 volutions are 1.75 to 2.37 mm long and 0.74 to 1.03 mm wide, with form ratio of 2.36 to 2.76. Proloculus small, spherical, and 0.04 to 0.08 mm in outer diameter. Shell compactly coiled; first volution subspherical, succeeding volutions increase markedly in length. Spirotheca thin, about 0.005 mm thick in inner volutions and 0.01 to 0.02 mm thick in outer ones, and composed of tectum, diaphanotheca, and upper and lower tectoria. Septa almost unfluted throughout shell. Chomata massive, highly asymmetrical, tunnel side slopes nearly vertical, poleward slopes rather low. Tunnel narrow and about half as high as chamber, with a fairly regular path. Axial fillings markedly heavy, well developed in all volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73957	2.10	0.76	2.76	0.06
73958	1.24	0.56	2.21	0.04
73959	1.20	0.60	2.00	0.08
73960	1.75	0.74	2.36	0.08
73961	1.86	0.76	2.39	0.08
73962	2.37	1.09	2.30	0.06
73963	1.92	0.74	2.59	–

GSC no.	Width of Volution (mm) 1	2	3	4	4½	5	5½	6	7
73957	0.09	0.14	0.35	0.49	–	0.76	–	–	–
73958	0.12	0.21	0.31	0.47	0.56	–	–	–	–
73959	0.14	0.23	0.33	0.47	–	0.60	–	–	–
73960	0.12	0.19	0.27	0.39	–	0.60	0.74	–	–
73961	0.14	0.23	0.35	0.47	–	0.67	–	0.78	–
73962	0.10	0.16	0.25	0.37	–	0.49	–	0.68	1.03
73963	0.10	0.16	0.27	0.37	–	0.52	0.74	–	–

Remarks. Specimens of *Wedekindellina uralica* (Dutkevich) are closely similar to the holotype from the western Urals in shape, size, and heavy axial fillings. Several other species and subspecies are closely similar in their construction. *Wedekindellina uralica inflata* (Dutkevich) is thicker, larger, and has a much larger proloculus; *W. uniformis* Thompson has more numerous volutions, a more closely coiled shell and is of a much smaller size per volution than *Wedekindellina uralica* (Dutkevich). However, some species, such as *Wedekindellina subovata* Safonova, *W. curta* Lebedeva, *Parawedekindellina kamensis* Safonova, and *P. pecholica* Rauser are probably immature specimens of *Wedekindellina uralica* (Dutkevich).

Occurrence. Wedekindellina uralica (Dutkevich) occurs at GSC loc. C-32127, 1105.2 m (3626 ft.) above the base of the Nansen Formation, GSC loc. C-32132, 1114.3 m (3656 ft.), GSC loc. C-31882, 1166.2 m (3826 ft.) and GSC loc. C-31901, 1215.5 m (3988 ft.).

Wedekindellina quasicylindrica n. sp.

Plate 8, figures 12-19

Material. Eight axial sections: holotype GSC 73989, paratypes GSC 73986–73988, 73990–73993.

Etymology. Latin, *quasi*, simulating or appearing as if; *cylindrica*, cylinder; after the shape of the species.

Description. Shell of medium size, subcylindrical to cylindrical, central part slightly vaulted, lateral slopes uniform, and poles narrowly rounded. Adult specimens contain 6 to 6½ volutions, reach 2.39 to 2.8 mm in length and 0.78 to 1.01 mm in width, with form ratio of 2.77 to 3.44. Proloculus minute and spherical, 0.05 to 0.11 mm in outside diameter. Shell tightly coiled, slowly and uniformly expanding in height and rapidly increasing in length; first volution spherical, second volution ellipsoidal, succeeding volutions range from subcylindrical to cylindrical. Spirotheca thin, about 0.005 to 0.01 mm thick in inner volutions and 0.015 to 0.02 mm in outer ones, composed of a tectum, a rather thick diaphanotheca, and a discontinuous lower tectorium. Septa broadly fluted in polar regions and almost planar in other parts of the shell. Chomata broad and asymmetrical, about half as high as chamber in inner volutions, but narrow, small, and slightly asymmetrical in outside ones. Tunnel narrow in inner volutions, becoming broad in outer ones, with a regular path. Axial fillings not dense, and confined to the polar regions of second to fourth volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73986	2.37	0.74	3.20	0.06
73987	1.67	0.48	3.48	0.06
73988	2.39	0.80	2.99	–
73989	2.68	0.76	3.44	0.06
73990	2.45	0.80	3.06	0.11
73991	2.80	1.01	2.77	0.06
73992	1.73	0.49	3.53	0.05
73993	2.97	0.93	3.19	0.08

GSC no.	Width of Volution (mm) 1	2	3	4	4½	5	6	6½
73986	0.12	0.19	0.27	0.43	–	0.62	0.74	–
73987	0.12	0.21	0.29	0.40	0.48	–	–	–
73988	0.10	0.16	0.25	0.39	–	0.60	0.80	–
73989	0.12	0.17	0.28	0.38	–	0.49	0.66	0.78
78990	0.19	0.29	0.41	0.58	–	0.80	–	–
78991	0.10	0.16	0.29	0.45	–	0.72	1.01	–
78992	0.12	0.19	0.29	0.43	0.49	–	–	–
78993	0.14	0.23	0.35	0.52	–	0.78	0.93	–

Remarks. The new species is closely similar to *Wedekindellina lata* Thompson in several features, but differs in having a uniform, mature shape, tightly coiled shell, and a much smaller shell per volution. It also resembles *Wedekindellina minuta* (Henbest) in general shape. However, the latter species has a much smaller shell and markedly heavy axial fillings in all volutions.

Occurrence. Wedekindellina quasicylindrica n. sp. is found at GSC loc. C-32135, 1120.4 m (3676 ft.) above the base of the Nansen Formation, GSC loc. C-31881, 1163.4 m (3817 ft.), GSC loc. C-31882, 1166.2 m (3826 ft.), and GSC loc. C-31883, 1169.2 m (3836 ft.).

Wedekindellina sp. A

Plate 8, figures 20-22

Material. One axial and two oblique sections: hypotypes GSC 73994–73996.

Description. Shell large for genus, elongate fusiform, central part vaulted, lateral slopes straight or slightly concave, and poles bluntly pointed. One mature specimen with 8 volutions is 5.77 mm long and 1.57 mm wide, with

a form ratio of 3.69. Proloculus small and spherical, about 0.06 mm in outer diameter. First two volutions tightly coiled, succeeding volutions rapidly and uniformly expanding, but more rapidly increasing in length than in height. Spirotheca thin, about 0.01 mm in inner volutions and 0.02 mm in outer ones, and composed of tectum, diaphanotheca, and upper and lower tectoria. Septa gently folded near poles, almost unfluted elsewhere. Chomata broad and highly asymmetrical, tunnel side slopes are steep and poleward slopes are low. Tunnel narrow and about half as high as chamber, with a slightly irregular path. Axial fillings markedly heavy, occurring in all volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73994	4.94	1.36	3.63	0.06
73995	4.74	1.63	2.91	0.06
73996	5.77	1.57	3.69	0.06

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	6	7	8
73994	0.13	0.26	0.41	0.51	0.80	1.03	1.36	–
73995	0.14	0.26	0.39	0.60	0.87	1.15	1.46	1.63
73996	0.12	0.21	0.32	0.47	0.68	0.81	1.19	1.57

Remarks. This species is easily distinguished from the other known species of the genus *Wedekindellina* by its larger shell, and relatively numerous volutions.

Occurrence. Wedekindellina sp. A occurs at GSC loc. C-31666, 1328.7 m (4359 ft.) above the base of the Nansen Formation, and GSC loc. C-31676, 1358.2 m (4456 ft.).

Wedekindellina pulchra n. sp.

Plate 9, figures 1-13

Material. Thirteen axial sections: holotype GSC 73997, paratypes GSC 73998–74009.

Etymology. Latin, *pulchra*, beautiful, pretty, or lovely; referring to the outline of the species.

Description. Shell small, shortly fusiform with slightly vaulted central part, somewhat convex lateral slopes, and blunt poles. Adult shells with 5½ volutions are 2.02 to 2.55 mm long and 0.76 to 0.97 mm wide, with form ratio of 2.49 to 2.8. Proloculus minute and spherical, 0.04 to 0.1 mm in outside diameter. Shell regularly coiled; first two volutions closely coiled, succeeding volutions slowly and uniformly expanding. First volution spherical, second volution ellipsoidal, other volutions fusiform. Spirotheca thin, about 0.005 mm thick in inner volutions and 0.01 to 0.015 mm thick in the outer ones, and composed of a thin tectum, a rather thick diaphanotheca, and a lower tectorium of variable thickness. Septa gently folded near poles and almost unfluted elsewhere. Chomata low, broad, and asymmetrical in inner volutions and narrow, high, and slightly symmetrical in outer ones. Tunnel narrow and low in inner volutions becoming low and broad in outer volutions, with a regular path. Axial fillings rather thin and narrow in the poles of fourth and fifth volutions.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
73997	2.12	0.82	2.59	0.07
73998	2.04	0.82	2.49	0.04
73999	2.55	0.95	2.68	0.08
74000	2.12	0.74	2.86	0.09
74001	1.67	0.63	2.65	0.08
74002	1.22	0.61	2.00	0.06
74003	1.63	0.64	2.55	0.08
74004	2.02	0.74	2.73	0.08
74005	1.77	0.74	2.38	–
74006	2.47	0.89	2.78	0.10
74007	2.47	0.97	2.55	0.08
74008	2.02	0.76	2.66	0.07
74009	2.49	0.89	2.80	0.08

	Width of Volution (mm)						
GSC no.	1	2	3	4	4½	5	5½
73997	0.12	0.21	0.31	0.47	–	0.70	0.82
73998	0.10	0.17	0.29	0.45	–	0.68	0.82
73999	0.14	0.22	0.34	0.54	–	0.76	0.95
74000	0.12	0.21	0.33	0.49	–	0.74	–
74001	0.14	0.22	0.33	0.52	–	0.63	–
74002	0.14	0.21	0.32	0.52	0.61	–	–
74003	0.12	0.20	0.30	0.43	–	0.64	–
74004	0.16	0.25	0.35	0.52	–	0.74	–
74005	0.13	0.21	0.33	0.53	–	0.74	–
74006	0.16	0.25	0.40	0.61	–	0.89	–
74007	0.14	0.25	0.37	0.56	–	0.78	0.97
74008	0.12	0.20	0.31	0.47	–	0.66	0.76
74009	0.16	0.24	0.35	0.52	–	0.76	0.89

Remarks. In general shape, *Wedekindellina pulchra* n. sp. is closely similar to *Wedekindellina uralica* (Dutkevich); the latter species, however, has more volutions, and much heavier axial fillings. *Wedekindella pulchra* also resembles *W. matura* Thompson, but differs in having a fusiform shell, fewer volutions, smaller size, and larger form ratio.

Occurrence. Wedekindellina pulchra n. sp. occurs commonly at the following horizons in the Nansen Formation: GSC loc. C-31884, 1170.7 m (3841 ft.) above the base, GSC loc. C-31885, 1175.3 m (3856 ft.), and GSC loc. C-31648, 1277.4 m (4191 ft.).

Genus *Fusulinella* Moeller, 1878

Type species. Fusulinella bocki Moeller, 1878

Fusulinella praecolaniae Safonova

Plate 11, figures 1-11

Fusulinella praecolaniae Safonova. Rauser-Chernoussova et al., 1951, p. 215, 216, Pl. 29, figs. 4, 5.

Fusulinella vozhgalensis Safonova. Rauser-Chernoussova et al., 1951, p. 220, 221, Pl. 31, figs. 1, 2; Wang et al., 1981, p. 27, 28, Pl. 1, figs. 17-25.

Material. Nine axial sections and two sagittal sections: hypotypes GSC 74041-74051.

Description. Shell small, subellipsoidal, with vaulted central part, slightly convex lateral slopes, and rounded poles. Mature shells consisting of 5½ to 6 volutions have lengths of 2.27 to 2.41 mm, widths of 1.01 to 1.15 mm, and form ratios of 2.01 to 2.34. Proloculus minute, spherical, and 0.06 to 0.1 mm in outside diameter. Inner three volutions tightly coiled, outer ones loosely coiled. Spirotheca composed of tectum, thick diaphanotheca, and upper and lower tectoria. Septa slightly fluted near poles, but almost unfluted in other parts of the shell. Chomata massive, narrow and low, about one third to one half as high as volutions. Tunnel narrow in inner volutions, becoming broad in outer ones, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74041	2.41	1.03	2.34	0.08
74042	2.08	0.91	2.29	0.08
74043	2.27	1.05	2.16	0.06
74044	2.04	0.91	2.24	0.08
74045	1.83	0.77	2.38	0.08
74046	2.27	1.01	2.25	0.06
74047	2.31	1.15	2.01	0.10
74048	–	0.82	–	0.10
74049	–	1.00	–	0.10
74050	2.47	1.11	2.23	0.10
74051	1.63	0.67	2.43	0.06

	Width of Volution (mm)							
GSC no.	1	2	3	4	4½	5	5½	6
74041	0.13	0.21	0.31	0.47	–	0.70	1.03	–
74042	0.14	0.28	0.47	0.74	–	0.91	–	–
74043	0.11	0.19	0.29	0.45	–	0.68	–	1.05
74044	0.16	0.25	0.41	0.62	–	0.91	–	–
74045	0.16	0.25	0.39	0.60	0.77	–	–	–
74046	0.14	0.24	0.37	0.58	–	0.87	1.01	–
74047	0.15	0.23	0.37	0.58	–	0.95	1.15	–
74048	0.19	0.30	0.52	0.82	–	–	–	–
74049	0.19	0.30	0.45	0.70	–	1.00	–	–
74050	0.21	0.33	0.54	0.74	–	1.11	–	–
74051	0.14	0.27	0.43	0.67	–	–	–	–

Remarks. Fusulinella praecolaniae Safonova shows a wide range of variability in shape and size. The specimens illustrated here agree in every respect with the type specimens described by Safonova (*in* Rauser-Chernoussova et al., 1951) from the Kashirsky and Podolsky horizons of the Russian Platform. Also, the specimens identified by Safonova (*in* Rauser-Chernoussova et al., 1951) and Wang et al. (1981) as *Fusulinella vozhgalensis* Safonova fall within the range of variation of the type specimens of *Fusulinella praecolaniae* Safonova; *F. vozhgalensis* Safonova should thus be a synonym of *F. praecolaniae* Safonova. This species resembles *Fusulinella praebocki* Rauser but differs in having tightly coiled inner three volutions and loosely coiled outer ones.

Occurrence. Fusulinella praecolaniae Rauser occurs in the Nansen Formation at GSC loc. C-32134, 1117.4 m (3666 ft.) above the base, GSC loc. C-31882, 1166.2 m (3826 ft.), GSC loc. C-31689, 1401.5 m (4598 ft.), and GSC loc. C-31696, 1426.2 m (4679 ft.).

Fusulinella zelleri Thompson

Plate 12, figures 1-17; Plate 13, figures 17-19

Fusulinella zelleri Thompson, 1961, p. 1133, Pl. 135, figs. 17-20.

Material. Twenty-one axial sections: hypotypes GSC 74061-74077, 74093-74096.

Description. Shell is of medium size, fusiform, central portion vaulted, lateral slopes slightly concave or straight, and polar regions narrowly rounded. Mature shells consisting of 7 to 7½ volutions are 3.5 to 4.61 mm long and 1.42 to 1.67 mm wide, with form ratio of 2.46 to 2.76. Proloculus small, spherical, and 0.06 to 0.13 mm in outside diameter. All volutions regularly coiled, slowly and uniformly expanding. Spirotheca typical of genus. Septa folded in polar regions but planar in central part of volutions. Chomata narrow with steep tunnel and low poleward slopes. Tunnel almost half as high as the chamber, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74061	3.79	1.44	2.63	0.08
74062	3.50	1.42	2.46	0.06
74063	2.14	1.11	1.93	0.12
74064	3.70	1.46	2.53	0.12
74065	3.75	1.32	2.84	0.10
74066	3.55	1.05	2.43	0.08
74067	3.34	1.13	2.95	0.10

74068	3.26	1.17	2.79	0.12
74069	2.72	1.09	2.50	0.08
74070	–	–	–	0.10
74071	3.63	1.30	2.79	0.07
74072	3.05	1.11	2.75	0.10
74073	3.46	1.55	2.23	0.10
74074	3.17	1.36	2.33	0.10
74075	2.16	0.93	2.32	0.07
74076	3.75	1.46	2.57	0.10
74077	4.61	1.67	2.76	0.11
74093	3.17	1.34	2.37	0.10
74094	3.05	1.36	2.24	0.10
74095	3.71	1.26	2.94	0.08
74096	4.14	1.65	2.51	0.08

GSC no.	Width of Volution (mm)									
	1	2	3	4	5	5½	6	6½	7	7½
74061	0.14	0.23	0.35	0.54	0.74	–	1.03	–	1.44	
74062	0.12	0.25	0.42	0.58	0.76	–	1.11	1.42	–	–
74063	0.23	0.37	0.57	0.83	1.11	–	–	–	–	–
74064	0.21	0.33	0.49	0.71	0.95	–	1.28	1.46	–	–
74065	0.16	0.29	0.45	0.66	0.93	–	1.32	–	–	–
74066	0.14	0.28	0.46	0.72	1.05	–	–	–	–	–
74067	0.19	0.29	0.45	0.70	0.97	1.13	–	–	–	–
74068	0.23	0.33	0.49	0.70	0.97	–	1.17	–	–	–
74069	0.15	0.27	0.41	0.58	0.78	–	1.09	–	–	–
74070	0.19	0.29	0.39	0.56	0.76	–	–	–	–	–
74071	0.12	0.22	0.35	0.54	0.80	–	1.13	–	1.3	
74072	0.15	0.23	0.34	0.48	0.76	–	0.93	1.11	–	–
74073	0.23	0.33	0.47	0.68	0.97	–	1.36	1.55	–	–
74074	0.16	0.27	0.39	0.56	0.82	–	1.17	1.36	–	–
74075	0.16	0.27	0.41	0.60	0.80	0.93	–	–	–	–
74076	0.21	0.32	0.48	0.72	0.99	–	1.32	1.46	–	–
74077	0.19	0.31	0.47	0.68	0.95	–	1.32	–	1.67	–
74093	0.19	0.28	0.41	0.62	0.90	–	1.17	1.34	–	–
74094	0.19	0.29	0.43	0.61	0.87	–	1.22	1.36	–	–
74095	0.16	0.27	0.39	0.56	0.78	–	1.09	–	1.26	–
74096	0.14	0.25	0.38	0.57	0.80	–	1.07	–	1.45	1.65

Remarks. Specimens of *Fusulinella zelleri* Thompson from the Nansen Formation are closely similar in size, shape, and internal structures to the type specimens from Ward Hunt Island. This species is similar to *Fusulinella nevadensis* Verville, Thompson, and Lokke; but differs from that species in having a smaller size and fewer volutions. It also resembles *Fusulinella alta* Verville, Thompson, and Lokke; however, the latter species has a more elongate shell, a much longer axis of coiling, and a larger form ratio. In fact, there are no remarkable differences between *Fusulinella zelleri, F. alta,* and *F. nevadensis*, and further study might show that they are conspecific.

Occurrence. Fusulinella zelleri Thompson was found at nine levels within the Nansen Formation on Ellesmere Island. They are GSC loc. C-31661, 1319.5 m (4329 ft. above the base), GSC loc. C-31693, 1420.7 m (4661 ft.), GSC loc. C-31696, 1426.2 m (4679 ft.), GSC loc. C-31697, 1428.7 m (4687 ft.), GSC loc. C-31745, 1527.4 m (5011 ft.), GSC loc. C-31746, 1529 m (5016 ft.), GSC loc. C-31784, 1620.4 m (5316 ft.), GSC loc. C-31786, 1628 m (5341 ft.), and GSC loc. C-31787, 1628.7 m (5343 ft.).

Fusulinella nevadensis Verville, Thompson and Lokke

Plate 15, figures 1-10; Plate 16, figures 1-14

Fusulinella nevadensis Verville, Thompson, and Lokke, 1956, p. 1283-1285, Pl. 135, figs. 1-6.

Material. Twenty-four axial sections: hypotypes GSC 74117–74140.

Description. Shell large for genus, elongate fusiform, central part distinctly inflated, lateral slopes slightly concave or almost straight, and poles narrowly rounded to pointed. Mature specimens of 7½ to 8½ volutions are 4.12 to 4.86 mm long and 1.65 to 1.96 mm wide, with form ratio of 2.16 to 2.59. Proloculus small, spherical, and 0.06 to 0.14 mm in outside diameter. Inner two volutions closely coiled, succeeding volutions gradually and uniformly expanding; first volution ellipsoidal, others from thickly fusiform to elongate fusiform. Spirotheca thin, composed of tectum, diaphanotheca, and upper and lower tectoria, except for last volution; thickness of spirotheca about 0.005 to 0.01 mm in inner volutions and 0.02 to 0.04 mm in outer ones. Septa broadly fluted in polar regions and almost planar in central part. Chomata high and narrow, asymmetrical in inner volutions, but symmetrical in outer ones, about two thirds as high as chamber. Tunnel narrow, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74117	4.14	1.92	2.16	0.10
74118	4.28	1.83	2.34	0.10
74119	3.83	1.79	2.14	0.07
74120	3.65	1.66	2.20	0.10
74121	3.79	1.63	2.33	0.10
74122	4.08	1.63	2.50	0.08
74123	4.28	1.96	2.18	0.08
74124	3.81	1.72	2.20	0.10
74125	4.00	1.69	2.37	0.12
74126	4.86	1.94	2.51	0.07
74127	4.16	1.65	2.52	0.10
74128	3.75	1.61	2.33	0.10
74129	2.37	1.11	2.14	0.06
74130	3.63	1.63	2.23	0.12
74131	4.04	1.57	2.57	0.10
74132	3.30	1.53	2.16	0.10
74133	4.41	1.83	2.41	0.08
74134	4.16	1.77	2.35	0.07
74135	2.60	1.19	2.18	0.08
74136	4.08	1.75	2.33	0.08
74137	3.91	1.67	2.34	0.14
74138	2.41	0.99	2.43	0.06
74139	4.10	1.67	2.46	0.12
74140	4.64	1.79	2.59	0.10

GSC no.	Width of Volution (mm)										
	1	2	3	4	5	6	6½	7	7½	8	9
74117	0.19	0.26	0.45	0.62	0.90	1.24	–	1.65	1.92	–	–
74118	0.16	0.24	0.33	0.45	0.66	0.95	–	1.34	–	1.83	–
74119	0.16	0.25	0.37	0.55	0.76	1.03	–	1.36	–	1.79	–
74120	0.16	0.27	0.39	0.54	0.72	0.99	–	1.29	–	1.66	–
74121	0.16	0.29	0.45	0.64	0.91	1.24	–	1.63	–	–	–
74122	0.16	0.27	0.43	0.64	0.93	1.24	–	1.63	–	–	–
74123	0.21	0.33	0.47	0.68	0.97	1.30	–	1.73	1.96	–	–
74124	0.17	0.27	0.41	0.70	0.82	1.14	–	1.55	1.73	–	–
74125	0.19	0.31	0.45	0.65	0.91	1.26	–	1.69	–	–	–
74126	0.12	0.21	0.32	0.48	0.70	0.95	–	1.28	–	1.67	1.94
74127	0.16	0.27	0.39	0.55	0.76	1.07	–	1.42	1.65	–	–
74128	0.20	0.31	0.45	0.63	0.87	1.22	–	1.61	–	–	–
74129	0.14	0.23	0.33	0.45	0.64	0.93	1.11	–	–	–	–
74130	0.22	0.33	0.47	0.68	0.91	1.24	–	1.63	–	–	–
74131	0.21	0.33	0.52	0.72	1.01	1.42	1.57	–	–	–	–
74132	0.20	0.31	0.43	0.62	0.82	1.13	–	1.53	–	–	–
74133	0.16	0.29	0.45	0.67	0.93	1.22	–	1.63	1.83	–	–
74134	0.16	0.27	0.41	0.62	0.87	1.17	–	1.59	1.77	–	–
74135	0.14	0.25	0.40	0.60	0.84	1.19	–	–	–	–	–
74136	0.14	0.25	0.43	0.62	0.92	1.30	–	1.75	–	–	–
74137	0.22	0.33	0.49	0.70	0.96	1.25	–	1.67	–	–	–
74138	0.14	0.23	0.35	0.49	0.70	0.99	–	–	–	–	–
74139	0.23	0.35	0.49	0.69	0.97	1.34	–	1.67	–	–	–
74140	0.19	0.29	0.41	0.60	0.84	1.17	–	1.61	–	1.79	–

Remarks. Fusulinella nevadensis Verville, Thompson, and Lokke was first described from the Ely Limestone of Nevada. The type specimens show some variation in shape, form ratio, and size. The Nansen specimens fall within the range of variation of the type specimens. This species is most closely similar to *Fusulinella alta* Verville, Thompson, and Lokke, but differs by its inflated central portion and smaller form ratio.

Occurrence. Fusulinella nevadensis Verville, Thompson, and Lokke occurs commonly in the Nansen Formation at GSC loc. C-31687, 1396.3 m (4581 ft.) above the base, GSC loc. C-31692, 1416.2 m (4646 ft.), GSC loc. C-31695, 1422.2 m (4666 ft.), GSC loc. C-31701, 1434.5 m (4706 ft.), GSC loc. C-31715, 1461.9 m (4796 ft.), GSC loc. C-31726, 1481.7 m (4861 ft.), GSC loc. C-31744, 1523.9 m (5000 ft.), GSC loc. C-31757, 1542.7 m (5061 ft.), GSC loc. C-31759, 1548.8 m (5081 ft.), and GSC loc. C-31789, 1632.6 m (5356 ft.).

Fusulinella devexa Thompson

Plate 14, figures 10-19

Fusulinella devexa Thompson, 1948, p. 94, 95, Pl. 32, figs. 6, 10, Pl. 35, figs. 1-15, Pl. 36, figs. 7-10, 12-17; Rich, 1961, Pl. 143, figs. 6-9; Ross and Sabins, 1965, p. 186, Pl. 24, figs. 6-9.

Material. Ten axial sections: hypotypes GSC 74107–74116.

Description. Shell of medium size, elongate fusiform, axis of coiling straight, central area inflated, lateral slopes slightly concave, poles sharply pointed. Mature shells of 7 to 9 volutions are 3.25 to 4.74 mm long, 1.4 to 1.79 mm wide, with form ratio of 2.03 to 2.65. Proloculus small, spherical, and 0.04 to 0.1 mm in outside diameter. All volutions regularly coiled, first two volutions ellipsoidal, third to fifth volutions inflated fusiform, and outer volutions inflated elongate fusiform. Spirotheca thin, composed of four layers, except in the last two volutions that usually consist of a tectum and a thick dense layer, probably a diaphanotheca. Septa regularly fluted in the extreme polar regions, almost planar or irregularly unfluted in the other part of shell. Chomata well developed, asymmetrical in inner volutions, less asymmetrical in outer ones. Tunnel narrow, high in inner volutions and low in outer ones, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74107	4.74	1.48	2.65	0.06
74108	2.68	1.32	2.01	0.06
74109	3.30	1.46	2.62	0.06
74110	3.38	1.40	2.41	0.04
74111	2.88	1.24	2.34	0.06
74112	3.36	1.63	2.03	0.07
74113	2.68	1.32	2.03	0.06
74114	3.34	1.48	2.26	0.08
74115	3.67	1.40	2.32	0.11
74116	3.25	1.79	2.56	0.10

GSC no.	Width of Volution (mm)										
	1	2	3	4	5	6	6½	7	7½	8	9
74107	0.12	0.2	0.31	0.49	0.68	0.93	–	1.28	1.48	–	–
74108	0.16	0.25	0.38	0.58	0.80	1.12	–	1.32	–	–	–
74109	0.12	0.21	0.33	0.47	0.68	0.95	–	1.28	1.46	–	–
74110	0.10	0.21	0.35	0.57	0.79	1.10	–	1.40	–	–	–
74111	0.12	0.19	0.31	0.45	0.68	1.03	1.24	–	–	–	–
74112	0.13	0.23	0.36	0.56	0.78	1.07	–	1.42	1.63	–	–
74113	0.14	0.21	0.33	0.52	0.76	–	–	–	–	–	–
74114	0.19	0.33	0.47	0.70	0.95	1.28	1.48	–	–	–	–
74115	0.20	0.32	0.47	0.66	0.89	1.19	–	1.42	–	–	–
74116	0.16	0.27	0.41	0.56	0.77	1.05	–	1.22	–	1.59	1.79

Remarks. The present specimens are identical to *Fusulinella devexa* Thompson from the Cuchillo Negro Formation of Mud Springs Mountains, U.S.A. in all important characters. This species is similar to *Fusulinella subpulchra submesopachis* Putrja, but differs in its elongate shell, larger form ratio, and smaller size of corresponding volutions.

Occurrence. Specimens of *Fusulinella devexa* Thompson are exceedingly abundant at GSC loc. C-31902, 1218 m (3996 ft.) above the base of the Nansen Formation, GSC loc. C-31655, 1304.9 m (4281 ft.), GSC loc. C-31656, 1307.9 m (4291 ft.), GSC loc. C-31697, 1428.7 m (4687 ft.), GSC loc. C-31713, 1455.5 m (4775 ft.), and GSC loc. C-31722, 1475.6 m (4841 ft.).

Fusulinella fugax Thompson

Plate 17, figures 1-21

Fusulinella fugax Thompson, 1948, p. 88, 89, Pl. 32, fig, 2; Pl. 33, figs. 1-8.

Material. Twenty axial sections and one sagittal section: hypotypes GSC 74141–74161.

Description. Shell of medium size, inflated fusiform, with slightly curving axis of coiling, inflated central part, concave lateral slopes, and pointed poles. Mature shells of 6½ to 7 volutions are 2.64 to 3.42 mm long and 1.19 to 1.48 mm wide, with form ratio of 2.13 to 2.41. Proloculus small, spherical, and 0.06 to 0.14 mm in outside diameter. All volutions regularly coiled, slowly and uniformly expanding; inner volutions ellipsoidal, outer ones inflated fusiform or fusiform. Spirotheca composed of tectum, thick diaphanotheca, and upper and lower tectoria. Septa broadly fluted in extreme polar regions, unfluted in the central part of shell. Chomata well developed, massive and asymmetrical, tunnel side slope nearly vertical and poleward slopes shallow in inner volutions, but nearly symmetrical with both tunnel side and poleward slopes equally steep in outer volutions. Tunnel high and narrow, about one half to two thirds as high as volutions, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74141	2.76	1.19	2.32	0.10
74142	2.60	1.28	2.03	0.08
74143	2.33	1.11	2.10	0.08
74144	2.72	1.22	2.23	0.14
74145	2.31	1.07	2.16	0.06
74146	2.60	1.17	2.22	0.08
74147	2.86	1.24	2.31	0.10
74148	1.75	0.91	1.92	0.10
74149	2.64	1.24	2.13	0.06
74150	2.80	1.19	2.35	0.10
74151	1.77	0.93	1.90	0.06
74152	2.87	1.28	2.32	0.08
74153	3.25	1.38	2.36	0.11
74154	2.62	1.28	2.05	0.10
74155	3.09	1.38	2.24	0.06
74156	3.17	1.38	2.30	0.08
74157	–	1.34	–	0.10
74158	3.13	1.30	2.41	0.08
74159	3.42	1.48	2.31	0.07
74160	1.44	0.70	2.06	0.08
74161	3.34	1.42	2.35	0.08

GSC no.	Width of Volution (mm) 1	2	3	4	4½	5	5½	6	6½	7
74141	0.19	0.28	0.43	0.62	–	–	–	–	–	–
74142	0.16	0.25	0.37	0.57	–	0.82	–	1.11	–	–
74143	0.14	0.23	0.36	0.56	–	0.80	–	1.11	–	–
74144	0.25	0.4	0.58	0.89	–	1.22	–	–	–	–
74145	0.14	0.25	0.39	0.62	–	0.89	–	1.07	–	–
74146	0.24	0.39	0.58	0.85	–	1.17	–	–	–	–
74147	0.16	0.27	0.42	0.60	–	0.82	–	1.05	1.24	–
74148	0.20	0.29	0.43	0.64	–	0.91	–	–	–	–
74149	0.12	0.25	0.38	0.60	–	0.78	–	1.07	–	1.24
74150	0.16	0.27	0.39	0.58	–	0.78	–	1.03	1.19	–
74151	0.19	0.25	0.41	0.64	–	0.93	–	–	–	–
74152	0.15	0.25	0.37	0.55	–	0.77	–	1.11	1.28	–
74153	0.20	0.31	0.43	0.62	–	0.84	–	1.11	–	–
74154	0.19	0.30	0.45	0.74	–	1.09	1.28	–	–	–
74155	0.21	0.41	0.60	0.82	–	1.15	1.38	–	–	–
74156	0.16	0.27	0.39	0.56	–	0.82	–	1.17	1.36	–
74157	0.21	0.31	0.45	0.62	–	0.88	–	1.05	1.34	–
74158	0.14	0.25	0.37	0.56	–	0.80	–	1.12	1.30	–
74159	0.16	0.28	0.42	0.62	–	0.84	–	1.15	–	1.48
74160	0.14	0.25	0.39	0.58	0.70	–	–	–	–	–
74161	0.14	0.25	0.38	0.58	–	0.76	–	1.03	–	1.42

Remarks. The Nansen specimens are identical to typical representatives of *Fusulinella fugax* Thompson in every respect. The only difference is that the size of the shell is a little larger than that of Thompson's holotype (1948, Pl. 33, fig. 1). Because this species is characterized by the shape of its shell, it can be easily distinguished from any other described forms.

Occurrence. Fusulinella fugax Thompson is abundant in the Nansen Formation and occurs at GSC loc. C-31652, 1294.2 m (4245 ft.) above the base, GSC loc. C-31653, 1298.2 m (4259 ft.), GSC loc. C-31721, 1475.6 m (4841 ft.), GSC loc. C-31786, 1628 m (5341 ft.), GSC loc. C-31787, 1628.7 m (5343 ft.), and GSC loc. C-31788, 1629.6 m (5346 ft.).

Fusulinella subpulchra submesopachis Putrja

Plate 11, figures 12-20

Fusulinella subpulchra submesopachis Putrja, 1956, p. 427, 428, Pl. 10, fig. 5. *Material.* Nine axial sections: hypotypes GSC 74052–74060.

Description. Shell of medium size, fusiform with highly inflated central part, concave lateral slopes, and sharply pointed poles. Mature specimens of 6½ to 7 volutions are 3.13 to 3.54 mm long and 1.55 to 1.71 mm wide, with form ratio of 1.85 to 2.07. Proloculus medium, spherical, and 0.08 to 0.16 mm in outside diameter. All volutions uniformly and gradually expanding. Spirotheca composed of four layers: tectum, diaphanotheca, and upper and lower tectoria. Septa closely fluted in the poles and unfluted in the other parts of the shell. Chomata well developed, high and narrow, slightly asymmetrical, both tunnel side slopes and poleward side slopes rather steep. Tunnel narrow and high, about two thirds as high as chamber, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74052	2.93	1.50	1.95	0.10
74053	3.09	1.42	2.18	0.12
74054	3.13	1.55	2.02	0.14
74055	3.30	1.71	1.93	0.08
74056	2.60	1.42	1.83	0.06
74057	3.13	1.69	1.85	0.08
74058	3.38	1.55	2.18	0.10
74059	2.06	1.07	1.93	0.09
74060	3.50	1.68	2.07	0.16

	Width of Volution (mm)								
GSC no.	1	2	3	4	5	5½	6	6½	7
74052	0.23	0.39	0.58	0.83	1.28	1.50	–	–	–
74053	0.21	0.35	0.50	0.76	1.03	–	1.42	–	–
74054	0.27	0.41	0.60	0.81	1.11	–	1.55	–	–
74055	0.21	0.35	0.54	0.84	1.22	–	1.71	–	–
74056	0.15	0.27	0.42	0.66	0.97	–	1.42	–	–
74057	0.19	0.33	0.47	0.64	0.89	–	1.28	–	1.69
74058	0.21	0.37	0.60	0.84	1.17	–	1.55	–	–
74059	0.16	0.25	0.39	0.61	0.88	1.07	–	–	–
74060	0.29	0.41	0.57	0.78	1.06	–	1.46	1.69	–

Remarks. The specimens illustrated here agree in every respect with the holotype of *Fusulinella subpulchra submesopachis* Putrja from Eastern Donbas, U.S.S.R. This subspecies is similar to *Fusulinella eopulchra* Rauser, but differs from that species in its larger shell, longer axis of coiling, larger size per volution, and slightly asymmetrical chomata. It also resembles *Fusulinella lanbensis* (Thomas), but the latter species is larger and has vaulted lateral slopes and asymmetrical chomata.

Occurrence. Fusulinella subpulchra submesopachis Putrja occurs in the Nansen Formation commonly at GSC loc. C-31654, 1301.2 m (4269 ft.), GSC loc. C-31671, 1347.6 m (4421 ft.), GSC loc. C-31681, 1381.1 m (4531 ft.), GSC loc. C-31713, 1455.5 m (4775 ft.), GSC loc. C-31744, 1523.9 m (5000 ft.), and GSC loc. C-31783, 1617.4 m (5306 ft.).

Fusulinella sp. A

Plate 13, figure 20

Material. The material includes only one axial section: hypotype GSC 74097.

Description. Shell large for genus, elongate fusiform, central portion inflated, lateral slope deeply concave, and poles blunt. A mature shell of 6½ volutions is 5.4 mm long, 1.65 mm wide, with a form ratio of 3.07. Widths of the first to sixth and one half volutions are 0.26, 0.39, 0.68, 0.8, 1.05, 1.42, and 1.65 mm, respectively. Proloculus is large, spherical and 0.17 mm in outside diameter. Shell regularly coiled, inner two volutions closely coiled, other volutions expand uniformly; first volution ellipsoidal, second to fourth volutions thickly fusiform, succeeding volutions elongate fusiform. Spirotheca thin, about 0.01 to 0.02 mm thick in inner volutions and 0.03 to 0.04 mm thick in outer ones, composed of tectum, rather thick diaphanotheca, and upper and lower tectoria. Septa broadly fluted in the extreme polar regions and almost planar elsewhere. Chomata well developed in all volutions, massive and asymmetrical, tunnel side slopes vertical, poleward slopes low. Tunnel high and narrow, about two thirds as high as volution, with a regular path.

Remarks. This species is characterized by relatively few volutions, larger shell, large size per volution, and larger proloculus. It can be easily distinguished from other known species of the genus *Fusulinella.*

Occurrence. Fusulinella sp. A occurs only at GSC loc. C-31786, 1628 m (5341 ft.) above the base of the Nansen Formation.

Fusulinella subpulchra Putrja

Plate 14, figures 7-9

Fusulinella subpulchra Putrja, 1939, p. 182, 183, Pl. 1, figs. 11, 12; Rauser *in* Rauser-Chernoussova et al., 1951, p. 234, 235, Pl. 35, figs. 3, 4; Putrja, 1956, p. 426, 427, Pl. 10, figs. 1-4.

Material. Three axial sections: hypotypes GSC 74104–74106.

Description. Shell of medium size, fusiform, central part highly vaulted, lateral slopes slightly concave or straight, and poles sharply pointed. Mature shells of 8 volutions are 2.88 to 2.93 mm long and 1.26 to 1.36 mm wide, with form ratio of 2.15 to 2.29. Proloculus minute, spherical, and 0.03 to 0.08 mm in outside diameter. All volutions compactly coiled, first volution spherical and coiled at right angle to the outer ones, other volutions vary from ellipsoidal, to inflated fusiform, to fusiform, slowly and uniformly expanding outward. Spirotheca thin, composed of tectum, diaphanotheca, and upper and lower tectoria. Septa closely fluted in polar regions and almost planar in medium part of shell. Chomata well developed, highly asymmetrical, tunnel side slopes steep, poleward slopes rather low, about two thirds as high as chamber. Tunnel high and narrow, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74104	2.60	1.19	2.10	0.04
74105	2.88	1.26	2.29	0.03
74106	2.93	1.36	2.15	0.08

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	6	7	8
74104	0.10	0.19	0.33	0.56	0.76	1.03	1.19	–
74105	0.10	0.14	0.23	0.35	0.53	0.72	0.95	1.26
74106	0.12	0.20	0.29	0.41	0.58	0.78	1.05	1.36

Remarks. The specimens from the Nansen Formation are identical to typical representatives of *Fusulinella subpulchra* Putrja from the Moscovian of Donbas, U.S.S.R. in all important characters. In the development of chomata, this species is closely similar to *Fusulinella iowensis* Thompson. However, the latter form is short, obese, and uniformly fusiform with bluntly pointed poles. It can be distinguished from *F. subpulchra submesopachis* Putrja by having more volutions, being smaller per volution, and by the shape of the chomata.

Occurrence. Fusulinella subpulchra Putrja occurs at GSC loc. C-31721, 1475.6 m (4841 ft.) above the base of the Nansen Formation, and GSC loc. C-31790, 1635.7 m (5365 ft.).

Fusulinella rara Schlykova

Plate 18, figures 1-13; Plate 24, figures 17-20

Fusulinella pseudobocki var. *rara* Schlykova, 1948, p. 134, 135, Pl. 7, figs. 3-5.

Fusulinella rara Rauser. Rauser-Chernoussova et al., 1951, p. 231, 232, Pl. 34, figs. 3, 4; Bogush, 1963, p. 38, 39, Pl. 6, figs. 1-3.

Fusulinella helenae Rauser. Rauser-Chernoussova et al., 1951, p. 229, 230, Pl. 31, figs. 4, 5.

Fusulinella rara forma *curta* Reitlinger, 1961, p. 244, Pl. 4, fig. 7.

Material. Fifteen axial sections and two near-central tangential sections: hypotypes GSC 74162–74174, 74280–74283.

Description. Shell large for genus, elongate fusiform to subcylindrical, central part slightly vaulted, and poles narrowly to broadly rounded. Mature shells having 5½ to 6 volutions are 3.4 to 4.74 mm long and 1.22 to 1.82 mm wide, with form ratio of 2.33 to 2.87. Proloculus small, spherical, and 0.06 to 0.12 mm in outside diameter. All volutions regularly coiled, inner two to three volutions tightly coiled, outer ones rapidly and uniformly expanded; first volution spherical, second volution ellipsoidal, third and fourth volutions elongate ellipsoidal, and succeeding volutions elongate fusiform to subcylindrical. Spirotheca thick, composed of tectum, rather thick diaphanotheca, and upper and lower tectoria. Thickness of spirotheca about 0.01 to 0.02 mm in inner volutions and 0.03 to 0.05 mm in outer ones. Septa closely fluted in polar regions and almost planar in central part. Chomata well developed, slightly asymmetrical, tunnel side slopes steep. Poleward slopes low and extended to the poles, narrow and high, about one half to two thirds as high as chambers in inner volutions; rather low, about one third to one half as high as chambers and nearly symmetrical in outer volutions; both tunnel side and poleward slopes rather steep in outer volutions, and sometimes missing in the last volution. Tunnel high and narrow in inner volutions, becoming low and somewhat broad in the outer ones, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74162	2.97	1.03	2.78	0.06
74163	2.60	1.05	2.48	–
74164	2.93	1.28	2.29	0.08
74165	4.28	1.48	2.89	0.10
74166	2.92	1.15	2.54	0.06
74167	4.20	1.36	3.09	0.12
74168	3.38	1.13	2.99	0.12
74169	4.33	1.61	2.69	0.08
74170	3.25	1.35	2.41	–
74171	4.74	1.65	2.87	0.06
74172	3.54	1.22	2.90	0.10
74173	4.65	1.73	2.69	0.10
74174	3.75	1.32	2.84	0.06
74280	3.46	1.30	2.66	0.05
74281	3.40	1.46	2.33	0.10
74282	4.66	1.76	2.65	0.11
74283	4.28	1.82	2.35	0.06

	Width of Volution (mm)							
GSC no.	1	2	3	4	4½	5	5½	6
74162	0.19	0.35	0.60	0.87	–	1.03	–	–
74163	0.14	0.29	0.48	0.74	–	1.05	–	–
74164	0.16	0.28	0.45	0.70	–	1.09	–	1.28
74165	0.29	0.39	0.60	0.95	–	1.48	–	–
74166	0.15	0.27	0.47	0.76	–	1.15	–	–
74167	0.25	0.45	0.74	1.15	1.36	–	–	–
74168	0.21	0.37	0.58	0.93	–	1.13	–	–
74169	0.16	0.28	0.46	0.76	–	1.15	–	1.61
74170	0.14	0.29	0.58	0.91	–	1.35	–	–
74171	0.17	0.31	0.52	0.79	–	1.22	–	1.65
74172	0.16	0.30	0.44	0.66	–	1.00	1.22	–
74173	0.20	0.33	0.56	0.85	–	1.26	–	1.73
74174	0.16	0.30	0.54	0.89	–	1.32	–	–
74180	0.12	0.26	0.41	0.60	–	0.92	–	1.30
74181	0.19	0.32	0.50	0.73	–	1.09	–	1.46
74182	0.21	0.37	0.64	1.01	–	1.52	1.76	–
74183	0.19	0.35	0.63	1.05	–	1.48	1.82	–

Remarks. *Fusulinella rara* Schlykova shows some variability in shape and size. The present specimens fall within the range of variability of type specimens from the U.S.S.R. The type specimens of *Fusulinella helenae* Rauser (Rauser-Chernoussova et al., 1951, p. 229, 230, Pl. 31, figs. 4, 5) and *Fusulinella rara* forma *curta* Reitlinger (Reitlinger, 1961, p. 244, Pl. 4, fig. 7) are most closely related in shape, size, and internal features to *Fusulinella rara* Schlykova. There are no remarkable differences among these three species. So, we refer *F. helenae* Rauser and *F. rara* forma *curta* Reitlinger to *F. rara* Schlykova. This species resembles *Fusulinella protensa* Thompson, but differs from the latter in being larger and having slightly asymmetrical chomata in the outer volutions.

Occurrence. *Fusulinella rara* Schlykova is abundant in the Nansen Formation at GSC loc. C-31655, 1304.9 m (4281 ft.) above the base, GSC loc. C-31685, 1390.2 m (4561 ft.), GSC loc. C-31687, 1396.3 m (4581 ft.), GSC loc. C-31695, 1422.2 m (4666 ft.), and GSC loc. C-31696, 1426.2 m (4679 ft.).

Fusulinella daviesi n. sp.

Plate 19, figures 16, 17

Material. Two axial sections: holotype GSC 74191, paratype GSC 74190.

Etymology. Named for G.R. Davies, in acknowledgment of his early fieldwork in the type area of the Nansen Formation with one of the authors (WWN).

Description. Shell large for the genus, elongate fusiform with slightly vaulted central part, somewhat concave or convex lateral slopes, and bluntly pointed poles. Mature specimens of 6½ to 7 volutions are 4.3 to 4.53 mm long and 1.48 to 1.85 mm wide, with form ratio of 2.4 to 2.91. Proloculus small, spherical, and 0.09 to 0.1 mm in outside diameter. All volutions regularly coiled, inner three volutions tightly coiled, succeeding volutions uniformly expanding; first two volutions subspherical, third volution ellipsoidal, succeeding volutions fusiform to elongate fusiform. Spirotheca composed of tectum, thick diaphanotheca,, and upper and lower tectoria; upper tectorium usually lacking in the last volution; thickness of spirotheca 0.005 to 0.01 mm in inner volutions and 0.02 to 0.06 mm in outer volutions. Septa broadly fluted in polar regions, sometimes reaching lateral slopes in the last volution, but almost unfluted in the medial part. Chomata low and asymmetrical, tunnel side slopes rather steep and poleward slopes low, about one fifth to one quarter as high as chamber. Tunnel very low and narrow in inner volutions and becomes broad in outer ones, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74190	4.30	1.48	2.91	0.10
74191	4.53	1.85	2.45	0.09

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	6	6½	7
74190	0.16	0.27	0.41	0.64	0.91	1.32	1.48	–
74191	0.14	0.23	0.35	0.54	0.85	1.28	–	1.85

Remarks. The new species is allied with *Fusulinella subcylindrica* Bogush in some respects, but the latter species has a longer axis of coiling, a larger form ratio, and stronger septal fluting. *Fusulinella daviesi* also resembles *Fusulinella longiaxilaris* Bogush, but the latter species has a larger form ratio, fewer volutions, a smaller shell, and stronger chomata. It can be distinguished from *Fusulinella rara* Schlykova and *F. mosquensis lyskovensis* Bogush by its greater number of volutions, its smaller size per volution, and its much weaker chomata.

Occurrence. *Fusulinella daviesi* n. sp. has been found only at GSC loc. C-31692, 1416.2 m (4646 ft.) above the base of the Nansen Formation.

Fusulinella pseudobocki Lee and Chen

Plate 19, figures 1-15

Fusulinella (*Neofusulinella*) *pseudobocki* Lee and Chen, 1930, p. 122, 123, Pl. 9, figs. 10-14, Pl. 10, figs. 1-7.

Fusulinella pseudobocki Toriyama, 1947, p. 34, 35, Pl. 9, fig. 1; Rauser *in* Rauser-Chernoussova et al., 1951, p. 227, 228, Pl. 32, figs. 8, 9; Sheng, 1958, p. 91, Pl. 8, figs. 6-10; Grozdilova and Lebedeva, 1960a, p. 154, 155, Pl. 24, figs. 4, 5; Bogush, 1963, p. 84, 85, Pl. 5, figs. 24, 25; Sheng et al., 1976, p. 204, 205, Pl. 2, figs. 16, 17; Lin et al., 1977, p. 26, Pl. 5, fig. 9; Wang et al., 1982, p. 43, Pl. 7, fig. 12.

Material. Fifteen axial sections: hypotypes GSC 74175–74189.

Description. Shell of medium size, elongate fusiform, central part inflated, poles blunt. Adult shells having 5½ to 6 volutions are 2.27 to 2.97 mm long and 1.01 to 1.44 mm wide, with form ratios of 2.05 to 2.54. Proloculus small, spherical, with outer diameter of 0.07 to 0.12 mm. All volutions regularly coiled and uniformly expanding. Spirotheca composed of tectum, relatively

thick diaphanotheca, and upper and lower tectoria. Septa almost planar in central part of whorls, but slightly folded at the umbilical ends. Chomata prominent, asymmetrical, and developed in all volutions. Tunnel narrow and low, about one third to one quarter as high as chamber, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74175	2.72	1.03	2.64	0.11
74176	2.60	0.92	2.83	0.10
74177	2.27	1.01	2.24	0.09
74178	3.05	1.13	2.70	0.08
74179	2.41	1.03	2.24	0.08
74180	2.76	0.94	2.94	0.07
74181	3.38	1.26	2.68	0.08
74182	2.18	0.99	2.20	0.08
74183	2.95	1.44	2.05	0.08
74184	3.17	1.14	2.78	0.12
74185	0.76	0.45	1.69	0.10
74186	2.97	1.17	2.54	0.10
74187	2.14	0.97	2.21	0.10
74188	1.88	0.82	2.29	0.10
74189	3.46	1.22	2.83	0.08

	Width of Volution (mm)						
GSC no.	1	2	3	4	4½	5	6
74175	0.21	0.33	0.56	0.89	1.03	–	–
74176	0.25	0.39	0.62	0.92	–	–	–
74177	0.16	0.26	0.39	0.59	–	0.84	1.01
74178	0.19	0.33	0.54	0.91	1.13	–	–
74179	0.19	0.29	0.45	0.74	–	1.03	–
74180	0.16	0.29	0.45	0.72	0.94	–	–
74181	0.19	0.31	0.52	0.82	–	1.26	–
74182	0.14	0.24	0.39	0.62	–	0.99	–
74183	0.16	0.29	0.47	0.72	–	1.17	1.44
74184	0.22	0.35	0.54	0.82	–	1.14	–
74185	0.19	0.29	0.45	–	–	–	–
74186	0.17	0.27	0.41	0.63	–	0.97	1.17
74187	0.19	0.31	0.52	0.80	0.94	–	–
74188	0.19	0.28	0.43	0.68	0.82	–	–
74189	0.23	0.37	0.57	0.89	–	1.22	–

Remarks. *Fusulinella pseudobocki* Lee and Chen is widely distributed in China, Japan, and the U.S.S.R. It was initially described by Lee and Chen (1930) from the Middle Carboniferous Huanglung Limestone at Lungta in the suburbs of Nanjing, eastern China. The specimens from Ellesmere Island are closely related in shape, size, and internal characters to the holotype of *Fusulinella pseudobocki* Lee and Chen.

Occurrence. In the type area of the Nansen Formation, *Fusulinella pseudobocki* Lee and Chen is common at GSC loc. C-32145, 1152.4 m (3781 ft.) above the base, GSC loc. C-31688, 1398.8 m (4589 ft.), GSC loc. C-31694, 1422 m (4665 ft.), and GSC loc. C-31697, 1428.7 m (4687 ft.).

Fusulinella subcolaniae Reitlinger

Plate 21, figures 1-6

Fusulinella subcolaniae Reitlinger, 1961, p. 241, Pl. 3, figs. 11-12. *Material.* Six axial sections: hypotypes GSC 74209–74214.

Description. Shell of medium size, elongate fusiform, central part inflated, lateral slopes slightly concave or convex, poles blunt. Mature shells of 6 volutions are 2.37 to 2.88 mm long and 0.93 to 1.22 mm wide, with form ratios of 2.23 to 2.88. Proloculus minute, spherical, with outside diameter of 0.04 to 0.1 mm. Shell closely coiled, uniformly and slowly expanding. Spirotheca thin, composed of four layers. Septa weakly folded in polar regions and almost planar elsewhere. Chomata poorly developed, low and narrow, slightly asymmetrical; both tunnel and poleward slopes usually steep; sometimes missing in the outer volutions. Tunnel narrow, with slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74209	2.88	1.11	2.59	0.06
74210	2.06	0.84	2.45	0.08
74211	2.47	1.05	2.35	0.06
74212	2.74	0.95	2.88	0.10
74213	2.72	1.22	2.23	0.10
74214	2.37	0.93	2.55	0.04

	Width of Volution (mm)					
GSC no.	1	2	3	4	5	6
74209	0.19	0.25	0.37	0.57	0.80	1.11
74210	0.16	0.27	0.41	0.62	0.84	–
74211	0.12	0.22	0.35	0.54	0.76	1.05
74212	0.16	0.23	0.35	0.54	0.78	0.95
74213	0.16	0.26	0.40	0.66	0.89	1.22
74214	0.12	0.31	0.45	0.66	0.93	–

Remarks. The specimens from the Nansen Formation are identical to typical representatives of *Fusulinella subcolaniae* Reitlinger in shape, size, and internal characters. This species can be distinguished from *Fusulinella colaniae* Lee and Chen by its smaller proloculus, smaller size, fewer volutions, and weaker chomata.

Occurrence. *Fusulinella subcolaniae* Reitlinger was found in the Nansen Formation at GSC loc. C-32134, 1117.4 m (3666 ft.) above the base, GSC loc. C-31881, 1163.4 m (3817 ft.), GSC loc. C-31883, 1169.2 m (3836 ft.), and GSC loc. C-31884, 1170.7 m (3841 ft.).

Fusulinella eopulchra Rauser

Plate 20, figures 1-16

Fusulinella eopulchra Rauser. Rauser-Chernoussova et al., 1951, p. 235, Pl. 35, figs. 5-8; Forbes, 1960, p. 213, 214, Pl. 30, figs. 20-23; Kawano, 1961, p. 62-64, Pl. 1, figs. 17-24; Ross and Dunbar, 1962, p. 26-28, Pl. 4, figs. 1-5; Sheng and Sun, 1975, p. 9, Pl. 3, fig. 1; Lin et al., 1977, p. 24, Pl. 4, fig. 16.

Material. Sixteen axial sections: hypotypes GSC 74192–74207.

Description. Shell of medium size, rhombiform, medium part strongly inflated, lateral slopes slightly concave, poles sharply pointed. Mature shells of 7 to 7½ volutions have lengths of 2.84 to 4.12 mm, widths of 1.52 to 1.87 mm, and form ratios of 1.83 to 2.0. Proloculus of medium size, spherical, with outside diameter of 0.06 to 0.16 mm. Shell regularly coiled, inner volutions closely coiled, outer volutions uniformly expanding. Spirotheca composed of four layers, with a thick diaphanotheca. Septa complicated near poles and almost unfluted in other parts of shell. Chomata well developed, high and asymmetrical, tunnel side slopes high and steep, poleward slopes low. Tunnel rather high and narrow, about two thirds height of volution, with an irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74192	2.84	1.55	1.83	0.08
74193	2.49	1.38	1.80	0.11
74194	2.47	1.36	1.82	0.20
74195	3.33	1.61	2.07	0.13
74196	2.39	1.24	1.93	0.08
74197	3.13	1.69	1.85	0.08
74198	2.64	1.24	2.13	0.10
74199	3.50	1.77	1.98	0.16
74200	2.02	1.09	1.85	0.10
74201	3.30	1.52	2.17	0.06
74202	3.47	1.64	2.05	0.14
74203	1.85	1.16	1.59	0.12
74204	3.21	1.61	1.99	0.10
74205	3.70	1.94	1.91	0.16
74206	1.46	0.80	1.83	0.10
74207	3.90	1.87	2.09	0.10

GSC no.	Width of Volution (mm) 1	2	3	4	5	5½	6	6½	7	7½
74192	0.15	0.25	0.39	0.56	0.76	–	1.11	–	1.55	–
74193	0.19	0.33	0.54	0.78	1.05	–	1.38	–	–	–
74194	0.25	0.37	0.54	0.74	1.05	–	1.36	–	–	–
74195	0.27	0.41	0.60	0.87	1.19	–	1.61	–	–	–
74196	0.17	0.27	0.39	0.58	0.87	1.24	–	–	–	–
74197	0.19	0.33	0.47	0.64	0.89	–	1.28	–	1.69	–
74198	0.20	0.29	0.44	0.62	0.84	–	1.24	–	–	–
74199	0.29	0.43	0.60	0.80	1.13	–	1.52	1.77	–	–
74200	0.16	0.28	0.41	0.58	0.79	–	1.09	–	–	–
74201	0.16	0.28	0.40	0.59	0.80	–	1.11	–	1.52	–
74202	0.24	0.34	0.47	0.68	0.95	–	1.30	–	1.64	–
74203	0.23	0.39	0.57	0.76	1.02	1.16	–	–	–	–
74204	0.16	0.27	0.39	0.56	0.80	–	1.19	–	1.61	–
74205	0.29	0.41	0.60	0.80	1.10	–	1.52	–	1.94	–
74206	0.16	0.25	0.39	0.59	0.80	–	–	–	–	–
74207	0.19	0.31	0.47	0.68	0.91	–	1.22	–	1.63	1.87

Remarks. The specimens from the Nansen Formation of Ellesmere Island are closely related in shape, size, and internal structures to type specimens of *Fusulinella eopulchra* Rauser from the Myachkovsky horizon of the Russian Platform. The only difference is that the Arctic specimens have more volutions. This species is closely similar in general shape to *Fusulinella itoi* Ozawa, but the latter species is much smaller and has a smaller proloculus.

Occurrence. Fusulinella eopulchra is abundant in the type area of the Nansen Formation on northern Ellesmere Island and occurs at the following horizons: GSC loc. C-31680, 1379.3 m (4525 ft.) above the base, GSC loc. C-31693, 1420.7 m (4661 ft.), GSC loc. C-31701, 1434.5 m (4706 ft.), GSC loc. C-31726, 1481.7 m (4861 ft.), and GSC loc. C-31790, 1635.7 m (5366 ft.).

Fusulinella jamesensis Thompson, Pitrat, and Sanderson

Plate 14, figures 4-6

Fusulinella jamesensis Thompson, Pitrat, and Sanderson, 1953, p. 548, 549, Pl. 57, figs. 8-11; Igo, 1957, p. 206, 207, Pl. 7, fig. 1-9.

Material. Three axial sections: hypotypes GSC 74101–74103.

Description. Shell of medium size, inflated fusiform, axis of coiling slightly shifting, central part slightly vaulted, lateral slopes slightly concave or somewhat convex, and polar ends pointed. Mature shells consisting of 5 to 5½ volutions have lengths of 2.02 to 2.27 mm and widths of 1.07 to 1.11 mm, with form ratio of 1.89 to 2.05. Proloculus small, spherical, and 0.06 to 0.08 mm in outside diameter. Shell closely coiled, and uniformly expanding. Spirotheca composed of four layers, but in the first and last volutions, spirotheca consists only of a tectum and an underlying dense layer, probably diaphanotheca. Septa weakly fluted at the polar ends, and planar elsewhere. Chomata well developed, high and narrow, slightly asymmetrical, both tunnel side slopes and poleward slopes rather steep, about half as high as chamber. Tunnel high and narrow, with an irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74101	2.27	1.11	2.05	0.08
74102	2.02	1.07	1.89	–
74103	2.22	1.11	2.00	–

	Width of Volution (mm)					
GSC no.	1	2	3	4	5	5½
74101	0.16	0.29	0.47	1.11	–	–
74102	0.12	0.27	0.47	0.76	1.07	–
74103	0.10	0.23	0.39	0.60	0.97	1.11

Remarks. The type specimens of *Fusulinella jamesensis* Thompson, Pitrat, and Sanderson from central British Columbia show some variation in shape and size. The Ellesmere Island specimens seem to display the same range of variation as the type specimens. This species is similar in shape to *Fusulinella paracolaniae* Safonova, but the latter species has more volutions, a smaller size per volution, and highly asymmetrical chomata. *Fusulinella jamesensis* also resembles *Fusulinella paracolaniae crassa* Reitlinger, but differs from that species in having fewer volutions, smaller size per volution, a smaller form ratio, and slightly symmetrical chomata.

Occurrence. Fusulinella jamesensis Thompson, Pitrat, and Sanderson occurs at GSC loc. C-31656, 1307.9 m (4291 ft.) above the base of the Nansen Formation, GSC loc. C-31671, 1347.6 m (4421 ft.), and GSC loc. C-31673, 1352.1 m (4436 ft.).

Fusulinella taishakuensis Sada

Plate 13, figures 1-15

Fusulinella taishakuensis Sada. Sada and Yokoyama, 1970, p. 39-41, Pl. 1, figs. 1, 3-7.

Material. Fifteen axial sections: hypotypes GSC 74078–74092.

Description. Shell of medium size, inflated fusiform with highly inflated central part, slightly concave lateral slopes, and blunt polar regions. Mature specimens of 6 to 6½ volutions have length of 2.08 to 2.76 mm and width of 1.26 to 1.52 mm, with form ratio of 1.65 to 1.9. Proloculus small, spherical, and 0.06 to 0.1 mm in outside diameter. First two volutions closely coiled, spherical to subspherical, succeeding volutions thickly fusiform and slowly and uniformly expanding. Spirotheca composed of four layers. Septa closely folded near poles and unfluted in other parts of the shell. Chomata developed in all volutions, asymmetrical; tunnel side slopes steep; poleward slopes very low, narrow, and high in inner volutions, but nearly symmetrical; both tunnel side and poleward slopes rather steep in outer volutions. Tunnel narrow, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74078	2.16	1.26	1.71	0.06
74079	1.90	0.95	2.00	0.06
74080	1.67	0.82	2.04	0.07
74081	2.22	1.34	1.66	–
74082	2.16	1.26	1.71	0.10
74083	1.52	0.76	2.00	0.10
74084	1.85	1.08	1.71	0.04
74085	2.60	1.38	1.88	0.10
74086	2.08	1.26	1.65	0.08
74087	2.76	1.52	1.82	0.09
74088	2.24	1.34	1.84	0.10
74089	2.33	1.30	1.79	–
74090	2.55	1.34	1.90	–
74091	–	1.13	–	0.06
74092	2.09	1.28	1.61	0.08

	Width of Volution (mm)							
GSC no.	1	2	3	4	5	5½	6	7
74078	0.16	0.31	0.49	0.74	1.05	–	1.26	–
74079	0.16	0.27	0.43	0.64	0.95	–	–	–
74080	0.14	0.23	0.39	0.56	0.82	–	–	–
74081	0.10	0.21	0.37	0.62	0.93	–	1.34	–
74082	0.19	0.31	0.45	0.62	0.91	–	1.26	–
74083	0.19	0.27	0.39	0.56	0.76	–	–	–
74084	0.12	0.25	0.39	0.60	0.89	1.08	–	–
74085	0.16	0.27	0.47	0.68	1.00	–	1.38	–
74086	0.14	0.23	0.37	0.58	0.87	–	1.26	–
74087	0.19	0.31	0.49	0.74	1.09	–	1.52	–
74088	0.19	0.25	0.45	0.66	0.97	–	1.34	–
74089	0.08	0.25	0.45	0.70	1.07	–	1.30	–
74090	0.12	0.21	0.33	0.52	0.76	–	1.13	1.34
74091	0.14	0.23	0.37	0.54	0.76	–	1.13	–
74092	0.16	0.27	0.41	0.66	0.91	1.28	–	–

Remarks. The type specimens of *Fusulinella taishakuensis* Sada from the Aishaku Limestone, Japan show a wide range in shape, form ratio, and size. The Ellesmere Island specimens are identical to *Fusulinella taishakuensis* Sada in shape (inflated fusiform), form ratio, and chomata developed. The only difference is that the corresponding volutions in the Canadian specimens are a little smaller than those of the holotype. This species is closely similar to *Fusulinella itoi* Ozawa and *F. cabezasensis* Ross and Sabins in some features, but differs from those species in its shorter axis of coiling, smaller form ratio, and narrow and high chomata in outer volutions. It can be distinguished from *Fusulinella subpulchra* Putrja by the smaller number of volutions, larger size, and narrow and high chomata.

Occurrence. Fusulinella taishakuensis Sada is abundant in the Nansen Formation of Ellesmere Island and occurs at the following localities: GSC loc. C-32145, 1152.4 m (3781 ft.) above the base, GSC loc. C-31650, 1286.6 m (4221 ft.), GSC loc. C-31651, 1292.7 m (4241 ft.), GSC

loc. C-31653, 1298.2 m (4259 ft.), GSC loc. C-31668, 1335.4 m (4381 ft.), GSC loc. C-31669, 1338.4 m (4391 ft.), GSC loc. C-31685, 1390.2 m (4561 ft.), and GSC loc. C-31727, 1484.8 m (4871 ft.).

Fusulinella thorsteinssoni n. sp.

Plate 24, figures 6-16

Material. Eleven axial sections: holotype GSC 74272, paratypes 74269–74271, 74273–74279.

Etymology. The species is named in honour of R. Thorsteinsson, in recognition of his pioneering contributions to the interpretation of the Carboniferous and Permian stratigraphy of Ellesmere Island.

Description. Shell of medium size, thickly fusiform, central part highly inflated, lateral slopes slightly concave, and poles pointed. Mature shells of 7 to 7½ volutions are 2.55 to 2.78 mm long and 1.32 to 1.4 mm wide, with form ratio of 1.93 to 1.98. Proloculus small, spherical, and 0.04 to 0.1 mm in outside diameter. Inner three volutions closely coiled, first volution coiled at a large angle to the outer ones, second and third volutions vary from spherical to ellipsoidal, remaining volutions inflated fusiform, and uniformly and rapidly expanding outward. Form ratios in the holotype are about 1.45 in third, 1.55 in fourth, 1.88 in fifth, and 1.93 in seventh volution. Spirotheca rather thin, composed of tectum, diaphanotheca, and upper and lower tectoria. Thickness of spirotheca measures about 0.01 to 0.02 mm in inner three volutions and 0.03 to 0.04 mm in outer ones. Septa closely fluted in extreme polar regions, but unfluted in the central part of shell. Chomata small and narrow, slightly asymmetrical, both tunnel side and poleward slopes rather steep, but usually absent from last volution. Tunnel narrow and low, about one third as high as chamber, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74269	1.69	0.95	1.78	0.04
74270	1.67	0.92	1.83	0.06
74271	2.22	1.13	1.96	0.06
74272	2.55	1.32	1.93	0.07
74273	2.29	1.19	2.06	0.06
74274	2.27	1.28	1.77	0.10
74275	2.78	1.40	1.98	0.04
74276	2.16	1.30	1.66	0.08
74277	2.31	1.19	1.94	0.08
74278	2.00	1.22	1.64	0.09
74279	2.29	1.11	1.92	0.06

	Width of Volution (mm)								
GSC no.	1	2	3	4	5	6	6½	7	7½
74269	0.12	0.21	0.31	0.47	0.70	0.95	–	–	–
74270	0.10	0.16	0.27	0.39	0.58	0.78	0.92	–	–
74271	0.12	0.19	0.29	0.43	0.64	0.91	1.13	–	–
74272	0.14	0.23	0.33	0.47	0.66	0.97	–	1.32	–
74273	0.12	0.22	0.35	0.55	0.84	1.19	–	–	–
74274	0.16	0.27	0.45	0.68	1.05	1.28	–	–	–
74275	0.10	0.16	0.27	0.39	0.59	0.87	–	1.19	1.40
74276	0.13	0.23	0.36	0.58	0.87	1.30	–	–	–
74277	0.14	0.24	0.37	0.58	0.87	1.19	–	–	–
74278	0.14	0.23	0.35	0.54	0.79	1.22	–	–	–
74279	0.12	0.21	0.32	0.47	0.74	1.11	–	–	–

Remarks. This new species is closely similar in general shape to *Fusulinella taishakuensis* Sada. *Fusulinella thorsteinssoni* differs from that species, however, because of its endothyrid juvenarium, smaller size per volution, and narrow and small chomata. *Fusulinella thorsteinssoni* resembles *Fusulinella pokajamiensis* Lebedeva; the latter, however, is smaller and has fewer volutions, well developed chomata, and somewhat weaker fluted septa near poles. It is also similar to *F. elegantula* Ishii in some features, but differs from that species in having a larger size per volution and having more closely fluted septa in the polar regions. It can be distinguished from *Fusulinella cabezasensis* Ross and Sabins by its highly inflated central part, smaller size, and closely folded septal fluting in polar regions.

Occurrence. Fusulinella thorsteinssoni n. sp. is abundant in the type Nansen Formation and occurs at GSC loc. C-31648, 1277.4 m (4191 ft.) above the base, GSC loc. C-31656, 1307.9 m (4291 ft.), GSC loc. C-31659, 1312.5 m (4306 ft.), GSC loc. C-31673, 1352.1 m (4436 ft.), GSC loc. C-31687, 1396.3 m (4581 ft.), GSC loc. C-31693, 1420.7 m (4661 ft.).

Fusulinella mosquensis Rauser and Safonova

Plate 24, figure 5

Fusulinella mosquensis Rauser and Safonova. Rauser-Chernoussova et al., 1951, p. 230, 231, Pl. 34, figs. 1, 2.

Fusulinella mosquensis var. *bosbiensis* Bogush, 1963, p. 86, 87, Pl. 5, fig. 1.

Material. Only one axial section of a specimen has been found in the type area of the Nansen Formation: hypotype GSC 74268.

Description. Shell small, subellipsoidal, central part slightly vaulted, one side of lateral slopes somewhat convex, opposite side slightly concave, poles narrowly

rounded. One mature specimen of 4 volutions is 2.01 mm in length, 1.01 mm in width, and has a form ratio of 2.16. Widths of the first to fourth volutions are 0.2, 0.37 0.6 and 1.01 mm, respectively. Proloculus is small and spherical, about 0.08 mm in outside diameter. All volutions regularly coiled, first volution tightly coiled, other volutions rapidly and uniformly expanding. Spirotheca thin, composed of tectum, a diaphanotheca, and upper and lower tectoria. Septa slightly folded in the extreme poles, almost planar elsewhere. Chomata developed in all volutions, asymmetrical, about half as high as chambers. Tunnel narrow and high in inner volutions, becoming rather low in the outer ones, with an almost regular path.

Dimensions. The dimensions of the single specimen are given above, under "Description".

Remarks. Fusulinella mosquensis shows a wide range of variation in the type specimens described by Rauser-Chernoussova and Safonova (1951, Pl. 34, figs. 1, 2) from the Podolsky and Myachkovsky horizons on the Russian Platform, U.S.S.R. The present specimens fall within the range of variability of the type specimens. Also, the specimens described by Bogush (1963) as *Fusulinella mosquensis bosbiensis* Bogush are closely similar in shape, size, and internal characters to *F. mosquensis* Rauser and Safonova, and those specimens are herein referred to *F. mosquensis* Rauser and Safonova. This species resembles *Fusulinella pseudoschwagerinoides* Putrja, but the shell of the latter has sharply pointed poles, a smaller size, and an endothyrid first volution. It is also allied to *F. jamesensis* Thompson, Pitrat, and Sanderson, from which it differs in having a slightly vaulted central part, a smaller size, and well developed chomata.

Occurrence. Fusulinella mosquensis Rauser and Safonova has been found only at GSC loc. C-31693, 1420.7 m (4661 ft.) above the base of the Nansen Formation.

Fusulinella pseudobocki ovoides Rauser

Plate 22, figures 20, 21

Fusulinella pseudobocki ovoides Rauser. Rauser-Chernoussova et al., 1951, p. 228, 229, Pl. 33, figs. 1, 2.

Fusulinella oviformis Bogush, 1960, p. 11, Pl. 1, fig. 4; Bogush, 1963, p. 93, 94, Pl. 7, figs. 3, 4.

Material. Two axial sections: hypotypes GSC 74246, 74247.

Description. Shell of medium size, elongate ellipsoidal with slightly vaulted central part and lateral slopes, and blunt polar regions. One mature specimen with 5½ volutions is 3.17 mm long and 1.47 mm wide, with form ratio of 2.16. Proloculus small, spherical, and 0.09 to 0.12 mm in outside diameter. First volution tightly coiled and spherical, second and third volutions ellipsoidal, succeeding volutions elongate ellipsoidal. Spirotheca very thin in first and last volutions, about 0.005 to 0.01 mm thick and composed of a tectum and a less dense layer, probably diaphanotheca; in other volutions spirotheca is relatively thick, about 0.03 to 0.04 mm thick, consisting of tectum, diaphanotheca, and upper and lower tectoria. Septa weakly fluted near poles and unfluted in other parts of shell. Chomata well developed, narrow and slightly asymmetrical, both tunnel side slopes and poleward slopes nearly vertical. Tunnel high and narrow, about one half to two thirds as high as chamber, with an irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74246	2.55	1.36	1.88	0.12
74247	3.17	1.47	2.16	0.09

	Width of Volution (mm)					
GSC no.	1	2	3	4	5	5½
74246	0.21	0.33	0.58	0.95	1.36	–
74257	0.16	0.27	0.43	0.72	1.17	1.47

Remarks. The type specimens of *Fusulinella pseudobocki ovoides* Rauser show a wide range of variation in shape, number of volutions, and size. The Nansen specimens fall within the range of variation displayed by the type specimens. The specimens identified by Bogush (1960, 1963) as *Fusulinella oviformis* Bogush are closely similar in shape, size, and internal structure to *Fusulinella pseudobocki ovoides* Rauser. Accordingly, we consider *F. oviformis* Bogush to be a synonym of *F. pseudobocki ovoides* Rauser. *Fusulinella pseudobocki ovoides* resembles *Fusulinella permira* Bogush in some features, but the latter is larger and has more volutions, a thicker spirotheca, and a wider tunnel.

Occurrence. Fusulinella pseudobocki ovoides Rauser has been found only at GSC loc. C-31680, 1379.3 m (4525 ft.) above the base of the Nansen Formation.

Fusulinella famula Thompson

Plate 23, figures 3-16

Fusulinella famula Thompson, 1948, p. 91-93, Pl. 32, figs. 4, 5, Pl. 38, figs. 1-9; Ross and Sabins, 1965, p. 167,

Pl. 25, figs. 25-27; Ross, 1969a, p. 1412, 1413, Pl. 170, fig. 8, Pl. 171, figs. 1-10.

Material. Fourteen axial sections: hypotypes GSC 74250–74263.

Description. Shell medium to large, thickly fusiform, central part highly inflated, lateral slopes slightly convex in inner volutions and almost straight or slightly concave in outer ones, poles blunt. Mature specimens have 8 to 8½ volutions, are 2.88 to 4.04 mm long and 1.55 to 2.18 mm wide, with form ratio of 1.81 to 1.94. Proloculus small, spherical, and 0.04 to 0.1 mm in outside diameter. All volutions closely and regularly coiled, first two volutions subspherical, succeeding volutions gradually increase proportionately more in length than in height, attaining an ellipsoidal to thickly fusiform shape. Spirotheca thin, composed of tectum, a rather thick diaphanotheca, and lower and upper tectoria, about 0.01 mm thick in inner volutions and 0.02 to 0.04 mm thick in outer ones; thickest part is about 0.06 mm. Septa loosely and irregularly fluted near poles, sometimes reaching to lateral slopes, but unfluted in the medial part. Chomata well developed, strong, narrow, and slightly asymmetrical in outer volutions, and usually missing in the last volution. Tunnel narrow and high, two thirds to three quarters as high as chamber, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74250	1.50	0.82	1.83	0.06
74251	2.27	1.17	1.94	0.12
74252	2.22	1.55	1.47	0.06
74253	2.88	1.55	1.86	0.06
74254	2.06	1.28	1.61	0.08
74255	2.88	1.59	1.81	0.06
74256	2.06	1.09	1.89	0.08
74257	3.03	1.85	1.64	0.06
74258	1.69	1.07	1.58	0.08
74259	4.04	2.18	1.85	0.08
74260	2.84	1.75	1.62	0.10
74261	1.82	1.03	1.77	0.06
74262	3.09	1.71	1.81	0.08
74263	3.58	1.85	1.94	0.04

GSC no.	Width of Volution (mm) 1	2	3	4	5	5½	6	6½	7	7½	8	8½
74250	0.12	0.21	0.34	0.49	0.68	–	0.82	–	–	–	–	–
74251	0.21	0.37	0.53	0.74	0.99	1.17	–	–	–	–	–	
74252	0.12	0.25	0.38	0.58	0.83	–	1.15	–	1.55	–	–	–
74253	0.12	0.20	0.33	0.49	0.68	–	0.89	–	1.22	–	1.55	–
74254	0.16	0.25	0.39	0.60	0.78	–	1.11	–	1.28			
74255	0.12	0.21	0.34	0.49	0.70	–	0.93	–	1.26	–	1.59	–
74256	0.16	0.29	0.43	0.62	0.80	–	1.09	–	–	–	–	–
74257	0.16	0.31	0.46	0.64	0.85	–	1.11	–	1.46	1.85	–	–
74258	0.14	0.23	0.34	0.48	0.68	–	0.95	1.07	–	–	–	–
74259	0.14	0.25	0.43	0.66	0.95	–	1.30	–	1.73	–	2.10	–
74260	0.21	0.33	0.52	0.76	1.22	–	1.38	–	1.75	–	–	–
74261	0.14	0.23	0.35	0.52	0.70	–	0.83	1.03	–	–	–	–
74262	0.14	0.23	0.37	0.54	0.73	–	0.99	–	1.32	–	1.71	–
74263	0.13	0.23	0.37	0.56	0.74	–	0.99	–	1.34	–	1.67	1.85

Remarks. The specimens from the Nansen Formation are closely similar in shape, size, and form ratio to the type specimens from the Mud Springs Mountains of New Mexico, U.S.A. (Thompson, 1948); they differ only in having weaker chomata. The Nansen specimens resemble *Fusulinella iowensis* Thompson, but the latter form is more subglobose and smaller, and has broader chomata. In general shape, *F. famula* is similar to *Beedeina arizonensis* (Ross and Sabins). It differs from the latter species, however, in having less pronounced septal folding. *Fusulinella famula* Thompson can be distinguished from *F. paraiowensis* Putrja by its larger overall size and by its size per volution.

Occurrence. Fusulinella famula Thompson is abundant in the Nansen Formation and occurs at GSC loc. C-31713, 1455.5 m (4775 ft.) above the base, and GSC loc. C-31757, 1542.7 m (5061 ft.).

Fusulinella subelliptica n. sp.

Plate 21, figures 7-16

Material. Ten axial sections: holotype GSC 74222, paratypes GSC 74215–74221, 74223, 74224.

Etymology. Latin, *sub*, somewhat; *elliptica*, elliptical; referring to the shape of the species.

Description. Shell of moderate size, subellipsoidal with vaulted central part, slightly convex lateral slopes, and narrowly or broadly rounded poles. Mature specimens have 5½ to 6 volutions, are 1.96 to 2.84 mm long, 1.19 to 1.67 mm wide, and with form ratio of 1.65 to 1.98. Proloculus small, spherical, and 0.08 to 0.1 mm in outside diameter. All volutions loosely and regularly coiled, first two volutions spherical to subspherical with a form ratio of about 1.1 to 1.26, second and third volutions ellipsoidal with a form ratio of about 1.37 to 1.58, succeeding volutions subellipsoidal with a form ratio of 1.65 to 1.98. Spirotheca relatively thick, about 0.04 to 0.06 mm in outer volutions, composed of tectum, thick diaphanotheca, and lower and upper tectoria; in the last volution, spirotheca usually consists of tectum and rather thick diaphanotheca. Septa broadly fluted in the polar regions and almost planar in the central part of shell. Chomata poorly developed, small, narrow, and slightly asymmetrical, both tunnel side and poleward slopes relatively steep, but sometimes missing in the last two volutions. Tunnel narrow and low, about one third to one quarter as high as chamber, with a slightly irregular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74215	1.97	0.89	1.99	0.07
74216	1.92	1.05	1.83	0.10
74217	1.96	1.19	1.65	0.08
74218	1.63	0.97	1.68	0.08
74219	2.27	1.05	2.16	0.08
74220	2.66	1.26	2.11	0.10
74221	2.64	1.26	2.10	0.10
74222	2.60	1.40	1.85	0.08
74223	2.84	1.43	1.98	0.10
74224	2.51	1.67	1.50	–

	Width of Volution (mm)							
GSC no.	1	2	3	4	4½	5	5½	6
74215	0.16	0.29	0.49	0.80	–	0.99	–	–
74216	0.19	0.31	0.50	0.79	1.05	–	–	–
74217	0.16	0.26	0.43	0.68	–	0.98	1.19	–
74218	0.23	0.40	0.64	0.97	–	–	–	–
74219	0.23	0.41	0.70	1.00	–	–	–	–
74220	0.27	0.52	0.84	1.26	–	–	–	–
74221	0.23	0.38	0.56	0.82	–	1.26	–	–
74222	0.19	0.37	0.54	0.82	–	1.24	1.40	–
74223	0.23	0.38	0.59	0.84	–	1.19	1.43	–
74224	0.16	0.35	0.60	0.93	–	1.26	–	1.67

Remarks. This new species is characterized by its subellipsoidal shape, loosely coiled shell, thick spirotheca, and poorly developed chomata. Although similar to *Fusulinella biconica* (Hayasaka) in general shape, the latter is much larger, has more volutions, smaller form ratio, and well developed and highly asymmetrical chomata. This new species also resembles *Fusulinella schubertellinoides elshanica* Rauser, but the latter species has an endothyrid juvenarium, relatively broad tunnel in the outer volutions, and almost unfluted septa. *Fusulinella subelliptica* can be distinguished from *Fusulinella valida* Reitlinger by its smaller shell, fewer volutions, more loosely coiled shell, and more poorly developed chomata.

Occurrence. Fusulinella subelliptica n. sp. occurs in the Nansen Formation at GSC loc. C-31657, 1309.5 m (4296 ft.) above the base, GSC loc. C-31658, 1311 m (4301 ft.), GSC loc. C-31669, 1338.4 m (4391 ft.), GSC loc. C-31688, 1398.8 m (4589 ft.), GSC loc. C-31689, 1401.5 m (4598 ft.), and GSC loc. C-31695, 1422.2 m (4666 ft.).

Fusulinella schwagerinoides (Deprat)

Plate 21, figures 17, 18

Neofusulinella schwagerinoides Deprat, 1913, p. 42-44, Pl. 7, figs. 17-22.

Fusulinella (Neofusulinella) schwagerinoides, Lee, 1927, p. 18, 19, Pl. 2, fig. 18; Lee and Chen, 1930, p. 124, 125, Pl. 10, figs. 1, 2.

Fusulinella schwagerinoides ovalis Reitlinger, 1961, p. 243, Pl. 4, fig. 2. *Material.* Two axial sections: hypotypes GSC 74225, 74226.

Description. Shell large for genus, fusiform with vaulted central part, slightly convex lateral slopes, and blunt poles. Mature specimens of 5½ to 6 volutions are 4.12 to 4.66 mm long, 1.71 to 1.96 mm wide, and 2.38 to 2.41 in form ratio. Proloculus small, about 0.04 to 0.08 mm in outside diameter. Shell regularly coiled, first three volutions tightly coiled, other volutions expand rapidly outward. Spirotheca composed of tectum, diaphanotheca, and upper and lower tectoria, except in the last volution where the spirotheca usually consists of tectum and a diaphanotheca. Thickness of spirotheca about 0.01 to 0.02 mm in inner two volutions and 0.03 to 0.07 mm in outer ones. Septa broadly fluted in the polar regions and almost planar in medium part. Chomata well developed and highly asymmetrical in inner volutions, but poorly developed and rather low, about one third to one quarter as high as chamber in outer volutions. Tunnel high and narrow in inner volutions, and broad and low in outer volutions, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74225	4.12	1.71	2.41	0.08
74226	4.66	1.96	2.38	0.04

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	5½	6
74225	0.14	0.27	0.49	0.84	1.38	1.79	–
74226	0.16	0.31	0.54	0.84	1.34	–	1.96

Remarks. The Nansen specimens are identical to typical representatives of *Fusulinella schwagerinoides* (Deprat) in shape, size, and internal features. Reitlinger (1961) described a new subspecies, *Fusulinella schwagerinoides ovalis* Reitlinger; however, the holotype of *Fusulinella schwagrinoides ovalis* is so closely similar in shape, size, and internal features to *F. schwagerinoides* (Deprat) that we refer *F. schwagerinoides ovalis* Reitlinger to *F. schwagerinoides* (Deprat). *Fusulinella schwagerinoides* is similar in general shape to *Fusulinella valida superba* Reitlinger, but differs from that species in that the former has fewer volutions, smaller size per volution, and a smaller overall size. It also resembles *F. rara* Schlykova, but the latter species is elongate fusiform, has a longer axis of coiling, and a larger form ratio.

Occurrence. Fusulinella schwagerinoides (Deprat) has been found only at GSC loc. C-31655, 1304.9 m (4281 ft.) above the base of the Nansen Formation.

Fusulinella cabezasensis Ross and Sabins

Plate 22, figures 1-19

Fusulinella cabezasensis Ross and Sabins, 1965, p. 189, Pl. 26, figs. 9-13. *Material.* Nineteen axial sections: hypotypes GSC 74227-74245.

Description. Shell of medium size, thickly fusiform, with highly inflated central part, highly concave lateral slopes, and pointed poles. Adult shells of 6½ to 7 volutions are 2.36 to 2.93 mm long and 1.22 to 1.61 mm wide, with form ratio of 1.91 to 2.11. Proloculus small, spherical, and 0.06 to 0.12 mm in outside diameter. All volutions regularly coiled, first two volutions spherical and tightly coiled, outer ones thickly fusiform, slowly and uniformly expanding. Spirotheca composed of tectum, thick diaphanotheca, and upper and lower tectoria, except in the last volution where tectoria are usually lacking. Septa closely fluted near poles, occasionally reaching to lateral slopes, but almost planar in central part. Chomata asymmetrical, tunnel side slope vertical, poleward slope low in inner volutions, becoming less asymmetrical, both tunnel side and poleward slopes rather steep in outer volutions. Tunnel high and narrow, about one half to two thirds as high as chamber, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74227	2.64	1.34	1.97	0.08
74228	2.22	1.05	2.11	0.06
74229	2.93	1.44	2.03	0.10
74230	2.39	1.09	2.19	0.08
74231	2.60	1.19	2.10	0.10
74232	2.60	1.19	2.10	0.06
74233	2.20	1.13	1.95	0.08
74234	1.94	0.95	2.04	0.08
74235	2.43	1.19	2.04	0.12
74236	2.47	1.26	1.96	0.12
74237	2.02	1.03	1.96	0.12
74238	2.41	1.13	2.13	0.10
74239	2.45	1.28	1.91	0.10
74240	1.76	0.84	2.10	0.10
74241	2.88	1.30	2.21	0.08
74242	2.58	1.22	2.11	0.06
74243	2.37	1.03	2.30	0.10
74244	3.36	1.61	2.09	0.10
74245	1.24	0.59	2.10	0.11

GSC no.	Width of Volution (mm) 1	2	3	4	5	5½	6	½	7
74227	0.14	0.25	0.35	0.52	0.72	–	1.01	–	1.34
74228	0.16	0.27	0.43	0.65	0.93	1.05	–	–	–
74229	0.16	0.29	0.43	0.64	0.89	–	1.24	1.44	–
74230	0.19	0.30	0.45	0.68	0.91	–	1.09	–	–
74231	0.14	0.27	0.43	0.62	0.89	–	1.19	–	–
74232	0.16	0.29	0.45	0.64	0.91	–	1.19	–	–
74233	0.23	0.39	0.60	0.84	1.13	–	–	–	–
74234	0.19	0.35	0.54	0.72	0.95	–	–	–	–
74235	0.23	0.39	0.56	0.78	1.03	–	1.19	–	–
74236	0.19	0.29	0.43	0.62	0.89	–	1.26	–	–
74237	0.21	0.33	0.48	0.68	0.91	–	1.03	–	–
74238	0.21	0.37	0.56	0.82	1.13	–	–	–	–
74239	0.15	0.26	0.38	0.56	0.77	–	1.07	1.28	–
74240	0.17	0.27	0.43	0.60	0.84	–	–	–	–
74241	0.21	0.35	0.54	0.80	1.15	1.3	–	–	–
74242	0.15	0.25	0.36	0.56	0.79	–	1.07	1.22	–
74243	0.20	0.31	0.50	0.72	1.03	–	–	–	–
74244	0.17	0.29	0.45	0.66	0.91	–	1.24	–	1.61
74245	0.19	0.27	0.39	0.59	–	–	–	–	–

Remarks. The Nansen specimens are identical to the primary type specimens of *Fusulinella cabezasensis* Ross and Sabins in shape, size, and internal features. They are superficially similar to *Fusulinella subpulchra submesopachis* Putrja, but differ from the latter form in having more volutions, a smaller size, and a smaller form ratio. This species is similar to *Fusulinella eopulchra* Rauser in some respects, but the latter has a rhombiform shape, larger size of corresponding volutions, and highly asymmetrical chomata in the outer volutions. *Fusulinella cabezasensis* can be distinguished from *Fusulinella whitensis* Ross and Sabins and *F. nipperensis* Ross and Sabins by its more thickly fusiform shape and highly concave lateral slopes.

Occurrence. Fusulinella cabezasensis Ross and Sabins is abundant in the Nansen Formation of Ellesmere Island, and occurs at GSC loc. C-31683, 1387.2 m (4551 ft.) above the base, GSC loc. C-31715, 1461.9 m (4796 ft.), GSC loc. C-31721, 1475.6 m (4841 ft.), GSC loc. C-31722, 1475.6 m (4841 ft.), GSC loc. C-31746, 1529 m (5016 ft.), and GSC loc. C-31784, 1620.4 m (5316 ft.).

Fusulinella pokojamiensis Lebedeva

Plate 14, figures 1-3

Fusulinella pokojamiensis Lebedeva, 1966a, p. 199, 200, Pl. 9, figs. 1, 2.

Material. Three axial sections: hypotypes GSC 74098-74100.

Description. Shell small, subrhomboidal, central part highly inflated, lateral slopes straight or slightly concave, poles sharply pointed. Mature shells of 5 volutions are 1.52 to 1.67 mm long and 0.76 to 0.82 mm wide, with form ratio of 2 to 2.04. Proloculus minute, spherical, and 0.07 to 0.1 mm in outside diameter. All volutions closely

and regularly coiled. Spirotheca thin, composed of four layers, but in outer volutions usually consists of tectum and a thick, less dense layer of diaphanotheca. Septa closely fluted in polar regions, but almost planar in middle part of volutions. Chomata high and narrow, slightly asymmetrical, both tunnel side and poleward side slopes relatively steep. Tunnel narrow and high, about two thirds as high as volution, with a fairly regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74098	1.69	0.74	2.28	0.08
74099	1.28	0.64	2.00	0.09
74100	1.59	0.78	2.04	0.06

	Width of Volution (mm)					
GSC no.	1	2	3	4	4½	5
74098	0.14	0.24	0.35	0.52	0.74	-
74099	0.16	0.27	0.41	0.64	-	-
74100	0.12	0.25	0.37	0.54	-	0.78

Remarks. The Nansen specimens are identical to typical specimens of *Fusulinella pokojamiensis* Lebedeva in being thickly fusiform, and in size, number of volutions, and development of chomata. *Fusulinella pokojamiensis* is similar to *Fusulinella jamesensis* Thompson, Pitrat, and Sanderson and *F. pygmaea* Ishii in some features; however, *F. jamesensis* is fusiform, has a larger shell and form ratio and *F. pygamea* is much smaller in total shell size and has a smaller per volution size. It also resembles *F. minuta* Grozdolova, but differs from the latter species in its sharply pointed poles and larger form ratio.

Occurrence. Fusulinella pokojamiensis Lebedeva has been found only at GSC loc. C-31792, 1647.9 m (5406 ft.) above the base of the Nansen Formation.

Fusulinella subcolaniae decurta Reitlinger

Plate 24, figures 1-4

Fusulinella subcolaniae forma *decurta* Reitlinger, 1961, p. 242, Pl. 3, fig. 14.

Fusulinella bella Grozdilova and Lebedeva, 1961, p. 173, Pl. 1, figs. 13, 14.

Material. Four axial sections: hypotypes GSC 74264–74267.

Description. Shell small, fusiform, central portion vaulted, lateral slopes straight or slightly concave, poles sharply pointed. Mature shells possessing 6 volutions have lengths of 1.75 to 2.22 mm, widths of 0.91 to 1.0 mm, and form ratios of 1.87 to 2.02. Proloculus minute, spherical, and 0.06 to 0.08 mm in outside diameter. Shell closely coiled, slowly and uniformly expanding; but in some specimens first volution is coiled at a large angle to axis of outer volutions. Spirotheca thin, composed of tectum, thin diaphanotheca, and upper and lower tectoria. Septa almost planar throughout except for polar regions. Chomata well developed, slightly asymmetrical, about two thirds as high as volution. Tunnel high and narrow, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74264	1.75	0.91	1.92	0.06
74265	2.02	0.94	2.15	0.08
74266	1.90	0.95	2.00	0.08
74267	1.87	1.00	1.87	0.06

	Width of Volution (mm)					
GSC no.	1	2	3	4	5	6
74264	0.11	0.19	0.31	0.45	0.66	0.91
74265	0.16	0.22	0.32	0.46	0.65	0.94
74266	0.15	0.25	0.35	0.48	0.68	0.95
74267	0.12	0.21	0.33	0.47	0.72	1.00

Remarks. Fusulinella subcolaniae decurta Reitlinger is characterized by its fusiform shape, small size, and well developed chomata. The Nansen specimens are closely related in every respect to the type specimens of *Fusulinella subcolaniae decurta* Reitlinger from the Russian Platform. Some specimens from the Lower Tastubsky horizon of the Timan Mountains, U.S.S.R., have been described as a new species *Fusulinella bella* by Grozdilova and Lebedeva. *Fusulinella bella* is closely similar in shape, size, and internal structure to *Fusulinella subcolaniae decurta* Reitlinger, and therefore *F. bella* Grozdilova and Lebedeva is considered to be a synonym of *F. subcolaniae decurta* Reitlinger. This subspecies resembles *Fusulinella bocki pauciseptata* Rauser and Beljaev, but differs from that species in having a larger shell and slightly weaker chomata. It can be distinguished from *Fusulinella paracolaniae* Safonova by its smaller size per volution and smaller overall size, as well as sharply pointed poles.

Occurrence. Fusulinella subcolaniae decurta Reitlinger has been found only at GSC loc. C-31726, 1481.7 m (4861 ft.) above the base of the Nansen Formation.

Fusulinella sp. B

Plate 23, figures 1, 2

Material. Two axial sections: hypotypes GSC 74248, 74249.

Description. Shell of medium size, elongate fusiform, central portion inflated, lateral slopes sharply concave, poles pointed. Adult shells of 5½ to 6 volutions are 3.4 to 3.42 mm long and 1.42 to 1.55 mm wide, with form ratio of 2.21 to 2.39. Proloculus is spherical and 0.12 to 0.17 mm in outside diameter. All volutions regularly coiled, uniformly and gradually expanding. Spirotheca composed of tectum, diaphanotheca, and upper and lower tectoria. Septa broadly fluted in the polar regions and almost planar elsewhere. Chomata well developed, slightly asymmetrical, both tunnel side and poleward side slopes rather steep, high and narrow, about two thirds as high as chamber. Tunnel narrow and high, with a regular path.

Dimensions.

GSC no.	Length (mm)	Width (mm)	Form Ratio	Diameter of Proloculus (mm)
74248	3.40	1.42	2.39	0.17
74249	3.42	1.55	2.21	0.12

	Width of Volution (mm)						
GSC no.	1	2	3	4	5	5½	6
74248	0.29	0.46	0.68	0.95	1.24	1.42	–
74249	0.25	0.43	0.64	0.87	1.13	–	1.55

Remarks. Fusulinella sp. B is similar in general shape to *Fusulinella subpulchra submesopachis* Putrja from Eastern Donbas, U.S.S.R. It differs from the Donbas species in having more volutions, a longer axis of coiling, and larger form ratio. It also resembles *Fusulinella eopulchra* Rauser, but the latter is smaller per volution, and has more volutions and a much smaller form ratio.

Occurrence. Fusulinella sp. B has been found in the Nansen Formation only at GSC loc. C-32145, 1152.4 m (3781 ft.) above the base and GSC loc. C-31790, 1635.7 m (5366 ft.).

Subfamily FUSULININAE Moeller, 1878

Genus *Beedeina* Galloway, 1933 emend. Ishii, 1957

Type species. Fusulinella girtyi Dunbar and Coudra, 1927.

Beedeina elegans decurta (Rauser and Safonova)

Plate 20, figure 17

Fusulina elegans forma *decurta* Rauser and Safonova. Rauser-Chernoussova et al., 1951, p. 286, 287, Pl. 46, fig. 7.

Fusulina elegans var. *decurta* Rauser. Rauser-Chernoussova, 1961b, p. 192.

Material. Only one axial section of specimen was found in the section studied: hypotype GSC 74208.

Description. Shell of medium size, inflated fusiform, central part inflated, lateral slopes somewhat concave, poles blunt. A mature shell of 6 volutions is 3.25 mm long and 1.52 mm wide, with a form ratio of 2.14. Widths of the first to sixth volutions are 0.21, 0.37, 0.57, 0.84, 1.13, and 1.52 mm, respectively. Proloculus is small, spherical, and 0.09 mm in outside diameter. First volution tightly coiled and subspherical, succeeding volutions slowly and uniformly increasing proportionately more in length than in height, attaining a rhomboidal to inflated fusiform shape. Spirotheca thin, composed of tectum, diaphanotheca, and upper and lower tectoria; diaphanotheca rather thick, upper tectorium poorly developed and usually lacking in the last volution. Thickness of spirotheca about 0.01 to 0.02 mm in inner volutions and 0.02 to 0.03 mm in outer volutions. Septa moderately and irregularly folded across the chamber in outer volutions. Chomata well developed, massive and high, about two thirds as high as chamber, highly asymmetrical in inner volutions, becoming more symmetrical in outer volutions, both tunnel side and poleward side slopes rather steep in outer volutions. Tunnel narrow and high, with a regular path.

Dimensions. The dimensions of the single specimen are given above, under "Description".

Remarks. The specimen from the type Nansen Formation of Ellesmere Island is identical to the primary types of *Beedeina elegans decurta* (Rauser and Safonova) in shape, form ratio, number of volutions, development of septal folds, and chomata. The only difference is that the width of corresponding volutions is a little smaller in the Canadian material than in the holotype (Rauser and Safonova, *in* Rauser-Chernoussova et al., 1951, Pl. 46, fig. 7). This subspecies is closely related to *Beedeina elegans* Rauser and Beljaev, but differs from the latter in the shape of its shell and a slightly smaller form ratio. It also resembles *Beedeina cheni* (Igo) in some features, but that species has a much shorter axis of coiling and a smaller form ratio. *Beedeina elegans decurta* can be distinguished from *Beedeina arizonensis* (Ross and Sabins) by the larger form ratio, larger per volution size, and the relatively fewer volutions of the former.

Occurrence. Beedeina elegans decurta (Rauser and Safonova) is very rare in the type Nansen Formation and has been found only at GSC loc. C-31790, 1635.7 m (5366 ft.) above the base.

REFERENCES

Beauchamp, B.

1987a: Stratigraphy and facies analysis of the Upper Carboniferous to Lower Permian Canyon Fiord, Belcher Channel and Nansen formations, southwestern Ellesmere Island. Ph.D. thesis, University of Calgary, 276 p.

Beauchamp, B., Davies, G.R., and Nassichuk, W.W.

1989a: Upper Carboniferous to Lower Permian *Palaeoaplysina*-phylloid algal buildups, Canadian Arctic Archipelago. *In* Reefs, Canada and Adjacent Areas, H.H.J. Geldsetzer, N.P. James, and G.E. Tebbutt (eds.); Canadian Society of Petroleum Geologists, Memoir 13, p. 590-599.

Beauchamp, B., Harrison, J.C., and Henderson, C.M.

1989b: Upper Paleozoic stratigraphy and basin analysis of the Sverdrup Basin, Canadian Arctic Archipelago: Part 1, time frame and tectonic evolution. *In* Current Research, Part G, Geological Survey of Canada, Paper 89-1G, p. 105-113.

Bogush, O.I.

1960: Foraminifery aravanskikh sloev khr. Kara-Chatyr. Paleontologicheskii Zhurnal, no. 2, Izd-vo Akademia Nauk S.S.S.R., p. 3-16.

1963: Foraminifery i stratigrafiia srednego i verkhnego Karbona vostochnoi chasti Alaiskogo khrebta. Institut Geologii i Geofiziki, Sibirskoe Otdelenie, Akademia Nauk S.S.S.R., p. 3-132.

Bogush, O.I. and Iuferev, O.V.

1962: Foraminifery i stratigrafiia Kamennougolnykh otlozhenii Karatau i Talasskogo Altai. Institut Geologii i Geofiziki, Sibirskoe Otdelenie, Akademia Nauk S.S.S.R., p. 154-186.

Brouwer, A. and Ginkel, A.C. van

1964: La succession Carbonifère dans la partie méridionale des montagnes Cantabriques (Espagne Nord-Ouest). Compte Rendu, 5me Congrès Carbonifère, Paris (1963), p. 307-319.

Chang, L.H.

1961: Some Middle Carboniferous fusulinids from western K'unlun, Sinkiang. Acta Palaeontologica Sinica, v. 9, no. 2, p. 151-156, pl. 1. (in Chinese with English abstract)

Chen, J.

1978: Order Fusulinida (Carboniferous). *In* Atlas of Fossils of Southwest China, Sichuan Volume, Part 2, From Carboniferous to Mesozoic, Chengdu Institute of Geology and Mineral Resources, Southwest China Institute of Geological Sciences, Geological Publishing House, Peking, China, p. 17-616, pls. 3-34. (in Chinese)

Chen, S.

1934: Fusulinidae of the Huanglung and Maping limestones, Kwangsi. National Research Institute of Geology, Memoir 14, p. 33-54, pls. 6-8.

Cheong, C.H.

1974a: Stratigraphy and paleontology of the Samcheog Coalfield, Gangweon-Do, Korea (ll). Journal of the National Academy of Sciences, Korea, p. 61-99.

1974b: Some new forms of Fusulininae, including a new genus *Xenostaffella*, from Korea. Journal of the Geological Society of Korea, v. 10, no. 2, p. 59-88, pls. 1-4.

Chuvashov, B.I., Ivanova, R.M., and Kolchina, A.N.

1984: Upper Paleozoic Deposits of the Eastern Slope of the Urals—Stratigraphy and Geological History. Uralian Scientific Centre, Academy of Sciences of the U.S.S.R., Sverdlovsk, 230 p., 31 pls.

Dalmatskaja, I.I.

1961: Stratigrafiia i foraminifery srednekamennougolnykh otlozhenii gorkovskogo i ulianovskogo povalzhia. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia S.S.S.R., v. 5, p. 7-54.

Davies, G.R. and Nassichuk, W.W.

1986: Ancient reefs in the high Arctic. GEOS, v. 15, no. 4, p. 1-5.

1988: Lacustrine oil shales—Carboniferous precurors to a rift basin. GEOS, v. 15, no.1, p. 7-10.

1990: Submarine cements and fabrics in Carboniferous to Lower Permian, reefal, shelf margin and slope carbonates, northwestern Ellesmere Island, Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 399, 77 p.

in press: Carboniferous and Permian history of the Sverdrup Basin, Arctic Islands. *In* Innuitian Orogen and Arctic Platform: Canada and

Greenland, H.P. Trettin (ed.); Geological Survey of Canada, no. 3 (*also* Geological Society of America, The Geology of North America, v. E.)

Deprat, J.
1913: Les Fusulinides des calcaires carbonifèriens et permiens du Tonkin, du Laos et du Nord-Annam. *In* Étude des Fusulinides de Chine et d'Indochine et classification des calcaires à fusulines (II Mémoire), Mémoires de la Service Geologique de l'Indochine, v. 2, pt. 1, 74 p., 10 pls.

Dunbar, C.O. and Henbest, L.G.
1930: The fusulinid genera *Fusulina, Fusulinella* and *Wedekindella*. American Journal of Science, ser. 5, v. 20, p. 357-364.

1942: Pennsylvanian Fusulinidae of Illinois. Illinois State Geological Survey, Bulletin 67, 218 p., 23 pls.

Dunbar, C.O., Troelsen, J., Ross, C., Ross, J.P., and Norford, B.
1962: Faunas and correlation of the late Paleozoic rocks of northeast Greenland. Part 1. Meddelelser om Grønland, v. 167, no. 4, 16 p.

Durkina, A.V.
1959: Foraminifery nizhnekamennougolnykh otlozhenii Timano-Pechorskoi provintsii. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 10, p. 132-335.

Dutkevich, G.A.
1934: Some new species of Fusulinidae from the Upper and Middle Carboniferous of Verkhne-Chussovskye Gorodki on the Chussovaya River (western slope of the middle Ural). Transactions of the Geological Oil Institute, ser. A, v. 36, p. 3-98, 6 pls. (in Russian with English summary)

Forbes, C.L.
1960: Carboniferous and Permian Fusulinidae from Spitsbergen. Palaeontology, v. 2, pt. 2, p. 210-225, pls. 30-33.

Ganelina, R.A.
1956: Foraminifery vizeiskikh otlozhenii severo-zapadnykh raionov Podmoskovnoi kotloviny. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 8, p. 61-184.

Grozdilova, L.P.
1966: Foraminifery verkhnego karbona severnogo Timana. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 14, p. 254-331.

Grozdilova, L.P. and Lebedeva, N.S.
1950: Nekotorye vidy shtaffell srednekamennougolnykh otlozhenii zapadnogo sklona Urala. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 3, p. 5-46.

1954: Foraminifery nizhnego karbona i bashkirskogo iarusa srednego karbona Kolvo-Visherskogo kraia. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 7, p. 4-236.

1960: Foraminifery kamennougolnykh otlozhenii zapaduogo sklona Urala i Timana. Gostoptekhizdat, 188 p.

1961: Nizhnepermskie foraminifepy severnogo Timana. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 13, p. 161-283.

Han J.
1980: Phylum Protozoa—Fusulinida. Paleontological Atlas of Northeast China, Paleozoic Volume. Part 1. Geological Publishing House, Peking, China, p. 18-640, 35 pls. (in Chinese)

Henbest, L.G.
1928: Fusulinellas from the Stonefort Limestone Member of the Tradewater Formation. Journal of Paleontology, v. 2, no. 1, p. 70-85, pls. 8-10.

Igo, H.
1957: Fusulinids of Fukuji, southeastern part of the Hida Massif, central Japan. Science Reports of the Tokyo Kyoiko Diagaku. ser. C, v. 5, no. 47, p. 153-246, 15 pls.

1972: Fusulinacean fossils from Thailand. Part 6. Geology and Palaeontology of Southeast Asia, v. 10, p. 63-116, pls. 9-19.

Ingavat, R., Toriyama, R., and Pitakpaivan, K.
1980: Fusuline zonation and faunal characteristics of the Ratburi Limestone in Thailand and its equivalents in Malaysia. Geology and Palaeontology of Southeast Asia, v. 21, p. 43-62.

Ishii, K.
1962: Fusulinids from the middle Upper Carboniferous Itadorigawa Group in western Shikoku, Japan. Part 2. Genus *Fusulinella* and other fusulinids. Journal of Geoscience, Osaka City University, v. 6, art. 1, p. 1-58, pls. 6-12.

Ivanova, A.P.
1926: Sredne- i verkhne-kamennougolniye otlozheniya Moskovskoi gubernii. Biulleten Moskovskoe obshchestvo ispytatelei prirody. Otdel geologicheskii, v. 36, no. 1, 2, p. 133-180.

Ivanova, E.A., Solovieva, M.N., and Shik, E.M.
1979: The Moscovian Stage in the U.S.S.R. and throughout the world. *In* The Carboniferous of the U.S.S.R., R.H. Wagner, A.C. Higgins, and S.V. Meyen (eds.); Yorkshire Geological Society, Occasional Publication no. 4, p. 117-146.

Kanmera, K.
1954: The fusulinids from the Yayamadake Limestone of the Hikawa Valley, Kumamoto Prefecture, Kyushu, Japan. Part 1. Japanese Journal of Geology and Geography, v. 25, no. 1, 2, p. 117-144, pls. 12-14.

Kawano, M.
1961: Stratigraphical and paleontological studies of the Paleozoic formations in the western part of the Chugoku Massif. Bulletin of the Faculty of Education, Yamaguchi University, Mathematics and Science, v. 11, 133 p., 15 pls.

Lebedeva, N.A.
1954: Foraminifery nizhnego karbona Kuznetskogo basseyna. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 7, p. 237-295.

1966a: Foraminifery srednego karbona severnogo Timan. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 14, p. 176-229.

1966b: Foraminifery verkhnegokarbona severnogo Timan. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 14, p. 254-331.

Lee, J.S.
1927: Fusulinidae of North China. Palaeontologia Sinica, ser. B, v. 4, no. 1, 172 p., 24 pls.

Lee, J.S., Chen, S., and Chu, S.
1930: Huanglung Limestone and its fauna. Memoirs of the Institute of Geology, Shanghai, v. 4, p. 85-143, pls. 3-13.

Lin, J., Li, J., Chen, G., and Zhou, Z.
1977: Phylum Protozoa—Fusulinida. Paleontological Atlas of Central-South China, Part 2. Geological Publishing House, Peking, China. p. 4-96, pls. 1-30. (in Chinese)

Lin, J.L.
1987: A Late Carboniferous paleogeographic reconstruction. Seismology and Geology, v. 9, no. 2, p. 91-94. (in Chinese with English summary)

Liu, Z., Xiao, X., and Dong, W.
1978: Order Fusulinida. Atlas of Fossils of Southwest China. Guizhou Volume, Part 2. Geological Publishing House, Peking, China. p. 18-640, pls. 1-35. (in Chinese)

Mamet, B.L., Nassichuk, W.W., and Roux, A.
1979: Algues et stratigraphie du paléozoïque supérieur de l'Arctique Canadien. *In* 2e Symposium International sur les Algues Fossiles, Bulletin des Centres de Recherches, Exploration-Production, Elf-Aquitaine, v. 3, no. 2, p. 669-683, 3 pl.

1987: Algues carbonifères et permiennes de l'Arctique Canadien. Geological Survey of Canada, Bulletin 342, 143 p.

Nassichuk, W.W.
1975: Carboniferous ammonoids and stratigraphy in the Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 237, 240 p., 18 pls.

1984: Atokan stratigraphy in the Sverdrup Basin, Canadian Arctic Archipelago. *In* The Atokan Series (Pennsylvanian) and its Boundaries — A Symposium, P.K. Sutherland (ed.); Oklahoma Geological Survey, Bulletin 136, p. 157-167.

Nassichuk, W.W. and Bamber, E.W.
1978: Middle Pennsylvanian biostratigraphy, eastern Cordillera and Arctic Islands—a summary. *In* Western and Arctic Canadian Biostratigraphy, P.S. Warren Memorial Volume, C.R. Stelck and B.D.E. Chatterton (eds.); Geological Association of Canada, Special Paper 18, p. 395-413.

Nassichuk, W.W. and Davies, G.R.
1980: Stratigraphy and sedimentation of the Otto Fiord Formation—a major Mississippian-Pennsylvanian evaporite of subaqueous origin in the Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 286, 87 p.

Nassichuk, W.W. and Wilde, G.L.
1977: Permian fusulinaceans and stratigraphy at Blind Fiord, southwestern Ellesmere Island. Geological Survey of Canada, Bulletin 268, 59 p., 5 pls.

Nassichuk, W.W., Furnish, W.M., and Glenister, B.F.
1965: The Permian ammonoids of Arctic Canada. Geological Survey of Canada, Bulletin 131, 56 p., 5 pls.

Ozawa, Y.
1925: Paleontological and stratigraphical studies on the Permo-Carboniferous limestone of Nagato. Part 2, Paleontology. Imperial University of Tokyo, Coll. Science Journal, Tokyo, Japan, v. 45, art. 6, p. 1-90, pls. 1-14.

Putrja, F.S.
1939: K izucheniiu srednekamennougolnykh foraminifer v Donetskom basseine. Mater po geol. i polezn. iskop. Azovo-Chernom. upr., sb. 8. Rostov n/D, p. 175-188, pl. 1.

1956: Stratigrafiia i foraminifery srednekamennougolnykh otlozhenii Vostochnogo Donbassa. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 8, p. 333-485.

Putrja, F.S. and Leontovich, G.E.
1948: K izucheniiu srednekamyennougolnykh fuzulinid Saratovskogo Povolzhia. Moscow Society of Naturalists, Bulletin, v. 53, Geology Section, v. 23, p. 11-45.

Rauser-Chernoussova, D.M.
1961a: Srednekamennougolnye otlozheniia Vozhgalskogo raiona. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia S.S.S.R., v. 5, p. 55-79.

1961b: Biostratigraficheskoe raschlenenie po foraminiferam srednekamennougolnykh otlozhenii samarskoi luki i srednego zavolzhja. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia S.S.S.R., v. 5, p. 149-212.

Rauser-Chernoussova, D.M., Beljaev, G., and Reitlinger, E.
1936: Die Ober-Paläozoischen Foraminiferen aus dem Petschoralande (der Westabhang der Nord-Urals). Academy of Sciences of the U.S.S.R., Transactions of the Commission of the Polar Regions, v. 28, p. 159-232, pls. 1-6. (Russian with German summary)

1940: On the Carboniferous Foraminifera of the Sanara Bend. Transactions of the Geological Oil Institute, Leningrad–Moscow, v. 7, 88 p., 9 pls. (Russian with English summary)

Rauser-Chernoussova, D.M., Kireeva, G.D., Leontovich, G.E., Gryzlova, N.D., Safonova, T.P., and Chernova, E.I.
1951: Srednekamennougolnye fusulinidy Russkoi Platformy i sopredelnykh oblastei. Akademia Nauk S.S.S.R., Institute of Geological Sciences, Ministry of the Petroleum Industry of the U.S.S.R., 380 p., 58 pls.

Rauser-Chernoussova, D.M. and Safonova, T.P.
1961: Stratigrafiia srednekamennougolnykh otlozhenii permskogo prikamia. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia S.S.S.R., v. 5, p. 80-148.

Reitlinger, E.A.
1961: Stratigrafiia srednekamennougolnykh otlozhenii razreza skv. No. 1 krasnoi poliany v srednem zavolzhe. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia, v. 5, p. 218-260.

Rich, M.
1961: Stratigraphic section and fusulinids of the Bird Spring Formation near Lee Canyon, Clark County, Nevada. Journal of Paleontology, v. 35, no. 6, p. 1159-1180, pls. 142-146.

Rosovskaya, S.E.
1963: Drevneishie predtaviteli fuzulinid i ikh predki. Akademia Nauk S.S.S.R., Trudy, Paleontologicheskii Institut, v. 97, p. 3-128.

Ross, C.A.
1967a: Development of Fusulinid (Foraminiferida) fauna realms. Journal of Paleontology, v. 41, no. 6, p. 1341-1354.

1967b: Late Paleozoic Fusulinacea from northern Yukon Territory. Journal of Paleontology, v. 41, no. 3, p. 709-725, pls. 79-86.

1969a: Middle and Upper Pennsylvanian fusulinaceans, Gila Mountains, Arizona. Journal of Paleontology, v. 43, no. 6, p. 1405-1422, pls. 170-174.

1969b: Upper Paleozoic Fusulinacea: *Eowaeringella* and *Wedekindellina* from the Yukon Territory and giant *Parafusulina* from British Columbia. Geological Survey of Canada, Bulletin 182, p. 129-134, pls. 14-16.

1973: Pennsylvanian and Early Permian depositional history, southeastern Arizona. American Association of Petroleum Geologists, Bulletin, v. 57, no. 5, p. 887-912.

Ross, C.A. and Bamber, E.W.
1978: Middle Carboniferous and Early Permian fusulinaceans from the Monkman Pass area, northeastern British Columbia. Geological Survey of Canada, Contributions to Canadian Paleontology, Bulletin 267, p. 25-41, pls. 1-7.

Ross, C.A. and Dunbar, C.O.
1962: Faunas and correlation of the late Paleozoic rocks of northeast Greenland. Fusulinidae, Part 2. Meddelelser om Grønland, v. 167, no. 5, 55 p., 7 pls.

Ross, C.A. and Ross, J.R.P.
1985: Carboniferous and Early Permian biogeography. Geology, v. 13, p. 27-30.

Ross, C.A. and Sabins, F.F. Jr.
1965: Early and Middle Pennsylvanian fusulinids from southeast Arizona. Journal of Paleontology, v. 39, p. 173-209, pls. 21-28.

Ross, C.A. and Tyrrell, W.W. Jr.
1965: Pennsylvanian and Permian fusulinids from the Whetstone Mountains, southeast Arizona. Journal of Paleontology, v. 39, p. 615-635, pls. 75-78.

Roth, R. and Skinner J.
1930: The fauna of the McCoy Formation, Pennsylvanian, of Colorado. Journal of Paleontology, v. 4, no. 4, p. 332-352, pls. 28-31.

Sada, K. and Yokoyama, T.
1970: Fusulinids of the *Fusulinella* Zone of the Taishaku Limestone (Studies of the stratigraphy and the microfossil faunas of the Carboniferous and Permian Taishaku Limestone in West Japan, no. 3). Memoirs of the Faculty of General Education, Hiroshima University. III. v. 4, p. 445-53, pl. 1.

Schlykova, T.I.
1948: Fuzulinidy verkhnego karbodna Samarskoi Luki. Trudy VNIGRI, Mikrofauna S.S.S.R., v. 1, p. 109-136.

Semikhatova, E.N.
1961: Znachenie foraminifer v izuchenii srednekamennougolnykh otlozhenii oblasti Dono-Medveditskikh dislokatsii. Akademia Nauk S.S.S.R., Geologicheskii Institut, Regionalnaia Stratigrafiia S.S.S.R., v. 5, p. 297-356.

Sheng, J.C.
1958: Fusulinids from the Penchi Series of the Taitzeho Valley, Liaoning. Acta Palaeontologica Sinica, no. 143, n. ser. B, no. 7, 119 p., 16 pls. (in Chinese with English summary)

Sheng, J.C. and Sun, D.D.
1975: Fusulinids from Qinghai province of China. Geological Publishing House, Peking, China, 97 p., 14 pls. (in Chinese)

Sheng, J., Min, Q., and Wang, L.
1976: Fusulinid zones of the Middle Carboniferous Huanglong Limestone at Jinsigang near Nanjing. Acta Palaeontologica Sinica, v. 15, no. 2, p. 196-210, pls. 1-3. (in Chinese with English abstract)

Skinner, J.W.
1931: Primitive fusulinids of the mid-continent region. Journal of Paleontology, v. 5, no. 3, p. 253-259, 1 pl.

Skinner, J.W. and Wilde, G.L.
1967: *Eowaeringella*, new generic designation for fusulinids of the group of *Wedekindellina ultimata* Newell and Keroher. Journal of Paleontology, v. 41, p. 1004,1005.

Smith, A.G., Hurley, A.M., and Briden, J.C.
1981: Phanerozoic Paleocontinental World Maps. Cambridge University Press, 102 p.

Stewart, W.J.
1968: The stratigraphic and phylogenetic significance of the fusulinid genus *Eowaeringella*, with several new species. Cushman Foundation for Foraminiferal Research, Special Publication no. 10, 29 p., 7 pls.

Thomas, N.L.
1931: New early fusulinids from Texas. Texas University, Bulletin 3101, p. 27-33, pl. 1.

Thompson, M.L.
1934: The fusulinids of the Des Moines Series of Iowa. University of Iowa, Studies in Natural History, v. 16, no. 4, n. ser., no. 284, p. 273-332, pls. 20-23.

1935a: The fusulinid genus *Staffella* in America. Journal of Paleontology, v. 9, p. 111-120, pl. 13.

1935b: Fusulinids from the Lower Pennsylvanian Atoka and Boggy formations of Oklahoma. Journal of Paleontology, v. 9, no. 4, p. 291-306, pl. 26.

1936a: Fusulinids from the Black Hills and adjacent areas in Wyoming. Journal of Paleontology, v. 10, no. 2, p. 95-113, pls. 13-16.

1936b: Pennsylvanian fusulinids from Ohio. Journal of Paleontology, v. 10, no. 8, p. 673-683, pls. 90, 91.

1942: New genera of Pennsylvanian fusulinids. American Journal of Science, v. 240, no. 6, p. 403-420, pls. 1-3.

1944: Pennsylvanian Morrowan rocks and fusulinids of Kansas. Kansas Geological Survey, Bulletin 52, p. 409-431, pls. 1, 2.

1945a: Pennsylvanian rocks and fusulinids of east Utah and Northwest Colorado correlated with Kansas sections. Kansas Geological Survey, Bulletin 60, p. 17-84, pls. 1-6.

1945b: Upper Desmoinesian fusulinids. American Journal of Science, v. 243, p. 443-445, pls. 1, 2.

1947: Stratigraphy and fusulinids of pre-Desmoinesian Pennsylvanian rocks, Llano Uplift, Texas. Journal of Paleontology, v. 21, no. 2, p. 147-164, pls. 31-33.

1948: Studies of American fusulinids. University of Kansas Paleontological Contributions, Protozoa, art. 1, 184 p., 38 pls.

1961: Pennsylvanian fusulinids from Ward Hunt Island. Journal of Paleontology, v. 35, no. 6, p. 1130-1136, pls. 135, 136.

1965: Pennsylvanian and Early Permian fusulinids from Fort St. James area, British Columbia, Canada. Journal of Paleontology, v. 39, no. 2, p. 224-234, pls. 33-35.

Thompson, M.L., Pitrat, C.W., and Sanderson, G.A.
1953: Primitive Cache Creek fusulinids from central British Columbia. Journal of Paleontology, v. 27, no. 4, p. 545-552, pls. 57, 58.

Thompson, M.L., Shaver, R.H., and Riggs, E.A.
1959: Early Pennsylvanian fusulinids and ostracods of the Illinois Basin. Journal of Paleontology, v. 33, no. 5, p. 770-792, pls. 104-107.

Thompson, M.L., Verville G.J., and Lokke, D.H.
1956: Fusulinids of the Desmoinesian–Missourian contact. Journal of Paleontology, v. 30, no. 4, p. 793-810, pls. 89-93.

Thorsteinsson, R.
1972: Geology, Eureka Sound South, District of Franklin. Geological Survey of Canada, Map 1300 (scale 1:250 000).

1974: Carboniferous and Permian stratigraphy of Axel Heiberg Island and western Ellesmere Island, Canadian Arctic Archipelago. Geological Survey of Canada, Bulletin 224, 115 p.

Thorsteinsson, R. and Tozer, E.T.
1970: Geology of the Arctic Archipelago. *In* Geology and Economic Minerals of Canada. Geological Survey of Canada, Economic Geology Report No. 1, 5th edn., p. 548-574.

Toriyama, R.
1947: On the fusulinids in the Yasuba type of limestone conglomerate in the Kwanto Mountainland, part 4: Studies on the Yasuba Conglomerate and its allies. Japanese Journal of Geology and Geography, v. 20, nos. 2-4, p. 33-39, pl. 9.

1958: Geology of Akiyoshi. Part 3, Fusulinids of Akiyoshi. Memoirs of the Faculty of Science, Kyushu University, ser. D, v. 7, 264 p., 48 pls.

1967: The fusulinacean zones of Japan. Memoirs of the Faculty of Science, Kyushu University, ser. D., v. 18, no. 1, p. 35-260.

Toriyama, R., Pitakpaivan, K., and Ingavat, R.
1978: The paleogeographic characteristics of fusuline faunas of the Ratburi Group in Thailand and its equivalents in Malaysia. Proceedings of the Third Regional Conference on Geology and Mineral Resources of Southeast Asia, Bangkok, Thailand, p. 107-111.

Tozer, E.T., and Thorsteinsson, R.
1964: Western Queen Elizabeth Islands, Arctic Archipelago. Geological Survey of Canada, Memoir 332, 242 p.

Troelson, J.C.
1950: Contributions to the geology of Northwest Greenland, Ellesmere and Axel Heiberg islands. Meddelelser om Grønland, v. 147, no. 7.

van Ginkel, A.C.
1965: Carboniferous fusulinids from the Cantabrian Mountains (Spain). Leidse Geologische Mededelingen, v. 34, 225 p., 53 pls.

1971: Fusulinids from the uppermost Myachkovian and Kasimovian strata of northwestern Spain. Leidse Geologische Mededelingen, v. 47, p. 115-161, pls. 1-13.

von Moeller, V.
1879: Die Foraminiferen des russischen Kohlenkalks. Academy of the Imperial Science St.-Petersbourg, Memoir VII, v. 27, no. 5, 131 p., 7 pls.

Verville, G.J., Thompson, M.L., and Lokke, D.H.
1956: Pennsylvanian fusulinids of eastern Nevada. Journal of Paleontology, v. 30, no. 6, p. 1277-1287, pls. 133-136.

Wang, Y., Sheng, J., and Zhang, L.
1981: Fusulinids from Xizang of China. Palaeontology of Xizang, Part 3. The Comprehensive Scientific Expedition of the Qinghai-Xizang Plateau. Academia Sinica, Science Press, 80 p., 21 pls. (in Chinese with English abstract)

Wang, Y., Wang, L., Wang, J., Zhu, Z., Lin, G., Zhang, L., and Qian, Q.
1982: Phylum Protozoa—Fusulinida. Paleontological Atlas of East China, Late Paleozoic Volume, Part 2. Nanjing Institute of Geology and Mineral Resources (eds.); Geological Publishing House, Peking, China, 445 p., 30 pls.

PLATES 1 to 24

These specimens are housed in the National Type Collection of Invertebrate and Plant Fossils of the Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario.

All figures are unretouched photographs.

PLATE 1

(All figures x 50)

Figures 1, 2. *Eostaffella ampla* (Thompson); axial sections

1. Hypotype, GSC 73847; GSC loc. C-31891 (slide 3, specimen 2).
2. Hypotype, GSC 73848; GSC loc. C-31892 (slide 1, specimen 5).

Figures 3-5. *Millerella* sp. cf. *M. porcupinensis* Ross; axial sections

3. Hypotype, GSC 73849; GSC loc. C-31892 (slide 1, specimen 3).
4. Hypotype, GSC 73850; GSC loc. C-31892 (slide 1, specimen 4).
5. Hypotype, GSC 73851; GSC loc. C-31656 (slide 8, specimen 2).

Figures 6-8. *Pseudoendothyra nielseni* (Ross and Dunbar); axial sections

6. Hypotype, GSC 73852; GSC loc. C-31892 (slide 3).
7. Hypotype, GSC 73853; GSC loc. C-31892 (slide 4, specimen 1).
8. Hypotype, GSC 73854; GSC loc. C-31892 (slide 6, specimen 1).

Figures 9-11. *Pseudoendothyra struvei* (Moeller); axial sections

9. Hypotype, GSC 73855; GSC loc. C-32134 (slide 1).
10. Hypotype, GSC 73856; GSC loc. C-32134 (slide 6, specimen 2).
11. Hypotype, GSC 73857; GSC loc. C-32130 (slide 8, specimen 4).

Figures 12-18. *Pseudoendothyra preobrajenskyi* (Dutkevich); axial sections

12. Hypotype, GSC 73858; GSC loc. C-31780 (slide 1, specimen 1).
13. Hypotype, GSC 73859; GSC loc. C-31780 (slide 1, specimen 2).
14. Hypotype, GSC 73860; GSC loc. C-32130 (slide 3, specimen 4).
15. Hypotype, GSC 73861; GSC loc. C-32130 (slide 2, specimen 1).
16. Hypotype, GSC 73862; GSC loc. C-32130 (slide 6).
17. Hypotype, GSC 73863; GSC loc. C-32130 (slide 4, specimen 2).
18. Hypotype, GSC 73864; GSC loc. C-32130 (slide 4, specimen 1).

Figures 19, 20. *Pseudoendothyra* sp. A; axial sections

19. Hypotype, GSC 73865; GSC loc. C-31784 (slide 13, specimen 2).
20. Hypotype, GSC 73866; GSC loc. C-31780 (slide 1, specimen 3).

Figures 21, 22. *Pseudoendothyra jazvensis* (Grozdilova and Lebedeva); axial sections

21. Hypotype, GSC 73867; GSC loc. C-32134 (slide 3).
22. Hypotype, GSC 73868; GSC loc. C-32131 (slide 29).

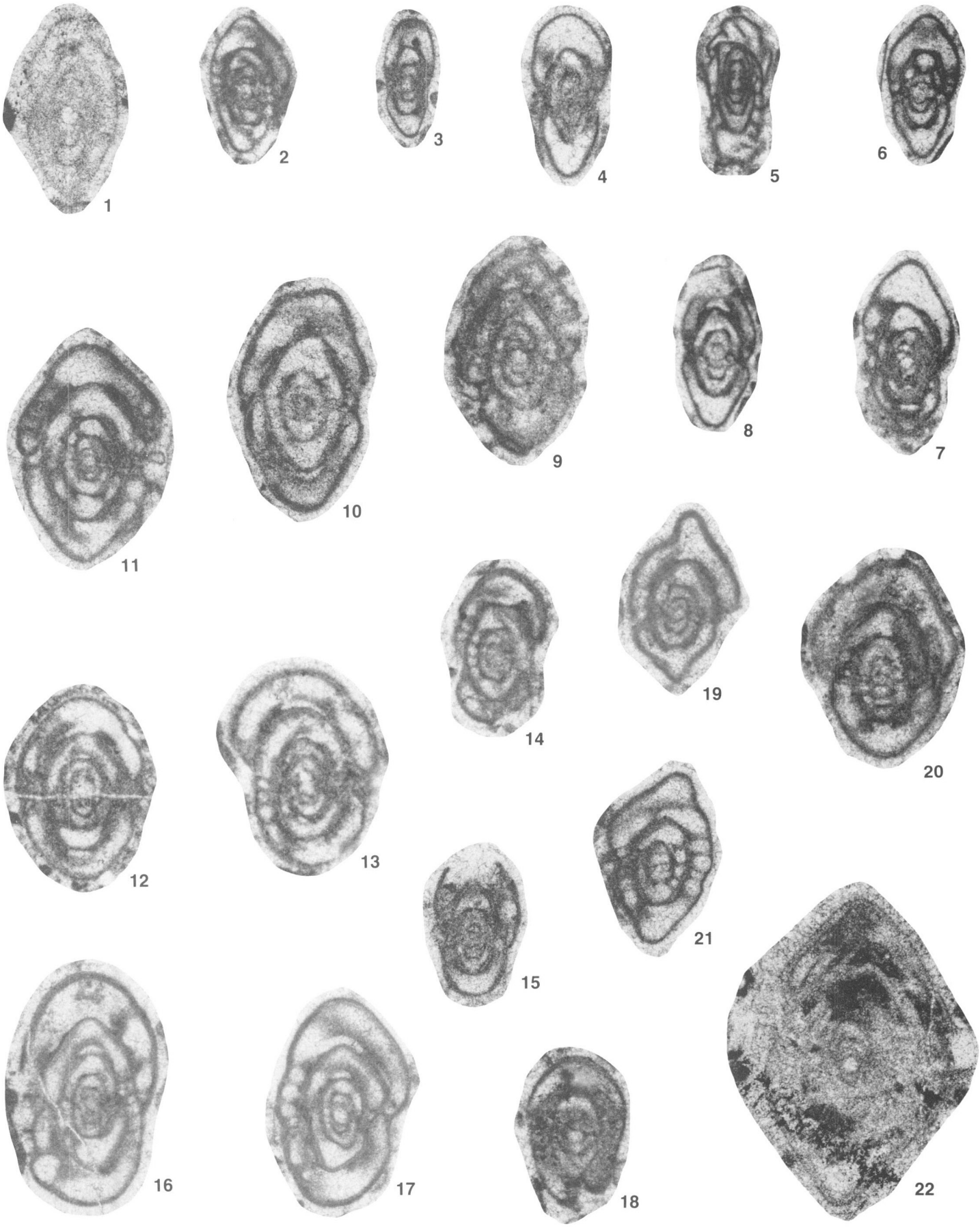

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE 2

(All figures x 50)

Figures 1-3. *Pseudoendothyra ellesmerensis* n. sp.; axial sections

1. Holotype, GSC 73869; GSC loc. C-31892 (slide 6, specimen 8).
2. Paratype, GSC 73870; GSC loc. C-31892 (slide 4, specimen 2).
3. Paratype, GSC 73871; GSC loc. C-31892 (slide 2).

Figures 4-11. *Pseudoendothyra holmensis* (Ross and Dunbar) axial sections (figs. 4-10); sagittal section (fig. 11)

4. Hypotype, GSC 73872; GSC loc. C-32130 (slide 3, specimen 1).
5. Hypotype, GSC 73873; GSC loc. C-31890 (slide 9, specimen 1).
6. Hypotype, GSC 73874; GSC loc. C-31890 (slide 4, specimen 1).
7. Hypotype, GSC 73875; GSC loc. C-31890 (slide 6, specimen 1).
8. Hypotype, GSC 73876; GSC loc. C-31890 (slide 6, specimen 2).
9. Hypotype, GSC 73877; GSC loc. C-32130 (slide 5, specimen 1).
10. Hypotype, GSC 73878; GSC loc. C-31890 (slide 7, specimen 2).
11. Hypotype, GSC 73879; GSC loc. C-31890 (slide 7, specimen 3).

Figures 12-20. *Pseudoendothyra probatus* (Durkina); axial sections

12. Hypotype, GSC 73880; GSC loc. C-31890, (slide 8, specimen 2).
13. Hypotype, GSC 73881; GSC loc. C-31890 (slide 8, specimen 1).
14. Hypotype, GSC 73882; GSC loc. C-32132 (slide 4).
15. Hypotype, GSC 73883; GSC loc. C-32130 (slide 2, specimen 2).
16. Hypotype, GSC 73884; GSC loc. C-31890 (slide 5, specimen 1).
17. Hypotype, GSC 73885; GSC loc. C-32130 (slide 7).
18. Hypotype, GSC 73886; GSC loc. C-31890 (slide 7, specimen 1).
19. Hypotype, GSC 73887; GSC loc. C-31890 (slide 9, specimen 2).
20. Hypotype, GSC 73888; GSC loc. C-32130 (slide 11).

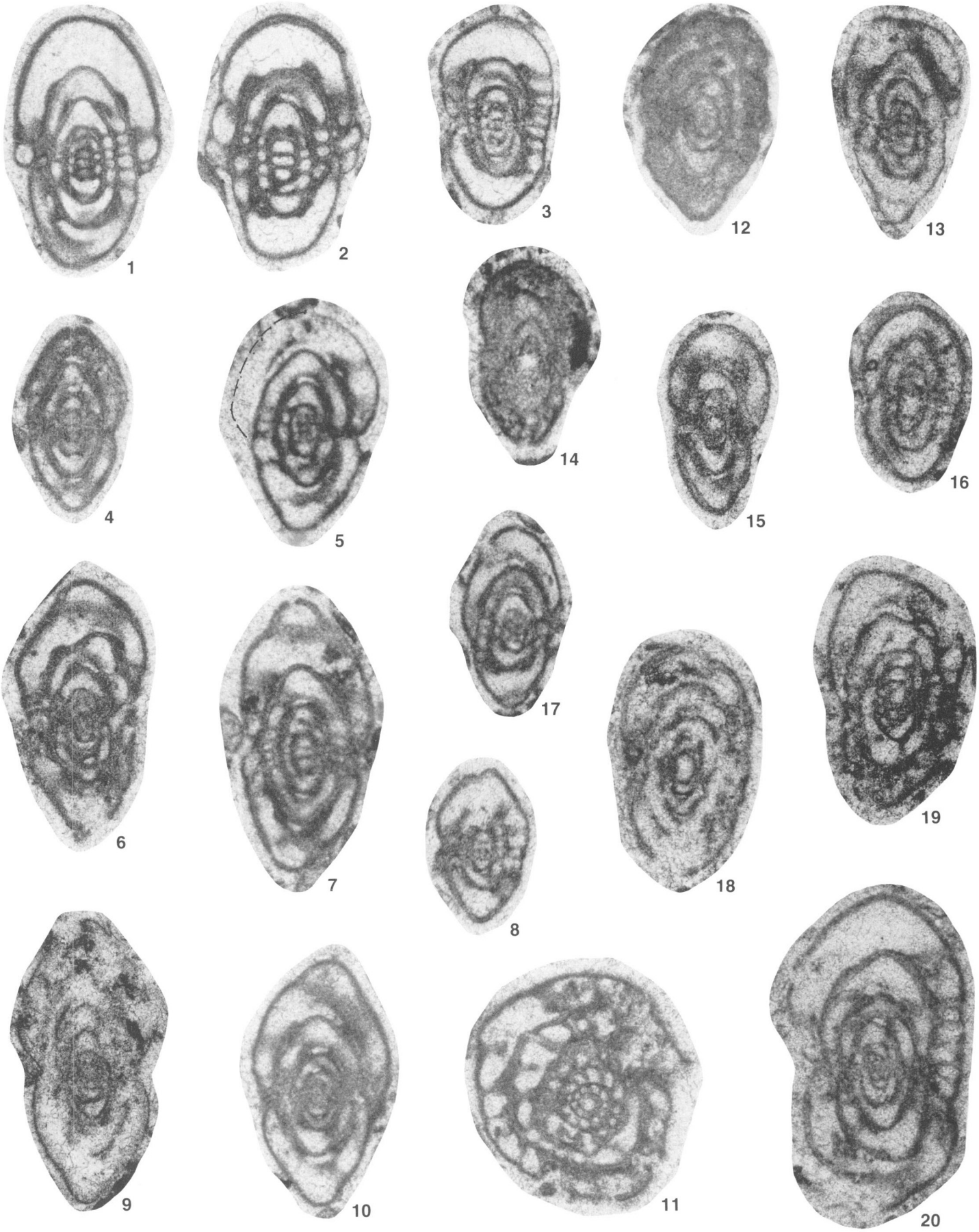

1
2
3
12
13
14
4
5
15
16
17
6
7
18
19
8
9
10
11
20

PLATE 3

(All figures x 50)

Figures 1-6. *Pseudoendothyra rara* (Grozdilova); axial sections

1. Hypotype, GSC 73889; GSC loc. C-31892 (slide 6, specimen 7).
2. Hypotype, GSC 73890; GSC loc. C-31892 (slide 5, specimen 2).
3. Hypotype, GSC 73891; GSC loc. C-31892 (slide 5, specimen 1).
4. Hypotype, GSC 73892; GSC loc. C-31892 (slide 6, specimen 3).
5. Hypotype, GSC 73893; GSC loc. C-31892 (slide 6, specimen 4).
6. Hypotype, GSC 73894; GSC loc. C-31892 (slide 6, specimen 2).

Figure 7. *Schubertella* sp. cf. *S. acuta* Rauser; axial section

Hypotype, GSC 73895; GSC loc. C-31901 (slide 6, specimen 3).

Figures 8, 9. *Schubertella lata elliptica* Sheng; axial sections

8. Hypotype, GSC 73896; GSC loc. C-31688 (slide 5).
9. Hypotype, GSC 73897; GSC loc. C-31696 (slide 22, specimen 2).

Figure 10. *Schubertella texana* (Thompson); axial section

Hypotype, GSC 73898; GSC loc. C-31890 (slide 7, specimen 5).

Figures 11-16. *Staffella moelleri* Ozawa; axial sections

11. Hypotype, GSC 73899; GSC loc. C-32130 (slide 5, specimen 2).
12. Hypotype, GSC 73900; GSC loc. C-32135 (slide 1).
13. Hypotype, GSC 73901; GSC loc. C-31884 (slide 1, specimen 2).
14. Hypotype, GSC 73902; GSC loc. C-31892 (slide 1, specimen 1).
15. Hypotype, GSC 73903; GSC loc. C-32130 (slide 3, specimen 2).
16. Hypotype, GSC 73904; GSC loc. C-32130 (slide 1, specimen 1).

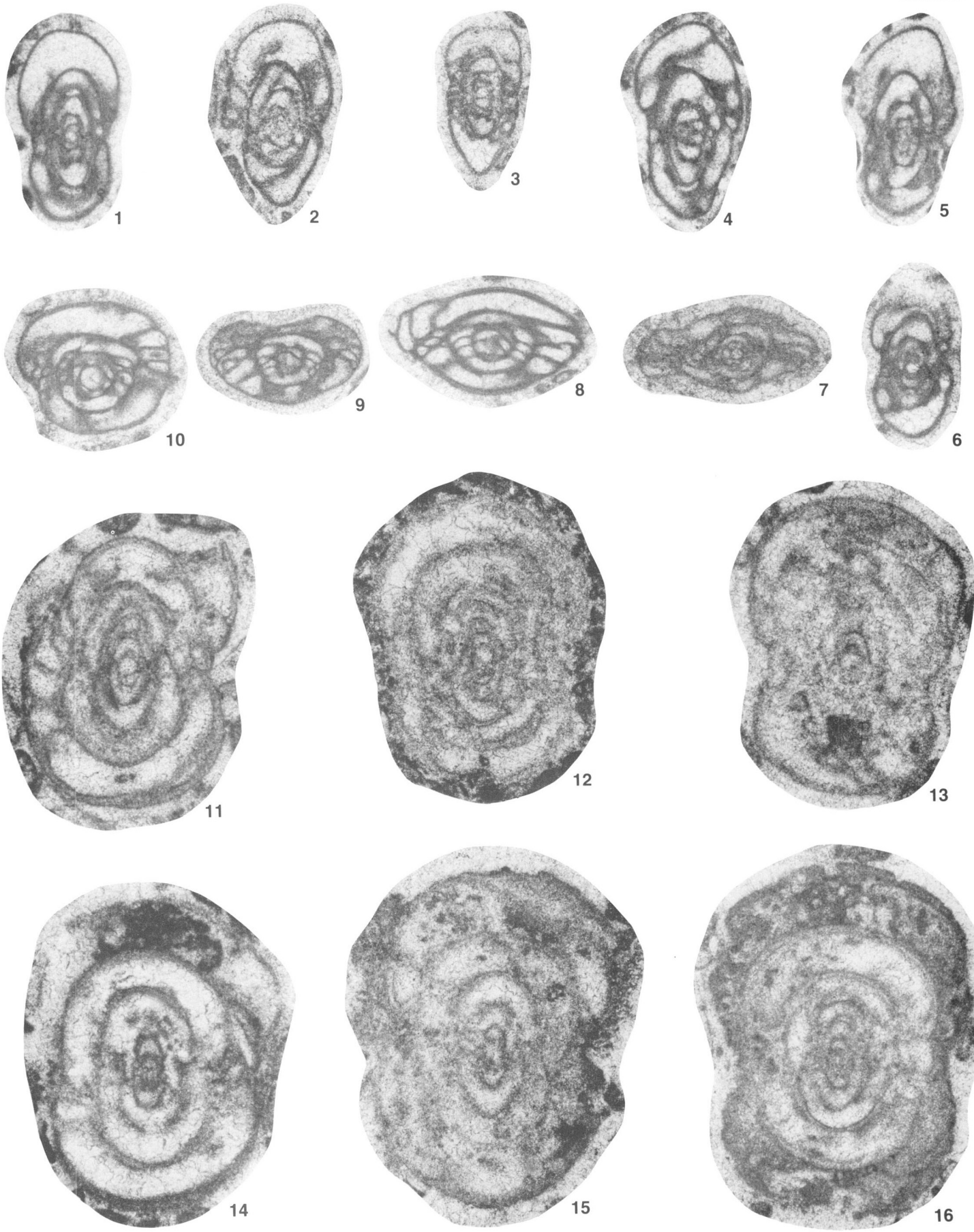

1
2
3
4
5
10
9
8
7
6
11
12
13
14
15
16

PLATE 4

(All figures x 50)

Figures 1-7. *Staffella pseudosphaeroidea* Dutkevich; axial sections (figs. 1, 3, 6, 7); near-central tangential sections (figs. 2, 4, 5)

1. Hypotype, GSC 73905; GSC loc. C-32130 (slide 10).
2. Hypotype, GSC 73906; GSC loc. C-31884 (slide 1, specimen 1).
3. Hypotype, GSC 73907; GSC loc. C-32134 (slide 5).
4. Hypotype, GSC 73908; GSC loc. C-32134 (slide 4).
5. Hypotype, GSC 73909; GSC loc. C-31671 (slide 5).
6. Hypotype, GSC 73910; GSC loc. C-31892 (slide 1, specimen 2).
7. Hypotype, GSC 73911; GSC loc. C-32131 (slide 11).

Figures 8-10. *Staffella mochaensis* van Ginkel; axial sections

8. Hypotype, GSC 73912; GSC loc. C-31890 (slide 2).
9. Hypotype, GSC 73913; GSC loc. C-31890 (slide 4, specimen 3).
10. Hypotype, GSC 73914; GSC loc. C-31647 (slide 1).

1
4
8
5
7
9
2
6
3
10

PLATE 5

(All figures x 50)

Figures 1-8. *Schubertella gracilis* Rauser; axial sections (figs. 1-3, 5-8); sagittal section (fig. 4)

1. Hypotype, GSC 73915; GSC loc. C-31689 (slide 11).
2. Hypotype, GSC 73916; GSC loc. C-31689 (slide 4, specimen 4).
3. Hypotype, GSC 73917; GSC loc. C-31689 (slide 4, specimen 5).
4. Hypotype, GSC 73918; GSC loc. C-31689 (slide 4, specimen 6).
5. Hypotype, GSC 73919; GSC loc. C-32145 (slide 3, specimen 2).
6. Hypotype, GSC 73920; GSC loc. C-31890 (slide 8, specimen 4).
7. Hypotype, GSC 73921; GSC loc. C-32131 (slide 10, specimen 1).
8. Hypotype, GSC 73922; GSC loc. C-31689 (slide 10).

Figure 9. *Schubertella obscura mosquensis* Rauser; axial section

Hypotype, GSC 73923; GSC loc. C-31652 (slide 10).

Figures 10-12. *Schubertella lata* Lee and Chen; axial sections

10. Hypotype, GSC 73924; GSC loc. C-32131 (slide 16).
11. Hypotype, GSC 73925; GSC loc. C-31881 (slide 12).
12. Hypotype, GSC 73926; GSC loc. C-31884 (slide 5, specimen 3).

Figures 13-23. *Ozawainella mosquensis* Rauser; axial sections (figs. 13-21, 23); near-central tangential section (fig. 23)

13. Hypotype, GSC 73927; GSC loc. C-31654 (slide 5).
14. Hypotype, GSC 73928; GSC loc. C-31654 (slide 2, specimen 2).
15. Hypotype, GSC 73929; GSC loc. C-31654 (slide 2, specimen 1).
16. Hypotype, GSC 73930; GSC loc. C-31654 (slide 4).
17. Hypotype, GSC 73931; GSC loc. C-31650 (slide 12, specimen 1).
18. Hypotype, GSC 73932; GSC loc. C-31650 (slide 12, specimen 2).
19. Hypotype, GSC 73933; GSC loc. C-31666 (slide 11).
20. Hypotype, GSC 73934; GSC loc. C-31653 (slide 2, specimen 1).
21. Hypotype, GSC 73935; GSC loc. C-31651 (slide 1).
22. Hypotype, GSC 73936; GSC loc. C-31653 (slide 1).
23. Hypotype, GSC 73937; GSC loc. C-31650 (slide 13, specimen 3).

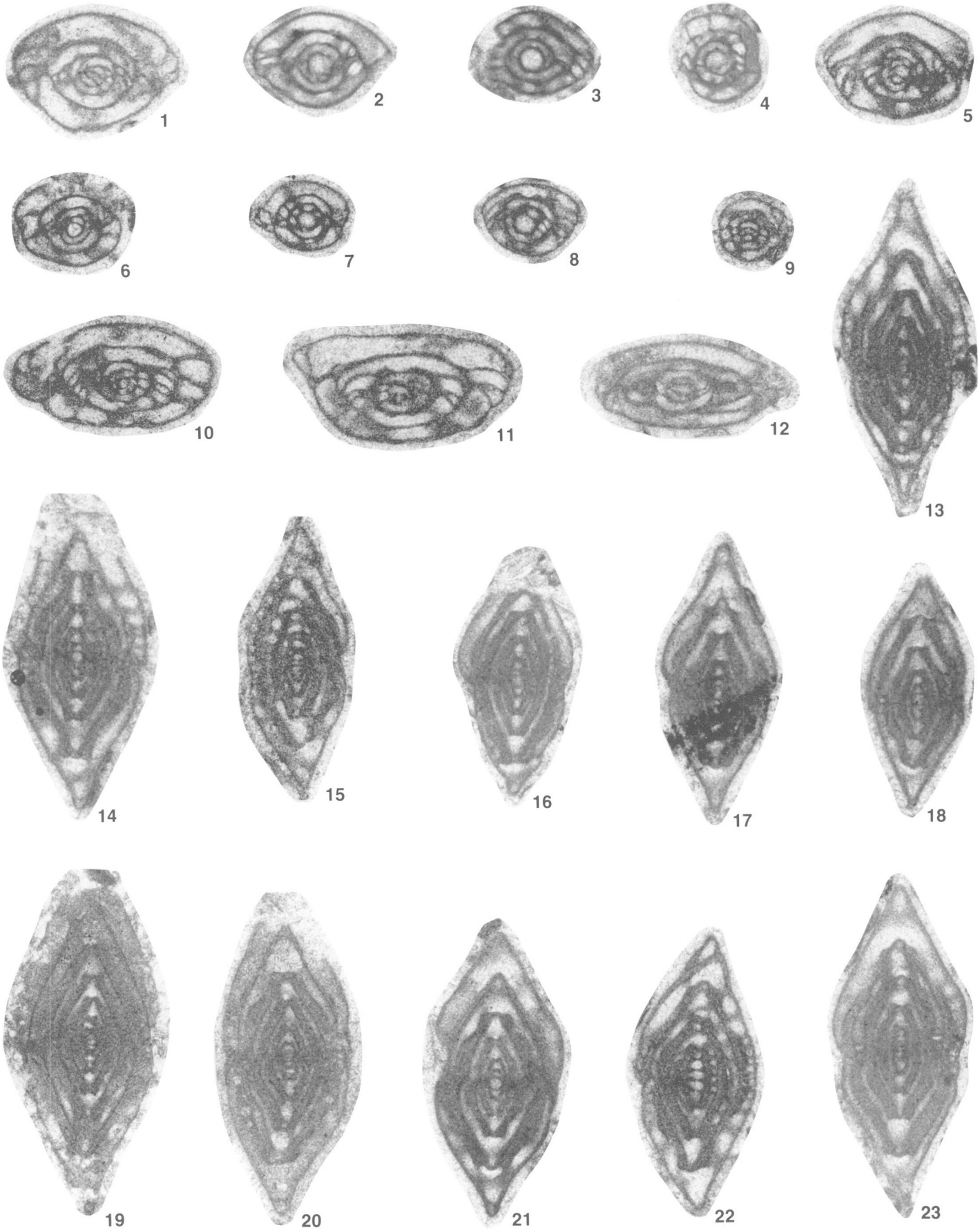

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

PLATE 6

(All figures x 50, unless indicated otherwise)

Figures 1-3. *Neostaffella subquadrata* (Grozdilova and Lebedeva); axial sections, x 20

1. Hypotype, GSC 73938; GSC loc. C-31650 (slide 11).
2. Hypotype, GSC 73939; GSC loc. C-32128 (slide 5).
3. Hypotype, GSC 73940; GSC loc. C-31654 (slide 1, specimen 1).

Figures 4, 5. *Neostaffella khotunensis* (Rauser); axial sections

4. Hypotype, GSC 73941; GSC loc. C-31666 (slide 10).
5. Hypotype, GSC 73942; GSC loc. C-31881 (slide 9, specimen 1).

Figures 6-9. *Neostaffella sphaeroidea* (Ehrenberg); near-central tangential sections, x 20 (figs. 6, 8, 9); axial section, x 20 (fig. 7)

6. Hypotype, GSC 73943; GSC loc. C-31666 (slide 7).
7. Hypotype, GSC 73944; GSC loc. C-31666 (slide 2).
8. Hypotype, GSC 73945; GSC loc. C-31666 (slide 3).
9. Hypotype, GSC 73946; GSC loc. C-31673 (slide 5).

Figures 10-18. *Ozawainella turgida* Sheng; axial sections (figs. 10, 11, 13, 15-17); near-central tangential sections (figs. 12, 14, 18)

10. Hypotype, GSC 73947; GSC loc. C-31652 (slide 9).
11. Hypotype, GSC 73948; GSC loc. C-31652 (slide 7).
12. Hypotype, GSC 73949; GSC loc. C-32127 (slide 1).
13. Hypotype, GSC 73950; GSC loc. C-31652 (slide 6).
14. Hypotype, GSC 73951; GSC loc. C-31676 (slide 1).
15. Hypotype, GSC 73952; GSC loc. C-31651 (slide 2).
16. Hypotype, GSC 73953; GSC loc. C-31675 (slide 1).
17. Hypotype, GSC 73954; GSC loc. C-31654 (slide 3, specimen 1).
18. Hypotype, GSC 73955; GSC loc. C-31654 (slide 3, specimen 2).

Figure 19. *Ozawainella pseudoangulata* (Putrja); axial section

Hypotype, GSC 73956; GSC loc. C-31676 (slide 3).

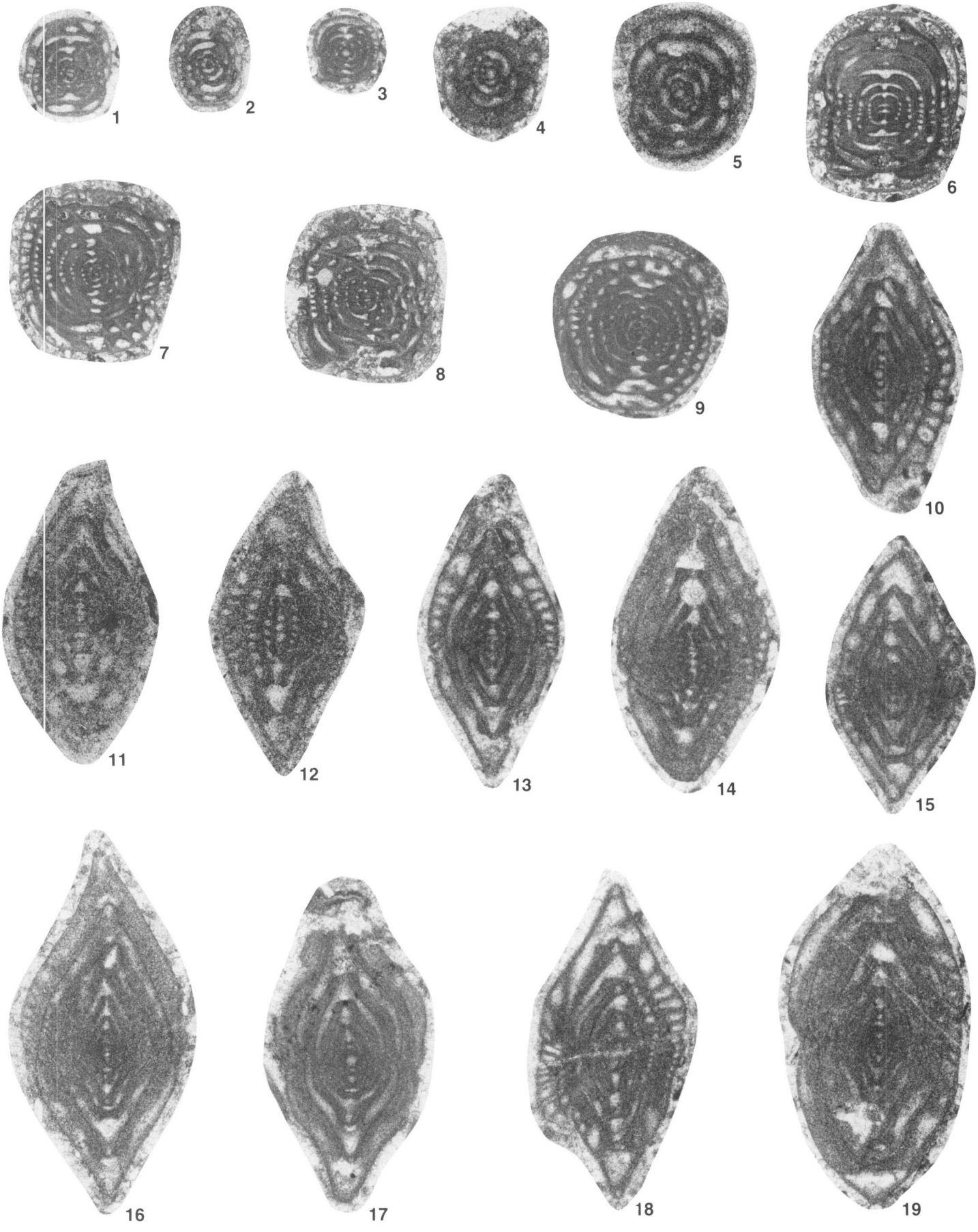

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

PLATE 7

(All figures x 20)

Figures 1-7. *Wedekindellina uralica* (Dutkevich) axial sections (figs. 1-3, 4, 6,); near-central tangential sections (figs. 5, 7)

1. Hypotype, GSC 73957; GSC loc. C-32127 (slide 2).
2. Hypotype, GSC 73958; GSC loc. C-32132 (slide 1).
3. Hypotype, GSC 73959; GSC loc. C-31901 (slide 1).
4. Hypotype, GSC 73960; GSC loc. C-31882 (slide 2).
5. Hypotype, GSC 73961; GSC loc. C-32127 (slide 3, specimen 1).
6. Hypotype, GSC 73962; GSC loc. C-32132 (slide 2).
7. Hypotype, GSC 73963; GSC loc. C-32127 (slide 3, specimen 2).

Figures 8-18. *Wedekindellina uralica longa* (Dutkevich); axial sections

8. Hypotype, GSC 73964; GSC loc. C-31668 (slide 10).
9. Hypotype, GSC 73965; GSC loc. C-31901 (slide 5).
10. Hypotype, GSC 73966; GSC loc. C-31901 (slide 7).
11. Hypotype, GSC 73967; GSC loc. C-31671 (slide 4).
12. Hypotype, GSC 73968; GSC loc. C-31653 (slide 7).
13. Hypotype, GSC 73969; GSC loc. C-31901 (slide 3).
14. Hypotype, GSC 73970; GSC loc. C-31656 (slide 9).
15. Hypotype, GSC 73971; GSC loc. C-31901 (slide 2).
16. Hypotype, GSC 73972; GSC loc. C-31901 (slide 4).
17. Hypotype, GSC 73973; GSC loc. C-31668 (slide 3).
18. Hypotype, GSC 73974; GSC loc. C-31901 (slide 8).

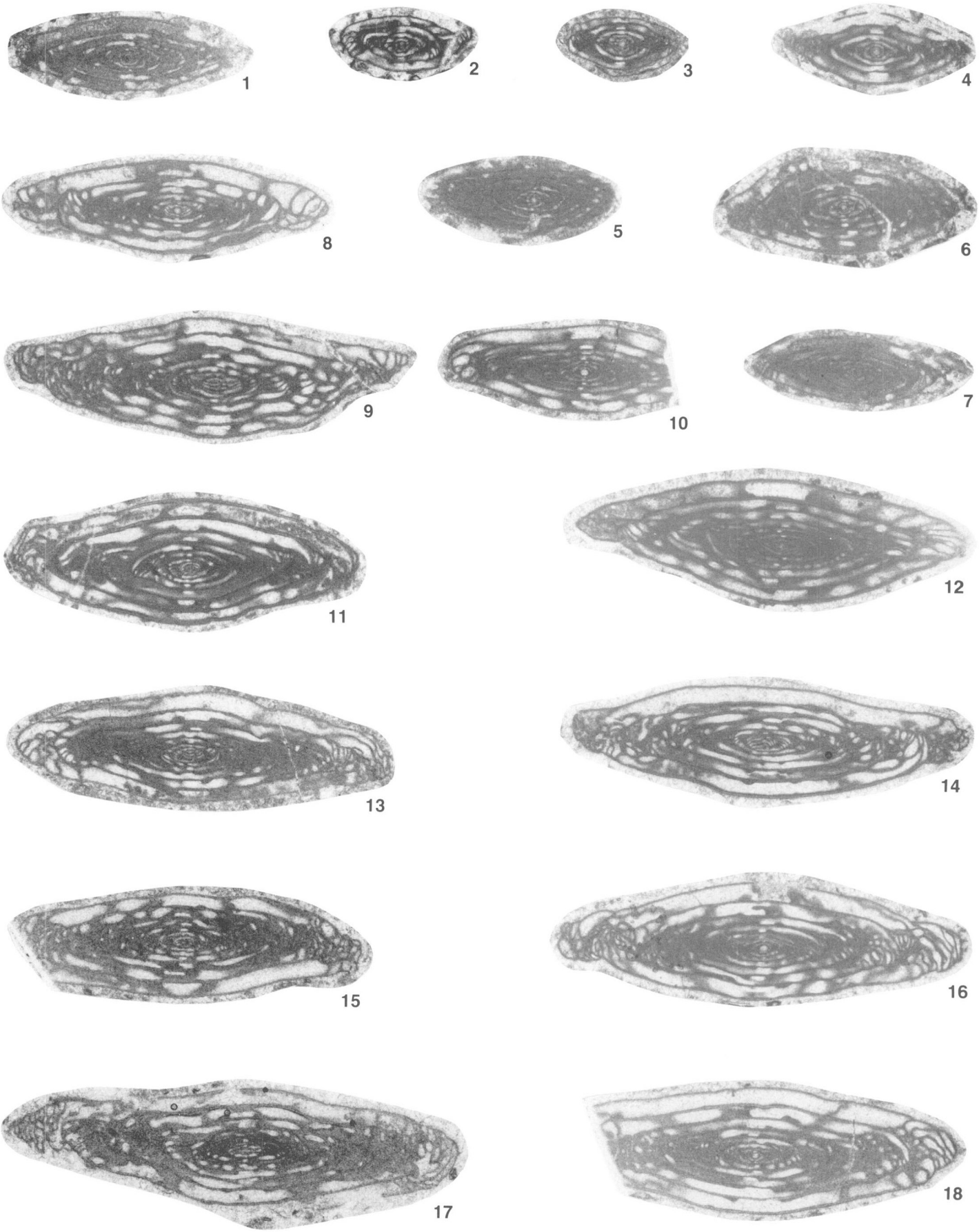

1
2
3
4
8
5
6
9
10
7
11
12
13
14
15
16
17
18

PLATE 8

(All figures x 20)

Figures 1-11. *Wedekindellina pseudomatura* Ross and Tyrrell; axial sections

1. Hypotype, GSC 73975; GSC loc. C-32131 (slide 17).
2. Hypotype, GSC 73976; GSC loc. C-32130 (slide 21).
3. Hypotype, GSC 73977; GSC loc. C-32130 (slide 22).
4. Hypotype, GSC 73978; GSC loc. C-32130 (slide 18).
5. Hypotype, GSC 73979; GSC loc. C-32130 (slide 19, specimen 1).
6. Hypotype, GGS 73980; GSC loc. C-32131 (slide 1).
7. Hypotype, GSC 73981; GSC loc. C-32130 (slide 15).
8. Hypotype, GSC 73982; GSC loc. C-32130 (slide 23).
9. Hypotype, GSC 73983; GSC loc. C-32130 (slide 27).
10. Hypotype, GSC 73984; GSC loc. C-32130 (slide 25).
11. Hypotype, GSC 73985; GSC loc. C-32131 (slide 13).

Figures 12-19. *Wedekindellina quasicylindrica* n. sp.; axial sections

12. Paratype, GSC 73986; GSC loc. C-31882 (slide 7).
13. Paratype, GSC 73987; GSC loc. C-31883 (slide 2).
14. Paratype, GSC 73988; GSC loc. C-32135 (slide 3).
15. Holotype GSC 73989; GSC loc. C-31881 (slide 11).
16. Paratype, GSC 73990; GSC loc. C-31882 (slide 9).
17. Paratype, GSC 73991; GSC loc. C-31882 (slide 6).
18. Paratype, GSC 73992; GSC loc. C-31881 (slide 5, specimen 2).
19. Paratype, GSC 73993; GSC loc. C-31883 (slide 9).

Figures 20-22. *Wedekindellina* sp. A; oblique sections (figs. 20, 21); axial section (fig. 22)

20. Hypotype, GSC 73994; GSC loc. C-31676 (slide 4).
21. Hypotype, GSC 73995; GSC loc. C-31666 (slide 4).
22. Hypotype, GSC 73996; GSC loc. C-31666 (slide 1).

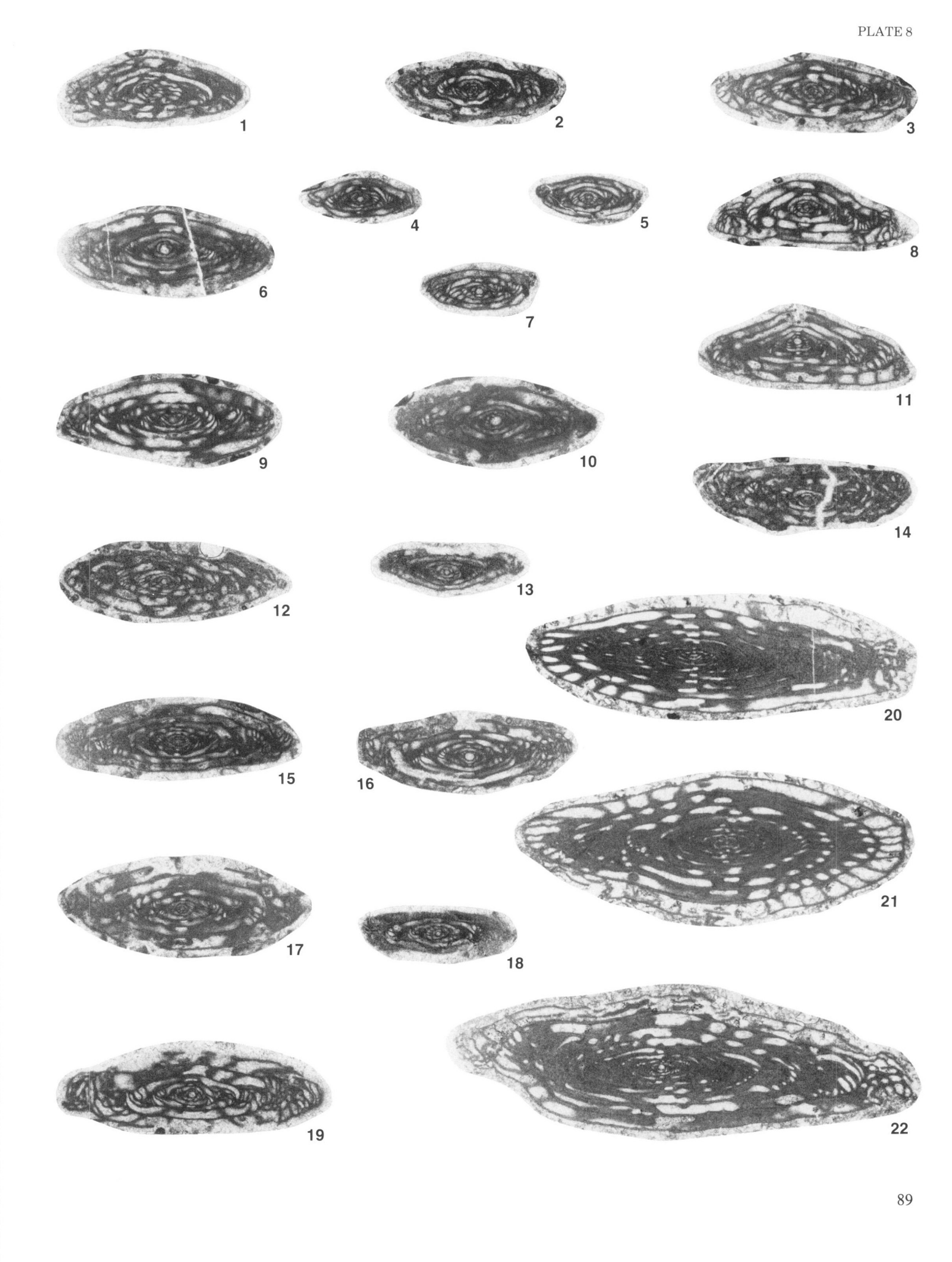

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE 9

(All figures x 20)

Figures 1-13. *Wedekindellina pulchra* n. sp.; axial sections

1. Holotype, GSC 73997; GSC loc. C-31648 (slide 9).
2. Paratype, GSC 73998; GSC loc. C-31885 (slide 3).
3. Paratype, GSC 73999; GSC loc. C-31885 (slide 8).
4. Paratype, GSC 74000; GSC loc. C-31885 (slide 9).
5. Paratype, GSC 74001; GSC loc. C-31885 (slide 2).
6. Paratype, GSC 74002; GSC loc. C-31884 (slide 4, specimen 2).
7. Paratype, GSC 74003; GSC loc. C-31885 (slide 1).
8. Paratype, GSC 74004; GSC loc. C-31885 (slide 7).
9. Paratype, GSC 74005; GSC loc. C-31885 (slide 5, specimen 1).
10. Paratype, GSC 74006; GSC loc. C-31884 (slide 3).
11. Paratype, GSC 74007; GSC loc. C-31884 (slide 4, specimen 1).
12. Paratype, GSC 74008; GSC loc. C-31885 (slide 4).
13. Paratype, GSC 74009; GSC loc. C-31885 (slide 6).

Figures 14-22. *Wedekindellina matura* Thompson; axial sections

14. Hypotype, GSC 74010; GSC loc. C-32146 (slide 2).
15. Hypotype, GSC 74011; GSC loc. C-32134 (slide 6, specimen 1).
16. Hypotype, GSC 74012; GSC loc. C-31890 (slide 10).
17. Hypotype, GSC 74013; GSC loc. C-31890 (slide 1).
18. Hypotype, GSC 74014; GSC loc. C-32130 (slide 26).
19. Hypotype, GSC 74015; GSC loc. C-32130 (slide 12).
20. Hypotype, GSC 74016; GSC loc. C-31650 (slide 3).
21. Hypotype, GSC 74017; GSC loc. C-31648 (slide 8).
22. Hypotype, GSC 74018; GSC loc. C-32134 (slide 11).

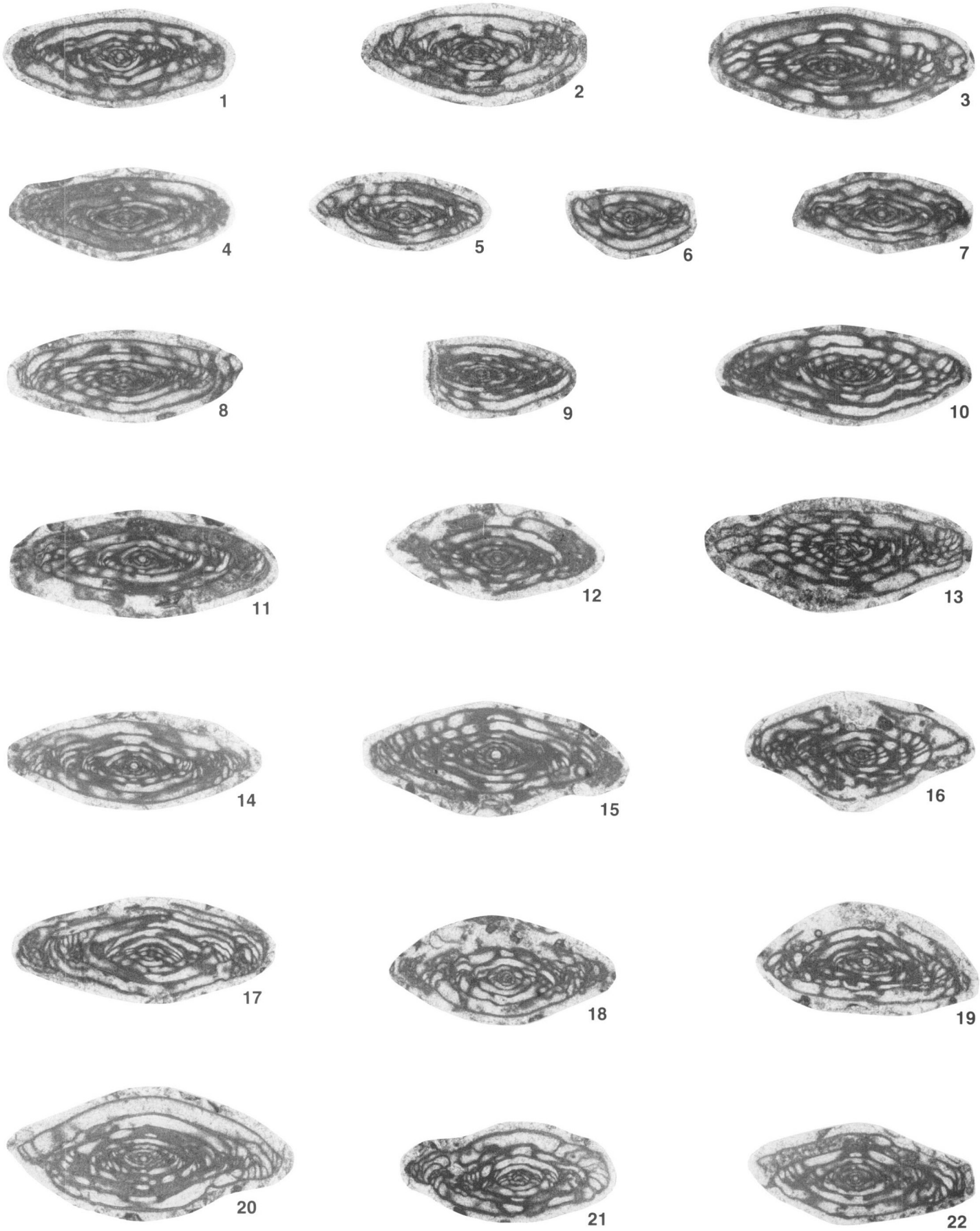

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE 10

(All figures x 20)

Figures 1-22. *Wedekindellina lata* Thompson; axial sections

1. Hypotype, GSC 74019; GSC loc. C-31881 (slide 7).
2. Hypotype, GSC 74020: GSC loc. C-32134 (slide 8).
3. Hypotype, GSC 74021; GSC loc. C-32134 (slide 7).
4. Hypotype, GSC 74022; GSC loc. C-32134 (slide 10).
5. Hypotype, GSC 74023; GSC loc. C-31901 (slide 6, specimen 2).
6. Hypotype, GSC 74024; GSC loc. C-31902 (slide 3).
7. Hypotype, GSC 74025; GSC loc. C-32144 (slide 2).
8. Hypotype, GSC 74026; GSC loc. C-32145 (slide 8).
9. Hypotype, GSC 74027; GSC loc. C-31650 (slide 8).
10. Hypotype, GSC 74028; GSC loc. C-32144 (slide 5).
11. Hypotype, GSC 74029; GSC loc. C-31654 (slide 8, specimen 2).
12. Hypotype, GSC 74030; GSC loc. C-32144 (slide 1).
13. Hypotype, GSC 74031; GSC loc. C-31881 (slide 8).
14. Hypotype, GSC 74032; GSC loc. C-31884 (slide 7).
15. Hypotype, GSC 74033; GSC loc. C-31654 (slide 10).
16. Hypotype, GSC 74034; GSC loc. C-32144 (slide 4).
17. Hypotype, GSC 74035; GSC loc. C-32144 (slide 3).
18. Hypotype, GSC 74036; GSC loc. C-31881 (slide 4).
19. Hypotype, GSC 74037; GSC loc. C-31901 (slide 6, specimen 1).
20. Hypotype, GSC 74038; GSC loc. C-31901 (slide 9).
21. Hypotype, GSC 74039; GSC loc. C-32128 (slide 1).
22. Hypotype, GSC 74040; GSC loc. C-31901 (slide 10).

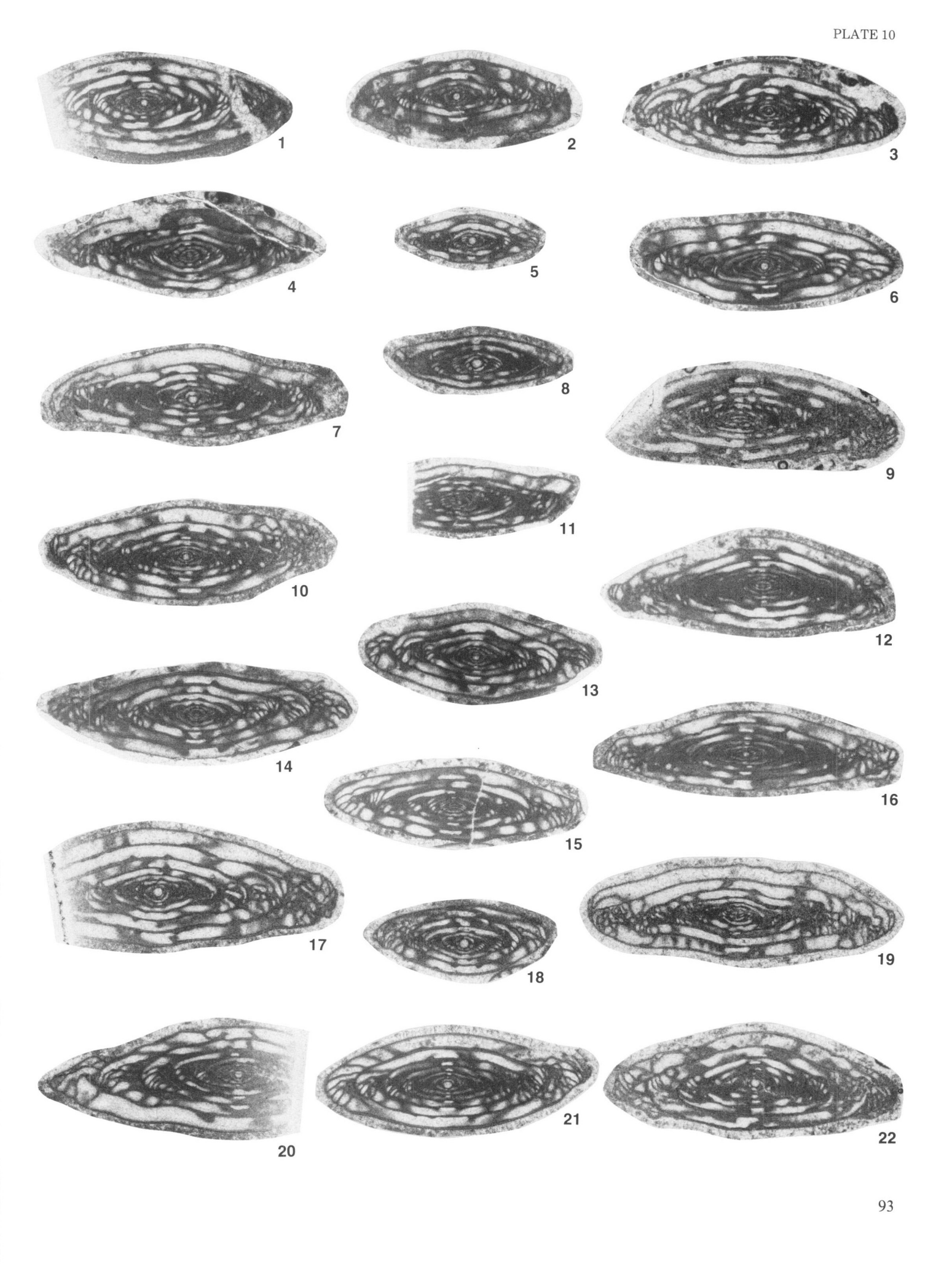

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE 11

(All figures x 20)

Figures 1-11. *Fusulinella praecolaniae* Safonova; axial sections (figs. 1-7, 10, 11); sagittal sections (figs. 8, 9)

1. Hypotype, GSC 74041; GSC loc. C-32134 (slide 23).
2. Hypotype, GSC 74042; GSC loc. C-31696 (slide 19, specimen 1).
3. Hypotype, GSC 74043; GSC loc. C-31696 (slide 21, specimen 1).
4. Hypotype, GSC 74044; GSC loc. C-31696 (slide 15).
5. Hypotype, GSC 74045; GSC loc. C-31689 (slide 3).
6. Hypotype, GSC 74046; GSC loc. C-31882 (slide 5).
7. Hypotype, GSC 74047; GSC loc. C-31689 (slide 2, specimen 1).
8. Hypotype, GSC 74048; GSC loc. C-31696 (slide 21, specimen 2).
9. Hypotype, GSC 74049; GSC loc. C-31696 (slide 19, specimen 2).
10. Hypotype, GSC 74050; GSC loc. C-31696 (slide 22, specimen 1).
11. Hypotype, GSC 74051; GSC loc. C-31696 (slide 25).

Figures 12-20. *Fusulinella subpulchra submesopachis* Putrja; axial sections

12. Hypotype, GSC 74052; GSC loc. C-31713 (slide 2).
13. Hypotype, GSC 74053; GSC loc. C-31783 (slide 4, specimen 1).
14. Hypotype, GSC 74054; GSC loc. C-31744 (slide 7).
15. Hypotype, GSC 74055; GSC loc. C-31654 (slide 8, specimen 1).
16. Hypotype, GSC 74056; GSC loc. C-31671 (slide 2).
17. Hypotype, GSC 74057; GSC loc. C-31681 (slide 1).
18. Hypotype, GSC 74058; GSC loc. C-31744 (slide 9).
19. Hypotype, GSC 74059; GSC loc. C-31654 (slide 6).
20. Hypotype, GSC 74060; GSC loc. C-31744 (slide 8).

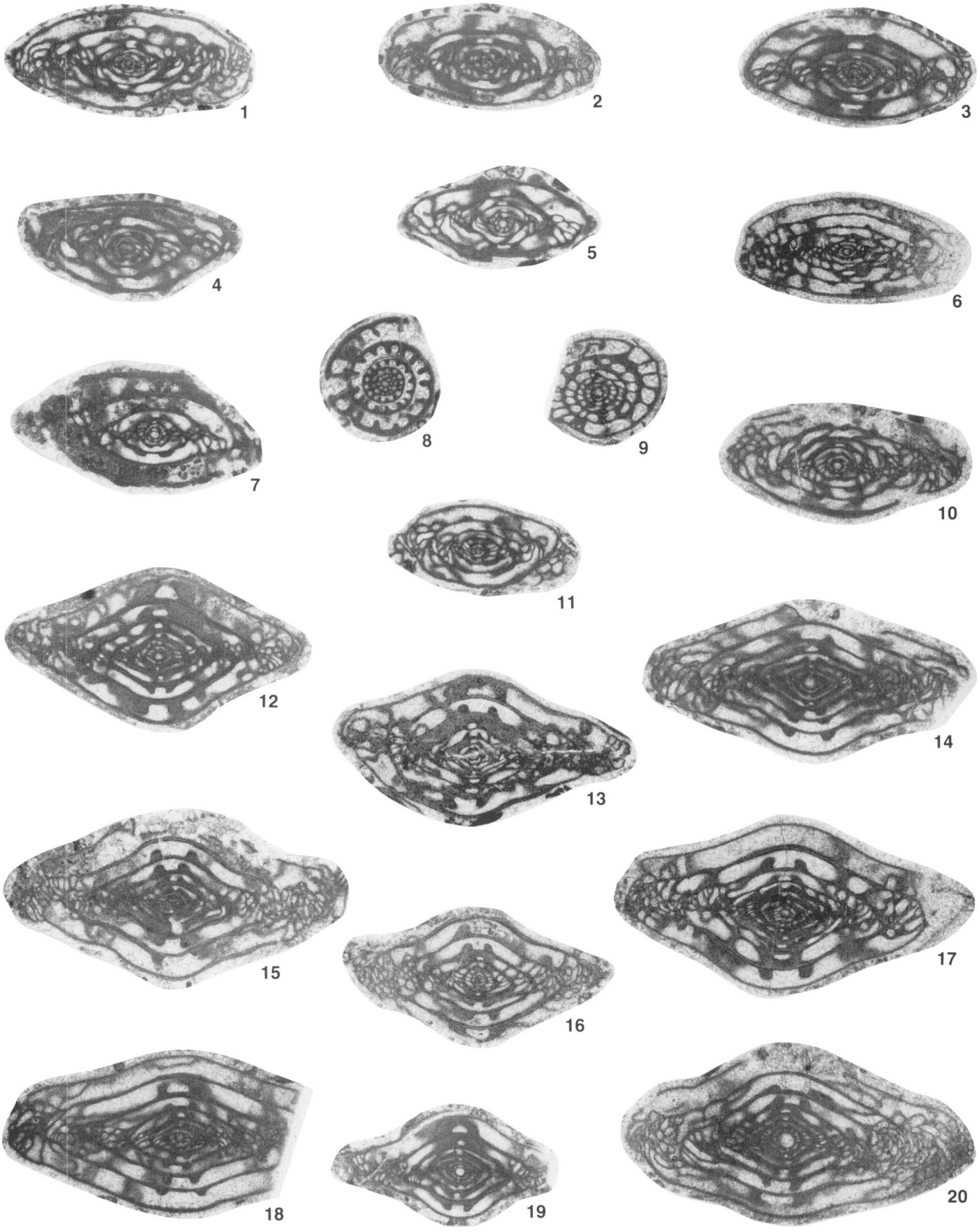

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

PLATE 12

(All figures x 20)

Figures 1-17. *Fusulinella zelleri* Thompson; axial sections

1. Hypotype, GSC 74061; GSC loc. C-31693 (slide 3).
2. Hypotype, GSC 74062; GSC loc. C-31786 (slide 16, specimen 1).
3. Hypotype, GSC 74063; GSC loc. C-31786 (slide 19).
4. Hypotype, GSC 74064; GSC loc. C-31786 (slide 25).
5. Hypotype, GSC 74065; GSC loc. C-31786 (slide 27).
6. Hypotype, GSC 74066; GSC loc. C-31697 (slide 9).
7. Hypotype, GSC 74067; GSC loc. C-31697 (slide 4).
8. Hypotype, GSC 74068; GSC loc. C-31697 (slide 5).
9. Hypotype, GSC 74069; GSC loc. C-31786 (slide 28).
10. Hypotype, GSC 74070; GSC loc. C-31784 (slide 18).
11. Hypotype, GSC 74071; GSC loc. C-31746 (slide 3, specimen 1).
12. Hypotype, GSC 74072; GSC loc. C-31696 (slide 5).
13. Hypotype, GSC 74073; GSC loc. C-31696 (slide 6).
14. Hypotype, GSC 74074; GSC loc. C-31696 (slide 9).
15. Hypotype, GSC 74075; GSC loc. C-31661 (slide 6).
16. Hypotype, GSC 74076; GSC loc. C-31697 (slide 7).
17. Hypotype, GSC 74077; GSC loc. C-31661 (slide 4).

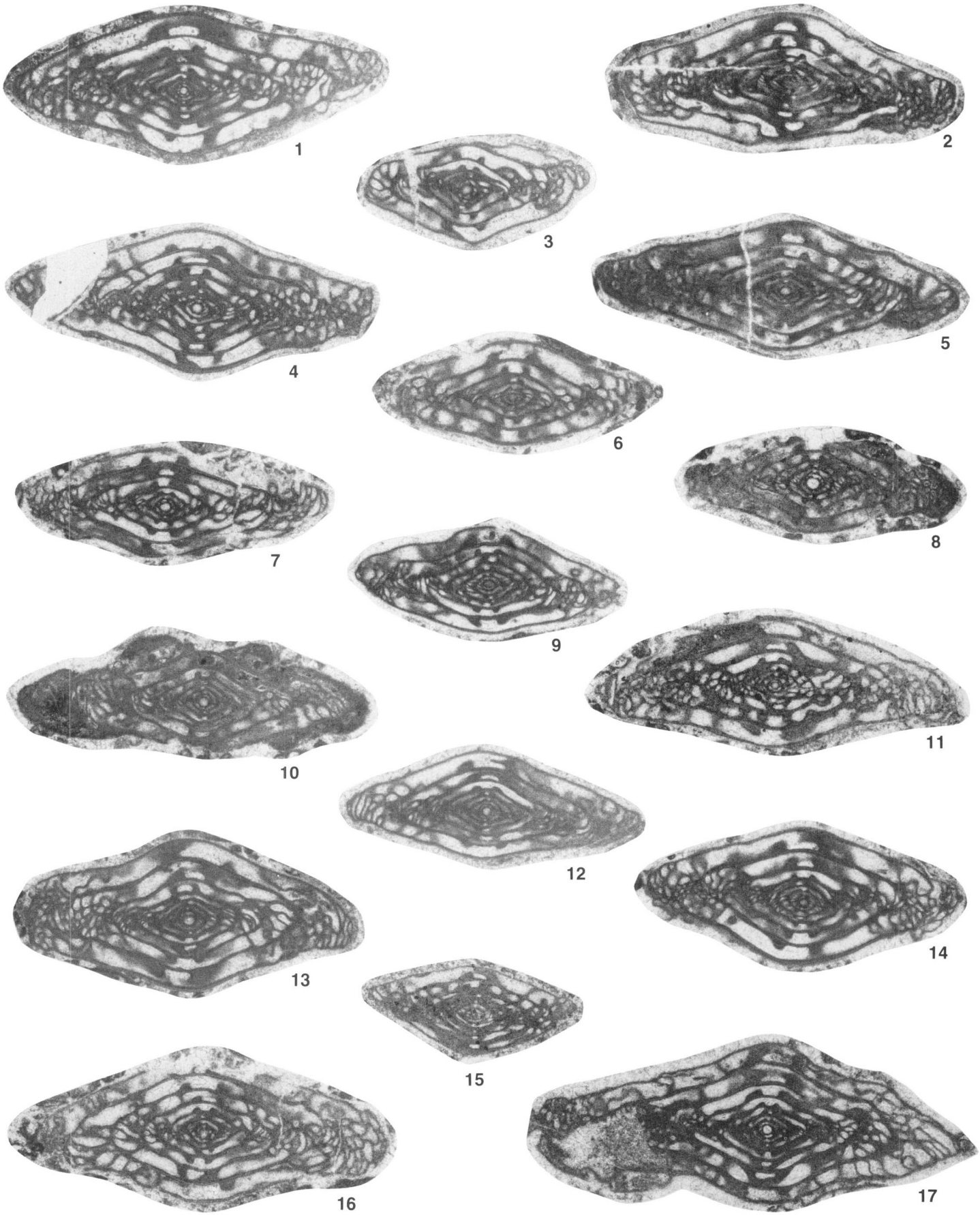

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

PLATE 13

(All figures x 20)

Figures 1-15. *Fusulinella taishakuensis* Sada; axial sections

1. Hypotype, GSC 74078; GSC loc. C-31653 (slide 6).
2. Hypotype, GSC 74079; GSC loc. C-31650 (slide 5).
3. Hypotype, GSC 74080; GSC loc. C-31651 (slide 5).
4. Hypotype, GSC 74081; GSC loc. C-31668 (slide 8).
5. Hypotype, GSC 74082; GSC loc. C-31727 (slide 4).
6. Hypotype, GSC 74083; GSC loc. C-32145 (slide 1).
7. Hypotype, GSC 74084; GSC loc. C-31668 (slide 6).
8. Hypotype, GSC 74085; GSC loc. C-31669 (slide 3).
9. Hypotype, GSC 74086; GSC loc. C-31650 (slide 2).
10. Hypotype, GSC 74087; GSC loc. C-31650 (slide 1).
11. Hypotype, GSC 74088; GSC loc. C-31727 (slide 1).
12. Hypotype, GSC 74089; GSC loc. C-31669 (slide 4).
13. Hypotype, GSC 74090; GSC loc. C-31653 (slide 4).
14. Hypotype, GSC 74091; GSC loc. C-31685 (slide 4, specimen 2).
15. Hypotype, GSC 74092; GSC loc. C-31669 (slide 1).

Figures 16-19. *Fusulinella zelleri* Thompson; axial sections

16. Hypotype, GSC 74093; GSC loc. C-31784 (slide 17).
17. Hypotype, GSC 74094; GSC loc. C-31787 (slide 8).
18. Hypotype, GSC 74095; GSC loc. C-31745 (slide 8, specimen 2).
19. Hypotype, GSC 74096; GSC loc. C-31661 (slide 5, specimen 1).

Figure 20. *Fusulinella* sp. A; axial section

Hypotype, GSC 74097; GSC loc. C-31786 (slide 24).

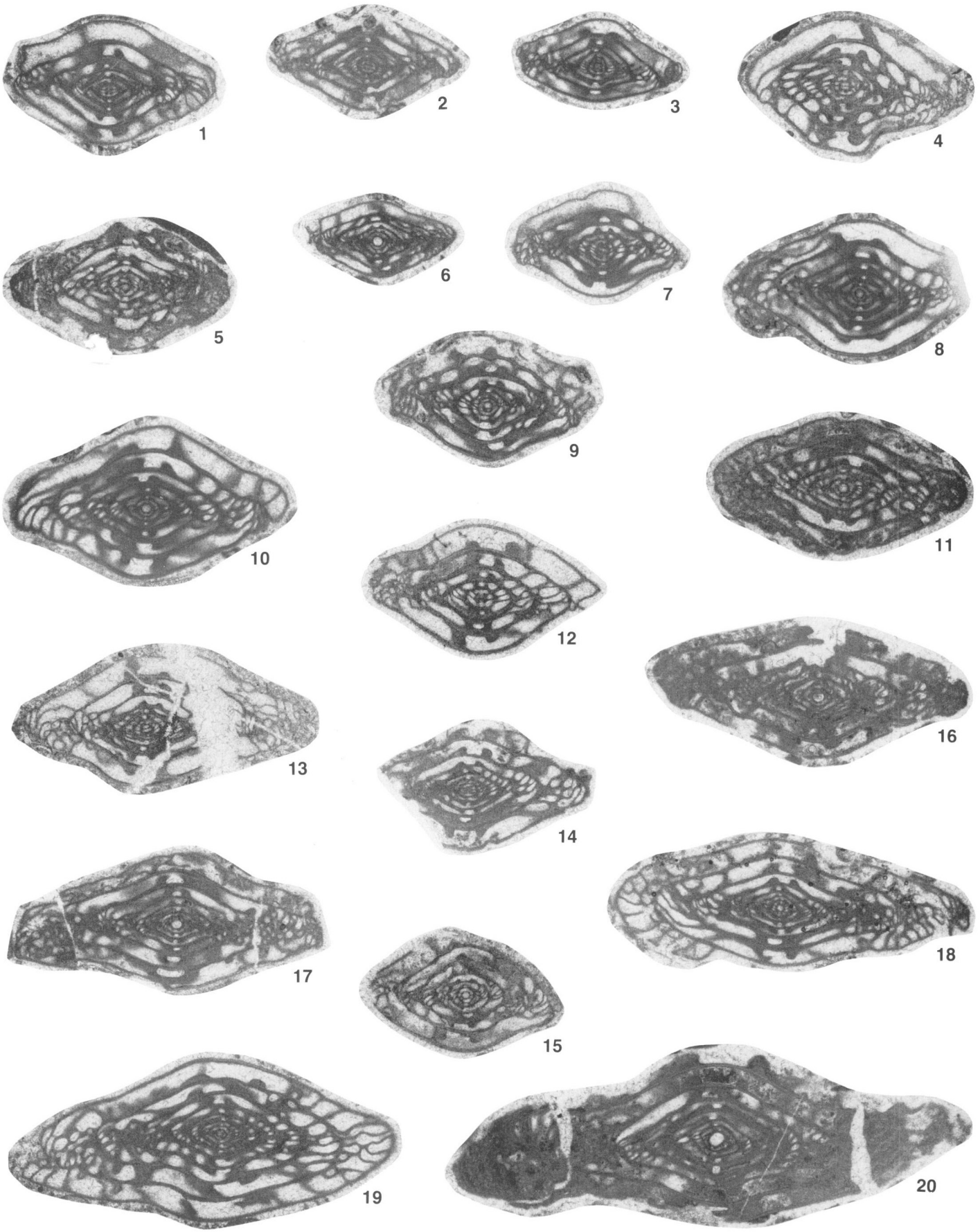

1
2
3
4
5
6
7
8
9
10
11
12
13
14
16
17
18
15
19
20

PLATE 14

(All figures x 20)

Figures 1-3. *Fusulinella pokojamiensis* Lebedeva; axial sections

1. Hypotype, GSC 74098; GSC loc. C-31792 (slide 3).
2. Hypotype, GSC 74099; GSC loc. C-31792 (slide 2).
3. Hypotype, GSC 74100; GSC loc. C-31792 (slide 4).

Figures 4-6. *Fusulinella jamesensis* Thompson, Pitrat, and Sanderson; axial sections

4. Hypotype, GSC 74101; GSC loc. C-31656 (slide 6).
5. Hypotype, GSC 74102; GSC loc. C-31673 (slide 3, specimen 1).
6. Hypotype, GSC 74103; GSC loc. C-31671 (slide 3).

Figures 7-9. *Fusulinella subpulchra* Putrja; axial sections

7. Hypotype, GSC 74104; GSC loc. C-31790 (slide 7).
8. Hypotype, GSC 74105; GSC loc. C-31790 (slide 8).
9. Hypotype, GSC 74106; GSC loc. C-31721 (slide 3).

Figures 10-19. *Fusulinella devexa* Thompson; axial sections

10. Hypotype, GSC 74107; GSC loc. C-31713 (slide 1).
11. Hypotype, GSC 74108; GSC loc. C-31902 (slide 2).
12. Hypotype, GSC 74109; GSC loc. C-31697 (slide 8).
13. Hypotype, GSC 74110; GSC loc. C-31713 (slide 7).
14. Hypotype, GSC 74111; GSC loc. C-31656 (slide 7).
15. Hypotype, GSC 74112; GSC loc. C-31902 (slide 1).
16. Hypotype, GSC 74113; GSC loc. C-31655 (slide 1).
17. Hypotype, GSC 74114; GSC loc. C-31713 (slide 5).
18. Hypotype, GSC 74115; GSC loc. C-31655 (slide 5).
19. Hypotype, GSC 74116; GSC loc. C-31722 (slide 5).

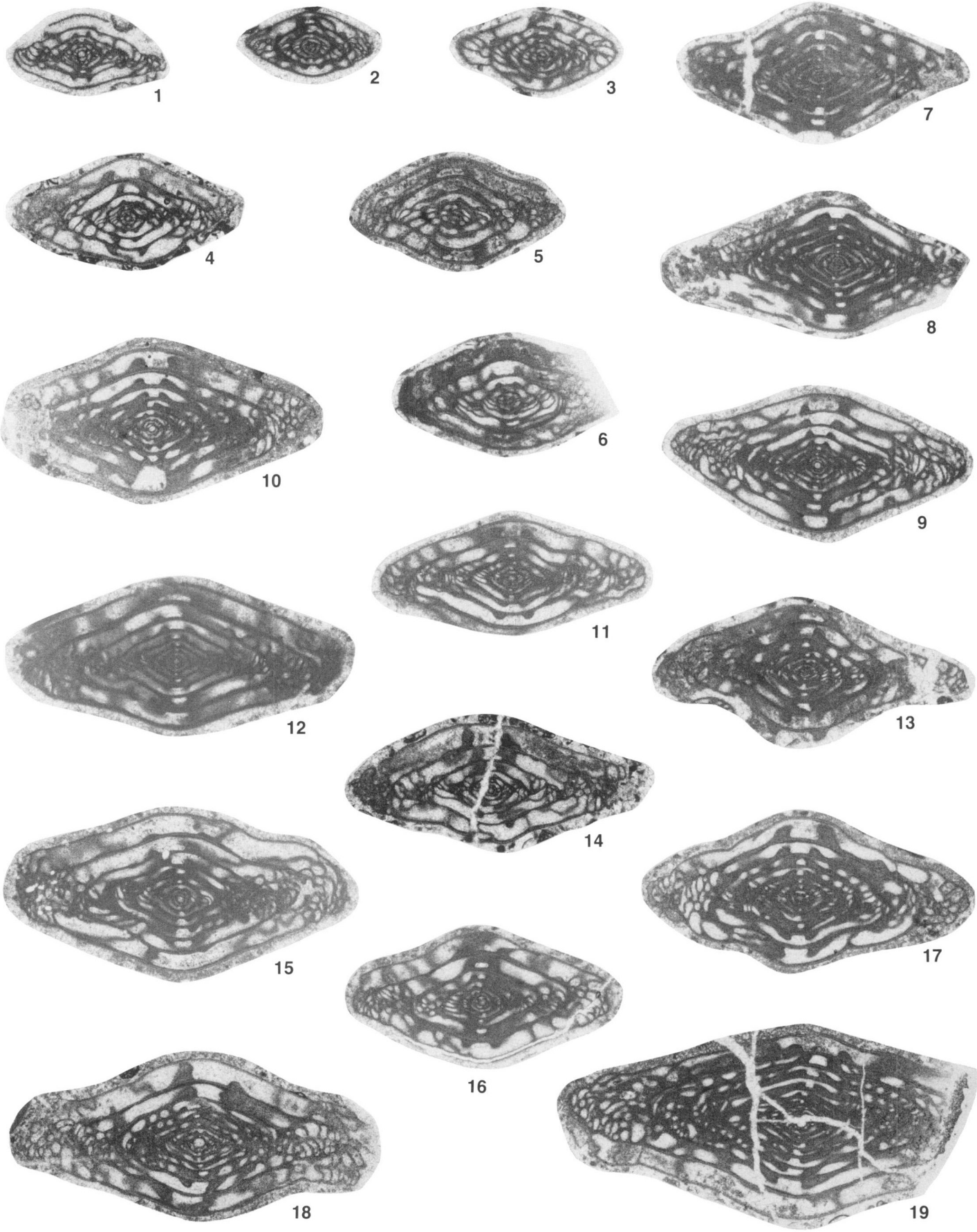
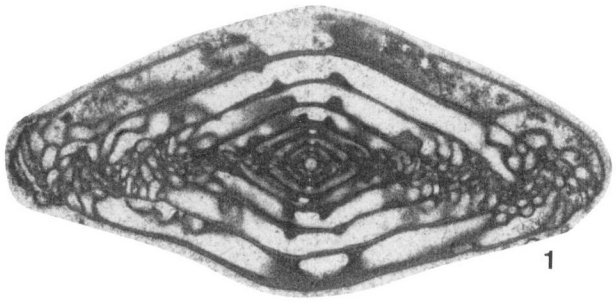

1
2
3
7
4
5
8
10
6
9
11
12
13
14
15
17
16
18
19

PLATE 15

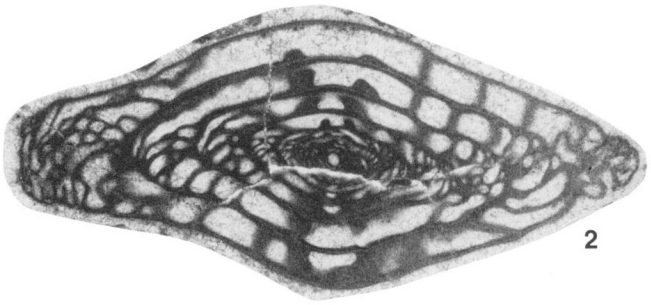
(All figures x 20)

Figures 1-10. *Fusulinella nevadensis* Verville, Thompson, and Lokke; axial sections

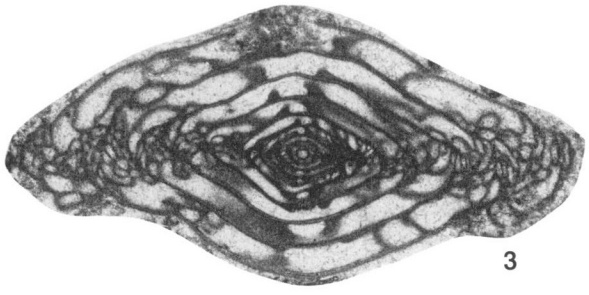
1. Hypotype, GSC 74117; GSC loc. C-31726 (slide 51).
2. Hypotype, GSC 74118; GSC loc. C-31687 (slide 2).
3. Hypotype, GSC 74119; GSC loc. C-31726 (slide 32).
4. Hypotype, GSC 74120; GSC loc. C-31726 (slide 43, specimen 2).
5. Hypotype, GSC 74121; GSC loc. C-31726 (slide 47).
6. Hypotype, GSC 74122; GSC loc. C-31726 (slide 44).
7. Hypotype, GSC 74123; GSC loc. C-31726 (slide 26).
8. Hypotype, GSC 74124; GSC loc. C-31726 (slide 45).
9. Hypotype, GSC 74125; GSC loc. C-31726 (slide 52, specimen 1).
10. Hypotype, GSC 74126; GSC loc. C-31726 (slide 49).



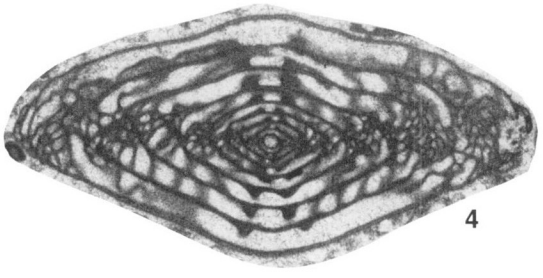
1



2

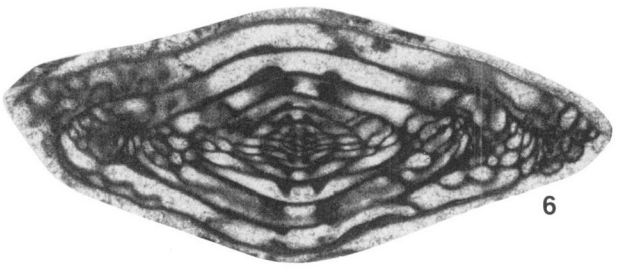


3

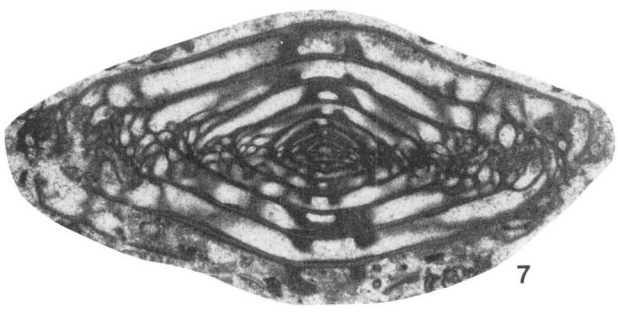


4

5

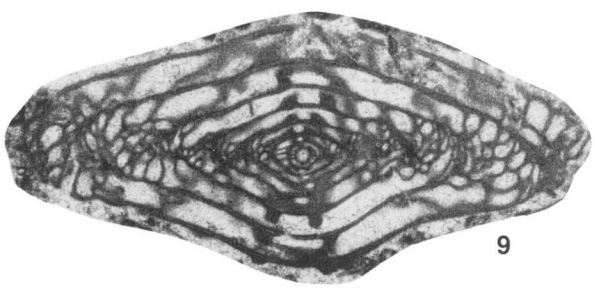


6

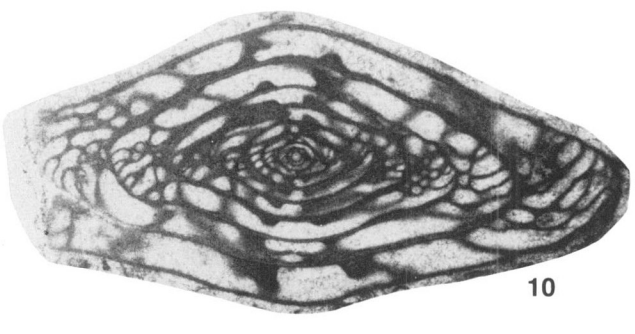


7

8



9



10

PLATE 16

(All figures x 20)

Figures 1-14. *Fusulinella nevadensis* Verville, Thompson, and Lokke; axial sections

1. Hypotype, GSC 74127; GSC loc. C-31744 (slide 16)
2. Hypotype, GSC 74128; GSC loc. C-31695 (slide 22).
3. Hypotype, GSC 74129; GSC loc. C-31757 (slide 12).
4. Hypotype, GSC 74130; GSC loc. C-31715 (slide 4).
5. Hypotype, GSC 74131; GSC loc. C. 31744 (slide 14).
6. Hypotype, GSC 74132; GSC loc. C-31726 (slide 33).
7. Hypotype, GSC 74133; GSC loc. C-31789 (slide 1).
8. Hypotype, GSC 74134; GSC loc. C-31715 (slide 6).
9. Hypotype, GSC 74135; GSC loc. C-31715 (slide 5).
10. Hypotype, GSC 74136; GSC loc. C-31701 (slide 1).
11. Hypotype, GSC 74137; GSC loc. C-31759 (slide 7).
12. Hypotype, GSC 74138; GSC loc. C-31744 (slide 13).
13. Hypotype, GSC 74139; GSC loc. C-31692 (slide 4).
14. Hypotype, GSC 74140; GSC loc. C-31744 (slide 15).

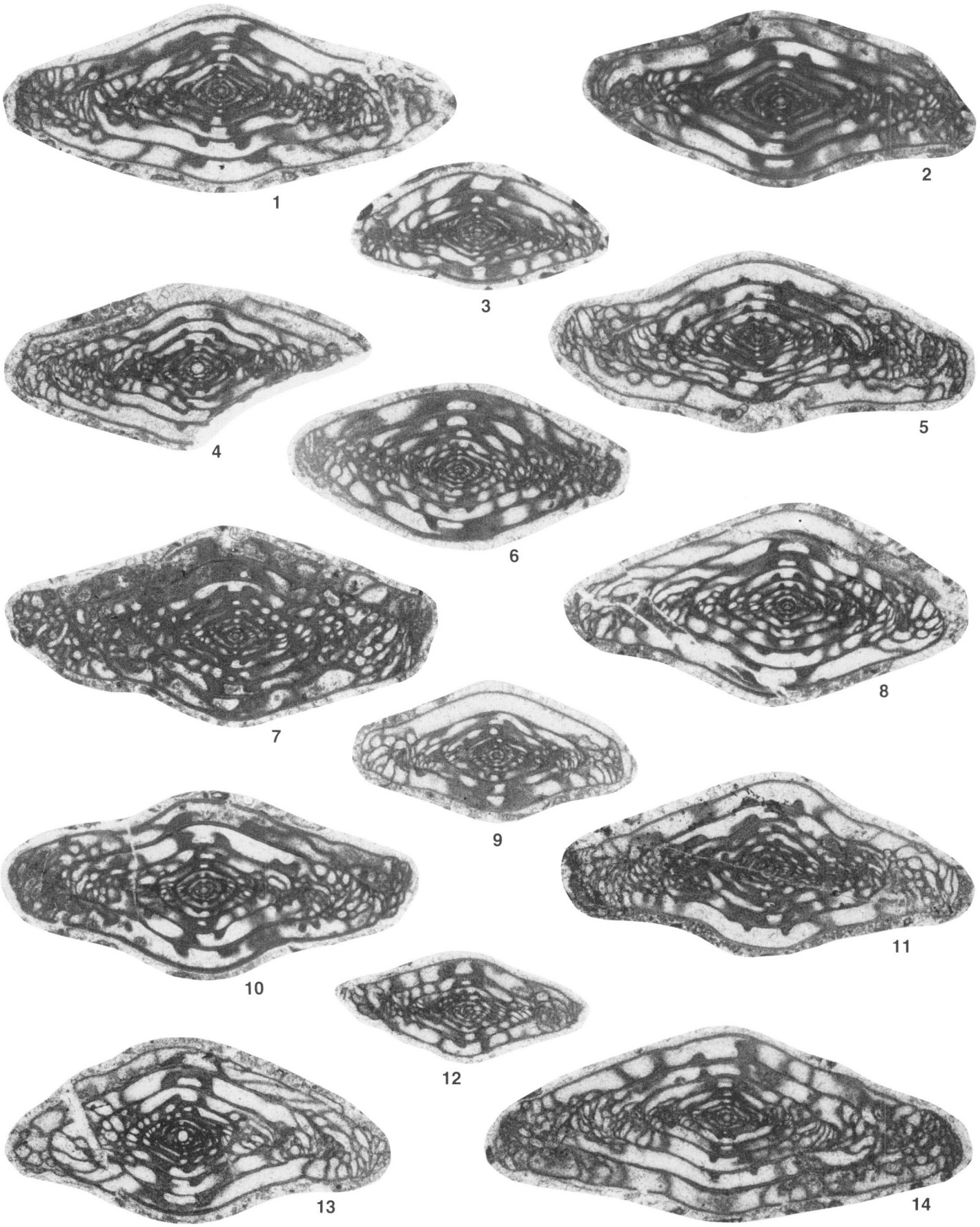

1
2
3
4
5
6
7
8
9
10
11
12
13
14

PLATE 17

(All figures x 20)

Figures 1-21. *Fusulinella fugax* Thompson; axial sections (figs. 1-16, 18-21); sagittal section (fig. 17)

1. Hypotype, GSC 74141; GSC loc. C-31787 (slide 4).
2. Hypotype, GSC 74142; GSC loc. C-31786 (slide 15).
3. Hypotype, GSC 74143; GSC loc. C-31786 (slide 11).
4. Hypotype, GSC 74144; GSC loc. C-31787 (slide 5).
5. Hypotype, GSC 74145; GSC loc. C-31786 (slide 13).
6. Hypotype, GSC 74146; GSC loc. C-31788 (slide 5).
7. Hypotype, GSC 74147; GSC loc. C-31787 (slide 7).
8. Hypotype, GSC 74148; GSC loc. C-31786 (slide 16, specimen 2).
9. Hypotype, GSC 74149; GSC loc. C-31721 (slide 7).
10. Hypotype, GSC 74150; GSC loc. C-31787 (slide 6).
11. Hypotype, GSC 74151; GSC loc. C-31652 (slide 1).
12. Hypotype, GSC 74152; GSC loc. C-31721 (slide 9, specimen 1).
13. Hypotype, GSC 74153; GSC loc. C-31786 (slide 17).
14. Hypotype, GSC 74154; GSC loc. C-31652 (slide 3).
15. Hypotype, GSC 74155; GSC loc. C-31653 (slide 5).
16. Hypotype, GSC 74156; GSC loc. C-31786 (slide 26).
17. Hypotype, GSC 74157; GSC loc. C-31721 (slide 9, specimen 2).
18. Hypotype, GSC 74158; GSC loc. C-31721 (slide 2).
19. Hypotype, GSC 74159; GSC loc. C-31786 (slide 22).
20. Hypotype, GSC 74160; GSC loc. C-31787 (slide 3).
21. Hypotype, GSC 74161; GSC loc. C-31721 (slide 1).

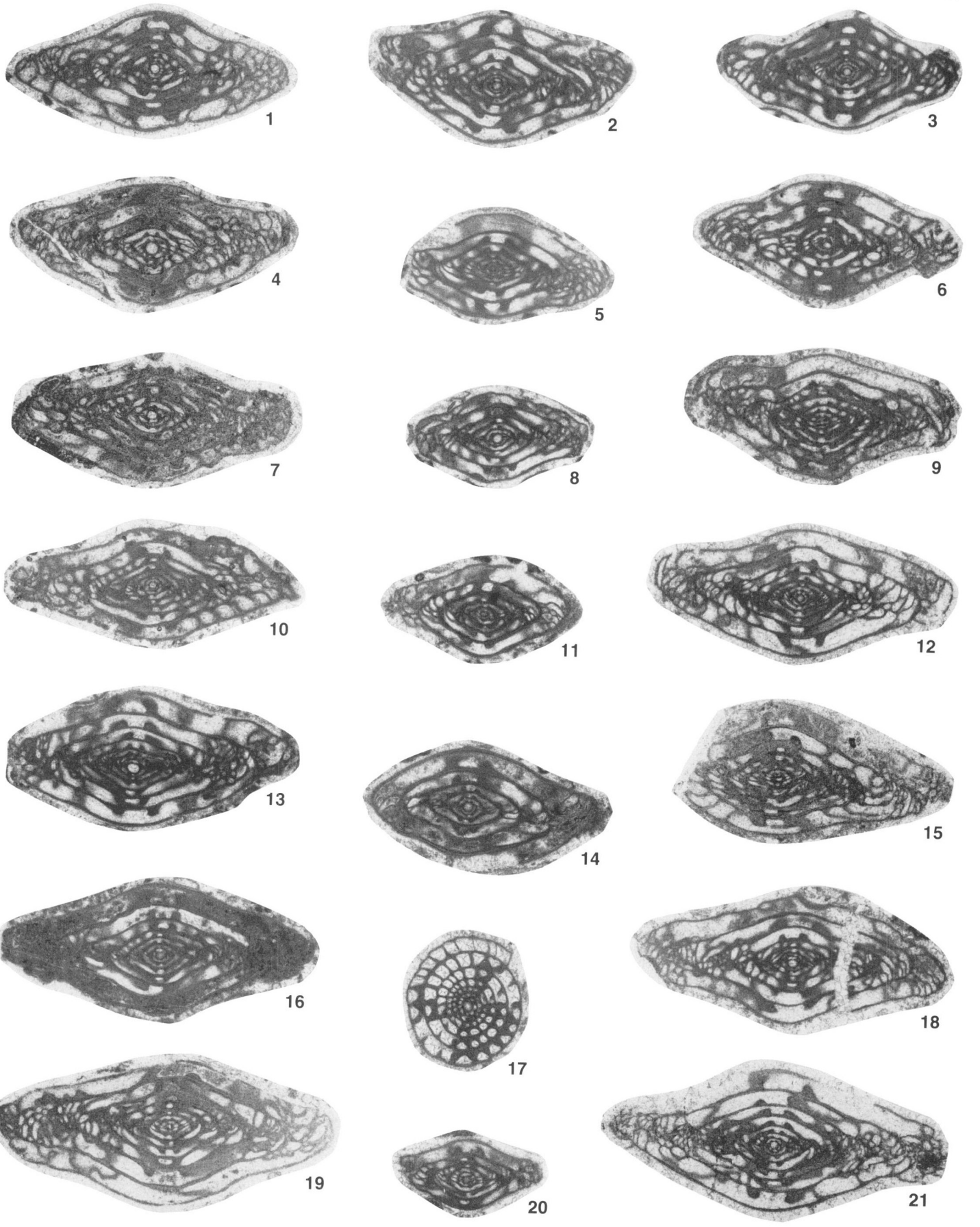

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

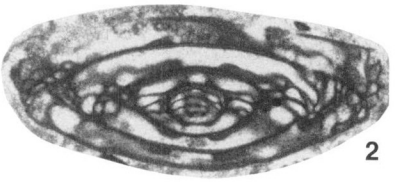
PLATE 18

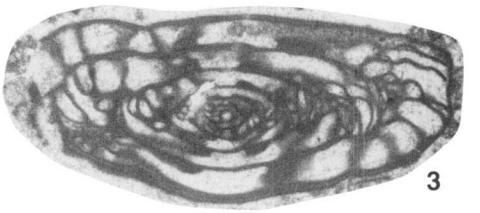
(All figures x 20)

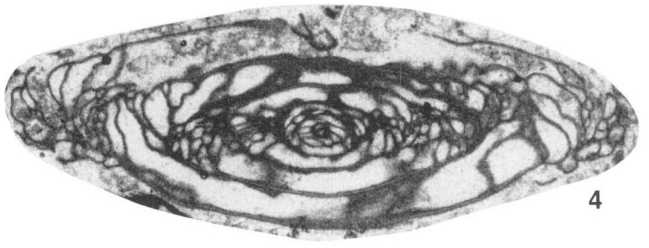
Figures 1-13. *Fusulinella rara* Schlykova; axial sections (figs. 1, 3-8, 10-13); near-central tangential sections (figs. 2, 9)

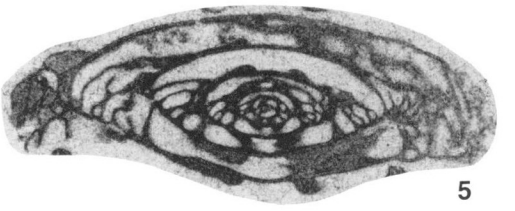
1. Hypotype, GSC 74162; GSC loc. C-31685 (slide 3).
2. Hypotype, GSC 74163; GSC loc. C-31695 (slide 24, specimen 1).
3. Hypotype, GSC 74164; GSC loc. C-31695 (slide 19).
4. Hypotype, GSC 74165; GSC loc. C-31695 (slide 25).
5. Hypotype, GSC 74166; GSC loc. C-31687 (slide 5).
6. Hypotype, GSC 74167; GSC loc. C-31687 (slide 4).
7. Hypotype, GSC 74168; GSC loc. C-31685 (slide 2).
8. Hypotype, GSC 74169; GSC loc. C-31687 (slide 9).
9. Hypotype, GSC 74170; GSC loc. C-31687 (slide 8, specimen 1).
10. Hypotype, GSC 74171; GSC loc. C-31655 (slide 6).
11. Hypotype, GSC 74172; GSC loc. C-31687 (slide 7).
12. Hypotype, GSC 74173; GSC loc. C-31655 (slide 8).
13. Hypotype, GSC 74174; GSC loc. C-31695 (slide 26).

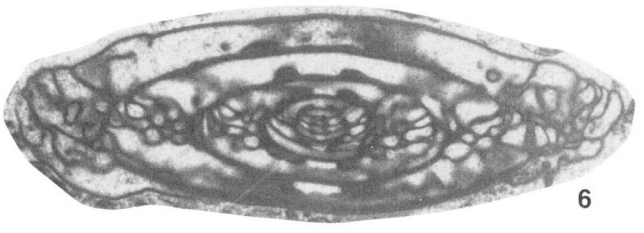
1

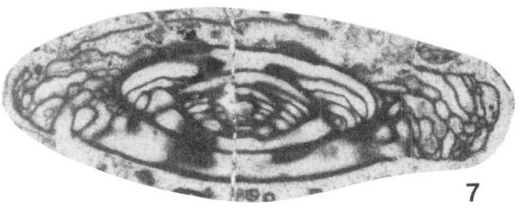

2

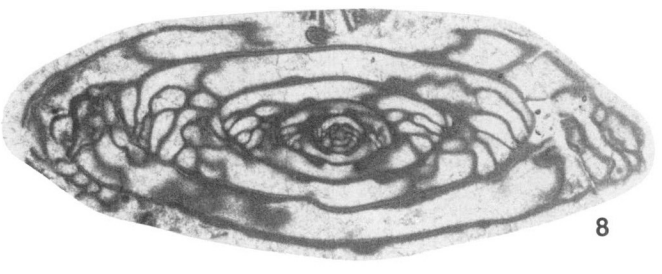

3

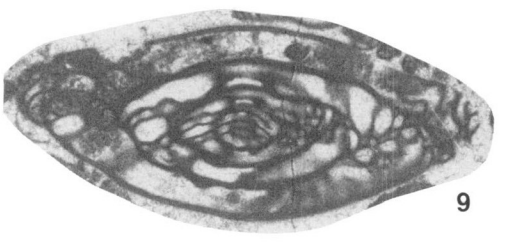

4

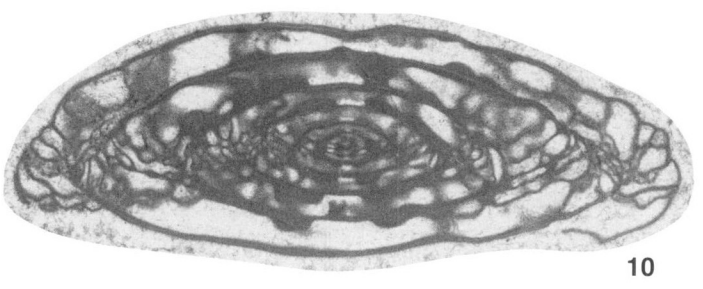

5


6

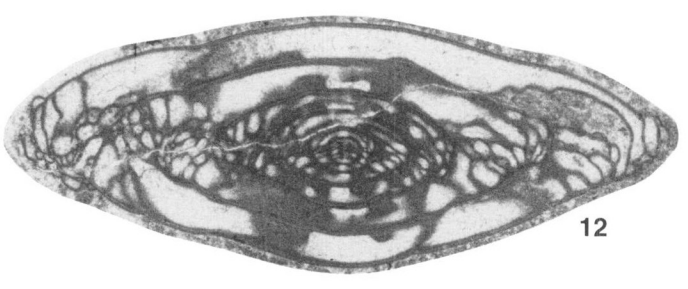

7


8


9


10

11


12

13

PLATE 19

(All figures x 20)

Figures 1-15. *Fusulinella pseudobocki* Lee and Chen; axial sections

1. Hypotype, GSC 74175; GSC loc. C-32145 (slide 5).
2. Hypotype, GSC 74176; GSC loc. C-31697 (slide 3, specimen 1).
3. Hypotype, GSC 74177; GSC loc. C-32145 (slide 6).
4. Hypotype, GSC 74178; GSC loc. C-31688 (slide 6).
5. Hypotype, GSC 74179; GSC loc. C-31697 (slide 10).
6. Hypotype, GSC 74180; GSC loc. C-31697 (slide 2).
7. Hypotype, GSC 74181; GSC loc. C-31697 (slide 13).
8. Hypotype, GSC 74182; GSC loc. C-32145 (slide 3, specimen 1).
9. Hypotype, GSC 74183; GSC loc. C-31694 (slide 2).
10. Hypotype, GSC 74184; GSC loc. C-31697 (slide 1).
11. Hypotype, GSC 74185; GSC loc. C-31697 (slide 18, specimen 2).
12. Hypotype, GSC 74186; GSC loc. C-32145 (slide 4, specimen 1).
13. Hypotype, GSC 74187; GSC loc. C-31697 (slide 18, specimen 1).
14. Hypotype, GSC 74188; GSC loc. C-32145 (slide 2).
15. Hypotype, GSC 74189; GSC loc. C-31688 (slide 4).

Figures 16, 17. *Fusulinella daviesi* n. sp.; axial sections

16. Paratype, GSC 74190; GSC loc. C-31692 (slide 1).
17. Holotype, GSC 74191; GSC loc. C-31692 (slide 2).

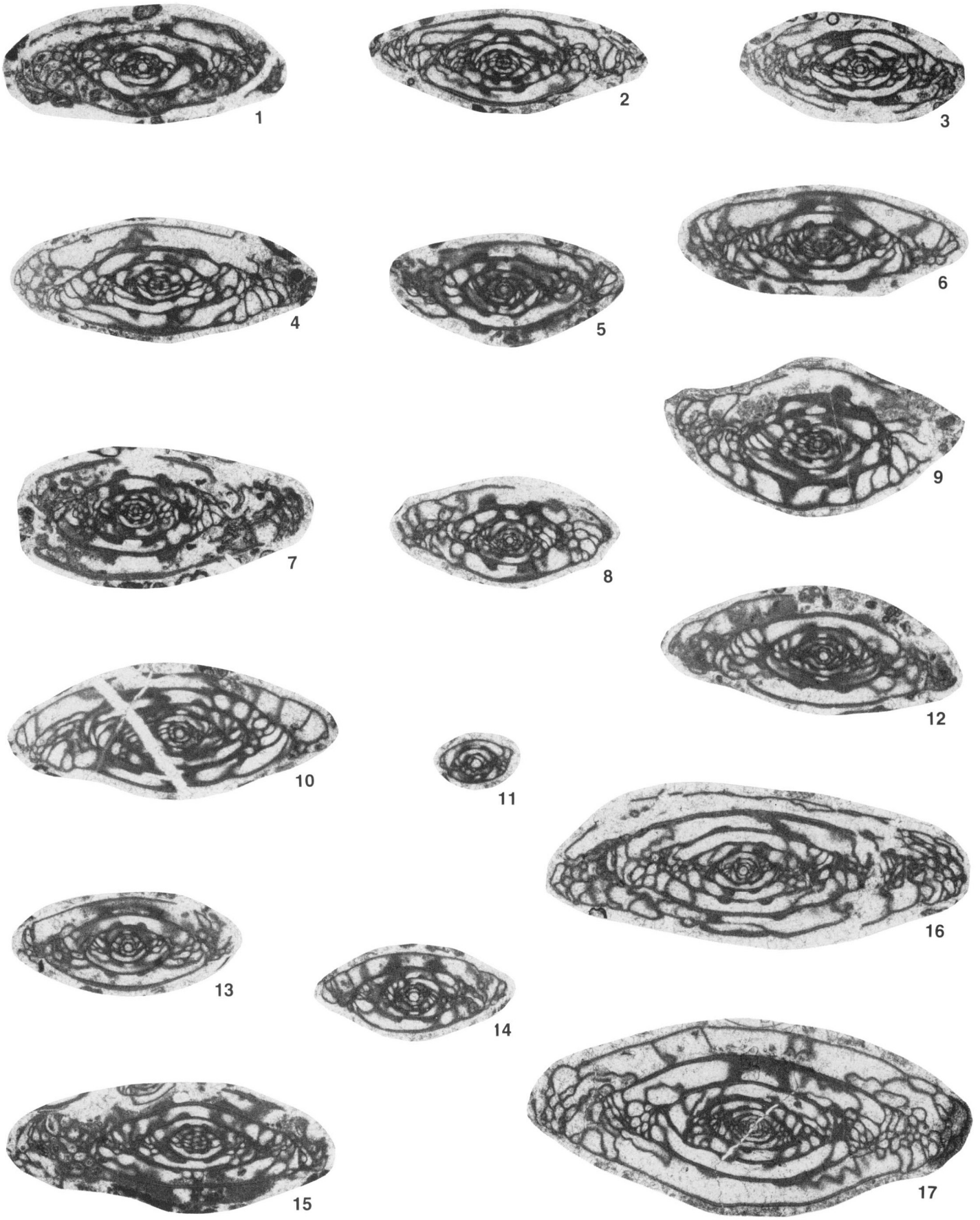

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

PLATE 20

(All figures x 20)

Figures 1-16. *Fusulinella eopulchra* Rauser; axial sections

1. Hypotype, GSC 74192; GSC loc. C-31726 (slide 14).
2. Hypotype, GSC 74193; GSC loc. C-31701 (slide 5).
3. Hypotype, GSC 74194; GSC loc. C-31701 (slide 8, specimen 1).
4. Hypotype, GSC 74195; GSC loc. C-31726 (slide 25).
5. Hypotype, GSC 74196; GSC loc. C-31726 (slide 31).
6. Hypotype, GSC 74197; GSC loc. C-31680 (slide 1).
7. Hypotype, GSC 74198; GSC loc. C-31790 (slide 5).
8. Hypotype, GSC 74199; GSC loc. C-31693 (slide 1).
9. Hypotype, GSC 74200; GSC loc. C-31790 (slide 2).
10. Hypotype, GSC 74201; GSC loc. C-31693 (slide 5).
11. Hypotype, GSC 74202; GSC loc. C-31726 (slide 29, specimen 2).
12. Hypotype, GSC 74203; GSC loc. C-31790 (slide 3).
13. Hypotype, GSC 74204; GSC loc. C-31726 (slide 28).
14. Hypotype, GSC 74205; GSC loc. C-31726 (slide 41).
15. Hypotype, GSC 74206; GSC loc. C-31726 (slide 13).
16. Hypotype, GSC 74207; GSC loc. C-31790 (slide 9).

Figures 17. *Beedeina elegans decurta* (Rauser and Safonova); axial section

Hypotype, GSC 74208; GSC loc. C-31790 (slide 1).

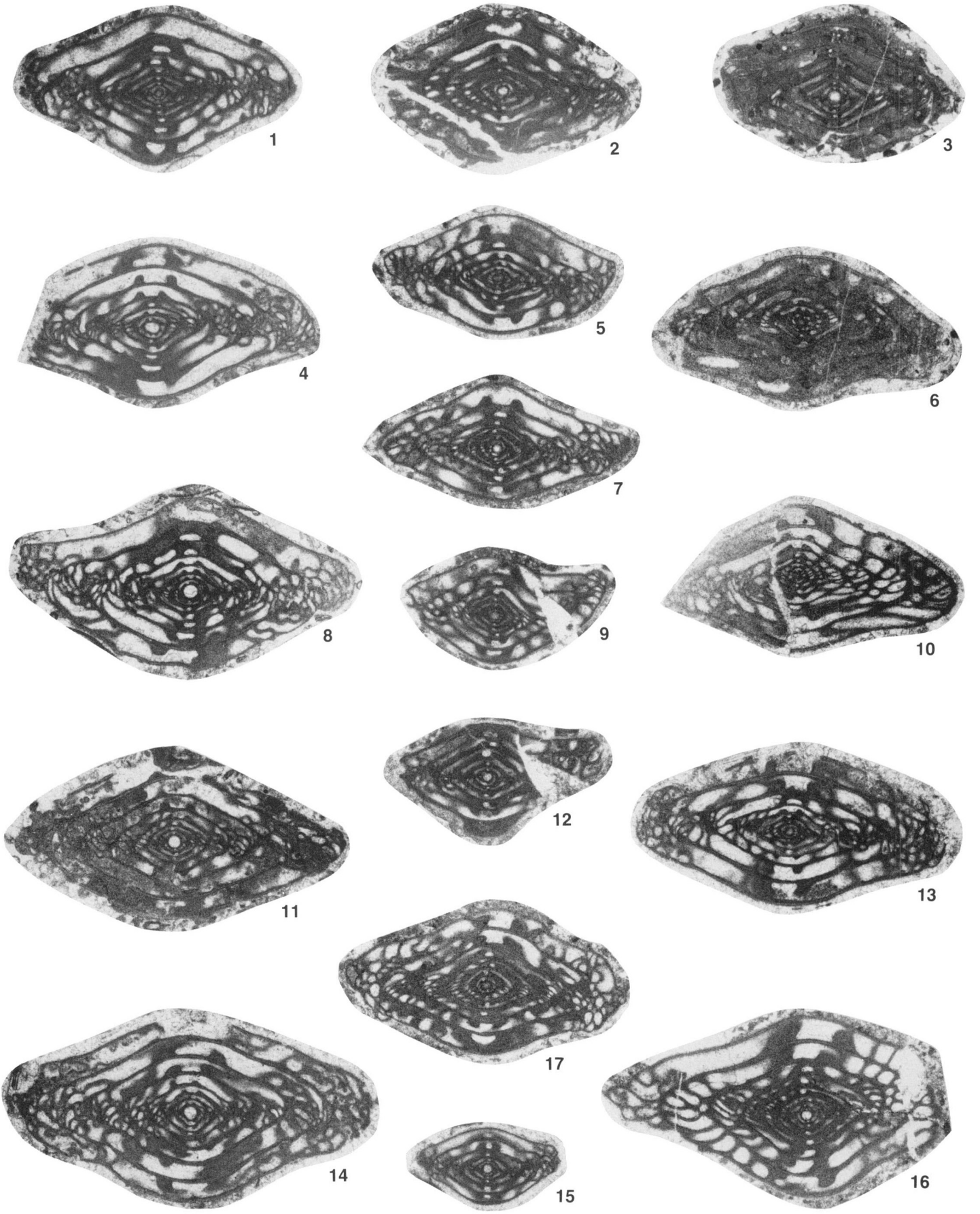

1
2
3
4
5
6
7
8
9
10
11
12
13
17
14
15
16

PLATE 21

(All figures x 20)

Figures 1-6. *Fusulinella subcolaniae* Reitlinger; axial sections

1. Hypotype, GSC 74209; GSC loc. C-31881 (slide 9, specimen 2).
2. Hypotype, GSC 74210; GSC loc. C-31881 (slide 6).
3. Hypotype, GSC 74211; GSC loc. C-32134 (slide 20).
4. Hypotype, GSC 74212; GSC loc. C-31881 (slide 10).
5. Hypotype, GSC 74213; GSC loc. C-31884 (slide 5, specimen 1).
6. Hypotype, GSC 74214; GSC loc. C-31883 (slide 6).

Figures 7-16. *Fusulinella subelliptica* n. sp.; axial sections

7. Paratype, GSC 74215; GSC loc. C-31695 (slide 8).
8. Paratype, GSC 74216; GSC loc. C-31695 (slide 5).
9. Paratype, GSC 74217; GSC loc. C-31658 (slide 5).
10. Paratype, GSC 74218; GSC loc. C-31658 (slide 1).
11. Paratype, GSC 74219; GSC loc. C-31689 (slide 6)
12. Paratype, GSC 74220; GSC loc. C-31688 (slide 2).
13. Paratype, GSC 74221; GSC loc. C-31695 (slide 16).
14. Holotype GSC 74222; GSC loc. C-31657 (slide 3).
15. Paratype, GSC 74223; GSC loc. C-31658 (slide 2).
16. Paratype, GSC 74224; GSC loc. C-31669 (slide 5).

Figures 17, 18. *Fusulinella schwagerinoides* (Deprat); axial sections

17. Hypotype, GSC 74225; GSC loc. C-31655 (slide 3).
18. Hypotype, GSC 74226; GSC loc. C-31655 (slide 4).

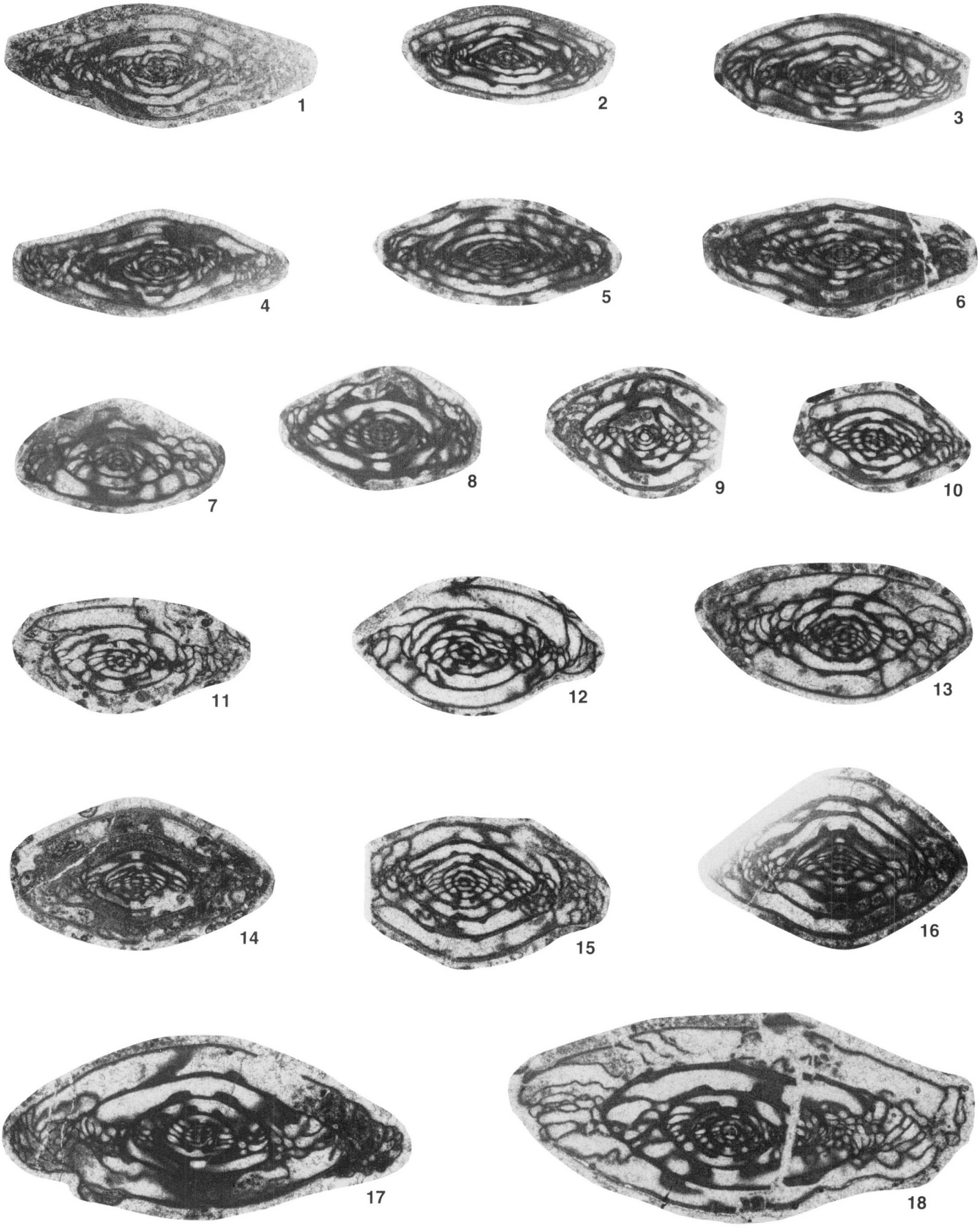

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

PLATE 22

(All figures x 20)

Figures 1-19. *Fusulinella cabezasensis* Ross and Sabins; axial sections

1. Hypotype, GSC 74227; GSC loc. C-31721 (slide 5).
2. Hypotype, GSC 74228; GSC loc. C-31715 (slide 3).
3. Hypotype, GSC 74229; GSC loc. C-31784 (slide 3).
4. Hypotype, GSC 74230; GSC loc. C-31784 (slide 8).
5. Hypotype, GSC 74231; GSC loc. 31784 (slide 12).
6. Hypotype, GSC 74232; GSC loc. C-31784 (slide 4).
7. Hypotype, GSC 74233; GSC loc. C-31722 (slide 3).
8. Hypotype, GSC 74234; GSC loc. C-31722 (slide 2).
9. Hypotype, GSC 74235; GSC loc. C-31721 (slide 4).
10. Hypotype, GSC 74236; GSC loc. C-31746 (slide 2).
11. Hypotype, GSC 74237; GSC loc. C-31784 (slide 11).
12. Hypotype, GSC 74238; GSC loc. C-31784 (slide 23).
13. Hypotype, GSC 74239; GSC loc. C-31683 (slide 1).
14. Hypotype, GSC 74240; GSC loc. C-31784 (slide 2).
15. Hypotype, GSC 74241; GSC loc. C-31784 (slide 7).
16. Hypotype, GSC 74242; GSC loc. C-31746 (slide 5).
17. Hypotype, GSC 74243; GSC loc. C-31784 (slide 13, specimen 1).
18. Hypotype, GSC 74244; GSC loc. C-31722 (slide 4).
19. Hypotype, GSC 74245; GSC loc. C-31784 (slide 1).

Figures 20, 21. *Fusulinella pseudobocki ovoides* Rauser; axial sections

20. Hypotype, GSC 74246; GSC loc. C-31680 (slide 3).
21. Hypotype, GSC 74247; GSC loc. C-31680 (slide 2).

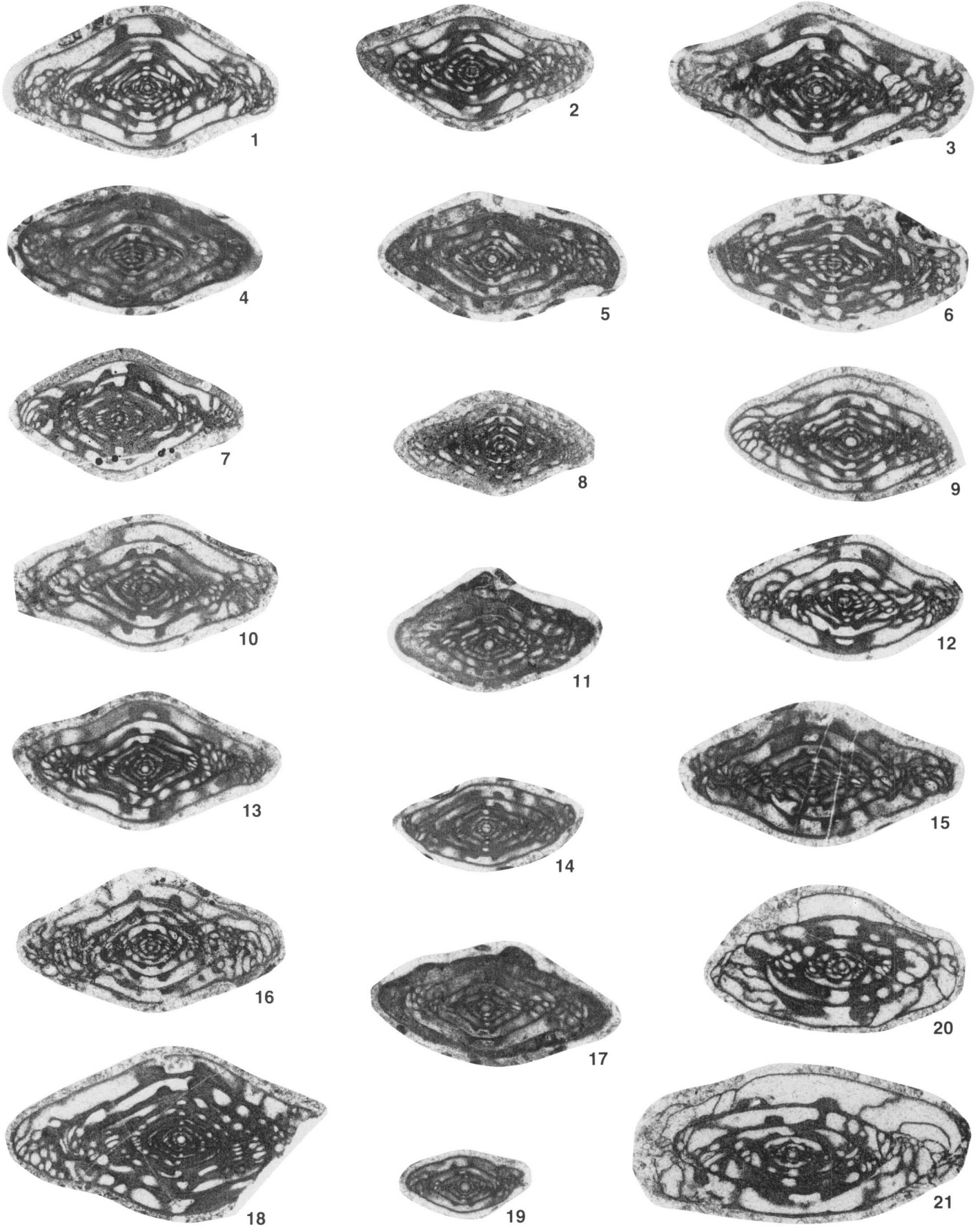

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
20
18
19
21

PLATE 23

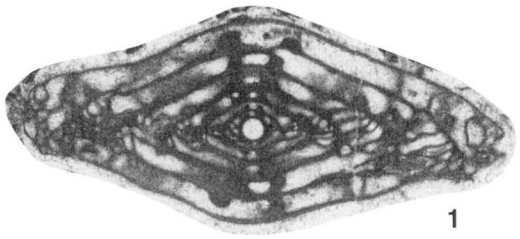
(All figures x 20)

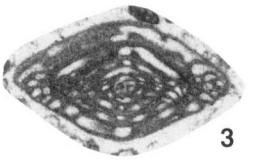
Figures 1, 2. *Fusulinella* sp. B; axial sections

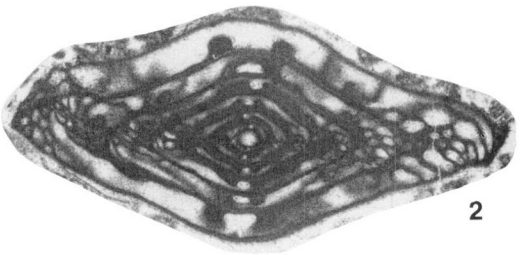
1. Hypotype, GSC 74248; GSC loc. C-32145 (slide 10).
2. Hypotype, GSC 74249; GSC loc. C-31790 (slide 6).

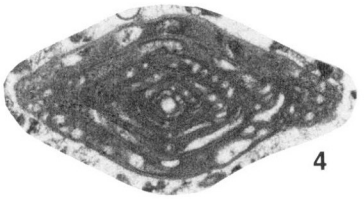
Figures 3-16. *Fusulinella famula* Thompson; axial sections

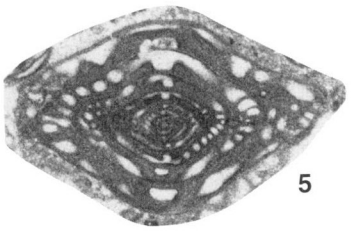
3. Hypotype, GSC 74250; GSC loc. C-31757 (slide 2).
4. Hypotype, GSC 74251; GSC loc. C-31757 (slide 10).
5. Hypotype, GSC 74252; GSC loc. C-31713 (slide 4).
6. Hypotype, GSC 74253; GSC loc. C-31713 (slide 3).
7. Hypotype, GSC 74254; GSC loc. C-31757 (slide 1).
8. Hypotype, GSC 74255; GSC loc. C-31757 (slide 8).
9. Hypotype, GSC 74256; GSC loc. C-31713 (slide 8).
10. Hypotype, GSC 74257; GSC loc. C-31757 (slide 5).
11. Hypotype, GSC 74258; GSC loc. C-31757 (slide 3).
12. Hypotype, GSC 74259; GSC loc. C-31757 (slide 7, specimen 1).
13. Hypotype, GSC 74260; GSC loc. C-31713 (slide 6).
14. Hypotype, GSC 74261; GSC loc. C-31757 (slide 4).
15. Hypotype, GSC 74262; GSC loc. C-31757 (slide 7, specimen 2).
16. Hypotype, GSC 74263; GSC loc. C-31757 (slide 6).

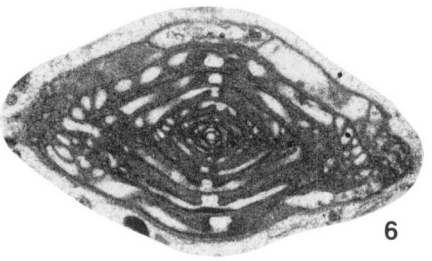

1

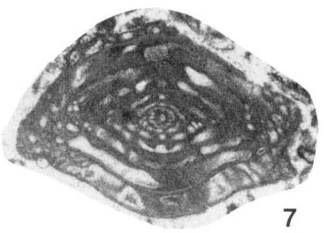

3

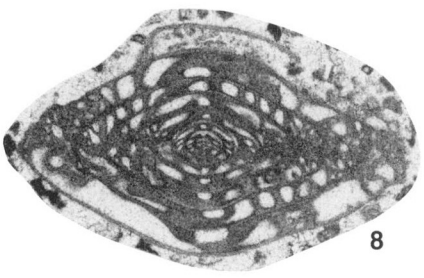

2


4

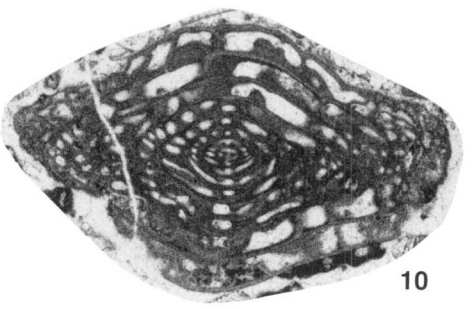

5

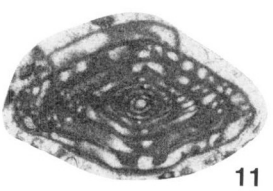

6

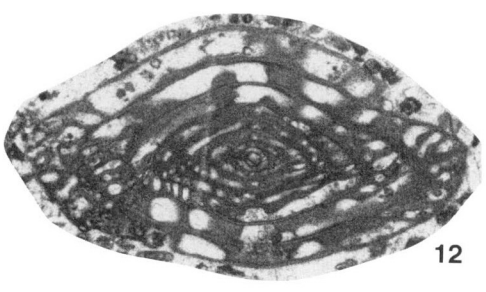

7

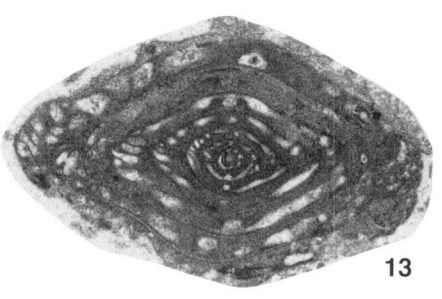

8

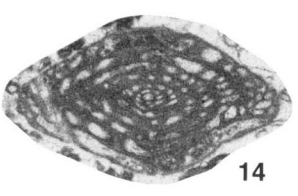
9

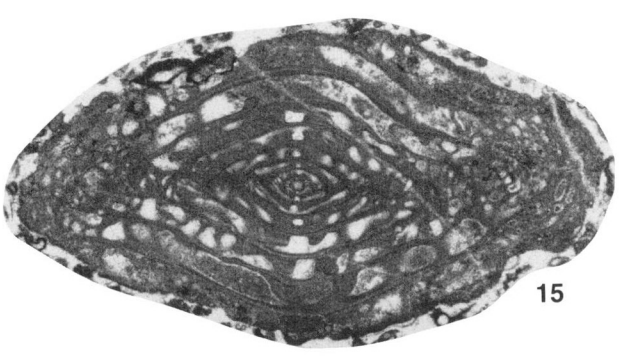

10


11


12


13


14


15

16

PLATE 24

(All figures x 20)

Figures 1-4. *Fusulinella subcolaniae decurta* Reitlinger; axial sections

1. Hypotype, GSC 74264; GSC loc. C-31726 (slide 15).
2. Hypotype, GSC 74265; GSC loc. C-31726 (slide 10).
3. Hypotype, GSC 74266; GSC loc. C-31726 (slide 20).
4. Hypotype, GSC 74267; GSC loc. C-31726 (slide 6).

Figure 5. *Fusulinella mosquensis* Rauser and Safonova; axial section

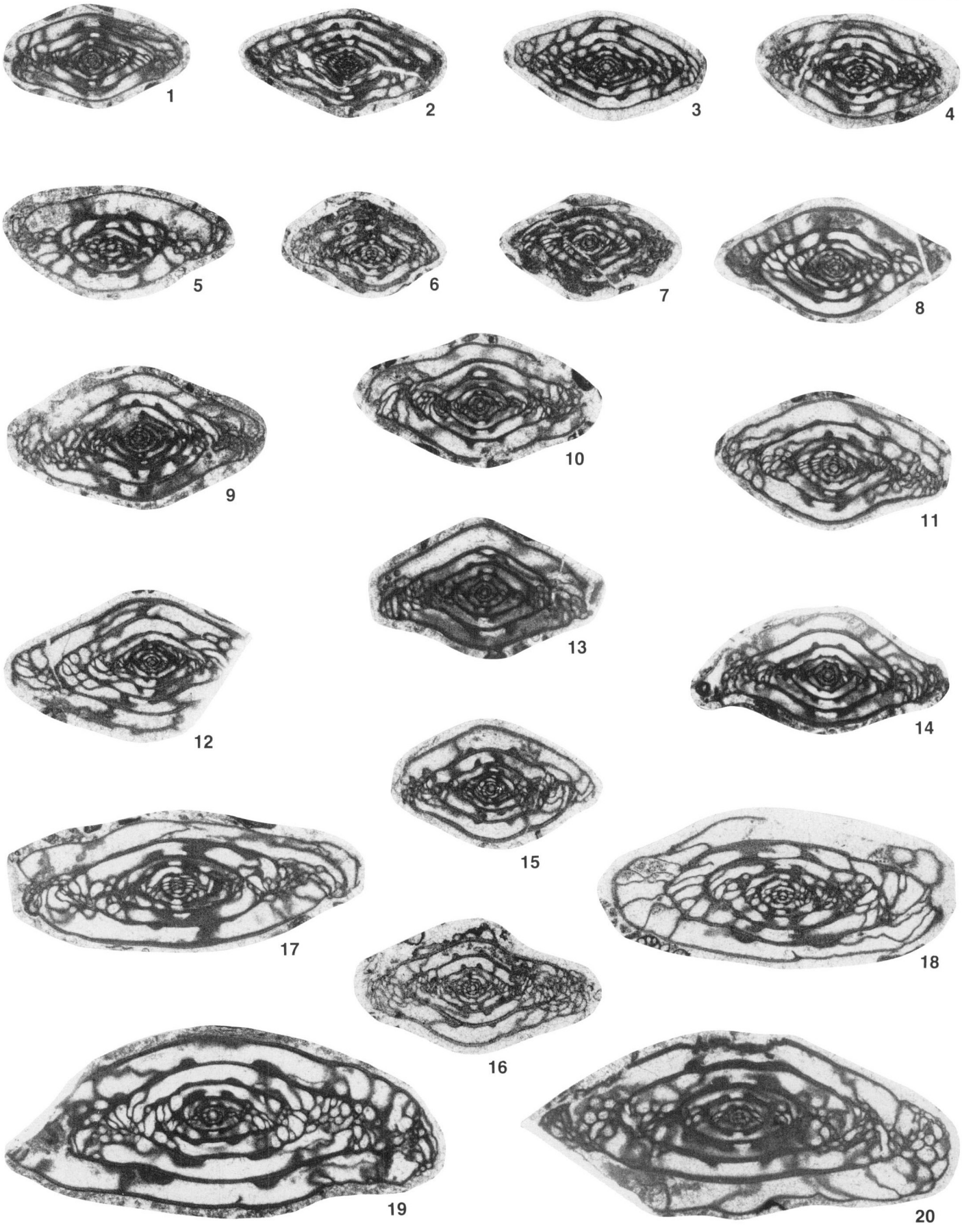
Hypotype, GSC 74268; GSC loc. C-31693 (slide 6).

Figures 6-16. *Fusulinella thorsteinssoni* n. sp.; axial sections

6. Paratype, GSC 74269; GSC loc. C-31673 (slide 2).
7. Paratype, GSC 74270; GSC loc. C-31673 (slide 1).
8. Paratype, GSC 74271; GSC loc. C-31659 (slide 4).
9. Holotype, GSC 74272; GSC loc. C-31693 (slide 4).
10. Paratype, GSC 74273; GSC loc. C-31648 (slide 6).
11. Paratype, GSC 74274; GSC loc. C-31648 (slide 3).
12. Paratype, GSC 74275; GSC loc. C-31687 (slide 10).
13. Paratype, GSC 74276; GSC loc. C-31648 (slide 2).
14. Paratype, GSC 74277; GSC loc. C-31656 (slide 8, specimen 1).
15. Paratype, GSC 74278; GSC loc. C-31648 (slide 1).
16. Paratype, GSC 74279; GSC loc. C-31648 (slide 5).

Figures 17-20. *Fusulinella rara* Schlykova; axial sections

17. Hypotype, GSC 74280; GSC loc. C-31696 (slide 3).
18. Hypotype, GSC 74281; GSC loc. C-31696 (slide 4).
19. Hypotype, GSC 74282; GSC loc. C-31696 (slide 1).
20. Hypotype, GSC 74283; GSC loc. C-31696 (slide 2).


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
17
18
16
19
20